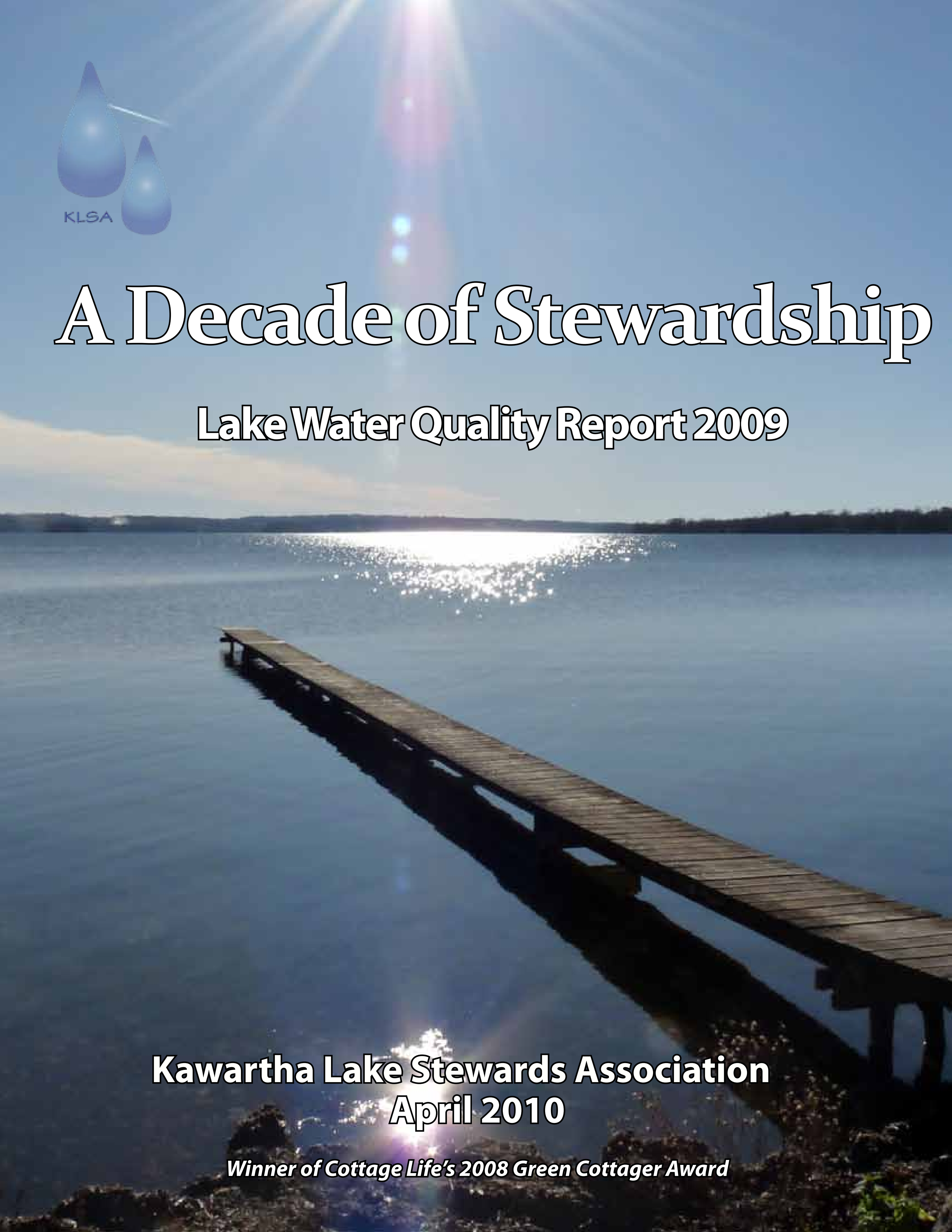

A Decade of Stewardship

Lake Water Quality Report 2009

Kawartha Lake Stewards Association
April 2010

Winner of Cottage Life's 2008 Green Cottager Award

Kawartha Lake Stewards Association

Lake Water Quality Report - 2009

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

Kawartha Lake Stewards Association
24 Charles Court, RR 3, Lakefield, ON K0L 2H0
Email: kawarthalakestewards@yahoo.ca

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

http://klsa.wordpress.com

Our cover photo for this tenth anniversary edition is by Anita Locke, Lakefield Ward Councillor with the Township of Smith-Ennismore-Lakefield and a freelance writer closely associated with the *Lakefield Herald*. Her loves of kayaking and photography produce some wonderful images, seen elsewhere in this report.

KLSA is grateful for the funding from the Ontario Trillium Foundation for two special projects: its 2009 Aquatic Plants Guide and a new two-year study of algae in the Kawartha Lakes.

The Ontario Trillium Foundation
La Fondation Trillium de l'Ontario

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Anita Locke

Red-winged blackbird, female

Chair's Message

2009 was a year of rewarding accomplishments. To name a few: the distribution phase of the Aquatic Plants Guide, the expansion of our water testing program into the City of Kawartha Lakes territory, our Kawartha Lakes Flow Maps project, a KLSA-Fleming College partnership study concerning storm water pollution in Lindsay, continued sewage treatment plant performance monitoring, well-attended KLSA general meetings and growth in networking with the objective of promoting community awareness.

All of that on top of our mandate, as a non-profit volunteer organization, to monitor and report on the water quality of the Kawartha Lakes. In 2009, monitoring alone involved sampling for *E.coli* at 99 sites in 14 lakes and phosphorus/water clarity at 42 sites in 14 lakes.

In this our tenth year of operation, KLSA has proven to be a trusted and respected source of water quality data collection and interpretation among shoreline residents, government agencies and businesses within the Kawartha watershed.

What can we do about water weeds and algae?

This was the question raised in recent years and with increasing intensity by Kawartha Lakes property owners attending our KLSA public meetings. True to our mission statement we undertook a two year research project with the objective of better identifying and understanding aquatic plants and the six management methods familiar to us in the Kawartha Lakes: benthic mats, herbicides, cutters, mechanical harvesters, raking or dredging and corn feed for carp. The project concluded last summer with the distribution of 5,000 copies of our Aquatic Plants Guide. A limited number of copies will be available at our 8 May Spring General Meeting in Bobcaygeon and you can find the guide at our website http://klsa.wordpress.com (or google klsa).

Janet Duval

Calm evening on Deer Bay Reach

But water weeds were only the first of two growing concerns. The increasing prevalence of algae was the second. This raised the question: Could we undertake a study exploring lake water algae with the objective of publishing a companion guide to our well received 2009 Aquatic Plants Guide? KLSA has structured a two year algae research project culminating with a summer of 2012 public education program focused on a Kawartha Lakes Algae Handbook. The Ontario Trillium Foundation, an agency of the Government of Ontario, has awarded KLSA a $71,000 grant over 24 months in support of this project.

As with aquatic plants, there is little information available to the public on freshwater algae and their ecology. We want to answer some basic questions about algae in our Kawartha Lakes: What are the types, how do we identify them, how concerned should we be, what limiting factors constrain algal growth and blooms and what can be done to avoid excessive algal growth?

To do this we are relying on many of the same partners who supported the Aquatic Plants Guide. The Ontario Trillium Foundation, public volunteers and donors made that project possible. Again, we have entered a collaborative agreement with Trent University and will receive the results of a two year research program involving field experiments to determine spatial distribution of algal biomass and its relationship with potential limiting nutrients. The research will also include an examination of the relationships between algal biomass and the abundance of aquatic plants both at the shoreline and beyond. Dr. Paul Frost, Assistant Professor in the Department of Biology, Trent University, has volunteered to both staff and manage the research part of this project much as Dr. Eric Sager, Manager of Trent University's Oliver Ecological Centre, led the Aquatic Plants research project. KLSA is fortunate to have both as ongoing volunteer scientific advisors.

KLSA expansion in the City of Kawartha Lakes

In November 2008 the City of Kawartha Lakes Council provided the support needed for KLSA to expand our lake monitoring program beyond the existing two dozen sites on Pigeon and Sturgeon Lakes. The positive response from Balsam and Shadow Lake Associations resulted in six new test sites on Balsam and two new sites on Shadow Lake and a keen interest to continue this increase in test coverage. We have established testing protocols with the Centre for Alternative Wastewater Treatment at Fleming College in Lindsay. Duplication of lake monitoring effort is avoided by working in close partnership with the Kawartha Conservation Authority and its Water Watch program.

Partnership with Fleming College – Lindsay campus

There is something very rewarding when students in your own community contribute significantly to a better understanding of our Kawartha Lakes environmental issues. Again this year, Fleming College – Lindsay has contributed with two KLSA projects: the Kawartha Lakes Flow Maps (GIS) and a Storm Sewer Impacts Study.

Why do we need yet another map? You will see why as you read further in this annual report. At the risk of oversimplification just remember, if we are to limit or perhaps reduce the nutrient loading on our lakes, we have to determine where the nutrients are coming from and when. Where does our lake water come from and where is it exiting? Not an easy task when you consider the variety of nutrient loading inputs and outputs given our Trent-Severn Waterway chain of lakes. What exits one lake is input to the next, resulting in a cumulative downstream effect. Flows that must be quantified include channel inflow/outflow, land drainage, precipitation, atmospheric loading, municipal sewage treatment plant discharge, lakebed storage, nutrient regeneration from lake sediments and the list goes on. With a better idea of water flow, we hope to be able to use the hundreds of test results we accumulate each summer to quantify, track and trend specific sources. This is a first step to limiting nutrients in our lakes.

Monitoring and controlling municipal discharge, be it from our six Kawartha Lakes sewage treatment plants (STPs) or storm water outfalls, has always been a KLSA priority. STPs are described as the most controllable large sources of phosphorus on our lakes and we continue to spot monitor STP performance against their Provincial Certificates of Approval.

Anita Locke

Great Blue Heron

In this annual report we have included a Kawartha Lakes Storm Sewer Outfalls study conducted by students in the Credit for Product course in the third year Ecosystem Management Technology program at Fleming College. The results were a surprise, the recommended mitigation strategies welcomed.

Partnerships and networking

Over this decade of operation, KLSA has enjoyed the support of many volunteers and cottage associations helping to accomplish our lake monitoring program. Partnering that started with the Trent-Severn Waterway (Parks Canada), Ministry of the Environment's Lake Partner Program and our three townships (Galway-Cavendish & Harvey, Smith-Ennismore-Lakefield, and Douro-Dummer) has exploded into a network of partners including City of Kawartha Lakes, Kawartha Conservation Authority, Ontario Trillium Foundation, collaborative agreements with Trent University and Fleming College, the Lakefield Herald, Stony Lake Heritage Foundation, McColl Turner Chartered Accountants, Peterborough County Stewardship, Lakeland Alliance and the many small business supporters listed elsewhere in this report.

Where are we heading?

KLSA sees an increasing need for public engagement in addressing the health of our watershed. We see potential in today's "lake management plan" concept of involving all levels of government, citizen action groups and conservation organizations. The Lake Simcoe Protection Act is the highest profile example to date. Kawartha Conservation Authority has completed a Lake Scugog Management Plan. With today's fiscal restraints there is insufficient current capacity for the field work and public dissemination required of these management plans. The KLSA organization has the volunteer infrastructure to support future lake management plans.

Our successful collaborative projects with Trent University and Fleming College have demonstrated the value of applying scientific analysis to better understand the ecological responses of our shallow lake ecosystem to phosphorus management. We see a need to give our land use planners, watershed managers and policy makers a model or decision-making framework geared to evaluating the ecological and economic consequences of lake ecosystem management alternatives. KLSA is in a position to provide partnership support.

Spring meeting

KLSA holds two public meetings each year. This year's Spring General Meeting will be on Saturday, May 8th, 10:00 am to 12:00 pm, meeting place to be announced.

Our featured speaker will be Ms. Ana M. Morales discussing "Algae in the Kawartha Lakes," the subject of our recently awarded Ontario Trillium Foundation grant. Ms. Morales is an M.Sc. student working with Dr. Paul Frost at Trent University in the Environmental and Life Sciences graduate program. She has an undergraduate degree from Florida International University in Biological Sciences. Other speakers will include Dr. Eric Sager (wild rice and the role of phosphorus), Kathleen Mackenzie (maps and monitoring), Kevin Walters (storm water pollution) and The Honourable Ric McGee, Mayor of the City of Kawartha Lakes, who will share with us his vision of the Kawarthas as an international centre for water quality.

We hope that the KLSA activities outlined in this report will justify your continued support.

Mike Stedman
KLSA Chair

A Message from the Mayor City of Kawartha Lakes

I would like to thank the KLSA for their hard work and dedication to improve water quality in our region. The conclusions from the Town of Lindsay storm water study provide valuable data and recommendations so that we may all improve water quality in our lakes and rivers. The efforts of KLSA in conjunction with Fleming College students and faculty serve to increase awareness for everyone to do their part to improve water quality in the Kawartha Lakes.

KLSA, along with numerous NGOs and government agencies, understands the importance of water quality and how it impacts our natural environment and our very existence. By working together and developing new relationships with educational institutions such as Trent University and Fleming College and in partnership with our Federal and Provincial Governments, our region can become an international leader in water quality.

Thanks to one and all for your continued commitment to protect our primary natural resource – OUR WATER!

Ric McGee

Mayor, City of Kawartha Lakes

Kawartha Lake Stewards Association Executive Summary - 2009 Report

The Kawartha Lake Stewards Association (KLSA) is a volunteer-driven, non-profit organization of shoreline owners (cottagers, year-round residents and local business owners) in the watershed of the Trent-Severn Waterway. 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, forging valuable partnerships with Trent University, Fleming College and the Kawartha Conservation Authority. KLSA research initiatives have investigated various factors that affect water quality such as sources of phosphorus and methods of aquatic plant management, and we are now beginning to research algae in the Kawartha Lakes. Recent public education initiatives have included the publication of an Aquatic Plants Guide and the preparation of computer generated maps, showing water flows into and out from the Kawartha Lakes.

Introduction to the Watershed: The Central and Lower Kawarthas

The Kawartha Lakes are a unique chain of lakes occupying a broad, shallow valley running across the central part of Southern Ontario (Trent Valley). In our 2006, 2007 and 2008 reports, KLSA Vice-Chair Kevin Walters started with an overview of the lakes, and then provided detailed descriptions of the upper lakes, located north of Fenelon Falls and the central lakes: Sturgeon, Pigeon, Little and Big Bald, Sandy, Buckhorn and Chemong Lakes and the Mississagua River.

In this report, Kevin continues the journey eastward from Buckhorn through the Lovesick Lakes, Lower Buckhorn Lake and Deer Bay, the Wolf Island area, the Mississagua River and Burleigh Falls. This area encompasses the third central basin of the Kawarthas, comprised of two sub-basins. Its early history was documented by Samuel Strickland in a book published in 1853. Until 1953, the entire area was known as Lovesick Lake but in that year, the government of the day applied that name to the lake at the eastern end of the basin and called the middle section Lower Buckhorn. There is much speculation as to the origin of the name Buckhorn – was it derived from the original First Nations' name for the area, the antler-like shape of the lakes or antlers on a building? Lovesick Lake's name may have its origins in a Chippewa legend of thwarted love.

Construction of dams and the adjustment of water levels for navigation purposes significantly affected this section of the Kawarthas, combining lakes that were previously separated and eliminating rapids and ponds. Many of the Shield rock islands in the northern section are Crown land, including Wolf Island Provincial Park, or are part of the Trent Waters Indian Reserve. The Shield is a significant geological feature of this area, particularly along County Road 36 just north of Lower Buckhorn and Lovesick Lake.

The Mississagua River drains several reservoir lakes to the north and enters the lake at the Buckhorn end, in a convoluted maze of islands and channels. Parts of the river are navigable by canoe or small boat into the Kawartha Highlands Park. One of the channels of the Mississagua River appears to have been called Buckhorn Creek but this name has been lost. Deer Bay Creek, however, does exist and drains wetlands and small lakes to the north, entering Lower Buckhorn just west of Wolf Island. Burleigh Falls ends the Central Lakes area. The waterfall, previously known as Peninsula Falls, splits around Burleigh Island and another island to the west and tumbles into the lower lakes. The article provides highlights of the history, geology and geography of the region.

***E.coli* Bacteria Testing**

In 2009, KLSA volunteers tested 99 sites in 14 lakes. Each site was tested up to 6 times during the summer for *E.coli* bacteria. Samples from 78 sites were analyzed by SGS Lakefield Research and those from 21 sites were analyzed at the Centre for Alternative Wastewater Treatment laboratory at Fleming College in Lindsay, facilitating sampling in Balsam and Shadow Lakes.

Public beaches are posted as unsafe for swimming when levels reach 100 *E.coli*/100 mL of water. KLSA believes that counts in the Kawartha Lakes should not exceed 50 *E.coli*/100 mL. In general, *E.coli* levels were low throughout the summer, consistent with other years. Of the 99 sites tested, 63 were "very clean" (no readings above 20), 22 were "clean" (1 or 2 readings above 20), 8 were "somewhat elevated" (3 readings between 20-100) and 3 were designated as "needing observation" because they had more than 2 counts over 100 or more than

3 counts over 20. The high results are generally due to pollution from waterfowl or cattle or because the sites receive runoff from wetlands.

Detailed lake and site results can be found in Appendix E. Thank you to all our volunteer water samplers and to Board member Rod Martin, who coordinated the expansion of the program to the western lakes.

Phosphorus Testing
In 2009, as part of the Ministry of the Environment's Lake Partner Program, volunteers collected water samples 6 times per year (May to October) at 42 sites on 14 lakes for phosphorus testing. Samples were analyzed by the Ministry lab.

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 algal growth accelerates, adversely affecting enjoyment of the lakes.

Overall in the cool, rainy summer of 2009, average phosphorus levels were slightly lower than in the past eight years. The reasons for this are unclear. Phosphorus levels were low from May to October and in all the lakes. 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) and from lake to lake (Shield lakes tend to have lower levels) but the differences were less pronounced than in previous years. Detailed results are provided in Appendix F.

KLSA is grateful to the many volunteers who participated in our monitoring programs.

Rethinking the Phosphorus - Aquatic Plants Connection
A study conducted by scientists at the University of Florida at Gainesville and the Florida Lakewatch Program questioned the common assumption that excess nutrients in lake water, such as phosphorus and nitrogen, stimulate the growth of aquatic plants.

The study results suggested that it is the nutrients in the sediments that encourage weed growth, whereas the nutrients in the water stimulate the growth of algae.

The researchers also found that phosphorus concentrations in lakes with submerged aquatic plants were lower than in lakes without weeds. They concluded that aquatic plants and algae that grow on the plants actually remove phosphorus from the water.

This study has implications for the Kawartha Lakes, which are generally shallow and subject to the Alternative Stable States theory whereby lakes may be dominated either by weeds or algae. The research sparked a discussion among Board members and KLSA scientific advisor Dr. Eric Sager. Excerpts from this discussion are included in the report. More research is needed to explore these issues further.

A Study of Storm Sewer Outfalls in the City of Kawartha Lakes
One of the partnerships KLSA has developed in recent years is with the Fleming College Ecosystem Management Technology Program. Under the supervision of Professor Sara Kelly, with assistance from KLSA Board member Kevin Walters, three students in the third year of the program undertook a study of storm sewer outfalls in the City of Kawartha Lakes as a Credit for Product course.

The purpose of their study was to determine the amount of phosphorus and *E.coli* found in runoff from storm sewer outfalls in Lindsay. Eight sites were selected, representing a range of low and high traffic areas and a mix of residential and commercial locations.

Samples were collected within the first hour of a major rainfall and were tested for phosphorus and *E.coli* at an accredited laboratory. The phosphorus levels were as expected at most outfalls. *E.coli* levels were higher than expected at five of the eight outfalls where samples were collected. The level at one site was extremely high. Further study is needed to determine the source of the *E.coli* at these sites.

To improve the situation, the students recommended the creation of more natural buffers around outfalls.

Constructed wetlands, bio-retention ponds and sand filtration were methods recommended to remove *E.coli* and phosphorus or reduce their concentrations. It was also proposed that the outfalls be monitored year-round.

Monitoring Kawartha Sewage Plants
In 2006, another group of Fleming College students undertook a study of sewage treatment plant discharge into the Kawartha Lakes, again supervised by Professor Sara Kelly. This article by Kevin Walters follows up on the 2006 data, examining phosphorus outputs in 2008.

Lindsay currently discharges about 25% of its allowable limit of phosphorus. For reasons that are not clear, the two side-by-side plants at Bobcaygeon are allowed to discharge five times the concentration permitted at Lindsay. Although the Bobcaygeon facilities only discharge about 33% of the permitted amount, their discharge levels are high in relation to the size of the population and may contribute to the relatively high phosphorus levels in Pigeon Lake.

The Lakefield plant operates very well. Further monitoring is required, particularly around the Bobcaygeon plants and the one at Fenelon Falls.

How Does a Sewage Treatment Plant Work?
In the fall of 2009, several KLSA members joined Chris Norman, senior operator of the Lakefield Sewage Treatment Plant, for a tour of the plant and the adjacent sewage lagoons.

One of the KLSA Board members who went on the tour, Pat Moffat, prepared an interesting description of the pump house and the lagoons, explaining the various stages in the process of treating wastewater to turn it into clean effluent. Chris Norman is willing to give tours of the Lakefield plant to the public.

Wild Rice in the Kawarthas
In response to a concern raised at one of the recent KLSA public meetings, this year's report includes an article on wild rice in the Kawarthas. The author, Deryck N. Robertson, a biology student at Trent University, studied the history and biology of wild rice in the Kawartha Lakes in a reading course supervised by Dr. Eric Sager.

Wild rice was much more prevalent before European settlement occurred. The construction of a dam at Hastings in 1838, a hurricane in 1928 and the introduction of carp to the lakes in the 1950s destroyed many of the rice beds. Wild rice can, however, still be found in many Kawartha Lakes including Rice, Little Bald, Pigeon, Mitchell, Canal, Cameron, Sturgeon, Chemong, Buckhorn and Lake Scugog.

In some locations, growth is increasing, causing concerns for residents due to its interference with cottaging and boating activities. The article describes the biology and growth process of the rice. The article concludes that the resurgence is likely due to optimal growing conditions, less competition from other plant species and increases in nutrients in the water. Other factors that might have affected it are zebra mussels that increase water clarity and the carp die-off of 2007. Permits are required to remove wild rice from shorelines.

Overview of the KLSA-Trent Ontario Trillium Foundation Project on Algae
An article by Dr. Paul Frost introduces an exciting new initiative of KLSA and scientists at Trent University. Algae are a diverse group of microscopic plants that form the base of lake food webs. If supplied with excessive nutrients, algal populations can bloom and produce poor water quality.

As nutrients continue to enter the lakes, there is the possibility that undesirable algal blooms may become more common in the Kawartha Lakes. KLSA is delighted to announce that Ontario Trillium Foundation funding has been approved for a two year collaborative project with a Trent University research team led by Dr. Paul Frost, to answer basic, important questions about algae in the Kawartha Lakes.

The study will identify the primary algal species in the Kawartha Lakes, the factors that constrain algal growth and methods of preventing excessive algal growth. The results of the study will be presented in a workshop for shoreline residents. Also, an educational booklet on algae, similar to the Aquatic Plants Guide, will be published and distributed in 2012.

GIS Maps of the Kawartha Lakes
In another collaborative effort with students and faculty at Fleming College, three students in the Geographic Information Systems (GIS) program prepared maps showing flows into and out of the Kawartha Lakes. The purpose of the project was to improve our understanding of the sources of phosphorus in the lakes and to quantify the flows.

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 and ratepayer associations and municipalities and businesses that provide financial support.

We are also very grateful to the Trent-Severn Waterway for its ongoing partnership with us and to the Ontario Trillium Foundation for funding our aquatic plants project and, in the coming years, the algae project.

Thank you also to:
- Dr. Eric Sager, Manager of the Trent University Oliver Ecological Centre
- Dr. Paul Frost, Assistant Professor, Department of Biology and Head of the Laboratory of Environmental Stoichiometry, Trent University
- Professor Sara Kelly and her students at Fleming College
- staff at the Ministry of the Environment Lake Partner Program
- staff at SGS Lakefield Research and the Centre for Alternative Wastewater Treatment
- Simon Conolly, publisher of the Lakefield Herald

Executive Summary prepared by Sheila Gordon-Dillane, KLSA Director

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

Jim Dillane

The KLSA Editorial Committee at work: (l-r) Janet Duval, Kathleen Mackenzie, Simon Conolly, Sheila Gordon-Dillane, Pat Moffat. Missing is Kevin Walters.

The Central and Lower Kawarthas

In previous editions of the Annual Report, KLSA Vice-Chair Kevin Walters outlined the physical geography and some early history of the Kawartha Lakes region (2006) and described in detail the Upper Lakes of Shadow, Balsam and Cameron (2007) and some of the Central Lakes (2008). You can review these online at http://klsa.wordpress.com. This year Kevin tackles the easterly side of the Central Lakes, defined herein as those lakes located between the two major changes in elevation, at Fenelon Falls and at Burleigh Falls.

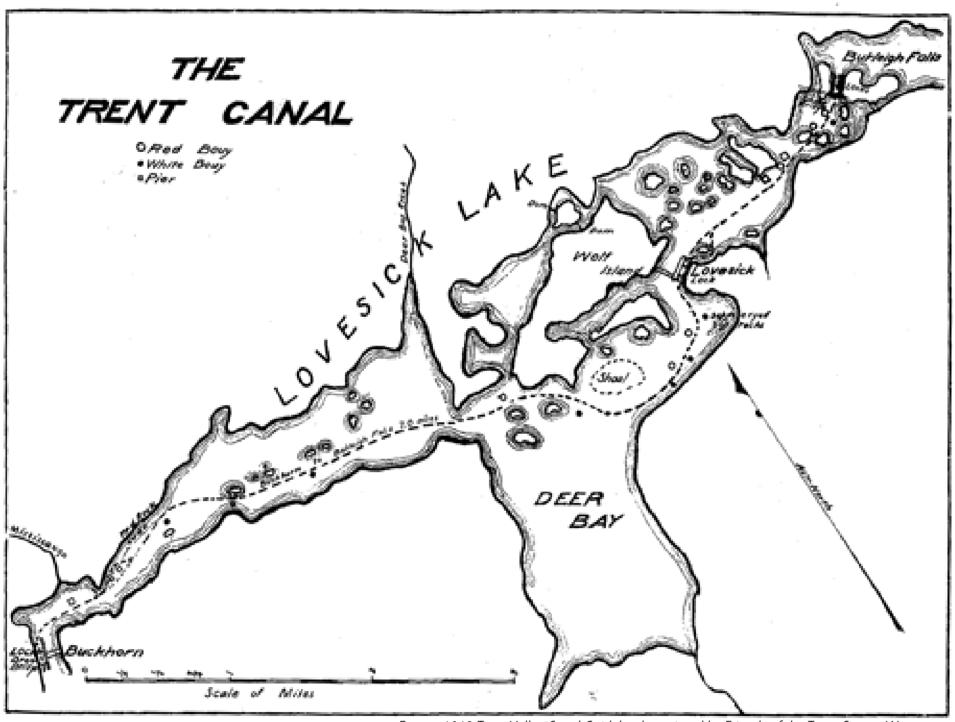
by Kevin Walters B.A. Sc., P.Eng.
Vice-Chair, KLSA

The Lovesicks

Last year's story ended at Buckhorn. Heading eastward from here, we enter the third central basin, lying between the villages of Buckhorn and Burleigh Falls. Much smaller than most of the upstream lakes, but about the same size as Cameron Lake, it is comprised of two sub-basins.

The Lovesick basin is a very scenic basin founded on hard granitic/gneissic Shield rock for the most part, hemmed in at the south end by the scarp of the edge of the limestone caprock, well noted in a book by Samuel Strickland, *Twenty-Seven Years in Canada West,* originally published around 1853. Islands abound, including the large Wolf Island, which almost severs off the smaller eastern part of the lake, the part that currently carries the name Lovesick exclusively. Strickland's book contains a wonderfully detailed description of the lakes, including references to that unique landscape-completing occupant of the Kawarthas, the Eastern Red Cedar.

From about the turn of the previous century until 1953, it was all called Lovesick Lake, officially, although the upper main basin was commonly referred to simply as Deer Bay and Deer Bay Channel, the predominate features of this part of the lake. Prior to this the lake as a whole seems to have had a number of names including 'Caughwawkuonykauk', 'Surprise', 'Rocky', and 'Tripe'. The latter unfortunate name may have been a misprint on the U.S. Coastal map intended to read as 'Triple', given the basin's tripartite nature. Or perhaps it was in reference to prevailing opinions on the story of how Lovesick Lake acquired its name (see below). The upper part has also been known, not surprisingly, as Deer Lake.



From a 1912 Trent Valley Canal Guidebook reprinted by Friends of the Trent-Severn Waterway.

Lower Buckhorn Lake and Deer Bay

An 1826 map appears to label the arm of water from 'Little Buckhorn' to Deer Bay inclusive as 'Shebauticon', but without any noun following it, such as 'lake' or 'rapids', it is not clear what this word meant or what it really applied to. Possibly it referred to the series of lakes interspersed with rapids that would have existed originally. It bears a strong resemblance to 'Shebaughtickwyong,' the old U.S. survey map name for the 'Tri-Lakes', which spanned the waters from Pigeon Lake to Chemong. Shebauticon may be of similar origin, or simply a contraction.

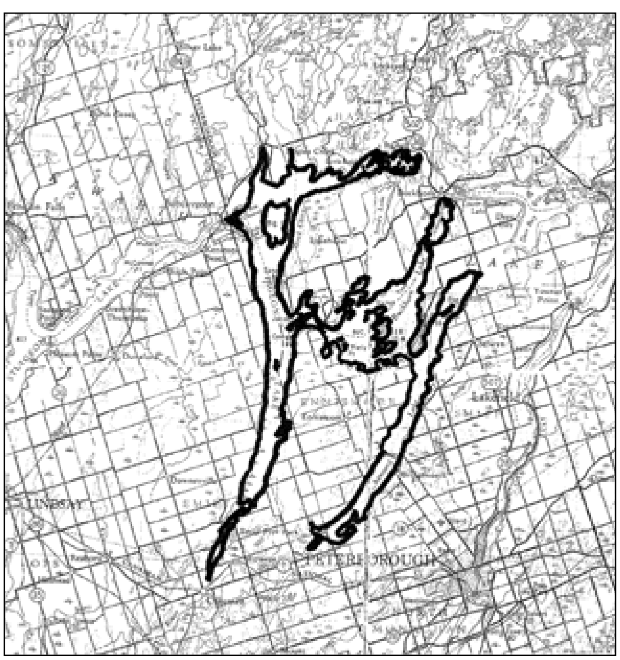
For the longest time, the lake we now call Lower Buckhorn was simply known as 'Deer Bay', which included all the water west of and including the Burleigh Chutes. The name Lovesick showed up on maps in the mid-19th century, initially for the east end of the lake, and later, the entire basin. By government imposition in 1953, the name Lovesick was pushed to the east end of the basin. The main part was given the name Lower Buckhorn Lake, perhaps at the expense of the northern basin of Buckhorn Lake (southwest of here) where this name is far more appropriate, and which possibly bore this name at some point. 'Lower Buckhorn' therefore seems to be a misnomer for any part of Lovesick Lake, and there seems to be no documentation available as to why 'Lower Buckhorn' was suddenly applied to it in 1953.

However, the likely source for the name is found in Samuel Strickland's book. In this book Strickland refers to the mills at Buckhorn "being almost in the middle of the lake," and mentions the rapids located here. Upstream, he calls the lake 'Upper Buckhorn' while downstream, he calls the lake 'Lower Buckhorn'.

Whereas rapids have universally defined the limits of lakes elsewhere, it is odd that Strickland considered the Buckhorn Rapids and its mills to be in the "middle of the lake," especially when this was at a part of the lake or lakes that was so narrow as to be the location of a bridge, and where furthermore there were two sets of rapids, one at the current dam site, the other further downstream where the Mississagua River joins, now submerged. Even stranger, given that he called the two parts of this lake Upper and Lower Buckhorn, it would appear that even Strickland paradoxically saw this lake as two separate basins.

While no maps of the time seem to exist to support his nomenclature (contemporary ones simply refer to this stretch of lake below the village of Buckhorn as the Otonabee River), it seems to have been an attempt to provide a 'lake' name for a basin otherwise simply known as the Otonabee River and Deer Bay. A peculiar choice or not, he no doubt would be pleased to know that today, his choice of name has prevailed.

His book sheds light on the origin of the name Buckhorn. While local accounts of today have the village name derived from antlers adorning a building at Hall's Bridge, the former name for the village of Buckhorn, it is certain that the lake already bore the name, and the village simply adopted the lake name in due course.



In the name 'Buckhorn' is found reinforcement for the single-lake concept for the upstream 'tri-lake' basin. It appears, from Strickland's account, that the natives saw Buckhorn Lake as part of a larger ragged lake of numerous arms resembling the prongs on the antlers of a buck. That the name Buckhorn derives from the shape of the lakes seems logical since we know that upstream, Sturgeon Lake so acquired its name.

Strickland refers to the eastern, marly arm, later called Mud or Chemong, as being one prong, with Deer Bay being the opposite prong. Looking at maps, this is somewhat hard to see, especially when Buckhorn Lake doesn't look anything like an antler, but more like the buck's head. Then of course there are those rapids in between that make it unlikely that the natives saw these two basins as being one lake.

Strickland's interpretation may have slightly missed the mark. Recall those antlers adorning that building, an oval top-of-skull with antlers projecting on either side. Looking at a map of our 'tri-lake' we see the central ovoid form of Buckhorn Lake, with Pigeon and Chemong Lakes vaguely looking like symmetrical antlers on either side, connected to the head, or Buckhorn Lake, by Gannon's Narrows and Harrington Narrows respectively. Hence it is Pigeon and Chemong that were likely the horns of the great 'Buckhorn'. Only the Bald Lakes then form any prominent prong off one of the main 'horns'.

Perhaps then, Shebaughtickwyong means Buckhorn. If so, this means that, for a time, the entire tri-lake 'Lake Kawartha' basin was once called Buckhorn Lake.

Perhaps then we should call 'Lake Kawartha' 'Great Buckhorn Lake' instead, since the entire lake was most likely seen that way by the natives, and perhaps by early explorers. The old name 'Lake Kawartha' refers to Pigeon, Buckhorn and Chemong Lakes, as described in the 2008 report.

Lower Buckhorn would seem to be excluded from our picture here, or would it? Perhaps we are looking down on our intact animal from above, and Buckhorn Lake is the whole head and part of the neck. We then see the large head and larger antlers on either side, and then Lower Buckhorn appears to be the rest of the neck and then Deer Bay is the body. Would that be how Deer Bay got its name, being the body of the deer or buck? Further research may determine.

If indeed Lower Buckhorn is the neck and body of the buck, Lower Buckhorn again seems an inappropriate choice, as this lake has little to do with the horns of the buck.

Perhaps Upper Buckhorn and Lower Buckhorn were instead the names that referred to the two sets of rapids, the 'upper Buckhorn rapids' and the 'lower Buckhorn rapids'. It is hard to imagine these twin cascades being called anything else. This would easily lead to confusion over the names for the lakes, however, when one of them was called Buckhorn.

Lovesick Lake

A preliminary interpretation of that early native word Caughwawkuonykauk by the Curve Lake natives is 'lovesick', and this may be the source of the lake name, as well as providing evidence that the entire basin from Buckhorn to Burleigh was, and is, reasonably called Lovesick Lake.

There is romance behind the name. An old story told to Samuel Strickland in 1852 relates to a handsome young Chippewa named Richard Fawn who fell desperately in love with a blue-eyed Irish maiden named Katherine. Despite his amorous appeals in the approved manner of Indian courtship, she had no interest in Fawn's attentions and married a young immigrant farmer instead. Richard Fawn retired to an island on Lovesick Lake determined to die of his love, until his friends found him and persuaded him to come home.

Unlike Strickland's vision of Buckhorn Lake where the rapids "in the middle of the lake" are at the narrowest part, or where one usually differentiates basins, the Lovesick rapids are located in the widest part of the lake, and are strung out between islands in parallel, not in series. This suggests that these were rapids that could be deemed to be located in the middle of the lake. However, recognizing that they were nonetheless somewhat separate lakes, historically and physically appropriate names for the lakes within this basin would be Upper Lovesick and Lower Lovesick respectively.

The extreme east end of Lovesick Lake was originally a pair of distinct, separate, small and apparently nameless bodies of water separated by rapids. Each was stepped approximately two-thirds of a metre lower than the balance of the 'lower' Lovesick Lake; the fast water between islands was referred to as the Burleigh Chutes. The raising of the water by the Burleigh dams has eliminated these chutes and merged the small ponds in between with the main lake.

Wolf Island area

During construction of the Trent Valley Canal in the late 1800s, seven dams, each only one metre high, were thrown up in the area of fast water between the islands of the archipelago, including Wolf Island, to facilitate navigation. Here water levels originally jumped by nearly half a metre seasonally. As the canal plans evolved, it was intended to later raise the waters of the lower, eastern portion of the basin an additional metre or so to match the upper part, and thereby eliminate this temporary lock and dam system at Wolf Island. The main dam at Burleigh Falls was constructed by about 1887 with this in mind. Never

Jay Duval

Aerial view of Lovesick Lake looking northeast toward Burleigh Falls.

Paul Duval

Old cedar stumps, some still standing (back left) with roots in the water, show that this shallow bay west of Wolf Island was dry land before the area was dammed in the 1880s.

finished, the Burleigh dam stands uncompleted at its north end and obviously higher than needed for the current lake level.

With the further raising of the water level in the eastern part to unify this water body, the name of Lovesick Lake for the entire basin would likely have remained to this day, as this would have then been one lake without question.

In the eastern sub-basin (today's Lovesick Lake) we see the deepest lake water since the Fenelon River, at 25 metres deep. The larger upper basin apparently reaches only 15 metres as indicated on the TSW charts, although local accounts have it much deeper than that. Large portions of the Lovesicks have depths of less than 4 metres however, and many of these areas were formerly occupied by rice beds. Other areas were seasonally inundated lowlands, now sporting stumps of the formerly flood tolerant trees.

Few of the islands in this body of water are the domain of private cottages. Most are Crown land, part of Wolf Island Provincial Park, or they belong to Islands in the Trent Waters Indian Reserve, which is inhabited seasonally by members of the Curve Lake, Hiawatha, and Scugog First Nations. The number of private cottage islands increases as one approaches Burleigh Falls. One unusual island, Scow Rock, looks something like a partly scuttled scow sitting just south of Marshall's Island alongside the canal route. The charts however have the name in the wrong location, i.e., further downstream near Ruba Island. In the upper basin, large low-relief islands to the west of Wolf were partly submerged by the dams constructed in the Lovesick Rapids archipelago. Like many shallow bays in the Kawarthas, all the waters in this area with a depth of less than one metre were once dry land. Poor charting of this area has made navigation between the islands somewhat risky, but the total absence of development provides a sense of pure wilderness.

These bedrock islands are all clustered in the northern part of the lake(s), as is typically seen in the upstream Lake

Kawartha system, and downstream in the Lower Lakes. There is a reason for the sudden disappearance of Shield-rock islands south of a diagonal line drawn across the lakes. Here, a geological fault in the Shield has caused all the bedrock in the south to be at a lower elevation, and hence we see areas like Deer Bay or Clear Lake devoid of islands or shoals. Along the south shores, the limestone caprock usually sits in the lake waters, and in fact, the lower layers of the limestone caprock appear to extend under the lake in several places, creating flat, shallow shelves. North of the fault, the bedrock has been thrust upward, raising remnants of the Paleozoic era limestone caprock to higher elevations well above the lake waters, and causing the underlying Shield rock to be exposed along the shoreline and as numerous islands within the lakes.

Similarly, just north of Lower Buckhorn and Lovesick Lake along County Road 36 we drive along Shield rock that, were we south of the lakes, would be below lake level. This stretch between Buckhorn and Burleigh Falls was once called the Oregon Trail owing to its winding, wagon-road like condition. We rise up onto one of many flat-topped mesas of outlying limestone, the highest being at the intersection with Deer Bay Reach Road. This is not in itself unusual, as many of these outlying resilient patches of limestone exist north of the lakes. However, this one is different. Just northeast of that intersection, we find an outcropping of Shield rock at the summit. This is the tip of an enormous knob of Precambrian rock that rises up through the limestone to poke above the surface, and appears to have acted like a pin holding the surrounding limestone caprock in place against the onslaught of the glaciers.

A little further east, in a rock cut just east of the crossing of Deer Bay Creek, there is an exposure of the contact of the overlying Paleozoic sedimentary rock with the Shield, where another of these mesas occurs. This reveals the exact, unaltered surface of the Shield as it existed over 500 million years ago, when it was first submerged by the Iapetus Ocean, as well as the first sea sediments that were subsequently laid on top of it. This particular road cut apparently exposes the only known bedrock from the Cambrian period in the area, a foot-thick band of sandstone lying between the Precambrian 'basement' and the Shadow Lake formation just above it.

Samuel Strickland makes references to the limestone caprock and offers very insightful thought into the origins of this geologically intricate basin. Undoubtedly, he would have had little difficulty in accepting the geological theories and knowledge of today.

Mississagua River

The Mississagua River, a very clear, well-regulated stream draining a cluster of recreational reservoir lakes to the north, now exclusively enters the lake at the Buckhorn end, in a convoluted maze of islands and channels. The flow discharged down this river from the upstream Mississagua Lake dam effectively compensates for the reduced flow coming out of 'Lake Kawartha' or 'Great Buckhorn' via the Buckhorn dam, and brings the flow-through rate back to around 17 cubic metres per second (cms) or 600 cubic feet per second (cfs), as first seen entering Shadow Lake and again entering Pigeon Lake.

Those islands at the mouth of the Mississagua River were islands in the mainstream current before the canal construction. Owing to the rock ridge in the river that formed the second set of rapids at Buckhorn, some of the main Trent River flow was forced north and east through those islands, while picking up the Mississagua River mid-stream at the north end. Today, owing to higher water levels and an improved channel, the main river is able to make its way downstream without using those island back-channels, leaving them to the Mississagua instead.

With a small boat or canoe, a short hop over a short swift at the County Road 36 bridge allows navigation for 3 km along the east channel of the Mississagua river into the new Kawartha Highlands Provincial Park. About halfway along this route, the river splits around a large island, with the west channel conveying most of the flow over a series of rapids. The east channel is flat water for another kilometre or so. Like the loss of the west channel into Big Bald Lake (2008 Annual Report), this channel, which commences just below the Scotts Mills dam, is gradually disappearing. Both as a result of the high regulation of this stream through the large number and size of the upstream reservoir lakes, and through construction of diversion works within it by early loggers, this channel only occasionally sees Mississagua River flows of any significance, and is gradually filling in. It is becoming further obstructed and obscured by beaver activity. This channel, however, offers a better canoe route into the Kawartha Highlands Park, in that there are no portages here until one reaches the area just below the Scotts Mill dam. Certainly the primary reason for the gradual disappearance of this channel is those early loggers, who constructed a blind dam on this channel, presumably to avoid losing logs to its twists and turns. In a constricted location along the channel a short distance below the mill site, the deteriorating crib dam limits the ability of the river to utilize this channel. Recently, snowmobilers have demolished it to a degree in order to provide a drier crossing upstream. Perhaps this will allow the river to seek this route again to some degree.

In this area the river passes through another large marsh. Like the marsh at the bottom of the lost west channel, this one is certainly due to sediments brought down the east branch, mainly following the disastrous fires and subsequent erosion that followed the logging.

As part of the ongoing considerations for the expanded Kawartha Highlands Park, serious consideration might be given to making deliberate alterations to the landscape here, restoring the eastern mouths of the Mississagua River, in order to mimic the natural condition and compensate somewhat for the effects of the heavy controls that human activity has placed on this unusual stream.

'Buckhorn Creek'

Early records indicate the existence of a tributary stream draining into today's Lower Buckhorn and called 'Buckhorn Creek'. It was believed to be somewhat larger than the Squaw River. And yet today, no creek carries this name, nor can any nameless or otherwise named creek be found draining to the lakes. Where did this stream go? While it may be possible to obliterate a stream channel by human activities, a stream can never really disappear because its drainage area and the source of the flow remain and will cause the creek to reappear, provided of course that rain continues to fall. Was it fictitious, and never really existed? This would seem unlikely, as all the other creeks referred to are real. The name strongly suggests a location near Buckhorn. This in turn suggests that, since we have a lost channel near here, being that branch of the Mississagua that once flowed to Big Bald Lake, there may be a connection. But it seems unlikely that this was Buckhorn Creek, as it would more likely have been called Bald Creek.

Early, somewhat crude maps from 1822 also show two streams draining toward Buckhorn, one heading to or from the Bald Lakes, and a larger one evidently the Mississagua River, leading more or less to its current outlet. Perhaps this is a further clue as to Buckhorn Creek's whereabouts.

The east channel of this river picks up a large and currently nameless stream about midway between the Scotts Mills dam and Lower Buckhorn Lake. Perhaps this is Buckhorn Creek. If the original primary outlet for the Mississagua River was the Bald Lakes as is suspected, this would have left the east channel as the outlet for this nameless creek, thereby becoming part of this creek. We would thus have had the Mississagua River draining to the Bald Lakes (with a small portion draining back into the east channel) and the east channel appearing to be simply Buckhorn Creek.

Whatever the precise situation, it appears that the former various channels of the Mississagua River and the lost Buckhorn Creek are intricately connected.

Deer Bay Creek

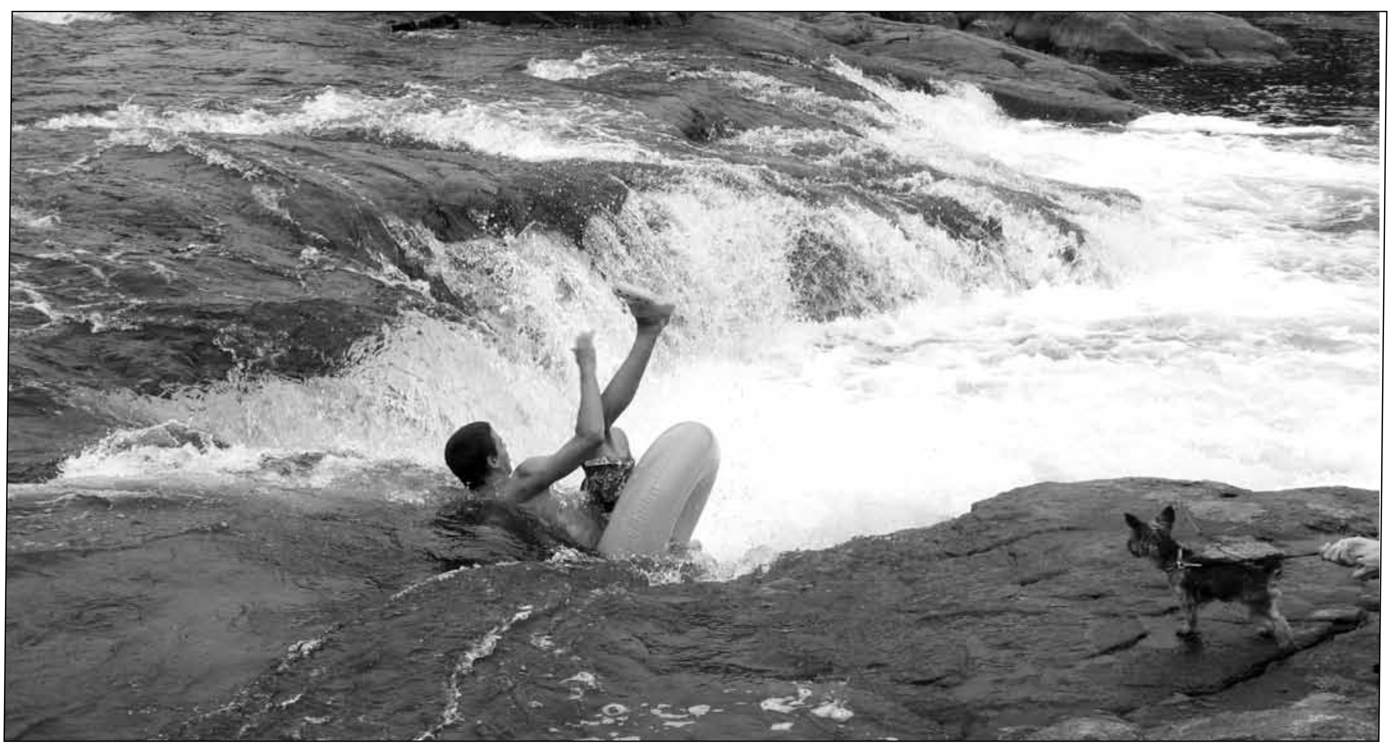
Deer Bay Creek, a tannic stream draining wetlands and small lakes to the north, many of which, like the Mississagua, are located within the newly expanded Kawartha Highlands Provincial Park, enters Lower Buckhorn just west of Wolf Island. This and the Mississagua largely compensate for evaporation from the Lovesicks. Only minor drainage comes in from the south via a couple of small nameless streams entering Deer Bay. The effects of isostatic rebound, a rising and tilting land phenomenon resulting from the retreat of the glaciers, is still having an effect on the Central Lakes. Given that their outlets are all to the northeast, where the land is rising faster than that to the southwest, the lakes of the central section – including especially Lake Scugog - are rising. Ultimately, the marshy south ends, themselves a product of the prior tilting of the landscape, will refill to a depth comparable to the balance of the lakes, although this will take centuries. The rate of submergence of the shallow and marshy south ends is in the order of two to five cm per century.

The dry summer weather net evaporation losses in the Central Lakes are about 4 cms (150 cfs), while perhaps 3.3 cms (120 cfs) is recovered via all the tributary streams, meaning that more water is lost to evaporation than can be replenished.

Burleigh Falls

At Burleigh Falls, the rushing waters from 'the Lovesicks' originally split around a number of islands, in a series of rapids and pools above the falls. Aside from the main dam, which handles most of the flow, a smaller side dam located on a side channel called Perry's Creek, along with a couple of blind dams further to the west, hold back the water of an expanded (Lower) Lovesick Lake. The original central channel has been utilized for the locks, and therefore no longer acts as a spillway. Yet another small channel sits forgotten between the main dam and the lock, and is mainly dry. A small concrete bridge once crossed it for the roadway which has now been replaced by the adjacent Highway 28. This channel would only function in the event of extreme high water spilling over the north end of the unfinished main dam. Recent construction of a store and gas bar has blocked most of this spillway and one hopes that a major flood someday does not catastrophically reclaim the passage.

As with the upstream Burleigh Chutes, the upper portion of what was once called the Burleigh Rapids has been submerged, and the waterfall, previously known as Peninsula Falls, splits around Burleigh Island and the one to the west and tumbles into the Lower Lakes.



Janet Duval

When the water level is low enough for safety, tubing over Burleigh Falls can be fun.

E.coli Bacteria Testing

By Kathleen Mackenzie
KLSA Vice-Chair

During the summer of 2009, KLSA volunteers tested 99 sites in 14 lakes for *E.coli.* Each site was tested up to 6 times over the summer.

Samples from 78 sites were analyzed by SGS Lakefield Research. Samples from the other 21 sites were analyzed at the Centre for Alternative Wastewater Treatment laboratory at Fleming College. This was the first year we have had access to this laboratory. Because of its convenient west Kawartha location, volunteers were able to submit samples from Balsam Lake and Shadow Lake.

The complete results and the description of our protocol can be found in Appendix E.

No news is good news

It is difficult to compare *E.coli* results year-to-year because, unlike phosphorus, some sites change. However, generally, the readings looked similar to those in previous years (see below). Throughout the summer, the vast majority of readings were below 20 *E.coli*/100mL, which is as low as can be expected in surface water. It is normal for a Kawartha lake to have one or two readings between 20 and 50 during the summer. As in other years, readings over 100 *E.coli*/100mL (Ontario's safe swimming limit) were rare, and limited to a very small number of sites.

Site Rating	Number of Sites	Comments
"Very clean": all readings less than 20 *E.coli*/100 mL	63	These are very low counts for surface water, indicating excellent recreational quality, and reflecting careful shoreline management by cottagers.
"Clean": 1 or 2 readings over 20 *E.coli*/100 mL	22	
"Somewhat elevated": 3 readings over 20 *E.coli*/100 mL	8	These sites are still considered to have excellent recreational quality. Reasons for slightly elevated counts include low circulation, presence of large populations of waterfowl or inflow from wetlands.
"Needing observation": More than 2 counts over 100, or more than 3 counts over 20 *E.coli*/100 mL	3	These sites are all at the mouths of creeks as they flow into the lake, and are not swimming areas.

Thanks go to our intrepid volunteers who braved the cool, wet days of 2009 to collect water samples and chauffeur them to their respective laboratories. Special thanks go to Rod Martin, who worked so hard to develop a new volunteer corps in Balsam and Shadow Lakes, and who coordinated the new testing program at the Centre for Alternative Wastewater Treatment.

Anita Locke

Canada Geese

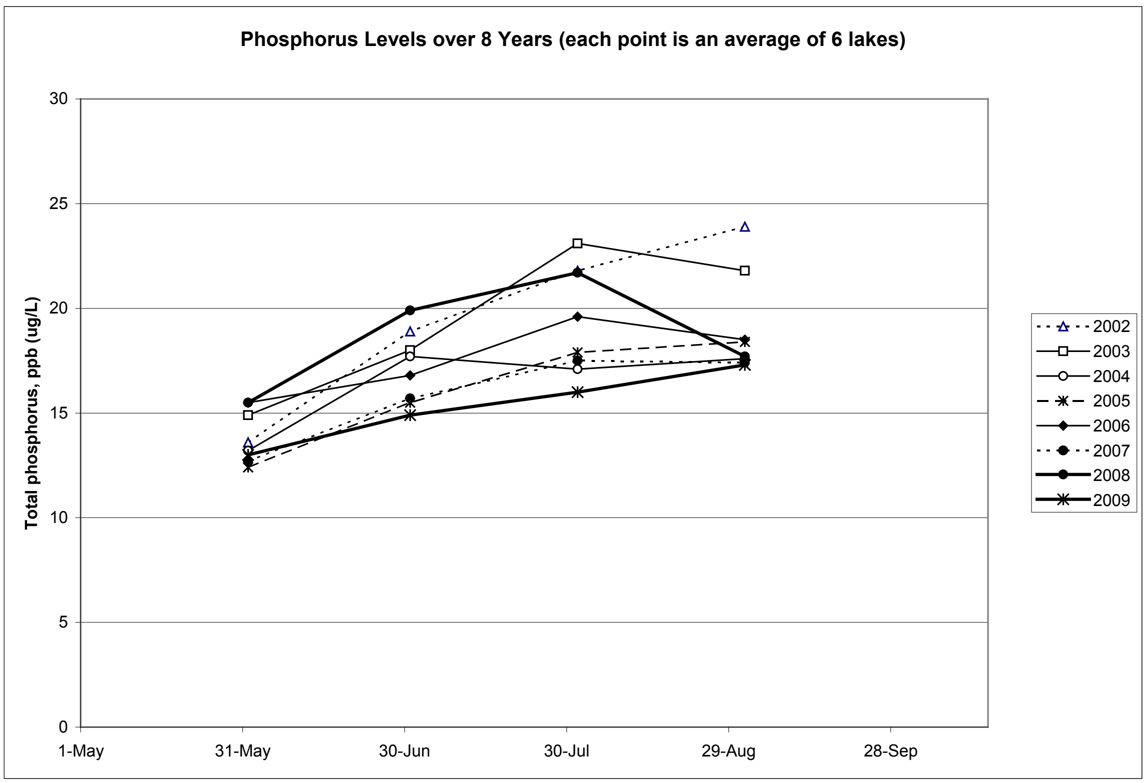
Phosphorus Testing

By Kathleen Mackenzie
KLSA Vice-Chair

In 2009, KLSA volunteers collected water samples from 42 locations on 14 lakes, from Balsam Lake downstream to Katchewanooka Lake. Sites were tested 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.

2009: A Low-Phosphorus Year

In 2009, phosphorus levels were somewhat lower throughout the Kawartha Lakes than in other years (see below).



What was it about 2009 that resulted in low phosphorus levels? The most distinguishing feature of summer 2009 was the lack of sun and warmth. As stated by Environment Canada, "For the second consecutive year, Canada's top weather story was about disappointing summer weather. …. This year it was …uncomfortably cold in central Canada, where it rained hard and often." (www.ec.gc.ca, Canada's Top 10 Weather Stories for 2009). Many people hardly swam due to the cold air and water. But why would that result in lower phosphorus levels? Let's do a quick review of phosphorus-determining factors.

Factors that may cause *higher* phosphorus levels in the Kawartha Lakes:

- Drainage from the south, where we find more people, more agriculture, and higher-phosphorus (limestone) geology and soil (see map p. 41) (south end of Sturgeon and Balsam, Chemong, Katchewanooka)
- Possibly disturbance of lake sediments by wind or boats
- Fertilizer use near shoreline

- Precipitation. This is a large contributor of phosphorus in neighbouring Lake Simcoe.
- Sewage treatment plant effluents
- Possibly septic system drainage

Factors that may cause *lower* phosphorus levels in the Kawartha Lakes:
- Drainage from the north, which is a less densely populated, less agricultural part of the watershed, with a lower-phosphorus (granitic) geology (e.g., Upper Stoney, Big Bald, Balsam)
- Low-phosphorus springs are thought to decrease phosphorus levels in White Lake
- Marl chemistry in lakes with a very high calcium carbonate level. Certain conditions (usually warmth and light) cause precipitation of the calcium carbonate, and phosphorus is co-precipitated. In lakes such as Big Bald and Sandy, marl precipitation results in very low phosphorus levels.
- Growth of aquatic plants. They may remove phosphorus from the water (see p.24).

Factors that may affect phosphorus levels *one way or another*:
- Biological cycles. As plants and animals grow, they absorb phosphorus. As they decay and die, they release it into the water.
- Storage into and release from lake sediments. This is very difficult to measure.

Cool, wet weather would increase the spring flush, which might lower phosphorus levels somewhat. However, that wouldn't explain why the phosphorus levels stayed low through August. Also, another cool, wet year, 2008, demonstrated relatively high phosphorus levels. Low phosphorus levels were probably caused by some combination of the above factors, but there is no obvious explanation.

Changing as we flow
As in previous years, phosphorus levels rose about 5 ppb between Balsam and Sturgeon Lakes. We hope to have more measurements in Cameron Lake next year to see exactly where this change occurs. Then, levels remained the same as water flowed down the Trent-Severn Waterway, with a slight drop in Stony Lake due to inflow from low-phosphorus Upper Stoney.

Low phosphorus lakes vs. higher phosphorus lakes
There are some low phosphorus lakes, whose levels rarely exceeded 10 ppb (Sandy, Upper Stoney, White, most of Balsam). Big Bald was a mid-range lake (not exceeding 15 ppb) and the rest of the lakes had at least two measurements exceeding 15 ppb. Differences between the lakes were not as obvious as in previous years.

Spring flush
As in previous years, apart from the low-phosphorus lakes, phosphorus levels tended to climb from June 1 to August 1, and then declined slightly to September 1. Low spring levels were thought to be due to the spring flush.

In general
2009 was a low-phosphorus summer season, from May to October, and in all the lakes. The usual patterns of rising and falling phosphorus were seen from month to month and from lake to lake, but less so than in other years.

Anita Locke

Painted turtles

Expanding Our Testing in the City of Kawartha Lakes

by Rod Martin
KLSA Director, Sturgeon Lake

The Kawartha Lake Stewards Association has been actively involved in monitoring water quality for a decade. From its beginnings in the eastern Kawarthas, this program soon expanded into the City of Kawartha Lakes. For a number of years, up to two dozen sites on Pigeon and Sturgeon Lakes were tested for *E.coli.* A larger number of sites in the City were involved in phosphorus monitoring through the Lake Partner Program, many by our same volunteers.

This past year our directors placed a high priority on expanding our *E. coli* monitoring in these important lakes at the top of the Trent-Severn Waterway. Support from the City of Kawartha Lakes made it possible for us to cover the laboratory cost of each new site for the season. Members of the Balsam Lake and Shadow Lake Associations who had attended our spring meeting expressed an interest in the program and became instrumental in establishing six new sites on Balsam Lake and two new sites on Shadow Lake. It was a pleasure to work with these new volunteers and to feel their enthusiasm for the protection of our water quality. We quickly established a fuel-saving hand-off system for transporting samples to the Centre for Alternative Wastewater Treatment (CAWT) at Fleming College in Lindsay. As the season progressed we attended meetings of several property owners' groups and have already made plans to add a number of new sites next year. Some valued friendships were made in the process.

The decision to use the CAWT lab for samples collected in the upper lakes was a very good one. Not only have we saved time and money in transport, but we have met another dedicated group of like-minded people who have been a great help to us. These professionals will no doubt be a valuable resource to our organization as we continue our expansion.

As a result of this growth, our relationship with the Kawartha Conservation Authority has grown. We certainly share similar concerns and can be of assistance to each other in accomplishing mutual objectives. We have been delighted with the help that has been offered to us this year. Kawartha Conservation has conducted a water quality program called Water Watch for a considerable time, and has offered to share its expertise and data with us. It is our hope that our efforts will be complementary and that the partnership will continue to grow.

As spring approaches we eagerly wait for our spring meeting in Bobcaygeon, when we hope to meet more interested groups and hopefully continue to expand our testing in the upper lakes.

Anita Locke

Damsel fly

Rethinking the Phosphorus – Aquatic Plants Connection

By Pat Moffat, KLSA Past Chair

Do excess nutrients in lake water, such as phosphorus and nitrogen, stimulate the growth of aquatic plants (aka water weeds)? The answer to this question seems simple and obvious. For years KLSA, like most volunteer water watchers and government agencies, has assumed that if we can somehow decrease the amount of nutrients entering the Kawartha Lakes, the result will be less weed growth.

But is this really true?

In November 2009, KLSA's scientific advisor, Dr. Eric Sager, attended the North American Lake Management conference in Hartford, Connecticut. There he was introduced to some thought-provoking research by three scientists at the Department of Fisheries and Aquatic Sciences at the University of Florida at Gainesville and the Florida Lakewatch program. Their results suggest that it's the nutrients in the sediments that encourage aquatic weed growth, not the nutrients in the water itself. The nutrients in the water encourage the growth of algae, particularly phytoplankton, the tiny floating pollen-like algae that turn lakes an unsightly green. The aquatic plants, on the other hand, actually appear to remove nutrients from the water, which reduces the amount of phytoplankton and makes the water clearer.

What they did

Scientists Roger Bachmann, Mark Hoyer and David Canfield set out to determine "whether the concentrations of phosphorus and nitrogen in the water of Florida lakes determine the abundance of aquatic plants." From 1983 to 1999, they sampled the aquatic plants from 319 Florida lakes, recording several important factors: the percentage of lake surface covered by floating and emergent aquatic plants (e.g., water lilies and bulrushes, respectively), the percentage of lake water volume "infested" by aquatic macrophytes, the estimated wet weights of the plants and the species of plants present. Then they used water monitoring data from the Lakewatch volunteer monitoring program to correlate nutrient levels in the lakes with plant growth. (See how useful volunteer water monitoring is!) The lakes they studied were located throughout the state and covered the gamut from near-pristine to high rates of shoreline development.

What they found

When the scientists analyzed their results over those 16 years, they were surprised. "We found no good relationship between the amounts of plant nutrients in lake water and the abundance of aquatic plants," they wrote. "There was no statistical correlation between the two variables."

They concluded that "aquatic plants in these Florida lakes do not respond to nutrients in the water in the same way that the phytoplankton do." Why not? The authors speculated that aquatic plants get their major nutrients from the lake sediments rather than from the water itself, which can explain why some lakes can have virtually no algae, but support a healthy population of aquatic plants. The plants are in effect feeding on the nutritious sediments.

Even more interesting, the scientists found that the concentration of phosphorus in those lakes that had submerged aquatic plants was lower than in those lakes that had no aquatic plants! "This is the opposite of the theory that higher total phosphorus levels would lead to higher aquatic plant levels," the authors stated. As to why this was so, they speculated that many aquatic plants, as well as the algae that grow on their surfaces (periphyton), actually remove nutrients from the water, which reduces chlorophyll (phytoplankton) in the water and in turn increases water clarity.

The implications

The Florida scientists relate their findings to the concept of "Alternative Stable States." This is an idea we have written about in previous KLSA annual reports. (See for example, "The Battle between Weeds and Algae" by Bev Clark, formerly coordinator of MOE's Lake Partner Program, on p. 27 of KLSA's 2004 Report.) According to the Alternative Stable States theory, shallow lakes come in two different "states," depending upon whether aquatic plants or algae dominate. If the plants are most abundant, then "a significant part of the lake" will be taken over by plants, and the water will be clear. If the lake is dominated by phytoplankton, then the water will be turbid. These two states are "stable" because once established, a lake resists changing over to the other state. "In the macrophyte [aquatic plant] state the aquatic plants out-compete the phytoplankton for nutrients and also prevent wind-driven sediment resuspension," the authors conclude. "In the algal state the turbid waters prevent sufficient light from reaching the lakebed to allow substantial growths of macrophytes." It takes "some major event" for a lake to switch from one state to the other.

An example of a lake that has flipped from one state to another is Lake Baldwin, near Orlando, where grass carp were introduced to control the aquatic vegetation. The fish did such a good job that within only two years, the aquatic plants went from occupying 69 per cent of the lake to occupying zero per cent! Once the plants were gone, however, the phosphorus content of the water tripled, the green phytoplankton increased by 5 times, and the Secchi depth of the water decreased from a clear 5 metres to a murky 1.5 metres. Obviously, introducing carp to this lake, and removing all the aquatic plants, qualified as a "major event."

There is much in this Florida study that may be relevant for our Kawartha Lakes. In fact, when Eric Sager sent it around as an attachment to the KLSA Board, an email discussion ensued. Here's a short excerpt:

Kevin Walters: We suspect that we have high-nutrient sediments owing to a century of sewage discharges and agricultural runoff, not to mention natural deposits in a basin with glacial deposits of limestone origin. However, we do know that there is in fact a correlation between P (phosphorus) and weeds, since in our north-central southern Ontario (especially Haliburton) lakes where P levels are usually less than 10 ppb, we have few to no weeds at all in these lakes, and the lake bottom deposits are as nutrient poor as the water, since the sediments are mostly derived from gneissic or granitic rocks. So, if we could reduce the nutrients in the sediment as well as the water, weed growth will go down. With P reductions in the lake water, we will see a gradual loss of P in the sediments as the weeds take it up and redistribute some of it to the water as they die, but this may take a long time. Perhaps the best thing we can say about the weeds is Grow, baby, grow!, since they are, in the process, removing that excess P from the sediments and will eventually exhaust the supply. Short-term pain for long-term gain.

Eric Sager: I agree, but even in the low P lakes (like we have on the Shield), those sediments have the potential to support high levels of aquatic plant biomass. (Just ask the folks at Kasshabog where total P is around 3-5 and they've got fanwort populations that far exceed the plant growth that we have in the Kawarthas.) The other interesting note is that they [the Florida scientists] refer to the periphyton (algae attached to the plants) as being more connected with Total Phosphorus in the water column.

Kathleen Mackenzie: Over the years, I have repeatedly heard limnologists state that aquatic plant growth is not related to nutrient levels in the water (though algal growth generally is). In an article by two Quebec scientists, the predictor for aquatic plant growth in temperate lakes was found to be most closely correlated to the slope of the lake bed! They reasoned that slope determined the stability and type of sediment, both important for plant growth. It is interesting that this Florida article states that plants do not get their nutrients from the water, but plant growth removes nutrients from the water! This seems like a paradox, but it probably means that the periphyton growing on the surface of the plants is removing those nutrients. So in some ways maybe it would be a GOOD idea to harvest some aquatic plants at the END of the summer. Let them grow, thereby pulling the nutrients out of the water and sediment, and then harvest them just before they start to die and release their plantily (as opposed to bodily!) minerals back into the lake and sediments. However, it seems to me that harvesting plants at the BEGINNING of the season is a BAD idea – for this could increase nutrient levels in the water and therefore algal growth.

For the complete article, see Roger W. Bachmann, Mark V. Hoyer and Daniel E. Canfield, Jr., Aquatic plants and nutrients in Florida lakes, in *Aquatics*: 26 (3) 4-11 or follow this link:
http://fishweb.ifas.ufl.edu/Faculty%20Pubs/CanfieldPubs/Aquatics2004LR.pdf

The Quebec study that Kathleen Mackenzie refers to is: Duarte, C. and Kalff, J., 1986. *Limnol. Oceanogr.* 31(5). 1072-1080.

A Study of Storm Sewer Outfalls in the City of Kawartha Lakes

This is a condensed version of a report commissioned by KLSA and produced by students of Fleming College in the third year Ecosystem Management Technology program, Credit for Product course. Kathleen Wylie, Stephanie Theriault and Mark Gaizauskas conducted the study between September and December 2009 under the supervision of Professor Sara Kelly. The full, scholarly version of the report with citations is available at http://klsa.wordpress.com.

Introduction

In urban environments, many different contaminants run off lawns, streets and sidewalks during rainfalls. These contaminants then flow into a storm sewer system and usually end up in water bodies, with little to no filtration along the way. The Ministry of the Environment has designated storm water contamination a significant problem for watersheds that include urban areas. Two of the most significant contaminants are phosphorus and *Escherichia coli* (*E. coli*), which have been considered in this study.

E. coli can have many sources, including agricultural activities, overflow from sanitary sewer systems, failing septic systems, and feces from domestic pets. *E. coli* is not naturally found in water, and cannot survive long once outside of the intestine of the organism. This means that any *E. coli* found in water samples is from recent contamination.

If water is not treated for *E. coli* before drinking, humans can become severely ill, with symptoms such as bloody diarrhea, abdominal cramps and fever. In some cases, it can even lead to kidney failure and death. A guideline published by the Federal-Provincial-Territorial Committee on Drinking Water specifies that *E. coli* should not be present in drinking water, and that, for recreational water "the geometric mean of at least five samples, taken during a period not to exceed 30 days, should not exceed 2000 *E. coli*/L (or 200 *E.coli*/100mL). Resampling should be performed when any sample exceeds 4000 *E. coli*/L."

Phosphorus occurs naturally in rocks, soil, animal waste, plant material, and the atmosphere. It is also present in fertilizers, which are used in agriculture and home gardens and lawns, found in discharge of industrial and municipal waste, and in surface water runoff from residential and urban areas. Human health is not threatened directly by phosphorus, but it can promote the growth of toxic algal blooms, which affect the potability, taste, odour and colour of water. Overall, excess phosphorus can contribute to the eutrophication of water bodies.

Because phosphorus has no direct effect on human health, there are no set guidelines for acceptable levels found in drinking water. There also are no national guidelines for phosphorus for the protection of aquatic life. A framework for the management of phosphorus in freshwater systems is being developed by the Canadian Council of Ministers of the Environment Water Quality Task Group to address the issue.

The location of the storm water outfall study was the town of Lindsay (City of Kawartha Lakes), which has a population of 16,930. The bedrock is primarily limestone and alluvial plains. The Scugog River runs south to north through the east end of town. The majority of the storm water outfalls drain into the Scugog River, so the outfalls chosen for sampling are located at different points along the river.

Most of the outfalls drain storm water from residential locations, and are found at the end of streets. There are also outfalls draining storm water from the downtown streets. The Lindsay storm water system is separate from its sanitary (sewage) pipes, as opposed to a combined system. This prevents mixing of raw sewage with storm water runoff.

Purpose and scope

The purpose of this study was to determine the amount of phosphorus and *E. coli* found in runoff from storm water sewer outfalls in Lindsay. The results will be used to make recommendations regarding additional studies in the area, and treatment of storm water before it can reach large water bodies such as the Scugog River. Samples of storm water runoff were collected from eight locations and tested at the Centre for Alternative Wastewater Treatment lab at Fleming College in Lindsay.

Method

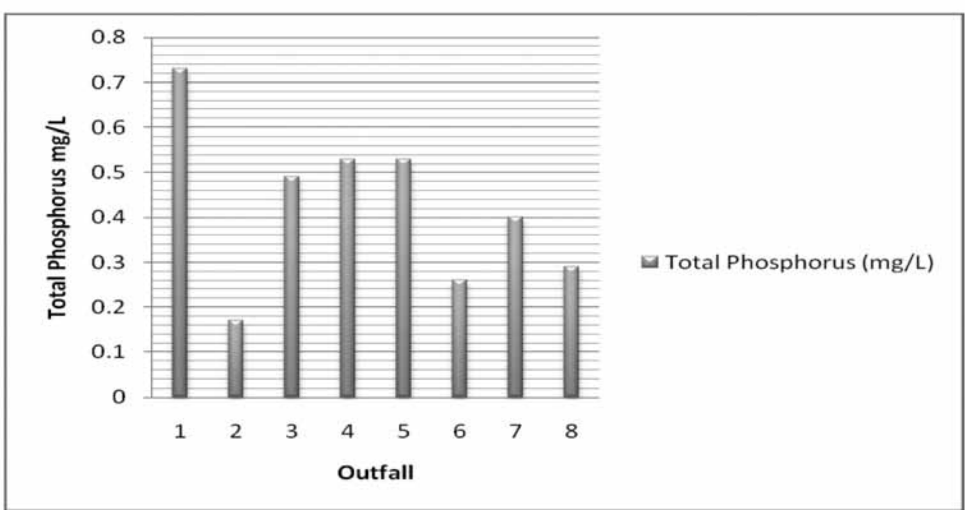
The City of Kawartha Lakes provided maps of the storm sewer system. From these maps eight outfall locations within the city were chosen, varying from low traffic urban sites to high traffic urban sites and from residential to commercial. These locations were picked as representative of the total outfalls, for their size, flow rate and land use.

Outfall #	**Location**	**Land Use**
1	South end of Lindsay, where Lindsay Street crosses the Scugog. This outfall is upstream of the others.	Agricultural, Cemetery
2	End of Mary Street draining east	Residential
3	Drains west from Russell Street	Residential
4	Grassy area north of Riverview Road	Residential, Commercial
5	Old site of the rail station, north east of Kent and Lindsay Streets	Commercial
6	Along the bike path north of Kent Street	Commercial
7	Along the bike path north of Kent Street	Commercial
8	North end of city near Pottinger Street, draining east into the Scugog, and downstream of the other sites.	Residential

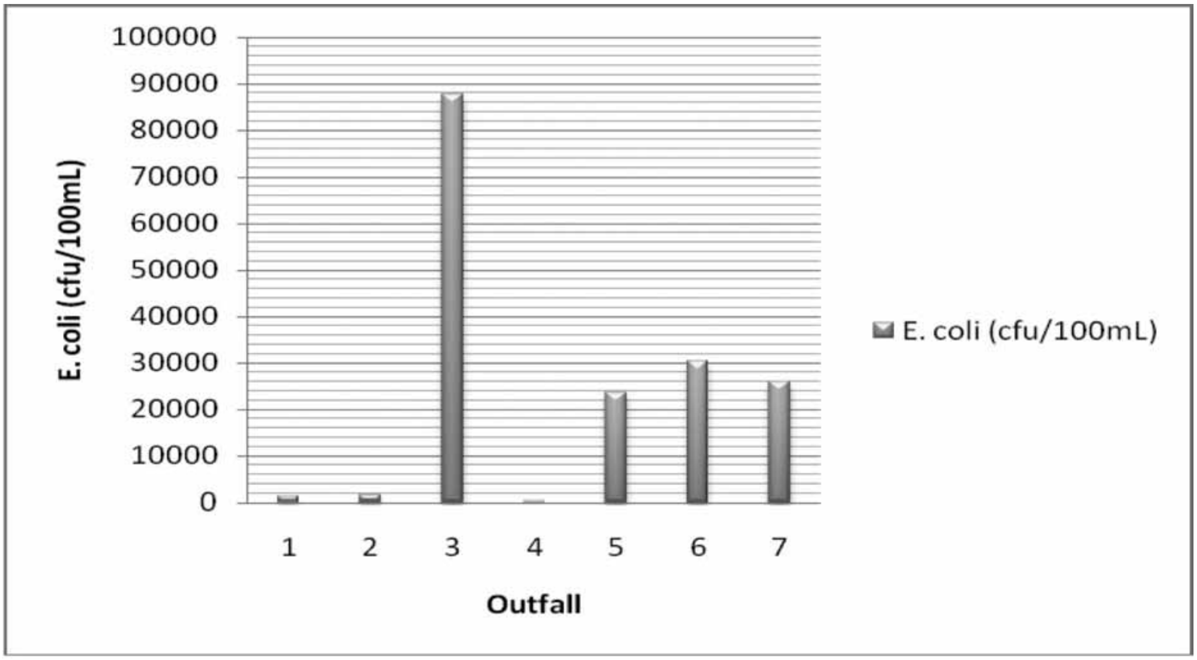
Samples were collected at each outfall within the first hour of a major rainfall event and tested for phosphorus and *E. coli* levels at the Centre for Alternative Wastewater Treatment at the Frost Campus at Fleming College, which is certified to test phosphorus and *E. coli* by the Canadian Association for Laboratory Accreditation.

Results

Total Phosphorus in the storm water samples



E. coli levels in the storm water samples



Note: cfu = "Colony Forming Units" or cells
Outfall 8 had a count of 2,000,000 *E.coli*/100 mL, making it too significant of an outlier to include in the graph.

Discussion

Outfall # 1, located very close to the graveyard on the south side of Lindsay, feeds into wetland plants on its way to the Scugog River.

It was predicted that the runoff would show average levels of *E. coli* and phosphorus. Since the testing was conducted in the fall it was hypothesized that lower levels of phosphorus would be found because fertilizers, which are a large source of phosphorus, are typically used during spring and summer months. The city also contains forested areas and some natural buffers and small wetland areas around the Scugog River, which help trap contaminants before they reach the water, and also filter runoff. Phosphorus levels are deemed average when they are between 0.006 to 0.561 parts per million (ppm). For analytical purposes these parameters were used.

E. coli is usually a serious problem when there are heavily populated wildlife areas, water fowl or domestic animals. Non-permeable ground causes runoff concentrations to rise drastically. Paved areas and turf grass are not very efficient at breaking down wildlife feces, whereas tall grasses and natural buffers are significantly more efficient. During conditions of saturation-excess, *E. coli* is quickly transported across the surface of saturated soils, and does not have much of an opportunity to unite with the soil matrix. Since the City of Kawartha Lakes has a healthy level of riparian plant life and natural buffers around the river, it was predicted that *E. coli* would be inhibited from flowing freely across the soil surface, and the levels should fall within the average concentrations of *E. coli* in sewer outfalls.

According to the Federal-Provincial Working Group on Recreational Water Quality, in water used for recreation, concentrations of *E. coli* should not exceed 200 *E. coli*/100 mL (Federal-Provincial Working Group on Recreational Water Quality, 2009). Drinking water should contain zero *E. coli* after being put through a filtration process.

The information being used as comparisons for average levels of phosphorus and *E. coli* is for water bodies, not

Outfall # 2 at the end of a residential street drains directly into the Scugog River.

outfall water, so it is expected that the outfall numbers may be slightly higher and still in a relatively normal range.

The test results disproved our predictions for *E.coli*. Five of the storm water outfalls tested very high for *E.coli*, with outfall eight having extremely high *E.coli* levels (2,000,000/100mL). One study states that *E.coli* counts in storm water usually range from 1,000 to 10,000 units per 100 mL, and that higher counts such as 100,000 per 100 mL could indicate the presence of cross-connections with sanitary sewers. Outfalls number three, five, six, seven and eight all fell well above the recommended range.

Test results confirmed our predictions for phosphorus. The first storm sewers showed slightly high levels of total phosphorus. The levels used for comparison were those deemed acceptable for bodies of water such as lakes and rivers, so having slightly higher levels in runoff was to be expected. This shows that the Scugog River has an acceptable amount of phosphorus. It is important to maintain or lower these levels, to prevent the lake from becoming eutrophic (too rich in nutrients). If this study was conducted in the spring and summer months, the levels would most likely be higher due to high usage of fertilizers.

Outfall # 3 on the east side of the river flows through a channel to drain into the Scugog.

When interpreting the results, we faced the problem of not having actual runoff averages from other studies. Also, sampling was not started until 30 minutes into the rainfall and finished one hour into the rainfall. It is recommended that all samples should be collected within the first 30 minutes of the rainfall, to collect the highest and most accurate concentrations in runoff. Further research needs to be done to back up the test results. In the future all areas should be tested at the same time during the rainfall; this would help remove bias from individual samples.

Outfall # 4 located by an open area of turf grass drains directly into the Scugog River.

Recommendations

Several of the outfalls showed high levels of phosphorus or *E. coli*. The general consensus from the literature is that phosphorus and *E. coli* tests should be conducted year round for several years, in order to better understand the potential severity of the issue. Therefore it is recommended that the Kawartha Lake Stewards Association follow up this preliminary study with a more complete study.

The creation of more **natural buffers** around outfalls is also recommended. In approximately half of the outfalls studied, there is adequate space to build **constructed wetlands** before the runoff is introduced into the Scugog River. This is also the most natural way of solving this problem, and will mitigate other pollutants from entering the Scugog River while having the potential to be aesthetically pleasing. This technique appeared most often in the literature and seemed to have a high success rate with a relatively low cost. This will not remove all of the *E. coli*, but will lower the

Outfall # 5, very close to Kent Street, drains into a holding area that leads to the river.

Outfall # 6, very close to Kent Street, flows directly into the Scugog.

concentration. It is also a natural approach that requires little follow-up work to maintain effectiveness.

Bio-retention ponds are very similar and also an effective method of removing phosphorus and *E. coli*. A study in North Carolina showed that *E. coli* levels were lowered by 71% because of the use of this technique.

Sand filtration is another possible technique for removing phosphorus and *E. coli*. For those storm sewers that do not have the room to construct wetlands, this should be considered. This method requires very little area and is very cost effective.

It is also recommended that **the source of *E.coli* on outfall # 8 be researched further**. Possibilities include a cross-connection with a sanitary sewer or a leaky sewage pipe infecting the area that drains into this outfall.

During sampling it was also observed that there is a good possibility of high levels of chemical pollutants and sediment loading during rainfall events. This may also be causing problems for the water body. It would be an asset to have this data as well to get a better analysis of the health of the river and the runoff quality.

Outfall # 7, located near the city core, has cement blocks to alter the flow leading to the Scugog River.

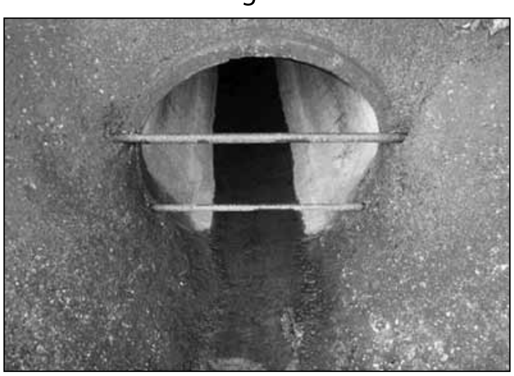
Conclusions

Understanding the effects of storm water on local water bodies is always important. In the area where this study was conducted, the effects are especially important because the town of Lindsay draws its drinking water from the Scugog River, and it is also used for recreational purposes.

In urban areas of Ontario, beaches are seasonally shut down because of high levels of *E. coli*, which may cause health problems for people who use the water for recreational activities. This also applies to the Kawartha Lakes. If there are high levels of *E. coli* and phosphorus, this should be publicly noted and corrected.

Excess phosphorus loading causes plankton and algae to grow exponentially. This will eventually cause aquatic organisms to suffocate because of the large amount of oxygen required to decompose algae. This will also make the body of water become less attractive because the taste, colour, and odour will change.

The results of testing showed that there were extremely high concentrations of *E. coli* in five of the runoff samples. They also showed that one outfall had above average levels of phosphorus. This study should be followed with a more thorough and in-depth look at the storm water in Lindsay, as no data previously existed to show whether or not this is a significant and ongoing problem. The outfalls need to be monitored year round, to understand the complete cycle of water and contaminants that move through the storm water system. Only then can the impact be fully diagnosed and only then can a proper solution be put forth.



Outfall # 8, the furthest north, flows east directly into the Scugog River.

Monitoring Kawartha Sewage Plants

By Kevin Walters, KLSA Vice-Chair

Early studies

In 2006 we had some students at Fleming College in Lindsay, under the tutorship of Sara Kelly, undertake a study of the sewage plants discharging into the Kawartha Lakes. This excellent program allows groups like ours the opportunity to undertake small studies that might take a semester to complete, for little or no budget. Here keen teams of 3 to 4 students are matched with 'employers' for the benefit of all concerned.

Our project for that year required the students to get statistics on rated capacity of the sewage plants, typical output quantity, and a few key parameters such as phosphorus levels. The results of that study indicated that there have been vast improvements made over the years, especially at Lindsay, but some issues remained. Such was the case with Bobcaygeon, where phosphorus discharges were excessive and the effects were seen as producing algal pea-soup conditions in Pigeon Lake.

Overall, the need to reduce the excessive weed growth seen recently, as well as, perhaps, the unappealing growth of the algae *Mougeotia* called for a reduction in controllable phosphorus.

Phosphorus outputs in 2008

As a follow-up, we studied reports from a few sewage plants in 2008. What we saw was that the Lindsay plant continued to remain well under its reasonably stringent permitted requirements, especially for phosphorus. The two side-by-side Bobcaygeon plants did likewise, but not as well, and their requirements are not nearly as tight.

Lindsay

- Lindsay is allowed to discharge 0.2 mg/L of phosphorus in its effluent to the lakes, at the mouth of the Scugog River.
- In 2008, the overall average was 0.049 mg/L, just under a quarter of what they are allowed.
- Lindsay's population continues to grow however, and the total amount of phosphorus may be going up.
- The removal rate was 97% and the total loading to the lake was an average of 0.866 kilograms of phosphorus per day.

Bobcaygeon

- Bobcaygeon is allowed to discharge 1.0 mg/L of phosphorus at either plant, which is five times the allowable concentration of Lindsay.
- In fact it discharged about 0.34 mg/L overall on average from both plants.
- The overall removal rates were about 86 and 90% respectively, and the total average phosphorus loading rate was 0.70 kilograms per day.
- This is close to the amount of Lindsay's contribution and yet Lindsay treats about 15 times the sewage volume. Clearly, Bobcaygeon's is a relatively large contribution in comparison, and one that calls for major improvement.
- This may also be an important contributor to the higher levels of phosphorus we now see in Pigeon Lake and downstream.

Lakefield

- This plant, which is actually an enhanced lagoon system, produces an excellent quality effluent with a discharge of phosphorus in the 0.09 mg/L range.

Fenelon Falls

- We await the Fenelon report in order to review and comment.

If Lindsay and Lakefield can do it, why not the others? We will monitor this situation and see what can be done to improve it.

Phosphorus levels are quite high in the north end of Sturgeon Lake, quite similar to the rest of the lake. It might be the result of sewage plant issues.

How Does a Sewage Treatment Plant Work?

By Pat Moffat, KLSA Past Chair

On a cool Saturday morning in the fall of 2009, a clutch of KLSA Board members and a few spouses stand on the damp grass outside the pump house at the Lakefield Sewage Treatment Plant on the first stage of our tour with the plant's senior operator, Chris Norman. Chris has come in on his free time to show us the inner workings of the plant and the lagoons and to answer our questions.

The Lakefield plant was built in 1972, Chris explains, and serves the 3000 people who live in the town. Prior to that, Lakefield was on private septic systems. Each day, about 300,000 imperial gallons of wastewater – or almost 1500 cubic metres – flow into the pump house for treatment. As much as 99 per cent of that is water only. The challenge in operating a sewage treatment plant is to remove the one per cent of solids and potential pollutants and to make sure that the treated water that enters the nearby river or lake is clean. The Ministry of the Environment defines just how clean the end-of-pipe water must be in 'Certificates of Approval'. and those numbers vary from plant to plant, depending upon their capacity and whether they discharge into environmentally sensitive waters.

In Lakefield's case, the MOE requires that the plant discharge no more than 0.5 milligrams of phosphorus per litre of water each day, for a daily total loading of 0.8 kilograms. In addition, the plant must not discharge concentrations of *E.coli* bacteria greater than 200 organisms per 100 millilitres.

The Lakefield plant does an excellent job at meeting these limits. Chris Norman and a co-worker, the only employees at both the Lakefield sewage treatment plant and the drinking water plant, manage to achieve an average phosphorus discharge of 0.09 mg/L, a total daily loading of 0.12 kg, and *E.coli* numbers below 4. How do they do this? How does this plant work?

The pump house

Walking into the pump house, which is reverberating loudly with the sound of rushing water, we peer down 3 dark metres to watch the wastewater entering the plant. It comes in by gravity alone from the town's pipe infrastructure, without any pumping. Simple grates catch most of the debris. We can see material such as rags clinging to the grates. Chris had explained that there is a lot of leakage into the system. In the drinking water pipes, water tends to leak out, but in the sewage system, it leaks in. In fact, Chris had said, "Potable drinking water goes into the houses, but during a winter rainfall we can get four to five times that much coming into the sewage treatment plant. That's 400 to 500 per cent more water coming out than goes in!" That's because of downspouts connected to the sewer pipes, leaking pipes, and sump pumps. Water conservation measures such as low-flush toilets can help this problem, he added.

When the incoming wastewater moves beyond the grates, a chemical goes in – aluminum sulfate – which precipitates out most of the remaining solid matter. Then the water is pumped up the hill in a large pipe to the plant's lagoons. Before leaving the pump house area, we take a look at the huge generator, a big-ticket item that was installed in 1991 to ensure the plant continues working during power outages.

The lagoons

A short ride up the hill takes us to the settling ponds, the lagoons where the solids in the wastewater settle out. Lakefield's plant is technically a 'secondary' treatment plant because it uses a chemical to clump the particulate matter, it aerates the lagoons, and uses both aerobic (with oxygen) and anaerobic (without oxygen) processes. In contrast, the old 'primary' plants had only settling lagoons, with no chemicals or aeration, while a 'tertiary' plant uses additional filters and disinfection after secondary treatment to achieve extremely clean effluent. The large plant in Peterborough, which is also technically a secondary plant, uses mechanical action to accelerate the sewage processing time. "The Peterborough plant takes a day and a half to process the same amount of water that we do here in three and a half months," explains Chris, with a wave of his arm towards the two lagoons.

If you didn't know this was a sewage treatment operation, you might think you were looking at two natural ponds, or perhaps one large one with a dirt causeway dividing it in two. We see ducks paddling near a bed of bulrushes, and we cannot detect a sewage odour at all. Chris says that turtles, foxes, cranes, herons and osprey all visit these ponds, although there are no fish in them, and while the bacterial sewage treatment process produces methane and hydrogen sulfide, there is rarely a smell stronger than a natural marsh.

Mike Stedman

John Ambler, Ann Ambler, Rob Little, Donnie Stedman, Chris Norman, Kathleen Mackenzie, Pat Moffat.

When the water containing the aluminum sulfate is pumped up the hill, it enters the first pond, which is about 3 metres deep. Air is pumped in, providing oxygen, which digests the sewage and produces methane and hydrogen sulfide gas as by-products. Submerged curtains in this pond move the water along in a snake-like fashion. In the frost-free months, water exiting this pond enters the second lagoon, which is about 2 metres deep. Here, anaerobic bacteria continue to digest the sludge on the bottom and 'polish' the water, or finish the sewage digestion process. Water generally remains in the first lagoon for two months, and in the second for another six weeks.

Sewage sludge of course builds up slowly on the floors of the pond. This can be dredged out and dried. But after 30 years of the plant's operation, Chris says there is still no need to remove it.

The final stage in the treatment process is ultraviolet (UV) light disinfection. Water leaving the second lagoon enters a small building nearby, where UV light tubes – similar to those in cottage pump houses, but much larger and more expensive – kill bacteria as the water moves through troughs. From there, the water enters the final large pipe that carries it by gravity down the hill and into the Otonabee River just downstream of Lakefield.

The water leaving the treatment plant is very clean. "The phosphorus coming into the system is between 3 and 6 milligrams per litre *[3000 to 6000 ppb]*, and it exits at less than 0.1 *[100 ppb]*" says Chris. "So we're taking a lot out." The *E.coli* levels of 0, 1, 2, or 3 per 100 millilitres at the end of the treatment process are, as we KLSA water testers know, better than many of our test sites on the Kawartha Lakes.

There's just one thing about the sewage treatment process that worries Chris Norman, and he doesn't know what can be done about it. "The high pharmaceutical drug use today does not bode well for our water," he says. "The human body does not use 100 per cent of ingested drugs – the residuals are excreted in human waste and wind up at wastewater treatment plants. Chemical precipitation and UV disinfection will remove or inactivate some of these drugs but not all. The remainder goes back to the water course, which then becomes drinking water for a downstream community." It's a vicious circle, Chris emphasizes: the concentration of drugs in our drinking water is steadily rising, and the technology to solve the problem is not yet developed.

Note: Since our fall visit, a second pipe is being installed at the Lakefield plant, for a cost of between $1 million and $2 million, to carry pumped wastewater up the hill to the lagoons. The two pipes will offer redundancy in the system and a better pumping capacity, which will help deal with the extra water during rain storms.

Chris Norman is available to give tours of the Lakefield plant to the public. Tours can be arranged through Peterborough Utilities.

Wild Rice in the Kawarthas

By Deryck N. Robertson

Introduction

Wild rice (*Zizania spp. L.*) is the only native cereal crop found in North America. Historically, it has been important socially, culturally and economically for First Nations for over 1000 years. It is an important food source and habitat for water fowl, and was once widely distributed over most of eastern North America. The grain has been known by many names, such as Canadian rice, Indian rice, water oats and as "manonin" (translated as "good berry"), which was derived from the Menominee tribe.

Throughout its range, the distribution of wild rice was much greater before European settlement. In the Kawarthas, the construction of the Trent-Severn Waterway raised water levels in lakes that sustained extensive wild rice beds. Charles Fothergil, a naturalist living in the Rice Lake area, stated that 10,000 bushels were harvested each year in the early 1800s by First Nations people from that lake alone. Once the dam was built in 1838 at Hastings, the water level rise in the lake (by 1.8m) eliminated many of the rice beds. Further damage was caused by a hurricane in 1928 and the introduction of carp (*Cyprinus carpio*) in the 1950s.

Through archaeological evidence, it is believed that the rice growing in the Trent River system was brought to the area from New York State by early inhabitants. Core samples show the emergence of *Poaceae* or wild grass pollen around 2100 years ago and archaeological sites have been found to be associated with historic wild rice beds. Wild rice can still be found throughout the Kawartha Lakes area in many of the water bodies, including Rice Lake, Little Bald Lake, Pigeon Lake, Mitchell Lake, Canal Lake, Cameron Lake, Sturgeon Lake, Lake Scugog, Chemong Lake and Buckhorn Lake.

More recently, anecdotal evidence suggests that stands of wild rice have been increasing in some of the lakes throughout the Kawartha Lakes region in areas where they once thrived. This resurgence has been problematic for many shoreline residents, leading to conflicts between landowners, governmental agencies, environmentalists, and First Nations people who continue to harvest this natural resource for its seed.

Many questions have been asked as to why some populations are rebounding while those in other locations in the Kawarthas are not. This paper will explore the ecology of wild rice, highlight some of the reasons for the original decline, and suggest possible reasons for the resurgence.

Taxonomy of wild rice

Wild rice is an annual grass (Family: *Poaceae*) that must grow from seed each year.

It belongs to the same family as Asian rice (*Oryza sativa*). Globally there are four species of wild rice belonging to the genus *Zizania* including *Z. texana* (Texas wild rice, found only in Texas) and *Z. Latifolia*, found only in Asia. In Canada there are two distinct species of wild rice described by Dore (1969): *Z. aquatica L.* (annual or southern wild rice) and *Z. Palustris L.* (northern wild rice). These species are further divided into two varieties each: *Z. aquatica L. var. aquatica, Z. Aquatica L. var. brevis* (Fassett), *Z. Palustris L. var. palustris*, and *Z. Palustris L. var. interior*. Northern wild rice (*Z. Palustris L. var. palustris*) is the most common species found in Canada, and more specifically, in the Kawartha Lakes Region. The range of this species has been extended by plantings, much of which is attributed to early explorers carrying seeds with them during their travels.

Northern wild rice (*Palustris L. var. palustris*)

Ecology

Dore (1980) describes northern wild rice as an emergent, annual grass that stands 0.6-1.2m above the water with leaf blades between 0.4 and 1.2cm wide. It also has the largest grain of all the wild rice species. In comparison, southern wild rice grows up to 3m in height and has leaves 1-5cm wide.

Stands of wild rice are usually found along the shores of lakes and in slow moving rivers. The substrate can be variable, and wild rice has been found to grow in gravel, rock, and sand, but dense beds are most often found in soft, organic substrates classified as silts, muds and "oozes". Water that is nutrient rich is preferred but wild rice tolerates a range both of pH and alkalinity. However, studies have found that nutrients are absorbed from the sediments, making water chemistry of secondary importance to potential growth.

The distribution of wild rice is naturally patchy, and much research has been undertaken to determine the reasons for this. In studies of sediments comparing non-productive and productive wild rice beds, while there were differences in pH, nitrogen, and potential nitrogen mineralization, a measurement of redox potential, was determined to be the major difference between sites. Redox (Reduction/Oxidation) potential in the sediment influences the solubility and bioavailability of both minerals and metals and is directly affected by oxygen levels.

It has also been found that lakes with high sulphate concentrations (>40mg/L) do not support large rice beds, and even levels of greater than 10mg/L are detrimental to growth. Sulphate is a naturally occurring element that is readily soluble in water that lowers pH, and forms salts with other mineral salts such as magnesium, calcium, and phosphorus. Levels of sulphate deposition have been declining due to emission controls on fossil fuel burning plants. However, it has also been found that pulses of sulphates from wetlands into water bodies can be greater than deposition through precipitation. Ontario drinking water guidelines set sulphate concentration at 500mg/L for aesthetic reasons, but some jurisdictions like British Columbia have also set limits of 100mg/L for freshwater aquatic life.

For optimal growth, northern wild rice prefers a water depth of between 60 and 100cm. Seeds must overwinter in water to remain viable, and the freezing of sediments that contain seeds does not impair their viability. If stored dry, seeds lose 45% of viability in only four weeks and 59% after six weeks. Germination occurs in 4 to 60 C water, and has been found to be influenced by pH and conductivity. Water depth of as little as a few centimetres is required for emergence and seedlings are totally submerged in the early parts of the growing season, often while ice remains on the surface. Stable water levels at the floating leaf stage is the most important requirement as the plants are not deeply rooted and are very susceptible to variations in water levels; increases can uproot plants, and decreases can cause them to fall over. Dore (1969) reports that whole stands of wild rice have been destroyed by dramatic changes in mid-summer water levels in Manitoba and Ontario.

Competition from other aquatic macrophytes can occur, but wild rice will grow in deeper water zones outside of usual shoreline plants such as cattails and reeds. Wild rice will grow alongside floating water lilies, as stored food in the seed enables sufficient growth before the lilies complete their leaf growth thus shading the water. Once the plant reaches the surface (aerial stem stage), the competition for light ceases. However, wild rice growth can be disadvantaged by thick mats of other macrophytes. Wild rice can be suppressed by shade and grows best at the seedling stage in full sunlight. Some shading is tolerated due to the stored nutrient reserves in the seeds.

Nutritionally, wild rice contains between 12.4-15% protein, 0.5-0.8% fat, 0.6-1.1% fibre, and 72-75% carbohydrate. Per 100g, it contains between 17-22mg calcium, 80-161mg magnesium, 298-400mg phosphorus, 55-344mg potassium, 3-6mg zinc, 4mg iron, 0.45mg thiamine, 0.63mg riboflavin, and 6.2mg niacin. Recent research has found that wild rice hulls are also a source of antioxidants.

Straw accumulation

As the seeds shatter easily when ripe (September to October), the density of this species tends to increase during subsequent growing seasons. Once the seeds have fallen, the plant dies and the above-ground biomass (called straw) will either sink to the sediment or remain floating on the surface. In 1986, Lee found that straw biomass in Ontario lakes ranged from 3000 to 17,000 kg per hectare. This accumulated straw has been implicated in the natural cyclical patterns of wild rice growth, as nitrogen retained in undecomposed matter after almost one year was 43%, and by weight ranged from 6% to 28% (Sain 1984). Archibold (1990) found that when removing straw and then returning it to the lake after shredding, production of seed increased 3.5%. This finding suggests that leaving nutrients stored in straw might also have the opposite effect: reducing seed production. It would take several years to build up enough straw to begin to see a reduction in new growth; however, if nutrient enrichment of the lakes is offsetting the nitrogen remaining in the straw, that time line might be even longer or non-existent.

Eric Sager

Wild rice at the north end of Chemong Lake

Pests of wild rice

Wild rice has few natural enemies, but historic famines in First Nations in Minnesota have been attributed to damage done to wild rice crops from insect predation. A moth, *Apamea apamiformis*, deposits eggs within the florets in early July. When they hatch, they feed on the grain, eventually boring a hole out and then continuing to feed on the remaining grain. The rice stalk borer (*Chilo plejadellus Zincken*) feeds on the grain, the leaves, and the inside of the stem, weakening the stalk to the point that it can break in strong winds.

Fungal pests have also been noted. While *Claviceps zizaniae (Fyles) Panitdou*, an ergot, is not common in Canada, small infections were found in both Peterborough and Hastings Counties in 1952, and the smut *Entyloma lineatum (Cke.) Davis*, attacks the leaves and stems but does not kill the plant. There are other pests that have been identified, but no serious damage has been reported.

Declines in wild rice have been, and continue to be, attributed to human-caused factors: fluctuating water levels; the introduction of exotic species such as carp that uproot wild rice plants, and invasive plant species that compete for habitat and resources; boat wakes; herbicide applications; and removal by landowners.

Carp were first reported to be problematic for wild rice as early as 1952 and the decline of rice in Rice Lake and Buckhorn Lake has been attributed to their presence. Carp have also been the cause of plant decline, including wild rice, in Cootes Paradise Marsh in Hamilton. These invasive coarse fish thrash around as they search for food, uprooting the rice plants, and as long as these fish remain in the lakes, wild rice growth will remain depressed.

Along with fluctuating water depths, the increased use of lakes for permanent homes and cottages since the creation of the Trent-Severn Waterway has been implicated as a major factor in the decline of wild rice as landowners remove the easily uprooted plants. Boat wakes, invasive plant and animal species all may have contributed to the overall decline. As no research has been completed, determining one or two causal factors is problematic.

Conclusion: wild rice resurgence

The resurgence of wild rice in the Kawartha Lakes region is most likely due to the return of optimal growing conditions in specific locations, less competition from other plant species, and increases in nutrients entering the lakes. Consistent water levels at the crucial floating leaf stage in the annual life cycle along with increased solar penetration at the seedling stage are also possibilities. It is also possible that we are seeing the high point in the cyclical behaviour of wild rice and in the near future, those beds that are now flourishing will disappear, while others will emerge.

There are many questions that remain when attempting to find answers to the resurgence of wild rice. Future areas of study and questions to answer include: Is the increase in wild rice due simply to natural cycles? What are the effects of zebra mussels (and increased water clarity) on wild rice growth? Did the 2007 carp die-off stimulate increased wild rice growth? Are long-term nutrient level increases in phosphorus and nitrogen encouraging the wild rice resurgence? And finally, are water levels more consistent at specific growth stages in those lakes experiencing increased wild rice growth?

Many shoreline landowners find aquatic plants, including wild rice, to be problematic to the enjoyment of their property. While understandable, this plant growth must be considered natural as lakes in this area are shallow and nutrient rich, providing a perfect environment for aquatic macrophytes. Removing plants from the shoreline by hand or through using aquatic herbicides may seem like a good idea, but permits are required when carrying out any nearshore changes. It is also important to note that while the majority of the rice in the Kawarthas is the northern species, southern wild rice (*Z. aquatica*) can be found but is considered extremely rare in Ontario and has been listed as vulnerable to extirpation.

Selected bibliography

Archibold, O.W. 1990. The effect of stand thinning and straw management on the productivity of lake grown wild rice in Saskatchewan. *Aquat. Plant Manage*. 28: 46-49.

Dore, W.G. 1969. *Wild rice*. Ottawa: Agric. Can. Publ. 1393. 84pp.

Dore, W.G. and J. McNeill. 1980. *Grasses of Ontario*. Agric. Can. Monogr. 26. 566pp.

Lee, P.F. 1986. *Summary report: the aquaculture of wild rice*. Lakehead University, Thunder Bay. 42pp.

Sain, P. 1984. Decomposition of wild rice (*Zizania aquatica*) straw in two natural lake of northwestern Ontario. *Can. J. Bot*. 62(7): 1352-1356.

Deryck N. Robertson is a biology student at Trent University, who studied wild rice in a fourth year reading course supervised by Dr. Eric Sager.

Overview of the KLSA-Trent Ontario Trillium Foundation Project on Algae

By Dr. Paul Frost, Trent University, Peterborough

Algae are a diverse group of microscopic plants that form the base of lake food webs. If supplied with excessive nutrients, algal populations can bloom and produce poor water quality. As nutrients continue to enter the lakes from urban runoff, farmland, sewage treatment plants, cottage septic systems, and the soil itself, there is the possibility that undesirable algal blooms may become more common in the Kawartha Lakes. Yet there is very little information available to the public on freshwater algae and their ecology.

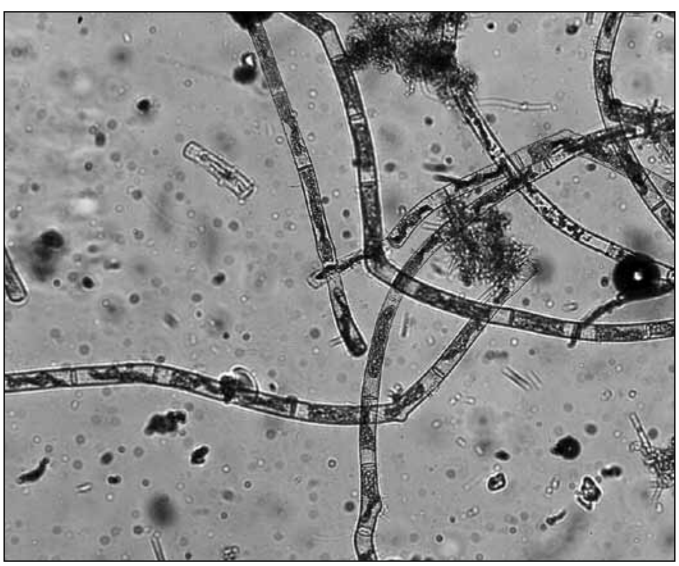
In a new collaborative project, the Kawartha Lake Stewards Association and Trent University aim to answer some basic questions about algae in the Kawartha Lakes:

1. What are the primary algal species in the Kawartha Lakes and how do we identify them?
2. What limiting factors constrain algal growth and blooms in the Kawartha Lakes?
3. What can be done to help prevent future occurrences of excessive algal growth?

To address these questions, we have initiated a project funded by the Ontario Trillium Foundation to study the algae of the Kawartha Lakes and their ecology. Specifically, we will investigate the different types of algae, their distribution and abundance, and the primary controllers of their growth in the Kawartha Lakes. In particular, students at Trent University, with help from KLSA, will sample the Kawartha Lakes frequently throughout the coming summer to assess algal communities in the different lakes. In addition, we will complete a series of experiments that will assess which nutrients are limiting to both floating and attached algal communities.

This information on Kawartha Lakes algae will be used to generate a workshop for shoreline residents and cottagers that will include a PowerPoint presentation on algae and demonstrations of algal sampling and identification. A booklet on algae for shoreline owners and the general public, similar to the Aquatic Plants Guide produced by KLSA in 2009, will be published and distributed in 2012.

We are very grateful to the Ontario Trillium Foundation for its award of $71,000 over two years to support this project.



Paul Frost

Eric Sager

A microscopic view of *Mougeotia*, which produced algal blooms during the summer of 2009 such as this one on Lovesick Lake.

GIS Maps of the Kawartha Lakes:

Where Does our Water Come From? Where Does our Phosphorus Come From?

By Kathleen Mackenzie, KLSA Vice-Chair

After a number of years of monitoring the Kawartha Lakes, KLSA has discovered that phosphorus levels, an important indication of water quality, change from month to month, and from lake to lake. Inevitably this leads to the question of "Why?" What determines phosphorus levels on the Kawartha Lakes?

Two main factors determining phosphorus levels

The two main determinants of phosphorus levels in the Kawartha Lakes, as in most lakes, are the geology and land use of the watershed. (These ideas are examined in Dr. Michael White's report "Phosphorus and the Kawartha Lakes" found on the KLSA website.)

1. **Geology**: Areas of high-phosphorus, soluble rocks and soil contribute phosphorus to our lakes through surface runoff and groundwater. We find this in the area mainly south of the Kawartha Lakes. In contrast, north of the lakes we find low-phosphorus, insoluble rocks that contribute relatively little phosphorus to runoff and groundwater.

2. **Land use**: Agriculture and denser human populations (think fertilizers, sewage treatment plants, septic systems) add to the phosphorus load of a watershed. Conversely, areas of sparse populations and wilderness tend to contribute little phosphorus. Again we see a north/south split in our watershed, with little human activity north of the lakes, but more towns and farms in our southern watershed.

We felt the next step was to quantify where the water in our lakes is coming from. How much is coming from the higher-phosphorus south? How much from the lower-phosphorus north? Does the balance between north and south change from lake to lake? From month to month? We felt this would be best illustrated through custom-made maps – and we knew where we wanted to have the cartographic work done!

Geographic Information Systems, Fleming College

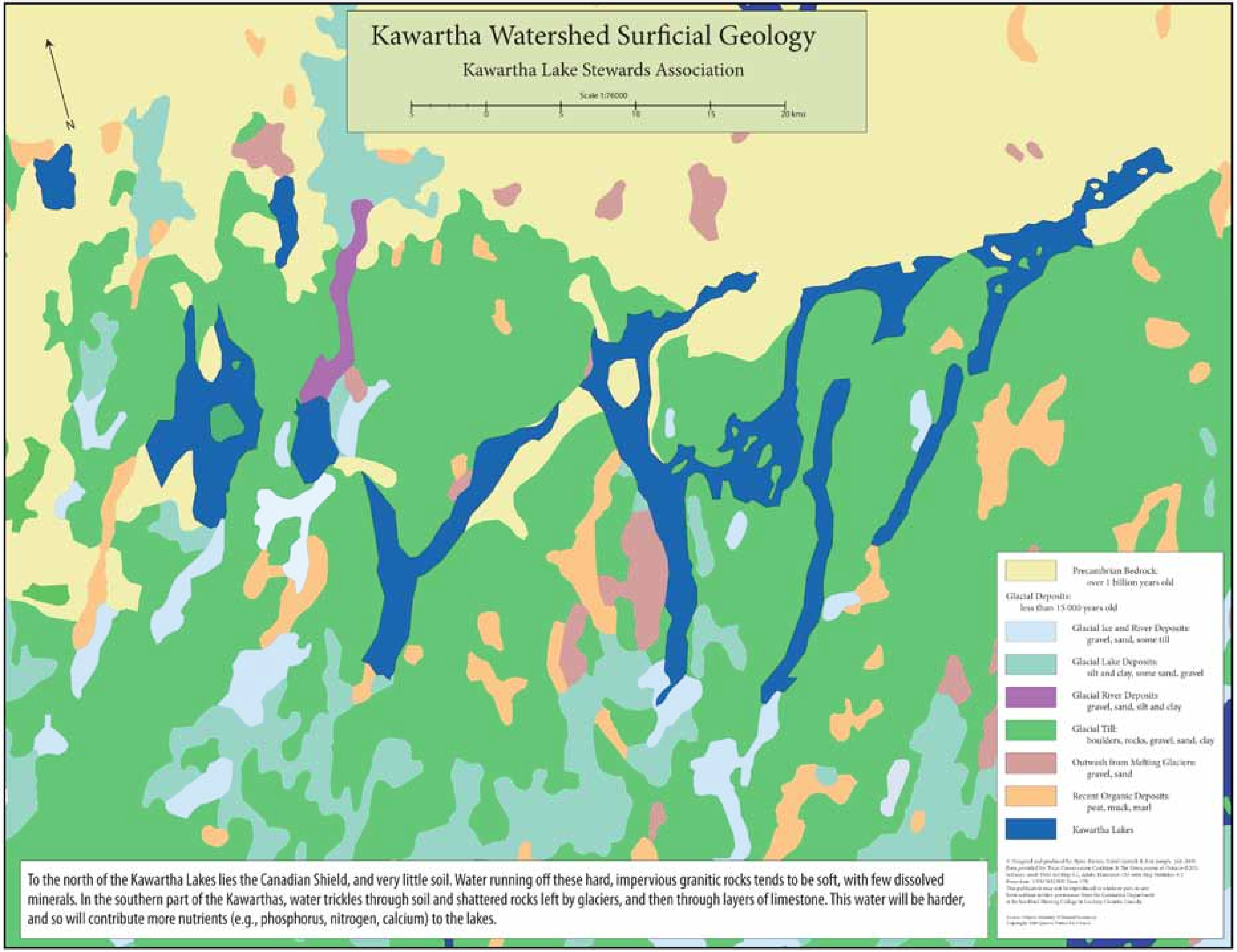
Enter the computer geeks. The Geographic Information Systems program at Fleming College trains its students (most of them already with university degrees) to use state-of-the-art computer programs to make maps. Fortunately for us, an important part of the program is a co-operative project with a community group. We applied and our project was chosen by a group of three students, Ryan Barton, David Gostick and Kris Joseph. Over a period of a few months, the students collected the necessary data from various government agencies, plus an important part was contributed by KLSA Director Kevin Walters, and they created the maps on the following pages. We hope you like them. Many thanks to our hard-working students and to Fleming College for helping us out!

Kris Joseph

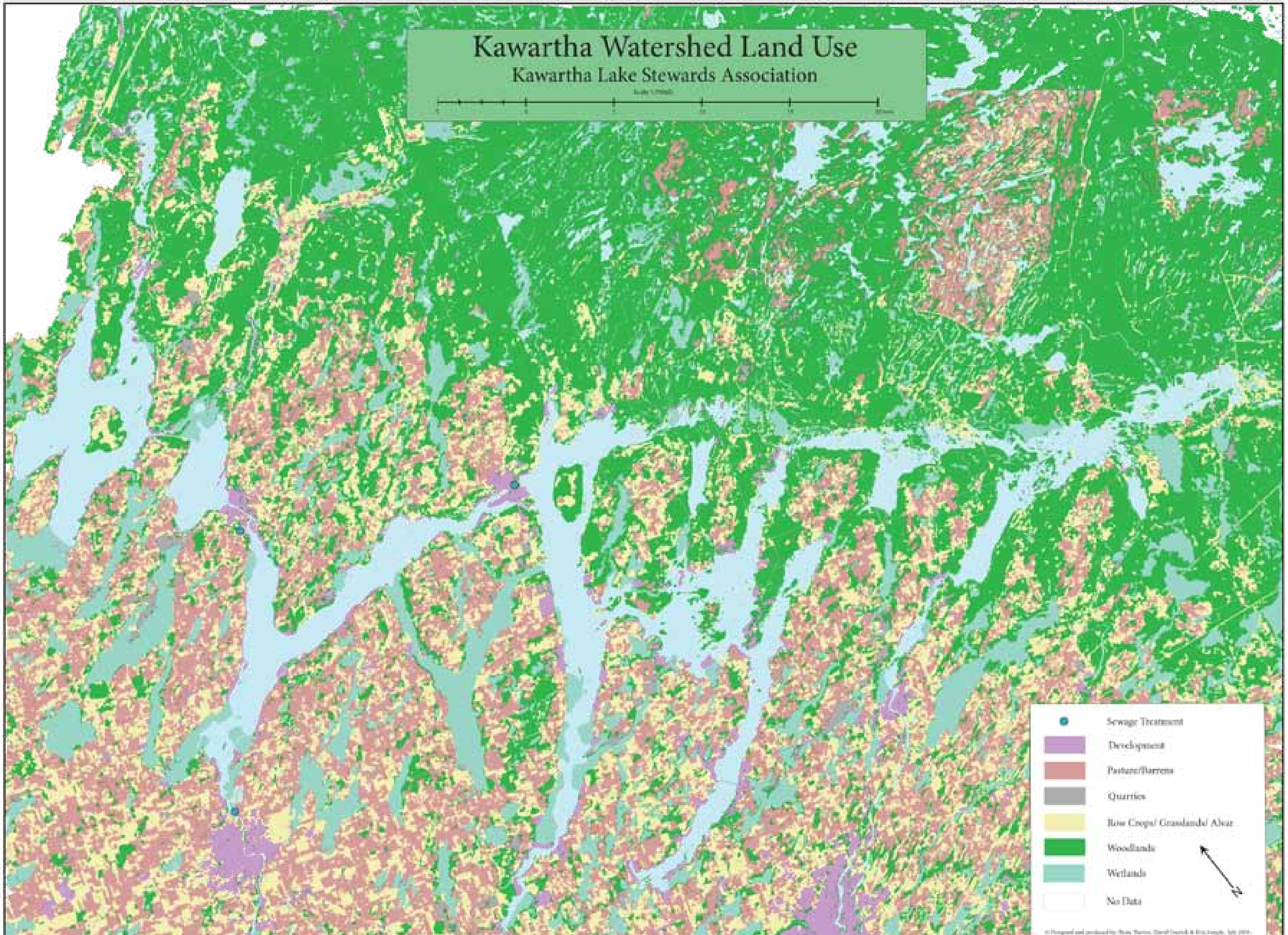
The three Fleming College students who developed the KLSA maps: (l-r) David Gostick, Kris Joseph and Ryan Barton.

Copying maps

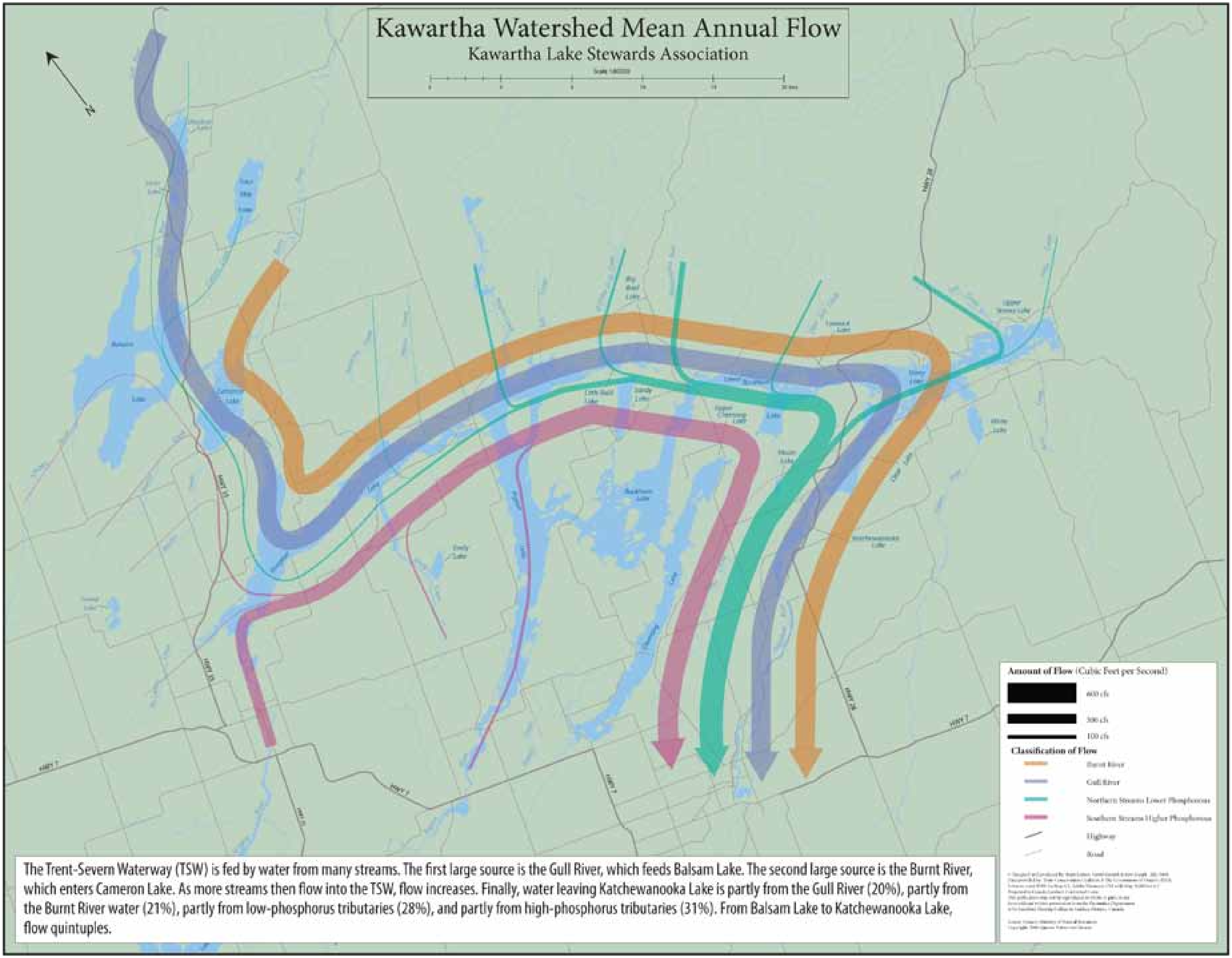
The maps are available on our website. If you give your local copyshop staff a CD of the maps, they will print you an 11 x 17 colour copy on glossy paper for about $1.50.



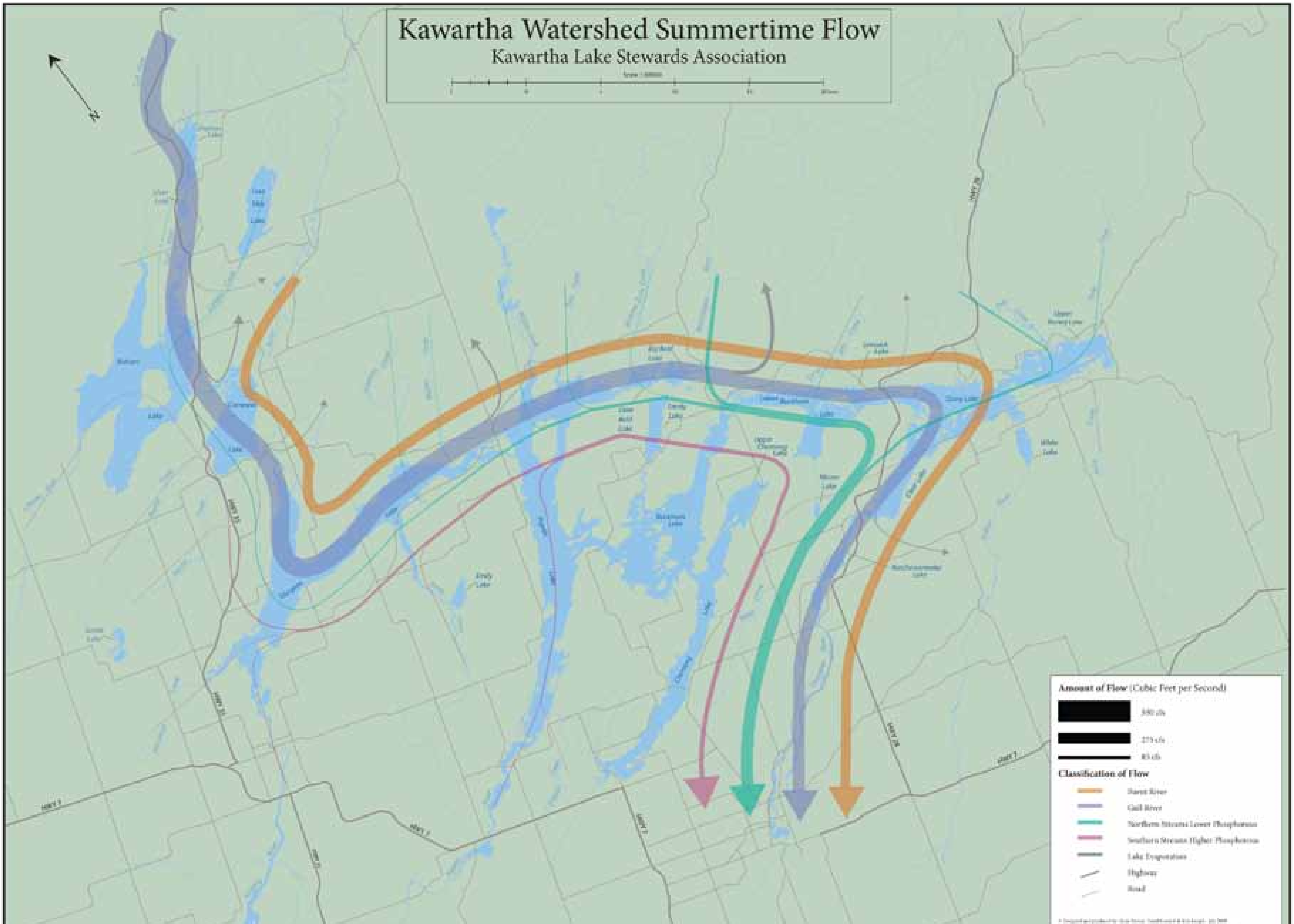
To the north of the Kawartha Lakes lies the Canadian Shield, and very little soil. Water running off these hard, impervious granitic rocks tends to be soft, with few dissolved minerals. In the southern part of the Kawarthas, water trickles through soil and shattered rocks left by glaciers, and then through layers of limestone. This water will be harder, and so will contribute more nutrients (e.g., phosphorus, nitrogen, calcium) to the lakes.



To the north of the Kawartha Lakes, coniferous forest predominates and human populations are low. To the south, agriculture is the predominant land use, and population density is higher. Therefore, drainage from the southern part of the Kawartha Lakes watershed will tend to be higher in nutrients and pollutants than drainage from the north.



The Trent-Severn Waterway (TSW) is fed by water from many streams. The first large source is the Gull River, which feeds Balsam Lake. The second large source is the Burnt River, which enters Cameron Lake. As more streams then flow into the TSW, flow increases. Finally, water leaving Katchewanooka Lake is partly from the Gull River (20%), partly from the Burnt River water (21%), partly from low-phosphorus tributaries (28%), and partly from high-phosphorus tributaries (31%). From Balsam Lake to Katchewanooka Lake, flow quintuples.



During the summer, almost all the Trent-Severn Waterway water comes from reservoir lakes to the north, and there is very little contribution from streams to the south. Total flow remains the same from Cameron to Katchewanooka, as the small additions from tributaries are equal to loss from evaporation.

Appendix A:

KLSA Mission Statement, Executive Board & Other Volunteers

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.

Board of Directors

Mike Stedman, Chair
Lakefield resident

Kathleen Mackenzie, Vice-Chair
Association of Stony Lake Cottagers

Kevin Walters, Vice-Chair
Lovesick and Harvey Lakeland Estates

Ann Ambler, Secretary
Lovesick Lake Association

Sheila Gordon-Dillane, Assistant Secretary
Concession 17 Pigeon Lake Cottagers Association

John Burgess, Treasurer
Gallery-on-the-Lake Association

Pat Moffat, Past Chair
Lovesick Lake Association

Jeffrey Chalmers, Director
Birchcliff Property Owners Association (Clear Lake)

Janet Duval, Director
Deer Bay Reach and Black Duck Bay, Lower Buckhorn

Robert Green, Director
Victoria Springs Cottage Association, Lower Buckhorn/Deer Bay

Rod Martin, Director
Sturgeon Lake Association

Mark Potter, Director
Lower Buckhorn Lake Owners' Association

Contact KLSA at: kawarthalakestewards@yahoo.ca

Other Volunteers

Balsam Lake-Balsam Lake Association:
Ross Bird, Doug and Peggy Erlandson,
Leslie Joynt, Diane Smith, Jeff Taylor, Steve and Laura Watt

Big Bald Lake Association: Ron Brown, John Shufelt

Big Cedar Lake: Barry Hooper

Buckhorn Lake - Buckhorn Sands Property Owners: Mike and Mary Belas

Clear Lake – **Birchcliff Property Owners' Association:** – Jeff Chalmers
Kawartha Park Cottagers' Association: – Judith Platt

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

Lovesick Lake-Lovesick Lake Association: Ron Brown, Chris Brown, John Ambler

Lower Buckhorn Lake-Lower Buckhorn Lake Owners' Association:
John and Cathy Burgess, Richard Johnston, Jim Keyser, Jeff Lang, Peter Miller, Mike Piekny,
Mark and Diane Potter, Dave Thompson

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

Pigeon Lake-North Pigeon Lake Ratepayers' Association: Tom McCarron and Francis Kerr

Pigeon Lake-Victoria Place: Ralph and Nona Erskine

Sandy Lake- Fire Route 48: Mike and Diane Boysen

Sandy Lake-Harvey Lakeland Common Owners' Association: Percy Payette

Shadow Lake: Eveline Eilert, Gail McCormack

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

Sturgeon Lake-Sturgeon Lake Association: Don Holloway, Rod Martin

Upper Stoney Lake-Upper Stoney Lake Association: Karl, Kathy, Ken, and Kori Macarthur

White Lake-White Lake Association: Wayne Horner

Appendix B: Financial Partners For 2009

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 Beyond Testing Costs
Big Cedar Road Committee
Birchcliff Property Owners Association
Black Duck Bay Road Owners Association
Buckhorn Sands Owners Association
Harvey Lakeland Owners Association
North Pigeon Lake Ratepayers Association
Sandy Lake Owners Association
Stoney Lake Heritage Foundation
White Lake Cottagers Association

Private Business Donations
Buckhorn Hardware
Camp Kawartha
Clearview Cottage Resort
Egan Marine Houseboats
Environ Mills International
Lakefield IGA
Pine Vista Resort
Reach Harbour Marina
Rosedale Marina

Individual Donations
Eleonore Boljkovac
Lori Bowerman
Bob Brown
H. Campbell
S. Gallagher
Patricia Green
Robert Green
Jim Keyser
Carol McCanse
M. Purdy
L. Trott
Anonymous

Many thanks to all of our generous donors

Appendix C: Treasurer's Report

Treasurer's Report – 2009

The attached financial statement shows the 2009 income and operating expenses for the Kawartha Lake Stewards Association, as well as the net cash position for the association as of December 31, 2009.

As in previous years, our 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 McColl Turner for their continued support of KLSA.

Total KLSA income for 2009 was $19,743.00. Our primary sources of income were:

- Trent-Severn Waterway (Parks Canada) grant - $3,000.00
- Ontario Trillium Foundation grant (2nd installment for Aquatic Plant Study) - $4,500.00
- Municipal Townships grants - $5,756.00
- Local community association donations - $4,975.00
- Private business / individual donations - $1,470.00

Normal operating expenses for 2009 (excluding the KLSA Aquatic Plants Guide project) remained relatively constant year-over-year at approximately $11,000.00.

Our primary operating expense areas included:

- *E.coli* water test fees - $5,000.00
- KLSA insurance coverage for volunteers and Board members - $1,750.00
- Printing and distribution for 2008 KLSA Annual Report - $3,450.00
- General administration (office supplies, postage, bank fees, etc.) - $1,500.00.

Our major project-related expense in 2009, totalling over $14,000.00, was the preparation, printing, and distribution of our KLSA Aquatic Plants Guide, completed in the 2nd quarter of 2009. This two year project was undertaken in 2008 in collaboration with Trent University following receipt of a significant grant in excess of $49,000.00 from the Ontario Trillium Foundation. Total KLSA costs for the project over the two year time frame were approximately $64,000.00.

Our 2009 year-end cash position of $8,617.00 is down from our 2008 year-end position as a result of the 2009 costs incurred in finalizing the Aquatic Plants Guide project; however, we do have adequate cash resources to cover first half 2010 operating expenses.

Continued funding support from all government, community, and private sources will be necessary to maintain our ongoing water quality testing efforts and associated endeavours throughout the Kawartha Lakes in 2010.

Treasurer: John Burgess (January 31, 2010)

Financial Statements of

KAWARTHA LAKES STEWARDS ASSOCIATION

December 31, 2009

Note To The Financial Statements
December 31, 2009

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 2009, the Association published its Aquatic Plant Guide from the grant received over the past two years from the Ontario Trillium Foundation. The project was conducted in partnership with Trent University. The 2009 funding from Ontario Trillium Foundation was for $4,500 (2008 - $44,900), while the Kawartha Lake Stewards Association added a further $ 9,606 to the study from groups and individuals' donations (2008 - $4,800).

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

McCOLL TURNER

McColl Turner LLP
Chartered Accountants
362 Queen St., Peterborough, ON
K9H 3J6

Telephone 705 743 5020
Facsimile 705 743 5081
Email info@mccollturner.com
Website www.mccollturner.com

REVIEW ENGAGEMENT REPORT

To Mr. John Burgess, Treasurer
KAWARTHA LAKES STEWARDS ASSOCIATION

We have reviewed the statement of financial position of Kawartha Lakes Stewards Association as at December 31, 2009 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
February 17, 2010

KAWARTHA LAKES STEWARDS ASSOCIATION

Statement of Financial Position - December 31, 2009

	(Unaudited) 2009	2008
ASSETS		
Current Assets		
Cash	$ 8,617	11,415
Guaranteed Investment Certificate	-	3,327
	8,617	14,742
NET ASSETS	8,617	14,742
	$ 8,617	$ 14,742

Statement of Operations
Year ended December 31, 2009

	(Unaudited) 2009	2008
REVENUE		
Parks Canada, Trent-Severn Waterway	$ 3,000	$ 3,000
Ontario Trillium funding for aquatic plant project	4,500	44,900
Municipal grants	5,756	6,995
Associations	4,975	5,000
Private contributions	1,470	4,280
Cottage Life Award	-	2,500
Interest	42	140
	19,743	66,815
EXPENDITURES		
Water testing fees	4,973	4,846
Aquatic plant project	14,106	49,700
Annual report costs	3,438	2,208
Registration fees, insurance and membership fee	1,828	1,969
Telephone, copies and other administrative costs	1,479	1,178
Bank charges	44	49
	25,868	59,950
EXCESS OF (EXPENDITURES OVER REVENUE) REVENUE OVER EXPENDITURES FOR THE YEAR	(6,125)	6,865
NET ASSETS - beginning of year	14,742	7,877
NET ASSETS - end of year	$ 8,617	$ 14,742

McCOLL TURNER

Appendix D: Privacy Policy

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.

Jeffrey Chalmers, KLSA Privacy Officer

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

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 swim 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 ¼ teaspoon of fecal matter! Therefore, it is easier to "find" than most other less plentiful bacteria.
-
- *E.coli* itself can be dangerous. Although most strains of *E.coli* are harmless, some strains cause serious disease, 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.

Lake-by-Lake *E.coli* Results

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;
- A "–" indicates no data available for that date.

Balsam Lake									
2009 *E.coli* Lake Water Testing *E.coli*/100 mL									
Site	**2-Jul-09**	**20-Jul-09**	**23-Jul-09**	**27-Jul-09**	**4-Aug-09**	**10-Aug-09**	**13-Aug-09**	**24-Aug-09**	**1-Sep-09**
1	3	3	-	5	3	8	-	-	-
2	3	-	5,8	5, 11	8	**55**	33,49,**136**	3,3,3	3
3	11	3	-	5	3	3	-	-	3
4	5	3	-	3	3, 5	11	-	-	3
5	8	5, 3	-	22	25	3	-	-	3, 8
6	3, 3	3	-	3	3	13	-	-	3
5A	-	-	-	-	-	16	-	-	-
5B	-	-	-	-	-	19, 28	-	-	-
5N	-	-	-	-	-	3	-	-	-

Apart from Site 2, all counts on Balsam Lake were below 30, and almost all were below 20, which is normal for a Kawartha Lake. Site 2's higher readings on August 10 and 13 had no apparent cause. Site 2 is near the inflow from a creek. There had been some heavy rain just before August 10, which may have caused counts to rise. However, there had been heavy rains before the July 2 and July 27 tests as well, and there were no high counts observed on those dates.

Big Bald Lake						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**8-Jul-09**	**20-Jul-09**	**28-Jul-09**	**28-Jul-09**	**11-Aug-09**	**2-Sep-09**
1	9	6	1	12	6	1
2	0	2	2	0	1	0
3	12	0	0	0	0	0
5	0	2	0	2	7	1
7	0	2	8	0	4	1
8	2	0	19	0	8	5

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

Big Cedar Lake						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**2-Jul-09**	**20-Jul-09**	**27-Jul-09**	**4-Aug-09**	**10-Aug-09**	**8-Sep-09**
640	15	5	4	8	8	0

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;
- A "–" indicates no data available for that date.

Buckhorn L: Buckhorn Sands						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**13-Jul-09**	**21-Jul-09**	**27-Jul-09**	**4-Aug-09**	**10-Aug-09**	**1-Sep-09**
A	1	0	0	0	2	0
B	3	0	11	4	0	0
C	1	0	0	1	0	0
D	14	14	30	0	2	37

As in previous years, counts were uniformly low in all locations tested in the Buckhorn Sands area.

Clear Lake: Birchcliff Property Owners						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**7-Jul-09**	**21-Jul-09**	**6-Aug-09**	**13-Aug-09**	**19-Aug-09**	**14-Sep-09**
BB	4	6	2	0	2	5
1	0	2	0	4	0	0
2	1	1	0	3	0	0
3	3	2	0	9	2	34
4	0	2	4	13	30	3
5	1	1	0	1	1	0
6	0	4	0	3	1	4
7	0	5	0	0	0	0
8	3	2	2	0	25	**61**

Over the years, Site 8 occasionally has had counts over 50. This is a shoal where birds sometimes roost, likely the source of bacteria.

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;
- A "–" indicates no data available for that date.

Clear L: Kawartha Park						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**7-Jul-09**	**21-Jul-09**	**31-Jul-09**	**7-Aug-09**	**17-Aug-09**	**8-Sep-09**
A	0	2	0	0	1	0
B	0	2	0	29	1	0
C	1	2	0	0	1	2
D	5	2	1	0	10	1
P	1	2	0	0	5	0
S	0	2	0	2	1	0

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

Katchewanooka Lake: Sites 1,7						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**2-Jul-09**	**20-Jul-09**	**27-Jul-09**	**4-Aug-09**	**10-Aug-09**	**1-Sep-09**
1	5	12	6	1	1	0
7	15	3	2	0	0	1

Katchewanooka Lake: Sites 2,5,6						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**6-Jul-09**	**8-Jul-09**	**20-Jul-09**	**28-Jul-09**	**6-Aug-09**	**11-Aug-09**
2	12	-	11	**52**	**61**	3, 33, **60**
5	**106**	14**, 300, 340, 420**	30,**72,74**	14, **78,179**	22, **70, 75**	49, 45, 24
6	7	-	1	0	7	1

Site 2 has historically had the occasional count over 50, so is not as consistently low as Sites 1 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 this year has frequent counts over 50, similar to 2003 and 2004. This is at the mouth of a creek. Upstream are farms, a golf course, and a wetland area, any of which may be contributing to the counts. Fortunately, Site 5 is not a swimming area.

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;
- A "–" indicates no data available for that date.

Lovesick Lake						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**1-Jul-09**	**22-Jul-09**	**29-Jul-09**	**5-Aug-09**	**11-Aug-09**	**2-Sep-09**
15	1	1	1	0	5	1
16	0	0	2	0	0	2
17	1	2	1	1	2	1

This is the second year of testing on these three locations. As in 2008, counts were uniformly low.

Lower Buckhorn Lake						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**6-Jul-09**	**19-Jul-09**	**27-Jul-09**	**3-Aug-09**	**9-Aug-09**	**31-Aug-09**
1	0	0	3	6	1	6
2	1	0	8	1	2	3
3	7	25	18	28	12	7
4A	37	21	34	14	6	13
4B	43	**54**	**103**	49	1	43
5	0	0	0	1	0	0
8	0	0	3	0	0	1
9	0	0	1	4	1	1
10	0	0	0	1	0	0
11	1	0	3	2	-	2
12	3	1	8	3	-	9
13	6	3	-	-	-	-
14	0	0	1	1	0	3
4C	-	-	-	22	-	-
4D	-	-	-	15	-	-
4E	-	-	-	1	-	-
4F	-	-	-	1	-	-

Sites 4A and 4B had lower counts than in previous years. These sites are close to an inflow from a large wetland area, whose streams have high *E.coli* counts (see KLSA Annual Report 2004 Appendix E).

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;
- A "–" indicates no data available for that date.

Pigeon Lake: Concession 17 Pigeon Lake Cottagers Assoc.						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**5-Jul-09**	**19-Jul-09**	**27-Jul-09**	**4-Aug-09**	**9-Aug-09**	**31-Aug-09**
A	0	0	7	1	3	1
B	1	7	0	1	0	11
3	2	0	5	1	2	3

Counts were uniformly low on all the above sites, which is consistent with past years.

Pigeon Lake: North Pigeon Lake Ratepayers' Assoc.						
2009 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**3-Jul-09**	**21-Jul-09**	**4-Aug-09**	**10-Aug-09**	**17-Aug-09**	**8-Sep-09**
1A	2	25	2	0	-	1
5	4	8	**99**	30	-	9
6	37	33	17	12	-	13
8	0	3	0	0	-	1
13	17	5,5	**440**	46	0,3,4,5,6	0

Over the past few years, Sites 5 and 6 have exhibited counts between 50 and 100 quite regularly. This is probably because they are near an area that often has a large population of Canada Geese (for further discussion see KLSA Annual Report 2003 Appendix D and 2004 Appendix E).

On August 4 when there was an unusually high reading of 440, the volunteers noticed a strong smell from the nearby Bobcaygeon sewage treatment plant.

Pigeon Lake: Victoria Place					
2009 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**2-Jul-09**	**20-Jul-09**	**4-Aug-09**	**10-Aug-09**	**1-Sep-09**
1	30	3	5	5	8
2	8	3	3	3	3,3
3	8	3	3,3	3	3
4	3	3,3	5	19	3
5	13, 11	5	8	3	3

Counts were uniformly low on all the Victoria Place sites.

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;
- A "–" indicates no data available for that date.

Sandy Lake: Fire Route 48					
2009 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**2-Jul-09**	**20-Jul-09**	**4-Aug-09**	**10-Aug-09**	**4-Sep-09**
MD1	0	0	0	0	1
MD2	-	-	-	0	-

As in 2008, counts were uniformly very low on this Sandy Lake site.

Sandy Lake: Harvey Lakeland					
2009 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**2-Jul-09**	**17-Jul-09**	**7-Aug-09**	**16-Aug-09**	**28-Aug-09**
SR	15	4	19	**105**	**202**
SS	0	0	8	**99**	8
PP	1	0	2	**76**	1
CW	4	0	10	35	1
PS	-	-	-	40	0

The high counts are probably due to waterfowl populations congregating on rock islets. These sites are not in swimming locations.

Shadow Lake				
2009 *E.coli* Lake Water Testing *E.coli*/100 mL				
Site	**27-Jul-09**	**4-Aug-09**	**10-Aug-09**	**1-Sep-09**
1	16, 16	8, 3	43	11

This was our first year of testing on Shadow Lake. Counts were typical of a Kawartha 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;
- A "–" indicates no data available for that date.

Stony Lake: Association of Stony Lake Cottagers							
2009 *E.coli* Lake Water Testing *E.coli*/100 mL							
Site	**30-Jun-09**	**6-Jul-09**	**08-Jul-09**	**30-Jul-09**	**4-Aug-09**	**11-Aug-09**	**8-Sep-09**
E	0	-	4	3	8	1	3
F	1	-	0	4	1	0	0
I	1	-	1	2	1	8	1
L	0	-	2	1	2	11	0
P	2	-	0	2	0	0	0
26	**69**	1, 0, 2	26	**54**	15	17, 22, 13	5
27	7	-	28	17	11	5	9
28	3	-	29	19	8	42	3

Stony Lake: Association of Stony Lake Cottagers – Sites J,K					
2009 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**15-Jul-09**	**20-Jul-09**	**28-Jul-09**	**10-Aug-09**	**1-Sep-09**
J	4	2	1	1	2
K	2	0	3	0	1

Generally, counts on Stony Lake were very low. There were some elevated counts at Site 26 on June 30 and July 30. This site is located in a long, narrow, shallow bay with little circulation. Were these two elevated counts due to rainfall runoff, as we thought they were in 2005? It doesn't seem that rainfall was the culprit, because rain was only steady and light (volunteer notes) before June 30 and July 30. It is interesting to note that rain had been heavy for 48 hours previous to the August 11 test, and that reading was not elevated.

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;
- A "–" indicates no data available for that date.

Sturgeon Lake: North Shore Combined Group

2009 *E.coli* Lake Water Testing
E.coli/100 mL

Site	2-Jul-09	20-Jul-09	27-Jul-09	30-Jul-09	4-Aug-09	10-Aug-09	1-Sep-09
2	5	8, 5	49	-	**76**	46	5
2A	5	8	16	-	**79**	**52**	6
3	36	**146**	**132, 166**	**102, 127, 156, 161, 200**	**69**	**87**	19
4	8	5	3	-	3	3	3
5	16	3	22	-	**119**	**90**	11
WS1	**59**	3	5	-	5	13	3
SB1	11	19	33	-	8	19	5
SB2	5	25	11	-	5	5, 3	11

As in previous years, there were several high counts, some over 100, in several locations in Sturgeon Lake. This is the only lake in the KLSA test area with frequent high counts in multiple sites. The cause is unclear, but the answer may, literally and figuratively, lie in the lake sediments (see KLSA Annual Report 2008 for more detail). Are the sediments possibly harbouring populations of *E.coli*, which cause high counts in the water after being stirred up on a windy day? The KLSA is looking at possibilities for further research.

Upper Stoney Lake: Upper Stoney Lake Assoc.

2009 *E.coli* Lake Water Testing
E.coli/100 mL

Site	2-Jul-09	20-Jul-09	27-Jul-09	3-Aug-09	1-Sep-09
6	17	4	6	8	7
20	26	1	1	7	1
21	2	2	2	0	1
52	23	13	24	9	44
65	7	0	0	3	1
70	3	0	1	2	0
78A	7	1	2	1	2

Consistent with past years, counts on all the Upper Stony Lake sites were uniformly low.

Appendix F: 2009 Phosphorus and Secchi Data

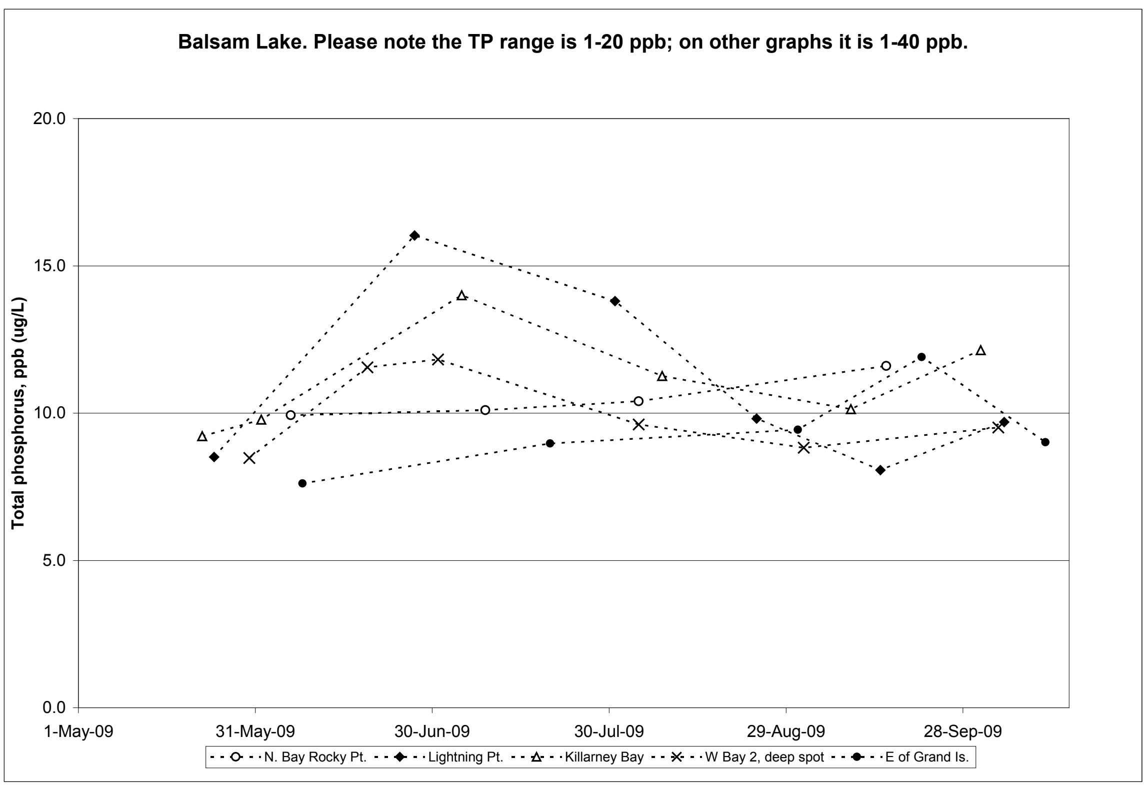
Why test for phosphorus? Arguably, phosphorus is the chemical that does the most aesthetic damage to inland lakes. Phosphorus encourages algal growth, resulting in a turbid lake and eventually thicker, enriched sediments that are more likely to grow aquatic plants. The Ontario Ministry of the Environment's 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 runoff from native 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.

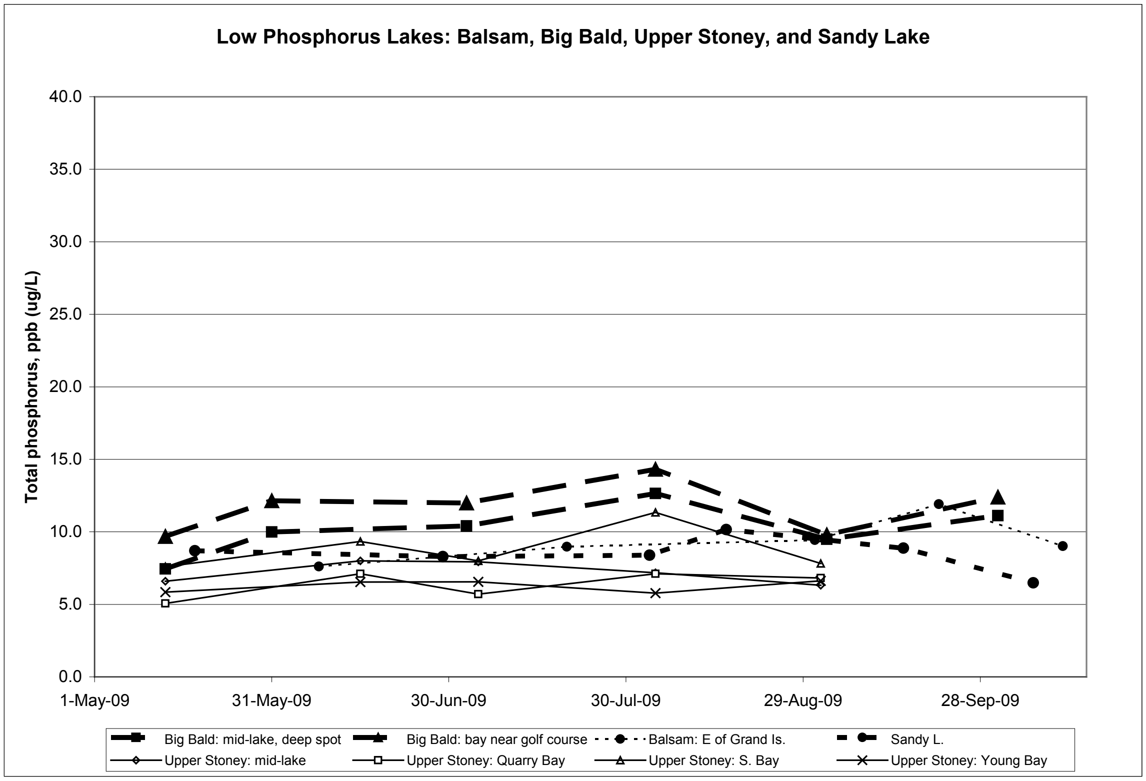
Balsam Lake



In Balsam Lake, there is a large inflow from the Gull River in the northeast corner, and almost all of this flows out the east side to Cameron Lake. There are very small inflows from the south, so water quality varies within Balsam Lake. The entire lake has relatively low phosphorus levels compared to most other Kawartha Lakes.

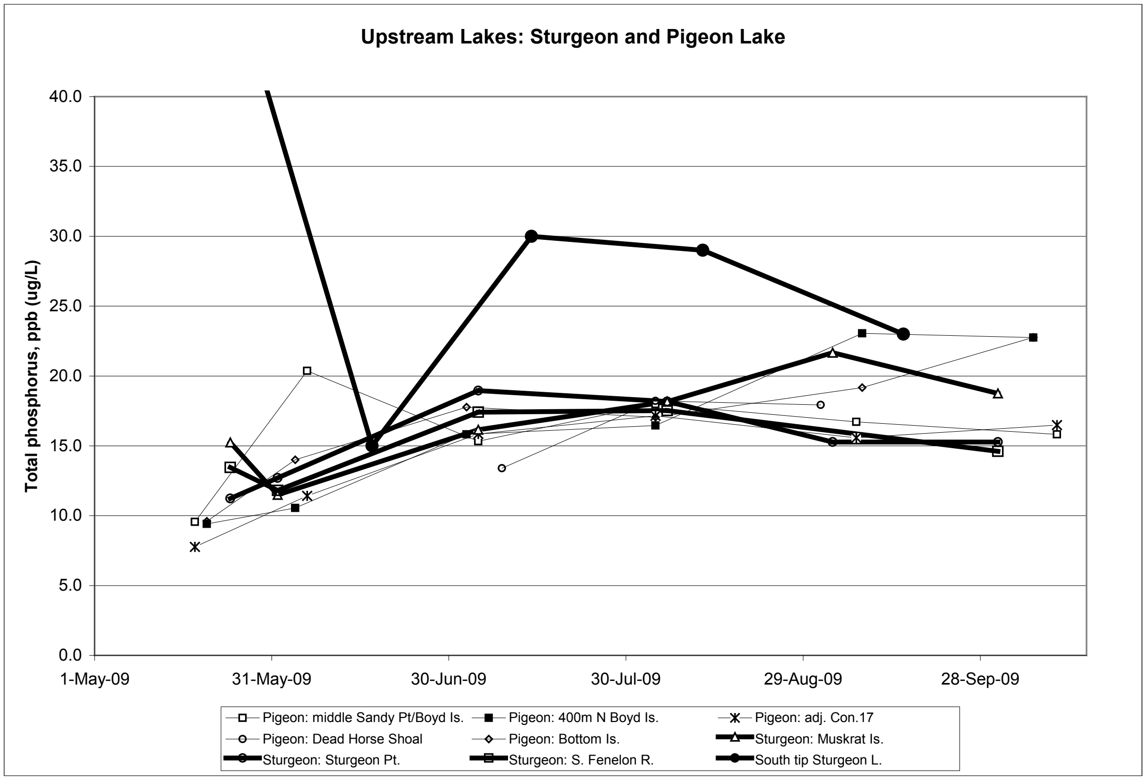
As with most sites, phosphorus levels were somewhat lower than in previous years; West Bay was lower relative to the other sites this year. The high count at the end of June at Lightning Point was also observed last year. It would be interesting to measure algal and zooplankton growth around this time to see if this is a biologically-controlled phosphorus 'blip'.

Low Phosphorus Lakes: Balsam, Big Bald, Upper Stoney, and Sandy Lake



This graph is very similar to previous years. Similar to many other Kawartha Lakes this year, the Upper Stoney sites were somewhat lower in phosphorus than in previous years. Big Bald Lake and Sandy Lake, both marl-controlled lakes (precipitation of marl co-precipitates phosphorus) were an exception to the low phosphorus syndrome this year – their phosphorus levels were similar to those of previous years. Perhaps this was because marl tends to precipitate in warmer water, and 2009 was a cold-water summer.

Upstream Lakes: Pigeon and Sturgeon Lake

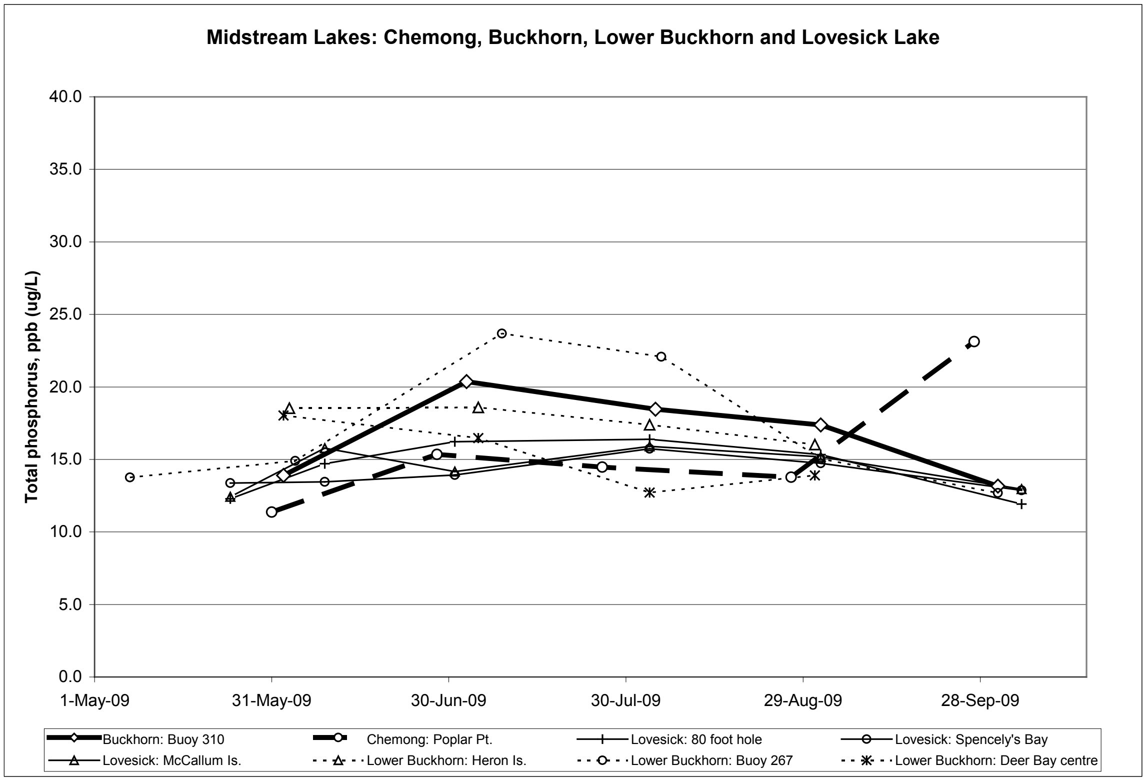


As with most other Kawartha lakes, phosphorus levels in Sturgeon Lake and Pigeon Lake were somewhat low compared to other years. (However, the "off-the-graph" reading for the South Tip Sturgeon Lake site was 55 ppb.)

During the time that water flows through Cameron Lake (between Balsam "E. of Grand Is." and Sturgeon "S. of Fenelon Falls") there is a jump in phosphorus levels of 3 to 4 ppb, during July and August. Unfortunately, we do not have phosphorus data for Cameron Lake, but plan to in the future. Is Cameron Lake receiving large amounts of phosphorus form Burnt River? From some creeks from the south that drain agricultural lands? Or is phosphorus rising, not in Cameron Lake, but at Fenelon Falls?

This was one of the rare years when water flowed into Scugog River from Lake Scugog throughout the summer; often water is retained in Lake Scugog during hot summers, and the Scugog River has a limited flow. The Scugog River is obviously a high-phosphorus input into the Trent-Severn Waterway (S. tip Sturgeon Lake site is where the Scugog River enters Sturgeon Lake), but in years of very low flow its phosphorus contribution may not be large.

Midstream Lakes

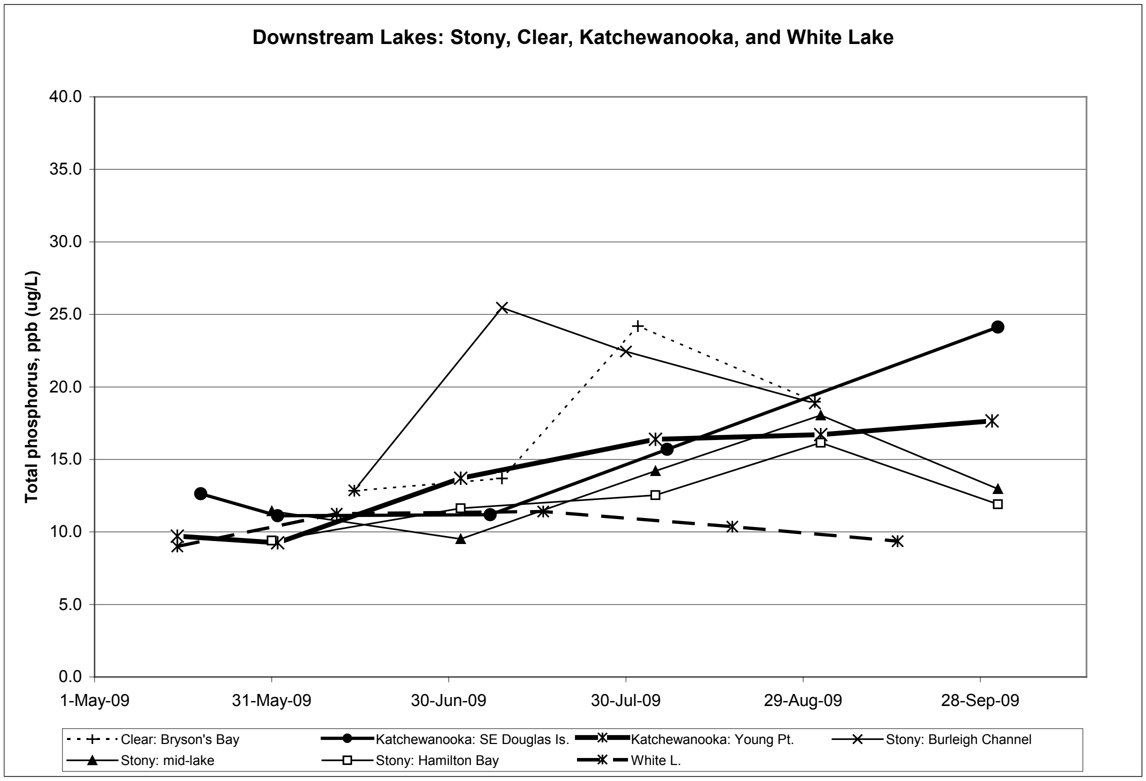


As seen elsewhere in the Kawartha Lakes, phosphorus levels were relatively low this year in the midstream lakes. Levels were similar to 2007 (also a relatively low phosphorus year). In the past, we have often seen a rise of 2 or 3 ppb as water flows from Pigeon to Lovesick, but that did not happen this year.

Anita Locke

The Lakefield Marsh

Downstream Lakes



As with so many other sites, the phosphorus levels were slightly lower in all these sites than in other years. In many years, we have seen a large drop between Lovesick Lake and mid-Stony Lake (due to the diluting effect of Upper Stoney's low-phosphorus water flowing into Stony), but the difference between Lovesick and Stony was hardly noticeable this year.

Burleigh Falls, in only its third year of testing, has proven to be a rather volatile site; there were high readings on Aug. 1 and Sep. 1 in 2007. The two high readings in 2007 and the two seen here (early July and Aug. 1) were not seen in the Lovesick site just upstream from them, so it's uncertain what is causing them.

The high reading at Bryson's Bay was unusual for this site.

Conclusion

Generally, the phosphorus readings throughout the Kawartha Lakes were the lowest they have been in 8 years. In the past, phosphorus levels tended to increase as the water flowed downstream to a maximum in Lovesick Lake, and drop in Stony Lake; this rise and fall was hardly noticeable this year. Also in the past, phosphorus levels rose in many lakes from June to September; this rise was much smaller this year. It was a very late, cold spring, and a cool, wet summer with cooler than normal water temperatures. Did this somehow dictate the lower phosphorus levels? If so, how? There just is no obvious answer at this point. It is reassuring, however, to see relatively low phosphorus levels in our lakes.

Following is the complete record of total phosphorus (TP) measurements taken in 2009.
*indicates sample likely contaminated

LAKE_NAME	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Average TP (µg/L)
BALSAM LAKE	N Bay Rocky Pt.	6-Jun-09	9.5	10.3	9.9
BALSAM LAKE	N Bay Rocky Pt.	9-Jul-09	10.1	10.1	10.1
BALSAM LAKE	N Bay Rocky Pt.	4-Aug-09	9.9	10.9	10.4
BALSAM LAKE	N Bay Rocky Pt.	15-Sep-09	10.9	12.3	11.6
BALSAM LAKE	N/E end-Lightning Point	24-May-09	9.0	8.0	8.5
BALSAM LAKE	N/E end-Lightning Point	27-Jun-09	16.2	15.8	16.0
BALSAM LAKE	N/E end-Lightning Point	31-Jul-09	14.3	13.4	13.8
BALSAM LAKE	N/E end-Lightning Point	24-Aug-09	9.7	9.9	9.8
BALSAM LAKE	N/E end-Lightning Point	14-Sep-09	7.3	8.9	8.1
BALSAM LAKE	N/E end-Lightning Point	5-Oct-09	8.3	11.1	9.7
BALSAM LAKE	South Bay-Killarney Bay	22-May-09	9.0	9.4	9.2
BALSAM LAKE	South Bay-Killarney Bay	1-Jun-09	9.8	9.8	9.8
BALSAM LAKE	South Bay-Killarney Bay	5-Jul-09	16.0	12.0	14.0
BALSAM LAKE	South Bay-Killarney Bay	8-Aug-09	11.4	11.1	11.3
BALSAM LAKE	South Bay-Killarney Bay	9-Sep-09	8.8	11.5	10.1
BALSAM LAKE	South Bay-Killarney Bay	1-Oct-09	9.7	14.5	12.1
BALSAM LAKE	W Bay2, deep spot	30-May-09	8.6	8.3	8.5
BALSAM LAKE	W Bay2, deep spot	19-Jun-09	12.1	11.0	11.6
BALSAM LAKE	W Bay2, deep spot	1-Jul-09	13.1	10.6	11.8
BALSAM LAKE	W Bay2, deep spot	4-Aug-09	9.0	10.2	9.6
BALSAM LAKE	W Bay2, deep spot	1-Sep-09	9.1	8.6	8.8
BALSAM LAKE	W Bay2, deep spot	4-Oct-09	9.4	9.7	9.5
BALSAM LAKE	E of Grand Is	8-Jun-09	7.7	7.6	7.6
BALSAM LAKE	E of Grand Is	20-Jul-09	8.3	9.6	9.0
BALSAM LAKE	E of Grand Is	31-Aug-09	9.0	9.9	9.4
BALSAM LAKE	E of Grand Is	21-Sep-09	12.4	11.4	11.9
BALSAM LAKE	E of Grand Is	12-Oct-09	7.0	11.0	9.0
BIG BALD LAKE	Mid Lake, deep spot	13-May-09	7.9	7.0	7.5
BIG BALD LAKE	Mid Lake, deep spot	31-May-09	9.8	10.2	10.0
BIG BALD LAKE	Mid Lake, deep spot	3-Jul-09	10.9	9.9	10.4
BIG BALD LAKE	Mid Lake, deep spot	4-Aug-09	12.5	12.8	12.7
BIG BALD LAKE	Mid Lake, deep spot	2-Sep-09	9.3	9.7	9.5
BIG BALD LAKE	Mid Lake, deep spot	1-Oct-09	11.7	10.6	11.1
BIG BALD LAKE	Bay nr golf course	13-May-09	10.5	8.9	9.7
BIG BALD LAKE	Bay nr golf course	31-May-09	11.3	13.0	12.1
BIG BALD LAKE	Bay nr golf course	3-Jul-09	12.0		12.0
BIG BALD LAKE	Bay nr golf course	4-Aug-09	14.4	14.3	14.3
BIG BALD LAKE	Bay nr golf course	2-Sep-09	9.3	10.3	9.8
BIG BALD LAKE	Bay nr golf course	1-Oct-09	11.7	13.0	12.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	2-Jun-09	13.9	*25.2	13.9
BUCKHORN LAKE (U)	Narrows, red buoy C310	3-Jul-09	20.3	20.4	20.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	4-Aug-09	18.2	18.7	18.5
BUCKHORN LAKE (U)	Narrows, red buoy C310	1-Sep-09	15.1	19.7	17.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	1-Oct-09	12.7	13.7	13.2
CAMERON LAKE	W end, deep spot	20-May-09	10.2	10.9	10.5
CAMERON LAKE	S end, deep spot	24-May-09	10.6	9.3	10.0

CHEMONG LAKE	Poplar Pt.	31-May-09	11.1	11.6	11.4
CHEMONG LAKE	Poplar Pt.	28-Jun-09	14.4	16.3	15.3
CHEMONG LAKE	Poplar Pt.	26-Jul-09	15.0	14.0	14.5
CHEMONG LAKE	Poplar Pt.	27-Aug-09	13.9	13.7	13.8
CHEMONG LAKE	Poplar Pt.	27-Sep-09	24.9	21.3	23.1
CHEMONG LAKE	S. of Causeway	4-Jun-09	20.6	16.9	18.8
CHEMONG LAKE	S. of Causeway	25-Jul-09	17.6	17.9	17.8
CHEMONG LAKE	S. of Causeway	17-Sep-09	14.5	17.2	15.8
CLEAR LAKE	Main Basin, deep spot	10-Jul-09	13.8	13.5	13.7
CLEAR LAKE	Fiddlers Bay	10-Jul-09	13.8	13.4	13.6
CLEAR LAKE	Brysons Bay	14-Jun-09	12.2	13.5	12.8
CLEAR LAKE	Brysons Bay	9-Jul-09	13.8	13.6	13.7
CLEAR LAKE	Brysons Bay	1-Aug-09	21.9	26.5	24.2
CLEAR LAKE	Brysons Bay	31-Aug-09	19.0	18.9	19.0
KATCHEWANOOKA LAKE	S/E Douglas Island	19-May-09	12.5	12.8	12.6
KATCHEWANOOKA LAKE	S/E Douglas Island	1-Jun-09	12.4	9.8	11.1
KATCHEWANOOKA LAKE	S/E Douglas Island	7-Jul-09	11.1	11.3	11.2
KATCHEWANOOKA LAKE	S/E Douglas Island	6-Aug-09	17.0	14.4	15.7
KATCHEWANOOKA LAKE	S/E Douglas Island	1-Oct-09	22.6	25.7	24.1
KATCHEWANOOKA LAKE	Young Pt near locks	15-May-09	10.1	9.4	9.7
KATCHEWANOOKA LAKE	Young Pt near locks	1-Jun-09	9.3	9.2	9.3
KATCHEWANOOKA LAKE	Young Pt near locks	2-Jul-09	13.7	13.7	13.7
KATCHEWANOOKA LAKE	Young Pt near locks	4-Aug-09	14.1	18.7	16.4
KATCHEWANOOKA LAKE	Young Pt near locks	1-Sep-09	16.5	17.0	16.7
KATCHEWANOOKA LAKE	Young Pt near locks	30-Sep-09	18.3	17.0	17.7
LOVESICK LAKE	80' hole at N. end	24-May-09	12.1	12.5	12.3
LOVESICK LAKE	80' hole at N. end	9-Jun-09	13.6	15.8	14.7
LOVESICK LAKE	80' hole at N. end	1-Jul-09	16.4	16.0	16.2
LOVESICK LAKE	80' hole at N. end	3-Aug-09	16.3	16.5	16.4
LOVESICK LAKE	80' hole at N. end	1-Sep-09	15.0	15.7	15.3
LOVESICK LAKE	80' hole at N. end	5-Oct-09	12.0	11.9	11.9
LOVESICK LAKE	Spenceley's Bay	24-May-09	13.5	13.2	13.4
LOVESICK LAKE	Spenceley's Bay	9-Jun-09	13.6	13.3	13.5
LOVESICK LAKE	Spenceley's Bay	1-Jul-09	13.8	14.0	13.9
LOVESICK LAKE	Spenceley's Bay	3-Aug-09	16.1	15.4	15.7
LOVESICK LAKE	Spenceley's Bay	1-Sep-09	14.5	14.9	14.7
LOVESICK LAKE	Spenceley's Bay	5-Oct-09	13.4	12.3	12.9
LOVESICK LAKE	McCallum Island	24-May-09	13.3	11.6	12.4
LOVESICK LAKE	McCallum Island	9-Jun-09	16.3	15.2	15.8
LOVESICK LAKE	McCallum Island	1-Jul-09	14.1	14.3	14.2
LOVESICK LAKE	McCallum Island	3-Aug-09	16.6	15.2	15.9
LOVESICK LAKE	McCallum Island	1-Sep-09	15.0	15.4	15.2
LOVESICK LAKE	McCallum Island	5-Oct-09	12.7	13.2	13.0
LOWER BUCKHORN LAKE	Heron Island	3-Jun-09	18.6	18.5	18.5
LOWER BUCKHORN LAKE	Heron Island	5-Jul-09	18.1	19.1	18.6
LOWER BUCKHORN LAKE	Heron Island	3-Aug-09	17.1	17.7	17.4
LOWER BUCKHORN LAKE	Heron Island	31-Aug-09	15.1	17.0	16.0
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	7-May-09	13.7	13.8	13.8
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	4-Jun-09	*22.9	14.9	14.9
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	9-Jul-09	24.3	23.1	23.7

LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	5-Aug-09	21.2	23.0	22.1
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	1-Sep-09	14.3	15.7	15.0
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	1-Oct-09	13.5	11.9	12.7
LOWER BUCKHORN LAKE	Deer Bay-centre	2-Jun-09	19.8	16.3	18.0
LOWER BUCKHORN LAKE	Deer Bay-centre	5-Jul-09	17.5	15.4	16.5
LOWER BUCKHORN LAKE	Deer Bay-centre	3-Aug-09	12.0	13.4	12.7
LOWER BUCKHORN LAKE	Deer Bay-centre	31-Aug-09	14.3	13.5	13.9
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	18-May-09	9.2	10.0	9.6
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	6-Jun-09	20.8	20.0	20.4
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	5-Jul-09	15.3	*35.7	15.3
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	4-Aug-09	17.5	18.4	18.0
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	7-Sep-09	16.1	17.3	16.7
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	11-Oct-09	15.0	16.6	15.8
PIGEON LAKE	N-400m N of Boyd Is.	20-May-09	9.0	9.8	9.4
PIGEON LAKE	N-400m N of Boyd Is.	4-Jun-09	10.7	10.4	10.6
PIGEON LAKE	N-400m N of Boyd Is.	3-Jul-09	16.8	14.9	15.8
PIGEON LAKE	N-400m N of Boyd Is.	4-Aug-09	16.5	16.5	16.5
PIGEON LAKE	N-400m N of Boyd Is.	8-Sep-09	22.5	23.6	23.1
PIGEON LAKE	N-400m N of Boyd Is.	7-Oct-09	22.5	23.0	22.8
PIGEON LAKE	N end, Adjacent Con 17	18-May-09	8.2	7.3	7.8
PIGEON LAKE	N end, Adjacent Con 17	6-Jun-09	11.3	11.6	11.4
PIGEON LAKE	N end, Adjacent Con 17	5-Jul-09	15.7	16.0	15.9
PIGEON LAKE	N end, Adjacent Con 17	4-Aug-09	16.8	17.5	17.2
PIGEON LAKE	N end, Adjacent Con 17	7-Sep-09	16.2	15.0	15.6
PIGEON LAKE	N end, Adjacent Con 17	11-Oct-09	15.6	17.4	16.5
PIGEON LAKE	C 340 off Dead Horse Shoal	9-Jul-09	*32.7	13.4	13.4
PIGEON LAKE	C 340 off Dead Horse Shoal	4-Aug-09	17.8	18.7	18.2
PIGEON LAKE	C 340 off Dead Horse Shoal	1-Sep-09	17.4	18.5	17.9
PIGEON LAKE	N-300yds off Bottom Is.	20-May-09	9.8	9.4	9.6
PIGEON LAKE	N-300yds off Bottom Is.	4-Jun-09	14.4	13.7	14.0
PIGEON LAKE	N-300yds off Bottom Is.	3-Jul-09	17.4	18.2	17.8
PIGEON LAKE	N-300yds off Bottom Is.	4-Aug-09	18.4	15.7	17.1
PIGEON LAKE	N-300yds off Bottom Is.	8-Sep-09	17.9	20.4	19.2
PIGEON LAKE	N-300yds off Bottom Is.	7-Oct-09	23.5	22.1	22.8
SANDY LAKE	Mid Lake, deep spot	18-May-09	7.9	9.5	8.7
SANDY LAKE	Mid Lake, deep spot	29-Jun-09	6.2	10.4	8.3
SANDY LAKE	Mid Lake, deep spot	3-Aug-09	8.9	7.9	8.4
SANDY LAKE	Mid Lake, deep spot	16-Aug-09	9.3	11.0	10.2
SANDY LAKE	Mid Lake, deep spot	15-Sep-09	8.7	9.0	8.9
SANDY LAKE	Mid Lake, deep spot	7-Oct-09	6.6	6.3	6.5
SCUGOG LAKE	E end, off Ceasarea	19-May-09	17.4	18.7	18.0
SCUGOG LAKE	E end, off Ceasarea	27-Jun-09	17.2	20.4	18.8
SCUGOG LAKE	E end, off Ceasarea	28-Jul-09	25.1	22.8	23.9
SCUGOG LAKE	E end, off Ceasarea	13-Aug-09	16.3	16.4	16.3
SCUGOG LAKE	E end, off Ceasarea	7-Sep-09	12.1	12.7	12.4
SCUGOG LAKE	E end, off Ceasarea	12-Oct-09	15.9	15.5	15.7
SCUGOG LAKE	Viewlake-deep spot	7-Jun-09	16.9	16.9	16.9
SCUGOG LAKE	Viewlake-deep spot	9-Jul-09	13.2	13.3	13.3
SCUGOG LAKE	Viewlake-deep spot	9-Aug-09	19.2	19.7	19.5
SCUGOG LAKE	Viewlake-deep spot	5-Sep-09	12.6	19.1	15.8

SCUGOG LAKE	Viewlake-deep spot	1-Oct-09	17.0	17.2	17.1
STONY LAKE	Burleigh locks chan.	14-Jun-09	13.0	12.8	12.9
STONY LAKE	Burleigh locks chan.	9-Jul-09	25.3	25.6	25.5
STONY LAKE	Burleigh locks chan.	30-Jul-09	20.9	24.0	22.4
STONY LAKE	Burleigh locks chan.	31-Aug-09	17.5	20.2	18.9
STONY LAKE	Gilchrist Bay	7-Jun-09	10.8	11.9	11.3
STONY LAKE	Gilchrist Bay	20-Jul-09	15.9	14.9	15.4
STONY LAKE	Mouse Is.	27-Apr-09	11.5	11.7	11.6
STONY LAKE	Mouse Is.	31-May-09	9.9	13.0	11.4
STONY LAKE	Mouse Is.	2-Jul-09	9.1	9.9	9.5
STONY LAKE	Mouse Is.	4-Aug-09	13.7	14.8	14.2
STONY LAKE	Mouse Is.	1-Sep-09	17.9	18.2	18.0
STONY LAKE	Mouse Is.	1-Oct-09	13.3	12.7	13.0
STONY LAKE	Hamilton Bay	27-Apr-09	9.0	10.9	10.0
STONY LAKE	Hamilton Bay	31-May-09	9.3	9.5	9.4
STONY LAKE	Hamilton Bay	2-Jul-09	11.9	11.3	11.6
STONY LAKE	Hamilton Bay	4-Aug-09	12.5	12.5	12.5
STONY LAKE	Hamilton Bay	1-Sep-09	16.5	15.8	16.2
STONY LAKE	Hamilton Bay	1-Oct-09	11.8	12.1	11.9
STURGEON LAKE	Muskrat Is. at Buoy C388	24-May-09	14.4	16.1	15.2
STURGEON LAKE	Muskrat Is. at Buoy C388	1-Jun-09	11.0	12.0	11.5
STURGEON LAKE	Muskrat Is. at Buoy C388	5-Jul-09	17.6	14.7	16.2
STURGEON LAKE	Muskrat Is. at Buoy C388	6-Aug-09	18.3	18.0	18.2
STURGEON LAKE	Muskrat Is. at Buoy C388	3-Sep-09	22.1	21.3	21.7
STURGEON LAKE	Muskrat Is. at Buoy C388	1-Oct-09	17.1	20.4	18.8
STURGEON LAKE	Sturgeon Point Buoy	24-May-09	11.3	11.2	11.2
STURGEON LAKE	Sturgeon Point Buoy	1-Jun-09	13.3	12.2	12.7
STURGEON LAKE	Sturgeon Point Buoy	5-Jul-09	20.1	17.9	19.0
STURGEON LAKE	Sturgeon Point Buoy	6-Aug-09	18.2	18.2	18.2
STURGEON LAKE	Sturgeon Point Buoy	3-Sep-09	15.1	15.5	15.3
STURGEON LAKE	Sturgeon Point Buoy	1-Oct-09	17.5	13.1	15.3
STURGEON LAKE	S of Fenelon R-Buoy N5	24-May-09	13.6	13.3	13.5
STURGEON LAKE	S of Fenelon R-Buoy N5	1-Jun-09	10.6	13.1	11.8
STURGEON LAKE	S of Fenelon R-Buoy N5	5-Jul-09	17.6	17.3	17.4
STURGEON LAKE	S of Fenelon R-Buoy N5	6-Aug-09	15.7	19.3	17.5
STURGEON LAKE	S of Fenelon R-Buoy N5	3-Sep-09	*161.6	*155.5	
STURGEON LAKE	S of Fenelon R-Buoy N5	1-Oct-09	14.1	15.2	14.6
UPPER STONEY LAKE	Quarry Bay	13-May-09	5.4	4.8	5.1
UPPER STONEY LAKE	Quarry Bay	15-Jun-09	6.9	7.3	7.1
UPPER STONEY LAKE	Quarry Bay	5-Jul-09	5.5	5.9	5.7
UPPER STONEY LAKE	Quarry Bay	4-Aug-09	7.3	6.9	7.1
UPPER STONEY LAKE	Quarry Bay	1-Sep-09	6.3	7.3	6.8
UPPER STONEY LAKE	Young Bay	13-May-09	5.8	5.8	5.8
UPPER STONEY LAKE	Young Bay	15-Jun-09	6.5	6.5	6.5
UPPER STONEY LAKE	Young Bay	5-Jul-09	7.0	6.1	6.6
UPPER STONEY LAKE	Young Bay	4-Aug-09	6.0	5.6	5.8
UPPER STONEY LAKE	Young Bay	1-Sep-09	6.9	6.4	6.6
UPPER STONEY LAKE	S Bay, deep spot	13-May-09	8.0	7.2	7.6
UPPER STONEY LAKE	S Bay, deep spot	15-Jun-09	9.9	8.8	9.3
UPPER STONEY LAKE	S Bay, deep spot	5-Jul-09	7.6	8.4	8.0
UPPER STONEY LAKE	S Bay, deep spot	4-Aug-09	11.1	11.6	11.3
UPPER STONEY LAKE	S Bay, deep spot	1-Sep-09	7.9	7.7	7.8

UPPER STONEY LAKE	Crowes Landing	13-May-09	5.6	4.8	5.2
UPPER STONEY LAKE	Crowes Landing	15-Jun-09	7.3	7.7	7.5
UPPER STONEY LAKE	Crowes Landing	5-Jul-09	6.8	5.7	6.3
UPPER STONEY LAKE	Crowes Landing	4-Aug-09	6.5	6.5	6.5
UPPER STONEY LAKE	Crowes Landing	1-Sep-09	6.9	6.5	6.7
UPPER STONEY LAKE	Mid Lake, deep spot	13-May-09	7.8	5.4	6.6
UPPER STONEY LAKE	Mid Lake, deep spot	15-Jun-09	*12.1	8.0	8.0
UPPER STONEY LAKE	Mid Lake, deep spot	5-Jul-09	8.5	7.4	7.9
UPPER STONEY LAKE	Mid Lake, deep spot	4-Aug-09	6.8	7.6	7.2
UPPER STONEY LAKE	Mid Lake, deep spot	1-Sep-09	6.5	6.2	6.3
WHITE LAKE (DUMMER)	S end, deep spot	15-May-09	8.5	9.6	9.0
WHITE LAKE (DUMMER)	S end, deep spot	11-Jun-09	12.1	10.4	11.3
WHITE LAKE (DUMMER)	S end, deep spot	16-Jul-09	10.8	12.0	11.4
WHITE LAKE (DUMMER)	S end, deep spot	17-Aug-09	*20.2	10.4	10.4
WHITE LAKE (DUMMER)	S end, deep spot	14-Sep-09	9.7	9.0	9.4
WHITE LAKE (DUMMER)	S end, deep spot	15-Oct-09	9.1	8.7	8.9

Janet Duval

Reeds and water lilies on Deer Bay Reach, Lower Buckhorn

2009 Secchi Depth Measurements

LAKE_NAME	STN	Site ID	Site Description	Date	Secchi (metres)
BALSAM LAKE	6902	2	N Bay Rocky Pt.	6-Jun-09	5.0
BALSAM LAKE	6902	2	N Bay Rocky Pt.	23-Jun-09	5.0
BALSAM LAKE	6902	2	N Bay Rocky Pt.	7-Jul-09	4.8
BALSAM LAKE	6902	2	N Bay Rocky Pt.	20-Jul-09	5.8
BALSAM LAKE	6902	2	N Bay Rocky Pt.	15-Aug-09	6.5
BALSAM LAKE	6902	2	N Bay Rocky Pt.	3-Sep-09	5.5
BALSAM LAKE	6902	2	N Bay Rocky Pt.	15-Sep-09	5.3
BALSAM LAKE	6902	5	N/E end-Lightning Point	24-May-09	3.2
BALSAM LAKE	6902	5	N/E end-Lightning Point	24-May-09	3.2
BALSAM LAKE	6902	5	N/E end-Lightning Point	22-Jun-09	4.0
BALSAM LAKE	6902	5	N/E end-Lightning Point	29-Jun-09	2.8
BALSAM LAKE	6902	5	N/E end-Lightning Point	31-Jul-09	4.9
BALSAM LAKE	6902	5	N/E end-Lightning Point	31-Jul-09	4.9
BALSAM LAKE	6902	5	N/E end-Lightning Point	24-Aug-09	3.8
BALSAM LAKE	6902	5	N/E end-Lightning Point	31-Aug-09	4.2
BALSAM LAKE	6902	5	N/E end-Lightning Point	14-Sep-09	3.8
BALSAM LAKE	6902	5	N/E end-Lightning Point	5-Oct-09	3.4
BALSAM LAKE	6902	5	N/E end-Lightning Point	5-Oct-09	3.4
BALSAM LAKE	6902	7	South Bay-Killarney Bay	22-May-09	2.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	24-May-09	2.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	1-Jun-09	3.4
BALSAM LAKE	6902	7	South Bay-Killarney Bay	5-Jul-09	3.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	5-Jul-09	3.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	8-Aug-09	3.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	8-Aug-09	3.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	6-Sep-09	3.7
BALSAM LAKE	6902	7	South Bay-Killarney Bay	1-Oct-09	4.5
BALSAM LAKE	6902	8	W Bay2, deep spot	30-May-09	5.4
BALSAM LAKE	6902	8	W Bay2, deep spot	19-Jun-09	4.0
BALSAM LAKE	6902	8	W Bay2, deep spot	2-Jul-09	4.2
BALSAM LAKE	6902	8	W Bay2, deep spot	4-Aug-09	3.5
BALSAM LAKE	6902	8	W Bay2, deep spot	1-Sep-09	4.0
BALSAM LAKE	6902	8	W Bay2, deep spot	6-Oct-09	4.2
BALSAM LAKE	6902	9	E of Grand Is	8-Jun-09	3.0
BALSAM LAKE	6902	9	E of Grand Is	20-Jul-09	4.0
BALSAM LAKE	6902	9	E of Grand Is	31-Aug-09	4.0
BALSAM LAKE	6902	9	E of Grand Is	21-Sep-09	3.5
BALSAM LAKE	6902	9	E of Grand Is	12-Oct-09	4.0
BIG BALD LAKE	6941	1	Mid Lake, deep spot	13-May-09	5.5
BIG BALD LAKE	6941	1	Mid Lake, deep spot	1-Jun-09	5.2
BIG BALD LAKE	6941	1	Mid Lake, deep spot	23-Jun-09	4.8
BIG BALD LAKE	6941	1	Mid Lake, deep spot	7-Jul-09	4.1
BIG BALD LAKE	6941	1	Mid Lake, deep spot	20-Jul-09	6.0
BIG BALD LAKE	6941	1	Mid Lake, deep spot	4-Aug-09	4.5
BIG BALD LAKE	6941	1	Mid Lake, deep spot	2-Sep-09	4.8
BIG BALD LAKE	6941	1	Mid Lake, deep spot	1-Oct-09	5.3

BUCKHORN LAKE (U)	7131	1	Narrows, red buoy C310	3-Jul-09	2.0
CHEMONG LAKE	6951	7	Poplar Pt.	30-May-09	1.3
CHEMONG LAKE	6951	7	Poplar Pt.	29-Jun-09	1.4
CHEMONG LAKE	6951	7	Poplar Pt.	29-Jul-09	1.2
CHEMONG LAKE	6951	7	Poplar Pt.	28-Aug-09	1.2
CHEMONG LAKE	6951	7	Poplar Pt.	30-Sep-09	1.2
CLEAR LAKE	6955	2	Main Basin, deep spot	10-Jul-09	4.2
CLEAR LAKE	6955	3	Fiddlers Bay	11-Jul-09	4.2
CLEAR LAKE	6955	4	Brysons Bay	12-Jun-09	2.9
CLEAR LAKE	6955	4	Brysons Bay	1-Aug-09	3.7
CLEAR LAKE	6955	4	Brysons Bay	31-Aug-09	3.8
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	4-May-09	3.6
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	19-May-09	3.5
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	1-Jun-09	3.8
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	18-Jun-09	4.5
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	7-Jul-09	5.7
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	20-Jul-09	5.9
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	6-Aug-09	5.8
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	18-Aug-09	4.7
KATCHEWANOOKA LAKE	7076	1	S/E Douglas Island	1-Oct-09	4.8
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	15-May-09	4.2
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	1-Jun-09	5.0
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	16-Jun-09	4.8
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	2-Jul-09	5.6
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	16-Jul-09	5.2
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	4-Aug-09	5.0
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	17-Aug-09	5.3
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	1-Sep-09	5.3
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	14-Sep-09	5.1
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	30-Sep-09	4.6
KATCHEWANOOKA LAKE	7076	2	Young Pt near locks	16-Oct-09	5.0
LOVESICK LAKE	7087	1	80' hole at N. end	24-May-09	6.0
LOVESICK LAKE	7087	1	80' hole at N. end	9-Jun-09	5.5
LOVESICK LAKE	7087	1	80' hole at N. end	1-Jul-09	5.0
LOVESICK LAKE	7087	1	80' hole at N. end	4-Aug-09	6.0
LOVESICK LAKE	7087	1	80' hole at N. end	1-Sep-09	6.0
LOVESICK LAKE	7087	1	80' hole at N. end	2-Oct-09	6.0
LOVESICK LAKE	7087	2	Spenceley's Bay	24-May-09	6.0
LOVESICK LAKE	7087	2	Spenceley's Bay	9-Jun-09	5.5
LOVESICK LAKE	7087	2	Spenceley's Bay	1-Jul-09	5.0
LOVESICK LAKE	7087	2	Spenceley's Bay	4-Aug-09	5.0
LOVESICK LAKE	7087	2	Spenceley's Bay	1-Sep-09	5.0
LOVESICK LAKE	7087	2	Spenceley's Bay	2-Oct-09	5.0
LOVESICK LAKE	7087	3	McCallum Island	24-May-09	6.0
LOVESICK LAKE	7087	3	McCallum Island	9-Jun-09	5.5
LOVESICK LAKE	7087	3	McCallum Island	1-Jul-09	5.0
LOVESICK LAKE	7087	3	McCallum Island	4-Aug-09	4.0
LOVESICK LAKE	7087	3	McCallum Island	1-Sep-09	4.5
LOVESICK LAKE	7087	3	McCallum Island	2-Oct-09	4.5
LOWER BUCKHORN LAKE	6990	1	Heron Island	24-May-09	5.1

LOWER BUCKHORN LAKE	6990	1	Heron Island	3-Jun-09	5.1
LOWER BUCKHORN LAKE	6990	1	Heron Island	5-Jul-09	4.1
LOWER BUCKHORN LAKE	6990	1	Heron Island	5-Jul-09	4.1
LOWER BUCKHORN LAKE	6990	1	Heron Island	3-Aug-09	4.8
LOWER BUCKHORN LAKE	6990	1	Heron Island	3-Aug-09	4.2
LOWER BUCKHORN LAKE	6990	1	Heron Island	31-Aug-09	4.2
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	7-May-09	4.7
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	22-May-09	4.2
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	4-Jun-09	7.0
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	21-Jun-09	4.2
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	9-Jul-09	5.9
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	21-Jul-09	6.1
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	5-Aug-09	4.7
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	19-Aug-09	4.5
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	1-Sep-09	5.4
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	16-Sep-09	4.5
LOWER BUCKHORN LAKE	6990	4	Deer Bay W-Buoy C267	1-Oct-09	5.7
LOWER BUCKHORN LAKE	6990	6	Deer Bay-centre	3-Jun-09	3.7
LOWER BUCKHORN LAKE	6990	6	Deer Bay-centre	5-Jul-09	3.3
LOWER BUCKHORN LAKE	6990	6	Deer Bay-centre	5-Jul-09	3.3
LOWER BUCKHORN LAKE	6990	6	Deer Bay-centre	3-Aug-09	4.2
LOWER BUCKHORN LAKE	6990	6	Deer Bay-centre	31-Aug-09	3.2
PIGEON LAKE	6919	3	Middle, Sandy Pt/Boyd Is.	18-May-09	3.0
PIGEON LAKE	6919	3	Middle, Sandy Pt/Boyd Is.	6-Jun-09	2.9
PIGEON LAKE	6919	3	Middle, Sandy Pt/Boyd Is.	5-Jul-09	2.9
PIGEON LAKE	6919	3	Middle, Sandy Pt/Boyd Is.	4-Aug-09	2.6
PIGEON LAKE	6919	3	Middle, Sandy Pt/Boyd Is.	7-Sep-09	3.6
PIGEON LAKE	6919	3	Middle, Sandy Pt/Boyd Is.	11-Oct-09	3.0
PIGEON LAKE	6919	12	N-400m N of Boyd Is.	24-May-09	3.3
PIGEON LAKE	6919	12	N-400m N of Boyd Is.	24-May-09	2.3
PIGEON LAKE	6919	12	N-400m N of Boyd Is.	3-Jul-09	3.5
PIGEON LAKE	6919	12	N-400m N of Boyd Is.	4-Aug-09	3.2
PIGEON LAKE	6919	12	N-400m N of Boyd Is.	8-Sep-09	3.7
PIGEON LAKE	6919	13	N end, Adjacent Con 17	18-May-09	3.1
PIGEON LAKE	6919	13	N end, Adjacent Con 17	6-Jun-09	2.8
PIGEON LAKE	6919	13	N end, Adjacent Con 17	5-Jul-09	2.9
PIGEON LAKE	6919	13	N end, Adjacent Con 17	4-Aug-09	2.8
PIGEON LAKE	6919	13	N end, Adjacent Con 17	7-Sep-09	3.3
PIGEON LAKE	6919	13	N end, Adjacent Con 17	11-Oct-09	3.0
PIGEON LAKE	6919	15	C 340 off Dead Horse Shoal	9-Jul-09	3.0
PIGEON LAKE	6919	15	C 340 off Dead Horse Shoal	21-Jul-09	3.0
PIGEON LAKE	6919	15	C 340 off Dead Horse Shoal	4-Aug-09	2.8
PIGEON LAKE	6919	15	C 340 off Dead Horse Shoal	19-Aug-09	2.9
PIGEON LAKE	6919	15	C 340 off Dead Horse Shoal	4-Sep-09	3.6
PIGEON LAKE	6919	16	N-300yds off Bottom Is.	24-May-09	3.8
PIGEON LAKE	6919	16	N-300yds off Bottom Is.	24-May-09	2.3
PIGEON LAKE	6919	16	N-300yds off Bottom Is.	3-Jul-09	3.5
PIGEON LAKE	6919	16	N-300yds off Bottom Is.	4-Aug-09	3.2
PIGEON LAKE	6919	16	N-300yds off Bottom Is.	8-Sep-09	3.7
SANDY LAKE	7241	2	Mid Lake, deep spot	18-May-09	6.8
SANDY LAKE	7241	2	Mid Lake, deep spot	28-Jun-09	6.1
SANDY LAKE	7241	2	Mid Lake, deep spot	31-Jul-09	5.0

SANDY LAKE	7241	2	Mid Lake, deep spot	8-Aug-09	5.0
SANDY LAKE	7241	2	Mid Lake, deep spot	18-Aug-09	4.9
SANDY LAKE	7241	2	Mid Lake, deep spot	13-Sep-09	4.4
SANDY LAKE	7241	2	Mid Lake, deep spot	11-Oct-09	4.7
STONY LAKE	7133	4	Burleigh locks chan.	12-Jun-09	3.0
STONY LAKE	7133	4	Burleigh locks chan.	9-Jul-09	3.3
STONY LAKE	7133	4	Burleigh locks chan.	30-Aug-09	6.1
STONY LAKE	7133	4	Burleigh locks chan.	31-Aug-09	3.6
STONY LAKE	7133	7	Mouse Is.	27-Apr-09	3.1
STONY LAKE	7133	7	Mouse Is.	1-Jun-09	4.5
STONY LAKE	7133	7	Mouse Is.	2-Jul-09	5.1
STONY LAKE	7133	7	Mouse Is.	4-Aug-09	3.8
STONY LAKE	7133	7	Mouse Is.	1-Sep-09	4.0
STONY LAKE	7133	7	Mouse Is.	1-Oct-09	3.9
STONY LAKE	7133	8	Hamilton Bay	27-Apr-09	3.3
STONY LAKE	7133	8	Hamilton Bay	1-Jun-09	4.1
STONY LAKE	7133	8	Hamilton Bay	2-Jul-09	4.1
STONY LAKE	7133	8	Hamilton Bay	4-Aug-09	4.1
STONY LAKE	7133	8	Hamilton Bay	1-Sep-09	4.1
STONY LAKE	7133	8	Hamilton Bay	1-Oct-09	4.1
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	24-May-09	3.3
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	24-May-09	3.3
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	24-May-09	3.3
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	2-Jun-09	3.1
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	2-Jun-09	3.1
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	2-Jun-09	3.1
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	5-Jul-09	3.6
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	5-Jul-09	3.6
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	5-Jul-09	3.6
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	7-Aug-09	3.8
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	7-Aug-09	3.8
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	7-Aug-09	3.8
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	2-Sep-09	3.1
STURGEON LAKE	6924	4	Muskrat Is. at Buoy C388	2-Sep-09	3.1
STURGEON LAKE	6924	5	Sturgeon Point Buoy	24-May-09	3.4
STURGEON LAKE	6924	5	Sturgeon Point Buoy	24-May-09	3.4
STURGEON LAKE	6924	5	Sturgeon Point Buoy	24-May-09	3.4
STURGEON LAKE	6924	5	Sturgeon Point Buoy	2-Jun-09	3.1
STURGEON LAKE	6924	5	Sturgeon Point Buoy	2-Jun-09	3.1
STURGEON LAKE	6924	5	Sturgeon Point Buoy	2-Jun-09	3.1
STURGEON LAKE	6924	5	Sturgeon Point Buoy	5-Jul-09	2.5
STURGEON LAKE	6924	5	Sturgeon Point Buoy	5-Jul-09	2.5
STURGEON LAKE	6924	5	Sturgeon Point Buoy	5-Jul-09	2.5
STURGEON LAKE	6924	5	Sturgeon Point Buoy	7-Aug-09	2.8
STURGEON LAKE	6924	5	Sturgeon Point Buoy	7-Aug-09	2.8
STURGEON LAKE	6924	5	Sturgeon Point Buoy	7-Aug-09	2.8
STURGEON LAKE	6924	5	Sturgeon Point Buoy	2-Sep-09	3.2
STURGEON LAKE	6924	5	Sturgeon Point Buoy	2-Sep-09	3.2
STURGEON LAKE	6924	5	Sturgeon Point Buoy	2-Oct-09	3.4
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	24-May-09	2.8
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	24-May-09	2.8
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	24-May-09	2.8
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	2-Jun-09	3.1

STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	2-Jun-09	3.1
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	2-Jun-09	3.1
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	5-Jul-09	2.8
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	5-Jul-09	2.8
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	5-Jul-09	2.8
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	7-Aug-09	2.5
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	7-Aug-09	2.5
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	7-Aug-09	2.5
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	2-Sep-09	3.3
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	2-Sep-09	3.3
STURGEON LAKE	6924	6	S of Fenelon R-Buoy N5	2-Oct-09	2.6
UPPER STONEY LAKE	5178	1	Quarry Bay	13-May-09	5.4
UPPER STONEY LAKE	5178	1	Quarry Bay	14-Jun-09	5.3
UPPER STONEY LAKE	5178	1	Quarry Bay	2-Jul-09	6.5
UPPER STONEY LAKE	5178	1	Quarry Bay	3-Aug-09	6.0
UPPER STONEY LAKE	5178	1	Quarry Bay	1-Sep-09	5.8
UPPER STONEY LAKE	5178	1	Quarry Bay	14-Oct-09	7.6
UPPER STONEY LAKE	5178	3	Young Bay	13-May-09	5.1
UPPER STONEY LAKE	5178	3	Young Bay	14-Jun-09	5.5
UPPER STONEY LAKE	5178	3	Young Bay	2-Jul-09	6.2
UPPER STONEY LAKE	5178	3	Young Bay	3-Aug-09	6.0
UPPER STONEY LAKE	5178	3	Young Bay	1-Sep-09	6.2
UPPER STONEY LAKE	5178	3	Young Bay	14-Oct-09	6.6
UPPER STONEY LAKE	5178	4	S Bay, deep spot	13-May-09	3.4
UPPER STONEY LAKE	5178	4	S Bay, deep spot	15-Jun-09	3.4
UPPER STONEY LAKE	5178	4	S Bay, deep spot	2-Jul-09	3.4
UPPER STONEY LAKE	5178	4	S Bay, deep spot	3-Aug-09	3.4
UPPER STONEY LAKE	5178	4	S Bay, deep spot	1-Sep-09	3.4
UPPER STONEY LAKE	5178	4	S Bay, deep spot	14-Oct-09	3.4
UPPER STONEY LAKE	5178	5	Crowes Landing	13-May-09	5.6
UPPER STONEY LAKE	5178	5	Crowes Landing	14-Jun-09	5.4
UPPER STONEY LAKE	5178	5	Crowes Landing	2-Jul-09	6.4
UPPER STONEY LAKE	5178	5	Crowes Landing	3-Aug-09	6.1
UPPER STONEY LAKE	5178	5	Crowes Landing	1-Sep-09	5.9
UPPER STONEY LAKE	5178	5	Crowes Landing	14-Oct-09	6.5
UPPER STONEY LAKE	5178	6	Mid Lake, deep spot	13-May-09	5.5
UPPER STONEY LAKE	5178	6	Mid Lake, deep spot	11-Jun-09	5.3
UPPER STONEY LAKE	5178	6	Mid Lake, deep spot	2-Jul-09	5.6
UPPER STONEY LAKE	5178	6	Mid Lake, deep spot	3-Aug-09	6.5
UPPER STONEY LAKE	5178	6	Mid Lake, deep spot	1-Sep-09	5.8
UPPER STONEY LAKE	5178	6	Mid Lake, deep spot	14-Sep-09	6.7

Appendix G: Glossary

Algae – Simple, one-celled or colonial plant-like organisms that grow in water, contain chlorophyll and do not differentiate into specialized cells and tissues like roots and leaves.

Aquatic plants – Plants that grow partially or entirely submerged in lakes and streams or in waterlogged, wetland soils.

Archipelago – A chain or cluster of islands.

Biomass – The amount of living matter produced in a chosen area or volume of habitat. Usually measured by dry weight, biomass indicates how productive, for example, a lake, pond, forest or meadow is.

Bio-retention pond - An artificial pond with vegetation around the perimeter, used to manage stormwater runoff to prevent flooding and downstream erosion and to improve water quality by removing soluble nutrients through uptake.

Canadian Shield – Also called the Precambrian or Laurentian Shield, it covers as bedrock much of central and northeastern Canada and the United States. The Shield is one of the oldest geological formations in the world, composed of metamorphosed rocks originally laid down between 4.5 billion and 540,000 million years ago. Often covered with forest, it provides relatively low-phosphorus water to the Kawartha Lakes.

Caprock – A geological term for a harder or more resistant rock type overlying a weaker or less resistant rock type.

Chlorophyll a – A green plant pigment found in photosynthesizing organisms; the amount of chlorophyll a in surface water samples indicates the amount of free-floating algae.

Constructed wetland - An artificial marsh or swamp created for discharge such as wastewater, stormwater runoff or sewage treatment, and as habitat for wildlife. Similar to natural wetlands, these wetlands can be constructed to remove sediments and heavy metals from the water.

***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* cause severe gastrointestinal illness. Drinking water and recreational water are tested for the presence of these bacteria.

Ergot – A group of fungi of the genus *Clavicaps* that grow on grasses and grains.

Eutrophication – The aging of a body of water as it increases in dissolved nutrients like phosphorus and declines in oxygen. This is often a natural process that can be accelerated by shoreline development and other human activities.

Extirpation – This occurs when a species becomes extinct in one location but continues to exist elsewhere.

Gneiss – A common, widely distributed type of rock formed by high grade regional metamorphic processes from pre-existing formations that were originally igneous or sedimentary rock.

Iapetus Ocean – Named for the Greek god who was the father of Atlas, an ocean that existed in the Neoproterozoic and Paleozoic eras of the geologic timescale (between 600 and 400 million years ago).

Isostatic rebound – Also called glacial rebound, the rise of land masses that were depressed by the huge weight of ice sheets during the last glacial period.

Macrophyte – A plant, generally aquatic, that is visible to the eye, i.e. not microscopic.

Marl and marl lake – Marl is limestone (calcium carbonate) that collects on the lake bottom. Marl lakes receive drainage from limestone dominated watersheds. Acidic rainfall dissolves the limestone as it percolates through the rocks or soil. When the high-calcium water in the lake warms in the summer, the carbon dioxide-forming carbonic acid is reduced and the dissolved limestone precipitates out.

Mesa – The Spanish word for table, a mesa is an elevated area of land with a flat top and sides that are usually steep cliffs.

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.

Periphyton – Algae attached to plants.

Phosphorus – A widely occurring chemical element that stimulates the growth of terrestrial and aquatic plants as well as algae. Much phosphorus in the Kawarthas comes from the atmosphere, from within the bedrock (especially the limestone), as well as from decaying vegetation on the bottoms of lakes and streams. Much may also be coming from human sources.

Phytoplankton ("floating plants") – Tiny, often microscopic free-floating algae that can turn lake water greenish, and are fed upon by zooplankton, zebra mussels, baby fish, etc.

Riparian – The interface between the land and a body of water.

Safe swimming level – The Ontario Ministry of 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.

Scarp – The steeper side of an escarpment, sometimes forming a cliff.

Secchi disk – A circular disk with alternating black and white quarters, which is lowered to specific depths in surface water, used to estimate water clarity.

Smut – A group of plant parasitic fungi.

Substrate – The earthy material that exists in the bottom of a marine habitat, like dirt, rocks, sand or gravel.

Tannic water –Brown-stained water containing astringent chemicals produced by the decay of vegetation.

Taxonomy – The practice and science of classification.

Turbidity – Cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are invisible to the human eye.

Water column – A hypothetical cylinder of water from the surface to the bottom of a stream, river or lake, within which scientists measure physical and/or chemical properties.

Appendix H: Rainfall in the Kawarthas - Summer 2009

This chart shows rainfall (mm) at three sites in the Kawarthas during the summer of 2009. Rainfall over 10 mm is in **bold**.

Date/09	Stony Lake	Trent U.	Lindsay	Date/09	Stony Lake	Trent U.	Lindsay
Jun25	0.0	0.0	0.0	**Aug1**	0.0	0.0	0.0
Jun26	0.0	0.0	0.0	**Aug2**	0.0	1.3	0.0
Jun27	0.0	0.0	0.0	**Aug3**	0.0	0.0	1.1
Jun28	6.8	**13.0**	0.0	**Aug4**	5.3	**27.4**	**28.5**
Jun29	0.0	**12.6**	**10.1**	**Aug5**	0.0	0.0	0.0
Jun30	5.3	0.0	4.0	**Aug6**	0.0	0.0	0.0
June Total		52.8		**Aug7**	0.0	0.0	0.3
June Ave.		78.9		**Aug8**	0.0	1.0	1.1
Jul1	**22.1**	**16.4**	5.9	**Aug9**	7.9	6.5	11.3
Jul2	**25.3**	8.6	7.4	**Aug10**	0.0	0.0	2.1
Jul3	0.0	1.9	**10.6**	**Aug11**	0.0	0.0	2.8
Jul4	0.0	0.0	0.9	**Aug12**	7.1	0.0	0.0
Jul5	0..0	0.0	0.0	**Aug13**	0.0	0.0	0.0
Jul6	0.0	1.0	0.0	**Aug14**	0.0	0.0	0.4
Jul7	6.5	2.2	1.6	**Aug15**	0.0	0.0	0.0
Jul8	1.2	0.0	1.9	**Aug16**	0.0	0.0	0.2
Jul9	0.0	0.0	0.6	**Aug17**	6.6	**11.6**	6.1
Jul10	0.0	0.0	0.0	**Aug18**	0.0	0.0	5.0
Jul11	3.5	3.7	0.9	**Aug19**	0.0	0.0	0.0
Jul12	0.0	0.0	0.0	**Aug20**	**11.8**	8.2	**42.2**
Jul13	0.0	0.0	0.0	**Aug21**	1.2	0.6	2.0
Jul14	0.0	0.0	0.9	**Aug22**	5.9	5.8	0.5
Jul15	0.0	1.2	0.0	**Aug23**	0.0	1.3	0.0
Jul16	0.4	0.0	2.0	**Aug24**	0.0	0.0	0.0
Jul17	0.0	0.0	0.5	**Aug25**	0.0	0.0	1.1
Jul18	0.0	0.0	2.9	**Aug26**	1.8	3.0	0.7
Jul19	0.0	0.0	0.0	**Aug27**	0.0	0.0	0.0
Jul20	0.0	0.0	0.4	**Aug28**	0.0	0.0	0.5
Jul21	0.0	0.0	0.1	**Aug29**	**25.7**	**19.1**	**10.7**
Jul22	0.0	0.0	0.0	**Aug30**	1.2	0.0	0.0
Jul23	**11.2**	**30.1**	0.8	**Aug31**	0.0	0.0	0.0
Jul24	**14.4**	0.7	**13.3**	**Aug Total**		85.8	
Jul25	8.2	**15.0**	4.5	**Aug Ave.**		91.6	
Jul26	0.0	2.1	9.9	**Sep1**	0.0	0.0	0.5
Jul27	0.0	2.2	1.9	**Sep2**	0.0	0.0	0.2
Jul28	0.0	1.3	1.9	**Sep3**	0.0	0.0	0.0
Jul29	5.9	8.5	0.3	**Sep4**	0.0	0.0	0.5
Jul30	0.0	0.0	1.7	**Sep5**	0.0	0.0	0.6
Jul31	0.0	0.0	0.0	**Sep6**	0.0	0.0	0.0
July Total		94.9		**Sep7**	0.0	0.0	0.2
July Ave.		68.4		**Sep8**	0.0	0.0	0.3
				Sep9	0.0	0.0	0.0

Testing Our Water Weeds Knowledge

As part of KLSA's aquatic plants project, we created "pop quizzes" for everyone who came to our Spring general meeting and our Fall Annual General Meeting in 2009. At the spring meeting, held on May 9, 2009 in Bobcaygeon, we launched KLSA's Aquatic Plants Guide, the 40-page booklet summarizing our 2008 research and public education project on aquatic plant control, which was supported by the Ontario Trillium Foundation and many other donors.

That initial quiz was designed to test members' knowledge of local aquatic weed control before they had reviewed the Plants Guide. At the fall KLSA meeting, held on October 3, 2009 in Buckhorn, we gave a similar quiz, to see whether knowledge of aquatic plants had improved over the summer, with the help of the Plants Guide.

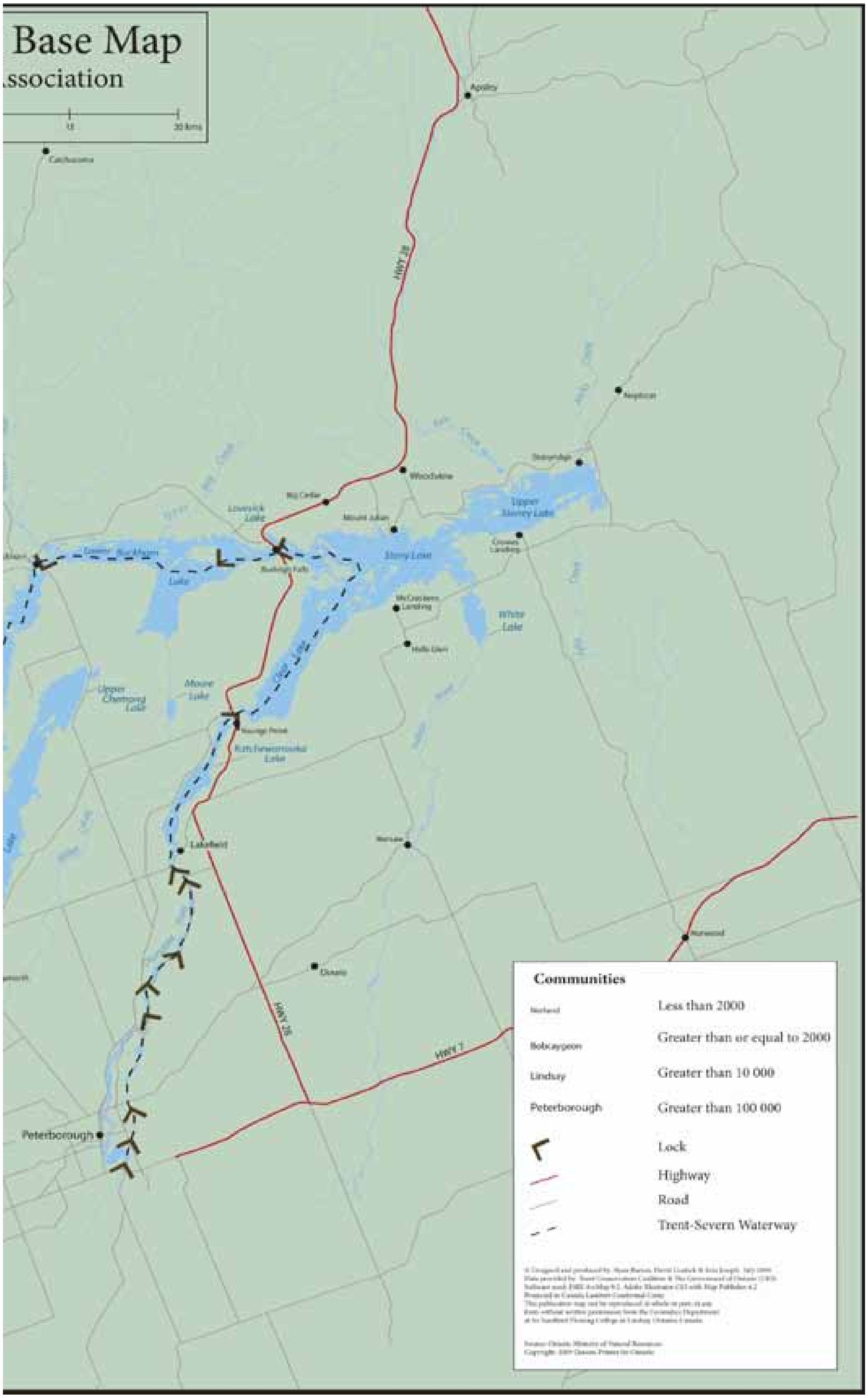
How well did we do?

At the spring meeting, 67 people took the test, which contained a total of 23 points, multiple choice or true or false. The average score was 55%. At the fall meeting, 51 people took the test, worth 15 points, and the average score was 63%. So we improved our knowledge of aquatic habitat, aquatic plants and weed control by 8% over the summer. Is this impressive, or what?

Anita Locke

Backwaters


Kawartha Watershed Base Ma
Kawartha Lake Stewards Association
N
HWY 35
Shadow Lake
Silver Lake
Four Mile Lake
Balsam Lake
Cameron Lake
Fenelon Falls
Bobcaygeon
Big Bald Lake
Little Bald Lake
Sandy Lake
Buckhorn Lake
Pigeon Lake
Emily Lake
Upper Chemong Lake
Chemong Lake
Lindsay
Peterborough
HWY 7
Lake Scugog


Base Map
ssociation
Apsley
HWY 28
Woodview
Burleigh Falls
Stony Lake
Upper Stoney Lake
Lakefield
Peterborough
HWY 28
HWY 7
Communities
Less than 2000
Bobcaygeon
Greater than or equal to 2000
Lindsay
Greater than 10 000
Peterborough
Greater than 100 000
Lock
Highway
Road
Trent-Severn Waterway

Appeal to Readers

KLSA relies heavily on generous donations from individuals, businesses, and cottage associations to carry on its valuable work. Run completely by volunteers, some of its ambitious plans for 2010 include:

- ☐ A major study of **algae** in the Kawartha Lakes
- ☐ Continuing review of phosphorus levels outside **sewage treatment plants**
- ☐ A follow-up study of *E. coli* and phosphorus levels in **Lindsay storm sewers**
- ☐ A study of the **effect of shoreline residential development** on *E.coli* and phosphorus levels, on a unique mid-Kawartha waterway
- ☐ Attention to **emerging public concerns** such as a new invasive hybrid milfoil and expanding wild rice beds.
- ☐ **PowerPoint presentations** on our work and research, including an *E.coli* primer for your group or association.
- ☐ As always, sampling of lake waters for *E.coli* bacteria, phosphorus and clarity

With its strong volunteer roster, rigorous water monitoring, ground-breaking research, and many local partnerships, KLSA provides excellent value for every dollar it receives.

✂ *Please clip and mail to KLSA*

☐ I believe in what KLSA is doing. Here's my personal donation of $________
Individual donations of $40 or more qualify for a charitable receipt. Please write personal cheques of $40 or more to The Stoney Lake Heritage Foundation *with notation "for KLSA" and mail to KLSA at the address below.*
Cheques under $40 should be made out to KLSA. We also give business receipts:

☐ KLSA may list my name as a donor in its publications.

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

☐ I would be willing to help test water quality on my lake during the summer, if you can use me.

My name ____

Permanent address ________________________________

________________________ Postal code _____________

Name of my association or business if applicable: __________

____

Email ____

Name of my lake __________________________________

Phone ____

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