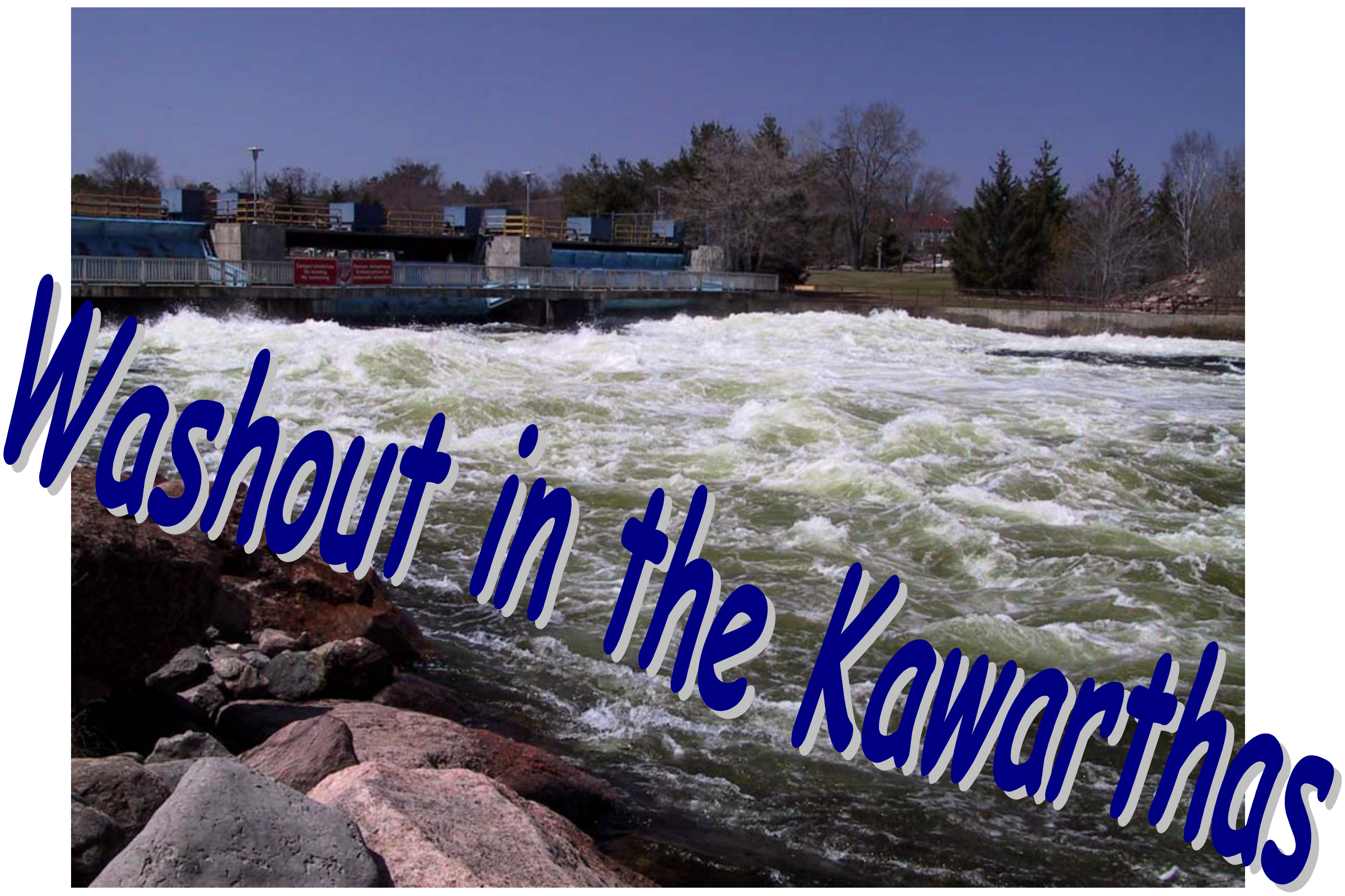
Kawartha Lake Stewards Association
Winner of FOCA'S 2002 Jerry Strickland Award

Lake Water Quality 2004 Report



May 2005

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Special Thanks to the following Major Sponsors of KLSA

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

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This year's cover graphic is the rapids at the Buckhorn dam and helps to convey the title theme of the 2004 report, **"Washout in the Kawarthas".** Jeff Chalmers, our hard working Treasurer and report production guru, contributed all the photographs in the report, as well as designing the cover.

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Message from the Chair

This is the fourth annual report by the Kawartha Lake Stewards Association (KLSA) about its water quality testing program. Our program focuses on bacteria *(E.coli)* and phosphorus in lake water within the watershed of the Kawartha Lakes section of the Trent-Severn Waterway. KLSA is a volunteer driven, non-profit organization representing local lake associations of cottagers and year-round residents in the Kawartha Lakes area. KLSA was started because there was no coordinated lake water testing program being done by government agencies, and the testing on some lakes by volunteers was inconsistent lake to lake.

Appendix A contains KLSA's mission statement and lists of its Executive Board members and volunteers.

Highlights of 2004

In 2004, KLSA volunteers sampled 116 sites (compared with 119 sites in 2003) for *E.coli* on 12 lakes. Phosphorus samples were taken at 34 locations, an increase from 27 in the previous year. We did not test for *E.coli* in Chemong Lake again this year through lack of volunteers but we hope that volunteers will come forward in the coming year. We welcomed more volunteers from Sturgeon Lake in 2004 and several new volunteers from other KLSA lakes. White Lake Cottager's Association, a new member of KLSA, will begin a full water testing program in 2005.

2004 saw our first survey of aquatic plants ("weeds"). (Please see the "Glossary" in Appendix G for a definition of "aquatic plants" and other words you may not be familiar with in this report.) Although only six volunteers completed the observation logs, the results are an indication of the weed species common in our lakes and their growth patterns over the summer. Zebra mussel populations and algae were also surveyed. We hope that more lakes will participate in the 2005 program.

Our two local Conservation Authorities presented a fall training workshop on benthic macroinvertebrates, the "bugs" that live on the bottom of lakes and streams. Surveying them is a sophisticated and sensitive means of tracking water quality and the health of aquatic habitats over time. KLSA representatives from seven Kawartha Lakes attended the training session. Depending upon interest and funding, KLSA may incorporate benthic invertebrate studies into its ongoing programs.

Our funding activities continue to be successful. About 42% of our funds came from participating associations and individuals in '04. The other 58% came from local municipalities, businesses and the Trent-Severn Waterway. Appendix B lists our donors and sponsors. We hope that our donors will find this report interesting and valuable. We look forward to their continuing support.

As indicated in the Treasurer's Report in Appendix C, we have an ongoing surplus of approximately $4,000, which will cover the current report production and our 2005 spring testing. Most of our expenses, 72%, are for lab analysis and reporting of *E.coli* results by SGS Lakefield Research. An additional 17% is spent on annual report production and distribution. Insurance, bank fees and office expenses account for the remaining 11%.

KLSA's new Privacy Policy, written to assure our members that the Association will use and disclose information about them appropriately, was issued to members and other volunteers and is attached in Appendix D.

At a summer planning meeting of the KLSA Executive Board, several changes in policy were agreed upon as we move forward:

- After four years of water sampling, a number of sites have shown consistently low *E.coli* counts, indicating little reason to be concerned about swimming safety there. We believe that some of these sites could be "retired" after review by the local volunteers, if they would like to reduce their overall number of sampling sites.
- Due to our increasing concern about the levels of phosphorous in our lakes and our desire to know more about the sources of this important nutrient, we decided to focus more of our efforts here. We intend to initiate a Phosphorous Source Study this coming year.
- In order to ensure continuity of the Executive Board in the future, Board members are asked to inform the Chair at the next Annual General Meeting (AGM) whether they intend to step down during the year. The Board will be expanded from six to eight members at the next AGM. In the meantime, two Associate Directors were elected at the 2004 fall meeting.

Two successful volunteer meetings and training sessions and three Executive Board meetings were held in 2004. Five of the six Board members from 2003/2004 were re-elected as the new Board for 2004/2005. For his past service on the Board, we thank Ron Elliott, who stepped down, and we welcome new Board member Tom Mccarron.

Roles for members of the Board for 2004/2005 are as follows:

Jim Keyser – Chair
Jeff Chalmers - Secretary/Treasurer/Report Production
Pat Moffat - Vice-Chair: Aquatic Plants Studies/Report Editor
Kathleen Mackenzie - Vice Chair: Bacteria and Phosphorus Water Testing Programs
Tom Mccarron - Director: Fundraising
Mark Potter – Director at Large

Ann Ambler will continue in her role as KLSA recording secretary.

We welcome Kevin Walters and Mike Stedman as Associate Directors. Kevin has taken on the project manager role for the new phosphorus source study this year.

We also welcome Dr. Eric Sager, of Trent University's Oliver Ecological Centre, who is advising us on our aquatic plants research and other initiatives.

Related issues

Briefs were submitted in 2003 on two significant policy directions that could in the long term affect the water quality in the lakes of the TSW and Peterborough County. These are:

- The draft proposed "Rideau Canal and Trent-Severn Waterway Policies for In-Water and Shoreline Works and Related Activities," and
- The Shoreland Areas and the Waterfront section of the new County of Peterborough Official Plan, which is awaiting Ministry approval.

Contact Jim Keyser for more information on these issues. (See Appendix A.)

Thank you

On behalf of all KLSA Board members and volunteers, I want to extend our sincere thanks to our donors and supporters, workshop speakers, SGS Lakefield Research staff, the staff at MOE's Lake Partner Program, the Peterborough County-City Health Unit, the Buckhorn Community Centre, Sir Sandford Fleming College Cartography Department, the City of Peterborough Land Information Services Division, Trent University's Geography Department and the Oliver Ecological Centre. Special thanks go to George Gillespie of McColl Turner Chartered Accountants for reviewing our financial records. Thanks to Tom Cathcart of the Peterborough County-City Health Unit and Bev Clark, coordinator of MOE's Lake Partner Program, for their advice and assistance throughout the year. Many thanks to Dr. Eric Sager, Meredith Carter of ORCA, and Bev Clark for contributing to this year's report.

To find out more about KLSA, or to discuss any aspect of this report, please contact me or any other member of the Board.

Jim Keyser, Chair

Wetland in springtime

Introduction to the Watershed

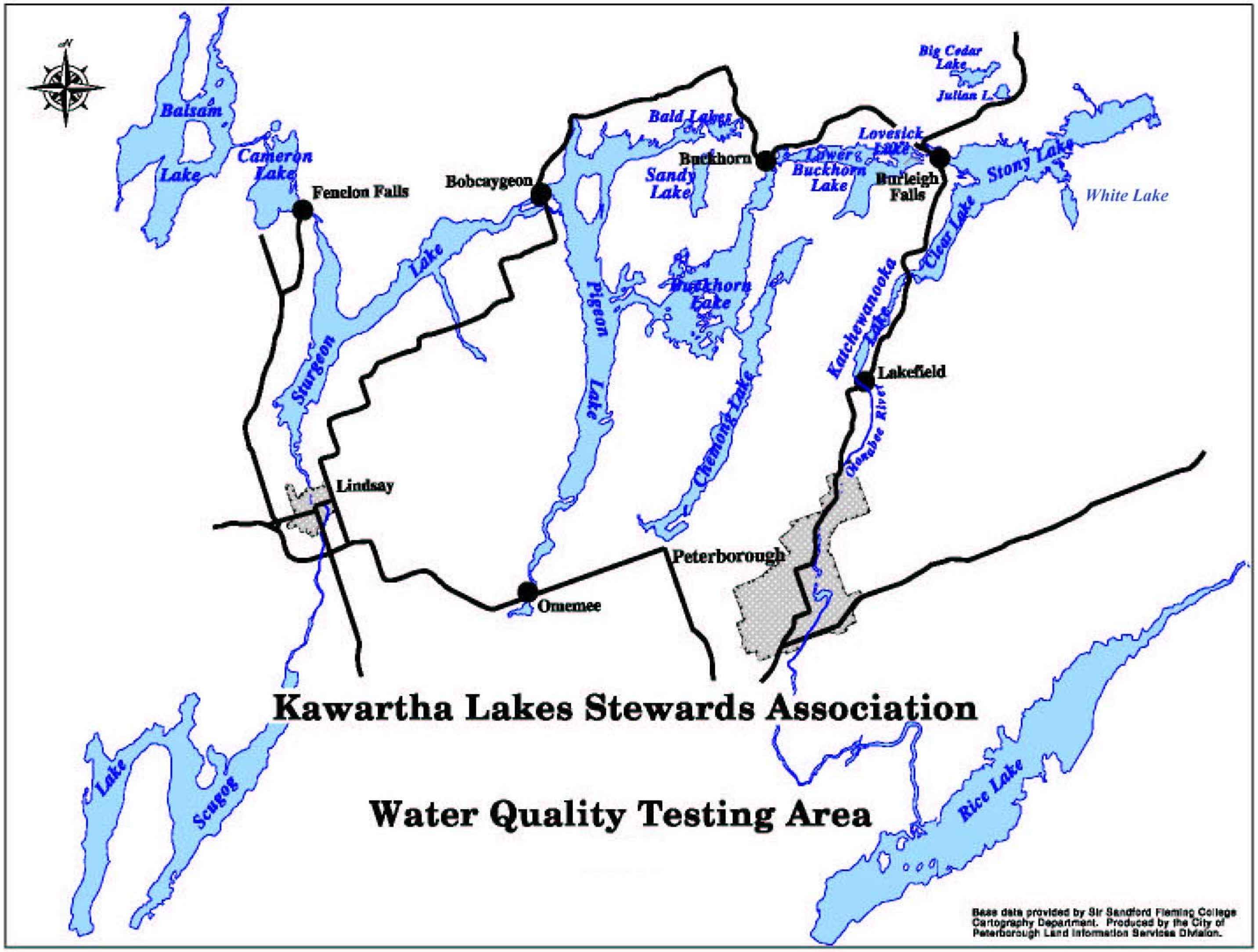
The Kawartha Lakes have been a magnet for tourism for more than a century. The shorelines and islands in the system are home to thousands of cottagers and permanent residents, and the lakes are visited by a great many fishermen, boaters, hunters and campers every year. Because the Kawarthas are situated on the interface of the granite Precambrian Shield and the younger limestone formations from ancient lakes, they support a great diversity of flora and fauna. Wildlife such as great blue heron, river otters, loons, mink, osprey, as well as deer, squirrels, raccoons, Canada geese and beavers swim the waters and roam the forest and wetland habitats of these beautiful lakes.

The Kawartha Lake Stewards Association (KLSA) is concerned primarily with the watershed that originates at the height of land at Balsam Lake and flows south through Katchewanooka Lake into the Otonabee River. The dozen lakes that form the chain of the Trent-Severn Waterway are actually an expanded river system. The water entering the system in the spring from the granite Shield is clear, cool, and low in phosphorus. As it flows downstream, it is fed increasingly by water from the limestone formations, which is higher in natural phosphorus. Human inputs of nutrients from sewage treatment plants, agriculture, pleasure boats and cottages bring more phosphorus into the lakes.

This situation is causing increasing concern. Through its water testing partnership with MOE's Lake Partner Program, KLSA has learned that our lakes often have phosphorus concentrations of 20 ppb (parts per billion) or above. MOE has identified an average phosphorus concentration of 20 ppb as the border between water of "good" recreational quality and water that is of "poor" quality. In other words, it won't take much more phosphorus for our clear water to turn greenish and smelly with algae. In some parts of the system, this is already happening late in the summer. Consequently, KLSA is now putting greater emphasis on attempting to find and quantify the sources of excess phosphorus in the Kawarthas so that effective actions can be taken to reduce those inputs and better protect our lakes.

Each year, KLSA shares what we are learning about water quality and lake habitats, to help people understand the connections between human activities and the health of the precious natural resource that is the Kawartha Lakes. Publishing this annual report is a major part of our outreach efforts. We also hold workshops twice a year on our testing programs and water quality issues. Most KLSA volunteers represent local lake associations, and report on our work at local meetings and in newsletters. In this way, many thousands of cottagers and residents learn about possible sources of bacterial contamination and about the importance of helping to decrease human inputs of phosphorus to our lakes.

Map of the Kawartha Lakes 2004 Testing Area



Executive Summary

2004 was KLSA's fourth year of testing for *E.coli* bacteria and phosphorus in the Kawartha Lakes. Volunteers represented 12 lakes, all within the watershed of the Trent-Severn Waterway (TSW) flowing south and east out of Balsam Lake. We also carried out an aquatic weeds survey and received training in monitoring aquatic habitats using benthic invertebrates. The most surprising finding in 2004 was that our phosphorus levels were significantly lower throughout the summer than in previous years. We believe this may be due to the heavy rainfall in parts of our testing area in July, resulting in high Waterway flows. There were frequent rainstorms throughout the watershed in July, the most dramatic one causing the major Peterborough flood on July 14. This burst of high flow appears to have washed out the TSW system much as the annual spring flush does.

Bacteria: Generally the Kawartha Lakes sites we tested have very low bacteria levels despite their intensive use. Only four sites out of 116 tested this year had more than two single readings over the summer that exceeded 100 *E.coli* per 100 millilitres of water, and only one of those sites was in fact used for swimming. (Five readings in one day with a geometric average over 100 *E.coli*/100 mL will result in a beach being posted unsafe for swimming.) But KLSA considers bacteria counts above 50 *E.coli*/100 mL to be cause for concern. In 2004, 52 out of 726 readings, or 7.2 percent, were over 50. This was more than double 2003's number of readings over 50 (18 out of 525, or 3.4 percent).

The higher bacterial counts in 2004 were almost certainly due to the heavy and frequent July rains, as heavy rain washes any sewer overflows, septic system leakage, animal feces, etc. into the water. KLSA has compared rainfall data for the past four years with our bacteria results. We have found that if rainfall in the 48 hours prior to water sampling is less than 10 mm (1/3 inch), then 10 to 15 percent of all sites will test over 20 *E.coli*/100 mL, whereas if rainfall is more than 10 mm in the previous 48-hour period, bacteria counts tend to rise significantly.

The most important things we can do to decrease *E.coli* inputs to our lakes are to discourage Canada geese from congregating on our property (by keeping a natural vegetated shoreline and minimal manicured lawn), and to have septic systems checked and pumped out regularly.

Aquatic plants ("weeds"): Six volunteers at four lakes in different parts of the watershed recorded species and densities of water weeds by observing weed beds every three weeks from May to October. (For several years, cottagers have complained about thick weeds that make swimming and boating difficult, and floating mats of weeds that must be raked out of the lake.) An encouraging finding of this first survey was that Eurasian water milfoil, the only non-native, "invasive" aquatic plant seen at any of our sites, dominated the aquatic habitat at only one site. At two sites, it was not observed at all. Volunteers also recorded observations of algae and zebra mussels throughout the season.

Native aquatic plants are essential to healthy, living lakes. They are certainly preferable to proliferations of algae, both for recreational enjoyment and habitat health. Excess nutrients in our lakes, especially phosphorus, could stimulate unsightly algal growth late in the season. This is already happening in nearby Rice Lake. The most important conclusion from our initial weeds survey is that we need to do a more scientific study in 2005 in order to begin to understand the relationships between aquatic plants, algae, zebra mussels, and phosphorus.

Phosphorus: Phosphorus is the nutrient primarily responsible for influencing algal and plant growth. For the past few years, phosphorus levels in most of the lakes in our testing program have been approaching the Ministry of Environment's danger level of an average of 20 ppb (parts per billion) phosphorus in lake water. Around this level, algae can "bloom" more frequently and lakes can become more greenish and murky, affecting tourism and property values.

But in 2004, the majority of our 34 phosphorus sampling sites showed lower phosphorus levels than in previous years. Average phosphorus levels climbed to about 17 ppb in early July, but then, instead of rising to about 22 ppb as in 2002 and 2003 and staying there, phosphorus levels fell slightly to about 16 ppb, where they remained for the rest of the season. Phosphorus levels are strongly correlated with water flow levels. When flows are high, phosphorus levels stay relatively low. In July 2004, the quantity of water flowing through the Lakefield lock was approximately *triple* the amount of water in 2002 and 2003, creating a huge July "wash out" around the time of the Peterborough flood.

2004 was unique in our four years of testing in that phosphorus levels actually fell over the course of the season; we cannot assume that they will remain under 20 ppb in the future. We have many questions about the origins and roles of phosphorus in our lakes. KLSA hopes to begin answering such questions through more in-depth studies in 2005. In addition to the more quantitative study focusing on aquatic plants, algae, and zebra mussels, we aim to carry out a phosphorus source study to find out where all of the phosphorus is coming from in the Kawarthas.

Bacteria Testing

What we did

KLSA started the year with an orientation workshop in May to review sampling techniques and to hand out sampling bottles. KLSA volunteers collected lake water samples from 116 sites on 12 Kawartha Lakes. Sites were tested six times during the summer, from the July 1st weekend until Labour Day. Samples were taken to SGS Lakefield Research, usually within a few hours, and tested the same day. Occasionally they were refrigerated overnight before being taken to the lab. Each group tested up to 14 sites, and the same sites were tested on all six dates.

Most of the sites were the same as in 2003. It was felt that most sites should remain the same to give long-term baseline data. However, some sites were changed as volunteers became more aware of where potential hot spots could be. Some sites that had consistently very low counts for three years were deleted. New sites were given different labels to prevent confusion when comparing data from various years.

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 of 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, shallow bays)
- Areas near inflows (from culverts, streams, wetlands)
- Areas of concentrated populations of wildlife (near wetlands, areas popular with waterfowl).

The goals of this testing, now in its fourth year, were twofold:

- To see how safe the water was for swimming at these sites, and
- To provide baseline data for ongoing monitoring in future years.

Please note:

- *The 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* indicates fecal contamination from warm-blooded animals such as birds or mammals, including humans. It is not found, for instance, on rotting vegetation. 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 $\frac{1}{4}$ teaspoon of fecal matter! Therefore, it's 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 SGS Lakefield Research 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.

Interpreting the Results: What is a "High" *E.coli* Count?

When is an *E.coli* count considered to be of concern? These are the KLSA guidelines:

1. *Of serious concern: over 100 E.coli/100 mL.* Public beaches are posted as unsafe for swimming when 5 samples taken along a beach on one day have a geometric average of over 100 *E.coli*/100 mL. Therefore, any KLSA counts over 100 are retested as soon as possible. If counts persist, KLSA informs nearby residents. We want to make them aware of the problem for their own swimming safety, and to seek their cooperation in trying to determine where the bacteria are coming from.
2. *Of some concern: between 50 and 100 E.coli/100 mL.* KLSA believes our lakes should be cleaner than public beaches, and believes that *E.coli* counts on Kawartha lakes should not exceed 50 *E.coli*/100 mL. Volunteers are notified if a reading is over 50 *E.coli*/100 mL, and are asked to retest. If counts remain high after retesting, our policy is to inform adjacent landowners of the results.
3. *Unusual: 20 – 50 E.coli/100 mL.* It is normal for a location to have a reading between 20 and 50 once or twice over the summer. However, three or more counts in this range are unusual and reason for investigation.
4. *Normal: less than 20 E.coli/100 mL.* Readings under 20 can be considered normal for surface water, indicating low levels of pollution.

What we found

For Lake-by-Lake results with commentary, please see Appendix E.

Generally, *E.coli* counts on all the lakes tested were very low throughout the summer, indicating excellent recreational water quality. The 116 sites that were tested regularly (four or more times) could be classified as follows:

- *65 sites: "Very Clean" (no readings above 20 E.coli/100 mL).* 65 out of 116 sites were considered "very clean" surface water.
- *36 sites: "Clean" (counts rose above 20 E.coli/100 mL once or twice).* An occasional elevated count or "spike" of over 20 was not deemed of concern.
- *4 sites: "Slightly Elevated" (counts rose above 20 E.coli/100 mL three times).* At four sites (Clear Lake Birchcliff/Site 8, Katchewanooka/Site 2, Lower Buckhorn/Site 8 and North Pigeon Lake Ratepayers/Site5), there were three counts over 20 during the summer. Compared to 2002 and 2003, the counts for Clear Lake Birchcliff/Site 8 were unusually high, but for the other three sites, counts were similar to the two previous years.
- *7 sites: "Needing Observation" (counts rose above 20 E.coli/100 mL 4 to 6 times).*
    - *a.* Three of these seven sites (Lower Buckhorn/Site 3, North Pigeon Lake/Site 6 and Site 12) had no readings over 60. All three were located close to a site with *E.coli* counts over 100 (see below). Cleaning up those locations would probably decrease counts at these three sites as well.
    - *b.* The Pigeon Lake Gamiing/Site East had high counts in 2003 as well. Because of these two years of high counts, this site should be tested more frequently next year.
    - *c.* The three remaining sites were Sturgeon Lake/North Shore sites, and it was the first year these areas were tested. All are at or near swimming areas. One property owner is working with KLSA to decrease counts, and more in-depth testing will occur next year.
- *4 sites: "Investigation recommended" (more than two counts over 100 E.coli/100 mL).*
    - a. Two of these sites, Katchewanooka/Site 5 and North Pigeon Lake/Site 7, had recurring counts of over 100 *E.coli*/100 ml in 2003. Fortunately, neither is a swimming area, and the property owners are aware of the high counts. The Peterborough County-City Health Unit has been very helpful in aiding KLSA in investigating these two locations, but the source of *E.coli* is as yet unidentified. Public Health has no requirement to be involved in bacterial

levels in surface waters (with the exception of public beaches). However, if poor sanitation is found to be the cause of high counts, Public Health will become involved.

b. North Pigeon Lake/Site 11's high counts were probably caused by drainage from Site 7. 2004 was the first year that Site 11 was tested.
c. Lower Buckhorn/Site 4 had much higher counts than in previous years. Site 4 was near an inflow that drained from wetlands. Testing done upstream on the creeks showed high counts, indicating that this is likely the source the bacteria. The local shoreline residents have been informed.

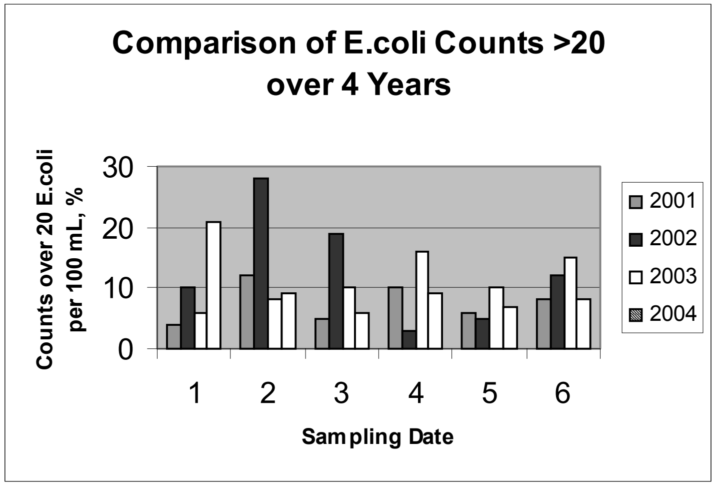
Possible causes of elevated *E.coli* counts

Our *E.coli* tests do not, unfortunately, tell us where the *E.coli* comes from. Recently, methods have been developed that can identify whether *E.coli* found in a certain area are from cattle, wildlife, people, etc. This is called bacteria source tracking, and requires a great deal of time and expertise and, therefore, dollars. Results can come as a surprise. For example, a shellfish bed off the Virginia coast faced closures due to high *E.coli* counts. The suspected culprits were septic systems, but the main source of *E.coli* turned out to be shellfish-loving raccoons. In another case, high *E.coli* counts on the Boise River in Idaho were thought to be from agriculture, but waterfowl were identified as the main culprit. (www.epa.gov/OWWM/mtb/bacsortk.pdf)

We can only make educated guesses, then, about the sources of elevated *E.coli* counts. These are discussed in the Lake-by-Lake Results (Appendix E). To summarize, the sources of counts over 50 *E.coli*/100 mL appear to be:

1. *Canada geese or other waterfowl (5 sites).*
2. *Narrow bay after heavy rain (4 sites).* Large amounts of runoff from extensive shorelines into small volumes of water with little circulation seem to result in high counts.
3. *Inflow, not correlated with rain (3 sites).* These inflow sites had high counts that did not increase after heavy rain.
4. *Inflow, correlated with rain (2 sites).* These inflow sites had high counts only after heavy rain.
5. *Intense human activity (2 sites)*
6. *Construction (1 site)*
7. *Unknown (7 sites)*

Rainfall and *E.coli*



The above graph indicates how many sites tested above 20 *E.*coli/100 mL on testing dates over four years. It tries to answer the questions: Is there any one period of the year when E.coli counts are high? For example, are they high after long weekends (Dates 1, 4 and 6), or are they higher at the beginning or end of the summer?

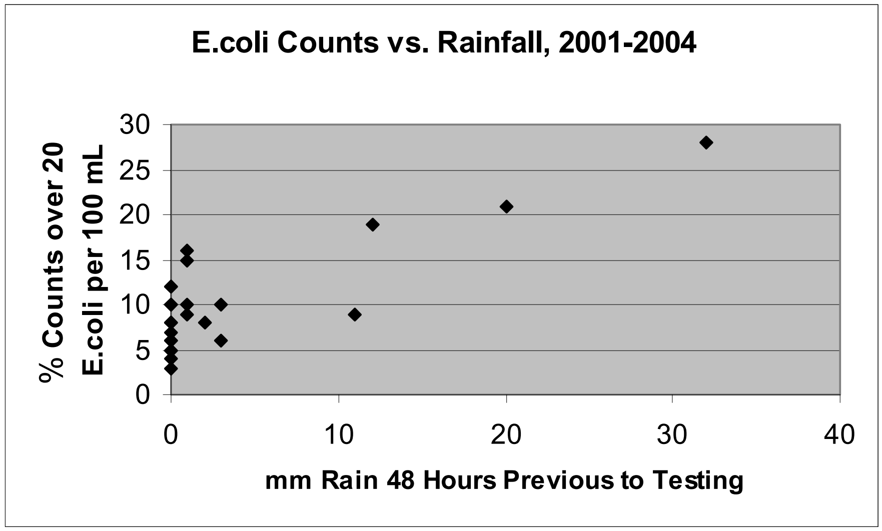
The above graph shows that:

- There does not seem to be any one weekend that has consistently higher or lower *E.*coli counts than others. Long weekends, with their intense human use, don't seem to result in significantly higher counts.
- *E.coli* levels do not seem to rise over the summer. *E.coli* do not seem to accumulate in the water.

However, if *E.coli* results are compared to rainfall in the 48 hour period previous to testing, a pattern emerges (see graph "*E.coli* Counts vs. Rainfall 2001-2004"). We see that, if rainfall in the 48 hours previous to testing is less than 10 mm (1/3 inch), then 10-15% of all sites will test over 20 *E.coli*/100 mL. However, if rainfall is more than 10 mm in the 48-hour period previous to testing, counts tend to rise.

More rainfall = more runoff = more bacteria

This runoff effect is well known: Peterborough's public beaches are automatically closed for at least 24 hours after any rainstorm over 25 mm.



Our first testing date in 2004 provided the perfect conditions for very high *E.coli* counts. At the end of the July 1 weekend, it poured early Monday morning in the hours just before sampling. It is hard to know how much rain fell; the Peterborough Airport, Trent University and the Oliver Centre measured no rain at all on July 5. However, 7 out of 7 logs (diaries) kept by our volunteers mentioned the heavy rain, so it was estimated to be 20 mm. The rain stopped by breakfast time, and our intrepid volunteers got out in their wet boats and collected their water samples. As expected, counts were somewhat elevated that day.

It is interesting that Week 2 did not produce more high counts. These samples were taken on July 19, just five days after the Peterborough flood of July 14. This is probably because the flood rains were very local; the Trent University station measured 240 mm (almost 10 inches!), the Peterborough Airport measured 20 mm, and the Oliver Centre measured 11 mm. This was typical of 2004's many heavy but very localized rainstorms.

This demonstrates that our volunteers' *E.coli* logs are very important. In these logs, volunteers record rainfall for 48 hours before testing. All 7 *E.coli* logs for this date recorded heavy rain on Week 1. On Week 2, about half of the volunteers recorded heavy rain, and the other half recorded light rain. For this year, the year of the heavy, local rainstorm, these *E.coli* logs were more informative in telling us about local rainfall than nearby weather stations.

Conclusions

- Generally, the Kawartha Lakes have very low bacteria levels, despite their intense use. Almost all testing was done where we thought counts would be highest; we were looking for "hot spots." In spite of this, only 52 of 726 readings were over 50 *E.coli*/100 mL. (50 *E.coli*/100 mL is the maximum KLSA believes to be acceptable on our lakes.) However, this was higher than last year's level of 18/525. These higher counts were almost certainly a result of the heavy and frequent July rains.
- There are only 4 sites that were classed as "Investigation Recommended," having counts of over 100 *E.coli*/100 mL several times over the summer. As discussed previously, only one of these is actually used for swimming; in all cases, residents have been informed, and Public Health is helping these landowners to try to find the reason for these elevated counts.
- High counts were found near large groups of waterfowl (especially Canada Geese), in narrow bays after heavy rains, and at some inflows (streams entering the lakes).
- Looking at the past four years of data, it appears that elevated counts are correlated with high rains (more than 10 mm) in the 48-hour period before testing.

What can we do to keep *E.coli* counts down?

- To discourage Canada Geese, do not provide a safe place for them to congregate on land. They feel safe only if they can see predators coming, i.e., where there is no tall vegetation. That's why geese love trimmed grass! If you need to have grass around your cottage but don't want the geese, keep your grassy area to a minimum, and let taller vegetation grow nearby.
- Geese will come up on the shore during the day only if there is a flat, non-vegetated area along the shoreline. If there is a well-vegetated shoreline, geese regard it as an impenetrable wall and won't go past it. You will notice at the Toronto Zoo that all stream shorelines are now lined with native vegetation, and the Canada Geese, as a result, stay on the water during the day. A well-vegetated shoreline also prevents runoff from going into the lake, and is an ideal habitat for all sorts of interesting wildlife. Keep your lawn away from the shoreline.
- Keep your septic system working well. Have it checked every three years and pumped out every five years or so.

Aquatic Plants

(also known as Water Weeds)

For several years, Kawartha residents, cottagers and visitors have been concerned about weed growth in our lakes. It has seemed to many of us that the amount of weeds has been gradually increasing. Huge floating mats of weeds have been washing up on shorelines and have to be raked out by hand. Thick beds of weeds in some areas make swimming and boating difficult. Cottagers have tried to control the weeds by pulling them up by the roots, cutting them off, putting down heavy fabric to smother their growth, and even using herbicides.

In 2004, KLSA decided to try to get a handle on the weed situation. Our aim was to gather some baseline data to discover which species of weeds we have in our lakes, which ones are causing the problems (e.g. native or invasive species?), what their distribution and growth patterns are, and maybe even what is causing such thriving weed beds. Our weed survey, summarized later in this section, was based on a pilot project that volunteers initially carried out in Lovesick Lake in 2003 (See KLSA's 2003 report, <u>Changing as We Flow</u>). We plan to continue studying aquatic plants (weeds) in 2005, refining our methods, becoming more quantitative in our approach, and incorporating more information about other factors that may influence or be related to aquatic weed growth, such as algae, zebra mussels, and phosphorus levels.

A word about language: The term "weeds" gives aquatic plants, or macrophytes, a bad name! Diverse species of native aquatic plants are a big part of what makes a lake system healthy. During the time that we observed our changing beds of aquatic plants this past summer, some of us became quite fond of them. One volunteer pressed and mounted several specimens, and another photographed them. And so, from here on, we will attempt to "weed out" the derogatory term and refer to "aquatic plants."

In this section, Dr. Eric Sager of Trent University, our aquatic plants study advisor, introduces the common aquatic plants of the Kawarthas, and outlines the factors that contribute to their growth. Next, Pat Moffat, KLSA coordinator of the 2004 aquatic plants survey, reports on the study, describing our methodology, observations, and plans for 2005. Finally, Bev Clark, coordinator of MOE's Lake Partner Program, shows what might lie ahead for the Kawartha Lakes if our nutrient levels (mainly phosphorus) continue to rise. He describes a disturbing alternating state of aquatic plants and algae currently being seen in nearby Rice Lake.

Aquatic Plants 101

What we have and how they grow

by Dr. Eric Sager
Aquatic biologist, Oliver Ecological Centre, Trent University

Anyone who has spent time on one of the many beautiful Kawartha Lakes likely has had an intimate experience with an aquatic macrophyte. Macrophytes are a very diverse group of plants that have many different growth forms. They can be found rooted in the sediments underwater, such as tape grass (*Vallisneria americana*) or the invasive Eurasian water milfoil (*Myriophyllum spicatum*), or floating on the surface like the fragrant water lily (*Nymphaea odorata*), or floating freely throughout and on top of the water, like coontail (*Ceratophyllum demersum*) or duckweed (*Lemna minor*). Then there are those macrophytes that are found rooted in water-saturated sediments, but that carry out part of their life cycle above the water, such as cattails (*Typha sp.*) or wild rice (*Zizania aquatica*). Typically, all of these plants are found in nearshore areas where the quality and quantity of light is sufficient to allow photosynthesis to take place and the energy from wave activity has not eroded away the rooting substrate.

These aquatic plants provide many services to the broader lake ecosystem. They dissipate the energy of wind and wave action, which reduces the potential for shoreline erosion, while the roots reduce the amount of bottom sediment resuspension. Taller macrophytes can modify their physiochemical environment by slowing water flow, which will increase the sedimentation of particles that are suspended in the water column. These particles often contain important plant nutrients and thus the macrophytes are actually creating a more fertile rooting substrate for themselves and are reducing the availability of nutrients to phytoplankton, the tiny, free-floating plant life in water bodies. Macrophytes also serve as a substrate for colonization by the very small plants and animals that feed upon them, and as a refuge from predators for small fishes and invertebrates. Finally, they provide important forage for many of our native waterfowl species.

In some regions, aquatic macrophytes have been deemed a problem because of their excessive biomass, which can interfere with the recreational use of our lakes and rivers. This luxurious growth is often linked to large inputs of phosphorus from the watershed. Typically, lakes that are characterized as eutrophic (highly productive, with a high nutrient availability) have a significant phytoplankton (free-floating algae) population in the water column, which results in a very turbid and green-coloured lake. However, in shallow lakes such as the Kawarthas, the rooted macrophytes are able to reach the surface of the water to obtain sufficient amounts of light and ultimately are able to out-compete the phytoplankton, thus keeping the water clear.

However, if external nutrient inputs continue to rise, from sources such as sewage treatment plants, agricultural fertilizers, and shoreline development, there is a potential for a significant change in the lake ecosystem in the Kawarthas. Macrophyte species richness has been observed to decrease as lakes become more eutrophic due to light limitation to submerged vegetation. As water transparency declines, macrophyte communities can shift in composition from a dominance of submergent (e.g. coontail) to canopy forming (e.g. milfoil) to floating-leaved (water lily) to emergent (cattails) vegetation. Such changes lead to decreased abundance and diversity of macrophytes as lakes become enriched and can trigger a switch from a clear-water to a turbid-water stable state. This could have significant impacts on the health of other components of the ecosystem. (See Bev Clark's article on the two stable states, p. 27.)

Two of the more abundant macrophytes that we have in the Kawarthas are the native tape grass or wild celery (*Vallisneria americana*) and the exotic invasive Eurasian water milfoil (*Myriophyllum spicatum*). Ministry of Natural Resources macrophyte surveys of the early 1970s identified tape grass and our native milfoil species (*Myriophyllum exalbescens*) as the two most abundant and problematic species. Already by the late 1970s this trend changed as Eurasian water milfoil became the dominant macrophyte species of the Kawarthas. The fact that our native tape grass, a highly desirable aquatic plant that forms a rosette at the sediment surface, continues to co-exist with the exotic milfoil, which forms a canopy at the water surface, may be due to the presence of zebra mussels. These small mussels are an additional exotic invader to the Kawarthas that has ensured that surface light can penetrate to maximal depths. By actively filtering the water column, zebra mussels may also be responsible for maintaining the conditions necessary for a clear-water, macrophyte-dominated system of lakes. Interestingly, recent research out of the Great Lakes suggests a link between zebra mussels and a nuisance algal species – *Cladophora* – that has been washing up on shores and fouling beaches. Apparently the greater light penetration in the water column provided by the zebra mussels is beneficial for this "green hair" algae, and the mussels' waste also provides fertilizer. It is not known whether a similar *Cladophora* invasion may be on the horizon for the

Kawarthas. (Ed. note: This is one of the common algaes observed in our aquatic plants survey. See p. 23.)

Nevertheless, this last point highlights one of the important reasons for a continued aquatic plant monitoring program throughout the Kawartha Lakes. Not only will it provide useful information to natural resource managers, but it will also introduce those who use and enjoy the lakes to the important role that macrophytes play in the greater lake ecosystem.

Natural Area on Clear Lake Shoreline

KLSA 2004 Aquatic Plants Survey

2004 was KLSA's first year to attempt to study aquatic plants throughout the Kawarthas. Our aim was to start gathering baseline data about which species we have in our lakes, and their growth patterns from spring to fall. The ultimate management point we were concerned about was: how can we decide how to best control nuisance aquatic plants unless we understand what we have? Based on the comments of Lovesick Lake volunteers in a pilot survey of aquatic plants in 2003, we broadened our observations to include not only the plants but also algae and zebra mussels. We suspect that there is something interesting going on between the aquatic plants, the appearance or non-appearance of algae, the zebra mussels, and the phosphorus levels in our lakes. Our 2004 survey is a first step towards understanding those relationships.

What we did

Six KLSA volunteers representing four Kawartha lakes were able to complete the observation logs in this first aquatic plants survey. The four lakes are located at quite different points in the waterway: Pigeon Lake is in the middle-upper watershed, Big Bald Lake is off stream from the Trent-Severn Waterway, Lovesick is in the lower-middle region of the chain, and Katchewanooka is the most downstream lake before the water enters the Otonabee River.

Each "weed watcher" chose a site at least three metres square on his or her shoreline and recorded aquatic plant species and density in a log every three weeks from May 22 to October 11. Weed species were identified using the Ministry of Natural Resources' aquatic weeds key and an invasive species key provided by the Ontario Federation of Anglers and Hunters. (See last year's report for drawings and descriptions of the various species.) Density of plant growth was estimated as "sparse" (one to 20 plants per square meter), "moderate" (21 to 50 per square meter) or "dense" (51 or more) by observations from the surface or snorkeling under water. As the season progressed, it became almost impossible to distinguish the densities of each particular species; we were concerned with the overall speed of growth of the weed beds.

Volunteers also recorded the presence or absence of algae on each observation date, floating just under the water's surface? dark green hair-like algae growing on rocks or logs? tiny spheres of pollen-like algae suspended in the water column? green "scum" floating on the surface?

A brief word about algae: Some volunteers have expressed confusion about what algae actually is. As indicated above, there are several types of algae in our lakes. But all share some important characteristics that differentiate them from true plants. Algae are collections of similar cells, put together rather like beads on a string. These cells are not differentiated as they are in plants, so there are no roots, stems or leaves, for example. Algae are simpler organisms than plants. They are green, due to the presence of chlorophyll A, and yes, they often are slimy.

Zebra mussels were also observed in our survey, and volunteers noted whether they appeared to be old shells on the substrate, or young ones fastened onto rocks, or clinging to the plants.

In addition, two volunteers recorded water temperature in the weed beds, some commented on weather patterns and lake levels, or anecdotally compared current aquatic plant growth to previous years.

Many thanks to Sheila Gordon-Dillane (Pigeon Lake), Bob Saunders and Bonnie Ginter-Brown (Big Bald), Ron Brown and Pat Moffat (Lovesick), and Peter Fischer (Katchewanooka). Although Ruth Barrett of Lovesick was not able to complete the log, she pressed and dried some good specimens.

What we found

Most of our weed watchers felt that the aquatic plant problems weren't as bad as they had been during previous summers. That is, there were fewer and smaller mats of floating weeds to rake out of the lakes.

Plants

Our observation logs revealed a healthy diversity of aquatic plant species at the six locations chosen. Only one non-native invasive species was noted: Eurasian water milfoil. It appears at about the same time during the season as the native northern water milfoil, and is distinguished from it by its bright red growing tip. Other (native) species observed, and roughly in the order in which they appeared in the spring were: coontail, curly-leafed pondweed, floating-leafed pondweed, tape grass (or wild celery), Canada water weed, northern water milfoil, horned pondweed, and, in only one location, on Pigeon Lake, slender water nymph. (Horned pondweed - which we had mistakenly been calling "smart weed" - and slender water nymph were not found in our identification keys. Dr. Sager identified them for us from a fresh sample in one case and a photograph in the other.)

Not surprisingly, growth densities developed from sparse in the early spring to greatest density in mid August. Later in the season, the plants began to die off. Tape grass, the plant that forms the problematic floating mats, was noted as "sparse" in half of the logs by mid June, and as "sparse," "moderate" or in one case "dense" in all logs by mid July. Its spiral flower was in evidence by late July. Although this is the plant that most cottagers are worried about, Dr. Sager points out that its presence is actually a sign of a healthy aquatic habitat.

As for the one truly worrisome species in the Kawarthas so far, Eurasian water milfoil was regularly seen at only four of our six sites. At Big Bald Lake there was no Eurasian milfoil seen at all in the site on the north side of the lake, while at the site on the south side, it dominated the aquatic vegetation throughout the season. This suggests that local factors influence the colonization patterns of this plant. At no other site besides Big Bald-south, did Eurasian milfoil overpower the native species. However, two volunteers mentioned that although there were few Eurasian milfoil plants in their survey sites, farther out in deeper water there were dense beds of them.

According to Dr. Sager, there is some evidence in the scientific literature of occasional "crashes" of Eurasian water milfoil populations due to a native water weevil that feeds on and eventually kills the plants. It would be worth finding out more about this, as it suggests that this invasive species may not be such a threat to our lakes' ecology as has been feared.

Algae and zebra mussels

Our first survey came up with more questions than answers about the relationships between aquatic plants, algae and zebra mussels. Two of our survey sites had very little algae at all from spring to fall (Big Bald-north and Lovesick-Feathers Island). Other sites (particularly Pigeon Lake and Katchewanooka) had prolific algae of several different types: the dark green, hair-like algae growing on sediments and rocks (perhaps *Cladophora*?), large floating green blooms, and the pollen-like suspended algae. The Katchewanooka site was unique among our six sites in having a brown "mat" or "scum" on the lake bottom and shrouding the plants from early July until mid-October. (According to Eric Sager, this could be "marl," which is a plant by-product formed during photosynthesis. It is characteristically found on plants living in "hardwater" or limestone lakes.)

A clue to the relationships of these three characters of the underwater scene – weeds, algae, and zebra mussels – might be found in the contrast between the two Lovesick Lake sites. Both sites contained beds of healthy and diverse aquatic plants, with the same species represented. Eurasian water milfoil was represented but did not predominate at either site. But the site on the northeast shore had relatively few young zebra mussels but prolific algal growth in August and September. The Feathers Island site, meanwhile, had astonishing numbers of new zebra mussels – with thousands of them clinging to the aquatic plants – and virtually no algae at all.

It is tempting to jump to the conclusion that zebra mussels protect against algae, but our Pigeon Lake survey site had an abundance of plants, algae, AND zebra mussels!

What's next?

Our 2004 survey was a good first step, even though only six volunteers completed the logs. We now know which species of aquatic plants are commonly growing in the Kawarthas, at least at the six sites observed in our lakes. We have found that Eurasian water milfoil has not taken over our local aquatic habitats. We know that we need to learn more about the relationships among the aquatic plants, the algae, the zebra mussels, and other factors such as water temperature and turbidity, and water chemistry, especially phosphorus.

At this writing, plans for the 2005 study are still being discussed. We may keep the survey log format for those who would like to continue gathering that baseline data. The logs may reveal interesting variations over the course of several years. We may switch to, or add, a more quantitative biomass study. We do aim to carry out, with the help of biologists, a more detailed study involving aquatic plants, algae, zebra mussels and water chemistry at several sites on one lake, which would serve as a model for the entire Kawartha system.

Details on the 2005 aquatic plants study will be available at the KLSA spring workshop.

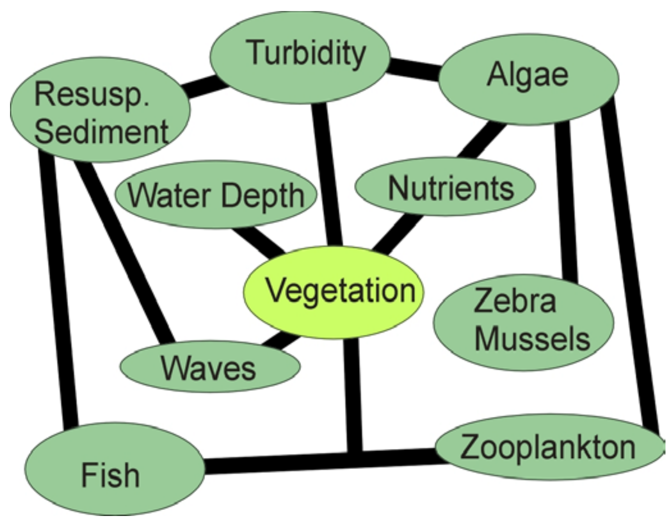
The Battle between Weeds and Algae

Vision of things to come in the Kawarthas?

by Bev Clark
Coordinator, MOE Lake Partner Program

Rice Lake, located at the downstream end of the Kawartha Lakes, changes its appearance dramatically as the open-water season progresses. In the spring and early summer the lake has clear water and a huge crop of broad-leafed aquatic plants. Towards the end of the summer, and into the fall, the aquatic plants disappear and the water becomes much less clear as algal growth increases. At a glance, it might seem like something has gone wrong in the lake, but these seasonal progressions are quite normal for an enriched, eutrophic water body like Rice Lake. The two states, one with clear water and aquatic plants and the other with opaque water, fewer plants, and more algae are different but stable states.

Factors Influencing Weed Growth



For lakes that display both stable states in the course of a single open-water season, the lake usually starts the year with the clear-water, aquatic plant state. As the lake increases in nutrients towards the end of summer, a shift will occur to the turbid state where algal communities flourish and the water becomes too opaque for aquatic plants to thrive. Generally speaking, the more productive the lake is, the earlier in the season the shift will occur. In other words, if a lake is becoming more and more enriched over time, we might expect to see a shift to the algal bloom state earlier and earlier in the season. In extreme cases, some shallow lakes may lose the ability to maintain a clear water state for any portion of the year.

The reason these two conditions are called "stable states" is because there are processes at work in each case that essentially work to keep the lake from changing from one state to the other. When the lakes are clear, with large crops of aquatic plants, the algae have a difficult time establishing themselves. This is because the aquatic plants produce shade, reduce nutrient availability by taking up nutrients from the water, reduce the resuspension of sediment particles by stabilizing the bottom sediments, provide refuge for zooplankton (microscopic animals that graze on algae), and finally, they may excrete chemical substances that can keep algae from growing. These things work together to keep the water clear, which is good for the aquatic plants that require the light to grow.

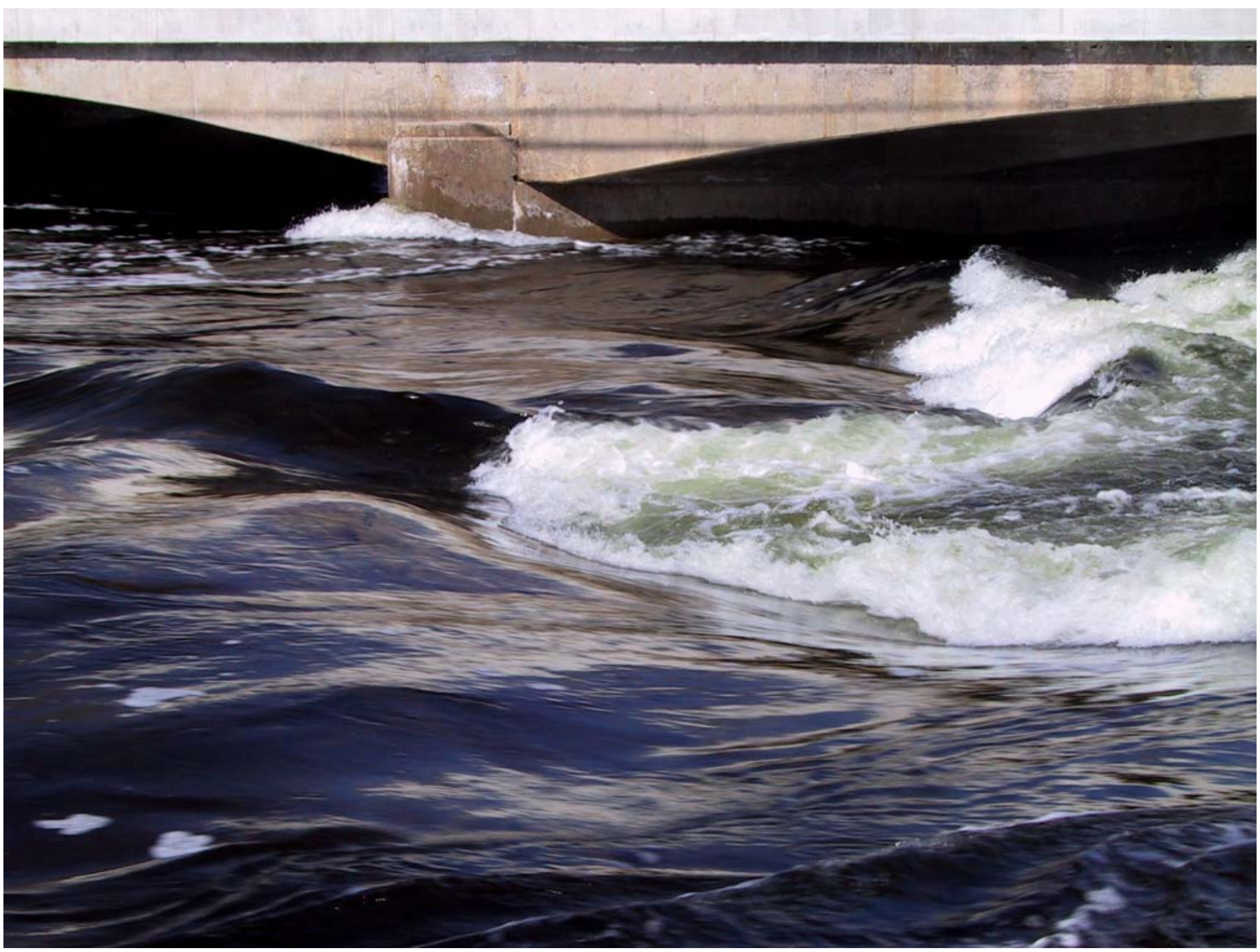
If the nutrients increase enough to allow the algae to get a foothold, the aquatic plants are shaded and begin to lose the competition for light. After the plants are reduced there is the possibility for the resuspension of bottom sediments, which makes the water even more turbid. As the plants disappear, the zooplankton lose their refuge and get picked off by small fish. Zooplankton eat algae so this reduces the amount of algal grazing, which allows even more rapid development of algae. Once the zooplankton are diminished, the fish may turn to feeding on bottom organisms, which further increases the suspension of bottom sediments into the water column, which further shades and diminishes the aquatic plants. These factors are all bad news for the plants and they can disappear entirely after a critical turbidity level has been exceeded. These factors work in concert to stabilize and maintain the lake in the turbid water state. These conditions usually remain until the lake gets cold and freezes. In the spring the process begins over again.

So why exactly does Rice Lake go through these two phases every year? The process requires that there be an increase in nutrients between the spring and the late summer to cause the shift towards a turbid water state. In our case, this happens because the Kawartha Lakes are flushed with Haliburton water and snowmelt in the spring of the year. This lowers nutrients, favouring the clear-water, aquatic-plant phase. As the year progresses, the dilution by Haliburton water is decreased, and the local inputs of phosphorus through sewage treatment plants, agricultural runoff, or the resuspension of nutrients from lake sediments become relatively more important and the lake gradually increases in nutrients. At some point in the summer, this eventually gives the algae enough of a foothold to start the process towards a turbid water phase.

In cases where lakes have eutrophied to the point where there are continuous algal blooms, reclamation efforts are considered effective if the lake can be returned to a situation where it can maintain a lengthy clear-water phase. There are few, if any, lakes in Ontario that have reached this point. Throughout the Kawartha Lakes, however, conditions are ideal for the lakes to develop one or both of these stable states. Rice Lake is doing it now and some of the other lakes occasionally have late summer algal blooms. Other lakes in the system are not enriched enough to get to the turbid water phase. Generally speaking, these conditions are normal and common for shallow, off-shield lakes like some of the Kawartha Lakes. What we wish to avoid are those cases where the lakes spend too much of the year in the turbid water phase.

There is some food for thought in all of this: if you are complaining about the weeds, you should remember that they are probably the lesser of two evils. Algal blooms can develop into smelly messes that affect the taste and odour of the water and in some cases (as with the blue-green algae) can release toxins into the water.

[Ed. note: To help avoid the turbid, algal state, one must identify the sources of excess phosphorus entering our system, and reduce those inputs. See "Phosphorus Source Study," p. 51.]



High Flows at Burleigh Falls

Benthic Bugs

2004 Training Program for Monitoring Benthic Invertebrates

by Meredith Carter
Manager of Watershed Health
Otonabee Region Conservation Authority

Benthic macroinvertebrates, or the bugs that live in the sediment at the bottom of lakes, rivers and wetlands, are a widely used biological indicator of the quality of water and aquatic habitats. Benthic means bottom dwelling, macro means that they can be seen with the naked eye and invertebrate means that they have no backbone. Worms, snails, clams, leeches, beetles and various fly larvae are benthic macroinvertebrates that are commonly found in the Kawartha Lakes area. These organisms are excellent indicators of water quality because they each have a different tolerance for pollution or disturbance. They can also provide information about long-term water quality trends because they are frequently sedentary and cannot escape unfavourable conditions.

Project background

The Kawartha Lakes Water Quality Monitoring and Education Program was created by the Otonabee Region Conservation Authority and the Kawartha Conservation Authority in response to water quality concerns in the Kawartha Lakes expressed by seasonal and permanent residents.

Many local lake associations have well developed water quality monitoring programs that involve water chemistry analysis at numerous sites on each lake. Other organizations including the local Health Unit, Conservation Authorities and the Ministry of the Environment also have water quality monitoring programs in the same areas. Due to differences in the scale of data collected, parameters analyzed, sampling frequency and data interpretation it is difficult to agree on the overall quality of water for a specific lake.

It is recognized that in order to protect and preserve water quality in the Kawartha Lakes, it is important to monitor water quality both to document and assess current conditions and to recognize changes. Recently, the value of biological monitoring in aquatic environments, in addition to water chemistry, has been emphasized by federal and provincial organizations.

The goal of our program is for the local Conservation Authorities to train volunteers from local lake associations in the collection of benthic macroinvertebrates and the interpretation of samples collected. This information can then be compared with available water chemistry data to provide a more complete picture of local water quality trends and conditions. Our aim is to get local associations started, so that they will be able to continue gathering data on their own or through an umbrella group such as the Kawartha Lake Stewards Association.

The workshop day

The training workshop was held on October 3, 2004 at the Oliver Ecological Centre owned by Trent University, located on Pigeon Lake. Representatives from seven lake associations attended the full day program.

Workshop at the Oliver Ecological Centre

Participants were introduced to benthic macroinvertebrates as water quality indicators at a classroom style session in the morning. They learned about the common species of benthic invertebrates found in the Kawartha area, and discussed how to select monitoring locations. In the afternoon participants learned about sampling methods and equipment, and then most donned chest waders and lifejackets and went into the water with nets to collect samples.

Later, they sorted and identified the specimens they had collected, and Conservation Authority staff introduced them to the Citizen Science Data-Base (www.citizenscience.ca), which is where real data would be entered. This data-base provides an index of water quality back to participants when the data is entered correctly.

Future activities

Since this was a training program only, no results were obtained as to the quality of water and aquatic habitats based on the benthic bugs collected. That will be the next step, if lake associations choose to pursue this program in 2005.

Otonabee Conservation and Kawartha Conservation hope to host a similar session in the spring of 2005. We would welcome the participation of KLSA volunteers again.

Project partners

Thanks to the following groups for their contributions to this program: Ecological Monitoring and Assessment Network – Environment Canada; Mountain Equipment Co-op Environment Fund; Ontario Benthos Biomonitoring Network – Ministry of the Environment; Shell Environment Fund; Wildlife Habitat Canada – Citizen Science Project.

For more information on plans for 2005, please contact Gerry Sullivan, ORCA watershed biologist   705-745-5791

Phosphorus and Water Clarity Testing

Why test for phosphorus and clarity?

High phosphorus levels result in a loss of water *clarity*, in the same way that an untended aquarium becomes green and murky. Phosphorus enters lakes from fertilizers, erosion, septic systems, sewage treatment plants, etc. The immediate effect is an increase in algal growth, turning the lake murky. Algae absorb phosphorus, then die and sink to the bottom of the lake. These bottom sediments provide a rich "soil" for aquatic plant growth and can continue to release phosphorus back into the lake. Thus phosphorus, once it enters a lake, tends to stay there.

The Ministry of the Environment's Provincial Water Quality Objectives (www.ene.gov.on.ca/envision/gp/#groundwater , Report #3303) state:

- Phosphorus concentrations should not exceed an average of 20 ppb (parts per billion, or micrograms per litre) during the ice-free period. At levels higher than 20 ppb, algal growth accelerates, potentially creating unsightly and often foul-smelling algal "blooms."
- Ice-free averages of less than 10 ppb give "a high level of protection against aesthetic deterioration."

Phosphorus levels and water clarity, then, are used to track lake health deterioration or improvement.

How did we measure phosphorus?

KLSA took water samples for phosphorus analysis at 34 locations, an increase from 27 sites in 2003. Sampling was taken around the first of each month, from May to October. In contrast to sampling for bacteria, which is done at elbow depth below the water's surface, phosphorus samples are taken from deeper parts of the lakes, with a collection bottle lowered down to the required depth by a heavy object.

All testing was done through the Ontario Ministry of the Environment's Lake Partner Program. The Lake Partner Program supplies bottles and mailing containers. Samples are tested for phosphorus at an MOE laboratory at no cost to cottagers other than volunteer time. Ontario cottagers are fortunate to have this excellent program.

Anyone interested in tracking their lake's phosphorus levels should join the Lake Partner Program. We encourage you to email them at lakepartner@ene.gov.on.ca or phone them at 1-800-470-8322.

Because the Lake Partner Program refined their laboratory technique in 2002, our phosphorus measurements are almost *ten times more precise* than they were before 2002! Starting in 2002, a measurement of 6.0 ppb means that the measurement has a 95% probability of being between 5.4 and 6.6 ppb. This greater precision means that we will be able to detect much smaller changes in phosphorus levels month-to-month and year-to-year. This change in precision is why 2001 results were reported as 8, l2, 14, 22 ppb, etc., while results in 2002 and after are reported as 8.6, 11.5, 23.7 ppb, etc.

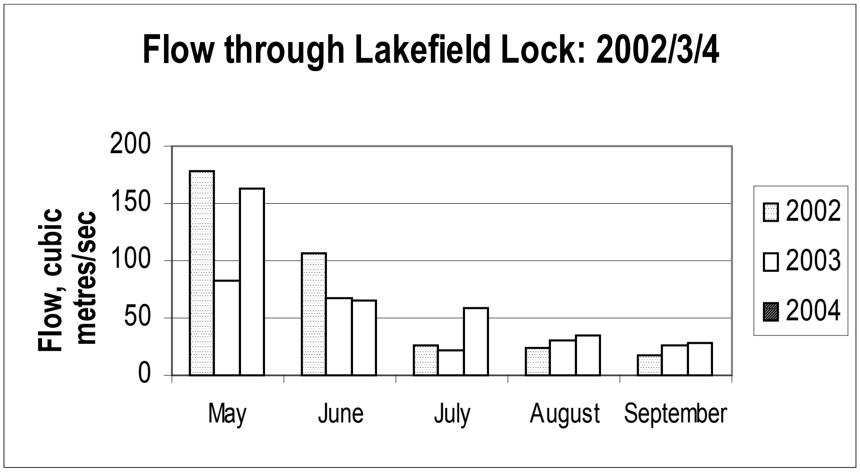
For complete phosphorus and Secchi depth data, see Appendix F.

Spring phosphorus levels vs. summer phosphorus levels

Please refer to the three graphs, "Flow at Lakefield Lock vs. Average Kawartha Lake Phosphorus Level" (below). We can see that:

- In 2002 and 2003, flow volumes in May and June (the "spring flush"), were between 50 and 270 cubic metres/sec, dropping dramatically in July to about 20 cubic metres per second, where they remained until October.
- In 2002 and 2003, the average phosphorus levels on the Waterway (excluding peripheral low-phosphorus lakes) rose from about 13 ppb in May to 22 ppb by August 1 and then leveled off.
- Flows and phosphorus levels are strongly correlated. When flows are high, phosphorus levels stay low. The large majority of this high flow comes from the north, so we see that the northern inflow "flushes out" the waterway with low-phosphorus water. As this flow decreases, local drainage becomes more predominant, and phosphorus levels rise. (For a further discussion, please see section "What Drives the Seasonal Phosphorus Cycle on Our Lakes?" in the 2003 KLSA report.)
- In 2004 there was a striking difference in the amount of flow during July compared to 2002 and 2003. Rather than flow decreasing sharply from June to July (as it did in 2002 and 2003), mid July flows returned to spring like levels. At this time, there were many heavy local rainstorms throughout the watershed, the most notable causing the Peterborough flood. In July 2004, the quantity of water flowing through Lakefield was approximately *triple* the

amount of water that flowed through in 2002 and 2003, as seen in the chart below.



- The effect of this huge July "wash out" can be seen in the 2004 phosphorus curve. The entire system's phosphorus levels, rather than climbing up to about 22 ppb by August 1 and staying there, remained at around 16 ppb for the rest of the summer. (See graph, "Average Kawartha Lake Phosphorus Levels," p. 43 & 44.)
- It is interesting to note that, when 2004 flows dropped in August and September to levels similar to 2002/3, phosphorus levels did *not* climb. It would appear that it is the late June and July phosphorus inputs that are critical in raising summer phosphorus levels. If July phosphorus inputs are flushed out, phosphorus levels remain low for the rest of the summer; there don't seem to be the same large phosphorus inputs in August or September.

Upstream phosphorus vs. downstream phosphorus

The chart below shows how the phosphorus levels change as water flows downstream from Pigeon Lake to Lake Katchewanooka. In each lake, a location was chosen which best reflected the lake as a whole, usually in the middle of the canal flow.

Following the Flow: Deepest Lake Locations
June-to-September Average Phosphorus* Levels in 2001/2/3/4

Lake	Location	2001 TP, ppb	2002 TP, ppb	2003 TP, ppb	2004 TP, ppb
Pigeon	Con. 17 or midway Sandy Pt.-Boyd Is.**	18.2	14 (estimated)	17.6	14.1
Buckhorn	Centre	18.8	16.9	22.1	16.4
Lower Buckhorn	Heron Is.	20.8	17.6	18.7	16.9
Lovesick	80 ft. hole	21.2	21.1	21.5	17.6
Stony	N Mouse Is.	16.4	14.6	14.8	16.2
Clear	Centre	14.0	14.6	14.8	15.2
Katchewanooka	SE Douglas Is.	15.0	18.4	21.2	14.5
Average		17.8	16.7	18.7	15.8

*Four-month averages were used here because KLSA was missing several May and October readings. However, these would be very close to six-month averages, as spring levels are lower and October levels are higher than average.
** These two locations are very close, and would have the same phosphorus levels.

As seen in the chart, in all four years, the phosphorus levels changed in the same way as water flowed downstream. The phosphorus levels were relatively low at the upstream end of the canal (Pigeon Lake), and increased as the water flowed downstream through Buckhorn and Lower Buckhorn into Lovesick Lake. Phosphorus levels then decreased in Stony Lake, probably because of an inflow of low-phosphorus water from Upper Stoney Lake. Levels stayed the same as the water flowed into Clear Lake, and then levels rose somewhat in Lake Katchewanooka.

It is inflows from the north, primarily from Balsam Lake and additionally from Bald Lake and Upper Stoney Lake, that keep phosphorus levels low. When there is little inflow from the north, phosphorus levels rise. This indicates that flow from the south and local runoff are higher in phosphorus than flows from the Shield in the north.

Northern inflows = lower phosphorus water
Southern and local inflows = higher phosphorus water

Approaching the algal danger zone

Keeping in mind that a seasonal-average phosphorus level of 20 ppb indicates potential for algal blooms, it appears that many of our lakes are approaching the "danger zone" of algae overgrowth (see Appendix F for complete set of data). Also, algal blooms tend to happen more frequently later in the summer, and that is when our phosphorus levels are highest. If phosphorus levels were to rise, there would likely be an increased incidence of nuisance algal growth, particularly in mid - to late summer.

How do phosphorus levels differ from lake to lake?

It is interesting to compare phosphorus levels amongst the Kawartha Lakes. Please refer to the following graphs, which represent our 2004 data: Upstream Lakes, Mid-Stream Lakes, Downstream Lakes, and Low Phosphorus Lakes.

All Lakes

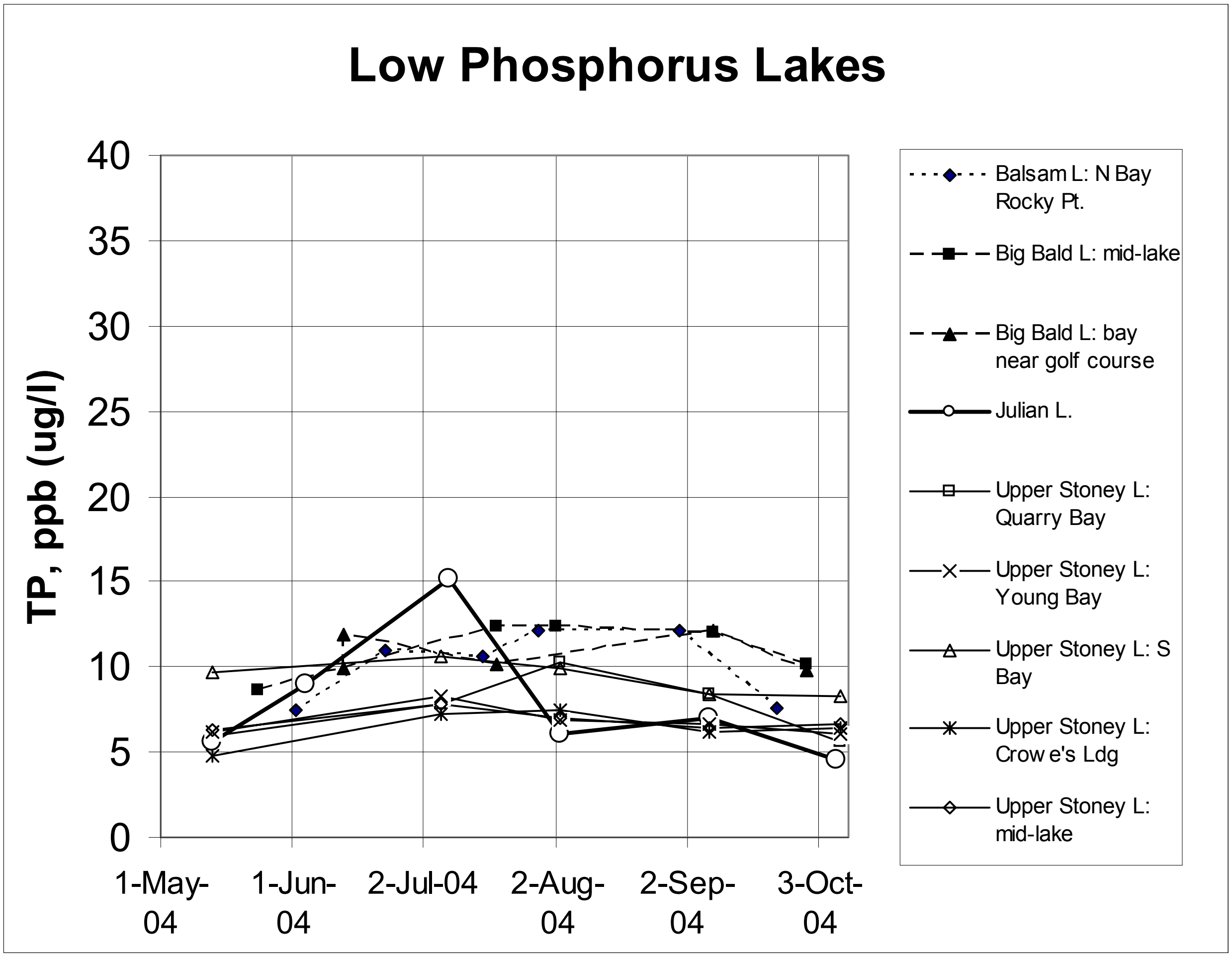
The effect of the downpours during the last half of July and the resulting high flows can be seen in all graphs. Instead of phosphorus levels climbing during the last half of July as they did in 2002 and 2003, most phosphorus levels either remained stable or fell during July.

There was no consistency in August and September phosphorus readings. In the downstream lakes they rose slowly, in the midstream lakes they fell slowly, and in the upstream lakes it was half-and-half.

Low-Phosphorus Lakes

This graph shows phosphorus levels in the lakes that receive their inflow from northern areas. This northern water is low in phosphorus, rarely above 12 ppb, because it flows from low-phosphorus granite, and from sparsely-populated, non-agricultural land with less fertilizer use and fewer septic systems than lands further south. These low-phosphorus lakes flow *into* the Trent-Severn Waterway.

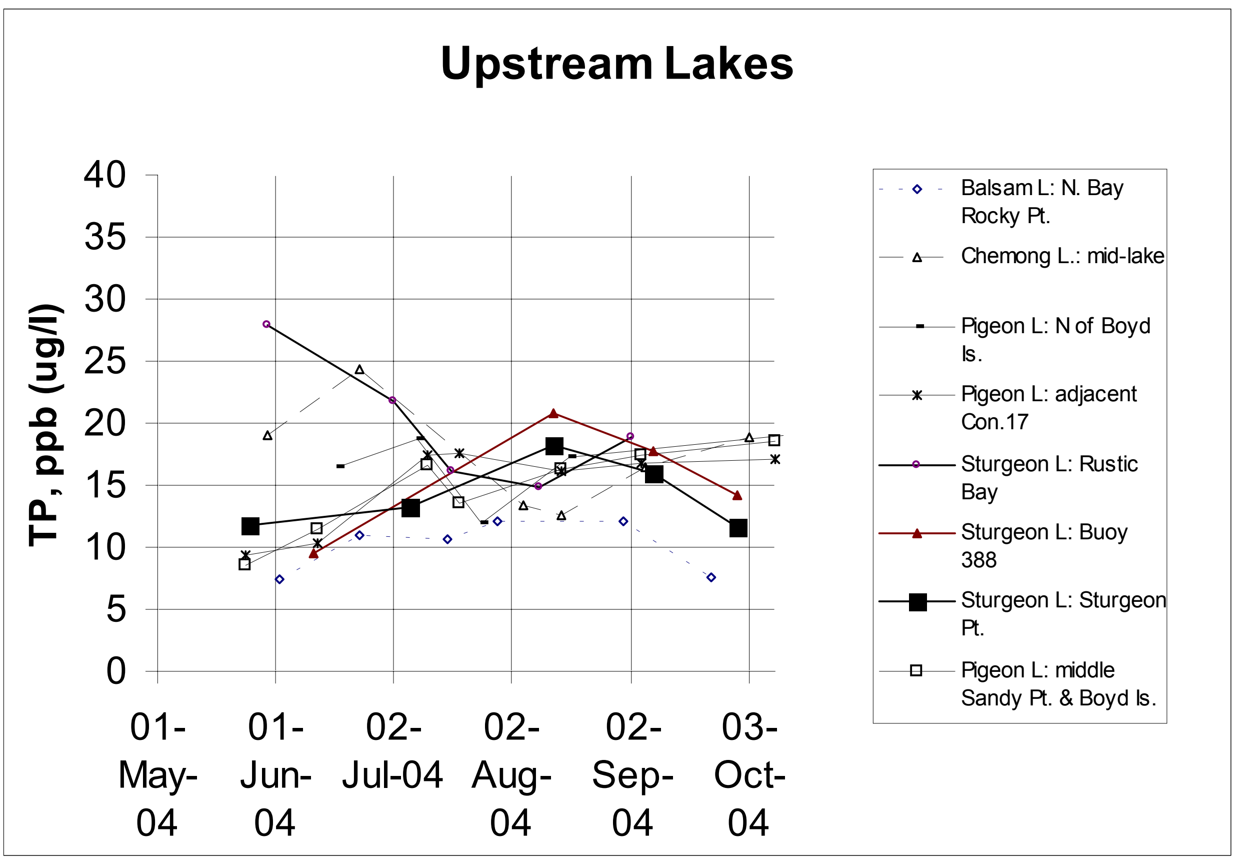
The July "blip" of high phosphorus in Julian Lake was also seen in 2003. There is no obvious reason for this - for example, there seems to be very little fertilizer use nearby.



Upstream Lakes
The phosphorus levels in these lakes were very similar to 2003. Balsam Lake is at the top of the Trent-Severn Waterway; from Balsam Lake, water flows northwest to Georgian Bay and southeast to Lake Ontario; it is "the great divide" of the Waterway. Its water is nearly all from the north, and its phosphorus levels are, predictably, the lowest on this graph.

The two high spring readings in Chemong and Sturgeon Lake/Rustic Bay were not seen in 2003. These were surprising, as May had been a very high flow month, and high readings around June 1 were not seen in any other lakes.

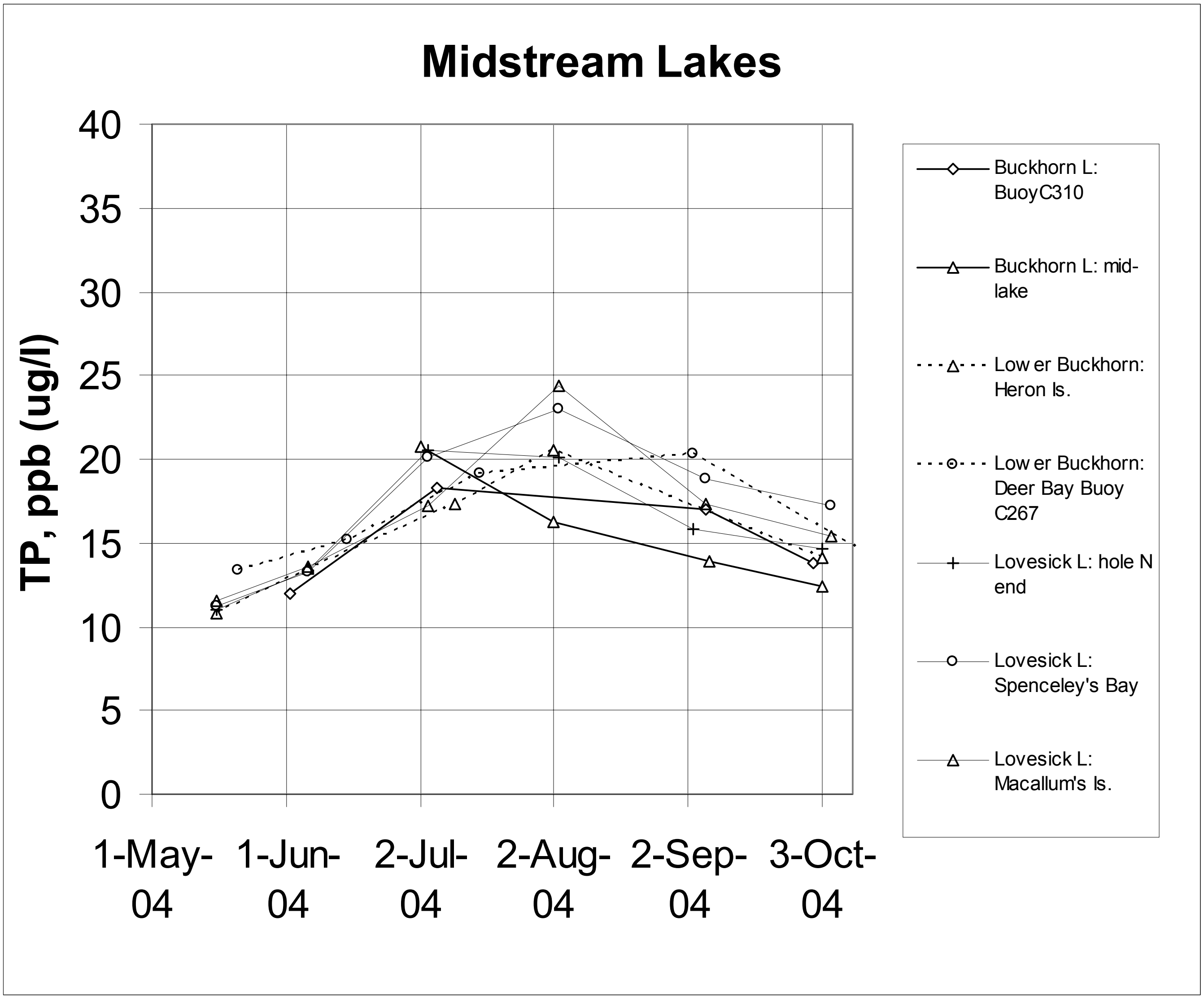
One might have expected Sturgeon Lake to be lower in phosphorus than its neighbour downstream, Pigeon Lake. However, the two lakes had very similar phosphorus levels. This may be due to an inflow of northern water into the north end of Pigeon Lake from Big and Little Bald Lake.



Midstream Lakes

In these lakes, water continues down the canal, and little water feeds in from the north. Phosphorus levels rise as the water flows from Buckhorn to Lower Buckhorn and on into Lovesick. In June and July, phosphorus was about 3 ppb higher than in the upstream lakes, and by August 1, levels were about 5 ppb higher than their neighbours upstream. By September, phosphorus levels were similar to the upstream lakes.

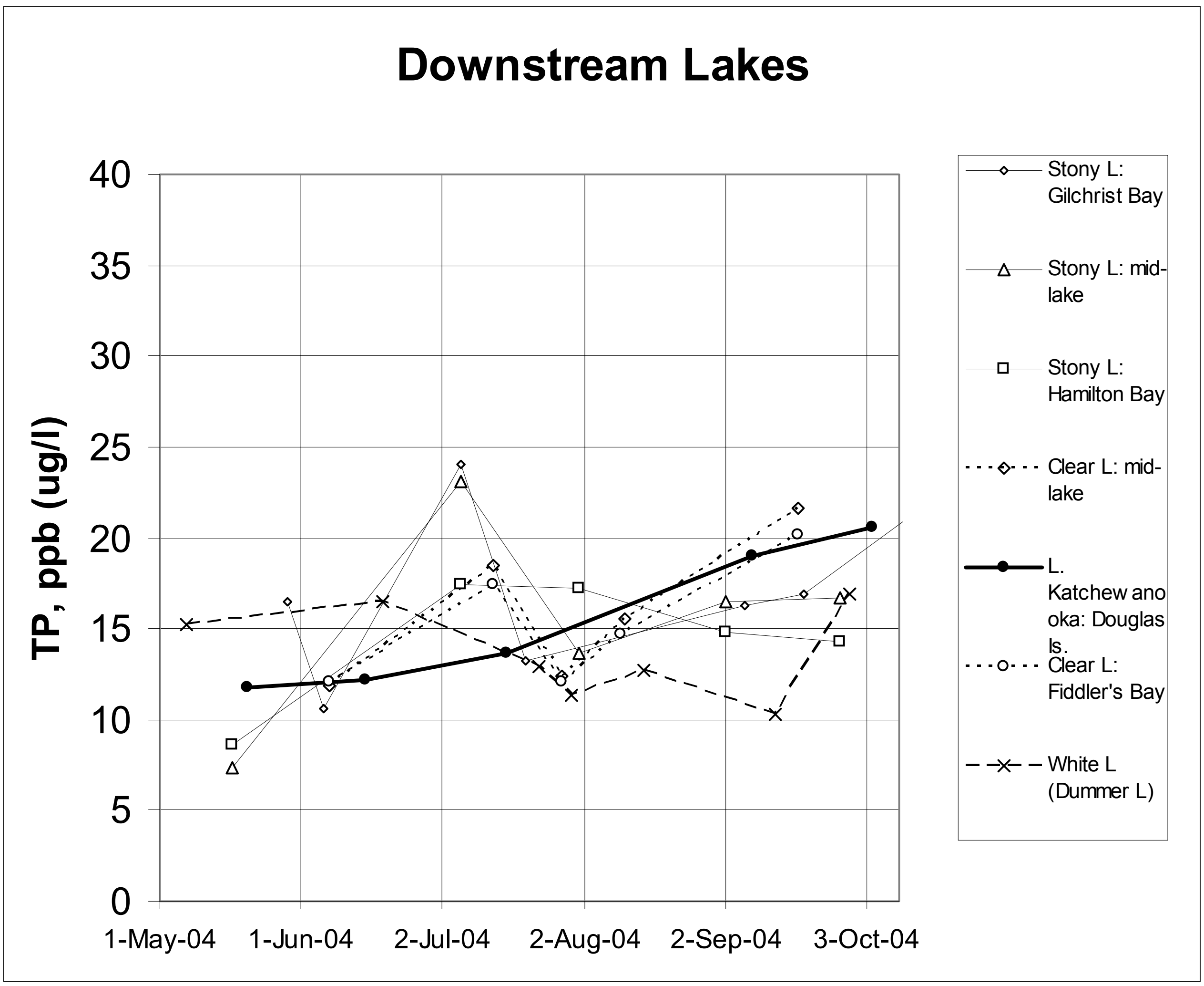
Compared to 2003, early spring readings were much lower, probably due to the high flows in May. August and September readings were about 5 ppb lower in 2004 than in 2003, probably due to high July flows.



Downstream Lakes

Mid-summer phosphorus levels on the downstream lakes hovered around 16 ppb (except for two anomalies in early July that will be discussed below). This level is about 3 ppb lower than in the midstream lakes. This is probably due to a significant inflow of northern water from Upper Stoney Lake.

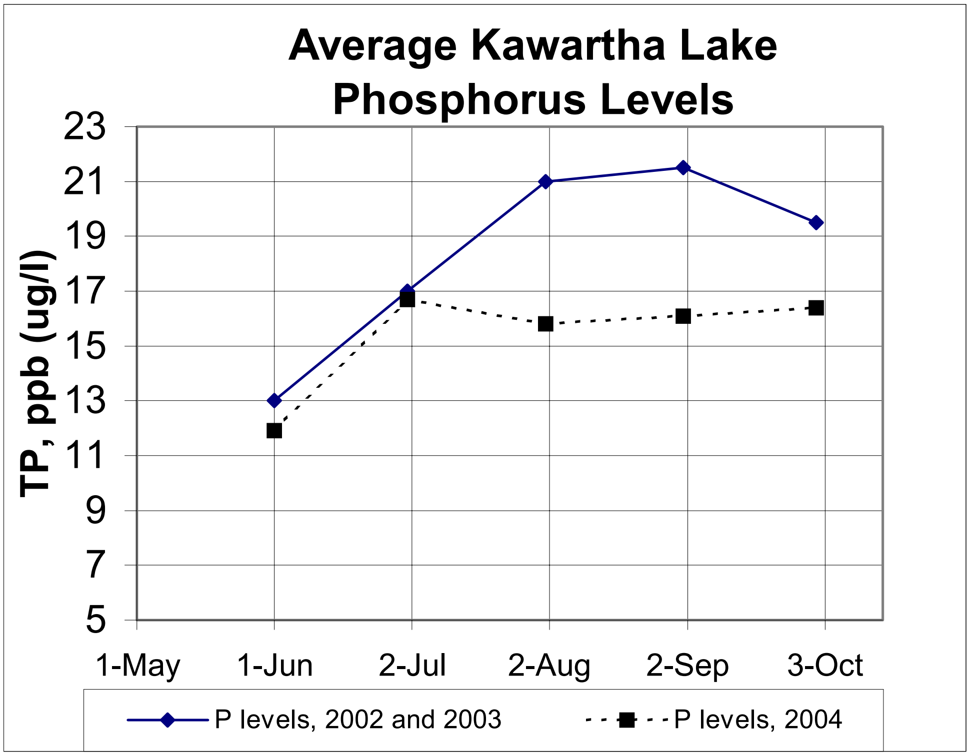
Compared to 2003, the August and September readings were somewhat lower. The only significant difference was that Lake Katchewanooka had much lower phosphorus levels this year throughout July, August and September. Whatever you're doing, keep it up, Lake K!

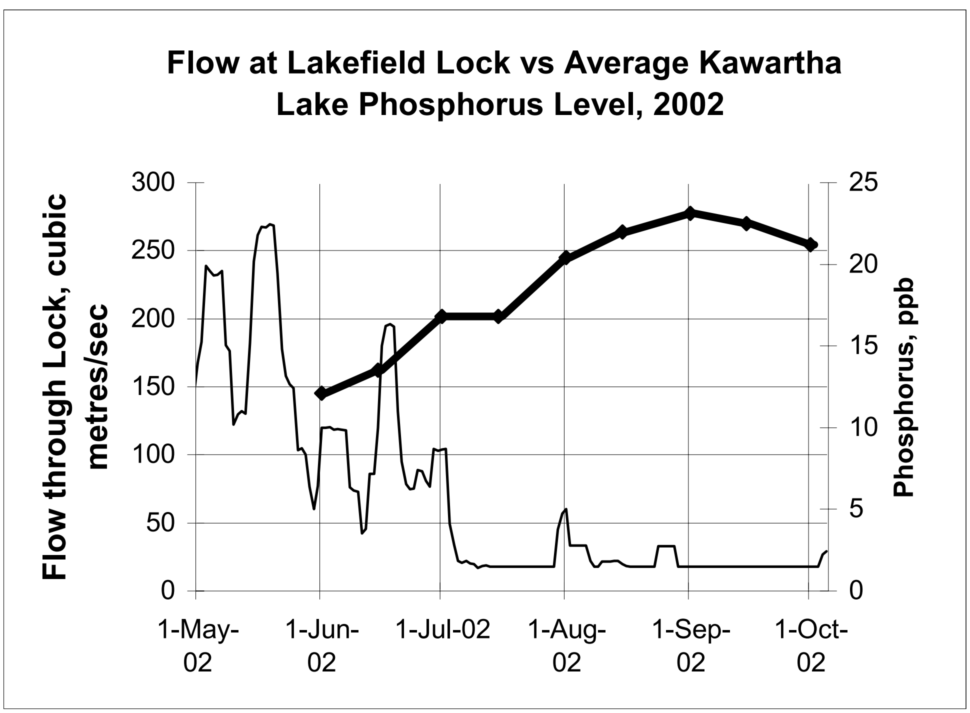


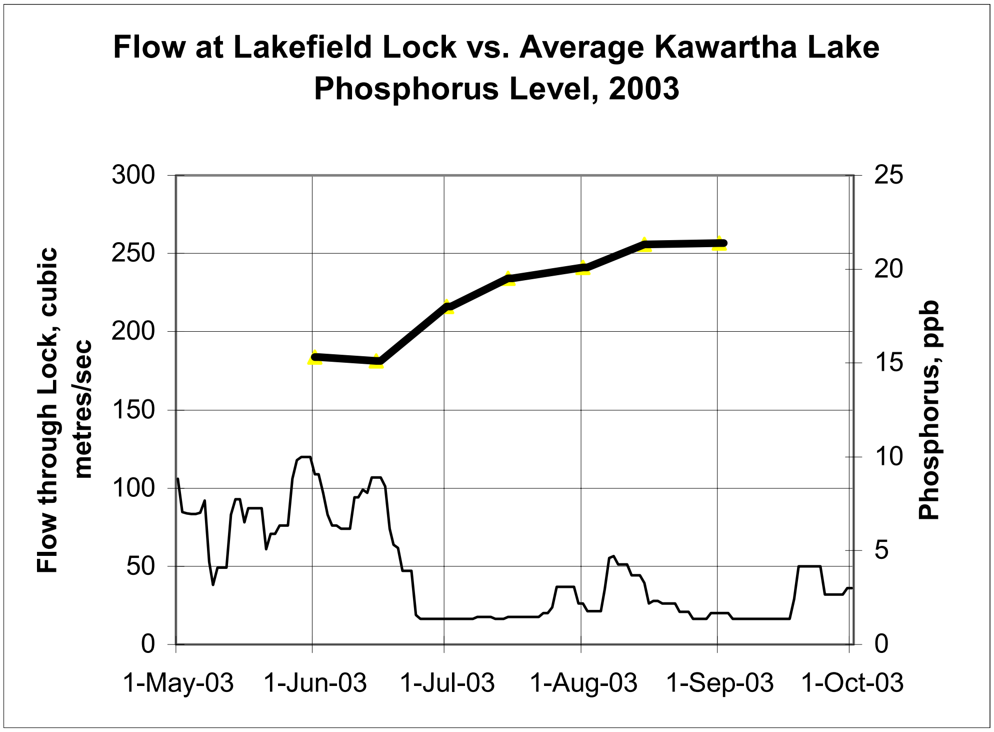
Gilchrist Bay is located at the junction of Stony Lake and Upper Stoney. One would think that Gilchrist Bay's water would be a mixture of Stony and Upper Stoney water. However, the Gilchrist Bay phosphorus levels were almost identical to the central Stony Lake levels, including a "spike" in early July. It is odd that the "spike" was not seen in Hamilton Bay, which is halfway between the Stony mid-lake location and Gilchrist Bay! Does water flow directly from the Trent-Severn into Gilchrist Bay and is Hamilton Bay a bit of a "backwater"? As in 2003, it seems that Gilchrist Bay is more similar to Stony Lake than to low-phosphorus Upper Stoney.

There is a water control dam at the south end of Gilchrist Bay. Water flows south out of Gilchrist Bay into White Lake. White Lake is fairly shallow and is situated in a limestone and phosphorus-rich area. Therefore, one would expect White Lake to be higher in phosphorus than Gilchrist Bay, but, in this first year of testing, phosphorus levels were actually somewhat lower in White Lake in August and September. Why would this be?

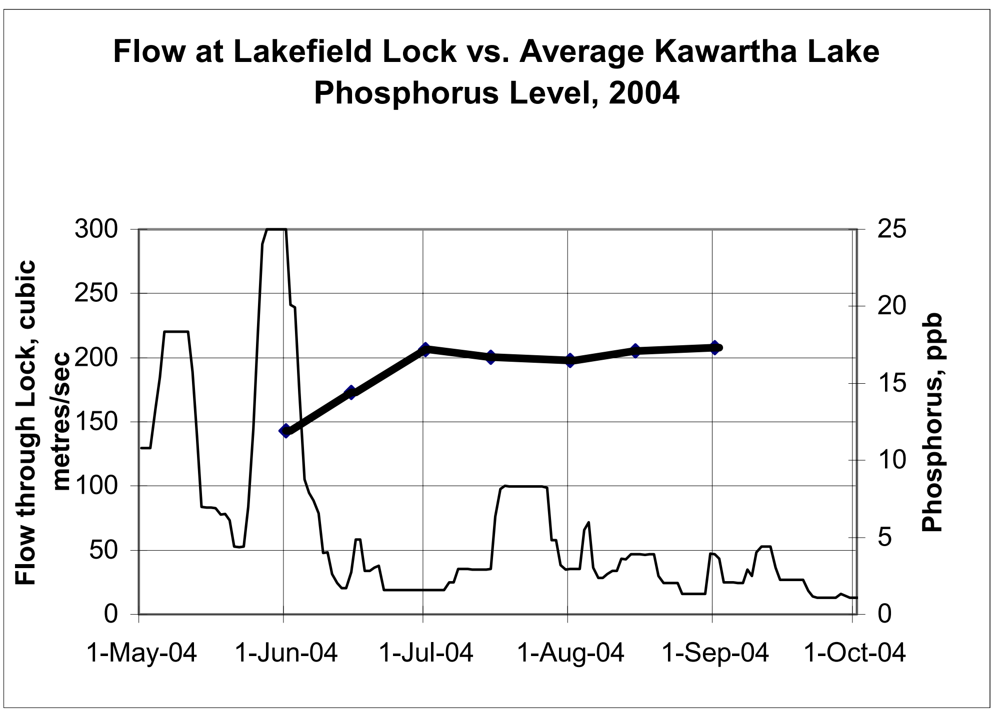
Upper Stoney view from Doe Island


Average Kawartha Lake Phosphorus Levels
TP, ppb (ug/l)
23
21
19
17
15
13
11
9
7
5
1-May
1-Jun
2-Jul
2-Aug
2-Sep
3-Oct
P levels, 2002 and 2003
P levels, 2004


Flow at Lakefield Lock vs Average Kawartha Lake Phosphorus Level, 2002
Flow through Lock, cubic metres/sec
Phosphorus, ppb
300
250
200
150
100
50
0
25
20
15
10
5
0
1-May-02
1-Jun-02
1-Jul-02
1-Aug-02
1-Sep-02
1-Oct-02



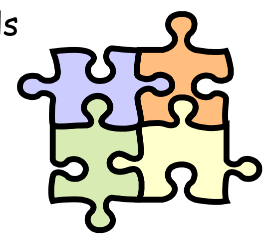
Flow at Lakefield Lock vs. Average Kawartha Lake Phosphorus Level, 2003
Flow through Lock, cubic metres/sec
Phosphorus, ppb
300
250
200
150
100
50
0
25
20
15
10
5
0
1-May-03
1-Jun-03
1-Jul-03
1-Aug-03
1-Sep-03
1-Oct-03



Flow at Lakefield Lock vs. Average Kawartha Lake Phosphorus Level, 2004
Flow through Lock, cubic metres/sec
Phosphorus, ppb
300
250
200
150
100
50
0
25
20
15
10
5
0
1-May-04
1-Jun-04
1-Jul-04
1-Aug-04
1-Sep-04
1-Oct-04

Do we really understand our watershed?

It would seem that our phosphorus data supplies us with more questions than answers. There are so many factors that determine phosphorus levels that variations here and there across the summer may always remain mysteries. For instance, our phosphorus levels may be affected by zebra mussels. Is there a time during the year when zebra mussels filter relatively quickly, perhaps during a "growth spurt"? This would *remove* phosphorus from the lake water. Is there a time when many zebra mussels die off and decompose? This would *add* phosphorus to the water.
Other factors may come into play. There may be significant amounts of phosphorus coming from the atmosphere in the forms of dust and rain. Sediments at the bottom of the lake are often rich in phosphorus, and under certain conditions can release this phosphorus into the water.
The only factor that seems to be obviously affecting phosphorus levels is flow. Large flow = low phosphorus levels, and vice versa. But that doesn't explain many of the variations we see in the graphs. Every year, though, something becomes a little clearer as our data fit together. We are gradually putting together our watershed puzzle.



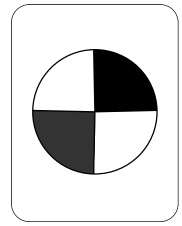
What's alive for 2005?

In 2005, we will expand our testing to four locations in Sturgeon Lake. We intend to add a phosphorus testing site in the south end of Pigeon Lake as well, where high-phosphorus water flows in from the south.

We are aiming to have an expert or team of experts analyze our watershed during this coming year, to determine where our phosphorus is coming from. (See Searching for the Sources of Phosphorus, p. 49.)

We are just beginning to see year-to-year variations. If our volunteers can "hang in there," we will continue to collect valuable and interesting data on our watershed, for many years to come.

Measuring water clarity (Secchi disk depth)

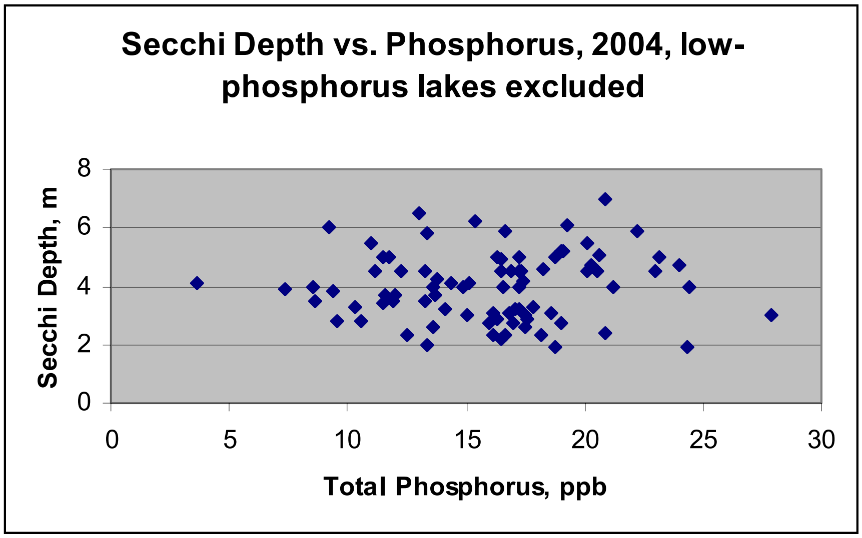


Secchi disk depth is a measure of lake water clarity. A Secchi disk is a circle the size of a paint can lid. It looks like a pie cut in quarters with alternating black and white sections. The disk is lowered until it disappears from sight. This is called the Secchi disk depth. A clear lake will have a larger Secchi disk depth than a murky lake.

KLSA volunteers took Secchi disk readings at the same time as phosphorus, and Secchi readings were submitted to the Lake Partner Program. See Appendix F for a complete set of data.

The Secchi disk depth is the most practical indicator of water quality. People can't see phosphorus or *E.coli*, but they can see turbid water! Time and again, researchers have tried to correlate property values with water clarity. One study from Maine (Michael, H.J., Boyle, K.J., Bouchard, R. 1996. *Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes.* www.umaine.edu/mafes/publications/recreat.htm) found that there was a correlation between water clarity, as measured by Secchi depth, and property values. Specifically, they found that water with a Secchi depth of over 4 metres was considered high quality water. However, as water clarity was reduced to Secchi depth readings of less than 4 m, property values started to decrease. If your lake has a Secchi reading of less than 4 m, any further decrease should be cause for concern!

A more recent study published by researchers at Bemidji State University, Minnesota (www.mississippiheadwaters.org) confirmed that water clarity "proved a significant explanatory variable of lakeshore property prices...that is, all else being equal, property prices paid are higher on lakes having higher water clarity." However, they also found that usually people would pay more for groomed properties rather than those left in their pristine and natural state. "This tendency seems to reveal that buyers prefer a condition that has and can contribute to degrading lake quality -- a contradiction of their preference for locating on lakes with higher water quality."



The chart above shows the Secchi depths and corresponding phosphorus levels seen in 2004. Low-phosphorus lakes were excluded from this graph; these measurements were taken from lakes that were along the main flow from Sturgeon Lake through Lake Katchewanooka, including Chemong Lake. Looking at the graph, we observe:

1. Exactly half the lakes have a Secchi depth of less than 4 m. If the Maine research (above) applies to our lakes, more phosphorus inputs and the resulting loss in clarity could decrease property values in many of our lakes.

2. However, there does not seem to be a strong correlation between phosphorus level and Secchi depth in these lakes. Theoretically, higher phosphorus levels cause lower Secchi readings, but this is not demonstrated here.

Therefore, at this time, it would seem wise to keep phosphorus levels low in order to keep property values high. However, our data cannot guarantee that this will increase clarity.

Nevertheless, we need to be vigilant about keeping excess phosphorus out of our lakes. Here's what you can do:

- Avoid fertilizer;
- Keep your septic system running well;
- Use phosphate-free cleaners (especially dishwasher detergent, which can be extremely high in phosphorus); persuade your local store to stock no-phosphate products, and persuade your neighbours to buy them. These products are often low in toxicity as well, so they are septic system-friendly.

- Keep a naturalized shoreline and property; the vegetation prevents erosion and filters runoff.
- Preserve the wetlands around your lake. If you see someone filling in a wetland, even a small one, contact your local Conservation Authority.
- Educate and energize your politicians! Make sure shorelines and wetlands are protected in your Official Plan and by-laws.

Fall morning on the Otonabee River

Searching for the sources of phosphorus

In our four years of water quality sampling, KLSA has been gradually shifting its emphasis from *E.coli* to phosphorus. Overall, *E.coli* counts have been reassuringly low. The few problem areas that we have detected are being addressed. However, the high phosphorus levels in the Kawartha Lakes are becoming a great concern. Generally, higher phosphorus levels mean murkier water and more algal 'blooms'. The Ministry of the Environment recommends that, to keep water quality acceptable for most recreational activities, average phosphorus levels should remain below 20 ppb. Although phosphorus levels in 2004 were unusually low, probably due to heavy rains in July, in previous years many of our lakes have had phosphorus levels near or over 20 ppb. If our phosphorus levels rise – and projections for increased shoreline development give good reason to suppose that they will – then our lakes could become less attractive, and property values and tourism could decline.

KLSA believes that it is time to find out where the phosphorus is coming from in the Kawartha Lakes. We are certain at this point that some of the phosphorus is natural in origin. But we believe that there are significant inputs of phosphorus that are not natural, and therefore have the potential to be reduced. We can only take effective action to reduce phosphorus inputs into our lakes if we know where most of it originates.

Major phosphorus sources are likely to be atmospheric deposition, phosphorus leaching out of the sediments (internal loading), urban runoff, sewage treatment plants, and agriculture. Other sources will probably include septic systems, fertilizers, or boats flushing out greywater.

A 1998 study on Lake Simcoe concluded that phosphorus sources (disregarding internal loading, which is difficult to measure) were: atmospheric deposition 40.1%; tributaries 27.6%; urban runoff 21.9%; sewage treatment plant 5.7%; drainage from marsh agriculture 5.6%. Wouldn't it be interesting and valuable to have this sort of information for our watershed?

To this end, in 2005 we hope to carry out a comprehensive and scientifically valid study to discover our phosphorus sources. This initial study will be a literature search of all the data currently available for our system, contained in government reports, research reports, academic papers, articles and other sources. This work will be carried out by a partner who can provide financial and/or manpower resources, or a consultant hired by KLSA. A steering committee of the KLSA Executive will work with the project staff over the summer. Once we have chosen our partner or consultant, and we know what the study will cost, we will be doing fund-raising specifically targeted for this study. We hope to raise the required funds as soon as possible so that the phosphorus study can get underway early in the 2005 season.

Following is an excerpt from the study's terms of reference, prepared by Kevin Walters, a KLSA associate board member. It explains more about the aims, scope and details of the project.


Katchewanooka Inflow

2005 Kawartha Lakes Phosphorus Source Study

Phosphorus has long been accepted as the primary element needed for plant growth in aquatic environments, because of its relative rarity as compared with the other needed element, nitrogen. There has been significant water sampling done in the watershed over the past several decades, but little appears available in terms of establishing the breakdown of the sources of the phosphorus entering the subject lakes. A rich arable farm country, primarily located in the southern half of the watershed, suggests significant natural sources, but this has clearly been augmented by human activity.

The study's objectives are to assemble the readily available data on phosphorus quantities from the various sources, including:

- The streamflow of each definable watercourse,
- Municipal stormwater runoff,
- Sewage treatment plants,
- Groundwater sources including shoreline septic system inputs,
- Direct rainfall and airborne deposition on the lake surface,
- Resuspension of phosphorus from the lake sediments.

This data will allow the determination of what amounts of phosphorus arise from where.

The exact breakdown of source components may not be determinable for some sources, i.e. it will likely not be possible in some instances to separate farming activity from natural, arable land background levels, unless some data can be found for a basin with like soils, but without farms. As well, there may not be any reliable or definitive data on actual lakeshore septic system inputs, or data to permit the separation of them from other lakeshore land-use activities. Such needed investigation, as indicated here, will be the subject of another phase of the study; a methodology for a definitive determination of phosphorus inputs from Kawartha Lakes lakeshore development has already been formulated. This second study is to occur subsequently or concurrently, depending upon funding.

It is hoped that the results of KLSA's phosphorus source study will lead to cost-effective action in terms of setting and directing phosphorus reduction strategies to those areas where the most difference can be made. The ultimate goal will be to develop a plan, with other partners, that will hopefully succeed over time in reducing phosphorus loading to the Kawartha Lakes.

Appendix A:
KLSA Mission Statement, Executive Board & Other Volunteers

Mission Statement

The Kawartha Lake Stewards Association objects are to carry out a coordinated, consistent, water quality testing program (including bacteria and phosphorus) of lake water on lakes within the Trent Canal System watershed. The Kawartha Lake Stewards Association will ensure water quality test results, prepared by an accredited laboratory with summary analysis, are made available to all interested parties. In future years the Kawartha Lake Stewards Association may expand its water quality program and may concern itself with other related matters.

Pat Moffat, Kathleen Mackenzie and Jeff Chalmers
working on the 2004 report

Directors

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Lower Buckhorn Lake Owners' Assoc.
(416) 694-4141, (705) 654-3839
email: jjameskeyser@aol.com

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email: patmoffat@yahoo.com

Kathleen Mackenzie, Vice-Chair
Assoc. of Stony Lake Cottagers
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Newcomb Dr. Cottagers' Assoc. (Lwr Buckhorn)
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North Pigeon Lake Ratepayers' Assoc.
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Recording Secretary

Ann Ambler, Recording Secretary
Lovesick Lake Association
(705) 654-4537
email: annambler@hotmail.com

Expert Advisor

Dr. Eric Sager
Acting Director, Oliver Ecological Centre

KLSA E-mail: kawarthalakestewards@yahoo.ca

Other Volunteers

Big Bald Lake	Big Bald Lake Assoc. – Rob Arkell, John Stewart, Ron Brown
Buckhorn Lake	Buckhorn Sands Property Owners - Mary and Mike Belas Sandbirch Estates - Keith Clark
Clear Lake	Birchcliff Property Owner's Assoc. - Jeff Chalmers Kawartha Park Cottager's Assoc. - Judith Platt
Julian Lake	Julian Lake Cottagers - George Loyst
Katchewanooka Lake	Peter Fischer, Lake Edge Cottages
Lovesick Lake	Lovesick Lake Association - Ann Ambler, Ron Brown, Katie Brown, Marlene Steele, Pat Moffat
Lower Buckhorn Lake	Lower Buckhorn Lake Owners' Assoc. - Mark Potter, Don McLeod, Fred Turk, Harry Shulman, Jim and Cindy Chapman, Mike Piekny, Jeff Lang, Peter Miller, Bob Green, Bruce Ward
Pigeon Lake	Concession 17 Cottager's Assoc. - Sheila Gordon Dillane Gamiing - Mieke Schipper, Elaine Petreman North Pigeon Lake Ratepayers' Assoc. - Ron Elliot, Don Fieghen Victoria Place - Dennis Hearse, Bill Bedley, Gary Westlake Sugar Bush - Tall Cedars - James Cole
Sandy Lake	Harvey Lakeland - Doug Russell
Stony Lake	Stony Lake Cottager's Assoc. -Kathleen Mackenzie, Ralph Reed, Bob Woosnam, Gail Szego
Sturgeon Lake	Sturgeon Lake Assoc. - Bill Parish, Rod Martin, Don Holloway, Doug Ridge
Upper Stoney Lake	Upper Stoney Lake Cottagers' Assoc.- Karl and Kathy MacArthur, Peter Knapp

Listed are our primary volunteers; many others helped on many occasions.

Appendix B: Donors and Sponsors of the KLSA

Parks Canada, Trent Severn Waterway
City of Peterborough
Mattamy Homes Limited, Pigeon Lake
Stony Lake Heritage Foundation, Upper Stoney & Lower Stony Lake
Township of Galway-Cavendish-Harvey
Township of Douro-Dummer
Lower Buckhorn Lake Owners Association
Birchcliff Property Owners Association of Douro-Dummer, Clear Lake
Township of Smith-Ennismore-Lakefield
Lovesick Lake Association, Lovesick Lake
Big Bald Lake Cottagers Association
Harvey Lakeland Cottagers Association
Victoria Place Association Inc., Pigeon Lake
Buckhorn Tourist Association
Juniper Point Association, Stony Lake
Kawartha Park Cottagers' Association, Clear Lake
Sandbirch Estates Association, Buckhorn Lake
Julian Lake Cottagers' Association, Julian Lake
Pigeon Lake Cottagers' Association
Bayview Estates Recreation Association
Kenhill Beach Association, Sturgeon Lake
Stinson's Bay Property Owners Association
Gamiing – Centre for Sustainable Lakeshore Living Inc.
Marrick's Landing, Lovesick Lake

Thanks to all of our generous supporters.

Appendix C: Financial Report

2004 Revenue & Expenses

December 31, 2004

Balance Forward from December 31, 2003		$3,980.29
Revenue		
Twsp. of Smith-Ennismore-Lakefield	350.00	
Parks Canada, Trent Severn (bal. -2003 commitment)	1,200.00	
Harvey Lakeland Cottagers Assoc.	300.00	
Victoria Place Assoc. - Pigeon	300.00	
Julian Lake Cottagers Assoc.	165.00	
Big Bald Lake Cottagers (2003 payment)	300.00	
City of Peterborough	1,500.00	
Township of Douro-Dummer	750.00	
Lovesick Lake Assoc.	330.00	
Mattamy Homes Limited	1,500.00	
Marrick's Landing	50.00	
Gamiing -Centre for Sustainable Lakeshore Living Inc.	50.00	
Pigeon Lake Cottage Assoc.	150.00	
Twsp. of Galway-Cavendish & Harvey	1,000.00	
Stony Lake Heritage Foundation	1,100.00	
Kenhill Beach - Sturgeon	100.00	
Juniper Point - Stony	250.00	
Birchcliff Property Owners Assoc. - Clear	500.00	
Sandbirch Estates - Buckhorn	175.00	
GIC Interest	4.93	
GIC Interest	31.30	
Big Bald Lake Cottagers	300.00	
Lower Buckhorn Lake Owners Assoc.	700.00	
GIC Interest	32.00	
Buckhorn Tourist Assoc.	250.00	
Parks Canada, Trent Severn (initial 2004 commitment)	1,800.00	
Bayview Estates Recreation Assoc.	100.00	
Stinson's Bay Property Owners Assoc.	55.00	
Kawartha Park Cottagers Assoc.	200.00	
Total Revenue	13,543.23	$13,543.23

Expenses		
Bank Fees	5.00	
SGS Lakefield Research Limited - #C49597	1,071.07	
Bank Fees	5.00	
Bank Fees	5.00	
Bank Fees	5.00	
Sir Sandford Fleming College (2003 report printing)	1,344.60	
B&M Prolink Trust (Insurance)	918.00	
Jeff Chalmers (expenses)	232.48	
Ann Ambler (expenses)	339.75	
Pat Moffat (expenses)	21.28	
SGS Lakefield Research Limited - #E59969	1,153.46	
Bank Fees	3.75	
SGS Lakefield Research Limited - #E61005	1,220.87	
SGS Lakefield Research Limited - #E61756	2,276.96	
F.O.C.A.	152.48	
Jim Keyser (expenses)	143.00	
Bank Fees	3.75	
Bank Fees	3.75	
SGS Lakefield Research Limited - #E62812, E63697, E63816	2,344.37	
Bank Fees	3.75	
Bank Fees	3.75	
Total Expenses	11,257.07	**$11,257.07**
Net Balance		**$6,266.45**

Investment Account

Transaction	Debit	Credit	Balance	
Balance Forward			4,000.00	
Deposit from Chequing		1,000.00	5,000.00	
Deposit from Chequing		4,000.00	9,000.00	
GIC Redemption	1,000.00		8,000.00	
GIC Redemption	2,000.00		6,000.00	
Account Balance			6,000.00	**$6,000.00**
Grand Total				**$12,266.45**

Financial Statements of

KAWARTHA LAKES STEWARDS ASSOCIATION

December 31, 2004

Note To The Financial Statements
December 31, 2004

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.

As a non-profit association under section 149(1)(l) of the Income Tax Act, the association is not responsible to pay income tax and is therefore prohibited from distributing any of its profits to, or for the personal benefit, of its members, directors or affiliates.

McCOLL TURNER

McCOLL TURNER

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

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

REVIEW ENGAGEMENT REPORT

To Mr. A. Jeffrey Chalmers, Secretary/Treasurer
KAWARTHA LAKES STEWARDS ASSOCIATION

We have reviewed the statement of financial position of Kawartha Lakes Stewards Association as at December 31, 2004 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

Peterborough, Ontario
April 4, 2005

KAWARTHA LAKES STEWARDS ASSOCIATION

Statement of Financial Position - December 31, 2004

(Unaudited)

	2004	2003
ASSETS		
Current Assets		
Cash	$ 4,236	3,980
Guaranteed Investment Certificates	6,000	4,000
Amounts receivable	1,200	1,200
	11,436	9,180
LIABILITIES		
Current Liabilities		
Accounts payable and accrued liabilities	$ 180	$ 1,221
NET ASSETS	11,256	7,959
	$ 11,436	$ 9,180

Statement of Operations

Year ended December 31, 2004

(Unaudited)

	2004	2003
REVENUE		
Parks Canada, Trent-Severn Waterway	$ 3,000	$ 1,800
Municipal grants	3,600	1,975
Associations	4,300	4,550
Private contributions	1,375	1,750
Pledge receivable	1,200	1,200
Interest	68	30
	13,543	11,305
EXPENDITURE		
Water testing fees	7,056	5,273
Annual report costs	1,345	886
Registration fees, insurance and membership fee	1,070	1,068
Telephone, copies and other administrative costs	737	935
Bank charges	38	39
	10,246	8,201
EXCESS OF REVENUE OVER EXPENDITURE FOR THE YEAR	$ 3,297	$ 3,104
NET ASSETS - BEGINNING OF YEAR	7,959	4,855
NET ASSETS - END OF YEAR	$ 11,256	$ 7,959

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, e-mail 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.

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Jeffrey Chalmers, K.L.S.A. Privacy Officer
4 Conger Street, Peterborough, ON K9H 4Y6

Appendix E: 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;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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.

Big Bald Lake

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	5-Jul-04	19-Jul-04	26-Jul-04	3-Aug-04	9-Aug-04	8-Sep-04
1	20	7	2	8	2	7
2	4	1	2	1	0	5
3	1	1	0	0	6	1
4	2	1	0	0	0	0
5	0	4	0	1	0	1
8	3	8	0	1	7	0

Big Bald Lake is fed by water from the north, and flows into the Trent-Severn Waterway. As in previous years, counts were consistently low, even after heavy rain (July 6).

Big Bald Lake

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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 Lake: Buckhorn Sands

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	6-Jul-04	19-Jul-04	26-Jul-04	4-Aug-04	9-Aug-04	6-Sep-04
A	2	1	5	18	7	2
B	7	10	0	1	8	3
C	2	7	0	2	6	0
D	4	22	4	1	2	0

As in previous years, *E.coli* counts were near or below 20.

Buckhorn Lake: Sandbirch Estates

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	8-Jul-04	20-Jul-04	25-Jul-04	4-Aug-04	8-Aug-04	6-Sep-04
A	32	-	26	14	1	**85**
B	3	-	0	2	3	0
C	**62**	0,1,1,0	4	0	2	2

Site A showed 3 out of 5 counts over 20, which is somewhat high for this location. Site B was uniformly extremely low.

Due to a miscommunication, Site C was not retested immediately after the count of 62, and the other sites were not tested on July 20.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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 Lake: Birchcliff Property Owners of Douro-Dummer

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date								
Site No.	**8-Jul-04**	**13-Jul-04**	**19-Jul-04**	**25-Jul-04**	**11-Aug-04**	**16-Aug-04**	**27-Aug-04**	**8-Sep-04**
1	0	-	0	0	1	3	-	1
2	0	-	14	11	0	8	-	2
3	0	-	2	1	1	1	-	2
4	3	-	46	9	6	3	-	1
5	1	-	0	2	1	1	-	3
6	3	-	9	5	2	2	-	31
7	0	-	4	0	3	**100**	4	2
7	-	-	-	-	-	-	4	-
7	-	-	-	-	-	-	3	-
7	-	-	-	-	-	-	3	-
8	0	-	1	9	24	**106**	**106**	3
8	-	-	-	-	-	-	**146**	2
8	-	-	-	-	-	-	**38**	7
8	-	-	-	-	-	-	**1580**	9
BB	**90**	2	14	4	19	0	-	3
BB	-	2	-	-	-	-	-	-
BB	-	10	-	-	-	-	-	-
BB	-	33	-	-	-	-	-	-

Generally, counts were low, but there were a few counts near 100 *E.coli* which were looked into. Site 7's high count may have been due to construction nearby, which was causing a fair bit of erosion. Correlation between shoreline construction and a temporary high count has been noticed in previous years (2001 Clear Lake, 2003 Clear Lake).

Site 8 is in an area where many waterfowl congregate, on rocks and long docks. A property owner is looking into ways to discourage waterfowl "loitering."

The high count at Site BB was most likely due to heavy rains. The inflow had a very high volume that day. This high inflow/high count correlation was observed in 2002, when Site BB was labeled Site N Stony Lake.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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 Lake: Kawartha Park Cottagers' Assoc.

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date							
Site No.	5-Jul-04	19-Jul-04	26-Jul-04	4-Aug-04	10-Aug-04	16-Aug-04	7-Sep-04
A	2	14	0	0	-	-	-
B	3	7	0	0	1	12	1
C	0	0	0	0	0	0	0
D	0	10	0	0	0	36	0
J	-	-	-	-	1	0	1

These four sites showed consistently low counts, despite one of the sites being at a stream inflow. This is similar to the previous 3 years.

Bird proofing dock

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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.

Julian Lake

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	**5-Jul-04**	**19-Jul-04**	**26-Jul-04**	**3-Aug-04**	**19-Aug-04**	**7-Sep-04**
A	3	0	0	2	1	0
B	7	1	23	7	2	0
C	3	3	0	1	0	0

Julian Lake is mainly spring fed. Although it is not part of the Trent-Severn Waterway, it is nearby and its shoreline is ringed with cottages. Canada geese were seen only on July 5 at Site B. There were heavy rains before July 5 and July 26, but this did not seem to have a large effect on this lake, probably a reflection of the well vegetated shoreline and well forested local region.

Sunrise on shield lake

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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.

Katchewanooka Lake

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date							
Site No.	**6-Jul-04**	**9-Jul-04**	**20-Jul-04**	**27-Jul-04**	**4-Aug-04**	**10-Aug-04**	**8-Sep-04**
1	1	-	2	1	1	2	13
2	5	-	12	8	46	**83**	36
3	22	-	6	1	2	8	6
4	4	-	11	1	4	2	6
5	**120**	48	**179**	**156**	**287**	**102**	42
5	-	**139**	**191**	-	**247**	**556**	18
5	-	5	**133**	-	**318**	**400**	17
5	-	**158**	**180**	-	**173**	**468**	**135**
5	-	-	**191**	-	**179**	**198**	**314**
6	1	-	3	6	7	0	**69**

Site 5 is at the mouth of a stream. This site did not have frequent high counts in 2001 and 2002, but had recurring high counts in 2003 and 2004. Over the years, counts have not been highly correlated with heavy rain. Local residents have been notified of the counts. Fortunately, this is not a swimming area. There are a variety of land uses upstream. Permission has been given to KLSA to come on private property to test upstream in the future.

Sawer Creek Dam – Otonabee River south of Lakefield

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	**4-Jul-04**	**19-Jul-04**	**26-Jul-04**	**3-Aug-04**	**9-Aug-04**	**6-Sep-04**
1	3	0	0	1	5	0
4	3	3	1	8	1	0
5A	6	7	1	2	19	0
6	10	0	0	1	0	0
9	13	1	1	1	0	3
11	1	2	1	0	0	0

Lovesick Lake in previous years has had an occasional high reading, but with no obvious reason. The 2004 readings were extremely low, despite fairly heavy rain before the July 19 and August 3 dates. The generally low readings might reflect the abundance of Crown and First Nations land in this lake, combined with good shoreline management.

It should be noted that the first samples were collected on July 4, before the heavy rains on the morning of July 5, which may have kept these counts lower than on other lakes sampled that weekend.

Farm on Trent Severn Waterway

Lower Buckhorn Lake

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date								
Site No.	4-Jul-04	8-Jul-04	14-Jul-04	18-Jul-04	25-Jul-04	2-Aug-04	8-Aug-04	6-Sep-04
1	1	-	-	8	5	5	3	6
2	0	-	-	9	0	3	13	6
3	14	-	-	19	32	27	41	33
4	**105**	**84**	**62**	**77**	39,50	**	34	14
4	-	**131**	**55**	**121**	47	-	34	-
4	-	**342**	-	-	50	-	-	-
4	-	**164**	-	-	**53**	-	-	-
5	1	-	-	9	2	4	43	0
6	3	-	-	3	3	12	13	0
7	6	-	-	5	0	1	2	-
8	1	-	-	3	1	30	22	3
9	0	-	-	2	0	3	4	1
10	4	-	-	1	2	0	1	0
11	2	-	-	11	1	17	2	4
12	14	-	-	14	8	7	6	3
13	1	-	-	2	3	0	3	0
14	0	-	-	-	-	2	9	5
15	-	-	-	-	-	3	4	-

** On August 3, there were 10 tests taken around Site 4. Results were all between 87 and 162.

Of the 14 locations tested on Lower Buckhorn Lake, 10 locations showed all readings below 20, despite the fact that there were heavy rains before the July 18, August 2, and August 8 tests. It is interesting to note that, while many lakes had elevated counts on their July 5 sampling date due to heavy rain early in the morning of July 5, the first sampling date on Lower Buckhorn was July 4 and counts were generally low.

Sites 3 and 4 are located in a bay that is fed by several streams that flow out of wetlands and areas of plentiful wildlife. A large number of retests this summer indicated the high counts were coming from several locations upstream. *E.coli* counts decreased as water flowed down the bay and out into the lake. The counts at Sites 3 and 4 did not seem to rise much after heavy rains (July 18 and August 2), as one would expect from a wetland outflow. Perhaps there had been so much rain during the wet spring and early summer that the wetlands had been flushed out by this time. The local residents have been informed of the high *E.coli* counts.

Site 5's reading of 43 had no apparent cause, nor did Site 8's readings of 22 and 30. One or two readings between 20 and 50 per summer are normal for the Kawartha lakes.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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 Cottagers' Assoc.

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	**4-Jul-04**	**19-Jul-04**	**25-Jul-04**	**3-Aug-04**	**9-Aug-04**	**6-Sep-04**
3	12	0	3	0	2	0
4	11	0	**51**	0	3	3
4	-	-	-	0	-	-
4	-	-	-	0	-	-
4	-	-	-	0	-	-
4	-	-	-	4	-	-
A	3	1	0	12	3	1

The *E.coli* counts for the three Concession 17 sites were very low. Apart from one reading of 51, all readings were less than 20, which was consistent with other years. There was no obvious reason for the one somewhat elevated reading of 51 at Site 4/July 25, in that there were no heavy populations of waterfowl nearby, no higher-than-normal inflow, and there had not been recent rain in the area.

Pigeon Lake: Gamiing

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date							
Site No.	**6-Jul-04**	**7-Jul-04**	**13-Jul-04**	**14-Jul-04**	**20-Jul-04**	**2-Aug-03**	**7-Sep-04**
East	6	-	-	-	1	35	7
West	-	**101**	5	-	6	11	0
South	-	**269**	-	**420**	43	27	0

Site West has consistently low *E.coli* results in 2004, as it had in 2002. (2003 tests were incomplete.)

Site South and East both had high counts on July 6, possibly caused by recent heavy rains. Both Sites South and East submitted 3 retest samples on July 20, but only one sample was tested due to a paperwork mixup at the laboratory. This was shortly after the Peterborough flood of July 15, and the laboratory was extremely busy.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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: North Pigeon Lake Ratepayers' Assoc.

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date					
Site No.	**8-Jul-04**	**21-Jul-04**	**25-Jul-04**	**30-Jul-04**	**17-Aug-04**
1	4	-	-	0	-
3	3	8	-	0	0
4	10	32	-	39	4
5	11	37	-	**57**	26
6	**60**	**58**	19	41	18
6	-	-	23	-	-
7	**420**	**182**	**103**	**214**	**188**
7	-	**201**	**110**	-	-
7	-	**200**	**123**	-	-
8	6	22	-	1	4
9	20	3	-	-	11
11	**520**	**194**	**158**	**217**	**191**
11	-	**202**	**109**	-	-
11	-	**198**	**140**	-	-
12	40	**56**	35	**58**	47
12	-	-	34	-	-
12	-	-	43	-	-

There was only one testing date that followed heavy rains, on July 8, and this is when Site 7 and 11 had their highest counts. On other dates there had been little or no rain in the previous 48 hours.

Site 7 is a "backwater" area, with little circulation, shallow water, and no swimming. Site 11, also not a swimming area, is nearby, and had counts very similar to Site 7. The North Pigeon Lake volunteer spoke with the Peterborough Public Health Unit in December 2004, and they will look into this further next year.

Sites 5 and 6 are swimming areas near Site 7. These exhibited several elevated counts as in previous years.

There was a large number of waterfowl near Sites 6, 7 and 11 on July 25 and 30, and on August 17. This is a possible source of the high counts in these areas.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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: Victoria Place

2004 *E.coli* Lake Water Testing
***E.coli* count, *E.coli*/100 ml**
Test Date

Site No.	6-Jul-04	20-Jul-04	22-Jul-04	4-Aug-04	16-Aug-04	7-Sep-04
1	4	**265**	21,11	0	8	0
1	-	-	19,6,	-	-	-
1	-	-	8,16,	-	-	-
1	-	-	23,12	-	-	-
1	-	-	19,18	-	-	-
2	5	50	-	0	6	0
3	2	8	-	3	1	6
4	0	11	-	2	0	3
5	3	11	-	5	9	4

There were widespread rains on July 5, but it is uncertain whether this rain occurred in the Victoria Park region. However, volunteers did record heavy rains before the July 20 testing date. This may have had some role in raising counts on that date at Sites 1 and 2. There is no inflow near here, but the shoreline is heavily used by people and there were 5 geese nesting nearby and using this open (non-vegetated) shoreline. Perhaps shoreline runoff raised the *E.coli* levels.

The very high count of 265 at Site 1/July 20 was very short-lived. When the swimmers heard of the high count, they made efforts to keep the geese away from the area.

Volunteers at the Oliver Ecological Centre

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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: Harvey Lakeland

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date							
Site No.	**05-Jul-04**	**09-Jul-04**	**19-Jul-04**	**26-Jul-04**	**03-Aug-04**	**08-Aug-04**	**10-Sep-04**
1	**119**	-	13	15	4	3	11
2	**57**	**81**	3	7	19	0	8
2	-	8	-	-	-	-	-
2	-	8	-	-	-	-	-
3	2	0	1	4	0	1	33
3	-	0	-	-	-	-	-
3	-	2	-	-	-	-	-
4	1	-	2	13	1	0	0
5	1	-	0	0	0	0	5
6	7	-	3	6	2	0	0

The Sandy Lake volunteer recorded heavy rains before the July 5 sampling date, light rains before the August 9 sampling date, and light to heavy rains before the other 4 dates. The heavy rains early in the morning of July 5 after a very busy 4-day long weekend may have been the cause of the high counts on Sites 1 and 2 on July 5.

Bird droppings on a raft were observed near Site 1 on July 19, but this did not seem to raise the *E.coli* levels there significantly. Apart from July 5, at 2 out of 6 sites counts were very low on this lake.

Bird proofing beach area

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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: Assoc. of Stony Lake Cottagers

2004 *E.coli* Lake Water Testing
***E.coli* count, *E.coli*/100 ml**
Test Date

Site No.	5-Jul-04	12-Jul-04	19-Jul-04	22-Jul-04	25-Jul-04	3-Aug-04	9-Aug-04	8-Sep-04
A	1	-	0	-	0	0	1	0
E	10	-	3	-	1	0	6	2
F	12	-	2	-	2	1	2	7
G	3	-	3	-	2	4	4	5
I	**99**	0,3,	3	-	0	2	1	0
I	-	0,3	-	-	-	-	-	-
J	11	-	6	-	6	1	15	27
K	1	-	1	-	1	2	0	2
L	1	-	1	-	4	8	32	0
P	**56**	2,0,	**1580**	0,6,	2,3,	1	1	0
P	-	3,1	-	2,6	2	-	-	-
Q	-	-	-	2,2,	-	-	-	-
Q	-	-	-	1,0	-	-	-	-
24	**65**	0,2,	4	-	2	2	12	10
24	-	0,3	-	-	-	-	-	-
25	**61**	6,9,	9	-	5	5	6	8
25	-	9,6	-	-	-	-	-	-
26	11	-	3	-	2	6	5	3
27	24	-	6	-	9	5	1	2
28	15	-	0	-	0	1	2	0

Generally, the sites at Stony Lake had very low "background" counts of less than 20 *E.coli*/100 mL. On July 5, after a very busy long weekend followed by heavy rain, the counts were elevated at Sites I, P, 24, 25 and 27. All but Site P were situated in long, narrow bays, so the runoff would have been quite concentrated there. Site P would have had a very high level of human activity on the weekend on the shore and in the water, which may have caused the count of 56 on July 5.

July 5 was the only date preceded by heavy rain; all others were preceded by light rain.

These higher counts indicate that, in narrow bays with less circulation, it is especially important to make every effort to keep runoff to a minimum, and to try to filter runoff with shoreline vegetation.

The cause of the extremely high but short-lived count at Site P on July 19 remains unknown. This is a place where a large number of people use the shoreline and water, but local wildlife may also have been the source of the high count.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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: East Shore

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml			
Site No.	**11-Jul-04**	**27-Jul-04**	**9-Aug-04**
101	0	3	4
102	2	4	13
103	1	2	2
104	0	7	0
108	4	4	0
109	2	0	3
110	0	2	1

This is the first year these sites were tested; the sites have changed since last year.

There was little or no rain before the 3 testing dates. This year's sites were in a bay, but there was a fair bit of circulation in the bay, as wind tends to blow into the bay. All counts were very low.

Ron Brown, Jeff Chalmers & Kathleen Mackenzie look for Benthic Bugs

Benthic Bug toolkit

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date							
Site No.	**5-Jul-04**	**19-Jul-04**	**22-Jul-04**	**28-Jul-04**	**3-Aug-04**	**9-Aug-04**	**7-Sep-04**
1	4	8	-	4	5	8	9
2	31	26	-	**238**	-	**106**	**1120**
2	-	-	-	-	-	**99**	-
2	-	-	-	-	-	41	-
2a	-	-	-	-	35	-	-
2b	-	-	-	-	14	-	-
2c	-	-	-	-	24	-	-
2d	-	-	-	-	20	-	-
3	8	**86**	**87**	**74**	47	38	30
3	-	-	**83**	-	**56**	36	-
3	-	-	**80**	-	47	12	-
3	-	-	13	-	4	12, 9	-
3a	-	-	-	**133**	-	-	-
4	1	5	-	0	4	2	7
5	38	26	-	**55**	**87**	**54**	**180**
5	-	-	-	-	**150**	46,34	-
5	-	-	-	-	**81**	40	-
5	-	-	-	-	**460**	44	-
6	0	4	-	19	5	3	2
SPGOLF	7	2	-	44	0	5	14
SPPD	15	3	-	10	2, 9	6	30
SPPD	-	-	-	-	4, 4	-	-
WS1	11	7	-	**121**	7, 2	8	14
WS1	-	-	-	-	7, 3	-	-
WS2	2	2	-	7	5	4	13

Last year, the North Shore group "got their feet wet" by testing once; this is the first year this group has fully participated in the testing program. There were 4 sites on this lake that had higher counts than what would be considered normal background counts, i.e., counts under 20, with 1 or 2 between 20 and 50 *E.coli*/100 mL.

Site NS2 was an area where an abutment reduced water circulation, and where seagulls tended to congregate. Also, there were often many Canada Geese on the grassy shore nearby. The property owner would like to do what he can to solve this problem, and perhaps a solution can be found for next summer.

Site NS3 was in an inflow of a creek that flows from land where cattle graze. There was no swimming at this location, but it would be advisable to test at the nearest swimming area next year, as counts were elevated on several occasions.

Site NS5 was near a boat launch, a beach area, and near an area where numerous geese and ducks swim. Any one of these could be a source for the frequent elevated *E.coli* counts.

WS1, like NS3, was near small streams that drained from agricultural land. There are a number of cottages nearby, so if more high counts are seen in future years, perhaps the streams should be tested.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming;
- Kawartha Lake Stewards Association believes the safe swimming level for our lakes should be more stringent than this, and have set the acceptable level at 50 *E.coli*/100 mL. KLSA regards counts over 50 as cause for concern;
- 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.

Upper Stoney Lake: Upper Stoney Lake Cottagers' Assoc.

2004 *E.coli* Lake Water Testing *E.coli* count, *E.coli*/100 ml Test Date						
Site No.	**6-Jul-04**	**19-Jul-04**	**27-Jul-04**	**3-Aug-04**	**9-Aug-04**	**7-Sep-04**
6	15	10	32	3	8	34
20	14	2	12	25	9	5
21	2	0	0	3	5	0
52	7	21	10	32	17	18
56	4	1	0	1	0	2
62	1	1	0	0	1	0
63A	1	1	1	1	1	3
65	3	0	1	2	1	0
70	3	0	0	4	0	0
78A	1	3	1	9	4	1
85	1	1	1	3	2	0
99	0	2	2	1	2	1

Counts on Upper Stoney Lake were very low. As in the previous three years, there are occasional numbers between 20 and 50 at 2 or 3 locations, but they did not persist.

Early spring on Lower Stony Lake

Appendix F: 2004 Phosphorus and Secchi Data

Following is the complete record of phosphorus and Secchi disk measurements taken in 2003. Look up your lake and ask:
How close is our lake to the 20 ppb seasonal average limit?
How well do our Secchi readings and phosphorus readings correlate?
How do your lake's phosphorus levels change throughout the season?

2004 Secchi Depth Results			2004 Total Phosphorus Results				
Secchi(m)	**Date**	**Lake**	**Site Description**	**Date**	**TP1 (ug/L)**	**TP2 (ug/L)**	**TP Avg.**
7.00	2-Jun-04	**Balsam lake**	**N Bay Rocky Pt.**	2-Jun-04	6.26	8.74	7.50
5.00	23-Jun-04			23-Jun-04	11.11	10.78	10.95
4.50	30-Jun-04			-	-	-	-
5.50	16-Jul-04			16-Jul-04	10.68	10.51	10.60
5.70	29-Jul-04			29-Jul-04	13.41	10.86	12.14
5.00	31-Aug-04			31-Aug-04	12.47	11.74	12.11
8.50	19-Sep-04			-	-	-	-
7.50	23-Sep-04			23-Sep-04	7.70	7.50	7.60
3.60	2-Jul-04	**Balsam Lake**	**NE End Lightning Point**	2-Jul-04	11.94	12.91	12.43
3.60	18-Jul-04			18-Jul-04	11.17	11.35	11.26
3.20	2-Aug-04			-	-	-	-
3.20	18-Sep-04			-	-	-	-
3.40	3-Oct-04			-	-	-	-
-	-	**Big Bald Lake**	**Mid-lake**	24-May-04	8.50	8.81	8.66
4.40	19-Jul-04			19-Jul-04	11.09	13.61	12.35
3.60	2-Aug-04			2-Aug-04	12.31	12.50	12.41
3.10	9-Aug-04			-	-	-	-
3.30	8-Sep-04			8-Sep-04	11.70	12.34	12.02
5.50	30-Sep-04			30-Sep-04	10.20	10.20	10.20
-	-	**Big Bald Lake**	**Bay near golf course**	13-Jun-04	9.54	10.29	9.92
-	-			13-Jun-04	12.38	11.49	11.94
-	-			19-Jul-04	10.58	9.59	10.09
-	-			8-Sep-04	11.89	12.46	12.18
-	-			30-Sep-04	9.79	9.83	9.81
2.74	30-May-04	**Chemong Lake**	**Mid-lake, Causeway**	30-May-04	18.49	19.58	19.04
1.95	12-Jun-04			-	-	-	-
1.90	23-Jun-04			23-Jun-04	25.27	23.33	24.30
2.05	3-Jul-04			-	-	-	-
2.10	25-Jul-04			-	-	-	-
2.00	5-Aug-04			5-Aug-04	13.56	13.15	13.36
2.30	15-Aug-04			15-Aug-04	12.94	12.08	12.51
2.20	6-Sep-04			6-Sep-04	16.87	16.11	16.49
1.95	19-Sep-04			-	-	-	-
1.90	3-Oct-04			3-Oct-04	18.50	19.10	18.80
3.20	7-Jun-04	**Clear Lake**	**Main Basin, Mid-lake**	7-Jun-04	11.63	12.06	11.85
3.65	13-Jul-04			13-Jul-04	19.02	17.83	18.43
3.85	28-Jul-04			28-Jul-04	11.34	13.48	12.41
3.42	11-Aug-04			11-Aug-04	15.83	15.30	15.57
	18-Sep-04			18-Sep-04	22.09	21.06	21.58

2004 Secchi Depth Results			2004 Total Phosphorus Results				
Secchi(m)	**Date**	**Lake**	**Site Description**	**Date**	**TP1 (ug/L)**	**TP2 (ug/L)**	**TP Avg.**
3.66	7-Jun-04	**Clear Lake**	**Fiddlers Bay**	7-Jun-04	12.04	11.99	12.03
3.43	13-Jul-04			13-Jul-04	17.31	17.47	17.39
3.62	28-Jul-04			28-Jul-04	11.64	12.47	12.06
4.02	10-Aug-04			10-Aug-04	14.96	14.52	14.74
	18-Sep-04			18-Sep-04	20.27	19.96	20.14
5.00	13-May-04	**Jullian Lake**	**Mid-lake**	13-May-04	5.46	5.63	5.55
7.00	4-Jun-04			4-Jun-04	8.46	9.41	8.94
4.50	8-Jul-04			8-Jul-04	15.90	14.34	15.12
4.00	19-Jul-04			-	-	-	-
4.00	3-Aug-04			3-Aug-04	5.70	6.34	6.02
4.50	14-Aug-04			-	-	-	-
5.00	7-Sep-04			7-Sep-04	6.90	7.20	7.05
5.80	7-Oct-04			7-Oct-04	4.50	4.70	4.60
4.97	20-May-04	**Kathewanooka Lake**	**S/E Douglas Island**	20-May-04	10.86	12.65	11.76
4.00	31-May-04			-	-	-	-
4.50	15-Jun-04			15-Jun-04	11.76	12.71	12.23
6.85	6-Jul-04			-	-	-	-
3.70	16-Jul-04			16-Jul-04	13.93	13.37	13.65
5.00	3-Aug-04			-	-	-	-
5.20	8-Sep-04			8-Sep-04	19.66	18.39	19.03
5.05	4-Oct-04			4-Oct-04	20.40	20.80	20.60
5.50	16-May-04	**Lovesick Lake**	**deep hole N. end**	16-May-04	11.29	10.69	10.99
-	-			6-Jun-04	13.39	*20.01	13.39
4.50	4-Jul-04			4-Jul-04	20.38	20.71	20.55
4.50	3-Aug-04			3-Aug-04	20.10	*29.34	20.10
4.50	6-Sep-04			-	-	-	-
6.50	5-Oct-04			-	-	-	-
-	-			3-Sep-04	16.27	15.40	15.84
-	-			3-Oct-04	14.92	14.28	14.6
4.50	16-May-04	**Lovesick Lake**	**Spenceley's Bay**	16-May-04	*16.61	11.18	11.18
4.50	6-Jun-04			6-Jun-04	13.11	13.48	13.30
5.50	4-Jul-04			4-Jul-04	20.09	*27.38	20.09
4.50	3-Aug-04			3-Aug-04	23.00	*30.60	23
5.00	6-Sep-04			6-Sep-04	19.40	18.20	18.80
5.00	5-Oct-04			5-Oct-04	18.00	16.40	17.20
5.00	16-May-04	**Lovesick Lake**	**Macallums Island**	16-May-04	12.35	10.70	11.53
4.00	6-Jun-04			6-Jun-04	13.73	13.50	13.62
4.50	4-Jul-04			4-Jul-04	16.88	17.62	17.25
4.00	3-Aug-04			3-Aug-04	*31.35	24.43	24.43
4.50	6-Sep-04			6-Sep-04	17.20	17.40	17.30
6.25	5-Oct-04			5-Oct-04	15.00	15.70	15.35
-	-	**Lower Buckhorn Lake**	**Heron Island**	16-May-04	10.73	10.81	10.77
-	-			6-Jun-04	12.46	14.46	13.46
-	-			10-Jul-04	*22.02	17.30	17.30
-	-			2-Aug-04	20.50	20.51	20.51
-	-			3-Oct-04	13.14	16.10	14.12

2004 Secchi Depth Results			2004 Total Phosphorus Results				
Secchi(m)	Date	Lake	Site Description	Date	TP1 (ug/L)	TP2 (ug/L)	TP Avg.
5.81	21-May-04	**Lower Buckhorn Lake**	**Deer Bay West Buoy C267**	21-May-04	14.38	12.26	13.32
4.78	3-Jun-04			-	-	-	-
4.10	15-Jun-04			15-Jun-04	14.06	16.21	15.14
5.02	5-Jul-04			-	-	-	-
5.23	16-Jul-04			16-Jul-04	18.82	19.40	19.11
4.53	4-Aug-04			-	-	-	-
4.22	12-Aug-04			-	-	-	-
4.72	3-Sep-04			3-Sep-04	19.30	21.30	20.30
6.49	22-Oct-04			22-Oct-04	12.50	13.60	13.05
-	-	**Lower Buckhorn Lake**	**Deer Bay-centre**	16-May-04	8.27	8.98	8.63
-	-			5-Jun-04	13.90	16.06	14.98
-	-			10-Jul-04	18.61	19.67	19.14
-	-			2-Aug-04	15.26	13.87	14.57
-	-			3-Oct-04	19.09	21.00	18.55
3.50	24-May-04	**Pigeon Lake**	**Middle, Sandy Pt & Boyd Is.**	24-May-04	8.65	8.53	8.59
3.40	12-Jun-04			12-Jun-04	12.54	10.52	11.53
2.30	11-Jul-04			11-Jul-04	16.08	17.30	16.69
2.60	19-Jul-04			19-Jul-04	14.04	13.09	13.57
2.90	15-Aug-04			15-Aug-04	16.22	16.38	16.30
3.00	5-Sep-04			5-Sep-04	17.62	16.36	17.49
3.10	10-Oct-04			10-Oct-04	18.60	*25.10	18.60
4.00	17-Jun-04	**Pigeon Lake**	**N end, 400m N of Boyd Is.**	17-Jun-04	15.07	17.99	16.53
-	-			8-Jul-04	19.02	18.37	18.70
3.50	25-Jul-04			25-Jul-04	11.80	12.10	11.95
3.20	17-Aug-04			17-Aug-04	17.10	17.35	17.23
6.10	18-Oct-04			18-Oct-04	19.60	18.90	19.25
3.80	24-May-04	**Pigeon Lake**	**N end, Adjacent Con 17**	24-May-04	9.89	9.07	9.38
3.30	12-Jun-04			12-Jun-04	9.87	10.73	10.30
2.60	11-Jul-04			11-Jul-04	16.32	18.66	17.49
2.90	19-Jul-04			19-Jul-04	17.48	17.69	17.59
3.10	15-Aug-04			15-Aug-04	16.84	15.47	16.16
3.10	5-Sep-04			5-Sep-04	15.52	18.07	16.80
3.20	10-Oct-04			10-Oct-04	17.00	17.10	17.05
5.00	19-May-04	**Pigeon Lake**	**Channel - S. end of Boyd Is.**	19-May-04	-	-	-
6.00	30-May-04			30-May-04	9.91	8.53	9.22
4.00	5-Jul-04			5-Jul-04	22.42	20.00	21.21
3.00	4-Aug-04			4-Aug-04	15.08	15.08	15.08
	6-Aug-04			6-Aug-04	16.55	15.49	16.02
3.00	6-Sep-04			6-Sep-04	-	-	-
3.20	17-Aug-04	**Pigeon Lake**	**N end-300yds off Bottom Is.**	17-Aug-04	8.8	7.7	8.2
5.90	18-Oct-04			18-Oct-04	20.00	24.40	22.20

2004 Secchi Depth Results			2004 Total Phosphorus Results				
Secchi(m)	Date	Lake	Site Description	Date	TP1 (ug/L)	TP2 (ug/L)	TP Avg.
4.50	29-May-04	**Stony Lake**	**Burleigh Falls**	29-May-04	17.12	15.87	16.50
4.30	24-Jul-04			-	-	-	-
5.25	15-Aug-04			-	-	-	-
5.35	6-Sep-04			-	-	-	-
6.75	25-Sep-04			-	-	-	-
2.80	6-Jun-04	**Stony Lake**	**Gilchrist Bay**	6-Jun-04	10.60	10.60	10.60
4.75	6-Jul-04			6-Jul-04	23.28	24.80	24.04
-	-			20-Jul-04	13.33	13.09	13.21
3.33	25-Aug-04			-	-	-	-
5.00	6-Sep-04			6-Sep-04	17.20	15.40	16.30
4.50	19-Sep-04			19-Sep-04	17.29	16.52	16.91
7.00	11-Oct-04			11-Oct-04	21.30	20.40	20.85
3.90	17-May-04	**Stony Lake**	**Mid-lake, Mouse Island**	17-May-04	7.22	7.45	7.34
4.50	1-Jun-04			-	-	-	-
5.00	6-Jul-04			6-Jul-04	22.91	23.37	23.14
4.10	1-Aug-04			1-Aug-04	14.10	13.12	3.63
4.90	2-Sep-04			2-Sep-04	16.90	18.00	16.45
5.90	27-Sep-04			27-Sep-04	17.00	16.30	16.65
4.00	17-May-04	**Stony Lake**	**Hamilton Bay**	17-May-04	8.16	8.97	8.57
4.20	1-Jun-04			-	-	-	-
4.20	6-Jul-04			6-Jul-04	*24.26	17.44	17.44
4.00	1-Aug-04			1-Aug-04	16.99	17.44	17.22
4.00	2-Sep-04			2-Sep-04	14.20	15.50	14.85
4.10	27-Sep-04			27-Sep-04	14.21	14.45	14.33
3.00	30-May-04	**Sturgeon Lake**	**S end, Rustic Bay**	30-May-04	29.80	26.03	27.92
-	-			2-Jul-04	23.15	20.47	21.81
2.30	17-Jul-04			17-Jul-04	15.87	16.45	16.16
-	-			9-Aug-04	15.40	14.16	14.78
-	-			2-Sep-04	20.61	17.00	18.81
2.80	11-Jun-04	**Sturgeon Lake**	**N/E end, Muskrat Is. at Buoy**	11-Jun-04	9.76	9.39	9.58
4.40	6-Jul-04			-	-	-	-
2.40	13-Aug-04			13-Aug-04	20.77	20.99	20.88
3.30	8-Sep-04			8-Sep-04	16.50	19.10	17.80
3.20	30-Sep-04			30-Sep-04	14.10	14.20	14.15
-	-	**Sturgeon Lake**	**Sturgeon Point**	25-May-04	13.32	10.14	11.73
4.00	11-Jun-04			-	-	-	-
3.50	6-Jul-04			6-Jul-04	13.22	13.27	13.25
2.30	13-Aug-04			13-Aug-04	18.20	18.10	18.15
2.75	8-Sep-04			8-Sep-04	15.60	16.30	15.95
3.70	30-Sep-04			30-Sep-04	11.40	11.70	11.55
3.70	2-Jun-04	**Upper Buckhorn Lake**	**N end, buoy C310**	2-Jun-04	12.40	11.66	12.03
4.60	6-Jul-04			6-Jul-04	17.91	18.65	18.28
3.40	2-Aug-04			-			
2.75	6-Sep-04			6-Sep-04	16.30	17.70	17.00
4.27	1-Oct-04			1-Oct-04	14.30	13.20	13.75

2004 Secchi Depth Results			2004 Total Phosphorus Results				
Secchi(m)	Date	Lake	Site Description	Date	TP1 (ug/L)	TP2 (ug/L)	TP Avg.
-	-	Upper Buckhorn Lake	Mid-lake, 30m from shore	2-Jul-04	21.77	19.62	20.70
-	-			2-Aug-04	15.91	16.64	16.28
-	-			7-Sep-04	14.28	13.44	13.86
-	-			3-Oct-04	11.85	12.90	12.37
4.20	13-May-04	Upper Stoney Lake	Quarry Bay	13-May-04	6.30	5.63	5.97
7.60	6-Jul-04			6-Jul-04	9.26	6.33	7.80
4.60	3-Aug-04			3-Aug-04	12.67	7.87	10.27
5.40	7-Sep-04			7-Sep-04	6.78	10.04	8.41
6.30	8-Oct-04			8-Oct-04	5.90	5.30	5.60
4.70	13-May-04	Upper Stoney Lake	Young Bay	13-May-04	6.62	5.63	6.13
6.60	6-Jul-04			6-Jul-04	8.51	8.14	8.33
5.10	3-Aug-04			3-Aug-04	6.62	7.14	6.88
6.10	7-Sep-04			7-Sep-04	6.68	6.59	6.64
6.00	8-Oct-04			8-Oct-04	5.80	6.30	6.05
3.20	13-May-04	Upper Stoney Lake	S Bay	13-May-04	10.81	8.53	9.67
3.20	6-Jul-04			6-Jul-04	11.38	9.74	10.56
3.20	3-Aug-04			3-Aug-04	10.15	9.60	9.88
3.20	7-Sep-04			7-Sep-04	7.74	8.98	8.36
3.20	8-Oct-04			8-Oct-04	7.80	8.70	8.25
5.80	13-May-04	Upper Stoney Lake	Crowes Landing	13-May-04	4.46	5.17	4.82
7.20	6-Jul-04			6-Jul-04	7.86	6.55	7.21
5.00	3-Aug-04			3-Aug-04	7.17	7.67	7.42
6.10	7-Sep-04			7-Sep-04	5.79	6.54	6.17
6.90	8-Oct-04			8-Oct-04	9.40	6.40	6.40
5.30	13-May-04	Upper Stoney Lake	Mid-lake, Deepest area	13-May-04	6.30	6.18	6.24
7.50	6-Jul-04			6-Jul-04	8.02	7.54	7.78
4.80	3-Aug-04			3-Aug-04	6.66	7.36	7.01
5.90	7-Sep-04			7-Sep-04	5.96	6.90	6.43
6.30	8-Oct-04			8-Oct-04	7.20	6.20	6.70
-	-	White Lake	South End	7-May-04	15.25	*22.48	15.25
-	-			19-Jun-04	16.38	16.65	16.52
-	-			23-Jul-04	12.94	12.93	12.94
-	-			30-Jul-04	11.50	11.18	11.34
-	-			15-Aug-04	12.91	12.59	12.75
-	-			13-Sep-04	10.46	10.19	10.33
-	-			29-Sep-04	*23.41	16.91	16.91

Appendix G – Glossary

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

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.

Algal blooms – Sudden proliferations of algae.

Benthic macroinvertebrates – The "bugs" (worms, larvae, snails, etc.) that live in the sediments on the bottoms of lakes and streams.

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.

***E.coli* bacteria** – A bacteria that lives 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 this bacteria.

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.

Invasive or exotic species – Plants or animals that are not historically native to an area. Because such species often have no predators in their new environment, they can push out similar, native plants or animals and come to dominate an ecosystem.

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

Micrograms per litre – See below.

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 approximately equal.

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 our native 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.

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.

Substrate – The surface on which something grows, such as the bottom of a stream or lake (rocky, muddy, sandy, etc.), which provides the soil for aquatic plants.

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

Zooplankton ("floating animals") – Tiny, sometimes microscopic free-floating animals (many look like microscopic shellfish) that eat phytoplankton and in turn provide food for young fish and other small aquatic animals.

Appendix H: Rainfall in the Kawarthas

Rainfall (mm) at Three Locations in the Kawarthas, Summer 2004															
Oliver Centre (North Pigeon Lake), Trent Univ. (N. Ptbo.), Peterborough Airport (S. Ptbo.)															
Water Testing Dates are in BOLD											T Means Trace of rain <0.2 mm				
June				July				August				September			
Date	Oliver Centre	Trent Univ.	Ptbo. Airport	Date	Oliver Centre	Trent Univ.	Ptbo. Airport	Date	Oliver Centre	Trent Univ.	Ptbo. Airport	Date	Oliver Centre	Trent Univ.	Ptbo. Airport
1	1.3	4.6	9.2	1		5.8	5.8	1	0.1			1			
2			T	2				2	0.7	1.2	1.2	2			
3				3				**3**	**0.8**	**T**	**7.4**	3			
4				4	6.9	19.2	19.4	**4**	**3.7**	**T**	**2.2**	4			
5				**5**			**T**	5				5			
6		T	T	**6**		**41.8**		6	0.1	0.4		**6**			
7	0.3		6.8	7	9.8		24.0	7	0.2			**7**	**4.7**	**1.6**	**2.2**
8		11.6		8		3.6	6.4	8				**8**		**40.2**	**3.0**
9	5.5	6.8	0.6	9			T	**9**				9	16.3	9.2	47.2
10			T	10				10	0.3	20.0	14.8	10			
11				11				11	5.7		T	11	0.1		
12				12	0.1			12	0.2			12	0.1		
13	0.3	8.8	6.6	13		3.0		13	3.3	T	0.4	13			
14	8.5	4.0	18.2	14	11.1	239.8	19.6	14	0.6	2.6	4.2	14	0.1		
15	0.1			15	23.4	7.4	83.8	15	0.1		T	15			
16				16	0.6	1.2	4.6	16	0.1			16	0.6	0.2	0.4
17		T	0.2	17	0.1	17.8	15.6	17		1.0	T	17			
18				18		3.6	4.8	18	0.4	6.0	3.6	18			
19			T	**19**			**6.8**	19	0.9		T	19			
20				20	0.7	11.8	2.6	20				20			
21	2.6	14.6	7.6	21				21				21			
22	11.5		0.8	22	12.6	25.4	18.2	22				22	0.1		
23		0.5	T	23	0.1			23				23			
24	9.3	1.8	7.2	24				24				24	0.1		
25	0.1			**25**				25		1.6		25			
26	0.1	0.2	T	**26**		**6.8**	**2.4**	26	1.4	3.8	6.4	26	0.1	T	
27		T		**27**	**3.4**	**1.8**	**8.2**	27	8.8	8.6	24.6	27	0.1		
28	0.4	T	1.8	28	1.4	T	0.2	28	2.4	3.0	4.4	28	0.2		
29	0.9	0.2	1.6	29	0.1			29	8.0	23.0	27.6	29			
30				30	1.4	19.2	3.8	30	0.1	8.2	5.8	30	0.1		
				31	15.0	1.2	23.2	31							
Ttl	40.9	53.1	60.6	Ttl	86.7	409.4	249.4	Ttl	37.9	79.4	102.6	Ttl	22.6	51.2	52.8


Sunrise on shield source lake


"Last One In"

Notes

Notes