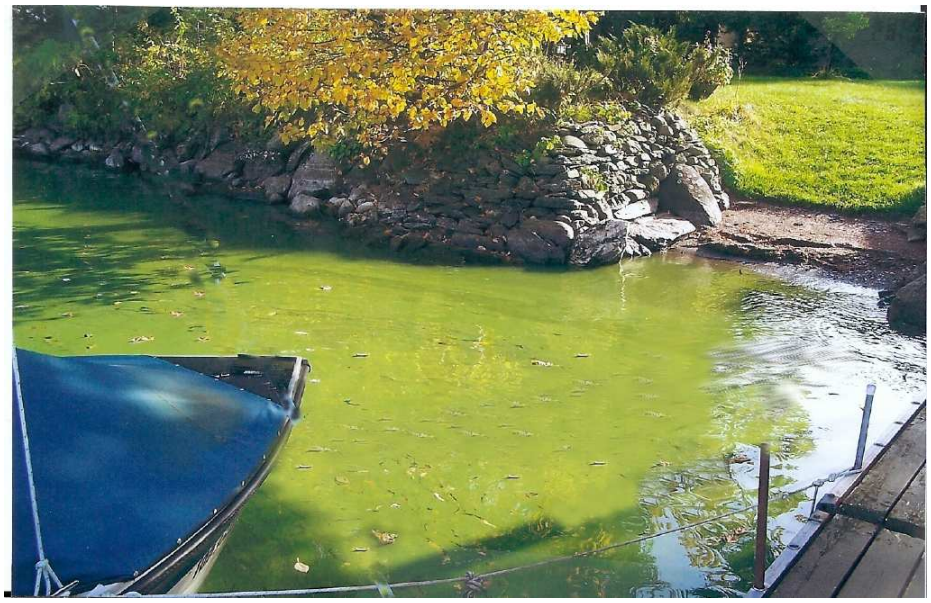
BROME LAKE AND BLUE-GREEN ALGAE

By Peter F. Wade



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Overview

This booklet brings together a series of articles
published *In Brome County News*
reviewing the history of the blue-green algae
problem facing Brome Lake.

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On September 25, 2009, the Quebec Department of Health closed Brome Lake due to "large toxic blue-green algal blooms". (On October 19, the lake was re-opened.)

On August 17, 2006, for the very first time, the lake was closed by the government for the same reason. (Subsequent lab results did not indicate that the threshold for harmful toxicity had been reached.)

Recently Gerry Moar, owner of Marina Knowlton, sued the government over lost revenues due to the lake closure in 2006. He argued, in small claims court, that the government had little justification for the closure, which deprived him of business revenue. The judge disagreed, stating that the Ministry of Health had to make decisions in favour of protecting public health even when evidence supporting the presence of a risk was doubtful.

Newcomers to the Town of Brome Lake, startled by the publicity surrounding the first lake closure in 2006 and believing that algal blooms are a new phenomenon, are asking why it is taking so long to solve the problem.

It has taken longer than they think.

In 2000, Renaissance Lac Brome (RLB), the lake association, counted 118 consecutive days when "blue algae" were present.

In August, 1968, *Brome Lake News* reported: "Pollution Renders Lake Unusable for Second Time in 13 months ... the bloom had to be seen to be believed--a thick green pea soup covering every inch of the 4000 acres of surface water ..."

The problem is complex

Phosphorus in the lake is viewed as the main culprit since its presence allows the algae to flourish. Phosphorus is contained in animal and human waste and products such as fertilizer.

There are many other factors (not all of which have been identified) which help to create algal blooms. Some of these, for example, are weather conditions which are not under our control. Others, over which we do have control, have not been addressed conscientiously.

Fixing the lake is a long-term project and requires the participation of all parties (not all of whom have got on board):

> Residents near lake and water courses - to vegetate their shorelines, refrain from using fertilizers, and keep their septic systems in good condition;
>
> Town Council - to keep urbanization low near the lake and close to streams, prevent the sewer system from overflowing into the lake, and manage run-off in roads, ditches and construction sites;
>
> Motorboat owners - to avoid high speeds close to shore and in shallow water.

The requirements for collaboration extend to those in the watershed of the lake having farms or properties near water courses.

Some History

The first local concerted activity to address lake blooms started in 1964 when the Brome Lake Conservation Association (formed in 1962) helped to convince four municipalities around Brome Lake to amalgamate in 1971 into the Town of Brome Lake (TBL). One of the prime objectives was to have a single municipality responsible for protecting the lake and a common set of bylaws.

A major first step was the construction of a town sewer serving Knowlton and Bondville, both of which prior to 1973 relied on septic systems (or worse!) for sewage treatment.

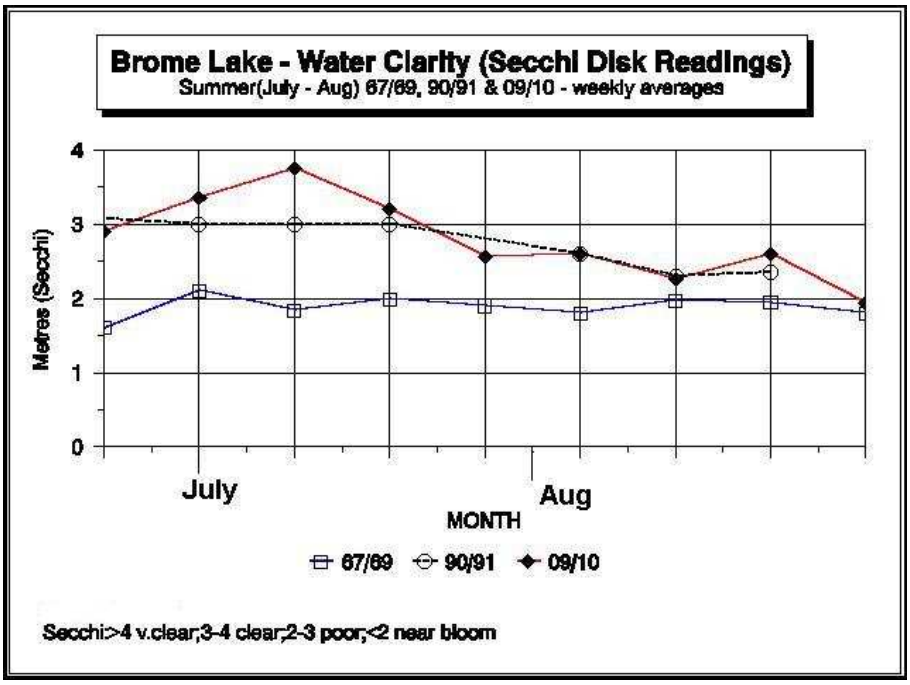
Since the early 1990's, TBL has spent close to $1 million on studies and consultants.

Many government studies on the lake have been carried out before and after that time.

RLB has held meetings and workshops to encourage residents to do their part, and participated in projects with TBL and government agencies such as replanting trees and vegetation on river banks and shorelines.

The ducks don’t seem to mind blue-green algae (2007)

The graph below shows how lake clarity (used as one indicator of approaching algal blooms) has changed from the late 1960's until now. A major improvement is shown in the interval 1967/69 to 1990/91. This has been attributed to the construction of the Town sewer mentioned above.



The graph shows relatively little impact from efforts since then. This could be due to the fact that:

(1) Secchi (clarity) readings do not reflect all aspects of the lake's health;

(2) steps such as re-vegetating the shorelines are only partial solutions, showing their impact over time;

(3) other initiatives such as the Town's recent test project with Teknika have no significant short-term effect;

(4) practicable solutions have not yet been found to reduce the impact of other factors thought to be significant, such as the high level of phosphorus which has accumulated in the lake bed.

The Town's master plan must be updated soon, and TBL has a new council. Opportunities exist to change town practices and to review and improve bylaws affecting urban density, protection of wetlands and other factors affecting lake water quality.

Chapter 1

A Measure of Lake Clarity – The Secchi Disk

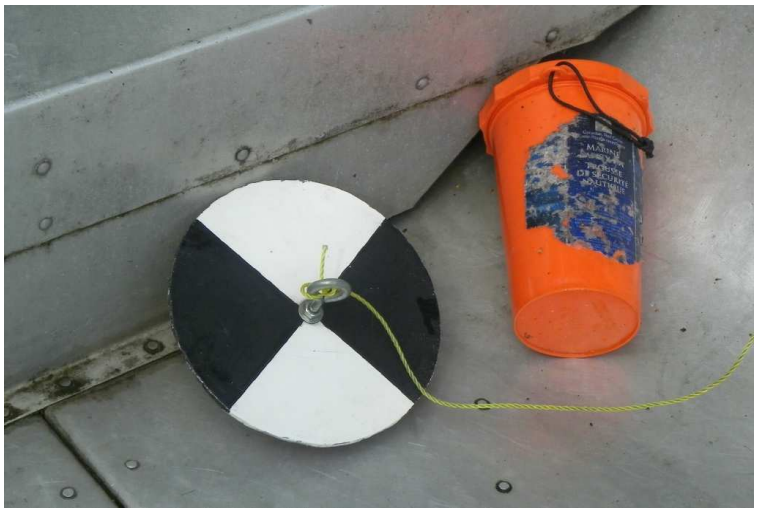
The Secchi Disk is a weighted disk, 8 inches in diameter, painted with a standard pattern of alternating black and white wedges. It is lowered on a rope into the lake (usually at the deepest location) until it can no longer be seen and this depth is taken as a measure of water clarity.

Secchi readings are usually made every 7 to 10 days, within two hours of noon and when weather conditions permit. For safety reasons, scheduled dates are postponed due to storms and high winds. Variability in the Secchi readings can be introduced by a sampler's eyesight, the amount of sunlight, wavy lake conditions, and even turbulence caused by rain or motorboat traffic preceding the sampling.

You might think that taking a sample at only one location would not be representative of the lake as a whole. However, in the past, sample readings were taken in as many as six locations on the lake within a short time period and the results were found to be very similar.

Water clarity is commonly used as a general (if approximate) indicator of water quality. For Brome Lake any value over four metres is usually considered good. Less than two metres often predicts an algal bloom - which could result in the government closing the lake for health reasons.

The following chapters will discuss the main factors believed to affect lake quality and the degree to which corrective action is meeting with success.



A Secchi Disk

Chapter 2

Algal Blooms –

What Are They? and What Causes Them?

In the past you have probably seen such headlines as: ‘The health of Brome Lake is precarious’, ‘Brome Lake is eutrophic’, and ‘Brome Lake is closed due to toxic cyanobacteria’. They all refer to essentially the same condition – namely that our lake is ageing prematurely due to urbanization and, to a lesser extent, agricultural practices, in our watershed.

The technical term for lake ageing is ‘eutrophication’. It can be natural, which is extremely slow, or accelerated due to human activity. During the process, a lake becomes rich in nutrients (in particular phosphorus) which nourish aquatic vegetation (weeds, algae) and cyanobacteria. When weather conditions are favourable, the water in the lake can then turn green - a phenomenon known as an algal, or algae, bloom.

As the lake ages, it gradually loses oxygen and fills in with organic and non-organic matter. This matter comes mostly from decomposing vegetation but also from sediments created by shoreline erosion, or carried to the lake by streams and ditches. In addition to providing an ideal habitat for weeds, these sediments transport phosphorus to the lake.

Algal blooms and heavy weed growth in a lake are both indicators of advances in the eutrophication process.

It is important to differentiate between algae and lake weeds (or ‘macrophytes’). Algae belong to a class of vegetation labelled by biologists as ‘photoplankton’ which grow by photosynthesis. ‘Photosynthesis’ has been defined as the process used by plants to combine sunlight, water and carbon dioxide to produce oxygen and sugar (energy). Algae are, in general, microscopic, invisible to the eye as individual units.,

‘Cyanobacteria’ (like algae) also grow by photosynthesis and have sometimes been referred to as ‘blue-green’ algae because of the pigments they contain. However, since researchers found them more like bacteria, they were renamed ‘cyanobacteria’. When conditions are favourable they can multiply in great numbers forming important accumulations and becoming visible as ‘blooms’ due to the colour (green) that they give to the water. In their various forms they can be seen as (a) suspended particles, (b) filaments or thin strings, or (c) a film or gelatinous scum on the surface. Blooms during the summer are difficult to predict but seem heavily influenced by the weather, preferring hot, calm conditions. This is when they can cause a problem of toxicity.

Chapter 3

Sources of Phosphorus

Phosphorus is contained in animal and human waste, decaying organic matter, and fertilizers. When the material is left on land near lakes and streams, it is carried by run-off, streams and ditches to the lake. When our municipal sewer system overflows, it is into the lake. Faulty septic systems near lakes and streams are another source. (Sewage contains phosphorus produced from household products such as dishwasher detergent as well as harmful coliform bacteria.)

When shorelines and riverbanks are denuded of trees and bushes (to produce a manicured lawn, for example), the amount of run-off increases, as may erosion. Improperly constructed ditches leave raw earth - providing more sediments to carry phosphorus into the lake (see the photo below).

Once in the lake, much of the phosphorus attached to the sediments sinks to the bottom and is not removed by the flow at the lake outlet. Phosphorus in the lake bottom is augmented by decaying organic matter and remains there until water conditions facilitate its release. (Tests on Brome Lake samples have indicated a substantial store of phosphorus in the bottom.)

Among projects planned, or underway, by Renaissance Lac Brome, are hydrology studies (to detail how streams feed the lake), and watershed sampling surveys to identify sources of phosphorus. These projects are needed to determine a ‘phosphorus budget’ for the lake. This estimates: the amount of phosphorus entering the lake (by source) and how it is distributed; the amount leaving it; and the amount retained in the bottom. Once this information is available, it will be possible to set priorities for projects designed to apply remedial measures.

A ditch poorly constructed by TBL at Argyll parking lot. Note raw earth, ready for erosion.

Chapter 4

History of Efforts to Rejuvenate the Lake

The problems with the lake were recognized by residents and tourists many years ago – even before the formation of the Town. Records indicate that the Brome Lake Conservation Association (BLCA) was organized by citizens in the early 1960s because of the serious condition of the lake. The Association established a newsletter, the *'Brome Lake News'* which was published in the form of a newspaper with Peter White's help. (Mr. White, a BCLA Board member, was part owner of *The Record*.)

After discussions with local politicians, BLCA directors decided that municipal fusion was a necessary pre-requisite to rejuvenation of the lake. At the time, the villages of Foster and Knowlton, and the Township of Brome (Bondville, Fulford, Iron Hill and West Brome) controlled sections of territory surrounding the lake. The BLCA objective was to have a single municipality having the lake within its jurisdiction. Bylaws to protect the lake could then be uniformly applied throughout. As well, one town council could lobby the government for support.

The formation of the Town of Brome Lake (TBL) in 1971 (a process started in 1968) came about partly as a result of the Association's efforts, and partly as a means for local residents to thwart attempts by Bromont and Cowansville to annex large sections of the Township of Brome.

Financed by government grants, consulting engineers and biologists were then employed to determine the major steps necessary to improve lake clarity. There was no municipal sewage system at that time. Even septic systems, when they existed, were primitive. One study in the summer of 1971 (supported by the Quebec Department of the Environment) involved taking lake samples in front of every lakeshore residence. Sewage disposal effectiveness was rated AA, A, B (occasional pollution), C (gross pollution). It was found that at least 75% of residences contributed directly or indirectly to pollution of the water. A map of the lake showing every residence located on it (together with its pollution rating) was displayed at a public meeting. It was instructive to see the speed with which most of the worst cases were corrected.

The next important study was a plan to construct a municipal sewer system from Knowlton to a treatment pond in Bondville. A public meeting of taxpayers was held by Mayor Blackwood to present a resolution for a borrowing by-law to cover the cost of the system. The amount was enormous for a rural town. Payments were extended to 'eternity' to spread the pain. (In fact TBL property owners may still be paying.) If memory serves me correctly, the meeting needed 5 to oppose the resolution and fell short by 1. So the resolution carried and the sewage system was constructed. Extensions were added in later years.

Chapter 5

History of Efforts to Rejuvenate the Lake

(continued)

Following the construction of the first section of the town sewer in the early 70s, there remained three sources of concern regarding sewage: (1) the duck farm; (2) properties with their own septic system; (3) overflows of the sewer system itself.

The Duck Farm

A 1991 letter from the Brome Lake Environment Commission to the Ministry of the Environment quoted estimates that about 36% of the phosphorus entering the lake came from the duck farm, mostly from the open manure piles, but some from the lagoon. (Tests in 1998 indicated 'elevated levels' of phosphorus in the sediments on the bottom of the Pearson stream adjoining the farm.) Since that time, duck farm management has taken steps to correct the situation by removing the lagoon and putting the manure piles on an impermeable base with pipes to a cistern which stores the rain run-off. More recently, many trees were planted on duck farm property to absorb the phosphorus left in the ground.

Properties With Their Own Septic Systems

For those without access to a municipal sewer system, current regulations require a standard installation with holding tank and drainage field where property dimensions and soil conditions are suitable. Otherwise a sealed tank or acceptable alternative (such as an '*Ecoflo*' unit) are required. Traditional standard installations were designed to treat for coliform bacteria not phosphorus.

With the standard installation, the phosphorus becomes fixed in the soil under the drainage field. However, with time, the soil can become saturated and lose its absorption capacity. The effluent containing the phosphorus is then free to flow towards the lake. (The life of such systems has been estimated to be between fifteen and thirty years, yet no restrictions have yet been set on the age of drainage fields.)

Over the years, regulations have tightened but unless an installation can be proven to pollute, the Town has been reluctant to force conformance to current standards - and non-conforming systems are still installed without the inspector's knowledge. An analysis by Renaissance Lac Brome concludes that of 249 installations belonging to lake residents, 71% do not respect the 'minimum' distance from the lake.

Essentially the Town has adopted a ‘hands-off’ approach to the control of installed septic installations – with the exception of the recent mandatory ’pump-out’ every two years. To illustrate this, the June 28, 2001 issue of *Le Devoir* contained an article titled ‘Lac Brome: Un lac en sursis’ which quoted a property for sale ad stating ‘septic installation, nonconforming, but tolerated by Town of Brome Lake’.

Sewer System Overflows

The Town sewer system was extended in 1993 to the 400 Lakeside condos and then to the Inverness condos. In all, there are now seventeen pumping stations. In early years, few were equipped with generators or back-up pumps. Consequently, in the case of a power outage or equipment failure, the sewage would find its way via ditches (or pipes) into the lake. The Town has always been reluctant to divulge the extent of these overflows. In fact in 1992, when a pumping station was vandalized and the Town refused to provide information on the resulting overflow, a complaint was made to the Access to Information Commission. The response was that the Town had no grounds for withholding this information. (While the reliability of the data was not assured, records indicated overflows as extensive as 127 hours in 1990.)

Since then, we understand, most stations have been equipped with generators and some with back-up pumps. Overflow occurrences (but not durations) are listed on a government web site as reported by a Town contractor. According to these figures, overflows have been practically eliminated. However, as current Mayor Decelles has stated, when overflows do occur there is no adequate holding area at each station to prevent sewage from reaching the lake. One solution to this, offered by the duck farm, is to connect a pipe to their large storage cistern and divert any overflow there, via the Centre Rd. station.

Pumping station at Centre Rd. with generator (see arrow)

Chapter 6

How Motor Boats Affect Lake Health

While Brome Lake is a body of water ideally suited for boating of all kinds, this chapter will discuss only motorboats (MBs), their impact on lake health, and local restrictions that apply to them.

You may be surprised at the results of a recent census carried out by Renaissance Lac Brome (RLB) indicating that Brome Lake has 467 resident MBs and other motorized craft, (56% with motors over 50 hp). Maybe it's the price of gas, but, going by the traffic, these boats don't seem to be spending much time on the lake these days.

Active research into a possible relationship between MBs and lake health began only in the 1980s. Before that, complaints against MBs related mainly to safety and noise. Then, lake algal blooms became a recognized problem. Researchers increased their efforts to explore the degree to which MBs can: (a) stir up lake bottoms, causing the sediments to release phosphorus (algae food), and (b) create waves causing shoreline erosion, which delivers more sediments to the lake.

The conclusion of studies seems to be that the churning effect of most boat 'hull shape/ propulsion type/speed' combinations tapers off after 3 metres of water depth and that 'no-wake' zones for water up to that depth are the most effective protection for lakes with MBs.

Up until 1989, there were no restrictions for MBs on Brome Lake. (Even then, some smaller lakes were banning all MBs.) But in 1987, a man drowned when his sailboat was struck by a MB. Then, in 1990, a canoe was cut in half when the driver of a 225 hp MB was 'blinded by the sun'.

In 1989, out of a concern for lake safety (mostly for swimmers and fishermen), TBL's Environment Commission (a forerunner of the Environment Committee) asked the Brome Lake Conservation Association (BLCA) to carry out a survey of lake residents to get their opinions on what (if any) MB restrictions should be introduced. A 44% response rate was obtained from the 540 questionnaires distributed, 69% of the responders owning MB's. Based on the answers, BLCA's main recommendations to the Town were:

Motors in excess of 75 hp should not be permitted on the lake; all boats with mechanical propulsion should be banned on tributaries feeding the lake; a 'slow-speed' (10 km/h max) zone should be established in the first 150 m from the shore; 'Jet skis' should be banned; all boats resident on the lake should be registered by the Town, with annual fees to cover the costs of the boat patrol and the distribution of buoys.

Accepting only the ‘slow-speed zone’ and the banning of MBs on the tributaries, then Mayor, Gilles Decelles, said that any restrictions on hp (should they be considered necessary) would be introduced gradually. The two restrictions (as requested by the Town) received approval from the Federal Department of Transport in 1990 - at which time they went into effect. Since then, in 1997, TBL replaced the ban on MBs in the Pearson stream by a 5 km/h speed limit. Commendably, despite strong pressure from MB owners to weaken the 150 m slow-speed zone restrictions, these have remained in effect. It is interesting to note that the fortuitously stringent 150 m limits in most cases correspond with the recommended 3 metre ‘no-wake zone’ except for locations marked by five or six buoys. However, the exact boundaries of the zone at the Coldbrook outlet remain in doubt, due to the wetlands. There is no speed limit in the center of the lake and the gradual reduction in hp was never implemented.

Boat at edge of slow-speed zone

Chapter 7

How Motor Boats Affect Lake Health

(continued)

This chapter will continue the topic of local restrictions applying to motorboats (MBs).

In 2005, the promoter of an inland development purchased a lakefront lot in Cedar Bay and sold servitudes for the right to park cars and rent space at a large multi-berth dock he constructed. This essentially created a marina in a residential neighbourhood. As a result of the outcry from residents around the lake who envisioned the same thing happening to them, TBL revised its by-laws to prohibit the establishment of any new marinas and multi-berth docks. Since then, the Eugene Park Owners Association has built a multi-berth dock and sought to build a concrete boat ramp. As well, a dock with 'public access' has been constructed in the development on the former Berry property. It would seem that confusion exists about: (a) which jurisdiction (TBL or MDDEP, the Quebec Ministry of the Environment) is involved, and (b) the meaning of 'acquired rights', 'public access', and 'right-of-way'.

In 2006, when the lake was closed for health reasons by the provincial government for the first time in known history, Renaissance Lac Brome (RLB) proposed: (1) Converting the 150 m 'slow-speed' zone to a 'no-wake' zone and (2) Setting the boundaries at a minimum of 150 m from shore but further out, if necessary, until the water was 3 m deep. This set off a firestorm with the motorboat owners, who maintained that their favourite skiing areas would be adversely affected. Attempts were made by RLB to join forces with Le club de ski Lac Brome to resolve the issue, but these fell apart when the water ski club, without public consultation, requested approval from the Federal Department of Transport in 2008 for the installation of two ski courses on the lake. Although there was some question about one course being located in the slow-speed zone of the lake, TBL said they had no objection. Approval for both courses was received from the Feds. In 2010, this matter is still the subject of controversy.

To date, the recommendation from RLB to redefine the existing 150 m 'slow-speed' zone has not been addressed by the Town.

TBL's past approach to controlling motorboats (with the health of the lake in mind?) has been a 'rocky' road involving a certain attitude of 'laissez-faire'. This year's project to revise TBL's master plan will present an opportunity to correct some of the ambiguities that now exist in the bylaws affecting motorboats, and that are creating public annoyance and frustration.

Chapter 8

Lake Levels, Foster Dam, and Bromont's Water Demands

Lake levels are related to lake health in several ways. Higher levels increase shoreline erosion, provide more water volume to dilute incoming phosphorus, and slow weed growth by cutting sunlight to the lake bottom. For lake residents, higher levels decrease the amount of shoreline and may cause flooding of properties. For recreational boaters, higher levels provide relief from rocks on the bottom of a shallow lake.

The Foster dam, owned by Southern Canada Power, was reconstructed in 1941. At the time, the target level for the lake over the summer months was 196.54 metres (above sea level). In 1966, the dam was sold to the Town of Bromont for $2,000, after the village of Foster (where it was located) showed no interest. As a condition of sale, Bromont was required to maintain the same target lake level.

When The Town of Brome Lake (TBL) was formed in 1971, Council became concerned about control of the lake, especially in view of the widely fluctuating lake levels which were occurring. Attempts to purchase the dam from Bromont were turned down due to Bromont's resolve to protect their water supply.

In 1975, the Ministry of Natural Resources, after conferring with TBL and the Brome Lake Conservation Association (BLCA), revised the lake target levels to be 196.9m on July 1, declining by 0.3m (a foot) during the summer. The dam in its present condition was unable to meet these targets.

In 1984, the dam was reconstructed by the government. TBL and Bromont signed an entente in which it was agreed that the dam would be controlled so that lake levels would be maintained according to the previously-agreed levels, with the condition that Bromont would be guaranteed a minimum outflow from the dam of .88 cubic metres/second (90 percent of the time). In the entente, it was stated that the guaranteed outflow had priority over the target lake levels because 'potable water needs took priority over recreational needs'. In 1988, TBL bought the dam for $30,000 under the conditions of the previous entente.

In 1990, Bromont requested permission from the government to construct Lake Marchessault, an artificial lake to serve as a reservoir for their residential and other needs. At the BAPE hearings, TBL expressed concern that the project could have an adverse affect on the levels of Brome

Lake. Government engineers stated that the TBL/Bromont entente was based on imprecise historical data and that the terms should be reevaluated when more precise data on output at the dam were available. (Based on all the submissions, the BAPE report concluded that a new impact study was required before permission for Lake Marchessault could be granted.)

During 2006, the provincial government installed a device below the Foster dam to obtain more precise measurements of the outflow. The results were made available on the internet along with lake level data. Based on the published graphs, a rough summary of the results is given below for the summer months since then.

Year	Lake level (% below target)	Outflow (% below target)	Rainfall (inches)
2007	20	50	16.27
2008	7	40	20.44
2009	3	11	15.68

To provide the basis for a reevaluation of the terms of the TBL/Bromont dam agreement, Renaissance Lac Brome is developing a project for a more precise analysis of the data.

An early version of the Foster Dam

Chapter 9

Is There a Problem With Weeds in Brome Lake?

Apart from being a nuisance to swimmers and boaters, heavy quantities of weeds in a lake are an indication that lake water quality is deteriorating (also called ageing or entering a stage of eutrophication).

In response to complaints from lake residents about weeds, Renaissance Lac Brome commissioned a study of weeds in Brome Lake by Biofilia, a firm of environment consultants based in Laval. The study was carried out in September, 2009. The objective was to develop an inventory of weeds, identifying their species and population sizes. In addition, Biofilia were asked to determine the factors facilitating their growth in the various locations, and present recommendations about the best way of getting rid of them.

By comparing the new inventory with data from previous studies (over last 30 years) it was possible to draw conclusions about the rate of increase of weed growth in the lake.

Only the major study parameters and conclusions from the 75-page report will be presented here.

The growth of water weeds or 'macrophytes' (their technical name) is encouraged by the presence of 'fine' sediments (such as silt) on the lake bottom, together with the presence of nutrients, such as phosphorus (carried to the lake by sediments or released by decomposing organic matter).

Since an essential factor for weed growth is the presence of sunlight, the study was limited to the shoreline of the lake, in water depths up to 3m (beyond which there is little light penetration). This comprised 22 per cent of the total lake surface. Significant weed growth was found in one third of the area surveyed.

The density and species of weed growth were used to classify sections of the shoreline into four categories, based on their level of eutrophication (ageing).

Hypereutrophic (worst) 3%: Marina Knowlton area. Depth of silt in lake bottom – 70 cm. The problem is probably accentuated by boat traffic stirring up sediments from the lake bottom. Also some species of weeds proliferate when they are cut by boat propellers.

Eutrophic 33%: South portion of lake (including mouth of Pearson and Coldbrook streams); mouth of Quilliams stream; the bay east of Fisher's Point. Silt depth – 20 cm and greater. Factors: stone walls on Pearson shorelines and early duck farm activity; incoming sediments from ditches, etc.

Mesotrophic 21%: Douglass Beach; mouth of Inverness stream; outlet of lake. Factors: one unusual species found (possible source – unwashed external boat).

Oligotrophic (best) 43%: North side of lake.

The report concluded with the following comments (specific to weeds):

Certain listed invasive species of weeds (in specified locations) should be watched to make sure they do not get out of control.

The level of weed growth (overall) is not at the danger stage, but a weed inventory should be repeated every year or two.

Care should be taken before introducing certain identified harmful species into water gardens since they may migrate into the lake.

Large-scale programs to remove weeds require a detailed study before applying for a Certificate of Authorization from MDDEP (Ministry of the Environment). As an alternative, you can manually pull them out by the roots. Do not cut them because this causes most species to multiply.

No reported action plan has resulted from this study.

Weeds at mouth of Coldbrook stream

Chapter 10

Quebec Holds Hearings on Health of Lakes

In October 2009, a Quebec government commission requested submissions from individuals and organizations on the subject of 'Quebec lakes and cyanobacteria' ("*Situation des lacs au Quebec et cyanobacteries*"). These were to be discussed at a hearing held in August 2010.

The hearing was organized by the Quebec *'Commission des transports et de l'environnement'* to get feedback on the effectiveness to date of the government's action plan initiated in 2007 to improve the health of Quebec's lakes. Since that time, in 2008, 138 Quebec lakes experienced one or more blooms (patches of blue-green algae floating on the surface). In 2009 Brome Lake was closed in September due to "large toxic algal blooms".

At least 2 local lake associations prepared briefs: Memphremagog Conservation Inc.(MCI), and Renaissance Lac Brome (RLB).

While their comments covered much of the same ground, Lake Memphremagog has the additional complications that (1) the lake is a source of drinking water and (2) its borders are shared by 2 countries.

Cyanobacteria (often toxic) are associated with blooms of blue-green algae. While the occurrence of blooms is influenced by many factors such as weather, blue-green algae are known to thrive on phosphorus. Phosphorus is contained in human and animal waste and products such as fertilizer and dishwasher detergents, as well as sediments in ditches and lake bottoms (due to run-off).

Recommended corrective action includes;

- ensuring effectiveness of sewage treatment systems;
- restricting development around lakes and water courses;
- restricting use of products containing phosphorus;
- creating protection zones on lakeshores and river banks
- restricting boat traffic which stirs up the bottom
- improving construction and ditching practices for erosion control

After assessing current progress in these areas, the submissions observed that:

Governments at all levels (federal, provincial and municipal) are involved in setting regulations affecting lake health. However, jurisdictions overlap and the principles adopted by each are often not consistent. This results in confusion and inefficiencies.

Government jurisdictions are not organized by lake-watershed. This reduces accountability for lake health.

At the municipal level:

- Councils are reluctant to create and enforce bylaws viewed as unpopular by many residents (voters); in addition, they probably lack the resources required;

- the lure of tax dollars may result in land-use plans which allow dense development close to lakes and rivers;

- where regulations exist regarding septic systems and shoreline protection, these are often circumvented by lax enforcement, 'acquired rights' or 'minor derogations';

- improved public works practices (eg. ditching) may be resisted due to added costs or employee resistance.

There is a need for more research in such areas as:

- what is the capacity of a lake for (1) development and (2) boat traffic;

- factors affecting creation of blooms and their toxicity

- the life cycle of cyanobacteria;

- better, and more consistent, test methods.

Two examples illustrate the above short-comings:

(1) A water-ski association requested permission to install in Brome Lake a ski course, a large portion of which violated a local bylaw by being within a 10 k/h speed zone set by the municipality to avoid disturbing sediments rich in phosphorus. The Federal Department of Transport with jurisdiction for 'navigable waters' gave permission. The local council (not the current one) said they had no objection.

(2) The Quebec Dept. of Municipal Affairs requires that new development in rural areas be concentrated within 'urban perimeters' (areas for high 'urban' density identified in municipal land-use plans).

In the case of Brome Lake, the urban perimeter encircles the lake. To protect the lake, the urban perimeter should be re-located. However TBL must request it and many government departments must agree for this to happen.

Finally, it was pointed out that while local lake associations are active in disseminating information, motivating their members, monitoring lake quality, collecting water samples and lobbying municipal councils, they lack resources both financial and technical. In most cases they are not even allowed charitable status to permit them to provide income tax receipts for donations.

This water ski course, near the Coldbrook outlet, is
(according to the Federal Department of Transport)
"at least 150 metres from shore".

Presentation by Renaissance Lac Brome at Hearing on Government Action Plan

In August 2010 the Quebec '*Commission des transports et de l'environnement'* held a public hearing to get feedback from various public bodies regarding the effectiveness of their 2007 Action Plan to improve the health of Quebec lakes.

All three political parties were involved. Renaissance Lac Brome (RLB) was one of the lake associations invited to present a brief.

Among the recommendations made by RLB President, James Wilkins, were (as translated):

- Support community lake associations financially and technically by means of a program similar to the discontinued '*programme des lacs'*;

- Modify the law on Urban Planning to add safeguards regarding water quality which will provide a legal basis for relevant regional and municipal regulations;

RLB recommendations continued

- Put in place measures to ensure the sustainable development of the territory and the minimal environmental impact of new and existing construction;
- Within MDDEP (Quebec Ministry of the Environment), create a function to assist community lake associations to work more effectively;

- Make better use of fiscal measures to ensure water quality in lakes and rivers;

- Create national standards to harmonize regulations regarding: watersheds, shorelines, fertilizers, detergents containing phosphates, etc.;

- Revise and simplify relevant provincial laws and jurisdictions;

- Discuss with federal authorities: (1) questions of navigation concerning small lakes and (2) the possibility of allowing organizations, formed to protect the environment, to issue income tax receipts;

- Find concrete means to bring about watershed management involving local and regional associations and provide them with the legal and financial measures necessary;

- Update the 2007 government action plan to include the suggestions made in this brief, particularly those relating to responsibilities, objectives, and financial resources.

After the presentation, a 50 minute period was allocated for members of the Commission to ask questions. There was general interest in the issues raised by RLB, many of which touched on areas not covered by others.

Chapter 11

Why Is It Taking So Long to Fix The Lake?

It has been generally accepted (even back in the 1960's) that phosphorus is the main culprit in the production of algal blooms.

Thus, the fact that we are still experiencing blooms in the lake from time to time is not a question of lack of knowledge regarding the root of the problem. It's a question of:

(a) knowing where best to concentrate our corrective effort;
(b) getting those involved to make the effort;
(c) finding financial resources to cover project funding;
(d) finding and obtaining government approval and funding for solutions.

(While it's not always obvious, we ARE making progress, in my opinion, despite the lack of speed.)

Where, among the following, should we devote most of our attention?

(a) The sources? (septic installations, manure piles, fertilizers, phosphorus stored in the lake bottom).

(b) Factors facilitating run-off carrying phosphorus from the sources? (streams feeding the lake with denuded river banks, denuded shorelines, poorly constructed drainage ditches).

(c) Other factors? (such as lake level, concentrated urbanization close to the lake).

For our lake, we lack knowledge about the relative importance of the various sources of phosphorus and the factors facilitating its entry into the lake. Even when we know the answers, the appropriate solution may not be certain.

Efforts to date have been directed towards: re-vegetating denuded shorelines and river banks and cutting back on the residential use of fertilizers. There has been talk about improving control of: ditching practices, septic installations and use of fertilizers by golf courses. It must be recognized that the expected impacts of such actions will be gradual and incremental. The problem of phosphorus stored in the lake bottom has been largely ignored, except that a slow-speed zone for boats has been created to reduce stirring up the sediments. A Teknika research project to restrict sediments entering the lake has been funded by the Quebec government and the Town. Monitoring of lake clarity by RLB and sampling of lakes and streams has continued throughout the summer.

One way of determining priorities for an action plan would be to commission an up-to-date 'phosphorus budget' for the lake. This estimates phosphorus input to the lake from all sources. By deducting the phosphorus output at the dam (data on outflow volume and phosphorus content are available), it is possible to estimate how much, each year, is being added to (or subtracted from) the store of phosphorus at the bottom of the lake. This project should be coupled with a hydrological study of flow patterns within the lake of the six feeder streams to determine their relative residence times.

Once the priorities have been established, an action plan can be developed within available resources. Desirably, this would be somewhat more detailed than '**Inform. Regulate. Act.**', all that has been made known of the current plan proposed by Teknika.

Who will supply the effort?

To date it has been the various lake associations (currently Renaissance Lac Brome) who have been doing the 'heavy lifting'. You would think that a municipality which was formed with a primary objective of protecting the lake would provide the enthusiasm. However, over the years, the Town's record of planning and action in this regard has been most erratic. Relevant bylaws set by one Council have been nullified by another. Bylaw enforcement has been weak. Dense development has been permitted around the lake. Lake association advice has been ignored, especially with regard to consultant studies, some of which have involved significant sums of taxpayer money.

Most of the time, the Town does not possess the technical resources to direct the lake program. What is encouraging, however, is that the present administration seems prepared to work with RLB to determine what should be done.

Much of the responsibility for taking action rests with town residents. It is they who decide whether to observe grass-cutting bylaws, desist from using fertilizers, drive their boats appropriately, etc. They are also the main beneficiaries of a sparkling healthy lake, so the incentive is there - but support has been less than encouraging.

While the word 'effort' does not couple easily with the word 'government', it would be beneficial for lake health if the various government departments could get their acts together to remove conflicting attitudes regarding lake regulations. This problem has already been discussed in earlier chapters so will not be detailed here. Also it may not be generally known, but the approval of the Ministry of the Environment (MDDEP) is necessary before many projects involving the lake can be initiated (such as a 'public' boat ramp, or lake dredging).

Who will supply the money?

To date the amount of money spent by TBL on consultants would be considered sufficient for ordinary lake needs. Large projects would require government grants. RLB's activities rely largely on member donations.

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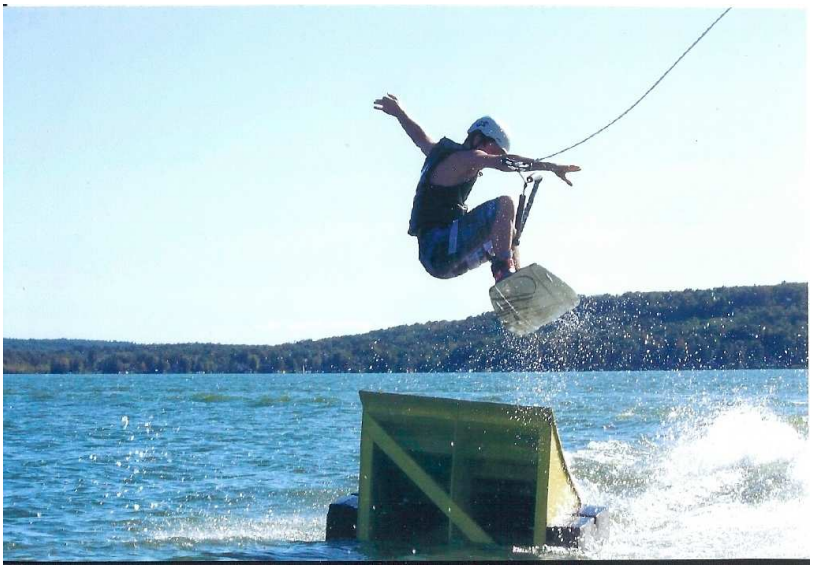
To summarize

Bringing the lake back to health is not a simple matter, since the sources of the cause (phosphorus) can differ for every lake. Sources must first be identified and prioritized. Remedial measures are either simple, but with slow effect, or more difficult (such as dealing with phosphorus in the bottom sediments). Resident and Town support, which are essential, have not been wholehearted. The lake is one of TBL's most valuable assets. The least we can do is take care of it.



Enjoying the lake

About the Author

Peter Wade is a long-time resident of Domaine Brome (Foster). His background includes experience in industrial research, management consulting, and university teaching. He is a Fellow of the Royal Statistical Society. Since his arrival at the lake in 1964, he has been actively involved with Renaissance Lac Brome and its forerunner, the Brome Lake Conservation Association, as well as other community organizations. From 1989 to 1991, he was a member of TBL's Environment Commission. In 1987, he was one of the four founders of the Brome Lake Land Foundation, an environmental organization which now has holdings of over 500 acres of forests and wetlands for protection.