Shuswap Lake

2010

Environmental Impact Study

(SLEIS 2010)

July 30, 2010 to August 05, 2010

By
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http://www.shuswaplakewatch.com
Introduction

The Shuswap Lakes are a vital water source for a large number of communities with a rapidly growing population. Maintaining a high lake water quality is essential to the health of the local residents as well as to the rich local wildlife and fish habitat.

Recent indicators and studies have reinforced the concerns that the water quality of the lake system is increasingly deteriorating. While fingers have begun to point to all directions, the cause is most likely the results of the continuous accumulation of pollutants and few other factors. However, it is agreed on that the problem needs to be properly addressed before reaching the ecological lake tipping point with long-term environmental consequences.

The Shuswap Lakes (including Mara Lake) have about 50 permanent year-round inlet streams. During the runoff, usually between April and June, the number of inlets increases to over 500, elevating the lake up to 4 metres. The large inflow of melting snow water combined with the strong current through the lake system has a wash-out effect for pollutants and other harmful substances. However, perhaps as an early result of global warming or just the periodic cycle of lower snow accumulation, this self-healing balance has been upset. The wash-out cycles are longer, allowing more pollutants to accumulate in the lake water. Less current has been leading to warmer water temperatures, especially near the shoreline and in shallow sections of the lakes. Warmer water lowers the oxygen content, to some degree alters the chemical balance and reaction in the lake, and, as a consequence, has been placing additional stress on the fish habitat.

A visual indicator for water deterioration is the expanding of algae growth between Mara Lake, Shuswap Lake, and the Narrows since 2008. The exact causes and consequences are still being researched. However, environmental factors appear to play a significant role in the continuous growth, and, aided by the lake current, rapidly overtake the complete lake system.
Sources of Contamination

While there are many contributing sources for water contamination and pollution in the Shuswap Lakes, the following 3 poorly regulated segments may constitute the major cause:

1. **Agriculture and Farming Industry**

   Agriculture is the largest water user within the Shuswap Lake watershed. Large quantities of water are needed for irrigation, food preparation, animal stock, and cleaning purposes. Based on the dependency on water, agricultural farms are preferably located along rivers and permanent lake inflow streams.

   Years ago this was not a problem as small farms had a low impact on the environment. In the recent years, however, small farms have been replaced by large milk factories. The soil that once supported 30 to 50 milk cows in the past is now populated by large numbers of animals, often 600 / 700 and more with alarming environmental consequences. Large quantities of fertilizers and pesticides are used to boost and protect the feed harvest, along with excessive water withdraw for field irrigation. Liquefied manure is being stored in large ponds and repeatedly sprayed over the farmland, often between layers of snow to conceal the disposal. This mixture of chemicals becomes absorbed in the soil, waiting to get flushed into the watershed with the next snowmelt. Those contaminants may have been a contributing factor to the recent algae growth in the Shuswap Lakes.

2. **The Tourism Industry**

   The tourism industry is a vital lifeline for this region. Visitors come here for the beauty of the lake as well as the many activities the lake region offers. While the increasing popularity of the Shuswap Lakes greatly benefits the economic interest of this region, the environmental impact is equally substantiated. Every natural habitat has its limitations in regard of recreational use and population density. Expanding beyond those limitations requires a well designed infrastructure with focus on public services and ecological protection. The number and capacity of sewage treatment facilities has to increase, antibacterial treatment of drinking water must be more closely monitored, and clear rules and regulations have to be in place and, most importantly, must be properly enforced. The financial commitment is substantial, and yet few companies and organizations financially benefit from tourism and local residents suffer the ecological consequences and the economic burden. An environmental tax, utilized to maintain and upgrade the local infrastructure, for those directly profiting from tourism may well be a fair and more effective approach of the future.

   The growing number of increasingly powerful speedboats is clearly noticeable over the past years. A rising popularity of Sea Doo’s and other powerful water toys is adding to
the traffic density, especially close to shoreline and beaches. On the lighter note, the noise pollution on previously secluded lake sections has become a frequent source of complaints. Speeding boats and water toys, especially close to the shoreline, have been generating frequent high amplitude water waves, causing beach erosion and disturbances to the sensitive fish habitat. The propeller-caused jet effect below the surface significantly amplifies the damaging disturbances in shallow waters.

Bilge pumps of inboard motors frequently discharge a mixture of water, oil residues, grease, and other substances directly unfiltered into the lake. Almost unavoidable fuel spills during the refill at marine fuel stations have been adding even more visible layers of contaminants to the water table. Running powerful submerged water pumps underneath the docks may push the contaminants off the shore but is far besides a real environmental solution.

The Shuswap Lakes are home to about 250 rental houseboats, each with a sleep capacity between 10 and 30 people. Nearly all carry a hot tub, and most boats offer all the luxuries of a home, including multiple showers, sinks, toilets, dishwasher, and washing machines. Being entirely separated from the access to the shore-based infrastructure, all boats carry a septic holding tank of different size. With exception of few (mostly private) boats, no rental houseboat is equipped with a greywater collection system.

Assuming an average of 20 guests per houseboat, the total number of people directly living on the lake during peak season calculates to 5,000. In other words, more or less 5,000 people on houseboats alone dumping large quantities of greywater, garbage, and partially human waste directly into the Shuswap Lake reservoir and its beaches.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Water Use (L)</th>
<th>Frequency</th>
<th>Total Use per Boat (L)</th>
<th>Water Withdrawal by all Boats on Lake (L)</th>
<th>Discharge Back Into The Lake (L)</th>
<th>Amount Stored in Septic Tanks (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shower (5 Min.)</td>
<td>100.00</td>
<td>2</td>
<td>4,000</td>
<td>1,000,000</td>
<td>1,000,000</td>
<td></td>
</tr>
<tr>
<td>Washing Machine</td>
<td>225.00</td>
<td>5</td>
<td>1,125</td>
<td>281,250</td>
<td>281,250</td>
<td></td>
</tr>
<tr>
<td>Dishwasher (or washing by hand)</td>
<td>40.00</td>
<td>5</td>
<td>200</td>
<td>50,000</td>
<td>50,000</td>
<td></td>
</tr>
<tr>
<td>Hand Washing</td>
<td>8.00</td>
<td>15</td>
<td>2,400</td>
<td>600,000</td>
<td>600,000</td>
<td></td>
</tr>
<tr>
<td>Brushing Teeth</td>
<td>10.00</td>
<td>2</td>
<td>400</td>
<td>100,000</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Hot Tub</td>
<td>1600.00</td>
<td>1</td>
<td>1,600</td>
<td>400,000</td>
<td>400,000</td>
<td></td>
</tr>
<tr>
<td>Toilet (1 Flush)</td>
<td>15.00</td>
<td>10</td>
<td>3,000</td>
<td>750,000</td>
<td>1,000,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12,725</td>
<td></td>
<td>3,181,250</td>
<td>2,431,250</td>
<td>1,000,000</td>
<td></td>
</tr>
</tbody>
</table>

*Table 1: Daily water withdrawal and discharge by houseboats (all values in Litres)*
The water use and discharge in table 1 is calculated based on statistical data for the average Canadian household. This demonstrates that each day nearly 2.5 Mio. Litres of lake water is circulated through houseboats – pumped in, used and contaminated, and returned to the lake. An additional 1 Million Litres of water and human waste is stored in blackwater tanks and circulated through sewage treatment plants, foremost in Sicamous and Salmon Arm.

Houseboats are supplied with biodegradable soaps for personal use. It is an open secret, however, that guests are bringing their own preferred personal hygiene products to be used on the lake. As for washing machines, regular shelf products are supplied and used on the lake. Hot tubs are equipped with drain valves and guests are still educated and encouraged to make frequent use of this option, although anti-bacterial chemicals are supplied in tablet form and its use urgently suggested.

Official demands to install greywater containment tanks on all boats have remained ignored. No documented effort has been made by the houseboat companies to comply or even to find suitable solutions. This “profit before conversation” policy remains continuously tolerated by environmental agencies.

Once the houseboats return to the base, potent cleaning solutions are used to clean the outside of the boat. Utilizing pressure washers, those solutions are pushed overboard to further contaminate the lake water. Oil changes and engine maintenance is done on the water, while powerful bilge pumps transport spills and residues into the lake. The design of fuel tanks makes it nearly impossible to avoid overflow and fuel spills during refuels. Small amounts of raw sewage are injected into the water with nearly each pump out. Powerful submerged water pumps are used to push contaminants away from the marina and to conceal the magnitude of pollution and contamination.

Even with greywater contained in tanks, it remains unexplored and questionable whether the current infrastructure of treatment plants is actually capable to absorb the near triple increase of liquid inflow into the system.
3. POPULATION DENSITY ALONG THE SHORELINE

People have always been attracted by lakes and other water bodies. In the recent years large developers have begun the take advantage of this trend by proposing or developing housing projects close to shoreline, mostly multi-level condominium complexes with often hundreds of units. The marketing strategy and major selling point is the recreational value of the Shuswap Lakes and unrestricted access to the lakes. It is therefore not surprising that each unit has its own boat slip within the attached dock area.

The current development proposals on Mara Lake alone would easily add over 1,500 condominium units to the Sicamous region, if approved. The short-term benefits for the district are of political nature:

a) Quick and easy money injection for the municipality and district
b) Reduction of the local unemployment rate in the construction sector.

The long-term environmental consequences, however, are significant for two reasons:

a) Increase of the Population Density
   Assuming a residency per condo unit of at least 2 people, the population density for the District of Sicamous alone would instantly double. The job market for Sicamous and the lake region is deeply rooted in tourism and generally limited to a few summer months. Expecting other industries to become attracted to this region is unrealistic, not just because of environmental limitations and for logistic reasons. The economic balance between demand and supply would become further offset. An over-supply on job seekers drives wages down, especially for the cheap labour market like the tourism sector, and therefore reduces the quality of life for most old and new residents in this region.

A significant population increase will also place a much higher demand on public services, especially for drinking water distribution, garbage disposal, and sewage treatment capacities. Furthermore, taking the greywater issue from houseboats into consideration, Sicamous in particular may be looking at a challenge in the future. Many residential properties still utilize their own septic drain fields and will have to be connected to the public sewage system at some point, thus placing an even higher demand on the public services sector.

Concentrated density hotspots are a contributing factor for lake pollution as well. Large parking areas, roads, and other concrete covered areas close to the shoreline are collecting numerous pollutants on the surface, like oil spills from vehicles, exhaust residues, air pollutants, and tire rubber particles - just to mention few. With each rainfall, all pollutants are being washed quickly and directly into the lake. On its own, it may seem insignificant but nevertheless, as an accumulative factor for the lake deterioration it should not be ignored. And
with boat slips assigned to each unit, further pollution can be expected through boat cleaning, exhaust particles, and bilge pump-outs.

b) **Intensification of the Recreational Lake Use**

1,500 condo units would inject the same amount of boat slips into the Mara Lake, not counting other water toys and floating devices. The long-term impact is nothing less than catastrophic.

Imagining a nice Sunday afternoon in the summer with the newly added residency deciding to take advantage of the recreational value of the lake:

- powerful speedboats challenge each other in race-like competitions,
- water-skiers circle in slalom patterns all over the lake,
- children enjoy their tube rides behind the boats,
- Sea-Doo practice their acrobatic abilities,
- canoes and small fishing boats try to stay afloat in this Tsunami-like environment,
- houseboats applauding to the spectacle,
- ultralight aircrafts circle on top of it all, waiting for landing and take-off opportunities,
- and even a few survivalists take on the gamble of a swim.

The noise pollution for beach residents would be unbearable. Wave after wave is pounding the beaches and eroding the shoreline, wildlife around the floodplains is irreversible disturbed, and underwater propulsion streams is putting a new layer of stress onto the fish habitat.

It may sound highly exaggerated but this new reality is already apparent around popular beaches of the Shuswap Lakes, foremost near Nielson Beach, Marble Point, Cinnemousun Narrows, and Copper Island. Accidents and other incidents have become frequent in those areas – but it would be nothing compared to the compacted vicinity of the Mara Lake.

Water pollution in the Shuswap Lakes is an accumulative fusion of multiple sources. Each one has to be researched and attended to individually in order to make a positive and lasting impact.

This study is designed to collect and provide the core data as a comprehensive building block for responsible decisions in the future.
Objective

It is an undisputed fact that the Shuswap Lakes’ natural balance has been changing. Preserving measures are essential to avoid irreversible long-term consequences for public health and fish habitat.

Shuswaplakewatch.com is determined to address this subject by initiating a comprehensive environmental impact study. Our goal is to create a solid data foundation for further studies and subsequent decision-making. The raw study data and all analytical reports will be freely available on this web site as well as widely distributed to surrounding communities, local sectors of government, and various interest groups.

The discharge of lake pollutants is a year-round issue with accumulative peak during spring and summer. Based on the potential sources, a classification table can be established as follows:

<table>
<thead>
<tr>
<th>Season</th>
<th>Sources</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>Residential, Farming</td>
<td>high</td>
</tr>
<tr>
<td>Summer / Fall</td>
<td>Tourism, Farming</td>
<td>high</td>
</tr>
<tr>
<td>Winter</td>
<td>Residential</td>
<td>moderate</td>
</tr>
</tbody>
</table>

In order to effectively identify the pollution status and accumulative time tables, this impact study is divided into 2 parts:

Phase I....... Summer 2010........ Shuswap Lakes
Phase II...... Spring 2011.......... Lake Inflow Streams

Follow-up studies may be performed throughout the summer of 2011.

Results from other sources of water sampling as well as environmental studies may serve for the purpose of data comparison and data validation.

The objective for both study phases is summarized as follows:
Phase I: Shuswap Lake System

- Establish a lake water quality chart for the complete lake system
- Identify potential water pollutants
- Identify potential pollution hotspots
- Map the lake flow by strength and direction throughout the complete lake system
- Classify beaches and shorelines based on on-flow and ecological sensibility
- Identify pollution status on and around most frequently used beaches
- Identify lake traffic by section and type of watercrafts
- Create inventory of recreational businesses and head capacities
- Create inventory of sewage treatment facilities, capacity, breaking-points
- Record weather conditions, temperature, wind speed, and wind direction
- Record water temperatures, lake levels, and wave amplitudes
- Register incidents recorded by police, ambulance, park rangers
- Collect lake inflow/outflow data, calculate turn-over frequency, time/flow diagrams, etc.
- Create comprehensive GIS layered maps containing all study data and results

Phase II: Lake Inflow Streams

- Create inventory of farms, acreage, cattle count, along rivers and streams
- Estimate average manure production
- Map plant/feed types and growth near streams
- Identify frequently used fertilizer and pesticides
- Identify points of fluid discharge into streams
- Establish buffer / storage capacity of Mable Lake
- Establish inflow / outflow database for Mable Lake
- Resume monitoring Sugar Lake dam operations
- Sample water quality in Mable Lake
- Sample water quality on key stream sections
- Create pollutant accumulation tables along streams
- Create multi-layered GIS maps containing all data and results

The frequency and volume of water samples may vary based on available fundings for chemical analysis and reporting.

Additional data collection may occur as required.
In the recent years a number of independent studies and water quality sampling have been done throughout the lake, some even for the purpose to proof or disproof certain points of view in this matter. While intentions have been well-meant, the fact remains that too many independent studies quickly result in confusion and become ignored over time - and therefore are somewhat counterproductive in the long run.

It is not the objective of shuswaplakewatch.com to simply increase the number of studies done on the lake. We are aiming towards a well organized and comprehensive study to obtain a wide range of data and information as a foundation for further efforts in this matter, as well as to provide a solid basis and guideline for responsible local and regional planning and decision-making.

Therefore, shuswaplakewatch.com is actively seeking the support and cooperation from government, local communities, environmental groups, and local residents. We have no interest in claiming sole ownership of this study project. In fact, if more qualified officials or interest groups are willing to assume leadership and study oversight, we are ready and prepared to step back for the benefit of the success of this study. We feel that only the result matters, as the ecologic health of the Shuswap Lake watershed benefits us all.

A complete list of all supporting interest groups, government agencies, and individuals will be provided on shuswaplakewatch.com.
Study Execution and Methods

The Environmental Impact Study is scheduled to be implemented for the duration of one week at the peak of the tourism season. The August long weekend has been chosen as it signifies the most intense utilization of the lake, thus providing fact-based information in a worst case scenario.

The data collection will start at 6:00AM on Friday, July 30, 2010 and it will last to Thursday, August 5, 2010 at 10:00PM.

Follow-up, as necessary, will continue to the end of the year 2010.

The date to the execution of Phase 2 depends on the start of the 2011 runoff and will be evaluated and announced at the end of the winter.

Lake Traffic Recording:
Lake traffic counts will register and classify all traffic on the lake passing the predefined checkpoints as outlined on Map 4
All traffic is divided into categories as follows:

- Houseboats
- Speedboats, Recreational Boats
- Sea-Doo
- Tugboat / Logging, Ferryboat
- Canoe
- Fishing Boat
- Swimmer
- Waterskiing
- Tubing
- Other

Each count is associated with the time of day and direction of travel.
Counts are performed during daytime only between 6:00AM and 10:00PM.

Houseboat Overnight Beaching
Beaching houseboats are counted once a day around dusk. Beaches and parks are identified by name or GPS coordinates. Unruly observations are noted as comments.
Water Sampling
The frequency of water sampling will be dictated by the funds available for scientific analysis. Preferably, water samples should be taken at least once per day on strategic locations as outlined on map 3. Sampling locations are chosen to isolate the Shuswap Lakes from inflow streams and to separate lake sections based on expected traffic as well as potential pollution hotspots. This approach should allow the creation of pollution accumulation charts throughout the complete lake system. Lake outflow sampling will identify the water quality exiting the Shuswap Lakes.

Lake Inflow/Outflow and Water Throughput
Calculations will be based on data from existing flow gauges located in inflow streams and the lake outflow near Chase. It should allow a fairly precise estimation for the hourly amount of water being transported through the lake. Further calculations may give a good indication for the degree of pollutant absorption by inflowing freshwater.

Lake Current, Speed, and Direction
Because of the irregularity of the shoreline, changing water inflow and depth variations, the fluid dynamics of the Shuswap Lake is rather complex and mostly uncharted. Measuring the water flow, speed, and direction in various depths may lead to a better understanding of shore on-flow and the transfer of pollutants within the lake system. The size of the lake makes this a long-term project to be started with this study. Once completed, a detailed map can be generated and cross-referenced by soil samples on most vulnerable beaches. Communal and residential water intakes may be planned and located more responsibly in the future.

Lake Levels, Water Temperatures, Weather
Lake level measurements will continue as usual. Water temperature measurements will extend to the sampling locations. Participation, if any, will be recorded by volume and location.

Recreational Facilities
A list of recreational facilities containing information about total capacity and actual utilization by visitors will provide a good estimation about the quantitative factor of tourism in this area. Those numbers will be cross-referenced with the capacity data of local water treatment facilities.

Farming, Cattle Inventory
In preparation for Phase 2, a list of farms, located close to lake inflow streams, is being assembled, including information about property acreage and type and number of cattle. The database will be used to establish strategic locations for water sampling and section maps.
Analysis, Reporting, Distribution, and Data Availability

Shuswaplakewatch.com has created a series of databases to be populated with the core study data. This database will be used as foundation for all subsequent reports and analytical and statistical calculations. The raw data will be available online through special query pages in early August 2010.

Following the impact study, extensive reports will be generated and distributed to government and local communities. In addition, shuswaplakewatch.com will organize public education seminars throughout local communities and schools to explain the health status of the lake and how to protect the environment for the future of our children. We will also provide sectional reports to local permit hearings and testify to the reported data, if necessary.

Furthermore, shuswaplakewatch.com will seek the cooperative data to exchange with environmental groups throughout other Canadian watersheds to find or share better environmental management solutions for the future.

A free news publication is already under development. The first volume of “shuswaplakewatch.com Environmental News” will be published with begin of this impact study.
Volunteers and Support

The successful completion of this study is dependent on the availability and active support of volunteers. Especially the traffic count requires a large number of helpers with a significant commitment on time. Local schools will be contacted in an attempt to fill those positions in form of a summer student science project.

Shuswaplakewatch.com will organize the transport of helpers and supply to the predefined locations. Therefore, we are seeking the urgent support of boat owners providing those services on a voluntary basis.

A preliminary list of volunteer requirements with expected time commitment is complied as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>Daily Time Commitment</th>
<th>Boat Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Section Administrator / Organizer</td>
<td>2 - 3 hrs.</td>
<td></td>
</tr>
<tr>
<td>Water Sampler</td>
<td>1 hr.</td>
<td>yes</td>
</tr>
<tr>
<td>Traffic Counters</td>
<td>8 hrs. Shift</td>
<td></td>
</tr>
<tr>
<td>Houseboat Counters for Beaches</td>
<td>1 - 2 hrs.</td>
<td>yes</td>
</tr>
<tr>
<td>Water Samples Collector</td>
<td>2 - 3 hrs.</td>
<td>yes</td>
</tr>
<tr>
<td>Volunteer and Supply Transportation</td>
<td>2 - 3 hrs.</td>
<td>yes</td>
</tr>
<tr>
<td>Lake Flow Measurement Helper</td>
<td>varies</td>
<td>yes</td>
</tr>
<tr>
<td>Data Input Person</td>
<td>3 hrs.</td>
<td></td>
</tr>
<tr>
<td>Touristic Data Collectors</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>Investigator / Reporter</td>
<td>1 - 2 hrs.</td>
<td></td>
</tr>
<tr>
<td>Data Analyst</td>
<td>1 - 2 hrs.</td>
<td></td>
</tr>
<tr>
<td>Bookkeeper, Financial Controller</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>Fundraiser</td>
<td>2 - 3 hrs.</td>
<td></td>
</tr>
<tr>
<td>General Helper</td>
<td>2 - 3 hrs.</td>
<td></td>
</tr>
</tbody>
</table>

Inquiries and further questions can be directed to the address below. An online registration form is to follow shortly.

To offset the cost for this study and to cover the expenses associated with the analysis of water samples, we thankfully welcome your financial contributions. Shuswaplakewatch.com will maintain a detailed financial bookkeeping, publically accessible on our site. Leftover funds will go to the benefits of the project volunteers in its entirety.
Contact Information

Project Leader, Logistics, and Organizer:

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All inquiries, questions, or comments are welcome.

Thank you for your consideration and interest in this subject.
Appendix

Map 1: Water Flow and Current
**Map 2: Organizational Lake Sections**

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mara Lake</td>
</tr>
<tr>
<td>2</td>
<td>Sicamous Channel</td>
</tr>
<tr>
<td>3</td>
<td>Salmon Arm</td>
</tr>
<tr>
<td>4</td>
<td>Sicamous to Cinnemousun Narrows</td>
</tr>
<tr>
<td>5</td>
<td>Anstey Arm</td>
</tr>
<tr>
<td>6</td>
<td>Cinnemousun Narrows</td>
</tr>
<tr>
<td>7</td>
<td>Seymour Arm</td>
</tr>
<tr>
<td>8</td>
<td>Cinnemousun Narrows to Adams River</td>
</tr>
<tr>
<td>9</td>
<td>Adams River to Little Shuswap Lake</td>
</tr>
<tr>
<td>10</td>
<td>Little Shuswap Lake</td>
</tr>
</tbody>
</table>
Map 3: Water Sampling Locations
Map 4: Lake Traffic Check Points