

2017

WATER QUALITY REPORT

Photo Credit: Darren Robinson Photography



Water quality is monitored throughout the Shuswap watershed—at lakes, rivers, in the shallows and the deep, at beaches, at effluent outfalls and more—at different times of the year, and by different organizations for different reasons.

The Shuswap Watershed Council (SWC) is a **partnership of many organizations** with an interest in or responsibility for **monitoring and enhancing water quality** in this region. The SWC is pleased to present a summary of water quality monitoring results and water quality improvement projects on behalf of its partners for 2017.

In this second annual report on water quality from the SWC you'll find results and information about:

- Shuswap Lake, Mara Lake, Mabel Lake, Gardom Lake, White Lake, and Adams Lake
- Shuswap River and Salmon River
- Water quality at popular beaches
- Nutrient research in the Shuswap River and Salmon River
- Nonylphenols and Shuswap Lake
- Canoe Creek
- Algal blooms
- Water quality improvement and stewardship initiatives
- Keeping invasive zebra and quagga mussels out of the Shuswap

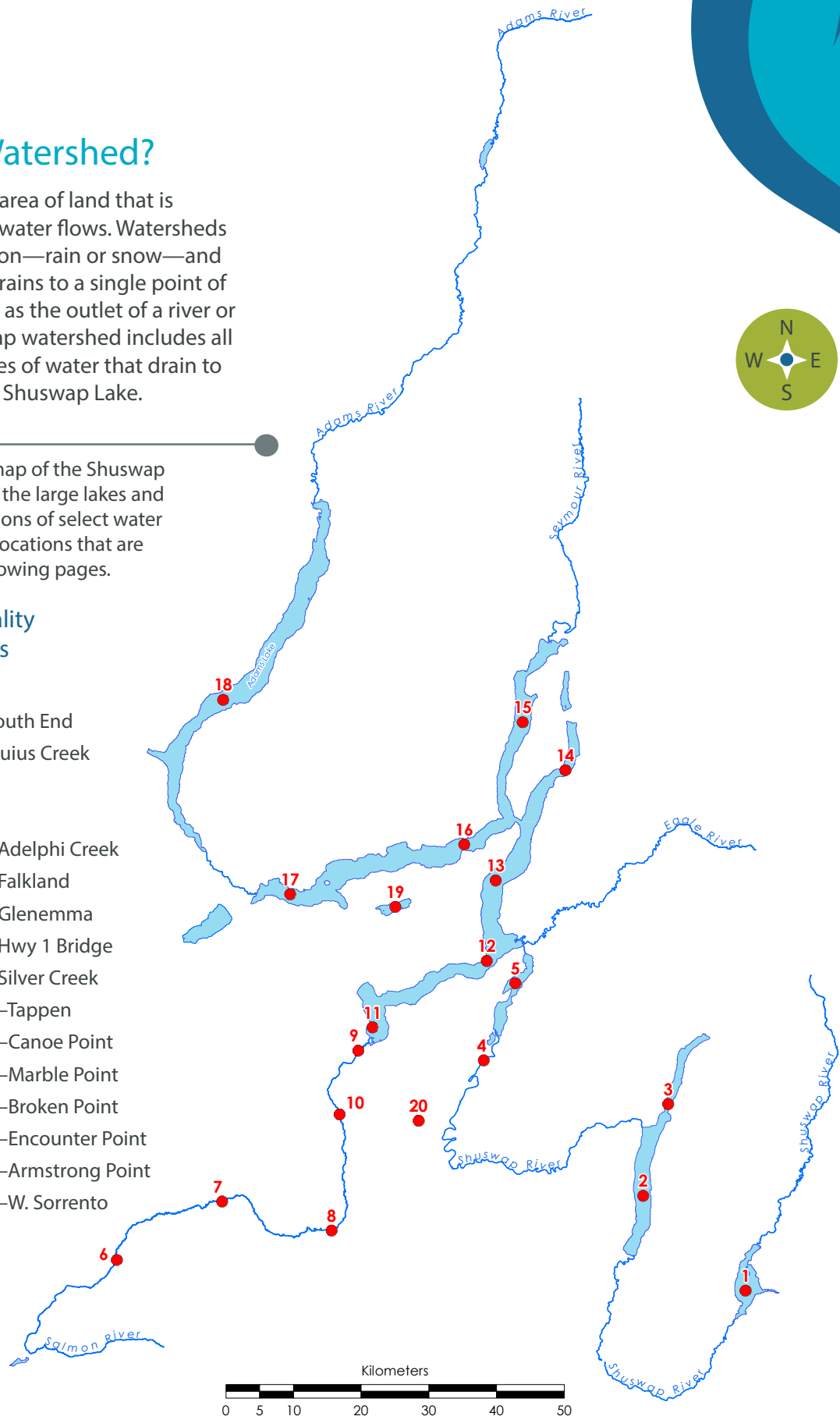
What is a Watershed?

A watershed is an area of land that is defined by where water flows. Watersheds receive precipitation—rain or snow—and over time, water drains to a single point of convergence such as the outlet of a river or a lake. The Shuswap watershed includes all the land and bodies of water that drain to the outlet of Little Shuswap Lake.

This is a simplified map of the Shuswap watershed. It shows the large lakes and rivers, and the locations of select water quality monitoring locations that are reported on the following pages.

Select Water Quality Sample Locations

1. Sugar Lake
2. Mabel Lake—South End
3. Mabel Lake—Tsuius Creek
4. Shuswap River
5. Mara Lake
6. Salmon River—Adelphi Creek
7. Salmon River—Falkland
8. Salmon River—Glenemma
9. Salmon River—Hwy 1 Bridge
10. Salmon River—Silver Creek
11. Shuswap Lake—Tappen
12. Shuswap Lake—Canoe Point
13. Shuswap Lake—Marble Point
14. Shuswap Lake—Broken Point
15. Shuswap Lake—Encounter Point
16. Shuswap Lake—Armstrong Point
17. Shuswap Lake—W. Sorrento
18. Adams Lake
19. White Lake
20. Gardom Lake

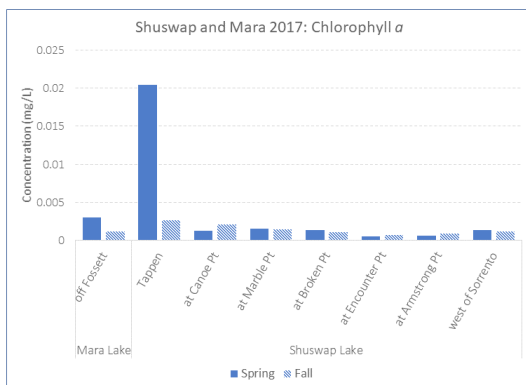
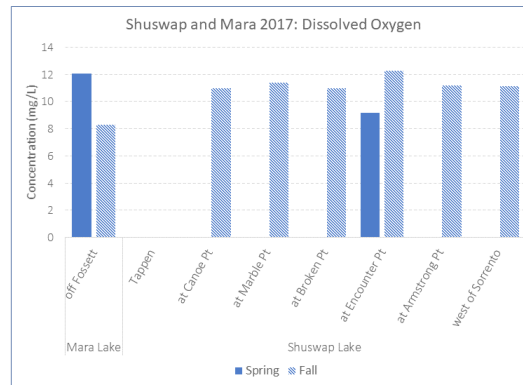
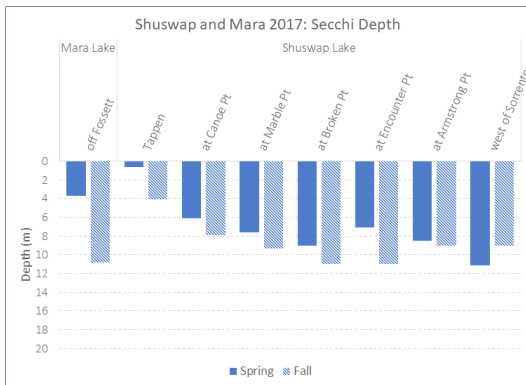
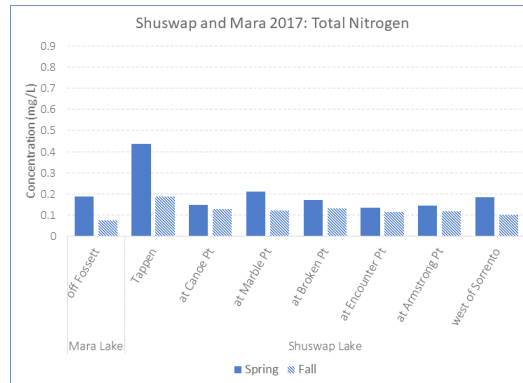
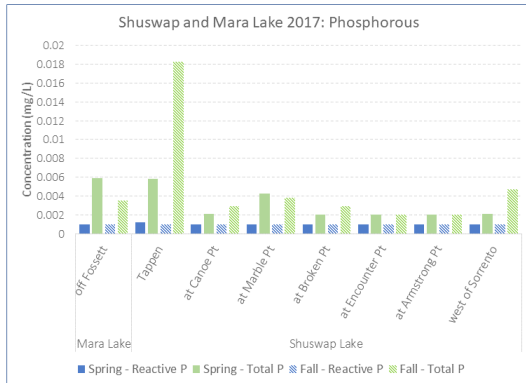




The BC Ministry of Environment and Climate Change Strategy monitors water quality at the lakes covered in this report twice per year, in the spring and fall, at several locations. Here is a snapshot of water quality monitoring results from 2017.

Shuswap and Mara Lakes

shuswapwater.ca



Shuswap and Mara Lakes are part of a larger province-wide network of lakes that the BC Ministry of Environment and Climate Change Strategy samples each year. The data from all the lakes provide valuable information about current conditions, climate change, and trends across the province.

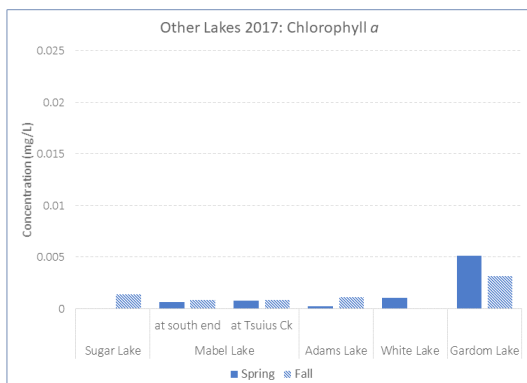
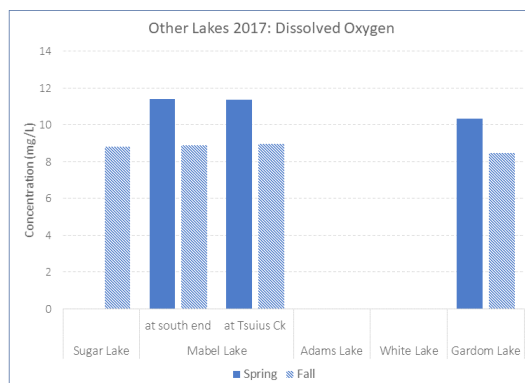
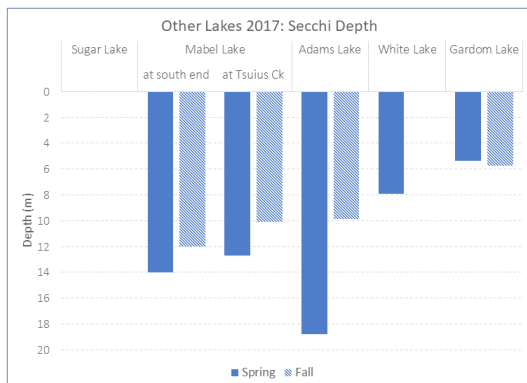
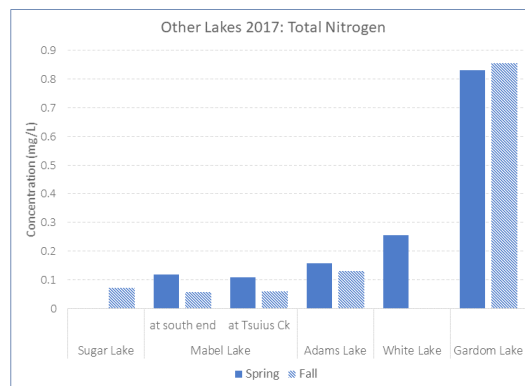
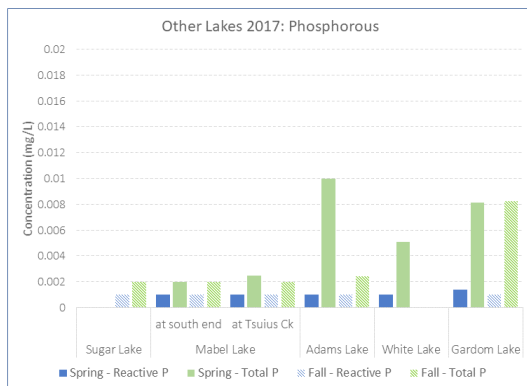
Phosphorus (P) and Nitrogen (N) are important to monitor because they are key nutrients in an aquatic ecosystem for productivity. Aquatic life such as algae, invertebrates and fish need these nutrients to grow and reproduce. Therefore, nutrients are important for supporting a healthy ecosystem. But, excessive nutrients and algae growth can reduce water clarity, create odours, and reduce the quality of water for drinking and recreation.

There are two types of P reported: **Reactive P and Total P**. Reactive P is a form of phosphorus that's immediately available (also known as 'bio-available') to plant life (i.e., algae and aquatic plants). Therefore, Reactive P is the form of P that has the potential to trigger an algal bloom. Total P is a measurement of all forms of phosphorus, including reactive P, particulate P (bound to soil particles), and other forms.

A volunteer with the Gardom Lake Stewardship Society prepares to set out and collect oxygen and temperature data on Gardom Lake.
Photo credit: Gardom Lake Stewardship Society



Sugar Lake, Mabel Lake, Adams Lake, White Lake and Gardom Lake



Wondering where these monitoring sites are located? Check the map on Page 4 to find out.

Living by Water

The Gardom Lake Stewardship Society is a group of volunteers who have been involved in water quality monitoring since the 1990s, as well as encouraging stewardship practices to maintain and improve the health of the lake. Gardom Lake is part-way through a lake 'aging process', which happens over geologic time as lakes silt in and become more vegetated. Here are some suggestions for living by water to minimize impacts and not speed up the aging process:

- 1 Protect riparian vegetation and keep it intact
- 2 Keep fertilizers and manure from going into run-off, ditches and creeks
- 3 Keep a well-maintained septic system

What's a Secchi Depth measurement?

Secchi depth is a relative measurement of water clarity. A Secchi disk—a circular disk with alternating black and white wedges—is lowered in the water on a rope until the contrasting black and white wedges are no longer visible beneath the water. At this point, the depth of the Secchi disk is recorded: this is the Secchi depth measurement. The higher the measurement, the clearer the water.

Generally speaking, a lake's water clarity can be reduced by a number of factors such as fine silt, algae, or dissolved compounds such as tannins. Shuswap and Mara Lake typically have high Secchi depth measurements in most locations. The spring measurements tend to be smaller due to the influence of spring run-off on water clarity, particularly at the Tappen site which is relatively shallow and influenced by the Salmon River.



Understanding the data—Reflections from an impact assessment biologist

Spring sampling is conducted early in the season, just after surface ice melts and before the surface water temperatures begin to rise. This is known as “spring turnover”. This is the period when lake water circulates: upwelling currents bring nutrient-rich water from the deep areas of the lake to the surface, and return oxygen-rich waters to the bottom. Water and algae samples collected during this period are used to predict growing season productivity (i.e., algae, plankton and fish) and the ecological health (known formally as “trophic condition”) of the lake.

Fall samples are collected late in the growing season, before the surface temperatures cool and the lakes are still stratified (distinct layers of warm and cool water). The samples collected at this time indicate how the lake reacted to the spring nutrient inputs, algae, seasonal weather effects, and oxygen levels. Data collected over a number of years provides information on trends in water quality, algal growth, and potential impacts of climate.

The monitoring results for 2017 on these pages show nutrients, algae (represented by Chlorophyll *a*), and water clarity (represented by Secchi depth). The highest total phosphorus levels were noted during fall sampling at Tappen in Shuswap Lake, while the highest total nitrogen and Chlorophyll *a* concentrations were seen during the spring sampling at this site. Although these were the highest values in 2017, they are significantly lower than the results from the 2016 monitoring program. There is less concern for the reported high fall values for total phosphorus because the other measurements—low values of reactive phosphorus, total nitrogen, and Chlorophyll *a* and reduced water clarity—suggest that this may be particulate phosphorus associated with turbid inflows from the Salmon River following fall rain events. All other Shuswap Lake sites showed very low nutrient and algae in 2017; furthermore, they are lower than the results in 2016. Secchi depths were similar at all sites to the results in 2016, except at Tappen where turbid inflows from the Salmon River and algal growth reduced the water clarity.

In other lakes—including Adams, Gardom and White (reported on p. 6)—the highest spring values for total phosphorus likely represent a similar situation as at Tappen: low values for reactive phosphorus, total nitrogen, and Chlorophyll *a* suggest that it is likely particulate phosphorus making up the total phosphorus values, and is not bio-available. In Gardom Lake, the 2016 total phosphorus concentrations in the surface waters were relatively low while Chlorophyll *a* data was slightly higher than other years. Secchi depths were similar to historic values, indicating that the lake is in the mesotrophic range (medium productivity) (ref: Sokal, 2017). Conditions in White Lake were quite similar indicating it is also mesotrophic (ref: Harding, 2017). Water monitoring sites on Mabel and Sugar Lakes show much lower concentrations of nutrients and algae than White and Gardom Lakes, more similar to parts of Shuswap Lake. In general, the data suggest that Adams, Sugar and Mabel are in the oligotrophic range (low productivity), similar to the outer arms and main body of Shuswap Lake. By comparison, White, Mara and Gardom Lakes are slightly more productive.

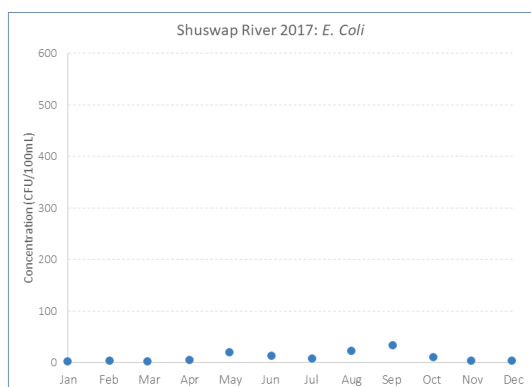
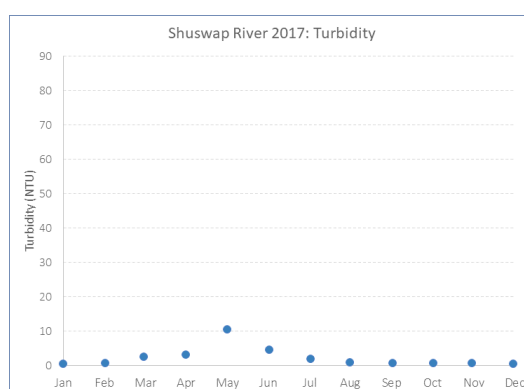
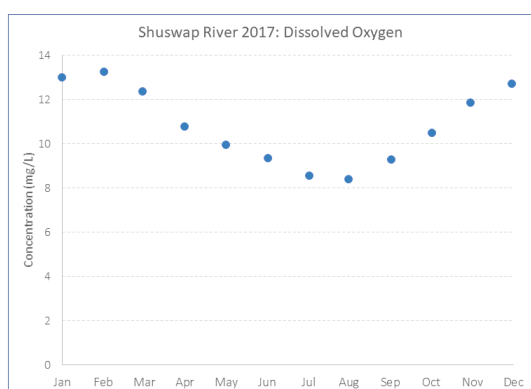
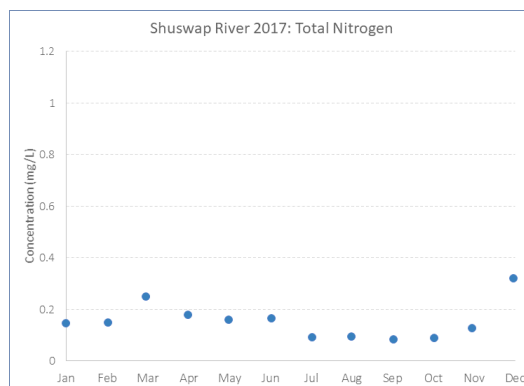
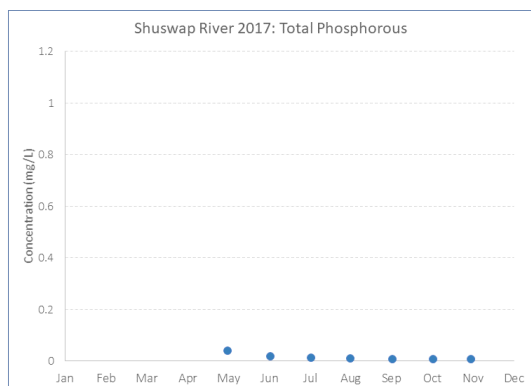
The long-term trends for total phosphorus and Chlorophyll *a* during the spring and fall samples generally indicate that concentrations in water are higher during the warmer growing season of the fall samples, than the cool spring conditions. With the exception of the Tappen site, the values for total phosphorus during the growing season are low—within the oligotrophic range. The higher total phosphorus concentrations at Tappen in the Salmon Arm Bay likely reflect contributions from the Salmon River, White Creek, and Tappen Creek, and to a lesser extent contributions from the Salmon Arm Wastewater Treatment Plan (ref: Tri-Star Environmental Consultants, 2014). The higher concentrations of Chlorophyll *a* in Mara Lake during the fall sampling period likely reflect the late season nutrient inputs from the Shuswap River.

—submitted by Dennis Einarson, R.P.Bio

Shuswap River



shuswapwater.ca



Notice the scale on the y-axis (vertical axis) of these charts. We chose to use the same scale for both rivers, for easy comparison. The Shuswap River, by volume, is a larger river than the Salmon River but has much lower concentrations of nutrients.

Nutrient research underway in the Shuswap watershed

Nutrients have long been of interest in the Shuswap because of their importance to lake health and productivity, and their ability to trigger an algal bloom. Water quality monitoring in our region has indicated that generally water quality is good in most locations at most times of year. Monitoring has also revealed that the largest loads of nutrients to the lakes are coming from the Shuswap and Salmon Rivers (see more on this on p. 5).

The Shuswap Watershed Council has entered into a **three-year research partnership with UBC–Okanagan** to determine the sources of nutrients in the rivers. This project entails collecting and analyzing water quality from 20 different sites on the two rivers. The SWC is committed to this research project because the results will help answer the following questions:

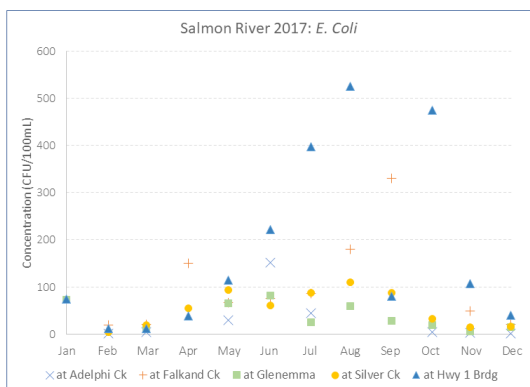
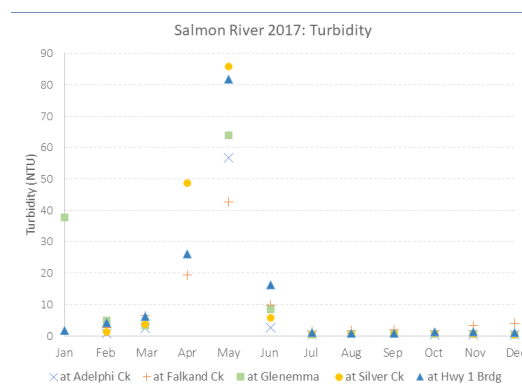
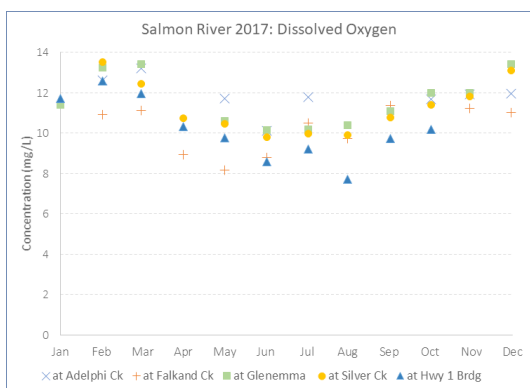
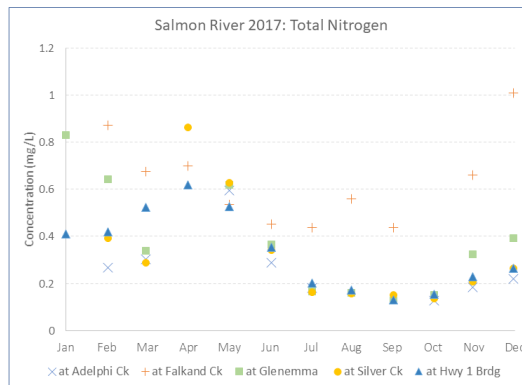
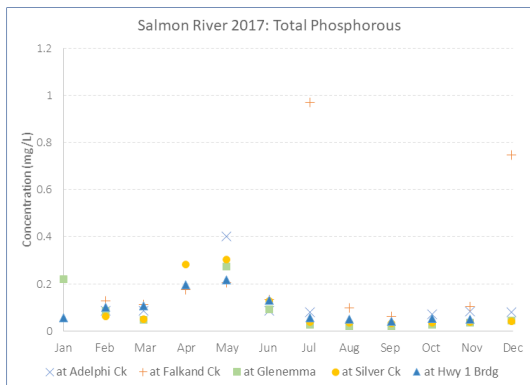
- Are there excess nutrients in the rivers that are not from the natural environment?
- If so, where are they coming from and how are they getting into the rivers?

Having answers to these questions will help inform decisions to protect our water quality. The project is now in its third year, and results are anticipated in Spring 2019.



These data are collected from a long-term monitoring site located at Rosemond Road. See the map on p. 4.

Salmon River



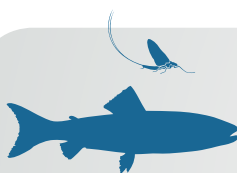
 Dissolved oxygen is important to monitor because it is crucial to gill-breathing animals such as fish and invertebrates. It's also important for some of the chemical processes that take place in an aquatic ecosystem.



Photo credit: City of Salmon Arm

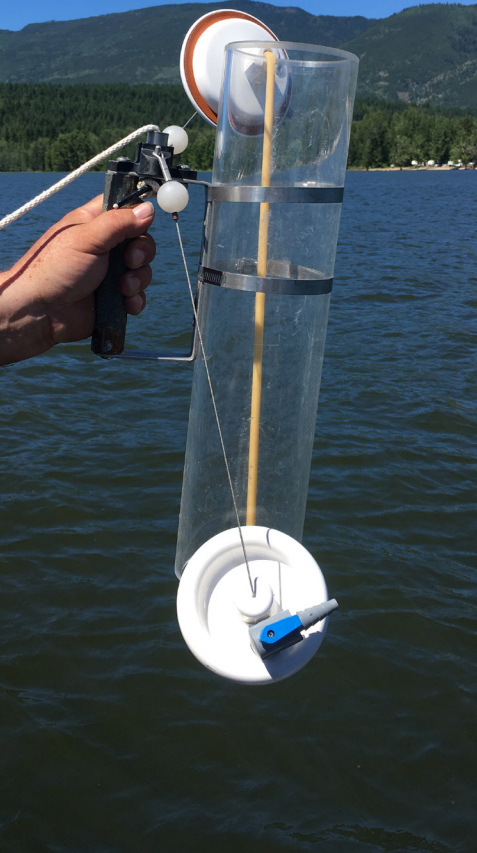
Canoe Creek Monitoring Program

Canoe Creek flows through 11 km of the City of Salmon Arm before entering Shuswap Lake. It provides water for farms, homes, industries and institutions; it also recharges groundwater and supports fish and wildlife.

An important component of the City's Liquid Waste Management Plan was to establish a monitoring program on Canoe Creek to ensure that public health

and environmental values were being protected. A water quality monitoring program on Canoe Creek was implemented by the City in 2012 to test for anthropogenic (human caused) impacts from nearby septic systems. Test results consistently came back negative—indicating that anthropogenic pollution couldn't be detected in Canoe Creek—and in 2016 the City concluded the monitoring program.

This “Van Dorn” sampler is used to collect deep water samples



Nonylphenols—not in the Shuswap

In 2017 the Shuswap Watershed Council initiated a special water quality monitoring project in Shuswap Lake to test for nonylphenols. **Nonylphenols are a group of synthetic compounds that occur in many industry and consumer products such as detergents, shampoos, cosmetics, lubricants, plastics, rubbers, paints, and more.** They can be toxic and persistent in the environment, and harmful to aquatic life such as algae, invertebrates and fish. Because of the occurrence of nonylphenols in consumer products, it's possible that household wastewater contains small amounts of the substances.

The SWC, working in partnership with the City of Salmon Arm and the BC Ministry of Environment, tested water samples for nonylphenols from spring to fall 2017.

The results are good! **Nonylphenols were not detected in any samples collected from the lake;** a trace amount of one type of nonylphenol was detected in the City's wastewater treatment plant effluent.

These results suggest that nonylphenols are entering the lake via treatment plant effluent, but in minuscule amounts that are undetectable. The *Canadian Water Quality Guidelines for the Protection of Aquatic Life* sets the guideline for nonylphenols in fresh water at 1 microgram per litre, and Shuswap Lake is well within that limit.

About algal blooms

Algae are a natural and important part of an aquatic ecosystem. An algal bloom occurs when the number of algae rapidly increases, usually due to a change in environmental conditions such as an influx of nutrients or increased sunlight. There are many different species of algae, with different impacts. An algal bloom can discolour the water and create an unsightly scum; in a worst-case scenario, an algal bloom can produce toxins harmful to people, pets, and wildlife.

It's not uncommon for small isolated pockets of algae to occur in Shuswap Lake, especially in spring and early summer when water levels rise and a fresh supply of nutrients enters the lakes. That time of year there can also be organic debris in the lakes, which can make identifying algae a challenge.

If you suspect you've encountered an algal bloom, call the Provincial RAPP line at **1-877-952-RAPP (7277)**.



Are you curious about how water quality monitoring in the Shuswap is done? We wrote a blog about that! Look for it on our website.

shuswapwater.ca

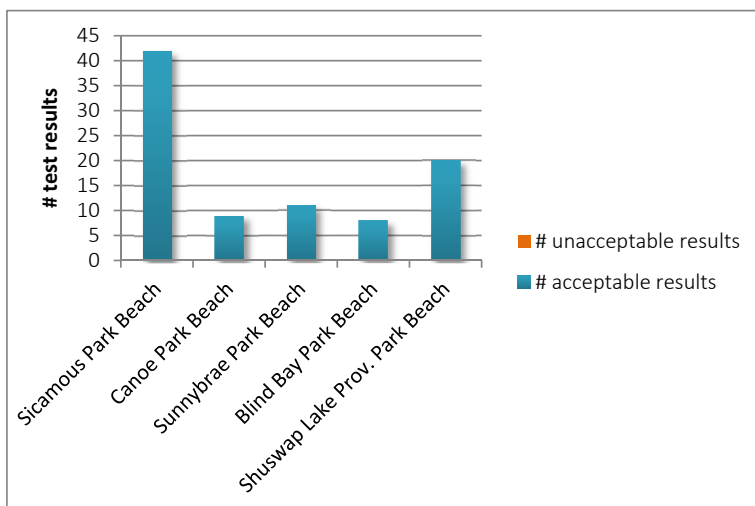


DID YOU KNOW

Shuswap Lake is one of only a few large lakes in BC without a dam or flow control structure on the outlet? The lake level fluctuates three to four metres annually. Average residence time of the water—from the time water flows into the lake and then out again—is approximately 2 years. That means that over two years, all the water in the lake is completely refreshed.

Swimming Beaches

Interior Health Authority is the regulatory agency that oversees water quality monitoring at popular swimming beaches in the Shuswap. Water samples are collected and tested throughout the summer months for *E. coli*, a type of bacteria that is an indicator of water contamination. Here are the results from their beach sampling program in 2017.



What is an acceptable or unacceptable result?



There are federal guidelines for water quality for swimming and recreation. They recommend that a safe bacteria level is less than 400 *E. coli* in a 100 mL sample, or an average of less than 200 *E. coli* in five consecutive 100 mL samples collected on a weekly basis. Above this, a swimming advisory may be issued.

Some beaches are tested more frequently than others. **All the water quality samples collected at these five popular beaches met the federal water quality guideline for swimming and recreation in 2017.**

Above: Fencing crew at Alderson Creek
Photo credit: Yucwmenlucwu

Below: One of the recently restored sites
at Alderson Creek, with new livestock
fencing and riparian shrubs and trees.
Photo credit: Yucwmenlucwu



Improving water quality in the Shuswap

The Shuswap Watershed Council has been pleased to support water quality improvement projects in our watershed. Since the SWC began its programs in 2016, it has provided two grants of \$10,000 each toward two different water quality restoration projects.

The SWC partnered with **Yucwmenlucwu**, a resource management company owned and managed by Splatstin Indian Band, to install livestock exclusion fencing and riparian vegetation at Alderson Creek which is a tributary to Fortune Creek and ultimately to the Shuswap River. These restoration techniques **will reduce erosion, siltation, and fecal pollution by livestock, as well as stabilize the stream banks** and provide more shade and cover.

In 2017, the SWC entered into an agreement with the **Gardom Lake Stewardship Society** and is contributing \$10,000 toward a wetland restoration project being led by the Society. Once complete, the wetland will improve water quality flowing into Gardom Lake.

Wetlands are exceptional at improving water quality because they capture nutrients and sediment. Size for size, small wetlands—such as this one will be—are the most effective.



A volunteer with the Gardom Lake Stewardship Society is marking out where a wetland will be established near Gardom Lake.
Photo credit: Gardom Lake Stewardship Society

Keeping invasive Zebra and Quagga Mussels out of the Shuswap

Zebra and quagga mussels are small freshwater mussels native to Eurasia with tremendous destructive potential due to their ability to cling to, colonize and completely encrust any and all hard surfaces under water: boats, pilings, water supply and irrigation systems, docks, and more. They litter beaches with their small razor-sharp shells, they produce foul odours, and they pollute water quality putting the lake ecosystem and drinking water at risk. The cost to property owners and tax-payers for dealing with these impacts would be tens of millions per year.

Fortunately, zebra and quagga mussels are not known to be present in the Shuswap, or anywhere in BC. The Columbia Shuswap Invasive Species Society has monitored several sites throughout the Shuswap for invasive mussels for the past three years. All their test

results have come back negative, meaning the mussels have not been detected. **The Society will continue with its monitoring program in 2018, with additional support from the Shuswap Watershed Council.**

We all need to do our part to keep BC free of zebra and quagga mussels. Watercraft owners, in particular, need to be vigilant. This is because the primary way the mussels spread is by 'hitch hiking' on watercraft and fishing gear from one waterbody to another. Anyone bringing a watercraft of any kind into BC is required to stop at watercraft inspection stations where potentially infested watercraft will be inspected and decontaminated. Additionally, watercraft owners need to 'Clean, Drain and Dry' their watercraft every time they move it from one waterbody to another.



Here, a CSISS staff person deploys monitoring equipment to check for zebra and quagga mussel larvae, which are tiny and free swimming. To date, zebra and quagga mussels—adult or larvae—have not been detected in the Shuswap watershed. Photo credit: Columbia Shuswap Invasive Species Society



This unidentifiable object has been in infested water and is now encrusted in a thick layer of invasive mussels. Photo credit: Columbia Shuswap Invasive Species Society

Help keep the Shuswap clean

Here's what you can do as a resident of the Shuswap to help maintain our water quality:

- Make sure you know where your wastewater goes. Is your household on a septic system, or connected to sewer? If it's septic, you're responsible for keeping it in good repair. The Septic Smart Homeowner's Guide is a good place to start: csrd.bc.ca/septicsmart/homeowners-guide
- Properly dispose of unused medications. Don't throw them out or flush them—return them to a pharmacy
- Don't ever flush personal care products such as wipes, floss, swabs and hygiene products—not even if it says "flushable" on the package!
- Don't put fats, oils or grease down the drain. Cool it, scrape it, and dispose of it in your garbage. Large quantities of liquid fats and oils should be dropped off a hazardous waste facility (e.g., Salmon Arm landfill).

Acknowledgements

Thanks go to members of the SWC's Water Quality Monitoring Group for their contributions to this summary. In particular, the SWC wishes to acknowledge the BC Ministry of Environment and Climate Change Strategy, Interior Health Authority, Splatins, Gardom Lake Stewardship Society, the City of Salmon Arm, and the Columbia Shuswap Invasive Species Society.

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Tri-Star Environmental Consultants. 2014. SLIPP Water Quality Report: Sources of Nutrients 2014.



What do you think?

Would you like share your feedback on this water quality report with us? Please contact the SWC, care of the Fraser Basin Council in Kamloops:

Erin Vieira, SWC Program Manager
evieira@fraserbasin.bc.ca | 250.314.9660



Photo Credit: Darren Robinson Photography



Who We Are

About the Shuswap Watershed Council

The SWC was established in 2014 as a watershed-based partnership to enhance water quality and safe recreation in the Shuswap. There are 17 members that represent three regional districts, two municipalities, the Secwepemc Nation, two provincial government agencies and Shuswap communities. The SWC is a collaborative, non-regulatory group. It works alongside organizations that have regulatory roles in managing the Shuswap watershed, complimenting their work and carefully avoiding duplication.

Staff

The Fraser Basin Council, a provincial non-government organization, provides staff services to the Shuswap Watershed Council.

Our Vision

Enhanced water quality that supports human and ecosystem health and the local economy in the Shuswap watershed.

What We Do

Our Objectives

The SWC's objectives are to maintain and enhance water quality in the Shuswap watershed through collaboration with water quality monitors; to coordinate and report on water quality in the Shuswap; to inform residents and visitors about water quality in the Shuswap, and advocate for good practices to prevent water quality degradation; and to encourage safe behaviour by recreationists on and near water.

The Work

The SWC's work on water quality and safe water-based recreation is guided by its five-year plan.