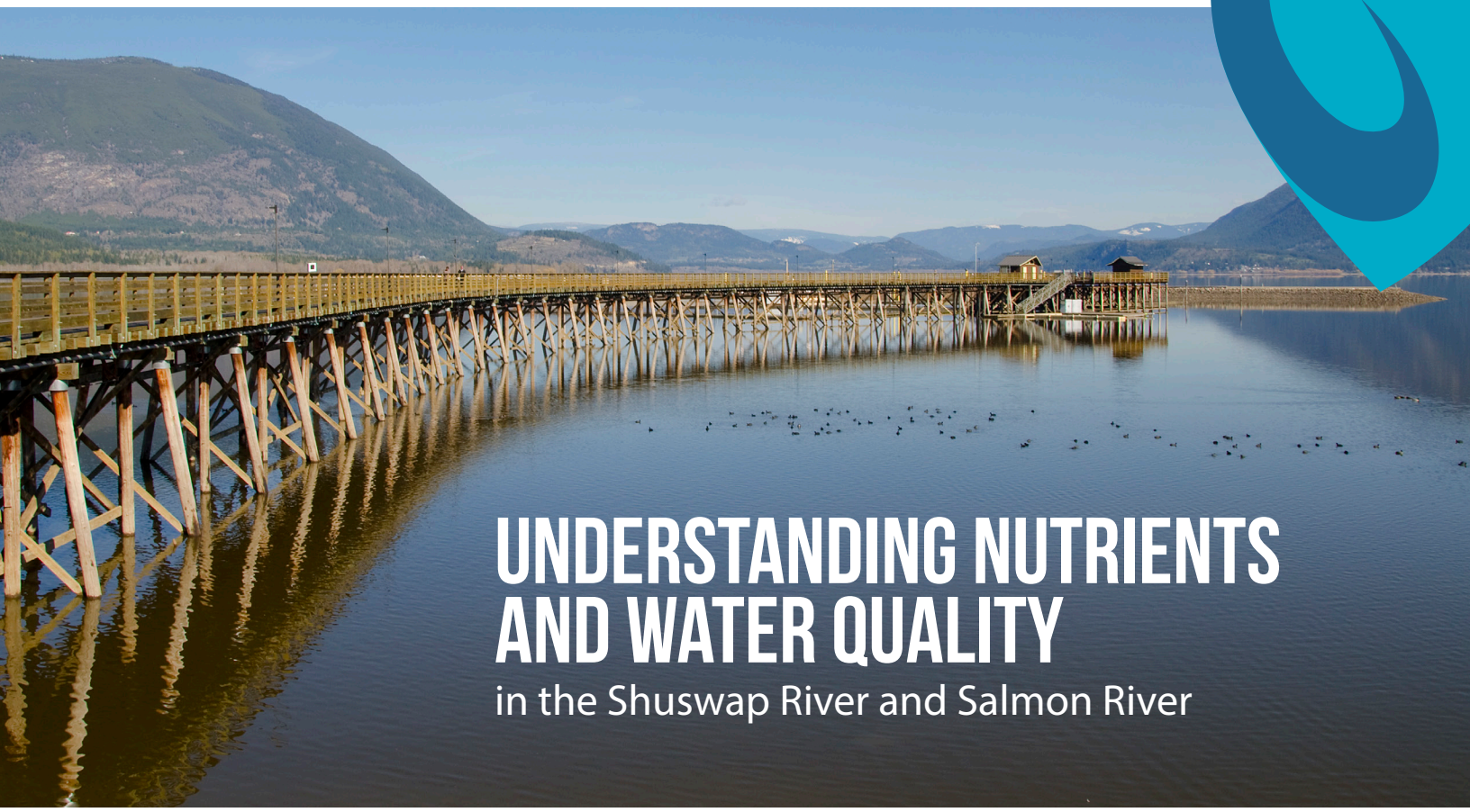
SHUSWAP
watershed council



UNDERSTANDING NUTRIENTS AND WATER QUALITY

in the Shuswap River and Salmon River

Photo Credit: Darren Robinson Photography

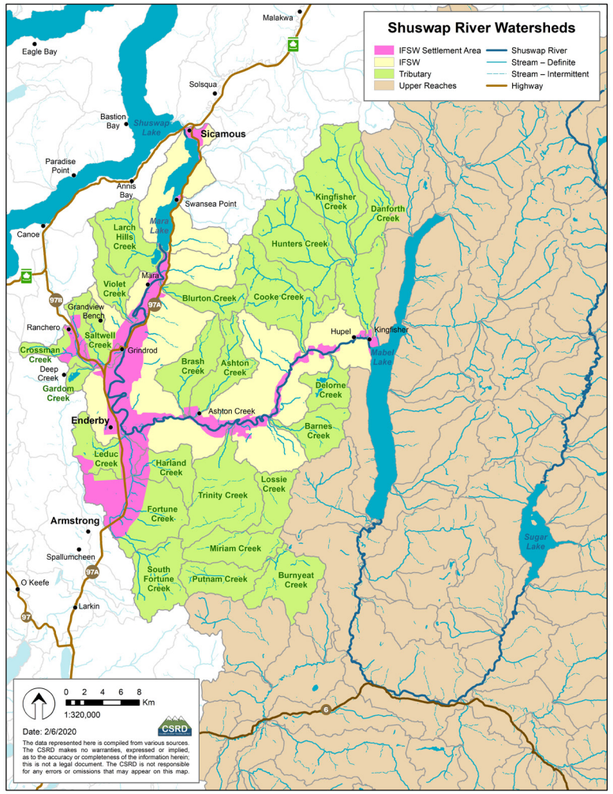
Why was a nutrient study undertaken?

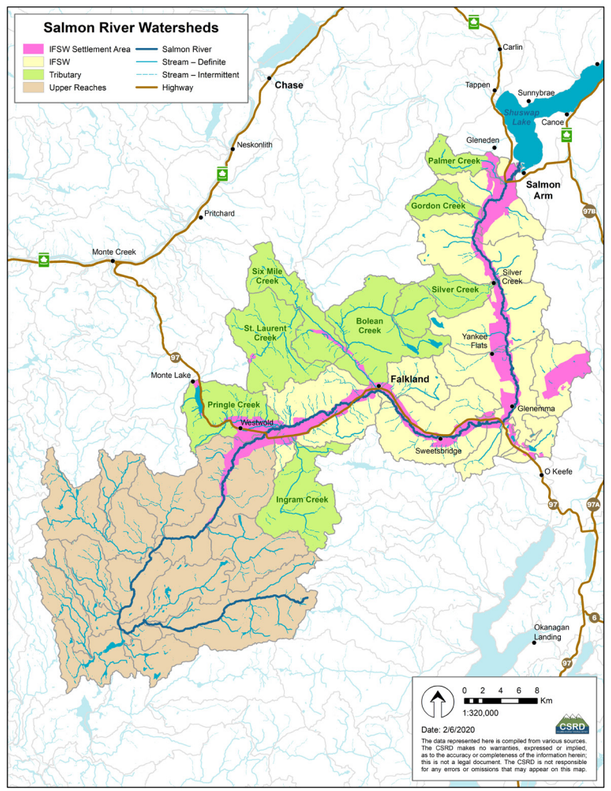
Nutrients have long been of interest in the Shuswap because of their importance to lake health and productivity, and their ability to trigger an algal bloom. Water quality monitoring in our region has indicated that generally, water quality is good in most locations at most times of year; it has also shown us that the largest loads of nutrients to the lakes are coming from the Shuswap and Salmon Rivers.

Starting in 2016, the Shuswap Watershed Council worked with researchers at UBC–Okanagan to better understand nutrients in the rivers flowing into the lakes. To do this, the research team collected and analyzed water samples from 20 different sites on the two rivers, and from over 80 additional sites at ditches, seasonal streams, and from wells over a period of three years. This essentially creates a 'nutrient budget' for the two rivers, illustrating the change in nutrient concentration as the rivers flow from the upper reaches through the valley bottoms, ultimately into Mara Lake and Shuswap Lake.

shuswapwater.ca

Phosphorus (P) is a key nutrient in an aquatic ecosystem. Aquatic life such as algae, invertebrates and fish need P to grow and reproduce. Therefore, it's 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. Furthermore, P is considered a "limiting nutrient" in most lakes in our region. That means that P levels are holding back algae and other plant life; if more P is added, more plant life and algae will grow.





What we've learned so far

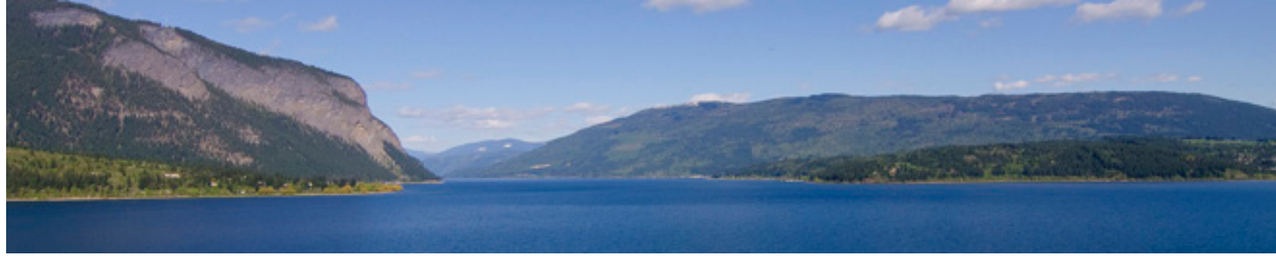
The research data was compiled and evaluating according to which **region of the watershed** it is from:

The **upper reaches**, as indicated by the darker brown areas on the maps, are mostly forested, and are minimally impacted by housing, farming, and commercial development. These reaches of the Shuswap River and Salmon River have very low nutrient concentrations, but because they drain such vast areas of land the total nutrient load from the upper reaches is significant.

The major **tributaries**, as indicated by the green areas on the maps, are streams that flow into the Shuswap River and Salmon River year round. Most of the tributaries drain a forested upland area, and a small proportion of valley bottom, before flowing into the river. The tributaries drain a much smaller area than the upper reaches, and their nutrient concentrations are low. Consequently, they contribute the smallest load of nutrients.

In the valley bottoms, there are seasonal streams, ditches, groundwater, and surface run-off flowing directly into the Shuswap River and Salmon River. These areas are known as **incremental flow sub-watersheds, or IFSWs**. These portions of the watershed are represented by the light brown and pink areas on the maps, the latter of which are the settled parts of the IFSWs. The IFSWs are the areas with the most impacts from housing, farming and commercial development. Although they account for the smallest percentage of land, these water sources are rich in nutrients. Consequently, the nutrient load from IFSWs is very significant.

Nutrient values are expressed in terms of **concentration** (kg/ha/year) and **load** (kg/year).



This table shows the concentrations, total load, and percentage of load for the upper reaches, tributaries, and IFSWs for the Shuswap River and Salmon River:

Shuswap River—total P			
Source	Concentration (kg/ha/year)	Total loading (kg/year)	Percent total loading
Upper Reaches	0.08–0.072	30,200	48%
Tributaries	0.07	4090	6%
IFSW	1.46–14.3	29,200	46%
Totals	—	63,490	

Salmon River—total P			
Source	Concentration (kg/ha/year)	Total loading (kg/year)	Percent total loading
Upper Reaches	0.068–0.32	10,200	23%
Tributaries	0.0287	3820	9%
IFSW	0.091–0.583	30,700	69%
Totals		44,720	

The research data was also compiled and evaluated according to which **land type** it is from

Data from the Shuswap River and Salmon River watersheds were combined to determine the total P loadings from different land uses:

Forested land contributed an average of 0.035 kg/ha/yr to the rivers. When the researchers compared this value to other data for forested land that's reported in scientific literature, they found this concentration to be relatively very low.

Urban land contributed an average of 3.83 kg/ha/yr. This value was found to be within the range of what's reported about urban land in other scientific literature.

Agricultural land contributed an average of 13.5 kg/ha/yr. This value was found to be within the range, but on the high side, of what's reported about agricultural land in other scientific literature.

What are the conclusions?

The naturally very low nutrient concentrations in the upper reaches of the watershed mean that the Shuswap River, Salmon River, and downstream Mara and Shuswap Lakes are sensitive to nutrient inputs. Put another way, only small additional loads of P would double or quadruple the total amounts.

Although significant nutrient loads are coming from both the upper reaches and the IFSWs, the more important conclusion from a management perspective is that the highest concentration of nutrients is from the IFSWs. These small areas of land are contributing 46% and 69% of the nutrient load to the Shuswap River and Salmon River, respectively. Furthermore, agricultural land and urban areas within the IFSWs contribute the highest concentrations of nutrients. Therefore, these are the areas where management action will be most effective.

What the data don't tell us

- Which specific areas are contributing the highest loadings. This study looked at land uses and regions of the watershed, it did not examine specific parcels of land or point sources.
- Whether the nutrient loadings from the IFSWs are from current activities or past activities. The high concentrations of P in the IFSWs are partly attributable to 'Legacy Phosphorus'—that is, P that has accumulated in agricultural soils over decades at a rate faster than it could be used by plants or seeped out via groundwater. This is a 'legacy' of a bygone era of farming practices less nutrient-efficient than modern farming.
- Changes over time. However, this is an important consideration and the SWC and research team are working on a follow-up research project that involves the collection and analysis of sediments from the bottom of Mara Lake to learn about historic nutrient loadings from the Shuswap River. The results will show us how human settlement and development in this part of the watershed is correlated to long-term changes in water quality.

What's Next?

This research project has shown us which areas of the watershed we ought to focus our efforts at mitigating, or decreasing, P inputs to the Shuswap River and Salmon River. Mitigative works should reduce the flow of P-rich waters to the rivers from farms and urban areas within IFSWs. There are several methods to achieve this, including the development of wetlands, enhancement of riparian areas, new irrigation practices, different livestock practices, and improved manure management, to name a few.

It is important to understand that mitigative works may not result in immediate changes to nutrient loadings or water quality. These are long term efforts, and their effectiveness may not be observed for years or decades. Nonetheless, it's never too early to take steps to protect water quality for the future.

The Shuswap Watershed Council is currently seeking **community partners** willing to apply new land management or farming practices to reduce, capture or divert Phosphorus so it doesn't end up in rivers or lakes. The Council has **grant funding** to pay for costs associated with new nutrient management practices. For more information, please contact the Program Managers, c/o Fraser Basin Council.

Acknowledgments

The SWC would like to thank staff at the Columbia Shuswap Regional District for producing the maps in this pamphlet.

For more information about this study, and water quality in the Shuswap

A portion of these results are documented in a Master's Thesis, available online here: **https://bit.ly/35Buz52**. A full report from the research team will also be available early in 2020.

For annual water quality reports produced by the Shuswap Watershed Council, visit **https://www.fraserbasin.bc.ca/Water_Quality_Data.html**

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 18 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.

SHUSWAP watershed council

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Contact: *For more information, please contact the SWC, care of the Fraser Basin Council in Kamloops:*

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Shuswap Watershed Council. Water Quality and Nutrients. January 2020.