

The identification of the source(s) and transport mechanisms of phosphorus and nitrogen in the Lower Shuswap, and Salmon Rivers.

Progress Update prepared for the Shuswap Watershed Council,
January 2017

Introduction

The scope, methodology and general research questions have not changed, and can be reviewed in the September 2016 report ([link](#)). This report will cover where current sampling is at as of January 2017, the addition of piezometers to the project, new constraints, and future work.

Sampling

SAMPLE SITES

Sample sites have not changed since the September 2016 report. Sampling occurs on the stretch of the Lower Shuswap from Mabel lake to Mara lake ([map 1](#)) and on the Salmon River from the Westwold Aquifer to Shuswap Lake ([map 2](#)).

SAMPLING FREQUENCY

The frequency of sampling increases with discharge. Currently sampling is at once every 4 to 5 weeks due to the presence of ice and snow. Discharge will increase in the coming months with snowmelt, and therefore sampling will increase.

PHOSPHOROUS AND NITROGEN ANALYSIS

Currently 240 water samples from various sites have been analyzed for phosphorous and nitrogen concentrations using colorimetric determination methods, which are extensively covered in the September 2016 Report. Data will be further analyzed in the coming months to determine any anomalies.

DISCHARGE DATA

Discharge has been monitored by hand. Base flow levels were measured in late fall before freezing occurred. Base flow is defined as the portion of flow that is not attributed to runoff, and is marked by groundwater seepage contributions. Base flow will be considered our lowest measurement when creating our rating curves, which will be paired with staff gauge data (available on all creeks) and pressure transducer data (on select creeks) to interpolate the discharge between hand measurements.

Piezometers

DESIGN

Piezometers are small amounts of tubing used to measure ground water depth, as well as sample ground water. They are driven into the ground and covered in a mesh casing to keep fine silts out, but allow water in.

As of September 2016, we had 30 piezometers built. Unfortunately, the piezometer design was not stiff enough to resist collapsing when driven into the ground. Piezometers were redesigned using $\frac{3}{4}$

inch polyethylene drip irrigation hose instead. The same basic design was still used, with the bottom 6 inches of the 2 meter long tubing being drilled with holes and covered with a mesh screen to keep sediment out of these holes, but allow water in. The piezometers were installed by placing the tubing inside 1.5 inch steel pipe, which was capped and driven into the ground using a fence pounder to depth of at least 1 meter. Water was then collected from the piezometer and analyzed at lab with the same methods used for analyzing the river samples.

LOCATIONS

Piezometers were installed in three different stretches on the Shuswap River; from the Canoe put-in near Kingfisher Creek to Ashton Creek, from downstream of Ashton Creek to Enderby, and from Grindrod to Mara lake. A map of the locations can be seen [here](#). There remain large gaps in the coverage, which we hope to fill in the coming months with additional piezometer installations.

Constraints/Problems

Recently we have had an issue with our pressure transducers, which measure water level, being stolen. Two of the seven pressure transducers have been taken, first the one at Ashton Creek and later, the one at Fortune Creek. We are considering replacing them and moving them to locations on private property, with the land owner's consent.

Looking Forward

Our research is no longer in the beginning stages, but we have many more months of monitoring, as well as a few other objectives, listed below.

CONTINUING SAMPLING

River sampling will continue as planned until June of 2017. Frequency will increase with discharge. In June of 2017, we will have one year worth of samples and data. The data will be analyzed to determine whether sampling should continue in the same locations or not. Changes or additions of locations would be added to account for consistent anomalies in the data.

PIEZOMETERS

More piezometers will be installed to cover the extent of the entire Shuswap river. Existing piezometers will be sampled infrequently when water levels are considered safe for boating in the summer.

ADDITIONAL WELL MONITORING

In addition to our own piezometers, we would like to analyze resident's wells, when possible, to supplement our data. Specifically, we will be looking to test wells on Mabel lake road, as well as some on Fortune Creek. Residents will be sought out and contacted in the coming months.

Note: The following future initiatives remain the same as those from September 2016.

MASS BALANCE

After gathering water samples and data for the next year, we will work to answer the research questions mentioned above using a mass balance approach. A mass balance assumes that all inputs must equal the outputs. Using this approach, if the natural inputs are not equal to the total outputs in terms of nutrients, it can be assumed that nutrients are coming in from some other source. These sources will likely include agriculture, industry etc.

LAND USE COEFFICIENTS

Using the mass balance approach and our data, we will be working to determine land use coefficients for the surrounding areas. These coefficients apply a number to each type of land use which can then be used to estimate nutrient loading into the river, without direct measurement. These coefficients can be used for entire watersheds to make management decisions.

LITERATURE REVIEW

Currently, the past reports prepared by the Fraser Basin Council and the Shuswap Watershed Council related to water quality and overall health of the lower Shuswap have been reviewed to gain a better understanding of the area. We have also reviewed papers related to colorimetric determination of phosphorous and nitrogen, as well as literature relating to land use coefficients. All these subjects and more will be reviewed more thoroughly throughout the project.

THESIS DEFENSE

One of the biggest objectives of this project for myself, is to gain enough knowledge and understanding of the nutrient loading within these systems to write a thesis. I then hope to publish my findings in a peer reviewed journal, as well as defend my thesis and receive a master's degree by summer of 2018.

Summary

In the time between September 2016 and January 2017, monitoring is continuing steadily, and the installation of piezometers has been completed. In this time, we have collected close to 250 samples from 20 different sites on the lower Shuswap and Salmon Rivers. The samples have been tested for phosphorous and nitrate levels using colorimetric determination methods. Discharge data has also been gathered at these sites, and staff gauges and pressure transducers have been installed. Focus is now being shifted to supplement our monitoring network with additional wells, replacing pressure transducers, and eventually looking at the last years' worth of data to determine our next steps.

Contact Information

If there are any questions pertaining to the project, feel free to contact me;

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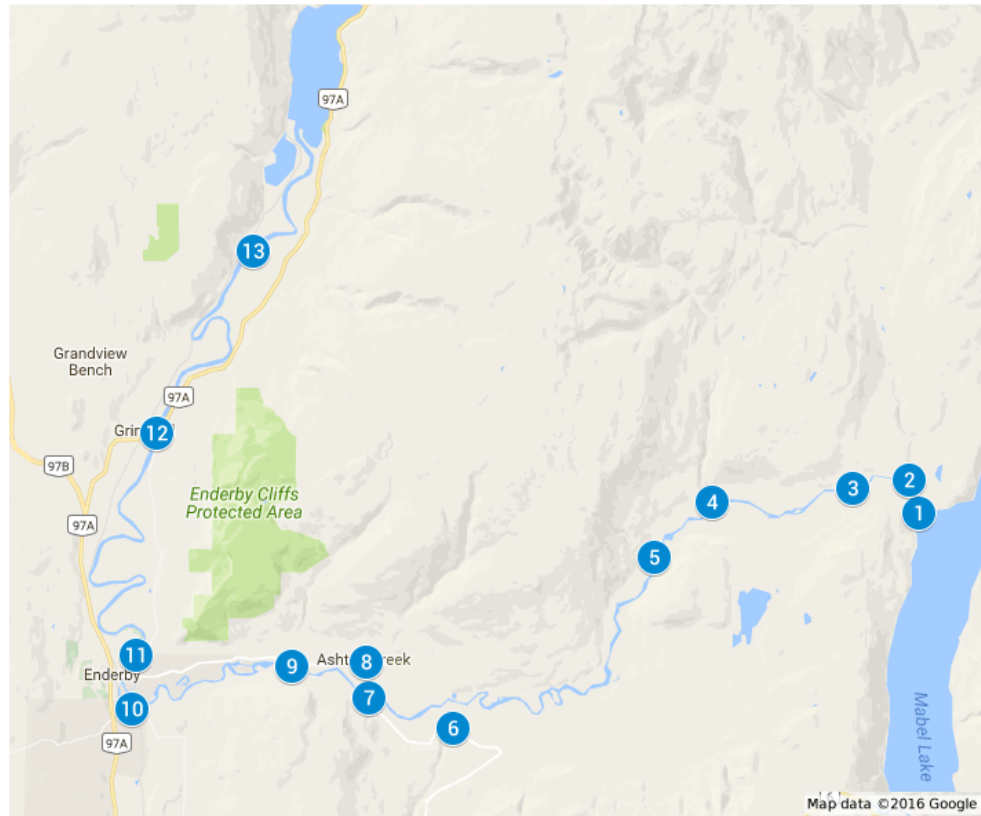
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Appendix

MAP 1-2: SAMPLING SITES

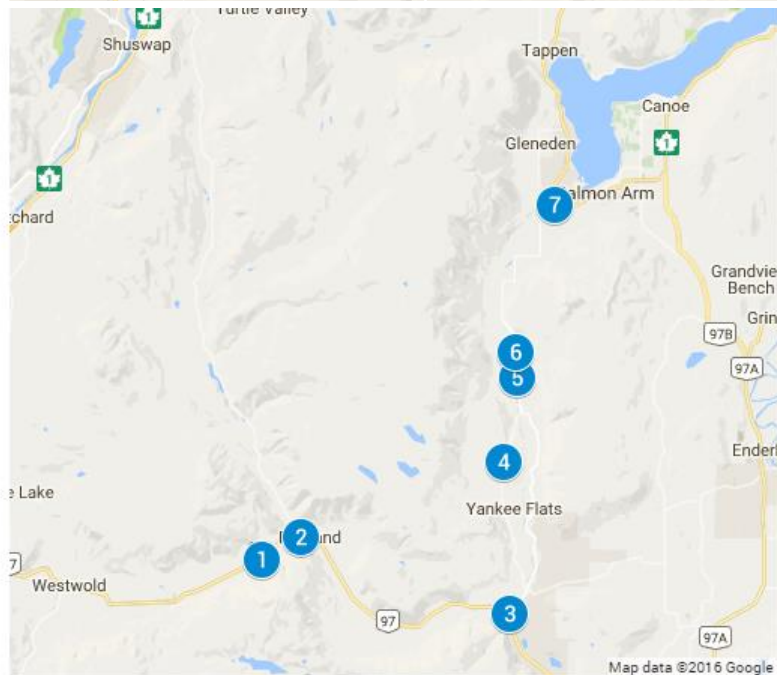
Shuswap River Sample Sites

- 1 Rivermouth Marina
- 2 Kingfisher Creek
- 3 Shuswap Canoe Put In
- 4 Cooke Creek
- 5 Falls Creek
- 6 Hidden Creek
- 7 Shuswap at Ashton Crk Bridge
- 8 Ashton Creek
- 9 Brash Creek
- 10 Fortune Creek
- 11 Enderby Boat Launch
- 12 Grindrod
- 13 Mara Lake Bridge

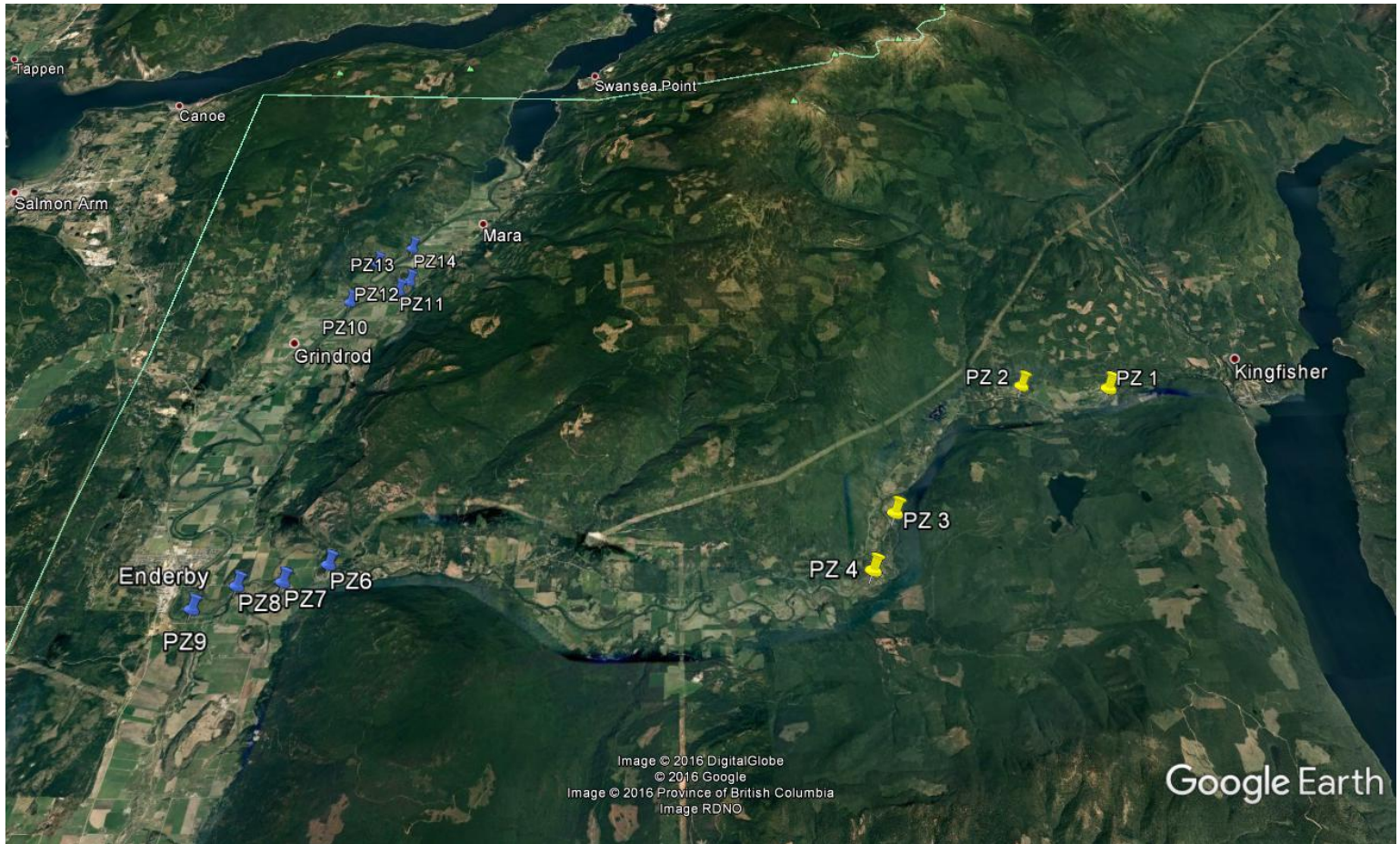


Salmon Sample Sites

- 1 Upstream Falkland
- 2 Bolean Creek
- 3 Glenemma
- 4 Spa Creek
- 5 Silver Creek
- 6 Downstream Silver Crk
- 7 HWY 1 Bridge



MAP 3: PIEZOMETER LOCATIONS



Map 1: Piezometer location maps
GPS coordinates available upon request

SEPTEMBER 2016 REPORT



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Document

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