RESULTS OF WATER QUALITY MONITORING PROGRAM 2019

Haslam Lang Community Watershed

Project Number: 20-103
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Client:
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EARTH WATER LAND

SUMMARY

The Powell River Salmon Society (PRSS) monitors water quality in the Haslam Lang Community Watershed, which supplies drinking water to the City of Powell River and the community of Brew Bay. The watershed supports salmonids and there is a hatchery operation on Lang Creek operated by the PRSS. Maintaining water quality is important for providing clean drinking water and maintaining salmon habitat.

The PRSS retained Statlu Environmental Consulting Ltd. (Statlu) to analyze water quality data collected during 2019 and to compare the data with previous years of monitoring. Stage, turbidity, pH, salinity, and water temperature were recorded bi-weekly at six locations within the watershed. The measurements were taken at Lang Creek near the Alex Dobler Salmon Centre, the outlet of Duck Lake, Anderson Creek, Blackwater Creek, Haslam Lake, and the weir at the outlet of Haslam Lake named Slough Station. Water quality monitoring at the six sites began in 1997 for most of the recorded parameters. The data collected during this project has been a valuable tool for establishing baseline conditions within the watershed, which allows changes to be detected and analyzed, and provides effective evaluation for forestry operations in the watershed.

The stage and discharge measurements were lower in 2019 than in 2018, but remain within the normal ranges recorded in the watershed. Turbidity and pH varied within the normal range during 2019. The turbidity within the watershed has been decreasing, and pH has been consistently closer to neutral since 1997. Water temperature was slightly cooler during the summer of 2019 than during the previous several years, and remains within normal variations for the watershed. Salinity has increased in all six streams over the past two years, but remains well within good water quality standards. The data suggests that forest management strategies intended to protect water quality have been effective within the watershed.

Data on additional water quality parameters such as fecal coliform and dissolved metals has not been collected since 2010. It would be worthwhile to sample these parameters again in future in order to verify that these parameters remain within desirable levels.

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APPENDICES

1.0 INTRODUCTION

The Powell River Salmon Society (PRSS) receives funding from British Columbia Timber Sales (BCTS) and the Powell River Community Forest to conduct water quality monitoring within the Haslam Lang Community Watershed. The watershed provides drinking water to the City of Powell River, the community of Brew Bay, and is important for fish habitat. The PRSS maintains and operates a hatchery on Lang Creek.

As part of an ongoing water quality monitoring program, the PRSS retained Statlu Environmental Consulting Ltd. (Statlu) to analyze data collected during 2019 and to compare the results with previous years of monitoring.

2.0 BACKGROUND

Sustainable development within the Haslam Lang Community Watershed has been a priority for over two decades. A water quality monitoring program within the watershed started in 1997 and a watershed management plan was implemented in 1999.

The Haslam Lake and Lang Creek Integrated Watershed Management Plan (IWMP) guides sustainable development within the watershed while identifying resources at risk and effectively managing public interests. Since the implementation of the IWMP, watershed assessments, stakeholder involvement, and implementation of best management practices have provided sound scientific and practical guidance for sustainable development in the watershed.

The water quality monitoring program is a key component of the watershed management plan process. The water quality data provides a baseline that can be used to identify short term changes, long term trends, and potential problems within the watershed. The monitoring program also ensures that license requirements are met throughout the year. One requirement is to maintain a minimum flow greater than 15 ft^3/s (0.42 m^3/s) in Lang Creek downstream of the storage dam at all times of the year, and this minimum should be increased to 25 ft^3/s (0.71 m^3/s) during the months of October and November. Ensuring the minimum flow requirements are met and that good water quality is maintained is key for sustainable

development within the watershed. If potential problems are identified, the data can be used to guide management strategies that will reduce risks within the watershed and to downstream resources.

Three watershed assessments have been completed; the first in 1999 (Carson, 2000), the second in 2003 (Carson, 2003), and the latest in 2015 (Carson Land Resource Management, 2015). Additionally, Carson (2010) completed an assessment of water quality effects of the Powell River Community Forest Operations (PRCF) within the Powell River area, including area within the PRCF but outside the community watershed. Statlu provided a draft watershed assessment to forest licensees in November 2019 and has received review comments from some of them at the time of this report.

3.0 METHODOLOGY

The PRSS monitored water quality within the watershed during 2019 and sent the data to Statlu for analysis. The stage, turbidity, pH, water temperature, and salinity were measured on a bi-monthly basis at six locations. The measurements were recorded at Lang Creek near the Alex Dobler Salmon Centre, the outlet of Duck Lake, Blackwater Creek, Anderson Creek, Haslam Lake near the community water intake, and Haslam Lake at Slough Station (Figure 1 in Appendix 1). Continuous stream flow data was collected on Lang Creek at the Alex Dobler Salmon Center. From 1997 to 2001, several other streams in the watershed were monitored. While there is no recent data from these streams, previously collected data remains relevant as a record of past conditions.

Two graphs are presented for each water quality variable (stage, turbidity, pH, water temperature, and salinity) measured at the six location within the watershed. The first graph shows the variability of the data during 2019, and the second graph compares the 2019 data to the history of data recorded since 1997. The 2019 graphs allows data variability to be compared to events that occurred during the year. The long term graphs show how water quality variables have changed over time and allow trends to be identified.

The daily maximum and minimum discharge was extracted from the continuous stream flow data recorded on Lang Creek. The discharge rates are plotted against daily precipitation data collected at the Powell River A climate station, located at Powell River Airport.

4.0 OBSERVATIONS

During the monitoring program, the PRSS made field observations and took photographs to record present conditions within the watershed at several monitoring sites.

Photo 1: Anderson Creek, January 2020.

Photo 2: Low water levels in Blackwater Creek, early September 2020.

Photo 3: A side channel of Blackwater Creek with uprooted and leaning trees, July 2020.

5.0 RESULTS

5.1 Precipitation and Air Temperature

Total monthly precipitation and mean monthly air temperature data for 2019 is compared to the 30 year average from 1981 to 2010 (Figure 2). The climate data is from the Powell River A climate station at Powell River Airport, which is 130 m above mean sea level and approximately 7 km southwest of Haslam Lake (Environment Canada, 2018). Precipitation data was missing for 6 days during 2019. The total precipitation recorded during 2019 was 849.4 mm, which is 36% less than the 1335.3 mm recorded in 2018, and 30% less than the 30 year average from 1981 to 2010 of 1205.2 mm per year. September 2019 had above normal precipitation, and most of the summer had near-average precipitation, while most other months had below normal precipitation.

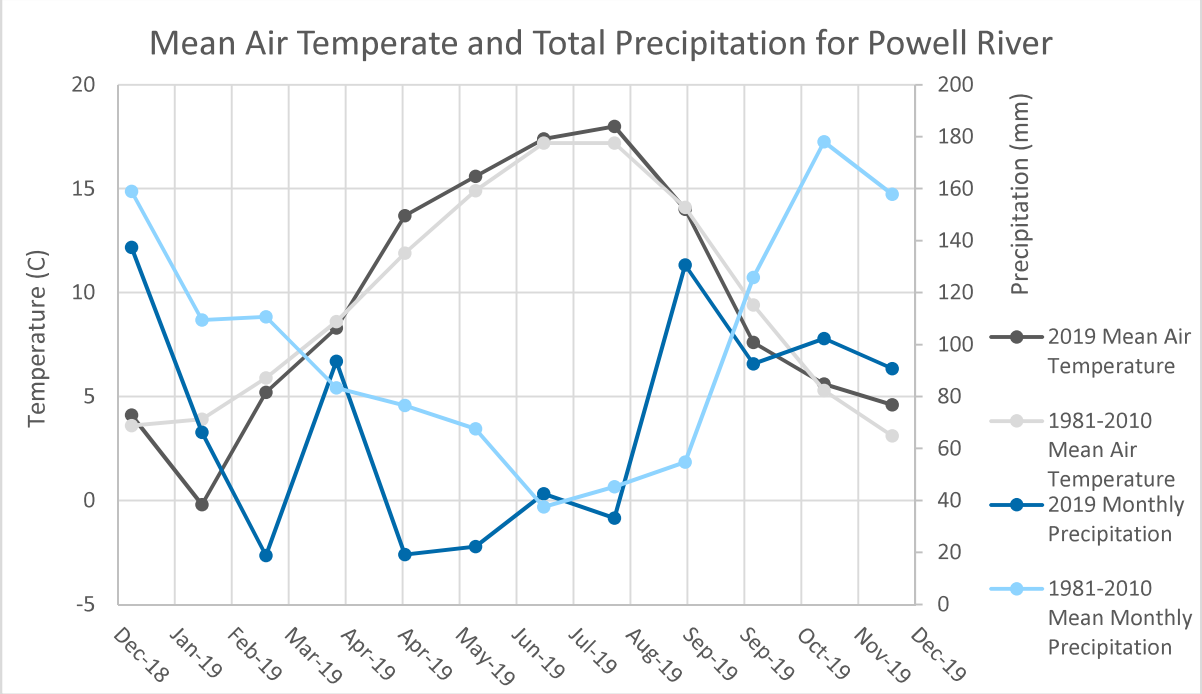


Figure 2: Mean air temperature (C°) and total monthly precipitation (mm) at the Powell River A climate station for 2019 compared to the 30 year average from 1981 to 2010.

5.2 Stage and Hydrograph

River stage was recorded at six locations within the watershed during 2019 (Figure 3). The stage data for Haslam Lake is plotted on a secondary axis because its stage reference point is a geodetic elevation. Despite having two different reference points, the stage data can be compared and Figures 3 shows how water level changed within the watershed during 2019. The 2019 stage measurements are consistent with variations recorded since 1997 (Figure 4).

Continuous data recording in Lang Creek during 2019 recorded discharge rates throughout the day. The daily maximum and minimum discharge was extracted from the data and plotted against daily precipitation for the same site (Figure 5).

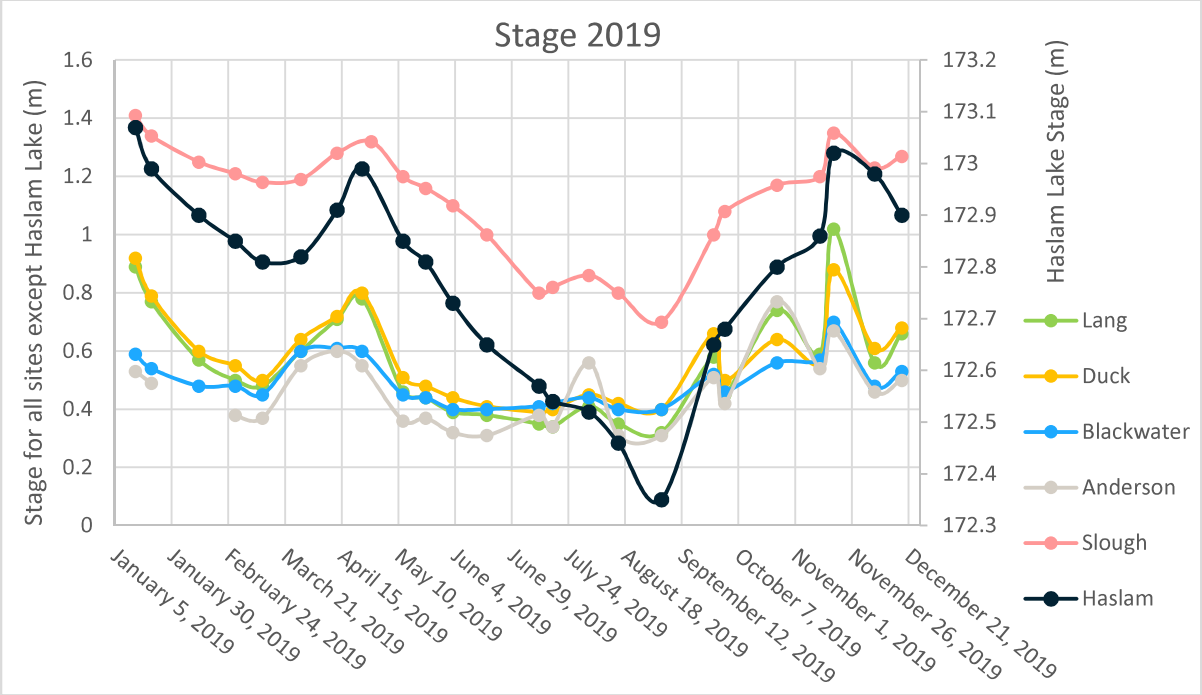


Figure 3: Stage discharge at six sites within the community watershed during 2019. The stage for Haslam Lake is graphed on a secondary axis.

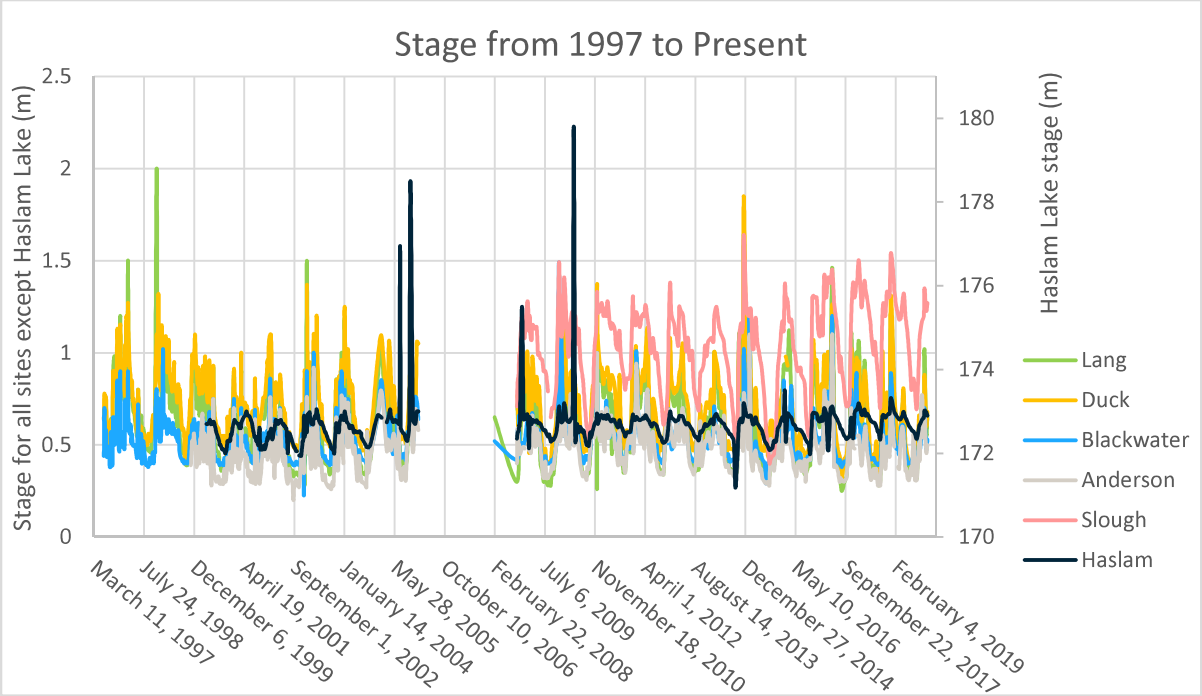


Figure 4: Stage discharge at six sites within the community watershed between 1997 and present. The stage for Haslam Lake is graphed on a secondary access.

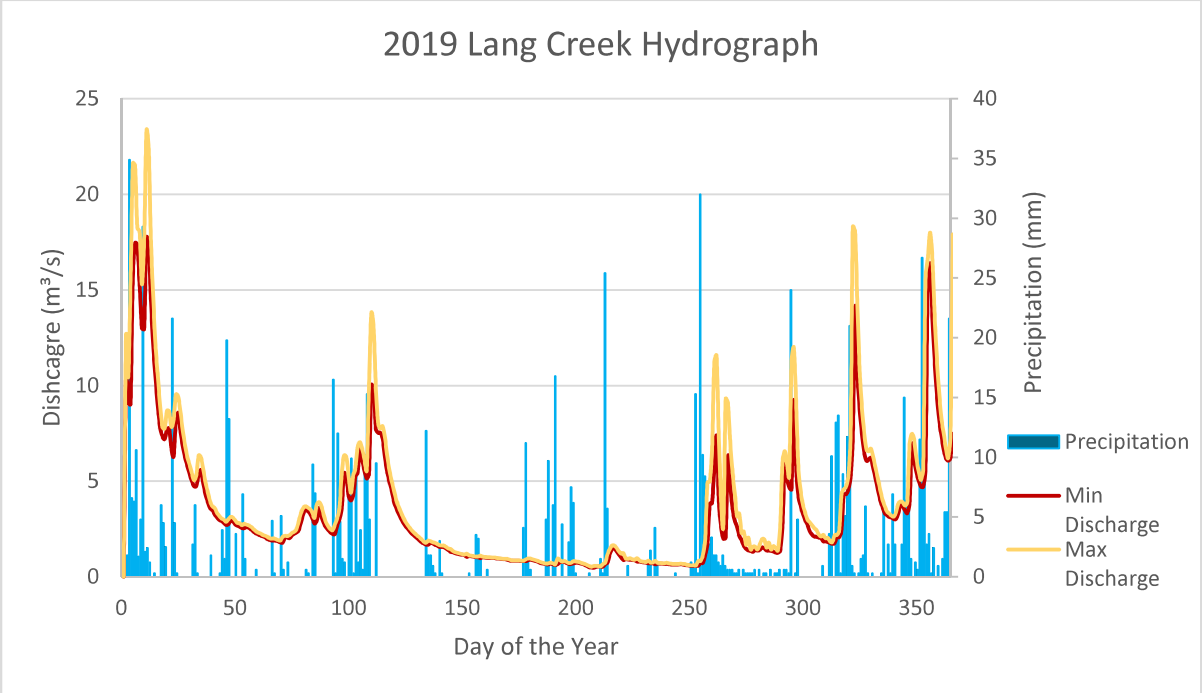


Figure 5: 2019 Hydrograph for Lang Creek. The minimum and maximum discharge (m^3/s) is plotted against the total precipitation (mm) recorded at the same site.

The maximum peak discharge in Lang Creek for 2019 was recorded in January at 23.3 m^3/s. The lowest discharge was in July at 0.472 m^3/s. The average discharge through 2019 was 3.77 m^3/s and the median discharge was 2.38 m^3/s. The 2019 discharge values are less than those recorded in 2018, which had a maximum discharge of 49.9 m^3/s (53% less than 2018), an average of 6.02 m^3/s (37% less than 2018), and a median of 3.99 m^3/s (40% less than 2018). The minimum discharge in 2019 was greater than the minimum discharge in 2018 of 0.382 m^3/s (24% greater than 2018).

5.3 Turbidity

Turbidity was consistent through most of 2019 for all 6 sites, staying between approximately 0.25 NTU and 3 NTU (Figure 6). The turbidity in Lang Creek spiked to 6.47 NTU in the second half of November. Turbidity measurements are greatest in Lang Creek, Haslam Lake, and Blackwater Creek. Slough recorded a small turbidity spike in the second half of April. Anderson and Duck Creeks show minimal changes in turbidity through the year.

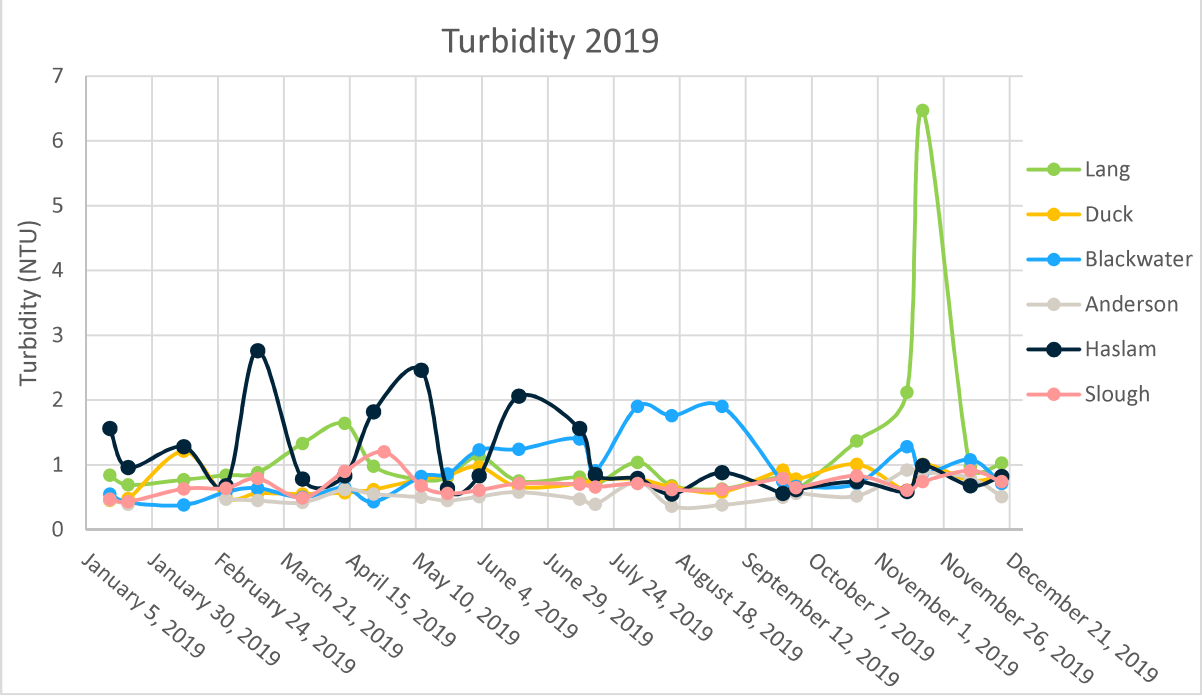


Figure 6: Turbidity through 2019 at six sites within the Haslam Lang Community watershed.

Graphing turbidity data from 1997 to present shows episodic spikes in turbidity through the years (Figure 7). The maximum turbidity recorded in 2019 was 6.47 NTU in Lang Creek, which is well below previous recorded turbidity spikes in the watershed.

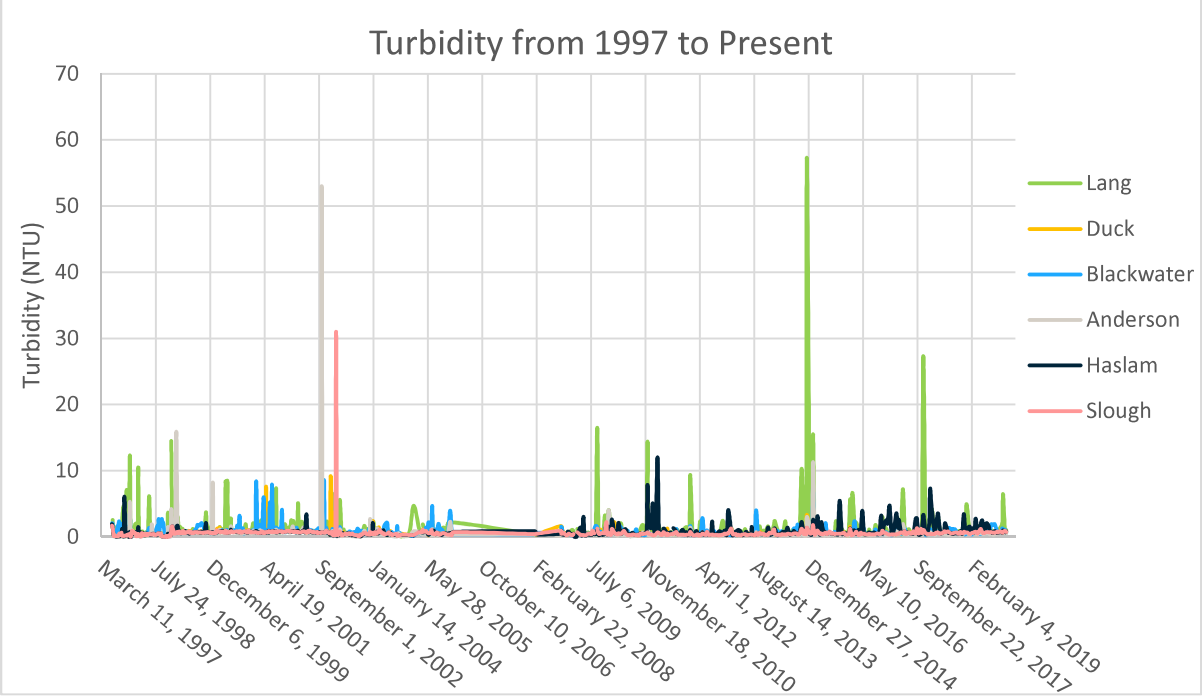


Figure 7: Turbidity at six sites within the Haslam Lang Community watershed between 1997 and present.

5.4 pH

The pH at all measured locations stayed between 6.7 and 7.3 during 2019 (Figure 8). The pH measurements were greatest between June and September and lowest during the second half of October. Variations in pH for the recorded history of each creek are shown in Figure 9. The variation during 2019 is within normal variations over the last 5 years, which is less than the variability recorded from 1997 to 2013.

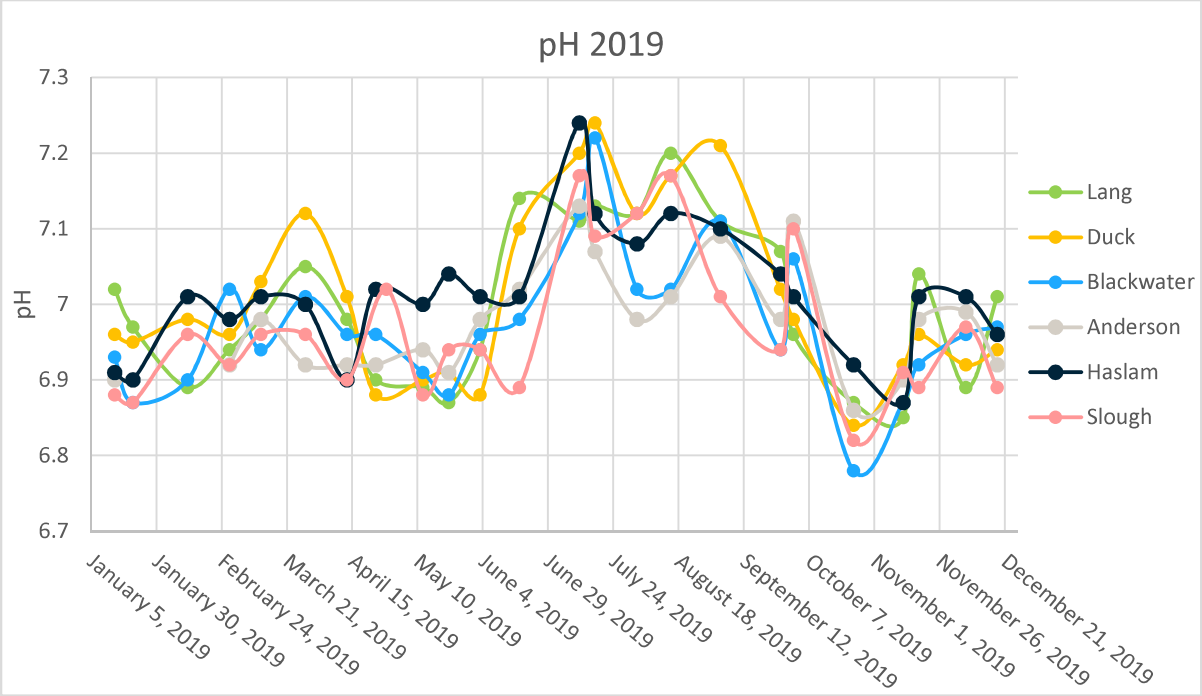


Figure 8: pH at six sites within the Haslam Lang Community watershed.

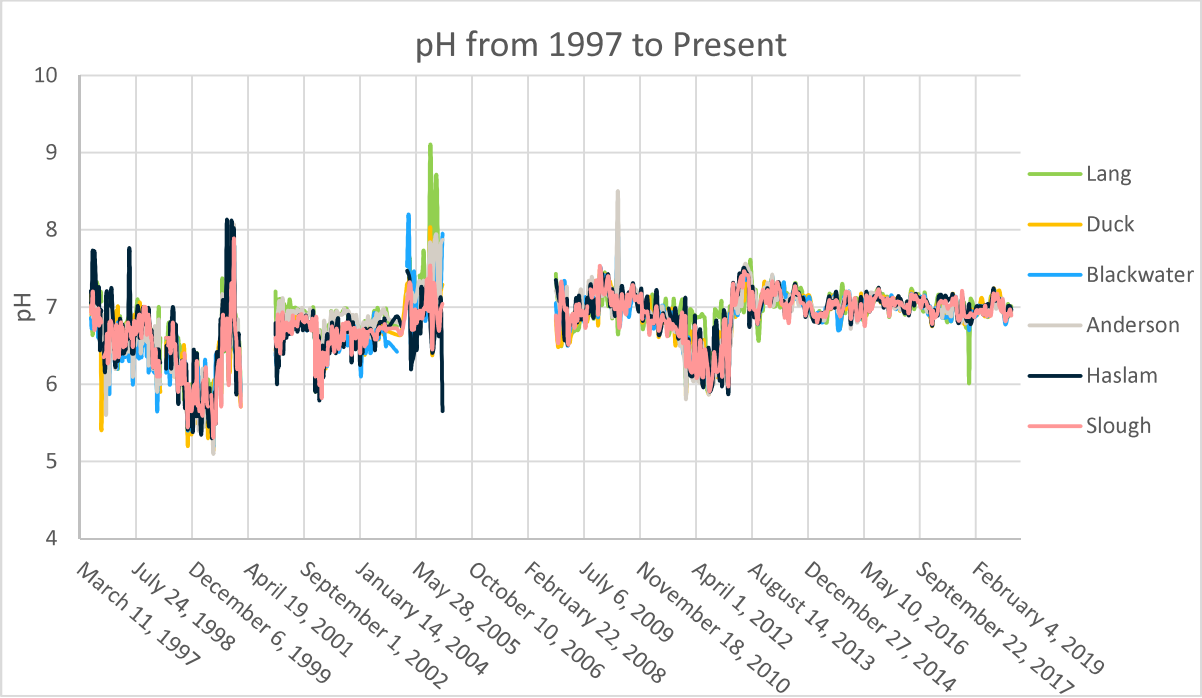


Figure 9: pH at six sites within the Haslam Lang Community watershed between 1997 and present.

5.5 Salinity

Salinity varied from about 4 ppm to 22 ppm at the six recorded sites during 2019 (Figure 10). Blackwater and Anderson Creeks showed the greatest variability in salinity, with the greatest measurements in the watershed from June to September and the lowest measurements in the watershed between the second half of February and the first half of March. Lang Creek recorded a spike in salinity during the second half of November. Haslam Lake showed the narrowest range in salinity, varying between 6 ppm and 14 ppm.

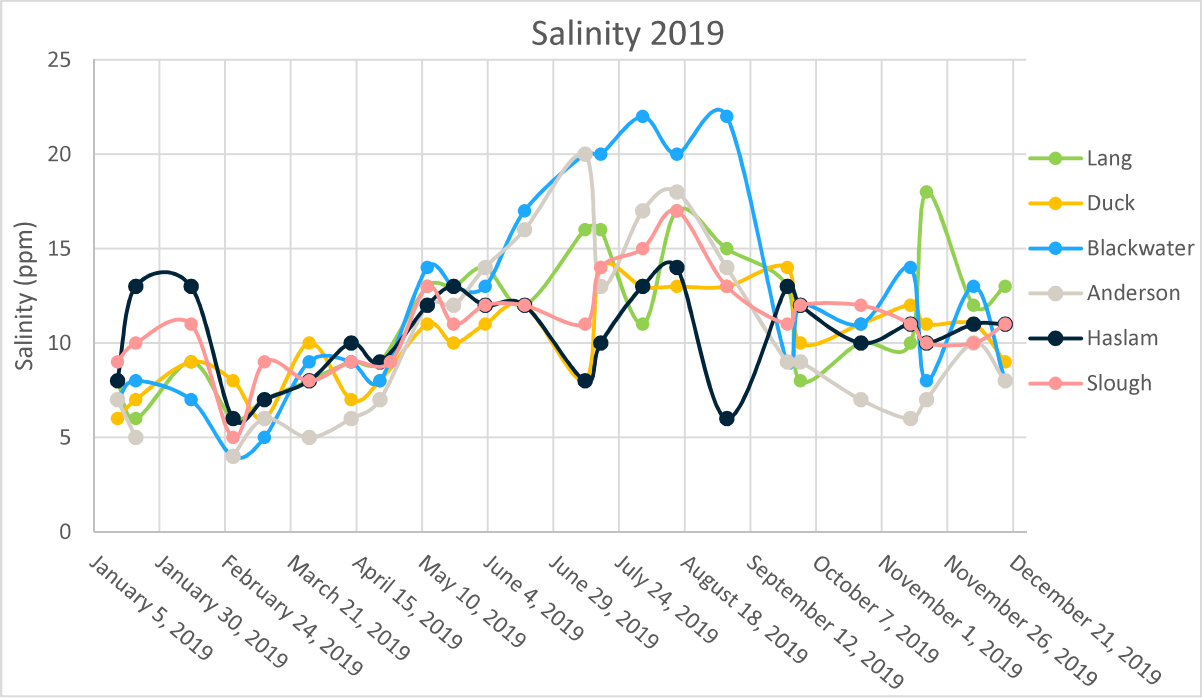


Figure 10: Salinity at six sites within the Haslam Lang Community watershed.

Salinity data from 1997 to present are graphed on Figure 11, with a gap between 2006 and 2008 when no monitoring occurred. Salinity data recorded from 1997 to 2006 are greater than salinity data recorded from 2008 to 2019. The abrupt decrease in salinity could result from equipment or measuring differences between the two periods. From 2009 to 2018, the salinity data for all six creeks varies from 0 ppm to 16 ppm, and has average values between 4 ppm and 6 ppm. Salinity values started to increase at the end of 2018, and they continued to increase through 2019. In 2019, salinity varies from 4 ppm to 22 ppm at the six sites, with average values between 10 ppm and 12 ppm, a 100% to 150% increase from 2018. Blackwater and Anderson Creeks typically have the greatest salinity spikes during the summer months, and that trend continued in 2019. The maximum salinity value in 2019 is 38% greater than the maximum value recorded in 2018.

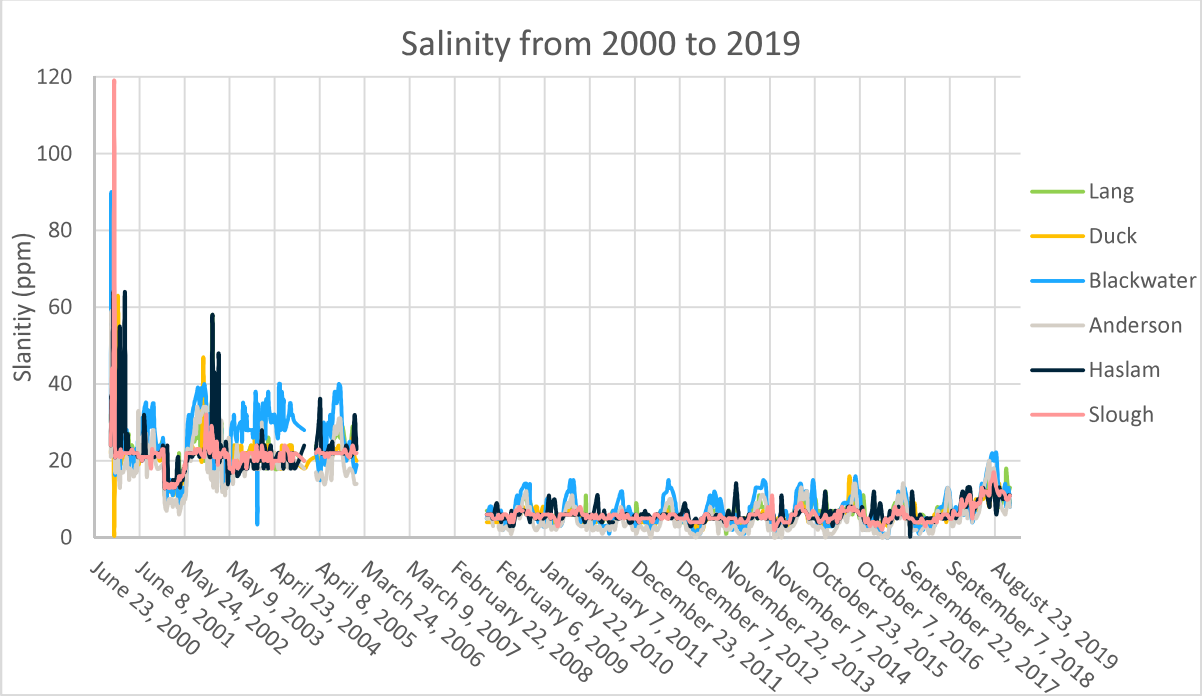


Figure 11: Salinity at six sites within the Haslam Lang Community watershed between 2009 and present.

5.6 Water Temperature

Water temperature data during 2019 shows that the coldest temperatures occurred in February and the warmest temperatures were between May and September (Figure 12). The maximum water temperatures in 2019 were slightly cooler than in the previous several years, and remain within the normal variability recorded at the six sites from 1997 to 2018 (Figure 13). The highest water temperature recorded in the watershed was 23.2 °C in Duck Creek, 8% cooler than the 2018 maximum of 25.2 °C in Duck Creek.

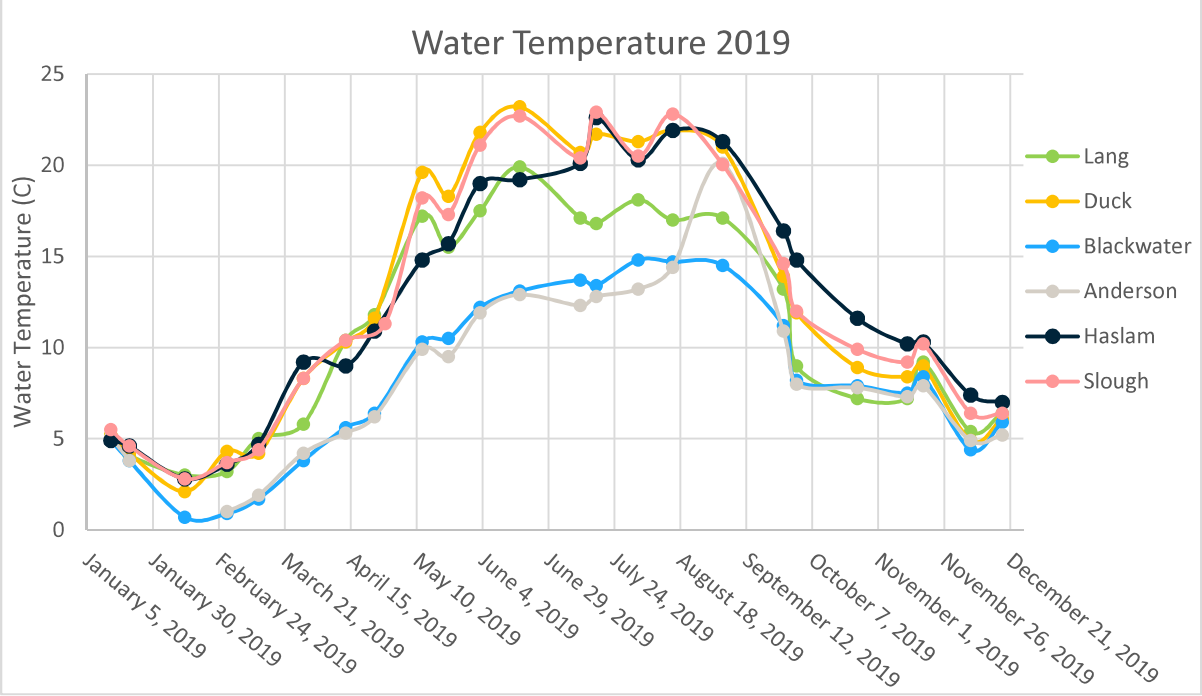


Figure 12: Water temperature measured at six sites within the Haslam Lang Community watershed.

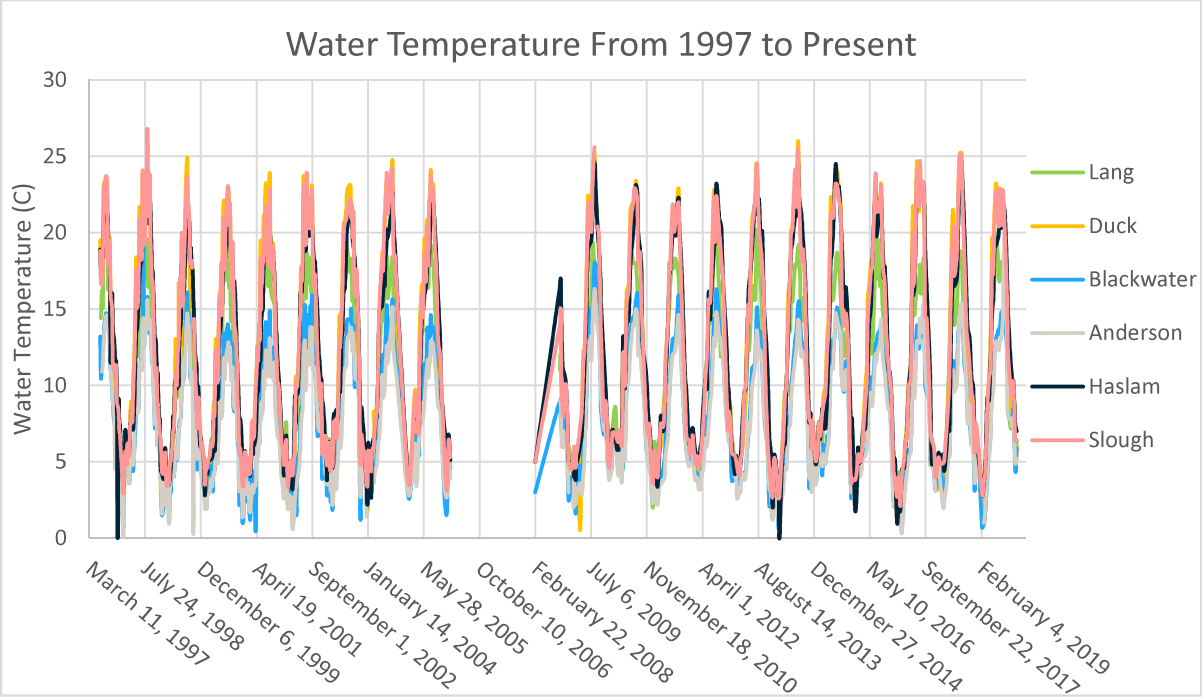


Figure 13: Water temperature at six sites within the Haslam Lang Community watershed between 1997 and present.

6.0 DISCUSSION

The stage of each creek shows similar variability throughout 2019, with peaks during the winter months and the lowest levels recorded at the beginning of September. The stage variability is similar to the precipitation data, with peaks occurring after precipitation events. The stage data at all measurement sites shows a similar trend to the continuous discharge data recorded in Lang Creek. The discharge data shows little variability between the end of May and beginning of September (Days 150 to 250), suggesting that water levels in Haslam Lake fell below the elevation of the weir which controls water flow into Lang Creek. A small spike in discharge after precipitation on August 1 was likely caused by streams flowing into Lang Creek downstream of the weir.

The average discharge in Lang Creek during 2019 was 3.77 m^3/s, which is 2.25 m^3/s (37%) less than the 2018 average of 6.02 m^3/s. The decreased average discharge is likely because 2019 was drier than 2018 and the 30 year average from 1981 to 2010 for the Powell River A climate station. In contrast, the summer precipitation for 2019 was greater than in 2018 and greater than the 30 year average. As a result, the minimum discharge recorded in Lang Creek for 2019 was 0.472 m^3/s, which is 24% greater than the minimum discharge recorded in 2018 of 0.382 m^3/s. Using the measured minimum discharge of 0.47 m^3/s at the Alex Dobler Salmon Centre, we estimate that it is proportional to a discharge of about 0.3 m^3/s in Lang Creek downstream of the weir at Haslam Lake. Measuring discharge at the weir could improve this estimate and confirm whether the terms of the water license are being met.

The turbidity data for Slough, Lang, and Anderson Creeks is similar to the stage and discharge data trends during 2019. The peak turbidity reading in Lang Creek on November 18, 2019 corresponds to precipitation that fell between November 11 and November 18. The bi-weekly stage measurement on November 12 was the highest measurement of the year. The continuous discharge data recorded in Lang Creek recorded a maximum value for 2019 on November 18. Peak flows caused by heavy precipitation or rain on snow events can cause stream bank erosion and landslides, increasing water turbidity. Runoff from roads and ditches can also add sediment to streams during these conditions.

The peak turbidity recorded in Haslam Lake occurred during the first half of the year when stage measurements were at a minimum or falling towards a minimum, probably as a result of inflows to the lake or wind events stirring up bank sediments near the measurement location. The peak turbidity in Blackwater Creek occurred during the summer when stage was at a minimum. The peak turbidity in both creeks is well within normal values for good water quality.

From 1997 to present, the turbidity has been decreasing and the maximum measurements during 2019 are well below maximum values recorded in previous years. This suggests that watershed management practices have been effective by limiting sediment production and reducing the volume of water that transports sediment from roads and ditches directly into the streams.

pH tends to reach a minimum during the wet season when water levels are high and is greatest during the summer when water levels are low. This is typical of creeks where the ground water comprises the majority of flow during summer when water levels are low. Ground water contains more dissolved solids than precipitation and runoff, which increases the pH of water. The pH recorded during 2019 is within the normal variability recorded from 1997 to present.

Salinity values from 2000 to 2006 are greater than values recorded after 2008. The abrupt decrease in salinity values occurred after a two year monitoring hiatus and could be caused by equipment or measuring differences between the two monitoring periods. The data recorded from 2008 to 2019 shows a continuous trend, with increasing values at the end of 2018 and during 2019. The recent salinity increase over the last two years is probably accurate and not due to equipment error, but there is some chance that it is instrumental error. PRSS should check the age and calibration standards of their salinity measuring instrumentation and determine if any source of contamination is present or if any required maintenance to the instrument is necessary. If these sources of bias can be disproved, then the trend in salinity is likely as observed and might be related to the drier than normal year, as discussed below. To verify the data, the PRSS will purchase new equipment, ensuring their results are accurate and reliable.

The greater salinity values recorded at the end of 2018 continued through 2019. The salinity is highest during the summer when water levels are low, suggesting that groundwater contributes to the increase. The stage, discharge, and total precipitation measurements were less in 2019 than in 2018, which means that groundwater makes up a greater proportion of the stream flow. Ground water has more dissolved solids in it than precipitation does, which increases stream salinity. The salinity measurements during the fall of 2019 remained greater than the measurements taken during the spring. A similar trend was observed in 2018, and suggests that salinity levels in the fall do not recover to spring levels, but rather recover to a new equilibrium that is slightly greater. Despite the increase from previous years, the salinity remains low for all streams in the watershed.

Water temperature is coldest during the winter months and warmest during the summer. The coldest water temperature measurement was recorded in Blackwater Creek at the end of February, after a long period of cold. The warmest water temperatures recorded in 2019 are less than in previous years and are within the normal range recorded in the creeks from 1997 to present.

Samples for some general water chemistry parameters like fecal coliform, total metals, and CaCO3 equivalent were last completed in 2010 (Carson, 2017). No data on these parameters was collected in 2018. Additional data collection of these parameters would be useful to maintain a robust baseline monitoring program.

7.0 CONCLUSION

The Powell River Salmon Society (PRSS) monitors water quality in the Haslam Lang Community Watershed, which supplies drinking water to the City of Powell River and the community of Brew Bay. The watershed supports salmonids and there is a hatchery operation on Lang Creek operated by the PRSS. Maintaining water quality is important for providing clean drinking water and maintaining salmon habitat.

The PRSS retained Statlu Environmental Consulting Ltd. (Statlu) to analyze water quality data collected during 2019 and to compare the data with previous years of monitoring. Stage, turbidity, pH, salinity and water temperature were recorded bi-weekly at six locations within the watershed. The measurements were taken at Lang Creek near the Alex Dobler Salmon Centre, the outlet of Duck Lake, Anderson Creek, Blackwater Creek, Haslam Lake, and the weir at the outlet of Haslam Lake named Slough Station. Water quality monitoring at the six sites began in 1997 for most of the recorded parameters. The data collected during this project has been a valuable tool for establishing baseline conditions within the watershed, which allows changes to be detected and analyzed.

The stage and discharge measurements were lower in 2019 than in 2018, but remain within the normal ranges recorded in the watershed. Turbidity and pH varied within the normal range during 2019. The turbidity within the watershed has been decreasing, and pH has been consistently closer to neutral since 1997. Water temperature was slightly cooler during the summer of 2019 than during the previous several years, and remains within normal variations for the watershed. Salinity has increased in all six streams over the past two years, but remains well within good water quality standards. The data suggests that forest management strategies intended to protect water quality have been effective within the watershed.

Data on additional water quality parameters such as fecal coliform and dissolved metals has not been collected since 2010. It would be worthwhile to sample these parameters again in future in order to verify that these parameters remain within desirable levels.

8.0 LIMITATIONS

The recommendations provided in this report are based on observations made by Statlu and are supported by information Statlu gathered. Observations are inherently imprecise. Conditions other than those indicated above may exist on the site. If such conditions are observed or if additional information becomes available, Statlu should be contacted so that this report may be reviewed and amended accordingly.

This report was prepared considering circumstances applying specifically to Powell River Salmon Society and the forestry organizations which provide funding for the water quality sampling. It is intended only for internal use by the client for the purposes for which it was commissioned and for use by government agencies regulating the specific activities to which it pertains. It is not reasonable for other parties to rely on the observations or conclusions contained herein.

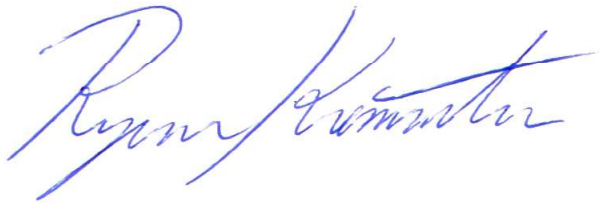
Statlu prepared the report in a manner consistent with current provincial standards and on par or better than the level of care normally exercised by Professional Geoscientists and Professional Agrologists currently practicing in the area under similar conditions and budgetary constraints. Statlu offers no other warranties, either expressed or implied.

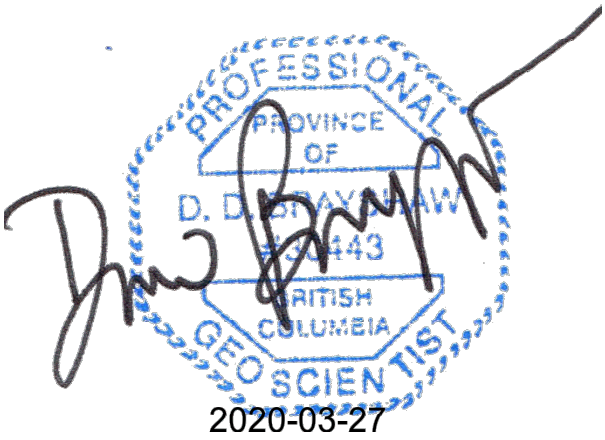
9.0 CLOSURE

Please contact me should you have any questions or if you require further clarification.

Yours truly

Statlu Environmental Consulting Ltd.





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ENVIRONMENTAL CONSULTING

Figure 1: Monitoring Stations within Haslam Lang Community Watershed

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