RESULTS OF WATER QUALITY MONITORING PROGRAM 2018

Haslam Lang Community Watershed

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Client:
Powell River Salmon Society
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EARTH WATER LAND

SUMMARY

The Powell River Salmon Society (PRSS) has been monitoring the water quality in the Haslam Lang Community Watershed for roughly two decades. The community watershed supplies both the City of Powell River and the community of Brew Bay with drinking water. The watershed is not officially designated as a fisheries sensitive watershed because of the community watershed designation, but it does support salmonids and there is a hatchery operation on Lang Creek which is run by PRSS.

The PRSS retained Statlu Environmental Consulting Ltd. (Statlu) to analyze the data gathered during 2018 and compare the results to data from previous years of monitoring. Bi-monthly measurements were taken at six sites including Lang Creek, the outlet of Duck Lake, Anderson Creek, Blackwater Creek, Haslam Lake, and the weir at the outlet of the lake named Slough Station. Water quality parameters such as stage, turbidity, pH, salinity, and water temperature were measured and recorded.

Measurements started in 1997 for most of the water quality parameters. The long record of water quality has been an effective tool to establish baseline conditions for the watershed and detect variations from the norm. The data collected in 2018 does not show any trends that fall outside of the previously measured range of variability, suggesting that forest management strategies intended to protect water quality have been effective in 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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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 Haslam Lang Community Watershed provides drinking water to the City of Powell River and the community of Brew Bay. In addition to community water use, fish are an important resource in the watershed, and PRSS maintains a hatchery operation on Lang Creek.

As part of an ongoing water quality monitoring program, the PRSS retained Statlu Environmental Consulting Ltd. (Statlu) to analyze and discuss the results from the data gathered during 2018 and compare the results to data from previous years of monitoring.

2.0 BACKGROUND

Studies in the Haslam Lang Community Watershed have been ongoing for approximately two decades. The water quality monitoring program within the watershed started in 1997.

The Haslam Lake and Lang Creek Integrated Watershed Management Plan (IWMP) was implemented in 1999 to guide 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 provides a key component of the watershed management plan process by providing water quality data which can be used to identify potential problems and guide management strategies to reduce downstream risks.

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 is currently completing a new watershed assessment.

3.0 METHODOLOGY

Water quality data was collected by PRSS and provided to Statlu for analysis. Five water quality characteristics including stage, turbidity, pH, water temperature, and salinity were recorded on a bi-monthly basis during 2018. The measurements were completed at six sites within the watershed: Lang Creek, the outlet of Duck Lake, Blackwater Creek, Anderson Creek, Haslam Lake near the community water intake, and Haslam Lake at Slough Station (the weir at the outlet of Haslam Lake marked as "Weir" in Figure 1 in Appendix 1). In the past, several additional streams were monitored over the period 1997-2001. These streams are no longer monitored but data collected from them remains relevant as a record of past conditions.

For each water quality parameter, two graphs are presented. The first shows the variability through the 2018 period of record. The second illustrates the 2018 data against the entire length of recorded data for each stream, allowing for quick comparison of the 2018 data against the entire range of past variability. In most of the streams, some data was not recorded between approximately 2005 and 2008, when there was a hiatus in the data collection program.

All the data from 2018 was used as recorded except for one point on October 4, 2018 in Haslam Lake. The salinity measurement was abnormally high, and a field note mentioned that the reading was suspect and the probe was recalibrated subsequent to the measurement. I therefore did not include this point in the salinity graphs. This is consistent with past practice and some corrections have previously been made to the data prior to 2018 to fix input errors as well.

4.0 OBSERVATIONS

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

Photo 1: Stream gauging in Slough Creek, September 2018.

Photo 2: Weir at the outlet of Haslam Lake and the start of Lang Creek.

Photo 3: Introduction of fine sediment into Haslam Lake following the 2017 construction of the new water pipeline.

Photo 4: Side channel of Blackwater Creek caused by overturned tree. Destabilization of banks following recreational use in the area.

5.0 RESULTS

5.1 Precipitation and Air Temperature

Total precipitation and mean air temperature data for 2018 (Figure 2) was obtained from the climate station at Powell River Airport, located at 130 m above mean sea level and approximately 7 km southwest of Haslam Lake (Environment Canada, 2018).

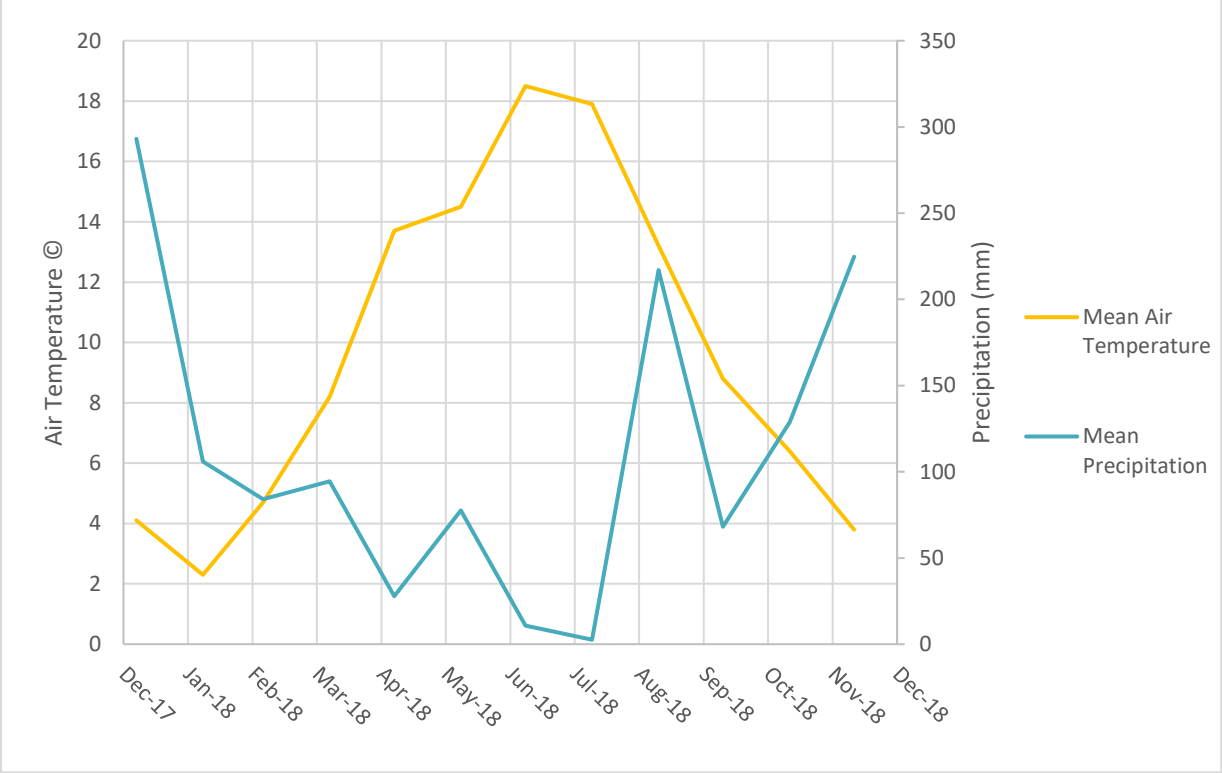

Figure 2: Mean air temperature (C°) and mean precipitation (mm) at the Powell River airport climate station for 2018.

5.2 Stage and Hydrograph

Stage was recorded at six sites throughout the watershed. Stage for Haslam Lake was graphed on a second axis because the measurements were significantly higher than the other sites since they reference geodetic elevation, but how the stage compares to the other creeks is still evident in Figure 3. Figure 4 shows the variations of stage at each site between 1997 and present.

Continuous discharge data was recorded in Lang Creek over the course of 2018. Data included maximum and minimum discharge in cubic meters per second and was graphed against precipitation data recorded at the same site. The resulting hydrograph is shown on Figure 5.

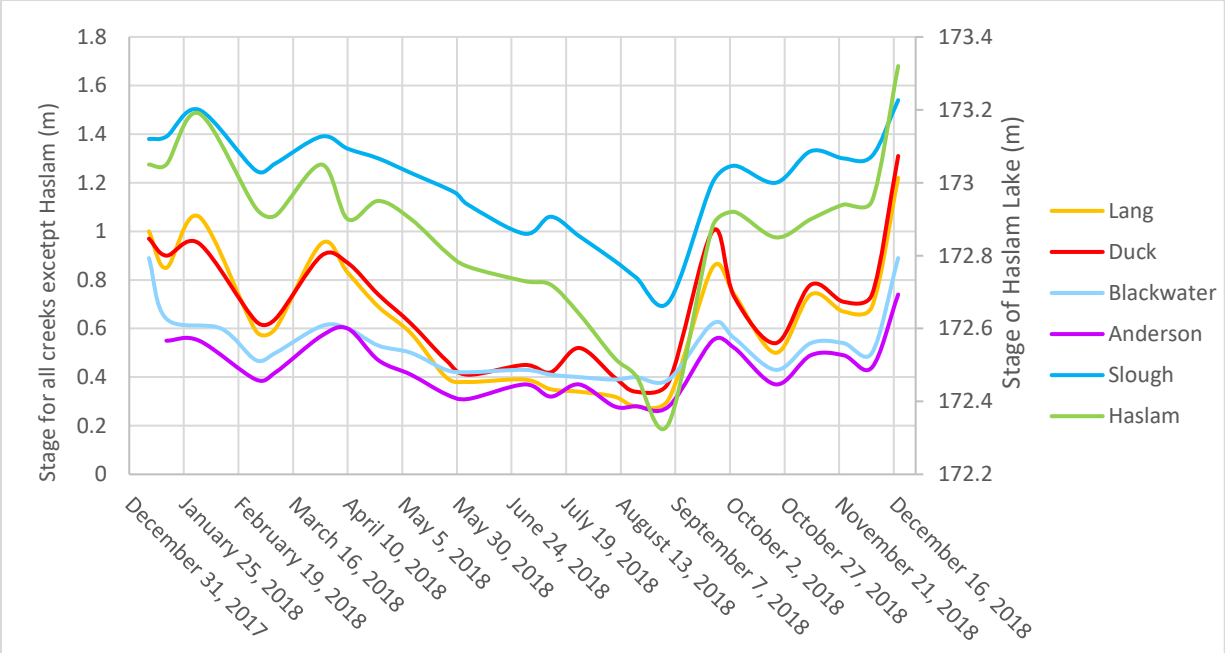

Figure 3: Stage discharge through 2018 at six sites within the community watershed. The stage for Haslam Lake was graphed on a secondary axis to show how the trend of water level fluctuations compare to the other streams.

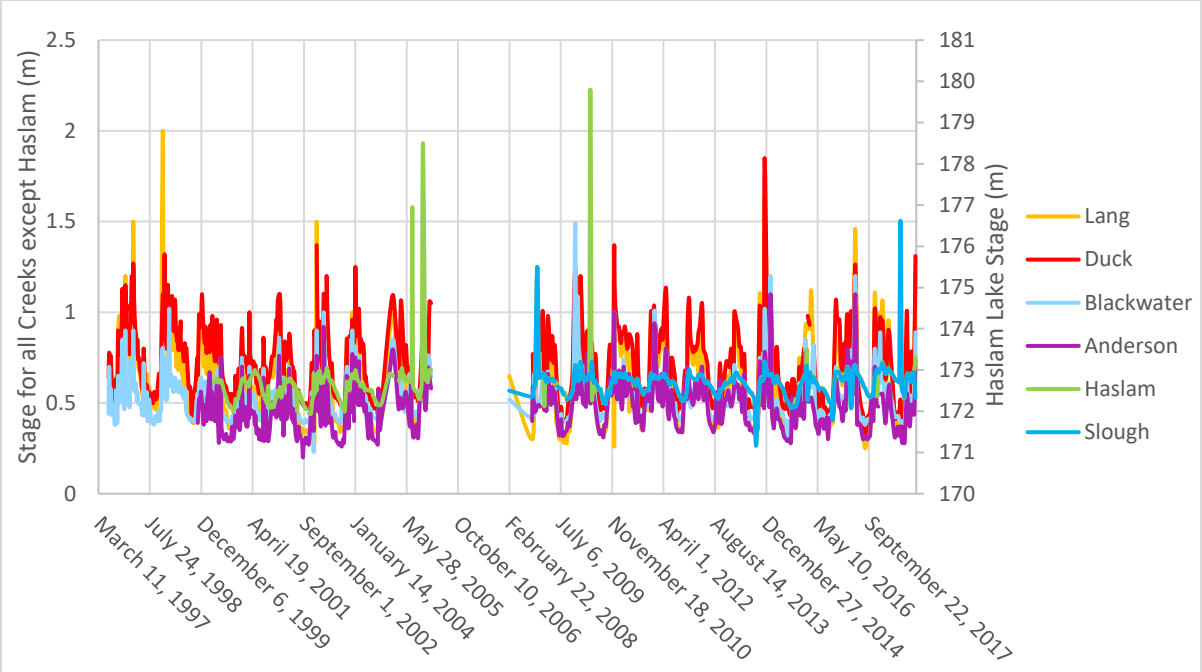

Figure 4: Stage discharge at six sites within the community watershed between 1997 and present. Haslam Lake was graphed on a secondary access.

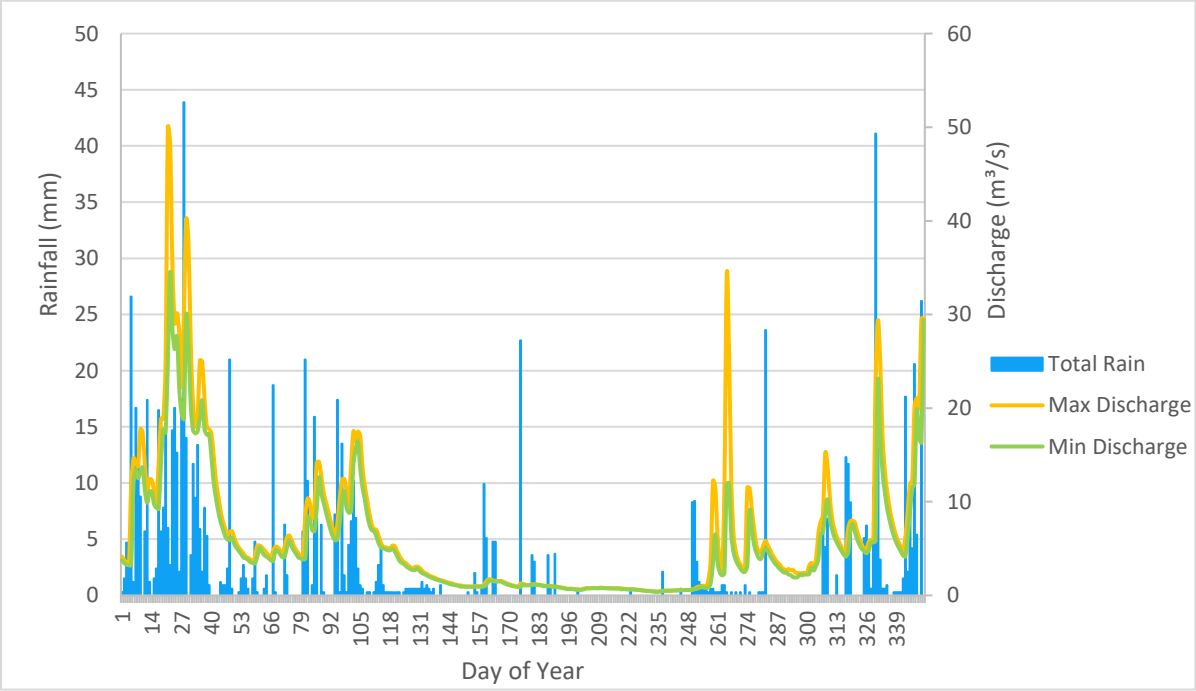

Figure 5: 2018 Hydrograph for Lang Creek. Minimum and maximum discharge (m3/s) plotted against total rainfall at the same site.

The maximum peak discharge in Lang Creek for 2018 recorded in January at 49.94 m^3/s. The lowest discharge was in late August at 0.382 m^3/s. The average discharge through 2018 was 6.02 m^3/s and the median discharge was 3.99 m^3/s.

5.3 Turbidity

The existing water pipeline extending from Haslam Lake to the city of Powell River was recently replaced, becoming operational again at the end of 2017. Excavation from construction resulted in areas of exposed sediment near the Haslam Lake water station. With increased precipitation and surface runoff in January 2018, the excavated area acted as a sediment source, introducing fine sediment and increasing the turbidity within Haslam Lake. The observed spikes in turbidity in Haslam Lake and in Lang Creek over the course of 2018 (Figure 6) may be connected to the construction of the new pipeline.

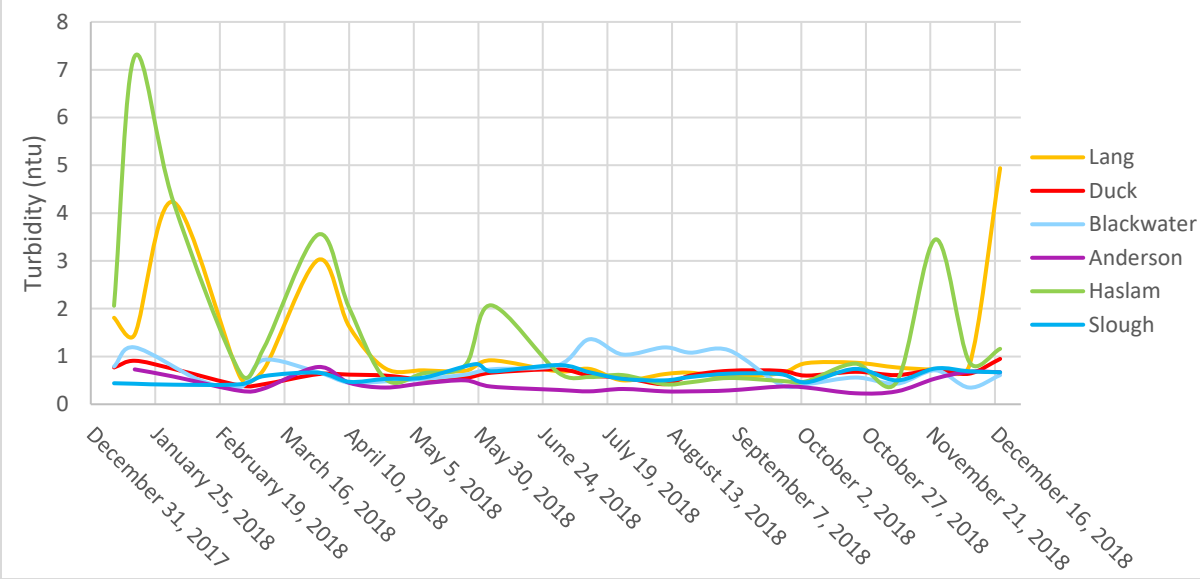

Figure 6: Turbidity through 2018 at six sites within the Haslam Lang Community watershed.

Episodic spikes in turbidity from data starting in 1997 are shown in Figure 7. The maximum turbidity recorded in 2018 was approximately 7 NTU in Haslam Lake. When compared to the rest of the data record, the 2018 spikes are well below previously recorded peaks in turbidity. In general, turbidity for Haslam and Lang follows the trend of precipitation and runoff observed for Lang Creek, while the Slough, Anderson and Duck stations show no significant turbidity.

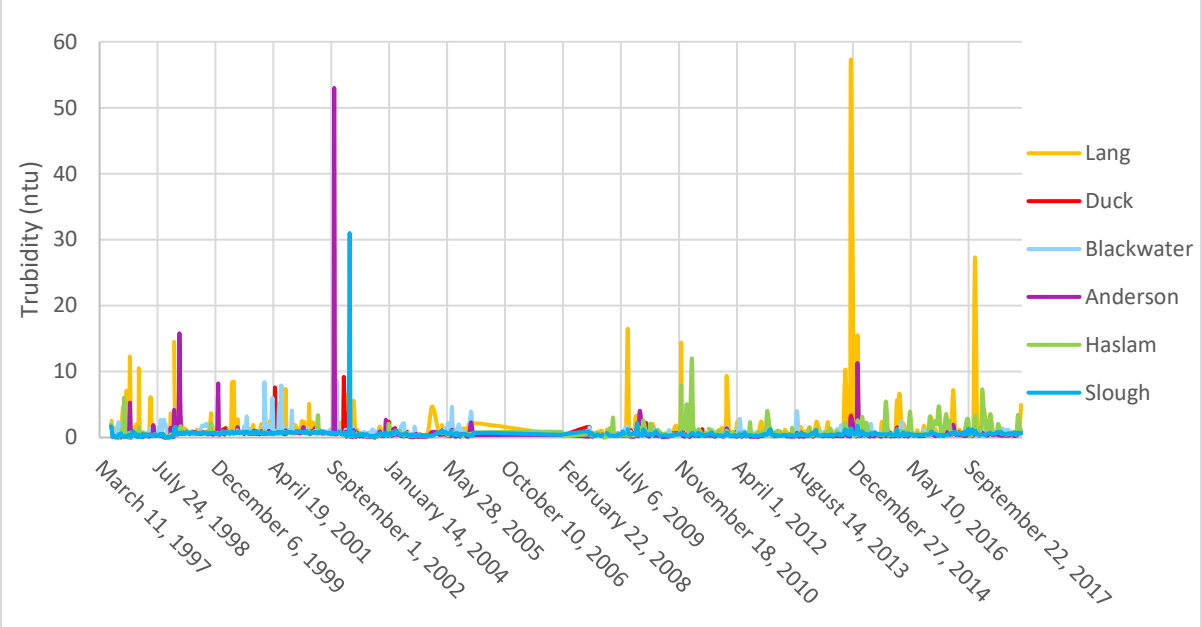

Figure 7: Turbidity at six sites within the Haslam Lang Community watershed between 1997 and present.

5.4 pH

During 2018, pH stayed within the range of 6.6 to 7.2 in all creeks except for Lang Creek (Figure 8). Variations in pH over the entire length of recorded for each creek is shown in Figure 9.

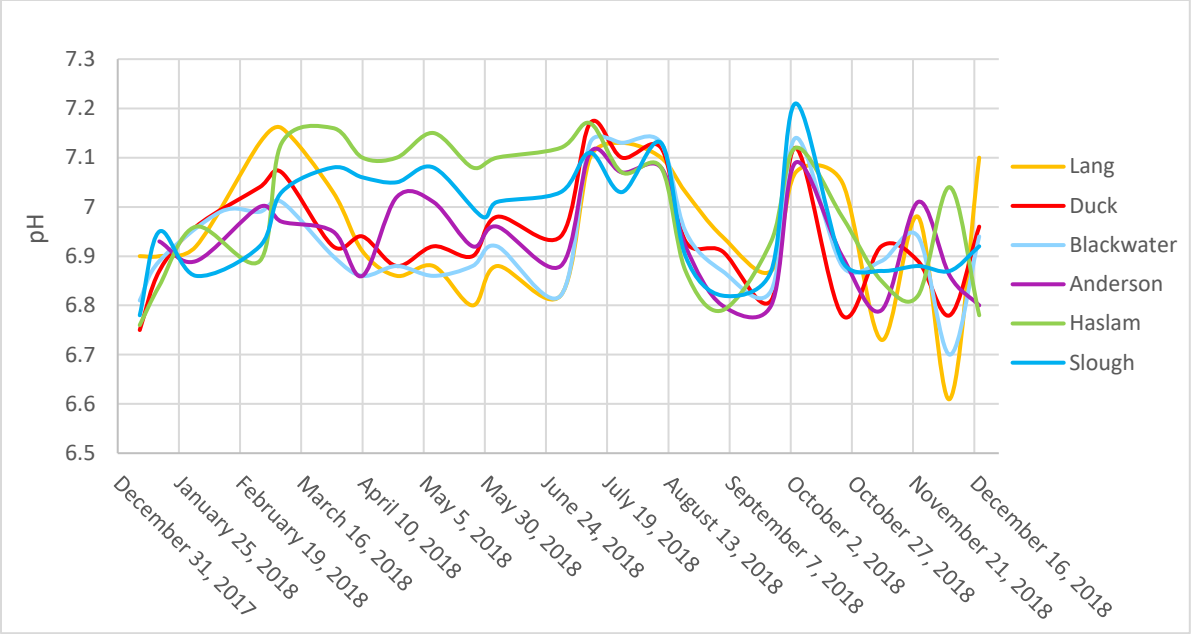

Figure 8: pH at six sites within the Haslam Lang Community watershed.

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

5.5 Salinity

Variations in salinity through 2018 are presented in Figure 10, with Anderson Creek experiencing the greatest variations. Salinity over the course of record is presented in Figure 11 and similarly, Anderson Creek shows the greatest variance. Salinity increased in all of the sampled streams over 2018, but remained within the range of historic variability. There does not appear to be a long-term trend in salinity overall, but historically, Blackwater Creek has had the highest peaks. In the last few years (2017 and 2018) Anderson Creek has had salinities equal to or higher than Blackwater Creek, while the salinity of Blackwater Creek has declined.

Past years' reports have reported water conductivity (milliohms per centimeter) rather than water salinity. The two numbers are related, and one may be converted into the other. The data Statlu received this year was listed as salinity, and we have accordingly reported it as such. The trends are the same regardless of the units used to measure it.

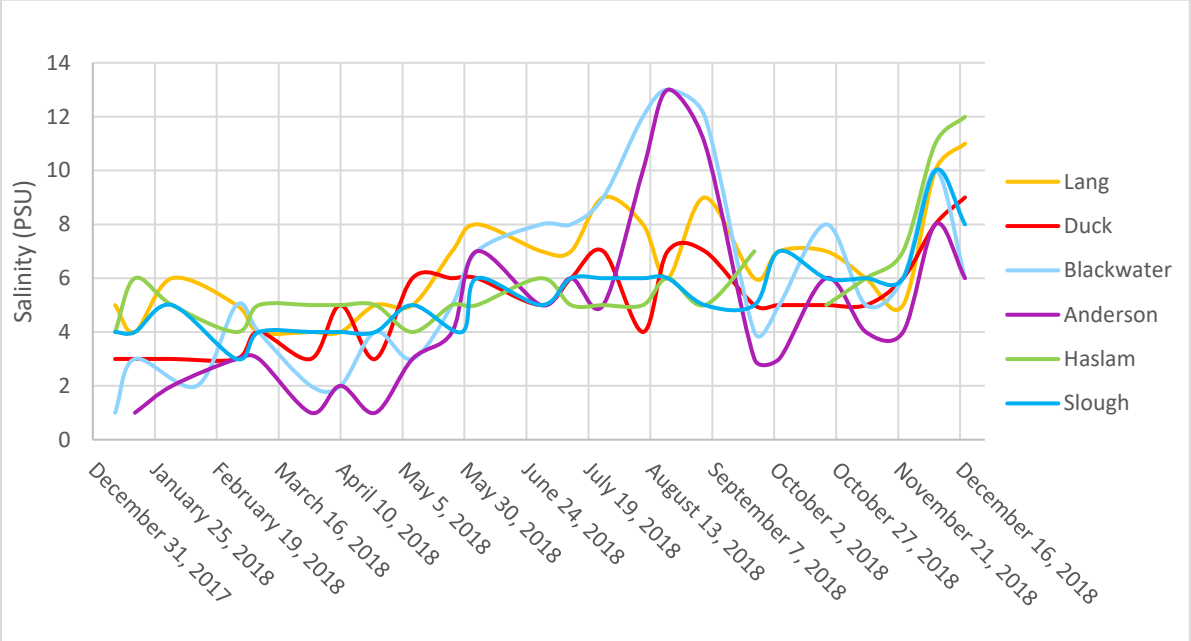

Figure 10: Salinity at six sites within the Haslam Lang Community watershed.

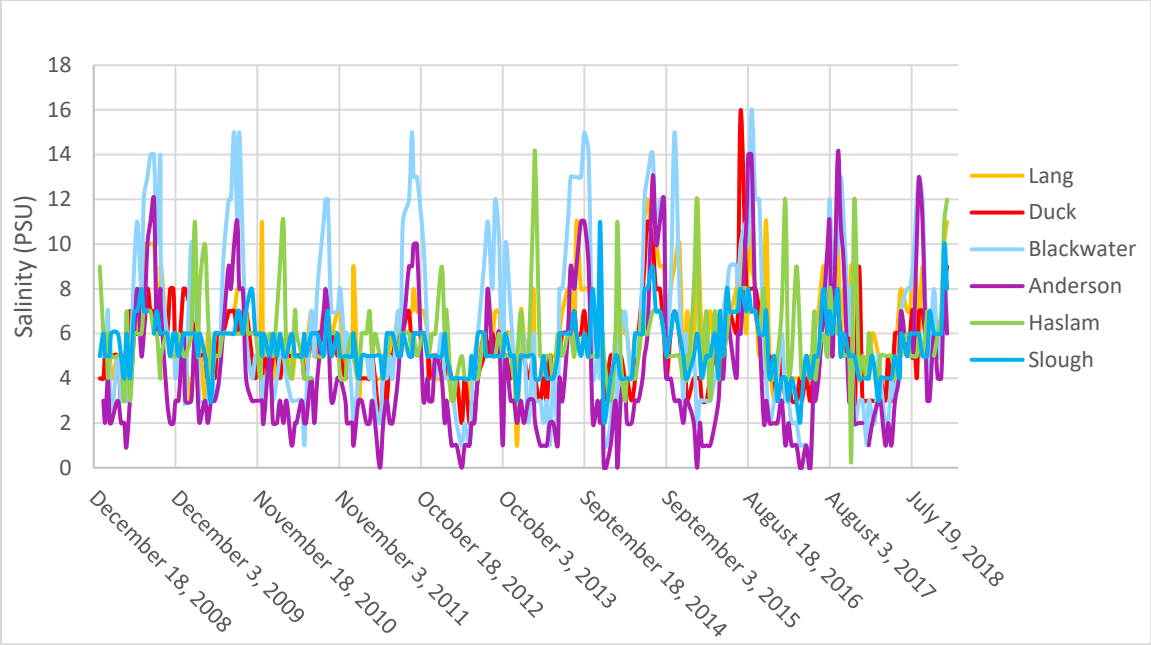

Figure 11: Salinity at six sites within the Haslam Lang Community watershed between 2009 and present.

5.6 Water Temperature

The range in water temperature within in each creek through 2018 is presented in Figure 12, and the range over the course of the entire length of data is presented in Figure 13.

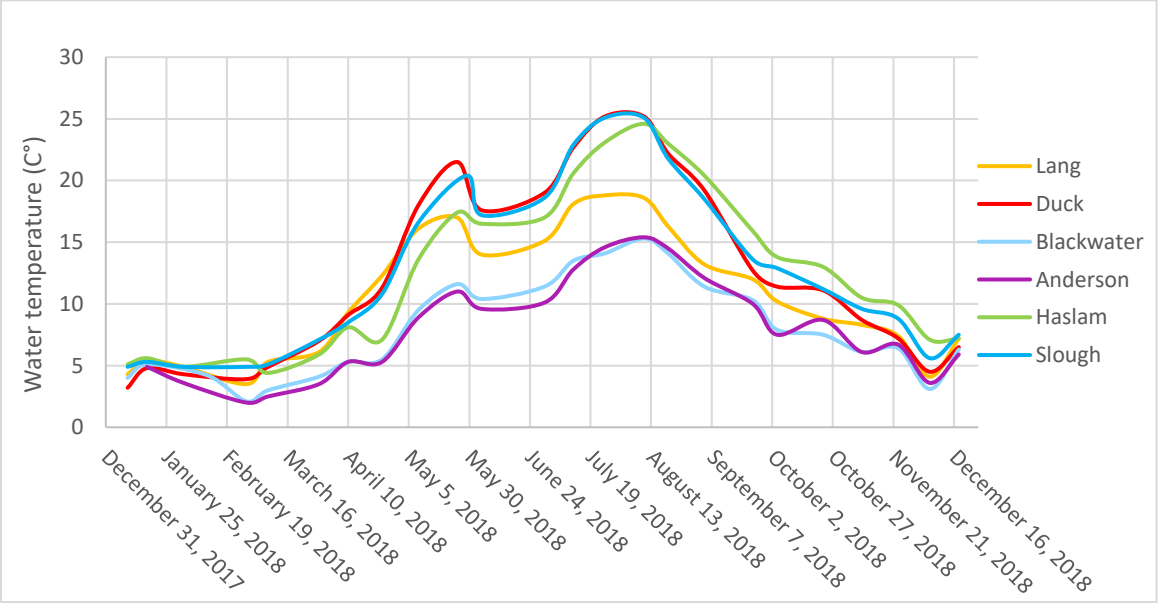

Figure 12: Water temperature in six sites within the Haslam Lang Community watershed.

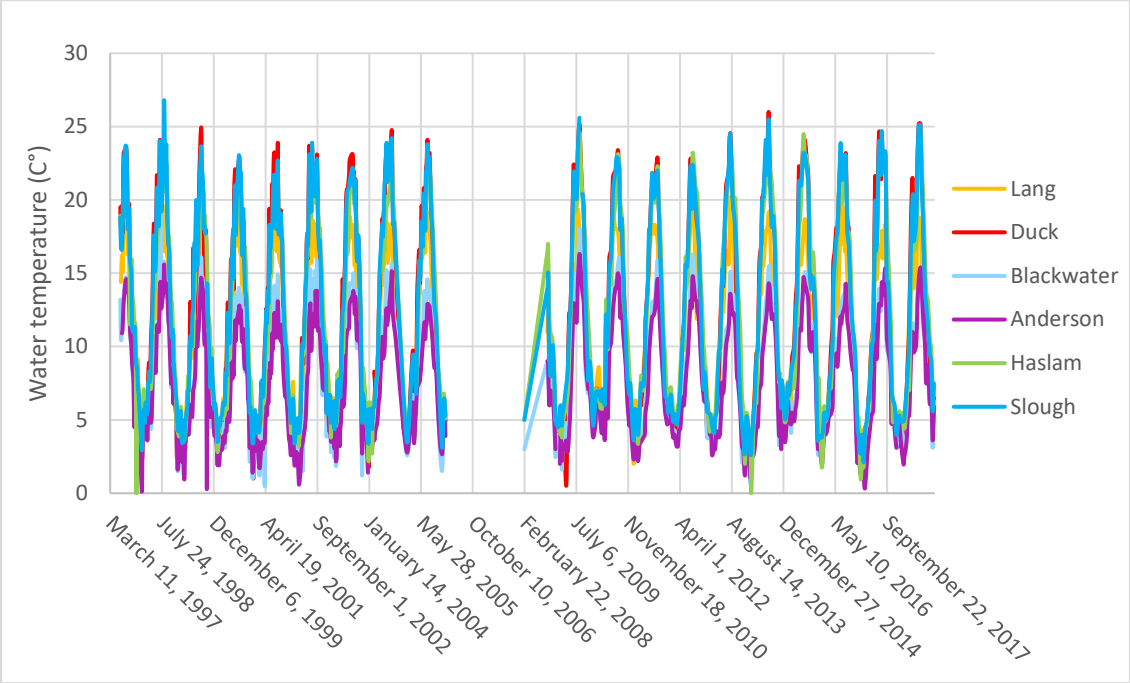

Figure 13: Water temperature at six sites within the Haslam Lang Community watershed between 1997 and present.

6.0 DISCUSSION

The stage of each creek varied similarly throughout 2018 with the lowest flows occurring through the summer months, and peak flows occurring in the winter months. There were no outstanding anomalies in 2018 compared to the stage recorded in all other years. The stage versus discharge relationship at the Slough Station site shows a reasonably strong trend based on the measurements taken between January and March of 2018.

The summer of 2018 was warmer and drier than normal in southwestern BC, with a secondary dry spell occurring throughout the month of October. It is likely that water level was below the weir level at the outlet of Haslam Lake through the summer months, which is presented as sustained low flow in the 2018 Lang Creek hydrograph. With increased precipitation in September, water level likely overtopped the weir, respectively showing greater discharges in the Lang Creek hydrograph before dropping below the level of the weir again in October. Beginning in November with more precipitation, continuous flow overtopped the weir showing increased discharge in Lang Creek.

Peak flows are common after rainfall or rain-on-snow events and can decrease channel stability, leading to sedimentation in creeks. Overland flow during these events may also transport fine sediment from roads, ditches, or other sediment sources into waterways. Increases in turbidity are associated with these peak flows that occur during the winter months. Turbidity fluctuated in Lang Creek and Haslam Lake in the winter months, which is likely related to higher peak flows and a potential sediment source from pipeline construction in January 2018. Though the maximum recorded turbidity in Haslam Lake peaked around 7 NTU in 2018, this peak is significantly lower than previous annual maximums, suggesting that watershed management practices to reduce sediment production from roads, and reduce sediment transport by roads and ditches into waterways have been effective.

The 2017 water monitoring report for the watershed (Carson, 2017) summarized the total proportions of time over the period of record between 1997 and 2016 that various levels of turbidity were experienced in Lang Creek, Anderson Creek, and the outlet of Duck Lake. The data from 2018 remains on trend with the results presented in the Carson (2017) report.

pH ranged between 6.8 and 7.2 in all creeks throughout 2018. Since 1997, there have been several trends in pH that were mostly uniform at all six sites. The pH steadily decreased between 1997 and 2000, before increasing again to average around 6.8. Since 2013, the pH has remained steady at around 7.0. During the summer months when streamflow is lower, groundwater makes up a greater portion of stream flow which can result in slightly lower pH readings.

Like pH, salinity tends to increase as groundwater becomes a larger portion of stream flow, which typically occurs in the summer months. These spikes were most evident in Blackwater Creek and Anderson Creek in 2018. These variations are also evident in the longer dataset which started in 2009. The increased salinity observed near the end of 2018 does not match this pattern, but the cause of it is uncertain; it may relate to the unusually dry October weather.

There were no anomalies with water temperature through 2018. Water temperature increased up to 25°C in the slough at the outlet of Haslam Lake and at the outlet of Duck Lake during the summer months when flows were the lowest and decreased down to approximately 2°C in Anderson Creek in the winter months. The highest temperatures recorded in 2018 were the fourth highest on record, but this range in water temperature is in line with the average trends observed since 1997, and summer 2018 was exceptionally warm and dry in southwestern BC.

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) has been monitoring the water quality in the Haslam Lang Community Watershed for roughly two decades. The community watershed supplies both the City of Powell River and the community of Brew Bay with drinking water. The watershed is not officially designated as a fisheries sensitive watershed because of the community watershed designation, but it does support salmonids and there is a hatchery operation on Lang Creek which is run by PRSS.

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Measurements started in 1997 for most of the water quality parameters. The long record of water quality has been an effective tool to establish baseline conditions for the watershed and detect variations from the norm. The data collected in 2018 does not show any trends that fall outside of the previously measured range of variability, suggesting that forest management strategies intended to protect water quality have been effective in the watershed.

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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 Tolko Industries Ltd. 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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APPENDIX 1: FIGURE 1 WATERSHED MAP