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Haslam Lake Lang Creek Water Quality and Quantity Monitoring Program for 2011

Photo by Alex Dobler

Prepared for

Powell River Salmonid Enhancement Society

Funded by BC Timber Sales and the Powell River Community Forest

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Summary

British Columbia Timber Sales and and the Powell River Community Forest provide funds to the Powell River Salmonid Enhancement Society for monitoring water quality throughout the Haslam Lang Community Watershed. This report presents 2011 data (as well as selected 2010 data) and discusses progress of the water quality monitoring program to date.

During 2011, the automated monitoring station located at the Salmon Enhancement Society Counting Station at the mouth of Lang Creek continued to record stage, rainfall, turbidity, and water and air temperature on a continuous basis. Stage, water and air temperature data was deemed reliable with sensors working properly. Unfortunately turbidity data was rejected in its entirety. The rainfall meter appeared to be working but the calibration must have been off and so rainfall total was underestimated.

Bi-monthly, on-site sampling has been carried out by the Powell River Salmonid Enhancement Society at six strategic locations within the watershed throughout the 2011 season. This data has been collected from 1997 to present with a two year gap (2006, 2007) and provides an excellent historic record of variability of water quality parameters. As well as capturing water quality data at distinct points in time at a number of locations, the repeated visits of the observer to sites throughout the watershed enhanced the understanding of local sediment generation problems.

Water temperature recorders, (Hobos) have been employed in 2011 on Anderson Creek, Blackwater Creek and at the hatchery on upper Lang Creek. This continuous temperature data was of high quality and provides important insights into temperature fluctuations during the critical maximum high water temperatures of summer.

The hydrograph developed from lower Lang Creek data indicated a peak flow of 30 m^3/sec in a mid November storm whereas in December 2010 there was a peak flow measure at 62 m^3/sec. Summer low flow appeared to be similar with those in 2010, albeit not such a long duration. Management of the weir outlet and sluice gates strongly influences both high and low flow on Lang Creek.

As a result of non-participation of the Ministry of Environment, no water samples were analyzed by laboratory in the 2011. Last year that laboratory samples were analysed was 2009

All digital data, well beyond what can be presented here, is archived at the office of the Powell River Salmonid Enhancement Society and can be made available to interested users.

Recommendations are provided to fine tune efficiency of the monitoring program. As mentioned in last year's report the existing turbidity meter at the mouth of Lang Creek should be removed from service. Recalibrating the low discharge portion of the rating curve is also recommended. The rain gauge should be checked and recalibrated.

I. INTRODUCTION

Forest Investment Accounts (FIA) and the Powell River Community Forest provided funding to the Powell River Salmon Enhancement Society in 2011 to monitor water quality within the Haslam Lang Watershed. The purpose of water quality monitoring is to

- provide information for resource management planning and decision making at the community and regional level;
- establish baseline levels in support of specific criteria/objectives development and attainment reporting;
- provide information on the status, health, trends and uses of water resources;
- employ and train persons from local communities to foster interest and involvement in community watersheds.

This report presents a range of data collected during the 2011 monitoring season, makes some comparisons with 2010 data, comments on management significance of data and provides recommendations for ongoing monitoring.

II. BACKGROUND

The Monitoring Area lies immediately east of Powell River. It is confined to the drainages associated with Haslam Lake and Lang Creek, comprising a total area of around 12,800 ha. Elevations range from sea level at the mouth of Lang Creek to 1103 meters on Tin Hat Mountain. Most of the area falls within the Coastal Western Hemlock Biogeoclimatic zone. Douglas fir, red cedar, western hemlock and alder are the most common tree species found. Along the highest ridges on the north east portion of the watershed, one encounters the Mountain Hemlock Biogeoclimatic Zone. Most of the watershed has either been logged or burned in the last 80 years although small isolated patches of old growth remain. A network of forest roads is maintained within the watershed. An even more extensive network of old skid trails occurs at lower elevations throughout the watersheds and these are now used extensively for recreation activities.

Most of the watershed (excepting land immediately adjacent to Lang Creek) is comprised of crown land. Forestry for timber extraction is likely to be the major industrial use of the watersheds for the foreseeable future. Forest Development Plans have been drawn up, indicating future cutblocks and required access roads. The Ministry of Environment, Lands and Parks, (MoELP) completed the first Coastal Watershed Assessment Procedure (CWAP) in 1997. The results from this study indicated that the forest harvesting activities planned was conservative, and unlikely to influence hydrological characteristics of the watershed. Mining does not play much of a role on the area. Small rock quarries are used for the extraction of road ballast. Agriculture is restricted to a few small hobby farms along lower Lang Creek. Settlement (low density) is likewise confined to the southern strip adjacent to Lang Creek and even less so along the southern slopes of Haslam Lake. Being close to the population center of Powell River, the Haslam Lang area is popular with recreationists for riding ATVs, hiking, and non-motorized boating. Fisheries resources are substantial, particularly in the lower watershed. A large salmon population is supported along the course of Lang Creek within the lower 8 km of channel and adjacent tributaries. Major investment has been made in a fish hatchery, a counting station and an artificial spawning channel on Lang Creek. In 2000, Lang Creek was classified as a sensitive stream because of its high fisheries values. In the summer of 2000, a second Coastal Watershed Assessment Procedure (CWAP) was carried out which supported the conclusions of the first

CWAP. It also stressed that good management would be more important to the continued health of the watershed than the actual amount of watershed logged or roaded. The Community Forest, which is a major licensee, conducted an assessment of its roads positioned within the watershed area in 2009 which showed that the great majority of roads were being well managed. No substantial sediment sources from these roads or cutblocks had impacted water quality at the Powell River Water intake or on Lang Creek itself. Some of the more intractable management problems were often related to recreation uses. This had not changed in 2011.

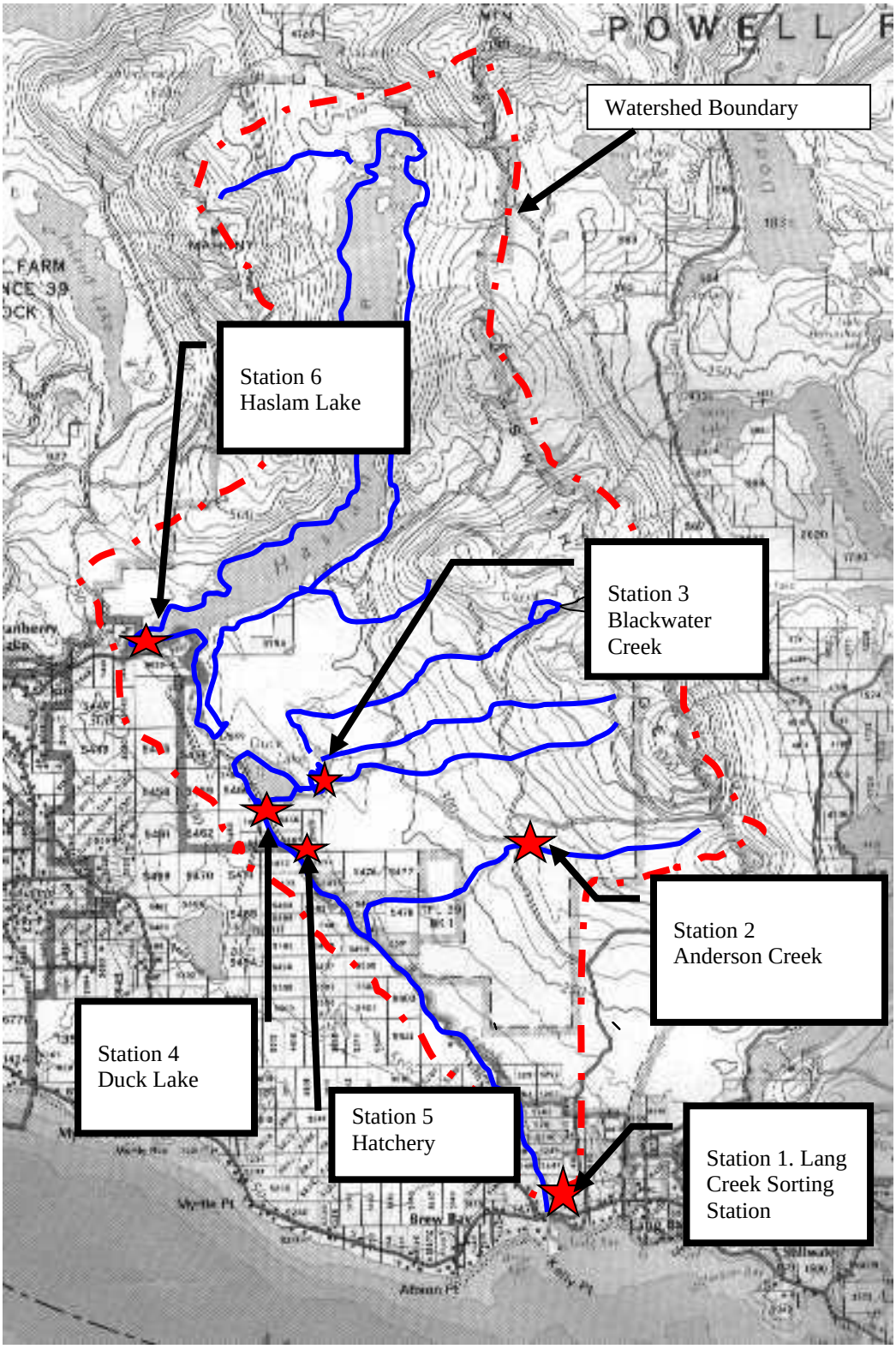
III. METHODOLOGY

This project was instigated to provide a continuation for a monitoring program than ran between 1997 and 2001 and restarted in 2008 within the Haslam Lang Community Watershed. Between 2001 and 2006, the Powell River Salmonid Enhancement Society maintained a small water quality data collection program. The water quality data that has been collected to date provides a reliable base line documenting water quality at strategic locations within the Haslam Lang Watershed. The sampling schedule is presented in Table 1. The sites chosen for water sampling were almost the same as those developed in the original program and are located on the map on Figure 1.

Table 1. Schedule for Monitoring Sites

Station	Sampling Interval	Sampling For
Station 1 Lang Creek Sorting Station Provincial Identification Number E220912	Continuous Bimonthly	Water temperature, stage, air temp, rainfall Portable meter to check on continuous recorders
Station 2 Anderson Creek Provincial Identification Number (4 km upstream of E220913)	Continuous Bimonthly	Temperature by Hobo Portable meter for turbidity, pH, specific conductivity, temp and discharge
Station 3 Black Water Creek Provincial Identification Number E220914	Continuous Bimonthly	Temperature by Hobo Portable meter for turbidity, pH, specific conductivity, temp and discharge
Station 4 Outlet of Duck Lake Provincial Identification Number E220915	Bimonthly	Portable meter for turbidity, pH, specific conductivity, temp, and discharge
Station 5 Upper Lang Creek Hatchery	Continuous	Temperature by Hobo
Station 6 Haslam Lake (near intake)	Bimonthly	Portable meter for turbidity, pH, specific conductivity ,temp

Figure 1. Location of Monitoring Stations within Haslam Lang Community Watershed



IV. SAMPLING PROCEDURES

A. Water sampling for laboratory analyses

No laboratory analyses were conducted in 2011 by the Ministry of environment. This is still considered a significant shortcoming of the monitoring program but was beyond the control of the Society.

B. Analysis using portable meters

Bi monthly analysis of water temperature, pH, turbidity and salinity were conducted using portable meters. Before sampling, the meters were calibrated with standard solutions following directions supplied by the meter manufacturers.

C. Automated samplers An automated stage, rainfall and turbidity recorder is located at the mouth of Lang Creek. (Sorting Station) Data loggers (Hobos $_{TM}$) were used to record hourly water temperature on Anderson, Blackwater and on Lang Creek at the Hatchery near Duck Lake.

V. RESULTS AND DISCUSSION

Results and discussion of data collected during the course of the monitoring program are presented below. Not all data is presented here because of the sheer volume. Some water temperature data was collected at a 15 minute interval, others hourly over the whole year. All of the original digital information used to develop these figures and tables is available on Excel spread sheets at the Powell River Salmon Enhancement Society office.

A. Water Quality

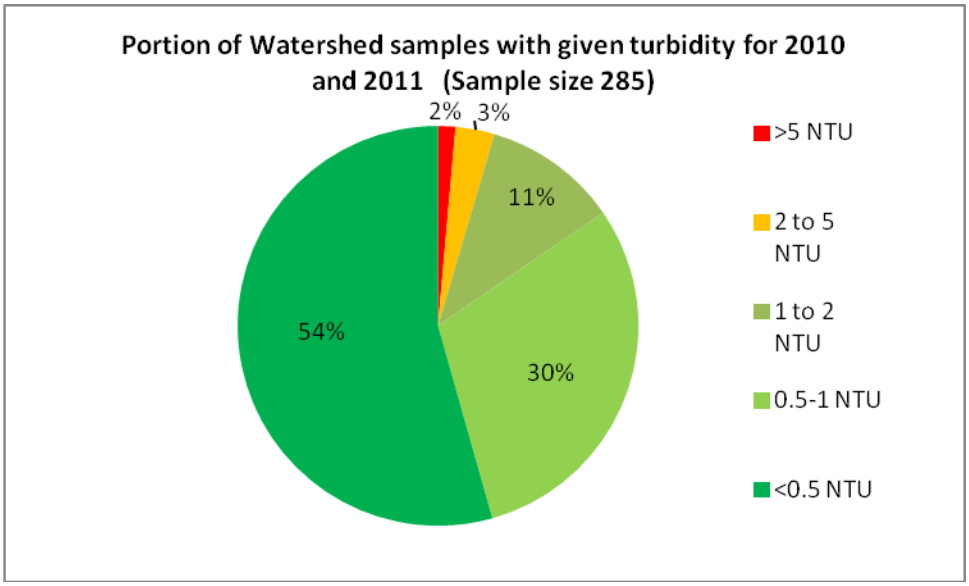
1. Laboratory Results: Water Chemistry and Biology

Last laboratory analyses were conducted by the Ministry of Environment (or their equivalent) in 2009. No new data was collected in 2010 or 2011.

2. Turbidity measurements with portable meter

On Figure 2 all bi monthly turbidity samples are compiled to show their range of magnitude for 2010 and 2011. Of the total of 285 samples taken at 6 sites over the previous 2 years, 4 samples exceeded 5 ntu, 9 samples fell between 2 and 5 ntu, 31 samples fell between 1 and 2 ntu, 86 samples fell between 0.5 and 1 and 155 samples were less than 0.5 NTU. The great majority of events were considered to be natural, ie not influenced by human activities. The few exceptions were noted below.

Figure 2



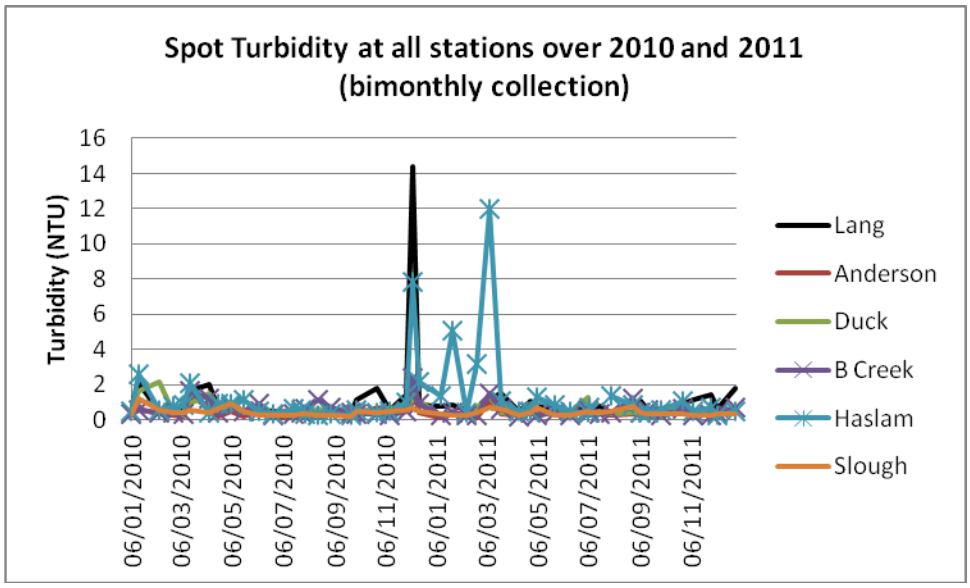
On Figure 3 spot turbidities are provided for 2010 and 2011. At all stations, turbidity events are most common between November of 2010 and March of 2011 and are usually associated with heavy precipitation, overland flow and greater discharge. Previously collected real time data showed peak turbidity flows during the rising limb of the hydrograph. Turbidities did not exceed 2 (and only rarely exceeded 1 ntu) between Spring and Autumn equinox for all sites.

Three of the four turbidity events in excess of 5 NTU actually occurred along the shore of Haslam Lake immediately across from the intake. In all cases these higher turbidities were a result of wave action on unconsolidated materials that occur along the shore when lake levels were extremely high.

Occasional turbidity peaks in excess of 5 (which exceeds Ministry of Health guidelines) occur on Lang Creek. In the 48 samples collected in 2010 and 2011 at the Lang Creek Sorting Station, 1 sample exceeded 5 ntu., 2 samples fell between 2 and 5 NTU, 11 samples fell between 1 and 2 ntu and the rest were less than 1. The small turbidity events on Black water Creek (1NTU) in the summer is most likely a result of dust generated on the Duck Lake FSR.

The reader is reminded that spot checked turbidity readings are a small subset of a total turbidity sample. Turbidity events are episodic and easily missed with spot sampling. However, given the technical difficulties of acquiring good continuous turbidity data, spot recordings are much better than no record at all.

Figure 3. (2010 and 2011 Bimonthly turbidity data)



On Figure 4 turbidity data from the head waters and mouth of Lang Creek are presented. As in previous years, it is apparent that the turbidity events occuring at the mouth of Lang Creek were generated along the channel of the Lang Creek and its tibutaries and not upstream of Duck lake which acts as an effective buffer.

Figure 4. 2010 and 2011 Bimonthly Turbidity Data for Duck and Lang Creek Stations)

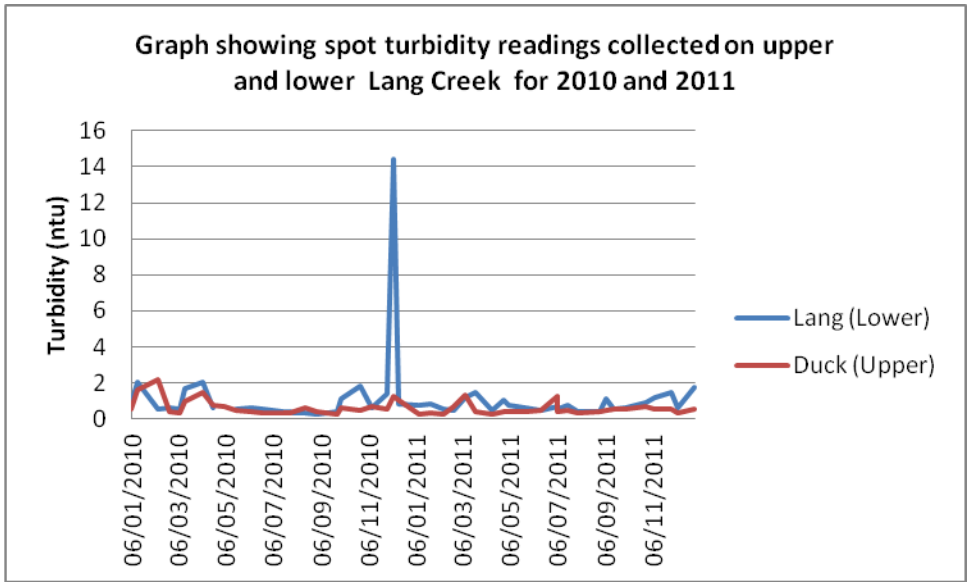
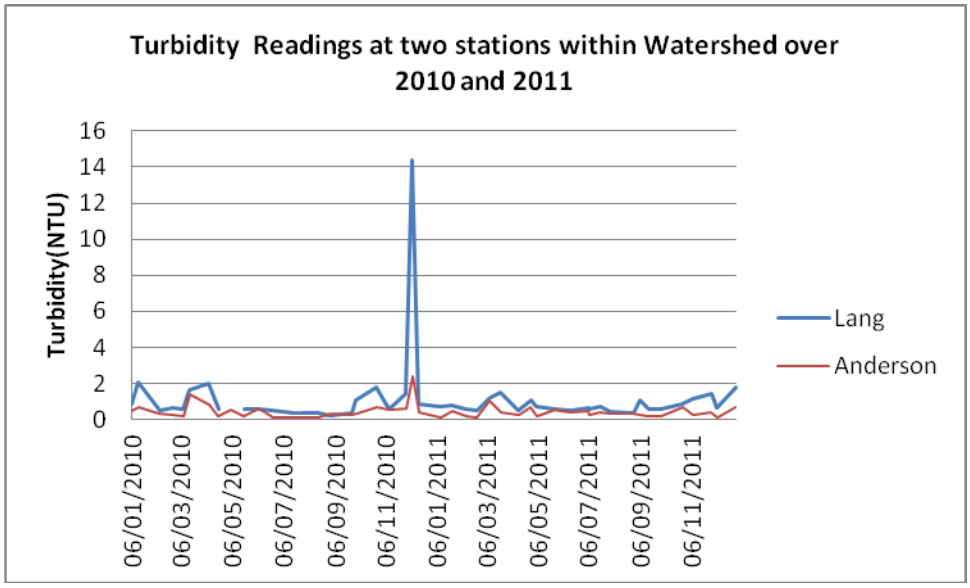


Figure 5 shows that for 2010 and 2011, Anderson Creek always had a lower turbidity value that the main stem of Lang Creek. Nornal "background " levels are generally less than 1 NTU. In the two instance with a slightly elevated turbidity on Anderson Creek, Lang Creek was also experiencing higher turbidities. While all streams in direct connection with Lang Creek will immediately contibute their full sediment load to the main stem of Lang Creek, as mentioned above, the more usual reason for turbity peaks on Lang Creek is sediment generated within the main channel of Lang Creek itself.

Figure 5 2010, 2011 Bimonthy Turbidity Data forLower Lang andAnderson Creek)



3. Continuous Turbidity Meter at Sorting Station on Lower Lang Creek

The continuous turbidity meter located on Lower Lang Creek mis-functioned and could not be calibrated. It did not provide any reliable data for 2011.

4. pH with Portable Meter

Figure 6 shows the variability over 2010 and 2011 in pH for the 6 sampling sites within the watershed. The pH is near neutral to slightly acid. Two anomolies in 2010 show up on this data set which almost certainly a result of the limestone based surfacing material used on the Duck Lake FSR. Small particulate particles of limestone from the road surface has found its way into the stream during those sample events. These increased values of 1 pH unit are unlikely to have any measurable impact on those streams but should be considered if any change in biological activity is noted on those streams.

Figure 6. Bimonthly pH at various stations within Haslam Lang Watershed 2010, 2011

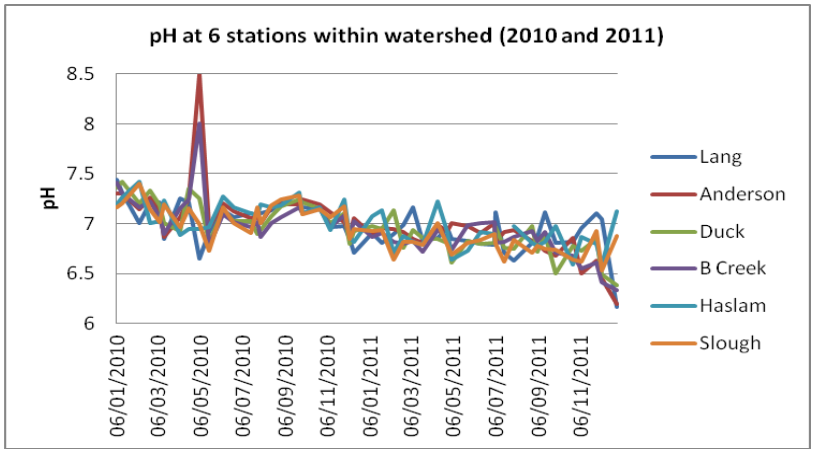
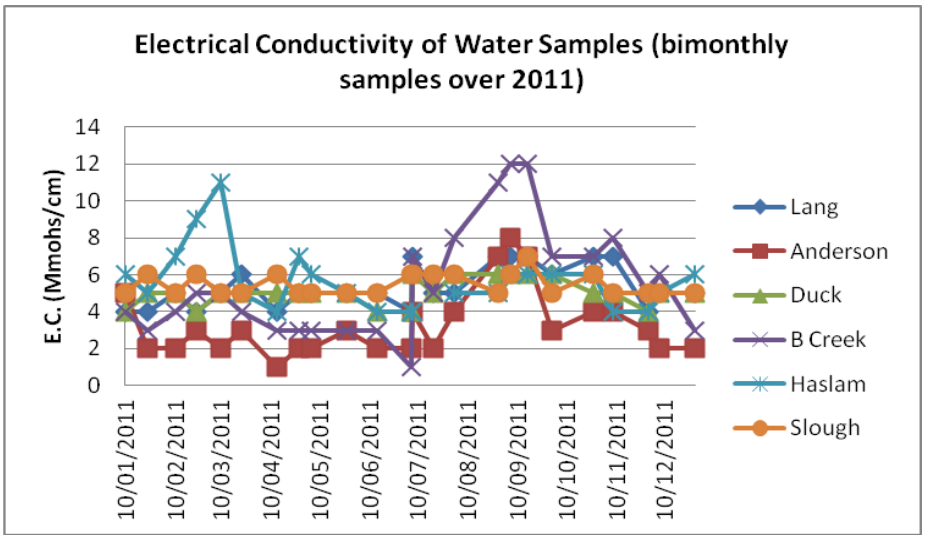


Figure 7 shows the levels of electrical conductivity of water measured over all the 6 sites over 2011. These levels (between 2 and 12 mmoh/cm) indicate a very low level of dissolved salts as is expected in coastal watersheds dominated by granitic bedrock.

Figure 7. 2011 Bimonthly Electrical Conductivity Data

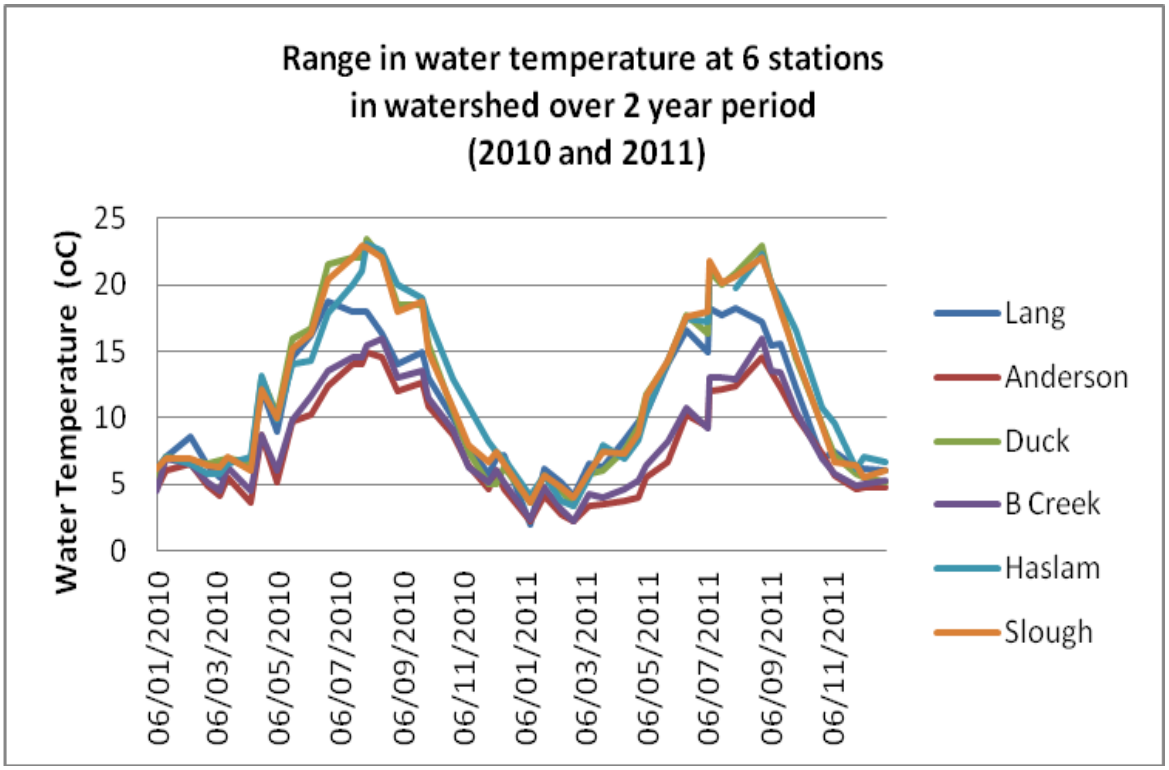


B. Water Temperature Monitoring Results

1. Bimonthly Manual collection from 6 sites within the watershed

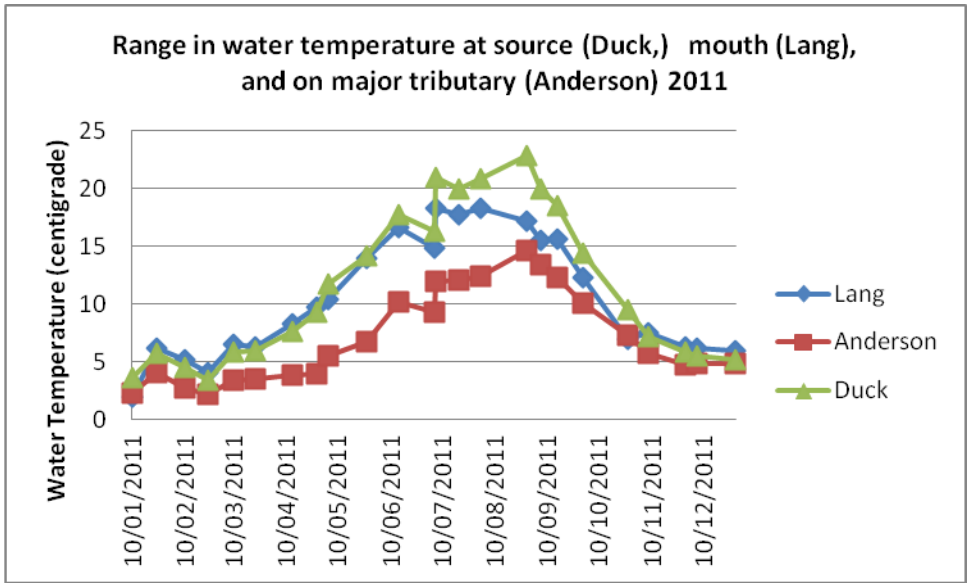
Figure 8 shows the range of, and variability between water temperatures of the major sampling sites over 2010 and 2011. Highest summer temperatures (>22 ° C) are recorded at the surface of lakes, (Haslam, Slough, Duck) lowest summer temperatures from small streams under forest cover (Anderson and Blackwater Creek) and intermediate summer temperatures on streams where warmer lake water is cooled as it flows through forested riparian zone (Lang).

Figure 8. (2010, 2011 Bimonthly Water Temperature at Sampled Stations)



On Figure 9 the cooling effect of Lang Creek water passing from its outlet on Duck Lake to the mouth at the sorting station is portrayed. During the hottest period in the summer, Lang Creek can be cooled as much as 4 degrees centigrade along its passage between Duck lake and the mouth. Evapotranspiration and direct shading from riparian vegetation likely influence this cooling effect as well as additions of much cooler water from Anderson Creek and two other unnamed creeks east of Anderson Creek and ground water seeping directly into the channel. Previous reports have stressed the importance of these small streams as cool water havens for salmonids while the main channel of Lang Creek is much warmer.

Figure 9. (2011 Bimonthly Water Temperature for Upper and Lower Lang Creek and major tributary)



On Figure 10and 11, water temperature data for Anderson Creek is provided. Note that for the warmest period of the summer, at 14 degrees centigrade, the water of Anderson Creek is an important sanctuary for heat stressed fish from the main stem of Lang Creek

Figure 10 Continuous watertemperature data on Anderson Creek over 2011

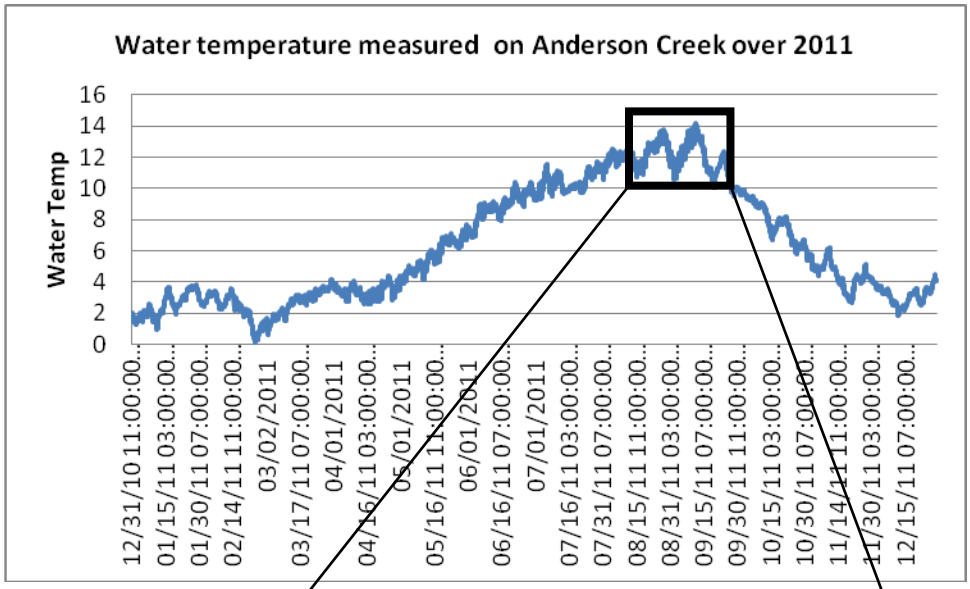
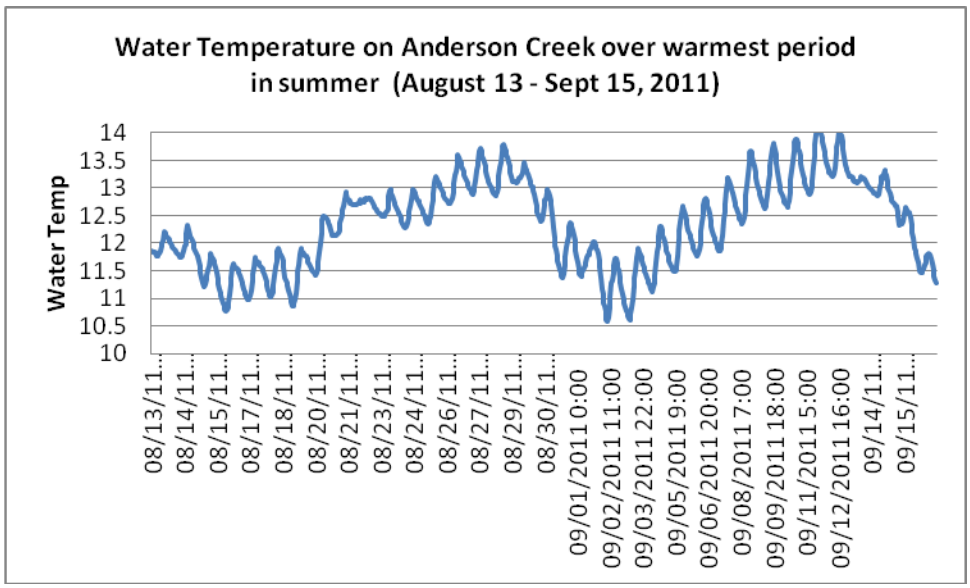


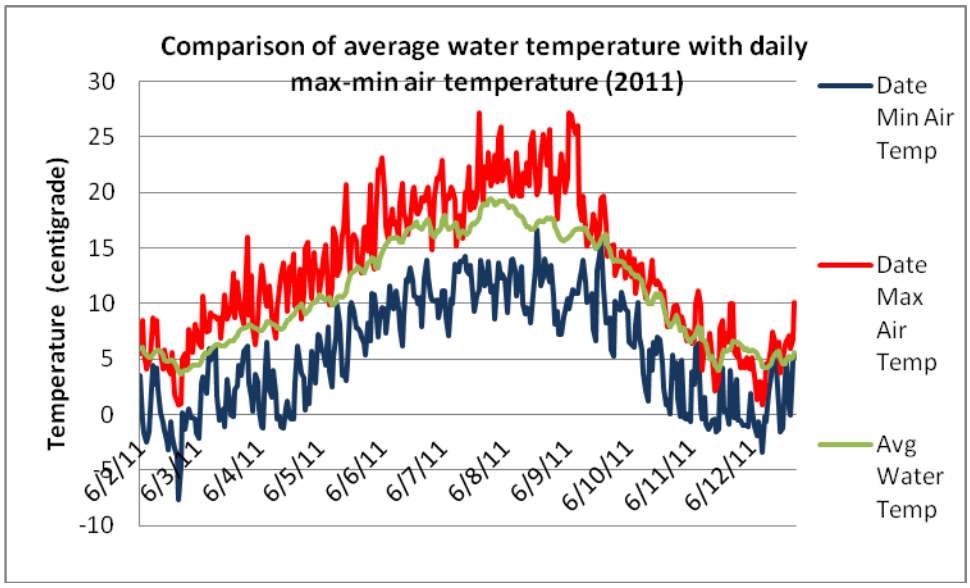
Figure 11 Continuous water temperaturedata for warmest period on Anderson Creek (2011)



2. Continuous Temperature data from Lower Lang Creek (Sorting Station)

Figure 12 provides daily minimum and maximum air and average water temperatures collected from the Sorting Station on lower Lang Creek over 2011. Air temperatures peaked at over 27 º C in midsummer whereas summer water temperatures did not exceed 20 º C. Diurnal variation in air temperature occasionally exceeds 20 º C whereas the diurnal fluctuation in water temperature really exceeds 2 º C.

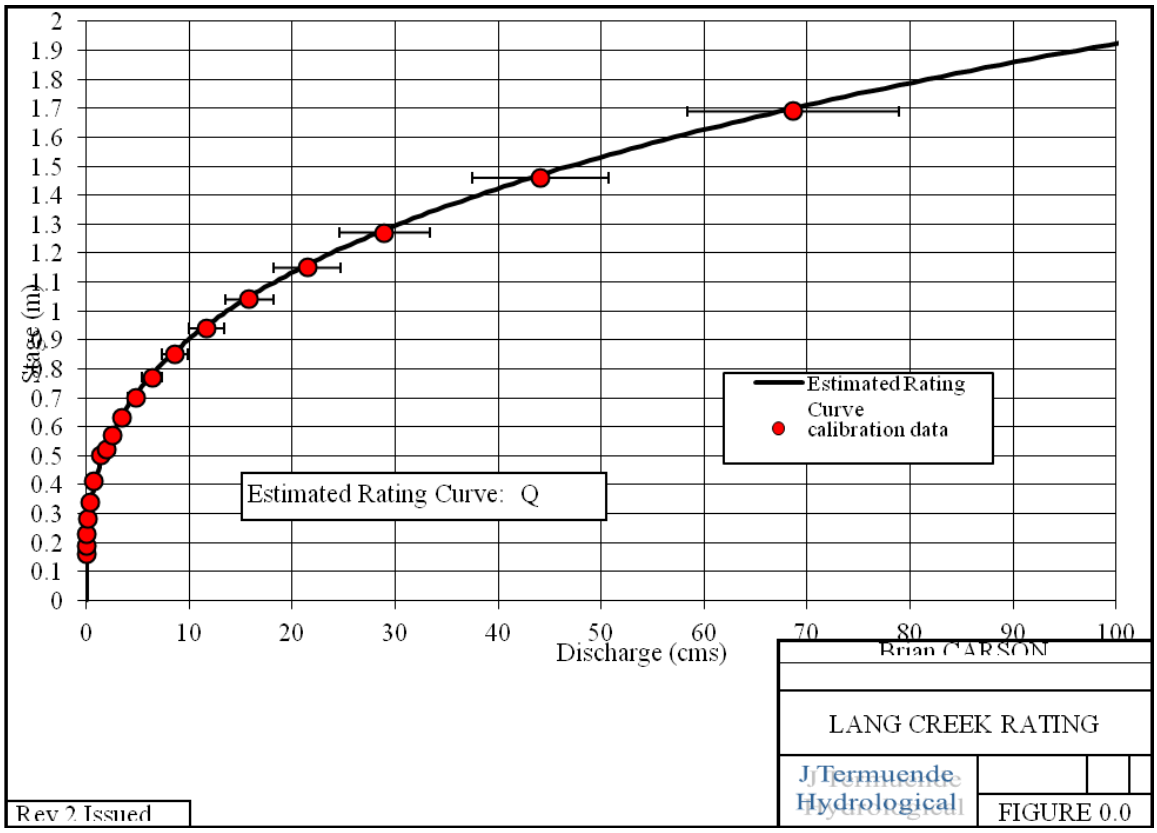
Figure 12. 2010 Max Min Air and Water Temperatures for Lower Lang Creek



C. **Discharge of Lang Creek over 2011 Season**

The original stage discharge curve developed for Lang Creek is presented on Figure 13. It is assumed that the configuration of the channel bed has not changed drastically since this original curve was constructed and higher flows should be relatively good. However, there may need to be some fine tuning at the low flow stages where small changes in the channel configuration resulting from winter storm flow can result in proportionally larger changes in the stage-discharge curve at flows below 1cms.

Figure 13. Stage Discharge Curve for Lower Lang Creek



On Figure 14 and 15, hydrographs for 2010 and 2011 are presented. The highest recorded flow in 2011 was around 30 m^3/sec whereas in 2010 it was double that figure, (62 m^3/sec). As has been stated in previous reports, control on the height of the weir is central to the management of peak flow and requires skilled management. 2011 data recorded a major extended peak flow (25-30 m^3/sec) between March 12 and 18 which was a major snowmelt event. The duration of the low flow period in 2011 was significantly less than in 2010.

Figure1 14

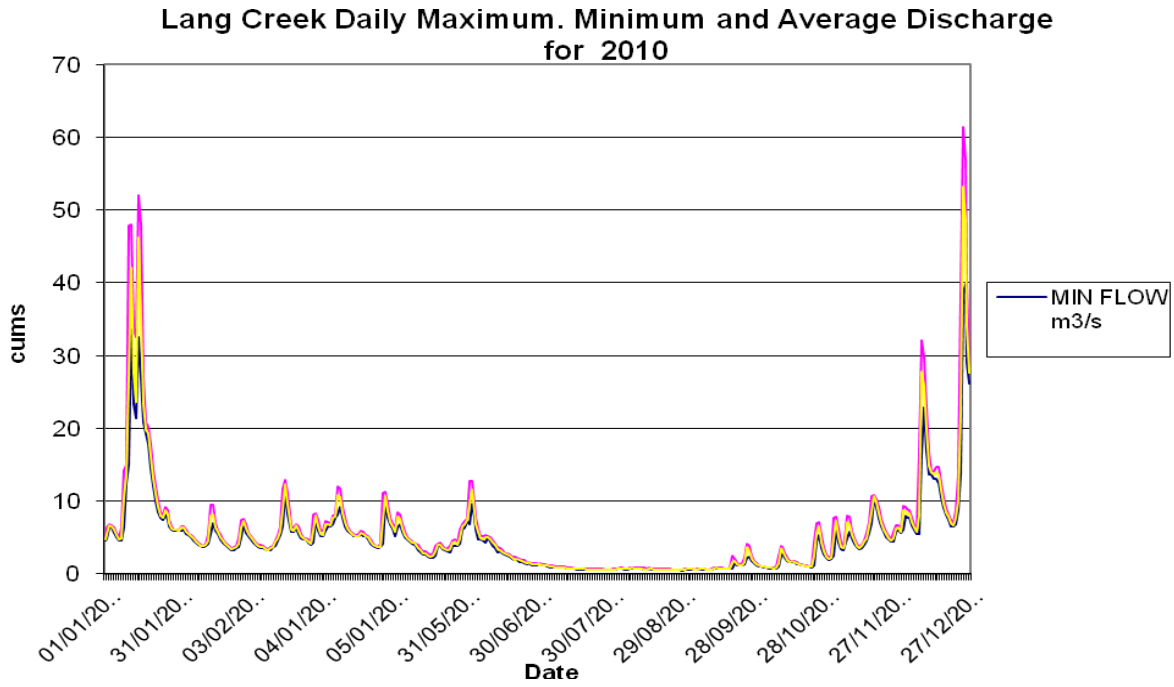
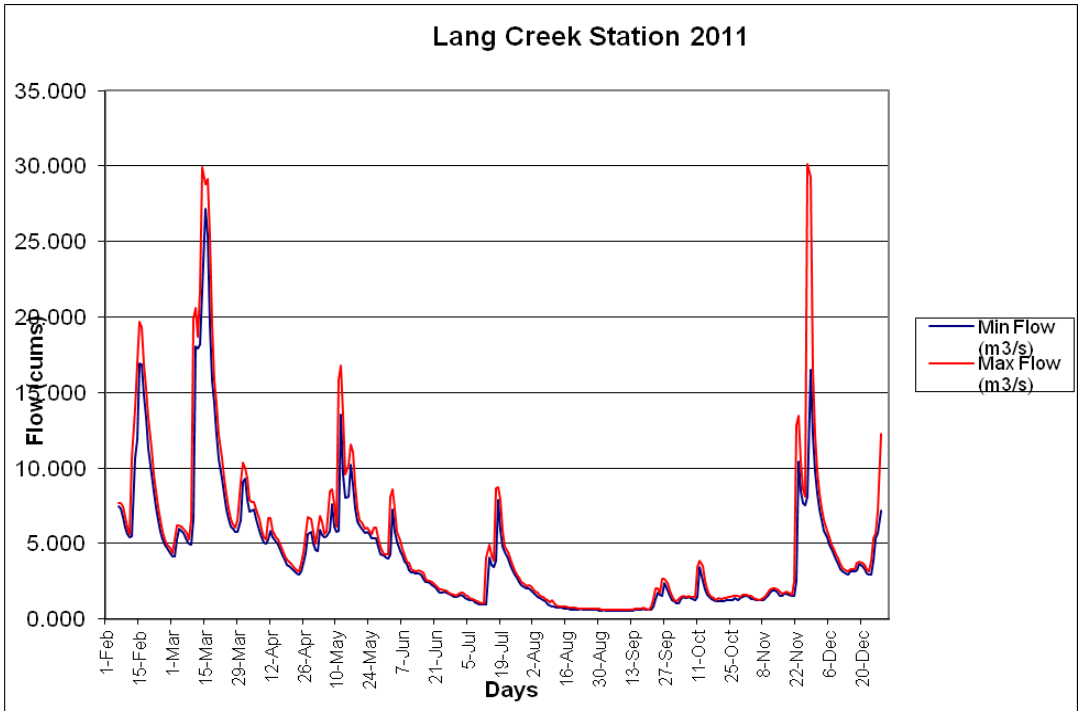
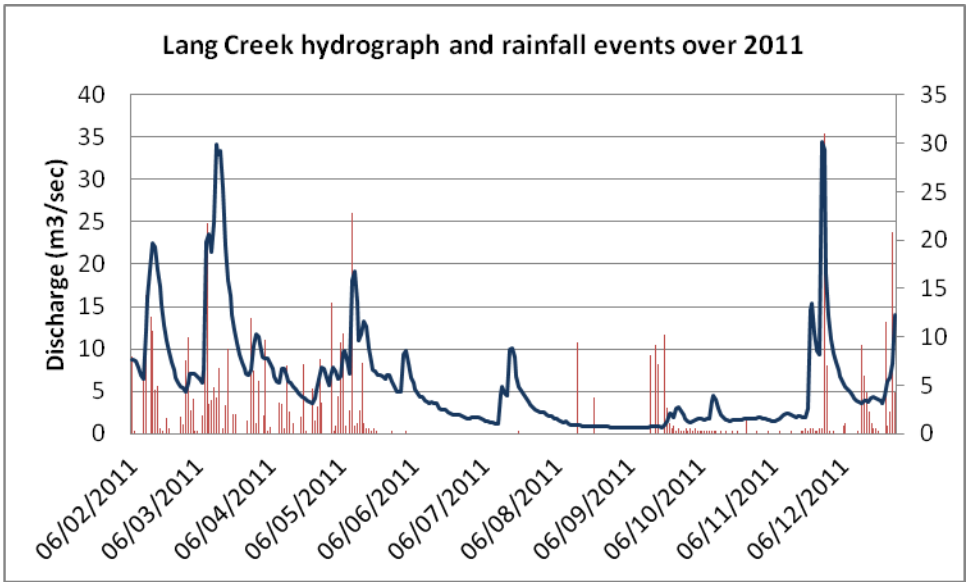


Figure 15



On Figure 16 the 2011 Lang Creek hydrograph is presented in conjunction with available daily rainfal data. While most peak flow events were associated with rainfall an anomoly was noted in the early summer of 2011. It appears that the rain guage was not functioning for that period.

Figure 16



VI. CONCLUSIONS AND RCOMMENDATIONS FOR THE 2012 SAMPLING YEAR

The 2011 season was successful at collecting high quality data and the Powell River Salmon Enhancement Society should be commended for a job well done as a volunteer organization. The data collected in 2011 supports a general conclusion that water quality is not significantly impacted by its various users at this time.

Opportunities to upgrade management of the monitoring network include:

1. The bimonthly sampling conducted at 6 stations throughout the watershed continues to provide an important record of water quality and its variability throughout the year. An equally important role is getting personnel into the field to observe the effects of roads and road use on water quality. These activities are and should remain central to the water quality monitoring within the Haslam Lake, Lang Creek Watershed

2. Laboratory analysis of water samples should be restarted to capture at least 2 characteristic hydrological events at the 5 sampling sites. Most important events to be targeted for sampling include summer low flow and winter peak flow at the selected stations.

3. The Society should re-build stage discharge curve for low flows at the Lang Creek Sorting Station (i.e. with flows less than 1 m^3/sec). This is a relatively easy process and can be done by a non specialist. Once properly calibrated, it would be useful and interesting to compare discharge measured at the Powell River Weir on Haslam Lake with that measured at the Sorting Station at the mouth of Lang Creek. Precise data will be crucial when discussing management of the weir with Powell River District.

4. Allowing too much hold back of Haslam Lake water during winter causes some lakeshore flooding which in turn can become a source of fine sediment generation. The weir is primarily being managed to hold back water to maintain summer and fall discharge on Lang Creek and this will always be its primary purpose. However, two secondary goals might also be considered. 1. Reducing peak flows on Lang Creek and 2. Preventing very high lake levels by keeping lake levels lower throughout the winter.

5. Given the general lack of funds, it is recommended that the continuous turbidity probe at the Sorting Station on Lang Creek be decommissioned.

6. The rain gauge at the Sorting Facility should be inspected to ensure it is working to dealer specifications.