YUKON PLACER SECRETARIAT

Water Quality Monitoring Annual Report 2014

Big Creek Watershed

Water Quality Objective Monitoring, Big Creek Watershed, 2014

Hydrologic and Geomorphic Characteristics of the Big Creek Drainage Basin

Big Creek, a major tributary to the Yukon River, drains an area of approximately 1750 square kilometers and has an overall channel length of approximately 77 km. The drainage basin is located west-south-west of Minto and north-west of Carmacks.

Big Creek has its headwaters in the Dawson Range and eventually drains into the Yukon River below the old town site of Minto. There are several areas of exposed bedrock forming high rock bluffs along the creek. Above the Water Survey of Canada (WSC) gauging station, the creek is entrenched within a narrow valley, while below the gauging station the creek flows through a low flat area before entering the Yukon River. The creek banks are generally lined with spruce, willows and poplars. Most of the creek flows over a bed of course gravel, underlain by shallow bedrock. There has been very little channel migration evident along the lower portion of the creek, below the confluence with Seymour Creek, but above this point, Big Creek has been prone to heavy flooding and substantial migration has occurred.

The Water Survey of Canada gauging station (09AH003) is located 9.7 km from the confluence of Big Creek with the Yukon River.

Topographical drainage Basin	1750 Sq. Kilometers
Area of Lakes	0%
Area of Forest	98%
Channel Length	77 Kilometers
Terrain	75% non-glaciated / 25% glaciated

In 2014, water samples were collected at 5 different sites in the Big Creek basin. Sampling commenced on July 2nd, 2014 and a total of 157 samples were collected up until the end of the season on September 9th, 2014. A combination of automatic composite sampling and grab sampling methods were used in the basin. An additional 12 samples were collected by CMI staff during routine mine inspections.

Atmospheric data was collected using two portable weather stations; one located near the mouth of Big Creek, the second on Seymour Creek above all mining.

Basin total flow data was provided to us by the Water Survey of Canada station located near the mouth of Big Creek. Flow data for the individual tributaries to Big Creek was collected at the time of sampling by the staff of E.M.R CMI using the methodology outlined in the Yukon Placer Secretariats, Water Quality Monitoring Protocol.

Site Codes and Global Position of Water Quality Sampling Locations in the Big Creek Watershed

SITE CODE	LOCATION	LAT_Y	LONG_X
BI01	Big Creek near the mouth at bridge	62.59901	-137.01318
BI02	Big Creek u/s of Seymour Creek	62.35579	-137.1779
BI03	Big Creek u/s Happy Creek and d/s Boliden Creek	62.34543	-137.25592
BI04	Big Creek u/s Boliden Creek d/s Mechanic Creek	62.35129	-137.29741
BI05	Upper Big Creek u/s of Mechanic Creek	62.3484	-137.30298
BI06	Upper Big Creek above all mining (AAM)	62.37486	-137.38141
BI_BO01	Boliden Creek mouth at road culvert	62.34525	-137.25809
BI_SE_BO01	Bow Creek mouth	62.306	-137.21629
BI_HA01	Happy Creek mouth	62.34672	-137.23535
BI_ME01	Mechanic Creek mouth	62.34764	-137.30185
BI_ME02	Mechanic Creek	62.34085	-137.31169
BI_ME03	Mechanic Creek at road crossing	62.33065	-137.31941
BI_ME04	Mechanic Creek above all mining (AAM)	62.32771	-137.32123
BI_RE01	Revenue Creek mouth	62.34504	-137.27414
BI_RE02	Revenue Creek u/s of Whirlwind Creek	62.33569	-137.27481
BI_SE01	Seymour Creek mouth	62.3556	-137.177
BI_SE01A	Seymour Creek u/s of the mouth	62.31777	-137.2084
BI_SE02	Seymour Creek at road crossing	62.30057	-137.21416
BI_SE03	Seymour Creek above all mining (AAM)	62.2788	-137.17442
BI_RE_WH01	Whirlwind Creek mouth	62.33558	-137.27507
BI_RE_WH02	Whirlwind Creek above all mining (AAM)	62.33235	-137.28101
BI_ST01	Stoddart Creek mouth	62.36389	-137.14028

Water Quality Objective monitoring, Big Creek Watershed – Summary

Between 1998 and 2000, this basin was extensively monitored, providing us with a vast amount of baseline information at the time. Placer activities in this watershed have recently increased. Due to the greater interest in the area, and recent changes in mining locations and levels of activity, the Big Creek Watershed was designated a '*major*' watershed for monitoring in 2014. This meant that a major proportion of our monitoring efforts were spent in the basin, that more than one third of our monitoring equipment inventory was deployed in the Big Creek area, and that our seasonal monitoring schedule included many repeat visits throughout the season.

A total of four automatic water sampling stations were set up from July 2nd until shutdown on September 9th as well as two portable weather monitoring stations. An attempt to keep these sites maintained and continuously monitored was made throughout the season however through a combination of equipment failure, site instability and finally widespread flooding in a large area of Big Creek that bared access to the area, only an insignificant amount of data could be collected. **From the limited amount of data** obtained by these instruments and through on site visits and sampling conducted by

CMI staff, the following observations regarding the water quality in the basin can be made:

Overall water quality in the Big Creek basin, could not be determined nor accurately compared to the minimum objectives set under the *Fish Habitat Management System* due to the limited data collected. The only observation that could be made was that the Total Suspended Solids concentrations from water samples collected at our water quality monitoring site at the mouth of Big Creek, was above the WQO of 25 mg/L ,16 days out of a total of 68 days that we were able to monitor.

On those occasions when the WQO were not met and the Total Suspended Solids levels were greater than the objectives, a direct correlation between environmental conditions and the volume of solids in the water was observed.

In most cases, rain fall, either as localised events or basin wide occurrences, increased the amount of surface run off and subsequent soil erosion from the land, increasing the input of sediment into the receiving waters. These increases occurred simultaneously at the time of the rain event or immediately in a period of one or two days after the rain event, as surface water continued draining from the land and ground water infiltrated the water course. On July 30th, the failure of a major water retention structure located upstream on Guder Creek led to an extremely large deposit of sediment that flowed into Seymour creek. Seymour Creek drains directly into Big Creek. This extra sediment load was monitored in Seymour creek on the day of the event and measured two days later, on August 1st, at the mouth of Big Creek. Remnants of the event could still be detected on August 2nd. By the 3rd of August levels had dropped back to the norm.

Increases in the volume of sediment laden ground and surface water entering the system add to the amount of sediment in the water course. The ability of the receiving water to dilute these inputs of sediment is negated by the re-suspension of stream bed material and by the further erosion of the streams banks that occurs along with the increased flows that are generated by the aftermath of these rain events.

All of these factors; precipitation leading to increased sediment input and increased flows from these rain events re-suspending and further eroding material, lead to an increase in suspended solids concentrations and a decrease in water quality.

The Fish Habitat Management System - Big Creek Watershed (Category A)

Sample Results that Exceed Water Quality Objectives for 2014

Sampling Station	BI01	BI_SE01	BI02	BI03	BI04	BI05	Other	Other	Other	Other
Location Description	Mouth	Mouth	u/s BI_SE01	d/s BI_ME01	u/s BI_ME01	BI backgrd				
Type of sampling	Auto/Grab	Auto/Grab	Auto/Grab	Grab	Grab	Auto/Grab				
Lat Y	62.59901	62.35560	62.35579	62.35129	62.34840	62.37486				
Long X	-137.01318	-137.17700	-137.17790	-137.29741	-137.30298	-137.38141				
Habitat Classification	High	Moderate-H	High	Moderate-M	Low	Moderate-L				
Water Quality Objective (mg/L)	25	25	25	50	200	80				
Date of Sampling										
7/7/14	418.7									
7/8/14	36.4									
7/21/14	224.4									
7/22/14	236.0									
7/23/14	41.6									
7/30/14 13:02	153.6	66820.0								
7/30/14 18:54	153.6	903.0								
7/31/14	573.2	164.8								
8/1/14	92.8	33.4								
8/2/14	37.2									
8/24/14		99.8								
8/26/14	94.2									
8/27/14	86.4									
9/6/14	26.4									
9/7/14	283.6									
9/8/14	278.8									
9/9/14	137.2									
Total Seasonal Average TSS (mg/L) by site	44	2839.6								
Number of days sampled	68	23								

Legend: Not continuously monitored

Water Samples that are: Above / Below the Water Quality Objective

NOTE: Site BI05 is no longer accessible by road.