

Hydrologic and Geomorphic Characteristics of the Indian River Drainage Basin

The Indian River, a major tributary to the Yukon River, drains an area of approximately 2220 square kilometers and has an overall channel length of approximately 120 km. The drainage basin is located 60 km south of Dawson.

Indian River, a gravel bed stream, is a tributary of Yukon River. The Indian River basin lies within the Klondike Plateau, a gently sloping upland south of Tintina Trench consisting of accordant summits (e.g., King Solomon Dome, Australia Mountain). The present flood plain descends about 53 m over a distance of 33 km with an overall gradient of about 1.6 m/km between the confluences of Dominion Creek and Ruby Creek.

The Water Survey of Canada (WSC) gauging station (09EB003) is located 1.5 km from the confluence of the Indian River with the Yukon River.

Topographical drainage Basin	2220 Sq. Kilometers
Area of Lakes	0%
Area of Forest	85%
Channel Length	120 Kilometers
Terrain	non-glaciated

In 2008, water samples were collected at 34 different sites in the Indian River basin. Sampling commenced on May 14th, 2008 and a total of 154 samples were collected up until the end of the season on August 25th, 2008. A combination of automatic composite sampling and grab sampling methods were used in the basin.

Atmospheric data was collected using two portable weather stations, one located near the mouth of the Indian River and the other located at a background site on the Indian River.

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

In 2008, the effluent discharge standards for the Indian River Basin were those set under the existing *Yukon Placer Authorization*. Beginning in 2009, the effluent standards for all 19 separate watersheds in the Yukon, including the Indian River, will be set under the *Fish Habitat Management System*. The *Fish Habitat Management System* replaces the YPA with approximately 19 separate watershed authorizations, each of which are class authorizations under Section 35(2), governing placer mining in specific drainage basins.

Site Codes and Global Position of Water Quality Sampling Locations in the Indian River Watershed

SITE CODE	LOCATION	LAT_Y	LONG_X
IND 01	Indian River at mouth	63.77794	-139.70927
IND 02	Indian River u/s of Nine Mile Ck, d/s of Ophir Ck	63.77337	-139.34888
IND 03	Indian River d/s of Ruby Ceek	63.76852	-139.31589
IND 04	Indian River d/s of Quartz Ceek	63.74484	-139.15034
IND 05	Indian River d/s of Gimlex bridge	63.73735	-139.07439
IND 05A	Indian River d/s Montana Creek	63.69810	-138.97296
IND 06	Indian River d/s of Tamarack mine drain	63.69385	-138.93163
IND 07	Indian River u/s of Tamarack mine drain	63.64296	-138.87100
IND 08	Indian River at bridge over to Eureka (background)	63.61241	-138.72108
IND AUS 01	Australian Creek mouth	63.62037	-138.68327
IND DOM 01	Dominion Creek mouth u/s of Sulphur Ceek	63.62565	-138.69148
IND DOM 02	Gold Run Creek mouth	63.69152	-138.59724
IND DOM 03	Grant Pup Creek mouth	63.70445	-138.57770
IND DOM 04	Dominion Creek u/s Gold Run Ck, d/s Burnham Ck	63.71686	-138.54523
IND DOM 05	Burnham Creek mouth	63.72881	-138.52914
IND DOM 06	Dominion Creek u/s of Burnham, d/s Arkansas Ck	63.73349	-138.52496
IND DOM 07	Arkansas Creek mouth	63.74499	-138.51467
IND DOM 08	Kentucky Creek mouth	63.75940	-138.51349
IND DOM 09	Jensen Creek mouth	63.77149	-138.53495
IND DOM 10	Nevada Creek mouth	63.80472	-138.60658
IND DOM 11	Champion Pup Creek mouth	63.82743	-138.68361
IND DOM 12	Chapman Pup Creek mouth	63.83091	-138.69487
IND DOM 13	8 below Pup Creek mouth	63.83350	-138.71324
IND DOM 14	Troublesome Pup Creek mouth	63.83500	-138.74991
IND DOM 15	Almeda Pup Creek mouth	63.83905	-138.78414
IND DOM 16	Caribou Creek mouth	63.84294	-138.80054
IND DOM 17	Mummie Pup Creek mouth	63.85705	-138.85352
IND DOM 18	Lombard Pup Creek mouth	63.85677	-138.85347
IND EUR 01	Eureka Creek Below All Mining (BAM)	63.60483	-138.83099
IND MON 01	Montana Creek mouth	63.69810	-138.97296
IND NIN 01	Nine Mile Creek mouth	63.79533	-139.40988
IND QUA 01	Quartz Creek mouth	63.74271	-139.13976
IND QUA 02	Quartz Creek at dredge	63.75333	-139.12445
IND RUB 01	Ruby Creek mouth	63.76226	-139.29227
IND SUL 01	Sulphur Creek mouth u/s of Dominion Ck	63.63774	-138.68327
IND SUL 02	Sulphur Creek u/s of large culverts	63.65632	-138.67613
IND SUL 03	Sulphur Creek at Brimstone Gulch	63.74023	-138.84891
IND SUL 04	Sulphur Creek right fork headwaters	63.82285	-138.92863
IND TAM 01	Tamarack mine drain	63.64308	-138.87200

Water Quality Objective monitoring, Indian River Watershed – Summary

This basin has been extensively monitored for the past 5 years providing us with a vast amount of information regarding the state of the water quality in a historically mined watershed. The Indian River basin is a heavily diverse watershed, with vast areas of active mining as well as inactive, reclaimed and partially reclaimed, sections. Placer activities in this watershed have remained consistent over the last decade. Due to the great interest in the area, and recent changes in mining locations and levels of activity, the Indian River Watershed was once again designated a 'major' watershed for monitoring in 2008. This meant that a major proportion of our monitoring efforts were spent in the basin, and that our monitoring schedule included many repeat visits throughout the season.

One automatic water sampling station and two weather stations were set up and maintained from May 14th until shutdown on August 25th. From the data obtained by these instruments and through on site visits and sampling conducted by CS&I staff, the following observations regarding the water quality in the basin can be made:

The overall water quality in the basin, met the minimum objectives set under the *Fish Habitat Management System* throughout the monitoring season. On those occasions when the WQO were not met and the Total Suspended Solids levels were greater than the objectives, there is a direct correlation to environmental conditions influencing the amount of solids concentrations in the water.

In all 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.

Increases in sediment laden ground and surface water entering the system add to the amount of sediment in the water. 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.