

Addendum Report



To: Nicola Watershed Community Round Table

Company: WMC

From: David Sellars

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Subject: Addendum to the Surface Water and Groundwater Supply and Interaction Study Phase 1 & 2

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A report titled Surface and Groundwater Supply and Interaction Study - Phase 1 and 2 (March 31, 2008) was submitted to the Nicola Watershed Community Round Table and was intended to fill knowledge gaps as part of the planning process leading to a water use management plan for the Nicola Watershed. The goal of the study was to determine the current and future water supply in the Nicola Watershed from surface and groundwater sources. This addendum has been prepared to provide additional results from the WMC Watershed Model by dividing the Coldwater River sub-catchment into two separate sub-catchments.

A description of the WMC Watershed Model and the methodology of developing the model to simulate the monthly and/or weekly water supply in the Nicola basin is included in the Surface and Groundwater Supply and Interaction Study - Phase 1 and 2 (March 31, 2008). This addendum describes the changes that were made to the watershed model to produce flow results from a divided Coldwater River sub-catchment.

As requested by the Nicola Watershed Community Round Table, water supply results were required for the Upper Coldwater sub-catchment south of Kingsvale and the Lower Coldwater sub-catchment from the south of Kingsvale to Merritt. A Water Survey of Canada hydrometric station is situated on Coldwater River near Brookmere (Station number 08LG048) and measures unregulated streamflow. A summary description of station 08LG048 is included in Table 1. Because the hydrometric station records natural streamflow, the measurement data from this station was used as a calibration point in the WMC Watershed Model. The hydrometric station is approximately 6 kilometers south of Kingsvale. Due to its proximity to Kingsvale and since water supply estimates are most accurate at calibration points, station 08LG048 was used as the point of division between Upper Coldwater and Lower Coldwater sub-catchments. The division between the Upper and Lower Coldwater sub-catchments was extended to the boundaries of the Coldwater River sub-catchment along topographic divides.

Table 1: Details of Hydrometric Station 08LG048

Latitude	49°51'20" N
Longitude	120°54'27" W
UTM Northing	5524808
UTM Easting	650371
Drainage Area	316 km ²

The input and parameters used in the watershed model were not modified with the division of the Coldwater River sub-catchment. The same future climate projections for the years 2020 and 2050 were used in the model:

- A2: Assumes regional resiliency and adaptation
- B2: Assumes local resiliency and adaptation

Furthermore, the same scenarios for the mountain pine beetle infestation were used in the model simulation:

- MPB infestation for current conditions (2006)
- MPB infestation for 2015
- MPB infestation for 2050

The only change to the model was how the output was collected from the model. Similar to the model results provided in the Surface and Groundwater Supply and Interaction Study, the influence of upstream surface water runoff was removed from any downstream sub-catchments. For the Coldwater River sub-catchments, surface water runoff from the Upper Coldwater sub-catchment was not included as flow into the Lower Coldwater sub-catchment. The following statistical analyses were carried out on the data for minimum annual weekly, minimum annual monthly and annual natural flows.

- Mean
- 1 in 5 year drought frequency
- 1 in 10 year drought frequency
- 1 in 15 year drought frequency
- 1 in 50 year drought frequency

The estimated drought frequency flows in each sub basin for the five scenarios are provided in Table 2. The natural flows in each sub basin are the flows only from that sub basin and do not include any surface stream flows from upstream sub basins. The minimum annual weekly and minimum annual monthly low flows were for the period July to October because winter low flows are of less interest.

The drought frequency analysis shows that the average yearly flows from the Upper Coldwater sub-catchment are higher than the Lower Coldwater sub-catchment flows. However, the minimum annual monthly and minimum annual weekly flows in the Upper Coldwater sub-catchment are lower than the Lower Coldwater sub-catchment. This is a result of the watershed model simulating greater groundwater storage and discharge along the lower Coldwater River Valley and within Midday Creek Valley and Voght Creek Valley (tributary systems along the Lower Coldwater sub-catchment). The annual low flows for both Lower Coldwater sub-catchment and Upper Coldwater sub-catchment are considered resilient to extreme drought since in a 1 in 50 year drought year the annual low flows are greater than 25% of average annual low flows.

Table 2: Results of Drought Frequency Analysis for Upper Coldwater River and Lower Coldwater River

Month	Average Monthly Flows I/s									
	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater
January	1191.78	1211.45	1923.54	1644.77	1968.12	1656.99	3245.79	2325.58	2800.91	2028.51
February	1673.56	1335.85	3140.54	2372.37	3345.73	2502.11	4478.88	3472.37	4461.55	3308.72
March	2760.02	1876.66	5131.11	3412.19	4519.99	3088.90	6302.61	3937.04	5863.64	3775.30
April	10140.14	5453.73	14521.10	6769.96	13144.85	6282.35	14690.46	5161.83	14934.54	5625.10
May	23382.88	6796.73	22633.94	5335.49	24154.65	5985.60	19201.07	3330.11	20222.25	3748.27
June	20384.88	3256.83	18853.40	3016.78	19504.31	3123.18	13702.02	1873.55	14814.89	2019.11
July	7821.19	2237.55	6199.88	2182.71	6215.72	2057.93	3955.47	1782.02	4537.47	1783.24
August	3146.36	1571.73	2362.61	1887.52	2292.50	1651.30	1709.17	1573.20	1887.85	1587.17
September	1235.23	1272.55	1175.36	1487.10	1155.08	1431.33	855.37	1317.30	983.88	1315.28
October	2599.66	1215.32	2569.05	1375.82	2813.46	1393.97	2721.77	1295.11	2533.98	1269.25
November	3149.36	1199.22	4390.45	1567.14	4310.79	1554.00	5829.35	1729.86	4965.18	1553.20
December	1280.12	1112.31	1848.69	1378.58	2072.14	1455.11	2521.80	1581.46	2347.71	1471.96
Average	6563.76	2378.33	7062.47	2702.54	7124.78	2681.90	6601.15	2448.29	6696.15	2457.09

	DROUGHT FREQUENCY - Minimum Annual Weekly I/s									
	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater
Mean	567.00	1120.00	524.00	1280.00	523.00	1270.00	430.00	1160.00	447.00	1170.00
1 in 5	428.00	928.00	387.00	1080.00	387.00	1070.00	315.00	972.00	329.00	982.00
1 in 10	381.00	819.00	339.00	957.00	341.00	948.00	276.00	870.00	290.00	879.00
1 in 15	362.87	764.01	321.45	896.16	324.62	884.82	261.38	819.69	275.96	828.11
1 in 50	324.00	613.00	282.00	727.00	288.00	708.00	230.00	685.00	245.00	690.00

	DROUGHT FREQUENCY - Minimum Annual Monthly I/s									
	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater
Mean	716.00	1140.00	644.00	1290.00	651.00	1290.00	529.00	1180.00	554.00	1190.00
1 in 5	499.00	942.00	451.00	1090.00	456.00	1080.00	376.00	984.00	392.00	995.00
1 in 10	438.00	833.00	400.00	974.00	403.00	962.00	330.00	881.00	344.00	892.00
1 in 15	418.11	778.01	384.21	913.16	386.04	898.82	314.21	830.11	328.21	840.52
1 in 50	378.00	630.00	351.00	745.00	352.00	724.00	281.00	695.00	295.00	703.00

	DROUGHT FREQUENCY - Annual I/s									
	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater	Upper Coldwater	Lower Coldwater
Mean	6440.00	2240.00	6880.00	2560.00	6930.00	2540.00	6360.00	2330.00	6460.00	2340.00
1 in 5	4980.00	1570.00	5300.00	1850.00	5340.00	1820.00	4820.00	1680.00	4900.00	1690.00
1 in 10	4270.00	1280.00	4560.00	1540.00	4610.00	1510.00	4130.00	1390.00	4190.00	1400.00
1 in 15	3948.27	1157.16	4226.57	1411.31	4276.57	1375.46	3831.67	1267.16	3879.97	1277.16
1 in 50	3130.00	861.00	3400.00	1090.00	3450.00	1040.00	3090.00	961.00	3120.00	970.00