

CITY OF WILLIAMS LAKE

Review of 2009 Receiving Environment Monitoring Data



March 2010
Ref: 602-021



April 20, 2010

Our File: 602-021

City of Williams Lake
450 Mart Street
Williams Lake, B.C. V2G 1N3

Attention: Mr. Joe Engelberts

Dear Sir:

RE: Review of 2009 Receiving Environment Monitoring Data

Attached herewith is the writer's review report of the monitoring data for the Fraser River above and below the City's wastewater treatment plant outfall on October 1, 2009. On this date, the Fraser River flow was about 780 cms which is approximately two times the 7 day 2 year return low flow on which the MSR registration and Initial Dilution Zone (IDZ) calculations were based. With the river flow being significantly greater than 375 cms on which the IDZ was based, it would be anticipated that the impact of the City's outfall in terms of increased concentrations of the various monitoring parameters would be negligible. The monitoring data indicates no water quality differences above and below the outfall consistent with the theoretical dilution ratio concentrations.

Should questions arise related to any aspect of this review report, please call.

Yours truly,

TRUE CONSULTING GROUP

A handwritten signature in black ink, appearing to read "D Underwood", is written over a horizontal line.

Dave Underwood, P. Eng.

DU/cab

Enclosure

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City of Williams Lake

Review of Receiving Environment Monitoring Data

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SECTION 1.0 – INTRODUCTION

In December 2001, TRUE Consulting Group (TRUE) prepared a report for the City of Williams Lake titled “Outfall Assessment and Environmental Impact Report”. This report described upgrading requirements to the City’s wastewater treatment plant outfall into the Fraser River to comply with the Municipal Sewage Regulation (MSR) and provided an environmental impact assessment to confirm compliance with receiving environment sections of the MSR. The report was reviewed with staff of the Ministry of Environment and formed the basis for an application for registration under the MSR by the City of Williams Lake in January 2002. The MSR registration application was accepted by the Ministry of Environment and the effective date established as January 31, 2002.

In the spring of 2002, the City of Williams Lake completed construction of an extension of the treatment plant outfall to achieve compliance with the outfall design provisions of the MSR. The outfall was extended about 40m “further” into the Fraser River to insure that the east edge of the initial dilution zone as defined in the MSR did not extend beyond the calculated river edge at the 7 day low flow having a return frequency of 2 years.

In July 2004, the City of Williams Lake entered into discussions with the Ministry of Environment to develop a receiving environment monitoring program consistent with the requirements of the MSR. From these discussions an appropriate receiving environment monitoring program was agreed to by both the City and Ministry staff as described in a TRUE letter dated August 23, 2004 (copy enclosed Appendix A). The City of Williams Lake proceeded with the implementation of the receiving environment monitoring program in September 2004. This report presents a review of the receiving environment monitoring data for 2009 with comparisons provided with data for the period 2004 to 2008 inclusive.

SECTION 2.0 – RECEIVING ENVIRONMENT MONITORING PROGRAM & REVIEW REQUIREMENTS

The Receiving Environment Monitoring program is described in a TRUE letter dated August 23, 2004 (please refer to Appendix A) and comprises annual sampling of the Fraser River and Williams Lake River summarized as follows.

- Fraser River approximately 100m upstream of Outfall (Station No. 1)
- Fraser River at the midpoint of the Calculated Edge of the Initial Dilution Zone (Station No. 2)
- Williams Lake River upstream of Confluence with the Fraser River (Station No. 3)

The sampling of the Fraser River represents monitoring necessary to comply with the MSR. The sampling of the Williams Lake River is included only for general information purposes. The Williams Lake River quality testing is intended to provide the City with a background database for future planning and infrastructure assessment purposes.

Monitoring parameters are summarized following.

Turbidity	Sites 1, 2 and 3
Total Suspended Solids	Sites 1, 2 and 3
Total Phosphorus (as P)	Sites 1, 2 and 3
Ortho Phosphorus (as P)	Sites 1, 2 and 3
Ammonia Nitrogen (as N)	Sites 1, 2 and 3
Nitrate – Nitrite Nitrogen (as N)	Sites 1, 2 and 3
Fecal Coliforms (3 samples each site)	Sites 1, 2 and 3

Sampling of the Williams Lake River for fecal coliform was suggested recognizing that it is a potential source of fecal coliform in the Fraser River adjacent to the recreation area located downstream of the outfall. Three fecal coliform samples were suggested at each of the three sites recognizing that fecal coliform results can be variable.

From the Municipal Sewage Regulation and correspondence from the Ministry of Environment, monitoring program, review and reporting requirements are:

- discharger (City) must document any effect of the discharge on the receiving environment using appropriate statistical and graphic analysis.
- discharger (City) must document any trends in environmental quality in the receiving environment affected by the discharge using background or pre-discharge data and by using all the years of record in which the discharge has taken place.
- the report must be written by a qualified professional and provide interpretation of the monitoring data.
- the report should explain the sampling results in relation to the key issues outlined in the registration. The key issues are the effectiveness of the mixing of the effluent with receiving waters, ammonia levels at the edge of the initial dilution zone and fecal coliform impacts on the beach area from May to September inclusive.

SECTION 3.0 – WASTEWATER TREATMENT PLANT EFFLUENT QUALITY DATA

Data from monthly sampling of the wastewater treatment plant effluent by the City of Williams Lake for the period January 01, 2004 to December 31, 2009 are summarized in Table 3.1. Comparisons of the effluent quality data presented in Table 3.1 with assumptions presented in the “Outfall Assessment and Environmental Impact Report” dated December 2001 are as follows:

➤ **Ammonia (as N)**

Assumed Concentration December 2001 – 30 mg/L

2004/2005 Data (Table 3.1) – Fall, Winter, Spring – Average 18.3 mg/L

2004/2005 Data (Table 3.1) – Summer, July, Aug., Sept. – Average 0.3 mg/L

2006 Data (Table 3.1) – Fall, Winter, Spring – Average – 20.0 mg/L

2006 Data (Table 3.1) – Summer, Aug. Sept. Oct. – Average – 2.9 mg/L

2007 Data (Table 3.1) – Fall, Winter, Spring – Average – 17.60 mg/L

2007 Data (Table 3.1) – Summer, July, Aug., Sept., Oct. – Average – 5.21 mg/L

Summer (delete August) – Average – 1.68 mg/L

2008 Data (Table 3.1) – Fall, Winter, Spring – Average – 22.7 mg/L

2008 Data (Table 3.1) – Summer, July, Aug., Sept., Oct. – Average – 3.2 mg/L

2009 Data (Table 3.1) – Fall, Winter, Spring – Average – 22.0 mg/L

2009 Data (Table 3.1) – Summer, July, Aug., Sept., Oct. – Average – 0.7 mg/L

Historically, effluent ammonia concentrations are in the range of 15.0 to 25.0 mg/L in the fall, winter and spring periods and decrease to consistently less than 5.0 mg/L during the summer months, typically July to October. For the fall, winter and spring of 2009, the average ammonia concentration of 22.0 mg/L is generally consistent with historical data and significantly less than the assumed effluent ammonia concentration of 30 mg/L used in the December 2001 “Outfall Assessment and Environmental Impact” report. In the summer months of 2009, the ammonia nitrogen averaged 0.7 mg/L for the 4 month period (July to October inclusive) and averaged 0.19 mg/L in the three month period from July to September inclusive. The effluent ammonia concentrations for 2009 are consistent with data for the period 2004 to 2008.

**TABLE 3.1: WILLIAMS LAKE WASTEWATER TREATMENT PLANT
EFFLUENT QUALITY**

<i>Date</i>	<i>BOD₅</i>	<i>TSS</i>	<i>NH₃ (as N)</i>	<i>Tot P</i>	<i>Total Ortho P</i>
Jan-04	24	15	19.60	3.85	3.24
Feb-04	26	20	19.70	3.87	2.77
Mar-04	10	4	19.50	3.58	3.07
Apr-04	<10	13	11.60	3.83	3.2
May-04	21	22	17.10	4.1	2.94
Jun-04	77	42	0.15	5.22	2.96
Jul-04	16	27	0.06	3.3	2.71
Aug-04	14	11	0.02	3.33	2.85
Sep-04	16	12	1.21	4.69	2.39
Oct-04	<10	14	16.40	3.76	2.71
Nov-04	13	27	17.10	3.65	3.1
Dec-04	27	32	16.50	3.44	2.89
Jan-05	32	24	18.00	3.71	2.86
Feb-05	28	10	18.50	3.69	3.69
Mar-05	21	26	18.20	3.84	3.14
Apr-05	16	10	22.80	4.17	3.87
May-05	15	17	20.80	3.66	3.25
Jun-05	18	16	18.90	3.52	2.97
Jul-05	18	27	0.24	3.48	3.01
Aug-05	<10	18	<0.01	3.27	3.06
Sep-05	11	10	0.27	3.22	3.12
Oct-05	<10	13	2.40	3.29	2.85
Nov-05	<10	9	19.10	3.61	3.37
Dec-05	19	18	19.70	3.43	2.95
Average 2004 and 2005				3.73	3.04
Jan. 19/06	22	28	18.5	3.23	2.91
Feb. 16/06	26	21	20.5	3.31	2.68
Mar. 15/06	20	14	18.3	3.37	2.94
Apr. 19/06	13	14	17.6	3.48	3.01
May 17/06	11	5	19	3.24	2.94
June 20/06	16	30	24.3	3.38	2.99
July 18/06	<10	19	23.1	3.66	3.21
Aug. 16/06	28	36	<0.005	3.72	2.99
Sept. 18/06	17	25	2.45	3.41	2.83
Oct 17/06	<10	20	3.38	3.49	2.69
Nov. 16/06	<10	20	18.6	3.2	2.86
Dec. 14/06	23	12	20.8	3.24	3.01
Average 2006				3.39	2.92

**TABLE 3.1: WILLIAMS LAKE WASTEWATER TREATMENT PLANT
EFFLUENT QUALITY
(continued)**

2007							
<i>Date</i>	<i>BOD₅</i>	<i>TSS</i>	<i>NH₃ (as N)</i>	<i>Tot P</i>	<i>Total Ortho P</i>	<i>Total Coliform</i>	<i>Fecal Coliform</i>
Jan. 16/07	67	25	21.85	3.16	2.63		
Feb. 15/07	24	17	25.4	4.06	2.61		
Mar. 15/07	16	29	11.8	3.44	3.23		
Apr. 16/07	16	11	24.7	3.3	2.97		
May 15/07	12	13	13.1	3.95	3.31	10,600	685
June 14/07	<10	17	24.9	4.11	3.82		
July 12/07	25	32	0.059	3.58	3.12		2,400
Aug. 16/07	26	28	15.8	4.71	2.32	47,000	1,035
Sept. 17/07	36	30	0.332	3.56	3.06	6,400	1,130
Oct. 23/07	26	107	4.66	3.73	3		33,000
Nov. 14/07	15	14	15.3	3.98	2.85	27,000	1,600
Dec. 18/07	21	20	23.3	4.74	3.06		119,000
Average 2007				3.86	3.00		
2008							
<i>Date</i>	<i>BOD₅</i>	<i>TSS</i>	<i>NH₃ (as N)</i>	<i>Tot P</i>	<i>Total Ortho P</i>	<i>Total Coliform</i>	<i>Fecal Coliform</i>
Jan. 17/08	30	17	20.7	3.88	2.9	69,000	21,000
Feb. 12/08	25	19	21.2	4.58	3.57	147,000	55,000
Mar. 11/08	16	17	23	4.06	2.52	90,000	6,600
Apr. 16/08	20	118	23.8	4.46	3.62	28,000	1,170
May 13/08	20	9	21	4.7	3.62	38,000	4,250
June 24/08	12	9	26.2	4	3.87	15,100	3,900
July 15/08	7	23	12.5	4.5	3.46	9,450	1,940
Aug. 19/08	11	31	0.1	4.03	3.17	10,250	740
Sept. 17/08	8	18	0.16	3.75	3.17	9,550	2,150
Oct. 15/08	10	15	0.042	3.15	3.13	11,350	1,185
Nov. 17/08	14	9	20.6	3.74	3.36	17,850	1,850
Dec. 2008	15	42	24.2	3.7	2.93	155,000	100,000
Average 2008				4.05	3.28		

**TABLE 3.1: WILLIAMS LAKE WASTEWATER TREATMENT PLANT
EFFLUENT QUALITY
(continued)**

<i>2009</i>							
<i>Date</i>	<i>BOD₅</i>	<i>TSS</i>	<i>NH₃ (as N)</i>	<i>Tot P</i>	<i>Total Ortho P</i>	<i>Total Coliform</i>	<i>Fecal Coliform</i>
Jan. 13/09	15	12	23.2	3.59	3.05	2,150	380
Feb 17/09	20	18	22.0	3.65	3.19	3,800	5,150
Mar 12/09	26	13	21.0	3.74	3.06	14,550	2,350
Apr 14/09	15	20	22.1	2.9	2.79	48,000	4,700
May 12/09	16	8	28.2	4.14	3.69	38,000	5,050
June 15/09	26	31	21.5	4.72	4.6	5,600	27,500*
July 20/09	10	15	0.15	3.72	3.69	820	440
Aug 17/09	10	27	0.016	4.75	4.53	6,050	1,450
Sept 22/09	<10	23	0.4	3.6	3.47	11,200	2,750
Oct 13/09	17	19	2.2	3.52	3.26	12,100	1,610
Nov 17/09	<10	16	15.3	2.72	2.33	16,250	2,290
Dec 21/09	19	20	22.6	3.12	3.49	49,050	4,250
Average 2009				3.68	3.43		

*suspected sampling and/or reporting error

Note: all results reported as mg/L except fecal/total coliform – number/100 mLs

➤ Phosphorus

	<i>Assumed Concentration December 2001</i>	<i>2004/2005 Averages</i>	<i>2006 Average</i>	<i>2007 Average</i>	<i>2008 Average</i>	<i>2009 Average</i>
Total Phosphorus	6.0 mg/L	3.73 mg/L	3.39 mg/L	3.86 mg/L	4.05 mg/L	3.68 mg/L
Total Ortho Phosphorus	5.5 mg/L	3.04 mg/L	2.92 mg/L	3.00 mg/L	3.28 mg/L	3.43 mg/L

In the period to December 2001, the City of Williams Lake did not monitor the effluent quality for either total phosphorus or total ortho phosphate. In the absence of any actual data, effluent concentrations for total phosphorus of 6.0 mg/L and total ortho phosphorus of 5.5 mg/L were assumed based on data for other lagoon systems treating primarily municipal wastewater. Monitoring data for phosphorus in 2009 is consistent with

historical data. Average concentrations for total and orthophosphorus through 2009 are approximately 60% of the assumed concentration used to support the MSR Registration.

➤ Total and Fecal Coliform

In 2007, the City of Williams Lake initiated sampling of the wastewater treatment plant effluent for fecal and total coliform. As presented in Table 3.1, effluent fecal coliform concentrations in 2009 ranged between 380 (Jan) to 5150 (Feb). An effluent concentration of 27,500 was measured/reported for June. Analysis of this data suggests a sampling and/or reporting error for June 2009 because, as would be expected, effluent fecal coliform concentrations were lower in the remaining summer months.

Data presented in Table 3.1 for 2009 suggests that when the City's treatment lagoons are not covered by ice, averages about 2000 per 100 mLs.

SECTION 4.0 – RECEIVING ENVIRONMENT MONITORING

Monitoring data of the receiving environment by the City of Williams Lake in accordance with the monitoring program as described in TRUE letter dated August 23, 2004 is presented in Table 4.1. The analytical report from Stewart Group Geochemical for samples taken on October 1, 2009 is contained in Appendix B.

River flow data for the period when the sampling was undertaken on October 1, 2009 has been obtained from the Water Survey of Canada website for the Fraser River at Marguerite (Station 08 MC 018). On October 1, 2009, the Fraser River flow was about 780 cms with a decreasing trend (please refer to Appendix C). As compared to the calculated 2 year return low flow of 375 cms as presented in the MSR registration supporting document, the October 2009 river flow was about 2.0 times higher. Associated with a river flow of 780 cms, the theoretical dilution ratio in the initial dilution zone is derived as follows.

- cross sectional area of IDZ at 7 day 2 year return low flow of 375 cms = 40.9m²*
(*from December 2001 TRUE report)
- estimated cross sectional area of IDZ at 780 cms = 68.4m²
- estimated velocity – 2.0 m/sec
- flow in IDZ cross section – 68.4m² x 2.0 m/sec = 136 cms

**Table 4.1: Receiving Environment Monitoring Data
Fraser River**

Date	Sept. 21, 2004		Sept. 29, 2005		Dec. 07, 2006	
	Upstream Site 1	At IDZ** Site 2	Upstream Site 1	At IDZ** Site 2	Upstream Site 1	At IDZ** Site 2
River Flow	1750 cms		1120 cms		600 cms	
River Flow Trend	decreasing		increasing		stable	
Turbidity (NTU)	21	22	9.2	9.1	4.5	4.7
Total Suspended Solids	22	24	8	10	not done	
Nitrate+Nitrate (as N)	0.050	<0.003	<0.003	0.053	0.089	0.095
Total Phosphate (as P)	0.023	0.107	0.003	0.045	0.0197	0.063
Ortho Phosphate (as P)	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ammonia (N)	0.067	0.031	0.032	0.142	0.099	0.131
Fecal Coliform (CFU/100ml)***	99	55	62	93	67	160± (Note 4)

**Table 4.1: Receiving Environment Monitoring Data
Fraser River (continued)**

Date	Oct. 25, 2007		Sept. 18, 2008		Oct. 1, 2009	
	Upstream Site 1	Upstream Site 1	Upstream Site 1	At IDZ** Site 2	Upstream Site 1	At IDZ Site 2
River Flow	1700 cms		1000 cms		780 cms	
River Flow Trend	increasing		decreasing		decreasing	
Turbidity (NTU)	19	7.3	7.3	17	14	14
Total Suspended Solids	not done		16		22	24
Nitrate+Nitrate (as N)	0.021	0.029	0.029	0.028	0.044	0.041
Total Phosphate (as P)	0.122	0.034	0.034	0.098	0.086	0.107
Ortho Phosphate (as P)	<0.003	<0.003	<0.003	<0.003	0.052	0.079
Ammonia (N)	0.107	0.017	0.017	0.395	0.054	0.042
Fecal Coliform (CFU/100ml)***	76	61	61	61	14	15 (Note 6)

Williams Lake River (5)

Date	Sept. 21, 2004	Sept. 29, 2005	Dec. 07, 2006	Oct. 25, 2007	Sept. 18, 2008	Oct. 1, 2009
Turbidity (NTU)	1.4	2.8	0.35	<1	0.3	0.2
Total Suspended Solids	2	1	not done	not done	<1	3
Nitrate+Nitrate (as N)	<0.003	<0.003	0.024	<0.003	<0.003	<0.007
Total Phosphate (as P)	0.015	0.058	0.011	0.016	0.009	0.071
Ortho Phosphate (as P)	<0.003	0.010	<0.003	<0.003	<0.003	0.051
Ammonia (N)	0.007	0.131	0.073	<0.005	<0.005	0.059
Fecal Coliform (CFU/100ml)***	11	82	5	6	35	6

** refer to Appendix A for sampling site location plan

*** average of 3 samples

(4) Fecal coliform concentrations at IDZ >200, >200 and 81

(5) Monitoring data presented in Table 4.1 for the Williams Lake River is intended for background purposes.

(6) Re-sampled October 13, 2009 – Fecal Coliform

From the above, the estimated dilution ratio at the IDZ on October 1, 2009 is presented as follows:

	<i>December 2001 IDZ Dilution Ratio Calculation</i>	<i>October 1, 2009 IDZ Dilution Ratio Calculation</i>
Fraser River Flow	375 cms*	780 cms
Flow in IDZ Cross Section	75.9 cms	<u>±136 cms</u>
Effluent Discharge Volume	8000m ³ /day	5940m ³ /day (actual)**
Theoretical Dilution Ratio at IDZ	820:1	1980:1

* 7 day 2 year return low flow

** Average daily discharge rate for the period September 30 to October 2 from City of Williams Lake Annual Report

Using the theoretical dilution ratio of 1980:1 for October 1, 2009, the increase in total phosphorus, orthophosphorus, ammonia and fecal coliform concentrations measured at the IDZ compared to background are calculated as follows:

Total Phosphorus – 3.60 mg/L ÷ 1980 = 0.002 mg/L increase

Total Orthophosphorus – 3.44 mg/L ÷ 1980 = 0.002 mg/L increase

Total Suspended Solids – 23 mg/L ÷ 1980 = 0.012 mg/L (not measurable)

Ammonia – 0.403 mg/L ÷ 1980 = 0.0002 mg/L increase (not measurable)

Fecal Coliform – 2300/100 ml ÷ 1980 = 1.1/100 ml increase

The above theoretical calculations would suggest that the City of Williams Lake effluent should not be “identifiable” by significant concentration increases of the monitoring parameters upstream and downstream of the outfall.

On the basis of the preceding theoretical dilution ratio calculations, interpretive comments related to receiving environment monitoring data in Table 4.1 are presented as follows:

- the turbidity concentrations above and below the outfall (14 and 14 NTU respectively) are the same concentration. As would be expected, the effluent discharge is not reflected in an increase in turbidity of the Fraser River.

- total suspended solids concentrations above and below the outfall were 22 and 24 mg/L respectively. As described for turbidity, these concentrations are considered to be the same as would be expected.
- the sampling data illustrates no increase in either ammonia concentrations or nitrate concentrations between Site 1 and 2. This data is consistent with theoretical calculations.
- the total phosphorus concentration above the outfall (0.086 mg/L) on October 1, 2009 was slightly less than that measured at the IDZ (0.107 mg/L) representing an increase in concentration of 0.021 mg/L. On the basis of theoretical dilution calculations the expected increase in total phosphorus concentration is 0.002 mg/L. Although the measured IDZ total phosphorus concentration is slightly higher than that which would be expected given the dilution calculations, the measured IDZ concentration of 0.107 mg/L is not identified as a concern.
- fecal coliform concentrations (average of three samples) were 14 per 100 ml upstream of the outfall and 15 per 100 ml downstream of the outfall. The sampling data is consistent with theoretical dilution calculations. Of most importance is that all fecal coliform concentrations are less than 200/100 ml, the standard for recreational waters.
- the ortho phosphorus concentration above the outfall (0.052 mg/L) on October 1, 2009 was slightly less than that measured at the IDZ (0.079 mg/L) representing an increase in concentration of 0.027 mg/L. On the basis of theoretical dilution calculations the expected increase in ortho phosphorus concentration is 0.002 mg/L at the IDZ. Although the measured IDZ ortho phosphorus concentration is slightly higher than that which would be expected given the dilution calculations, the measured IDZ concentration of 0.079 mg/L is not identified as a concern.

Of more significance than the orthophosphorus concentration change within the initial dilution zone is concentration of orthophosphorus reported for all three samplings sites. All samplings in the period 2004 to 2008 for the Fraser River had orthophosphorus concentrations less than the detection limit, i.e. 0.003 mg/L. Orthophosphorus concentrations in October 2009 were an order of magnitude higher averaging

0.065 mg/L. Sanitary orthophosphorus concentration of the Williams Lake River in October 2009 was an order of magnitude higher than the average for the period 2004 to 2008.

Discussions with the environmental lab manager at Stewart Group Geochemical & Assay have determined that the length of time between sampling (Oct. 1, 2009) and analysis (Oct. 5, 2009) due to a shipping error may have impacted results as it relates to orthophosphorus concentrations. Based on historic sampling results and on the fact that all three samples representing two different water courses identified higher than expected orthophosphorus concentrations, the extended time period between sampling and analysis is a reasonable explanation for the elevated orthophosphorus concentrations.

At this time, elevated orthophosphorus concentrations measured in 2009 make this a key parameter to monitor in future years in order to confirm that the apparent anomaly is explained by a shipping error.

SECTION 5.0 – SUMMARY

This review of receiving environment (Fraser River) monitoring data for sampling by the City of Williams Lake on October 1, 2009 may be summarized as follows.

- at the time of sampling on October 1, 2009 the Fraser River flow was 780 cms. This flow is about 200% greater than the 7 day low flow having a 2 year return period of 375 cms used for the MSR dilution zone calculations.
- the MSR registration supporting documents calculated a dilution rate of 820:1 at the edge of the initial dilution zone corresponding to a river flow of 375 cms. With river flow of 780 cms on October 1, 2009, the dilution ratio achieved at the IDZ is estimated to be 1980:1.
- on October 1, 2009 when the Fraser River sampling was undertaken, the quality of the City's effluent being discharged is noted as below in accordance with measurements conducted on September 22, 2009:

BOD	-	<10 mg/L
Suspended Solids	-	23 mg/L
Ammonia (as N)	-	0.403 mg/L
Total Phosphorus	-	3.6 mg/L
Total Ortho Phosphorus	-	3.47 mg/L
Fecal Coliform	-	2300/100 ml

- water quality data for the Fraser River upstream of the City outfall (Site 1) and at the IDZ (Site 2) for samples taken on October 1, 2009 indicates:
 - no increase in turbidity or total suspended solids consistent with the calculated dilution ratio.
 - a slight increase in total and dissolved orthophosphorus.
 - no increase of fecal coliform concentrations which is consistent with the calculated dilution ratio.
 - no increase in ammonia (as N) concentration which is consistent with the calculated dilution ratio.
- orthophosphorus concentrations in the Fraser River above and below the initial dilution zone were an order of magnitude higher than historical data. The source of the orthophosphorus is perhaps explained by a shipping error and extended time between sampling and analysis. Future sampling results should confirm this explanation.

APPENDIX 'A'

Receiving Monitoring Program – TRUE letter dated August 23, 2004



August 23, 2004

Our File: 602-021

Ministry of Water, Land and Air Protection
400 – 640 Borland Street
Williams Lake, B.C.
V2G 4T1

Attention: Mr. Doug Hill

Dear Sir:

RE: *Receiving Environment Monitoring Program*
Your File: RE 255 – City of Williams Lake

The City of Williams Lake has requested the writer present a proposal to you for the Receiving Environment Monitoring Program associated with the registration of the City's wastewater treatment plant and outfall to the Fraser River under the Municipal Sewage Regulation. A "draft" receiving environment monitoring program proposal was presented in a letter dated July 15, 2004. This proposal formed the basis for discussion with representatives of the City of Williams Lake at City Hall on July 20, 2004. On the basis of this meeting, the receiving environment monitoring program has been finalized and is presented herein.

1.0 Description of Works and Monitoring Programme Constraints

Associated with the registration of the City's sewerage works under the Municipal Sewage Regulation (MSR), the City's outfall was extended in 2002 "further" into the Fraser River to fully comply with the Initial Dilution requirements of the MSR. Referring to TRUE drawing 602-021-05 R2, as constructed drawing of the outfall extension, the outfall location and calculated initial dilution zone as referenced in documentation supporting the MSR regulation are illustrated. The drawing also illustrates the calculated Fraser River width at 2 year low flow (375 cms) and the, as surveyed, edge of river on May 01, 2001 at which time the river flow was 2310 cms. In relation to the as surveyed stream boundary on May 01, 2001, the outfall is approximately 65m from the east riverbank.

Winter weather conditions make access to the Fraser River for sampling purposes impractical in the period from November to April annually. Outside of this period, the monthly mean flows for Fraser River as measured at Marguerite are tabulated as follows:

May	2902 cms
June	3300 cms
July	2825 cms
August	1909 cms
September	1320 cms
October	1100 cms

.../2

On the basis of these mean flow data, it is our opinion that undertaking sampling for the purpose of receiving environment monitoring in the period from May to August when the Fraser River flow is greater than 2000 cms would provide no meaningful data. This suggestion is based on:

- (1) the centre point of the initial dilution zone will be approximately 65m from the edge of the river and very difficult to "locate" for sampling purposes.
- (2) in relation to the 2 year low flow of 375 cms, the calculated dilution ratio for a discharge volume of 8000 m³/day is 820:1. When the river flow is 2000 cms, the average depth of water in the initial dilution zone is 6m and the calculated dilution ratio is about 4200:1.
- (3) assuming that ammonia is the parameter of particular concern, and that the ammonia concentration in the discharge is 30 mg/L (conservatively high), the calculated increase in concentration at the edge of the initial dilution zone is 0.006 mg/L which is approaching the minimum detection limit of the ammonia test.

Correspondence from the Ministry of Water, Land and Air Protection dated February 04, 2002 requests that the receiving environment monitoring programme address possible "fecal coliform impacts on the beach area from May to September inclusive". Referring to drawing 602-021-05 the following should be noted relative to the recreation area.

- (1) in the period May to September when the Fraser River flows are of the order of 2000 cms, the outfall is a minimum of 50 m into the river at the recreation area.
- (2) while the recreation area is only approximately shown on drawing 602-021-05, the majority of the area is upstream of the outfall. The southern extent of the recreation area is about 15 m downstream of the outfall.

In the period May to August when mean river flows are 2000 cms or greater it would appear impossible for fecal coliforms from the outfall to impact the river edge fronting the recreational area. It is the writer's opinion that the Williams Lake River is however a potential source of fecal coliforms in the Fraser River adjacent to the recreation area.

2.0 Receiving Environment - Proposed Monitoring Programme

On the basis of the discussion of the outfall and Fraser River flows, it is proposed that receiving environment monitoring be undertaken sometime in the period after September 15th annually when Fraser River flows, based on historical data, will be in the range of 1100 to 1300 cms. At this time natural turbidity concentrations in the river will be approaching seasonal minimums therefore water quality parameters will not be as subject to anomalies attributable to suspended solids as compared to sampling in May, June or July. At periods of lower flow in the Fraser River, it is anticipated that it will be more straightforward for the City to determine the location of the initial dilution zone for sampling purposes.

Effluent and receiving environment parameters referenced in the MSR would form the basis for the proposed monitoring programme. The proposed monitoring program is presented as follows:

Sample Locations:

- Site 1 – 100m upstream of outfall – Fraser River
- Site 2 – midpoint of calculated edge of initial dilution zone – Fraser River
- Site 3 – Williams Lake River – upstream of confluence with Fraser River

Monitoring Parameters

Turbidity	Sites 1, 2
Total Suspended Solids	Sites 1, 2
Total Phosphorus (as P)	Sites 1, 2 and 3
Ortho Phosphorus (as P)	Sites 1, 2 and 3
Ammonia Nitrogen (as N)	Sites 1, 2 and 3
Nitrate – Nitrite Nitrogen (as N)	Sites 1, 2 and 3
Fecal Coliforms (3 samples each site)	Sites 1, 2 and 3

Sampling of the Williams Lake River for fecal coliform is suggested recognizing that it is a potential source of fecal coliform in the Fraser River adjacent to the recreation area. Three fecal coliform samples are suggested at each of the three sites recognizing that fecal coliform results can be variable.

In the course of the meeting on July 20, 2004, it was requested that the Williams Lake River also be sampled for nutrient parameters. While this sampling is not specifically required to comply with the requirements of the MSR, concurrent sampling for nutrients of the Williams Lake River would provide data that, in the future, may assist the City in addressing water quality concerns related to stormwater discharges, the effectiveness of the proposed Stormwater Management Plan intended to be implemented on a phased basis and background data to support a possible future application for an increase in the wastewater discharge quantity.

Other requirements and suggestions relative to the sampling and monitoring program discussed on July 20, 2004 are summarized as follows:

- sampling should be scheduled for a period of relatively stable weather conditions. For example, sampling would not be appropriate immediately following a period of significant rainfall which may have resulted in short term increases in turbidity and suspended solids in the Fraser River.
- the flow in the Fraser River at the Marguerite Station on the date of sampling should be reported with the sampling data. Flow data for the Fraser River of Marguerite can be obtained from the Environment Canada website as follows:
 - web address: www.msc.ec.gc.ca/wsc1
 - follow links to "Real Time Hydrometric Data"
 - Fraser River at Marguerite is Station 08 MC 018.
- sampling site No. 2, centre of the edge of the initial dilution zone, may be located by using GPS equipment. Local datum coordinates for Site 2 are provided on drawing 602-021-05. The GPS coordinates for Site 2 can be calculated from measured GPS coordinates of on shore reference points.

➤ suggested sample depths at the three sample sites are:

- Site 1 – 0.6m depth
- Site 2 – 2.0m depth if practical
- Site 3 – midstream and mid depth

Depth suggestions at Sites 1 and 3 have the objective of ensuring that floatable materials do not influence the sample analytical results. In late September, it is anticipated that the water depth at the outfall will be about 4m. A sample depth of 2m is suggested to ensure that the sample is as representative as possible.

I trust this letter satisfactorily responds to the requirements for a receiving Environment Monitoring programme for the City of Williams Lake's sanitary sewer outfall to the Fraser River. Should questions arise, please contact the undersigned.

Yours truly,



T.R. Underwood, P. Eng.

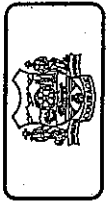
TRU/cab

attach.

cc: City of Williams Lake, Attn: Brian Lawrence
TRUE Consulting Group, Attn: Dave Underwood

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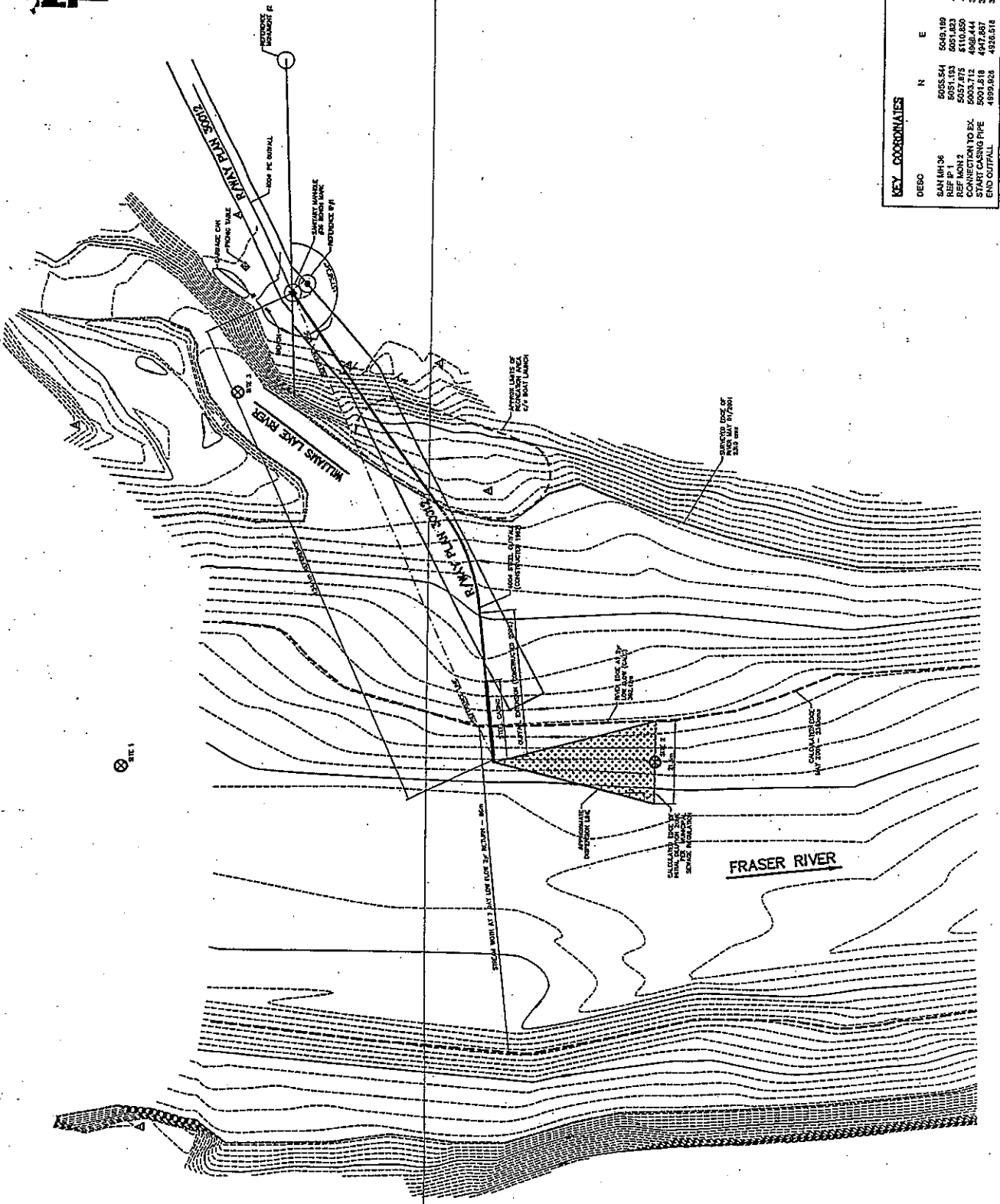
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**SANITARY SEWER
OUTFALL
EXTENSION**

**OVERALL
LOCATION
PLAN**

Sheet No. _____



KEY COORDINATES

DESCO	N	E	ELEV
SAN MH#38	5055.544	5249.189	493.56
MANHOLE #2	5057.023	5251.823	493.50
REF. MANHOLE #2	5057.023	5251.823	493.50
CONNECTION TO EX.	5003.713	4932.444	391.34
START CASING PIPE	5001.418	4947.567	391.45
END OUTFALL	4899.828	4926.616	391.725

APPENDIX 'B'

**Analytical Report – Alex Stewart Geochemical
October 15, 2009**

Please note:

Fraser River samples were taken on October 1, 2009.

Due to a shipping error by DHL, the samples were sent to Vancouver, and not Kamloops.

The samples spent the weekend in transit, possibly elevating the coliforms counts, as the time delay was greater than 30 hours and the arrival temperature was above 4 Celsius.
(Results E09-2044).

As requested by MOE, coliforms were re-sampled on October 13, 2009. Sampling was performed from shore with a dip tube.
(Results E09-2096).

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2953 Shuswap Road
Kamloops, BC
V2H 1S9 Canada
Tel + 1 250 573 5700
Fax + 1 250 573 4557
Toll Free + 1 877 573 5755
www.stewartgroupglobal.com

RECEIVED

OCT 20 2009



StewartGroup
Geochemical & Assay

CITY OF WILLIAMS LAKE

ANALYTICAL RESULTS - #:E09-2044

CITY OF WILLIAMS LAKE
450 Mart Street
WILLIAMS LAKE, BC
V2G 1K3

15-Oct-09

ATTENTION: George Bell

FRASER RIVER SAMPLES

SAMPLE IDENTIFICATION:

Samples Received: October 5, 2009

Samples Dated: October 1, 2009

Labelled: #1: Site 1

#2: Site 2

#3: Site 3

<u>PARAMETERS:</u>	<u>YOUR SAMPLES</u>			<u>CDWG</u>
	<u>1</u>	<u>2</u>	<u>3</u>	
Turbidity (NTU)	14	14	0.2	1
Total Suspended Solids	22	24	3	500
Ammonia (as N)	0.054	0.042	0.059	-
Total Phosphate (as P)	0.086	0.107	0.071	-
Ortho Phosphate (as P)	0.052	0.079	0.051	-
Nitrate (as N)	0.036	0.034	0.004	10
Nitrite (as N)	0.008	0.007	<0.003	-
Fecal Coliform (CFU/100mL) #1	81	96	5	0
Fecal Coliform (CFU/100mL) #2	39	106	8	0
Fecal Coliform (CFU/100mL) #3	41	123	5	0

NOTE: Results expressed in mg/L unless otherwise indicated.

NOTE: Results of 0 are the equivalent to <1 CFU per 100ml.

ECO-TECH LABORATORIES LTD.

John Andrew, BSc.

Environmental Lab Manager

JA/ap

Eco Tech Laboratory Ltd.
2953 Shuswap Road
Kamloops, BC
V2H 1S9 Canada
Tel + 1 250 573 5700
Fax + 1 250 573 4557
Toll Free + 1 877 573 5755
www.stewartgroupglobal.com



StewartGroup
Geochemical & Assay

ANALYTICAL RESULTS - #:E09-2096

CITY OF WILLIAMS LAKE
450 Mart Street
WILLIAMS LAKE, BC
V2G 1K3

16-Oct-09

ATTENTION: George Bell

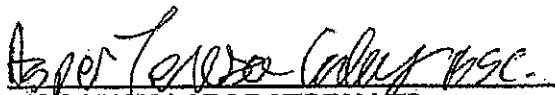
FRASER RIVER SAMPLES

SAMPLE IDENTIFICATION: 3 Water Samples Received: October 14, 2009
Samples Dated: October 13, 2009
Labelled: #1: Site 1
 #2: Site 2
 #3: Site 3

<u>PARAMETERS:</u>	<u>Your Samples</u>		
	<u>1</u>	<u>2</u>	<u>3</u>
Fecal Coliform (CFU/100mL) #1	24	18	14
Fecal Coliform (CFU/100mL) #2	6	15	17
Fecal Coliform (CFU/100mL) #3	13	11	19

NOTE: Results expressed in mg/L unless otherwise indicated.

NOTE: Results of 0 are the equivalent to <1 CFU per 100ml.


ECO TECH LABORATORY LTD.
John Andrew, BSc.
Environmental Lab Manager

JA/ap

APPENDIX 'C'

**Water Survey of Canada Historical Streamflow Data.
Fraser River at Marguerite for September 29, 2009 to
October 4, 2009**



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FRASER RIVER NEAR MARGUERITE (08MC018)

Data Category: Real Time

Parameter Type: Discharge Discharge

Note - if primary water level is not current, try Redundant Water Level in parameter drop-down list

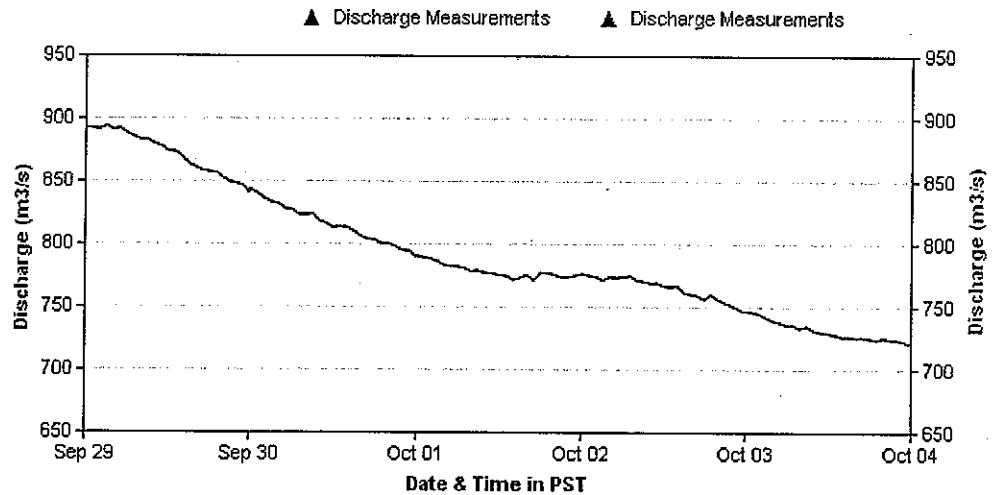
Station Navigation

- EC Map
- Text Search
- Google Map
- Customization
- Hydrometric Portfolio

In partnership with



British Columbia
Ministry of Environment



Y-Axis View: Min Max Start Date: Sep 29 2009 End Date: Oct 4 2009

Statistics for period of record

- Max
- Mean
- Lower quartile
- Min
- Upper quartile
- Median

The current primary water level as of 2010-03-29 14:00:00 is: 2.96 metres. Most recent station visit: 2010-03-15 13:50:00, Measured water level: 1.812metres, Measured discharge: n/a . Deviation: n/a. Curve 31 is currently used to generate the preliminary discharge values on the graph. If the recent measured discharge deviates from the curve by more than 5%, the displayed discharge information may be inaccurate and will be revised for final publication following detailed review of stage and discharge records.

Click the following links for information on ice conditions at stations, and data spikes and dips.

Station Information:

Active or discontinued	Active	Province/Territory	BC
Latitude	52° 31' 48" N	Longitude	122° 26' 32" W
Gross drainage area	114000 km ²		
Record length	57 Years	Period of record	1950 - 2006
Regulation type	Regulated		

Hydrometric measurement

Period of record	Type	Operation schedule	Gauge type
1950 - 1955	Flow	Continuous	Recorder
1956 - 1964	Flow	Seasonal	Recorder
1965 - 1968	Flow	Continuous	Recorder
1969 - 1984	Flow	Continuous	Manual
1985 - 2006	Flow	Continuous	Recorder



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FRASER RIVER NEAR MARGUERITE (08MC018)

Data Category: Real Time

Parameter Type: Raw water level Discharge

Note - if primary water level is not current, try Redundant Water Level in parameter drop-down list

Station Navigation

EC Map
Text Search
Google Map

Customization

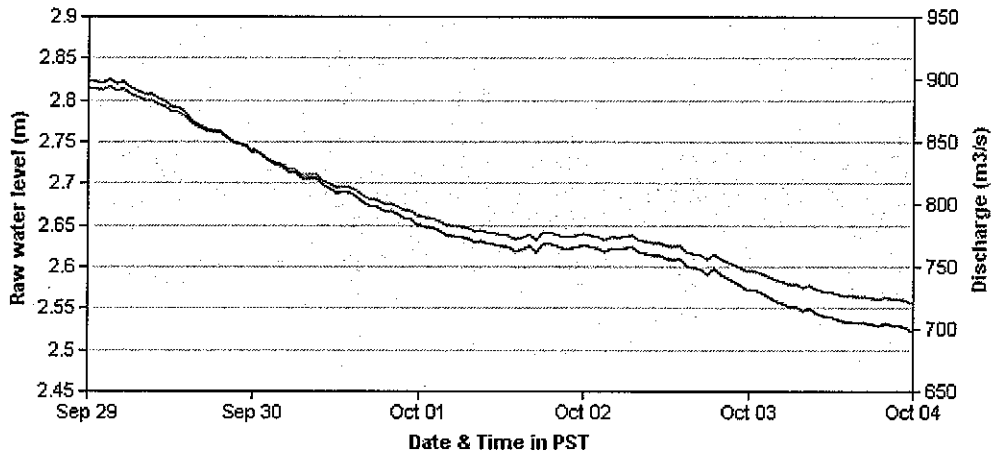
Hydrometric Portfolio

In partnership with



British Columbia Ministry of Environment

▲ Stage Measurements ▲ Discharge Measurements



Y-Axis View

Min Max

Start Date

Sep 29 2009

End Date

Oct 4 2009

Statistics for period of record

- Max Mean Lower quartile
 Min Upper quartile Median

The current primary water level as of 2010-03-29 14:00:00 is: 2.96 metres. Most recent station visit: 2010-03-15 13:50:00, Measured water level: 1.812metres, Measured discharge: n/a . Deviation: n/a. Curve 31 is currently used to generate the preliminary discharge values on the graph. If the recent measured discharge deviates from the curve by more than 5%, the displayed discharge information may be inaccurate and will be revised for final publication following detailed review of stage and discharge records.

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1969 - 1984	Flow	Continuous	Manual
1985 - 2006	Flow	Continuous	Recorder