CITY OF WILLIAMS LAKE

Review of 2010 Receiving Environment Monitoring Data

TRUE CONSULTING

March 2011
Ref: 602-021

City of Williams Lake

Review of Receiving Environment Monitoring Data

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Appendices

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 ensure 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 2010 with comparisons provided with data for the period 2004 to 2009 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

  2010 Data (Table 3.1) – Fall, Winter, Spring – Average – 18.5 mg/L
  2010 Data (Table 3.1) – Summer, July, Aug., Sept., Oct. – Average – 9.44 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 2010, the average ammonia concentration of 18.5 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 2010, the ammonia nitrogen averaged 9.44 mg/L for the 4 month period (July to October inclusive) and averaged 7.91 mg/L in the three month period from August to October inclusive. The average effluent ammonia concentrations in the four month period between July and October are approximately 2.5 times higher than the average for previous years through this time period but comparable to 2007. In particular, concentrations in September were considerably higher in comparison to previous years' data. Contributing factors may include colder weather conditions in September 2010 as a result of forest fire impacts on the region. The average effluent ammonia concentration of 9.44 mg/L through the summer months of 2010 is higher than historical averages, however is well below the assumed concentration of 30mg/L in the December 2001 "Outfall Assessment and Environmental Impact" report.

TABLE 3.1: WILLIAMS LAKE WASTEWATER TREATMENT PLANT EFFLUENT QUALITY

2004 and 2005

Date	*BOD5*	*TSS*	*NH3 (as N)*	*Tot P*	*Total Ortho P*
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

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

2006

Date	*BOD5*	*TSS*	*NH3 (as N)*	*Tot P*	*Total Ortho P*
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

2007

Date	*BOD_5*	*TSS*	*NH_3 (as N)*	*Tot P*	*Total Ortho P*	*Total Coliform*	*Fecal Coliform*
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		119000
Average 2007				3.86	3.00		

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

2008

Date	*BOD_5*	*TSS*	*NH_3 (as N)*	*Tot P*	*Total Ortho P*	*Total Coliform*	*Fecal Coliform*
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		

2009

Date	*BOD_5*	*TSS*	*NH_3 (as N)*	*Tot P*	*Total Ortho P*	*Total Coliform*	*Fecal Coliform*
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		

*apparent sampling/reporting error

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

2010

Date	*BOD_5*	*TSS*	*NH_3 (as N)*	*Tot P*	*Total Ortho P*	*Total Coliform*	*Fecal Coliform*
Jan. 12/10	14	8	21.8	3.15	2.82	45,500	2,600
Feb. 16/10	14	14	22.9	3.84	3.73	40,500	15,600
Mar. 15/10	16	17	24.2	3.32	3.28	20,750	1,425
Apr. 6/10	17	10	28.8	4.09	3.42	18,500	1,800
May 18/10	16	40	26.3	2.309	2.247	33,000	3,450
June 15/10	14	41	26.5	5.21	4.08	26,500	7,200
July 13/10	18	35	14.04	3.65	1.41	244,500	17,800
Aug. 23/10	34	50	2.94	4.00	1.69	25,000	6,200
Sept. 14/10	12	35	15.6	3.89	2.26	36,000	5,550
Nov. 2/10	39	14	5.18	3.54	2.74	66,500	29,000
Nov .17/10	<10	22	12.0	3.18	2.67	335,000	74,000
Dec .15/10	20	10	21.7	3.49	2.90	101,500	18,500
Average 2010				3.64	2.77		

Note: all results reported as mg/L except fecal/total coliform – CFU/100 mL

- Phosphorus

	Assumed 2001 Concentration	*2004/2005 Average*	*2006 Average*	*2007 Average*	*2008 Average*	*2009 Average*	*2010 Average*
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	3.64 mg/L
Total Ortho-Phosphate	5.5 mg/L	3.04 mg/L	2.92 mg/L	3.00 mg/L	3.28 mg/L	3.43 mg/L	2.77 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 orthophosphorus. In the absence of any actual data, effluent concentrations for total phosphorus of 6.0 mg/L and total orthophosphorus of 5.5 mg/L were assumed based on data for other lagoon systems treating primarily municipal wastewater. Monitoring data for phosphorus in 2010 is consistent with historical data. The average concentration for total phosphorus through 2010 is approximately 60% of the assumed concentration used to support the MSR Registration, and the average concentration for orthophosphorus through 2010 is approximately 50% 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 2010 ranged between 1,425 (Mar) to 74,000 (Nov). In the fall of 2010 the City of Williams Lake initiated the de-sludging of its two anaerobic treatment cells. This was completed by removing sludge from the cells and discharging into Geotubes to facilitate biosolids de-watering. Filtrate material released from the Geotubes was returned to the effluent polishing cell.

Total and fecal coliform concentrations in 2010 compared to previous years data in general for all months with the exception of October and November. Higher concentrations in these months may be attributable to the de-sludging work that was undertaken in these months. Historically, there has been fecal coliform concentrations greater than the 74,000 result for November 2010 therefore the relatively high result for November is not unprecedented.

Dewatering of the sludge contained in the Geotubes will continue until the summer of 2011. As such, additional spikes in total and fecal coliform concentrations may result in early in 2011.

Data presented in Table 3.1 for 2010 suggests that when the City's treatment lagoons are not covered by ice, fecal coliform averages about 14,500 CFU per 100 mL.

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 4, 2010 is contained in Appendix B.

River flow data for the period when the sampling was undertaken on October 4, 2010 has been obtained from the Water Survey of Canada website for the Fraser River at Marguerite (Station 08 MC 018). On October 4, 2010, the Fraser River flow was about 1260 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 2010 river flow was about 3.5 times higher. Associated with a river flow of 1260 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 1260 cms = 120.5m²
- estimated velocity – 2.0 m/sec
- flow in IDZ cross section – 120.5m² x 2.0 m/sec = 241 cms

TABLE 4.1: RECEIVING ENVIRONMENT MONITORING DATA
FRASER RIVER

Date	*Sept. 21, 2004*		*Sept. 29, 2005*		*Dec. 07, 2006*		*Oct. 25, 2007*	
	Upstream Site 1	*At IDZ** Site 2*	*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		1700 cms	
River Flow Trend	decreasing		increasing		stable		increasing	
Turbidity (NTU)	21	22	9.2	9.1	4.5	4.7	19	17
Total Suspended Solids	22	24	8	10	not done		not done	
Nitrate+Nitrate (as N)	0.05	<0.003	<0.003	0.053	0.089	0.095	0.021	0.028
Total Phosphate (as P)	0.023	0.107	0.003	0.045	0.0197	0.063	0.122	0.098
Ortho Phosphate (as P)	<0.003	<0.003	<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	0.107	0.395
Fecal Coliform (CFU/100ml)***	99	55	62	93	67	160+ (Note 4)	76	61

TABLE 4.1: RECEIVING ENVIRONMENT MONITORING DATA FRASER RIVER (continued)

Date	*Sept. 18, 2008*		*Oct. 1, 2009*		*Oct. 4, 2010*	
	Upstream Site 1	*At IDZ** Site 2*	*Upstream Site 1*	*At IDZ** Site 2*	*Upstream Site 1*	*At IDZ** Site 2*
River Flow	1000 cms		780 cms		1260 cms	
River Flow Trend	decreasing		decreasing		decreasing	
Turbidity (NTU)	7.3	7.5	14	14	91	70
Total Suspended Solids	16	15	22	24	244	267
Nitrate+Nitrate (as N)	0.029	0.025	0.044	0.041	0.125	0.089
Total Phosphate (as P)	0.034	0.032	0.086	0.107	0.673	0.58
Ortho Phosphate (as P)	<0.003	<0.003	0.052	0.079	0.16	0.121
Ammonia (N)	0.017	<0.005	0.054	0.042	0.027	0.035
Fecal Coliform (CFU/100ml)***	61	18	14	15 (Note 6)	168	96

RECEIVING ENVIRONMENT MONITORING DATA WILLIAMS LAKE RIVER (5)

Date	*Sept. 21, 2004*	*Sept. 29, 2005*	*Dec. 07, 2006*	*Oct. 25, 2007*	*Sept. 18, 2008*	*Oct. 1, 2009*	*Oct. 4, 2010*
Turbidity (NTU)	1.4	2.8	0.35	<1	0.3	0.2	1.3
Total Suspended Solids	2	1	not done	not done	<1	3	5
Nitrate+Nitrate (as N)	<0.003	<0.003	0.024	<0.003	<0.003	<0.007	<0.006
Total Phosphate (as P)	0.015	0.058	0.011	0.016	0.009	0.071	0.051
Ortho Phosphate (as P)	<0.003	0.01	<0.003	<0.003	<0.003	0.051	0.051
Ammonia (N)	0.007	0.131	0.073	<0.005	<0.005	0.059	0.01
Fecal Coliform (CFU/100ml)***	11	82	5	6	35	6	13

** 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 4, 2010 is presented as follows:

	December 2001 IDZ Dilution Ratio Calculation	*October 4, 2010 IDZ Dilution Ratio Calculation*
Fraser River Flow	375 cms*	1260 cms
Flow in IDZ Cross Section	75.9 cms	±120.5 cms
Effluent Discharge Volume	8000 m^3/day	4810 m^3/day (actual)**
Theoretical Dilution Ratio at IDZ	820:1	4330:1

* 7 day 2 year return low flow

** Average daily discharge rate for the period October 3 to October 5, 2010 from City of Williams Lake Annual Report

Using the theoretical dilution ratio of 4330:1 for October 4, 2010 and effluent values from September 14, 2010, the increase in total phosphorus, orthophosphorus, ammonia and fecal coliform concentrations measured at the IDZ compared to background are calculated as follows:

Total Phosphorus – 3.89 mg/L ÷ 4330 = 0.0009 mg/L increase
Total Orthophosphorus – 2.26 mg/L ÷ 4330 = 0.0005 mg/L (not measurable)
Total Suspended Solids – 35 mg/L ÷ 4330 = 0.008 mg/L (not measurable)
Ammonia – 15.6 mg/L ÷ 4330 = 0.004 mg/L increase
Fecal Coliform – 5,550/100mL ÷ 4330 = 1.3/100mL 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 (91 and 70 NTU respectively) are considered to be the same order of magnitude 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 244 and 267 mg/L respectively. As described for turbidity, these concentrations are considered to be the same as would be expected.

- The sampling data illustrates a minimal increase in ammonia concentrations (increase of 0.008 mg/L) and no increase in nitrate concentrations between Site 1 and 2. The sampling results are consistent with the dilution calculations, i.e. there should be a minimal or no increase in ammonia and nitrate at the IDZ.

- Fecal coliform concentrations (average of three samples) were 168 per 100 ml upstream of the outfall and 96 per 100 ml downstream of the outfall. Theoretical calculations based on the estimated dilution ratio of 4330:1 suggest that the Site 2 concentrations should be about 1.3 CFU/100 ml higher than Site 1. All coliform results are less than 200 CFU/100 ml, the standard for recreational contact.

- The total phosphorus concentration and orthophosphorus concentration above the outfall on October 4, 2010 was greater than the concentration at the IDZ. The sampling results are consistent with the dilution calculations, i.e. there should be a minimal or no increase in total phosphorus and orthophosphorus at the IDZ.

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. In the *Review of 2009 Receiving Environment Monitoring Data* Report, it was noted that orthophosphorus concentrations in October 2009 were an order of magnitude higher averaging 0.065 mg/L. Discussions with the environmental lab manager at Stewart Group Geochemical & Assay had led to the conclusion that an extended time period between sampling and analysis (Oct. 1, 2009 to Oct. 5, 2009) was a reasonable explanation for the elevated orthophosphorus concentrations. However, the orthophosphorus concentrations in October 2010 were two times higher than measured in 2009, averaging 0.14 mg/L. It is beyond the scope of this assessment to determine why orthophosphorus concentrations apparently continue to increase in the Fraser River, however similar concentrations measured both upstream (0.16 mg/L) and at the IDZ (0.121 mg/L) suggest that the discharge of municipal effluent from the City of Williams Lake is not a significant contributing factor to the orthophosphorus concentrations in the Fraser River.

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 4, 2010 the Fraser River flow was 1260 cms. This flow is about 300% 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 1260 cms on October 4, 2010, the dilution ratio achieved at the IDZ is estimated to be 4330:1.

- On October 4, 2010 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 14, 2010:

BOD	-	12 mg/L
Suspended Solids	-	35 mg/L
Ammonia (as N)	-	15.6 mg/L
Total Phosphorus	-	3.89 mg/L
Total Ortho Phosphorus	-	2.26 mg/L
Fecal Coliform	-	5,550/100 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 4, 2010 indicates:

  - No increase in turbidity and a slight increase in total suspended solids consistent with the calculated dilution ratio.
  - No increase in total phosphorus and orthophosphorus.
  - No increase of fecal coliform concentrations which is consistent with the calculated dilution ratio.
  - A slight 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 continue an increasing trend which was first identified in 2009. In

2009, orthophosphorus concentrations were an order of magnitude higher as compared to 2008 possibly due to an extended time between sampling and analysis. The 2010 orthophosphorus concentration both upstream and downstream average 0.14 mg/L (100% higher than 2009 concentrations) with no apparent explanation. Comparable orthophosphorus concentrations both upstream and at the IDZ indicate that City of Williams Lake discharge of municipal effluent is not a contributing factor to orthophosphorus concentrations in the Fraser River.

APPENDIX 'A'

Receiving Monitoring Program – TRUE letter dated August 23, 2004

TRUE
CONSULTING GROUP

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 form 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 m^3/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:

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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
Otho 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/wscl
  - 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.

.../4

- 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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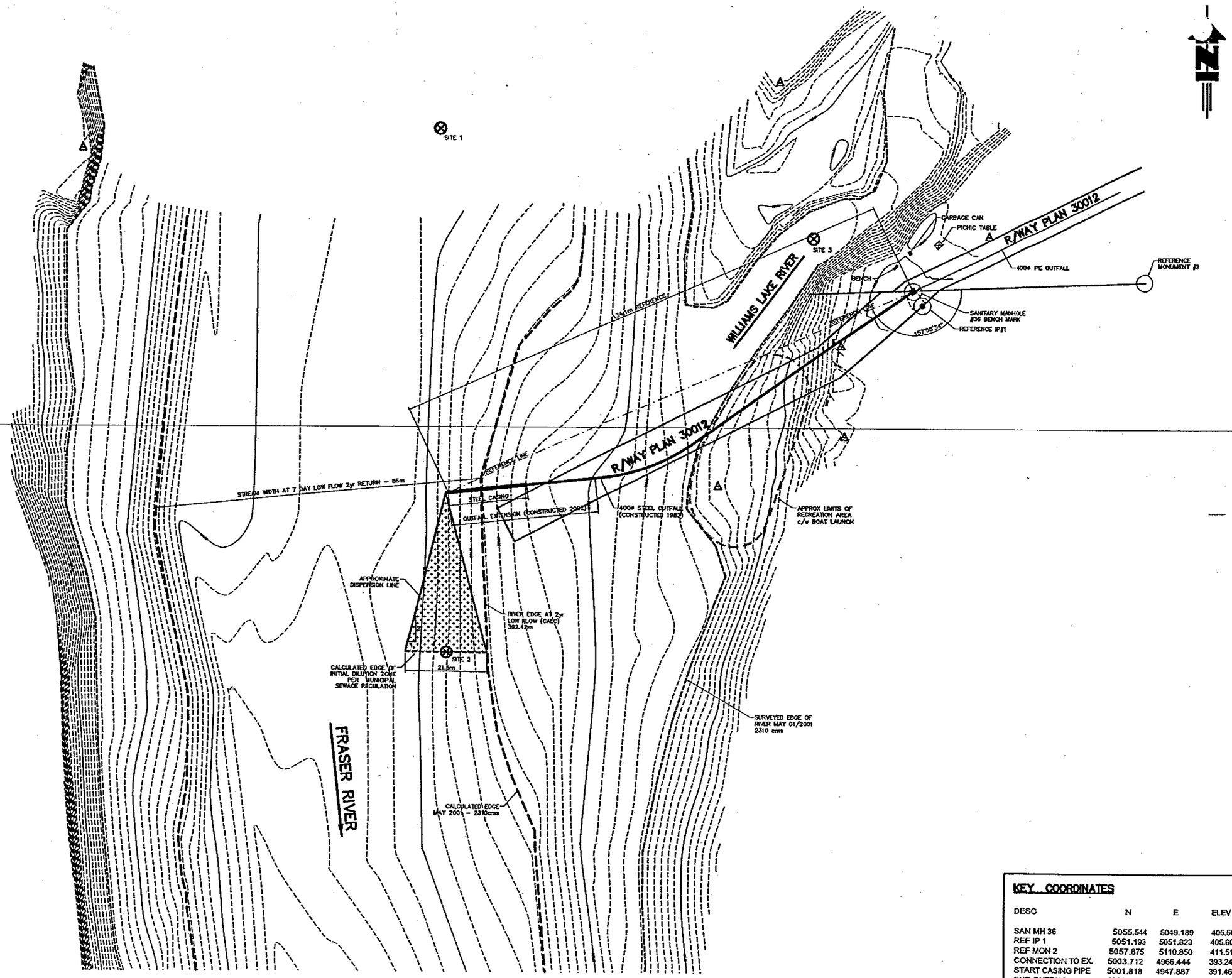

KEY COORDINATES

DESC	N	E	ELEV
SAN MH 36	5055.544	5049.189	405.56
REF IP 1	5051.193	5051.823	405.60
REF MON 2	5057.875	5110.850	411.51
CONNECTION TO EX.	5003.712	4966.444	393.24
START CASING PIPE	5001.818	4947.887	391.46
END OUTFALL	4999.928	4926.518	391.725

No.	DATE	DESCRIPTION	BY	APP'D
9				
8				
7				
6				
5				
4				
3	JULY 14/04	ADDED PROPOSED SANITARY SEWER	BL	TRUE
2	MAY 5/04	AS CONSTRUCTED	BL	TRUE
1	JUNE 6/03	ISSUED FOR CONCEPTUAL APPROVAL	YW	TRUE

ISSUES / REVISIONS

SCALE 1:500
DESIGN BY TRUE
DRAWN BY BL
DATE JUNE 2003
CHK. BY
DATE

TRUE CONSULTING GROUP

SANITARY SEWER OUTFALL EXTENSION

OVERALL LOCATION PLAN

SHEET No. OF

DRAWING No. 602-021-05

ISSUE/REV. 3

50% REDUCED DWG

APPENDIX 'B'

Analytical Report – Alex Stewart Geochemical
February 18, 2010

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Toll Free + 1 877 573 5755
www.stewartgroupglobal.com

StewartGroup
Geochemical & Assay

ANALYTICAL RESULTS - #:E10-2456

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

18-Oct-10

2010 PO#:13741

RECEIVED
OCT 22 2010
CITY OF WILLIAMS LAKE

ATTENTION: George Bell

SAMPLE IDENTIFICATION: 2 Water Sample Received: October 5, 2010
Sample Dated: October 4, 2010
Labelled: #1: Site 1
#2: Site 2
#3: Site 3

PARAMETERS:	1	2	3
Turbidity (NTU)	91	70	1.3
Total Suspended Solids	244	267	5
Ammonia (as N)	0.027	0.035	0.01
Total Phosphate (as P)	0.673	0.58	0.051
Ortho Phosphate (as P)	0.16	0.121	0.051
Nitrate	0.122	0.086	<0.003
Nitrite	0.003	0.003	<0.003
Fecal Coliform (CFU/100mL)	159	106	5
Fecal Coliform (CFU/100mL)	183	72	12
Fecal Coliform (CFU/100mL)	163	110	21

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

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 October 2, 2010 to
October 6, 2010

Environment Canada Environnement Canada

Canada

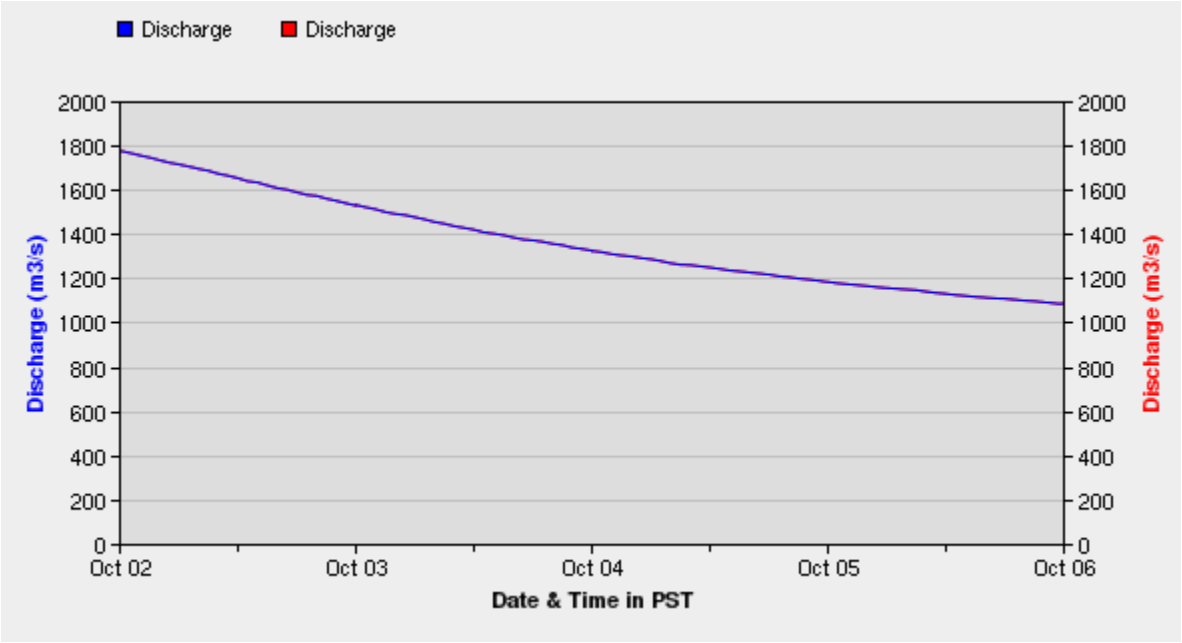
Home > Real Time Graph >

FRASER RIVER NEAR MARGUERITE [BC] (08MC018)

Data Category: Real Time Go Tabular Data

Parameter Type: Discharge Discharge Redraw

Note - if primary water level is not current, try redundant water level in parameter drop-down list.



Modify Graph Settings

Start Date: October 2 2010 **End Date:** October 6 2010 Redraw

Y-axis scale (primary)

Min. Limit:

Max. Limit:

Additional statistics

- Max
- Min
- Mean
- Median
- Upper Quartile
- Lower Quartile

Y-axis scale (secondary)

Min. Limit:

Max. Limit:

Additional statistics

- Max
- Min
- Mean
- Median
- Upper Quartile
- Lower Quartile

Environment Canada Environnement Canada

Canada

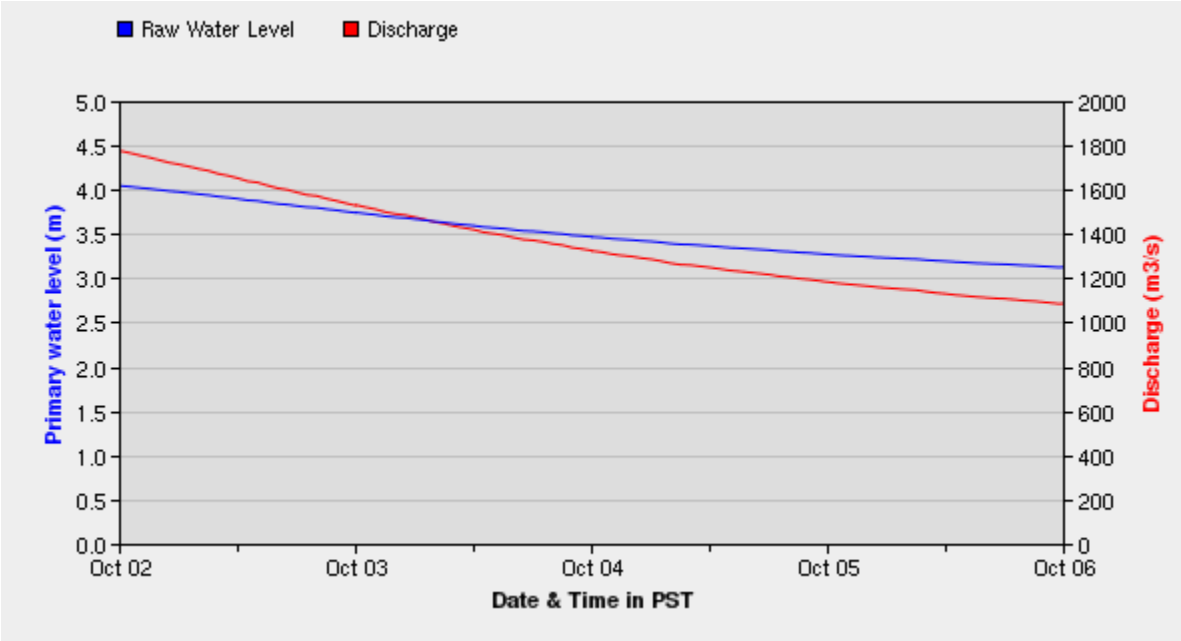
Home > Real Time Graph >

FRASER RIVER NEAR MARGUERITE [BC] (08MC018)

Data Category: Real Time Go Tabular Data

Parameter Type: Primary water level Discharge Redraw

Note - if primary water level is not current, try redundant water level in parameter drop-down list.



Modify Graph Settings

Start Date: October 2 2010 **End Date:** October 6 2010 Redraw

Y-axis scale (primary)

Min. Limit:

Max. Limit:

Additional statistics

- Max
- Min
- Mean
- Median
- Upper Quartile
- Lower Quartile

Y-axis scale (secondary)

Min. Limit:

Max. Limit:

Additional statistics

- Max
- Min
- Mean
- Median
- Upper Quartile
- Lower Quartile