

Coquitlam

For Committee

February 25, 2013
Our File: 11-5225-04/000/2013-1
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To: City Manager
From: General Manager, Engineering and Public Works

Subject: **Coquitlam River Water Quality Monitoring Update**

For: **Council-in-Committee**

Recommendation:

That the Committee receive this report dated February 25, 2013, of the General Manager, Engineering and Public Works, entitled "Coquitlam River Water Quality Monitoring Update" for information.

Report Purpose:

The purpose of the report is to provide an update on the water quality monitoring of the Coquitlam River undertaken by the City during 2012.

Strategic Goal:

The monitoring program outlined in this report supports the City's Corporate Objective to continually improve processes, policies and services.

Executive Summary:

During the summer and fall of 2012, the City of Coquitlam initiated a water quality monitoring program for the Coquitlam River to help build a current database of water quality data. Through this report, the resultant data is being made available to inform Council and the community on the findings. The monitoring approach was adapted from the draft "Stage 1" framework for water quality monitoring as developed by Metro Vancouver's Stormwater Interagency Working Group (SILG). Based on SILG's draft framework, an examination of the sampling results for the 2012 Coquitlam River water quality monitoring program indicates overall positive watershed health with the majority of parameters being achieved at all locations during both dry and wet weather conditions. The City intends to repeat the monitoring program in 2013 to further assess and build on the 2012 data set. Results of the 2012 monitoring program will be shared with the many stakeholders that have interest in the Coquitlam River watershed, including the Coquitlam River Watershed Roundtable, the Coquitlam River Aggregate Committee, the City's Sustainability and Environmental Advisory Committee and through the City's website.

Background:

Over the years, a variety of monitoring and habitat restoration projects have been undertaken along the Coquitlam River by various agencies and stewardship groups; however, there has been a lack of consistent water quality monitoring. To help fill this gap, staff developed a water quality monitoring program that was initiated during the summer of 2012 by the City's Environmental Services Division. This initiative is intended to help build a current set of water quality data that will be useful for monitoring the health and integrity of the Coquitlam River, and can be used as a resource to help guide future activities and decision-making processes with regard to the Coquitlam River watershed.

Discussion/Analysis:

Study Overview

Beginning August 31, 2012, the City's Environmental Services Division initiated a river-wide water quality sampling program of the Coquitlam River. The monitoring approach, criteria levels and selection of parameters were adapted from the protocol developed by the Metro Vancouver Stormwater Interagency Liaison Group (SILG) working in consultation with the BC Ministry of Environment. Under the Regional Liquid Waste Management Plan, the SILG was created to facilitate municipal stormwater management activities and to research sustainable stormwater management practices. The SILG includes representatives from regional and municipal government, including Coquitlam staff. The protocol developed by SILG forms part of an overall stormwater monitoring framework that is intended to help evaluate the effectiveness of Integrated Stormwater Management Plans throughout the region and provide a stepwise approach to the adaptive management of stream health. The work of the SILG is in its final stages of review and will be forwarded later this year to the Metro Vancouver Board for their endorsement. For reference, a copy of the draft framework is provided as Attachment # 1 to this report.

Coquitlam is among the first municipalities to use the monitoring approach recommended by the SILG and apply the evaluation criteria which has been incorporated into the draft adaptive management framework. The attainment or non-attainment of specific criteria are colour-coded into green, yellow and red levels and each level is associated with recommended time frames for adaptive management actions to be undertaken.

For example, the Green Level indicates that attainment of the criteria has been achieved and no further monitoring is required for five years and no adaptive management actions are required. The Yellow Level indicates a borderline attainment/non-attainment level and recommends further monitoring and adaptive management actions within five years. The Red Level indicates that there is significant non-attainment of the criteria and adaptive management actions are required within one to two years, depending on the severity of the non-attainment.

The Coquitlam River monitoring program involved sampling at seven locations along the Coquitlam River; from just below the Coquitlam River Dam at the Al Grist Memorial Hatchery to the downstream end at Colony Farm. The sampling locations are situated fairly evenly along the length of the River and receive stormwater inputs from a variety of land uses along the River that include undeveloped, residential, commercial and industrial uses. The original program included a sampling location at Upper Coquitlam Park as part of the seven sites; however, during a September 2012 meeting of the Core Committee to the Coquitlam River Watershed Roundtable, some Committee members requested consideration of testing on Fulawka Creek as they felt the program could benefit from obtaining data pertinent to that particular stream. Due to the close proximity of the Fulawka location to the Upper Coquitlam Park site, staff were able to accommodate the request by discontinuing monitoring of the Upper Coquitlam Park site and commencing monitoring at the Fulawka site. Sampling at the other six locations was completed as per the initial program design. The sampling location map and site images are provided as Attachments # 2 and # 3, respectively.

Water samples were collected at each location along the River on a weekly basis for a period of five consecutive weeks during the dry season (August/September 2012), and for five consecutive weeks during the rainy season (November/December 2012). As recommended by the SILG protocol, the five weekly results for each sampling period at each location were averaged and this value was compared to the evaluation criteria developed by the SILG. Staff used field equipment to measure Dissolved Oxygen, pH, Temperature, Turbidity and Conductivity levels and laboratory analyses for the remaining water quality parameters: Nitrate, Chlorophyll a, E. coli, Fecal Coliforms and five Metals (Cadmium, Copper, Iron, Lead and Zinc). In addition to the parameters recommended by SILG, the samples were also analyzed for total hardness, Nitrite, Nitrate plus Nitrite, Calcium, Magnesium, Potassium, Sodium and Sulphur (as part of the lab package) and Total Suspended Solids (as requested by members of the Coquitlam River Watershed Roundtable). A summary of results is included as Attachment #4 and a copy of all of the data collected is included as Attachment #5.

Study Results

The 2012 water quality data results provided in Attachment # 4 indicate a Green Level result was consistently achieved for 12 out of 14 parameters. In many cases, the parameters were found to be well within the Green Level. For example, even the highest average Turbidity level at the sites did not exceed one-half of the maximum amount allowed within the Green Level.

Dissolved Oxygen (DO) was the only parameter that was found regularly occurring within the Yellow Level at all sample locations. Normally, the amount of DO in water is affected by water temperature and the saturation level for oxygen in water is lowered as water temperature increases. However, the results for DO obtained as part of the 2012 monitoring program do not appear to be affected by changes in temperature. Both temperature and DO are parameters that form part of BC Hydro's ongoing research studies related to their Buntzen/Coquitlam water use plan. As such, the results of the 2012 monitoring program will be shared with BC Hydro for further discussion, review and advice.

At the Riverbend Site, the average result for Total Copper was found to be within the Red Level during the summer flow period. Of the five samples collected at this location during the summer, four were found to be well within the green level, but one sample returned a result of 138ug/L, which skewed the average of the five results towards the red level. The reason for this anomaly in the results is unknown. Further sampling will be conducted in 2013 to help determine whether there is an issue at this location that requires further assessment.

While the majority of the test parameters were found to be within the Green Level, indicating attainment of the criteria levels, staff intend to repeat the monitoring program in 2013 to confirm and build on the 2012 data set.

Study Limitations

The 2012 monitoring program for the Coquitlam River provides a substantial set of water quality data over the length of the River that represent current conditions for the River. It is recognized, however, that the study was limited in its scope and is not intended to provide a detailed assessment of the health of the River or to draw conclusions about the influences or impacts of any land uses that may affect the River. The data provide a snapshot of the overall health of the river system, and are useful for identifying potential issues and areas that require further monitoring and assessment.

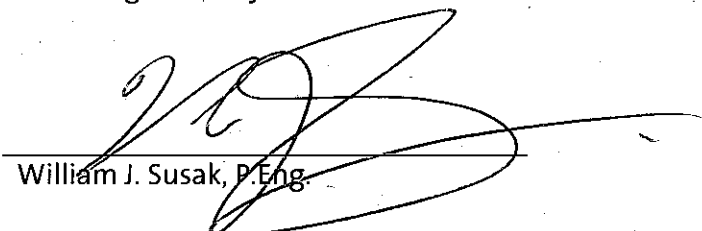
Financial Implications:

Funding for this limited sampling program has been accommodated within the existing budget for the Environmental Services Division.

Conclusion:

The 2012 monitoring program for the Coquitlam River provides a valuable set of current water quality data that can be viewed as a snapshot of the overall health of the river system. The approach taken for the 2012 program was adapted from the protocol for water quality monitoring as developed by SILG, in consultation with the BC Ministry of Environment, and is part of a framework being developed for monitoring the effectiveness of Integrated Stormwater Management Plans. This framework provides a stepwise approach to the characterization and adaptive management of stream health. Based on SILG's draft framework, an examination of the sampling results for the 2012 Coquitlam River water quality monitoring program indicates overall positive watershed health with the majority of parameters in attainment at all locations. The City intends to repeat the monitoring program in 2013 to further assess and build on the 2012 data set. For consistency, the 2013 program will follow the same approach as in 2012, and plans include sampling for the same parameters at the same locations.

Results of the 2012 monitoring program will be shared with the many stakeholders that have interest in the Coquitlam River watershed through the Coquitlam River Watershed Roundtable, the Coquitlam River Aggregate Committee, the City's Sustainability and Environmental Advisory Committee and through the City's website.



William J. Susak, P.Eng.

Attachments:

1. Water Quality Monitoring Criteria as adapted from SILG
2. Coquitlam River Water Quality Testing sites
3. Photos of Sampling Locations
4. Average Results for Summer Flow and Fall/Winter Flow Sampling Periods
5. Raw Data

This report was prepared by Margaret Birch, Environmental Services Coordinator, Caresse Selk, Environmental Stewardship Coordinator, Bela Piocza, Environmental Services Officer, and reviewed by Steffanie Warriner, P.Eng., Environmental Services Manger.

Water Quality Monitoring Criteria as adapted from the proposed Stage 1 Stormwater Monitoring Approach developed by the Stormwater Inter-Agency Liaison Group

Sampling is 5 samples taken over 5 weeks in a row, in both the low flow period (Aug/Sept) and in the wet weather period (Nov/Dec). Average of the 5 samples from the low flow period, and average of the 5 samples from the wet weather period are to be compared to the assessment table below.




Water Quality Monitoring Parameters	Green Level	Yellow Level	Red Level
	Attainment (No further monitoring for 5 years; no adaptive management required.)	Borderline attainment/non attainment (Adaptive management actions required within 5 years.)	Non-attainment (Adaptive management action required within 1-2 years.)
Dissolved Oxygen (mg/L)*	Greater than 11 mg/L	6.5 to 11 mg/L	Less than 6.5 mg/L
pH (rel. Units)	6.5 to 9.0	6.0 to 6.5 or 9.0 to 9.5	<6 or >9.5
Water Temperature (deg. C)			
low flow summer	<16	16 – 18	Over 18
wet weather fall winter	7 - 12	5 – 7 or 12 – 14	Under 5 or over 14
Turbidity (NTU)*	Average from 0 to 5	Average between 5 to 25	Average above 25
Nitrate (mg/L)	<2 mg/L	2 – 5 mg/L	>5 mg/L
Chlorophyll a	<2 ug/L	2 – 5 ug/L	>5 ug/L
Conductivity uS/cm	0 – 50	50 – 200	Above 200
E. Coli (CFU/100 ml)			
(E. Coli for freshwater)	E. Coli geomean 0 – 77	E. Coli geomean 78 – 385	E. coli geomean over 385
(Enterococci for marine)	Enterococci geomean 0 – 20	Enterococci geomean 21 – 100	Enterococci geomean over 100
Fecal coliforms (CFU/100 ml)	geoman 0 – 200	geomean 201-1,000	geomean over 1,000
Metals (Total Metals ug/L)*			
Iron	<800 ug/L	800 – 5,000 ug/L	>5,000 ug/L
Cadmium	<0.03 ug/L	0.03 – 0.15 ug/L	>0.15 ug/L
Copper	<3 ug/L	3 – 20 ug/L	>20 ug/L
Lead	<5 ug/L	5 – 25 ug/L	>25 ug/L
Zinc	<6 ug/L	6 – 40 ug/L	>40 ug/L

CP hardness needed to assess metals. Rank values assume hardness approximating 100 mg/L CaCO₃

Coquitlam River Water Quality Testing Sites



Legend

-  Water Quality Sampling Location
-  Watercourse
-  Municipal Boundary

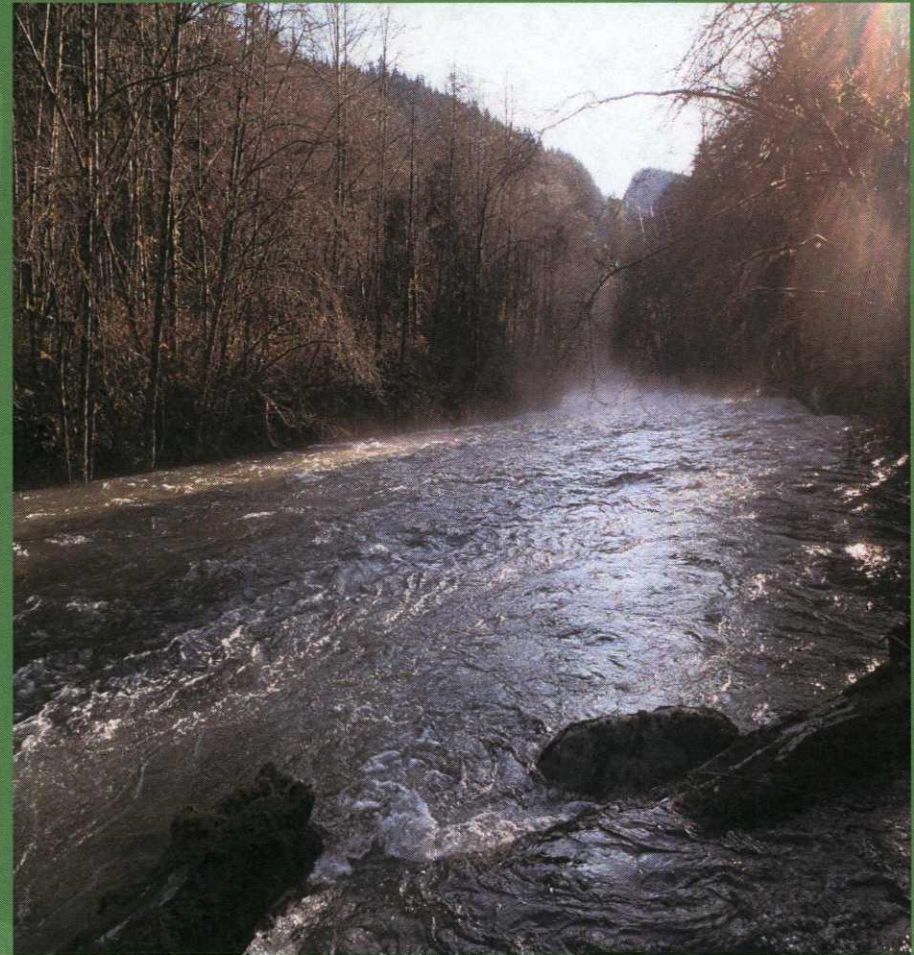
Map produced by the City of Coquitlam Feb, 2013 Engineering and Public Works Dept, Mapping Section. The City assumes no responsibility for the correctness of information shown. 2012 data provided by cities of Coquitlam and Port Coquitlam.

Al Grist Memorial Hatchery– Site 1



Sept 21, 2012

GIS - 516,634.432 - 5,464,991.136 Metres



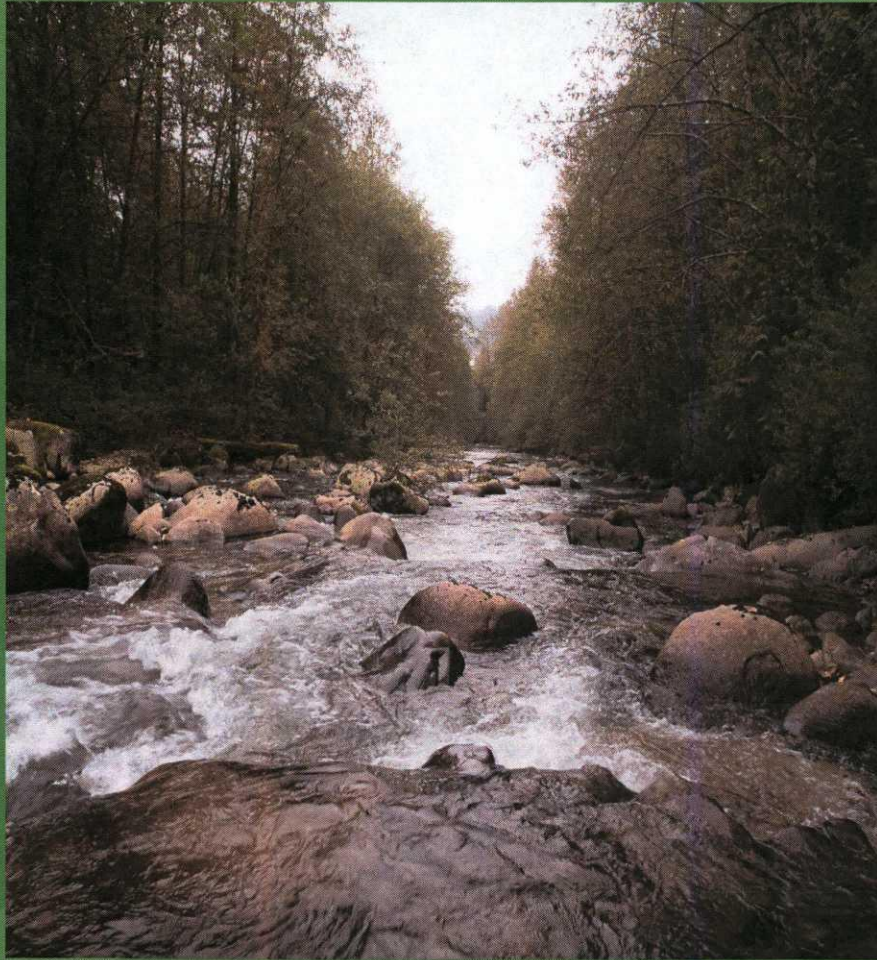
Nov 9, 2012

Lat 49 18 9N Long 122 46 58 W

Coquitlam

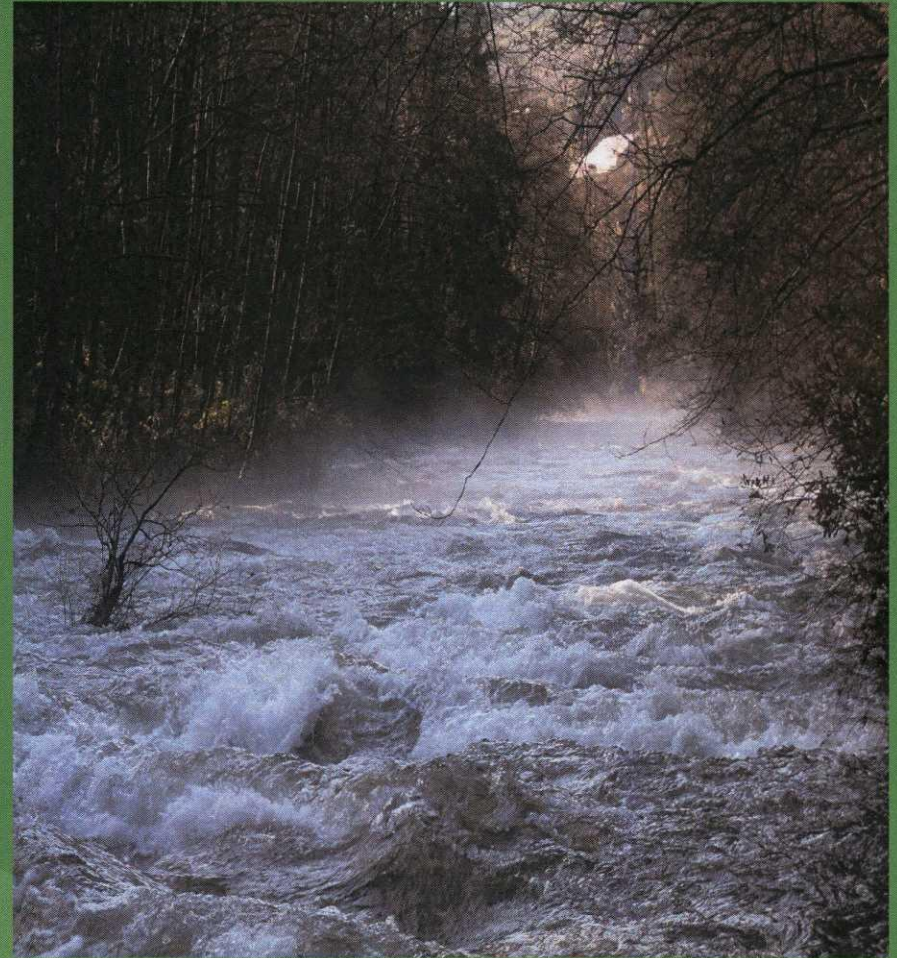
Fulawka Creek– Site 2

This site added Sept 21, 2012, the third week of low flow sampling.



Sept 21, 2012

GIS 516,617.823 -5,464.155.056 Metres



Nov 9, 2012

Lat 49 18 15N Long 122 46 34W

Coquitlam

Upper Coquitlam Park – Site 3

This sampling site location discontinued after Sept 21, 2012 low flow sampling event, the third week of sampling period.



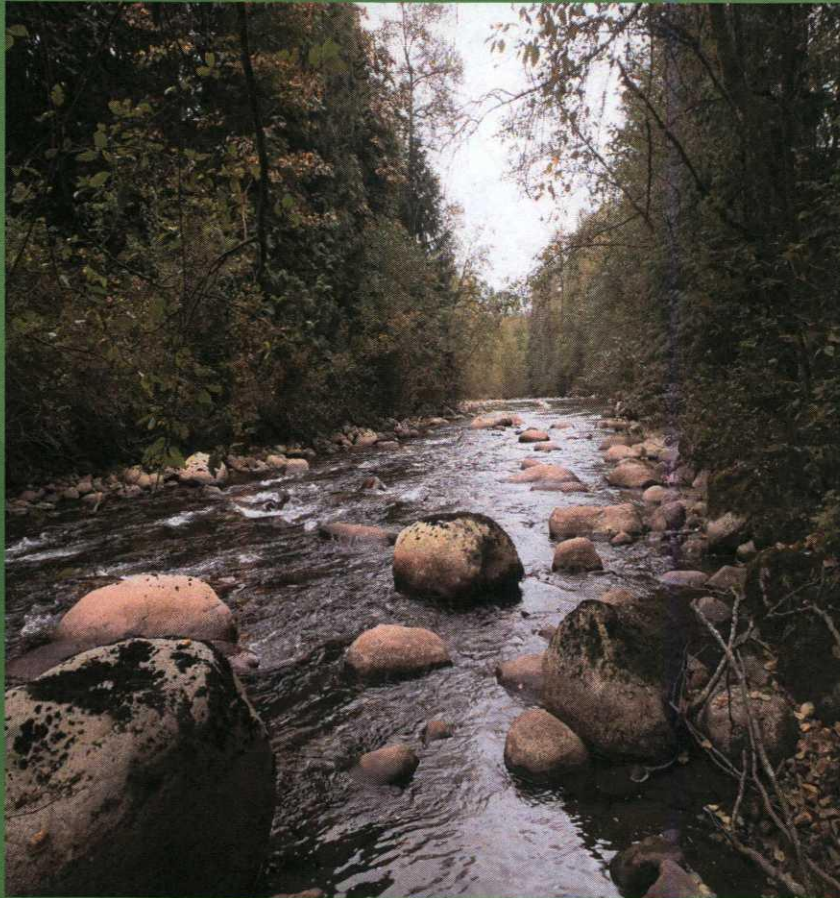
Sept 14, 2012

GIS 516,575.591 – 5,462,115.376 metres

Lat 49 19 34N Long 122 46 18W

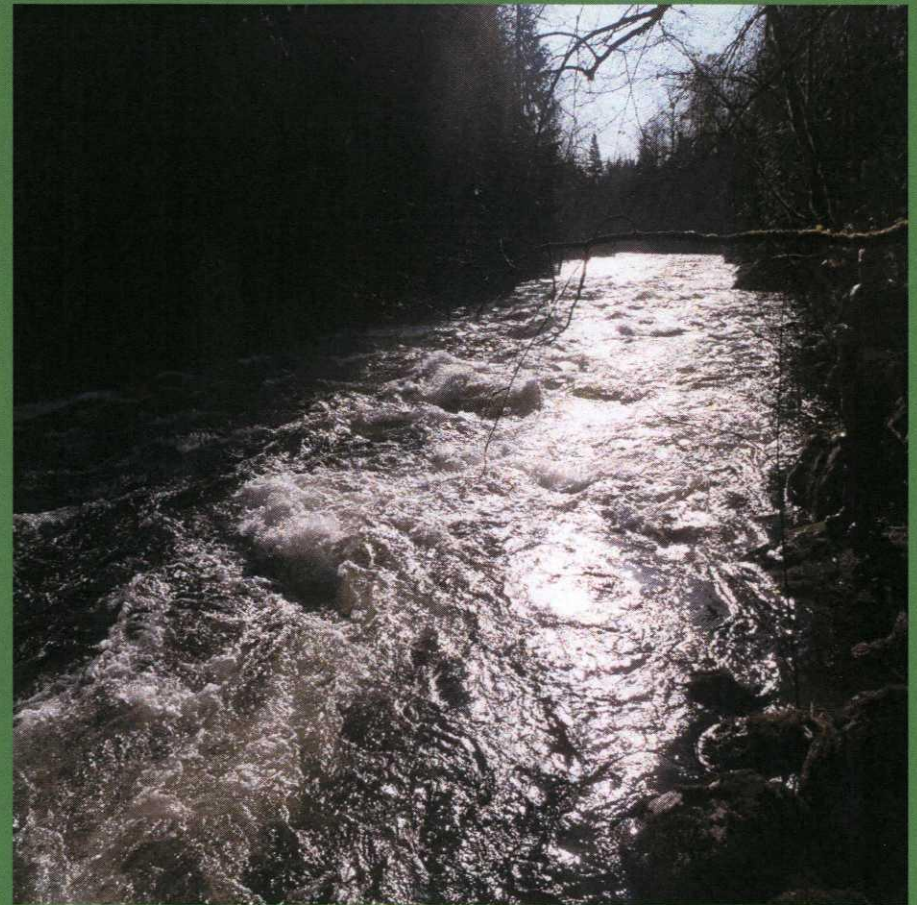
Coquitlam

Gravel Pits – Site 4



Sept 14, 2012

GIS 516,575.591 - 5,462,115.376 Metres



Nov 9, 2012

Lat 49 18 40N Long 122 46 8W

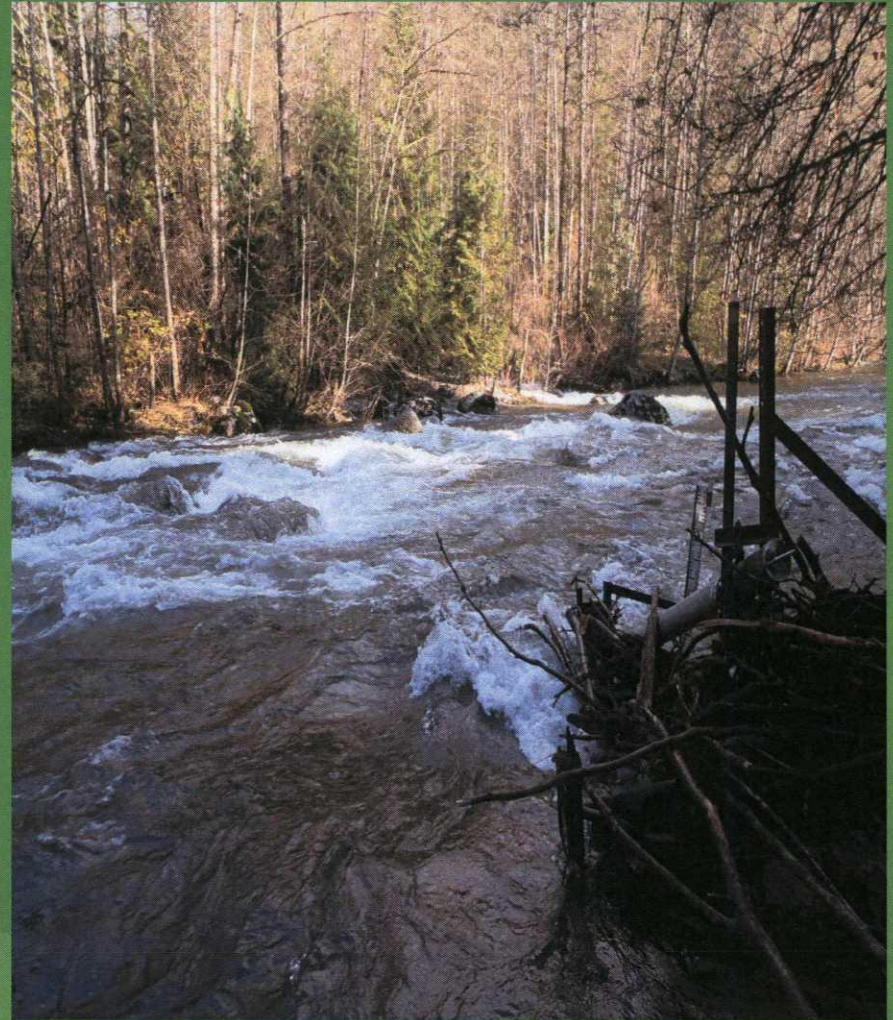
Coquitlam

Galette Avenue – Site 5



Sept 21, 2012

GIS 516,634.689 - 5,461,274.487 Metres

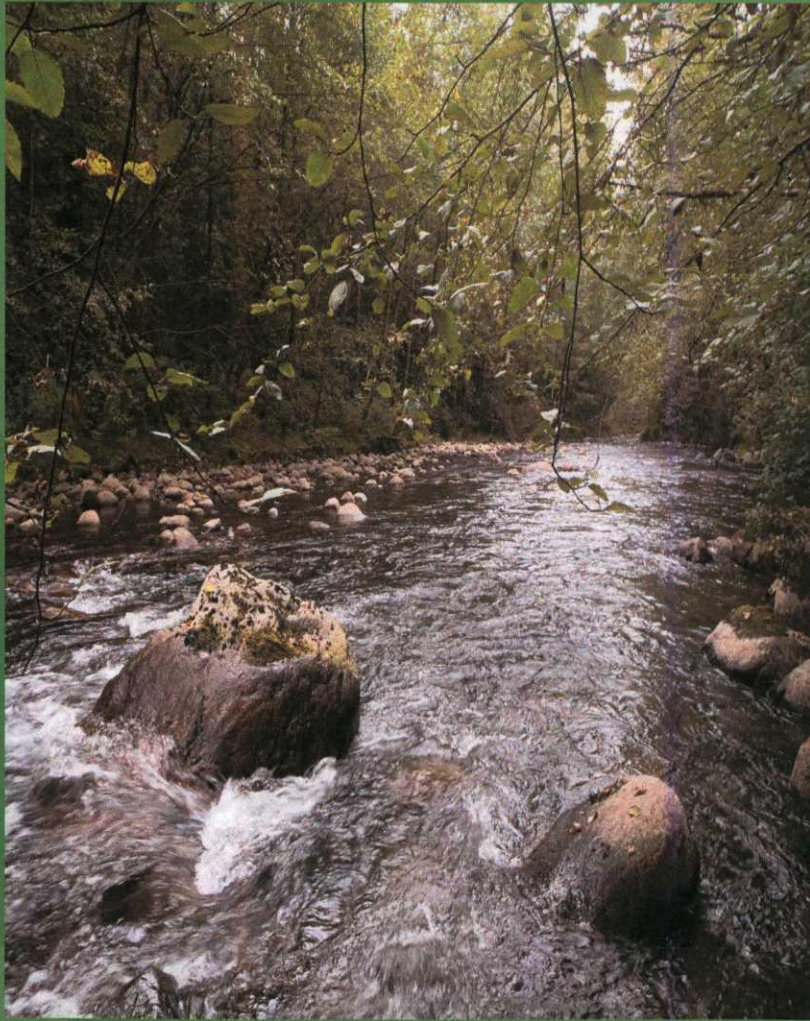


Nov 9, 2012

Lat 49 18 14N Long 122 46 16W

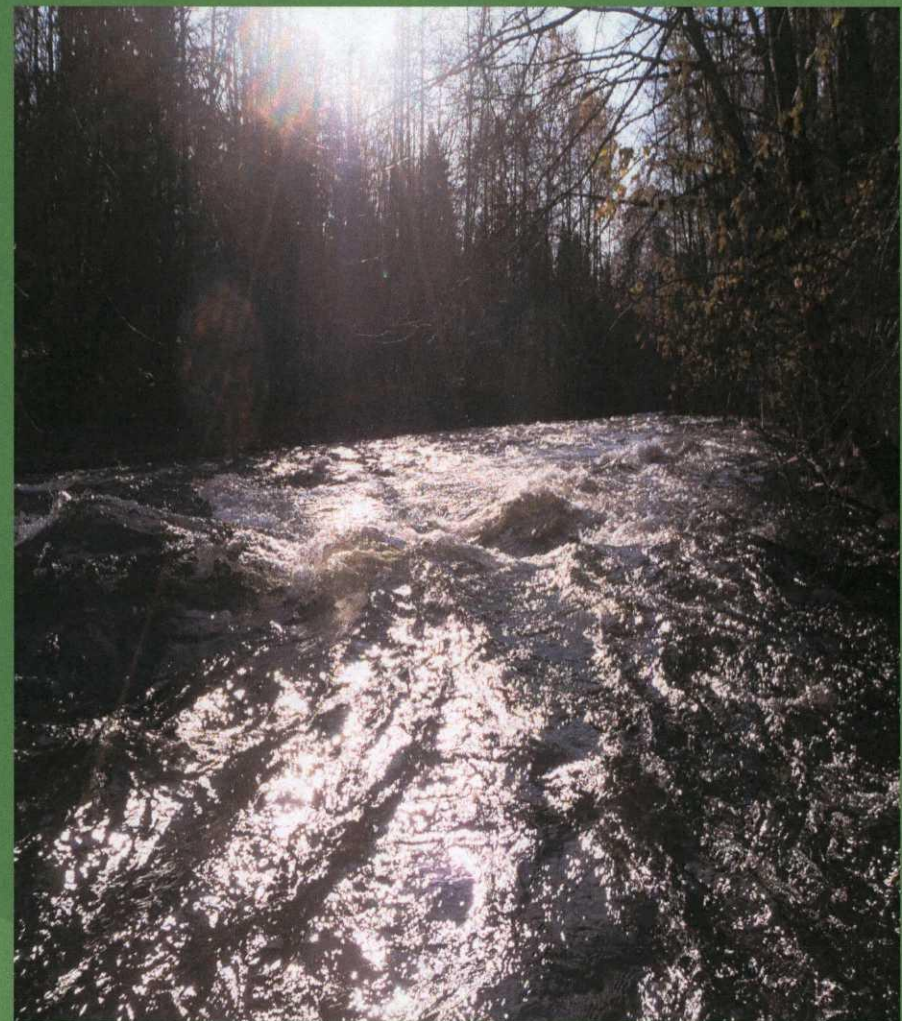
Coquitlam

Salt Spring Avenue– Site 6



Sept 21, 2012

GIS 516,470.658 - 5,459,247.132 Metres



Nov 9, 2012

Lat 49 17 8N Long 122 46 24W

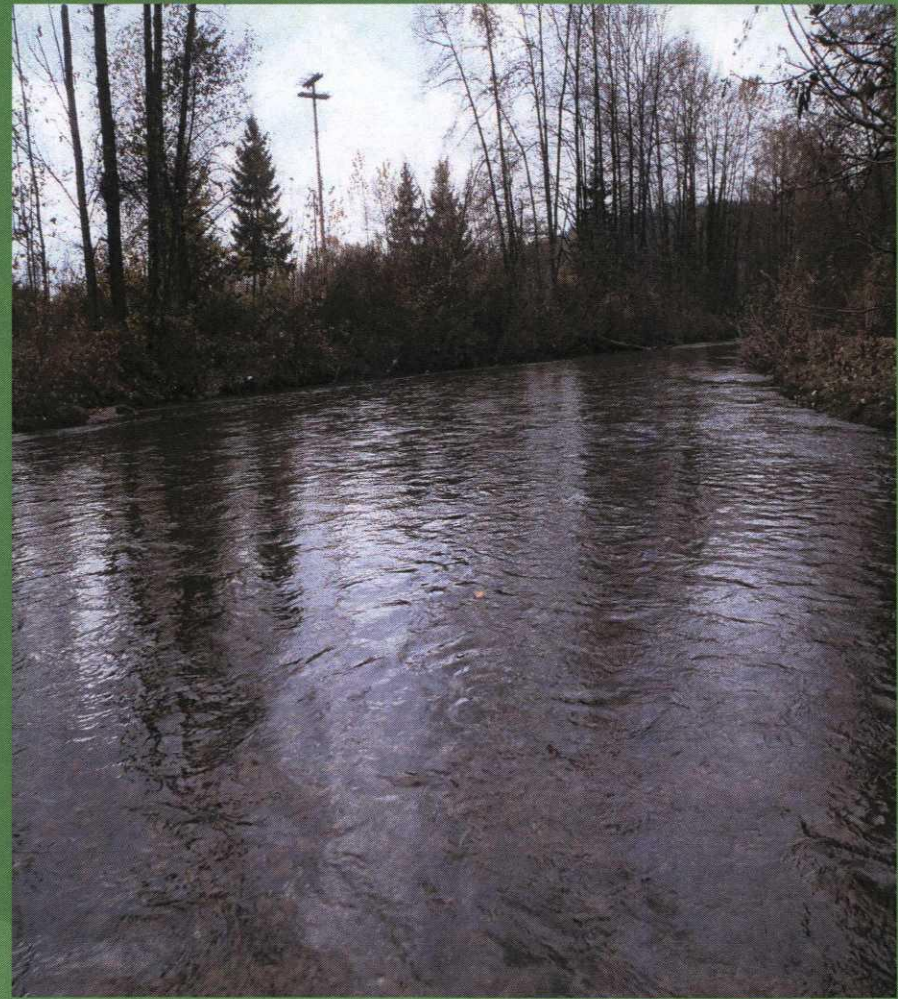
Coquitlam

Riverbend – Site 7



Sept 21, 2012

GIS 515,319.915 - 5,456,554.102 Metres



Nov 9, 2012

Lat 49 15 42N Long 122 47 31W

Coquitlam

Colony Farm – Site 8



Sept 21, 2012

GIS 514,039.490 - 5,454,259.481 Metres



Nov 9, 2012

Lat 49 14 28N Long 122 48 25W

Coquitlam

2012 Coquitlam River Water Quality Monitoring Program

Average results for Summer Flow and Fall/Winter Flow Sampling Periods

Coquitlam River Testing Sites by Location	Dissolved Oxygen ¹ (mg/L)	pH ² (Relative Units)	Temperature (Degrees Celsius)	Turbidity (NTU)	Nitrate ³ (mg/L)	Chlorophyll a (ug/L)	Conductivity (uS/cm)	E. Coli (CFU/100 ml)	Fecal Coliforms (CFU/100 ml)	Total Iron (Fe) (ug/L)	Total Cadmium (Cd) (ug/L)	Total Copper (Cu) (ug/L)	Total Lead (Pb) (ug/L)	Total Zinc (Zn) (ug/L)
Al Grist Memorial Hatchery														
Summer Flow	10	7.7	16.0	0	Not collected	1	10	18	25	60	0.01	0	0	3
Fall/Winter Flow	11.8	6.7	7.0	2	0	0	7	4	20	103	0.01	1	0	3
Fulawka Creek														
Summer Flow ⁴	Insufficient data for all parameters to calculate an average result.													
Fall/Winter Flow	9.9	6.6	7.0	1	0	1	7	5	11	117	0.01	1	0	3
Upper Coquitlam Park														
Summer Flow ⁵	Insufficient data		16.0	0	Not collected	1	9	6	10	72	0.01	0	0	3
Fall/Winter Flow	No data was collected for any parameters at this sampling site. It was discontinued when Fulawka Creek site established.													
Gravel Pits														
Summer Flow	9.8	7.8	16.0	1	Not collected	1	17	7	18	129	0.01	0	0	3
Fall/Winter Flow	9.7	6.6	7.0	2	0	0	10	10	23	218	0.01	1	0	3
Galette Ave														
Summer Flow	9.5	7.9	16.0	0	Not collected	1	16	9	17	118	0.01	0	0	3
Fall/Winter Flow	9.9	6.7	7.0	2	0	1	9	7	24	172	0.01	1	0	3
Saltspring Ave														
Summer Flow	9.5	7.9	15.6	0	Not collected	1	18	15	45	105	0	0	0	3
Fall/Winter Flow	9.4	6.5	7.0	2	0	1	16	12	23	184	0.01	1	0	3
Riverbend														
Summer Flow	9.3	8.1	16.0	1	Not collected	1	20	29	80	139	0.01	28 ⁶	0	3
Fall/Winter Flow	9.8	6.8	7.0	2	0	0	12	12	33	201	0.01	1	0	3
Colony Farm														
Summer Flow	9.1	8.0	16.0	1	Not collected	1	26	35	98	301	0.01	1	0	3
Fall/Winter Flow	9.3	7.0	7.0	2	0	1	19	29	62	303	0.01	1	0	3

Green Level	Attainment (No further monitoring for 5 years; no adaptive management required)	Refer to Attachment # 1 for the Water Quality Monitoring Criteria as adapted from SILG.
Yellow Level	Borderline attainment/ non attainment (Adaptive management actions required within 5 years)	
Red Level	Non attainment (Adaptive management action required within 1-2 years)	

Summer Flow is the Low Flow (dry) sampling period: 5 samples taken over 5 consecutive weeks from August 31 to September 28, 2012.

Winter Flow is the Wet Weather sampling period: 5 samples taken over 5 consecutive weeks from November 9 to December 14, 2012

The summary averages for each parameter are based on the average of five data results for each sampling period. For parameters where less than five data results were used, it has been noted in the footnotes below. Parameter results found to be less than the detectable limits by the lab were recorded as one-half the value in order to calculate a meaningful average. For example, a parameter result of "< 3.0" for Sulphur was evaluated as "1.5".

Footnotes:

¹ During the Summer Flow sampling period, only three results were available for Dissolved Oxygen due to equipment error. The equipment was subsequently recalibrated and used successfully for the remainder of the program.

² During the Summer Flow sampling period, only four results were available for pH due to equipment error. The equipment was subsequently recalibrated and used successfully for the remainder of the program.

³ Nitrate sampling was not initiated until the Fall/Winter Flow sampling period.

⁴ As Fulawka Summer Flow results comprise only 2 of 5 weeks from September 21, 2012, there is insufficient data available to calculate a statistically meaningful average. This location was added to the program after the Summer Flow period began.

⁵ Upper Coquitlam Park Summer Flow average results are based only on 3 of 5 weeks' results from August 31 - September 14, 2012, as this location was discontinued when the Fulawka location was added. Further, as a result of the site change, and equipment error for DO and pH, there was insufficient data to calculate a statistically meaningful average for these two parameters.

⁶ One of the five data samples collected at the Riverbend site for Total Copper during the Summer Flow period was significant for Copper (138 ug/L); however, the remaining four samples fell well within the Green Level range (0.45 ug/L). Further assessment at this location is planned for 2013.

2012 Coquitlam River Water Quality Program Raw Data - Summer Flow Week 1 of 5

Aug. 31, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:51 AM		10:24 AM	10:49 AM	11:25 AM	12:08 PM	2:47 PM	3:23 PM
DO	mg/L	9.34		9.36	9.41	9.44	9.35	9.28	9.42
pH		6.83		6.52	7.09	7.24	7.21	7.35	7.02
Temperature	C	15.8		15.6	15.6	15.7	16.1	17.5	17
Turbidity	NTU	0.26		0.34	0.38	0.35	0.46	0.88	1.47
Nitrate (N)	mg/L								
Chlorophyll a	ug/L	0.52		1.01	2.00	<0.50	1.21	1.42	1.00
Conductivity	uS/com	7.9		8.6	13.7	13.3	15.3	18.7	25
E. coli	CFU/100 mL	18		2	8	10	12	17	38
Fecal Coliforms	CFU/100 mL	19		2	8	12	12	25	55
Total Cadmium (Cd)	ug/L	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Copper (Cu)	ug/L	0.26		0.3	0.34	0.34	0.31	0.39	0.45
Total Iron (Fe)	ug/L	54.9		73.9	114	113	100	129	310
Total Lead (Pb)	ug/L	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L								
Total Hardness (CaCO3)	ug/L	3.2		3.64	5.97	6.13	7.21	7.86	10.3
Nitrite (N)	mg/L								
Nitrate plus Nitrite (N)	mg/L								
Total Calcium (Ca)	mg/L	1.03		1.14	1.74	1.77	2.13	2.31	3.07
Total Magnesium (Mg)	mg/L	0.154		0.193	0.395	0.416	0.459	0.505	0.629
Total Potassium (K)	mg/L	0.155		0.173	0.267	0.273	0.291	0.334	0.432
Total Sodium (Na)	mg/L	0.567		0.606	0.93	0.937	1.11	1.33	2.01
Total Sulphur (S)	mg/L	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Summer Flow Week 2 of 5

Sept. 7, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:26 AM		9:58 AM	10:30 AM	10:55 AM	11:17 AM	12:10 PM	12:41 PM
DO	mg/L	192.31		223.55	205.03	202.66	187.95	152.35	151.85
pH		3.6		3.88	4.34	4.67	4.74	4.78	4.82
Temperature	C	17.1		16.7	16.5	16.5	16.1	16	15.7
Turbidity	NTU	0.15		0.17	0.67	0.77	0.47	0.51	0.71
Nitrate (N)	mg/L								
Chlorophyll a	ug/L	<0.50		0.65	0.68	<0.50	<0.50	<0.50	<0.50
Conductivity	uS/com	8.3		9.1	17.1	16.5	17.8	20.4	24.2
E. coli	CFU/100 mL	3		8	12	8	22	32	29
Fecal Coliforms	CFU/100 mL	13		29	38	36	65	80	110
Total Cadmium (Cd)	ug/L	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Copper (Cu)	ug/L	0.28		0.68	0.43	0.28	0.27	0.3	0.43
Total Iron (Fe)	ug/L	57.8		69.3	128	120	105	142	301
Total Lead (Pb)	ug/L	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L								
Total Hardness (CaCO3)	ug/L	3.29		3.93	7.66	7.37	7.97	8.84	11
Nitrite (N)	mg/L								
Nitrate plus Nitrite (N)	mg/L								
Total Calcium (Ca)	mg/L	1.06		1.23	2.24	2.16	2.34	2.63	3.34
Total Magnesium (Mg)	mg/L	0.156		0.209	0.501	0.48	0.514	0.554	0.654
Total Potassium (K)	mg/L	0.159		0.175	0.322	0.332	0.337	0.355	0.435
Total Sodium (Na)	mg/L	0.569		0.611	1.09	1.06	1.19	1.44	2.15
Total Sulphur (S)	mg/L	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

These parameters not included in averages as data outside of expected range subsequent inspection of equipment indicated malfunction.
 No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Summer Flow Week 3 of 5

Sept. 14, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		10:13 AM		10:34 AM	10:58 AM	11:15 AM	11:34 AM	12:14 PM	12:46 PM
DO	mg/L	92.34		99.01	99.55	95.45	100.54	110.74	125.13
pH		6.61		6.13	6.78	6.75	6.74	7.39	7.52
Temperature	C	16.4		16.3	15.7	15.7	15.2	15.1	14.9
Turbidity	NTU	0.31		0.4	0.54	0.41	0.37	0.42	0.65
Nitrate (N)	mg/L								
Chlorophyll a	ug/L	0.93		0.91	1.51	2.12	1.29	1.53	1.07
Conductivity	uS/com	10.3		10.1	18.8	16.1	18.4	19.6	26.2
E. coli	CFU/100 mL	54		8	7	6	9	21	21
Fecal Coliforms	CFU/100 mL	67		8	7	6	9	23	46
Total Cadmium (Cd)	ug/L	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Copper (Cu)	ug/L	0.31		0.27	0.34	0.3	0.28	0.53	1.79
Total Iron (Fe)	ug/L	69.9		72.9	136	119	105	127	293
Total Lead (Pb)	ug/L	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L								
Total Hardness (CaCO3)	ug/L	4.76		4.05	8.4	7.33	7.78	8.43	11.2
Nitrite (N)	mg/L								
Nitrate plus Nitrite (N)	mg/L								
Total Calcium (Ca)	mg/L	1.43		1.28	2.46	2.17	2.32	2.53	3.4
Total Magnesium (Mg)	mg/L	0.29		0.204	0.552	0.463	0.482	0.513	0.652
Total Potassium (K)	mg/L	0.239		0.202	0.372	0.321	0.326	0.353	0.456
Total Sodium (Na)	mg/L	0.68		0.61	1.14	1.03	1.13	1.35	2.11
Total Sulphur (S)	mg/L	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

These parameters not included in averages as data outside of expected range subsequent inspection of equipment indicated malfunction.

No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Summer Flow Week 4 of 5

Sept. 21, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:15 AM	9:45 AM		10:20 AM	10:40 AM	11:02 AM	12:00 PM	12:30 PM
DO	mg/L	10.21	9.58		9.89	9.37	9.15	9.09	8.69
pH		8.48	8.41		8.59	8.82	8.71	8.79	8.57
Temperature	C	16.7	16.7		16.2	16.1	15.7	15.5	15.5
Turbidity	NTU	0.32	0.49		0.44	0.46	0.53	0.4	0.75
Nitrate (N)	mg/L								
Chlorophyll a	ug/L	1.58	1.74		1.77	0.83	1.37	2.27	1.22
Conductivity	uS/com	12.3	8.9		18.1	16.6	19	21	28.8
E. coli	CFU/100 mL	4	6		4	18	24	52	68
Fecal Coliforms	CFU/100 mL	12	22		26	65	110	160	230
Total Cadmium (Cd)	ug/L	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
Total Copper (Cu)	ug/L	0.44	0.24		0.34	0.28	0.3	0.38	0.49
Total Iron (Fe)	ug/L	51.8	61.8		131	117	106	122	311
Total Lead (Pb)	ug/L	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L	<4.0	<4.0		<4.0	<4.0	<4.0	<4.0	<4.0
Total Hardness (CaCO3)	ug/L	3.39	3.62		7.87	7.01	7.8	8.72	11.4
Nitrite (N)	mg/L								
Nitrate plus Nitrite (N)	mg/L								
Total Calcium (Ca)	mg/L	1.09	1.15		2.24	2.02	2.27	2.55	3.39
Total Magnesium (Mg)	mg/L	0.162	0.181		0.552	0.479	0.52	0.573	0.709
Total Potassium (K)	mg/L	0.168	0.181		0.351	0.314	0.342	0.366	0.477
Total Sodium (Na)	mg/L	0.576	0.607		1.16	1.05	1.18	1.44	2.13
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Summer Flow Week 5 of 5

Sept. 28, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:20 AM	9:38 AM		9:57 AM	10:13 AM	10:35 AM	11:26 AM	11:55 AM
DO	mg/L	10.53	10		10.04	9.79	10.14	9.6	9.23
pH		8.82	8.69		8.81	8.93	8.81	8.89	8.71
Temperature	C	15.8	16.2		15.8	15.7	15.4	15.4	15.3
Turbidity	NTU	0.39	0.34		0.53	0.45	0.5	0.61	0.69
Nitrate (N)	mg/L								
Chlorophyll a	ug/L	<0.50	<0.50		0.78	1.68	0.73	1.06	1.27
Conductivity	uS/cm	9.2	8.9		17.2	15.9	18.6	20.6	28
E. coli	CFU/100 mL	13	5		5	5	9	24	19
Fecal Coliforms	CFU/100 mL	13	16		12	14	28	110	51
Total Cadmium (Cd)	ug/L	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
Total Copper (Cu)	ug/L	0.29	0.26		0.33	0.3	0.28	138	0.47
Total Iron (Fe)	ug/L	63.9	63		136	123	107	175	289
Total Lead (Pb)	ug/L	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L	<4.0	<4.0		<4.0	<4.0	<4.0	<4.0	4
Total Hardness (CaCO3)	ug/L	3.89	3.51		7.59	7.15	7.8	8.62	10.8
Nitrite (N)	mg/L								
Nitrate plus Nitrite (N)	mg/L								
Total Calcium (Ca)	mg/L	1.22	1.12		2.19	2.12	2.29	2.55	3.25
Total Magnesium (Mg)	mg/L	0.207	0.173		0.514	0.454	0.508	0.55	0.661
Total Potassium (K)	mg/L	0.18	0.168		0.318	0.3	0.327	0.352	0.46
Total Sodium (Na)	mg/L	0.65	0.603		1.06	0.993	1.13	1.4	2.05
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

Data results for copper on this date is significantly higher compared to other sampling dates.

2012 Coquitlam River Water Quality Program Raw Data - Fall/Winter Flow Week 1 of 5

Nov. 9, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		10:26 AM	10:51 AM		11:19 AM	11:38 AM	12:00 PM	12:49 PM	1:25 PM
DO	mg/L	12.37	9.32		9.3	10.01	10.07	11.03	9.66
pH		6.96	7.09		7.08	7.21	6.94	6.94	7
Temperature	C	9.2	9.1		9.1	9.1	9.3	9.3	9.2
Turbidity	NTU	2.59	1.29		1.37	1.28	1.08	1.09	1.44
Nitrate (N)	mg/L	0.101	0.119		0.11	0.111	0.17	0.133	0.136
Chlorophyll a	ug/L	<0.50	0.71		0.74	0.68	0.76	<0.50	0.85
Conductivity	uS/com	6	5.1		6.2	6.2	8.9	6.7	9.2
E. coli	CFU/100 mL	3	<1		1	2	<1	2	7
Fecal Coliforms	CFU/100 mL	43	1		25	53	<1	64	12
Total Cadmium (Cd)	ug/L	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
Total Copper (Cu)	ug/L	0.34	0.4		0.57	0.5	1.03	0.45	0.52
Total Iron (Fe)	ug/L	60.8	63.1		133	122	170	100	181
Total Lead (Pb)	ug/L	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	6.2	<5.0	<5.0
TSS	mg/L	<4.0	<4.0		<4.0	<4.0	<4.0	<4.0(1)	<4.0
Total Hardness (CaCO3)	ug/L	3.33	2.71		3.6	3.37	5.13	3.64	4.72
Nitrite (N)	mg/L	<0.0050	<0.0050		<0.0050	<0.0050	<0.0050	<0.0050(1)	<0.0050
Nitrate plus Nitrite (N)	mg/L	0.101	0.119		0.11	0.111	0.17	0.133(1)	0.136
Total Calcium (Ca)	mg/L	1.04	0.891		1.13	1.08	1.63	1.16	1.51
Total Magnesium (Mg)	mg/L	0.176	0.118		0.191	0.164	0.258	0.181	0.228
Total Potassium (K)	mg/L	0.17	0.136		0.168	0.156	0.208	0.175	0.207
Total Sodium (Na)	mg/L	0.583	0.512		0.577	0.537	0.779	0.664	0.846
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

(1) Sample analysed past recommended hold time.

2012 Coquitlam River Water Quality Program Raw Data - Fall/Winter Flow Week 2 of 5

Nov. 16, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:58 AM	10:17 AM		10:36 AM	10:51 AM	11:12 AM	11:57 AM	12:26 PM
DO	mg/L	8.98	9.15		9.03	8.94	8.84	8.68	8.47
pH		5.62	5.95		6.05	6.21	6.24	6.43	6.5
Temperature	C	8.1	7.7		7.7	7.7	8	7.8	7.8
Turbidity	NTU	0.61	0.55		0.99	0.56	0.8	0.8	0.9
Nitrate (N)	mg/L	0.111	0.121		0.128	0.136	0.151	0.181	0.218
Chlorophyll a	ug/L	<0.50	<0.50		<0.50	<0.50	<0.50	1.01	<0.50
Conductivity	uS/com	7.4	7.7		12.6	10.7	16.4	15.3	23.8
E. coli	CFU/100 mL	2	4		2	5	9	19	22
Fecal Coliforms	CFU/100 mL	2	4		2	5	9	21	29
Total Cadmium (Cd)	ug/L	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	0.013
Total Copper (Cu)	ug/L	0.55	0.54		0.54	0.46	0.49	0.55	0.67
Total Iron (Fe)	ug/L	56.3	56.2		140	87.6	90.5	163	323
Total Lead (Pb)	ug/L	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L	<4.0	<4.0		<4.0	<4.0	<4.0	<4.0	<4.0
Total Hardness (CaCO3)	ug/L	4.04	3.34		6.34	5.42	6.1	8.01	11.6
Nitrite (N)	mg/L	0.0057	0.006		0.0063	<0.0050	0.0075	0.0068	0.0069
Nitrate plus Nitrite (N)	mg/L	0.117	0.127		0.135	0.136	0.158	0.188	0.225
Total Calcium (Ca)	mg/L	1.24	1.07		1.85	1.6	1.84	2.44	3.58
Total Magnesium (Mg)	mg/L	0.227	0.161		0.416	0.347	0.368	0.469	0.654
Total Potassium (K)	mg/L	0.204	0.153		0.283	0.223	0.252	0.323	0.471
Total Sodium (Na)	mg/L	0.666	0.674		0.921	0.869	0.984	1.4	2.44
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Fall/Winter Flow Week 3 of 5

Nov. 23, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:47 AM	10:15 AM		10:30 AM	10:55 AM	11:40 AM	12:25 PM	1:00 PM
DO	mg/L	14.16	10.77		10.19	10.02	9.54	9.79	9.38
pH		6.45	6.47		6.45	6.48	6.4	6.65	6.6
Temperature	C	6.6	6		6.1	6.1	7	6.5	7.1
Turbidity	NTU	1.91	1.97		4.4	4.2	4.28	3.44	3.58
Nitrate (N)	mg/L	0.11	0.129		0.111	0.125	0.312	0.142	0.211
Chlorophyll a	ug/L	0.62	1.4		<0.50	0.97	<0.50	0.67	1.7
Conductivity	uS/com	8.5	6.6		9.1	8.3	16.3	11.3	18.4
E. coli	CFU/100 mL	4	15		19	13	35	29	80
Fecal Coliforms	CFU/100 mL	40	42		53	42	77	53	210
Total Cadmium (Cd)	ug/L	<0.010	0.01		<0.010	<0.010	<0.010	<0.010	0.011
Total Copper (Cu)	ug/L	0.7	0.79		1.21	0.98	1.08	2.91	1.56
Total Iron (Fe)	ug/L	160	195		375	320	361	307	339
Total Lead (Pb)	ug/L	<0.20	<0.20		0.32	0.2	0.26	0.25	0.29
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	<5.0	5.1	5.7
TSS	mg/L	<4.0	4.8		5.5	7.5	6.3	6.8	5.3
Total Hardness (CaCO3)	ug/L	4.29	4.2		5.42	5.02	8.65	5.75	8.72
Nitrite (N)	mg/L	<0.0050	<0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate plus Nitrite (N)	mg/L	0.11	0.129		0.111	0.125	0.312	0.142	0.211
Total Calcium (Ca)	mg/L	1.29	1.29		1.54	1.46	2.67	1.74	2.74
Total Magnesium (Mg)	mg/L	0.258	0.238		0.382	0.335	0.483	0.341	0.459
Total Potassium (K)	mg/L	0.212	0.19		0.257	0.226	0.33	0.25	0.399
Total Sodium (Na)	mg/L	0.685	0.669		0.807	0.845	1.27	0.886	1.57
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Fall/Winter Flow Week 4 of 5

Dec. 7, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:32 AM	9:44 AM		10:01 AM	10:16 AM	10:34 AM	11:35 AM	12:05 PM
DO	mg/L	13.05	10.28		10.48	10.36	9.31	9.71	9.36
pH		6.64	6.46		6.47	6.55	6.37	6.9	6.7
Temperature	C	5.6	5.5		5.5	5.5	6.7	5.9	6.1
Turbidity	NTU	1.32	1.32		4.19	3.36	2.5	2.27	2.73
Nitrate (N)	mg/L	0.153	0.214		0.178	0.193	0.609	0.238	0.311
Chlorophyll a	ug/L	<0.50	1.09		<0.50	0.51	1.09	<0.50	0.55
Conductivity	uS/com	7.6	7.9		10.5	9.6	21.8	13.2	20.8
E. coli	CFU/100 mL	5	6		20	9	10	5	10
Fecal Coliforms	CFU/100 mL	5	7		24	10	11	7	14
Total Cadmium (Cd)	ug/L	<0.010	<0.010		<0.010	0.013	0.018	<0.010	0.011
Total Copper (Cu)	ug/L	0.52	1		0.83	0.76	0.96	0.62	0.83
Total Iron (Fe)	ug/L	103	136		256	179	160	199	317
Total Lead (Pb)	ug/L	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L	<4.0	<4.0		4.5	<4.0	<4.0	<4.0	4.2
Total Hardness (CaCO3)	ug/L	4.19	4.03		5.55	5.12	11.1	6.69	10.3
Nitrite (N)	mg/L	<0.0050	<0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate plus Nitrite (N)	mg/L	0.153	0.214		0.178	0.193	0.609	0.238	0.311
Total Calcium (Ca)	mg/L	1.28	1.23		1.63	1.54	3.53	2.07	3.24
Total Magnesium (Mg)	mg/L	0.241	0.23		0.361	0.309	0.559	0.37	0.532
Total Potassium (K)	mg/L	0.197	0.179		0.243	0.204	0.354	0.272	0.391
Total Sodium (Na)	mg/L	0.692	0.709		0.834	0.806	1.62	1.11	1.86
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.

2012 Coquitlam River Water Quality Program Raw Data - Fall/Winter Flow Week 5 of 5

Dec. 14, 2012	Units	Hatchery	Fulawka	Upper CQ Park	Pits	Galette	Saltspring	Riverbend	Colony Farm
Time		9:40 AM	9:45 AM		10:09 AM	10:25 AM	10:41 AM	11:15 AM	11:42 AM
DO	mg/L	10.4	9.96		9.68	9.98	9.38	9.55	9.39
pH		7.83	7.13		6.92	6.9	6.68	6.9	6.84
Temperature	C	5.3	5.1		5.2	5.1	5.8	5.4	5.6
Turbidity	NTU	1.09	0.74		1.31	1.29	1.99	1.37	1.8
Nitrate (N)	mg/L	0.145	0.171		0.158	0.181	0.363	0.212	0.29
Chlorophyll a	ug/L	0.63	<0.50		<0.50	<0.50	<0.50	<0.50	0.93
Conductivity	uS/com	7.3	7.6		11.3	10	18.2	14.9	24.2
E. coli	CFU/100 mL	5	1		9	6	4	3	27
Fecal Coliforms	CFU/100 mL	11	2		12	11	16	21	46
Total Cadmium (Cd)	ug/L	0.013	<0.010		<0.010	<0.010	<0.010	0.011	<0.010
Total Copper (Cu)	ug/L	0.53	0.72		0.55	0.53	0.99	0.62	0.9
Total Iron (Fe)	ug/L	134	135		184	152	138	235	356
Total Lead (Pb)	ug/L	<0.20	<0.20		<0.20	<0.20	<0.20	<0.20	<0.20
Total Zinc (Zn)	ug/L	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
TSS	mg/L	<4.0	<4.0		<4.0	<4.0	<4.0	<4.0	<4.0
Total Hardness (CaCO3)	ug/L	7.03	4.14		6.22	5.53	9.06	8.14	12.4
Nitrite (N)	mg/L	<0.0050	<0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate plus Nitrite (N)	mg/L	0.145	0.171		0.158	0.181	0.363	0.212	0.29
Total Calcium (Ca)	mg/L	2	1.28		1.84	1.65	2.83	2.52	3.88
Total Magnesium (Mg)	mg/L	0.495	0.229		0.397	0.343	0.486	0.446	0.66
Total Potassium (K)	mg/L	0.34	0.189		0.258	0.226	0.414	0.365	0.51
Total Sodium (Na)	mg/L	1.08	0.732		0.935	0.859	1.49	1.4	2.57
Total Sulphur (S)	mg/L	<3.0	<3.0		<3.0	<3.0	<3.0	<3.0	<3.0

No data collected for this site or parameter.