University of British Columbia

Drinking Water Quality Monitoring Report
2013

June, 2014

Executive Summary

The University of British Columbia implemented a Drinking Water Quality Monitoring Program in 2002. This monitoring program was developed based on the standard program adopted by Metro Vancouver member municipalities, the Guidelines for Canadian Drinking Water Quality (GCDWQ), and input from the Vancouver Coastal Health Authority. With this approved monitoring program in place, UBC has collected and analyzed water quality data since 2002. This report outlines this program and its results for the year 2013.

The implementation of the Drinking Water Quality Monitoring program was a significant commitment made by UBC to monitor the delivery of safe and high quality water. It generates valuable data for gaining understanding of UBC's water distribution system and for evaluating the historic performance of the system in a reliable and systematic way. Most importantly, it allows for potential health hazards to be identified and consumer's water concerns to be addressed.

The sampling analysis results have demonstrated a satisfactory performance of the UBC distribution system. There were no recorded instances of E. coli detected in 2013. There were 3 recorded instances of total coliforms in 2013. None of these events exceeded the BC Drinking Water Protection limit for total coliforms.

A Unidirectional Flushing Program has been implemented. This will reduce the risk of sediment and corrosion by-product build-up in the water mains, as well as improve water quality. Concerns in regards to total coliforms and chlorine residual were addressed by an increased spot-flushing program.

All water quality complaints were responded to by either the Facility Managers or UBC Utilities and were resolved satisfactorily. A protocol for recording complaints is included in the UBC Emergency Response Plan – Water Utility.

UBC is committed to delivery of water of the highest quality, and will continue to make the necessary investment to ensure its continued success.

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APPENDICES:

1.0 Introduction

The purpose of this report is to provide a summary of the Drinking Water Quality Monitoring Program during 2013 for the UBC Utilities water distribution system.

During 2013 the provision of drinking water was governed by the Drinking Water Protection Regulation (pursuant to the Drinking Water Protection Act). This regulation requires suppliers of drinking water in BC to:

- Develop a process to notify the Drinking Water Officer (DWO) of situations or conditions that render or could render the water unfit to drink;
- Implement a plan for collecting, shipping and analyzing water samples in compliance with the direction set by the DWO;
- Implement a plan for reporting monitoring results to the DWO and to water users including the preparation of an annual report;
- Implement an emergency response and contingency plan.

UBC Utilities monitors the water quality in the UBC distribution system on a weekly basis in accordance with their Drinking Water Quality Monitoring Program. Appendix B includes a graphic summary of test results for 2013.

This document includes a brief introduction to UBC's water distribution system and its drinking water monitoring and testing program. The remaining parts of this document summarize the results and analysis of water samples collected in 2013 and evaluates the distribution system's performance in delivering safe and quality drinking water.

2.0 Water Distribution System

UBC receives water from Metro Vancouver's Water District (GVWD) through two supply points via the University Endowment Lands. Water is then supplied to UBC's customers through its distribution system. UBC is in the process of developing a comprehensive operations and maintenance (O&M) program for the water distribution system to ensure the highest quality water is delivered at sufficient quantity and pressure to its customers. The O&M program in 2013 included a water main flushing program; system pressure controls were adjusted to improve flow and chlorination to some areas, as well as installation of new main line pipes and appurtenances in a number of areas.

Significant Improvements to the System Include:

1. **Unidirectional Flushing Program** has been implemented with a goal of completely cleaning the system and maintaining low HPC levels in the water distribution system. This will reduce the risk of sediment build-up and microbiological re-growth in the water mains. As well, in response to complaints and ongoing monitoring of water quality, spot flushing is carried out as required.

2. **Capital Improvements** to the system are made as areas are redeveloped or new development takes place. Old water mains are replaced, enlarged and or extended, dead ends eliminated and new hydrants, valves and services installed.

    a) Biological Sciences Road
    As part of the upgrade to Biological Sciences Road the existing 200mm cast iron pipe at West Mall was replaced with 47m of 250mm DI pipe. In addition, a new service was provided for the Campus Planning and Community Services building.

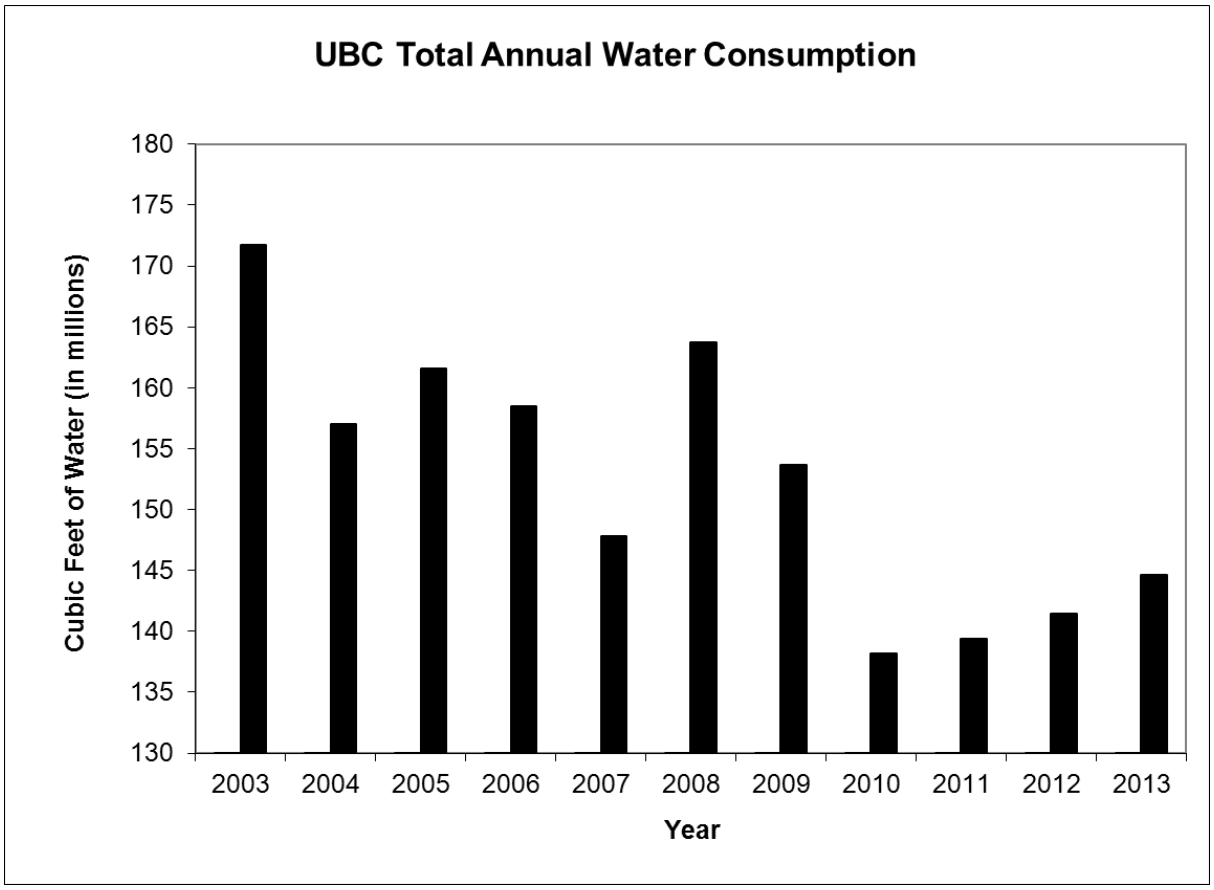
    b) Public Realm –University Blvd, Main Mall to West Mall
    This ongoing major Capital Works Project involved a number of different contracts but gave the opportunity to upgrade older piping, improve water supply and with additional valves improve the efficiency of water distribution in the area. On University Blvd between West Mall and Sauder Lane 50m of 300mm DI pipe was installed. The works also included an irrigation supply chamber and a permanent blow-off assembly. On University Blvd at the Neville Scarfe Bldg 60m of 200mm DI pipe was installed including a new service to the building.

    c) Miscellaneous Services
    In addition to the many improvements to the distribution system, new services were provided with improved valving and new hydrants for the following projects: New Alumni Bldg, Lots 32 and 33 (South Campus).

3. **UBC Emergency Response Plan – Water Utility**
    The UBC ERP-WU includes different possible emergency scenarios, protocols, procedures and staff responsibilities in emergencies. Revisions to the plan in 2014\2015 will include contact name updates and distribution system changes. In addition to these scenarios, if an extraordinary turbidity event occurs, the Metro Vancouver and Municipal Response Procedure will be followed (see Appendix C).

4. **Cross Connection Control Program -** The consolidation of the different programs into UBC Utilities' Cross Connection Control Program occurred in 2007. At that time a computerized database and tracking system was implemented and 710 devices are now tracked. UBC Utilities also oversees the UBC Academic and Hospital CCC Programs. The number of assemblies registered increased by 12% in 2013. The program incorporates testing and annual certification of devices as well as site inspections. UBC Utilities also provides advice and oversight on new installations at existing, non-compliant facilities. A full survey of all facilities will be planned for 2014/15.

Below is a summary of average annual water purchased by UBC over the last 10 years. As illustrated the overall consumption at UBC is declining in response to a number of factors including water conservation initiatives.



3.0 Testing and Monitoring Program

Drinking water quality is a function of source water quality, water treatment, and water quality changes after treatment. As a result, monitoring of drinking water quality consists of three components: source water monitoring, monitoring after treatment, and monitoring in the distribution system. While Metro Vancouver's Water District carries out testing of water at the source and testing after treatment, UBC's Drinking Water Quality Monitoring Program is focused on monitoring the water quality within its own water distribution system.

The monitoring and testing program consists of routine monitoring, for obtaining an accurate overview of water quality within the distribution system, and non-routine monitoring, for handling complaint and emergency situations. Monitoring includes two components: collection of the sample and laboratory analysis of the sample.

3.1 Routine Monitoring

The collection of water samples was completed as part of an annual contract with CARO Environmental Services from sampling sites within UBC on a regular basis. These water samples were then forwarded to laboratories for analysis. The collection, transportation and analysis of samples were performed in accordance with the *Standard Methods for the Examination of Water and Wastewater 21st Edition*. All analyses were conducted by laboratories that are approved by Canadian Association of Environmental Analytical Laboratories or an equivalent certification program for the other tests performed.

All testing parameters except vinyl chloride were analyzed by the laboratories of Metro Vancouver. Analysis of vinyl chloride, a volatile organic compound, was tested by the laboratory of CARO Environmental Services.

3.1.1 Sampling Parameters

The parameters that were analyzed are summarized in the following table:

Table 1. Sampling Parameters

	PARAMETERS
Microbiological	Total Coliforms, E. coli, Heterotrophic Plate Count (HPC)
Chemical and Physical	Turbidity, Temperature, Free Chlorine Residual, pH, Aluminium, Copper, Iron, Lead, Zinc, Haloacetic Acids (HAAs), Trihalomethanes (THMs), Vinyl Chloride Odour/Taste (complaint basis)
Radiological	None

Guidelines for chemical and physical parameters are:

1. (MAC) – Health based and listed as a maximum acceptable concentration.

2. (AO) – Based on aesthetic considerations and listed as an aesthetic objective; or

3. (OG) – Established based on operational considerations and listed as an operational guidance value.

The significance of the parameters of most relevance is briefly discussed below. Further details regarding the parameters listed in the above table can be found by accessing the supporting documents of the GCDWQ through the following web site, http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index_e.html, or by contacting Health Canada at (613) 957-2991.

Total and E. coli Coliforms

One of the primary concerns in water quality is the growth of coliform bacteria. The presence of total coliforms indicates that treatment is inadequate or that the distribution system is experiencing regrowth or infiltration. The presence of E. coli indicates a possibility of fecal contamination. Escherichia coli (E. coli), one species in the fecal coliform group, is a definite indicator of the presence of feces contamination within the distribution system.

Heterotrophic Plate Counts

Heterotrophic Plate Counts (HPC) are used to estimate the general bacterial population. Historically the HPC test has been used to indicate when conditions in the distribution system are favourable for the growth of bacteria. It was felt that if the growth of heterotrophs is controlled, growth of coliforms should be also controlled. However there is uncertainty as to the significance of the HPC test. The Canadian Drinking Water Quality Guidelines removed HPCs as an indicator of drinking water quality. Monitoring

for HPCs has been maintained to assist in understanding changes in operational conditions to the system.

Unlike other indicators such as Escherichia coli or total coliforms, low concentrations of HPC organisms will still be present after drinking water treatment. In distribution systems HPC provides some indication of stagnation, tuberculation, chlorine residual, and available nutrients for bacterial growth. High HPC measurements have not been found to correlate with illness incidence and no outbreaks have been directly linked to elevated concentrations of HPC flora in tap water; however a sudden rise in HPC measurements collected from a site that has traditionally had low counts is an indicator that something has changed in the system and should be investigated. UBC uses the historical figure of 500 CFU/100mL as a baseline measurement that will trigger investigation into possible changes in the distribution system.

Free Chlorine Residual

Free chlorine residual provides a good indication of water quality within the distribution system. Low chlorine residual may indicate deteriorating water quality as a result of bacterial regrowth or stagnant water. Maintaining a free chlorine residual of at least 0.2 mg/L in the distribution system has been observed to reduce the level of HPC.

Turbidity

Turbidity in water is caused by suspended matter, such as clay, slit, organic and inorganic matter. Controlling turbidity is important for both health and aesthetic reasons. Bacteria, viruses and protozoa can adhere to suspended particles in turbid water and thus be protected from disinfection. Also, excessive turbidity detracts from the appearance of treated water and has often been associated with unacceptable tastes and odours.

Disinfection Byproducts

Haloacetic acids (HAAs) and Trihalomethanes (THMs) are disinfection byproducts and are formed in drinking water when chlorine reacts with organic matter that is naturally present in raw water supplies. Research suggests that HAAs have an adverse impact on human health and may possibly be carcinogenic. The most common THM is chloroform. Chloroform is also classified as being possibly carcinogenic to humans. There is a trade off between reducing risk from disinfection byproducts and having enough chlorine to provide water safe from bacteria and parasites.

Copper

Copper is used extensively in plumbing for domestic water systems. Although copper is frequently found in surface water, distributed water contains considerably more copper than the original water supply because of the dissolution of copper from copper piping. Copper can stain laundry and plumbing fixtures and cause an undesirable bitter taste in water. Copper intake at extremely high doses can result in adverse health effects.

Iron

Iron is naturally present in food and drinking water. However, there is no evidence to indicate that concentrations of iron commonly found in food or water constitute any

hazard to human health. Iron can stain laundry and plumbing fixtures and cause undesirable tastes in beverages. The precipitation of excessive iron imparts an objectionable reddish-brown color to the water. Iron may also promote the growth of certain microorganisms, which can lead to the deposition of a slimy coat in piping.

Lead

Lead was used in drinking water plumbing and as solder in distribution systems. Older distribution systems may also be made from lead pipe. Lead is present in tap water as a result of dissolution from natural sources or from household plumbing systems. Lead is a cumulative general poison and has been classified as being potentially carcinogenic to humans. Fetuses, infants, young children and pregnant women are most susceptible to adverse health effects. In order to minimize exposure to lead introduced into drinking water from plumbing systems, it is recommended that only cold water be used, after an appropriate period of flushing to rid the system of standing water, for sampling, drinking, beverage preparation and cooking.

Vinyl Chloride

The presence of vinyl chloride in potable water is associated mainly with the use of polyvinyl chloride (PVC) water pipes manufactured with incompletely polymerized vinyl chloride monomer. Acute exposure or chronic inhalation exposure results in a variety of adverse effects in humans. Sufficient evidence has accumulated to implicate vinyl chloride as a human and animal carcinogen.

Zinc

Although zinc is present in surface waters at low concentrations, levels in tap water can be considerably higher because of the use of zinc in plumbing materials. Water containing zinc in excess concentrations has an undesirable astringent taste and may develop a greasy film upon boiling. Long-term ingestion of zinc in quantities considerably in excess of the daily requirement has not resulted in adverse effects.

pH

pH is controlled in water to minimize corrosion and incrustation. Corrosion may increase below 6.5 and incrustation and scaling may increase above pH 8.5. There is also a decrease in the efficiency of chlorine disinfection processes with increasing pH levels. In addition, through discussions with Metro Vancouver, it was noted that pH assists in the interpretation of sampling results for disinfection by-products, and thus should be sampled at the same time.

3.1.2 Sampling Locations

Sampling locations are distributed in different areas within UBC so as to obtain an accurate overview of water quality of the distribution system. The 16 locations were strategically selected based on land use and system configuration. They include residential area supply, high-density residential area supply, institutional area supply, and water source supply. These locations are illustrated in Figure 1 in Appendix A. To date 15 of the stations are installed and operational with the remaining stations to be installed with proposed system upgrades.

Site	Location	Flow Category	Description
WQB7-001	Iona Drive at Theology Mall	Low	VST Residences
WQC3-002	NW Marine east of West Mall	Low	Supply to Residences
WQD2-003	Place Vanier west of Lower Mall	Low	Place Vanier Residences
WQH3A-004	Lower Mall south of Agronomy Rd.	Low	Totem Park Residences
WQH3B-005	Tap in Totem Park		Service Connection
WQL3-006	Stadium Rd. east of Main Mall	Medium	Thunderbird Stadium
WQJ5-007	Thunderbird Crescent	Low	Thunderbird Residences
WQG6-008	Health Sciences Mall	Medium	Hospital Supply
WQF7B-009	Wesbrook Mall south of Univ. Blvd.	Medium	Hospital Supply
WQF7A-010 (future)	Univ. Blvd. At Wesbrook Mall	Source	Main Pump Station Supply
WQJ10-011	Fairview Place west of Acadia Rd.	Medium	Acadia Residences and PVC in area
WQM8-012	Hampton Place	Low	Hampton Place Residences
WQN9-013	16th Ave. at UBC border	Source	Low Pressure Feed
WQQ6-014	Animal Science	Low	Animal Science Area
WQQ7-015	Wesbrook Mall at BC Research	Medium	Supply to BC Research and Triumph
WQT7-016	Nurseries Road at Triumf	Dead End	Supply to Environment Services

3.1.3 Sampling Frequency

UBC, as a purveyor of drinking water to a maximum population of approximately 50,000-60,000 is required to test at least 40 samples per month as outlined in the *Drinking Water Protection Regulation*. In general, parameters that have greater effects on health were sampled and analyzed more often than those that only affect the aesthetic quality. The sampling frequency of different parameters from different sampling locations is summarized in Table 3.

Table 3. Sampling Frequency

Frequency:	WEEKLY	QUARTERLY	SEMI-ANNUALLY
Parameters:	Total coliforms Fecal coliform HPCs Free chlorine residual Turbidity Temperature	Haloacetic Acids pH Temperature Trihalomethanes	Copper Zinc Lead Iron Temperature Vinyl chloride
Site Category:	Various Campus Areas	Various Campus Areas	Tap in Building and Campus Areas

3.2 Non-routine Monitoring

CARO Environmental Services was on-call for monitoring water quality complaints and emergency situations. The UBC Emergency Response Plan – Water Utility includes a protocol for recording consumer complaints to ensure efficient response and follow up. In any emergency situation the procedures outlined in the UBC Emergency Response Plan were followed.

4.0 Sample Analysis Results

A total of 612 samples were taken from the water distribution system during 2013. Most samples did not exceed the limits set out in the BCDWPR or the GCDWQ. The sample analysis results are summarized in Table 4 below, and some of the parameters worth noting are discussed in this section. It should be noted that the limits contained within the GCDWQ are recommendations only and representative of best practices. These can become requirements if the Drinking Water Officer places a condition on the Operating Permit for UBC. At present there are no such conditions placed on UBC.

Table 4. Summary of Analysis Results *

Sample Station	Samples Taken	HPC CFU/ml			Free Chlorine Residual mg/L			Turbidity NTU			Positive Coliform Tests	Positive E coli Tests
		Low	Average	High	Low	Average	High	Low	Average	High		
WQB7-001 (UBC-001)	54	2	9.69	62	0.01	0.33	0.53	0.1	0.22	0.69	None	None
WQC3-002 (UBC-002)	54	2	12.31	68	0.02	0.31	0.62	0.1	0.24	1.4	1	None
WQD2-003 (UBC-003)	55	2	6.64	32	0.01	0.30	0.6	0.08	0.53	17	None	None
WQH3A-004 (UBC-004)	54	2	3.79	18	0.05	0.41	0.57	0.09	0.25	1.7	None	None
WQL3-006 (UBC-006)	27	2	8.00	30	0.19	0.46	0.61	0.1	0.21	0.42	1	None
WQJ5-007 (UBC-007)	27	2	7.80	20	0.16	0.46	0.66	0.08	0.21	0.45	None	None
WQG6-008 (UBC-008)	27	2	105.00	36	0.18	0.45	0.64	0.09	0.20	0.44	None	None
WQF713-009 (UBC-009)	35	2	5.54	28	0.12	0.45	0.58	0.07	0.19	0.51	None	None
WQJ10-011 (UBC-011)	64	2	8.18	26	0.05	0.39	0.76	0.09	0.20	0.95	None	None
WQM8-012 (UBC-012)	27	2	9.33	70	0.21	0.40	0.56	0.09	0.26	1.2	None	None
WQN9-013 (UBC-013)	54	2	11.29	80	0.03	0.38	0.68	0.08	0.22	0.48	None	None
WQQ6-014 (UBC-014)	52	2	3.07	6	0.05	0.37	0.62	0.1	0.24	0.96	None	None
WQQ7-015 (UBC-015)	54	4	32.52	150	0.04	0.38	0.72	0.08	0.22	0.99	None	None
WQT7-016 (UBC-016)	28	2	153.08	1300	0.05	0.26	0.49	0.14	0.28	1.1	1	None
UBC Average			26.9			0.38			0.25			
UBC Total	612										3	0
Drinking Water Quality			< 500			> 0.2			< 5		< 10	< 1

*For reporting averages, test results below the detectable limit are given a value of 0.

Coliform

The BCDWPR requires that (1) no sample should contain Escherichia coli (E. coli) and that (2) no sample should contain more than 10 total coliform per 100 millilitre and not more than 10% of samples from the distribution system in a given calendar month should show the presence of total coliform bacteria.

Of the 612 samples analyzed for microbiological criteria in 2013, no E. coli was detected. There were three recorded instances of total coliforms during 2013. None of these events exceeded the BC Drinking Water Protection limit.

The presence of total coliform bacteria in water in the distribution system in isolated non-consecutive tests normally indicates bacterial re-growth in the system. Re-growth is a phenomenon seen in many water distribution systems even though there has been no loss of primary treatment or loss of system integrity, which might result in contamination. Total coliform bacteria are frequently detected in distribution water

samples, particularly those samples with low free chlorine residuals. In Metro Vancouver and member water utilities, re-growth typically occurs when the water warms up in the late summer and early fall. During this period it is critical to maintain adequate chlorine residual to as many areas as possible. As UBC has no re-chlorination stations, this is accomplished through spot flushing to draw in fresh water to sensitive areas identified by monitoring chlorine residuals.

The maintenance of chlorine residual is dependent on a number of factors:

- The amount of chlorine in the source water (from Metro Vancouver)
- The chlorine demand in the water
  - Amount of organics
  - Water temperature
- Residence time of the water in the distribution system.

*Heterotrophic Plate Count, HPC **

Elevated levels of HPC's can be used as an indicator of possible changes in the conditions in a water distribution system. In 2013, there were only two higher than normal HPC readings recorded. The elevated counts were not repeated in subsequent tests.

***** see explanation for HPC (p.6)

Turbidity

The GCDWQ guidelines recommend a Maximum Acceptable Concentration (MAC) of 1 Nephelometric Turbidity Unit (NTU) at the source. However, UBC's monitoring program tests only water within its distribution system. Turbidity measured to be less than 5 NTU is not discernable to the naked eye, but at higher levels the particulate matter in water may cause colour, taste and odour concerns for consumers. For this reason UBC Utilities tries to maintain the level of turbidity in the distribution system to below 5.0 NTU, as recommended in the Canadian Guidelines for Drinking Water Quality.

There was only one recorded elevated level of turbidity in 2013, possibly as a result of construction activity. The line was flushed and the elevated level of turbidity was not repeated.

Free Chlorine Residual

No sampling station within UBC fell below the average free chlorine residual concentration target of 0.2mg/L. However, in 14 of the sampling locations there were individual instances where free chlorine dropped below that concentration target on at least one occasion. As with HPC, low chlorine residual is merely a warning sign and not an indication of water quality problems. UBC has no re-chlorination stations but implements a program of spot flushing those locations that encounter low chlorine residuals.

Disinfection By-products

The source water at WQN9-013 was tested four times for disinfection by-product concentration. See the table below for analysis results.

		THM (ppb)						HAA (ppb)							Extras
Sample	Date Sampled	Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average	pH units PH
UBC-013	2/19/2013 9:07	<1	<1	<1	29	30	**30**	<0.5	12	<1	2	13	28	**28**	**7.3**
UBC-013	5/17/2013 12:40	<1	<1	<1	56	57	**43**	<0.5	27	<1	3	34	65	**46**	**7.0**
UBC-013	9/17/2013 9:47	1	<1	<1	28	29	**38**	<0.5	11	<1	6	24.4	43	**45**	**7.4**
UBC-013	11/26/2013 9:35	<1	<1	<1	26	26	**35**	<0.5	8	<1	5	13.4	28	**41**	**7.1**
							37							**40**	**7.2**
							Average							**Average**	**Average**

The annual average THM concentration of 37 ppb (0.04 mg/L) is well below the GCDWQ recommended maximum of 100 ppb (0.1 mg/L). The Canadian guideline level for the Haloacetic group (HAA) is 80 ppb (0.08 mg/L.). The average HAA concentration of 40 ppb is 40 ppb below the recommended maximum and is measured at the source water from Metro Vancouver as it enters UBC's distribution system. Some studies have indicated that as water approaches the extremities of the distribution system, HAA levels decrease as residence times increase, especially during summer months as temperature levels rise.

Vinyl Chloride

Vinyl chloride concentration was tested twice during 2013. The tests were both below the detection limit of 1 ppb, which is below the GCDWQ recommended 2 ppb (0.002mg/L).

pH

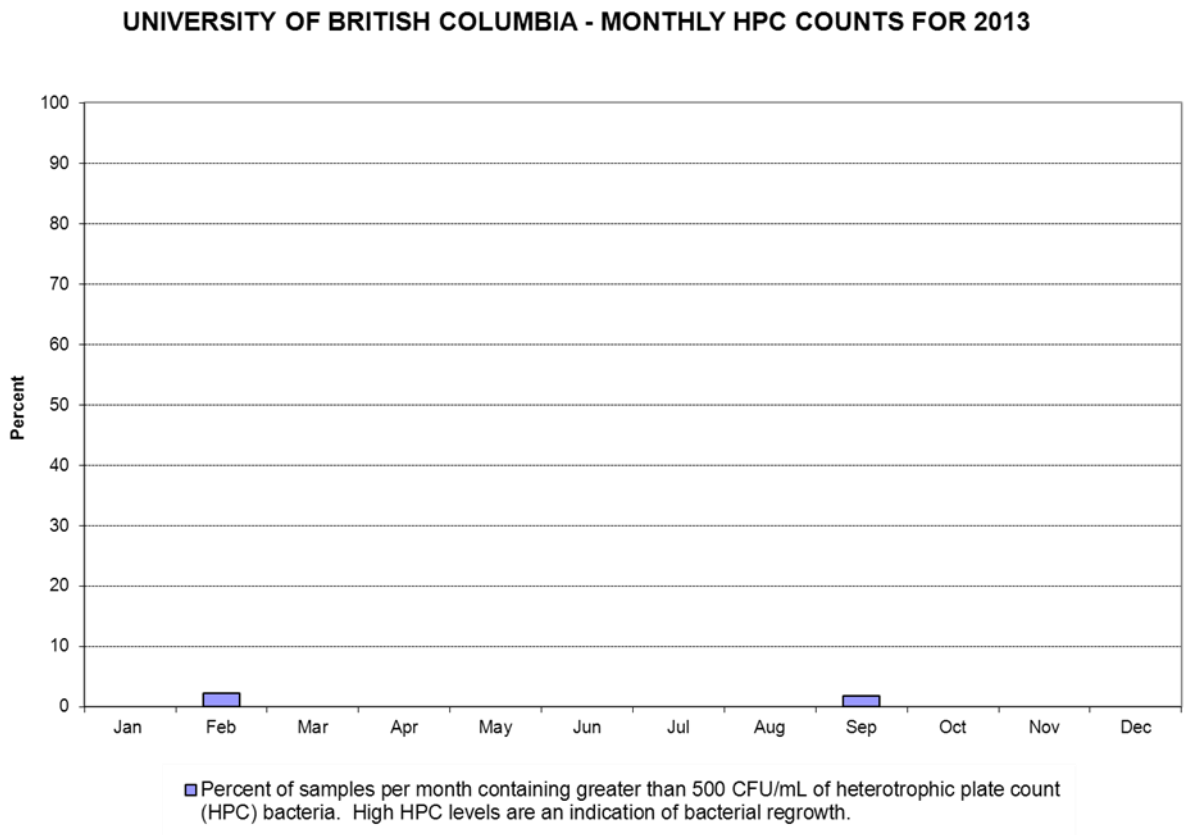
The Aesthetic objective for pH set out by GCDWQ is 6.5 - 8.5. Grab samples taken from WQN9-013, tested for pH at 7.0 – 7.4 throughout 2013. Since pH is largely determined by source water characteristics, water entering from Metro Vancouver controls its magnitude. Higher than normal pH levels were discovered in a localized area in the South Campus. With weekly flushing normal readings were maintained. The pH readings were not high enough to be a health concern nor is the area affected in a residential neighborhood.

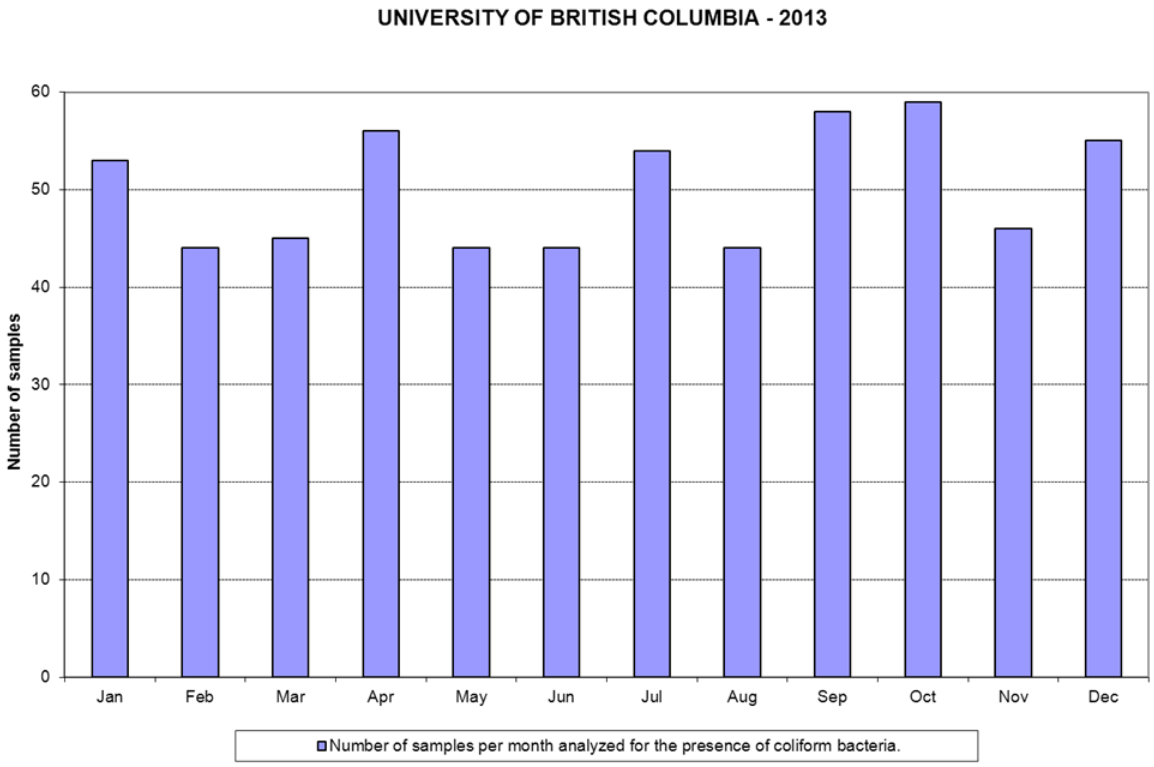
Metals

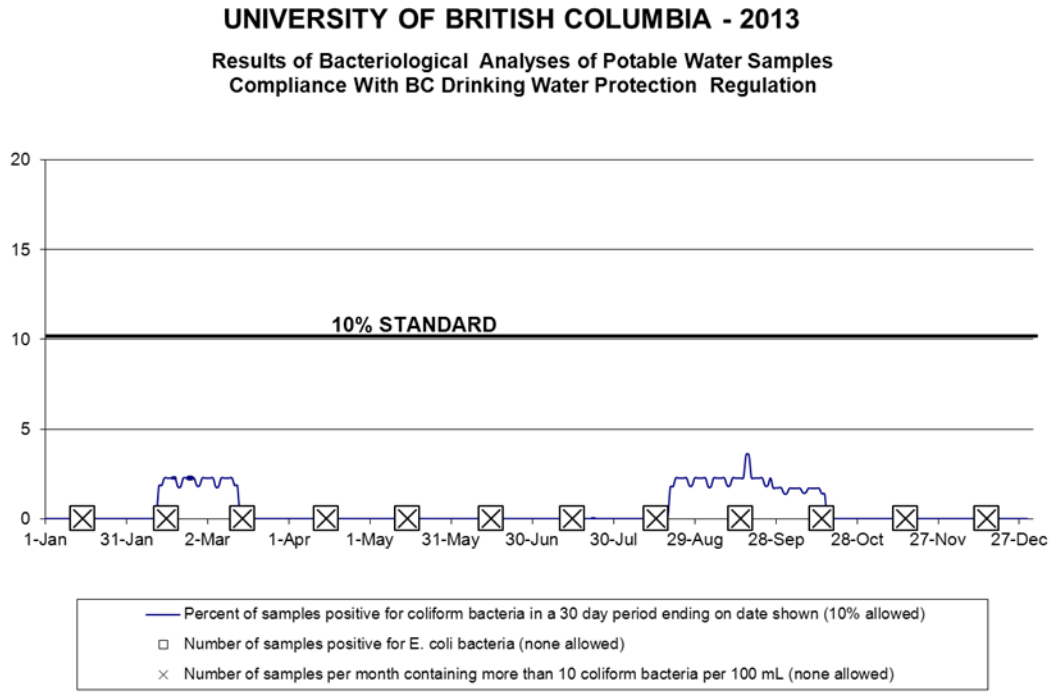
Three sample locations were tested a total of six times for metals during 2013. See table next page.

Sample Name	Date Sampled	Aluminum Total mg/L	Copper Total mg/L	Iron Total mg/L	Lead Total mg/L	Zinc Total mg/L
UBC-003	5/7/2013 11:20	0.067	0.010	0.006	<0.0005	<0.003
UBC-003	11/12/2013 11:00	0.027	0.007	0.003	<0.0005	<0.003
UBC-005	5/7/2013 11:00	0.060	0.379	0.004	0.0014	0.027
UBC-005	11/12/2013 10:40	0.035	0.002	0.003	<0.0005	0.003
UBC-008	5/7/2013 10:50	0.109	0.003	0.007	0.0006	<0.003
UBC-008	11/12/2013 9:58	0.029	0.002	0.002	0.0007	<0.003
CGDWQ Health Guidelines		N/A	N/A	N/A	0.010	N/A
CGDWQ Aesthetic Objective		N/A	1.0	0.30	N/A	5.0

All metal levels fall below the recommended guidelines outlined GCDWQ.




UNIVERSITY OF BRITISH COLUMBIA - 2013
Number of samples
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Number of samples per month analyzed for the presence of coliform bacteria.


UNIVERSITY OF BRITISH COLUMBIA - 2013
Results of Bacteriological Analyses of Potable Water Samples
Compliance With BC Drinking Water Protection Regulation
20
15
10
5
0
10% STANDARD
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Percent of samples positive for coliform bacteria in a 30 day period ending on date shown (10% allowed)
Number of samples positive for E. coli bacteria (none allowed)
Number of samples per month containing more than 10 coliform bacteria per 100 mL (none allowed)

5.0 Summary

The University of British Columbia implemented a Drinking Water Quality Monitoring Program in 2002. This monitoring program was developed based on the standard program adopted by Metro Vancouver member municipalities, the Guidelines for Canadian Drinking Water Quality (GCDWQ), and input from the Vancouver Coastal Health Authority. With this approved monitoring program in place, UBC has collected and analyzed water quality data since 2002.

The implementation of the Drinking Water Quality Monitoring program was a significant commitment made by UBC to deliver consumers safe and quality water. It generates valuable data for gaining understanding of UBC's water distribution system and for evaluating the past performance of the system in a reliable and systematic way. Most importantly, it allows for potential health hazards to be identified and consumer's water concerns to be addressed.

A Unidirectional Flushing Program has been implemented. This will reduce the risk of sediment and corrosion by-product build-up in the water mains, as well as improve water quality.

The sampling analysis results have demonstrated a satisfactory performance of the UBC distribution system. There were no recorded instances of E. coli detected in 2013. There were 3 recorded instances of total coliforms in 2013. None of these events exceeded the BC Drinking Water Protection limit for total coliforms. Concerns in regards to total coliforms and chlorine residual were addressed by an increased flushing program.

A protocol for recording complaints has been developed and is included in the UBC Emergency Response Plan – Water Utility.

UBC is committed to delivery of water of the highest quality, and will continue to make the necessary investment to ensure its continued success.

References:

British Columbia Drinking Water Protection Regulation. Drinking Water Protection Act Reg. 200/2003, 2003

Guidelines for Canadian Drinking Water Quality – Health Canada, Sixth Edition, 1996 with updated summary table, May 2008.

Water Quality Monitoring and Reporting Plan for the METRO VANCOUVER and Member Municipalities, Regional Engineers Advisory Committee (REAC), May 2000

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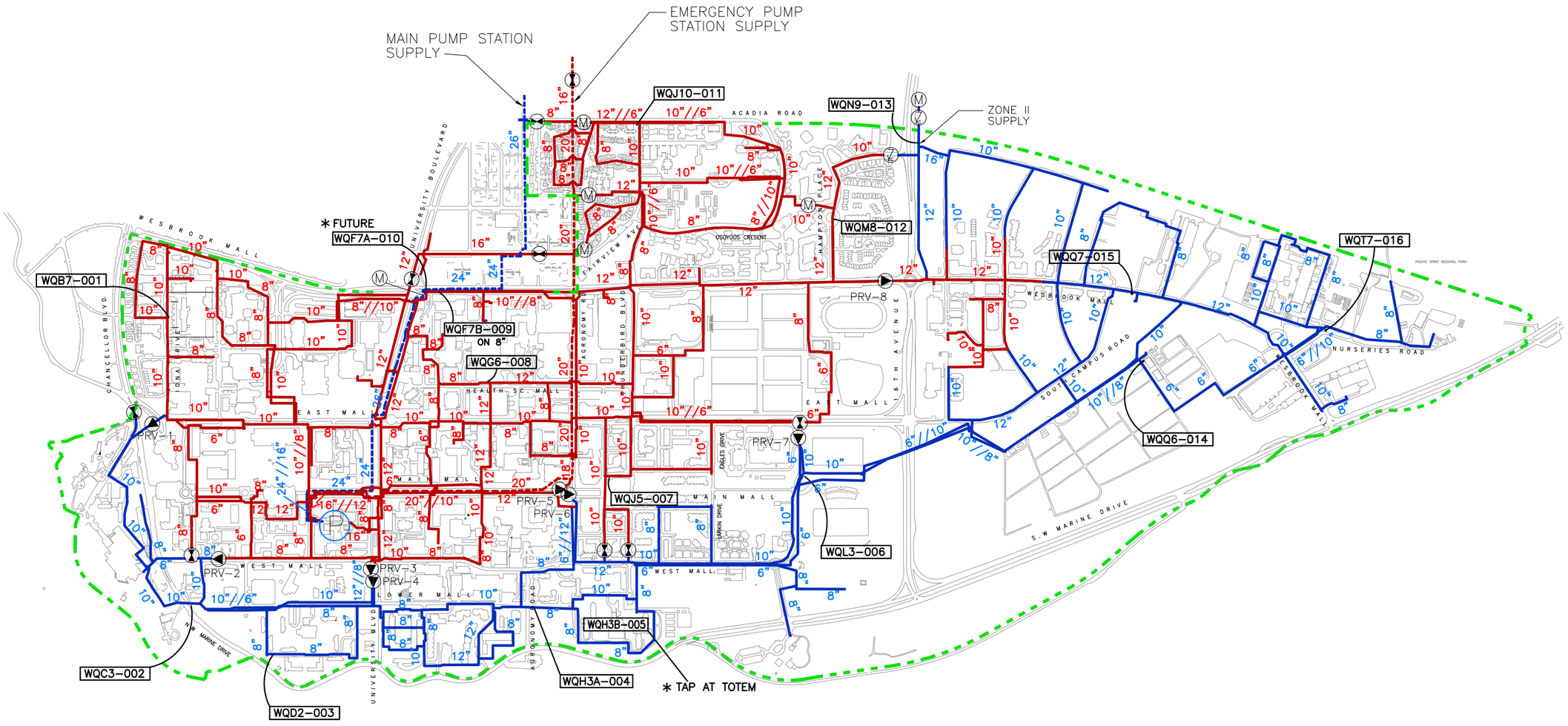
APPENDIX A

Water Sampling Sites Site Map



The University of British Columbia
Utilities

LEGEND:

- 12" Zone I High Pressure Zone
- 12" Zone II Low Pressure Zone
- Zone I – Alternate Pump Station Supply
- Zone II – Main Pump Station Supply
- (M) Meter Station
- Pressure Reducing Station
- Check Valve Station
- Valve Normally Closed
- (P) Powerhouse Booster Pumps
- WQQ6–014 Water Quality Monitoring Site
- UBC Boundary

MAJOR WATER SYSTEM SCHEMATIC

Prepared By:
UBC UTILITIES
2040 West Mall,
Vancouver, B.C.

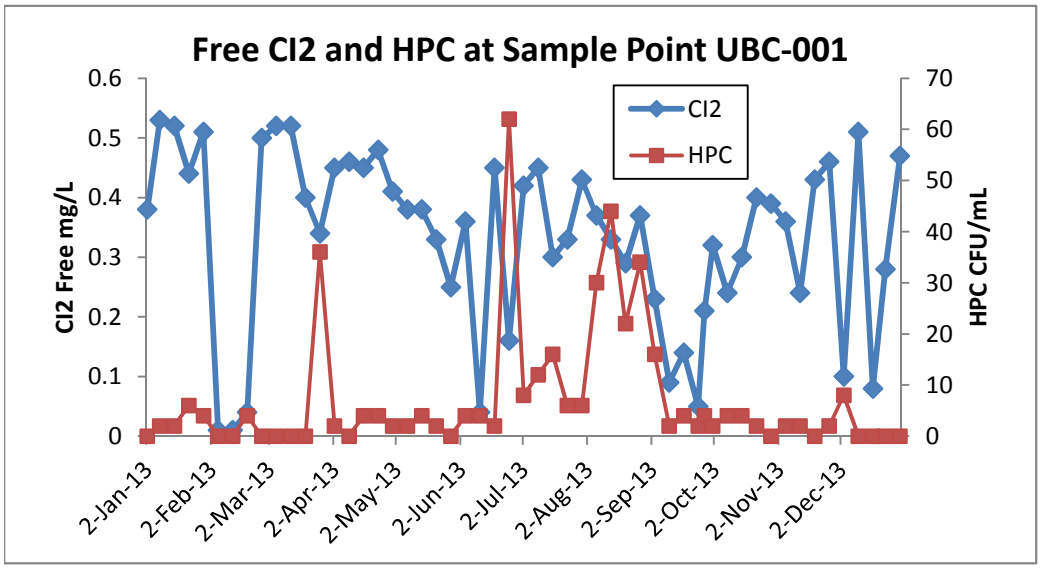
Drawn: DB	1
Design: –	
Scale: N.T.S	
Date: May 5/14	

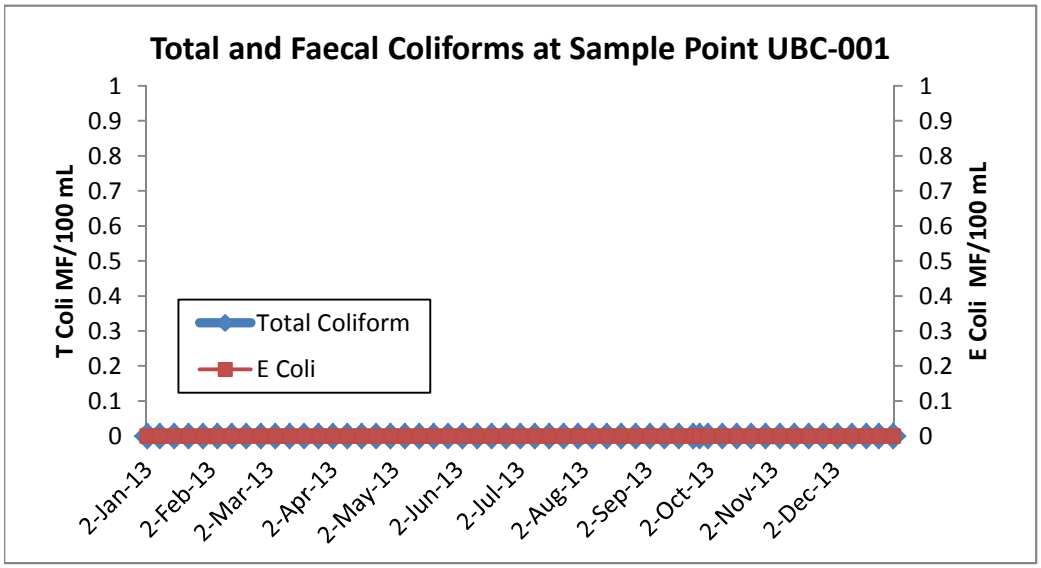
APPENDIX B

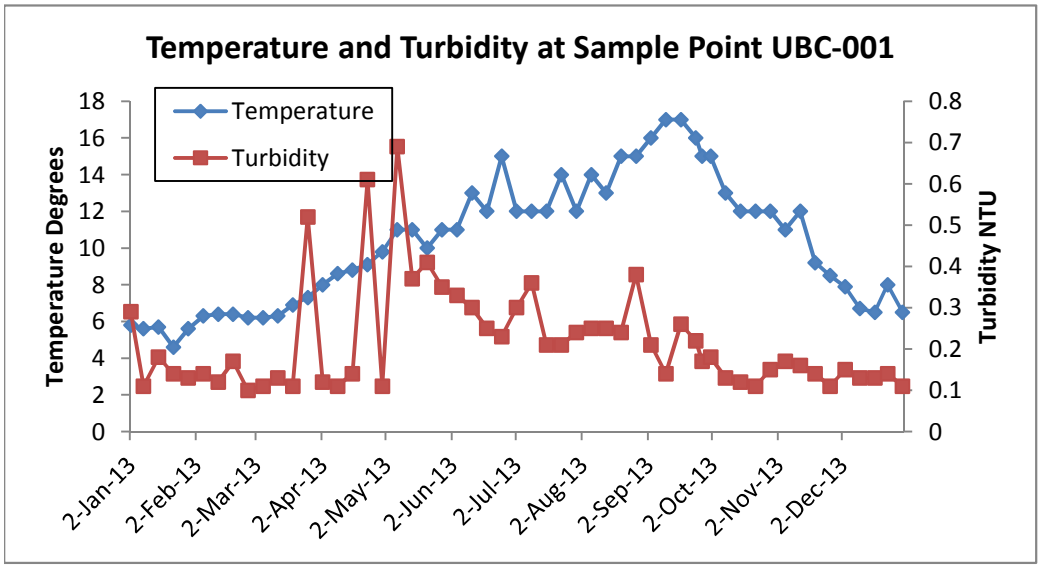
Sample Analysis Results

Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-001	2-Jan-13	0.38	<1		<1		<2	5.8	0.29
UBC-001	8-Jan-13	0.53	<1		<1		2	5.6	0.11
UBC-001	15-Jan-13	0.52	<1		<1		2	5.7	0.18
UBC-001	22-Jan-13	0.44	<1		<1		6	4.6	0.14
UBC-001	29-Jan-13	0.51	<1		<1		4	5.6	0.13
UBC-001	5-Feb-13	0.01	<1		<1		<2	6.3	0.14
UBC-001	12-Feb-13	0.01	<1		<1		<2	6.4	0.12
UBC-001	19-Feb-13	0.04	<1		<1		4	6.4	0.17
UBC-001	26-Feb-13	0.5	<1		<1		<2	6.2	0.1
UBC-001	5-Mar-13	0.52	<1		<1		<2	6.2	0.11
UBC-001	12-Mar-13	0.52	<1		<1		<2	6.3	0.13
UBC-001	19-Mar-13	0.4	<1		<1		<2	6.9	0.11
UBC-001	26-Mar-13	0.34	<1		<1		36	7.3	0.52
UBC-001	2-Apr-13	0.45	<1		<1		2	8	0.12
UBC-001	9-Apr-13	0.46	<1		<1		<2	8.6	0.11
UBC-001	16-Apr-13	0.45	<1		<1		4	8.8	0.14
UBC-001	23-Apr-13	0.48	<1		<1		4	9.1	0.61
UBC-001	30-Apr-13	0.41	<1		<1		2	9.8	0.11
UBC-001	7-May-13	0.38	<1		<1		2	11	0.69
UBC-001	14-May-13	0.38	<1		<1		4	11	0.37
UBC-001	21-May-13	0.33	<1		<1		2	10	0.41
UBC-001	28-May-13	0.25	<1		<1		<2	11	0.35
UBC-001	4-Jun-13	0.36	<1		<1		4	11	0.33
UBC-001	11-Jun-13	0.04	<1		<1		4	13	0.3
UBC-001	18-Jun-13	0.45	<1		<1		2	12	0.25
UBC-001	25-Jun-13	0.16	<1		<1		62	15	0.23
UBC-001	2-Jul-13	0.42	<1		<1		8	12	0.3
UBC-001	9-Jul-13	0.45	<1		<1		12	12	0.36
UBC-001	16-Jul-13	0.3	<1		<1		16	12	0.21
UBC-001	23-Jul-13	0.33	<1		<1		6	14	0.21
UBC-001	30-Jul-13	0.43	<1		<1		6	12	0.24
UBC-001	6-Aug-13	0.37	<1		<1		30	14	0.25
UBC-001	13-Aug-13	0.33	<1		<1		44	13	0.25
UBC-001	20-Aug-13	0.29	<1		<1		22	15	0.24
UBC-001	27-Aug-13	0.37	<1		<1		34	15	0.38
UBC-001	3-Sep-13	0.23	<1		<1		16	16	0.21
UBC-001	10-Sep-13	0.09	<1		<1		2	17	0.14
UBC-001	17-Sep-13	0.14	<1		<1		4	17	0.26
UBC-001	24-Sep-13	0.05	<1		<1		2	16	0.22
UBC-001	27-Sep-13	0.21	<1		<1		4	15	0.17
UBC-001	1-Oct-13	0.32	<1		<1		2	15	0.18
UBC-001	8-Oct-13	0.24	<1		<1		4	13	0.13
UBC-001	15-Oct-13	0.3	<1		<1		4	12	0.12
UBC-001	22-Oct-13	0.4	<1		<1		2	12	0.11
UBC-001	29-Oct-13	0.39	<1		<1		<2	12	0.15
UBC-001	5-Nov-13	0.36	<1		<1		2	11	0.17
UBC-001	12-Nov-13	0.24	<1		<1		2	12	0.16
UBC-001	19-Nov-13	0.43	<1		<1		<2	9.2	0.14
UBC-001	26-Nov-13	0.46	<1		<1		2	8.5	0.11
UBC-001	3-Dec-13	0.1	<1		<1		8	7.9	0.15
UBC-001	10-Dec-13	0.51	<1		<1		<2	6.7	0.13
UBC-001	17-Dec-13	0.08	<1		<1		<2	6.5	0.13
UBC-001	23-Dec-13	0.28	<1		<1		NA	8	0.14
UBC-001	30-Dec-13	0.47	<1		<1		NA	6.5	0.11

Sample Point WQB7-001 (UBC-001)

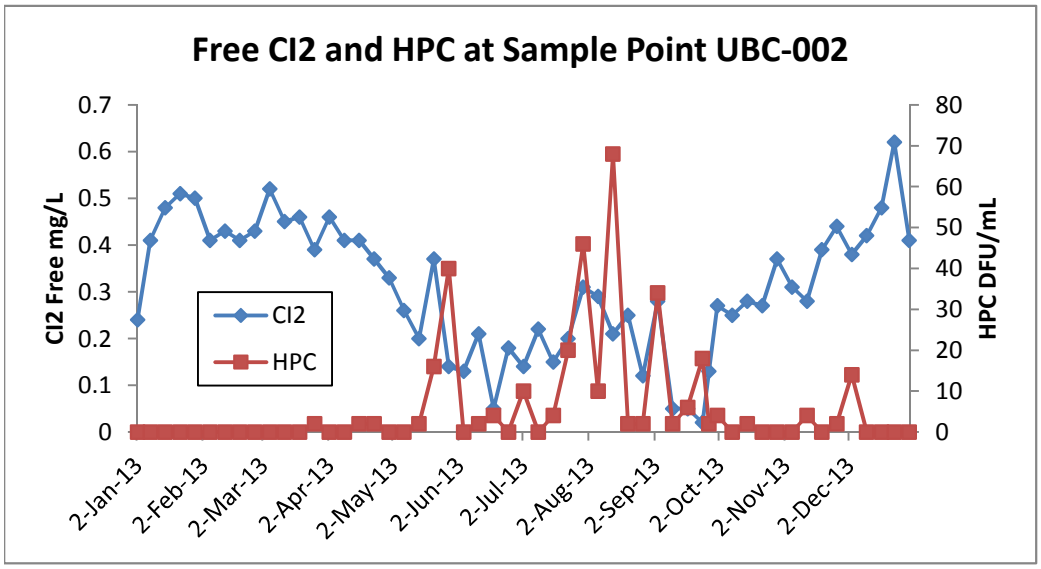


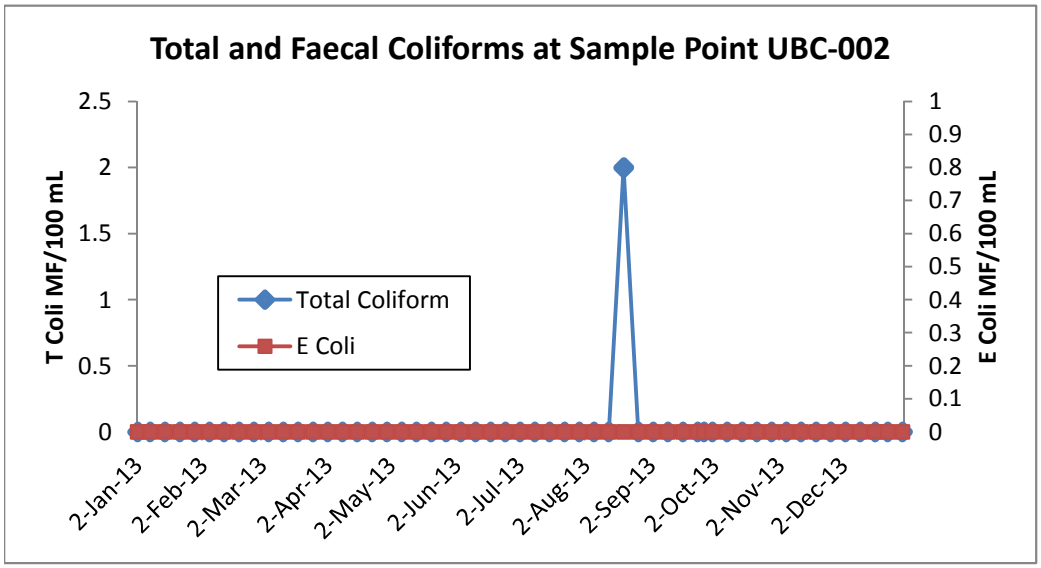


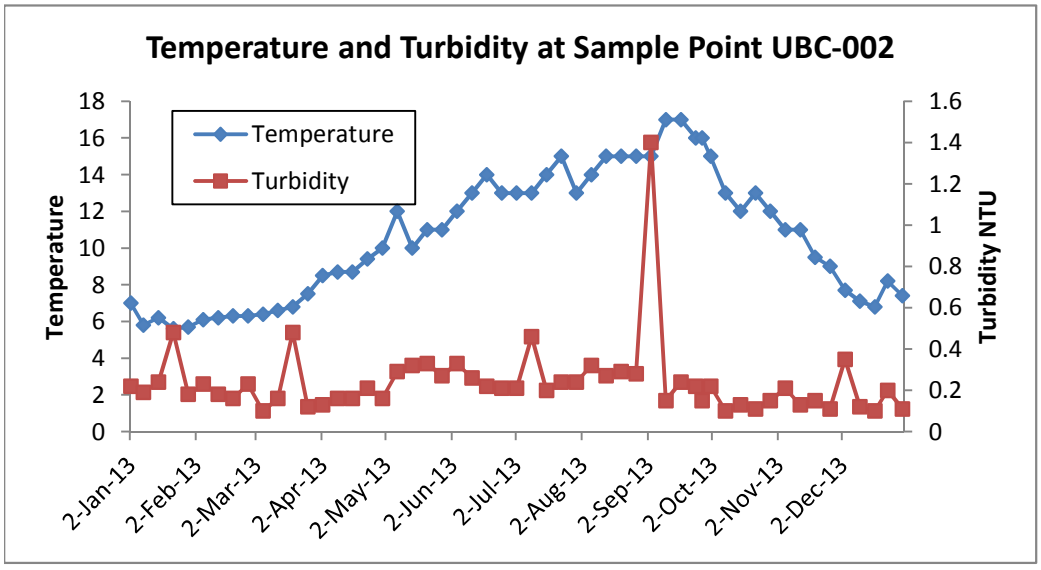


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-002	2-Jan-13	0.24	<1		<1		<2	7	0.22
UBC-002	8-Jan-13	0.41	<1		<1		<2	5.8	0.19
UBC-002	15-Jan-13	0.48	<1		<1		<2	6.2	0.24
UBC-002	22-Jan-13	0.51	<1		<1		<2	5.6	0.48
UBC-002	29-Jan-13	0.5	<1		<1		<2	5.7	0.18
UBC-002	5-Feb-13	0.41	<1		<1		<2	6.1	0.23
UBC-002	12-Feb-13	0.43	<1		<1		<2	6.2	0.18
UBC-002	19-Feb-13	0.41	<1		<1		<2	6.3	0.16
UBC-002	26-Feb-13	0.43	<1		<1		<2	6.3	0.23
UBC-002	5-Mar-13	0.52	<1		<1		<2	6.4	0.1
UBC-002	12-Mar-13	0.45	<1		<1		<2	6.6	0.16
UBC-002	19-Mar-13	0.46	<1		<1		<2	6.8	0.48
UBC-002	26-Mar-13	0.39	<1		<1		2	7.5	0.12
UBC-002	2-Apr-13	0.46	<1		<1		<2	8.5	0.13
UBC-002	9-Apr-13	0.41	<1		<1		<2	8.7	0.16
UBC-002	16-Apr-13	0.41	<1		<1		2	8.7	0.16
UBC-002	23-Apr-13	0.37	<1		<1		2	9.4	0.21
UBC-002	30-Apr-13	0.33	<1		<1		<2	10	0.16
UBC-002	7-May-13	0.26	<1		<1		<2	12	0.29
UBC-002	14-May-13	0.2	<1		<1		2	10	0.32
UBC-002	21-May-13	0.37	<1		<1		16	11	0.33
UBC-002	28-May-13	0.14	<1		<1		40	11	0.27
UBC-002	4-Jun-13	0.13	<1		<1		<2	12	0.33
UBC-002	11-Jun-13	0.21	<1		<1		2	13	0.26
UBC-002	18-Jun-13	0.05	<1		<1		4	14	0.22
UBC-002	25-Jun-13	0.18	<1		<1		<2	13	0.21
UBC-002	2-Jul-13	0.14	<1		<1		10	13	0.21
UBC-002	9-Jul-13	0.22	<1		<1		<2	13	0.46
UBC-002	16-Jul-13	0.15	<1		<1		4	14	0.2
UBC-002	23-Jul-13	0.2	<1		<1		20	15	0.24
UBC-002	30-Jul-13	0.31	<1		<1		46	13	0.24
UBC-002	6-Aug-13	0.29	<1		<1		10	14	0.32
UBC-002	13-Aug-13	0.21	<1		<1		68	15	0.27
UBC-002	20-Aug-13	0.25	2		<1		2	15	0.29
UBC-002	27-Aug-13	0.12	<1		<1		2	15	0.28
UBC-002	3-Sep-13	0.28	<1		<1		34	15	1.4
UBC-002	10-Sep-13	0.05	<1		<1		2	17	0.15
UBC-002	17-Sep-13	0.05	<1		<1		6	17	0.24
UBC-002	24-Sep-13	0.02	<1		<1		18	16	0.22
UBC-002	27-Sep-13	0.13	<1		<1		2	16	0.15
UBC-002	1-Oct-13	0.27	<1		<1		4	15	0.22
UBC-002	8-Oct-13	0.25	<1		<1		<2	13	0.1
UBC-002	15-Oct-13	0.28	<1		<1		2	12	0.13
UBC-002	22-Oct-13	0.27	<1		<1		<2	13	0.11
UBC-002	29-Oct-13	0.37	<1		<1		<2	12	0.15
UBC-002	5-Nov-13	0.31	<1		<1		<2	11	0.21
UBC-002	12-Nov-13	0.28	<1		<1		4	11	0.13
UBC-002	19-Nov-13	0.39	<1		<1		<2	9.5	0.15
UBC-002	26-Nov-13	0.44	<1		<1		2	9	0.11
UBC-002	3-Dec-13	0.38	<1		<1		14	7.7	0.35
UBC-002	10-Dec-13	0.42	<1		<1		<2	7.1	0.12
UBC-002	17-Dec-13	0.48	<1		<1		<2	6.8	0.1
UBC-002	23-Dec-13	0.62	<1		<1		NA	8.2	0.2
UBC-002	30-Dec-13	0.41	<1		<1		NA	7.4	0.11

Sample Point WQC3-002 (UBC-002)

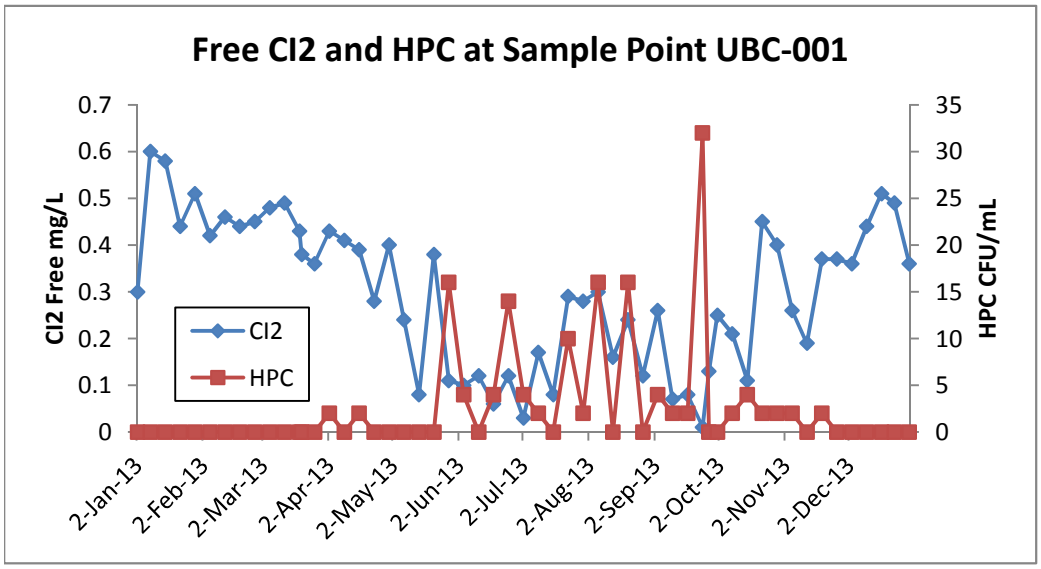


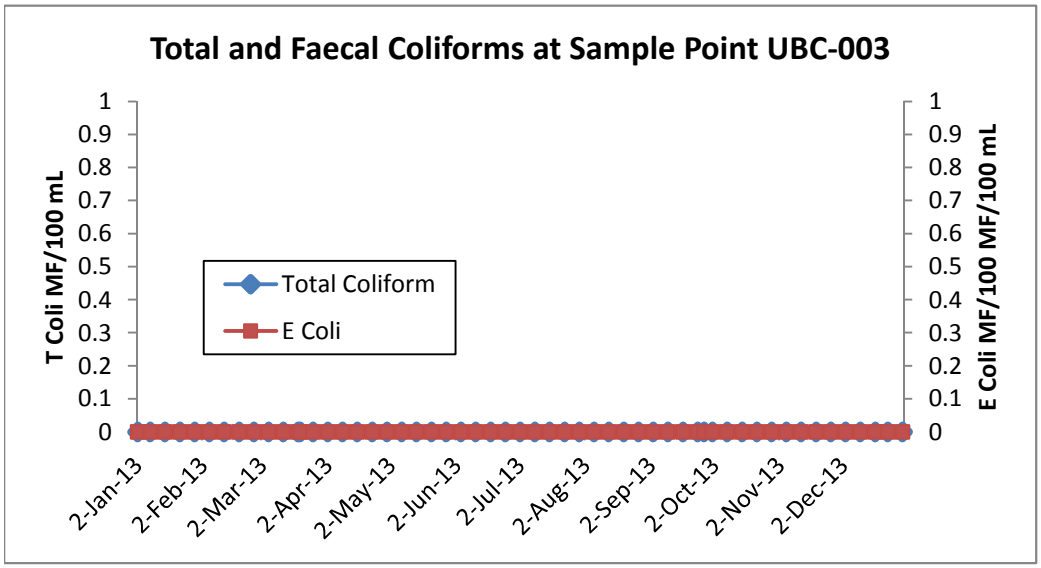


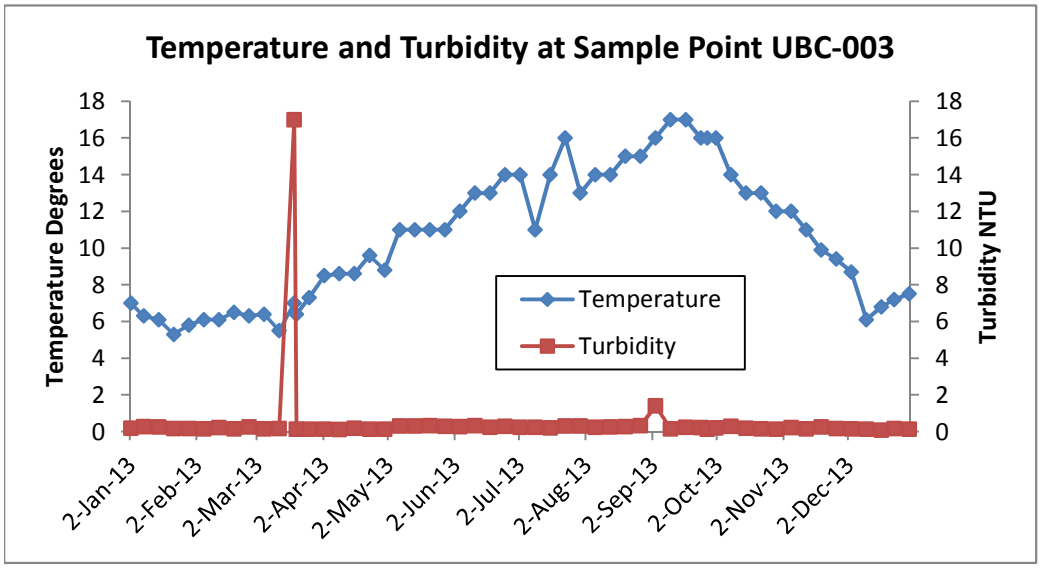


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-003	2-Jan-13	0.3	<1		<1		<2	7	0.18
UBC-003	8-Jan-13	0.6	<1		<1		<2	6.3	0.27
UBC-003	15-Jan-13	0.58	<1		<1		<2	6.1	0.25
UBC-003	22-Jan-13	0.44	<1		<1		<2	5.3	0.16
UBC-003	29-Jan-13	0.51	<1		<1		<2	5.8	0.16
UBC-003	5-Feb-13	0.42	<1		<1		<2	6.1	0.15
UBC-003	12-Feb-13	0.46	<1		<1		<2	6.1	0.22
UBC-003	19-Feb-13	0.44	<1		<1		<2	6.5	0.15
UBC-003	26-Feb-13	0.45	<1		<1		<2	6.3	0.25
UBC-003	5-Mar-13	0.48	<1		<1		<2	6.4	0.15
UBC-003	12-Mar-13	0.49	<1		<1		<2	5.5	0.17
UBC-003	19-Mar-13	0.43	<1		<1		<2	7	17
UBC-003	20-Mar-13	0.38	<1		<1		<2	6.4	0.13
UBC-003	26-Mar-13	0.36	<1		<1		<2	7.3	0.14
UBC-003	2-Apr-13	0.43	<1		<1		2	8.5	0.14
UBC-003	9-Apr-13	0.41	<1		<1		<2	8.6	0.12
UBC-003	16-Apr-13	0.39	<1		<1		2	8.6	0.19
UBC-003	23-Apr-13	0.28	<1		<1		<2	9.6	0.14
UBC-003	30-Apr-13	0.4	<1		<1		<2	8.8	0.13
UBC-003	7-May-13	0.24	<1		<1		<2	11	0.31
UBC-003	14-May-13	0.08	<1		<1		<2	11	0.3
UBC-003	21-May-13	0.38	<1		<1		<2	11	0.32
UBC-003	28-May-13	0.11	<1		<1		16	11	0.29
UBC-003	4-Jun-13	0.1	<1		<1		4	12	0.28
UBC-003	11-Jun-13	0.12	<1		<1		<2	13	0.32
UBC-003	18-Jun-13	0.06	<1		<1		4	13	0.23
UBC-003	25-Jun-13	0.12	<1		<1		14	14	0.29
UBC-003	2-Jul-13	0.03	<1		<1		4	14	0.24
UBC-003	9-Jul-13	0.17	<1		<1		2	11	0.24
UBC-003	16-Jul-13	0.08	<1		<1		<2	14	0.2
UBC-003	23-Jul-13	0.29	<1		<1		10	16	0.3
UBC-003	30-Jul-13	0.28	<1		<1		2	13	0.31
UBC-003	6-Aug-13	0.3	<1		<1		16	14	0.24
UBC-003	13-Aug-13	0.16	<1		<1		<2	14	0.25
UBC-003	20-Aug-13	0.24	<1		<1		16	15	0.28
UBC-003	27-Aug-13	0.12	<1		<1		<2	15	0.32
UBC-003	3-Sep-13	0.26	<1		<1		4	16	1.4
UBC-003	10-Sep-13	0.07	<1		<1		2	17	0.15
UBC-003	17-Sep-13	0.08	<1		<1		2	17	0.23
UBC-003	24-Sep-13	0.01	<1		<1		32	16	0.22
UBC-003	27-Sep-13	0.13	<1		<1		<2	16	0.14
UBC-003	1-Oct-13	0.25	<1		<1		<2	16	0.21
UBC-003	8-Oct-13	0.21	<1		<1		2	14	0.29
UBC-003	15-Oct-13	0.11	<1		<1		4	13	0.18
UBC-003	22-Oct-13	0.45	<1		<1		2	13	0.15
UBC-003	29-Oct-13	0.4	<1		<1		2	12	0.13
UBC-003	5-Nov-13	0.26	<1		<1		2	12	0.22
UBC-003	12-Nov-13	0.19	<1		<1		<2	11	0.15
UBC-003	19-Nov-13	0.37	<1		<1		2	9.9	0.25
UBC-003	26-Nov-13	0.37	<1		<1		<2	9.4	0.16
UBC-003	3-Dec-13	0.36	<1		<1		<2	8.7	0.15
UBC-003	10-Dec-13	0.44	<1		<1		<2	6.1	0.13
UBC-003	17-Dec-13	0.51	<1		<1		<2	6.8	0.08
UBC-003	23-Dec-13	0.49	<1		<1		NA	7.2	0.17
UBC-003	30-Dec-13	0.36	<1		<1		NA	7.5	0.13

Sample Point WQD2-003 (UBC-003)

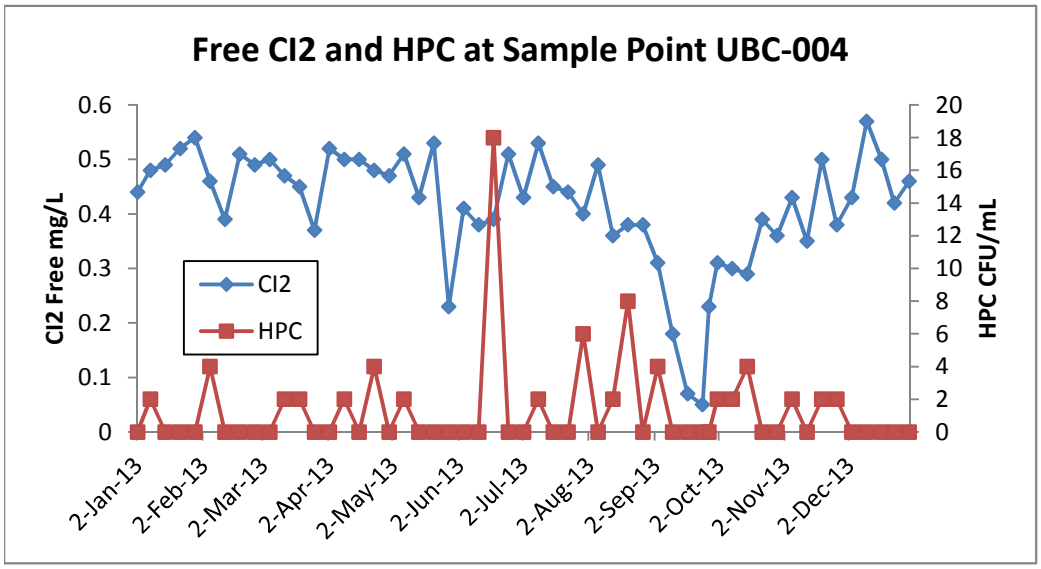


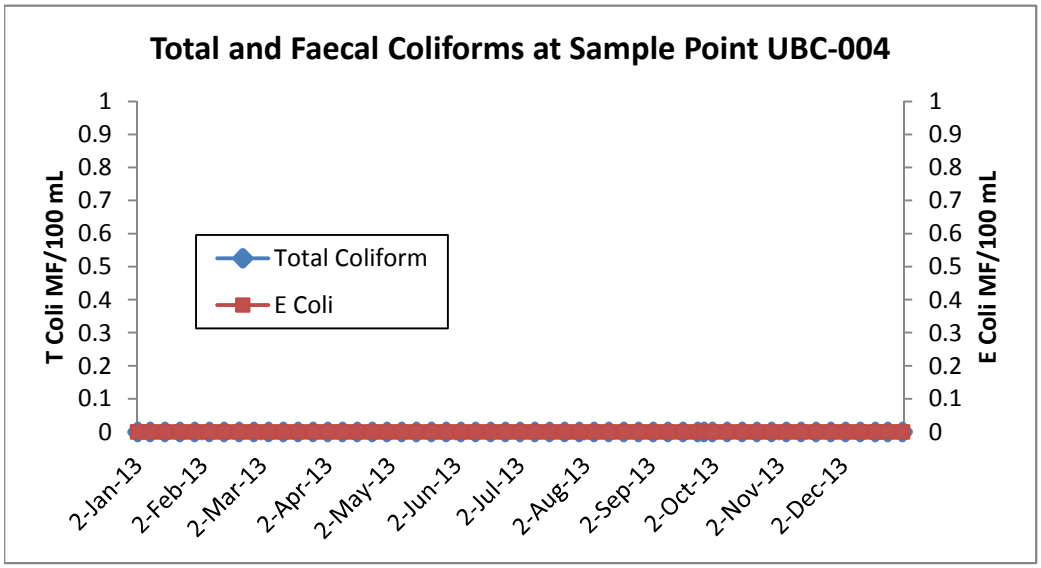


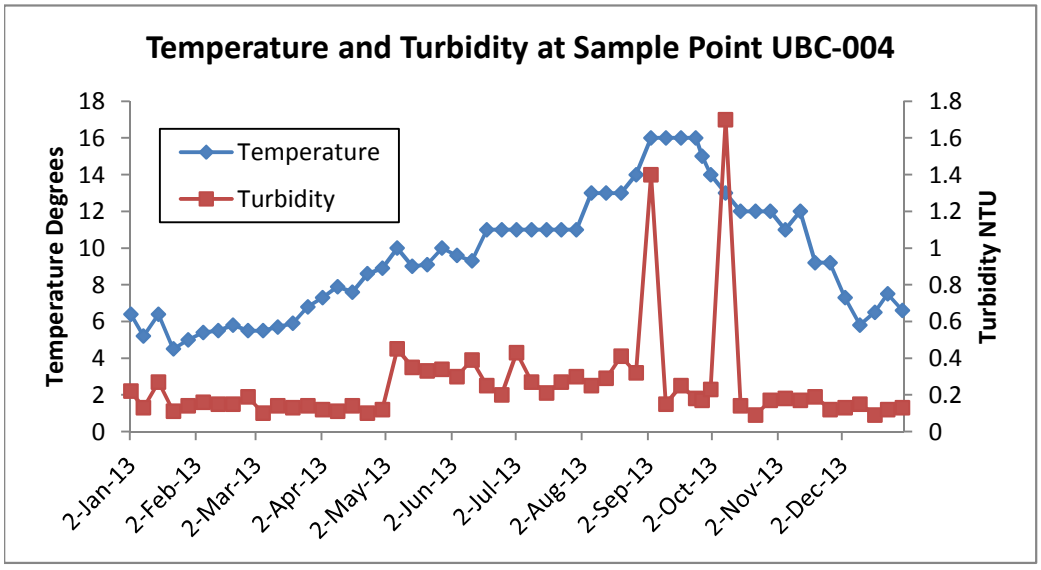


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-004	2-Jan-13	0.44	<1		<1		<2	6.4	0.22
UBC-004	8-Jan-13	0.48	<1		<1		2	5.2	0.13
UBC-004	15-Jan-13	0.49	<1		<1		<2	6.4	0.27
UBC-004	22-Jan-13	0.52	<1		<1		<2	4.5	0.11
UBC-004	29-Jan-13	0.54	<1		<1		<2	5	0.14
UBC-004	5-Feb-13	0.46	<1		<1		4	5.4	0.16
UBC-004	12-Feb-13	0.39	<1		<1		<2	5.5	0.15
UBC-004	19-Feb-13	0.51	<1		<1		<2	5.8	0.15
UBC-004	26-Feb-13	0.49	<1		<1		<2	5.5	0.19
UBC-004	5-Mar-13	0.5	<1		<1		<2	5.5	0.1
UBC-004	12-Mar-13	0.47	<1		<1		2	5.7	0.14
UBC-004	19-Mar-13	0.45	<1		<1		2	5.9	0.13
UBC-004	26-Mar-13	0.37	<1		<1		<2	6.8	0.14
UBC-004	2-Apr-13	0.52	<1		<1		<2	7.3	0.12
UBC-004	9-Apr-13	0.5	<1		<1		2	7.9	0.11
UBC-004	16-Apr-13	0.5	<1		<1		<2	7.6	0.14
UBC-004	23-Apr-13	0.48	<1		<1		4	8.6	0.1
UBC-004	30-Apr-13	0.47	<1		<1		<2	8.9	0.12
UBC-004	7-May-13	0.51	<1		<1		2	10	0.45
UBC-004	14-May-13	0.43	<1		<1		<2	9	0.35
UBC-004	21-May-13	0.53	<1		<1		<2	9.1	0.33
UBC-004	28-May-13	0.23	<1		<1		<2	10	0.34
UBC-004	4-Jun-13	0.41	<1		<1		<2	9.6	0.3
UBC-004	11-Jun-13	0.38	<1		<1		<2	9.3	0.39
UBC-004	18-Jun-13	0.39	<1		<1		18	11	0.25
UBC-004	25-Jun-13	0.51	<1		<1		<2	11	0.2
UBC-004	2-Jul-13	0.43	<1		<1		<2	11	0.43
UBC-004	9-Jul-13	0.53	<1		<1		2	11	0.27
UBC-004	16-Jul-13	0.45	<1		<1		<2	11	0.21
UBC-004	23-Jul-13	0.44	<1		<1		<2	11	0.27
UBC-004	30-Jul-13	0.4	<1		<1		6	11	0.3
UBC-004	6-Aug-13	0.49	<1		<1		<2	13	0.25
UBC-004	13-Aug-13	0.36	<1		<1		2	13	0.29
UBC-004	20-Aug-13	0.38	<1		<1		8	13	0.41
UBC-004	27-Aug-13	0.38	<1		<1		<2	14	0.32
UBC-004	3-Sep-13	0.31	<1		<1		4	16	1.4
UBC-004	10-Sep-13	0.18	<1		<1		<2	16	0.15
UBC-004	17-Sep-13	0.07	<1		<1		<2	16	0.25
UBC-004	24-Sep-13	0.05	<1		<1		<2	16	0.18
UBC-004	27-Sep-13	0.23	<1		<1		<2	15	0.17
UBC-004	1-Oct-13	0.31	<1		<1		2	14	0.23
UBC-004	8-Oct-13	0.3	<1		<1		2	13	1.7
UBC-004	15-Oct-13	0.29	<1		<1		4	12	0.14
UBC-004	22-Oct-13	0.39	<1		<1		<2	12	0.09
UBC-004	29-Oct-13	0.36	<1		<1		<2	12	0.17
UBC-004	5-Nov-13	0.43	<1		<1		2	11	0.18
UBC-004	12-Nov-13	0.35	<1		<1		<2	12	0.17
UBC-004	19-Nov-13	0.5	<1		<1		2	9.2	0.19
UBC-004	26-Nov-13	0.38	<1		<1		2	9.2	0.12
UBC-004	3-Dec-13	0.43	<1		<1		<2	7.3	0.13
UBC-004	10-Dec-13	0.57	<1		<1		<2	5.8	0.15
UBC-004	17-Dec-13	0.5	<1		<1		<2	6.5	0.09
UBC-004	23-Dec-13	0.42	<1		<1		NA	7.5	0.12
UBC-004	30-Dec-13	0.46	<1		<1		NA	6.6	0.13

Sample Point WQH3A-004 (UBC-004)



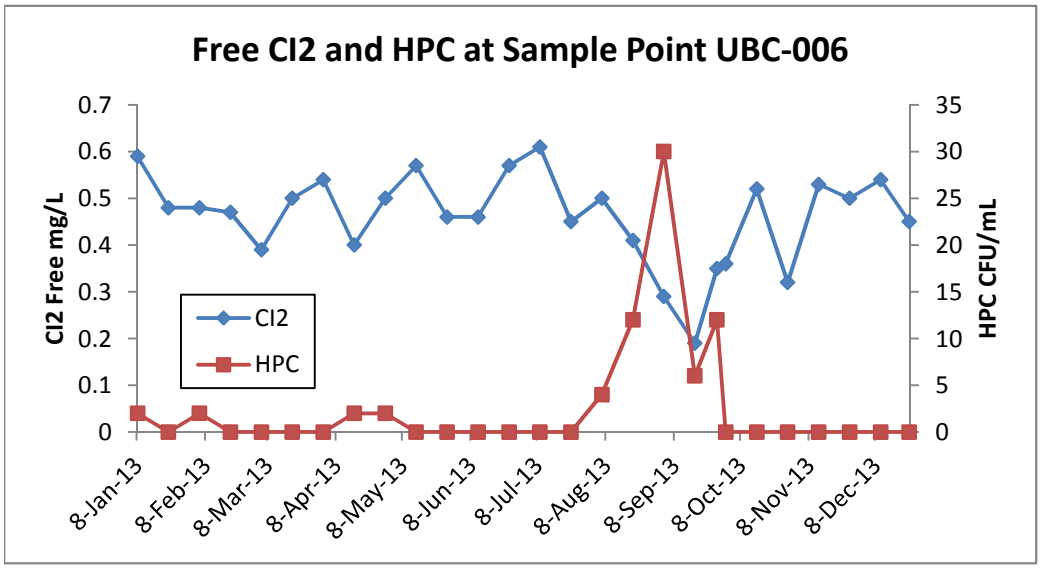


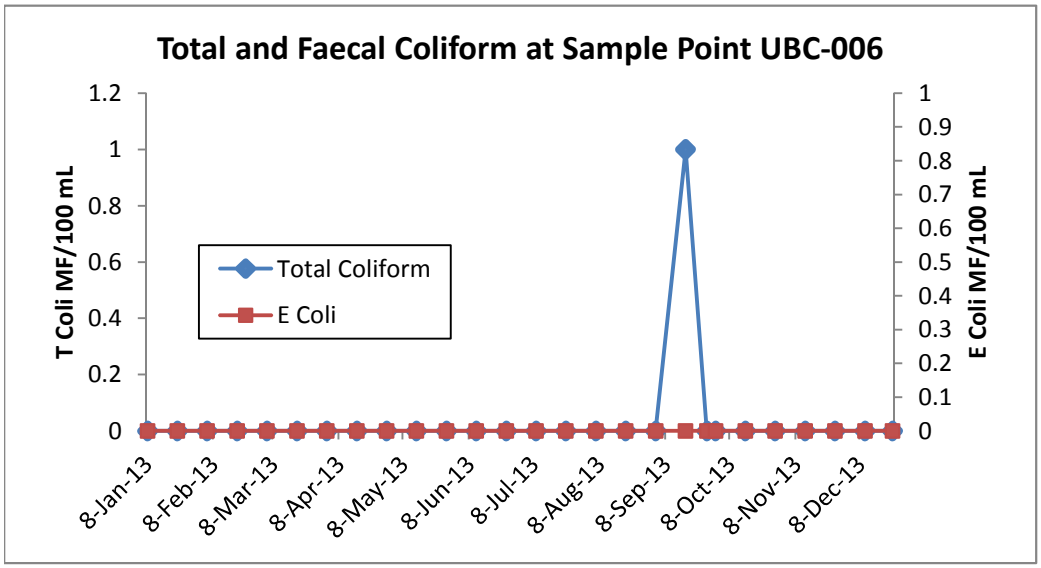


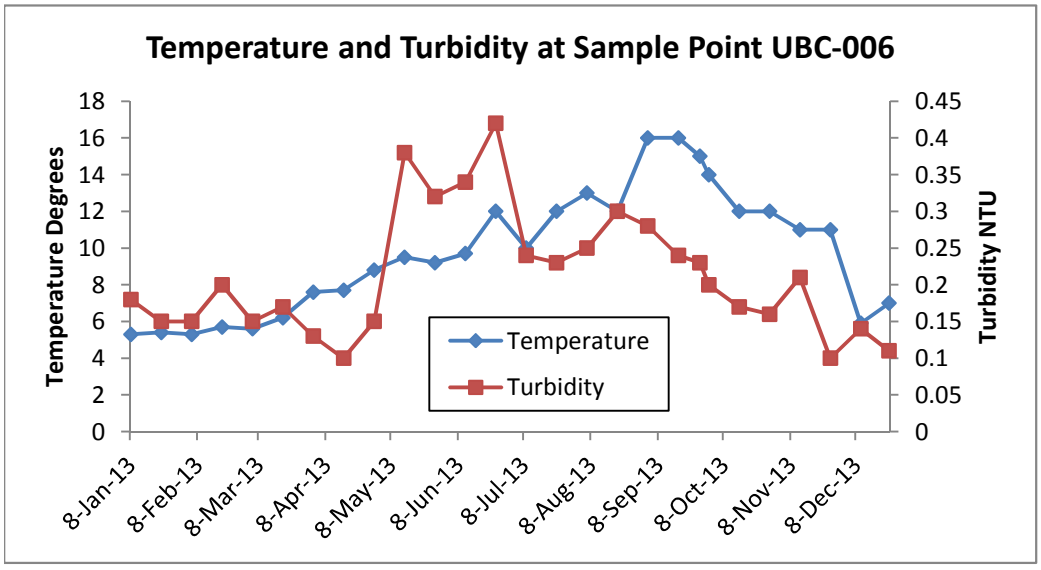
Sample Point WQL3-006 (UBC-006)

Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-006	8-Jan-13	0.59	<1		<1		2	5.3	0.18
UBC-006	22-Jan-13	0.48	<1		<1		<2	5.4	0.15
UBC-006	5-Feb-13	0.48	<1		<1		2	5.3	0.15
UBC-006	19-Feb-13	0.47	<1		<1		<2	5.7	0.2
UBC-006	5-Mar-13	0.39	<1		<1		<2	5.6	0.15
UBC-006	19-Mar-13	0.5	<1		<1		<2	6.2	0.17
UBC-006	2-Apr-13	0.54	<1		<1		<2	7.6	0.13
UBC-006	16-Apr-13	0.4	<1		<1		2	7.7	0.1
UBC-006	30-Apr-13	0.5	<1		<1		2	8.8	0.15
UBC-006	14-May-13	0.57	<1		<1		<2	9.5	0.38
UBC-006	28-May-13	0.46	<1		<1		<2	9.2	0.32
UBC-006	11-Jun-13	0.46	<1		<1		<2	9.7	0.34
UBC-006	25-Jun-13	0.57	<1		<1		<2	12	0.42
UBC-006	9-Jul-13	0.61	<1		<1		<2	10	0.24
UBC-006	23-Jul-13	0.45	<1		<1		<2	12	0.23
UBC-006	6-Aug-13	0.5	<1		<1		4	13	0.25
UBC-006	20-Aug-13	0.41	<1		<1		12	12	0.3
UBC-006	3-Sep-13	0.29	<1		<1		30	16	0.28
UBC-006	17-Sep-13	0.19	1		<1		6	16	0.24
UBC-006	27-Sep-13	0.35	<1		<1		12	15	0.23
UBC-006	1-Oct-13	0.36	<1		<1		<2	14	0.2
UBC-006	15-Oct-13	0.52	<1		<1		<2	12	0.17
UBC-006	29-Oct-13	0.32	<1		<1		<2	12	0.16
UBC-006	12-Nov-13	0.53	<1		<1		<2	11	0.21
UBC-006	26-Nov-13	0.5	<1		<1		<2	11	0.1
UBC-006	10-Dec-13	0.54	<1		<1		<2	5.9	0.14
UBC-006	23-Dec-13	0.45	<1		<1		NA	7	0.11

Sample Point WQL3-006 (UBC-006)



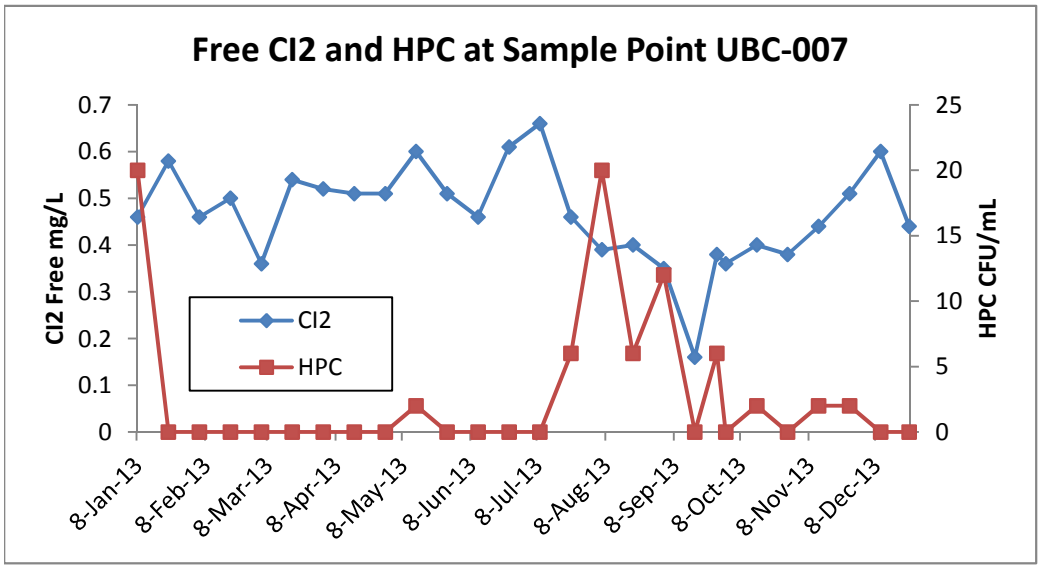


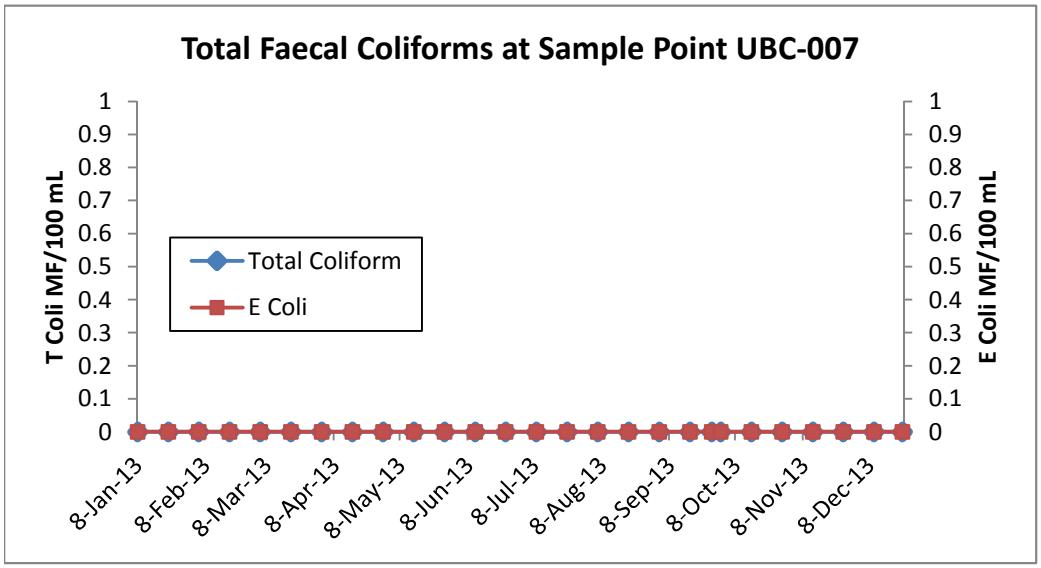


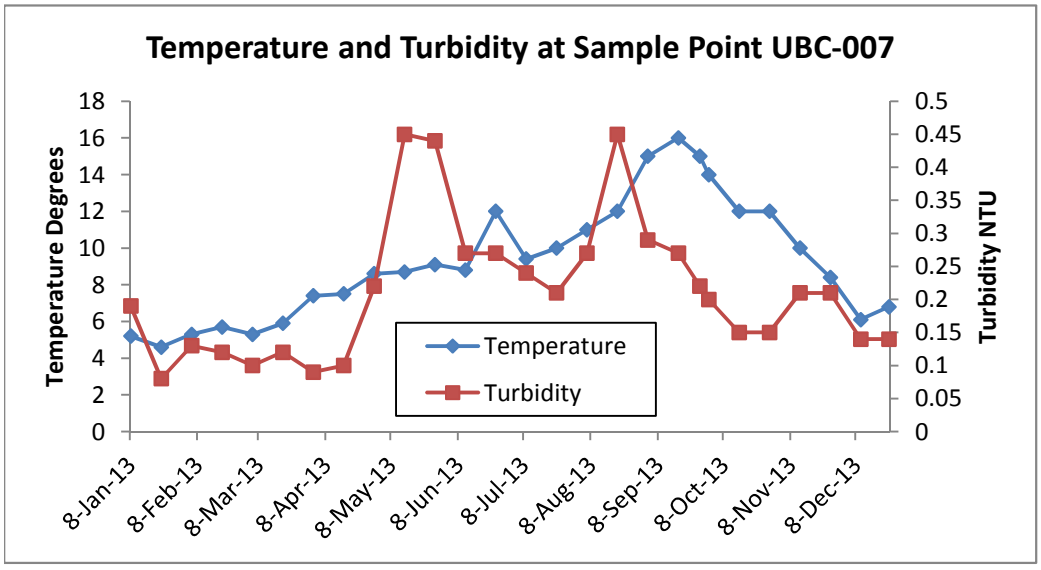
Sample Point WQJ5-007 (UBC-007)

Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-007	8-Jan-13	0.46	<1		<1		20	5.2	0.19
UBC-007	22-Jan-13	0.58	<1		<1		<2	4.6	0.08
UBC-007	5-Feb-13	0.46	<1		<1		<2	5.3	0.13
UBC-007	19-Feb-13	0.5	<1		<1		<2	5.7	0.12
UBC-007	5-Mar-13	0.36	<1		<1		<2	5.3	0.1
UBC-007	19-Mar-13	0.54	<1		<1		<2	5.9	0.12
UBC-007	2-Apr-13	0.52	<1		<1		<2	7.4	0.09
UBC-007	16-Apr-13	0.51	<1		<1		<2	7.5	0.1
UBC-007	30-Apr-13	0.51	<1		<1		<2	8.6	0.22
UBC-007	14-May-13	0.6	<1		<1		2	8.7	0.45
UBC-007	28-May-13	0.51	<1		<1		<2	9.1	0.44
UBC-007	11-Jun-13	0.46	<1		<1		<2	8.8	0.27
UBC-007	25-Jun-13	0.61	<1		<1		<2	12	0.27
UBC-007	9-Jul-13	0.66	<1		<1		<2	9.4	0.24
UBC-007	23-Jul-13	0.46	<1		<1		6	10	0.21
UBC-007	6-Aug-13	0.39	<1		<1		20	11	0.27
UBC-007	20-Aug-13	0.4	<1		<1		6	12	0.45
UBC-007	3-Sep-13	0.35	<1		<1		12	15	0.29
UBC-007	17-Sep-13	0.16	<1		<1		<2	16	0.27
UBC-007	27-Sep-13	0.38	<1		<1		6	15	0.22
UBC-007	1-Oct-13	0.36	<1		<1		<2	14	0.2
UBC-007	15-Oct-13	0.4	<1		<1		2	12	0.15
UBC-007	29-Oct-13	0.38	<1		<1		<2	12	0.15
UBC-007	12-Nov-13	0.44	<1		<1		2	10	0.21
UBC-007	26-Nov-13	0.51	<1		<1		2	8.4	0.21
UBC-007	10-Dec-13	0.6	<1		<1		<2	6.1	0.14
UBC-007	23-Dec-13	0.44	<1		<1		NA	6.8	0.14

Sample Point WQJ5-007 (UBC-007)

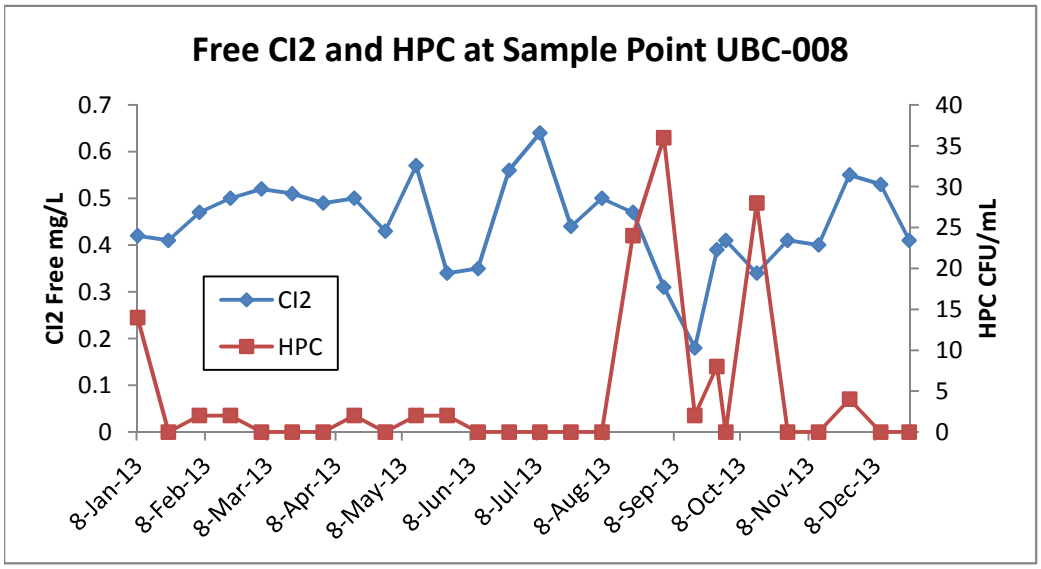


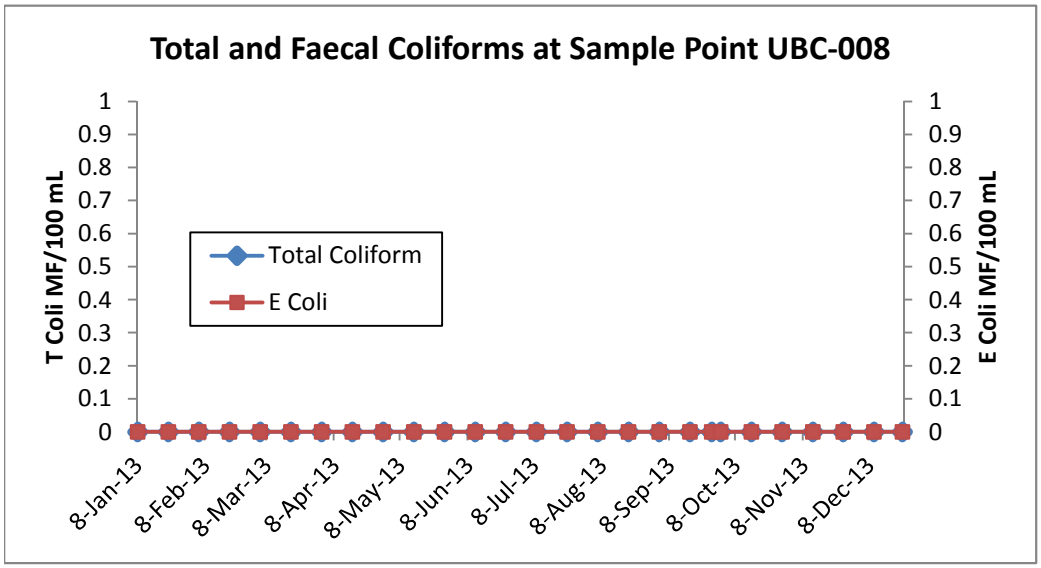


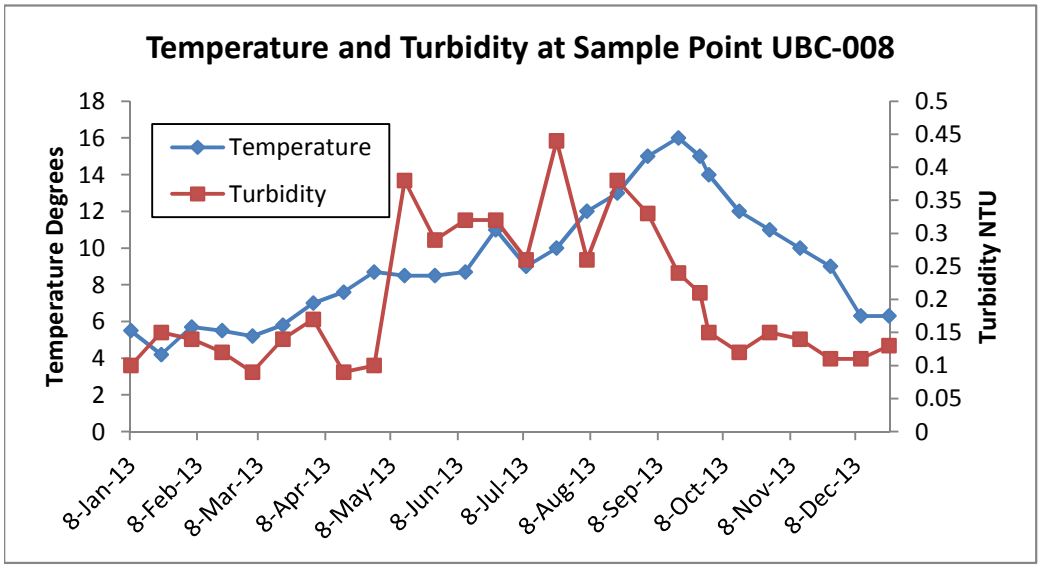


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-008	8-Jan-13	0.42	<1		<1		14	5.5	0.1
UBC-008	22-Jan-13	0.41	<1		<1		[contamination] LA	4.2	0.15
UBC-008	5-Feb-13	0.47	<1		<1		2	5.7	0.14
UBC-008	19-Feb-13	0.5	<1		<1		2	5.5	0.12
UBC-008	5-Mar-13	0.52	<1		<1		<2	5.2	0.09
UBC-008	19-Mar-13	0.51	<1		<1		<2	5.8	0.14
UBC-008	2-Apr-13	0.49	<1		<1		<2	7	0.17
UBC-008	16-Apr-13	0.5	<1		<1		2	7.6	0.09
UBC-008	30-Apr-13	0.43	<1		<1		<2	8.7	0.1
UBC-008	14-May-13	0.57	<1		<1		2	8.5	0.38
UBC-008	28-May-13	0.34	<1		<1		2	8.5	0.29
UBC-008	11-Jun-13	0.35	<1		<1		<2	8.7	0.32
UBC-008	25-Jun-13	0.56	<1		<1		<2	11	0.32
UBC-008	9-Jul-13	0.64	<1		<1		[contaminated] LA	9	0.26
UBC-008	23-Jul-13	0.44	<1		<1		<2	10	0.44
UBC-008	6-Aug-13	0.5	<1		<1		<2	12	0.26
UBC-008	20-Aug-13	0.47	<1		<1		24	13	0.38
UBC-008	3-Sep-13	0.31	<1		<1		36	15	0.33
UBC-008	17-Sep-13	0.18	<1		<1		2	16	0.24
UBC-008	27-Sep-13	0.39	<1		<1		8	15	0.21
UBC-008	1-Oct-13	0.41	<1		<1		<2	14	0.15
UBC-008	15-Oct-13	0.34	<1		<1		28	12	0.12
UBC-008	29-Oct-13	0.41	<1		<1		<2	11	0.15
UBC-008	12-Nov-13	0.4	<1		<1		<2	10	0.14
UBC-008	26-Nov-13	0.55	<1		<1		4	9	0.11
UBC-008	10-Dec-13	0.53	<1		<1		<2	6.3	0.11
UBC-008	23-Dec-13	0.41	<1		<1		NA	6.3	0.13

Sample Point WQG6-008 (UBC-008)



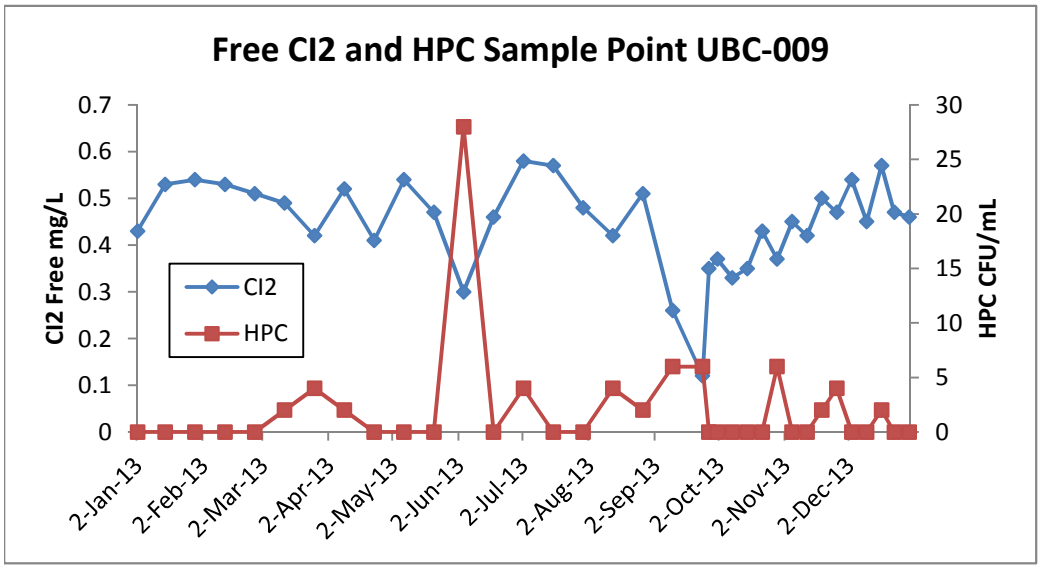


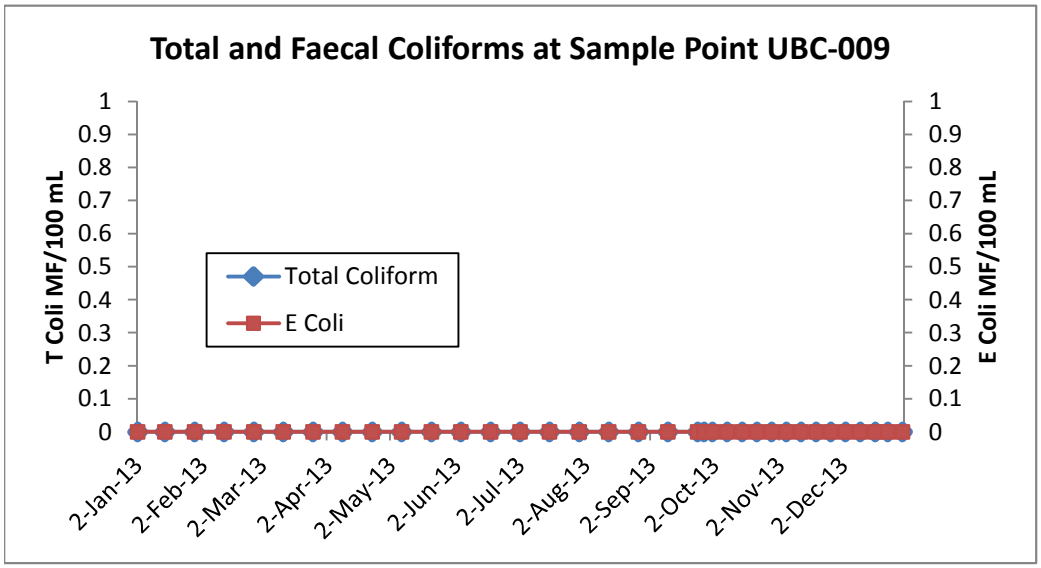


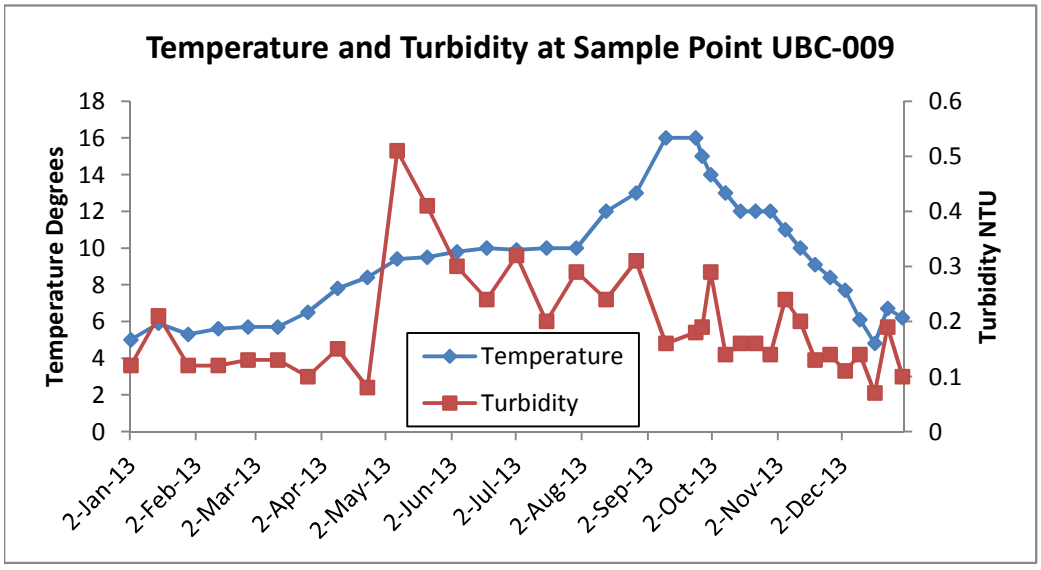
Sample Point WQF713-009 (UBC-009)

Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-009	2-Jan-13	0.43	<1		<1		<2	5	0.12
UBC-009	15-Jan-13	0.53	<1		<1		<2	5.9	0.21
UBC-009	29-Jan-13	0.54	<1		<1		<2	5.3	0.12
UBC-009	12-Feb-13	0.53	<1		<1		<2	5.6	0.12
UBC-009	26-Feb-13	0.51	<1		<1		<2	5.7	0.13
UBC-009	12-Mar-13	0.49	<1		<1		2	5.7	0.13
UBC-009	26-Mar-13	0.42	<1		<1		4	6.5	0.1
UBC-009	9-Apr-13	0.52	<1		<1		2	7.8	0.15
UBC-009	23-Apr-13	0.41	<1		<1		<2	8.4	0.08
UBC-009	7-May-13	0.54	<1		<1		<2	9.4	0.51
UBC-009	21-May-13	0.47	<1		<1		<2	9.5	0.41
UBC-009	4-Jun-13	0.3	<1		<1		28	9.8	0.3
UBC-009	18-Jun-13	0.46	<1		<1		<2	10	0.24
UBC-009	2-Jul-13	0.58	<1		<1		4	9.9	0.32
UBC-009	16-Jul-13	0.57	<1		<1		<2	10	0.2
UBC-009	30-Jul-13	0.48	<1		<1		<2	10	0.29
UBC-009	13-Aug-13	0.42	<1		<1		4	12	0.24
UBC-009	27-Aug-13	0.51	<1		<1		2	13	0.31
UBC-009	10-Sep-13	0.26	<1		<1		6	16	0.16
UBC-009	24-Sep-13	0.12	<1		<1		6	16	0.18
UBC-009	27-Sep-13	0.35	<1		<1		<2	15	0.19
UBC-009	1-Oct-13	0.37	<1		<1		<2	14	0.29
UBC-009	8-Oct-13	0.33	<1		<1		<2	13	0.14
UBC-009	15-Oct-13	0.35	<1		<1		<2	12	0.16
UBC-009	22-Oct-13	0.43	<1		<1		<2	12	0.16
UBC-009	29-Oct-13	0.37	<1		<1		6	12	0.14
UBC-009	5-Nov-13	0.45	<1		<1		<2	11	0.24
UBC-009	12-Nov-13	0.42	<1		<1		<2	10	0.2
UBC-009	19-Nov-13	0.5	<1		<1		2	9.1	0.13
UBC-009	26-Nov-13	0.47	<1		<1		4	8.4	0.14
UBC-009	3-Dec-13	0.54	<1		<1		<2	7.7	0.11
UBC-009	10-Dec-13	0.45	<1		<1		<2	6.1	0.14
UBC-009	17-Dec-13	0.57	<1		<1		2	4.8	0.07
UBC-009	23-Dec-13	0.47	<1		<1		NA	6.7	0.19
UBC-009	30-Dec-13	0.46	<1		<1		NA	6.2	0.1

Sample Point WQF713-009 (UBC-009)

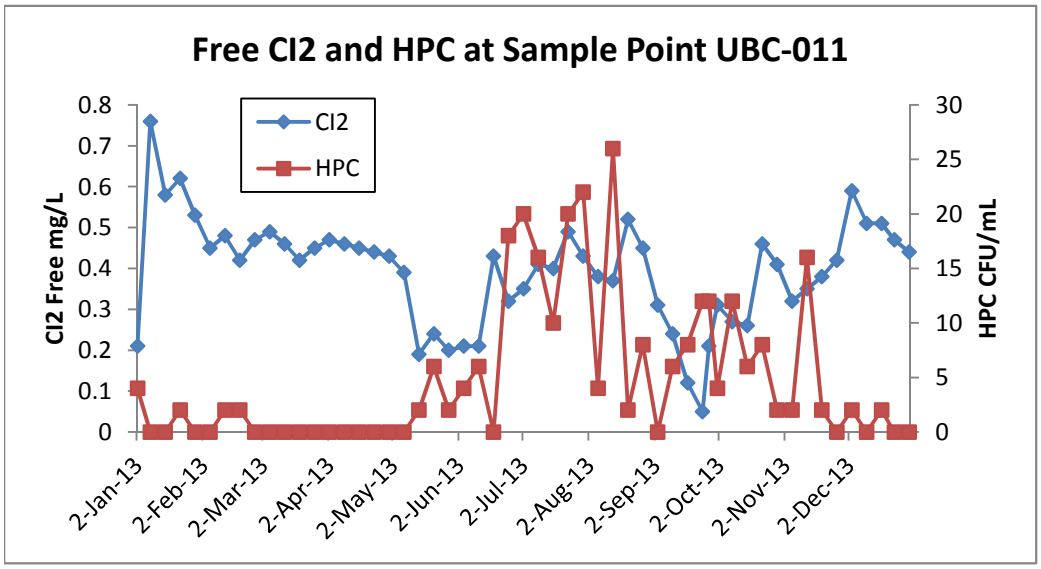


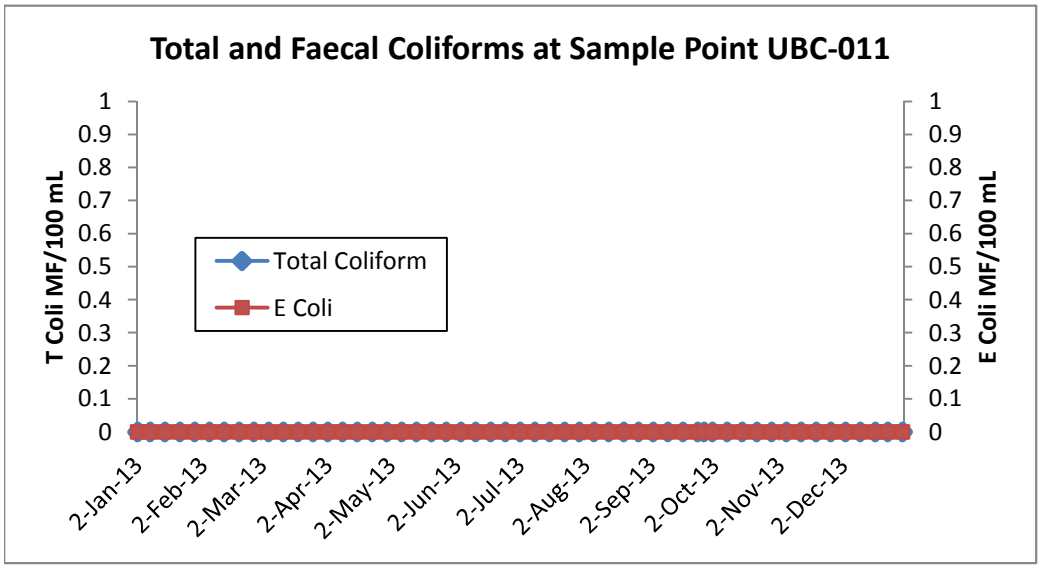


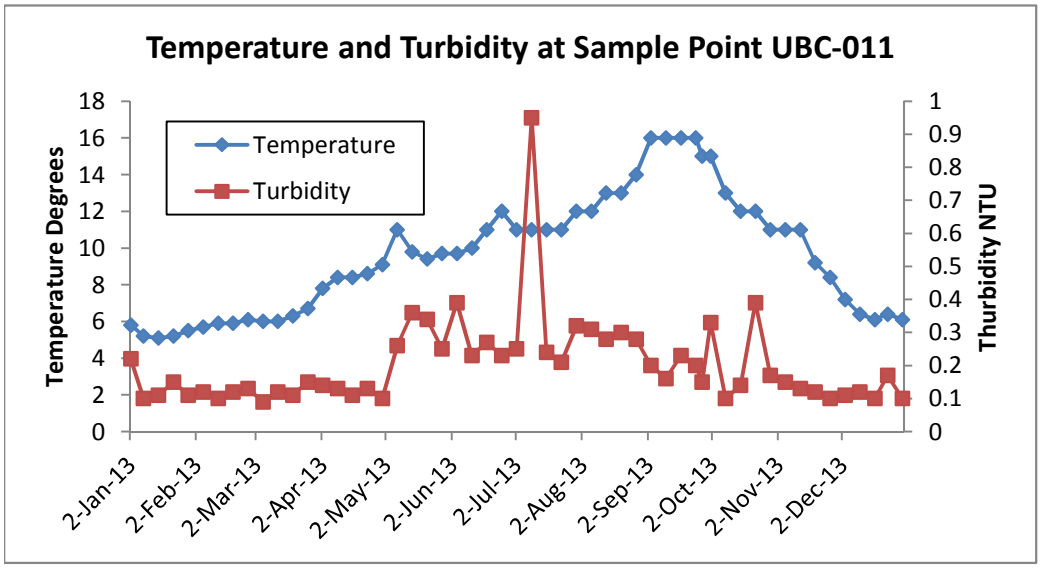


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-011	2-Jan-13	0.21	<1		<1		4	5.8	0.22
UBC-011	8-Jan-13	0.76	<1		<1		<2	5.2	0.1
UBC-011	15-Jan-13	0.58	<1		<1		<2	5.1	0.11
UBC-011	22-Jan-13	0.62	<1		<1		2	5.2	0.15
UBC-011	29-Jan-13	0.53	<1		<1		<2	5.5	0.11
UBC-011	5-Feb-13	0.45	<1		<1		<2	5.7	0.12
UBC-011	12-Feb-13	0.48	<1		<1		2	5.9	0.1
UBC-011	19-Feb-13	0.42	<1		<1		2	5.9	0.12
UBC-011	26-Feb-13	0.47	<1		<1		<2	6.1	0.13
UBC-011	5-Mar-13	0.49	<1		<1		<2	6	0.09
UBC-011	12-Mar-13	0.46	<1		<1		<2	6	0.12
UBC-011	19-Mar-13	0.42	<1		<1		<2	6.3	0.11
UBC-011	26-Mar-13	0.45	<1		<1		<2	6.7	0.15
UBC-011	2-Apr-13	0.47	<1		<1		<2	7.8	0.14
UBC-011	9-Apr-13	0.46	<1		<1		<2	8.4	0.13
UBC-011	16-Apr-13	0.45	<1		<1		<2	8.4	0.11
UBC-011	23-Apr-13	0.44	<1		<1		<2	8.6	0.13
UBC-011	30-Apr-13	0.43	<1		<1		<2	9.1	0.1
UBC-011	7-May-13	0.39	<1		<1		<2	11	0.26
UBC-011	14-May-13	0.19	<1		<1		2	9.8	0.36
UBC-011	21-May-13	0.24	<1		<1		6	9.4	0.34
UBC-011	28-May-13	0.2	<1		<1		2	9.7	0.25
UBC-011	4-Jun-13	0.21	<1		<1		4	9.7	0.39
UBC-011	11-Jun-13	0.21	<1		<1		6	10	0.23
UBC-011	18-Jun-13	0.43	<1		<1		<2	11	0.27
UBC-011	25-Jun-13	0.32	<1		<1		18	12	0.23
UBC-011	2-Jul-13	0.35	<1		<1		20	11	0.25
UBC-011	9-Jul-13	0.41	<1		<1		16	11	0.95
UBC-011	16-Jul-13	0.4	<1		<1		10	11	0.24
UBC-011	23-Jul-13	0.49	<1		<1		20	11	0.21
UBC-011	30-Jul-13	0.43	<1		<1		22	12	0.32
UBC-011	6-Aug-13	0.38	<1		<1		4	12	0.31
UBC-011	13-Aug-13	0.37	<1		<1		26	13	0.28
UBC-011	20-Aug-13	0.52	<1		<1		2	13	0.3
UBC-011	27-Aug-13	0.45	<1		<1		8	14	0.28
UBC-011	3-Sep-13	0.31	<1		<1		<2	16	0.2
UBC-011	10-Sep-13	0.24	<1		<1		6	16	0.16
UBC-011	17-Sep-13	0.12	<1		<1		8	16	0.23
UBC-011	24-Sep-13	0.05	<1		<1		12	16	0.2
UBC-011	27-Sep-13	0.21	<1		<1		12	15	0.15
UBC-011	1-Oct-13	0.31	<1		<1		4	15	0.33
UBC-011	8-Oct-13	0.27	<1		<1		12	13	0.1
UBC-011	15-Oct-13	0.26	<1		<1		6	12	0.14
UBC-011	22-Oct-13	0.46	<1		<1		8	12	0.39
UBC-011	29-Oct-13	0.41	<1		<1		2	11	0.17
UBC-011	5-Nov-13	0.32	<1		<1		2	11	0.15
UBC-011	12-Nov-13	0.35	<1		<1		16	11	0.13
UBC-011	19-Nov-13	0.38	<1		<1		2	9.2	0.12
UBC-011	26-Nov-13	0.42	<1		<1		<2	8.4	0.1
UBC-011	3-Dec-13	0.59	<1		<1		2	7.2	0.11
UBC-011	10-Dec-13	0.51	<1		<1		<2	6.4	0.12
UBC-011	17-Dec-13	0.51	<1		<1		2	6.1	0.1
UBC-011	23-Dec-13	0.47	<1		<1		NA	6.4	0.17
UBC-011	30-Dec-13	0.44	<1		<1		NA	6.1	0.1

Sample Point WQJ10-011 (UBC-011)

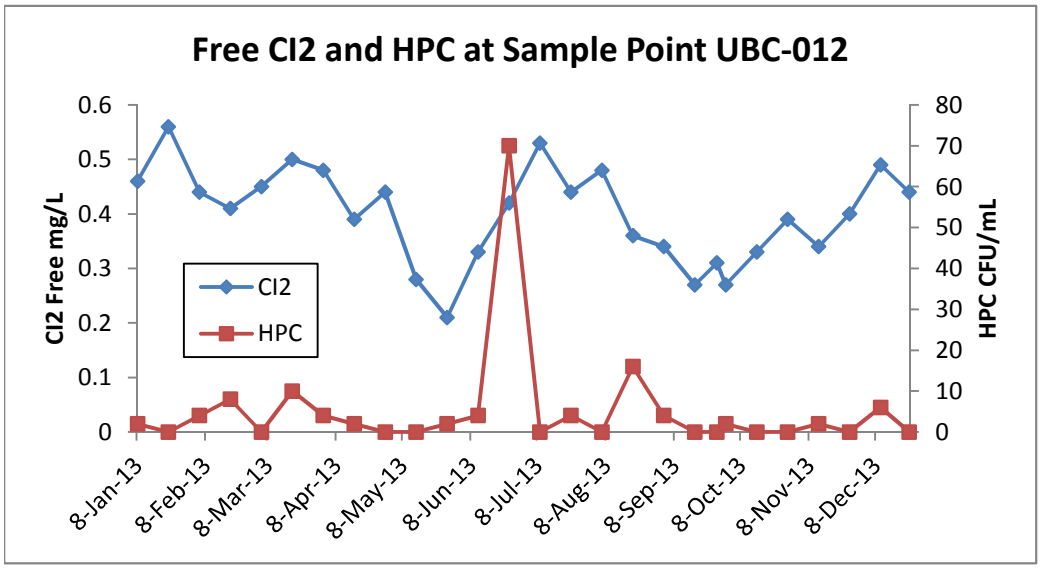


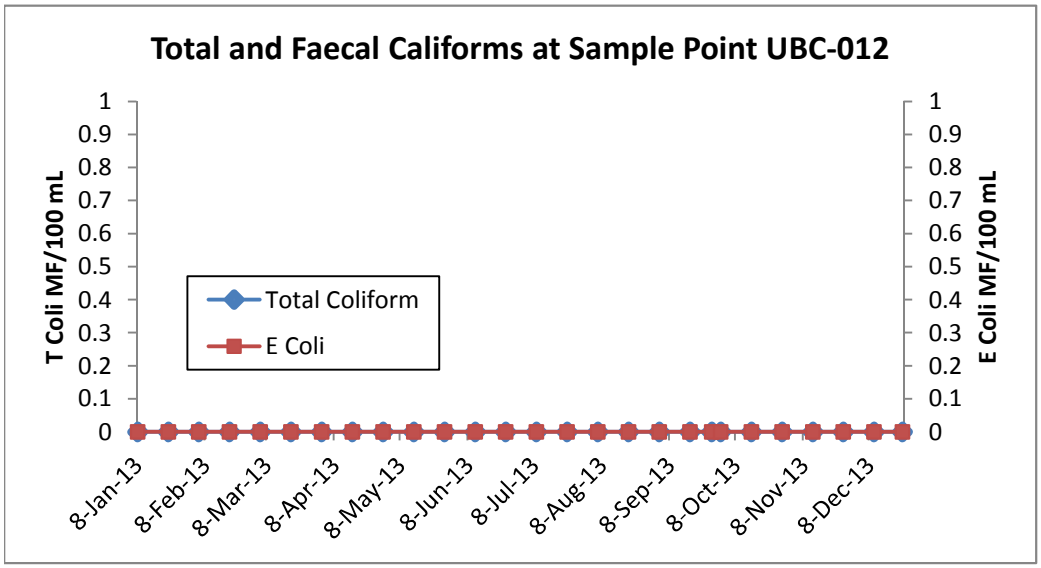


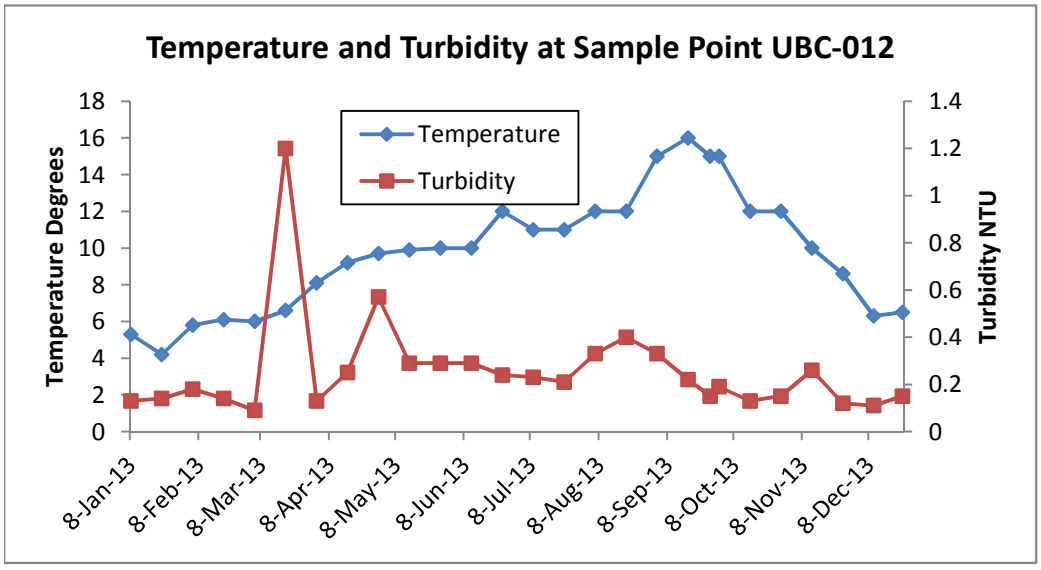


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-012	8-Jan-13	0.46	<1		<1		2	5.3	0.13
UBC-012	22-Jan-13	0.56	<1		<1		<2	4.2	0.14
UBC-012	5-Feb-13	0.44	<1		<1		4	5.8	0.18
UBC-012	19-Feb-13	0.41	<1		<1		8	6.1	0.14
UBC-012	5-Mar-13	0.45	<1		<1		<2	6	0.09
UBC-012	19-Mar-13	0.5	<1		<1		10	6.6	1.2
UBC-012	2-Apr-13	0.48	<1		<1		4	8.1	0.13
UBC-012	16-Apr-13	0.39	<1		<1		2	9.2	0.25
UBC-012	30-Apr-13	0.44	<1		<1		<2	9.7	0.57
UBC-012	14-May-13	0.28	<1		<1		<2	9.9	0.29
UBC-012	28-May-13	0.21	<1		<1		2	10	0.29
UBC-012	11-Jun-13	0.33	<1		<1		4	10	0.29
UBC-012	25-Jun-13	0.42	<1		<1		70	12	0.24
UBC-012	9-Jul-13	0.53	<1		<1		<2	11	0.23
UBC-012	23-Jul-13	0.44	<1		<1		4	11	0.21
UBC-012	6-Aug-13	0.48	<1		<1		<2	12	0.33
UBC-012	20-Aug-13	0.36	<1		<1		16	12	0.4
UBC-012	3-Sep-13	0.34	<1		<1		4	15	0.33
UBC-012	17-Sep-13	0.27	<1		<1		<2	16	0.22
UBC-012	27-Sep-13	0.31	<1		<1		<2	15	0.15
UBC-012	1-Oct-13	0.27	<1		<1		2	15	0.19
UBC-012	15-Oct-13	0.33	<1		<1		<2	12	0.13
UBC-012	29-Oct-13	0.39	<1		<1		<2	12	0.15
UBC-012	12-Nov-13	0.34	<1		<1		2	10	0.26
UBC-012	26-Nov-13	0.4	<1		<1		<2	8.6	0.12
UBC-012	10-Dec-13	0.49	<1		<1		6	6.3	0.11

Sample Point WQM8-012 (UBC-012)

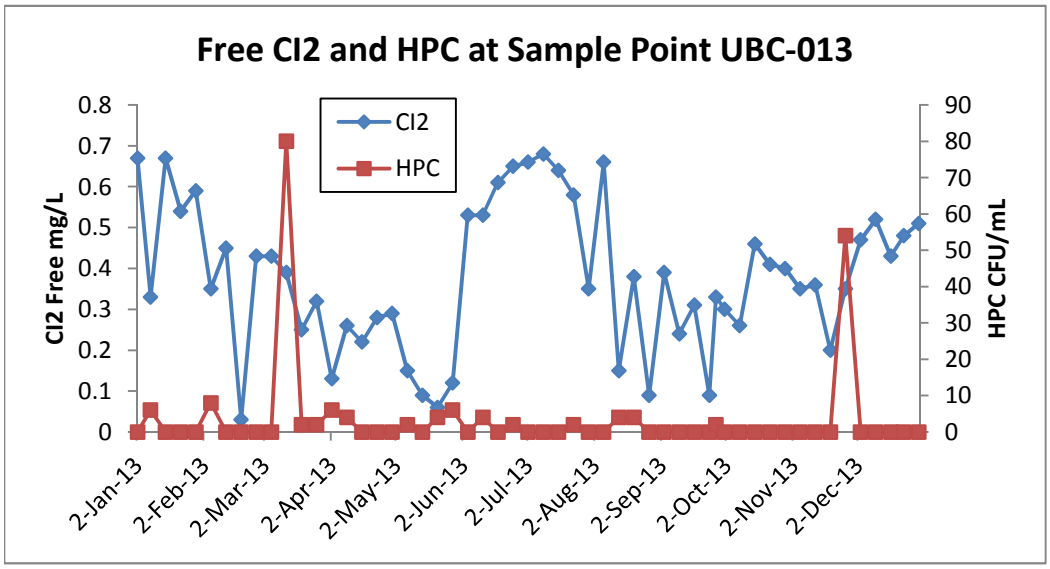


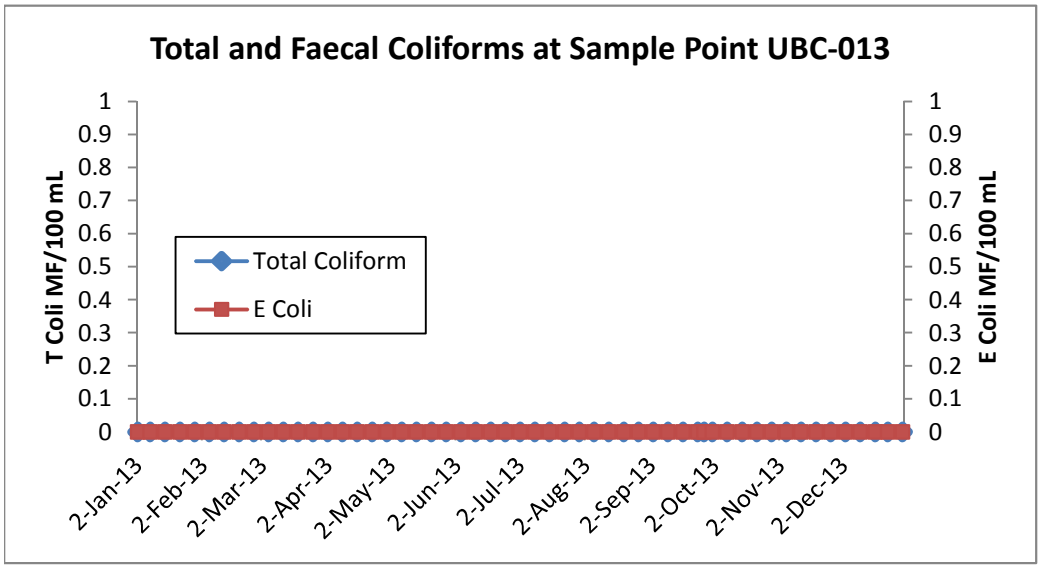


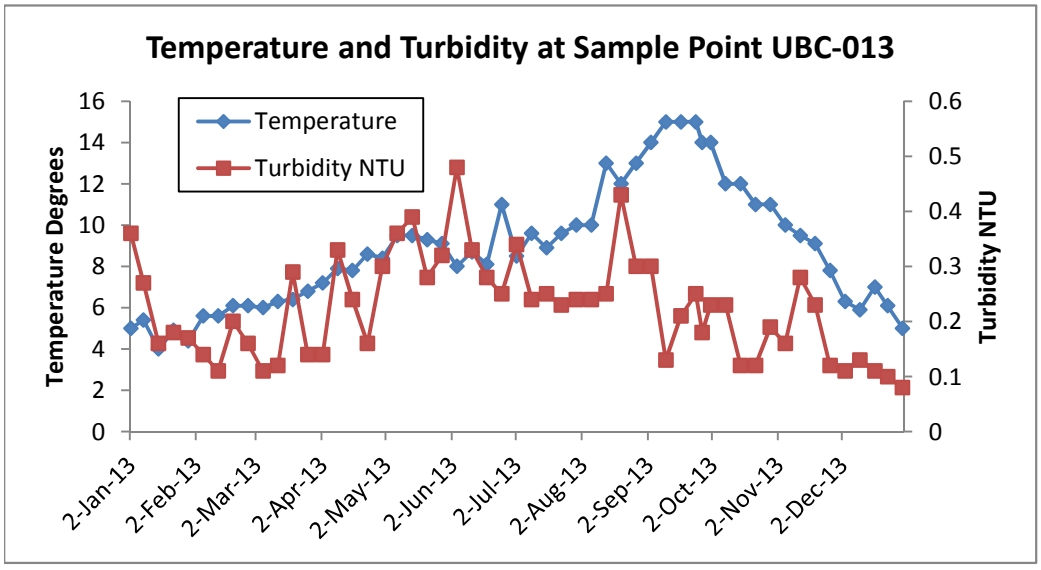


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-013	2-Jan-13	0.67	<1		<1		<2	5	0.36
UBC-013	8-Jan-13	0.33	<1		<1		6	5.4	0.27
UBC-013	15-Jan-13	0.67	<1		<1		<2	4	0.16
UBC-013	22-Jan-13	0.54	<1		<1		<2	4.9	0.18
UBC-013	29-Jan-13	0.59	<1		<1		<2	4.4	0.17
UBC-013	5-Feb-13	0.35	<1		<1		8	5.6	0.14
UBC-013	12-Feb-13	0.45	<1		<1		<2	5.6	0.11
UBC-013	19-Feb-13	0.03	<1		<1		<2	6.1	0.2
UBC-013	26-Feb-13	0.43	<1		<1		<2	6.1	0.16
UBC-013	5-Mar-13	0.43	<1		<1		<2	6	0.11
UBC-013	12-Mar-13	0.39	<1		<1		80	6.3	0.12
UBC-013	19-Mar-13	0.25	<1		<1		2	6.4	0.29
UBC-013	26-Mar-13	0.32	<1		<1		2	6.8	0.14
UBC-013	2-Apr-13	0.13	<1		<1		6	7.2	0.14
UBC-013	9-Apr-13	0.26	<1		<1		4	7.9	0.33
UBC-013	16-Apr-13	0.22	<1		<1		<2	7.8	0.24
UBC-013	23-Apr-13	0.28	<1		<1		<2	8.6	0.16
UBC-013	30-Apr-13	0.29	<1		<1		<2	8.4	0.3
UBC-013	7-May-13	0.15	<1		<1		2	9.5	0.36
UBC-013	14-May-13	0.09	<1		<1		<2	9.5	0.39
UBC-013	21-May-13	0.06	<1		<1		4	9.3	0.28
UBC-013	28-May-13	0.12	<1		<1		6	9.1	0.32
UBC-013	4-Jun-13	0.53	<1		<1		<2	8	0.48
UBC-013	11-Jun-13	0.53	<1		<1		4	8.7	0.33
UBC-013	18-Jun-13	0.61	<1		<1		<2	8.1	0.28
UBC-013	25-Jun-13	0.65	<1		<1		2	11	0.25
UBC-013	2-Jul-13	0.66	<1		<1		<2	8.5	0.34
UBC-013	9-Jul-13	0.68	<1		<1		<2	9.6	0.24
UBC-013	16-Jul-13	0.64	<1		<1		<2	8.9	0.25
UBC-013	23-Jul-13	0.58	<1		<1		2	9.6	0.23
UBC-013	30-Jul-13	0.35	<1		<1		<2	10	0.24
UBC-013	6-Aug-13	0.66	<1		<1		<2	10	0.24
UBC-013	13-Aug-13	0.15	<1		<1		4	13	0.25
UBC-013	20-Aug-13	0.38	<1		<1		4	12	0.43
UBC-013	27-Aug-13	0.09	<1		<1		<2	13	0.3
UBC-013	3-Sep-13	0.39	<1		<1		<2	14	0.3
UBC-013	10-Sep-13	0.24	<1		<1		<2	15	0.13
UBC-013	17-Sep-13	0.31	<1		<1		<2	15	0.21
UBC-013	24-Sep-13	0.09	<1		<1		<2	15	0.25
UBC-013	27-Sep-13	0.33	<1		<1		2	14	0.18
UBC-013	1-Oct-13	0.3	<1		<1		<2	14	0.23
UBC-013	8-Oct-13	0.26	<1		<1		<2	12	0.23
UBC-013	15-Oct-13	0.46	<1		<1		<2	12	0.12
UBC-013	22-Oct-13	0.41	<1		<1		<2	11	0.12
UBC-013	29-Oct-13	0.4	<1		<1		<2	11	0.19
UBC-013	5-Nov-13	0.35	<1		<1		<2	10	0.16
UBC-013	12-Nov-13	0.36	<1		<1		<2	9.5	0.28
UBC-013	19-Nov-13	0.2	<1		<1		<2	9.1	0.23
UBC-013	26-Nov-13	0.35	<1		<1		54	7.8	0.12
UBC-013	3-Dec-13	0.47	<1		<1		<2	6.3	0.11
UBC-013	10-Dec-13	0.52	<1		<1		<2	5.9	0.13
UBC-013	17-Dec-13	0.43	<1		<1		<2	7	0.11
UBC-013	23-Dec-13	0.48	<1		<1		NA	6.1	0.1
UBC-013	30-Dec-13	0.51	<1		<1		NA	5	0.08

Sample Point WQN9-013 (UBC-013)

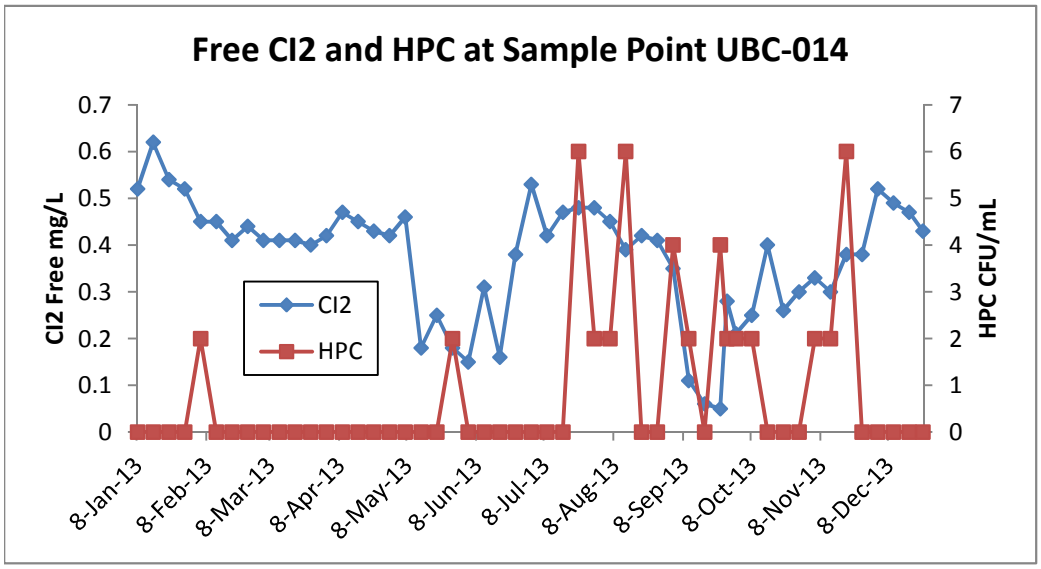


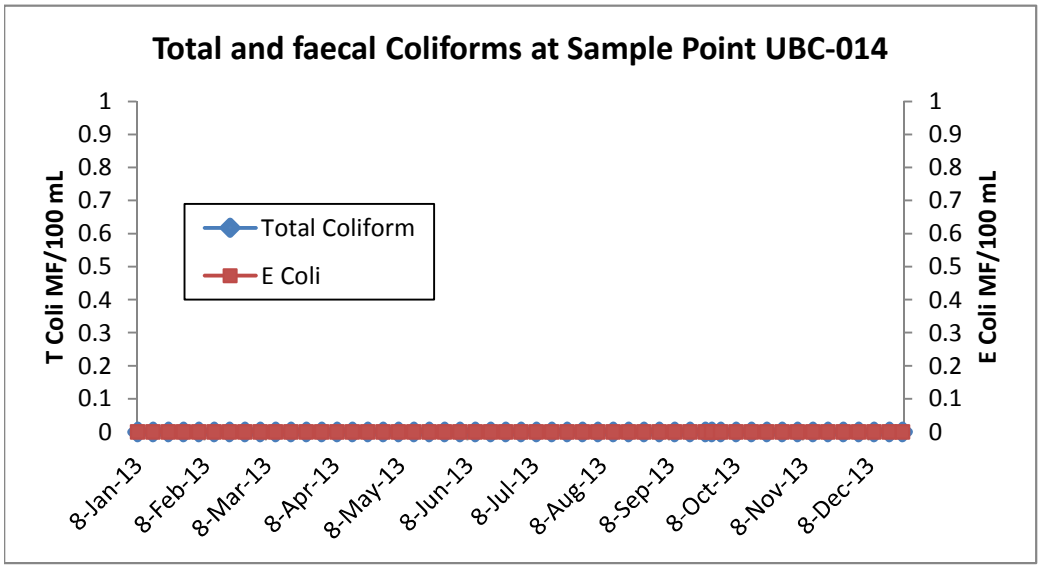


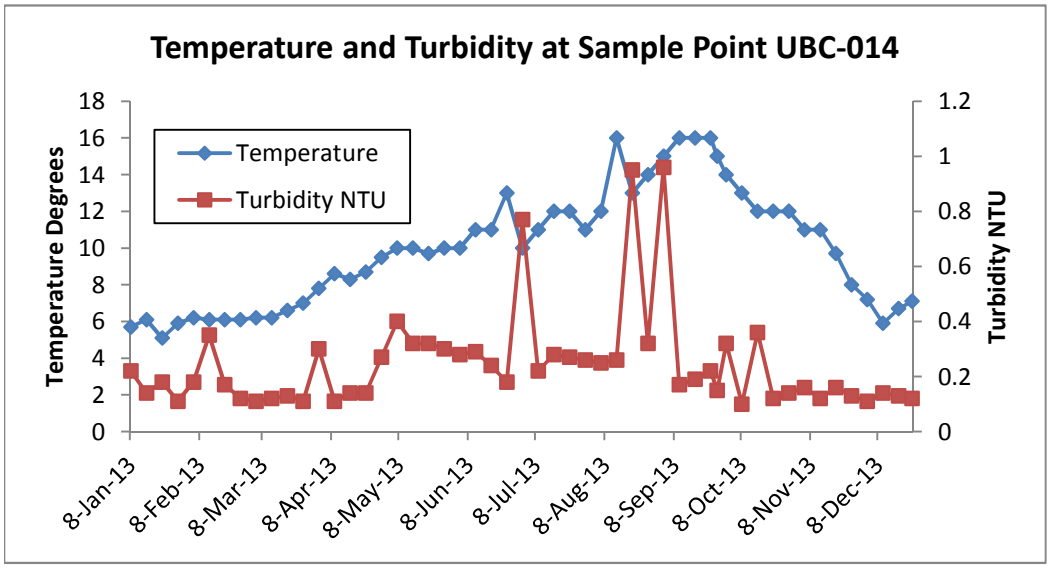


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-014	8-Jan-13	0.52	<1		<1		<2	5.7	0.22
UBC-014	15-Jan-13	0.62	<1		<1		<2	6.1	0.14
UBC-014	22-Jan-13	0.54	<1		<1		<2	5.1	0.18
UBC-014	29-Jan-13	0.52	<1		<1		<2	5.9	0.11
UBC-014	5-Feb-13	0.45	<1		<1		2	6.2	0.18
UBC-014	12-Feb-13	0.45	<1		<1		<2	6.1	0.35
UBC-014	19-Feb-13	0.41	<1		<1		<2	6.1	0.17
UBC-014	26-Feb-13	0.44	<1		<1		<2	6.1	0.12
UBC-014	5-Mar-13	0.41	<1		<1		<2	6.2	0.11
UBC-014	12-Mar-13	0.41	<1		<1		<2	6.2	0.12
UBC-014	19-Mar-13	0.41	<1		<1		<2	6.6	0.13
UBC-014	26-Mar-13	0.4	<1		<1		<2	7	0.11
UBC-014	2-Apr-13	0.42	<1		<1		<2	7.8	0.3
UBC-014	9-Apr-13	0.47	<1		<1		<2	8.6	0.11
UBC-014	16-Apr-13	0.45	<1		<1		<2	8.3	0.14
UBC-014	23-Apr-13	0.43	<1		<1		<2	8.7	0.14
UBC-014	30-Apr-13	0.42	<1		<1		<2	9.5	0.27
UBC-014	7-May-13	0.46	<1		<1		<2	10	0.4
UBC-014	14-May-13	0.18	<1		<1		<2	10	0.32
UBC-014	21-May-13	0.25	<1		<1		<2	9.7	0.32
UBC-014	28-May-13	0.18	<1		<1		2	10	0.3
UBC-014	4-Jun-13	0.15	<1		<1		<2	10	0.28
UBC-014	11-Jun-13	0.31	<1		<1		<2	11	0.29
UBC-014	18-Jun-13	0.16	<1		<1		<2	11	0.24
UBC-014	25-Jun-13	0.38	<1		<1		<2	13	0.18
UBC-014	2-Jul-13	0.53	<1		<1		<2	10	0.77
UBC-014	9-Jul-13	0.42	<1		<1		<2	11	0.22
UBC-014	16-Jul-13	0.47	<1		<1		<2	12	0.28
UBC-014	23-Jul-13	0.48	<1		<1		6	12	0.27
UBC-014	30-Jul-13	0.48	<1		<1		2	11	0.26
UBC-014	6-Aug-13	0.45	<1		<1		2	12	0.25
UBC-014	13-Aug-13	0.39	<1		<1		6	16	0.26
UBC-014	20-Aug-13	0.42	<1		<1		<2	13	0.95
UBC-014	27-Aug-13	0.41	<1		<1		<2	14	0.32
UBC-014	3-Sep-13	0.35	<1		<1		4	15	0.96
UBC-014	10-Sep-13	0.11	<1		<1		2	16	0.17
UBC-014	17-Sep-13	0.06	<1		<1		<2	16	0.19
UBC-014	24-Sep-13	0.05	<1		<1		4	16	0.22
UBC-014	27-Sep-13	0.28	<1		<1		2	15	0.15
UBC-014	1-Oct-13	0.21	<1		<1		2	14	0.32
UBC-014	8-Oct-13	0.25	<1		<1		2	13	0.1
UBC-014	15-Oct-13	0.4	<1		<1		<2	12	0.36
UBC-014	22-Oct-13	0.26	<1		<1		<2	12	0.12
UBC-014	29-Oct-13	0.3	<1		<1		<2	12	0.14
UBC-014	5-Nov-13	0.33	<1		<1		2	11	0.16
UBC-014	12-Nov-13	0.3	<1		<1		2	11	0.12
UBC-014	19-Nov-13	0.38	<1		<1		6	9.7	0.16
UBC-014	26-Nov-13	0.38	<1		<1		<2	8	0.13
UBC-014	3-Dec-13	0.52	<1		<1		<2	7.2	0.11
UBC-014	10-Dec-13	0.49	<1		<1		<2	5.9	0.14
UBC-014	17-Dec-13	0.47	<1		<1		<2	6.7	0.13
UBC-014	23-Dec-13	0.43	<1		<1		NA	7.1	0.12

Sample Point WQQ6-014 (UBC-014)

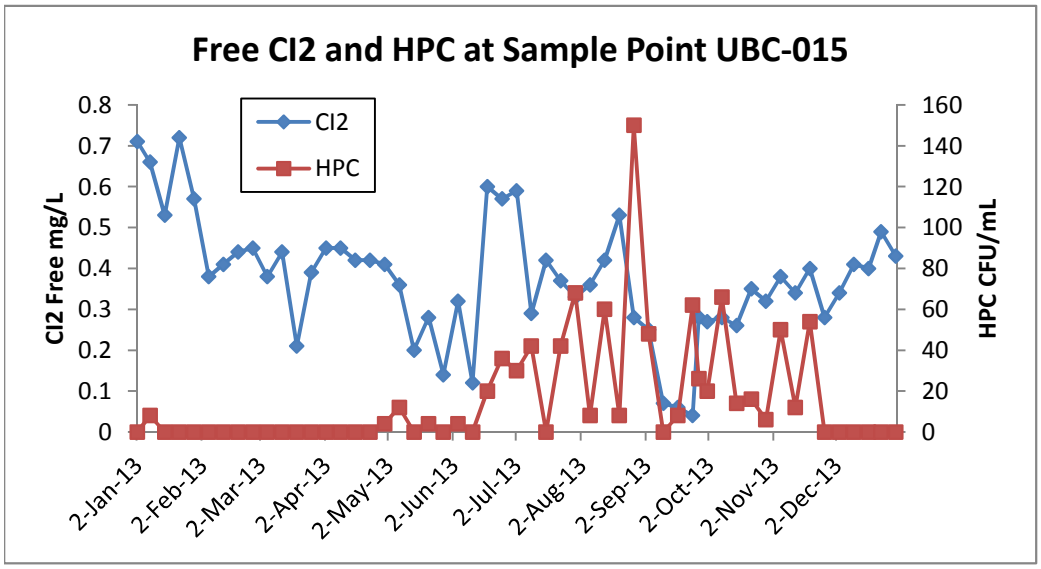


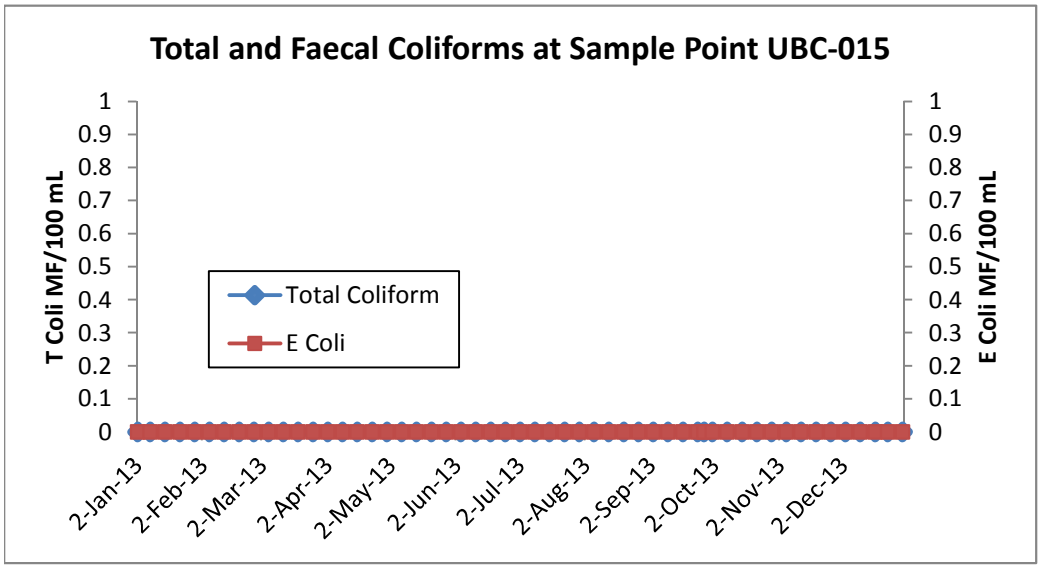


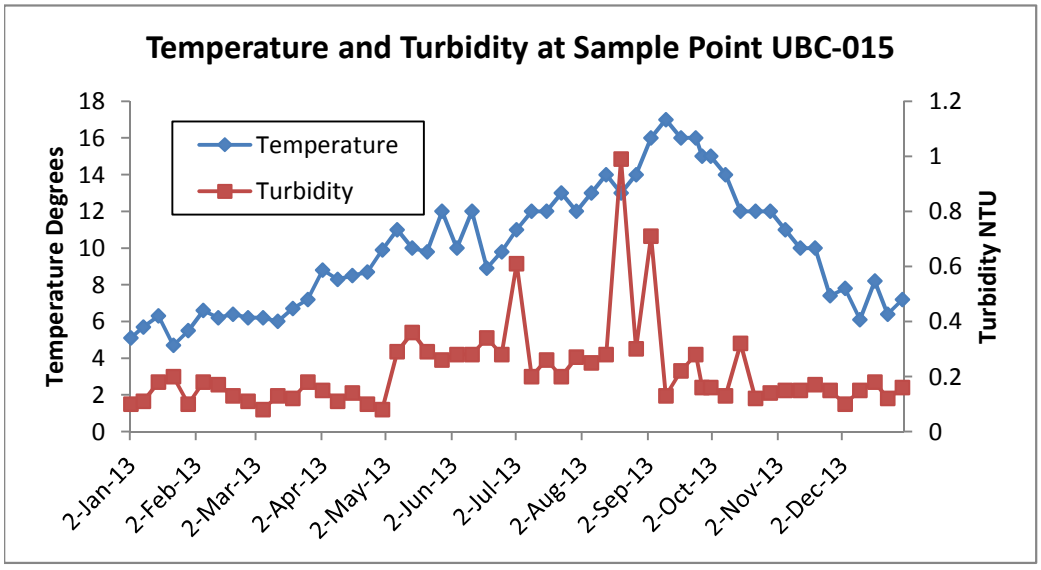


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-015	2-Jan-13	0.71	<1		<1		<2	5.1	0.1
UBC-015	8-Jan-13	0.66	<1		<1		8	5.7	0.11
UBC-015	15-Jan-13	0.53	<1		<1		<2	6.3	0.18
UBC-015	22-Jan-13	0.72	<1		<1		<2	4.7	0.2
UBC-015	29-Jan-13	0.57	<1		<1		<2	5.5	0.1
UBC-015	5-Feb-13	0.38	<1		<1		<2	6.6	0.18
UBC-015	12-Feb-13	0.41	<1		<1		<2	6.2	0.17
UBC-015	19-Feb-13	0.44	<1		<1		<2	6.4	0.13
UBC-015	26-Feb-13	0.45	<1		<1		<2	6.2	0.11
UBC-015	5-Mar-13	0.38	<1		<1		<2	6.2	0.08
UBC-015	12-Mar-13	0.44	<1		<1		[contamination] LA	6	0.13
UBC-015	19-Mar-13	0.21	<1		<1		<2	6.7	0.12
UBC-015	26-Mar-13	0.39	<1		<1		<2	7.2	0.18
UBC-015	2-Apr-13	0.45	<1		<1		<2	8.8	0.15
UBC-015	9-Apr-13	0.45	<1		<1		<2	8.3	0.11
UBC-015	16-Apr-13	0.42	<1		<1		<2	8.5	0.14
UBC-015	23-Apr-13	0.42	<1		<1		<2	8.7	0.1
UBC-015	30-Apr-13	0.41	<1		<1		4	9.9	0.08
UBC-015	7-May-13	0.36	<1		<1		12	11	0.29
UBC-015	14-May-13	0.2	<1		<1		<2	10	0.36
UBC-015	21-May-13	0.28	<1		<1		4	9.8	0.29
UBC-015	28-May-13	0.14	<1		<1		<2	12	0.26
UBC-015	4-Jun-13	0.32	<1		<1		4	10	0.28
UBC-015	11-Jun-13	0.12	<1		<1		[contamination] LA	12	0.28
UBC-015	18-Jun-13	0.6	<1		<1		20	8.9	0.34
UBC-015	25-Jun-13	0.57	<1		<1		36	9.8	0.28
UBC-015	2-Jul-13	0.59	<1		<1		30	11	0.61
UBC-015	9-Jul-13	0.29	<1		<1		42	12	0.2
UBC-015	16-Jul-13	0.42	<1		<1		<2	12	0.26
UBC-015	23-Jul-13	0.37	<1		<1		42	13	0.2
UBC-015	30-Jul-13	0.33	<1		<1		68	12	0.27
UBC-015	6-Aug-13	0.36	<1		<1		8	13	0.25
UBC-015	13-Aug-13	0.42	<1		<1		60	14	0.28
UBC-015	20-Aug-13	0.53	<1		<1		8	13	0.99
UBC-015	27-Aug-13	0.28	<1		<1		150	14	0.3
UBC-015	3-Sep-13	0.25	<1		<1		48	16	0.71
UBC-015	10-Sep-13	0.07	<1		<1		<2	17	0.13
UBC-015	17-Sep-13	0.06	<1		<1		8	16	0.22
UBC-015	24-Sep-13	0.04	<1		<1		62	16	0.28
UBC-015	27-Sep-13	0.28	<1		<1		26	15	0.16
UBC-015	1-Oct-13	0.27	<1		<1		20	15	0.16
UBC-015	8-Oct-13	0.28	<1		<1		66	14	0.13
UBC-015	15-Oct-13	0.26	<1		<1		14	12	0.32
UBC-015	22-Oct-13	0.35	<1		<1		16	12	0.12
UBC-015	29-Oct-13	0.32	<1		<1		6	12	0.14
UBC-015	5-Nov-13	0.38	<1		<1		50	11	0.15
UBC-015	12-Nov-13	0.34	<1		<1		12	10	0.15
UBC-015	19-Nov-13	0.4	<1		<1		54	10	0.17
UBC-015	26-Nov-13	0.28	<1		<1		<2	7.4	0.15
UBC-015	3-Dec-13	0.34	<1		<1		<2	7.8	0.1
UBC-015	10-Dec-13	0.41	<1		<1		<2	6.1	0.15
UBC-015	17-Dec-13	0.4	<1		<1		<2	8.2	0.18
UBC-015	23-Dec-13	0.49	<1		<1		NA	6.4	0.12
UBC-015	30-Dec-13	0.43	<1		<1		NA	7.2	0.16

Sample Point WQQ7-015 (UBC-015)

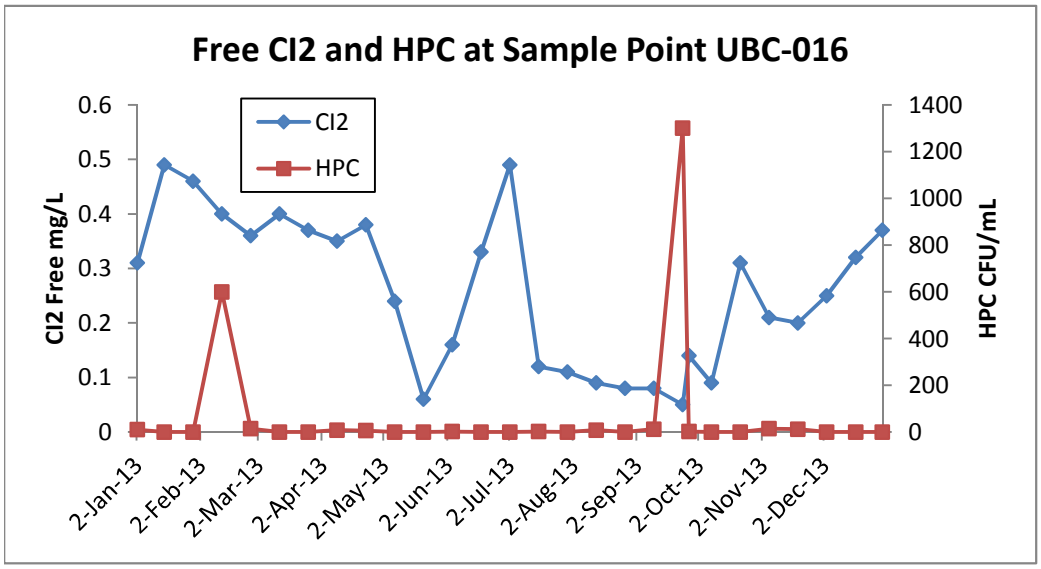


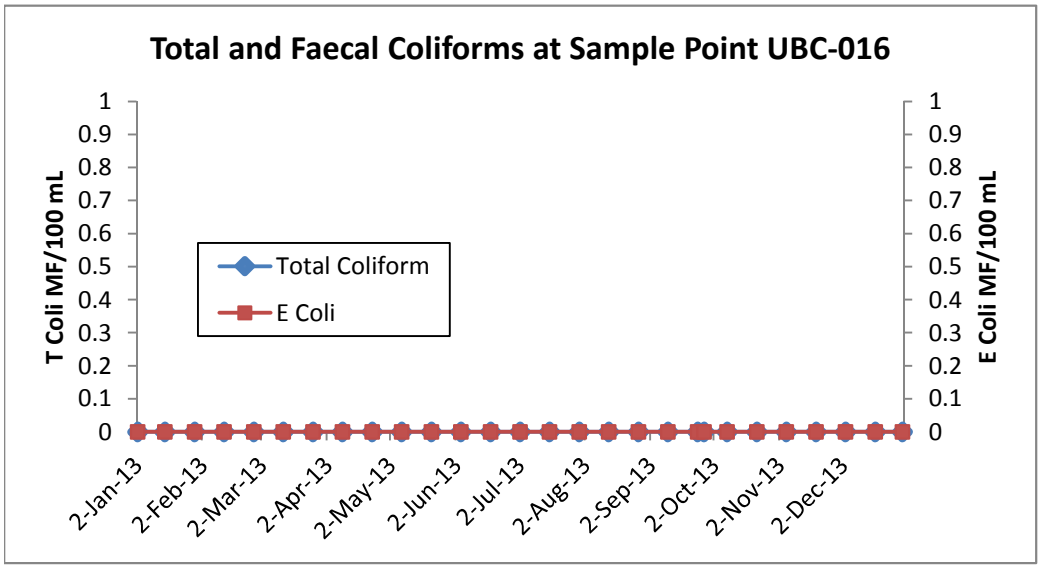


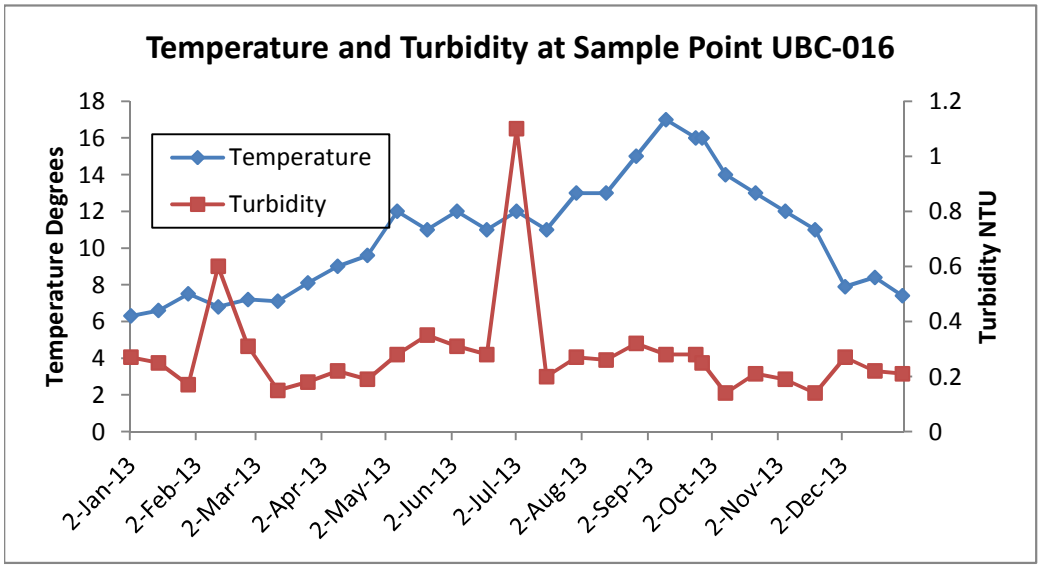


Sample name	Sampled date	Chlorine Free mg/L	Total Coliform MF/100mL	Total Coliform MPN/100 mL	Ecoli MF/100mLs	E Coli MPN/100 mL	HPC CFU/mls	Temperature °C	Turbidity NTU
UBC-016	2-Jan-13	0.31	<1		<1		10	6.3	0.27
UBC-016	15-Jan-13	0.49	<1		<1		<2	6.6	0.25
UBC-016	29-Jan-13	0.46	<1		<1		<2	7.5	0.17
UBC-016	12-Feb-13	0.4	[CGC (Confluent Growth with Coliform) - Positive for coliform bacteria.] CGC		[CG (Confluent Growth) - Invalid; compromised by too much bacterial growth.] CG		600	6.8	0.6
UBC-016	26-Feb-13	0.36	<1		<1		14	7.2	0.31
UBC-016	12-Mar-13	0.4	<1		<1		[contamination] LA	7.1	0.15
UBC-016	26-Mar-13	0.37	<1		<1		<2	8.1	0.18
UBC-016	9-Apr-13	0.35	<1		<1		8	9	0.22
UBC-016	23-Apr-13	0.38	<1		<1		6	9.6	0.19
UBC-016	7-May-13	0.24	<1		<1		<2	12	0.28
UBC-016	21-May-13	0.06	<1		<1		<2	11	0.35
UBC-016	4-Jun-13	0.16	<1		<1		2	12	0.31
UBC-016	18-Jun-13	0.33	<1		<1		<2	11	0.28
UBC-016	2-Jul-13	0.49	<1		<1		<2	12	1.1
UBC-016	16-Jul-13	0.12	<1		<1		2	11	0.2
UBC-016	30-Jul-13	0.11	<1		<1		<2	13	0.27
UBC-016	13-Aug-13	0.09	<1		<1		8	13	0.26
UBC-016	27-Aug-13	0.08	<1		<1		<2	15	0.32
UBC-016	10-Sep-13	0.08	<1		<1		12	17	0.28
UBC-016	24-Sep-13	0.05	<1		<1		1300	16	0.28
UBC-016	27-Sep-13	0.14	<1		<1		2	16	0.25
UBC-016	8-Oct-13	0.09	<1		<1		<2	14	0.14
UBC-016	22-Oct-13	0.31	<1		<1		<2	13	0.21
UBC-016	5-Nov-13	0.21	<1		<1		14	12	0.19
UBC-016	19-Nov-13	0.2	<1		<1		12	11	0.14
UBC-016	3-Dec-13	0.25	<1		<1		<2	7.9	0.27
UBC-016	17-Dec-13	0.32	<1		<1		<2	8.4	0.22
UBC-016	30-Dec-13	0.37	<1		<1		NA	7.4	0.21

Sample Point WQT7-016 (UBC-016)







APPENDIX C

Metro Vancouver and Municipal Response Procedure

SOURCE WATER TURBIDITY EVENTS

Metro Vancouver and Municipal Response Procedures

Action will be initiated by LCOC control room operator based on information received through the SCADA system or from field staff

A — Developing Situation
High alarm limits reached at river or at in-lake buoys.

Control room will immediately notify: **Utility Systems Control Superintendent (or designate)**

Utility Systems Control Superintendent (or designate)

Monitor situation and evaluate potential impacts.
Notify the following Division Managers (or designates) as required: Quality Control, Utility Systems Operations, Water Treatment Operations and Watershed Management.

- **Superintendent of Utility Systems Operations (or designate)** → Prepare operations field crews to isolate source if necessary.
- **Water Treatment Operations Division Manager (or designate)** → Increase chlorine residual up to a level as high as 1.5 mg/L, if possible, at both primary and secondary disinfection stations.
  Increase ozone CT at Coquitlam if possible.
  Notify affected municipalities of treatment changes.
- **Watershed Management Division Manager (or designate)** → Investigate cause of the turbidity event.
  Advise Utility Systems Control Superintendent (or designate) as required.

Utility Systems Control Superintendent (or designate)

- Situation ends (readings fall, no evidence of slides, etc.).
- **Situation escalates** (confirmation of rising turbidity readings, visual confirmation of slides etc.). → (return to **B**)

B — Imminent Situation
>1 NTU expected or at intake.

Control room will immediately notify: **Utility Systems Control Superintendent (or designate)**

Utility Systems Control Superintendent (or designate)

Immediate Actions:
- Notify Utility System Operations, Water Treatment Operations and Quality Control Division Managers (or designates.)
- Minimize flow from affected source and consider the need to isolate the source.

Priority Notification (immediately following steps above):
- Operations staff of affected municipalities.

- **Superintendent of Utility Systems Operations (or designate)** → Isolate source (as directed) with the assistance of Water Treatment.
- **Water Treatment Operations Division Manager (or designate)** → Make further adjustments to water treatment as required taking changes made under **A** into account. Confirm treatment changes with Quality Control.
  Prepare to assist with isolating source.
- **Quality Control Division Manager (or designate)** → Evaluate and monitor situation - collect water quality information as required.
  Notify: Metro Vancouver MHO (or delegate) and other DWOs (or DWO delegates) for extraordinary turbidity events.
  Notify: Metro Vancouver Communications, O&M Department Manager, Commissioner and Water Quality Contacts of affected municipalities.
- **Watershed Management Division Manager (or designate)** → Investigate cause of the turbidity event. Advise Manager of Utility Systems Operations and the Quality Control Division Manager (or designates) of findings.

GVRD Communications

If Required:
Notify: Board Chair, Water Committee Chair and Board members of affected municipalities.
For extraordinary turbidity events, notify public by issuing press release.

Municipalities

Increase Cl_2 residual at existing municipal secondary disinfection stations by up to 0.5 mg/L above usual treatment levels, if possible.
For extraordinary turbidity events, notify local public health contacts.

Updated October 2007