

December 7, 2018

File: 5620-55

Environmental Health Officer
Central Vancouver Island Health Region
1665 Grant Avenue
Nanaimo, BC V9S 5K7

Dear Environmental Health Officer

**Re: Chemainus Water System Water Quality Report
Premises Number 1310823
Report for the Period Jan 1/16 to Dec 31/16**

Please find the Municipality of North Cowichan's Water quality report for the Chemainus Water System attached.

Sincerely

Clay Reitsma, M. Eng., P. Eng
Senior Manager of Engineering

clay.reitsma@northcowichan.ca

c: Robert Bell- Assistant Operations Manager – Utilities



1 General

This report is comprised of two parts.

- The first part provides a summary of the data along with a compliance assessment. This part is provided to the VIHA and is also published on the Municipality's website at www.northcowichan.ca on an annual basis.
- The second part includes all of the relevant data tables and charts that back up the summary report. This part is provided to the VIHA only but is available to the public upon request.

2 Operator Information

Contact Name	Clay Reitsma, M.Eng. P.Eng.
Phone	250-746-3100
Email	Clay.Reitsma@NorthCowichan.ca

3 System Description

This water system has two water supplies.

Water can be supplied to Chemainus from the Bannon Creek/Holyoak watersheds. The watersheds have two natural storage reservoirs; Holyoak Lake and Bannon Creek Reservoir. Runoff from the Bannon Creek watershed is collected and stored in Bannon Creek Reservoir. During wetter months there is sufficient runoff to ensure that Bannon Creek Reservoir is full. During drier months water that has been collecting in Holyoak Lake is released to supplement runoff flows. Just downstream of Bannon Creek Reservoir intake, the water is chlorinated to kill any pathogens that may be in the water.

Starting on Oct 15/10 Chemainus can be seasonally supplied from the well site. The water is chlorinated at the well site prior to distribution. Water is then pumped from the well site into the Chemainus distribution system. Pumped well water in excess of the town's demand is delivered to two concrete reservoirs located on Copper Canyon Road.

The wells are permitted to operate between Oct 15 and Jun 15. From Jun 16 to Oct 14 the town is fed from the surface water supply.

4 Boil Advisories

None

5 Results

5.1 Water Consumption

Table 1: Average daily water consumption by month and quarter.

Item	Average Daily Consumption (m³/d)
Observed	
- Jan	2667
- Feb	2360
- Mar	2278
- Quarter 1	2438
Observed	
- Apr	2284
- May	2682
- Jun	3471
- Quarter 2	2811
Observed	
- Jul	4201
- Aug	4125
- Sep	3035
- Quarter 3	3795
Observed	
- Oct	2433
- Nov	2277
- Dec	2589
- Quarter 4	2435
Observed	
- Annual	2872

Chart (CH-004)

Start Date: 01-Jan-2017 00:00:00
End Date: 31-Dec-2017 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Parameter Class: Physical
Parameters: Flow (Volumetric Rate) [m3/d]

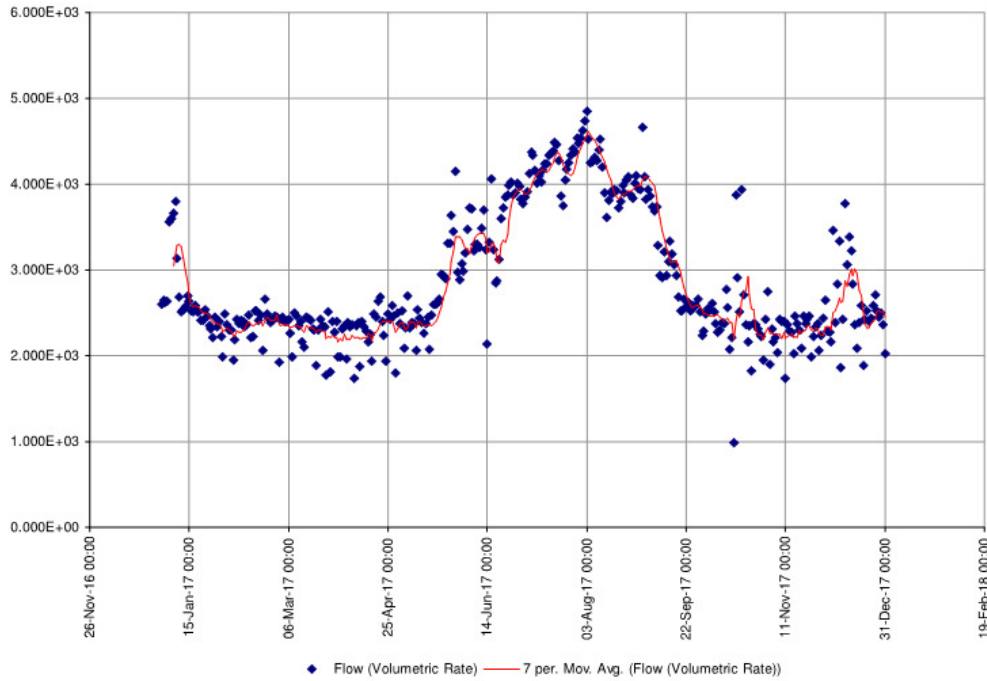


Figure 1: Average daily water consumption.

5.2 Residual Chlorine

Table 2: Finished water minimum and maximum free chlorine residual by quarter.

Item	Minimum (mg/L)	Maximum (mg/L)	Percent of Samples in Compliance (%)	
			100 % >= 0.20 mg/L	100 % <= 4.00 mg/L
Compliance Requirement			100 % >= 0.20 mg/L	100 % <= 4.00 mg/L
Observed				
- Quarter 1	0.370	1.568	100.00	100.00
- Quarter 2	0.401	2.824	100.00	100.00
- Quarter 3	1.122	2.283	100.00	100.00
- Quarter 4	0.222	4.988	100.00	97.83
Observed				
- Annual	0.222	4.988	100.00	99.49

Chart (CH-001)

Start Date: 01-Jan-2017 00:00:00
End Date: 31-Dec-2017 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Treatment Levels: Water - Finished
Parameter Class: Chlorine
Parameters: Free Cl2 (Max Day) [mg/L], Free Cl2 (Min Day) [mg/L]

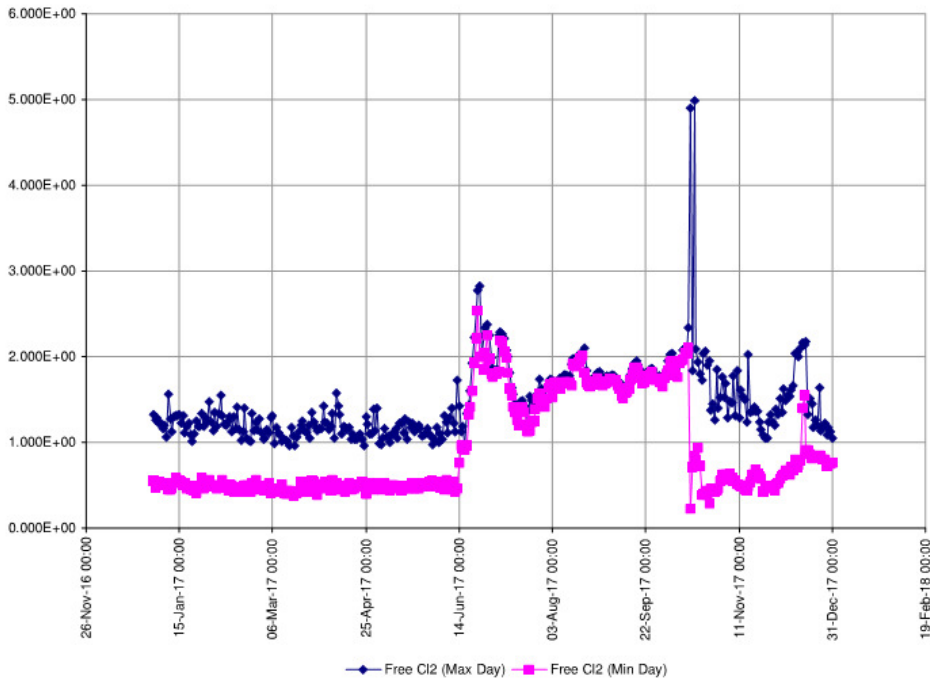


Figure 2: Finished water daily minimum and maximum free chlorine residual.

Table 3: Distribution system minimum total chlorine residual by quarter.

Item	Minimum (mg/L)	Percent of Samples in Compliance (%)
Compliance Requirements		100 % \geq 0.05 mg/L
Observed		
- Quarter 1	0.010	99.28
- Quarter 2	0.000	98.43
- Quarter 3	0.000	96.69
- Quarter 4	0.000	98.64
Observed		
- Annual	0.000	98.23

Chart (CH-001)

Start Date: 01-Jan-2017 00:00:00
 End Date: 31-Dec-2017 23:59:59
 System: Chemainus Drinking Water
 Project: Regular Sampling
 Treatment Levels: Water - Distribution System
 Parameter Class: Chlorine
 Parameters: Total Cl2 (Instantaneous) [mg/L]

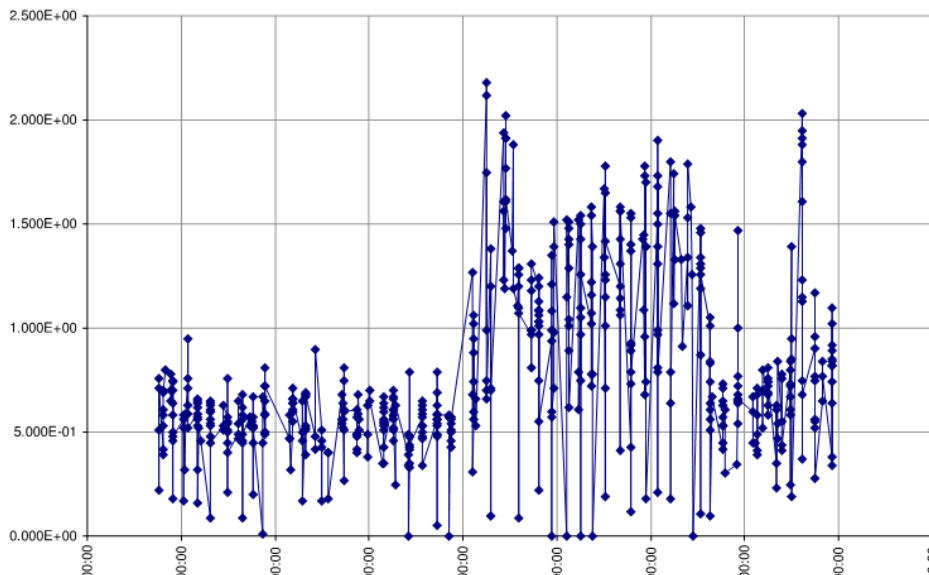


Figure 3: Distribution system minimum total chlorine residual.

Table 4(a): Distribution system maximum free chlorine residual by quarter.

Item	Maximum (mg/L)	Percent of Samples in Compliance (%)
Compliance Requirement		100% <= 4.00 mg/L
Observed		
- Quarter 1	0.930	100.00
- Quarter 2	1.890	100.00
- Quarter 3	1.880	100.00
- Quarter 4	2.010	100.00
Observed		
- Annual	2.010	100.00

Table 4(b): Distribution system minimum free chlorine residual by quarter (VIHA Proposed Standard).

Item	Minimum (mg/L)	Percent of Samples in Compliance (%)
Compliance Requirements		100 % >= 0.2 mg/L 100% <= 4.0
Observed		
- Quarter 1	0.030	94.96
- Quarter 2	0.000	94.49
- Quarter 3	0.000	94.04
- Quarter 4	0.000	95.24
Annual	0.000	94.68

Chart (CH-001)

Start Date: 01-Jan-2017 00:00:00
End Date: 31-Dec-2017 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Treatment Levels: Water - Distribution System
Parameter Class: Chlorine
Parameters: Free Cl2 (Instantaneous) [mg/L]

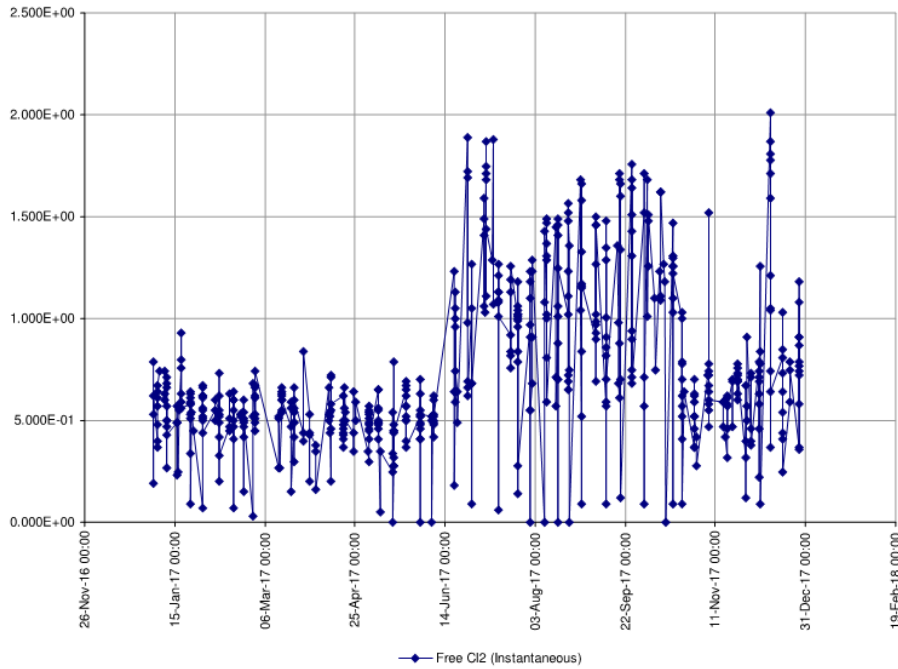


Figure 4: Distribution system maximum free chlorine residual.

5.3 Turbidity

Table 5: Finished water maximum turbidity by month and quarter.

Item	Maximum (NTU)	Percent of Samples in Compliance (%)	
		100% <= 5 NTU	>95% <= 1 NTU (In A Month)
Compliance Requirement			
Observed			
- Jan	0.653	100.00	100.00
- Feb	0.118	100.00	100.00
- Mar	0.105	100.00	100.00
- Quarter 1	0.653	100.00	100.00
Observed			
- Apr	0.226	100.00	100.00
- May	0.095	100.00	100.00
- Jun	0.379	100.00	100.00
- Quarter 2	0.379	100.00	100.00
Observed			
- Jul	0.627	100.00	100.00
- Aug	0.543	100.00	100.00
- Sep	0.598	100.00	100.00
- Quarter 3	0.627	100.00	100.00
Observed			
- Oct	0.449	100.00	100.00
- Nov	0.208	100.00	100.00
- Dec	0.184	100.00	100.00
- Quarter 4	0.449	100.00	100.00
Observed			
- Annual	0.653	100.00	100.00

Chart (CH-001)

Start Date: 01-Jan-2017 00:00:00
End Date: 31-Dec-2017 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Treatment Levels: Water - Finished
Parameter Class: Physical
Parameters: Turbidity (Daily Avg) [NTU]

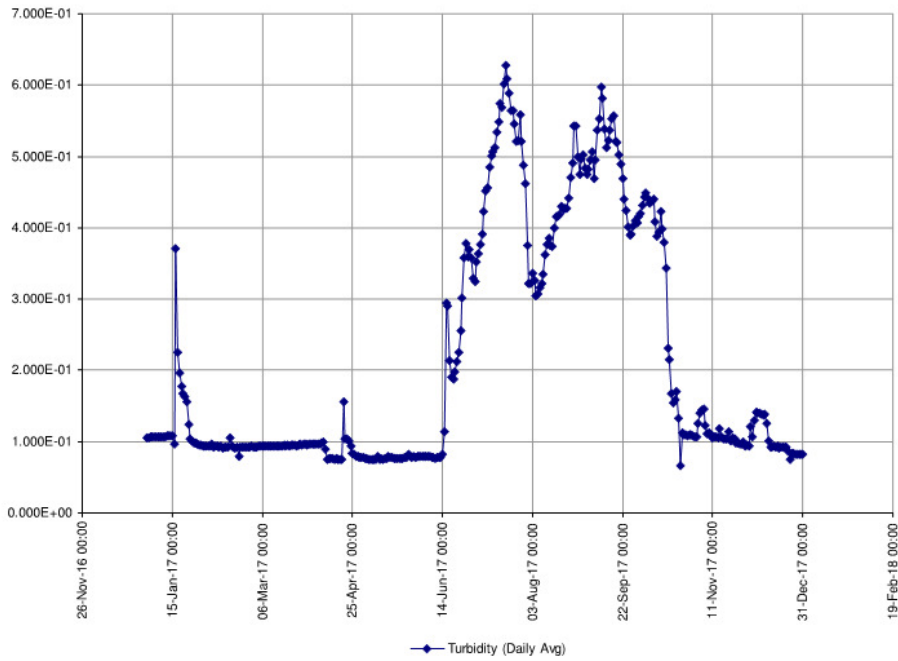


Figure 5: Finished water turbidity.

5.4 Coliforms

Table 6: Distribution system maximum total coliforms by quarter.

Item	Maximum (CFU/100 mL)	Percentage of Samples in Compliance (%)	
		100% < 10 MPN/100 mL	>90% < 1 MPN/100 mL
Compliance Requirement		100% < 10 MPN/100 mL	>90% < 1 MPN/100 mL
Observed			
- Quarter 1	0.000	100.00	100.00
- Quarter 2	2.000	100.00	96.00
- Quarter 3	0.000	100.00	100.00
- Quarter 4	0.000	100.00	100.00
Observed			
- Annual	2.000	100.00	99.19

Table 7: Distribution system maximum *Escherichia* coliforms by quarter.

Item	Maximum (CFU/100 mL)	Percentage of Samples in Compliance (%)
Observed		
- Quarter 1	0.000	100.00
- Quarter 2	0.000	100.00
- Quarter 3	0.000	100.00
- Quarter 4	0.000	100.00
Observed		
- Annual	0.000	100.00

5.5 Cysts

Table 8: Raw water maximum number of *Giardia* cysts by quarter.

Item	Maximum (Cysts/100 L)
Compliance Requirement	0 Cysts / 100 L
Observed	
- Quarter 1	No Data
- Quarter 2	0.000
- Quarter 3	0.000
- Quarter 4	0.000
- Annual	0.000

Table 9: Raw water maximum number of *Cryptosporidium* cysts by quarter.

Item	Maximum (Cysts/100 L)
Compliance Requirement	0 Cysts / 100 L
Observed	
- Quarter 1	No Data
- Quarter 2	0.000
- Quarter 3	0.000
- Quarter 4	0.000
- Annual	0.000

Table 10: Finished water *Giardia* cysts minimum log reduction by quarter.

Item	Minimum (Log Reduction)	Percent of Samples in Compliance (%)
Compliance Requirement [1]		Jan 1 -- Jun 13 100 % \geq 1.5 Log Jun 14 – Oct 15 100 % \geq 3.0 Log Oct 16 – Dec 31 100% $>$ 1.5 Log
Observed - Quarter 1	1.280	91.49
- Quarter 2	1.290	91.77
- Quarter 3	34.970	100.00
- Quarter 4	1.920	100.00
Observed - Annual	1.280	96.06

[1] Compliance requirements vary for log reduction of *Giardia* cysts depending on the whether the source water is from the ground or surface supply.

Chart (CH-005)

Start Date: 01-Jan-2017 00:00:00
End Date: 30-Jun-2017 23:59:59
System: Chemainus Drinking Water
Treatment Levels: Water - Finished
Parameter Class: Cyst
Parameters: Giardia (Log Reduction) [Log]

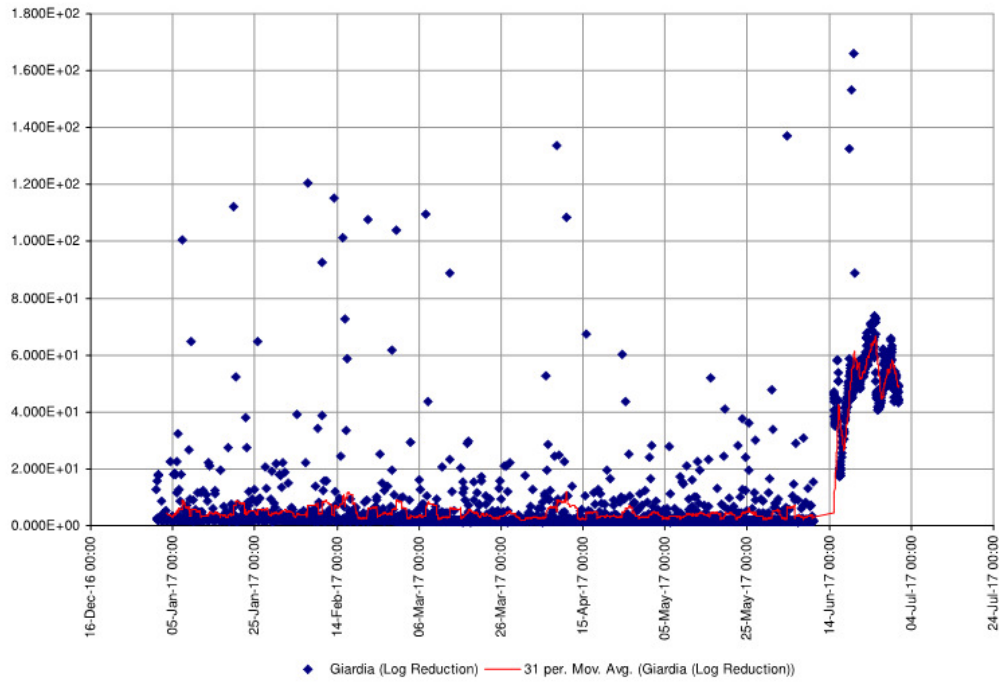


Figure 6: Giardia log reduction (Jan 1 to Jun 30).

Chart (CH-005)

Start Date: 01-Jul-2017 00:00:00
End Date: 31-Dec-2017 23:59:59
System: Chemainus Drinking Water
Treatment Levels: Water - Finished
Parameter Class: Cyst
Parameters: Giardia (Log Reduction) [Log]

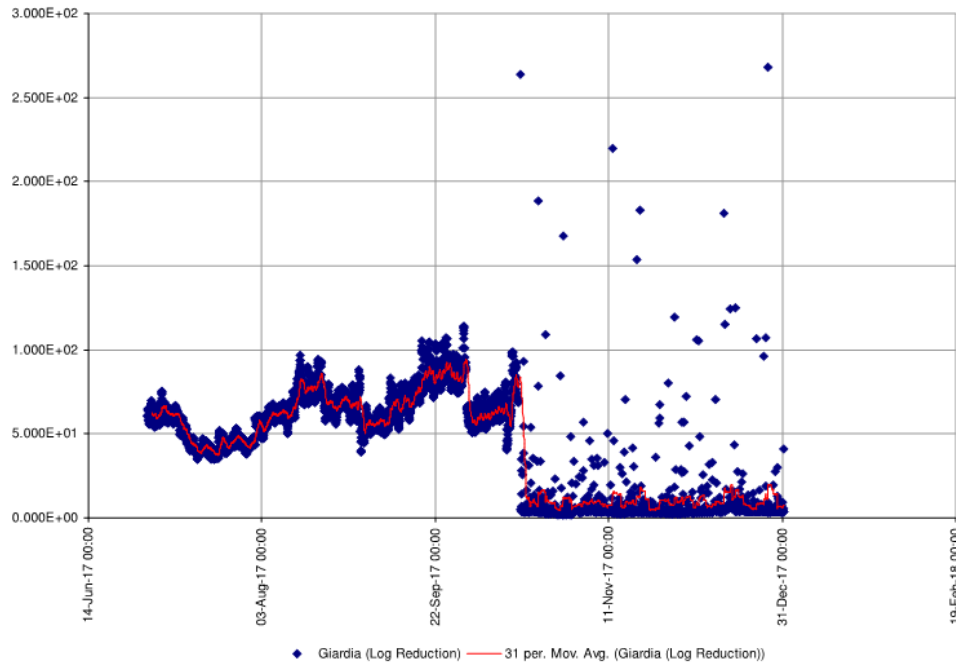


Figure 7: Giardia log reduction (July- Dec 31)

5.6 THMs

Table 11: Finished water maximum THMs by quarter.

Item	Maximum (ug/L)	Percent of Samples in Compliance (%)
CDWQG Requirements [3]		100 % <= 100 ug/L
Observed		
- Quarter 1	5.100	100.00
- Quarter 2	3.500	100.00
- Quarter 3	87.00	100.00
- Quarter 4	5.220	100.00
Observed		
- Annual	87.00	100.00

[3] The THMs for this water supply can be high when on the surface supply. This is caused by the relatively high chlorine dosing rate required to ensure that the required log reduction of giardia and cryptosporidium cysts is achieved; however, when on the well supply the THMs drop significantly and are well within CDWQG limits.

Chart (CH-001)

Start Date: 01-Jan-2017 00:00:00
 End Date: 31-Dec-2017 23:59:59
 System: Chemainus Drinking Water
 Parameter Class: THM
 Parameters: Total THM [µg/L]

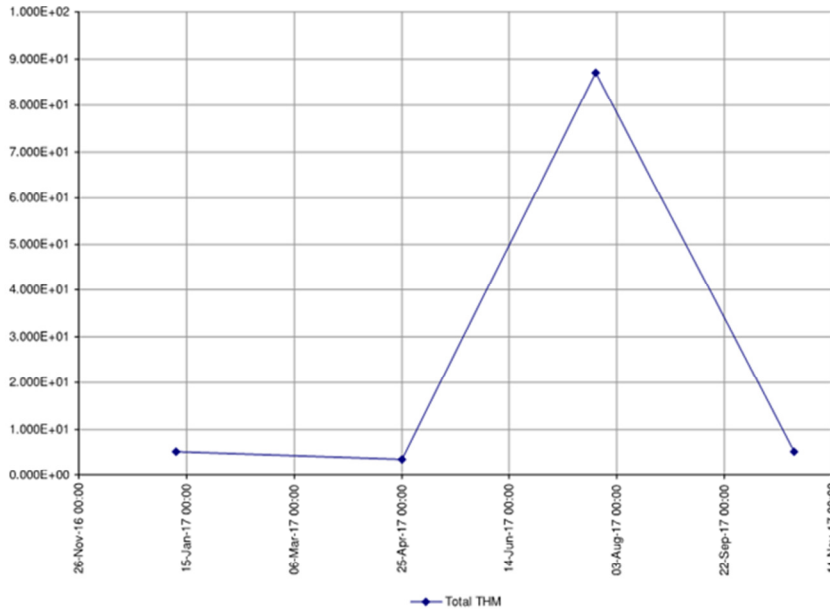


Figure 8: Finished water THMs.

5.7 Miscellaneous Parameters

Table 12: Finished water miscellaneous parameters.

Item	Compliance Assessment/Comments
Metals	All parameters met CDWQG limits.
Microorganisms	No limits exist.
Algae	No limits exist.
PAH	All parameters met CDWQG limits.
Chemicals [3]	All parameters met CDWQG limits with the exception of pH which did not meet the aesthetic objective.

[3] The pH limits are not minimum or maximum acceptable limits; rather they are aesthetic objectives. The pH is typically low for this water supply. The lower pH is usually associated with the Bannon supply.

6 Future Improvements

None proposed at this time

7 Additional Comments

Should you have any questions regarding this report, please do not hesitate to contact the Municipality at (250) 746-3100.

Sincerely



Clay Reitsma, M.Eng., P.Eng.

Manager of Engineering (Infrastructure & Environment)

cc. Robert Bell, Assistant Operations Manager - Utilities

CR/cr

Enclosures