

November 29, 2017

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
Manager of Engineering (Infrastructure & Environment)

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

Three – June 28 – July 4, 2016; August 19, 2016; & October 8, 2016.

5 Results

5.1 Water Consumption

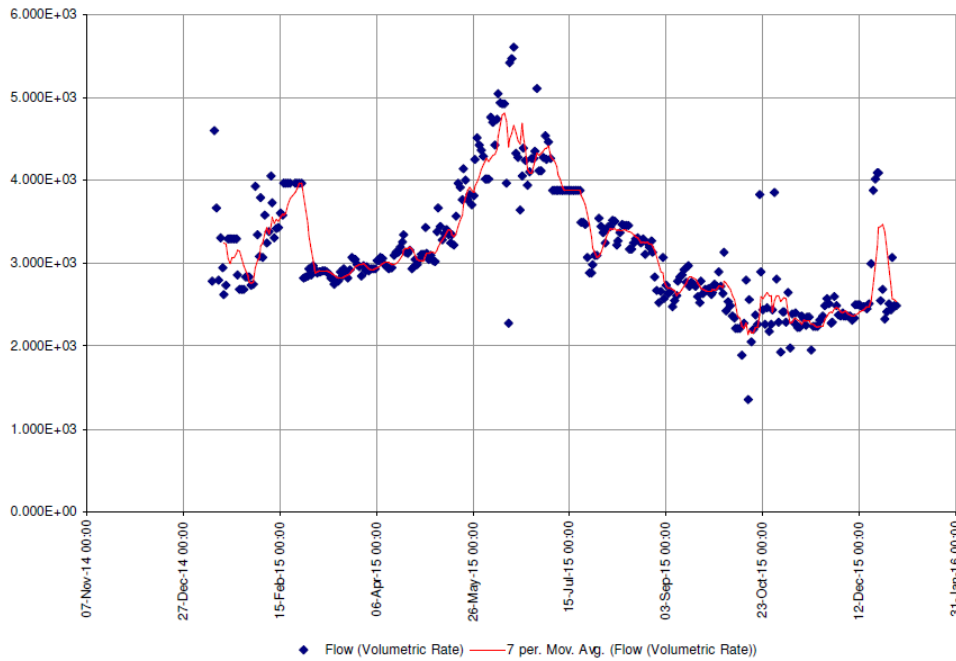
Table 1: Average daily water consumption by month and quarter.

Item	Average Daily Consumption (m³/d)
Observed	
- Jan	2386
- Feb	2537
- Mar	2436
- Quarter 1	2451
Observed	
- Apr	2439
- May	3497
- Jun	3503
- Quarter 2	3150
Observed	
- Jul	3651
- Aug	5035
- Sep	4191
- Quarter 3	4293
Observed	
- Oct	2746
- Nov	2479
- Dec	2553
- Quarter 4	3124
Observed	
- Annual	3124



Chart (CH-004)

Start Date: 01-Jan-2015 00:00:00
End Date: 31-Dec-2015 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Parameter Class: Physical
Parameters: Flow (Volumetric Rate) [m3/d]



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Figure 1: Average daily water consumption.

5.2 Residual Chlorine

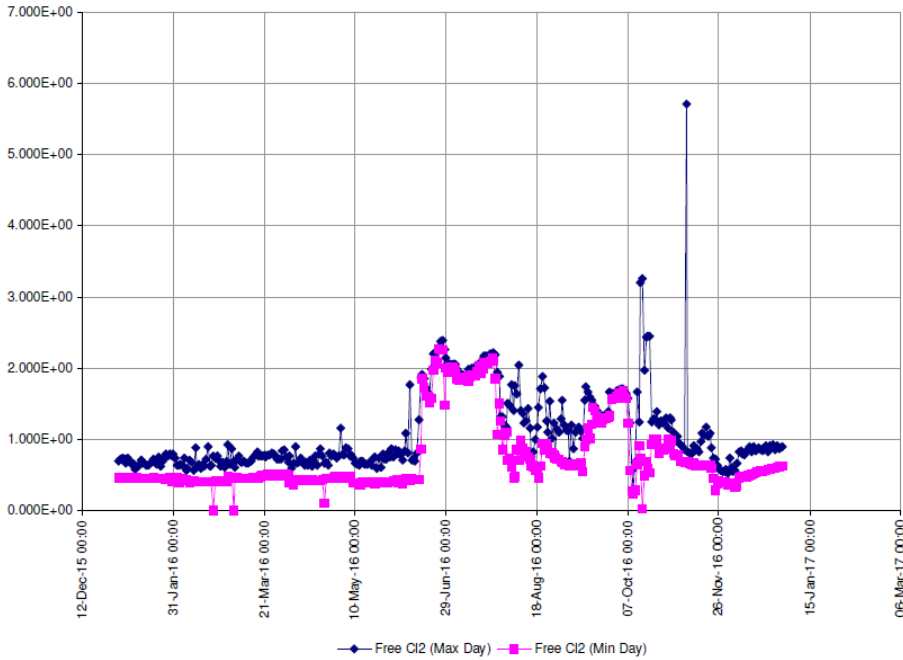
Table 2: Finished water minimum and maximum free chlorine residual by quarter.

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	0.509	0.930	97.80	100.00
- Quarter 2	0.105	2.393	98.90	100.00
- Quarter 3	0.463	2.217	100.00	100.00
- Quarter 4	0.035	5.716	98.91	98.91
Observed				
- Annual	0.000	5.716	98.91	99.73

Chart (CH-001)



Start Date: 01-Jan-2016 00:00:00
End Date: 31-Dec-2016 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]



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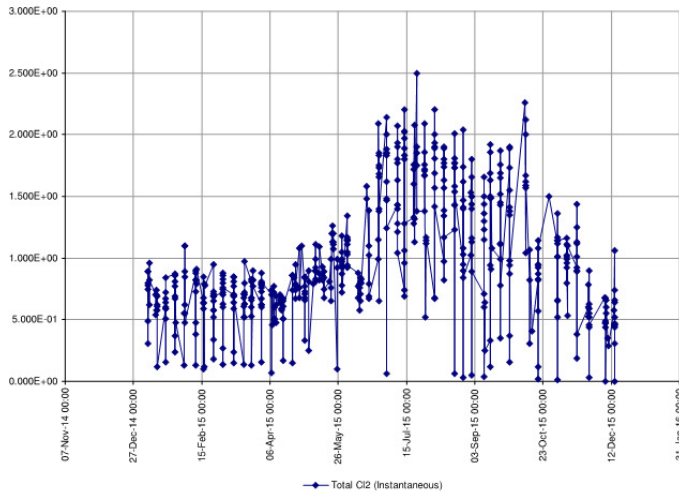
Figure 2: Finished water daily minimum and maximum free chlorine residual.

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	0.00	100.00
- Quarter 2	0.060	100.00
- Quarter 3	0.030	98.73
- Quarter 4	0.000	94.17
Observed		
- Annual	0.000	98.56

Chart (CH-001)

Start Date: 01-Jan-2015 00:00:00
 End Date: 31-Dec-2015 23:59:59
 System: Chemainus Drinking Water
 Project: Regular Sampling
 Treatment Levels: Water - Distribution System
 Parameter Class: Chlorine
 Parameters: Total Cl2 (Instantaneous) [mg/L]



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Figure 3: Distribution system minimum total chlorine residual.

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

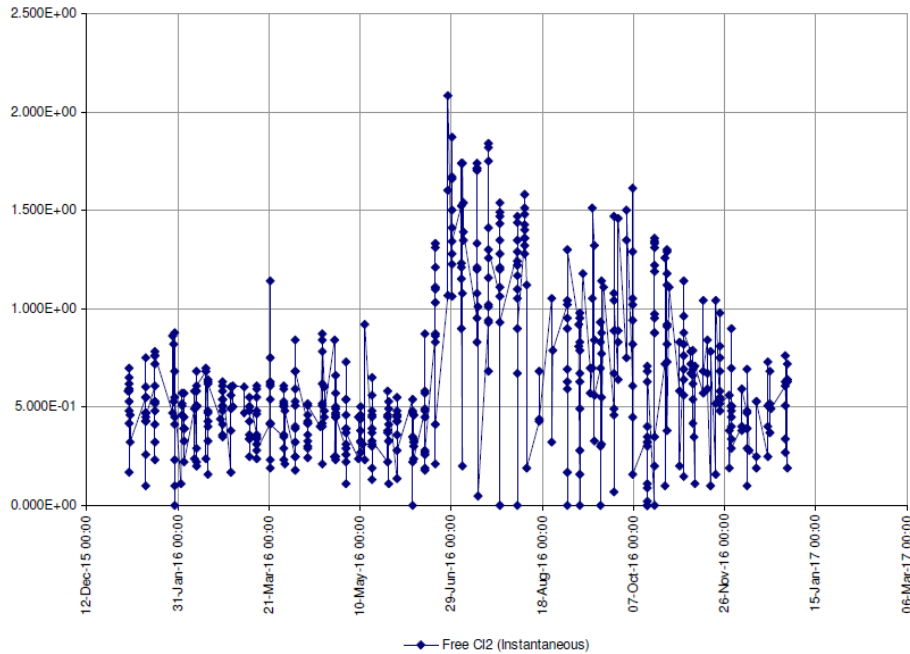
Item	Maximum (mg/L)	Percent of Samples in Compliance (%)
Compliance Requirement		100% \leq 4.00 mg/L
Observed		
- Quarter 1	1.140	100.00
- Quarter 2	2.080	100.00
- Quarter 3	1.840	100.00
- Quarter 4	1.610	100.00
Observed		
- Annual	2.080	100.00

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 % \geq 0.2 mg/L 100% \leq 4.0
Observed		
- Quarter 1	0.000	94.12
- Quarter 2	0.000	92.95
- Quarter 3	0.000	92.70
- Quarter 4	0.000	88.57
Annual	0.000	92.15

Chart (CH-001)

Start Date: 01-Jan-2016 00:00:00
End Date: 31-Dec-2016 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Treatment Levels: Water - Distribution System
Parameter Class: Chlorine
Parameters: Free Cl2 (Instantaneous) [mg/L]



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Figure 4: Distribution system maximum free chlorine residual.

5.3 Turbidity

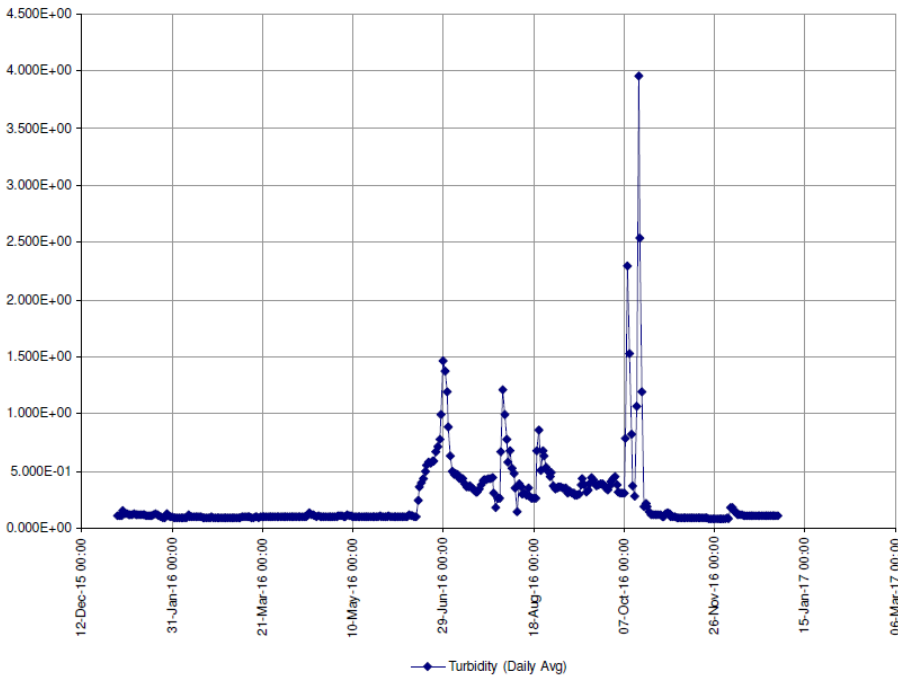
Table 5: Finished water maximum turbidity by month and quarter.

Item	Maximum (NTU)	Percent of Samples in Compliance (%)	
		100% <= 5 NTU	>95% <= 1 NTU (In A Month)
Compliance Requirement			
Observed			
- Jan	0.172	100.00	100.00
- Feb	0.148	100.00	100.00
- Mar	0.111	100.00	100.00
- Quarter 1	0.172	100.00	100.00
Observed			
- Apr	0.194	100.00	100.00
- May	0.144	100.00	100.00
- Jun	1.463	100.00	95.45
- Quarter 2	1.463	100.00	98.80
Observed			
- Jul	1.193	100.00	96.77
- Aug	1.210	100.00	96.77
- Sep	0.446	100.00	100.00
- Quarter 3	1.210	100.00	97.83
Observed			
- Oct	4.926	100.00	85.42
- Nov	0.153	100.00	100.00
- Dec	0.275	100.00	100.00
- Quarter 4	4.926	100.00	95.88
Observed			
- Annual	4.926	100.00	98.20

Chart (CH-001)



Start Date: 01-Jan-2016 00:00:00
End Date: 31-Dec-2016 23:59:59
System: Chemainus Drinking Water
Project: Regular Sampling
Treatment Levels: Water - Finished
Parameter Class: Physical
Parameters: Turbidity (Daily Avg) [NTU]



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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	0.610	100.00	100.00
- Quarter 2	0.000	100.00	100.00
- Quarter 3	1.240	100.00	96.97
- Quarter 4	9.000	100.00	97.14
Observed			
- Annual	9.000	100.00	98.59

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

Item	Maximum (CFU/100 mL)	Percentage of Samples in Compliance (%)
		100 % < 1 CFU/100 mL
CDWQG Requirements		100 % < 1 CFU/100 mL
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	No Data
- Quarter 4	No Data
- 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	No Data
- Quarter 4	No Data
- 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 % >= 1.5 Log Jun 14 – Oct 15 100 % >= 3.0 Log Oct 16 – Dec 31 100% > 1.5 Log
Observed - Quarter 1	1.491	99.91
- Quarter 2	1.332	96.07
- Quarter 3		
- Quarter 4	1.384	99.59
Observed - Annual		98.62

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

Due to Testing on the Chemainus Wells Flows from our SCADA system are non-representative of actual demand, therefore giardia log reduction calculations were not completed for Quarter 3 of 2016.

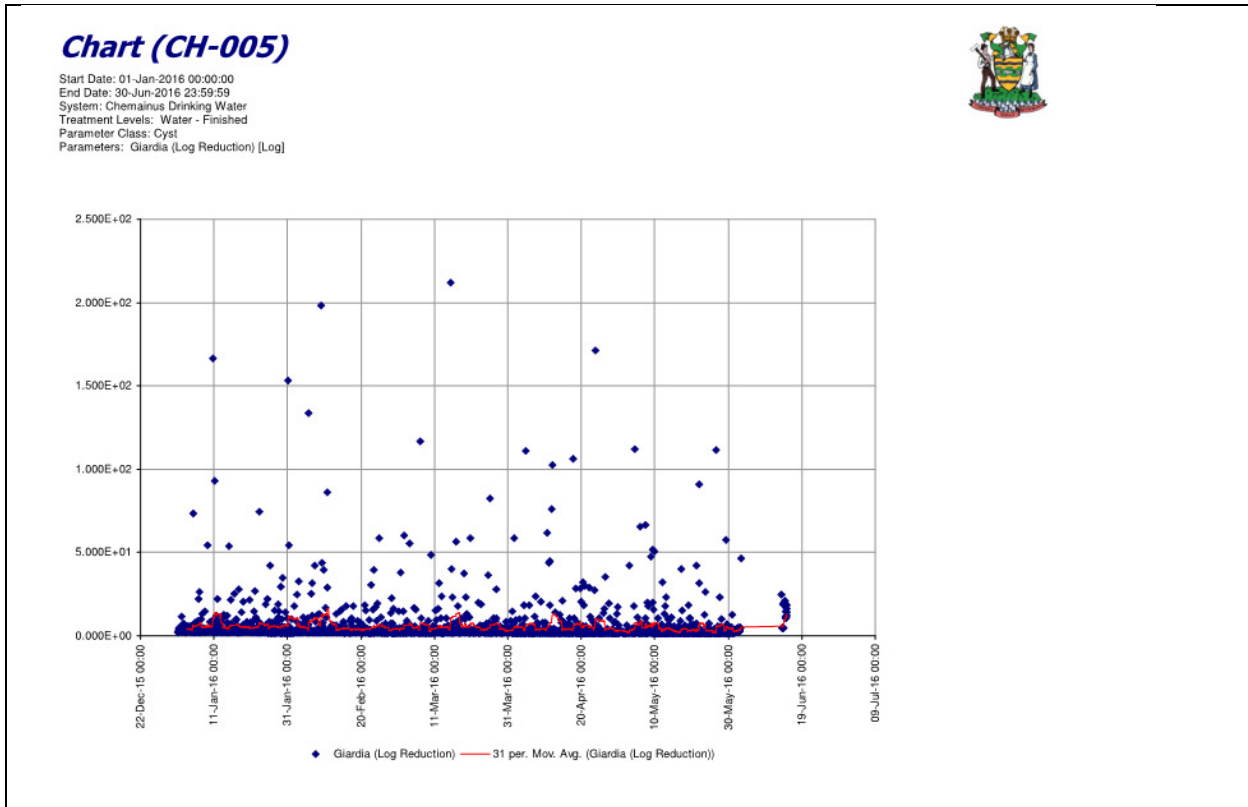


Figure 6: Giardia log reduction (Jan 1 to Jun 30).

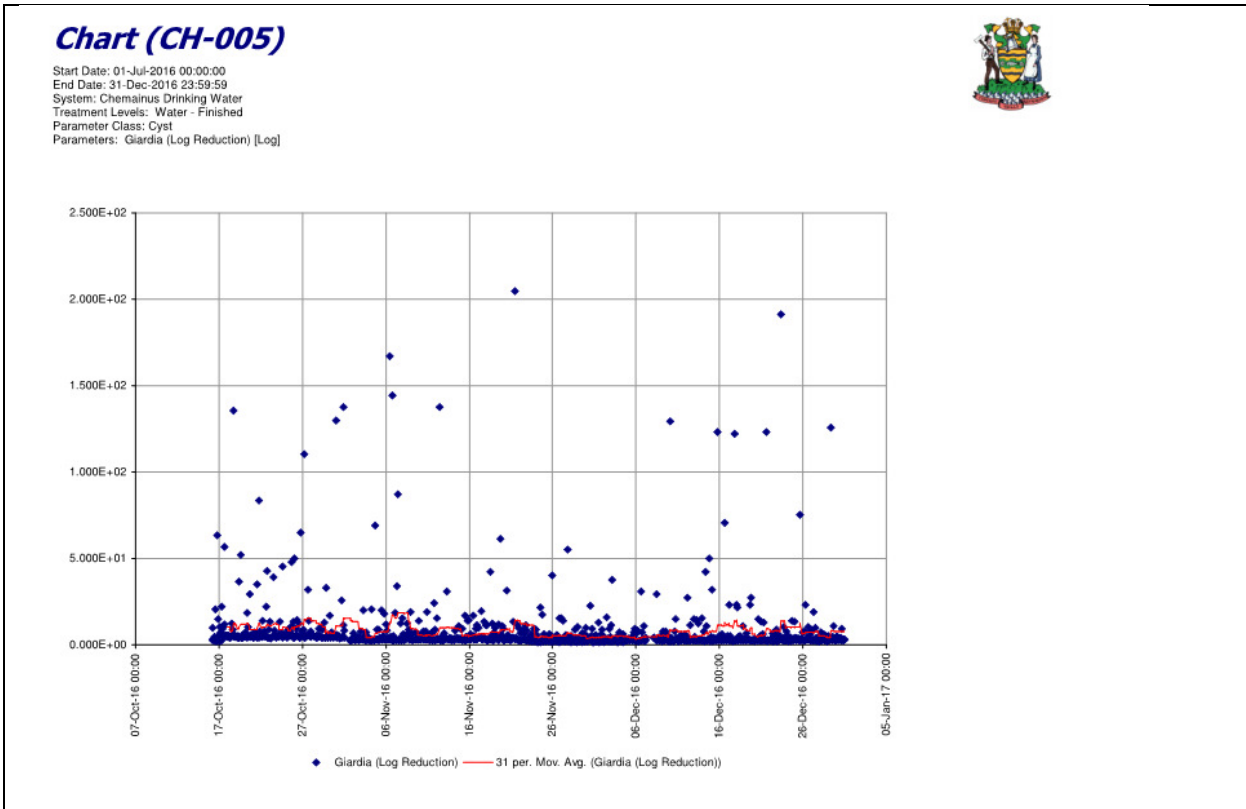


Figure 7: Giardia log reduction (July- Dec 31)

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	4.300	100.00
- Quarter 2	3.600	100.00
- Quarter 3	96.00	100.00
- Quarter 4	17.00	100.00
Observed		
- Annual	96.00	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.

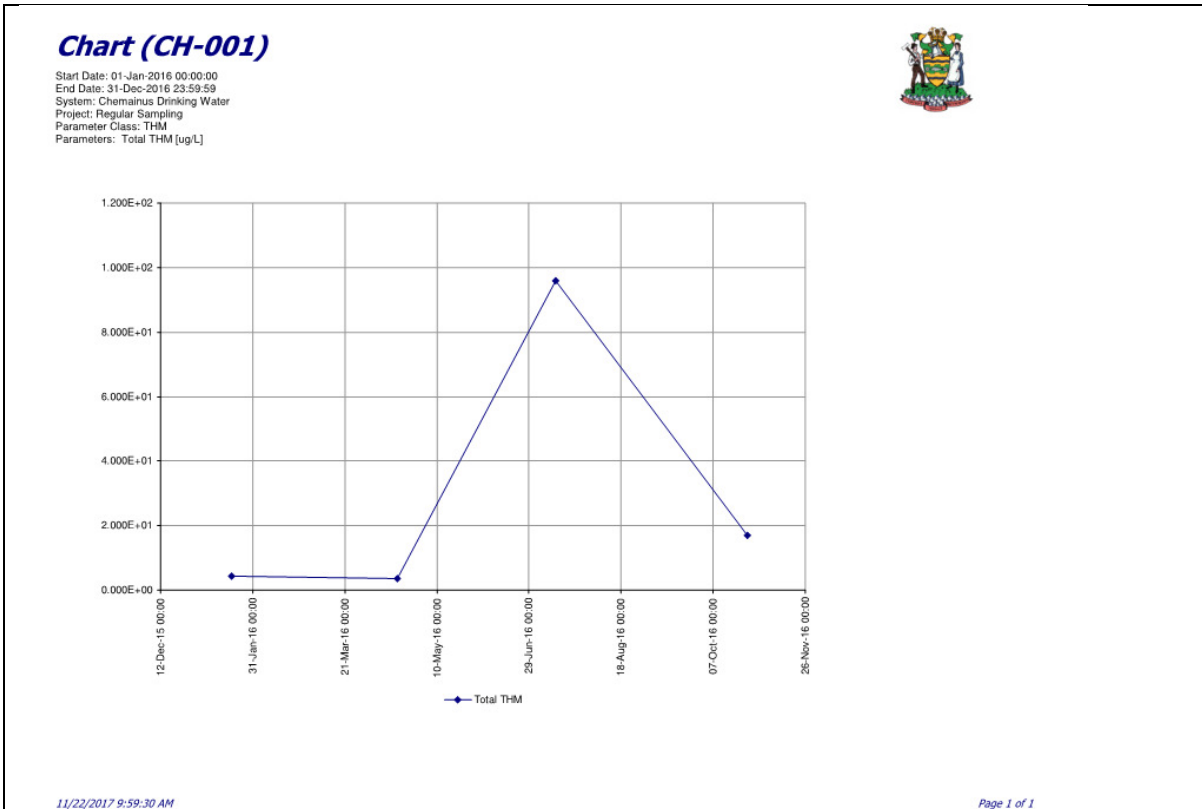


Figure 8: Finished water THMs.

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