



Town of Mahone Bay
2019 Water Treatment & Distribution Report
Approval No. 2008-061157-02





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Introduction

In accordance with the Town of Mahone Bay Approval to Operate Municipal – Water Works – Treatment Facility, No.2008-061157-02, the following report satisfies section 11.d annual reporting. The current Approval was issued in May 2019 to replace the previous Approval No.2008-061157-A01. The reporting period discussed is from January 1st, 2019 through December 31st, 2019. The report contains the following information:

- a list of all laboratories used for parameter analysis
- a summary and discussion of the quantity of water supplied
- a summary and interpretation of analytical results obtained in accordance with monitoring and recording section of the Approval
- a summary and interpretation of analytical results obtained in accordance with corrosion monitoring program
- a summary and interpretation of analytical results obtained from treatment backwash monitoring program
- a review of the QA/QC program for measurement validation
- date and description of any emergency or upset conditions
- a list of each certified operator and their level of certification
- any changes to the contingency plan or emergency notification procedures
- an update on the status of the source water protection plan
- summary of residuals removed from the facility
- records of any complaints and the follow-up actions

Background

The Town of Mahone Bay (TOMB) is located on the south shore of Nova Scotia in Lunenburg County. The Town is primarily a residential community with one main area of commercial development on Main Street. The Water Treatment Plant (WTP) serves a population of approximately 1000 with a design capacity of 981,956L/day. The water supply system is classified as a Class II Water Treatment Facility and a Class I Water Distribution System.

Regulatory Requirements

In Nova Scotia, municipal water treatment and distribution is controlled through federal, provincial, and municipal regulatory acts, regulations, bylaws and guidelines. This includes, but is not limited to the following:

- Environment Act
- Water and Wastewater Facilities and Public Drinking Water Supplies Regulations
- Emergency Spills Regulations
- American Water and Wastewater Association Standards (AWWA)
- American National Standards Institute Standards (ANSI)
- Health Canada: Guidelines on Canadian Drinking Water Quality (GCDWQ)
- Facility Classification Standards
- Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems
- Nova Scotia Treatment Standards for Municipal Drinking Water Supplies
- Guidelines for Monitoring Public Drinking Water Supplies (GMPDWS)
- Town of Mahone Bay Water Utility - Schedule of Rules and Regulations Governing the Supply of Water and Water Services
- Town of Mahone Bay - Water Utility Schedule of Rates for Water and Water Services

Water Supply Overview

The source water for the Town of Mahone Bay is Oakland Lake, which is located approximately 1 km northeast of the Town, off Highway 3. The lake has a surface area of 0.65 km², a maximum depth of 15 m, and a water yield of 5,000m³/day. The Oakland Lake Watershed has an area of 4.05 km². In July 2007, under section 106 of the Environment Act, the Province of Nova Scotia enacted the Oakland Lake Watershed Protected Water Area Designation which describes the watershed area and all applicable regulations and restrictions. The raw water pumphouse, located at Oakland Lake, pumps water through a 200mm cast iron transmission main 3 km to the Water Treatment Plant.

The raw water from Oakland Lake is characterized by low turbidity, pH, and hardness, and high natural organic matter and colour. Iron levels are generally slightly greater than the GCDWQ aesthetic objective of 0.3 mg/L.

The Town's current Approval for Water Withdrawal No.2008-061974-02 permits an average rate of withdrawal of 710 m³/day (averaged over 30 days) and a maximum rate of withdrawal of 960 m³/day (averaged over 3 days).

Water Treatment Plant Overview

The Town of Mahone Bay WTP, commissioned in 2008, is located at 68 Zwicker Lane in Mahone Bay, Nova Scotia. Water from Oakland Lake is pumped to the WTP where it undergoes the following treatment processes: pH adjustment, coagulation, flocculation, low-pressure membrane filtration, UV disinfection, primary chlorine disinfection, pH adjustment, secondary chlorine disinfection, and corrosion inhibitor addition.

Section 7 of the Approval establishes water quality requirements - performance and limits, which are summarized in Table 1 as they relate to the treatment process section of the annual report:

Section 7	
General Requirements	<p>a.(i) Treatment shall be sufficient to ensure 3-log reduction (99.9%) of Giardia and Cryptosporidium</p> <p>(ii) Treatment shall be sufficient to ensure 4-log reduction (99.99%) of viruses</p> <p>b. Primary disinfection...shall address a minimum of 0.5-log inactivation for Giardia when used in conjunction with filtration...a minimum UV dose (IT) of 40 mJ/cm² is required.</p> <p>c. Shall be treated to minimize corrosion of water distribution and/or plumbing systems</p>
Primary Disinfection Requirements	<p>d. The facility shall have a minimum of two primary disinfection units to ensure that inadequately disinfected water is not distributed.</p> <p>e. Continuous on-line monitoring of the primary disinfection process is required at each treatment facility...Water systems shall be equipped with alarm</p>

	capabilities to notify operations staff if the disinfection process fails
Filtration Requirements	<p>h. A minimum of two filter units (redundancy) is required</p> <p>j. The membrane system used for pathogen reduction shall have continuous indirect integrity testing.</p> <p>k. Continuous indirect integrity testing shall be conducted at a minimum frequency of once every 5 minutes.</p> <p>p. Direct integrity testing shall be conducted on each membrane filtration unit at least once per day and as soon as the Approval holder becomes aware when the turbidity exceeds 0.1 NTU for more than 15 minutes.</p> <p>q. For membrane filtration, turbidity levels from individual membrane units:</p> <p>(i) Shall be less than or equal to 0.1 NTU in at least 99% of measurements made, or at least 99% of the time each calendar month</p> <p>(ii) Shall not exceed 0.3 NTU at any time</p>

Table 1: Summary from section 7 of the Approval related to treatment.

Distribution System Overview

Water produced by the WTP is stored in the clearwell reservoir which is a concrete reservoir located adjacent to the WTP that has a water storage capacity of 2000 m³. The clearwell reservoir provides capacity for domestic water use and fire protection.

Treated water is delivered to the consumer by a gravity distribution system. The distribution system was largely constructed in the 1940s and has since undergone modifications and upgrades. The original distribution system components are cast iron pipe of 150mm and 200mm diameter and the modification and upgrades components are PVC pipe of 150mm and 200mm diameter.

Section 7 of the Approval establishes water quality requirements - performance and limits, which are summarized in Table 2 as they relate to the distribution system section of the annual report:

Section 7	
Secondary Disinfection and Residual Monitoring Requirements	<p>u. secondary disinfection through the use of chlorine shall be used</p> <p>v. Disinfection process shall be operated to ensure minimum chlorine residual value throughout distribution system at all times of: (i) 0.20mg/L free chlorine residual</p> <p>w. Disinfection process shall be operated to ensure the maximum chlorine residual value does not exceed: (i) 4.0 mg/L free chlorine residual</p> <p>x. Continuous monitoring of chlorine residual is required for finished water leaving the Facility, with measurements taken at no more than 5-minute intervals</p> <p>y. Continuous monitoring of the chlorine residual is required for water leaving any storage structure within the water distribution system, with measurements taken at no more than 5-minute intervals</p> <p>z. Monitoring of the water distribution system for chlorine residual is required...sampling and testing frequency is the same as for bacteriological sampling requirements</p>
Distribution Turbidity Requirements	<p>al. A turbidity value of 5.0 NTU or less shall be achieved on water distribution system sampling</p>
Turbidity Monitoring Requirements	<p>ap. Continuous or grab sample monitoring of the water distribution system is required...sampling and testing frequency is the same as for bacteriological sampling requirements</p>

Aluminum Residual Values	ar. Based upon a running annual average of monthly samples, reduce residual aluminum levels to the lowest possible extent with a maximum operational value of...0.2mg/L
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Table 2: Summary from section 7 of the Approval related to distribution.

Laboratory Results

In addition to performing water quality analysis in-house, multiple samples are sent to accredited laboratories for analysis. The Nova Scotia Health Authority - Southshore Regional Hospital conducted the weekly bacteriological analysis. AGAT Laboratories in Dartmouth, Nova Scotia conducted all other third-party analysis. Included in Appendix A is a copy of AGAT Laboratories' CALA accreditation certificate. Table 3 identifies the laboratories used by TOMB and the parameters analyzed at each.

Laboratory	Parameter Analysis	
Southshore Regional Hospital 90 Glen Allen Drive Bridgewater, NS B4V 3S6	<ul style="list-style-type: none"> • TC & E.Coli – Presence/Absence 	
AGAT Laboratories 11 Morris Drive, Unit 122 Dartmouth, NS B3B 1M2	<ul style="list-style-type: none"> • Alkalinity • Hardness • Iron • Aluminum • TTHM • HAA • TC & E.Coli – MPN • Total Metals • Standard Water Analysis 	<ul style="list-style-type: none"> • Nutrients • Lead • Copper • Manganese • Conductivity • Dissolved Oxygen • Microcystin • MAC/IMAC

Table 3: TOMB list of laboratories and parameters.

Water Supply Summary & Discussion

Raw water supplied to the Town of Mahone Bay WTP is withdrawn from Oakland Lake. The total volume of water withdrawn from Oakland Lake during the reporting period was 223.261 million litres which is an average daily withdrawal volume of 611,674 L for the calendar year. In 2019, the month of July had the maximum total monthly withdrawal rate and the month of February had the minimum total monthly withdrawal rate; 21,196,500 L and 16,457,000 L respectively. Compared with 2018, there was an increase of 18.041 million litres in the total annual water withdrawn from Oakland Lake. Water withdrawal rates remained within prescribed Approval limits of an average rate of withdrawal of 710,000 litres per day (L/d) averaged over 30 days and a maximum rate of withdrawal of 960,000 L/day averaged over 3 days; see Figures 1 and 2. Table 4 identifies the total volume of water withdrawn from Oakland Lake, the total volume of water supplied to the Town and the maximum demand month in 2019, respectively. Water withdrawal and supply volumes by month are in Table 5.

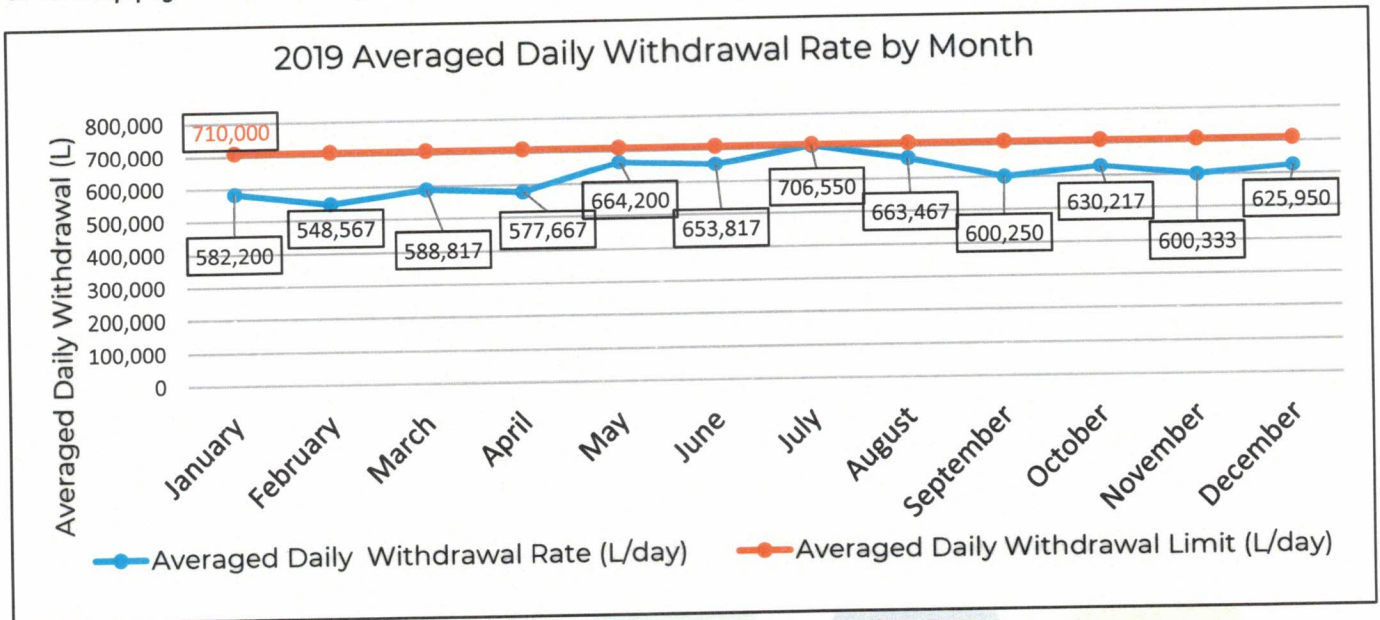


Figure 1: Comparison of 2019 averaged daily withdrawal rate by month with limit.

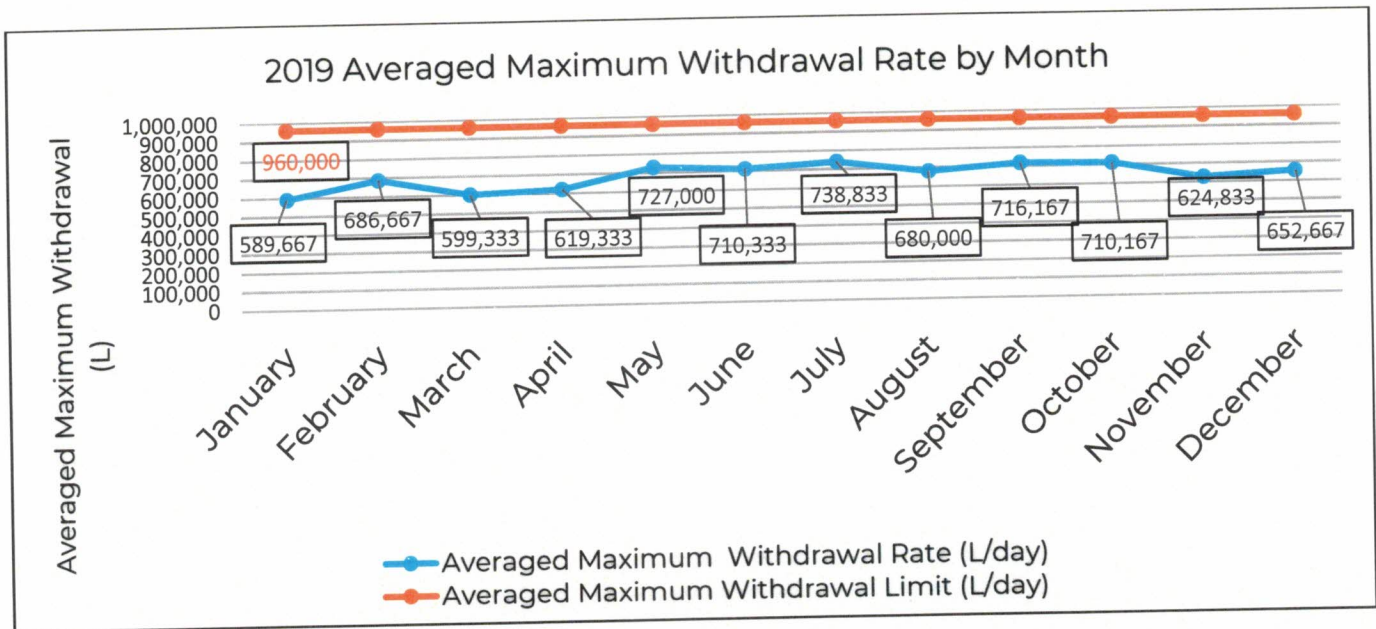


Figure 2: Comparison of 2019 averaged maximum withdrawal rate by month with limit.

Year	Total Water Withdrawal (L)	Total Water Supplied (L)	Maximum Withdrawal Month: July (L)	Maximum Supplied Month: July (L)
2019	223,261,000	204,573,000	21,196,500	19,320,000

Table 4: 2019 Overview of water withdrawal and supply.

Month	Total Withdrawal Volume per Month (L)	Averaged Daily Withdrawal Rate (L/day)	Averaged Maximum Withdrawal Rate (L/day)	Total Monthly Water Supplied (L)	Averaged Daily Water Supplied (L/day)
January	17,466,000	582,200	589,667	16,007,000	533,567
February	16,457,000	548,567	686,667	15,080,000	502,667
March	17,664,500	588,817	599,333	16,147,000	538,233
April	17,330,000	577,667	619,333	15,914,000	531,367
May	19,926,000	664,200	727,000	18,155,000	605,167
June	19,614,500	653,817	710,333	18,043,000	601,433
July	21,196,500	706,550	738,833	19,320,000	644,000
August	19,904,000	663,467	680,000	18,360,000	612,000

September	18,007,500	600,250	716,167	16,513,000	550,433
October	18,906,500	630,217	710,167	17,405,000	580,167
November	18,010,000	600,333	624,833	16,348,000	544,933
December	18,778,500	625,950	652,667	17,281,000	576,033

Table 5: 2019 Monthly water withdrawal and supply.

Monitoring & Reporting Analytical Results & Discussion

The WTP has analytical equipment which provides for continuous process monitoring before, during, and after treatment. For the purposes of the annual report, only parameters required to be monitored in the Approval will be discussed.

In accordance with the 2019 Annual Sampling Plan, weekly bacteriological samples were collected from the distribution system for analysis. Additionally, quarterly total trihalomethanes (TTHM) and haloacetic acids (HAA₅) samples and annual samples of raw and treated water were collected for analysis. Daily and weekly process monitoring sample collection and analysis was conducted by Operations Staff in-house and quarterly QA/QC samples were sent to a third-party laboratory for analysis.

All continuous monitoring equipment, portable, and benchtop analytical equipment used at the WTP are calibrated and verified in accordance with the manufacturers' recommendations.

Raw Water

Turbidity

In accordance with the Approval raw water is continuously monitored for turbidity upon entering the WTP. In 2019, the annual average turbidity value entering the plant was 0.36 NTU. Table 6 displays the average turbidity values for each month in NTU and the annual trendline for raw water turbidity is in Appendix B.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.32	0.30	0.33	0.37	0.34	0.42	0.47	0.22	0.32	0.38	0.49	0.39

Table 6: 2019 Average raw water turbidity by month.

GMPDWS

Annual water analysis, as prescribed under the GMPDWS, was conducted on raw water. The samples were analyzed by AGAT Laboratories.

Treated Water

Turbidity

Each filter train in the WTP has continuous monitoring equipment for effluent turbidity. Current alarm setpoints ensure that the train shutdowns at a turbidity reading of 0.3 NTU or of 0.1 NTU for greater than 15 minutes. Appendix B includes the annual trendline for filter effluent turbidity for Skid A and B. Filtrate grab samples were collected and analyzed 5 days per week for a total of 260 samples. The filtrate samples are collected prior to the treated water moving from the WTP to the clearwell reservoir. The average turbidity of the filtrate grab samples in 2019 was 0.05 NTU. Table 7 displays the average monthly effluent turbidity values for Skid A and B in 2019. Both Skid A and Skid B membrane unit turbidity values were less than 0.1 NTU in at least 99% of the measurements made in 2019. Table 8 displays the average monthly turbidity values for filtrate samples in 2019.

Jan		Feb		Mar		Apr		May		Jun	
A	B	A	B	A	B	A	B	A	B	A	B
0.013	0.023	0.016	0.021	0.013	0.017	0.014	0.016	0.016	0.014	0.019	0.015
Jul		Aug		Sep		Oct		Nov		Dec	
A	B	A	B	A	B	A	B	A	B	A	B
0.017	0.016	0.026	0.019	0.044	0.035	0.020	0.017	0.018	0.015	0.017	0.015

Table 7: 2019 Average filter effluent turbidity by month.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.04	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05

Table 8: 2019 Average filtrate turbidity by month.

Distribution turbidity is monitored through grab samples collected at the WTP distribution sample tap, prior to the first consumer and at the Town Hall, located centrally in the distribution system. These samples are collected 5 days per week for a total of 260 samples per year, respectively. Additional turbidity samples are collected from RPS and Bayview School on a weekly basis when bacteriological

sampling occurs. A total of 52 samples are collected at each of these sites per year. Table 9 provides the monthly average turbidity results for each site. In 2019, the range of turbidity values was between 0.04 NTU – 0.84 NTU which is within the prescribed limit of 5.0 NTU. Figure 3 displays water distribution system turbidity values in comparison with the limit.

Month	Distribution Tap (NTU)	Town Hall (NTU)	RPS (NTU)	Bayview School (NTU)
January	0.05	0.05	0.06	0.06
February	0.05	0.05	0.08	0.14
March	0.07	0.06	0.08	0.11
April	0.06	0.06	0.10	0.09
May	0.05	0.05	0.07	0.08
June	0.05	0.05	0.07	0.07
July	0.05	0.05	0.08	0.14
August	0.06	0.05	0.07	0.09
September	0.06	0.06	0.07	0.10
October	0.06	0.06	0.07	0.09
November	0.06	0.06	0.08	0.08
December	0.06	0.06	0.07	0.30

Table 9: 2019 Distribution system monthly average turbidity results.

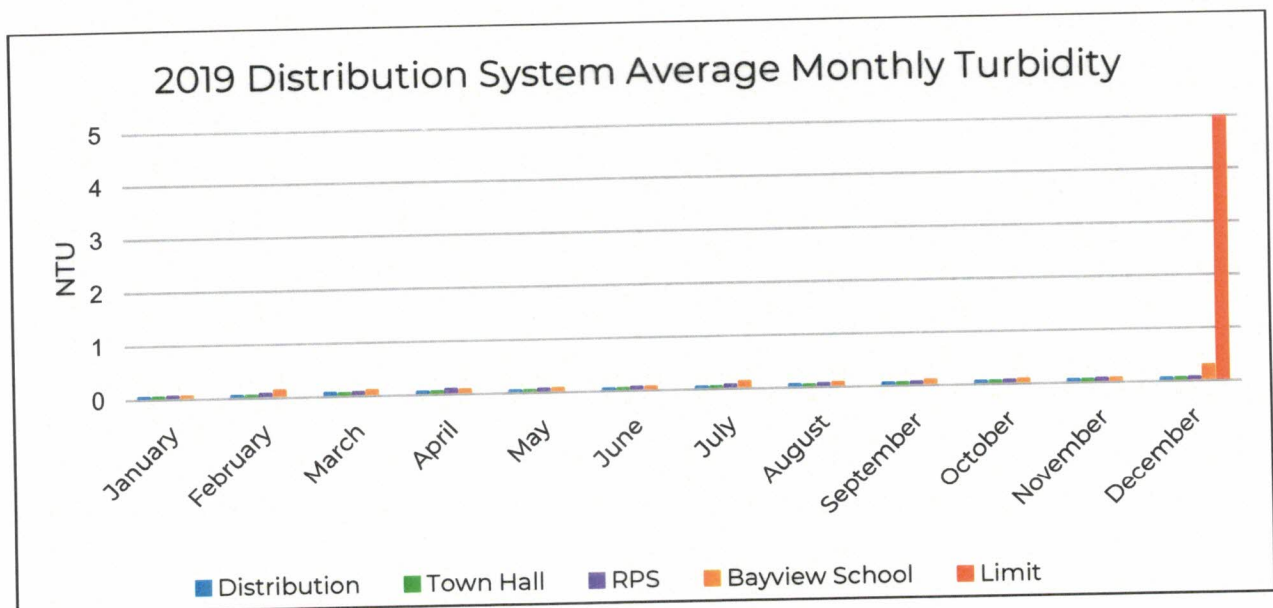


Figure 3: 2019 Distribution system monthly average turbidity values compared with limit.

Aluminum Residual

In accordance with the Approval aluminum residual is monitored on a monthly basis in-house and a quarterly sample is sent to a third-party laboratory for analysis as a component of the QA/QC program. In 2019, the range of aluminum residual in treated water was 0.000mg/L to 0.106mg/L. Table 10 provides the results for 2019 based on a running annual average.

Month	Aluminum Residual Filtrate (mg/L)	Aluminum Residual Town Hall (mg/L)
January	0.007	0.020
February	0.009	0.020
March	0.011	0.022
April	0.011	0.023
May	0.012	0.022
June	0.014	0.029
July	0.015	0.028
August	0.016	0.027
September	0.018	0.027
October	0.018	0.025
November	0.019	0.023
December	0.019	0.026

Table 10: 2019 Running annual average aluminum residual.

Primary Disinfection

The Town of Mahone Bay WTP uses both UV light and chlorination to achieve primary disinfection. The WTP does not store sodium hypochlorite for more than three months, therefore bromate and chlorate are not sampled. The system is required to provide 0.5-log Giardia reduction and 4.0-log virus reduction. Following filtration, water passes through a UV reactor which provides 3.0-log Giardia reduction. The UV system continuously monitors UV intensity to ensure that dosing achieves the minimum 40 mJ/cm² required. There is only one UV reactor, therefore the UV system redundancy is provided by chlorination. After UV disinfection, 12% sodium hypochlorite is injected into the water to achieve the required 4.0-log virus reduction. In 2013, CBCL Ltd. prepared a System Assessment

Report (SAR) which confirms both UV log reductions and chlorination log reductions are adequately achieved by the current disinfection system. Under section 3.1.4.2 Chlorination, the SAR identifies 12 as the minimum CT requirement for chlorine disinfection. The SAR includes a calculated CT value of 162 based on high flow and minimum chlorine dose for both the chlorine contact pipe and the reservoir. The free chlorine residual and system calculated CT value for primary disinfection are monitored continuously. If a low chlorine value is detected, Operators are notified and the plant will shut-down. In 2019, operational conditions remained within the design range for achieving CT/IT. The 2019 annual UV IT, CT, and filtrate free chlorine residual trendline is included in Appendix B.

It should be noted that the intensity probe of the UV reactor system failed in October 2019. Despite knowledge that the UV lamps were operating within the prescribed life hours, the chlorine redundancy system was activated to ensure the required 0.5-log reduction for Giardia was achieved and measurable for the duration of the time the intensity probe was out of service. The UV system continued to run during this time and Operators performed regular in-house grab samples for UV transmittance and absorbance; monthly averages in Table 11. Grab samples are collected 5 days per week for a total of 260 samples per year.

Month	UVT	UVA
January	94.7	0.020
February	94.8	0.021
March	94.9	0.021
April	95.5	0.019
May	96.0	0.017
June	96.2	0.016
July	95.7	0.018
August	95.3	0.020
September	95.5	0.019
October	95.7	0.018
November	95.7	0.018
December	95.7	0.018

Table 11: 2019 In-house filtrate UV transmittance & absorbance monthly average.

Secondary Disinfection

Secondary disinfection is achieved through the addition of 12% sodium hypochlorite to water exiting the clearwell reservoir on route to the first consumer. Chlorine residual is continuously monitored and if residual drops to 0.6 mg/L for 15 minutes, Operators are notified. Included in Appendix B is the secondary disinfection distribution free chlorine residual trendline for 2019. Free chlorine residual grab samples are collected 5 days per week from the distribution tap at the WTP and Town Hall, for a total of 260 samples per year, respectively. Additional free chlorine grab samples are collected from RPS and Bayview School on a weekly basis when bacteriological sampling occurs. A total of 52 samples are collected at each of these sites per year. Table 12 provides the monthly average free chlorine results for each site in the distribution system monitored. In 2019, the range of free chlorine values was between 0.66 mg/L and 2.40 mg/L, which is within the prescribed range of 0.20 mg/L to 4.0 mg/L; there were no incidents of free chlorine residual below 0.20mg/L. Figure 4 displays water distribution system free chlorine residual in comparison with the limit.

Month	Distribution Tap (mg/L)	Town Hall (mg/L)	RPS (mg/L)	Bayview School (mg/L)
January	1.58	1.12	1.24	1.19
February	1.74	1.17	1.30	1.22
March	1.56	1.15	1.27	1.08
April	1.64	1.18	1.16	1.17
May	1.67	1.28	1.21	1.15
June	1.61	1.23	1.11	0.12
July	1.78	1.26	1.15	1.01
August	1.85	1.30	1.20	0.88
September	2.07	1.44	1.43	1.16
October	1.74	1.38	1.33	1.24
November	1.86	1.41	1.49	1.29
December	1.75	1.33	1.21	1.07

Table 12: 2019 Distribution system monthly average free chlorine residual results.

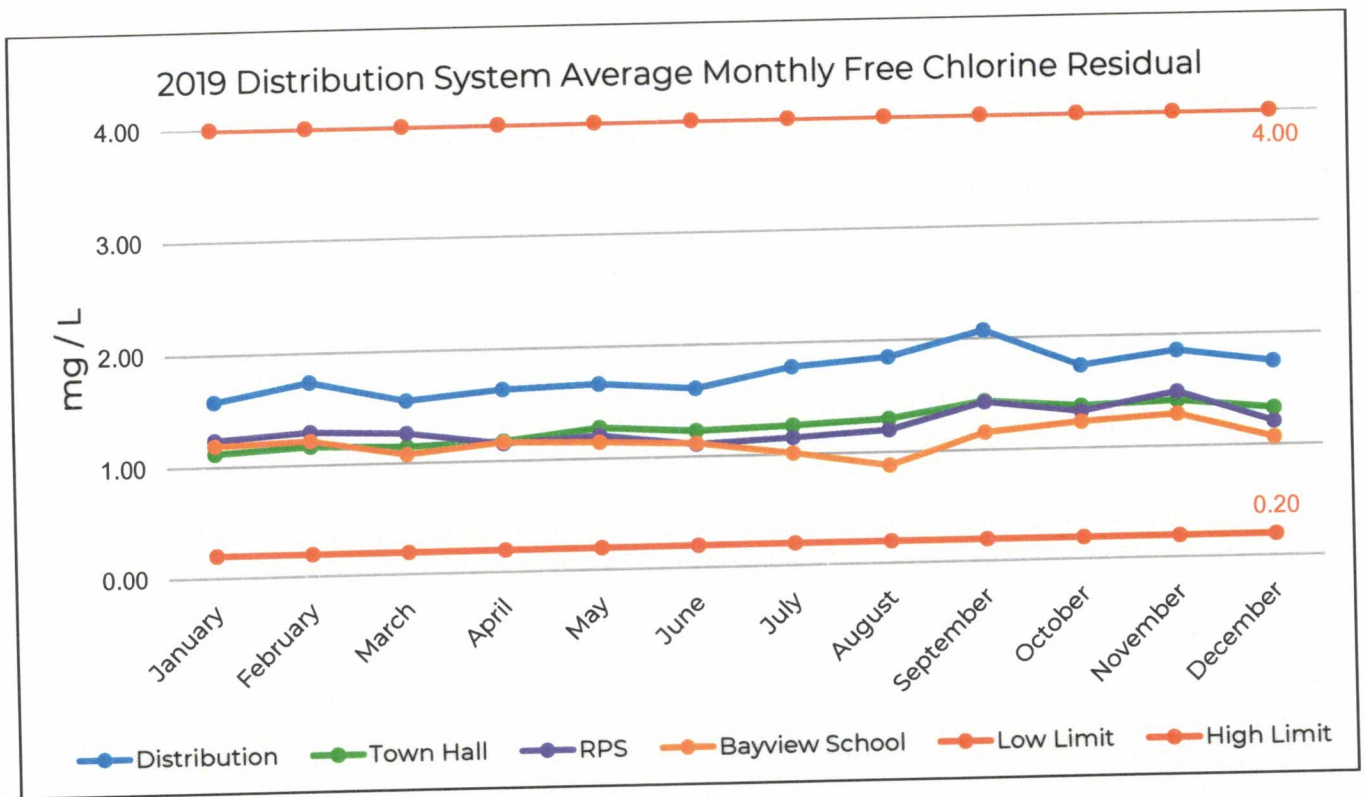


Figure 4: 2019 Distribution monthly average free chlorine residuals compared with limit.

Bacteriological Results

Weekly bacteriological samples were collected from the distribution system for analysis by Southshore Regional Hospital. Sample sites include the WTP distribution tap, Town Hall, RPS, and Bayview School. A total of 208 samples were collected from regular sample sites. Sample results are submitted to the NSE in the form of a monthly summary. All sample results were absent of total coliform and e.coli.

TTHM and HAA₅

Quarterly TTHM and HAA₅ samples were collected from the distribution system for analysis by AGAT Laboratories. Samples were collected at Town Hall to represent the middle of the distribution system and RPS to represent the extremity of the distribution system. TTHM and HAA₅ samples were collected at RPS and HAA₅ samples were collected at Town Hall. Tables 13 - 16 provide the results for 2019 based on a running locational annual average for both parameters. In 2019, the

range of TTHM quarterly values was between 0.055 mg/L and 0.066 mg/L, which is under the prescribed limit of 0.100 mg/L. For the same time period, the range of HAA₅ quarterly values was between 0.032 mg/L and 0.040 mg/L, which is under the prescribed limit of 0.080 mg/L. Figure 5 displays the TTHM results in comparison with the limit and Figure 6 displays the HAA₅ results in comparison with the limit.

Quarter 1: Running Locational Annual Average			
Quarter	TTHM RPS (mg/L)	HAA ₅ RPS (mg/L)	HAA ₅ Town Hall (mg/L)
Q2 - 2018	0.080	0.050	0.056
Q3 - 2018	0.087	0.049	0.046
Q4 - 2018	0.055	0.030	0.021
Q1 - 2019	0.040	0.030	0.026
Q1 - 2019	0.066	0.040	0.037

Table 13: 2019 Quarter 1 TTHM & HAA₅ results.

Quarter 2: Running Locational Annual Average			
Quarter	TTHM RPS (mg/L)	HAA ₅ RPS (mg/L)	HAA ₅ Town Hall (mg/L)
Q3 - 2018	0.087	0.049	0.046
Q4 - 2018	0.055	0.030	0.021
Q1 - 2019	0.040	0.030	0.026
Q2 - 2019	0.062	0.036	0.034
Q2 - 2019	0.061	0.036	0.032

Table 14: 2019 Quarter 2 TTHM & HAA₅ results.

Quarter 3: Running Locational Annual Average			
Quarter	TTHM RPS (mg/L)	HAA ₅ RPS (mg/L)	HAA ₅ Town Hall (mg/L)
Q4 - 2018	0.055	0.030	0.021
Q1 - 2019	0.040	0.030	0.026
Q2 - 2019	0.062	0.036	0.034
Q3 - 2019	0.083	0.057	0.062
Q3 - 2019	0.060	0.038	0.036

Table 15: 2019 Quarter 3 TTHM & HAA₅ results.

Quarter 4: Running Locational Annual Average			
Quarter	TTHM RPS (mg/L)	HAA ₅ RPS (mg/L)	HAA ₅ Town Hall (mg/L)
Q1 - 2019	0.040	0.030	0.026
Q2 - 2019	0.062	0.036	0.034
Q3 - 2019	0.083	0.057	0.062
Q4 - 2019	0.034	0.033	0.033
Q4 - 2019	0.055	0.038	0.039

Table 16: 2019 Quarter 4 TTHM & HAA₅ results.

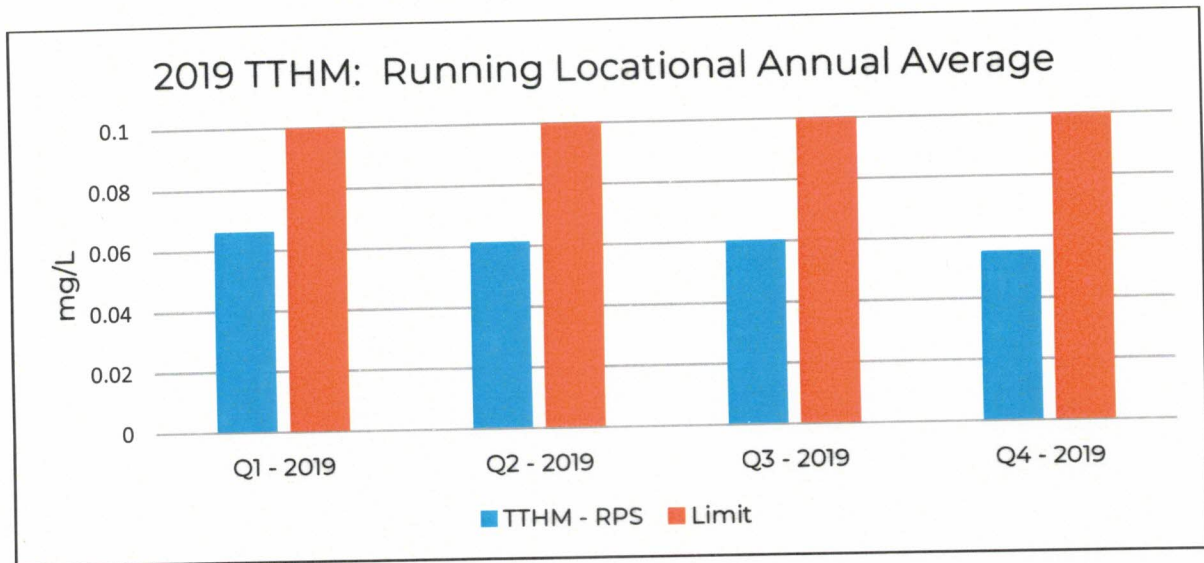


Figure 5: 2019 Distribution running locational annual average TTHM compared with limit.

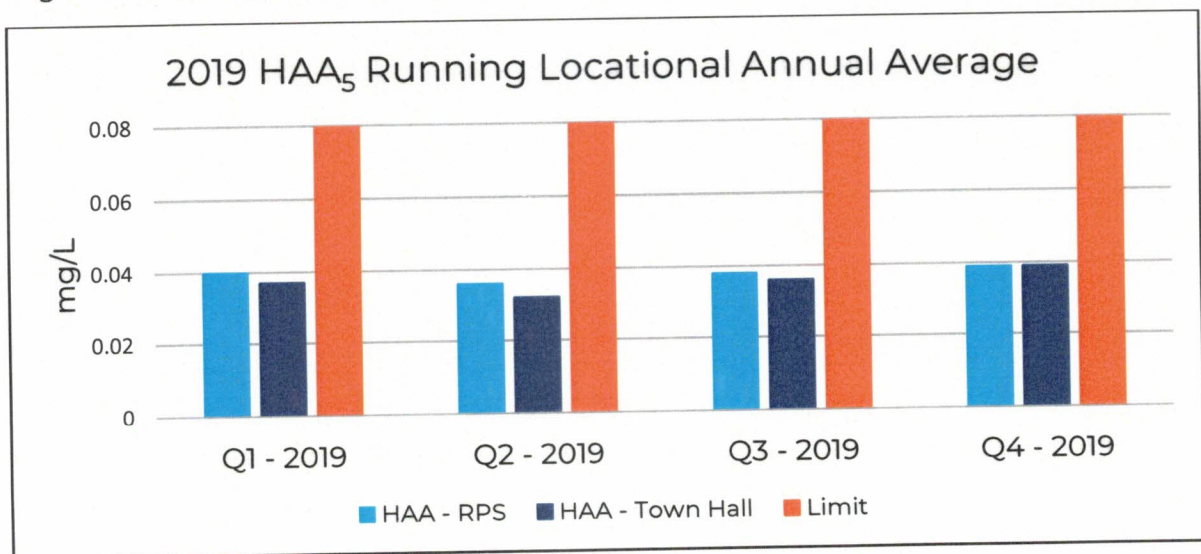


Figure 6: 2019 Distribution running locational annual average HAA₅ compared with limit.

GMPDWS

Annual water analysis, as prescribed under the GMPDWS, was conducted on treated water. The samples were analyzed by AGAT Laboratories and no treated water parameter were outside of guideline limits.

Corrosion Monitoring Program Results & Discussion

pH

pH of distribution water is continuously monitored at the WTP prior to reaching the first consumer. Grab samples are collected 1 – 5 times per week from distribution sample points for in-house analysis. The corrosion control strategy tries to achieve a pH of 7.60-8.00 at Town Hall and 7.60-9.00 at distribution tap. Table 17 provides a monthly average of pH results for 2019.

Month	Distribution Tap	Town Hall	RPS	Bayview School
January	8.28	7.84	7.88	8.00
February	8.06	7.87	7.86	7.89
March	7.91	7.79	7.66	7.71
April	8.44	7.94	7.88	7.88
May	8.67	7.97	8.09	8.20
June	8.39	7.79	8.03	7.96
July	8.34	7.80	8.08	8.11
August	8.62	7.80	8.02	8.04
September	8.62	7.82	7.99	8.00
October	8.58	7.84	7.92	8.01
November	8.53	8.05	8.03	8.02
December	8.80	7.90	8.05	8.14

Table 17: 2019 Average pH results by month.

Alkalinity

Alkalinity grab samples are collected once per week for in-house analysis and quarterly for laboratory analysis as a component of the QA/QC program. Table 18 provides a monthly average of alkalinity results for 2019

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		Oct	Nov	Dec
21.0	20.9	21.9	21.3	21.2	23.2	21.5	24.2	26.4		25.5	22.8	20.8

Table 18: 2019 Average alkalinity results (mg/L) by month.

Hardness

Hardness grab samples are collected once per week for in house analysis and quarterly for laboratory analysis as a component of the QA/QC program. Table 19 provides a monthly average of hardness results for 2019.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
6.5	5.3	6.6	5.2	4.8	5.8	4.9	5.1	6.4	7.2	6.9	6.1

Table 19: 2019 Average hardness results (mg/L) by month.

Conductivity

Conductivity is a new corrosion control parameter in the current Approval and was included in the Annual Sampling Plan for 2020. Grab samples are collected quarterly for laboratory analysis. In 2019, conductivity was sampled in the last quarter at Town Hall with a result of 155.0 umho/cm.

Temperature

Temperature is continuously monitored by on-line analyzers at intervals of no greater than five minutes, at the raw water entry point, primary disinfection point, and secondary disinfection point.

Dissolved Oxygen

Dissolved oxygen is a new corrosion control parameter in the current Approval and was included in the Annual Sampling Plan for 2020. Grab samples are collected quarterly for laboratory analysis. In 2019, dissolved oxygen was sampled in the last quarter at Town Hall with a result of 12.8 mg/L.

Orthophosphate

Orthophosphate grab samples are collected once per week from distribution samples points for in-house analysis of corrosion inhibitor residual. The corrosion control strategy uses a residual range of 0.40-0.70 mg/L as an indicator for corrosion inhibitor dosing adjustment. During seasonal water main flushing

residual is increased to aid in system recovery. Table 20 provides a monthly average of orthophosphate results for 2019.

Month	Town Hall	RPS	Bayview School
January	0.62	0.68	0.65
February	0.67	0.65	0.59
March	0.63	0.66	0.56
April	0.70	0.76	0.74
May	0.75	0.76	0.84
June	0.73	0.75	0.78
July	0.70	0.75	0.78
August	0.70	0.74	0.84
September	0.65	0.89	0.95
October	1.13	1.20	1.26
November	0.72	0.76	0.84
December	0.65	0.64	0.71

Table 20: 2019 Average orthophosphate (mg/L) results by month.

Lead

Lead samples are collected annually from distribution sample points during the warmest month of the year for laboratory analysis. Sampling requirements have changed in 2019 which is reflected in the Annual Sampling Plan for 2020. The lead samples collected in 2019 used the Health Canada 30-minute stagnation method, which is the current method for sampling, however the sample size will increase in the 2020 sampling season. In 2019, lead samples were collected from the raw water, distribution tap, Town Hall, RPS, and Bayview School. The samples were reported as <0.005 mg/L, which is compliant with the maximum allowable concentration of 0.005mg/L.

Copper

Sampling requirements changed in 2019 for copper, which is reflected in the Annual Sampling Plan for 2020. Copper samples will be collected annually from distribution sample points during the warmest month of the year for laboratory analysis. In 2019, copper was included in the annual sampling from the raw water

and distribution tap. The samples were reported as 0.003 mg/L and <0.001 mg/L, respectively, which is compliant with the maximum allowable concentration of 2.0mg/L.

Manganese

Regular manganese sampling began in the second quarter of 2019. Samples are collected from raw water, water entering the distribution system, and distribution system sample locations for laboratory analysis. Table 21 provides manganese sampling results for 2019. All samples were compliant with the maximum allowable concentration of 0.120 mg/L and all treated water samples were compliant with the aesthetic objective of 0.020 mg/L.

Month	Raw	Distribution Tap	Town Hall	RPS	Bayview School
January	<0.002	<0.002	<0.002	<0.002	<0.002
February	0.002	0.002	0.002	0.002	/
March	0.024	0.003	0.003	0.002	0.002

Table 21: 2019 Manganese (mg/L) results by month.

Treatment Backwash Monitoring Program

In accordance with the current Approval section 14. Backwash water discharged from the treatment process was discharged to the TOMB municipal wastewater collection system.

QA/QC Program

TOMB takes a variety of steps to maintain QA/QC in its water quality monitoring. Sampling is conducted in accordance with internal SOPs at consistent locations throughout the treatment process and in the distribution system. In-house laboratory analysis is completed in accordance to established analysis procedures using appropriate equipment that has regular maintenance and calibration completed. Additionally, quarterly duplicates are sent to AGAT Laboratories. On-line instrumentation is regularly maintained and calibrated in accordance with manufacturer specifications and multiple grab samples are taken throughout the treatment process to verify instrument performance. Annually, bacteriological

samples are collected and sent to both AGAT Laboratories and Southshore Regional Hospital for analysis.

Emergency / Upset Conditions

During 2019, there was one emergency/ upset condition. During hurricane Dorian, there was extended loss of power of the raw water pump station. A back-up generator was contacted on site to resolve the outage while utility power was down. A permanent back-up generator is now on site to mitigate future power loss concerns and provide reliable water production.

Operators & Certifications

In 2019, Operational Staff included a total of three certified Operators. Meghan Rafferty, Water/Wastewater Operator and ODRC, holds a Class II Water Treatment Certificate and Class II Water Distribution Certificate. Robert Dolimount, Water/Wastewater Operator, holds a Class II Water Treatment Certificate and a Class I Water Distribution Certificate. Tony Smith, Public Works Operator, holds an Operator-in-Training Certificate.

Contingency Plan & Emergency Notification Procedures

In 2019, there were no changes to the contingency plan. The emergency notification procedure was updated, and a copy was forwarded to the Department on July 25, 2019. The updated emergency notification procedure is included in Appendix C.

Source Water Protection Plan

In accordance with section 6. of the Approval, TOMB as an approved Source Water Protection Plan. The plan was reviewed by the Watershed Advisory Committee on October 07, 2019 at which time the Committee agreed that amendment was not necessary.

Residuals Summary

Type of Residual	Processing Method	Expected Annual Volume
Membrane Filter Backwash Water	Sanitary sewer	Approximately: 16, 425m ³
Chemical Clean-In-Place Waste (Filter Membranes)	Onsite chemical containment followed by disposal to sanitary sewer	Approximately: 965m ³
Empty Chemical Treatment Drums	Shipped back to supplier	Approximately: 116

Table 22: Residuals summary.

Complaints & Corrective Actions

There was a total of 10 water complaints during the reporting period. Of the 10 complaints, 6 were related to discoloured water, 2 to low pressure, 1 to smell, 1 to no water, and 1 to health-based parameter concerns.

In all cases of discoloured water, spot flushing of the area was conducted. The discolouration is the result of iron in the distribution system originating from cast iron pipes. The water treatment process includes addition of Carus 3050, a corrosion inhibitor and 58% light soda ash, a pH adjuster to minimize corrosion in the distribution system and water service piping. In all cases of low water pressure site visits were conducted by Operations Staff. One was the result of a clogged internal filter system and one was the result of a line blockage which was removed. A site visit was conducted to the residence that complained of a sulphur smell and the meter was removed to assess water quality entering home, which was clear and did not have a smell, no further action taken. In the case of no water at the residence, a site visit was conducted. It was determined that the homeowner had inadvertently frozen the service line in the basement by piling frozen wood over an uninsulated section of water line. It was thawed and the problem was remediated.

Lastly, in the case of the health-based parameter concern, the homeowner had a sample analyzed by a company that supplies in-home water treatment system and

was concerned about the manganese result of 0.12ppm he had received. The homeowner was educated on the sample protocols for the Town water system and the upcoming manganese MAC from Health Canada. Additionally, a water sample was taken from the kitchen tap and an adjacent fire hydrant to be tested for manganese, the results were 0.024mg/L and 0.008mg/L, respectively.

Table 23 lists the dates, locations, complaint types, and actions for each complaint received during the reporting period:

Date	Location	Complaint	Action
January 14	906 Main St.	No Water	Thawed line in basement
February 06	260 Main St.	Sulphur smell	Site visit
April 05	46 Fauxburg Rd.	Cloudy water	Flushed
April 18	575 Main St.	Discoloured water	Flushed
April 29	105 Fairmont St.	Concern re: manganese	Third party analysis
July 05	83 Fairmont St.	Discoloured water	Flushed
July 29	924 Main Street	Low pressure	Site visit
August 16	16 Garden Ln.	Discoloured water	Flushed
October 03	Civic Wharf	Discoloured water	Flushed
November	15 Main St.	Low pressure	Leak detection & replacement service line section

Table 23: 2019 Complaints and corrective actions.

Conclusion

During the reporting period, TOMB managed and operated the Oakland Lake pumping station, the water treatment plant, and the water distribution system in accordance with Approval No. 2008-061157-02.

Report Prepared By:

Water/Wastewater Operator

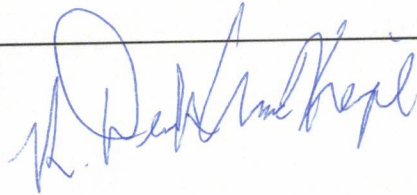
Meghan Rafferty



Report Reviewed By:

Director of Operations

Derrick MacKenzie



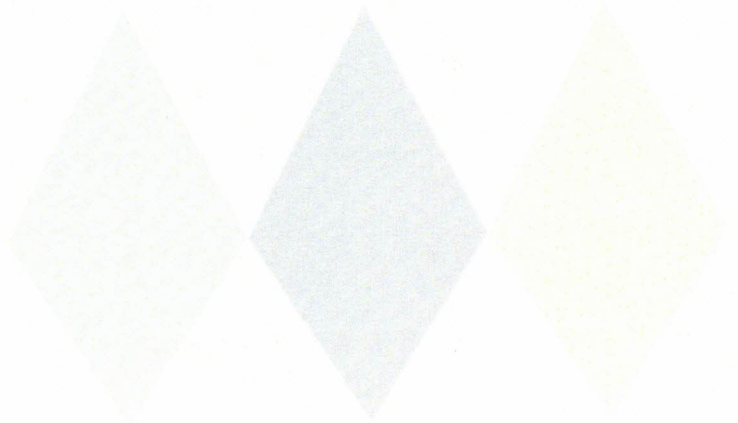
Report Reviewed By:

CAO

Dylan Heide



Appendix A
AGAT Laboratories CALA Certification



Canadian Association
for Laboratory Accreditation Inc.
Certificate of Accreditation



AGAT Laboratories
AGAT Laboratories (Calgary)
11 Morris Drive, Unit 122
Dartmouth, Nova Scotia

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



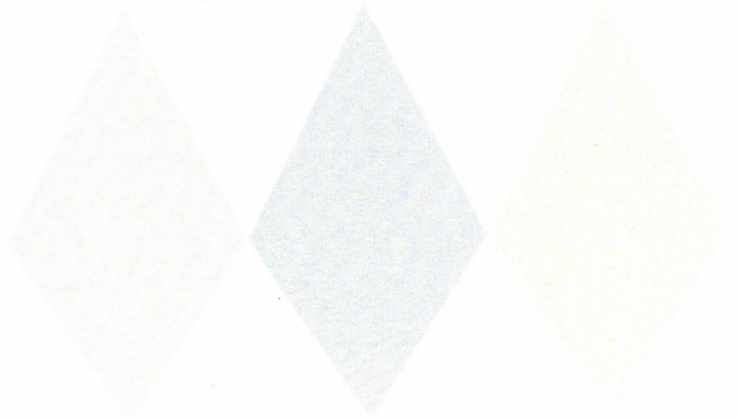
Accreditation No: A3588
Issued On: October 3, 2016
Accreditation Date: December 7, 2007
Expiry Date: April 3, 2019



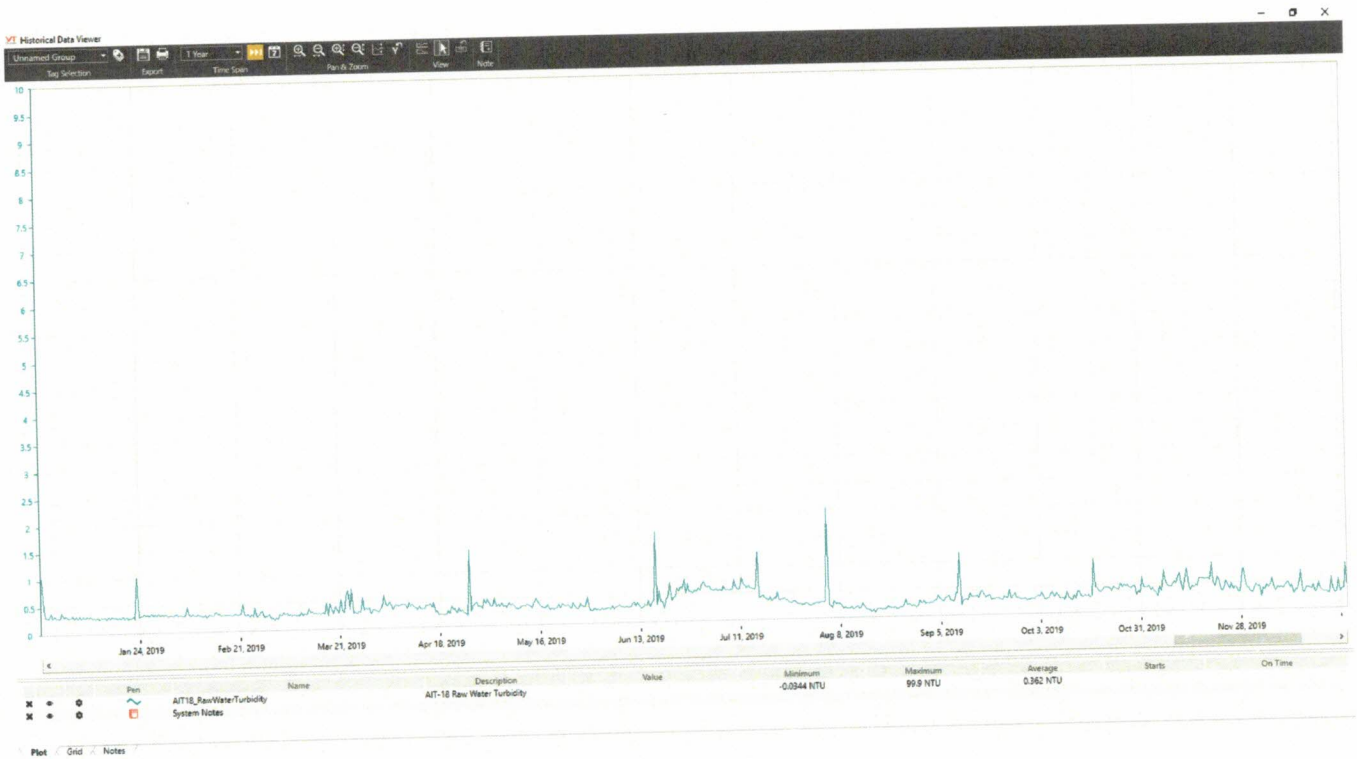

President & CEO

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request. reproduction must follow policy in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca

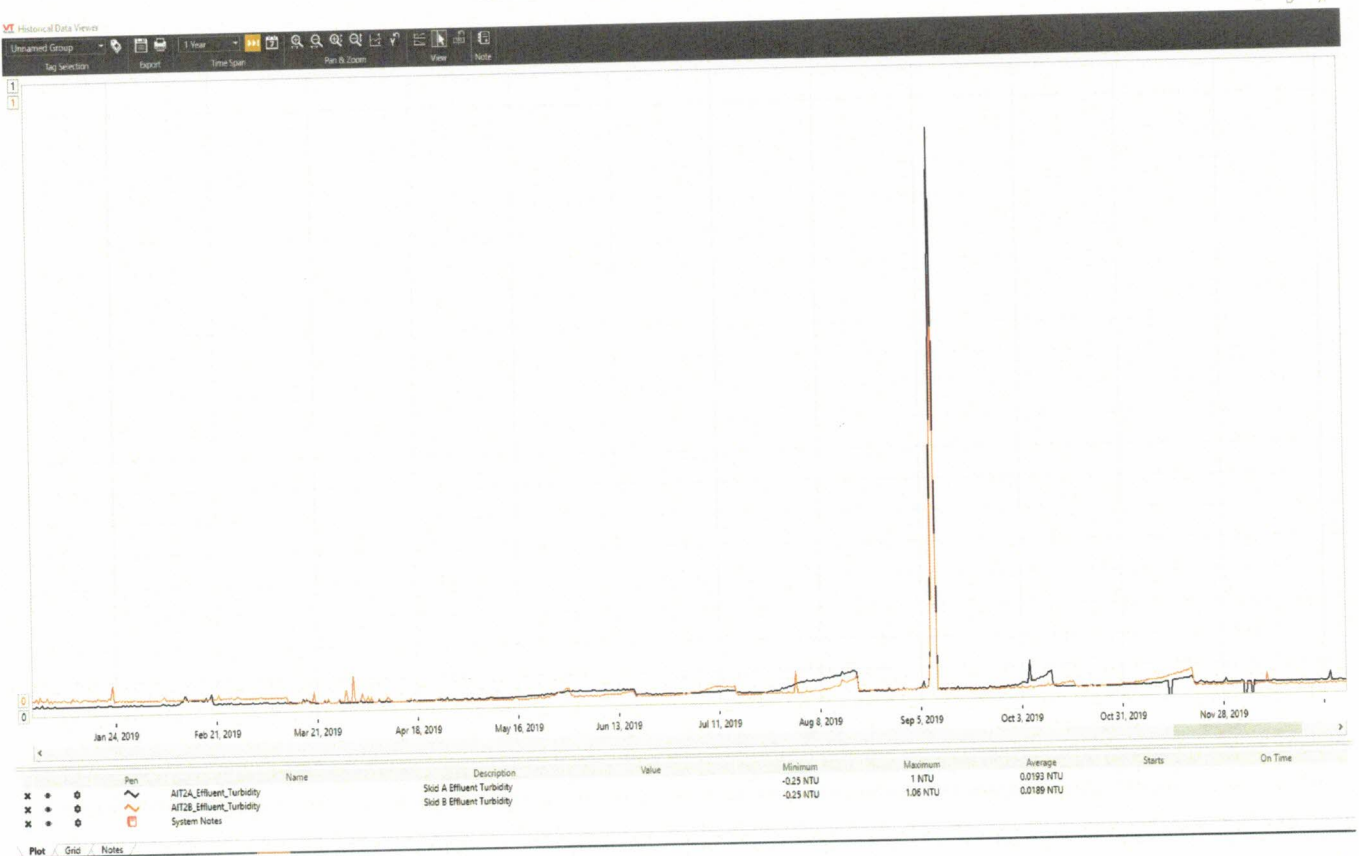
Appendix B
Annual Trendlines



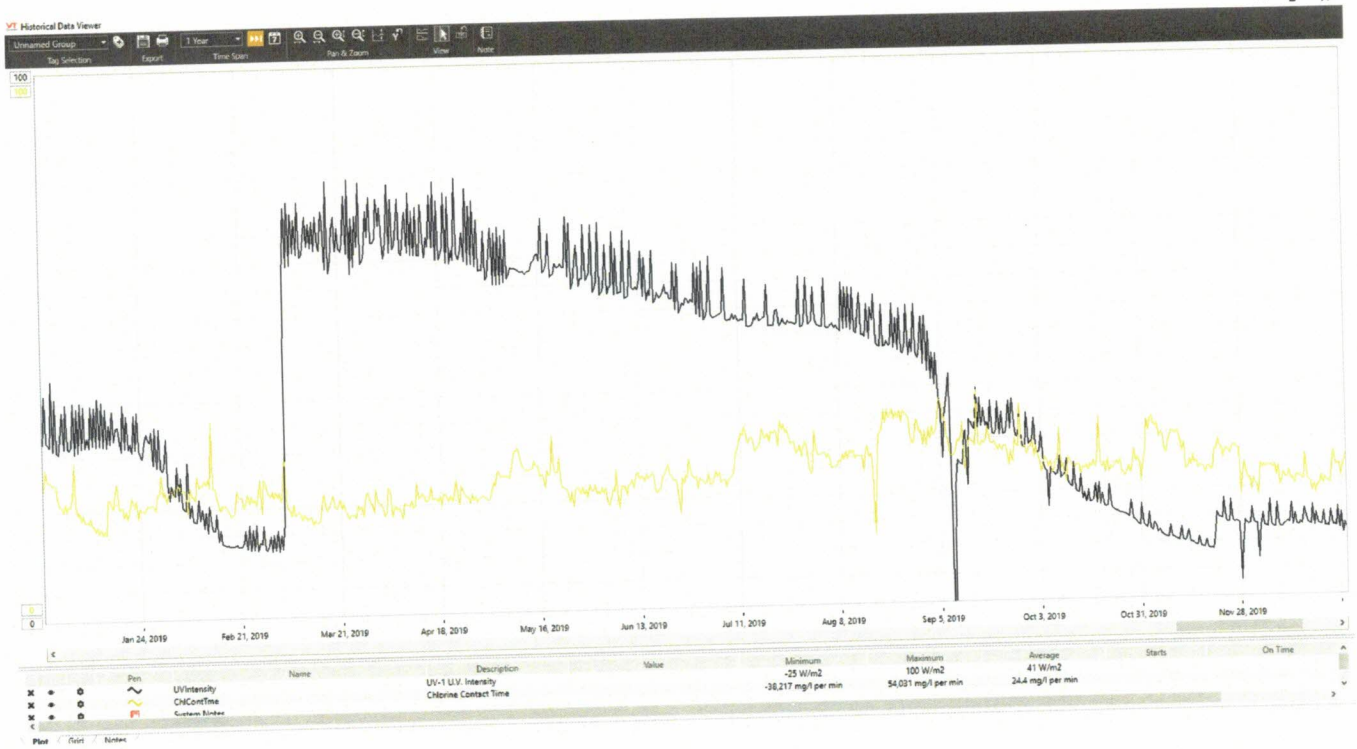
Raw Water Turbidity



Skid A & Skid B Turbidity



CT/IT



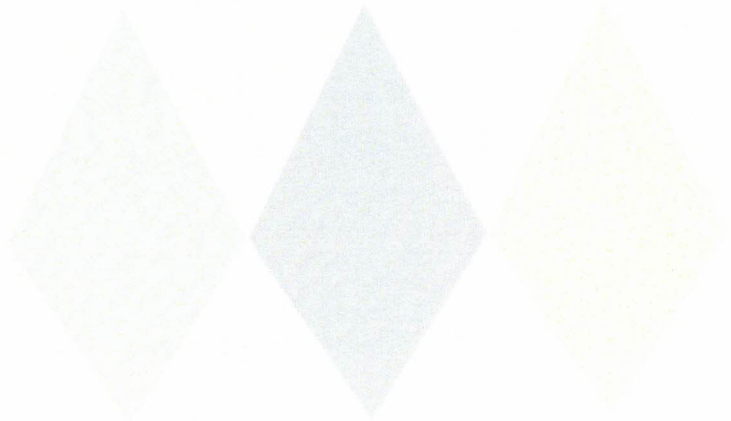
Filtrate Free Chlorine



Distribution Free Chlorine



Appendix C
Emergency Notification Procedure



Chapter 9

Emergency Notification Procedures

The Town of Mahone Bay maintains a 24-hour emergency contact schedule which details the after-hours emergency notification process within the Town's Utilities, including the Water Utility. This contact schedule is updated and distributed weekly by the Director of Operations. The schedule is emailed to staff, utilities, and the after-hours call centre and a hard copy is posted at Town Hall in the Administrative Office. Emergency situations for the Water Utility will be responded to by the on-call Operator who will assess the situation and activate the contingency plan(s) included in the Operations Manual, if necessary. Should the activation of a Contingency Plan be required, the on-call Operator will advise the Overall Direct Responsible Charge (ODRC) and the Director of Operations.

ODRC Meghan Rafferty	Director of Operations Derrick MacKenzie
Water Treatment Plant: 902.624.0613 Work Cell: 902.523.0782 Home Cell: 705.978.2918	Office: 902.624.9859 Work Cell: 902.521.0393 Home Phone: 902.624.9105

Below is an emergency contact list with a description of possible emergency events and associated Contingency Plans (CP):

What to Report	When to Report	Who to Contact	Special Considerations
Power outage Oakland Lake Pumping Station	Immediately	Nova Scotia Power <u>1.800.428.6004</u>	In the event of an extended power outage refer to CP#2
Parameters exceeding drinking water legislation	Immediately	Nova Scotia Environment Bridgewater: <u>902.543.4685</u> After-Hours: <u>902.893.6347</u>	Refer to CP#7; CP#6 & CP#8 as directed by NSE
Improper Disinfection	Immediately	Nova Scotia Environment Bridgewater: <u>902.543.4685</u> After-Hours: <u>902.893.6347</u>	Refer to CP#4 as directed by NSE
Major Water Main Break	Immediately	Nova Scotia Environment Bridgewater: <u>902.543.4685</u> After-Hours: <u>902.893.6347</u>	Refer to CP#4 as directed by NSE
Source Water Contamination	Immediately	Nova Scotia Environment Bridgewater: <u>902.543.4685</u> After-Hours: <u>902.893.6347</u> REMO Acting REMC: Chris Kennedy Cell: <u>902.212.1165</u> Office: <u>902.541.5309</u>	Refer to CP#9

SCADA Failure & PLC Programming Failure	Immediately	KRC Industrial Controls & Automation Ltd. Cell: <u>902.521.3438</u> Shop: <u>902.530.3899</u> Email: kcook@krc-controls.ca PALL Programmer: <u>607.758.1804</u>	
Emergencies Involving Dangerous Goods	Immediately	CANUTEC 24hour: <u>1.888.226.8832</u> Environmental Emergencies Reporting Centre 24hour: <u>1.800.565.1633</u>	
Vandalism / Security	Immediately	RCMP <u>911</u> Lunenburg Detachment: <u>902.624.8674</u>	
Fire Emergency	Immediately	Mahone Bay Fire Department <u>911</u> Fire Hall: <u>902.624.8437</u> Fire Chief R.Nowe: <u>902.275.8551</u> richardnowe@hotmail.com	
Medical Emergency	Immediately	Ambulance <u>911</u> Poison Centre <u>1.800.565.8161</u>	

Additional Contact Information:

- Southshore Regional Hospital: 902.543.4603
- Fisherman's Memorial Hospital: 902.634.8801
- Regional Medical Officer of Health: Annapolis Valley, South Shore & South West Nova
Dr. Jennifer Cram: 902.365.1701 ext.1513
MOH On Call After Hours/Weekends: 902.473.2222
- Mahone Bay Nursing Home: 902.624.8341
- Bayview Community School: 902.624.2120
- South Shore Housing Authority: 902.543.8200
- Alliance Dental Clinic: 902.624.8433
- Mahone Bay Medical Centre: 902.624.8373
- RPS Composites: 902.624.3002