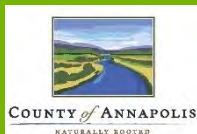



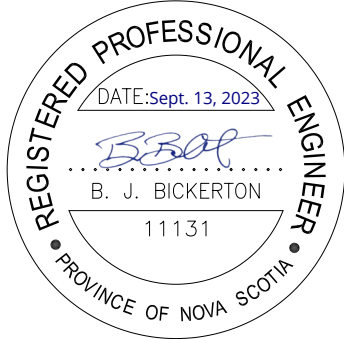


2023 Water System Assessment Report Margaretsville Water Treatment Plant

Final Report



230822.00 • September 2023

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A	DRAFT	BB	2023-06-30	ML
Issue or Revision		Reviewed By:	Date	Issued By:
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September 13th, 2023

Mr. Jim Young, P.Eng.
Director of Municipal Operations
Municipality of the County of Annapolis
752 St. George Street
Annapolis Royal, NS B0S 1A0

Dear Mr. Young:

RE: *Margaretsville 2023 Water System Assessment Report*

Please find enclosed the 2023 System Assessment Report (SAR) for the Margaretsville Water Treatment Plant (WTP) completed by CBCL Limited (CBCL) on behalf of the Municipality of the County of Annapolis (MOCA). This report includes the specific requirements of a SAR as outlined in the Nova Scotia Environment and Climate Change (NSECC) *Approval to Operate* for a WTP.

Yours very truly,

CBCL Limited

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Project No: 230822.00

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1 Project

1.1 Introduction

The objective of this System Assessment Report (SAR) is to verify that the operation, supply, and distribution of water provided by Margaretsville Water Treatment Plant (WTP) complies with the environmental standards for safe drinking water as outlined in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* (June 2022). This report follows the Terms of Reference provided by Nova Scotia Environment and Climate Change (NSECC). In addition to verifying the required performance, this report will identify any sources of concern and provide appropriate recommendations.

The overall study area includes the network of source wells, source water pond and watershed, treatment, storage and distribution infrastructure in the community of Margaretsville. The infrastructure is owned by the Municipality of the County of Annapolis (MCA) and includes:

- ▶ Medium risk GUDI wells.
- ▶ Well houses and pump stations.
- ▶ Slow sand filters.
- ▶ Transmission and distribution mains.
- ▶ Water distribution storage – (Ben Phinney Road gunite tank reservoir).

1.2 Purpose

CBCL Limited (CBCL) has been retained by MCA to complete the 2023 SAR for the Margaretsville WTP to verify that the system meets the requirements to comply with the current standards outlined by NSECC. Previous SARs for the Margaretsville system were completed in 2003 and 2013.

This report, prepared by CBCL, verifies that the Margaretsville system can achieve current environmental standards, and quantitatively verifies that the Margaretsville system can:

- ▶ Meet current environmental standards, which are frequently updated and enhanced for public health protection.
- ▶ Meet the minimum requirements set out in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*.
- ▶ Demonstrate performance with disinfection criteria.
- ▶ Demonstrate performance with turbidity criteria.

- ▶ Demonstrate that online equipment is in place and appropriately alarmed to continuously monitor chlorine residual, individual filter effluent, and all parameters related to other primary disinfectants.
- ▶ Confirm that waste streams generated by treatment facilities are adequately managed.

This report is organised into four sections as follows:

- 1 Characterization of the Water Source.
- 2 Treatment Processes, Facilities and Equipment.
- 3 Operations, Monitoring and Management.
- 4 Ability to Comply.

2 Characterization of the Water Source

This section of the SAR characterizes the source water for the Margarettsville WTP by reporting on the following:

- 1 Microbial risks.
- 2 Chemical and Physical risks.
 - a. Lead and corrosion control.
 - b. *Guidelines for Canadian Drinking Water Quality (GCDWQ)*.
 - c. *Guideline for Monitoring Public Drinking Water Supplies (GMPDWS)*.
 - d. Source Water Protection Plan (SWPP) monitoring.
- 3 Source Quantity.
- 4 SWPP.

2.1 Source Description & Schematic

Raw water for the Margarettsville WTP originates from a series of “dug wells” called the East Crock and the West Crock. Both crocks are classified as medium-risk GUDI wells according to the *Approval to Operate*.

The crocks are located to the south of the WTP on a county-owned 5.4-hectare parcel of land. Each crock is intended to draw from a shallow groundwater aquifer, reported as spring water which is intercepted by the wells as it flows to the storage pond. Based on the proximity to the storage pond, the dug wells are likely to be fed directly from the storage pond. The storage pond has an area of approximately 4,500 m² and a capacity of 8,000 m³. The quality of water drawn from the crocks has some typical characteristics of both surface and groundwater, but have been identified as GUDI wells and have the water quality concerns such as elevated turbidity and/or the presence of pathogens associated with surface water.

Two drilled wells (PW1 and PW2) are located on the property adjacent to the storage tank, though both wells have been decommissioned. The crock locations are displayed on the distribution map (Appendix C). Crock construction information can be found in Table 2.1.

Table 2.1: Summary of the Source Water Cocks

Production Crock	Parameter	Value
East Crock	UTM (Easting)	337963
	UTM (Northing)	4988984
	UTM (Zone)	20
	Well Total Depth (m)	2.4
	Casing Depth (m)	2
	Diameter (mm)	1,830
	Screen Description	Dug Well
West Crock	UTM (Easting)	337928
	UTM (Northing)	4988949
	UTM (Zone)	20
	Well Total Depth (m)	NA
	Casing Depth (m)	NA
	Diameter (mm)	NA
	Screen Description	Dug Well

The area of land surrounding the wells was designated as a Protected Water Supply under the directive of the Nova Scotia *Environment Act* in 1967. A map of the Source Water Protection Area (SWPA) is presented in Appendix B.

Under normal operating conditions, water flows under gravity from the West Crock to the slow sand filters, while the East Crock functions as a secondary/back-up source. Filtered water is chlorinated and directed to a storage tank to achieve Contact Time (CT) before flowing by gravity into the distribution system. The drilled wells were intended to serve as a back-up supply during periods of drought and/or intensive water use.

The *Approval to Operate* sampling requirements should be reviewed and updated to clarify the source is a High-Risk GUDI supply, or surface water source, to better reflect the treatment plant operations and ensure conservative treatment requirements are applied. Similarly, the Water Withdrawal approval should be reviewed to determine whether individual well flow limits are appropriate versus a single wellfield/pond supply flow regardless of the crock in use.

2.1.1 Back-up Water Supplies

The Margaretsville WTP back-up water supply is the East Crock. This crock feeds into a combined common pipe which then flows to the treatment system. There are two drilled wells onsite that were previously used as back-up supplies, though both wells have been decommissioned.

2.2 Microbial Risks

Treatment requirements for a municipal water system include the following:

- ▶ 3.0-log reduction in protozoa (e.g., *Cryptosporidium* oocysts and *Giardia* cysts).
- ▶ 4.0-log reduction in viruses.

Log reductions of microbial agents must be achieved by a combination of engineered filtration and disinfection. Disinfection must provide a minimum of 0.5-log inactivation of *Giardia*.

2.2.1 Surface Water Sources

For the purposes of this report, the two dug well crocks will be described as surface water sources, although this may not be strictly accurate. Raw water for the Margaretsville WTP originates from a series of “dug wells” which are immediately adjacent to a storage pond. These dug wells have been identified as being under the direct influence of surface water. Surface water is required to meet a minimum 3.0-log reduction for protozoa (e.g., *Cryptosporidium* oocysts and *Giardia* cysts) and a minimum of 4.0-log reduction of viruses according to the outlined requirements in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* (2022)

The WTP utilizes an engineered filtration and disinfection process consisting of slow sand filters and free chlorine to achieve the required log reductions. The *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* assigns slow sand filtration a 3.0-log removal credits for protozoa (e.g., *Cryptosporidium* oocysts and *Giardia* cysts), and 2.0-log removal credit for viruses from filtration. Remaining log reductions for *Giardia* and viruses are met using free chlorine (sodium hypochlorite). Table 2.2 provides the minimum pathogen reduction credits achieved at the Margaretsville WTP by unit process.

Table 2.2: Minimum Pathogen Reduction Credits Achieved at the Margaretsville WTP

Treatment	Protozoa		Virus	Individual Filter Turbidity Limit
	<i>Cryptosporidium</i>	<i>Giardia</i>		
Slow Sand Filtration	3.0-log	3.0-log	2.0-log	<ul style="list-style-type: none"> ▶ Shall be less than or equal to 1.0 NTU in at least 95% of the measurements made or at least 95% of the time each calendar month. ▶ Shall not exceed 3.0 NTU at any time. ▶ Filter-to-waste shall be provided to ensure filtered water, immediately after filter cleaning, is directed to a waste or recycle stream.
Chlorination		0.5-log	2.0-log	
Minimum Total Reduction	3.0-log	3.0-log	4.0-log	

2.2.1.1 Bacterial Quality

The existing *Approval to Operate* (Schedule A) does not require raw water bacteriological testing for total coliforms and *E. coli* at the WTP, and as such, no raw water quality data is available to review. As the plant treats surface water, it is assumed that colony-forming bacteria is regularly present in the source water.

2.2.1.2 Protozoa Water Quality

Schedule A within the existing *Approval to Operate* document prescribes that the minimum sampling frequency requirements to test for the presence of protozoa (*Cryptosporidium* oocysts and *Giardia* cysts) in the raw water is at the request of NSECC. To date, no raw water protozoa quality testing has been requested. The prevalence of protozoa in the source water is unknown, the plant is designed to treat medium-risk GUDI sources and as such the assumption is that protozoa may be present at any given time.

2.2.1.3 Viral Water Quality

Schedule A within the existing *Approval to Operate* document outlines that the minimum sampling frequency requirements to test for the presence of viruses in the raw water is at the request of NSECC. To date, no raw water virus testing has been requested. No information on viral water quality is available; it is assumed that viruses may be present in the source water at any given time.

2.2.2 Groundwater Sources

The drilled wells onsite are not utilized by the Margaretsville WTP, no water withdrawal approval for these sources was available. The dug wells should be treated as “High-Risk GUDI”, equivalent to surface water sources.

2.3 Chemical & Physical Risks

2.3.1 Disinfection By-Products

Trihalomethanes (THMs) and Haloacetic Acids (HAAs) are currently monitored on a quarterly basis at three different locations within the distribution system to establish the Locational Running Annual Averages (LRAAs). The sample locations are as follows:

- ▶ Site A: 100 Gordon Road.
- ▶ Site B: 303 Seaman Street.
- ▶ Site C: 2558 Highway 362.

Site A was selected to represent the central part of the distribution system. Site B and C have been chosen due to their long retention time. The number of sampling locations appears to be adequate to represent the distribution system.

2.3.1.1 Trihalomethanes

THM concentration results for 2022 are provided in Table A.3 (Appendix A). THM levels observed in the distribution system in 2022 complied with the LRAA maximum of 100 µg/L.

2.3.1.2 Haloacetic Acids

HAA5 concentration results for 2022 are provided in Table A.3 (Appendix A). HAA5 levels observed in the distribution system in 2022 complied with the LRAA maximum of 80 µg/L.

2.3.1.3 Other Disinfectant By-Products

Other Disinfection-By-Products (DBPs) listed in the NSECC Terms of Reference include Bromate, Chlorate, Chlorite, and N-Nitroso dimethylamine (NDMA). Sodium hypochlorite is used for primary and secondary disinfection. Conversations with the operator confirmed sodium hypochlorite is stored for no longer than six weeks and as such, monitoring for these other DBPs is not required.

2.3.2 Lead & Corrosion Control

2.3.2.1 Lead

MCA has established a Lead and Copper Sampling Program. The purpose of this program is to implement consistent sampling of lead in residential buildings to assess public exposure to lead, as well as to evaluate the WTP's Corrosion Control Program.

The Lead Sampling Program outlines the sample locations and provides the following sections:

- ▶ Collecting Samples for Lead and Copper.
 - Sample Protocol and Number of Samples.
 - Sample Information.
- ▶ Notification and Investigation Procedures.
- ▶ Taking Action.
- ▶ Public Information and Communication Plan.

The *GCDWQ* has set a Maximum Acceptable Concentration (MAC) of 0.005 mg/L for total lead. The minimum number of residential sample locations is determined by the current serviced population based on the serviced population size. Table 2.3 displays the ranges for the minimum number of sample locations based on the serviced population size.

Table 2.3: Minimum Number of Sample Locations

Number of People Served	Number of Sample Locations (Annual)
≤500	5
501-3,300	10
3,301-10,000	20
10,001-100,000	30
>100,000	50

As of 2022, the Margaretsville WTP serves a maximum of approximately 150 people therefore, five locations are required to comply with the Lead and Copper Sampling Program. MCA sampled five residential locations for lead, which is in compliance with the minimum number of sample locations required. All samples taken were 1L flushed samples. Residential lead was above the prescribed 5 µg/L at three of the five sites. Sample numbers, dates, and results for 2022 are presented in Table 2.4 below.

Table 2.4: Lead & Copper Sampling Locations & Results

Sample Number	Sample Date	Sample Location	Lead Results (µg/L)	Copper Results (µg/L)
1	06/28/2022	100 Seaman Street	7.38	378
2	06/28/2022	1 Seaman Street	2.90	968
3	06/28/2022	180 Seaman Street	6.37	109
4	06/28/2022	7 Lighthouse Road	8.44	29
5	06/28/2022	2768 Highway 362	2.46	1,780

MCA followed the necessary response procedures as outlined in the 2022 monitoring plan. The homeowners and NSECC were notified of the exceedance, and flushed sample re-tests for two sites were collected. The results of the re-tests are presented in Table 2.5.

Table 2.5: Re-Test Lead Results

Sample Number	Sample Date	Sample Location	Lead Results (µg/L)
6	07/27/2022	180 Seaman Street	<0.5
7	07/27/2022	7 Lighthouse Road	3.2

Results from the re-tests indicate one location is still in exceedance of the MAC of lead. This site should be contacted to address the issue follow-up sampling should be done in accordance with *Requirements for Lead and Copper Management*. Based on the current Approval to Operate requirements, Tier 1 and 2 six-hour stagnation tests should be conducted at all sites where exceedances were observed to follow the *Approval to Operate*.

The *NSECC Requirements for Lead and Copper Management* are expected to supersede the current Approval to Operate sampling requirements, which draw from the

Health Canada Guidance for Controlling Corrosion. Clarification from NSECC on lead and copper sampling requirements should be requested and an updated Approval to Operate with current sampling requirements should be provided.

2.3.2.2 Corrosion Control

The *Approval to Operate* (Schedule A) includes requirements for a Corrosion Monitoring Program, including sampling for various parameters on a quarterly basis. Sampling parameters include the following:

- ▶ pH.
- ▶ Alkalinity.
- ▶ Conductivity.
- ▶ Temperature.
- ▶ Dissolved oxygen.
- ▶ Chlorine residual.

The sampling location and frequency outlined in the *Approval to Operate* indicates that a total of three sampling sites are required (one leaving the WTP and two in the distribution system). The WTP Annual Report indicates that these parameters are not being monitored at any sampling locations in the distribution system, which is not in compliance with the *Approval to Operate*. Only one flushed lead and copper sample result is included in the 2022 Annual Report under Corrosion Control.

The *Approval to Operate* indicates that these parameters will assist MCA in determining the corrosivity of the water and the type of corrosion control system that may be needed. MCA should identify three locations within the distribution system to sample quarterly for two consecutive years. If the water is not corrosive as evidenced by sample results for key parameters in conjunction with residential lead levels, the sampling frequency can change to annually between the months of May and August upon approval from NSECC.

Operations staff confirmed that corrosion control monitoring has not previously been done in accordance with the Approval to Operate but has now been included in routine sampling for 2023. MCA should sample quarterly and test for all listed parameters as per their *Approval to Operate*. Quarterly samples must be taken for two consecutive years. After these two years, if water is deemed to be not corrosive, sampling can change to annually between the months of May and August, upon approval from NSECC.

2.3.3 Guidelines for Canadian Drinking Water Quality

All parameters prescribed in the *GCDWQ* with associated MACs, are required to be analyzed in the raw and treated water entering the distribution system once every five years. The most recent round of *GCDWQ* compliance sampling were completed on or scheduled for the following dates:

- ▶ Sample Date #1: August 2016.
- ▶ Sample Date #2: July 21, 2021.
- ▶ Sample Date #3: Scheduled July 2026.

Results from the last round of sampling, as required by NSECC, are provided in Appendix E. Previous results from 2016 testing indicated no noticeable trends were identified between the past 2 rounds of sampling. The next round of sampling will be completed in 2026 to meet the minimum requirements of one sampling event every five years.

Raw water samples were drawn at the WTP inlet, treated samples were collected from the exit of the WTP entering the distribution system. All treated samples were in compliance with the NSECC sampling requirements for the health-related parameters of the *GCDWQ* in 2021 and 2016. Corrective action was taken, and no exceedances have been reported since. No parameters of concern were above maximum acceptable concentrations in either the raw or treated set of samples in 2021. pH was above 7.0 in raw and treated water. There were no distinguishable water quality trends in the past two rounds of sampling.

MCA should ensure that both raw water and treated water are sampled for all parameters outlined in the *GCDWQ* on a five-year basis.

2.3.4 Guidelines for Monitoring Public Drinking Water Supplies

The *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* requires that municipal water utilities monitor water quality for the parameters listed in the *GMPDWS*. As per the *Approval to Operate*, raw and treated water samples are collected and tested annually at an accredited third-party lab. The last round of sampling was completed in July 2022 and the results are provided in Appendix F. pH was slightly lower than the 7.0 – 10.5 target range in both raw and treated water, all other parameters were within acceptable limits. There were no distinguishable water quality trends in the past two rounds of sampling.

As per the last round of sampling completed, the Margaretsville WTP is in compliance with the NSECC sampling requirements of the *GMPDWS*. The next round of compliance testing is scheduled to occur in summer 2023.

In 2019, Health Canada added a health-based maximum for total manganese of 120 µg/L. NSECC updated the *GMPDWS* to reflect this change and requires monitoring of total manganese in raw, treated, and distribution system samples. As per the Municipality's *Approval to Operate*, manganese is to be sampled twice per year, during the spring and fall. Samples were taken in July 2022 and were below the health based maximum.

Operations staff confirmed that manganese sampling was incorporated into routine sampling this year (2023). In past years in-house manganese testing was done on a quarterly basis, which would not be in compliance with the *Approval to Operate*

which requires samples to have confirmation by an accredited laboratory. Manganese testing for raw water samples should be taken twice per year in the spring and fall, and distribution system samples should be taken quarterly to comply with the Approval to Operate.

2.3.5 Source Water Protection Plan for Monitoring

According to the 2022/2023 annual monitoring plan, the SWPP has not identified additional water quality parameters of concern that require monitoring. The Margarettsville Source Water Protection Plan has outlined the recommended monitoring plan and possible sources of contaminants as point sources and non-point sources. A list of the parameters, sample locations, and the associated sampling schedule is provided in Table 2.6.

Table 2.6 Margarettsville Monitoring Stations & Sampling Schedule

Parameter	Locations		
	PW-2 and Southwest / East Crook Wells Water	Water Supply Reservoir	Raw water before treatment
Turbidity	Quarterly	Quarterly	Daily*
Conductivity	Quarterly	Quarterly	Annual**
pH	Quarterly	Quarterly	Daily*
Total Coliform and <i>E. coli</i>	Annual	Annual	Annual
Pathogens/Viruses	Annual	Annual	Annual
Nitrate	Annual	Annual	Annual**
Orthophosphate	Annual	Annual	Annual
Sodium	Annual	Annual	Annual
Chloride	Annual	Annual	Annual
Total Dissolved Solids (TDS)	Annual	Annual	Annual**
Pesticides/Herbicides	Annual	Annual	Annual
Polychlorinated Biphenyls (PCBs)	Annual	Annual	Annual
Lead	Annual	Annual	Annual**
Volatile Organic Compounds (VOCs)	Annual	Annual	Annual
Total Petroleum Hydrocarbons	Annual	Annual	Annual
Total Organic Carbon	Annual	Annual	Annual**

*Requirement of the utility's approval to operate

**Requirement of the Guidelines for Monitoring Public Drinking Water Supplies (GMPDWS)

The sampling protocols for the active watersheds provides sufficient data and information needed to constantly evaluate the effectiveness of the SWPP. The sampling network provides a strong early warning system for potential contamination or changes in source water quality.

Currently this monitoring plan is not fully implemented; the Annual Sampling Plan and SWPP monitoring requirements should be reconciled, and MCA should conduct sampling accordingly.

2.3.6 Cyanobacteria

A monitoring and protection program against the risk of cyanobacteria is not required as per the *Approval to Operate*.

Algae blooms could occur at multiple locations in the source water area or on the slow sand filters themselves, which are located outdoors and are uncovered. Monitoring of both the storage pond and the slow sand filters should be visually inspected weekly by operations staff between the months of May to October in accordance with typical monitoring requirements for surface water sources in the province. If algal blooms are suspected, response triggers for cyanotoxin testing (microcystin-LR) should be conducted. The Approval to Operate should be updated to include these monitoring requirements; otherwise, the Municipality should conduct this monitoring proactively.

2.4 Filter Backwash Water

There is no backwash process used for Margaretsville's slow sand filtration. Upkeep on the filters is completed by draining a single filter then raking and removing the top layer of sludge that has formed. The sludge does not contain additives or treatment products. This process has proven effective and water quality remains consistent.

2.5 Source Quantity

Water withdrawal permits are issued by NSECC in order to document the allowable withdrawals from the source water. The *Approval for Operation - Water Withdrawal* number for the WTP is 2014-090989-01 with an expiry date of July 1, 2025. The document is attached in Appendix H.

The *Approval for Operation - Water Withdrawal* authorizes the following withdrawal rates:

- ▶ Average rate of withdrawal: 105,000 litres per day (LPD) (averaged over 30 days).
- ▶ Maximum rate of withdrawal: 160,000 LPD.

Raw water flow data for 2022 is provided in Table A.6 (Appendix A) and is presented below in Figure 2.1. A copy of the *Approval for Operation - Water Withdrawal* is provided in Appendix H. The average daily rate of withdrawal of the WTP in 2022 was 66 m³/d, with a maximum rate of withdrawal of 181.5 m³/d occurring in October. In 2022, the WTP used 63.1% of its allotted average yearly withdrawal rate. The maximum use exceeded the raw water withdrawal limits in 2022 during October. This event was due to the filtered water recirculating since one sand filter was turned off for cleaning. This flow is not representative of actual withdrawal and, therefore, no follow up action was needed.

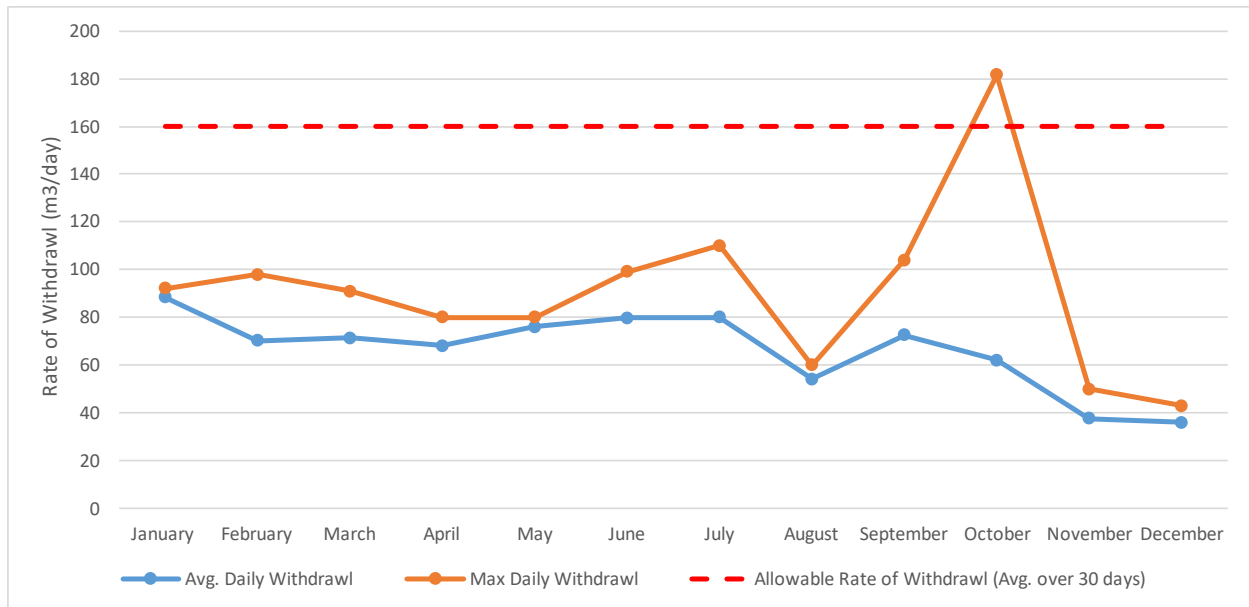


Figure 2.1: 2022 Withdrawal Data by Month

The Municipality has not reported the individual crock flow in its annual reports, however, this is required to comply with the current approval requirements. There is no flow monitoring directly from the source water; flow monitoring is only located on the slow sand filter outlet.

The Approval to Operate should be reviewed and updated to better represent the system as a surface-water sourced system instead of a GUDI well fed system. At minimum a flowmeter should be installed at the inlet to the slow sand filters (from combined crocks). Individual crock flowmeters could be installed if deemed necessary and in accordance with the Approval requirements.

2.5.1 Demand Growth

According to the 2022/2023 sampling plan, the WTP serves approximately 150 residents. Given the current population for the community and the average production rate of the WTP versus capacity and allowable withdrawal, demand growth is expected to be met by the current drinking water system for the foreseeable future.

2.6 Source Water Protection Plan

The Municipality has established a SWPP in compliance with the *Approval to Operate*. Appendix B identifies the source water protection zones. Additionally, a GIS file showing these water protection zones is to be provided digitally separate from this report. The SWPP was last updated in 2015.

The objective of the SWPP is to protect the Margaretsville source water supply area for the WTP, whilst considering relevant social and economic factors within the area.

The original SWPP was adopted in 2015. The Source Water Protection Advisory Committee (SWPAC) recognizes the protection of source water is the first step in the approach to clean and safe drinking water. Water is drawn from two medium-risk GUDI wells. The source water area is a combination of Municipality owned land and private properties which are used for a variety of residential, commercial, agricultural, and industrial activities. Outlined within the SWPP are the identified potential contamination sources and risk management recommendations to mitigate and prevent potential source water contamination.

Potential source water contaminants identified in the SWPP are as follows:

- ▶ Heating oil tanks.
- ▶ Road salts.
- ▶ Commercial fuel spills.
- ▶ Septic systems.
- ▶ Storm water collection.
- ▶ Chemical storage.
- ▶ Fertilizers/manure.
- ▶ Nova Scotia Power Incorporated (NSPI) infrastructure.
- ▶ Herbicides/pesticides.
- ▶ Forest and structural fires.

The six primary management strategies adopted in the SWPP are described below:

- 1 **Acquisition of Land** - Typically the most expensive option, but also the most effective, as it provides direct control over the land usage and development.
- 2 **Best Management Practices (BMPs)** - Methodologies used by residents and industry to define practical and effective means of protecting source water areas.
- 3 **By-Laws** - By-laws are enacted under Municipal Planning Strategies and allow the Municipality to restrict land usage and activities in sensitive areas.
- 4 **Contingency Planning** - Not all risks to a protected water area can be mitigated. Contingency planning defines emergency response protocols, in case of a dangerous contamination occurrence within the SWPA.
- 5 **Designation** - Regulations enacted under the Nova Scotia Environment Act, Section 106. The SWPA can be formally designated as a Protected Water Area under this legislation. Regulations can be drafted that would enable the Municipality to define allowable activities within the protected area.
- 6 **Education and Stewardship** - Educating people and communities on the importance of source water protection creates a sense of ownership and shared responsibility of the water resource and the need for its protection.

MCA indicated that an active SWPAC meeting has not been held for an extended period of time. As such, the meeting minutes from the previous two SWPAC meetings are not available to append to this report. The date of the next SWPAC meeting has not been scheduled.

As part of the *Approval to Operate*, MCA must review and update the SWPP on an annual basis.

2.7 Conclusion & Recommendations

The objective of this section was to provide a detailed characterization of the source water through a review of available information. Specifically, the focus was on assessing the WTP's approach and ability to protect against pathogenic organisms, effectiveness of DBP monitoring, lead and corrosion control/monitoring, assessment of *GCDWQ* and *GMPDWS* parameters, filter backwash discharge, source quantity, and the SWPP.

2.7.1 Treatment Requirements to Protect Against Pathogenic Organisms

The WTP draws water from a high-risk GUDI / surface water supply. As per the *Nova Scotia Treatment Standards for Municipal Drinking Systems*, high-risk GUDI groundwater sources require 3.0-log reduction for protozoa and 4.0-log reduction for viruses.

Using engineered filtration and disinfection with sodium hypochlorite, the WTP meets the treatment requirements to protect against *Giardia*, *Cryptosporidium*, and viruses.

2.7.2 GUDI Classification

All production wells are classified as medium risk-GUDI.

The *Approval to Operate* reflects requirements for high-risk GUDI, which appears to be an appropriate classification. The Municipality is treating the supply as high-risk and not conducting MPA sampling every two years. The GUDI status should be reviewed and updated accordingly.

2.7.3 Disinfection By-Products

The Municipality monitors THMs and HAA5 at three different locations throughout the distribution system, which are at the centre of the distribution system (Site C), and at the distal ends of the system (Site A and B). THM and HAA5 levels observed in the distribution system comply with the LRAA maximum of 100 µg/L and 80 µg/L, respectively.

2.7.4 Lead & Corrosion Control

The WTP does not adequately monitor lead concentrations or corrosion control parameters in the distribution system. In 2022, five locations were sampled, and three locations were above the MAC of 0.005 mg/L.

MCA should ensure that responses to residential lead exceedances are in accordance with the Lead Sampling Program requirements. The Municipality should perform six-

hour stagnation tests on residences where flushed lead samples were in exceedance. The current requirements for lead, copper and corrosion sampling should be clarified by NSE and the approval documents updated to match.

The Corrosion Control Program (sampling) is not currently implemented. MCA should sample quarterly and test for all listed parameters as per their *Approval to Operate*. Quarterly samples must be taken for two consecutive years. After these two years, if water is deemed to be not corrosive, sampling can change to annually between the months of May and August, upon approval from NSECC.

2.7.5 Guidelines for Canadian Drinking Water Quality

The WTP samples for GCDWQ parameters every five years. The last round of sampling results indicate that all treated samples are in compliance with the NSECC and GCDWQ sampling requirements. The next round of sampling is scheduled for summer 2026 to meet the minimum requirements of one sampling event every five years.

2.7.6 Guidelines for Monitoring Public Drinking Water Supplies

As per the *Approval to Operate*, the GMPDWS samples are collected and tested annually. The last round of sampling was completed in July 2022 and the next round of compliance testing is scheduled to occur in summer 2023, in compliance with the GMPWS. All parameters tested in 2022 were within acceptable limits with the exception of pH, which was marginally lower than the target pH range of 7.0 – 10.5 in raw and treated samples.

In 2019, Health Canada added a health-based maximum for total manganese of 120 µg/L. NSECC updated the GMPDWS to reflect this change and requires monitoring of total manganese in raw, treated, and distribution system samples.

Manganese testing for raw water samples should be taken twice per year in the spring and fall, and distribution system samples should be taken quarterly to comply with the Approval to Operate.

2.7.7 Source Water Protection Plan Monitoring

The current SWPP includes a monitoring program. The sampling protocols provides sufficient data and information needed to constantly evaluate the effectiveness of the SWPP. The monitoring plan provides MCA with a strong warning system for potential contamination or changes in source water quality.

Currently this monitoring program is not fully implemented; the Annual Sampling Plan and SWPP monitoring requirements should be reconciled, and MCA should conduct sampling accordingly.

2.7.8 Filter Backwash Water Discharge

The Municipality does not use filter backwash.

2.7.9 Source Quantity

The WTP used 63.1% of its allotted average yearly withdrawal rate in 2022. The exceedance that was recorded in October 2022 was due to maintenance and was not representative of actual plant flow. Therefore, the WTP is in compliance with its withdrawal limits in 2022.

2.7.10 Source Water Protection Plan

Appendix B identifies the boundaries of the Margarettsville protected water area. The Water Protection Zone Mapping in GIS Format to be provided separately. The last two SWPAC meetings were not included as they have not been held for an extended length of time.

As part of the *Approval to Operate*, MCA must review and update the SWPP on an annual basis.

3 Treatment Processes, Facilities, & Equipment

3.1 Treatment Process

The Municipality owns and operates the WTP and associated works at 1557 Ben Phinney Road, Margaretsville, Annapolis County, Nova Scotia. The *Approval to Operate* classifies the system as a Class II Water Treatment Facility and a Class I Water Distribution Facility. The *Approval to Operate* is attached in Appendix G, and the details are as follows:

- ▶ Approval Holder: Municipality of the County of Annapolis.
- ▶ Approval No: 2004-038542-02.
- ▶ Expiry Date: June 1, 2029.

3.1.1 Treatment Process Schematic

The WTP consists of the slow sand filtration and chlorine disinfection. A schematic of the treatment process is presented in Figure 3.1 and in Appendix K.

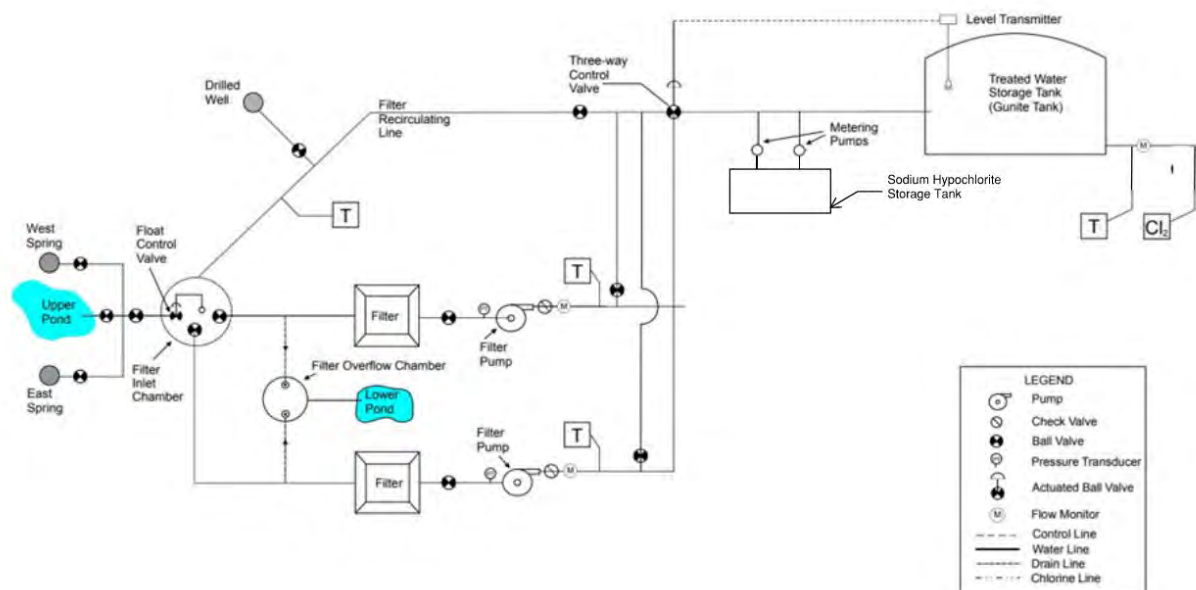


Figure 3.1: Schematic of Margaretsville WTP

3.1.1.1 Filtration (Slow Sand Filters)

Raw water flows by gravity from the crocks to a splitting chamber, located between the two sand filters. The level in the splitting chamber is equal to the level of the sand filters, which are directly connected hydraulically. Flow into the chamber is controlled by a float valve, which closes when the chamber (and hence the active slow sand filters) reaches the intended maximum filter operating level. The design allows for automatic replenishment of the slow sand filters from the source without the need for pumping or electric/pneumatic control valves.

Each slow sand filtration reservoir has an area of 125 m² and is capable of processing 130 m³ of water per day. The filtration system is designed to allow each filter to individually meet the daily maximum demand. Original design drawings (“Issued for Approval” revision) indicate that Filter 1 was to be enclosed in a fabric building while Filter 2 is left outdoors; this building was not constructed and both filters are located outside, uncovered. More recent drawings/record drawings for the system were not available for review.

Each slow sand filter has a filter underdrain collection piping system which is routed from the slow sand filters to the main WTP building. The filtrate from each filter is pumped to a common header which then passes through an automatic three-way valve. The valve directs filtered water either to the chlorination point and storage reservoir (when the reservoir level calls for water) or directs the water back to the slow sand filter inlet chamber. The two filter pumps operate 24/7; the three-way valve operates based on level in the storage reservoir to refill the reservoir and meet demand from the community.

3.1.2 Turbidity Levels & Associated Criteria

3.1.2.1 Surface Water

The *Nova Scotia Treatment Standards for Municipal Drinking Water Systems* outlines the prescribed filter turbidity levels for slow sand filtration systems. The individual filter turbidity limits are as follows:

- ▶ Shall be less than or equal to 1.0 NTU in at least 95% of the measurements made or at least 95% of the time each calendar month.
- ▶ Shall not exceed 3.0 NTU at any time.
- ▶ Filter-to-waste shall be provided to ensure filtered water, immediately after filter cleaning, is directed to a waste or recycle stream.

Verification of filters 1 and 2 to continuously achieve the minimum 3.0-log removal credits for protozoa and 2.0 log removal credits for viruses was evaluated using Option 2 as outlined in the *NSECC Terms of Reference for Municipal Drinking Water Systems*.

The Margaretsville WTP utilizes SCADA to provide individual filter effluent turbidity data. Figure 3.2 illustrates the 2022 turbidity level breakdown for filters 1 and 2.

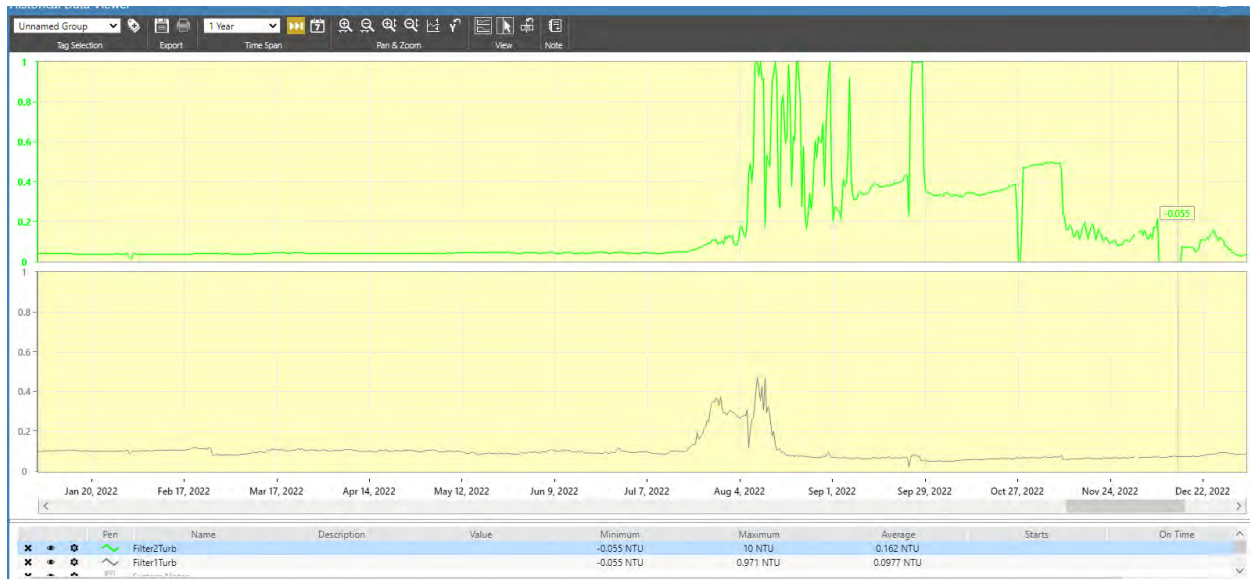


Figure 3.2: 2022 Turbidity Levels for Filters 1 & 2

The data presented above demonstrates the ability for both filter units to produce filtered water with turbidity less than or equal to 1.0 NTU in at least 95% of the measurements made. The exceedances for filter 2 were due to the filter being taken offline and cleaned throughout August and September. As the filters were not put back online until mid November 2022, these exceedances are not representative of actual filter effluent. Since no water exceeding 1.0 NTU was discharged to the distribution system from filter 2, no corrective action was taken. As such, the Margaretsville WTP meets all the requirements to receive the removal credits as per *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*.

3.1.2.2 GUDI Wells

The primary water source for the system are two dug wells; these are currently classified in some documentation as medium-risk GUDI, but for the purposes of this report are being treated as high-risk GUDI/surface water supplies, as described earlier in this report.

3.1.2.3 Non-GUDI Wells

This section is not applicable for this system.

3.1.2.4 Review of the Standard Operating Procedure for Filtration Process

The most recent revision of the operations manual for the Margaretsville WTP was issued in 2020. This revision outlines procedures on filter repair and cleaning. There is no operational documentation outlining how to operate the filters on a day-to-day basis. Through the SCADA system, the plant operators have the ability to establish filter set point

alarms and critical shut-down parameters. Currently the system sends out an alarm to the operators if either filter effluent turbidity exceeds 1.0 NTU for duration of ten minutes.

A Standard Operating Procedure (SOP) for the filtration process should be created which outlines the procedures to properly operate the slow sand filters and the various regulatory requirements that need to be met to keep the WTP operational. This should also include the necessary procedures for turbidity exceeding 1.0 and 3.0 NTU in the filter effluent, and clear procedures for notification, plant shut-down, and bringing the WTP online after a process upset in the WTP filter effluent.

3.1.2.5 Inspection of Turbidity Meters

Online monitoring of filter effluent turbidity is conducted using a HACH 1720E series turbidimeter. These meters meet and exceed the *USEPA Method 180.1* rules for measuring turbidity for drinking water compliance. The analysis method is based upon the comparison of light scattering by the sample under defined conditions with the intensity of light scattered by a standard reference suspension. These units are capable of measuring turbidity levels with an accuracy of $\pm 2\%$ of the reading or ± 0.02 NTU (whichever is greater) from 0 to 40 NTU.

The Municipality's Operations and Maintenance Manual does not include a detailed quality assurance and calibration program. Turbidimeters are cleaned and inspected on a weekly basis by operators and are calibrated as needed.

MCA should update the Quality Assurance/Quality Control (QA/QC) Standard Operating Procedure (SOP) to better reflect the operation, maintenance, and calibration of the online monitoring equipment. The updated SOP should include sections on equipment start-up, calibration, maintenance, and troubleshooting.

3.1.3 Membrane Filtration

This section is not applicable for this system.

3.1.4 Primary Disinfection

Under the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*, treatment processes using medium-risk GUDI groundwater as their source water are required to have the ability to achieve:

- ▶ 3.0-log reduction for *Giardia* and *Cryptosporidium*.
- ▶ 4.0-log reduction for viruses.
- ▶ A minimum of 0.5-log inactivation for *Giardia* with primary disinfection (chlorine) when used in conjunction with filtration.

Slow sand filtration systems are able to receive a 3.0-log removal credit for protozoa (*Cryptosporidium* oocysts and *Giardia* cysts), based on obtaining the individual filter turbidity limits described in the *Nova Scotia Treatment Standards for Municipal Drinking Water*

Systems . As a result, the WTP is required to provide a 2.0-log inactivation of viruses and a 0.5-log inactivation for *Giardia* using disinfection. Sodium hypochlorite is used to achieve primary chemical disinfection in the storage chamber until the CT control point at the outlet of the plant. A schematic of the primary disinfection system is provided in Appendix K.

3.1.4.1 Chemical Disinfection (CT Concept)

CT calculations are based on various operational, treatment, and system design parameters. Operational parameters including maximum flowrate, chlorine dosing rate, and contact volume will affect the time that primary disinfection occurs and the efficiency of disinfection. Furthermore, environmental conditions such as pH and temperature affect the efficiency of disinfection and are included in CT calculations. Calculations reflect the worst-case scenario to ensure that adequate disinfection will always occur in a given water disinfection system.

Primary disinfection occurs in the reservoir at the WTP, with the CT control point located downstream of the tank. The reservoir is designed to hold a maximum volume of 1,023 m³ and is considered to have the minimum baffling condition as it includes a single unbaffled inlet and outlet.

All design parameters used to calculate the CT ratio for the WTP are listed below in Table 3.1 and Table 3.2.

Table 3.1: CT Design Parameters (Margaretsville WTP)

CT Design Parameters	Values
Maximum Flow (m ³ /day)	181 m ³ /day
Minimum Water Level in the Tank	20%
Maximum pH	8.0
Minimum Temperature (°C)	0.5°C
Minimum Free Chlorine Residual (mg/L)	0.3 mg/L

Table 3.2: Contact Chamber Design Parameters for CT Calculations

CT Design Parameters	Values
Volume (m ³)	1,023 m ³
Baffling Factor	0.1

$$Contact\ time\ (min) = \frac{Volume\ (m^3) \times Peak\ volume\ percent}{Max\ Flow\ (\frac{m^3}{day})} = \frac{(1023\ m^3) \times (0.2)}{181\ \frac{m^3}{day}} = 1,628\ min$$

$$CT_{actual}\ (mg \cdot min/L) = Chlorine\ Residual\ (\frac{mg}{L}) * Contact\ Time\ (min) * Baffling\ Factor$$

$$CT_{actual} (mg * min/L) = 0.3 \frac{mg}{L} * 1,628 min * 0.1 = 48.8 mg * min/L$$

$$CT_{req} = 46 mg * min/L \text{ (for 0.5-log Giardia at Temp = 0.5 °C, pH = 8.0, Free Chlorine = < 0.4 mg/L)}$$

$$\frac{CT_{actual}}{CT_{req}} = \frac{48.8 mg * min/L}{46 mg * min/L} = 1.06$$

The CT calculation above for the 0.5-log inactivation of *Giardia* confirms that the Margaretsville WTP is meeting the minimum CT required. This is the case as the ratio of $CT_{actual}/CT_{required}$ is greater than one and confirms proper disinfection. As none of the CT design parameters above were exceeded in 2022, the WTP was in compliance with primary disinfection requirements outlined in the *Nova Scotia Treatment Standards for Municipal Drinking Water Systems*.

3.1.4.2 UV Disinfection (IT Concept)

This section is not applicable for this system.

3.1.4.3 Redundancy, Monitoring, & Alerting

Online monitoring of chlorine residual is accomplished using a HACH CL17 chlorine analysers that continuously collect primary disinfection residual readings and transmit the data to the SCADA system for monitoring and alarming, as required. Control limits are set in the SCADA system to alarm and notify operators of any issues with primary disinfection. Warning alarms are set at a chlorine residual 0.7 mg/L to provide warning that chloride residuals are falling.

A HACH CL17 Chlorine Analyzer (online) and a HACH DR2000 spectrophotometer (benchtop) are used to measure chlorine residual leaving the WTP. The model uses colorimetric Diethyl-P-Phenylene Diamine (DPD) chemistry to monitor water continuously for free or total residual chlorine. This unit accuracy is $\pm 5\%$ or ± 0.03 mg/L (ppm), whichever is greater. The device is in good working order and monthly, bi-annual, and annual maintenance is conducted according to the manufacturer's specification.

3.1.4.4 Standing Operating Procedures

The WTP doesn't have a formal SOP for the disinfection process. A general SOP outlines the requirements for disinfection to meet chlorine residual limits throughout the distribution system.

MCA should update the current disinfection SOP to formally outlines operational setpoints, worst case scenario CT values, response procedures, and operation/maintenance of the disinfection equipment.

3.1.5 Secondary Disinfection

Secondary disinfection is achieved by maintaining a minimum free chlorine residual of 0.2 mg/L at all points within the distribution system. Grab samples are collected weekly at three designated sample locations, and online monitors continuously record free chlorine residual levels leaving the WTP. All monitoring equipment is maintained and calibrated as required. The chlorine dose for primary disinfection is driven by the dose required to maintain adequate disinfection residual throughout the distribution system. Residuals throughout the distribution system are typically higher than 0.7 mg/L.

3.1.6 Other Critical Processes

No other critical processes.

3.1.7 Waste Streams

3.1.7.1 Filter-to-Waste

The slow sand filters are equipped with a filter-to-waste feature, which is intended to be used only in very infrequent scenarios when the filter media is replaced or scraping is completed, at the discretion of the operator. The filter does not need to be filtered to waste, even after these events; piping at the WTP allows 100% of the filter effluent to be redirected to the filter inlet splitter chamber. Filtered water under all scenarios does not contain chlorine residual or other treatment chemicals (i.e. coagulant) found in conventional water treatment plants. If filter-to-waste feature is used, it is intended to be directed into a pond adjacent to the WTP and slow sand filters.

3.1.7.2 Filter Backwash Water - Discharging into a Freshwater Watercourse

This section is not applicable for this system.

3.1.7.3 Filter Backwash Water - Discharge to Land or Soil

This section is not applicable for this system.

3.1.7.4 Filter Backwash Water – Discharge to a Marine or Brackish Environment

This section is not applicable for this system.

3.1.7.5 Other Waste Streams

The WTP does not have any other waste streams.

3.2 Distribution Water Quality

Distribution system water quality samples are collected from the locations listed below in Table 3.3. The map of the distribution system can be found in Appendix C.

Table 3.3: Margaretsville WTP Distribution Sampling Sites

Site	Location
Site A	303 Seamen Street
Site B	100 Gordon Road
Site C	2558 Highway 362

3.2.1 Chlorine Residual Levels

To satisfy the requirements of the *Approval to Operate*, operators utilize a bench-scale test method to collect grab samples for free chlorine from Site A and C as identified on the Water Distribution Map, presented in Appendix C, on a weekly basis. All data for 2022 from both locations showed levels greater than 0.7 mg/L. Site B was tested for chlorine residual from April through October.

The water storage tank has continuous chlorine residual monitoring which measures the chlorine residual levels leaving the tank. Values are reported in the SCADA software package which initiates alarms if the level drop below 0.7 mg/L. In 2022, chlorine residual at the outlet of the water storage tank never fell below 1.0 mg/L. The existing system is in good condition and meets all the requirements outlined in the *Approval to Operate*.

3.2.2 Microbial Water Quality

Schedule A in the *Approval to Operate* requires grab samples to be collected on a weekly basis to monitor for total coliforms and *E. coli*. These samples were taken at locations A and C in the distribution system.

Two samples are collected in the water distribution on a weekly basis, to meet the minimum sampling frequency set out in the *Approval to Operate*. All test results in 2022 showed absent for the presence of *E. coli* and total coliforms. The number of samples exceeds the minimum number of samples required for a population of 150 residents. The sampling locations represent the center and the distal end of the distribution system. As a result, the distribution system microbial water quality for the WTP is within compliance.

3.2.3 Turbidity

The distribution system is monitored for turbidity on a weekly basis at Sites A and C. Site B was tested for turbidity from April through October. Schedule A in the *Approval to Operate* requires samples to be collected on a weekly basis to monitor for distribution turbidity to ensure values are maintained below 5.0 NTU. All turbidity samples collected in 2022 were within compliance.

3.2.4 Cross Connection Control Program

The Municipality has developed a Cross Connection Control Program to comply with NSECC requirements. The program requires all multi residential units (greater than four units), industrial, commercial, and institutional buildings to install a Backflow Prevention Device (BFD) on their water service lateral. The devices are installed to provide premises isolation at the entrance to the building for new sprinkler services, and on the customer's side of the water meter for domestic services.

Currently the plan does not meet the minimum requirements outlined in *A Guide to Assist Nova Scotia Municipal Water Works Develop a Cross Connection Control Program*. **MCA should update the cross-connection control program to include a detailed project scope, budget, authority, and timelines.**

3.2.5 Other Distribution System Monitoring Programs

MCA conducts the following distribution system monitoring:

- ▶ Annual flushing program with inspection of hydrants and system gate valves.
- ▶ Ongoing leak detection program in development, includes both flow monitoring and correlation and acoustic leak detection equipment.

There is currently no formal reservoir inspection program in place at the Margaretsville reservoir. It is recommended that a program be established to conduct interior inspection in the reservoir on a regular basis.

3.3 On-Site Inspection

An on-site inspection was conducted on May 19, 2023 by Ben Bickerton, M.A.Sc., P.Eng. and Meghan Lea, M.A.Sc., EIT. There were obvious no concerns identified at this time other than those identified elsewhere in this report.

3.4 Conclusion & Recommendations

3.4.1 Filtration

All filters appear to be performing to acceptable standards and filter effluent turbidity was less than or equal to 1.0 NTU in at least 95% of the measurements for water directed to distribution in 2022.

A Standard Operating Procedure (SOP) for the filtration process should be created which outlines the procedures to properly operate the slow sand filters and the various regulatory requirements that need to be met to keep the WTP operational. This should also include the necessary procedures for turbidity exceeding 1.0 and 3.0

NTU in the filter effluent, and clear procedures for notification, plant shut-down, and bringing the WTP online after a process upset in the WTP filter effluent.

3.4.2 Primary Disinfection

The WTP uses sodium hypochlorite as primary disinfection. Calculations for CT confirm that primary disinfection adequately attains a 0.5-log reduction of Giardia at the CT control point (outlet of the storage tank) prior to reaching the first service in the distribution system.

MCA should update the current disinfection SOP to formally outlines operational setpoints, worst case scenario CT values, response procedures, and operation & maintenance of the disinfection equipment.

3.4.3 Secondary Disinfection

Secondary disinfection is achieved by maintaining a minimum free chlorine residual of 0.2 mg/L at all points within the distribution system. Grab samples are collected weekly at designated sample locations in the distribution system. Online analyzers continuously monitor free chlorine residual levels leaving the water storage structure.

3.4.4 Other Critical Processes

The treatment process at the WTP appears to be in good working order. There are no other critical processes in this system.

3.4.5 Waste Streams

3.4.5.1 Filter-to-Waste

This section is not applicable for this system.

3.4.5.2 Filter Backwash Water

This section is not applicable for this system.

3.4.6 Distribution Water Quality

3.4.6.1 Chlorine Residual Levels

Chlorine residuals are monitored continuously from the outlet of the holding tank, and by grab samples taken weekly at three distribution sampling points. Data for 2022 from all locations showed levels greater than 0.2 mg/L.

3.4.6.2 Microbial Water Quality

All *E. coli* and total coliform test results in 2022 showed absent for total coliform and *E. coli*. As a result, the distribution system microbial water quality for the WTP is within compliance.

3.4.6.3 Turbidity

The distribution system was monitored for turbidity on a weekly basis at three sites in the distribution system. All turbidity samples collected in 2022 from these three locations are within compliance and below 5.0 NTU.

3.4.6.4 Cross Connection Control Program

A Cross Connection Control Program has been developed in partial compliance with NSECC requirements. Currently the plan does not meet the minimum requirements outlined in *A Guide to Assist Nova Scotia Municipal Water Works Develop a Cross Connection Control Program*. **MCA should update the cross-connection control program to include a detailed project scope, budget, authority, and timelines.**

3.4.6.5 Other Distribution System Monitoring Programs

MCA conducts the following distribution system monitoring:

- ▶ Annual flushing program with inspection of hydrants and system gate valves.
- ▶ Ongoing leak detection program in development, includes both flow monitoring and correlation and acoustic leak detection equipment.

There is currently no formal reservoir inspection program in place at the Margaretsville reservoir. It is recommended that a program be established to conduct interior inspection in the reservoir on a regular basis.

3.4.7 On-Site Inspection

An on-site inspection was conducted on May 19, 2023, and no obvious concerns were identified at that time.

4 Operations, Monitoring, & Management

4.1 Operations & Maintenance

As required by the *Approval to Operate*, the Municipality has a limited Operations and Maintenance Manual which outlines the characteristics of the WTP and includes emergency actions and a SOP for normal operations. Copies of the Operations and Maintenance Manual are available digitally, and operations staff have access to these documents and are aware of their contents.

All certified operators make process adjustments such as chemical dosing changes, perform equipment and instrument maintenance as required based on experience, and continuous evaluation of the system performance. The Operator in Direct Responsible Charge (ODRC) is ultimately responsible for changes, and significant changes beyond routine adjustments are discussed with the ODRC prior to implementing the change. The Operations and Maintenance Manual lacks detailed SOPs for the operations staff to follow. The maintenance plan was reviewed and is not adequate to ensure the long-term viability of the Municipal Public Drinking Water Supply, including distribution system components.

Sections of the Operations and Maintenance Manual includes the following:

- ▶ Sections 1-3: General Sections.
 - Preface.
 - Table of Contents.
 - Risk & Safety Assessment.
- ▶ Section 4-11: Operation & Maintenance Performance Standards.
 - Regular Water Supply Inspections.
 - External Reporting.
 - Interpreting Turbidity Test Results.
 - Interpreting Free Chlorine Residual Test Results.
 - Well Pump Monitoring.
 - Equipment Lock-Out.
 - Decision to Engage the Back-Up Water Supply.
 - Back-Up Water Source Preparation.
 - Issuing A Boil Water Order Advisory.
- ▶ Appendices (by Section):
 - Section 4: Margarettsville Water Supply Daily-Production and Reserves Report Form.

- Section 4: Margaretsville Water Supply Daily Water Quality Test Report Form.
- Section 4: Margaretsville Water Supply Treatment Facilities Daily Report Form.
- Section 4: Margaretsville Water Supply Treatment Equipment Check-List Form.
- Section 4: Margaretsville Property Inspection Report Form.
- Section 4: Margaretsville Water Supply Schematic Plan.
- Section 4: Margaretsville Water Supply Exterior Valve and Fitting Location Plan.
- Section 4: Margaretsville Historic Water Demand Table (to be replaced quarterly).
- Section 4: Margaretsville Water Supply Sampling and Testing Plan (to be replaced annually).
- Section 5: Margaretsville Water Supply Operating Permit.
- Section 6: Margaretsville Water Supply, Filter #1 Turbidity SPC Chart (to be replaced quarterly).
- Section 6: Margaretsville Water Supply, Filter #2 Turbidity SPC Chart (to be replaced quarterly).
- Section 6: Margaretsville Water Supply, Treated Water Reservoir Turbidity SPC Chart (to be replaced quarterly).
- Section 7: Reservoir Discharge, Free chlorine Residual SPC Chart.
- Section 12: NS Department of Environment and Labour, Interpretive Bulletin, Municipal Public Drinking Water Supplies, Procedure for Handling Positive Coliform Test Results.

MCA should update the Operation and Maintenance Manual to include detailed SOPs in accordance with the NSECC document *A Guide to Assist Nova Scotia Municipal Water Works Develop a Comprehensive Operations Manual*.

4.2 Monitoring & Reporting

A 2022-2023 monitoring program of the WTP was submitted to NSECC. The plan includes quality assurance programs, water quality compliance limits, data evaluation, sampling sites, and monitoring plans. Compliance monitoring is required to ensure the water distributed after leaving the plant adheres by the quality standards of *GCDWQ*. A summary of the raw , treated and SWPP sampling programs analyzed at accredited third-party labs are provided in Table 4.1 ,Table 4.2 and Table 4.3 respectively.

Table 4.1: Raw Water Sampling Program

Summary of Raw Water Requirements			
Parameter	Approval to Operate Sampling Requirements		Margaretsville 2022 Sampling Program
	Location	Frequency	Frequency
Turbidity	Individual wells	Continuous	Continuous
Water Volume	Individual wells	Continuous	Continuous
All GMPDWS	Individual wells	Annually	Annually
Health related GCDWQ	Individual wells	Every 5 Years	Every 5 Years
Manganese	Individual wells	Spring and Fall	Spring and Fall
Viruses	Individual wells	As Requested	As Requested
<i>Giardia</i> and <i>Cryptosporidium</i>	Individual wells	As Requested	As Requested
Microscopic Particulate Analysis	Individual wells	Every two years in spring following rainfall	Not required*

*Individual wells are not actual wells and are better defined as surface fed crocks, therefore an MPA analysis is not needed. MPA is not required for waters treated as high-risk GUDI or surface water.

Table 4.2: Distribution Water Sampling Program

Summary of Treated Water and Distribution Monitoring Requirements			
Parameter	Approval to Operate Sampling Requirements		Margaretsville 2022 Sampling Program
	Location	Frequency	Frequency
Turbidity	Distribution sampling points	Weekly Grab	Weekly Grab
Temperature	CT Control Point	Continuous	Continuous
pH	CT Control Point	Continuous	Continuous
Free Chlorine	CT Control Point	Continuous	Continuous
	Storage Structure Outlet	Continuous	Continuous
Total Coliform & <i>E. coli</i> (P/A)	Distribution Samples	Weekly Grab	Weekly Grab
	Distribution Samples	Weekly Grab	Weekly Grab
All GMPDWS	Entering Distribution	Annually	Annually
Health related parameters as per the GCDWQ	Entering Distribution	Every 5 Years	Every 5 Years
Corrosion Monitoring Program	Select distribution sampling points	Quarterly Grab	Annual as per current NSECC approval
Lead and Copper (Random daytime testing)	Select distribution sampling points	Annual grab (between May to October)	Annual between May to October, distribution sampling points
Manganese	Storage tank, distribution sampling points	Quarterly grab sample	Quarterly grab sample
HAA's	Select distribution points	Quarterly	Quarterly
THM's	Select distribution points	Quarterly	Quarterly
Viruses	Distribution Samples	As Requested	As Requested
<i>Giardia</i> and <i>Cryptosporidium</i>	Distribution Samples	As Requested	As Requested

Table 4.3: SWPP Water Sampling Program

Parameter	Locations		
	PW-2 and Southwest / East Crock Wells Water	Water Supply Reservoir	Raw water before treatment
Turbidity	Quarterly	Quarterly	Daily*
Conductivity	Quarterly	Quarterly	Annual**
pH	Quarterly	Quarterly	Daily*
Total Coliform and <i>E. coli</i>	Annual	Annual	Annual
Pathogens/Viruses	Annual	Annual	Annual
Nitrate	Annual	Annual	Annual**
Orthophosphate	Annual	Annual	Annual
Sodium	Annual	Annual	Annual
Chloride	Annual	Annual	Annual
Total Dissolved Solids (TDS)	Annual	Annual	Annual**
Pesticides/Herbicides	Annual	Annual	Annual
Polychlorinated Biphenyls (PCBs)	Annual	Annual	Annual
Lead	Annual	Annual	Annual**
Volatile Organic Compounds (VOCs)	Annual	Annual	Annual
Total Petroleum Hydrocarbons	Annual	Annual	Annual
Total Organic Carbon	Annual	Annual	Annual**

*Requirement of the utility's approval to operate

**Requirement of the Guidelines for Monitoring Public Drinking Water Supplies (GMPDWS)

4.2.1 Review of Recent Submitted Annual Report

The 2022 Annual Report was reviewed. Not all sections were completed; most notably, distribution system corrosion control parameters and manganese, lead and copper sampling results were not included.

MCA should ensure that each section of the Annual Report where applicable to the Margarettsville system is completed in its entirety each year. The document can be modified from the basic template provided by NSECC.

4.3 Management

The system has been classified as a Class II Water Treatment (WT) Facility and a Class I Water Distribution (WD) Facility. John Webber, Level III WD is the ODRC of the WTP. Plant staffing information is provided as:

- ▶ John Webber (ODRC) - Level III Water Treatment, Level II WD.
- ▶ James Jenner - Level III WT, Level I WD.
- ▶ Charles Grant – Level I WT, Level I WD.
- ▶ Amy Brown – Level I WT, Level 1 WD.

The ODRC protocol information is provided in Appendix A.

4.4 Conclusion & Recommendations

4.4.1 Operation & Maintenance

The WTP has a comprehensive Operations and Maintenance Manual. Specific SOPs for the Margarettsville system should be developed for inclusion in the manual, specifically around filtration and disinfection protocols.

4.4.2 Monitoring & Reporting

The 2022-2023 Annual Monitoring Program and 2022 Annual Report were reviewed and have addressed most requirements in the Approval to Operate, with exception of detailed corrosion control, raw water flow and lead/copper sampling results. The program was adequate in meeting sampling requirements from the *GCDWQ* and *GMPDWS* requirements, with the exception of manganese. Lab samples are analyzed by an accredited laboratory.

4.4.3 Management

The ODRC is John Webber. All operators are adequately certified and there are a sufficient number of operators as well as back-up personnel available. The procedure for when the ODRC is absent is outlined in Appendix A.

5 Ability to Comply

This section will provide a summary of conclusions as per the NSECC Terms of Reference.

5.1 Summary

5.1.1 Treatment Processes, Facilities, & Equipment

5.1.1.1 Treatment Process

Water is supplied from two surface water fed crocks. The treatment process consists of slow sand filtration and chlorine disinfection prior to entering the distribution system. The *Approval to Operate* is valid until June 2029.

5.1.1.2 Turbidity Levels & Associated Criteria

The turbidity of filtered water leaving the slow sand filtration units must be less than or equal to 1.0 NTU in at least 95% of the measurements made in each calendar month. The filters were all able to meet this criterion. Filter turbidity is also not to exceed 3.0 NTU at any time. During 2022, there were no occurrences with measurements above 3.0 NTU. The two slow sand filters were compliant with the turbidity level criteria outlined in the *Approval to Operate*.

5.1.1.3 Primary Disinfection

All municipal drinking water systems in Nova Scotia are required to meet treatment standards to achieve:

- ▶ 3.0-log removal for *Giardia* and *Cryptosporidium*.
- ▶ 4.0-log removal credits for viruses.

The slow sand filtration system at the WTP has been assigned 3.0-log removal credits for *Giardia* and *Cryptosporidium* and 2.0-log removal credit for viruses. As such, the 0.5-log removal of *Giardia* and 2.0-log removal of viruses is completed using chlorine disinfection. CT calculations for the “worst case scenario” confirm that chlorine disinfection is adequate to always achieve both the 0.5-log reduction of *Giardia* and 2.0-log reduction of viruses. As such, the combination of slow sand filtration and disinfection is able to remove and inactivate protozoa (*Giardia* and *Cryptosporidium*) and viruses to NSECC’s treatment standards.

5.1.1.4 Secondary Disinfection

Secondary disinfection is achieved by maintaining a minimum free chlorine residual of 0.2 mg/L at all points within the distribution system with booster stations. Weekly grab samples within the distribution system are used to ensure that the minimum chlorine residual is met.

5.1.1.5 Other Critical Processes

No other critical processes.

5.1.1.6 Process Waste Streams

This section is not applicable for this system.

5.1.2 Distribution System Water Quality

5.1.2.1 Chlorine Residuals

Chlorine residuals in the distribution system are acceptable and met a minimum concentration of 0.2 mg/L. Weekly samples were performed on the treated water at three locations. Online continuous monitoring was also conducted at the outlet of the water storage reservoir in the distribution system. Chlorine residuals never fell below 0.2 mg/L at any site.

5.1.2.2 Microbial Water Quality

In 2022, microbiological samples for *E. coli* and total coliforms were collected at two locations weekly. All results for each location were absent for *E. coli* and total coliforms, therefore, complying with the requirements of the *Approval to Operate*.

5.1.2.3 Turbidity

Grab samples are collected weekly from three distribution samples points. All samples collected were below 5.0 NTU and met the requirements outlined in the *Approval to Operate*.

5.1.2.4 Cross Connection Control Program

MCA has implemented an approved Cross Connection Control Program to partially comply with NSECC requirements. **MCA should update the cross-connection control program to include a detailed project scope, budget, authority, and timelines.**

5.1.2.5 Other Distribution Monitoring Programs.

No other distribution monitoring is required.

5.1.3 Operations, Monitoring, & Management

5.1.3.1 Operations & Maintenance

The Municipality has an Operations and Maintenance Manual that outlines the characteristics of the WTP and includes emergency actions.

5.1.3.2 Monitoring & Reporting

The 2022-2023 monitoring program and 2022 Annual Report appear to address all requirements, with minor exceptions including lead & copper, manganese, and corrosion control sampling results.

5.1.3.3 Management

The WTP has been classified a Class II Water Treatment Facility and a Class I Water Distribution Facility. John Webber, Level II Water Distribution is the ODRC of the WTP.

5.1.4 Recommendations

Table 5.1 summarizes the recommendations to problems identified throughout this report.

Table 5.1: Recommendations

Category	Problem/Challenge Area	Recommended Action	Time Frame to Complete	Opinion of Cost
SWPP	Annual SWPAC Meetings	Recommence Annual SWPAC meeting.	1 year	No cost if done in-house
Treatment	Disinfection SOP	Add notification and response procedures for inadequate CT to SOP.	6 months	Complete – In house
Treatment	Filtration SOP	Develop a comprehensive SOP for filtration in accordance with the NSECC guidance manual.	6 months	Complete – In house
Sampling	Sampling Frequency	Increase sampling frequency from annually to quarterly for corrosion control parameters and collect manganese samples as per the <i>Approval to Operate</i>	Annually	\$1000/year

Category	Problem/Challenge Area	Recommended Action	Time Frame to Complete	Opinion of Cost
Sampling	Lead Exceedance Re-testing	Locations where lead concentrations exceeded the MAC should be retested using a 6-hour stagnation test as per the <i>Approval to Operate</i> .	3 months	\$100
Water Quality	SWPP and Manganese Monitoring	Complete monitoring proposed in the SWPP, including water quality sampling and watershed inspections.	1 year	\$10,000/year
Monitoring	Cyanobacteria monitoring	Establishing monitoring program for cyanobacteria in the raw water source and in slow sand filters.	3 months	No cost if done in-house
Monitoring	Copper and Lead monitoring	Copper and Lead sampling frequency and number of locations should be clarified with NSECC, and the approval should be updated to reflect any changes.	1 year	No cost if done in-house
Regulatory	Currently categorized as a groundwater system	The Approval to Operate should be reviewed and updated to better reflect the system as a high-risk GUDI or surface water system.	1-year	No cost-NSECC to change
Management	Limited Cross Connection Control Plan	Update Cross Connection Control Plan to comply with minimum requirements set by NSECC.	3 months	No cost if done in-house
Source Quantity	Flow Monitoring	Add a combined flowmeter on the inlet of the slow sand filters.	6 months	\$25,000

5.2 Report Preparation

5.2.1 Engineer's Declaration

I, the undersigned, hereby declare that to the best of my knowledge, the information contained herein and the information in support of this submission, as completed by me, is complete and accurate in accordance with my obligations under the Engineering Profession Act and its regulations. I further declare that this submission has been prepared in accordance with the published standard for this submission.



Ben Bickerton, P. Eng., M.A.Sc.
Process Engineer

APPENDIX A

Tables Required by the Terms of References

Table A.1: Groundwater Under the Direct Influence of Surface Water: MPA Test Results
 Table not required for this system as it is not a groundwater system.

Table A.2: Annual Trihalomethanes Concentrations (THMs) by Sample Location

Sampling Period/Month		Site A	Site B	Site C
		THM total (mg/L)	THM total (mg/L)	THM total (mg/L)
Q1	January	0.016	0.032	0.030
	February	-	-	-
	March	-	-	-
Q2	April	-	-	-
	May	0.028	0.040	0.050
	June	-	-	-
Q3	July	0.054	0.066	0.067
	August	-	-	-
	September	-	-	-
Q4	October	0.048	0.068	0.036
	November	-	-	-
	December	-	-	-
LRAA (mg/L)		0.036	0.051	0.045
Meets MAC of 0.1 mg/L (100 µg/L)		Yes	Yes	Yes

Table A.3: Annual Haloacetic Acid Concentrations (HAA5) by Sample Location

Sampling Period/Month		Site A	Site B	Site C
		HAA (5) mg/L	HAA (5) mg/L	HAA (5) mg/L
Q1	January	0.021	0.034	0.032
	February	-	-	-
	March	-	-	-
Q2	April	-	-	-
	May	0.04	0.046	0.047
	June	-	-	-
Q3	July	0.068	0.064	0.069
	August	-	-	-
	September	-	-	-
Q4	October	0.023	0.033	0.019
	November	-	-	-
	December	-	-	-
LRAA (mg/L)		0.038	0.044	0.041
Meets MAC of 0.08 mg/L (80 µg/L)		Yes	Yes	Yes

Table A.4: Health-Related Parameters in the Guidelines for Canadian Drinking Water Quality

Parameter	MAC (mg/L)	Raw Water			Treated Water		
		Sampling Period			Sampling Period		
		08/30/2016	07/21/2021	2026	08/30/2016	07/21/2021	2026
Bacteria							
Total Coliforms	None per 100 mL	-	-	-	-	-	-
<i>E. coli</i>	None per 100 mL	-	-	-	-	-	-
Aluminum	2.9	<0.01	<0.01	-	<0.01	0.063	-
Antimony	0.006	<0.02	<0.02	-	<0.02	ND	-
Arsenic	0.01	<0.02	<0.02	-	<0.02	ND	-
Atrazine	0.005	<0.0005	<0.0005	-	<0.0005	ND	-
Barium	2	0.01	0.01	-	0.01	0.026	-
Benzene	0.005	<0.001	<0.001	-	<0.001	ND	-
Benzo[<i>a</i>]pyrene	0.00004	-	-	-	-	ND	-
Boron	5	0.08	0.08	-	0.09	ND	-
Bromate	0.01	<0.01	<0.01	-	<0.01	ND	-
Bromoxynil	0.03	<0.0003	<0.0003	-	<0.0003	ND	-
Cadmium	0.007	<0.0003	<0.0003	-	<0.0003	ND	-
Carbon tetrachloride	0.002	<0.00056	<0.00056	-	<0.00056	ND	-
Chlorate	1	<0.02	<0.02	-	0.24	ND	-
Chlorite	1	<0.02	<0.02	-	<0.02	ND	-
Chlorpyrifos	0.09	<0.001	<0.001	-	<0.001	ND	-
Chromium	0.05	<0.02	<0.02	-	<0.02	ND	-
Copper	2	0.05	0.05	-	<0.02	0.00005	-
Cyanide	0.2	-	-	-	-	0.0018	-
Cyanobacterial toxins	0.0015	-	-	-	-	ND	-
Dicamba	0.11	<0.005	<0.005	-	<0.005	ND	-
1,4-Dichlorobenzene	0.005	<0.001	<0.001	-	<0.001	ND	-
1,2-Dichloroethane	0.005	<0.002	<0.002	-	<0.002	ND	-
1,1-Dichloroethylene	0.014	<0.002	<0.002	-	<0.002	ND	-
Dichloromethane	0.05	-	-	-	-	ND	-
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.1	-	-	-	-	ND	-
Dimethoate	0.02	-	-	-	-	ND	-
1,4-Dioxane	0.05	-	-	-	-	-	-
Diquat	0.05	<0.05	<0.05	-	<0.05	ND	-
Ethylbenzene	0.14	<0.02	<0.02	-	<0.02	ND	-
Fluoride	1.5	-	-	-	-	ND	-
Glyphosate	0.28	<0.15	<0.15	-	<0.15	ND	-
Haloacetic acids - Total (HAAs)	0.08	<0.004	<0.004	-	185	45.44	-
Lead	0.005	<0.005	<0.005	-	<0.005	ND	-
Malathion	0.19	<0.005	<0.005	-	<0.005	ND	-
Manganese	0.12	<0.02	<0.02	-	<0.02	0.012	-
Mercury	0.001	<0.00005	<0.00005	-	<0.00005	ND	-
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	0.35	-	-	-	-	ND	-
Metribuzin	0.08	<0.00025	<0.00025	-	<0.00025	ND	-
Nitrate-Nitrogen	10	2.38	2.38	-	1.63	ND	-
Nitrilotriacetic acid (NTA)	0.4	-	-	-	-	ND	-
Nitrite-Nitrogen	1	-	-	-	-	ND	-

Parameter	MAC (mg/L)	Raw Water			Treated Water		
		Sampling Period			Sampling Period		
		08/30/2016	07/21/2021	2026	08/30/2016	07/21/2021	2026
N-Nitroso dimethylamine (NDMA)	0.00004	-	-	-	-	ND	-
Pentachlorophenol	0.06	<0.001	<0.001	-	<0.001	ND	-
Perfluorooctane Sulfonate (PFOS)	0.0006	-	-	-	-	ND	-
Perfluorooctanoic Acid (PFOA)	0.0002	-	-	-	-	ND	-
Selenium	0.05	<0.002	<0.002	-	<0.002	ND	-
Strontium	7	0.033	0.033	-	0.032	0.062	-
Tetrachloroethylene	0.01	<0.001	<0.001	-	<0.001	ND	-
Toluene	0.06	<0.002	<0.002	-	<0.002	ND	-
Trichloroethylene	0.005	<0.001	<0.001	-	<0.001	ND	-
2,4,6-Trichlorophenol	0.005	<0.0005	<0.0005	-	<0.0005	ND	-
Trihalomethanes (THM)	0.1	<0.01	<0.01	-	149	75	-
Turbidity	See Approval	0.6	0.6	-	0.5	0.32	-
Uranium	0.02	<0.0002	<0.0002	-	<0.0002	ND	-
Vinyl chloride	0.002	<0.0006	<0.0006	-	<0.0006	ND	-
Xylenes (total)	0.09	<0.04	<0.04	-	<0.04	ND	-

Table A.5: Guidelines for Monitoring Public Drinking Water Supplies

Parameter	MAC	AO	2022
	(mg/L)	(mg/L)	
Alkalinity			07/05
Aluminium	0.1/0.2		07/05
Ammonia			07/05
Antimony	0.006		07/05
Arsenic	0.01		07/05
Barium	1		07/05
Boron	5		07/05
Cadmium	0.005		07/05
Calcium			07/05
Chloride		≤250	07/05
Chromium	0.05		07/05
Colour		≤ 15 TCU	07/05
Conductivity			07/05
Copper		≤1.0	07/05
Fluoride	1.5		07/05
Hardness			07/05
Iron		≤0.3	07/05
Lead	0.01		07/05
Magnesium			07/05
Manganese	0.12	≤0.02	07/05
Nitrate-nitrogen	10		07/05
pH		6.5-8.5	07/05
Potassium			07/05
Selenium	0.01		07/05
Sodium		≤200	07/05
Sulphate		≤500	07/05
Total Dissolved Solids		≤500	07/05
Total Organic Carbon			07/05
Turbidity			07/05
Uranium	0.05		07/05
Zinc		≤5	07/05

Table A.6.a: Water Withdrawal Data

Source 1 – Production Well 1 (P1)				
Month	Monthly Maximum Daily Rate (m ³ /d)	Monthly Average Daily Rate (m ³ /d)	Monthly Withdrawal Volume (m ³)	Annual Withdrawal Volume (m ³)
January	92	88	2,653	-
February	98	70	2,107	-
March	91	71	2,138	-
April	80	68	2,043	-
May	80	76	2,283	-
June	99	80	2,389	-
July	110	80	2,401	-
August	60	54	1,621	-
September	104	72	2,174	-
October	181.5	62	1,861	-
November	50	38	1,125	-
December	43	36	1,077	-
Total Annual Withdrawal				23,872

Table A.6.b: Water Withdrawal Data Comparison to Approved Limits

Source - East River			
Specify Approved Withdrawal Limits			Exceeds(Yes/No)
Maximum Daily Rate (m ³ /day)		160	No
Average Daily Rate (m ³ /day)		105	No
Volume (30 days) (m ³)		3,150	No
Volume (Annual) (m ³)		38,325	No

*Exceedances due to recirculating water, no corrective action taken

Table B.1: Membrane Filtration Direct Results

Not required for this system.

Table B.2 - Filter Backwash Water – Discharges to A Freshwater Watercourse

Not required for this system.

Table B.3 - Filter Backwash Water – Discharge to Land or Soil

Not required for this system.

Table B.4 - Filter Backwash Water – Discharge to A Marine Or Brackish Environment

Not required for this system.

Table C.1: Operator in Overall Direct Responsible Charge

The operator in overall direct responsible charge (ODRC) is: *(Specify name - add additional lines if more than one ODRC operator)*

John Webber

Signature of operator:

John Webber

Date:

May 26/23

Protocols in place during the absence of the operator in ODRC include (specify):

When on vacation:

James Jenner

When ill:

James Jenner

Other (specify)

James Jenner

APPENDIX B

Watershed Boundary Plan



MARGARETSVILLE SOURCE WATER PROTECTION PLAN

Annapolis County, Nova Scotia

**FIGURE 2
PROTECTED WATER AREA AND
WATER SUPPLY INFRASTRUCTURE**

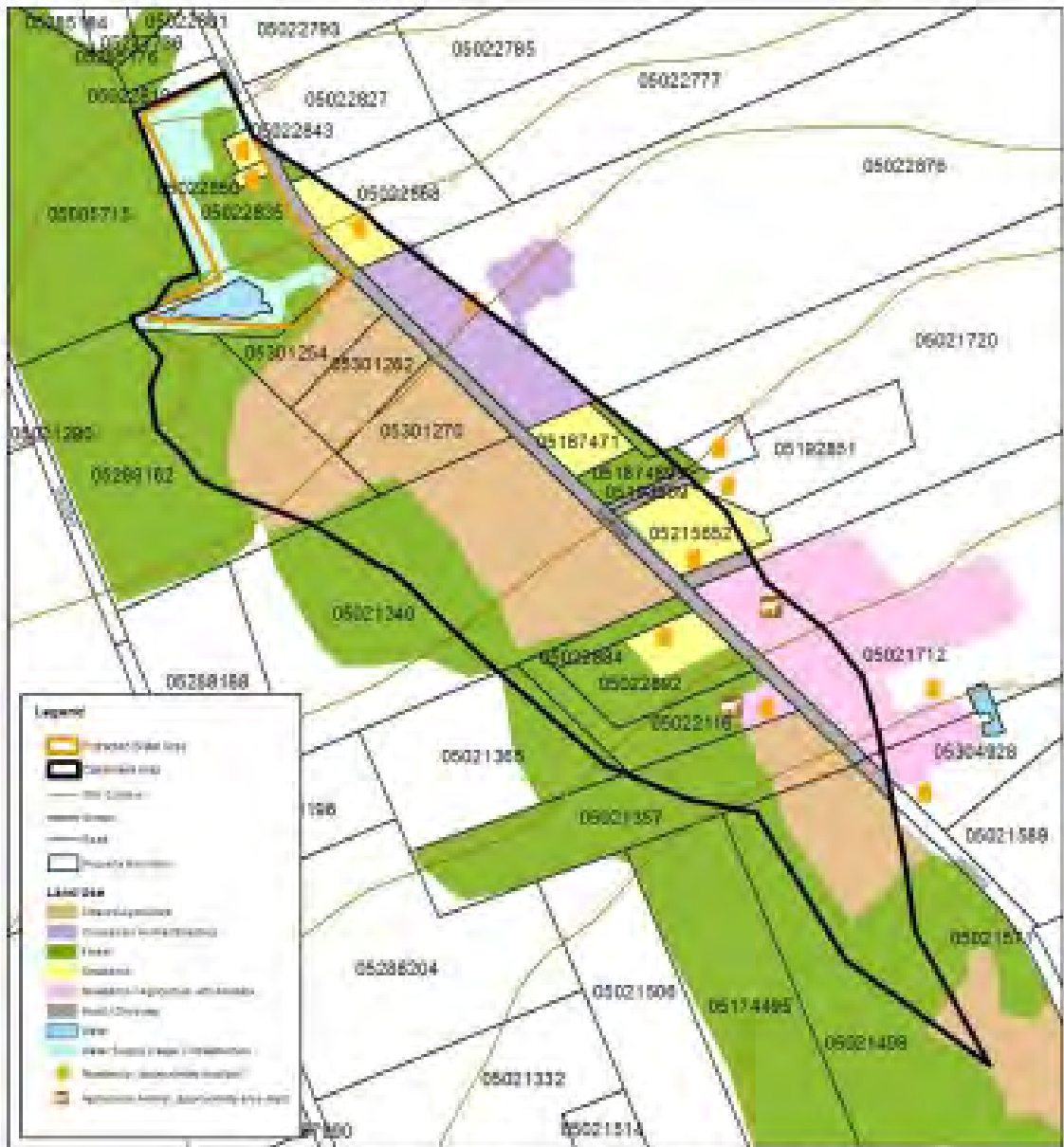
Legend

- Wells
- Protected Water Area
- Water
- Property Boundary
- 10m Contour
- Streams
- Road
- Residence (approximate location)
- Forest

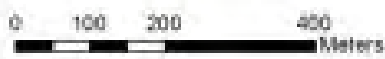


COUNTY OF ANAPOLIS

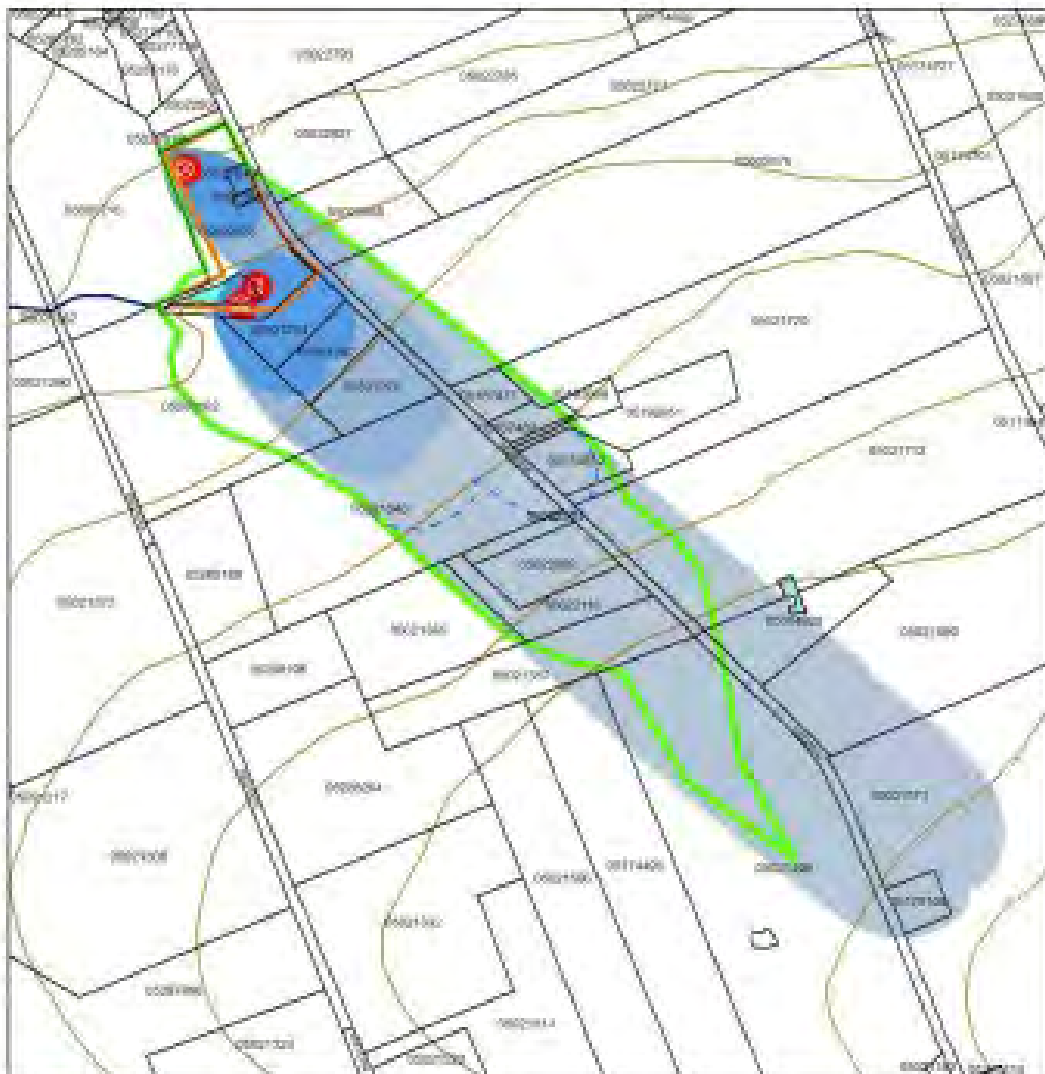















MARGARETSVILLE SOURCE WATER PROTECTION PLAN
 Annapolis County, Nova Scotia
FIGURE 3
PROTECTED WATER AREA AND CATCHMENT AREA
EXISTING LAND USE



Collect in Annapolis



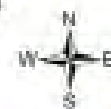
Legend

-  Private road only
-  Source water protection area
- Well Head Protection Area**
-  Well site 01 (Upper Cove)
-  Well site 02 (Lower Cove)
-  24 Hour Drawdown Zone
-  48 Hour Drawdown Zone
-  1:1 Slope Limit of Communal Property
-  Municipal Boundary
-  Water of Flow
-  Surface Water
-  Property Boundary

MARGARETSVILLE SOURCE WATER PROTECTION PLAN

Annapolis County, Nova Scotia

**FIGURE 4
WELL SITE CONTROL ZONES
AND WELL HEAD PROTECTION AREAS**



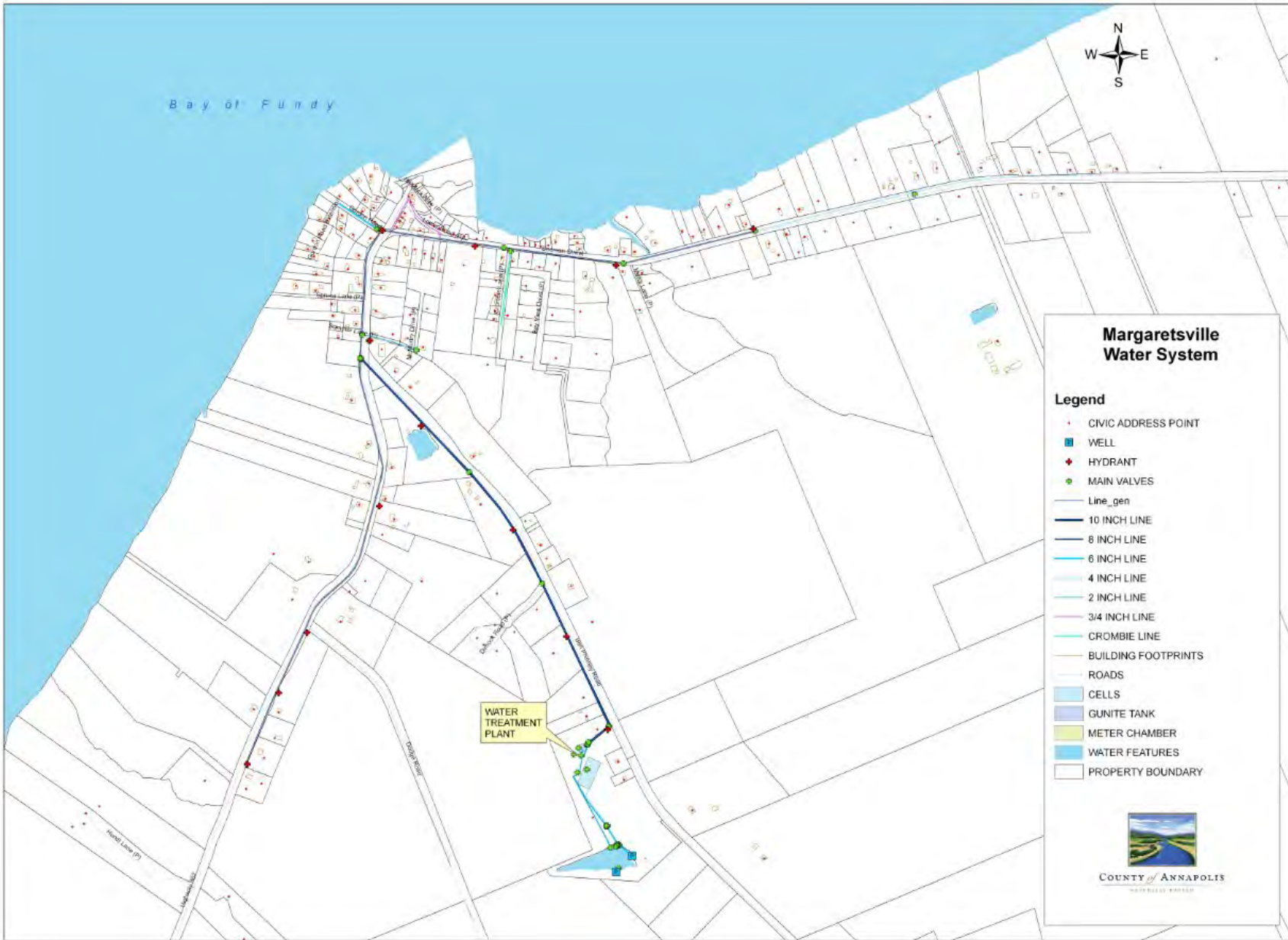
0 125 250 500
Meters



COUNTY OF ANAPOLIS

APPENDIX C

Distribution Map



APPENDIX D

Corrosion Control Program Results

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
PO Box 100
Annapolis Royal, NS B0S1A0
(902) 532-3141

ATTENTION TO: James Jenner

PROJECT:

AGAT WORK ORDER: 22X914200

WATER ANALYSIS REVIEWED BY: Sara Knox, Data Reviewer

DATE REPORTED: Jul 13, 2022

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

***Notes**

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



Certificate of Analysis

AGAT WORK ORDER: 22X914200
PROJECT:

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL: (902)468-8716
FAX: (902)468-8924
http://www.agatlabs.com

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Halifax - Metals - Health Canada

DATE RECEIVED: 2022-06-29

DATE REPORTED: 2022-07-13

Parameter	Unit	SAMPLE DESCRIPTION: 100 Seaman St		1 Seaman St		180 Seaman St		7 Lighthouse Road		2768 Hwy 362	
		SAMPLE TYPE: Water		Water		Water		Water		Water	
		G / S	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL
			4033735		4033810		4033811		4033812		4033813
Total Copper	ug/L	1	378	10	968	1	109	29	10	1780	
Total Lead	ug/L	0.06	7.38	0.06	2.90	0.06	6.37	8.44	0.06	2.48	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
4033735-4033813 < - Values refer to Report Detection Limits.
Analysis performed at AGAT Edmonton (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 22X914200

PROJECT:

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jul 13, 2022			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
Halifax - Metals - Health Canada																
Total Copper	193	4048330	<1	<1	NA	< 1	108%	70%	130%	100%	80%	120%	84%	70%	130%	
Total Lead	193	4048330	<0.5	<0.5	NA	< 0.05	97%	70%	130%	100%	80%	120%	100%	70%	130%	

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
 If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

Certified By: _____



AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.



11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlabs.com>

Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 22X914200

PROJECT:

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Copper	INOR-171-6100, -6202	SM 3030 E; SM 3125 B	ICP-MS
Total Lead	INOR-171-6202	SM 3030 E; SM 3125 B	ICP-MS



AGAT Laboratories

Unit 122 • 11 Morris Drive
Dartmouth, NS
B3B 1M2

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P: 902.468.8718 • F: 902.468.8924

Laboratory Use Only

Arrival Condition: Good Poor (see notes)

Arrival Temperature: 15.9, 15.1, 15.7

Hold Time: _____

AGAT Job Number: 22X914200

Notes: water
water, ice packs 122 JUN 29 9:27
(J. Jenner)

Chain of Custody Record

Report Information

Company: Annapolis County
Contact: James Jenner
Address: PO BOX 100 Annapolis Royal
Nova Scotia
Phone: 902-526-0566 Fax: 902-532-2096

Client Project #: _____
AGAT Quotation: _____

Please Note: If quotation number is not provided client will be billed full price for analysis.

Invoice To

Same Yes / No

Company: _____
Contact: _____
Address: _____
Phone: _____ Fax: _____
PO/Credit Card#: _____

Report Information (Please print):

1. Name: JAMES JENNER
Email: jjenner@annapoliscounty.ca
2. Name: John Webber
Email: jwebber@annapoliscounty.ca

Regulatory Requirements (Check):

- List Guidelines on Report Do not list Guidelines on Report
- PIRI
 - Tier 1 Res Pot Coarse
 - Tier 2 Com N/Pot Fine
 - Gas Fuel Lube
- CCME
 - Industrial NSEQS-Cont Sites
 - Commercial HRM 101
 - Res/Park Storm Water
 - Agricultural Waste Water
 - FWAL
 - Sediment Other _____

Report Format

- Single Sample per page
- Multiple Samples per page
- Excel Format included
- Export

Turnaround Time Required (TAT)

Regular TAT 5 to 7 working days

Rush TAT Same day 1 day
 2 days 3 days

Date Required: _____

Drinking Water Sample: Yes No Salt Water Sample: Yes No
Reg. No.: _____

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments - Site/Sample Info, Sample Containment
100 Seaman St	June 28 /22	water	1	Municipal
1 Seaman St	June 28 /22	water	1	Corrosion Control
180 Seaman St	June 28 /22	water	1	Sampling
7 Lighthouse Road	June 28 /22	water	1	Canada Lead
2768 HWY 362	June 28 /22	water	1	+ Copper
				for Marqaretsville

Field Filters/Preserved	Standard Water Analysis	Metals: Total	Dis	Available	Mercury	BOD	CBOD	pH	TSS	TDS	USS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (P/P)	low level	Tier 2: TPH/BTEX fractionation	SCME/CNS: TPH/BTEX	VOC	THM	HA	PAH	PCB	TC+EC	P/A	HRN	MF	HPC	L. Pseudomonas	Fecal Coliform	MPN	MF	Other: Canada Lead	Other: Copper	Hazardous (Y/N)			

Signature: <u>John Webber</u> Date: <u>June 28 /22 12pm</u>	Signature: <u>[Signature]</u> Date: <u>June 28 /22 12pm</u>	Signature: _____ Date: _____	Page: <u>1</u> of <u>1</u> Blank Copy - Client Yellow Copy - AGAT White Copy - N/A
--	--	---------------------------------	---



CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
PO Box 100
Annapolis Royal, NS B0S1A0
(902) 532-3141

ATTENTION TO: James Jenner

PROJECT:

AGAT WORK ORDER: 22X926232

WATER ANALYSIS REVIEWED BY: Sara Knox, Data Reviewer

DATE REPORTED: Jul 29, 2022

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

***Notes**

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



Certificate of Analysis

AGAT WORK ORDER: 22X926232
PROJECT:

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL: (902)468-8718
FAX: (902)468-8924
http://www.agatlabs.com

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Lead					
DATE RECEIVED: 2022-07-28			DATE REPORTED: 2022-07-29		
		SAMPLE DESCRIPTION: 180 Seaman St		7 Lighthouse	
		SAMPLE TYPE: Water		Road	
		DATE SAMPLED: 2022-07-27		2022-07-27	
		09:00		09:00	
Parameter	Unit	G / S	RDL	4141982	4142054
Total Lead	ug/L	5	0.5	<0.5	3.2

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to Canadian Drinking Water Quality - updated 2022-07
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 22X926232

PROJECT:

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jul 29, 2022			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Lead															
Total Lead	4143884		<0.5	<0.5	NA	< 0.5	105%	80%	120%	104%	80%	120%	95%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Certified By: _____





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Dartmouth, Nova Scotia
CANADA B3B 1M2
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Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 22X926232

PROJECT:

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Lead	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS



AGAT Laboratories

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Dartmouth, NS
B3B 1M2

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Laboratory Use Only

Arrival Condition: Good Poor (see notes)
Arrival Temperature: 14.6, 15.6
Hold Time:
AGAT Job Number: 22X926232

Notes: over temp

Chain of Custody Record

P: 902.468.8718 • F: 902.468.8924

Report Information

Company: Annapolis County
Contact: James Jenner
Address: PO BOX 100 Annapolis Royal
Nova Scotia
Phone: 902-526-0566 Fax: 902-532-2096
Client Project #:
AGAT Quotation:
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):

1. Name: JAMES JENNER
Email: jenner@annapoliscounty.ca
2. Name: John Webber
Email: jwebber@annapoliscounty.ca

Report Format

- Single Sample per page
- Multiple Samples per page
- Excel Format Included
- Export

Turnaround Time Required (TAT)

Regular TAT 5 to 7 working days 28-31 7th
Rush TAT Same day 1 day
 2 days 3 days

Date Required:
Drinking Water Sample: Yes No Salt Water Sample Yes No
Reg. No.:

Invoice To

Same Yes / No

Company: _____
Contact: _____
Address: _____
Phone: _____ Fax: _____
PO/Credit Card#:

Regulatory Requirements (Check):

- List Guidelines on Report Do not list Guidelines on Report
- PIRI
- Tier 1 Res Pot Coarse
- Tier 2 Corn N/Pot Fine
- Gas Fuel Lubo
- CCME CDWQ
- Industrial NSEQS-Cont Sites
- Commercial HRM 101
- Res/Park Storm Water
- Agricultural Waste Water
- FWAL
- Sediment Other _____

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments - Site/Sample Info, Sample Containment	Field Filled/Preserved	Standard Water Analysis	Metal: Total Diss. Available	Mercury	BOD CBOD	pH	TSSS TDS VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PRR) low level	Tier 2: TPH/BTEX/Extraction	COMECOS TPH/BTEX	VOC	THM	HAH	PAH	PCB	TOC EC P/A MPN MF	HPC L Pseudomonas	Fecal Coliform MPN MF	Other: Canada Lead	Other:	Hazardous (Y/N)
180 Seaman St	July 27 /22 9am	water	1																							✓	n	
7 Lighthouse Road	July 27 /22 9am	water	1																							✓	n	

Date/Time John Webber <i>John Webber</i>	Date/Time July 27/22 10 am	Date/Time <i>Kneller</i>	Date/Time July 27/22 10 am	Page <input type="checkbox"/> of <input type="checkbox"/>
Samples Received By (Sign)	Samples Received By (Print Name)	Samples Received By (Sign)	Samples Received By (Print Name)	Pink Copy - Client Yellow Copy - AGAT White Copy - AGAT

APPENDIX E

Last Round of Sampling Data for *GCDWQ*

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
PO Box 100
Annapolis Royal, NS B0S1A0
(902) 532-3141

ATTENTION TO: James Jenner
PROJECT: Margratsville WTP

AGAT WORK ORDER: 21X778056

FOOD CHEMISTRY REVIEWED BY: David Ohayon, Director of Laboratory Operations Quebec

MISCELLANEOUS ANALYSIS REVIEWED BY: Ashley Dussault, Report Writer

TRACE ORGANICS REVIEWED BY: Amy Hunter, Trace Organics Supervisor, B.Sc.

WATER ANALYSIS REVIEWED BY: Ashley Dussault, Report Writer

DATE REPORTED: Aug 18, 2021

PAGES (INCLUDING COVER): 28

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

***Notes**

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056

PROJECT: Margratsville WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Glyphosate (Montreal) (ug/L)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
				Margratsville	Margratsville
				Raw	Treated
				Water	Water
				2021-07-21	2021-07-21
				13:00	13:00
Parameter	Unit	G / S	RDL	2767079	2767185
Glyphosate	ug/L		15	<15	<15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Montréal (unless marked by *)

Certified By:





AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056

PROJECT: Margravs WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlebs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Canadian Drinking Water MAC Package (Radiochemistry)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
				Margravs	Margravs
				Raw	Treated
				Water	Water
				2021-07-21	2021-07-21
				13:00	13:00
Parameter	Unit	G / S	RDL	2767079	2767185
Radionuclides - Gross Alpha*	Bq/L	0.5	0.1	Y	Y
Radionuclides - Gross Beta*	Bq/L	1.0	0.1	Y	Y

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

2767079-2767185 *Analysis performed at subcontracted laboratory.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margratsville WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
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FAX (902)468-8924
<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Canadian Drinking Water MAC Package (Subcontracted)						
DATE RECEIVED: 2021-07-22				DATE REPORTED: 2021-08-18		
				Margratsville	Margratsville	
		SAMPLE DESCRIPTION:		Raw	Treated	
		SAMPLE TYPE:		Water	Water	
		DATE SAMPLED:		2021-07-21	2021-07-21	
				13:00	13:00	
Parameter	Unit	G / S	RDL	2767079	2767185	
Nitroacetic Acid (NTA)	mg/L	0.4	0.03	Y	Y	
Lead-210 (Hfx 2012-05)	Bq/L	0.2	0.02	Y	Y	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
2767079-2767185 *Analysis performed at subcontracted laboratory.
Analysis performed at AGAT Halifax (unless marked by *)

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margratsville WTP

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TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Canadian Drinking Water MAC Package (HAAs, VOCs)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
Parameter	Unit	G / S	RDL	Margratsville	Margratsville
				Raw	Treated
SAMPLE DESCRIPTION:				Water	Water
SAMPLE TYPE:				2021-07-21	2021-07-21
DATE SAMPLED:				13:00	13:00
				2767079	2767185
Chloroacetic Acid	ug/L		0.5	<0.5	0.6
Bromoacetic Acid	ug/L		0.5	<0.5	<0.5
Dichloroacetic Acid	ug/L		0.5	<0.5	20.7
Trichloroacetic Acid	ug/L		0.5	<0.5	14.2
Bromochloroacetic Acid	ug/L		0.5	<0.5	8.1
Dibromoacetic Acid	ug/L		0.5	<0.5	1.8
Haloacetic Acids	ug/L	80	4.0	<4.0	45.4
Vinyl Chloride	ug/L	2	0.6	<0.6	<0.6
Chloroethane	ug/L		5	<5	<5
1,1-Dichloroethylene	ug/L	14	2	<2	<2
Methylene Chloride (Dichloromethane)	ug/L	50	2	<2	<2
Methyl-t-Butyl-Ether (MTBE)	ug/L	15 AO	2	<2	<2
Chloroform	ug/L		1	<1	44
1,2-Dichloroethane	ug/L	5	2	<2	<2
Carbon Tetrachloride	ug/L	2	0.56	<0.56	<0.56
Benzene	ug/L	5	1	<1	<1
Trichloroethylene	ug/L	5	1	<1	<1
Bromodichloromethane	ug/L		1	<1	24
Toluene	ug/L	60, 24 AO	2	<2	<2
Dibromochloromethane	ug/L		1	<1	7
Tetrachloroethylene	ug/L		1	<1	<1
Chlorobenzene	ug/L	80, 30 AO	1	<1	<1
Ethylbenzene	ug/L	140, 1.6 AO	2	<2	<2
Bromoform	ug/L		1	<1	<1
Xylenes (Total)	ug/L	300 AO	4	<4	<4
1,4-Dichlorobenzene	ug/L	5, 1 AO	1	<1	<1
1,2-Dichlorobenzene	ug/L	200, 3 AO	1	<1	<1
Total Trihalomethanes	ug/L	100	1	<1	75

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056

PROJECT: Margratsville WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Canadian Drinking Water MAC Package (HAAs, VOCs)

DATE RECEIVED: 2021-07-22

DATE REPORTED: 2021-08-18

Surrogate	Unit	Acceptable Limits	Margratsville	Margratsville
			Raw	Treated
SAMPLE DESCRIPTION:			Water	Water
SAMPLE TYPE:			Water	Water
DATE SAMPLED:			2021-07-21	2021-07-21
			13:00	13:00
Acceptable Limits			2767079	2767185
2-Bromobutanoic acid	%	50-130	116	111
Toluene-d8	%	60-130	93	90
4-Bromofluorobenzene	%	60-130	102	96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard. Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
Analysis performed at AGAT Halifax (unless marked by *)

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margravsille WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Carbamate Pesticides (Water)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
		MARGRAVSILLE		MARGRAVSILLE	
		Raw		Treated	
		Water		Water	
		2021-07-21		2021-07-21	
		13:00		13:00	
		2767079		2767185	
Parameter	Unit	G / S	RDL		
Aldicarb	µg/L	2	<2.0	<2.0	<2.0
Bendiocarb	µg/L	2	<2	<2	<2
Carbofuran	µg/L	5	<5	<5	<5
Carbaryl	µg/L	5	<5	<5	<5
Diuron	µg/L	10	<10	<10	<10
Triallate	µg/L	1	<1	<1	<1
Temephos	µg/L	10	<10	<10	<10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
2767079-2767185 Results relate only to the items tested.
Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margratsville WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Diquat/Paraquat					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
		Margratsville		Margratsville	
		Raw		Treated	
		Water		Water	
		2021-07-21		2021-07-21	
		13:00		13:00	
		2767079		2767185	
Parameter	Unit	G / S	RDL		
Diquat	µg/L		5	<5	<5
Paraquat	µg/L		1	<1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margravsille WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

OC Pesticides (Water) (for Halifax)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
Parameter	Unit	G / S	RDL	Margravsille	Margravsille
				Raw	Treated
				Water	Water
				2021-07-21	2021-07-21
				13:00	13:00
				2767079	2767185
alpha-BHC	µg/L		0.01	<0.01	<0.01
Hexachlorobenzene	µg/L		0.01	<0.01	<0.01
beta-BHC	µg/L		0.05	<0.05	<0.05
Gamma-Hexachlorocyclohexane	µg/L		0.01	<0.01	<0.01
delta-BHC	µg/L		0.01	<0.01	<0.01
Heptachlor	µg/L		0.01	<0.01	<0.01
Aldrin	µg/L		0.01	<0.01	<0.01
Heptachlor Epoxide	µg/L		0.01	<0.01	<0.01
Oxychlorane	µg/L		0.05	<0.05	<0.05
gamma-Chlordane	µg/L		0.1	<0.1	<0.1
op'-DDE	µg/L		0.01	<0.01	<0.01
Endosulfan I	µg/L		0.002	<0.002	<0.002
alpha - chlordane	µg/L		0.05	<0.05	<0.05
pp'-DDE	µg/L		0.05	<0.05	<0.05
Dieldrin	µg/L		0.02	<0.02	<0.02
op'-DDD	µg/L		0.05	<0.05	<0.05
Endrin	µg/L		0.05	<0.05	<0.05
Endosulfan II	µg/L		0.002	<0.002	<0.002
pp'-DDD	µg/L		0.05	<0.05	<0.05
op'-DDT	µg/L		0.04	<0.04	<0.04
Endrin Aldehyde	µg/L		0.05	<0.05	<0.05
Endosulfan Sulfate	µg/L		0.05	<0.05	<0.05
pp'-DDT	µg/L		0.05	<0.05	<0.05
Endrin Ketone	µg/L		0.05	<0.05	<0.05
Methoxychlor	µg/L		0.04	<0.04	<0.04
Mirex	µg/L		0.05	<0.05	<0.05

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Certificate of Analysis

AGAT WORK ORDER: 21X778056

PROJECT: Margratsville WTP

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
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<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

OC Pesticides (Water) (for Halifax)				
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18	
			Margratsville	Margratsville
		SAMPLE DESCRIPTION:	Raw	Treated
		SAMPLE TYPE:	Water	Water
		DATE SAMPLED:	2021-07-21	2021-07-21
			13:00	13:00
	Surrogate	Unit	Acceptable Limits	2767079
				2767185
TCMX	%	50-140	82	101
Decachlorobiphenyl	%	50-140	84	105

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2767079-2767185 DDT total is a calculated parameter. The calculated value is the sum of op'DDT and pp'DDT.
DDD total is a calculated parameter. The calculated value is the sum of op'DDD and pp'DDD.
DDE total is a calculated parameter. The calculated value is the sum of op'DDE and pp'DDE.
Endosulfan total is a calculated parameter. The calculated value is the sum of Endosulfan I and Endosulfan II.
Chlordane total is a calculated parameter. The calculated value is the sum of Alpha-Chlordane and Gamma-Chlordane.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: _____



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056

PROJECT: Margravsille WTP

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http://www.agatlabs.com

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

OP Pesticides (Water)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
		Margravsille		Margravsille	
SAMPLE DESCRIPTION:		Raw		Treated	
SAMPLE TYPE:		Water		Water	
DATE SAMPLED:		2021-07-21		2021-07-21	
		13:00		13:00	
Parameter	Unit	G / S	RDL	2767079	2767185
Phorate	µg/L		0.5	<0.5	<0.5
Dimethoate	µg/L		2.5	<2.5	<2.5
Terbufos	µg/L		0.5	<0.5	<0.5
Diazinon	µg/L		1	<1	<1
Malathion	µg/L		5	<5	<5
Chlorpyrifos	µg/L		1	<1	<1
Parathion	µg/L		1	<1	<1
Azinphos-methyl	µg/L		2	<2	<2
Surrogate	Unit	Acceptable Limits			
Triphenyl phosphate (surr)	%	50-140	86	97	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to ODWS - Table D
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

2767079-2767185 Results relate only to the items tested.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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AGAT WORK ORDER: 21X778056
PROJECT: Margratsville WTP

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<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Phenoxy Acid Herbicides (Water)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
Parameter	Unit	G / S	RDL	Margratsville	Margratsville
				Raw	Treated
				Water	Water
				2021-07-21	2021-07-21
				13:00	13:00
				2767079	2767185
2,4-D	µg/L		0.5	<0.5	<0.5
2,4,5-T	µg/L		0.5	<0.5	<0.5
2,4,5-TP	µg/L		0.5	<0.5	<0.5
Dicamba	µg/L		0.5	<0.5	<0.5
Dichlorprop	µg/L		0.5	<0.5	<0.5
Dinoseb	µg/L		0.5	<0.5	<0.5
Picloram	µg/L		0.5	<0.5	<0.5
Diclofop-methyl	µg/L		0.5	<0.5	<0.5
2,3,4,6-Tetrachlorophenol	µg/L		0.5	<0.5	<0.5
2,4-Dichlorophenol	µg/L		0.2	<0.2	<0.2
2,4,5-Trichlorophenol	µg/L		0.5	<0.5	<0.5
2,4,6-Trichlorophenol	µg/L		0.5	<0.5	<0.5
Bromoxynil	µg/L		0.3	<0.3	<0.3
MCPA	µg/L		5.0	<5.0	<5.0
MCPP	µg/L		5.0	<5.0	<5.0
Pentachlorophenol	µg/L		0.1	<0.1	<0.1
Surrogate	Unit	Acceptable Limits			
DCAA	%	50-140	76	70	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Toronto (unless marked by *)

Certified By: 



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margravsille WTP

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<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Triazine Pesticides [water]					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
				Margravsille Raw	Margravsille Treated
				Water	Water
				2021-07-21 13:00	2021-07-21 13:00
Parameter	Unit	G / S	RDL	2767079	2767185
Trifluralin	µg/L		1.0	<1.0	<1.0
Simazine	µg/L		1.0	<1.0	<1.0
Atrazine	µg/L		0.5	<0.5	<0.5
Metribuzin	µg/L		0.25	<0.25	<0.25
Prometryne	µg/L		0.25	<0.25	<0.25
Metolachlor	µg/L		0.11	<0.11	<0.11
Alachlor	µg/L		0.5	<0.5	<0.5
Cyanazine	µg/L		1.0	<1.0	<1.0
Surrogate	Unit	Acceptable Limits			
Triphenyl phosphate (surr)	%	30-130		78	93

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to ODWS - Table D
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

2767079-2767185 Results relate only to the items tested.
Analysis performed at AGAT Toronto (unless marked by *)

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PROJECT: Margratsville WTP

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<http://www.agatlabs.com>

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Trihalomethanes in Water					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
		Margaratville		Margaratville	
SAMPLE DESCRIPTION:		Raw		Treated	
SAMPLE TYPE:		Water		Water	
DATE SAMPLED:		2021-07-21		2021-07-21	
		13:00		13:00	
Parameter	Unit	G / S	RDL	2767079	2767185
Chloroform	ug/L		1	<1	44
Bromodichloromethane	ug/L		1	<1	24
Dibromochloromethane	ug/L		1	<1	7
Bromoform	ug/L		1	<1	<1
Total Trihalomethanes	ug/L		1	<1	75
Surrogate	Unit	Acceptable Limits			
Toluene-d8	%	60-140		93	90
4-Bromofluorobenzene	%	60-140		102	96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Halifax (unless marked by *)

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AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21X778056
PROJECT: Margravsille WTP

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CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
SAMPLING SITE:

ATTENTION TO: James Jenner
SAMPLED BY:

Canadian Drinking Water MAC Package (Metals, Hg & Inorganics)					
DATE RECEIVED: 2021-07-22			DATE REPORTED: 2021-08-18		
Parameter	Unit	G / S	RDL	Margravsille	Margravsille
				Raw	Treated
				Water	Water
				2021-07-21	2021-07-21
				13:00	13:00
				2767079	2767185
Total Aluminum	ug/L	2900, 100	10	<10	<10
Total Antimony	ug/L	6	2	<2	<2
Total Arsenic	ug/L	10	2	<2	<2
Total Barium	ug/L	2000	5	10	10
Total Boron	ug/L	5000	5	8	9
Total Cadmium	ug/L	7	0.3	<0.3	<0.3
Total Chromium	ug/L	50	2	<2	<2
Total Copper	ug/L	2000, 1000	2	5	<2
Total Iron	ug/L	300 AO	50	<50	<50
Total Lead	ug/L	5	0.5	<0.5	<0.5
Total Manganese	ug/L	120, 20 AO	2	<2	<2
Total Selenium	ug/L	50	2	<2	<2
Total Strontium	ug/L	7000	5	33	32
Total Uranium	ug/L	20	0.2	<0.2	0.2
Total Zinc	ug/L	5000 AO	5	<5	<5
Total Sodium	mg/L	200 AO	0.1	12.3	16.2
Mercury	ug/L	1	0.05	<0.05	<0.05
pH		7.0-10.5		7.44	7.54
Turbidity	NTU	1.0	0.5	0.6	<0.5
True Color	TCU	15 AO	5.00	<5.00	<5.00
Chloride	mg/L	250 AO	1	11	10
Fluoride	mg/L	1.5	0.12	<0.12	<0.12
Nitrate as N	mg/L	10	0.05	2.38	1.63
Sulphate	mg/L	500 AO	2	4	3
Bromate	mg/L	0.01	0.01	<0.01	<0.01
Chlorate	mg/L	1	0.02	<0.02	0.24
Chlorite	mg/L	1	0.02	<0.02	<0.02

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PROJECT: Margravsille WTP

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CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Canadian Drinking Water MAC Package (Metals, Hg & Inorganics)

DATE RECEIVED: 2021-07-22

DATE REPORTED: 2021-08-18

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to Canadian Drinking Water Quality - updated 2021-03
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
2767079-2767185 Chloramines is a calculated parameter. The calculated parameter is non-accredited. The component parameters of the calculation are accredited.
Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
 PROJECT: Margravesville WTP
 SAMPLING SITE:

AGAT WORK ORDER: 21X778056
 ATTENTION TO: James Jenner
 SAMPLED BY:

Food Chemistry Analysis

RPT Date: Aug 18, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Glyphosate (Montreal) (ug/L)															
Glyphosate	728	NA	< 15	< 15	0.0%	< 15	105%	70%	130%	108%	70%	130%	94%	70%	130%

Certified By: _____



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Results relate only to the items tested. Results apply to samples as received.

Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis															
RPT Date: Aug 18, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
							Lower	Upper		Lower	Upper		Lower	Upper	
Canadian Drinking Water MAC Package (HAAs, VOCs)															
Chloroacetic Acid	1	2774693	0.8	0.9	NA	< 0.5	107%	70%	130%	70%	60%	130%	64%	60%	130%
Bromoacetic Acid	1	2774693	< 0.5	< 0.5	NA	< 0.5	103%	70%	130%	80%	60%	130%	74%	60%	130%
Dichloroacetic Acid	1	2774693	30.9	29.4	5.0%	< 0.5	99%	70%	130%	101%	60%	130%	102%	60%	130%
Trichloroacetic Acid	1	2774693	33.5	30.4	9.7%	< 0.5	91%	70%	130%	78%	60%	130%	81%	60%	130%
Bromochloroacetic Acid	1	2774693	6.3	6.1	3.2%	< 0.5	87%	70%	130%	100%	60%	130%	97%	60%	130%
Dibromoacetic Acid	1	2774693	0.9	1.0	NA	< 0.5	89%	70%	130%	106%	60%	130%	105%	60%	130%
Vinyl Chloride	1	2769177	< 0.6	< 0.6	NA	< 0.6	133%	50%	140%	120%	60%	130%	127%	50%	140%
Chloroethane	1	2769177	< 5	< 5	NA	< 5	117%	50%	140%	112%	60%	130%	123%	50%	140%
1,1-Dichloroethylene	1	2769177	< 2	< 2	NA	< 2	140%	50%	140%	131%	60%	130%	133%	50%	140%
Methylene Chloride (Dichloromethane)	1	2769177	< 2	< 2	NA	< 2	128%	50%	140%	121%	60%	130%	133%	50%	140%
Methyl-t-Butyl-Ether (MTBE)	1	2769177	< 2	< 2	NA	< 2	120%	60%	140%	120%	60%	140%	124%	60%	140%
Chloroform	1	2769177	58	52	10.9%	< 1	132%	50%	140%	128%	60%	130%	200%	50%	140%
1,2-Dichloroethane	1	2769177	< 2	< 2	NA	< 2	120%	50%	140%	109%	60%	130%	124%	50%	140%
Carbon Tetrachloride	1	2769177	< 0.56	< 0.56	NA	< 0.56	135%	50%	140%	132%	60%	130%	131%	50%	140%
Benzene	1	2769177	< 1	< 1	NA	< 1	132%	70%	130%	123%	70%	130%	128%	70%	130%
Trichloroethylene	1	2769177	< 1	< 1	NA	< 1	131%	50%	140%	122%	60%	130%	133%	50%	140%
Bromodichloromethane	1	2769177	6	5	18.2%	< 1	119%	50%	140%	118%	60%	130%	132%	50%	140%
Toluene	1	2769177	3	2	NA	< 2	123%	70%	130%	113%	60%	140%	108%	60%	140%
Dibromochloromethane	1	2769177	< 1	< 1	NA	< 1	105%	50%	140%	98%	60%	130%	110%	50%	140%
Tetrachloroethylene	1	2769177	< 1	< 1	NA	< 1	123%	70%	130%	118%	60%	140%	115%	60%	140%
Chlorobenzene	1	2769177	< 1	< 1	NA	< 1	110%	50%	140%	110%	60%	130%	112%	50%	140%
Ethylbenzene	1	2769177	< 2	< 2	NA	< 2	122%	70%	130%	114%	60%	140%	116%	60%	140%
Bromoform	1	2769177	< 1	< 1	NA	< 1	107%	50%	140%	95%	60%	130%	97%	50%	140%
1,4-Dichlorobenzene	1	2769177	< 1	< 1	NA	< 1	116%	50%	140%	98%	60%	130%	101%	50%	140%
1,2-Dichlorobenzene	1	2769177	< 1	< 1	NA	< 1	118%	50%	140%	97%	60%	130%	114%	50%	140%
Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution. If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated. VOC Matrix spike, Blank spike, Certified Reference Material: More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits.															
Trihalomethanes in Water															
Chloroform	1	2769177	58	52	10.9%	< 1	132%	50%	140%	128%	60%	130%	NA	50%	140%
Bromodichloromethane	1	2769177	6	5	18.2%	< 1	119%	50%	140%	118%	60%	130%	132%	50%	140%
Dibromochloromethane	1	2769177	< 1	< 1	NA	< 1	105%	50%	140%	98%	60%	130%	110%	50%	140%
Bromoform	1	2769177	< 1	< 1	NA	< 1	107%	50%	140%	95%	60%	130%	97%	50%	140%
Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution. Matrix spike performed on a different sample than the duplicate. If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.															
Diquat/Paraquat															
Diquat		TW	< 5	< 5	NA	< 5	94%	50%	140%	91%	50%	140%	92%	50%	140%

AGAT QUALITY ASSURANCE REPORT (V1)

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Results relate only to the items tested. Results apply to samples as received.

Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Aug 18, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Paraquat		TW	< 1	< 1	NA	< 1	88%	50%	140%	90%	50%	140%	92%	50%	140%
OC Pesticides (Water) (for Halifax)															
alpha-BHC	2797080		< 0.01	< 0.01	NA	< 0.01	102%	50%	140%	86%	50%	140%	92%	50%	140%
Hexachlorobenzene	2797080		< 0.01	< 0.01	NA	< 0.01	109%	50%	140%	96%	50%	140%	96%	50%	140%
beta-BHC	2797080		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	85%	50%	140%	93%	50%	140%
Gamma-Hexachlorocyclohexane	2797080		< 0.01	< 0.01	NA	< 0.01	98%	50%	140%	91%	50%	140%	105%	50%	140%
delta-BHC	2797080		< 0.01	< 0.01	NA	< 0.01	106%	50%	140%	86%	50%	140%	102%	50%	140%
Heptachlor	2797080		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	84%	50%	140%	105%	50%	140%
Aldrin	2797080		< 0.01	< 0.01	NA	< 0.01	106%	50%	140%	96%	50%	140%	107%	50%	140%
Heptachlor Epoxide	2797080		< 0.01	< 0.01	NA	< 0.01	113%	50%	140%	97%	50%	140%	102%	50%	140%
Oxychloridane	2797080		< 0.05	< 0.05	NA	< 0.05	103%	50%	140%	89%	50%	140%	104%	50%	140%
gamma-Chlordane	2797080		< 0.1	< 0.1	NA	< 0.1	114%	50%	140%	98%	50%	140%	104%	50%	140%
op'-DDE	2797080		< 0.01	< 0.01	NA	< 0.01	94%	50%	140%	89%	50%	140%	96%	50%	140%
Endosulfan I	2797080		< 0.002	< 0.002	NA	< 0.002	114%	50%	140%	100%	50%	140%	106%	50%	140%
alpha - chlordane	2797080		< 0.05	< 0.05	NA	< 0.05	116%	50%	140%	98%	50%	140%	104%	50%	140%
pp'-DDE	2797080		< 0.05	< 0.05	NA	< 0.05	100%	50%	140%	100%	50%	140%	103%	50%	140%
Dieldrin	2797080		< 0.02	< 0.02	NA	< 0.02	118%	50%	140%	99%	50%	140%	101%	50%	140%
op'-DDD	2797080		< 0.05	< 0.05	NA	< 0.05	115%	50%	140%	107%	50%	140%	104%	50%	140%
Endrin	2797080		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	103%	50%	140%	100%	50%	140%
Endosulfan II	2797080		< 0.002	< 0.002	NA	< 0.002	118%	50%	140%	94%	50%	140%	107%	50%	140%
pp'-DDD	2797080		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	105%	50%	140%	102%	50%	140%
op'-DDT	2797080		< 0.04	< 0.04	NA	< 0.04	102%	50%	140%	94%	50%	140%	102%	50%	140%
Endrin Aldehyde	2797080		< 0.05	< 0.05	NA	< 0.05	116%	50%	140%	89%	50%	140%	106%	50%	140%
Endosulfan Sulfate	2797080		< 0.05	< 0.05	NA	< 0.05	103%	50%	140%	95%	50%	140%	108%	50%	140%
pp'-DDT	2797080		< 0.05	< 0.05	NA	< 0.05	100%	50%	140%	96%	50%	140%	105%	50%	140%
Endrin Ketone	2797080		< 0.05	< 0.05	NA	< 0.05	106%	50%	140%	96%	50%	140%	109%	50%	140%
Methoxychlor	2797080		< 0.04	< 0.04	NA	< 0.04	85%	50%	140%	101%	50%	140%	102%	50%	140%
Mirex	2797080		< 0.05	< 0.05	NA	< 0.05	101%	50%	140%	92%	50%	140%	108%	50%	140%
OP Pesticides (Water)															
Phorate	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	97%	50%	140%	74%	50%	140%	72%	50%	140%
Dimethoate	2767079	2767079	< 2.5	< 2.5	NA	< 2.5	105%	50%	140%	85%	50%	140%	94%	50%	140%
Terbufos	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	98%	50%	140%	93%	50%	140%	98%	50%	140%
Diazinon	2767079	2767079	< 1	< 1	NA	< 1	86%	50%	140%	95%	50%	140%	98%	50%	140%
Malathion	2767079	2767079	< 5	< 5	NA	< 5	98%	50%	140%	105%	50%	140%	93%	50%	140%
Chlorpyrifos	2767079	2767079	< 1	< 1	NA	< 1	88%	50%	140%	98%	50%	140%	95%	50%	140%
Parathion	2767079	2767079	< 1	< 1	NA	< 1	86%	50%	140%	86%	50%	140%	105%	50%	140%
Azinphos-methyl	2767079	2767079	< 2	< 2	NA	< 2	95%	50%	140%	95%	50%	140%	98%	50%	140%
Phenoxy Acid Herbicides (Water)															

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
 PROJECT: Margravesville WTP
 SAMPLING SITE:

AGAT WORK ORDER: 21X778056
 ATTENTION TO: James Jenner
 SAMPLED BY:

Trace Organics Analysis (Continued)															
RPT Date: Aug 18, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
2,4-D	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	101%	50%	140%	115%	50%	140%	95%	50%	140%
2,4,5-T	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	92%	50%	140%	120%	50%	140%	102%	50%	140%
2,4,5-TP	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	90%	50%	140%	116%	50%	140%	100%	50%	140%
Dicamba	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	89%	50%	140%	108%	50%	140%	98%	50%	140%
Dichlorprop	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	90%	50%	140%	103%	50%	140%	90%	50%	140%
Dinoseb	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	80%	50%	140%	106%	50%	140%	95%	50%	140%
Picloram	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	95%	50%	140%	93%	50%	140%	83%	50%	140%
Diclofop-methyl	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	92%	50%	140%	79%	50%	140%	114%	50%	140%
2,3,4,6-Tetrachlorophenol	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	76%	50%	140%	82%	50%	140%	73%	50%	140%
2,4-Dichlorophenol	2767079	2767079	< 0.2	< 0.2	NA	< 0.2	76%	50%	140%	94%	50%	140%	91%	50%	140%
2,4,5-Trichlorophenol	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	90%	50%	140%	84%	50%	140%	84%	50%	140%
2,4,6-Trichlorophenol	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	75%	50%	140%	86%	50%	140%	76%	50%	140%
Bromoxynil	2767079	2767079	< 0.3	< 0.3	NA	< 0.3	98%	50%	140%	94%	50%	140%	93%	50%	140%
MCPA	2767079	2767079	< 5.0	< 5.0	NA	< 5.0	96%	50%	140%	108%	50%	140%	86%	50%	140%
MCPP	2767079	2767079	< 5.0	< 5.0	NA	< 5.0	98%	50%	140%	108%	50%	140%	92%	50%	140%
Pentachlorophenol	2767079	2767079	< 0.1	< 0.1	NA	< 0.1	106%	50%	140%	91%	50%	140%	79%	50%	140%
Triazine Pesticides [water]															
Trifluralin	2767079	2767079	< 1.0	< 1.0	NA	< 1.0	95%	50%	140%	72%	50%	140%	78%	50%	140%
Simazine	2767079	2767079	< 1.0	< 1.0	NA	< 1.0	86%	50%	140%	95%	50%	140%	96%	50%	140%
Atrazine	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	94%	50%	140%	98%	50%	140%	95%	50%	140%
Metribuzin	2767079	2767079	< 0.25	< 0.25	NA	< 0.25	105%	50%	140%	86%	50%	140%	73%	50%	140%
Prometryne	2767079	2767079	< 0.25	< 0.25	NA	< 0.25	98%	50%	140%	93%	50%	140%	92%	50%	140%
Metolachlor	2767079	2767079	< 0.11	< 0.11	NA	< 0.11	86%	50%	140%	95%	50%	140%	77%	50%	140%
Alachlor	2767079	2767079	< 0.5	< 0.5	NA	< 0.5	95%	50%	140%	97%	50%	140%	78%	50%	140%
Cyanazine	2767079	2767079	< 1.0	< 1.0	NA	< 1.0	88%	50%	140%	105%	50%	140%	79%	50%	140%
Carbamate Pesticides (Water)															
Aldicarb	2767079	2767079	< 2.0	< 2.0	NA	< 2.0	98%	50%	140%	98%	50%	140%	106%	50%	140%
Bendiocarb	2767079	2767079	< 2	< 2	NA	< 2	102%	50%	140%	99%	50%	140%	101%	50%	140%
Carbiofuran	2767079	2767079	< 5	< 5	NA	< 5	102%	50%	140%	99%	50%	140%	101%	50%	140%
Carbaryl	2767079	2767079	< 5	< 5	NA	< 5	108%	50%	140%	114%	50%	140%	115%	50%	140%
Diuron	2767079	2767079	< 10	< 10	NA	< 10	107%	50%	140%	103%	50%	140%	100%	50%	140%
Triallate	2767079	2767079	< 1	< 1	NA	< 1	101%	50%	140%	99%	50%	140%	99%	50%	140%
Temephos	2767079	2767079	< 10	< 10	NA	< 10	104%	60%	130%	104%	60%	130%	105%	60%	130%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: 

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Quality Assurance

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
 PROJECT: Margravesville WTP
 SAMPLING SITE:

AGAT WORK ORDER: 21X778056
 ATTENTION TO: James Jenner
 SAMPLED BY:

Water Analysis															
RPT Date: Aug 18, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE	
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Canadian Drinking Water MAC Package (Metals, Hg & Inorganics)															
Total Aluminum	2767843		<10	<10	NA	< 10	103%	80%	120%	102%	80%	120%	106%	70%	130%
Total Antimony	2767843		<2	<2	NA	< 2	95%	80%	120%	99%	80%	120%	94%	70%	130%
Total Arsenic	2767843		<2	<2	NA	< 2	98%	80%	120%	98%	80%	120%	97%	70%	130%
Total Barium	2767843		68	69	0.6%	< 5	92%	80%	120%	96%	80%	120%	NA	70%	130%
Total Boron	2767843		<5	<5	NA	< 5	100%	80%	120%	102%	80%	120%	103%	70%	130%
Total Cadmium	2767843		<0.3	<0.3	NA	< 0.3	101%	80%	120%	99%	80%	120%	95%	70%	130%
Total Chromium	2767843		2	2	NA	< 2	97%	80%	120%	97%	80%	120%	104%	70%	130%
Total Copper	2767843		74	73	1.3%	< 2	101%	80%	120%	101%	80%	120%	NA	70%	130%
Total Iron	2767843		299	305	1.9%	< 50	98%	80%	120%	102%	80%	120%	NA	70%	130%
Total Lead	2767843		<0.5	<0.5	NA	< 0.5	94%	80%	120%	97%	80%	120%	93%	70%	130%
Total Manganese	2767843		6	7	NA	< 2	99%	80%	120%	98%	80%	120%	109%	70%	130%
Total Selenium	2767843		<2	<2	NA	< 2	98%	80%	120%	93%	80%	120%	84%	70%	130%
Total Strontium	2767843		34	34	0.5%	< 5	89%	80%	120%	92%	80%	120%	NA	70%	130%
Total Uranium	2767843		0.5	0.5	NA	< 0.2	91%	80%	120%	94%	80%	120%	95%	70%	130%
Total Zinc	2767843		25	25	NA	< 5	99%	80%	120%	99%	80%	120%	97%	70%	130%
Total Sodium	2767843		6.8	6.7	2.6%	< 0.1	106%	80%	120%	109%	80%	120%	NA	70%	130%
Mercury	2783599		<0.026	<0.026	NA	< 0.05	98%	80%	120%		80%	120%	100%	70%	130%
pH	2775452		8.49	8.56	0.8%	< 10	101%	80%	120%	NA	80%	120%	NA	80%	120%
Turbidity	2792437		2.0	2.0	NA	< 0.5	93%	80%	120%	NA	NA	NA	NA	NA	NA
True Color	2766372		<5.00	<5.00	NA	< 5	92%	80%	120%	97%	80%	120%	NA	NA	NA
Chloride	2785643		4	4	NA	< 1	96%	80%	120%	NA	80%	120%	86%	70%	130%
Fluoride	2785643		<0.12	<0.12	NA	< 0.12	108%	80%	120%	NA	80%	120%	91%	70%	130%
Nitrate as N	2785643		0.11	0.12	NA	< 0.05	91%	80%	120%	NA	80%	120%	90%	70%	130%
Sulphate	2785643		47	47	0.7%	< 2	99%	80%	120%	NA	80%	120%	NA	70%	130%
Bromate	2767079	2767079	<0.01	<0.01	NA	< 0.01	99%	70%	130%	NA	70%	130%	94%	70%	130%
Chlorate	2767079	2767079	<0.02	<0.02	NA	< 0.02	104%	70%	130%	NA	70%	130%	98%	70%	130%
Chlorite	2767079	2767079	<0.02	<0.02	NA	< 0.02	105%	70%	130%	NA	70%	130%	95%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

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QA Violation

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY
 PROJECT: Margravsille WTP

AGAT WORK ORDER: 21X778056
 ATTENTION TO: James Jenner

RPT Date: Aug 18, 2021			REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Sample Id	Sample Description	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
				Lower	Upper		Lower	Upper		Lower	Upper
Canadian Drinking Water MAC Package (HAAs, VOCs)											
1,1-Dichloroethylene	2769177	Margravsille Raw	140%	50%	140%	131%	80%	130%	133%	50%	140%
Chloroform	2769177	Margravsille Raw	132%	50%	140%	128%	60%	130%	200%	50%	140%
Carbon Tetrachloride	2769177	Margravsille Raw	135%	50%	140%	132%	80%	130%	131%	50%	140%
Benzene	2769177	Margravsille Raw	132%	70%	130%	123%	70%	130%	128%	70%	130%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
 If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.
 VOC Matrix spike, Blank spike, Certified Reference Material : More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits.



11 Morris Drive, Unit 122
 Dartmouth, Nova Scotia
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 http://www.aqallabs.com

Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Food Chemistry Analysis			
Glyphosate	ORG-100-5115F	MA.403-GLYAMP 1.0 Modifiée	HPLC
Miscellaneous Analysis			
Radionuclides - Gross Alpha*			
Radionuclides - Gross Beta*			
Nitroacetic Acid (NTA)			
Lead-210 (Hfx 2012-05)			INCUBATOR



Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Chloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromoacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Dichloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Trichloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Bromochloroacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Dibromoacetic Acid	ORG-120-5110	EPA 552.3	GC/ECD
Haloacetic Acids	ORG-120-5110	EPA 552.3	GC/ECD
2-Bromobutanoic acid	ORG-120-5110	EPA 552.3	GC/ECD
Vinyl Chloride	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Chloroethane	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
1,1-Dichloroethylene	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Methylene Chloride (Dichloromethane)	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Methyl-t-Butyl-Ether (MTBE)	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Chloroform	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
1,2-Dichloroethane	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Carbon Tetrachloride	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Benzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Trichloroethylene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Bromodichloromethane	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Toluene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Dibromochloromethane	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Tetrachloroethylene	VOL-120-5001	EPA SW-846 5230B/8260	GC/MS
Chlorobenzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Ethylbenzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Bromoform	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Xylenes (Total)	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
1,4-Dichlorobenzene	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
1,2-Dichlorobenzene	VOL-120-5001	EPA SW-846 5030B/8260B	GC/MS
Total Trihalomethanes	VOL-120-5001	EPA SW846 5230B/8260	GC/MS
Toluene-d8	VOL-120-5001	EPA SW846 5030B/8260B	GC/MS
4-Bromofluorobenzene	VOL-120-5001	EPA SW846 5030B/8260B	GC/MS
Aldicarb	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Bendiocarb	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Carbofuran	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Carbaryl	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Diuron	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Triallate	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Temephos	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Diquat	ORG-91-5102	EPA 549.1	HPLC
Paraquat	ORG-91-5102	EPA 549.1	HPLC
alpha-BHC	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
beta-BHC	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
delta-BHC	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD

Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Heptachlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor Epoxide	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Oxychlordanes	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
gamma-Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
op'-DDE	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Endosulfan I	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
alpha - chlordanes	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDE	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Dieldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
op'-DDD	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Endrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan II	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDD	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
op'-DDT	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Endrin Aldehyde	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan Sulfate	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endrin Ketone	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Methoxychlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Mirex	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
TCMX	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Phorate	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Dimethoate	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Terbufos	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Diazinon	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Malathion	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS

Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Chlorpyrifos	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Parathion	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Azinphos-methyl	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Triphenyl phosphate (surr)	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
2,4-D	ORG-91-5110	EPA SW-846 8151A	GC/ECD
2,4,5-T	ORG-91-5510	EPA SW-846 8151A	GC/ECD
2,4,5-TP	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Dicamba	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Dichlorprop	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Dinoseb	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Picloram	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Diclofop-methyl	ORG-91-5110	EPA SW-846 8151A	GC/ECD
2,3,4,6-Tetrachlorophenol	ORG-91-5110	EPA SW-846 8151A	GC/ECD
2,4-Dichlorophenol	ORG-91-5110	EPA SW-846 8151A	GC/ECD
2,4,5-Trichlorophenol	ORG-91-5100	EPA SW-846 8151A	GC/ECD
2,4,6-Trichlorophenol	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Bromoxynil	ORG-91-5110	EPA SW-846 8151A	GC/ECD
MCPA	ORG-91-5110	EPA SW-846 8151A	GC/ECD
MCPP	ORG-91-5110	EPA SW-846 8151A	GC/ECD
Pentachlorophenol	ORG-91-5110	EPA SW-846 3510 & 8151	GC/ECD
DCAA	ORG-91-5110	EPA SW-846 8151	GC/ECD
Trifluralin	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Simazine	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Atrazine	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Metribuzin	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Prometryne	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Metolachlor	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Alachlor	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Cyanazine	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Triphenyl phosphate (surr)	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS

Method Summary

CLIENT NAME: MUNICIPALITY OF ANNAPOLIS COUNTY

AGAT WORK ORDER: 21X778056

PROJECT: Margravesville WTP

ATTENTION TO: James Jenner

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Aluminum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Total Arsenic	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Barium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Boron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Cadmium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Chromium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Copper	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Iron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Lead	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Manganese	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Selenium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Strontium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Uranium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Zinc	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Sodium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Mercury	INOR-121-6100 & INOR-121-6107	SM 3112 B	CV/AA
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
True Color	INOR-121-6008	SM 2120 B	LACHAT FIA
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INOR-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Bromate	INOR-121-6005	SM 4110 B	ION CHROMATOGRAPH
Chlorate	INOR-121-6005	SM 4110 B	ION CHROMATOGRAPH
Chlorite	INOR-121-6005	SM 4110 B	ION CHROMATOGRAPH

APPENDIX F

Last Round of Sampling Data for *GMPDWS*

Table 8 - Guidelines for Monitoring Public Drinking Water Supplies (Section 33 of Regulations)

Parameter	Health based guideline (mg/l)	AO [or OC] (mg/l)	Raw mg/l (maximum this year)	Treated mg/l (maximum this year)	Date	Location
Alkalinity	-	-	60	58	July 5	M-Ville
Aluminum	0.1-0.2	-	.032	.014		
Ammonia	-	-	<.00003	.00003		
Antimony	0.006	-	<.002	<.002		
Arsenic	0.010	-	<.002	<.002		
Barium	1	-	<.005	<.005		
Boron	5	-	.010	.011		
Cadmium	0.005	-	<.00009	<.00009		
Calcium	-	-	.018	.014		
Chloride	-	≤250	15	19		
Chromium	0.05	-	<.001	<.001		
Colour	-	≤15	<5	<5		
Conductivity	-	-	208	197		
Copper	-	≤1.0	<.001	.002		
Fluoride	1.5	-	<.12	<.12		
Hardness	-	-	76.2	61.7		
Iron	-	≤0.3	<.050	<.050		
Lead	0.010	-	<.0005	<.0005		
Magnesium	-	-	.0076	.0065		
Manganese	-	≤0.05	<.003	<.003		
Nitrate - nitrogen	10	-	4.06	1.67		
pH	-	6.5-8.5	6.94	6.93		
Potassium	-	-	.0016	.0008		
Selenium	0.01	-	<.001	<.001		

Parameter	Health based guideline (mg/l)	AO [or OC] (mg/l)	Raw mg/l (maximum this year)	Treated mg/l (maximum this year)	Date	Location
Sodium	-	≤200	12	14	July 5	M-Ville
Sulphate	-	≤500	6	5		
Total Dissolved Solids	-	≤500	.114	.102		
Total Organic Carbon	-	-	1.5	1.8		
Turbidity	Sec Approval	-	.8	<.5		
Uranium	0.02	-	<.0002	<.0002		
Zinc	-	≤5.0	<.005	<.005		
OTHER PARAMETERS SAMPLED						
Has any of the parameter exceeded Guidelines Yes..... No...X.						
If Yes provide date of occurrence and date when Department was notified:						
Action taken:						
Certified Lab:AGAT						

APPENDIX G

Approval to Operate



55 Starrs Rd. Unit 9
Yarmouth NS
Canada B5A 2T2

902-742-8985 P
902-742-7796 F
www.novascotia.ca

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1 s.1

APPROVAL HOLDER: MUNICIPALITY OF THE COUNTY OF ANNAPOLIS

SITE PID: 05022835

APPROVAL NO: 2004-038542-02

EXPIRY DATE: June 1, 2029

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Municipal - Water Works - Water Treatment Facility

Administrator: Paddy-joe MacMillan

Effective Date: June 1, 2019

The Minister's powers and responsibilities under the Act with respect to this Approval have been delegated to the Administrator named above. Therefore, any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise advised in writing.

Page 1 of 22

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: MUNICIPALITY OF THE COUNTY OF ANNAPOLIS

Project: Margaretsville WTP at GUDI Wells

Site:

<u>PID</u>	<u>Civic #</u>	<u>Street Name</u>	<u>Street Type</u>	<u>Community</u>	<u>County</u>
05022835	1557	BEN PHINNEY	RD.	MARGARETSVILLE	ANNAPOLIS COUNTY

Approval No: 2004-038542-02

File No: 94600-30-YAR-2004-038542

Reference Documents

- Application submitted March 8, 2018 and attachments.

1. Definitions

- a. Act means Environment Act, 1994-95, c.1, s.1, and includes, unless the context otherwise requires, the regulations made pursuant to the Act, as amended from time to time.
- b. Administrator means a person appointed by the Minister for the purpose of the Act, and includes an acting administrator.
- c. CT means disinfectant residual in mg/l multiplied by the contact time in minutes.
- d. Contact Time denoted as T10 is an effective contact time for disinfection in minutes and represents the time when 10% of the water passes the contact unit; that is 90% of the water remains in the unit and will be exposed to longer disinfection within the unit. T10 can be established by tracer studies or calculated using theoretical hydraulic detention times multiplied by an appropriate baffling factor listed in the "Nova Scotia Treatment Standards for Municipal Drinking Water Systems" as amended from time to time.
- e. Continuous monitoring is sampling of flow through analysis equipment that creates an output signal a minimum of once every five minutes.

Page 2 of 22

- f. Department means the Department of Environment, and the contact for the Department for this approval is:

Nova Scotia Environment
Western Region, Yarmouth Office
55 Starrs Road, Unit 9
Yarmouth, NS, B5A 2T2

Phone: 902-742-8985
Fax: 902-742- 7796

- g. Grab sample means an individual sample collected in less than 30 minutes and which is representative of the substance sampled.
- h. Inadequate Primary Disinfection means water that does not meet the required CT/IT.
- i. Inadequate Secondary Disinfection means water that does not meet the required disinfectant residual in the distribution system.
- j. Log reduction means a negative of the base 10 logarithm of the fraction of pathogens remaining after the treatment process.

log reduction = log removal by physical treatment + log inactivation by disinfection

where log removal by physical treatment is equal to the credit assigned to the filtration technology indicated in the Department's "Nova Scotia Treatment Standards for Municipal Drinking Water Systems", as amended from time to time; and

log inactivation by disinfection is equal to the inactivation which shall be calculated as defined by the Department's "Nova Scotia Treatment Standards for Municipal Drinking Water Systems", as amended from time to time.

- k. Minister means the Minister of Environment and includes any person delegated the authority of the Minister.
- l. QA/QC means quality assurance and quality control.
- m. Quarterly sampling means samples taken once per quarter with no less than a 45 day interval between sampling events.
- n. Site means a place where a designated activity and/or undertaking is occurring or may occur

2. Scope

- a. This Approval (the "Approval") relates to the Approval Holder(s) and their

application and all documentation submitted to the Department prior to the issuance of this approval for the Municipal Water Treatment Facility situated at or near Margaretsville, NS (the "Site").

- b. This Approval supersedes previous Approval number 2004-038542-01 which is now null and void.

3. General

- a. The Approval Holder(s) shall conduct the Designated Activity in accordance with the following provisions:
 - i. The Act, as amended from time to time;
 - ii. Any standard adopted by the Department, as amended from time to time, which includes but is not limited to the following:
 - (a) The Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems (2004), as amended from time to time;
 - (b) By January 1, 2020, the Nova Scotia Treatment Standards for Municipal Drinking Water Systems (2012), as amended from time to time;
 - (c) the Guidelines for Monitoring Public Drinking Water Supplies, as amended from time to time; and
 - (d) Health Canada's Guidelines for Canadian Drinking Water Quality, as amended from time to time.
 - (e) Facility Classification Standards (2009), as amended from time to time
- b. Nothing in this Approval relieves the Approval Holder(s) of the responsibility for obtaining and paying for all licenses, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws or provincial or federal legislation. The Minister does not warrant that such licenses, permits, approvals or other authorizations will be issued.
- c. If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.
- d. Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- e. If the Minister cancels or suspends this Approval, the Approval Holder(s) remains subject to the penalty provisions of the Act.

- f. The Approval Holder(s) shall advise the Department in writing prior to any proposed extensions or modifications to the Site. An amendment to this Approval may be required before implementing any extension or modification.
- g. The Approval Holder(s) shall immediately notify the Department of any incidents of non-compliance with this Approval.
- h. The Approval Holder(s) shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.
- i. All sampling and analysis must be performed in accordance with the following as amended from time to time: Standard Methods for the Examination of Water and Wastewater, or the analytical methods section of Health Canada's guideline technical document for the parameter of concern. All samples shall be collected by persons trained in appropriate sample collection procedures.
- j. Unless written authorization is received otherwise from the Minister, all samples required by this Approval shall be analyzed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.
- k. Notwithstanding the above item, the following parameters may be analyzed at the Site or a laboratory that is not certified.

Alkalinity*, Aluminium Residual*, Chloramines, Chlorine Dioxide Residual, Chlorine Residual, Colour, Conductivity*, Fluoride Residual*, Hardness*, Iron*, Manganese*, Methane*, Free Ammonia (as N)*, Ozone Residual, pH, Temperature, Total Organic Carbon, Turbidity and UV Absorbance.

* These parameters must have a Quality Assurance/Quality Control component that includes quarterly confirmation by an accredited laboratory.

- l. The Approval Holder(s) shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the designated activity are made fully aware of the terms and conditions which pertain to this Approval.
- m. Upon any changes to the Registry of Joint Stock Companies information, the Approval Holder(s) shall provide a copy to the Department within five business days.

4. Releases

- a. Releases shall be reported in accordance with the Act.
- b. Releases shall be cleaned up in accordance with the Act.

5. Residuals Management

- a. The Residuals Management Plan shall be submitted to the Department by October 1, 2019.
- b. All residuals generated at the Site shall be managed in accordance with a Residuals Management Plan deemed acceptable by the Department.
- c. Changes to the Residuals Management Plan must be submitted in writing for review and be deemed acceptable by the Department prior to implementation.
- d. The residuals management plan shall contain, at a minimum, the following information for each waste stream :
 - i. type of residual;
 - ii. processing method;
 - iii. expected annual volume of residuals to be generated by the activity.
- e. The Approval Holder(s) shall record the following information each time residuals are removed from the facility and make the records available to the Department immediately upon request:
 - i. the type of residual,
 - ii. the volume of each residual transported, expressed as cubic metres or kilograms,
 - iii. hauler, if applicable
 - iv. date of transport
 - v. final destination of residuals

6. Operation

- a. The Municipal Public Drinking Water Supply has been classified as a Class II water treatment facility and a Class I water distribution facility.
- b. When it is necessary to use a by-pass to divert water around one or more unit processes, the Approval Holder(s) shall immediately notify the Department and identify the anticipated period of time that the by-pass will be in service.
- c. When it is necessary to use a by-pass to divert water around one or more unit processes, the Approval Holder(s) shall immediately initiate a Boil Water Advisory. The Approval Holder(s) shall maintain the boil advisory until otherwise advised by the Department.
- d. The Approval Holder(s) shall ensure the development and implementation of a

cross-connection control program to protect the Municipal Public Drinking Water Supply from contamination due to cross-connections from commercial, institutional, industrial, multi-unit residential, and agricultural facilities, at a minimum, and avoid any cross-connections within the drinking water treatment facility. The program shall be submitted to the Department for review on or before June 1, 2020. Upon review, the Department may require changes to the cross-connection control program.

- e. The Approval Holder(s) shall demonstrate that any water supply system component in contact with treated water has been disinfected after construction, repair or maintenance in accordance with ANSI(American National Standards Institute)/AWWA (American Water Works Association) C651 - Disinfection of Water Mains, ANSI/AWWA-C653 - Disinfection of Water Treatment Plant, and ANSI/AWWA C652 - Disinfection of Water Storage Facilities or the latest revisions.
- f. The Approval Holder(s) shall ensure that all chemicals used in the treatment process and all materials contacting the water are of "food grade" quality and meet both the AWWA quality criteria as set out in AWWA standards and the ANSI safety criteria as set out in ANSI standard NSF/60 (for chemical additives) or NSF/61 (for materials). A copy of the appropriate NSF certification is to be kept on Site and is to be available for review immediately upon request by the Department.
- g. The Approval Holder(s) shall discontinue use of any chemical found to have adverse effects on finished water quality limits as prescribed in this Approval.
- h. Emergency Notification Procedures:
 - i. The Approval Holder(s) shall ensure that the emergency notification procedures are reviewed and updated on a yearly basis. The Approval Holder(s) shall document in the annual report what modifications were made to the emergency notification procedures and how the procedures were communicated to their staff.
 - ii. A copy of the emergency notification procedures are to be maintained on Site at all times and are to be available for review immediately upon request by the Department.
 - iii. The Approval Holder(s) shall ensure that all employees are trained in accordance with the emergency notification procedures and shall keep a record of training at the facility for a minimum period of five (5) years.
- i. Operations Manual:
 - i. A copy of the operations manual is to be kept on Site at all times and is to be available for review immediately upon request by the Department.

- ii. The Approval Holder(s) shall ensure that all employees are trained in accordance with the operations manual and shall keep a record of training at the facility for a minimum period of five (5) years.
- j. A set of drawings, incorporating any amendments made from time to time, shall be retained on Site by the Approval Holder(s) for as long as the Municipal Public Drinking Water Supply is kept in operation and are to be available for inspection or review by departmental staff immediately upon request.
- k. The Approval Holder(s) shall establish procedures for receiving and responding to complaints including a reporting system that records and documents what steps were taken to determine the cause of complaint and the corrective measures taken to alleviate the cause and prevent its recurrence.
- l. The Approval Holder(s) shall establish security measures to assure the safety of the Municipal Public Drinking Water Supply.
- m. The Approval Holder(s) shall maintain a written list of the name of each laboratory utilized, and the parameters analyzed by each laboratory, and shall submit this list to the Department immediately upon request.

7. System Assessment Report

- a. The Approval Holder(s) shall submit a "System Assessment Report" to the Department by April 1, 2023, to verify that the Municipal Public Drinking Water Supply complies with the Act and standards.
- b. The System Assessment Report shall be in accordance with the Department's "Terms of Reference for System Assessment Reports for Water Works" as amended from time to time.
- c. The Approval Holder(s) shall provide the Department with their corrective action plan to address deficiencies identified by the "System Assessment Report" by October 1, 2023. Any changes to the corrective action plan shall be submitted to and deemed acceptable by the Department.

8. Source Water Protection

- a. The Approval Holder(s) shall implement the accepted Source Water Protection Plan in accordance with the accepted schedule.
- b. The Approval Holder(s) shall ensure that the Source Water Protection Plan is reviewed and updated on a yearly basis. The Approval Holder(s) shall ensure that any changes are documented in the annual report.
- c. The Approval Holder(s) shall modify the Source Water Protection Plan including updates, if so directed by the Department.

9. Water Quality Requirements - Performance and Limits

General Requirements

- a. Utilizing both the engineered filtration and disinfection processes, the treatment facility shall meet the following treatment efficiencies:
 - i. Treatment shall be sufficient to ensure 3-log reduction (99.9%) of Giardia and Cryptosporidium, and
 - ii. Treatment shall be sufficient to ensure 4 log reduction (99.99%) of viruses
- b. Primary disinfection through the use of UV, chlorine, and/or Department approved alternate disinfectant shall address a minimum of 0.5-log inactivation for Giardia when used in conjunction with filtration. The disinfection log inactivation shall be based on CT/IT values as described in "Nova Scotia Treatment Standards for Municipal Drinking Water Systems". CT values shall be calculated as defined by the Department's "Nova Scotia Treatment Standards for Municipal Drinking Water Systems". A minimum UV dose (IT) of 40mJ/cm² is required.
- c. The treated water shall minimize corrosion of the water distribution and/or plumbing systems..

Primary Disinfection Requirements

- d. The facility shall have a minimum of two primary disinfection units to ensure that inadequately disinfected water is not distributed. Each disinfection unit shall be capable of meeting the maximum day demand flow. Where more than two disinfection units are provided, the maximum day demand flow shall be met when the largest unit is out of service.
- e. Continuous on-line monitoring of the primary disinfection process is required at each treatment facility with measurements taken at a minimum of once every five minutes to ensure that inadequately disinfected water does not enter the distribution system. Water systems shall be equipped with alarm capabilities to notify operations staff if the disinfection process fails to operate properly to prevent inadequately disinfected water from being distributed.
- f. In the event of an emergency situation where water enters the water distribution system that does not meet the water quality limits as prescribed in this Approval, the Approval Holder(s) shall issue a boil water advisory, do-not-consume, or do-not-use advisory as described in the Guidelines for Monitoring Public Drinking Water Supplies and immediately notify the Department.
- g. Standard operational procedures (SOPs) for the disinfection process shall be developed, implemented and communicated to all operations staff and documented in the operations manual required herein. The procedures and a log indicating the date and method of communication to staff shall be made available to the Department immediately upon request.

- i. The standard operational procedures shall indicate the design ranges for achieving CT (e.g. minimum temperature and chlorine residual; maximum flow and pH) and/or IT (e.g. min UV intensity, min UV transmittance, and max water flow).
- ii. When operational conditions are outside the design ranges for achieving CT/IT, the Approval Holder shall notify the Department as soon as the Approval Holder becomes aware, investigate the cause and take necessary corrective action. CT/IT shall be calculated during every such event.

Filtration Requirements

General Requirements:

- h. A minimum of two filters (redundancy) is required. Where two filters or membrane units are provided, each shall be capable of supplying maximum daily demands with the largest filter out of service. Where more than two filters or membrane units are provided, the maximum day demand shall be met with the largest filter out of service.

Individual Filter Turbidity Values:

- i. For slow sand filtration, turbidity levels from individual filters:
 - i. shall be less than or equal to 1.0 NTU in at least 95% of measurements made, or at least 95% of the time each calendar month;
 - ii. shall not exceed 3.0 NTU at any time.
- j. The filtration process shall be operated in such a manner as to remove an individual filter from service if the turbidity exceeds the values specified herein.
- k. Filtration processes for pathogen reduction are required to be continuously monitored, with measurements taken at a minimum frequency of once every five minutes. Filtration processes shall have a shut off feature and alarm when turbidity criteria are not achieved . The Approval Holder shall notify the Department as soon as they become aware of turbidity values that do not meet the requirements of this Approval.
- l. Standard operational procedures for the filtration process shall be developed, implemented and communicated to all operations staff and documented in the operations manual required herein. The procedures shall be made available to the Department immediately upon request.

Distribution Turbidity Values:

- m. A turbidity value of 5.0 NTU or less shall be achieved on water distribution system sampling.

- n. Unless specified otherwise in this approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the “Guidelines for Monitoring Public Drinking Water Supplies”.
- o. Where turbidity values of greater than 5.0 NTU are observed in the water distribution system, the Approval Holder(s) shall investigate the cause and take corrective action as necessary and notify the Department immediately.

Turbidity Monitoring Requirement:

- p. Continuous monitoring, with measurements taken at no more than five minute intervals, is required for individual filter effluent.
- q. Continuous or grab sample monitoring at least once a day is required for raw water prior to pre-treatment.
- r. Continuous or grab sample monitoring of the water distribution system is required. Unless specified otherwise in this approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the “Guidelines for Monitoring Public Drinking Water Supplies”.

Secondary Disinfection and Residual Monitoring Requirements

- s. Secondary disinfection through the use of Free Chlorine shall be used to maintain a chlorine residual in the water distribution system.
- t. The disinfection process shall be operated in such a manner as to ensure that the following minimum chlorine residual value is achieved throughout the water distribution system at all times:
 - i. 0.20 mg/L free chlorine residual.
- u. The disinfection process shall be operated in such a manner as to ensure that the maximum chlorine residual delivered to consumers does not exceed the following value:
 - i. 4.0 mg/L free chlorine residual.
- v. Continuous monitoring of the chlorine residual is required for the water leaving any water storage structure within the water distribution system, with measurements taken at no more than five minute intervals.
- w. Monitoring of the water distribution system for chlorine residual is required. Unless specified otherwise in this Approval, sampling and testing frequency is the same as for bacteriological sampling requirements as stated in the “Guidelines for Monitoring Public Drinking Water Supplies”.

10. Backup Water Systems

- a. Prior to the use of a backup water system, the Approval Holder(s) shall immediately notify the Department and identify the anticipated period of time that the backup system will be in service.
- b. For backup systems that do not meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, the Approval Holder(s) shall immediately initiate a Boil Water Advisory as stated in the “Guidelines for Monitoring Public Drinking Water Supplies” prior to the use of the backup system. The Approval Holder(s) shall maintain the boil advisory until otherwise advised by the Department.
- c. For backup systems that meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, the backup water system may continue to operate until the main water system is put back into service or as otherwise directed by the Department.

11. Laboratory Reports and Water Quality Results

- a. The Approval Holder shall submit copies of the laboratory certificate of analysis to the Department immediately upon request.
- b. The Approval Holder(s) will authorize and work with laboratories to electronically report water quality results to the Department upon implementation of an on-line drinking water quality surveillance program.
- c. Electronic reporting shall not replace the Approval Holder(s)’s responsibility to notify the Department immediately, by telephone, of the presence of bacteria or an exceedance of a maximum acceptable concentration for a health-related parameter listed in the “Guidelines for Canadian Drinking Water Quality”.

12. Monitoring and Recording

- a. The Approval Holder(s) shall monitor and sample the municipal public drinking water supply system in accordance with a monitoring program deemed acceptable by the Department and which meets the minimum requirements of Schedule A, attached. In the case of a discrepancy between Schedule A and the accepted monitoring program, the accepted monitoring program shall apply.
- b. All required monitoring data must be collected and submitted in the units of measure indicated in the standard(s).
- c. Sampling shall be representative of the water distribution system.
- d. On or before October 1 of each year, the Approval Holder(s) shall recommend to the Department the monitoring program for the municipal public drinking water supply for the following calendar year, highlighting any proposed changes and the reason for the changes. Any existing monitoring program shall remain in place until the recommended monitoring program is deemed acceptable by the

Department.

- e. The monitoring program shall meet the minimum requirements of the Department's "A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans", as amended from time to time.
- f. The monitoring program shall be acceptable to the Department.
- g. The Approval Holder(s) is responsible for implementing, on an annual basis, the monitoring program and subsequent revisions as deemed acceptable by the Department.
- h. The Approval Holder(s) shall not move, relocate or otherwise alter the location of the sampling locations indicated in the approved monitoring program without written permission from the Department.
- i. Following a review of any of the analytical results required by this Approval, the Department may alter the frequencies, location, and parameters for analyses required for this Approval or require other remedial action.
- j. Any flow measuring devices and continuous water quality analysers and indicators with alarm systems shall be installed, maintained and calibrated as specified by the instrument manufacturer's instructions. Calibration logs for each instrument shall be maintained at the site and be available for inspection immediately upon request by the Department.
- k. The Approval Holder(s) shall establish a QA/QC program to validate the measurements obtained from continuous monitoring equipment and for all analysis conducted at the Site or a non-certified laboratory.
- l. The Approval Holder(s) shall establish and conduct process control testing and sampling and record the results. Results are to be made available for inspection or review by departmental staff immediately upon request.
- m. The Approval Holder(s) shall establish and conduct source water protection testing and sampling and record the results. Results are to be made available for inspection or review by departmental staff immediately upon request.

13. Reporting

Reporting Upon Request

- a. The Approval Holder(s) shall keep records continually updated in such a way, that weekly and/or monthly reporting of monitoring and sampling results can be immediately sent to the Department upon request.

Annual Reporting

- b. The Approval Holder(s) shall prepare and submit to the Department, an annual

report for the municipal public drinking water supply.

- c. The annual report shall be submitted on or before April 1 following the completion of the calendar year being reported upon.
- d. The annual report shall contain, but not be limited to, the following information:
 - i. a summary and discussion of the quantity of water supplied during the reporting period on a per month basis showing design values, maximum daily flow and average daily flow for each month and any other parameters or conditions specified in the Water Withdrawal Approval.
 - ii. a summary and interpretation of analytical results obtained in accordance with the monitoring and recording section of this Approval, including an explanation for any exceedance of the maximum acceptable concentration (MAC) of health-related parameters listed in the "Guidelines for Canadian Drinking Water Quality", latest edition and the actions taken to address the exceedance;
 - iii. a summary and interpretation of analytical results obtained in accordance with the corrosion assessment/control monitoring program including but not limited to residential lead sampling results;
 - iv. annual trend graphs for parameters that are continuously monitored;
 - v. date and description of any emergency or upset conditions which occurred during the period being reported upon and action taken to correct them;
 - vi. any modifications to the contingency plan or emergency notification procedures including a description of how the information was communicated to staff;
 - vii. a list of the names of each laboratory utilized by the Approval Holder(s) and the parameters analyzed by each laboratory;
 - viii. an update on the status of the source water protection plan, including any modifications to the plan or implementation schedule, and a summary of activities taken to achieve the goals and objectives of the plan;
 - ix. all incidents of free chlorine residual below 0.20 mg/L in the water distribution system shall be detailed with a description of any actions taken;
 - x. mathematical verification that the operational conditions remained within the design range for achieving CT/IT; if operational conditions went outside the design ranges, provide CT/IT calculations and a summary of corrective actions taken;
 - xi. mathematical verification that the individual filter turbidity values are less than or equal to 1.0 NTU in at least 95% of the measurements made, or at

Page 14 of 22

least 95% of the time each calendar month;

- xii. summary of residuals removed from the facility including: type; volume (m³ or kg); hauler and date of transport; if applicable, and final destination;
- xiii. incidents of non-compliance with this Approval, the date it was reported to the Department, and corrective actions taken by the Approval Holder(s);
- xiv. any complaints received and the steps taken to determine the cause of the complaint and the corrective measures taken to alleviate the cause and prevent its recurrence;
- xv. a review of the QA/QC program to validate the measurements obtained from continuous monitoring equipment and for all analysis conducted at the facility or a non-certified laboratory;
- xvi. a list of each certified operator and their level of certification;

Emergency Reporting on Operation

- e. The Approval Holder(s) shall notify the Department immediately of an incident that may adversely affect the quality of the water within the municipal public drinking water supply. Notification shall be made to a live person by phone or in person and followed by fax or email. These incidents shall include but not be limited to: the presence of bacteria; inadequately disinfected water being directed to the water distribution system; sewage or other releases in the source municipal public drinking water supply area; line breakage that may result in cross contamination; exceedance of turbidity values required by this approval; if using membrane filtration, failure of direct integrity test, etc.
- f. The Approval Holder(s) shall notify the Department immediately of any analytical results that exceed the maximum acceptable concentration (MAC) of health-related parameters listed in the "Guidelines for Canadian Drinking Water Quality", latest edition. Notification shall be made to a live person by phone or in person and followed by fax or email.
- g. When bacteria are detected at the municipal public drinking water supply, the Approval Holder(s) shall notify the Department immediately of the presence of bacteria and take corrective action as outlined in the latest edition of the "Guidelines for Monitoring Public Drinking Water Supplies" as amended from time to time. Notification shall be made to a live person by phone or in person and followed by fax or email.
- h. If the chlorine residual in the water distribution system is less than 0.20 mg/L free chlorine, the Approval Holder(s) shall notify the Department immediately of the low chlorine residual and take corrective action to obtain the required residual. Notification shall be made to a live person by phone or in person and followed by fax or email.

14. Contingency Plan

- a. The contingency plan is to meet the minimum requirements of the Department's "A Guide to Assist Nova Scotia Municipal Water Works Develop a Comprehensive Operations Manual" and "Contingency Planning Guidelines" as amended from time to time.
- b. The Approval Holder(s) shall ensure that the contingency plan for the Municipal Public Drinking Water Supply is reviewed and updated on a yearly basis. The Approval Holder(s) shall document in the annual report what modifications were made to the plan and how the plan was communicated to their staff.
- c. The Approval Holder(s) shall ensure that all employees are trained in accordance with the contingency plan and shall keep a record of training at the facility for a minimum period of five (5) years.
- d. A copy of the contingency plan is to be maintained on Site at all times and is to be available for review immediately upon request by the department.

15. Records

- a. The Approval Holder(s) shall keep the following records and water quality analyses:
 - i. All incidents of suspected and/or confirmed disease outbreaks attributed to the water system shall be documented and kept for a minimum of ten years.
 - ii. Bacteriological, chlorine residual and turbidity analyses shall be kept for two years.
 - iii. Chemical analysis shall be kept for 10 years.
 - iv. Annual water withdrawal records shall be kept for 10 years.
- b. The Approval Holder(s) shall retain the following information for a period of five (5) years:
 - i. Calibration and maintenance records.
 - ii. Continuous monitoring data.
- c. A copy of project reports, construction documents and drawings, inspection reports, shall be kept for the life of the Water Supply System.

Schedule A		
Medium-Risk GUDI		
Water Quality Parameters	Sample Location	Minimum Frequency
Turbidity		
Turbidity	Individual GUDI well (at wellhead)	Continuous at no more than 5 minute intervals
	Distribution system sample points	Weekly grab sample
Primary Disinfection (Parameters to be monitored depend on the disinfection method used)		
Free Chlorine		
Free Chlorine Residual	CT control point (water entering the distribution system)	Continuous at no more than 5 minute intervals – must meet CT design criteria
Temperature	CT control point	Continuous at no more than 5 minute intervals or daily grab – must meet CT design criteria
pH	CT control point	Continuous at no more than 5 minute intervals – must meet CT design criteria
Secondary Disinfection (Parameters to be monitored depend on disinfection method used)		
Free Chlorine		
Free Chlorine Residual	Storage structure outlet	Continuous at no more than 5 minute intervals
	Distribution system sample points	Weekly grab sample
Microbial Quality		
Total Coliforms and <i>E. coli</i> (present/absent)	Water entering the distribution system	Weekly grab sample
	Distribution system sample points	Weekly grab sample
Microscopic Particulate Analysis (MPA)	Raw water from each individual GUDI well	Every two years in spring following a rainfall
Viruses	Raw water	As requested by the Department
	Water distribution system	As requested by the Department
Giardia and	Raw water	As requested by the

Schedule A																
Medium-Risk GUDI																
Water Quality Parameters	Sample Location	Minimum Frequency														
Cryptosporidium		Department														
	Water distribution system	As requested by the Department														
Corrosion Monitoring Program																
<ul style="list-style-type: none"> pH Alkalinity Temperature Conductivity Dissolved oxygen Chlorine or chloramine residual Corrosion inhibitor residual (if used) <p>These parameters will assist the utility determine the corrosivity of the water and type of corrosion control the system should install, if needed.</p>	<p>Point of entry and representative locations within the distribution system based on population served:</p> <table border="1"> <thead> <tr> <th>Population</th> <th># of distribution samples</th> </tr> </thead> <tbody> <tr> <td><100</td> <td>1</td> </tr> <tr> <td>101-500</td> <td>2</td> </tr> <tr> <td>501-3,300</td> <td>3</td> </tr> <tr> <td>3,301-10,000</td> <td>4</td> </tr> <tr> <td>10,001-100,000</td> <td>6</td> </tr> <tr> <td>>100,000</td> <td>10</td> </tr> </tbody> </table>	Population	# of distribution samples	<100	1	101-500	2	501-3,300	3	3,301-10,000	4	10,001-100,000	6	>100,000	10	<p>Quarterly grab sample for two consecutive years*</p> <p>* An owner may submit a request to NSE for a reduction in the frequency of point-of-entry and distribution monitoring requirements from quarterly to annually between May and October if the water is not corrosive as evidenced by point-of-entry and distribution sample results for key parameters in conjunction with residential lead levels (e.g. the 90th percentile lead concentrations are below the lead action level for a period of two consecutive years).</p> <p>*If the water is corrosive as evidenced by point-of-entry and distribution sample results for key parameters in conjunction with residential lead levels (e.g. the 90th percentile lead concentrations are above the lead action level in any given year), the utility shall implement a corrosion control program or optimize their existing program. The utility shall submit a corrosion control program to NSE for review and acceptance. Once accepted by NSE, the</p>
Population	# of distribution samples															
<100	1															
101-500	2															
501-3,300	3															
3,301-10,000	4															
10,001-100,000	6															
>100,000	10															

Schedule A								
Medium-Risk GUDI								
Water Quality Parameters	Sample Location	Minimum Frequency						
		utility shall follow the corrosion control monitoring parameters, location(s) and frequency included in their program.						
Lead – flushed sample(s)	Representative locations within the distribution system based on population served – see table above.	Annually – during the warmest month* * An owner may submit a request to NSE to stop collecting flushed samples for lead from the distribution system, if samples collected from the distribution system during the warmest month for a period of two consecutive years show the utility does not have lead present in fittings or other components in the distribution system.						
Lead – Stagnated Sampling (as per Health Canada's Guidance for Controlling Corrosion in Drinking Water Distribution Systems, as amended from time to time) Tier 1 Sampling <ul style="list-style-type: none"> • Minimum 6-hour stagnation period • Collect first draw 1 litre sample. May collect 4 1-litre samples in case Tier 2 sampling is required. 	Where possible, sites shall be selected to include: 1/ at least 50% of sites with lead service lines (where present); 2/ locations that contain copper pipes with lead solders or lead pipes; and 3/ locations with lead containing brass fittings.	Annually between May to October to assess corrosivity of water to lead release. If < 10% (defined as 90 th percentile) of initial sample results are above the lead action limit for a period of two consecutive years, submit request to NSE to sample once per year (reduced annual). If > 10% (defined as 90 th percentile) of initial sample results are above the lead action limit, proceed to Tier 2 sampling.						
	Number of monitoring sites is based on the population served as shown in the following table:							
	<table border="1"> <thead> <tr> <th>Population</th> <th># of sites</th> <th># of sites</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Population	# of sites	# of sites			
Population	# of sites	# of sites						

Schedule A			
Medium-Risk GUDI			
Water Quality Parameters	Sample Location	Minimum Frequency	
		(Routine annual)	(Reduced annual)
	<100	5	5
	101-500	10	5
	501-3,300	20	10
	3,301-10,000	40	20
	10,001-100,000	60	30
	>100,000	100	50
*An owner may submit a request to NSE for a reduction in the number of residential samples if the 90th percentile lead concentrations are below the lead action level for a period of two consecutive years.			
Tier 2 Sampling <ul style="list-style-type: none"> Minimum 6-hour stagnation period Collect first draw 4* x 1 litre samples (or additional 3 x 1 litre samples from Tier 1) <p>* More than 4 samples may be required to identify the source of lead, depending on several factors including the length and diameter of piping, etc.</p>	Sample at 10% of sites sampled in Tier 1 (sites with the highest lead concentration). For systems serving 500 or fewer people a minimum of two sites are required.	Only required when >10% of Tier 1 samples exceed the lead action limit.	
	Each 1 liter sample is analyzed to obtain a profile of lead contribution from the: <ul style="list-style-type: none"> -Faucet -Plumbing (leaded solder, brass and bronze fittings, brass water meter, etc.) -Lead service line 		
Process Control			
Water Volume	Each individual well	Continuous at no more than five minute intervals	
Disinfection By-products			
Total Trihalomethanes (THMs)	Select distribution system sample point(s) – representative of highest level. Areas in the distribution system with the longest disinfectant retention time.	Quarterly - locational running annual average (lraa) based on a minimum of 4 quarterly samples.	
Haloacetic Acids (HAAs)	Select distribution system sample point(s) – where historical data show the	Quarterly - locational running annual average (lraa) based on a minimum	

Schedule A		
Medium-Risk GUDI		
Water Quality Parameters	Sample Location	Minimum Frequency
	highest concentration. Where historical data is not available concentrations shall be monitored in the middle and extremities of the distribution system.	of 4 quarterly samples.
Chlorate – if storing sodium hypochlorite more than 3 months	Water entering distribution system	Quarterly
Bromate – if storing sodium hypochlorite more than 3 months	Water entering distribution system	Quarterly
Treatment Process Backwash Wastewater		
If required, treatment process backwash wastewater- parameter(s), location(s), and frequency in accordance with this approval and the accepted annual monitoring program.		
General Chemical and Physical Quality		
General chemical and physical parameters listed in the Guidelines for Monitoring Public Drinking Water Supplies	Raw and treated water	Minimum annually
Manganese	<ul style="list-style-type: none"> • Raw water (prior to treatment) • Entering the distribution system • Distribution system 	<ul style="list-style-type: none"> • Twice per year (spring and fall) • Quarterly • Quarterly <p>* The Approval Holder may request a reduction in sample frequency, if it is determined that manganese is not a parameter of concern for the water supply.</p>
Guidelines for Canadian Drinking Water Quality		
All health-related parameters in the Guidelines for Canadian Drinking Water Quality	Raw and treated water	Every 5 years unless system assessment report or source water protection plan requires more frequent monitoring.
Source Water Protection		
Parameters as per the source water protection monitoring program	Locations and frequencies in accordance with the source water protection monitoring program.	

APPENDIX H

Approval to Withdrawal



136 Exhibition Street
Kentville, NS
Canada B4N 4E5

902-679-6086 T
902-679-6186 F
www.novascotia.ca

Our File Number: 95100-30-KEN-2014-090989

August 2, 2022

MUNICIPALITY OF THE COUNTY OF ANNAPOLIS
PO BOX 100
ANNAPOLIS ROYAL, NS B0S1A0

Dear Sir or Madam

**RE: Approval for Operation - Water Withdrawal. Approval No. 2014-090989-01
PID # 05022835**

Enclosed please find Approval 2014-090989-01 for Operation of the Water Withdrawal at 1557 Ben Phinney Rd. Margaretsville, Annapolis County Nova Scotia.

Strict adherence to the attached terms and conditions is imperative in order to validate this approval.

Despite the issuance of this Approval, the Approval Holder is still responsible for obtaining any other authorization which may be required to carry out the activity, including those which may be necessary under provincial, federal or municipal law.

Should you have any questions, please contact Lanying X Zhao, Western Region, Kentville Office at 902-679-6086.

Yours truly,

A handwritten signature in black ink, appearing to read "RC", with a long horizontal flourish extending to the right.

Robert Cuthbert
District Manager



55 Starrs Rd. Unit 9
Yarmouth NS
Canada B5A 2T2

902-742-8985 P
902-742-7796 F
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APPROVAL

Province of Nova Scotia Environment Act, S.N.S. 1994-95, c.1 s.1

APPROVAL HOLDER: MUNICIPALITY OF THE COUNTY OF ANNAPOLIS

SITE PID: 05022835

APPROVAL NO: 2014-090989-01

EXPIRY DATE: July 1, 2025

Pursuant to Part V of the Environment Act, S.N.S. 1994-95, c.1 s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Water Approval - Water Withdrawal

Administrator: Robert Cuthbert

Effective Date: August 2, 2022

The Minister's powers and responsibilities under the Act with respect to this Approval have been delegated to the Administrator named above. Therefore, any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise advised in writing.

Page 1 of 8

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Department of Environment and Climate Change

Approval Holder: MUNICIPALITY OF THE COUNTY OF ANNAPOLIS

Project: Margretnville Municipal Water Supply

Site:

<u>PID</u>	<u>Civic #</u>	<u>Street Name</u>	<u>Street Type</u>	<u>Community</u>	<u>County</u>
05022835	1557	BEN PHINNEY	RD.	MARGARETSVILLE	ANNAPOLIS COUNTY

Approval No: 2014-090989-01

File No: 95100-30-KEN-2014-090989

Grid Reference: Easting - 337919, Northing - 4988947

Reference Documents

- Application submitted February 28, 2022 and attachments.

1. Definitions

- a. Act means Environment Act, 1994-95, c.1, s.1, and includes, unless the context otherwise requires, the regulations made pursuant to the Act, as amended from time to time.
- b. Department means the Nova Scotia Department of Environment and Climate Change, and the contact for the Department for this approval is:
Nova Scotia Department of Environment and Climate Change
Western Region, Kentville Office
136 Exhibition Street
Kentville, Nova Scotia B4N 4E5

Phone: (902) 679-6086
Fax: (902) 679-6186
- c. Minister means the Minister of Environment and Climate Change and includes any person delegated the authority of the Minister.
- d. Site means a place where a designated activity and/or undertaking is occurring or may occur.

2. Scope

Page 2 of 8

- a. This Approval (the "Approval") relates to the Approval Holder(s) and their application and all documentation submitted to the Department prior to the issuance of this approval for the Water Withdrawal situated at or near Ben Phinney Road, Margaretsville, Annapolis County.
- b. The Approval Holder(s) shall ensure the designated activity is carried out in accordance with this Approval and reference documents, including the application and supporting documentation.
- c. This approval authorizes only the activities outlined in the Scope section. All other watercourse alterations require additional Approvals or Notifications.

3. General

- a. The Approval Holder(s) shall conduct the Designated Activity in accordance with the following provisions:
 - i. The Act, as amended from time to time;
 - ii. Any standard adopted by the Department, as amended from time to time.
- b. Nothing in this Approval relieves the Approval Holder(s) of the responsibility for obtaining and paying for all licenses, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws, provincial or federal legislation, or other organizations. The Minister does not warrant that such licenses, permits, approvals or other authorizations will be issued.
- c. No authority is granted by this Approval to enable the Approval Holder(s) to commence or continue the designated activity on lands which are not in the control or ownership of the Approval Holder(s). It is the responsibility of the Approval Holder(s) to ensure that such a contravention does not occur. The Approval Holder(s) shall provide, to the Department, proof of such control or ownership upon expiry of any relevant lease or agreement. Failure to retain said authorization may result in this Approval being cancelled or suspended.
- d. If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.
- e. Any request for renewal or amendment of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- f. The Approval Holder(s) shall advise the Department in writing prior to any proposed extensions or modifications to the Activity and/or the Site. An amendment to this Approval may be required before implementing any extension or modification.
- g. The Approval Holder(s) shall immediately notify the Department of any incidents of non-compliance with this Approval.

- h. The Approval Holder(s) shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.
- i. Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures that are all deemed acceptable to the Department.
- j. Unless written authorization is received otherwise from the Minister, all samples required by this Approval shall be analyzed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.
- k. Any well that is required to be decommissioned by the Minister or that is not being used or maintained for present or future use shall be decommissioned in accordance with the Well Construction Regulations.
- l. The Approval Holder(s) shall ensure that this Approval, or a copy, is present on Site while personnel are on Site.
- m. The Approval Holder(s) shall ensure that personnel directly involved in the designated activity are made fully aware of the terms and conditions of this Approval.
- n. Upon any changes to the Registry of Joint Stock Companies information, the Approval Holder(s) shall provide a copy to the Department within five business days.

4. Covenant Conditions

- a. By granting this Approval, the Department is not responsible for any damages as a result of the approved activities, including any water quality or quantity problems that may be encountered by the Approval Holder(s) or other parties.
- b. By issuing this approval, the department is not providing any assurance(s) as to sufficient water quantity and/or quality to meet any requirements of the Approval Holder(s).

5. Fees

- a. The Approval Holder(s) shall, upon receipt of an invoice from the Department stating the amount owing in accordance with the Fees Regulations, as amended from time to time, pay to the Minister of Finance the amount stipulated.

6. Operation

- a. This Approval applies to the following water withdrawal locations: Well 1 (East) and Well 2 (West). Available location and construction details for the two dug wells are identified in the Well Construction Information Table found in this Approval.

- b. The Maximum Pumping Rate (litres/day), Average (30-day) Pumping Rate, 30-day Withdrawal Volume (litres) and Annual Withdrawal Volume shall adhere to the limits shown in the Approved Groundwater Withdrawal Table found in this Approval.
- c. If the water withdrawal authorized by this approval causes interference problems with any existing well supplies, the withdrawal rates shall be reduced and/or the problem rectified by the Approval Holder(s) in accordance with an action plan deemed acceptable to the Department.
- d. The Approval Holder shall submit a request to the Department, prior to implementation, for any proposed changes, including well deepening and well casing alterations. Such work may require an amendment to this Approval, depending upon the nature of the work and at the discretion of the Department.

7. Monitoring

- a. Well production flow meters shall be installed, maintained, and monitored separately for: Well 1 (East) and Well 2 (West).
- b. The Approval Holder(s) shall measure well water levels in production well(s): Well 1 (East) and Well 2 (West), at a minimum, on at least a monthly basis if manually measuring.
- c. Water level data shall be recorded as a geodetic elevation and tabulated in a spreadsheet.

8. Reporting

- a. The Approval Holder(s) shall prepare an Annual Report in a format acceptable to the Department summarizing the following information, as required by the terms and conditions of this Approval, for each calendar year. The completed Annual Report shall be submitted to the Department upon request.
 - i. a comparison of monitoring results to Approval limits and an evaluation of whether all results demonstrate compliance with Approval conditions. The evaluation of compliance shall also be presented in a statement at the beginning of the report;
 - ii. results shall be provided in graphical format along with historical trends. Any instances of non-compliance shall be clearly noted on the graph;
 - iii. any instances of non-compliance and mitigation measures taken.
 - iv. any complaints received and the steps taken to determine the cause of the complaint and the corrective measures taken to alleviate the cause and prevent its recurrence;
 - v. observations of effects of the activity on other surface and groundwater users and/or the environment;

- vi. the following records for the term of the annual report for each production well and the total wellfield:
 - (a) daily pumping rate (litres/day)
 - (b) average (30-day) pumping rate
 - (c) 30-day withdrawal volume (litres)
 - (d) annual withdrawal volume
- vii. current and historical water levels for Well 1 (East) and Well 2 (West).
- viii. available current and historical raw water quality (general chemistry and metals) for Well 1 (East) and/or Well 2 (West)

9. Records

- a. The Approval Holder(s) shall collect and maintain the following monitoring records for the duration of the authorized activity:
 - i. observations of effects of the activity on other surface and groundwater users and/or the environment
 - ii. complaints received and the steps taken to determine the cause of the complaint, the corrective measures taken to alleviate the cause and prevent its recurrence;
 - iii. based on flow meter readings for Well 1 (East) and Well 2 (West) and for the total:
 - Daily pumping rate (L/day)
 - Average (30-day) pumping rate (L/day)
 - 30-day withdrawal volume (L)
 - Annual withdrawal volume (L)
 - iv. available current and historical raw water quality (general chemistry and metals) for: Well 1 (East) and/or Well 2 (West)
 - v. current and historical water levels for: Well 1 (East) and Well 2 (West)
- b. The monitoring records shall be submitted to the Department upon request and in a format and timeframe acceptable to the Department.
- c. The Approval Holder(s) shall ensure that all records required by this Approval are maintained for a period of five (5) years and are to be made available to the Department upon request.

10. Site Specific Conditions

- a. The annual reports for the years from 2022 to 2024 shall be prepared and submitted to the Department along with the application for approval renewal by April 1, 2025.

Approved Groundwater Withdrawal Limits Table				
Production Well Name	Maximum Pumping Rate (L/day)	Average Pumping Rate Over 30 Days (L/day)	30 Day Withdrawal Volume (L)	Annual Withdrawal Volume (L)
Well 1 (East)	140,000	60,000	1,800,000	21,900,000
Well 2 (West)	140,000	60,000	1,800,000	21,900,000
Total	160,000	105,000	3,150,000	38,325,000

Well Construction Information Table			
Production Well Name	NSE Well Log Number	Parameter	Value
Well 1 (East)	NA	UTM (Easting)	337963
		UTM (Northing)	4988984
		UTM (Zone)	20
		Well Total Depth (m)	2.4
		Casing Depth(m)	2
		Diameter (mm)	1830
		Screen Description	Dug Well
Well 2 (West)	NA	UTM (Easting)	337928
		UTM (Northing)	4988949
		UTM (Zone)	20
		Well Total Depth (m)	NA
		Casing Depth(m)	NA
		Diameter (mm)	NA
		Screen Description	Dug Well



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APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1 s.1

APPROVAL HOLDER: TOWN OF STELLARTON

SITE PID: 00986091

APPROVAL NO: 2004-039003-02

EXPIRY DATE: August 23, 2023

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Water Approval - Water Withdrawal

Administrator: Jennifer McDonald

Effective Date: July 23, 2019

The Minister's powers and responsibilities under the Act with respect to this Approval have been delegated to the Administrator named above. Therefore, any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise advised in writing.

Page 1 of 10

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: TOWN OF STELLARTON

Project: Stellarton Water Treatment Plant

Site:

PID	Civic #	Street Name	Street Type	Community	County
00986091	345	SOUTH FOORD	ST.	STELLARTON	PICTOU COUNTY

Approval No: 2004-039003-02

File No: 95100-30-PIC-2004-039003

Grid Reference: Easting - 526345, Northing - 5043952

Reference Documents

- Application submitted June 3, 2019 and attachments.
- CBCL. February 2018. Town of Stellarton Water Supply - NSE Water Withdrawal Approval Application
- Town of Stellarton. January 2018. Water Conservation Plan.
- Fisheries and Oceans Canada. July 12, 2018. Letter: East River to Pictou Harbour - Town of Stellarton, Water Withdrawal - Implementation of Measures to Avoid and Mitigate Serious Harm to Fish and Prohibited Effects on Listed Aquatic Species at Risk.
- CBCL. March 24, 2017. Low Flow Analysis of the East River of Pictou under Climate Change Conditions
- CBCL. February 2004. Low Flow Analysis of the East River of Pictou.
- CBCL. May 3, 2019. Proposed Alternative Methodology for Monitoring Flow in East River (EMail Correspondence).
- DFO. May 28, 2019. Comments Regarding CBCL's Proposed Alternative Methodology for Monitoring Flow in East River (EMail Communication)

1. Definitions

- a. Act means Environment Act, 1994-95, c.1, s.1 , and includes, unless the context otherwise requires, the regulations made pursuant to the Act, as amended from time to time.
- b. Administrator means a person appointed by the Minister for the purpose of this Act, and includes an acting administrator.
- c. Approval means an Approval issued pursuant to this Act with respect to an activity.
- d. Associated Works means any building, machinery, equipment, device, tank, system, stockpile, or other related infrastructure.
- e. Department means the Department of Environment, and the contact for the Department for this approval is:
Nova Scotia Environment
Eastern Region, Pictou Office
20 Pumphouse Road
Granton, Nova Scotia B2H 5C6

Phone: (902) 396-4194
Fax: (902) 396-4765
- f. Extension means an increase in size, volume or other physical dimensions of an activity such that the increase may cause an adverse effect if not properly mitigated.
- g. Minister means the Minister of Environment and includes any person delegated the authority of the Minister.
- h. Modification means a change to an activity that may cause an adverse effect if not properly mitigated and includes, but is not limited to, the expansion of the same process, addition of product lines and replacement of equipment with different technology other than that presently in use.
- i. Site means a place where a designated activity and/or undertaking is occurring or may occur.

2. Scope

- a. This Approval (the Approval) relates to the Approval Holder(s) and their application and all documentation submitted to the Department prior to the issuance of this approval for the Water Withdrawal situated at or near Stellarton Water Treatment Plant.
- b. The Site and/or Facility shall not exceed the area as outlined in the application

and supporting documentation.

- c. This approval authorizes only the withdrawal of water. All other watercourse alterations require additional Approvals or Notifications.

3. General

- a. The Approval Holder(s) shall construct, operate and reclaim the Facility in accordance with the following provisions:
 - i. The Act;
- b. Nothing in this Approval relieves the Approval Holder of the responsibility for obtaining and paying for all licenses, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws or provincial or federal legislation. The Minister does not warrant that such licenses, permits, approvals or other authorizations will be issued.
- c. No authority is granted by this Approval to enable the Approval Holder(s) to construct or operate the Facility on lands which are not in the control or ownership of the Approval Holder(s). It is the responsibility of the Approval Holder(s) to ensure that such a contravention does not occur.
- d. If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.
- e. Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- f. If the Minister cancels or suspends this Approval, the Approval Holder(s) remains subject to the penalty provisions of the Act and regulations.
- g. The Approval Holder shall advise the Department in writing prior to any proposed extensions or modifications to the Site. An amendment to this Approval may be required before implementing any extension or modification.
- h. The Approval Holder(s) shall immediately notify the Department of any incidents of non-compliance with this Approval.
- i. The Approval Holder(s) shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.
- j. Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.
- k. Unless written authorization is received otherwise from the Minister, all samples

required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's Policy on Acceptable Certification of Laboratories as amended from time to time.

- l. The Approval Holder(s) shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the Facility operation are made fully aware of the terms and conditions which pertain to this Approval.
- m. Upon any changes to the Registry of Joint Stock Companies information, the Approval Holder(s) shall provide a copy to the Department.

4. Covenant Conditions

- a. The Approval does not authorize any activity that would:
 - i. Prejudice any riparian rights of any owner or of any person lawfully in possession of or holding any lands abutting the watercourse;
 - ii. Cause any damage or nuisance to adjacent or abutting lands; or
 - iii. Discharge surface water onto adjoining lands without the authorization of the affected landowner(s).
- b. The Approval Holder is responsible to construct and maintain any culvert, bridge, dam, sluice, flume, conduit, well, or other approved structure in or on the water resource so that the structure(s) operate as originally designed and intended, and so that risks related to potential failure of the structure(s) are effectively mitigated.
- c. The Approval Holder must rehabilitate the site to the satisfaction of the Minister and pay all expenses and costs of such rehabilitation in any of the following circumstances:
 - i. Upon the expiry or termination of this Approval; or
 - ii. If the culvert, bridge, dam, sluice, flume, conduit, well, or other approved structure in or on the water resource is not appropriately maintained to mitigate risks related to potential failure of the structure(s).
- d. The Department shall not be held responsible for any water quality or quantity problems that may be encountered by the Approval Holder(s).

5. Fees

- a. The Approval Holder shall, upon receipt of an invoice from the Department stating the amount owing in accordance with the Fees Regulations, as amended from time to time, pay to the Minister of Finance the amount stipulated.

6. Operation

- a. The rates, volumes, and period of water withdrawal from East River shall adhere to the limits set out in the Surface Water Withdrawal Limits Table found in this Approval for the purpose of operating a municipal water supply.
- b. A minimum Ecological Maintenance Flow shall be maintained in East River immediately downstream of the existing withdrawal point in accordance with the following schedule:
 - i. 1.31 cubic meters/second from July 1st to September 30th.
- c. Should flow in the watercourse be reduced to the ecological maintenance flow, the Approval Holder shall notify the Department within 1 business day.
- d. The Approval Holder(s) shall be responsible for the on-going maintenance and management of the structure to appropriate standards (e.g., Canadian Dam Association Dam Safety Guidelines), as identified by a professional engineer. As part of compliance with this condition, the Approval Holder(s) shall:
 - i. Retain the services of a professional engineer licensed to practice in the Province of Nova Scotia to oversee the design, construction, management and maintenance of all structures.
 - ii. Provide a signed and stamped letter from the engineer confirming compliance with this condition at the Department's request.

7. Monitoring

- a. The Approval holder shall install and maintain a flow meter which is capable of recording the total volume of water withdrawn.
- b. The Approval Holder(s) shall record flow meter readings corresponding to withdrawal volumes for each day, and also record the monthly average withdrawal rate once per month. Data shall be tabulated within a spreadsheet and compared to approved limits shown in the Approved Surface Water Withdrawal Table found in this Approval.
 - i. The flow meter is to be placed in a location and manner to accurately measure the water being withdrawn.
 - ii. The Approval Holder shall relocate the meter if directed to do so by the Department.
 - iii. The flow meter shall be installed and maintained as per the manufacturer's specifications.
- c. The Approval Holder(s) shall record flow rates in the East River immediately downstream of the water control structure on a daily basis. Data shall be tabulated within a spreadsheet and compared to the Ecological Maintenance Flow requirements found in this Approval.

- d. Flow rates in the East River shall be measured following a methodology acceptable to the Department.
- e. The Approval holder shall develop a stage-discharge curve to establish the relationship between the water level in the East River and the rate of flow.
 - i. The methodology employed to monitor flow rates in the East River flows and the development of the stage-discharge curve shall be completed by or under the direct supervision of a qualified person or qualified professional trained and experienced in stream gauging.
 - ii. Stream gauging standards that follow recognized industry best practices, such as International Organization for Standardization standard 748:2007 and World Meteorological Organization No. 1044, shall be used in developing the stage-discharge curve.
 - iii. Sufficient measurements of stage versus flow shall be made during low flow stages to ensure accurate measurement of low flows.
- f. The stage-discharge curve, plotted at a scale which clearly shows the low flow end of the curve, a best-fit equation describing the low flow stage-discharge relationship, and a report describing its development shall be submitted to NSE for review and acceptance, by no later than November 29, 2019.
 - i. The stage-discharge curve shall be validated and/or recalibrated at the request of the Department.
 - ii. The Approval holder shall comply with any additional requirements provided by NSE on improving the calibration of the stage-discharge curve.
- g. The Approval holder shall ensure all staff responsible for monitoring flow rate in the East River understand the water level corresponding to Ecological Maintenance Flow requirements of this Approval.
 - i. If for any reason alterations are made to the monitoring equipment, the Approval Holder shall immediately notify NSE, shall record this event in the water level log, and shall immediately re-establish the monitoring equipment under the direction of a qualified person or qualified professional.
- h. At the request of the Department, the Approval Holder shall take digital photographs of East River below the water control structure. The photographs shall be submitted to the Department within one business day of the photo being taken.

8. Contingency Plan

- a. The Approval holder shall submit a final draft of the Contingency Plan to the

Department for review and approval on or before October 31, 2019. The Contingency Plan shall be to the satisfaction of the Department and shall identify the flow rate(s) that will trigger implementation of the Contingency Plan.

- b. The Approval holder shall implement the above-noted Contingency Plan as approved by the Department.
- c. The Approval Holder shall update the Contingency Plan at the request of the Department, to the satisfaction of the Department.
- d. A copy of the most recent Contingency Plan shall be kept at the facility at all times and shall be made available to an inspector upon request.
- e. The Approval Holder(s) shall ensure that all employees are trained in accordance with the Contingency Plan and training records shall be kept and be made available to the Department upon request.
- f. The Approval Holder shall implement, maintain, and update the Water Conservation Plan outlined in the approval application on an annual basis. The latest Water Conservation Plan shall be made available to the Department upon request.

9. Records

- a. The Approval Holder shall collect and maintain the following monitoring records for the duration of the authorized water withdrawal:
 - i. Daily flow meter reading
 - ii. Daily water withdrawal volume
 - iii. A daily record of the water level in the river and corresponding watercourse flow rate.
 - iv. A record of the most recent calibration of the stage-discharge curve
 - v. Observations of effects of the activity on other surface and groundwater users and/or the environment.
- b. The monitoring records shall be submitted to the Department upon request in a format and timeframe acceptable to the Department.
- c. The Approval Holder(s) shall ensure that all records required by this Approval are maintained for a period of five (5) years and are to be made available to the Department upon request.

10. Reporting

- a. The Approval Holder(s) shall provide an annual report summarizing the following

information, as required by the terms and conditions of this Approval, for each calendar year:

- i. A comparison of monitoring results to Approval limits and an evaluation of whether all results demonstrate compliance with Approval conditions. The evaluation of compliance shall also be presented in a statement at the beginning of the report.
 - ii. Daily withdrawal volumes
 - iii. Daily withdrawal volumes averaged over each month and for the calendar year.
 - iv. A summary of instances when flow in the watercourse was below the Ecological Maintenance Flow as prescribed in this Approval, including the date and associated flow rate.
 - v. A summary of instances when the Contingency Plan was initiated including the actions taken to reduce water consumption during periods of low flow.
 - vi. A summary of water conservation measures implemented.
 - vii. Any complaints received and the steps taken to determine the cause of the complaint and the corrective measures taken to alleviate the cause and prevent its recurrence
 - viii. Observations of effects of the activity on other surface and groundwater users and/or the environment.
- b. The annual report shall be submitted in a format acceptable to the Department, to the Department on April 30 each year. The report shall include all monitoring data required by this Approval for the calendar year, presented in a spreadsheet format, electronically and in printed copy.

Table 1: Surface Water Withdrawal Limits – Town of Stellarton

Period of Withdrawal	MM/DD	Start Date:	01/01	End Date:	12/31
Daily duration of withdrawal	Hours	24			
Frequency of withdrawal	Daily				
Average daily withdrawal volume (averaged over 30 days)	L/Day	3,810,000			
Maximum daily withdrawal volume	L/Day	7,100,000			

APPENDIX I

Source Water Protection Plan Meeting Minutes

Not available, meetings not held.

APPENDIX J

Standard Operating Procedures for Disinfection

OPERATION & MAINTENANCE PERFORMANCE STANDARDS

What is CT Disinfection?

CT Disinfection is Nova Scotia's current disinfection standard.

It's used to demonstrate the level of disinfection treatment in your water.

CT is simply the concentration of chlorine in your water times the time of contact that the chlorine has with your water.

$$CT = \text{Concentration of Chlorine} \times \text{Time of Contact}$$

The concept itself is easy to understand.

Who needs CT Disinfection?

Every waterworks in Nova Scotia that uses a raw water source that is either:

- (i) surface water; or
- (ii) groundwater under the influence of surface water (GWI),

must disinfect the treated water to kill any pathogens that make it through the water treatment plant.

CT Disinfection demonstrates that the required disinfection is being achieved. Nova Scotia's disinfection standard's have evolved over the years and will continue to evolve as we learn more about water borne pathogens and how to inactivate them. Where once the standards targeted only bacteria and viruses, using 20 minutes of chlorine contact time, we now also target Giardia, using CT disinfection, and in the near future we will target cryptosporidium as well, using ultra violet (UV) radiation. However, right now, Nova Scotia's disinfection standard is CT Disinfection. All surface and GWI water systems should be using CT Disinfection to demonstrate that you are achieving sufficient water treatment to inactivate both Giardia and viruses. Disinfection with free chlorine that inactivates Giardia will usually provide enough CT to kill viruses as well. This discussion will focus on Giardia inactivation, but bare in mind the same principals apply to viruses as well.

Why Practice CT Disinfection?

Practicing CT Disinfection is the safe thing to do.

CT Disinfection is the disinfection standard in Nova Scotia.

The standard has changed because we know we can do better than just 20 minutes of chlorine contact time. As of today, CT Disinfection is also the water treatment industry standard for disinfection. It is the best method to ensure that the water you are providing your customers is safe. If your water has been exposed to the surface, it has also been exposed to surface contamination, whether from livestock, wild animals or other human activity. It will most likely be biologically contaminated. If you can show that you have provided a safe level of treatment, then you can demonstrate that you have been duly diligent in performing your duty.

CT disinfection protects your water, and by protecting your water, you are also protecting yourself. And whether you like it or not, you need to protect yourself too.

How to Use CT Disinfection

Let's start with the basics.

$$CT = \text{Concentration} \times \text{Time}$$

CT is the concentration of chlorine in your water times the time the water is in contact with that chlorine. To use CT to demonstrate that you have sufficient water treatment, you need to do the following three things.

1. Determine how much CT you need.
2. Determine how much CT you have achieved.
3. Ensure CT achieved is more than CT required.

Using CT Disinfection is a straightforward three step process. So let's look at these steps.

How to Determine the Required CT (CT_{required})

Water treatment can be broken into two phases:

1. the water treatment plant; and
2. the disinfection.

CT Disinfection focuses on the second phase, but let's focus for a moment on the entire process. Today's water treatment standards are based on the removal of Giardia from raw water. Giardia removal requirements for the entire water treatment process are based on the quality of the raw water. Therefore, an operator must test the raw water for Giardia to know the water treatment requirements. The water quality target for treated potable water is no more than one Giardia cyst per 100,000 litres of water.

Treated Water Giardia Target ≤ 1 cyst / 100,000 L

The required treatment then, is the difference between the existing Giardia concentration in the raw water and the treatment target Giardia concentration for treated water. But even for pristine water, the absolute minimum Giardia inactivation requirement is 3.0 Log.

But what does that mean, "3 Log inactivation"?

Let's look at an example.

Typically, Giardia sampling requires 1000 litres to be passed through a special filter. The filter is sent to an accredited lab for analysis. If for example, your raw water has 100 cysts in a 1000 litre sample, this is the same as saying the sample has 10,000 cysts/100,000 litre. We have just multiplied the 100 cysts and the 1,000 litres each by 100. We have done this in order to compare the concentration of Giardia in the raw water sample with the treated water target. We know our treated water Giardia target is less than 1 cyst / 100,000 L, therefore we must reduce the Giardia concentration in the raw water by 10,000 times in order to meet the treated water Giardia target.

Another way to express this 10,000 times reduction is by counting the zero's, in this case

10,000 has 4 zero's ($10,000 = 10^4$). Therefore we need 4 Log reduction.

This can also be stated as 99.99% reduction. Again count the 9's. 4 Log is expressed with four nines, 99.99%. Two Log removal would be 99%; three Log 99.9%.

The required level of Giardia reduction is summarized in Table 1, based on quarterly samples of Giardia concentrations in the raw water entering the water treatment plant.

Table 1: LEVEL OF GIARDIA REDUCTION

Raw Water <u>Giardia</u> Levels*	Recommended <u>Giardia</u> Log Reduction
< 1 cyst/100 L	3-log
1 cyst/100 L - 10 cysts/100 L	3-log - 4-log
10 cysts/100 L - 100 cysts/100 L	4-log - 5-log
> 100 cysts/100 L	> 5-log

How to Achieve Required Giardia Log Inactivation

The obvious next question is, "How do we achieve this required Log inactivation of Giardia?" As we already saw, there are two phases to water treatment:

1. the water treatment plant; and
2. the disinfection.

If your water treatment plant is treating water in accordance with Nova Scotia's Environment's water treatment plant performance standards, then you will be given credit for an appropriate level of Giardia reduction. For a conventional water treatment plant, you would receive 2.5 Log credits for Giardia reduction, if your treatment meets the performance standard.

But, as mentioned previously, the minimum over all treatment requirement, even in pristine water source is 3.0 Log reduction of Giardia. The balance of the Giardia inactivation treatment requirements must be made up by disinfection. This is where CT Disinfection is used.

Example:

Let's look at an example of the water treatment requirements for a raw water source with 10,000 cysts per 100,000 litres.

Since this is equal to 10 cysts per 100 litres, we see from Table 1 that the total treatment requirement would be at least 4.0 Log inactivation of Giardia cysts. If a conventional water treatment plant with coagulation, flocculation, sedimentation and filtration is treating the water and meeting the performance standards, a 2.5 Log credit is given for Giardia inactivation at the water treatment plant.

The remaining 1.5 Log Giardia inactivation requirement must be achieved by disinfection.

Step 1: Determining the Required CT (CT_{required})

The first step in using CT Disinfection is to determine the required CT (CT_{required}) to demonstrate that enough disinfection is occurring.

Chlorine's effectiveness to inactivate Giardia cysts is dependent on temperature, pH, concentration of chlorine and time of contact.

To determine CT_{required} we need to know:

- 1 The **minimum temperature** of the water during disinfection. The minimum temperature of the water in the chlorine contact chamber must be monitored.
Minimum temperature is used because chlorine's ability to disinfect becomes less with lower temperatures. By using the lowest temperature of the water when determining CT_{required}, we know that the disinfection that occurred was at least as good as the lowest temperature allowed.
2. The **maximum pH** of the water during disinfection. The maximum pH of the water in the chlorine contact chamber must be monitored.

Chlorine's ability to disinfect becomes less as pH increases. By using the maximum pH when determining CT_{required}, we know that the disinfection that occurred was at least as good as the disinfection that occurs at the maximum pH.

3. The **minimum chlorine residual** in the water during disinfection. The minimum chlorine residual in the water must be monitored at the end of the disinfection chamber.
We know that higher chlorine dosages disinfects better.
The lowest chlorine residual is used because the water in the chlorine contact chamber has been exposed to at least that concentration of chlorine.
- 4 The **required Log reduction of Giardia by disinfection** must also be known.
As discussed previously, the required Log reduction by disinfection is based on the raw water Giardia concentration with allowances for the treatment at the water treatment plant.

With this information, we use Giardia CT tables to determine the CT_{required}.

CT_{required} Tables

An example of a CT_{required} table for inactivation of Giardia is included on the following page. A full set of CT_{required} tables are found in Appendix A of the Standards and Guidelines for Municipal Water and Wastewater.

As well, you can download this document from the Internet at the following website.

http://web.cecs.pdx.edu/~fishw/UO_CT-Glossary.pdf

The CT Tables are used as follows:

1. Make sure you are using the **correct table**. The tables are specific to the target organism and the type of disinfectant. Most likely you will use the **Giardia inactivation table for free chlorine**. Most surface and GWI water treatment plants disinfect with free chlorine. Free chlorine is more than ten times better at inactivating Giardia than chloramines.
2. The tables are also temperature specific. You must use the table that corresponds to your **measured minimum temperature**.
3. The tables are divided into pH sections. Locate the section of the table that corresponds to your **measured maximum pH**.
4. Within the appropriate pH section, locate the column for your **required disinfection Log inactivation** for Giardia.
5. Within the appropriate pH section, locate the row for your measured **minimum free chlorine residual** concentration on the left side of the table.
6. Read the **CT_{required}** value from the table where the chlorine residual row meets the required Log inactivation column.

Free Chlorine Residual (mg/l)	pH = 6.0 Log Inactivations					pH = 6.5 Log Inactivations					pH = 7.0 Log Inactivations					pH = 7.5 Log Inactivations								
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
	0.4	16	32	49	66	81	97	20	39	59	78	98	117	23	46	70	93	116	139	28	55	83	111	138
0.6	17	33	50	67	83	100	20	40	60	80	100	120	24	48	72	95	119	143	29	57	86	114	143	171
0.8	17	34	52	69	86	103	20	41	61	81	102	122	24	49	73	97	122	146	29	58	87	117	146	175
1	18	35	53	70	88	105	21	42	63	83	104	125	25	50	75	99	124	149	30	60	90	119	149	183
1.2	18	36	54	71	89	107	21	42	64	85	106	127	25	51	76	101	127	152	31	61	92	122	153	187
1.4	18	36	55	72	91	109	22	43	65	87	108	130	26	52	78	103	129	155	31	62	94	125	156	187
1.6	19	37	56	74	93	111	22	44	66	88	110	132	26	53	79	105	132	158	32	64	96	128	160	192
1.8	19	38	57	75	95	114	23	45	68	90	113	135	27	54	81	108	135	162	33	65	98	131	163	194
2	19	39	58	77	97	116	23	46	69	92	115	138	28	55	83	110	138	165	33	67	100	133	167	200
2.2	20	39	59	79	98	118	23	47	70	93	117	140	28	56	85	113	141	169	34	68	102	135	170	204
2.4	20	40	60	80	100	120	24	48	72	95	119	143	29	57	86	115	143	172	35	70	105	139	174	208
2.6	20	41	61	81	102	122	24	49	73	97	122	146	29	58	88	117	146	175	36	71	107	142	178	213
2.8	21	41	62	83	103	124	25	49	74	99	123	148	30	59	90	119	148	178	36	72	109	145	181	217
3	21	42	63	84	105	126	25	50	76	101	125	151	30	61	91	121	152	182	37	74	111	147	184	221

Free Chlorine Residual (mg/l)	pH = 8.0 Log Inactivations					pH = 8.5 Log Inactivations					pH = 9.0 Log Inactivations							
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
	0.4	33	66	99	132	165	198	39	79	118	157	197	236	47	93	140	186	233
0.6	34	68	102	136	170	204	41	81	122	163	203	244	49	97	146	194	243	291
0.8	35	70	105	140	175	210	42	84	126	168	210	252	50	100	151	201	251	301
1	36	72	108	144	180	216	43	87	130	173	217	260	52	104	156	208	260	312
1.2	37	74	111	147	184	221	45	89	134	178	223	267	53	107	160	213	267	320
1.4	38	76	114	151	189	227	46	91	137	183	228	274	55	110	165	219	274	329
1.6	39	77	116	155	193	232	47	94	141	187	234	281	56	112	169	225	281	337
1.8	40	79	119	159	198	238	48	96	144	191	239	287	58	115	173	230	288	345
2	41	81	122	162	203	243	49	98	147	196	245	294	59	118	177	235	294	353
2.2	41	83	124	165	207	248	50	100	150	200	250	300	60	120	181	241	301	361
2.4	42	84	127	169	211	253	51	102	153	204	255	306	61	123	184	245	307	368
2.6	43	86	129	172	215	258	52	104	156	208	260	312	63	125	188	250	313	375
2.8	44	88	132	175	219	263	53	106	159	212	265	318	64	127	191	255	318	382
3	45	89	134	179	223	269	54	108	162	216	270	324	65	130	195	259	324	389

CT_{required} is read directly from the table.

Using these CT tables is straight forward. It will become a routine procedure once you've done it a few times.

The CT_{required} tables are temperature specific for water temperatures at 5°C increments. If your temperature falls between two temperatures for which tables exist, for example 8°C, then you need to determine the CT_{required} by one of the following methods:

1. Determine the CT_{required} at both 5°C and 10°C from the corresponding tables and estimate the CT_{required} value for 8°C using the CT_{required} values for 5°C and 10°C; or
2. Use the CT_{required} table that exists for the next **lower temperature**. To determine CT_{required} for 8°C we could use the CT_{required} value for 5°C. This will produce a value that is conservative (i.e. higher) and adds an extra measure of safety.

Similarly, the pH sections within each table are in 0.5 pH unit increments. To determine the $CT_{required}$ value for a pH that does not correspond to one of the given pH sections, the $CT_{required}$ value can be estimated using the pH sections higher and lower than your measured pH or by using the $CT_{required}$ value at the next **higher pH** section.

Step 2: Determining the Actual CT ($CT_{achieved}$)

The second step to using CT Disinfection is determining the actual CT we are achieving with disinfection.

Remember that CT equals concentration times time.

$$CT_{achieved} = \text{Concentration} \times \text{Time}$$

To determine $CT_{achieved}$, we need to know the actual minimum chlorine concentration and the actual time that the water is in contact with the chlorine.

Multiplying these together gives us the actual $CT_{achieved}$ at the time the parameters were measured.

But, we want to know the **Minimum $CT_{achieved}$** every day.

Therefore we need to use the **Minimum Chlorine Residual** that occurs each day. This is the same minimum chlorine residual concentration that we used to determine $CT_{required}$. It will be measured at the outlet of the chlorine contact chamber in mg/L. To determine the minimum chlorine residual in a 24 hour period, the chlorine residual must be measured throughout that 24 hour period. Collecting a single grab sample once per day in no way indicates that the chlorine residual did not vary to a lower concentration since the last sample was collected the previous day. One of the important recommendations from the **Walkerton Inquiry** was that **every surface water or GWI water treatment plant should have on-line chlorine analyzers.**

If you don't have one, due diligence would require that you get one. Not only will you be able to ensure your water is safe 24 hours a day, in the event that something does go wrong in your system, you can identify whether or not it was due to disinfection.

The **Minimum Chlorine Residual** is therefore the lowest chlorine residual monitored each day.

We also need to know the **Actual Time** that water is in contact with the chlorine.

This is where it gets a little tricky, so this is where you need to **pay close attention**.

Table 3: TYPICAL BAFFLING CONDITIONS

Baffling Condition	T_{10}/T Ratio	Baffling Description
Unbaffled (mixed flow)	.1	None, agitated basin, very low length to width ratio, high inlet and outlet flow velocities
Poor	.3	Single or multiple unbaffled inlets and outlets, no intra-basin baffles
Average	.5	Baffled inlet <u>or</u> outlet with some intra-basin baffles
Superior	.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders
Perfect	1.0	Very high length to width ratio (pipeline flow), perforated inlet, outlet, and intra- basin baffles

--	--	--

T_{MIN} is the minimum time that the average unit of water is in the reservoir, or if you will, the minimum contact time on any day.

$$T_{MIN} = \frac{\text{minimum volume of water in the reservoir (m}^3\text{)}}{\text{maximum hourly flow rate (m}^3\text{/min)}}$$

maximum hourly flow rate (m³/min)

I indicated previously that the T in CT is where it gets a little tricky.

T_{MIN} is the key concept to grasp.

Let's look at the top of the T_{MIN} equation:

'minimum volume of water in the reservoir (m³)'

We know that water levels in your disinfection reservoir will fluctuate throughout the day.

Everything else being equal, when the level of water in the reservoir is at its lowest point, (i.e. when you have your minimum volume of water in storage) the water will spend the least amount of time in the reservoir and you will therefore have the least amount of time available for chlorine contact. Similarly, for the bottom of the T_{MIN} equation:

'maximum hourly flow rate (m³/min)' (from the reservoir)

Everything else being equal, when the flow rate from the disinfection reservoir is at its highest, the water will spend the least amount of time in the reservoir and you will have the least amount of time available for chlorine contact.

Combining these two scenarios, we get:

$$T_{MIN} = \frac{\text{minimum volume of water in the reservoir (m}^3\text{)}}{\text{maximum hourly flow rate (m}^3\text{/min)}}$$

Substituting our details into the CT equation, we get the full $CT_{achieved}$ equation:

$$CT_{achieved} = \text{Conc. of Cl}_2 \times F_{SC} \times \frac{\text{minimum volume of water in the reservoir (m}^3\text{)}}{\text{maximum hourly flow rate (m}^3\text{/min)}}$$

Step 3: Comparing CT Values

The third and final step is to compare $CT_{achieved}$ to $CT_{required}$ to determine if we meet the disinfection requirement.

If not, we need to determine why not, and take the appropriate actions to ensure CT disinfection requirements are met.

Summary of Required Steps Used in CT Disinfection

Let's quickly review the three steps used in CT Disinfection.

Step 1: Determine $CT_{required}$ using the correct CT Table.

Step 2: Calculate $CT_{achieved}$ using the formula.

Step 3: Compare $CT_{achieved}$ to $CT_{required}$.

- If $CT_{achieved} \geq CT_{required}$, then you will have met your disinfection requirement.
- If not, you must take the appropriate actions to ensure CT Disinfection requirements are met.

Summary of Required Information to Use CT Disinfection

Let's do a quick review of the required information to use CT Disinfection.

1. The **required Giardia inactivation by disinfection** will be determined in conjunction with Nova Scotia Environment based on the Giardia concentration in your raw water and the configuration and treatment of your water treatment plant.
2. The **short circuiting or baffling factor (F_{sc})** of your chlorine contact chamber (i.e. clearwell or disinfection reservoir) will be assigned in conjunction with Nova Scotia Environment, based on tracer studies done on your reservoir or by comparing your reservoir configuration with other similarly configured reservoirs with known short circuiting factors.
3. The **maximum flow rate through your chlorine contact chamber** will either be known from previous determination of the flow rate or the maximum flow rate must be monitored each day.
4. The **minimum storage within the chlorine contact chamber** will either be known, for example the volume in storage at distribution pump shut off, or if the system is operated with a fluctuating water level well above the minimum, the minimum volume in storage must be monitored each day.
5. The **minimum temperature** of your water during chlorine contact must be monitored each day. The need for online monitoring equipment will vary depending on the daily temperature fluctuation range.
6. The **maximum pH** of your water during chlorine contact must be monitored each day. The need for online monitoring equipment will vary depending on the daily pH fluctuation range.
7. The **minimum free chlorine residual** of your water during chlorine contact must be determined by monitoring your chlorine residual throughout each day with an online chlorine analyzer at the outlet of the chlorine contact chamber.

Example CT Disinfection Calculation

Let's work through an example:

This example is for a small water system in a small Provincial Park.

However, the procedures are directly applicable to any sized water treatment system. The system has a poorly baffled reservoir.

Data:

Short Circuiting Factor, $F_{sc} = 0.10$

Minimum water temperature = 5° C

maximum pH of water = 8.0

required Giardia Log inactivation by disinfection = 0.5 Log

minimum free chlorine residual concentration = 0.8 mg/L

total reservoir volume = 20 m³

minimum reservoir storage at pump shut off = 5 m³

maximum pumping rate from the reservoir = 0.05 m³/min

Step 1: Determine CT required

Use Table A-2 in the Standards and Guidelines for Giardia Inactivation at 5° C. Locate the pH 8 section. Within the pH = 8.0 section find the Log inactivation 0.5 column and the chlorine concentration 0.8 mg/L row.

We read the required CT from the table $CT_{required} = 35 \text{ mg}\cdot\text{min/L}$

Step 2: Determine CT achieved

To determine $CT_{achieved}$ we use our formula:

$$CT_{achieved} = \text{Conc. of } Cl_2 \times F_{SC} \times \frac{\text{minimum volume of water in the reservoir (m}^3\text{)}}{\text{maximum hourly flow rate (m}^3\text{/min)}}$$

We plug in our data values:

1. Monitored chlorine residual at the contact chambers outlet, 0.8 mg/L;
2. Our known short circuiting factor, $F_{SC} = 0.1$;
3. Our minimum volume of water in storage, in our case that's where the distribution pumps are set to shut down, 5 m^3 ; and,
4. the maximum pumping rate from the contact chamber, $0.05 \text{ m}^3/\text{min}$.

$$CT_{achieved} = 0.8 \text{ mg/L} \times 0.10 \times \frac{5 \text{ (m}^3\text{)}}{0.05 \text{ (m}^3\text{/min)}}$$

We do the math, and calculate $CT_{achieved} = 8 \text{ mg}\cdot\text{min/L}$

Step 3: Compare CT Values

Now we compare $CT_{achieved}$ to $CT_{required}$

Clearly, $CT_{achieved}$ (8) is less than $CT_{required}$ (35)

This means that we **do not achieve** the required disinfection.

So we must change the operation to improve $CT_{achieved}$ to ensure the required disinfection is met. The first impulse might be to increase the chlorine dosage. However, the dosage would have to be increased to extremely high levels to achieve the required Giardia inactivation.

So let's look at the configuration of the disinfection chamber illustrated in Figure 4.

Repeat Step 2: Determine the revised CT achieved

Plugging in our revised data we calculate:

$$CT_{achieved} = C \times F_{SC} \times \frac{\text{minimum volume of water (m}^3\text{)}}{\text{maximum flow rate (m}^3\text{/min)}}$$

$$CT_{achieved} = 0.8 \text{ mg/L} \times 0.3 \times \frac{15 \text{ (m}^3\text{)}}{.05 \text{ (m}^3\text{/min)}}$$

$$CT_{achieved} = 72 \text{ mg}\cdot\text{min/L}$$

Step 3: Compare CT Values

Comparing the revised $CT_{achieved}$ to $CT_{required}$ we find:

$$CT_{achieved} (72) \text{ exceeds } CT_{req'd} (35)$$

So we now meet the required disinfection for Giardia inactivation

That is all there is to this discussion of CT disinfection.

Evaluating Your Own Disinfection System

Now as operators, you need to take a hard look at your waterworks systems to determine how well you are doing with your own disinfection.

- Do you meet the CT disinfection standard?
- Are you providing the safest water possible?
- Are you protecting yourself by practicing due diligence?

If you answer “No” to any of these questions, you need to make some changes at your waterworks.

OPERATION & MAINTENANCE PERFORMANCE STANDARDS

ACTIVITY: Calibration and Maintenance CL17

PERFORMANCE STANDARD

ACTIVITY

Calibration

The CL17 Chlorine Analyzer is factory calibrated. A built-in electronic curve is preprogrammed into the instrument. **This instrument does not require recalibration unless specified by your regulatory agency for compliance reporting purposes.**

If you are required to do a two-point calibration or if your sample stream chlorine concentration is typically less than 0.5 mg/L. If your sample stream chlorine concentration is typically greater than 0.5 mg/L, you can perform a Calibration by Comparison.

If the calibration you perform requires you to adjust the CAL ZERO by more than 0.2 Mg/L, a SYSTEM WARNING caused by a MARGINAL ZERO error will appear. Similarly, Adjusting the CAL STD by more than 10% (up or down) will produce a MARGINAL GAIN ERROR.

If either of these errors occur, reset the instrument to the default calibration, check the standards, and repeat the calibration. If the error messages persist, contact the Customer Service department.

Calibration on known standards

CAUTION

Chemical exposure hazard. To familiarize yourself with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards. Protective eye wear is always recommended when contact with chemicals is possible.

This procedure provides the best overall accuracy by establishing the zero mg/L reference and the span setting. Perform the calibration as follows:

1. Prepare a zero chlorine reference solution by adding approximately 4 mL of Ferrous Ammonium Sulfate, Cat. No. 181133NC, to approximately 2 liters of the normal sample or chlorine-free demineralized water.

Note: Enter the zero value before the chlorine standard value.

2. Place a container of zero reference water above the analyzer with at least two feet of head. Plumb the system to enable the sample flow to be shut off so the zero reference water can enter the analyzer in its place. Allow the analyzer to run on zero reference water for approximately 10 minutes.

3. When the readings are stable, set the zero reference.

a. Enter the **SETUP** menu.

b. Press the **DOWN ARROW** key until **CAL ZERO** is displayed.

c. Press **ENTER** to display the current measured value.

d. Press **ENTER** to force the value to zero.

4. Prepare a chlorine standard solution with a value between 3 and 5 mg/L. Determine the value of the standard to the nearest 0.01 mg/L.

5. Remove the container of zero reference water and substitute the chlorine standard solution. Allow the analyzer to run on the standard solution for approximately 10 minutes.

6. When the readings are stable, enter the **SETUP** menu.

7. Press **ENTER** when **CAL STD** is displayed. The current measured value is displayed.

8. Press **ENTER** and edit the value. Press **ENTER** again to accept the value. The measured value will be forced to the entered value. Press the **EXIT** key three times to

return to normal display mode.

9. Remove the standard and restore sample flow to the analyzer. The instrument is now calibrated.

Calibration by comparison

Note: Make sure sample chlorine concentration is relatively stable before taking a grab sample for laboratory analysis. Perform the laboratory analysis as quickly as possible.

Calibration by comparison involves analyzing the sample stream with a reliable, accurate laboratory method, such as a DPD spectrophotometric or amperometric titration method then setting the analyzer to match. Accuracy specifications over the full 0 to 5 mg/L range cannot be assured unless the sample chlorine concentration used for calibration is greater than 3.0 mg/L. Setting the calibration at a lower concentration may provide accuracy at that point but can cause large errors in other portions of the span.

Perform a calibration by comparison as follows:

1. When the sample chlorine concentration is relatively stable, obtain a grab sample for analysis.
2. Perform a laboratory analysis (DPD spectrophotometric or amperometric titration method) on the grab sample and record the value.
3. Enter the **SETUP**.
4. Press **ENTER** when **CAL STD** is displayed. The current measured value is displayed.
5. Press **ENTER** and edit the value to match the value from the laboratory analysis. Press **ENTER** again to accept the value. The measured value will be forced to the entered value.
6. Press the **EXIT** key three times to return to normal display mode.

Scheduled maintenance

Replenish the reagents

One 500-mL bottle each of buffer and indicator solution lasts approximately one month. Discard the old containers with any unused contents and install the new bottles.

Replace the pump tubing

Over a period of time, the clamping action of the pump/valve module will soften the tubing and cause it to collapse and obstruct liquid flow. This breakdown is accelerated at high temperatures. The following replacement schedules, based on ambient operating temperature, are recommended:

- Below 27 °C (80 °F), replace at six-month intervals.
- Above 27 °C, replace at three-month intervals.

Pump tube replacement procedure:

1. Shut off sample flow to the instrument and set the POWER (I/O) switch to OFF (O).
2. Remove the screws securing the pinch plate to the pump/valve module. Loosen in small increments, moving from one screw to the other to allow tension to be relieved evenly. Remove the plate.
3. Disconnect the pump tubes from the inlet and outlet fittings and discard the tube assemblies.
4. Cut four 2-inch lengths of 1/16-inch ID tubing (white). Install one 1/16-to 1/8-barb elbow fittings in one of the 1/16-inch ID tubes (white) and 1/16-inch barb union fittings in the three remaining tubes. Although one of the pump tubes is not used for fluid flow, it must be included to provide even compression on all four tubes.
5. Install the two screws through the pinch plate and into the pump/valve module. When

securing the pinch plate, advance the screws in small increments moving from one screw to the other so that the plate is drawn down evenly. Tighten until snug, do not overtighten.

6. Set the POWER (I/O) switch to ON (I) and restore sample flow through the instrument. Allow the instrument to run for approximately one hour to fill the reagent lines.

Maintenance

Replace the analyzer tubing

Remaining tubing in the analyzer should be replaced annually.

The maintenance kit is available with the tubing harnesses assembled (6868800) or unassembled (6868900) If you have ordered the unassembled maintenance kit, use Figure 21 and Table 7 on page 41 to determine the tubing lengths and positions.

When installing new tubing it is helpful to dip the ends in hot water before making the connections. It also is recommended that one tube at a time be removed and replaced.

Numbers on the illustration correspond to the item numbers listed in the legend where the size, catalog number, and quantity also are given. The length given in Table 7 tells how long that particular tubing segment at a time should be; the operator must cut a piece to that length from a coil of the proper tubing.

The catalog number given for the tubing in the legend identifies the coil of tubing to cut the segment from and not the number of the segment itself.

DPD Reagent tubing may darken before the scheduled replacement time but that will not affect the performance of the instrument.

Clean the colorimeter

The colorimeter measuring cell may collect sediment or develop a film growth on the inside walls. Cleaning with an acid solution and a cotton swab on a monthly basis is recommended. Depending on sample conditions, it may be necessary to clean the cell more often.

CAUTION

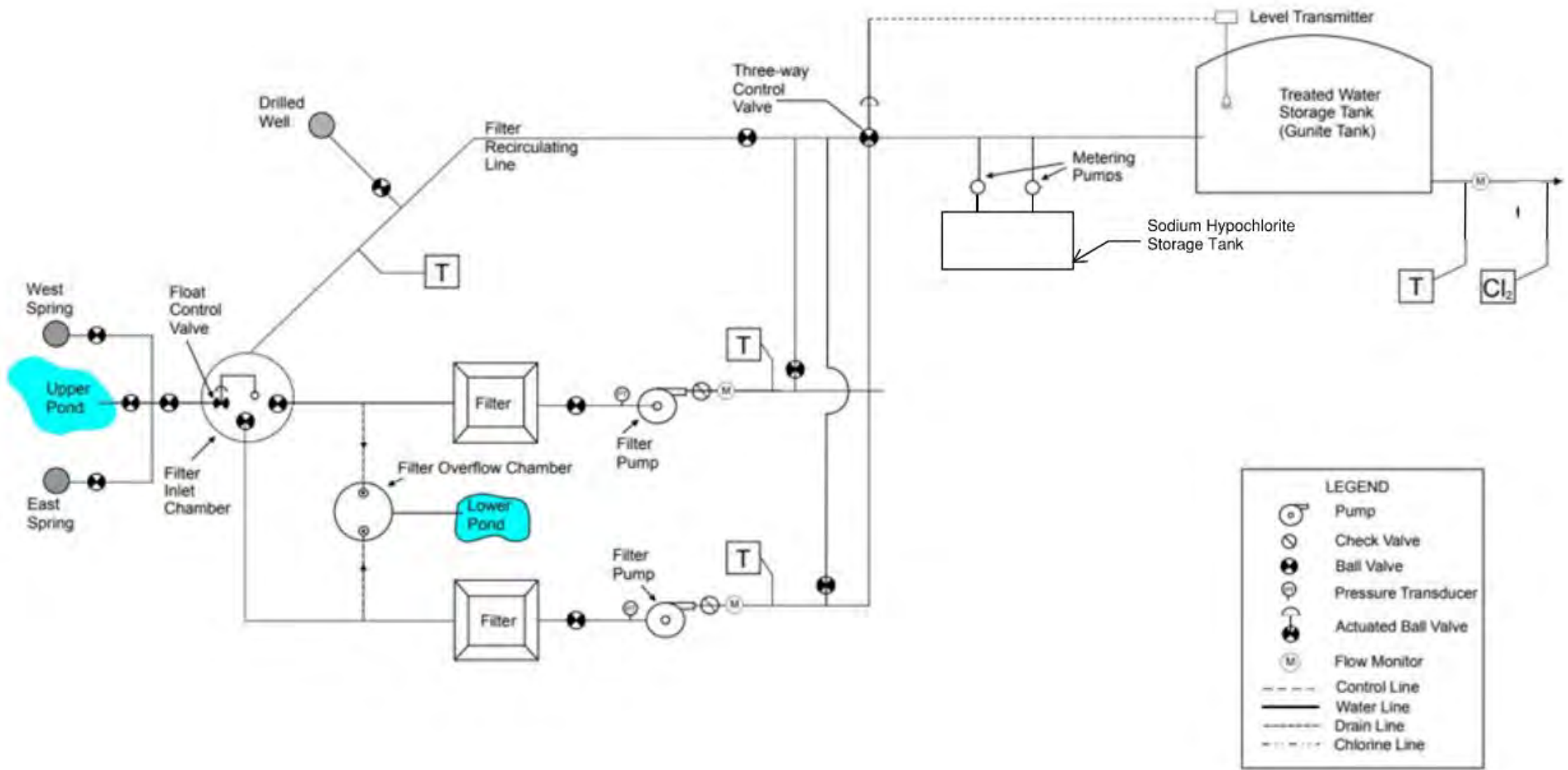
Chemical exposure hazard. The chemicals used in this procedure may be hazardous if inappropriately handled or accidentally misused. Please read all warnings on the reagent labels. Protective eye wear is always recommended when contact with chemicals is possible.

Colorimeter cell cleaning procedure:

1. Press the **MENU** key, then press the down **ARROW** key until the **MAINT** menu appears. Press **ENTER**.
2. Press the down **ARROW** key to scroll to the **CLEAN** option. Press **ENTER**.
3. Remove the rubber plug on the top of the colorimeter assembly.
4. Remove the magnetic stir bar using a bent steel paper clip as a retrieval tool.
5. Wait until **CLEAN** flashes on the status line of the display, then fill the colorimeter with 19.2 N Sulfuric Acid Standard Solution (203832).
- Note:** Lower normality sulfuric acid will NOT be sufficient for cleaning the colorimeter.
6. Allow the sulfuric acid to stand in the colorimeter for 15 minutes.
7. Insert a wooden or paper cotton-tipped swab* into the opening and move it up and down with a gentle scrubbing action, cleaning the interior surfaces of the colorimeter cell. Clean the stir bar with the cotton swab.
8. Install the stir bar.
9. Replace the rubber plug on the top of the colorimeter assembly and make sure the cover is on the viewing port of the colorimeter.
10. Press the **EXIT** key to immediately return to normal operation; the instrument will return to normal operation automatically after 60 minutes.

APPENDIX K

Schematic of the Treatment & Disinfection Process



LEGEND	
	Pump
	Check Valve
	Ball Valve
	Pressure Transducer
	Actuated Ball Valve
	Flow Monitor
	Control Line
	Water Line
	Drain Line
	Chlorine Line

APPENDIX L

Historical Effluent Graphs SCADA

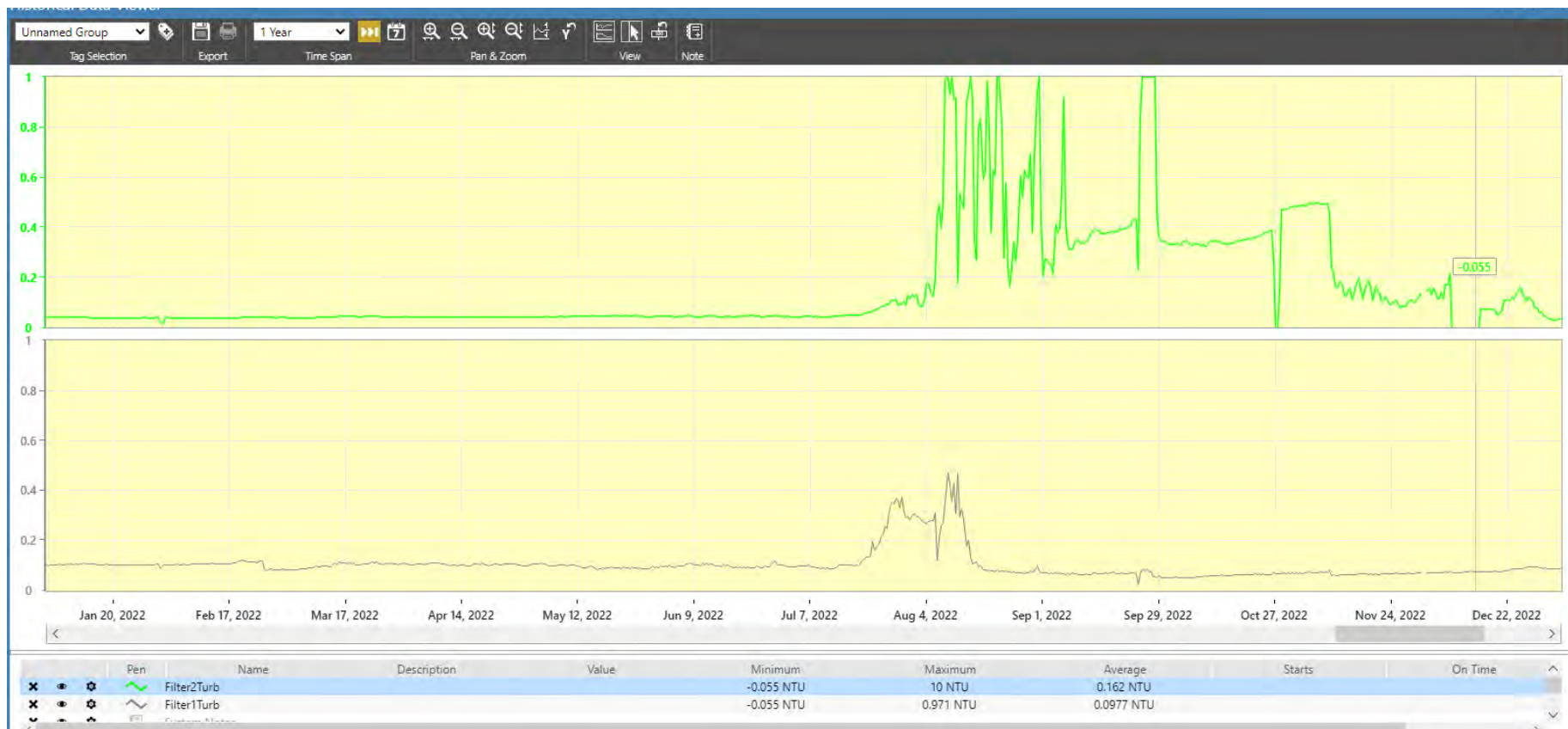


Figure A: 2022 Filter Turbidities (Y-axis: 0–1 NTU, X-axis: January through December 2022) for 2022

APPENDIX M

Terms of Reference Checklist

Nova Scotia Environment & Climate Change
System Assessment Report
Terms of Reference Checklist



PART I

Introduction

This checklist was prepared as a companion document to the Terms of Reference for System Assessment Reports for Municipal Drinking Water Systems, 2022. For detailed information on each of the submission requirements below, please consult the source document. For ease of reference, reports should follow the format and sequence of the checklist below. Where possible, section references should follow section and subsection numbering conventions used in the checklist.

Where data is required to be submitted for “the most recent calendar year”, Approval Holders may submit 12 consecutive months of data within a 2-year period from the date the system assessment report is due.

PART II Characterization of the Water Source

2.0 Source Water Characterization

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.1 Source Description and Schematic*				
i. Describe the water source(s) used to meet water consumption demand.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.1	4
ii. Describe any sources that are used as back-up supplies.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Identify sources on a map.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. C	
iv. Document what precautions are required for back-up supplies.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. If a back-up supply is intended to be used without precautions, verify that it meets the Nova Scotia Treatment Standards for Municipal Drinking Water Systems or if the back-up supply is connected to an adjoining municipality, document the name of the Municipal Public Drinking Water Supply to which it is connected.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. For Municipal Public Drinking Water Supplies that purchase water from an adjoining system, identify system connections on a map.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vii. Document the name of the municipal public drinking water supply(s) that water is purchased from and proceed to section 2.3.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.2 Microbial Risks				
2.2.1 Surface Water Sources				
i. Summarize microbial risks and water quality variability of the surface water source(s).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.2.1	9
ii. Submit raw water quality data for total coliforms and E. coli, as well as Cryptosporidium and Giardia if available, for the most recent calendar year as an Appendix.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.2.2 Groundwater Sources				
i. Verify that all individual wells have been classified in accordance with the Protocol for Determining Groundwater Under the Direct Influence of Surface Water.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Summarize the GUDI status by individual well and identify at which step in the GUDI Protocol the well was categorized as GUDI or non-GUDI.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. For wells that are no longer in use, identify if the well has been properly decommissioned or is being maintained as a back-up well or monitoring well.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. For GUDI wells, complete Table A.1 and verify that the GUDI classification has not changed based on the results of microscopic particulate analysis (MPA) testing required every two years.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Verify that MPA samples were taken following a rainfall event in accordance with Step 3 of the GUDI Protocol (e.g., if there is a 15-day time-of-travel, then the well shall be sampled 15 days after a surface water event).	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. Inspect the site(s) to verify that there are no changes to the surrounding area to warrant re-classification of the well(s).	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
vii. Recommend corrective action for wells: <ul style="list-style-type: none"> • For which MPA test results indicate a change in GUDI classification. • Where changes to the surrounding area have occurred to warrant re-classification of the well per the GUDI Protocol. • Where any other concerns are identified. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
viii. Submit raw water quality data for total coliforms and E. coli bacteria for the most recent calendar year as an Appendix.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ix. For GUDI wells, submit any raw water quality data for Cryptosporidium or Giardia (if available) for the most recent calendar year as an Appendix.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.3 Chemical Risks				
2.3.1 Disinfection By-Products				
a) Trihalomethanes (THMs)				
i. Complete Table A.2 to summarize quarterly THM concentrations by sampling location.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App.A	
ii. For non-GUDI systems that have had quarterly sampling reduced to annual sampling: <ul style="list-style-type: none"> Note the acceptance date for this reduction in sampling frequency. Modify Table A.2 to summarize annual results, including sampling date. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. If the locational running annual average for any sampling location exceeds the maximum acceptable concentration, recommend corrective actions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Verify that sampling locations are appropriate as follows: <ul style="list-style-type: none"> Are samples collected at the point(s) in the distribution system with the highest potential THM concentrations? Are an adequate number of sites sampled to represent exposure levels system-wide? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App.A	
v. Identify THM sampling locations on a map of the distribution system.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. C	
vi. Recommend sampling location/frequency changes if necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
b) Haloacetic Acids (HAA5)				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Complete Table A.3 to summarize HAA5 concentrations by sampling location.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. A	
ii. For non-GUDI systems that have had quarterly sampling reduced to annual sampling: <ul style="list-style-type: none"> Note the acceptance date for this reduction in sampling frequency. Modify Table A.3 to summarize annual results, including sampling date. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. If the locational running annual average for any sampling location exceeds the maximum acceptable concentration, recommend corrective actions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Verify that sampling locations are appropriate as follows: <ul style="list-style-type: none"> Are samples collected at the location(s) where historical data show the highest HAA5 concentrations? If historical data are not available, are HAA5 concentrations monitored in the middle and extremities of the distribution system to determine the highest concentrations? Are samples collected in areas where disinfectant residuals are significantly lower than the system average because of long residence time? In systems with booster chlorination stations and water tanks/reservoirs, are HAA5 concentrations monitored downstream of these components? Are an adequate number of sites sampled to represent system-wide exposure levels? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App A	
v. Identify HAA5 sampling locations on a map of the distribution system.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App C	
vi. Recommend sampling location/frequency changes if necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
c) Other Disinfection By-Products (DBPs)				
i. Identify which other DBPs are required to be monitored and compare this to existing monitoring (see Table 1 in the Terms of Reference).	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Verify that sampling locations are appropriate.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Identify sampling locations on a map of the distribution system.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Recommend sampling location/frequency changes if necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Summarize concentrations for the most recent calendar year as an Appendix.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. Recommend corrective actions if any maximum acceptable concentration is exceeded.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.3.2 Lead and Corrosion Control				
a) Lead and Copper				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Verify that sampling locations and frequencies for lead are appropriate as follows: <ul style="list-style-type: none"> Does the residential sampling program meet the minimum requirements as outlined in the Lead and Copper Management Requirements – Municipal Public Drinking Water Supplies or as otherwise accepted by the Department? Are residences suspected to be at the highest risk for lead targeted in the residential sampling program? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2	10
ii. Recommend sampling location/frequency changes if necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2	11
iii. Summarize and append lead and copper concentrations by sampling location and sample protocol used for the most recent calendar year.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2	11
iv. Summarize corrective actions taken when residential sample results exceeded the maximum acceptable concentration, as outlined in the Lead and Copper Management Requirements – Municipal Public Drinking Water Supplies. <ul style="list-style-type: none"> Are the corrective actions taken in line with the minimum requirements outlined in the Lead and Copper Management Requirements – Municipal Public Drinking Water Supplies or as otherwise accepted by the Department? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2	12
v. Recommend program improvements, where applicable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2	13
b) Corrosion Control				
i. Review the corrosion control program: <ul style="list-style-type: none"> Does one exist? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2.2	13
<ul style="list-style-type: none"> Does it include the minimum monitoring requirements as outlined in the Guidelines for Monitoring Public Drinking Water Supplies – Part 1? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2.2	13

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
<ul style="list-style-type: none"> Does it include action limits for the corrosion monitoring parameters that trigger follow-up? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2.2	14
ii. Summarize the water quality results of the corrosion control program for the most recent calendar year as an Appendix.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Recommend corrective actions if concerns are identified from the review of the corrosion control program.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2.2	14
iv. If a corrosion control program does not exist, document why, including water quality results that demonstrate non-corrosivity of the water, or recommend the need for a more comprehensive corrosion control program. Note: The Langelier Index is no longer considered an adequate measure of corrosivity. The submission of water quality results based solely on a positive Langelier Index will not be accepted as justification for not having a corrosion control program. Note: The Engineer is not required to develop a corrosion control program as part of the System Assessment Report.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.2.2	14
2.3.3 Guidelines for Canadian Drinking Water Quality* *Municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply may obtain water quality results from the Approval Holder of the Municipal Public Drinking Water Supply that treats the water.				
i. Verify that the full suite of health-related parameters (see Table A.4 in the Terms of Reference) has been analyzed a minimum of once every five years for all raw water sources and treated water and document sampling dates.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.3	14
ii. Review the data to: <ul style="list-style-type: none"> Verify that sampling locations and frequencies are appropriate for cyanobacterial toxins and pesticides. Identify if any maximum acceptable concentrations (MACs) have been exceeded. Identify parameters with detectable concentrations. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.3	14

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iii. Discuss any trends for parameters with detectable concentrations.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Include laboratory results from the last round of sampling as an Appendix.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. E	
v. Identify when the next round of sampling is scheduled to occur.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.3	14
vi. Recommend corrective actions if any MACs are exceeded.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vii. Recommend any changes to the monitoring program (frequency/location) if sampling is inappropriate for cyanobacterial toxins, pesticides or other parameters with enhanced monitoring that was recommended for parameters with detectable concentrations.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.3.4 Guidelines for Monitoring Public Drinking Water Supplies				
i. Verify that the parameters in the Guidelines for Monitoring Public Drinking Water Supplies (see Table A.5) have been analyzed as required in all raw water sources and treated water and document the sampling dates.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.4	15
ii. Review the data to: <ul style="list-style-type: none"> • Verify that sampling locations and frequencies are appropriate. • Identify if any maximum acceptable concentrations (MACs) have been exceeded. • Identify any aesthetic parameters that may compromise disinfection or other critical processes. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.4	15
iii. Discuss any water quality trends.	<input type="checkbox"/>	<input type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iv. Include laboratory results from the last round of sampling as an Appendix.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.4	15
v. Identify when the next round of sampling is scheduled to occur.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.4	15
vi. If any MACs are exceeded, recommend corrective actions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vii. Recommend any changes to the monitoring program, sampling location/ frequencies if necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.3.5 Source Water Protection Plan Monitoring*				
*This section is not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply.				
i. For Approval Holders monitoring any other chemical parameters for source water protection purposes, summarize the parameters, their sampling frequency, and their measured concentrations.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.5	15
ii. Recommend corrective actions if concentrations are detectable or increasing.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.5	15
iii. Review the source water protection plan monitoring program: <ul style="list-style-type: none"> • Does one exist? • Does it include monitoring of parameters that provide the information that is needed to evaluate the effectiveness of the source water protection plan? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.5	15

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.3.6 Cyanobacteria*				
*This section is only applicable to surface water sources.				
i. Identify whether the source of supply has been impacted by cyanobacterial blooms.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Summarize and append any results for cyanobacterial blooms through visual observation and/or confirmation from laboratory results including dates.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Discuss any corrective actions taken when cyanobacteria have been detected in the source water.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Discuss the treatment capability of the facility to remove microcystin toxins and identify any vulnerabilities.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Provide recommendations if necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.3.6	15

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.4 Filter Backwash Water*				
*Not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply				
i. Document the impact on the raw water source if water from the filter backwash treatment system is discharged upstream of the raw water intake.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Provide recommendations if this discharge impacts the source.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.5 Source Quantity*				
*Not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply				
i. Compile existing Water Withdrawal Approvals and include copies of these as an Appendix.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.5	
ii. Complete Table A.6.a and A.6.b to compare water withdrawals to approved limits.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. A	
iii. Recommend corrective actions, including water conservation measures, if water withdrawals are greater than approved limits.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.5	
iv. Recommend corrective actions if water withdrawals are approaching approved limits and growth is forecast to increase withdrawals beyond approved limits.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.5	

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
2.6 Source Water Protection Plan*				
*Not applicable for municipalities that only distribute water purchased from another Municipal Public Drinking Water Supply.				
i. Identify the source water protection zone(s) on a map.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.6	20
ii. Submit the source water protection zone(s) in GIS format to the Department. If zones are not available in GIS format, contact the Watershed Planner for your supply.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Summarize the status of the source water protection plan and implementation schedule.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.6	20
iv. Document the dates of the last two SWPP meetings.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Note the status of meeting actions and/or SWPP deliverables.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.6	20
vi. Make recommendations to address any concerns identified by the advisory committee or the source water protection planning process.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.6	20
2.7 Conclusions and Recommendations				
i. Refer to the Terms of Reference.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.7	

PART III Treatment Processes, Facilities and Equipment

3.0 Evaluation of Treatment Processes, Facilities and Equipment

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.1 Treatment Processes				
i. Compile existing Approval(s) to Operate and include copies of these as an Appendix. For Approval Holders that only distribute water purchased from another Municipal Public Drinking Water Supply, document the name of the treatment facility, and proceed to section 3.2.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. G	
3.1.1 Treatment Process Schematic				
i. Provide a schematic of the treatment process from the source to treated water entering the distribution system.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1	24
3.1.2 Turbidity Levels and Associated Criteria				
a) Surface Water				
i. Verify that filtration technologies are meeting specified turbidity limits to receive the assigned log removal credits outlined in Table C2 of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems by either Option 1 or Option 2.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.2	25
ii. Submit individual filter effluent turbidity values for the most recent calendar year by month (Option 1) or by the time interval graphed (Option 2).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.2	26
iii. Recommend corrective actions if the supply does not meet stipulated turbidity limits.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iv. For Municipal Public Drinking Water Supplies with cartridge filters assigned log reduction credits for protozoa, provide the highest recorded individual filter differential pressure reading for each month of the most recent calendar year.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Review the standard operating procedures (SOPs) for the filtration process: <ul style="list-style-type: none"> • Have control limits been set to alarm and notify operators of issues related to the filtration process? • Have procedures been developed to remove a filter or membrane unit from service before turbidity or differential pressure (i.e., for cartridge filters assigned log reduction credits) exceeds stipulated values? • Have procedures been implemented and communicated to all operations staff? • Have procedures been documented in the operations manual? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. Inspect the filtration process to verify that continuous on-line turbidity measurements are taken and recorded for each individual filter at a minimum of once every five minutes.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.2	27

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.		Yes	N/A	Section	Page #
vii.	Inspect the on-line turbidimeters: <ul style="list-style-type: none"> • Do they have the required range and accuracy to measure turbidity levels? • Are they in good working order? • Do they have a maintenance and quality assurance/calibration program? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.2	27
viii.	Inspect the filtration process to verify that there are a minimum of two filters.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.2.5	28
ix.	Document if the maximum day flow can be met with the largest filter out of service. Note: If the facility is unable to meet maximum day flows with the largest filter out of service, improvements to meet the Treatment Standards may be deferred to a future expansion provided SOPs are in place to minimize filter rate changes and spikes in turbidity which can result in filter breakthrough.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
x.	Make recommendations to address any concerns identified by the review of the filtration SOPs, inspection of on-line turbidimeters, and filter redundancy.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.2.4	27

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
b) GUDI Wells				
i. Verify that natural filtration is achieving specified turbidity limits to receive the assigned log removal credits outlined in Table C2 of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems by either Option 1 or Option 2.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Submit individual GUDI well turbidity values for the most recent calendar year by month (Option 1) or by the time interval graphed (Option 2).	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. For GUDI wells that do not meet stipulated turbidity limits, contact the Department to determine what requirements shall apply.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Inspect the site(s) to verify that continuous on-line turbidity measurements are taken for each individual GUDI wellhead at a minimum of once every five minutes.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Inspect the on-line turbidimeters: <ul style="list-style-type: none"> • Do they have the required range and accuracy to measure turbidity levels? • Are they in good working order? • Do they have a maintenance and quality assurance/calibration program? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. Make recommendations to address any concerns identified by the inspection of the on-line turbidimeters.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
c) Non-GUDI Wells				
i. Summarize turbidity levels in non-GUDI wells by either Option 1 or Option 2.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Note if measurements are by daily grab samples or continuous on-line turbidimeters.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Submit non-GUDI system turbidity for individual wells or combined flow for the most recent calendar year by month (Option 1) or by the time interval graphed (Option 2).	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. For non-GUDI wells that do not meet stipulated turbidity limits, contact the Department to determine what requirements shall apply.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Where continuous measurements are taken, inspect the on-line turbidimeters: <ul style="list-style-type: none"> • Do they have the required range and accuracy to measure turbidity levels? • Are they in good working order? • Do they have a maintenance and quality assurance/calibration program? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. Where grab samples are taken, inspect the monitoring equipment, SOPs, maintenance, and quality assurance/calibration program to ensure equipment is in good working order and measurements are appropriate.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vii. Make recommendations to address any concerns identified by the inspection of on-line turbidimeters or grab sample protocols.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.1.3 Membrane Filtration – Additional Requirements				
i. Complete Table B.1 to verify that each individual membrane treatment unit that is used for pathogen reduction credits is free of any integrity breaches and determine its log removal value using pressure-based testing.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Make recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. For Municipal Public Drinking Water Supplies with integrated membrane systems, summarize the process used to verify the rejection rate remains adequate for organics removal.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Make recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
3.1.4 Primary Disinfection				
i. Document how many inactivation log credits are required by the disinfection process for each target microorganism (e.g., protozoa and/or viruses).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4	29
ii. Discuss how disinfection is achieved (e.g., chemical disinfectants, UV or both).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.1	29

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
a) Chemical Disinfection (CT Concept)				
i. Where chemical disinfectants are used, provide a schematic of the primary disinfection process including, but not limited to: <ul style="list-style-type: none"> Tank(s) dimensions. Baffling configuration and assumed baffling factor. Water level operating range, highlighting the low level. Disinfection type (e.g., free chlorine, chlorine dioxide, ozone). Minimum disinfectant concentration at the CT control point. Minimum water temperature. Maximum pH of the water for free chlorine or optimum pH for chlorine dioxide or ozone. Maximum flow and minimum retention time - if the tank used to achieve CT is subject to water level fluctuations, verify if the inflow/outflow represents the maximum flow condition. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.1	29
ii. Calculate the design CT.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.1	29
iii. Verify that operational conditions remained within the design range for achieving CT at all times during the most recent calendar year.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.1	29
iv. Where operational conditions went outside the design range, identify the cause, document the corrective actions taken and verify that CT was calculated during every such event.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Make recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
b) UV Disinfection (IT Concept)				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Where UV disinfection is used, provide a schematic of the primary disinfection process including, but not limited to: <ul style="list-style-type: none"> • Unit manufacturer and model. • Validation standard. • Maximum flow. • Minimum intensity at the end of lamp life. • Minimum transmittance at the end of lamp life. • Correction for water temperature. • Maximum concentrations for water quality parameters that promote fouling (e.g., iron, manganese, hardness). • Sleeve cleaning method. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Verify that the unit has been designed to deliver a UV dose of 40 mJ/cm ² or Department accepted alternate dose. Specify the alternate dose, if applicable.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iii. Verify that the following conditions were met at all times during the most recent calendar year: <ul style="list-style-type: none"> Was the intensity above the minimum required? Was the flow below the maximum allowed? Was the transmittance above the minimum required? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Where operational conditions went outside the design range, identify the cause, document the corrective actions taken and verify that IT was calculated during every such event.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Provide recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
e) Redundancy, Continuous Monitoring and Alerting				
i. Inspect the primary disinfection process to verify the following: <ul style="list-style-type: none"> Are there a minimum of two primary disinfection units? Are the primary disinfection units sized to meet maximum day demand with one unit out of service? Is on-line monitoring of the primary disinfection process in place with measurements taken and recorded at least once every five minutes? Have control limits been set to alarm and notify operators that the primary disinfection process is not working properly? Are protocols in place to prevent inadequately disinfected water from entering the distribution system? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.3	31
ii. Inspect the on-line instrumentation: <ul style="list-style-type: none"> Do they have the required range and accuracy to measure chlorine concentrations? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.3	31

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
<ul style="list-style-type: none"> Are they in good working order? Do they have a maintenance and quality assurance/calibration program? 	<input type="checkbox"/>	<input type="checkbox"/>		
iii. Provide recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
d) Standard Operating Procedures				
i. Review the standard operating procedures for the disinfection process: <ul style="list-style-type: none"> Do they specify the design ranges for achieving CT (e.g., temperature, disinfectant residual, flow, pH) or IT (e.g., intensity, flow, transmittance)? Do they include notification and response procedures when operational conditions are outside CT or IT design ranges? Do they include procedures to ensure the disinfection process is working properly? Do they include response procedures when the disinfection process is not working properly? Have they been implemented and communicated to all operations staff? Have they been documented in the operations manual? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.4	32
ii. Provide recommendations to address any concerns identified.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.4.4	32
3.1.5 Secondary Disinfection				
i. Describe the secondary disinfection process.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.5	31
ii. Inspect the secondary disinfection process to verify the following:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.5	31

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
<ul style="list-style-type: none"> • Are on-line continuous chlorine residual monitors in place to measure chlorine residual entering the distribution system at least once every five minutes? • Are the on-line chlorine residual monitors in good working order? • Is there a maintenance and quality assurance/calibration program in place? 				
iii. Where free chlorine is used for both primary and secondary disinfection, refer to Section 3.1.4 and note if the chlorine dose is controlled by CT (primary disinfection) or distribution system residual maintenance (secondary disinfection).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.5	31
iv. Where UV light is used for primary disinfection to receive protozoa inactivation credits, calculate the design CT for virus inactivation credits.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Where UV light is used for primary disinfection to receive protozoa inactivation credits, verify that operational conditions remained within the design range for achieving CT for virus inactivation at all times during the most recent calendar year.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
vi. Where operational conditions went outside the design range, identify the cause, document the corrective actions taken and verify that CT was calculated during every such event.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vii. Provide recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
3.1.6 Other Critical Processes				
i. Evaluate and inspect other critical processes against established standards and guidelines.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Recommend corrective actions where necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
3.1.7 Waste Streams				
a) Filter-to-Waste				
i. Describe the filter-to-waste process.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.1.7.1	32
ii. For chemically assisted filtration, verify that turbidity is less than or equal to 0.2 NTU before returning a filter to service.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Identify recommendations, if necessary, to meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
b) Filter Backwash Water – Discharge Into A Freshwater Watercourse				
i. Summarize treatment of the filter backwash water, if applicable, and identify the watercourse it is discharging into.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Identify any discharge criteria specified in the Approval to Operate.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
iii. Complete Table B.2. <ul style="list-style-type: none"> • Does sampling meet the minimum requirements as outlined in the Nova Scotia Treatment Standards for Municipal Drinking Water Systems? • Does effluent quality meet the discharge criteria stipulated in the Approval to Operate? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App A	
iv. If the water quality does not meet the discharge criteria stipulated in the Approval to Operate or if there are no discharge criteria stipulated in the Approval to Operate, identify recommendations to meet the requirements specified in Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. Recommend corrective actions where necessary to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
c) Filter Backwash Water – Discharge To Land Or Soil				
i. Summarize treatment of the filter backwash water, if applicable, and identify the location of discharge.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Identify whether the municipal public drinking water supply has a Discharge Management Plan in accordance with Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, as amended from time to time.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Identify the effluent discharge criteria specified in the Approval to Operate, or the Department accepted Discharge Management Plan.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Complete Table B.3. <ul style="list-style-type: none"> Does effluent quality meet the discharge criteria stipulated in the Approval to Operate, or the Department accepted Discharge Management Plan? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
v. If the water quality does not meet the discharge criteria stipulated in the Approval to Operate, or the Department accepted Discharge Management Plan, identify recommendations to meet the minimum requirements for a plan specified in Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, as amended from time to time.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vi. Identify operational, maintenance, and monitoring procedures in the Discharge Management Plan that do not meet the minimum requirements for a plan as specified in Part V – Management of Waste Streams of the Nova Scotia Treatment Standards for Municipal Drinking Water Systems, as amended from time to time.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
vii. Recommend corrective actions where necessary to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
d) Filter Backwash Water – Discharge To A Marine Or Brackish Environment				
i. Summarize treatment of the filter backwash water, if applicable, and identify the watercourse it is discharging into.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Identify any discharge criteria specified in the Approval to Operate.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iii. Complete Table B.4. <ul style="list-style-type: none"> Does effluent quality meet the discharge criteria stipulated in the Approval to Operate? 	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
iv. Recommend corrective actions where necessary to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
e) Other Waste Streams				
i. Review other waste streams and verify that they are being managed appropriately.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Provide recommendations to address any concerns identified.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.		Yes	N/A	Section	Page #
3.2 Distribution Water Quality					
3.2.1 Chlorine Residual Levels					
i.	Review distribution system chlorine residuals for the most recent calendar year available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.1	33
ii.	Recommend corrective actions where residuals are routinely less than 0.20 mg/L or 0.40 mg/L (depending on the concentration specified in the Municipal Public Drinking Water Supply's Approval to Operate) where free chlorine is used (or less than 1.0 mg/L combined chlorine for chloraminated systems).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.1	33
iii.	Inspect all distribution water storage tanks to verify that on-line continuous chlorine residual monitors are in place to measure chlorine residual at the storage tank outlet at least once every five minutes.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.1	33
iv.	Inspect the on-line chlorine residual monitors to ensure that they are in good working order and that a maintenance and quality assurance/calibration program is in place.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.1	33
v.	Recommend corrective actions where necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.1	33

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2.2 Microbiological Water Quality				
i. Review total coliforms and E. coli results for the most recent calendar year available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.2	33
ii. Discuss any presence of bacteria in the distribution system and identify recommendations where necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.2	33
iii. Verify that sampling locations and frequencies meet the requirements of the Guidelines for Monitoring Public Drinking Water Supplies Part I, including any re-sampling required after the presence of bacteria is detected.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.2	33
iv. Identify sampling locations on a map of the distribution system.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.2	33
v. Recommend sampling location/frequency changes if necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.2	33

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2.3 Turbidity				
i. Review distribution system turbidity results for the most recent calendar year available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.3	33
ii. Verify that a protocol exists for investigating the cause of turbidity values above 5 NTU.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.3	33
iii. Discuss any values above 5 NTU and identify recommendations identified where necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.3	33

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.2.4 Cross Connection Control Program				
i. Review the cross connection control program. <ul style="list-style-type: none"> Does it meet the minimum requirements as outlined in A Guide to Assist Nova Scotia Municipal Water Works Develop a Cross Connection Control Program, as amended from time to time. Are implementation timelines being met in accordance with the accepted plan? Provide an update on the status of the Cross Connection Control Program, including any modifications to the plan or implementation schedule, and a summary of the activities taken to achieve the goals and objectives of the program. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.2.4	34
ii. Provide recommend where necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
3.2.5 Other Distribution System Monitoring/Programs				
i. Review any other distribution system monitoring or programs that are in place to deal with threats to distribution system integrity, including but not limited to infrastructure age, watermain breaks, leak detection, pressure transients, etc.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
ii. Provide recommendations where necessary.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
3.3 Site Inspection				
i. Conduct a site inspection to evaluate treatment processes, as well as other facilities and equipment as per the requirements outlined in section 3.3 of the Terms of Reference.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.3	34
3.4 Conclusions and Recommendations				
i. Refer to section 3.4 of the Terms of Reference.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.4	

PART IV Operations, Monitoring and Management

4.0 Review of Operations, Maintenance, Monitoring and Management

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
4.1 Operations and Maintenance				
i. Review the comprehensive operations manual: <ul style="list-style-type: none"> • Does one exist? • Is it current and up to date? • Does it include SOPs, emergency notification procedures and contingency plans? • Is it available on site or an alternate location accepted by the Department? • Are operations staff aware of its contents? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.1	37
ii. Evaluate the procedures an operator follows to identify any problem(s) with the water treatment and distribution process, determine the changes needed to correct the problem(s) and how adjustments to the processes are approved and performed as needed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.1	38
iii. Verify that a maintenance program exists and is adequate to ensure the long-term viability of the Municipal Public Drinking Water Supply, including distribution system components.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.1	38
iv. Identify recommendations where necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.1	38
4.2 Monitoring and Reporting				

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
i. Review the annual monitoring program to: <ul style="list-style-type: none"> • Does one exist? • Is it current and up to date? • Does it meet the minimum requirements as outlined in the Nova Scotia Treatment Standards for Municipal Drinking Water Systems and A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans? • Are operations staff aware of its contents? 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.2	38
ii. Identify the laboratories being used for water quality analyses.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.2	38
iii. Verify that the Municipal Public Drinking Water Supply is operating in accordance with the Policy on Acceptable Certification of Laboratories.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.2	38
iv. Review reporting requirements and verify that the Approval Holder has complied with the immediate, annual and ad hoc reporting requirements outlined in the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.2	38
v. Review the most recent annual report and identify any concerns in the System Assessment Report.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.2	38
vi. Identify recommendations where necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.2	38

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
4.3 Management				
i. Review the number of certified operators and back-up personnel to verify that the municipal public drinking water supply is operating in accordance with Part I of the Water and Wastewater Facilities and Public Drinking Water Supplies Regulations.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.3	41
ii. Complete Table C.1 to identify the operator(s) in overall direct responsible charge (ODRC) and summarize what protocols are in place during the absence of the operator(s) in ODRC. Note: The ODRC operator(s) must sign Table C.1.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	App. A	
iii. Review the water quality goals that the Municipal Public Drinking Water Supply has and evaluate their plan(s) to accomplish or maintain these goals.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.3	41
iv. Identify recommendations where necessary.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.3	41
4.4 Conclusions and Recommendations				
i. Refer to section 4.4. of the Terms of Reference.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.4	

PART V REPORT SUBMISSION

5.0 Ability to Comply

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
5.1 Summary				
i. Summarize conclusions and identify all recommendations necessary to meet the Nova Scotia Treatment Standards for Municipal Drinking Water Systems.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5.1	43
ii. Include preliminary cost estimates and an implementation schedule to address the above requirements. Costs shall be presented and prioritized with respect to public health risks. Note: If the corrective action plan submitted to the Department varies from the risk-based approach documented in the System Assessment Report, written justification shall be included in the corrective action plan for varying the priority.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5.1.4	46
iii. Highlight any obvious problems associated with the Municipal Public Drinking Water Supply that jeopardize treated water quality to the point that it no longer meets the health protection standards adopted by the Department.	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Confirm all applicable information has been submitted to the Department. Indicate the section and page number where the information is documented.	Yes	N/A	Section	Page #
5.2 Report Preparation				
i. Submit three (3) copies of the System Assessment Report to the Department and include a copy of this completed checklist.	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
ii. Engineer's Declaration (refer to section 1.4 of the Terms of Reference)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5.2	48



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