



Town of Mahone Bay
2019 Wastewater Treatment & Collection Report
Approval No. 2016 – 096100

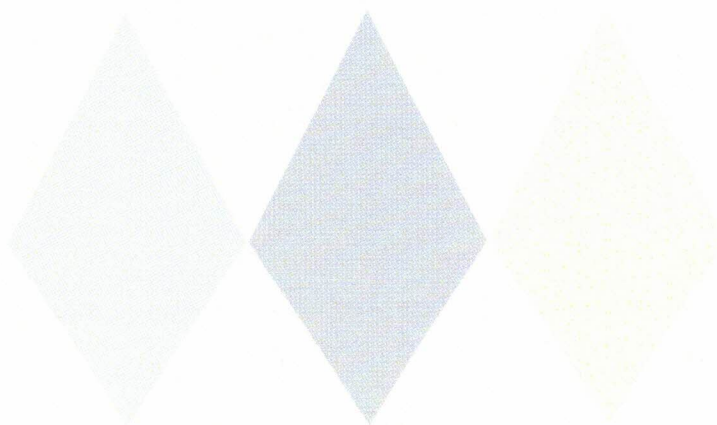




Table of Contents

List of Tables

| | |
|---|----|
| Table 1: Effluent Limits from section 7 of Approval | 3 |
| Table 2: Sampling Frequency and Location from section 9(a) of Approval..... | 3 |
| Table 3: 2019 Effluent Discharge Overview..... | 4 |
| Table 4: 2019 Monthly Effluent Data..... | 4 |
| Table 5: 2019 Effluent Analysis Parameters | 5 |
| Table 6: 2019 Quarterly CBOD ₅ Results..... | 6 |
| Table 7: 2019 Quarterly TSS Results..... | 7 |
| Table 8: 2019 Quarterly E. Coli Results..... | 8 |
| Table 9: 2019 Quarterly pH Results | 9 |
| Table 10: 2019 Quarterly TCR Results..... | 10 |
| Table 11: 2019 Pumping Station Overflow Events by Month..... | 12 |

List of Figures

| | |
|--|----|
| Figure 1: 2019 Average daily effluent flow Sewage Treatment Plant | 5 |
| Figure 2: Effluent CBOD ₅ results compared to Limit | 6 |
| Figure 3: Effluent TSS results compared to Limit | 7 |
| Figure 4: Effluent E. Coli results compared to Limit..... | 8 |
| Figure 5: Effluent pH results compared to Limit..... | 9 |
| Figure 6: Effluent TCR results compared to future Limit | 10 |
| Figure 7: Effluent Un-ionized Ammonia results compared to federal Limit..... | 11 |
| Figure 8: Pumping Station Overflows versus Precipitation | 12 |

Report

| | |
|--|----|
| Introduction | 1 |
| Background | 1 |
| Collection System Overview..... | 1 |
| Sewage Treatment Plant Overview | 2 |
| Regulatory Requirements | 2 |
| Flow Monitoring Data & Discussion..... | 4 |
| Analytical Results & Discussion..... | 5 |
| Emergency / Upset Conditions..... | 11 |
| Complaints & Follow-up Actions..... | 13 |
| Conclusion | |

Introduction

The Town of Mahone Bay holds an Approval to Operate Sewage Treatment Plant and Associated Works No. 2016 – 096100, herein referred to as the Approval, issued by the province of Nova Scotia under the Environment Act. In accordance with section 9(d) of the Approval, the following report satisfies annual reporting requirements for the period of January 1st, 2019 through December 31st, 2019. The report contains a summary and discussion of the quantity of wastewater treated, a summary and interpretation of analytical results obtained, the averaging period sampling result averages, a description of any emergency or upset conditions, and a description of any complaints received and the follow-up actions.

Background

The Town of Mahone Bay is located on the south shore of Nova Scotia in Lunenburg County. The Town population is approximately 1000 and it is a primarily residential community with one main area of commercial development on Main Street. The wastewater collection system is comprised of approximately 5.5 km of gravity sewer pipe and 1.1 km of forcemain. The majority of sewer pipe was installed in the 1940s. There are three wastewater pumping stations in the system which carry the untreated wastewater to an aerated lagoon treatment facility, located at 918 Main Street. The wastewater pumping stations and treatment facility were constructed and made operational in 1994. The Sewage Treatment Plant has a design flow of 852 m³/day. Treated effluent is discharged into Mahone Bay Harbour near the Town limit with Maders Cove.

Collection System Overview

The Town of Mahone Bay has a combined storm and sanitary sewage interceptor system. The system is comprised of a trunk sewer from Clairmont Street to the lagoon access road, a branch sewer from Parish Street under the Mahone Bay Harbour, and three pumping stations (PS1, PS2, PS3). The interceptor system has a combination of gravity and forcemain sewers. All manholes and covers are standard except for the manhole at Parish Street and Edgewater Street, where the chamber houses removable screens for the pipe which crosses under the Mahone Bay Harbour.

PS1 is located at the south end of Main Street across from civic number 866, PS2 is located at the Government Wharf, and PS3 is on the waterfront adjacent to the Independent Grocer parking lot. Each pump station has 2 submersible pumps which have separate valving and include a ball valve and a plug valve on each pipe discharge line. Pump control stations are located at each site and include an RTU with internal control program, a level transducer, and a SCADA Pak to bring all data to the central SCADA site at the Water Treatment Plant. The three pump stations have system overflow pipes of 300mm PVC with a 12 mm bar screen at the entrance. The overflow pipes for PS1 and PS3 have flap check valves and discharge directly into Mahone Bay Harbour. The overflow pipe for PS2 discharges into an adjacent storm sewer prior to entering Mahone Bay Harbour. Wastewater travels from PS3 to PS2 to PS1 prior to being pumped to the Sewage Treatment Plant.

Sewage Treatment Plant Overview

The Town of Mahone Bay Sewage Treatment Plant consists of the headworks, lagoon basins, and weir chamber. It has a hydraulic retention time of 25 days and a total sewage design flow of 852 m³/day. Wastewater is pumped from the collection system through a 200mm PVC forcemain to the headworks where it passes through a bar screen into the grit removal chamber. From there, the wastewater travels to lagoon Cell 1, which has the largest number of aerators, 33. Cell 1 provides the majority of soluble biological oxygen demand reduction. Next, wastewater travels to lagoon Cell 2a which has 16 aerators and is divided from lagoon Cell 2b by means of a floating Hypalon baffle. Wastewater enters lagoon Cell 2b through engineered windows in the floating baffle. Cell 2b has 8 aerators. Following aeration, the wastewater enters lagoon Cell 3a, where it is treated with chlorine. Cell 3a does not have aerators which allows a quiescent settling volume. This cell provides a hydraulic retention time of 12 hours. Cell 3a is divided from Cell 3b by another floating Hypalon baffle. The wastewater travels from Cell 3a to Cell 3b through an engineered window in the baffle, whereupon it is exposed to aeration via 3 aerators to achieve natural de-chlorination. The wastewater remains in Cell 3b for an additional 12 hours of hydraulic retention time. Prior to discharge, the treated effluent travels from Cell 3b to the effluent weir chamber which houses a continuous discharge flow meter. The effluent then enters a 200mm PVC gravity outfall pipe for discharge through a diffuser into Mahone Bay Harbour.

Regulatory Requirements

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

- Canadian Environmental Protection Act
- Wastewater System Effluent Regulations under the Fisheries Act
- Nova Scotia Environment Act
- Atlantic Canada Standards and Guidelines Manual for the Collection, Treatment, and Disposal of Sanitary Sewage
- Town of Mahone Bay By-Laws: Sewer Discharge, Sewer Connection, and Use of Sewers & Drains

Section 9(b) of the Approval states that compliance is achieved if "...the average value calculated for the averaging period meets the specified limit in section 7".

Under section 7 of the Approval, Performance and Limits, the following effluent limits are established:

| Effluent Limits | |
|--|--|
| Effluent Parameter | Concentration Limit |
| Carbonaceous Biological Oxygen Demand (CBOD ₅) | shall not exceed 25 mg/L |
| Total Suspended Solids (TSS) | shall not exceed 25 mg/L |
| E.Coli | Shall not exceed 200 E.Coli /1 00 mL |
| pH | within range of 6 to 9 |
| Non-acutely lethal | N/A |
| Total Chlorine Residual (TCR) | Shall not exceed 0.02 mg/L *Effective Jan.01.2021 |

Table 1: Effluent Limits from section 7 of Approval.

Under section 9(a) of the Approval, Monitoring and Reporting, the following sampling and parameter analysis is conducted at the frequency and locations listed in Table 1:

| TABLE 1 | | | | |
|--|-------------|--------------------------------|------------------|-------------------------------|
| PARAMETER | SAMPLE TYPE | MINIMUM FREQUENCY | AVERAGING PERIOD | LOCATION |
| CBOD ₅ | Grab | Monthly | Quarterly | Treated effluent discharge |
| TSS | Grab | Monthly | Quarterly | Treated effluent discharge |
| E.Coli | Grab | Monthly | Quarterly | Treated effluent discharge |
| pH | Grab | Monthly | Quarterly | Treated effluent discharge |
| If chlorine is used: Total Chlorine Residual | Grab | Monthly | Quarterly | Treated effluent discharge |
| Plant Volumes | N/A | Continuous | Quarterly | Entering or leaving the plant |
| Fish Toxicity | Grab | As requested by the Department | N/A | Treated effluent discharge |

Table 2: Sampling Frequency and Location from section 9(a) of Approval.

Flow Monitoring Data & Discussion

The final effluent from the Sewage Treatment Plant is discharged into Mahone Bay Harbour. The total volume of treated wastewater effluent discharged in 2019 was 248,226 m³. Table 1 provides an overview of the 2019 effluent discharge volumes, as well as the average monthly flow, the maximum flow month volume, and the low

flow month volume. Table 2 provides information on 2019 effluent flow and volumes by month. Figure 1 plots the daily average effluent flow monthly from 2019. The average daily effluent flow does not typically exceed the design flow; higher flows are associated with increased precipitation and lower flows correspond to summer months.

| Year | Total Effluent Volume (m³) | Average Total Monthly Flow (m³/month) | Peak Flow Month: April (m³) | Low Flow Month: August (m³) |
|-------------|--|---|---|---|
| 2019 | 248,226 | 20,686 | 35,992 | 5,623 |

Table 3: 2019 Effluent Discharge Overview.

| Month | Total Effluent Volume (m³) | Average Daily Flow (m³/day) | Maximum Monthly Volume (m³) | Minimum Monthly Volume (m³) |
|--------------|--|---|---|---|
| January | 24,597 | 793 | 1,052 | 575 |
| February | 15,270 | 545 | 718 | 210 |
| March | 22,470 | 725 | 1,548 | 275 |
| April | 35,992 | 1200 | 1,694 | 729 |
| May | 31,148 | 1005 | 3,461 | 426 |
| June | 27,278 | 909 | 1,804 | 377 |
| July | 9,402 | 303 | 1,062 | 37 |
| August | 5,623 | 181 | 400 | 46 |
| September | 10,878 | 363 | 770 | 117 |
| October | 11,743 | 379 | 723 | 99 |
| November | 24,207 | 807 | 2,211 | 364 |
| December | 29,618 | 955 | 1,507 | 323 |

Table 4: 2019 Monthly Effluent Data.

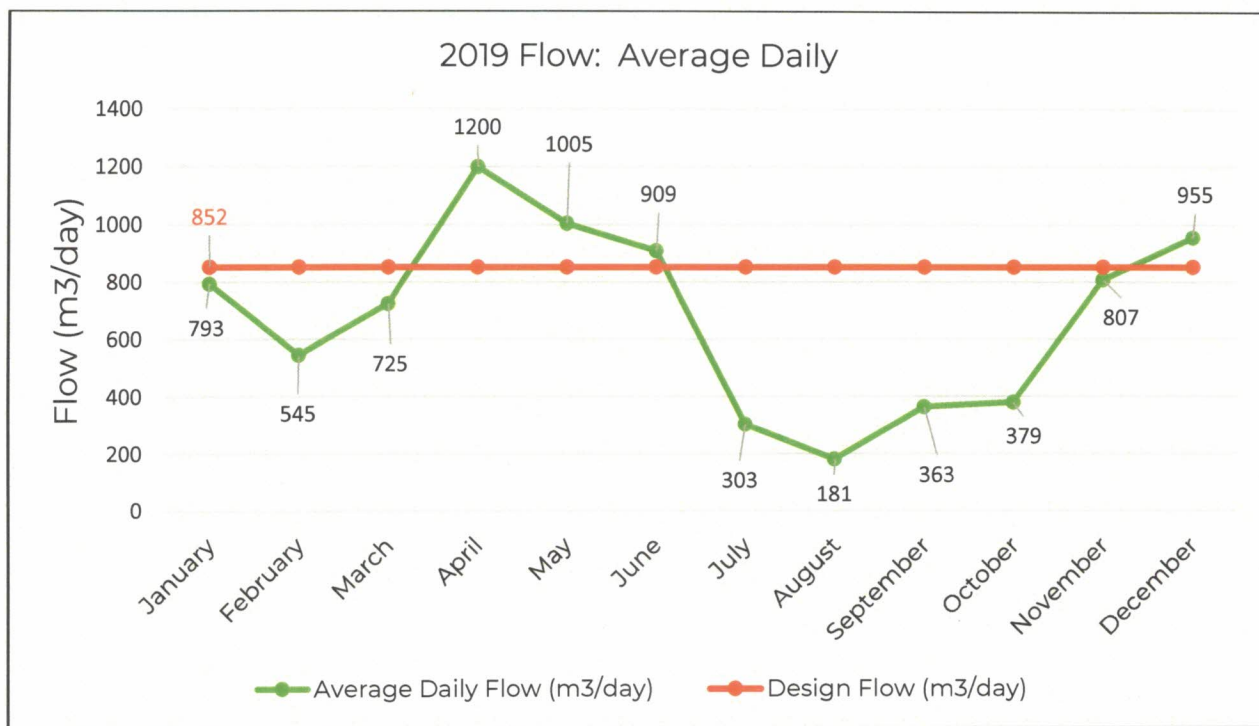


Figure 1: 2019 Average daily effluent flow Sewage Treatment Plant.

Analytical Results & Discussion

Wastewater samples were collected monthly and submitted to AGAT Laboratories for analysis. AGAT Laboratories is in Dartmouth, Nova Scotia and holds valid CALA accreditation, as seen in the certificate in Appendix A. AGAT conducted wastewater analysis for the Town of Mahone Bay including, but not limited to, the following:

| Effluent |
|------------------------|
| CBOD ₅ |
| Total Suspended Solids |
| E. Coli |
| pH |
| Un-ionized Ammonia |

Table 5: 2019 Effluent Analysis Parameters.

Operations Staff collected and analyzed wastewater effluent samples for pH and total chlorine residual (TCR) on a routine basis.

The effluent analytical results are compared to the effluent limits in the following Figures 2 through 7.

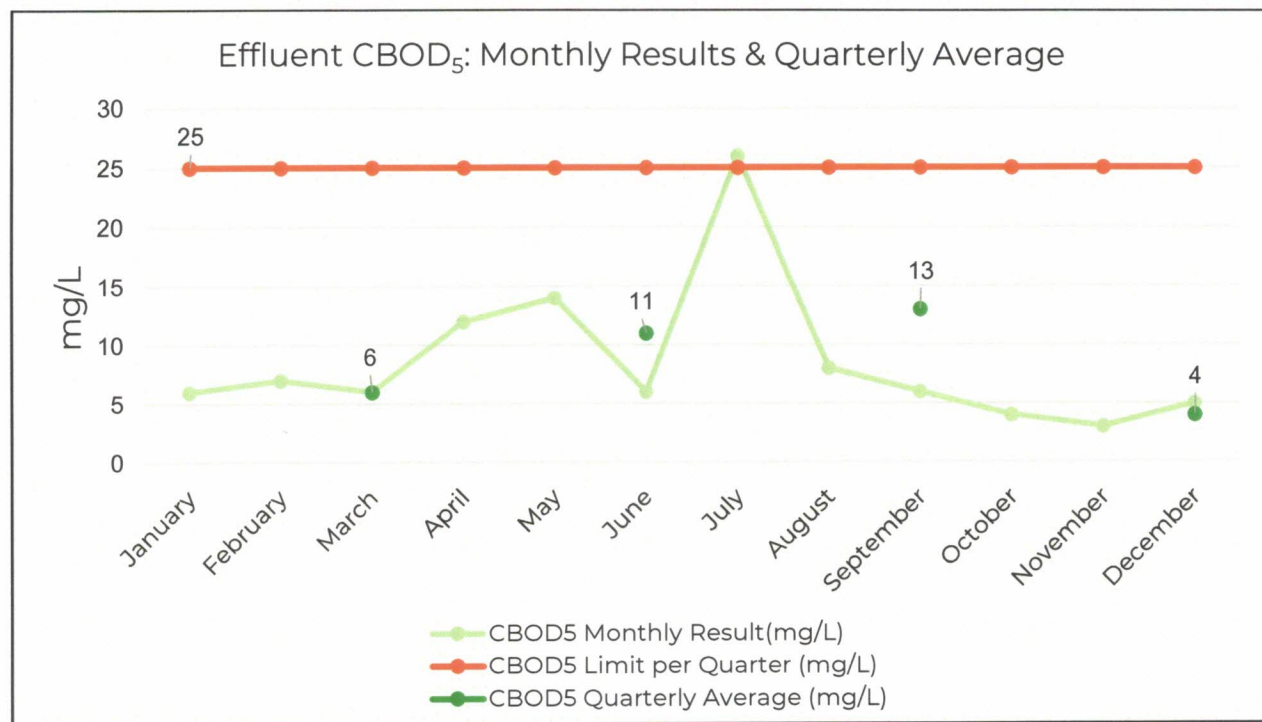


Figure 2: Effluent CBOD₅ results compared to Limit.

CBOD₅ monitoring was conducted monthly and sample results were below the performance limit in all months excluding July. In accordance with compliance limits, all averaging quarters were below the performance limit of 25 mg/L.

| 2019 Average CBOD ₅ Results | |
|--|---------|
| Quarter 1 | 6 mg/L |
| Quarter 2 | 11 mg/L |
| Quarter 3 | 13 mg/L |
| Quarter 4 | 4 mg/L |

Table 6: 2019 Quarterly CBOD₅ Results.

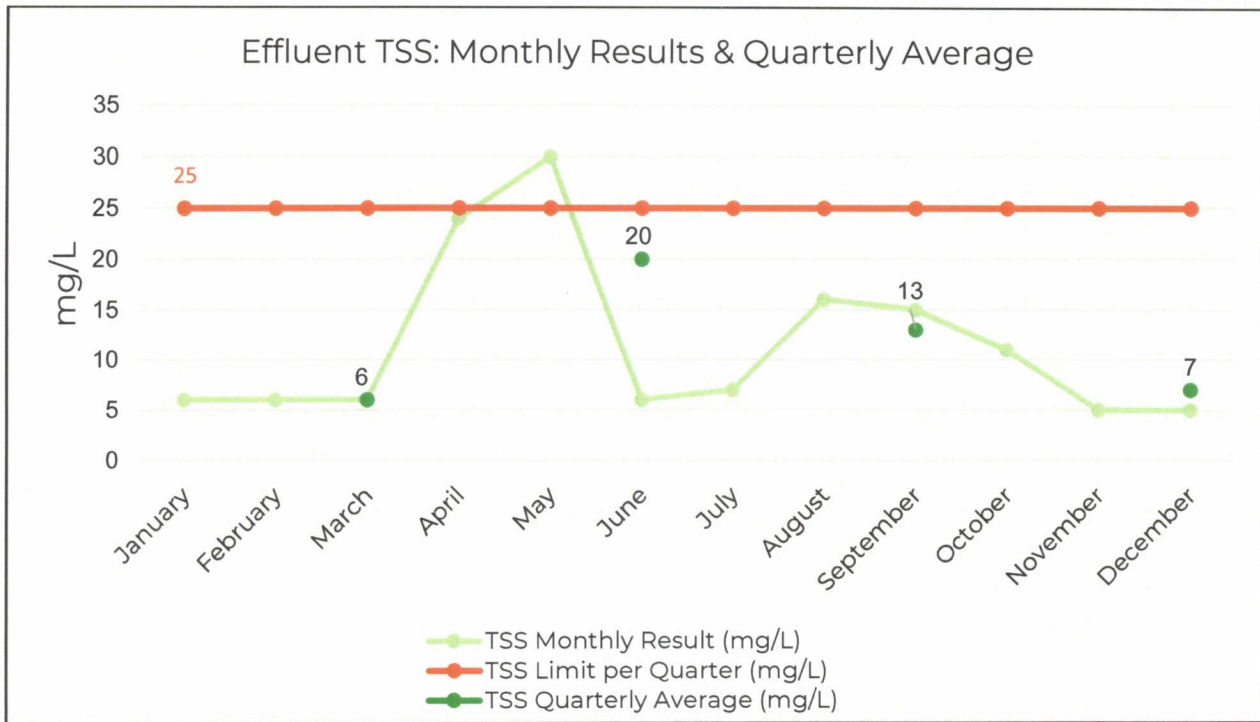


Figure 3: Effluent TSS results compared to Limit.

TSS monitoring was conducted monthly and sample results were below the performance limit, excluding May. In accordance with compliance limits, all averaging quarters were below the performance limit of 25 mg/L.

| 2019 Average TSS Results | |
|--------------------------|---------|
| Quarter 1 | 6 mg/L |
| Quarter 2 | 20 mg/L |
| Quarter 3 | 13 mg/L |
| Quarter 4 | 7 mg/L |

Table 7: 2019 Quarterly TSS Results.

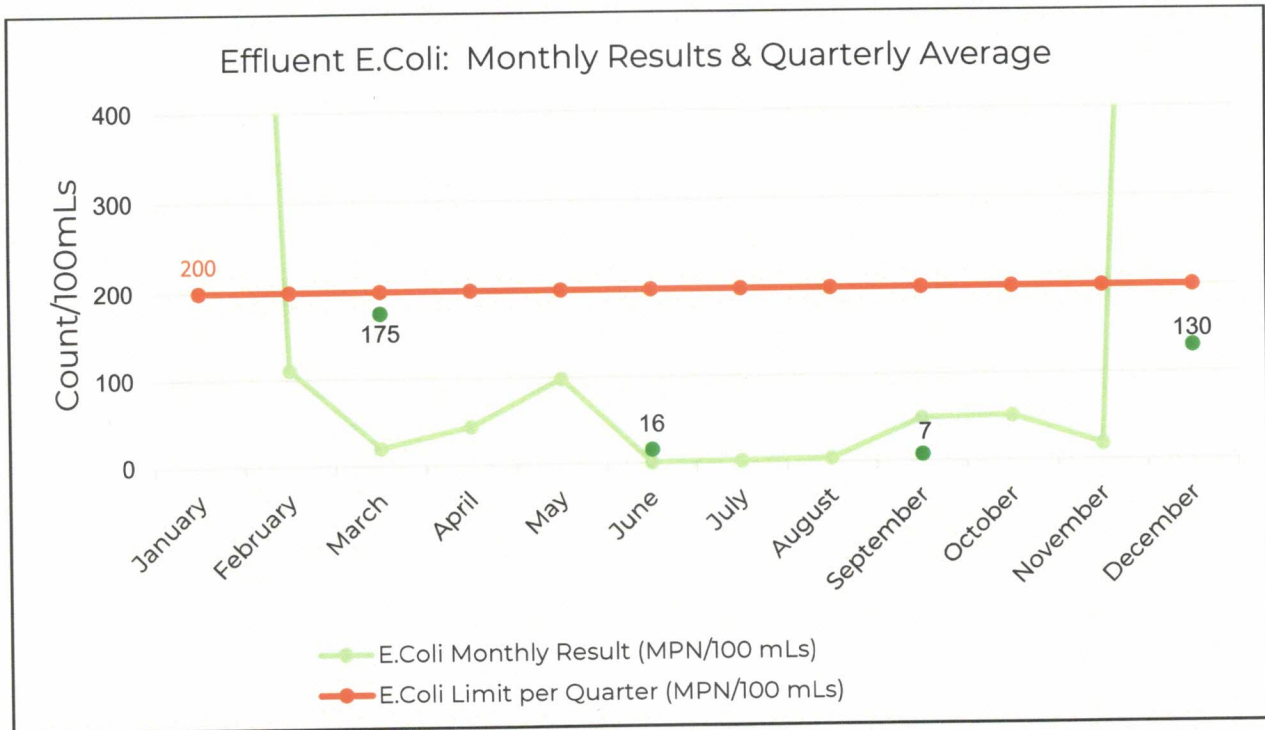


Figure 4: Effluent E. Coli results compared to Limit.

E. Coli monitoring was conducted monthly and sample results were below the performance limit, excluding January and December. In accordance with compliance limits, all averaging quarters were below the performance limit of 200 E.Coli / 100 mL.

| 2019 Average E. Coli Results | |
|------------------------------|--------------|
| Quarter 1 | 175 / 100 mL |
| Quarter 2 | 16 / 100 mL |
| Quarter 3 | 7 / 100 mL |
| Quarter 4 | 130 / 100 mL |

Table 8: 2019 Quarterly E. Coli Results.

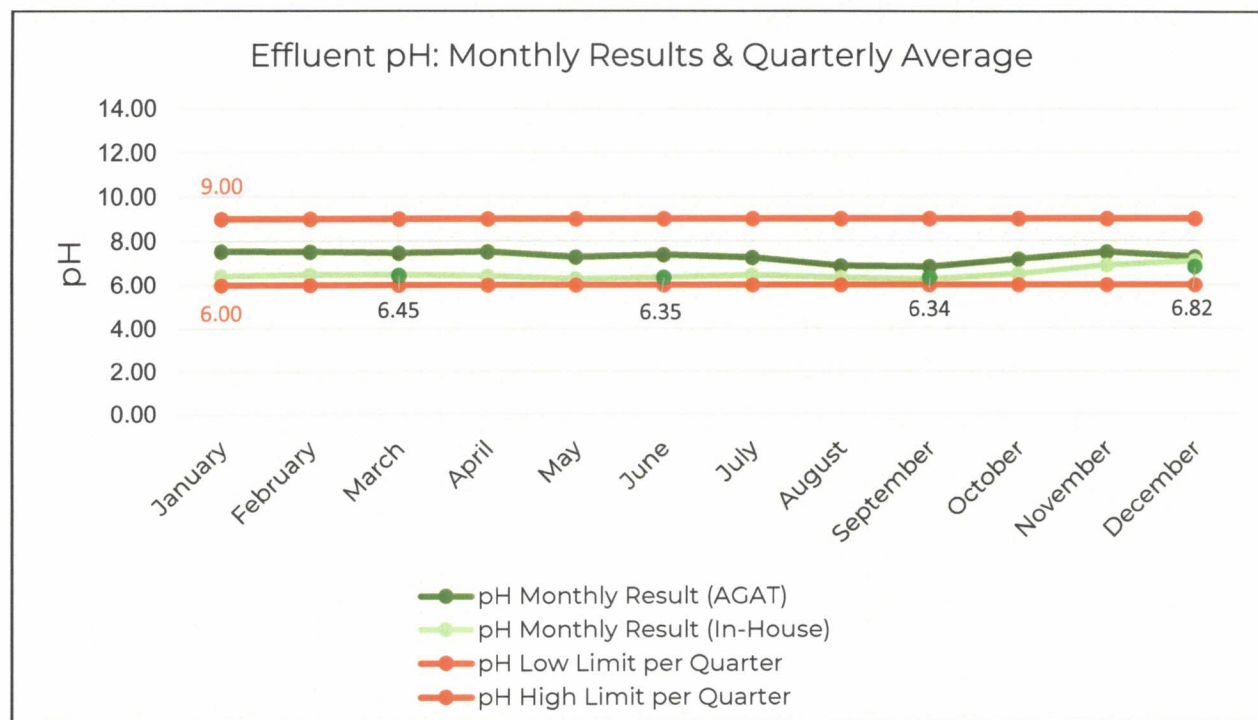


Figure 5: Effluent pH results compared to Limit.

| 2019 Average pH Results | |
|-------------------------|------|
| Quarter 1 | 6.45 |
| Quarter 2 | 6.35 |
| Quarter 3 | 6.34 |
| Quarter 4 | 6.82 |

Table 9: 2019 Quarterly pH Results.

Operations staff conducted pH monitoring on a routine basis during regular station checks. Monthly averaged results were within performance limits in all months. In 2019, the in-house maximum monthly average pH was 7.09 in December and the in-house minimum monthly average pH was 6.26 in September. All four averaging quarters were within the performance limit range of pH 6 – 9.

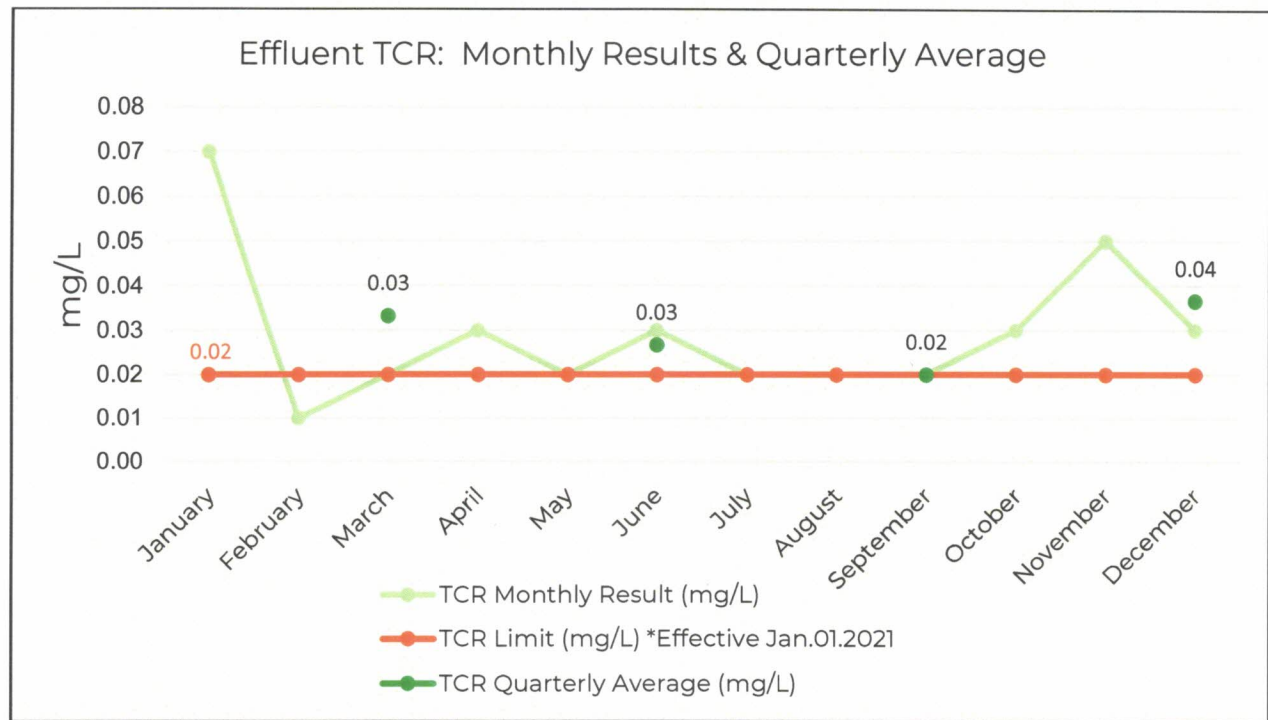


Figure 6: Effluent TCR results compared to future Limit.

| 2019 Average TCR Results | |
|--------------------------|-----------|
| Quarter 1 | 0.03 mg/L |
| Quarter 2 | 0.03 mg/L |
| Quarter 3 | 0.02 mg/L |
| Quarter 4 | 0.04 mg/L |

Table 10: 2019 Quarterly TCR Results.

Operations staff conducted TCR monitoring on a routine basis during regular station checks. Most sample results were above the anticipated performance limit in all months. In 2019, the maximum monthly average TCR was 0.07 mg/L in January and the minimum monthly average TCR was 0.01 mg/L in February. Three of the four averaging quarters were above the anticipated performance limit of 0.02

mg/L, effective January 1st, 2021. The Town engaged CBCL Ltd. to conduct a De-chlorination Options Review in 2019, which is currently under review by Nova Scotia Environment (NSE). Upon approval and direction from NSE the Town will move forward with the specification, tender, and construction phases of the project in order to ensure effluent will continue to meet disinfection performance limits while also meeting the impending TCR performance limit of 0.02 mg/L.

Un-ionized Ammonia

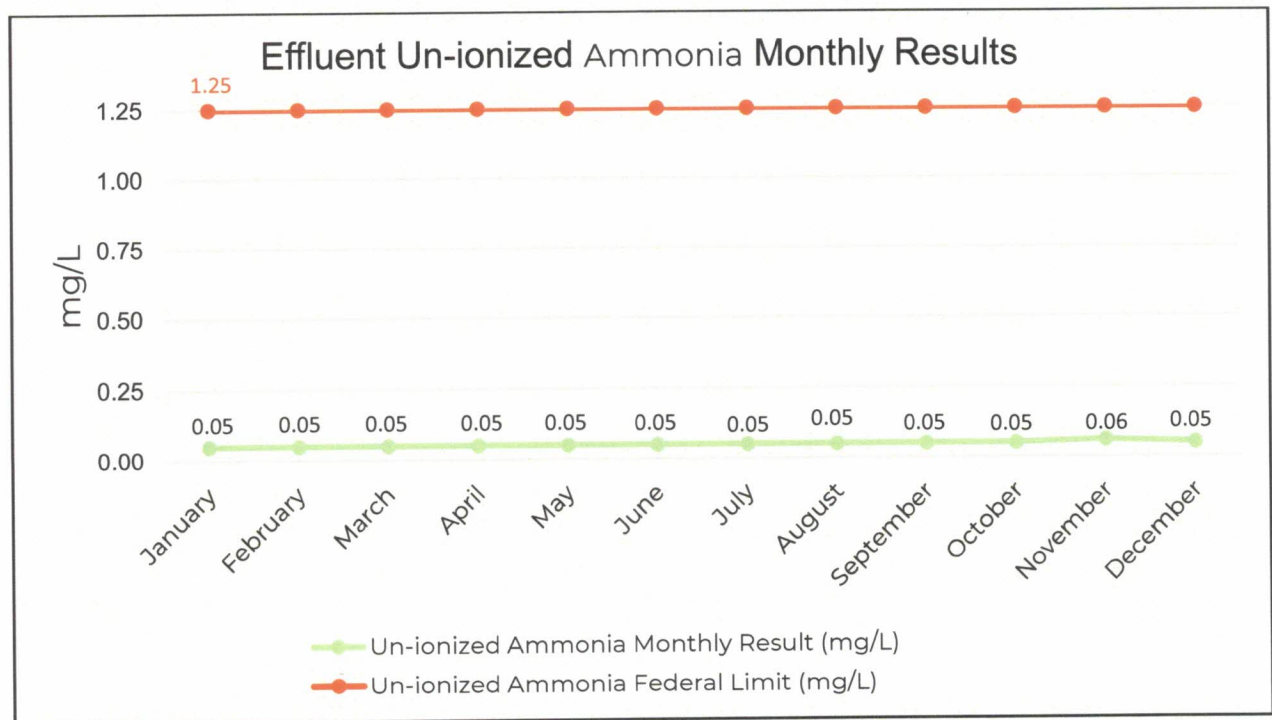


Figure 7: Effluent Un-ionized Ammonia results compared to federal Limit.

Un-ionized ammonia monitoring was conducted monthly and sample results were below the federal performance limit of 1.25 mg/L in all months.

Emergency / Upset Conditions

The Town of Mahone Bay sewage interceptor system is a combined storm and sewage collection system. The result of the combined system is overflow events from the pumping stations into Mahone Bay Harbour due to weather events which cause increased inflow and infiltration. Overflow events, including the date, time, volume, duration, and cause are reported to Environment Canada. The combined pumping station overflow volume for 2019 was 110,361 m³. Most overflow events were linked to weather events and tide infiltration. Table 5 outlines 2019 pumping station overflow events by month and Figure 8 compares 2019 overflow events at each pumping station versus total precipitation data taken from the Environment Canada historical data available for Halifax International Airport weather station.

| 2019 Pumping Station Overflow Events | | | |
|--------------------------------------|--------|-------|--------|
| Month | PS #1 | PS #2 | PS #3 |
| January | 85 | 314 | 4,558 |
| February | 0 | 0 | 1,284 |
| March | 4,243 | 109 | 3,006 |
| April | 2,945 | 113 | 2,353 |
| May | 0 | 0 | 22 |
| June | 10,408 | 0 | 855 |
| July | 1,561 | 0 | 0 |
| August | 0 | 0 | 0 |
| September | 14,582 | 913 | 2,896 |
| October | 4,241 | 0 | 1,263 |
| November | 13,816 | 0 | 1,076 |
| December | 34,122 | 11 | 5,585 |
| Total: | 86,003 | 1,460 | 22,898 |

Table 11: 2019 Pumping Station Overflow Events by Month.

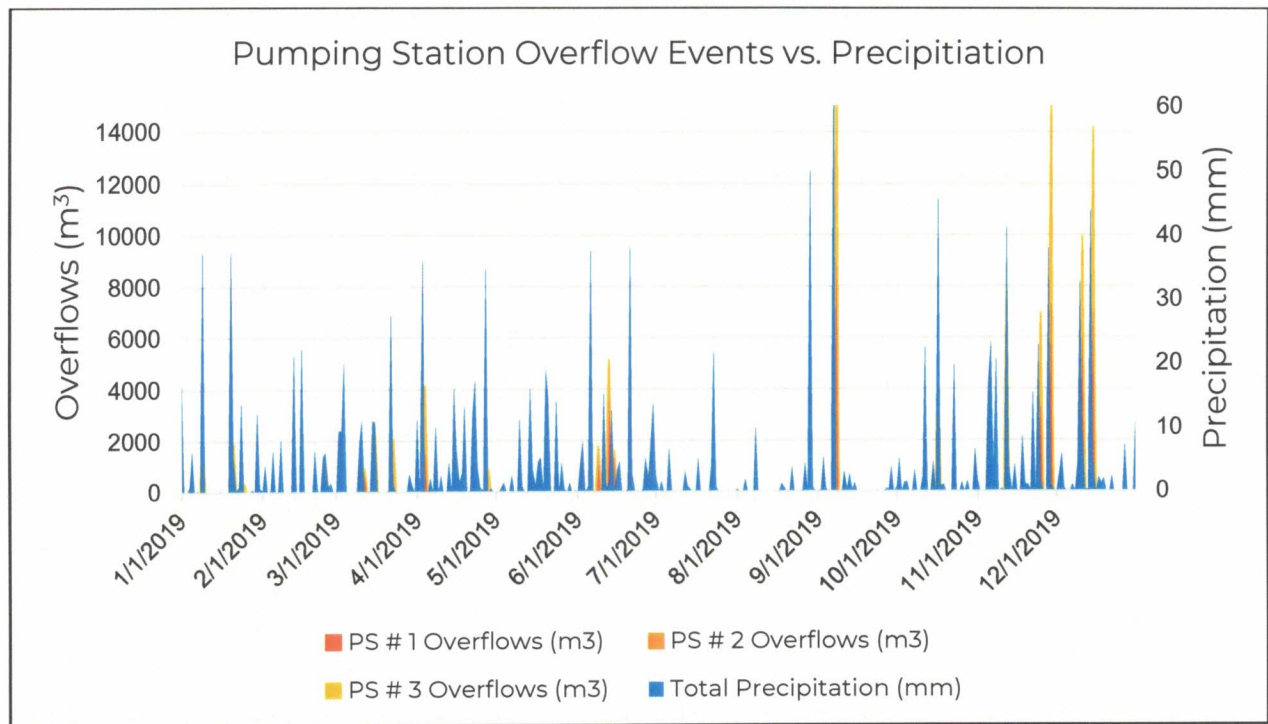


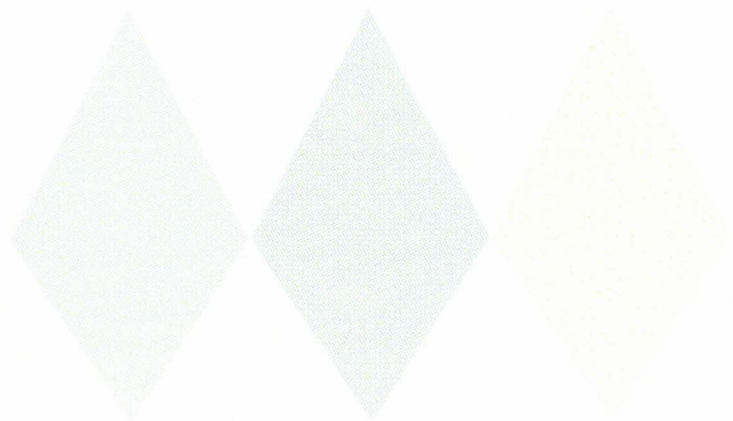
Figure 8: Pumping Station Overflows versus Precipitation.

Complaints & Follow-Up Actions

The Town of Mahone Bay received a total of three sewer related complaints in 2019. Two of the three complaints were received by the Director of Operations and one through the Town Office. All complaints were assigned to Operations staff. The complaints were all related to sewer back-ups. Operations staff conducted site visits in all three cases. One complaint was determined to be the responsibility of the property owner and required a plumbing company to clear the sewer lateral of a blockage. Two complaints were determined to be the responsibility of the Town. The complaints occurred during heavy rainfall events that inundated the sewer system. Operations staff successfully controlled downstream flow by decreasing the number of lift pumps running simultaneously in the first incident. The second event was not successfully controlled by limiting the number of pumps running and Operations staff arranged for third party contractors to perform sewer main cleaning. The result of the sewer main inspection revealed fabric partially blocking the main, which was successfully removed. It should be noted the two events were in January and December of 2019, respectively.

Conclusion

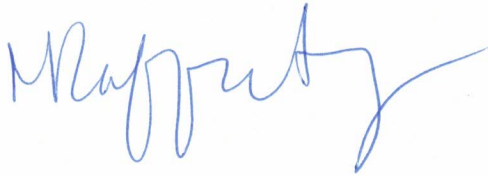
All required sampling and monitoring were completed. Sample results in all four quarters achieved compliance. The Town continues to move forward with efforts related to de-chlorination such that future compliance requirements will be achieved. Emergency and upset conditions which occurred at the pumping stations were recorded and reported. Each sewer related complaint was investigated and resolved. During the reporting period, the Town of Mahone Bay operated the Sewage Treatment Plant and associated works in accordance with the current Approval.



Report Prepared By:

Meghan Rafferty

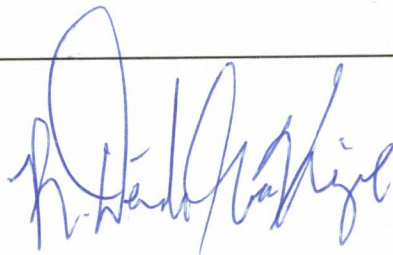
Water/Wastewater Operator, ODRC



Report Reviewed By:

Derrick MacKenzie

Director of Operations



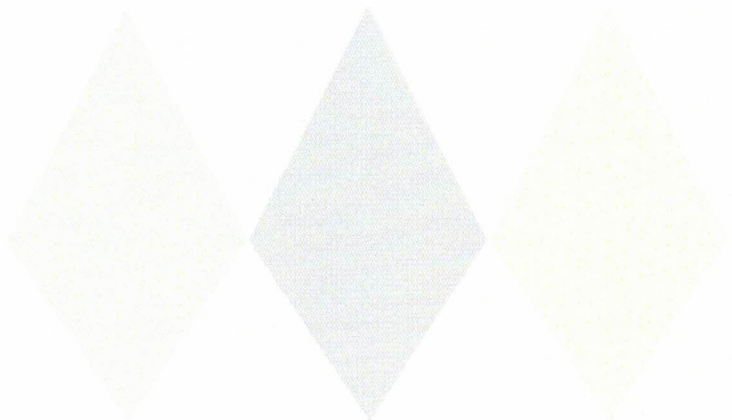
Report Reviewed By:

Dylan Heide

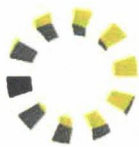
CAO



Appendix A



Canadian Association for Laboratory Accreditation Inc.



CALA

Certificate of Accreditation

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

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Accreditation No.: A3588
Issued On: January 22, 2019
Accreditation Date: December 7, 2007
Expiry Date: July 22, 2021



CALA

Andrew M. Adams

President & CEO

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