



## TOWN OF CLARK'S HARBOUR

NOVA SCOTIA  
(INCORPORATED MARCH 4TH, 1919)

November 16, 2023

RE: Wastewater Treatment Facility

Dear Warden Nickerson and Councillors:

As you may be aware, the Town of Clark's Harbour is pursuing the possibility of constructing a new wastewater treatment facility. The existing one, which was constructed in 1976 is nearly 50 years old and is definitely showing its age. Following an inspection by the NS Dept of Environment and Climate Change in December of 2021, there were many noted deficiencies, and this is when it was decided that mere "Band-Aids" would not solve problems ongoing for many years. There was a feasibility study completed by CBCL in June of 2022 and it indicated that a new facility would be the best choice. This new facility would only accommodate its existing customers or at the very least leave us with very little ability for growth.

Before making any concrete decisions, it was thought that the best practice would be to reach out to the Municipality of Barrington to inquire if there was any interest in sharing a facility in some compacity. One day, the Dept of Environment and Climate Change may come knocking on your door and indicate that a municipal sewer system is required for your residents of Cape Sable Island. Wouldn't it be nice if a facility already existed that could at least service the southern loop of CSI?

In the fall/winter of 22/23, both Councils decided on yet another feasibility study to determine if there was adequate land available to support a facility to service at least 1500 households and to determine potential costs. We are of the understanding that there is funding available for such a facility and that it is looked more favourably upon if two or more municipal units work together. We would like to get this project off the ground in a timely manner and we would be most appreciative of your support. I would like to add that Council voted for a 50/50 split of operations and capital if you should desire to join us on this endeavor.

Sincerely,

Jennifer Jones  
Town Clerk/Treasurer




# Town of Clark's Harbour Wastewater Feasibility Study

Final Report



230814.00 • July 2023

0	First Issue	NM	11-Jul-2023	HS
A	Draft	NM	20-Jun-2023	HS
Rev.	Issue	Reviewed By:	Date	Issued By:
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July 11, 2023

Ms. Jennifer Jones  
Town Clerk  
Town of Clark's Harbour  
PO Box 160  
Clark's Harbour, NS B0W 1P0

Dear Ms. Jones:

**RE: *Town of Clark's Harbour Wastewater Treatment Plant Feasibility Study***

CBCL Limited is pleased to submit this report for your review, which presents the results of the wastewater treatment feasibility study completed for the Town of Clark's Harbour.

Yours very truly,

CBCL Limited



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Project No.: 230814.00

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# 1 Background

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The Town of Clark's Harbour (TCH) is located on the south shore of Cape Sable Island, Nova Scotia and has a population of 725 as reported by Statistics Canada in the 2021 TCH census. The TCH Wastewater Treatment Plant (WWTP) is located on Woodlands Street near the northern boundary of the town and was constructed in 1976 as part of a larger servicing project for the TCH. The serviced area contains residences, fish processing plants, a school, and several commercial establishments. Treated effluent from the plant is discharged to an ocean outfall that extends approximately 300 m into Clark's Harbour.

The existing WWTP utilizes an extended air activated sludge process and includes:

- ▶ A manually raked bar-screen.
- ▶ Aeration tank with mechanical aerator/mixer.
- ▶ Secondary clarifier.
- ▶ Sludge storage tank.
- ▶ Sludge drying beds (which are not currently used).
- ▶ Chlorine/de-chlorination contact chambers.

A system assessment of the TCH WWTP was completed by CBCL in July 2022. The resulting recommendation from the assessment was that the WWTP required significant upgrades to improve the treatment effectiveness and reliability, and to improve operator health and safety on site. Several options were provided as part of the system assessment which ranged from the base level improvements (minimum necessary works) to the more elaborate option, i.e., replacement of the WWTP with an alternative treatment process.

Following TCH Council and staff review of the assessment report, TCH concluded a replacement WWTP should be further investigated. Therefore, CBCL was retained by TCH in 2023, with the assistance of the Municipality of the District of Barrington (MoDB) under a Memorandum of Understanding, to perform a feasibility study to evaluate the potential for a replacement WWTP (new construction). To maximize the return on investment, the feasibility study will consider the incorporation of municipal flows generated from neighbouring communities.

## 1.1 Objectives

The objective of this study is to determine the maximum theoretical capacity of a new WWTP based on the flow capacity of the existing outfall pipeline (which is to remain in place), the available footprint at the existing site along with the TCH owned neighbouring lots, and the constraints of the current *Approval to Operate* (A.T.O). Following the determination of maximum theoretical capacity for the new WWTP, this study will then determine the feasibility, if any, of which additional communities could be included.

The general scope of work required to ensure the study meets its objective includes:

- ▶ Establishing design criteria and developing conceptual designs for an upgraded WWTP for the TCH.
- ▶ Assessing infrastructure requirements for expanding the WWTPs service area to neighbouring communities.
- ▶ Developing capital and operating cost estimates for upgraded facility and sewer network.

## 2 Wastewater Characteristics

### 2.1 Existing Flows & Loading

Historical flow data from January 2021 to December 2022, provided by the TCH, was reviewed to determine the Average Daily Flow (ADF), Peak Day Flow (PDF), Average Dry Weather Flow (ADWF), and the peaking factor (PDF:ADF ratio) currently experienced by the system.

The flow is measured by an overflow weir and level sensor. The readings were taken daily by the operations team, with the exception of weekends. Due to flow readings accumulating over the weekend, Monday readings are typically significantly higher than other daily readings therefore Monday readings were not included in the data analysis. Table 2.1 summarizes the existing flow parameters at the TCH WWTP.

Table 2.1: Existing Flow Parameters

Parameter	Value
Service Population (2021 Census)	725
ADF (m <sup>3</sup> /d)	230
ADWF (m <sup>3</sup> /d)	150
Per Capita Flow (m <sup>3</sup> /cap/d)	0.32
PDF (m <sup>3</sup> /d)	770
Peaking Factor (PDF: ADF)	3.4

Figure 2.1 shows a graph of the ADF for 2022 compared to the precipitation for the same period. For the most part, it can be noted that the precipitation does have an impact on the ADF, as both can be seen to peak together, or within a 24-hr period of each other. This indicates there is noticeable Inflow and Infiltration (I&I) occurring in the system.

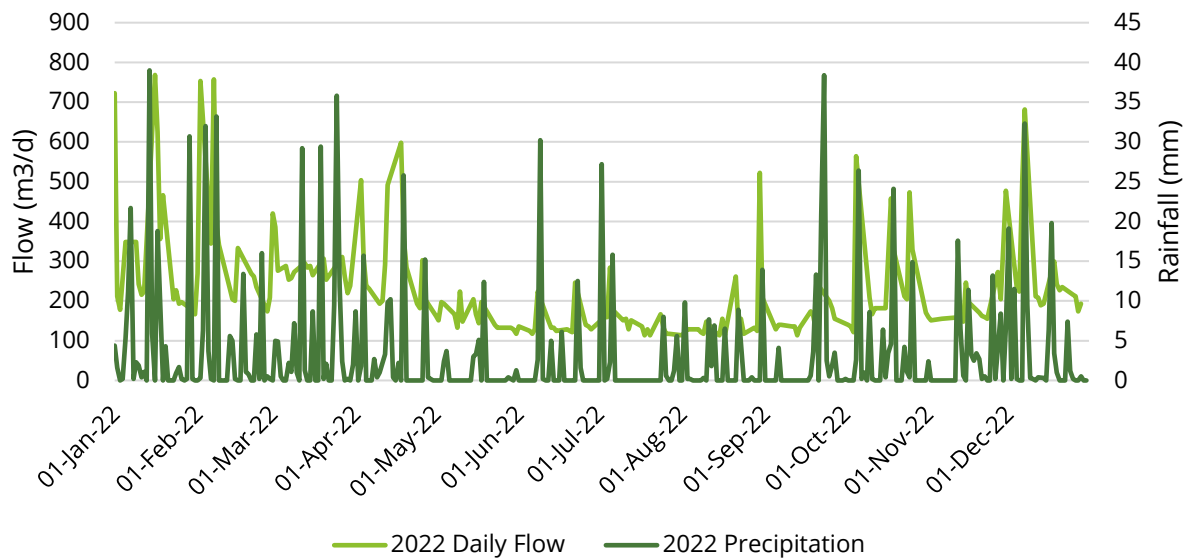


Figure 2.1 Average Daily Flow and Rainfall

The ADF was calculated to identify the contribution of sanitary sewer flows to the system without extraneous flows due to I&I. The ADF was defined as the average of flows that met the following criteria:

- ▶ Between the months of May and October.
- ▶ No rain within the previous 24 hours.
- ▶ No more than 5 mm of rain in the previous 48 hours.

As seen in Table 2.1, the ADF is 65% of the ADF therefore it is evident that I&I has a large impact on the calculated ADF.

Per capita flow was calculated by dividing the ADF by the serviced population. The flows are in line with the theoretical per capita flow rate of 0.34 m<sup>3</sup>/day listed in the Atlantic Canada Wastewater Systems Guidelines (ACWWA, 2022).

Wastewater loads are typically characterized by Carbonaceous Biochemical Oxygen Demand (cBOD), Total Suspended Solids (TSS), and Total Kjeldahl Nitrogen (TKN). The plant data collected by operators did not include influent data therefore theoretical per capita loading rates for cBOD, TSS and TKN were used to calculate influent loading conditions. The cBOD and TSS loadings of 0.08 kg and 0.09 kg per capita per day, respectively, were used from the Atlantic Canada Wastewater Guidelines Manual (ACWWA, 2022) to calculate cBOD and TSS influent loading. The theoretical TKN loading of 0.014 kg per capita per day was used from Metcalf and Eddy, Wastewater Engineering Treatment and Resource Recovery, 5<sup>th</sup> edition to calculate influent TKN loading. A summary of the assumed existing influent loading conditions is provided in Table 2.2.

Table 2.2: Existing Influent Loading Conditions

Parameter	Per Capita Load (kg/capita/day)	Average Load (kg/d)	Average Concentration (mg/L)
cBOD	0.08	58	253
TSS	0.09	65	285
TKN	0.014	10	44

## 2.2 Effluent Sampling

The original plant was designed to achieve secondary treatment standards which at the time of design were 30 mg/L for cBOD and TSS. Effluent disinfection was required to limit coliform density to 1000 MPN per 100 mL. The plant did not have an ammonia limit and was not designed to nitrify based on the design loading rates.

In 2015, the Federal Wastewater System Effluent Regulations (WSER) under the fisheries act set effluent cBOD and TSS limits of 25 mg/L as well as an un-ionized ammonia limit of 1.25 mg/L as NH<sub>3</sub>-N.

In addition to WSER limits, the revised A.T.O, dated February 16, 2022, includes an *E. coli* limit of 200 MPN/100 mL and total residual chlorine (TRC) limit of 0.02 mg/L, as chlorine is used to disinfect the effluent prior to discharge.

Due to these changes in regulations, the effluent discharge requirements for which the new WWTP will be designed to meet are summarized in Table 2.3.

Table 2.3 Effluent Discharge Requirements

Parameter	Effluent Limit	Compliance	Required by
cBOD (mg/L)	25	Quarterly Average	WSER + A.T.O
TSS (mg/L)	25	Quarterly Average	WSER + A.T.O
Un-ionized Ammonia (as NH <sub>3</sub> -N) (mg/L)	1.25	Upper Limit	WSER
Total Residual Chlorine (mg/L)	0.02	Upper Limit	A.T.O
<i>E. coli</i> (MPN/100mL)	200	Quarterly Geometric Mean	A.T.O

Effluent sample data from January 2021 to May 2022 are presented in Figure 2.2 and average values are summarized in Table 2.4.

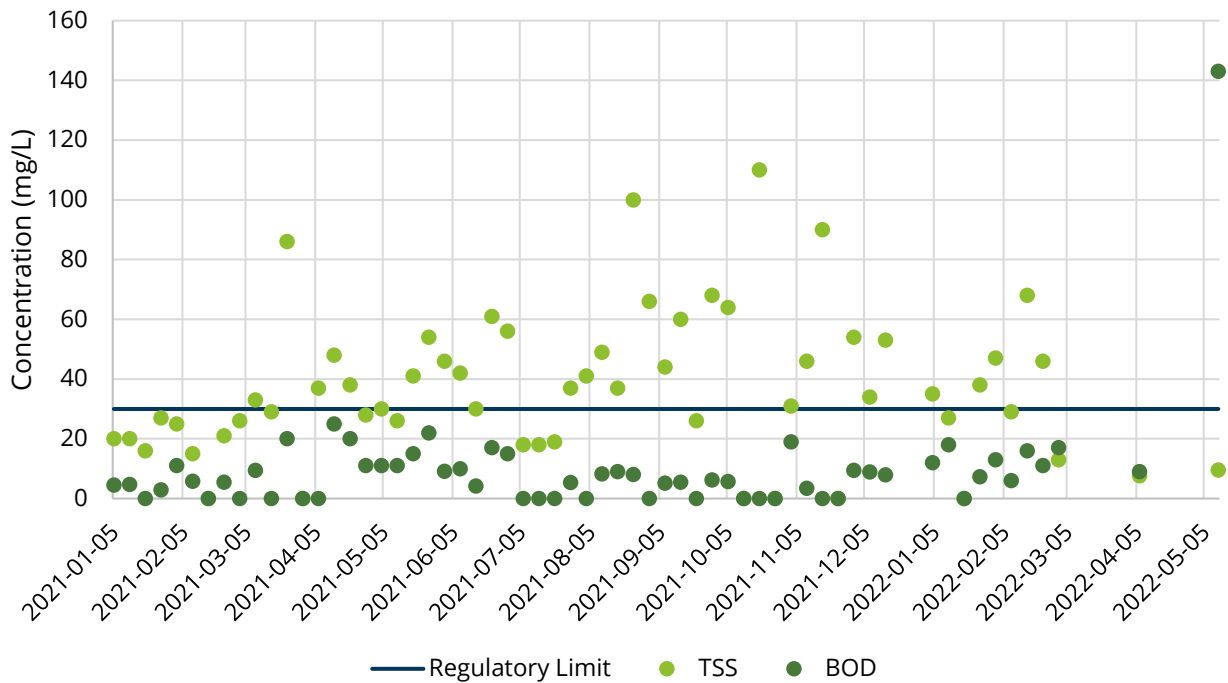


Figure 2.2: Effluent TSS and cBOD concentration

Table 2.4: Average Effluent Characteristics (2021 – 2022)

Parameter	2021	2022	Required Limits
cBOD (mg/L)	<9	14	25
TSS (mg/L)	41	41	25
Fecal Coliforms (MPN/100mL)	168	351	200

The current effluent data indicates that the plant is consistently meeting its cBOD limit however it periodically exceeds TSS and Fecal Coliforms. These excursions are typically due to high flows driven by precipitation events.

## 3 Additional Communities

The neighbouring communities that TCH would like to consider including in the WWTP, where economically viable, include:

- ▶ Lower Clark's Harbour.
- ▶ Newellton.
- ▶ West Head.
- ▶ Centerville.
- ▶ South Side.
- ▶ The Hawk.

Together with TCH, these communities form what is referred to as the Southern Loop of Cape Sable Island.

### 3.1 Additional Flows & Loads

MoDB provided current population data for the neighbouring areas that will be considered in this study. The theoretical per capita flow of 0.34 m<sup>3</sup>/day (ACWWA, 2022) was used to estimate additional flow to the system from neighbouring areas. A summary of populations from the neighbouring areas is provided in Table 3.1.

Table 3.1: Additional Community Populations

Community	Population
Lower Clark's Harbour	113
Newellton	252
West Head	50
Centerville	218
South Side	253
The Hawk	99
Total Additional Population	985

The additional communities considered would not include any industrial wastewater contributions to the sewer system and wastewater would predominately be from residential sources. Therefore, additional flow and load calculations are based on typical municipal wastewater compositions.

Although discussions with stakeholders indicated population growth is not expected in the area over the next 25 years, a low annual growth rate of 0.5% was used as a safety factor. The projected populations used for the design of the WWTP are summarized in Table 3.2.

Table 3.2: Projected 2048 Population; 0.5% Growth Per Annum

Parameter	2023 Population	Growth Population	2048 Population
Clark's Harbour	725	96	821
Additional Communities	985	131	1,116
Total Population	1,710	227	1,937

Based on a projected Southern Loop population of 1,937 in the design year of 2048, the following design criteria has been determined for the TCH WWTP (Table 3.3). ADF is based on the theoretical per capita flow of 0.34 m<sup>3</sup>/day which is in line with observed per capita flow rates currently experienced at the WWTP (0.32 m<sup>3</sup>/day). PDF was calculated using the existing peaking factor (PDF:ADF) observed at the plant of 3.4, based on flow data provided for 2022. Influent loadings were calculated using the per capita loading rates summarized in Table 2.2 and the total population as shown in Table 3.2.

Table 3.3: TCH WWTP 2048 Design Criteria

Parameter	Value	
ADF (m <sup>3</sup> /d)	660	
PDF (m <sup>3</sup> /d)	2,240	
	Concentration (mg/L)	Load (kg/d)
cBOD	253	167
TSS	285	188
TKN	44	30

## 3.2 Sewer System Upgrades

### 3.2.1 Existing TCH Sewer System

The TCH sewage collection system is a conventional gravity collection system. There are gravity sewers along the main roads leading to a total of seven (7) pump stations. These stations then feed the wastewater to Sewage Pump Station (SPS) #3, which pumps all wastewater up to the WWTP at a maximum flow rate of approximately 12 L/s. All existing pump stations in TCH have a maximum flow rate of approximately 12 L/s and any increase in flow through the collection system would require upgrades to all existing pump stations.

With the exception of TCH, the additional communities of the Southern Loop are currently serviced by on-site septic systems. It is reported by TCH that some of the systems are

failing or have failed due to the age of the infrastructure. All additional communities in the Southern Loop will require the installation of a sewer collection system with pumping arrangements where necessary to send sewage to the new TCH WWTP.

The portion of the Southern Loop to be included into the TCH WWTP is distributed along approximately 25 km of main road. The number of connections to the sewer main from the additional communities was estimated using the 2023 population of the additional communities (985 residents) and the people per dwelling based on the TCH 2021 census (approximately 2 residents per dwelling) (Statistics Canada, 2023). Based on these calculations, there are an estimated 500 additional residences that would be serviced by the proposed sewer system at the time of construction.

Below is an outline of two collection system options: a conventional gravity collection system or pressurized effluent sewer system. For both options, sewer lines were not accounted for through approximately a 1 km stretch along Bakers Flats on Centreville South Side Road. This area was identified by stakeholders as a low-lying marsh area that does not contain any residences or buildings therefore a sewer connection is not required, at this time.

### 3.2.2 Conventional Gravity Collection System

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Conventional wastewater collection systems consist of sewers sloped to allow flow by gravity to a low point. Where necessary, the wastewater is conveyed to a pump station and pumped through a forcemain to a high point, which in turn flows via a gravity section to the next low point. This conveyance continues until the wastewater reaches the WWTP or SPS #3 in this case.

Gravity sewers are typically buried deep enough to accept ground floor or basement sewage by gravity (2 to 6 m deep) and pipes are no less than 200 mm in diameter. Buildings below the collection pipe must use a pump to discharge to the collection system. Newer sewer systems are generally separated systems, meaning the sewers only convey sanitary sewage to the WWTP to minimize extraneous flows due to storm events entering the WWTP.

Concrete manholes are used for maintenance and inspection access. Manholes are typically spaced 100 meters apart along the service main as well at all intersections and changes in pipe direction, size, and grade.

Regardless of method or quality of construction, conventional gravity collection systems have potential to experience I&I to some extent, increasing the hydraulic load to the treatment plant. In comparison to this, the pressurized effluent sewer system, as described below, should not suffer from I&I issues.

### 3.2.3 Pressurized Effluent Sewer System

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In a pressurized effluent sewer system, wastewater from each residence discharges to an on-site effluent sewer tank (EST) which provides primary treatment (solids removal) prior to pumping filtered effluent to the sewer main leading to the WWTP.

Pressurized effluent sewer system laterals and mains consist of small diameter, low-pressure, shallow buried pipes, generally 1 to 2 m deep (below frost level) which is advantageous for rocky terrain, such as Cape Sable Island. Effluent sewer tanks allow for smaller sewer main diameters (50 mm to 100 mm) compared to a conventional gravity collection system (100 mm to 200 mm) as the majority of solids remain in the tank and only the liquid portion is pumped to the sewer main.

The pressurized sewer mains follow the ground profile and are typically PVC or HDPE pipe. Pressurized effluent sewer systems do not require the installation of manholes or satellite pump stations to carry sewage to the WWTP or SPS #3 in this case. Maintenance access is possible at the residential pump chamber or at cleanouts provided in the main.

### 3.2.4 Options for Sewage Collection Network

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#### 3.2.4.1 Option 1: Conventional Gravity Collection System

Based on preliminary mapping of the Southern Loop's topography, a gravity sewer main with several satellite pump stations leading to sections of forcemain will be required to transmit wastewater to the new TCH WWTP. A map of the proposed gravity sewer main and pump stations is provided in Appendix A.

For this option, flows from South Side, Lower Clark's Harbour and The Hawk would tie into the existing collection system in TCH at SPS #7 while flows from Centreville, Newellton, and West Head would tie into the existing system at SPS #2. Extending the existing TCH collection system to the neighbouring communities would require upgrading all existing pump stations to handle the increase in flow.

Preliminary details of the conventional collection sewer system proposed to service all Southern Loop communities include:

- ▶ Approximately 20 km of 200 mm gravity sewer.
- ▶ Approximately 11 km of 100 mm sewer forcemain.
- ▶ 15 satellite duplex pump stations.
- ▶ Approximately 518 additional serviced residences.
- ▶ Approximately 200 manholes.
- ▶ All 7 existing pump stations in TCH require upgrading to handle increased flow.
- ▶ Buildings below the elevation of the collection sewers will require pumping.

### 3.2.4.2 Option 2: Pressurized Effluent Sewer System

Currently, all residences under consideration to be added to the TCH sewer system are serviced by on-site systems (septic tanks). As indicated by stakeholders, some of these on-site systems are nearing the end of their lifecycle. Therefore, the proposed solution is to replace all old/failing on-site systems with ESTs designed for pressurized sewer systems. Residents who recently replaced their septic tank would be able to connect to the system in the future once their septic tank has reached the end of its lifecycle.

Discussions with suppliers indicated that it is possible for existing septic tanks to be retrofitted with an effluent filter and pump rather than installing an EST, provided the existing septic tank meets several requirements and quality standards. However, this method is not recommended as conventional septic tanks are not designed to meet the same level of solids removal as ESTs and therefore could cause operational problems leading to more frequent collection system maintenance.

Since solids are retained within the tank, regular maintenance of the EST is required, on average every five years. As all ESTs are connected to the WWTP collection system, servicing/cleaning of the tanks would be the responsibility of the municipality.

The municipality would also be responsible for the installation of the individual systems and connection to the main pressure sewer. Installation cost on private property is therefore the responsibility of the municipality. To somewhat counterbalance this cost, there is typically a nominal “connection fee” for connecting each dwelling to the network.

A map of the proposed pressurized effluent sewer system is provided in Appendix A however the pump stations noted on the map would not be required for this option. A pressurized effluent sewer main would be installed alongside the existing collection system throughout TCH until SPS #3, after which all flow would be sent to the WWTP. Therefore, for this option, only SPS #3 would require upgrading to handle the increased flow and the existing collection system in TCH would not be upgraded or altered.

Based on preliminary mapping of the area, details of the pressurized effluent sewer system proposed to service all Southern Loop communities include:

- ▶ Approximately 23 km of 80 mm pressure sewer.
- ▶ Installation of approximately 518 effluent sewer tank systems (one at each residence).
- ▶ Required upgrade of SPS #3.
- ▶ Manholes and satellite pump stations are not required, however clean-outs may be required and located where necessary.
- ▶ Effluent sewer tank maintenance/clean-outs approximately every 5 years.

## 3.3 Collection System Construction Methodology

Installing the sewer main will require trench excavations running alongside main roads (SK01) with the depth of trench dependent on the sewer system selected (2 to 6 meters for gravity sewer, 1 to 2 meters for pressurized effluent sewer). Other construction works include pipe installation, and site/road works such as backfilling, bedding, asphaltting, and grading.

Service laterals from the main sewer will connect individual residences to the collection system. For the conventional gravity collection system, connecting households to the main would require trenching on each property to install lateral piping connections from the house to the main. Following installation, the trenches will require backfilling, bedding, and grading. Houses below grade will also require the installation of a pump to discharge wastewater from the residence to the main.

Connections from individual residences with a pressurized effluent sewer system would require an excavation of 2.5 m diameter by a minimum of 1.5 m deep to install the EST below grade as well as 1 to 2 m deep trenches to install piping connections (house to tank, tank to main). Depth of the EST excavation would be dependent upon the position of the gravity line from the residence relative to grade. The EST would require a reinforced concrete slab and ballast backfill to hold the tank in place. The site would require backfilling, bedding, and grading following piping and equipment installation on the property. The works would also require de-commissioning and possible removal of the existing septic tank system.

Due to the span of the proposed sewer network, its construction and installation is anticipated to be carried out modularly over 5 years. As shown in SK02 (Appendix B), the proposed sewer network area has been subdivided into the following three zones for buildout:

- ▶ Zone 1: Lower Clark's Harbour and South Side.
- ▶ Zone 2: The Hawk.
- ▶ Zone 3: West Head, Newellton, and Centreville.

Zones 1 and 2 combined contain approximately the same population and estimated number of dwellings as in Zone 3 therefore, the proposed construction methodology is to initially service "half" of the Southern Loop followed by the remaining "half" at a later date. Initially servicing half of the Southern Loop could be achieved by installing sewer mains in Zones 1 and 2 prior to Zone 3. Alternatively, Zone 3 could be serviced prior to Zones 1 and 2. It is important to note that due to the location of Zone 2, a portion of Zone 1 is required in order to convey Zone 2 sewage to the WWTP therefore, Zone 2 would be built in conjunction with or following Zone 1.

## 4 TCH WWTP Upgrade

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Based on results of the system assessment in 2022, a replacement WWTP was recommended for the TCH which included the construction of two (2) Sequencing Batch Reactor (SBR) tanks and potentially using the existing aeration tank as an influent equalization tank. The proposed WWTP in the system assessment report was based on the current service population of the existing WWTP. Given that TCH would like to expand the service area to include as many additional communities as possible, the maximum achievable capacity of the replacement WWTP needed to be determined.

### 4.1 Design Capacity

As TCH would like the replacement WWTP to use the existing outfall pipeline, to avoid regulatory complexities, the treatment plant capacity will be limited by the following:

- ▶ Flow capacity of the existing outfall pipeline.
- ▶ Available footprint for building the WWTP.
- ▶ Effluent requirements of the current A.T.O.

Effluent from the existing WWTP flows by gravity to Manhole 70 (MH70) on Woodlands Street and continues by gravity to the outfall, which extends approximately 300 m into Clark's Harbour. The outfall consists of 200 mm P.V.C and ductile iron piping. Using appropriate design conditions, the hydraulic capacity of the outfall was calculated at 40 L/s.

Two lots neighbouring the site of the existing WWTP were identified by TCH for the construction of the new WWTP (Appendix C). Discussions with stakeholders indicated the neighbouring lots are south-west of the existing site and run along Woodland Street. By utilizing the two identified lots, there would be an additional 1,693 m<sup>2</sup> (lot 1 = 968 m<sup>2</sup>, lot 2 = 725 m<sup>2</sup>) of space available to build the new WWTP. However, this would require significant site works to prepare the area for construction and stakeholders indicated keeping the WWTP within the footprint of the existing 4,573 m<sup>2</sup> site would be preferred.

### 4.2 Site Layout

Following discussions with manufacturers, it is estimated the new WWTP could fit within the 4,573 m<sup>2</sup> lot on which the existing WWTP currently sits and therefore will likely not require the two available lots adjacent to the site for construction. The preliminary proposed layout of the new WWTP is provided in Appendix D (SK04).

As depicted by the piping in SK04, raw influent will enter the WWTP through the existing forcemain where it will be sent to the headworks portion of the process building for preliminary screening. Screened wastewater will then flow by gravity to the pump station retrofitted from the existing aeration tank. Wastewater will be continuously pumped to one of the SBR tanks via the pump station.

Following treatment in the SBR, treated effluent will flow by gravity to the UV disinfection process room in the process building. Following disinfection, the effluent will be discharged by gravity to Clark's Harbour via the existing outfall pipeline. Wasted sludge will be pumped from the SBR basins via submersible pumps during the settle/idle phase and be sent to the aerated sludge holding tank where it will be stored until collection.

## 4.3 WWTP Upgrade Details

The proposed replacement WWTP would include the construction of two SBR tanks and a new process building which would house the headworks screen, blowers, controls, and disinfection equipment. The existing aeration tank would be retrofitted to operate as a sludge storage tank, to store sludge until collection, and a pump station to pump screened influent wastewater to the SBR tanks.

### 4.3.1 Preliminary Treatment & Process Building

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The proposed WWTP will include the construction of a new process building to house the equipment and protect it from wear and tear and extend equipment life. As shown in SK04, the process building will be separated into three rooms, one room for each of the following processes:

- ▶ Headworks (preliminary screening).
- ▶ Blowers and controls.
- ▶ Disinfection.

The building will be 10 by 14 m, with a wood frame and steel siding or split-faced block on a new concrete foundation. The process room of the building will be a confined space and the building will be considered a classified area based on the nature of the building and will be equipped with an HVAC system.

As shown in SK04, blowers and controls will be housed within the new process building. Blowers will be used to supply air to the WWTP processes, and the controls will be connected to a Supervisory Control and Data (SCADA) system to allow operators to view the status of all equipment at the WWTP.

Raw influent wastewater will be supplied to the treatment facility via an upgraded lift station (SPS #3) and existing forcemain. A new shaftless spiral fine screen with 6 mm perforations will be installed in the headworks (screen) room within the process building to improve upfront solids capture and removal of large debris and rags that contribute to

additional maintenance in the WWTP. The system will be equipped with an endless bag for improved odour control. The screen room will be hazardous rated as the process handles raw sewage.

### 4.3.2 Sequencing Batch Reactor

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Screened influent from the headworks room will be sent by gravity to a pump station (retrofitted from the existing aeration tank) which will continuously pump flow to one of the SBR tanks for biological treatment (SK04).

Biological treatment, the main treatment component of the plant, will be provided by SBR technology. An SBR process is an aerobic suspended growth biological treatment process which provides the same unit processes as a conventional activated sludge system (aeration and sedimentation). In a conventional activated sludge system, these processes take place in separate tanks whereas with an SBR, the processes are carried out sequentially in the same tank.

The SBR is a fill-and-draw activated sludge system. All SBR systems have five steps in common, which are carried out in sequence as follows:

- ▶ Fill – Pre-screened wastewater fed to the reactor.
- ▶ React – Mixing and aeration.
- ▶ Settle – Sedimentation/clarification.
- ▶ Decant – Withdrawal of treated wastewater from the reactor.
- ▶ Idle – Removal of waste sludge from the reactor.

During the react phase, microorganisms contact the organic matter (cBOD) in the wastewater and a large amount of oxygen is provided by aerators within the tank to facilitate biodegradation of the organic matter and nitrogen. Aeration is discontinued at the settling phase, which allows suspended solids to settle to the bottom, leaving a clear treated effluent above a settled sludge blanket. The treated effluent is then withdrawn from the tank by an automated, time-controlled decant mechanism. Following the decant phase, an idle phase occurs between cycles during which sludge wasting can occur.

Sludge wasting plays an important role in overall treatment performance and maintains the Food-to-Microorganism (F:M) ratio within the reactors. A submersible Wasted Activated Sludge (WAS) pump will be installed in each reactor basin which will send WAS to an aerated sludge holding tank retrofitted from the existing aeration tank. Following a period of settling in the holding tank, supernatant liquid on top of the settled sludge will be pumped back to the SBR basins via the pump station.

A two-reactor system, each with decanter mechanisms, is proposed for this installation. The tanks will be constructed of cast-in-place concrete. The configuration is typically operated with one reactor in the react phase while the second reactor is in the settling and decant phases. This allows for one blower to aerate both reactors and spreads out the

decant periods so there is no overlap which would result in a higher flowrate through the disinfection system and outfall.

The SBR will typically operate based on a 4-hour cycle during average flow, resulting in 6 batches per day, per tank. SBRs are ideal for effectively handling large variations in flow through operating/programming adjustments. For example, during periods of peak flows, the idle cycle can be reduced or eliminated leading to more cycles per day with the same batch size. Conversely, during periods of low flow, the fill phase will be extended and result in fewer batches treated per day. This method of operating allows tankage which has been sized based on average flow rates to treat peak flow rates by altering cycle times as opposed to requiring additional tankage. Operation of the SBR will be controlled by a PLC operating on timer control with a level override.

The reactors will be equipped with fine bubble diffusers for aeration and mixing. Two positive displacement rotary lobe blowers (one duty and one standby) will be located inside the blowers and controls room within the process building (SK04). The blowers will provide the required airflow per reactor to support the biological degradation of wastewater within the SBR basin. The airflow rate will be automatically controlled by feedback from a Dissolved Oxygen (DO) probe in each SBR basin.

### 4.3.3 Disinfection

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Treated effluent decanted from the SBR tanks will flow by gravity to the disinfection room within the new process building (SK04). Disinfection of the secondary effluent prior to discharge will be by Ultraviolet (UV) light technology to provide rapid and effective inactivation of microorganisms. UV systems are installed in either stainless steel or concrete channels with UV lamps oriented horizontally, parallel to the direction of flow.

UV disinfection is a physical disinfection process rather than a chemical process, such as chlorination, which is currently used at the WWTP. Utilizing UV disinfection technology eliminates the need to purchase, transport, store, and handle chemicals on an ongoing basis and would eliminate the TRC effluent discharge requirement for the WWTP.

Following UV disinfection, the effluent will discharge to Clark's Harbour by gravity through the existing outfall pipeline (SK04). The UV disinfection system will be sized appropriately to handle the peak flowrate capacity of 40 L/s.

### 4.3.4 Sludge Storage & Disposal

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Half of the existing aeration tank will be repurposed to store WAS from the SBR tanks. By dividing the existing 427 m<sup>3</sup> tank in half, there will be sufficient volume to provide storage capacity for 30 days prior to disposal by trucking off-site. WAS will be transferred to the aerated sludge holding tank by submersible pumps located within the reactor tanks (SK04).

The existing aerator will be decommissioned and removed from the aeration tank. A cast-in-place concrete partition will be installed to separate the aerated sludge holding tank from the pump station. The aerated sludge holding tank will be equipped with new coarse bubble diffusers for aeration with a dedicated positive-displacement blower located in the blower room providing the required airflow.

## 4.4 WWTP Construction Methodology

Based on the results of the WWTP System Assessment in 2022, upgrades/replacement of the existing WWTP is a priority in order to meet final effluent discharge requirements and provide operators with a safe place to work. Construction of the WWTP is proposed prior to the construction of the sewer collection system which as previously mentioned could be carried out modularly over 5 years. Therefore, the WWTP buildout options are as follows:

- ▶ Buildout A: To treat only the TCH area (i.e., current flows and loads)
- ▶ Buildout B1: TCH + ½ Southern Loop (Zones 1 & 2 or Zone 3)
- ▶ Buildout C: Full Southern Loop (TCH, Zones 1, 2, & 3)
- ▶ Buildout B2: Buildout B1 + SBR tankage added once remainder of Southern Loop is serviced at a later date.

Buildouts A, B, and C would result in the construction of 2 SBR tanks of varying dimensions. As the WWTP would be constructed prior to the addition of neighbouring communities, the WWTP would initially operate with similar flows currently experienced at the plant (ADF = 230 m<sup>3</sup>/d). As previously noted, an SBR system is ideal for handling large variations in flows and initial operation would treat current TCH influent flows using one SBR train while the second train remains offline. Once the sewer system has been installed to service additional communities thereby increasing flow to the plant, the second reactor train can be brought online, and the plant will operate both SBR trains cyclically in parallel. Tankage for Buildout C would have a slightly larger footprint (5 x 16.5 m) than those for Buildouts A and B (5 x 12 m) in order to adequately handle flows.

Buildout B2 is an addition to Buildout B 1 whereby the WWTP would initially be built to service TCH and half of the Southern Loop. For this buildout, one (1) additional SBR tank (5 x 12 m) would be added to the WWTP once the remaining half of the Southern Loop is serviced by the selected sewer system (SK04). The addition of the SBR tank would not require significant upgrades to other process at the WWTP (headworks, aeration, disinfection, etc.) as future flows and loading would be taken into consideration during initial design.

The construction methodology for the new WWTP will require careful forethought and planning. The ideal construction of the new WWTP would minimize interruption to the existing treatment plant. Construction of the two SBR tanks and new process building could be achieved without disrupting the current operation of the existing treatment plant. However, operational modifications would be required while the existing aeration tank is retrofitted to a sludge holding tank and pump station. Ideally, the SBR could operate with

modified pumping arrangements to provide biological treatment of the wastewater while the existing aeration tank is retrofitted.

The existing clarifier will be decommissioned and infilled with a concrete slab. The space can be repurposed as additional storage and/or lab space for the operators. The existing control building will remain in place and be used as an office for operators.

Design and construction of this project is anticipated to be completed over a 5-year period. The estimated timeline for completing the proposed TCH WWTP and sewer collection system is summarized in Table 4.1.

Table 4.1: Estimated Project Timeline

Time	Task
Fall/Winter 2023	Preliminary and detail design of WWTP
Spring 2024	Tender to WWTP
Spring/Summer 2024	Preliminary and detail design of sewer collection system
Summer 2024 – Spring 2025	Construction of WWTP
Fall 2024	Tender of sewer collection system
Spring 2025 – Winter 2026*	Construction of sewer collection system
Fall 2025 – 2027*	Connection of initial homes
Post 2027*	Connection of remaining homes

\*Timing dependent on sewer collection system option

## 5 Cost Assessment

Capital and operating costs have been developed for the proposed WWTP upgrades presented in Chapter 4 and both collection system options presented in Chapter 3. Equipment sizing and associated costs may be reduced if fewer additional communities are connected to the system.

### 5.1 Capital Costs

Opinions of Probable Capital Cost for the collection system expansion and new WWTP are provided in Appendix E and summarized in Table 5.1. These estimates include allowances for engineering, unforeseen changes during design and construction (i.e., contingencies) as well as the consideration for remote location (i.e., Cape Sable Island).

Table 5.1 Opinion of Probable Cost for WWTP Plant Upgrade & Collection System Expansion

Zone	Parameter	Option #1 Conventional Gravity Sewer	Option #2 Pressurized Effluent Sewer
1	Sewer System Capital Cost	\$18,693,250	\$16,469,265
	Design Development Contingency (25%)	\$4,673,313	\$4,117,316
	Escalation/Inflation Contingency (0%)*	-	-
	Location Factor (1.2)	\$3,738,650	\$3,293,853
	Construction Contingency (25%)	\$4,673,313	\$4,117,316
	Zone 1 Subtotal	\$31,778,525	\$27,997,751
2	Sewer System Capital Cost	\$8,625,000	\$6,415,620
	Design Development Contingency (25%)	\$2,156,250	\$1,603,905
	Escalation/Inflation Contingency (0%)*	-	-
	Location Factor (1.2)	\$1,725,000	\$1,283,124
	Construction Contingency (25%)	\$2,156,250	\$1,603,905
	Zone 2 Subtotal	\$14,662,500	\$10,906,554
3	Sewer System Capital Cost	\$21,131,250	\$16,941,225
	Design Development Contingency (25%)	\$5,282,813	\$4,235,306
	Escalation/Inflation Contingency (0%)*	-	-
	Location Factor (1.2)	\$4,226,250	\$3,388,245

	Construction Contingency (25%)	\$5,282,813	\$4,235,306
	Zone 3 Subtotal	\$35,923,125	\$28,800,083
	Full Collection System Capital Cost	\$82,364,150	\$67,704,387
	Wastewater Treatment Plant Capital Cost**	\$3,317,304	\$3,317,304
	Design Development Contingency (25%)	\$829,326	\$829,326
	Escalation/Inflation Contingency (0%)*	-	-
	Location Factor (1.2)	\$663,461	\$663,461
	Construction Contingency (25%)	\$829,326	\$829,326
	WWTP Subtotal	\$5,639,417	\$5,639,417
	Total Direct & Indirect Construction Costs	\$88,003,570	\$73,343,810

\*Costing is based on 2023 dollars. Due to uncertainty of the markets, we are unable to estimate an inflation percentage over the next four years.

\*\*WWTP Capital Costs based on initial build of WWTP to service Full Southern Loop (Buildout C).

Although the WWTP capital cost provided in Table 5.1 is based on the buildout of a treatment plant that will be able to service TCH and the full Southern Loop, other buildout options were considered. The Opinions of Probable Capital Cost for each WWTP buildout option considered are summarized in Table 5.2.

Table 5.2: Opinion of Probable Cost for WWTP Buildout Options

Parameter	Buildout A	Buildout B1	Buildout C	Buildout B2
	TCH	TCH + ½ Southern Loop	Full Southern Loop	Buildout B1 + Following ½ SL
Mobilization, Bonds, Insurance & Pre-construction management	\$131,360	\$138,743	\$157,967	\$47,538
Civil Work	\$150,800	\$158,000	\$162,000	\$40,000
Demolition	\$26,100	\$26,100	\$26,100	-
Reinforced Concrete	\$108,800	\$122,400	\$136,000	\$85,000
Masonry and Walls	\$40,000	\$40,000	\$40,000	-
Roof Structure and Roofing	\$65,000	\$65,000	\$65,000	-
Miscellaneous Metals	\$33,000	\$33,000	\$33,000	\$15,000
Interior/Exterior Building Finish	\$51,000	\$51,000	\$51,000	-
Process Equipment	\$1,127,200	\$1,197,650	\$1,409,000	\$350,000
Valves and Piping	\$103,700	\$109,800	\$122,000	\$62,000
Process Integration (instrumentation & control)	\$102,400	\$108,800	\$128,000	\$59,750

HVAC	\$82,000	\$82,000	\$82,000	-
Electrical	\$394,520	\$419,178	\$493,150	\$215,000
General Contractor Overheads and Profit, Fees (15%)	\$342,678	\$361,939	\$412,088	\$124,013
<b>Total Direct &amp; Indirect Costs (excluding contingencies)</b>	<b>\$2,758,558</b>	<b>\$2,913,610</b>	<b>\$3,317,304</b>	<b>\$998,301</b>
<b>Contingency &amp; Allowances</b>				
Design Development contingency (25%)	\$689,639	\$728,402	\$829,326	\$249,575
Escalation/Inflation (0%)*	-	-	-	-
Location Factor (1.2)	\$551,712	\$582,772	\$663,461	\$199,660
Construction Contingency (25%)	\$689,639	\$728,402	\$829,326	\$249,575
<b>Total Construction Costs without HST</b>	<b>\$4,690,000</b>	<b>\$4,954,000</b>	<b>\$5,640,000</b>	<b>\$1,698,000**</b>

\*Costing is based on 2023 dollars. Due to uncertainty of the markets, we are unable to estimate an inflation percentage over the next four years.

\*\*Cost of Buildout B2 is in addition to costs associated with Buildout B1.

Capital cost estimates in Table 5.1 and Table 5.2 include contingency and engineering but do not include taxes. The opinion of probable costs presented are based on CBCL’s experience, qualifications and best judgment and are an order of magnitude estimate used for evaluation purposes. For a more detailed cost estimate a concept design would be required. CBCL cannot warrant or guarantee that actual costs will not vary from the opinion provided.

## 5.2 Operating Costs

Estimated annual operating costs for the proposed WWTP and collection system options are provided in Table 5.3. Operating costs were developed for the equipment based on experience and operations of similar systems/facilities, coupled with details from equipment suppliers.

Table 5.3: Operating Cost Estimates

System	Annual Operating Cost Estimate
Wastewater Treatment Plant*	\$107,000
Conventional Gravity Sewer	\$43,500
Pressurized Effluent Sewer	\$55,038

\*WWTP Operating Costs based on initial build of WWTP to service Full Southern Loop (Buildout C).

The annual operating cost estimate for the WWTP includes heat & power, electricity, sludge management/disposal and a maintenance allowance. The annual operating cost estimates for the collection systems are based on maintenance allowance for the system.

The following assumptions were utilized in developing the operating cost information:

- ▶ Electricity costs are estimated at \$0.15/kWh.
- ▶ Annual WWTP Maintenance Costs are assumed to be 2% of equipment costs.
- ▶ Annual Maintenance Costs for the gravity sewer are assumed to be \$110/per 100 m of sewer and \$200 per manhole.
- ▶ Annual Maintenance Costs for the pressurized effluent sewer system are assumed to be \$850 per EST clean-out.
- ▶ EST clean-out on average every 5 years; 2.5 cleanings/EST over 20 years; 518 ESTs.

## 5.3 Net Present Value

Discounted present value calculations were carried out to estimate the Net Present Value (NPV) of the two proposed sewer collection system options. This is the standard method for calculating the relative costs of different options. NPV is calculated using Equation 5.1, where “Cost in period n” is the net cost in a given year, “n” is the year from 1 to 20, and “rate” is the real discount rate. This cost is calculated for each year in question and the yearly costs are summed.

Equation 5.1: Net Present Value

$$NPV = \sum \frac{\text{Cost in period } n}{(1 + \text{rate})^n}$$

The effect of this calculation is that costs which occur soon are weighted more heavily than costs which occur further down the road, based on the idea that a dollar today is worth more than a (more uncertain) dollar in the future. The calculations in the report were carried out without applying an assumed inflation rate. This is called a real NPV. If inflation is used (called nominal NPV), it is applied to both the costs (which are higher by inflations) and the discount rate (nominal discount rate equals real discount rate plus inflation, therefore higher) so that the higher costs are discounted faster, and the two effects cancel each other out, giving the same result whether the real or nominal NPV is calculated. The real discount rate used in these calculations is 8% and the time period over which it is calculated is 20 years, starting in 2023.

The life cycle cost comparison of the options considered is provided in Table 5.4. The NPV for the WWTP was not included/considered at this time as the SBR would be common to both options. This analysis is provided to demonstrate the life cycle costs (over 20 year) for the collection system.

Table 5.4: Life Cycle Cost Comparison

Category	Option 1 Gravity System	Option 2 Pressure Sewer
Total Annual Operation Costs	\$43,500	\$55,038
20 years Operations Cost - Present Value	\$427,000	\$684,000
Capital Cost*	\$48,449,500	\$39,826,110
Net Present Value	\$50,267,200	\$42,269,700

\*From Appendix E. Note: Capital costs are exclusive of contingencies.

## 6 Recommended Option

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Regardless of the sewer collection system selected, the costs associated with the WWTP remain separate from the sewer system. As per the results of the System Assessment carried out by CBCL in 2022, a new SBR treatment process at the existing TCH WWTP site is the recommended option for the TCH WWTP upgrade.

The sizing and costing of a new SBR WWTP proposed in this study are greater than those estimated in the 2022 report. This is due to the expansion of treatment capacity to service additional communities as well as the significant increase in construction costs experienced since the completion of the 2022 report. This significant increase in construction cost has been experienced industry wide and is a function of low availability of skilled labour in addition to global factors.

Based on Capital Cost estimates, the recommended buildout option for the WWTP is to initially build the WWTP with capacity to service the full Southern Loop (Buildout C). This option would lead to higher costs incurred initially but likely result in an overall cost savings of approximately \$1 million i.e., full Southern Loop service through Buildout C would cost \$5.64 million while full service through Buildout B1 plus B2 would cost \$6.65 million (\$4.95 million + \$1.7 million).

From both a capital and life cycle cost perspective, Option #2, a pressurized EST system has the lowest estimated cost. Although annual operating costs are slightly higher for Option #2, the NPV of the overall costs indicates possible cost savings. Based on the preliminary cost analysis, Option #2 is the recommended option for expanding wastewater treatment services to neighbouring communities in the Southern Loop.

## 7 References

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ACWWA. (2022). *Atlantic Canada Wastewater System Guidelines*.

Metcalf and Eddy. (2014). *Wastewater Engineering Treatment and Resource Recovery*. Fifth Edition.

Statistics Canada . (2023). *Census Profile, 2021 Census of Population* . Retrieved from Statistics Canada Catalogue.

We hope you find this Feasibility Study of interest. We are available, at your convenience, to discuss in more detail any aspect of this report.

Prepared by:  
Helena Steeves, EIT, M.ASc.  
Process Engineer in Training

Reviewed by:  
Nick Moriarty, B.Eng.  
Process Specialist

# APPENDIX A

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## Proposed Sewer Main Network



**Legend**

- Existing gravity sewer
- Existing forcemain to WWTP
- Proposed sewer mains
- No sewer system
- Proposed pump stations (gravity sewer)
- ➔ Flow path

<b>2 ISSUED FOR REPORT</b>							
No.	Description	No.	Description	No.	Description		
Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
11/07/23	N.T.S.		HS	NM	NM	230814.00	-



TOWN OF CLARK'S HARBOUR WWTP FEASIBILITY STUDY

PROPOSED SEWER MAIN NETWORK

Drawing

SK01

# APPENDIX B

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## Proposed Sewer Main Zoning



**Legend**

- Existing gravity sewer
- Existing forcemain to WWTP
- No sewer system
- Zone 1
- Zone 2
- Zone 3

<b>0 ISSUED FOR REPORT</b>							
No.	Description	No.	Description	No.	Description		
Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
11/07/23	N.T.S.	-	HS	NM	NM	230814.00	-



TOWN OF CLARK'S HARBOUR WWTP FEASIBILITY STUDY

PROPOSED SEWER NETWORK BUILD OUT ZONES

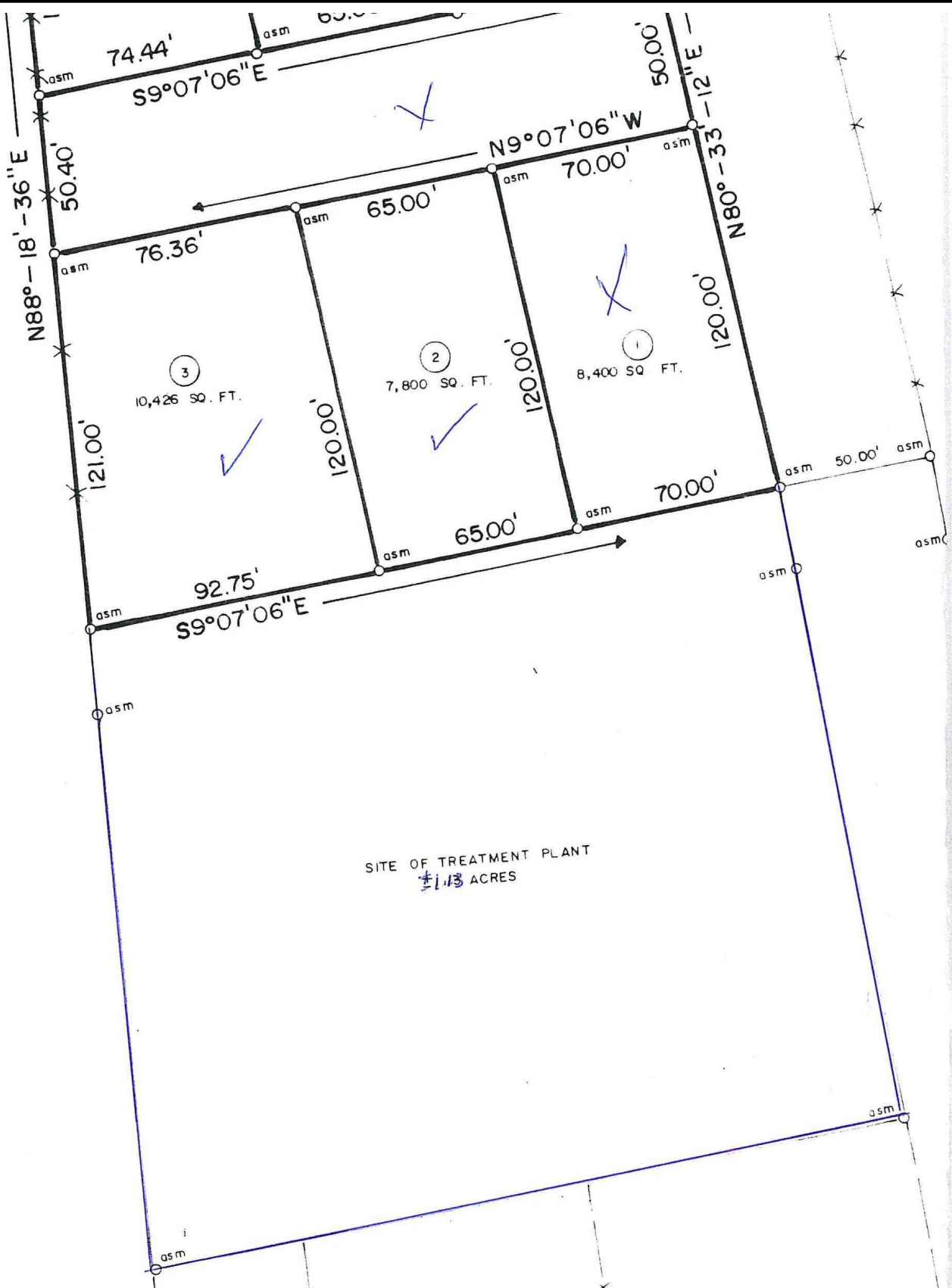
Drawing

**SK02**

# APPENDIX C

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## Site Arrangements & Lots



SITE OF TREATMENT PLANT  
1.13 ACRES

1 ISSUED FOR REPORT							
No.	Description	No.	Description	No.	Description	No.	Description
Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
11/07/2023	N.T.S.	-	-	HS	NM	230814.00	-



TOWN OF CLARK'S HARBOUR FEASIBILITY STUDY

SITE ARRANGEMENTS AND LOTS

Drawing  
**SK03**

# APPENDIX D

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## Site Plan Outline

DRAWING NAME: Y:\HALIFAX\DATA\PROJECTS\2023\230814.00\TOCH REGIONAL PLANT FEASIBILITY STUDY\44 CAD\06 PROCESS\230814.00\_SK04.DWG LAYOUT NAME: SK04 PLOT DATE: Thursday, July 6, 2023 9:09:55 AM CAD OPERATOR: DBR880



- Legend
- - - Existing forcemain 100 mm
  - - - Proposed forcemain 100 mm
  - - - Gravity line 150 mm
  - - - Sludge line 75 mm
  - - - Existing gravity outfall 200 mm

	Date 11/07/2023	Scale N.T.S.	Designed --	Drawn DB	Checked HS	Approved NM	CBCL No. 230814.00	Contract --
	TOWN OF CLARK'S HARBOUR FEASIBILITY STUDY						Drawing	
	SITE PLAN OUTLINE						SK04	
	1	ISSUED FOR REPORT						
No.	Description							



# APPENDIX E

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## Opinion of Probable Cost Summaries




**OPINION OF PROBABLE CONSTRUCTION COSTS**

**Town of Clark's Harbour WWTP**  
**SBR Treatment System Upgrade and Collection System Expansion**

DATE:	July 11, 2023
CBCL FILE No.:	230814.00
EST. DESCRIPTION :	Class D

No.	DESCRIPTION	Option 1: Conventional Gravity Sewer System				Option 2: Pressurized Effluent Sewer System			
		QTY.	UNIT	MATERIAL COST		QTY.	UNIT	MATERIAL COST	
				\$/ UNIT	\$			\$/ UNIT	\$
<b>1</b>	<b>Collection System</b>								
1.1	<b>Zone 1</b>								
	Sewer Force Mains	4,750	m	\$ 1,000	\$ 4,750,000	9,500	m	\$ 900	\$ 8,550,000
	Sewer Gravity Mains	5,750	m	\$ 1,200	\$ 6,900,000	--	--	--	--
	Duplex Pump Station	5	ea	\$ 120,000	\$ 600,000	--	--	--	--
	Manholes (every 100 m)	60	ea	\$ 10,000	\$ 600,000	--	--	--	--
	Effluent Sewer Tank & Connection Kit	207	ea	\$ -	\$ -	207	ea	\$ 12,300	\$ 2,546,100
	Sewage Connections (house to main or house to tank, tank to main)	207	ea	\$ 15,000	\$ 3,105,000	207	ea	\$ 5,000	\$ 1,035,000
	Effluent Sewer Tank Install	207	ea	\$ -	\$ -	207	ea	\$ 10,000	\$ 2,070,000
	Upgrade Existing TCH PS	5	ea	\$ 60,000	\$ 300,000	1	ea	\$ 120,000	\$ 120,000
	General Contractor Overheads and Profit, Fees		15%		\$ 2,438,250				\$ 2,148,165
	<b>TOTAL ESTIMATED ZONE 1 COLLECTION SYSTEM COSTS (Excluding Contingencies, Allowance &amp; Factors)</b>				\$18,693,250				\$ 16,469,265
1.2	<b>Zone 2</b>								
	Sewer Force Mains	600	m	\$ 1,000	\$ 600,000	4,500	m	\$ 900	\$ 4,050,000
	Sewer Gravity Mains	4,250	m	\$ 1,200	\$ 5,100,000	--	--	--	--
	Duplex Pump Station	3	ea	\$ 120,000	\$ 360,000	--	--	--	--
	Manholes (every 100 m)	60	ea	\$ 10,000	\$ 600,000	--	--	--	--
	Effluent Sewer Tank & Connection Kit	56	ea	\$ -	\$ -	56	ea	\$ 12,300	\$ 688,800
	Sewage Connections (house to main or house to tank, tank to main)	56	ea	\$ 15,000	\$ 840,000	56	ea	\$ 5,000	\$ 280,000
	Effluent Sewer Tank Install	56	ea	\$ -	\$ -	56	ea	\$ 10,000	\$ 560,000
	Upgrade Existing TCH PS	-	ea	\$ 60,000	\$ -	-	ea	\$ 120,000	\$ -
	General Contractor Overheads and Profit, Fees		15%		\$ 1,125,000				\$ 836,820
	<b>TOTAL ESTIMATED ZONE 2 COLLECTION SYSTEM COSTS (Excluding Contingencies, Allowance &amp; Factors)</b>				\$8,625,000				\$ 6,415,620
1.3	<b>Zone 3</b>								
	Sewer Force Mains	4,750	m	\$ 1,000	\$ 4,750,000	8,500	m	\$ 900	\$ 7,650,000
	Sewer Gravity Mains	6,750	m	\$ 1,200	\$ 8,100,000	--	--	--	--
	Duplex Pump Station	6	ea	\$ 120,000	\$ 720,000	--	--	--	--
	Manholes (every 100 m)	80	ea	\$ 10,000	\$ 800,000	--	--	--	--
	Effluent Sewer Tank & Connection Kit	255	ea	\$ -	\$ -	255	ea	\$ 12,300	\$ 3,136,500
	Sewage Connections (house to main or house to tank, tank to main)	255	ea	\$ 15,000	\$ 3,825,000	255	ea	\$ 5,000	\$ 1,275,000
	Effluent Sewer Tank Install	255	ea	\$ -	\$ -	255	ea	\$ 10,000	\$ 2,550,000
	Upgrade Existing TCH PS	3	ea	\$ 60,000	\$ 180,000	1	ea	\$ 120,000	\$ 120,000
	General Contractor Overheads and Profit, Fees		15%		\$ 2,756,250				\$ 2,209,725
	<b>TOTAL ESTIMATED ZONE 3 COLLECTION SYSTEM COSTS (Excluding Contingencies, Allowance &amp; Factors)</b>				\$21,131,250				\$ 16,941,225
	<b>TOTAL ESTIMATED COLLECTION SYSTEM COSTS (Excluding Contingencies, Allowance &amp; Factors)</b>				\$ 48,449,500				\$ 39,826,110
	Contingency & Allowances								
	Design development contingency		25%		\$ 12,112,375				\$ 9,956,528
	Escalation/Inflation (based on 2023 dollars)		0%		\$ -				\$ -
	Location Factor		1.20		\$ 9,689,900				\$ 7,965,222
	Construction Contingency		25%		\$ 12,112,375				\$ 9,956,528
	<b>TOTAL ESTIMATED COLLECTION SYSTEM COSTS (Including Contingencies, Allowance &amp; Factors)</b>				\$ 82,364,150				\$ 67,704,387

 <b>OPINION OF PROBABLE CONSTRUCTION COSTS</b> <b>Town of Clark's Harbour WWTP</b> <b>SBR Treatment System Upgrade and Collection System Expansion</b>				DATE: July 11, 2023					
				CBCL FILE No.: 230814.00					
				EST. DESCRIPTION: Class D					
No.	DESCRIPTION	QTY.	UNIT	Option 1: Conventional Gravity Sewer System		Option 2: Pressurized Effluent Sewer System			
				MATERIAL COST		QTY.	UNIT	MATERIAL COST	
				\$ / UNIT	\$			\$ / UNIT	\$
<b>2</b>	<b>Wastewater Treatment Plant (Servicing Full Southern Loop)</b>								
	Mobilisation, Bonds, Insurance, Pre Construction Management				\$ 157,967		\$ 157,967		
	Civil Work				\$ 162,000		\$ 162,000		
	Demolition				\$ 26,100		\$ 26,100		
	Reinforced Concrete				\$ 136,000		\$ 136,000		
	Masonry and Walls				\$ 40,000		\$ 40,000		
	Roof Structure and Roofing				\$ 65,000		\$ 65,000		
	Miscellaneous Metals				\$ 33,000		\$ 33,000		
	Interior/Exterior Building Finish				\$ 51,000		\$ 51,000		
	Process Equipment				\$ 1,409,000		\$ 1,409,000		
	Valves and Piping				\$ 122,000		\$ 122,000		
	Process Integration (Instrumentation & Control)				\$ 128,000		\$ 128,000		
	HVAC				\$ 82,000		\$ 82,000		
	Electrical				\$ 493,150		\$ 493,150		
	General Contractor Overheads and Profit, Fees		15%		\$ 412,088		\$ 412,088		
	<b>TOTAL ESTIMATED WASTEWATER TREATMENT PLANT COSTS (Excluding Contingencies, Allowance &amp; Factors)</b>				\$ 3,317,304		\$ 3,317,304		
	Contingency & Allowances								
	Design Development Contingency Allowance		25%		\$ 829,326		\$ 829,326		
	Escalation/Inflation (based on 2023 dollars)		0%		\$ -		\$ -		
	Location Factor		1.20		\$ 663,461		\$ 663,461		
	Construction Contingency		25%		\$ 829,326		\$ 829,326		
	<b>TOTAL ESTIMATED WASTEWATER TREATMENT PLANT COSTS (Including Contingencies, Allowance &amp; Factors)</b>				\$5,639,417		\$5,639,417		
	<b>TOTAL OPINION OF PROBABLE CONSTRUCTION COST exc. HST</b>				\$ 88,003,567		\$ 73,343,804		
	HST		15%		\$13,200,535		\$11,001,571		
	<b>TOTAL OPINION OF PROBABLE CONSTRUCTION COST inc. HST</b>				\$101,205,000		\$84,346,000		

\*Escalation/Inflation factor based on 2023 dollar value

Contingencies for collection system shown for combined system, i.e., Zone 1 + 2+ 3

<b>Note 1</b>	A Design Development Contingency Allowance is so necessary design changes impacting construction costs can be made as the design is developed.
<b>Note 2</b>	A Construction Contingency is to allow for Change Order costs of additional work over and above the contract Awarded price
<b>Note 3</b>	The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
<b>Note 4</b>	The Location Factor is for variances between construction co The Location Factor is for variances between construction costs at the location of the project & historical costs data



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