Town of Mahone Bay
Staff Report re 2019 ICIP Project Application(s) – Green: Environmental Quality Category
January 16, 2019

General Overview:

The intent of this staff report is to present background information and analysis to assist Council in providing direction to staff regarding the projects for which we will be applying for funding under the Investing in Canada Infrastructure Program (ICIP) current call for project applications in the Green: Environmental Quality Category (i.e. water / wastewater projects).

Background:

The current ICIP funding window for project applications in the Green: Environmental Quality Category was announced Nov 22nd by Municipal Affairs Minister Chuck Porter with an application deadline of Jan 18th. The combined Federal / Provincial contribution under this program will be 73.33%. Information on this call for application is attached as Appendix A.

The Town of Mahone Bay may submit up to two projects (which may themselves be combinations of the projects described herein) for consideration, providing they can reasonably be completed by Mar 31st, 2021. Staff expect further ICIP funding windows for projects of other categories over the next several years; it will likely be at least 3-5 years before another such water/wastewater project intake is announced (during which time Staff will renew the current long-term capital plan, applying an asset management lens). The funding process is competitive; should the Town apply for two projects it is possible only one will be approved.

Under the Environmental Quality category, a project must meet at least one of the following outcomes to be eligible: 1) increased capacity to treat and/or manage wastewater and stormwater; 2) increased access to potable water; and/or 3) increased capacity to reduce and/or remediate soil and/or air pollutants. Staff have identified five potential water / wastewater projects which meet these criteria. These projects were identified based on a review of the 2008 Infrastructure Review Study (attached as Appendix B), condition data compiled by the recent provincial Asset Management Pilot, the 2018 straight pipes study (attached as Appendix C) and noted operational / customer issues.

The five eligible projects identified by Staff include:

1) East Main Waterline Rehabilitation
2) West Main (Cherry Lane to Long Hill) Utilities Rehabilitation
3) West Main Water Extension
4) West Main (Long Hill to Town Boundary) Utilities Rehabilitation
5) East Main Straight Pipes Wastewater Extension

The first four projects on this list required external estimates which Town Staff obtained from KVM Consultants. The pre-design Cost Estimates Report and associated sketches, as submitted by KVM Consultants, dated January 11, 2019, is attached as Appendix D. External estimates for project five – the East Main wastewater extension to address identified straight pipe outflows – were included in the 2018 study (page 8).

Analysis:

Director of Operations Derrick MacKenzie provides the following analysis concerning the projects included in the pre-design Cost Estimates Report from KVM Consultants:

Project #1:
The undertaking of this project should address intermittent discolored water complaints we have been receiving the past couple of years from nearby residents.

Also, this project proposes an increase in the size of water main from 150 mm to 250 mm diameter which is a step ahead in terms of improving fire flows in the area.

Further, this section of water main is approximately 70 years old and is approaching the end of its serviceable life span.

Project #2:
The undertaking of this project should address intermittent complains from local residents who have experienced sewer back-ups resultant from roots in laterals and in the main which decrease the carrying capacity of the pipes and can lead to temporary blockages. The project proposes the replacement of the sewer main, manholes, and laterals in this section of Town, which upon recent camera inspections is shown to suffer from problems such as significant groundwater infiltration at pipe joints, cracked pipe and roots growing inside the main and services laterals.

The undertaking of this project should address intermittent complains from local residents who have experienced flooding from storm water run-off. The project proposes the replacement of the existing underground storm water pipe with a new large diameter storm sewer running from the intersection of Clearway & Main St. to 416 Main St. This aspect of the project may need to be modified in the event an easement through private property can not be obtained. The age of the existing underground storm water pipe is in the vicinity of 40 year; the pipe is mainly corrugated steel pipe and it is approaching the end of its serviceable life span.

This project proposes an upgraded water main of 300 mm diameter in place of the existing 200 mm main which is a step ahead in terms of improving fire flows in the area. The existing water main is approximately 70 years old and is approaching the end of its serviceable life span.

The project proposes the replacement of a section of the raw water transmission main which is approximately 70 years old and is approaching the end of it serviceable life span.

Project #3:
The undertaking of this project should improve the volume of water received by residents living in the immediate area. At present, residents in the affected area complain of low flow and pressure. The existing main and service laterals have been shown to have restriction/decrease in the pipe diameter created by corroding galvanized steel fittings used to install the pipe.

Project #4:
The undertaking of this project would see substantial upgrades to water infrastructure in the area including replacement of a section of the raw water transmission main. Both water and sewer infrastructure in the area are approximately 70 years old and approaching the end of their serviceable life span. Implementation of this project would improve fire flows in the area, and benefit the potential development of a new nursing home near 210 Main St. (the developer may provide a capital contribution to this project).

In terms of the 4 projects identified in the Capital Costs Estimates report by KVM Consultants, I believe the project most positively impactful on the community would be implementation of Project #2.

Rationale for project five is included in the 2018 study.

Financial Analysis:

Town Staff have completed the following analysis of capital costs associated with the five identified projects. No operating impacts have been included in the analysis below and few are anticipated; potential operating impacts – all positive – could include reduced losses of treated water due to minor leaks in depreciated lines (projects 1, 2, 3, and 4) and reduced stormwater inflow to wastewater treatment (projects 2 and 4). Also not included in the analysis below is any reference to potential MacLeod Group contribution to project four.

#	PROJECT	Value	Borrowing	Annual Cost	Tax Rate	Water Rate
1	**E. Main Waterline**	$890,602	$326,458	$16,323	*0.00*	6.60%
2	**Cherry Lane to Long Hill**	$2,607,150	$955,674	$47,784	*1.59*	6.44%
3	**W. Main Water Extension**	$327,458	$120,033	$6,002	*0.00*	2.43%
4	**Long Hill to W. Boundary**	$1,501,718	$550,468	$27,523	*0.69*	5.57%
5	**E. Main Straight Pipes**	$120,711	$44,247	$2,212	*0.11*	0.00%
	TOTAL	**$5,447,639**	**$1,996,880**	**$99,844**	**2.39**	**21%**

*See attached spreadsheet – Appendix E – for additional financial analysis / calculation detail.

Project costs will be split between the Water Utility and Town General (wastewater and stormwater). As of March 31st, 2018 the Water Utility was carrying $693,620 of Debt. It is forecast that the Debt load of the Utility as of March 31st, 2019 will be $635,320. The balance of the Water Depreciation Reserve is estimated to be approximately $120,000 as of March 31st, 2019. Staff recommend the Town not draw on the Depreciation Reserve to fund the identified projects as maintaining a balance is important in responding to unforeseen expenses.

Following submission of the ICIP funding application(s) the Town's contribution(s) would be approved for the 2019-20 capital budget (including carry-over to 2020-21 as required), and would subsequently be included in the next available Municipal Finance Corp debenture issue.

The 2019-2021 water rate study which is currently underway for submission to the Nova Scotia Utility & Review Board (NSUARB) for new rates effective July 1st, 2019 will factor in all costs to the Water Utility associated with approved projects. Separate NSUARB applications will still be required for any capital projects in excess of $250,000.

Links to Strategic Plan:

Key Strategic Initiatives and Core Activities

3.1 ***21st Century Infrastructure***

- **Asset Management**
- **Optimize efficiency of Utilities**
- **Meet and exceed standards for water and wastewater**

Recommendation:

THAT Council approve one or more of the identified projects for application to the Investing in Canada Infrastructure Program – Green: Environmental Quality Category (assigning priority accordingly) and direct staff to submit application(s) to the Department of Municipal Affairs by the January 18th, 2019 deadline.

Attached for Council Review:

- ICIP Program Information
- 2008 infrastructure Study
- 2018 Straight Pipes Study
- Pre-Design Cost Estimates Report
- Financial Analysis Spreadsheet

Respectfully Submitted,

Dylan Heide
Town of Mahone Bay CAO

Investing in Canada Infrastructure Program

Nova Scotia Project Submission Guide - Annexes

Green Infrastructure – Environmental Quality Sub-Stream

NOVA SCOTIA DEPARTMENT OF MUNICIPAL AFFAIRS
December 2018

Annex A – Application Guide

ABOUT THE PROGRAM

The Green Infrastructure – Environmental Quality Sub-Stream will fund infrastructure projects that will support quality and management improvements for drinking water, wastewater and stormwater, as well as reductions to soil and air pollutants through solid waste diversion and remediation. It is a component of the wider Investing in Canada Infrastructure Program (ICIP) which will provide funding through an Integrated Bilateral Agreement between Canada and Nova Scotia.

Under the Environmental Quality Sub-Stream, a project must meet at least one of the following outcomes to be eligible:

- Increased capacity to treat and/or manage wastewater and stormwater
- Increased access to potable water
- Increased capacity to reduce and/or remediate soil and/or air pollutants

In Nova Scotia, a call for applications begins on December 3, 2018 and closes January 18, 2018. Municipalities are invited to submit up to a maximum of 2 applications for consideration. During this call, it is anticipated that there will be more projects that qualify for funding than there are program funds available. Consequently, eligible projects will be subject to technical evaluation and ranked according to the extent to which they meet the program's objectives and the eligibility criteria.

Projects with total estimated eligible expenditures of $10 million or more will be required to complete a climate lens assessment (including a greenhouse gas emissions assessment that includes a cost-per-tonne calculation and a climate change resilience assessment). This work must be completed to Nova Scotia and Canada's satisfaction prior to Canada's approval of project funding.

Projects with total estimated eligible expenditures of $10 million or more will be required to report on community employment benefits.

Approved projects will be subject to reporting requirements as the projects progress. Applicants are encouraged to familiarize themselves with the requirements described in this guide.

This round of funding targets projects that can be started in Fiscal 2019-20 or 2020-21.

Funding provided by the federal and provincial government towards infrastructure projects is cost-shared with municipalities. The level of federal contribution for this sub-stream is 40% with an additional 33.33% provincial contribution. The remaining eligible project costs, plus all ineligible project costs, and cost overruns are the responsibility of the applicant.

Where applicants plan to use or have applied for funds from other federal programs, the source of these funds must be indicated on the application form. Applicants who have other funding or grants in place for their project should note that the program is subject to stacking rules. Note that Gas Tax Funds are considered to be a federal contribution for these purposes and will not be able to be utilized for the ultimate recipient's funding contribution to the project.

Introduction

This guide provides an overview of the information required when completing an application under the Investing in Canada Infrastructure Program. Additional information may be requested as needed.

A complete project submission includes the following:

- ☐ A completed Project Application
- ☐ KML file with project location details (see Annex C)
- ☐ Attestation signed by designated municipal official (last page of the application)
- ☐ A completed Environmental and Aboriginal Consultation Information (ACES) questionnaire*
- ☐ Climate Lens assessment(s), *as applicable*
- ☐ A detailed cost estimate
- ☐ A Council Resolution supporting the submission of the project under the ICIP and the project's priority

The project application contains 8 sections:

1. Project Tombstone Information
2. Project Finances
3. Project implementation Details
4. Outcomes, Indicators and Targets
5. Climate Lens
6. Community Employment Benefits reporting
7. Risks and Mitigation Strategies
8. Attestation

*** Note that capital costs, including site preparation or construction, will not be reimbursed until it is confirmed that Environmental Assessment requirements and Aboriginal Consultation obligations have been met to the extent possible at the time a claim is processed.**

Project Eligibility

Under the Investing in Canada Infrastructure Program (ICIP), the way that project eligibility is determined has changed. In the past, eligibility was based exclusively on asset type. With ICIP, project eligibility is now assessed using an outcomes-based approach. In order to be considered for funding, a project must align with at least one immediate outcome within one of the investment streams. The project must also meet all applicable program requirements as outlined in the ICIP Bilateral Agreement.

Table 1. Immediate Outcomes for the Green Infrastructure - Environmental Quality funding stream

Funding Stream	Immediate Outcomes
Green Infrastructure - Environmental Quality	• Increased capacity to treat and manage wastewater and stormwater • Increased access to potable water • Increased capacity to reduce or remediate soil and air pollutants

Information Required for Project Submission

Please Note: Mandatory Fields are indicated by an * on the application form, and must be completed.

1 PROJECT TOMBSTONE INFROMATION

PROJECT TITLE

A concise but meaningful description of the asset and the work to be completed. For example: *Upgrade the main water line to the Wastewater facility (Plant 5)* would be an acceptable title, while *Pipe at Plant 5* is not.

PROJECT ID

To be assigned by DMA.

PROJECT DESCRIPTION

A brief but meaningful description of the following: the scope (identify all major quantifiable components); the approximate output(s) that the project will generate (e.g. water treatment plant, or 5km of new sewer pipes); why the project is needed; how the need was identified (e.g. study, federal/provincial regulatory requirement, etc.); and the plan for Project Management. The description must clearly identify how the project will meet relevant immediate outcomes (as per Table 1).

Quantitative information regarding the project (e.g. Number pumps, capacity of new pipes, etc.) will be collected as part of the performance measurements information in Section 4 of the application.

PROJECT CHARACTERISTICS

Answer yes or no to the questions, and provide additional details as required.

ULTIMATE RECIPIENT TYPE

Type of Entity who will receive funds to deliver the project.

LOCATION

Indicate the address of the Ultimate Recipient

Provide a KML file with the project location(s). This is not a picture or PDF map of the project location, but a digital spatial representation of the project location produced by a geographic information system. See Annex C at the end of this document.

2 PROJECT FINANCES

Complete the financial tables.

Total Project Costs: Sum of eligible and ineligible costs from all sources.

Total Eligible Costs: Sum of all eligible costs associated with the project.

Federal Contribution: Amount of funding sought from INFC for the project.

Provincial Contribution: Amount of funding contributed by the Province.

Ultimate Recipient Contribution: Amount of funding contributed by the ultimate recipient.

Other Contribution: Amount of funding sought from any other sources of funding (such as municipal share when not Ultimate Recipient, donations, other federal funding). Clearly identify the name of the entity that will provide each source of funding.

The total of all funding sources must add up to the total project costs (and not only eligible costs). Note that program cost sharing and federal stacking limits must be respected.

The fiscal year breakdown represents the portion of the contribution that will be claimed for reimbursement for each relevant fiscal year. The fiscal year begins April 1 and ends March 31 of the following year.

3 PROJECT IMPLEMENTATION DETAILS

NATURE OF PROJECT

Indicate the % of each: New, Rehabilitation, Expansion, Other (provide explanation)

ASSET OWNERSHIP AND OPERATION

Indicate if the Ultimate Recipient will own and operate the asset. If not, provide additional information regarding asset ownership and operation. Include the name and type of entity and a brief description of the arrangement.

PROJECT SCHEDULE

Provide details about the project schedule.

Forecasted Construction Start Date: date on which construction is expected to begin (shovels in the ground)

Forecasted Construction End Date: date of substantial completion

SOLE SOURCE CONTRACTING

Indicate if sole source procurement will be used, including relocation of utilities. If YES, for each sole source contract include the following information, if known: estimated amount of the sole source contract, who will be conducting the work, the nature of the work, and explain why sole source contracting will be used. *Note that projects that require sole source contracts may need Federal Treasury Board submission for project approval.*

4 OUTCOMES, INDICATORS AND TARGETS

IMMEDIATE OUTCOMES

Select the immediate outcome(s) that apply to the project. See Annex B for additional information.

INDICATORS

Provide expected results for all indicators that are relevant to the project. See Annex B for additional information.

5 CLIMATE LENS

For projects with a cost of $10 million or greater, a Climate Lens Report will be required. The Climate Lens consists of two assessments: a greenhouse gas (GHG) mitigation assessment; and a climate change resilience assessment. The assessments shall follow Infrastructure Canada's Climate Lens guidance documents.

Summary information is required as part of this project application, and the complete assessment will be required prior to project commencement for those projects that are formally approved.

Climate Lens assessment thresholds for ICIP

Funding Streams	GHG Mitigation Assessment	Climate Change Resilience
Environmental Quality sub-stream of Green Infrastructure	If total eligible costs are $10M or greater	If total eligible costs are $10M or greater

6 COMMUNITY EMPLOYMENT BENEFITS REPORTING

Reporting on community employment benefits is a requirement for projects with a total eligible cost of $10 million or greater. Approved projects will be provided with reporting requirements information.

Summary information is required as part of this project application for projects with a total eligible cost of $10 million or greater.

7 RISKS AND MITIGATION STRATEGIES

From the included list, select the factors for each of the four categories (project complexity, project readiness, public sensitivity, and Ultimate Recipient Risk) that have a reasonable likelihood of affecting the project. Briefly describe why this is a risk to the project and the mitigation strategies.

8 ATTESTATION

The Attestation must be signed by a designated official (CAO/Clerk) of Ultimate Recipient. This designated official must have the authority to attest that:

- Project information is complete and accurate;
- The designated official has the authority to submit this application on behalf of the Ultimate Recipient;
- Acknowledgement that the appropriate forms as required for this submission must be received by Municipal Affairs prior to application acceptance.

Annex B – Outcomes and Indicators Guidance

Investment Stream: Green Infrastructure - Environmental Quality

IMMEDIATE OUTCOMES	INDICATORS

Increased capacity to treat and manage wastewater and stormwater	Number/length and type of wastewater and stormwater assets receiving investment
	• Wastewater
	  • Treatment plants
	  • Lagoon systems
	  • Wastewater pump stations
	  • Wastewater lift stations
	  • Wastewater storage tanks
	  • Linear wastewater assets
	• Stormwater
	  • Drainage pump stations
	  • Management facilities – ponds and water wetlands
	  • Management facilities – all other permitted end-of-pipe facilities
	  • Linear stormwater assets

	Physical condition of wastewater/stormwater assets receiving investment (before investment and at project conclusion) • Very poor, Poor, Fair, Good or Very Good
	Number of wastewater systems achieving compliance with federal effluent regulations
	Volume of materials diverted, measured in cubic metres/day (before investment and at project conclusion)
	Capacity to dispose of materials, measured in cubic metre/day (before investment and at project conclusion)
Increased access to potable water	Number/length and type of drinking water assets receiving investment • Water treatment facilities • Reservoir • Pump stations • Local water pipes • Transmission pipes
	Physical condition of potable water assets receiving investment (before investment and at project conclusion) • Very poor, Poor, Fair, Good or Very Good
	Will any of the following long-term drinking water advisories be resolved as a result of this project? (Select from drop down list)
Increased capacity to reduce or remediate soil and air pollutants	Volume of materials diverted, measured in tonnes/year (before investment and at project conclusion)
	Capacity to dispose of materials, measured in tonnes/year (before investment and at project conclusion)
	The geographic footprint of lands which have been remediated (provided by GPS file, .kml format) • Is the site ready for intended use at project conclusion (yes/no)

DEFINITIONS

Physical Condition: is measured on a 5-point scale, as defined below.

- **NA:** Before project, asset did not exist.
- **Very poor**: The asset is unfit for sustained service. Near or beyond expected service life, widespread signs of advanced deterioration, some assets may be unusable.
- **Poor**: Increasing potential of affecting service. The asset is approaching end of service life; condition below standard and a large portion of system exhibits significant deterioration.
- **Fair**: The asset requires attention. The assets show signs of deterioration and some elements exhibit deficiencies.
- **Good**: The asset is adequate. Acceptable, generally within mid stage of expected service life.
- **Very good**: Asset is fit for the future. Well maintained, good condition, new or recently rehabilitated.

Potable water assets include the following:

- **Local water pipes** include all connecting pipes, of diameter less than 416 mm, between pump stations, re- chlorination facilities and storage facilities if these are located within the distribution system.
- **Pump stations** include pump stations within the non-linear potable water system owned by your organization, as well as all pump stations leased by your organization through a capital lease agreement.
- **Reservoir:** A pond, lake, or basin (natural or artificial) that stores, regulates, or controls water. Include the number of reservoirs and water towers within the distribution, transmission, or integrated system owned by your organization or leased by your organization through a capital lease agreement.
- **Transmission pipes** include all connecting pipes, of diameter greater than or equal to 416mm, between pump stations, re-chlorination facilities and storage facilities when located between the source and the treatment plant or between the treatment plant and the distribution system.

Storm water assets include the following:

- **Linear storm water assets** include culverts less than 3 meters in diameter, open ditches, storm water pipes (diameter: < 450 mm), storm water pipes (diameter: ≥ 450 mm to < 1,500 mm), and storm water pipes (diameter: ≥ 1,500 mm) owned by your organization or leased by your organization through a capital lease agreement.
- **Storm water drainage pump stations** include storm water drainage pump stations that are connected to drainage swales, ditches and storm sewers. **Exclude** combined pump stations which convey combined sewage/storm water to wastewater treatment plants.
- **Storm water management facilities – All other Permitted End-of-Pipe Facilities** includes engineered end-of- pipe facilities that have received a permit or approval to operate and which are not storm water ponds or wetlands (e.g. oil-grit separators, etc.).
- **Storm water management facilities – Storm water management ponds and storm water wetlands:** includes engineered end-of-pipe facilities that have received a permit or approval to operate and which may provide peak flow control, runoff quality control, runoff control for downstream erosion, runoff volume control, etc. Includes dry ponds, wet ponds, and storm water wetlands etc.

Annex C – How to Create A .KML File

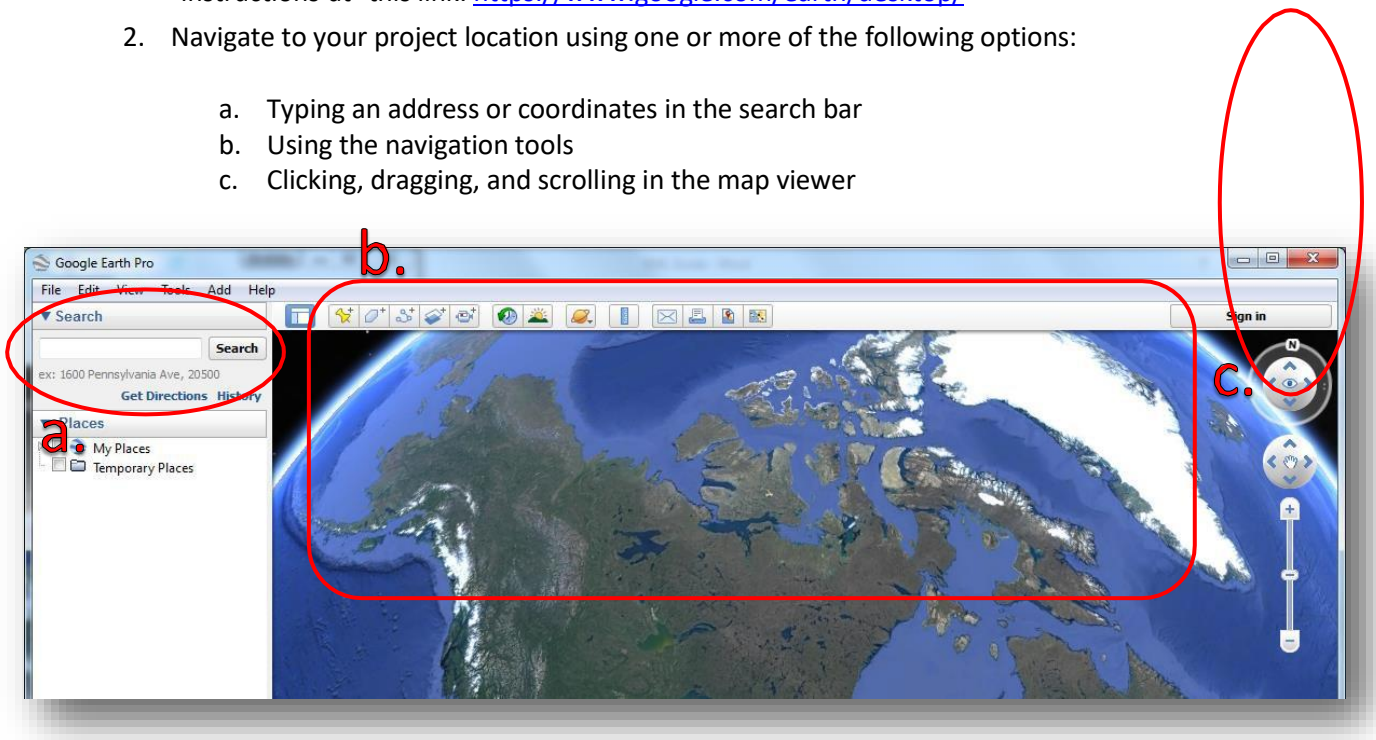
This guide will walk you through the steps to create a .KML file by Google Earth's free desktop application. Other geographic software packages like ArcGIS or QGIS may also be used to create the file, although this guide only provides instructions for the use of Google Earth. Using a .KML allows a variety of point, polygon, and line data be represented spatially with detail and consistency.

USING GOOGLE EARTH

*If you already have Google Earth installed on your system, skip to step 2.

1. If you don't already have Google Earth (free) installed on your system, follow the download instructions at this link: https://www.google.com/earth/desktop/
2. Navigate to your project location using one or more of the following options:

    a. Typing an address or coordinates in the search bar
    b. Using the navigation tools
    c. Clicking, dragging, and scrolling in the map viewer

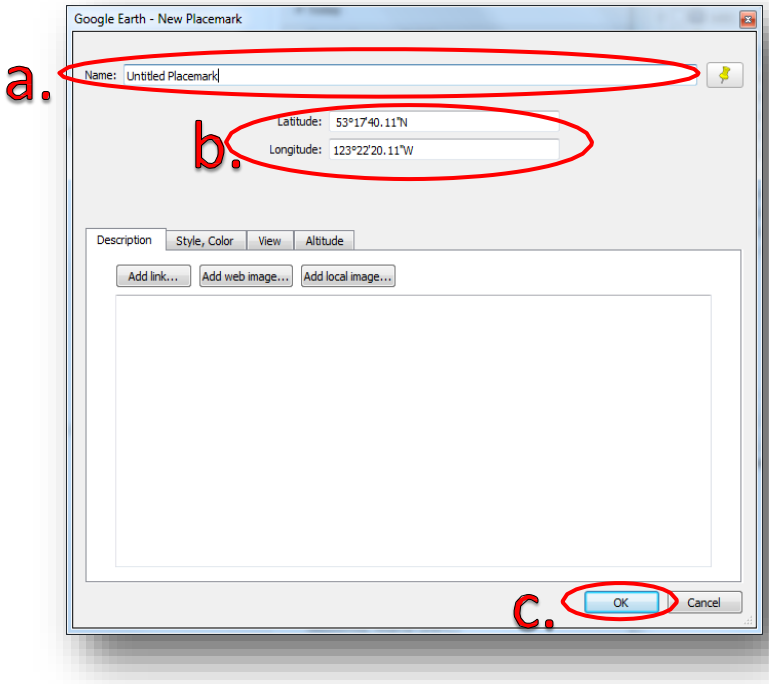


3. Draw your project on the map in the proper location using the placemark, polygon, and path tools (pictured below). You may draw as many components of varying types (point, line, polygon) as necessary.

Choose the appropriate drawing tool for the type of component you are drawing:

a. Placemark: point project components
   - Examples include: wells, outfalls, culverts, etc.

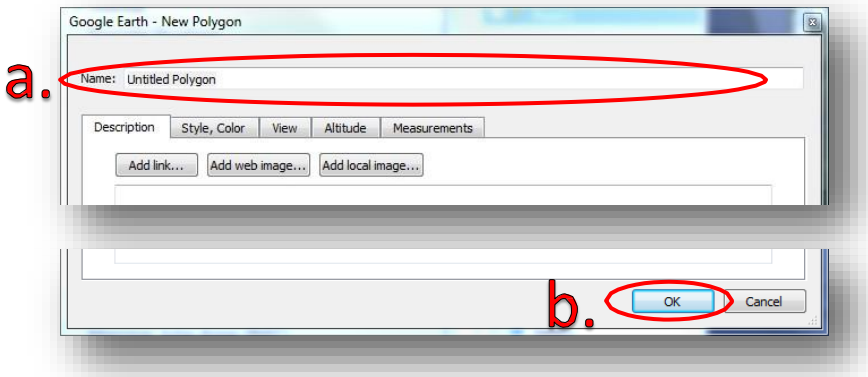
Clicking this button will add a placemark to the map and bring up a corresponding dialogue box (see below).



- You can move the placemark by clicking and dragging it to the desired location or entering the desired latitude and longitude coordinates in the dialogue box (a).
- You can rename the placemark by changing the entry in the 'Name' field of the dialogue box (b).
- Click 'OK' when finished (c).

b. Polygon: project components that consist of an area of any shape
   - Examples include: building footprints, vegetation cuts, sewer/wastewater lagoons, etc.

Clicking this button will bring up a dialogue box and a crosshair cursor (see below). Click as many times as necessary to create a closed polygon that represents your project feature.

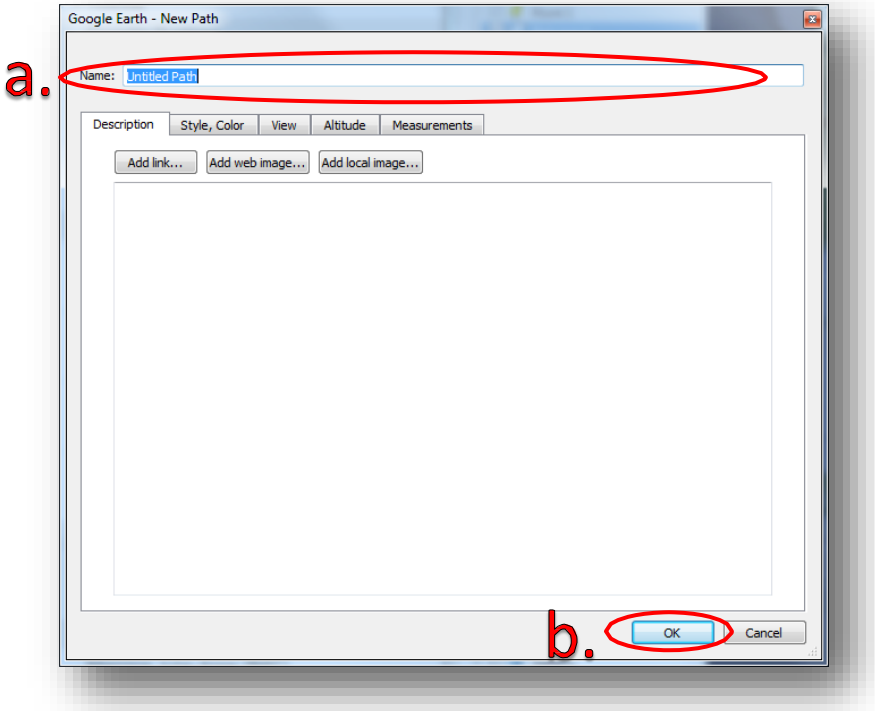


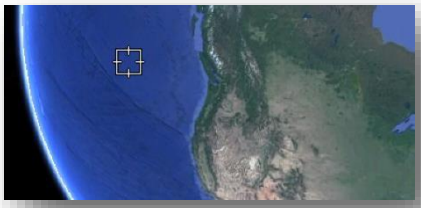
- You can rename the polygon by changing the entry in the 'Name' field of the dialogue box (a).
- Click 'OK' when finished (b).

c. Path: linear project components

– Examples include: roads, sewer lines, railways, pipelines, trails, transmission lines, etc.

Clicking this button will bring up a dialogue box and a crosshair cursor (see below). Click as many times as necessary to create a line that represents your project feature.





– You can rename the polygon by changing the entry in the 'Name' field of the dialogue box (a).

– Click 'OK' when finished (b).

All drawn components will appear in the 'Places' sidebar under the 'Temporary Places' folder.

4. Export the shapes to .KML to be shared.

*** Warning: If you have multiple shapes, they will need to be exported individually as separate .KML files.**

Annex D – Eligible / Ineligible Expenses for Approved Projects

ELIGIBLE EXPENSES

Eligible expenses will include the following:

a) all costs considered to be direct and necessary for the successful implementation of an eligible project, in the opinion of Canada and Nova Scotia, excluding those identified under Ineligible Costs, below;

b) the capital costs of constructing or renovating a tangible asset, as defined and determined according to generally accepted accounting principles in Canada;

c) all planning (including plans and specifications), assessment and design costs specified in the agreement such as the costs of environmental planning, surveying, engineering, architectural supervision, testing and management consulting services, to a maximum of 15% of total funding award;

d) costs related to meeting specific Program requirements, including completing climate lens assessments (as outlined in Section 6) and creating community employment benefit plans (costs for climate lens assessments can be incurred prior to project approval, but can only be paid if and when a project is approved by both the Province and Canada for contribution funding);

e) the costs of engineering and environmental reviews, including environmental assessments and follow-up programs as defined in the *Canadian Environmental Assessment Act 2012* and the costs of remedial activities, mitigation measures and follow-up identified in any environmental assessment;

f) the costs of Aboriginal consultation, and where appropriate, accommodation;

g) the costs directly associated with joint federal and provincial communication activities (press releases, press conferences, translation, etc.) and with federal and provincial project signage; and

h) the incremental costs of the eligible recipient's employees related to construction of the project may be included as eligible costs under the following conditions:

   i. The recipient is able to demonstrate that it is not economically feasible to tender a contract;

   ii. The employee or equipment is engaged directly in respect of the work that would have been the subject of the contract; and,

   iii. The arrangement is approved in advance and in writing by the Province and by Canada.

Eligible costs are limited to the following:

a) costs incurred between the project approval date and the project completion date set out in the Shared Cost Agreement, except for costs associated with completing climate lens assessments and creating community employment benefit plans, which are eligible before project approval, but can only be paid if and when a project is approved by the Province and Canada and a signed Shared Cost Agreement is in place.

INELIGIBLE EXPENSES

The following are deemed ineligible costs:

a) costs incurred prior to the approval of the project, except for expenditures associated with completing climate lens assessments and creating community employment benefit plans as required (but can only be paid if and when a project is approved by the Province and Canada and a signed Shared Cost Agreement is in place);
b) incurred after the project completion date set out in the Shared Cost Agreement with the exception of expenditures related to audit and evaluation requirements pursuant to the agreement;
c) costs related to developing a funding application and application supporting documentation;
d) costs incurred for cancelled projects;
e) costs of relocating entire communities;
f) land acquisition;
g) real estate and other fees related to purchasing land and buildings;
h) financing charges, legal fees and interest payments on loans, including those related to easements (e.g. associated surveys);
i) costs associated with operating expenses and regularly scheduled maintenance work;
j) leasing land, buildings and other facilities;
k) leasing of equipment other than equipment directly related to the construction of the project;
l) overhead costs, including salaries and other employments benefits, direct or indirect costs associated with
m) operating expenses, administration and regularly scheduled maintenance work, and more specifically any costs related to planning, engineering, architecture, supervision, management and other activities normally carried out by staff, except those indicated in Eligible Expenditures;
n) costs related to furnishing and non-fixed assets which are not essential for the operation of the asset/project;
o) any goods and services costs which are received through donations or in kind;
p) taxes for which the ultimate recipient is eligible for a tax rebate and all other costs eligible for rebates;
q) all capital costs, including site preparation, vegetation removal and construction costs, until Canada has been satisfied that the federal requirements under the Canadian Environmental Assessment Act, 2012 (CEAA, 2012), other applicable federal environmental assessment legislation that is or may come into force during the term of the Agreement, and other applicable agreements between Canada and Aboriginal groups have been met to the extent possible and continue to be met; and
r) all capital costs, including site preparation, vegetation removal and construction costs, until Canada is satisfied that any legal duty to consult, and where appropriate, to accommodate Aboriginal groups or other federal consultation requirement, has been met and continues to be met.

Contents

Appendices

Chapter 1 Introduction

1.1 Background

The Town of Mahone Bay has been approached by developers who are interested in the construction of new residential areas within Town boundaries. Some of these developments represent a significant increase to the Town's population and as a result the Town has expressed concerns as to the ability of the existing water and sewer infrastructure to service the potential developments.

The Town has retained CBCL Limited to:

1. Evaluate the ability of the existing infrastructure to service the potential developments;
2. Identify infrastructure upgrades, if required, to service the potential developments; and
3. Identify options to improve fire flows within the Town.

1.2 Potential Developments

Potential residential developments that have been reviewed as part of this study are as follows:

- MADE for Mahone Bay, 6 ha (15 Ac) between School Street and Fairmont Street, extending to the south west;
- Hawthorne Development, 15 ha (38 Ac) south of the CNR track and MADE development;
- Wye Street development, 11 ha (27 Ac) north of Long Hill Road and West of Clearway Street, and to the north-west of the CNR track;
- Bay Centre development, 3 ha (7 Ac) south of Clearland Road;
- Kinburn development, 0.5 ha (1.3 Ac) east of Spur Street off of Kilburn Street; and
- Quinlan Condominiums, on Main Street near Cherry Lane (building complete but not fully occupied).
- Harbour Lands, 0.7 ha (1.8 Ac) on Main Street close to the government wharf.

The locations of the potential developments are provided in Figure 1, included in Appendix A. Note that all figures referenced in this report are provided in Appendix A.

1.3 Purpose of Report

This report is not indented to provide servicing details for each development, but is intended to provide the Town with information for planning purposes. A detailed assessment of how any new development would be serviced by the Town would be required prior to connecting them to the Town's system.

Chapter 2 Water and Wastewater Infrastructure Review

2.1 Water Infrastructure Review

The water infrastructure generally consists of the following:

- Source water – Oakland Lake
- Raw water pump house, currently being upgraded;
- Raw water transmission main;
- Water treatment consisting of an existing conventional treatment process, currently being upgraded to a membrane process;
- Chlorine disinfection;
- Lined and covered earthen water storage reservoir; and
- Water distribution system fed by gravity from the water storage reservoir.

As noted above, the Town is currently upgrading the water infrastructure by means of modifications to the raw water pump house and the construction of a new water treatment plant.

Figure 2 provides an overview of the water infrastructure system.

2.1.1 Raw Water Pump House and Transmission Main

The raw water pump house is located at Oakland Lake and consists of a wood frame building which houses two end suction centrifugal pumps.

Upgrades currently being undertaken at the pump house include the following:

- Replacement of the existing 169 mm (6.75”) diameter impellers with 206 mm (8.25”) diameter impellers;
- Replacement of the existing full voltage starters with variable speed drives;
- Replacement of the existing PVC discharge pipe with stainless steel piping.

The existing maximum pump discharge with one pump operating is 409 Lpm (90 Igpm). The maximum discharge with one pump operating following the completion of the upgrades will be 757 Lpm (166 Igpm).

The raw water is pumped through an existing three kilometre long 200 mm (8”) diameter cast iron transmission main to a new water treatment plant. The condition of the transmission main, installed in the 1940’s, is not known. Increasing the flow through the transmission main will require increased pressure in the transmission main. Due to the uncertainty of the condition of the transmission main, there is potential that the increase

pressure could create or increase leaks in the transmission main. Due to the location of the transmission main locating and repairing these leaks could be difficult and time consuming. A major leak in the raw water transmission main could result in the water treatment plant shutting down.

2.1.2 Water Treatment Plant

The water treatment plant is being upgraded to meet current Department of Environment and Labour (NSEL) requirements. Process equipment generally includes the following:

- Coagulation pre-treatment system;
- Micro-filtration (MF) water treatment system;
- Ultra Violet (UV) disinfection system,
- Chlorination disinfection; and
- Various chemical feed metering pump systems.

The new water treatment system will be located in a masonry block building.

2.1.3 Coagulation Pre-treatment

The coagulation pretreatment system is constructed of prefabricated aluminum tankage which contains a flash mixing and 2 equally sized flocculation chambers. The total volume of the flocculation chambers is 22,680 L (6,000 USgal). The design parameters of the membrane require a 20 minute flocculation time. The maximum throughput of the pretreatment system is 1,134 Lpm (249 Igpm).

2.1.4 MF Treatment System

The MF treatment system consists of two PALL, model AP4, treatment skids operating in parallel. Each skid consists of 12 MF modules with 4 spare MF module connections available for future expansion. Each MF module has a design capacity of 56.8 Lpm (12.5 Igpm). The installed capacity of each skid is 681 Lpm (150 Igpm), and both skids are expandable to 909 Lpm (200 Igpm).

2.1.5 Ultra Violet (UV) System

The UV system is a Trojan UV Swift SC B08, which contains low pressure amalgam UV lamps, and is designed to provided a 3.0 log reduction of *Giardia* at up to a flow of 816 Lpm (180 Igpm) and a UV Transmittance (UVT) of 85%. The UVT is a measure of the percent of UV that is available for disinfection. The design UVT of 85% is considered conservative and if actual UVT were measured to be greater than 90% the system design rating could be increased to 1,134 Lpm (250 Igpm).

2.1.6 Chemical Meter System

Chemical metering pump systems are provided for sodium hypochlorite, soda ash, corrosion control, and coagulant. The chemical metering pump systems consist of individual metering pumps for each application point which can be easily replaced with higher capacity models, if required.

2.1.7 Water System Capacity Discussion

The following table provides a summary of current capacities and future capacities of each water treatment component.

Table 1: Water Treatment Process Capacities

Process	New Treatment Plant Capacity	Ultimate New Treatment Plant Capacity
Raw Water Pumps	682 Lpm	757 Lpm
Pre-treatment	682 Lpm	1,134 Lpm
MF System	682 Lpm	909 Lpm
UV System @ 85% UVT	682 Lpm	816 Lpm

2.1.8 Reservoir

The 2 ML (440,000 Igal) lined and covered earthen water storage reservoir supplies the Town by gravity. The reservoir was designed based on a future average water demand of 489,000 Lpd (107,590 Igpd) and future peak water demand of 733,000 Lpd (161,280 Igal).

The water storage reservoir volume has several functions as follows:

- Water storage for fire protection (1,300,000 L);
- Peak balancing (184,000 L);
- Emergency storage (371,000 L);
- Operating band (60,000 L); and
- Backwash storage for a conventional water treatment system (90,000 L).

2.1.9 Distribution System

The distribution system was constructed in the 1940's with some later modifications and upgrades. The distribution system reportedly consists of the following:

- 3,200 m (10,500 ft) of 150 mm (6 inch) Cast Iron (CI) piping;
- 1,680 m (5,510 ft) of 200 mm (8 inch) CI piping; and
- 3,050 m (10,000 ft) of 150 mm (6 inch) PVC piping.

Water is supplied to the distribution by a 200 mm (8 inch) diameter CI watermain from the reservoir.

It is our understanding that some of the older watermains have significant tuberculation and reduced inside diameter. These pipes therefore have a

significant reduction in flow capacity when compared to new piping of similar diameter.

Water and sanitary mains in several streets are reportedly installed in close proximity to each other.

2.2 Wastewater System Review

The existing wastewater treatment system generally consists of the following:

- Gravity Collection system;
- Three pump stations and associated forcemains; and
- Aerated lagoon wastewater treatment system.

Figure 3 provides an overview of the wastewater infrastructure system.

2.2.1 Sanitary Sewers

The existing sanitary sewer system consists of approximately 5.5 km of mostly combined (sanitary sewage and storm water) gravity sewer pipes and 1.1 km of sewage forcemain (from three pump stations).

All wastewater is collected by a sanitary sewer system. The system varies in age and materials, with the majority of the pipe installed in the 1940's. The majority of the sanitary sewer system, however, is a combined wastewater collection system and storm water collection system. As a result there is a significant amount of storm water discharge in the system.

Storm water discharge is a concern for any central sanitary sewage collection system. Due to the age of the system and original design of the system as a combined system, however, significant storm water entry is to be expected. The Town has identified some major storm water entry points into the system that could be removed, as follows:

- At Main Street between Clearway Street and Cherry Lane;
- Behind the post office; and
- At Fairmount Street near Pine Grove.

2.2.2 Pump Stations

The sanitary sewers convey the sewage by gravity to one of three sewage pumping stations (PS). The pumping stations discharge the sewage consecutively from PS3 to PS2, and finally to PS1. PS1 pumps all the wastewater generated in the town to the wastewater treatment plant.

The three pumping stations are submersible, wet-well type. Control panel are located adjacent to the wells and provide power and control functions for the pumps. The pump stations are SCADA ready but currently do not

have data storage ability. The level of the wastewater in the pump station is monitored by a level transducer and used to control pump on/off cycles.

The pumping stations are located along the waterfront, and their locations and capacity are outlined in Table 2.

Table 2: Pump Station Capacities

Pump Station	Location	Design Capacity (Lps)		
		1 Pump in Operation	2 Pumps in Operation	Forcemain Diameter
PS1	Terminal	27	52	200 mm
PS2	Gov. Wharf	40	58	200 mm
PS3	Save Easy	42	56	150 mm

Note: PS3 pumps to PS2. PS2 pumps to PS1. PS1 pump to STP

Each pumping station has more then one inlet pipe feeding into the wet-well. All the pumping stations have an overflow pipe that discharges directly to the harbour, and during large rain events the stations overflow into the harbour. There is no historical information on overflow volume and frequency.

Observations at PS3 indicated evidence that the pump station frequently fills to the underside of the access hatch, and Town staff reported that the PS has overflowed through the access hatches on occasion. It was also noted that sea water inflow has been experienced at PS3. It is expected that PS3 receives the majority of the storm water flows.

Town staff also reported that when both pumps are in operation at PS2, there are overflows from the forcemain discharge manhole, indicating that either there is a blockage or the capacity of the receiving collection system is not adequate.

2.2.3 Wastewater Treatment System

Wastewater is treated by an aerated lagoon. The effluent from the lagoons is chlorinated and the flow measured prior to being discharged into Mahone Bay.

The lagoons were designed based on a wastewater generation rate of 568 L/cap/day and a future population of 1,500 for a daily design flow of 852,000 Lpd (187,460 Igpd). The effluent limits for BOD and TSS are 30 mg/L respectively.

The aerated lagoon system has a total volume of 23,300 m^3 (5,126 MIG) and is divided into three basins. The first basin contains 40% of the lagoon volume, and the remaining 60% is evenly split between the other two basins.

Air is provided to the basins by one of two 40 hp blowers at a rate of 0.42 m^3/min (14.8 SCFM).

Data provided from the flow metering station was received and reviewed. The data, however, did not appear to be reasonable. Town staff checked the flow meter and determined that the meter was not operating correctly and that the data collected was not reliable. As a result there is no actual flow data available for the wastewater treatment system.

There were no records of lagoon effluent quality on file. A sample of effluent was collected by Town personnel during this study. The results of the sampling event are provided in Table 3.

Table 3: Wastewater Treatment Sample Results

Parameter	Influent	Effluent
BOD	59 mg/L	<5 mg/L
TSS	64 mg/L	6 mg/L
E. Coli.	> 24,192/100mL	10/100 mL
Total Coliform	> 24,192/100mL	86/100 mL

The results indicate that the lagoon is performing well at the time it was sampled. As well, because the results are well below the regulated limit, it is suspected that the lagoon may contain some excess capacity.

2.3 Current and Projected Population

The 2006 census reports the population of Mahone Bay to be 904.

The projected population of the MADE development was provided by Town at 200 based on the revised concept.

The projected populations for Hawthorne (Phase 2) and Bay Centre developments were provided by the Town based on current concept plans.

Wye Street development population was calculated on the density of Phase 1 of the Hawthorne development. The density of Phase 1 of the Hawthorne was calculated to be 15 persons/Ha based on the number of units and the area of the development.

The Kinburn development was identified as a possible 24 unit apartment building. Based on 2.5 people per unit this development would house a population of 60.

The Quinlan Condominiums on Main Street have been constructed and has 34 units. Based on 2.5 people per unit this development would house a population of 85.

Projected populations for the potential development are provided in Table 4.

Table 4: Potential Development Populations

Development Name	Area (ha)	Projected Population
MADE	6.1	200
Hawthorne	14.5	130
Wye Street	10.9	164
Bay Centre	6.4	80
Kinburn	0.5	60
Condo	0.5	85
Harbour Lands	0.7	50
Total	**39.6**	**769**

An increase in the Town's population by 769 persons would put the total population at 1,673.

2.4 Estimated Water Demand

The average day water demand for the period of from 23 June 2006 to 18 September 2007 was 449,000 Lpd (98,786 Igpd). Over the same period, the maximum day water demand was 604,500 Lpd (133,000 Igpd), which represents a peaking factor of 1.35. Based on a 2006 population of 904, the per capita average day and maximum day water demand are 497 Lpd/cap and 668 Lpd/cap respectively.

The Town measures all water utilities by residential, commercial, and industrial. Water billing information provided by the Town indicates that the average day water use is approximately 340 Lpd/cap (75 Igpd/cap). Applying the calculated peaking factor of 1.35 the maximum day water use is estimated at 459 Lpd/cap (101 Igpd/cap). The difference between the average day water demand and the average day water use is 141,620 Lpd (31,200 Igal) and is attributed to water loss/leakage in the system.

The potential developments are not expected to increase water loss and town water use also included commercial and industrial customers. Therefore, it is reasonable to Towns measured water use to determine the water demand of the potential developments. Table 5 provides a summary of the estimated water demand by potential development.

Table 5: Estimated Water Demand

Development	Population	Water Demand	
		Average Day (Lpd)	Max Day (Lpd)
Existing	904	449,000	604,500
MADE	200	68,000	91,800
Hawthorne	130	44,200	59,670
Wye Street	164	55,760	75,276
Bay Center	80	27,200	36,720
Kinburn	60	20,400	27,540
Quinlan	85	28,900	39,015
Harbour Lands	50	17,000	22,950
Total Future	**1,673**	**710,460**	**957,171**

2.5 Estimated Wastewater Generation

Wastewater generation rates are required to assess pipe capacity and treatment plant capacity. Actual values were not available; therefore estimates of current day and expected future day were developed.

The average day wastewater generation is the average wastewater generation including sanitary, storm water, and inflow and infiltration (I/I) sources, over a one year period. The peak wet weather flow is the peak day sanitary generation plus the peak storm water and I/I generation and is used to size collection system components such as pumps and pipes. The peak wet weather will occur over the duration of a rain event and will likely cause the pump stations to overflow.

Existing average day wastewater generation was assumed to be equal to the current average day water usage plus a daily allowance of 115,000 Lpd 25,300 Igpd) for I/I which was obtained from "Mahone Bay Comprehensive Water and Sewerage Study" dated 1989. It is known that the pump stations currently overflow; therefore, the peak wet weather flow is higher than the pumping capacity of the stations. The pumping system in pump station 3 is rated for 56 Lps or 4,838,400 Lpd (1,064,500 Igpd).

Future development estimated wastewater generation were based on the *Atlantic Canada Standards and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage*. Design guidelines are as follows:

- Daily Domestic Flow 340 Lpd/cap (75 Igd/cap)
- I/I Flow 0.28 Lps/Ha
- Harmon Peaking Factor Based on Population

Table 6 presents the estimated wastewater generation for the existing Town and projected wastewater generation for each potential development.

Table 6: Estimated Wastewater Generation

Development	Population	Wastewater Generation	
		Average Day (Lpd)	Peak Wet Weather Flow (Lpd)
Existing	904	422,360	4,838,400
MADE	200	68,000	428,980
Hawthorne	130	44,200	536,900
Wye Street	164	55,760	496,670
Bay Center	80	27,200	273,360
Kinburn	60	20,400	99,780
Quinlan	85	28,900	135,270
Harbour Lands	50	17,000	90,280
Total Future	**1,673**	**683,820**	**6,899,640**

3.1 Water Treatment System

The limiting component of the treatment system is the raw water pumping system, which has an existing capacity of 757 Lpm (166 Igpm). The pumps could be replaced with larger pumps to meet higher demands, but this would place additional stress on the raw water transmission main.

Assuming a 95% recovery rate from the water treatment plant, the effective raw water pumping rate, water available for use, is 719 Lpm (158 Igpm) or 1,035,360 Lpd (227,800 Igpd). The projected population, assuming all potential developments are completed, has a maximum day water demand of 957,171 Lpd (210,600 Igpd), which is within the existing pumping capacity.

The UV system, with a maximum design flow of 816 Lpm (180 Igpm), or 1,175,040 Lpd (258,500 Igpd), at a UVT of 85%, is the next limiting component and can accommodate the project maximum day demand.

The MF system and pre-treatment system are both suitable to handle the estimated future water demands. Note, however, that additional membrane modules will need to be installed into one of the four spare spaces provided to accommodate the additional flow. Note that the number of membranes must be equal in both membrane system. Each membrane module has a design flow rating of 56.8 Lpm (12.5 Igpm)

3.2 Reservoir

The volume of the reservoir was reassessed based on the projected population and the membrane treatment process as compared to a conventional treatment system. The membrane system provides its' own storage for system use such as backwashing within the treatment plant, therefore, the volume reserved in the reservoir for backwashing can be utilised for other sources. The volume for each function has been recalculated and is as follows:

- water storage for fire protection (1,300,000 L);
- peak balancing (281,675 L);
- emergency storage (395,419 L); and
- Total required volume of 1,977,093 L.

The existing reservoir volume of 2 ML (440,000 IGal) is therefore sufficient to meet the projected future requirements of the Town.

3.3 Existing Water Distribution System

CBCL Limited developed a water distribution model using WaterGEMS V8 XM software. The model was calibrated based on fire flow testing conducted by CGI on October 9, 2007.

3.3.1 Existing Domestic Flows Conditions

The hydraulic grade line (HGL) at the reservoir is approximately 75.1 m and is reduced through a pressure reducing valve (PRV) to 68.1 m. This lower HGL maintains a maximum water pressure, along Main Street and Edgewater Street, of 95 psi. The lowest pressure in the system is along Long Hill Road which is below 30 psi. The homes along that road have domestic booster pumps to increase the water pressure to acceptable levels.

The current HGL serves lands from 2 m to 23 m in elevation. Individual booster pumps service lands up to the 40 meter contour. Under the current HGL a static pressure of 280 kPa (40 psi) would be observed at an elevation of 40 m. Due to dynamic losses in the system, however, servicing this elevation is not realistic with the current infrastructure.

3.3.2 Existing Fire Flows Conditions

The Town retained the services of CGI to conduct fire flow testing in the Town. Testing was conducted on the night of October 9, 2007, and the results are attached as Appendix B. The results indicate available fire flows in the range of 759 Lpm (167 Igpm) to 2,650 Lpm (583 Igpm). Refer to Figure 4 for locations of hydrants tested and a summary of results.

Fire flow testing was done at night when domestic demands on the system are lowest. The results show that the available fire flow does not meet the requirements of *The Fire Underwriters Survey's Water Supply for Public Fire Protection*, 1999, as recommended for different types of structures. The recommended fire flows are presented in Table 7.

Table 7: Fire Flow Recommendations

Typical Development Type	Recommended Fire Flow (Lpm)	Recommended Fire Flow (Igpm)	Duration
Residential	4,000	880	1.5
Apartment	6,000	1,320	2.0
Commercial	10,000	2,200	2.5
Institutional	14,000	3,080	3.0

Note - The CGI final report will recommend fire flows for specific structures in Town.

3.4 Water Distribution Model

3.4.1 Boundary Conditions

The following parameters were used in the Model to assess domestic and fire flow conditions and potential required upgrades to serve future developments:

- Average projected daily water demand for Mahone Bay based on:
  - 497 L per capita per day (LPCD) [109 imperial gallons per capita per day (IGPD)].

- Short term service population (Current):
  - Population 904
  - Average Day Demand 449,000 Lpd (312 Lpm, 69 Igpm)
  - Average Day Water Use 307,360 Lpd (213 Lpm, 47 Igpm)

- Ultimate Service Population and Water Demand (See Table 5):
  - Population 1,687
  - Existing Avg. Day Demand 810,460 lpd (562 lpm, 123 Igpm)

- Pressures:
  - Maximum service water pressure 690 kPa (95 psi)
  - Minimum service water pressure 275 kPa (40 psi)
  - Fire flow residual pressure 150 kPa (22 psi)

- HGL:
  - Reservoir 75.1 m (246 ft)
  - Town Zone 68.1 m (223 ft)

- Demand Peaking Factors:
  - Measured Peaking Factor
  - Town of Mahone Bay Max Day 1.35 x Ave. Day
  - 500-1000 People
  - Maximum Day Demand Factor 2.75 x Ave. Day
  - Peak Hour Demand Factor 4.13 x Ave. Day
  - 1001-2000 People
  - Maximum Day Demand Factor 2.5 x Ave. Day
  - Peak Hour Demand Factor 3.75 x Ave. Day

- Friction Factor:
  - C Factor (new pipe) 120

3.4.2 Distribution System Upgrades to Improve Fire Flow

Upgrades to the water distribution system are required to provide a minimum of 9,090 Lpm (2000 Igpm) through the downtown along Main Street to Fauxburg Road and 4,000 Lpm, (880 IGPM) through residential

portions of town. Should the CGI report recommend higher flows throughout the town, the model should be revisited to confirm that the sizes are able to provide the flows where required. Potential distribution system upgrades to improve fire flows are indicated in Figure 5 and are described as follows:

- Install approximately 2150 m (7052 ft) of 300 mm (12 inch) diameter trunk watermain from the reservoir along Main Street to Fairmont Street;
- Install approximately 300 m (984 ft) of 250 mm (10 inch) diameter watermain along Main Street from Fairmount Street to Fauxburg Road;
- Install approximately 340 m (1,115 ft) of 200 mm (8 inch) pipe along Edgewater Street from Main Street;
- Install approximately 430 m (1,410 ft) of 250 mm (10 inch) diameter pipe on Fairmount Street from Main Street to Pine Grove Street;
- Install approximately 575 m (8,450 ft) of 200 mm (8 inch) diameter watermain along Clearway Street to provide fire flows to the school. (May not be required if School has fire storage tank); and
- Upgrade the dead end watermains along Shady Lane and Welcome Street to 200 mm (8 inch) watermains.

The distribution system upgrades will, based on the current hydraulic grade line, will allow lands up to the 40 m elevation to be serviced with adequate pressure for both domestic and fire flows. Lands up to the 45 m elevation can be serviced with fire flows. Booster pumps will be required to meet domestic demands above 40 m elevation and fire flows above 45 m elevation.

The Town could also explore the idea of using dry hydrants as part of the Town's overall fire suppression strategy. A dry hydrant is a stand alone hydrant that extends into a body of water. Generally the preference is to use a freshwater source for the dry hydrant but salt water sources are also used when required. Dry hydrants can be used to supplement available fire flows and are typically installed and managed by the Fire Service.

The Town will have to determine if and how they want to employ dry hydrants. Discussions should be held between the Town, the fire department and CGI to determine the preferred method of using dry hydrants along the harbour to provide the most fire protection coverage as it relates to insurance rates. The Town can then make a decision as to if and how to best use dry hydrants in their fire protection strategy.

3.4.3 Extensions of Services to Potential Ddevelopments

Each potential development will require the extension of the water system to service the new lands. The extensions, however, will not provide the developments with adequate fire flows unless the distribution system modifications recommended to improve fire flows have been completed.

In the event that the potential developments were built ahead of the recommend distribution systems modification the existing distribution system would supply the developments with maximum day demand. Peak hour demands could also be supplied but with limitations. Under a peak hour situation the distribution pressures at elevations higher than 25 m will generally see a reduction in pressures. The higher elevations in the Hawthorne and Wye developments will see pressures as low as 20-25 psi under peak hour demands. It is expected that fire flows will be reduced to between 340 Lpm and 909 Lpm (75 and 200 Igpm) during maximum day demand.

A description of the required service extensions for each potential development is presented below. The descriptions assume that the distribution modifications have been completed. The comments provided are on major piping configuration only. Exact sizes will have to be confirmed during detailed design and based on structure type and location in the potential developments.

Hawthorne

The provision of fire flows to the Hawthorne development requires the replacement of the existing 150 mm (6 inch) CI watermain on Clairmont Street with a 300 mm (12 inch) diameter pipe. The potential 300 mm (12 inch) diameter watermain could be extended on Hawthorne Street and through the subdivision or along the path of the existing wastewater collection main servicing Hawthorne. The 300 mm (12 inch) watermain will be connected to Fairmont Street to eliminate dead end piping.

Domestic servicing of homes at higher elevations will require boosted pressures either by a central booster station, or individual domestic booster pumps.

M.A.D.E. for Mahone Bay

Servicing the M.A.D.E. for Mahone Bay development will require the extension of a 200 mm diameter watermain up School Street to the site. It will also require the looping of the watermain through the site, creating a connection from School Street to Fairmont Street.

Wye Street

Provisions for servicing the Wye Street development with fire flows requires the extension of a 300 mm diameter watermain on Wye Street, and making a connection to the existing watermain on Welcome Street.

Bay Centre

Servicing of the Bay Centre development on Clearland Road will require the extension of the water system either on Edgewater Street, or on Orchard Street. It is recommended that the water system be connected to

Clearway Street. Servicing for the Bay Centre lands can be accomplished by extending a 200 watermain from the end of the 150 mm watermain in Orchard Street through the development and making a connection to Clearway Street.

Kinburn

Servicing the Kinburn development can be accomplished off Kinburn Street or Main Street. The water service main would be sized during design of the potential development.

Quinlan Condo

The Quinlan condominium on Main Street currently uses an on-site fire storage reservoir to provide adequate fire volume. The potential upgrades may make the storage tank redundant.

Harbour Lands

The Harbours Lands are adjacent to Main Street, a currently serviced road. There would be no local infrastructure requirements other then a service lateral for this project.

4.1 Sanitary Collection System

Sanitary sewer capacities were calculated based on pipe size, slope, and roughness. Roughness was assumed to be n = 0.013 and where pipe slopes were unknown 0.6% was assumed. Pipe sizing was based on peak wet weather flow as presented in Table 5.

There have been reports that PS 3 and the discharge manhole for PS 2 have overflowed in the past, indicating that the at times the existing sanitary collection system is over loaded. Any additional sanitary flows from the potential developments will have to be offset by I/I reduction or storm water/sanitary system separation to prevent possible increase in system overflows. Extension of the collection system will be required to connect the potential developments into the existing system.

The potential extensions of the collection system are provided on Figure 3. A description of the required upgrades is presented below for each potential development.

M.A.D.E. for Mahone Bay

The MADE for Mahone Bay development sanitary connections can be made to either School Street or to Fairmont Street. Some areas of the development will require a sanitary connection to the School Street gravity main which ultimately flows to PS3. Efforts should be made to convey sanitary flows into the Fairmont Street gravity main which flows into PS2 where possible in an effort to reducing energy costs by limiting pumping.

Hawthorne

Phase 1 of the Hawtorn development is currently serviced and it is assumed that the existing collection system will be used to service Phase 2.

Wye Street

Servicing the Wye Street development may require two (2) connections. The most direct connection is to the existing 200 mm in Welcome Street. There is capacity in the sewer for the entire development. Due to the elevation changes of the site it will be difficult to get gravity flow to one connection. An additional connection may be required further up Clearway Street or the construction on a pumping station. Based on calculations there is also capacity in the Clearway Street sewer to accommodate the flow from the development.

Bay Centre

The Bay Centre development will most likely require the installation of sanitary sewers in Edgewater Street and Clearland Road or Main Street.

There may also be in an opportunity to connection cross-country to Clearway Street. The preferred approach will have to be confirmed during detailed design.

Kinburn

The Kinburn development will not require an extension of the existing collection system. The development will most likely be connected to Main Street by a lateral.

Quinlan Condo

The condominium on Main Street is currently connected to the sanitary system.

Harbour Lands

The Harbours Lands are adjacent to Main Street, a currently serviced road. There would be no local infrastructure requirements other then a service lateral for this project.

4.2 Wastewater Pump Stations

The Canadian Council of Ministers of the Environment (CCME) is in the process of establishing new requirements for pump stations. These requirements have not been finalized but it our understanding that existing pump stations will not be permitted to exceed existing overflow levels. If any new development is to proceed, therefore, either the pumps will have to be replaced or infiltration equal to the flow expected from the potential new development will have to be diverted from the pump station.

Replacing the existing pumps with higher capacity pumps will have the negative affect of increasing the hydraulic loading to the wastewater treatment plant. If I/I is removed or storm water is diverted, the hydraulic loading to the treatment plant should not increase.

4.2.1 Pump Upgrade

Replacing the current pumps with larger capacity pumps will reduce overflows at the pump stations but will not address pipe capacity concerns. The larger pumps will discharge the inflow to the next pumping station and eventually to the sewage treatment plant. Increased flows into the treatment plant will overload the treatment plant during rain events. There is also the potential that there could be increased overflows at sewage forcemain discharge manholes.

4.2.2 I/I and Storm Water Reduction

The reduction of I/I and storm water into the system will reduce the volume of sewage being conveyed and treated. Reduction of I/I and storm

water will reduce the pumping requirement and the number and volume of overflows that are experienced at the pumping stations. The Town is aware of several storm water entry points that are major contributors, that if eliminated, would provide substantial reduction in storm water flows. It is not known, however, if the reduction from the known sources will be sufficient to allow new development.

4.2.3 Sewer Rehabilitation

Based on the estimated sanitary sewer flow and conversations with town staff, there are several initiatives that should be undertaken by the town to upgrade the sanitary system. The initiatives are as follows:

- Install flow monitoring equipment on the sewage pumping stations overflows to record volumes and number of overflows;
- Develop an I/I reduction strategy;
- Reduce or eliminate known sources of I/I;
- Investigate PS 2 forcemain discharge manhole and receiving collection pipe for possible blockage; and
- Continue to expand storm sewers throughout the town to establish dedicated sanitary and storm systems.

4.3 Treatment Plant

The wastewater treatment plant is currently treating an estimated average day flow of 422,360 Lpd (92,930 Igpm), which is less than the design average day flow of 852,000 Lpd (187,460 Igpd). There is, therefore, additional capacity in the treatment system based on average day conditions.

The flow meter requires repair or replacement to confirm the assumptions of flow. Additional effluent quality data is also needed to confirm that the system is in compliance with the existing permit to operate.

Chapter 5 Summary and Opinion of Cost

5.1 Water System

The existing pumps, once the upgrades have been completed, appear to be capable of meeting the estimated future population. The maximum pumping rate, however, will need to be verified once the pump upgrades have been completed.

The membrane system can be easily expanded by adding up to 4 additional membrane modules per train. Each membrane module is designed for 56.8 Lpm. Pall provided a quote of $2,400 per membrane.

The volume of reservoir is sufficient to meet the project population and water demands.

The water distribution system cannot supply the recommended fire flows for fire protection to the Town's residents. Modifications to the distribution system have been presented that will provide the recommend fire flows to the existing Town residents. The modifications required to meet the fire flow demands are also required to provide reliable domestic and fire flow protection to the potential developments.

A salt water dry hydrant could be used as an alternative to upgrading the distribution system to supply fire flows. This would however only provide fire protection to residents adjacent to the dry hydrant. An assessment of the existing collection system ability to supply only domestic flows to the potential developments concluded that fire flows would be reduced to between 370 and 909 Lpm (75 and 200 Igpm).

In the event that the potential developments were built ahead of the recommend distribution systems modification the existing distribution system could supply the potential developments with maximum day demand. Peak hour demands could also e supplied but with limitations. Under a peak hour situation the distribution pressures at elevations higher than 25 m will generally see a reduction in pressures. The higher elevations in the Hawthorne and Wye developments will see pressures as low as 20-25 psi under peak hour demands.

5.2 Wastewater System

Connecting new development to the sanitary system should be done in such a method as to not increase sanitary overflows. Increasing pumping capacity to offset any increase in sanitary flows is not recommended. Storm water separation, and I/I reduction measures should be implemented

to free up capacity in the wastewater collection and treatment system. A detailed investigation would be required to determine the cost to remove I/I from known storm water entry points.

It is important that, prior to any work being conducted to remove I/I or storm water from the system, the existing frequency and volume of pump station overflows should be measured. The pump station controller can be upgraded to allow it to communicate to the new water treatment plant SCADA system. This upgrade would provide continuous online monitoring of wet well liquid level which could be used to determine when the pump station is overflowing and the volume of overflow.

Town staffs have reported that the discharge manhole for PS 2 forcemain overflows. The manhole and gravity sewer should be inspected for blockages.

The flow meter at the wastewater treatment plant is not functioning properly. It is recommended that the flow meter be repaired or replaced.

It is recommended that the effluent from the wastewater treatment plant be sampled and analysed as per the requirements of NSEL.

5.3 Opinion of Modifiaction Capital Costs

CBCL's cost database was used to estimate capital costs. Costs are +/- 25% and exclude land acquisition costs, if required, and HST. A 25% engineering and contingency has been incorporated into the costs. This cost represents the consultant's opinion of probable construction costs. The consultant has no control over the cost or availability of labour, equipment, materials, or over market conditions or the contractor's method of pricing. The consultant's opinions of probable construction costs are made on the basis of the consultant's professional judgement and experience. The consultant makes no warranty, express or implied, that the bids or the negotiated cost of the work will not vary from the consultants opinion of probable construction costs.

5.3.1 Estimate of Potential Development Service Extension Capital Costs

The opinion of capital costs of the water distribution and wastewater collection system improvements are presented in Table 8. The costs have been broken down to fire flow improvements and service extensions to potential developments.

Table 8: Summary of Distribution and Collection Capital Costs

Potential Development	Water Distribution Extension	Wastewater Collection Extension	Total
MADE for Mahone Bay	$ 88,100	$ 50,000	$ 130,100
Hawthorne Development	$ 562,500	$ 150,000	$ 712,500
Wye Street	$ 462,500	$ 150,000	$ 612,500
Bay Center	$ 293,750	$ 252,500	$ 546,250
Kinburn	N/A	N/A	See note
Harbour Lands	N/A	N/A	See note
Quinlan	N/A	N/A	See note

Note: Extensions of distribution/collection system not required for servicing or development exists and already serviced.

5.3.2 Estimate of Fire Flow Upgrades Capital Cost

The opinion of capital costs to improve the fire flows are presented in Table 9.

Table 9: Fire Flow Improvements Capital Costs

Description	Cost
Main Street	$1,381,950
Edgewater Street	$ 176,120
Fairmont Street	$ 233,490
Clearway Street	$ 297,850
Total	**$2,089,410**

5.3.3 Estimate of Mechanical Upgrade Capital Cost

The opinion of capital costs to upgrade mechanical equipment is presented in Table 10.

Table10: Mechanical Upgrade Capital Costs

Description	Cost
Pump station SCADA System	$ 7,500
Raw Water Pump Upgrades	$ 30,000
Additional Membrane Modules (4 per skid)	$ 2,400 each
Waste Water Pump Upgrades	$80,000
Wastewater Flow Meter	$ 3,000

Appendix A

Figures

Appendix B

CGI Fire Flow Test Results

Report for

Town of Mahone Bay

Sewage Options Project - 2018

Bluenose Coastal Action Foundation

ABLE

Table of Contents

January 31st, 2018
493 Main Street
Mahone Bay, Nova Scotia

Phone: 902 624 8327
Email: clerk@townofmahonebay.ca

The Town of Mahone Bay has requested a sewer study along Edgewater Street, as far as Main Street, and along Main Street at the treatment plant road eastward for approximately 300 meters. The purpose of the study is to evaluate and determine the best solution for affected properties in these areas. Some properties have functioning sewage disposal systems, while others have straight sewage pipes that discharge directly into the waters of Mahone Bay. The areas under review are geographically separated and each area has a different solution that has been developed for your review:

1. A series of on-site sewage disposal systems to service the properties along Edgewater Street

This option replies on a possible Town led program to create a Wastewater Management District and replace the straight pipes with new on-site sewage disposal systems. Similar programs in Nova Scotia have qualified for two-thirds cost sharing from the federal and provincial governments, resulting in the benefitting property owners contributing a little over one-third of the total project cost.

2. A 300-m extension of the existing conventional gravity sewer along Main Street to the Town Boundary at Maders Cove.

This proposed sewer extension will remove at least four straight pipes from discharging into the basin in this area. It will also allow another six homeowners along the 300m route to discharge into the sewer system, retiring their onsite sewage disposal systems, when required.

The proposed project involves collection of sewage in gravity lines draining to an existing lift station which pumps the sewage to the sewage treatment plant.

The project is estimated to require a capital investment of $207,310 and annual operating costs of $800.

S. Brooke Nodding
Executive Director
Bluenose Coastal Action

Andre Veinotte
Engineer
ABLE Engineering Services Inc.

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2.0 Current State of Existing Properties

The Town of Mahone Bay is located on the northwest shore of Mahone Bay, along the South Shore of Nova Scotia, in Lunenburg County. The sewage collection system for the Town consists of a combination of gravity sewer pipes and a sewage force main that all feed into a series of three wastewater collection pumping stations leading to a wastewater treatment plant constructed in 1994. The current system is a combined sewage – stormwater system that, on occasion, may overflow. Not all Town of Mahone Bay residents are connected to the Town's central wastewater treatment facility. There are approximately 30 properties not currently connected; some of which are presumed to have straight pipe septic systems directly discharging untreated sewage into Mahone Bay.

A survey was prepared and sent to the residents by the town. Of the 30 property owners surveyed, 13 responded with information regarding the type and condition/effectiveness of their existing on-site sewage treatment system.

After receiving the information from the property owners, staff from ABLE Engineering Services carried out a field survey on those properties that are not connected to central sewer and were identified as lacking functional on-site sewage treatment systems.

A summary of the state of identified properties can be found in Table A.

Table A Summary of Identified Properties

Street	Civic #	Straight Pipe	On-site System?	Comments
Edgewater	261	No	Yes	Currently serviced by an ATU which was installed in May 2016.
Edgewater	255	No	Yes	Civic numbers 255, 249 and 237 form a condo corp. The condominum is serviced by a 20 year old pumped C2-R located on the northern portion of the property
Edgewater	249	No	Yes	
Edgewater	237	No	Yes	
Edgewater	217	No	Yes	Currently serviced by a sloping sand filter which was installed in 2015
Edgewater	205	No	Yes	Currently serviced by an unknown on-site sewage disposal system. There is sufficient room for a replacement system if deemed nessesary.
Edgewater	191	No	Yes	Currently serviced by an unknown on-site sewage disposal system. There is sufficient room for a replacement system if deemed nessesary.
Edgewater	165	No	Yes	Currently serviced by an unknown on-site sewage disposal system. There is sufficient room for a replacement system if deemed nessesary, probably a holding tank.
Edgewater	141	No	Yes	Currently serviced by an unknown on-site sewage disposal system. There is sufficient room for a replacement system if deemed nessesary.
Edgewater	133	No	Yes	Currently serviced by an unknown on-site sewage disposal system (new tank in 2015). There is sufficient room for a replacement system if deemed nessesary, probably an ATU.
Edgewater	121	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-03. The proposed system will likely be a sloping sand filter.
Edgewater	101	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-04. Sewage will be will likely be a timed dose sloping sand filter.
Edgewater	97	No	No	Connected via pump system to sewer main beneath Orchard St.. There is sufficient room for a replacement system if deemed nessesary.
Edgewater	89	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-04. Sewage will be will likely be a timed dose ATU system with outfall to ditch.
Edgewater	77	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-04. The proposed system will likely be a sloping sand filter.
Edgewater	63	Yes	No	Anglican Church - one sink only; no toilets in church. Could be connected to Rectory Building (civic 53) which is serviced by sewer main below Parish Street, or install new ATU as shown in SK-04
Edgewater	53	No	No	Anglican Church Rectory - connected to sewer main beneath Parish St.
Main	922	No	No	Connected to sewer main beneath Main St.
Main	924	No	No	Connected to sewer main beneath Main St.
Main	932	No	No	Connected to sewer main beneath Main St.
Main	942	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-05. An on-site system would likely be an ATU.
Main	944	No	Yes	2 residences on this property, owner reports each with a functioning on-site sewage system.
Main	958	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-05. An on-site system would likely be an ATU.
Main	964	No	Yes	Currently serviced by an ATU which was installed in August 2017.
Main	970	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-05. An on-site system would likely be an ATU.
Main	984	Yes	No	There is sufficient room for a replacement system as shown in Drawing SK-05. An on-site system would likely be an ATU.
Main	994	No	Yes	Owner indicated has septic tank and disposal field of unknown type. There is sufficient room for a replacement system if deemed nessesary.
Main	995	No	No	No building on this property (former Smeltzer Boat Shed).
Main	997	No	No	Boat shed with no water or sewer facilities.

2.1 Sewage Treatment Options

Of the 30 identified properties, 9 have been found to be discharging untreated waste into the Mahone Bay Harbour. A common public misconception is that people think they are "grandfathered" to continue to allow this sewage to discharge untreated into the environment. This concept was finally eliminated in 2007 when the *NS Environment Act* was updated. If a person cannot find an acceptable solution to manage sewage on their property, Nova Scotia Environment now has the authority to terminate legal occupancy. Thankfully, this has not yet happened, although there have been several cases where existing lots have been denied building permits due to the inability for a proper sewage management system to be installed.

To decide if these properties should be connected to the existing central sewage system, or be solved using a decentralized approach, is determined by the cost per connection.

2.1.1 On-site Sewage Disposal

A modern on-site sewage disposal system is a very efficient way to manage sewage from a structure in a responsible manner. A modern system consists of a septic tank, which receives all the effluent that has been generated. It is sized to allow time for settleable solids to sink to the bottom, even when there are high peak loadings. The environment in a septic tank is anaerobic – meaning the bacteria that live in there do not require oxygen. What leaves the septic tank is a liquid, tea-like effluent that still contains at least half of the phosphorous, much of the nitrogen, and enough living bacteria and possibly viruses to still represent a potential health risk to the public. The effluent leaving the tank still requires treatment.

The most common way to treat this effluent is to introduce it to the subsurface, in a gentle manner, by spreading it out along a contour on a slope in a trench, or where it is flat and there is enough soil, in a bed. Ideally, for this to work for the lifetime of the residence, this effluent should be released to the bed or contour intermittently. Otherwise it will trickle into a bed and slowly overload the soil until it is plugged and in need of replacement. This usually takes about 15-25 years.

Where there is insufficient space for a conventional system, alternative methods can be used to pre-treat the effluent, through a series of aeration chambers, prior to releasing it to the soils. This type of technology is called an Aerobic Treatment Unit (ATU). There are several ATU's approved for use in Nova Scotia. They can be scaled up in size and used in non-residential applications.

Some properties produce high cyclic weekly loading, followed by time periods of minimal loading in-between. This is the case for many community buildings including churches. Since most of the capital cost for a system is due to the construction of the disposal field, it is often best to design the disposal field for the average weekly flow, rather than the peak flow when the facility is at full capacity (such as a wedding or funeral). To this end, we generally add storage tanks, and using a simple timer, slowly release the effluent to the disposal field over a period of time (yet to be designed). This method is called "timed-dose storage".

The estimated capital costs for servicing the discharging properties with on-site systems are listed in Table B.

Table B Capital Costs Estimate for On-site Sewage

Property Identifier	Probable System		Construction Cost	Engineering Cost
121 Edgewater St.	Gravity Sloping Sand Filter		$13,000	$1,390
101 Edgewater St.	Time Dose Sloping Sand Filter		$25,000	$1,390
89 Edgewater St.	Time Dose ATU		$30,000	$1,390
77 Edgewater St.	Pressurized Sloping Sand Filter		$16,000	$1,390
63 Edgewater St.	Combine Sewer with Rectory		$2,000	$0
		Sub-total	**$91,560**	**$5,560**
942 Main St.	ATU with dispersion		$19,000	$1,390
958 Main St.	ATU		$18,000	$1,390
970 Main St.	ATU		$18,000	$1,390
984 Main St.	ATU with dispersion		$19,000	$1,390
		Sub-total	**$79,560**	**$5,560**
			Total	**$171,120**

2.1.2 Sewer Extension

Extending the central sewer system to connect the identified properties can provide some nice advantages to the owners of the properties and, in some cases, the community. Municipal systems can properly, and cost-effectively, manage large volumes of waste water from a variety of residential and commercial sources and home buyers often view them as adding value to a home.

When on-site sewage disposal systems are maintained by public agencies, homeowners feel less responsible for their care and upkeep. That said, there are pros and cons associated with sewer systems.

Some benefits include:

- Home buyers generally view central sewer systems favorably.
- Central sewer systems rely on less regular maintenance from the homeowner to continue to function properly.
- Compared to on-site sewage disposal systems, central sewer systems may be less sensitive to non-human waste that is commonly flushed down the pipes.

Some drawbacks include:

- Off-property sewer upgrades can cost homeowners quite a bit either in billing increases or at the time of a home purchase.
- Homeowners are responsible for maintaining the sewer line that connects the house to the public sewer system. When this line clogs or deteriorates, repairs are necessary.

The estimated capital costs for servicing the discharging properties with on-site systems are listed in Table B.

Servicing properties along Edgewater Street was not seriously considered due to its topography; it would require a pump station to move the sewage from the properties to the nearest sewer main. The pump station generally costs $100K itself, and we estimate a cost of at least another $100K to route the new gravity sewers and force main. The estimated capital costs for servicing the discharging properties with central sewer are listed in Table C.

Table C Capital Costs Estimate for Sewer Extension

Property Identifier		Estimated Cost
Edgewater St.	Pump Station and Sewer Extension to Civic #121	>$200,000
	Sub-total	$N/A
Main St. East	8" Sanitary Gravity Sewer	$65,000
	Manholes	$16,500
	Lateral Connections	$10,250
	Engineering	$19,000
	Contingency Allowance	$5,000
	Sub-total	$115,750
	Total	**>$315,750**

3.0 Detailed Cost Comparisons and Finances

Along Edgewater Street, the choice to treat sewage from a financial perspective is simple. The properties in this section should be serviced with on-site sewage disposal systems.

The identified properties on Main Street, are somewhat more challenging to solve using the on-site sewage method. This is primarily due to space constraints on the lots, and the presence of drinking water wells. Fortunately, the topography of the area may provide an option to install a sewer extension in this section of town.

It should also be noted that if Main Street is to be excavated for installation of new sewer main, the Town should also consider extension of water main at the same time, and as well should consider replacing all cross culverts within the work area.

The capital costs for the two options are shown in Tables B and C.

On-site sewage disposal systems can qualify for funding programs much in the same way that central water or sewer infrastructure would, but they must be located within an area that has been established through a by-law as a Wastewater Management District (WMD). Once the WMD is created, the systems can be considered Municipally owned, operated, and maintained for a period of time (minimum 10 years).

Wastewater management districts are areas established by a Municipality (similar to a sewer district), but within which it has the authority to manage all wastewater treatment systems both public and private (i.e. individual, on-site sewage disposal systems). This means that in a WMD a Municipality has the authority to enter onto private property for purposes of constructing, inspecting, repairing, upgrading or replacing on-site septic treatment systems. The Municipality also has the authority to establish charges similar to those in a sewer district, to carry out the above noted duties.

The link below is to information from Municipal Affairs regarding WMDs and explains the process on setting up a WMD.

https://novascotia.ca/dma/pdf/mun-local-government-resource-handbook-5-10.pdf

3.1.1 Estimated Construction Costs

Property Identifier	Capital Cost	Cost/Connection
Edgewater St **On-site Sewage Disposal Systems**	$85,560	$21,390*
Edgewater St **Sewer Extension**	>$200,000	>$50,000
Main St. **On-site Sewage Disposal Systems**	$79,560	$19,890
Main St. **Sewer Extension**	$115,750	$28,938

*** Cost per connections are somewhat higher than typical due to the sewage load from the Churches.**

3.1.2 Estimate of Annual Operating Costs

On-site Sewage Disposal:

This report assumes the Town will enact a Wastewater Management District by-law, per the *NS Municipal Government Act*. The new systems would be owned by the Town for a period of 10 years. Maintenance costs for the proposed systems will vary somewhat, but average approximately $200 per year. The property owners would be responsible for energy costs in cases where pumps or compressors are utilized in the design. In the event that ownership of the sewage disposal system remains with the property owner, costs to the town would be nil.

Sewer Extension:

Additional energy costs would be approximately $400 per year for eight new connections to the existing pumping station. Another $100 would be needed annually for normal maintenance and repairs. Wastewater treatment costs to the Town of Mahone Bay for the proposed 300-meter extension are as follows:

Maintain Sewers and Lift stations/year		$500
Additional operating costs		$100
	Total	$600

3.2. Finances

The financial requirements to carry out the project are estimated to be between $171,120 and $207,310 for the construction costs depending if the discharging properties are serviced only by on-site sewage disposal or a combination of a gravity sewer system extension and on-site sewage disposal systems.

If a Wastewater Management District is enacted, then all capital costs would quality to be funded equally by the three levels of government. Other Municipalities have successfully received Federal funding from the Small Communities Fund to finance their WMDs.

3.3 CHANGES OR RISKS

The project costs are always an unknown until such time as the project is put out to tender. There is always the risk that costs of contractors willing to complete the work could increase suddenly due to competing projects commencing at the same time. Tenders will be evaluated upon receipt, and, if over budget, there is always the option of re-tendering at a later date or dividing the project up into manageable components.

Risks of delays of one or more components of the project are reduced as they are all being handled by the same firm; and the contractors will be expected to co-ordinate work schedules for successful project completion.

4.0 Impact of Climate Change on Pump Stations

In Nova Scotia, we are already experiencing warmer, wetter winters and hotter, drier summers compared to a few decades ago. Coastal sensitivity maps show that most of Nova Scotia is vulnerable to the effects of climate change. Much of our infrastructure was not built for a higher frequency of extreme weather events. By the end of the century, we can expect rapid acceleration in climate change, far beyond what we have observed to date. Likely impacts on the environment, society, and economy need to be addressed if we do not want to feel the full effects of more frequent and intense weather events, rising sea levels, and changes in our biodiversity and ecosystems.

Richards and Daigle (2011) state that local, or "relative" sea level in the neighbouring Town of Lunenburg is expected to rise by **0.9 meters** by year 2100. Areas of the coast will be permanently inundated due to sea level rise. Of greater concern, however, are the impacts associated with a higher possible storm surge. With local sea level higher, storm surges will reach further inland and could flood areas that have not been at risk of flooding in the past. In addition, storms may become more frequent and intense due to climate change, which means that the likelihood of a disastrous storm surge increases. While a number of hazards will be more likely to occur in the Town of Lunenburg due to climate change, this report focuses on the hazards associated with sea level rise and storm surge. We provide information on which areas of the Town will likely be affected by coastal inundation or an extreme storm surge, and illustrate the locations of infrastructure, buildings, and other community assets that may be at risk. We conclude by recommending adaptation measures that should be taken in order to prepare for possible sea level rise and storm surge scenarios.

Plausible Upper Bound Water Level in Lunenburg for Year 2100, calculated as the sum of: current HHWLT, predicted sea-level rise plus error bar, and the maximum storm surge recorded to date (Table B 22 - Richards and Daigle, 2011, p. 78) HHWLT (m) (CGVD28) Sea-Level Rise (2100) + Error Bar (m) Maximum Storm Surge to Date (m) Plausible Upper Bound Water Level (m) by Year 2100 1.63 1.54 1.63 **= 4.8 m** for Lunenburg and surrounding area which would include the Town of Mahone Bay.

4.1 Climate Change Mitigation Strategies for Sewage Collection and Pumping Stations

As previously discussed, the Town of Mahone Bay will see maximum storm surges in the order of 4.8m by the year 2100. As they currently exist, these storm surges will flood the sewage pumping stations and the water would then gravitate to the collection system. Street flooding following a rain event may also inundate pump stations and damage electrical equipment. The magnitude of the risk of a pump station experiencing flooding depends on their location and exact design. The impact of flooding would be wet well overflow that normally would cause local contamination and human health risk. In the case of flooding due to storm surge, the overflow would also be underwater and non-functional which would result in possible local sewage backups.

There are several strategies that can be implemented to improve the performance of pump stations against flooding events.

- Raising tops of lift stations above expected sea level rise and predicted storm surge levels to prevent storm water entering the system.
- Installing flapper valves, or one-way valves, on all overflows from sewage collection system to prevent sea water entering collection system.
- Installing watertight covers on lift stations and manholes to prevent storm water entering system.
- Install holding tank or surge tanks at lift stations to hold sewage during periods of extended power outages caused by storm events.
- Eliminate combined sewer systems to vastly decrease the inflow into the collection system.
- Eliminate and/or reduce storm water entering sanitary sewers from roof drains, sump pumps, leaking manholes, pipes, etc.
- Provide back-up power and/or portable pumping equipment for pumping stations and sewage treatment facilities.
- All new sewage infrastructure to be constructed to accommodate predicted climate change events.
- Steer new development and infrastructure away from low lying areas.

Each of these items would require a detailed engineering design to be implemented, and should be studied in detail to determine which items would provide the maximum benefit against flooding.

5.0 Conclusion

Of the 30 identified properties, only eight were confirmed to have sewage straight pipes which discharge into the harbour. An additional pipe, consisting of discharge from a sink, was also found, but can be readily connected to a structure that exists on the same lot.

There are also six properties that have systems of an unknown type, and are unverifiable. We have confirmed that each of these properties can be serviced with replacement on-site sewage disposal systems in the event of a malfunction.

The properties located on Edgewater Street are not practically serviceable from the central system, due to the distance from services and because a pump station would be required. As a result, on-site sewage disposal systems are proposed for the 4 properties in this area that have straight pipe sewage systems.

The option of an extension to the gravity collection system along Main Street has a number of benefits to the environment. The proposed sewage collection system will eliminate the discharges in this area from the 4 existing straight pipes. This option may also provide an avenue for future growth for the Town. The parcels of land along this section of Main Street are large as the lot sizes are currently restricted by on-site sewage regulations.

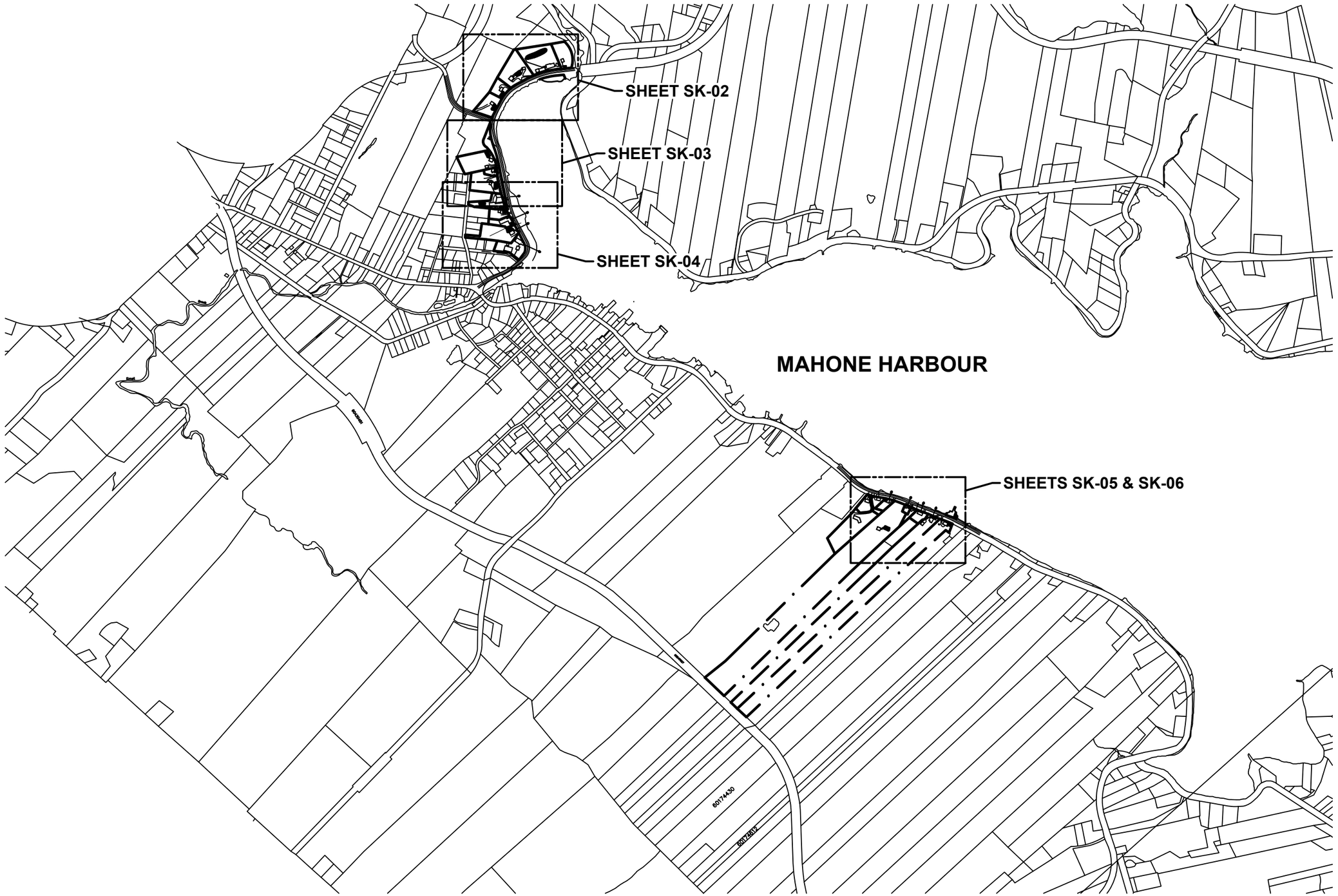
In the event that a Main Street sewer extension is not acceptable to the Town of Mahone Bay, on-site sewage disposal systems can be installed in this area if needed.

If a Wastewater Management District is created, all capital costs for sewage projects, even those built on private lands, qualify for funding from the Federal and Provincial governments.

References:

William Richards and Réal Daigle, *"Senarios and Guidance to Climate Change and Sea Level Rise – NS and PEI municipalities"*

Appendix A Drawings



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Bluenose Coastal Action Foundation

LEGEND

BOUNDARY LINE
DITCH LINE..CENTER LINE OF DITCH
OHWM.....ORDINARY HIGH WATER MARK
OWM.....ORDINARY WATER MARK
ROW.....RIGHT OF WAY BOUNDARY

GENERAL NOTES:
- DRAWING UNITS ARE IN METERS.
- PROPERTY BOUNDARIES SHOWN HAVE BEEN DERIVED FROM NSPRD INFORMATION AND AERIAL IMAGERY.

PROJECT

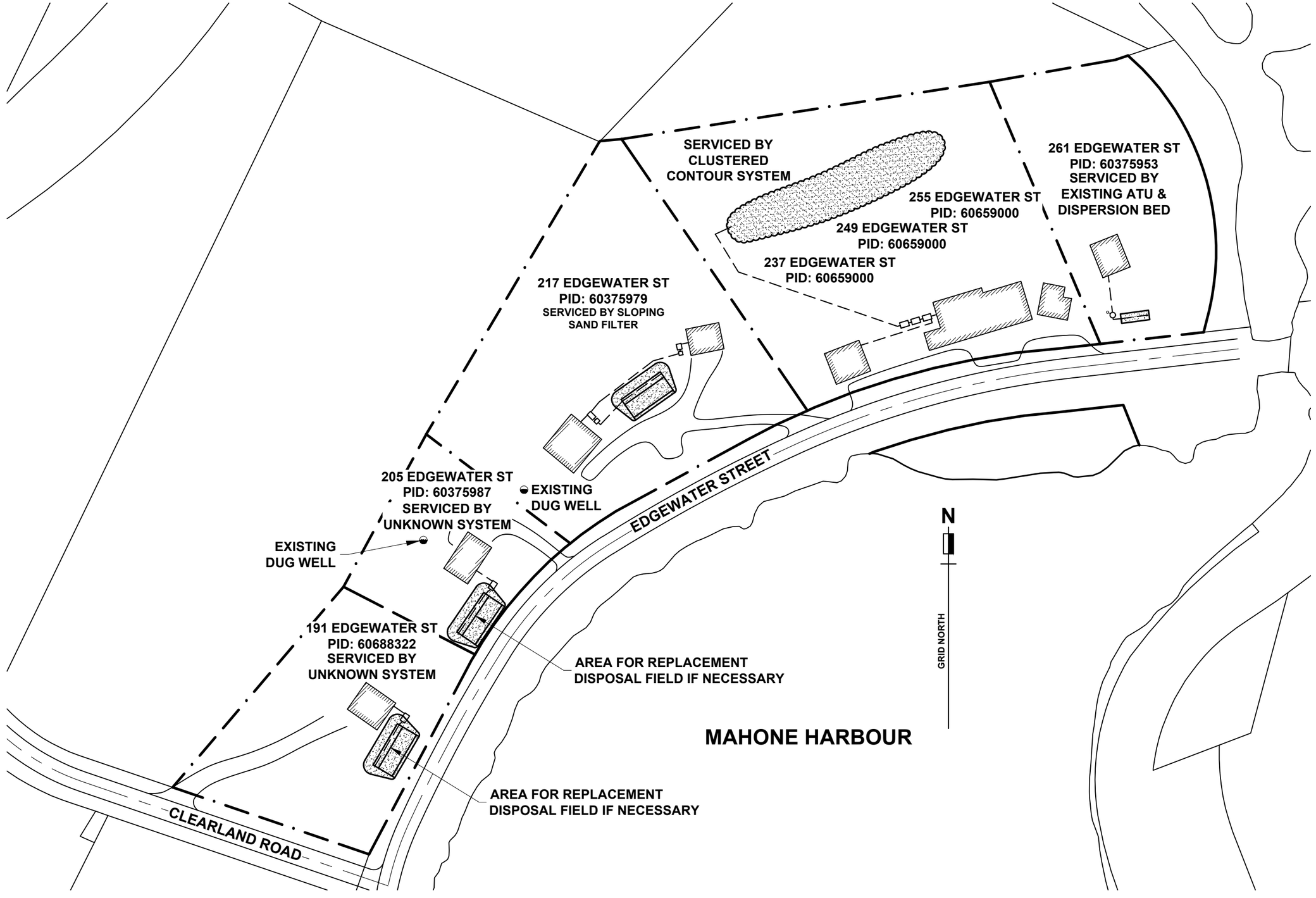
BLUENOSE COASTAL ACTION FOUNDATION SEWAGE STUDY MAHONE BAY

DRAWING

EXISTING STRAIGHT PIPE KEY PLAN

DESIGNED	A.VEINOTTE
DATE	02FEBRUARY2018
DRAWN	M.ENGLAND
DATE	02FEBRUARY2018
CHECKED	A.VEINOTTE
DATE	02FEBRUARY2018
APPROVED	
DATE	

PROJECT NO.	REVISION
170726-04	A
DRAWING NO.	SHEET NO.
SK-01	1 OF 6



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Bluenose Coastal Action Foundation

LEGEND

STRAIGHT PIPE----------

SEPTIC TANK----------

SLOPING SAND FILTER-

DISPERSION BED---------

PEAT MODULE----------

ADVANCED TREATMENT UNIT--------

BOUNDARY LINE

DITCH LINE..CENTER LINE OF DITCH
OHWM.....ORDINARY HIGH WATER MARK
OWM.....ORDINARY WATER MARK
ROW.....RIGHT OF WAY BOUNDARY

GENERAL NOTES:
- DRAWING UNITS ARE IN METERS.
- PROPERTY BOUNDARIES SHOWN HAVE BEEN DERIVED FROM NSPRD INFORMATION AND AERIAL IMAGERY.

PROJECT

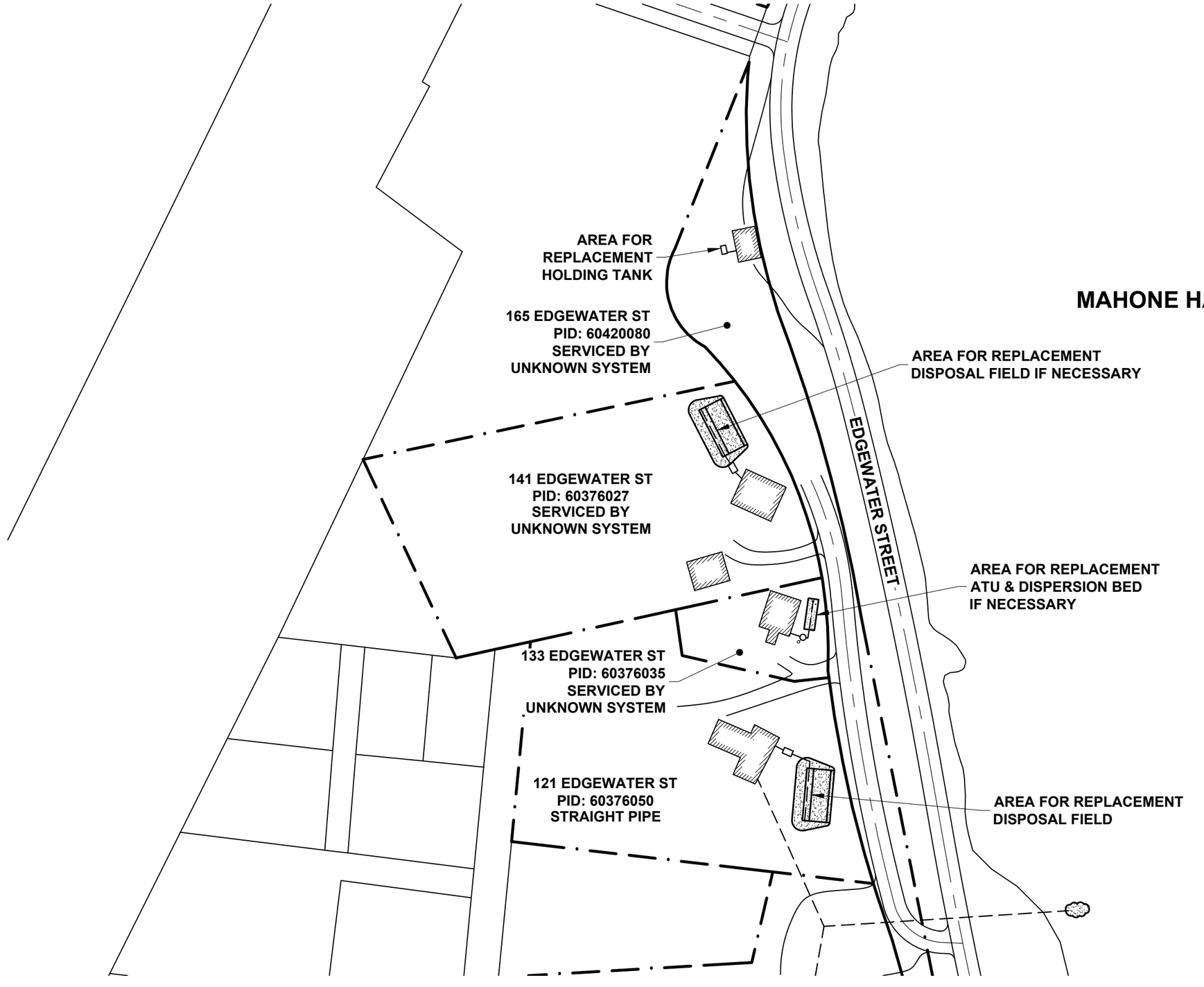
BLUENOSE COASTAL ACTION FOUNDATION SEWAGE STUDY MAHONE BAY

DRAWING

EDGEWATER STREET NORTH EXISTING & CONCEPTUAL ON-SITE PLAN

DESIGNED	A.VEINOTTE
DATE	02FEBRUARY2018
DRAWN	M.ENGLAND
DATE	02FEBRUARY2018
CHECKED	A.VEINOTTE
DATE	02FEBRUARY2018
APPROVED	
DATE	

PROJECT NO.	REVISION
170726-04	A
DRAWING NO.	SHEET NO.
SK-02	2 OF 6



ABLE

ABLE ENGINEERING SERVICES INC.
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P.O. BOX 959
CHESTER, NOVA SCOTIA, B0J 1J0
TEL. 1-833-756-8433
FAX. 902-273-3072
engineering@ableinc.ca

Bluenose Coastal Action Foundation

LEGEND

STRAIGHT PIPE----------
SEPTIC TANK----------
SLOPING SAND FILTER-
DISPERSION BED---------
PEAT MODULE----------
ADVANCED TREATMENT UNIT--------
BOUNDARY LINE
DITCH LINE..CENTER LINE OF DITCH
OHWM.....ORDINARY HIGH WATER MARK
OWM.....ORDINARY WATER MARK
ROW.....RIGHT OF WAY BOUNDARY

GENERAL NOTES:
- DRAWING UNITS ARE IN METERS.
- PROPERTY BOUNDARIES SHOWN HAVE BEEN DERIVED FROM NSPRD INFORMATION AND AERIAL IMAGERY.

PROJECT

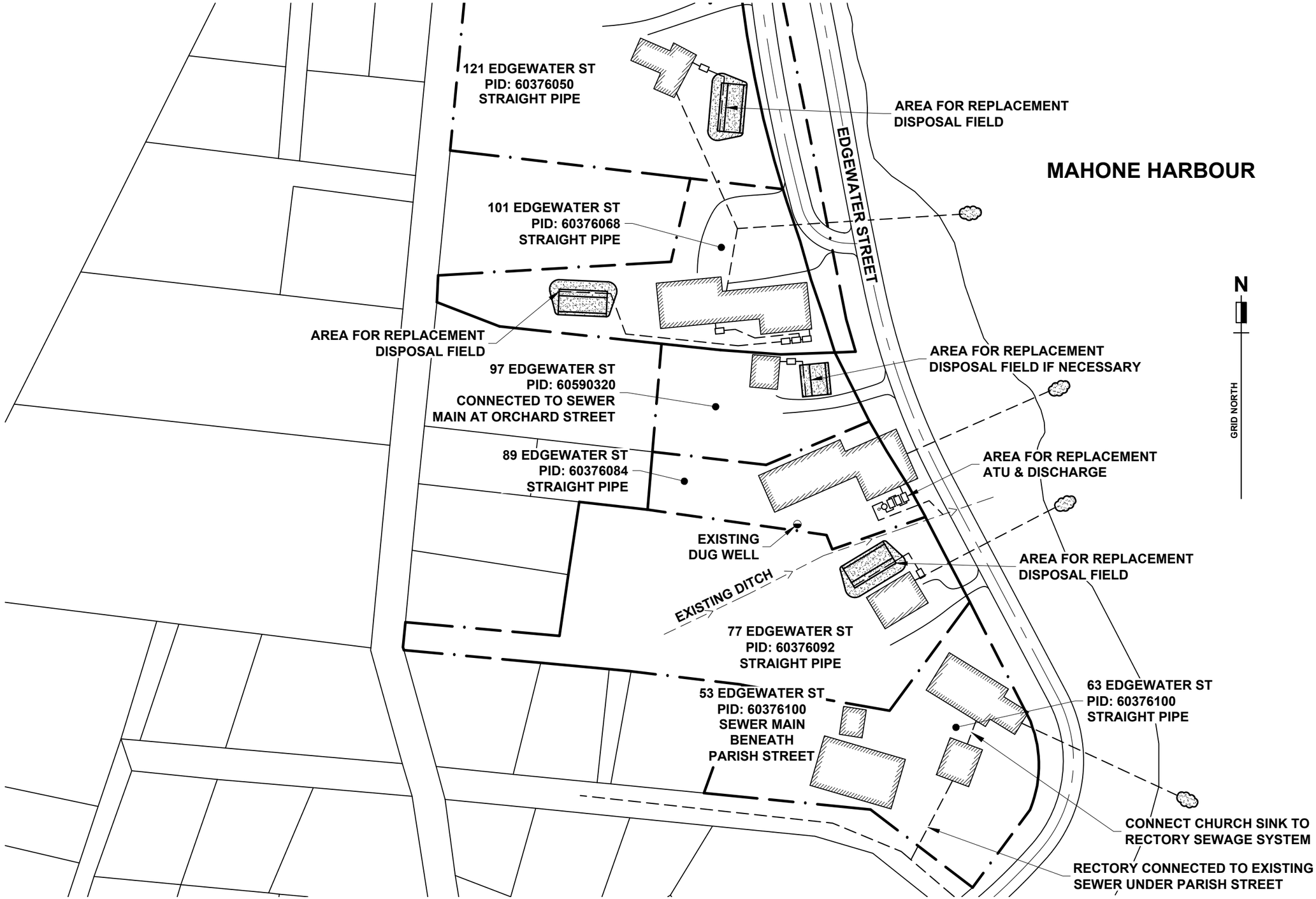
BLUENOSE COASTAL ACTION FOUNDATION SEWAGE STUDY MAHONE BAY

DRAWING

EDGEWATER STREET EXISTING & CONCEPTUAL ON-SITE PLAN

DESIGNED	A.VEINOTTE
DATE	02FEBRUARY2018
DRAWN	M.ENGLAND
DATE	02FEBRUARY2018
CHECKED	A.VEINOTTE
DATE	02FEBRUARY2018
APPROVED	
DATE	

PROJECT NO.	REVISION
170726-04	A
DRAWING NO.	SHEET NO.
SK-03	3 OF 6



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Bluenose Coastal Action Foundation

LEGEND

STRAIGHT PIPE----------
SEPTIC TANK----------
SLOPING SAND FILTER-
DISPERSION BED---------
PEAT MODULE----------
ADVANCED TREATMENT UNIT--------
BOUNDARY LINE
DITCH LINE..CENTER LINE OF DITCH
OHWM.....ORDINARY HIGH WATER MARK
OWM.....ORDINARY WATER MARK
ROW.....RIGHT OF WAY BOUNDARY

GENERAL NOTES:
- DRAWING UNITS ARE IN METERS.
- PROPERTY BOUNDARIES SHOWN HAVE BEEN DERIVED FROM NSPRD INFORMATION AND AERIAL IMAGERY.

PROJECT

BLUENOSE COASTAL ACTION FOUNDATION SEWAGE STUDY MAHONE BAY

DRAWING

EDGEWATER STREET SOUTH EXISTING & CONCEPTUAL ON-SITE PLAN

DESIGNED	A.VEINOTTE
DATE	02FEBRUARY2018
DRAWN	M.ENGLAND
DATE	02FEBRUARY2018
CHECKED	A.VEINOTTE
DATE	02FEBRUARY2018
APPROVED	
DATE	

PROJECT NO.	REVISION
170726-04	A
DRAWING NO.	SHEET NO.
SK-04	4 OF 6

MAHONE HARBOUR

N

GRID NORTH

AREA FOR REPLACEMENT
ATU & DISPERSION BED

AREA FOR REPLACEMENT
ATU & DISCHARGE

AREA FOR REPLACEMENT
ATU & DISCHARGE

AREA FOR REPLACEMENT
ATU & DISPERSION BED

MAIN STREET

922 MAIN ST
PID: 60682622
SEWER MAIN
AT MAIN STREET

EXISTING
DUG WELL

942 MAIN ST
PID: 60371366
STRAIGHT PIPE

958 MAIN ST
PID: 60371341
STRAIGHT PIPE

964 MAIN ST
PID: 60532249
SERVICED BY ATU

932 MAIN ST
PID: 60419629
CONNECTED TO
SEWER MAIN
AT MAIN STREET

924 MAIN ST
PID: 60371374
SEWER MAIN
AT MAIN STREET

EXISTING
DUG WELLS

970 MAIN ST
PID: 60371325
STRAIGHT PIPE

EXISTING
DRILLED WELL

984 MAIN ST
PID: 60371309

EXISTING
DUG WELL

995 MAIN ST
PID: 60371291

997 MAIN ST
PID: 60504487

994 MAIN ST
PID: 60371283

AREA FOR REPLACEMENT
DISPOSAL FIELD IF NECESSARY

AREA FOR REPLACEMENT
DISPOSAL FIELD IF NECESSARY

944 MAIN ST
PID: 60371358
SERVICED BY
UNKNOWN SYSTEM

ABLE

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engineering@ableinc.ca

Bluenose
Coastal Action
Foundation

LEGEND

STRAIGHT PIPE----------
SEPTIC TANK----------
SLOPING SAND FILTER-
DISPERSION BED---------
PEAT MODULE----------
ADVANCED
TREATMENT UNIT--------
BOUNDARY LINE
DITCH LINE..CENTER LINE OF DITCH
OHWM.....ORDINARY HIGH WATER MARK
OWM.....ORDINARY WATER MARK
ROW.....RIGHT OF WAY BOUNDARY

GENERAL NOTES:
- DRAWING UNITS ARE IN METERS.
- PROPERTY BOUNDARIES SHOWN HAVE BEEN DERIVED FROM NSPRD INFORMATION AND AERIAL IMAGERY.

PROJECT

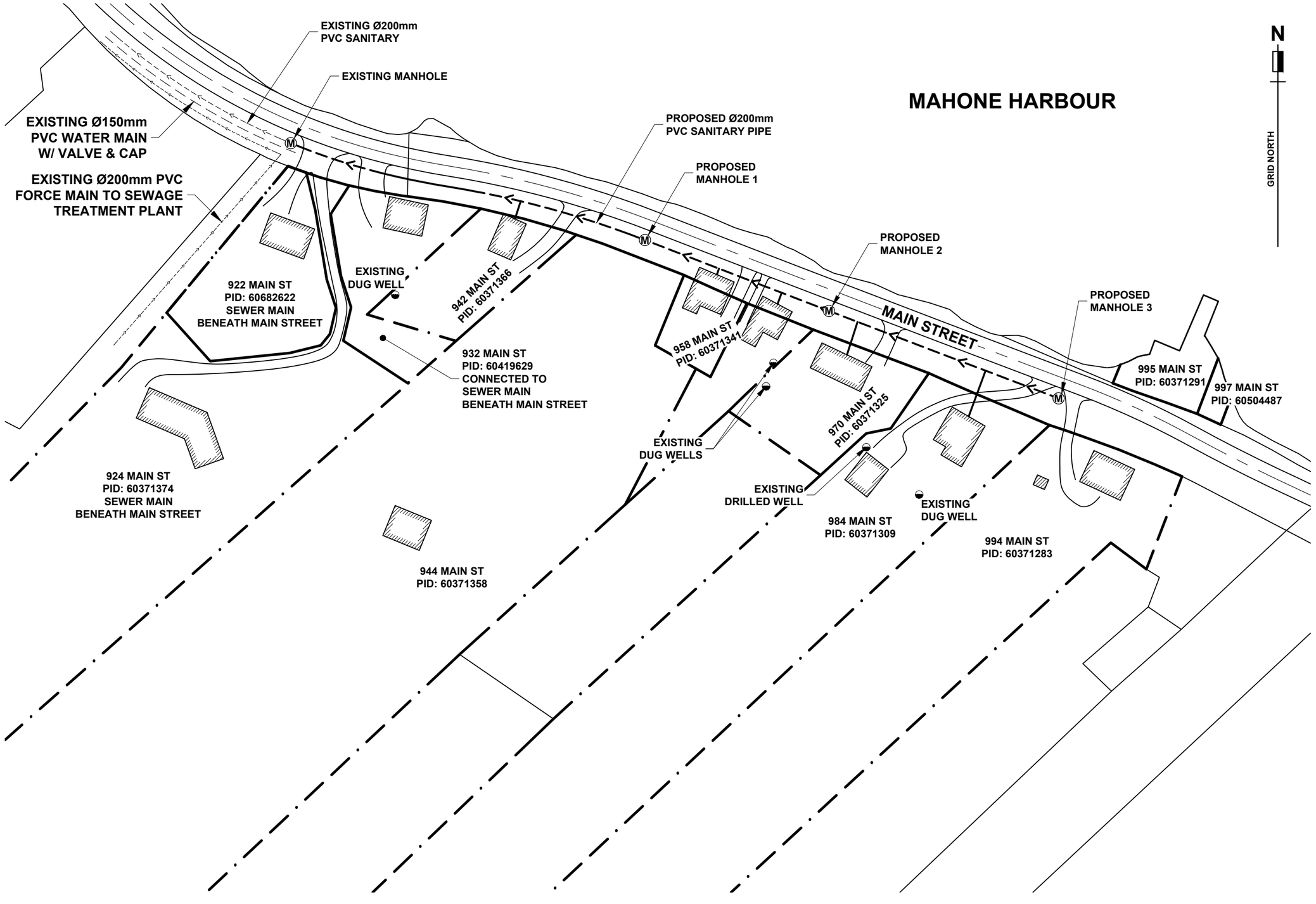
BLUENOSE COASTAL ACTION FOUNDATION SEWAGE STUDY MAHONE BAY

DRAWING

MAIN STREET EXISTING & CONCEPTUAL ON-SITE PLAN

DESIGNED	A.VEINOTTE
DATE	02FEBRUARY2018
DRAWN	M.ENGLAND
DATE	02FEBRUARY2018
CHECKED	A.VEINOTTE
DATE	02FEBRUARY2018
APPROVED	
DATE	

PROJECT NO.	REVISION
170726-04	A
DRAWING NO.	SHEET NO.
SK-05	5 OF 6



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Bluenose Coastal Action Foundation

LEGEND

PROPOSED Ø200mm PVC SANITARY PIPE

EXISTING Ø200mm PVC SANITARY PIPE

BOUNDARY LINE
DITCH LINE..CENTER LINE OF DITCH
OHWM.....ORDINARY HIGH WATER MARK
OWM.....ORDINARY WATER MARK
ROW.....RIGHT OF WAY BOUNDARY

GENERAL NOTES:
- DRAWING UNITS ARE IN METERS.
- PROPERTY BOUNDARIES SHOWN HAVE BEEN DERIVED FROM NSPRD INFORMATION AND AERIAL IMAGERY.

PROJECT

BLUENOSE COASTAL ACTION FOUNDATION SEWAGE STUDY MAHONE BAY

DRAWING

MAIN STREET PROPOSED SEWER EXTENSION CONCEPT PLAN

DESIGNED	S.DEWAR
DATE	29JANUARY2018
DRAWN	M.ENGLAND
DATE	02FEBRUARY2018
CHECKED	A.VEINOTTE
DATE	02FEBRUARY2018
APPROVED	
DATE	

PROJECT NO.	REVISION
170726-04	A
DRAWING NO.	SHEET NO.
SK-6	6 OF 6

KVM File: 648
January 11, 2019

KVM
CONSULTANTS
LIMITED

Town of Mahone Bay
493 Main Street
Mahone Bay, Nova Scotia
B0J 2E0

Attn: Derrick MacKenzie, Director of Public Works

Re: Capital Cost Estimates – Main Street Projects 1 to 4

In response to your request for scale of magnitude cost estimates we offer the following.

1.0 Understanding

The Town of Mahone Bay is considering applications for infrastructure funding. All four projects are located on various sections of Main Street. Project overviews follow with details of proposed works and the basis of cost estimates provided later in this letter report.

- Project # 1 includes watermain replacement from Fairmount Street southerly along Main Street to Civic 794.
- Project # 2 includes watermain, sanitary and storm sewer replacement between Cherry Lane and Long Hill Road.
- Project # 3 includes small diameter waterline replacement along Main Street west from Civic 147 to Civic 15 located at the Town boundary.
- Project # 4 includes watermain and sanitary sewer replacement between Long Hill Road and Civic 147 and watermain replacement from Main Street to the water treatment plant and reservoir.

All four projects are shown schematically on the attached civic address mapping.

2.0 Opinion of Probable Costs of Construction

The 2019 probable costs for each project follows. The estimates include 15% construction contingency and a 7 to 10% allowance for consulting fees.

Project #	Estimated Costs	HST (15%)	Total
1	$854,000.00	128,100.00	$982,100.00
2	$2,500,000.00	$375,000.00	$2,875,000.00
3	$314,000.00	$47,100.00	$361,100.00
4	$1,440,000.00	$216,000.00	$1,656,000.00

51 COBEQUID ROAD
SUITE 202
LOWER SACKVILLE
NOVA SCOTIA
B4C 2N1

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@eastlink.ca

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3.0 Project Details:

Project # 1

In greater detail this project will include:

- New 250 mm watermain complete with valves, hydrants and water service laterals.
- Installation of new concrete curb and sidewalk from Feaubeaux Street southerly to Civic 794. This will include widening of the paved surface to accommodate parallel parking where feasible.
- Reinstatement of all surface features disturbed during underground services installation.

Project # 2

In greater detail this project will include:

- New 300 mm watermain complete with valves, hydrants and water service laterals between Cherry Lane and Long Hill Road.
- New 200 mm raw watermain from Clearway Street to Long Hill Road.
- New 250 mm sanitary sewer complete with manholes and sewer laterals from Cherry Lane to Long Hill Road.
- New large diameter storm sewer from Clearway Street to Civic 416 and then to Ernst Brook. This component will require an easement over private property.
- Reinstatement of all surface features disturbed during underground services installation.

Project # 3

In greater detail this project will include:

- New 50 mm waterline complete with water service laterals between Civics 147 and 15.
- Reinstatement of all surface features disturbed during underground services installation.

Project # 4

In greater detail this project will include:

- New 300 mm watermain complete with valves, hydrants and water service laterals between Long Hill Road and the water treatment plant and reservoir.
- New 200 mm watermain complete with valves, hydrants and water service laterals between Civics 201 and 147.

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- New 200 mm raw watermain from Long Hill Road to the water treatment plant and reservoir.
- New 200 and 250 mm sanitary sewer including manholes and service laterals from Long Hill Road to Civic 147.
- Reinstatement of all surface features disturbed during underground services installation

4.0 Basis of Estimates

The cost estimates include a 15 % construction contingency and a 7 to 10 % allowance for consulting fees. Consulting fees will reflect the project complexity and construction duration.

The above estimates are based on conceptual layouts prepared with 1:2000 scaled topographic mapping with 2.0m contours. The mapping is based 1989 aerial photography and therefore may not be representative of current conditions.

Detailed design of the proposed works may identify underground utility crossing conflicts which could result in the need to revisit the concepts and corresponding estimated costs.

The estimates do not include land purchases or right-of-way acquisitions.

Estimates of trench rock excavation are approximation based on previous experience in the Town. The true costs of trench rock excavation will only be known when the projects are constructed.

KVM Consultants has no control over the cost of labour and materials, the contractor's method of determining prices, or competitive bidding or market conditions. This opinion of probable cost of construction is made on the basis of contractor's progress applications, experience, qualifications and best judgment of the professional consultant familiar with the construction industry. KVM Consultants cannot and does not guarantee that proposals, bids or actual construction costs will not vary from this or subsequent cost estimates.

If you have any questions or comments on the above please call at your convenience.

Yours truly,

Kent V Morash

Kent V. Morash, B.Sc, P.Eng.
KVM/mtm

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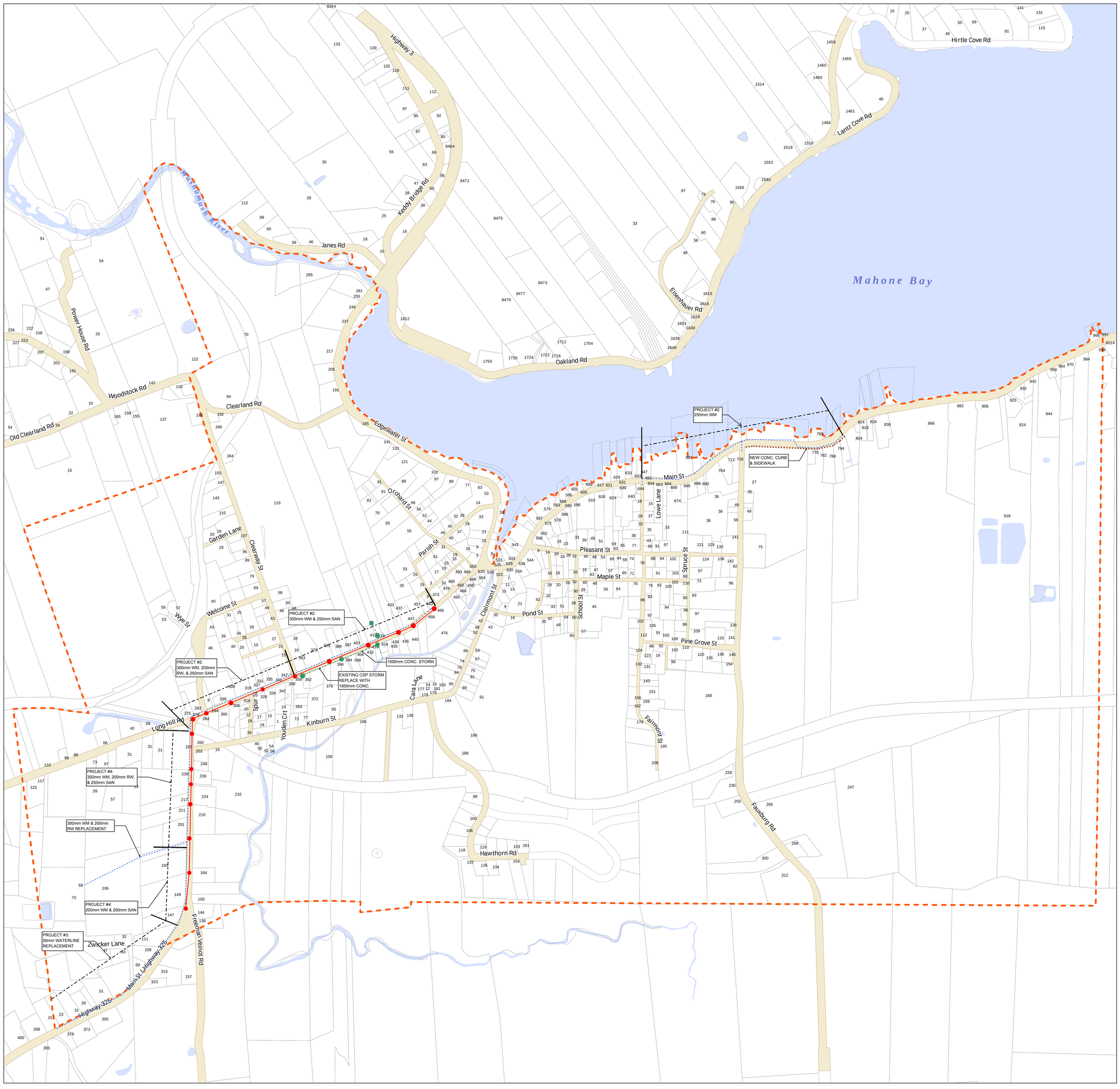
#	PROJECT	Engineer Cost Estimate	*4.286%* HST (post-rebate)	*27%* Town Share	Amort-ization Term	Deben-ture Term	*3.29%* Borrowing Cost	Total Annual Cost	% Water	*1.33%* Depreciation Transfer	TG ANNUAL COST	*Expressed as Cents on Tax Rate*	WATER ANNUAL COST	Annual Cost per Customer	*Expressed as % increase on annual bill*
1	**E. Main Waterline**	$854,000	$36,602	$238,414	40	20	$88,044	$16,323	100%	$11,845	$0	*0.00*	$28,168	$43	*6.60%*
2	**Cherry Lane to Long Hill**	$2,500,000	$107,150	$697,934	40	20	$257,740	$47,784	33%	$11,557	$31,857	*1.59*	$27,484	$42	*6.44%*
3	**W. Main Water Extension**	$314,000	$13,458	$87,661	40	20	$32,372	$6,002	100%	$4,355	$0	*0.00*	$10,357	$16	*2.43%*
4	**Long Hill to W. Boundary**	$1,440,000	$61,718	$402,010	40	20	$148,458	$27,523	50%	$9,986	$13,762	*0.69*	$23,748	$36	*5.57%*
5	**E. Main Straight Pipes**	$115,750	$4,961	$32,314	40	20	$11,933	$2,212	0%	$0	$2,212	*0.11*	$0	$0	*0.00%*
	TOTAL	$5,223,750	$223,890	**$1,458,333**			$538,547	**$99,844**		$37,744	**$47,831**	*2.39*	**$89,756**	**$138**	*21.03%*



Representation of the Town of Mahone Bay in Nova Scotia
Scale: 1:3,500,000

Scale: 1:3,500

900 450 0 900
Feet

250 125 0 250
Metres

- Civics
- Maintained Public Streets
- Properties
- Town of Mahone Bay Boundary
- Water

Colour Codes

- (Existing) Storm
- (Proposed) Storm
- (Proposed) San
- (WM) Water
- (RW) Raw Water

Rev.:	Description:	Date:
4	Updated	15/01/21
3	Updated	13/03/12
2	Updated to include Youden Crt (Private)	11/07/15
1	Updated	10/07
0	Showing public streets and civic numbers	08/01/16

TOWN OF MAHONE BAY

Civic Address Map

From Date: 14/12
To Date: 15/01
Date Printed: 15/01/21

Status: Exists
Project ID: n/a
Classification #: 05400-55

Digital Folders and File Name:
Map Library\ Mahone Bay Town\ Facilities Buildings and Structures \CivicAddressMap_Municipal_TOMB "CivicAddressMap_Municipal_TOMB_34x42"

Sources:
Digital Base Map Data from Service Nova Scotia and Municipal Relations

Prepared by the Municipality of the District of Chester

Coordinate System/Datum: UTM NAD83 CSRS ZONE 20N

Map Disclaimer:
Information shown on these drawings is compiled from numerous sources and may not be complete or accurate. The Municipality of the District of Chester is not responsible for any errors, omissions or deficiencies in these drawings.

Actual Map Size: w 42" x h 34"