Municipal Climate Change Action Plan
Town of Pictou
Final Report

131047.00 ● Final Report ● December 20, 2013

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Prepared for:
Town of Pictou

Town of Pictou
AS CONSTANT AS THE NORTHERN STAR
Birthplace of New Scotland

Prepared by:

CBCL LIMITED
Consulting Engineers

Final Report	V. Fernandez	20/12/2013	A. Wilson
Draft Report	V. Fernandez	12/11/2013	A. Wilson
Issue or Revision	***Reviewed By:***	***Date***	***Issued By:***

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December 20, 2013

Scott Conrod, CMA
Chief Administrative Officer
Town of Pictou
PO Box 640
40 Water Street
Pictou, N.S. B0K 1H0

Dear Mr. Conrod:

RE: MCCAP –Final Report

We are pleased to submit our final report for the Town's Municipal Climate Change Adaptation Plan.

Yours very truly,

CBCL Limited

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INTRODUCTION

The following action plan relates to:

- The implementation of identified projects;
- The process to be employed in the establishment of upcoming priorities, relative to infrastructure upgrades and installations; and
- Initiatives such as amendments to Municipal Planning Documents and public education endeavours.

The intent is to have infrastructure projects and initiatives mitigate the impact of climate change. With respect to infrastructure investments, this Municipal Climate Change Action Plan (MCCAP) will be used within the Town's multiple year capital budget; referred to as the Capital Investment Plan (CIP). Financing sources within the CIP typically involve the use of federal gasoline tax allocated to the Town, special reserves, grants from the Provincial and Federal governments, funding from general revenues, and long term debt. The intent of this MCCAP is to evaluate and prioritize areas prone to climate change and to also consider (weight) the impact of change and payback relative to the ratepayers of the Town.[1]

The MCCAP is a 'living document'. One component of implementation, see Chapter 8 of this plan, involves a requirement to renew and update the MCCAP at least twice in a five year cycle. The MCCAP is also intended to be companion document. To be effective the Town believes that the recommendations and implementation plan must involve and be in synchronization with the Town's Municipal Planning Documents, Integrated Community Sustainability Plan, operational budgets, and its CIP.

This plan has been laid out in nine chapters: Purpose; Local Climate Change Impacts & Hazards; Affected Locations; Affected Facilities, Infrastructure & Service Delivery; Socio-Economic and Environmental Considerations; Priorities for Adaptive Actions; Mitigation Plans; Implementation; and References.

[1] Over the last five years the Town has contributed to and withdrawn from a special "environmental project reserve". The Town further utilizes several capital budgeting techniques to prioritize projects including: the calculation of straight payback timeframes; and the development and use of discounted cash flow statements which in part recognizes the value of money over time.

CHAPTER 1 PURPOSE OF THE MCCAP

The goals of this section are to:

(1) Establish terms of reference for the Town of Pictou Municipal Climate Change Action Plan (MCCAP).
(2) Identify MCCAP team and Adaptation Committee members.
(3) Identify the stakeholders involved.
(4) Outline the process for accountability.

1.1 Background/Terms of Reference

As a requirement of the 2010-2014 Gas Tax Agreement and Municipal Funding Agreements, municipalities wishing continued access to Gas Tax funds must prepare and submit a Municipal Climate Change Action Plan (MCCAP) to Service Nova Scotia and Municipal Relations (SNSMR) by December 31, 2013. The MCCAP is an amendment to the Integrated Community sustainability Plans (ICSPs).

Mitigation Plan Process from *NS Municipal Climate Change Action Plan Guidebook*

The Nova Scotia provincial government created a Municipal Climate Change Action Plan Guidebook to assist municipalities with the development of their Action Plans. The guidebook outlines the desired approach for the development of a climate change adaptation plan to:

- Build a team;
- Determine impacts & hazards;
- Identify affected locations;
- Identify affected facilities & infrastructure;
- Outline:
  - Social Considerations;
  - Economic Considerations;
  - Environmental Considerations; and
- Establish priorities for adaptive actions.

Adaptation Plan Process from *NS Municipal Climate Change Action Plan Guidebook*

The guidebook also outlines the process for the preparation of a corporate climate change mitigation plan, which involves three steps:

- Collecting energy and emissions information;

- Completing an energy and emissions inventory table; and
- Setting goals and identifying actions for mitigation.

1.2 MCCAP Team Member/Adaptation Committee

The individuals involved in the preparation and execution of the MCCAP for the Town of Pictou, hereafter referred to the Adaptation Committee, consists of the following Town members:

Table 1.1: Contact Information for Each Member of the Adaptation Committee

Name	Contact Information
Joseph Hawes, Mayor	Pictou Town Office 40 Water Street P.O. Box 640 Pictou, Nova Scotia B0K 1H0 Phone: (902) 485-4372 Email: joe.hawes@townofpictou.ca
Cam Beaton, Deputy Mayor	Pictou Town Office 40 Water Street P.O. Box 640 Pictou, Nova Scotia B0K 1H0 Phone: (902) 485-4372
Scott Conrod, CMA Chief Administrative Officer	Pictou Town Office 40 Water Street P.O. Box 640 Pictou, Nova Scotia B0K 1H0 Phone: (902) 485-4372Email: scott.conrod@townofpictou.ca
Jim Chisholm, Town Engineer, Overall Direct Responsible Charge - Water Utility	Town of Pictou Public Works Department 40 Browns Point Rd P.O. Box 640 Pictou, Nova Scotia B0K 1H0 Phone: (902) 485-4372 jim.chisholm@townofpictou.ca

Name	Contact Information
Kyle Slaunwhite, P. Eng. Chief Operator	Wastewater Treatment Plant 183 Browns Point Road P.O. Box 640 Pictou, Nova Scotia B0K 1H0 Phone: (902) 485-4372 Email: kyle.slaunwhite@townofpictou.ca
Jeffrey Turnbull, MCIP, LLP Development Officer	Town of New Glasgow Engineering and Public Works 235 Park Street New Glasgow, Nova Scotia B2H 5B7 Phone: (902) 755-8351 Email: jeff.turnbull@newglasgow.ca
Michael Thompson, CBOI Building Official and GIS Technician	Town of New Glasgow Engineering and Public Works 235 Park Street New Glasgow, Nova Scotia B2H 5B7 Phone: (902) 755-8390 Email: Mike.Thompson@newglasgow.ca

1.3 Stakeholder Consultation

Community concerns are summarized in the Town's Integrated Community Sustainability Plan (ICSP). The document was developed in consultation with community members with the objective of establishing objectives for the environmental, economic, social and cultural sustainability of the Town. The ICSP reflects the interest of the community in focusing capital budget investments on improving the Town infrastructure related to water and waste/stormwater separation and diversion.

In addition, the Town keeps records of the weather related problems reported by the affected members of the Town, the Town staff and emergency services. These reports are considered impact indicators for weather related events and for the location of vulnerable areas.

1.4 Mandate and Process for Accountability

As required by the SNSMR, the Adaptation Committee was formed to provide advice and input to the team preparing the MCCAP. The identified climate change issues, hazards, affected locations, infrastructure and facilities and proposed adaptation actions clearly identify the issues and needs of the Town of Pictou. The Adaptation Committee and other assigned individuals will be responsible for implementing the MCCAP for their areas according to the priority level assigned to the planned adaptation measures.

The Adaptation Committee will be a permanent working group following a similar structure as the Town's Planning Advisory Committee. The committee has prepared this MCCAP in consideration of the Town's ICSP, Capital Investment Plan (CIP), and Planning Documents. External consulting expertise was engaged to facilitate an initial draft of the plan. Deliverables will be ongoing, including annual updates of the plan and inclusion of plan elements within the Town's CIPs, ICSP and Municipal Planning Documents.

The Committee is accountable to Town Council. It shall follow the CAO (Chief Administrative Officer) model of local government and provide recommendations and reports to Council through the CAO. The templates for Council briefing notes and recommendation reports will be revised to include comments, topics and recommendations relative to the MCCAP. The Council will approve a policy that includes, without limitation, the above and will receive annual update reports on the progress of the Town's MCCAP.

CHAPTER 2 LOCAL CLIMATE CHANGE IMPACTS & HAZARDS

This section of the MCCAP provides information on significant climate change issues and hazards that will impact the Town of Pictou. The goals of this section include the following:

- Identify and understand past weather patterns and climate changes in the Town;
- Identify anticipated climate changes in The Town and the potential hazards that may occur in the future; and
- Conclude if any opportunities (e.g. potential benefits) exist from future climate changes.

2.1 Types of Issues and Hazards from Past to Present

Past and present climate change issues and hazards within the Town include:

- Storm Surges;
- Storm Events; and
- Reduced Sea Ice.

2.1.1 Storm Surges

Storm surges result from the meteorological effects on the sea such as wind setup (which is a function of the fetch and the wind duration) and low pressure, which raises the harbour from the predicted tide level. Extreme storm surges typically occur during storms or high wind events and can coincide with a high and/or spring tide. Since the height of breaking waves in part is determined by water depth, storm surges coinciding with high tides allow larger waves to break closer to shore, which compounds the flooding impacts. The following hazards have been known to occur within The Town as a result of storm surges:

- Coastal erosion;
- Episodic flooding;
- Sanitary Sewer backup at lift stations and flooding; and
- Damage to infrastructure and properties from wave action.

These events are also predicted to be more destructive with an increase in sea levels. Damages caused by surges will likely worsen in the future without the implementation of mitigation measures.

2.1.2 Storm Events

Nova Scotia is prone to extratropical and tropical cyclones due to the location of the province along the eastern seaboard. Extratropical cyclones occur when warm air from the southern Atlantic meets cold air coming from the west. These cyclones are most frequent in the fall and winter when temperature differences are most pronounced. In the past, storm events have caused the following damage within the Town:

- Damage to infrastructure and properties;
- Sanitary Sewer backup at lift stations and inside properties;
- Flooding;
- Road closures due to flooding, washouts, ice and snow;
- Coastal Erosion; and
- Power outages.

In the future, the result of climate warming in Nova Scotia is predicted to cause more intense and frequent storms (Government of Nova Scotia, 2009a). The main concerns are the increased risk in the intensity of storms and extreme precipitation events with resulting flooding, inland erosion, liquefactions, high wind events, impacts on natural resources and increased potential for more frequent damage to infrastructure. The Town of Pictou is serviced by a combined sewer conveyance system; therefore, storm events directly:

- Affect the hydraulic capacity of the sewer;
- Increase the chances of sewer backup; and
- Increase the volume of water to be treated at the treatment plant.

2.1.3 Reduced Sea Ice

The year 2010 set the record for the least amount of average sea ice in over 40 years. A reduction in winter sea ice coverage is occurring over the Gulf of St Lawrence (Environment Canada, 2013). As a result winter storm waves can develop more often and increase erosion rates, putting shoreline properties and infrastructure at greater risk.

2.1.4 Geographical Extent

Figure 2.1 shows areas of the Town that have been affected by weather events in the past.

2.1.5 Level of Preparedness

Emergency measures organizations (see Section 5) are in place in the Town to react to different levels of emergency. These organizations strive to ensure that government agencies and citizens are prepared for emergency situations. Chapter 6 of this MCCAP outlines some additional emergency preparedness considerations for future events which are anticipated to be more frequent and extreme.

town of Pictou
Birthplace of New Scotland

Town Boundary

Storm Surge Flooding

Heavy Rain Flooding

Wastewater Lifting Station Backup
Storm surge-Heavy Rain

Streams

Figure 2.1
Areas Already Affected by Weather Hazards

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Coordinate System:
NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

2.2 Future Issues and Hazards

Many of the potential future issues and hazards are similar to those that have occurred historically within the Town. Other potential future issues and hazards which may occur and cause problems within the community include:

- Sea Level Rise;
- Increased annual temperatures;
- More frequent and intense precipitation events;
- Increasing freshwater deficit; and
- Seawater intrusion.

2.2.1 Sea Level Rise

Relative sea level rise (SLR) relates to land subsidence (i.e. sinking of land surface, as currently occurring in NS due to post-glacial ocean loading of the continental shelf). A rise in sea level can geographically extend the impact of tides and storm surges (Government of Nova Scotia, 2009a). Sea level rise can also have an impact on storm events such as erosion, increasing the flooding extent, and beach migration (Government of Nova Scotia, 2009b).

The storm surge and SLR estimate provided by Daigle and Richards for NS Municipalities (2011) is consistent with the above sources, and is used throughout the present assessment. By 2100, the mean sea level in the Town of Pictou area is anticipated to rise approximately 1.05 m ± 0.48 m. The report predicts an extreme total sea level of 4.59 m respect to Chart Datum (3.67 m respect to CGVD28) for the year 2100. This value represents the simultaneous occurrence of a 1 in 100 year storm surge and the highest astronomical tide (the HHWLT or spring tide). The value also includes sea level rise.

The identified hazards of the gradual predicted increase in sea level for the Town includes

- Increased erosion;
- Permanent inundation; and
- More extreme flooding events.

In addition, the downtown area of the Town is built on top of an embankment, which is exposed to the coastal environment. The geotechnical properties of the fill material are unknown; therefore, the adaptation committee expressed concerns on the potential vulnerability of the area to land undermining and infrastructure (liquefactions) damage caused by the combined effects of sea level rise and storm surges.

2.2.2 Increased Annual Temperatures

An increase in the annual temperature could result in the following issues and hazards:

- Increase in forest fires due to drier forests;
- Loss or reduction in certain species;
- Introduction of pests and invasive species;
- Land erosion due to longer growing season and freeze-thaw cycles;
- Reduced Sea Ice; and
- Increase length of growing season.

According to climate models, the Town of Pictou will likely experience warmer weather in the coming years. By the 2080s, average temperatures are expected to increase in all four seasons by 3 to 4 °C (from 1980s levels).

2.2.3 More Frequent and Intense Precipitation Events

The main concern for the Town of Pictou is the potential for increased intensity of short period rainfall. Such increase is expected to exacerbate current problems associated with sanitary sewer backup, basement flooding, infrastructure damage and excess of wastewater inflow into the treatment plant. The community members have shared their concerns and recommendations about the need of focusing capital budget investments on improving the infrastructure related to wastewater and stormwater. According to ICSP, the community identifies the separation of the stormwater sewer as a sustainability initiative that will considerably improve public safety, property service, community/economic development; and health and wellness.

2.2.4 Increasing Freshwater Deficit

There is a threat to freshwater sources due to warmer temperatures. This prediction is expected to result in warmer wetter winters and warmer and dryer summers. Wetter winters will cause increased rainfall events and runoff flow rates. This may reduce the recharge rate of the groundwater table as runoff will not be absorbed as quickly. Dryer summers could lead to a decrease in the availability of water supply.

Water is provided by 13 different wells. The ICSP qualifies the water as good. However, seawater intrusion to groundwater wells can occur as a result of climate change, dryer summers, sea-level rise and over-pumping. Saltwater intrusion would reduce the amount of groundwater available.

A freshwater deficit could result in the following issues and hazards within the Town of Pictou:

- Drier forests;
- Reduced groundwater and seawater intrusion;
- Change in stream water levels/flows and thus habitat for fish;
- Impacts on potable water supply including quality and quantity; and
- Seawater intrusion.

2.2.5 Geographical Extent

Figure 2.2 shows the location of those areas recognized as vulnerable to the described hazards.

2.2.6 Potential Future Climate Change Benefits

- Increased potential for longer tourism season;
- Longer growing season for farmers; and
- Potential farming of new crops (e.g. grapes).

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- Town Boundary
- Extreme Rainfall (floodplain mapping needed)
- Sea Level Rise
- Extreme Storm Surges Wave Damage
- Wastewater Flooding (unless mitigation measures are implemented)
- Streams

Figure 2.2
Areas at Risk for Future Weather Hazards

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Coordinate System:
NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

2.3 Information Gaps

Generally the following information is lacking relating to hazards caused by climate change:

- Data on infiltration and inflow into the sanitary system;
- Floodplain mapping;
- Accurate erosion rates and erosion maps;
- High-resolution elevation data for low-lying areas;
- Bathymetry of the coastal area; and
- Geotechnical study in the area considered vulnerable to differential settlement or land undermining.

CHAPTER 3 AFFECTED LOCATIONS

The main goal of this section is to identify the locations within the Town of Pictou where issues have occurred and are anticipated in the future. Figure 3.2 shows municipal and community assets located in the areas at risk under present and future climatic conditions as identified in section 2.

3.1 Areas Impacted from Past to Present

3.1.1 Downtown and Residential Areas

Several areas of the Town experience seasonal flooding caused by sewer backups. The Town has received multiple reports of basement flooding and wastewater backups during heavy rainfall events. This type of problem represents a threat for public safety and health. Figure 3.1 shows overflowing wastewater at the lifting station located at Front Street.

Figure 3.1: Pumping Station at Front Street

The Adaptation Committee identifies limited sewer capacity as the main cause of the problem. According to an assessment performed by the Public Works Department, the combined operation of the sewer as well as infiltration and inflow are the main reasons for the limited capacity of the system. Development of a stormwater management plan as well as computer modelling of the sewer systems are identified as measures that will improve the Town's ability to mitigate the impact of these types of events.

3.1.2 Jitney Trail

Jitney Trail is used by members of the community and tourists for walking and cycling. As shown in Figure 3.3, the trail is located adjacent to the coastline and several residential and commercial properties. The image shows flooding during a minor storm surge. The vulnerability of the trail and the neighbouring infrastructure is expected to increase with the predicted climate changes.

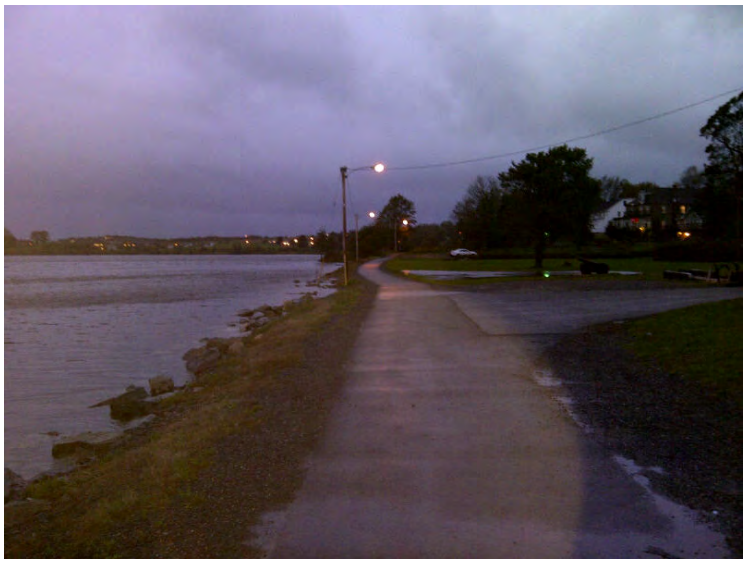

Figure 3.3: Jitney Trail

Figure 3.4 shows the base of a flooded utility pole located along the trail during a minor storm surge. The Adaptation Committee has identified power outages as one of the major vulnerabilities of the Town. Utility towers and poles located close to the coastline have been identified as vulnerable infrastructure. Climate hazards may cause not only the interruption of energy and communication services, but collapse of the infrastructure. This could cause personal injuries and damage to neighboring properties.

Figure 3.4: Flooded Utility Pole Anchor

The Adaptation Committee has identified the need of a coastal hydrodynamic and wave model to evaluate the potential extent of flooding, in addition to, the modification of the Town's Land Use By-Law and the establishment of design criteria for coastal protection structures.

3.2 Level of Vulnerability to Climatic Events in the Town of Pictou from Past to Present

The following matrix was prepared to assist the committee in assigning a relative degree of vulnerability of the Town to the climate change events that have occurred in the past. Hazards with severe impacts will require closer attention and may require more adaptive planning (Table 3.1). The table shows the level of severity, the frequency and the magnitude of the areas that have been affected by weather events to date. Each hazard was assessed according to the following criteria.

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Birthplace of New Scotland

Figure 3.2
Town and Community Assets at Risk

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- M.E. Lloyd Sewer
- Extreme Rainfall (floodplain mapping needed)
- Potential Land Slide Damaged Infrastucture
- Sea Level Rise
- Extreme Storm Surges Wave Damage
- Wastewater Flooding (unless mitigation measures are implemented)

- Air Force
- County Office
- Fire Department
- Historic and Heritage Center
- Hospital/Nursing Homes
- Justice Comp
- Pier C
- Additction Services
- Church
- Commercial Buildings
- Post Office
- Public Works
- RCMP
- School
- Sewage Treatment Plant
- Sport Facility
- Theater
- Town Hall
- Wastewater Lift Station
- Groundwater Well
- Inn
- Library
- Marina
- NSCC
- Newspaper
- Park
- Residential Area
- School
- baseball
- Water Tower

Level of Severity: The degree of damages caused by each hazard has been categorized as:

- High: Severe impacts including economic and natural resources;
- Moderate: moderate impacts, not catastrophic; and
- Minor: minor effects or impacts, situation has been addressed (new infrastructure in place or planned).

Frequency: The frequency of occurrence has been categorized as:

- Often: events that take place at least once a year;
- Sometimes: events take place every two to five years; and
- Rarely: event that have taken place every ten years.

Affected Area: The size of the area affected by weather events has been categorized as:

- Large: 25% or more of the Town area has experienced damages;
- Medium: 5 to 25 % of the Town area has suffered damages; and
- Small: less than 5% of the Town area has been affected.

Table 3.1: Past Climate Change Hazard Impact Matrix

Hazard	Severity			Frequency			Area		
	High	Moderate	Minor	Often	Sometimes	Rarely	Large	Medium	Small
Storm Surges	x				x			x	
Flooding	x			x			x		
Coastal Erosion		x		x					x
Winter Snow Storms		x		x				x	
Wave Damage	x			x				x	
Hurricanes/Wind Storms		x			x			x	
Sea Level Rise		x			x			x	
Drought		x			x				x

3.3 Level of Vulnerability to Future Climate Change in the Town of Pictou

The areas presented in section 3.1 and Figure 2.1 are anticipated to have climate change issues in the future. One the biggest concern for the Town is the reduced capacity of the sanitary system. Flooding problems are likely to be exacerbated by the predicted changes in precipitation patterns. Specific locations where problems are expected to occur in the future are shown in Figure 2.2.

The following matrix was prepared to assist the committee in assigning a relative degree of vulnerability of the Town to the expected climate change events. Hazards with severe impacts will require closer attention and may require more adaptive planning (Table 3.2). The matrix was filled according to the criteria described above.

Table 3.2: Future Climate Change Hazard Impact Matrix

Hazard	Severity			Frequency			Area		
	High	Moderate	Minor	Often	Sometimes	Rarely	Large	Medium	Small
Storm Surges	x			x			x		
Flooding	x			x			x		
Coastal Erosion	x			x				x	
Winter Snow Storms		x		x				x	
Wave Damage	x			x			x		
Hurricanes/Wind Storms		x			x			x	
Sea Level Rise	x			x			x		
Drought		x		x				x	

3.4 Information Gaps

Data and information gaps related to affected locations are identified below:

- High-resolution elevation data for low-lying areas;
- Bathymetry of the coastal area;
- Geotechnical study in the area considered vulnerable to differential settlement and land undermining landslides;
- Floodplain mapping;
- Computer models of the coastal hydrodynamics, the water distribution systems and the wastewater and storm water sewers; and
- Detailed survey mapping of the Town infrastructure.

CHAPTER 4 AFFECTED FACILITIES, INFRASTRUCTURE & SERVICE DELIVERY

The main objective of this section is to identify key facilities and infrastructure in the Town of Pictou and whether these are at risk for future damage resulting from climate change. Potential impacts of climate change and the provision of municipal services are also discussed.

4.1 Key Facilities and Infrastructure

Key facilities and their position relative to vulnerable areas are shown in Figure 4.1. It can be observed that most of the key facilities are located within areas at risk.

4.2 Key Vulnerabilities

4.2.1 Historic Impacts to Key Infrastructure and Facilities

Historically, facilities and infrastructure within the Town have been impacted by climate change events. A list of infrastructure and facilities experiencing past issues during climate change events is provided in Table 4.1 below.

4.2.2 Potential Future Impacts to Key Infrastructure and Facilities

In the future, facilities and infrastructure listed in Table 4.2 also have the potential to be impacted by future climate change events such as storm surges, storm events, increased temperature and flooding events.

Table 4.1: Public Infrastructure Experiencing Past Issues During Climate Change Events

Category	Specific Infrastructure	Location	Type of Damage
Coastal Infrastructure	Wharf	Market Wharf	Flooding
Water supply & Treatment	Groundwater Wells	Coastal Area	Increase on salt concentration during dry weather

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Figure 4.1
Town Assets at Risk

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- Extreme Rainfall (floodplain mapping needed)
- Potential Land Slide Damaged Infrastucture
- Sea Level Rise
- Extreme Storm Surges Wave Damage
- Wastewater Flooding (unless mitigation measures are implemented)
- M.E. Lloyd Sewer

- Post Office
- Public Works
- RCMP
- School
- Sewage Treatment Plant
- Sport Facility/ Emergency Shelter
- Theater
- Town Hall
- Groundwater Well
- Air Force
- County Office
- Fire Department
- Historic and Heritage Center
- Hospital/Nursing Homes
- Justice Comp
- Pier C
- Wastewater Lift Station
- Water Tower

Category	Specific Infrastructure	Location	Type of Damage
Power Utilities & Supplies	Power and phone towers	Downtown areas	Flooding and disruption caused by severe rain, storm surge and severe wind storms
Roads, Bridges, Culverts & Trails	Walking Trail	Jitney Trail	Partial flooding due to storm surge and loss of shoreline/trail
Roads, Bridges, Culverts & Trails	Access Road	Caladh Avenue	Flooding
Buildings and Parking Lots	Parking lot	Courthouse	Parking lot flooding during storm surges and intense rainfall
Buildings and Parking Lots	Building	Pictou Elementary School	Seasonal flooding
Wastewater Collection and Treatment	Pipe network	ME Lloyd line	Limited capacity caused by stormwater infiltration and inflow. Sanitary sewer backup leading to basement flooding.
Wastewater Collection and Treatment	Lifting stations	Front, Sinclair and Dawson streets	Sanitary sewer backup due to infiltration and inflow, storm surges and extreme rainfall events

Table 4.2: Key Infrastructure at Risk of Experiencing Issues during Climate Change Events in the Future

Category	Specific Infrastructure	Location	Type of Damage
Coastal Infrastructure	Wharfs and Marinas	Pictou coastline	Flooding caused by storm surges
Water supply & Treatment	Groundwater	Entire groundwater well network	Increase on salt concentration during dry weather, decreased rate of groundwater recharge due to dryer summers
Power Utilities & Supplies	Power and telephone towers	Areas located south of West River Rd and High Street	Permanent flooding caused by sea level rise, seasonal flooding cause by events of severe rain, storm surge and severe wind storms
Roads, Bridges, Culverts & Trails	Walking trails and roads	Streets and Roads located south of West River Rd and High Street	Permanent flooding caused by sea level rise, seasonal flooding cause by events of severe rain, storm surge and severe wind storms
Roads, Bridges, Culverts & Trails	Culverts	Culverts located under Beeches Road and rotary towards Highways 106, 6 and 376	Potential surcharging caused by more intense rainfalls

Category	Specific Infrastructure	Location	Type of Damage
Roads, Bridges, Culverts & Trails	Highway	Highways 106, 6 and 376	Potential overtopping and washout of sections of the roads after culvert surcharges caused by more intense rainfall events
Buildings and Parking Lots		Community, provincial and municipal structures located south of West River Rd and High Street	Parking lot flooding during storm surges and intense rainfall
Wastewater Collection and Treatment	Treatment facility	183 Browns Point Road	Potential increase of overflows caused by more intense rainfalls prior to separation of stormwater system. Permanent flooding caused by sea level rise, seasonal flooding cause by events of severe rain, storm surge and severe wind storms

4.3 Vital or Important Facilities and Infrastructure during an Emergency

Facilities and infrastructure within the Town of Pictou which have been identified as important or vital during an emergency include the following:

- Police station;
- Fire department;
- Sutherland Harris Memorial Hospital;
- Facilities located outside areas under emergency, considered as appropriate for providing shelter during emergencies: Rink, Armories Gym, Pictou Elementary School, Pictou Academy, the Anglican Church of Pictou County and, if not affected by coastal flooding during a particular emergency, Pictou United Church, Stella Maris Church, and the First Presbyterian Church; and
- Highway 106, River John Road, Three Brook Rd and NS route 376 for evacuation, transportation of injured, and transportation of supplies.

4.4 Risk Assessment Tables

Tables 4.3 to 4.7 constitute the completed Infrastructure Risk Evaluation framework provided by the Canada-Nova Scotia Infrastructure Secretariat.

4.5 Information Gaps

A description of data and information gaps related to infrastructure and services are identified below:

- No setback criteria from shorelines along coastal areas and inland lakes and water courses.
- Floodplain mapping;

- High resolution digital elevation model;
- Floodplain mapping;
- Computer models of the coastal hydrodynamics, the water distribution systems and the wastewater and stormwater sewers; and
- Detailed mapping of the Town infrastructure.

Table 4.3: Town of Pictou – Water Infrastructure Risk Assessment

Water System	Water Source (Wells, Surface Water, Other)	Water Treatment Plant	Water Storage Facilities	Water Pumping Facilities	Water Distribution System	Individual Water Service Lines
Sea Level Rise					**X**	**X**
Extreme Snow			**X**			
Extreme Rain	**X**		**X**	**X**	**X**	**X**
Extreme Wind	**X**		**X**			
Flooding	**X**		**X**	**X**	**X**	**X**
High Temp	**X**		**X**	**X**	**X**	**X**
Low Temp						
Erosion						
Earthquake						
Impacts	Drier Summers/Slower recharge rate		Flooding caused by precipitation changes	Flooding caused by precipitation changes	Increase in water usage and flow rates	Increase in water usage and flow rates
	Higher runoff / less recharge available		Increase in water usage and water storage	Increase in water usage and pumping rates	Flooding caused by storm surges and SLR	Flooding caused by storm surges and SLR
	Potential power outages		Higher weight loads due to snow	Potential power outages	Flooding caused by precipitation changes	Flooding caused by precipitation changes
			Damage on the only water storage tank			
Possible Adaptation Measures	Continuous monitoring of water quality and levels		Upgrade stormwater drainage system	Upgrade stormwater drainage system	Upgrade stormwater drainage system	Upgrade stormwater drainage system

Water System	Water Source (Wells, Surface Water, Other)	Water Treatment Plant	Water Storage Facilities	Water Pumping Facilities	Water Distribution System	Individual Water Service Lines
	Monitor pumping rates		Floodline mapping studies	Floodline mapping studies	Floodline mapping studies	Floodline mapping studies
	Education of the public on water consumption		Education of the public on water consumption	Education of the public on water consumption	Education of the public on water consumption	Education of the public on water consumption
	Monitor leakage in distribution network				Construction of coastal protection structures	Construction of coastal protection structures

Table 4.4: Town of Pictou – Sanitary Sewer Infrastructure Risk Assessment

Sanitary Sewer System	Wastewater Treatment Plant	Buildings	Wastewater Gravity Sewer	Wastewater Pressure Sewer (Forcemain)	Pumping Stations
Sea Level Rise	**X**	**X**	**X**	**X**	**X**
Extreme Snow	**X**	**X**	**X**	**X**	**X**
Extreme Rain	**X**	**X**	**X**	**X**	**X**
Extreme Wind					
Flooding	**X**	**X**	**X**	**X**	**X**
High Temp	**X**	**X**	**X**	**X**	**X**
Low Temp					
Erosion	**X**	**X**	**X**	**X**	**X**
Earthquake					
Impacts	Treatment of larger flows caused by I&I	Basement flooding	Reduced hydraulic capacity	Limited capacity caused by I&I	Pumping larger flows caused by I&I
	Flooding caused by storm surges and SLR	Storm surge and SLR - sanitary lead flooding	Limited capacity caused by I&I		Flooding caused by storm surges and SLR
	Intrusion of sediments dragged by runoff	Clogged sanitary leads	Intrusion of sediments dragged by runoff	Intrusion of sediments dragged by runoff	Intrusion of sediments dragged by runoff

Sanitary Sewer System	Wastewater Treatment Plant	Buildings	Wastewater Gravity Sewer	Wastewater Pressure Sewer (Forcemain)	Pumping Stations
	Potential power outages			Potential power outages	Potential power outages
Possible Adaptation Measures	Reduction of stormwater infiltration and inflow	Separation of combined sewer system	Separation of combined sewer system	Separation of combined sewer system	Separation of combined sewer system
	Reparation of pavements and manhole leads	Reduction of stormwater infiltration and inflow	Reduction of stormwater infiltration and inflow	Reduction of stormwater infiltration and inflow	Reduction of stormwater infiltration and inflow
	Separation of combined sewer system	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures
	Construction of coastal protection structures				

Table 4.5: Town of Pictou – Stormwater Infrastructure Risk Assessment

Storm Sewer System	Catchbasins	Manholes	Pipes
Sea Level Rise	**X**	**X**	**X**
Extreme Snow	**X**	**X**	**X**
Extreme Rain	**X**	**X**	**X**
Extreme Wind			
Flooding	**X**	**X**	**X**
High Temp	**X**	**X**	**X**
Low Temp			
Erosion	**X**	**X**	**X**
Earthquake			
Impacts	Flooding caused by SLR and Storm surges	Surcharge caused by water backup	Surcharge caused by limited capacity
	Intrusion of sediments dragged by runoff	Intrusion of sediments dragged by runoff	Intrusion of sediments dragged by runoff

Storm Sewer System	Catchbasins	Manholes	Pipes
Possible Adaptation Measures	Separation of stormwater from the sanitary sewer	Separation of stormwater from the sanitary sewer	Separation of stormwater from the sanitary sewer
	Sedimentation and erosion control measures	Sedimentation and erosion control measures	Sedimentation and erosion control measures
	Maintenance, reparation and upgrade	Maintenance, reparation and upgrade	Maintenance, reparation and upgrade
	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures

Table 4.6: Town of Pictou – Building Infrastructure Risk Assessment

Municipal Buildings	Buildings
Sea Level Rise	**X**
Extreme Snow	**X**
Extreme Rain	**X**
Extreme Wind	
Flooding	**X**
High Temp	**X**
Low Temp	
Erosion	**X**
Earthquake	
Impacts	Flooding caused by storm surges and SLR
	Flooding caused by sewer backups
	Heavy loads of snow on rooftop
	Potential power outages
Possible Adaptation Measures	Construction of coastal protection structures
	Floodplain mapping
	Separation of combined sewer
	Reduction of stormwater infiltration and inflow

Table 4.7: Town of Pictou – Road Infrastructure Risk Assessment

Roads	Bridges	Traffic Signals	Street Lighting	Signs	Culverts	Sidewalks	Local Roads	Collectors
Sea Level Rise	**X**	**N/A**	**X**	**X**	**X**	**X**	**X**	**X**
Extreme Snow	**X**	**N/A**	**X**	**X**	**X**	**X**	**X**	**X**
Extreme Rain	**X**	**N/A**	**X**	**X**	**X**	**X**	**X**	**X**
Extreme Wind		**N/A**						
Flooding	**X**	**N/A**	**X**	**X**	**X**	**X**	**X**	**X**
High Temp	**X**	**N/A**	**X**	**X**	**X**	**X**	**X**	**X**
Low Temp		**N/A**						
Erosion	**X**	**N/A**	**X**	**X**	**X**	**X**	**X**	**X**
Earthquake		**N/A**						
Impacts	Erosion at abutments	**N/A**	Flooding caused by storm surges and SLR	Flooding caused by storm surges and SLR	Flooding caused by storm surges and SLR	Flooding caused by storm surges and SLR	Flooding caused by storm surges and SLR	Flooding caused by storm surges and SLR
	Overtopping caused by SLR and storm surges	**N/A**	Flooding caused by precipitation changes	Flooding caused by precipitation changes	Flooding caused by precipitation changes	Flooding caused by precipitation changes	Flooding caused by precipitation changes	Flooding caused by precipitation changes
	Overtopping caused by heavy rainfall	**N/A**			Clogging caused by eroded sediments	Flooding caused by manholes surcharge	Overtopping caused by limited drainage capacity	Overtopping caused by limited drainage capacity

Roads	Bridges	Traffic Signals	Street Lighting	Signs	Culverts	Sidewalks	Local Roads	Collectors
Possible Adaptation Measures	Construction of coastal protection structures	**N/A**	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures	Construction of coastal protection structures
	Floodplain mapping	**N/A**	Floodplain mapping	Floodplain mapping	Floodplain mapping	Floodplain mapping	Floodplain mapping	Floodplain mapping
	Separation of combined sewer	**N/A**	Separation of combined sewer	Separation of combined sewer	Separation of combined sewer	Separation of combined sewer	Separation of combined sewer	Separation of combined sewer
	Sediment and erosion control measures	**N/A**	Sediment and erosion control measures	Sediment and erosion control measures	Sediment and erosion control measures	Sediment and erosion control measures	Sediment and erosion control measures	Sediment and erosion control measures

CHAPTER 5 SOCIO-ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS

The objective of this section is to determine which communities, groups and individuals will be affected by climate change and to identify groups that are available to assist.

5.1 Who will be Affected

5.1.1 Vulnerable Communities, Groups and Individuals

The following identified communities, groups or individuals may be particularly vulnerable to climate change hazards because of their location or other factors:

- Commercial and Recreational Services;
- Private, Commercial and Industrial Property Owners;
- Public Transportation Users;
- Small Communities and Individuals requiring assistance; and
- Emergency Response Workers.

Table 5.1 identifies socio economic and environmental implications and concerns related to potential climate change impacts and hazards.

5.1.2 Considerations on EMO Plans

The Town of Pictou participates within a Regional Emergency Measures Organization (REMO) that uses an Incident Command System to classify emergencies in accordance with their degree of severity. Prior to, during, and after emergencies such as coastal storms and floods, the Town or REMO (depending on the severity of the incident), will be responsible for the following:

- Analyzing risks and hazards and developing emergency plans to address situations that might impact life, property, and the wellbeing of persons within the Town;
- Preparing and implementing local emergency programs using the resources available to them;
- Directing and controlling all emergency operations, as long as the magnitude of the situation remains within the capability of the local authority;
- Requesting assistance from other municipalities/local authorities; and

- Informing the provincial government (Emergency Measures Organization - EMO) about the emergency and possible requirements for assistance.

Table 5.1: Socio-economic and Environment Implications and Concerns Related to Potential Climate Change Impacts and Hazards

Social Group	Vulnerable Location	Potential Climate Change Impact or Hazard	Economic Implications	Environmental Concerns
Town Residents	Residential Areas: • <10 m above sea level; • in proximity to sewer system with limited capacity causes by I&I; and • Coastal Roads: <4m above sea level.	• Sea Level Rise; • Storm Events/ Sewer System Backup; • Storm Surge/Erosion; and • Flooding.	• Repairs to damaged properties; • Potential relocation of some property locations; • Relocation of wells and septic systems; and • Costs associated with closure and repair of roads, streets and Highway 106 Causeway (e.g. waiting times for) transport truck.	• Loss or damage to shoreline habitat; • Contamination of land and properties with sanitary water; and • Contamination with pollutants carried by retrieving water.
Commercial, Recreational and Transportation Sailors	All wharves and marinas.	• Sea Level Rise; • Storm Events; • Storm Surge; and • Flooding.	• Interruption of Services; • Repairs to damaged areas; • Relocation or replacement of wharves or marinas; and • Delay of shipments to commercial and industrial facilitates.	• Loss or damage to shoreline habitat; and • Contamination with pollutants carried by retrieving water.
Private, Commercial and Industrial Property Owners	• Coastal area: <10m above sea level; and • Properties in proximity to sewer system with limited capacity causes by I&I.	• Sea Level Rise; • Storm Events; • Storm Surge/Erosion; and • Flooding.	• Repairs to damaged properties; • Potential relocation of some property locations; and • Relocation of wells and septic systems.	• Impacts to aquatic organisms due to contamination; and • Loss or damage to shoreline habitat.

Social Group	Vulnerable Location	Potential Climate Change Impact or Hazard	Economic Implications	Environmental Concerns
Small Communities And Individuals Requiring Assistance(i.e. senior and ill residents)	• Isolated areas (e.g. one road access); and • Areas located to streams prone to flooding.	• Increased Temperature/Forest Fires; • Winter Storms; • Reduced Sea Ice; • Flooding; and • Storm Events.	• Increased emergency response costs; and • Closure of roads due to storms or longer term-climate change impacts.	• Habitat Loss.
Emergency Response Workers	All areas.	• Storm Events; • Flooding; and • Increased Temperature	• Increased costs associated with increased demand.	• Habitat Loss.
First Nations:	Coastal residences, resources, ceremonial areas, burial grounds: <4m above sea level.	• Sea Level Rise; • Storm Events; • Storm Surge; and • Flooding.	• Costs associated with shoreline protection; • Repairs to damaged areas; and • Relocation of wells and septic systems.	• Groundwater contamination from septic and sewage systems; and • Loss or damage to shoreline habitat.

The NS Emergency Management Office (EMONS) offers assistance to communities to upgrade their existing planning by training and other tools:

- The ***Municipal Emergency Management Guide*** outlines key components and steps to help communities to develop plans, create exercises and ensure resources have been identified before an emergency occurs;
- A **Public Safety Officer** is available to speak to community council members on Municipal Emergency Management, or to conduct a community presentation on Personal Preparedness;
- The ***Municipal Self-Assessment Tool*** helps municipalities identify key areas of focus and to ensure hazards are clearly understood;
- **Rural Disaster Resilience** project resources are available from the Emergency Management Office;
- The ***Guide to Business Continuity Planning*** (developed by the Government of Canada, Office of Critical Infrastructure Protection and Emergency Preparedness) assists local businesses in developing strategies to deliver and resume their services, during and after an emergency, respectively;
- **Crisis Communication Planning** would assist local communities and businesses in outlining and delegating responsibilities in the event of a crisis, and how to communicate with clients and the public;
- **Emergency Management Training Planning** is offered to individuals and organizations that have a role to play in an emergency. Training is offered in Basic Emergency Management, Incident Command System, Emergency Operations Centre Management, Exercise Design and Emergency Public Information;
- The EMONS website provides detailed information as to Environment Canada weather warnings, Environment Canada hurricane and tropical storm watches and warnings, and United States National Hurricane Centre warnings. As well as providing either direct information or links to alerts and warnings, the EMONS website provides hazards information on:
  - Hurricanes;
  - Floods;
  - Wildfires;
  - Search and Rescue Operations;
  - Power Outages;
  - Winter Storms; and
  - Storm Surges.

5.1.3 Potential Climate Hazard Impacts on Health and Safety of Residents

5.1.3.1 HEALTH

The committee identifies backups in the sanitary sewer system as a hazard for public safety and health as they may cause floods, e.g. facilitate the spread of bacteria and diseases.

5.1.3.2 SAFETY

In general, other health impacts on residents would be limited to concerns that are not directly within the remit of the Town, such as: issues related to potentially reduced quantity of potable water (i.e. drought); increase in pests (i.e. ticks); and the loss of services for prolonged periods (i.e. power outage

during storm). Some of these impacts could have a larger impact on already vulnerable populations such as seniors or infants.

Safety issues are perhaps more acute and are typically related to short duration, high intensity events such as storms. These events could cause flooding, rapid erosion, and impacts to power lines that may present hazards to people in their homes or travelling. Impacts on telecommunications infrastructure could impact the ability to announce warnings or for people in difficulty to call for help. However, the emergency measures organizations and their emergency plans should be sufficient to deal with these types of events.

Therefore, emergency plans should be updated on an annual basis to include current resources and up-to-date contact information. Information should also include damage and potential damage from severe weather events in recent years, such as storm surges. Emergency response procedures should be upgraded to plan for future coastal flooding events. Areas subject to flooding or storm waves may not be accessible by emergency response vehicles and crews, resulting in delayed response times during a fire, vehicle accident, power outage or other emergency situation. These areas should be described in the emergency plans and approaches and equipment to deal with these situations should be identified.

5.1.4 Parties Available for Help During Weather Emergencies

Individuals, organizations, agencies or groups that may be able to help in the event of a weather related emergency are listed below:

- Nova Scotia Emergency Management Office;
- Public Works department: emergencies related with road, water or wastewater infrastructures;
- Nova Scotia Power : emergencies related with power outages;
- For fire emergencies and rescue: Fire Department; and
- For environmental emergencies: Nova Scotia Environment.

5.2 Economic Implications

5.2.1 Potential Economic Impacts

Table 5.1 outlines the potential economic impacts related to various groups in the Town. Many of the impacts will be associated with areas that are not under municipal jurisdiction, but as with other issues, the Town can have a role in the organization of information and bringing people together to educate themselves about the issues. Also, from an overall economic point of view and the protection of municipal resources used to service residents, the Town may wish to limit development in vulnerable areas. Therefore, the development of floodplain mapping and improved mapping of potential sea level rise and storm surge impacts would be a useful exercise. The Town can either present this information to enable residents and developers to assess risks to their properties, or if desired, The Town can use the information to develop more refined zoning and setbacks within the Land Use By-Law and to limit development in vulnerable areas.

Warmer temperatures could benefit the tourism industry. The longer warm season could make tourism-based businesses more viable improving the attractiveness of the area to year-round residents and

improving the amount of taxes collected by the Town. However, more residents will result in more demands for services so the potential benefit must be balanced against increased costs.

5.2.2 Options for Mitigating Economic Impacts

Creating a community awareness of the impacts of coastal storms, flooding and erosion will empower residents to take action in the area of personal preparedness. Furthermore, encouraging residents to gain an education – however general – in the area of climate change will inspire them to plan long term for the benefit of future generations.

A variety of low-cost options are available to communities who wish to foster greater awareness and education in the areas of climate change, coastal processes and emergency preparedness, including:

- Guest speakers – from local watershed groups, government agencies, or universities, for example – may be invited to speak to the community as an individual presentation or as part of a series of related lectures;
- Promotion of relevant local community/college/courses may create awareness of educational opportunities in relevant subject areas (e.g., emergency preparedness, business continuity management, watershed health, climate change);
- Promotion of literature related to the issues and impacts presented here could be carried out through a community book club or library, if available;
- Public activities such as open houses, networking sessions, dances and community barbecues foster friendship and closeness among residents. Such connections increase goodwill between neighbours, raise awareness of vulnerable residents, and strengthen communities in times of emergency; and
- Newsletters/fact sheets – could be produced for distribution or inserted with applications for development permits.

5.3 Environmental Issues

Wetlands: Wetlands support extensive biodiversity, can work as filters for pollutants and retain carbon and other emissions. Rising temperatures and floods will lower the quality of the water, and will introduce changes in the delicate balance necessary to sustain wetland ecosystem. Small increases in the variability of precipitation regimes will significantly impact wetland plants and animals at different stages of their life cycles.

Fish and Fish Habitat: Fish and fish habitat are vulnerable to climate change. For example, increased temperature may reduce surface water levels in watercourses which could negatively impact the instream flow and habitat needs of fish species. Furthermore, storm events and increased sewer backups and wastewater flooding can increase the risk of bacteria and sediments entering the aquatic environment which can cause lethal and sub-lethal impacts to fish. Additionally, coastal erosion and sea level rise will alter fish habitat and watercourses close to the coast.

Groundwater: Storm surges and the predicted sea level rise pose a risk to fresh groundwater sources located near the coast.

5.3.1 Emergency Preparedness in the Context of Environmental Issues

To reduce the impacts of climate change on sensitive habitats and species at risk, The Town could consider the following in future planning strategies:

- Implement setbacks from sensitive habitats within their area;
- Encourage developers to use as much existing disturbed areas for new developments rather than disturbing new habitat;
- Limit the spread of invasive species by encouraging routine washing of construction equipment being used in The Town; and
- Require landowners, within the unserviced areas of Town, to build septic systems in locations which will not likely be flooded.

The Town can also liaise with Nova Scotia Environment, the Provincial Departments of Natural Resources and Transportation and Infrastructure Renewal and Environment Canada/Canadian Wildlife Service to identify sensitive areas in their areas and measures that can be taken to reduce impacts to those areas. Some examples would include:

- Ensuring that new culverts and bridges are not undersized and meet specifications for the projected 1:100 year flood events including climate change;
- Consider implementing coastal erosion control measures that threaten sensitive areas; and
- Encourage research into mitigation and preventative measures to lessen impacts of insect species which are potential threats to the Town.

5.4 Information Gaps

A description of data and information gaps related to socioeconomic and environmental considerations are identified below:

- **Emergency Response** - Lack of a coordination of response to storm and other climate change events (inland erosion, liquefactions etc.). There should be a regional response team with representatives from each area, RCMP, NS Dept. of TIR, NS Emergency; and
- **Public Education** – There is a need for more information which is available to the public to help them prepare and response to climate change events. This could include fact sheets, codes of practise, brochures, on line info, workshops, etc.

CHAPTER 6 PRIORITIES FOR ADAPTIVE ACTIONS

In order of priority, the Town needs to:

- Look after the infrastructure, facilities, and programs for which they are directly responsible;
- Advocate for other levels of government and utilities to look after infrastructure for which they are responsible, but which plays a major role in the operations of the Town or life of Town residents; and
- Inform the public of climate change issues that may affect them and their decision-making as well as the climate change adaptation and mitigation efforts being undertaken the Town.

6.1 Development of a Stormwater Management Plan

A stormwater management plan will provide a set of guidelines, strategies and management practices needed to mitigate community exposure to flooding risks. As first step, the Town has begun separating the storm sewer system from the sanitary system.

The Town has recently designed and installed a main stormwater trunk line along Church Street, which runs east to west and parallel to the harbour. The main trunk line can receive separated north/south lines from higher elevation areas of the Town. Only limited portions of separated stormwater collector lines to the Church Street system have been designed to date. Appendix "A" contains the as built drawings of the Church Street system, in addition to proposed installations for the Wellington Street area of Town. However, in order to support the design and prioritization of upstream collector systems, the Town requires the following additional information:

- Drainage requirements in the area surrounding school and playfield infrastructure.
- Are these requirements better served by a north south collector to the Church Street system, or alternatively the creation of an east west stormwater system?
- A formalized plan that will utilize information obtained from a Lidar survey and documentation of combined flows and systems currently in place in various areas of the Town.

The Stormwater Management Plan may also influence the Town's street resurfacing/upgrading plan.

6.2 Stormwater Infiltration and Inflow Reduction

The reduction of infiltration and inflows has been identified as a priority to reduce flooding risks, sewer backups and wastewater volumes. This improvement will reduce flooding caused by more frequent storm events and more intense rainfalls.

In order to assess the efficiency and effectiveness of an infiltration and inflow program, the Adaptation Committee proposes the implementation of a pilot project on the M.E. Lloyd sewer line. This line experiences regular sewer backups and is in urgent need of additional capacity. It connects various areas of the Town, but only services a few properties and as such should not be experiencing such serious capacity issues.

Infiltration and inflow issues can be identified and addressed with the following procedures:

- Collection of flow gauging data to establish baseline conditions and quantify volume of extraneous flows;
- Field investigations including: manholes inspections, house to house survey, smoke testing and CCTV in sewer cameras; and
- Modelling the system performance under different rainfall events to establish the magnitude of the issue against clear climatic event benchmarks.

Once the magnitude and origin of the extraneous inflows are identified, the following corrective measures can be implemented:

- Repair of the manholes allowing the intrusion of extraneous flows into the sewer system. The repairs may include replacement of manhole covers, sealing/reconstruction of affected sections, and/or re-grading of surrounding pavement;
- Installation or replacement of missing or broken cleanout caps; and
- Redirection of downspouts/foundation drains into a separate stormwater sewer system.

6.3 Ensure Critical Infrastructure Has Back-Up Power

The Town should review water supply systems, the sewage treatment plant, lift stations, and buildings/ facilities that could require back-up power. These sites should be assessed for the need to have a back-up generator.

6.4 Additional Emergency Preparedness Considerations

While emergency measures organizations are in place to react to natural and other disasters, these organizations also undertake a number of activities to ensure that government agencies and citizens are prepared for emergency situations. It is recommended that The Town work with their respective Emergency Measures Organizations to educate the public about having adequate food, water, and fuel for emergency events. They should also develop and test systems that will warn residents about major storm events and provide information about moving to safer locations as required.

The Town's fire department and EMO should ensure that they or other nearby facilities have a plan and the resources available to act as a local command center and locations which can be used as emergency

shelters. The Town should also work with their protective services agencies to ensure emergency vehicles can access flooded areas.

The Town should also examine their fuel quantity storage policies to ensure they will have adequate fuel on hand to operate equipment such as snowplows, fire trucks and other emergency vehicles and back-up generators for two weeks without re-supply.

Changes in the demographics of the area mean that there are fewer middle-aged able-bodied people available to respond in an emergency. The Town should advocate for Provincial assistance in the development of an approach to address this concern.

6.5 Water Distribution System Assessment

The Town relies on one water tower; therefore the community is at risk of water shortage if a severe weather event affects the tower. Therefore the development of a computer model for the water distribution infrastructure and the identification of sites for additional storage is identified as a priority measure for adaptation.

6.6 Regularly Inspect Sewage Treatment Plant Outfalls

With the increased incidence and severity of storm events, the Town should increase their regular inspections of sewage treatment plant outfalls to identify damage to pipes, erosion that may lead to failure and sedimentation that may affect performance of the outfall. When such occurrences are noted, immediate corrective action should be taken.

6.7 Review of Municipal Structures for Snow Loading

The Town should review all structures they own and ones that might be used as emergency shelters to ensure that they have sufficient structural integrity to support anticipated snow loads.

6.8 Improved Mapping of Potential Climate Change Impacts

The Town should obtain Lidar data. This data should be correlated with the province's geo-referenced digital aerial photography. Climate change information related to sea level rise and storm surge should be integrated and kept updated as new information becomes available.

6.9 Establishment of Coastal Setbacks and Climate Change Considerations for New Municipal Development

Coastal setbacks will help to reduce risks associated with increased flooding and erosion, and long term inundation associated with climate change. In addition, all new development should undergo a climate change review by a qualified professional engineer and include a statement about how potential issues have been addressed.

6.10 Publication of Annual Reports

On an annual basis, the Town may publish a report containing information about weather related issues and opportunities experienced by the community. The report may identify hotspots or common issues, assess available data, and determine what can be addressed by the Town and what needs to be passed onto other levels of government. The report can also provide information about the mitigation and adaptation measures that have been implemented all over the community.

6.11 Annual Regional Meeting

It is recommended that The Town meet annually with:

- Other Pictou county committees;
- The local First Nations community;
- relevant provincial government departments such as Transportation and Infrastructure Renewal, Natural Resources, and Environment, and the Municipal Services Division of Service Nova Scotia and Municipal Relations;
- Nova Scotia Power Inc.; and
- Developers and utility providers.

These agencies control infrastructure that is critical to The Town.

6.12 Advocacy and Education

Advocacy: The Town should advocate for a role in the development of the Provincial Coastal Strategy to have influence on the process that the Province is developing and the decisions that are being made on coastal zoning.

Education: The Town can play a role in educating/informing the public, including businesses, about how climate change directly impacts their lives and operations by:

- Informing residents about what The Town is doing about climate change;
- Identifying the risks and encouraging people to think about them; and
- Informing residents about how climate risks or opportunities could affect them.

The Town should jointly develop a brochure that talks about climate change risks and the appropriate placement of buildings to lessen risks. This information should be provided with their building permit application forms, so people know the issues and can make better informed decisions about where and how they build. The Town could also circulate the brochure with their tax bills.

6.13 Operational Considerations

Given the increase in severity and frequency of winter storms, the Town wishes to create a Special Purpose Tax Reserve Fund to buffer the potential of significant operational cost overruns. The Financial

Reporting and Accounting Manual as prescribed by Service Nova Scotia and Municipal Relations as... "the system of accounting to be used by municipalities...", requires that accounting of special reserves be maintained separate and apart from operating and capital reserve funds. A special purpose tax reserve is restricted to use for the purpose for which it was raised and is not unlike the environmental project reserve previously established by Council. Council has the ability to fund a winter storm reserve from the general tax rates or by transferring surpluses derived from general operations into this special purpose tax reserve.

The Town of Pictou currently operates under the Chief Administrative Officer model of local government. As part of this approach, the CAO and Department Heads routinely table briefing notes and recommendation reports for Council consideration. These memorandums currently require staff commentary on the relationship of the topic at hand to the Town's Integrated Community Sustainability Plan (ICSP). Modifications will be introduced to the memorandum templates to ensure Council is aware of staff opinions and advice relative to MCCAP implications.

The MCCAP is intended to work in companion with the Town's CIP, ICSP, Planning Documents, and operational budgets. As such, updates to the MCCAP will be required. The Town will formally update the MCCAP twice during a five year planning cycle.

CHAPTER 7 MITIGATION PLANS

7.1 Introduction

Energy reduction strategies for the Town of Pictou favour those opportunities for the reduction of heat loss first and then opportunities for the use of alternative energy sources. The main heat loss reduction strategies implemented by the Town include: improved insulation in basement and ceilings, improved space heating efficiency and space heating controls. A strategy for energy reduction included the purchase of newer fuel-efficient equipment.

7.2 Energy and Emissions Inventory

The Corporate Energy and Emissions Spreadsheet developed by the Union of Nova Scotia Municipalities (UNSM) has been completed and attached as Appendix B. Table 7.1 shows the summary of the emissions calculated within this spreadsheet.

Table 7.1: Energy & Emissions Inventory Summary Table

Emission Category	Energy Type	Energy Consumption per year	Cost($)	Units	Emission Factor (Kg CO_2/units)	Emissions (tCO2e)
Buildings	Electricity	828554	124283.1	kWh	0.00084	1171.16
	Oil	177287	133814	L	2.68	
Vehicle Fleet	Gasoline	23478	22989.76	L	2.34	104.25
	Diesel	20563	17262.65	L	2.63	
Street and Area Lights	Electricity	202706.4	30405.96	kWh	0.00084	170.29
Water and Wastewater	Electricity	1,441,344	216201.6	kWh	0.00084	586.4
Waste	N/A					

7.3 Mitigation Actions Implemented

The Town has invested $581,925 in a range of emission control projects that will translate in a CO2 emission reduction of 630 tonnes and annual energy savings of $121,509. Table 7.2 shows a list of projects implemented to meet the current ICSP. Appendix C shows a list of the emission mitigation projects implemented up to date. These strategies for emission reduction aim at the same time to

comply with the Memorandum of Understanding on Climate Change made between UNSM and the Province of Nova Scotia.

Table 7.2: Projects Implemented During the Current ICSP

Projects Complete to Date		
Project Name	**Description**	**MCCAP Category**
Church Street Storm Water Separation	In 2012 the Town completed the installation of a storm sewer trunk line that will service the majority of the western end of town.	Storm Water Reduction
deCoste Storm Water Separation	To reduce back-ups at a major sanitary lift station, a project was completed in a portion of the downtown to separate storm water.	Storm Water Reduction
Prince Street Storm Water	The lower portion of Prince Street was deemed to be a major contributor of stormwater to the sanitary system. To reduce volumes, a portion of the street was equipped with a separate stormwater system.	Storm Water Reduction
Public Works Upgrades	As part of the Town's energy conservation program the building has been upgraded with insulation, furnace damper vents and diffusers.	Energy Losses/CO_2 reductions
Fire Hall Upgrades	As part of the Town's energy conservation program the building has been upgraded with insulation, furnace damper vents and diffusers.	Energy Losses/CO_2 reductions
Airfield Engineering Flight Upgrades	As part of the Town's energy conservation program the building has been upgraded with insulation, furnace damper vents.	Energy Losses/CO_2 reductions
Town Hall Upgrades	As part of the Town's energy conservation program the building has been upgraded with boiler controls and damper vents, and new windows and doors.	Energy Losses/CO_2 reductions
deCoste Center Upgrades	As part of the Town's energy conservation program the lighting has been upgraded.	Energy Losses/CO_2 reductions
Fisheries Training Pool Upgrades	As part of the Town's energy conservation program the facility has been upgraded with boiler damper and replaced fans for speed reduction.	Energy Losses/CO_2 reductions
RCMP Building Upgrades	As part of the Town's energy conservation program the building has been upgraded with programmable thermostats.	Energy Losses/CO_2 reductions
Wellhouses Upgrades	As part of the Town's energy conservation program the wellhouses have been upgraded with insulation and VFDs.	Energy Losses/CO_2 reductions

Figure 7.1 Installation of Main Storm Sewer Church Street

Figure 7.2 New Windows at Town Office

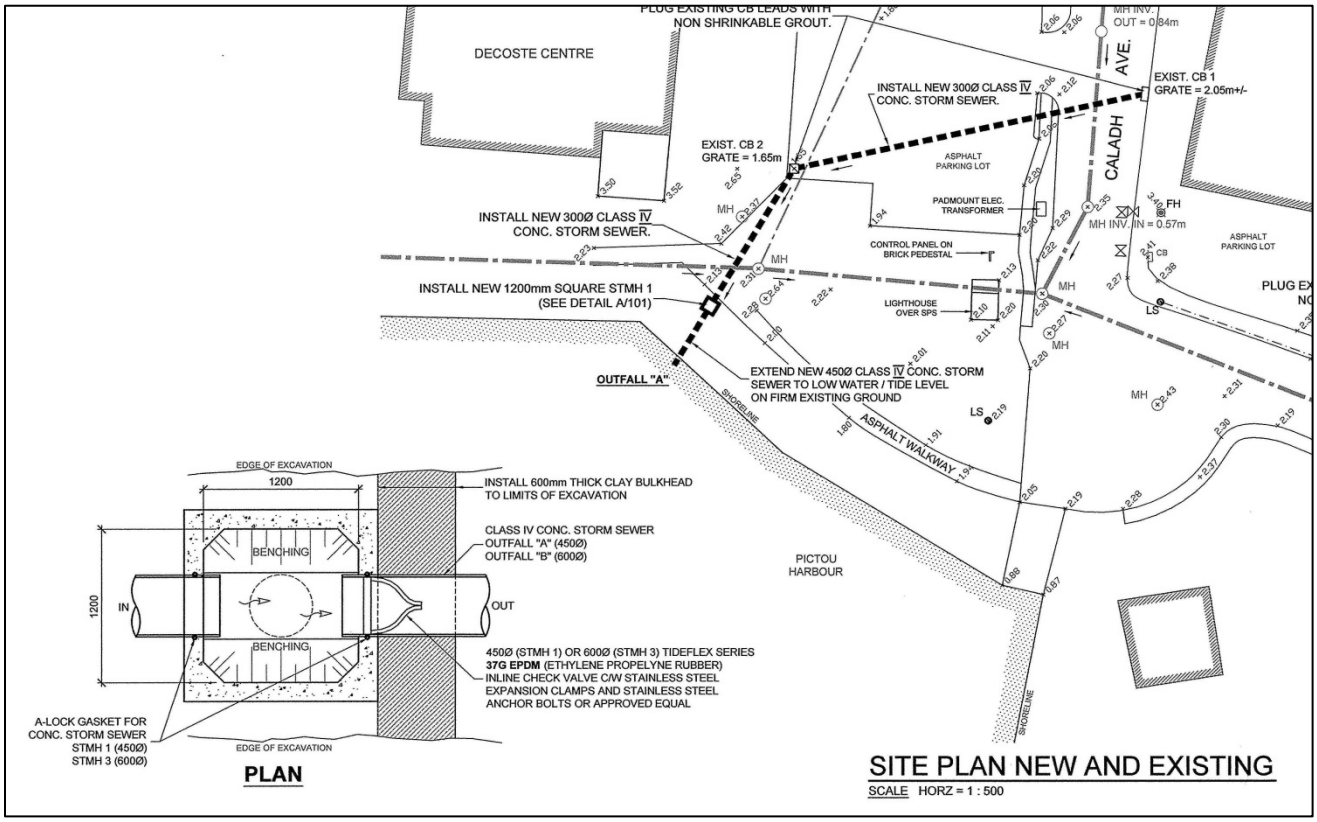

Figure 7.3 Storm Sewer Separation at the deCoste Parking Lot

7.4 Emission Reduction Goals

The Town of Pictou plans to implement the following projects with the aim of continuing to reduce energy consumption and greenhouse gases emission:

- Separation of storm sewer systems to reduce the excess inflows into the wastewater treatment plant and consequently reduce the energy demand of the facility and lifting stations;
- Reduction of infiltration and inflow into the sewer system to reduce the excess volume of wastewater flowing into the treatment plant. This would consequently reduce the energy demand of the facility and lifting stations;
- Installation of LED streetlights;
- Implementation of SCADA System in order to reduce daily visitation to each well site and related fuel use (a drop from 7 to 1 time per week is expected); and
- Centralization of Water Treatment in chlorination, backwash, UV treatment. Energy requirements will be consolidated from 9 sites to 1.

CHAPTER 8 IMPLEMENTATION

As can be seen in table 8.2, the Town has several projects relating to climate change that are currently in various stages of completion. The purpose of this table is to summarize the information gaps and other project components, such as external financing, that are required in order for the project(s) to be completed.

Similar to most major capital undertakings, the projects listed below require (and are at) various points of pre-design, detailed design, and project (construction) management. Figures 8.1 to 8.4 show three of these projects at various stages of implementation.

Implementation will be guided through an ongoing prioritization process. The Town recognizes that many factors can influence project implementation, e.g. debt affordability, the nature and availability of external financing, and regulatory requirements. Meeting regulatory requirements will take precedent. From a general perspective, however, the Town will utilize table 8.1 to guide implementation priorities. Figure 8.5 shows the estimated timeframe for the implementation of the MCCAP.

Table 8.1: Prioritization Methodology

	Prioritization Table				
Issue	**Severity (0-3)**	**Frequency (0-1)**	**Area (0-1)**	**Cost Recovery (0-5)**	**Total Score (0-10)**
Storm Sewer Separation	3	1	0.5	2	6.5
I&I Reduction	3	1	1	1	6
CO2 Emissions	1	0	1	5	7
Water Conservation	3	0.5	1	2	6.5

Table 8.2: Future Projects Relating to MCCAP

Future/In Progress Projects					
Project Name	**Description**	**MCCAP Category**	**Information Gaps**	**Comments**	**Costs**
Wellhead Upgrades (control related)	The Water Utility will be upgraded to include new higher efficiency pumps, and VFDs. These upgrades will reduce energy requirements at all 13 sites.	CO_2 reduction	• Total Energy reduction is unknown	Expected completion: February 2014	$315,000
Water System SCADA	A SCADA system will allow for the electronic data collection at 14 sites thereby eliminating the daily sites by operators.	CO_2 reduction	• Expected Site visits for servicing requirements	Expected completion: February 2014	$315,000
Wellhead Upgrades (process related)	Wellheads will be upgraded with more efficient technology, e.g. ultraviolet disinfection to reduce chemical injection.	CO_2 reduction	• Total Energy reduction is unknown	Expected completion: February 2014	$315,000
Stormwater Separation in Downtown Area	The Town has developed storm separation drawings for flood prone areas in the downtown (an area surrounding the Provincial the Justice Building).	Storm Water Reduction	• Cost Sharing Options	Western boundary complete	$70,000
Wellington Street Storm Water	The Town has developed storm separation drawings for Wellington Street. This is a large collection area for storm sewer which requires separation.	Storm Water Reduction	• Dated costing • Existing Infrastructure	Projection were developed in 2009	$250,000
Piloting of Water Treatment Technology	The goal is to identify a technology that is both effective and efficient, e.g. low demand for backwash water, chemicals and electricity.	Water Conservation CO_2 reduction	• Completely new technology. Operating parameters unknown	One pilot includes biological technology	$127,000
Water Meters	Water meters are being installed at each service location. Several studies show that meters result in a 15% reduction in water usage.	Water Conservation	• Total water savings is unknown • Total cost is a moving target	Expected Completion: January 2014	$522,000

Future/In Progress Projects					
Project Name	**Description**	**MCCAP Category**	**Information Gaps**	**Comments**	**Costs**
Line/Hydrant Replacement	The Water Utility undertakes annual water line replacements. The goal is to develop a master plan that will address prioritized areas prone to leaks/breaks, and replace sections and components to address volume and pressure issues.	Water Conservation	• Distribution Line replacement Master Plan	WaterGEMs or hydraulic modelling could be used for a ranking system	$110,000 per year Masterplan $20,000
Water Treatment Plant	A pre-design report has been completed which in turn will be update with information obtain from the technology pilots. The new centralized treatment plant will reduce the number of disinfection sites from 9 to 1.	CO_2 reduction	• Only pre-design exists • Technology unselected • Cost estimates are from 2009 • No large infrastructure programs currently exist	Pilot Project will determine technology to be used.	$4.5 million
LED Streetlight Replacement	A complete streetlight replacement program needs to be conducted. All high pressure sodium and mercury vapour lights and fixtures will be replaced with LED technology. Energy savings under LED may be 80% of current day costs.	Energy Losses/CO_2 reductions	• Total savings is unknown • Streetlight locations map does not exist • Total billed may not be total existing • Total cost is unknown	This project is in the early stages. It has low appeal according to the MCCAP but financially it has great incentive (80% reduction in energy cost)	Unknown
M.E. Lloyd Sewer	The Town is investigating sources of I&I to the M.E. Lloyd sewer. This particular services a significant portion of the northern end of Town and is currently prone to flooding.	I&I Reduction	• Detailed contour mappings/surveys do not exist • Source(s) of I&I is unknown • Cost estimates are unknown	Current status is negatively impacting private property owners. Illegal connections may exist.	Unknown

Figure 8.1 Upgrades to Wellheads (Process related -2013)

Figure 8.2 Water Treatment Pilot – Conventional 2013

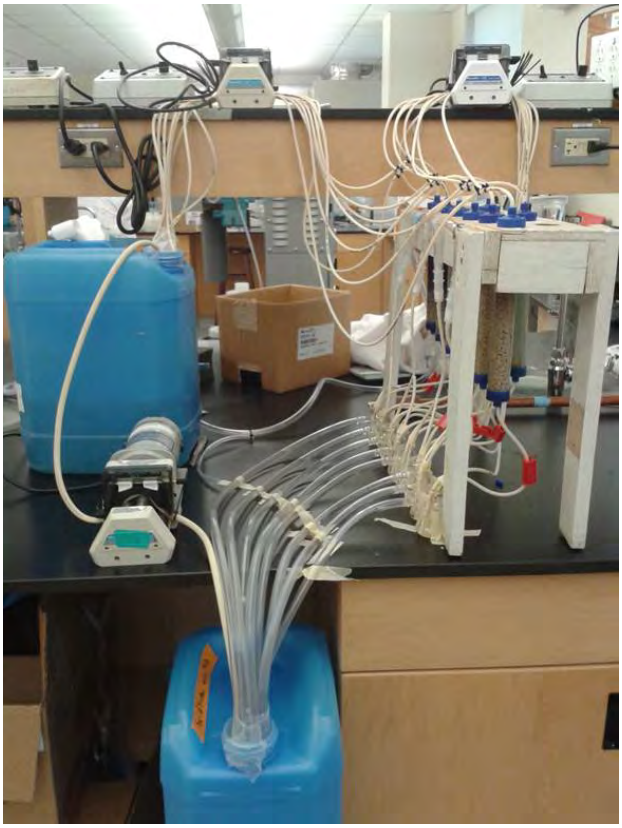

Figure 8.3 Water Treatment Pilot – Biological 2013

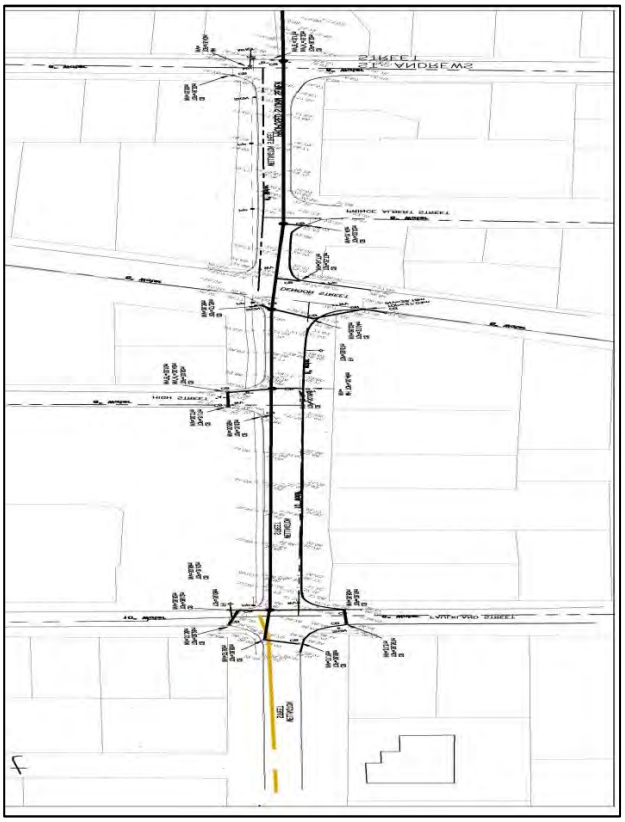

Figure 8.4 Wellington Street Stormwater Design

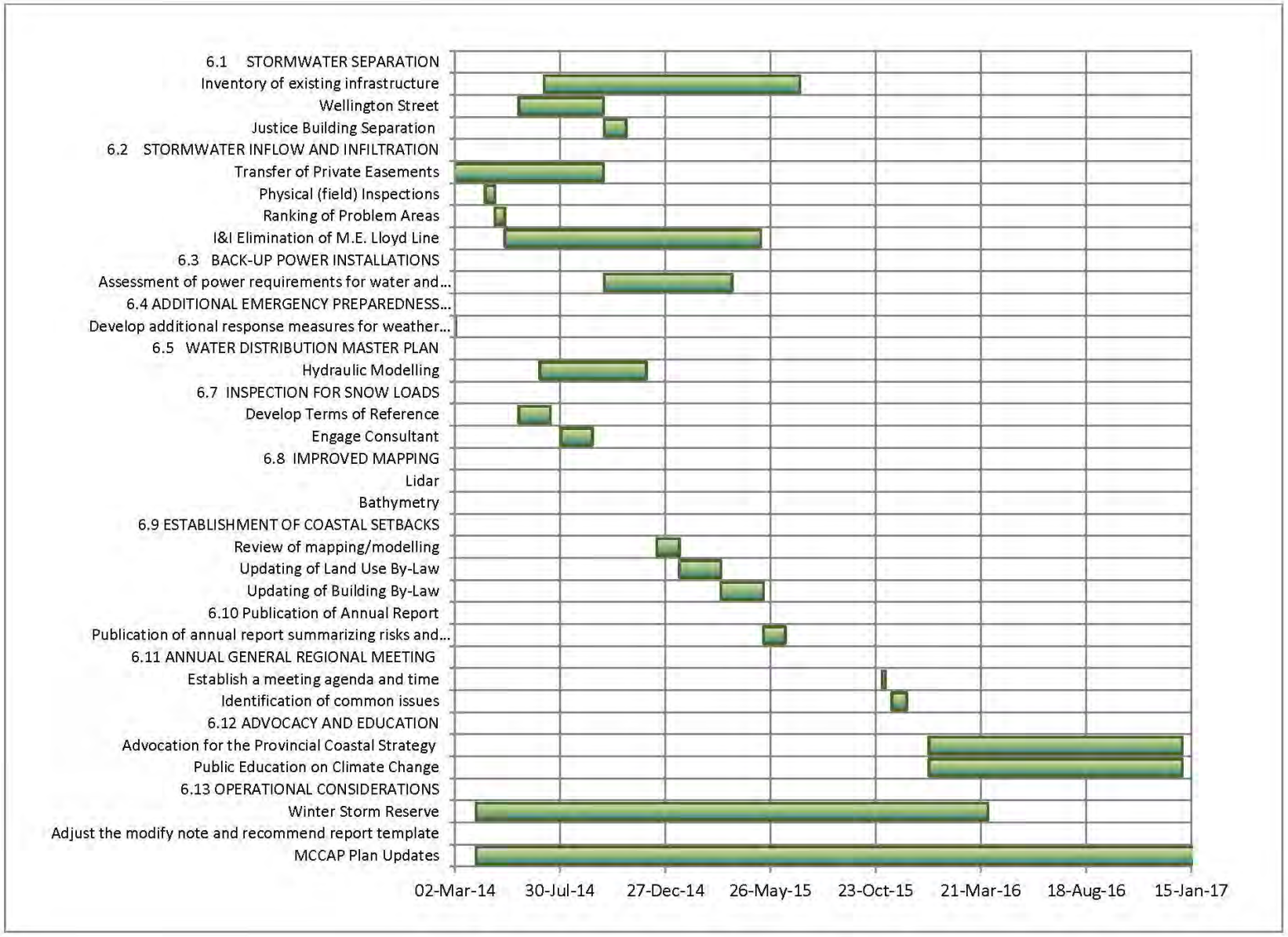

Figure 8.5 Timeframe for Implementation of MCCAP for the Town of Pictou

CHAPTER 9 REFERENCES

Daigle R., Richards W. 2011. "Scenarios and guidance for adaptation to climate change and sea level rise – NS and PEI municipalities". Report commissioned by the Atlantic Climate Solutions Association. www.atlanticadaptation.ca

Environment Canada. Canadian Ice Service. 2013. Available online: http://www.ec.gc.ca/glaces-ice/?lang=En&n=1C648CC3-1&wsdoc=62910372-2248-11DF-8EC5-90A4909AA923/ Accessed 2013.

Government of Nova Scotia. 2009a. Sea level rise and storm events. The 2009 state of Nova Scotia's Coast Report. Available online: https://www.novascotia.ca/coast/documents/state-of-the-coast/WEB_SLRSE.pdf Accessed November 2013.

Government of Nova Scotia. 2009b. Our Coast. Live. Work. Play. Protect. The 2009 state of Nova Scotia's coast technical report. Available online: http://www.novascotia.ca/coast/documents/report/Coastal-Tech-Report-Nov-09.pdf Accessed November 2013.

Intergovernmental Panel on Climate Change, Fifth Assessment Report. Climate Change 2013: Approved Summary for Policymakers Working Group I of the IPCC, September 2013. http://www.climatechange2013.org/images/uploads/WGIAR5-SPM_Approved27Sep2013.pdf

Kennedy, G. 2012. Development of a GIS-based approach for the assessment of relative seawater intrusion vulnerability in Nova Scotia, Canada. Nova Scotia Department of Natural Resources, Halifax, Nova Scotia. 10pp.

Mersey Tobeatic Research Institute (MTRI) 2008. Species at Risk in Nova Scotia: Identification and In formation Guide. 89 pp.

Nova Scotia Department of Natural Resources (NSDNR). 2013. NS Endangered Species Act: Legally Listed Species. http://novascotia.ca/natr/wildlife/biodiversity/species-list.asp, Accessed October 2013.

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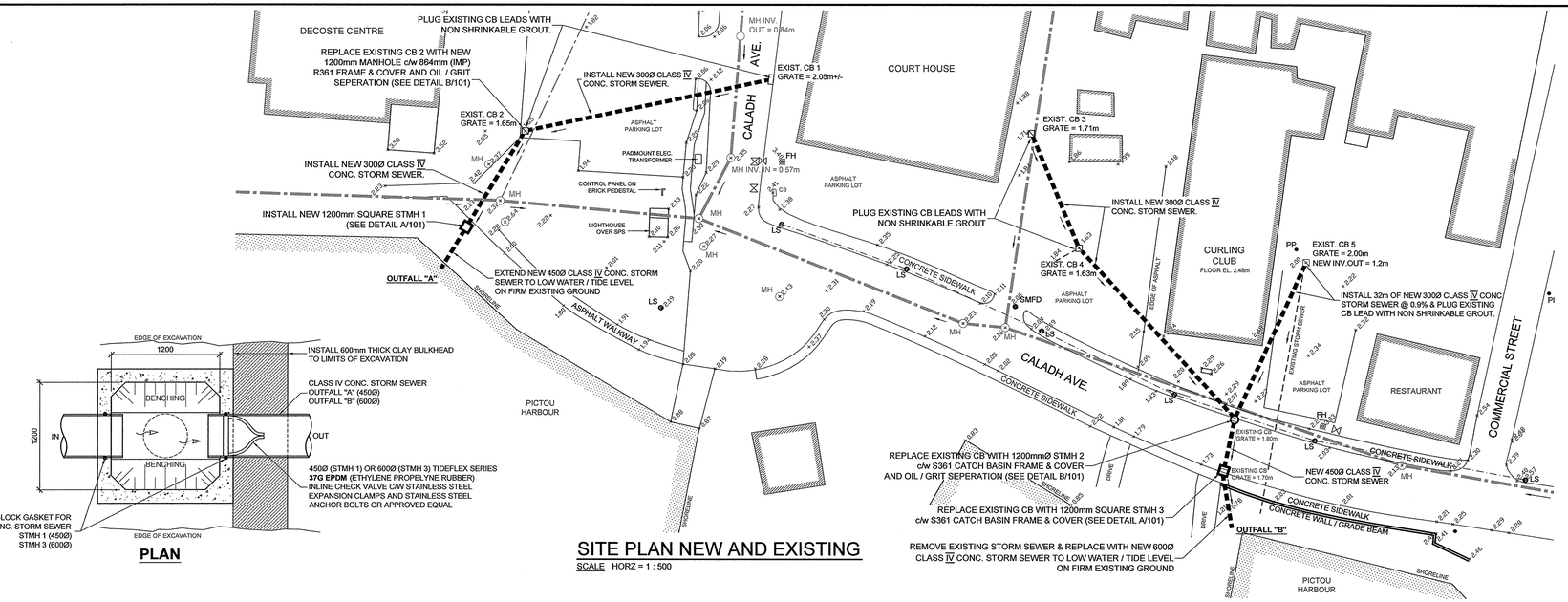
Water Resources Engineer

Victoria Fernandez, M.A.Sc.
Water Resources Engineering

APPENDIX A

Implemented and Proposed Stormwater Separation Project Drawings



SITE PLAN NEW AND EXISTING

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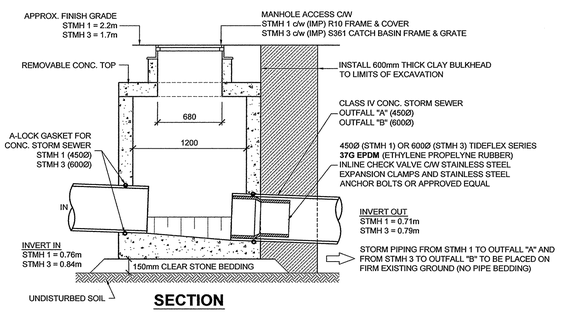
PLAN



SECTION

1200x1200 SQUARE MANHOLE CHECK VALVE DETAIL (A 101)

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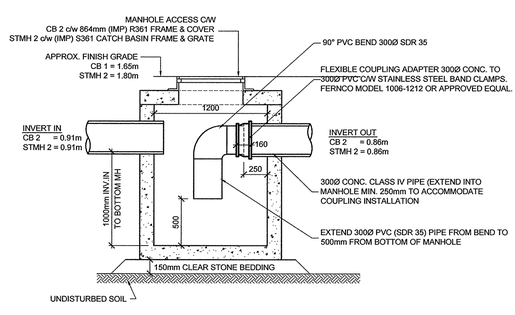


OIL / GRIT SEPERTOR DETAIL (B 101)

SCALE: N.T.S

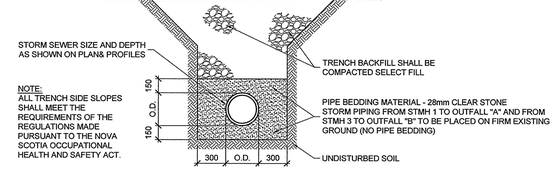
EXISTING PAVED AREAS:
- MATCH EXISTING ASPHALT THICKNESS
- 150mm TYPE-1 GRAVEL
- 300mm TYPE-2 GRAVEL
- IN SHALLOW BURY AREAS PLACE TYPE-2 GRAVEL FROM TOP OF PIPE BEDDING TO UNDERSIDE OF TYPE-1 GRAVEL

EXISTING CONCRETE SIDEWALKS CURBS & GUTTERS:
- 100mm THK. SIDEWALK / CONCRETE CURB & GUTTER TO MATCH EXISTING
- 150mm TYPE-1 GRAVEL
- 35MPa CONCRETE STRENGTH
- 6 - 8% AIR ENTRAINMENT

EXISTING GRASSED AREAS:
- 100mm THK. TOPSOIL
- SODDED

SURFACE REINSTATEMENT

EXISTING GRAVEL AREAS:
- 150mm TYPE-1 GRAVEL
- 300mm TYPE-2 GRAVEL
- IN SHALLOW BURY AREAS PLACE TYPE-2 GRAVEL FROM TOP OF PIPE BEDDING TO UNDERSIDE OF TYPE-1 GRAVEL



TYPICAL TRENCH DETAIL (C 101)

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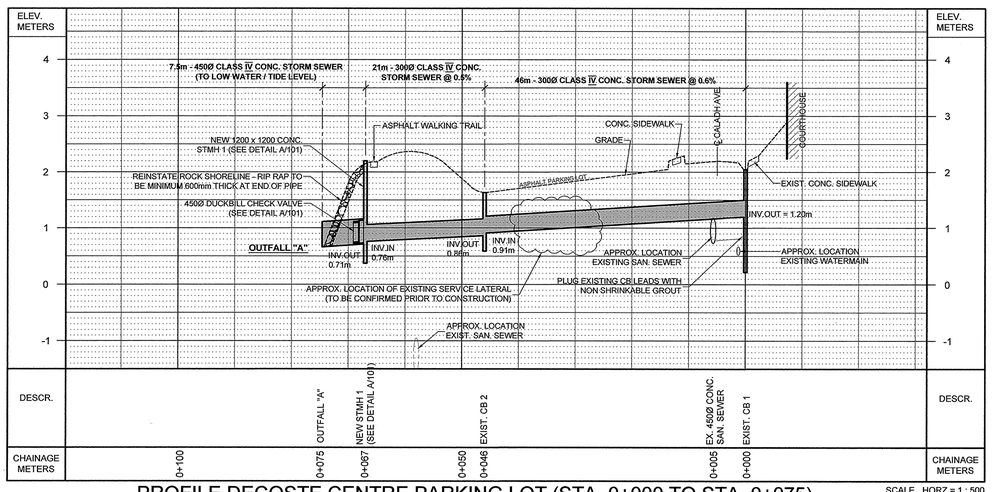

PROFILE DECOSTE CENTRE PARKING LOT (STA. 0+000 TO STA. 0+075)

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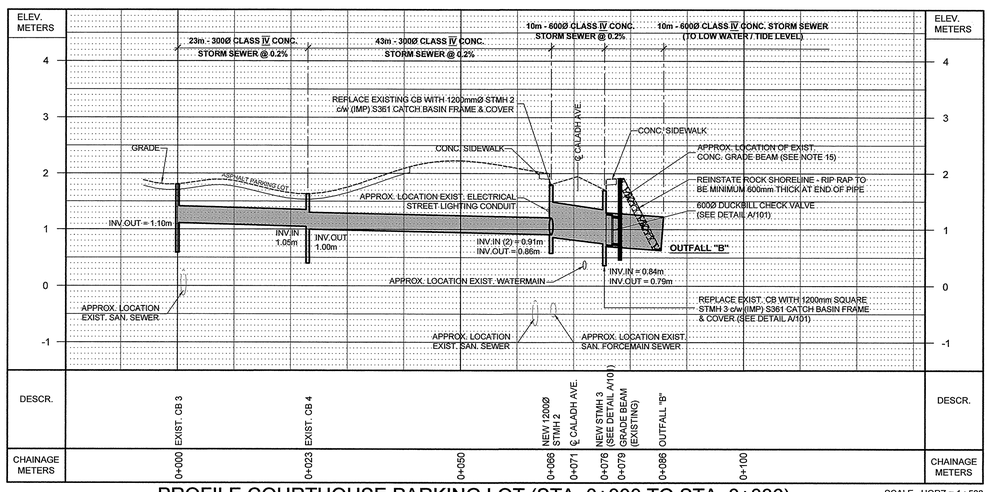
VERT = 1 : 50



PROFILE COURTHOUSE PARKING LOT (STA. 0+000 TO STA. 0+086)

SCALE HORZ = 1 : 500
VERT = 1 : 50

NOTE:

1. ELEVATION REFERENCED TO NSCM 206600 & 228979
2. CONTRACTOR TO CONFIRM LOCATIONS / INVERTS OF EXISTING WATER / SANITARY / STORM SEWERS IN THE FIELD THAT MAY BE AFFECTED BY NEW CONSTRUCTION.
3. CONTRACTOR TO CONTACT ALL UTILITIES TO COORDINATE CONSTRUCTION & OBTAIN ALL PERMITS. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY SUPPORTS & INSTALLATIONS TO ACCOMMODATE THE CONSTRUCTION.
4. KEEP ROADWAY CLEAR OF DEBRIS.
5. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL SERVICES (LATEST EDITION)
6. ALL WORK TO BE COMPLETED IN ACCORDANCE WITH NOVA SCOTIA OCCUPATIONAL HEALTH & SAFETY REGULATIONS. ALL WORK WITHIN NSTIR RIGHT OF WAY TO BE COMPLETED IN ACCORDANCE WITH NSTIR TRAFFIC CONTROL MANUAL. TRAFFIC CONTROL PLAN TO BE PRE-APPROVED BY NSTIR. TRAFFIC INTERRUPTION TO BE KEPT TO A MINIMUM. CONTRACTOR MUST PROVIDE RE-INSTATEMENT TO TOWN OF PICTOU STANDARDS / ACCEPTANCE.
7. CONTRACTOR TO PROVIDE AN EROSION / SEDIMENTATION CONTROL PLAN PRIOR TO CONSTRUCTION.
8. WHERE NEW STORM SEWER CROSSES OVER EXISTING WATERMAIN PROVIDE POLYETHYLENE ENCASEMENT FOR 3 JOINTS ON EITHER SIDE OF CROSSING OR AS SPECIFIED ON DRAWING.
9. PRECAST CONCRETE MANHOLES TO BE TO CSA CAN3-A23.3 "DESIGN OF CONCRETE STRUTURES". ALL CONCRETE MATERIAL FABRICATION AND PRACTICES SHALL CONFORM TO THE STANDARD CAN3-A23.1 "CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION".
10. GRAVEL AND ASPHALT TO NSTIR STANDARD SPECIFICATION "HIGHWAY CONSTRUCTION AND MAINTENANCE". CONCRETE TO BE 35MPa COMPRESSIVE STRENGTH WITH 6-8% AIR ENTRAINMENT.
11. ALL MANHOLES TO BE MANUFACTURED WITH A-LOK GASKETS AT PIPE INLET / OUTLET. RE-USE EXISTING CATCH BASIN FRAMES & COVERS. MANHOLES / CATCH BASINS TO BE INSTALLED ON 150mm CLEAR STONE BEDDING.
12. THE CONTRACTOR SHALL REINSTATE ALL EXISTING FEATURES (ASPHALT, CURBS, SIDEWALKS, RIP RAP, GRASS, DITCHES, ETC.) TO EXISTING CONDITIONS.
13. THE PROPOSED STORM DRAINAGE IS INTENDED TO REMOVE STORM WATER FROM THE EXISTING SANITARY SEWER SYSTEM AND TO PROVIDE STORM DRAINAGE FOR THE DRAINAGE AREA SHOWN ON THIS DRAWING.
14. CONNECT NEW PIPING TO EXISTING CATCH BASIN (UNO). INSTALL PIPING IN EXISTING CATCH BASINS AND PLACE UNSHRINKABLE GROUT AT INTERFACE BETWEEN PIPE AND CATCH BASIN. IF THE STRUCTURAL INTEGRITY OF THE EXISTING CATCH BASINS CANNOT BE MAINTAINED DURING PIPE INSTALLATION, REPLACE CATCH BASIN.
15. **PIPE INSTALLATION AT CONCRETE GRADE BEAM:**
    - REMOVE EXISTING PIPE AT GRADE BEAM
    - ENLARGE EXISTING HOLE THROUGH GRADE BEAM USING A CONCRETE SAW
    - INSTALL NEW 600mmØ CONCRETE PIPE
    - FILL SPACE BETWEEN NEW PIPE AND GRADE BEAM WITH 35MPA CONCRETE.
16. ALL DEBRIS / WASTE MATERIAL DISPOSAL TO BE AS PER TOWN OF PICTOU INSTRUCTIONS.

MATCHING EXISTING ASPHALT:

- SAW CUT EXISTING ASPHALT TO ENSURE SQUARE / CLEAN EDGE AND TO EXPOSE FULL THICKNESS OF EXISTING ASPHALT.
- GRADE NEW GRAVELS AND PLACE NEW ASPHALT SUCH THAT A SMOOTH GRADE TRANSITION FROM OLD TO NEW ROADWAY IS OBTAINED (IE. NO WATER PONDING OR BUMPS)
- AT MATCH POINT OF NEW TO EXISTING ASPHALT APPLY GENEROUS THICK COAT OF EMULSIFIED ASPHALT (TACK) - RSI TO SAW CUT EDGES PRIOR TO PLACEMENT OF NEW ASPHALT.

LEGEND:

- +0.84 — SPOT ELEVATION
- SMFD — SURVEY MARKER FOUND
- PP — POWER POLE
- LS — LIGHT STANDARD
- FH — FIRE HYDRANT
- WATER VALVE
- MH11 — SANITARY SEWER & MANHOLE
- CB — STORM SEWER & CATCH BASIN
- BUILDING FACE
- SHORELINE
- NEW STORM SEWER
- NEW STORM MANHOLE (SQUARE)
- NEW STORM MANHOLE (ROUND)

No.	Issue	Date
0	Issued For Tender	2 March 2011
No.	Revision	Ckd. By / Date

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Stamp

REGISTERED PROFESSIONAL ENGINEERS — M. C. MacDOUGALL — 6666 — PROVINCE OF NOVA SCOTIA — DATE

Const. North

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Dwg. Standards Ckd. By:

Designed By:

Dwg. Design Ckd. By:

Date Printed: 02 March 2011

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Drawing Title: Plan & Profile

Project No.: LH1052282

Dwg. No.: 101

Rev. No.: 0

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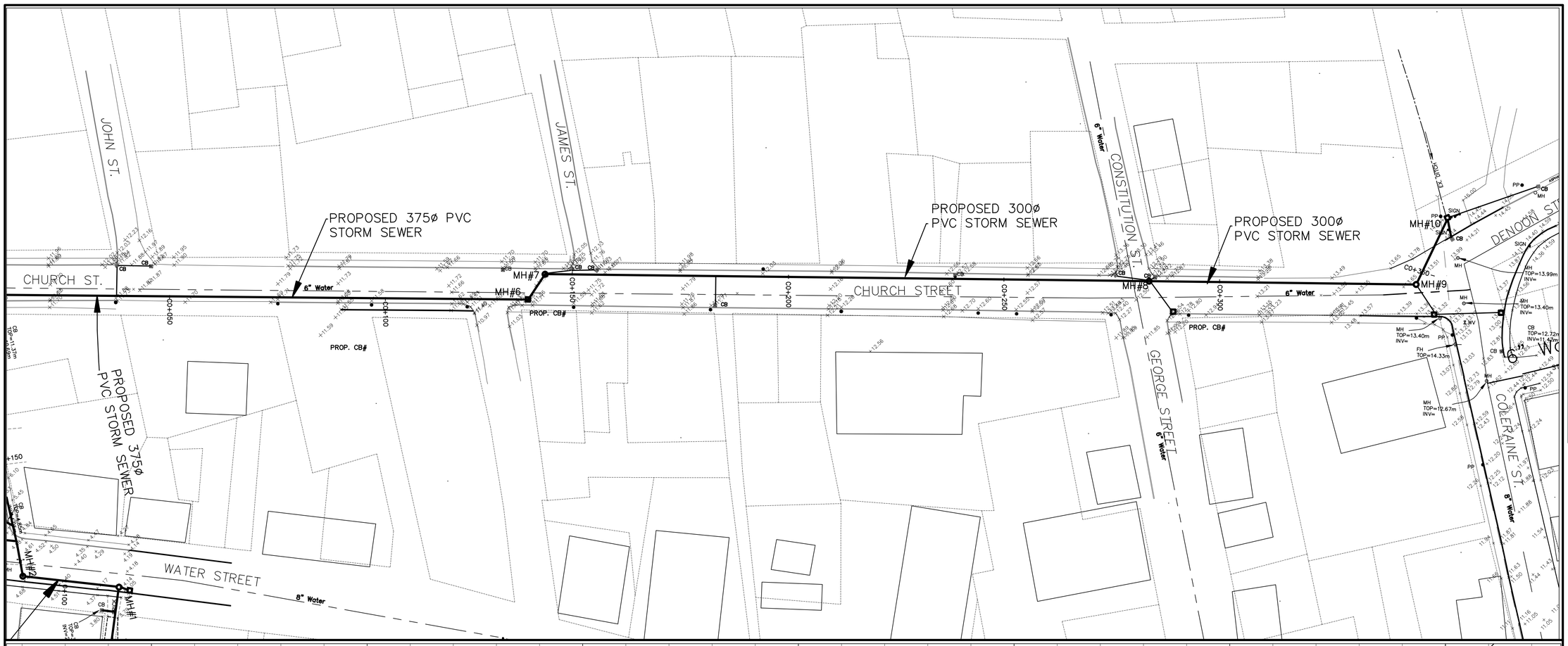

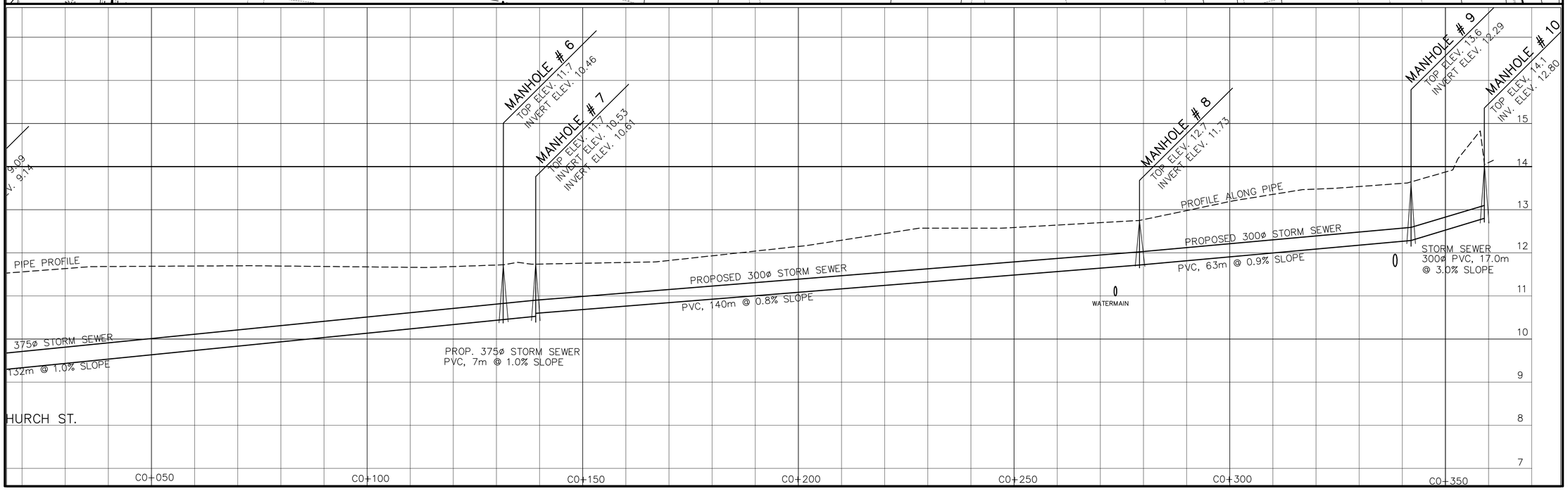

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1	09.04.06	CLIENT REVIEW	KR	
1	09.04.03	REWORK TO NEW SURVEY DATA	KR	

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Project

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Title

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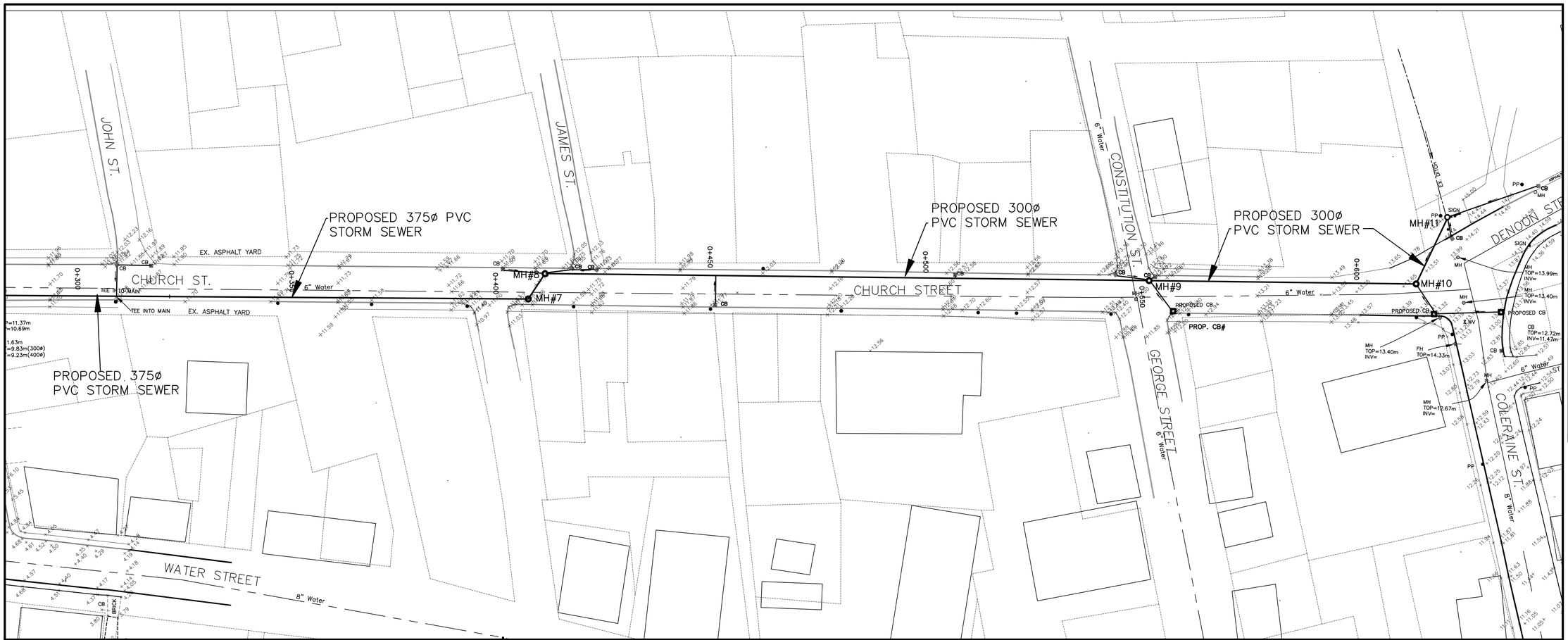

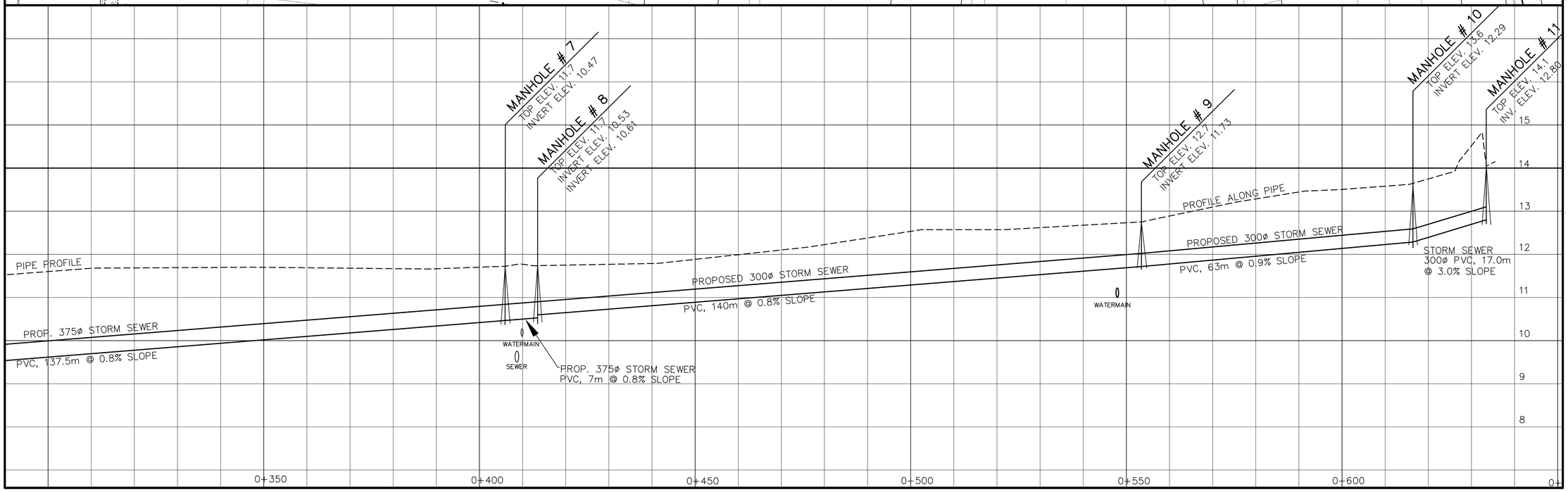

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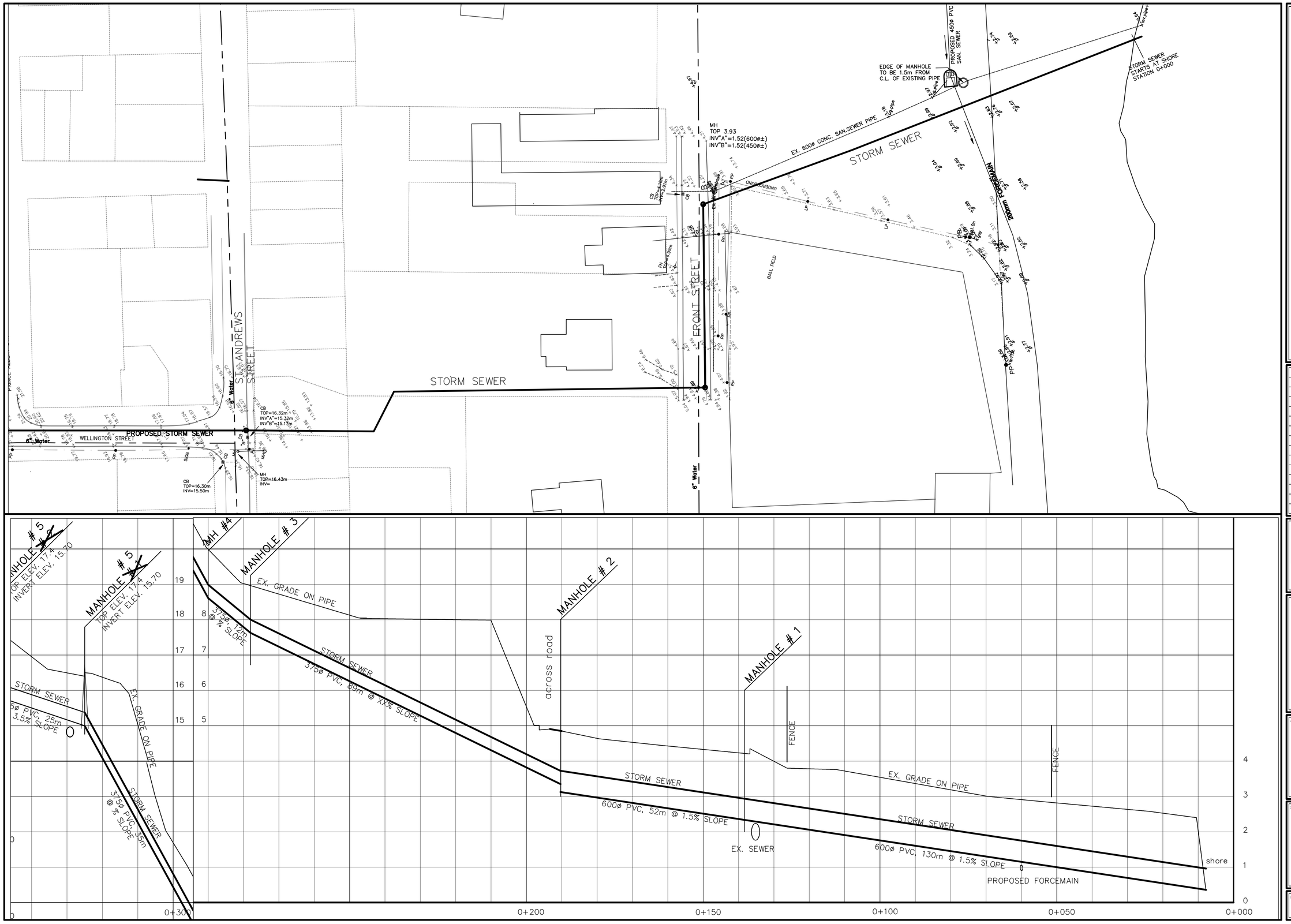

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Title

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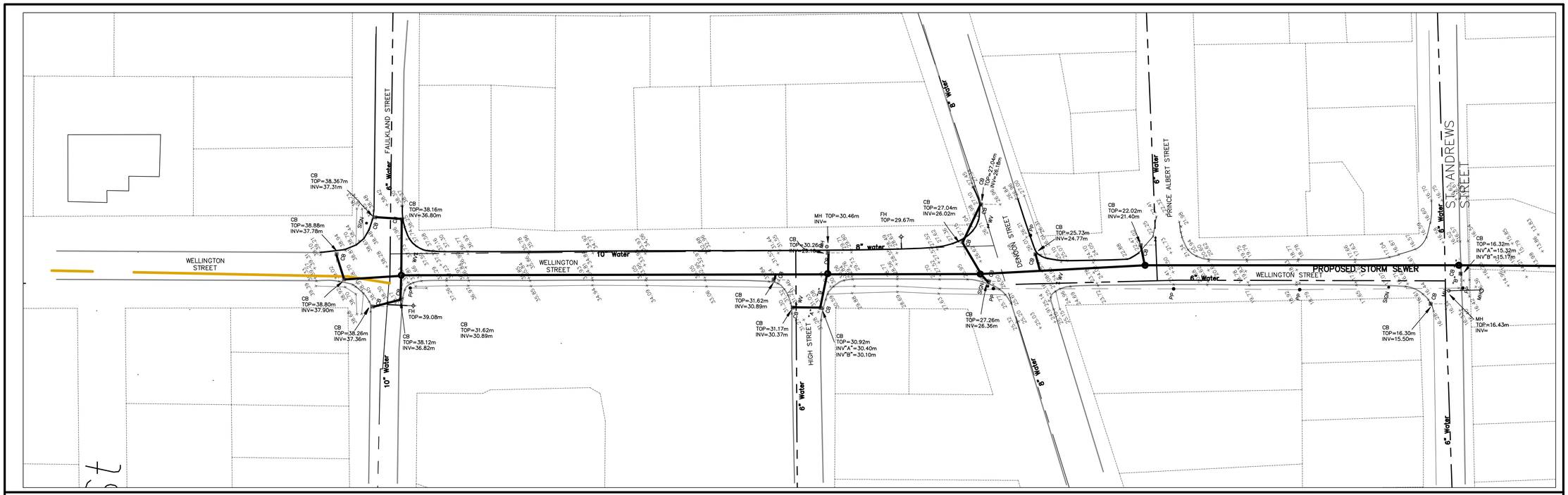

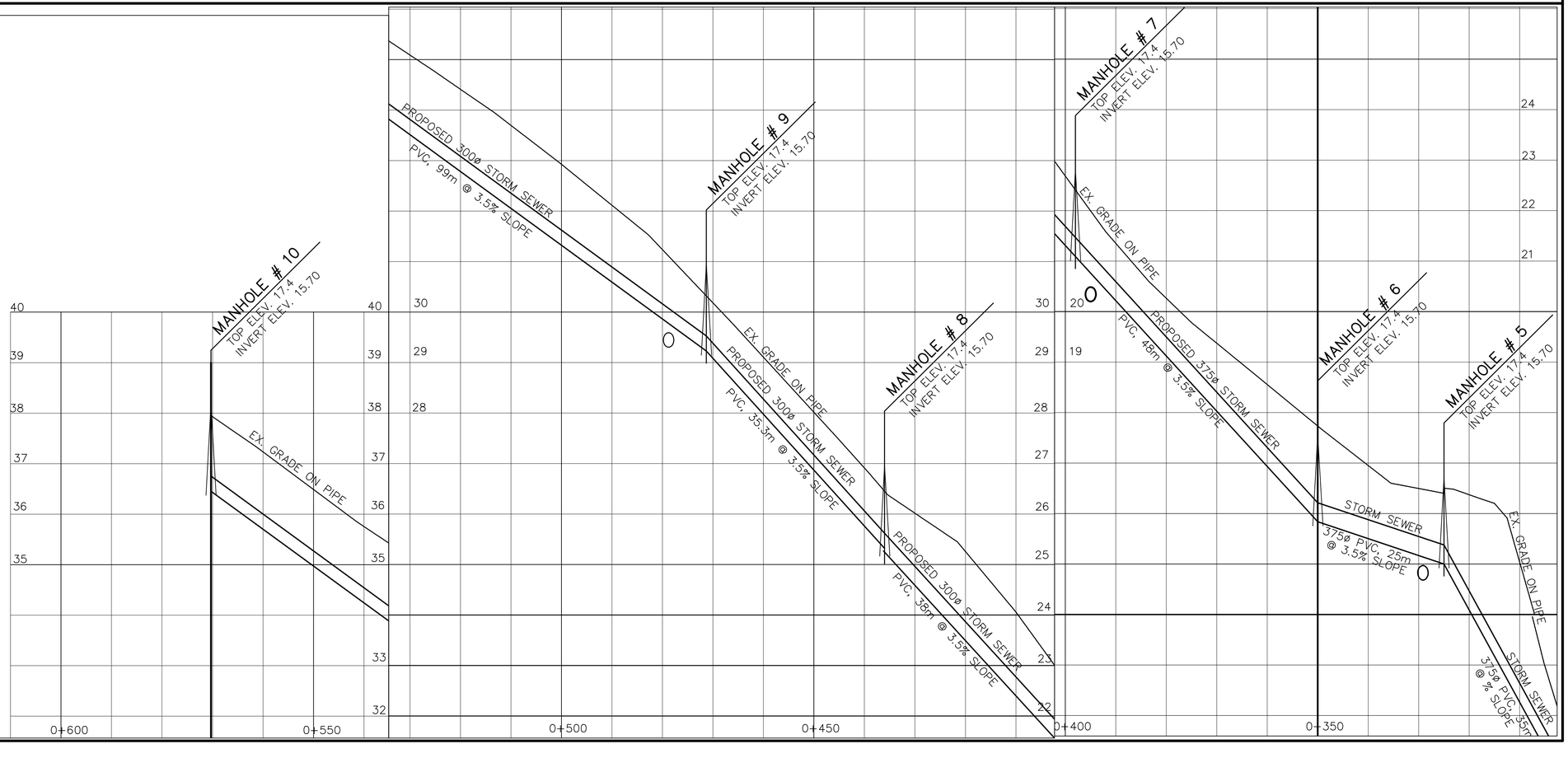

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Project

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Title

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Revision

APPENDIX B

Corporate and Emissions Spreadsheet

Buildings

Buildings **Town of Pictou**

Corporate Inventory

A) Energy Consumption - Buildings

				Emissions Coefficients																					
				Type Selected Coefficient					AP		2.68 kg eCO2/L			AP											
	1. Indicators			2. Electricity (kWh)							3. Furnace Oil (L)					TOTALS									
Building or Building Group Name	Occupants	Operating Hours	Total Floor Area (m^2)	Account Number(s)	Total Use (kWh)	Total kWh Cost ($)	Total Demand Charges (kVA)	Total Demand Cost ($)	Total eCO_2 (t)	Total SO_2 (t)	Account Number(s)	Total Use (L)	Cost ($)	Total eCO_2 (t)	Total SO_2 (t)	Total Cost ($)	Total eCO2 (t)	Cost ($) / Operating Hour	Total Cost ($) / Occupant	Cost ($) / m^2	Total ekWh	ekWh/m^2	eCO_2 (t) / Operating Hour	eCO_2 (t) / Occupant	eCO_2 (t) / m^2
Town of Pictou Administration Building	4	2000.00	1,500.00		58,840.00	$8,826.00			49.43	0.53		13,086.00	$10,729.00	35.07	111.49	$19,555.00	84.50	$9.78	4888.75	$13.04	199,514.50	133.01	0.04225	21.12490	0.05633
Pictou Firehall	12	4000.00	774.00		33,719.00	$5,057.85			28.33	0.30		14,124.00	$11,580.00	37.85	120.34	$16,637.85	66.18	$4.16	1386.49	$21.50	185,552.00	239.73	0.01654	5.51486	0.08550
Pictou RCMP Building	2	8000.00	440.00		150,240.00	$22,536.00			126.21	1.36				0.00	0.00	$22,536.00	126.21	$2.82	11268.00	$51.22	150,240.00	341.45	0.01578	63.10531	0.28684
Pictou Train Station Museum	30	2000.00	840.00		47,056.00	$7,058.40			39.53	0.43		12,483.00	$10,121.00	33.45	106.36	$17,179.40	72.98	$8.59	572.65	$20.45	181,248.25	215.77	0.03649	2.43281	0.08689
Pictou Marina Building	1	2000.00	100.00		11,264.00	$1,689.60			9.46	0.10				0.00	0.00	$1,689.60	9.46	$0.84	1689.60	$16.90	11,264.00	112.64	0.00473	9.46244	0.09462
Pictou Hector Interpretive Center	10	1500.00	630.00		75,125.00	$11,268.75			63.11	0.68				0.00	0.00	$11,268.75	63.11	$7.51	1126.88	$17.89	75,125.00	119.25	0.04207	6.31095	0.10017
Pictou Hector Gift Shop	4	1500.00	150.00		11,000.00	$1,650.00			9.24	0.10				0.00	0.00	$1,650.00	9.24	$1.10	412.50	$11.00	11,000.00	73.33	0.00616	2.31017	0.06160
deCoste Entertainment Center	4	2000.00	1,220.00		135,680.00	$20,352.00			113.98	1.23				0.00	0.00	$20,352.00	113.98	$10.18	5088.00	$16.68	135,680.00	111.21	0.05699	28.49484	0.09343
Pictou Public Works	4	2000.00	408.00		91,980.00	$13,797.00			77.27	0.83		17,464.00	$14,430.00	46.80	148.79	$28,227.00	124.07	$14.11	7056.75	$69.18	279,718.00	685.58	0.06204	31.01806	0.30410
Pictou AEF Building	30	3000.00	1,846.00		99,090.00	$14,863.50			83.24	0.90		16,438.00	$13,489.00	44.05	140.05	$28,352.50	127.30	$9.45	945.08	$15.36	275,798.50	149.40	0.04243	4.24318	0.06896
Pictou Fisheries Training Pool	6	3000.00	1,174.00		114,560.00	$17,184.00			96.24	1.04		103,692.00	$73,465.00	277.89	883.46	$90,649.00	374.13	$30.22	15108.17	$77.21	1,229,249.00	1047.06	0.12471	62.35531	0.31868
Totals	107	31,000.00	9,082.00		828,554.00	$124,283.10	#DIV/0!	$0.00	696.04	7.49		177,287.00	$133,814.00	475.13	1,510.49	$258,097.10	1,171.16	$8.33	2412.12	$28.42	2,734,389.25	#DIV/0!	0.03778	10.94546	0.12895

B) Air Pollutants

	2. Electricity - Air Pollutants			3. Furnace Oil (L)		
	Total Use (kWh)	AP Coefficient	Total AP (t)	Total Use (L)	AP Coefficient	Total AP (Kg)
Carbon Monoxide (CO)	828554.00	N/A	N/A	177287.00	0.000600	106.372200
Sulphur Dioxide (SO2)		0.000009	7.490128		0.008520	1510.485240
Oxides of Nitrogen, expressed as NO2 (NOx)		0.000002	1.267688		0.002400	425.488800
Volatile Organic Compounds (VOCs)		N/A	N/A		0.000024	4.254888
Total Particulate Matter (TPM)		N/A	N/A		0.000240	42.548880
Particulate Matter less than or equal to 10 microns (PM10)		N/A	N/A		0.000120	21.274440
Particulate Matter less than or equal to 2.5 microns (PM2.5)		N/A	N/A		0.000030	5.318610

Vehicle Fleet

Vehicle Emissions **Town of Pictou**

Corporate Inventory

A) Vehicle Emissions

				Emissions Coefficients							
				2.34 kg CO_2 / L				2.63 kg CO_2 / L			
	2. Indicators			3. Gasoline (L)				4. Diesel (L)			
1. Vehicle or Vehicle Group Name	Total Vehicle KM's	Total Vehicle Hours	# of Vehicles	Account Number(s)	Total Use (L)	Cost ($)	Total eCO_2 (t)	Account Number(s)	Total Use (L)	Cost ($)	Total eCO_2 (t)
Light Duty Vehicles Utility Trucks,Vans				3	23,478.10	$22,989.76	54.94				0.00
Heavy Duty Trucks Mobile Equipment							0.00		18,748.80	$19,716.24	49.31
Totals	0.00	0.00	0		23,478.10	$22,989.76	54.94		18,748.80	$19,716.24	49.31

Street Lights

Streetlights **Town of Pictou**

Corporate Inventory

		Emission Coefficient							
		0.00084006							
	Cost per kWh	3. Electricity (kWh)							
	$0.15	2. Indicators				4. Total			
Light Type	Account Number	# of Lights	Wattage per Fixture	Hours of Operation per Day	Days of Operation per Year	Total Use per Year (kWh)	Cost per Year ($)	Total eCO_2 (t) per Year per Light Type	Total eCO_2 (t) per Year per Streetlight
High Pressure Sodium		349	70	12	365	107,003.40	$16,050.51	89.89	0.257562396
High Pressure Sodium		6	100	12	365	2,628.00	$394.20	2.21	0.36794628
High Pressure Sodium		1	150	12	365	657.00	$98.55	0.55	0.55191942
High Pressure Sodium		54	250	12	365	59,130.00	$8,869.50	49.67	0.9198657
High Pressure Sodium		19	400	12	365	33,288.00	$4,993.20	27.96	1.47178512
Totals		429	194	12	365	202,706.40	$30,405.96	170.29	0.713815783

B) Air Pollutants

	2. Electricity - Air Pollutants		
	Total Use (kWH)	AP Coefficient	Total AP (KG)
Carbon Monoxide (CO)	202,706.40	N/A	N/A
Sulphur Dioxide (SO2)		0.000009	1.832466
Oxides of Nitrogen, expressed as NO2 (NOx)		0.000002	0.310141
Volatile Organic Compounds (VOCs)		N/A	N/A
Total Particulate Matter (TPM)		N/A	N/A
Particulate Matter less than or equal to 10 microns (PM10)		N/A	N/A
Particulate Matter less than or equal to 2.5 microns (PM2.5)		N/A	N/A

Water and Wastewater

Water and Wastewater **Town of Pictou**
Corporate Inventory

			Emissions Coefficients																								
			Type Selected Coefficient						AP	2.68 kg eCO2/L				AP	50.79 kg eCO_2/GJ				AP	2.63 kg eCO2/L				AP			
	Indicators		Electricty (kWh)							3. Furnace Oil (L)					4. Natural Gas					5. Diesel					TOTALS		
Facility or Facility Group Name	Output (1000L)	Floor Area (m^2)	Account Number(s)	Total Use (kWh)	Total kWh Cost ($)	Total Demand Charges (kVA)	Total Demand Cost ($)	Total eCO_2 (t)	Total SO_2 (t)	Account Number(s)	Total Use (L)	Cost ($)	Total eCO_2 (t)	Total SO_2 (Kg)	Account Number(s)	Total Use (GJ)	Cost ($)	Total eCO_2 (t)	Total NO_x (Kg)	Account Number(s)	Total Use (L)	Cost ($)	Total eCO_2 (t)	Total NO_x (KG)	Total Cost ($)	Total eCO_2 (t)	Total ekWh
Waste Water Facility				734,424.00	$110,163.60			616.96	6.64				0.00	0.00				0.00	0.00				0.00	0.00	$110,163.60	616.96	734,424.00
Waste Water Pumping System				706,920.00	$106,038.00			593.86	6.39				0.00	0.00				0.00	0.00				0.00	0.00	$106,038.00	593.86	706,920.00
WWTP Generator								0.00	0.00				0.00	0.00				0.00	0.00		1,297.00	$1,193.24	3.41	93.90	$1,193.24	3.41	13,942.75
Total	0.00	#DIV/0!		1,441,344.00	$216,201.60	#DIV/0!	$0.00	1,210.82			0.00	$0.00	0.00			0.00	$0.00	0.00			1,297.00	$1,193.24	3.41		$217,394.84	1,214.23	1,455,286.75

	2. Electricity			3. Fuel Oil (L)			4. Natural Gas			5. Diesel		
	Total Use (kWH)	AP Coefficient	Total AP (Kg)	Total Use (L)	AP Coefficient	Total AP (Kg)	Total Use (GJ)	AP Coefficient	Total AP (Kg)	Total Use (L)	AP Coefficient	Total AP (Kg)
Carbon Monoxide (CO)	1,441,344.00	N/A	N/A	0.00	0.00	0.00	0.00	0.04	0.00	1,297.00	0.02	20.23
Sulphur Dioxide (SO2)		0.01	13,029.75		0.01	0.00		0.00	0.00		0.00	6.17
Oxides of Nitrogen, expressed as NO2 (NOx)		0.00	2,205.26		0.00	0.00		0.04	0.00		0.07	93.90
Volatile Organic Compounds (VOCs)		N/A	N/A		0.00	0.00		N/A	N/A		0.01	7.67
Total Particulate Matter (TPM)		N/A	N/A		0.00	0.00		0.00	0.00		0.01	6.60
Particulate Matter less than or equal to 10 microns (PM10)		N/A	N/A		0.00	0.00		0.00	0.00		0.01	6.60
Particulate Matter less than or equal to 2.5 microns (PM2.5)		N/A	N/A		0.00	0.00		0.00	0.00		0.01	6.60

Waste

Waste Town of Pictou

Corporate Inventory

		3. Landfill Without CH4 Recovery			4. Landfill With CH4 Recovery (Landfill gas flared or used for energy generation)							
		Emissions Coefficient (tonne eCO2 / tonne waste)			Emissions Coefficient (tonne eCO2 / tonne waste)							
		Paper - 0.58	Trimmings - 0.238	Food - 0.400	Paper - 0.114	Trimmings - 0.059	Food - 0.100					
1. Type of Waste	2. Number of Employees	Waste to Landfill (wet t)	Cost of Landfilling	Total eCO_2 (t)	Waste to Landfill (wet t)	Cost of Landfilling	Total eCO_2 (t)	Total Cost ($)	Total eCO2 (t)	Cost per Employee ($)	eCO2 per Employee (t)
Paper											
Yard Trimmings											
Food Scraps											
Totals											
OR											
Mixed Solid Waste	60	973	25835.25	486.5			0	25835.25	486.5	430.5875	8.108

Insert Comments Here:

Pictou County's solid waste is divided into compostables, recyclables and garbage. The handling of this solid waste is shared among the 6 municipal units in Pictou County. The Town of Pictou County share of the the waste collected and processed during 2007, was 324 tonnes of garbage, 245 tonnes of recylables, and 404 tonnes of organic waste, collected and transported to The Pictou County Solid Waste Facility. The garbage was transferred to the Guysborough Landfill site, the recuyclables transported to a facility for cost recovery, and the organics composted. The energy costs per tonne calulated based on fuel costs are $27.20 for garbage to landfill, $26.45 for recylables, and $15.48 for organics. The Town of Pictou's overall cost sharing of the facility is 5.78% for 2007. The total cost of energy for solid waste is $21, 595.97.

APPENDIX C

Emission Reduction Projects Implemented to-date

Street Lights							
	Project Description	**Project Cost**	**Annual Savings**	**Calculated Payback (Years)**	**Reduced kWh (@.13 kWhr)**	**Reduced Liters of Oil (@ .85 L)**	**Project Type**
Retrofit	Study to Determine the Need and Suitable Accessories	$6,000	$3,486	1.72	26,815.38		23,329
Retrofit	Reduce Lighting Load - Use Occupancy Sensors	$200	$60	3.33	461.54		402
Retrofit	Install Area Lights on Buildings Rather than Poles	$700	$180	3.89	1,384.62		1,205

Vehicle Fleet							
Project Type	**Project Description**	**Project Cost**	**Annual Savings**	**Calculated Payback (Years)**	**Reduced kWh (@.13 kWhr)**	**Reduced Liters of Oil (@ .85 L)**	**Equivalent Annual KGs of CO2 Saved**
House K.	Measure and Monitor Transportation Data	$2,000	$1,210	1.65		1,424	3,815
House K.	Routine Maintenance Upkeep	$10,000	$2,012	4.97		2,367	6,344
House K.	Rationalize Travel	n/a	n/a	n/a			
House K.	Rationalize Correct Vehicle for the Job	n/a	n/a	n/a			
M. Maint.	No Idling Policy	n/a	n/a				
Retrofit	Vehicle Cab Heating	n/a	n/a				

Vehicle Fleet							
Project Type	**Project Description**	**Project Cost**	**Annual Savings**	**Calculated Payback (Years)**	**Reduced kWh (@.13 kWhr)**	**Reduced Liters of Oil (@ .85 L)**	**Equivalent Annual KGs of CO2 Saved**
Retrofit	Block Heaters	n/a	n/a				
Retrofit	Smart Fleet	n/a	n/a				
Retrofit	Remote Monitoring With Camera	n/a	n/a				

Water and Wastewater Utilities							
Project Type	**Project Description**	**Project Cost**	**Annual Savings**	**Calculated Payback (Years)**	**Reduced kWh (@.13 kWhr)**	**Reduced Liters of Oil (@ .85 L)**	**Equivalent Annual KGs of CO2 Saved**
Retrofit	Reduce Speed Of Pumps With VSD	$3,000	$1,750	1.71	13,461.54		11,712
Retrofit	Reduce Cost- Install Capacitors	$400	$105	3.81	807.69		703
Retrofit	Reduce Heat Loss through Pump-House Roof	$360	$89	4.04	684.62		596
Retrofit	Upgrade Motors for Improved Efficiency	$800	$132	6.06	1,015.38		883
Retrofit	Reduce Heat Loss Through Pump - House Wall	$1,050	$121	8.65	934.23		813