

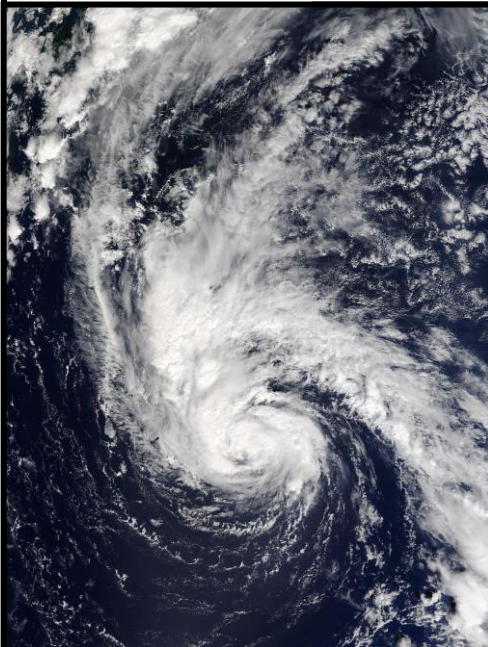


Municipal Climate Change Action Planning

Halifax Regional Municipality

Submitted by: HRM Energy & Environment

Submitted to: Service Nova Scotia and Municipal Relations
September 2013



Executive Summary

In relation to the 2010-2014 Gas Tax and Municipal Funding Agreements, municipalities in Nova Scotia are required to prepare and submit to Service Nova Scotia and Municipal Relations (SNSMR) a Municipal Climate Change Action Plan (MCCAP) report by December 31, 2013.

Halifax Regional Municipality's (HRM's) long standing commitment to responding to community concerns regarding global climate change is best reflected through participation with the Partners for Climate Protection (PCP) network of Canadian municipal governments as well as the initiation of the Climate SMART (Sustainable Mitigation and Adaptation Risk Toolkit) in 1997 and 2003, respectively.

Financially supported by the Federation of Canadian Municipalities (FCM) *Green Municipal Fund*, PCP represents a partnership between FCM and ICLEI – Local Governments for Sustainability. Essentially, the PCP program outlines five (5) milestones which collectively provide a guidance framework for municipalities to reduce greenhouse gas emissions.

The main goal of the Climate SMART initiative was to develop management and planning tools to prepare for climate change impacts, and to create strategies to reduce practices that directly contribute to climate change. One of the planning tools developed in association with this initiative was the *Climate SMART - Climate Change Risk Management Strategy for Halifax Regional Municipality* (also known as the *Climate Risk Management Strategy*). This tool has provided HRM with the information and protocols needed to assess risk from climate change by adapting available risk management guidance from other jurisdictions (such as, Australia and the Caribbean).

As a result, HRM's MCCAP submission approach is based on continuing to move forward as a leader in the mitigation of pollutants to the environment and adaptation to climate change, by focusing on the operationalization of adaptation and maturation of effective policy in lieu of working retroactively to deconstruct and reassemble past work.

The Transportation and Public Works (TPW), the Planning & Infrastructure (P&I), the Community & Recreation Services (C&RS), and the Halifax Regional Fire & Emergency (HRFE) business units (BUs) of HRM were identified for primary consultation regarding climate change adaptation (CCA), based on the following rationale:

- Maintaining an up-to-date vision of perceived pressures associated with the *Climate Risk Management Strategy* is significant to better ensuring the success of planning for climate change impacts;
- The HRFE, TPW and P&I BUs provide management support and fulfill liaison roles for HRM Standing Committees; and
- Operationalization of adaptation and maturation of effective policy is the focus of this submission.

Upon the completion of this report, it was determined that HRM has been consistently working to include a number of operational as well as policy related initiatives associated with both CCA and climate change mitigation (CCM), including:

Climate Change Adaptation:

Recent/Current Operational CCA Initiatives
<i>Innovative and Responsive Funding</i>
HRM has capitalized on a number of Provincial and Federal funding opportunities including the <i>Atlantic Climate Adaptation Solutions</i> funding as well as the Province of Nova Scotia’s <i>Climate Change Adaptation Fund</i> .
<i>Enhance Community Outreach</i>
HRM has employed the use of various public art initiatives to increase public awareness regarding the local implications of climate change.
HRM staff have collaborate to present content and complete pilot project associated with the <i>Climate SMART Community Action Guide to Climate Change and Emergency Preparedness</i> in rural areas of HRM (including Eastern Passage). ♦
HRFE’s “ <i>Fire SMART</i> ” presentations provide fire prevention and preparedness information through public education.
HRM is currently acting as a program sponsor for Clean Nova Scotia’s RainYards initiative, which is working to improve residential stormwater management in the Oakhill Lake Community.
HRM staff are developing a two (2) year project to revise the Community Energy Plan (CEP). ♦
In 2007, HRM released the <i>Climate Change: Developers Risk Management Guide</i> as a voluntary climate change and best management practices guide.
HRM websites have historically been used to communicate information regarding climate change to the public (including, the E&E homepage, select Naturally Green Newsletters, and the HRFE website dedicated to wildfire safety awareness).
HRM Emergency Management Office’s (EMO) relationship with the Amateur Radio Community represents a potential expanded emergency communication ability during periods in which public safety communication systems have been overloaded or have failed (i.e. via providing a means for point-to-point/ non-internet based e-mail services etc.).
<i>Improve HRM Inreach</i>
The HRM EMO led Business Continuity Planning (BCP) initiative includes a framework for the coordination and collaboration between HRM BUs related to emergency responses associated with CCA.
HRFE currently collaborates with the Community Planning department of HRM regarding discretionary approval development agreements as well as large scale by-right subdivision developments.
<i>Hazard and Risk Mapping</i>
HRM EMO’s planned updated to the Master Emergency plan will include revisions to the: Sector Profile Mapping, Critical Infrastructure as well as Hazard Risk and Vulnerability Assessment components.
The 2007 acquisition of LiDAR (Light Detection and Ranging data) for 1400 square kilometres of HRM, including Halifax Harbour and the East Petpeswick Peninsula (located within Musquodoboit Harbour) has been used to conduct a vulnerability matrix analyses and associated map for harbourfront properties.
Floodplain delineations (such as those completed for Bedford and Sackville) are reviewed by HRM staff, as directed by the Halifax Charter and the 5 (five) Statements of Provincial Interest Regarding Flood Risk Areas.
<i>Consideration of Climate Change in Business Planning</i>
CCA content was reflected in the 2013/2014 business plans reviewed in this report (including: TPW; P&I; C&RS; HRFE; Finance and Information, Communication and Technology; Halifax Regional Police; Legal, Insurance and Risk Management Services; and Metro Transit etc.).
CCA business planning content was also highlighted by the 25 capital projects outlined in Section 3.3.5.
<i>Life Cycle Assessment</i>
HRM’s commitment to including life cycle costing is currently reflected in the business plans developed for the following capital projects that relate to both CCA and CCM: ♦
<ul style="list-style-type: none"> • Consulting Buildings (Project # CBX01268) • Mechanical – Category 6 (Project # CBX01269)

Recent/Current Operational CCA Initiatives
<i>Intergovernmental Collaboration</i>
HRM has worked with the Provincial government through a variety of funding programs and through the submission of comments/involvement with the development of new policies and strategies, including: <ul style="list-style-type: none"> • The Union of Nova Scotia Municipalities and Province of Nova Scotia’s Memorandum of Understanding on Climate Change; • The Environmental Goals and Sustainable Prosperity Act (EGSPA) and the Provincial Climate Change Action Plan; • The Regional Adaptation Collaborative – Atlantic Canada Adaptation Solutions (RAC-ACAS); • The Emergency Response Intergovernmental Collaboration; and • The Canadian Institute of Planners.
To date, municipal, provincial and federal government agencies have collaborated and agreed to the proposed HRM EMO Incident Command System (ICS) which will ensure a consistent, united approach to climate change related emergency response between all levels of government.
HRFE’s “Fire SMART” presentations represent a collaborative partnership between HRM and the Provincial government.
<i>Updating Design Criteria</i>
TPW Design & Construction staff are actively involved with the Transportation Association of Canada (TAC).
The recapitalization of the Northwest Arm Seawalls and Cole Harbour Salt Marsh Trail used best available science to inform project specifications, including climate change considerations.
HRM has developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification including potential CCA responses (such as, installing grey water systems that recover non-sewage waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps.).
<i>Other</i>
TPW incorporates the use of a Surface Distress Index (SDI) to rate the condition of road surfaces. Cold and hot asphalt patching methods allow for HRM to respond to impacted road conditions all year round.
HRM applies liquid brine (a mixture of salt and water) to roads up to 48 hours before an expected snowfall or freezing rain event.
HRM fleets are serviced prior to the onset of each season and HRM is investing in more multipurpose fleets which are operational all year round (as opposed to vehicles which are confined to only winter or summer use).

◆ Denotes correlation with CCM operational initiative.

Recent/Current Policy Related CCA Initiatives
Draft 2 of the HRM Regional Municipal Planning Strategy (RMPS) includes a chapter (2.5.1 Climate Change) and associated policy statements (Policy E-26) dedicated to climate change.
HRM has developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification including potential CCA responses (such as, installing grey water systems that recover non-sewage waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps).
HRM has created policies related to climate change based on floodplain mapping, riparian buffers and sea level rise (i.e. such as, the Community Plans for Bedford and Sackville, Schedule W of the Downtown Halifax Land Use By Law, and Policy E-16 of Draft 2 of the RMPS).
A hydrogeological assessment requirement has been added to Chapter 3 (the Settlement and Housing Section) of Draft 2 of the RMPS.
The Point Pleasant Park Master Plan considers a mix of plant cover considering species selection based on potential climate change impacts.
HRM is currently conducting a planned five-year review of the Active Transportation (AT) Priority Plan. ≈
Policy recommendations are provided by the Urban Forest Master plan (UFMP) related to tree species selection under a changing climate.
Chapter 2 of Draft 2 of the RMPS includes the CEP and associated policy statements related to climate change. ≈
Watershed studies conducted in association with the Watershed Planning section (Chapter 2.4) of Draft 2 of the RMPS include climate change considerations.

Recent/Current Policy Related CCA Initiatives

Chapter 8.7.1 (Electrical and Telecommunications Lines) of Draft 2 of the RMPS notes that *HRM has commissioned various studies to examine the benefits of underground utilities in terms of cost, reliability, and aesthetics*, as well as the requisite policy statements.

≈ Denotes correlation with CCM policy related initiative.

Climate Change Mitigation:

Recent/Current Operational CCM Initiatives
Halifax Regional Municipality Corporate Plan to Reduce Greenhouse Gas Emissions 2012-2020.
HRM staff have collaborated to present content and complete pilot project associated with the <i>Climate SMART Community Action Guide to Climate Change and Emergency Preparedness</i> in rural areas of HRM (including Eastern Passage). ♦
CCM was reflected in the 2013/2014 HRM business plans reviewed in this report (including: TPW; P&I; and Finance and Information, Communication and Technology).
HRM staff are developing a two (2) year project to revise the CEP. ♦
CCM business planning content was also highlighted by the 18 capital projects outlined in Section 4.1.

♦ Denotes correlation with CCA operational initiative.

Recent/Current Policy Related CCM Initiatives
HRM is currently conducting a planned five-year review of the Active Transportation (AT) Priority Plan. ≈
HRM has developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification including CCM content (including: transportation, water conservation, construction waste management, atmosphere, materials, indoor air quality, building materials, and energy conservation considerations etc.) ≈
Chapter 2 of Draft 2 of the RMPS includes the CEP and associated policy statements related to climate change.≈
Chapter 2 of Draft 2 of the RMPS includes policy statements associated with Wind Energy.

≈ Denotes correlation with CCA policy related initiative.

Based on the information collected and reviewed during this study, it has been determined that HRM has met the MCCAP Guidebook requirements for both CCA and CCM.

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1. Introduction to HRM's MCCAP Submission Approach

As noted in the Municipal Climate Change Action Plan (MCCAP) Guidebook, in accordance with the 2010-2014 Gas Tax and the Municipal Funding Agreements, municipalities in Nova Scotia are required to prepare and submit to Service Nova Scotia and Municipal Relations (SNSMR) a MCCAP report by December 31, 2013.

As per the letter sent by the Energy & Environment Department (E&E) of the Halifax Regional Municipality (HRM) to SNSMR on 12 October 2012 (Appendix A), the intention of HRM is to deliver a MCCAP submission that:

- *Overviews how existing policy, planning, and administrative activities at HRM meets the requirements;*
- *How work is embedded in policy in the Halifax Regional Municipal Planning Strategy (RMPS);*
- *Overview of current work related to climate change adaptation; and*
- *Demonstrate how adaptation is engrained in municipal activities.*

To clearly demonstrate how these objectives have been met, this submission has been organized into the following pertinent sections:

2. HRM's Governance Structure and Climate Change:
 - a. This Section provides an overview of how the existing governance and decision making framework of HRM addresses climate change.
3. Historical Review of HRM's Climate Change Adaptation Planning:
 - a. This Section provides a summary of HRM's work progression primarily in conjunction with an update of the *Climate SMART - Climate Change Risk Management Strategy*, including discussions of :
 - i. Policy, planning and administrative activities as well as other work completed to demonstrate how climate change adaptation (CCA) is engrained in municipal activities; and
 - ii. The checklist requirements described in *Appendix A: Submission Template – Mandatory Plan Content of the Municipal Climate Change Action Plan Guidebook*
4. Historical Review of HRM's Climate Change Mitigation Planning:
 - a. This Section provides a summary of HRM's work progression , including discussions of :
 - i. Policy, planning and administrative activities as well as other work completed to demonstrate how climate change mitigation (CCM) is engrained in municipal activities; and
 - ii. The checklist requirements described in *Appendix A: Submission Template – Mandatory Plan Content of the Municipal Climate Change Action Plan Guidebook*

This MCCAP submission approach permits HRM to continue to move forward as a leader in the mitigation of pollutants to the environment and adaptation to climate change, by focusing on the operationalization of adaptation and maturation of effective policy in lieu of working retroactively to deconstruct and reassemble past work.

2. HRM's Governance Structure and Climate Change

The existing governance and decision making framework of HRM inherently accounts for the incorporation of a working group approach to address both CCA and CCM.

The basis of this approach is reflected by Regional Council's Vision and Guiding Principle for HRM (outlined in Draft 2 of the RMPS) which aim to:

- *"Enhance our quality of life by fostering the growth of healthy and vibrant communities, a strong and diverse economy, and sustainable environment."* ; and
- *"Seek to address the needs and views of all sectors of HRM, recognizing the diversity of its citizens, community and geography."*



As a result, in terms of this submission, HRM's adaptation team\committee is primarily defined in the context of existing Standing Committees.

2.1 The Standing Committee Approach – General Background

In November 2010, a Standing Committee approach was adopted by Regional Council in order to meet the following objectives:

- Streamline and consolidate a number of existing Committees of Council;
- Better enable Council's and staff's focus on the Corporate Plan and Council's focus areas; and
- Improve the efficiency and effectiveness of Council decision making by providing opportunity for increased discussion on strategic issues prior to coming to Regional Council.

As a result, Regional Council developed the following two (2) Standing Committees that correlate with CCA and CCM:

- **Executive Standing Committee**: Includes the focus areas of membership selection, Chief Administrative Officer (CAO) review, emergency management, volunteer awards, Council governance issues and corporate performance. In terms of CCA, the role this Committee plays is also supplemented by the operation of the Emergency Management Organization (EMO) and Joint Emergency Management (JEM) concept; and
- **Environment & Sustainability**: Includes the focus area of Environment & Sustainability (including but not limited to solid waste resources, energy security and sustainability, parks, urban and rural forests, open spaces, and water resource management etc.).

Collectively these groups:

- Include membership from local government officials, staff and other stakeholders (including community groups and volunteers); and

- Represent HRM’s commitment to addressing climate change through the operationalization and maturation of environmental policy, community engagement and emergency preparedness.

2.1.1 Executive Standing Committee

The principle role of the Executive Standing Committee (ESC) is to fulfil the self-governance functions of Regional Council. This Committee relates to CCA in terms of the subsequent duties and responsibilities identified in association with Emergency Management, including:

- Acting as the Emergency Management Advisory Committee of Council with responsibilities as outlined under *By-Law E-100 Respecting the Prompt and Coordinated Response to Emergency Management* (Appendix A);
- Advising Council on the development of Emergency Management plans and present the Municipal Emergency Management Plans to Regional Council;
- Briefing Council on developments during a local state of emergency; and
- Performing any such other duties in regard to Emergency management as may be required and directed by Council.

The committee is currently comprised of the following eight (8) local government officials:

- Chair: Mayor Mike Savage;
- Vice Chair: Councillor Linda Mosher (District 9: Peninsula West, Armdale);
- Councillor Brad Johns (District 14: Upper/Middle Sackville, Beaver Bank);
- Deputy Mayor Reg Rankin (District 12: Timberlea, Beechville, Clayton Park West);
- Councillor Russell Walker (District 10: Birch Cove, Rockingham, Fairview);
- Councillor Matt Whitman (District 13: Hammonds Plains, St. Margaret’s Bay);
- Councillor Steve Craig (District 15: Lower Sackville); and
- Councillor Bill Karsten (District 3: Dartmouth South, Eastern Passage).

Committee meetings occur at a frequency of no less than four (4) times annually and operate in accordance with *Administrative Order One - Respecting the Procedures of the Council* (Appendix A).

Management support and liaison for the committee occurs through the Office of the Chief Administrative Officer (CAO) and/or Deputy CAO, the Office of the Municipal Clerk, and HRM’s Emergency Management Organization (EMO) Coordinator.

As previously noted, the role this Committee plays in terms of CCA is supplemented by the operation of the Emergency Management Organization (EMO) and Joint Emergency Management (JEM) concept which are further described in Section 2.1.1.1.

The complete Terms of Reference (TOR) under which the Executive Standing committee operates is provided in Appendix A.

2.1.1.1 Emergency Management Organization and Joint Emergency Management

HRM's EMO was established as a result of *By-Law Number E-100 – Respecting of a Prompt and Coordinated Response to an Emergency* (a copy of this by-law is provided in Appendix A). The main goal of EMO is to promote emergency preparedness and coordinate emergency management within HRM through:

- Coordinating and preparing municipal emergency measures plans, training and exercises;
- Assuming responsibility for ongoing public self-help education programs related to emergency preparedness;
- Following activation of the municipal plan or a declaration of state of local emergency;
- Prescribing, as necessary, duties to be fulfilled by employees, agents, and volunteer fire fighters of the Regional Municipality; and
- Performing such other duties as may be required by the Council.

This organization is currently comprised of an Advisory Committee (i.e. the aforementioned Executive Standing Committee), a Planning Committee, and a Coordinator. Specific membership and duties of these groups is outlined in the *HRM Emergency Management Organization (EMO)* document provided in Appendix A.

To improve upon the preparation and response of community organizations in relation to a wide range of emergencies, including those outlined in *HRM's Community Action Guide to Climate Change and Emergency Preparedness* (such as, extreme weather events, sea level rise, and forest fires etc.), EMO developed a Joint Emergency Management (JEM) concept.

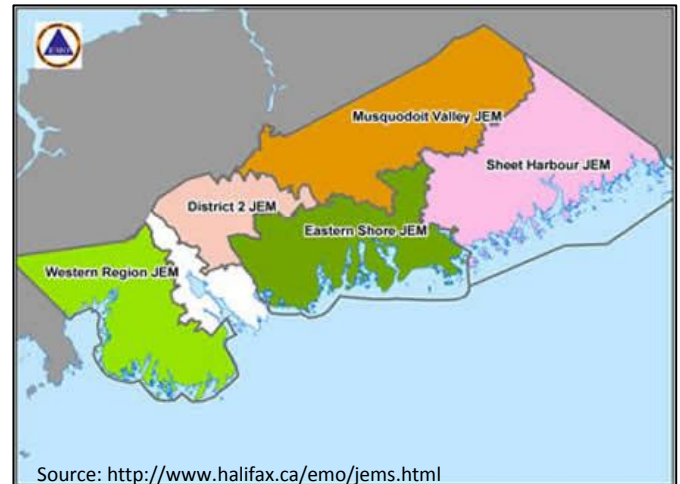
The principles associated with this management concept include:

- Working with local agencies and community residents;
- Participating in emergency planning and response;
- Coordinating neighbor/community emergency preparedness and awareness;
- Participating in coordinated humanitarian efforts;
- Supporting 1st Responders;
- Bringing local community resources to bear during an emergency event;
- Acting as a single voice from the community to establish priorities and resource allocations;
- Maintaining a local community resource list; and
- Training to assist the community through future unknown perils.

Accordingly, the Mission Statement of JEMs is “to promote awareness of local community resources, to train local agencies to work together and provide structure for coordinated local emergency response.”

Currently, EMO directs the operation of five (5) JEM teams in HRM:

- Eastern Shore;
- Musquodoboit Valley and Area;
- Riverlake (formerly District 2) ;
- Sheet Harbour and Area; and
- Western Region.



2.1.2 Environmental & Sustainability Standing Committee

The principle role of the Environmental & Sustainability Standing Committee (ESSC) is to provide advice to Regional Council on matters relating to Environment and Sustainability. The duties and responsibilities of the committee in terms of climate change include:

- To progress policy related to municipal CCA and CCM, including the policy requirements of the Infrastructure Secretariats Gas Tax Funding Program;
- To promote community adoption of climate change mitigation and adaptation measures; and
- To provide governance oversight of the *Climate SMART – Climate Change Risk Management Strategy for Halifax Regional Municipality* (a general overview and a complete copy of this strategy are provided in Section 3 and Appendix B, respectively).

The committee is currently comprised of the following eight (8) local government officials:

- Chair: Councillor Barry Dalrymple (District 1: Waverly, Fall River, and Musquodoboit Valley);
- Vice Chair: Councillor Jennifer Watts (District 8: Peninsula North);
- Councillor Darren Fisher (District 6: Harbourview, Burnside, Dartmouth East);
- Deputy Mayor Reg Rankin (District 12: Timberlea, Beechville, Clayton Park West);
- Councillor Lorelei Nicoll (District 4: Cole Harbour and Westphal);
- Councillor Bill Karsten (District 3: Dartmouth South, Eastern Passage); and
- Councillor Steve Craig (District 15: Lower Sackville).

Committee meetings occur at a frequency of no less than four (4) times annually and operate in accordance with *Administrative Order One - Respecting the Procedures of the Council* (a copy of this order is provided Appendix A).

Management support and liaison for the Committee occurs through the office of the Director of the Planning & Infrastructure (formerly known as Infrastructure and Asset Management) in coordination

with the Energy and Environment office (formerly known as the Sustainable Environmental Management Office or SEMO), and divisions of Transportation & Public Works.

The complete Terms of Reference (TOR) under which the ESSC operates is provided in Appendix A.

3. Historical Review of HRM's Climate Change Adaptation Planning

HRM's commitment to responding to community concerns regarding global climate change is directly correlated with the initiation of the Climate SMART (Sustainable Mitigation and Adaptation Risk Toolkit) program in 2003. The main goal of the Climate SMART initiative was to develop management and planning tools to prepare for climate change impacts, and to create strategies to reduce practices that directly contribute to climate change. One notable tool created from this initiative was the *Climate SMART – Climate Change Risk Management Strategy*



for Halifax Regional Municipality (also known as the *Climate Risk Management Strategy*), developed in 2007. This document was prepared with financial support and/or in-kind contributions from the Government of Canada's *Climate Change Impacts and Adaptation Program*; Halifax Regional Municipality; Environment Canada; and the Province of Nova Scotia. Essentially, this tool has provided HRM with the following framework (including associated information and protocols) required to effectively assess climate change risks:

1. Step 1: Understanding the Context
 - a. This step provided the overall context for the Municipal Business Units (BUs) and affected environment in which climate change impacts are or have the potential to occur. Developing the context included a review of the administrative components (i.e. the HRM governance and management structures) as well as the broader physical, social and regulatory environments that influence the Municipality.
2. Step 2: Identify Climate Change Impacts and Risks
 - a. This step included assemblage of available information related to climate change specific to the jurisdiction of the Municipal BUs and the affected environmental, social and economic elements. The impacts identified in this step were then used as the basis for describing the potential risks to the Municipal BUs and affected environmental, social, and economic elements.
3. Step 3: Identify, Quantify and Qualify the Risks
 - a. This step carried out a qualitative review of the risks to HRM by determining the likelihood of an event and the potential consequences resulting from the event. This information was then assessed for potential impacts on HRM BUs and assets (under its

direct control) as well as environmental, social, and economic elements within HRM's jurisdiction or scope of influence.

4. Step 4: Prioritize the Risks
 - a. This step summarized the outputs of Step 3 in order to rank impacts in terms of overall or integrated risk to HRM 's BUs and assets (under its direct control) as well as environmental, social and economic elements.
5. Step 5: Identify the Options to Manage the Risks (i.e. CCA Options)
 - a. In this step the HRM BUs reviewed and identified potential options to manage the impacts in the preceding steps with emphasis on those listed as high risk priorities (refer to p. 79, Table 6-1 Adaptation Response and Requirements, of the *Climate Risk Management Strategy*).
6. Step 6: Identify the Resources, Barriers and Timeframes (i.e. Identification of Priorities for Actions)
 - a. In this step the HRM BUs reviewed the options identified in Step 5 and determined the resources (technical and financial) required to implement the measures, the timeframe in which they should occur, and the possible barriers to implementing the measures.

A complete copy of the original *Climate Risk Management Strategy* can be referenced in Appendix B.

3.1 Climate Change Impacts, Adaptation Responses and Requirements

Maintaining an up-to-date vision of perceived pressures is significant to better ensuring the success of planning for climate change impacts. As a result, since its inception, HRM has completed two (2) update reviews of the high risk climate change impacts, adaptation responses and requirements outlined in the *Climate Risk Management Strategy*. Consequently, based on the following factors, the Transportation and Public Works (TPW), the Planning & Infrastructure (P&I), the Community & Recreation Services (C&RS) and the Halifax Regional Fire & Emergency (HRFE) BUs were identified for primary consultation during the preparation of this report:

- Climate change is anticipated to directly impact these BUs;
- The HRFE, TPW and P&I BUs provide management support and fulfill liaison roles for the ESC and ESSC (outlined in Sections 2.1.1 and 2.1.2, respectively); and
- Operationalization of adaptation and maturation of effective policy is the focus of this submission.

Brief overviews of each BU are provided below.

Transportation & Public Works

In general, this BU “consolidates both the critical and operational-based services that contribute to sustainable public infrastructure and transportation networks”. In addition, TPW also holds the following asset responsibilities:

- Asset manager/steward for 1,790 km of roads, 2,100 km of curbs, 850 km of sidewalks, 22 km of gravel roads and 85 bridges;
- Asset steward for 825 park properties, 325 playgrounds, 174 ball diamonds, 130 sport fields, and 230 Sport courts;
- Asset steward of approximately 221 of 350 buildings;
- Contract management for delivery of building recapitalization program;
- Asset manager/ steward for 500 Municipal vehicles, 400 pieces of small equipment, 320 Transit vehicles, 280 police vehicles, and 300 fire vehicles;
- Asset owner/manager/steward for 270 traffic signals, 180 crosswalk lights, 40,500 streetlights;
- 740 km white & yellow painted centre lines;
- 9,000 manufactured signs;
- Collection of recyclables, organics and refuse at approx. 140,000 eligible properties; and
- Contract management for operation and maintenance of 5 solid waste processing facilities and 2 land fill sites.



Source: <http://halifax.ca/municipalops>

The following key TPW contacts were identified for consultation during the 2013 review:

- Director of Transportation & Public Works;
- Manager of Corporate Fleet & Equipment;
- Manager of Design & Construction Services;
- Manager of Municipal Operations; and
- Manager of Traffic & Right of Way.

Planning & Infrastructure

The primary role of this BU (formerly identified as Infrastructure & Asset Management and Community Development) is to guide *“HRM’s physical change and growth policy, medium and long-term planning, project development, construction and management.”*

The following key P&I contacts were identified for consultation during the 2013 review:

- Director of Planning & Infrastructure;
- Manager of Infrastructure;
- Manager of Planning;
- Manager of Facility Development; and
- Manager of Real Estate and Land Management.



Source: <http://www.halifax.ca/RealPropertyPlanning/>

Community & Recreation Services

This BU provides services in the areas of recreation programming, youth development, community development and partnerships, culture and heritage, civic events, development approvals, regulatory compliance, and citizen contact centres.

The following key C&RS contacts were identified for consultation during the 2013 review:

- Director of Community & Recreation Services;
- Manager of Citizen Contact Centres;
- Manager of Community Recreation & Culture; and
- Manager of Development Approvals.



Halifax Regional Fire & Emergency

The main role of HRFE is to serve and protect the 413,700 permanent residents of HRM located within a 5,577 km² area. Staff (including both career and volunteer fire crews) are located in 57 fire stations throughout the Municipality and provide a full range of emergency services including: fire prevention (fire inspections & code enforcement, fire investigations, plans examination, and public fire safety education), fire suppression and rescue, technical rescue (auto extrication, machinery, ice-water, high and low angle rope, trench, and confined space rescue, USAR – urban search & rescue), hazardous materials response including CBRN (chemical, biological, radioactive, & nuclear), pre-hospital emergency medical services, and emergency preparedness.



The following key HRFE contacts were identified for consultation during the 2013 review:

- Deputy Fire Chief of Operations; and
- Manager of EMO.

3.1.1 2013 Consultation Findings

Summaries of the key findings extracted from the 2013 consultation process are provided below.

Transportation & Public Works

Since 2007, TPW's responses and requirements for addressing climate change impacts have continued to evolve and develop from an operational standpoint. During the 2013 review process, the following key climate change impacts were identified for TPW:

1. Potential disruption to transportation infrastructure due to impacts from sea-level rise (SLR), coastal erosion, inundation and impacts from increases in intensity of extreme events (floods, storms).
2. Increased costs for road maintenance (both winter and summer) to mitigate impacts on pavement from frost heave and heat. Of note: during the 2013 review this impact was updated to include associated affects related to sidewalks and traffic signs.



Source: <http://www.halifax.ca/fleetservices/>

To date, TPW has responded to these impacts as follows:

- a) TPW has continued to work with HRM's EMO to develop an all hazards Business Continuity Plan (BCP) planning for impacts related to transportation infrastructure. More specifically, EMO has identified Mission Critical and Essential Services (MCES) for each HRM BU (based on the HRM service catalogue); subsequently these BUs are currently working to identify their general service capabilities to support this initiative. In addition to the BCP planning, climate change risks associated with infrastructure are also intended to be addressed through HRM's Enterprise Asset Management program (led by the Planning & Infrastructure BU) and proposed Enterprise Risk Management Strategy (led by the Finance & Information Technology BU). Section 3.3.3 provides further details regarding these initiatives.
- b) TPW Design & Construction staff are actively involved with the Transportation Association of Canada (TAC). The Climate Change Task Force within TAC is currently undertaking various studies to understand the implications of climate change in Canadian Municipalities. The Task Force is due to provide guidelines for municipalities in order to coordinate efforts related to CCA. HRM is seeking to use future guidelines in adjusting current design standards in conjunction with adapting to climate change; and
- c) TPW incorporates the use of a Surface Distress Index (SDI) to rate the condition of road surfaces. Cold and hot asphalt patching methods allow for HRM to respond to impacted road conditions all year round (cold patching is used for winter repairs and hot patching is used in the summer and represents a more permanent solution).

Although, impacts associated with i) Increased variability in demand for snow and ice removal due to impacts on snow and rainfall patterns and ii) Greater demand on emergency service vehicles due to impacts from extreme events (floods, droughts, forest fires, heat waves, storms) are still considered to be relevant and will continue to be reassessed moving forward, HRM has recently addressed these impacts by employing the following measures:

- d) Since 2012, HRM has applied “liquid brine” (a mixture of salt and water) to roads up to 48 hours before an expected snowfall or freezing rain event. This technique reduces the amount of salt used and increases driver safety during milder winters; and
- e) While TPW has not noticed an increase in the demand for emergency services (to date), fleets are serviced prior to the onset of each season and HRM is investing in more multipurpose fleets which are operational all year round (as opposed to vehicles which are confined to only winter or summer use).

Planning & Infrastructure

During the 2013 review process, overlaps in relation to the perceived pressures/interests of the P&I and TPW BUs as well as the P&I and C&RS BUs were noted in regards to the relevance of select climate change impacts, adaptation responses and requirements initially outlined in the *Climate Risk Management Strategy* (originally identified for the Infrastructure and Asset Management and Community Development BUs). Although such observations can partially be attributed to recent corporate restructuring within HRM, it also suggests an expanded understanding amongst these BUs of the interconnectivity of climate change impacts and the required coordination for operationalization of the associated adaptation initiatives.

The following key climate change impacts were identified to represent common perceived pressures/interests between the P&I and TPW BUs:

1. Climate change will profoundly impact all policies and programs relating to environmental sustainability;
2. Greater incidents of building infrastructure failure due to increased intensity and scope of extreme events (floods, droughts, heat waves, storms) resulting in increased risk of exposure to litigation and added demand for improvements to building inspection services and standards;
3. Potential disruption to waste collection and management services due to impacts on transportation infrastructure from coastal erosion, coastal inundation and extreme events (floods, storms, forest fires etc.); and



4. Anticipated increased insurance costs associated with damage to buildings and infrastructure from SLR.

To date, HRM has responded to these impacts as follows:

- a) Developing polices in conjunction with the 5 year regional plan review associated with Energy Conservation, Water Conservation, and Storm Water Management (see Sections 3.4 and 4.2);
- b) Completion of the Point Pleasant Park Master Plan which considered a mix of plant cover considering species selection based on potential climate change impacts;
- c) Inclusion of policy recommendations within the Urban Forest Master Plan (URMP) related to tree species selection under a changing climate;
- d) Involvement with the Provincial Coastal Consultations;
- e) Participation with the Canadian Institute of Planners (CIP);
- f) Partnering with the Regional Adaptation Collaborative, Atlantic Climate Adaptation Solutions (RAC-ACAS) to complete a number of research projects (see Section 3.3.7);
- g) Acquiring LiDAR (Light Detection and Ranging) data covering and area of approximately 1400 square kilometres of HRM (including Halifax Harbour and the East Petpeswick Peninsula) and incorporating available LiDAR data to inform floodplain restrictions in conjunction with the Bedford and Sackville Community Plans as well as vulnerability and assessment mapping for Halifax Harbour;
- h) Recapitalization of the Northwest Arm Seawalls and Cole Harbour Salt Marsh Trail;
- i) Releasing the Climate Change: Developers Risk Management Guide as a voluntary climate change and best management practices guide;
- j) Development of voluntary Sustainability Guidelines in the Downtown Halifax Land Use By Law (Section 5 of Schedule S-1: Design Manual) to mirror LEED silver certification and includes potential CCA responses (such as, installing grey water systems that recover non-sewage waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps etc.);
- k) Accounting for SLR within Schedule W of the Downtown Halifax Land Use By Law;
- l) Continuing to update pre-existing vulnerability modeling and mapping to account for larger parcels that extend inland from Halifax Harbour as well as incorporating available information associated with wave run-up studies;
- m) In association with EMO, SEMO presented content associated with the *Climate SMART Community Action Guide to Climate Change and Emergency Preparedness (Community Action Guide)* to the JEM Teams for future dissemination into rural areas of HRM; including a subsequent public vulnerability mapping pilot project in Eastern Passage/Cow Bay;
- n) Similar to TPW, the P&I BU is also working to identify their general service capabilities to support EMOs all hazard BCP and MCES initiatives. As previously mentioned, in addition to the BCP planning, climate change risks associated with infrastructure are also intended to be addressed through HRM's Enterprise Asset Management program and proposed Enterprise Risk Management Strategy (see Section 3.3.3);

- o) Chapter 8.7.1 (Electrical and Telecommunications Lines) of Draft 2 of the HRM RMPS notes that *HRM has commissioned various studies to examine the benefits of underground utilities in terms of cost, reliability, and aesthetics*, as well as the following policy statements:
- *SU-23 When planning streetscape improvement projects for commercial areas or heritage districts within HRM, consideration shall be given to the underground placement of electrical and communication lines. Highest priority shall be given to projects within the Regional Centre.*
 - *SU-24 HRM may consider amendments to the Downtown Halifax Municipal Planning Strategy and Land Use By-law to create incentives for the underground placement of electrical and communication lines by private developments and to make provision for cost-sharing with HRM where funds are available and additional areas can benefit.*
 - *SU-25 HRM shall require, under the Subdivision By-law, the underground placement of electrical and communication lines for subdivision applications in which new streets are proposed.*

The following key climate change impacts were identified to represent common perceived pressures/interests between the P&I and C&RS BUs:

5. Impacts on viable land use and zoning options due to increased incidents of coastal erosion and impacts on transportation infrastructure and coastal inundation due to storm surge;
6. Impacts on planning and design or location of emergency services centres, and emergency services evacuation routes/measures due to increase incidents of coastal erosion and impacts on critical infrastructure and coastal inundation due to SLR, storm surge and extreme events (floods, droughts, heat-waves, storms);
7. Increased uncertainty in settlement patterns and urban planning due to climate variability, SLR and impacts from extreme events; and
8. Impacts on viable land use and zoning options due to increased risks from forest fires in the urban/rural fringe.

To date, HRM has responded to these impacts as follows:

- p) In conjunction with bullet point g) provided above, the Community Planning department also conducts reviews of floodplain delineations as directed by the Halifax Charter and the 5 (five) Statements of Provincial Interest Regarding Flood Risk Areas;
- q) As the Regional Plan identifies areas of growth, HRM has developed policies related to climate change based on floodplain mapping (which related most directly to inland areas), riparian buffers (which relate to both inland and coastal areas) and SLR (which currently primarily relates to Halifax Harbour). Such policies can be referenced in the Community Plans that have been developed for Bedford and Sackville, Schedule W of the Downtown Halifax Land Use By Law, and Policy E-16 of Draft 2 of the RMPS (Section 3.4 provides further detail); and
- r) Incorporating a hydrogeological assessment requirement within the Chapter 3: Settlement and Housing Section of Draft 2 of the RMPS (Section 3.4 provides further detail);

In addition, bullet points i, n, and o (listed above) also directly relate to HRM's efforts to respond to these impacts.

Halifax Regional Fire and Emergency

The key climate change impacts identified during the 2013 review associated with this HRFE include:

1. Coastal Erosion and impacts on transportation infrastructure impacting access for emergency service vehicles. Similarly, coastal inundation due to storm surge may impeded access for emergency vehicles;
2. Greater number of vulnerable communities (sick, elderly, young, infirm) making demands on emergency services due to increased intensity and scope of extreme events (floods, droughts, heat-waves, storms);
3. Impact on planning and design or location of emergency service centres and emergency service evacuation routes/measures due to increased incidents of coastal erosion and impacts on critical infrastructure and coastal inundation due to SLR, storm surge and extreme events (floods, droughts, forest fires, heat-waves, and storms); and
4. Potential for increased fire risks from forest fires that may be combined with additional blow down due to storm events in the urban/rural fringe requiring additional resources in these areas.



Furthermore, it was determined that the following impacts initially identified in the 2007 currently relate more directly to responsibilities associated with stakeholders other than HRM (such as Bell Aliant and the Province of Nova Scotia):

5. Increased damage and disruption of vulnerable and critical utilities and infrastructure that may impact emergency communications ; and
6. Increased demand on emergency services from stress over-loading of public health infrastructure from the cumulative effects of extreme events, injuries, breakdown in essential services electrical power, communications and introduction of disease.

HRM's role in these cases would generally be limited to that of a system user. As a result, HRM would not be in a position to determine required responses for these impacts. However, HRFE would be available to provided support to the direct stakeholders, if required.

To date, HRFE has responded to the above noted relevant impacts as follows:

- a) As previously noted, EMO (directed by HRM By Law E-100) has been developing all hazards BCP framework for HRM and has identified the MCES for each BU based on the HRM service

catalogue. As a result, HRM BUs are working to identify their general service capabilities to support this initiative. As noted in preceding sections, in addition to the BCP planning, climate change risks associated with infrastructure are also intended to be addressed through HRM's Enterprise Asset Management program and proposed Enterprise Risk Management Strategy (see Section 3.3.3).

- b) The Incident Command System (ICS) portion of HRM's Master Emergency Plan (which is an all hazards plan that is not specific to climate change but will account for related emergencies) which is currently under review, will also account for these impacts. In general, this system represents a multi-level response model that is consistent with current industry practices. To date, the municipal, provincial, and federal government agencies have all agreed to the proposed ICS. The planned updates to the Master Emergency Plan will include revisions to the: Sector Profile Mapping, Critical Infrastructure as well as Hazard Risk and Vulnerability Assessment (HRVA) components;
- c) EMO is planning to incorporate the available LiDAR data as well as vulnerability and flood plain mapping (such as the information that is currently available for Halifax Harbour, East Petpeswick Peninsula, Bedford, and Sackville) in conjunction with the planned update of the aforementioned HRVA document;
- d) EMO has collaborated with former SEMO staff to present content associated with the *Climate SMART Community Action Guide to Climate Change and Emergency Preparedness (Community Action Guide)* to the JEM Teams for future dissemination into rural areas of HRM; including a subsequent public vulnerability mapping pilot project in Eastern Passage/Cow Bay;
- e) EMO has organized a relationship with the Amateur Radio community to support the use of mobile telecommunication resources (such as, point-to-point/non-internet based e-mail services) for periods in which public safety telecommunication systems have been overloaded or have failed.
- f) Upon request, HRFE provides "*Fire SMART*" presentations to communities. This represents a collaborative partnership with the Provincial government regarding fire prevention and preparedness through public education; and
- g) HRFE collaborates with Community Planning regarding discretionary approval development agreements as well as large scale by-right subdivision developments.

Further details regarding the content provided in this Section can be referenced in Appendix C.

3.2 Climate Change Adaptation Research

Completing continued reviews of the high risk climate change impacts, adaptation responses and requirements outlined in the *Climate Risk Management Strategy* has assisted HRM to focus on the completion of a wide array of research projects associated with CCA. A list of select research efforts HRM has engaged, completed, or contributed to (to date) are provided below:

- Climate SMART - Climate Change: Developer's Risk Management Guide (HRM, 2007);
- Climate SMART - Community Action Guide to Climate Change and Emergency Preparedness (HRM, rev 2010);
- Economic Implications of Buried Electrical Utilities (Marbek Resource Consults, 2007);
- Planning for Climate Change and Coastal Zone Management – Land Use Vulnerability, Hazard, and Exposure in Halifax Harbour (Kosloski, 2008);
- Halifax Harbour Extreme Water Levels in the Context of Climate Change: Scenarios for a 100-Year Planning Horizon (Forbes et al., 2009);
- Point Pleasant Park - Storm Waves and Shoreline Restoration (Coldwater Consulting Ltd., 2009);
- Risk and Vulnerability Assessment Tool – Halifax Regional Municipality (Dickie, 2009);
- Climate SMART: Community Action Guide to Climate Change and Emergency Preparedness (HRM, rev 2010);
- Northwest Arm Shoreline Restoration Study (Coldwater Consulting Ltd., 2010);
- Sea Level Rise Adaptation Planning for Halifax (HRM, 2010);
- Cole Harbour/Salt Marsh Trail Hydrodynamic Modelling and Coastal Engineering (Coldwater Consulting Ltd., 2011);
- Public Participation Vulnerability Mapping Project, Halifax Regional Municipality – Pilot Project Eastern Passage-Cow Bay (HRM, 2011);
- Extreme Waves and Wave Run-Up in Halifax Harbour Under Climate Change Scenarios (Xu and Perrie, 2012);
- Development of a Urban Forest Canopy Model for Input into a LiDAR based Storm Runoff Model for Halifax Harbour Watersheds (Monette and Hopkinson, 2012);
- Municipal Climate Adaptation Case Study Report (HRM, 2012);
- Halifax Regional Municipality Urban Forest Master Plan (HRM, 2012);
- Planning for the Wildland-Urban Interface in the HRM (Whitman et al, 2012); and
- Birch Cove Lakes Watershed Study (AECOM, 2013).

In addition to the above noted research initiatives, in association with the update reviews of the *Climate Risk Management Strategy* and the MCCAP Guidebook, HRM staff noted that further work was required in terms of supporting planned urban forestry and EMO vulnerability and hazard assessment work as well as addressing the economic implications of climate change. As a result, the following reports and/or surveys were completed to meet these objectives:

- Future Wildfire Risk in the HRM Wildland-Urban Interface Under Climate Change (Whitman et al., 2013);

- Urban Forests and Hazard Management: Trade-Offs Between Wildfire Risk and Benefits from Trees in the HRM Wildland-Urban Interface (Whitman et al., 2013);
- Rural Fire Station Hazard Assessments (GENIVAR, 2013); and
- Economic Sector Survey (Stantec, 2013).

Brief summaries of these reports and/or surveys are provided below.

3.2.1 Future Wildfire Risk in the HRM Wildland-Urban Interface Under Climate Change

This report, prepared by Whitman et al (2013), notes that areas in which urban development abut and intermix with wildlands (such as the Acadian Forests of HRM) are referred to as wildland-urban interfaces (WUIs). Analysis of WUIs is important because these areas possess inherent elevated fire risks. This is primarily due to their natural fire regimes and close proximity to developments containing complex fuel sources (such as decorative landscaping etc.). This importance is further substantiated by the notion that future changes in climate are anticipated to alter the Acadian Forest by impacting storm event severity as well as shifting the composition of tree species and the associated disturbance regimes.

In summary, the report incorporated the use of the Forest Fire Behaviour (FBP) system to model burn probability and the key pathways (drivers) of forest fire risk (including fire weather, storm severity, species composition, and pest outbreaks etc.) as well as their associated qualitative net impacts over a 100 year period.



The main findings documented in the report include:

- Forest fire risks associated with HRM's WUI are projected to increase due to:
 - Variability in precipitation and lengthened fall fire season;
 - Increased tropical cyclone severity (increasing woody debris);
 - Transitioning of tree species within the Acadian Forest (increasing woody debris associated with maladapted deciduous trees and standing dead conifers over the short-term); and
 - Increased severity and duration of insect outbreaks (increasing stand mortality).
- Forest fire risks associated with HRM's WUI are projected to decline in HRM over the long term due to:
 - Changing tree species composition within the Acadian Forest. However, as described above, HRM is also expected to face temporary/intermediate periods of elevated fire risk due to transitioning tree species over the shorter term.

The following key recommendations were provided to address the management required for the intermediate stages of elevated risk and WUI development:

- Introducing a fuel (i.e. woody debris etc.) management program on public property and educating private citizens and citizens organizations about fuel loading and landscape-level fire risk; and
- Incorporating land use planning to limit ongoing WUI development, identify WUI and manage WUI areas for fire risk.

3.2.2 Urban Forests and Hazard Management: Trade-Offs Between Wildfire Risk and Benefits from Trees in the HRM Wildland-Urban Interface

This report prepared by Whitman et al (2013), highlights a requirement for urban managers to balance trade-offs between benefits from the urban forest (i.e. reducing cooling costs and noise levels, providing water and air filtration, protecting human health as well as mental wellbeing etc.) and associated wildfire hazards (i.e. property loss, infrastructure damage, insurance payments, mental health impacts for affected residents, and potentially loss of life etc.).



Although HRM’s adopted Urban Forest Master Plan (UFMP) was identified to guide the development of sustainable urban forest and steer decisions around urban forest issues, it was noted to primarily focus on the urban core with little emphasis on peri-urban areas. Ultimately, the UFMP was reported to set goals for increasing tree planting, increasing tree canopy, and protecting as well as promoting the urban forests of HRM. Furthermore, HRM was also documented to have recommendations for the implementation of fuel treatments to reduce wildfire risk in the WUI. These treatments were found to be similar to those of *FireSMART*, a fuel management program developed in Alberta that provides the following recommendations for homeowners:

- Remove the majority of fuels and vegetation from the ten (10) metre area closest to their home (known as “Priority Zone 1”); and
- Apply fuel management treatments, such as stand thinning, in areas outside this zone.

The scope of this report included the application of a modified *FireSMART* treatment for the study communities of Beaver Bank and Spryfield using a detailed forest layer in the ArcGIS program. The simulated fuel treatment analysis indicated losses in urban benefits from energy conservation, carbon dioxide sequestering, air quality and stormwater perspectives. Despite these losses the simulated fuel management treatments were shown to markedly reduce the quantity of residences that were in direct contact with areas of elevated wildfire risk as well as decrease the overall wildfire risk in fringe areas outside of these structures.

Ultimately, the report identified the following key findings:

- The priority for management should shift from increasing urban forests within the core, to the management of WUI areas to reduce wildfire risk at the fringe;

- Short-term management priorities should focus on the reduction of wildfire risk through fuel treatments;
- Recommendations of both *FireSMART* and the UFMP can be incorporated, such that low-wildfire risk tree species (adaptable to expected future climate condition) are planted to mitigate the removal of trees via fuel treatment initiatives; and
- Long-term management priorities should shift towards the promotion of urban forest to coincide with the anticipated decreases in wildfire hazards and associated changes to forest composition over time.

3.2.3 Rural Fire Station Hazard Assessments

This study completed by Genivar (2013) provided a high level assessment of climate change impacts associated with HRM’s rural communities as well as the level of preparedness available to respond to such events. Consultations were focused on gathering information from Rural Fire Chiefs as these individuals were identified to have valuable “front-line” experience regarding how climate change is impacting their communities.



The key findings documented in this report relating to climate change impacts included:

- Climate change is considered a significant, frequent, and ongoing issue within rural HRM. Historically these areas have directly experienced the effects of climate change via: infrastructure damages (mainly the result of road washouts and erosion), power outages, drinking water issues, forest fires, and emergency service delivery interruptions (due to road blockages); and
- A common concern was also expressed by the Fire Chiefs related to the safety of elderly populations, as these members represent the dominant demographic in these communities.
 - Of note: This concern is consistent with the high risk climate change impacts identified for HRFE in Section 3.1.1 and is intended to be addressed via the subsequent responses outlined in that section.

In terms of the level of preparedness to respond to climate change, the report offered the following conclusions:

- In general, the Fire Chiefs expressed confidence in their preparedness to respond to weather related emergencies. This confidence was attributed to:
 - The collaboration between various official and local resources (such as, the HRM Emergency Management Office, the Nova Scotia Emergency Management Office, and the HRM Integrated Emergency Services (IES) etc.) which have collectively made it easier for the fire stations to provide required services to community members;

- Since Hurricane Juan and White Juan, additional measures have also been taken to prepare rural communities for extreme weather events, including the provision of new equipment at the fire stations (such as, generators etc.); and
- The majority of the fire stations were reported to be in good or excellent physical condition and HRFE was acknowledged for instituting a proactive approach to complete required repairs.

3.2.4 Economic Sector Survey

This survey was conducted by Stantec (2013) to obtain feedback from local economic development/commerce organizations within HRM, in order to better assess the potential economic implications associated with climate change. Approximately 28 stakeholders were interviewed providing valuable feedback from the following economic sectors: development, architecture, environment, energy, health, not-for profit, education, construction, and entertainment.

The key findings highlighted in this survey included:

- Education was reported as the most important industry in HRM today, closely followed by defence, port industries, technology, health care, and marine based initiatives;
- Technology was considered to be the most important industry regarding the future of HRM, followed by education, marine, port industry, health care, and defence;
- Although losses to HRM's industries were not reported, the majority of stakeholders acknowledged that weather and climate have the potential to affect these industries in the future, as follows:
 - Tourism was commonly reported as being susceptible to climate change in both negative and positive contexts:
 - Negative impacts were reported in association with damages to infrastructure, boardwalks, waterfront stores, beach accesses and trails.
 - Some respondents indicated that climate change could potentially extend the tourism season, representing a potential positive outcome of climate change.
 - Industries located downtown or in close proximity to the harbour were reported to be vulnerable to future climate change impacts. More specifically, infrastructure including transportation networks, building and parking lots were documented to be potentially affected by rising water levels, storm surges, hurricanes, and floods. These impact were, in turn, identified to have the potential to impart subsequent impacts on other industries such as, tourism and local businesses (i.e., road and marine transportation may be disrupted due to associated damages, adverse weather could translate into potential losses of revenue as well as leave some citizens without necessary supplies).
 - SLR was also documented to have the potential to impart impacts on real estate and urban development.
- A general consensus was noted amongst the respondents that dealing with the potential economic ramifications of climate change should be a priority for HRM (i.e. to better ensure that

HRM maintains its attractiveness for economic development; including an emphasis on considerations relating to coastal planning and energy security);

- The following potential economic opportunities were also identified for HRM in conjunction with change in climate:
 - Research and development opportunities associated with new technology and sustainable development (such as, green technologies, ocean science, green construction industries, cleaner energy, energy efficiency, and energy conservation initiative etc.).
 - Promoting and encouraging the utilization of HRM's Universities and knowledge to further develop sustainable technologies.

3.2.5 Cost-Benefit Analysis of Adaptation Options for Atlantic Coastal Infrastructure under a Changing Climate

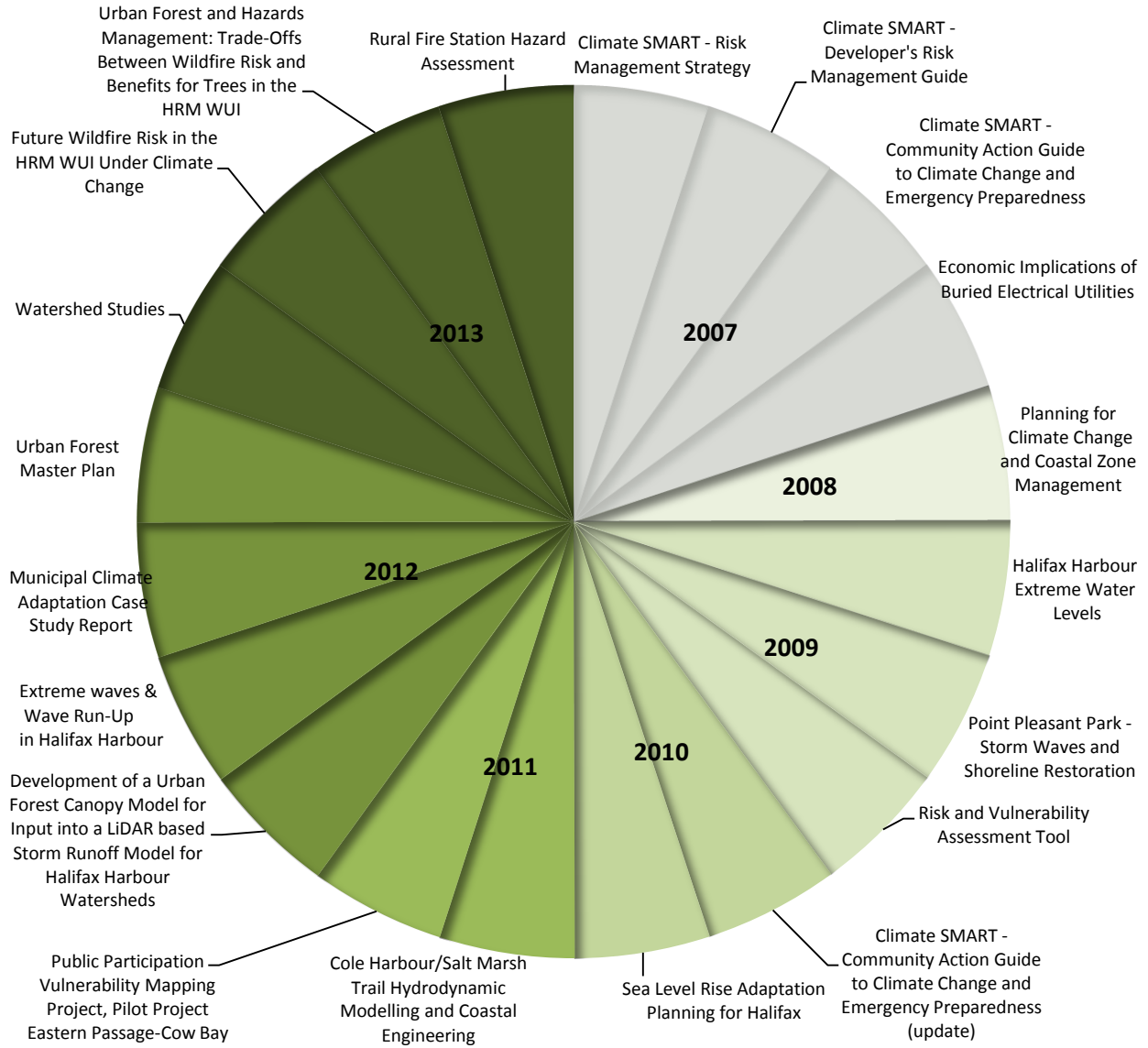
This (currently pending) initiative represents large regional-scale economic studies supported by Natural Resources Canada and the associated *Climate Change Impacts and Adaptation Division Adaptation Platform Economics Working Group*. The main objectives of this project are to:

- Build on existing climate change impacts and adaptation work along the Atlantic coastline that focussed on coastal erosion, sea level rise scenarios, coastal flooding and infrastructure vulnerability, by adding an economic layer of analysis;
- Quantify the economic costs from potential damage impacting Atlantic coastal infrastructure under a future changing climate;
- Quantify and compare the cost-benefit ratios for effective adaptation options for Atlantic coastal infrastructure under a future changing climate;
- Develop regional knowledge and skills - in governments, non-governmental organizations and academic institutions - in the application of cost-benefit analysis to climate change adaptation options in order to strengthen communities and livelihoods along the Atlantic coastline; and
- Develop approaches/methods for building the economic knowledge and tools necessary to help decision-makers make better adaptation investment choices and policy decisions that can be applied elsewhere (regionally, nationally).

HRM has issued a *Letter of Support* for this project as well as provided financial assistance for its completion. HRM plans to utilise the information gathered from this work to further refine/bridge existing knowledge gaps between CCA and the development of a comprehensive future economic strategy.

Figure 1 provided below, highlights HRM's consistent commitment to completing CCA research since the inception of the *Climate Risk Management Strategy*.

Figure 1: HRM CCA Research Timeline (2007-2013)



Copies of the research documents outlined in this section can be referenced in Appendix B.

3.3 Operationalization of Adaptation

The following corporate priorities for action, initially outlined in Section 7 of the *Climate Risk Management Strategy*, provide the current basis for the development of CCA operational initiatives in HRM:

- Innovative and Responsive Funding;
- Enhance Community Outreach;
- Improve HRM Inreach;
- Hazard and Risk Mapping;
- Integration of Climate Change Risk into Business Planning;
- Life-Cycle Approach to Decision Making;
- Improved Intergovernmental Collaboration; and
- Updating Design Criteria.

As a result, in conjunction with the information compiled in the preceding sections of this report, this section provides a summary of HRM's recent/current CCA operational initiatives and highlights future opportunities pertaining to the above noted actions.

3.3.1 Innovative and Responsive Funding

Based on the *2007 Climate Risk Management Strategy*, funding to develop risk management tools and implement adaptation measures was identified as a primary barrier to the establishment of an effective risk management regime for identified climate change impacts in HRM. To address this issue, HRM has since hired permanent staff within the Energy & Environment department dedicated to this work. HRM has capitalized on numerous Provincial and Federal funding opportunities including the *Atlantic Climate Adaptation Solutions (ACAS)* funding as well as the Province of Nova Scotia's *Climate Change Adaptation Fund* to complete much of the adaptation research outlined in Section 3.2.

Recent investments in new and recapitalized infrastructure have also included climate change considerations such as, engineering studies for coastal infrastructure deemed susceptible to SLR and storm surge (e.g. the Northwest Arm Shoreline Restoration Study and the Cole Harbour/Salt Marsh Trail Hydrodynamic Modelling and Coastal Engineering Project).

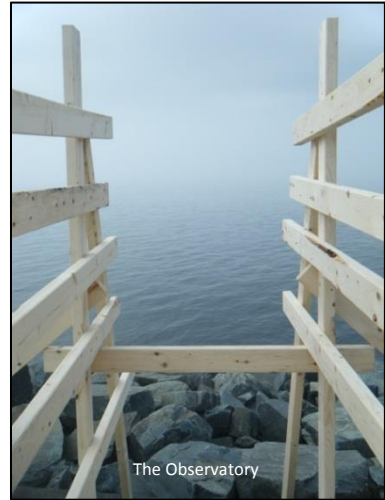
Addressing innovative and responsive funding opportunities is considered an on-going activity for HRM. From an economic perspective, a continued need to seek research and development opportunities associated with new technology and sustainable development (such as, green technologies, ocean science, green construction industries, cleaner energy, energy efficiency, and energy conservation initiative etc.) as well as promoting and encouraging the utilization of HRM's Universities to further develop sustainable technologies, have been identified as priorities for the municipality, moving forward.

3.3.2 Enhance Community Outreach

HRM has worked to enhance community outreach regarding CCA through a variety of operational initiatives including, public art installations, community education programs, development agreements, and websites. Brief descriptions of these initiatives are provided below.

Public Art Initiatives

In the spring/summer of 2010, SEMO collaborated with the former Community Relations and Cultural Affairs division of HRM (currently identified as the Regional Recreation & Culture department) to increase public awareness of climate change specific to HRM by highlighting the associated impacts via a competitive public art initiative entitled *“Climate Change Impacts in HRM: Temporary Art Opportunity”*. The main goal of this program was to impress upon casual viewers the effects of climate change by providing a visual representation of the projected impacts to Halifax Harbour. An installation completed by artist Jose Luis Torres named *“The Observatory”* was put on display from September-November 2010 and included signage discussing climate change issues in HRM and where to obtain more information. Useful feedback was received from this project which was deemed successful in creating interest around the topic.



In addition, in conjunction with the 2011 Nocturnal Art at Night annual festival held in Halifax, SEMO provided additional funding to support an artistic project that highlighted the urgency of mitigating and adapting to climate change. The installation called *“The Same Boat Horn”*, created by artist Kyle Jackson, included an interactive sculpture which allowed members of the public to call out a warning/rescue message over the sea and connect with other coastal residents around the world.

Community Education Programs

HRM staff has consistently worked to involve and educate residents on the impacts of climate change emphasizing that communities must work together to mitigate and adapt. The most prominent initiative



HRM has employed to date, includes the collaboration between E&E/SEMO and EMO staff (previously noted in Section 3.1.1) to present content associated with the *Climate SMART Community Action Guide to Climate Change and Emergency Preparedness (Community Action Guide)* to JEM Teams for future dissemination into rural areas of HRM. These efforts culminated in the completion of a subsequent 2011 public vulnerability mapping pilot project in Eastern Passage/Cow Bay. It has been noted that, similar projects will need to be conducted in several other communities before the level of success of these initiatives can be

effectively ascertained (i.e. in terms of expanding HRM’s corporate knowledge of climate change vulnerabilities and weather related impacts as well as expanding the associated GIS mapping database).

Also, in addition to partnering with the Provincial government to provide “*Fire SMART*” presentations to communities within Nova Scotia (as outlined in Section 3.1.1), a number of additional educational activities are held by HRFE to inform residents in HRM of fire related risks including, the annual HRFE program for Fire Safety Week conducted at local schools. Furthermore, following the Tantallon wildfire in 2008, HRM held twenty (20) community engagement sessions to provide wildfire risk education to residents. Although inherently correlated, the relationship between climate change and wildfire risks has not been specified within these educational programs. As a result, there is an opportunity for E&E staff to work with HRFE to expand the content of these initiatives, including the consideration for increased management of woody debris on HRM lands, outlined in Section 3.2.1.

Furthermore, HRM is also a program sponsor for Clean Nova Scotia’s RainYards initiative. Entering its second year of delivery, this program is currently working to improve residential stormwater management in the Oakhill Lake Community of HRM, through landscape changes and property retrofits for 100 participants (Clean Nova Scotia, 2013).

In moving forward with community outreach related to climate change, HRM is seeking to investigate alternative or supplemental approaches to increase participation and deliver a more robust engagement program to residents. Currently, the Community Energy Plan (CEP) endorsed by Regional Council in 2007, has been identified as a potential future tool to continue both CCA and CCM education throughout HRM. In addition, in response to a need to update the CEP and respond to community input related to energy opportunities, HRM staff are developing a two (2) year project to revise the plan. This project will also consider a 2012 Halifax Chamber of Commerce policy recommendation document issued to HRM in association with the RMPS review process (a copy of this submission is provided in both Appendix B and Appendix D).

Development Agreements

As noted by Richardson (2012), development agreements represent a flexible mechanism for HRM to address coastal climate change risks. HRM’s initial recognition for the application of this mechanism to address CCA is reflected by the 2007 release of the *Climate Change: Developers Risk Management Guide*.

The most notable current and future opportunities for HRM to continue working with development agreement applicants to address climate change are represented by Schedule W (Storm Surge Protection Zoning) and Chapter 5 (voluntary Sustainability Guidelines) of the Downtown Halifax Land Use By Law, outlined in Sections 3.1.1 and 3.4.

Websites

To a more limited degree of success, websites have also been used as a means to communicate information regarding climate change to the public (including the Climate SMART website <http://www.halifax.ca/climate/index.html>, the Energy & Environment homepage <http://www.halifax.ca/environment/semohome.html> , and select Naturally Green Newsletters <http://www.halifax.ca/environment/>). In addition, HRFE also has a website dedicated to providing education related to wildfire safety in HRM (<http://www.halifax.ca/fireprevention/WildlandFires.html>).

This website provides: tips for protecting homes and property from wildfires, a link to the Nova Scotia Department of Natural Resources (NSDNR) website as well as a NSDNR pamphlet on wildfire safety.

Communications

Based on EMO’s relationship with the Amateur Radio Community (outlined in Section 3.1.1), the use of point-to-point/non-internet based e-mail services continues to be supported for periods in which public safety telecommunication systems have been overloaded or have failed due to a wide variety of potential impacts; including those associated with climate change.

3.3.3 Improve HRM Inreach

Due to the vast area encompassed by HRM (approximately 5,491 km²) as well as the variation and complexity of the assets housed within this Municipality (as outlined in Section 3.1) completing a large scale (single event) infrastructure risk assessment, based solely on CCA, was not deemed financially feasible. As a result, improved HRM “inreach” via the utilization of existing and proposed management frameworks have been identified as the most appropriate channels to account for such risks. As noted in Section 3.1.1, in addition to the EMO led BCP planning initiative, the HRM Enterprise Asset Management (EAM) program and proposed Corporate Risk Management Strategy have been identified as the most suitable management opportunities to account for these risks. Brief summaries of these initiatives, in conjunction with the potential for the inclusion of CCA infrastructure risk assessments, are provided below.

The Enterprise Asset Management Program

The main goal of the EAM Program is to progress HRM toward the whole-of-community outcome expressed in the following Strategic Objective:

- *“To have sustainable, reliable infrastructure that provides optimal service delivery in support of community health, safety, economic prosperity and quality of life”*

To facilitate this progress the EAM Program will implement tools, strategies, policies and procedures to advance asset management within HRM. Essentially, the EAM Program is focused on improvements to the following four (4) key areas of asset management:



1. Decisions regarding when to repair, renew, rehabilitate, replace and dispose of assets are well informed, are based on full life cycle costs, opportunity costs, benefits, and risks;
2. Asset management is fully integrated with corporate budgets, business plans, and reporting processes;
3. Accountability and responsibility for ownership, control, and reporting requirements must be clearly defined, and fully embedded in the organizational structure; and
4. Asset management must be undertaken within a predictable, reasonable, and transparent policy framework.

Essentially, this program has been designed to implement key components of best practice asset management, including:

- Establishing a Program Office;
- Completing some initial (foundational) asset management tasks;
- Implementing a single, enterprise level, asset register;
- Establishing an Operational EAM system;
- Developing Strategic EAM guiding principles and framework;
- Assessing EAM Financial Models; and
- Determining a pathway to Sustainable EAM for Halifax.

Of these components, the *“Developing Strategic EAM guiding principles and framework”* represents the stage at which infrastructure service risks associated with climate change can be first managed based on the data and tools provided in the preceding steps of the program. These include: the single, enterprise-level asset register; the establishment of an operational EAM system and key components; as well as other planning tools (including, innovative and responsive funding, enhanced community outreach, hazard and risk mapping, business planning, intergovernmental collaboration, updating design criteria as well as the maturation of policy within the RMPS etc.).

In order to better ensure that climate change risks are effectively accounted for within this program, the above noted information will need to be reviewed by a multidisciplinary CCA focus group, formed from HRM staff, that is centered on service delivery risk (including managers from P&I, TPW, C&RS, Legal Services, HRFE, as well as subject matter experts from EAM etc.). Once the information has been evaluated, it can then be incorporated in to EAM program through consultation with the Strategic EAM team members. The Strategic EAM project is currently in the scope definition phase and the team members will be identified once a project plan is completed (Fall 2013).

To supplement the analysis of the CCA focus group, HRM could incorporate the use of the formalized risk assessment procedure known as the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol. This protocol was developed through a partnership between Engineers Canada and Natural Resources Canada. It has been successfully applied in 24 infrastructure case studies (including buildings, storm water/wastewater systems, roads, bridges, culverts, water supply and management systems etc.) located across Canada (Engineers Canada, 2013). This tool can be applied to any type of civil infrastructure and is available at no financial charge through a license agreement with Engineers Canada.

In summary, the protocol is divided into five (5) main steps including: Project Definition, Data Gathering & Sufficiency, Risk Assessment, Engineering Analysis, as well as Conclusions and Recommendations. As noted by Engineers Canada (2011), the general outcomes from such an analysis will fall into five (5) major recommendation categories, including:

1. *Remedial action is required to upgrade the infrastructure;*
2. *Management action is required to account for changes in the infrastructure capacity;*
3. *Continue to monitor performance of infrastructure and re-evaluate at a later time;*

4. *No further action is required; and/or*
5. *There are gaps in data available or data quality that requires further work.*

A copy of the PIEVC Protocol is provided in Appendix B.

The HRM Corporate Enterprise Risk Management Strategy

Although it is in the early stages of development, HRM's Finance & Information Technology department is developing Terms of Reference (TOR) for priority outcome teams to support the development of a Corporate Enterprise Risk Management Strategy, based on the following priority themes of HRM's Regional Council:

1. Economic Development;
2. Excellence in Service Delivery;
3. Financial Stewardship;
4. Governance & Communication; and
5. Healthy Communities.

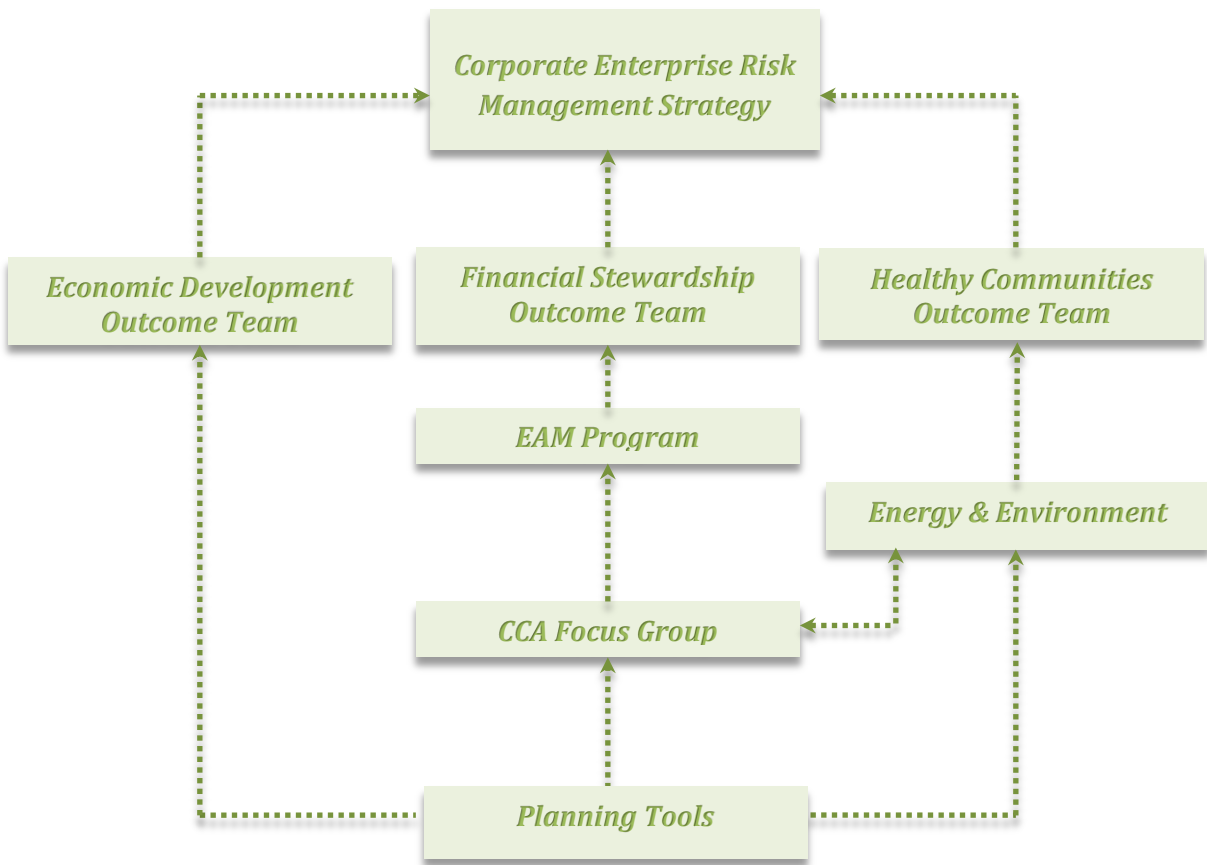
HRM management staff involved with the following components are scheduled to become members of the Economic Development, Financial Stewardship, and Healthy Community priority outcome teams:

- i. the Regional Plan Review;
- ii. the EAM Program,; and/or
- iii. the Energy & Environment department.

A schematic outlining the interconnectivity and proposed inclusion of CCA infrastructure risk within these frameworks is provided in Figure 2, below.

Ultimately, the EAM and Corporate Risk Management Strategy provide a means to relay CCA information to the ESC and ESSC and inform Regional Council on matters related to the associated climate change risks, priorities, and financial costs across the organization.

Figure 2: CCA Infrastructure Risks - Existing and Proposed HRM Management Frameworks

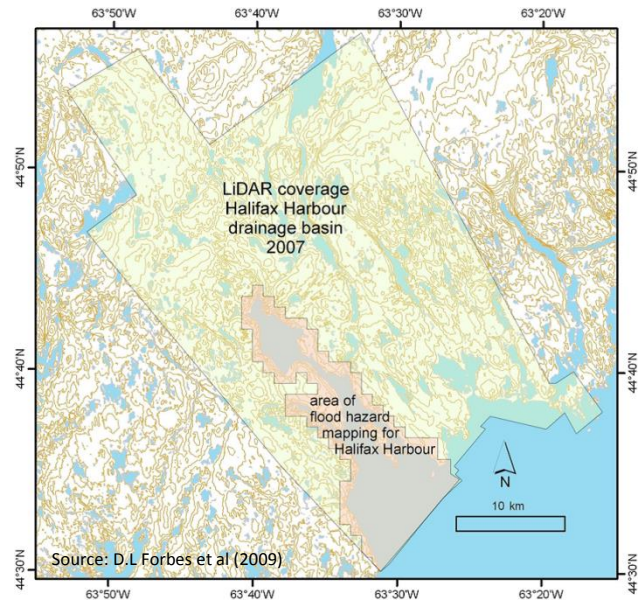


.....> Denotes the pathways in which CCA risks are intended to be incorporated within HRM management frameworks

3.3.4 Hazard and Risk Mapping

As noted in Sections 3.1.1 and 3.2, since the development of the 2007 *Climate Risk Management Strategy*, HRM has undertaken a substantial amount of work in regards to the acquisition and creation of hazard and risk mapping.

The 2007 acquisition of LiDAR (Light Detection and Ranging data) for 1400 square kilometres of HRM, including Halifax Harbour and the East Petpeswick Peninsula (located within Musquodoboit Harbour), was cost-shared, receiving funding from NRCan, the Halifax Port Authority, HRM and the Province of Nova Scotia. This information has been valuable in assisting with HRM's preparation and adaptation for climate change and was initially outlined in the 2007 *Climate Risk Management Strategy* as an adaptation requirement (i.e. listed in Table 6.1 as "e.g. LiDAR to delineate zones of vulnerability and prioritize protection/relocation"). For example, this data was recently used to complete a project outlined in Section 3.2 entitled *Halifax Harbour Extreme Water Levels in the Context of Climate Change: Scenarios for a 100-year Planning Horizon* (D.L. Forbes et al., 2009), funded by HRM, NRCan, Nova Scotia Department of Energy, and the Halifax Port Authority (with in-kind expertise provided by NRCan, Applied Geomatics Research Group, Dalhousie University, and the Nova Scotia Department of Natural Resources). Based on the premise that scientific information is the foundation for CCA planning processes, this study included the following components: creating a digital elevation model (DEM) using the LiDAR data, identifying future SLR and flooding risk around Halifax Harbour over the next 100 years, and mapping future flood hazard zones. Ultimately, this information has been used in the consideration of new investments and expenditures as well as in the development of related CCA policy.



To further refine the findings of the 2009 study, HRM partnered with Dalhousie University in 2012 to model wave run-up and seiche through an ACAS funded project titled "*Extreme Waves and Wave Runup in Halifax Harbour under Climate Change Scenarios*" (Xu and Perrie, 2012). This study noted that development proponents are currently not required to demonstrate that extreme waves and wave run-up effects have been incorporated into their project design and engineering; however, information from this research study could be considered in amendments to land use by-laws. For instance, development proponents could be required to conduct site-specific wave studies based on the methodology outlined in the study and then demonstrate that appropriated adaptive responses have been incorporated into the overall design. Although the modeling of extreme waves and wave run-up has provided an opportunity for HRM to forecast water levels, further development of an interactive decision support system is required.

In addition to providing a means to respond to the adaptation requirements outlined in the *Climate Risk Management Strategy* (such as, *using LiDAR to delineate zones of vulnerability and prioritize protection/relocation, and enforcement of setbacks, using data to update setback requirements as vulnerability data improves*), this information has also been collectively used to conduct vulnerability analyses for Halifax harbourfront properties. A summary of the most recent associated work HRM has completed, to date, is provided below.

Halifax Harbourfront Property – Vulnerability Matrix

This matrix identifies parcels along the Halifax Harbourfront, within the five (5) metre contour, that may be exposed to sea level rise and subsequently susceptible to increased erosion, permanent inundation and flooding. The matrix is centered on the following three (3) criteria:

- The built environment, including: consideration of structures and infrastructure present, ownership, future land use, known brownfields, hazardous uses, designated growth centres, locations/elevations of critical facilities; and
- The natural environment, including: consideration of shore type and topography; and
- Two (2) sea level rise scenarios,
 1. Scenario 2: based on an expected SLR from the A1F1 scenario from the 2007 Intergovernmental Panel on Climate Change (IPCC) report. The worst case scenario is shown as a 0.57 metre (m) SLR between 2000 and 2100; and
 2. Scenario 3: based on a recent report (Grinsted et al., 2009) that included expected SLR with glacial melt and ice sheet contributions. The worst case scenario from this report was documented as a 1.58 m SLR between 2000 and 2010.

Based on these criteria, a Boolean point scoring system was then used to quantify the associated vulnerability. A score of one (1) indicates vulnerability while a score of zero (0) denotes no vulnerability.

The following assumptions were included in the evaluation of lands vulnerable to SLR around the Halifax Harbourfront:

- Storm surge affects all parcels equally, irrespective of orientation (this was a required generalization due to data limitations);
- The form of the coast was designated to remain static over a 100 year period (accurate predictions of the future form of the coast are currently not available);
- As it is a qualitative component, that is difficult to quantify, social vulnerability was not included in this assessment;
- As the study area is located in an urban area, recommendations and adaptation strategies were formed specific to an urban context;
- Land uses around the harbour area were assumed to remain static (i.e. they will not change in the future and no buildings will be built or moved). Over time, the vulnerability of the local built environment may change (due to increased development or other alterations to the built environment). Therefore, the vulnerability matrix will require regular updates. The automation of this process is a recommended next step;

- Only one (1) occurrence of each criteria was documented per parcel (e.g. a parcel with multiple building points expected to experience inundation or flooding received a score of one (1) for the building point vulnerability criteria).

The findings associated with the most recent Halifax Harbourfront vulnerability matrix assessment, include:

- A total of 2406 parcels were found below or intersecting with the five (5) metre contour. This number is anticipated to change over time through parcel subdivision or consolidation;
- 1497 of these 2406 parcels were identified to be impacted by Scenario 2c while 2036 parcels were identified to be impacted by Scenario 3c;
- The range in which vulnerability impacts can be assessed spans from a minimum of level 4% to a maximum level of 92%;
- Vulnerability levels of 63% or higher were documented for 93 parcels along Halifax Harbour;
- Vulnerability levels of 33% or lower were reported for 790 parcels;
- The majority of the parcels (1523) fell within the medium vulnerability category, reporting levels between 34% and 62%.

It is important to recognize that the two (2) selected sea level rise scenarios, currently incorporated in the matrix, may change when further research is conducted and more sophisticated data or methodology becomes available (such as the pending IPCC Fifth Assessment Report (AR5) due for completion in October 2014). There are also opportunities for future considerations to account for the available wave run-up studies as well as other coastal areas of HRM including, Downtown Dartmouth, the Bedford Basin, Eastern Passage, and Chebucto. As outlined in Section 3.1.1, EMO is also looking to incorporate this information (including available LiDAR data for Halifax Harbour and the East Petpeswick Peninsula as well as available flood plain mapping for Bedford and Sackville) into the planned update of the HRVA document.

3.3.5 Consideration of Climate Change in Business Planning

During the annual business plan cycle, HRM BUs evaluate the potential risks to their operations. As a result, the HRM Proposed Project Budget for 2013/2014 was reviewed to identify how CCA has been accounted for by the HRM BUs identified in Section 3.1, over the short term planning horizon. In general, the CCA deliverables highlighted for these BUs are consistent with the CCA responses outlined in Section 3.1.1. Brief summaries outlining these deliverables are provided below:

Transportation & Public Works

- TPW 1.2: Implement a new rating process for existing sidewalks that satisfies requirements for Design and Construction Services as well as Municipal Operations;
- TPW 1.3: Complete a detailed inspection of all HRM owned and maintained road bridge structures that will enable staff to develop a maintenance plan as well as short, medium and long term capital programs;
- TPW 1.4: Rate one-third of the pavement inventory and one-half of the sidewalk inventory (through the new rating process) prior to winter 2013;
- TPW 2.1: Identify unit costs for delivery of services developed to ensure that operating cost of capital is established for new and renovated infrastructure;

- TPW 2.3: Complete thorough condition assessments 5-10 year capital work plan for Community run facilities and rural fire stations; and
- TPW 4.4: Operationalize the Urban Forest Master Plan through the completion of study with Dalhousie, release By-Law and identified plantings for the season (Municipal Operations).

Planning & Infrastructure

- P&I 1.1: Complete Regional Plan 5-Year Review;
- P&I 2.2: Continue implementing an EAM program for HRM which provides sustainable, reliable infrastructure;
- P&I 3.3: Complete the 25 year recapitalization Plan and prepare funding options. This includes a detailed site condition assessment of all HRM facilities which is currently underway; and
- P&I 5.3: Develop project charter and year one deliverables for Integrated Stormwater policy, Stormwater Infrastructure Funding Program delivery, Support Regional Watershed Advisory Board and the Clean Nova Scotia RainYards project.

Community & Recreation Services

Upon review of 2013/2014 C&RS business plan the most relevant services this BU provides (in terms of CCA) include:

- The citizen contact centres: including, the Corporate Call Centre which takes urgent requests for service and dispatches appropriate service responders (regular hours run from 7am to 11pm, in emergency situations the line is available 24/7; there is also a supplemental or secondary site available in case the main building is not accessible during periods of emergency); and
- Regulatory compliance: including, licencing (i.e. inspection of licensed service providers for compliance with by-laws and regulations), building approvals (i.e. reviews and issues permits, performs inspections for various types of building activities including new construction and renovation, as well as multiple unit residential, commercial, industrial and institutional buildings), and building/property standards (i.e. providing minimum standard investigations and compliance related to dangerous and unsightly premises etc.).

As a result, the following key deliverables for C&RS were deemed applicable to CCA:

- CRS 1.3: Improve Corporate Customer Service Culture,
 - a) Create new program of service quality in all Customer Service Centres;
 - b) Measure the performance and create a rewards and recognition program; and
 - c) Explore opportunities to engage all employees in creating a corporate customer service culture.
- CRS 2.2: Develop continuous improvement plan to streamline the development review process,
 - a) work with Government Relations and External Affairs (GREA) and Greater Halifax Partnership (GHP) to address HRM's regulatory environment and service culture including benchmarking, best practices, and research development related fees; and
 - b) Clarify roles and responsibilities with partner departments & agencies.

Halifax Regional Fire & Emergency (HRFE)

- F&E 1.2: Determine various options relating to the deployment of apparatus and station location, safe and effective staffing levels, organization structure and support processes;
- F&E 1.4: Develop a proactive Community Outreach Program;
- F&E 2.2: Conduct a community hazard assessment that supports accepted industry standards around hazards, risk and vulnerability assessment (HRVA) practices;
- F&E 2.3: Complete the transition of emergency incident management protocols to better reflect the use of the Incident Command System (ICS) at both the emergency site and in the HRM Emergency Operations Centre (EOC); and
- F&E 2.4: Complete evacuation sector profile update and ensure a shared user access.

The HRM Proposed Project Budget for 2013/2014 also highlighted CCA business planning considerations related to additional HRM BUs, including :

Finance and Information, Communication and Technology

- FICT 2.5: Deliver and manage technological solutions of the Asset Data Registry and Operational EAM projects under the Enterprise Asset Management (EAM) Program; and
- FICT 3.2: Establish Enterprise Risk Management of HRM.

Halifax Regional Police

- HRP 1.1: Strike a committee to develop a strategic plan that will address service delivery, succession management, organizational structure and change as well as capital projects; and
- HRP 1.5: Provide leadership and coordination to corporate strategic alignment in public safety by convening meetings, reviewing and tracking progress and planning for the next business cycle.

Legal, Insurance and Risk Management Services

- LIRM 1.2: Create efficiencies within the BU, administratively and collaboratively with input internally and from other BUs (technology, processes, file/case management, etc.); and
- LIRM 1.3: By-law review multi-year project – a solicitor has been hired to carry out a complete review of HRM By-laws (new, amend existing, consolidate existing).

Metro Transit

- MT 1.1: Work with FICT to produce and install a foundational, computer aided dispatch and automated vehicle location (CAD/VAL) solution.

Although climate change was not always directly referenced, HRM's commitment to CCA was reflected in all of the aforementioned business plans reviewed. This finding is based on the observed general consistency between the content of the business plans and the CCA responses outlined in Section 3.1.1 and 3.3.

Capital Projects

In addition, based on the review of the HRM Proposed Project Budget 2013/2014 document, the following proposed 2013/2014 capital projects were also identified to be correlated with CCA:

Capital Project:	Description/Correlation with CCA:
Bedford Community Centre (Project # CBX01334)*	The Province of Nova Scotia is constructing a new school in Bedford West to serve the growing population of the area. HRM is partnering with the Province to expand the school programming to include community facilities. The building is targeting LEED Gold status.
Consulting Buildings (Project # CBX01268)*	<p>This project was created to fund: energy performance, life cycle costing, LEED, needs assessment, operational planning, communications, graphic materials, presentations, condition analysis and recommendation, design, contract documents, and tendering.</p> <p>The associated 2013/2014 priority projects include:</p> <ul style="list-style-type: none"> • Functional analysis of core fire stations; • Program of requirements for the Fire Services Training Facility; • Functional/structural analysis of the St. Mary's Boat Club; • Preliminary design work for St. Andrews Centre recapitalization; and • Condition assessment of the Citadel High community space.
Facility Assessment (Project # CB990002)	<p>This program is aimed at assessing the condition of HRM owned facilities to determine the recapitalization needs for each facility. The results of the assessment are needed for the EAM program.</p> <p>The associated 2013/2014 priority projects include (but are not limited to):</p> <ul style="list-style-type: none"> • Fund the maintenance and updating of the data collected in previous years; • Complete the program to have electronic (CAD) files of all the buildings; and • Commence the recapitalization plan for assets in parks.
Mechanical – Category 6 (Project # CBX01269)*	This project was created to fund: energy performance, life cycle costing, LEED, condition analysis and recommendation, contract documents, tendering, HVAC, plumbing, sprinklers, boilers, controls dehumidifiers, and refrigeration.

Capital Project:	Description/Correlation with CCA:
Enterprise Asset Management (Project # CID00634)	<p>The EAM strategic road map (plan) was completed in April 2012.</p> <p>The associated business tools priority projects include:</p> <ul style="list-style-type: none"> • Purchase of corporate asset management solution; • Implementation of right-of-way-module; • Development of corporate asset data registry; and • Implementation of Asset Works fleet solution.
Conventional Bus Expansion (Project # CVD00434)*	<p>This project relates to the purchase of new buses for the expansion and improvement of conventional transit service within the HRM urban transit boundary. New buses will allow an increase in frequency of service and/or service to new areas and help develop a more extensive and environmentally friendly public transportation system. With increased utilization of public transportation by HRM residents, greenhouse gas emissions can be reduced.</p> <p>In 2013/2014, nine (9) 40-foot conventional buses would be purchased for expansion purposes. Plans also include improvements to schedule adherence on key route and implementation of new feeder services for the expanded Woodside Ferry service.</p>
Conventional Bus Replacement (Project # CVD00435)*	<p>Recapitalization of the Metro Fleet includes the acquisition of Transit buses to replace an aging fleet. Buses are identified for replacement to best meet the ongoing demands of providing safe, reliable transit service that is responsive to the ever changing demographics of HRM. Newer buses are more environmentally friendly, more reliable, provide accessible low-floor service and are less costly to maintain than older buses. Ten (10) buses are scheduled to be replaced in 2013/2014.</p>
New Transit Map (Project # CM990002)	<p>Metro Transit and HRM Corporate Communications will be investigating opportunities to redesign the system route map in 2013/2014. The existing route map has not undergone any significant modifications in many years, and because of the service expansion and growth that have taken place, the existing design is no longer functional. The purpose of the new Route Map will be to provide transit passengers with clearer information and plan trips more efficiently.</p>

Capital Project:	Description/Correlation with CCA:
Regional Water Access/Beach Upgrades (Project # CPX01331)	<p>This program is based on maintaining safe and functional infrastructure to access HRM's lakes, beaches and harbour fronts. Included in this project is life-cycle refurbishment or replacement of municipally owned wharfs, boat launches, sea walls, and amenities.</p> <p>The associated 2013/2014 priority projects include (but are not limited to):</p> <ul style="list-style-type: none"> • The continuation of the Northwest Arm seawall; restoration at Sir Sanford Fleming Park and upgrades to the wharf beside the boast launch; • Completion of the retaining wall at Papermill Lake; • The Jubilee Road boat launch upgrade; • Concrete restoration and railing upgrades at the Sullivan's Pond/Shubie Canal Locks; • Boat launch upgrades at the Bay Lookout Wharf; • Boat launch upgrades at Bisset Lake; and • Boat launch upgrades at Lake Charlotte.
Street Trees (Project # CP990001)*	This project provides for a tree planting program as identified by the UFMP. The trees provide aesthetic value, sequester carbon, and play a role in the storm water management system as well as provide shade.
Bridges (Project # CRU01077)	This project addresses major upgrades or replacements to various HRM owned street and road bridge structures. Funding is also used to cover fees for bridge assessments, engineering designs, and construction inspection and contract administration.
Curb Renewals (Project # CYU01076)	This project addresses upgrading existing deteriorated asphalt and concrete curbs, or to construct new concrete curbs. Curb renewals improve the functionality of street drainage and the asset life is expected to be 40-50 years, when using concrete upgrade materials.
Municipal Operations (Project # CR990002)	This project budget includes gravel road maintenance and street drainage improvements, sidewalk slab replacement, bridge recapitalization, guide rail maintenance, road shoulder repair, micro surfacing, and pot hole repair.
Other Road Related Works (Project # CRU01079)	This project covers funding for a variety of areas including installation of new guardrails and retaining walls, upgrade of existing guiderails and walls, upgrading of walkways, and materials testing requirements for capital projects.

Capital Project:	Description/Correlation with CCA:
Storm Sewer Upgrades (Project # CR000001)	<p>This account was created as a contingency to fund storm sewer upgrades where it may be in the best interest of HRM to contribute to a storm sewer upgrade, where the current system is insufficient and the road structure is being negatively impacted.</p> <p>Years 2013/2014 and 2014/2015 of this plan are a part of the Stormwater Infrastructure – Funding Interim Solution presented to council in February 2013. In the next two (2) years, it is expected that, HRM in conjunction with HRWC, will jointly create an integrated Stormwater Policy with sustainable funding.</p>
Street Recapitalization (Project # CYX01345)	<p>This project relates to upgrading existing HRM owned and maintained asphalt street surfaces, through a variety of rehabilitation methods. Life expectancies of the methods range from 5-20 years. The appropriate method is selected using sound asset management techniques to maximize the impact of the investment and subsequently improve the functionality of the network.</p>
New Sidewalks (Project # CR000003)*	<p>This projects deals with the installation of new sidewalks. New sidewalks provide pedestrian safety and support the Active Transportation Plan, described below. This project also includes and increased operating budget for snow clearing and rehabilitation.</p>
Active Transportation Plan (Project # CTU00420)	<p>This plan, approved by Regional Council in 2006, describes the development of a regional active transportation network (AT) over a 25 year period. The aim of this plan is to help residents bike, walk, roll, blade and use other “human powered” ways to move around the Municipality. Therefore, promoting personal health and recreation, assisting with managing congestion, reducing emissions and supporting municipal objectives for efficient land use.</p> <p>The associated 2013/2014 priority projects include (but are not limited to):</p> <ul style="list-style-type: none"> • Next phase of the Burnside Drive Trail (Commodore to Wright Avenue); • Implement recommendation from the Peninsula North-South AT corridor; • Construction of an AT connection from Mumford Road to Olivet Street across the CN rail line; • At connections at the Porter’s Lake Metro X Terminal; • Design of overpass structure that make use of salvaged bikeway panels from the MacDonald Bridge; • Additional on-street bike parking in commercial areas.

Capital Project:	Description/Correlation with CCA:
Functional Transportation Plans (Project # CTU00884)	Functional transportation studies are required to support the implementation of the Regional Plan and to deal with unanticipated occurrences affecting the region. These studies are generally conducted with other agencies (such as Transport Canada, the Province of Nova Scotia, and Halifax Harbour Bridges etc.) but are initiated in an as-needed basis. The 2013/2014 studies are expected to deal with the Highway 111 interchange, Portland Street, as well as a travel survey of bridge, pedway and bikeway users.
Overhead Wiring Conversion (Project # CTU01284)	<p>HRM has committed to the undergrounding of overhead utilities in the Capital District of the Municipality since the initial “pole free zone” was established in downtown Halifax in 1977. Substantially undergrounding occurred during the 1980s under the Provincial Main Street program. The only work completed since the 1990s has occurred in relation to private developments. This project provides the implementation mechanism to take advantage of opportunities to install overhead wiring underground, in conjunction with other public or privately funded projects.</p> <p>Currently, undergrounding is occurring in conjunction with the Queen Street street-scaping in the proximity of the new Central Library. Future potential projects include: Barrington Street, Spring Garden Road, Quinpool Road, Nantucket Avenue, Ochterloney Street, and Hollis Street.</p>
Road Network Model (Project # CTU01285)	A computerized regional trip demand model has been developed for HRM in 2011. This model allows the operation of the road and transit network to be simulated and capacity demands to be projected for growth scenarios. This is an important tool in testing the value of capacity investments. Associated funding is used to install traffic-count hardware on the street network and collect household travel data, which is critical to validating the model. Much of this work is being completed in collaboration with Dalhousie University.

Capital Project:	Description/Correlation with CCA:
Variable Messaging Signs (Project # CTX01115)	<p>Variable message signs provide valuable information to drivers regarding construction, road closures, and unplanned incidents. These messages can reduce congestion and vehicle delay as well as improve safety. The Halifax Harbour Bridges (HHB) have installed several such signs in the vicinity of their properties, this project would allow continued collaboration with HHB to add new permanent signs at strategic locations.</p> <p>Proposed locations for the signs include: Highway 102 at Miller Lake, Highway 102 at Bayers Lake Business Park, Highway 101 at Beaverbank Road, Highway 118 at Dartmouth Crossing, and Barrington Street at Cornwallis (if the budget permits).</p>
Trunk Mobile Radios (Project # CID01362)	<p>The Provincial Trunk Mobile Radio System (TMR) serves federal, provincial and municipal radio users throughout the province. HRM users include Halifax Regional Police (HRP), HRFE, TPW as well as HRWC. The current radio communications technology is becoming outdated and requires replacement. Both short and long term solutions will be developed over the next five (5) years.</p> <p>The associated 2013/2014 planned work includes:</p> <ul style="list-style-type: none"> • Planning and initiation of an interim replacement system; and • The creation of a TMR Roadmap.
Opticom Signalization System (Project # CEJ01220)	<p>The Opticom Signalization System clears traffic for responding emergency vehicles to better ensure that they can proceed with increased safety when responding to an emergency. Infrared emitters on the vehicle send out signals to traffic light sensors to cause them to subsequently change. This initiative addressed the safety of HRFE personnel as well as public expectations associated with service delivery.</p> <p>The associated 2013/2014 work includes the upgrading of 32 signals.</p>
Computer Aided Dispatch (Project # CIP00763)	<p>This project supports the investment required to support mission critical technologies leveraged by the Halifax Regional Police (HRP), HRFE, and HRM EMO. During the 2013/2014 period, HRM Finance Information Communication and Technology (ICT) will partner with HRP, HRFE, and HRM EMO to design and implement a Situation Awareness solution that will provide more timely, accessible, and accurate information to emergency personnel during an emergency event.</p>

*Denotes this capital project also correlates with CCM.

Capital Projects Supplementary Reports

Currently, when the HRM Capital Steering Committee (comprised of senior managers) reviews a capital project they complete a *Capital Project Supplementary Report*. As depicted by the capital projects listed above, this reporting process has been moving from examining projects from a strictly economic standpoint, towards a more holistic view including social and environmental benefits. Although not currently a formal requirement, this represents an additional opportunity for the consideration of CCA related impacts from a business planning perspective.

HRM Reserves

HRM has 52 active reserves, with individual business cases outlining the associated funding sources and permitted expenditures. Of the 16 reserves that are dedicated to “maintaining a state of good repair” , the following two (2) Equipment and Operating Reserves have been identified as funding sources for previously noted CCA Capital Projects, including:

- *Q206 Fire Vehicles & Equipment* (Opticom Signalization System, Project # CEJ01220); and
- *Q321 Information and Communication Technologies* (Computer Aided Dispatch, Project # CIP00763)

2010-2014 Gas Tax

HRM is currently planning to incorporate funds collected in association with the 2010-2014 Gas Tax Agreement to finance the following aforementioned CCA correlated projects:

- Conventional Bus Expansion (Project # CVD00434);
- Conventional Bus Replacement (Project # CVD00435); and
- Street Recapitalization (Project # CYX01345).

3.3.6 Life Cycle Assessment

As noted in Section 3.3.3 planned improvement through the EAM program regarding the following key area of asset management will account for life cycle costing assessment of HRM infrastructure, moving forward:

1. *Decisions regarding when to repair, renew, rehabilitate, replace and dispose of assets are well informed, are based on full life cycle costs, opportunity costs, benefits, and risks.*

HRM’s commitment to including life cycle costing is also currently highlighted in Section 3.3.5, via the direct inclusion of this priority action in the business plans developed for the following capital projects:

- Consulting Buildings (Project # CBX01268)
- Mechanical – Category 6 (Project # CBX01269)

3.3.7 Intergovernmental Collaboration

HRM has long recognized that, due to jurisdictional issues and financial considerations, the undertaking and progression of adaptation measures requires intergovernmental collaboration. As a result, since the *Climate Risk Management Strategy* was initially created, HRM has worked with the Provincial

government through a variety of funding programs as well as through the submission of comments and involvement in the development of new policies and strategies, via:

- The Union of Nova Scotia Municipalities and Province of Nova Scotia’s Memorandum of Understanding on Climate Change;
- The Environmental Goals and Sustainable Prosperity Act (EGSPA) and the Provincial Climate Change Action Plan;
- The Regional Adaptation Collaborative – Atlantic Canada Adaptation Solutions (RAC-ACAS);
- The Emergency Response Intergovernmental Collaboration; and
- The Canadian Institute of Planners.

Descriptions of HRM’s involvement with the above noted programs and/or organizations are provided below.

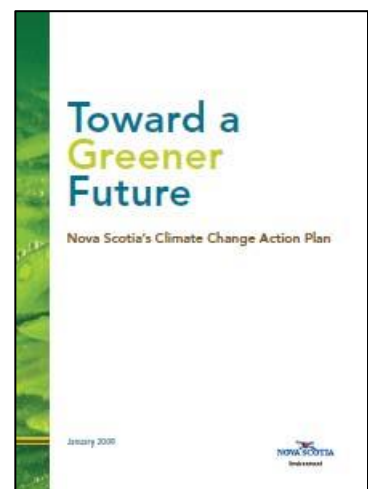
The Union of Nova Scotia Municipalities and Province of Nova Scotia’s Memorandum of Understanding on Climate Change

A Memorandum of Understanding (MOU) on Climate Change, signed in November 2009, exists between the Union of Nova Scotia Municipalities (UNSM) and the Province of Nova Scotia. The MOU outlined the terms and conditions upon which the parties agree to work together to address the challenges and opportunities relating to climate change. In terms of HRMs municipal responsibility, it stated that *“Municipalities will continue to take action on climate change impacts through direct actions including policy development, land-use planning initiatives, emissions reductions, the development and implementation of Integrated Community Sustainability Plans and through the initiatives of the UNSM Municipal Sustainability Office.”*

The Environmental Goals and Sustainable Prosperity Act (EGSPA) and the Provincial Climate Change Action Plan

In 2009, the Province of Nova Scotia released a Climate Change Action Plan deliverable in association with the Environmental Goals and Sustainable Prosperity Act (EGSPA). Under this action plan the Province of Nova Scotia made the following commitments related to CCA:

- Create and Adaptation Fund within Nova Scotia Environment to encourage adaptation research and development commencing in 2009 (Historically HRM has received funding from both the Provincial Adaptation Fund as well as the Atlantic Canada Adaptation Solutions Project);
- Develop statements of provincial interest on adaptation by 2010 to provide guidance on land use planning. This is a formal tool, established under the Municipal Government Act to protect the interests of the Province in such areas as land use, water resources, and community planning (ongoing);
- Incorporate climate change impacts and adaptation response plans into the strategies and initiatives of all provincial



departments by 2012 (ongoing);

- Establish criteria in 2009 for the consideration of climate change during Nova Scotia Environment's environmental assessment process and develop a guide to climate change for project proponents;
- Launch a web-based clearinghouse of information and tools to support adaptation to climate change in Nova Scotia in 2009 (<http://climatechange.gove.ns.ca>);
- Begin work on provincial vulnerability assessment and progress report on adaptation to climate change in Nova Scotia. This report, which will be updated biannually, will provide updates on the latest climate research, review critical information gaps, and provide policy direction for the province;
- Continue to work with other Atlantic Provinces on common adaptation goals (ACASA project);
- Create an interdepartmental steering committee and external advisory committee responsible for coordinating adaptation effort and providing adaptation policy advice, in 2009;
- Ensure that design standards and plans for new provincial construction, and for the renewal of existing provincial infrastructure, reflect projected climate trends, not historical records, by 2010 (ongoing);
- Release a Sustainable Coastal Development Strategy by 2010, with an emphasis on strengthening resiliency to climate change impacts along the coast of Nova Scotia;
- Take sea-level rise into consideration and place priority on conserving coastal wetlands in preparing a policy to prevent net loss of wetlands;
- Develop a strategy, led by the Department of Natural Resources, to ensure the sustainability of the province's natural capital in forests (forestry), minerals (mining), parks, and biodiversity by 2010.;
- Develop a comprehensive water resource management strategy by 2010; including consideration of climate change impacts related to water quality and quantity; and
- Through the Department of Natural Resources, lead an interdepartmental and forest industry working group on forest carbon management and forest adaptation to climate change as well as the development of a Coastal Development Strategy. In December 2009, the Department of Fisheries and Aquaculture released the State of Nova Scotia's Coast Report (<http://www.gov.ns.ca/coast/>).

HRM staff collaborated, supported, and contributed to the above noted actions, through participation in:

- The development of *the Wetlands Policy*, the *Natural Resources Strategy*, the *Water Resource Management Strategy*, and the *Coastal Development Strategy*;
- Coastal consultations held by the province in 2010 on the *State of the Coast Report* and the *Provincial Coastal Strategy*; including the submission of comments on the proposed strategy on behalf of all HRM BUs; and
- The development of the *Water Resources Management Strategy* between 2008 and 2010, by commenting on discussion papers, participating in public consultations and reviewing the "options" document for stakeholder feedback in spring 2010.

The Regional Adaptation Collaborative – Atlantic Canada Adaptation Solutions (RAC-ACAS)

The Government of Canada has partnered with Provinces across the Country to deliver the Regional Adaptation Collaborative Program (RAC). The Atlantic RAC, the *Atlantic Climate Adaptation Solutions (ACAS)* Project, represents a collaborative effort that builds on the *Atlantic Climate Change Adaptation Strategy* signed by the Atlantic Environment Ministers in 2008. The ACAS included 64 partners including the Province of Nova Scotia, HRM, as well as several other municipalities, and organizations. The main goal of this project is to create a framework for comprehensive, integrated and long-term planning for climate adaptation in the Atlantic Region. ACAS aims to improve the ability of Atlantic Canadians to



prepare for climate change by integrating adaptation measures into a variety of commonly used planning and decision making processes.

The Emergency Response Intergovernmental Collaboration

Emergency response in HRM requires the involvement of all three (3) levels of government with the majority of resources (personnel and equipment) allotted within provincial and federal jurisdictions. As a result, impacts associated with climate change are being considered in regards to the updating of HRMs Emergency Master Plan (an all hazards plan that, although not specific to climate change, will consider related emergencies) including: Sector Profile Mapping, Critical Infrastructure as well as Hazard Risk and Vulnerability Assessment (HRVA). The recent WUI studies outlined in Section 3.2.1 and 3.2.2 represent additional opportunities for information sharing and collaboration between HRFE and the Nova Scotia Department of Natural Resources in terms of increased invasive species intervention, resource assessments as well as continued public education regarding the management of woody debris on private property.

The Canadian Institute of Planners (CIP)

The 2007 *Climate Risk Management Strategy* outlined the requirement for HRM to liaise with similar sized coastal municipalities to share knowledge regarding CCA. HRM has worked to address this goal through involvement with the Canadian Institute of Planners (CIP). More specifically, HRM participated in the 2010 CIP Conference which focused on climate change as well as the *Planning for Climate Change Adaptation* workshop, held in the spring of 2013.

Since 2007, CIP has been worked in partnership with Natural Resources Canada (NRCan) and other stakeholders including the Government of Nunavut, to bring climate change knowledge, adaptation strategies and plans, policies and tools to professional planners in all parts of Canada. In terms of CCA, CIP has sought to:



- Establish a national policy for the institute and its members;
- Create educational learning modules to increase members, planning students and stakeholders awareness of planning related climate change issues;

- Create tools and resources to better equip CIP members, students and stakeholders to deal with climate change impacts and adaptation.

HRM's most recent commitment to continued intergovernmental collaboration is reflected through the planned participation in the *Cost-Benefit Analysis of Adaptation Options for Atlantic Coastal Infrastructure under a Changing Climate* project outlined in Section 3.2.5.

In addition, although portions of the Point Pleasant and Urban Forest Master Plans as well as Draft 2 of the RMPS (Chapter 2) account for ecological impacts associated with CCA to some degree (i.e. via the Green Belting: Building an Open Space Network , Water Resources, and Watershed Planning Sections) there is an opportunity for coordination between all three (3) levels of government to work towards an improved management of natural resources and protection of coastal habitats to better achieve: natural habitat management and conservation, better use of mitigation and/or compensation for habitat impacts and improved land use planning in coordination with harbour planning.

There is also another opportunity for HRM to work with the federal and provincial agencies to streamline its approval process and requirements for flood proofing associated with brownfield redevelopment including, sharing historical land use information to refine the vulnerability assessment of a parcel in association with climate change impacts (such as, storm events and/or SLR).

3.3.8 Updating Design Criteria

As noted in Section 3.1.1,

- *TPW Design & Construction staff are actively involved with the Transportation Association of Canada (TAC). The Climate Change Task Force within TAC is currently undertaking various studies to understand the implications of climate change in Canadian Municipalities. The Task Force is due to provide guidelines for municipalities in order to coordinate efforts related to CCA. HRM is seeking to use future guidelines in adjusting current design standards in conjunction with adapting to climate change; and*
- *The recapitalization of the Northwest Arm Seawalls and Cole Harbour Salt Marsh Trail used best available science to inform project specifications. This included engineering studies completed by Coldwater Consulting that accounted for climate change impacts.*

Currently, the lack of comprehensively established CCA national standards and codes as well as the varied infrastructure responsibilities between regional and provincial stakeholders (i.e. HRM, HRWC, and the Province of Nova Scotia) represent barriers to the inclusion of consistent CCA design criteria over the short term planning horizon. For instance, the general responsibilities of HRM Design & Construction Services (DCS) include capital projects associated with road work, retaining walls, and existing bridges. This includes upgrading and repairing existing streets and infrastructure outside the HRWC service boundary, whereas the onus to install new infrastructure is placed on developers, whose permits are issued through the Development Approvals section of C&RS. Furthermore, highways and associated infrastructure generally fall under the responsibility of the Provincial government.

In light of such barriers, as noted in Section 3.1.1, HRM has:

- Released the Climate Change: Developers Risk Management Guide in 2007 as a voluntary resource for climate change and best management practices; and
- Developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By Law (Section 5 of Schedule S-1: Design Manual) to mirror LEED silver certification including, potential CCA responses (such as, installing grey water systems that recover non-sewage waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps etc.).

Furthermore, the PIEVC Engineering protocol, outlined in Section 3.3.3 represents an opportunity for HRM to provide recommendations and highlight the level of action required to address infrastructure issues within the EAM program. HRM's Integration Committee (which includes members of the Provincial Government, HRM, HRWC and Heritage Gas) also presents an opportunity for HRM to coordinate with key infrastructure stakeholders in terms of the implementation of forthcoming CCA design criteria.

3.4 Climate Change Adaptation & the Regional Municipal Planning Strategy

Collectively, the CCA research initiatives HRM has completed to date, in conjunction with the 2013 consultation process, have provided an effective means to inform the municipal decision making



process. This is important as, land use regulation is one of the select areas in which HRM BUs have considerable control over managing climate change risks. However, as implementing such measures (e.g. coastal setbacks) could potentially impart negative effects on associated land values, HRM has invested in scientific research (outlined in Section 3.2) to support the associated planning decisions. The following sections outline how CCA has been captured by current policy related initiatives as well as identifies additional opportunities for future consideration.

3.4.1 Current Initiatives

HRM currently addresses climate change through the RMPS via long term thinking and planning based on a holistic view of HRM. This is further substantiated by the fact that Draft 2 of the HRM RMPS includes the following Chapter and policy statements dedicated climate change:

- Chapter 2.5: Energy and Climate Change
 - Chapter 2.5.1: Climate Change
 - *As a permanent feature of Gas Tax Funding, all municipalities in Nova Scotia are required to complete a Municipal Climate Change Action Plan prior to December 2013. The Regional Planning Strategy complies with this requirement*
 - *E-26 The recommendations of the Climate Risk Management Strategy for Halifax Regional Municipality, approved by principle by Council in 2008, shall provide guidance for corporate priority actions to manage the risks associated with climate change.*

As a result, HRM has worked diligently to incorporate CCA policies into the RMPS and associated Land use By-laws, including:

- Development of voluntary Sustainability Guidelines in the Downtown Halifax Land Use By Law (Section 5 of Schedule S-1: Design Manual) to mirror LEED silver certification and include potential CCA responses (such as, installing grey water systems that recover non-sewage waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps etc.);
- Development of policies related to climate change based on floodplain mapping (which related most directly to inland areas), riparian buffers (which relate to both inland and coastal areas) and SLR (which currently primarily relates to Halifax Harbour). Such polices can be referenced in the Community Plans that have been developed for Bedford and Sackville, Schedule W of the Downtown Halifax Land Use By Law, and Policy E-16 of Draft 2 of the RMPS.
- Incorporation of a hydrogeological assessment requirement within the Chapter 3: Settlement and Housing section of Draft 2 of the RMPS, including policy statement S-20.
- Completion of the Point Pleasant Park Master Plan which considered a mix of plant cover considering species selection based on potential climate change impacts;
- Inclusion of policy recommendations within the UMPF that relate to tree species selection under a changing climate;
- Inclusion of a Community Energy Plan (CEP) and associated policy statements provided in Chapter 2 of Draft 2 of the RMPS;
- Consideration of climate change within watershed studies conducted in association with the Chapter 2.4: Watershed Planning section of Draft 2 of the RMPS.
- Chapter 8.7.1 (Electrical and Telecommunications Lines) of Draft 2 of the HRM RMPS notes that : *HRM has commissioned various studies to examine the benefits of underground utilities in terms of cost, reliability, and aesthetics*, as well as requisite policy statements regarding commercial areas, heritage districts, incentives and new subdivision applications (policy statements SU-23, SU-24, and SU-25, respectively).

Copies of the above noted references are provided in Appendix B.

3.4.2 Future Opportunities

Based on the findings outlined in this report, the following policy related opportunities were also identified for future consideration:

- The following recommendations associated with the research outlined in Sections 3.2.1 and 3.2.2 should be assessed for associated planning and service delivery implications:
 - Incorporating land use planning to limit ongoing WUI development, identify WUI and manage WUI areas for fire risk;
 - The priority for management should shift from increasing urban forests within the core, to the management of WUI areas to reduce wildfire risk at the fringe;
 - Short-term management priorities should focus on the reduction of wildfire risk through fuel treatments;

- Recommendations of both *FireSMART* and the UFMP can be incorporated, such that low-wildfire risk tree species (adaptable to expected future climate condition) are planted to mitigate the removal of trees via fuel treatment initiatives; and
- Long-term management priorities should shift towards the promotion of urban forest to coincide with the anticipated decreases in wildfire hazards and associated changes to forest composition over time.
- As noted in Section 3.3.5, it is expected that, HRM in conjunction with HRWC, will jointly create an Integrated Stormwater Policy with sustainable funding over the next two (2) years.
- Future opportunities exist for developing SLR setbacks from associated CCA tools for additional coastal areas of HRM (other than the Halifax Harbourfront) including Downtown Dartmouth, the Bedford Basin, Eastern Passage and Chebucto.
- An opportunity also exists to HRM to further examine the compatibility of permitted uses under the various zones in and around industrial operations. Measures can be introduced under the land use by-laws to minimize the flood/sea level rise impacts for industrial operations and residential development as well as enable the coexistence of a mix of land use activities at the waterfront.
- HRM can examine opportunities for minimizing the impacts of shoreline infilling that could potentially increase flood events. Depending on the severity of the impact, HRM can examine options for minimum ground floor elevations, appropriate land use and location restriction and use development agreements or site plan control by-laws to control the location of the development on the property in relation to the harbour and the parcels vulnerability to sea level rise and flood impact. It can also negotiate with the property owner to protect the matter of interest to the public safety or to acquire water lot(s) outright.

3.5 Findings: Climate Change Adaptation

Upon completion of this report it was determined that HRM has been working to include a number of operational as well as policy related initiatives associated with CCA. This section provides a summary of recent CCA related measures employed by HRM, to date. Ultimately, the findings of this *Climate Risk Management Strategy* update review will act to provide both the ESC and ESSC with guidance regarding the corporate priority actions required to manage climate change risks.

Recent/Current Operational CCA Initiatives
<i>Innovative and Responsive Funding</i>
HRM has capitalized on a number of Provincial and Federal funding opportunities including the <i>Atlantic Climate Adaptation Solutions (ACAS)</i> funding as well as the Province of Nova Scotia's <i>Climate Change Adaptation Fund</i> .
<i>Enhance Community Outreach</i>
HRM has employed the use of various public art initiatives to increase public awareness regarding the local implications of climate change.
HRM staff have collaborated to present content and complete pilot project associated with the <i>Climate SMART Community Action Guide to Climate Change and Emergency Preparedness</i> in rural areas of HRM (including Eastern Passage). ♦
HRFE's " <i>Fire SMART</i> " presentations provide fire prevention and preparedness information through public education.
HRM is currently acting as a program sponsor for Clean Nova Scotia's RainYards initiative, which is working to improve residential stormwater management in the Oakhill Lake Community.
HRM staff are developing a two (2) year project to revise the CEP. ♦
In 2007, HRM released the <i>Climate Change: Developers Risk Management Guide</i> as a voluntary climate change and best management practices guide.

Recent/Current Operational CCA Initiatives
HRM websites have historically been used to communicate information regarding climate change to the public (including, the E&E homepage, select Naturally Green Newsletters, and the HRFE website dedicated to wildfire safety awareness).
HRM EMO's relationship with the Amateur Radio Community represents a potential expanded emergency communication ability during periods in which public safety communication systems have been overloaded or have failed (i.e. via providing a means for point-to-point/ non-internet based e-mail services etc.).
Improve HRM Inreach
The HRM EMO led BCP initiative includes a framework for the coordination and collaboration between HRM BUS related to emergency responses associated with CCA.
HRFE currently collaborates with the Community Planning department of HRM regarding discretionary approval development agreements as well as large scale by-right subdivision developments.
Hazard and Risk Mapping
HRM EMO's planned updated to the Master Emergency plan will include revisions to the: Sector Profile Mapping, Critical Infrastructure as well as Hazard Risk and Vulnerability Assessment (HRVA) components.
The 2007 acquisition of LiDAR (Light Detection and Ranging data) for 1400 square kilometres of HRM, including Halifax Harbour and the East Petpeswick Peninsula (located within Musquodoboit Harbour) has been used to conduct a vulnerability matrix analyses and associated map for harbourfront properties.
Floodplain delineations (such as those completed for Bedford and Sackville) are reviewed by HRM staff, as directed by the Halifax Charter and the 5 (five) Statements of Provincial Interest Regarding Flood Risk Areas.
Consideration of Climate Change in Business Planning
CCA content was reflected in the 2013/2014 business plans reviewed in this report (including: TPW; P&I; C&RS; HRFE; Finance and Information, Communication and Technology; Halifax Regional Police; Legal, Insurance and Risk Management Services; and Metro Transit etc.).
CCA business planning content was also highlighted by the 25 capital projects outlined in Section 3.3.5.
Life Cycle Assessment
HRM's commitment to including life cycle costing is currently reflected in the business plans developed for the following capital projects that relate to both CCA and CCM: ♦
<ul style="list-style-type: none"> • Consulting Buildings (Project # CBX01268) • Mechanical – Category 6 (Project # CBX01269)
Intergovernmental Collaboration
HRM has worked with the Provincial government through a variety of funding programs and through the submission of comments/involvement with the development of new policies and strategies, including:
<ul style="list-style-type: none"> • The Union of Nova Scotia Municipalities and Province of Nova Scotia's Memorandum of Understanding on Climate Change; • The Environmental Goals and Sustainable Prosperity Act (EGSPA) and the Provincial Climate Change Action Plan; • The Regional Adaptation Collaborative – Atlantic Canada Adaptation Solutions (RAC-ACAS); • The Emergency Response Intergovernmental Collaboration; and • The Canadian Institute of Planners.
To date, municipal, provincial and federal government agencies have collaborated and agreed to the proposed HRM EMO Incident Command System (ICS) which will ensure a consistent, united approach to climate change related emergency response between all levels of government.
HRFE's "Fire SMART" presentations represent a collaborative partnership between HRM and the Provincial government.
Updating Design Criteria
TPW Design & Construction staff are actively involved with the Transportation Association of Canada (TAC).
The recapitalization of the Northwest Arm Seawalls and Cole Harbour Salt Marsh Trail used best available science to inform project specifications, including climate change considerations.
HRM has developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification including potential CCA responses (such as, installing grey water systems that recover non-sewage

Recent/Current Operational CCA Initiatives
waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps.).
<i>Other</i>
TPW incorporates the use of a Surface Distress Index (SDI) to rate the condition of road surfaces. Cold and hot asphalt patching methods allow for HRM to respond to impacted road conditions all year round.
HRM applies liquid brine (a mixture of salt and water) to roads up to 48 hours before an expected snowfall or freezing rain event.
HRM fleets are serviced prior to the onset of each season and HRM is investing in more multipurpose fleets which are operational all year round (as opposed to vehicles which are confined to only winter or summer use).

◆ Denotes correlation with CCM operational initiative.

Recent/Current Policy Related CCA Initiatives
Draft 2 of the HRM Regional Municipal Planning Strategy (RMPS) includes a chapter (2.5.1 Climate Change) and associated policy statements (Policy E-26) dedicated to climate change.
HRM has developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification including potential CCA responses (such as, installing grey water systems that recover non-sewage waste water or uses roof or ground storm water collection systems, or recover ground water from sump pumps.).
HRM has created policies related to climate change based on floodplain mapping, riparian buffers and sea level rise (i.e. such as, the Community Plans for Bedford and Sackville, Schedule W of the Downtown Halifax Land Use By Law, and Policy E-16 of Draft 2 of the RMPS).
A hydrogeological assessment requirement has been added to Chapter 3 (the Settlement and Housing Section) of Draft 2 of the RMPS.
The Point Pleasant Park Master Plan considers a mix of plant cover considering species selection based on potential climate change impacts.
HRM is currently conducting a planned five-year review of the Active Transportation (AT) Priority Plan. ≈
Policy recommendations are provided by the Urban Forest Master plan (UFMP) related to tree species selection under a changing climate.
Chapter 2 of Draft 2 of the RMPS includes the CEP and associated policy statements related to climate change. ≈
Watershed studies conducted in association with the Watershed Planning section (Chapter 2.4) of Draft 2 of the RMPS include climate change considerations.
Chapter 8.7.1 (Electrical and Telecommunications Lines) of Draft 2 of the RMPS notes that <i>HRM has commissioned various studies to examine the benefits of underground utilities in terms of cost, reliability, and aesthetics</i> , as well as the requisite policy statements.

≈ Denotes correlation with CCM policy related initiative.

Based on the information collected and reviewed during this study, it has been determined that HRM has met the MCCAP Guidebook requirements for CCA. A summary checklist outlining this compliance is provided in Appendix E.

4 Historical Review of HRM's Climate Change Mitigation Planning

Initiated in 1997, HRM's commitment of reducing greenhouse gases (GHGs) is best reflected through the Municipality's participation with the Partners for Climate Protection (PCP) network of Canadian municipal governments. Financially supported by the Federation of Canadian Municipalities (FCM) *Green Municipal Fund*, PCP represents a partnership between FCM and ICLEI – Local Governments for Sustainability. The following five (5) milestones of the PCP program collectively provide a guidance framework for municipalities to reduce greenhouse gas emissions (FCM, 2013):

- **Milestone 1:** Creating a GHG emissions inventory and forecast;
- **Milestone 2:** Setting an emissions reductions target;
- **Milestone 3:** Developing a local action plan;
- **Milestone 4:** Implementing the local action plan or a set of activities; and
- **Milestone 5:** Monitoring progress and reporting results.

In 2011, HRM achieved Milestone 5 recognition for monitoring, verifying and reporting corporate GHG emission reductions. HRM's *Corporate Plan to Reduce Greenhouse Gas Emissions* represents one (1) of the most recent CCM planning efforts the Municipality has completed in association with this recognition. A brief summary of this plan is provided below.

Halifax Regional Municipality Corporate Plan to Reduce Greenhouse Gas Emissions 2012-2020

This plan was engaged following the PCP Milestone 5 recognition, to meet the following objectives:

- Establish a realistic but ambitious corporate GHG reduction target; and
- Provide guidance on achieving the target.

As a result, HRM staff conducted consultations with both internal and external stakeholders (such as Clean Nova Scotia etc.) to develop priorities for GHG reductions. In addition, the following three (3) key components were also used in the development of the plan:

- The HRM Corporate GHG Emissions Inventory 2008;
- Progress Report on Greenhouse Gas Emission Reductions 2005-2011; and
- The HRM Corporate Local Action Plan to Reduce GHG Emissions (2005)

HRM's corporate emissions have been identified to primarily relate to the use of fossil fuels to power the three (3) corporate sectors:

- Buildings (electricity and temperature control);
- Vehicle Fleets; and
- Outdoor Lighting.

Recent emission reduction activities associated with these corporate sectors were documented to include:

- Buildings:
 - Large scale energy efficiency projects and retrofits including, the Dartmouth Sportsplex, Energy Performance Contract for the Burnside Transit Facility; Alderney 5, Sackville Sports Stadium, and Cole Harbour Place;
 - Minor retrofits including lighting replacements;
 - Oil to natural gas conversions; and
 - Energy efficient new building design.
- Vehicle Fleets:
 - Replacement of gas with efficient diesel units;
 - Investigation of alternative fuels;
 - Smart Cars for employee use;
 - Initiation of a fleet driver training program; and
 - Utilization of *Vehicle Right Sizing Filter* and life cycle analysis for new vehicle purchases.
- Outdoor Lighting:
 - Traffic signal conversions to LED lamps; and
 - Street light conversions to LED lamps.

Analysis of related information indicated that HRM should aim for a 30% reduction in equivalent carbon dioxide (eCO₂) below 2008 levels by 2020. Meeting this goal was generally correlated with the following three (3) GHG reduction approaches:

- Energy conservation;
- Improved energy efficiency; and
- Cleaner sources of energy.

More specifically, the key actions identified for each corporate sector to achieve this goal were highlighted to include:

- Buildings:
 - New energy efficient building design (including building to LEED Silver and LEED Gold standards);
 - Continued oil to natural gas conversions;
 - Upgrade old oil boilers to new high efficiency units;
 - Energy conservation and energy efficient projects;
 - Shift from the status quo (i.e. district heating, geothermal heating, solar heating for domestic hot water, and solar photovoltaics); and
 - Provincial shift to renewable electricity (i.e. the Province of Nova Scotia is aiming to increase the share of renewable electricity sources to 40% by 2020).
- Vehicle Fleet:
 - Vehicle operation: 3-year driver education program (including *Drivewise 101* training, idle reduction, and speed reduction);
 - Preventative vehicle maintenance; and
 - Procurement planning (including purchasing and piloting new technology).

- Outdoor Lighting:
 - Converting remaining street light to LED and ensure that all new installation are LED;
 - Replace sport field lighting fixtures with energy efficient units as needed; and
 - Provincial shift to renewable electricity.

The GHG Reduction Plan is scheduled to be reviewed and updated in 2016. A copy of this plan is provided in Appendix D.

4.1 Climate Change Mitigation Research and Operational Initiatives

In addition to the projects highlighted in the *Halifax Regional Municipality Corporate Plan to Reduce Greenhouse Gas Emissions 2012-2020* study (summarized above) the following include CCM research and operational initiatives engaged, completed, or contributed to by HRM, to date:

- Halifax Regional Municipality Corporate Local Action Plan to Reduce GHG Emissions (Dillon, 2005);
- Halifax Regional Municipality Community Local Action Plan to Reduce Greenhouse Gas Emissions (Dillon, 2006);
- Community Energy Plan – Task 1 Final Report (CBCL, 2007);
- Community Energy Plan – Task 2 Stakeholder and Public Consultation (CBCL, 2007);
- Community Energy Plan – Task 3 Future Demand and Supply Assessments (CBCL, 2007);
- Community Energy Plan – Task 4 Implementation Plan (CBCL, 2007);
- Community Energy Plan – Task 5 Education and Awareness Programs (CBCL, 2007);
- Community Energy Plan – Task 6 Monitoring Plan (CBCL, 2007);
- Community Energy Plan – Task 7 Community Energy Plan (CBCL, 2007);
- Climate SMART - Community Action Guide to Climate Change and Emergency Preparedness (HRM, rev 2010);
- HRM Corporate Greenhouse Gas Emissions Inventory 2008 (HRM, 2010);
- Progress Report: Greenhouse Gas Emission Reductions 2005-2011 (HRM, 2011);
- Installing vending misers to power down vending machines if movement is not detected within a specified timeframe (e.g. 15 minutes) and repowering the machine only when needed to keep products chilled (HRM, 2012);
- Incorporating Energy Performance Contracts whereby energy services companies provide the upfront capital and are paid back through guaranteed energy savings (HRM, 2012); and
- Initiating a Print SMART program in partnership with Xerox to consolidate printing and fax devices into robust centralized, multi-purpose machines (HRM, 2013).

Copies of the research documents and/or more detailed descriptions of the above noted operational initiatives are provided in Appendix D.

4.1.1 Consideration of Climate Change Mitigation in Business Planning

Similar to the assessment completed in Section 3.3.5 for CCA, the Proposed HRM Operating Budget for 2013/2014 was also reviewed to identify how CCM has been accounted for by HRM over the short term planning horizon. Brief summaries outlining the CCM deliverables identified are provided below:

- TPW 5.3: Achieve operational efficiencies by reducing composting facility waste water transport and treatment costs;
- TPW 6.1: Support business case and implementation plan for the deployment of LED lighting;
- P&I 1.5: Expand and enhance Transportation Demand Management
 - Smart Trip Implementation: increase number of participating employers.
 - Active Transportation: identify strategic investment initiatives (Peninsula Halifax Corridor Bikeway).
 - Implement North-South Peninsula Cycling Corridor.
 - Construct additional 3 km of bike lane on Hammonds Plains Road and Kearny Lake Road.
- P&I 5.1: Manage Solar City residential domestic hot water project (1000 installations); and
- P&I 5.2: LED Streetlight Conversion with the purchase of street lights and poles from Nova Scotia Power (NSPI) and the development of a Request for Proposal (RFP) for the conversion project.

The HRM Proposed Project Budget for 2013/2014 also highlighted CCM business planning considerations related to the Finance and Information, Communication and Technology (FICT) BU, including:

Finance and Information, Communication and Technology

- FICT 1.4: Determine HRM’s role in the East Port District Energy Project.

In addition, the following proposed 2013/2014 capital projects were also identified to be correlated with CCM:

Capital Project:	Description/Correlation with CCM:
Bedford Community Centre* (Project # CBX01334)	The Province of Nova Scotia is constructing a new school in Bedford West to serve the growing population of the area. HRM is partnering with the Province to expand the school programming to include community facilities. The building is targeting LEED Gold status.
Consulting Buildings* (Project # CBX01268)	<p>This project was created to fund: energy performance, life cycle costing, LEED, needs assessment, operational planning, communications, graphic materials, presentations, condition analysis and recommendation, design, contract documents, and tendering.</p> <p>The associated 2013/2014 priority projects include:</p> <ul style="list-style-type: none"> • Functional analysis of core fire stations; • Program of requirements for the Fire Services Training Facility; • Functional/structural analysis of the St. Mary’s Boat Club; • Preliminary design work for St. Andrews Centre recapitalization; and • Condition assessment of the Citadel High community space.

Capital Project:	Description/Correlation with CCM:
<p>Electrical – Category 7 (Project # CBX01275)</p>	<p>This project was created to fund: energy performance, life cycle costing, LEED, condition analysis and recommendation, contract documents, tendering, power distribution, electrical service entry, exterior and interior lighting, heating, and cabling (data).</p> <p>The associated 2013/2014 priority projects include:</p> <ul style="list-style-type: none"> • Sackville Landing distribution panel on lighting standards; • Grand Parade lighting upgrades and electrical panel; and • Electrical work in support of mechanical upgrades at various locations.
<p>Energy Efficiency Projects (Project # CBX01161)</p>	<p>Funds related to this project will be used to leverage cost shared funding for building focused energy efficiency projects from funding partners such as Ecotrust, FCM, NRCAN, and NSPI Demand Side Management. Project selection will be based upon suitability of the project and the success of funding applications. Some examples of energy efficiency projects would include the installation of solar panels or conversion of a heating system to natural gas. Such projects typically save on heating costs and reduce greenhouse gas emissions.</p>
<p>Mechanical – Category 6* (Project # CBX01269)</p>	<p>This project was created to fund: energy performance, life cycle costing, LEED, condition analysis and recommendation, contract documents, tendering, HVAC, plumbing, sprinklers, boilers, controls dehumidifiers, and refrigeration.</p> <p>The associated 2013/2014 priority project includes:</p> <ul style="list-style-type: none"> • Replacement of the Eric Spicer boiler.
<p>Conventional Bus Expansion* (Project # CVD00434)</p>	<p>This project relates to the purchase of new buses for the expansion and improvement of conventional transit service within the HRM urban transit boundary. New buses will allow an increase in frequency of service and/or service to new areas and help develop a more extensive and environmentally friendly public transportation system. With increased utilization of public transportation by HRM residents, greenhouse gas emissions can be reduced.</p> <p>In 2013/2014, nine (9) 40-foot conventional buses would be purchased for expansion purposes. Plans also include improvements to schedule adherence on key route and implementation of new feeder services for the expanded Woodside Ferry service.</p>

Capital Project:	Description/Correlation with CCM:
Conventional Bus Replacement* (Project # CVD00435)	Recapitalization of the Metro Fleet includes the acquisition of Transit buses to replace an aging fleet. Buses are identified for replacement to best meet the ongoing demands of providing safe, reliable transit service that is responsive to the ever changing demographics of HRM. Newer buses are more environmentally friendly, more reliable, provide accessible low-floor service and are less costly to maintain than older buses. Ten (10) buses are scheduled to be replaced in 2013/2014.
Emission Reduction – Public Transit Buses (Project # CTI00695)	This project relates to an engine fan retrofitting system that reduces the draw on the engine, reduces fuel consumption as well as vehicle noise. This system requires fewer repairs and translates to approximate fuel consumption savings of 10%.
Street Trees* (Project # CP990001)	This project provides for a tree planting program as identified by the UFMP. The trees provide aesthetic value, sequester carbon, and play a role in the storm water management system as well as provide shade.
New Sidewalks* (Project # CR000003)	This project deals with the installation of new sidewalks. New sidewalks provide pedestrian safety and support the Active Transportation Plan, described below.
Active Transportation Plan (Project # CTU00420)	<p>This plan, approved by Regional Council in 2006, describes the development of a regional active transportation network (AT) over a 25 year period. The aim of this plan is to help residents bike, walk, roll, blade and use other “human powered” ways to move around the Municipality. Therefore, promoting personal health and recreation, assisting with managing congestion, reducing emissions and supporting municipal objectives for efficient land use.</p> <p>The associated 2013/2014 priority projects include (but are not limited to):</p> <ul style="list-style-type: none"> • Next phase of the Burnside Drive Trail (Commodore to Wright Avenue); • Implement recommendation from the Peninsula North-South AT corridor; • Construction of an AT connection from Mumford Road to Olivet Street across the CN rail line; • At connections at the Porter’s Lake Metro X Terminal; • Design of overpass structure that make use of salvaged bikeway panels from the MacDonald Bridge; • Additional on-street bike parking in commercial areas.

Capital Project:	Description/Correlation with CCM:
Regional Trails Active Transportation (Project # CPX01196)	Halifax Regional Trails Active Transportation (AT) includes 19 Community Trail Projects as well as partnership proposals between HRM corporate agencies in the urban core. Priorities pertain to the Regional Trails Plan and HRM's Active Transportation Plan. This AT infrastructure delivers off road, multiuse trail connection between communities and neighborhoods throughout HRM. The primary corridors are aimed at a large percent of HRM residents and provide healthy, green AT mobility for the evolving sustainable transportation network across HRM.
Biolac System Hwy 101 Landfill (Project # CWU01064)	This project includes a provision of a leachate holding tank and unloading system to potentially receive leachate from outside sources treated at the Highway 101 facility. This will allow for more moisture to be added to the final engineered cell to produce and capture more landfill gas and subsequently more energy for the grid.
Burner Installation Hwy 101 Landfill (Project # CWU01065)	This project includes the replacement of an oil fired burner mounted on a 300,000 BTU heating boiler in a Leachate Control building to provide more efficient and reliable heating.
LED Conversion of HRM Streetlights (Project # CT000005)	This project involves purchasing approximately 28,500 NSPI streetlight fixtures presently in operation (including roadway lights and other applications such as parking lots and pathways). The roadway fixtures are required by law to be replaced by more efficient LED fixtures. It is anticipated that by the beginning of July 2013, NSPI will have converted approximately 4,000 fixtures to LED, and HRM an additional 500. The project includes removal and recycle/scrap of existing fixtures, upgrades to brackets and wiring, as required, and installation of new fixtures. The operational savings from reduced energy costs will be captured in a reserve and offset the purchase cost of new lights.
Street Lighting (Project # CRU00792)	This project relates to HRM's active development of a street light guideline that reflects: consistent application of recommended lighting design standards; recognition of impacts resulting from obtrusive lighting; improvement of urban design through uniform lighting installations; and reduction of energy consumption through utilization of energy efficient technologies. More specifically, this project relates to the replacement and maintenance of street light infrastructure including pole and power enclosures.
Traffic Signal Relamping Program (Project # CT000002)	This project relates to the replacement of incandescent traffic signals with LED technology and the industry standard suggestion to replace such lamps every eight (8) years to maintain appropriate light levels. One main benefit of the LED conversion was a reported reduction in electricity costs of approximately 85%.

Capital Project:	Description/Correlation with CCM:
Transportation Demand Management Program (Project # CTR00908)	This initiative includes programs and projects whose objective is to reduce single occupant vehicle trips, particularly during commuting peaks.

*Denotes this capital project also correlates with CCA.

Furthermore, GHG *reductions from developed projects* is considered a key service area metric for E&E. As a result, this department has subsequently projected annual GHG reductions of approximately 7,500 and 4,000 tonnes for the periods of 2012/2013 and 2013/2014, respectively.

Capital Projects Supplementary Reports

As noted in Section 3.3.5, when the Capital Steering Committee reviews a capital project they complete *Capital Project Supplementary Reports*. Similar to the case noted for CCA, the above noted CCM correlated initiatives demonstrate that this reporting process is moving away from examining projects from a strictly economic standpoint. As a result, this process also represents an opportunity for the consideration of CCM related impacts from a business planning perspective.

HRM Reserves

The following reserves have been identified as funding sources for previously noted CCM Capital Projects, including:

Capital Reserves

- Q103 Capital Surplus Reserve (Emission Reduction – Public Transit Buses, Project # CTI00695; Street Lighting, Project # CRU00792);
- Q119 Sackville Landfill Closure Reserve (Biolac System Hwy 101 Landfill, Project # CWU01064); and
- Q131 Energy and Underground Services Reserve (Energy Efficiency Projects, Project # CBX01161).

Operating Reserves

- Q327 LED Street Lighting Reserve (LED Conversion of HRM Streetlights, Project # CT000005).

2010-2014 Gas Tax

HRM is currently planning to incorporate funds collected in association with the 2010-2014 Gas Tax Agreement to finance the following aforementioned CCM correlated projects:

- Conventional Bus Expansion (Project # CVD00434); and
- Conventional Bus Replacement (Project # CVD00435).

Community Feed-in Tariff

The Community Feed-in Tariff (COMFIT) is a component of the Province of Nova Scotia's *Renewable Electricity Plan*, which promotes local economic development, energy security and diversity as well as cleaner energy production (Nova Scotia Department of Energy, nd). Essentially, this program provides an opportunity for small-scale power producers to receive an established price per kilowatt hour (KWh) for projects producing electricity from eligible renewable resources.

In June 2013, HRM's ESSC recommended that Regional Council should direct staff to prepare a report for a small wind turbine project in conjunction with the COMFIT program (including discussions of the process, financial implications, revenue expectations and possible options for development and construction). It is currently intended that the findings of this report will be used by Regional Council for further consideration and potential inclusion in the 2014 budget.

4.2 Climate Change Mitigation & the Regional Municipal Planning Strategy

As noted in Section 3.4.1, HRM currently addresses climate change through the RMPS. To date, the majority of CCM related policy is included in the Chapter 2.5: Energy and Climate Change section of Draft 2 of the RMPS. Examples of CCM policy related content includes:

- Chapter 2.5.2: The Community Energy Plan
 - *In partnership with other agencies, HRM intends to achieve the most significant improvement to energy sustainability, security, renewable technology, and environmental emissions among similar sized cities in Canada over the next 10 years.*
 - The following eight (8) main goals established by the Plan:
 - *Improve the energy efficiency of buildings;*
 - *Increase transportation choice and efficiency;*
 - *Increase industrial energy efficiency;*
 - *Encourage energy efficient land use planning and neighborhood site planning;*
 - *Increase efficiency of infrastructure;*
 - *Increase energy security and diversify energy supply;*
 - *Educate and engage residents and businesses; and*
 - *Demonstrate local government leadership.*
 - *E-27 The Community Energy Plan (CEP), approved by Council in 2007 and as updated, shall continue to provide guidance to HRM actions and programs with the goal of embedding considerations of energy security, energy conservation, energy distribution and energy consumption into all aspects of HRM activities. Updates to the CEP will seek proven, integrated and systematic approaches to energy planning in collaboration with community stakeholders with the goal of reducing corporate and community energy consumption with particular emphasis on using renewable energy (geothermal, solar, wind) and district energy.*
 - *E-28 Where deemed advisable to implement or further an action or program of the Community Energy Plan, HRM may consider amendments to Secondary (Community) Planning Strategies and Land Use By-laws or any other by-laws of the Municipality.*
 - *E-29 The Halifax Regional Municipality Corporate Plan to Reduce Greenhouse Emissions: 2012 – 2020, as approved in principle by Regional Council in 2012, shall provide guidance on what actions should be taken to achieve municipal targets for reducing corporate greenhouse gas emissions. Progress reports shall be prepared to measure the progress made in achieving this target.*
- Chapter 2.5.3: Wind Energy

- *With the passage of The Electricity Act (May 2010), Nova Scotia has adopted aggressive renewable energy targets which are likely to be achieved in large part through the use of wind energy. HRM intends to implement measures to help achieve these targets.*
- *E-30 Within all Regional Plan Designations, HRM shall establish three overlay zones including an Urban Wind (UW-1) Zone, a Rural Wind (RW-2) Zone and a Restricted (R) Zone within the Land Use By-law to regulate wind energy facilities. These regulations will be implemented through the community land use by-laws. The Urban Wind (UW-1) Zone and the Rural Wind (RW-2) Zone shall be applied to those areas where various categories of wind energy facilities shall be permitted in urban and rural areas. The Restricted (R) Wind Zone shall be applied to the those areas where wind energy faculties shall be prohibited including Regional Parks, Conservation Areas, Protected Areas and the Western Commons and areas within Urban HRM not suitable for wind energy facilities.*
- *E-31 HRM shall establish requirements within the applicable Land Use By-laws that include wind energy performance standards and regulations to control height, scale, access, setback and separation distances of such facilities in order to adequately address operational needs, safety concerns and the mitigation of impacts to adjacent properties.*
- *E-32 HRM seeks to encourage the development of large scale wind energy facilities in rural areas by permitting the expansion of wind farms in suitable locations. Accordingly, where a large scale wind turbine is proposed to connect to a wind energy facility on an adjacent lot, the setback requirement from the property boundary may be waived where the adjoining property forms part of the same wind farm.*
- *E-33 HRM shall seek to ensure that Federal and Provincial processes comply with municipal requirements for large scale wind energy facility development. Where Federal and Provincial regulations have been amended, HRM may also amend municipal land use by-law regulations to remain consistent with these changes.*
- *E-34 HRM shall seek to recognize advances in wind energy technology and wind energy standards and may amend wind turbine municipal land use by-law regulations to reflect these changes.*

Chapter 4.2.2 (Active Transportation) of Draft 2 of the RMPS also includes the following CCM content:

- *T-2 The Active Transportation Plan, approved by Council in November 2006, shall provide guidance for the objectives, policies, plans and standards for an active transportation network. Consideration shall be given to revisions to this Plan to further advance the goals of, supporting healthy lifestyles, enhancing public safety improving environmental quality and reducing auto dependency.*

As previously noted, HRM has also developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification. More specifically, these guidelines include CCM considerations within the transportation, water conservation, construction waste management, atmosphere, materials, indoor air quality, building materials, and energy conservation sections etc.

In addition, HRMbyDesign’s Centre Plan is anticipated to reinvent development and community design within the Regional Centre and act as a model for future planning efforts across the entire municipality. One of the main objectives of this Plan is to reduce HRM’s environmental footprint through the reduction in energy and resource consumption associated with dense and walkable communities.

4.3 Findings: Climate Change Mitigation

This section provides a summary of recent CCM measures employed by HRM, to date.

Recent/Current Operational CCM Initiatives
Halifax Regional Municipality Corporate Plan to Reduce Greenhouse Gas Emissions 2012-2020.
HRM staff have collaborate to present content and complete pilot project associated with the <i>Climate SMART Community Action Guide to Climate Change and Emergency Preparedness</i> in rural areas of HRM (including Eastern Passage). ♦
CCM was reflected in the 2013/2014 HRM business plans reviewed in this report (including: TPW; P&I; and Finance and Information, Communication and Technology).
HRM staff are developing a two (2) year project to revise the CEP. ♦
CCM business planning content was also highlighted by the 18 capital projects outlined in Section 4.1.

♦ Denotes correlation with CCA operational initiative.

Recent/Current Policy Related CCM Initiatives
HRM is currently conducting a planned five-year review of the Active Transportation (AT) Priority Plan. ≈
HRM has developed voluntary Sustainability Guidelines in the Downtown Halifax Land Use By-Law to mirror LEED silver certification including CCM content (including: transportation, water conservation, construction waste management, atmosphere, materials, indoor air quality, building materials, and energy conservation considerations etc.) ≈
Chapter 2 of Draft 2 of the RMPS includes the CEP and associated policy statements related to climate change.≈
Chapter 2 of Draft 2 of the RMPS includes policy statements associated with Wind Energy.

≈ Denotes correlation with CCA policy related initiative.

Based on the information collected and reviewed during this study, it has been determined that HRM has met the MCCAP Guidebook requirements for CCM. A summary checklist outlining this compliance is provided in Appendix E.

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 2. HRM MCCAP Approach Letter
 3. ESC Terms of Reference
 4. By-Law Number E-100
 5. HRM Emergency Management Organization
 6. ESSC Terms of Reference
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Appendix B: Applicable Climate Change Adaptation References

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10. Sea Level Rise Adaptation Planning for Halifax
11. Cole Harbour/Salt Marsh Trail Hydrodynamic Modelling and Coastal Engineering
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14. Development of a Urban Forest Canopy Model for Input into a LiDAR based Storm Runoff Model for Halifax Harbour Watersheds
15. Municipal Climate Adaptation Case Study Report
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18. Birch Cove Lakes Watershed Study (climate change content only)
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 - b. Chapter 2.3: Water Resources
 - c. Chapter 2.4: Watershed Planning
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- d. Chapter 2.5: Energy and Climate Change
 - e. Chapter 2.5.1: Climate Change
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Appendix C: 2013 Corporate Consultation Summaries

Appendix D: Applicable Climate Change Mitigation References

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Appendix E: MCCAP Overall Compliance Summary

