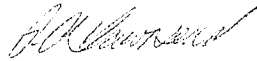


Environment and Sustainability Committee
March 3, 2011

TO: Chair and Members of Environment and Sustainability Committee

SUBMITTED BY:



Phillip Townsend, Director, Infrastructure and Asset Management

DATE: February 14, 2011

SUBJECT: Climate SMART Risk Management Strategy Update

INFORMATION REPORT

ORIGIN

This report originates from:

- The *Climate SMART Risk Management Strategy for Halifax Regional Municipality (HRM)*, developed in 2007 as part of Climate SMART (Sustainable Mitigation and Adaptation Risk Toolkit).

BACKGROUND

In 2003, the Climate SMART (Sustainable Mitigation and Adaptation Risk Toolkit) program was initiated in response to community concerns regarding global climate change and the impacts being felt in the region. The goal of Climate SMART was to develop management and planning tools to prepare for climate change impacts, and to develop strategies to reduce practices that contribute to climate change in the first place. The *Climate SMART Risk Management Strategy for Halifax Regional Municipality (HRM)* (the Risk Management Strategy) was one such tool. In 2007, the Risk Management Strategy was completed and published on the www.halifax.ca/climate website. The 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.

The strategy was intended to help HRM achieve its goal of being a leader in the mitigation of pollutants to the environment and adaptation to climate change by providing direction on the incorporation of climate change risk management and adaptation in future corporate business unit plans.

DISCUSSION

This update on the 2007 *Climate SMART Risk Management Strategy for HRM* has been prepared in order to provide a discussion regarding HRM's progress on the implementation of the climate change adaptation responses and requirements outlined in the strategy. It also suggests actions for continuing to move forward with climate change adaptation planning.

This update discusses the steps HRM has taken to prepare for and adapt to climate change as outlined in the strategy. It discusses what is required on a go forward basis to ensure that climate change is better incorporated into our everyday decision making processes.

The update considers what has been done by municipal staff and their partners to address the following priorities:

- Innovative and Responsive Funding
- Improving Community Outreach
- Improving HRM Inreach
- Hazard and Risk Mapping
- Integration of Climate Change into Business Plans
- Life Cycle Assessment Approach
- Improved intergovernmental Collaboration and Coordination
- Update Design Criteria for Infrastructure

The review showed that HRM has a number of actions underway at this time in terms of preparing for and adapting to climate change, however, there is still much work to be done. Adaptation is a constant challenge that requires consideration in everything HRM will do for years to come. The recommendations made in the update are meant to be discussion points for the Climate SMART Committee (made up of various HRM employees) and Council.

BUDGET IMPLICATIONS

Not applicable.

FINANCIAL MANAGEMENT POLICIES / BUSINESS PLAN

This report complies with the Municipality's Multi-Year Financial Strategy, the approved Operating, Project and Reserve budgets, policies and procedures regarding withdrawals from the utilization of Project and Operating reserves, as well as any relevant legislation.

COMMUNITY ENGAGEMENT

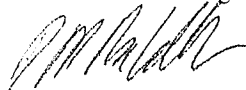
This initiative requires much community engagement, and this is discussed as part of how we have moved forward in terms of adapting to climate change. Community Outreach is very important to the success of how HRM adapts to our changing climate. Presentations have been given in a number of communities in HRM on Climate Change mitigation and adaptation. Community Engagement Sessions are currently being organized to help communities better adapt to climate change impacts.

ATTACHMENTS

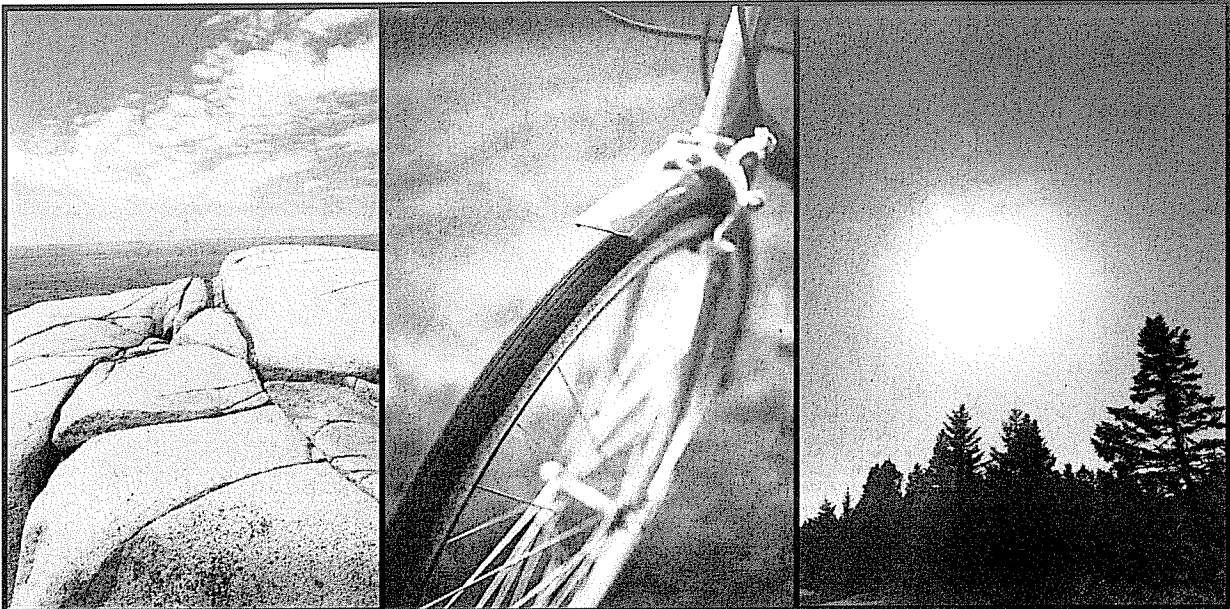
1. Climate SMART Risk Management Strategy Update
2. Appendix A Interview Results
3. Appendix B Business Plan Summary Review

A copy of this report can be obtained online at <http://www.halifax.ca/commcoun/cc.html> then choose the appropriate Community Council and meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

Report Prepared by: Kathryn Cooper-MacDonald, Environmental Performance Officer,
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Report Approved by: Richard MacLellan, Manager, Sustainable Environment Management Office, 490-6056



Climate SMART Risk Management Strategy for HRM: February 2011 Status Update

Sustainable Environment Management Office, HRM



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Appendix A: Table 6-1 Interview Results

Appendix B: Business Plan Summary Review

Executive Summary

There is no doubt that we will have no choice but to address the climate change challenges we face in the very near future. The Halifax Regional Municipality (HRM) is already feeling the pressures of sea level rise, intense storms, and aging infrastructure and therefore we have been and need to continue taking action. This document, the *Climate SMART Risk Management Strategy for HRM: February 2011 Status Update* is a compilation of the steps HRM has taken at the corporate level to ensure that we are adapting to the changes we are facing. It is required that adaptation becomes a basic consideration in infrastructure and corporate decision making. It is a public trust responsibility to do so.

The *Climate SMART Risk Management Strategy for Halifax Regional Municipality (HRM)* (the Risk Management Strategy, for which this update has been completed, was finalized by Dillon Consulting in 2007. The 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. This Risk Management Strategy provides HRM with the information necessary and the proper protocols to assess risks from climate change by adapting risk management guidance from other jurisdictions such as Australia and the Caribbean to HRM.

This status update reviews the adaptation actions and requirements and the priority and performance indicators outlined in the 2007 Risk Management Strategy in order to determine where the municipality is at in terms of risk management and suggest actions for moving forward. The status update clearly shows that HRM has been working diligently in terms of climate change adaptation work. HRM needs to continue working to get our house in order and to continue working with our partners to collect the proper baseline information and enabling materials required for adaptation.

In the area of **innovative and responsive funding**, HRM has dedicated funding and sought out funding opportunities to move forward in adapting to climate change. The Sustainable Environment Management Office (SEMO) hired permanent staff dedicated to this work. HRM has capitalized on a number of Provincial and Federal funding opportunities including the *Atlantic Climate Adaptation Solutions (ACAS)* funding and the Province of Nova Scotia's *Climate Change Adaptation Fund*. Our budgeting process and recent investments in new and recapitalized infrastructure has also included climate change considerations including completion of engineering studies for coastal infrastructure deemed highly sensitive to sea level rise and storm surge (i.e. the Northwest Arm Seawall). Moving forward more work is required to ensure this becomes standard practice.

In the area of **community outreach** HRM staff have been working hard to involve and educate our residents on the impacts of climate change and how we must work together to mitigate and adapt. Initiatives relating to this have included a 2010 update to *The Community Action Guide to Climate Change and Emergency Preparedness* (the Community Action Guide), one of the tools

created as part of the Climate SMART initiative. Partnerships have been created across business units to look at creative ways of engaging the community through tools such as public art. SEMO has partnered with our Emergency Measures Organization (EMO) in an initiative to present the Community Action Guide to Joint Emergency Management teams in rural HRM and to engage residents in creating risk maps for their areas. While most of this work is early in the process it has been a success thus far and will continue to be built upon into the future.

In the area of **corporate inreach** HRM staff has been working to bring more and more information on climate change in HRM to Council's attention; however the 2007 Risk Management strategy itself was never brought to Council. HRM is in the process of adopting a new risk management tool for the organization, and Legal Services has advised that Climate Change has been identified as one of the biggest risks to the organization. This will ensure that climate change considerations are in the forefront. Also, information that comes out of this, and other related initiatives now has a committee to work within, the *Environment and Sustainability Committee*, which will provide a new platform to communicate climate change risks, priorities and associated costs across the organization.

In the area of **hazards and risk mapping** the municipality a lot of work has been undertaken since the development of the Risk Management Strategy. With the acquisition of LIDAR (Light Detection and Ranging) data for 1400 square kilometres of HRM, a number of projects to better map our risks and vulnerability have been undertaken. One such project identified future sea level rise and flooding risk around Halifax Harbour over the next 100 years, and mapping future flood hazard zones. This project has been beneficial in providing HRM with the background science needed to consider new investments and expenditures, as well as policy changes relating to adaption to climate change. The information gained from this project is being utilized to move forward with a vulnerability assessment for Halifax Harbour.

In the area of **consideration of climate change in business planning** as part of its annual business plan cycle, HRM's business units evaluate the potential risks to their operations from a variety of threats. In terms of HRMs 2009/2010 business plans, the only business plan that specially mentioned climate change was the Infrastructure and Asset Management business plan. Many other business units including Fire and Emergency Services, Community Development, Police Services and Transportation and Public Works, have priorities that relate to adapting to climate change, but offer no discussion on the risks or links. Climate Change is considered one of HRMs top risks and therefore, will be a top consideration with the new risk management tool to be adopted by HRM in 2011.

In the area of **Life Cycle Assessment**, HRM does not have a formalized Life Cycle Assessment approach at this time. However, cost/benefit assessments for HRM Capability Projects (a project that increases or expands a level of service, new development) have been moving from examining strictly economic costs and benefits, to more of a holistic view, looking at economic, social and environmental benefits.

In the area of **Intergovernmental Collaboration** it is recognized that adaptation measures cannot be undertaken by HRM alone due to jurisdictional issues and financial considerations. HRM has been working with the Province under funding programs, and through submission of comments and involvement in the development of new policies and strategies developed and currently

under development. A Memorandum of Understanding on Climate Change, signed in November 2009, exists between the Union of Nova Scotia Municipalities and the Province of Nova Scotia. This 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 states that: *Municipalities will continue to take action on climate change impacts through direct actions including policy development, land-use planning initiatives, emission reductions, the development and implementation of Integrated Community Sustainability Plans and through the initiatives of the UNSM Municipal Sustainability Office.*

In the area of **updating our design criteria** to include climate change considerations no changes have been made to HRM's Redbook at this time as a result of climate change considerations. A report undertaken in 2008 by Environment Canada, the Canadian Council of Professional Engineers, through the Public Infrastructure Engineering Vulnerability Committee, assessed the vulnerability of Canada's infrastructure to climate change. The report provides a protocol for incorporating climate change in engineering design for the following infrastructure:

- water resources infrastructure
- stormwater and wastewater infrastructure
- roads and associated structures
- buildings

HRM participated briefly in this working group, however not actively. As of yet, HRM has not been using this new information in engineering design, or the assessment of the vulnerability of our own infrastructure. It should be noted that building to LEED (Leadership in Energy and Environmental Design) Silver standards (at a minimum) is now standard practice for all new municipal buildings. One of the most progressive aspects of the LEED system is that it encourages an integrated approach to the design and construction of buildings. That is, it considers matters such as energy conservation and air quality right from the design stages, which has not been part of traditional practice. As a result of this self-imposed standard, HRM has seen the construction of better, more efficient and more user-friendly buildings that in most cases take into consideration climate change adaptation measures (i.e. storm water retention considerations through use of green roofs, rainwater collection and recycling).

HRMs ability to adapt to our changing climate is a shared responsibility with our residents, other levels of government and industry. It is not something that can be done alone. We need to continue to work with Climate SMART project partners to get the additional data and support required to improve our risk management capacities. Below are a summary of the recommendations for moving forward that were identified as part of the process of collecting information for this update:

- To continue to identify and attract innovative and responsive funding. This is a constant priority that involves staff time and dedication.
- To review the purpose and use of the *EMO Cost Recovery Reserve Account* and the amount of money contributed each year, with consideration for climate change in mind. To explore additional uses for this funding, including use for preparation activities, not just recovery. As per the Risk Management Strategy a fund such as this should be used not necessarily solely for hard

assets such as generators or snow removal equipment but could also be used for additional community outreach as well as co-funding for mapping and on-going climate modeling specific to HRM. Alternatively, HRM will explore other opportunities to create a reserve fund that would meet this requirement. The *Sustainable Communities Reserve* will be considered as an option for projects that help us prepare for climate change in our region.

- Scientific studies predict increasingly frequent and intense storm events in our region due to climate change. HRM should develop a formal tracking system for HRM to better track and allocate costs related to extreme events to support requests for post event relief funding from the provincial and federal government. A current process is in place for this but needs enhancement.
- To continue to search for climate change adaptation funding opportunities and maximize ACAS funding available to HRM until March 31, 2012.
- To advance the *Community Action Guide for Climate Change and Emergency Preparedness* project which received Provincial Funding, in order to create capacity within HRM communities. Through this project HRM, SEMO and EMO, will develop a specific methodology that can be applied to other communities throughout the municipality who are interested in undertaking a similar exercise after the project has completed.
- To continue leveraging partnerships between SEMO and EMO in implementing the Community Action Guide to Climate change and Emergency Preparedness to educate communities, and to empower residents to work together to adapt. A communications plan for proactively presenting this guide to community groups across HRM will be developed.
- To continue to create cross-departmental partnerships to engage the public on Climate Change. (e.g. SEMO and Cultural Affairs continuing to work together to use creative methods to educate our public about climate change issues in HRM through Public Art and to work to build a partnership with fire prevention to educate on this topic and its relationship with climate change).
- To better utilize the website and Naturally Green to get the message out on climate change adaptation. Therefore, starting in the spring of 2011, Naturally Green should contain a section titled *Climate Change in HRM*. This section will contain information on climate change, climate change mitigation and climate change adaptation in HRM.
- To review and update the content of the Climate SMART webpage to reflect the current situation. The entire content of the website should be reviewed and updated on a yearly basis, with information being added as it presents itself.
- To action Council's directions relating to the Sea Level Rise Study; particularly the community consultations.

- To continue to build emergency preparedness capacity through EMOs creation of more JEM Teams, and the training of existing JEM teams on climate change and its relationship with extreme events.
- To proceed with the ACAS project to have Dal Planning students review the relevance of tools, such as Climate Change: The Developers Risk Management Guide. If required to update the guide and from this, create a communications plan to ensure it is disseminated to and utilized by the development community.
- To continue working with development agreement applicants to design new buildings and sites more sustainably, with considerations for climate change adaptation and mitigation in mind (i.e. using the Sea Level Rise Study to inform development around Halifax Harbour, HRMbyDesign bonus zoning and sustainable building).
- To present the Risk Management Strategy and this update to Council with recommendations to be adopted in order to move forward in with adaptation planning. Council should be presented with the recommendation that climate change be reflected in all business plans and be an overarching priority of the Regional Plan Review.
- To create a Climate SMART Team championed and endorsed by Senior Management in Infrastructure and Asset Management. The Climate SMART Team should:
 - Actively participate in internal planning processes (Outcome Area Plans, Corporate Plan, Business Plans, Business Continuity Process, Regional Plan Review, Functional Plan Development and Corporate Risk Management Process) to ensure that Climate Change considerations are prioritized, appropriate targets are developed, and budgets are set aside.
 - Work with boards and committees of Council
 - Pursue the actions outlined in the Risk Management Strategy and assign responsibilities, work with consultant teams when required.
 - Provide yearly updates to Council on the status of the Risk Management Strategy.
- To develop a Training Program on Climate Change Risk Management to be provided to each business unit, in particular those involved in the preparation of the business planning process.
- To bring information regarding climate change and adaptation to Council for discussion, working through the Environment and Sustainability Committee.
- To determine, define and implement the roles and responsibilities for LiDAR management internally. This initiative should be led by Data and Business Information Management in consultation with Community Development and Infrastructure and Asset Management as the two primary data users. A working group on LiDAR data should be formalized. With the Council motion for further study such as the SLR Study for Halifax Harbour in other areas of HRM, this data is required to improve topographic mapping in vulnerable areas of HRM; particularly those areas located along the coast. Acquiring more of this data with no process to properly manage,

store and maintain the information is not beneficial. Once roles and responsibilities for LiDAR Data Management are decided internally, discussions should be held with external partners (i.e. the Province) on potential cost-sharing agreements for acquiring data for the rest of HRM.

- To complete Halifax Harbour (ACAS Project) wave runup and seiche modelling (ACAS Project); finalize Vulnerability and Risk mapping for Halifax Harbour to the extent possible; present the information to all staff and Council as a policy tool for use in infrastructure planning, development approvals and EMO planning.
- To provide web-based climate change adaptation mapping to HRM citizens.
- HRM should continue to assess watershed subject to new development and enact policies for development approvals based on potable water availability.
- To complete the Storm water Management Functional Plan.
- To adopt policies to require hydrogeological assessments for development applications.
- To conduct forest fire risk mapping and require forest fire risk assessments to address forest fire and urban/wildland interface issues in HRM. Opportunities exist to undertake a Forest Fire Risk Assessment project with ACAS funding.
- To complete Business Continuity Planning Process. EMO should lead business units through the business continuity planning process to consider a number of the adaptation responses and requirements outlined in the Risk Management Strategy (i.e. loss of transportation routes, loss of communications).
- To ensure that SEMO staff or Climate SMART Committee should participate in the HRM new risk management process to be implemented, to ensure that the appropriate climate change risks are considered.
- To work with the Regional Plan Review considering an overarching goal to improve air quality through the reduction of greenhouse gas emissions, and to adapt to the climate changes that are upon us. Climate change mitigation and adaptation should be engrained as a common theme. The Regional Plan is actually a risk management document, and should be used across the organization by all business units in considering their actions. In order for the municipality to receive Gas Tax Funding, a Climate Change Action Plan must be added to a municipality's *Integrated Community Sustainability Plan (ICSP)*, which in HRM's case is the Regional Plan.
- To finalize functional plans relating to climate change, including the Water Quality Monitoring Functional Plan, Waste Water Management Functional Plan, Storm Water Functional Plan and the Hazards to Development Functional Plan.

- To Finalize and implement the Urban Forest Master plan recommendations and requirements relating to climate change.
- To move forward with Council's recommendations on the Sea Level Rise Study; in particular, to incorporate study findings into the Halifax Harbour Plan, and also consider similar examinations of other coastal areas within the municipality.
- To implement the Risk Assessment Strategy at the Business Unit level. Appendix D shows the effective use of this Strategy's tool with Community Development. HRM should adopt this strategy and conduct training exercises with each business unit to undertake this process. Appropriate funding levels should be allocated to start this process. It is recommended that implementation start with those business units most affected by climate change including: Community Development, Infrastructure and Asset Management and Fire and Emergency Services.
- To evaluate ways to better incorporate risk management related to climate change into our budgeting process to allocate more funds for adaptation options relating to our infrastructure, and the recapitalization of our infrastructure.
- To develop a Life Cycle Assessment approach for Infrastructure and Asset Management that considers Climate Change Adaptation for all recapitalization projects, and is incorporated into the planning process for Capability Projects. The approach should introduce a formalized process to take climate change adaptation into account in decision making relating to asset management.
- IAM and TPW should conduct a case study based review of the PIEVC Protocol in order to incorporate climate change and infrastructure vulnerability considerations into development and management decision making.
- To continue to collaborate with other levels of government on climate change adaptation related initiatives in keeping with the UNSM MOU on Climate Change.
- To actively participate in committees such as PIEVC. Active participation with other levels of government in updates for design criteria – PIEVC, Engineers Canada/NS, CSA Standards.
- To adopt a climate change mitigation and adaptation lens in ongoing review of the HRM Redbook.

The Climate SMART Risk Management Strategy

In 2003, the Climate SMART (Sustainable Mitigation and Adaptation Risk Toolkit) program was initiated in response to community concerns regarding global climate change and the impacts being felt in the region. The goal of Climate SMART was to develop management and planning tools to prepare for climate change impacts, and to develop strategies to reduce practices that contribute to climate change in the first place. The *Climate SMART Risk Management Strategy for Halifax Regional Municipality (HRM)* (the Risk Management Strategy) was one such tool. In 2007 the Risk Management Strategy was completed and published on the www.halifax.ca/climate website. The 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.

The strategy was intended to help HRM achieve its goal of being a leader in the mitigation of pollutants to the environment and adaptation to climate change by providing direction on the incorporation of climate change risk management and adaptation in future corporate business unit plans.

In addition to the Risk Management Strategy, the Climate SMART project enabled the *Community Action Guide to Climate Change and Emergency Preparedness*, and the *Climate Change: Developer's Risk Management Guide*. Related to climate change mitigation, in particular greenhouse gas (GHG) emission reduction planning has come from is the *Greenhouse Gas Emissions Local Action Plan*, the *Community Local Action plan* and the *Community Energy Plan*. The Halifax Regional Municipality (HRM) has identified these as key strategies to benefit the environment and reduce energy costs. ***This update mainly deals with adaptation actions taken at this time. For more information on actions relating to mitigation and GHG emission reduction please see the website, <http://www.halifax.ca/environment/semo.html>.***

Introduction

This update on the 2007 *Climate SMART Risk Management Strategy for HRM* has been prepared in order to provide a discussion regarding HRM's progress on the implementation of the climate change adaptation responses and requirements outlined in the strategy. The following tables from the Risk Management Strategy were used as guidance for this process:

- **Table 6-1: Adaptation Responses and Requirements**
- **Table 8-1: Priorities and Performance Indicators**

This update discusses the steps HRM has taken to prepare for and adapt to climate change as outlined in the strategy and discusses what is required on a go forward basis to ensure that climate change is better incorporated into our everyday decision making processes.

HRM is committed to studying, mitigating and adapting to the climate change impacts in our region. The municipality sees this as an ongoing process that must be done in collaboration with other levels of government.

Methodology

Interviews were conducted with staff from business units most likely to be impacted by climate change risks as identified in the *Climate SMART Risk Management Strategy for HRM*. The purpose of each interview was to discuss the adaptation responses and requirements identified in Table 6-1 (p. 79-90) and the priorities and performance indicators identified in Table 8-1 (p.99) of the Risk Management Strategy.

The discussions included the following topics:

- The status of responses and actions identified in this table (i.e. initiated, ongoing, completed);
- the relevance of the responses and actions outlined;
- resources required for responses and actions;
- responsibility for particular responses and actions;
- requirements for additional actions related to climate change adaptation; and
- the status of performance indicators.

Appendix A, includes a modified version of Table 6-1 including observations on points taken in the interview process and identifies the names of each individual interviewed from a particular business unit.

- A desktop review of municipal policy, legislation and studies related to climate change in HRM was completed.
- A desktop review of municipal business plans for the business units implicated in the strategy was completed (see Appendix B).
- A desktop review of *Naturally Green* articles since 2005 was conducted.
- A desktop review of provincial strategies and documents was completed, including a review of the *Provincial Climate Change Strategy* (2009). A follow-up to determine the status of strategies in development was also completed. Note: a number of these strategies have not been finalized at this time (i.e. The Provincial Coastal Strategy, DRAFT Wetland Policy).
- A desktop review was completed of the report *Adapting to Climate Change: Canada's First National Engineering Vulnerability Assessment of Public Infrastructure* (April 2008) released by Environment Canada, the Canadian Council of Professional Engineers, through the Public Infrastructure Engineering Vulnerability Committee. This report assesses the vulnerability of Canada's infrastructure to climate change and the incorporation of climate change in engineering design for the following types of infrastructure:

- water resources infrastructure
- stormwater and wastewater
- roads and associated structures
- buildings

The information gathered through interviews has been used to discuss the status of the priorities and performance indicators listed in Table 8-1 of the Risk Management Strategy. The document has been organized in sections that reflect the priorities identified in this table. The sections include discussions on the work that has been undertaken in relation to these priorities.

At the end of this document, a series of recommendations have been suggested in order to move forward in the implementation of the Risk Management Strategy. The recommendations have also been broken up based on the priorities listed in Table 8-1.

Attached is Appendix A which includes a modified version of Table 6-1 that includes information gathered through the research process, the table includes the following new columns:

Are the Responses and Requirements included in Legislation, Policy or Documentation?	What actions have been taken by the BU to achieve the Adaptation Responses and Requirements?
--------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------

It should also be noted that adaptation responses and requirements were grouped into one column and requirements were added and removed if discussion indicated that this made sense.

Appendix B includes notes from the review of Business Plans that were reviewed as part of this process.

Assumptions

It should be noted that since the development of the Risk Management Strategy, the responsibility for stormwater and wastewater infrastructure no longer lies with Halifax Regional Municipality but with the Halifax Regional Water Commission (HRWC). Therefore, some of the actions outlined in the Risk Management Strategy are no longer within HRM's control and have therefore not been addressed in this update.

A number of adaption responses and requirements outlined in the Risk Management Strategy (**Table 6-1: Adaptation Responses and Requirements**) are not immediate requirements, but are requirements that will be phased in as the climate here in HRM continues to change and the appropriate studies are undertaken to provide the municipality with the information it needs to justify certain expenditures. Therefore, it was not expected that all of these actions would be completed at this time.

Priorities and Performance Indicators

Discussion: Where Are We Now?

How to Fund the Variety of Actions Needed in HRM

How to fund the variety of actions needed in HRM to adapt to climate change was a key concern to all who participated in the development of the Climate SMART (Sustainable Mitigation and Adaptation Risk Toolkit) *Climate Change Risk Management Strategy for Halifax Regional Municipality*, as adaptation measures are expected to increase costs to all HRM stakeholders over the business-as-usual case. In the three years since the development of the Risk Management Strategy, HRM has identified and attracted funding to study the effects of climate change in the region and fund responses. Funding has also been utilized to educate our residents and our employees on climate change related topics. At this time HRM will continue to seek funding which will allow the municipality to conduct studies, develop policy and support legislative changes to address and respond to climate change impacts in HRM.

HRM Budgeting Process

In terms of HRM's budget for climate change adaptation, the budgeting process for business units addresses requirements for operations and service delivery, including those operations and services being affected by our changing climate. HRM spends the following:

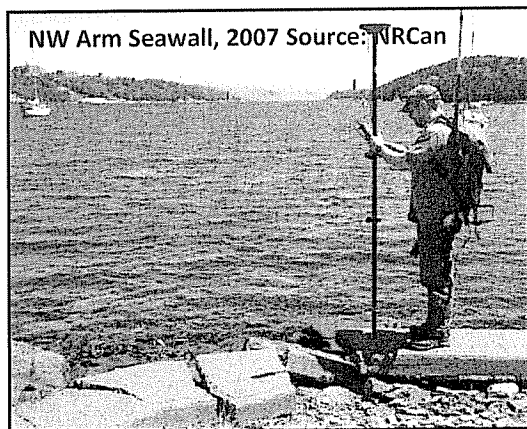
- **Operational Money (to complete service delivery - planning, snow operations, waste collection, etc.), and**
- **Project Money**

For operational money, climate change impacts have and will continue to put pressure on the budget. At this time, pressures are being met with existing budget envelopes. At some point, these pressures will need to be met with an increase to operational envelopes. HRM staff is confident that the budgeting process will allow for this. However, that does not mean that a more formal process for considering anticipated climate change impacts is not required. The budgeting process looks at what is needed right now, but not necessarily how we should be preparing for climate change in the future through budgeting decisions today.



For project money, HRM projects are vetted through a capital planning process that has been increasingly looking at adaptation. The budgets for new (capability) projects would likely include

the costs of necessary adaptation measures if they were accounted for. The process for capability projects (a project that increases or expands a level of service, new development) involves review by the Capital Steering Committee. In this review a Capital Supplementary Sheet is filled out. This sheet has recently been expanded to look at economic, social and environmental benefits, which would in turn consider some climate change related implications; however, this is still in development and is not yet a formalized process.



In a number of cases the budgets for recapitalization (base) projects have also been specified with adaptation measures in mind. For example, the recapitalization of the Northwest Arm Seawalls or Cole Harbour Salt Marsh Trail is using best science to inform the project specification with engineering studies completed by Coldwater Consulting that take into account climate change impacts in HRM. However, there is no formal process to consider adaptation in all projects.

Emergency Management Organization Cost Recovery Reserve

At this time HRM's Emergency Management Organization (EMO) is not responsible for budgeting for operational responses to an extreme event, but, as discussed, municipal departments do have operational budgets (i.e. Transportation and Public Works, Infrastructure and Asset Management). Since EMO is a coordinating agency and it does not have much in the line of assets, they do not have a large budget.

One of the responses mentioned in the Risk Management Strategy was the need to establish a reserve fund that will allow HRM to prepare for and respond to extreme events. The *EMO Cost Recovery Reserve Account* has existed since 2001. This reserve is used for the following purposes:

- Internal:** To provide a source for certain internal HRM departments to charge unbudgeted expenses arising out of a response to an emergency event.
- External:** To provide a means for payment to external agencies that have provided services to the HRM at a large scale or EMO activated event.

Emergency events are more than events related to climate change. Currently considerations for potentially more extreme events are not included in the considerations of annual contributions, withdrawals and balances of this reserve. Instead, the balance and reserve activity is reviewed on an annual basis to determine if changes to the amount contributed are necessary. At this time

it is not clear whether this process considers climate change. This fund currently totals \$272,751, and no funds have been added for the 2010-2011 budget.

HRM Dedicated Staff Persons

The Risk Management Strategy stated that addressing funding requirements should be an on-going activity carried out by key HRM staff and that at least one full-time equivalent (FTE) in staffing was required. The Sustainable Environment Management Office (SEMO) of HRM's Infrastructure and Asset Management (IAM) created permanent positions in 2009 for Environmental Performance Officers responsible for both greenhouse gas emission (GHG) reduction/climate change mitigation and climate change adaptation policy and strategy. Since this time, more resources, time and energy have been placed on educating staff and the community on climate change impacts, mitigation and adaptation in HRM. These permanent positions will be vital to ensuring that the required adaptation responses and requirements outlined in Table 6-1 and any additional measures identified will be carried out.

Atlantic Climate Adaptation Solutions Project Funding

As stated in the Risk Management Strategy, other levels of government are very important sources of funding for climate change adaptation. The latest source of funding is through the *Regional Adaptation Collaborative (RAC)*. The Government of Canada has partnered with Provinces across the Country to deliver the RAC program. The Atlantic RAC, the *Atlantic Climate Adaptation Solutions (ACAS)* Project, an 8.2 million dollar collaborative, builds on the *Atlantic Climate Change Adaptation Strategy* signed by the Atlantic Environment Ministers in 2008. The project involves extensive collaboration and \$3.5 million over three years from Natural Resources Canada (NRCan), as well as matching or in-kind funding from sixty-four (64) regional partners including the Nova Scotia Department of Environment; Nova Scotia Community College; Dalhousie University; HRM and several other provincial departments, municipalities, and organizations.

The purpose 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. More specifically, the provinces are partnering with communities, organizations, and universities in delivering projects in three thematic areas: integrating adaptation into coastal erosion and inland flooding planning, protecting groundwater resources, and building capacity of adaptation practitioners.

HRM, a partner in this initiative, has a number of climate change adaptation projects underway which contribute to HRM's goal of developing a systems-based approach to climate change adaptation. The projects will serve to fulfil a number of the requirements outlined in Table 6-1 of the Risk Management Strategy including modelling of wave run-up and seiche for Halifax Harbour, watershed studies, and, as outlined later in this section, the Halifax Harbour Sea Level Rise (SLR) Study completed in 2009. Below is a list of HRM's projects under this initiative:

- Digital Elevation Model in 1m, 2m, and 5m grids. Join and clean approximately 1400 LiDAR data tiles;
- Wave runup and seiche modelling for extent of wave runup and seiche in Halifax Harbour (underway);
- Watershed, sub-watershed, wetland, ephemeral stream, vernal pond GIS modeling. Correction of Halifax Harbour Watersheds and GPS culverts for flow correction;
- Sackville Floodplain Modeling;
- Tree Canopy, 3D building model GIS (underway);
- Impervious surface, stormwater, sediment modelling;
- Develop local meteorological projections for stormwater model inputs;
- Halifax Harbour land use vulnerability assessment (underway);
- Develop climate change adaptation strategy for HRM Northwest Arm seawalls and coastal structures (completed);
- Land use vulnerability assessment for Eastern Shore;
- Develop climate change adaptation strategy for the Salt Marsh Trail in Cole Harbour (completed).



Image: New watershed created from one meter LiDAR data overlaid on original watershed created from Nova Scotia elevation data (Andrew Vogels, 2008).

LiDAR Project Funding

In 2007, *PHB Technologies / LaserMap Image Plus* was contracted by HRM to survey the following areas using LIDAR (Light Detection and Ranging):

- Halifax;
- Musquodoboit;

The project covered a total of approximately 1400 square kilometres of HRM. The survey work took place in May, 2007. The project was cost-shared, receiving funding from NRCan (approximately \$20,000), the Halifax Port Authority (approximately \$10,000), HRM (approximately \$100,000 -120,000) and the Province (approximately \$50,000) (monetary values were taken from interview with Roger Wells, 2010).

The acquisition of this data is vital to helping in HRM's preparation and adaptation for climate change. It was included in Table 6-1 of the Risk Management Strategy as an adaptation requirement (see Community Development Section – Improved topographic mapping e.g. LiDAR to delineate zones of vulnerability and prioritize protection/relocation). This data is now being utilized for a number of projects around Halifax Harbour, including projects that will help HRM better adapt and prepare for climate change impacts in our region. The Sea Level Rise Project (SLR) discussed in the following section is one such project.

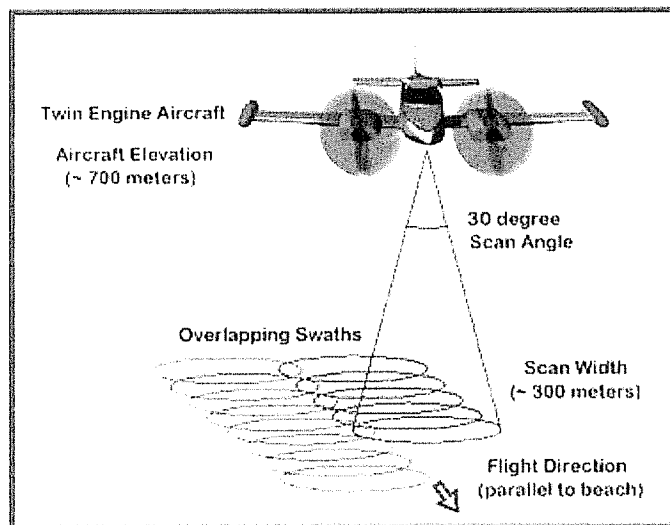


Image: Collecting LiDAR data *property of National Oceanic and Atmospheric Administration (NOAA)*

Sea Level Rise Project Funding

The LiDAR Data discussed in the previous section was utilized for a recent project titled *Halifax Harbour Extreme Water Levels in the Context of Climate Change: Scenarios for a 100-Year Planning Horizon* (D.L. Forbes, G.K. Manson, J. Charles, K.R. Thompson, R.B. Taylor, 2009). This study was completed in 2009 and presented to council in 2010. This project was funded by the following partners, HRM, NRCan, Nova Scotia Department of Energy (DOE) and the Halifax Port Authority, with in-kind expertise provided by NRCan, Applied Geomatics Research Group (Nova Scotia Community College), Dalhousie University and Nova Scotia Department of Natural Resources (NSDNR). The rationale and objectives for this project revolve around the premise that information is the foundation for adaptation, that science is required to inform the planning process, and that some conventional planning practices used in HRM are not appropriate or sustainable.

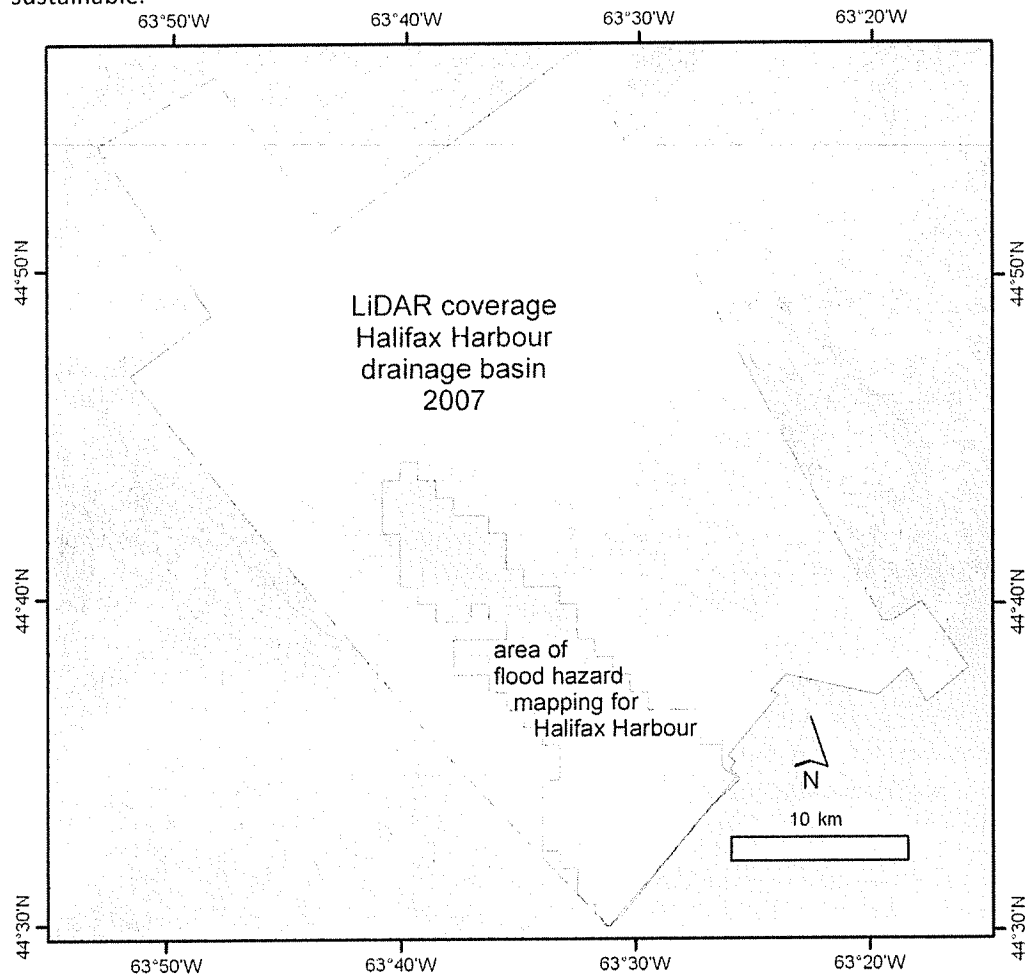


Image: Halifax Harbour, showing extent of 2007 LiDAR coverage for harbour drainage basin and subset used for flood hazard mapping in the harbour (Forbes et al, 2009)

The study involved the following: creating a digital elevation model (DEM) using LiDAR mapping, identifying future sea level rise and flooding risk around Halifax Harbour over the next 100 years, and mapping future flood hazard zones. This project has been beneficial in providing HRM with the background science needed to consider new investments and expenditures, as well as policy changes relating to adaption to climate change. All of this information will be used to assist in defining our adaptation options and applying the results into the Halifax Harbour Plan and in the Regional Plan review.

At this time, additional work is being undertaken to build on the sea level rise study. For example, through ACAS funding, HRM is partnering with Dalhousie University to model wave runup and seiche to further refine the results of the SLR study. They are also conducting vulnerability analyses for the harbourfront properties using this information. Public and stakeholder consultation is planned for the spring/summer 2011 to communicate the results of these studies.

This project and its funding has helped HRM achieve some of the adaptation requirements listed in Table 6-1, including using data from the Climate SMART studies and follow up studies, and improving topographic mapping (e.g. using LiDAR to delineate zones of vulnerability and prioritize protection/relocation, and enforcement of proposed setbacks, using data to update setback requirements as vulnerability data improves). Once additional LiDAR is acquired for HRM, future discussions are required to undertake similar studies outside of Halifax Harbour.

Provincial Climate Change Adaptation Fund

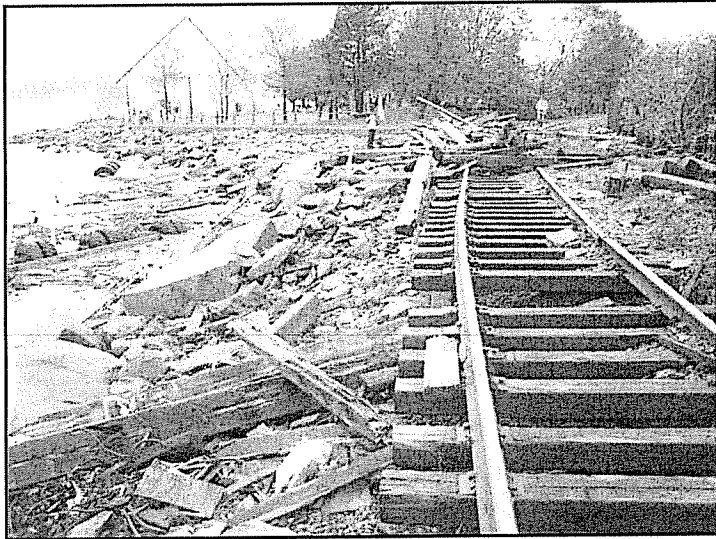
As a deliverable related to the Provincial *Environmental Goals and Sustainable Prosperity Act* (EGSPA), the Province of Nova Scotia released a *Climate Change Action Plan* in January 2009. Under the action plan (<http://climatechange.gov.ns.ca/doc/ccap.pdf>), the Province committed to create an adaptation fund to encourage adaptation research and development. In October 2010 HRM received \$5000 from such a fund, the *Provincial Climate Change Adaptation Fund*, held by the Department of Energy, Climate Change Directorate. The Climate Change Adaptation Fund aims to help Nova Scotia become more resilient to the impacts of climate change. Its objectives are to: identify and assess the threats and opportunities related to climate change in Nova Scotia; and build Nova Scotia's capacity to become better suited to new and different climatic conditions.

The Risk Management Strategy states that some of the financial burden of Climate Change adaptation should also be shared by residents and businesses in HRM through emergency preparedness and risk reduction as preparedness can reduce HRM's response costs. Guidance related to how communities and individuals can adapt to climate change and be prepared for extreme events is available in the *Climate SMART Community Action Guide to Climate Change and Emergency Preparedness* (Community Action Guide) completed in 2007 and updated in 2010. HRM will be using the money from the provincial fund for a partnership between SEMO and our Emergency Measures Organization (EMO) to disseminate the Community Action Guide to vulnerable communities through a community engagement exercise. Disseminating the guide to vulnerable communities was one of the adaptation requirements in Table 6-1 of the Risk

Management Strategy. Additional funds to increase awareness will be provided in kind by EMO, SEMO and Community Development.

Disaster Assistance Funding

On September 28, 2003, Hurricane Juan, a category 2 storm, hit central Nova Scotia passing directly over Halifax Regional Municipality and a state of emergency was declared. In addition to the large clean-up effort and emergency response required, the Municipality suffered significant damage to its critical infrastructure. In fiscal years 2003/04 through 2006/07, a total of \$23.8 million in clean up and recovery costs were incurred. While a portion of these costs have been



recovered through insurance claims, charitable donations and the overall operating budget in each of those years, there is an estimated recovery of \$17 million under the Disaster Financial Assistance Agreement (DFAA). Thus far, \$11.5 million has been received against the estimated total recoverable under the DFAA program. The final amount recoverable under the DFAA program will not be known until all claims have been reviewed and adjudicated and any amount deemed not recoverable at that time will be

a cost to the HRM operating budget. However, staff continues to work with the province to ensure that appropriate, sufficient claim documentation is provided in support of the amounts claimed and considered eligible under the program.

Image: Debris deposited on and beneath undercut CN rail line at Dartmouth Point on the morning after Hurricane Juan, NRCan

Other Opportunities for Funding Climate Change Adaptation

Funding options included in this section have not been widely utilized for adaptation initiatives, however there are opportunities associated with them to do so. The first option is Gas Tax Funding (GTF) – Infrastructure Funding contributing to cleaner air, cleaner water, and reduced GHG emissions. The GTF supports environmentally sustainable municipal infrastructure such as: public transit, drinking water, wastewater infrastructure, green energy, solid waste management, and local roads. HRM should consider all of these projects Climate Change mitigation and adaptation. In order for the municipality to receive GTF, it required that a Climate Change Action Plan be added to a municipality's *Integrated Community Sustainability Plan* (ICSP), which is HRM's Regional Plan.

The Green Municipal Fund provides below market loans and grants as well as educational and training services to support municipal initiatives that improve air, water and soil quality and protect the climate. Our access to this fund has mainly been used for GHG reduction related initiatives. There are opportunities to use this funding for adaptation-related projects. When HRM borrowed \$20 million from the Federation of Canadian Municipalities' Green Investment Fund to help finance the Harbour Solutions Project, the loan was granted at 1.5% less than the Government of Canada bond rate, allowing HRM to save up to \$400 000 per year on loan repayments. The money saved is deposited every year into a *Sustainable Community Reserve*, which is managed by the Sustainable Environment Management Office (SEMO) and intended to fund sustainability projects. Since its initiation, the Reserve has supported initiatives such as the Pollution Prevention Program and the delivery of sustainability training to HRM staff. This fund could also be used toward Climate Change Adaptation Projects if required.

Improve Community Outreach

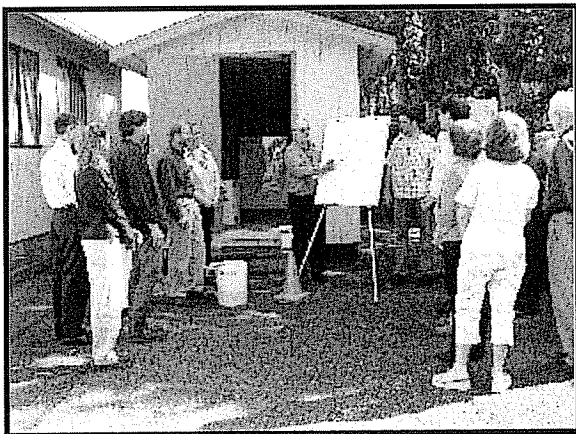
In 2007, impacts from climate change became more prominent in the public with the release of the Intergovernmental Panel on Climate Change's *Climate Change 2007: Impacts, Adaptation and Vulnerability – Summary for Policy Makers*, which highlighted the impacts of climate change that are projected to occur despite measures to reduce GHGs. HRM has begun to focus more on adaptation education and preparedness, which included Climate SMART and its supporting materials and recent studies. It is important that the focus be on both mitigation and adaptation as the two go hand in hand.

The following vehicles have been used since the development of Climate SMART to communicate risks and adaptation measures with the public:

1. The *Community Action Guide to Climate Change and Emergency Preparedness* (2007, 2010)
2. *Climate Change: Developers Risk Management Guide* (2006)
3. Public Art Initiatives
4. *Naturally Green* Newsletters
5. The website: [www. Halifax.ca/climate](http://www.Halifax.ca/climate)
6. Wildfire Program (not specifically with Climate Change in mind, however, still educates on protecting homes and communities from wild land/urban interface fires)

Community Action Guide to Climate Change and Emergency Preparedness

In 2009/2010 the *Community Action Guide to Climate Change and Emergency Preparedness*, which was also developed as one of the tools of the Climate SMART initiative, was presented to community groups upon request. A number of presentations have been given since the spring of



2010 after the Environmental Performance Officer (EPO) for Climate Change Adaptation was hired with the Sustainable Environment Management Office. The presentations have often been requested immediately following extreme weather events; however HRM realizes that it must keep these issues and the urgency of preparedness in the forefront long after events are in the immediate minds of residents. In 2011, efforts will be made to set up these presentations proactively with community groups.

As SEMO has started to get more requests to present the content of this guide to the community, it felt that the guide required updating. Therefore the *Community Action Guide to Climate Change and Emergency Preparedness* (2006)

was reviewed and updated in November 2010. The Community Action Guide was reviewed in consultation with HRM Emergency Management Organization (EMO) staff. The review included:

- updating Climate Change information based on the latest data available;
- updates on relevant studies to help with adaptation and emergency preparedness in HRM (including the Halifax Harbour Sea Level Rise Study, 2009);
- updates on references, tools, and contact information;
- updates on more recent suggestions on how to mitigate and adapt to climate change based on current technologies; and
- the review also involved ensuring that the guide was consistent with EMO's approach to Emergency Planning.

Since September 2010, SEMO has been working with HRM's EMO to present the guide to the Joint Emergency Management (JEM) teams in 4 rural areas of HRM, including Tantallon, Eastern Shore, Sheet Harbour, and Musquodoboit Valley. The mission of the JEM teams is to promote awareness of local community resources, to train local agencies to work together and provide a structure for coordinated local emergency response. SEMO and EMO are utilizing this great resource to get the message of the *Community Action Guide* out and to work with the respective communities within their JEM area to undertake some of the actions outlined in this guide.

Joint Emergency Management (JEM) is a concept developed by the Halifax Regional Municipality's Emergency Management Office (EMO), to allow community organizations to prepare for, and respond quickly to, a wide range of emergencies. In times of crises, EMO will activate JEM Support Centres (JSC) to coordinate humanitarian response to the JEM coverage area. These centres are facilities where trained individuals can meet to provide local input to the Emergency Operations Centre, located in Dartmouth. The first JEM was created in 2000. To increase emergency capability, the Fire and Emergency Services Business Plan mentions the need for more Joint Emergency Management (JEM) teams, and the development of more things like these teams to increase capacity. EMO has been increasing the number of these teams in HRM, recently adding a JEM team in Fall River.

As part of communicating the contents of the updated Community Action Guide and working with the community to prepare them for climate change emergencies, SEMO and EMO staff submitted a joint funding application to the Province of Nova Scotia Climate Change Directorate's, *Climate Change Adaptation Fund*. As previously mentioned, HRM has been awarded \$5000 from the fund to host community engagement sessions within select rural communities in HRM to go through the vulnerability and risk mapping exercise outlined in the Community Action Guide. The project is titled the *Public Participation GIS Vulnerability Mapping Initiative for Rural Areas in HRM*. The project serves to create climate change capacity in rural communities. It will provide assistance to HRM's EMO in gaining valuable information on vulnerabilities and risks that only community knowledge could provide. A series of consultations will be held by SEMO staff, EMO staff, and the local JEM team in the chosen communities, to engage citizens to prepare for a climate change emergency. These sessions will be creative and collaborative, serving to create public "mental maps" that identify community-specific risks and vulnerabilities. This information will later be placed into EMO's GIS Mapping program to help EMO staff and the JEMs team in updating

Emergency Preparedness and Response plans for these particular areas. This project is still under development.

Climate Change: Developers Risk Management Guide

The Climate Change: Developers Risk Management Guide was written in 2006. This guide is slated to be updated in 2011. However, it came up in the interview process that the benefits of such a tool need to be examined.

The Developer's Guide has not been formally adopted or fully utilized by the development community and HRM planning and development staff. Both groups see the publication as a good reference source, however its use is not mandatory, and the guide has no formal requirements for action.

In the field of Climate Change education the government sponsored 'workbook' or 'toolkit' approach appears to have become a popular means of providing greater understanding of the challenges and opportunities presented by our changing climate. Although the popularity of this approach is undeniable its effectiveness is open to question.

HRM has provided a scholarship grant to the Dalhousie School of Planning through the ACAS funding for a research project on this topic. The scope of the proposed research project will involve a literature review of the effectiveness of toolkits and accompanying implementation strategies. Utilizing a case study approach, the researcher will ask:

- How do municipalities put the toolkits they are creating to work?
- How do municipalities give their toolkits "teeth" (i.e. in forms of policy, planning processes and development requirements etc.)?
- How do municipalities measure success?
- Is the HRM Developer's Guide effective? How can it be improved?
- What can other ACAS municipalities learn from this research?

Public Art Initiatives

HRM has identified public art as an excellent tool for getting the word out and educating our community on issues relating to sustainability. Therefore, in 2010 a partnership was created between SEMO and Community Relations and Cultural Affairs to work on such initiatives.

In the spring/summer of 2010, SEMO teamed up with Community Relations and Cultural Affairs to educate the public through a public art initiative aimed at highlighting the impacts of climate change specific to HRM. A competition was launched titled the *Climate Change Impacts in HRM: Temporary Public Art Opportunity*. By articulating the projected impacts of climate change on Halifax Harbour with public art, HRM's goal was to impress upon casual viewers the effects of climate change and its real impact. By extension, HRM hoped to generate interest in the root causes of climate change, to present effective ways of adapting and mitigating our impact and to attract people to view information relating to climate change on HRM's website.



The chosen project "The Observatory" by artist Jose Luis Torres was installed from September – November 2010 and included signage discussing the issue of climate change in HRM and where to obtain more information. Great feedback was received relating to the project and it was successful in creating interest on the topic.

Nocturne Art at Night is an annual festival bringing art and energy to the streets of Halifax. HRM's Public Art Coordinator sits on the Nocturne Committee, and HRM is a proud sponsor of this event. This year, a number of projects in the program related to environmental issues in HRM. SEMO provided additional funding to support one project in particular that highlighted the urgency of mitigating and adapting to climate change. The project was titled "The Same Boat Horn" by artist Kyle Jackson. This was a large, interactive sculpture which enabled the public to call out a warning/rescue message over the sea and connect to other coastal dwellers around the world.

Naturally Green

A review was conducted of *Naturally Green* articles since Climate SMART's initiation in 2005. The review showed that few articles on climate change adaptation have been published since 2006. In 2005, the summer, winter/spring and fall issues all included information on the Climate SMART initiative, mitigation and adaptation. In 2006, the winter issue included information on HRM's response to climate change and extreme weather and included tips for preparing an emergency preparedness kit. In 2006, the fall issue included an article titled: *Climate Change Impacts and HRM*.

Since this time, there have been articles relating to mitigating GHG emissions, energy efficiency projects and sustainable transportation projects being undertaken by HRM, but no mention of adaptation.

There is a deficiency in communication of adaptation using this tool. *Naturally Green* was named one of the three (3) primary tools to getting the message out on Climate SMART and HRM's adaptation strategy in the Risk Management Strategy, but since this strategy's development in 2007, it has not been utilized for this purpose.

The Website: www.halifax.ca/climate

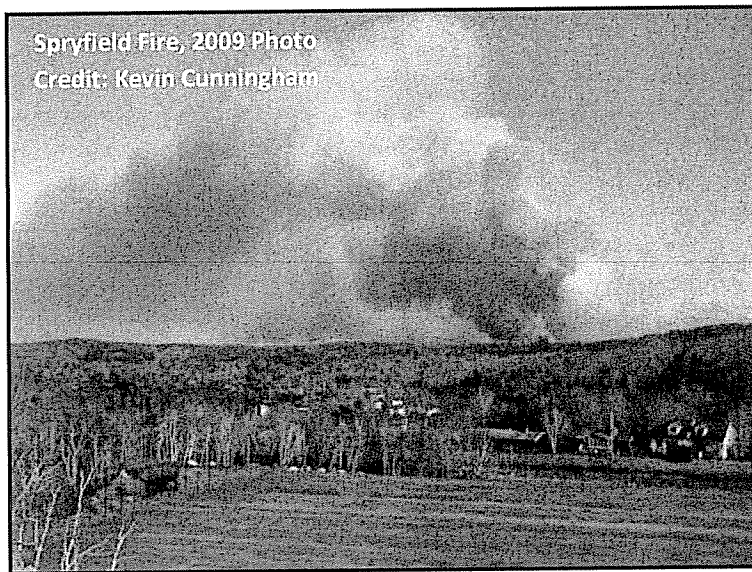
SEMO makes information on climate change available to the public on our website www.halifax.ca/climate. Information relating to climate change has been added to the website since the development of the Climate SMART program; however information that has been on the website since this time has not been updated.

SEMO has been adding important media articles on climate change to the website, including a Canadian Geographic Article released in 2010 titled *Halifax Harbour Faces Rising Waters*. Also added in 2010 was the 2009 Sea Level Rise Study. The website has also been utilized to communicate information on education opportunities such as "The Observatory", the temporary art project mentioned previously.

Wildfire Program

Fire Services also has a website to educate about wildfire safety in HRM.

<http://www.halifax.ca/fireprevention/WildlandFires.html>. This website provides tips for protecting homes and property from wildfires. It also provides a link to Nova Scotia Department of Natural Resources (NSDNR) website, and NSDNR's pamphlet on wildfire safety. A number of educational activities are held to educate residents in HRM on fire, including a program for Fire Safety Week done every year with schools. After the wildfire in Tantallon in 2008, HRM held twenty (20) community engagement sessions to educate about risks of wildfire in HRM. However, neither this website nor any of the educational opportunities have included information relating to how climate change and wildfires may relate. There is potential here for SEMO to work with this program to educate about the relationship between climate change and forest fires.



In order to affect change at the municipal level, Regional Council needs to direct HRM's Business Units to address climate change in business planning and within operational activities. In order to do that, Regional Council needs to be informed of the risks, measures to manage the risks and an understanding of the costs.

HRM, through Community Development (Regional and Community Planning) and Infrastructure and Asset Management (the Sustainable Environment Management Office and Real Property Planning), has been working to bring information regarding climate change and adaptation to Council for discussion. An example of such initiative was the presentation given to Council on the Halifax Harbour Sea Level Rise Project in February 2010. In November 2010, the updated *Community Action Guide to Climate Change and Emergency Preparedness* was also presented to Council for information to remind them of this initiative, and to inform them of the related provincial funding received.

Councillors have also shown interest in the issue of climate change in HRM. At the January 12th, 2010 meeting of Council, Councillor Barkhouse made a request for an information report. The information report was to include the various actions being taken by HRM and other levels of government to incorporate climate change adaptation actions and mitigation of the risk and vulnerability to our infrastructure and community from the impacts of extreme weather events to our municipal planning, design, management and operational activities. The information report was provided to Council for information on March 23rd, 2010.

At this time, most of the information staff has brought to Council on climate change adaptation has been solely for information purposes rather than for direction or decision making (with the exception being the sea level rise study). Although, the 2007 Climate SMART Risk Management Strategy was not presented to Council for adoption. However, HRM is in the process of adopting a new risk management tool for the organization, and Legal Services has advised that Climate Change has been identified as one of the biggest risks to the organization. This means that Climate Change and the information gained through the Climate SMART initiative will be revisited and taken through the new risk management tool. With this as a starting point, the Risk Management Strategy for Climate Change will be updated and adopted in the future.

A new Committee of Council was initiated in January 2011. This committee, The *Environment and Sustainability Committee*, will provide a new platform to communicate climate change risks, priorities and associated costs.

Hazard and Risk Mapping

Land use regulation is one of the few areas where HRM Business Units have significant degree of control over managing risks from climate change impacts. However, it was noted that in order to implement measures (e.g. coastal setbacks), this may result in potentially negative impacts on land values that will be challenged. As a result, HRM requires strong scientific data on which to base such planning decisions. HRM has taken several strides towards acquiring such data so that when land use regulations are put in place, they are based on the best available science.

As part of the Risk Management Strategy, Community Development was taken through a Risk Assessment Process for their business unit (Appendix D of the Risk Management Strategy). Throughout this process, flooding and forest fires were deemed the biggest risks their unit must plan for. Forest fires are a risk in HRM due to the predicted increase in drier conditions, and the increase in land development in rural communities.

Currently, HRM has planning mechanisms in place for setbacks to development along our coast and watercourses, including:

- Regional Plan Policy E-10 HRM shall, through the applicable land use by-law, require the retention of a minimum 20 metre wide riparian buffer along all watercourses throughout HRM to protect the chemical, physical and biological functions of marine and freshwater resources. The by-law shall generally prohibit all development within the riparian buffer but provisions shall be made to permit board walks, walkways and trails of limited width, fences, public road crossings, driveway crossings, wastewater, storm and water infrastructure, marine dependent uses, fisheries uses, boat ramps, wharfs, small-scale accessory buildings or structures and attached decks, conservation uses, parks on public lands and historical sites and monuments within the buffer. In addition, no alteration of land levels or the removal of vegetation in relation to development will be permitted.
- Regional Plan Policy E-16 HRM shall, through the applicable land use by-law, prohibit all residential development on the coast within a 2.5 metre elevation above the ordinary high water mark, except for lands designated Halifax Harbour on the Generalized Future Land Use Map and industrial lands within the port of Sheet Harbour. Provisions shall be made within the by-law to permit residential accessory structures, marine dependant uses, open space uses, parking lots and temporary uses within the 2.5 metre elevation.

No planning mechanisms are currently in place to protect from forest fire risks.

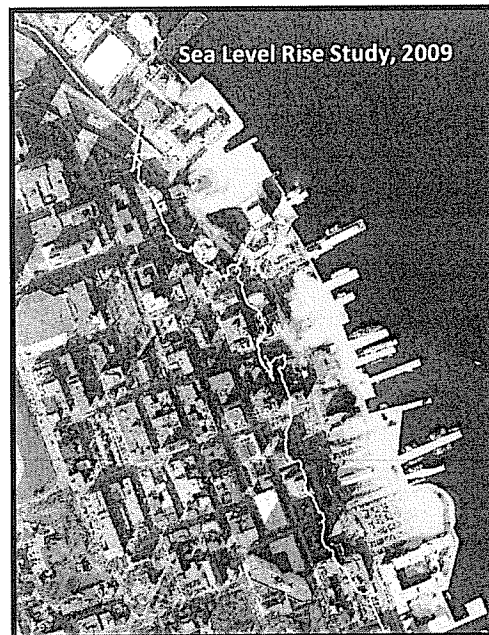
These policies and new policies relating to other climate change related risks and hazards are to be revisited during the upcoming Regional Plan review. New science and information gained over the last 6 years will be utilized to inform any changes. A number of the initiatives discussed below will inform policy.

Other issues also exist relating to climate change and hazards (i.e. public and private dams and their management). These are all things that must be and will be considered in the Hazards to Development Functional Plan requirement of the Regional Plan. This Plan has not yet been completed. More information on the plan is discussed in this section.

LiDAR Acquisition, Sea Level Rise (SLR) and Vulnerability Assessments

LiDAR and Sea Level Rise Projects

A key tool to enable HRM to develop appropriate plans, policy and by-laws to manage risks from climate change impacts is the development of mapping that identifies areas at risk in HRM. For most of HRM, mapping at the scale required to inform policy and decision making is not available. However, around the same time the Risk Management Strategy was being developed, HRM was in the process of acquiring LiDAR data for Halifax Harbour and the East Petpeswick Peninsula. This data was acquired and processed and is being utilized for a number of studies in HRM relating to climate change adaptation, including the 2009-2010 Sea Level Rise Study (SLR Project). This study projected areas at risk from inundation resulting from sea level rise and storm surge associated with climate change. However, not all of the LiDAR Data has been cleaned and available for use in such projects. Only about 60 out of the 1400 tiles have been processed.



The SLR Project was presented to Council on February 9, 2010. The most plausible scenario for planning purposes presented to Council indicates that relative sea level rise by the year 2100 is estimated at 0.73 m above current water level. If we then factor in a storm event (storm surge) having a 50-year return period (1.74 M), the resultant water level is 2.67 M, excluding wave run-up. Further work is currently being done by a Dalhousie University and a post-doctoral researcher student to model wave run-up and seiche for Halifax Harbour; this is being funded under the ACAS program.

At Committee-of-the-Whole, Councillors approved public and harbourfront stakeholder consultations, directed staff to further develop appropriate climate change adaptation measures for incorporation into the Halifax Harbour Plan, and also consider similar examinations of other coastal areas within the municipality. HRM has been working with developers around Halifax Harbour to communicate the information from the SLR Project as part of the development agreement process; developers are required to show how they have considered the potential impacts of sea level rise and storm surge in their project application before being granted approval.

Acquiring and processing LiDAR data is costly and to this point, sufficient funds have not been available to map the entire municipality. HRM is also still in the process of increasing our capacity

to deal with the data and its management. Discussions are currently happening internally around management of LiDAR data (between IAM, Community Development and Business Processes and Information Management); once this is made clear, there is opportunity to start discussions with our Provincial and Federal counterparts on cost sharing future acquisition. The Province (GeoNOVA) is in the process of completing a report (to be completed in early 2011) that will set the course for LiDAR acquisition for the entirety of the Province, which will have implications for HRM moving forward.

Vulnerability Assessments for Halifax Harbour and Musquodoboit Harbour

HRM is in the process of conducting a sea level rise and storm surge vulnerability assessment for Halifax Harbour using the data gained from the SLR project. The vulnerability assessment combines predictions of future SLR and storm surge with the existing natural features and current and future land uses around Halifax Harbour.

In 2008, a Dalhousie University Master of Planning candidate conducted a study titled *Planning for Climate Change and Coastal Zone Management: Land Use Vulnerability, Hazard, and Exposure in Halifax Harbour*. The student developed a matrix of elements where each parcel of land would be either given a point or not, based on impacts for the Dartmouth Plan area. Following this, in 2009 a Centre of Geographic Sciences (COGS) student further examined and developed the *Risk and Vulnerability Assessment Tool* or matrix. This expanded the work of the 2008 vulnerability analysis. In 2010 HRM's Community Development made further adjustments to the vulnerability matrix by adding the twenty-three (23) elements and seven (7) sea level rise scenarios. With assistance from HRM's GIS team, these changes were added and applied to all of the lands abutting Halifax Harbour (from Chebucto Head to Hartlen Point) up to the 5 metre contour. As mentioned in the previous discussion, wave runoff and seiche modelling is currently underway. When this is completed it will be added into the vulnerability assessment to further increase its accuracy.

The vulnerability assessment tool will help HRM estimate potential damage and direct economic costs related to a certain magnitude event. It can also be used to inform planning decisions on certain lands and for emergency planning purposes. HRM is continuing to work in-house and to partner with academic institutions in NS to build on the vulnerability assessment work.

Dalhousie University's Environmental Planning Studio (2010) decided to do their class project on the sea level rise impact of a rural community in HRM. The report they produced assesses sea level rise vulnerability for the coastal region surrounding the Village of Musquodoboit Harbour, focusing on the Musquodoboit Harbour Estuary and Petpeswick Inlet and area for which LiDAR data is available. This work is nearing completion and is a valuable document for HRM to continue building vulnerability knowledge across the municipality, for those areas where accurate LiDAR mapping is available.

Watershed Studies and Hydrogeological Assessments

An adaptation requirement in Table 6-1 of the Risk Management Strategy requires HRM to gain a better understanding of the carrying capacity of areas proposed for new development. Since 2006, a number of watershed studies have been undertaken in HRM to inform secondary planning strategies in HRM.

Policy E-17 of the Regional Plan states that watershed or sub-watershed studies concerning natural watercourses shall be carried out as part of comprehensive secondary planning processes. These studies shall determine the carrying capacity of the watersheds to meet the water quality objectives which shall be adopted following the completion of the studies.

These studies have been undertaken for the following locations at this time:

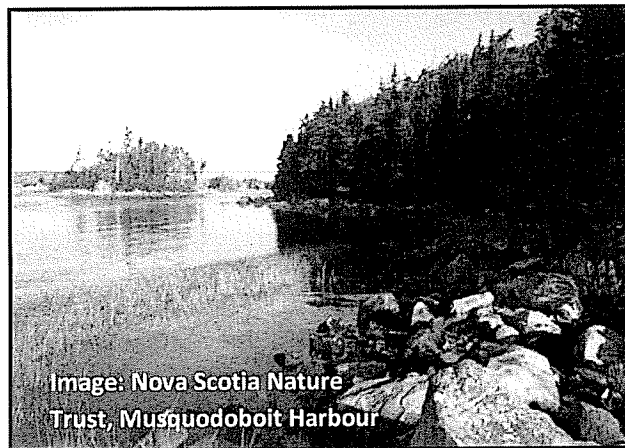
- Musquodoboit Harbour
- Shubenacadie and Grand Lake
- Hubbards

The following are underway:

- Porter's Lake
- Tantallon

Request for proposals are to go out shortly for the following:

- Port Wallace area within the Shubenacadie Lakes Watershed
- Birch Cove Lakes



Other important developments regarding consideration of water in new development are the May 2010 changes made to Section 3 of Chapter 39 of the Acts of 2008, the *Halifax Regional Municipality Charter*, section 281(3), which states:

(ja) with respect to subdivision applications that are located outside the serviced area as that term is defined in Section 190 and that are for the creation of ten or more lots, requirements for hydrogeological impact assessments including an evaluation of the quality, quantity and sustainability of water supply within the proposed subdivision and an evaluation of the cumulative impacts on water supplies outside of the proposed subdivision;

(jb) in areas where hydrogeological impact assessments are required, water supply standards that must be met before a subdivision can be approved, for quantity, sustainability of water supply and for the cumulative impact on water supplies outside of the proposed subdivision;

This now allows HRM to require hydrogeological assessments for certain types of development outside of our serviced area. Currently, HRM is requiring this to be done through the Development Agreement process. This has been ongoing since 2006 with open space design subdivisions, however, there has only been one proposal since this time. HRM needs to put legislative amendments in place to move forward and require this for as-of-right approvals. This process is currently underway, with no anticipated date of completion at this time. Discussions are being held with HRM's legal services around what we can and cannot do to capture existing subdivisions with developers wanting to add more lots.

Forest Fire Risk Assessments

Another performance indicator for Hazard and Risk mapping was the area of HRM that has been mapped for forest fire risk. Table 6-1 indicates that one of the adaptation response requirements is to map forest fire risk in HRM and to undertake forest fire risk assessments for new developments. Neither has been done at this time. However, HRM works closely with Nova Scotia Department of Natural Resources (NSDNR) on issues and education relating to forest fires. The NSDNR regularly assesses fire weather conditions across the province. They produce and distribute provincial fire weather indices, both current and forecast, for suppression preparedness and public awareness. They also allocate resources provincially for fire suppression and crew support. There are DNR fire towers across the Province, including in HRM.

As mentioned, Table 6-1 states that forest fire risk assessments should be completed for new developments in the urban/rural fringe. This was also identified as a response in the community development specific risk assessment, included as Appendix D of the Risk Management Strategy. This is currently not being done. However, Fire Services is on Community Development's consultation list for discretionary approval development agreements, as well as large scale by-right subdivision developments. The fire department will usually review plans and consider roads, fire parking, and availability of water for fire purposes (fire hydrant placement). A pamphlet is usually provided to the developer that provides information on how to protect homes and property from a wildfire (DNR publication). This document discusses 15 important steps to a well-protected home and property (i.e. no tree limbs within 3 m of a flue or chimney). The pamphlet also provides a risk assessment framework so that a homeowner can determine their risk related to a wild fire. None of the recommendations included in this guide are legislated and are mainly for existing homeowners trying to prevent damage to their homes.

Environment Canada Mapping for Key Climate Change Parameters

In the Risk Management Strategy, Environment Canada mapping for key climate change parameters was included as Appendix D to identify, develop and refine mapping for temperature, precipitation, and heat wave duration (see Appendix D of original Risk Assessment). Environment Canada continues to develop meteorological hazard mapping across Canada and this will be publicly available as the regions are completed. For an example of the mapping produced, see: www.hazards.ca. This website aims to assist local and provincial governments plan for

emergencies in their jurisdictions by providing information on the types of atmospheric hazards common to the region and the climatology of those events.

Hazards to Development Functional Plan

The major initiatives required in order to ensure HRM considers Hazards and Risks in terms of our development are outlined under the Regional Plan, Chapter 2: Environment which states that staff are to develop the following:

2.4.4 Potential Hazards to Development Functional Plan

There are numerous potential hazards in HRM that may be encountered wherever development of land takes place throughout the Municipality. These hazards may present substantial risk to life and property when not fully addressed. Hazard planning should consider potential threats such as the effects of climate change, coastal inundation and storm surge events, wildland fire, contaminated sites, abandoned mines, pits and quarries, abandoned land fill and disposal sites, dam failure and radon gas.

The Potential Hazards to Development Functional Plan should consider:

- 1. identifying areas, such as the location of contaminated sites, abandoned mines, pits and quarries, and areas at high risk for radon exposure through cooperation and collaboration with the Province;*
- 2. preparing an Historical Land Use Map to identify sites that may have been contaminated through former land uses;*
- 3. developing guidelines to protect the public from potential hazards, as listed above;*
- 4. developing guidelines to educate the general public about potential hazards to human life and property; and*
- 5. developing management plans for climate change, coastal inundation and storm surge events, wildland/urban interface fires and emergency preparedness for dam failure.*

Policy E-21 states: HRM shall prepare a Potential Hazards to Development Functional Plan to seek measures to mitigate risks to life and property associated with development.

This plan has not yet been developed. Precursors to this Functional Plan, from a climate change perspective, are the Water Quality Monitoring Functional Plan, Waste Water Management Functional Plan, and Storm Water Functional Plan. In addition, the ClimateSMART project, and the adaptation projects (such as the Halifax Harbour / Sea Level Rise project) that have been completed are fundamental cornerstones that will fit into the climate change hazards element of the functional plan.

Integration of Climate Change into Business Plans

As mentioned previously, in order to affect change at the municipal level, enabling policies could be adopted by Regional Council to provide direction for HRM's Business Units to address climate change in business planning and within operational activities. In order to do that, Regional Council should be informed of the risks, measures to manage the risks and an understanding of the costs. The Risk Management document developed in 2007 and this update on the status provides the information necessary for Regional Council to gauge the risks to HRM and the general actions necessary. The costs of the actions can only be assessed qualitatively at this point as specific actions need to be developed by HRM's Business Units with the support of the tools provided in this report and additional data as they become available. Appendix D of the 2007 Risk Management Strategy is a Climate Change Risk Assessment Protocol for HRM Business Units to use to more fully incorporate climate change in their decision making. Although the Risk Management Strategy has not been adopted by HRM's Regional Council, Appendix D could be used by business units to consider their specific climate change risks and risk management training needs could be developed in anticipation of Council's eventual adoption of the strategy.

Corporate Risk Management Strategy

HRM has an overall Corporate Risk Management Plan that is updated every year by Risk and Legal Services. This plan considers climate change risk and immediate yearly requirements for dealing with climate change if necessary. If climate change risks are identified to be of concern that year, then the risks will be assigned to the appropriate business unit to be addressed in their business plan. However, through discussions with Risk Management and Legal, the risks identified in this process have not been deemed so serious at this time that they should be acted on immediately. This is seen as something that will change as time goes by and risks become more immediate.

Business Plans

As part of its annual business plan cycle, HRM's business units evaluate the potential risks to their operations from a variety of threats. Given the potential economic, social and environmental costs resulting from climate change impacts, climate change needs to be evaluated as a threat to the operation of the business units. As mentioned in the previous paragraph, it is being considered yearly in the Corporate Risk Management Plan.

The 2007 Risk Management Strategy provided an initial assessment of risks to HRM Business Units, and a pilot exercise was undertaken with HRM's Community Development to evaluate key steps in the process to mainstream climate change risk management into the unit's business cycle. Key steps resulting from the pilot exercise are provided in Appendix D of the 2007 Risk Management Strategy. From discussions with other business units, this process has not been applied to any other section.

The following 2009-2010 business plans were reviewed as part of this update to determine whether any specific considerations relating to climate change were made:

- Community Development
- Fire and Emergency Services
- Infrastructure and Asset Management
- Business Planning and Information Management
- Police Services
- CAO's office
- Risk and Legal Services
- Finance
- Transportation and Public Works

One of the performance measurements of the Risk Management Strategy was the number of business units addressing climate change in business plans. The only business plan that specially mentioned climate change was the Infrastructure and Asset Management business plan. It had specific actions listed under the strategic goal of environmental sustainability that mentions climate change and relates back to requirements listed in the Risk Management Strategy on risk management, watershed planning, and hazards to development:

- Lead the completion of the next phase of the development of the Watershed Study program;
- Development is accommodated in HRM with a greater emphasis on sustainability and both public and private infrastructure is better protected from environmentally based hazards;
- Deliver an HRM Corporate Climate Change Management Strategy;
- Complete IAM contribution to the development of the environmentally based Hazard Management Functional Plan as set out in the Regional Plan;
- Increase energy efficiency and reduce building-related greenhouse gas emissions for HRM facilities;
- Promote and support legislative changes to require increased energy efficiency and reduce greenhouse gas emissions for all buildings and development in HRM.

Many other business units including Fire and Emergency Services, Community Development, Police Services and Transportation and Public Works, have priorities that relate to adapting to climate change, but offer no discussion on the risks or links. For a detailed summary of the review undertaken please see Appendix B: Business Plan Summary.

Business Continuity Planning Process

In the Fire and Emergency Services business plan, the requirement for Business Continuity Planning to be led by EMO is discussed. At this time, a Business Continuity Planning (BCP) Committee is being led by EMO. The BCP Process includes representation from all HRM business units. Thus far, the BCP Committee has identified mission critical and essential services for every business unit in HRM. Each business unit is now required to develop plans to ensure that these services are provided in an emergency. However, no specific plans have been created by any unit

at this time. EMO has created a Draft BCP Template for business units to help them with their specific plans. Loss of transportation routes is an element that each unit will have to develop as part of their departmental BCP. Loss of communications is one area that each unit will also have to consider. These are both actions that are required to be addressed in Table 6.1 of the Risk Management Strategy.

Urban Forest Masterplanning Process

HRM and Dalhousie University are developing an Urban Forest Master Plan (UFMP) to ensure a sustainable future for the urban forest in HRM. HRM's urban forest includes all trees within the urban core. Street trees, park trees, trees on private and public land all make up our urban forest. This process will take into account the benefits of the urban forest for both the mitigation of climate change (i.e. GHG uptake) and adaptation to climate change (i.e. stormwater benefits). It will also consider, as was done for Point Pleasant Park, the species mix that is appropriate for our changing climate. This will be more prominent for heavily treed areas than for street trees. This plan is well underway at this time.

This information and plan will set the stage for how HRM manages and maintains the urban forest. The requirement to complete this plan was indicated in the IAM business unit plan and is an extremely important piece of information for use in planning for mitigation and adapting to climate change in HRM.



Image: Hurricane Juan Damage 2003, Point Pleasant Park Masterplan

Including climate change adaptation measures in development, infrastructure, and buildings may result in an increase in up-front costs for HRM as design criteria will change in a more conservative direction to make facilities more resilient to climate change. Financial and planning decisions, however, are often made on a short term, e.g. budget cycle, basis and do not necessarily incorporate the long term costs of operations and maintenance. Cost/benefit analysis of climate change risks should become a standard part of the operational and financial budgeting process for all HRM Business Units. HRM's Asset Management Program will likely include the development of a formalized life cycle assessment approach.

Cost Benefit Analysis for Capability Projects

At this time, cost/benefit assessments for Capability Projects (a project that increases or expands a level of service, new development) is moving from examining strictly economic costs and benefits, to more of a holistic view. When the Capital Steering Committee is reviewing a project they complete a Capital Supplementary Sheet, which has recently been expanded to look at economic, social and environmental benefits. In turn, this will allow consideration of some climate change related implications but this is not a formalized requirement at the present time. It is important that this becomes an approved and required process because in order to properly consider climate change in our development, longer term economic benefits (e.g., reduced maintenance) and broader social benefits must be considered.

Public Infrastructure and Vulnerability Committee 2008 Protocol

In 2008, Environment Canada and the Canadian Council of Professional Engineers, through the Public Infrastructure Engineering Vulnerability Committee, finalized a report that assessed the vulnerability of Canada's infrastructure to climate change. This document provides a protocol for incorporating climate change in engineering design for the following infrastructure:

- water resources infrastructure
- stormwater and wastewater infrastructure
- roads and associated structures
- buildings

At this time, the report has not been utilized by HRM for consideration in assessing our infrastructure's vulnerability to climate change. However, HRM has a building condition assessment process underway that could be used as the first step to defining "the project" (discussed in the protocol) in terms of buildings the information gained through this assessment could be used to determine HRM building Vulnerability to Climate Change factors.

The protocol is available at the following link:

http://www.pievc.ca/e/doc_list.cfm?dsid

Improved Intergovernmental Collaboration and Coordination

Throughout the Risk Management Strategy it is recognized that adaptation measures described in the preceding sections cannot be undertaken by HRM alone due to jurisdictional issues and financial considerations. The strategy also noted that there was little overall policy direction related to climate change adaptation at either the federal or provincial government levels and that it is these two levels of government who have the most legislative responsibility (see Table 2-3 of the Risk Management Strategy). The weakness in intergovernmental collaboration and coordination of climate change activities was seen as a significant barrier to making progress on climate change issues. However, HRM has been working with other levels of government on a number of initiatives relating to climate change since 2007.

Environmental Goals and Sustainable Prosperity Act and Provincial Climate Change Action Plan

As a deliverable related to the Environmental Goals and Sustainable Prosperity Act (EGSPA), the Province of Nova Scotia released a Climate Change Action Plan in January 2009. Under the action plan (<http://climatechange.gov.ns.ca/doc/ccap.pdf>) the Province committed to the following actions related to Climate Change adaptation:

- Create an Adaptation Fund within Nova Scotia Environment to encourage adaptation research and development starting in 2009 (completed, HRM received \$5000 from the Provincial Adaptation Fund, and funding through 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 province's interest 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.gov.ns.ca/>).
- Begin work on a 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 the other Atlantic Provinces on common adaptation goals (ACAS project).
- Create an interdepartmental steering committee and external advisory committee responsible for coordinating adaptation efforts 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. A major part of the strategy will focus on strengthening our resiliency to climate change impacts along our coast (to be released in 2011 in the final stages of development).
- Take sea-level rise into consideration and place priority on conserving coastal wetlands in preparing a policy to prevent net loss of wetlands. The Environmental Goals and Sustainable Prosperity Act requires that this policy be developed by 2009 (still in draft form).
- Develop a strategy to ensure the sustainability of the province's natural capital in forests (forestry), minerals (mining), parks, and biodiversity by 2010. This strategy will be led by the Department of Natural Resources (in its final stage of development - will not be publicly released until sometime in the next year).
- Develop a comprehensive water resource management strategy by 2010. As a key priority, the strategy will consider climate change impacts on water quality and quantity (Released in December 2010).
- Lead, through the Department of Natural Resources, an interdepartmental and forest industry working group on forest carbon management and forest adaptation to climate change. Of particular interest for this report, is the development of the 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/>).

Halifax Regional Municipality staff continues to collaborate, support, and contribute to these actions. For example we have participated in the development of the *Wetlands Policy*, the *Natural Resources Strategy*, the *Water Resource Management Strategy* and the *Coastal Development Strategy*; all required under EGSPA and the *Climate Change Action Plan* (2009). Staff from HRM participated in the Coastal Consultations held by the Province in May on the *State of the Coast Report* and the *Provincial Coastal Strategy*; we also submitted comments on the proposed strategy in June on behalf of all business units in HRM. Many of the comments related specifically to climate change adaptation, as the recommendations and requirements to come out of this strategy will affect how we adapt to climate change. HRM also participated in 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. This document was released by the Province in December 2010 and will be used in the development of related policies and functional plans in HRM.

Regional Adaptation Collaborative - Atlantic Canada Adaptation Solutions

As previously mentioned, the Government of Canada has partnered with Provinces across the Country in delivering the Regional Adaptation Collaborative Program (RAC). The Atlantic RAC, the *Atlantic Climate Adaptation Solutions* Project, an 8.2 million dollar collaborative builds on the *Atlantic Climate Change Adaptation Strategy* signed by the Atlantic Environment Ministers in 2008. The project has 64 regional partners including the Province of Nova Scotia and HRM and several other provincial departments, municipalities, and organizations. The purpose of this project is to create a framework for comprehensive, integrated and long-term planning for climate adaptation in the Atlantic Region. *Atlantic Climate Adaptation Solutions* 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.

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

A Memorandum of Understanding on Climate Change, signed in November 2009, exists between the Union of Nova Scotia Municipalities and the Province of Nova Scotia. This 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 states that: *Municipalities will continue to take action on climate change impacts through direct actions including policy development, land-use planning initiatives, emission reductions, the development and implementation of Integrated Community Sustainability Plans and through the initiatives of the UNSM Municipal Sustainability Office.*

Emergency Response Intergovernmental Collaboration

Emergency response in HRM involves all three levels of government with the majority of the resources (personnel and equipment) within provincial and federal jurisdictions. While emergency response measures are in place and continually reviewed by all three levels of government, it is noted that risks associated with climate change impacts are not currently an integral part of the emergency planning process. Consideration of the projected increase in intensity and frequency of extreme events resulting from climate change and the resulting resources needs to be evaluated. In addition, it is recognized that the EMOs need to have information on the location of vulnerable people. This is seen as an important emergency response issue regardless of the impacts from climate change.

DNR and Fire work together on issues and education relating to urban/wildfire interface and forest fires in our region. From a review of information included on the NSDNR website and the HRM EMO website, no information on the relationship between climate change and a potential

increase in wildfires has been developed at this time. This is something that should be developed in the future, as a collaborative effort with the Province. HRM should begin discussions with the province on this issue.

HRM has reciprocal agreements with different municipalities and organizations to help in emergency response (equipment, staff, and other resources) and standing offers with others. In terms of increasing fleet and staff to deal with emergency event situation, this is determined on a yearly basis based on needs. Currently, HRM is actually decreasing fleet; standing offers are set up with other municipalities and levels of government for fleet and equipment that may be required in case of an extreme event. DNR provides us with equipment and resources in terms of fighting forest fires. HRM has an organized relationship with the Amateur Radio community so HRM can provide mobile telecommunications resources to a stricken area within HRM using both Amateur Radio gear and some EMO radio gear. HRM EMO participates on an inter-agency liaison committee to determine and share critical infrastructure data.

Canadian Institute of Planners and Climate Change

Table 6-1 discusses the requirement for HRM to liaise with similarly sized municipalities, in particular coastal municipalities, to share knowledge. The Canadian Institute of Planners provides a good forum for this sort of collaboration and discussion to occur. The theme of the CIP Conference in October 2010 was Climate Change. This conference brought planning professionals from municipalities and firms across the country to learn about impacts and discuss solutions to mitigate and adapt to the challenges and opportunities we will deal with in relation to climate change.

Since 2007, the Canadian Institute of Planners (CIP) has been working in partnership with Natural Resources Canada (NRCan) and, more recently with Indian and Northern Affairs Canada (INAC) and the Government of Nunavut (GN), to bring climate change knowledge, adaptation strategies and plans, policies and tools to professional planners in all parts of Canada.

CIP set out to do the following in relation to climate change adaptation:

- 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

This work is well underway, and there are a number of opportunities for HRM CIP members to work with and learn from it.

Update Design Criteria for Infrastructure

A key concern raised during the development of the Risk Management Strategy was that design criteria for infrastructure needs to be updated to reflect climate change model projections for HRM in terms of storm event intensity and frequency. Current criteria rely on hindcasting and data sets that do not include the most recent meteorological data, which shows an increase in storm intensity and frequency. This information is seen as critical to make appropriate planning decisions and to justify the increase in cost that will accompany the change in the criteria. No changes have been made to HRM's redbook at this time as a result of climate change considerations.

Environment Canada (EC) has developed a projection of extreme precipitation return periods to the 2080s for use in developing new design criteria: In addition, precipitation Intensity-Duration-Frequency (IDF) charts are in the process of being updated with the latest observations for sites across Canada this was finalized for short duration rainfall intensity for HRM in April 2010.

A report undertaken in 2008 by Environment Canada, the Canadian Council of Professional Engineers, through the Public Infrastructure Engineering Vulnerability Committee, assessed the vulnerability of Canada's infrastructure to climate change. The report provides a protocol for incorporating climate change in engineering design for the following infrastructure:

- water resources infrastructure
- stormwater and wastewater infrastructure
- roads and associated structures
- buildings

HRM participated briefly in this working group, however not actively. As of yet, HRM has not been using this new information in engineering design, or the assessment of the vulnerability of our own infrastructure.

It should be noted that building to LEED (Leadership in Energy and Environmental Design) Silver standards (at a minimum) is now standard practice for all new municipal buildings. One of the most progressive aspects of the LEED system is that it encourages an integrated approach to the design and construction of buildings. That is, it considers matters such as energy conservation and air quality right from the design stages, which has not been part of traditional practice. As a result of this self-imposed standard, HRM has seen the construction of better, more efficient and more user-friendly buildings that in most cases take into consideration climate change adaptation measures (i.e. storm water retention considerations through use of green roofs, rainwater collection and recycling).

Discussion: HRM Moving Forward with Climate Change Risk Management

Below, please find a summary of the priorities HRM should focus on based on the research and information review completed for this update on the status of the Risk Management Strategy.

Identify and Attract Funding Opportunities

- To continue to identify and attract innovative and responsive funding. This is a constant priority that involves staff time and dedication.
- To review the purpose and use of the *EMO Cost Recovery Reserve Account* and the amount of money contributed each year, with consideration for climate change in mind. To explore additional uses for this funding, including use for preparation activities, not just recovery. As per the Risk Management Strategy a fund such as this should be used not necessarily solely for hard assets such as generators or snow removal equipment but could also be used for additional community outreach as well as co-funding for mapping and on-going climate modeling specific to HRM. Alternatively, HRM will explore other opportunities to create a reserve fund that would meet this requirement. The *Sustainable Communities Reserve* will be considered as an option for projects that help us prepare for climate change in our region.
- Scientific studies predict increasingly frequent and intense storm events in our region due to climate change. HRM should develop a formal tracking system for HRM to better track and allocate costs related to extreme events to support requests for post event relief funding from the provincial and federal government. A current process is in place for this but needs enhancement.
- To continue to search for climate change adaptation funding opportunities and maximize ACAS funding available to HRM until March 31, 2012.

Improve Community Outreach

- To advance the *Community Action Guide for Climate Change and Emergency Preparedness* project which received Provincial Funding, in order to create capacity within HRM communities. Through this project HRM, SEMO and EMO, will develop a specific methodology that can be applied to other communities throughout the municipality who are interested in undertaking a similar exercise after the project has completed.
- To continue leveraging partnerships between SEMO and EMO in implementing the Community Action Guide to Climate change and Emergency Preparedness to educate communities, and to

empower residents to work together to adapt. A communications plan for proactively presenting this guide to community groups across HRM will be developed.

- To continue to create cross-departmental partnerships to engage the public on Climate Change. (e.g. SEMO and Cultural Affairs continuing to work together to use creative methods to educate our public about climate change issues in HRM through Public Art and to work to build a partnership with fire prevention to educate on this topic and its relationship with climate change).
- To better utilize the website and Naturally Green to get the message out on climate change adaptation. Therefore, starting in the spring of 2011, Naturally Green should contain a section titled *Climate Change in HRM*. This section will contain information on climate change, climate change mitigation and climate change adaptation in HRM.
- To review and update the content of the Climate SMART webpage to reflect the current situation. The entire content of the website should be reviewed and updated on a yearly basis, with information being added as it presents itself.
- To action Council's directions relating to the Sea Level Rise Study; particularly the community consultations.
- To continue to build emergency preparedness capacity through EMOs creation of more JEM Teams, and the training of existing JEM teams on climate change and its relationship with extreme events.
- To proceed with the ACAS project to have Dal Planning students review the relevance of tools, such as Climate Change: The Developers Risk Management Guide. If required to update the guide and from this, create a communications plan to ensure it is disseminated to and utilized by the development community.
- To continue working with development agreement applicants to design new buildings and sites more sustainably, with considerations for climate change adaptation and mitigation in mind (i.e. using the Sea Level Rise Study to inform development around Halifax Harbour, HRMbyDesign bonus zoning and sustainable building).

Recommendations

- To present the Risk Management Strategy and this update to Council with recommendations to be adopted in order to move forward in with adaptation planning. Council should be presented with the recommendation that climate change be reflected in all business plans and be an overarching priority of the Regional Plan Review.
- To create a Climate SMART Team championed and endorsed by Senior Management in Infrastructure and Asset Management. The Climate SMART Team should:

- Actively participate in internal planning processes (Outcome Area Plans, Corporate Plan, Business Plans, Business Continuity Process, Regional Plan Review, Functional Plan Development and Corporate Risk Management Process) to ensure that Climate Change considerations are prioritized, appropriate targets are developed, and budgets are set aside.
 - Work with boards and committees of Council
 - Pursue the actions outlined in the Risk Management Strategy and assign responsibilities, work with consultant teams when required.
 - Provide yearly updates to Council on the status of the Risk Management Strategy.
- To develop a Training Program on Climate Change Risk Management to be provided to each business unit, in particular those involved in the preparation of the business planning process.
 - To bring information regarding climate change and adaptation to Council for discussion, working through the Environment and Sustainability Committee.

Hazard and Risk Mapping

- To determine, define and implement the roles and responsibilities for LiDAR management internally. This initiative should be led by Data and Business Information Management in consultation with Community Development and Infrastructure and Asset Management as the two primary data users. A working group on LiDAR data should be formalized. With the Council motion for further study such as the SLR Study for Halifax Harbour in other areas of HRM, this data is required to improve topographic mapping in vulnerable areas of HRM; particularly those areas located along the coast. Acquiring more of this data with no process to properly manage, store and maintain the information is not beneficial. Once roles and responsibilities for LiDAR Data Management are decided internally, discussions should be held with external partners (i.e. the Province) on potential cost-sharing agreements for acquiring data for the rest of HRM.
- To complete Halifax Harbour (ACAS Project) wave runup and seiche modelling (ACAS Project); finalize Vulnerability and Risk mapping for Halifax Harbour to the extent possible; present the information to all staff and Council as a policy tool for use in infrastructure planning, development approvals and EMO planning.
- To provide web-based climate change adaptation mapping to HRM citizens.
- HRM should continue to assess watershed subject to new development and enact policies for development approvals based on potable water availability.
- To complete the Storm water Management Functional Plan.
- To adopt policies to require hydrogeological assessments for development applications.

- To conduct forest fire risk mapping and require forest fire risk assessments to address forest fire and urban/wildland interface issues in HRM. Opportunities exist to undertake a Forest Fire Risk Assessment project with ACAS funding.

• Completion of Strategic Planning and Engineering Maps

- To complete Business Continuity Planning Process. EMO should lead business units through the business continuity planning process to consider a number of the adaptation responses and requirements outlined in the Risk Management Strategy (i.e. loss of transportation routes, loss of communications).
- To ensure that SEMO staff or Climate SMART Committee should participate in the HRM new risk management process to be implemented, to ensure that the appropriate climate change risks are considered.
- To work with the Regional Plan Review considering an overarching goal to improve air quality through the reduction of greenhouse gas emissions, and to adapt to the climate changes that are upon us. Climate change mitigation and adaptation should be engrained as a common theme. The Regional Plan is actually a risk management document, and should be used across the organization by all business units in considering their actions. In order for the municipality to receive Gas Tax Funding, a Climate Change Action Plan must be added to a municipality's *Integrated Community Sustainability Plan (ICSP)*, which in HRM's case is the Regional Plan.
- To finalize functional plans relating to climate change, including the Water Quality Monitoring Functional Plan, Waste Water Management Functional Plan, Storm Water Functional Plan and the Hazards to Development Functional Plan.
- To Finalize and implement the Urban Forest Master plan recommendations and requirements relating to climate change.
- To move forward with Council's recommendations on the Sea Level Rise Study; in particular, to incorporate study findings into the Halifax Harbour Plan, and also consider similar examinations of other coastal areas within the municipality.
- To implement the Risk Assessment Strategy at the Business Unit level. Appendix D shows the effective use of this Strategy's tool with Community Development. HRM should adopt this strategy and conduct training exercises with each business unit to undertake this process. Appropriate funding levels should be allocated to start this process. It is recommended that implementation start with those business units most affected by climate change including: Community Development, Infrastructure and Asset Management and Fire and Emergency Services.

Climate Change Adaptation Opportunities

- To evaluate ways to better incorporate risk management related to climate change into our budgeting process to allocate more funds for adaptation options relating to our infrastructure, and the recapitalization of our infrastructure.
- To develop a Life Cycle Assessment approach for Infrastructure and Asset Management that considers Climate Change Adaptation for all recapitalization projects, and is incorporated into the planning process for Capability Projects. The approach should introduce a formalized process to take climate change adaptation into account in decision making relating to asset management.
- IAM and TPW should conduct a case study based review of the PIEVC Protocol in order to incorporate climate change and infrastructure vulnerability considerations into development and management decision making.

Increased Interdepartmental Collaboration and Coordination

- To continue to collaborate with other levels of government on climate change adaptation related initiatives in keeping with the UNSM MOU on Climate Change.

Climate Change Mitigation and Adaptation

- To actively participate in committees such as PIEVC. Active participation with other levels of government in updates for design criteria – PIEVC, Engineers Canada/NS, CSA Standards.
- To adopt a climate change mitigation and adaptation lens in ongoing review of the HRM Redbook.

Conclusion

HRM has a number of actions underway at this time in terms of preparing for and adapting to climate change, however there is still much work to be done. Adaptation is a constant challenge that requires consideration in everything HRM will do for years to come. The recommendations made in this report are meant to be discussion points for the Climate SMART Committee, and are seen mainly as actions HRM can begin taking and can accomplish immediately. Through discussing these recommendations, it is important that roles and responsibilities for leading and moving forward with actions are identified. As business units undertake climate change risk assessments related to their own mandates, more specific actions may be identified that cancel out some recommendations listed in this document. This report does not rule out other recommendations and requirements included in the Risk Management Strategy document.

References and Links

- For HRM Climate SMART Information visit www.halifax.ca/climate

The following documents can be accessed at this link:

- *The Climate SMART Climate Change Risk Management Strategy for HRM* (2007)
- Reports on Sea Level Rise Study. Including *Halifax Harbour Extreme Water Levels in the Context of Climate Change: Scenarios for a 100-Year Planning Horizon* (D.L. Forbes, G.K. Manson, J. Charles, K.R. Thompson, R.B. Taylor, 2009).
- *The Community Action Guide for Climate Change and Emergency Preparedness* (November 2010).
- *The Climate Change: Developers Risk Management Guide* (August 2007)
- The Sustainable Environment Management Office website www.halifax.ca/environment/sem.html
- HRM Fire and Emergency Services Joint Emergency Management Team information is available at www.halifax.ca/emo/jems.html
- HRM Fire Safety website www.halifax.ca/fireprevention/WildlandFires.html.
- HRM Budget information can be accessed at www.halifax.ca/budget/index.html
- Climate Change Nova Scotia Website climatechange.gov.ns.ca/
- Government of Canada, Climate Change Website www.climatechange.gc.ca
- HRM Regional Planning website www.halifax.ca/regionalplanning/index.html
- *Adapting to Climate Change: Canada's First National Engineering Vulnerability Assessment of Public Infrastructure* (April 2008) is available at the following link: www.pievc.ca/e/doc_list.cfm?dsid=4
- Province of Nova Scotia *Climate Change Action Plan* (January 2009) is available at the following link: climatechange.gov.ns.ca/doc/ccap.pdf
- Environment Canada meteorological hazard mapping can be accessed at www.hazards.ca
- *The State of Nova Scotia's Coast Report* can be accessed at www.gov.ns.ca/coast/

- *The Memorandum of Understanding on Climate Change between UNSM and the Province* can be accessed at <http://www.sustainability-unsm.ca/climate-change-and-energy.html>

Appendix A: Interview Results

Business Units (BUs) Impacted	Relevant Climate Change Impacts	Adaptation Responses and Requirements	Are the Responses and Requirements included in Legislation, Policy or Documentation?	What actions have been taken by the BU to achieve the Adaptation Responses and Requirements?	Other Responsible Entities – non HRM
Fire and Emergency Services (Barry Manuel, Robert Kamperman, Holly Weatherby, Andy Boutiller)	<ul style="list-style-type: none"> Coastal Erosion and Impacts on Transportation infrastructure impacting access for emergency services and vehicles. Similarly, coastal inundation due to storm surge may impede access for emergency services and vehicles. Greater range 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). Increased damage and disruption of vulnerable critical utilities and infrastructure that may impact emergency communications Potential for increased risks from forest fires that may be combines with additional blow down due to storm events in the urban/rural fringe requiring additional resources in these areas. Increased demand on emergency services from stress and over-loading of the public 	<ul style="list-style-type: none"> Development of a pre-event prevention and mitigation strategy as is would apply to "Mission Critical and Essential Services". Development of contingency plans to mitigate loss of transportation and/or communication infrastructure during an event. Develop an all hazards business continuity plan by business unit. Identification of Mission Critical and Essential Services by business unit and based on the HRM service catalogue. Current emergency and evacuation related data review. Staffing and resource requirements to be considered for potential emergency impacts from climate change (i.e. increased resources and capabilities to address forest fires in the urban/rural fringe especially in unserviced areas). 	<ul style="list-style-type: none"> Master Emergency Plan (2003) – All Hazards Plan, not specific to Climate Change, but considers related emergencies. HRM Bylaw E-100 	<ul style="list-style-type: none"> A Business Continuity Planning (BCP) Committee is currently being led by EMO Business Continuity Planning process (BCP) started by EMO includes representation from all HRM Business Units. Thus far, the BCP Committee has identified Mission Critical and Essential services for every BU in HRM. Each business unit is now required to develop plans to ensure that these services are provided in an emergency. No specific plans created for any units at this time, however, EMO has created a DRAFT business continuity planning template for business units to help them with their specific plans. BCP Committee - Loss of transportation routes is an element that each BU will have to develop as part of their departmental BCP. Loss of communications is one area that each BU will also have to consider. The Master Emergency Plan is updated in stages in 2009 the Infectious Disease Plan Annex was 	EMO NS; Public Safety Canada; NSTIR; EC and NRCan for climate change modelling and sea level rise/inundation modelling.

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	<p>health infrastructure (including HRM emergency services) from the cumulative effects of extreme events, injuries, breakdown in essential services such as electrical power, and communications and introduction of diseases.</p> <ul style="list-style-type: none"> Impacts on planning and design or location of emergency services centers and emergency services evacuation routes/measures due to increase incidents of coastal erosion and impacts on transportation infrastructure and coastal inundation due to sea level rise, storm surge and extreme events (floods, droughts, forest fires, heat waves and storms). 			<p>updated.</p> <ul style="list-style-type: none"> DRAFT EMO Emergency Telecommunications Plan has been prepared. EMO has an organized relationship with the Amateur Radio community so HRM can provide mobile telecommunications resources to a stricken area within HRM using both Amateur Radio gear and some EMO radio gear. In terms of increasing staffing and resources to deal with emergency event situations, this is determined on a yearly basis based on needs. Standing offers are set up for fleet and equipment that may be required additionally in case of an extreme event. Educational programs and initiatives undertaken relating to Forest Fire Preparedness Partnership with the Provincial Government related to fighting forest fires and education around the issues. 	

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		<ul style="list-style-type: none"> Advise planning and legal on the areas of establishment of appropriate adaptation and risk reduction measures, including protection, abandonment, compensation and legal issues for coastal property and private residences facing increased erosion. Sea Level Rise Risk Assessment should be undertaken for new coastal developments. Hydrogeological assessments should be undertaken for all new developments. Forest Fire risk assessments should be undertaken for new developments. Fire protection requirements should be reviewed and updated as required. 	<ul style="list-style-type: none"> Land Use Bylaw Regional Plan Note specific policies relating to CC. New Development: required a vertical elevation 2.5 m from water courses and a horizontal setback of 20m. 	<ul style="list-style-type: none"> Will participate in Regional Plan review 2011 to further consider risk reduction measures related to Climate Change to update Bylaws (i.e. 2.5 m and 20 m currently used could change) Fire Services is on Community Developments consultation list for discretionary approval development agreements, as well as large scale by-right subdivision developments. <p>See Community Development for more.</p>	

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		<ul style="list-style-type: none"> Community Risk Management Guide disseminated to vulnerable communities in consultation with SEMO Impact of increased intensity/frequency of extreme events needs to be factors in with regards to vulnerable communities. Emergency management and contingency planning needs to be expanded at the community level, through the establishment of community preparedness plans. 	<ul style="list-style-type: none"> Community Risk Management Guide for CC and Emergency Preparedness (2010). 	<ul style="list-style-type: none"> The Community Risk Management Guide Developed as part of Climate SMART, is up-to-date (2010) completed by SEMO in consultation with EMO. Joint Emergency Management Teams exist in 5 areas of HRM – Eastern Shore JEM, Musquodoboit Valley JEM, Tantallon JEM, Fall River JEM, and Sheet Harbour JEM. These teams are responsible among other things for coordinating neighbour/community preparedness and awareness. Fire and Emergency Services has been increasing the number of these teams in HRM. 	
				See Infrastructure and Asset Management for information on Community Outreach.	

Business Units (BUs) Impacted	Relevant Climate Change Impacts	Adaptation Responses and Requirements	Are the Responses and Requirements included in Legislation, Policy or Documentation?	What actions have been taken by the BU to achieve the Adaptation Responses and Requirements?	Other Responsible Entities – non HRM
		<ul style="list-style-type: none"> Data from Climate SMART project and follow-up studies. Including improved topographic mapping using LiDAR for all of HRM. Improved hazard mapping e.g. LiDAR to delineate zones of vulnerability and prioritize protection/relocation. Inventory and development of vulnerability maps of coastal ecosystems, communities, infrastructure and buildings at risk from Climate change impacts. Need to identify and map vulnerable critical utilities and infrastructure within HRM to allow emergency services providers to be able to respond on a priority basis Geo-locate all emergency service centres and evacuation routes and prioritize based on likelihood of flooding or other know climate change factor. 	<ul style="list-style-type: none"> Land Use Bylaw Regional Plan Note specific policies relating to CC. New Development: required a vertical elevation 2.5 m from water courses and a horizontal setback of 20m. 	<ul style="list-style-type: none"> Small pilot project to start in the rural areas with JEMs in relation to vulnerability mapping (SEMO, EMO). See Community Development for more. 	

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		<ul style="list-style-type: none"> • Develop a multi-agency response model that is consistent with current industry practices. • Continued and more organized and consistent collaboration with other business units in HRM to incorporate climate change in the EMO system. Also continued cooperation and collaboration with other levels of Government. • Discussions to be held, between municipal, provincial and federal agencies on the designation of one emergency response system. • An improved understanding of the adaptive capacity of the health response service (provincially operated) in HRM to address increased outbreaks of diseases and illnesses associated with climate change. 		<ul style="list-style-type: none"> • An inter-agency liaison committee to determine and share critical infrastructure data exists. • SEMO, EMO, CD have created partnerships to educate on, and prepare the community for climate change risks. Future opportunities for partnerships (i.e. with Fire Services) are also been investigated at this time. • CD, RPP, have been working together on vulnerability assessment for Halifax Harbour related to Sea Level Rise. SEMO and EMO are also looking at this work, and determining how to use this information for emergency planning opportunities in addition to landuse planning. 	

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Infrastructure and Asset Management (Peter Duncan, John Charles, Roger Wells, Peter Bigelow, Dave Hubley)	<ul style="list-style-type: none"> Climate Change will profoundly impact all policies and programs relating to environmental sustainability. Greater incidents of building and infrastructure failure due to increased intensity and scope of extreme events (floods, droughts, heat waves, storms etc.) resulting in increased risk of exposure to litigation and added demands for improvements to building inspections services and standards. Potential disruption of waste collection and management services due to impacts on transportation infrastructure from coastal erosion, coastal inundation, and extreme events (floods, storms forest fires). Increased demand for water recreation parks due to longer and warmer summers likely to result in more drought and greater need for irrigation. Increased demand for biological control agents in recreational parks due to potential for increased variability in incidents and location of pests, and on the natural disturbance regime, pest cycle and rate of in- 	<ul style="list-style-type: none"> In collaboration with the CAO work with Federal and Provincial Governments to develop and implement appropriate Climate Change Risk Management Policies. Active participation with other levels of government in updates for Design Criteria – Engineers Canada/NS, CSA Standards. Studies and information on climate change should be incorporated into infrastructure planning (i.e. culvert sizes, sea level rise). Additional liaison with similarly sized municipalities, in particular coastal municipalities to share knowledge. 	<p>The IAM Business Plan outlines a number of priorities specific to Climate Change</p>	<ul style="list-style-type: none"> HRM participated briefly on a working group for PIEVC, has not reviewed the report finalized in 2008. No changes have been made to our Redbook since 2007 that related to adapting to Climate Change. Gas Tax Funding Requirement – ICSP to include Climate Change Action Plan. HRM has been involved in the Provincial Coastal Consultations, which has included contributions and liaison with other coastal communities throughout NS. HRM RAC-ACAS partner with a number of projects. This work with the NS Climate Change Directorate should bring other municipalities together to discuss adapting to climate change. Participation in CIP, discussions with other municipalities and provinces at this forum, CIP Conference 2010 – Focus on Climate Change. Process for Capability Projects (a project that increases or expands a level of service, new development) when the capital steering committee is reviewing a project they fill out of complete a Capital Supplementary Sheet, this sheet has been ex- 	<ul style="list-style-type: none"> EC and NRCan for climate change modeling and sealevel rise/inundation modeling. EMO NS; Public Safety and Emergency Preparedness Canada; NSTPW PIEVC CIP Development Community NSDNR (Forest Fires) EC Programs for donating land University partners

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	<p>festation.</p> <p>Anticipated increased insurance costs associated with damage to buildings and infrastructure from sea level rise.</p>			<p>panded to look at economic, social and environmental benefits, which would in turn consider some climate change related implications. However, this sheet is not yet a formalized process.</p> <ul style="list-style-type: none"> • The recapitalization of the Northwest Arm Seawalls and Cole Harbour Salt Marsh Trail is using best science to inform on the project specification with engineering studies completed by Coldwater Consulting that take into account climate change impacts in HRM. 	
					<ul style="list-style-type: none"> • 5 year review of regional plan.

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		<ul style="list-style-type: none"> Information to be provided to the community level through HRM communications including Naturally Green and the HRM website. Appropriate adaptation risk assessment and risk management measures incorporated into municipal physical planning processes and guidance provided to assist developers in assessing possible risks. Policy set related to Climate Change specifically should be included in the 5 year Regional Plan review. Community Outreach by SEMO. 	<ul style="list-style-type: none"> The Community Action Guide The Regional Plan Developers Risk Management Guide SLR Study 	<p>Planned policy set relating to climate change including policies relating to Energy Conservation, Water Conservation and SW Management.</p> <ul style="list-style-type: none"> LEED for Neighbourhood Design principles to be incorporated into next review of regional plan. SLR Study incorporated by developers for development around Halifax Harbour, in development agreements. Developers Risk Management Guide to Climate Change, planned update in 2011. Review of benefits of a tool such as this by Dalhousie. NSDNR Forest Fire guidelines for urban wildland interface provided to developers at risk. Presentations are being made to Joint Emergency Management Teams (JEMs) regarding the Community Action Guide and its dissemination SEMO is providing presentation on the guide to community groups upon request SEMO has received Provincial CC Adaptation Funding to undertake the vulnerability and Risk 	

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		<ul style="list-style-type: none"> Consideration of Climate Change Risk Issues in the HRM Risk Management Plan. 	<ul style="list-style-type: none"> Yearly Risk Management Plan 	<p>Mapping portion of creating Community Action Plans. This will be used to pilot the creation of these maps for a select few communities within rural HRM.</p>	
	<ul style="list-style-type: none"> Vulnerability assessments to determine species and park areas at risk. Parks may need to modify species mix to be compatible with projected climate changes (longer dry periods, increased temperatures, pest infestations). Investigate biological control options for pest management and assess capacity for improved irrigation options. Apply findings of research on the impacts of climate change on terrestrial and aquatic ecosystems as the information becomes available. Urban Forest Master Plan should be developed (new). 	<ul style="list-style-type: none"> Point Pleasant Park Masterplan 	<ul style="list-style-type: none"> Urban Forest Master plan to include policy recommendations relating to species mix. Template for Vulnerability Assessments developed as part of the Point Pleasant Park Masterplan and now being used in the UFMP. The Point Pleasant Park Masterplan considered mix of plant cover considering future climate change in terms of species selected; those species that are being selected in the park are being so for long term viability. Biological control options have been piloted for Himalayan balsam and Japanese knotweed that were semi-successful. Moving towards controlled application of herbicide. 		

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Legal and Risk Services (Mary Ellen Donovan, Peter Ross)	<ul style="list-style-type: none"> Increased Demand for by-laws that will restrict or control development in vulnerable areas. Vulnerability and exposure to climate change impacts resulting in an increased in the scope and range of HRM risk assessment and management framework to satisfy "due diligence". 	<ul style="list-style-type: none"> Buying Vulnerable Coastal Land, restricting development. Land donations under existing revenue Canada Tax Programs <p>Assess costs of expropriation in vulnerable areas. Encourage Land Owners to donate lands for conservation under existing revenue Canada tax programs.</p>	<p>Are the Responses and Requirements included in Legislation, Policy or Documentation?</p>	<ul style="list-style-type: none"> At this time 4 parcels of coastal land have been purchased primarily to provide access, but also development has been restricted by Real Property Planning. (e.g. Cow Bay, Shad Bay). At this time no lands have been donated under existing Revenue Canada Tax Programs, however, Real Property Planning has been involved in discussions on potential changes to this tax law. Issues with the Law before used to require that capital gains be paid on the land, this will likely not be required based on discussions. 	
		<ul style="list-style-type: none"> Consideration of Climate Change Risk Issues in the HRM Risk Management Plan. Future Bylaw Development when required in consultation with other business units (e.g. Community Development) 	<p>Corporate Risk Management Plan (yearly)</p> <ul style="list-style-type: none"> Land Use Bylaw Regional Plan 	<ul style="list-style-type: none"> HRM Risk Management Plan considers Climate change, and immediate yearly requirements for dealing with Climate Change if necessary, if issues are showing to be pressing in the Risk Matrix. 	Other levels of government

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Transportation and Public Works (Beate Shannon)	<ul style="list-style-type: none"> Potential Disruption to transportation infrastructure due to impacts from sea-level rise, coastal erosion, inundation and impacts from increases in intensity of extreme events (floods, storms) Increased costs for road maintenance both winter and summer to mitigate impacts on pavement from frost heave and heat Increased variability in demand for snow and ice removal due to impacts on snow and rainfall patterns Greater demand on emergency services vehicles due to impacts from extreme events 	<ul style="list-style-type: none"> Need additional insurance coverage and development of measures to reduce insurable risk from climate change impacts HRM needs to investigate appropriate insurance approaches for vulnerable coastal communities and infrastructure. 	<ul style="list-style-type: none"> Not required at this time. Insurance exclusions change by the insurance companies as a result of climate change (i.e. if HRM has INFC in a flooded area, the exclusion on that property may change to exclude flooding, no longer covered for funding). HRM would not investigate appropriate insurance approaches for residents. This is not a municipal responsibility. 	<ul style="list-style-type: none"> Not required at this time. Insurance exclusions change by the insurance companies as a result of climate change (i.e. if HRM has INFC in a flooded area, the exclusion on that property may change to exclude flooding, no longer covered for funding). HRM would not investigate appropriate insurance approaches for residents. This is not a municipal responsibility. 	
	<ul style="list-style-type: none"> No specific contingency plans, work is often done in consultation with Fire and Emergency services in terms of response. Events are dealt with on an event by event basis, can't write contingency plans for each and everything because there is just too many different areas in HRM. Reciprocal agreements have been formed with different municipalities and organizations to help in response (equipment, staff, and other resources), standing offers with others. In terms of increasing fleet and staff to deal with emergency event situation, this is determined on a yearly basis based on needs. Currently HRM is actually decreasing fleet; standing offers are set up for fleet 	<ul style="list-style-type: none"> Develop contingency planning for impacts on transportation infrastructure in collaboration with Fire and Emergency and Police Services Incorporation of Climate change Risk Assessment into business unit planning Increases in vehicle fleet to meet anticipated risks. 	<ul style="list-style-type: none"> No specific contingency plans, work is often done in consultation with Fire and Emergency services in terms of response. Events are dealt with on an event by event basis, can't write contingency plans for each and everything because there is just too many different areas in HRM. Reciprocal agreements have been formed with different municipalities and organizations to help in response (equipment, staff, and other resources), standing offers with others. 	<ul style="list-style-type: none"> No specific contingency plans, work is often done in consultation with Fire and Emergency services in terms of response. Events are dealt with on an event by event basis, can't write contingency plans for each and everything because there is just too many different areas in HRM. Reciprocal agreements have been formed with different municipalities and organizations to help in response (equipment, staff, and other resources), standing offers with others. In terms of increasing fleet and staff to deal with emergency event situation, this is determined on a yearly basis based on needs. Currently HRM is actually decreasing fleet; standing offers are set up for fleet 	NS Transportation and Infrastructure Renewal; Public Safety and Emergency Preparedness Canada

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	(floods, droughts, forest fires, heat waves and storms)			<ul style="list-style-type: none"> and equipment that may be required additionally in case of an extreme event. If Climate Change Risk Issues are identified as part of Risk and Insurance Services Risk Assessment Process, and part of this involves an action or requirement of Transportation and Public Works, they will be tasked with responding. 	
		<ul style="list-style-type: none"> Inventory and the development of vulnerability maps of communities, infrastructure and buildings at risk from climate change impacts. Appropriate adaptation risk assessment and risk management measures incorporated into municipal physical planning and waste management processes. Improved Hazard mapping to delineate zone of vulnerability 		<ul style="list-style-type: none"> Vulnerability Mapping for Halifax Harbour being done by Community Development. Need for other areas outside of HH. 	

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		<p>and prioritize protection or re-location.</p> <ul style="list-style-type: none"> • Data from Climate SMART project and follow on studies (if funded) 			
		<ul style="list-style-type: none"> • Will require additional resources to address increased deterioration of roads. 		<ul style="list-style-type: none"> • Maintenance staff on the ground proactively looking for impacts to our infrastructure during events, and in general. 	

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Community Development (Roger Wells, Thea Langille, David Lane, John Charles, Maureen Ryan, Maria Jacobs)	<ul style="list-style-type: none"> 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. Impacts on planning and design or location of emergency services centers, and emergency services evacuation routes/measures due to increase incidents of coastal erosion and impacts on transportation infrastructure and coastal inundation due to sealevel rise, storm surge and extreme events (floods, droughts, heatwaves, storms) Increased uncertainty in settlement patterns and urban planning due to climate variability, sea level rise and impacts from extreme events. Impacts on viable land use and zoning options due to increased risks from forest fires in the urban/rural fringe. 	<ul style="list-style-type: none"> Revised vulnerability mapping will be required to identify the areas unsuitable for development due to flooding or coastal inundation risks. Local planning advisory committees, community groups and the general public need to take a pro-active role in identifying ecosystems, identifying eco-systems, buildings, infrastructure and essential services that are vulnerable to climate change impacts, and establish appropriate adaptation measures to reduce risks. Planning regulation (i.e. By-laws and policies) to limit development in high risk areas. i.e. Setbacks. Forest fire assessments should be conducted for new developments in urban/rural fringe. These assessments must include consideration that forest fire risks will increase. Better understanding of groundwater carrying capacity needed in areas proposed for development Enforcement of proposed setbacks. Updating of setback requirements as vulnerability data improves. 	<ul style="list-style-type: none"> Land Use Bylaw Regional Plan Note specific policies relating to CC. New Development: required a vertical elevation 2.5 m from water courses and a horizontal setback of 20m. 	<ul style="list-style-type: none"> 5 year review of regional plan. Planned policy set relating to climate change including policies relating to Energy Conservation, Water Conservation and SW Management. LEED for Neighbourhood Design principles to be incorporated into next review of regional plan. SLR Study incorporated by developers for development around Halifax Harbour, in development agreements. Provision of Sea Level Rise Study (2009) to development in HH is being required in currently being required Development Agreements. Developers Risk Management Guide to Climate Change, planned update in 2011. Review of benefits of a tool such as this by Dalhousie. NSDNR Forest Fire guidelines for urban wild land interface provided to developers at risk. Halifax Charter (ja) with respect to subdivision applications that are located outside the serviced area as that term is defined in Section 190 and that are for the 	EC and NRCan for climate change modeling and sea level rise/inundation modeling; NSDNR, Development Community, Halifax Water, Universities, Province

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				<p>creation of ten or more lots, requirements for hydrogeological impact assessments including an evaluation of the quality, quantity and sustainability of water supply within the proposed subdivision and an evaluation of the cumulative impacts on water supplies outside of the proposed subdivision; (jb) in areas where hydrogeological impact assessments are required, water supply standards that must be met before a subdivision can be approved, for quantity, sustainability of water supply and for the cumulative impact on water supplies outside of the proposed subdivision;</p> <p>• Tree Planting/Cutting – HRM requires a 20m riparian buffer zone around water courses, otherwise tree preservation is typically done by the free will of the Developer or as a measure to placate opposition to a development. new provincial legislation re: Private Property. Need to consider bylaw changes to deal with this, and enforcement (CD).</p> <p>• LIDAR Project – In 2007 LIDAR Data was captured by PHB Laser map covering a total of 1400 square km incl. HH Drainage</p>	

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				Basin and East Peteswick Peninsula (recommendation re: more lidar for other parts of HRM).	

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		<ul style="list-style-type: none"> • Data from Climate SMART project and follow on studies (if funded). • Improved topographic mapping, e.g. LiDAR to delineate zones of vulnerability. GIS database. • Improved topographic mapping, e.g. LiDAR to delineate zones of vulnerability and prioritize protection/relocation. • Incorporation of climate change risk assessment into business unit integrated risk assessments. 		<ul style="list-style-type: none"> • Vulnerability Mapping for Halifax Harbour being done by Community Development. Need for additional areas outside of Halifax Harbour • Sea Level Rise Study (2009) In 2008, a Dalhousie University Master of Planning Candidate conducted the "Planning for Climate Change and Coastal Zone Management: Land Use Vulnerability, Hazard, and Exposure in Halifax Harbour" study which was delivered to HRM in April of 2008. She developed a matrix of elements where each parcel of land would be either given a point or not based on impacts for the Dartmouth Plan area. • Following this a COGS student further examined and developed the "Risk and Vulnerability Assessment Tool" or matrix. Delivered in 2009. This expanded the work on the Vulnerability analysis for the "Sea Level Rise Adaptation Planning" initiative. • A report on the sea level rise scenarios for 100 year planning was completed and mapped, used LiDAR. • Community Development made further adjustments to the Vulnerability Matrix. They added 	

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				<ul style="list-style-type: none"> the 23 elements and seven sea level rise scenarios to the vulnerability matrix. With assistance from our GIS team these changes were added and applied to all of the lands abutting Halifax Harbour up to the 5 metre contour. Partnerships with Universities in NS to build on vulnerability work. DAL Project on Musquodoboit Harbour. 	
		<ul style="list-style-type: none"> The evaluation of the cost of converting privately owned coastal land back to public land in most vulnerable areas compared to the costs of fortification and/or compensation. 		See Infrastructure and Asset Management	
CAO (no meeting)	Any impacts on HRM resulting from climate change are relevant to the CAO's office as climate change will affect overall operations, service delivery, insurance, and liability	<ul style="list-style-type: none"> The CAO must provide direction to staff to implement the consideration of climate change in business unit planning e.g. through risk assessment approaches. It also must communicate the implications of climate change to Regional Council. Increased collaboration with federal and provincial governments to develop com- 	HRM Risk Management Plan considers climate change, and immediate yearly requirements for dealing with Climate Change if necessary, if issues are showing to be pressing in the Risk Matrix.	<p>A new Committee of Council was initiated in January 2011. The <i>Environment and Sustainability</i> Committee will provide a new platform to communicate climate change risks, priorities and associated costs.</p>	Provincial and federal governments, Union of Nova Scotia Municipalities, Federation of Canadian Municipalities.

Business Units (BUs) Impacted	Relevant Climate Change Impacts	Adaptation Responses and Requirements	Are the Responses and Requirements included in Legislation, Policy or Documentation?	What actions have been taken by the BU to achieve the Adaptation Responses and Requirements?	Other Responsible Entities – non HRM
		<p>plementary climate change adaptation programs and to provide necessary modeling data.</p> <ul style="list-style-type: none"> Set policy that requires all business units to incorporate climate change in risk assessment undertaken as part of annual business plan development. <p>Facilitate increase in capacity and resources required by Business Units to adequately manage risks.</p> <ul style="list-style-type: none"> Provide guidance information and tools for staff to implement policy direction on climate change adaptation and risk management approaches. Incorporation of climate change risk assessment into business unit integrated risk assessments. Dedicated personal to facilitate coordination of appropriate risk management measures with Provincial and federal governments. Union of Nova Scotia Municipalities Federation of Canadian Municipalities. 			
Halifax Water (no meeting)	<p>It should be noted that since the development of the Risk Management Strategy, the responsibility for stormwater and wastewater management no longer lies with Halifax Regional Municipality but with Halifax Water. Therefore, some of the actions outlined in the risk management strategy are no longer</p>				

Business Units (BUs) Impacted	Relevant Climate Change Impacts	Adaptation Responses and Requirements	Are the Responses and Requirements included in Legislation, Policy or Documentation?	What actions have been taken by the BU to achieve the Adaptation Responses and Requirements?	Other Responsible Entities – non HRM
	within HRMs control and have therefore not been addressed in this update. However, as the stormwater management functional plan is developed HRM will be working closely with Halifax Water and Climate Change will be a consideration in this plans development.				

Appendix B: Business Plan Summary Review

Community Development: while not directly addressing climate change as a challenge in their plan they do consider related requirements in their business plans strategic and operational goals. Adaptation to climate change will have an impact on their mandate, whether it is enforcement related to new bylaws (including setbacks, riparian buffers and so on), the review of the Regional Plan, and of course, the development of the Hazards to Development Functional Plan. All these things are hugely important to HRMs adaptation. Any planning and discussion around more requirements for development relating to climate change considerations, must involve them, they would have to review any planning applications with these considerations in mind. They have considered related things in their strategic and operational goals in terms of enhancing their service delivery.

Fire and Emergency Services – While climate change was not referenced specifically, it is clear through the business plans challenges and priorities that work will be required on their part relating to climate change. Fire and emergency services are one of the most affected business units as the climate continues to change (i.e. more emergency response requirements relating to extreme weather events, storm surges etc., increase in staffing and training, and new technology required to deal with the potential for more forest fires etc.). The business plan notes that Fire and Emergency Services are facing challenges with developing and maintaining strategic partnerships (Table 6-1 discusses the need to ensure intergovernmental collaboration to incorporate climate change in EMO system) and increasing citizen's emergency capability (Table 6-1 which states Community Risk Management Guide disseminated to vulnerable communities and expanding emergency management and contingency planning at the community level, and assist in the establishment of community preparedness plans).

Part of increasing emergency capability in the business plan mentions the need for Joint Emergency Management (JEM) teams, and the development of more things like these teams to increase capacity. Fire and Emergency Services has been increasing the number of these teams in HRM, recently adding a JEM team in Fall River.

One of the biggest pieces of the Business Plan that relates to Climate Change is the requirement for Business Continuity Planning to be led by EMO. EMO is to provide leadership and support to all business units and affiliated agencies to ensure corporate readiness in the events of a disaster of large scale emergency situation. This includes the development of emergency plans, training and exercises among other things. Some of the specific objectives in the plan include specific or similar requirements listed in Table 6-1 for example the requirement to conduct a Hazards and Risks Vulnerability Analysis of the municipality.

Other examples relating to climate change and emergency preparedness in this business plan includes using the information from a hazards and risk assessment to coordinate the development of an overall business continuity plan for implementation. Also, the Development of comfort sectors updating evacuation centre profiles and creating an infectious disease plan. =

In Table 6-1 it also discusses the need to increase resources to deal with events and increases in forest fires. It is noted in the Business Plan that realigning staffing is done on a daily basis is done to ensure they are meeting their goals and maintaining service delivery. It also discusses relationships that have been built with other agencies to respond to such events.

Infrastructure and Asset Management: Infrastructure and asset management plays the lead role in the coordination of infrastructure related services, and therefore is one of the most crucial business units in terms of adapting to climate change. IAM deals with real property planning, sustainability, strategic transportation planning, facility development, design and construction and infrastructure planning. All these fit into HRMs ability to mitigate and adapt to climate change. In the challenges section of their business plan, aging infrastructure is mentioned, along with promoting the concept of sustainable development, corporate and community environmental stewardship, there is no specific mention to climate change challenges relating to our infrastructure. Strategic goals include long range capital planning, asset management strategy and environmental sustainability. All of these goals require the consideration of climate change in order to bring them to fruition in a responsible matter. There are some specific actions listed under these the strategic goal of environmental sustainability that mentions climate change and relates back to requirements listed in the Risk Management Strategy relating to risk management, watershed planning, and hazards to development:

- Lead the completion of the next phase of the development of the Watershed Study program ;
- Development is accommodated in HRM with a greater emphasis on sustainability and both public and private infrastructure is better protected from environmentally based hazards;
- Deliver an HRM Corporate Climate Change Management Strategy;
- Complete IAM contribution to the development of the environmentally based Hazard Management Functional Plan as set out in the Regional Plan;
- Increase energy efficiency and reduce building-related greenhouse gas emissions for HRM facilities;
- Promote and support legislative changes to require increased energy efficiency and reduce greenhouse gas emissions for all buildings and development in HRM.

The operational goals have elements that in some way should consider climate change, in particular the goal to implement HRMs Asset Management Program. The steps under this goal include the completion of the Urban Forest Master Plan, and working with Halifax Water to develop clear policy regarding ownership and management of stormwater systems. These are important pieces to being able to move forward with new policies and practices relating to adapting to climate change. There is a discussion provided on implementing and maintaining the capital project evaluation matrix as well, this matrix should include climate change considerations. It does mention that the Municipal Service Guidelines (the Redbook) should be updated. It was surprising to see that the implementation of HRMs Asset Management Program did not include a requirement to work with other levels of government to develop new design criteria and standards that consider climate change or to incorporate the recommendations of PIEVC study to our Redbook (add info on this). As indicated in Table 6-1 we need to be working with provincial and federal governments to develop and implement appropriate climate change risk management policies. The consideration of design criteria and updating to be appropriate for the changing climate should be a vital part of the next business plan.

Business Planning and Information Management: Climate Change has not been considered in this business plan. This business unit is responsible for the overall information management within the HRM organization; it is the lead in providing corporate direction regarding the collection, management, use, and protection of geographic and business data/ information under the following sections and programs. In Table 6-1 it discusses an increase in human resources to be on-call during extreme events and the need for improved hazard mapping to delineate zones of vulnerability. BPIM has some responsibility for data management and storage of the LiDAR data and the work that comes from it including vulnerability and risk maps. A discussion on this is not included anywhere in the business plan.

One of the challenges indicated in the business plan is the Lack of Information Management (IM) Policies & Practices – this is a huge challenge in terms of studies being undertaken in relation to climate change, as well as the storage of these projects and the LiDAR Data required. LiDAR should be added to the ICT Plan, it is currently not included. This should be placed as a priority for this business unit as more and more data is being collected and projects being developed, with no clear storage and management requirements. This data is not only an asset to adapting to climate change, but is also an asset that HRM can provide to outside entities for use, we could even considering selling the data.

Police Services: There is no mention to climate change risks to the police service indicated in this document. The challenges with Service Delivery Demands identified, including the police force continuing to examine technology processes and resource needs to determine the most efficient and effective way to meet the demands for service and visibility and to determine if new resources are required in the future. In Table 6-1 the possible increase in police resources, capacity, vehicles and infrastructure may be required; it discusses the need to work with EMO to develop contingency planning and also to factor in the increased intensity/frequency of extreme events with regards to human resources and delivery of services. The Police are continually examining technology processes and resource needs to determine the most efficient and effective way to meet the demands for service and visibility and to determine if new resources are required in the future. At this time the business plan does not specifically refer to extreme events.

CAOs Office: Climate Change risk has not been considered in the CAOs Business Plan; however, the plan discusses the challenges of delivering Council focus areas. Climate Change should be considered important across all of the focus areas, and should be inherent in each. Ensuring that this is included in each is extremely important and as of now, not occurring. The CAOs Business Plan also discusses those challenges of the implementation of strategic policy. There is definitely a need for more policy relating to climate change, through both mitigation and adaptation. Managing external relationships is also mentioned in the business plan. Often, the interests or mandates of more than one of our partners conflict or overlap. Effectively managing these multiple relationships is a challenge, but necessary to ensure the proper alignment of HRM's services and mandates with those of other stakeholders, as mentioned in the Risk Management Strategy we need to ensure that HRM, provincial and federal climate change priorities are in line, we need to be always thinking ahead and communicating with the province and federal government to ensure they are supporting us in our adaptation needs. We need to ensure a coordinated relationship with HRM and other levels of government on climate change priorities.

Risk and Legal Services: The business plan does not discuss climate change specifically. No Climate Change specific theme. However the plan does discuss how an increase in HRM's activities will have an impact on services provided and insurance cost. This relates to climate change. For example, with an increase in extreme events, sea level rise and storm surges the increase an increase in claims could occur around HRM infrastructure and general liability could go up. The plan also mentions that as part of business operations, staff has recognized and treated risk as much as possible without a framework or tool to help them. In evaluating the portfolio of risk within the organization, HRM needs to measure these risks against each other using a common measure. As resources are limited, the use of risk management can allow management to make decisions and assign resources effectively. The framework to do this is enterprise risk management. The first phase of working towards enterprise risk

management is to educate staff on the framework to identify and manage risk in a business unit before aggregating risk for the HRM risk portfolio. Therefore HRM is working towards a better framework to manage our risks

Finance: No specific discussion on climate change or related topics. The business plan discusses things like the review of taxes and fees to address increased costs of services etc. But does not specifically discuss how climate change may impact this.

Transportation and Public Works: Does not specifically address climate change in its business plan. However, TPWs mandate is to operate and maintains the Halifax Regional Municipality's transportation network and infrastructure including parks, buildings, structures, vehicles, streets, equipment, and solid waste management through education, quality customer service and support for a safe and sustainable environment within our Community. The business plan makes mention to the units continued efforts to balance economic growth, environmental concerns and fiscal responsibility to provide quality of life to all HRM citizens. In order to protect the environment and public safety, climate change mitigation and adaptation considerations must be made in relation to infrastructure. This is one of the business units that would be affected the most by our changing climate.

The business plan discusses the following needs that should take into account climate change:

- the need to continually review and update the redbook, reviewing and revising asphalt specifications,

The plan discusses the overall corporate movement toward a more "green" corporate culture, and indicates that TPW is committed to incorporating sustainable service practices wherever possible. As the HRM business unit with the largest workforce and greatest use of both service and transit vehicles, the commitment to being more environmentally, fiscally, socially and culturally conscious will have substantial impacts both on the organization and as a demonstration of leadership to our citizens. TPW is also responsible for providing alternative transportation options combined with an efficient transportation system and active transportation options improving the opportunities for alternative transportation. There are a number of mitigation measures considered in their business plan (i.e. Convert 300-500 conventional street lights with LED cut-off lights) but little discussed relating to adaptation.

The plan mentions the development of a five year capital plan for capability and recapitalization projects that focuses on outcomes will assist in the decision making process, aligning resources with the identified requirements; it should be noted that this plan should include adaptation to climate change considerations. This is important in terms of dealing with additional resources required to address increased in deterioration of roads as a result of climate change.

In table 6-1 under TPW it mentions the need to develop contingency planning for impacts on transportation infrastructure in collaboration with Fire and Emergency Services and Police Services. The Business plan discusses under its operational goals, the need for prepares emergency management. TPW provides substantial assistance in the municipal response to emergencies primarily through the provision of its own assets or by leveraging assets of others to accommodate/assist victims of emergencies as well as to provide the direct services to the public in order to restore the municipality to its pre-emergency state as soon as possible. As emergencies increase in complexity and affect more people, the expectation to respond in an efficient and immediate manner increases. The complexities of

asset provision and delivery of services also therefore escalate. A well developed, planned response for addressing emergency situations will ensure that the citizens receive the necessary support and level of service needed to overcome the emergency. In order to achieve this, the following steps have been listed in the Business Plan:

Emergency Plan developed and implemented for TPW

- Staffing and training plan developed and implemented for key EMO staff
- Re-write internal emergency response plan to focus on emergency management
- Participate in EMO joint planning initiatives and operations
- Develop an operational emergency management manual for each area involved directly with EMO operations including Transit, Municipal Operations, and Real Estate and Facility Services
- Complete a Business Continuity Plan and Emergency Preparedness Plan and take part in EMO sponsored exercises