



MUNICIPAL CLIMATE CHANGE ACTION PLAN

**Prepared by K. Malhotra
Climate Change Adaptation Committee
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Town Council
Sustainability Solutions Group
Union of Nova Scotia Municipalities
Federation of Canadian Municipalities



Sustainability
Solutions
Group



FCM

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1.0 INTRODUCTION

In December 2008, an extension to the Municipal Funding Agreement was announced to allow transfer of additional Gas Tax Revenues between the years 2010 and 2014 to enable municipalities to continue to invest in environmentally-sustainable infrastructure projects that contribute to reduced greenhouse gas emissions, clean water and clean air. As a result, each municipality is required to prepare and submit a Municipal Climate Change Action Plan (MCCAP) by December, 2013. The MCCAP focuses both on Climate Change Adaptation and Mitigation – how municipalities plan to respond to climate change. The Department of Service Nova Scotia and Municipal Relations has provided a guide and a template to aid municipalities in preparing the MCCAP. The MCCAP for the Town of Antigonish has been prepared using the guide and templates provided by the Province.

The Intergovernmental Panel on Climate Change (IPCC) has provided the status of climate change and its potential socio-environmental impacts. In Canada, provinces and municipalities are engaged to identify posed challenges and come up with solutions to adapt to them. Nova Scotia's recent Climate Change Action Plan¹ highlights the need to mitigate and adapt to Climate Change in years to come. The Province's work on Climate Change has concluded that warmer average temperatures, rising sea levels, and more-frequent, extreme storms are expected in years to come. As a result, the Province has identified two main goals: reduction of greenhouse gas (GHG) emissions and preparing for changes to the climate.

Communities along the coastline are especially susceptible from this occurring change in the climate. Key climate forecasts over the next 100 years in Nova Scotia are predicted as follows:

- Mean temperature increase of 1.1°C to 3.5°C by the year 2100.
- Relative sea level rise in Nova Scotia for the next century between 18 to 59 cm.
- Gradual precipitation increase between 32 mm to 100 mm by 2100.
- Increasing frequency and intensity of storms.
- High fluctuation in weather patterns.

The Municipal Climate Change Action Plan for the Town of Antigonish has established 18 adaptation priorities. The priorities are based on six hazard themes that are expected to have impact on the community and municipal infrastructure:

1. Drought
2. Heat Wave / Sustained Warming
3. Strong Wind and Hurricane
4. Intense Rain
5. Severe Winter Storm
6. Storm Surge / Sea Level Rise

Socio-economic considerations as well as impact on municipal infrastructure and the community at-large are also highlighted in the plan. In addition to identifying new adaptation priorities, the town is already moving ahead with many recommendations for mitigation that were a result of an energy audit that was conducted in 2009. The municipality has been upgrading infrastructure and applying retrofits based on the recommendations in the audit.

¹ <http://climatechange.gov.ns.ca/doc/ccap.pdf>



2.0 COMMUNITY PROFILE

The Town of Antigonish was incorporated in 1889. The town prides itself on being able to offer a good standard of living and a unique quality of life to its citizens. The town's history confirms the recognition of the importance of individuals, family, and the value of community. The Town of Antigonish is designated as a full-service community within the County of Antigonish and acts as a service centre for the surrounding region that includes Antigonish and Guysborough counties - many local businesses are based in the Service sector. The two largest employers are St. Martha's Regional Hospital and St. Francis Xavier University. The town is vibrant with almost every facet seeing growth with many new small to medium enterprises establishing in the area over the last decade. The Town of Antigonish is home to St. Francis Xavier University since 1855. The University boasts a "premier undergraduate experience" in Canada and has recently gone through an extensive revitalization program.

Antigonish's rich architectural history includes the foundation and establishment of the Sisters of St. Martha's Bethany House. The sisters established St. Martha's Hospital in 1906. One example of the strong "sense of community" in the town was reflected in 1986 when Antigonish led the way in raising a significant amount of initial capital to build a new hospital. The relationships these institutions have interwoven with the town make it the unique place it has become.

The Antigonish area experienced great deal of economic growth and retail development between 2004 and 2006 when the retail landscape of the town and county changed significantly. Much of the growth took place in the Post Road area, just outside of town. Atlantic Superstore, Walmart, and Central constructed new stores while the former Atlantic SuperValue, also located in this area, was redeveloped as a Staples Business Depot. Other areas also saw growth. In June 2005, Shoppers Drug Mart opened a new store downtown while the NSLC opened a new store attached to the existing Sobeys store, located next to mall. The following month a new GM dealership opened on the outskirts of town.

While filling essential needs of health, education and economic activity, cultural and social assets are strong and growing. Known as the "Highland Heart of Nova Scotia", Antigonish is home to the oldest, continuously running Highland Games in North America, dating back to 1861. Each year, the games bring people from all over the world to witness the varied history and culture. Other cultural assets include Festival Antigonish - the longest running theatre in Canada with a strong tradition of amateur theatre activity which has provided a firm foundation for new cultural development. The town is home to a significant number of not-for-profit organizations working on different initiatives that encompass the four pillars of sustainability. Antigonish is known for its deep rooted history in community development and known internationally for the Antigonish Movement and the COADY International Institute.

Location

Antigonish is located in the north eastern region of Nova Scotia between Pictou and Guysborough Counties as highlighted in Figure 1. The Antigonish area is made up of rural communities and the Town of Antigonish. The population of the Town of Antigonish in 2011 was approximately 4,524 not including the population of St. Francis Xavier University which is within town limits. The university's population is estimated at 4,200.



Variable	Data
Population in 2011	4524
2006 to 2011 population change (%)	+6.80%
Gender distribution (male, female)	1968, 2556
Age distribution (0-19, 20-34, 35-59, 60+)	960, 902, 1415, 1247
Immigrant count	277
Highest elevation	34 m (112 ft)
Land area (square km)	5.15
Population density per square km	878
Total private dwellings	2592
Total private households	1875
Average household size	2.4
Median household income before taxes in 2011	\$46,523
Population with post-secondary education	2087
Individuals in labour force	2376
Employed individuals	2147

Figure 1. Demographic Profile

Climate and Topography

The geographical location of Antigonish is N 45.67 degrees and W -61.91. Antigonish enjoys a moderate climate with cold winters and pleasant summers. Normal temperatures in winter range between -20 and 4 Degrees Celsius while summer temperatures range between 13 and 28 Degrees Celsius. The warmest months are July, August and September and the area goes through the normal four-season cycle. Winter is the predominant season which can last up to 5 months.

Variable	Data
Rainfall amount (annual average)	97.98 mm
Snowfall amount (annual average)	17.38 mm
Wind speed (annual average)	16 km/h
Average Daily Temperature – July	Low 12.4 C, High 24 C
Average Daily Temperature – January	Low -11.6C, High -1.5C
Elevation (mean metres above sea level)	10 to 40 metres

Figure 2. Climatic Data

3.0 MCCAP PROCESS

The process for the preparation of the MCCAP was undertaken by the municipality in August 2012. The MCCAP has resulted in identifying adaptation priorities that reinforce the larger environmental goals identified in the municipality's Integrated Community Sustainability



Plan. The MCCAP will allow for better local planning as part of a holistic approach to tackle the challenges posed from climate change. The chart below shows the planning process used in the development of the MCCAP.

Deliverable / Task	Goal / Strategy / Action	Timeline
Orientation and formation of Climate Change Adaptation Committee.	Understand requirements and establish a Climate Change Adaptation Committee (CCAC).	August 2012
Literature review and stakeholder meetings. Adaptation: Identify Climate Change issues & hazards, assess as well as affected locations.	Gather information from relevant documents including Municipal Strategic Plan, Municipal Planning Strategy, Integrated Community Sustainability Plan, Emergency Management Organization, Provincial Climate Change Strategy to: <ul style="list-style-type: none"> • Develop a draft list of hazards. • Inventory affected locations - facilities and infrastructure and who is affected. 	September 2012
Adaptation: Identify who will be effected and how. Assess risk and vulnerability. Identify foreseen issues resulting from Climate Change.	<ul style="list-style-type: none"> • Identify stakeholders that will be affected and how the municipality will be prepared to engage in / intercept a weather- related emergency. • Identify how the EMO plan will be integrated. • Identify potential economic implications locally and regionally, as a result of Climate Change. 	October 2012
Adaptation: Establish Priorities for Adaptation.	Identify priorities based on the hazard analysis.	November 2012
Mitigation: Municipal energy and green house gas reduction.	<ul style="list-style-type: none"> • Prepare description of how municipality intends to reduce energy use with the overall objective of reducing green house gases. • Provide reference to UNSM corporate energy emissions spreadsheet. 	December 2012
Mitigation: Establish Goals & Actions pertaining to the mitigation.	<ul style="list-style-type: none"> • Consult with stakeholder for goals and actions. • Prepare a list of goals and actions based on consultations 	February 2013
MCCAP: Draft Copy and Presentation.	<ul style="list-style-type: none"> • Prepare draft to review with CAM committee. • Meet with SNSMR to tweak draft. • Prepare final plan for presentation to and approval of Town Council. • Submit approved plan to SNSMR. 	March 2013
Final Submission	<ul style="list-style-type: none"> • Prepare final plan for presentation to and approval of Town Council. • Submit approved plan to SNSMR. 	April 2013

Figure 3. MCCAP Planning Process



Climate Change Adaptation Committee

The Town of Antigonish formed an Adaptation Committee in August 2012 to oversee the preparation of the MCCAP and to provide advice on Climate Change and other environmental matters to Council in an ongoing manner. The Committee was approved by Town Council in December 2012 as follows:

Council Minutes December 17, 2012:

RE: Municipal Climate Change Adaptation Committee

Moved by Councillor J. MacPherson. Seconded by Councillor S. Cameron.

“That the Town approves the creation of a Municipal Climate Change Adaptation Committee to develop the Municipal Climate Change Action Plan and provide advice on climate change and environmental matters to Council.”

The Committee’s Terms of Reference is available in *Appendix 7.1*. The membership includes Town Council members, staff from the town’s internal departments and community members with specific expertise to aid in the preparation of the MCCAP (*Appendix 7.2*) and mandated to continue on in the role of Sustainability Committee at-large for the Municipality of the Town of Antigonish.

4.0 CLIMATE CHANGE IN ANTIGONISH

Climate Change predictions for Nova Scotia generally apply to the Antigonish Area with small variation between inland and coastal regions. Based on accumulated data and analysis conducted, there are moderate changes expected in the climate over the next 50 to 100 years in the Antigonish Area. Based on the data available on the Climate Change Nova Scotia Website² and other sources, the following charts show temperature, precipitation and sea level rise projections between 1980 and 2080.

Season	Historical 1980s	Projected 2020s	Projected 2050s	Projected 2080s
Winter	-5.4°C	-4.3°C	-3°C	-1.7°C
Spring	+3.5°C	+4.4°C	+5.5°C	+6.6°C
Summer	+16.8°C	+17.8°C	+19°C	+20.1°C
Autumn	+8.1°C	+9.2°C	+10.3°C	+11.5°C
Annual	+5.7°C	+6.8°C	+8°C	+9.2°C

Figure 4: Temperature Projections in Antigonish

² <http://www.climatechange.gov.ns.ca/adaptation/49#table>



Season	Historical 1980s	Projected 2020s	Projected 2050s	Projected 2080s
Winter	+363.6mm	+377.8mm	+385.1mm	+404mm
Spring	+324.3mm	+334.3mm	+339.5mm	+352mm
Summer	+291.5mm	+296.6mm	+294.1mm	+294.7mm
Autumn	+403.9mm	+407.1mm	+404.4mm	+411.3mm
Annual	+1383.3mm	+1415.8mm	+1423.6mm	+1462.5mm
Difference vs Historical	+32.5mm	+32.5mm	+40.33mm	+79.22mm

Figure 5: Precipitation Forecasts

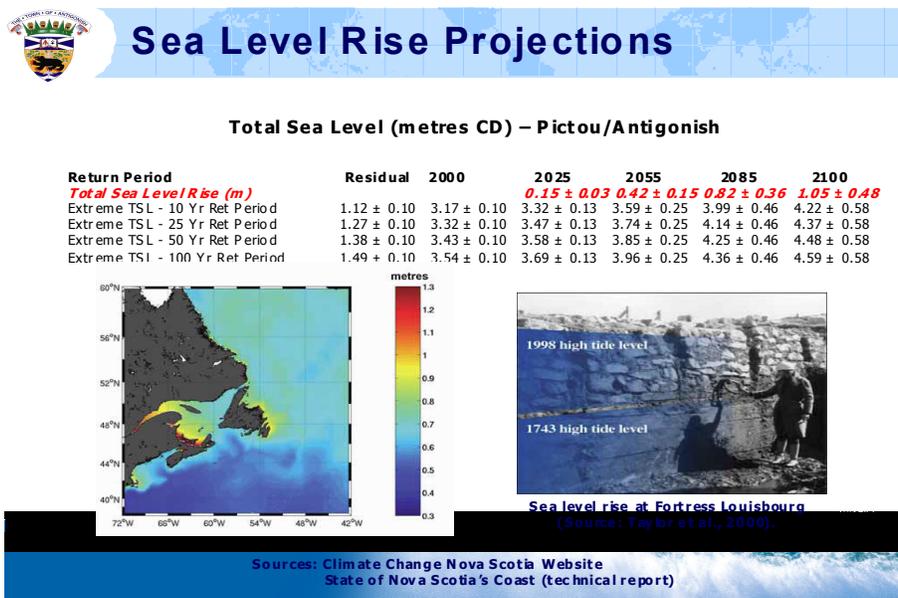


Figure 6: Sea Level Rise Projections

As part of the process to understand Climate Change, vulnerability and risks assessments were completed by the municipality based on historic climatic data. As a result, the following observations were made about climate change and potential sea-level rise:

- Coastline infrastructure at risk due to coastal flooding impacting area in the County of Antigonish.
- Faster erosion of shorelines impacting area in the County of Antigonish
- Greater risk of inland flooding.
- Intensive storm damage from storm surges and high winds.
- Warmer temperatures in summer with heat waves causing water shortages.
- Higher intensity of storms of greater frequency and with faster winds will pose infrastructure damage.
- Salt water intrusion will pose challenges to drinking supplies and natural surroundings.



The Adaptation Committee prepared multiple Sea Level Rise scenarios using Google and other tools to visualize the impact and better understand challenges under different scenarios.

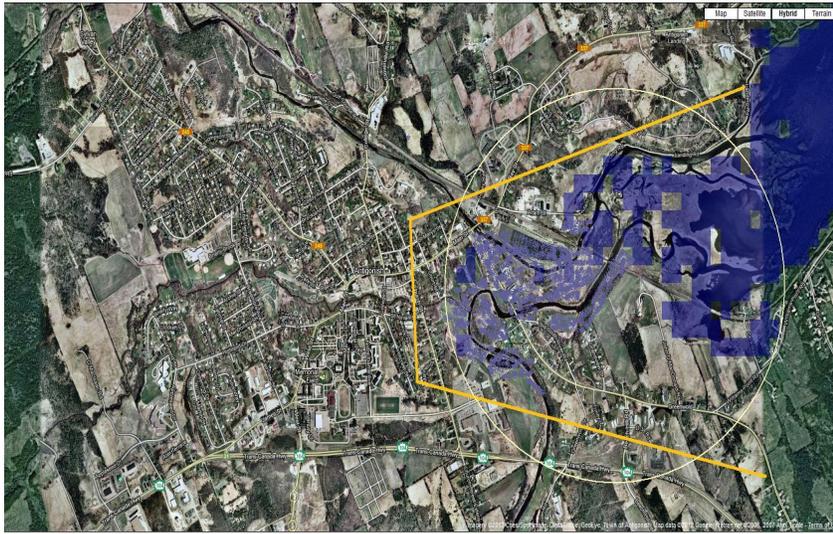


Figure 7: Sea Level Rise Projections up to +1 meter

While some of the scenarios were extreme depictions of what could happen, the exercise was useful in identifying vulnerabilities and potential actions that would need to be taken as well as how the actions integrate with Emergency Management Organization (EMO). Primary focus was given to the potential of flooding and its impacts as parts of the Town of Antigonish are in low-lying areas that are already susceptible to flooding. While the overall consequences of impacts from Climate Change on communities on the north-eastern shoreline of Nova Scotia have the ability to cause damage to infrastructure, it is noted that there are adequate resources already in place that can be mobilized in case of an emergency, especially in the Town of Antigonish.

5.0 ADAPTATION

The municipality has accepted the general definition of Adaptation in the context of Climate Change to be *“initiatives and measures that reduce the vulnerability of natural and human systems against actual or expected climate change effects.”* Climate change adaptation refers to actions that reduce the negative impact of climate change, while taking advantage of potential new opportunities. It involves adjusting policies and actions because of observed or expected changes in climate. Adaptation can be reactive, occurring in response to climate impacts, or anticipatory, occurring before impacts of climate change are observed. It is with hope that in most circumstances, anticipatory adaptations will result in lower long-term costs and be more effective than reactive adaptations.

The Regional Emergency Management Organization (EMO) Plan provides a detailed account of mobilization of resources in emergencies that go beyond the scope of available resources of the municipality. The EMO Plan was reviewed to ensure that the hazards identified in the MCCAP are covered and that measures are in place to deal with any



emergencies arising from those hazards. It is expected that in the near future any emergency needs resulting from the MCCAP will be incorporated into the EMO Plan.

Hazard Analysis

The Adaptation Committee consulted with stakeholders to identify hazards and vulnerabilities, their anticipated frequency, affected locations, impact on facilities and infrastructure, as well as potential socio-economic implications. Mapping and other visual tools were used to study the potential impacts of hazards.

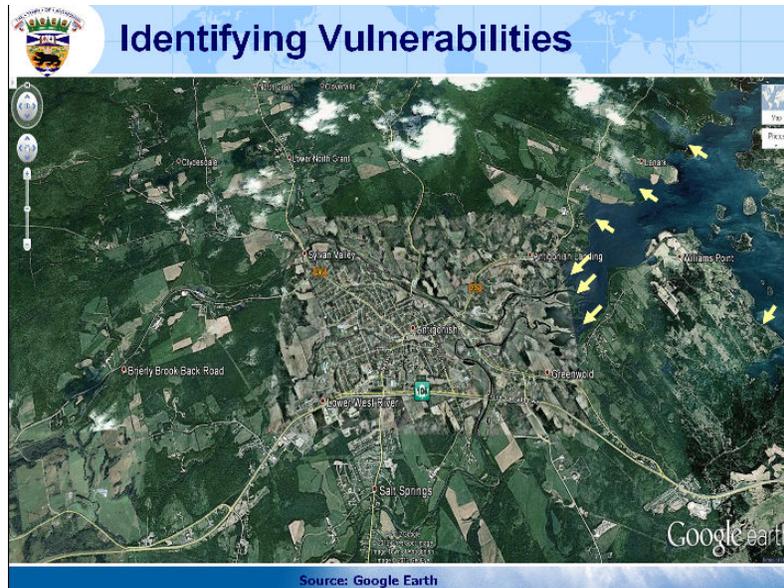


Figure 8: Vulnerability Assessment of Storm Surge

A Municipal Property Risk Map has also been prepared (*Appendix 7.3*). Municipal assets were identified and layered on the latest Flood Risk map for the Town of Antigonish and its fringe areas. In order to measure the risk posed to the community from each hazard, a frequency and vulnerability chart has been developed as follows.

Numeric value assigned	Frequency	Vulnerability
1	1 in 100 years	Low
2	1 in 35 years	Medium
3	1 in 20 years	Medium-High
4	1 in 10 years	High
5	1 in 5 years	Very high

Figure 9: Frequency and Vulnerability Values

6 hazard themes have been identified to have impact on the municipality. A template was developed to compile this information for each of the identified hazards. This information is presented in the next few pages of this plan.



HAZARD 1: DROUGHT

Description

A drought is an extended period of months or years when a region notes a deficiency in its water supply whether surface or underground water. Generally, this occurs when a region receives consistently below average precipitation.

Frequency: 2

Vulnerability: 4

General Impact on Town

- Substantial impact on the ecosystem and agriculture.
- Damage and harm the local economy.
- Fire hazard.
- Shortage of water supply.
- EMO implications.

Impact on Municipal Infrastructure

- Major strain on municipal water supply.

Affected Municipal Areas

Administration	Community Planning & Building Services	Electrical Utility	Emergency Services & By-Law Enforcement	Public Works	Recreation
Communication, Logistics and Decision-making.	N/A	Strain on service provider.	Water Shortage in fire hydrants and drinking water for Emergency Services (Hospital).	Water shortage will put strain on municipal water supply.	Columbus Field water park, Regional /Natural fields and all town-owned green spaces will be impacted.

Social, Economic and Environmental Considerations

- No water - major impact on residents, local businesses, hospital, schools and university.
- Sustaining community gardens will be difficult.

Priorities for Adaptation

- Identify alternative sources for water and emergency management of water supply during water shortage.
- Introduce water conservation measures.



HAZARD 2: HEAT WAVE / SUSTAINED WARMING

Description

A heat wave is a prolonged period of excessively hot weather, which may be accompanied by high humidity. A heat wave is measured relative to the usual weather in the area and relative to normal temperatures for the season. Sustained warming can result from gradual or abrupt warm weather that is sustained for long periods (3 or more months) where typically those periods would not be prone to this weather pattern.

Frequency: 3

Vulnerability: 4

General Impact on Town

- Substantial impact on ecosystem and agriculture.
- Damage and harm the local economy.
- Water supply challenges.
- Higher water temperatures will degrade fish habitat.
- Fire hazard.
- Shortage of water supply.
- Less winter snow feeding dam.
- EMO implications.

Impact on Municipal Infrastructure

- Major strain on municipal water supply.
- Strain on electrical utility.

Affected Municipal Areas

Administration	Community Planning & Building Services	Electrical Utility	Emergency Services & By-Law Enforcement	Public Works	Recreation
Communication, Logistics and Decision-making.	Municipal Planning Strategy will be affected.	Strain on service provider.	Water Shortage in fire hydrants and drinking water for Emergency Services (Hospital).	Water Shortage will put strain on municipal water supply.	Columbus Field water park, Regional /Natural fields and all town-owned green spaces will be impacted.

Social, Economic and Environmental Considerations

- No water - major impact upon local businesses and hospital, schools and university.
- Sustaining community Gardens will be difficult.
- Higher cost of power consumption not typically seen in the area during summer months.

Priorities for Adaptation

- Identify alternative water sources and emergency supply during water shortage.
- Introduce water conservation measures.



- Study on impact of forests and parks (trees, flora etc.) and wildlife.
- Consider Riparian improvements.
- Examine opportunities for Storm water to filter into ground for groundwater recharge.
- Ensure optimum ground cover in watershed to retain rain fall and charge ground water.
- Continue to improve leak detection efforts.
- Reduce Island Heat Effect – improvise with green roofs and more trees.



HAZARD 3: STRONG WIND / HURRICANE

Description

Wind is the flow of gases on a large scale. Wind consists of the bulk movement of air. In outer space, solar wind is the movement of gases or charged particles from the sun through space, while planetary wind is the out gassing of light chemical elements from a planet's atmosphere into space. Winds are commonly classified by their spatial scale, their speed, and the types of forces that cause them, the regions in which they occur, and their effect.

A hurricane is a tropical cyclone, occurring in the North Atlantic Ocean or the Northeast Pacific Ocean, east of the International Dateline. A wind of force 12 on the Beaufort scale, above 118 km/h, is also referred to as a hurricane irrespective of its origin or location. A tropical cyclone is a storm system characterized by a low-pressure center surrounded by a spiral arrangement of thunderstorms that produce strong winds and heavy rain. Tropical cyclones strengthen when water evaporated from the ocean is released as the saturated air rises, resulting in condensation of water vapor contained in the moist air.

Frequency: 4

Vulnerability: 5

General Impact on Town

- Fire hazard.
- Loss of electricity.
- Streets closed due to downed trees/debris.
- Possible flooding.
- EMO implications.

Impact on Municipal Infrastructure

- Strain on Power Utility.
- Strain on Emergency Services.
- Waste water plant in low area and could be impacted.
- Trees down and debris causing possible damage and clogging roads.

Affected Municipal Areas

Administration	Community Planning & Building Services	Electrical Utility	Emergency Services & By-Law Enforcement	Public Works	Recreation
Communication, Logistics and Decision-making.	Municipal buildings could be flooded posing challenges for operations.	Lack of power will make it difficult to function.	Access to major routes to Hospital and general problems for Emergency Services.	Town roads & streets will require clean up from debris.	All recreation facilities will be shut down with potential of mass damage.

Social, Economic and Environmental Considerations

- Seniors cut off from family members and access to medical services.
- Businesses unable to function due to lack of power.
- Traffic grid-lock a possibility.



- Loss of business and undue hardship for residents without proper insurance; timeframe for emergency response could create financial strain on municipality.
- Damage to public facilities and private property would take time to repair or replace, people from affected areas in County would be looking for accommodation in town, placing a strain on need facilities in town.
- Waste water plant could be impacted.

Priorities for Adaptation

- Monitor limbing program at Electric utility.
- Harness wind energy through wind turbines.
- Familiarization with EMO plans to deal with hurricanes.
- Municipal plan/mobilization of resources in case of such emergency.
- Update building code to ensure buildings can withstand stronger winds.
- Increase inventory of wires and poles for Electrical utility.
- Emergency preparedness in case of a Hurricane.



HAZARD 4: INTENSE RAIN

Description

Intense rain is caused by high precipitation levels in a very short duration of time. Intense rain can be a short duration (a few hours) or a long duration (more than 24 hours) event.

Frequency: 4

Vulnerability: 3

General Impact on Town

- Flooding.
- Power outage.
- Damage to rivers will cause widening and lowering of summer water levels.
- Faster water level rise in floodway.
- Transit at stand-still.
- EMO implications.

Impact on Municipal Infrastructure

- Risk to overtopping Sewer treatment plant.
- Risk to increased sanitary surcharge through manholes in areas prone to flooding; storm Water Surcharge.
- Damage to Roads.

Affected Municipal Areas

Administration	Community Planning & Building Services	Electrical Utility	Emergency Services & By-Law Enforcement	Public Works	Recreation
Communication, Logistics and Decision-making.	Municipal buildings could be flooded posing challenges for operations.	Possible power disruption.	Flooding and power outages can make it difficult for essential emergency services to respond.	Main town roads could be flooded hindering access.	All town-owned playgrounds could be flooded.

Social, Economic and Environmental Considerations

- Reduced snow ploughing budget.
- Increased recreation budget for parks.

Priorities for Adaptation

- Prepare new flood risk map; raise capacity of sewer treatment plant as necessary.
- Reduce holes in manhole covers in these areas.
- Re-model flood ways with predictions for 20 years out and Change flood policy.
- Communication plan for those at risk.
- Consult with County on whether there are plans to safeguard barrier beaches.
- Land Use Planning - new ways to build in flood-prone zones.
- Increase planting of shrubs/trees to areas affected by erosion.



HAZARD 5: SEVERE WINTER STORM

Description

A winter storm is an event in which includes low temperatures and heavy snowfall usually in conjunction with strong winds. Snowfalls in excess of 6 inches (15 cm) are usually universally disruptive. A massive snowstorm with strong winds and other conditions meeting certain criteria is known as a blizzard causing drifts. If temperatures do not rise high enough soon following such an event to melt the snow, residual snow fall and ice formation can cause long disruptions. If the temperature rises quickly after an event, flooding can occur.

Frequency: 3

Vulnerability: 4

General Impact on Town

- Power Outage.
- Trees down.
- Damage to homes and other infrastructure.
- Town shuts down.

Impact on Municipal Infrastructure

- Increases resources required for clean up; EMO may have to respond to more frequent and possibly simultaneous events.
- Challenges with maintaining water, wastewater, and electric utility.

Affected Municipal Areas

Administration	Community Planning & Building Services	Electrical Utility	Emergency Services & By-Law Enforcement	Public Works	Recreation
Communication, Logistics and Decision-making.	Municipal Buildings could be blocked posing delays and challenges for operations.	Possible power disruption.	Inability for essential emergency vehicles to get around. Chaos if inability to enforce traffic rules.	Keeping roads open for emergency vehicles and to the hospital.	All recreation facilities.

Social, Economic and Environmental Considerations

- Loss of business and hardship for residents without proper insurance.
- Damage to public facilities and private property would take time to repair or replace.
- Increased health risks to vulnerable populations, increased risk to public on streets.

Priorities for Adaptation

- EMO plan to deal with intense storms and Municipal plan/mobilization of resources.
- Increase back-up power locations, including Town Hall.
- Plan to maintain snow removal equipment.



HAZARD 6: STORM SURGE / SEA LEVEL RISE

Description

A storm surge is an offshore rise of water associated with a low pressure weather system, typically tropical cyclones and strong extra-tropical cyclones. Storm surges are caused primarily by high winds pushing on the ocean's surface. The wind causes the water to pile up higher than the ordinary sea level.

Sea level rise is attributed the warming of the earth's surface temperature. Between 1870 and 2004, global average sea levels rose 17 cm. From 1950 to 2009, measurements show an average annual rise in sea level of 1.7 ± 0.3 mm with satellite data showing a rise of 3.3 ± 0.4 mm from 1993 to 2009, a faster rate of increase than originally estimated.

Frequency: 2

Vulnerability: 5

General Impact on Town

- Flooding.
- Power outage.
- Damage to rivers.
- EMO implications.

Impact on Municipal Infrastructure

- Risk to overtopping Sewer treatment plant.
- Risk to increased sanitary surcharge through manholes in areas prone to flooding.
- Salt water damage through corrosion.
- Damage to parks or trails through erosion.
- Possible loss of gravity drainage of Sewer systems resulting in more frequent smaller level flooding.

Affected Municipal Areas

Administration	Community Planning & Building Services	Electrical Utility	Emergency Services & By-Law Enforcement	Public Works	Recreation
Communication, Logistics and Decision-making.	Limited access to municipal buildings. Hindrance to operation due to complete shut-down.	Most or all power could be cut-off.	All Emergency Services could be at stand-still.	Water utility and infrastructure.	Columbus Field water park, Regional /Natural fields and all town-owned green spaces will be impacted.

Social, Economic and Environmental Considerations

- Complete chaos possible in town with no access to Emergency Services.
- Transit grid-lock.
- Severe damage to businesses and homes.



- People from affected areas in County could seek accommodation in town, placing a strain on town facilities.

Priorities for Adaptation

- Complete new flood risk mapping; raise capacity of sewer treatment plant as necessary.
- Reduce holes in manhole covers in risk prone areas.
- Prepare communication plan to reach out to those at risk.
- Reduce holes in Manhole covers in these areas.
- Consult with County on whether there are plans to safeguard barrier beaches.



Adaptation Priorities

The adaptation priorities resulting from each of the six Hazards were compiled and as a result, the Committee identified 18 priorities for adaptation to Climate Change, as follows:

Public Works

1. Identify alternative sources for water and emergency management of water supply during water shortage.
2. Introduce water conservation measures.
3. Ensure Source Water Protection plan is up-date for groundwater recharge and optimum ground cover in watershed.
4. Continue to improve leak detection efforts.
5. Plan to maintain snow removal equipment.

Municipal Planning Building Services

6. Study on impact of forests and parks (trees, flora etc.) and wildlife.
7. Consider Riparian improvements.
8. Reduce Island Heat Effect – improvise with green roofs and more trees.
9. Re-model flood ways with predictions for 20 years out and Change flood policy.
10. Complete new flood risk mapping based upon sea-level rise models.
11. Land Use Planning – identify new ways to build in flood-prone zones.
12. Increase planting of shrubs/trees in areas affected by erosion.

Electric Utility

13. Monitor limbing program at Electric Utility.
14. Harness wind energy through wind turbines.
15. Increase back-up power locations, including Town Hall.

Municipal Administrative Services

16. Engage Emergency Management Organization to update provisions for hazard-related emergencies and prepare internal plan/mobilization of resources in case of emergencies.
17. Consult with the County of Antigonish on plan to safeguard barrier beaches.

Recreation

18. Inventory assets, how they may be affected and develop a plan in case of emergencies.

The municipality also believes that it will be important for local, regional and provincial stakeholders to identify and work on common priorities for adaptation so that these priorities can be accomplished in a resource-effective manner.



Safeguarding Statements of Provincial Interest

Of the 5 Statements of Provincial Interest (Drinking Water, Flood Risk Areas, Agricultural Land, Infrastructure and Housing), Flood Risk, Infrastructure and Housing are directly relevant in the context of planning in the Town of Antigonish.

With respect to Flood Risk, the municipality has recently completed LIDAR mapping which provides a far more accurate picture of lands which can be expected to be subject to some degree of flooding. The next step will be to remodel with 20-year predictions for ocean level rise and increased storm intensity to better understand the impact of surge and increased ocean levels near town.

The town's drinking water supply is located, and treated outside the town limits. Moreover, the watershed is largely owned by the town and crown and is subject to a Watershed Protection plan.

While Antigonish does have some lands within town which see limited agricultural use, they are not large enough to seek to protect. Most of them fall within flood prone areas making them less appealing as agricultural land in any event.

Climate Change will affect the town's Infrastructure and better planning policies will be implemented to increased retention of storm water on properties thus relieving pressure on storm water systems.

The National Building Code now requires higher levels of insulation and thermal performance in windows. This will prove advantageous in a warmer climate. With respect to planning, housing will be affected primarily due to new regulation concerning flood susceptibility. As we increasingly find ways to develop a community with decreased dependence on private automobiles and more multi-unit accommodations, we will be doing our part to reduce the environmental footprint.

Municipal Planning Strategy / Land Use By-Law

While it is impossible to say with any certainty what amendments will be adopted in a Municipal Planning Strategy or Land Use By-Law, it will be the intention of Council to bring the following amendments forward for consideration and review.

1. Consider riparian improvements:
 - Policy amendment emphasizing healthy riparian zones.
 - Consider amending setback from watercourse requirement with new requirements for preserving adequate riparian protection.

2. Reduce Island Heat Effect – improvise with green roofs and more trees:
 - Introduce policy support for increased greening generally in town.



- Introduce criteria in Development Agreement policy for increased green spaces and green roofs.
 - Where possible, the LUB will have requirements which increase greening over current regulation.
3. Land Use Planning - new ways to build in flood-prone zones:
- As recent modeling shows an increase to the area of land subject to flooding, and where the town has little else available for development, new models based on experience elsewhere will be examined for possible implementation in Antigonish.
 - Based on Flood Risk modeling, new regulation will be developed concerning development in 1:100 FW and marginal 1:20 FW in consideration of the Statements of Provincial Interest.
4. Erosion:
- Where storms of higher rain intensity are predicted to increase, erosion and subsequent sedimentation of waterways could become more problematic therefore policies will be examined to safeguard against this.
 - Increase planting of shrubs/trees in areas affected by erosion.
 - Increased planting requirements in areas with steep slope in association with development.

In addition to the above, the Planning Division of the municipality intends to:

- Source a study on impact of forests and parks (trees, flora etc.) and wildlife is recommended. This project may occur under Recreation & Parks.
- Re-model floodways with predictions for 20 years out as well as scenarios 20 year ocean level rise predictions and Change flood policy accordingly.

6.0 MITIGATION

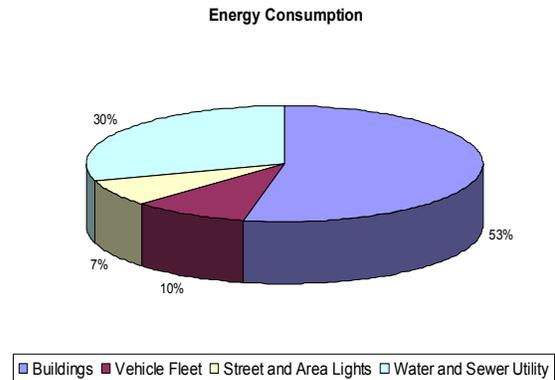
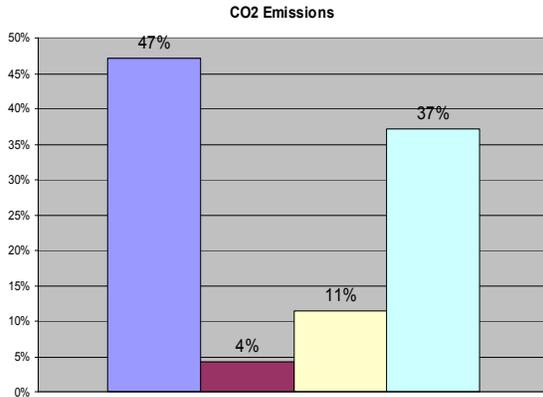
The municipality has accepted the general definition of Mitigation in the context of Climate Change to be *“the elimination or reduction of the frequency, magnitude or severity of exposure to risks, or minimization of the potential impact of a threat or warning.”* Climate Change mitigation is the human intervention to reduce the sources or enhance the sinks of greenhouse gases.

Energy and Emission Information

In 2009, the Town of Antigonish engaged a consultant to complete the Eco - Nova Scotia Municipal Energy Audit Report. The Municipal Energy Audit provides an inventory and an analysis of the energy consumed by the various assets of the Town of Antigonish in 2008. The report also provides a list of measures to reduce energy consumption and corresponding green house gases for each of the identified assets. The summary of the results are shown in the following charts.



Municipal Asset Category	Energy Use					Cost	Eq. CO2 (Tonnes)
	Oil/Diesel		Electrical		Total		
	Liters	GJ	KWh	GJ	GJ		
Buildings	165,431	6,399	1,126,652	4,056	10,455	\$280,646	1,421
Vehicle Fleet	47,992	1,856	0	0	1,856	\$47,992	129
Street and Area Lights	0	0	399,096	1,437	1,437	\$81,449	346
Water and Sewer Utility	42,404	1,640	1,157,696	4,168	5,808	\$152,058	1,119
Totals:	255,827	9,895	2,683,444	9,660	19,556	\$562,145	3,015



Figures 10 -12: Municipal Energy Consumption (2008)

Mitigation Goals and Actions

The audit provided multiple recommendations and opportunities to lower energy use and the GHG footprint of municipal assets. The municipality has been implementing recommendations from the audit. By far the largest energy consumer for the Town of Antigonish is the Water and Wastewater utilities. Together these utilities account for 56 % of municipal energy use, and 70% of equivalent green house gas generation. Therefore it has the greatest potential for energy use reduction and accounts for five of the six opportunities given the highest priority. A further detailed study focused directly on this topic was recommended.

The summary spreadsheet as part of the audit lists the potential cost savings of over 35 projects. The total estimated savings of all potential projects are calculated to be \$74,000 per year. However some of the projects are mutually exclusive where perhaps only one alternative of several may be chosen. The total green house gases saved from the opportunity projects are calculated as 468 metric tonnes per year. The total capital cost of all the projects is \$ 793,446.



Appendix 7.1

Climate Change Adaptation Committee Terms of Reference

Purpose of the Committee

The purpose of the Climate Change Adaptation Committee is to develop a Municipal Climate Change Action Plan and provide advice on Climate Change and environmental matters to Council.

Mandate

The Committee's mandate is to recommend to Council on all matters referred to the Committee, including:

- The development, implementation and progress of the Municipal Climate Change Action Plan for the Town of Antigonish;
- Reviewing the Corporate Energy and Emissions Assessment;
- Additional measures to address Climate Change including any plans, studies, and initiatives related to the environment including but not limited to ICSP;
- Recommending Climate Action Fund expenditures;
- And other items as directed by Council.

Membership

1. The Committee shall consist of 10 members, each with 1 vote, appointed or as otherwise directed by Council, who shall serve without compensation as follows:
 - 2 members of Council
 - 4 staff members
 - 3 community members
2. Members of the Climate Action Committee shall be appointed to one-year terms. Council may reappoint any member to additional terms.
3. Consideration will be given to include representatives with expertise in relevant areas such as Climate Change, the environment, energy, and community planning. Community experts may be called upon as non-voting members as required.
4. Staff on the Committee should represent different departments.
5. The Committee shall choose a Chair to preside over meetings as well as a Vice Chair to preside in the absence of the chairperson. The Committee may choose to have a recording secretary.



Meetings and Decision-making

1. The attendance of 6 committee members will form a quorum.
2. The Committee will apply the principle of decision-making 'by consensus'. *Consensus decision-making is a group decision-making process that seeks the consent of all participants. Consensus is defined professionally as an acceptable resolution, one that can be supported, even if not the "favourite" of each individual.* Where, consensus is not possible, a vote may be taken.
3. All meetings shall be held at the call of the Chair.
4. A Planning Services staff member will attend all meetings in a resource capacity.
5. Agendas will be circulated to the members within a reasonable timeframe.
6. All meetings of the committee and all meetings shall be open to the public.
7. Minutes of meetings of the Committee shall be compiled and distributed to all committee members.
8. All recommendations from the Climate Change Adaptation Committee will be forwarded to Council.



Appendix 7.2

Climate Change Adaptation Committee List of Committee Members as of November 28, 2012

Name	Profession	Organization	Role
J. MacPherson	Town Council	Town of Antigonish	Chair
L. Chisholm	Town Council	Town of Antigonish	Vice-Chair
S. Feist	Chief Administrative Officer	Town of Antigonish	Internal Committee Member
S. Day	Director, Planning & Building Services	Town of Antigonish	Internal Committee Member
T. Cameron	Recreation Coordinator	Town of Antigonish	Internal Committee Member
K. Proctor	Engineer	Town of Antigonish	Internal Committee Member
T. Wadden	Comptroller	Town of Antigonish	Internal Committee Member
H. Dunneilwood	Environmental Engineer	CJ MacLellan & Associates Inc.	Community Representation
D. Risk	Professor, Earth Sciences	StFX University	Community Representation
K. Malhotra	Consultant / Facilitator	Town of Antigonish	Community Representation
Support members:			
G. Smith	Building Inspector	Town of Antigonish	Hazard Response / EMO Committee
D. Wilson	Deputy Clerk	Town of Antigonish	Support

Appendix 7.3

