Village of New Maryland – Climate Change Adaptation Strategy
Overview Documentation Package

October 4, 2018

Prepared for:

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PUBLIC OPEN HOUSE
When: November 7, 2018
Time: 2:00pm to 4:00pm
7:00pm to 9:00pm
Where: Victoria Hall
466 New Maryland Hwy
New Maryland

New Nouveau Brunswick
Your Environmental Trust Fund at Work
Votre Fonds en fiducie pour l'Environnement au travail

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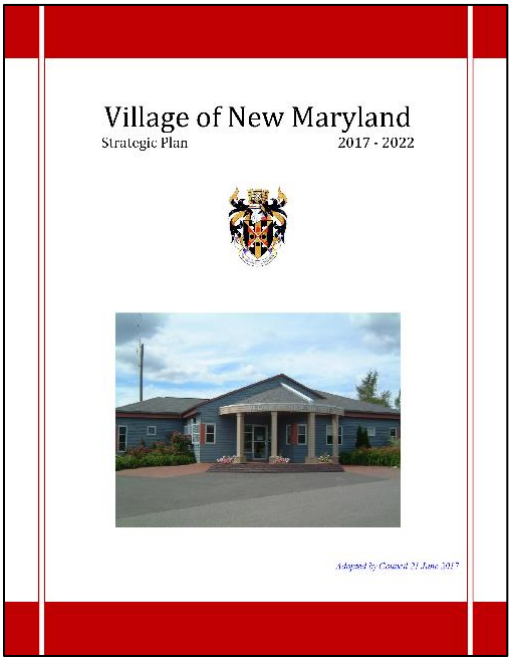
Glossary[1]

Adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.
Climate	Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.
Climate Projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases(GHGs) and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which is in turn based on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realized.
Intergovernmental Panel on Climate Change	The Intergovernmental Panel on Climate Change (IPCC) is the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation.
Mean Temperature	The mean temperature in degrees Celsius (°C) is defined as the average of the maximum and minimum temperature at a location for a specified time interval.
Representative Concentration Pathways (RCPs)	Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover. The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding emission scenarios. Extended Concentration Pathways (ECPs) describe extensions of the RCPs from 2100 to 2500 that were calculated using simple rules generated by stakeholder consultations and do not represent fully consistent scenarios.

[1] IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, pp. 117-130.

1.0 INTRODUCTION



New Maryland's commitment to preparing for the climate of the future reached a new milestone with the recent amendments to the Village of New Maryland Strategic Plan 2017-2022, which outlined the Village's awareness for the need to more fully incorporate climate change considerations into Village planning and operations. As such, the Council has committed to undertake development of a Climate Change Adaptation Strategy (CCAS) to identify, monitor and track its progress in efforts to mitigate and adapt to climate change. Stantec is excited to have been chosen to support the Village in this effort and provide a well-rounded, experienced team to provide tailored solutions.

The Village Council has set targeted objectives to:

- promote a green and energy efficient community that is resilient to climate change; and,
- ensure policies and activities take into consideration issues of climate change, energy efficiency and water conservation.

2.0 ABOUT THIS DOCUMENT

Stantec and the Village will host an open house to provide an overview of the strategy and receive feedback from the public and stakeholders. Stantec has completed its research, data collection and review for the New Maryland CCAS – work to date includes:

- the historical review of New Maryland's climate and climate events (rain storms, floods, ice storms, hurricanes etc.) that have occurred, and the impacts that were experienced during those events;
- consideration of potential climate change impacts that are possible in the New Maryland area;
- review and summary of projected future climate in the New Maryland area, based on models endorsed by the Intergovernmental Panel on Climate Change (IPCC);
- interviews with local representatives to gain first hand insight into the local effects of climate change and gain perspectives on the most important issues facing New Maryland;
- workshop with Village staff and Council to evaluate key priorities for the Village in growing to meet the future needs of residents, potential vulnerabilities to extreme climate events and how these may interact; and,
- draft climate adaptation strategy incorporating research, Village priorities and best practice guidance for climate adaptation.

This document provides a brief overview of information gathered and highlights work completed to orient you prior to the open house. The full climate strategy will be provided to Council following the public open house and will be shared with the public after that date.

3.0 CLIMATE ADAPTATION STRATEGY OVERVIEW

Overall, a community climate adaptation strategy involves the following key steps:

- defining the climate change (extreme weather events) scenarios the community will be exposed to;
- completing a vulnerability assessment of the community structures, functions, and populations (how severe will the impact from future climate events be?); and,
- identifying adaptation strategies to reduce vulnerability and increase resiliency of the community.

The products of a climate change adaptation plan are a comprehensive set of future climate predictions for the area, a vulnerability assessment and adaptation strategies. The vulnerability assessment is an exercise to identify what and how climate change will impact the community.

The adaptation policies/strategies are developed through a collaborative process. In this case, key collaboration included the workshop with Village staff and Council and the public open house with ongoing collaboration as the strategy is integrated into future policy revisions. The strategy provides insight into how the community will address the impacts identified in the vulnerability assessment given its resources, goals, values, and needs considering regional context. The climate change adaptation strategies will be codified and implemented through a number of instruments that already exist in the community such as by-laws, policies, and other strategic planning documents.

4.0 HISTORIC/CURRENT/PROJECTED CLIMATE PROFILE

The most valuable resource for defining an area's climate is to review local weather station data. New Maryland itself does not have a weather station that can be used to provide historical climate data. There are three nearby weather stations with historical data covering various time periods, as pictured below.

Climate data for these weather stations was obtained through the Climate Change Hazards Information Portal (CCHIP) created by Risk Sciences International (RSI). In addition to assembled climate data from weather stations, CCHIP also publishes data sets for the entire country, on a 10km by 10km grid – known as the CANGRD data. This gridded data was developed in a collaboration between Natural Resources Canada and Environment and Climate Change Canada (ECCC), and although data from a real weather station is preferable, this CANGRD data interpolates data from nearby stations, and is well accepted and researched. The CANGRD data was used when investigating the historical climate of New Maryland.

The future climate projections we perform most often use the Intergovernmental Panel on Climate Change (IPCC) greenhouse gas emissions (GHG) scenarios of RCP 8.5 (current trends in GHG emissions) and RCP 4.5 (some global reductions in GHG emissions).

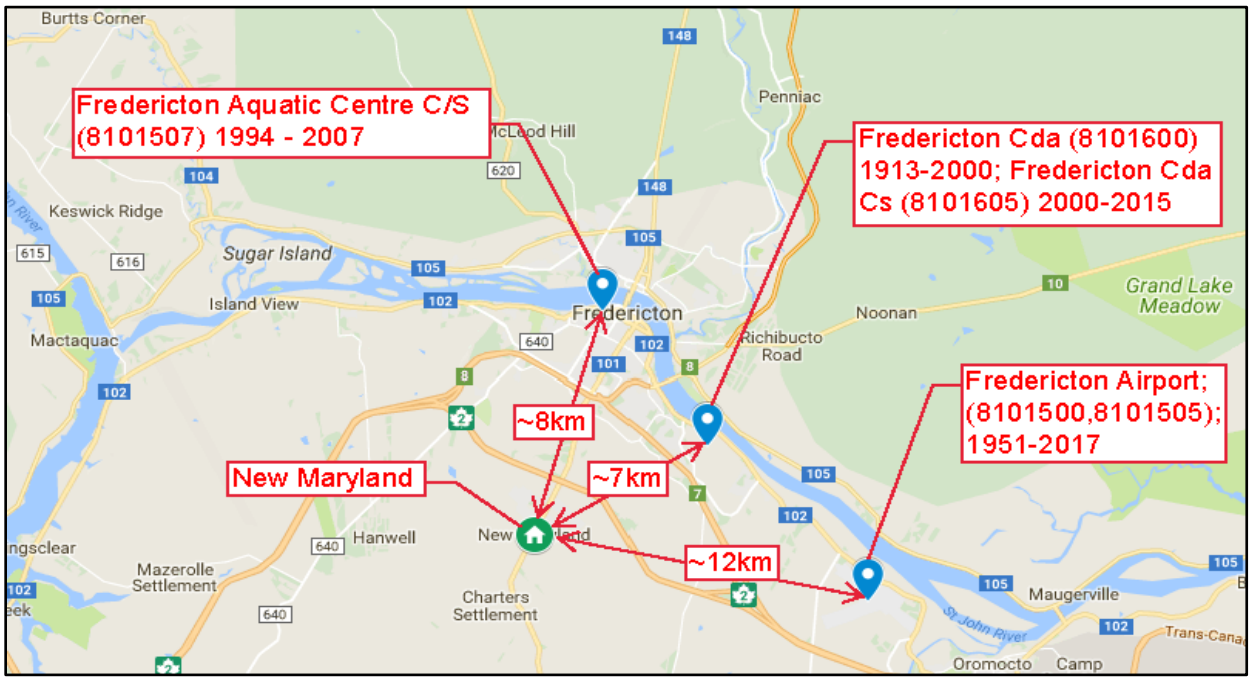


Figure 1: Site Location and proximity to closest weather stations

4.1 TEMPERATURE

Historic Annual Mean Daily Temperatures for New Maryland from 1984 to 2013 are represented by the blue bars in Figure 2. This figure also shows the 1981-2010 Climate Normal as the green bar. The Annual Mean Daily Temperatures for New Maryland can be seen to have increased by about 2 degrees Celsius in this period.

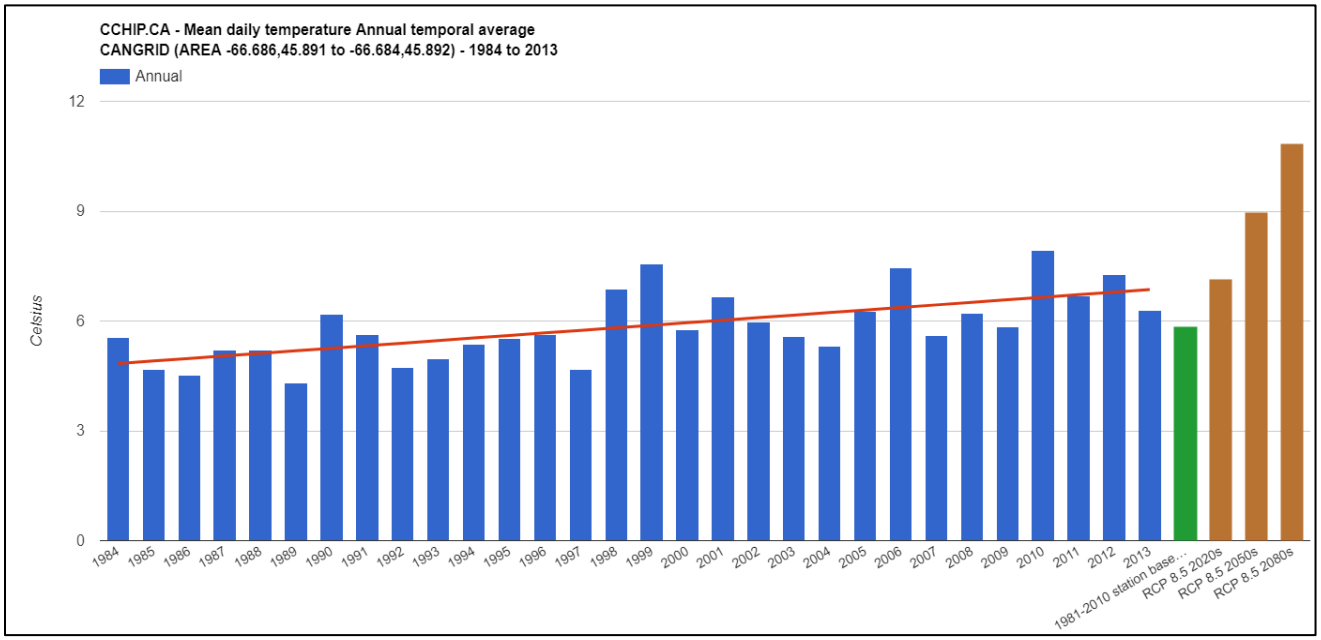


Figure 2: Annual Temporal Average – Mean Daily Temperature (RCP 8.5)

The brown bars in Figure 2 show the projected continuation of this trend under the RCP 8.5 scenarios in the 2020s, 2050s and 2080s respectively. The specific projected increase under RCP 8.5 and RCP 4.5 for each season, for future time periods is shown in Table 1.

Table 1: Average Change in Mean Temperature from Baseline

Season	Average Change in Mean Temperature from 1981-2010 Baseline (°C)					
	RCP 4.5			RCP 8.5		
	2020s	2050s	2080s	2020s	2050s	2080s
Annual	1.1	2.1	2.7	1.3	3.1	5.0
Winter	1.3	2.5	3.1	1.5	3.5	5.6
Spring	1.1	2.0	2.5	1.1	2.8	4.6
Summer	1.1	2.1	2.6	1.2	3.0	5.0
Autumn	1.1	2.1	2.5	1.3	3.0	4.9

A complete analysis of climatic temperatures, including maximum and minimum temperatures will be presented as an appendix with the final CCAS report.

4.2 PRECIPITATION

Historic Annual Precipitation for New Maryland from 1984 to 2013 are represented by the blue bars in Figure 3. This figure also shows the 1981-2010 Climate Normal as the green bar. There was not a significant trend indicating an increase or decrease of the annual precipitation for New Maryland in this period. *Please note: Precipitation includes both rain and snow. Snowfall is reduced by a factor of about 10 to provide an equivalent depth of rainfall in mm.*

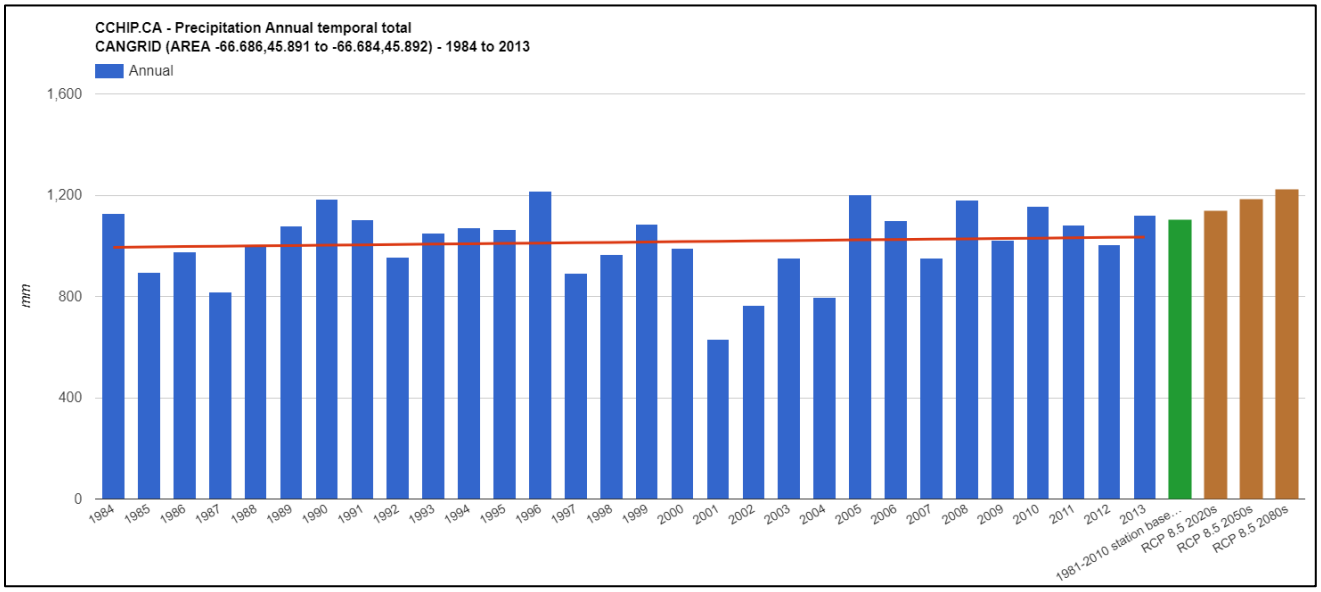


Figure 3: Annual Precipitation Temporal Total (RCP 8.5)

The climate projections for New Maryland suggest there will be an increase in the amount of precipitation in New Maryland in the 2020s, 2050s and 2080s – those projections can be viewed for each season, for future time periods in Table 2.

Table 2: Average Percent Change in Total Precipitation from Baseline

Season	Average Percent Change in Total Precipitation from 1981-2010 Baseline (%)					
	RCP 4.5			RCP 8.5		
	2020s	2050s	2080s	2020s	2050s	2080s
Annual	3.0	5.6	6.9	3.2	7.2	10.7
Winter	4.4	7.3	10.3	4.9	10.6	17.7
Spring	3.0	6.8	7.9	3.9	9.8	14.9
Summer	2.1	3.8	5.5	3.1	4.4	5.6
Autumn	2.7	4.9	4.1	1.1	4.2	4.9

However, the amount of precipitation that falls is not the only important factor when investigating precipitation. When it comes to designing systems that drain precipitation away from roadways

and homes, what becomes important is *how much precipitation falls in a certain amount of time and how often precipitation like that can be expected?*

In storm-water engineering design, these properties of precipitation are *Intensity, Duration, and Frequency.* A complete analysis of precipitation, including Intensity-Duration-Frequency (IDF) analysis will be presented as an appendix with the final CCAS report. Highlights of our research on climate projections to date suggest that precipitation may become around 30% more intense in the next 50 years. The result of this means that a precipitation event that historically might have occurred every 100 years, may now be expected between every 25 and 50 years.

4.3 HURRICANES

As we see in the results of interviews with local representatives, some the greatest impacts from climate events in the New Maryland area have been from hurricanes. Although rare and localized events like hurricanes are difficult to predict, viewing the historic occurrences of hurricanes can provide an indication of what to expect in the future. Beginning in 1966, daily satellite imagery became available at the National Hurricane Center, and thus statistics from this time forward are most complete[2].

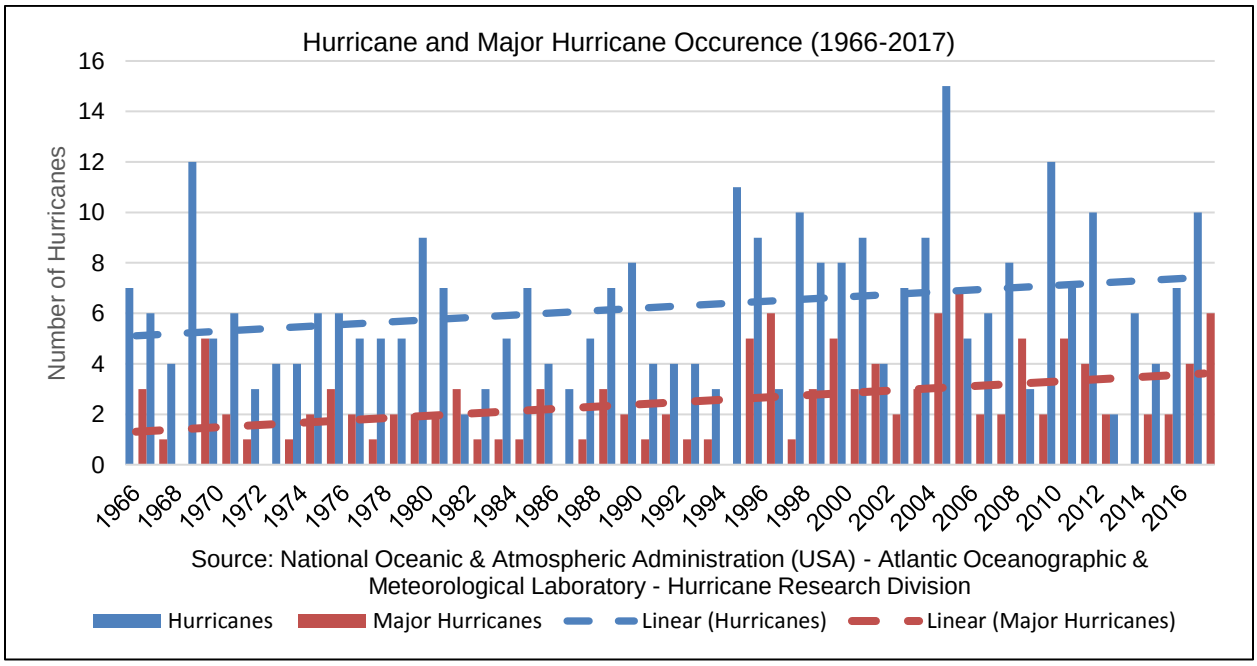


Figure 4: Annual Recorded Atlantic Hurricane Occurences (1966-2017). Hurricanes = Saffir-Simpson Hurricane Scale 1 to 5. Major Hurricanes = Saffir-Simpson Hurricane Scale 3, 4, or 5

A complete analysis of past, current and future climate will be included with the final CCAS report and will include other parameters such as wind, tornadoes, and daily frost.

[2] McAdie, C. J., C. W. Landsea, C. J. Neuman, J. E. David, E. Blake, and G. R. Hamner, 2009: Tropical Cyclones of the North Atlantic Ocean, 1851-2006. Historical Climatology Series 6-2, Prepared by the National Climatic Data Center, Asheville, NC in cooperation with the National Hurricane Center, Miami, FL, 238 pp.

4.4 SIGNIFICANT HISTORICAL EVENTS

Post Tropical Storm (Hurricane) Arthur – July 2014


CBC | news
New Brunswick
Arthur hits Maritimes: Post-tropical storm causes widespread blackouts
Rainfall of 170 mm possible in some areas of New Brunswick, with 110 km/h winds in Nova Scotia
CBC News · Posted: Jul 05, 2014 6:47 AM AT | Last Updated: July 6, 2014

"*Post-tropical storm Arthur battered the Maritimes today, at one point knocking out power to more than 290,000 homes and businesses.*"

"*In New Brunswick, the number of NB Power customers who lost service was more than 140,000, including more than 52,000 in the Fredericton area, at 10:30 p.m.*"

"*NB Power spokesman Bob Scott said high winds forced restoration operations in Fredericton to stop for the night Saturday.*"

"*City officials in Fredericton were urging people to stay off streets and roads because of the number of trees down.*"

Ice Storm of the Century – January 1998

One of the most destructive and disruptive storms in Canadian history hit Eastern Canada causing hardship for 4 million people and costing $3 billion. Power outages lasted from several hours to four weeks. Data suggests New Maryland area received 20-40mm of ice accumulation.

Environment Canada senior climatologist David Phillips: "*it's impossible to know when such a destructive ice storm might recur.*"

More Ice Storms – 2013, 2014, 2017


CBC | news
New Brunswick
By the numbers: New Brunswick's worst storms
3 times in the last 37 months NB Power has had to deal with a 'worst-in-decades' storms
Robert Jones · CBC News · Posted: Feb 03, 2017 6:00 AM AT | Last Updated: February 3, 2017

New Brunswick experienced severe ice storms again in 2013, 2014 and 2017 with total power outages totaling 88,000; 195,000; and 200,000 respectively.

Although predicting future ice storm occurrences like these is difficult; climate scientists are working to build models that help predict if climate change will have an effect on how often ice storms will occur.

The projected results clearly show that in the coldest months, eastern Canada could possibly receive more freezing rain events in the future than was historically experienced during the period 1958–2007. Southern Atlantic Provinces Region: 20% projected increase in severe ice storm event (>6 hours) frequency by 2081-2100.[3]

3 Chad Shouquan Cheng , Guilong Li & Heather Auld (2011) Possible Impacts of Climate Change on Freezing Rain Using Downscaled Future Climate Scenarios: Updated for Eastern Canada, Atmosphere-Ocean, 49:1, 8-21, DOI: 10.1080/07055900.2011.555728

5.0 LOCAL REPRESENTATIVE INTERVIEWS

Stantec conducted in-person interviews or received interview responses from 20 representatives from the New Maryland, including Village staff, committee members and current and former councilors. These interviews provide an incredible amount of information that will be valuable in developing a climate change adaptation plan for the Village of Maryland.

Interviewees expressed their concern about impacts to the village including but not limited to: ice storms, surface flooding, droughts, water supply, wastewater treatment, power outages, the aging local population, forest fires, recreational facilities and transportation access.

5.1 AREAS OF GREATEST CONCERN

Towards the end of the set of interview questions, one question asks: *What do you think are the most urgent issues facing the Village of New Maryland today with respect to climate change adaptation?* To help facilitate further discussion in the workshop, the responses to that question were analyzed to look at which particular issues were mentioned most often by the interviewees, the results are shown below.

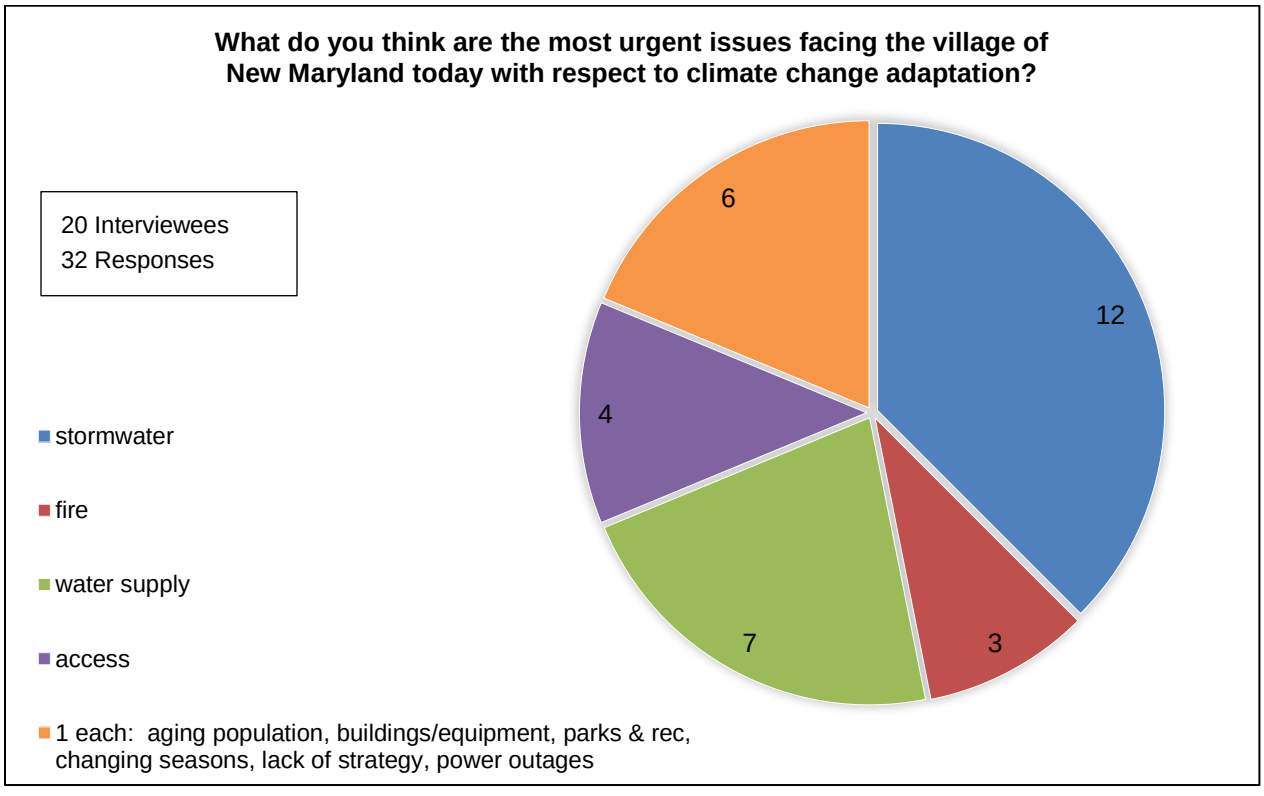


Figure 5: Mentions of specific climate change issues in responses from interviewees

6.0 SUMMARY OF WORKSHOP DISCUSSION

The workshop included discussion and validation of the following.

List of climate change impacts reviewed:

- Droughts; as they pertain to water supply and recreation facilities;
- Ice storms (accumulation large enough to cause tree/powerline damage);
- Snow storms (heavy accumulation);
- Rain storms; as they pertain to localized flooding;
- Hurricanes; and,
- Heat waves; as they pertain to resident health and recreation opportunities.

Identified vulnerabilities and associated gaps to be addressed:

- Storm water infrastructure and surface flooding;
- Source water supply and water usage;
- Forest fires;
- Power outages;
- Access to the village;
- Aging population;
- Condition of buildings and equipment;
- Conditions of parks and recreation facilities;
- Changes to the length of the typical seasonal climates; and,
- Lack of climate strategy.

This document is a snapshot of the data collected by Stantec and an introduction to the climate adaption topics. We encourage all interested to review this document and prepare any questions or suggestions you may have to discuss at the open house event. A survey/feedback form will be available at the open house or you can provide your input via email to rob.pero@vonm.ca.