Climate Change Review
in the Mississippi-Rideau Source Protection Region

Draft Review – September 2009

The Clean Water Act

This Climate Change Review was done under Ontario's Clean Water Act which requires municipalities and the local community to work together to protect local drinking water sources from becoming contaminated or depleted. The Act is primarily focused on minimizing threats to municipal drinking water sources (lakes, rivers and aquifers that supply municipal to residents). Where drinking water sources face significant threats, mandatory action could be required.

The key steps under this Act are:

2007 – Source Protection Committee Created

The Mississippi-Rideau Source Protection Committee is made up of 16 people representing a wide variety of local interests and sectors. This Committee is overseeing the development of science-based Source Protection Plans for the Mississippi River and Rideau River watersheds.

2009 – Complete Scientific Studies

Technical studies are mapping local sources of drinking water, determining if they are vulnerable to contamination or overuse, and identifying potential threats. This science will show us where source protection policies are needed, and what threats they need to address.

2012 – Develop Policies to Protect Source Water

Source Protection Plans will contain a combination of voluntary and mandatory land use policies to protect drinking water sources. Under the Act, policies must moderate significant threats and prevent others from becoming significant.

Climate Change Review

Under the Clean Water Act, the Province requires a summary of existing climate change knowledge and climate data, and an interpretation of how climate change can impact the conclusions in the technical Assessment Report (compilation of all the findings of the scientific studies).

What is Climate Change?

The Intergovernmental Panel on Climate Change (IPCC) is an international scientific organization developed to provide global and regional scientific information on climate change. According to publications from the IPCC, climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic (human) changes in the composition of the atmosphere or in land use.

Why study Climate Change?

A technical report titled “Climate Change and Water” released in June 2008 by the IPCC discusses impacts of a changing climate on a number of water related areas. This report states that on a global scale;

> “*Climate warming observed over the past several decades is consistently associated with changes in a number of components of the hydrological cycle and hydrological systems such as: changing precipitation patterns, intensity and extremes; widespread melting of snow and ice; increasing atmospheric water vapour; increasing evaporation; and changes in soil moisture and runoff. There is significant natural variability – on interannual to decadal time-scales – in all components of the hydrological cycle, often masking long-term trends*”.

Changing weather patterns are an important factor in source water protection planning for eastern Ontario, as studies forecast that climate change will result in warmer average temperatures. In turn, these changes may alter precipitation and other weather patterns. This could have short and long-term implications on water resources in the Mississippi-Rideau Source Protection Region.

Mississippi-Rideau Climate Change Review

A study called the ‘Review of Known Information about Climate Change in the Mississippi-Rideau Source Protection Region’ (referred to as the Mississippi-Rideau Climate Change study) was completed in 2009. Based on the information collected, this study looks at future regional climate predictions, and how they will impact water quality and quantity.

The study compiles relevant information from existing regional studies in an effort to identify what we know about climate change, and where information gaps may exist. Information on regional temperature, precipitation, and weather pattern trends was also collected.

A summary of the information contained in the Mississippi-Rideau Climate Change study is provided below. It is important to note that information presented herein is the best available to-date. As more information becomes available, a more concise understanding of local climate change and its impacts will develop.

The Experts

The Mississippi-Rideau Climate Change Review was completed by a private consultant (Jacqueline Oblak) in 2009 and peer-reviewed by an independent third party. The review conforms to the Assessment Report Technical Rules (dated December 12, 2008) issued under the Clean Water Act. The Technical Rules can be found at http://www.ene.gov.on.ca/en/water/cleanwater/cwa-technicalstudies.php

Step 1 – Information Review

Climate change studies have been carried out on large regional (i.e. eastern Canada and north eastern North America) and provincial scales, but little has been done to identify local impacts on water resources within the Mississippi-Rideau Region. The most important/relevant existing studies identified for the Mississippi-Rideau Region include:

1. **Fish, Fisheries, and Water Resources: Adapting to Ontario's Changing Climate. Subproject 4: Water Management Response to Climate**, by S. Kunjikutty and P. Lehman, Mississippi Valley Conservation. This study (referred to as the MVC Climate Change Study) is one of four components of a larger study on impacts of climate change on fish in the Mississippi Valley. It considers the impact of temperature and precipitation projections on water levels and flows in the Mississippi River. This study uses information related to the time period 2010-2039.
2. **Climate Change Projections for Ontario: Practical Information for Policymakers and Planners** by S.J.Colombo, D.W. McKenney, K.M. Lawrence and P.A. Gray, Ontario Ministry of Natural Resources. This province wide study (referred to as the MNR Climate Change Study) looks at climate change within MNR regions and districts, and provides a series of maps which show projected changes in temperature and climate (see http://www.web2.mnr.gov.on.ca/mnr/ccmapbrowser/climate.html). These projections vary depending on the type of greenhouse gas scenario and timeframe selected. For the purposes of the Mississippi-Rideau Climate Change Study, an A2 scenario (higher greenhouse gas emissions/temperatures) was selected, for the time period 2011-2040.
3. **Adapting to Climate Change in Addington Highlands: A Report to the Community** by R. McLeman and G. Gilbert, University of Ottawa. The report provides information on changes in local weather patterns, as collected through a series of interviews with residents in the western portion of the Mississippi-Rideau Region.

4. **From Impacts towards Adaptation, Mississippi Watershed in a Changing Climate** by P. Egginton and B. Lavender, Natural Resources Canada. This report provides an overview of what climate changes may occur and identifies impacts of these changes in the western half of the MRMississippi-Rideau, the Mississippi watershed.

5. Local data from Environment Canada's website on climate trends and variations (http://www.msc-smc.ec.gc.ca/ccrm/bulletin/national_e.cfm) was considered as well as information from the Atmospheric Hazards website (http://www.hazards.ca).

A number of other climate change reports and studies were consulted for the Mississippi-Rideau Climate Change study, most notably the work of the Intergovernmental Panel on Climate Change. These provided global information and specific technical information on climate change impacts.

Step 2 – Temperature and Precipitation Projections

The climate change information that was reviewed indicates that there will be more variability and weather extremes than seen in the past. Seasonal changes may include more rainfall and periods of snow melt in winter, and longer dry periods in summer. While historically these patterns have occurred periodically in the Mississippi-Rideau Region as part of the natural variability of weather, with climate change they are forecast to occur more regularly. Along with more subtle changes in weather patterns, overall changes in average temperature and precipitation may result.

Temperature

Temperature projections for the Mississippi-Rideau Region as presented in the MNR Climate Change Study and the MVC Climate Change Study indicate an overall increase in seasonal average values. Although the two studies show somewhat different results, they both indicate increases in both warm and cold seasons in the range of 0 to 2o Celsius. The temperature projections from the MVC Climate Change Study are presented below in Figure 1.

Figure 1. Temperature Projections from the MVC Climate Change Study

30 yr. period ending 2039	Projected Temperatures Changes					(^{0}C/30yr)
Summer				**Fall**		
	tmax	**tmin**			**tmax**	**tmin**
June	0.9	0.9		Sept	0.9	0.6
July	1.2	1.5		Oct	0	0.3
August	0.9	0.9		Nov	1.2	0.3
average	**1**	**1.1**		**average**	**0.7**	**0.4**
Winter				**Spring**		
	tmax	**tmin**			**tmax**	**tmin**
December	0.6	1.2		March	0.3	1.5
January	2.4	5.1		April	0.6	1.5
February	0.9	1.8		May	2.1	1.2
average	**1.3**	**2.7**		**average**	**1**	**1.4**

Precipitation

For the Mississippi-Rideau Region, both the MNR and MVC Climate Change Studies indicate that precipitation patterns will change. The MNR study forecasts a slight decrease in both warm and cold months of 0-10%. The MVC study forecasts a very slight precipitation increase (a few millimetres) in most months, with larger increases in fall.

Step 3 – Potential Impacts on Water Quality and Quantity

The information presented above indicates that, in the future, temperatures may increase and precipitation patterns may change. In the Mississippi-Rideau region, these changes are likely to have an impact on both water quality and quantity. Some of these potential impacts are listed below.

- Increased variability in the weather, with more extreme weather events (eg. heavy or prolonged rains). This may result in more frequent flooding beyond the traditional spring season.
- Flow rates in the river systems may be affected by changing temperature and precipitation patterns:
    - With winter temperatures more frequently above freezing, rainfall rather than snowfall may trigger episodes of snowmelt, with associated increased flows and water levels in rivers and lakes.
    - With less precipitation during hot months, traditionally low summer flow rates may decrease further as temperatures increase.
- Heavy rainfalls and associated localized flooding may flush contaminants into surface waters, thereby decreasing water quality. Similarly, surface contaminants may be flushed into fractured rock and other aquifer recharge areas.
- Higher water temperatures during summer may promote bacterial growth, increasing the risk of harmful contaminants occurring in surface water.

- Groundwater may also be exposed to bacterial growth, if organic contaminants enter the aquifer.

Conclusions

There is sufficient research to initiate the incorporation of climate change impacts into source water protection on a local scale. A lack of comprehensive local data and monitoring means, however, that it is currently difficult to make reliable predictions or draw definitive conclusions. These data gaps must be filled before any impacts of climate change on the Mississippi-Rideau region can be accurately assessed.

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