



# Grey-Bruce's State of the Environment Report

2014



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## What is in this report?

This is the first assessment of the state of Grey-Bruce's environment from a health perspective. This report aims to capture and present information on the state of the environment for 2013 (unless otherwise stated) in terms of: its condition, the pressures on it and driving forces contributing to those pressures, human health implications, and societal actions to address environmental concerns. The information in this report sets out baseline data as a yardstick against which to measure the changing state of our environment and its health implications for humans in future years.

The focus of this report is the natural and ambient environment; however we acknowledge that increasingly the built environment is considered part of the broader environment. The built environment of Grey-Bruce may be addressed in a future report. It is also important to note that this report is not yet a comprehensive report touching upon all the relevant environmental issues in Grey-Bruce, but rather a first step in bringing them together.

# Acknowledgements

This report was researched and written by Steven Lam (MPH – University of Guelph). Alanna Leffley (Grey Bruce Health Unit), Bob Hart (Grey Bruce Health Unit), and Dr. Donald Cole (University of Toronto) conceptualized the report, provided direction, vision, and revision support; all of which helped shape the outline and content of the report.

The report is a cooperative effort of the community as represented by various individuals who provided valuable input towards the production of Grey-Bruce's State of the Environment Report 2014. In alphabetical order, these individuals are:

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# Executive Summary

This first state of the environment report for Grey and Bruce counties sets a solid base from which to monitor and evaluate the environment in future years. In this report, Grey-Bruce's environment is described in terms of: its current condition, pressures on it and the driving forces underlying those pressures, human health implications, and societal actions to address environmental issues. The purpose of this report is to inform decision makers, planners, organizations and the broader community about the condition of the natural environment, whose health is essential to the well-being of residents of Grey and Bruce counties. As we gain a better understanding of the environment, its health, and its impact on human health, we can better protect our natural resources and human health.

There is a complex relationship between the environment and human health, and this report attempts to simplify this relationship into a set of indicators (environmental indicators and ecological indicators). While indicators were identified for many aspects of the environment, much data required for a comprehensive picture was not available, incomplete, or not representative of the entire region. Nevertheless, sufficient data were available to indicate that the Grey-Bruce environment was in relatively good condition and trends were identified where sufficient data were available (**Table 1**).

Environmental indicators include indicators of land, air and water quality. For land quality indicators, baseline energy consumption and greenhouse gas emission levels for Grey-Bruce were recently established in 2011, allowing for measurement of change over time. Waste diversion rates were increasing over time and some municipalities in Grey-Bruce have reached Ontario's waste diversion goal of 60%. More than half of Grey-Bruce's land remained as farmland which generates \$672 million annually in gross farm receipts. Soil cover appeared to be increasing over time but there was no data on other soil quality indicators.

For air quality indicators, air pollution levels consistently met provincial air quality guidelines, the number of air pollutant exceedances above provincial standards was low, and particulate matter concentrations have decreased significantly over time ( $p=0.035$ ); however, it is important to note that data came from just one monitoring station located in the town of Tiverton in the southern part of Bruce County.

For water quality indicators, Adverse Water Quality Incident reports showed that municipal drinking water quality appeared to be good; however private drinking water quality still presented concerns, as private drinking water samples submitted for testing have decreased over time. Surface water quality and beach water quality appeared to be in good condition. The number of exceedances above provincial beach water quality standards was low, with 2013 being the lowest in 5 years. Water levels of Lake

Huron and Georgian Bay appeared to be decreasing over the last 20 years with a record low in 2013, however water levels rose above-seasonal-average in 2014.

For ecological indicators, the incidence of vector diseases in Grey-Bruce has remained low over time. Forests and wetlands appeared to be in good condition; however more monitoring data is needed to determine trends in their ecological indicators. The status of biodiversity and fish and fish habitat could not be determined due to insufficient data.

Driving forces affect many aspects of the natural environment and include population growth, economic growth and climate change. Population growth in Grey-Bruce was very low at less than 1% from 2006 to 2011. Economic growth generally leads to more resource use which can be accompanied by pollution from agriculture, industries and transportation unless managed well; however economic progress in the region could not be determined due to insufficient data. Grey-Bruce climate indicators showed steady averages over the last 20 years. The climate indicators studied in this report were not detailed enough to be able to draw strong conclusions but it appears that present driving forces do not exert large pressures on the environment.

Pressures on Grey-Bruce's environment vary depending on the type of environmental health indicator one examines. For example, for water quality indicators, wetland condition indicators and fish and fish habitat condition indicators, the main pressures are sewage discharge, agricultural runoff, industrial leakage, and invasive species. Human health implications arising from the current state of the environment are documented throughout the report.

Initiatives to address environmental issues by the community, organizations and government bodies are documented throughout. With this report on the state of the environment, municipalities, organizations, planners, decision-makers and the broader community have an opportunity to better understand the natural environment and human health impacts. Regular updates to state of the environment reporting can help residents of the area stay informed and aware, and help governments and other stakeholders set priorities for action.

**Table 1: Summary of key findings.**

Indicator	Summary
<b>Environmental indicators</b>	
<b>Land</b>	<p><b>Energy:</b> Requirements for energy use reporting for the broader public sector were recently implemented by the Ministry of Energy in 2011. Baseline energy consumption and greenhouse gas (GHG) emissions were established allowing for changes to be measured into the future.</p> <p><b>Waste:</b> Waste diversion rates were steadily increasing over time in Grey County (<math>p=0.009</math>) but not in Bruce County. In 2012, the waste diversion rate for Grey-Bruce was 44%, which is lower than Ontario's 60% waste diversion goal. Some municipalities in Grey-Bruce have reached Ontario's waste diversion goal, with Owen Sound at 63% and Meaford at 60%.</p> <p><b>Agriculture:</b> The number of farms and farm area in Grey-Bruce has gradually decreased from 2006 to 2011. Despite the overall decrease in the number of farms and farm area, the total farm revenue increased by nearly 12%. Farmland represented 51% of Grey-Bruce's land, and farming generated about \$672 million annual in gross farm revenue. Grey-Bruce has the most livestock, especially cattle and calves, compared to other counties in Ontario.</p> <p><b>Soil:</b> Although soil cover appeared to be increasing over time, there was no data on other soil quality indicators (e.g., soil composition, soil biodiversity).</p>
<b>Air</b>	<p>Concentrations of key air pollutants (e.g., particulate matter and ozone) consistently met provincial air quality standards.</p> <p>The concentrations of particulate matter have decreased significantly over time (<math>p=0.035</math>).</p> <p>The number of smog days was low, with zero smog days declared in 2013.</p> <p>There is a huge data gap in air quality data as the only air quality monitoring station is in the town of Tiverton in Bruce County, which cannot represent air quality for all of Grey-Bruce.</p>
<b>Water</b>	<p><b>Drinking water quality:</b> The number of Adverse Water Quality Incident reports from Grey-Bruce water systems from 2009-2013 was consistently low, and corrective action and re-testing resulted in the Ontario Drinking Water Quality Standards being met. While fewer owners of private wells were getting their well water tested over time, adverse results from total coliforms decreased significantly over time (<math>p=0.004</math>) and adverse results from <i>E. coli</i> appeared steady over time.</p> <p><b>Surface water quality:</b> The majority of watersheds in Grey-Bruce score an "A" or "B" in terms of surface water quality.<sup>1</sup></p> <p><b>Ground water quality:</b> All wells in the Saugeen Valley Conservation Area scored an "A" in terms of ground water quality. The ground water quality in the Grey Sauble</p>

<sup>1</sup> A = Excellent conditions and B = Good conditions, according to Conservation Authority Watershed Report Cards.



	<p>Conservation Area could not be determined due to insufficient data.</p> <p><b>Beach water quality:</b> The number of exceedances above provincial beach water quality standards was low, with 2013 being the lowest in 5 years.</p> <p><b>Water quantity:</b> The water levels of Lakes Huron-Michigan appeared to be decreasing over time. In January 2013, water levels dropped to their lowest point in 20 years, however water levels have risen above-seasonal-average in 2014. Water quantity did not appear to be a concern for municipal water systems in the region.</p>
<b>Climate change</b>	<p>Climate change indicators (average temperatures and rainfall) appeared to be steady over the last 20 years but further climate change and variability indicators were not explored.</p> <p>There was a low number of heat alerts in Grey-Bruce over the last 10 years.</p>
<b>Ecological indicators</b>	
<b>Vectors</b>	The number of cases of Lyme Disease and West Nile Virus in Grey-Bruce was very low over time, with identified cases likely being travel related. There was no human cases of eastern equine encephalitis in Grey-Bruce.
<b>Biodiversity</b>	66 species were identified as 'species at risk' Grey-Bruce. Data was not available on where these species live.
<b>Fish and fish habitat</b>	Progress was made in fish community objectives for Lake Huron; however objectives were largely unmet as of 2010. Data was not available on the state of fish and fish habitat.
<b>Forests</b>	The majority of watersheds in Grey-Bruce scored an "A" or B" in terms of forest quality.
<b>Wetlands</b>	The majority of watersheds in Grey-Bruce scored an "A" in terms of wetland quality.



## *Preface*

In May of 2014, the Grey Bruce Health Unit hosted a Healthy Communities Conference to provide an opportunity to pool local knowledge, skills, and energies. Areas of discussion were about how we can have healthy environments and healthy local public policy, ensure our communities support people at highest risk for poor health as well as many other related topics.

The conference was opened with the following prayer by Jimelda Johnston of the Southwest Aboriginal Health Access Centre who kindly agreed to share it for this report.

“WeyWeyNaaboozhoo,

It’s great to be here, an honor to be part of this historical gathering in the Saugeen Territories, a land sacred to indigenous people around the Great Lakes.

Our ancestors are smiling today and happy to be included in such an important event as Healthy Communities.

One of our greatest values in life is relationship – right relationship – within Creation, our families, our community, our nation and beyond, nation to nation, community to community, family to family and self to creation.

Another of our greatest values in life is inviting ‘Zahweygizhemidoo’ (Our Creator) into the work, play, and relationships, so if we can for a moment before the event unfolds, focus and remember who we are addressing:

- Boozhoo Mishomis, Boozhoo Nokomis, Ogimah Binesse Kwe is my name, Maang Dodem, I am Mediwiwin, I am Anishnabae Kwe
- Creator, maker and giver of all life, we turn to you at this time of Knowledge seeking and creating right relationship with each other and ask you to be among us... and we give gratitude for our life and all the ways you share your perfect essence, you’re most beautiful perfect Creation. We are grateful for the four directions and the spirit keepers of those directions: Waabanong, Zawhwenong, Negahbenong, Giwaydinong whom have been fulfilling their responsibility from the beginning of time





- Miigwetch, for giving us a Loving Mother that provides us with all that we need to enjoy and live a good life, to help us heal, help us grow, nurtures us, protects us, provides every medicine for us, and loves us like a Mother with a heart, we are grateful.
- Miigwetch, for the water that flows through her, and is the essence of all life. We are grateful for the Thunderbirds that bring the purification and nurturing so essential for our babies and the water that surrounds them before their feet touch our loving mother, water that is so essential for future generations. We are grateful for the water, the water beings and the spirit keepers of the water, which are so essential to life for without water no life will survive. And for Grandmother Moon who in her waning and waxing works with the ebb and flow of water throughout Creation, both within and outside ourselves. We are grateful for our Grandmother Moon and this perfect essence of Creation.
- Geezis, our Grandfather Sun's movement is closer to our Mother giving warmth and balance, essential to life and sustenance in this beautiful Creation. We are grateful.
- We are grateful for the winds and air, from our first breath to our last breath. We have been blessed with the touch both within and outside ourselves, experiencing YOUR gentleness and strength. We are Grateful for the winds of the four directions that are so essential to life...
- Miigwetch, for the animals and birds, swimmers and flyers, crawlers, those below and above. Gratitude for our Dodems, those ones that Honor us to walk with them, and speak for them as they cannot speak for themselves. We are grateful for our relatives, so essential to the balance and enjoyment of this Creation.
- We ask, invite you into this time and place to acknowledge this life, which is not so much about our story, but your story and honouring the essence of healing, healthy relationships and healthy communities. There is so much to be grateful for, we can't even remember it all at this time, but know from our heart that we are grateful for everyone and everything in Creation.
- Miigwetch, Zahwegizemidoo
- Miigwetch Zahwegizemidoo
- Miigwetch Zahwegizemidoo
- Miigwetch Zahwegizemidoo
- Neh Kahnegenah.....All my relations"

# Table of Contents

Acknowledgements.....	3
<b>Executive Summary .....</b>	<b>4</b>
List of Figures .....	12
List of Tables .....	12
<b>Background .....</b>	<b>13</b>
Purpose .....	13
Ecosystem health .....	14
Reporting and framework.....	15
<b>Health Unit Counties Profile.....</b>	<b>16</b>
What is unique about Grey-Bruce?.....	16
Aboriginal population .....	17
Population growth and economic growth .....	18
<b>Environment .....</b>	<b>19</b>
Land.....	19
Energy use .....	19
Waste .....	21
Agriculture .....	23
Soil.....	27
Radon .....	29
Climate change.....	30
Air.....	35
Water .....	40
Drinking water quality.....	40
Surface water quality.....	43
Groundwater quality.....	46
Beach water quality .....	49
Water quantity.....	51
<b>Ecological Indicators .....</b>	<b>53</b>
Vector monitoring.....	53
Biodiversity .....	57

Fish and fish habitat monitoring.....	59
Forest conditions .....	61
Wetland conditions.....	63
<b>Conclusion</b> .....	65
Challenges and Future State of the Environment Reporting.....	67
References .....	68
Appendix A – Saugeen Ojibway Nation Territory Map .....	75
Appendix B – Waste Disposal Information .....	76
Appendix C – Municipal Drinking Water Systems.....	77
Appendix D – Conservation Authority Grading System .....	79
Appendix E – Source Protection Area Map.....	80
Appendix F – Beach Information.....	81
Appendix G – Full List of Known Species at Risk .....	82
Appendix H – Definitions of Species at Risk Categories.....	84
Appendix I – Fishery Management Zones.....	85
Appendix J – Data Gaps.....	86

## List of Figures

Figure 1: The DPSEEA Framework.....	15
Figure 2: Map of Grey-Bruce municipalities. ....	17
Figure 3: Map of Conservation Authority boundaries. ....	17
Figure 4: Total residential waste generated per person from 2008-2012.....	22
Figure 5: Percentage waste diverted from 2008-2012. ....	22
Figure 6: Area of land under tillage in Grey-Bruce from 2006-2011. ....	27
Figure 7: Annual amount of rainfall from 1992-2013. ....	31
Figure 8: Annual average summer temperatures (Jun, Jul, Aug) from 1992-2013.....	31
Figure 9: Annual average winter temperatures (Dec, Jan, Feb) from 1993-2013. ....	32
Figure 10: Annual number of heat alerts from 2003-2013.....	32
Figure 11: Number of emergency department visits due to natural cold and heat from 2003-2012. ....	33
Figure 12: Average annual ozone levels from 2003-2013. ....	36
Figure 13: Number of hourly ozone exceedances (>80 ppb) from 2003-2013.....	36
Figure 14: Average fine particulate matter (PM <sub>2.5</sub> ) levels from 2003-2013.....	37
Figure 15: Number of fine particulate matter (PM <sub>2.5</sub> ) Exceedances (>30 µg/m <sup>3</sup> ) from 2003-2013. ...	37
Figure 16: Number of smog days for Grey-Bruce and Ontario from 2003-2013.....	38
Figure 17: Overall surface water quality of watersheds in Grey-Bruce.....	44
Figure 18: Percentage of beach water sample exceedances above standard from 2004-2013.....	49
Figure 19: Surface water elevation for Lake Michigan-Huron from 1994-2014.....	51
Figure 20: Passive surveillance of ticks from 2010-2013. ....	54
Figure 21: Number of human cases of Lyme disease from 2005-2013. ....	54
Figure 22: Number of human cases of WNV from 2002-2012. ....	56
Figure 23: Overall forest condition of watersheds in Grey-Bruce. ....	61
Figure 24: Overall wetland condition for watersheds in Grey-Bruce. ....	63
Figure 25: Healthy communities. ....	65

## List of Tables

Table 1: Summary of key findings. ....	6
Table 2: Energy consumption of Grey-Bruce Municipalities in 2011.....	20
Table 3: Total number of farms, farm area, and farm revenue in Grey-Bruce in 2006 and 2011. ....	24
Table 4: Number of cattle, calves, goats, sheep and lambs by top county producers in 2011. ....	24
Table 5: Number of boil water advisories and adverse water quality incidents from 2009-2013. ....	41
Table 6: Private water sample test results for bacteria (total coliforms and <i>E. coli</i> ) from 2003-2013.....	42
Table 7: West Nile virus monitoring in Grey-Bruce from 2001-2013. ....	55
Table 8: Number of species at risk in Grey-Bruce in 2014.....	57

# Background

This is the first State of the Environment Report (SOER) oriented towards human health for Grey and Bruce counties. The development of the report was led by the Grey Bruce Health Unit (GBHU) with involvement from external agencies. Stakeholders from the GBHU, Ministry of the Environment and Climate Change, Ministry of Natural Resources and Forestry, Grey Sauble Conservation Authority, and municipal and county planners provided material or advice for the report, or commented on specific aspects of the report.

## Purpose

The purposes of the report are to:

- Provide information on the current *state* of Grey-Bruce's natural environment;
- Describe *pressures* on the state and *driving forces* behind those pressures;
- Describe *implications* for human health and *actions* to mitigate adverse health effects; and
- Increase awareness among decision-makers and the community about the importance of the environment, leading to more informed decisions surrounding management of the environment.

Human health and well-being are affected by the quality of the natural environment. A healthy natural environment can help us adapt to climate change, population growth and economic growth. Many people know that the air we breathe, the water we drink, and the land that surrounds us influence the health of individuals and communities. It is important to understand that ecological resources such as forests, wetlands and natural areas are also important to our health as they help to cool our environment, reduce the impacts of flooding and other natural hazards, as well as support sustainable water resources. A SOER can help us determine how healthy Grey-Bruce's environment is, by documenting the quality of the air, water, land, and ecological resources. Further, SOERs can inform policy and decision makers on priority areas for actions to ensure a healthy future for Grey County and Bruce County.

Traditionally, a **pressure-state-response** (PSR) framework, a linkage-based framework, is used to describe environmental indicators in SOERs. This framework is described below:

**Pressure** – humans exert pressure on the environment (e.g., burning of fossil fuels);

**State** – the state/condition changes as a result of the pressure (e.g., worsening air quality);

**Response** - develop and implement policies which influence human activities (e.g., initiatives to reduce use of fossil fuels).

A comprehensive SOER takes into account indicators of stress on the environment, indicators of the state of the environment, and indicators of societal response (Rapport and Singh 2006). Although the PSR framework incorporates these elements, it has limitations. Firstly, it provides a static representation of the environment and ignores significant interactions between components. Secondly, a ‘bottom line’ that would provide the community with an overall assessment of environmental trends is lacking with this framework. Thirdly, the PSR framework has been considered less suitable for describing human health linkages (WHO 1997). Most importantly, this framework alone does not provide a sense of immediacy to motivate actions to protect the natural environment, and subsequently health (Rapport and Singh 2006).

## Ecosystem health

Ecosystem health, or ‘Ecohealth’, is a transdisciplinary approach that recognizes the complex biophysical, social, and economic relationships between ecosystems and human health (Blockstein and McManus 2007). Ecosystems provide many ecosystem goods and services that are vital to human health and livelihood. Humans in turn are altering the capacity of healthy ecosystems to deliver goods and services. Greater awareness of the value of ecosystems is needed among decision-makers and the public at large. In a SOER, it is important that we not only consider the state of air, water, and land, but also the state of ecosystems and how they affect human health.

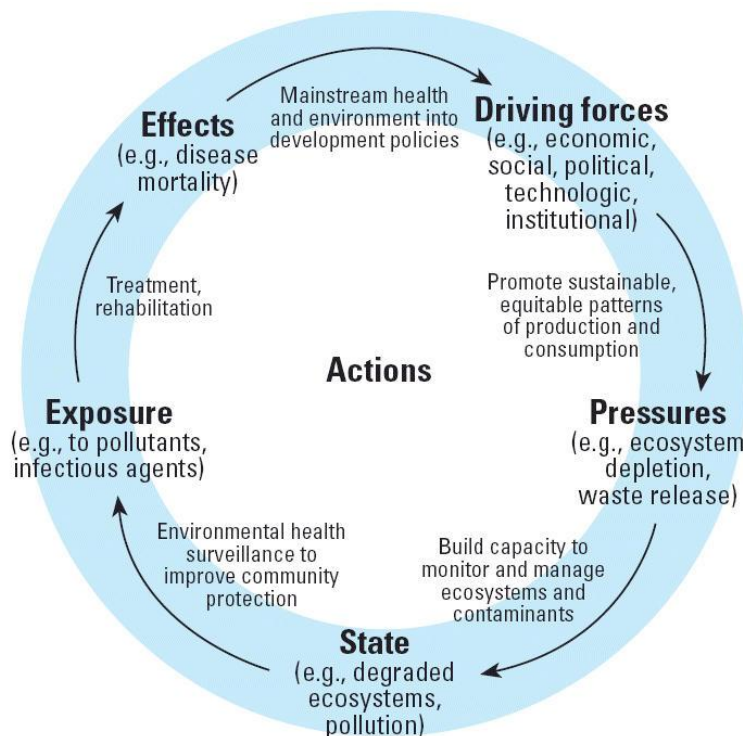
In order to better understand the linkages between the health of ecosystems and health of humans, collaboration is needed among sectors, disciplines and diverse stakeholder groups to integrate their perspectives on ecosystems and health. Individuals from public health, Ministry of the Environment and Climate Change, Conservation Authorities, Ministry of Natural Resources and Forestry, and municipal and county planners were consulted in the creation of this report.

An environmental scan of SOERs in Ontario showed that an Ecohealth focus has been used in past SOERs such as “Focus on Our Environment: York Region’s State of the Environment Report 2005” (YRHSD 2005) and “Renfrew County State of the Environment Report 2004” (Harrison 2004). A linkage-based framework which links the environment and ecosystems to human health was not used in past SOERs. Our report attempts to link these factors by using the framework below.



## Reporting and framework

All information used in this report were compiled from a variety of sources and assembled into the Driving Force, Pressure, State, Exposure, Effect and Action (DPSEEA) framework (**Figure 1**). The DPSEEA framework was created by the World Health Organization to guide the development of environmental indicators. It aims to describe a comprehensive picture of the way broad driving forces exert pressures on the state of the environment, affecting human health through various exposure pathways. For some indicators that do not fit well within this framework (i.e., no clear exposure or health effect), the Driving Force, Pressure, State, Impact and Response (DPSIR) was used (European Environment Agency 1997). Instead of describing the exposure or health effect of the indicator, the DPSIR framework describes the impact of the indicator on human health and ecosystems. For the purposes of our report, response and action are considered synonymous.



**Figure 1. The DPSEEA Framework.**

(Source: Carneiro et al. 2006, adapted from Corvalan et al. 2000).  
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# Health Unit Counties Profile

## What is unique about Grey-Bruce?

Grey and Bruce counties are upper-tier, regional municipalities located in Southwestern Ontario nested between Lake Huron and Georgian Bay (**Figure 2**). Together they have a population of 158,760 across 8,601 km<sup>2</sup> (Statistics Canada 2011a), encompassing 17 municipalities each with its own unique characteristics including culture, resources and environmental surroundings.

Major tourist attractions located within Grey-Bruce include the Bruce Peninsula National Park, several beaches (e.g., Sauble Beach, Southampton Beach, Northwinds Beach), the Bruce Grey Trails Network, many conservation areas and the Niagara Escarpment. The Niagara Escarpment is a United-Nations-designated “world biosphere reserve” and is one of only twelve such reserves in Canada. These reserves are recognized for their balance between development and conservation. The Niagara Escarpment is at the heart of many of Grey-Bruce’s natural attractions and one of Canada’s most significant landforms. Grey-Bruce’s unique natural features support the area’s recreation, agriculture and tourism industries.

Grey-Bruce has abundant freshwater assets such as Lake Huron, Georgian Bay and many rivers, wetlands and watersheds. We all live in a watershed; an area of land that drains into a common waterway such as a river, stream, lake or wetland. Each watershed offers natural beauties of beaches, waterfalls or woodlands and provides ecosystem goods and services such as safe drinking water, clean air, and sustainable water resources which contribute to livable communities. The watersheds of Grey and Bruce counties are looked after by five conservation authorities, with Grey Sauble Conservation Authority and Saugeen Valley Conservation Authority covering the majority of Grey-Bruce (**Figure 3**). Nottawasaga Conservation Authority (Grey Highlands, The Blue Mountains), Maitland Valley Conservation Authority (Huron-Kinloss, South Bruce) and Grand River Conservation Authority (Southgate) cover smaller parts of Grey-Bruce.



**Figure 2: Map of Grey-Bruce municipalities.**  
*Grey Bruce Health Unit, 2011.*



**Figure 3: Map of Conservation Authority boundaries.**  
*Conservation Authorities of Ontario, 2012.*

## Aboriginal population

Aboriginal people including First Nations and Métis account for 2.9% of the total population in Grey-Bruce (Statistics Canada 2011a). Aboriginal people have a major role to play in environmental management and development within their traditional territories and have a close connection to the land. There are three distinct Aboriginal groups in Grey-Bruce including the First Nations, Métis Nation of Ontario and Historic Saugeen Métis. There are two First Nations communities in Grey-Bruce which include the Chippewas of Nawash Unceded First Nation (located near Warton in Bruce County) and the Chippewas of Saugeen First Nation (located near Southampton in Bruce County). These two communities share a common Traditional Territory which covers much of Grey-Bruce (**Appendix A**). When working together on matters of mutual interest, they are collectively identified as the Saugeen Ojibway Nations. The Historic Saugeen Métis, also known as the 'Lake Huron watershed Métis', are an independent Métis community located in Southampton (Bruce County). The Métis Nation of Ontario is an Aboriginal organization for the Métis population and is active in conservation efforts in the Georgian Bay area.

## Population growth and economic growth

Population growth can be determined by looking at the change in population since the last census. A comparison of the 2011 census with the 2006 census indicates that Ontario's population increased by almost 6% (Statistics Canada 2011a). In Grey County, the population increase was 0.2% while in Bruce County the population increase was 1.2%. For Grey-Bruce, the overall increase was 0.6%.

The top three communities in terms of population growth were: Chippewas of Nawash First Nation (↑12.9%), Saugeen Shores (↑8.0%), and Hanover (↑4.8%). The top three communities in terms of population loss were: The Blue Mountains (↓5.5%), South Bruce (↓4.3%) and Saugeen First Nation (↓4.2%) (Grey Bruce Health 2012).

Economic growth could not be estimated for Grey-Bruce. While measures of economic growth exist at the national and provincial level exist (e.g., gross domestic product), measures of economic growth at the municipal level is not well established.

## Rural versus urban areas

Grey-Bruce is largely rural with 53% of the Grey-Bruce population living in a rural area and 47% living in small population centres (Statistics Canada 2013). By comparison, only 19% of Ontarians live in a rural area, with 12% living in small population centres, 9% living in medium population centres, and the remaining 60% living in large urban population centres. The City of Owen Sound (population 22,000) is the largest city or town in Grey-Bruce. Grey and Bruce counties share a public health agency, the Grey Bruce Health Unit (GBHU).



# Environment

## Land

Land use in Ontario is guided by several pieces of legislation and accompanying regulations. The Planning Act and the Provincial Policy Statement are two significant components of the planning system. The Planning Act sets out the ground rules for land use planning in Ontario and describes how land uses may be controlled and who may control them (MMAH 2013). The Provincial Policy Statement, issued under the Planning Act, provides direction on matters of provincial interest related to land use planning and development. It recognizes the complex inter-relationships among economic, environmental and social factors in planning. It includes policies on key issues that affect our communities, such as the efficient use and management of land and the protection of the environment and resources. The Niagara Escarpment Plan is the Ontario Government's land use plan that controls development on the Escarpment.

The Official Plan is an important tool when making land use decisions. Official Plans are produced by upper and single tier municipalities in Ontario and are used to guide development in the area that the municipality has jurisdiction. Goals of Official Plans include respecting the natural environment, minimizing adverse impacts on the environment, protecting significant features and water quality. They also provide policies and guidelines for the protection of natural heritage and archaeological resources for their economic, environmental and social benefits. There are two upper-tier Official Plans in Grey-Bruce; the Grey County Official Plan and Bruce County Official Plan.

## Energy use

Energy is important to our daily life and is an important pressure on the environment. The production and use of energy impact our environment by contributing to air pollution, global warming, disturbances of ecosystems and potential radioactivity from nuclear waste. Bruce Power, the world's largest operating nuclear facility, is located in Southern Bruce County near Kincardine. Emerging energy alternatives in Grey-Bruce are solar and wind. Although solar and wind are clean and viable sources of energy supply, they vary more in production than nuclear power. It is crucial to use energy efficiently and to conserve it wherever possible. Indicators of energy use include electricity consumption and greenhouse gas emissions.

**Driving force:** Population growth, economic growth (e.g., industries, transportation, and agriculture) are driving forces acting on energy use. Both provincial and local economic growth are drivers acting on energy use as Grey-Bruce is a net exporter of electricity from Bruce Power.

**Pressure:** Methods of energy production and demand for energy are pressures.

**State:** In 2011, Ontario's Ministry of Energy introduced Regulation 397/11 under the *Green Energy Act 2009* which requires that all municipalities and selected public sector bodies develop energy Conservation and Demand Management Plans (Ministry of Energy 2014a). As a first step in the process, municipalities must provide summaries of their 2011 energy consumption and greenhouse gas emissions for a range of facilities. They were required to report to the Ministry of Energy by July 1, 2013 and every year thereafter. See **Table 2** below shows the energy consumption and greenhouse gas emissions for Grey and Bruce counties in 2011.

**Table 2: Energy consumption of Grey-Bruce Municipalities in 2011.**

Municipality	Total Electricity Consumption (kWh)	Total Green House Gas Emissions (kg CO <sub>2</sub> )
<b>Grey County</b>		
Owen Sound	8,795,105	2,033,551
Chatsworth	853,016	218,123
Hanover	7,167,584	1,918,307
Georgian Bluffs	1,175,054	244,928
The Blue Mountains	3,883,272	812,199
Southgate	732,680	162,725
Meaford	Not available	Not available
Grey Highlands	2,321,419	551,743
West Grey	2,021,618	418,664
<b>Bruce County</b>		
Northern Bruce Peninsula	1,252,476	271,452
Huron-Kinloss	2,063,780	305,373
Kincardine	6,609,755	1,172,114
Arran-Elderslie	2,200,253	524,288
Brockton	1,945,871	467,493
Saugeen Shores	3,528,209	439,565
South Bruce	1,585,669	375,253
South Bruce Peninsula	2,192,719	408,033

*Energy use and greenhouse gas emissions for the Broader Public Sector, Ministry of Energy, 2014b.*

**Impact:** Burning of fossil fuels, such as coal, natural gas and oil produces a portion of Ontario's electricity but also the majority of greenhouse gas emissions, contributing to climate change. Ontario's energy supply mix is about 59% nuclear, 23% hydro, 11% gas, 2% coal and 3.4% wind (Bruce Power 2013). Wind turbines are found throughout Grey-Bruce and produce little or no pollution or greenhouse gases; however they are perceived as a source of health concern among



some residents. A recent large study found an association between wind turbines and distress in humans, however future research is needed to determine if a causal relationship exists or not (Arra et al. 2014). Nuclear power also generates electricity which produces no air pollution or global warming emissions when they operate. This too concerns some residents about the risk of radiation coming from Bruce Power, though current radiation emissions from Bruce Power are well within regulatory limits (Bruce Power 2014).

**Response:** Bruce County has an energy conservation plan (2014-2018) to reduce energy consumption and greenhouse gas emissions (Bruce County 2014a). The Saugeen Valley Conservation Authority has educational programs on energy conservation (Saugeen Conservation 2014). Municipalities are working on Energy Conservation and Demand Management Plans to support energy planning to reduce energy consumption and its related environmental impact. There are many conservation and renewable energy programs available in Ontario through the Ministry of Energy.

**Data Challenge:** One municipality is still working on their energy consumption and greenhouse gas emissions report. As reports become available, a complete baseline of energy consumption and greenhouse gas emissions can be determined and trends observed.

## Waste

Reduction, reuse and recycling of waste materials are positive actions that reduce our impact on the land. Converting and diverting waste reduces energy needed to collect and transport waste to landfills and are important for extending the life of landfill sites. These actions have societal, economic and environmental benefits that are vital for a sustainable community. Promoting sustainability in our natural environment can help reach the goal of having a healthy community.

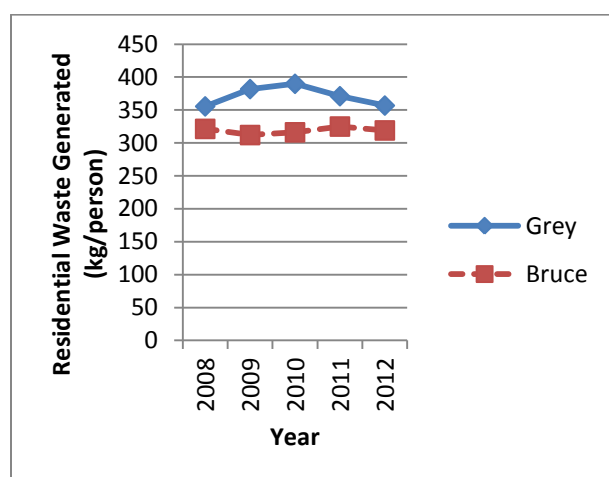
In Bruce County, the responsibility for waste management is split between the county and local municipalities (Bruce County 2014b). Local municipalities are responsible for waste collection, blue box recycling, electronics recycling and landfill site operations. Bruce County manages the Household Hazardous and Special Waste Collection Program, is involved in waste management education, and monitors the capacity and operations of the local landfill sites. In Grey County, the responsibility for waste management is with local municipalities (Grey County 2014a). Responsibilities include waste collection, recycling, landfill site operations and hazardous waste disposal.

Indicators of the state of waste include the total residential waste generated per person and the residential waste diversion rate. Residential waste accounts for approximately 34% of landfill waste in Grey-Bruce (estimated using provincial ratio to residential waste from Statistics Canada). As the population grows, it is important that the waste generated per person decreases to minimize impact on landfills. The residential waste diversion rate is the percentage of Blue Box and other residential waste that is kept out of landfill each year (WDO 2014a).

**Driving force:** Population growth and economic development (e.g., industries) are driving forces for waste generation.

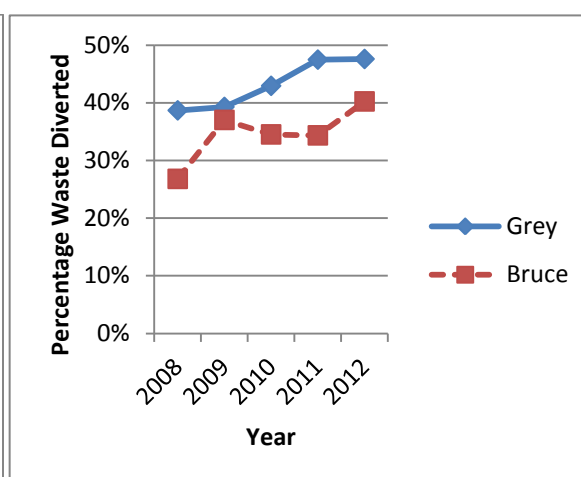
**Pressure:** Levels of packaging and changes in consumption patterns are pressures on landfills.

**State:** The total residential waste generated per person in Grey-Bruce has not changed significantly over time (**Figure 4**). The amount of waste diverted from landfills has increased significantly over time for Grey County ( $p=0.009$ ) but not for Bruce County (**Figure 5**). It is important to note that each municipality in Grey-Bruce has its own waste management plan and so has very different waste diversion rates. **Please see Appendix B** for total residential waste generated and diverted per year for individual municipalities.



**Figure 4: Total residential waste generated per person from 2008-2012.**

*Residential Generally Accepted Principles (GAP) Diversion Rates, Waste Diversion Ontario.*



**Figure 5: Percentage waste diverted from 2008-2012.**

*Residential Generally Accepted Principles (GAP) Diversion Rates, Waste Diversion Ontario.*

**Fun Fact:** According to Waste Diversion Ontario's 2012 Top 20 Municipalities for Diverting Residential Waste, Owen Sound ranks second best at 63.09% (WDO 2014b). Three other municipalities in Grey-Bruce are also on the list, including Meaford at 4<sup>th</sup> place with 59.75%.

**Impact:** The landfill capacity is limited and landfills take up valuable land space. Landfills also produce greenhouse gases which contribute to climate change. Many materials that end up as waste contain toxic substances. Over time, toxins from landfills have potential to leach into our soil and ground water, becoming an environmental and health hazard.

**Response:** Decreasing the environmental health impact of landfills can come from producing less waste and diverting more waste. Waste recycling in Grey-Bruce is growing each year thanks to the efforts of municipalities and provincial governments. Most municipalities in Grey-Bruce have a

waste management plan to achieve the provincial 60% waste diversion target (no target year specified). These management plans include strengthening existing or developing new waste diversion programs, developing educational campaigns to promote recycling, and performance and target monitoring. The Province provides long term direction for municipalities to move forward.

Composting is the natural breakdown of organic material by bacteria and fungi. Most household and yard waste can be composted and most municipalities in Grey-Bruce have a leaf and yard waste composting program. Further, homeowners can compost at home through a backyard composter.

Through the Blue Box Program which began in 2004, Ontario households play a key role in diverting packaging and printed paper waste from landfills (WDO 2014b). Almost 7 million tonnes of recyclable materials have been diverted since 2004. Each year, Waste Diversion Ontario requires municipalities to complete a survey, called the Municipal Datacall, in order to be eligible for funding for the Blue Box Program. Data collected through the Municipal Datacall allow Waste Diversion Ontario to monitor the effectiveness and efficiency of the program.

**Data Challenge:** Industrial, commercial and institution (ICI) waste account for a large percentage of landfill waste each year (66%), yet very little data is available on ICI diversion rates or waste composition. Because of the lack of data and reporting requirements, a trend in ICI waste diversion could not be determined.

## Agriculture

Agricultural land is beneficial for the production of food for humans and animals and it is necessary for sustainability. It is dependent on ecosystem services including the hydrological cycle, pollination, biological pest control and maintenance of soil structure (Power 2010). Agriculture is an important sector of Grey-Bruce's economy and is a large component of the region's land use. Agriculture can also retain a green environment and provide visual relief from urban development.

**Driving force:** Climate change, population growth and economic growth are driving forces acting on agriculture.

**Pressure:** Climate variability, extreme weather events (e.g., droughts), warming weather, water quantity and quality, farming practices, pest and disease infestations, land use, and demand for agricultural products are pressures relevant to agriculture.

**State:** More than half (58% or 2360 km<sup>2</sup>) of the total land area of Bruce County is farmland, and nearly half (44%, 1986 km<sup>2</sup>) of the total land area of Grey County is farmland (Statistics Canada 2011b). The number of farms and farm area in Grey-Bruce has decreased from 2006 to 2011 (**Table 3**). Despite the overall decrease in number of farms and farm area, total farm revenues increased by nearly 12%. Farms are becoming smaller and more productive.

**Table 3: Total number of farms, farm area, and farm revenue in Grey-Bruce in 2006 and 2011.**

	Grey County		Bruce County	
	2006	2011	2006	2011
Total number of farms	2,687	2,248	2,259	2011
% change in number of farms	↓16%		↓11%	
% change in number of farms for Grey-Bruce	↓13.5%			
Total farm area (acres)	567,212	490,707	613,156	583,239
% change in farm area	↓13.5		↓4.9	
% change in farm area for Grey-Bruce	↓9.2%			
Gross farm revenues (\$)	267,295,850	288,295,498	338,509,444	384,427,884
% change in gross farm revenues	↑7.9%		↑13.6%	
% change in gross farm revenues for Grey-Bruce	↑11.7%			

2011 Census of Agriculture, Statistics Canada

Grey-Bruce has a lot of livestock compared to other counties in Ontario, with cattle and calves being the most common type of livestock produced (**Table 4**).

**Table 4: Number of cattle, calves, goats, sheep and lambs by top county producers in 2011.**

Rank	County	Number of farms reporting	Total
<b>Cattle and Calves</b>			
1	<b>Bruce</b>	<b>1,224</b>	<b>158,710</b>
2	Wellington	1,241	142,197
3	Huron	1,002	129,529
4	<b>Grey</b>	<b>1,299</b>	<b>111,208</b>
<b>Goats</b>			
1	Oxford	104	12,086
2	<b>Bruce</b>	<b>117</b>	<b>10,390</b>
3	Perth	131	9,660
4	<b>Grey</b>	<b>114</b>	<b>8,217</b>
<b>Sheep and Lambs</b>			
1	Wellington	208	27,548
2	Huron	191	26,166
3	<b>Grey</b>	<b>262</b>	<b>25,181</b>
4	<b>Bruce</b>	<b>154</b>	<b>21,020</b>

2011 Census of Agriculture, Statistics Canada.

**Impact:** The high number of livestock farms in Grey and Bruce counties can result in large amounts of manure, potentially threatening ecosystems. Nutrient and pesticide runoff can negatively affect water quality of lakes and streams. Animal waste is a major source of nitrates and its entry into lakes

and streams contribute to algae blooms. Algae blooms can lead to increased treatment needs for drinking water and negative impacts on recreational activities such as swimming, fishing and tourism. Further, drinking water can be compromised leading to enteric illness in humans.

**Response:** The region could take a leadership role in slowing the decrease in number of farms and farm land area. Supporting agriculture and increasing the ability for farmers to be economically sustainable could be incorporated into county Official Plans. Further, promoting stewardship programs targeted towards farmers can mitigate adverse environmental impacts associated with agriculture.

Ontario Farmland Trust protects and preserves Ontario farmlands and associated agricultural features through land securement, stewardship, policy research and education (Ontario Farmland Trust 2014).

The *Nutrient Management Act 2002* addresses some of the agricultural runoff concerns by identifying how much manure is produced and stored on the farm, how runoff is managed and a plan for unforeseen circumstances or emergencies. Healthy Lake Huron is an initiative led by a team of dedicated environmental professionals to address the algae problem in Lake Huron through science and policy objectives. **For more information, please visit [healthylakehuron.ca](http://healthylakehuron.ca).**

**Data challenge:** Run-off from agricultural operations contributes to water pollution, but there is no data on the extent of agriculturally related pollution.

## Environmental Awareness on the Farm

An Environmental Farm Plan (EFP) is an assessment tool that farm families can use to identify and develop best practices for on-farm environmental stewardship in up to 23 different areas on the farm. With this tool a farm's environmental strengths and areas of concern are identified and a realistic action plan with a time table is produced. Environmental cost-share programs may be available to assist in implementing projects. Detailed information about EFPs can be obtained from the [Canada-Ontario Environmental Farm Plan](#) website.

Locally, the Long Alley Organic Dairy Farm, run by Ingo Huesing and his family, has had an EFP in place for several years. As part of their plan, the Huesing family has constructed fully contained manure storage on the farm to protect ground and surface water. As well, they capture surplus heat from the onsite yoghurt-making operation to provide hot water in the barns.



*Ingo Huesing, Long Alley Farm*



## Soil

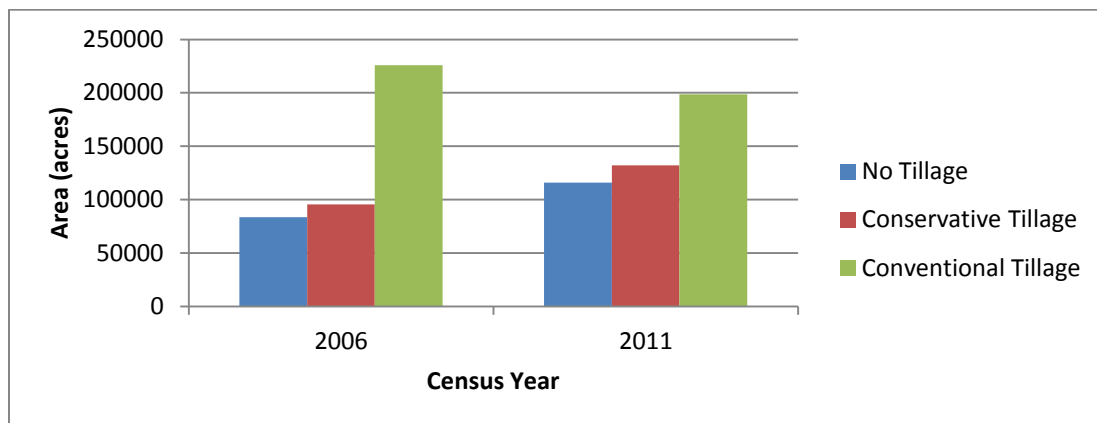
Healthy soil support the growth of plants and animals and provides humans with clean air, food, and water. It serves as the foundation for sustainable agriculture as well as the foundation for homes and infrastructure. The wide range of soil functions makes it a crucial environmental media and it is important that soil health is monitored.

Soil cover is important for maintaining organic matter. Organic matter holds nutrients and supports soil biodiversity. During farming practices, disturbances of soil should be kept at a minimum through minimal tillage. Tillage involves preparing soil for planting or seeding (Statistics Canada 2008). Conventional tillage, conservation tillage and no tillage are defined by the amount of crop residue left on the ground. The zero-till approach avoids any mechanical tillage of soil and attempts to keep soil disturbance to a minimum. Higher levels of tillage result in higher loss of soil cover.

**Driving force:** Climate change, land use, population growth are driving forces acting on soil pressures.

**Pressure:** Extreme weather events, farming practices (e.g., tillage, erosion, and compaction), loss of biodiversity and pollution from industries are pressures on soil conditions.

**State:** There has been an increase in the adoption of no tillage and conservative tillage with a simultaneous decline in the use of conventional tillage (**Figure 6**).



**Figure 6:** Area of land under tillage in Grey-Bruce from 2006-2011.

*2011 Census of Agriculture, Statistics Canada.*

**Impact:** An increase in soil cover over time indicates improvement in environmental sustainability as the soil is more protected from degradation (AAFC 2013). Given that more than half of Grey-Bruce's land is farmland (Statistics Canada 2011a) and the lack of heavy industries, soils in Grey-Bruce may not have suffered from significant amounts of contamination. However, it is important to note that damage to soils can negatively impact ecosystems directly through loss of biodiversity living within

the soil, negative impacts on habitat supported by the soil, and species dependent on soil organisms for food. Further, damaged soil can reduce farm productivity.

**Response:** There is little legislation related directly to soil and soil protection. The Province provides information and resources on agriculture and the environment, including best management practices, the Environmental Farm Plan, integrated pest management, soil conservation, and the Healthy Futures for Ontario Agriculture. Many Ontario farmers do their part to keep land and water safe through Environmental Farm Plans including managing waste run-off to ensure that farming land remains productive and environmentally sustainable.

The Bruce County Federation of Agriculture and the Grey County Federation of Agriculture represent the interests and concerns of farm families in their respective counties who are members of the Ontario Federation of Agriculture (OFA 2014). Their objectives include promoting and supporting initiatives which benefit the agricultural industry and the community of Bruce County, Grey County and the Province.

**Data Challenge:** Soil characteristics are described previously in Source Protection Area Assessment Reports (Drinking Water Source Protection 2011), but data is not available to report on soil quality.

# Radon

Radon is a naturally occurring radioactive gas found throughout the environment. It is a colourless and odourless decay product of uranium found in rocks and soil. Radon is a health concern to humans as it tends to collect in enclosed, non-ventilated below-ground spaces in homes, schools and workplaces, sometimes in very high concentrations. Radon is the largest source of exposure to naturally occurring radiation and is the second leading cause of lung cancer (after smoking).

**Driving force:** Not applicable as radon is naturally present in the environment.

**Pressure:** Not applicable as radon is naturally present in the environment.

**State:** A study by Health Canada in 2012 found higher than recommended radon levels in homes tested throughout the country (Health Canada 2012a). In Grey and Bruce counties, 11% of homes tested contained radon concentrations above the recommended limit, compared to 8.2% in Ontario.

**Exposure:** Radon can seep from soil into homes through cracks in the foundation or slab. Exposure to radon occurs through inhalation of radon gas found in homes.

**Effect:** When radon is inhaled, radon decays which produces decay products that damage lung tissues. Damaged lung tissues increase the risk of developing lung cancer (Health Canada 2012a). In Grey-Bruce, 20% of lung cancer deaths each year are attributable to radon, compared to 13% in Ontario (PHO 2014a). The risk of lung cancer depends on the level of radon in your house, how long you are exposed and whether you smoke.

**Action:** The GBHU strongly encourages all homes to get tested for radon, regardless of location. Radon testing is inexpensive and easy to do using a detector that can be purchased at a home improvement and other stores. Health Canada has established a guideline for radon in indoor air of 200 Becquerels/meter<sup>3</sup>. Remedial measures should be undertaken in buildings exceeding recommended radon concentrations. People who have private wells should test their water to ensure that radon levels are within provincial standards.

GBHU is participating in a national campaign to promote home radon awareness and testing through the National Radon Action Campaign. For information on this campaign, please visit [takeactiononradon.ca](http://takeactiononradon.ca).

# Climate change

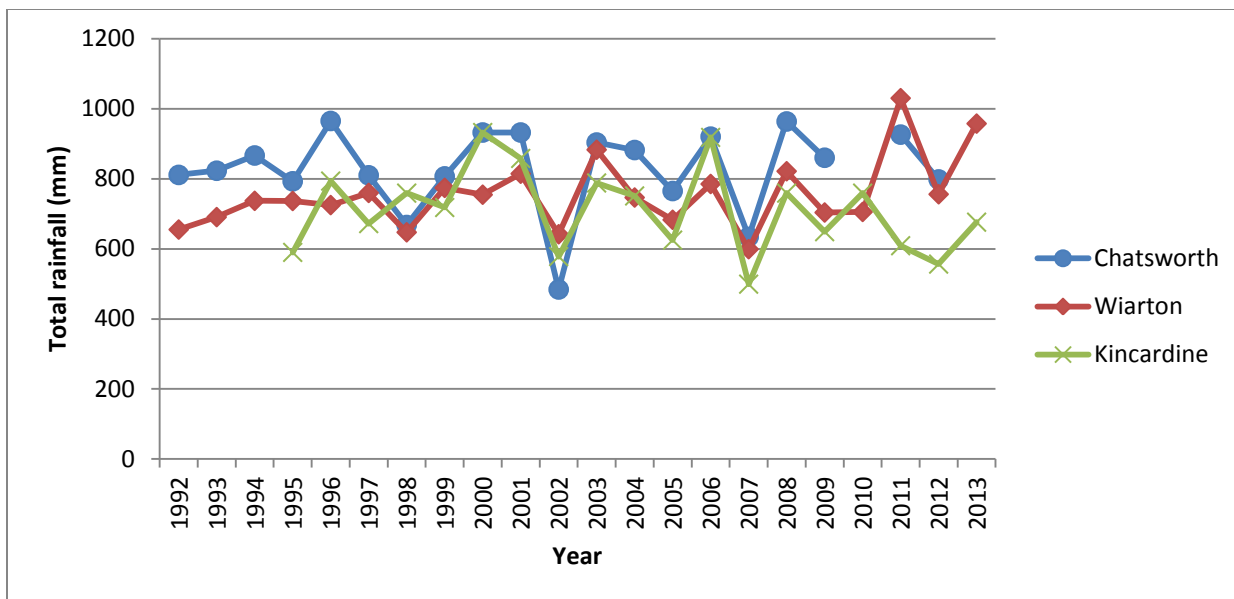
Climate change is not easily reversible change in weather patterns over time. Climate change is one of the most serious threats facing humans today, with a high proportion of people, infrastructure and economic activities vulnerable to the effects of climate change (e.g., extreme weather and natural disasters). Global surface temperatures have been increasing on average 0.6°C since the beginning of the 20<sup>th</sup> century (IPCC 2013). Grey-Bruce is seeing some changes in the environment as a result of climate change as well.

Due to the time constraints inherent in producing this report, climate change data was limited to readily available data from Environment Canada. Data sets included total rainfall from 1992 to 2013, average summer temperatures from 1992 to 2013, average winter temperatures from 1992 to 2013 and number of heat alerts. In addition the number of emergency department visits due to natural cold and heat from 2003 to 2012 was considered. The report does not look at potential driving factors such as CO<sub>2</sub> levels; it also does not consider global climate data or local factors such as lake temperatures. Finally the report does not address the severity, number or timing of extreme weather events.

**Driving force:** Natural causes (e.g., volcanic eruptions and solar variation) and human activities (e.g., burning fossil fuels and deforestation) are the main drivers of climate change.

**Pressure:** Human activities increase greenhouse gas emissions which are pressures contributing to climate change.

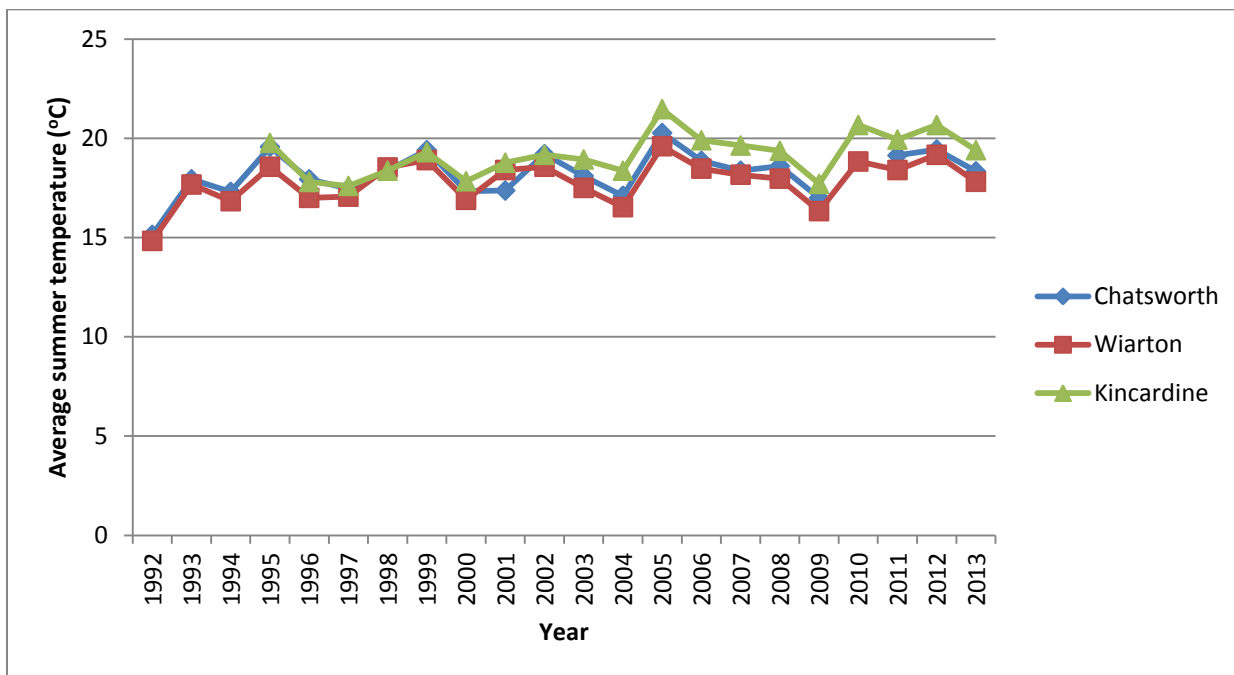
**State:** There is no significant change in average annual rainfall over time, but there have been heavy rainfall in 2011 and 2013 (**Figure 7**). Summer temperatures and winter temperatures have not changed significantly over time (**Figure 8 & 9**). Grey-Bruce experienced a very cold winter in 2013 (**Figure 9**). The number of heat alerts in Grey-Bruce has been relatively low over time (**Figure 10**).



**Figure 7: Annual amount of rainfall from 1992-2013.**

*Years with incomplete weather data have been excluded in the charts.*

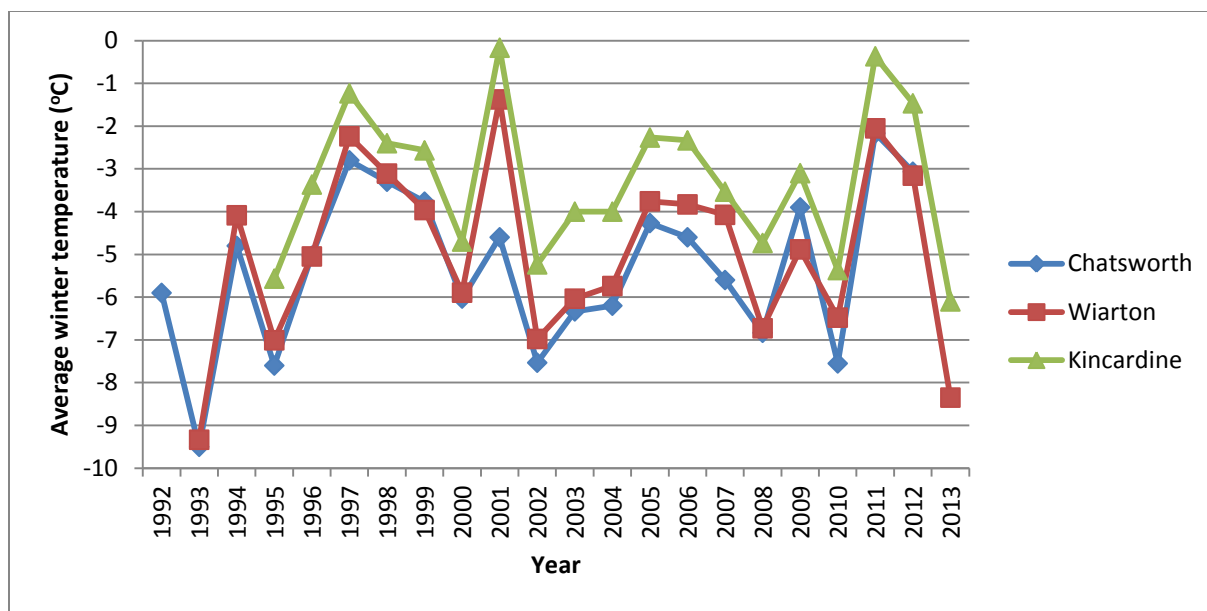
*Chatsworth, Wiarton and Kincardine Stations, Ministry of the Environment and Climate Change.*



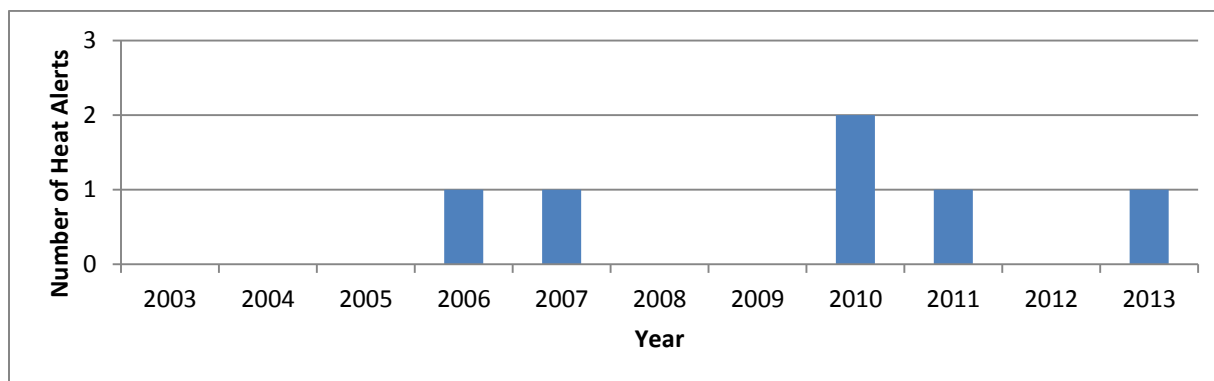
**Figure 8: Annual average summer temperatures (Jun, Jul, Aug) from 1992-2013.**

*Years with incomplete weather data have been excluded in the charts.*

*Chatsworth, Wiarton and Kincardine Stations, Ministry of the Environment and Climate Change.*



**Figure 9: Annual average winter temperatures (Dec, Jan, Feb) from 1993-2013.**  
*Chatsworth, Wiarton and Kincardine Stations, Ministry of the Environment and Climate Change.*

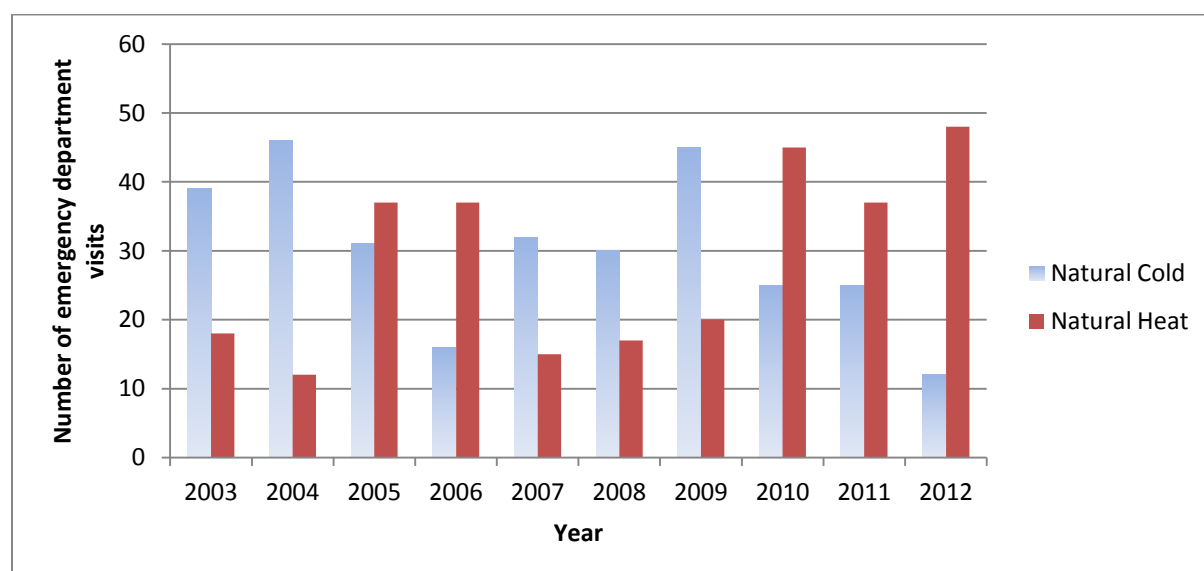


**Figure 10: Annual number of heat alerts from 2003-2013.**  
*GBHU media releases.*

**Exposure:** Everyone is exposed to the effects of climate change either directly (e.g., heat waves, extreme cold or natural disasters) or indirectly (e.g., increased spread of vector-borne diseases with warmer temperatures, or poor air quality). Certain subsets of the population are especially vulnerable to these effects. For example, during heat waves, low-income persons may be living in poor housing and are less able to afford air conditioning and may be less able to protect themselves from vectors (see Vector monitoring section below). On the opposite end of the scale, the extreme cold can affect those without shelter, outdoor workers, and those who work in an area without heat. Resource based activities such as farming and fishing are highly affected by extreme weather conditions.



**Effect:** The number of local emergency room related visits from natural cold or natural heat is presented in **Figure 11**. It appears that the number of natural cold related emergency department visits have decreased since 2009, and number of natural heat related emergency visits have increased since 2009. Exposure to extreme cold can cause cold stress including hypothermia and frost bite. Exposure to extreme heat increases the risk of heat related illnesses including heat stress, heat exhaustion and heat stroke (Health Canada 2011). Climate change can also lead to reduced air quality by increasing the level of ozone (IPCC n.d.); a pollutant considered a health risk for sensitive populations. Further, warmer weather is expected to increase the risk of vector-, water- and foodborne diseases (CDC 2010). It is unlikely that these effects will be as noticeable in Grey-Bruce as climate change in the area has so far been less dramatic than in other regions.



**Figure 11: Number of emergency department visits due to natural cold and natural heat in Grey-Bruce from 2003-2012.**

*PHO Ontario Health Profile Supplementary Data Tables for Grey Bruce Health Unit, 2014.*

**Action:** Carbon can be removed from the atmosphere through reforestation and good soil management practices. Further, reducing the reliance on hydrocarbon-powered transportation could reduce the release of greenhouse gases into the atmosphere. Conservation authorities have programs to monitor watershed conditions, as an indicator of climate change. The GBHU monitors land use management, recreational water and vector-borne diseases which can be considered indicators of climate change impacts as well.

**Data Challenges:** Climate data up to 2013 was only available for Chatsworth, Wiarton and Kincardine.

The number of extreme heats days and extreme cold days would allow better linkage between exposure and health effects, but this data was not compiled at the time of the report. Data on the number of days that heat alerts lasted would be a more relevant indicator than the number of heat

alert occurrences alone. Data on how long the heat alert lasted was not previously reported. It is recommended that this be collected from now on.

Climate variability is the ups and downs in climatic conditions over time. It can have a larger effect on the frequency of extremes (e.g., droughts, floods) than changes in mean climate conditions (Katz and Brown 1992). Climate variability can be a pressure on agricultural based activities, as many resources are accustomed to responding to seasonal variations in climate but not weather extremes. Climate variability data was not compiled at the time of the report but can be explored in a future SOER.

# Air

Air quality is an important indicator of the state of the environment and it is dependent on the health of our ecosystems. Ecosystem services can help to process air pollutants such as ground-level ozone and particulate matter. Ground-level ozone is a gas formed when nitrogen oxides ( $\text{NO}_x$ ) and volatile organic compounds (VOCs) react in the presence of sunlight. Naturally occurring ozone in the stratosphere is beneficial as it shields the Earth from harmful ultraviolet radiation, but ground-level ozone is a major environmental (e.g., crop damage) and health (e.g., respiratory irritant) concern.

Particulate matter is a general term for a mixture of microscopic solid particles and liquid droplets suspended in air. Particulate matter is classified according to its size, mainly due to the different health effects associated with particles of different size. Particulate matter can also negatively impact the environment through corrosion, damage to vegetation and reduced visibility (MOECC 2011). Ground-level ozone and  $\text{PM}_{2.5}$  (particulate matter less than 2.5 microns in diameter) are air pollutants of concern in Grey-Bruce and they are major contributors to smog and poor air quality.

## Drivers:

Climate change, population growth economic growth (e.g., industries, transportation) and urbanization are driving forces acting on air quality pressures.

## Pressures:

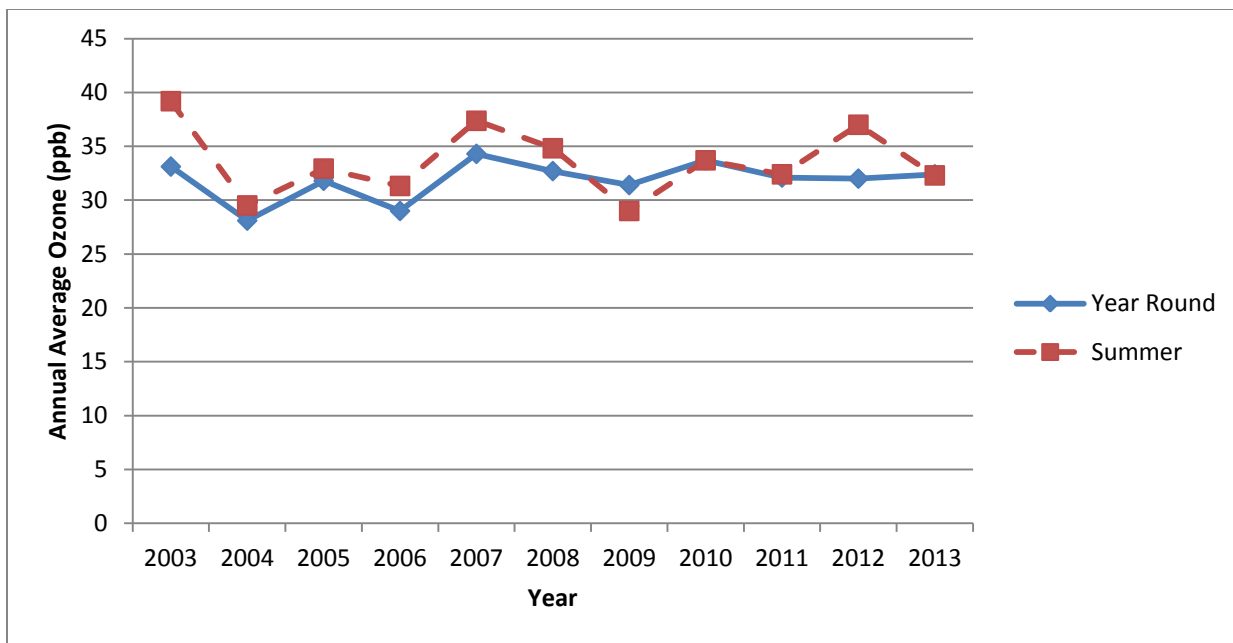
Ozone: Emissions from transportation accounts for a large amount of VOC and  $\text{NO}_x$  emissions (Air Quality Ontario 2011). Fossil fuels account for some  $\text{NO}_x$  emissions and general solvent use accounts for some VOC emissions.

$\text{PM}_{2.5}$ : Emissions from transportation, industry and power plants, wood and agricultural burning.

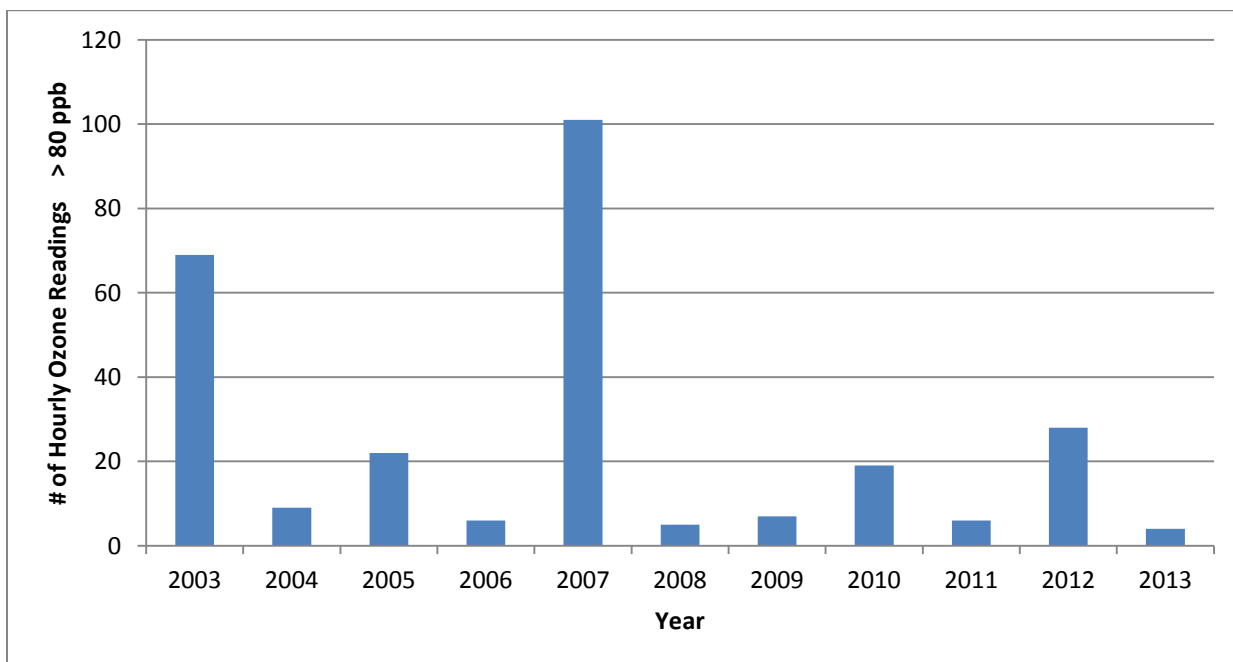
Smog: Ground level ozone and  $\text{PM}_{2.5}$  concentrations.

## State:

Ozone: Ground level ozone concentrations appear to be relatively constant over time (**Figure 12**). Ground level ozone concentrations are slightly higher in the summer (**Figure 12**) and occasionally exceed Ontario's one-hour ambient air quality criterion of 80 ppb (Ministry of the Environment 2011) (**Figure 13**). These exceedances vary from year to year. In 2013, the ozone levels exceeded the Ontario criteria on one day for 4 hours.



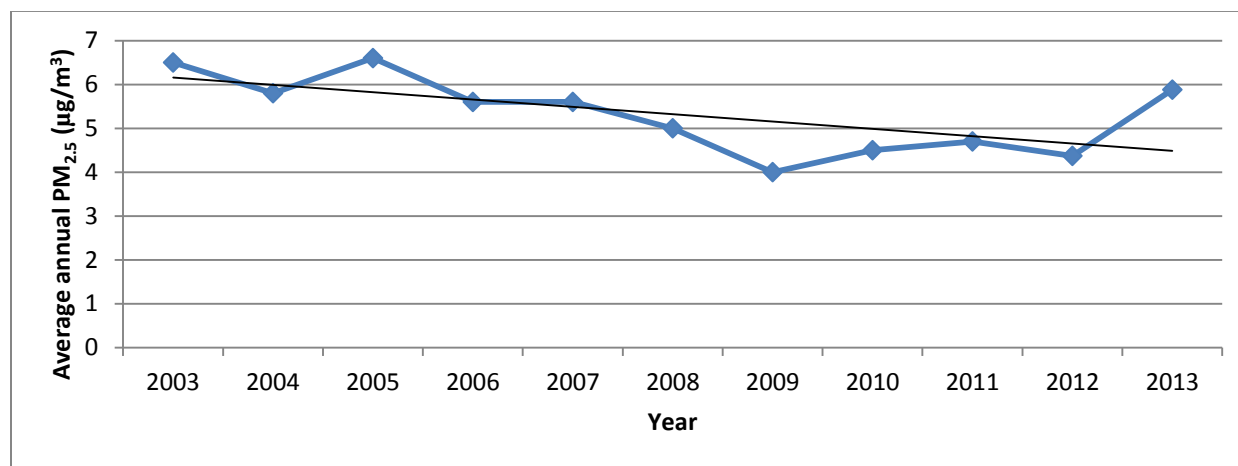
**Figure 12: Average annual ozone levels from 2003-2013.**  
*Tiverton weather station, Ministry of the Environment and Climate Change.*



**Figure 13: Number of hourly ozone exceedances (>80 ppb) from 2003-2013.**  
*Tiverton weather station, Ministry of the Environment and Climate Change.*

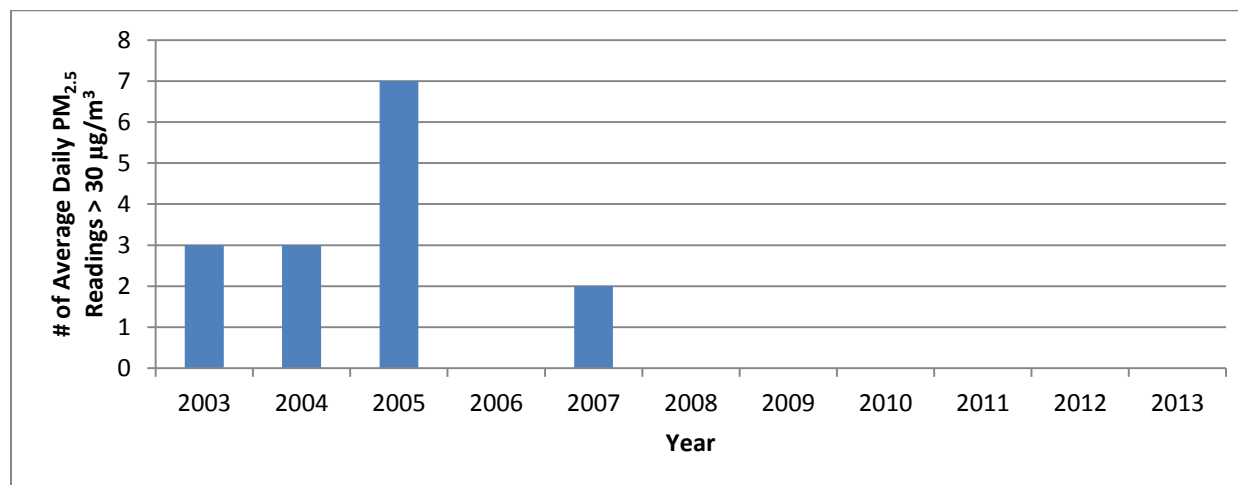
PM<sub>2.5</sub>: Particulate matter has significantly decreased over time ( $p=0.035$ ) (**Figure 14**). It is unclear whether or not the increase in PM<sub>2.5</sub> in 2013 reflects true values as a new SHARP monitoring method was implemented in January 1, 2013 (MOECC 2010a). The new SHARP monitor is able to detect additional components of PM<sub>2.5</sub> and as a result, there is potential of reporting higher PM<sub>2.5</sub> concentrations.

In 2002, the Canada-wide Standard for PM<sub>2.5</sub> was created as a result of the pollutant's adverse effects on human health and the environment (CCME 2007). The Canada-wide Standard for PM<sub>2.5</sub> is 30  $\mu\text{g}/\text{m}^3$  for a 24-hour averaging time. The number of exceedances over the criteria was rare in Grey-Bruce (**Figure 15**), with no exceedances in PM<sub>2.5</sub> observed since 2008.



**Figure 14: Average fine particulate matter (PM<sub>2.5</sub>) levels from 2003-2013.**

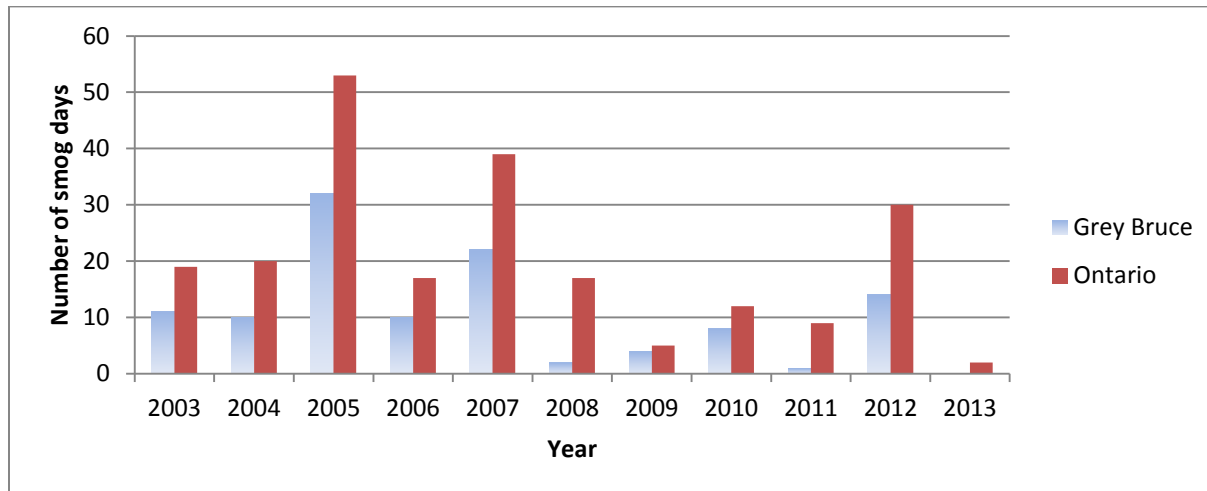
*Tiverton weather station, Ministry of the Environment and Climate Change.*



**Figure 15: Number of fine particulate matter (PM<sub>2.5</sub>) Exceedances (>30  $\mu\text{g}/\text{m}^3$ ) from 2003-2013.**

*Tiverton weather station, Ministry of the Environment and Climate Change.*

Smog: Grey-Bruce residents enjoy relatively good air quality with respect to smog (**Figure 16**). Typically, in years where more smog days are declared across Ontario, more smog days are also declared in Grey-Bruce. In 2013, Grey-Bruce had zero smog days, the first time since these statistics have been collected (MOECC 2010b).



**Figure 16: Number of smog days for Grey-Bruce and Ontario from 2003-2013.**

*Smog Advisory Statistics, Ministry of the Environment and Climate Change.*

### Exposure and effect:

**Ozone:** Ground level ozone forms when pollutants react in sunlight, with high ozone levels generally occurring on hot sunny days between noon and early evenings (MOECC 2005). Anyone who spends time outdoors when ground ozone levels are high may be at risk for adverse health effects, particularly those with lung and heart conditions. Urban areas are generally less exposed to ground level ozone because it is reduced by the reaction of nitrogen oxide (emitted from cars) with local combustion sources (MOECC 2011).

The health effects of short term exposure to ozone can include reduced lung function and increased respiratory symptoms (e.g., irritation of airways or difficulty breathing) (Health Canada 2010). Long term exposure may cause respiratory diseases and cardiovascular disease (State of the Air 2013).

**PM<sub>2.5</sub>:** Particulate matter is formed from pollutants released from transportation, industrial and natural sources. Unlike ozone, PM<sub>2.5</sub> can remain high day and night, throughout the year. Wood burning can be common in Grey-Bruce (due to its rural nature) and contributes to PM<sub>2.5</sub> levels. Although everyone is exposed to the harmful health effects of PM<sub>2.5</sub>, more sensitive populations include those with asthma, cardiovascular or lung disease, as well as children and elderly people.

The health effects of short-term exposure to PM<sub>2.5</sub> can include reduced lung function and aggravated asthma (Health Canada 1998). Long term exposure may increase risk of chronic diseases such as cardiovascular disease and lung cancer.

**Smog:** Smog is caused only by air pollution. High level of pollutants and high temperatures contribute to smog, however smog occurs throughout the year. Winter smog can be a serious concern when stagnant air causes a buildup of pollutants near the ground. Smog is unlikely to be an issue for Grey-Bruce as the exceedances of ozone and PM<sub>2.5</sub> have been low over time.

The Ontario Medical Association's Illness Cost of Air Pollution Model calculates the number of premature smog deaths that occur in a census area. In 2008, 161 premature, smog-related deaths were estimated for Grey-Bruce (Ontario Medical Association 2008).

**Actions:** Actions to reduce levels of smog, ozone and PM<sub>2.5</sub> include reducing the use of hydrocarbon fuel-powered vehicles and energy conservation techniques.

**Data Challenges:** The only air quality data monitoring station of Grey-Bruce is located in Tiverton in Bruce County. Air quality data is therefore not representative for all of Grey-Bruce.



# Water

Water is an essential component of life, as human bodies are made up of 90% water. We need to drink it to survive and drinking water comes from surface water or ground water. It is important that source water is protected and treatment measures are in place to ensure that the integrity of drinking water isn't compromised.

## Drinking water quality

Access to safe drinking water is a fundamental need for everyone and is crucial for individual health. The integrity of drinking water is important for human, animal and environmental health. Water quality may be affected by microbiological and/or chemical agents, water-borne bacteria, viruses or protozoa. Drinking water quality management is a crucial component in the prevention and control of water-borne disease.

**Driving force:** Climate change and economic growth (e.g., industry, agriculture) are driving forces acting on drinking water pressures.

**Pressure:** Warming temperatures, extreme weather events, consumption of water, agricultural runoff, industrial discharge and septic systems are pressures on drinking water quality.

**State:**

### *Communal drinking water systems and small drinking water systems*

Communal drinking water systems are regulated by the Ministry of the Environment and Climate Change (MOECC) and can range from large municipal water treatment plants to smaller systems servicing a designated facility. If a system is found unable to provide safe water (e.g., bacterial contamination or inadequate treatment), the system operator may issue boil water advisories to protect the health of the system users. The number of boil water advisories was generally low over time (**Table 5**).

Under the *Drinking Water Systems Regulation (O. Reg. 170/03)*, regulated municipal water systems are required to monitor their water and report any adverse results to the local health unit and the MOECC. The number of Adverse Water Quality Incidents (AWQIs) was generally low over time (**Table 5**).

Small drinking water systems (SDWS) are systems that do not get drinking water from a municipal drinking water system. They can include restaurants, seasonal trailer parks, summer camps, community centres and many other public facilities. SDWS are regulated under *Ontario SDWS Regulation 319* which outlines AWQI reporting requirements to the health unit. In 2013, public health responded to 59 AWQIs from SDWS (**Table 5**).

**Table 5: Number of boil water advisories and adverse water quality incidents reported from Grey-Bruce water systems from 2009-2013.**

Year	Number of boil water advisories from operators <sup>1</sup>	Number of adverse reports for municipal systems (O. Reg. 170/03) <sup>2</sup>	Number of adverse reports for small drinking water systems (O. Reg. 319/08) <sup>3</sup>
2009	20	127	29
2010	24	121	81
2011	20	87	87
2012	7	108	53
2013	21	85	51

<sup>1</sup>GBHU Boil Water Advisory Dataset.

<sup>2</sup>GBHU Adverse Reports Dataset.

<sup>3</sup>Laboratory Results Management Application.

### *Private water systems*

Residents in Grey-Bruce that do not obtain drinking water from a municipal drinking water system or SDWS rely on a private supply of water, usually a well. Approximately 32% of Grey-Bruce residents are using a private water supply. This estimate is derived from statistics on the number of users served by municipally-treated drinking water services and population estimates (**Appendix C**). The Province offers Ontario residents free bacteriological drinking water testing of their private water supply. GBHU supports this initiative by offering advice and encouraging private well owners to use the free water testing service. Residents typically seek advice if they receive notification of an adverse sample. Private drinking water supplies are the responsibility of the owner.

The most common well water testing practices are bacterial testing (total coliform and *E. coli*). Total coliforms are a group of bacteria commonly found in the environment. They are not likely to cause illness, but their presence indicates that the water supply may be vulnerable to contamination by more harmful microorganisms. *E. coli* is considered to be a species of coliform bacteria. *E. coli* bacteria is found only in human and animal waste, and its presence usually results from a recent animal or human waste contamination, likely from a nearby source.

According to the Ontario Drinking Water Standards, an adverse test result (an indicator that the water may not be safe to drink) occurs when there are greater than 5 total coliforms or greater than zero *E. coli* present in a 100 mL private water sample (MOE 1994). See **Table 6** for aggregate water sampling results from 2003-2013. The number of water samples submitted for bacteriological testing has decreased over the years. The percentage of adverse water quality incidents (AWQIs) from total coliforms decreased significantly over time ( $p=0.004$ ). There was no significant change in the percentage of AWQIs from *E. coli*. It is important to note that the sampling results cannot be interpreted as a representation of the overall quality of private well water. There can be multiple samples from single wells and testing is voluntary. Further, adverse results may be the result of poorly maintained wells as opposed to contaminated source water.

**Table 6: Private water sample test results for bacteria (total coliforms and *E. coli*) in Grey-Bruce from 2003-2013.**

Year	Total coliforms			<i>E. coli</i>		
	# Water Samples	# Adverse Results*	Percentage (%)	# Water Samples	# Adverse Results*	Percentage
2003	20,802	3,434	16.5	20,802	1,020	4.9
2004	18,839	2,600	13.8	18,839	1,141	6.1
2005	17,637	2,974	16.9	17,637	869	4.9
2006	16,344	2,589	15.8	16,344	696	4.3
2007	15,226	2,205	14.5	15,226	566	3.7
2008	14,542	2,021	13.9	14,542	735	5.1
2009	13,206	1,404	10.6	13,206	600	4.5
2010	13,723	1,519	11.1	13,723	732	5.3
2011	13,057	1,734	13.3	13,057	652	5.0
2012	12,337	1,279	10.4	12,337	516	4.2
2013	11,910	1,428	12.0	11,910	587	4.9

\*Adverse Water Quality Criteria Based on Ontario Drinking Water Standards.

Public Health Ontario Laboratories – Water Testing Information System Electronic Notification (WTISEN).

**Exposure:** Exposure to contaminated drinking water is mainly through ingestion.

**Effect:** Water resources that are not monitored well or fail to meet guidelines can cause adverse effects for people who consume or come into contact with them. Adverse health effects of contaminated drinking water mainly include enteric illnesses which are frequently characterized by nausea, vomiting and diarrhea. Infectious gastrointestinal diseases are caused by ingestion of pathogens that usually come from faeces of infected humans and animals. The three main types of water-borne pathogens that can cause gastroenteritis are bacteria (e.g., *Salmonella*, *Campylobacter*, *E. coli*), protozoa (e.g., *Giardia* and *Cryptosporidium*, and viruses (e.g., enterovirus and noroviruses). It is important to note that these diseases may come from other sources such as food. To see the incidence of *Giardiasis* or *Campylobacteriosis* in Grey-Bruce, please refer to Public Health Ontario's [Reportable Burdensome Infectious Disease Incidence snapshot](#).

**Action:** Source water protection plans are developed to protect and/or restore drinking water sources. Municipally supplied drinking water is tested frequently to ensure it meets Ontario Drinking Water Quality Standards. The Ministry of the Environment and Climate Change has a comprehensive inspection program to ensure that municipal drinking water systems operate in compliance with regulatory requirements. Treatment processes are in place to reduce or eliminate the potential for pathogens in drinking water. Information on the results of drinking water systems may be found in the annual reports prepared by municipalities to fulfil the public reporting requirements of *O. Reg. 170/03*. GBHU continues to encourage private well water owners to use the free water testing services.

#### **Data Challenges:**

For communal drinking water systems, the percent of AWQI reports (# adverse / total sampled) would be a better indicator of drinking water quality. GBHU receives notice of AWQIs from the Ministry of the Environment Spills Action Centre. The total number of water samples tested

however is not available. Although each municipality has its own annual drinking water systems report, the number of water samples tested is either not reported or incomplete. It is recommended that the number of water samples tested be reported clearly in annual drinking water systems reports.

It is important to note that adverse results from communal municipal water systems are not a good indicator of the state of water quality, as the quality of water is dependent on drinking water treatment rather than contaminated source water. Moving forward, measuring the effectiveness of source water protection plans in reaching objectives can be a better indicator of water quality.

## Surface water quality

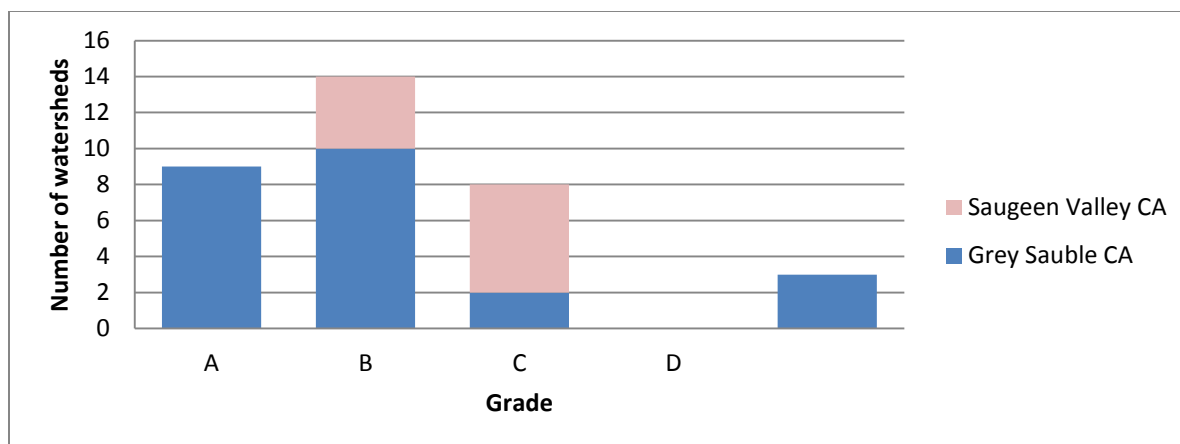
Grey-Bruce is home to a diverse range of surface water resources including 34 watersheds, Georgian Bay and Lake Huron. Some municipal water systems and residents in Grey-Bruce rely on surface water for drinking water purposes, and many rely on surface water for recreational purposes (e.g., fishing and swimming).

**Driving force:** Climate change and economic growth (e.g., industry, agriculture) are driving forces acting on surface water pressures.

**Pressure:** Warming temperatures, extreme weather events, surface and agricultural runoff, industrial discharges, presence of septic tanks, invasive species, low water levels, algae and urban influences (e.g., pesticides from lawns, stormwater) are pressures on surface water quality.

**State:** This report's assessment on the state of the surface water quality was based on the Grey Sauble Watershed Report Card 2013 and the Saugeen Valley Watershed Report Card 2013. These conservational authorities monitor watershed quality in Grey-Bruce, and they assign a grade to the watershed according to surface water quality indicators including total phosphorous, benthic invertebrates and bacteria (*E. coli*).

Surface water quality for the majority of the area has received an "A" or "B" grade, with only a few stretches of "C" in the south (**Figure 17**) (Please see **Appendix D** for definition of grades). In general, water quality improves upstream, away from dense agricultural areas.



**Figure 17: Overall surface water quality of watersheds in Grey-Bruce.**

*Grey Sauble Watershed Report Card 2013 and Saugeen Valley Watershed Report Card 2013.*

**Exposure:** River systems receive direct runoff from the ground surface as well as groundwater discharge from both the overburden and bedrock aquifers. Runoff into rivers eventually makes its way to Lake Huron and Georgian Bay (Source Protection Area 2011). If the runoff water is contaminated, the health of aquatic organisms may be adversely affected. Municipal drinking water systems and private wells that draw water from surface water are at risk for contamination. Subsets of population, especially children, older and immunocompromised people are sensitive to drinking water contaminants.

**Effect:** A change in water quality can negatively affect all levels of an ecosystem (EPA 2011). Surface water contamination can affect the health of wetlands and their ability to support healthy ecosystems. The health of aquatic organisms and animals that rely on the water may be affected, which subsequently affects our recreational benefits of fishing. Threats to human health include eating fish which have bioaccumulated contaminants. Further, surface water also has potential to contaminate drinking water. In this situation, adverse health effects including gastrointestinal illness can occur from ingesting contaminated water.

**Action:** The main legislative response to protecting existing and future sources of drinking water is the *Clean Water Act 2006*. Individuals can protect water by conserving water, maintaining septic systems, disposing hazardous waste properly and reducing the use of commercial fertilizers and pesticides. Some municipalities in Grey-Bruce have an inspection program where septic systems are evaluated to ensure that they are maintained (e.g., Huron-Kinloss, South Bruce Peninsula and Sauble Beach). Regular maintenance ensures that systems are working efficiently to preserve the natural environment and improve water quality. Stormwater management plans are implemented through the Planning Act in accordance with Natural Hazard Policies and MOECC stormwater guidelines to manage stormwater.

In May 2000, water was contaminated with *E. coli* and *Campylobacter* in the town of Walkerton in Bruce County. Within days, seven people had died and thousands of others had become ill from

drinking contaminated water. As a result, the provincial government assembled an inquiry, led by Justice O’Conner, and determined that drinking water was best protected by taking a multi barrier approach (O’Conner 2002). It includes selecting water from the best available source and protecting it from contamination, using effective water treatment and distribution systems, water testing and training of water operators.

Source Water Protection is a provincial government program led by MOECC, MNRF and others to ensure safe drinking water following the Walkerton tragedy. Justice O’Conner’s report of the Walkerton Inquiry identified Source Water Protection as the first barrier in a multi-barrier approach to ensuring safe drinking water. As a result, Source Protection Plans, a requirement of the *Clean Water Act 2006*, were developed in 2011 for watersheds in Grey-Bruce (DWSP 2011). A Source Protection Plan is a series of policies designed to protect drinking water sources, mainly municipal drinking water sources. Policies range from education programs to requirements for implementing best management practices (e.g., risk management plans and land use planning). There are three Source Protection Plans covering three areas in Grey-Bruce (Grey Sauble, Saugeen Valley, and North Bruce Peninsula) (**Appendix E**).

It is important to note that municipal water systems with highly vulnerable aquifers and significant groundwater recharge areas are the focus of Source Protection Plans. For information on how to protect private well systems, please visit [Ontario Ministry of Agriculture and Food’s Best Management Practices: Well Waters](#). The best way to protect sources of water is on a watershed basis because water flows across traditional boundaries such as towns and cities. Municipalities and conservation authority’s collaborate to protect source water.

## Brockton Surface Water Quality Committee

Following a blue-green algae bloom in two inland lakes in Grey-Bruce in 2010, a community group formed to monitor water quality of the lakes and look into ways to prevent the problem in the future. The Brockton Surface Water Quality Committee consisted of members of the community, municipal officials, and staff from the Grey Bruce Health Unit, Ministry of the Environment and Climate Change and the Walkerton Clean Water Centre (WCWC). The group identified a number of social and environmental factors acting on the lakes. Using a variety of methods including education and outreach, drafting a bylaw addressing nutrient loading and septic re-inspection, the group addressed many of these factors. Outcomes included shoreline naturalization, monitoring, and water quality assessment. The inland lake property owners associations secured a grant to do further primary research regarding the issue and in May 2014, an Education Day was hosted by the WCWC to provide information and education to the public. It is hoped that this research will be applied to inform Provincial wide improvements to methods to prevent or respond to blue-green algae blooms.

## Groundwater quality

Groundwater is found in the earth's surface in the loose soil, sand or gravel material or the solid rock formations called bedrock. Grey and Bruce counties rely heavily on groundwater as a source of supply for its drinking water needs (Waterloo Hydrogeologic 2003). There are areas in Grey-Bruce where groundwater flow systems are likely karst dominated. Karst is a unique landscape and hydrogeology created from eroded underground rocks. The unique hydrogeology results in aquifers that are highly productive but extremely vulnerable to contamination. Walkerton and Bruce Peninsula likely have karstic flow conditions which already show clusters of positive bacteriological contamination (Hamilton et al. 2011).

**Driving force:** Climate change, population growth and economic growth (e.g., agriculture, industries) are driving forces acting on groundwater pressures.

**Pressure:** Extreme weather events, surface and agricultural runoff, use of road salts, industrial discharges, landfill leachate, decaying plant or animal materials, pesticides, fertilizers, and septic tanks are pressures on groundwater quality.

**State:** This report's assessment on the state of groundwater has been based on the Saugeen Valley Watershed Report Card 2013. The Saugeen Valley Conservation Authority (SVCA) monitors 23 groundwater aquifers in 17 wells throughout the watersheds. Groundwater quality is graded on two parameters; chloride and nitrite/nitrate. All the watersheds with monitoring wells scored an 'A' grade (please see **Appendix D** for definition of grades). Average nitrate and chloride concentrations over a five year period were below the drinking water standards in all of the wells. There are no monitoring wells in the Penetangore (Bruce County), Beatty (Grey County), or Rocky Saugeen River (Grey County) Watersheds.

**Exposure:** Contaminants may enter drinking water systems if the source of drinking water is from contaminated groundwater. Subsets of population, especially children, older and immunocompromised people are sensitive to drinking water contaminants.

**Effect:** Drinking contaminated water may result in adverse health effects including gastrointestinal illness. Babies in particular are especially susceptible to diseases, such as methaemoglobinaemia, commonly called "blue-baby syndrome", which can result from oxygen deprivation caused by drinking water high in nitrate (Health Canada 2012b). Older people and those with certain disease conditions are also susceptible due to having weaker immune systems. Healthy human adults can consume fairly large amounts of nitrate without adverse health effects. Levels of nitrate were initially elevated in some Walkerton-area monitoring wells, but recent data analysis by the Source Protection Committee show decreasing trends in nitrate levels in monitoring wells (DWSP 2014). No other areas of Grey-Bruce have concerns about nitrate.

**Action:** The main response to protecting and maintaining water environment is the *Clean Water Act 2006*. Individuals can protect water through conservation; maintaining septic systems, reducing the

use of fertilizers and pesticides, controlling runoff and soil erosion, planting trees and shrubs, and disposing of hazardous waste properly. The *Nutrient Management Act 2002* helps to prevent contamination of groundwater by managing nutrient use on farms (MOECC 2014).

A Source Protection Plan is a management strategy designed to minimize the impact that human and natural activities have on the quality and supply of water resources (discussed previously, see Surface Water Quality section above). It is important to note that municipal water systems with highly vulnerable aquifers and significant groundwater recharge areas are the focus of source protection plans. The source protection committee continues to monitor Walkerton-area test wells for the presence of nitrates.

**Data Challenges:** The Provincial Groundwater Monitoring Network (PGMN) is a partnership between the MOECC and the Conservation Authorities of Ontario. It is a province-wide groundwater monitoring initiative designed to collect long-term baseline data on groundwater quality and quality in special areas of interest. Only data from Saugeen Valley Conservation Authority (SVCA) was used in this analysis. Although data was collected from groundwater monitoring wells in Grey Sauble SPA and Northern Bruce Peninsula SPA, the well locations do not adequately represent the region so the information was excluded from analysis.



## *Water Stewardship*

Stewardship activities play a significant role in sustaining and enhancing healthy environments. Informed and engaged communities “lead by example” by adopting behaviours that protect ecosystems and resources. As well, they advocate for policy change that can lead to comprehensive, broad-based approaches to environmental protection.



*Residents and cottagers attended a Water Stewardship Event hosted by the Municipality of Northern Bruce Peninsula and the Grey Bruce Health Unit. Participants discussed the impacts that human activities can have on ground and surface water quality, learned about ways to mitigate these impacts, and had the opportunity to have their water supplies tested for contaminants.*

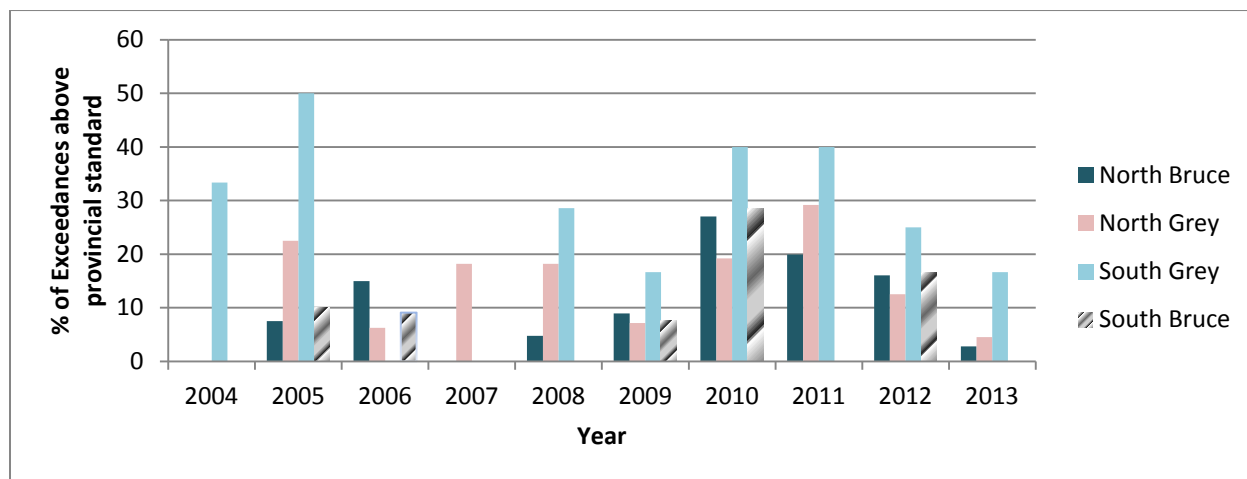
## Beach water quality

Beaches provide many ecosystem services including support for a diverse range of organisms, help regulate climate, and provide humans with social and economic benefits. The health and resilience of beach ecosystems depends on proper beach management. The GBHU conducts a beach management program under the authority of the *Health Protection and Promotion Act*.

**Driving Force:** Climate change, population growth and economic growth (e.g., industries, fisheries) are driving forces acting on beach water pressures.

**Pressure:** Warming temperatures and extreme weather events affect beach water quality. Potential pollution sources and safety hazards are identified during a pre-season assessment. Potential sources include animal waste, stream runoffs, marina facilities, urban and agricultural runoff, sanitary facilities (e.g., washrooms) and playground equipment. In addition, higher levels of *E. coli* have been associated with conditions such as weather (high rain and wind), high wave action, high water temperature and wildlife. The recent re-emergence of algae is another beach contaminant that is likely due to nutrient contaminants such as nitrogen and phosphorus.

**State:** Water quality conditions are determined by testing for the indicator organism *Escherichia coli*. The levels of *E. coli* are analyzed and are compared to the Provincial standard of a maximum of 100 *E. coli* /100 mL of water and posting of a beach may be considered when the provincial standard is exceeded. There have been exceedances in provincial standards among beaches in Grey-Bruce, with a lower number of exceedances occurring in 2013 (**Figure 18**).



**Figure 18: Percentage of beach water sample exceedances above provincial standard (100 *E. coli* / 100 mL) from 2004-2013.**

**North Bruce:** Black Creek, Lion's Head, Sauble

**North Grey:** Little Rivers, Northwinds

**South Grey:** Durham Middle Dam

**South Bruce:** Station

*Beach Management Reports, Grey Bruce Health Unit.*

**Exposure:** Exposure to contaminated beach water can occur through ingestion during swimming and other recreational activities.

**Effect:** Swimming in unsafe water can cause eye, ear, nose, throat infections, skin irritation and gastrointestinal illness. Individuals infected with *E. coli* may experience low fever, headache, nausea, stomach cramps, vomiting and bloody diarrhea which may lead to hemolytic uremic syndrome.

**Action:** **Water Quality Information** signs have been placed at the beaches to educate bathers of conditions that may cause the beach water to be unsafe for bathing.

**Unsafe for Swimming Warning** signs are placed at beaches where the Provincial standard for bacterial levels have exceeded along with other environmental factors. The beach remains posted as unsafe until re-samples indicate the bacterial levels are acceptable and within the Provincial standard. Other factors that may cause the water to be unsafe to swim include environmental spills, wastewater treatment plant bypasses, algae blooms, wildlife die-off, or safety hazards. Educating the public on avoiding the use of fertilizers near to lakes and water-courses and maintenance of septic systems can help to reduce *E. coli* levels. [The Shoreline Stewardship Guide](#) provides helpful stewardship tips that benefit the Georgian Bay and its residents. The guide focuses on the shoreline including areas from Tobermory to The Blue Mountains.

It is important to note that the *E. coli* levels, along with other environmental factors for the particular beach are used to determine the appropriate course of action (e.g., warning postings, beach closures). Beach sampling reflects only the current conditions at the time of sampling. There is often a two day delay between sampling and receiving sampling results from the lab. Hence, the public must assess if the water is likely safe to swim based on conditions such as recent rainfall, high waves, and wildlife.

The GBHU continues to monitor public beaches to prevent illness in swimmers. **For more information, please see [GBHU's Beach Management Reports](#).**

**Data Challenges:** The beach management program has changed significantly over time (**Appendix F**). The number and type of beaches tested has not been consistent over the years so determining the trend in beach quality is difficult.



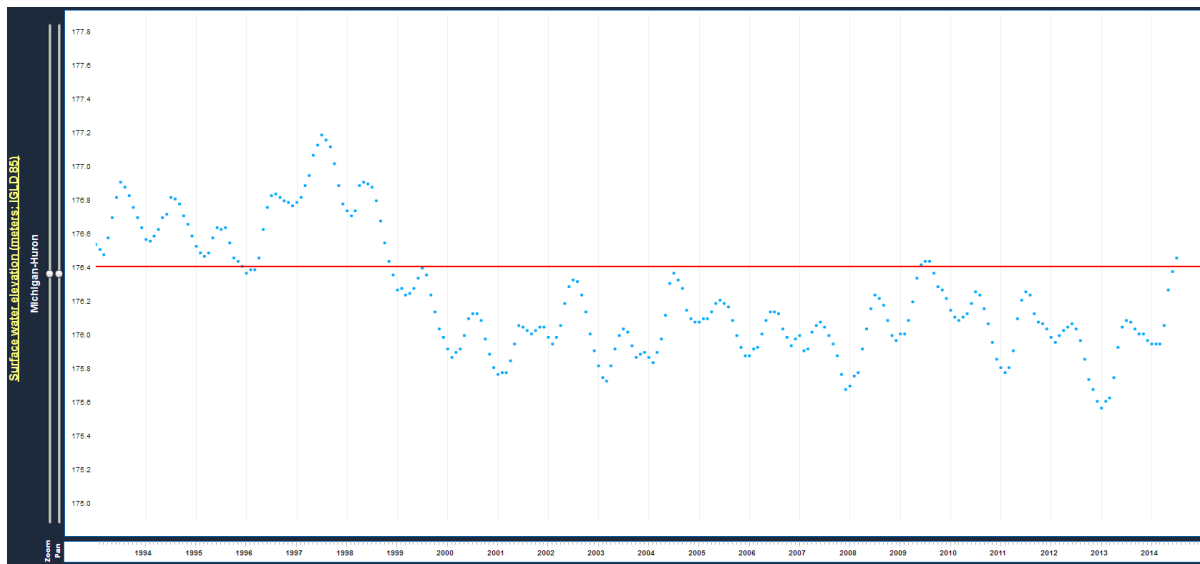
## Water quantity

Fluctuations in water levels in lakes and rivers occur naturally but can be exacerbated by climate change and human activities that impact on water ecosystems and subsequently human health. Water ecosystems are important for replenishing and purifying water resources, essential to human health. Water not only supports water use among humans, but also plant productivity, diversity, fish and fish habitats.

**Driving force:** Climate change, population growth and economic growth (e.g., agriculture) are driving forces acting on water quantity pressures.

**Pressure:** Warming temperatures, drought, pollution, agricultural runoff, land use, reduction of wetlands, algae blooms, consumption of and demand for water are pressures on water quantity.

**State:** Water levels of the Great Lakes are monitored by the National Oceanic and Atmospheric Administration through its Great Lakes Environmental Research Laboratory. Water levels of Lakes Michigan-Huron tend to be lower than the long term average of 176.4 m (**Figure 19**). In January 2013, water levels dropped to their lowest point in 20 years, about 83 centimeters beneath the long-term average. However, water levels have seen a larger-than-average seasonal rise in 2014. Water levels tend to rise through the early summer months and go down in the autumn, reaching a peak sometime in July.



**Figure 19: Surface water elevation for Lake Michigan-Huron from 1994-2014. The red line indicates long-term surface water elevation average (1918-present).**

*National Oceanic and Atmospheric Administration, The Great Lakes Hydro-Climate Dashboard.*

An analysis of average groundwater recharge and total groundwater use per year in Grey-Bruce was conducted in 2003 (Waterloo Hydrogeologic 2003). In summary, on a regional scale, there appears to be adequate groundwater available to meet current and future needs.

According to source water assessment reports, water quantity does not appear to be a concern for municipal water systems in the region. The potential of surface water or groundwater stress from municipal water systems in most subwatersheds in Grey-Bruce is low (DWSP 2011).

**Impact:** Low water levels disrupt ecosystems and contribute to increasing presence of invasive species, loss of biodiversity, weakening of species and increased nutrient loading. Increased nutrient loading can contribute to increase in algae blooms which are responsible for some unsafe beach postings in Grey-Bruce. Residents have also expressed concerns presented by low water levels including economic harm to businesses, drying up of wetlands and no longer accessible docks (Georgian Bay Leaders Initiative 2013). In Grey-Bruce, population growth is projected to be minimal in the immediate future and given the low consumptive water uses in the area, it seems unlikely that future usage will lead to any additional stress on the natural system (DWSP 2011). However, caution should be added that not all future uses can be accounted for or anticipated and large takings within specific areas may still lead to significant problems.

**Response:** The Georgian Bay Association, Georgian Bay Forever, Restore Our Water International and Stop the Drop are non-government organizations (NGOs) that are working towards restoring water levels of Lake Huron and Georgian Bay through activities including public education, raising awareness and advocacy. For more information on these individual NGOs, **please see the [Georgian Bay Association: Water Levels](#)**.

In March 2012, The International Joint Commission, a transnational water advisory body, released a report stating that over the next 30 years, lakes Superior, Michigan, Huron and Erie are likely to continue to fluctuate but still remain largely within the historical range (International Great Lakes Study 2012). While lower levels are likely to occur, the possibility of higher levels at times cannot be dismissed. Recommendations were made in April 2013 which includes recommending further investigation to restore Lake Michigan-Huron water levels and endorsing implementation of a comprehensive adaptive management approach (International Great Lakes Study 2013). For more information, **please visit [iugls.org](http://iugls.org)**.

**Data challenges:**

Groundwater: Under the provincial groundwater monitoring network, there are 10 groundwater wells being monitored under Grey Sauble Conservation Authority and 23 groundwater wells under Saugeen Valley Conservation Authority. Monitoring wells were equipped with data loggers and record water levels and temperature on an hourly basis. Monitoring ground water levels helps the Ministry obtain vital province-wide, baseline, annual and long term changes in groundwater storage, estimate recharge rates, determine the direction of ground water flow and track long term drought conditions. This data was not compiled at the time of the report.

# Ecological Indicators

## Vector monitoring

Vector-borne diseases are transmitted to humans and animals by arthropods (e.g., mosquito, flea or tick). The change in vector-borne disease incidence is an indicator of the changing environment. The GBHU conducts a vector-borne disease program to prevent or reduce the burden of vector-borne diseases of public health importance in Grey-Bruce. Important vector-borne diseases in the area include West Nile virus, Lyme disease and Eastern Equine Encephalitis virus.

**Driving force:** Climate change, land use changes, and economic growth (e.g., agriculture) are driving forces acting on vector pressures.

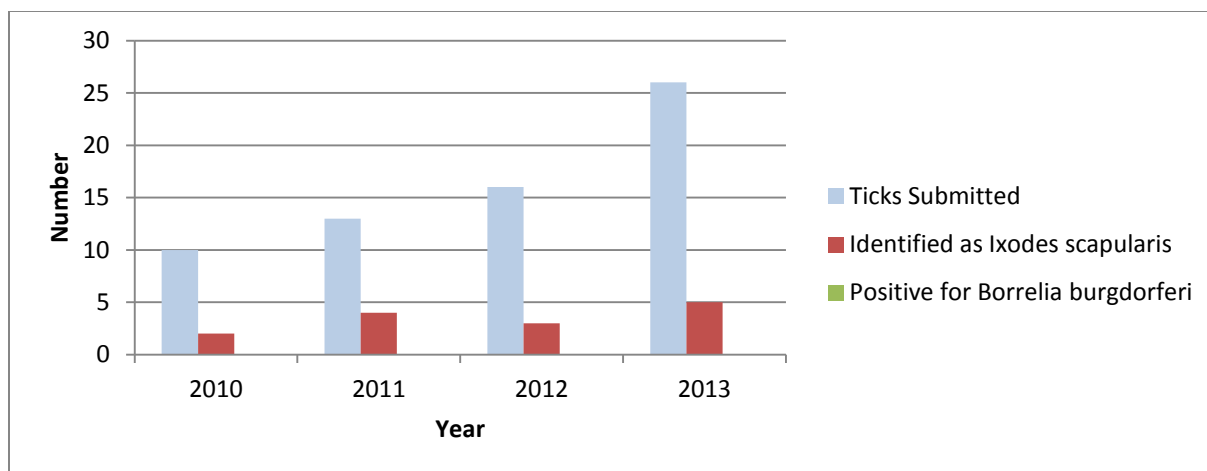
**Pressure:** Warming temperatures, the expansion of agricultural production, water management, and deforestation create new pressures on the ecosystem and in turn affect vector habitats, the carrying capacity of the environment for vector populations and infectious disease transmission (Campbell-Lendrum and Molyneux 2005).

### Lyme disease

Lyme disease is an infection caused by the corkscrew-shaped bacteria, *Borrelia burgdorferi*. In Ontario, these bacteria are spread by the bite of blacklegged ticks, *Ixodes scapularis*.

**State:** The GBHU conducts passive and active surveillance for Lyme disease.

Passive surveillance: Ticks found on a human or suspected of biting a human are tested for *Borrelia burgdorferi*. Although the level of ticks submitted for testing has increased over the years, no ticks have been positive for *Borrelia burgdorferi* (**Figure 20**). Data prior to 2010 is incomplete and was not included in this report.



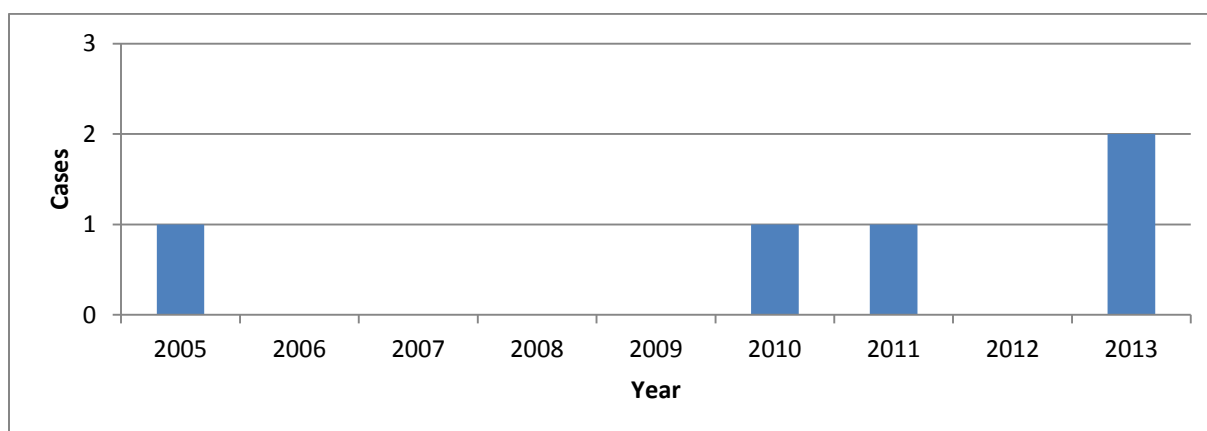
**Figure 20: Passive surveillance of ticks from 2010-2013.**

*Vector-Borne Diseases Annual Report, GBHU.*

**Active surveillance:** This method involves catching ticks in their habitat for species identification and bacteriological testing (also known as drag sampling). Drag sampling was not conducted in 2013 due to lack of tick stages identified in the previous two years and wet / cold weather conditions in the spring and summer of 2013.

**Exposure:** Lyme disease is transmitted to humans through the bite of an infected blacklegged tick.

**Effect:** The amount of Lyme disease human cases was relatively low in Grey-Bruce, with two cases identified in 2013 (**Figure 21**). All of the cases were determined to be travel-related. Symptoms of Lyme disease usually occur within one or two weeks which include fever, headache, muscle and joint pains, fatigue and a skin rash (typically looks like a red bull's eye) (MOHLTC 2013).



**Figure 21: Number of human cases of Lyme disease from 2005-2013.**

*Vector-Borne Diseases Annual Report, GBHU.*



## West Nile virus

West Nile virus (WNV) is an infection transmitted most commonly through the mosquito vector. Mosquitoes become infected when they bite a WNV positive bird.

**State:** GBHU conducts vector surveillance, wildlife surveillance and human surveillance.

Vector surveillance: Mosquito surveillance began in Grey-Bruce in 2003. No WNV positive mosquito pools were found in Grey-Bruce between 2003 and 2008 (**Table 7**). Since 2009, vector surveillance was not conducted as risk assessment analysis has not indicated a need.

Wildlife surveillance: Dead bird surveillance program is conducted because it appears to be the most sensitive early detection method for WNV activity. Positive bird cases usually come before positive human cases in the majority of health units in Ontario. The number of WNV in birds varies over time (**Table 7**). The dead bird surveillance program at GBHU was discontinued in 2009 due to lack of funding for bird viral testing.

**Table 7: West Nile virus monitoring in Grey-Bruce from 2001-2013.**

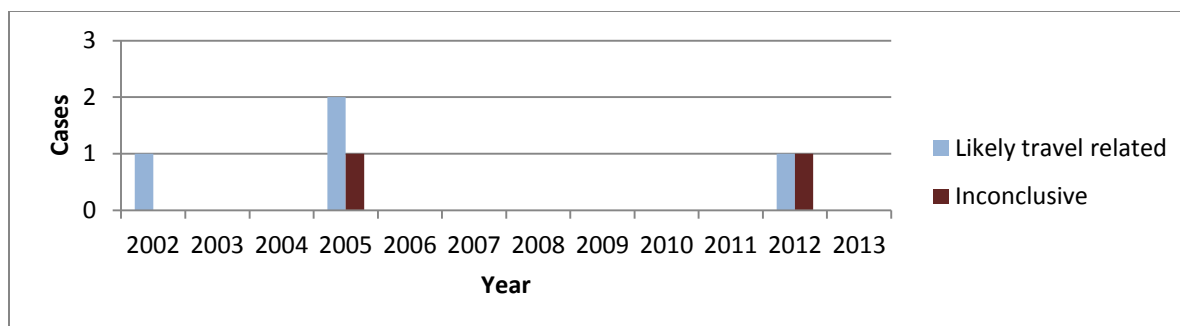
	Positive mosquito pools	Dead bird sightings	Birds sent for testing	Positive birds	Positive horses
2001	N/A	48	32	0	N/A
2002	N/A	75	26	3	N/A
2003	0	43	34	4	N/A
2004	0	20	20	3	N/A
2005	0	35	35	2	N/A
2006	0	33	29	8	N/A
2007	0	37	14	1	N/A
2008	0	17	17	4	2
2009	Discontinued (lack of a need)	Discontinued (lack of funding)			0
2010					0
2011					1
2012					0
2013					0

*Vector-Borne Diseases Annual Report, GBHU.*

**Exposure:** WNV is transmitted to humans through the bite of an infected mosquito.

**Effect:** WNV in humans was relatively low in Grey-Bruce, with no cases in 2013 (**Figure 22**). Most people infected with WNV have no symptoms or have flu-like symptoms. Very few people (fewer than 1% of those infected) have severe symptoms including drowsiness, blurred vision, confusion or muscle weakness which can lead to serious, sometimes fatal neurological illness. (PHAC 2013).





**Figure 22: Number of human cases of WNV from 2002-2012.**

*Vector-Borne Diseases Annual Report, GBHU.*

### Eastern equine encephalitis virus

Eastern equine encephalitis virus (EEEV) is a rare but serious viral infection that affects humans and horses. EEEV is transmitted through the bite of an infected mosquito.

**State:** GBHU conducts an EEEV mosquito trapping surveillance program. Mosquito trapping for EEEV was not conducted in Grey-Bruce in 2013 due to the lack of animal/bird cases identified in Grey-Bruce since 2011.

**Exposure:** EEEV are transmitted to humans through the bite of an infected mosquito.

**Effect:** There was no human cases of EEEV reported to date in Ontario. Most people infected with EEEV have no symptoms; however severe cases of EEEV begin with sudden onset of headache, fever, chills, vomiting and respiratory symptoms. Death can occur within 3-5 days of infection (PHAC 2012).

**Action:** Public education is a key component in vector-borne disease management. Throughout 2013, the VBD public education campaign consisted of several communication methods including:

- Public Health Inspector helpdesk line for public complaints and inquires (usually dead bird sightings, standing water complaints, tick identification)
- Media release “Don’t let the bugs bite” and “Bug Protection a Healthy Idea”
- GBHU website with up-to-date information regarding mosquito control

Individuals can protect themselves from vector-borne diseases by avoiding peak exposure times and places, wearing appropriate clothing and using insecticides and repellents (CDC 2013). The reduction of mosquito breeding sites on private and municipal property, and the submission of ticks by the public and healthcare providers is strongly encouraged (GBHU 2013). The GBHU continues to conduct a vector-borne disease (VBD) program to prevent or reduce the burden of vector borne diseases of public health importance in Grey-Bruce.

For more information, please see the [GBHU’s Vector-Borne Diseases Annual Report](#).

# Biodiversity

Biodiversity is a measure of species richness, ecosystem complexity and the amount of genetic variation in populations of plants or animals. Ecosystems with a higher degree of biodiversity can deal with more pressures. Healthy biodiversity is important in adapting to climate change and ensuring clean air, drinking water and economic benefits. Wildlife, including plants and animals, provide ecological, cultural, recreational and economic benefits and is a key component to Grey-Bruce's rich biodiversity. For the purpose of this report, the indicator for biodiversity is a negative indicator (i.e., reduced biodiversity), the number of at risk species in Grey-Bruce.

**Driving force:** Climate change, land use changes, population growth and economic growth (e.g., agriculture) are driving forces acting on biodiversity pressures.

**Pressure:** Warming temperatures, agricultural expansion, pollution, waste production, introduction of invasive species, and loss of habitat are pressures on biodiversity. Rising demand for residential and commercial development may also put pressure on natural and semi-natural habitats.

**State:** In 2013, there were 40 species at risk in Bruce County and 26 species at risk in Grey County (**Table 8**). For the type of rare species, please see **Appendix G**. For information on what threatened, endangered and special concern means, please see **Appendix H**.

**Table 8: Number of species at risk in Grey-Bruce in 2014.**

Bruce County				Grey County			
	Threatened	Endangered	Special Concern		Threatened	Endangered	Special Concern
<b>Birds</b>	6	4	5	<b>Birds</b>	4	3	4
<b>Fish</b>	0	1	2	<b>Fish</b>	0	1	1
<b>Insects</b>	0	2	0	<b>Insects</b>	0	1	0
<b>Mammals</b>	0	1	0	<b>Mammals</b>	0	1	0
<b>Plants</b>	4	3	5	<b>Plants</b>	0	1	2
<b>Snakes</b>	1	1	2	<b>Snakes</b>	1	0	2
<b>Turtles</b>	1	0	2	<b>Turtles</b>	1	0	2

*Species at risk in Bruce County and Grey County, MNRF, 2013.*

**Impact:** Although Grey-Bruce is rich in natural resources; there can be threats to Grey-Bruce's biodiversity as identified above. All species have a role in maintaining a healthy ecosystem. Biodiversity contributes to our overall health by providing us with ecosystem goods and services. In other words, with reduced biodiversity, our food and water resources may be at risk.

**Response:** The Province plays a key role in maintaining biodiversity. The *Endangered Species Act 2007* protects species at risk in Ontario. This act includes classifying species, providing immediate protection for species and providing immediate protection for habitat. Further, [Ontario's Biodiversity Strategy 2011](#), is a guiding framework for coordinating the conservation of Ontario's

species and ecosystems. Actions in this framework include engaging people, reducing threats and enhancing resilience (MNRF 2012). The Conservation Authorities plan and deliver a wide variety of natural resource programs such as stewardship, tree planting, habitat restoration, flood and erosion control, and source water protection that protects species, habitats and ecosystems (Ontario Conservation 2012).

The Lake Huron Biodiversity Conservation Strategy focuses on the conservation of the native biodiversity of Lake Huron. For more information, **please see the [Lake Huron Biodiversity Strategy 2010 report](#)**. Further, the Lake Huron Binational Partnership is an effort that focuses on key priorities that help to improve and protect the overall quality of Lake Huron. **For more information, please visit [binational.net](#)**.

The federal government sponsors National Wildlife Week to raise public awareness on actions to protect wildlife and habitat. MNRF is responsible for managing wildlife species and their habitat in Ontario. Research and monitoring programs help to determine the status of wildlife populations and their habitat. Results of the monitoring program are not available at the County level. To see the strategic guidance for MNRF's wildlife management program, **please visit [Ontario Biodiversity Strategy 2011](#)**.

**Data Challenges:** There is a huge data gap in biodiversity in terms of wildlife, ecosystems, natural communities and habitats. A natural heritage study is currently being conducted by Grey County in consultation with Conservation Authorities that can provide more biodiversity data in the future.

Further, a [natural heritage study](#) was done in Kincardine, but information from this study was not analyzed at the time of this report. The Bruce Peninsula Biosphere Association is currently conducting a Conservation and Stewardship Plan which addresses biodiversity issues in the Bruce Peninsula. For more information, **please visit [bpha.ca](#)**.

## Fish and fish habitat monitoring

Fish provide a source of food, recreational, employment and tourism benefits to humans as well as ecological diversity. Fish can be indicators of environmental change. As the population of fish declines, generally the health of the aquatic ecosystem declines as well. Monitoring fish and health of lakes is an important part of fisheries management by MNRF. Monitoring data collected by MNRF include fish abundance, species diversity, quality of fish habitat, and associated stressors on the fishery. The information is reviewed and used to adjust fisheries management strategies (e.g., fishing regulations and fish stocking) and enhance the monitoring program.

**Driving force:** Climate change, population growth and economic growth (e.g., agriculture, industries) are driving forces acting on fish and fish habitat pressures.

**Pressure:** Warming temperatures, industrial leakage, sport and commercial fishing, septic systems and agricultural runoff are pressures on fish and fish habitat.

**State:** The state of fish and habitats are not available at the local or county level. To see the monitoring highlights for certain types of fish in Ontario, please see [state of resources reports](#).

A regime shift may be occurring in the Lake Huron ecosystem. It is uncertain whether the lake has achieved a new stable state or is still in a state of continuous change (Great Lakes Fishery Commission 2013). Regime shifts occur when ecosystems move from one state to another, usually as a result of some disturbance. A new ecosystem state, or regime, may be characterized by different ecosystem services and societal benefits. If a regime shift has occurred, management of the lake would benefit from understanding the stability of the new regime.

Although there are some encouraging signs of progress, the majority of the fish community objectives for the lake remained unmet in 2010. As was stated in the previous state of the lake reports for Lake Huron, the management objectives for Lake Huron need to be revised as they appear to have little relevance to current conditions in the lake. For more information, please see [The State of Lake Huron in 2010](#).

**Impact:** Reduction in fish and fish habitat directly impacts the sustainability of ecosystems. Further, commercial and recreational fishing will be impacted which has negative implications on human livelihood. The state of fish and fish habitat in Grey-Bruce is unclear.

**Actions:** MNRF has created Fisheries Management Zone (FMZ) councils in 2009. Councils are working in FMZ to help develop management strategies for their zones. Grey County and Bruce County fisheries are located in 3 FMZs (13, 14, and 16) (**Appendix I**). Fisheries in each zone are usually managed in a similar way, but in some cases more intense management, planning and monitoring is needed for important fisheries. Grey-Bruce belong to FMZ 16, however is bordered by FMZ 13 and 14. For example, FMZ 14, which includes Georgian Bay, supports diverse cool and warm water aquatic communities (MNRF 2012). Dramatic changes have occurred in the fish community in

this zone due to invasive species and habitat loss. As a result, fisheries management in FMZ 14 is focused on fish community rehabilitation.

The Ontario Ministry of Natural Resources and Forestry (MNRF) operates 9 provincial fish culture stations which produce approximately 8 million fish each year for stocking into public waters. For more information, please see [State of resource monitoring: Fish Culture and Stocking in Ontario](#). MNRF works locally to get best management practices to landowners regarding maintain buffer systems and reducing contaminants to protect fisheries.

The *Fisheries Act*, administered by Fisheries and Oceans Canada, provides protection of fish habitat. Under this Act, no one may carry out any work that results in the harmful alteration, disrupt or destruction of fish habitat.

**Data Challenges:** The MNRF has developed and is currently implementing the Broad-scale Monitoring Program (BsM), which is part of the Ecological Framework for Fisheries Management (EFFM) strategy. The BsM program runs in 5-year cycles and is currently in Cycle 2. Cycle 1 wrapped up in 2012. This program is conducted on inland lakes across the Province of Ontario and it describes the current state of the fisheries resource at a FMZ level. A Zone report for Cycle 1 is currently being created by MNRF and will be available in the near future to inform on the state of fish in FMZ 16 (Grey-Bruce area).

## Forest conditions

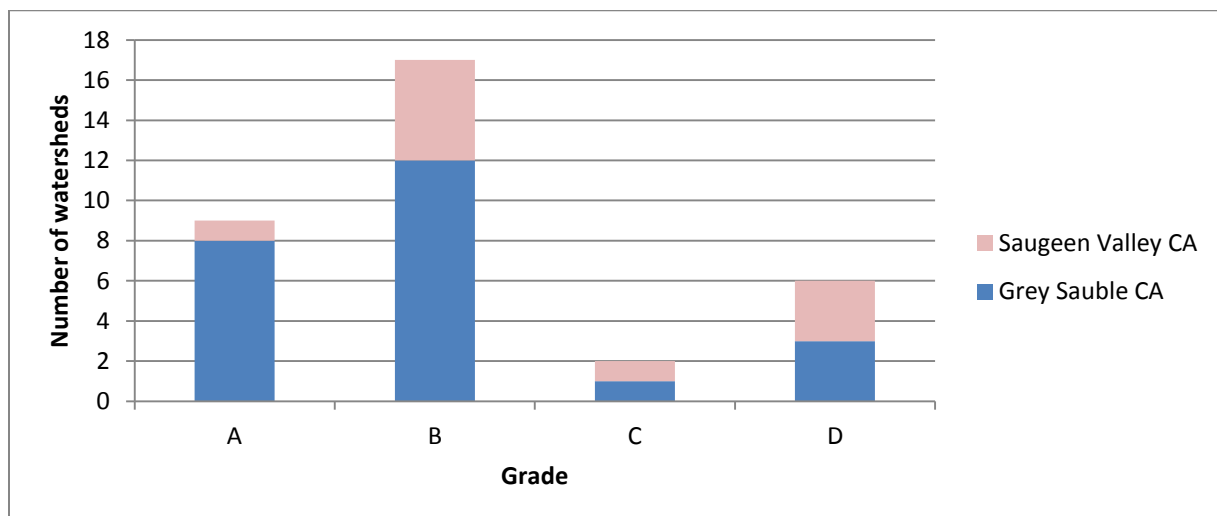
Trees and forests are an integral part of healthy ecosystems. Trees are natural filters that help reduce smog and pollution, thereby reducing our exposure to harmful effects of air pollution (e.g., cardiovascular and respiratory diseases). Examples of pollutants that trees can remove from the atmosphere include sulphur dioxides, carbon dioxide and ozone (Trees Ontario 2012). The better the condition of our forests, the better able we are to mitigate climate change and reduce air pollution.

**Driving force:** Climate change, population growth, economic growth, and land use changes are pressures acting on forest pressures.

**Pressure:** Warming temperatures, winter storms, introduction of invasive species (e.g., Emerald Ash Borer), and demand for resources (e.g., logging and clearing) are pressures on forest condition.

**State:** This report's assessment on the state of forest environment has been based on the Grey Sauble Watershed Report Card 2013 and the Saugeen Valley Watershed Report Card 2013. Forest conditions were graded based on the following indicators: % Forest Cover, % Forest Interior and % Riparian Cover (Grey Sauble Watershed Report Card 2013, Saugeen Valley Watershed Report Card 2013). Forest cover can support plants and animals, while forest interior provides habitat for various organisms. Riparian cover provides river bank stability, shading, food sources, habitats and filters impurities.

Forest quality for the majority of the area scores an "A" or "B" (**Figure 23**) (For information on what the grades mean, please see **Appendix D**). In general, forest conditions are poorest in the watersheds where agriculture is predominant and only small woodlots remain.



**Figure 23: Overall forest condition of watersheds in Grey-Bruce.**

*Grey Sauble Watershed Report Card 2013 and Saugeen Valley Watershed Report Card 2013.*

**Impact:** Forests support biodiversity, wildlife, and human health. They help to process air pollutants and provide green space for recreational purposes and visual relief. Some studies show a correlation between presence of trees and lower asthma rates (Lovasi et al. 2008).

**Response:** To maintain a healthy tree population, it is important to continuously plant new trees. This is particularly important in the face of threats such as Emerald Ash Borer and other invasive species. In the last 5 years, Saugeen Valley CA has planted 761,800 trees and Grey Sauble CA has planted 1,469,386 trees. Other organizations in the community including SauGreen for the Environment, Bruce Trail Conservancy and Pentangore Watershed Group have initiatives to support tree planting. The First Nations of Ontario also have tree planting initiatives in the Georgian Bay area.

The Grey Sauble Conservation Authority and Saugeen Valley Conservation Authority have Forest Management Plans which defines the management goals and objectives for all conservation authority lands and will guide the forest management activities over the next 20 year period. Grey County and Bruce County have by-laws that regulate cutting of trees within the county, promoting sound forest management practices. Ontario recognizes the importance of forestlands and raises landowner awareness about forest stewardship through the Ontario Managed Forest Tax Incentive Program.

## Wetland conditions

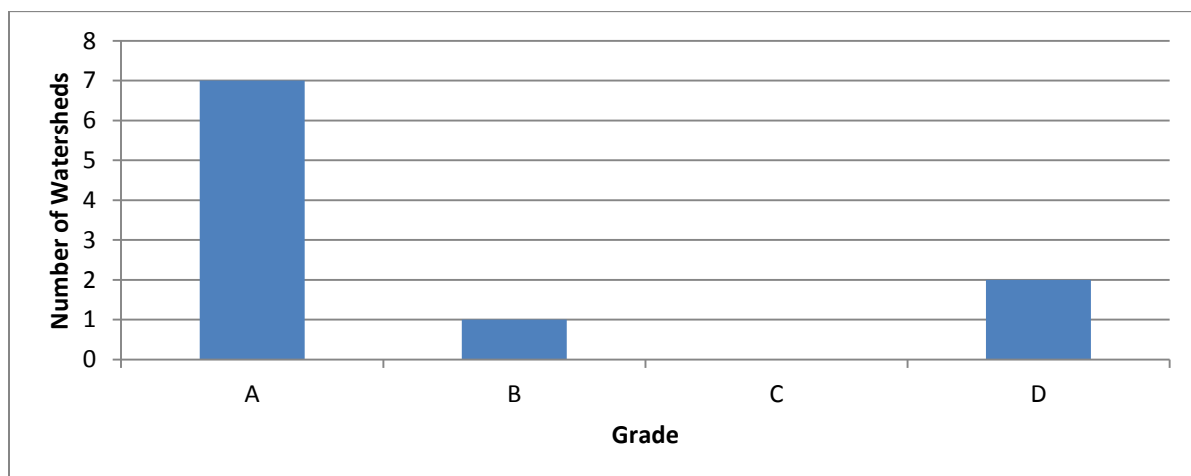
Wetlands play an important role in an ecosystem. As part of the hydrological cycle, they provide a buffer for heavy rainfall, help to store water and recharge groundwater. Further, wetlands help to reduce nutrients, filter ground water, provide diverse habitats and thus support species variety. Wetland conditions are graded based on the percentage of the watershed that is wetland. Some wetlands also have a tourist component that contributes to social and economic benefits.

**Driving force:** Climate change, population growth, economic development, urbanization and land use are driving forces acting on wetland pressures.

**Pressure:** Warming temperatures, agricultural expansion, development expansion, low water levels and draining of wetlands are pressures on wetlands.

**State:** This report's assessment on the state of wetlands has been based on the Saugeen Valley Watershed Report Card 2013. Wetland conditions are graded based on the percentage of the watershed that is wetland. The majority of the subwatersheds score an "A" (**Figure 24**) (For information on what the grades mean, please see **Appendix D**). One watershed scored a "B" (The Lower Main Saugeen watershed) while two others scored "D" grades (Pine and Penetangore watershed). Agriculture is the predominant land use in these watersheds, where wetlands have been removed and/or drained.

From 2006 to 2011, the number of farms reporting woodlands and wetlands decreased from 1,818 to 1,550 (↓17.3%). Total farm area decreased from 93,086 acres to 75,394 acres (↓23.5%) (Statistics Canada 2011b).



**Figure 24: Overall wetland condition for watersheds in Grey-Bruce.**  
*Saugeen Valley Watershed Report Card 2013.*



**Impact:** A reduction in wetlands means fewer habitats for fish, and subsequently a decline in fish availability. Further, the decline in wetlands reduces our ecosystem's ability to reduce floods and store water. Natural water filtration by wetlands can decrease which can compromise drinking water quality.

**Response:** The SVCA and GSCA participate in educational awareness functions to protect watersheds and wetlands. The MNRF play a role in protecting wetlands and encouraging stewardship (i.e., a personal commitment to care for the land). Under the Ontario Eastern Habitat Joint Venture (OEHJV), the Ministry supports partner agencies who talk to landowners about stewardship programs. Ducks Unlimited Canada, a partner of OEHJV, supports landowners in conserving biodiversity. For example, they help to put up fences to keep cattle away from sensitive wetlands.

**Data Challenges:** Only wetland monitoring data from Saugeen Valley Conservation's Watershed Report Card 2013 was considered in the analysis. Wetland conditions of watersheds in the Grey Sauble Conservation Area were not reported in the GSCA watershed report card and therefore were not able to be included in the analysis.

# Conclusion

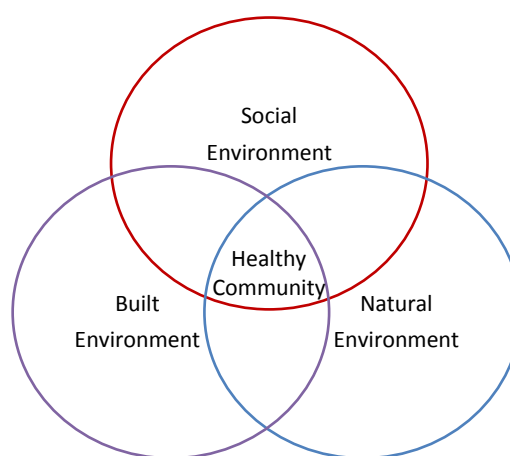
At the GBHU, our mission is to work with the Grey-Bruce community to protect and promote health, with the vision of working together for a healthier future for all. To accomplish this, the GBHU collaborates with a broad range of stakeholders across multiple levels in collective action. Information is shared among stakeholders to address issues of importance to the community. For this report, input from various environmental stakeholders (e.g., Ministry of the Environment and Climate Change, Ministry of Natural Resources and Forestry, Conservation Authorities, planners and health unit program managers) as well as information from primary and secondary data sources were gathered to identify and address environmental issues in Grey-Bruce.

This State of the Environment Report for Grey-Bruce provides a snapshot of natural environmental conditions including climate, air quality, water quality, and ecological resources. With a baseline established for some environmental indicators, the change in the natural environment can potentially be monitored over time. As this report is used, programs and priorities can be tailored towards environmental issues and better protect the natural environment.

For the most part, based on the information gathered in this report, Grey-Bruce's natural environment appears to be relatively "healthy". Environmental indicators of climate change, air quality, and water quality and quantity generally point toward a healthy state. Similarly, ecological indicators such as forests, wetlands and vector monitoring point toward a healthy state. There are some concerns on the state of other components of the environment as data from some environmental indicators are lacking. For example, data is significantly lacking for air quality, biodiversity, and fish and fish habitat indicators.

Many factors play a role in contributing to the healthy environment including local initiatives, community action and provincial policies. In particular, many partnerships among different organizations are tackling environmental issues and are making a difference.

A healthy natural environment is crucial component of creating healthy communities **(Figure 25)**. Individual and community health is affected by the environments in which we live, work, and play. Everyone has a role to play in building a healthy community. Individually, there are several steps that you can take to continue to make Grey-Bruce a healthy environment including: walking, biking, or taking public transportation when possible, not idling your car if you choose to drive, planting a tree, composting and recycling and reducing waste, and



**Figure 25. Healthy communities.**

conserving energy. For more tips, please visit the [GBHU website](#).

Collectively, we can have an impact on our environment. On a larger scale, working together as a community is needed in order to change the way energy is generated, waste is produced, and land and resources are managed. In 2012, The Tamarack Institute has launched a three year campaign called “A Thousand Conversations to Shape our Future” with the goal of getting people to talk about community, sharing experiences and deepen a sense of community. Recognizing the importance of building communities that are deeply connected and resilient, we are better able to deal with economic, social and environmental issues. We need to continue to partner more, share knowledge and learn from one another, to increase the ability to take collective action on key issues facing the community.

# Challenges and Future State of the Environment Reporting

In preparing this report, there were significant challenges in accessing data. In some cases, data were readily available and in other cases, data were lacking considerably. The lack of data is partly due to the complex nature of environmental data. For a complete list of data challenges, please see **Appendix J**. Nonetheless, this report has begun the process of tracking progress towards maintaining a natural healthy environment.

The DPSEEA framework was difficult to complete for some indicators since exposure (e.g., proportion of population exposed to a contaminant) and health effect (e.g., morbidity and mortality) data specific to Grey-Bruce residents was not available. As a result, general exposure and general health effects of the environmental indicator were described, or an alternative framework was used (DPSIR – driving force, pressure, state, impact, response).

There are various resources that can be explored in the future in order to strengthen SOERs. These resources are under development and will be available in the near future:

- Official Plan monitoring documents which report agricultural, and natural heritage data
- Natural Heritage Study by Grey County in consultation with Conservation Authorities
- Ministry of Natural Resources and Forestry Broad-scale Fisheries Monitoring Program report
- GIS mapping of significant woodlands, wetlands by counties and Conservation Authorities

Other resources that could be explored that are available:

- The Lake Huron-Georgian Bay Canadian Framework for Community Action
- Great Lakes Coastal Wetlands Consortium
- Great Lakes Restoration Database and Map - Community Conservation and Stewardship Plan for the Bruce Peninsula (Bruce Peninsula Biosphere Association)
- Conservation Authority Species At Risk Distribution Maps 2014 by Fisheries and Oceans Canada

State of the environment reporting will continue to evolve in response to the changing environmental priorities and public concerns. It is hoped that this report will inspire the collection and release of additional data that will help determine a comprehensive understanding of the state of the environment. Regular updates on the state of the environment can help residents of the area stay informed and aware, and help governments and other stakeholders set priorities for action.

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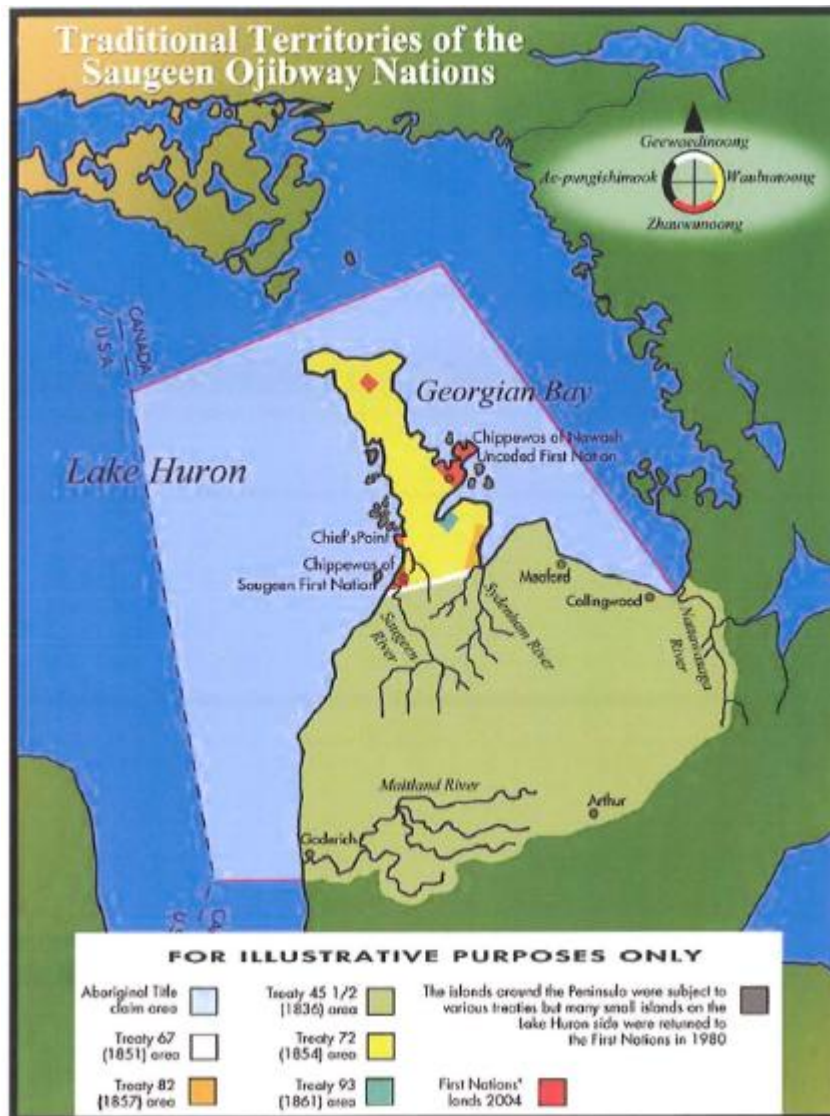
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# Appendix A – Saugeen Ojibway Nation Territory Map



Saugeen Ojibway Nation Territory Map, Grey County.

## Appendix B – Waste Disposal Information

Waste disposal data including total residential waste generated and waste diversion rate for individual municipalities in Grey-Bruce from 2008-2012 are presented below. The Bruce Area Solid Waste Recycling collects waste from all Bruce County municipalities except for Northern Bruce Peninsula.

Total residential waste generated per person in Grey-Bruce					
Municipality	2008	2009	2010	2011	2012
Owen Sound	432	460	505	404	323
Chatsworth	265	268	252	250	232
Hanover	303	373	294	256	255
Georgian Bluffs	229	209	183	163	170
Blue Mountains	304	328	434	432	470
Meaford	398	264	250	240	307
Grey Highlands	417	446	593	641	539
West Grey	359	582	433	475	472
South Grey	487	501	561	475	442
Northern Bruce Peninsula	346	449	420	404	439
Bruce Area Solid Waste Recycling	295	174	211	244	199

*Residential Generally Accepted Principles (GAP) Diversion Rates, Waste Diversion Ontario.*

Percentage waste diversion in Grey-Bruce					
Municipality	2008	2009	2010	2011	2012
Owen Sound	41%	37%	38%	50%	63%
Chatsworth	32%	32%	31%	30%	37%
Hanover	45%	30%	41%	42%	42%
Georgian Bluffs	30%	36%	41%	50%	34%
Blue Mountains	41%	40%	41%	40%	44%
Meaford	32%	45%	57%	62%	59%
Grey Highlands	40%	37%	48%	53%	55%
West Grey	37%	47%	35%	46%	55%
South Grey	45%	46%	49%	50%	34%
Northern Bruce Peninsula	30%	35%	37%	39%	40%
Bruce Area Solid Waste Recycling	23%	38%	31%	29%	39%

*Residential Generally Accepted Principles (GAP) Diversion Rates, Waste Diversion Ontario.*

## Appendix C – Municipal Drinking Water Systems

Township	Population <sup>1</sup>	Municipal Drinking Water System (DWS)	Drinking Water Category	Source	Number of users served <sup>2</sup>
<b>Grey County</b>					
Owen Sound	21688	Owen Sound DWS	LMRS*	Georgian Bay	21000
Chatsworth	6437	Chatsworth DWS	LMRS	Ground (GUDI)*	471
		Walter's Falls DWS	SMRS*	Ground (GUDI)	112
Hanover	7490	Hanover DSWS	LMRS	Ground and Ruhl Lake	7000
Georgian Bluffs	10404	Pottawatomi Village	SMRS	Ground (GUDI)	50
		Shallow Lake Well supply	LMRS	Ground (GUDI)	2500
		Oxenden Distribution System	LMRS	Georgian Bay	400
		East Linton DWS	LMRS	Georgian Bay	875
The Blue Mountains	6453	Thornbury DWS	LMRS	Georgian Bay	20401
Southgate	7190	Dundalk DWS	LMRS	Ground	1691
Meaford	11100	Meaford DWS	LMRS	Georgian Bay	4800
Grey Highlands	9520	Markdale DWS	LMRS	Ground	1300
		Kimberley-Amik-Talisman DWS	LMRS	Ground (GUDI)	350
West Grey	12286	Durham DWS	LMRS	Ground	2500
		Neustadt DWS	LMRS	Ground	460
<b>Total</b>	<b>92568</b>				<b>63910</b>
<b>Bruce County</b>					
Northern Bruce Peninsula	3744	Lion's Head DWS	LMRS	Georgian Bay	600
Huron Kinloss	6790	Ripley DWS Lakeshore DWS	LMRS	Ground	680
		Lucknow DWS	LMRS	Ground	3500
		Whitechurch DWS	LMRS	Ground	1100
		Huronville Subdivision	SMRS	Ground	93
		Distribution System	SMRS	Surface	207
Kincardine	11174	Armow DWS	SMRS	Ground	17
		Scott's Point DWS	SMRS	Ground	95
		Tiverton DWS	LMRS	Ground	760
		Underwood DWS	SMRS	Ground	75
		Kincardine DWS	LMRS	Lake Huron	9000
Arran-Elderslie	6810	Tara DWS	LMRS	Ground	1032

		Chesley DWS	LMRS	Ground	3348
Brockton	9432	Chepstow DWS Lake Rosalind DWS Walkerton DWS	SMRS SMRS LMRS	Ground (GUDI) Ground (GUDI) Ground	65 250 4500
Saugeen Shores	12661	Saugeen Shores DWS	LMRS	Lake Huron	12100
South Bruce	5685	Mildmay DWS Teeswater DWS	LMRS LMRS	Ground Ground	1200 1000
South Bruce Peninsula	8413	Foreman DWS Huron Woods DWS Amabel-Sauble DWS Oliphant DWS Wiarton DWS	SMRS SMRS LMRS SMRS LMRS	Ground (GUDI) Ground (GUDI) Ground (GUDI) Ground (GUDI) Colpoy's Bay	36 218 730 60 2800
<b>Total</b>	<b>64709</b>				<b>43466</b>

\*GUDI – Ground water under the direct influence of surface water.

\*LMRS – Large Municipal Residential System

\*SMRS – Small Municipal Residential System

<sup>1</sup> Statistics Canada Population Census, 2011.

<sup>2</sup> Ontario Drinking Water Systems Report, 2013.

Estimate of the proportion of population on municipal water supply or private water supply.				
County	Population	Users Served	Percentage of users on municipal water supply	Percentage of users on private water supply
Grey County	92568	63910	69%	31%
Bruce County	64709	43466	67%	33%
Grey-Bruce	157277	107376	68%	32%

## Appendix D – Conservation Authority Grading System

The grades used in this report are based on the Conservation Ontario provincial grading system (Conservation Ontario 2013). The Watershed Report Card Implementation Committee defined the grades, as follows:

- A – very healthy watershed conditions
- B – healthy watershed conditions
- C – watershed conditions require some enhancement
- D – poor watershed conditions that require improvement
- F – watershed significantly degraded requiring much improvement



## Appendix E – Source Protection Area Map

The Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region is comprised of three Source Protection Areas: Saugeen Valley SPA Grey Sauble SPA and Northern Bruce Peninsula SPA.



Assessment Reports, Drinking Water Source Protection, 2011.

## Appendix F – Beach Information

The GBHU's beach management program has changed significantly throughout the years and the details are presented below:

Year	# Beaches Tested	# Beach Postings	Blue Flag*	Comments
2004	42	4	N/A	- Program started
2005	46 ↑	4	N/A	- 4 beaches added to program
2006	46	5	1	- Blue Flag (BF) introduced - Sauble beach was first to get BF
2007	42 ↓	5	2	- Station Beach added to BF - 4 beaches removed from program (did not meet requirements of "public beach")
2008	26 ↓	0	4	- Northwinds and Little River were awarded BF - Cuts made to the number of beaches tested
2009	14 ↓	2	4	Review of historical and epidemiological data indicated that some beaches have low risk of unsafe water quality - removed from program
2010	8 ↓	19 (heavy rainfall)	4	- Reduction in the number of beaches sampled as some municipalities previously held contracts with the health unit to sample beaches that do not meet the definition of a public beach - No municipalities had contacted the health unit to sample their beach
2011	8	4	4	
2012	10 ↑	3	2	- Increase in number of beaches sampled as beach sampled was re-started for two beaches - Northwinds and Little River were not awarded BF
2013	10	0	2	

\*A Blue Flag is an international symbol of excellence which is awarded to beaches that achieve high standards in areas such as water quality, education and environmental management (Blue Flag n.d.).

*Grey Bruce Health Unit Beach Management Reports.*

## Appendix G – Full List of Known Species at Risk

Grey County		Bruce County	
Species	Status	Species	Status
Birds		Birds	
Bald Eagle	Special Concern	Bald Eagle	Special Concern
Barn Swallow	Threatened	Barn Swallow	Threatened
Black Tern	Special Concern	Black Tern	Special Concern
Bobolink	Threatened	Bobolink	Threatened
Eastern Meadowlark	Threatened	Cerulean Warbler	Threatened
Henslow's Sparrow	Endangered	Eastern Meadowlark	Threatened
King Rail	Endangered	Eastern Whip-poor-will	Threatened
Least Bittern	Threatened	Golden-winged Warbler	Special Concern
Loggerhead Shrike	Endangered	Henslow's Sparrow	Endangered
Louisiana Waterthrush	Special Concern	King Rail	Endangered
Peregrine Falcon	Special Concern	Least Bittern	Threatened
		Loggerhead Shrike	Endangered
		Peregrine Falcon	Special Concern
		Piping Plover	Endangered
		Short-eared Owl	Special Concern
Fish		Fish	
Northern Brook Lamprey	Special Concern	Lake Sturgeon	Special Concern
Redside Dace	Endangered	Redside Dace	Endangered
		Northern Brook Lamprey	Special Concern
Insects		Insects	
Rusty-patched Bumble Bee	Endangered	Hungerford's Crawling Water Beetle	Endangered
		Rusty-patched Bumble Bee	Endangered
Mammals		Mammals	
American Badger	Endangered	American Badger	Endangered
Plants		Plants	
Hart's-tongue Fern	Special Concern	American Ginseng	Endangered

Eastern Prairie Fringed-orchid	Endangered	Hart's-tongue Fern	Special Concern
Tuberous Indian-plantain	Special Concern	Broad Beech Fern	Special Concern
		Dwarf Lake Iris	Special Concern
		Eastern Prairie Fringed-orchid	Endangered
		Gattinger's Agalinis	Endangered
		Hill's Pondweed	Special Concern
		Hill's Thistle	Threatened
		Houghton's Goldenrod	Threatened
		Lakeside Daisy	Threatened
		Pitcher's Thistle	Threatened
		Tuberous Indian-plantain	Special Concern
Snakes		Snakes	
Eastern Ribbonsnake	Special Concern	Eastern Ribbonsnake	Special Concern
Massasauga Rattlesnake	Threatened	Massasauga Rattlesnake	Threatened
Milksnake	Special Concern	Milksnake	Special Concern
		Queensnake	Endangered
Turtles		Turtles	
Blanding's Turtle	Threatened	Blanding's Turtle	Threatened
Northern Map Turtle	Special Concern	Northern Map Turtle	Special Concern
Snapping Turtle	Special Concern	Snapping Turtle	Special Concern

*Species at risk in Bruce region and Grey Region, MNRF, 2013.*

## Appendix H – Definitions of Species at Risk Categories

<b>Extinct</b>	No longer lives anywhere in the world
<b>Extirpated</b>	Lives somewhere in the world, and at one time lived in the wild in Ontario, but no longer lives in the wild in Ontario
<b>Endangered</b>	Lives in the wild in Ontario but is facing imminent extinction or extirpation
<b>Threatened</b>	Lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it
<b>Special Concern</b>	Lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats

*Species at risk in Bruce region and Grey Region, MNRF, 2013.*

## Appendix I – Fishery Management Zones



Ministry of Natural Resources and Forestry, 2012b.

## Appendix J – Data Gaps

Indicator	Summary
Environment	
Land Use	<p><b>Energy:</b> An Energy Consumption and Greenhouse Gas Emission Report 2011 was not completed by a municipality so a complete energy consumption baseline cannot be established.</p> <p><b>Waste:</b> Data is not available or collected on industrial, commercial and institution waste diversion rates or waste composition.</p> <p><b>Agriculture:</b> Run-off from agricultural operations is contributing to water pollution, but there is no data on the extent of agricultural pollution.</p> <p><b>Soil:</b> Although data is available on soil cover, there is no data on other soil quality indicators (e.g., soil composition, soil biodiversity).</p>
Climate Change	<p>Climate data up to 2013 was only available for Chatsworth, Wiarton and Kincardine. Climate variability data from Environment Canada was not compiled at the time of the report.</p> <p>The number of extreme heats days and extreme cold days would allow better linkage between exposure and health effects, but this data was not compiled at the time of the report.</p> <p>Data on the number of days that heat alerts lasted would be a better indicator of climate extremes, rather than the number of heat alert occurrences. Data on how long the heat alert lasted was not previously reported.</p>
Air	<p>There is a lack of air quality monitoring stations in Grey-Bruce. Air quality data was derived from Tiverton Station in Bruce County, which is not representative of all of Grey-Bruce.</p>
Water quality	<p><b>Drinking water quality:</b> The percent of Adverse Water Quality Incident reports (# adverse / total sampled) would be a better indicator of drinking water quality but could not be determined. Although the number of adverse results is available, the total number of water samples tested is not.</p> <p>It is important to note that adverse results from communal municipal water systems are not a good indicator of the state of water quality. Measuring the effectiveness of source water protection plans in reaching objectives can be a better indicator of water quality.</p> <p><b>Ground water quality:</b> The Provincial Groundwater Monitoring Network (PGMN) is a partnership between the MOECC and the Conservation Authorities of Ontario. It is a province-wide groundwater monitoring initiative designed to collect long-term baseline data on groundwater quality and quality in special areas of interest. Only data from Saugeen Valley Conservation Authority (SVCA) was used in this analysis. Although data was collected from groundwater monitoring wells in Grey Sauble SPA and Northern Bruce Peninsula SPA, the well locations do not adequately represent</p>

	<p>the region so the information was excluded from analysis.</p> <p><b>Beach water quality:</b> The beach management program has changed significantly over time. The number and type of beaches tested has not been consistent over the years so determining the trend in beach quality is difficult.</p>
Water quantity	<p><b>Groundwater:</b> Under the provincial groundwater monitoring network, there are 10 groundwater wells being monitored under Grey Sauble Conservation Authority and 23 groundwater wells under Saugeen Valley Conservation Authority. Monitoring wells were equipped with data loggers and record water levels and temperature on an hourly basis. Monitoring ground water levels helps the Ministry obtain vital province-wide, baseline, annual and long term changes in groundwater storage, estimate recharge rates, determine the direction of ground water flow and track long term drought conditions. This data was not analyzed at the time of the report.</p>
Ecological Resources	
Biodiversity	<p>Although the types of species at risk are known in Grey-Bruce, updated information is not available on the number of species at risk and where they are located.</p>
Fish and fish habitat monitoring	<p>Monitoring data is not yet available at the local level or County level. Broad-scale monitoring is conducted across the province at the FMZ level by the Ministry of Natural Resources and Forestry. The first 5 year monitoring cycle was recently completed in 2012, and a report of findings will be available in the near future.</p>
Wetland condition	<p>Only wetland conditions data from Saugeen Valley Conservation's Watershed Report Card 2013 was considered. Wetland conditions data from Grey Sauble Conservation Authority were not reported in the GSCA watershed report card and therefore was not able to be included in the analysis.</p>