making our mark

NIAGARA OFFICIAL PLAN

NEW NIAGARA OFFICIAL PLAN

Climate Change Discussion Paper

Niagara Region
November 2019

SUSTAINABLE REGION

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Executive Summary

The Climate Change Discussion Paper is being undertaken by Niagara Region's Planning and Development Services division as part of the work program for the new Niagara Official Plan. Climate Change has been identified at both the Provincial and Regional level as a key area for land use planning policy development. This paper outlines past work, future trends and policy conformity requirements. It also offers readers an opportunity to become engaged in the project, through associated discussion questions.

Climate change is the long-term change in temperature and weather patterns, which results in rising temperatures, forecast unpredictability, extreme weather events and natural disasters such as wildfires, floods, and droughts. In Niagara, climate change projections indicate a warmer, wetter future with more extreme weather events.

Municipalities have been identified by the Government of Canada as being key partners in the fight against climate change, as they influence 50% of Canada's greenhouse gas emissions. Land use planning is one of the most effective processes for local adaptation to climate change, as existing tools available, such as official plans, zoning by-laws, and development permits can help to minimize climate change risk to the community. While there has been a range of climate change projections over the past several decades, the unpredictability of extreme weather is impacting Niagara communities. Regardless of varying climate change opinions, the intent is to build resilient communities that are able to withstand longer-term weather impacts.

The key sectors where climate change adaptation and mitigation intersects with land use planning are:

- Complete communities-neighbourhoods that are compact and mixed-use, providing amenities closer together.
- Infrastructure- assessing infrastructure risks and vulnerabilities; encouraging the use of green infrastructure and low impact development.
- Transportation- reducing automobile use through planned transit and active transportation.
- Energy-promoting alternative energy systems and energy efficiency through building design and orientation.
- Natural Environment- protecting the natural heritage and water resource systems; recognizing the importance of watershed planning for the protection of water; managing natural hazards; and undertaking stormwater management planning.
- Agriculture- protecting the agricultural land base; promoting local food, food security, and soil health.

Integrating climate change policies and considerations into these sectors is identified *through the Planning Act and Provincial Policy Statement, and provincial plans: A Place To Grow-Growth Plan, Greenbelt Plan, and Niagara Escarpment Plan, all of which the new Niagara Official Plan must conform to and be consistent with.*

This discussion paper builds upon previous climate change work completed at Niagara Region over the course of the past decade. The purpose of this paper is to provide information on climate change in order to develop policies suitable for the new Niagara Official Plan. Information within this report includes a background on climate change, the impacts in Niagara, how land use planning relates to climate change adaptation and mitigation, and provincial requirements to integrate climate change into official plans.

We Want to Hear From You!

Important to this discussion paper is gathering your feedback on this paper by answering the key discussion questions found in section 11.0 of the document. All responses are due by December 31, 2019.

Your answers will be reviewed and considered when developing options for the new Niagara Official Plan.

1.0 Purpose

One of the purposes for undertaking the Climate Change Work Program is to satisfy provincial requirements of including climate change policies in the new Niagara Official Plan. Additionally, climate change is increasingly impacting Niagara communities, making it crucial to mitigate and adapt to current and future changes in order to grow and protect the community into the future. While work previously has focussed on both corporate and community initiatives (see Appendix 2), the work for the Official Plan is primarily focussed on climate change adaptation and mitigation from a community level.

The purpose of the Climate Change Discussion Paper is to provide information on climate change in order to develop policies for the new Niagara Official Plan. This discussion paper provides an understanding of climate change, the legislative/policy requirements from the Province for addressing climate change in official plans, and discussion questions to identify options suitable for Niagara.

2.0 Introduction

Niagara Region is developing a new Niagara Official Plan through a process known as a 'municipal comprehensive review' to ensure conformity with provincial land use planning direction. The new Niagara Official Plan will be a long-range, policy planning document used to shape Niagara's physical, economic, and social development.

The Province requires municipalities to regularly review official plans to align with provincial requirements. Niagara's Regional Official Plan was first approved in the 1970's, with amendments made over the years; however, the official plan has never been comprehensively reviewed.

The process for developing the new Niagara Official Plan began in 2017 with the objective to make the plan contemporary and user friendly; provide a consistent structure; and reflect the current comprehensive planning framework.

There are five components to developing the new Niagara Official Plan, which includes:

Figure 1: *Components of the Niagara Official Plan*

Planning for climate change is within the Sustainable Region component; however, climate change considerations will be integrated into all sections of the Official Plan. In May 2018, Regional Council endorsed the Climate Change Work Program for the new Niagara Official Plan (PDS 22-2018), completing phase 1 of the work program. The climate change work program consists of six phases, with the objective to develop policies on climate change for the new Niagara Official Plan. The following chart identifies each phase.

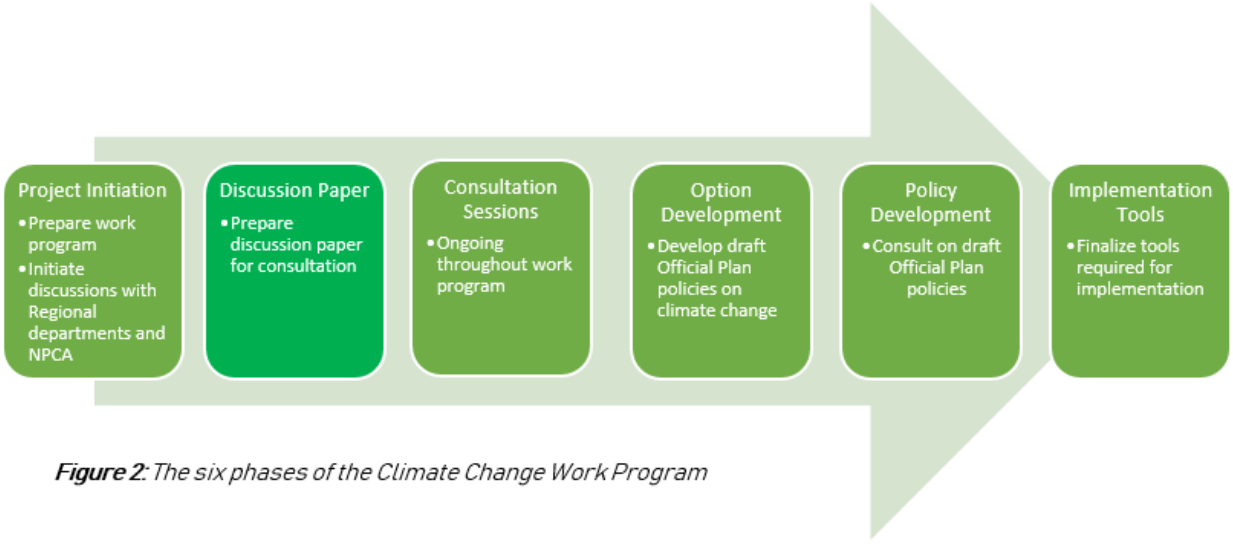


Figure 2: *The six phases of the Climate Change Work Program*

3.0 Background

3.1 Understanding Climate Change

Climate change is defined as a change in climate that alters the composition of the global atmosphere and natural climate variability observed over time due directly or indirectly by human activity.[1]

Climate change is different from weather, in that weather forecasts vary in the short term (daily or year-to-year) and the change in climate occurs in the long-term (30+ years). Changes to the climate result in rising temperatures, forecast unpredictability, extreme weather events and natural disasters such as wildfires, floods, and droughts.[2]

Greenhouse gases (GHG) make up part of Earth's atmosphere and act as a layer of insulation for Earth. The GHGs trap heat and warm the planet, much like the glass in a greenhouse. While there are natural GHGs, which have remained stable through natural processes that remove as much carbon as is released, there are human caused GHGs (through burning of fossil fuels, etc.), which have released more carbon dioxide than has been removed.[3] The result is an increase of GHGs that are warming the planet, contributing to climate change.

The United Nations Environment Programme, the Inter-governmental Panel on Climate Change (IPCC), has concluded the rate of warming of the climate is unequivocal and that most of the observed increase in global average temperature is due to human activity.[4] IPCC has also found that warming due to human activity from the pre-industrial period to the present will continue for centuries to millennia and will continue to cause further long-term changes. In Ontario, the average annual temperature has been increasing by approximately 1.3°C per 100 years from 1900 to present.

Climate change and global warming are different. Global warming only accounts for rising temperature, which is one aspect of climate change. The rate of global warming over the last 50 years is almost double the rate of warming over the last 100 years (Ministry of the Environment, Conservation, and Parks, 2019).

Greenhouse gases include carbon dioxide, methane, nitrous oxide, and ozone. As different greenhouse gases have different effects on the atmosphere, emission measurements are converted to the equivalent in carbon dioxide, the most common greenhouse gas (Auditor General of Canada, 2018).

[1] United Nations Framework Convention on Climate Change . (2011). *Climate change science- the status of climate change science today.*

[2] National Geographic Society. (2019, March 28).*Climate Change*. Retrieved from National Geographic.

[3] David Suzuki Foundation. (2017, October 5). *What are greenhouse gases?* Retrieved from David Suzuki Foundation.

[4] Environmental Commissioner of Ontario. (2016). *Facing Climate Change: Greenhouse Gas Progress Report* .Toronto.

3.2 Global and National Impacts

The impacts of climate change are far reaching and impact global, national, regional, and local initiatives. Globally, climate change has resulted in warming oceans, shrinking of the Greenland and Antarctic ice sheets, decreased snow cover, and sea level rise. In Canada, climate change has resulted in:

• **Floods:** Increasing with extreme precipitation events occurring more frequently.

• **Melting sea ice:** Reduction results in less protection from waves and storm surges, increasing the risk of coastal erosion and flooding.

• **Rising sea levels:** Global sea level has risen around 19cm since 1990.

• **Forest fires:** The land charred every year from wildfires has doubled since the 1970s and is likely to double or quadruple as temperatures increase. Approximately 2.5M hectares of land is charred every year (half the size of Nova Scotia).

• **Thawing permafrost:** Degrading, causing land deformations and landslides that impact roads, buildings, and other infrastructure.

• **Heat waves:** By 2100, the number of +30°C days in Canadian cities is expected to double.[5]

Smog in Toronto - *Toronto Star*

[5] Auditor General of Canada.(2018). *Perspectives on Climate Change Action in Canada.*

Canada is warming at twice the global rate

According to *Canada's Changing Climate Report* (2019), Canada is warming at twice the global rate due to local conditions. Canada's loss of snow and sea ice is reducing reflectivity of the surface, which increases the absorption of solar radiation, causing larger surface warming than southern regions.

3.3 Taking action on climate change

Taking action on climate change involves commitment from all sectors and people. Action can be broken down into two categories: mitigation and adaptation.

Mitigation refers to reducing or stabilizing the levels of GHG in the atmosphere. Examples include: • Reducing sources of greenhouse gases (such as burning fossil fuels for electricity) • Enhancing carbon "sinks" that store these gases (such as forests and soil) • Building compact, complete communities that provides active transportation opportunities to deter driving	**Adaptation** refers to adapting to the changes in climate that are already occurring. The goal is to reduce our vulnerability to the harmful effects of climate change, like extreme weather events to achieve **resiliency.** Examples include: • Building flood defenses • Planning for heatwaves and higher temperatures • Installing water-permeable pavements to better deal with floods and stormwater

In 2014, the Province of Ontario eliminated coal generation from 25% use in 2003 to 0% in 2014. This has resulted in significant GHG emission reductions-an example of mitigation. In 2012, the City of Welland undertook a stormwater and wastewater infrastructure assessment, which identifies the vulnerability of infrastructure systems in Welland and the level of adaptation required to reduce climate change vulnerability- an example of adaptation planning. The goal of adapting to climate change is making communities more resilient to the impacts of climate change.

3.4 The costs of climate change

Climate change has also contributed to increased financial risk to the public, governments and businesses. For example, increased rainfall may result in the likelihood of basement flooding occurring more regularly, with increased costs associated with prevention and clean up. Taking action on climate change can reduce financial risk, both on an individual and community level.

Shoreline erosion along Lake Ontario at Niagara Shores Park- *Niagara Now*

3.4.1 Human and environmental costs

The human costs associated with climate change range from health concerns due to air quality to natural disasters threatening life. In Toronto smog emissions from automobiles cost the economy $2.2B per year and kill an estimated 440 people per year.[6] In November 2018, data from the Centre of Research on the Epidemiology of Disasters found that the human impact of the 2018 climate disasters worldwide resulted in 5,000 deaths and 28.9M people needing emergency assistance or humanitarian aid.[7]

Environmental costs to climate change come from shoreline erosion, increase of invasive species, deterioration of wetlands and forests, among others. By the 2050s, flooding from climate change could cost between $1B and $8B per year for damage to Canada's coasts[8].

[6] Thompson, D. (2013). *Suburban Sprawl: Exposing hidden costs, identifying innovations.* Ottawa: Sustainable Prosperity.
[7] Daniel Levitt, P. A.-J. (2018, December 21). *Deadly weather: the human cost's of climate disasters*. Retrieved from The Guardian.
[8] Demerse, C. (2016). *The Costs of Climate Change.* Clean Energy Canada.

3.4.2 Financial costs

The impacts of climate change are already being observed in terms of the increasing costs of climate-induced emergencies, such as flooding. Findings from the Insurance Bureau of Canada found that more than 50 percent of all property and casualty claims in Canada are flood related, with hail, wind, ice, and fire comprising the rest.[9] Insurable payouts averaged $405M per year from 1983 to 2008. The insurance gap illustrates that for every $1 of insured losses borne by insurers in Canada, $3-4 are borne by governments and home and business owners.[10]

Emergencies occur when a hazard interacts with social elements in a manner that increases the risk of negative impacts that could exceed or overwhelm a group, facility, organization, or community's resources and ability to cope if not sufficiently managed (Martel, 2019).

In 2018, insurance payouts increased to $1.9B per year.[11] This is the fourth-highest amount of loses on record despite having no single massive event responsible. Instead, these losses arose from a number of smaller scale severe weather events across the country that impacted municipalities. These included the emergencies listed below, all of which originated from hazards that occur in Niagara:

- February storms and floods that caused more than $57M in insured damage across southern Ontario and Quebec;
- April storm that caused more than $85M in insured damage across Ontario and Quebec;
- April ice storm that affected southern Ontario and resulted in more than $190M in insured damage;
- May windstorm that affected Ontario and parts of Quebec and topped $410M – with $380M of this damage being in Ontario;
- A flood in Toronto on August 7 that caused over $80M in insured damage; and
- Ottawa-Gatineau tornadoes and windstorms on September 21 caused $295M in insured damage.[12]

[9] Feltmate, B. (2015, November/December). Plan for Change: The costs of not acting far exceed the costs of acting. *Renew Canada: The Infrastructure Magazine*, p. 10.
[10] Moudrak, N., Feltmate, B., Venema, H., & Osman, H. (2018). *Combating Canada's Rising Flood Costs: Natural infrastructure is an underutilized option .* Insurance Bureau of Canada, Intact Centre on Climate Adaptation, University of Waterloo.
[11] Insurance Bureau of Canada. (2019, January 16). *Severe weather causes $1.9 billion in insured damage in 2018*. Retrieved from Insurance Bureau of Canada.
[12] Ibid.

Other programs, such as the Canadian federal transfer program, Disaster Financial Assistance Arrangement (DFAA) that provides assistance to provinces and territories for natural disasters has seen an increase from $10M (1970-1995) to $360M (2011-2016) in payouts due to the increased frequency of natural disasters. The payout of $360M is more than the DFAA provided in its first 39 fiscal years combined.[13]

Within Niagara, heavy precipitation in 2013 cost the City of Niagara Falls $36,000 over a one week period from flood related claims. The costs increased to more than $100,000 with 160 claims from residents impacted.[14] In 2017, heavy rain resulted in the closing of Martindale Road bridge in St. Catharines as the ground beneath started to erode. The approximate cost of these repairs was $700,000. The Town of Lincoln had approximately $1M in damages from the Lake Ontario flooding that occurred in 2017.[15]

Bank of Canada taking Climate Action

In 2019, the Bank of Canada announced it would include climate change as a vulnerability when assessing financial stability in Canada through their Financial System Review. The Bank of Canada will begin a multi-year research effort to understand the risks that climate change poses to the economy and financial system (Poloz, et al., 2019).

2017 damage to the Martindale Road Bridge in St. Catharines- *Niagara Falls Review*

[13] Public Safety Canada. (2017). *2016-2017 Evaluation of the Disaster Financial Assitance Arragements.* Government of Canada.
[14] Spiteri, R. (2013, September 24). *Flood claims against city amounts to millions*. Retrieved from Niagara Falls Review.
[15] Dakin, D. (2018, November 26). *Brock researchers to introduce coastal research project to Lincoln residents and stakeholders*. Retrieved from Brock News.

According to the National Flood Insurance Program in the U.S. a 15cm flood in a 2,000 sqft home is likely to cause $40,000 US in flood damage. There is also costs to businesses such as loss of sales during closures. A recent study from the U.S. projects that climate change could cost some of the world's largest companies approximately $1 trillion US over the next five years, most of which would be damage to assets that would need to be replaced entirely.[16]

With the impacts of climate change already being felt, adaption to climate change, which includes programs designed to reduce the risk and impact of climate-related hazards are a key effort in adaptation. Reducing the potential impacts of an emergency before one actually occurs can ensure public safety and saves money as emergency management mitigation is more cost-effective than emergency response and recovery.

Brock University Shoreline & Climate Change Research Project

Starting in 2018, the Town of Lincoln is involved in Brock University's research on how coastal communities can deal with the impacts of climate change. The Town of Lincoln is one of the communities included, with a funding grant of $280,000 from the Marine Environmental Observation Prediction and Response Network (Dakin, 2018).

4.0 Risks and Opportunities in Niagara

4.1 How is climate changing in Niagara

While the climate is changing around the world, there are differences in these changes according to local conditions. Within Niagara, the climate is becoming warmer, wetter, and more extreme.

Climate changes already seen within Niagara have been:

- An increase in annual average temperature of 1.3°C in the last 40 years;
- Increase of +30°C days;
- More heat waves of 3 or more consecutive hot days;

In September 2018, Niagara broke a 73-year weather record for heat. Vineland hit 32.8°C, over the previous record of 31.7°C set in 1945 (Heslop, 2018).

[16] Riley, C. (2019, June 4). *Climate change will cost companies $1 trillion. It also means huge opportunities*. Retrieved from CNN Business.

- Longer growing season, with May and September significantly warmer;
- Increase in average number of frost-free days;
- More rain and less snow in winter;
- More summer droughts and dry spells;
- Increased numbers of freeze-thaw cycles (when daily temperatures fluctuate above and below freezing);
- Increase in heavy rain events.[17]

Future projections indicate these changes will increase, with more unpredictability. The Climate Atlas of Canada, released projections in 2018 for Niagara Falls, St. Catharines, and Welland. The Climate Atlas uses hindcasting, which models the climate of the past, to recreate the averages, extremes, and seasonal patterns to predict future climate. Projections from both Penney (2012) and The Climate Atlas of Canada (2018) for Niagara indicate:

- An increase in average annual temperature by 2°C-3.5°C by 2050-2080;
- An increase in annual precipitation by 38mm to 74mm by 2050-2080;
- An increase in the number of very hot days (+30°C) by 18-37 days by 2050-2080 ;
- Increase in freeze-free days by 30 to 50 days by 2050-2080.[18]

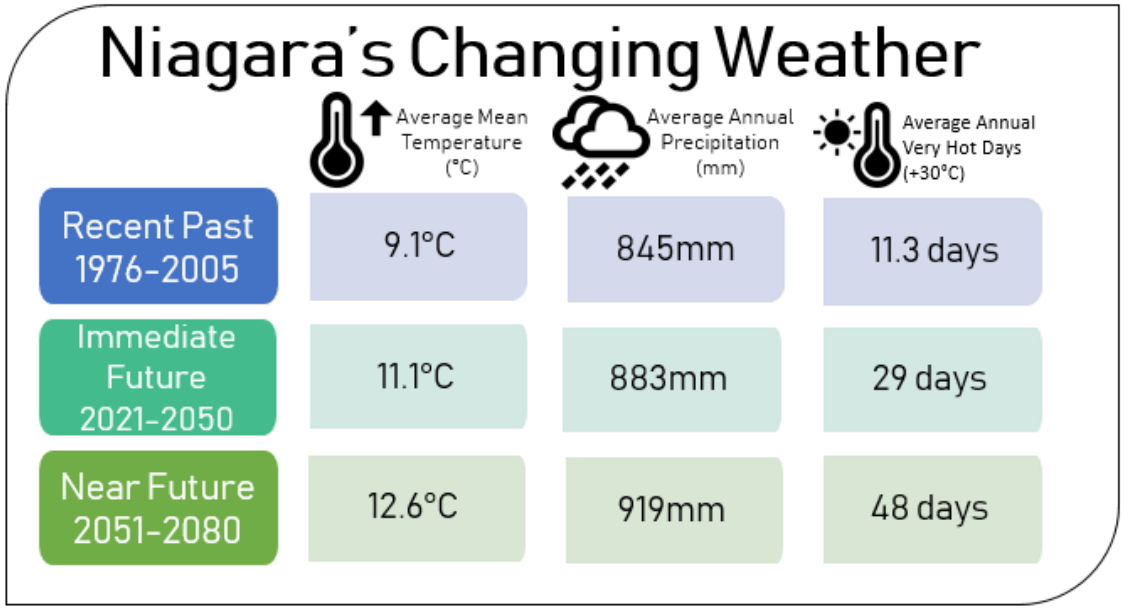


Figure 3: *Projections of Niagara's weather from the Climate Atlas of Canada, 2018. For more information visit see Climate Atlas of Canada (www.climateatlas.ca)*

[17] Penney, J. (2012). *Adapting to climate change: Challenges for Niagara.* Brock University's Environmental Sustainability Research Centre.
[18] Climate Atlas of Canada. (2018). *Climate Atlas Report*. Retrieved from Climate Atlas of Canada.

4.2 Impacts and risks due to climate change in Niagara

Climate change has and will continue to impact all sectors within Niagara. Warmer, wetter and extreme weather events are impacting human health, ecosystems and species, agriculture, and infrastructure in Niagara.

One of the noted impacts of climate change in the scientific literature is the frequency of severe weather events is likely to continue to increase, which will result in increased risks to public safety, increased losses, and increasing demands for Emergency Management related services.[19] Some of the hazards that may experience changes in frequency and severity due to climate change in Niagara are:

- Floods;
- Freezing Rain/Ice Storms;
- Severe Storms;
- Extreme Temperatures;
- Droughts; and
- Vectorborne Diseases (see Appendix 1).

Factors that can make a population or area more vulnerable to the impacts of climate-related emergencies include:

- Population demographics including age, health, etc.;
- Socio-economic factors;
- Lack of access points (e.g. roads) to certain areas;
- Land use; and
- Reliance on critical infrastructure.

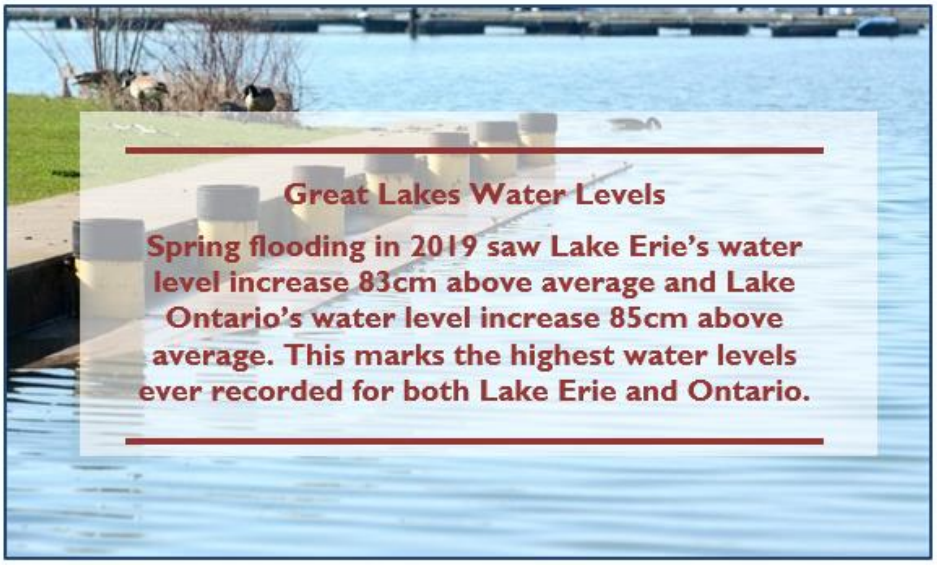
4.2.1 Flooding Risks

In July 2013, Niagara Falls' rainfall gauge on Stanley Avenue collected 106mm of rain, with 59mm being collected within one hour. The storm resulted in basement flood damage, sewage backups, and road closures due to the storms flash flooding.[20] Other notable rainfall events within the region were in July 2014, November 2015, May 2017, spring of 2019, and most recently in October 2019. Impacts due to flooding in Niagara has resulted in infrastructure damage, shoreline erosion, basement flooding, overwhelmed and backed up sewer systems, and flooded agricultural lands. Particularly prominent has been flooding at Lakeside Park and surrounding areas in St. Catharines due to the high water levels in Lake Ontario. The impacts have been flooding throughout the park forcing closure of both the beach and the historic carousal, with city staff pumping water out of the area. In the summer

[19] Insurance Bureau of Canada (IBC). (2019). Severe Weather Causes $1.9 Billion in Insured Damage in 2018; Ministry of Health and Long Term Care. (2016). Ontario Climate Change and Health Toolkit. Government of Ontario.
[20] Spiteri, R. (2013, September 24).

of 2019 the carousal and beach were reopened in the middle of August once water levels receded, far past the typical opening in May. There were also many calls to the city regarding basement flooding from residents in the surrounding area. The October storm, impacted Fort Erie, Port Colborne, and Wainfleet intensely causing major power outages and flooding due to high winds. According to National Oceanic and Atmospheric Administration, Lake Erie waves approached 15 feet and wind speeds reached 115km/ hour according to Environment Canada.[21]

Other impacts include milder weather in January and February of 2019 which saw more freezing rain, making road conditions slippery and dangerous resulting in a number of school, business, and community recreation closures across the region.



High water levels along Lake Erie- *St. Catharines Standard*

4.2.2 Human Health Risks

Climate change will have a monumental impact on human health and wellbeing. Extreme temperatures have led to excessive high heat alerts issued for Niagara Region. These alerts are issued when the daily temperatures reach 31°C (or humidex is at least 40°C) for two consecutive days or more. In the past five years, Niagara saw the most excessive high heat days in 2016 with 32 days. Increasing temperatures and precipitation also impacts recreational water quality, as amplified rainfall leads to higher rates of E. coli present within water from run off. Niagara Region Public Health regularly monitors public beaches

[21] Tessmer, J. (2019, November 1). *FERT Responds to Heavy Flooding and Power Outages in Fort Erie*. Retrieved from Town of Fort Erie.

throughout the summer months to determine if they are safe for swimming. Changes in temperature and subsequent air quality is expected to:

- Intensify the risk of heat related illness and death as well as exacerbate respiratory and cardiovascular conditions;
- Lead to behaviour changes of spending more time outside, increasing the rates of skin cancers, cataracts, and other eye damage from ultraviolet radiation exposure from being outdoors for extended periods;
- Increase airborne particulate matter, higher levels of ground-level ozone, and increased pollens/spores, worsening respiratory conditions, allergies, asthma, and chronic obstructive pulmonary disease, which can be fatal;
- Lead to higher rates of E.coli present within the water, which if ingested can lead to gastrointestinal disturbances, resulting in dehydration and potentially death in vulnerable populations;
- Increase the proliferation of algal blooms that produce cyanotoxins, contributing to various irritations and respiratory complications;
- Intensify foodborne illnesses, from products potentially exposed to dangerous temperatures that facilitate bacterial growth[22]; and
- Lead to the emergence of new vectorborne diseases, such as Malaria and Zika virus.

Sign located at Niagara beach indicating bacteria levels are too high to swim

'Be tick smart' sign at Rotary Park in St. Catharines- *St. Catharines Standard*

[22] Berry, P., Clarke, K., Fleury, M., & Parker, S. (2014). Human Health. In F. Warren, & D. Lemmen, *Canada in a changing climate: Sector perspectives on impacts and adaptation* (pp. 191-232). Ottawa: Government of Canada;
Ebi, K., Vidy, A., Berry, P., Paterson, J., & Yusa, A. (2016). *Ontario climate change health vulnerability and adaptation assessment guidelines: Technical document.* Toronto: Ministry of Health and Long-Term Care.

Changes in climate is also extending the habitat of ticks and mosquitos that can carry bacteria for West Nile Virus and Lyme disease. West Nile Virus is a nationally notifiable disease in Canada as 1 in 150 cases develop fatal complications such as encephalitis or meningitis, which can result in death.[23] Niagara Region Public Health has identified positive West Nile Virus mosquito pools in St. Catharines, Welland, Port Colborne, and West Lincoln.

Warmer temperatures has also allowed for faster maturation of the Lyme disease bacteria within blacklegged ticks and made certain areas of the province ideal for habitation.[24] Lyme disease is a nationally notifiable disease and in rare circumstances it can cause Lyme carditis which can cause death.[25] Currently, Niagara is listed as an 'estimated at risk area' for Lyme disease by Public Health Ontario.[26] As of August 2019, 2,251 ticks were submitted to Niagara Region Public Health with 245 being blacklegged ticks.[27]

4.2.3 Agriculture Risks

Agriculture is an important sector within Niagara, with more than 1,800 farms that contributed $1.41B to the economy as of 2016. The main types of farming in Niagara are fruit and tree nut farming; oilseed and grain farming; greenhouse, nursery, and floriculture production; other animal production; and poultry and egg production. Climate change has the ability to affect the agricultural sector, with impacts arising from the unpredictability of weather year to year. For example, flooding in the spring of 2017 and 2019 in Niagara caused problems for getting crops in the ground.[28] In January 2019, there were concerns in Niagara over the making of ice wine with a milder winter, as the minimum temperature required to harvest is -8°C.[29] This milder weather impacts the economic viability of the ice wine making sector.

These growing concerns add to the challenges faced by farmers directly impacted by climate change. The climate related changes that will have the most risk to agriculture are changes in precipitation patterns, warmer average temperatures, hot spells and heat waves and increased storms and extreme weather. The impacts associated with these changes include:

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[23] Centers for Disease Control and Prevention. (2019, September 25). *West Nile virus*.
[24] Estrada-Peña, A., Ayllón, N., & de la Fuente, J. (2012, Mar). Impact of climate trends on tick-borne pathogen transmission. *Front Physiol, 3*(64).; (Ebi, Vidy, Berry, Paterson, & Yusa, 2016); Irving, K., & Galway, L. (2019). An evaluation of tick and Lyme disease information on health unit websites in Ontario. *Environmental Health Review*, 20-27.
[25] Centers for Disease Control and Prevention. (n.d.). *Lyme Disease: What you need to know.* Centers for Disease Control and Prevention.
[26] Public Health Ontario. (2019). *Ontario Lyme Disease Map 2019 Estimated Risk Areas*.
[27] Benner, A. (2019, August 7). *Living with ticks 'becoming the norm' in Niagara*. Retrieved from The St. Catharines Standard.
[28] Benner, A. (2017, May 2). *Soggy spring worries farmers*. Retrieved from The Standard.
[29] Watters, H. (2019, January 11). *What if the harvest doesn't come? Niagara ice wine making is 'an extreme sport'*. Retrieved from CBC News.

- Increase of weed species (kudzu vine), agricultural crop pests (corn ear-worms), and survival of fungi, viruses, and bacteria over winter;
- Shorter growing season for cool weather crops (lettuce, spinach, potatoes), delayed spring planting, reduced season for ice wine;
- Decrease in yields for field crops (wheat), damage to fruit trees (apple), crop losses due to delayed harvests;
- Damage to greenhouses and livestock barns and power outages jeopardizing daily operations; and
- Heat stress in animals, increased energy costs for greenhouse operations, poultry deaths.[30]

Flooded vineyard in Niagara-on-the-Lake – *Niagara Now*

4.2.4 Ecosystems Risks

Niagara is within the Carolinian ecosystem, which extends along the north shore of Lake Erie and around the western edge of Lake Ontario, and hosts more plant and animal species than any other Canadian ecosystem. Ecosystems provide many benefits that can help to mitigate and adapt to climate change such as, storm protection, retention of water, flood control, pollination, and recreational activities, among others. However, climate change can put a strain on ecosystems that are already stressed or have been fragmented by deforestation, drainage of water, pollination, and invasive species, among others.

The climate related changes that have the most risk to ecosystems in the Niagara are warmer winters, increased summer heat, and higher water temperatures. Warmer winters can increase the insect and disease outbreak in trees and other vegetation, as invasive species are able to survive the mild winters and reproduce. For example, the Emerald Ash

[30] Penney, J. (2012).

Borer, an invasive exotic beetle, is currently devastating ash trees across Niagara and Ontario. Summer heat is increasing stress for trees and woodlands, making them more vulnerable to fire, and higher water temperatures are impacting a number of fish species.

Other climate change impacts include:

- Increase in some plant species, such as poison ivy, as a result of higher levels of $C0_2$;
- Decline in wetlands due to lower water levels, with impacts on wetland plants, marsh-nesting birds, and fish that spawn or live lifelong in vegetated wetland environments;
- Threats to fish from higher water levels; declining water levels; reduced flows in some rivers; reduced levels of dissolved oxygen in summer; and increased nutrients and siltation from storms;
- Expansion of warm-water fish (e.g. smallmouth bass, etc.), and invasive aquatic species (e.g. zebra mussels, Asian carp, etc.);
- Outbreaks of Type E botulism, from warmer water temperatures; low water levels; and low levels of dissolved oxygen, which caused mass die-offs of mudpuppy salamanders on the shores of Lake Erie and can threaten fish-eating birds; and
- Outbreaks of toxic blue-green algae blooms, from warmer water temperatures, stagnant and drought conditions, and phosphorous from agricultural run-off and sewage treatment plants that may enter into waterbodies following intense rainfall events.[31]

4.2.5 Infrastructure Risks

Infrastructure is foundational to communities as it includes the physical structures that provide many services, including sewage and water systems, stormwater management, energy generation and distribution, road transportation, etc. Climate change has and will continue to make infrastructure more vulnerable, which affects the infrastructure itself and subsequently those using it. In Niagara infrastructure challenges projected and occurring due to climate change includes:

- Higher temperatures leading to higher water temperatures
  Higher water temperatures impacting water quality, including phosphorus; E. coli bacteria; sediment and chloride from agricultural runoff; septic systems; manure storage and urban stormwater;
- Higher temperatures contributing to blue-green algae blooms affecting the taste and odour of drinking water in summer;
- Increased runoff and combined sewage system overflows from intense rainfall carrying more contaminants and infectious organisms into water bodies;
- Drier summers and more frequent droughts will occur, reducing groundwater recharge;

[31] Ibid.

- Intense rainfall and precipitation events result in significant wet weather events which overwhelm the sewer systems and back up sewage into basements and the environment;
- Seasonal demand for energy increasing the use of air conditioning systems being used in the summer;
- Extreme weather will affect transmission and distribution of electricity; and
- Extreme weather is likely to create the most dramatic impact damaging all kinds of buildings (apartments and homes, offices, commercial and industrial buildings, schools, hospitals, nursing homes, fire and police stations, farm buildings, etc.)

Lockview Public School roof damage from wind storm- *Niagara This Week*

4.3 Opportunities

While there are increased costs and various sectors impacted by climate change, there are also opportunities that can come from adapting to the climate.

Opportunities associated with a changing climate include longer growing seasons for value-added crops, increasing market for renewable energy, investing in resilient infrastructure, and preserving ecosystems, all of which contribute to a stronger economy. In 2012, the National Roundtable on the Environment and the Economy estimated that every $1 spent now on adaptation would yield between $9 and $38 worth of avoided damages in the future.[32] Adaptation strategies referenced include controlling pests, planting climate-resilient tree species, and prohibiting new construction in areas at risk of flooding.

The Carbon Disclosure Project (2019) found that while climate risk to businesses can be upwards of $1 trillion US, the climate-related opportunities could be $2.1 trillion US. The

[32] Durham Region Planning & Economic Development Department. (2019). *Climate Change Sustainability Discussion Paper.*

climate-related opportunities come from a shift in consumer preferences for products and services that are low-emission.[33] For example, in Niagara, Devron Ltd., a manufacturing company in Welland builds green living fences, construction materials to reduce erosion, and stormwater management products. Niagara Recycling, a locally owned and operated company has manufactured a product called Eco Glass, made entirely from recycled glass and used for sandblasting.

Building communities that are low density or sprawling heightens the cost of climate change. Sustainable Prosperity (2015) found that in Halifax suburban development costs the city $3,462 per household, whereas urban development costs the city $1,416 per household.[34] The increased costs associated with low-density development for governments comes primarily from more infrastructure (such as pipes, roads, etc.) and servicing of emergency services. Compact development can be used to both mitigate and adapt to climate change. Compact development mitigates climate change by lowering automobile dependence and promoting the use of transit and active transportation, with a mix of land uses closer together. Compact development within urban areas adapts to climate change by preserving natural and agricultural areas, which provide key ecosystem services such as water filtration, storage and runoff control, erosion control, etc. By encouraging intensification and compact development, cities will see savings under current climate conditions and continued adaptation can lead to communities that are more resilient.

Sprawling community- *McKinlay Surveyors*

Compact building design- *McKinlay Surveyors*

Natural features can play a vital role in economic savings. While assets are typically thought of as engineered infrastructure (roads, bridges, pipes), contributions from natural assets (forests, wetlands, greenspaces) can be calculated to determine the value of services they

[33] Carbon Disclosure Project. (2019, March 5). *Major Risk or Rosy Opportunity: Are companies ready for climate change?* Retrieved from Streets Blog USA.

[34] Thompson, D. (2013).

provide. The Municipal Natural Assets Initiative (MNAI) has conducted pilot projects with three municipalities in British Columbia, The Region of Peel, and the Town of Oakville. The following results were found:

- Town of Oakville's Maple Hurst Remnant Channel provides the equivalent stormwater services to an engineered asset, which would cost $1.24M-1.44M.
- Region of Peel's wetlands, forests, and meadows within two sub-watersheds mitigate a 100-year flood. The cost to replace the stormwater services provided would be the equivalent of $704M of engineered stormwater services under current conditions and $764M under climate change conditions.[35]

Both the Town of Oakville and Region of Peel's natural assets demonstrate the importance of identifying and protecting features within the environment that can provide necessary stormwater services, while being cost effective in the long-term.

5.0 Climate Change Resiliency through Land Use Planning

Land use planning has been identified as one of the most effective processes for local adaptation to climate change, as existing tools available, such as official plans, zoning by-laws, and development permits can help to minimize climate change risk to the community. Land use planning provides opportunities to reduce GHG emissions, and increase resiliency to climate change.[36] This section outlines areas where policy on climate change can be integrated and possible opportunities to achieve mitigation and adaptation.

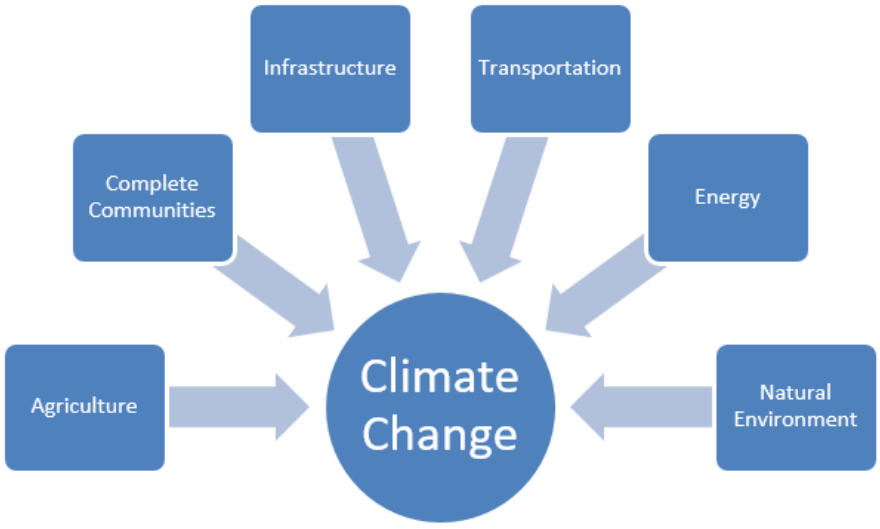

***Figure 4**: A climate change lens identifying sub-components of climate change*

[35] Municipal Natural Asset Initiative. (2018). *Municipal Natural Asset Initiative: Results from the first national cohort.*
[36] Canadian Institute of Planners. (2018). *Climate Change and Land Use Planning.* Canadian Institute of Planners.

5.1 Complete Communities and Infrastructure

Climate change mitigation and adaptation can be achieved through a focus on both the built and natural environment. The Province of Ontario has focused land use planning to achieve 'complete communities'. Complete communities can be defined as mixed-use neighbourhoods that offer and support convenient access to most necessities for daily living, including a mix of jobs, local stores, and services, full range of housing, transportation options and public service facilities.[37]

Supporting complete communities occurs through intensifying existing built-up areas, developing greenfield areas to be compact, and supporting a range of opportunities for reduction, reuse, recycling, composting and diversion. Building and supporting complete communities can help mitigate climate change, as necessities are closer to together, decreasing automobile dependence (decrease of GHG emissions) and maximizing energy conservation. Climate change adaptation can occur through design and orientation that promotes green infrastructure, such as street trees, urban forests, permeable surfaces, bioswales, and green roofs. Additionally, secondary plans can be used to comprehensively address mitigation and adaptation at a community scale.

Infrastructure refers to the physical structures (facilities and corridors) that form the foundation for development. This includes, sewage and water systems, septage treatment systems, stormwater management systems, waste management systems, electricity generation facilities, electricity transmission and distribution systems, communications/ telecommunications, transit and transportation corridors and facilities, oil and gas pipelines and associate facilities (Provincial Policy Statement, 2014)

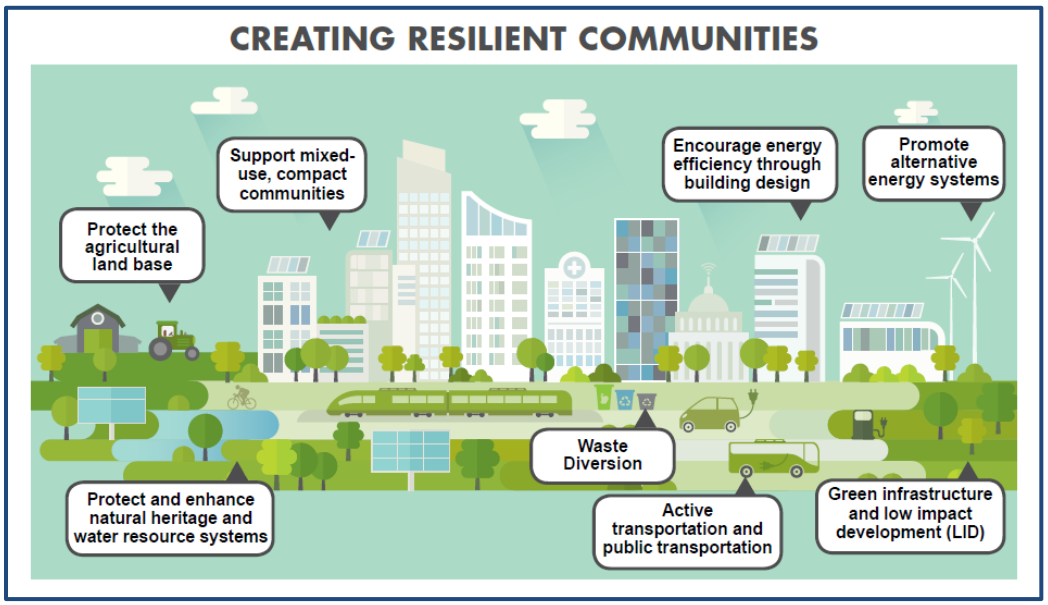

Figure 5: *Sample community identifying aspects to climate change adaptation and mitigation*

[37] A Place to Grow, 2019.

Essential to the development of complete communities is infrastructure. Infrastructure is foundational to the economy and residents quality of life. The infrastructure within the region includes roads, pipes, treatment plants, and other built infrastructure providing essential services such as drinking water, sewage treatment, stormwater drainage, solid waste disposal, transportation network, and energy. Due to changes in climate, more extreme weather can cause infrastructure to be vulnerable (e.g. localized flooding can overwhelm sewer systems, etc.).

Low-impact development is land development that mimics natural water cycles to manage stormwater. Examples include rain gardens, permeable pavements, green roofs, rainwater harvesting, bioswales, among others.

Therefore, ways to incorporate climate change considerations for infrastructure include,

- Encouraging the use of green infrastructure and low impact development;
- Supporting adaptive reuse of existing building stock and encouraging the reuse and recycling of building materials in the development process;
- Developing asset management policies and plans, with consideration of valuing natural assets (placing a value on the protection and benefits a natural feature provides).

5.2 Transportation

In Ontario, GHG emissions from the transportation sector in 2016 were 34% higher than 1990 levels. The majority of those emissions are due to passenger vehicles on the road. In Niagara, transportation emissions at the community level in 2006 accounted for 40% of total emissions. Achieving a reduction in automobile dependence and lowering GHG emissions from the transportation sector is a way to mitigate climate change and involves promoting other forms of travel:

- Transit
- Active transportation (cycling and walking)
- Carpooling
- Electric vehicles

GO Train approaching station, with individuals getting on and off the train

In order to encourage individuals to choose different forms of transportation, the use of complete streets and transit-supportive development is necessary to provide a variety of choices to individuals. The implementation of complete streets, which entails designing roads to be universally accessible, safe, and comfortable for all users, can promote individuals to choose different forms of transportation, as the infrastructure for other modes of transportation are available. Encouraging transit-supportive development, which includes compact, mixed-use development of both employment and residential densities, can promote a variety of transportation options as amenities are closer together, making walking or cycling more viable and transit infrastructure more accessible.

Climate change adaptation and mitigation can occur through land use policy direction such as:

- Expanding public transportation networks (bus & train) and encouraging carpooling;
- Promoting mixed-use developments and transit-oriented densities that supports a ‘complete streets’ approach and reduces the distance that people travel to work and other destinations;
- Encouraging active transportation through expanded cycling infrastructure and sidewalks; and
- Requiring or encouraging electric vehicle (EV) charging stations to encourage EV uptake.

5.3 Energy

Energy use occurs through everyday activities such as heating or cooling homes and businesses, transportation, electricity, etc. Most energy produced is non-renewable, meaning the energy cannot be replaced once consumed. Non-renewable forms of energy come from natural gas, coal, and oil. These energy sources are distributed through a central generation system, providing electricity through a network of high-voltage transmission lines that provides for multiple end users. Non-renewable energy produces high GHG emissions, resulting in water loss, waste, and land use to occupy large power plants and transmission lines. In Niagara, natural gas is the highest GHG emitting energy source used at 39 percent as of 2006, coming from the residential, commercial, and industrial sectors.

Niagara's 2006 Community GHG Emissions by Source

Natural Gas- 39%
Gasoline- 27%
Electricity- 18%
Diesel- 12%
Propane- 2%
Waste- 2%

Renewable forms of energy come from wind, solar, geothermal, biomass, and hydropower. These energy sources can be used through a distributed generation system, whereby energy is produced, stored and used in the local area where it will be consumed. This form of energy produces clean energy that can help to mitigate GHG emissions, to provide electricity during severe storms or power outages, and is effective for intensification of communities. District energy systems work in the same way, except are for thermal energy; heating or cooling buildings.

Changes in energy sources and consumption can take place for both existing buildings and planned developments. Land use patterns and urban design standards can be implemented to ensure developments support energy efficiency and demand reductions and opportunities for alternative energy systems. This can be implemented through:

- Developing green standards for new buildings (e.g. Toronto Green Standard, etc.);
- Requiring or encouraging higher energy efficiency building standards beyond the Ontario Building Code (e.g. Energy Star, LEED, etc.);
- Encouraging residents and businesses to conserve energy use; and
- Implementing community energy plans.

Energy Efficiency vs. Energy Conservation

Energy Efficiency refers to using technology that requires less energy to perform the same function (e.g. retrofits, LED lights, etc.)

Energy Conservation refers to behaviour that results in the use of less energy (e.g. turning off lights, etc.)

Promoting design and orientation to maximize energy efficiency and maximize the use of renewable energy and alternative energy systems can be achieved by:

- Encouraging district energy systems in new development;
- Implementing mechanisms to protect access to sunlight for solar energy, as surrounding buildings may become tall and cast shade;
- Incorporating urban heat island mitigation strategies (vegetation around buildings, greening parking lots, green walls, green roofs, tree planting); and
- Requiring or encouraging energy efficiency through green technology (sustainable roofs, low-impact development, stormwater management, green infrastructure, renewable heat and power).

Provincial changes repealing the *Green Energy Act (2009)*, which regulated renewable energy projects has amended the *Planning Act* to restore municipal planning authority for siting renewable energy projects. Consideration of land use compatibility and protecting natural heritage systems and water resources while also promoting alternative energy systems will need to be considered.

Urban Heat Island Effect

When an urban area is warmer than the rural areas surrounding it. The additional heat comes from people, cars, buses, trains. Buildings constructed closer together and paved surfaces can create an urban heat island effect as the heat is trapped between the surfaces. Rural areas are often shaded by trees and vegetation, which allows for a cooler climate.

5.4 Natural Environment

The natural environment is a broad term that consists of natural heritage features, natural hazards, and water resources. Natural heritage features and areas consist of wetlands, fish habitat, woodlands, valleylands, endangered and threatened species, wildlife habitat, and areas of natural and scientific interest.[38] Wetlands and woodlands are important for mitigating climate change as they both sequester carbon. Plants within a wetland are able to take carbon dioxide out of the air and store it in their tissues during photosynthesis.[39] Trees are able to absorb carbon for their lifetime through a similar process.[40]

Protecting, maintaining, restoring, and enhancing these features are crucial for offsetting GHG emissions that are being emitted from human activity, as they can help to absorb some of the carbon in the atmosphere.

[38] Provincial Policy Statement, 2014.
[39] Ministry of Natural Resources and Forestry. (2017). *A Wetland Conservation Strategy for Ontario 2017-2030.* Toronto: Queen's Printer for Ontario.
[40] Ministry of Agriculture, Food and Rural Affairs. (2001). *Carbon Sequestration and Ontario Agriculture.*

Natural heritage features also provide benefits to ecosystem services, such as flood control, improved air quality, and soil retention, among others. These features are best when connected, as opposed to being isolated as they are able to form a system. Maintaining or establishing linkages between features allows species to move and adapt as habitat changes, which is likely to increase with climate change.

Maple trees in forest- *Province of Ontario*

Water resources are vital to natural heritage features and should be considered together as forming the natural environment throughout a region. Water resources consist of ground water features and areas, surface water features (including shoreline areas) and hydrologic functions that sustain healthy aquatic and terrestrial ecosystems and human water consumption.[41]

Planning of water resources is conducted at the watershed or subwatershed scale in Ontario, as opposed to jurisdictional boundaries, in order to maintain and manage the natural system. This type of planning is an ecosystem-based approach that protects water for communities (drinking water supply, etc.) and the environment (aquatic species function, etc.).[42]

Under climate change conditions, such as changes in weather, lake levels, and stream flow, among others,communities and hydrologic features and their functions may be negatively impacted. For example, changes to climate may alter floodplains or drought conditions may

[41] Provincial Policy Statement, 2014.
[42] Ministry of the Environment and Climate Change. (2018). *Watershed Planning Guidance.*

change the hydrologic cycle, altering a once protected feature. The same change to a floodplain may increase the risk of flooding in a community. In order to protect water resources, watershed and subwatershed planning should identify baseline information of resources and consider how the impacts of climate change may impact those resources.

Changes to the climate also requires greater management of natural hazards. Natural hazards are features within the environment that can pose risk to public safety or property, such as flooding, erosion, or dynamic beach hazards. Climate change is an important consideration as it may increase the risk of natural hazards. For example, areas previously not at risk to flooding could become a natural hazard, or the risk of harm could become greater. Land use planning can mitigate the risks of natural hazards by considering setbacks away from hazardous lands and hazardous forest types.

Adaptation to climate change for the natural environment consists of:

- Ensuring the natural system is healthy, diverse, and connected;
- Increasing the tree canopy through tree planting and a canopy target;
- Enhancing natural vegetated areas;
- Prohibiting development in hazardous lands and natural areas;
- Stormwater management plans that assess extreme weather and encourage or require low-impact development and green infrastructure;
- Watershed and sub-watershed planning that considers climate change scenarios (e.g. how extreme storm events may impact/change floodplains);
- Promote water conservation and reuse (irrigation, harvesting rainwater into barrels, grey water systems); and
- Natural asset management.

5.5 Agriculture

Agriculture is crucial for both mitigation and adaptation to climate change. Farmers are stewards of the environment, seeing climate change impacts first hand and being able to respond immediately in order to remain economically viable. Many farmers have undertaken best management practices (BMP) to mitigate and adapt to climate change. These practices include:

Agri-food network includes elements important to the viability of the agri-food sector such as regional infrastructure and transportation networks; on-farm buildings and infrastructure; agricultural services, farmers markets, distributors and primary processing agriculture-supportive communities (Greenbelt Plan, 2017).

- Crop rotation strategies (the practice of growing different types of crops in the same area at different times of year to maintain a healthy balance of nutrients. In practice, this would entail planting corn and then rotating to soybeans, among others);
- The use of irrigation systems (surface drip, or sub-surface drip systems to ensure plants, fruits, and vegetables receive enough water);[43]
- Conservation tillage or no-tillage (working the soil as little as possible or not at all, resulting in an increase to nutrients in the soil; preventing soil erosion; improving water conservation; and promoting beneficial insect populations);[44] and
- Transitioning to lower-carbon fuel sources (e.g. ethanol, which is made from mostly corn or biodiesel, made from soybean oil and blended with diesel fuel).[45]

In addition to BMP's used by farmers, protecting the agricultural system, which includes preserving and promoting the agricultural land base and the agri-food network can help to mitigate and adapt to the impacts of climate change. Mitigation and adaptation from climate change for agriculture includes:

- Promoting the consumption of and accessibility to local food through farmers markets, community gardens, etc., in order to reduce GHG emissions from transporting goods;
- Protecting prime agricultural land for agricultural use;
- Promoting and allowing agriculture-related and on-farm diversified uses to provide more options to make agricultural businesses more resilient; and
- Encouraging urban agriculture (production of food within an urban area through community gardening or container gardening on balconies and rooftops).[46]

[43] Schaer, L. (2017). *The Real Dirt on Farming.* Farm & Food Care Ontario.
[44] Ibid.
[45] Ibid.
[46] Ontario Ministry of Agriculture, Food, and Rural Affairs. (2019, May 14). *Urban Agriculture Business Information Bundle*. Retrieved from Ontario Ministry of Agriculture, Food, and Rural Affairs.

6.0 Niagara Region Climate Change Initiatives

Many municipalities approach climate change from both a corporate and community perspective. Corporate initiatives address municipal facilities and operations, whereas community initiatives generally address broader community-wide matters such as the built environment. Niagara Region has been addressing climate change from a community and corporate perspective for over a decade, with this paper contributing and building upon work previously completed. The new Niagara Official Plan will primarily address community-based approaches to addressing climate change, but will contain references to certain corporate initiatives, as per provincial requirements. The following are some initiatives Niagara Region has undertaken related to corporate and community climate change adaptation and mitigation (see Appendix 2):

Year	Initiative
2005	Model Urban Design Guidelines
2008	Niagara Region Official Plan Amendment 187-2008- Climate Change Policies
2009+	Partners for Climate Change Protection Program • Corporate and Community GHG emissions inventory, reduction targets, climate change action plans
2012	Sustainable Niagara Action Plan
2013+	Imagine Niagara, 'Niagara 2041' • How We Grow, How We Go, How We Flow
2014+	Asset Management Plan
2014+	Energy Conservation and Demand Management Plan
2015	Niagara Region Official Plan Amendment 5-2015- Source Protection Policies
2018	New Niagara Official Plan- Climate Change Work Program
2019	Waste Management Collection- Every-Other-Week Garbage Collection

Figure 6: *Climate change initiatives conducted by Niagara Region. Please note this is not a comprehensive list of all initiatives.*

Highlights of corporate climate change initiatives include:

- Corporate GHG Inventory (contributions from Niagara Region services and facilities) identifying water and wastewater as emitting the highest portion of total GHG emissions at 40%;
- Corporate Action Plan created which identifies a GHG emission reduction target of 0% growth in GHG emission levels from 2006 by 2016, which was met.

- Corporate Action Plan set a goal to reduce emissions by 10-15% below 2006 levels by 2020, which will be tracked and met through the Energy Conservation and Demand Management Plan 2019-2023;
- Corporate Asset Management Plan that identifies climate change as an external issue that will affect level of service and performance for assets and will impact infrastructure; and
- Strategic Asset Management Policy that commits the Region to consider actions that may be required to address municipal infrastructure vulnerabilities caused by climate change.

Highlights of the community-focused climate change initiatives include:

- The creation of design guidelines that consider environmental sustainability as a principle;
- Community GHG Inventory identifying transportation as emitting the highest portion of total GHG emissions at 40%;
- *Adapting to Climate Change: Challenges for Niagara* by Dr. Jennifer Penney identifying sectors impacted by climate change as being agriculture, ecosystems, water supply infrastructure, stormwater management infrastructure, electricity distribution infrastructure, buildings, transportation infrastructure, tourism and recreation, human health and well-being, and the economy;
- Community Action Plan created which identifies a GHG emission reduction target of 6% below 2006 levels by 2016 and 10-15% 2006 levels by 2030;
- Identification of climate change as a priority area within the Water and Wastewater Master Servicing Plan Update, committing the Region to be aware and consider the potential impacts of climate change on the planning and sizing of infrastructure. Includes a Wet Weather Management Strategy for wastewater servicing as Niagara has a mix of separated and combined sewer systems, which can be impacted by wet weather conditions and climate change;
- The consideration of climate change through Growth Management-How We Grow, Transportation Master Plan (How We Go), and Water and Wastewater Servicing Study (How We Flow); and
- Regional Official Plan Amendment 5 that added source water protection policies to protect existing and future sources of drinking water.
- Every-other-week garbage collection starting in October 2020, which will encourage greater diversion of waste from landfills. Benefits include a net reduction in GHG emissions through increased composing and recycling, conservation of resources, reduced energy consumption, and a reduction in the number of collection vehicles on the road.

These initiatives are important for recognizing the progress that has been made on climate related work at the regional level. All of the projects previously conducted can be built upon to progress climate change adaptation and mitigation in Niagara.

7.0 Land Use Policy Framework in Ontario

In Ontario, the provincial government sets the direction for land use planning for upper-tier, single-tier, and lower-tier municipal governments. Policy direction from the Province is to be implemented at the municipal level through official plans and zoning by-laws.

The *Planning Act, Provincial Policy Statement, A Place to Grow (Growth Plan), Greenbelt Plan,* and *Niagara Escarpment Plan* are all provincial legislation and plans that Niagara Region's Official Plan must be consistent with and conform to in order to be approved by the Province of Ontario.

7.1 The Planning Act

The Planning Act is legislation that sets out how planning will be conducted in Ontario. Under Part III of the *Planning Act,* municipalities are to make an Official Plan, with goals, objectives, and policies to guide future growth and direction for the community. *Bill 139, Building Better Communities and Conserving Watersheds* (2017) made changes to the *Planning Act* outlining the mitigation of greenhouse gas emissions and adaptation to a changing climate is a matter of provincial interest. Additionally, Official Plans must contain climate change mitigation and adaptation policies with the intent to reduce GHG emissions and increase the resiliency of the community.

7.2 Provincial Policy Statement

The Provincial Policy Statement (PPS), 2014is issued under section three of the *Planning Act* and outlines visions and goals for Ontario's land use policies into the future. The *PPS* is reviewed every ten years to reflect new objectives of the provincial government. The *PPS* identifies how landscapes will be settled, how the built environment will be created, and how land and resources will be managed over the long term. Climate change has been identified in the *PPS (2014)* in relation to creating strong, liveable and healthy communities, which promote human health and social well-being, are economically and environmentally sound, and are resilient to climate change. Climate change is to be addressed in relation to:

- Settlement areas- minimize the negative impacts of air quality and climate change and promote energy efficiency; and prepare for the impacts of a changing climate.

- Infrastructure and public service facilities- shall be provided in a manner that prepares for the impacts of a changing climate.
- Energy conservation and air quality-promote compact form; promote active transportation; focus employment and commercial land uses on sites served by transit; promote design and orientation that maximizes energy efficiency; and maximize vegetation within settlement areas.
- Natural hazards-prepare for the impacts of a changing climate that may increase risk of natural hazards.

The Province released a proposed update to the *PPS* in July 2019. This update includes defining 'impacts of a changing climate' and requirements to consider the climate when planning for water, sewage, and stormwater management, previously not included in the *PPS*, 2014. These proposed changes, if passed, will bring the *PPS* into greater alignment with the provincial plans on this matter.

Impacts of a changing climate means the potential for present and future consequences and opportunities from changes in weather patterns at local and regional levels including extreme weather events and increase climate variability (Proposed PPS, 2019)

7.3 Provincial Plans

Beginning in 2015, a coordinated review of the provincial *Growth Plan for the Greater Golden Horseshoe, Greenbelt Plan, Niagara Escarpment Plan,* and *Oak Ridges Moraine Conservation Plan* was conducted.[47] Concluding in 2017, one of the purposes to updating these plans was to ensure planning contributes to reducing GHG emissions and identifies ways to adapt to climate change.

In July 2019, The *Growth Plan for the Greater Golden Horseshoe (2017)* was updated to *A Place to Grow- Growth Plan for the Greater Golden Horseshoe*.

[47] Ministry of Municipal Affairs and Housing. (2015, February 27). *Co-ordinated Reviw of Ontario Land Use Plans*. Retrieved from Ontario Newsroom.

Figure 7: *Front covers of the Provincial Plans (left to right): A Place to Grow (2019), Greenbelt Plan (2017), and Niagara Escarpment Plan (2017)*

7.3.1 A Place to Grow- Growth Plan

A Place to Grow-Growth Plan for the Greater Golden Horseshoe (2019) outlines how the province will manage growth through economic development and increasing the housing supply while also preserving the natural environment to ensure agricultural land, the agri-food sector, and cultural and natural heritage systems are protected. Climate change is addressed throughout this document, for example: by ensuring communities and infrastructure adapt to become more resilient, encouraging GHG emissions reductions across all sectors of the economy, and protecting water resources and natural areas. Within *A Place to Grow*, the goal of climate change mitigation and adaptation measures is for communities to move towards being environmentally sustainable.

A Place to Grow states that municipalities will develop and implement official plan policies in support of water conservation, energy conservation, air quality improvement and protection, integrated waste management, and excess soil reuse strategies.

Municipalities are to develop policies in their official plans to reduce GHG emissions and address climate change adaptation goals. The following *A Place to Grow* objectives relate to climate change, including:

- Supporting complete communities and intensification and density targets;
- Reducing automobile use through planned transit and active transportation;
- Assessing infrastructure risks and vulnerabilities;
- Undertaking stormwater management planning;
- Recognizing the importance of watershed planning for the protection of water;
- Protecting the natural heritage system and water resource systems; and

- Promoting local food, food security, and soil health, and protecting the agricultural land base.

A Place to Grow also encourages municipalities to establish, implement, and monitor GHG emission reduction targets and to develop GHG inventories for municipal operations, transportation, buildings, and waste management.

7.3.2 Greenbelt Plan

The *Greenbelt Plan*, 2017 works together with the *PPS, A Place to Grow (Growth Plan),* and the *Niagara Escarpment Plan (NEP*) to identify where urbanization should not occur in order to permanently protect the agricultural land base and the ecological and hydrological features contained within the Greenbelt area. The protected countryside, parkland, open space, and trails help build resilience to and mitigate climate change as these spaces:

- Have carbon sequestration potential;
- Act as green infrastructure;
- Help to recharge aquifers; and
- Protect biodiversity and sensitive areas.

Green infrastructure means natural and human-made elements that provide ecological and hydrologic functions and processes. Green infrastructure can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs (PPS).

The Greenbelt Plan notes that climate change will be an important consideration for shoreline management along the Great Lakes and poses a challenge for maintaining existing infrastructure and planning for new infrastructure. Encouraging the use of green infrastructure and identifying infrastructure risks and vulnerabilities are to be integrated into planning and managing growth within settlement areas of the *Greenbelt Plan.*

7.3.3 Niagara Escarpment Plan

The Niagara Escarpment Plan, 2017 *(NEP)* protects the Niagara Escarpment area to strike a balance between development and protection. The Niagara Escarpment extends from the Niagara River to the Bruce Peninsula. The geological and ecological features along the Niagara Escarpment provide clean air, drinking water, and help to mitigate the effects of climate change. The protection of the Niagara Escarpment is a key component to climate change mitigation and adaptation as escarpment features including valleylands, wetlands, woodlands, wildlife habitat, geological features and natural features provide essential ecosystem services, including resilience to climate change. *The NEP*, protects these escarpment features and encourages development in recreation areas to maximize the opportunities for the use of green infrastructure and appropriate low impact development.

8.0 Provincial Climate Change Initiatives

Actions, strategies, and plans at the provincial level have changed directions with the election of a new provincial government in 2018. Currently, climate change direction at the provincial level is contained within *A-Made-in-Ontario Environmental Plan*. The Plan was posted for comment through the Province's Environmental Registry for 60 days ending January 28, 2019. In addition to the provincial government's climate change initiatives, the federal government has also made commitments, which have been summarized in appendix 3.

Figure 8: *Provincial document entitled A-Made-In-Ontario-Environmental Plan, 2018*

8.1 A Made-in-Ontario Environmental Plan

In November 2018, the Province released a document titled *A Made-in-Ontario Environmental Plan* identifying how the current government will protect the environment. The plan will continue to develop and improve over the next 12 years, with revisions every four years. The plan broadly identifies protecting air, lakes, and rivers; addressing climate change; reducing litter and waste; keeping land and soil clean; and conserving land and greenspace. There are currently no timelines for the actions proposed within the document.

Actions to adapt and build resilience to climate change include:

- A provincial level impact assessment to identify how climate change will impact communities, critical infrastructure, economies, and the natural environment;
- Impact and vulnerability assessments for the transportation, water, agriculture, and energy sectors;
- Review land use planning policies and laws to update policy direction;
- Modernize the Building Code;

- Review the Municipal Disaster Recovery Assistance program to encourage climate resilient improvements when repairing or replacing damaged infrastructure after natural disasters; and
- Continue to support programs and partnerships to make the agriculture and food sectors more resilient to climate impacts.

The Plan also sets a target for reducing GHG emissions by 30% below 2005 levels by 2030. This target is in line with the federal government's commitment under the *Paris Agreement.* Actions to achieve the GHG emissions reduction target include:

- Low-carbon vehicle uptake;
- Regulating large GHG emission emitters through industry performance standards;
- Increasing the use of clean fuels (ethanol, renewable natural gas);
- A gradual expansion of programs related to energy conservation by utilities; and
- Creating a four-year $400M Ontario Carbon Trust fund to leverage private investment in clean technologies.

9.0 Summary

It is clear that the climate is changing in Niagara, with projections indicating warmer, wetter, and more extreme weather. The most prominent impacts already felt have been flooding, severe storms, and extreme temperatures impacting infrastructure, agriculture, human health, and ecosystems.

There are many opportunities to mitigate and adapt to climate change through land use planning such as intensifying build-up areas, encouraging the use of green infrastructure and low impact development, expanding cycling infrastructure, encouraging energy efficiency standards, increasing the tree canopy, protecting water resources, and protecting prime agricultural land, among others.

Niagara Region has begun to address climate change through initiatives such as, the Energy Conservation and Demand Management Plan, Asset Management Plan, and Waste Management every-other-week garbage collection beginning October 2020. We will build on this work by integrating climate change policies in the new Niagara Official Plan. The policies must meet provincial requirements and have consideration for broader policy changes, such as those relating to green energy.

10.0 Next Steps

The Climate Change Discussion Paper completes Phase 2 of the Climate Change Work Program. Section 11.0 of this paper includes discussion questions that Niagara Region's Planning and Development Services are asking the public to complete. The feedback received will be used to inform policy options for the new Niagara Official Plan.

11.0 Discussion Questions

Niagara Region's Planning and Development Services is interested in gathering feedback on the Climate Change Discussion Paper through five questions. The responses will be collected and used to develop policy options.

Please complete the questions here: Climate Change Discussion Questions

Please send in your responses by **December 31, 2019.**

Appendix 1: Hazards and Potential Impacts due to Climate Change

Hazard	Potential Changes	Potential Impacts
Floods	• Increased number of urban flooding incidents. • Higher probability of damaging seiche events due to an increase in lake levels.	• Injuries and deaths • Damage to property and infrastructure • Increased culvert, drain and road repairs • Mold concerns and need for remediation services • Need for sheltering evacuees • Increasing need for resources to manage response and recovery • Increased shoreline erosion and damage
Severe Storms	• More frequent and violent thunderstorms, extreme precipitation events, and windstorms. • Increased rainfall and storm activity may result in changes in lake levels and increase the risk of storm surge events.	• Injuries and deaths from violent storms • Damage to property and infrastructure • Increased culvert, drain and road repairs • Need for sheltering evacuees • Increasing need for resources to manage response and recovery • Environmental damage • Psychological health effects
Drought	• Some areas may experience an increased risk of drought. • Agricultural production may be negatively impacted. • Increased risk of wildland fires, brush fires etc.	• Economic losses • Environmental damage • Increased demand for resources to manage response • Decrease in lake water levels
Extreme temperatures	• Increase in the number of high heat days • Increase in frequency and duration of heatwaves	• Injuries and death due to heat related illnesses • Strain and disruption to critical infrastructure • Need for cooling centres
Freezing rain	• Warmer temperatures during winters may result in more freezing rain events • Increased severity of freezing rain events, including ice storms	• Injuries and death due to freezing rain accidents • Disruption of critical infrastructure • Damage to property and infrastructure • Need for shelter services and warming centres • Economic losses • Environmental damage
Vectorborne Diseases	• Changes in the geographical distribution of disease-carrying insects, rodents, and other species • Longer seasonal periods of disease transmission • Possible emergence of new diseases	• Injuries and deaths • Strain on the health care system • Economic losses

Figure 9: Some hazards and their potential impacts due to climate change-

Niagara Region Emergency Management. (2019). Niagara Region Hazard Identification and Risk Assessment; Emergency Management Ontario. (2012);
The Ontario Provincial Hazard Identification and Risk Assessment. Ministry of Community Safety and Correctional Services. Government of Ontario;
Ministry of Health and Long Term Care. (2016). Ontario Climate Change and Health Toolkit. Government of Ontario.

Appendix 2: Niagara Region Climate Change Initiatives

Niagara Region Model Urban Design Guidelines

The Niagara Region Model Urban Design Guidelines were completed in 2005 by Brook McIlroy Planning and Urban Design. These guidelines were a part of Regional Council's adoption of Smart Growth as a priority for the Region. The Model Urban Design Guidelines has guidelines for both the public and private realm and identifies environmental sustainability, stormwater management, and natural heritage, which are all important components to mitigate and adapt to climate change.

Design principles under environmental sustainability include:

- Conserving land through compact design that reduces pressure on natural features, open spaces, rural and agricultural lands;
- Conserve energy through street design, transit facilities, and recycling;
- Reducing water runoff by preserving natural vegetated environments, landscaping, and urban design strategies;
- Promoting alternative modes of travel such as walking, bicycling, and transit;
- Build 'Green' buildings as they are resource efficient, use less energy, and utilize construction materials efficiently;
- Recycle and reuse to find opportunities for adaptive reuse;
- Sustainable Site Plans that addresses the principles of water quality, consumption, and runoff. Design measures could include preservation of natural features, reduction of hard surfaces, and extensive landscaping.

Niagara Region Official Plan Amendment- Climate Change Policies

Regional Official Plan Amendment 187 was adopted by Regional Council on December 15, 2005 and approved by the Ontario Municipal Board on April 16, 2008. This amendment was undertaken by Niagara Region's Planning Department to be in consistent with the *PPS* 2005, which required municipalities to minimize the negative impacts to air quality and climate change, and promote energy efficiency (PPS 2005- 1.1.3.2). The following section was added to the Regional Official Plan in 2008.

Section 7.A.3 Air Quality and Climate Change

Air pollution is a significant health concern and affects agriculture, natural vegetation and wildlife. Climate change poses significant economic, environmental and health risks. Many of the activities responsible for greenhouse gas emissions also cause other forms of air pollution. Policies elsewhere in this Plan make a significant contribution to reducing emissions by:

- Promoting energy efficiency and alternatives to fossil fuel based energy in Regional facilities and operations;
- Emphasizing compact, mixed use development to reduce the need for travel;
- Supporting transit, walking and cycling;
- Encouraging waste reduction and diversion, use of landfill gas and water conservation; and
- Promoting green space, tree planting and natural heritage conservation.

Objectives

Objective 7.A.3.1	To reduce air pollutant and greenhouse gas emissions.
Objective 7.A.3.2	To promote measures that remove and store atmospheric carbon that otherwise would contribute to climate change.
Objective 7.A.3.3	To adapt to the effects of climate change.

Policies

Policy 7.A.3.1	The Region shall develop and implement a plan to reduce greenhouse gas emissions from Regional operations by at least 20% below 1994 levels and emissions from the community as a whole by at least 6% below 1994 levels by 2014.
Policy 7.A.3.2	The Region shall encourage and support energy conservation, district heating and combined heat and power, and alternative and renewable energy sources developed in accordance with Provincial and Federal legislation, policies and regulations.
Policy 7.A.3.3	The Region shall encourage the Federal and Provincial governments and local municipalities to pursue reductions in air pollutant and greenhouse gas emissions and to develop and implement strategies to adapt to the impacts of climate change.
Policy 7.A.3.4	Recognizing that some climate change may be unavoidable, the Region shall develop and implement plans to adapt to potential impacts.

Partners for Climate Change Protection Program

In January 2009, Regional Council endorsed Niagara Region's participation in the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) Program (ICP 2-2009). The program includes five milestones for municipalities to work through to take action on climate change, both corporately and in the community. The five milestones are:

1. Create a GHG emissions inventory and forecast
2. Set an emissions reduction target
3. Develop a local action plan
4. Implement the local action plan or a set of activities
5. Monitor progress and report results

2006 Corporate and Community GHG Emissions Inventory

Regional Council endorsed the 2006 Corporate GHG Emissions Inventory in March 2010 (ICP 15-2010) and the Community GHG Emissions Inventory in September 2010 (ICP 62-2010), completing milestone one within the PCP program. 2006 represents the baseline year for which GHG emissions were tracked and reported on from different sectors. The following charts comprise of the sectors used within the inventories and the percentage of GHG emissions the sectors produce. For the Community Inventory, the transportation sector represents the highest percentage of GHG emissions at 40 percent. The largest emissions come from gasoline from automobiles. For the Corporate Inventory, the water and wastewater sector has the highest percentage of GHG emissions at 40 percent. The emissions come from the energy used to treat water and wastewater across Niagara.

Community GHG Emissions Inventory	
Sector	% of GHG emissions
Residential	23%
Commercial	10%
Industrial	25%
Transportation	40%
Community Waste	2%

Corporate GHG Emissions Inventory	
Sector	% of GHG emissions
Buildings	30%
Vehicle Fleet	27%
Traffic Signals and Beacons	1%
Water and Wastewater	40%
Corporate Waste	2%

Figure 10: *Community and Corporate GHG emission results by sector from the 2006 Community GHG Emissions Inventory, 2010 & the 2006 Corporate GHG Emissions Inventory, 2010*

Corporate and Community Climate Change Action Plans

In 2012, *Adapting to Climate Change: Challenges for Niagara* by Dr. Jennifer Penney was published through a partnership with Brock University and Niagara Region. The report contains background information on how the climate is changing within Niagara, what the main impacts of climate change are for Niagara, initiatives already underway within the region, and the gaps that need to be addressed to adapt to the changes. Gaps identified within this report include:

- The need to allocate dedicated staff and budget to climate change adaptation, with a clear organizational structure (mandate, financial support, and collaboration);
- Support from strong political or executive champions, with commitment to reduce the impacts of climate change by local governments and business organizations;

- Identification of priority sectors and projects for adaptation (targeting areas that will be impacted the most);
- Conducting vulnerability and risk assessments for various sectors (e.g. vulnerability assessments of surface water and groundwater as conducted by NPCA);
- Keeping an inventory of activities being conducted to identify gaps;
- Implementing adaptation through activities as oppose to creating new projects or programs (simply consider 'asking the climate question'); and
- Continuing to monitor impacts and adaptation over time.

Adapting to Climate Change: Challenges for Niagara along with extensive community consultation within Niagara were used to develop both the Corporate Climate Change Action Plan and the Community Climate Change Action Plan, which were approved by Regional Council on January 30, 2013 (ICP 7-2013).

Both the Corporate and Community Climate Change Action Plans fulfill the PCP program's milestone two and three, which are to set emission reduction targets and develop local action plans. The targets within the plans are:

Community Targets	Corporate Targets
• 6% below 2006 levels by 2016 • 10-15% below 2006 levels by 2030	• 0% growth in GHG emission levels in 2016 from the 2006 baseline • 10-15% below 2006 levels by 2020

Figure 11: *Community and corporate targets from the Community Climate Change Action Plan, 2013 & Corporate Climate Change Action Plan, 2013.*

For the Community Climate Change Action Plan there were both priority new actions and ongoing and potential new actions. The priority new actions were a community-wide green roof strategy and engaging all of Niagara in climate change action. Ongoing and potential new actions were categorized by different sections, which includes local food, built form and transportation, community engagement and outreach, waste, industrial/commercial/institutional, and adaptation initiatives. Some of these actions include:

- The creation of a Local Food Action Plan
- An Active Transportation Strategy
- Complete Streets policy guidelines for Niagara
- Niagara Community Design Awards
- Review of Niagara's Residential Diversion Target
- Smart Growth Criteria Updates

In February 2014, the year one update for the Climate Change Action Plans was received for information by the Integrated Community Planning Committee (ICP 22-2014). In regards to

emission reduction targets, corporately Niagara Region had surpassed the initial target and was on track to reach the long-term emission reduction goal of 10-15% by 2020. The year one update outlines that for the community action plan, no data would be collected on the community's position until 2017 as it requires access to a number of external data sources.

To date, milestones one, two, and three have been completed, with the monitoring and reporting incomplete at this time due to restructuring at Niagara Region that did not have dedicated staff resources available.

Sustainable Niagara Action Plan

On July 18, 2012 the Sustainable Niagara Action Plan was approved by Regional Council (ICP 74-2012). The Sustainable Niagara Action Plan is an overarching framework to guide and facilitate integration of ongoing work at the Region and in the community for the next 50 years. The intent as outlined within the year one update (ICP 68-2013) is for the implementation of Sustainable Niagara to be regularly reported upon to ensure it remains a 'living' document. This Plan had three phases associated with it, which includes:

- Visioning and goal making through consultation with various stakeholders (2009-2010)
- Measurement framework consisting of 12 indicators to track progress and 8 goals (2011)
- Action Plan (2012-ongoing)

The action plan outlines various sectors to maintain sustainability, potential actions, and partners for implementing the actions. The actions range from individual level, community level, and municipal level commitments. One of the goals within this plan touches on ecosystems and the natural area, with the vision of having healthy, well-maintained and resilient natural systems that boast a wide range of species, clean air and water, and a green landscape. The potential actions include:

- Participate in broader GHG and climate change programs provincially, nationally and internationally;
- Consider policy and bylaw development or changes to support green roofs
- Develop a local action plan to reduce corporate and community GHG emissions
- Prioritize GHG emission management
- Create a plan to increase recycling rates, decrease water usage, and reduce sewer bypass rates
- Develop a strategy to achieve the recommended 30 percent natural/forest lands coverage in the region
- Incorporate more "green" stormwater infrastructure
- Mandate a specific percentage of vegetation in new developments by native species

Asset Management Plan

Under the Infrastructure for Jobs and Prosperity Act, 2015, principles have been set out by the Provincial government to regulate asset management planning for municipalities. On December 27, 2017, Ontario Regulation 588/17 was released which regulates asset management planning for municipal infrastructure. The regulation also requires greater consideration of how municipal infrastructure may be vulnerable to climate change.

Niagara Region completed a Strategic Asset Management Policy that was approved by Regional Council in May 2019 (CDS 20-2019) that commits the Region to consider actions that may be required to address municipal infrastructure vulnerabilities caused by climate change.

Niagara Region's Asset Management Plan (AMP) was updated in 2016 and approved by Regional Council in March 2017 (CSD 21-2017). The Asset Management addresses management of the Region's approximately $7.4B worth of assets, including water/wastewater, transportation, waste management, police services and Regional facilities including housing managed by Niagara Regional Housing (NRH), long term care homes, and the Region's administrative offices. In the AMP, climate change is recognized as an external issue that will affect level of service, and performance of assets.

To help meet the requirements of O.Reg 588, the Region has undertaken a phased, multi-year Asset Management Program, which includes a new corporate Asset Management Office that will help the Region deliver more consistent asset management practices including identification of and response to risks such as climate change.

Asset management plans will be updated again in 2021, corresponding with deadlines under the regulation and will more specifically address how the Region will manage the risks from climate change.

Energy Conservation & Demand Management Plan

The Energy Conservation and Demand Management (ECDM) Plan is a requirement under the *Electricity Act* (Ontario Regulation 507/18) which requires public agencies to develop and implement an ECDM Plan, and update it every five years. Niagara Region's first ECDM Plan was completed by VIP Energy Services Inc. and Niagara Region's Construction, Energy & Facilities Management in 2014 for 2014-2018 (CDS 85-2014). The ECDM has been updated as of July 2019 for 2019-2023 by WalterFedy and Niagara Region's Construction, Energy & Facilities Management (CDS 39-2019).

This document is a corporate-based approach to climate change mitigation-by reducing the amount of energy consumed at Regional facilities. The document outlines the baseline energy consumption from 2014-2018, a GHG emission reduction target for each building category (e.g. Administrative Offices, Storage Facilities, Police Stations, etc.) and sets energy

conservation measures for each building category (e.g. install interior and exterior LED lights, replace older equipment with energy efficient models, etc.).

The 2014 ECDM Plan met the goal to reduce overall energy consumption by 5% of 2011 levels by 2018 and the 2013 Corporate Climate Change Action Plan (CCCAP) goal to reduce overall GHG emissions to 2006 levels by 2016.

The goal for the 2019 ECDM Plan is to reduce electricity consumption by 7.9% (5,324,605 kWh) and Scope 1 GHG emissions by 4.4% (421 mtCO2e) by 2023[48]. The emission target from the 2013 CCCAP to reduce GHG emissions by 10-15% of 2006 levels by 2020 will be met as well.

Imagine Niagara

In 2013, an integrated process under the umbrella 'Niagara 2041' was initiated to undertake a Municipal Comprehensive Review (How We Grow), Transportation Master Plan (How We Go), and Water and Wastewater Master Servicing Study (How We Flow) to determine how Niagara would grow and to ensure this growth could be supported by the necessary infrastructure (water and wastewater and transportation).

Municipal Comprehensive Review (How We Grow)

The Municipal Comprehensive Review (MCR)- *'How We* Grow' was initiated in 2014. The MCR for growth management has transitioned into the creation of the new Niagara Official Plan. Phases 1 & 2, which includes a background review, technical analysis, issues and opportunities have been completed, as well as options for growth. The preferred growth option is ongoing with directional change in 2017 with the coordinated review of provincial plans and the 2019 changes to the *Provincial Policy Statement* and *A Place to Grow.*

Growth management is an important theme to help adapt to climate change as population allocation and employment growth can increase intensification and density and develop compact, mixed-use, and transit-supportive communities.

Transportation Master Plan (How We Go)

The Transportation Master Plan (TMP)-'How We Go' was completed in 2017. The purpose of the TMP is to present a long-term strategy to guide the planning, development, renewal, and

[48] **Scope 1** emissions are defined as direct emissions from sources owned or controlled by the organization (e.g. emissions from burning natural gas using on-site equipment)

maintenance of a multi-modal transportation system in a manner that is consistent with projected needs, and aligned with the region's growth and vision for a sustainable Niagara.

Some key recommendations within the TMP include:

- Planning and designing all Regional Road projects identified in the Road Capital Plan, including repaving, using a Complete Streets approach (designing roads to be universally accessible, safe, and comfortable for all users)
- Investing in active transportation facilities and supporting infrastructure to promote active lifestyles and healthy communities
- Strengthening core transit services and providing transit connections to all local municipalities
- Accommodating future growth in travel through strategic network capacity increases and addressing operational improvements at key constraints
- Improving sustainability, efficiency and safety for the transportation system by funding and staffing programs to adopt and lead Transit Demand Management (TDM) and Transportation System Management (TSM).

Water and Wastewater Servicing Study (How We Flow)

The 2016 Water and Wastewater Master Serving Plan Update (How We Flow) was initiated in 2013, providing a review, evaluation and development of water and wastewater servicing strategies for all servicing within the urban areas of the Region (Grimsby, West Lincoln, Lincoln, St. Catharines, Thorold, Welland, Pelham, Port Colborne, Niagara-on-the-Lake, Niagara Falls, and Fort Erie). It also uses updated population and employment growth forecasts projecting into 2041.

The vision statement for the Master Servicing Plan Update is to establish a cost effective infrastructure program that meets the service needs of existing users, meets regulatory and legislative requirements, supports growth, and addresses the priority areas of climate change, energy management, infrastructure optimization, system security, and resiliency.

As climate change is considered a priority area within the Master Servicing Plan Update, the Region commits to be aware and consider the potential impacts of climate change on the planning and sizing of infrastructure. The update includes a Wet Weather Management Strategy for wastewater servicing as Niagara has a mix of separated and combined sewer systems, which can be impacted by wet weather conditions and climate change. The wet weather program identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems.

Regional Official Plan Amendment 5- Source Protection Policies

Regional Official Plan Amendment (ROPA) 5 was adopted by Regional Council on April 22, 2015 and approved by the Province on May 22, 2015. The purpose of the amendment was to

implement Source Water Protection Policies into the Regional Official Plan, as required under the *Clean Water Act,* which seeks to protect existing and future sources of drinking water by preventing contaminants from entering sources of municipal drinking water. The amendment applies to the entire Niagara planning area with policies related to Intake Protection Zones (IPZs), within City of Thorold (DeCew Falls Water Treatment Plant), City of Port Colborne (PC Water Treatment Plant), and City of Niagara Falls (NF Water Treatment Plant). The following objectives were added to the Regional Official Plan:

7.E. Source Water Protection

Objective 7.E.1.A To protect existing and future municipal drinking water sources in the Niagara Region.

Objective 7.E.2.B To ensure that activities identified as drinking water threats either never become a significant threat or, if the activity is already taking place, the activity ceases to be a significant threat.

Objective 7.E.3.C To work collaboratively in promoting the stewardship of drinking water supplies in consultation with the Province, the Niagara Peninsula Conservation Authority, local municipal partners, other organizations and key stakeholders.

Objective 7.E.4.D To implement education and outreach programs which describe and promote best management practices and good stewardship of drinking water resources as required under the Niagara Peninsula Source Protection Plan.

Appendix 3: Federal Government Climate Change Initiatives

As climate change is a global issue, the Government of Canada is involved in a number of initiatives to mitigate and adapt to climate change. Mitigation at the federal level includes GHG emission reduction targets and implementing a carbon pollution pricing system across Canada. Adaptation at the federal level includes a national assessment of how the climate is changing in Canada and a strategy with actions for sustainable development. This section provides an overview of the initiatives the Government of Canada has been undertaking from 2016 to present.

Paris Agreement

The *Paris Agreement* is a global effort to mitigate and adapt to climate change. The goal of this agreement is to keep global temperature rise below 2°C above pre-industrial levels and to limit the temperature increase even further to 1.5°C. The agreement seeks to strengthen the ability of countries to deal with the impacts of climate change by inviting parties to prepare and communicate adaptation plans and priorities. The agreement allows all parties to determine their own contributions and regularly report on emission reductions every five years starting in 2023. The agreement entered into force November 4, 2016 with ratification of 55 countries that account for 55% of global emissions. Canada ratified the agreement October 5, 2016 with the following commitments:

Mitigation- Parties set targets for 2025 or 2030. Updates are to be made every five years.	Canada committed to reduce GHG emissions by 30% from 2005 levels by 2030
Adaptation-Parties are invited to prepare and communicate adaptation plans and priorities	Under article 4(19) Canada submitted its *Mid-Century Long-Term Low-Greenhouse Gas Development Strategy* on November 19, 2016. Key messages from the strategy include: • By mid-century reduce GHG emissions by 80% from 2005 levels to meet the goals of the Paris Agreement • Create a global clean growth economy by growing Canada's clean technology sector to achieve improved health and air quality for Canadians, more efficient technology, and mitigate pollutants • Transition to a low-carbon economy through innovation and investment • Ensure mid-century goals translate to long-term planning of infrastructure and energy investments • Each region will need to reduce emissions according to local conditions

Pan-Canadian Framework on Clean Growth and Climate Change

Created in 2016, this framework is the plan to simultaneously grow the economy while reducing GHG emissions and adapting to climate change. This framework builds on commitments made under the *Paris Agreement*, developing an actionable plan. The main initiative within this framework is carbon pollution pricing.

The carbon pollution pricing system has two components: a fuel charge and a regulatory trading system for large industry (Output-Based Pricing System-OBPS). The system is flexible to account for provinces and territories that have their own carbon pollution pricing systems. In Ontario, the OBPS was effective starting January 2019. It applies to industries emitting 50,000 tonnes of carbon emissions or more, per year. The fuel charge was effective starting April 2019. It is a charge applied to fossil fuels, paid by fuel

The proceeds of the carbon pollution pricing fuel charge is paid to individuals and families through Climate Action Incentive payments. For a family of four in Ontario this results in a payment of $307 through your tax return (Government of Canada, 2019).

producers and distributors. Both of these charges apply in Ontario, as there is no carbon pollution pricing system at the provincial level.

Canada's Changing Climate Report

In April 2019, Environment and Climate Change Canada in collaboration with Fisheries and Oceans Canada, Natural Resources Canada, and university experts released *Canada's Changing Climate Report* outlining how Canada's climate is changing. This is the first national assessment on climate change to be released, with subsequent reports outlining health assessments, regional perspectives, national issues, and Indigenous resilience for climate change to be released by 2021.

The report determines that it is extremely likely that human influences have been the dominant cause of global warming since mid-20th century, primarily due to GHG emissions. The report states global temperature change is effectively irreversible on multi-century timescales, as carbon dioxide emissions have a century long lifetime in the atmosphere and carbon dioxide is the main determinant of global temperature change (p.95). Human emissions of carbon dioxide will determine the rate at which global temperature change occurs. Currently Canada is warming at twice the global rate due to local conditions. Canada's loss of snow and sea ice is reducing reflectivity of the surface, which increases the absorption of solar radiation, causing larger surface warming than southern regions.

The report outlines changes in temperature and precipitation; snow, ice, and permafrost; freshwater availability, and oceans surrounding Canada. Key aspects of this report affecting southern Ontario include:

- Annual mean temperature for Ontario 2031-2050 is projected to increase by 1.5 degrees Celsius
- Extreme temperature changes will continue to occur into the future with temperatures becoming hotter and fewer extreme cold days
- Annual and winter precipitation will increase everywhere in Canada with summer precipitation decreasing in southern Canada, under a high emissions scenario
- Snow cover has decreased between 5-10 percent per decade since 1981 (late snow onset and early spring melt) and is very likely to decrease under all emission scenarios
- Seasonal lake ice cover has declined over the past five decades in Canada and spring lake ice breakup will be 10-25 days earlier by mid-century
- Increases of extreme precipitation will increase urban flooding
- Freshwater availability will be impacted by water related extremes such as droughts and floods.

The Federal Sustainable Development Strategy (FSDS)

In 2019, the Canadian government released the fourth Federal Sustainable Development Strategy (FSDS) 2019-2022. This is a three-year strategy outlining goals, targets, and actions for sustainable development. The goal of this strategy is to promote clean growth, ensure healthy ecosystems, and build safe, secure and sustainable communities.[49] A few of the goals within the strategy include:

- Transition governments to low-carbon, climate-resilient, and green operations
- Grow the clean technology industry in Canada
- Ensure infrastructure is modern, sustainable, resilient
- Safe and healthy communities are accessible to all to support health and well-being

Municipalities are identified as key partners in the fight against climate change, as they can influence about 50 percent of Canada's GHG emissions. Within Budget 2019, there was a pledge to support municipalities by investing $950M to increase energy efficiency in residential, commercial, and multi-unit buildings. The funding is to be delivered through the Green Municipal Fund by the Federation of Canadian Municipalities.

[49] Environment and Climate Change Canada. (2019). *A Federal Sustainable Development Strategy for Canada 2019-2022.* Gatineau: Environment and Climate Change Canada.

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