TOWN OF HALTON HILLS

Working Together Working for You!

Preparing for change in our climate

A report by the town environmental advisory committee

October 2013

Table of contents

Executive summary

Dear Mayor Bonnette

In March 2013, you asked the Town Environmental Advisory Committee to explore adaptation options for Halton Hills to prepare for the change expected in our climate. Committee members consulted with advisors from the community, climate adaptation experts and staff leaders from the Town, Region and Conservation Authorities.

We learned that our climate has already begun to change. There is unequivocal scientific evidence that change will continue and likely accelerate over several decades irrespective of the outcome of global efforts to slow the rate of the change. In particular we found that there will be a change in a wide variety of climate measures, including warmer, wetter weather in the winter and spring; hotter, drier weather in the summer and fall; and more extreme weather events. Most importantly, we discovered that there are proven adaptation actions that we can take to reduce the risk that change in the climate will disrupt and harm our community.

The summer of 2013 provides a warning about the weather we can expect to increasingly experience in Halton Hills as a result of climate change. For example, extreme rainfall in July resulted in more than one billion dollars in damage to homes, businesses and municipal infrastructure in Ontario, the most costly storm ever experienced in our province. Much of this damage was a few kilometres away from our community. It was only chance that we did not experience large losses in Halton Hills from this storm, and it is inevitable that similar storms will strike our community in the future. We also experienced an early heat wave; a number of tornado, thunderstorm and hail warnings were issued this summer; and, we continue to experience weather surprises, like the destruction of the local apple crop last year.

There will be some benefits from climate change, like reduced heating costs during warmer winters and a longer growing season for many crops, but there is extensive scientific evidence that climate change will bring more weather risks into our community. More weather risks, however, does not mean that we must experience more weather loss and damage. We have a choice. We can adapt our practices to prevent and resist weather risks from causing loss and damage. This paper describes how the application of existing and emerging knowledge about adaptation can help Halton Hills prepare for the expected change in the climate and build a more climate resilient community.

Other communities have begun taking action to adapt to climate change. Halton Hills should also be a leader in building a community resilient to the adverse impacts from the expected change in our climate. The options described in this paper would build on our Town's Community Sustainability Strategy, and complement work underway on the Mayor's Community Energy Plan, to improve energy conservation and support low impact development.

The Town Environmental Advisory Committee recommends that Town Council direct Town staff to develop an adaptation plan to prepare for change in our climate.

Bryan Boyce

Chair, Halton Hills Town Environmental Advisory Committee

Introduction

We have experienced flooding, extreme summer heat, tornadoes, winter blizzards and other hazardous weather events in Halton Hills. Warming of our climate is expected to bring more and larger perils in the future. However, an increase in adverse weather events does not need to result in more losses in our community. We can and should build a community that is resilient to the expected change in our weather, a community that is prepared for change in our climate.

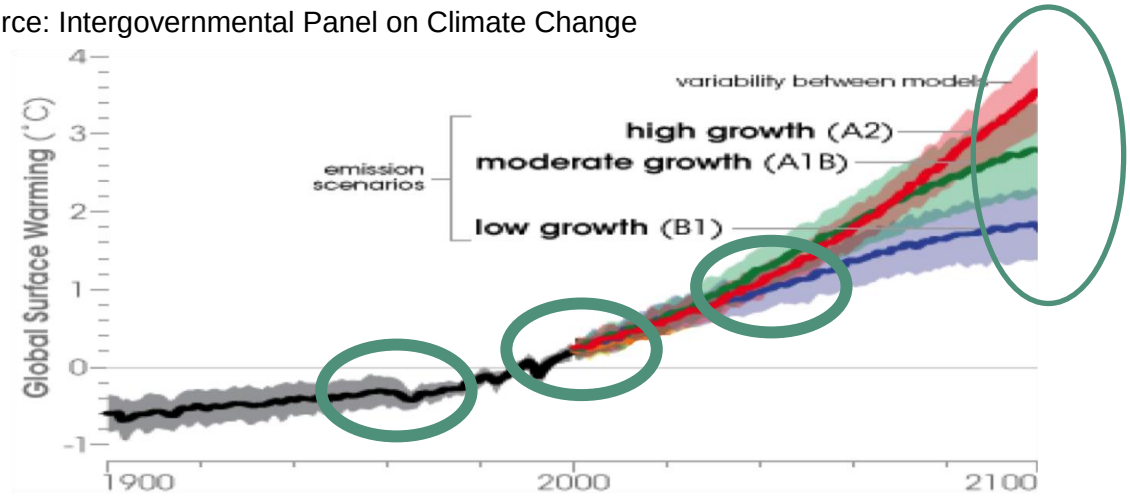
Halton Hills is participating in the international effort to prevent change in the climate. For example, recycling reduces waste, more energy efficient buildings reduce greenhouse gas emissions, and planting trees absorbs carbon emissions. The *Mayor's Community Energy Plan* will further detail actions to reduce future emissions. However, there is unequivocal scientific evidence that change in our climate is inevitable through the 2050s and likely much longer into the future despite local and global efforts to reduce the growth in greenhouse gas emissions. Beyond reducing our emissions it is important that we also adapt our behaviour to prepare for climate change.

Communities across Canada and around the world have begun investing in climate resilience. Specific adaptive actions have been tested and proven effective in reducing the risk that weather hazards result in loss and damage. Some of these actions have been tested in our community and are working, like our flood risk reduction and emergency management programs, but change in the climate will require us to intensify and expand our efforts if we are to maintain or improve our level of safety.

International experience demonstrates that the most effective and sustainable community efforts to prepare for change in our climate should be based on a longer-term strategy and action plan. Halton Hills needs to identify the specific changes in the climate projected for our community, perhaps with a focus on the period through until 2060. We need to identify the two or three most significant expected changes in our climate that likely pose the greatest threat to our community. We need to understand the options for confronting these hazards and reducing the risk that change will bring increased risk of loss and damage. And we need to establish a multi-year implementation strategy.

This paper sets out some of the findings of the Town Environmental Advisory Committee to guide Halton Hills toward establishing a climate change adaption plan to prepare for change in our climate. The experience in other communities demonstrates that it is possible for Halton Hills to develop an effective adaptation plan and implementation strategy in 18 to 24 months.

Source: Intergovernmental Panel on Climate Change



Integration with other Town initiatives

The Town Environmental Committee approached the request by Mayor Bonnette to develop a plan to prepare for climate change with a view to integrate this initiative with actions already being undertaken by our Town. This includes the *Mayor's Community Energy Plan* – still under development, the *Mayor's Green Plan* and the *Integrated Community Sustainability Strategy*. These are examples that guide the Town in its management of greenhouse gases, air quality, green economy initiatives, and energy use.

The Town of Halton Hills *Strategic Plan 2031* includes actions to foster a healthy community; reserve, protect and enhance our environment; foster a prosperous economy; preserve, protect and promote our distinctive history; preserve, protect and enhance our countryside; protect and enhance our agriculture; achieve sustainable growth; provide sustainable infrastructure and services; provide responsive and effective municipal government. Most of these strategies should consider the effects of climate change.

Multiple resources are available for delivering information about preparing for climate change to the Town Council and staff. The Town staff sustainability team contributes to monitoring and delivering sustainable management throughout the Town's operations and administration. A *Sustainability Implications Worksheet* has been developed to guide staff in assessments of how a proposal may contribute to the sustainability objectives of the Town of Halton Hills. There are also regular opportunities for staff to access information and improve understanding of sustainability through lunch and learn sessions.

In addition, there are online resources available to the staff and to Council to assist them in understanding the implications of climate change and to suggest additional resources to identify general actions that may be taken by municipalities with respect to climate change. One such online resource is *Municipal Climate Change Action Plan Guidebook*. The Town of Halton Hills is also a member of ICLEI Canada (Local Governments for Sustainability) and a member of the GTA-Clean Air Council – both groups are a potential source of information.

After completing research related to the significant challenges associated with climate change, the Committee feels that it is important to begin to consolidate under one plan suggested actions for adapting to climate change, perhaps placing a greater focus on proactive activities to prepare for change in our climate. We therefore propose the development of an adaptation plan for Halton Hills. We believe that there should be an in-house champion for this purpose, and recommend the formation of an advisory committee to assist the staff and Town Council in their roles.

Throughout our work on this project, the intention of the Committee has been to reinforce existing and ongoing Town initiatives, integrate our findings with ongoing processes as much as possible, all the while developing recommendations for new approaches necessary to adequately prepare for change in our climate. We hope that this paper will identify more clearly the needs that the Town Council should consider to prepare for climate change and thus create a re-examination of the priority of dealing with those matters to ensure we have an adopted strategy in place to manage the impact of ongoing climate change.

The United Nation's Intergovernmental Panel on Climate Change reports that increases in the temperature and changes in precipitation patterns have been observed around the globe over several decades. For example, Environment Canada reports that the average temperature in Canada over the past 50 years increased by 1.3°C, more than double the warming experienced in most other regions around the globe. The Institute for Catastrophic Loss Reduction report *Telling the Weather Story*, commissioned in 2012 by the Insurance Bureau of Canada, reports three or four decades of rising loss and damage across Canada due to extreme weather events. *Climate Change in Halton: A Health Perspective*, a 2012 report by the Halton Region Health Department, tracks historic change in our regional climate and projects expected change through the 2050s and beyond. These and other sources of information consistently advise that Halton Hills is expected to experience significant change in our climate.

Over the past 50 years Environment Canada has reported in our region:

- more extreme warm days
- more extreme warm nights
- fewer extreme cold days
- fewer extreme cold nights
- more days with precipitation
- decrease in annual total snowfall

Change in our climate has been complex and is forecast to remain so. In particular it is difficult to use global or national trends to predict future climate risks at the local level. Moreover, there is considerable variation in the specific climate information needed by decision makers. For example, those responsible for flood management may seek information about anticipated winter accumulation of snow and spring rainfall, while farmers may seek information about the risk of spring frost and the availability of water during the growing season.

The Halton Hills Town Environmental Advisory Committee identified three changes in our climate that appear most likely to impact our community through the 2050s -- It is virtually certain that our climate will be wetter during the winter and spring, and virtually certain that it will be warmer throughout the year, and likely that we will experience more large storms.

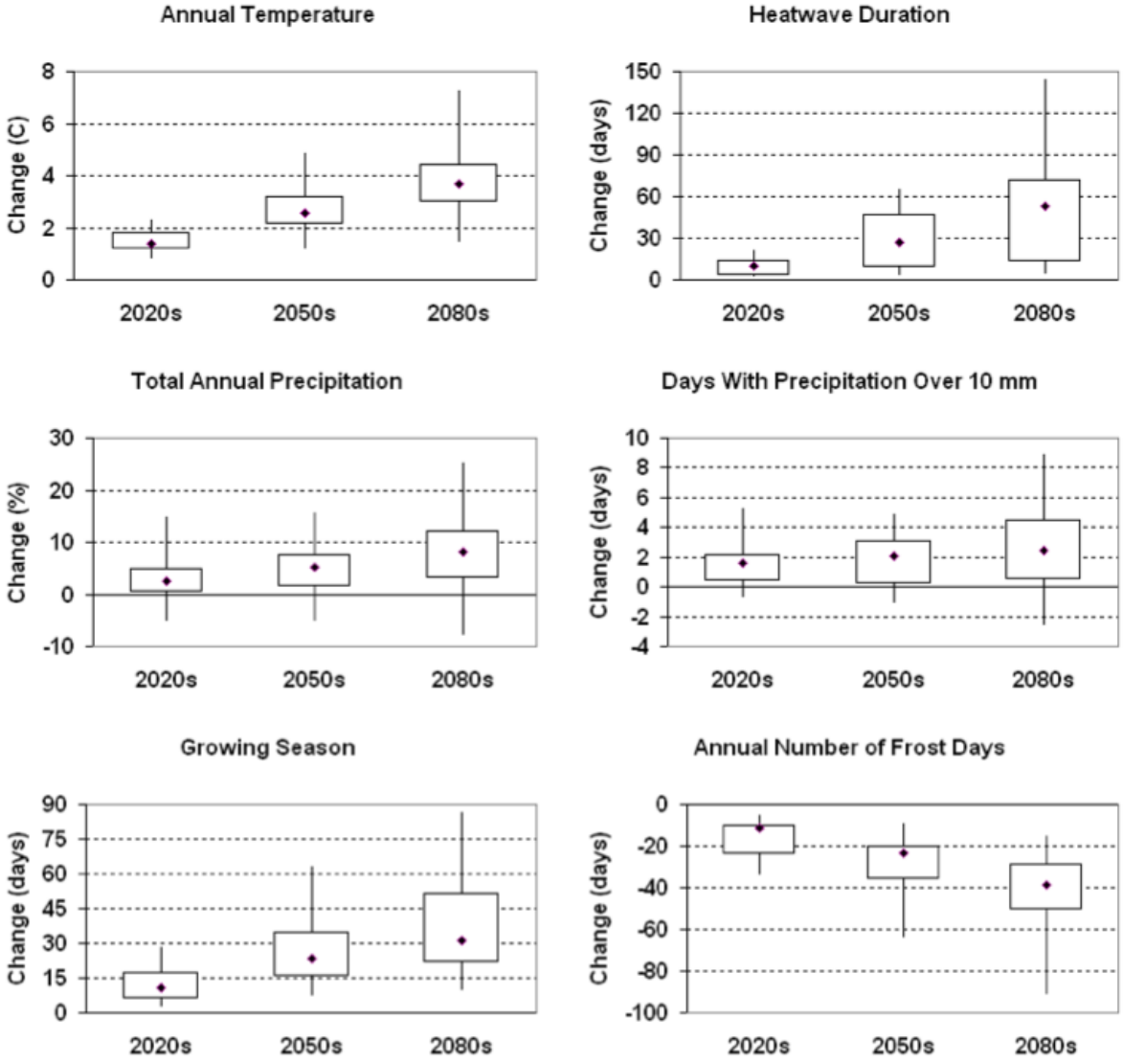
1. WETTER – MORE SEVERE RAINFALL

Research published in 2012 by Halton Region Health Department projects that the annual rainfall in our region will be 0.2% to 9.2% greater in the 2050s relative to our baseline climate measured during the 1971-2000 period. This projection is based on tools provided by the Canadian Climate Change Scenarios Network. The projections assume a low, medium and high rate of increase in greenhouse gas emissions to provide a range of climate projections.

The climate models project that average precipitation in our region is expected to increase by 5% through the 2050s. The expected increase in the winter and spring is 10%. The precipitation in the fall and summer is expected to be wetter some years and drier other years, but largely unchanged overall.

In the winter and spring the climate models project that a growing share of precipitation events in Halton Hills will involve rain, and a reduced share will involve snow. Moreover, a growing share of the precipitation will fall during extreme rain and snow events, while the models predict that there will be fewer mild and modest precipitation events.

In the summer and fall the models project little overall change in average precipitation, but more of this rain is expected during intense downbursts. Most years there will be more days during the summer and fall growing season when there is no rain or very little precipitation, likely bringing increased risk of temporary water shortages.



Source: Climate Change in Halton: A Health Perspective; Halton Region Health Department

2. WARMER – MORE EXTREME HEAT

The Halton Region report projects that the average temperature in our region will be 2.0°C to 3.2°C warmer in the 2050s relative to the baseline climate measured during 1971-2000. The warming is expected to be marginally greater in the winter, but is virtually certain throughout the year. This pace of warming will be double that projected for the world as a whole.

Beyond a warming in the average temperature, Halton Hills is expected to experience a significant increase in the frequency of extreme warm summer temperatures exceeding 30°C. Heat waves are projected to become more intense and more frequent. We presently have 5 or 6

days a year when the temperature exceeds 30°C. By the 2050s we are expected to experience a four to five fold increase in days when the temperature exceeds 30°C. We are virtually certain to experience days that will be warmer than ever recorded in our community, with some studies suggest that it is possible that the temperature in Halton Hills could exceed 40°C. It is virtually certain that we will experience more heat waves with consecutive days when the temperature is dangerously warm.

Extreme cold days are expected to decline significantly.

3. STORMIER – MORE LARGE STORMS

Climate change is likely to increase the frequency and severity of extreme weather events.

Beyond precipitation and temperature, current climate models are unable to project trends in the frequency and severity of many storm hazards, including hail, lightning, tornadoes, hurricanes and other severe wind events. It is virtually certain that Halton Hills will experience more extreme rainfall and more dangerous heat waves, and the models offer predictions about the likely frequency and severity. It is likely that we will experience more hail, lightning, tornadoes, hurricanes and other severe weather events, but the current climate models are unable to offer predictions about the likelihood and extent of change.

Global warming is expected to result in an increase in the number of days when we experience unstable atmospheric conditions that can lead to thunderstorms, hail and tornadoes. But this will be offset somewhat by a expected reduction in the pole-to-pole temperature gradient, so it is unclear in the scientific research the extent of change expected in summer storms.

Nevertheless, warmer summers are likely to spawn an increase in severe storms through the 2050s and beyond. There has been an increase in the number of summer days with winds in excess of 50 kms an hour, with a further 10 percent increase likely through the 2050s. Warming is expected to bring more and larger hail events. Some increase is expected in the frequency of lightning strikes and the number of tornadoes, although there is considerable uncertainty about the extent of change. It is also very likely that the frequency and severity of wildland fires will increase in our region, including brush fires. The largest increase is expected in the summer and fall. Studies also predict an increase in winter freezing rain events in our region through the 2050s. There is also a growing scientific literature warning of the risk of an increase in ‘weather surprises’ like the conditions that destroyed much of our local apple crop in 2012.

Actions to prepare for climate change

For thousands of years humans and ecosystems have adapted to changing climates. New challenges have emerged, however, because the projected pace and extent of change is greater than has been experienced for several thousand years. Adaptation actions are diverse and may involve behavioural changes; operations modifications; and revised planning, new regulations, infrastructure investments and public awareness. Adaptation may involve a minor adjustment in current practices, or require bold new initiatives. Fortunately the changes expected in the climate in Halton Hills are also expected in other communities, communities willing to share their experience and knowledge about adaptation options.

During July, August and September the Halton Hills Town Environmental Advisory Committee consulted with town staff and more than a dozen adaptation experts to identify examples of options that may help our community prepare for change in our climate. We established working groups to identify:

- Options for adapting to severe rainfall
- Options for managing extreme heat
- Options for coping with more large storms
- Options for building community resilience.

1. OPTIONS FOR ADAPTING TO SEVERE RAINFALL

Over the past ten years, it is estimated that Canadians have experienced more than $20 billion in water damage due to intense rainfall events, including water damage from sewers backing up into basements. Many parts of Canada, including Halton Hills, are expected to experience more frequent and severe intense rainfall due to climate change. However, it is possible to prevent an increase in intense rainfall from resulting in an increase in water damage by investing in actions to prevent loss. Our Town should prepare a plan to manage and reduce the risk of loss and damage from extreme rainfall.

Options for Halton Hills to adapt to more frequent or intense severe rainfall events include:

- Improving stormwater management and sanitary sewers
- Reducing lot-level flooding
- Reducing river flooding.

Improving stormwater management and sanitary sewers

Moderate rainfall events do not typically result in property damage because the expected volume of stormwater generated by these events is easily conveyed by stormwater sewers and waterways. Extreme rainfall events, however, can exceed the capacity of underground stormwater management infrastructure. Thus, since the 1970s, major overland stormwater management systems have been incorporated into new development across Canada. An assessment of stormwater conveyance capacity in Halton Hills – both underground and overland - would be an important part of the Town's climate change adaptation planning.

Standards used in to design, operate and maintain stormwater management systems should be assessed to identify how well they reflect both current and future climate conditions. For example, several communities in Canada have been assessing the adequacy of intensity-duration-frequency curves used for the design of new stormwater management infrastructure. A similar assessment should be included as part of adaptation planning in Halton Hills.

Infiltration and inflow of excess storm and groundwater into sanitary systems is a common cause of sanitary sewer surcharging resulting in wide-spread sewer backup events in private homes. A thorough assessment of infiltration in Halton Hills' sanitary sewer system and how infiltration might affect risk of sanitary sewer surcharging should be incorporated into a comprehensive climate change adaptation plan.

Previous experience, like the July 1969 storm, demonstrates that a significant amount of infiltration and inflow can originate on private properties, for example, through downspout connections into municipal sanitary sewer systems, through cracked or loose joints in private sanitary sewer connections, and through foundation drain connections to sanitary sewer systems. On the municipal side, infiltration sources may include cracked and shifted pipes, root infiltration into pipes, and accidental or illegal cross connections between stormwater and sanitary systems. Thus, an assessment of public and private sources of infiltration and inflow may be a component of identifying municipal infrastructure-related flood risk in Halton Hills.

It may also be prudent to conduct an assessment of the historic occurrence of basement flood events in Halton Hills. Collection of this type of information can be used to develop approaches to identify risk of future basement flooding under changing climate conditions.

Reducing lot-level flooding

Actions taken by property owners can significantly reduce the risk of water damage due to extreme rainfall. Some examples include the use of backwater valves to reduce sewer backup risk, reduction of infiltration and inflow in sanitary systems through disconnection of downspouts and foundation drains, ensuring that lot grading results in rainwater flowing away from structures, maintenance of private property stormwater conveyance and collection systems (e.g., swales and catch basins), and remove below grade openings including reverse sloped driveways. Disconnection of downspouts and foundation drainage from minor stormwater systems is also necessary in many instances.

Halton Hills could explore options for improving citizen awareness about potential basement flood damage. For example, the town could provide homeowners with information about lot-level actions to reduce their risk of water damage for existing homes and develop bylaws and other standards to reduce flood risk in new homes. Many examples of these approaches already exist in southern Ontario and Canada. Halton Hills may choose to assess the available tools to determine which would be most effective in its jurisdiction.

Reducing river flooding

Several factors may increase the potential for river flooding, including new development and creation of impervious surfaces in watersheds, as well as changes in precipitation regimes. Halton Hills should continue to work closely with the local Conservation Authorities to identify the areas at risk of flooding today and in a changing climate. The town should prohibit new development in areas exposed to flood hazards, apply structural measures to protect existing buildings in flood hazard areas, invest in structural measures to protect existing development in flood hazard areas, require flood proofing of vulnerable buildings, maintain an effective warning and mapping program, and otherwise manage the risk of flood damage.

Preventing new development in flood hazard areas should be a cornerstone of continued flood risk management in Halton Hills, and the municipality should ensure that their capacity and the capacity of partner organizations (for example, conservation authorities) to restrict development in flood hazard areas is not eroded over time.

Addressing riverine flood risk in Halton Hills may include the development of risk assessments for stream crossings and culverts, which may be vulnerable to failure under higher river flow conditions as a result of increasing intensity of extreme precipitation events. Identification of vulnerabilities of transportation routes under changing climate conditions is especially important when considering emergency access to critical facilities and emergency response in general.

Three illustrations of adaptation actions

Three examples of actions taken in other communities to reduce the risk of loss and damage from extreme rainfall are provided below. These measures include downspout disconnection strategies, assessment of stormwater and sanitary sewer infrastructure, and application of Low Impact Development (LID) measures.

Disconnect downspouts / roof leaders

Several Canadian municipalities have adopted financial assistance programs to encourage basement flood risk reduction measures in homes. Frequently, these programs are targeted to homes that have had basement flooding in the past or to homes that are located in flood prone areas. Retrofit programs are targeted to reduce sewer backup risk by disconnecting roof leaders, installing backwater valves and eliminating of storm/sanitary cross connections.

Many municipalities have implemented downspout disconnection programs. Downspout disconnection is a voluntary program that is encouraged in Mississauga, but is a mandatory program throughout Toronto. Most municipalities suffer from low uptake and compliance rates for urban flood risk reduction programs. Nevertheless, some communities, like Quebec City, achieved 100% compliance rates in a target neighbourhood.

Climate change assessment of storm and wastewater management systems

The City of Welland, in partnership of the Niagara Water Strategy and Ontario Ministry of Environment, assessed the vulnerability of their public infrastructure to climate change using a tool created by Engineers Canada's Public Infrastructure Engineering Vulnerability Committee (PIEVC). When the assessment was being considered, Welland updated its intensity, duration and frequency rainfall curves, identified areas with historic basement flooding, and updated its standards for new development projects.

The main objective of the project was to identify components of the City's wastewater and surface drainage collection system that were at risk of failure or damage due to extreme climatic events. Once these components were identified, Welland was able to develop a vulnerability assessment for future climate change scenarios and develop suitable adaptation actions.

Low Impact Development

One of the primary tenets of Low Impact Development (LID) is to design development so stormwater is safely and sustainably retained on-site. Retention and infiltration of stormwater on site has many advantages including recharging of underground water resources as well as reduced quantity and increased quality of stormwater that flows off of sites. Low Impact Development can also result in project cost savings by decreasing the amount of drainage infrastructure required.

There are resources available regarding Low Impact Development. In 2012 the Credit Valley Conservation Authority prepared a *Low Impact Development Discussion Paper*. In 2011 the Authority prepared a paper *Cost-Effective LID in Commercial and Residential Development*.

2. OPTIONS FOR MANAGING EXTREME HEAT

Climate change does not create new health problems, but it is expected to worsen existing problems. In particular, the anticipated increase in the frequency and intensity of heat waves will have a negative impact on public health in Halton Hills. The health impacts of extreme heat include heat stroke, heat exhaustion, fainting, and an aggravation of existing medical ailments like respiratory disorders. Individuals with an existing medical conditions, the elderly, infants, children, and workers in outdoor occupations are among those at greatest risk. Economically vulnerable citizens without access to air conditioning and transportation, and those who lack strong social networks and caregivers, will find it difficult to cope during these events. To illustrate, a 2009 heat wave in Vancouver, which saw temperatures reach 34.4 degrees over an eight day period, was linked to 156 deaths.

An important element of warmer weather will be the increased frequency of prolonged drought conditions. Since the year 2000, there has been an increased frequency in the number and duration of droughts across Ontario. Halton Hills has been affected by varying degrees of drought since 2000 with the most recent Level 1 status drought occurring in 2012. In the event of prolonged drought, Halton Hills becomes vulnerable to depleted surface and ground water resources. As the municipality is currently reliant on wells for water supply to both urban and rural dwellings, drought can be a significant hazard to Halton Hills' sustainability.

Prepare a heat response plan

Town Council may find it helpful to prepare a heat response plan specific to Halton Hills. The United Nations reports that one third of the cities in the United States vulnerable to heat events lack any written heat event planning, and many of the existing plans are "not more than cursory" although it has been shown that heat watch systems save lives.

Expand the Town's existing hot weather reponse efforts

Town Council may wish to consider working with the Region on a Heat Alert Advisory program to identify the location of cooling centres and other useful information for citizens. Currently, during periods of extreme heat residents are provided with information on the risks of heat and the availability of cooling centres as outlined in Halton Region's *Hot Weather Response Plan for Halton* and the *Town of Halton Hills Heat Alert Procedures*. There are opportunities to leverage existing resources and relationships within the Halton Hills community in order to meet this growing threat and provide additional targeted support to those at greatest risk.

The Town of Halton Hills currently owns and operates 3 indoor aquatic facilities and 3 outdoor splash pads. The Town's heat alert procedures could be modified to automatically extend operating hours at these facilities during a heat emergency, providing residents with an opportunity to cool off, a change that would particularly benefit families with young children. In addition, Links2Care is a local agency with funding from the Town and Region that provides support services to seniors. Seniors can register for and receive services that can include a telephone assurance program to check on their wellbeing. The Town could seek to ensure that this program is expanded to include contact with high-risk individuals during a heat emergency.

Emergency supply of water

One of the key factors the Town Council may wish to consider is whether there are adequate resources available to supply the public with water in times of severe and prolonged drought. Water supply falls under the jurisdiction of Halton Region, yet Town Council may wish to ensure that recreation centres, fire stations and other municipal buildings have an outside tap that can be accessed by the public for a temporary water supply. Town Council may also wish to consider utilizing underground holding tanks for rain water at municipal buildings, like those in the new fire stations in Halton Hills.

Prepare for bans on watering lawns and washing cars

Halton Hills is fortunate in that there are already protocols in place from the province in the form of the Ontario Low Water Response Program that is headed up by Conservation Halton and Credit Valley Conservation respectively. This program lists a number of actions for Council to consider in the event of drought. Town Council may also want to work closely with Halton Region to ensure that Regional watering restrictions are enforced to the fullest. Bans on watering lawns and washing cars have been enacted by a number of communities in Ontario during times of drought.

Three illustrations of adaptation actions

A number of communities have taken action to manage the risks associated with extreme heat events. This includes actions to reduce the risk of health problems, and to anticipate prolonged drought.

Vancouver Extreme Hot Weather Program

The City of Vancouver extreme hot weather committee completed the first phase of its planning in 2011. This included development of a heat alert and a 'Be Cool' communications campaign. The second phase of this work is focused on actions to minimize impacts on health, especially within vulnerable populations. Leveraging and adding support to the existing work program will ensure Vancouver matches the efforts of Toronto and other cities in planning for extreme heat. Some of the short and medium terms actions and tasks under the extreme hot weather preparedness work program include:

- Increase resources to support an expanded program, including additional staff time.
- Complete urban heat island effect mapping, and coordinate with parks on targeting green space and trees in hot areas of the City.
- Work with Coastal Communities at Risk research group on vulnerable population mapping.
- Develop policies for cool refuges and cooling capacity in civic facilities.
- Assess cooling capacity of facilities within identified hot spots and priorize for early policy implementation.
- Research and explore options for transporting those in need to cooling facilities during heat events.

Region of Durham has Integrated Adaptation in the Mainstream of its Business Plan

In 2009, Durham's Regional Council directed that climate change initiatives be implemented through existing business planning, risk and asset management processes. These are now proving effective processes for developing climate change adaptation strategies. In 2010, the Region joined ICLEI Canada's Adaptation Initiative. ICLEI's adaptation milestones are organized under: initiate; research; implement; and monitor/review. The similarity of this approach to Durham Region's business model assisted the Region in moving forward effectively. Climate change risk planning, including solutions implementation, is ongoing and updated annually as part of the Region's broader risk management practices. Results related to infrastructure also feed into the corporate asset management program. In fact, the 2012 Asset Management Update was Durham's first report to explicitly consider climate change adaptation requirements as a new reality of the annual business planning process.

Region of Peel Co-ordination with Other Stakeholders

The Region of Peel, through the Peel *Climate Change Strategy* project, is combating climate change though adaptation and mitigation actions in partnership with the Credit Valley Conservation, Toronto Regional Conservation Authority, the City of Brampton, the City of Mississauga, and the Town of Caledon. Input received through the process helped to shape the Strategy to transition the region of Peel toward a low carbon future, where communities embrace greener lifestyles and where natural systems are protected and enhanced. The *Peel Climate Change Strategy* implements the *Corporate Strategic Plan*, supports several Term of Council priorities, and is aligned with many goals and actions listed in Ontario's *Climate Change Adaptation Strategy and Action Plan*.

3. OPTIONS FOR COPING WITH MORE LARGE STORMS

Many of the most costly impacts of climate change--in terms of both life and property--will result from more frequent, longer-lasting, or more intense extreme weather events and associated natural hazards. This may include heavy precipitation events, floods, heat waves, droughts, and wildfires. Climate change will challenge the Town of Halton Hills and its residents to prepare for increased precipitation and stronger winds in shorter periods of time. The majority of significant power outages are due to storms. While most significant storms occur during warmer seasons, increasingly, climate change experts are recognizing the contributing role that warmer, wetter winters are having on storm events involving ice that can cause property damage and power outages.

Storms and associated natural disasters in 2013 have been estimated to cost the Canadian economy between $4B and $6B. Insurance companies, for example, recently reported that 2013 will be the most costly year ever for disaster damage claims. The impact of ongoing cleanup and recovery efforts on affected Canadians is expected to last between years and a decade.

Since the 1950s, the cost of natural disasters worldwide has risen 14-fold, according to the Centre for Research in the Epidemiology of Disasters.

Thanks, in part, to recent climate change events and a deeper appreciation for their impact on Canadians, there is renewed interest in climate change adaptation federally, provincially and municipally. For the Town of Halton Hills, there are many potential adaptation initiatives that could be considered when addressing the impact of more frequent and intense storms.

Tree management system

One opportunity to adapt to an increase in storm events is to mitigate wind and precipitation damage from fallen trees and limbs of trees by working with industry partners, Halton Hills Hydro and benchmark municipalities to develop a comprehensive Tree Management System. Today, contracted professionals trim trees in the path of hydro lines for residents of the Town. However, some municipalities have moved to treating trees as an asset with a detailed inventory of trees and their characteristics, including location, condition and maintenance records. This strategy has been implemented in some areas as a method to manage the Emerald Ash Borer insect, but the benefits to climate change adaptation are equally compelling. Specifically, a comprehensive Tree Management System could:

- Detail trees vulnerable to damage from wind and precipitation that could cause injury, property damage and/or loss of power during a storm
- Identify trees that could benefit from storm preparedness trimming and other proactive maintenance including planting trees strategically around vulnerable electrical equipment
- Capture costs associated with storm events and assist in developing financial tools such as a “Storm Contingency Fund” and “Preventative Maintenance Budget”
- Identify Tree Management Guidelines that could be promoted and adopted by the Town and its residents to manage trees on public and private property such as:
    - Planting trees as windbreaks for blowing precipitation
    - Planting trees to provide thermal and cooling properties to homes
    - Surveying trees to reduce storm damage risks.

Storm preparedness strategy for public/commercial facilities

By working with existing Town Departments, like Public Works and Engineering, along with public and commercial buildings, like local hospital, schools and manufacturing organizations, Town staff could develop a working group to encourage the implementation of a shared Storm Preparedness Strategy. This strategy's implementation could begin by revisiting the Town's ongoing surveys and renovation efforts associated with municipal building vulnerability to flooding and maintenance activities. It could then evolve to engage other stakeholders and plan for storm events by encouraging the procurement of generators for back-up power during outages, water pumps to assist in clearing floors susceptible to flooding and renovating current electrical fixtures and/or relocating electrical panels for easier and safer reconnection.

Implementing this strategy could result in the development of storm drills to emphasize the need to have a practiced set of activities that a building/facility's occupants know and can complete quickly to shelter safely when a storm is approaching. Town implementation of this strategy could involve the Town leading by example and sharing its own plans for storm event preparation across various municipal buildings with other working group members. This strategy could also entail developing a shared commitment to document and maintain these standards as part of a Town-wide Risk Management Plan as well as a guideline for future public and commercial development in the Town.

Emergency preparedness for town residents

The Town could consider championing an effort to advocate for the development of an emergency preparedness plan to acknowledge opportunities for Town residents to effectively deal with increased storms and resulting power outages, extreme winds and intense rainfall. The Town and other stakeholders, including Halton Hills Hydro, Region of Halton, local school boards and other local organizations, could provide standard and consistent communications using their online and social media resources. Opportunities exist to inform Town residents about:

- Preparing a home kit and car kit with food, battery/crank operated lighting, thermal apparel, heating equipment and communication supplies.
- Sheltering in place during a storm.
- Town locations available to provide: emergency shelter, heat/cooling centres, potable water for people/livestock.
- Instructions for appropriate use of 911 and emergency services during or after storms.
- Instructions for reporting power outages and/or dangerous electrical situations.
- Where to find Town and/or local emergency updates before, during and after storms.

This potential action reflects an increasing appreciation for, and usage by residents of, updated local information in a variety of formats. Additionally, this action reinforces the effectiveness of collaboration across organizations in adapting to climate change. Effective implementation of a comprehensive Emergency Preparedness Plan for Town residents may mean increased funding and support for Fire and other Emergency Response service providers to enhance safety programming and response resources.

There is value in continuing to educate homeowners and local organizations about climate change adaptation and opportunities to inspect, secure, repair and renovate aspects of their property that are most susceptible to damage.

Three illustrations of adaptation actions

Several municipal organizations in Canada have implemented climate change adaptation actions to maintain a safe and prepared environment.

City of Guelph

The City of Guelph implemented a Tree Inventory Management System several years ago to inventory all trees on public property using existing asset management and GIS applications in a web-enabled system for mobile devices. Over time, the initiative has allowed the City to better manage its assets, identify vulnerable trees and beneficial planting opportunities, engage seasonal and permanent staff members more efficiently in preventative maintenance programs and detail the impacts of adverse events such as storms and related cleanup activities on individual trees. The City continues to refine its program and notes that it supports several of the green initiatives implemented by the municipality and its residents.

Alberta

After the storm and subsequent flooding of 2013 many homeowners were faced with the daunting task of working to assess damage and repair their homes. The government updated its requirements for homeowners applying for Disaster Recovery Program funding to specify flood mitigation measures and add guidelines for homes being rebuilt to include adaptation actions. Specific changes include the installation of backflow prevention devices and the relocation of electrical panels from basements to a home's first floor for easier reconnection after an outage. These changes were implemented in August 2013 and are hoped to play a significant role not only in recovery efforts but also to encourage adaptation efforts across Alberta.

Toronto Hydro

Toronto Hydro has worked with several stakeholders to develop educational materials to encourage homeowners and residents to prepare for emergency events, including storms, which may result in power outages. Their *Emergency Preparedness Guide* is called ARE YOU READY? and contains information about how to develop an emergency plan and kit. What makes the guide particularly helpful is that it broaches the topic of assessing risks and hazards in your environment. This proactive approach positions stakeholders to deal effectively with storms and other climate change events.

Increasingly intense storms are an identified part of climate change. Adapting to climate change is a dynamic and continuous process of engaging stakeholders and working together. The Town, with its strong set of skilled Staff and other resources, is well-positioned to lead an initiative to develop an implementable climate change adaptation plan.

4. OPTIONS FOR BUILDING ADAPTIVE CAPACITY

While a large portion of the anticipated impacts of climate change were described in the preceding three sections (wetter, warmer, stormier), there may be some effects that are not easily anticipated, like the failure of the 2012 apple crop. Very warm weather in March of that year prompted trees out of dormancy and into an early bloom. A sudden return to freezing temperatures in April killed blossoms and immature fruit. Total losses were over 80% of the crop according to the Ontario Apple Growers. For consumers, this meant limited availability and higher prices for Ontario apples. For affected farmers, assistance from the provincial and federal government through the AgriRecovery program was denied, although $2 million was allocated directly to farmers to assist with on-farm risk mitigation strategies. It also seems likely that crop insurance premiums will increase in much the same way that residential insurance premiums are now increasing due to flooding in Calgary, Etobicoke and elsewhere in 2013.

Unanticipated events such as these make adaptation planning difficult. In fact, it is difficult to determine whether climate change is a factor in individual events, but it seems clear that extreme events of all kinds will become more frequent in the future. In general, the climate will be more variable; that is to say, although averages will still be used to describe the climate, more extreme values will be making up those averages. For example, it may be surprising to learn that temperatures were average for the summer of 2013, but cool temperatures for most of the peak vacation period in late July and early August were offset by single weeks of extreme high temperatures in late June and mid-July. Under these conditions, people's 'lived experience' will be one of 'crazy' weather.

Given this uncertainty around possible unanticipated impacts, municipal officials will need ongoing access to information, training, decision-making tools and expertise in order to continuously improve the climate change adaptation plan as more information becomes available. This will continue to build the resilience of our community as we face climate change forces that may be largely beyond our control. This cycle of continuous improvement is referred to as 'building climate change adaptation capacity' in this report.

Three illustrations of adaptation actions

Building Adaptive Capacity in the City of Vancouver

Other communities have used a variety of tools to build adaptation capacity but few have put the pieces together as well as the City of Vancouver in its *Climate Change Adaptation Strategy*. The following strengths are of potential benefit to the Town of Halton Hills in developing its own plan:

- The strategy is staff-driven. Staff members from across all City departments were assigned to work in the Adaptation Working Group that identified impacts and prioritized and reviewed actions. They also acted as communicators back to their own departments. The plan is more likely to be implemented since staff developed and understand it. Existing processes in Halton Hills, such as the Senior Management Team inter-departmental meetings and the Sustainabilty Worksheet, are tools that may be modified to similar effect.

- Vulnerability and risk assessments developed by staff were used to prioritize impacts. This approach helps to ensure that all potential impacts are identified and prioritized and recognizes that the City may already have 'adaptive capacity' to respond to some potential climate change impacts.
- Actions were evaluated according to a number of criteria to establish their relative priority. 'Must-do' actions include a timeline for including the action in the capital plan and / or operating budget as appropriate. This helps to ensure accountability in implementing the plan. Other actions were identified as 'monitor' or 'investigate further'.
- Prioritization took into account (and favoured) so-called 'no-regrets' actions: those that benefit the community regardless of the extent of climate change that eventually occurs. This included actions that contribute towards meeting the goals and objectives of related City initiatives such as asset management planning, Vancouver's *Greenest City Action Plan* and others. In Halton Hills, related initiatives could include the *Integrated Community Sustainability Strategy*, the *Mayor's Community Energy Plan* and others.
- Prioritization took into account (and favoured) those actions that were fully within the City's jurisdiction to act independently and for which specialized funding may be available.
- City departments were assigned 'Accountability' for each action and its timeline (as applicable), recognizing that responsibility may be shared across departments in some instances.
- Actions were identified as being small, medium or large efforts.

All of these steps require extensive staff consideration and input to achieve maximum effectiveness. It is therefore likely that a qualified facilitator will be required to act as the coordinator and guide should the Town decide to pursue a similar process. The result should be a plan that ensures incorporation of adaptation considerations in all Town of Halton Hills business on an ongoing basis (i.e., the plan should be a 'living document' with regular and systematic updates).

Town of Oakville Experience with ICLEI Canada

The Town of Oakville has been working to implement climate change mitigation and adaptation programs across all departments for several years. Oakville joined ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Program in the fall of 2010 to create a Climate Change Adaptation Strategy. Town staff were identified from across the organization to participate on the Climate Change Adaptation Team (CCAT). The Team is an internal working group, meant to build capacity of Town staff to move forward on planning for climate change and implement key actions. Though it is an internal team, key stakeholders external to the organization have been identified and are consulted as needed.

With the support of Council and the Town's Adaptation Champion, Cindy Toth, Director of Environmental Policy, the CCAT developed a comprehensive list of climate change impacts which have been run through comprehensive vulnerability and risk assessments. The Team is currently finalizing those assessments and are now drafting their Climate Change Adaptation Strategy. The BARC Program with ICLEI Canada has been instrumental in driving forward the

efforts of Oakville while at the same time giving the Town the framework, and through the online BARC Tool, the platform for moving through the five-milestone process.

Halton Hills has been working with ICLEI Canada for many years to advance the Town's work on sustainability, and should consider using ICLEI Canada's Building Adaptive and Resilient Communities Tool to support work on preparing for change in the climate.

Peel Region Establishes A Climate Change Communications Strategy

The Region of Peel has established a climate change strategy that addresses mitigation and adaptation. It is a principles-based strategy, that includes a targeted and proactive adaptation plan. One of the goals of the Peel strategy that should be considered by Halton Hills involves efforts to increase awareness about preparing for climate change. This includes development of a communication strategy to inform and engage staff, elected officials, the public and community partners.

Establish an adaptation plan

A CALL TO ACTION BY HALTON HILLS TOWN COUNCIL

In March 2013, Mayor Bonnette asked the Town Environmental Advisory Committee to prepare a Climate Change Plan. Committee members met with members of the community, adaptation specialists, and staff from the town, region, conservation authorities, school boards and Hydro to explore adaptation to climate change. We discovered that our climate has changed, and significant further change is expected. Moreover, we found that there are actions our community can take to prevent an expected increase in weather risks resulting in an increase in loss and damage. We can and should adapt our practices to reduce the risk that change in the climate will disrupt our community.

The Town Environmental Advisory Committee recommends that Town Council direct Town staff to develop an adaptation plan to prepare for change in our climate.

In particular, some ideas we suggest that Town Council should consider:

1. Establish a Climate Change Adaptation Advisory Committee or direct the Town Sustainability Advisory Committee to oversee development of a comprehensive, multi-year climate change adaptation plan.
2. Assess the full range of expected climate risks, with particular attention to the risk of an increase in severe rainfall, extreme heat, and large storms.
3. Build public awareness about the changes expected in our climate and the need for local actions that build climate resilience.
4. Review public infrastructure investments to ensure appropriateness for the climate today and throughout its life expectancy, including a focus on extreme rainfall.
5. Establish a Town strategy for managing the threats from summer extreme heat and prolonged drought.
6. Review the Town's Emergency Management Plan and develop a tree management strategy to consider the expected increase in the frequency and severity of storms.
7. Assign a Climate Change Adaptation Co-ordinator within the Office of Sustainability and secure decision support tools to build the Town's capacity to anticipate and systematically address climate impacts.

A comprehensive climate strategy should address emissions reduction and adaptation. Adaptation involves adjustment in our decisions, activities and thinking because of change in the climate in order to moderate the risk of harm or to take advantage of new opportunities. Ideally adaptive actions should be included in existing Town practices.

Research by Halton Region and others warn that our community is expected to experience more weather threats with a warming climate. More climate risks, however, does not need to result in increased loss and damage. We have a choice. We can and should take action to prepare. Prudent management of climate change involves a long-term commitment to continuously adapt our behaviour and practices to build a community resilient to adverse climate impacts. The overall goal should be to integrate climate change into existing planning processes by developing the tools and capacity to systematically address climate impacts as they emerge.

Appendices

Acton
Georgetown
Esquesing

Town of Halton Hills
Office of the Mayor
Rick Bonnette

March 26, 2013

Brian Boyce
36 Joycelyn Cres.
Georgetown, ON
L7G 2S4

Dear Brian:

Thank you for meeting with Councillor Kentner, David Smith and myself on March 25th, 2013 to discuss TEAC.

I was happy to have the opportunity to tell you how much Council values the work TEAC has done over the years. In fact the early work done by the original members has transformed how our community thinks about environmental and related issues. Just the past weekend we celebrated Earth Hour.

As you and your committee members know, Council approved our Sustainability Strategy. This plan was generated by input from our community and is a significant step forward for our town. The pillars; Cultural Vibrancy, Economic Prosperity, Social Wellbeing, and Environmental Health represent critical components to our Town's future. Through co-ordination, consultation and a common framework, Council will be engaging members of our town to implement the plan.

It is our intent to realign some of our existing Advisory Committees to work within this new framework.

As we discussed Brian, we see TEAC playing a significant role under the new pillar of Environmental Health. Exactly how that works for the all the pillars will be determined in the coming months, but we do want member of TEAC to remain engaged so they are ready when called upon.

I am looking forward to receiving your Climate Change Plan so that staff can review and comment on it. This will be a perfect transitional project ending TEAC and poising the group for many more future successes under the Sustainability Strategy Structure.

Brian, I have asked the CAO David Smith to keep you up to date on the progress of our transition from some of our existing committees to the new ones supporting the sustainability plan. If at any time you have questions, please feel free to contact David directly.

Sincerely,

Mayor Rick Bonnette

Town of Halton Hills • 1 Halton Hills Drive, Halton Hills (Georgetown), Ontario, L7G 5G2
Tel: 905-873-2601, ext. 2342 Toll Free: 1-877-712-2205 Fax: 905-873-2267 mayor@haltonhills.ca www.haltonhills.ca

MEMBERS OF THE TOWN ENVIRONMENTAL ADVISORY COMMITTEE

Bryan Boyce (Committee Chair)

Sue Biggs, MBA, PMP (Project Manager)
Jim Bray
Bill Gauley, P.Eng.
Dave Kentner (Member, Town Council)
Craig Kirkwood, P.Eng.
Paul Kovacs
Kelly McHale, Hon BSc
Eleanor Young, M.A.Sc., P.Eng.

Renee Brown (Council and Committee Services Coordinator)

THE CLIMATE CHANGE PREPAREDNESS PROJECT TEAM

Town Environmental Advisory Committee Contributors

Sue Biggs, MBA, PMP (Project Manager)
Jim Bray
Bill Gauley, P.Eng.
Craig Kirkwood, P.Eng.
Kelly McHale, Hon BSc
Bryan Boyce (Committee Chair)
Renee Brown (Committee Coordinator)
Dave Kentner (Member, Town Council)
Paul Kovacs
Eleanor Young, M.A.Sc., P.Eng.

Organizational Contributors

Suzanne Burwell
Environmental Sustainability Coordinator
Halton District School Board

Jennifer Gordon, PMP
Project Manager
Halton Hills Hydro Inc.

Trisha Henderson
Environmental Policy Coordinator
Town of Oakville

Tony Iavarone
Manager, Corporate Communications
Town of Halton Hills

Ewa Jackson
Acting Director
ICLEI Canada

Jeff Jelsma
Development Engineering Coordinator
Town of Halton Hills

John Kinkead, P.Eng.
Deputy CAO and Director, Water Resources
Credit Valley Conservation

Jaclyn Neill
Recreation Supervisor -Aquatics
Town of Halton Hills

Harry Olivieri
Deputy Chief Prevention and Public Education
Community Emergency Management Coordinator
Town of Halton Hills Fire Department

Ken Phillips
Chief Administrative Officer
Conservation Halton

Dan Sandink, MA, MSc (Pl)
Manager, Resilient Communities & Research
Institute for Catastrophic Loss Reduction

Peter Steer, M.Sc.
Environmental Health Senior Policy Analyst
Halton Region Health Department

Damian Szybalski, M.Sc.Pl., MCIP, RPP
Manager of Sustainability
Town of Halton Hills

Jason Thistlethwaite PhD
Director Climate Change Adaptation Project
University of Waterloo

SOME AVAILABLE RESOURCES

2013

- Active Healthy Kids Canada. **Are We Driving Our Children to Unhealthy Habits?** 2013.
- Bulletin of the Atomic Scientists. **Preaching Climate to the Unconverted.** 2013.
- http://www.torontohydro.com/sites/Corporate/Newsroom/Documents/TH_Emergency%20Kit_FINAL.pdf. **Emergency Preparedness Kit.** Toronto Hydro. 2013.
- http://www.emergencymanagementontario.ca/english/emcommunity/program_resources/hazardbasedplanning/Severe_Weather_Guideline.html. **Guideline for the Development of a Municipal Severe Weather Emergency Plan.** Ontario Ministry of Community Safety & Correctional Services. 2013.
- National Aeronautics and Space Administration (NASA). **Climate Change: How Do We Know?** 2013.
- http://www.ecee.on.ca/index.cfm?page=tree_home. **NeighbourWoods on the Grand.** Elora Environment Centre. 2013.
- http://www.ene.gov.on.ca/environment/en/category/climate_change/index.htm#climate. Ontario Ministry of the Environment. 2013.
- Town Sustainability Advisory Committee (Halton Hills). **Integrated Community Sustainability Strategy: Imagine Halton Hills.** 2013.
- http://www.hamilton.ca/CityDepartments/PublicWorks/Parks/Forestry/. **Trees Hamilton.** 2013.

2012

- American Thoracic Society. **An Official American Thoracic Society Workshop Report: Climate Change and Human Health.** 2012.
- http://www.climate.gov/news-features/features/global-warming-or-just-weather. **Attribution of Extreme Events in 2012.** Bulletin of the American Meteorological Society. 2012.
- Beacon Environmental and Urban Forest Innovations Inc. **City of Guelph Urban Forest Management Plan 2013-2032.** 2012.
- Clean Air Partnership. **Accelerating Adaptation in Canadian Communities Case Studies.** 2012.
- Halton Region. **Climate Change in Halton: A Health Perspective.** 2012.
- ICF Marbek. **Low Impact Development (L.I.D.) Discussion Paper.** 2012.
- The Sustainability Group. **City of Vancouver Climate Change Adaptation Strategy.** 2012.
- The City of Windsor. **City of Windsor Climate Change Adaptation Plan.** 2012.
- Toronto Environment Office. **Toronto's Future Weather & Climate Driver Study: Outcomes Report.** 2012.
- The Institute for Catastrophic Loss Reduction (ICLR) for Insurance Bureau of Canada. **Telling the Weather Story.** 2012.

2011

- http://www.haltonhills.ca/fire/pdf/emergency-response-plan-07-09-17.pdf. **Emergency Response Plan (Revised).** Town of Halton Hills. 2011.
- Health Canada Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch. **Communicating the Health Risks of Extreme**

Heat Events: Toolkit for Public Health and Emergency Management Officials. 2011.

- Peck, A., Bowering, E., and Simonovic, S.P. **City of London: Vulnerability of Infrastructure to Climate Change**
- **Final Report.** University of Western Ontario. Department of Civil and Environmental Engineering: Water Resources Research Project. 2011.
- Public Safety Standing Committee, City of Windsor. **Administrative Report: Mandatory Backwater Valve Installation for New Home Construction for Sewers.** 2011.

2010

- European Respiratory Society. **Climate Change and Respiratory Disease.** 2010.
- Ontario Ministry of Natural Resources, Ontario Ministry of the Environment, Ontario Ministry of Agriculture, Food and Rural Affairs, Ontario Ministry of Municipal Affairs and Housing, Ontario Ministry of Research and Innovation, Association of Municipalities of Ontario, Conservation Ontario. **Ontario Low Water Response.** 2010.

2009

- Saxe, D. and Campbell, J. **Heavy Weather.** Municipal World. 2009.

2008

- Town of Halton Hills. **Green Plan.** 2008.
- U.S. Climate Change Science Program. **Weather and Climate Extremes in a Changing Climate.** 2008.

2007

- Clean Air Partnership. **Adapting to Climate Change: Urban Regions Unprepared.** 2007.
- Parks and Recreation Ontario. **Investing in Healthy and Active Ontarians through Parks and Recreation Infrastructure.** 2007.
- Prodanovic, P. and Simonovic, S.P. **Development of rainfall intensity duration frequency curves for the City of London under the changing climate.** University of Western Ontario. Department of Civil and Environmental Engineering: Water Resources Research Project. 2007.
- The Climate Impacts Group, Joint Institute for the Study of Atmosphere and Ocean. **Preparing for Climate Change: A Guidebook for Local, Regional and State Governments.** University of Washington. 2007.

2003

- Nosal, R.M. (M.D.), Commissioner and Medical Officer of Health. **Report to Health and Social Services Committee: Hot Weather Response Plan for Halton Region.** 2003.

1969

- http://news.haltonhills.halinet.on.ca/92015/page/1?w=1600&h=1200. **Roads, Cellars Flooded in Damaging Cloudburst.** Georgetown Herald. 1969.

A HISTORY OF FLOODING IN HALTON HILLS (1946 - 1977)

Exerpts from the Credit Valley Conservation Report (1956)

Glenn Williams 1946

The village of Glen Williams experienced a sudden and disastrous flood on March 7, 1946. Unusually mild weather followed by heavy rain led to the break-up of the ice on the pond above the dam of the Beaumont Knitting Mills.

Suddenly, watchers saw a great tidal wave, choked with ice cakes, sweeping downstream, In a matter of minutes it swept away part of the Beaumont dam, roared over the flat lands bordering the river, and turned half the village into a torrent."

This flood was described in newspaper reports as "the worst within memory". Damage was done to the Beaumont Knitting Mills; to the factory of the Glen Textiles Ltd.; and to the plant of the Provincial Paper Limited, at the outskirts of Georgetown, where some stocks of paper were wetted and several electric motors were put out of action. The damage was estimated to be in excess of $4,000. Fortunately, no lives were lost.

Glenn Williams 1948

The reports of the freshet on the Credit, March 21, 1948, are limited to a single sentence: "The Credit River overflowed at Glen Williams, but damage was light."

Glenn Williams 1950

A severe flood occurred on April 4, 1950. A highway bridge was carried away at Glen Williams.

Hurricane Hazel 1954

The flood on the Credit River that resulted from “Hurricane Hazel”, while not so disastrous as the corresponding flood on the adjacent Humber, was, nevertheless, very severe. Part of the watershed was visited on October 19, when damage was noted at many points, and there were indications that the flows in the lower part of the river had been very heavy. On the whole, however, the damage observed was on the scale of a spring freshet and not of a major disaster.

Between Georgetown and Terra Cotta, the river seems to have risen little above its banks, and no flooding was reported at Glen Williams. Peak flow at Georgetown has been calculated at between 3,500 and 4,000 cubic feet per second. Below Georgetown the peaks rose more sharply, and the run-off from the clay plains was more intense

Glenn Williams 1961

Telegram (February 27) Reported by J. Bennett -"Gigantic Floes Batter Village" Glen Williams – A giant ice jam heaved out of the Credit River and brought four hours of fear to this village near Georgetown over the weekend. Carried by flood water, the ice slid in great blocks, pushing cars yards up the street of this village of 500. Just when the ice floes seemed on the point of sweeping away houses, the east river bank by the bridge gave way. The flood water roared through some low land and the march of ice through the village ended. The flood came as a result of an ice jam breaking higher upstream, at Terra Cotta, which formed late last week. At the same time, a half-mile long jam formed below Glen Williams and all efforts to blast it free failed. But torrential rains and high winds Saturday night blew the Terra Cotta jam and it surged down on Glen Williams. Another break at Terra Cotta late Sunday afternoon posed more trouble, but it flowed through the new channel at Glen Williams without flooding further. Caption to accompany photo: Chunks of ice block the river at Glen Williams, near Georgetown and have overflowed onto the road. The Credit River continued rising having flooded twenty homes, some to the depth of four feet.

Toronto Star (February 27) Glen Williams merchant George Preston has a problem. Ice from flood-swollen Credit jams vehicle against his store. Bulldozers were used to push 18-inch-thick cakes of ice back into the river after floods.

Georgetown Herald (March 2) "Spectular Glen Flood Piles Ice High in Streets" Flooded Basements Main Damage For Residents. By 6 o'clock Friday morning, the huge chunks of ice locked solidly a few hundred yards upstream from the old lower paper mill had created such a pile up that water flow diverted from the regular river course and split into two branches just above the bridge at the corner of the 9th line and Guelph Road.

The wall of water and ice released when a dam burst at Terra Cotta hit the jam at two o'clock Saturday night. The collision was spectacular. The seemingly immovable ice barrier which had resisted TNT charges throughout the day suddenly heaved throwing the miniature bergs in every direction. In minutes the water was gone. The impact of the Terra Cotta floe though unable to move the jam, created an open channel and the backed up water was through. Heavy winds and rain all day Sat. triggered the Terra Cotta break which started the chain reaction. Had the dam not burst there, the eventual end of the ice build up in the Glen was unperceivable. When the Terra Cotta water reached the Glen jam, the ice as back to the old Barraclough Mill. Though little water damage was reported in their home property, many Glen residents had their basements flooded. Some moved out of their homes temporarily and others just upstairs. Caption to accompany photo: In its diverted course the Credit River at the height of the flood made Glen road impassible in 4 spots.

Times and Conservator (March 2) Boating on the lawn highlighted the Glen Williams floods. Three foot blocks of ice jammed the main street and water rose to a height of 9 feet in some areas. Three feet of water over the road was a common sight facing motorists on the concession line immediately east of the 9th line in Glen Williams on Saturday.

Glenn Williams 1962

Georgetown Herald (March 15) Rescue Trainees Ready Should the Credit Go Wild" Sudden Rains Could Trigger Flooding With observers stationed at I2 points along the Credit River, municipalities are preparing for the possible danger of spring flooding. At writing time, the Credit at Glen Williams where flood water caused many residents to evacuate their homes last

year, was still for the most part ice covered. But it's felt a heavy rain or a sudden temperature hike could cause trouble.

Glenn Williams 1963

Georgetown Leader (March 20) Glen Williams residents have kept a wary eye on the waters this year, as the severe winter resulted in a build-up of more ice than usual. However, the break-up began quietly with a gentle outflow of ice and residents feel it augurs well for a dry spring in the Glen area.

Glenn Williams 1963

Georgetown Herald (December 31) "Some Homes Flooded As Ice Jams" Credit Helpless Until Flood Control Program Says Field Officer. Basements in a number of homes that front the 9th Line just south of the west Glen bridge were flooded when an unexpected ice jam caused the Credit River to overflow its banks at that point Thursday night. The jam came as the result of recent rains and unseasonal temperatures which acted on the river's ice surface the same as spring runoff. The trouble started when some of the ice cakes locked at a bend in the river a few hundred yards south of the west Glen bridge where the river is at one of its shallowest points. A second heavy float of ice chunks hit the jammed blocks about 8:30 Friday morning. And a third lot moved in Saturday. It's believed the pressure of the third flow brought about the breakup. By late Saturday all of the ice had moved out. During the height of the flood part of the 9th line was under water. Diverted water washed away part of the shoulder of the road and part of a drive-way on the property of P. Macdonald. Just before the weight of the ice freed the jam the ice as backed up from the bend to behind the Glen Williams public school. The Credit Valley Conservation Authority had a bulldozer at the site of the jam yesterday attempting to ease the sharp turn in the river's course and remove any obstructions which may lead to another situation in the spring. The flooding was the worst in the Glen since an ice jam caused near disaster condition in February of 1961.

Glenn Williams 1964

Georgetown Herald (January 14) "Ice Jammed Again Below Glen Bridge" Similar condition to those which brought about a minor flood in Glen Williams three weeks ago have created a second ice jam in the same location. Moderate temperatures and heavy rain Friday touched off the second breakup which brought a huge ice flow down stream Saturday morning. The ice cakes locked in a sharp bend in the river just south of the Glen Williams west bridge where the Credit Valley Conservation Authority had done some work removing obstacles and easing the angle after the first jam. At writing time no flooding had occurred although the level of the river is above normal.

Georgetown Herald (January 21) A jam which occurred a week ago is still locked solid and backed up water is raising the ice surface and spilling into basements which have been already flooded once by a jam in late December.

Toronto Star (February 10) A mother and her three children clung to a life-rope today as they evacuated their flood-threatened home at Glen Williams. Mrs. H. Colpitts strung the rope from her door to a tree near the road. She and the children waded through nearly 2 feet of swift – flowing floodwater from the ice-jammed Credit river. Basements of more than a dozen homes and stores close to the river were flooded and residents feared a break in the ice upstream could loose a sudden rush and sweep homes away. Two bridges carrying the main street

across the river withstood tons of ice piled up almost to road level. The street was under a foot of water at some points.

Georgetown Herald (February 11) “Flood Hits Glen” - Rain all Tuesday night and Wednesday morning created turbulent rivulets throughout the Credit River watershed which culminated in the sudden breakup of the ice that had blocked the river channel solid. At writing time, many Glen Williams homes were completely surrounded by muddy water. House in the immediate river area were evacuated.

Globe and Mail (February 11) At the village of Glen Williams, 50 houses were affected by floodwaters from the Credit River.

Norval and Georgetown 1969

Action Free Press (July 30) A storm which dumped an estimated three inches of rain on the Georgetown –Norval area skirted the district around 1:30 Monday. Norval and Georgetown were hardest hit. The west branch of the Credit River rose an estimated three feet and forced residents of the trailer camp at the foot of the Norval - Georgetown hill to evacuate. The 10th line of Esquesing which runs into Norval was reputed to be covered with a foot and a half of water at one point.

Georgetown 1972

Georgetown Herald (April 20) Turbulent water gushes out of the culvert under the CNR main line on its way to the John Street flats a few hundred yards down stream. Spring runoff was so heavy last week that the flats were completely under water. The low land bordered by John, McNabb, Queen and Guelph streets became a muddy lake last week when the swelling waters of the creek flowing through it created flood conditions.

Glenn Williams 1975

Brampton Daily Times (February 26) “Ice Jams on the Credit Flood Area Homes and Parks. The ice that jammed the Credit River, flooding 30 homes in Glen Williams, Eldorado Park in Huttonville and the Churchville and Meadowvale Park is now past Streetsville. In Eldorado Park, flood waters surged into the recreation pavilion damaging the floor with 3 inches of water.

Glenn Williams 1976

Georgetown Herald (February 18) Blasting to break up ice along the Credit River began early Tuesday morning by C.V.C.A. The initial blasting was one ½ mile north of the Paper Mill Dam.

Glenn Williams 1977

Orangeville Banner (March) Flood warnings were issued Wednesday, March 9 to local municipalities, police and press when warm water moved into the Credit River Valley. Thursday an ice jam developed in Glen Williams upstream of the Paper Mill dam.

Glenn Williams 1977

Georgetown Herald (March) One home is reported to have been flooded at Glen Williams.