





State of the Environment Report V

for the City of Burlington

BURLINGTON
Sustainable
Development Committee

CITY OF
Burlington

June 2015

Prepared by the Burlington Sustainable Development Committee

BURLINGTON
Sustainable
Development Committee

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Disclaimer

The opinions contained in the State of the Environment Report (SOER) are those of the Burlington Sustainable Development Committee and may not reflect the opinions of city or regional staff, council members or external agencies. Effort has been made to ensure facts and data are correct and up to date where possible at the time of writing and editing. However, it is acknowledged that many of the topics covered in this document are dynamic in nature. Therefore, some information may not reflect the current situation. A reader that is planning to use information in the SOER as reference material should contact the appropriate agency to ensure information contained herein continues to be relevant.

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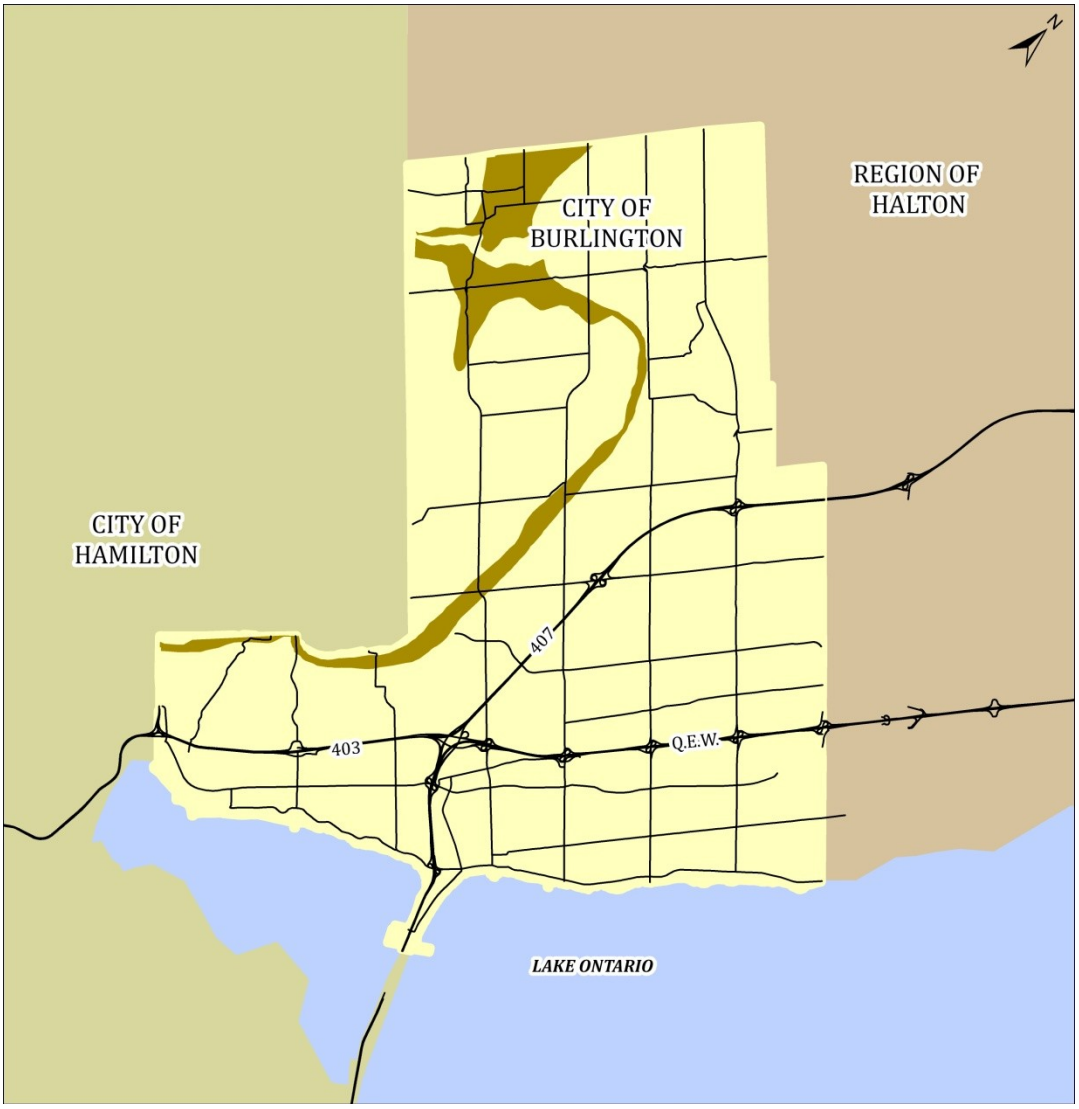
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Background

Burlington is a city that lies at the western end of Lake Ontario. In the northern part of the city are the Niagara Escarpment and the Greenbelt, both of which are being retained as rural lands. The area of the city south of the Niagara Escarpment and the Greenbelt, generally the lands south of Highway 407, form the urban area of the city. Administratively, the city is one of the local municipalities that make up Halton Region, and the city is part of the Greater Golden Horseshoe area as defined by the province.

City of Burlington



Sustainable Development

In 1990 the City of Burlington declared itself a sustainable development community, a community which is in harmony with its environment and which strives to provide its citizens with safe, comfortable livelihoods. The Sustainable Development Committee was established as a volunteer citizen committee to provide advice to Burlington City Council.

The definition of sustainable development that is used by the Sustainable Development Committee is the definition put forth by the United Nations Brundtland Commission on the Environment and Development: ″Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.″ The Committee has developed this definition into the following principles and objectives that are used as a framework for the committee's work:

Principles:

- Support responsible development that promotes efficiency and enhances the quality of life.
- Protect the environment in both a proactive and remedial manner, with emphasis on anticipation and prevention.
- Make decisions that recognize the interdependence of humans and nature in a common ecosystem.
- Promote responsible resource use and conservation practices.
- Have regard for environmental, economic and social costs and benefits in the development and use of resources, products and services.
- Promote responsible stewardship to ensure equitable use of natural and environmental resources in order to meet essential needs of both present and future generations.

Objectives:

- **Protection of Natural Resources**: Preserve and extend accessible green spaces, shorelines, natural water courses and the Niagara Escarpment for future generations.
- **Reforestation of the City**: Promote the replanting and management of vegetation on private and public property within the city.
- **Full Public Participation in Development Decisions**: Allow the public to be part of all planning decisions. Economic, environmental and social impacts of proposed developments should be considered.
- **Actively Promote Sustainable Development**: Advocate changes at the senior levels of government, as well as in the city, in order to evolve towards sustainability.
- **Make the Best Use of Land**: Land-use decisions based upon an ecosystem approach to ensure environmental integrity and diversity. To include, but not be limited to, promoting environmentally sensitive lands and using fertile soil for agriculture throughout the municipality.
- **Protection and Enhancement of Natural Features**: Protect and enhance Burlington's natural features by ensuring that the physical features of shorelines, agriculture lands, flood plains, forestry tracts and notable landmarks such as the Niagara Escarpment are preserved for future generations.
- **Natural Storm Water Management**: Protect water courses in their natural state and for those water courses that have been significantly altered, restoration to a more natural state will be encouraged as opportunities arise.
- **Balanced Development**: Provide a community plan and an economic strategy aimed at creating sustainable and appropriate forms of development that reflect human scale and

a sense of community as well as representing a balance between urban development and natural surroundings.

- **Efficient Urban Design**: Increase the efficiency of land use in the urban community in terms of energy and time, promote intensification and diversification policies rather than policies that generate urban sprawl.
- **Minimal Discharge of Toxic Pesticides and Other Toxic Chemicals**: Promote the elimination of private and public use of toxic pesticides and other chemicals that have negative effects on the environment, particularly those known to be persistent.
- **Accessible Community Development**: Form a new type of community development which includes readily available local community components such as commerce, shopping, employment, education and recreation within walking distance of all residences.
- **Responsible Use of Natural Resources**: Encourage conservation of natural resources, the city should work towards ensuring that users are charged for the full local costs of their individual use of water, electricity and sanitary sewers. There should also be educational programs to encourage conservation of natural resources.
- **Integration of Natural Features and Green Space**: Integrate natural features and green space in all new developments and intensification projects.
- **Energy Conservation**: Promote energy conservation through efficient land use planning and building design.
- **Ecosystem Auditing**: City of Burlington should prepare an objective ecosystem audit of the entire municipality at regular intervals.
- **Balanced Transportation System**: Develop a balanced transportation system including transit, pedestrian, and cycling amenities and best use of the road system for movement of goods and people, with the existing facilities used to their fullest capacity.
- **Evaluation of Development**: Continuous monitoring and evaluation of development should take place to ensure that it does not have adverse impacts on the city's finances and the environment.

Introduction

This is the fifth State of the Environment Report (SOER) prepared by the Burlington Sustainable Development Committee. The purpose of this report is to provide information on the state and health of Burlington's environment and to make recommendations for improving it.

Community growth and development have an impact on the environment. Environment as described in this report includes not only the components of the natural environment - air, water and land - but also the community environment - rural and urban land uses. The impact of growth on the environment is easily stated, but not easily measured. If Burlington is to remain sustainable, environmental impacts must be measured and minimized as the community grows and develops.

This report identifies eleven themes, represented by the chapter headings. Within each theme there are several issues, and for each of the issues, the report includes sections on:

- Why it was measured
- What was measured – indicators
- What was found – indicator values and trends
- What is happening to address the issue

Each chapter then ends with a conclusion and recommendations on all the issues in the chapter.

Progress is being made in certain areas of the city related to environmental sustainability:

- The Cootes to Escarpment Land Strategy and Park System has partnered various levels of government, agencies, utilities, and non-government organizations to preserve and expand natural areas and engage the community on the value of these lands. The system is one of the most biologically rich areas in Canada with moe than 1,580 documented species and habitat for more than 50 species at risk.
- Under Places to Grow and with a firm urban and rural boundary, the city will continue to transform from a suburban community to a more urban built environment that should support a sustainable transportation network.
- Support for urban agriculture and local food opportunities, such as community gardens, continues to grow.
- Halton Region continues to experience success in reducing the waste diversion rate by expanding programs for local residents.
- Greenhouse gas emissions from the community and city operations are decreasing.
- Water efficiency efforts appear to be working as water consumption on a per capita basis appears to be decreasing (for low rise residential development).

However, it is acknowledged that there are challenges facing the city going forward:

- The uncertainty of the impacts of climate change, not just with local infrastructure, but with health, food security, the natural environment, among others. A regional adapation strategy should be considered.

- The automobile is still the preferred mobility option in Burlington and changing the modal split in favour of other sustainable modes like transit, walking and cycling will require ongoing support in these areas.
- The urban forest is under threat by invasive species and urban development, making the Urban Forest Master Plan an important resource.

SOER V Recommendations

I. Natural Heritage:

1. That City Council approve the resources required to implement the remaining Urban Forest Management Plan recommendations, to continue to deliver the EAB Management Strategy and focus on community outreach and awareness, and partner with other organizations and agencies.

2. That the city complete a review of woodlands and treed resources that are not of regional interest (ie. those that are not Significant Woodlands) to implement a means of protection to reduce clear-cutting prior to development.

II. Land Use Planning:

3. That the city focuses on future land planning opportunities for mobility hubs, with design principles supporting energy efficient and smart development with a sustainable transportation network.

III. Rural Lands & Agriculture:

4. That the city expand the position and responsibilities of the Community Garden Coordinator from seasonal part time to support the local food movement in Burlington, by encouraging local food production and distribution, and supporting urban and rural agricultural programs.

IV. Waste Management:

5. That the city set goals and standards for waste diversion at public events being held at city parks and facilities. Work with Halton Region and the Parks & Recreation Department to develop a Waste Management guide/policy for special events being held on city property.

6. That the city complete an internal non-hazardous solid waste audit on City Hall. Establish baseline results and set a goal to increase waste diversion at city facilities. Share data with staff and follow up with the development of a waste reduction work plan.

V. Transportation:

7. That the city undertake Transportation Modal Split surveys on a more consistent basis than the Transportation Tomorrow Survey. It is recommended that this survey include questions to detail why residents of Burlington choose their preferred mode of transportation and what steps need to be taken to encourage residents to rely on more sustainable transportation options.

VI. Energy:

8. That the city continue the implementation of the Community Energy Plan with a focus on fuel and cost savings, by switching from gasoline vehicles to electric/hybrid vehicles, investigating opportunities for local sustainable generation (e.g. district and renewable energy), improving efficiency, increasing community engagement and improving the built form.
9. That the city continue with corporate energy reduction targets and mechanisms to find energy saving initiatives by considering both upfront capital and operating costs.
10. That the city works closely with the province to ensure the Long Term Energy Plan results in both energy and greenhouse gas emission savings.

VII. Air Quality:

No recommendations in this chapter.

VIII. Water:

11. That the city implement repairs and actions to mitigate future flooding impacts based on the results of the current study being carried out by the City of Burlington, Region of Halton and Conservation Halton in a cost effective manner. The study should include an update of the design standards for the stormwater system considering climate change impacts. That the city follow the principles (e.g. electrical boxes above flood level) required by Alberta when remediation is being carried out on residences, etc. (particularly where residences have been flooded repeatedly).
12. That the city request a geotechnical report through the development planning process to ensure the proper design is applied when building construction takes place near or below the water table, particularly in low lying areas where the water table level is near the surface. Ensure the Ontario Building Code requirements are implemented, such as waterproofing of the foundation walls and measures to mitigate a reduction in the bearing capacity of the soil.
13. That the city, in partnership with Conservation Halton as appropriate, undertake a series of pilot projects on city properties using Low Impact Development stormwater management techniques to treat stormwater runoff at its source rather than conveying it through the traditional stormwater infrastructure.
14. That the city work with the Region of Halton to include measures in the water conservation and efficiency strategy that encourage water use reduction by residents and industry, such as fixture and appliance rebates plus rainwater reuse incentives, education on items like water efficient humidifiers, and water use audits.
15. That the city, in collaboration with Conservation Halton, should establish a groundwater well below the escarpment in Burlington, to facilitate the measurement of groundwater levels and the collection of groundwater for analysis. This monitor will provide for an assessment of the long-term trends in groundwater conditions below the escarpment.
16. That the city ensure that where new development is proposed in the rural areas on private well water supply and or private sewage disposal system the region's Guidelines for Hydrogeological Studies and Best Management Practice is used to assess the development impact on groundwater quality and quantity.

IX. Wastewater:

17. That the city work with the region to establish a funded program for disconnection of downspouts and other rainwater handling systems from the sanitary sewer system. Several municipalities have already established programs to permanently disconnect downspouts from sanitary sewer to mitigate flooding.

X. Climate Change:

18. That the city ensure community resiliency by working with regional partners including Halton Region, Conservation Halton and the local municipalities to develop a climate change adaptation strategy.

XI. Sustainable Buildings:

19. That city staff re-introduce the green building standards originally proposed in 2012 to council and that staff continue to look at options to encourage builders to include green building measures in their projects, particularly during the preconsultation meetings. Involvement of the Sustainable Development committee members would be welcome.

20. That the city continue to undertake a training program for city staff who deal with planning applications and building permits to obtain LEED accreditation and to make use of the LEED Neighbourhood checklist developed by the SDC.

Previous *State of the Environment Reports* were prepared in 2011, 2007, 2004 and 1998. The number of topics reviewed and measured has changed over the years, based on the availability of data and based on the importance and relevance that the committee thought significant. Some topics can be traced over the years and it can be determined whether or not progress has been made on achieving sustainability. As many of the measures have changed and many of the results are subjective rather than objective, there is no overall conclusion on whether the state of the environment has improved or not. Changes to the report content were made for such reasons as new author preference and data became unavailable, but also the report was re-organized and alternative data sources were substituted.

The following table provides a summary of the topics covered in each of the five SOER reports:

Chapter	I - 1998	II - 2004	III - 2007	IV – 2011	V - 2015
Biota or Natural Heritage	ESAs	Biodiversity	ESAs	ESAs	Natural Heritage System
	-	-	Other Natural Areas	Cootes to Escarpment	Cootes to Escarpment
	-	-	-	Urban forest	Urban Forest
Urban Land Use Planning	Population	Population	Demographics	Demographics	Demographics
	Housing	Housing	Housing	Housing	Housing
	-	Commercial & industrial land	Employment Lands	Employment Lands	Employment Lands
	-	Brownfields	Brownfields	-	-
	Urban parks	Urban parks	Urban parks	Urban parks	Parks & Open Space
	-	-	-	Intensification	Intensification
	-	-	-	Sustainability indicators	-
	-	-	-	School infrastructure	School Infrastructure
Rural and Agriculture	Agriculture	Rural lands for agriculture	Rural lands for agriculture	Rural lands for agriculture	Rural lands for agriculture
	-	-	-	Rural lands	Rural lands
	-	-	-	Urban agriculture	Urban agriculture
	-	-	-	Farmers markets	Farmers markets
Waste Management	Closed landfill site	Closed landfill site	Closed landfill site	Closed landfill site	-
	Municipal solid waste	Municipal solid waste	Municipal solid waste	-	Residential Waste Collection
	Waste diverted	Waste diverted	Waste diverted	Waste diverted	Waste Diversion
	-	ICI waste	ICI waste	ICI waste	-
	Household hazardous waste	Household hazardous waste	Household hazardous waste	-	-
	Hazardous and liquid industrial waste	Hazardous and liquid industrial waste	-	-	-
	-	Pesticides	-	-	-
	PCB waste	PCB waste	-	-	-
	Biomedical waste	-	-	-	-
Transportation	Vehicles	Vehicles	Vehicles	Vehicles	Personal Vehicles
	Public transit	Public transit	Public transit	Public transit	Public transit
	Bikeways	Bikeways	Bikeways	Walking & cycling	Walking & Cycling
	Winter control	Winter control	-	-	-

Chapter	I - 1998	II - 2004	III - 2007	IV – 2011	V - 2015
Energy	-	-	-	-	Energy Production
	Electrical consumption	Electrical consumption	Electrical consumption	Electrical consumption	Energy Consumption
	-	-	Energy use & greenhouse gas	Energy use	-
Air Quality	Air quality index	Air quality index	Air quality index	Air quality index	Air Monitoring
	-	-	Smog	Smog	Smog
	Common air pollutants	Common air pollutants	Other air pollutants	Air pollutant characteristics	Air pollutant characteristics
	VOCs	VOCs	VOCs	-	-
	Wind and pollution	-	-	-	-
Water	-	Groundwater	Groundwater	Groundwater	Groundwater
	Surface water	Surface water	Surface water	Surface water	Surface water
	-	Stormwater management	-	Stormwater management	Stormwater management
	Drinking water quality	Drinking water quality	Drinking water quality	Drinking water quality	Drinking water
	Water consumption	Water consumption	Water consumption	Water consumption	Water consumption
	Recreational (beach closures)	Recreational (beach closures)	-	-	-
Wastewater	Effluent quality	Effluent quality	Effluent quality	Effluent quality	Effluent quality
	Effluent quantity	Effluent quantity	Effluent quantity	Effluent quantity	Effluent quantity
	-	-	Biosolids	Biosolids	Biosolids
Noise	Noise pollution	Noise pollution	-	-	-
Climate Change	-	-	Global climate trends	Global climate trends	-
	-	-	Possible change in Burlington	Possible change in Burlington	-
	-	-	Effects	Effects	Effects & Adaptation
	-	-	-	-	Mitigation of GHG Emissions
Sustainable Buildings	-	-	-	Green buildings	Green buildings
	-	-	-	Home renovations	-
Sustainable Consumption	-	-	-	Retailers	-
	-	-	-	Eco-certification labels	-
	-	-	-	Green procurement	-

Chapter 1: Natural Heritage

Introduction

The natural heritage in Burlington may be considered as the areas of the city which remain in a state or which have reverted to a state that is controlled by natural processes rather than human intervention. The best known of these is the portion of the Niagara Escarpment within the city boundaries. But there are a considerable number of smaller areas – creek valleys, woodlots, hedgerows, wetlands, etc. - that are also natural areas and are of importance to the ecological balance of our city. It should be emphasized that a substantial amount of these areas are in private ownership.

Natural areas provide habitat for a variety of plant and animal species, especially those that are rare or endangered. They provide travel corridors for animals and birds between various parts of the city. They provide groundwater recharge and cleansing areas. Some provide hiking and nature observation areas for residents and visitors. They are an essential part of our city and, if Burlington is to be truly sustainable, need to be preserved and enhanced.

What was recommended and where are we now?

The 2011 State of the Environment Report had two recommendations regarding natural heritage in Burlington:

Recommendation #1 That the city continue to support the Cootes to Escarpment Land Strategy and Park System by directing staff to work with partner agencies and landowners.
Status Update - Achieved Staff representatives are involved in the Cootes to Escarpment Land Strategy & Park System. Council recently approved additional funding of $25,000 towards a communications strategy. A celebration event was held on May 30th to recognize the donation of 15 hectares by the Holland family toward the Ecopark System.

Recommendation #2 That the city support the urban forest and implement the Urban Forest Management Plan.
Status Update - Ongoing Council approved the Urban Forest Management Plan in 2010 and implementation is ongoing such as the city's strategy to deal with the emerald ash borer infestation. Further, a private tree by-law was considered by council in 2013 but was not supported. The preferred course of action was to focus on public education/awareness related to tree care and health. Council did approve a public tree bylaw 68-2013 to regulate the planting, maintenance and removal of trees on public property www.burlington.ca/bylaws. Other items also approved included a public tree management policy to regulate the review and approval of city capital works projects impacting public trees, and delegated authority to the city arborist to approve tree removals subject to the new bylaw and policy. Additional information: Urban Forest Management Plan

This section focuses on three areas related to the city's natural heritage. The first issue deals with the Halton's Natural Heritage System, with information pertaining to both the regional Natural Heritage System and the Greenbelt Natural Heritage System. The second issue is the implementation of The Cootes to Escarpment EcoPark System. The third issue is related to the Urban Forest Management Plan that was approved in 2010 by the City of Burlington.

Issue: Natural Heritage System

The regional Natural Heritage System (NHS) is a systems approach to protecting and enhancing natural features and functions and is scientifically structured on the basis of the following components:

- significant habitat of endangered and threatened species,
- significant wetlands,
- significant coastal wetlands,
- significant woodlands,
- significant valleylands,
- significant wildlife habitat,
- significant areas of natural and scientific interest,
- fish habitat,

The Escarpment Natural Area and Escarpment Protection Area, as identified in the Niagara Escarpment Plan, are included in the regional NHS, along with regulated flood plains as determined by the Conservation Authority.

The Greenbelt Natural Heritage System also represents a systems approach to protecting natural features and functions within the Greenbelt Plan Policy Area, similar that of the regional Natural Heritage System with the following key features:

- sand barrens, savannahs and tall grass prairies,
- permanent and intermittent streams,
- lakes,
- seepage areas and springs, and
- alvars and,
- significant habitat of special concern species.

While the Greenbelt Natural Heritage System and the regional Natural Heritage System have different sets of planning policies, they complement each other and together implement Halton's vision of a sustainable natural heritage system that preserves and enhances the biological diversity and ecological functions of Halton.[1]

Within Burlington, the natural heritage system comprises 7,816 hectares.

What is Happening

Regional and Local Official Plans

The Region of Halton recently introduced a natural heritage systems (NHS) based approach under the Regional Official Plan Amendment 38 (ROPA 38). While portions of ROPA 38 remain under appeal, the natural heritage system policy framework and mapping were approved by the

[1] ROP February 18 2014 Interim Office Consolidation

Ontario Municipal Board on November 28, 2014. The city is currently updating the Official Plan which includes a conformity exercise with ROPA 38 and the identification of natural heritage system policies and mapping. Given that the natural heritage system has only recently been approved at the regional level, and has not yet been implemented at the local level, indicator data is not available for this issue and will be monitored in future State of the Environment Reports.

Long Term Monitoring
In 2005, Conservation Halton implemented the Long Term Environmental Monitoring Program. This program ensures that monitoring is completed in a consistent manner over an extended period of time. It also provides a comprehensive understanding of the structure and function of local ecosystems, which is necessary for assessing the long-term health of the watershed. It is designed to monitor species, ecosystems, and changes in the watershed over time. Monitoring reports are available on Conservation Halton's website.[2]

Biodiversity
Biodiversity is a term used to describe the number and variety of organisms found within a given geographic region. Ecosystems that have a wide variety of plants and animals tend to be healthier than those with a low level of biodiversity. Healthy ecosystems are dynamic and able to adapt more easily to naturally changing conditions. However, rapidly changing conditions caused by human activity have the potential to harm the natural environment and disrupt biodiversity.

Humans disrupt biodiversity in a number of different ways, including:

- Habitat degradation and loss
- Pollution
- Introduction of invasive species
- Unsustainable use of resources

Conservation Halton is committed to conserving biodiversity by protecting natural spaces, creating wildlife corridors, and increasing public awareness. Some of the activities which Conservation Halton is involved in include: review of development applications; undertaking long term monitoring; use of sustainable forest management practices, and raising awareness about invasive species and species at risk.

Natural Connections
Natural Connections is a collaborative outreach and engagement initiative between Conservation Halton and FutureWatch EDEP (Environment and Development Education Partners) aimed at connecting new communities in Halton to their natural surroundings. These connections serve as starting points to discuss social integration and local environmental issues, programs, services and opportunities. This initiative is designed to engage residents through a social, two-way dialogue that focuses as much on introducing residents to local conservation and recreation programs as it does on learning from their diverse perspectives on the environment.[3]

[2] www.hrca.ca
[3] www.hrca.ca

Issue: Cootes to Escarpment EcoPark

Why it was Measured

The Cootes to Escarpment EcoPark System is a collaborative initiative of nine local government and non-profit organizations in the Burlington-Hamilton area, at the southwestern end of Lake Ontario. Together, the partner organizations own or manage almost 1,900 hectares (4,700 acres) of natural lands in this area, and work together to protect, connect and restore the natural lands, and to deliver sustainable recreation and education opportunities.

The Cootes to Escarpment EcoPark System officially came into being in June 2013 via a Memorandum of Understanding (MOU) among the nine partner agencies, including:

- Bruce Trail Conservancy
- City of Burlington
- Conservation Halton
- Halton Region
- City of Hamilton
- Hamilton Conservation Authority
- Hamilton Naturalists' Club
- McMaster University
- Royal Botanical Gardens
- The Hamilton Harbour Remedial Action Plan Office also provides advice and secretarial support.

The MOU created a Governing Council and Management Committee to provide decision authority and guidance for implementation of the Cootes to Escarpment EcoPark System, and a Secretariat office to coordinate this work.

The MOU also establishes the following:

- A project work plan for 2013-2015;
- Joint partner funding for 2013-2015; and
- Exploration of special recognition or legislation for the area by the Provincial or Federal government.

What was Measured

A summary of the ecological significance of the Cootes to Escarpment Park System is provided in this section, as well as the amount of publicly owned hectares of park.

What was Found

The Cootes to Escarpment Park System is one of the most biologically rich areas in Canada with more than 1,580 documented species and includes habitat for more than 50 species at risk. It comprises part of the UNESCO World Biosphere Reserve (Niagara Escarpment) and is home to provincially significant wetlands, including Cootes Paradise and the RBG-Hendrie Valley-Lambs Hollow Wetland. It includes an important bird area of national significance (Cootes Paradise) and important amphibian and reptile areas (Cootes Paradise, Carroll's Bay and Grindstone Valley).

There is currently 1,900 hectares of publicly owned land in the park system at the time of writing this report.

What is Happening

In 2013-14, partners completed the Burlington Heights management plan which will be presented to City Council in the first quarter of 2015. Work is currently underway for the Clappison-Grindstone heritage lands and the Waterdown-Sassafras Woods Heritage Lands.

In September 2014, Conservation Halton, with funding support from the Bruce Trail Conservancy and the Hamilton Naturalist Club, finalized a transaction to purchase approximately 26 acres of natural areas in the EcoPark System abutting their existing Clappison Woods Resource Management Area. The Region of Halton is in the process of reviewing an application to reimburse Conservation Halton and their funding supporters 50% of the total eligible project costs associated with this transaction under the Greenlands Securement Program.

On May 30, 2014, the City of Burlington unveiled the new Eileen and John Holland Nature Sanctuary, an important addition to the EcoPark System. This 37-acre natural area was donated by Mr. John V. Holland to the City of Burlington in honour of his late wife Eileen.

Several events have been held recently to engage the local community in the new EcoPark. For example, a Community Stewardship Day was held to remove invasive species and plant native materials at the Nicholson Resource Management Area. This event was funded by the Walmart-Evergreen Fund.

On February 19, 2014, Dr. David Galbraith gave a presentation about the Cootes to Escarpment EcoPark System as part of Burlington Mayor Rick Goldring's "Inspire Burlington" series.[4] Dr. Galbraith spoke of the health benefits of access to natural areas. A number of Open Houses were also organized in early 2014 to invite the public to learn more about the EcoPark.

A joint fundraising strategy is being developed to support land securement, stewardship and Ecopark operations. This document will contain "best practices" or "guiding principles" for joint fundraising, as well as a statement of support to present to potential funders and donors. The Ecopark System Coordinator has developed a list of funding grant sources to approach for specific projects.

Stewardship and Land Securement

The partners will continue to work together to secure natural lands and work with private landowners to encourage stewardship on their properties. The EcoPark System Coordinator will work with the Hamilton Halton Watershed Stewardship Program to intensify efforts within the Cootes to Escarpment Park System area. Contact will be made with landowners to explain the environmental significance of the Park System and how to care for and enhance these natural lands.

Joint Management Plans

The Cootes to Escarpment Conservation and Land Management Strategy divides the EcoPark System into six core Heritage Lands Areas, which are geographic groupings of properties according to their core natural and cultural heritage and characteristics. An important focus of work in 2013-2015 will be on developing joint management plans for each of these six areas. Through completion of these plans, progress will be made towards harmonization of policies, regulations and land classification on EcoPark System lands and creation of new joint initiatives

[4] http://www.cootestoescarpmentpark.ca/news/details/inspire-burlington-presentation

to enhance existing programs and fill gaps related to habitat restoration, invasive species control, ecological inventories, environmental monitoring, education and interpretation, and cultural heritage protection.

Special Legislation
The partners will work together to explore special purpose legislation to recognize the EcoPark System. A detailed plan for creating special purpose legislation will be developed and implemented, including required approvals, timelines and involvement of key decision makers.

Issue: Urban Forest

Why it was Measured

Burlington's urban forest provides a wide range of environmental, economic and social benefits to the city's residents and to people across the region. The environmental benefits include, but are not limited to:

- Improving air quality by reducing air pollution;
- Cooling the 'urban heat island' through shading and evapo-transpiration;
- Treating and reducing the volume of stormwater runoff;
- Storing and sequestering atmospheric carbon; and,
- Providing habitat for urban and migratory wildlife.

In 2010, City Council approved the Burlington Urban Forest Management Plan (UFMP). The purpose of this plan is to establish a vision for Burlington's urban forest, review current practices of Burlington and compare them to established best practices in order to improve all aspects of urban forest management, inform and support current and future policy and budget directions and to promote public awareness of the importance of stewardship of Burlington's urban forest.

This Urban Forest Management Plan identifies opportunities on both public and private lands, in urban and rural Burlington, and focuses on five key areas:

1. Management and Implementation
2. Community Engagement and Stewardship
3. Protection and Preservation
4. Replenishment and Enhancement
5. Tree Health and Risk Management

Urban trees exist in a difficult environment. The lack of growing space above and below ground, contaminated and compacted soils, de-icing salt, and the physical damage caused by trenching, lawn mowers, and cars, are but a few of the factors that prevent most urban trees from reaching their potential.

Many urban forests have an over abundance of common species. This narrow genetic base leaves our urban forests vulnerable to insects and disease infestations. Dutch elm disease is a good example. The loss of elms in many North American cities was the crisis that first raised public awareness of the urban forest. Presently the largest threats are the Emerald Ash Borer and Gypsy Moths.

What was Measured

Information on the size of the tree canopy, the wooded natural areas and the number of street trees is found in this section. Progress on the implementation of the plan was also monitored.

What was Found

The Urban Forest Management Plan estimates that Burlington has a 23% tree canopy cover, with the majority of that being in the rural areas. Of that number,15% is in natural wooded areas, and the remaining 8% can be found along streets, parks, and other open spaces. The city's wooded natural areas cover over 3,800 hectares, with 3,150 hectares in the rural area. Most of these wooded areas are currently protected and designated as Environmentally Sensitive Areas (ESAs), and will remain protected in the future through the region's Natural Heritage System.

The Urban Forest Management Plan reports an inventory of 52,000 street trees found in the urban area. The majority are young or middle-aged, and non-native. Nearly one-fifth of the street trees are in conflict with utility lines or other infrastructure. There is little diversity with street trees as at least half are made up of Norway maple (25%), Ash (13%) and Honey locust (12%).

Of the 40 recommended actions in the UFMP, 14 of the actions have been deemed complete. Examples of completed actions include:

- Work order management process to track work requests and work performed on individual inventoried trees;
- Data added to the tree inventory on park trees and street trees located north of Highway 5;
- Use of a standard criteria and indicators to evaluate the state of the city's urban forest and track UFMP progress;
- Woodlands between 0.5 and one hectare delegated to the region under their tree by-law;
- Staff inspections of new tree plantings to ensure they meet specifications for future survival; and
- Addition of a landscape architect staff person in the Planning Department to assist with inspection and oversight of tree protection requirements.

One of the outstanding actions in the plan is to create an Urban Forest Community Coordinator function or role to support increased community engagement. This position would be a helpful addition to assist with the implementation of the UFMP, particularly with those actions related to establishing community partnerships, overseeing an urban forestry working group, as well as increasing public education and awareness to help improve tree health on public and private property.

What is Happening?

Emerald Ash Borer

The emerald ash borer (EAB) is a non-native beetle known to colonize in ash trees, laying eggs on the bark and in bark crevices on the trunk and branches. The larvae then tunnel beneath the bark and feed on the live cells between the bark and the sapwood, thereby cutting off the transport of nutrients and water to upper portions of the tree, and ultimately killing the tree.

The presence of the emerald ash borer in Burlington was first confirmed in 2010. EAB threatens to destroy the city's population of ash trees, which comprises approximately ten percent of the urban forest.

In 2010, Burlington City Council approved an EAB Management Strategy. This strategy involves treating ash trees with a diameter of 20 cm or greater, ongoing detection and surveying, and tree removals, as required. It also laid out strategies for further investigation of the city's ash trees and public communications. Council budgeted $11 million over the following 10 years to address this issue and committed to annual review of the EAB action plan.

In the 2013 Emerald Ash Borer Action Plan, staff recommended concentrating the detection surveys on the rural areas of the city. This involved placing 49 traps in various locations throughout the city's rural area including Lowville, Cedar Springs and Kilbride. The results of the detection survey in the rural area revealed moderate levels of EAB presence across all survey locations. This represents an increase from the results of studies conducted in previous years and indicates that EAB is now prevalent in both the urban and rural areas.[5]

As of February 2015, the total expenditure to date for the EAB Management Strategy is $2,260,969. Plans for 2015 include the treatment of 1,800 ash trees and the removal of an ever-increasing number of infested trees.

Private Tree By-Law

In 2013, the City of Burlington conducted a study on the feasibility of a Private Tree By-Law, one of the actions in the Urban Forest Management Plan. The purpose of this study was to explore options that would provide a balance between allowing for the reasonable use and enjoyment of private property, while addressing public concerns about tree cutting and the need to protect trees.

> Although the city is responsible for thousands of trees on streets and in parks and open spaces throughout the city, a large part of Burlington's urban forest grows on private property. These trees on privately owned land collectively provide benefits to more than just their owners. For this reason, it is the residents and those who own or manage trees on private property throughout the city that have the greatest ability to impact and influence the city's urban forest.
>
> Tree bylaws are being used progressively by more municipalities as one of the tools of urban forest management. They can be used for protecting both individual trees and small wooded areas on privately owned lands and are often implemented on the basis of protecting the overall urban forest canopy. In addition to protecting trees from being damaged or cut-down unnecessarily, private tree bylaws may also prevent trees from being removed prior to a development application being submitted.[6]

The recommendations from the Private Tree Bylaw Feasibility Review included several new initiatives aimed at increasing public education and awareness, protection of woodlands and building community partnerships to support the urban forest. It also recommended not implementing a private tree bylaw for the city.

This eight month comprehensive study involved extensive public consultation, including:

- Surveys of other municipalities
- Interviewing local arborists and tree care companies

[5] Report RPM-03-14
[6] Report RPM-08-13

- A community workshop
- Twp online public surveys
- A statistically valid telephone survey
- Media Releases
- Articles in City Talk
- Burlington Post Advertisements
- A project-specific page on the city website
- An email address and mailbox for public feedback
- Facebook and twitter posts
-

The findings of the over 70,000 touch points with the community were:

- **Residents recognize the value of trees to their community**. As seen through the various points of public engagement, residents agree that trees provide many benefits. The benefit to neighbourhood aesthetics and character is seen as the greatest benefit. As trees mature, there is a greater appreciation of the benefits they provide.
- **Support for a bylaw regulating trees on private property is low.** It was felt by many that there is more to be gained from a reward and incentive program instead of the implementation of additional regulations related to private lands. As the costs of administering and enforcing a bylaw were introduced, the support dropped even further. Many felt that efforts were better spent on education and awareness and not on additional regulations.
- **The unnecessary cutting of healthy trees on private property is not prevalent.** The survey of local arborists and tree care companies revealed approximately 1,800 trees were removed on private property in 2012 within Burlington. Further, a high percentage of these trees were removed for reasons related to tree health (78%), or property damage/landscape improvements (15%), with only 5% removed for home improvements (e.g. decks, additions, etc.). The number of trees reported to be removed for the latter category represents a small percentage of the estimated 1.7 million trees in Burlington.
- **Development is viewed by many as a contributor to the loss of trees.** The subject of a private tree bylaw frequently arises in conjunction with development sites. It is important to note that a tree on property that is part of a development application would be exempt from a private tree bylaw, if approved.
- **There is a desire amongst residents to increase public education and awareness about trees.** Throughout the consultation process, feedback from residents included suggestions around more voluntary means of protecting trees.

Mountainside Park Forest Health Inititiative

Mountainside Park contains a seven hectare wooded area that is designated a “Significant Woodland” based on Halton Region criteria. The woodlot is surrounded by urban development with minimal connections to other naturally vegetated corridors, a watercourse which traverses from north to south and several formal and ad hoc trails.

An assessment of the trees within the woodlot was performed by a professional Forest Resource Management consultant, which revealed numerous dead and dying trees requiring removal. Recognizing the importance of this woodlot to the community, a replanting initiative is planned to replant approximately 5,500 saplings throughout the woodlot. The saplings used for planting are of a species native to this area with many of those grown from seeds taken from

this woodlot and others across the city. The goal is to maximize the health and sustainability of this woodlot for future generation to enjoy.

Mohawk Park Forest Management Plan
The wooded area of Mohawk Park contains a high percentage of ash trees, which are threatened by the infestation of the emerald ash borer beetle. An assessment of the trees within the woodlot revealed approximately 200 dead and dying trees, mostly as a result of the emerald ash borer. As these trees present a potential safety hazard to adjacent properties and to people using the park for recreation, the dead and dying trees must be removed. In addition, there is a presence of invasive species such as common buckthorne and garlic mustard within the woodlot. The removal of these trees will unfortunately have a significant impact on the way the woodlot looks as it stands today.

To restore the health of the Mohawk Park woodlot, approximately 200 dead or dying trees and the invasive species will be removed. Also, 2,000 saplings will be planted in the spring. These saplings are of a species native to the area of Burlington, with many grown from seeds taken from woodlots within the city.

Roseland Tree Planting Initiative
The Roseland community is an area dominated by mature trees potentially reaching the end of their natural life. City staff have partnered with the Roseland Community Organization to identify locations for planting young trees in advance of the natural loss of the mature trees to maximize the tree canopy and to retain the neighbourhood character as much as possible. A focussed planting initiative will occur in spring/summer 2015.

Halton Forest Festival
The Halton Forest Festival is an annual four day outdoor event held at Rattlesnake Point Conservation Area. During the week, the festival educates grade 6 and 7 students who are provided with experiential, interactive and curriculum-linked activities that allow them to get outside and immerse themselves in their local environment. The event is followed by a public day which takes place during Conservation Halton's Fall into Nature event. The city has sponsored this event as it provides the community an opportunity to experience similar activities and presentations to learn about forestry stewardship.

Conclusion

As climate change has become a major concern for the world, it is critical that we preserve, restore and enhance what remains of our natural heritage. This is particularly true of interior forest habitats, which among other ecological functions, act as a 'carbon sink' by removing carbon dioxide from the atmosphere as part of the process of photosynthesis. Also it is important that the urban forest remains strong and healthy. The Cootes to Escarpment Land Strategy and Park System is an ambitious initiative that brings together various levels of government, agencies, utilities, and non-government organizations with the common goal to preserve and expand our natural areas and educate the public on the value of these lands.

Recommendation:

1. That City Council approve the resources required to implement the remaining Urban Forest Management Plan recommendations, to continue to deliver the EAB Management Strategy and focus on community outreach and awareness, and partner with other organizations and agencies.

2. That the city complete a review of woodlands and treed resources that are not of regional interest (ie. those that are not Significant Woodlands) to implement a means of protection to reduce clear-cutting prior to development.

Chapter 2: Land Use Planning

Introduction

Burlington originally settled along the lakefront and over the years urban development has spread northwards. New subdivisions have now been built north of Hwy 5, and the urban boundary is generally along Hwy 5 west of Guelph Line and Hwy 407 eastwards. All of the lands north of the urban boundary are protected by the provincial Greenbelt Plan and policies in the city's Official Plan, restricting urban development in this area. The boundaries of the Greenbelt Plan are shown in Figure 3.4 in the next chapter.

Burlington is a city transitioning from a suburban bedroom community with a small downtown and shopping malls, to a city with a vibrant downtown, intensifying arterial corridors, mixed use development and growing employment opportunities. However, this change also brings with it several challenges and/or opportunities. Should stable neighbourhoods be protected? How to deal with changes in transportation and support a more sustainable transportation network? How do mobility hubs factor into the changing Burlington? The demographics of Burlington have also changed; residents have aged and in percentage terms, there are fewer children.

The city is currently in the middle of updating its Official Plan, a document that describes the city's land use strategy over the next 20 years. It addresses the location and form of new housing, industry, offices and shops as well as anticipated needs for infrastructure. Streets, parks, transit, schools, community amenities, and everything else needed for a growing city are all considered in the Official Plan.

In the past, the city largely accommodated growth by expanding development outward. The city is now reaching a state of 'build out', meaning the undeveloped land at the edges of the city will no longer be available for new development and growth. Instead, the city must 'grow in place' within the urban limits. This means planning for and accommodating development that is more intensified with supporting services, such as institutions, employment and green spaces. There is also a strong connection between how the city grows and a sustainable transportation network, that supports active transportation opportunities and public transit.

With Burlington reaching greenfield buildout, the city is focusing its efforts to "Grow in Place". The goals of Burlington's "Grow in Place" strategy are to:

1. Focus growth within the urban area
2. Protect our rural and natural areas
3. Create a city with supporting land uses, infrastructure, and services to enable all of its residents to be supported throughout their entire lives.

Burlington is required to focus growth in existing urban areas under 'Places to Grow: Growth Plan for the Greater Golden Horseshoe, approved by the province in 2006. Focusing growth to urban areas ensures better use of land and infrastructure; preservation of employment areas for economic opportunities; and conservation of natural areas and agricultural lands and support of a better transportation system. The growth plan was recently amended to include population and employment projections to 2041.

What was recommended and where are we now?

The 2011 State of the Environment Report had one recommendation regarding land use planning in Burlington:

Recommendation #3 That the city work with the two school boards to examine planned school closures to ensure that, as much as possible, all school lands are preserved as public green space and that, where appropriate, the school building is re-used.
Status Update – Ongoing Staff work with the boards through a process to determine how much land the city may ask for when schools close (if any). Staff have also taken a report to council on the criteria to evaluate the need for land. The city currently has a surplus school process that involves community consultation. Change to the process would require a report to council for the structure and policy development. School boards have provincially mandated requirements to address planned school closures. This is a different process than disposal of land under 444/97. Any city involvement in surplus school sites must fall within provincial regulation 444/97 regarding the disposal of surplus school lands.

Issue: Demographics

Why it was Measured

The number of residents and their present and future needs for housing, employment, goods and services, transportation and recreation are the determining factors for land use designations.

The type of accommodation desired by residents of a city is determined by a variety of factors, among them age, family size and income. Young individuals, new Canadians, couples and families may seek high density (apartment) housing, as it is usually less expensive and often available on a rental rather than an ownership basis. As family size or income increase, lower density (town homes or detached houses) is often preferred. Seniors, tiring of or unable to continue with home maintenance may choose to move from low density housing into medium or high-density housing. Knowledge of the present and future demographic trends of a community helps to determine the types of housing that will be needed in the future.

The main data source for this chapter is the 2011 Statistics Canada census data, related to population growth and age groups. Additional demographic information regarding Burlington can be found in the Community Development Halton report Vital Signs.

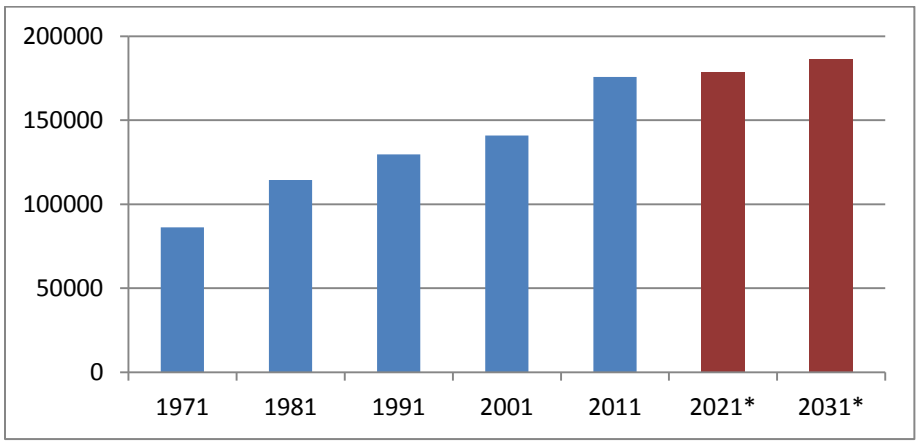
What was Measured

Population statistics from the 2011 Census of Canada were collected and were supplemented with information on projections from the “Best Planning Estimates of Population, Occupied Dwelling Units and Employment 2011 to 2031” from the Region of Halton, June 2011 as well as data from previous State of the Environment Reports for historic information.

What was Found

In 2011, Burlington had a population of 175,779 according to census data from Statistics Canada. Population growth from 1971 to 2011 is shown in the graph in Figure 2.1, with projections to 2031. The population more than doubled between 1971 and 2011, growing from 86,125 in 1971 to 175,779 in 2011. The estimated population for 2031 is 186,169. The graph shows limited projected growth in comparison to previous years which is partially due to the fact that the majority of Burlington's greenfield residential lands will be developed by 2015.

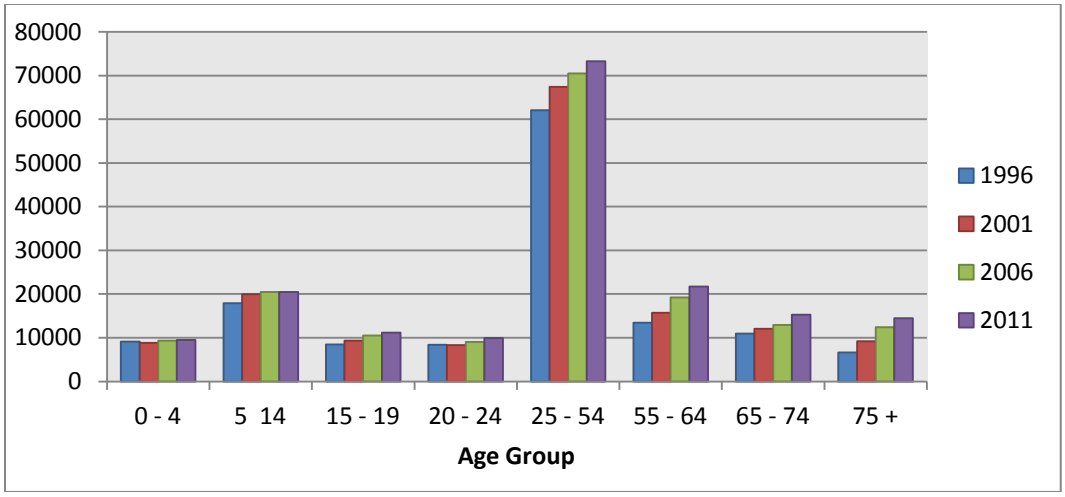
Figure 2.1: Population in Burlington 1971 to 2031



(*2021 & 2031 – forecasted population figures)

The range of age groups has changed in Burlington through time. Generally the median age of residents has been increasing, from 36.7 in 1996 to 41.8 in 2011. Burlington has the highest proportion of older residents in Halton; people aged over 65 make up 16.9% of the population of Burlington and 13.3% of the population of Halton. Similarly, people aged over 75 are 8.2% of the population in Burlington and 6.1% in Halton. Figure 2.2 shows that each age group in Burlington has been increasing between 1996 and 2011, with the exception of the 0 – 4 year and the 20 – 24 year age groups, which have not grown significantly. The age groups with the largest increases are the adult age groups, 25 – 54, 55 – 64 and seniors 75+.

Figure 2.2: Age groups in Burlington 1996 to 2011



Source: Statistics Canada

What is Happening

The city has grown gradually northwards over the years but the northern boundary for urban development is now fixed, so further expansion northwards will not happen. This is because the northern boundary of the city is the Greenbelt and urban development is not permitted in the Greenbelt. As the last greenfield areas are developed, development in the city will become all infill and generally more intensified.

Issue: Housing

Why it was Measured

As indicated in the population section, varying age groups with corresponding lifestyle characteristics generally impact the preference for different types of housing. As well, housing types have different environmental impacts. Low density (detached homes) provides a personal living space, buffer from one's neighbours and personal green space. However, the number of citizens who can be accommodated in this type of development is less, so that more land is needed to support a given population. Also, servicing costs on a per dwelling basis are greater and there is increased dependence on the automobile as distances from commercial and recreational services are often greater.

Medium and high density areas permit a greater population in a given area and, when well designed, can create liveable urban environments. Fewer vehicles per household may be needed as neighbourhood services will be within walking distance or close to transit services. Sustainable development requires a mix of housing types, commercial and institutional uses, and good neighbourhood design to meet the above considerations as equitably as possible.

What was Measured

Data on the number of dwelling units classified as low, medium and high density was obtained in five year intervals from 1981 to 2011 from Statistics Canada census data. Projections through 2031, also at five-year intervals, are from "Best Planning Estimates" Region of Halton, 2011. It should be noted that the definitions of medium and high density housing have changed from census to census, but the changes do not affect the overall conclusions. Currently, single detached and semi-detached housing units are considered to be low density, townhouses and duplexes are considered to be medium density, and apartment units are considered high density. Also the projections from the Best Planning Estimates do not contain revised projections to take into account provincial Growth Plan policies, so future projections will likely show a greater trend to higher density housing.

What was Found

Table 2.1 shows that the percentage of housing units of each type has been relatively constant over the last twenty-five years (1981 – 2011). Table 2.2 shows Burlington housing completions by type to be decreasing for low density housing and increasing for high density housing.

Table 2.1 Burlington Housing Units by Type

Year	Low Density		Medium Density		High Density	
	Actual	% Total	Actual	% Total	Actual	% Total
1981	22,605	59.9	7,025	18.6	8,250	21.8
1986	24,200	60.3	7,170	17.9	8,745	21.8
1991	27,935	60.4	8,200	17.7	10,126	21.9
1996	29,230	58.5	8,840	17.7	11,875	23.7
2001	34,645	60.4	9,424	16.5	13,250	23.1
2006	37,390	59.2	11,585	18.3	14,185	22.5
2011	39,250	57.1	13,705	19.9	15,820	23.0
2016*	38,936	54.4	13,820	19.3	18,862	26.3
2021*	39,324	52.5	14,213	19.0	21,343	28.5
2026*	39,424	50.7	14,537	18.7	23,726	30.5
2031*	39,540	49.1	14,839	18.4	26,193	32.5

Source: Past data from Statistics Canada Census Data 1981 - 2011
* Projected data from Halton Best Planning Estimates, 2011

In the 2011 census year, low density units made up 57.1% of the total housing units, medium density made up 19.9% and high density made up 22.5%. The percentages are expected to change in the future, with low density dropping to 49.1%, medium density dropping to almost 18.4% and apartment/high density increasing to 32.5%.

Table 2.2 shows housing completions by type, with a general trend of decreasing completions in the low density sector and increasing completions in the high density sector. This is representative of future residential development patterns in Burlington given the limited greenfield development opportunities.

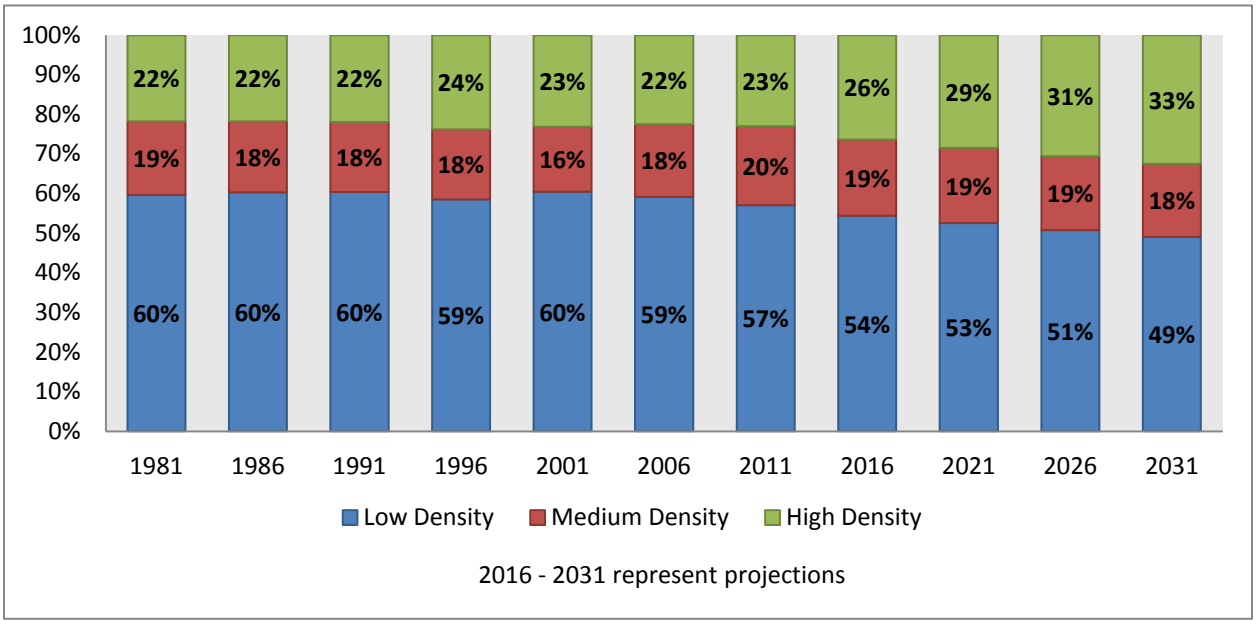
Table 2.2 Burlington Housing Completions by Type

Year	Low Density		Medium Density		High Density	
	Actual	% Total	Actual	% Total	Actual	% Total
2009	354	43.9	214	26.6	238	29.5
2010	466	42.6	139	12.7	488	44.6
2011	347	39.9	140	16.1	382	44.0
2012	298	49.5	154	25.6	150	24.9
2013	109	18.2	150	26.9	329	54.9

Source: Halton Region 2013 State of Housing Report

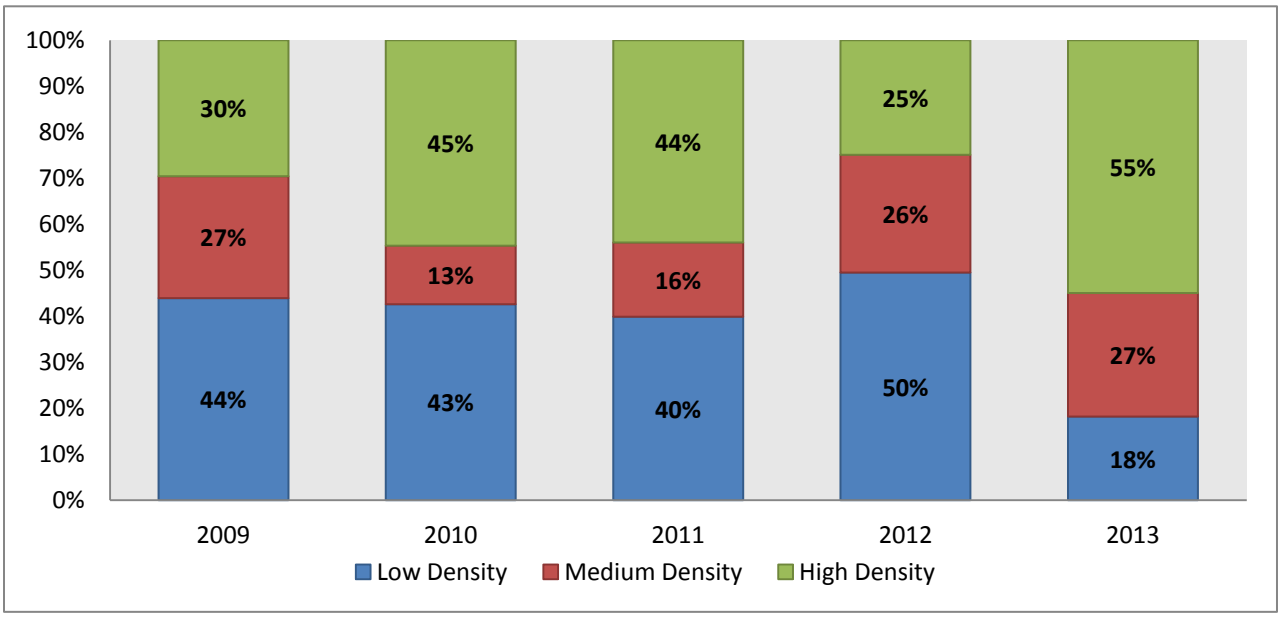
The data is shown in two graphs to illustrate that although the overall amounts of housing of each type in Burlington are increasing, there are identifiable shifts in the percentage mix of housing.

Figure 2.3: Burlington Occupied Housing Units by Type
1981 – 2031 – Actual and Projections



Source: Statistics Canada Census Data 1981 – 2011 & Halton Best Planning Estimates, 2011
1981 – 2011 – Actual; 2016 – 2031 - Projections

Figure 2.4: Burlington Housing Completions by Type, 2009 - 2013



Source: Halton Region 2013 State of Housing Report

What is Happening

The overall mix of housing in Burlington is changing from predominantly low density to an increasing percentage of medium and higher density housing. As much of the new higher density housing is within or close to mixed-use areas, this change will assist in making Burlington a more sustainable and healthy community as more residents will be within walking distance of shopping, recreation and leisure activities. Figure 2.4 illustrates that new housing unit completions over the past 5 years have shifted from being predominantly low density housing units with 44% new low density housing in 2009 to 55% high density units in 2013.

Issue: Intensification

Why it was Measured

A key focus of the provincial Growth Plan is intensification and Burlington has introduced planning policies in the Official Plan to encourage an increase in intensification within the city. Intensification will occur in the downtown Urban Growth Centre (UGC), along corridors such as Fairview Street and Plains Road, around GO Transit stations, and within potentially in some low density areas. Of special note is the opportunity provided by the four mobility hubs in Burlington, the downtown core and the three GO Transit stations, which have the potential to become special mixed use intensification areas which may support more people living and working in the city.

What was Measured

The previous section on housing looked at the types of housing units built in the city, and commented on the trend to higher densities. This section will measure the intensification as defined in the Growth Plan. The Growth Plan requires that the downtown Burlington Urban Growth Centre achieve a density of 200 residents and jobs per hectare by the year 2031, and that 40% of growth be within the built-up area after 2015 (note – the 40% is a requirement for regional municipalities, not local municipalities, so it is a requirement for Halton Region overall not for Burlington specifically). Burlington is expected to exceed the 40%.

What was Found

In 2006 work was undertaken by the planning department to define the boundaries of the Urban Growth Centre (UGC) in downtown Burlington. The boundaries of the UGC and the intensification corridors are shown in the map in Figure 2.5. The planning department estimated that there were 142 persons and jobs per hectare in 2006 in the UGC (report PL 93/06). This number can be monitored over the years to determine how well Burlington is achieving the Growth Plan target of 200 persons and jobs per hectare. In addition, the number of housing units built in the UGC and the intensification corridors can be measured over the years to determine whether the targets are being met.

Figure 2.5: Urban Growth Centre and Intensification Areas

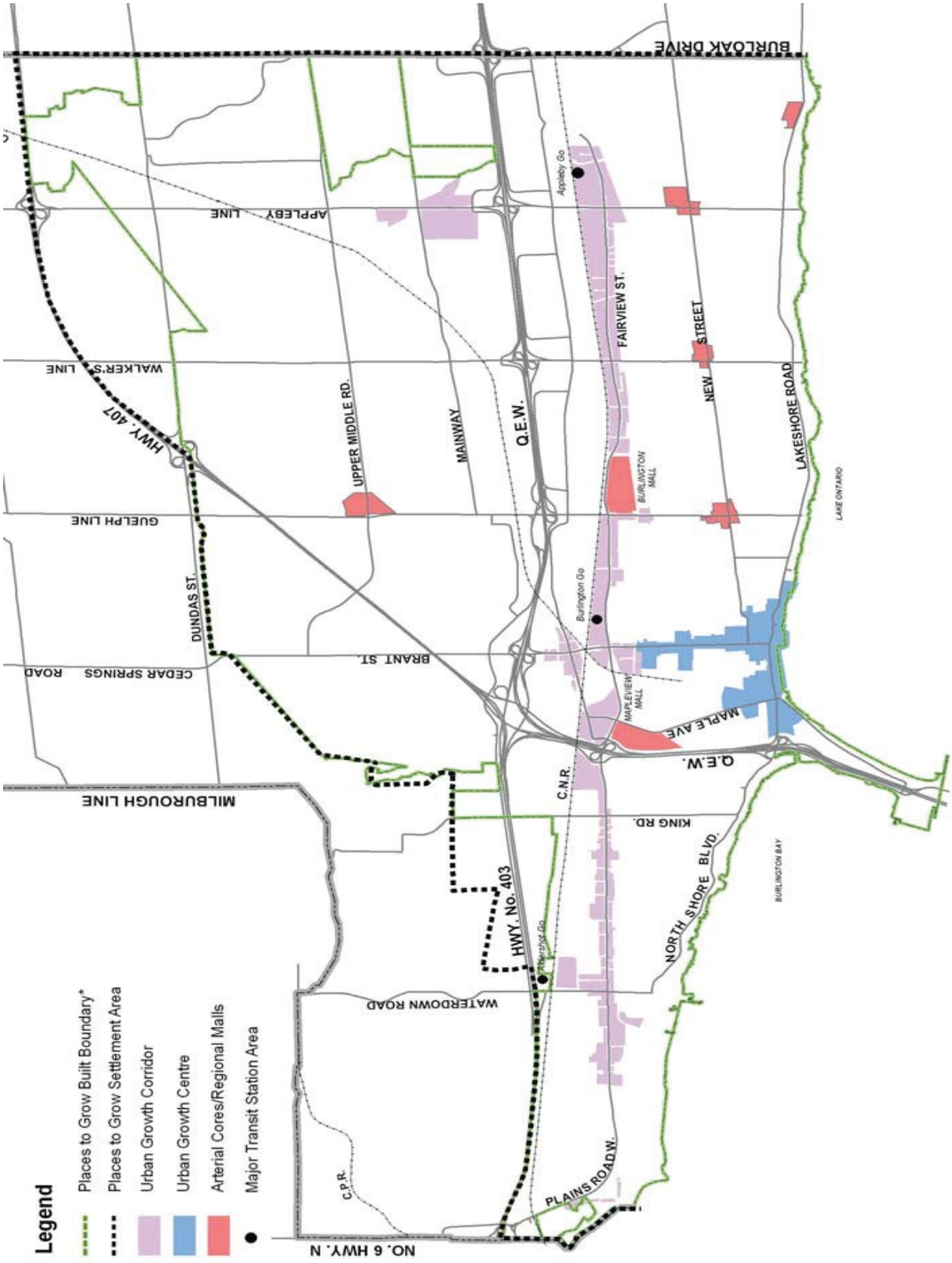
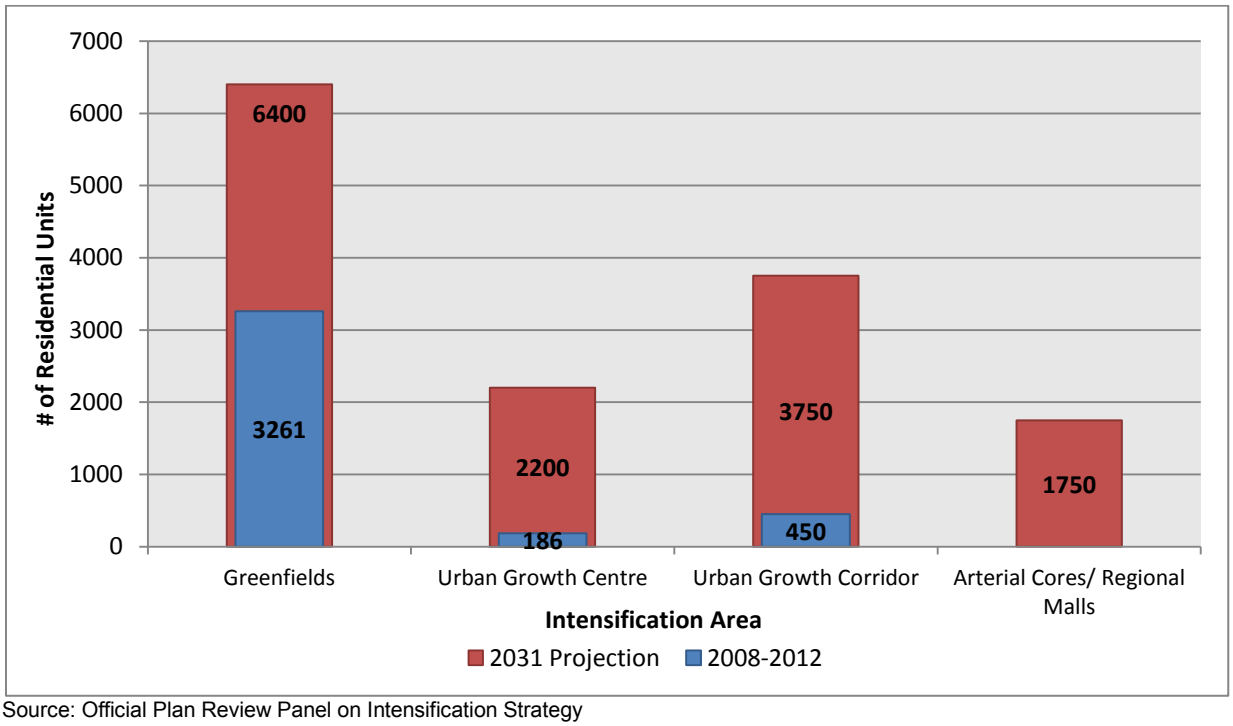


Figure 2.6 shows the new residential units within the areas identified from 2008 to 2012 compared to growth projections made for 2031.

Figure 2.6: Residential Units Built from 2008 – 2012 Compared to Residential Units to be Accommodated by 2031



Source: Official Plan Review Panel on Intensification Strategy

As Figure 2.6 illustrates, the majority of growth in residential units has been concentrated in greenfield areas as expected, with 50.9% of the 2031 projection having been met by 2012. This is followed by the urban growth corridor where 12% of the 2031 projection has been met.

Moving forward the shift to development in the urban growth and arterial core intensification areas will be critical to accommodating growth in the City of Burlington.

What is Happening

Official Plan

The Burlington Official Plan is under review, which must be updated every five years. In the past, the city largely accommodated growth by expanding development outward. Over time, the city expanded its urban boundaries, replacing greenfields with new schools, homes and more places to live, work and play. Updated policies will be included in the OP to deal with intensification to ensure complete communities and streets.

Mobility Hubs

As part of the City of Burlington's Official Plan review, the 'Mobility Hubs Opportunities and Constraints Study' was undertaken and completed in May 2014. The study included the Burlington GO station area and the Downtown Urban Growth Centre (both provincially designated mobility hubs) as well as the Aldershot and Appleby GO station areas. Applying Metrolinx' Mobility Hub Guidelines, the study reviewed opportunities and constraints for each area's future development into mixed use transit-supportive hubs and considerations for

detailed master planning (the next stage of planning work). City staff is currently reviewing the study findings and recommendations together with the input received by Council, the public and agencies, to develop mobility hub policy directions for the Official Plan and the Transportation Master Plan.

Issue: Employment

Why was it Measured

One attribute of a sustainable community is that it provides opportunities for its citizens to live and work by ensuring a balance of residential and commercial/industrial lands within the same community. It further seeks to integrate employment, retail and residential lands so that residents have opportunities to walk to neighbourhood commercial centres and perhaps to their place of employment as well.

What was Measured

The ratio of local employment[7] opportunities for the population was measured to determine whether employment opportunities were increasing or decreasing.

What was Found

The ratio of population to local employment is shown in Table 2.3.

Table 2.3: Employment to Population Ratio Data and Projections

Year	Population	Employment Total	Employment To Population Ratio (%)
1996	136,976	64,490	47.10
2001	150,836	77,130	51.10
2006	*164,415	*87,854	53.42
2011	*175,779	**92,060	52.37
Projection 2016	175,438	98,710	56.27
Projection 2021	178,847	102,846	57.51
Projection 2026	182,034	104,145	57.21
Projection 2031	186,169	105,349	56.59

Source: 1996 & 2001 data – State of the Environment Report IV
*2006 Population and Employment Total and 2011 Population came from census data from Statistics Canada;
**2011 Employment came from the 2014 Development Charges Study

Data was collected for 1996 to 2011, with a projection to 2031, as shown in Table 2.4. It was found that the ratio has increased over the years from 47% to nearly 53% in 2011, showing that more job opportunities were becoming available for local residents. Projections of the ratio indicate a further rise to almost 57% by 2021.

Since 2011, the Region of Halton has been conducting an annual comprehensive door-to-door business survey that captured employment and land-use information from all visible places of work. Data from the 2013 report showed that the City of Burlington has 37.8% of the jobs within

[7] Employment – defined as jobs located within Burlington (not the employed labour force residing in Burlington) and includes jobs with no fixed place of work such as construction sites and mobile servicing units

the region. Within the city itself, 49% of jobs as well as 40% of all businesses are located within the regional Official Plan (ROPA 38)'s designated employment areas. Looking at employment by type, almost three-quarters (72.8%) of all jobs were full time, the highest share among the local municipalities. By industry sector, over four-fifths (81.2%) of jobs in Burlington were within the service-based sector while the remaining 18.8% were goods-producing jobs.

What is Happening

The Burlington Economic Development Corporation (BEDC) has developed a strategy for employment growth to the year 2019. BEDC expects that employment growth will be faster than population growth over the next ten years, which will improve the employment to population ratio, thereby providing additional job opportunities for residents.

Securing Our Prosperity: Employment Lands Operational Plan

In 2012, the City of Burlington developed the Employment Lands Operating Plan to summarize BEDC's employment land strategies as well as provide a decision making framework to assist with setting strategic direction.

Issue: Parks and Open Space

Why it was Measured

Green space is a crucial component of any community as it provides opportunities for active and passive recreation pursuits as well as habitats for a variety of plant and animal species. Previous State of the Environment Reports have measured the amount of parkland by neighbourhood, but this measurement has not resulted in any firm conclusions as residents use a variety of parks and open space, not just those in their immediate neighbourhood. It was therefore decided not to continue the measurement of parks by neighbourhood or planning district.

What was Measured

The total amount of parks and open space was measured.

What was Found

The city in 2014 has a total of 573 hectares of park land and open space.[8] In reviewing this data, it should be remembered that this does not constitute all of the green space in Burlington but only those areas designated as city park land and open space. Other green space can be found in school properties, multi-purpose pathways, the Royal Botanical Gardens, Conservation Halton lands and private lands with public access, such as the Bruce Trail lands.

What is Happening

With the City of Burlington reaching greenfield build out there are limited opportunities to add to the existing park inventory. However, surplus school lands and innovative site development opportunities can allow for additional lands to be added to the parks inventory.

[8] Note: the previous SOER contained an error in the document using a figure of 1,468.11 hectares of parks in Burlington. The correct amount is 573 hectares.

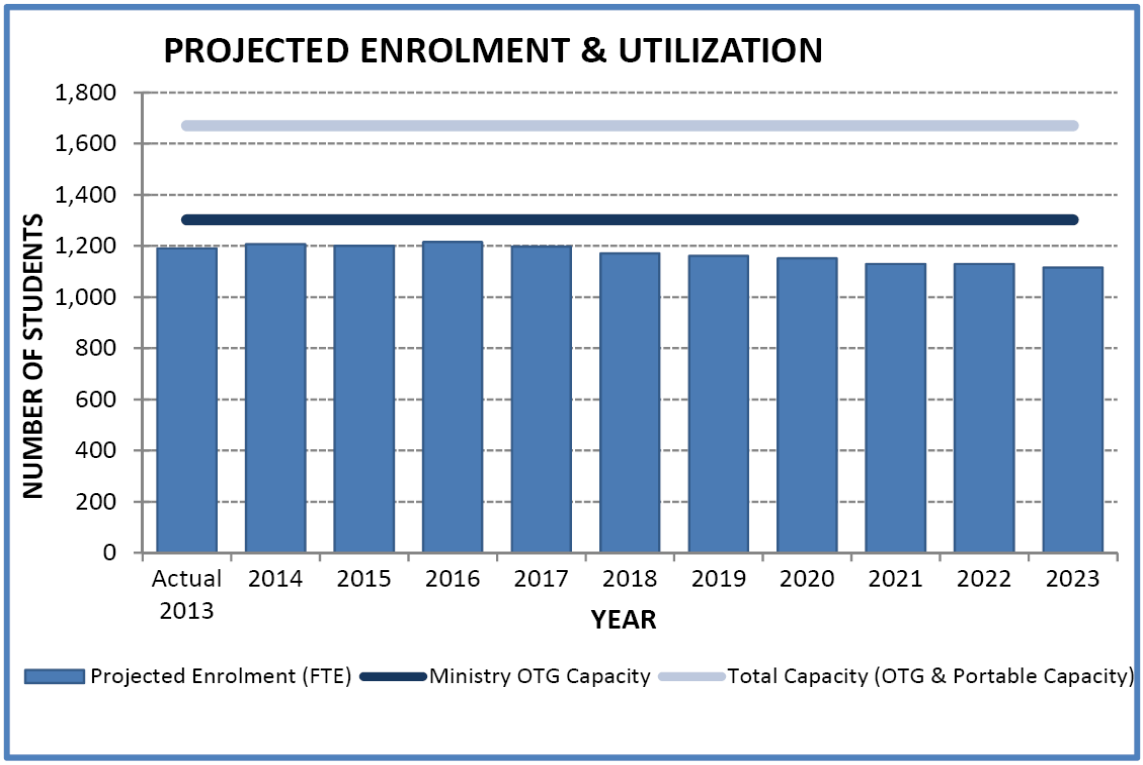
Issue: School Infrastructure and Enrolment

Why was it Measured
Modern and sustainable educational facilities are a valuable asset to a healthy community. Education facilities provide a centre for learning and a social focal point for the community. The surrounding schoolyard provides recreational facilities and valuable community green space.

What was Measured
Current and projected enrolment and utilization data for Burlington schools was measured.

What was Found
Burlington is a maturing city with an aging population, so the proportion of the population that is school aged is declining. This decline is reflected in school enrolment. A report to the Halton District School Board entitled Long Term Accommodation Plan 2013/2014 projects school enrolment for the period of 2013 to 2023. Data for Burlington's District School Board elementary school enrolment is provided in Figure 2.8 below.

Figure 2.8: City of Burlington Projected Enrolment & Utilization 2013 – 2023



Source: Halton District School Board Long Term Accommodation Plan 2013/2014

The graph shows that the total projected enrolment totals for the community currently falls below both the total capacity of the Halton District School Board (including portables) and the Ministry OTG (on the ground) capacity[9]. The projected enrolment trend shows that enrolment will decrease through to 2023.

[9] Ministry OTG capacity: the Ministry related capacity is based on a count of 23 per room while other rooms are counted at 9 (such as a special ed room).

Conclusion

Population Size and Demographics – the population of Burlington is aging, and has the oldest age profile in Halton. As most of urban Burlington has now been built out, new growth will be in intensification areas, and efforts must be made to ensure that the intensification areas are appropriate for all age groups and, in particular, meet the need of the aging population.

Housing – the data indicates a connection between availability of housing types and age demographics of a community; with a maturing population preferring higher density and greater rental availability. As residents age, they may find it necessary to relocate from the newer communities to the older communities to find the housing they need.

Intensification – the city has brought its Official Plan into conformity with the Growth Plan. The initial analysis of residential units built from 2008-2012 shows that intensification is occurring however there is a need to build more units in the Urban Growth Corridor, Urban Growth Centre, and arterial cores to meet 2031 targets.

Recommendations

1. That the city focuses on future land planning opportunities for mobility hubs, with design principles supporting energy efficient and smart development with a sustainable transportation network.

Chapter 3: Rural Lands and Agriculture

Introduction

A balance of rural and urban space provides necessary diversity for the sustainability of a community. Burlington is fortunate in that despite being within the densely populated Greater Toronto Area (GTA), a significant portion of its lands are designated as rural.

Over the last thirty years, Burlington has grown from a population of 100,000 to over 175,000 residents. Typical of most North American municipalities, Burlington has grown outward. Recognizing the importance of protecting its rural lands, the city established a firm urban and rural boundary in the 1994 Official Plan, strengthening past efforts to do the same.

In February 2005, the Province of Ontario passed the *Greenbelt Act* and released the Greenbelt Plan. The Act established 1.8 million acres of protected land between Niagara and Peterborough and strengthened the protection of Burlington's rural lands. The land is reserved for agricultural, natural heritage and rural uses and contains some of Ontario's best agricultural lands.

In Burlington, almost all of the rural and agriculture land is either within the Niagara Escarpment Plan or the Greenbelt area, or both plans. Agricultural land is an important resource for Burlington, by producing local food while giving economic return to the producer and related industries. A growing concern in Burlington is that there is not a large enough economic return generated from farm operations to ensure the continued viability of farming into the future.

There are a number of reasons to support a viable local agricultural system. Importing foods is becoming increasingly expensive and problematic. As the cost of oil and gas increases, the cost to transport these foods also increases. Importing our food over such large distances also has negative effects on our environment and the quality of the food we are getting. Epidemics such as Avian Bird Flu and Bovine Spongiform Encephalitis (BSE or "Mad Cow Disease") further complicate the ability to import food safely into local markets. Globally, the reliability of imported food is also likely to decrease steadily as the impacts of climate change alter the growing seasons and viability of crops. A local food source allows for greater control and a much shortened supply chain from grower to consumer. Foods are fresher, the resources consumed to get the product from field to table are reduced considerably, and the economic benefits are kept within the community.

What was recommended and where are we now?

The 2011 State of the Environment Report had three recommendations regarding rural lands and agriculture in Burlington:

Recommendation #4 The city support a community garden policy that identifies and builds communal plots, and communicates and co-ordinates availability through its website and communication capabilities.
Status Update – In Progress Work is underway by staff (CSI & Planning) to identify appropriate policy options to support community gardens. Community garden plots on city land have recently expanded in 2014 from Central Park to two other sites (Francis Road bike trail and Amherst Park).

Recommendation #5
The city continue to pursue interest in establishing a Farmers' Market in downtown Burlington, and actively promote and encourage residents to support local food producers and farms with an awareness campaign.

Status Update – In Progress
Bringing a market back downtown has been a long-standing goal for the city. Earlier efforts have been unsuccessful, largely because of the start-up funding required. Another major challenge is finding an experienced market provider/manager.
'Core Commitment', the downtown strategic action plan, was approved by Council late in 2013 and it includes the task of exploring opportunities to establish a year-round farmers market in the downtown. A staff report is pending for 2015 on the costs and location. Some preliminary work has been completed, identifying a few options both for low to moderate cost structures and a suitable location.

Recommendation #6
The city encourage citizens to establish backyard gardens through an awareness campaign.

Status Update – Not Achieved
Staff resources has been focused on the community garden initiative.

Issue: Rural Lands for Agricultural Use

Why was it Measured

A significant component of Burlington's rural area is its prime agriculture lands. This resource provides a number of benefits that contribute towards sustainability, such as access to fresh produce for residents and overall food security, carbon sinks to improve air quality, green space for the benefit of all, potential habitat and linkages for wildlife, and a highly productive economic base. Although the designation of the rural lands of Burlington as part of the Greenbelt Area removes the possibility of large scale residential, commercial or industrial development, changes may still occur in other ways (e.g. infrastructure development and aggregate operations). It is important to know what changes are taking place and how they affect the sustainability of agriculture in Burlington.

What was Measured

Farm Ownership

Farmers owning their farms generally indicates a more stable agricultural community, as generally speaking, farmers who are renting are less inclined to make the capital improvements required to maintain land, particularly if the rental is short term and/or informal. Furthermore, crop types tend to be limited to those requiring only short-term investments. This often results in rental lands not being used to their full potential or for their most productive use, leading to a deterioration of the agricultural land base. This situation then provides justification to take the land out of the agricultural land use designation, which not only reduces the overall agricultural land base, but can fragment an agricultural area leading to a loss of services which makes farming even more difficult and vulnerable.

Farm Type
Proximity to a highly urban area influences the type of farm. Farm type as an indicator can help provide insight into the diversity of the farm community and also the types of production that can exist in the near urban environment.

Farm Size
While smaller farms can function well and be highly productive, larger parcels are preferable to obtain economy of scale, long term profitability, and flexibility.

Farm Economics
Farm income as an indicator of sustainability is clear – if a business is not economically viable, it will discontinue its operations over time. Gross farm receipts and the ratio of costs to revenues are also used to measure the ongoing state of economic sustainability for agriculture in Burlington. In addition, the number of registered farm businesses was also used as an indicator. While a decline may indicate decreasing sustainability of the industry, it must be read in conjunction with other factors, such as farm size, as it may also point towards consolidation trends rather than loss of farmland.

Characteristics of Farm Operators
There has been an ongoing concern that younger generations are leaving farms to pursue other lines of work, creating a gap in the next generation required to take over the business. As agriculture becomes less sustainable and income drops, farmers may be forced to supplement their income with off farm income. Agricultural businesses require operators or farmers to run them. Therefore, in association with economic data, indicators that track the average age and number of hours worked both on and off the farm can provide insight into whether the operators are likely to continue farming.

What was Found

Farm Ownership
As can be seen from Table 3.1 there has been a continued decrease in farmland in Burlington between 1996 and 2011, from 5,046 to 3,186 hectares.

Table 3.1 - Area Farmed by Owners and Tenants in Burlington 1996-2011

Year	Total Area Farmed (ha)	Area farmed by owners		Area farmed by tenants	
		Area (ha)	Percentage	Area (ha)	Percentage
1996	5,046	3,078	61%	1,968	39%
2001	4,904	2,939	60%	1,965	40%
2006	4,306	2,778	65%	1,528	35%
2011	3,259	1,702	52%	1,487	46%

Source: Statistics Canada 1996, 2001, 2006, 2011

The total area farmed in Burlington has decreased by 35.4% since 1996.

Types of Farms
There have been considerable changes in terms of what is farmed over time. Miscellaneous Specialty farms continue to experience growth – this category includes such areas as horse farms, greenhouse operations, nurseries and sod farms, Christmas trees and maple syrup.

These operations cater directly to the consumer and tend to operate profitably using smaller parcels of land. While some would argue that the activities included in this category do not consist of traditional agricultural activities in terms of food production, these uses offer the farmer the opportunity to supplement their primary agricultural operations and generate additional income for the farm. Further, some farms, particularly on smaller parcels may be strictly hobby farms and may or may not have expectations with respect to generating revenues.

Farm Size

Table 3.2 shows that the number of farms decreased by 11.4% from 2006 to 2011. Average farm size across the province is generally increasing, however, Burlington and Oakville have experienced a decrease in the average farm size from 2006 to 2011. Burlington experienced the largest decrease from 2006 to 2011 in Halton Region with a 15% decline.

In comparison, the average size of a farm in Ontario was 244 acres (Statistics Canada 2011 Census). Burlington farms are considerably smaller than farms in Ontario and the GTA. Larger farms usually contain traditional livestock and cash crop operations, and smaller farms usually contain specialty crops. The smaller farm size in Burlington is due to the type of farms present –typically near-urban operations that mainly contain greenhouses, floriculture, nursery, vegetable, fruit, sheep and goats.

Table 3.2 - Farm size (acres) in Burlington 1996-2011

Year	Under 10	10-69	70-129	130-179	180-239	240-399	400-569	560-759	760-1119	1120-1599	Total farms	Average farm size
1996	22	48	15	9	5	7	4	0	2	1	113	110
2001	12	42	16	5	5	9	2	1	2	1	95	128
2006	9	34	15	5	2	8	2	1	2	1	79	135
2011	13	31	11	5	4	3	1	1	0	0	70	115

Source: Statistics Canada 1996, 2001, 2006, 2011

Farm Economics

The number of farms generating in excess of $100,000 in Burlington in 2011 has remained the same as that reported in 2006. Twenty-one or 42.8% of farms are generating over $100,000. While the number of farms is declining, this represents some encouraging news. The largest decline in farms reported in 2011 as compared to 2006 lies with those reporting Gross Farm Receipts of $10,000 to $24,999.

Caution needs to be taken when reviewing and interpreting Gross Farm Receipts. In the 2011 Census of Agriculture, there was a change to the use of Standard Industrial Classification codes to North American Inudstry Classification System. As a result, some of the classifications were broken down into additional categories. When only a small number of farms represented a particular category, issues of confidentiality arose and as a consequence data concerning gross farm receipts were suppressed. For example, vegetable, livestock combination, sheep, other livestock specialty categories that were previously reported, were suppressed in 2011 data. There are other categories such as goat and mushroom that had data suppressed in 2006 and 2011 data so it is difficult to get a truly accurate read on what is happening with respect to certain types of farming.

Table 3.3 - Gross Farm Receipts & Operating Expenses in Burlington 1996-2011

Year	Gross farm receipts	Total Operating Expenses	Net Revenue
1996	$33,794,742	$34,022,600	$(227,858)
2001	$23,974,891	$22,698,362	$1,276,529
2006	$30,613,802	$26,040,401	$4,573,401
2011	$23,242,635	$23,249,501	$(6,866)

Source: Statistics Canada 1996, 2001, 2006, 2011

Table 3.4 - Gross Farm Receipts and Operating Expenses per hectare in Burlington 1996-2011

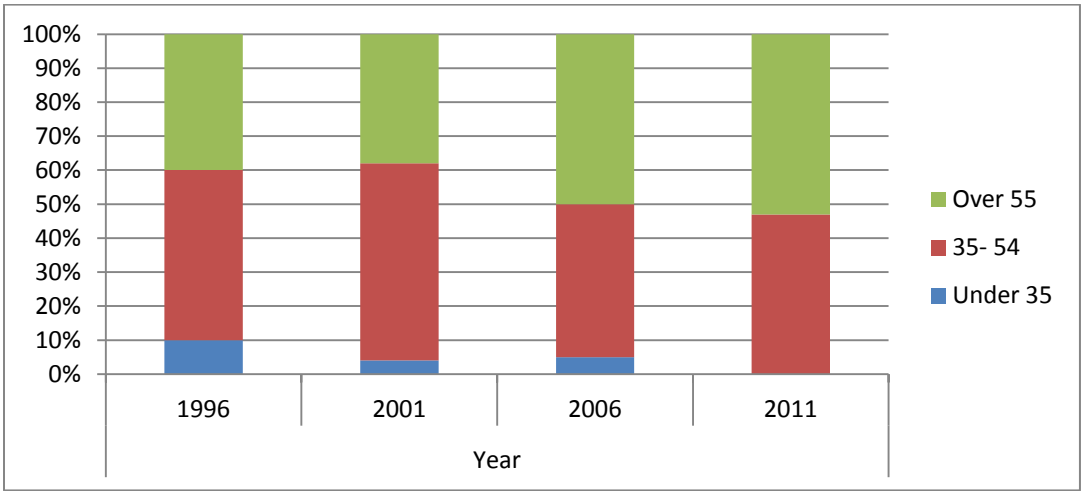
Year	Gross farm receipts per hectare	Total Operating Expenses per hectare	Net Revenue per hectare
1996	$6697	$6742	$(45)
2001	$4889	$4629	$260
2006	$7106	$6044	$1062
2011	$7128	$7128	$(0)

Source: Statistics Canada 1996, 2001, 2006, 2011

Characteristics of Farm Operators

Table 3.2 showed a decrease in the number of farms between 1996 and 2011. Figure 3.1 below shows that the average age of farm operators in Burlington has increased from 55.5 years in1996 to 57.5 years in 2011. The provincial average age of a farm operator is 54.5 years.

Figure 3.1 – Age of Farm Operators in Burlington 1996 – 2011



What is Happening

There are many programs, projects and initiatives happening within Burlington, Halton Region, the Greater Toronto Area and across Ontario and Canada to assist farmers and farming.[10]

The Greater Toronto Agriculture Action Plan

The GTA regions of Durham, Halton, Peel and York and City of Toronto, in partnership with the GTA Federations of Agriculture, and with the support of the Ontario Ministry of Agriculture and Food have prepared an Agriculture Action Plan that was officially launched in September of 2005. The purpose of the Action Plan is to keep the GTA agricultural industry competitive and the main areas of focus were economic development, education/marketing, land use/policy and accountability/responsibility. For a copy of the plan, contact the Region of Halton.

The Golden Horseshoe Food and Farming Alliance has recently completed Phase 1 of an Asset Mapping Project to gain a better understanding of the agricultural assets that exists. Phase 2 is currently underway. As well, the Golden Horseshoe Food and Farming Agri-profiles based on 2011 Census of Agriculture information was released in November 2014 highlighting critical trends and analysis of agriculture in this productive area.

Agricultural Community Development Fund

The Halton Agricultural Community Development Fund is a regional initiative to support and develop the agricultural industry and community in Halton. The program is open to agricultural organizations that have projects with a need for assistance. Projects should deliver regional objectives and policies, as set out in the regional Official Plan, and promote the sharing of information and expertise with other organizations.

Organic Farming

Across Canada there is an increasing interest in organic food production. Within Halton, a number of farms are registered as organic, though there are none currently in Burlington. In late 2006, the Canadian government published the Organic Products Regulation to regulate organic certification in Canada for organic products. In Ontario, there are a number of organizations that are qualified to certify farms and processing operations and the process can take anywhere from two to four years.

Farm to School Program

This program, initiated by Halton Region and coordinated by Halton Food for Thought, brings fresh, locally grown produce into Halton schools. St. John's School in Burlington participated in a pilot project in 2008 and, in 2010 the program expanded to 10 schools in Halton, including three in Burlington: Lakeshore, St. Gabriel's and St. John's. In the fall of 2014, the program was in 17 schools including seven in Burlington: Dr. Charles Best, Glenview, Holy Rosary, Lakeshore, Ryerson, St. Gabriel, and St. Patrick.

Halton Fresh Food Box Program

This is a non-profit group that provides fresh food to residents in Halton, but focuses on those in need. In 2014 the program reached 890 households, 27% being in Burlington. About 50% of the boxes are sponsored by donations, such as the Burlington and Oakville Rotary clubs, St. Vincent de Paul, and the Burlington and Georgetown food banks.

[10] Additional programs and services for Ontario farmers can be found on Factsheet 14-043, AgDex 871 or on the Ontario Ministry of Agriculture and Food website www.ontario.ca/omafra.

Halton Region's Local Food Procurement Policy
In April 2010, Halton Region became the first region in Canada to implement a local food procurement practice for its municipal food services. The cafeteria at Halton Regional Centre is supplied with fresh, local sustainable food under an agreement made with Local Food Plus (LFP) in 2010 to help support Ontario farms and reduce greenhouse gas emissions associated with the Region of Halton.

Halton Region's Rural Agricultural Strategy
Halton Region is currently undergoing the development of a Rural Agricultural Strategy that will deliver clear and concise direction on matters related to the economic sustainability of the agricultural and rural economy of Halton Region.

Halton Region's Agricultural Tourism Strategy
Halton Region has completed an Agri-Tourism Action Plan which reflects the aspiration to strengthen the future of agriculture through agri-tourism development in Halton. Since approval by Council in November 2013, there has been the launch of "Harvest Halton", a culinary event which partners chefs with local farmers and showcases the bounty grown in Halton Region along with the development of a Pumpkin Trail.

Halton Region's Halton Federation of Agriculture Coordination Grant
The purpose of this grant is to provide support for the operation and work of the Federation of Agriculture. The fund provides financial support towards projects/initiatives that deliver on the regional objectives or policies, as set out in the regional Official plan and promotes the sharing of information and expertise with other organizations.

Halton Region's Food Assessment Study
The Food System Assessment Study is a literature review on food systems that makes the value link between agriculture and nutrition. It covers issues such as food security, community gardens etc.

Halton Region's Agricultural Liaison Officer Position
The position of Agricultural Liaison Officer was filled in Jan 2013. The Agricultural Liaison Officer acts as a conduit between Halton Region and the agricultural community. Areas of focus include spearheading the development of a Rural Agricultural Strategy which will identify key areas where regional support can assist in supporting the long term sustainability of agriculture, marketing and promotion of local agricultural products to Halton communities, development and implementation of education programs to promote public awareness and support for the agricultural industry and the promotion of environmental stewardship and succession planning.

Halton Region's Agricultural Guidelines
Guidelines were developed to help implement and clarify the policy intent of the agricultural supportive polices of Halton Region's Official Plan.

Halton Region Countryside Strategy, Vision and LEAR Evaluation
These reports and studies were completed to clarify where in Halton, prime agricultural lands and specialty crop lands exist and to more clearly understand how agriculture exists in Halton.

Simply Local – A Guided Tour of Halton Farms
This initiative supports and markets the agricultural resources of the region from food products, horticulture, equestrian activities to agri-tourism activities.

Halton Region Agricultural Advisory Committee Farm Tour
This annual event showcases the innovative agriculture resources that exist in Halton Region.

Sustain Ontario Agricultural Support Videos
These videos were created to showcase the vibrant agricultural industry in Halton.

Canada-Ontario Environmental Farm Plan (EFP)
The EFP is a voluntary educational program for farm families delivered through local workshops. The ultimate goal is the preparation of an individualized Environmental Farm Management program that addresses a wide range of areas, including pesticide use, wetland preservation and manure management. Funding is available from a number of federal and federal/provincial programs. Since its establishment in 1992, almost half the farms in Ontario have participated in the program, though specific figures for Burlington were not available.

Growing Forward 2 (GF2)
Growing Forward 2 is a policy framework established on April 1, 2013 between the federal, provincial and territorial governments for the collaboration on agriculture policy, programs and services over the next five (5) years (2013 – 2018). Under this framework, three federal programs with the aim of generating economic growth are administered by Agriculture and Agri-Food Canada. These programs include AgriInnovation, AgriCompetitiveness and AgriMarketing. A suite of business risk management programs are also offered under the GF2 framework, which include AgriInvest, AgriStability, AgriInsurance and AgriRecovery.

Canadian Agricultural Loans Act (CALA) Program
The Canadian Agricultural Loans Act (CALA) Program is a loan guarantee program designed to give farmers easier access to credit for the establishment and development of farms. Under the CALA, farmers are better able to seize market opportunities.

Issue: Rural Lands

Why was it Measured

Most of Burlington's rural area is within the area covered by three provincial plans, the Greenbelt Plan, the Niagara Escarpment Plan and the Parkway Belt West Plan. These plans promote the conservation of rural and natural heritage lands and permit some small settlement areas. The Parkway Belt West Plan, despite including "Parkway" in its name, is more focused on utility corridors and highways than on parkland or green lands.

The city established a firm urban-rural boundary in its 1994 Official Plan. The introduction of the Greenbelt Plan in 2005 reinforced this boundary, providing additional protection to rural lands in Burlington. The area of the Greenbelt was measured in 2005 and 2010 to provide a baseline, so that its size can be tracked in the future to determine whether the Greenbelt has expanded or contracted. Similar measurements are being made of the Niagara Escarpment Plan area and the Parkway Belt West Plan area as a comparison.

The preservation of rural lands is important to maintain its productive farmlands, other resource industries, natural heritage areas and limited residential settlement areas. These areas are best suited for agriculture, forestry and recreational use. If they were re-designated to urban land uses, the benefits derived as rural and agricultural lands would be lost to the community.

What was Measured

The area of land within each of the Greenbelt Plan, the Niagara Escarpment Plan and the Parkway Belt West Plan areas was measured in 1978, 1985, 2005 and 2010. In Burlington, all Niagara Escarpment Plan lands are within the Greenbelt Plan area.

What was Found

The total amount of land within provincial plans has generally increased over time because of the addition of new plans, with the exception of a small loss between 2005 and 2010 because of deletions from the Parkway Belt Plan. The introduction of the Greenbelt Plan in 2005 provided increased protection for all lands north of Highway 407 from urban development. The amount of land within the Parkway Belt West Plan has decreased over the years as several amendments have deleted land from the plan.

What is Happening

Friends of the Greenbelt Foundation

The goal of the Friends of the Greenbelt Foundation is to nurture and support activities that preserve and enhance the Greenbelt's agricultural, rural and ecological integrity. One of its primary mandates is to distribute a $25 million endowment fund over the next five years to non-profit groups.

In the agricultural area, such projects might: promote and fund new markets for local produce from the Greenbelt; provide renewable power and energy conservation support to farmers; and support education and learning experiences for students and youth in agriculture. Other projects might work to preserve and enhance natural areas or promote rural land uses not directly related to agriculture.

City of Burlington Rural Summit

On January 19, 2013, the City hosted the Rural Summit event at Kilbride Public School, as part of Burlington's Official Plan Review. The day involved discussions related to a collective community vision for the Rural Area and themes that would support the vision. The event offered an opportunity for participants to engage in conversations with each other and a diversity of opinions emerged.

The comments showed that participants felt that areas of green space should not be lost and redevelopment should be controlled so that rural lands can remain undisturbed from urban encroachment. The information from this summit is being used to inform rural policy directions through the Official Plan review. The most recent regional Official Plan Amendment (ROPA 38) will also play a key role in the drafting of policy directions for rural lands.

Protecting Escarpment Rural Land (PERL)

PERL is an organization formed to protect and enhance Burlington's Niagara Escarpment and rural land in the Region of Halton. With the efforts of PERL, the consolidated hearings board (Joint Board) dismissed Nelson Aggregate Co.'s application for permits for a new quarry and aggregate processing operation on the Mount Nemo plateau of the Niagara Escarpment in 2012. This decision provided protection of the unique and sensitive ecologic areas of the Jefferson Salamander habitat.

Mount Nemo Heritage Conservation District
In 2013 the city commenced a preliminary study to examine a heritage conservation district designation for the Mount Nemo plateau. The study area stretches from Dundas Street to Britannia Road in the north, and Milborough and Walker's lines to the west and east respectively. The preliminary study was completed by a Heritage Consultant and was presented to the Development and Infrastructure Committee on January 13, 2014. (Staff report PB-07-14) The work of the consultant identified that the Mount Nemo Plateau possesses heritage character worthy of recognition as a cultural heritage landscape through further study and possible designation as a Heritage Conservation District (HCD). Staff recommended that decisions on whether or not to pursue a Heritage Conservation District study not occur until after public consultation.

Following two public meetings in the winter and spring of 2014, staff brought forward a report containing terms of reference and a recommendation to commence a full study. This report included a draft Study Area Control By-law which could be passed in the event that a potential threat arises to the integrity or character of the study area. Council endorsed this report.

Following completion of the HCD study, staff will report back to council prior to the commencement of a HCD plan.

Issue: Urban Agriculture/ Local Food

Why it was Measured
Once agricultural lands are urbanized they are essentially lost to future production and almost half of Ontario's urban land is built on former prime agricultural lands (Statistics Canada 2005). Feeding growing cities relies on sustainable agricultural sources. Urban agriculture can take on many forms, but generally, the objective is to increase the amount of fresh food grown within the urban area. It is seen as a sustainable practice because it uses fewer resources to get from the growing source to the table.

Many residents have the opportunity to garden in their back yards, but those who live in apartments or do not have back yards do not have the opportunity to garden, unless garden plots or community gardens are available. As the city continues to intensify, urban agriculture opportunities will become more important. The availability of community gardens in Burlington was measured to determine the opportunities available.

What was Measured
The number of garden plots available was measured.

What was Found
The number of community gardens and church sponsored garden plots in Burlington are shown in Table 3.5 and Table 3.6 respectively. Burlington currently administers three community gardens on city property with a total of 82 plots, which are run by a seasonal Community Gardens Coordinator. In addition, some community gardens are run by local places of worship (see Table 3.6). It is possible that there are more community or communal gardens on private property that are not advertised. For instance, some apartment buildings or condominiums may allow residents to plant gardens in the common areas. There are also 50 garden plots available in Bronte Creek Provincial Park, and although the park is in Oakville, it is on the border of the city and very close to many Burlington residents.

Table 3.5 - Community Gardens operated by the City of Burlington

Name	Location	# of plots (2014)
Amherst Park	2030 Amherst Heights Court	30
Central Park	2299 New St	30
Francis Road Bikeway	Warwick Dr & Marley Road	22
	Total	**82**

Source: City of Burlington Website

Table 3.6 - Community Gardens Sponsored by Places of Worship

Location	Sponsor	# of plots	
		2010	2014
3455 Lakeshore Road	Holy Cross Lutheran Church	12	20
1377 Walkers Line	North Burlington Baptist Church	52	52
Bromley Road	St. Elizabeth's Anglican Church	16	16
	Total	**80**	**88**

Source: Phone calls to churches

What is Happening

Halton Food Council
The goal of the Halton Food Council is to increase awareness of food system issues and opportunities in Halton Region and to communicate with a common voice to promote action.

Feeding Halton
This collaborative of social service agencies which includes; Food for Life, Halton Fresh Food Box, Halton Food for Thought, St. Christopher's Church and the Oakville Sustainable Food Partnership (Fruit Tree project) was formed to create efficiencies and reduce overlap in local food procurement and perishable donations and to offer a central access point for local fruit and vegetable growers to enter these markets.

Halton Region – Food Literacy brochures (adult and children's)
Two food literacy pieces were developed to challenge adults and children to "Take the Local Food Challenge" and increase the amount of local food consumed.

Grow To Give Program
The Grow to Give program is a collaborative effort by BurlingtonGreen and Food For Life which aims to provide volunteer opportunities for people to learn about and practice gardening skills by growing food to benefit those in need. Healthy organic produce is grown in dedicated donation gardens and then harvested and distributed to those in need via Food for Life's local neighbourhood outreach program.

Issue: Farmers' Markets and On-farm Sales

Why it was Measured
Farmers' markets provide the opportunity for residents to purchase fresh local produce directly from local farmers. The provision of farmers' markets links the rural area to the urban area and

provides a measure of the connection between farmers and residents. Locally produced food supports local farmers and also minimizes the costs and carbon footprint from food transportation.

What was Measured

The number of farmers' markets in both the rural and urban area of Burlington was measured. The markets in the urban area typically include several vendors who bring their produce into the city. The markets in the rural area are typically on the farm and sell the products grown on the farm; therefore the variety of products available is usually limited at the farm.

What was Found

There are currently three farmers' markets in Burlington, one located at Burlington Mall, one in Aldershot, and one in downtown Burlington operated by a private retailer. (See table 3.7).

Table 3.7 - Number of Farmers' Markets

Year	No. of markets	Name of market
1990	2	Downtown and Central Arena
2000	1	Burlington Mall
2010	2	Burlington Mall and Aldershot
2014	3	Burlington Mall, Aldershot & Centro

Source: A Guided Tour of Halton Farms

The Burlington Nelson Lions Club organizes the market in Burlington Mall – the market was originally located at the Central Arena parking lot starting in 1960 and moved to Burlington Mall fifteen years ago. It currently has 42 vendors, runs on Wednesdays, Fridays and Saturdays from May to October, and the Lions estimate that the market employs approximately 200 people, either through working on the stalls or in the field getting the produce ready for the market. The Aldershot market is located at 36 Plains Road East, runs on Thursdays and Sundays from May to November and is organized by the Aldershot Lions Club. The Centro market is privately owned and organized by Centro Garden, located on John Street just north of James Street in downtown Burlington. This market runs every Sunday from 9 am to 12 pm from May to the end of October.

The number of on-farm sales was measured for 2007, 2010 and 2012 – it was found in 2007 and 2010 that there were five farms selling fresh produce (including two farms in Milton) and three horse farms with riding (see Table 3.8). In the 2012 Guide there were found to be six farms selling fresh produce (including two farms in Milton) and three horse farms with riding (see Table 3.8). It is noted that there may be additional equestrian facilities in Burlington that are not listed in the Simply Local map as they may operate privately and may engage in other equestrian activities outside of riding.

Table 3.8 - On-farm Retail Shops

Farm type	2007 and 2010
Fresh produce	Applevale Orchards
	Bousfield's Apple and Cider (Milton)
	Greenfields Organic (Milton)
	Hutchinson Farm
	Uncle Scott's Farm
	Featherstone Farm
Horse Farms with riding	Bayview Equestrian Centre
	Reschburl Equestrian Centre
	Parish Ridge Stables

Source: Simply Local: Your guide to Halton Farms (2012)

Even though the urban population of Burlington has continued to grow, there has been limited growth in the number of farms selling produce between 2007 and 2012, and there has been a very small change in the number of farmers' markets in the urban area over the past 24 years.

What is Happening

Farm Fresh Halton/Simply Local
The Halton Farm Fresh program is a regional initiative to promote Halton's agriculture industry and create an important connection between Halton residents and Halton farms. The program promotes the consumption of locally produced farm products and participation in farm activities to encourage a strong link between the farming community and consumers. A brochure entitled A Guided Tour of Halton Farms has been developed, detailing farms in Halton Region that cater directly to the public such as 'pick your own', nursery products, equestrian farms and agricultural entertainment. Of the 50 farms and garden centres listed, 14% are in Burlington.

Eat Local Burlington
Eat Local Burlington is a group that organizes events through the social media tool Meetup.com to help support local farmers and businesses. The focus of the group is to eat organic locally grown food that can be found within 250 km of Burlington.

Conclusion

The average age of farmers is increasing steadily, while the number of younger farmers willing to take over the family farm or start their own farm operation is not growing.

Ensuring the economic sustainability of Burlington's agricultural resources will be as important as ensuring its environmental sustainability if we are to take advantage of the benefits of local food sources.

As noted in the 'What's Happening' sections above, there are a number of actions that have been taken by various levels of government to invigorate the agricultural industry; however, this is something that will take a coordinated effort on a number of different fronts to address.
Due to the population growth in the Greater Toronto Area, there is an increased need to find innovative ways to produce more food locally. Harvest sharing programs and community gardens are ways to encourage more food production locally by providing citizens who would

not normally be able to garden with space to grow their own food. Burlington has recently expanded its community gardens over the past couple of years but in addition to community gardening, programs to promote backyard gardening can also encourage citizens to grow their own food and decrease their dependency on commercial farming.

Recommendation

1. Expand the position and responsibilities of the Community Garden Coordinator from seasonal part time to support the local food movement in Burlington, by encouraging local food production and distribution, and supporting urban and rural agricultural programs.

Chapter 4: Waste Management

Introduction

We live in a society that undoubtedly generates more waste than ever before. As the population increases, total waste production increases. Although making responsible decisions about waste can be difficult, every day more people, businesses and communities are finding ways to cut down on their waste. Changing our attitude about waste, and learning the value of reduce, reuse and recycle is a great place to start.

Recycling is one of the first things that come to mind when we think of waste reduction. Although recycling is a better alternative to disposing waste material in the landfill, it is not an end-all, be-all solution. Sorting and selling of recycled materials is costly, using resources and energy in production and transportation of materials. Reducing the amount of waste that needs disposal is the goal we should be working towards. Sourcing products that can be re-used over and over again instead of using disposable products is another great way to reduce waste.

David Suzuki has spoken of a fourth R: *Rethinking*. When purchasing a new product, consumers can ask: Is the product needed? Would a second-hand item meet the need? Is there another way to purchase this product that uses fewer resources? Could the product be borrowed? What happens when this product is no longer of use? Who pays for the resulting waste? Purchasing goods and services is unavoidable; however, consumers hold the power to encourage change in the marketplace. Purchasing more sustainable options shows retailers and manufactures that there is demand for these products. Consumers can also avoid excessive packing and reach for the compostable, recyclable products to help limit waste. This chapter covers two waste management issues – residential waste collection in Halton Region and waste diversion and transformation, showing progress being made since 2011.

What was recommended and where are we now?

The 2011 State of the Environment Report had two recommendations regarding waste management in Burlington:

Recommendation #7
That waste reduction be a central theme in educating Burlington's citizens using the region's audit of residential garbage as a starting point.

Status Update - Ongoing
Staff have focused on raising waste reduction and diversion awareness tips with city staff as part of the zero waste program (e.g. Lunch & Learns; health fair activities, etc.). Updated signage has been installed on most centralized waste stations at city facilities reflecting the change in the region's three stream program. The Sustainable Development Committee is planning to become more involved in community outreach on this topic.

Recommendation #8
That the region be encouraged to recycle more plastics, and to research ways to recycle Styrofoam, especially number 6, as in Hamilton, and encourage local businesses to reduce their use of Styrofoam.

Status Update – Partially Achieved
In 2013, the region expanded the Blue Box program to include mixed plastics (includes rigid polystyrene) material along with empty paint cans and spiral-bound cardboard containers. The region also introduced a 22 gallon container that is larger and taller than the traditional Blue Box and implemented a 3 bag limit and garbage bag tag program to increase waste diversion.
No new sustainable processors or markets have emerged to successfully manage and recycle Styrofoam material. Bill 91 was being debated in the legislature (the new Waste Diversion Act - WDA) up until the election was called. The purpose of this updated WDA was to increase diversion by implementing Extended Producer Responsibility.

Issue: Residential Waste Collection – Halton Region

Halton Region provides weekly collection of Blue Box, GreenCart, bi-weekly garbage, every four week collection of large bulk materials, bi-weekly collection of yard waste (April to December) and metal call-in collection. The region also provides waste collection (garbage, recycling and organics) to multi-residential, schools and regional and municipal locations. There is a three bag/can limit for single family garbage collection with up to an additional three tagged bags. The region is in the process of expanding GreenCart organics collection to all multi-residential locations by 2018.

Recycling
Blue box material is processed by a private contractor, Emterra Environmental, and sorted at a materials recycling facility (MRF) in Burlington. The MRF sorts, crushes and bails recyclable material to be sold, transported and manufactured into new materials. For example, paper can be made into paper towel and boxboard. Until 2013, Halton Region only accepted plastic bottles, plastic lids and plastic containers. The reason being, the MRF only had the capacity to process plastic bottles, plastic lids and plastic containers, in addition to other recyclable materials such as glass and cardboard. New equipment has been added to the MRF, and the region has been able to expand the list of materials accepted in the Blue Box program. It's important to remember, not every blue box program is the same in Ontario.

To date, Halton Region will collect the following blue box materials in Burlington (and region-wide):

- Aluminum foil (aluminum foil, aluminum pie plates & baking trays)
- Black & clear plastic take-out containers
- Boxboard (cereal, detergent, tissue boxes, etc.; flatten; liners go in garbage)
- Boxed beverage containers (Tetra Paks®, juice & soup boxes, gable top containers such as milk and juice cartons
- Cardboard cans
- Clear plastic 'clam shell' containers
- Plastic bottles (beverage, soap, shampoo, cleaning bottles, laundry detergent)
- Plastic tubs & lids (cottage cheese, cream cheese, dips, margarine, yogurt tubs & lids); maximum size 4 litre (1 gallon)
- Plastic plant pots & trays
- Corrugated cardboard (tie in bundles no larger than 90 cm x 90 cm (3 ft x 3 ft x 1 ft)
- Empty metal paint cans (lids removed)
- Glass bottles & jars (clear or coloured, food & beverage glass containers)
- Magazines & books (hard & soft covered books)
- Metal food & beverage containers
- Plastic plates, cups & coffee cup lids (no cutlery)
- Newspapers & flyers
- Single-serve plastic food containers (no film or foil)

GreenCart
The GreenCart program was introduced by the region in 2008. In 2007, the waste diversion rate for Halton sat at approximately 43%. Since implementation of the GreenCart program that number has jumped 15% in the last eight years to 58.1%. GreenCart materials are collected once weekly and processed by AIM Waste Management, Hamilton's composting facility.

To date, Halton Region collects the following GreenCart materials in Burlington (and region wide):

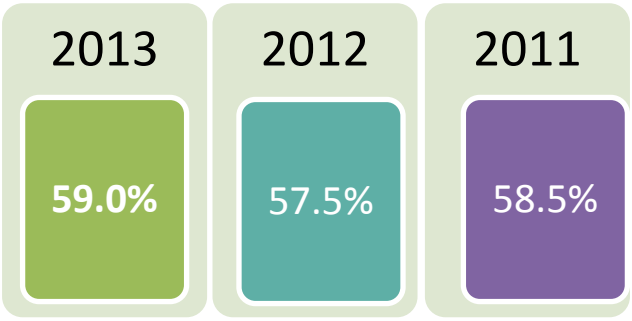
- Bread, toast, cereal, baked goods & pizza
- Cake, cookies, pie, muffins & candies
- Coffee grounds & filters, teabags
- Dairy products, cheese & yogurt (no containers)
- Eggs & egg shells
- Fruit (no plastic, elastics or stickers)
- Meat, fish & shellfish (including bones)
- Pasta, couscous, potatoes, rice, oatmeal, flour & grains
- Vegetables, corn cobs & husks, nuts & shells & salads (no plastic, elastics or stickers)
- Sauces, mayonnaise, salad dressing, syrups, peanut butter, jams & jellies (no containers)
- Fats & oils, lard, gravy, butter & margarine (no containers)
- Dairy products, cheese & yogurt (no containers)
- Eggs & egg shells
- Paper cups (no lids), paper plates, paper take-out food containers, paper egg cartons
- Dryer lint
- Human hair & nail clippings
- Houseplants
- Popsicle sticks & toothpicks
- Sawdust & cold wood ashes (in paper bags)
- Shredded paper
- Soiled paper towels & soiled facial tissues

Issue: Waste Diversion and Transformation

Why it was measured
A diversion rate is defined as the percentage of waste materials diverted from traditional disposal such as landfilling or incineration to be recycled, composted, or re-used.

What was measured
The diversion rate for Burlington's residential waste management collection delivered by Halton Region.

What was found
In 2011, when the previous SOER was published, the City of Burlington was sitting at a 58.5% diversion rate. Burlington's overall waste diversion rate increased to 59.0%, which is .09% higher than the overall waste diversion rate in Halton.



The positive change to the diversion rate is attributed to the three key 2012 to 2016 Halton Waste Management Strategy initiatives which were implemented by Halton Region in 2013:

- Decrease in Garbage Bag Limit and Introduce Bag Tags
  - In 2012, the region implemented the Garbage Bag Limit and Bag Tags Program, cutting the limit of garbage in half from six bags/cans bi-weekly to three bags/cans biweekly with a maximum of an additional three bags with garbage tags at $2 a tag.

- Expand Blue Box Materials and Enhance Blue Box Capacity
  - In 2013, the region added additional materials to the list of items already excepted in their Blue Box program. Items included more plastics, such as clam shall packaging and plant pots; empty metal paint cans; and spiral bound cardboard containers. In addition, they increased the size of curbside blue bins to 22 gallons.

- Enhance Multi-Residential Waste Diversion
  - Halton Region staff reached out to townhouses and multi-residential buildings throughout 2012, providing promotion and educational materials regarding recycling and blue box programs. As a result, Blue Box materials collected from multi-residential materials increased by almost three percent in 2013.[11]

Baseline data from the previous SOER is located in the following tables under the 2011 column. Halton Region provided data for 2012 and 2013 outlining total waste diverted through landfill (Table 4.1), Green Cart (Table 4.2) and total waste to landfill (Table 4.3).

Table 4.1 - Waste Diverted through Blue Box Program in Burlington (tonnes)

	2011	2012	2013
Residential Blue Box	15,112	14,465	14,650
Multi-Unit Blue Bin	2,621	2,633	2,660
Front End OCC*		29	43
Electronics (Events)	23	27	24
Metal/White Goods (Curbside)	71	41	54
Household Hazardous Waste (Events)	18	30	27
Sub-Total Recycling/Reuse	**17,845**	**17,225**	**17,457**

*OCC – Waste Collection & Cardboard

[11] *Information obtained from Halton Region 2013 Year End Waste Management Report

Table 4.2 - Waste Diverted through Green Cart Program in Burlington (tonnes)

	2011	2012	2013
Yard Waste (Curbside)	7,261	7,058	7,329
Christmas Trees	134	133	129
T-Vac (leaves)	5,209	4,512	3,924
GreenCart Organics	8,998	9,099	9,474
Sub-Total Organic	**21,602**	**20,803**	**20,857**
Total Diverted Material	**39,447**	**38,028**	**38,314**

Table 4.3 - Waste to Landfill in Burlington (tonnes)

	2011	2012	2013
Residential Garbage	22,723	22,810	21,291
Multi-Unit Front End Garbage	5,301	5,284	5,383
Total Landfilled Material	**28,024**	**28,094**	**26,674**

Source: Halton Region Waste Management Department
* Excludes bulk waste

The implementation of a Garbage Bag Limit and Bag Tags Program, expanded Blue Box material, and enhanced multi-residential waste diversion, has increased the City of Burlington's waste diversion rate by.05% from 2011, and 1.5% overall between 2011 to 2013 (Figure 4.1).

What is Happening

There are many ways that residents can participate in waste diversion measures. For example, household hazardous waste items may be dropped off in-person at the Regional Waste Management site on Regional Road 25. Accepted items include fuel, car batteries, antifreeze, bleach and paint; usable paint is available for free from the nearby Paint Reuse Shed. For a fee of $5/50 kg., items like tires, metal and wood can be deposited at the Container Station.

On site at the Regional Waste Management site is a permanent Salvation Army trailer that accepts clothing, linen, working computers and undamaged furniture. Several centres and organizations accept reusable items, such as The Reuse Centre, Goodwill, St. Vincent de Paul Society, and Habitat for Humanity ReStore.

Additionally, the following resources are offered in Halton Region:

Recycling Electronics

The recycling electronics program changed in 2009 with the implementation of the Ontario Electronic Stewardship (OES) program. Recycling groups registered with this program are monitored and must meet strict qualifications. Companies such as Staples participate in the OES WEEE (Waste, Electrical and Electronic Equipment) program and also have a yearly challenge to recycle ink cartridges (now over two million a year). The city's electronics are now being picked up by a company called Greentec. This is the same company that collects electronics dropped off by members of the public at Burlington fire stations. The money received in exchange for the electronics helps to support the city's Fire Extrication Team.

***Take It Back*! Halton**
Take It Back! Halton is a directory of local businesses that take back many of the products that they sell. Accepted materials include medications, cell phones and rechargeable batteries. This is a good example of extended producer responsibility (EPR), a worldwide initiative to involve producers and consumers in the total lifecycle of manufactured goods.

Household Hazardous Waste
Household hazardous waste continues to be accepted by the Region of Halton. Statistics on the collection of paint, oil, etc. is on a regional basis, rather than by municipality. This service reduces what is landfilled and ensures that hazardous waste is properly disposed of or recycled. Stewardship Ontario has developed an interactive website "*Do what you can"* that provides a list of the closest locations where people can take leftover consumer hazardous or special waste.

Yard Waste
Yard waste is composted at the Regional Waste Management site; the resulting compost is then available to residents for pick-up at no cost each spring and fall. Backyard composting is encouraged and composters are available from the region for $15.

Collection of Landfill Gas
Landfill gas collection at the Halton Waste Management site was initiated in the summer of 2006. In conjunction with Oakville Hydro, Halton Region produces electricity for 1,500 homes by using methane from the landfill site. This is done through three kilometres of piping buried in the waste; the methane is vacuumed to a generating station on site. In 2009, 4.1 million cubic metres of gas was collected.

Re-Use Centre – Burlington
The Reuse Centre is operated by The Burlington Reuse Environmental Group which is a not-for-profit charitable organization. The purpose of the Reuse Centre is to ensure that items which would otherwise be put in the landfill are available for use by others.[12]

Halton Enviro Guide
The Halton Enviro Guide is an environmental directory and includes environmentally-friendly businesses and services to help residents shop locally, provides eco tips and website links and information about environmental non-profit groups and government contacts.

Zero Waste
Burlington has implemented a zero waste strategy at City Hall and many of its facilities, which includes collection of the three waste streams. When the GreenCart was introduced at City Hall, the garbage produced was reduced by 50%. However, contamination of the Blue Box and GreenCart containers in satellite recreation centres continues to be an ongoing issue, despite providing updated signage of what is and is not accepted in each of the containers.

Community Waste Reduction
Individual citizens have shared this responsibility, as at the annual Ribfest event organized by the Rotary Club of Burlington Lakeshore where recycling and organics collection has become increasingly well-organized with support from community volunteers and Halton Region. Burlington Mall's waste diversion program for example has won them the 2009 gold award from the Recycling Council of Ontario.

[12] www.reusecentre.on.ca/

Provincial Requirements
Enforcing waste audits and waste reduction work plans that are updated annually in compliance with Ontario Regulation 102/04 is an important provincial role. Schools with enrolment over 350, retail complexes and construction and demolition projects that fall within the regulation's requirements should be assessed each year.

Bottled Water
Burlington restricts the sale of bottled water in most city facilities. To support the 'Thirsty? Try the Tap' program to promote tap water, the city has also upgraded or replaced many of its indoor and outdoor water fountains to add bottle fillers to ensure staff and facility patrons have the ability to re-fill reusable water bottles.

Conclusion

Waste management is a critical issue for municipalities worldwide. Improper management of waste can cause environmental and health effects, contribute to climate change through the release of greenhouse gases, and become costly to manage for future generations. The city, in partnership with Halton Region, is dedicated to the proper management of waste within the city and across the region. The City of Burlington plays a key role in the leadership of waste management within the community, and has demonstrated commitment to zero waste in corporate initiatives. With the expansion of Halton Region waste management programs there is increased opportunity for Burlington to expand their presence in managing waste, both corporately and publicly. The city can provide further initiative, increase diversion, and build a sustainable city by implementing the following recommendations: `

Recommendations

1. Set goals and standards for waste diversion at public events being held at city parks and facilities. Work with Halton Region and the Parks & Recreation Department to develop a Waste Management guide/policy for special events being held on city property.

2. Complete an internal non-hazardous solid waste audit on City Hall. Establish baseline results and set a goal to increase waste diversion at city facilities. Share data with staff and follow up with the development of a waste reduction work plan.

Chapter 5: Transportation

Introduction

Transportation planning in Burlington is challenging because the population is highly mobile and favours the automobile in the commute to and from work, and for access to shopping, recreation and other services. Three provincial highways and several regional roads pass through the city. GO Transit and VIA rail provide an alternative mode of transportation between communities in the Greater Toronto Area. Burlington Transit provides bus service, which is a transportation option available to residents unable to or preferring not to use the automobile.

The transportation sector is also a large consumer of non-renewable fossil fuels and has a major impact on the health and well-being of Burlington residents through environmental factors such as noise, stress and air pollution.

The intent of the present transportation policies in Burlington is to "*provide an integrated, diverse transportation system for all residents and businesses that are safe, convenient, affordable, efficient and energy-conserving while minimizing environmental impacts*".[13]

The contents of this chapter have been divided into three focus areas: personal vehicle transportation choices, public transit, and walking and cycling.

What was recommended and where are we now?

The 2011 State of the Environment Report had three recommendations regarding transportation in Burlington:

Recommendation #9 That the city continue to build more cycleways in Burlington – in particular that Lakeshore Road east of downtown be converted to contain bike lanes instead of a centre-turn lane within the next three years and that the connection to Hamilton across the lift bridge be implemented.
Status Update – Ongoing Currently 24.19 kms of on-road bike lanes have been completed, representing 60% of the goal of the Cycling MP (40 kms by 2015). A pilot project to install bike lanes on part of Lakeshore Road was not approved and sharrows were installed as an alternative. Staff continues to advocate for an improved crossing on the lift bridge with the federal government.

Recommendation #10 That the city undertake a cycling survey to determine the actual number of Burlington residents who ride their bikes, and to use the information to assist in the implementation and prioritization of the Cycling Master Plan.
Status Update – Partially Achieved The Burlington Cycling Committee hosted an on-line survey to gain an understanding of cycling habits in Burlington (e.g. distance and frequency; type of bike paths used, etc.).

[13] City of Burlington Official Plan, 2008, Part II p.26

Recommendation #11
That the city encourage GO Transit to undertake improvements to the Burlington and Aldershot stations, similar to the improvements planned for Appleby station.

Status Update – Partially Achieved
Burlington GO Station is undergoing major renovations to include access, egress and flow through the station improvements for both pedestrians and cyclists. There are no planned improvements to the Aldershot Station at this time.

Issue: Personal Vehicle Transportation Choices

Why it was Measured

Understanding the transportation choices Burlington residents are making helps to determine the transportation options that are needed to reduce congestion and traffic on the road and increase public satisfaction with the transportation options.

What was Measured

Some of the data sourced for the Transportation chapter was taken from the Transportation Tomorrow Survey, a survey funded by the provincial Ministry of Transportation as well as local governments. A total of 23 local, regional, provincial and transit operating agencies are involved in this survey. The travel information collected from the participating households in the region is summarized to describe how, why, where and when people travel. [14] Note that information on a household basis is not made public for privacy reasons.

However, caution is also noted regarding the TTS data, where methodological differences may explain changes over time (1986 – 2011). In addition, there appears to be significant discrepancies in the age distribution of the TTS sample relative to the census. A large segment of the population, mostly between 18 and 35, is not included in the frame from which the sample is drawn which means there is greater scope for hidden biases than in previous surveys.[15]

What was Found

The Transportation Tomorrow Survey shows that Burlingtonians are using automobile transportation much more frequently than other modes. The data in Table 5.1 highlights the overall transportation modal split over the years by Burlingtonians. The data does not show a significant change in modal split over the twenty-five years from 1986 to 2011. Automobile transportation continues to remain the dominant form of transport by Burlingtonians, however, there is a 2% increase in the percentage of Burlington residents using GO Transit, coupled with a 2% decrease of residents walking or cycling.

[14] www.transportationtomorrow.on.ca
[15] TTS. Version 1.0 Data Expansion & Validation. Data Management Group, Dept. of Civil Engineering, University of Toronto.

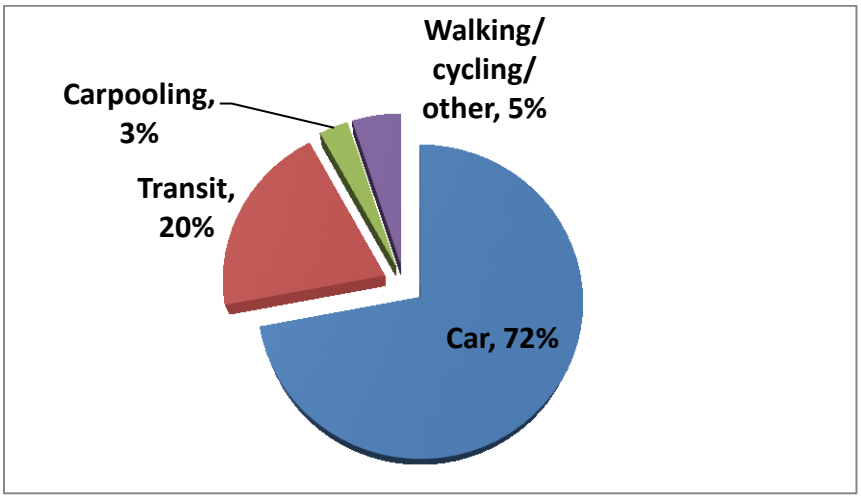
Table 5.1 - Modal Split of Trips by Burlington Residents (% of Trips)

Year	Automobile Driver	Automobile Passenger	Local Transit	GO Transit	Walking/cycling/ other
1986	72%	16%	3%	1%	8%
1991	74%	14%	2%	2%	9%
1996	74%	16%	1%	1%	7%
2001	75%	16%	1%	2%	6%
2006	73%	16%	2%	1%	8%
2011	73%	16%	2%	3%	6%

Source: Transportation Tomorrow Survey 1986-2011

The Region of Halton's Transit Master Plan – The Road to Change has forecasted the transportation modal split for 2031 to be the following:

Figure 5.1 - Region of Halton Transportation Master Plan Modal Split Forecast for 2031 (PM Peak Period)



The results of the latest modal split data from 2011 for the region at seven percent (PM Peak Period) shows that a significant change will be required to support public transit infrastructure to meet the Halton Region target of public transit accounting for 20% of transportation modal split by 2031.

Trip purpose is shown in Figure 5.2 and it is evident that there has been an increase in the overall number of home-based discretionary trips by Burlington residents up until 2006, after which there was a 1% decrease from 2006 to 2011. The overall percentage of non-home based trip purposes have also slightly increased from 17% in 1986 to 19% in 2011. Conversely, the percentage of home-based work related and school related trips have decreased over time.

Figure 5.2 - Trip Purpose for Burlington Residents (1986 – 2011)

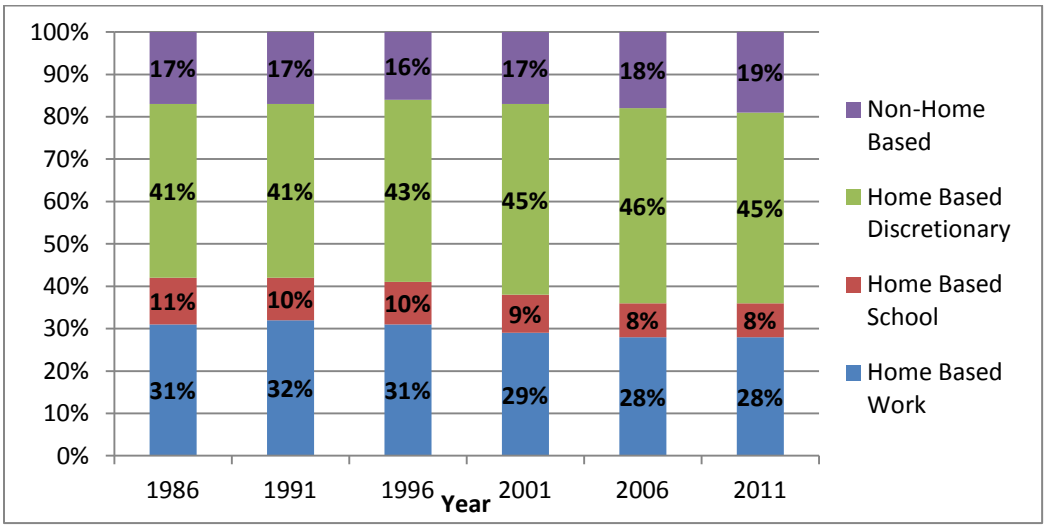


Table 5.2 below shows that the average of 1.7 automobiles per household has remained constant even though the number of households and vehicles in Burlington has increased over time.

Table 5.2 - Number of Vehicles per Household

Year	Number of households	Number of vehicles	Average vehicles per household
1986	40,300	68,510	1.7
1991	45,600	77,520	1.7
1996	50,400	85,680	1.7
2001	57,200	97,240	1.7
2006	63,200	107,440	1.7
2011	69,800	118,660	1.7

Source: Transportation Tomorrow Survey 1986-2011

What is Happening

Go Your Way – Burlington's Transportation Master Plan

The City of Burlington is developing a Transportation Master Plan 'Go Your Way' that is intended to map out a transportation future that will help the city grow in place by providing multiple travel options that are convenient and safe. This master plan will report the current state of transportation in Burlington, present challenges and possible alternatives for the future of transportation in the city and encourage community discussion on the issue of transportation.

Issue: Public Transit

Why it was Measured

Public transit is a key aspect for sustainable transportation movement. Within Burlington, residents can access several forms of public transit including: local bus service - Burlington Transit, regional bus service - GO bus, and regional and national rail service – GO train and VIA rail. Using public transit results in fewer vehicles traveling on the roads and therefore less traffic congestion, fewer accidents, lower levels of air pollutants and fewer greenhouse gas emissions. A diesel bus carrying 20 passengers emits about one-tenth the hydrocarbon and carbon monoxide, one-third as much carbon dioxide and about the same nitrogen oxide as 20 cars carrying one person each.

What was Measured

Statistics are available from Burlington Transit for trips on local transit. Statistics are not readily available for trips on GO Transit or VIA Rail specific for Burlington residents, so the movement by public transit outside of Burlington cannot be measured.

What was Found

The number of trips by local bus – Burlington Transit - was measured, as shown in Table 5.3. The number of trips per person has slightly increased over the past seventeen years. Despite the small increase over time, the average number of trips at approximately 12.5 per person in Burlington is relatively low.

Table 5.3 - City Transit Annual Ridership

Year	Transit Passengers	Population	Average Trips per Resident
1996	1,195,380	136,800	8.7
1997	1,228,850	139,700	8.8
1998	1,304,384	142,500	9.1
1999	1,395,344	145,300	9.4
2000	1,484,247	148,200	9.8
2001	1,504,695	151,000	10.2
2002	1,508,614	153,500	9.8
2003	1,500,038	156,200	9.6
2004	1,519,569	158,900	9.9
2005	1,625,458	161,600	10.4
2006	1,672,787	164,400	10.2
2007	1,714,260	167,400	10.2
2008	1,851,609	170,100	10.8
2009	1,860,825	172,400	10.8
2010	1,970,001	174,300	11.3
2011	2,109,516	175,779	12.0
2012	2,254,540	176,658	12.8
2013	2,212,814	177,541	12.5

Source: Annual Burlington Transit Reports to Council.

What is Happening

Transit Priority Measures
These measures give priority to transit vehicles at traffic lights. Priority measures have been installed at Fairview Street and Appleby Line, and at Fairview Street and Brant Street. Transportation Planning, Traffic Operations and Transit are working together to identify the potential for additional priority measures.

Smart Commute Halton
Smart Commute Halton encourages active and sustainable transportation by offering services and tools designed to make commuting easier for the employees of local organizations. Smart Commute is a program of Metrolinx and the municipalities in the Greater Toronto and Hamilton Area. Smart Commute Halton supports 25 member employers and approximately 19,000 employees. Within Burlington, Smart Commute Halton supports nine organizations, including the City of Burlington.

Smart Transit System
The city will be implementing Smart Transit System to support both fixed and para-transit service. This will include computer-aided dispatch and automatic vehicle location (CAD/AVL) technology for over 60 buses in Burlington Transit's fleet. This new software will keep dispatchers, drivers and passengers better informed on the real time schedule of the buses. Also, this software will be able to alert passengers and operators of any incidents or accidents that may cause delays to their bus route so that they are able to choose the best route to their destination. The system also supports automated on-board 'next stop' announcements and displays

Issue: Walking and Cycling

Why it was Measured
While automobile and transit transportation modes are popular among Burlington residents, it is important to consider the remaining modes that are movement choices: walking and cycling, for example. Active transportation choices typically utilize one of two networks: an off road multi-use pathway or an on-road lane.

What was Measured
The Cycling Master Plan was presented to Council in 2009 and several initiatives that were recommended have already commenced. For example, some of the gravel pathways have been re-surfaced with pavement. The cycling master plan will be updated through the Transportation Master Plan process.
There were three main goals for the cycling master plan:

- Address areas of concern in the city that are barriers to cycling or uncomfortable for cyclists
- Develop policies and other initiatives to create a bicycle friendly Burlington
- Develop a long-term cycling network and implementation plan

What was Found
The number of bike paths has been gradually increasing in Burlington, as shown in Table 5.4. The Cycling Master Plan creates a comprehensive network of on-road bike lanes and off-road multi-use paths and provides a framework for supportive policies, practices and programs to

encourage cycling in Burlington. The Cycling Master Plan will be reviewed and updated through the Transportation Master Plan study in 2015.

Table 5.4 - Kilometres of Cycling Facilities in Burlington

Year	Kilometres (Cumulative)	Details
2006	57	27 km bike lanes 30 km multi-use paths
2009	87	42 km bike lanes 3 km signed routes 42 km multi-use paths
2014	197.5	48 km bike lanes 6.4 km bike lane/ sharrow combination streets 11.7 km paved shoulders 52.5 km multi-use paths adjacent to the road 31.6 km multi-use paths off-road 47.3 km sharrows
Proposed	*373*	

Source: Cycling Master Plan 2009, City of Burlington

The Cycling Master Plan also recommended two special bikeway designs: bicycle priority streets and cycling tracks. Bicycle priority streets are local streets that have been redesigned for bicycle use as a priority over auto or transit use. Cycle tracks are segregated lanes for bicycles along sidewalks and driving lanes that have cyclist specific signals. While these ideas have not yet been accepted and put into motion they remain sustainable options for the city to consider.

Improvements were made to the Centennial and Hydro Corridor multi-use paths for paving and a refuge island was installed on Guelph Line. An intersection pedestrian signal was installed at the Walkers Line crossing of the multi-use path (between Dundas and Upper Middle). On-road bike lanes that were narrow throughout Burlington were widened to be brought to a standard of 1.3 – 1.5 m.

In 2010, the city started to introduce sharrows on roadways, which usually have low volumes in vehicular traffic and low speeds. A sharrow is a symbol that shows that the lane is to be shared by vehicles and bicycles. To-date the city has 47.3 kilometers of roads with sharrows.



What is Happening

Transit, Trails & Tourism Map
The transit, trails, and tourism Green Map was updated in 2014 showing the city's cycling network (bike lanes, bike sharrow routes, and multi-use paths) and transit routes with connections to trails for cycling and walking as well as a street index. This map also identifies recreation areas, schools, shopping centres, hotels, and emergency services in the City of Burlington.

Halton Region Cycling Map
Halton Region has updated their cycling map to include 8 new bike routes which include routes through the City of Burlington.

Bicycle Friendly Community Bronze Award
In 2012 the City of Burlington was awarded a Bicycle Friendly Community Bronze Award in Ottawa at the Association of Municipalities of Ontario's conference. The city was awarded the bronze rating by the Share the Road Cycling Coalition, an Ontario-based non-profit organization that promotes bicycling as a mode of transportation, recreation and fitness through provincial advocacy.

Car-free Sunday Festivals
Car free Sundays began implementation in the City of Burlington in 2011. As part of an initiative to make Burlington more pedestrian and cycling friendly, two car free festivals have been held each summer. During this festival, Appleby Line was closed from New Street north to Fairview Street, with the south lanes of Fairview closed from Appleby Line to Sherwood Forest Park. The festival also took place in Palladium Park in 2014. These areas were turned into a pedestrian friendly hub with activities to celebrate walking, riding and rolling.

Jane's Walk Events
Jane's Walk is a movement of free, citizen led walking tours inspired by Jane Jacobs, usually the first weekend of May. The walks get people to tell stories about their communities, explore their cities, and connect with neighbours. There have been two in Aldershot (2013 & 2014) with a third planned for 2015. The walk includes a guided walking conversation about the streetscape and a guided cycling conversation. The Sustainable Development Committee hosted a Jane's Ride in 2012 which focused on cycling infrastructure in the downtown area.

Community Trails Strategy
A city-wide Community Trails Strategy is being finalized and will be presented to City Council in 2015. The strategy will guide the development of recreational and utilitarian (for day-to-day travel) trails across the city, identify gaps for a well integrated trail system and make recommendations on standards and maintenance.

Coloured Bike Lanes
In an effort to improve cycling safety new cyclist and pedestrian facilities (bike lanes, jug-handle crossing at on-ramps, wider sidewalk) were implemented at the Fairview/QEW interchange including a blue coloured treatment for cycling lanes near the highway on-ramp, narrower lanes to promote slower speed and a reduction of the existing posted speed through the interchange from 60 km/hr to 50 km/hr.



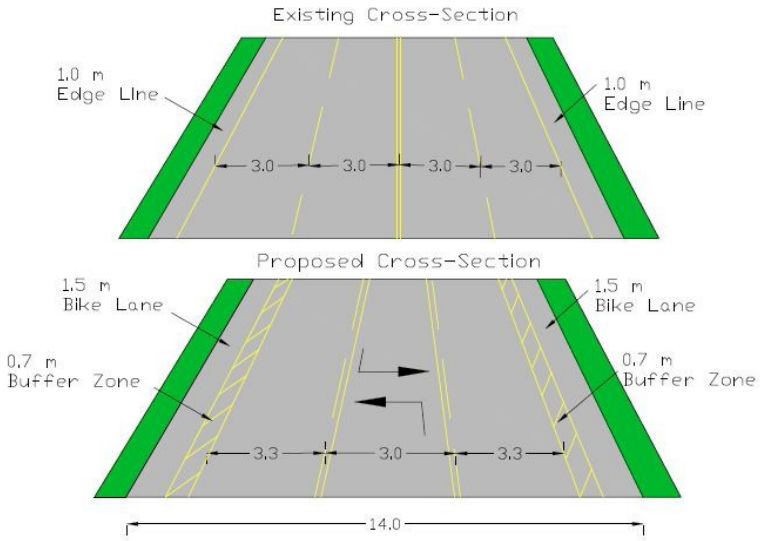




In November 2014, the green bike lanes were installed at the intersections of Fairview Street and Guelph Line and Prospect Street and Guelph Line as part of the resurfacing project on Guelph Line and Fairview St.

Palladium Way Buffered Bike Lanes
Pavement markings were made along a 2.4 km stretch of roadway on Palladium Way between Appleby Line and Walkers Line in the Alton community. Over this stretch there are now 1.6 m wide bike lanes with a 1.0 m wide buffer area between the vehicle lane and the bike lane.

Walkers Line & Appleby Line Retrofit
Walkers Line and Appleby Line were retrofitted in 2012 from 4 vehicle lanes to 3 vehicle lanes with buffered bike lanes. The bike lanes are 1.5 m wide with 0.7 m wide buffer zones.



Hydro Corridor Multi-use Paths
In 2011, two multi-use paths, a total of 9 km long and 4 m wide asphalt path was paved. This project included the replacement of pedestrian bridges, the installation of way-finding and safety signage, the installation of control gates at road crossings and 26 functional art benches and waste receptacles.

In addition, the city implemented winter maintenance (snow clearing) of the following multi-use paths: Beachway; Centennial; and the North Hydro corridor.

Halton Region Active Transportation Master Plan[16]
Halton Region is currently completing an Active Transportation Master Plan study to the year 2031 to develop the required strategy, infrastructure, initiatives and programs to promote non-motorized travel throughout the region, as recommended in the region's Transportation Master Plan (2031) – The Road to Change. As part of the plan the region has developed future walking and cycling networks. It is anticipated that the Active Transportation Master Plan will be completed in 2015.

Conclusion

Despite increases in transit services, improved GO train service and new bikeways, the predominant transportation choice of Burlington residents is the automobile. Unless there are changes in modal split away from the automobile, there will be no lessening of congestion on the roads and no reduction in pollution from the private automobile (unless there is a switch to electric or hybrid cars). Land use planning has a significant impact on local mobility options. By planning for complete and intensified neighbours with a firm urban rural boundary, a more sustainable transportation network can be supported, that includes walking, cycling and transit.

Recommendations

1. That the city undertake Transportation Modal Split surveys on a more consistent basis than the Transportation Tomorrow Survey. It is recommended that this survey include questions to detail why residents of Burlington choose their preferred mode of transportation and what steps need to be taken to encourage residents to rely on more sustainable transportation options.

[16] www.halton.ca/ActiveTransportation.

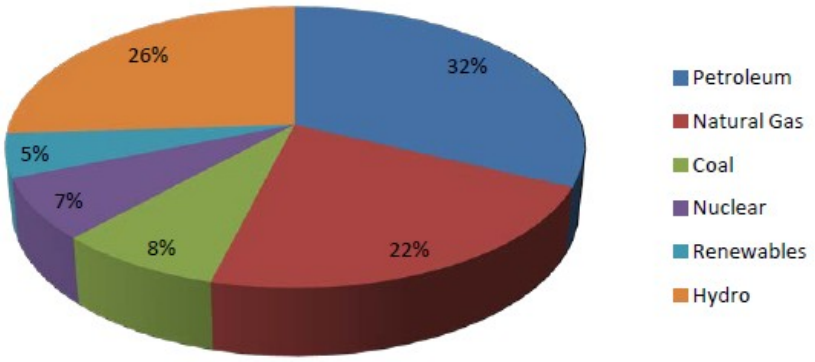
Chapter 6: Energy

Introduction

Canadians are among the highest per capita energy users in the world. We use energy to keep our homes and offices at a 'comfort level' despite wide ranging outside temperatures. We use energy to transport people and cargoes across our large and dispersed country. We use energy to power the various businesses that manufacture the products we export and use domestically.

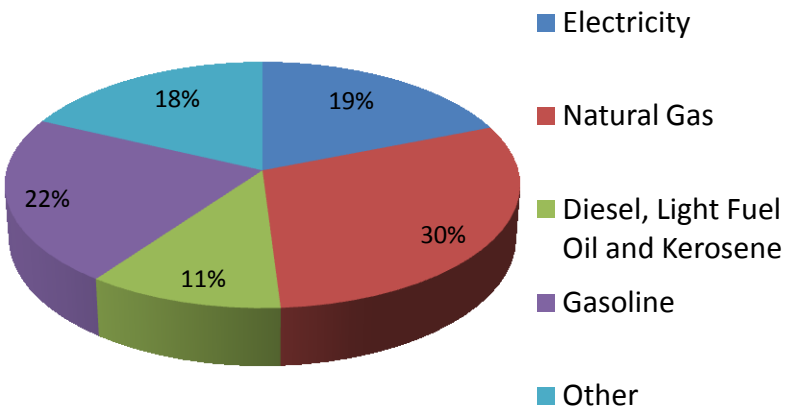
Nationally, in 2010, 62% of the energy consumed was from fossil fuel sources such as petroleum, coal and natural gas.[17]

Figure 6.1 - Canada's Total Energy Consumption by Type 2010[18]



In Ontario, it is slightly higher. The breakdown in this chart is slightly different in that electricity is not broken down by source of generation.

Figure 6.2 Ontario Energy Use by Energy Source[19]



[17] Burlington Community Energy Plan, January 2014. Page 26
[18] U.S. Energy Information Administration
[19] NRCan's Comprehensive Energy End Use 2010 Data Tables

There are three main concerns associated with the large-scale burning of fossil fuels.

- The process produces large quantities of carbon dioxide gas and other greenhouse gases that are a main contributor to climate change.
- Fossil fuels are non-renewable resources. Current data indicates that in the case of oil, our most versatile fossil fuel, we may soon reach a point where we are using more oil than we are discovering. From this point (often referred to as peak oil) our supply of oil will decline with resulting shortages and large-scale price increases.
- Extraction, transportation and preparation of fossil fuel resources can result in significant environmental damage, such as that seen in the Athabasca Oil Sands or the 2010 Gulf Coast oil well accident.

The major types of energy used in residences, businesses and industry are electricity and natural gas. Electrical energy is produced from a variety of sources, both renewable and non-renewable. The Canadian average is 23% from fossil fuels.

What was recommended and where are we now?

The 2011 State of the Environment Report had three recommendations regarding energy in Burlington:

Recommendation #12 That the city complete a Community Energy Plan with a focus on generation, including opportunities for district and renewable energy, community conservation initiatives, green building infrastructure, the distribution grid, and energy management. Consideration should also be given to land use planning and transportation initiatives to ensure an efficient and energy conserving community.
Status Update - Achieved Completed – 2014. Annual reports will be completed on the progress of the plan to be submitted to council.

Recommendation #13 That the city prepare corporate energy reduction targets and mechanisms to find energy saving initiatives by considering both upfront capital and operating costs.
Status Update - Achieved Completed – a corporate energy management plan and facility audits were completed in 2013. Staff report annually to council on progress.

Recommendation #14 That the city participate in a renewable energy co-operative with city facilities and residents, as permitted under the Green Energy and Green Economy Act 2009.
Status Update – Not Achieved The city has not pursued a partnership with a community cooperative, but staff are working on plans to expand the installation of solar panels on city facilities through the FIT program.

Issue: Energy Production/Supply

Why it was Measured

A continuing growth of electrical energy demand, particularly through the growth of electronics, on both an overall and per capita basis requires the construction of additional generation facilities and/or the purchase of energy from other jurisdictions, which may result in greater per-unit costs for consumers. For example, as demand for electricity approaches supply capacity, more expensive and typically more polluting sources of electrical energy generation must be brought online to support the load.

Issues related to the use of fossil fuels for energy include:

- Environmental damage associated with extraction of underground and surface resources, including irreparable destruction of native flora and associated ecosystems, displacement of native fauna, significant consumption of fresh water, pollution of surface waters, pollution of aquifers, contamination of nearby soil, and air pollution from flaring, off-gassing and refining operations
- Rapid depletion of non-renewable resources that can be used for production of materials and medicines, in addition to energy
- Criss-crossing of continents with pipelines, pumping stations, storage tanks, wellheads and other infrastructure to support extraction and delivery
- Production of large quantities of airborne carbon dioxide gas by combustion
- Release of methane, a powerful greenhouse gas, into the atmosphere from wellhead operations, leaks and system losses
- Production of nitrogen oxides, the primary contributor to photochemical smog, contributing to significant health effects and premature deaths
- Production of sulfur dioxide, the leading cause of acid rain

Although technically a cleaner source of electricity, nuclear energy plants have high capital and operating costs and carry the environmental challenge of the safe storage of radioactive spent fuel rods. Most water (hydro) power installations alter the landscape through the establishment of storage reservoirs behind dams.

What was Measured

The supply mix for electricity generation in Ontario is reviewed.

What was Found

Figure 6.3 shows the electricity supply mix for Ontario in 2005 and figure 6.4 shows the mix for 2014. It should be noted that the chart for 2005 includes hydro electric production under renewables; whereas, it is separate in the chart for 2014. Furthermore, in 2014, the last coal-fired generating station in Ontario was decommissioned, eliminating a significant source of greenhouse gas emissions in the province. Natural gas plants are now used as peaking plants in the province to meet fluctuations that occur in supply (from renewables) and demand for electricity on a daily basis, where nuclear and hydro sources provide the baseload supply.

Figure 6.3 - Electricity Supply Mix for Ontario 2005

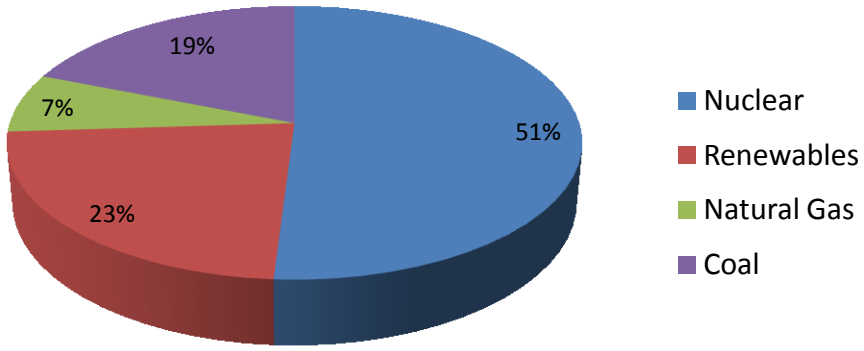
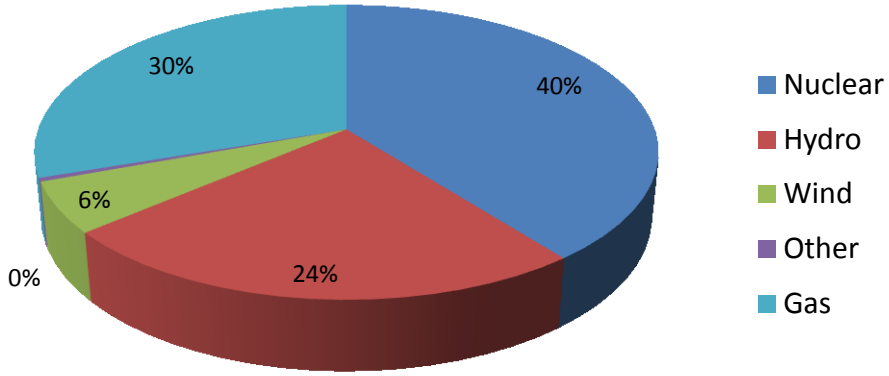


Figure 6.4 - Electricity Supply Mix for Ontario 2014[20]



At the time of writing this document, Ontario had an installed generating capacity of 32,829 MW.

Renewable Energy and the Feed-In Tariff (FIT) Program
One of the key elements of the provincial Green Energy and Green Economy Act 2009 was a mandate to the Ontario Power Authority to create and run a feed-in tariff program offering long-term secure contracts to developers of renewable energy projects. The program offers standardized rules and prices for projects of various sizes and fuel sources, and is designed to allow for a reasonable return on investment over the 20 year contract term.

The FIT program is divided into two streams – FIT and microFIT. The microFIT program has simpler application and contracting processes than the regular FIT program and is intended for renewable energy projects not more than 10kW. The Ontario Power Authority has created

[20] Independent Electricity Supply Operator, www.ieso.ca

partnership programs to help defray the “soft” costs related to development of community-owned and aboriginal-owned renewable power projects.

Table 6.1 - Renewable Energy Installations in Burlington

Program	Number of Installations	Installed Capacity
MicroFIT	86	688 kW
FIT	18	3,263 kW
Net Metering	4	12 kW
Total Renewables		3,963 kW

What is Happening

Achieving Balance – Ontario’s Long Term Energy Plan

In late 2013, the provincial government issued its updated Long Term Energy Plan after a comprehensive consultation and engagement process. The plan is intended to be flexible recognizing conditions can change on an annual basis. The Ministry of Energy has committed to providing annual energy reports on supply and demand, and progress on the implementation of the plan. The plan is based on five principles: cost-effectiveness, reliability, clean energy, community engagement and an emphasis on conservation and demand management before building new generation.

As noted above, conservation is the priority of the plan to help manage energy demand in the province. Recently, the Minister has directed the Ontario Energy Board to extend the CDM (conservation & demand management) framework for local distribution companies (electrical) and the DSM (demand & supply management) framework for the gas utilities for another five years. In addition, the province has put on hold plans to build two new nuclear reactors at the Darlington Generating Station. And the province has recognized that energy is greater than just electricity as the plan also references natural gas, combined heat and power, and district energy opportunities.

Burlington Community Energy Plan

Other than some renewable energy installations (see Table 6.1) in Burlington, there is little local energy generation in Burlington. However, in January 2014, City Council endorsed the first Community Energy Plan for Burlington. One of the five goals in the plan relates to Energy Generation and Security: “Increase sustainable local energy generation in Burlington and enhance supply security, in ways that support Burlington’s economic competitiveness.” One of the first priorities for the Energy Generation task group is to consider the feasibility of implementing a district energy system in Burlington, a more efficient means of distributing thermal (heating and cooling) energy to customers from a central plant. Local energy generation, particularly a district energy system, can result in a more resilient community, particularly in the face of impacts from climate change, such as severe weather events.

Ontario Power Authority (OPA) & Independent Electricity System Operator (IESO)
In 2015, the Ontario Power Authority and the Independent Electricity System Operator merged into one entity and is now referred to as the IESO. The IESO ensures there is enough power to meet the province's energy needs in real time while also planning and securing energy for the future. It does this by:

- balancing the supply of and demand for electricity in Ontario and directing its flow across the province's transmission lines
- planning for the province's medium- and long-term energy needs and securing clean sources of supply to meet those needs
- overseeing the electricity wholesale market where the market price of electricity is set
- fostering the development of a conservation culture in the province through programs such as saveONenergy[21]

Issue: Energy Consumption

Why it was Measured

The consumption of energy by a community is reflective of its size, economic activity and lifestyle. The United States and Canada far outpace other countries around the world in per capita consumption of energy. Comparisons of per capita GDP to energy consumed show that countries such as Norway, Switzerland and Japan manage to achieve comparable economic success with more efficient use of energy. These same comparisons show that Canada matches per capita energy consumption with the US, yet achieves only two-thirds the per capita GDP.

The majority of the energy we use in Ontario is obtained from the burning of fossil fuels, primarily oil and gas. The Burlington Community Energy Plan did not report on the breakdown of energy use in Burlington but it is expected to be similar. Understanding the uses for energy provides a context for reducing its consumption in specific ways.

The largest consumption of energy by sector is from transportation (Figure 6.1 for 2011 below). Most of this is fossil fuel which is an inefficient source of energy. In order to reduce consumption, more efficient forms of motive power are needed.

Buildings are responsible for a significant amount of energy use and are estimated to account for 38% of all secondary energy use in Canada, contributing 30% of all greenhouse gas emissions in the country. In order to effectively manage this, serious consideration must be given to design and construction techniques for new buildings and for retrofits in the city.

Heating and cooling systems can also be made more efficient through use of ground, water and air energy resources. Technologies to use these reduce energy input by utilizing the fact that energy is available for extraction.

Below the frost line, the earth is at a virtually constant temperature year round. It is therefore warmer than the air in winter and cooler than the air in summer. A series of horizontal or vertical pipes are laid some two or more meters below the ground and a liquid is pumped through them.

[21] www.ieso.ca

In winter the liquid extracts heat from the surrounding earth and this heat is transferred to air or water to warm the building. The reverse process takes place in the summer.

Similarly, water bodies can provide energy such as in wells, ponds and lakes. Both open and closed loop technology is used to either circulate the water itself or use a heat exchanger to transfer the energy from the water to the transfer medium.

In addition, the air is a renewable energy source and technical advancement of the heat pump technology has resulted in useable energy available down to temperatures as low as – 35 Celsius. For some applications, the use of air to air heat pumps can be a better choice when lower capital cost is balanced against the reduced efficiency.

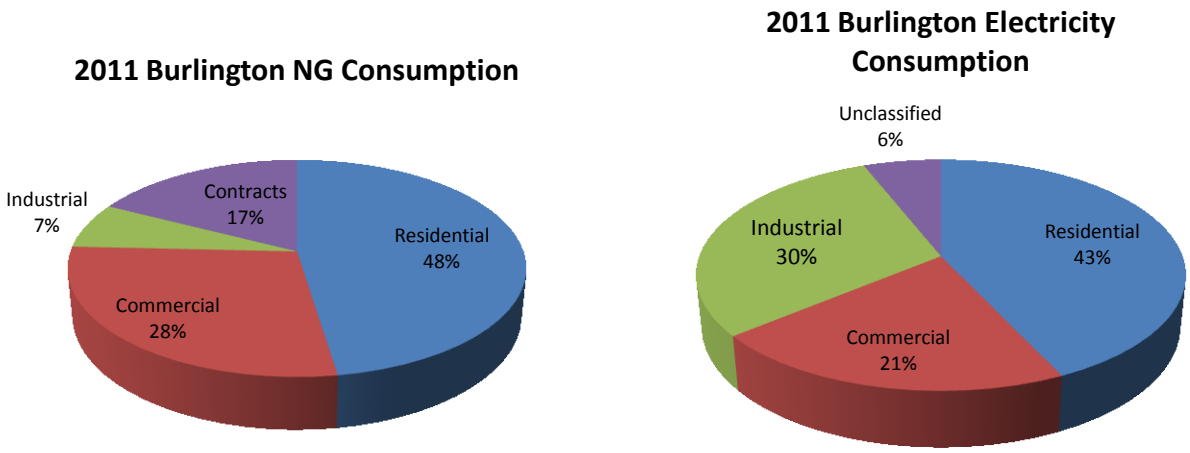
What was Measured

Community energy consumption in Burlington, including natural gas and electricity.

What was Found

The breakdown between electricity and natural gas is shown in Figure 6.7. This shows the residential sector uses about the same percentage of both electricity and gas, but industrial users consume a greater percentage of electricity than gas.

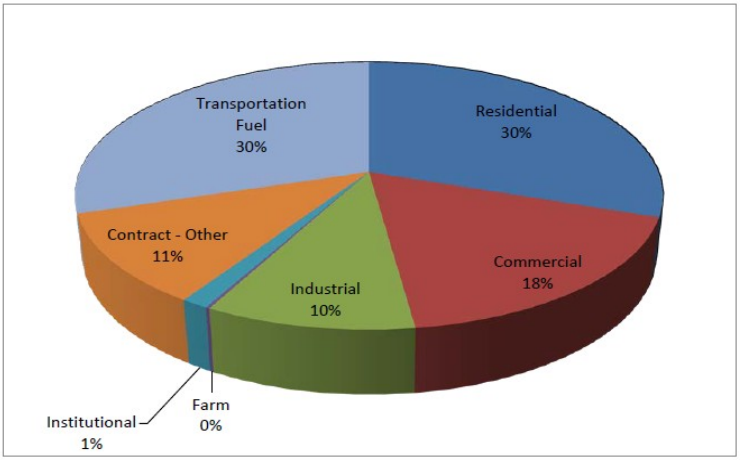
Figure 6.7 - Burlington Natural Gas and Electricity End Uses[22]



[22] Burlington Community Energy Plan

An overall view of energy consumption in Burlington (Figure 6.8) shows the commercial and industrial sectors consuming just under 40% where residential and transportation represent about 1/3 each.

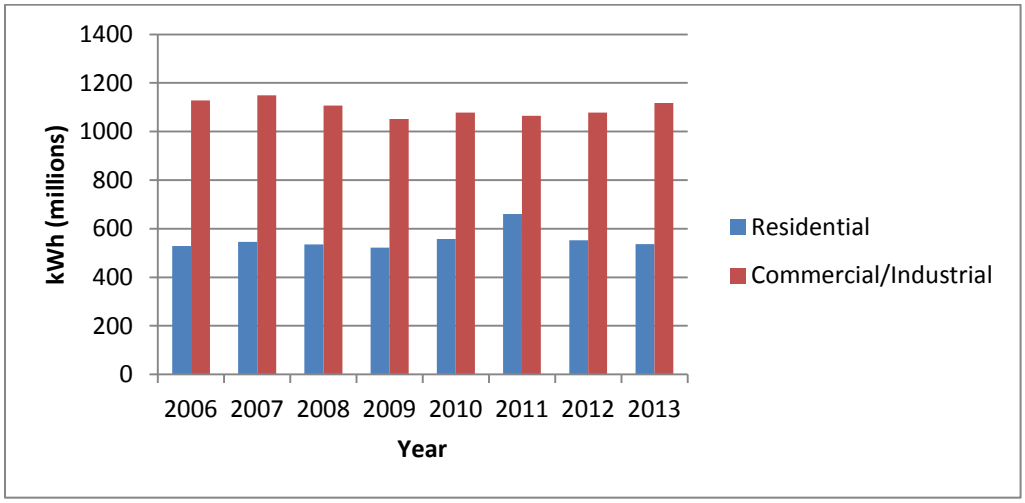
Figure 6.8 - Burlington Energy Consumption by Sector, 2011



Community energy consumption for everything from transportation, heating and cooling, industrial processes and electronics usage results in the emission of greenhouse gases, contributing to climate change. Additional details about climate change can be found in Chapter 10.

Figure 6.9 shows the Annual Electrical Consumption in Burlington for the residential, and industrial and commercial sectors. Although population continues to increase, the trend line for electrical consumption does not show an upward line, which may reflect success in local conservation programs.

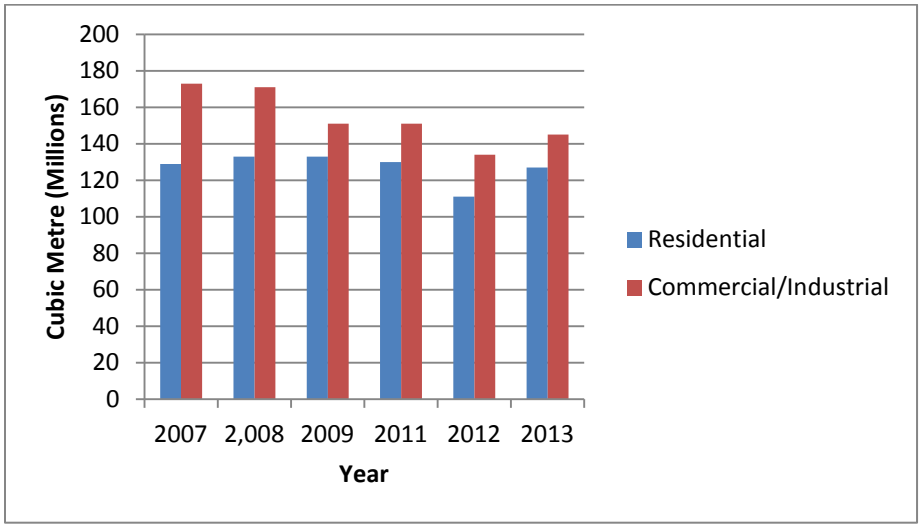
Figure 6.9 – Annual Electrical Consumption Burlington (kWh millions)



Total natural gas consumption for the commercial and industrial sector appears to be on the decline. Factors that could be contributing to this decline could be weather (heating degree

days); the economic downturn around 2008-9; and conservation programs delivered by Union Gas to their customers. On the residential side, a decline is not as evident but on a per capita base, accounting for population growth, there has been a reduction in NG consumption.

Figure 6.10 – Annual Natural Gas Consumption Burlington (m^3 millions)



Space heating accounts for 57% of residential energy use in Canada and approximately 52% of commercial/industrial energy use, according to the Canadian Centre for Energy Information. It is therefore prudent to seek methods to reduce the energy required for this function.

High performance building envelopes, characterized by highly insulated (high R-value) and airtight construction can greatly reduce energy demand for heating and cooling. The push toward adoption of LEED™ (Leadership in Energy and Environmental Design) building standards and a more comprehensive Ontario Building Code in 2012 will help drive these changes. Programs have been introduced to reduce the usage of electricity by households – one such program is the free removal of old refrigerators that use large amounts of electricity.

What is Happening

Community Energy Plan

Following the recommendation of SOER IV, the City of Burlington has developed both a Corporate Energy Management Plan and a Community Energy Plan. The latter was endorsed by Council in January, 2014. The plan includes five goal areas related to: 1) Behaviour Change and a Culture of Conservation; 2) Energy Efficiency; 3) Energy Generation and Security; 4) Land Use & Growth; and 5) Transportation.

The plan was developed by the city in partnership with Burlington Hydro. A Community Stakeholder Advisory Committee was an integral part of the process to provide feedback and guidance on the development of the plan. The involvement of the community stakeholders is an important part of the implementation process, as this is a community plan and not a City Hall plan.

There are a number of objectives under each goal, with a total of 55 actions in the plan for implementation. A key focus of the plan is on energy efficiency initiatives, energy conservation and behaviour change, recognizing that the cheapest kilowatt hour is the one that is not needed.

The city will monitor progress by tracking community energy consumption/savings and the resultant reduction in greenhouse gas (GHG) emissions.

Local Improvement Charges
The Province of Ontario passed legislation to permit municipalities to include energy efficiency and renewable energy under the longstanding Local Improvement Charge system. This system puts the cost of home improvements onto the tax bill of the property at low interest rates over long time periods. The intent is to give the homeowner a positive cash flow from the completion of renovations. The financing stays with the property so properties can be sold without restriction.

Achieving Balance – Ontario's Long Term Energy Plan
The province is proposing to extend natural gas to rural and northern communities. For those homes and communities currently using oil based furnaces or diesel generators, using natural gas can be a cleaner form of energy. However, the province should also consider the utilization of heat pumps, particularly in rural communities, as a cleaner and more efficient form of energy in its long term energy strategy.

Sustainable Vehicles
Electric/hybrid vehicles are becoming more popular as the technology improves. As well as reducing carbon emissions, electric/hybrid vehicles save fuel and money with minimal change in lifestyle – the main deterrent to energy conservation. The Burlington Community Energy plan recognizes this and has set goals and objectives to encourage electric vehicles including electric vehicle market monitoring and consideration of charging stations at city buildings and downtown parking lots.

The Sustainable Development Committee has been examining the switch to electric/hybrid vehicles. The current technology allows any driver to replace a gasoline/diesel powered passenger car or light truck with the equivalent electric or hybrid to suit travel distance and interior comforts. Although more study is needed, the cost to switch can be minimal. Some electric vehicle purchases pay back the added capital cost within three years such that the additional financing charges are more than paid for through the monthly fuel savings.

Conservation Programs[23]
The Ontario government has their SaveOnEnergy program that offers appoximately 50% back in financial incentives for businesses to upgrade their equipment to energy efficient equipment such as their lighting, HVAC (heating, ventilation and air conditioning) and refrigeration. Other incentives are also available for the homeowner along with tips on saving electricity. Union Gas also has assistance for both commercial and residential users.

For the homeowner, the financial assistance is not great. With the cancellation of the popular Federal EcoEnergy Retrofit Program, homeowners need more assistance.

[23] Burlington Community Energy Plan

There is a number of conservation and demand management programs available from the utility providers as listed below.

Burlington Hydro Inc.
Burlington Hydro Inc (BHI) delivers a slate of conservation and demand management programs that are designed and funded by the Ontario Power Authority (OPA):

- Heating and Cooling Incentives – Consumer Program
- *PeakSaver* PLUS – Consumer Program
- Consumer Coupons – Consumer Program
- Appliance Exchange Events - Consumer Program
- New Home High Performance Incentives – Consumer Program
- Demand Response – Business Program
- Small Business Lighting – Business Program
- Retrofit Program – Business Program
- High Performance New Construction – Business Program
- Energy Audits – Business Program
- Building Commissioning – Business Program
- Training & Support – Business Program
- Social and Assisted Housing Programs – Social Program

The highest participation in the Burlington Hydro residential programs is seen with the heating and cooling incentive, Peaksaver PLUS, the Fridge and Freezer Pick-up and Coupon programs. Commercial institutional and industrial programs have the highest participation in: small business lighting, electricity retrofit initiative incentive, energy audits, high performance new construction, and demand response 3.[24]
A summary of conservation savings is provided here:

Table 6.2 – Conservation Savings by Year and Sector in Burlington

	Residential kWh	ICI[25] kWh
2010	.7 million	2.3 million
2011	2.2 million	3.6 million
2012	1.4 million	6.9 million
2013	1.6 million*	5.7 million

Source: Burlington Hydro. (*includes Home Assistance Program along with Residential Programs)

Union Gas Limited
Union Gas Limited delivers a slate of conservation programs to consumer and business customers:

- Residential Energy Saving Kits – Consumer Program
- Drain Water Heat Recovery - Consumer Program
- Programmable Thermostat Rebates – Consumer Program
- Space Heating Programs – Business Program
- Water Heating Programs – Business Program
- Cooking Programs – Business Program
- Engineered Projects – Business Program

[24] Information on programs is available at www.saveonenergy.ca.
[25] ICI – Industrial, commercial and institutional uses

Halton Region - Water
Halton Region delivers a slate of water conservation and efficiency programs:

- Residential Toilet Rebates
- Rain Barrel Sales
- Annual Halton Children's Water Festival
- Distribution System Leak Detection
- Community Outreach
- Outdoor Water Use Strategy

Halton Region is responsible for the treatment and distribution of water and the collection and treatment of wastewater. Halton Region recognizes it is a significant energy customer. Opportunities for energy optimization exist in both water and wastewater and, where possible, are being considered as a part of projects undertaken by Halton Region.

Conclusion

Burlington's Community Energy Plan identifies key measures which will reduce energy consumption with the associated greenhouse gas emissions reduction. However, much more can be done to mitigate climate change by focusing on the largest contribution of carbon – transportation and promoting the use of electric/hybrid vehicles. Secondly, the use of renewable energy for heating and cooling homes and buildings including modern heat pump technology will reduce, rather than increase GHG emissions.

Recommendations

1. That the city continue the implementation of the Community Energy Plan with a focus on fuel and cost savings, by switching from gasoline vehicles to electric/hybrid vehicles, investigating opportunities for local sustainable generation (e.g. district and renewable energy), improving efficiency, increasing community engagement and improving the built form.
2. That the city continue with corporate energy reduction targets and mechanisms to find energy saving initiatives by considering both upfront capital and operating costs.
3. That the city works closely with the province to ensure the Long Term Energy Plan results in both energy and greenhouse gas emission savings.

Chapter 7: Air Quality

Introduction

Air pollution can occur anywhere. It occurs when the environment is contaminated by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Gas appliances, motor vehicles, industrial facilities and forest fires are common sources of air pollution.

Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulphur dioxide. Both ambient (outdoor) and household (indoor) air pollution cause respiratory and other diseases, which can be fatal.[26]

This chapter looks at two issues related to air quality – the status of air monitoring in Halton Region and the province and smog, which can impact health and quality of life.

What was recommended and where are we now?

The 2011 State of the Environment Report had two recommendations regarding air quality in Burlington:

Recommendation #15 That the Region of Halton be requested to install their air monitoring equipment in Burlington so that Burlington-specific air quality measurements can be obtained.
Status Update – Partially Achieved The city has not requested specific air monitoring equipment be installed in Burlington. However, in 2013, Halton Region Public Health staff prepared a report, Air Quality in Halton, comparing data from the region's Milton air monitoring station to data from the Ministry of the Environment's stations in Oakville and Milton. Results of the analysis were relatively consistent among Milton, Burlington and Oakville monitoring stations. It is anticipated that with additional years of monitoring, the evaluation of air quality trends in Halton Region will be possible.

Issue: Air Monitoring

Air Quality Index
The Air Quality Index (AQI) is an information system administered by the provincial Ministry of the Environment and Climate Change which provides the Ontario public with a continuous measure of the quality of the air on a real-time basis. The AQI measures six different contaminants and then places the readings on a common scale ranging from one upwards.

[26] World Health Organization (WHO)

The calculated number from each pollutant is called a sub-index. The contaminant that has the highest sub-index level at the time determines the AQI. In Ontario the contaminants that most often impact the AQI are ground level ozone and fine particulate matter.

The Index considers six common air contaminants:
- Carbon monoxide (CO)
- Fine particulate matter ($PM_{2.5}$)
- Total reduced sulphur compounds (TRS)
- Nitrogen dioxide (NO_2)
- Ground level Ozone (O_3)
- Sulphur dioxide (SO_2)

Air Quality Index Ratings
There are five areas of range for the AQI, described here:

Table 7.1 – Air Quality Index Descriptions

Category	Range	Description
Very Good	0 - 15	Air quality levels that meet long-term goals, normally occurring in areas having a pristine environment with no local man-made sources of air contaminants.
Good	15 - 31	Air quality levels that have no known adverse effects on human or animal health and negligible effects on vegetation, property or aesthetic values.
Moderate	32 - 49	Air quality levels that have negligible effects on human or animal health but may adversely affect very sensitive vegetation, property or aesthetic values.
Poor	50 - 99	Air quality levels that may have adverse effects on sensitive members of human or animal population, or may cause significant damage to vegetation, property or aesthetic values.
Very Poor	>100	Air quality levels that may have adverse effects on the health of large segments of the exposed population.

Air Quality Health Index
The Air Quality Health Index (AQHI) is designed to help Canadians make decisions about protecting their health by limiting short-term exposure to air pollution and adjusting activity levels during increased levels of air pollution. This tool was developed by Health Canada and Environment Canada and is available for select communities, including Halton Region. It was piloted in the City of Toronto in 2007. It also helps people understand their response to different pollution levels to help them plan and enjoy outdoor physical activities at times when health risks are low.

The AQHI is measured on a scale ranging from 1-10+. The AQHI index values are grouped into health risk categories as shown below. These categories help you to easily and quickly identify your level of risk.



The AQHI is calculated based on the relative risks of a combination of common air pollutants which are known to harm human health. It pays particular attention to people who are sensitive to air pollution and provides them with advice on how to protect their health during air quality levels associated with low, moderate, high and very high health risks. As evidence emerges on the dependent relationship between health and air quality the AQHI may become a measure of accountability for health outcomes influenced by air quality such as respiratory illnesses; asthma, obstructive lung disease and others.

Air Monitoring Stations
There are two air quality monitoring stations in or near Burlington. One station is positioned on the south western border of Burlington and another is located in mid-Oakville. The Region of Halton also operates a monitoring station in the Town of Milton. Although the wind pattern over Burlington is influenced by the topography of the Niagara Escarpment and lake breezes from Lake Ontario research has confirmed that readings from monitoring stations in Halton provide a reliable indication of Air Quality for Burlington.

The characteristics, sources, general health effects and ecological effects for the five common air pollutants are described in Table 7.2. The table also includes Ammonia and Volatile Organic Compounds.

Issue: Smog

Why it was Measured
A low-lying haze known as smog, which causes damage to human health, crops and property, often covers Ontario cities, villages and countryside. Smog is a mixture of pollutants primarily made up of ground level ozone and particulates ($PM_{2.5}$ - Breathable particles smaller than 2.5 microns). Other major contributors to smog include nitrogen oxides, volatile organic compounds, sulphur dioxide, carbon monoxide and ammonia.

What was Measured
Smog advisories are issued to the public by the Ministry of the Environment and Climate Change when widespread, elevated and persistent smog levels are forecast to occur within the next 24 hours, *or* if elevated smog conditions occur without warning and weather conditions conducive to elevated smog levels are forecast to continue for several hours. It is possible to subscribe to Smog Alerts at Smog Alerts Halton.

The smog advisory program covers those areas of Ontario where ozone levels are most likely to exceed the one-hour AAQC (Ambient Air Quality Criterion) of 80 ppb and $PM_{2.5}$ levels (particulate matter smaller than 2.5 microns) of 45 $\mu g/m^3$ three-hour running average.

Table 7.2 Pollutant Characteristics, Sources, General Health and Ecological Effects

Pollutant	Characteristics	Sources	General Health Effects	General Ecological Effects
Ground- level Ozone (O_3)	A colourless, odourless gas at ambient concentrations. A major component of summer smog. Formation and transport strongly dependent on meteorological conditions.	Not emitted directly into the atmosphere but produced when NOx and VOCs react in the presence of sunlight.	Irritation of the respiratory tract and eyes. Exposure in sensitive people can result in chest tightness, coughing and wheezing. Linked to increased hospital admissions and premature deaths. Considered toxic under *Canadian Environmental Protection Act, 1999* (CEPA).	Agricultural crop loss and visible leaf damage in many crops, garden plants and trees.
Fine Particulate Matter ($PM_{2.5}$)	Mixture of microscopic solid particles and liquid droplets in the air that are less than 2.5 microns in diameter. Major component of summer and winter smog. Composition varies with origin, residence time in the atmosphere, time of year and environmental conditions.	Formed indirectly from chemical reactions in the atmosphere or directly through fuel combustion (motor vehicles, power generation, industrial facilities, residential fireplaces and woodstoves, agricultural burning and forest fires, construction activity and road dust).	Particles may penetrate deep into the respiratory system. Aggravation of existing heart and lung diseases. Can exacerbate symptoms such as chest pain, shortness of breath, wheezing and fatigue. Linked to increased hospital admissions and premature deaths. PM containing metals released in emissions from copper smelters or refineries or zinc plants are considered toxic under CEPA.	Impacts include corrosion, soiling, and damage to vegetation and reduced visibility.
Sulphur Dioxide (SO_2)	Colourless gas with a strong odour similar to burnt matches.	Smelters, utilities, iron and steel mills, petroleum refineries, and pulp and paper mills. Lesser sources include transportation, residential, commercial and industrial space heating.	Breathing discomfort, respiratory illness, and aggravation of existing respiratory and cardiovascular disease. People with asthma, chronic lung or heart disease are most sensitive. Considered toxic under CEPA due to its contribution to formation of PM.	Leads to acid deposition that contributes to lake acidification, corroded buildings, reduced visibility and damage to trees and crops.
Nitrogen Oxides (NOx)	A reddish-brown gas with a pungent and irritating odour. Includes nitric	All combustion in air produces NOx. Major sources include transportation,	Increased sensitivity for people with asthma and bronchitis including coughing, wheezing, and shortness of	Leads to acid deposition that contributes to lake acidification, corrodes metals,

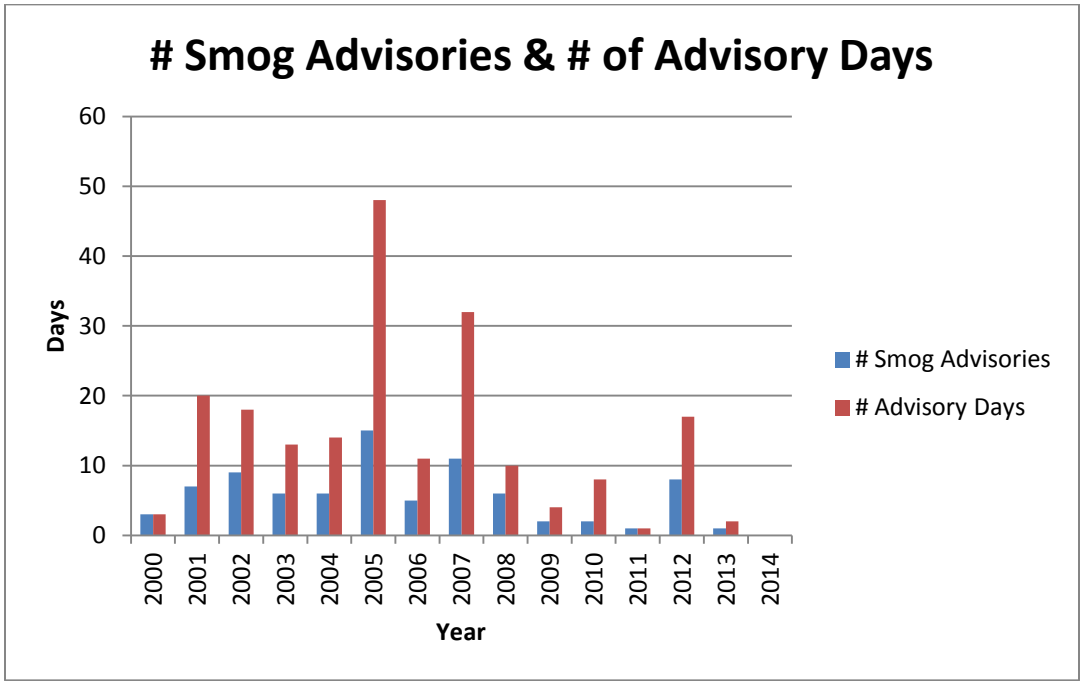
Pollutant	Characteristics	Sources	General Health Effects	General Ecological Effects
	oxide, nitrogen dioxide (NO_2) and nitrous oxide. A precursor to O_3.	power plants, primary metal production and incineration.	breath. Lung function impairment and reduced resistance to respiratory infection. NO and NO_2 considered toxic under CEPA due to its contribution to formation of PM.	fades fabric, degrades rubber and damages trees and crops.
Carbon Monoxide (CO)	Colourless, odourless, tasteless and, at high concentrations, a poisonous gas.	Incomplete combustion of fossil fuels mainly in the transportation sector.	Impairment of visual perception, work capacity, learning ability and performance of complex tasks. People with heart disease particularly susceptible.	
Ammonia (NH_3)	A colourless gas with a pungent odour noticeable above 50ppm Ammonia exists naturally in the air at levels between 1 and 5 parts in a billion parts of air (ppb). It is a precursor to smog yielding ammonium sulphates and nitrates.	Agricultural livestock and poultry waste management and fertilizer and pesticide application.	Gaseous NH_3 considered toxic under CEPA due to its contribution to formation of PM.	Can contribute to the nitrification and eutrophication of aquatic systems.
Volatile Organic Com-pounds (VOCs)	Carbon containing gases and vapours. They are “volatile” because they easily and quickly evaporate into the air.	Paints, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, glues and adhesives, permanent markers, and photographic solutions, and vehicles.	Health effects vary according to the specific compound. Severalhave been declared “toxic” under the CEPA due to their contribution to formation of PM, and some (e.g. benzene) are carcinogenic.	VOCs contribute to form O_3 and secondary PM

What was Found

Smog episodes are highly dependent upon weather conditions that vary from year to year and occur most often on hot sunny days from June to September. The burning of fossil fuels such as gasoline, diesel, and coal, are the main contributors. Burlington is also impacted by trans boundary emissions emanating from the Ohio Valley (coal fired generating stations) but much of

the local smog is generated by dust, construction, traffic, industry and other sources of particulate matter. Smog is estimated to contribute to over 1900 deaths in Ontario every year.

Figure 7.1: Smog Advisories and Smog Advisory Days in Halton-Peel 2000-2014



What is Happening

The Region of Halton developed a Smog Response Plan in 1999, which was adopted by the City of Burlington in 2000. The Plan was updated in 2006 and re-named The Halton Clean Air Plan, which was also adopted by the city.

Both the city and the region participate in the Greater Toronto and Hamilton Area Clean Air Council, a network of municipalities and health units from across the Greater Toronto and Hamilton area. It was established in 2001 to work collaboratively on the development and implementation of clean air and climate change mitigation and adaptation actions.

The City of Burlington has undertaken many initiatives described in this report to mitigate against air pollution and to promote the highest air quality possible. Initiatives include

- Burlington Community Energy Plan & Corporate Energy Management Plan
- Cycling Master Plan
- Mobility Hubs Study
- Transportation Demand Management for city employees under Smart Commute Halton
- Transportation Master Plan
- Corporate Green Fleet Strategy
- Corporate Sustainable Buildings Policy
- Green Procurement
- Anti-Idling By-Law

Burlington Idling Control By-law
In 2004, Burlington introduced an idling control by-law to control unnecessary idling. In June 2009 the by-law was updated and strengthened. The new by-law restricts idling to one minute and contains measures for anti-idling enforcement. Burlington Transit has also adopted a one minute idling policy.

Idling is now defined as a parking offence and parking enforcement officers can lay charges under the anti-idling by-law. There is a set fine of $100 and the city has been successful in charging offending motorists, as seen in Table 7.3.

Table 7.3 – Anti-idling Tickets & Warnings Issued in Burlington

Year	#Tickets	#Warnings
2010	15	31
2011	10	24
2012	7	2
2013	15	6
2014	13	2

Source: City of Burlington

Conclusion
There seems to be increased awareness of air quality issues by the residents and elected officials of Burlington recognizing the opportunities for community mitigation for pollution and related hazards. The Sustainable Development Committee has driven focus on key issues related to sustainable development, green neighbourhood design, preservation of the urban forest, sustainable transportation such as public transit and cycling, and alternative energy sources.

Recommendation
Although there is no recommendation in this chapter, recommendations provided in other sections such as Land Use Planning, Transportation, Energy and Sustainable Buildings all support this objective.

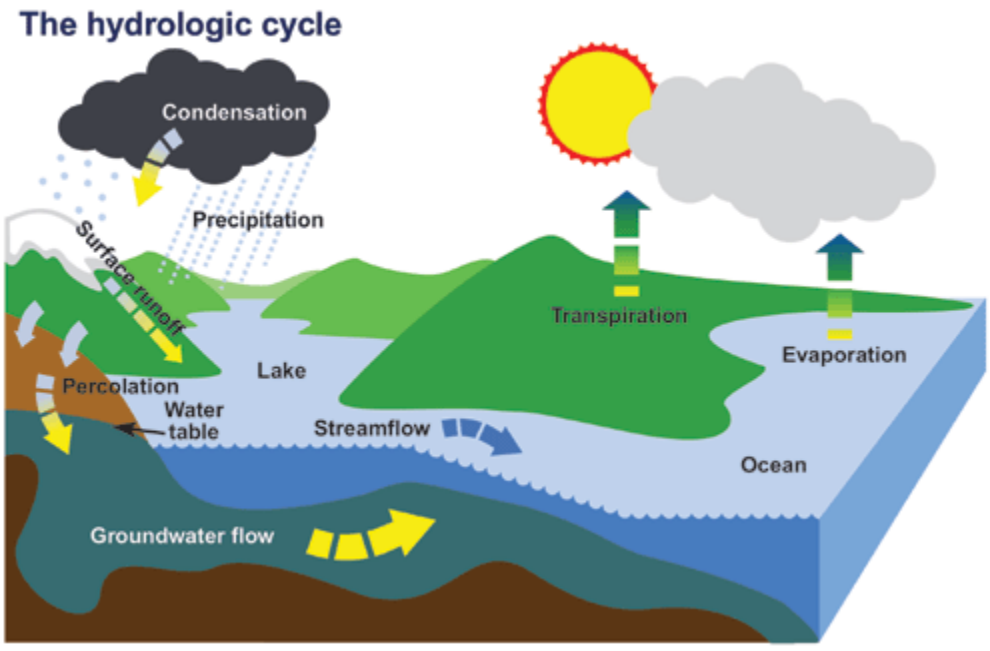
Chapter 8: Water

Introduction

Water is a basic necessity for life. It is essential for survival and it contributes immeasurably to the quality of life. The list of human uses for water is endless; including drinking, cleansing, industry, agriculture, power generation, transportation and recreation.

Water moves through the environment by a process known as the hydrologic or water cycle. This cycle moves water from lakes and oceans to the atmosphere, from the atmosphere to land, from the land to surface water or groundwater, and back to lakes and seas. Water enters the atmosphere by evaporation from oceans and lakes, and by evapotranspiration from soil and vegetation. Both processes are driven by heat, primarily from the sun. Atmospheric water condenses and falls to land as rain or snow precipitation. Precipitation may evaporate or percolate into the soil, where it may infiltrate into groundwater aquifers. Water that exceeds the soil's capacity or lands on impermeable surfaces runs off to surface water streams and rivers. Surface water, which flows at a relatively rapid rate, and groundwater, which flows at a much-reduced rate, discharges into lakes and oceans to complete the hydrological cycle. Figure 8.1 below gives a pictorial representation of the hydrological cycle.

Figure 8.1 - The Hydrologic Cycle



Source: Environment Canada 2013

Water may be contaminated at several points of the hydrologic cycle. The most obvious source of contamination is the discharge of industrial and municipal wastes to surface water. Surface water may also be contaminated by runoff from rural fields, roadways and urban lawns. Groundwater may be contaminated by landfill, septic bed leachate, and infiltration of chemicals and bacteria. Water in the atmosphere may be contaminated by airborne particulates and vapours.

Water can also be naturally purified at several points of the hydrological cycle. The process of evaporation cleanses water entering the atmosphere, while leaving contaminants behind. Water percolating through soil can be cleansed of chemicals forming insoluble complexes and contaminants digested by soil bacteria. Chemicals, which are very soluble in water, such as chloride or nitrate, pass readily through soil and enter groundwater. Contaminants in rivers and lakes may form water insoluble complexes, which are deposited in the sediment, while biodegradable chemicals may be removed through bacterial action.

What was recommended and where are we now?

The 2011 State of the Environment Report had two recommendations regarding water in Burlington:

Recommendation #16
That the city, in partnership with Conservation Halton as appropriate, undertake a series of pilot projects on city properties using Low Impact Development stormwater management techniques to treat stormwater runoff at its source rather than conveying it through the traditional stormwater infrastructure.

Status Update – In Progress
The city has completed the Aldershot Stormwater Master Plan (April 2013). Among other drainage improvement recommendations, the study recommended Low Impact Development (LID) techniques to be considered for existing and new development or public projects. Low impact development reduces stormwater runoff by emphasizing infiltration and provides many environmental and economic benefits including improved water quality, reduced flooding events, restored aquatic habitat, improved groundwater recharge and enhanced neighborhood landscape.
Townsend Avenue is one of the major roads in Aldershot that is currently being considered for re-construction. As part of the road design the city is proposing to consider LID techniques for stormwater management such as exfiltration pipes, infiltration trenches, porous pavement and bioretention facilities. The sandy soils in this area make these LID measures feasible.

Recommendation #17
That the city work with the Region of Halton to institute a comprehensive and well publicized water conservation and efficiency strategy that includes incentives to encourage water use reduction by residents and industry. Measures can include fixture and appliance rebates, rainwater reuse incentives, and a water distribution system leak detection program. The City of Guelph Water Conservation and Efficiency Strategy can be used as a template.

Status Update – In Progress
The Region of Halton is the lead agency on water conservation. Information about their programs can be found at: www.halton.ca/waterconservation. City sustainability staff promote the programs through community displays and links from the city's website.
City staff are also active participants in planning and delivering the annual Halton Children's Water Festival at Kelso Conservation Area, where over 4,000 elementary school children are educated on the importance of being good water stewards.

This chapter looks at surface water, stormwater management, groundwater, and drinking water.

Issue: Surface Water

Why it was Measured

Surface water is the component of the hydrologic cycle that flows above ground. Surface water provides habitat for aquatic life such as fish and other aquatic organisms. Surface water and surrounding areas also provides habitat for aquatic birds and mammals as well as recreational opportunities and a source of drinking water for humans.

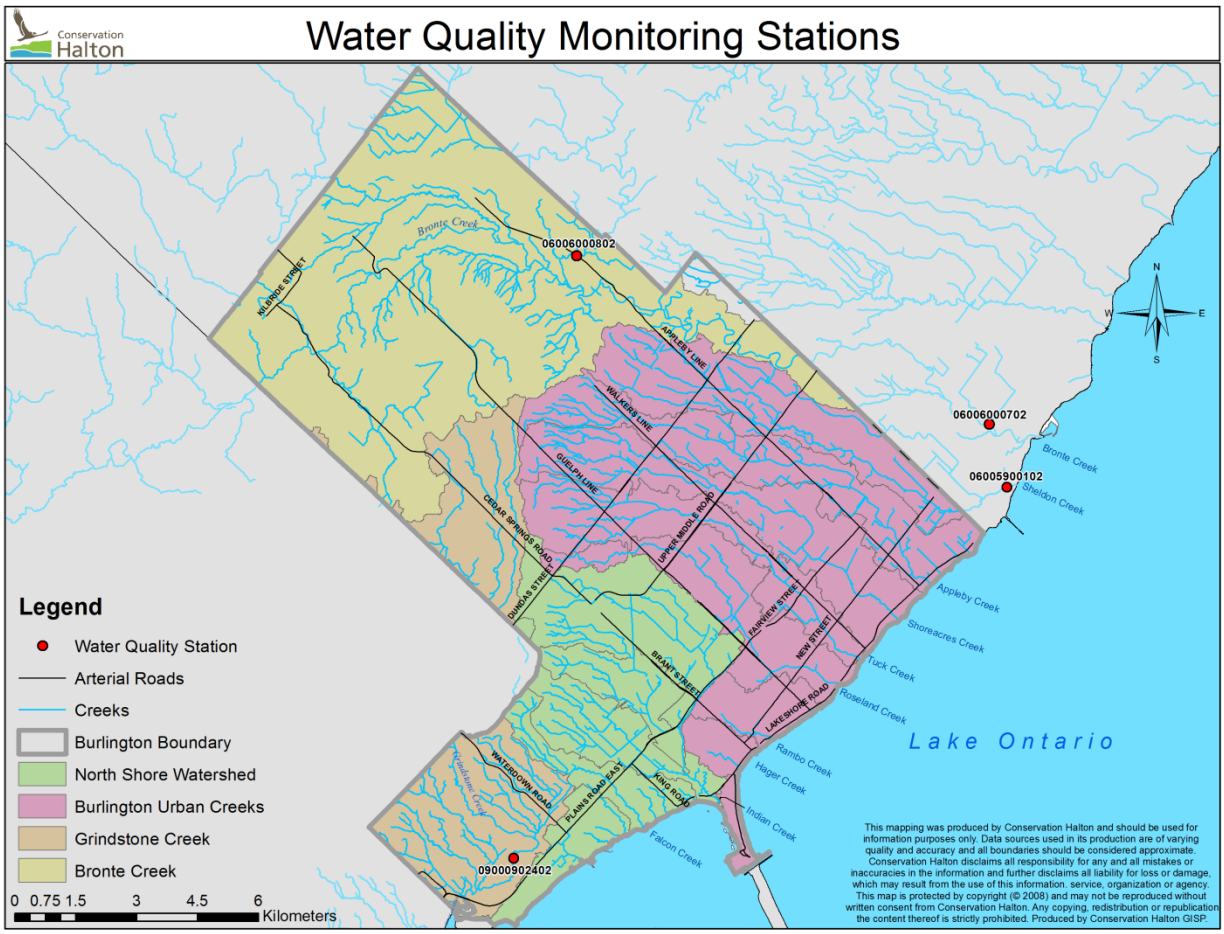
Surface water draining from Burlington's land area collects in Lake Ontario and Hamilton Harbour. Burlington creeks draining into Lake Ontario include Roseland, Tuck, Shoreacres, Appleby, Sheldon and Bronte while those draining into the Hamilton Harbour are Grindstone, Falcon, Indian, Edgewater, and Stillwater creeks, as well as the Hagar-Rambo creek diversion channel. Hamilton Harbour is considered an Area of Concern and is undergoing remediation subject to the objectives of the Hamilton Harbour Remedial Action Plan.

What was Measured

Conservation Halton monitors water quality in cooperation with the Ministry of the Environment (MOE) as part of the overall surface water-monitoring program. There are four watersheds that at least in part pass through Burlington; Bronte Creek, Burlington Urban Creeks, Northshore, and Grindstone Creek (see Figure 8.2 overleaf). A watershed is defined as the entire catchment area, both land and water, drained by a watercourse and its tributaries. A subwatershed refers to the catchment area drained by an individual tributary to the main watercourse. It is important to recognize that this means that Burlington cannot view surface water within its borders in isolation because what happens within Burlington's borders will impact surface water in neighbouring municipalities and vice versa.

Conservation Halton monitors many different aspects of water quality including physical parameters such as temperature and pH as well as chemical constituents such as nutrients, sediments, chloride and metals. Sources of contamination include road salt, pesticides, fertilizer, soil erosion, atmospheric deposition, leaking sewer lines and septic systems, and industrial and agricultural processes. In many cases, contaminants reach lakes and streams through the stormwater management infrastructure during snowmelts and rainfall events.

Figure 8.2 - Watersheds in Burlington



Source: Conservation Halton 2014

Among the most prevalent surface water contaminants are chloride, nutrients (phosphates), total nitrates and total suspended solids. Chloride is toxic in the fresh water environment. Fish and other aquatic species cannot survive in waters with high chloride concentrations. Excess concentrations of nutrients such as phosphorous can enhance the growth of aquatic vegetation. Nitrates can cause health concerns, particularly for infants, from an excess intake of nitrate. In addition, nitrate nutrient enrichment of surface water may support excess growth of algae and aquatic plants. The decay of large quantities of aquatic plants and algae uses oxygen thus reducing its availability to other aquatic animals. Large volumes of total suspended solids may cause negative effects on stream biota by reducing light penetration and smothering aquatic insects.

Acceptable concentrations of contaminants are set by Ontario's Ministry of the Environment and Climate Change (MOECC) and other regulatory bodies. The MOECC has set interim Provincial Water Quality Objectives (PWQO) for total phosphorus at 0.03 mg/L (milligrams per litre) in rivers and streams and 0.02 mg/L in lakes to prevent excessive plant growth. The Canadian Water Quality Guideline for Protection of Aquatic Life (CWQG) Objective for chloride is 128 mg/L. The Canadian Environmental Sustainability (CESI) Objective for nitrate +nitrite is 2.93 mg/L for prevention of excessive plant growth. While there is no PWQO for total suspended solids, it is generally accepted that where and when possible, concentrations should be below 25 mg/L.

Halton Region's Health Department monitors the water quality of local beaches to protect swimmers from illness or harm from June to September. A beach is considered unsafe for swimming if the water sample results indicate that the average level of *E.coli* is greater than100 *E.coli* /100 mL of water or there is an excess of algae. A sign will be in place advising that the beach is unsafe until further testing is completed where results indicate water quality is within acceptable limits.

What was Found

Grindstone Creek Watershed

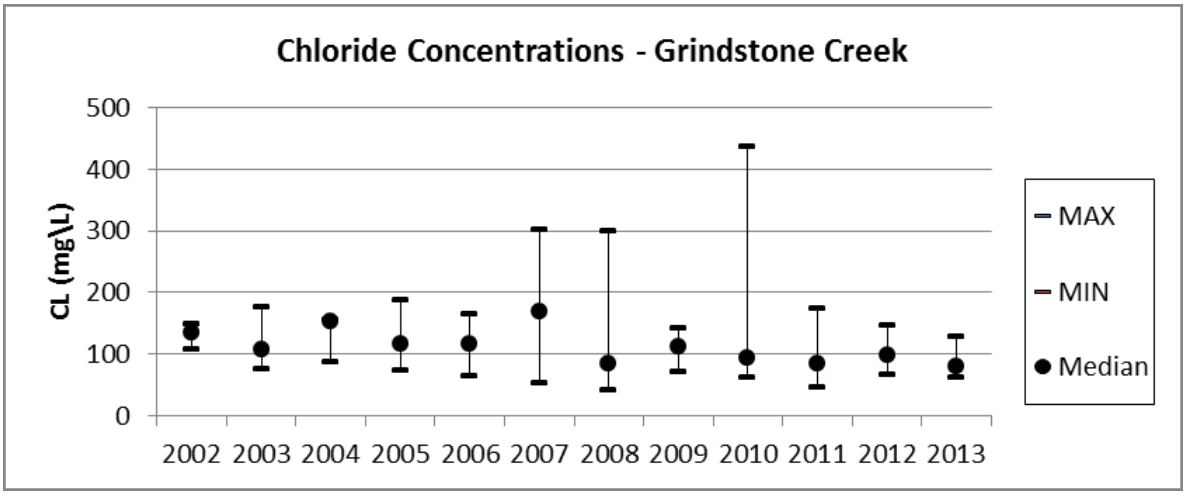
Most of the Grindstone Creek watershed is outside of Burlington in the former Flamborough Township, now in the City of Hamilton. The headwaters of the creek are the Hayesland swamp west of Millgrove. Two tributaries join the creek, one originating in Flamborough Centre, the other in Lake Medad. The lower reach of Grindstone Creek flows through Aldershot to the west end of Hamilton Harbour. The total area of the Grindstone Creek watershed is approximately 90 km^2. In the early 20^{th} century, Grindstone Creek had sufficient flow to support a number of water mill industries in Waterdown.

Base flow in the creek has declined over the years due to development of watershed lands but it still provides a significant proportion of the total flow into Hamilton Harbour, being one of the major watercourses emptying into the harbour. While the watershed is only 7% developed, it has suffered losses as a result of human activities. Over 60% of the forest cover and approximately 50% of the wetlands have been lost since the beginning of the 19th century. Conservation Halton has been monitoring Grindstone Creek water quality since the mid-1960s. The maximum, median and minimum concentrations of certain water quality results for Grindstone Creek at Unsworth Avenue are shown in Figure 8.3.

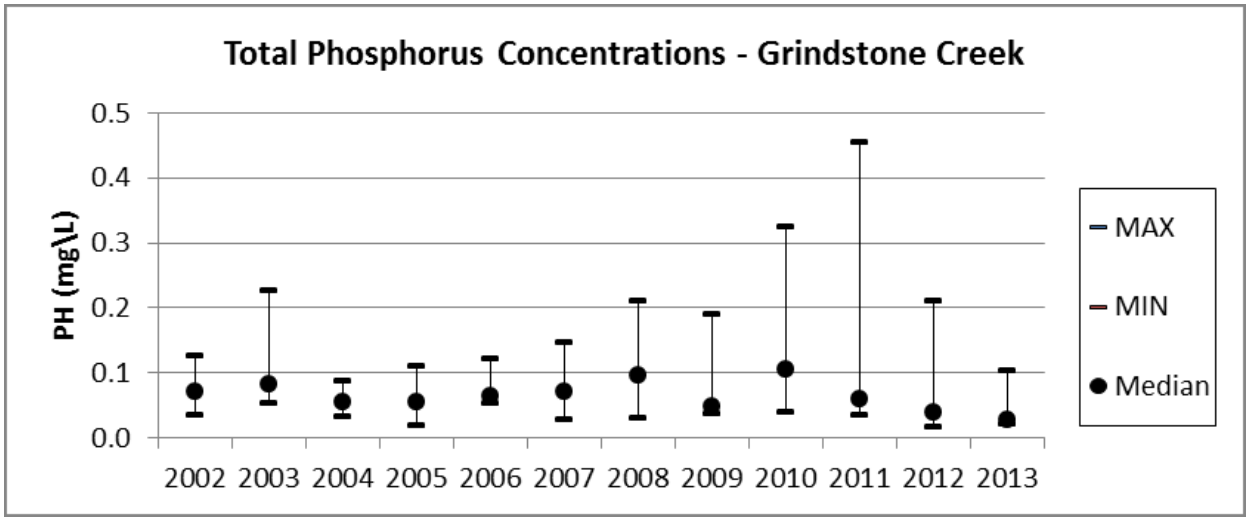
In general, chloride levels in Grindstone Creek as shown in Figure 8.3 are greater than the CWQG Objective of 128 mg/L, on several occasions although the median is normally lower.

Figure 8.3 - Monitoring in Grindstone Creek

Chloride Levels

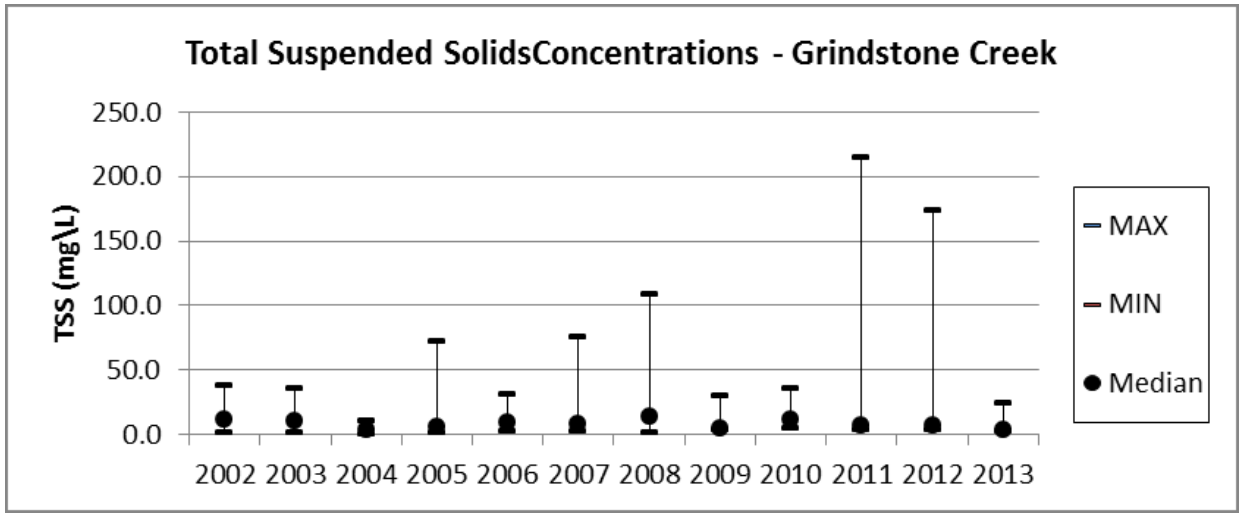


Phosphorus Levels



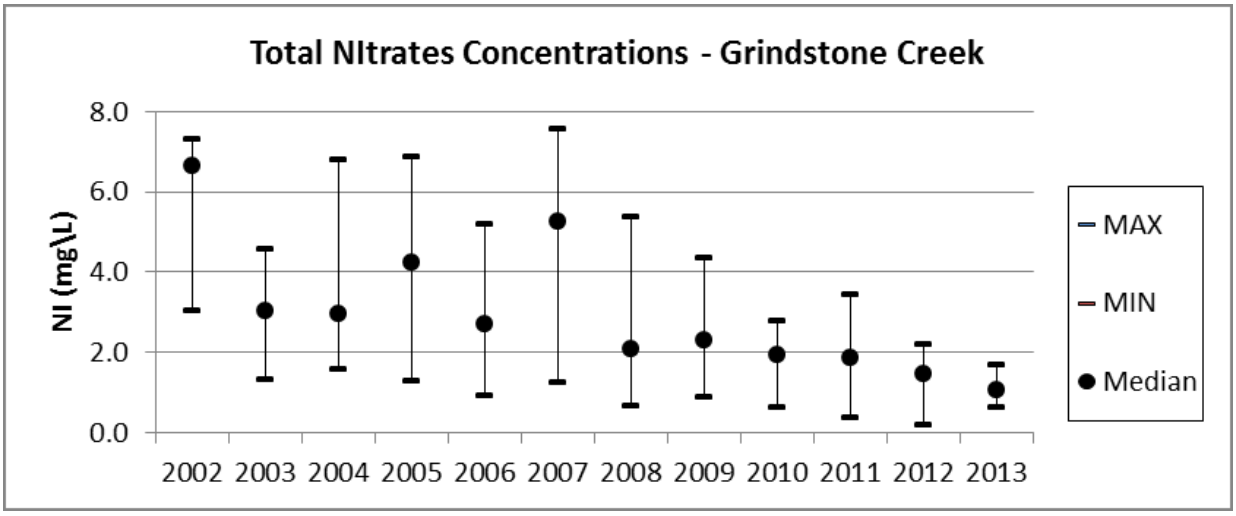
Total phosphorus levels on the other hand were higher than the Provincial Water Quality Objective of 0.03 mg/L in 2010 and 2011. These elevated concentrations are not only potentially harmful to the watershed; they are a concern for the remediation of Hamilton Harbour, an Area of Concern. Elevated nutrient concentrations are a problem in the Harbour. As nutrient loads from municipal infrastructure (e.g. wastewater treatment plants) are reduced, elevated loads from the watershed become a greater concern and delay the full remediation of Hamilton Harbour.

Suspended Solids



Grindstone Creek results for total suspended solids are not as encouraging. Though the majority of measurements have been less than the benchmark of 25 mg/L, there have been instances where results have been higher than desired.

Nitrates



Total Nitrates did exceed the CESI guideline of 2.93 mg/L from 2002 to 2009 and 2011 but it is trending downwards which is a good sign**.**

North Shore Watershed
This watershed, located on the north shore of Hamilton Harbour, contains several watercourses – Falcon, Indian and Edgewater-Stillwater Creeks and the Hager/Rambo Diversion Channel. It is a smaller watershed than that of Grindstone Creek, as these creeks drain from the toe of the Niagara Escarpment down to Hamilton Harbour. Much of the watershed is characterized as being in a mature state of development with such corridors as highways, rail lines and major utility lines passing through it. Land use includes industrial, commercial, recreational and residential components as well as two closed landfill sites. The North Shore watershed is approximately 33 km^2 in size.

Conservation Halton monitored water quality in the North Shore watershed in 2001 and 2002 as part of the North Shore Watershed Study. Based on that study, total phosphorus concentrations and total suspended solids levels were usually elevated in the watershed. No chloride data was collected. Conservation Halton has not collected any water quality data in the North Shore watershed since 2002.

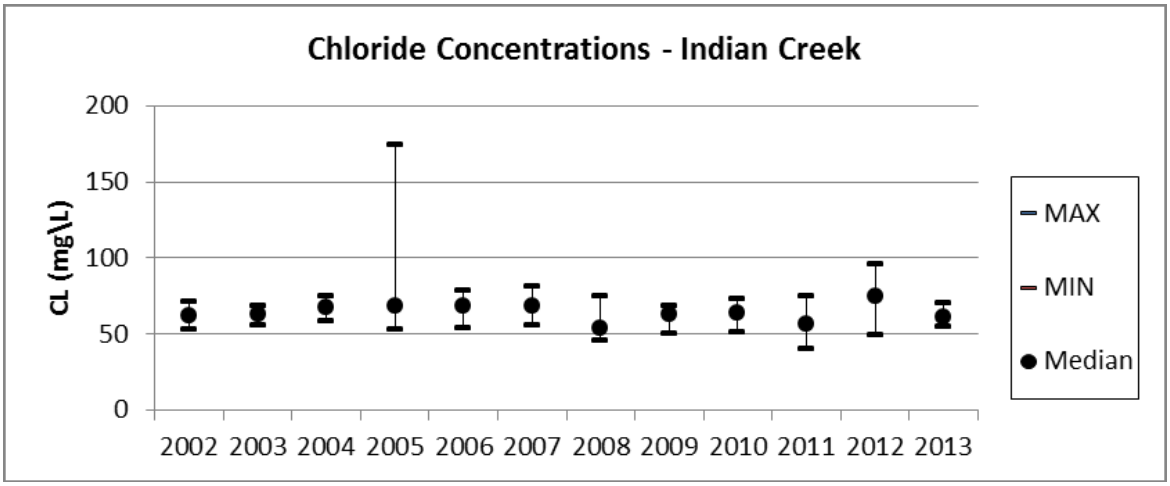
Bronte Creek Watershed
The Bronte Creek watershed is Burlington's largest, with an area of some 310 km^2. The creek originates near the community of Morriston, at the junction of Highways 6 and 401, and flows east and south through rural Burlington before entering the Town of Oakville. The scenic qualities of the watershed and its natural resources attract many visitors who come to hike, explore, fish and experience other recreational pastimes in the parks and conservation areas.

The watershed has experienced limited development in its history. About 4% of the watershed is settled with the majority concentrated in rural settlement areas of Kilbride, Cedar Springs and Lowville. These communities, as well as area farms, rely on groundwater for drinking water, irrigation and livestock watering. Urban expansion is starting to occur in the watershed, particularly as Milton expands to the west.

Conservation Halton has been monitoring the Bronte Creek watershed for more than four decades. The only monitoring station actually located in Burlington is situated on a tributary known as Indian Creek located on Appleby Line north of Zimmerman in northeast Burlington. Indian Creek is a highly altered tributary that has been degraded by the impacts of agriculture and is now being affected by urban development in Milton. The Indian Creek subwatershed is approximately 40 km^2. Historical water quality results for Indian Creek are shown in Figure 8.4.

Figure 8.4 - Monitoring in Indian Creek (Bronte Creek watershed)

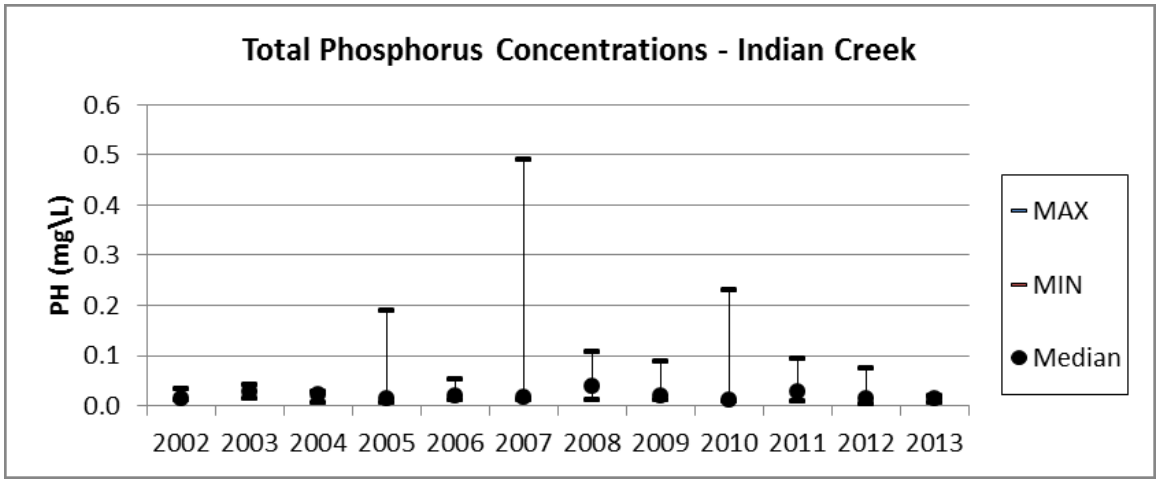
Chloride Levels



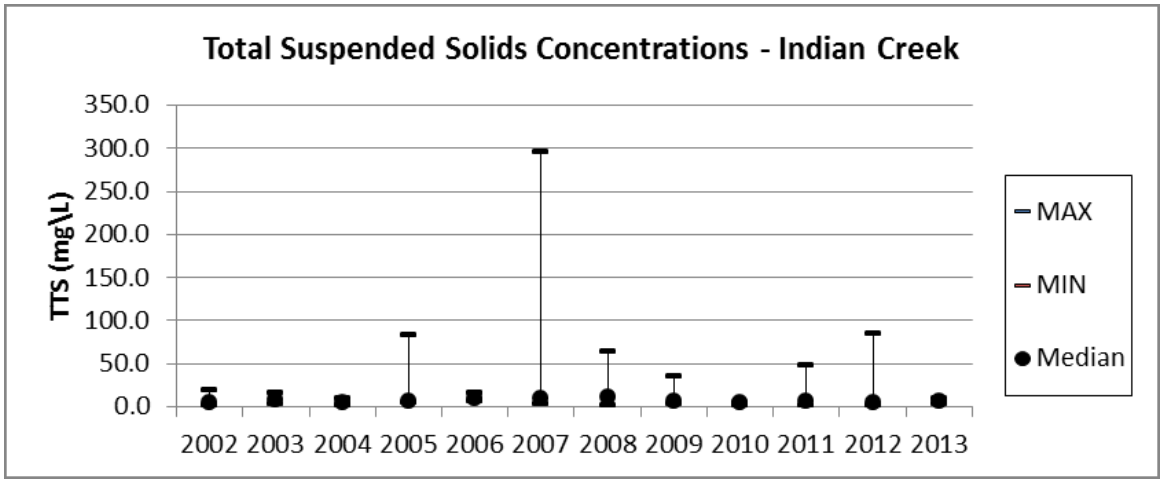
The measurements for chloride levels in Indian Creek are usually less than the CWQG Objective of 128 mg/L.

Like Grindstone Creek, phosphorus levels observed in Indian Creek are well above the provincial objective of 0.03 mg/L although in recent years the levels are getting closer but are still a source of concern.

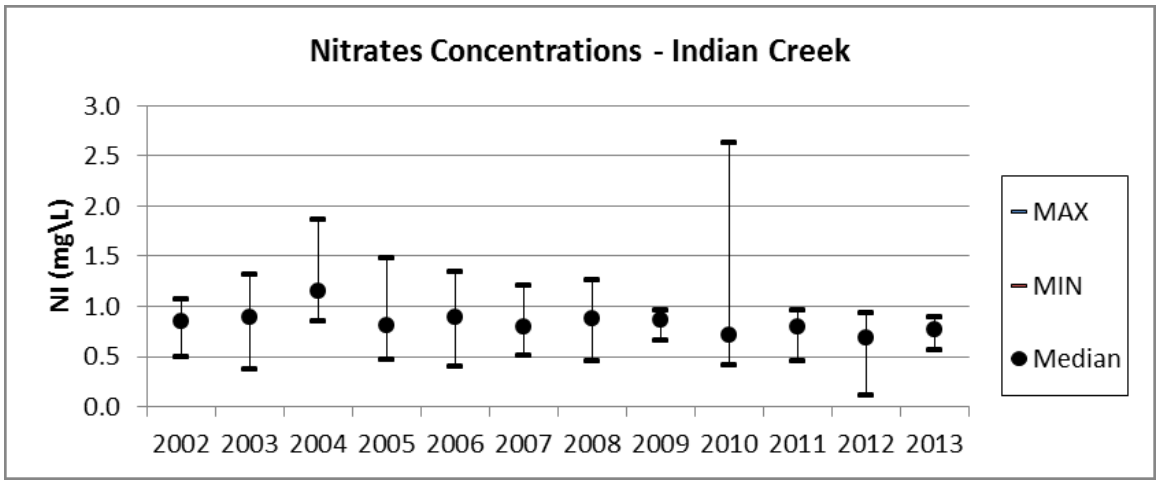
Phosphorus Levels



Suspended Solids



In general, the results for suspended solids are similar to Grindstone Creek. There have been a similar number of values exceeding the recommended limit of 25 mg/L.

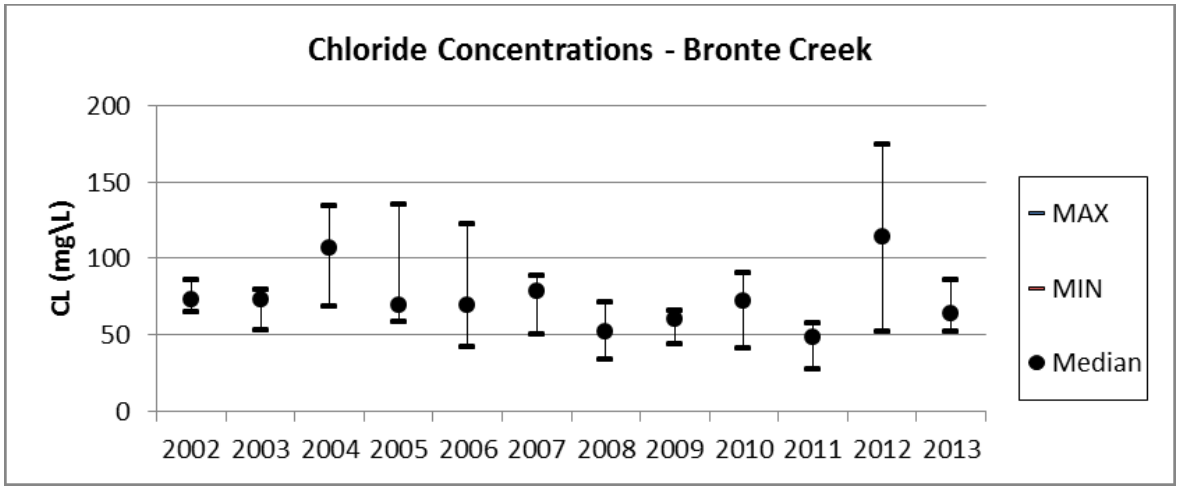


The nitrate levels for Indian Creek were below the 2.93 mg/L standard.

However, perhaps a more representative monitoring station for Bronte Creek is located in the Town of Oakville at Petro Canada Park. Situated on the main branch of Bronte Creek just upstream of the mouth, the data from this location reflects water quality throughout a large portion of central and northern Burlington. Some historical water quality results for Bronte Creek are shown in Figure 8.5.

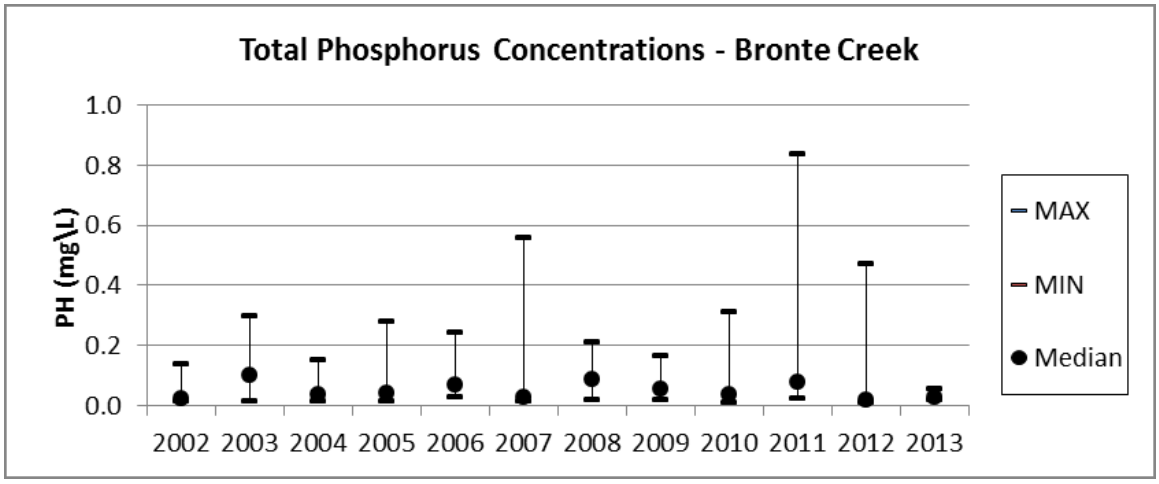
Figure 8.5 - Monitoring in Bronte Creek

Chloride Levels



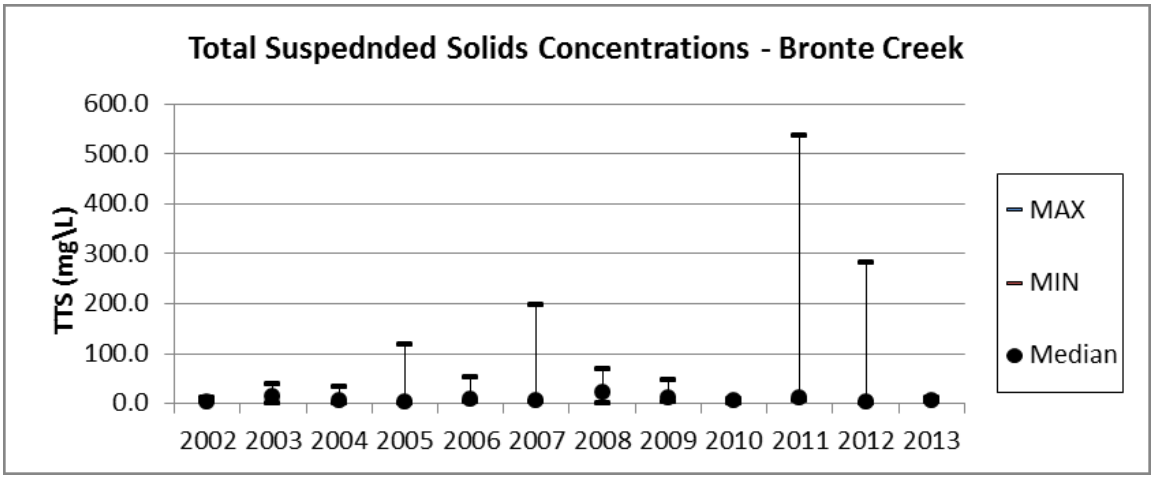
Median chloride concentrations in the main branch of Bronte Creek have at times exceeded the objective of 128 mg/L.

Phosphorus Levels



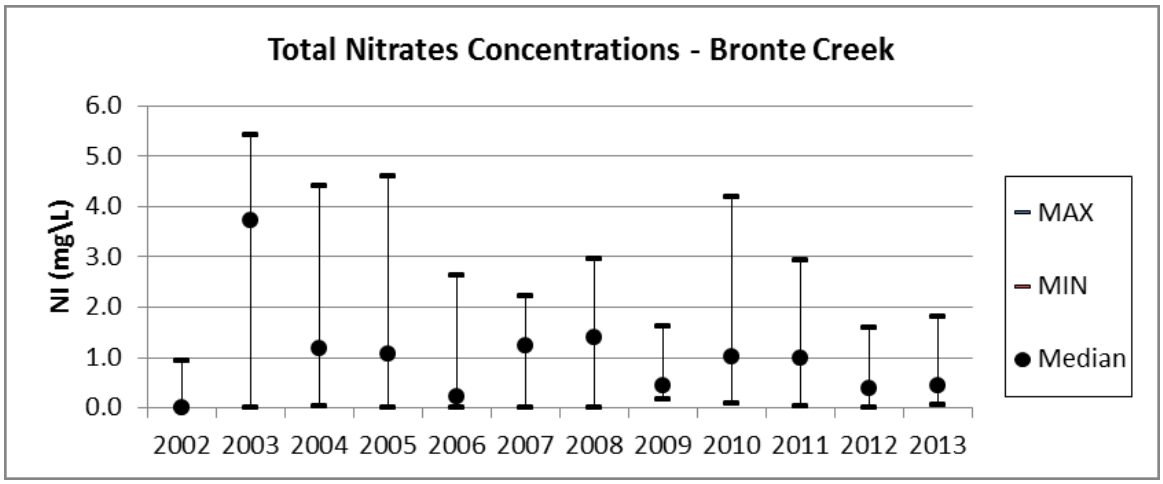
However, as is the case for other watersheds in Halton Region, total phosphorus concentrations often exceed the provincial objective of 0.03 mg/L. Not only does this affect the watershed, it has negative consequences for the near-shore area in Lake Ontario where excess algae growth can be a significant problem. The use of agricultural and domestic fertilizers is a factor in elevated phosphorus concentrations.

Suspended Solids



While total suspended solids concentrations are generally below the objective, individual readings can exceed the 25 mg/L target by a considerable amount. This may indicate erosion concerns during storm events.

Total Nitrates



Total Nitrate concentrations for Bronte Creek are above standard of 2.93 mg/L several times and higher than the Indian Creek readings.

Urban Burlington Watershed

This watershed consists of five relatively small creeks that drain from the escarpment to Lake Ontario – Roseland, Tuck, Shoreacres, Appleby and Sheldon. All these creeks are urbanized over much of their length and in some cases flow underground. Like the North Shore watershed, much of this watershed is characterized as being in a mature state of development with such corridors as highways, rail lines and major utility lines passing through it. Land uses include industrial, commercial, recreational and residential components.

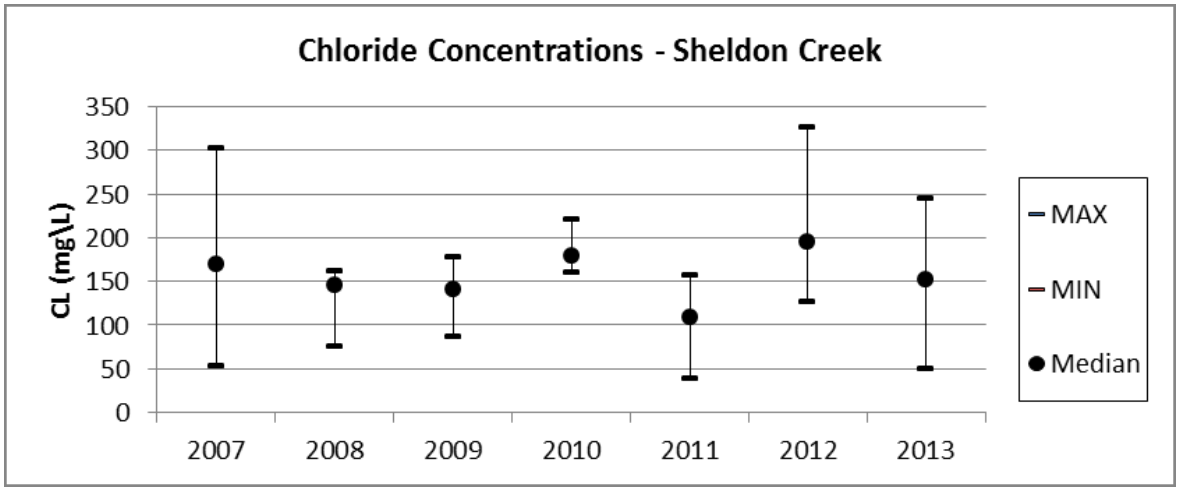
Conservation Halton has been monitoring Sheldon Creek water quality since 2007, so trends will not be readily apparent. The monitoring location is at Lakeshore Road. This location, near

the mouth of Sheldon Creek, is in the middle of the urban part of Burlington. The Sheldon Creek watershed is slightly more than 17 km^2 in size. Certain historical water quality results are shown in Figure 8.6.

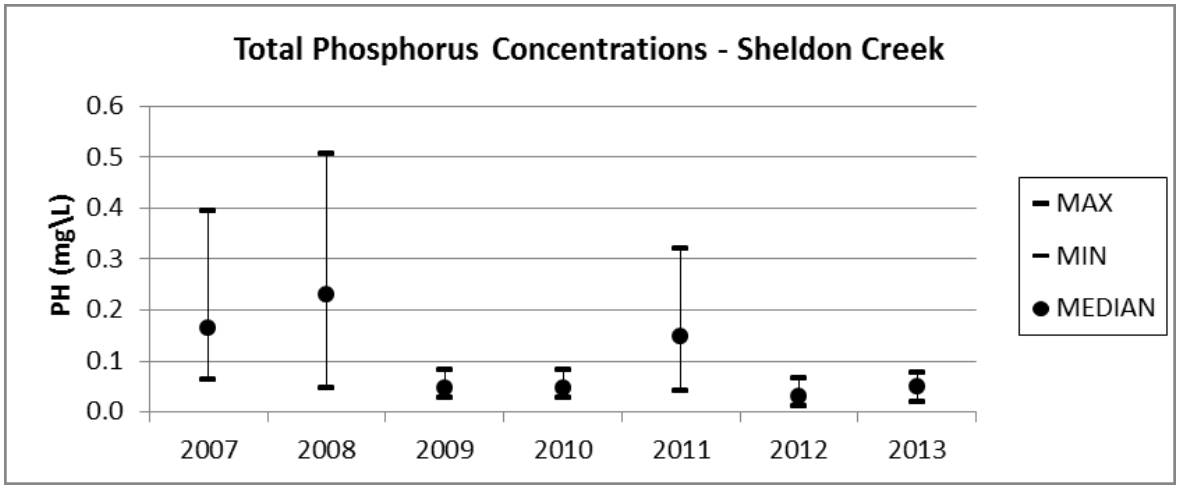
As might be expected, Sheldon Creek exhibits elevated levels of chloride concentrations. In almost all cases the results are above the provincial objective of 128 mg/L

Figure 8.6 - Monitoring in Sheldon Creek

Chloride Levels

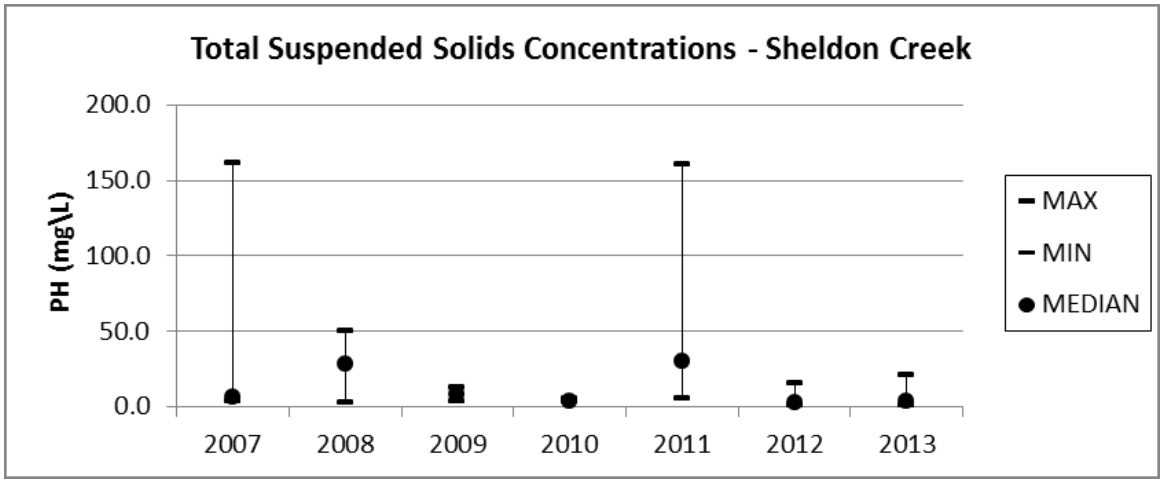


Phosphorus



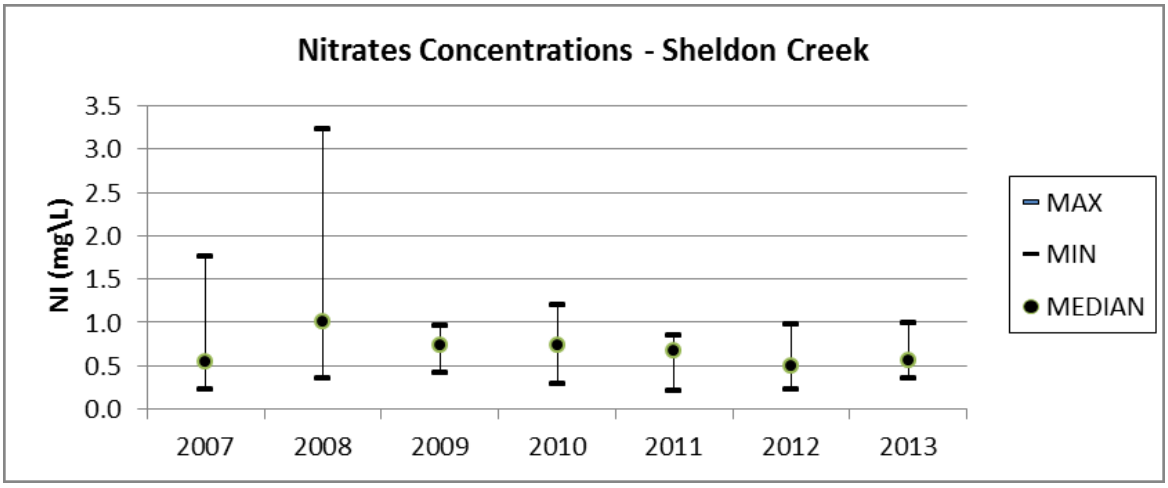
Peak values of total phosphorus are often higher than the other creeks in Burlington and well above the provincial objective of 0.03 mg/L. This affects the watershed itself and has negative consequences for the near-shore area in Lake Ontario. The use of cosmetic fertilizers is a contributing factor.

Suspended Solids



There are very few measurements of total suspended solids for Sheldon Creek, but a majority of the results exceed the recommended benchmark of 25 mg/L. This may be due to Sheldon Creek's location and the influence of urban runoff.

Total Nitrates



All Sheldon Creek Nitrate levels are all below standard 2.93 mg/L except 2008.

Table 8.1 - Burlington Beaches
Monitoring Samples and Postings (2011 – 2013)

Beach	Year	No. of Samples	No. of Postings
Beachway North and South	2011	26	5 postings at Beachway North and 5 postings on Beachway South
Beachway North and South	2012	18	5 postings on both Beachway North and 4 postings on Beachway South. Beachway Park was combined as one beach (post June 2012) and had 2 postings
Beachway Park	2013	48	16 postings for Beachway Park
Total	3 years	92	39 postings

Source: Region of Halton Health Department 2014
Note: After June 2012 the results Beachway North and South were combined.

Table 8.1 shows the sample results for Burlington Beaches. Recreational/beach water with more than 100 *E.coli* per 100mL is unacceptable for swimming and is posted as unsafe for swimming by Halton Region's Public Health Department. In urban areas storm water run-off and localized waterfowl populations are common sources of beach water pollution.

What is Happening

Environmental monitoring of city creeks is performed by Conservation Halton and City of Burlington staff on a semi-regular basis. City of Burlington staff assess all urban creeks for erosion every five years and adjust plans based on the results.

Conservation Halton (CH) does long-term monitoring of watershed both for flow and chemistry, and floodplain modelling using 100 year storm standards. This information is used in Watershed studies completed every six to eight years on each watershed like Grindstone Creek and in special projects such as Northshore where they are revisiting the Hamilton Harbour Remedial Action Plan objectives. Based on monitoring results, recommendations are made to improve or protect the watershed. They may include tree planting, erosion protection, buffers of land along creek beds or prevention of development in an area. These recommendations are normally carried out through the Hamilton-Halton Watershed Stewardship Program.

Hamilton-Halton Watershed Stewardship Program

Conservation Halton through the Hamilton-Halton Watershed Stewardship Program strives to protect, enhance and restore environmentally significant natural areas, watercourses and drinking water sources in the Halton watersheds through the development of an educated and empowered group of landowners. Since 1994, over 5,000 landowners have been contacted in the Hamilton and Halton Watersheds to share information about their individual roles in the protection and enhancement of natural areas and watercourses. Stewardship Agreements have been made with over 300 landowners covering 5,000 hectares of land, over 320 kilometres of buffered watercourses and over 3,000 hectares of natural area.

The Bay Area Restoration Council (BARC)
BARC is a community based not-for-profit group that assesses and promotes clean-up projects in Hamilton Harbour and its watershed. BARC works with all levels of government and the private sector to keep harbour restoration issues at the forefront of community discussions and decision-making. BARC delivers school programs, community events, resource materials and newsletters, and coordinates popular community planting and restoration events.

Local stakeholders and governments follow a clean up strategy, created by the community, called the Remedial Action Plan (RAP) and have authored Toward Safe Harbours reports highlighting the RAP's implementation, successes and setbacks. The RAP focuses on three key areas:

1. Water Quality – In the1970s Phosphates in the Harbour were at160 µg/L. Reductions in the usage of detergents reduced levels to 80 µg/L in the 1980s. Wastewaster treatment plant and industrial improvements have further reduced Phosphate concentration to 40 µg/L. Future improvements to the City of Hamilton Woodward and Halton Region Skyway plants should reduce levels to 20 µg/L by 2020. Up until this time the impact of non-point sources of pollution from surrounding watersheds was masked. With the recent improvements to the wastewater treatment plants, the next step will be to concentrate on reducing pollution sources from surrounding watersheds. Conservation Halton has started to look more closely at Grindstone and Indian Creek Watersheds to determine where improvements need to be made.

2. Toxic Substances – Progress on the Randle Reef project stalled in 2014 due to bids to build the containment facility being over budget. When the project is complete, it is expected to greatly improve the situation by managing the significant coal tar contamination in the harbour.

3. Fish and Wildlife – Most of the original fish in the Harbour have come back with improved water quality. Spencer Creek and Cootes Paradise Marshland and the mouth of the Grindstone Creek need to make a leap forward in water quality.

Trout Unlimited Canada Programs:

Yellow Fish Road™ Program - Motor oil, pesticides, fertilizer, soap, gasoline, and other household hazardous wastes either wash up or are disposed of into storm drains each year, which outlet into local streams or Lake Ontario. Yellow Fish Road is a hands-on project allowing youth to make a difference by increasing awareness of water pollution in their community. It was first introduced by Trout Unlimited Canada in 1991 and has over 220 communities participating, including Burlington. Volunteers paint 'yellow fish' symbols beside storm drains along local roads to remind people that anything entering the storm drain systems ends up in local streams and the lake untreated. As part of the program, information is dropped off door-to-door by participants advising residents where household hazardous waste can be dropped off for safe disposal or recycling.

Restoration at Lowville Park – Trout Unlimited as part of their Bronte Creek Restoration initiative in partnership with the City of Burlington commenced the restoration of a one kilometer section of Bronte Creek running through Lowville Park. Conservation Halton and Hamilton-Halton Watershed Stewardship also partnered with them. The objective of this restoration was to educate and foster public awareness, and to improve the overall health of the creek. This work was completed by private contractors with public participation over a number of weekends. This is a good example of groups working together to restore a creek.

Issue: Stormwater Management

Why it was Measured

Stormwater management is based on a planned set of public policies and infrastructure to deal with stormwater runoff from precipitation and snowmelt. Traditionally, stormwater management has been concerned primarily with conveying runoff as quickly as possible to downstream lakes and streams through piped drainage systems. The focus has changed over the years to consider water quality and erosion concerns, and most recently to include species and groundwater protection, and maintaining creek and stream physical characteristics. This evolution has led to the latest objective of maintaining predevelopment water conditions whenever development is proposed. This objective is not always understood or implemented.

In a natural environment rainfall is primarily absorbed on the land through infiltration, is evaporated, or taken up by plant transpiration, and surface runoff is minimized. Urbanization not only impacts water quality with the introduction of pollutants but is characterized by increased impervious surfaces, which prevents infiltration. There is less capability in the system for rainfall to be absorbed into the soil, detained, or treated. Thus, runoff from these impervious surfaces places high stresses on natural watercourses and related environments because a larger percentage of each rainfall event becomes runoff. Runoff can impact local creeks and streams through erosion because of higher volumes and higher velocity of the runoff. Figure 8.7 shows this pictorially.

In Burlington, when planning new greenfield developments, stormwater management is typically provided in a stormwater management facility. These facilities are designed for water quality, erosion and flood control that are designed to protect downstream lands and the environment. Generally speaking, these facilities contain a permanent pool of water that is part of the treatment process, with additional storage capacity for erosion and flood control. Wet ponds have been found to be much more effective at improving water quality than ‘dry’ ponds. Constructed wetlands and combined wetlands/wet ponds are also used for stormwater management.

Figure 8.7 - Stormwater Runoff



Source: Center for Watershed Protection (1999): Approaches to Impact of Urbanization, Watershed Kit Volume 2

What was Measured

Burlington's storm drainage system includes over 700 kilometers of underground storm sewer pipe, approximately 16,000 catch basins, 33 storm water management ponds, and 12 water quality control devices along with roadways, channels and creeks. The storm sewer system, which is under the city's jurisdiction, is completely separate from the wastewater (sanitary sewer) system that is under the Region of Halton's jurisdiction. Unlike some municipalities, there are no combined storm and sanitary sewer systems in Burlington which could result in serious water pollution problems.

Environmental monitoring is undertaken to check the effectiveness of stormwater management facilities. Monitoring can be undertaken for water quality, erosion and flood control. With respect to stream erosion within the urban area, city staff walk selected areas of each creek every year to inspect general conditions and specific erosion sites. The entire creek is walked every five years. Costs to rehabilitate streams for erosion problems can be very significant.

What was Found

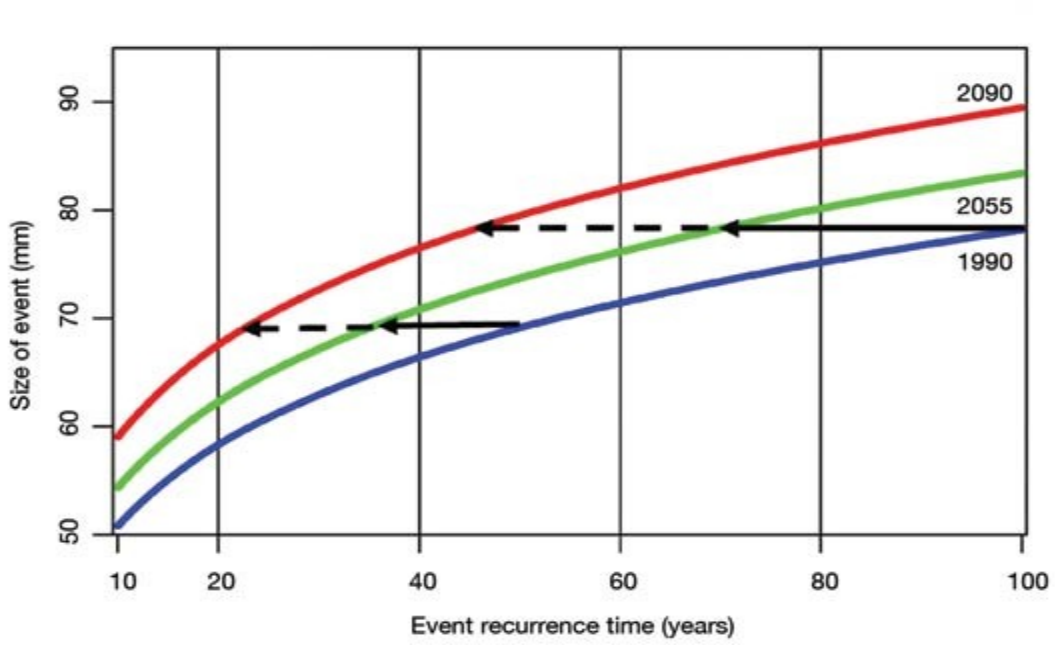
Stream health in Burlington is often relatable to the age of the development surrounding the creek. Creeks in older subdivisions were often straightened, narrowed, or hardscaped because the only consideration given was to rapidly address the stormwater. This led to high flow rates during storms and the resultant negative effects on soil erosion and fish habitat. Creeks that are rehabilitated as part of newer developments are now wider, less straight, and integrated with more natural plants and rock material. This means that creek health is improved in those areas and erosion problems are much less prevalent. However, creek erosion is still a significant environmental and financial issue for Burlington. Approximately $2.5 to 3.0 million is spent each year on prioritized projects covering erosion protection, culvert replacement, pond clean-up and drainage improvements.

The old infrastructure did not capture suspended solids, phosphorous, oil and grease or metals. Newly constructed infrastructure that includes the use of storm water ponds captures 70-80% of

the suspended solids, phosphorus, oil and grease metals. With new infill construction, pre-treatment is required to remove 70-80% of oil, grease and sediments.

The fifth report of the Intergovernmental Panel on Climate Change (2013) states “The frequency and intensity of heavy precipitation events over land will likely increase on average in the near term”. Figure 8.8 shows the projected change in extreme 24-hour events. In North America, a 70 mm storm is anticipated to occur once every 50 years. By 2055 this will be once every 35 years and, by 2090, once every 22 years. The timeframe between extreme storms is becoming shorter.

Figure 8.8 - Projected changes in extreme 24-hour precipitation events, North America between latitudes 25°N and 65°



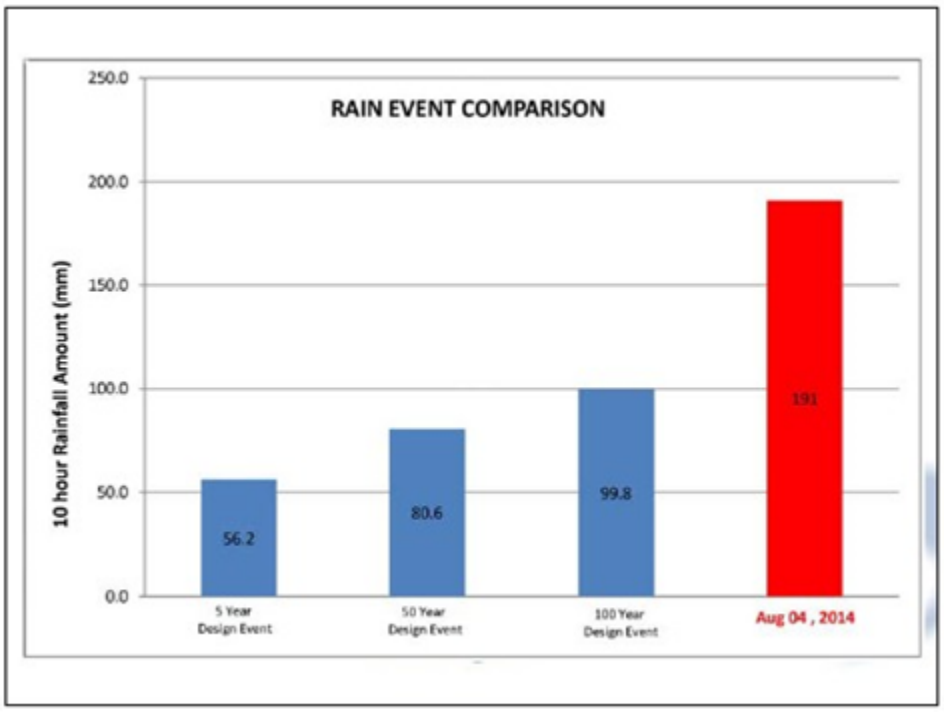
Source: From Impacts to Adaptation: Canada in a Changing Climate Environment Canada 2008

Table 8.2 - Recent Storm Events in Other Cities

City	Amount	Date
Burlington	191 mm	August 4, 2014
Detroit	116 mm	August 11, 2014
Baltimore	160 mm	August 12, 2014
Atlantic City	142 mm	August 12, 2014
Portland	163 mm	August 12, 2014
Islip, Long Island	330 mm	August 12, 2014
Phoenix	125 mm	August 19, 2014
Hiroshima	217 mm	August 19, 2014
Mississauga	126 mm	July 8, 2013
Thunder Bay	91 mm	May 28, 2012
Hamilton	110 mm	July 26, 2009
Peterborough	193 mm	July 15, 2004

Source: City of Burlington 2014

Figure 8.9 - Rain Event Comparison among Design Events with Burlington's August 4, 2014 Storm



Source: City of Burlington 2014

On August 4, 2014, Burlington experienced an extreme storm event receiving 191 mm of rain over eight hours. Table 8.2 shows where recent extreme storms have occurred. They are happening more frequently. Dave Philips, Environment Canada's Senior Climatologist stated: "Canadians are facing a 'new breed' of storms…the kind of weather that caused a flash flood in Burlington, Ontario. These (once in) 50-year floods are occurring every 10 years, because our climate has changed".

Figure 8.9 shows how the unexpected recent storm on August 4, 2014 exceeded the design events for the projected 50 year and 100 year storms. This storm overwhelmed Burlington's infrastructure and caused flooding with more than 3,000 homes. Most creeks south of the QEW were designed for the 50 year storm where north of the QEW highway, the 100 year storm or Hurricane Hazel were used for creek design. It greatly impacted the City of Burlington, showing a lack of infrastructure to handle it. The City of Burlington, Region of Halton and Conservation Halton responded quickly in an organized manner to minimize the consequences of the storm and provide relief to citizens to get them back on their feet by implementing the emergency response plan.

What is Happening

Leading communities in North America are currently employing a wide ranging approach called the treatment train approach whereby a series of solutions or best management practices are employed. More sustainable stormwater management, also called Low Impact Development (LID), includes techniques like bio-retention, swales, filter strips, and soak away pits as part of the solution. This will help to improve water quality, prevent erosion, and provide ground water

recharge. These source and conveyance techniques manage the stormwater as close to its source as possible by storing and releasing it at a slower rate or infiltrating it into the ground.

There is currently one project underway in Burlington that has been designed with sustainable LID measures. It is the Townsend Avenue Reconstruction in Aldershot. The storm drainage design will provide the following LID features: infiltration galleries, exfiltration pipes and permeable pavers for the tie-in to the new storm sewers. Burlington has not been as active in promoting and implementing sustainable stormwater measures as some neighbouring municipalities have been. To some extent we are limited to the effective of where we can use some LID measures as much of Burlington sits on impermeable clay. Sandy soils would be better.

Planning for stormwater management based on the past 100 year events may need to change given recent events where the type of rainfall events have dramatically changed – increased intensity where overland flows increase. Due to the extreme rainfall event the City of Burlington is currently working with the Region of Halton and Conservation Halton to:

- assess the impact of the storm,
- determine what needs to repaired, and
- implement repairs and actions to mitigate future storm impacts.

It is noted it will be extremely difficult and costly to prevent nearly all damages from reoccurring. The Region of Halton is providing flood update information as well as actions that residents can take to minimize or prevent flooding and how to respond to flooding.

Issue: Groundwater

Why it was Measured

Groundwater is the component of the hydrologic cycle which flows below ground and as such is an important component of the natural water balance. Groundwater provides water for drinking, irrigation, livestock watering, etc. and contributes to the flow of lakes and rivers. Water yielding sub-surface formations are called aquifers. Aquifers can either exist in bedrock, which permits the flow of water in fractures or cracks in the rock, or through unconsolidated materials such as sand and gravel. Aquifers are recharged by the infiltration of surface water and are discharged, as baseflow, into surface water streams, into lakes or as seeps or springs on land. Aquifers are tapped by wells to supply water for human use in rural Burlington. A series of geological formations underlie the City of Burlington, as outlined in Table 8.3.

Table 8.3 - Bedrock Formations in the Burlington Area

Group	Formation/ Member	Composition	Water Yield
Lockport	Gasport	dolostone	good
Clinton	Rochester	shale	poor
	Irondequoit	limestone	poor
	Rockway	dolostone with shale	poor
	Merritton	dolostone with shale	poor
Cataract	Cabot Head	shale	poor
	Manitoulin	dolostone	poor
	Whirlpool	sandstone	good
	Queenston	shale	poor

Source: 25. Project Unit 08-004. Update of Revisions to the Early Silurian Stratigraphy of the Niagara Escarpment: Integration of Sequence Stratigraphy, Sedimentology and Hydrogeology to Delineate Hydrogeologic Units, Brunton F. R., 2009

What was Measured

Groundwater quality is determined by analyzing water samples collected from wells. Groundwater quality results may be affected by the well construction and maintenance, by the geology through which the groundwater flows, and by the land uses in the vicinity and up gradient of the well.

Since groundwater quality is primarily of concern because of its use for drinking water and the baseflow in our creeks, the most common contaminants affecting human and aquatic health are measured. Nitrates and nitrites, sodium, bacteria (Coliform and *E. Coli*), metals, and nutrients are among the most common and measured groundwater parameters. Some of the sources of these contaminates are shown in Table 8.4.

Table 8.4 - Sources of Groundwater Contaminants

Nitrates and Nitrites	Fertilizer from lawns, gardens, and crops Animal waste Sewage effluent Organic soil material
Sodium	Erosion of salt deposits and sodium bearing rock Road salt infiltration Sewage effluent Leachate from landfills or industrial sites
Nutrients	Fertilizer Manure Compost
Bacteria (Coliform and *E. Coli*)	Agricultural runoff Sewage effluent Animal fecal matter

The presence of nitrate, sodium, and bacteria in groundwater impacts human health and surface water quality. Nitrites can cause serious short term and long term health effects particularly for infants and pregnant women when the nitrate is reduced to nitrite in the body.

Though sodium is an essential chemical for human health, excess sodium affects people with hypertension, heart disease, or kidney problems. Nutrients can cause excess growth of algae in the water. Since it is not practical to test for all forms of bacteria or pathogens, coliform and *E. coli* are often used as an indicator for the presence of other forms of bacteria. Coliform and *E. coli* may be present without causing illness, however, faecal coliforms such as E. coli O157:H7 are known to cause serious illness.

What was Found

The province has established a series of groundwater monitoring wells called the Provincial Groundwater Monitoring Network. One such well is in the City of Burlington located near McNiven Road in Kilbride. This well provides water samples from the dolostone bedrock of the Gasport Formation at a depth of 6.3 metres. Groundwater levels and water samples have been collected annually since 2001 and 2003, respectively and the samples analyzed to determine concentrations of major ions, trace metals, nutrients, and inorganics.

Another well, W338, was located nearby in Pleasantview near Aldershot. It was installed in soil at a depth of 2.5 metres and monitored from 2003 to 2011, when it was decommissioned.

Some of the groundwater quality results from W001 are summarized in Table 8.5. Three of the yearly samples for Sodium exceeded the 20 mg/L. If sodium concentration exceeds 20 mg/L the local Medical Officer of Health is notified to communicate this information to local physicians in case there are patients on sodium restricted diets who rely on groundwater as their drinking water source.

None of the Sodium samples were above the Ontario Drinking Water Quality Standard (ODWQS) Aesthetic Objective (AO) of 200 mg/L. Sodium concentrations above the AO limit can be detected by a salty taste in the water, although they are not harmful for most people. Both the Nitrate & Nitrite (Maximum Acceptable Concentration: 10 mg/L) and Chloride (AO limit: 250 mg/L) limits were not exceeded. The results are well below acceptable standards for drinking and the water is considered potable.

It should be noted that water samples were analyzed for metal concentrations due to toxicity but are not shown as they are well below limits.

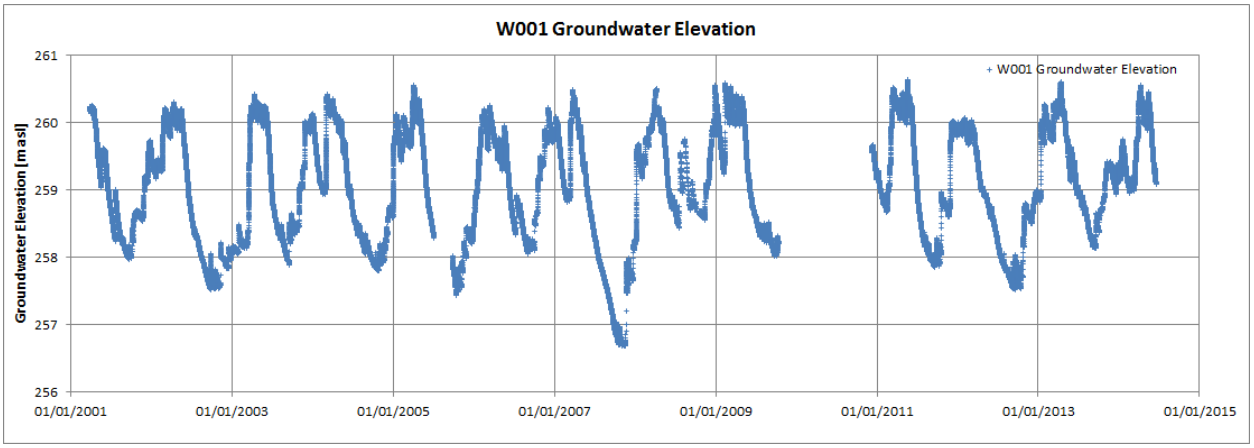
Table 8.5 - Groundwater Analytical Results at PGMN Well #W001 in Burlington

Sample Date	Sodium (mg/L)	Nitrate and Nitrite (mg/L)	Chloride (mg/L)
Oct 23, 2003	34.2	0.93	34.7
Oct 12,2005	11.0	0.45	14.8
Jul 10, 2007	5.0		8.0
Oct 20, 2008	6.9	0.61	11.2
Oct 14, 2009	14.7	0.94	15.1
Dec 8, 2010	29.0	1.36	51.9
Oct 11, 2011	9.1	0.68	12.2
Sep 24, 2012	40.1	0.55	18.2
Sep 30, 2013	19.3	0.83	15.3

Source: MOE 2014

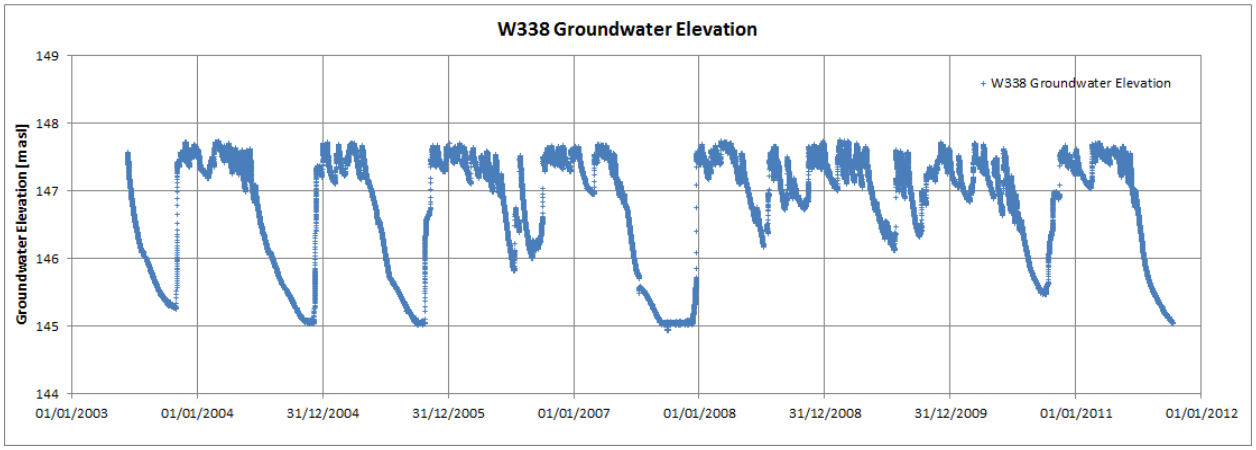
Figure 8.9 shows the water levels of W001 in Kilbride near McNiven Road. The water levels generally peak in the spring and hit the trough in fall. The fluctuation in groundwater levels has been stable over the monitored period, except during very wet (2008) and very dry (2007) years. The Region of Halton has five monitoring wells in the Kilbride area. Their water levels move in a similar pattern to W001. Figure 8.10 shows the water levels for well W338. Groundwater levels monitored at W338 were also stable and show an extended period in 2007 when the well went dry, and wetter years in 2006, 2007 and 2009.

Figure 8.9 - Water Level of Well 001



Source: Conservation Halton 2015

Figure 8.10 – Water Level of Well 338



Source: Conservation Halton 2014

The Halton Regional Health Department conducts periodic surveys of residential well water quality. Most of the private wells in the Region of Halton are located within the boundaries of the Town of Milton and the Town of Halton Hills. Therefore the published results primarily represent the wells in those areas. Twelve percent of the wells were within the City of Burlington.

Table 8.6 shows the Water Quality Results by Type of Well carried out by the Region of Halton Health Department. Phase 1 took place the summer of 2006 and Phase 2, the summer of 2007. Of those tested12% came from Burlington.

Table 8.6 - Water Quality Results by Type of Well

Bacteria, Nitrate and Overall Water Quality	Phase 1	Phase 2
Dug Wells		
Unsafe Total Coliform Levels	43%	43%
Unsafe *E. coli* Levels	5%	45%
Unsafe Nitrate Levels	1%	0%
Overall bacteriological Unsafe Water	44%	43%
Drilled Wells		
Unsafe Total Coli form Levels	32%	31%
Unsafe *E. coli* Levels	8%	3%
Unsafe Nitrate Levels	1%	0%
Overall bacteriological Unsafe Water	32%	31%

The Ministry of Environment and Climate Change's standard for a safe well has a total coliform count of five or less and an *E. coli* of 0 per 100mL. Based on this standard 37% of the wells were unsafe in Phase 1 and 38% of the wells were unsafe in Phase 2. These percentages are still much too high.

Dug/bored wells were 44% unsafe and 32% of drilled wells were unsafe in Phase 1. Similar results were 43% and 31% in Phase 2. Dug/bored wells are more vulnerable to near-surface contamination. It is recommended they be equipped with treatment devices.

What is Happening

Local agencies prioritize their well monitoring budgets based on issues that have the greatest impact on their mandates. The Kilbride monitoring station continues to be monitored through the Provincial Groundwater Monitoring Network. Private wells must be monitored for water quality by their owners. The Region of Halton provides easily accessible well water testing depots for pick-up of water sampling kits for bacteria analysis and for drop-off of filled sample bottles. The analysis results are mailed to the well owner. They will also provide a Test Your Well Water Reminder Service. Educational materials are readily available online and support will be provided if requested. Health Department staff attend events promoting what support is available for monitoring and testing wells.

Issue: Drinking Water and Water Consumption

Drinking water should be safe, aesthetically appealing, and free from objectionable colour or odour. The quality of drinking water is defined by its chemical, physical and biological content.

Drinking water regulations contain comprehensive requirements for sampling and testing. Waterworks (all plants, equipment structures, etc. design for the production, treatment, transmission, distribution and storage of drinking water owned and operated by the region) must take regular and frequent samples of their treated water and have the samples tested for microbiological parameters, chlorine residuals, turbidity, volatile organics and other health-related parameters.

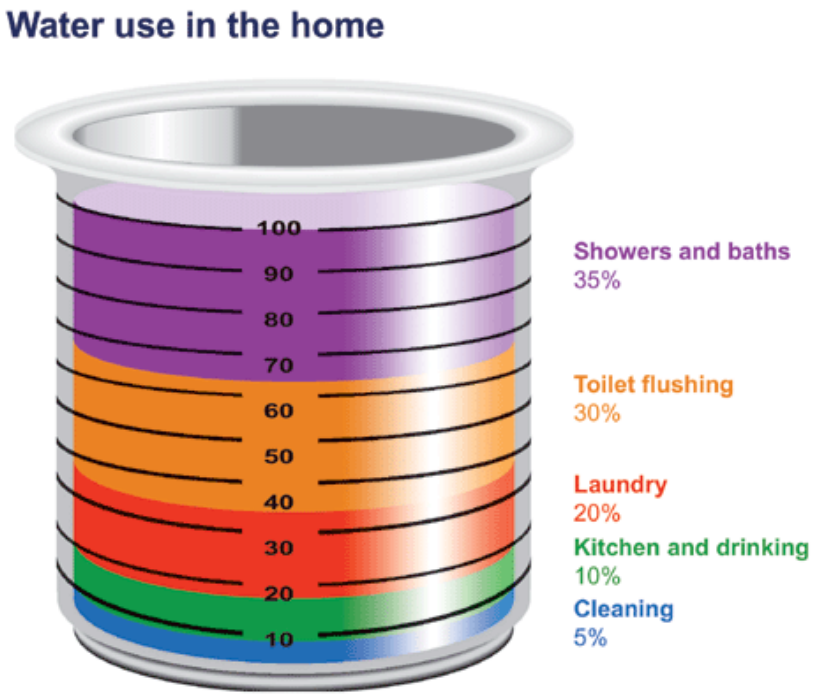
The Burlington Water Purification Plant (WPP), located at 3249 Lakeshore Road, Burlington, was designed to produce about 263 ML/d (million litres per day) of treated drinking water. The raw water source is Lake Ontario. The Burlington WPP is a conventional filtration plant with a process that consists of Actiflo® (microsand-enhanced clarification), filtration, fluoridation and ozone for disinfection and taste and odour control. Seasonally, the water is chlorinated at the intake for mussel control. The treatment chemicals used in 2013 were:

- chlorine gas (disinfection and mussel control)
- hydrofluosilicic acid (fluoridation)
- Polyaluminum chloride with provision to switch to aluminum sulphate (coagulation)
- polymer (coagulation aid)
- sulphuric acid (pH adjustment)
- sodium bisulphite (dechlorination)
- liquid oxygen (ozone generation)
- hydrogen peroxide (ozone quenching, taste and odour control)
- potassium hydroxide (pH adjustment)

The plant is controlled through a computerized Supervisory and Data Acquisition (SCADA) system that is monitored 24 hours per day, 7 days per week. Water quality tests are performed in accordance with the *Safe Drinking Water Act, 2002* and regulations. The treated drinking water is pumped into the South Halton distribution system, which serves Burlington, Oakville and parts of Milton. Burlington is also served by the Oakville Water Purification Plant (WPP), located at 21 Kerr Street, Oakville and the new Burloak Water Purification that has just recently come into service.

Treated municipal drinking water is used for residential and ICI (industrial, commercial and institutional) purposes. It is estimated that the residential sector consumes approximately 70% of water in Burlington whereas the ICI sector consumes approximately 30%, so the water habits of residents have a significant effect on the total water usage. Canadians use drinking water for a variety of residential uses. About 85% of water is used for indoor purposes and about 15% is used for outdoor purposes such as watering lawns and washing vehicles. Most indoor use is for bathing, showering and flushing toilets. Figure 8.11 shows proportionately how typical Canadians use water in the home. By understanding the use of water, it is possible to identify the greatest opportunities for efficiencies.

Figure 8.11 - Residential Indoor Water Usage



A further issue facing municipalities is water leakage in the distribution system before it reaches the end customers. Environment Canada has estimated that Canadian communities lose an average of 13% of their distributed water to leaks in pipes and other water infrastructure assets. Burlington would be expected to have a lesser percentage of leaks than the national average because it is a newer community with relatively new water infrastructure.

Why it was Measured

Canada is considered to be a water-rich nation, having 20-25 percent of the world's available fresh water. However, there needs to be awareness that its availability cannot be assumed to be unlimited. Only 0.9 percent of our fresh water is renewable, that increasing pollution of surface and groundwater is further reducing the supplies of readily available clean water, and that financing by municipal governments for the treatment of water supplies is becoming increasingly constrained. It has been estimated that the treatment and distribution of potable water and collection of wastewater can be approximately one third of a municipality's energy costs. Therefore, implementing water conservation measures to reduce demand for treated water can help achieve energy conservation and climate change mitigation objectives.

What was Measured

Data on local water consumption was obtained from Halton Region. The region collects water consumption data for each of the municipalities within its borders. Consumption comes from residential, industrial, commercial and institutional users.

What was Found

Tables 8.7 and 8.8 provide historical residential and ICI/multi-residential water consumption for Burlington, and generally show a drop in water consumption. Comparisons between annual

water use figures should be done with caution since there are a number of factors that may skew the results. Chief among them is the effect of temperature and rainfall on outdoor usage of water.

Table 8.7 - Low-rise Residential Water Consumption in Burlington (m^3)

Year	Residential	Per Capita	Per Capita Daily Consumption (litres)
2003	15,138,510	96.9	265
2004	15,024,612	94.5	259
2005	16,099,528	99.6	273
2006	14,675,716	89.3	245
2007	15,622,873	93.7	257
2008	13,995,372	82.8	227
2009	13,844,994	80.9	222
2010	13,866,149	79.9	219
2011	13,890,089	79.0	216
2012	14,202,030	79.8	219
2013	13,054,848	72.4	198

Source: Halton Region for Residential. The Per Capita and Per Capita Daily Consumption are based on calcualitions using estimated population numbers.

Table 8.8 - Industrial, Commercial, Institutional and Multi-residential Water Consumption in Burlington (m^3)

Year	ICI
2003	7,602,494
2004	7,591,717
2005	8,102,540
2006	7,719,287
2007	7,801,620
2008	7,039,847
2009	6,309,451
2010	6,467,657
2011	6,336,703
2012	6,242,269
2013	5,997,054

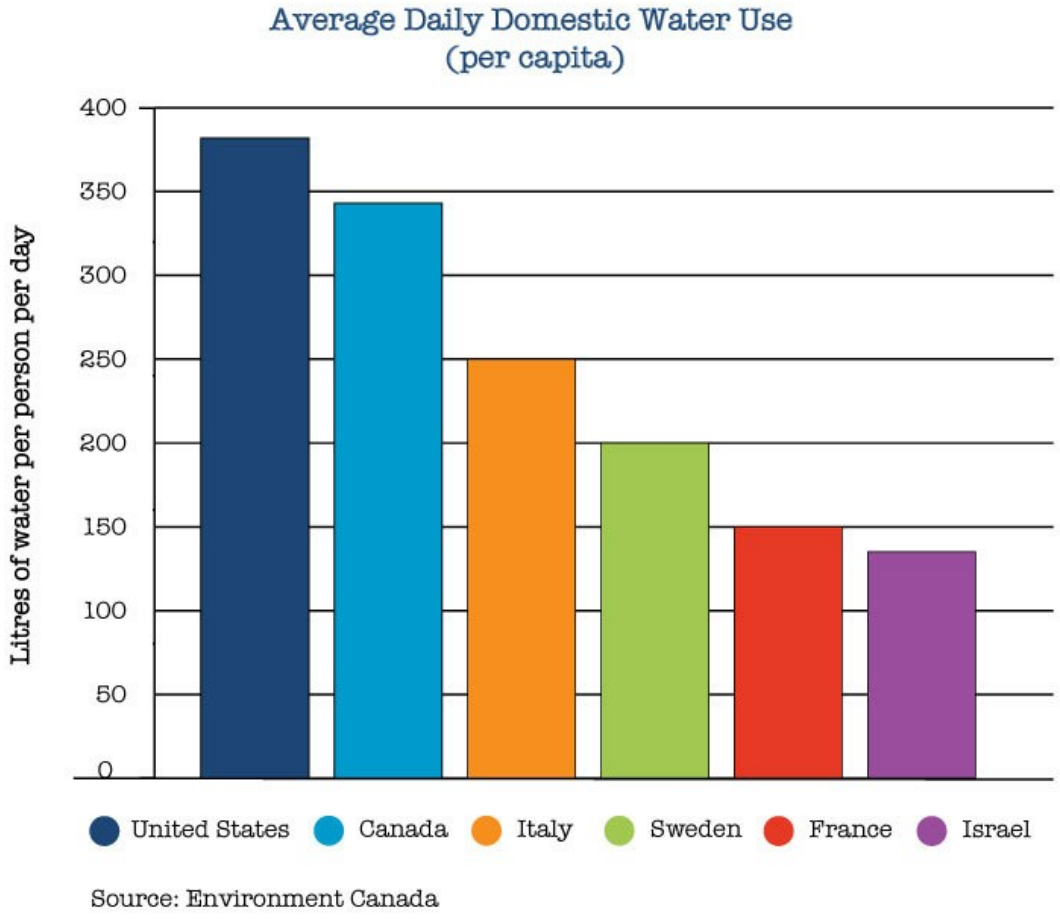
Source: Halton Region

The most recent Canadian data from Environment Canada indicates that the average Canadian used 259 litres of treated water for domestic use on a daily basis in 2011. The provincial daily average in 2009 was 225 litres per day. Multi-residential water use is combined with industrial, commercial and institutional users in Burlington through the billing process by Burlington Hydro, so a direct comparison between Burlington and Canadian or international residential consumption is not possible. However, Table 8.6 shows the average daily residential

consumption (for low-rise residential units only) as 198 litres per day in 2009, below the provincial average of 285.

Figure 8.12 shows a comparison between Canadian per capita consumption of residential water and per capita consumption in other countries. Residential consumption can be reduced using currently available practices and fixtures. Rainwater re-use, low flow toilets, and the use of drought tolerant planting materials are examples of methods that can be used to reduce the amount of water consumed by residents in Burlington. Table 8.6 shows a steady decline in consumption from 2003 to 2013 for low rise residential. Although water usage fluctuates year to year due to seasonal weather patterns, it could indicate a steady trend. Future data such as per capita water consumption should show trends on whether local conservation measures are working.

Figure 8.12 - Average Daily Consumption of Residential Water



Source: Environment Canada

What is Happening

Halton Region Programs

The region uses a combination of technical, financial, regulatory and education & outreach initiatives to encourage wise water use. The region is undertaking a number of programs for the public to conserve water including:

- High-Efficiency Toilet Rebate Program – provide a rebate $75 for Water Sense low-flow toilets
- Rain Barrel Truckload Sales – arrange for residents to purchase at $40.
- Outdoor Water Use Management System – during the summer and as needed restricting the amount of water people use by only permitting watering lawns on alternate days
- Halton Children's Water Festival – hosted annually by the region and Conservation Halton since 2006 and provides hands-on learning about water conservation and source protection to elementary school children
- Residential Leak Detection – check toilet flappers, faucets, showerheads, pipe connections, and outdoor faucets
- Water Efficient Landscaping and Irrigation Optimization
- Water Conservation Tips – advice for residents on how to reduce water consumption.

In addition the region carries out a number of initiatives including:

- Distribution System Leak Detection
- General Community Education and Outreach
- Water Policy Development

Source Water Protection

Conservation Halton and the Hamilton Conservation Authority work in partnership to coordinate the source water protection plan for the combined watershed region that includes most of Halton, Hamilton, and parts of Peel Region and Wellington County. The program aims to protect the health of the watershed's residents by protecting existing and future sources of drinking water. It is the first step in a multi-barrier approach to reduce the risks associated with water contamination and decreasing supplies.

The source of drinking water for the urban area of Burlington is Lake Ontario. Rural residents rely on private wells (groundwater). Within the city, only a release of raw sewage from the Skyway Wastewater Treatment Plant has been identified as a potential significant threat activity to the lake source water. The proposed Source Protection Plan includes policies to address this threat.

Conclusion

There is recognition within the City of Burlington and Halton Region that groundwater, surface water, and drinking water are important environmental and health assets that need to be monitored and cared for. The city and region, like other municipalities in the area, are monitoring the situation and taking steps to improve surface and ground water quality, reduce stormwater flow to local creeks, and reduce drinking water consumption. Burlington needs to be a leader in areas of stormwater management and risks falling behind unless local champions emerge to challenge the current standards.

Recommendations

1. That the city implement repairs and actions to mitigate future flooding impacts based on the results of the current study being carried out by the City of Burlington, Region of Halton and Conservation Halton in a cost effective manner. The study should include an update of the design standards for the stormwater system considering climate change impacts. That the city follow the principles (e.g. electrical boxes above flood level) required by Alberta when remediation is being carried out on residences, etc. (particularly where residences have been flooded repeatedly).
2. That the city request a geotechnical report through the development planning process to ensure the proper design is applied when building construction takes place near or below the water table, particularly in low lying areas where the water table level is near the surface. Ensure the Ontario Building Code requirements are implemented, such as waterproofing of the foundation walls and measures to mitigate a reduction in the bearing capacity of the soil.
3. That the city, in partnership with Conservation Halton as appropriate, undertake a series of pilot projects on city properties using Low Impact Development stormwater management techniques to treat stormwater runoff at its source rather than conveying it through the traditional stormwater infrastructure.
4. That the city work with the Region of Halton to include measures in the water conservation and efficiency strategy that encourage water use reduction by residents and industry, such as fixture and appliance rebates plus rainwater reuse incentives, education on items like water efficient humidifiers, and water use audits.
5. The city, in collaboration with Conservation Halton, should establish a groundwater well below the escarpment in Burlington, to facilitate the measurement of groundwater levels and the collection of groundwater for analysis. This monitor will provide for an assessment of the long-term trends in groundwater conditions below the escarpment.
6. That the city ensure that where new development is proposed in the rural areas on private well water supply and or private sewage disposal system the region's Guidelines for Hydrogeological Studies and Best Management Practice is used to assess the development impact on groundwater quality and quantity.

Chapter 9: Wastewater

Introduction

The proper collection and treatment of wastewater has a major impact on the health and quality of the life of a community. Wastewater (sewage) may be defined as the spent water of a community, containing the wastes from domestic, industrial or commercial use, as well as such surface or groundwater that may inadvertently infiltrate the wastewater system.

Domestic wastewater derives from washrooms, laundries and kitchens of dwellings, businesses and institutions. Industrial wastewater results from processes employed in industrial or manufacturing plants. Before an industry can discharge to the sanitary sewer, their wastewater must meet regional and provincial criteria. This can result in the industry having to install pre-treatment facilities. Wastewater (leachate) from closed landfill sites and cleanouts from septic tanks are discharged directly into the treatment plant. Surface and groundwater infiltrate the wastewater collection system through damaged pipe joints and sewer access covers.

The Burlington Skyway Wastewater Treatment Plant (WWTP) is located at 1125 Lakeshore Road in the City of Burlington, and is operated by the Region of Halton. It is a secondary treatment plant consisting of screening, raw sewage pumping, de-gritting, primary clarification, activated sludge, final clarification, and two-stage anaerobic digestion. The plant also has solids handling equipment including Dissolved Air Flotation, Waste Activated Sludge thickening, and belt filter presses. The final effluent is seasonally disinfected using ultra-violet irradiation prior to discharging into Hamilton Harbour.

The Skyway WWTP is renowned for its operational excellence, including year-round nitrification within a conventional activated sludge plant and enhanced effluent phosphorus and solids control, and routinely identified as a benchmark of wastewater optimization. Operating under one of the most stringent effluent limits of any lake-based wastewater treatment plant in the Greater Toronto and Hamilton (GTAH) area, the Skyway WWTP has met or bettered all of the initiatial Hamilton Harbour RAP loading targets and is on track to achieve the final RAP obligations.

In December 2009, a Schedule C Municipal Class Environmental Assessment (EA) was completed to evaluate alternatives and determine the preferred design concept for expanding the Skyway WWTP. In fall 2011, an expansion of the Skyway WWTP was awarded under the Green Infrastructure Fund. The federal government is contributing up to $51.5 million, and the province and region are covering the remaining $106.5 million. The project has four outcomes:

1. Increase the capacity of the Skyway WWTP from 118MLD (million litres per day) to 140MLD
2. Construct a new tertiary treatment facility
3. Upgrade the secondary treatment process
4. Construct a new operations facility and region-wide laboratory

Construction is expected to be completed in fall 2015. As of mid-2014, the project was 70% complete.

What was recommended and where are we now?

There were no recommendations for wastewater in the 2011 State of the Environment Report.

Issue: Wastewater Effluent Quality

Why it was Measured

Chemically, wastewater is made up of over 95 percent water with many materials that are either suspended or dissolved in the water. It is the small portion of wastewater, containing many different materials, that is of concern during the treatment process. The treated wastewater must be of such a quality that there are no public health issues, no watercourse pollution and no negative impact on the environment.

Contaminated water is the carrying agent for disease causing viruses, bacteria and intestinal parasites. As well, health consideration must be given to the effects of various chemical constituents, compounds, trace elements and metals on aquatic life and on drinking water.

What was Measured

The Region of Halton operates the Burlington Skyway WWTP in accordance with a Certificate of Approval issued by the Ministry of the Environment and Climate Change (MOECC). The Environmental Compliance Approval lists effluent objectives and non-compliance criteria, which are one of the most stringent effluent limits of any lake-based wasatewater treatment plan in the Greater Toronto and Hamilton Area.

The plant presently operates in accordance with the criteria and objectives outlined in Table 9.1. Although failure to meet effluent objectives is not chargeable by the MOE, every effort is made through design, construction and operation of the facility to meet these objectives. On the other hand, if non-compliance criteria are not met, charges can be laid by the MOE. In addition to these the region routinely monitors daily flows (average, maximum and minimum); total monthly flow; and other chemical parameters such as pH, TKN (total Kjeldahl nitrogen) and nitrate nitrogen.

A definition and discussion of the importance of the five parameters shown in Table 9.1 are provided in the following Table 9.2. It should also be noted that the criteria values in Table 9.1 are what must be achieved, while the objective values are what the plant is encouraged *to* achieve.

Table 9.1 - Skyway WWTP Certificate of Approval Objectives and Non-Compliance Criteria

Parameter	Objectives			Non-Compliance Criteria	
	Concentration (mg/L)	Loading (kg/day)	Based on (Average)	Concentration (mg/L)	Loading (kg/day)
$cBOD_5$	8.0	1180	Annual	10.0	1180
Suspended Solids	5.0	1180	Annual	10.0	1180
Total Phosphorus	0.3	47.2	Annual	0.5	47.2
Ammonia (NH_3)	2.3 4.5	330.4/ 660.8	Summer Winter	2.8 5.6	330 661
E. coli	150 CFU/100ml		Monthly	200 CFU/100ml	

CFU - Colony (bacterial) Forming Unit

What was Found

Table 9.2 below gives the monthly values during 2010 for the concentrations of the five parameters given in Table 9.1. Those wishing further detail may consult the weekly measurements given in Appendix B of the Skyway WWTP for 2010.

Table 9.2 - Skyway WWTP Final Effluent Concentrations (Monthly Averages) 2010

Collection Month	Ammonia Nitrogen (mg/L)	$cBOD_5$ (mg/L)	*E. coli* (CFU/ 100mL)	Suspended Solids (mg/L)	Total Phosphorous (mg/L)
January	0.12	2.1		5.2	0.15
February	0.14	2.2		3.7	0.14
March	0.45	2.3		5.4	0.11
April	0.12	2.0	9	4.6	0.15
May	0.05	1.8	15	3.7	0.14
June	0.06	2.1	18	3.5	0.10
July	0.05	2.1	13	3.8	0.11
August	0.05	1.9	18	3.1	0.13
September	0.05	1.7	9	4.5	0.21
October	0.06	1.7	13	3.9	0.18
November	0.08	1.7		3.4	0.15
December	0.12	3.4		6.3	0.19
Annual Average	0.12	2.1	14	4.3	0.15
Regulatory Limit	2.8/5.6	10.0	200	10.0	0.5
Number outside limit	0	0	0	0	0
RAP	0.97			2.1	0.12

Source - Skyway WWTP Annual Report 2010

The plant had no 'exceedences' of compliance criteria in 2010. This will be discussed further in the following sections.

Halton has agreed to more stringent effluent limits following completion of the current plant expansion (to 140 MLD). These new limits have been recognized by the Hamilton Harbour RAP committee and further support the delisting objectives.

Biochemical Oxygen Demand (BOD)
Biochemical Oxygen Demand *(*BOD) is the test that gives the most information on the polluted strength of the wastewater. BOD is a test measuring the amount of biodegradable material remaining in wastewater. It measures the quantity of oxygen required for micro-organisms to degrade or reduce the organic matter in the wastewater. It is also referred to as Carbonaceous BOD ($cBOD_5$), reflecting the principally carbonaceous nature of the biodegradable material. Any discharges with high BOD will decrease the dissolved oxygen in a water body, causing stress on fish and aquatic life.

All monthly averages were well below both the criteria and objective levels. The average BOD concentration in the incoming raw sewage was 147 mg/L and in the effluent was 2.1 mg/L for a reduction rate of 98.6% (98.3% in 2008).

Suspended Solids (SS)
Suspended solids consist of all of the floating materials in wastewater. It is an important test of the efficiency of the clarifier/settling tanks. All monthly averages were below the criteria and objective levels.

The average SS level in the incoming raw sewage was 174 mg/L and in the effluent was 4.3 mg/L for a reduction rate of 97.5% (97.8% in 2008). It should be noted that the Hamilton Harbour Remedial Action Plan (RAP) has set a final target of 2.1 mg/L to be achieved by 2015, which was not achieved during any month of operation.

Total Phosphorus
Phosphorus promotes the growth of aquatic plants (such as algae) in surface water. All monthly averages for the Skyway WWTP were below the criteria and objective levels. However, most months total phosphorus levels are above the Hamilton Harbour RAP final target of 0.12 mg/L.

The average phosphorus concentration in the incoming raw sewage was 3.77 mg/L and in the effluent was 0.15 mg/L for a reduction rate of 96.0% (an improvement from 95.5% in 2008).

Ammonia Nitrogen and Total Kjeldahl Nitrogen (TKN)
In wastewater, nitrogen is mostly in the form of ammonia (NH_3), although complex organic molecules may be present, which are measured as total Kjeldahl nitrogen (TKN). The Certificate of Approval sets limits and objectives for ammonia nitrogen only.

All monthly averages were well below the criteria and objectives, and were also below the Hamilton Harbour RAP final target of 0.97 mg/L. The average ammonia nitrogen concentration in the incoming raw sewage was 14.9 mg/L, compared to 0.12 mg/L in the treated effluent, for a reduction rate of 99.2%, which is a huge leap from 2008, when the reduction was 97.7%, and from the 94.7% achieved in 2000.

Faecal Coliforms
Faecal coliforms are a group of bacteria found in the faeces of humans and other warm-blooded animals. Of particular concern is *E. coli,* a bacterium in the faecal coliform group. It was a strain of *E. coli*, originating from cattle faecal material, which entered Walkerton's water supply and caused a major epidemic. The Certificate of Approval for the Skyway WWTP limits the level of *E. coli* in the effluent to 200 CFU per 100 ml.

Until 2003 the final effluent was disinfected by chlorination to destroy disease-causing pathogens. Excessive chlorination can have an adverse environmental impact on fish and other aquatic life. There is also a health concern with the formation of trihalomethanes (THM) as a result of chlorine disinfection.

The ultraviolet (UV) disinfection unit commissioned in May of 2003 has resulted in a great improvement in the levels of *E. coli* in the final effluent. All monthly averages are well below the criteria and objective levels.

Criteria Exceeded and Objectives Exceeded
Compliance with effluent limit criteria is usually based on a monthly or annual average. While, as stated above, all monthly averages and weekly readings were within compliance limits there were thirteen occasions when a weekly reading for Total Suspended Solids was above the objective criteria (5 mg/L). As noted in Table 9.1, the objective levels (which the plant is encouraged to achieve) are lower than the criteria levels and so are likely to be exceeded on more occasions.

Issue: Biosolids

Why it was Measured
Biosolids, or sludge, are collected from the various clarifiers and stored in the plant digesters. The digesters reduce total solids content and destroy pathogenic bacteria.

What was Measured
The disposal of biosolids from the Skyway Wastewater Treatment Plant (WWTP) is a complex process with nomenclature that can be confusing. Biosolids are hauled from the plant in two states: liquid or dewatered (water has been removed from the sludge by centrifuging or other means).

What was Found
Halton Region currently operates seven WWTPs that produce biosolids. In 2010, all wastewater treatment plant biosolids in Halton were directed to either temporary storage or applied to agricultural land for crop production. A total of 170,752 m^3 of liquid biosolids and 20,727 wet tonnes of dewatered biosolids were produced.

The Burlington Skyway WWTP produces the largest quantity of biosolids in Halton Region and represents about 35 percent of the total liquid biosolids production and 76 percent of the total dewatered biosolids production over the period. 29,316 m^3 digested biosolids were produced in 2008; of which 304 m^3 were taken directly to agricultural lands, and the remaining 29,012 m^3 were taken to Halton's W.A. Bill Johnson Biosolids Management Centre (BMC) located in

Oakville for temporary storage and dewatering. Skyway also produced 14,960 wet tonnes of dewatered biosolids.

Liquid biosolids are primarily stored at the BMC while the dewatered biosolids are transported to the Terratec Environmental Ltd. Power-Grow facility in Niagara Region prior to land application.

What is Happening

The volume of anaerobically digested liquid biosolids produced in Halton Region is projected to reach 366,754 m^3 by 2031. The amount of dewatered biosolids produced at the two WWTPs, which dewater biosolids on-site (Skyway and Mid-Halton), is expected to reach 44,298 wet tonnes by 2031.

In 1999, the Region of Halton developed a Biosolids Management Strategy that recommended program diversification and flexibility to address issues related to biosolids management. Since that time there have been additional changes in the regulation of biosolids management, as well as biosolids treatment technologies. In 2009, the region embarked on development of a Biosolids Master Plan to develop a long-term, environmentally sustainable, reliable, and cost effective biosolids management program that responds to current and future program challenges.

The specific purpose of the plan was to evaluate biosolids management methods and to recommend a strategy that ensures the program's long-term sustainability to the year 2031. A number of factors were considered in the development of the strategy, including population increases (projected to double by 2031), decreases in available agricultural land, finite off-season storage capacity, regulatory constraints, and public sensitivity.

The Plan considered a short-list of biosolids management methods for the region, which are summarized in Table 9.3.

Table 9.3 - Biosolids Management Methods – Refined Short List

Alternative	Method
Utilization on Land	Land Application of Liquid and Cake (Conventional Digestion)
	Land Application of Cake Only (Conventional Digestion)
	Land Application of Liquid and Cake (Advanced Digestion)
	Land Application of Cake Only (Advanced Digestion)
	Alkaline Stabilization (Regional Facility)
	Alkaline Stabilization (Shared Facility)
	Open Composting
	Composting Under Gore™
	In-Vessel Composting
	Heat Drying (Regional Facility)
	Heat Drying (Shared Facility)
Thermal Processes	Thermal Oxidation (Incineration, Regional Facility)
	Thermal Oxidation (Incineration, Shared Facility)

Land Application of Liquid and Cake (Conventional Digestion) as a preferred method and an element of Halton Region's Biosolids Management Strategy would continue a long and successful approach that has resulted in a long standing relationship with the agricultural community. However, recent changes in regulations along with the development of agricultural

land in Halton Region suggest that this method as the only element of a strategy will not be sustainable in the long-term as land availability declines and costs increase as biosolids must be land applied at greater distances from the source. In addition, a significant increase in biosolids storage would be needed to accommodate a Land Application only strategy.

Composting was the second ranked method and its use in Halton Region as part of the strategy would augment and diversify the existing land application program by diversifying the market and providing a higher quality product to other potential users outside of the agricultural community.

Thermal oxidation (incineration) as a partnership in a shared facility outside Halton Region was the first ranked Method based on the evaluation process. Thermal oxidation (incineration) diversifies Halton Region's Biosolids Management Strategy as it is the only method that does not depend on land application in some form as the final end use. Further, thermal oxidation (incineration) reduces the risk associated with the other two elements of the strategy as it is not sensitive to weather conditions, product acceptability, or market issues that challenge the other two methods of the strategy. Current thermal oxidation (incineration) technologies comply with all recent stringent emission regulations and can produce recoverable energy.

Accordingly, Halton Region's Preferred Biosolids Management Strategy involves:

- Continued land application to the extent that costs are controlled and reasonable, and vulnerabilities are minimized
- Investigation of composting opportunities to enhance Halton Region's land application program, and
- Investigation of thermal oxidation (incineration) partnership opportunities at a facility outside of Halton Region to diversify the strategy

Issue: Effluent Quantity

Why it was Measured

One of the limits to community growth is its ability to safely collect, treat and dispose of its wastewater. If limiting such growth is not a viable planning option, then any servicing strategy must expand to meet these needs. Effluent quantity and its relation to existing plant capacity is an important parameter.

What was Measured

Data on flows at the Skyway Wastewater Treatment Plant have been obtained for the period 1998 - 2010, together with information on bypass events for the same period.

What was Found

Flow Measurement

The current design capacity of the Skyway WWTP is 118,000 m^3/day with a design peak flow rating of 236,000 m^3/day. In 2010, the plant operated at 91% of design capacity. In 2008, the plant operated at 104% of design capacity.

Table 9.4 - Average and Maximum Daily Flow Rates 1998 – 2005

Year	Percent Utilization	Average Daily Flow (m^3)	Maximum Daily Flow (m^3)
1998	91	85,409	193,620
1999	87	81,530	178,200
2000	95	88,810	170,207
2001	98	90,149	191,809
2002	98/78*	92,491	174,871
2003	78	92,281	175,738
2004	81	95,679	197,539
2005	83	97,909	204,099
2006	88	103,930	211,970
2007	91	107,841	231,891
2008	104	127,100	235,300
2010	91	106,900	232,300

*Pre/post expansion values. Source: Skyway WWTP performance reports

Bypass Events

A bypass event occurs when the system is unable to collect or process a volume of raw wastewater, which therefore passes from the system in an untreated or partially treated form.

A bypass may occur at a pumping station or at the plant itself. In accordance with the Certificate of Approval, all bypasses must be reported to the MOE recording the time, location, duration, and estimated quantity of each bypass event along with the reasons for the event.

A complete listing of the fifteen bypass at the Skyway WWTP and 10 pumping station bypass events that occurred in 2010 is given in Table 8-3 and 8-4 of the 2010 Skyway WWTP annual report. A brief summary is given here:

1. Fifteen bypass events were caused by heavy precipitation and/or snowmelt. Total bypass volume was 287,119 m^3. All but one of the events was “secondary bypass,” where sewage exits the system following primary (clarification) treatment. On March 14, 2010, a bypass of raw sewage totalling 2,679 m^3 occurred.

2. Ten bypass events took place at pumping stations (four at station 8, three at station 10, and one each at stations 9, 14 and 21). Total bypass volume was 8,212 m^3. Nine bypasses were caused by heavy precipitation, and one was caused by equipment failure.

The total bypass volume measured represents 0.74% of the total flow through the plant. Table 9.4 below gives bypass numbers and volumes for 1998 through 2010.

Table 9.5 - Bypass Events - Skyway WWTP

Year	Total Flow (m^3)	Number of Bypass Events	Volume Bypassed (m^3)	Percentage Bypassed (%)
1998	31 131 052	35	1 367 659	4.4
1999	29 588 270	9	63 576	0.2
2000	31 893 960	13	93 450	0.3
2001	32 770 630	18	109 780	0.3
2002	33 553 020	12	19 650	0.06
2003	33 682 565	15	110 660	0.3
2004	35 029 260	7	74 320	0.2
2005	35 736 785	21	232 910	0.65
2006	37 200 828	15	217 740	0.58
2007	39 405 020	8	52 900	0.13
2008	44 698 700	19	167 900	0.37
2010	39 012 000	15	287 119	0.74

*In comparing this data to the bypass discussion above it must be remembered that $1m^3$ = 1000 L
Source: Burlington Skyway WWTP annual reports

Conclusion

The region is commended for consistently exceeding both the criteria and objectives in the Certificate of Approval for effluent levels. As well, the levels of most parameters are already approaching the RAP targets for 2015 (suspended solids remain a problem, with a further reduction of almost 50% needed to meet RAP targets). The introduction of UV disinfection of the effluent has led to marked and consistent reductions in the level of *E. coli* in the effluent. The plant has seen dramatic reductions in ammonia nitrogen.

The bypass percentage remained at or below 0.3% until 2005, when it more than doubled to 0.65%. It reduced to 0.13% in 2007 and 0.37% in 2008, but has now rebounded to 0.74%.

In 2008, the plant was operating above design capacity (104%). In 2010, the flow levels dropped to 107 MLD or 91% of capacity.

Recommendation

1. That the city work with the region to establish a funded program for disconnection of downspouts and other rainwater handling systems from the sanitary sewer system. Several municipalities have already established programs to permanently disconnect downspouts from sanitary sewer to mitigate flooding.

Chapter 10: Climate Change

Introduction

Current scientific and economic forecasts concerning climate change confirm past reports and recent experience – global temperatures are rising, affecting all life forms. For the past 300 years humans have been burning coal, oil and gas and destroying forests and wetlands that absorb carbon dioxide (CO_2), expanding the CO_2 'blanket' in the atmosphere and trapping the sun's heat. This is called the greenhouse effect.

Carbon dioxide molecules, once released into the atmosphere, last about 100 years. The safety level for CO_2 is 350 ppm (parts per million); earth is now at 400 ppm and rising. Global temperature is rising with this increased CO_2, or greenhouse gas emissions (GHG). Scientists agree that allowing global temperatures to rise beyond 2°C is dangerous. As the recent Intergovernmental Panel on Climate Change (5th assessment, 2014) asserts, climate change is real, human activity is largely responsible and human communities must act quickly to restore carbon 'sinks' (forests and wetlands) and reduce burning of fossil fuels through conservation and the conversion to renewable energy sources.[27]

Positive steps are encouraging within the province and at a local level. In April 2014 the last coal-powered plant in Ontario closed, eliminating a significant source of greenhouse gases in the province. At the city level, Burlington's CO_2 emissions at the community level and within city operations, on a per capita basis, have steadily decreased, helped along by the province's generation policy.

However, signs of climate change continue to be experienced and require a dedicated response. Arctic summer ice is melting at an exponential rate, thus reducing the reflective surface of the globe. In fact, the north is warming four times faster than the rest of the earth. While this melting may offer increased shipping and ecotourism opportunities, the gains are only short-term due to increased pollution and human activity.[28]

Besides the melting of polar ice, warmer temperatures are reducing permafrost which serves to trap methane gas. When this gas is released into the atmosphere it contributes to the greenhouse effect. Global sea levels have risen by eight inches in the past century.[29] The ocean is more acidic, which both weakens coral and the shells of mollusks and decreases the amount of carbon dioxide absorbed by the sea. Melting Arctic ice, increased oceanic acidity and rising sea levels, stresses on the Great Lakes Basin and negative impacts on human health and ecosystems are some of the effects of climate change. Locally, the Great Lakes continue to shrink, especially Lakes Huron and Michigan.[30] Two important effects of this stress on the Lakes are drinking water and shipping, which have health and economic impacts. While water is dealt with in this document (see chapter 8), human health and ecosystem effects are not.

[27] http://davidsuzuki.org/issues/climate-change/science/climate-change-basics/climate-change-deniers/
[28] Bob McDonald, www.thestar.com/news/world/2014/05/06/climate_change_a_threat_to_human_health_and_wellbeing_US_report_warns
[29] National Climate Assessment, May 2014 http://nca2014.globalchange.gov/
[30] Environment Canada, "Great Lakes Report," March, 2014 http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=B6344EC5-1

Canada withdrew from the Kyoto Accord, thus ending its participation in this initiative and the related opportunities for moral suasion among other countries. Decisions at the federal level continue to support the development of the Alberta Tar Sands, raising numerous environmental concerns. While 'green' jobs grow in the United States, Canada lags far behind.[31] Continued fossil fuel extraction and minimal support for 'green' job development only add to these negative effects.

The Role of Human Activity on Climate Change

The Intergovernmental Panel on Climate Change, 6th Assessment, affirms that the current global environmental crisis is founded on human activity. Beginning over 300 years ago with the Industrial Revolution, CO_2 and other harmful gases began over-accumulating in the atmosphere, increasing the greenhouse effect. Populations became aware of these dangers and gathered for international conferences like the UN Rio Summit in 1992. The Montreal Protocol of 1989 successfully banned CFCs on a global scale, thereby proving that concerted, international cooperation is possible and worthwhile. But recent actions have weakened international action, such as Canada's withdrawal from the Kyoto Accord, because some other countries were not signatories. International cooperation is precisely what is needed. Climate change does not carry a passport.

With the Industrial Revolution, more goods became available to more people. Consumerism grew and Gross Domestic Product has become the measure of success. More products at cheaper prices continue to lead to wasteful consumption. Reduce and reuse became the forgotten elements of the 3 Rs. Simon Kuznets asserts that GDP does not measure the 'welfare of a nation'. In 1968 Robert Kennedy, too, pointed out that GNP cannot measure the "health of our children, the quality of their education or the joy of their play."[32] Indeed, human beings need a new approach, such as a call for an Index of Sustainable Economic Welfare by Friends of the Earth.[33]

The traditional bedrock of product development is fossil fuel – coal, oil and gas. Currently the fossil fuel industry has 2,765 gigatons of carbon in reserve. Yet, only 20% of this can be used if the global community is committed to limiting the earth's warming to just 2°C.[34] Transitioning to green energy is tantamount to ensuring the health of the planet. Weaning production away from fossil fuels is central to this approach. People, production and consumption changes are all part of this formula. The growing divestment-from-fossil-fuel movement is building momentum and can become a powerful tool for change, just as "the divestment movement played a key role in helping liberate South Africa."[35] As green energy becomes more affordable, the transfer of investments toward sustainable energy sources becomes a wise environmental and economic choice.

Human beings have been part of climate change since the Pleistocene Epoch; however, significant impact dates from the Industrial Revolution. Indeed, as Naomi Klein summarizes, "We are products of an industrial project…linked to fossil fuels."[36] Today's decisions must be

[31] Andrew Weaver, University of Victoria , www.thestar.com/news/world/2014/05/06/climate_change_a_threat_to_human_health_and_wellbeing_US_report_warns
[32] http://davidsuzuki.org/blogs/science-matters/2014/02/measuring-progress-with-gdp-is-a-gross-mistake/
[33] ibid
[34] Hamilton 350 Committee for Action on Climate Change pamphlet
[35] Archbishop emeritus Desmond Tutu, http://greenfaith.org/programs/divest-and-reinvest/anglican-diocese-of-auckland-divestment-resolution
[36] www.theguardian.com/commentisfree/2014/apr/23/climate-change-fight-of-our-lives-naomi-klein

based on international cooperation, modulation of consumerism and reduction of the use of fossil fuel. The challenges are enormous, but so is the impact of climate change.

What was recommended and where are we now?

The 2011 State of the Environment Report had three recommendations regarding climate change in Burlington:

Recommendation #18
That the city and the region complete the five milestones under the Partners for Climate Protection program.

Status Update – In Progress
The city continues to progress in meeting the PCP program milestones, recently achieving two (setting reduction targets) and three (developing action plans). The city should be in a good position to meet milestones four and five as the corporate and community energy plans are implemented and reported on.

Recommendation #19
That the city complete the following:

- Develop and implement a corporate action plan with a more aggressive corporate target (at a minimum the federal 17% reduction from 2005 by 2020) for reducing CO2 emissions;
- Establish a working group to follow-up on the Take Action Burlington – Climate Change Summit to further engage the public and help develop a community action plan and reduction target; and,
- Track and monitor corporate and community progress on reducing greenhouse gas emissions on an annual basis.

Status Update – Partially Achieved
The city has already met its original corporate reduction target but has not set a new GHG emissions reduction target. However, energy reduction targets have been set in the corporate energy management plan, such as a 5% reduction in transit fuel, 15% reduction in energy consumption for facilities, and 20% reduction in energy for street lighting over a five year period.

An energy management team is being established at the city to focus on the corporate energy management plan. A community stakeholder advisory team assisted in the development of the Community Energy Plan and task groups are also being set up to implement the plan.
Energy data is being collected to track GHG emissions for corporate and community and will be reported on as part of the corporate and community energy plan progress reports.

Recommendation #20
That the city and region investigate in more depth how expected changes in weather and climate are likely to affect their operations and develop an adaptation plan to mitigate the damages of climate change and reduce the vulnerability of Burlington's inhabitants, critical infrastructure and environment.

Status Update – Partially Achieved
City staff continue to monitor information about climate change impacts. Although an overall adaptation plan has not been developed responding to the impacts of climate change, city staff are aware of potential risks, particularly related to severe weather events.

In response to the recent changes in the climate, engineering staff are reviewing the Intensity-duration-frequency (IDF) curves in a study that examines the variation in the rainfall events caused by climate change. This will provide information to update the IDF curves that were originally developed in the early nineties. In addition, staff are currently undertaking a Sheldon Creek Hydrology and Hydraulic study to see how the change in weather has impacted the watershed. For this purpose, rainfall and stream flow data was collected for six months which will be used to understand the watershed response to intense storm events.

The Community Energy Plan includes a goal related to local energy generation and security, ensuring that our local energy supply is resilient. District energy systems have proven to be resilient in the face of severe weather events, such as Hurricane Sandy.

The city has implemented a heat response program for employees, particularly outside workers, and makes available community cooling centres during heat advisory events.

Cost of Climate Change

In April 2014, TD Economics published a special report entitled "Natural Catastrophes: A Canadian Economic Perspective."[37] Highlights from the report state:

1. "Over the past three decades, there has been an increase in natural catastrophes and their associated damages…There's more to this spike than weather conditions, as socioeconomic factors have also played a significant role.
2. Natural catastrophes have major impacts on people, property, and prosperity all across Canada. The economic and financial impacts of natural catastrophes tend to be masked by the way that economic indicators, such as GDP, are calculated.
3. The long term financial impact of natural catastrophes is estimated to cost Canadians $5 billion per year in 2020, and $21-$43 billion by 2050.
4. With no sign that things are going to be getting any better, it's prudent for businesses and policy-makers to start thinking of the long-term implications of inaction, and place a larger emphasis on natural catastrophes when making investment decisions."

The authors go on to say that loss of life, destruction of property and disruption of businesses result from these events, which have doubled over the past thirty years to about 20 per year.

[37] www.td.com/documents/PDF/economics/special/NaturalCatastrophes.pdf

Table 10.1 - Top 10 Largest Canadian Natural Catastrophes since 2000

Year	Date	Location	Type of Catastrophe	Infrastructure Damage ($ mil)
2013	June 19 – 24	Southern Alberta	Flooding	$1,743
2013	July 8 – 9	Toronto, Ontario	Flooding	$944
2011	May 14 – 17	Slave Lake, Alberta	Wild fire	$742
2005	August 19	Southern Ontario	Wind/rainstorm	$625
2010	July 12 – 13	Southern Alberta	Wind/thunderstorm	$530
2012	August 12	Alberta	Flooding, hail, winds	$530
2009	July 24 – 28	Ontario	Heavy rains	$376
2005	June 6-8 & 17-19	Alberta	Flooding	$300
2009	July 11 – 13	Ontario & Quebec	Heavy rains	$228
2003	Summer months	British Columbia	Wild fire	$200

Source: Canadian Disaster Database; Insurance Bureau of Canada; TD Economics

Businesses need to identify how these events impact their bottom line and adjust long-term financial plans accordingly. Governments need to take a close look at their inventory of infrastructure to identify vulnerabilities and opportunities for proactive adaptation to prevent future damages, loss of life, or economic disruptions. As Craig Alexander, an author of the TD report states, every dollar spent on climate change prevention equals $9-38 saved in future costs.[38] Awareness and preparation is the first step toward ensuring the safety of people, property, and prosperity for Canada's future."[39]

In the Climate Forum's February 2013 document "International Innovation," further costs of severe climate events were identified, from rising insurance costs due to water damage to decrease in shipping capabilities on the Great Lakes (e.g. five containers must be left at the dock for each centimeter of draft lost). The document continues with the challenge to adapt, reduce unsustainable behaviours and identify new business opportunities – with the ultimate goal of building a healthier, more resilient society. Including costs to the health of both ecosystems and all species is part of this goal.

Issue: Mitigation of Greenhouse Gas Emissions

Reducing or mitigating greenhouse gas emissions is an important step in dealing with climate change. Supporting clean energy initiatives is vital to reducing the warming of the planet. For example, the Suzuki Foundation, in partnership with Trottier, has formed the Energy Futures Project to explore renewable energy for Canada. The Trottier Project is modeling a Canadian economy that shows steady economic and population growth, but reduces emissions from 500 megatonnes (million tonnes or Mt) in 1990 to 100 Mt in 2050. Providing financial incentives to local businesses that make significant clean energy choices is a possible incentive. Cooperation and knowledge-sharing will continue to move this research forward.

Protecting and expanding forests and wetlands improve carbon dioxide absorption. Actions to care for existing trees and increase the canopy are positive steps in this area, as are programs

[38] TD Report, April 2014
[39] www.climateforum.ca, International Innovation, Feb. 2013

to allow wetlands to flourish and even re-establish themselves. Increasing CO_2 absorption mitigates the heating of the atmosphere.

Securing local food sources is a matter of both human and planetary health. Supporting local farmers, encouraging sustainable agricultural practices and offering incentives to creative ideas for storage and distribution can lay the groundwork for feeding the city. Food sovereignty is an important step in climate change mitigation.

Transportation issues continue to be a weak point in the functioning of many cities. A Siemens survey of city planners found that poor public transit is the Achilles' heel of urban development and keeps many cities from being great.[40] Investing in public transportation systems that meet the needs of citizens will positively affect climate change, as will reduction of speed limits and continued designing of complete neighbourhoods.

Finally, all citizens need to gradually reduce the use of fossil fuels. As economist and IPCC author Ottmar Edenhofer states, "We need to move away from business as usual." [41] Or, as Brian Kelly of Durham Region has said, "this current business model is cooking the earth."[42] A growing number of voices, including Marc Lee, an investor in Vancouver, advocate the use of the UN Principles of Responsible Investment as a step toward managed divestment from fossil fuels, an indirect mitigation strategy.[43] Several universities such as Harvard and Princeton are exploring similar actions.

Reduction of dependence on fossil fuels goes hand-in-hand with development of clean energy sources. The synergy of all of these actions will continue to move the city toward more effective mitigation strategies.

What was Measured

The amount of carbon dioxide (tonnes eCO_2) emitted in Burlington from city operations and the community as a whole.

Why it was Measured

Greenhouse gases absorb and re-emit infrared radiation, warm the earth's surface and contribute to climate change. This measurement is key to establishing strategies to reduce emissions.

What was Found

Despite the fact that Canada's greenhouse gas emissions decreased over the five year period from 2005 to 2010 by six percent, the federal government projects that emissions will increase by another two percent leading up to 2020 due to energy projects in British Columbia and Alberta.

Burlington's greenhouse emissions on a community wide level and from city operations, as seen in the following tables, show a decrease since 2000 in all areas except transportation.

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[40] (http://davidsuzuki.org/blogs/science-matters/2014/03/canadas-success-depends-on-municipal-infrastructure-investments/)
[41] (http://report.mitigation2014.org/drafts/final-draft-postplenary/ipcc_wg3_ar5_final-draft_postplenary_chapter3.pdf; http://www.un.org/climatechange/blog/category/climate-change/page/2/)
[42] ("Climate Change – Hamilton" panel, May 12, 2014
[43] http://www.policynote.ca/why-the-city-of-vancouver-should-divest-from-fossil-fuels/

Figure 10.1 - GHG Emissions by Community Sector – Burlington 1994 – 2011

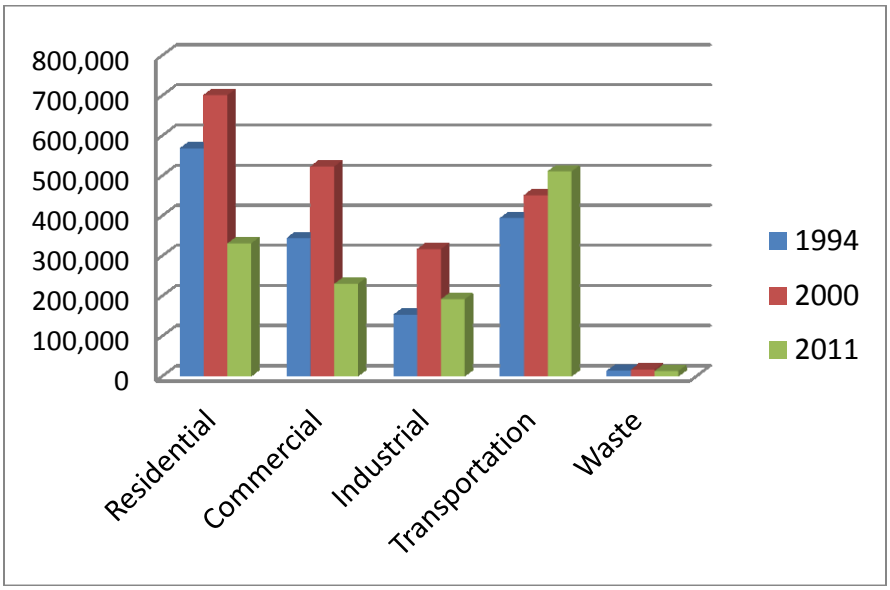


Figure 10.2 - Community Greenhouse Gas Emissions/Capita (Tonnes)

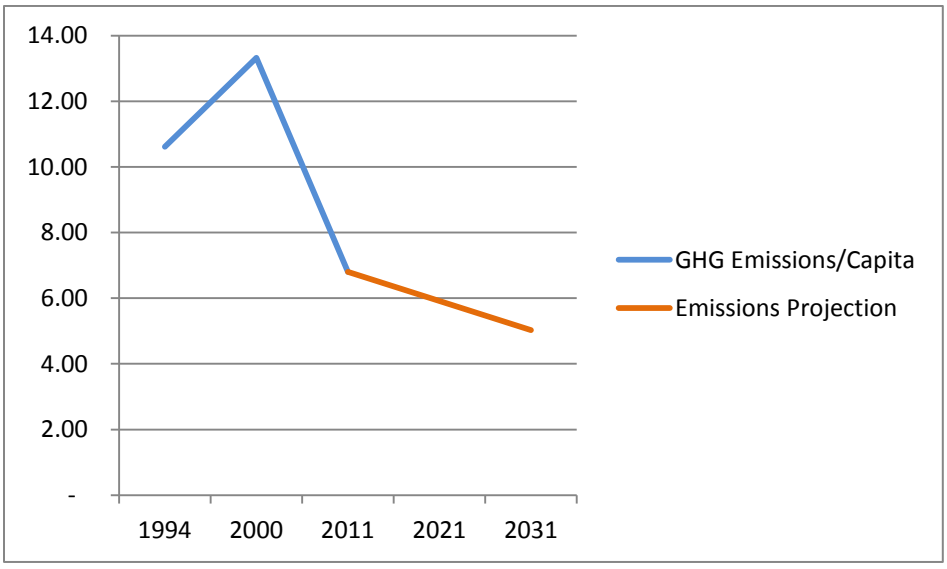
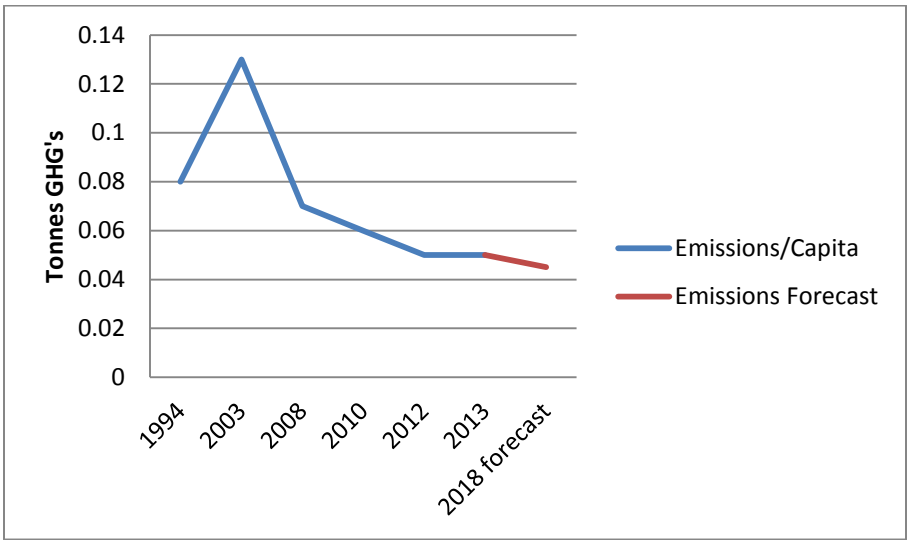


Figure 10.3 - Corporate (City Operations) Greenhouse Gas Emissions/Capita (tonnes)



Note: CO_2(e) emissions are calculated using the Partners for Climate Protection Milestone Tool developed by ICLEI.

What is Happening?

The City of Burlington has made significant progress in implementing the following triple bottom line goals, which are consistent with the strategic plan vision of 2011-2014:

Economy:	1. Manage energy costs
Society:	2. Support a vibrant, prosperous community
Environment:	3. Reduce greenhouse gas (GHG) emissions

Implementation of the Corporate Energy Management Plan (EMP) by the city for its facilities will achieve the following objectives aligned with the above goals:

1. Create a culture of energy efficiency and sustainability
2. Promote sustainable use of resources through:
    a. Energy conservation
    b. Energy efficiency
    c. Renewable energy
3. Reduce energy operating costs through implementation of best practices and advanced technologies
4. Increase the comfort and safety of occupants in city facilities
5. Increase equipment reliability and reduce maintenance costs

Concurrent with these goals, the city has made steady progress in reducing greenhouse gas emissions. This has been achieved by installing energy-efficient traffic signals, purchasing bicycles and hybrid vehicles for staff use, installation of LED lights and motion sensors, use of more efficient heating and air conditioning equipment, and use of renewable energy, such as the solar thermal seasonal water heating system for the Tansley Woods Community Centre pool.

As the city continues to implement the corporate energy management plan, it is expected that greenhouse gas emissions will continue to decrease. The following table illustrates some future initiatives:

Table 10.2 – Burlington Corporate EMP Measures

Initiatives	Tonnes CO^2 Avoided/Year
Meter integration with EMIS	13.5
Ice plant controls integration	54.0
M&T for all large building systems & equipment	96.5
Train arena, etc. staff; develop programs	96.5
Program to retrofit city buildings	852.0
Annual training program for building operators	96.5
TOTAL emissions avoided	**1,209.0**

In addition, the city has just completed a Community Energy Plan (2014) and, along with key community stakeholders, is beginning to implement the 55 actions in the plan that fall under the five goals in the plan:

1. Create leading edge community engagement in energy initiatives (conservation, generation and security) in order to enhance the implementation effectiveness and support sustained quality of life in Burlington.
2. Improve the energy efficiency of buildings in Burlington in ways that contribute to Burlington's overall economic competitiveness.
3. Increase sustainable local energy generation in Burlington and enhance supply security in ways that support Burlington's economic competitiveness.
4. Optimize integrated community energy systems and efficiency opportunities through land use planning.
5. Increase transportation efficiency.

Some of the priorities in the plan include looking at the feasibility of implementing a district energy system in Burlington, providing a more efficient means to distribute thermal (heating and cooling) energy to buildings; the feasibility of supporting the electric vehicle market through infrastructure investment; and improving the energy efficiency of existing buildings.

Two key initiatives which are underway at the time of writing this document are the Official Plan review, including the development of policies to support a healthy, liveable, sustainable, and efficient community. The second initiative is the Transportation Master Plan, where the challenge for the city will be to improve the modal split in Burlington by supporting active and sustainable types of transportation. With respect to the city's transit system, the recent approval to implement a $2 million tracking and information system for buses in Burlington will assist in establishing a baseline to measure demand and help to communicate route information to users.

The city has recently implemented community gardens in local parks as a way of supporting local food. The first garden in Central Park was a pilot program in partnership with

BurlingtonGreen. Recently, two additional gardens have been added at the Francis Road Bikeway and Amherst Park.

The city also has a green fleet transition strategy to improve the efficiency and reduce emissions from its fleet. It uses a bio-fuel mix in summer months. It avoids oversizing vehicles for the function required and continues to add hybrid vehicles into the fleet. The city has also added two hybrid aerial trucks to its heavy duty fleet.

In 2010, council approved the Urban Forest Management Plan, a plan to increase urban forest management effectiveness and efficiency, improve tree health and diversity, minimize risks to the public and maximize the benefits provided by a healthy and sustainable urban forest.

The city continues to engage citizens through the Take Action Burlington initiatives which include information on active transportation, Zero Waste projects, the anti-idling campaign, green buildings and renewable energy. Consumers can ascertain their carbon footprints in many ways, including www.myfootprint.org.

Issue: Climate Change Effects and Adaptation

It is generally accepted that mitigation measures as noted above are extremely important to reduce greenhouse gas emissions, however, it is also accepted that the impacts of climate change are already being experienced and strategies are required to adapt infrastructure and behaviour to these impacts. As stated in "Adapting to Climate Change: An Introduction for Canadian Municipalities"[44], the five steps for successful adaptation planning are: understanding vulnerability (with study of past and present events and responses), managing risk, awareness of climate change scenarios, identifying synergies and overcoming conflict, and leadership and partnerships.

Rising temperatures are evident. Globally the exponential increase in average temperatures from 1800 to the present is well known.[45] In 2003 Europe suffered 70,000 deaths because of extreme heat, plants and animals excluded. Because of Arctic warming, Canada experiences even greater temperature increase.

Rising temperatures cause greater evaporation of water, often endangering crops because of resulting drought or flooding. Food for all life forms can become scarce and may well challenge agricultural science to develop more heat resistant food sources. Hotter summers also mean increased energy consumption as the population tries to stay comfortable. Higher temperatures imply that there will be effects on health, food and energy.

Higher rainfalls and more severe weather events, as experienced in the past four years have an impact on water in the following ways: more pollutants, such as heavy metals and industrial and agricultural waste, are discharged into Lake Ontario; rivers and streams erode more severely; drinking water sources are compromised by increased algae growth and pollutants; water-related infrastructure is damaged or destroyed.

[44] https://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/municipalities/10079 from Natural Resources Canada
[45] www.giss.nasa.gov

Severe weather events, particularly flood events, are becoming more common as was experienced in Burlington on the August long weekend in 2014. The Insurance Bureau of Canada now lists flooding as the most frequent cause of claims, in some cases triggering a 23% increase in premiums. The impact of flooding on a province, and by extension on a city, is economically devastating because the federal government assists jurisdictions only after the $10 million mark. Flooding and drought are the threats related to water and climate change. Severe weather events can also have a significant and costly impact on the city's forestry inventory, such as the ice storm which occurred in late 2013.

Increased atmospheric temperatures can contribute to poor air quality and smog, particularly in urban areas, where the use of fossil fuels for transportation and heating is more concentrated. In 2008, the Canadian Medical Association estimated that that poor air quality cost the Canadian economy about $8 billion, much of it in health care costs and lost time/productivity.

Warmer temperatures also provide favourable conditions for invasive plant species and insect-borne and rodent-borne diseases. It is expected that diseases such as West Nile virus and Lyme disease will become more common. Increased temperatures in the Great Lakes can negatively impact aquatic species and contribute to increasing number of invasive species as well as the occurrence of algae blooms.[46]

What is Happening?

Currently, there is no overall coordinated Adaptation Strategy for municipal infrastructure and services for either the city or Halton Region in the face of climate change impacts to ensure community resilience. There are separate measures being implemented in various departments, but unlike some municipalities, a coordinated effort has not been taken at a city or regional level.

The city's Capital Works department continues to make improvements to upgrade and replace infrastructure but dealing with the increasingly frequent severe weather events which result in localized flooding continues to be a challenge. In certain areas of the city, basement flooding has become an issue. Voluntary programs exist to disconnect downspouts from the region's sanitary sewers and assist homeowners in subsidizing backwater valves to prevent sewage back-ups.

In response to the recent changes in the climate, engineering staff are reviewing the intensity-duration-frequency (IDF) curves in a study that examines the variation in the rainfall events caused by climate change. This will provide information to update the IDF curves that were originally developed in the early nineties. In addition, staff are currently undertaking a Sheldon Creek Hydrology and Hydraulic study to see how the change in weather has impacted the watershed. For this purpose, rainfall and stream flow data was collected for six months which will be used to understand the watershed response to intense storm events.[47]

The Community Energy Plan includes a goal related to local energy generation and security, ensuring that the local energy supply is resilient. District energy systems have proven to be resilient in the face of severe weather events, such as Hurricane Sandy.

The city implements heat-response measures during heat alerts issued by Halton Region Public Health Department, such as providing community cooling centres and extending the hours of

[46] Climate Change and Health – Tools for Schools, Halton Region Public Health Department.
[47] Staff report CSI-12-14

public swimming pools. Halton Public Health Department continues to educate the population about the risks related to extreme heat and smog, the advantages of using cars less frequently and the necessity of developing a personal emergency preparedness plan.

Some measures are in place to deal with issues of water, health, energy, buildings and ecosystems, with the energy piece being the most well developed. Under the provincial Emergency Management and Civil Protection Act, the City of Burlington annually does a risk assessment of business plans, which include dealing with severe weather events.

The city's Urban Forest Master Plan recognizes the role that trees play in climate modulation. The continued development of Burlington Hydro's 'GridSmartCity' initiative is a step in dealing with energy research and integration, as is the proposed Advanced Energy Centre in Toronto. The city is a member of Partners for Climate Protection (developed by the Federation of Canadian Municipalities and ICLEI's Cities for Climate Change Protection) and has completed three of the five established milestones at the corporate level and community level. The three milestones include the completion of a carbon inventory; setting reduction targets; and developing action plans.

The city has completed both a corporate Energy Management Plan for city operations and a Community Energy Plan, currently in the implementation stage. Finally, the Official Plan's goal of building vibrant neighbourhoods and improving walkability and employment in each neighbourhood points to awareness of and commitment to energy conservation. As former New York City Mayor Michael Bloomberg claims, cities are at the forefront of climate change action.[48]

Educating and engaging citizens and business owners about risk assessment and local action plans further addresses climate change challenges and acts as a model for other jurisdictions.

Region of Halton

Halton Region has implemented measures which help reduce the impacts of climate change, such as:

- An air quality program aimed at reducing air pollutant emissions;
- Smog Advisory and Heat/Cold Alerts issued to 450 agencies within the region, including the city;
- Development of public awareness programs related to GHG emission reduction and measures to adapt to climate change;
- Water conservation programs;
- Preparation of the "Personal Emergency Preparedness Guide";
- Monitoring and community awareness programs for diseases like West Nile Virus; and,
- Upgrades to water treatment systems to improve drinking water quality from the effect of algae blooms.

Conservation Halton

Conservation Halton is currently collecting data on precipitation and is developing mitigation plans related to flooding.

Conclusion

The Province of Ontario should be recognized for phasing out the coal fired electricity generating stations as they were a significant source of greenhouse gas and air emissions. The

[48] "Having the Climate Conversation", p. 14; www.latornell.ca/files/2013_sessions/Latornell_2013_W2E_Nick_Weigeldt.pdf

City also continues to progress with the mitigation of greenhouse gas emissions through its various initiatives related to energy efficiency upgrades, its green building policy and improving the sustainability of its fleet.

There are two significant challenges in the future facing the city. One is reducing greenhouse gas emissions related to the transportation sector, community wide. The emissions from this sector continue to rise; however, improving the modal split has proved to be challenging in a community that has built up around the use of the automobile. However, changes with land use planning to support a more intensified community with a focus on arterial corridors and mobility hubs, should help to achieve a more sustainable transportation network. Chapter 5 of this document deals with transportation in more detail.

The second challenge is related to adaptation. Adaptation is recognizing that the effects of climate change are already occurring and a coordinated plan or strategy is required to respond. In 2013, parts of the city suffered significant damage, particularly to trees and hydro infrastructure due to a severe winter ice storm, leaving many without power and a mess to clean up. In 2014, the south central part of Burlington experienced a severe rainfall event with just under 200 mm of rain falling, causing major flooding of homes, businesses and infrastructure. Some homeowners had just finished cleaning up their basements and replacing appliances from a minor flood event in the spring, only to be impacted by the second flood event in August.

The city and region are both involved in a number of initiatives to improve infrastructure and emergency response; however, consideration should be given to developing an overall community climate change adaptation strategy, as other municipalities have done. This work should also include a forecast of anticipated climatic effects in the long term (50 years) as the Region of Durham has been doing, so as to prepare for the anticipated changes in the climate, improving local resiliency.

Recommendations

1. Ensure community resiliency by working with regional partners including Halton Region, Conservation Halton and the local municipalities to develop a climate change adaptation strategy.

Chapter 11: Sustainable Buildings and Development

Introduction

Modern sustainability initiatives speak to an integrated and synergistic approach in the design of buildings. The practices and techniques to reduce the environmental impact of built form are evolving and there are a variety of solutions. Some of the key principles in achieving green developments include: location, compact form (density, use), energy efficiency, street pattern, alternative forms of transportation, renewable energy, water efficiency, waste management, parking management, and green networks.

From the environmental point of view, the best location for new development is within, or very close to existing development. For example, infill sites are usually within a city or a suburban neighbourhood where an interconnected grid of streets, retail areas, and good transit service already exist. A compact form of development not only saves agricultural land and natural features, it also provides much shorter distances between destinations within the urban area, further reducing the greenhouse gas emissions from transportation. Compact form is also represented by mixed-use developments as opposed to single land uses. To achieve a sustainable transportation network, streets should be located preferably on a grid around small-sized blocks to support walking and cycling. The province has set out requirements for infill development for each municipality that must be met before outward expansion can be approved.

One of the most discussed topics in terms of building green is the use of renewable energy. This is energy generated from natural resources – such as sunlight, wind, rain, tides and ground/water/air sources. But before this is investigated, measures should be first taken to conserve energy and to improve the efficiency of energy that is needed. This should also be done in a manner that reduces greenhouse gas emissions, not increase them.

Priorities in terms of water efficiency are to manage surface water and flood risk, encourage efficient use of water, and to protect watercourses. Through the design of new development, the focus should be not only on capturing the stormwater, but reusing it as grey water on site.

Green waste planning and management reduces our use of natural resources through actions such as re-use and recycling. It also enables us to recover value and energy from materials we use. It transforms the way we see materials such as sewage, which requires high levels of energy for treatment but can also be a valuable energy source.

Green developments increase parking efficiency by sharing, regulating and pricing; using off-site parking facilities; and improving walking and cycling conditions. The use of permeable pavement, preferably with heat reflective properties and bio-retention swales for treatment of runoff from parking lots can also be incorporated into the design of a green development.

Green networks are meant as urban networks of wildlife habitat, community gardens, urban farms, parks, green streets and farmers' markets. Urban nature is important not just for human health, but also for the health of the wildlife that shares our city spaces.

Further, other green building principles include material efficiency, indoor environmental quality, and the optimization of building operations and maintenance.

What was recommended and where are we now?

The 2011 State of the Environment Report had two recommendations regarding sustainable buildings in Burlington:

Recommendation #21
That the city prepare a program to encourage a level of green standards in all planning development applications, as well as to provide incentives for those who are willing to achieve higher standards than required.

Status Update – In Progress
In 2012, a report was presented to council recommending a community sustainable building guideline but a decision to approve it was deferred to allow for additional consultation. Staff continue to look at options to encourage builders to include green building measures in their projects.

Recommendation #22
That the city undertake a training program for city staff who deal with planning applications and building permits to obtain LEED accreditation. This program could also extend to educating the public on LEED.

Status Update – Partially Achieved
City Building staff attend seminars related to sustainable and green buildings at conferences. Examples include the Construct Canada Conference and a local seminar hosted by Sustainable Hamilton on 'Buildings that Give Back'. However, no formal LEED training program has been implemented.

Green buildings in Burlington are promoted on the city's website and case studies of green buildings were provided in the community energy plan.

Issue: Green Buildings in Burlington

Why it was Measured

Buildings consume large amounts of energy and water, as well as land and natural resources. They also produce a lot of waste going to landfill and air emissions. Due to these facts, it is important to focus on building more sustainable developments.

There are several rating systems used through the development industry to measure sustainability of the built form. The most common rating system used in the last few years in North America is Leadership in Energy and Environmental Design (LEED). It was decided to use this rating system to identify the number of buildings that were constructed to these standards in Burlington. The LEED™ system is not perfect but is the best reference available.

LEED was developed in 1994 by scientist Robert K. Watson, who was leading a broad-based consensus process which included non-profit organizations, government agencies, engineers, architects, developers, builders, manufacturers and other industry leaders. LEED was created to accomplish the following:

- Define 'green building' by establishing a common standard of measurement
- Promote integrated, whole-building design practices
- Recognize environmental leadership in the building industry
- Stimulate green competition
- Raise consumer awareness of green building benefits
- Transform the building market

LEED is a third-party certification program and an internationally accepted benchmark for the design, construction and operation of high performance green buildings. In 2002, Canada formed the Canada Green Building Council (CaGBC) and in July 2003 obtained an exclusive licence from the US Green Building Council to adapt the LEED rating system to Canadian circumstances. It is a voluntary program for builders in Canada.

There are several rating systems within LEED Canada: new construction; commercial interiors; core and shell; existing buildings; homes; and neighbourhood developments. The most commonly used is LEED for New Construction. Through LEED certification, the building's rating is based on required prerequisites and a variety of credits in the following six categories:

- Sustainable Sites (the use of the entire property so as to minimize the project's impact on the site)
- Water Efficiency (water efficient practices both indoors and outdoors)
- Energy and Atmosphere (energy efficiency, particularly in the building envelope and heating and cooling design)
- Materials and Resources (efficient utilization of materials, selection of environmentally preferable materials, and minimization of waste during construction)
- Indoor Environmental Quality (improvement of indoor air quality by reducing the creation of and exposure to pollutants), and
- Innovation and Design (special design methods, unique regional credits, measures not currently addressed in the Rating System and exemplary performance levels).

LEED for Homes also includes

- Location and Linkages (the placement of homes in socially and responsible ways in relation to the larger community), and
- Awareness and Education (the education of the homeowner, tenant, and/or building manager about the operation and maintenance of the green features of a LEED home)

Buildings can qualify for four levels of certification: certified, silver, gold, and platinum through points gained by incorporating certain measures.

One of the criticisms of LEED is the menu of items that architects and designers can pick and choose from. Green building measures become 'add-ons' instead of taking an integrated holistic design approach to ensure that the building or development is sustainable in its entirety. For instance, a building could achieve points for sustainable building measures with little focus on energy efficiency, resulting in an energy inefficient building.

In addition, ownership or tenure can also impact to the degree that a builder invests in sustainable building measures. If the builder is to retain ownership of the building, there is greater incentive to ensure that it is a sustainable, energy efficient building. However, if the builder is selling the building off or leasing it, there may be less incentive to achieve a building which is sustainable. In certain commercial real estate markets though, such as in Toronto, buildings that are not considered 'Class A' space if they do not meet LEED standards.

What was Measured

Data from the Canada Green Buildings website is provided on the number of buildings that have achieved LEED certification or have registered with the Canada Green Building Council with the intention of achieving LEED certification. Additional buildings that were built with green building measures but were not assessed through the LEED program are also listed.

What was Found

To date, five buildings in Burlington are completed and have achieved LEED Gold certification for new construction; two have achieved LEED Certification; and three have achieved LEED Certification for Interior Core & Shell Development. Table 11.1 is a summary of the LEED projects in Burlington. An additional 11 projects have registered with the Canada Green Building Council with targets to achieved LEED certification. Nine additional buildings are listed where green building measures have been incorporated but the projects were not assessed through the LEED program.

Table 11.1 - LEED buildings in Burlington[49]

Project	Address	LEED Canada Category	LEED level	Building type	Ownership
Union Gas	4475 Mainway	New Construction 1.0	Gold September 18, 2009	Office building	Private
Mountain Equipment Coop	Brant Street	New Construction 1.0	Gold January 6, 2010	New retail store	Private
Sun Life Insurance	3115 Harvester Road	Core and Shell 1.0	Silver June 29, 2010	New speculative office building	Private
TD Insurance	5045 South Service Road	Commercial Interiors 1.0		New office building	Private
Fire station #8	1827 Ironstone Drive	Commercial Interiors 1.0		New fire station	Government – City of Burlington

[49] Source: Canada Green Building Council LEED list September 9, 2014. This list may not indicate all of the registered projects because CaGBC publishes only the projects for which the consent of each project's primary contact person was received.

Project	Address	LEED Canada Category	LEED level	Building type	Ownership
Royal Botanical Gardens	680 Plains Road West	New Construction 1.0	Gold Feb. 9, 2011	Building addition - Camilla and Peter Dalglish Atrium & building renovations	Government - Province of Ontario
Burlington GO station	2101 Fairview Street	New Construction 1.0		Renovation to station	Government - Province of Ontario
Strata Condominium	551 Maple Avenue	New Construction 1.0		New residential apartment building	Private
Appleby Arena	1201 Appleby Line	New Construction 1.0	Certified June 10, 2013	2 new ice pads	Government – City of Burlington
McMaster University	4350 South Service Road	New Construction 1.0	Gold August 15, 2011	Lecture halls and classrooms	University - McMaster
Burlington Transit	3322 Harvester Road	New Construction 1.0	Certified July 8, 2014	Expansion & renovation of administration &maintenance facility	Government – City of Burlington
Burlington Performing Arts Centre	Locust Street	New Construction 1.0	Gold, Nov. 10, 2012	New theatre	Government – City of Burlington
Appleby Mall	5111 New Street	Commercial Interiors 1.0		Retail mall	Private
Cama Woodlands	159 Panin Road	New Construction 1.0		Nursing home	Private
Joseph Brant Admin Bldg & Family Health Centre	Lakeshore Road	New Construction 1.0		Hospital	Government - Province of Ontario
Residence	304 Seneca Avenue	Homes 2009		Residence	Private
Sunlife Office Campus	Harvester & South Service Road	Core & Shell Development 2009		Office	Private
Brock Avenue Apartments	470-486 Brock Avenue	New Construction 2009		Residential	Private

Project	Address	LEED Canada Category	LEED level	Building type	Ownership
Starbucks Appleby Village	491 Appleby Line	Interior/Core – Retail Pilot	Certified May 3, 2013	Retail – pilot	Private
Target	Burlington Mall	BD & C – Retail 2009	Certified May 17, 2013	Retail	Private
Target	Appleby Line	BD & C – Retail 2009	Certified May 23, 2013	Retail	Private
Paradigm Condominiums	2089 – 2095 Fairview Street	New Construction 2009		Residential	Private

There are other buildings in Burlington that are not LEED certified or LEED registered, but have incorporated green design measures:

- Alton Secondary School, Library & Community Centre
- Appleby Woods condominiums
- Canada Centre for Inland Waters
- Gateway Townes in Aldershot
- Ironstone condominiums
- Oakwood retirement community
- Green Schools Pilot Initiative: MM Robinson High School and CH Norton Public School

In addition, home builders and individuals are constructing residential housing to a higher degree of energy performance and reduced environmental impact. The new 2012 Ontario Building Code requires an EnerGuide Rating of 80 equivalent which means the dwelling is 80% as good as one that requires no net purchased external energy (through conservation and on-site generation).

Three examples of sustainable private homes built by the owners are located on: Hager Avenue, the first LEED for Homes certification in Burlington; Seneca Avenue, designed before LEED for Homes started but is equivalent to LEED Silver; and, on Side Road 2 at Walker's Line, a straw bale, off-grid house also built before LEED for Homes.

What is Happening

City of Burlington

From the list of projects in Table 11.1, it can be seen that the City of Burlington has initiated sustainable design of its own facilities, namely Fire Station 8, Appleby Ice Arena, the Transit Operations Centre, and the Performing Arts Centre. The city has a green building policy targeting LEED Silver for all new city facilities and major retrofits greater than 500 m^2.

The city has implemented renewable energy at some of its facilities, including solar thermal seasonal pool water heating at the Tansley Woods Community Centre (90 solar panels) and a

solar wall and solar energy (PV) panels at the new fire station. The city is in the process of expanding solar energy generation on other city facilities by leasing roofs to solar developers.

Other Municipal Examples
Some municipalities offer incentives for green buildings built by the private sector, such as a reduction in development charges (Town of Caledon) or fast-tracking green projects (City of Chicago). Other municipalities require all new buildings to comply with certain green standards (City of Toronto – Green Roofs).

Sustainable Building and Development Guidelines
City staff has been developing Sustainable Building and Development Guidelines to provide direction on sustainable building measures to be incorporated through the development process. Staff report PB-45-12 was presented to Council on September 4, 2012 and included an Official Plan Amendment, Sustainable Building and Development Guidelines, and a proposed implementation plan for the Sustainable Building and Development Guidelines. The report was deferred by Council in order to allow staff additional time to consult with the development industry and to address legal issues related to outstanding appeals of the Official Plan. Staff is currently working towards addressing the direction from Council, and it is anticipated that the guidelines will be addressed through the current Official Plan Review.

Sustainable Development Committee
The Sustainable Development Committee (SDC) is circulated on development applications by the Planning Department in order to review and provide comments to encourage sustainable development. Most recently, the SDC has developed a LEED Neighbourhood checklist that can aid staff during review of initial applications.

Development Permit System
The Province of Ontario passed regulations in 2007 that allow municipalities to use a Development Permit System (DPS) for land use planning. A DPS establishes a vision for future development in a neighbourhood and replaces the zoning, minor variance and site plan process. Extensive community consultation takes place during the preparation of a DPS By-law, and there may be potential for the incorporation of sustainable building designs and features into the requirements for new development. It should be noted however, that once the system is in effect, the permit process does not include any public consultation and only the developer can appeal a DPS application.

Conclusion

Since 2011, the city has seen several buildings that have achieved LEED certification or are in the process of achieving certification in the community, along with other buildings that have incorporated sustainable building measures. The city currently targets LEED silver certification for its new buildings.

The implementation of Community Sustainable Building and Development Guidelines should help to ensure more builders and developers are implementing green building measures in their projects.

Other initiatives are underway to ensure that Burlington is a livable community with a sustainable transportation network and an integrated community energy system approach. The city is reviewing and updating the Official Plan, a long term planning policy document, and is also working on a Transportation Master Plan. It is also in the early stages of implementing the

Community Energy Plan which has five goals and 55 actions to be implemented with community stakeholders.

Recommendations

1. That the city implement green building standards to require builders to include sustainable building measures in their projects,
2. That the city continue to undertake a training program for city staff who deal with planning applications and building permits to obtain LEED accreditation and to make use of the LEED Neighbourhood checklist developed by the SDC.