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The Regional Municipality of Durham
Report

To:	Committee of the Whole
From:	Commissioner of Finance
Report:	#2016-COW-21
Date:	September 7, 2016

Subject:

2016 Regional Program Climate Change Update

Recommendations:

That the Committee of the Whole recommends to Regional Council that:

A) The Regional Municipality of Durham program-based carbon footprint (greenhouse gas (GHG) emissions inventory) and forecast, including 2015 estimates for Regional facilities, fleets, traffic signals, water supply, sanitary sewerage and solid waste management operations, and revised historical GHG emissions for the 2007 to 2014 period (Section 3.0) be endorsed as the corporate carbon footprint for the 2016 reporting year;

B) Initiatives related to corporate climate mitigation, energy efficiency and demand side management, renewables implementation and other Regional program initiatives to reduce energy & fuel usage and GHG emissions as well as climate change adaptation objectives & planned strategic investments continue to be integrated into the annual Business Planning Cycle and the risk management, asset management and financial planning processes, with staff to continue to report to Council in the respective annual Servicing and Financing Studies and the Asset Management Plans, for the purposes of ensuring the Region is well-positioned to deal with potential impacts associated with climate change as it relates to the delivery of essential municipal services and infrastructure; and

C) This report be forwarded for information to the Region's eight local area municipalities and the Durham Region Roundtable on Climate Change and posted publicly on the Region's web site.

Report:

1. Background

This report highlights notable climate mitigation (GHG emission reduction) and climate adaptation (climate risk mitigation) initiatives across all Regional program areas which have been undertaken since the 2015 update (Report #2015-J-41). This report also provides an update to the corporate GHG emissions inventory (2007 to 2015) and forecast (2016 to 2020) and covers Regionally owned and/or leased facilities, vehicle fleets, traffic signals and related infrastructure, water supply and sanitary sewerage treatment, pumping and storage operations as well as Regional solid waste landfills (Section 3 and 4, respectively).

Current mitigation (or emission reduction) priorities are focused on reducing Regional program energy usage as highlighted within the Region's first five-year Conservation and Demand Management (CDM) Plan which was approved by Regional Council in June 2014 (Report #2014-J-17). The CDM Plan provides consolidated energy usage and GHG emissions data; previous, current and proposed means for conserving energy; and go-forward corporate goals and objectives related to energy management, including anticipated cost savings and estimates of potential reductions. The development, preparation and implementation of the plan is steered by an Energy Management Working Group comprised of Works and Finance staff, and is a sub-set of the Energy Advisory Sub-committee of the Corporate Climate Change Staff Working Group, which includes staff representation from across Regional operational areas, including, Water Supply and Sanitary Sewerage, Durham Region Transit, Solid Waste Management, Transportation, Works' Depots and Technical Support, Works' Facilities, Region of Durham Paramedic Services, Public Health, Social Services, Finance Department (Risk, Asset Management & Financial Planning) and the Chief Administrative Officer's Office.

CDM Plan goals and objectives were developed based upon strategic workshops and consultations with senior management and front-line staff from all operational areas, and are being implemented and updated through the annual Business Planning and Budget approvals processes. A sample summary of current and planned energy reduction/climate mitigation initiatives by the Regional departments is provided as Attachment #1.

Regional program areas are also addressing climate adaptation (climate risk mitigation) priorities as part of the broader risk and asset management processes, in consultation with the Climate Change Staff Working Group Adaptation Sub-committee, which includes risk management, asset management and financial planning staff. Attachments #3 and 4 outline climate adaptation measures and incremental costs based on approved 2015 and 2016 Budgets as well as including projections for the capital forecast (2017 to 2025). Future years' adaptation initiatives remain subject to Regional Council approvals as required.

Additional details and documentation on climate mitigation and adaptation initiatives are also found within other Regional Business Planning reports addressing specific climate change initiatives. Considerable climate mitigation and adaptation work and expenditures are planned or underway within Regional programs. This work is based upon the collaborative effort of Regional staff teams, including the Climate Change Staff Working Group and its two sub-committees (Energy Advisory and Adaptation), the Enterprise Risk Management group and the multidisciplinary Asset Management Team and Steering Committees comprised of senior management. Further implementation of climate mitigation and adaptation initiatives will be considered as part of the 2017 business planning and reporting cycle.

2. Climate Mitigation Initiatives Update

2.1 Overview

2.1.1 The most recent Corporate Climate Change Update (Report #2015-J-41) outlined various mitigation initiatives underway across Regional program areas. Since the last update, additional initiatives have been completed or are in the process of being completed as a result of the approved 2016 Business Plans. The following section outlines recent initiatives undertaken within Regional programs.

2.2 Regional Reporting and Energy Conservation and Demand Management Plan

2.2.1 Since 2013, the Province has required public agencies, including municipalities, to report on their annual energy usage and GHG emissions for designated facilities, as requirement by *Ontario Regulation 397/11* under the *Green Energy Act.* The Region's recent submission, as detailed within Report #2016-J-16, covers the Region's 2014 energy usage data for many of its facilities and operations. The Ministry of Energy has made all submission data available to the public through its *OpenData* website.

2.2.2 The regulation also requires broader public sector entities to develop and implement a comprehensive Energy Conservation and Demand Management (CDM) Plan which outlines previous, current and proposed means for conserving energy, while also outlining goals and objectives around energy conservation and management of energy while providing a forecast of expected results including cost and savings estimates. Regional Council endorsed the CDM Plan on June 4, 2014 (Report #2014-J-17) and it is to be updated every five years. The primary goals of the Plan were identified as follows:

- Enhance corporate energy awareness, communications, engagement and information sharing, including educational opportunities for staff to foster a "culture of conservation";
- Investigate existing standards and potential for new energy-related standards to ensure an effective and consistent approach to operations, maintenance, asset management and procurement;
- Per previous Council direction, continue to enhance energy-related performance measurement, to better understand energy usage variations and incorporate specific performance measures into individual business planning and budget documentation;
- Further integrate energy conservation into existing business planning and asset management analysis, including strategic assessments of specific corporate options for 2015 to 2024 Business Planning and the leveraging of external grant funding opportunities;
- Develop a corporate-wide five-year lighting retrofit strategy for consideration, including Works and Finance staff consolidation of the existing lighting inventory, options analysis, business case analysis and comprehensive reporting through Committee of the Whole, of a comprehensive technically and financially feasible plan, including recommendations and timelines for Council approval; and,
- Complete a retrospective assessment of the approved 2014/15 Embedded Energy Manager program, and provide future recommendations to Regional Council regarding potential implementation of similar programs across other Regional facilities and program areas.

2.2.3 The vision of the CDM is to attain continuous improvement in energy conservation and awareness across Regional operational areas while ensuring that energy conservation remains a primary focus to the Region's culture and decision making, reporting and approvals processes. Progress continues in achieving the goals and objectives outlined in the corporate CDM Plan as it relates to:

- Enhanced coordination between project staff and the Region's local distribution companies (LDCs) to consider energy efficiency and projected savings at the earliest stages of the project, supported through technical assistance from the LDC regarding project evaluation and application processes, where possible;

- Improvements to project scoping which consider energy efficiency and LDC program requirements to ensure eligibility for program incentives (i.e. lighting);

- Enhanced corporate communications and information sharing around completed energy efficiency and conservation initiatives across Departmental program areas to share in lessons learned;

- Continued improvements to energy monitoring and tracking of facility energy performance through use of internally-developed energy management tracking and data analysis tools which monitor operational area sector performance and energy intensity trends;

- Continued integration of energy efficiency and conservation into existing asset management and business planning processes, further supported by the consideration of available program funding opportunities, where available;

- Continued baseline data collection for the purposes of developing a corporate inventory as part of the corporate Lighting Strategy; and

- Evaluation of the notable success of the Region's participation in the Embedded Energy Manager (EEM) program at Duffin Creek Waste Pollution Control Plant (WPCP) with review of potential options for application elsewhere across Regional operational areas.

2.3 Additional Regulatory Requirements and Related Energy and Water Usage Benchmarking Initiatives

2.3.1 On February 25, 2016 the Province released its proposal to implement a regulatory requirement for energy and water usage reporting for large buildings in Ontario. The proposed Energy and Water Reporting and Benchmarking (EWRB) Initiative, as outlined in Environmental Bill of Rights Registry (EBR) Posting #012-6904 would require building/property owners to report energy and water usage annually as well as GHG emissions and building characteristics (e.g. gross floor area). The EWRB initiative would apply to prescribed large commercial, multi-unit residential and some industrial buildings (i.e. warehouses) of 50,000 ft^2 or more. Additional background to the proposed EWRB initiative was outlined in Report #2016-J-16.

2.3.2 The proposed EWRB initiative would be phased in over a three-year period with the first reporting deadline for submission of prior year usage data proposed for July 1, 2017 and would only apply to facilities 250,000 ft^2 or more. Second and third year reporting cycles would include properties/facilities of 100,000 ft^2 or more and 50,000 ft^2 or more, respectively. Electricity, natural gas and water utilities would be required to provide reporting entities with whole building, consolidated information upon request to allow for reporting.

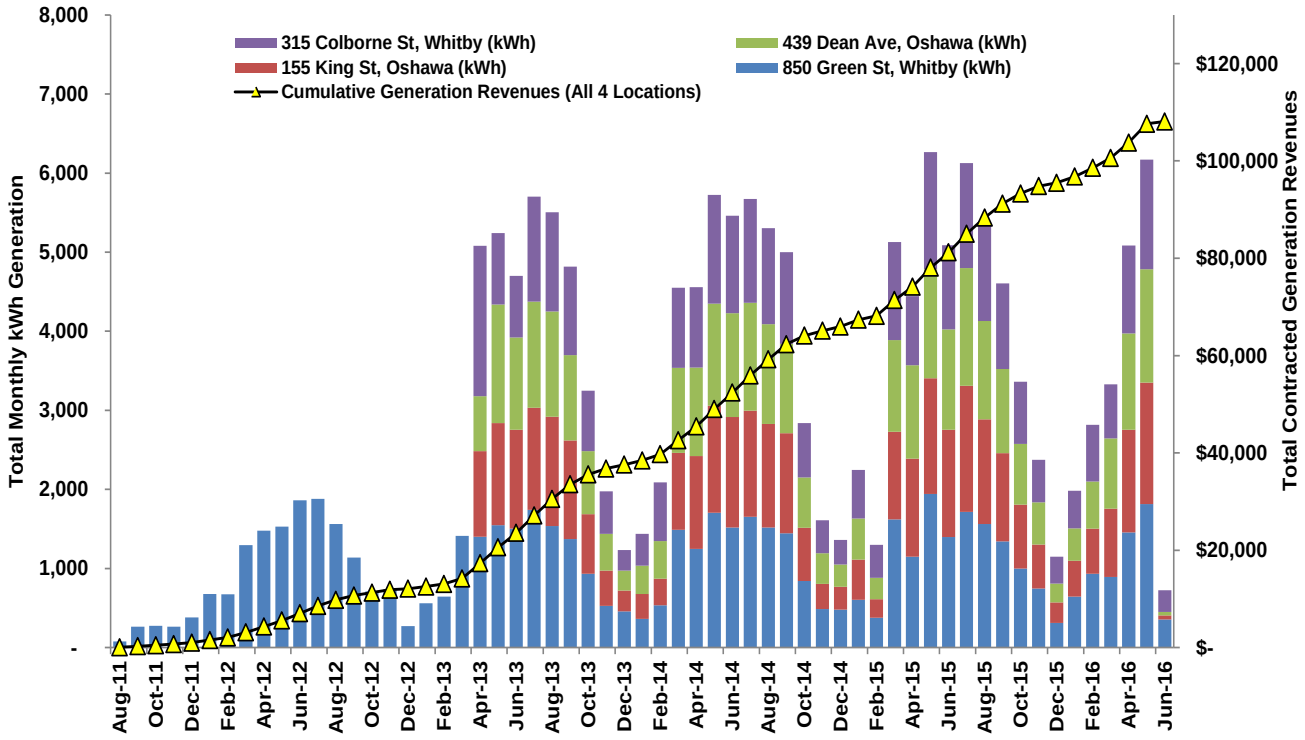
2.3.3 As there are several Regional facilities which meet the 50,000 ft^2 size threshold (largest Durham Regional Local Housing Corporation (DRLHC) multi-residential buildings and all the long-term care facilities) and fall under Municipal Property Assessment Corporation (MPAC) property codes which are proposed for reporting, it is anticipated that several Regional facilities may fall under the proposed EWRB initiative. Furthermore, given the Province has noted that electricity, natural gas and water utilities would be required to provide reporting entities with whole building, consolidated information upon request to allow for reporting, the Region will also need to determine what form of consolidated water consumption data would be required for potential end-use water customers.

2.3.4 With the recent passing of the *Energy Statute Law Amendment Act, 2016* which would enable the Ministry's proposed EWRB initiative, Regional staff are anticipating additional updates and next steps as it relates to potential implementation to determine Regional reporting and data collection and delivery requirements. Regional staff will report back to Regional Council providing updates on the initiative, where appropriate.

2.4 Feed-In Tariff (FIT) and Micro-Feed-in Tariff (microFIT) Solar Projects

2.4.1 The Region currently has four operational rooftop solar photovoltaic (PV) installations at Durham Region Local Housing Corporation sites in the City of Oshawa and the Town of Whitby. All projects are operating with all generated electricity sold back to the Ontario power grid under 20-year microFIT contracts. As shown in Figure 1, to-date the solar applications have generated and provided almost 0.2 million kWh of emission-free electricity to the grid while generating approximately $0.11 million in total microFIT contract revenues. The solar PV projects continue to be monitored by Regional staff with performance and related feedback assisting in the assessment of potential future projects.

Figure 1 – Rooftop Solar PV Generation and Contract Revenues (August 2011 to Current)



2.4.2 As noted within the Region's CDM Plan, solar options and related technologies are continuing to be assessed on a case-by-case basis as part of new build design, including technical and financial considerations and available FIT and microFIT program opportunities.

2.5 Energy Conservation and Incentives

2.5.1 As noted in staff Report #2015-J-41, the Region continues to work collaboratively with all of its respective electricity (*saveONenergy)* and natural gas (Enbridge Gas Distribution) LDCs to leverage available CDM programs, technical resources and incentives to assist with project implementation and validation of energy savings to help manage energy costs. Numerous programs provide support and incentives for various initiatives including, but not limited to:

- Funding for energy audits, building commissioning and/or re-commissioning;

- Technical support and resources to assist with identifying energy efficiency opportunities, project evaluation and measurement and verification (M&V) of energy savings; and
- Energy efficient new building construction, major renovation projects and capital upgrades, energy management and monitoring.

2.5.2 Energy conservation program incentives and resources are explored and evaluated for all of the Region's identified energy conservation initiatives at the earliest stages of project identification. Under the Provincial Conservation First policy, LDCs will continue to be provided with committed funding for energy conservation programs where electricity LDC programs (*saveONenergy* programs and individually and/or collaboratively offered programs and incentives) are in place until at least 2020.

2.6 Other Corporate Climate Change Mitigation/Energy Efficiency Initiatives

2.6.1 Through the 2016 Business Planning and Budget Process, as in prior years, the Region has continued to make energy efficiency a priority. The initiatives as outlined in Attachment #1 do not cover the full range of initiatives (i.e. various projects, such as facility structure and building envelope improvements, may contain elements of energy efficiency within their scope although not explicitly defined as conservation initiatives). Regardless, they provide a sample of projects budgeted and planned for 2016, projects currently underway and nearing completion and/or projects in the investigation stages which are being considered for more detailed assessment for future consideration.

2.6.2 To date, the Region has experienced notable success in participation in programs as made available through its LDCs where total incentives and implemented measures made available through the LDCs have totalled close to $1 million to-date. In addition, for the third year in a row, the Regional Municipality of Durham has been acknowledged by Veridian Connections as one of its top Conservation Champions, recognizing several major retrofit projects and over 4.7 million kWh of non-incented energy savings at Duffin Creek WPCP. While significant progress has been made, opportunities still exist for further improvement in energy management and performance across Regional operations.

2.6.3 The initiatives outlined, in addition to those previously completed and reported, are essential to the success of the Region's CDM Plan. As noted within the Region's CDM Plan, the Region looks to ensure that energy conservation remains central to the organization's culture and best-practice decision-making, reporting and approvals processes going forward. CDM Plan costs, benefits, and risks are considered annually, and monitored and reported within the broader long-term planning and management process with the goal of continuous improvement.

3. Data Accounting: Corporate Carbon Footprint and Forecast

3.1 This section provides an updated corporate GHG emissions inventory (2007 to 2015) and section 4 provides a forecast (2016 to 2020). Both cover Regionally-owned and/or leased facilities, vehicle fleets, traffic signals and related infrastructure, water supply and sanitary sewerage treatment, pumping and storage operations as well as Regional solid waste landfills. The accounting of the Region's corporate GHG emissions is coordinated through the Finance Department in consultation with Regional departments based on Council-endorsed GHG emission reporting protocols. The following Table 1 provides an overview of the Region's corporate carbon footprint from 2007 to 2015.

Table 1 - Corporate Greenhouse Gas Emissions Inventory (tonnes of carbon equivalent – CO_2e) 2007 to 2015 (estimated)

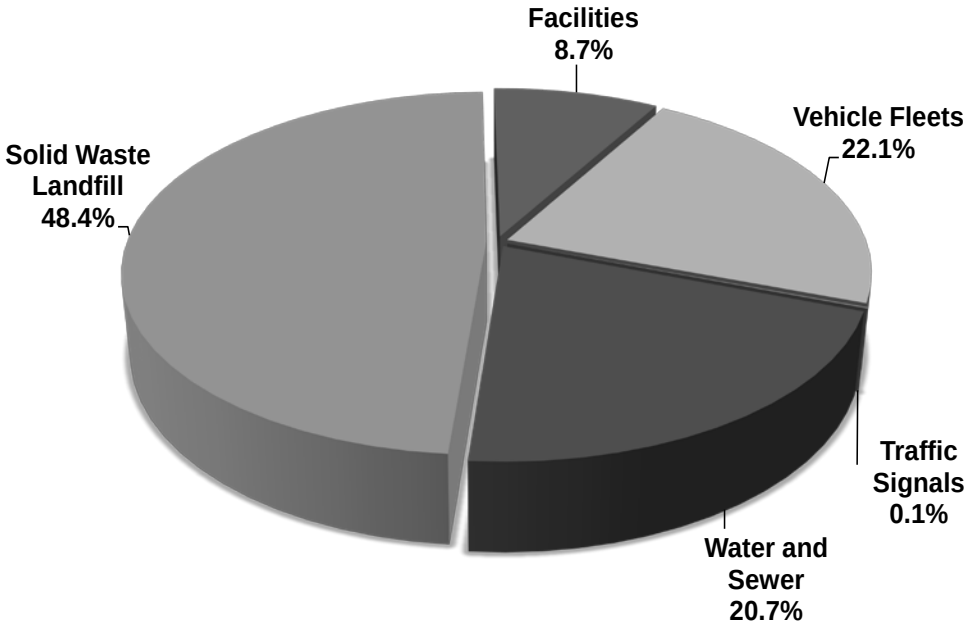
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Facilities	18,600	17,800	14,800	15,400	14,500	13,500	13,600	13,000	11,600
Vehicle Fleets	24,600	24,800	23,800	24,100	25,300	25,900	29,100	31,000	29,500
Traffic Signals	800	600	300	400	200	200	100	100	100
Water and Sewer	34,800	36,900	28,800	29,900	29,200	30,500	31,700	29,600	27,500
Solid Waste Landfill	82,400	79,400	76,600	73,900	71,400	68,700	66,800	66,300	64,500
Total Corporate GHG	**161,200**	**159,500**	**144,300**	**143,700**	**140,600**	**138,800**	**141,300**	**140,000**	**133,200**

Notes: The Facilities category includes administrative, child care, Works' depots, Region of Durham Paramedic Services (RDPS), Durham Regional Police Service (DRPS), solid waste management, transit, long-term care, social services, DRLHC and other miscellaneous Regional facilities and operations. The Vehicle Fleets category includes each of Durham Regional Transit (DRT), RDPS, DRPS and Works fleet and operations. The Water Supply and Sanitary Sewer category includes all Regionally-owned and operated water supply and sanitary sewerage facilities e.g. plants, pumping stations, reservoirs, Durham's share of Duffin Creek WPCP, and estimated fugitive wastewater emissions for WPCPs. The solid waste landfill category includes estimated methane emissions from all of the Region's landfills including those for Brock landfill which was capped in 2014.

3.2 Where required, the previously-reported 2007 to 2012 GHG emission inventory has been adjusted and restated to reflect additional or improved sources of data as well as revisions to landfill emissions estimation methods, fuel emission factors and emission intensity coefficients for electricity. The most significant adjustments come in the estimation of landfill methane emissions where updates to the coefficients, assumed global warming potential (GWP) of methane and various tonnage assumptions have updated the projections for methane generation and decay over time. Over the period from 2007 to 2015, the total corporate GHG emissions have decreased 17% despite ongoing growth of the Region and the resultant demand for Regional services. The projected decline in landfill GHG emissions over time is attributed to the discontinued disposal of waste at the Regional locations and the assumed gradual decline in methane generation over time.

3.3 As shown in Figure 2 below, just under 21 per cent of estimated corporate GHG emissions can be attributed to water and sanitary sewer operations while just over 48 per cent is sourced from Regional landfills, all of which are closed including the capped Brock landfill (as of September 2014). Approximately 22 per cent of corporate GHG emissions are attributed to fuel combustion in vehicle fleets (total), while just under 9 per cent and less than 1 per cent are from emissions associated with Regional owned or leased facilities (non-plant) and traffic signals and related infrastructure, respectively.

Figure 2 - Estimated 2015 Greenhouse Gas Emissions Inventory (tonnes of carbon equivalent – CO_2e)
2015 Estimated CO_2e = 133,200 tonnes



3.4 All the Region's closed monitored landfills pre-date modern requirements for landfill liners and leachate collection and rely primarily on natural attenuation. The landfills also pre-date modern diversion programs for paper and packaging. The approved Blackstock landfill reclamation pilot project currently underway represents a significant opportunity for the Region to address environmental concerns associated with older "legacy" landfill sites. While the business-as-usual approach is to backfill landfilled waste with greater compaction and less cover soil, the pilot landfill reclamation project underway offers a unique opportunity to investigate a totally different approach. The Region is piloting use of 'landfill mining' as a remediation method to remove the buried waste, metals and other recyclables and separate them for recycling and transport residual waste to the Durham York Energy Center (DYEC) for energy recovery. The remaining landfill recovery will be used to fill and grade the site and restore it to its original contours. This 'green' approach to landfill management is anticipated to provide environmental protection

by reducing the threat of ground and surface water contamination, significantly decreasing methane GHG gas generation for reduced climate impacts. In addition, increased diversion is anticipated from the recovery of plastics and metals. In the end it is hoped that the Region's landfill site(s), post-pilot study, could be restored and available for reuse or redevelopment as a public or green space. If feasible, future consideration will also be given to reclaiming the Region's other landfills.

3.5 The Region's corporate carbon footprint will continue to evolve over time with access to improved methodologies and updated input parameters. While retroactive adjustments to the footprint can be expected, the historical GHG emission footprint provides context to the overall GHG emission trend. It is recommended that Regional Council endorse the 2015 Regional program-based carbon footprint, including 2015 estimates for Regional facilities, fleets, traffic signals, water supply, sanitary sewerage and solid waste management operations, and revised historical GHG emissions for the 2007 to 2014 period, for the 2016 reporting year.

4. The Corporate Carbon Footprint Forecast

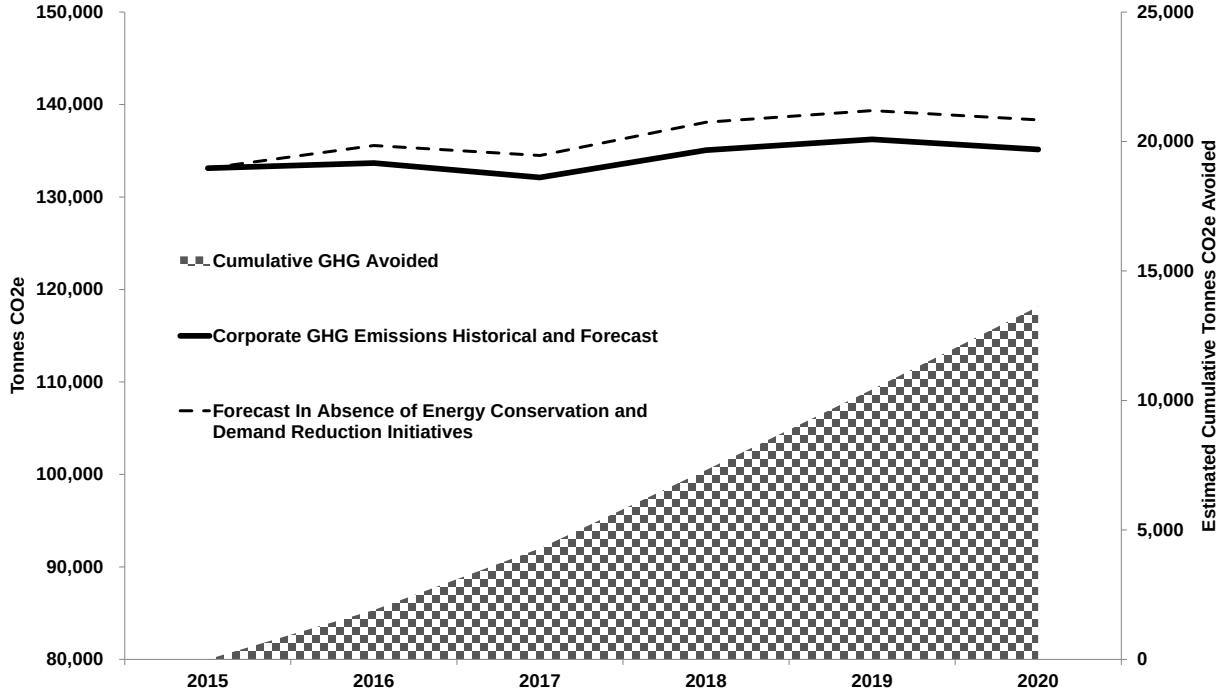
4.1 The following GHG emission inventory forecast for the 2016 to 2020 period includes estimated incremental effects attributed to the Region expanding services to meet its growth requirements. Such increases include, but are not limited to, fleet and facilities adjustments as detailed within departmental operational and capital and forecasts including DRPS, DRT and RDPS program areas.

4.2 The following Figure 3 also depicts a separate trend line which illustrates the potential effects and offsetting reductions as a result of various environmental and conservation initiatives which will serve to offset the overall absolute increases that can be expected through the growth and expansion of Regional services (mainly facilities and fleet).

4.3 While the full range of potential impacts from growth of Regional operations cannot be quantified, Figure 3 provides some indication of the general trend including provisions for growth.

REVISED FIGURE 3

Figure 3 - Corporate Greenhouse Gas Inventory Baseline Forecast



4.4 The projected increase in absolute emissions over the 2016 to 2020 period from facility operations and fleet and related energy usage is largely driven by:

- Growth in Regional fleets and related fuel usage;
- The addition of new facilities and expansion of existing locations;
- Projected growth in water and wastewater treatment to meet growth projections.

4.5 The largest fleet increases are associated with projected DRT service expansions over the forecast period, including continued growth of the Bus Rapid Transit (BRT) initiative.[1] However, the overall projected decline in landfill methane emissions offsets this increase, resulting in an overall net decline over time, without even considering potential reductions due to landfill mining.[2]

[1] While transit's share of the overall corporate carbon footprint may increase from an expanded fleet (net of vehicle efficiency improvements), an expanded public transit system can assist with reducing overall community emissions through convenient alternative transportation options, supporting a more compact form of urban development and while working to reduce emissions per passenger kilometer-travelled.

[2] Landfill GHG emission projections do not account for potential GHG reductions from the Blackstock landfill mining pilot initiative (or potential feasibility for other landfills). Future updates will acknowledge any related changes.

4.6 Given enhanced design standards and improved energy efficiency and performance, energy usage for newly designed facilities may be less on an area basis compared to older buildings.

4.7 The Region continues to be active in its identification, evaluation and implementation of energy conservation and demand management initiatives. Given the expectation for continued rising energy costs in the coming years, including anticipated cost impacts associated with carbon pricing under the new cap-and-trade program, such conservation measures have and will assist in providing material energy savings and cost avoidance to the Region. While such activities by the Region will continue, it is recognized that reductions serve as an offset in program areas which expect continued growth, such as water and sanitary sewer treatment and related operations (i.e. storage, pumping).

5. Climate Change Legislative Framework in Ontario

5.1 Overview

5.1.1 The Province of Ontario has established aggressive GHG emission reduction targets: 15 per cent below 1990 levels by 2020; and, 80 per cent below 1990 levels by 2050. The legislative and regulatory framework is now in place with a Provincial Climate Change Action Plan to determine where reductions are to be achieved and where reinvestments are expected to take place to help facilitate the Province's transition to a "low-carbon economy".

5.1.2 With the cap-and-trade emissions trading program set to commence on January 1, 2017, a wide range of impacts, direct and indirect, financially or otherwise, are anticipated to a wide range of stakeholders including direct emitters as well as end-use consumers of energy such as residents/households, business and broad public sector entities such as municipalities. As part of the Provincial Climate Change Strategy and Action Plan, it is expected that municipalities will have a significant role in assisting the Province in achieving its aggressive GHG emission targets. While municipalities have long been active in dealing with the challenges of climate change through significant investment in, and management of, essential infrastructure and services, a significant amount of additional investment and resources will be required to assist with the implementation of Action Plan items while mitigating taxpayer/ratepayer cost impacts.

5.2 Impacts on the Region Related to the Climate Change Mitigation and Low-Carbon Economy Act, 2016

5.2.1 On May 18, 2016 the government passed the *Climate Change Mitigation and Low-carbon Economy Act, 2016* and associated regulations with the cap-and-trade program is expected to commence January 1, 2017. The Region's comments to the Ministry of Environment & Climate Change (MOECC) regarding various elements of the proposed legislation and regulatory framework were detailed in Report #2016-F-22 and submitted as part of the public consultation process.

5.2.2 Based on review of the legislation and regulations, it is anticipated that the Region may have a direct compliance impact if larger single-point emitting facilities, including the Durham York Energy Centre are included.

5.2.3 Regional staff have begun incorporating the anticipated impacts of carbon pricing into the business planning and budget process including consideration of carbon intensity of commodity types and technologies as well as potential cost of emission allowances for upstream regulated entities.

5.2.4 The Region spends close to $40 million annually on energy-related expenditures for its various operations, including Regional facility and operation electricity and natural gas usage and fleet and equipment fuels. Approximately 64 per cent of the total is attributed to electricity consumption across Regional operations while over 29 per cent is fuels related to facility (non-natural gas) and fleet operations. The remaining 7 per cent is natural gas consumption across Regional facilities including Durham Regional Local Housing Corporation (DRLHC) family unit and multi-residential properties.

5.2.5 Using recent joint auction results between California and Quebec through the Western Climate Initiative (WCI), the potential carbon pricing impacts across functions can be estimated based on emission intensity of various fuel types and various technologies, where applicable.

5.2.6 In particular, vehicle fleet and facility operation-related fuel consumption (i.e. diesel for generators, furnace oil for Duffin Creek WPCP incineration) represents a significant share of total Regional energy costs and is expected to experience the largest relative cost impacts. While emission intensity and output can vary by fuel type and vehicle/equipment technologies, at just under 12 million litres of total fuel consumption (approximate 2015 volumes across fuel types), it is estimated that the Region may see cost increases of between $0.5 to $0.6 million corporate-wide as a result of the cap-and-trade program, of which the majority, over 60 per cent, is related to transit service diesel fuel consumption.

5.2.7 The Region generally consumes between 8 to 10 million cubic metres (m^3) of natural gas per year across all Regional operations with almost 40 per cent attributed to water supply and sanitary sewerage operations including Duffin Creek WPCP. The Region could face an incremental cost increase of between $0.3 to $0.4 million per year corporate-wide for natural gas as a result of the cap-and-trade program based on projected pricing.

5.2.8 Additional impacts may be felt by social housing providers across the Region where natural gas/fuel costs have ranged between $1.2 million and $1.7 million per year since 2010. While the social housing providers, including private non-profit providers, municipal non-profits and housing co-operatives will experience direct cost pressures, the Region may also see increases in subsidies paid to social housing providers based on the cost pass-through via the annual indexing of indexed benchmark costs issued by the province.

5.2.9 While the Province has proposed a number of actions for enhancing energy efficiency and lowering GHG emission reductions, including use of cap-and-trade program proceeds, the expected continued increase in carbon pricing over time is expected to result in continued budget pressures across Regional operational areas. Given the anticipated cost impacts under the cap-and-trade emissions trading program, the Region's corporate mitigation initiatives and energy conservation efforts will be of greater importance to lessen the potential cost impacts for Departmental programs and the delivery of services.

5.3 Potential Implications Related to Ontario's Five Year Climate Change Action Plan, 2016-2020

5.3.1 On June 8, 2016, the Province released its Climate Change Action Plan, 2016-2020 which outlined how it looks to move the province to a low-carbon economy over the next five years. The Plan also provides information around how cap-and-trade program proceeds will be invested to assist impacted business and consumers in transitioning under the new framework while also working to achieve additional GHG emission reductions.

5.3.2 The Action Plan provides a list of proposed climate change mitigation and adaptation initiatives and policies across eight broad action areas, many of which are expected to allow and/or require municipalities to play a significant and leading role in order to achieve the Province's targeted GHG emission reductions given its ownership and responsibility for delivery of key public infrastructure and essential services. An overview of the broad action areas is summarized in Attachment #2.

5.3.3 For the various action items in Attachment #2, total Action Plan Greenhouse Gas Reduction Account (GGRA) funding amounts range between $6.0 to $8.3 billion over the course of the plan implementation period with a target reduction of 9.8 million tonnes in 2020. While additional details and associated regulations are expected in the future, it is anticipated the municipalities will be expected to play a significant role in order to achieve the Province's targeted GHG emission reductions. Areas of potential impact to the Region under various Provincial Plan action items include, but are not limited to:

- Possible requirements for electric vehicles (EV) infrastructure and enhanced building and energy and low carbon performance standards for new building construction;
- Enhanced cycling networks and provision of cycling related facilities to interconnect along key networks and to public facilities;
- Enhanced access to energy monitoring and tracking tools such as the Green Button initiative which may extend to availability of water usage data;
- Enhanced availability or access to low carbon buses and commercial vehicles;
- Availability of retrofit funding for social housing apartments;
- Amendments to relevant legislation that will impact land use planning processes, passing of green by-laws, sustainable transportation management and planning as well as incorporation of mitigation and adaptation as mandatory for consideration within municipal official plans;
- Establishment of a program providing matching funds to municipalities for emission reduction projects and initiatives;
- Grants to municipalities for the development and implementation of Transportation Demand Management Plans; and
- Changes to Environmental Assessment process to consider climate change mitigation and adaptation.

5.3.4 As with the numerous energy conservation and demand side management activities undertaken by the Region to date, including those outlined within the Region's CDM Plan, participation in proposed initiatives may further the Region's progress in achieving its climate change goals and objectives outlined across operational areas. Programs will be considered through the Region's business planning and asset management processes.

5.3.5 Additional opportunities may be made available to the Region upon release of the Province's offset regulation which is expected later in 2016. The offset regulation, protocols and associated regulation under the overarching cap-and-trade framework may allow for the Region to participate in the market through generation of credits/allowances for reductions across non-regulated markets.

5.3.6 Regional staff continue to seek out energy efficiency programs and associated funding opportunities to assist with the advancement and implementation of energy conservation, GHG emission reducing initiatives and renewable energy generation opportunities, wherever possible. Continued support by senior levels of government and local electrical and natural gas utilities will assist the Region in achieving its climate change mitigation and energy conservation objectives both at the corporate and community level.

6. Climate Adaptation: Regional Program Climate Risk Mitigation

In consultation with senior management, the multidisciplinary Corporate Climate Change Staff Working Group and the current Corporate Asset Management & Risk Management working groups conduct key work to ensure climate vulnerability and risk assessments are advanced and considered for prioritization as part of the development of individual business and financial plans. Current work includes:

- Review and assessment of new and available research and analysis of anticipated local climate change projections and impacts;
- Vulnerability and risk reviews and updates conducted through Regional staff workshops (recently undertaken and currently under review for prioritizations and reporting within the 2017 Business Planning cycle) across program areas to consider potential operational and infrastructure risks and potential business continuity impacts;
- Support to individual program areas considering and reporting on adaptation as part of annual business plans, joint servicing and financing and planning studies; and,
- Consolidation of adaptation-related performance measures and benchmarks developed by individual program areas or through external benchmarking partnerships, to monitor and review ongoing progress and improvements.

Regional staff address a range of environment-related risks during the regular course of doing business to ensure sustainable and environmentally sensitive service delivery and stringent regulatory compliance.

Staff and senior management are continuing to improve the integration, information sharing and collaboration necessary to support the fullsome and multidisciplinary analysis/consideration of climate adaptation/resiliency opportunities and potential threats as a component of the annual business planning and asset management process and reporting structure. This facilitates and assists in:

- Selecting projects with the greatest benefits in terms of technical, financial and environmental considerations to ensure the long-term sustainability of infrastructure and programs;
- Ensuring continuous improvements to corporate climate resiliency, including both operational and infrastructure considerations;
- Coordinating and communicating adaptation-related initiatives to Regional Council and the public; and,
- Ensuring the continuous monitoring and review of potential vulnerabilities related to Regional infrastructure and service delivery due to future climate changes.

7. Increasing the Resiliency of Regional Programs and Infrastructure

The Region's Business Plans include what are deemed to be the most credible, aggressive and economically viable options to adapt to climate change.

A number of plans, improvements, capacity expansions and infrastructure initiatives, since the Corporate Adaptation Plan was approved, will further enhance the Region's capacity to adapt to climate changes. New investments include base and operational program changes, as well as significant new monies invested in resiliency capital in 2016.

Attachment #3 highlights key corporate investments approved through the 2016 Business Plans and Budgets. Adaptation-related operations, maintenance and capital plans included within the 2017 through 2025 forecast will continue to be refined throughout the 2017 annual Business Planning and Budget processes.

In addition to noted funding levels, Attachment #4 provides additional details on select adaptation initiatives which reduce risks related to:

- Infiltration into the sanitary sewer collection system;
- Potential for erosion and flooding;
- Protection of water quantity and quality;
- Monitoring and mitigation of higher maintenance operations and rehabilitation requirements, de-icing, snow removal, erosion mitigation and drainage, dust treatments and vegetation control;
- Ensuring environmental and groundwater protection at Regional landfill sites;
- Ensuring climate change considerations within municipal planning and development approvals;
- Emergency prevention and preparedness; and,
- An increase in the frequency, duration, and severity of extreme heat events.

8. Next Steps: Asset Management, Risk Mitigation and Resiliency

The Region of Durham's Asset Management program continues to evolve with changing conditions and updated technical information, as well as changes to industry best practices and new regulatory requirements. Regional staff consider Regional Asset Management planning as key to the establishment of a long-term and effective corporate response to addressing risk, including climate change and ensuring long-term sustainability.

Next steps identified through the asset management planning process include initiatives which will enhance corporate resiliency, including:

- Additional study of climate adaptation requirements related to existing facility infrastructure and operations, design etc. to determine how climate could affect condition, useful lives and current and future requirements;
- Incorporation of additional risk management strategies and improved risk assessment criteria to develop and assign more detailed risk ratings to Regional facilities and aid decisions around work prioritization and capital financial planning;
- Refining information databases for assets and condition ratings and working towards development of a detailed technical condition assessment strategy for water supply system and sanitary sewerage system facilities as well as for other non-water and sanitary sewer Regionally-owned facilities; and,
- Implementation of capital asset management software to support data collection for Facilities Management, including management and monitoring of capital and maintenance requirements, life-cycle planning, demand analysis, benchmarking, risk analysis and business and budget planning.

Significant climate adaptation initiatives and investments continue to be implemented each year across all program areas as well as progress in ensuring that corporate wide decision making business processes incorporate climate change considerations, priorities and actions in order to achieve long-term sustainability objectives.

9. Conclusions

Sustainability is a central component of Durham's best-practice decision-making, reporting and business planning approvals processes. Per Regional Council direction, climate mitigation and adaptation costs, benefits, risks and opportunities are considered, monitored and reported within the broader long-term business and financial planning and management process.

This annual Climate Change Update Report provides detailed information on Regional programs and services and efforts to both mitigate and respond to climate changes. It also provides up-to-date calculations of the Corporate Carbon footprint based upon approved protocols and information on the content and potential implications from Provincial policy and legislation related to provincial climate change mitigation and adaptation efforts.

The asset management planning process will continue to be key to implementation of forward-looking climate mitigation and adaptation policies and programs related to the prudent operation and maintenance of assets, capital rehabilitations, and the long-term planning of new and replacement infrastructure. Risk-related asset databases for each asset class will continue to be enhanced to assist maintenance strategies; monitoring of risk; useful life reviews; and life-cycle costing.

This report has been prepared through the multi-disciplinary efforts of Regional staff of the Works, Planning and Economic Development, Health, Social Services and Finance Departments as well as the CAO's Office, Durham Region Transit and Durham Regional Police Service.

10. Acronyms (attached)

11. Attachments (On Attached CD)

Attachment #1: Summary of Sample Climate Mitigation Initiatives by Region of Durham

Attachment #2: Ontario's Climate Change Action Plan, 2016-2020 – Proposed Action Areas

Attachment #3: Incremental Climate Adaptation/Resiliency Initiatives and New Funding (2015 & 2016 & 2017-2025 Forecast)

Attachment #4: Specific Regional Programs and Climate Adaptation Actions

Respectfully submitted,

Original signed by

R.J. Clapp, CPA, CA
Commissioner of Finance

Recommended for Presentation to Committee

Original signed by

G.H. Cubitt, MSW
Chief Administrative Officer

Acronyms

GHG	Greenhouse Gas
AD	Anaerobic Digestion
AHU	Air Handling Units
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BAS	Building Automation System
BRT	Bus Rapid Transit
CCA	Capital Cost Allowance
CCTV	Closed Circuit Television
CDM	Conservation and Demand Management
CTC	Central Lake Ontario
CWA	Clean Water Act
DEMO	Durham Emergency Management Office
DRHARS	Durham Region Heat Alert and Response System
DRLHC	Durham Region Local Housing Corporation
DRPS	Durham Region Police Service
DRT	Durham Region Transit
DYEC	Durham York Energy Centre
EBR	Environmental Bill of Rights
EEM	Embedded Energy Manager
EIS	Environmental Impact Studies
EV	Electric Vehicle
EWRB	Energy and Water Reporting and Benchmarking
FIT	Feed-In Tariff
HST	Harmonized Sales Tax
HVA	Highly Vulnerable Aquifers
HVAC	Heating Ventilation and Air Conditioning
I/I	Inflow and Infiltration
IPS	Influent Pumping Station
IPZ	Intake Protection Zone
IRR	Integrated Resource Recovery
KW	Kilowatt
kWh	Kilowatt hour
LDC	Local Distribution Company
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LTC	Long Term Care
M&V	Measurement and Verification
MEP/CEP	Municipal Energy Plan / Community Energy Plan
microFIT	Micro-Feed-in Tariffs
MOECC	Ministry of the Environment and Climate Change

MPAC	Municipal Property Assessment Corporation
MTCS	Modern Traffic Control System
OPS	Ontario Public Sector
OPUC/Oshawa PUC	Oshawa Power and Utilities Corporation
PV	Photovoltaic
R&D	Research and Development
RDPS	Region of Durham Paramedic Services
REM	Roving Energy Manager
SCADA	Supervisory Control and Data Acquisition
SDWT	Significant Drinking Water Threats
SGBLS	South Georgian Bay Lake Simcoe
SGRA	Significant Groundwater Recharge Areas
SPA	Source Protection Areas
SPC	Source Protection Committees
SPP	Source Protection Plans
SPR	Source Protection Region
SSPS	Sanitary Sewerage Pumping Station
TCA	Tangible Capital Asset
TCC	Trent Conservation Coalition
UPS	Uninterrupted Power Supply
VFD	Variable Frequency Drives
WHPA	Wellhead Protection Area
WPCP	Water Pollution Control Plant
WSP	Water Supply Plant

Summary of Sample Climate Mitigation Initiatives by Region of Durham

Operational Area	Initiative	Description
RDPS - Fleet	Use of ECO idle reduction system for fleet	Enhanced fuel vehicle consumption, reduce noise pollution and GHG emissions
DRPS - Fleet	Use of 4 cylinder and hybrid vehicles in non-patrol fleet functions (~10 per cent of fleet)	Enhanced fuel vehicle consumption
	Installation of invertor generators on public order and forensic identification scene vehicles	Reduced diesel generator requirements through use of battery power to operate lighting
DRT - Fleet	Enhanced engine technology through ongoing fleet replacement	Enhanced fuel vehicle consumption
DRPS West Division facility	Building automation system (BAS) system upgrades	Currently in design and consulting stage. Collaboration continues with local utilities including Veridian Connections for CDM program participation and measurement and verification of energy savings
Whitby WSP	Alternative treatment technologies pilot programme	To assist with process selection, to establish design criteria for the eventual plant expansion and upgrade for the existing plant, and determine the maximum sustainable design loading rates to minimize facility footprint, expected to commence in late-2016, the 12-month pilot program will test the suitability of varied filtration processes for the plant and will assist with the preliminary and detailed design of the plant expansion. The evaluation of alternative treatment technologies will be undertaken to determine potential for reduce pumping energy requirements due to enhanced plant recovery and reduced filter backwash frequency.

DRPS North Division facility	Building automation system (BAS) upgrades	Currently in design and consulting stage. Collaboration continues with local utilities including Hydro One Networks for CDM program participation and measurement and verification of energy savings
DRPS Centre East facility	LED parking lot lighting retrofit	Planned for 2016 and will leverage available CDM programs available through Oshawa PUC
Hillsdale Estates LTC Home	Implementation of various natural gas conservation measures	Natural gas savings through implementation of measures recommended through Enbridge Gas site assessment (targeting 5 per cent reduction from baseline)
	Implementation of up to 13 variable frequency drives (VFD) for air handling units (AHU)	With implementation expected over several years, with first VFD project underway, in collaboration with OPUC, initial annual electricity savings estimated at over 90,000 kWh with program incentive of over $9,000
	LED parking lot lighting retrofit	Planned for 2016 and will leverage available CDM programs available through Oshawa PUC
RDPS HQ	Exterior lighting retrofit	Currently underway and will leverage available CDM programs available through Whitby Hydro
Ajax WSP	Pump refurbishment	Completed refurbishment of pumps expected to yield combined peak demand reductions of almost 38kW and over 33,000 kWh of consumption reductions. Combined CDM program incentives totalled over $34,000
Taunton Rd Water Pumping Station		
Madawaska Sewerage Pumping Station	Pump Refurbishment	Planned for late-2016 with planned participation in CDM programs through OPUC for incentives and energy savings measurement

DRT Raleigh Maintenance Facility	Mechanical upgrades and lighting retrofit	Work ongoing with planned participation in CDM programs through OPUC for incentives and energy savings measurement
385 Beatrice St (Oshawa) DRLHC building	Interior and exterior lighting retrofit	Completed lighting retrofits to yield electricity savings and available CDM program funding
2 Nelson St (Bowmanville) DRLHC building	Interior and exterior lighting retrofit	Completed lighting retrofits to yield electricity savings and available CDM program funding
Courtice WPCP	Study of integrated resource recovery (IRR) options	Will examine options and technical solutions to derive value from plant waste and minimize overall plant inputs and work to achieve full or partial energy neutrality. Through the examination of infrastructure and plant treatment processes and exploration of possible synergies with alternative external sources (i.e. solid waste streams, DYEC), the study will outline options which will maximize resource recovery from water, energy and heat from waste streams and nutrients (materials) and provide recommendations around short and long-term IRR solutions for implementation
Duffin Creek WPCP	On-site, full-time staffing position dedicated to energy management	Participation in the Embedded Energy Manager (EEM) program over a two term period from April 2014 to end of 2015 saw total in-service energy reductions 6.2 million kWh and peak demand reductions of 761 kW, representing $0.74 million cumulative avoided electricity costs over the period. Continued participation in EEM initiative for 2016 with consideration being made across other Regional program areas for EEM resources.

Duffin Creek WPCP (Pickering)	Stage 3 Influent Pumping Station (IPS) Detailed Engineering Study and Implementation	The study evaluated optimization measures for the IPS (operational since May 2014) that could assist in reducing plant electricity consumption. Recommendations from the study have been implemented where low-cost control measures are anticipated to yield approximately 1.5 million kWh in annual energy savings. Given the construction of a similar pumping station to be used for Treatment Stages 1&2 at the plant (anticipated 2017), the optimization measures identified from this study will be applied to the new pumping station. The study also received $50,000 in program funding through Veridian Connections under the *saveONenergy* program
Duffin Creek WPCP (Pickering) and Ajax Maintenance Depot	System upgrades	Currently in process of implementation, the Combined energy savings, determined with the assistance of Veridian Connections' Roving Energy Manager (REM), are currently projected at 58kW of peak demand reductions with total program incentives totalling almost $53,000

DRLHC facilities (various locations)	Building insulation and weatherproofing	Currently in consultations with Enbridge Gas and Windfall Ecology Centre to determine potential opportunities available to DRLHC family units under the Home Winterproofing Program. The program provides new insulation (i.e. basement, attic) and draft-proofing measures at no cost to eligible participants with potential for up to 30 per cent in energy savings
Regional facilities (various locations)	Lighting upgrades	Currently in consultations with each of the Region's electrical LDCs regarding the enhanced and re-launched *saveONenergy* Small Business Lighting program for facility accounts of 100kW or less.
Materials Recovery Facility	HVAC system upgrades	Planned for late-2016 with planned participation in CDM programs through Whitby Hydro for incentives and energy savings measurement
Solid Waste Management	Study of anaerobic digestion (AD) options	To further the Region's diversion efforts through expanded organics capacity, the Region is retaining consulting expertise to examine and determining suitable anaerobic digestion (AD) options for the Region with consideration of appropriate service delivery models, regulatory and market requirements and project and cost risks. The analysis will also consider potential for production and marketing of outputs/products including electricity and/or alternative energy generation and/or sales and recoverable materials. A staff report is anticipated for December 2016 which will outline the AD business case analysis and recommended next steps

Ontario's Climate Change Action Plans 2016-2020-Proposed Action Areas

Broad Action Area - Transportation	
Goal	**Action Item**
Increase availability and use of lower-carbon fuel	Increase renewable content in fuels through establishment of Renewable Fuel Standard for gasoline
	Provide transitional assistance to fuel distributors for infrastructure upgrades and biofuels
	Undertake a pilot program for waste and agricultural methane as a fuel source
Increase use of electric vehicles (EV)	Extend incentives for EVs to 2020 for vehicle purchase and charging infrastructure
	Work to eliminate HST on zero emission vehicles by 2020
	Provide free overnight charging for residential/multi-residential EV consumers starting in 2017
	Income-tested rebates to assist with replacing older vehicles with hybrid or EV
	Increase EV charging infrastructure in public places in collaboration with federal government and private sector entities and requirements for EV charging infrastructure for certain new residential and commercial buildings
	Requirement for vehicle manufacturers offering the access to EV Incentive Program to participate in Electric and Hydrogen Advancement Program starting in 2017
	Enhanced public awareness with demonstration facility in collaboration with Plug N' Drive
Support Cycling and Walking	Work to accelerate Ontario's Cycling Strategy and Action Plan through enhanced commuter cycling networks, more cycling facilities and grade-separated routes and signals, more bike parking facilities at key points (i.e. public facilities, transit stations) and revisions to provincial road and highway standards requiring consideration of cycling infrastructure for road construction projects
Increase use of low-carbon trucks and buses	Establish a new Green Commercial Vehicle Program to provide incentives help enable the purchase of low carbon commercial vehicles
	Work in partnership with key industry stakeholders to establish natural gas and/or near/low emission fuelling stations
	Undertake a study and take appropriate action around enhancing competitiveness for Ontario's short-line railways
Accelerated GO Regional Express Rail deployment	Support the accelerated construction of GO Regional Express Rail

Broad Action Area – Buildings and Homes	
Goal	**Action Item**
Improve energy efficiency in multi-tenanted residential buildings	Retrofit social housing apartments
	Consider legislative/regulatory changes to lessen impact of higher energy costs on residential tenants from cap-and-trade
	Provide incentives for apartment building retrofits
Improve energy efficiency in schools and hospitals	Provide financial support to existing schools to improve energy efficiency and implement renewable energy technologies
	Establish a fund to assist universities, colleges and hospitals with facility retrofits and implementing renewable energy technologies
	Showcase low-carbon technologies through retrofit of heritage buildings
Assist homeowners in reducing carbon footprints	Increased support to homeowners in implementing low-carbon energy technologies with increased benefit for low-income households and vulnerable communities
	Establish program aimed at phasing out older wood stoves
	Provide incentives for the purchase or building of near net zero homes
	Utilization of cap-and-trade proceeds to offset cost of GHG reduction initiatives current recovered through residential and industrial customer billing
Establish lower-carbon standards for new buildings	Propose changes to the Ontario Building Code with long-term energy efficiency targets for new net zero small commercial buildings effective by 2030 or earlier
Promote low-carbon energy supply and products	Introduce renewable content requirements for natural gas and provide supports to enhance use across sectors including transportation, industrial and buildings sectors
Assist individuals and businesses with managing energy usage	By 2019, launch the Home Energy Rating and Disclosure Program which will require energy audits for sale of new of existing home
	Expand the Green Button initiative province-wide to assist with energy monitoring
	Enhance public access to climate change tools including guidance documents for businesses municipalities and homes to be available in 2017
Training, workforce and technical capacity	Expanded programs for low-carbon buildings sector workforce
	Support post-secondary training and innovation

Broad Action Items – Land Use Planning	
Goal	**Action Item**
Enhance climate change policies in the municipal land-use planning process	Proposed to empower municipalities with amendments to relvant legislation (i.e. Municipal Act) that would enable municipalities to require EV changing infrastructure on surface parking lots and allow for passing of green by-laws beyond building code, including sustainable transportation management
	Propose Planning Act amendments to ensure climate change, including GHG emission reductions and adaptation, is considered in planning decisions
	Propose amendments to the Planning Act to make climate change mitigation and adaptation mandatory in municipal official plans
	Eliminate minimum parking requirements over the next five years for municipal zoning bylaws
Support municipal and other stakeholder climate action	Establish a Challenge Fund/Program to support, through matching funds, emission reduction projects for municipalities that have a MEP/CEP or climate change policies and GHG inventories are already in place
	Support development of Community Energy Plans and Climate Action Plans
	Support community energy mapping and platforms
Reduce congestion and improve economic activity	Assist municipalities with pilot congestion management plan implementation
	Provide grants to municipalities and large employers to implement Transportation Demand Management Plans

Broad Action Item – Industry and Business	
Goal	**Action Item**
Assist industries in adopting low-carbon technologies	Assist companies with the transition to low-carbon with programs and services offered through an established green bank
Assist the agri-food sector in adopting low-carbon technologies	Provide assistance to food and beverage-processing sector to expand use of innovative technologies
	Retrofit agricultural facilities including greenhouses and grain dryers

Broad Action Items – Collaboration with Indigenous Communities	
Goal	**Action Item**
Collaborate with Indigenous Communities	Various collaborative efforts including connecting remote communities, movement away from diesel generation, development of microgrids and enhanced use of biomass to name a few

Broad Action Item – Research and Development	
Goal	**Action Item**
Support innovation and commercialization of new low-carbon technologies	Bolster the low-carbon clean-tech sector with support for research and development of accelerators and clusters
Set tax and regulatory policies that encourage innovations	Explore research and development credits to R&D to encourage investment
	Consider accelerated capital cost allowance (CCA) for GHG reducing technologies
	Update regulatory requirements to support adoption of innovative industrial technologies
Support research and development through a Global Centre for Low-Carbon Mobility	Create a Global Centre for Low-Carbon Mobility at a post-secondary institution which will support R&D around low- and no-carbon transportation and off-road technologies
Reduce emissions and energy costs across government	Enhance energy efficiency for provincial government buildings
	Increase provincial government GHG emission reduction target and develop strategy to move government operations to carbon neutrality
	Increase telecommuting opportunities for Ontario public sector staff
	Buy/lease green-plate-eligible passenger vehicles for OPS fleet where possible
	Use energy performance contracts across OPS, where possible
	Use public properties and buildings to demonstrate low-carbon technologies
	Review of OPS Procurement Directive to enable low-carbon procurement
	Reform fossil fuel policies and programs

Broad Action Item – Agriculture, Forecasts and Lands	
Goal	**Action Item**
Remove emissions from waste and move Ontario to a circular economy	Will implement the Waste-Free Ontario: Building the Circular Economy strategy which will call for zero waste in the province and zero GHG emissions from the waste sector with implementation over five years. Note increase in recycling in ICI sector and reduction of organics to landfill
Increase understanding of how agricultural and natural lands emit and store carbon	Develop a Land Use Carbon Inventory to assess ability of different land uses to emit and capture carbon
	Develop a Forest Carbon Policy Framework to clarify role of managed Crown forests in storing carbon
Maximize carbon storage from agriculture	Develop and implement and Agricultural Soil Health and Conservation Strategy to maximize long-term carbon storage in soils
Understand and enhance carbon storage in natural systems	Expansion of Ontario's Greenbelt to protect more green spaces and maintain carbon sequestration potential
	Protect grasslands with development and implementation of Ontario Grasslands Stewardship Initiative
	Complete the Far North Land Use Strategy
	Support tree planting programs to achieve 50 million trees planted Province-wide by 2025 including an increase in tree planting in urban boundaries and funding for irrigation
	Work with First Nation and Metis communities to improve understanding of flow of carbon
Update Environmental Assessments to account for climate change	Address climate change in Environmental Assessments through consideration of mitigation and adaptation

Attachment #3 **2015 and 2016 Approved Operational Budgets**

Adaptation Goal	Adaptation Objectives	Priority Adaptation Initiatives	Restated 2015 Budget	Base Increase	Program Increase	Approved 2016 Budget	Total Increase/ Decrease
1 Maintain effective and up-to-date emergency plans for natural and human-cause emergencies.	**a. Emergency management & business continuity.**	Emergency Management	1,122,000	(68,000)	87,000	1,141,000	19,000
		Public Alerting System Maintenance	150,000	-	-	150,000	-
		9-1-1 Management	3,047,000	95,000	(30,000)	3,112,000	65,000
		Data and infrastructure protection	461,000	-	-	461,000	-
		Data Security	626,000	69,000	10,000	705,000	79,000
		Interoperable communications	647,000	112,000	-	759,000	112,000
		Strategic Emergency Management	731,000	45,000	-	776,000	45,000
2 Enhance community wide resiliency and protect water quality, prevent water losses and implement Source Water Protection Plans for the region, including proposed policies/actions to mitigate drinking water threats.	**a. Support community wide resiliency and adaptation measures through the provision of funding to Conservation Authorities who have flood management responsibilities at the watershed level.**	Operations	5,329,504	133,931	(3,137)	5,460,298	130,794
		Watershed Planning	317,021	35,550	-	352,571	35,550
		Aquatic Resources/Fisheries	47,000	-	-	47,000	-
		Groundwater Management	30,000	3,000	-	33,000	3,000
		Watershed Monitoring	162,030	1,402	-	163,432	1,402
		Natural Heritage Systems	146,054	332	-	146,386	332
		Conservation Management Planning	116,570	(20,918)	-	95,652	(20,918)
		Flood Forecasting/Warning	119,915	355	-	120,270	355
		Natural Hazard Mapping	129,852	113	-	129,965	113
		Special Projects	60,000	39,000		99,000	39,000
		Watershed Projects	534,273	2,101		536,374	2,101
		York/Peel/Durham/TO Groundwater Management	175,000	-	-	175,000	-
	b. Provide funding for strategic land acquisitions in support of Regional goals and objectives including watershed protection and erosion mitigation.	Land Acquisition Funding to Conservation Authorities	899,000	(39,000)	-	860,000	(39,000)

Adaptation Goal	Adaptation Objectives	Priority Adaptation Initiatives	Restated 2015 Budget	Base Increase	Program Increase	Approved 2016 Budget	Total Increase/ Decrease
2 Enhance community-wide resilience **CONTINUED**	**c. Provide support and leadership to community-wide climate change mitigation and adaptation initiatives through the Durham Region Roundtable on Climate Change.**	Durham Region Roundtable on Climate Change	329,000	1,000	-	330,000	1,000
3 Formally expand asset management planning to consider and address risk, including climate risk, and optimize asset life-cycles ensuring Regional facilities, sites, fleets, equipment and transportation, water supply and sanitary sewerage systems continue to operate safely and effectively.	**a. Invest proactively in preventative maintenance and rehabilitation when most beneficial.**	Cleaning, Repairs, Maintenance Holes	1,664,000	-	34,000	1,698,000	34,000
		Sewer Connections Cleaning & Repair	2,002,000	1,000	409,000	2,412,000	410,000
		Flush at Hydrant - Blowoff	452,000	-	(2,000)	450,000	(2,000)
		Repair Watermains	2,070,000	-	206,000	2,276,000	206,000
		Main Leaks, Swabs, Cathodic Protection	534,000	-	-	534,000	-
		Valves/Hydrants inspections, maintenance, repair	2,236,000	-	330,000	2,566,000	330,000
		Water Service Connections and Repairs	2,064,000	-	1,836,000	3,900,000	1,836,000
		Water meter repairs and replacements	527,000	-	48,000	575,000	48,000
		Ploughing and Snow Removal	4,936,000	3,000	123,000	5,062,000	126,000
		Sanding and Salting	2,897,000	-	177,000	3,074,000	177,000
		Snow fence	163,000	1,000	41,000	205,000	42,000
		Winter road supervision/control/other winter maintenance	688,000	2,000	(36,000)	654,000	(34,000)
		Drainage & Spring Cleaning	631,000	1,000	(51,000)	581,000	(50,000)
		Roadside Maintenance - Road repairs, shoulder maintenance and grading,	2,768,000	1,000	-	2,769,000	1,000
		Bridge Maintenance	116,000	-	-	116,000	-
		Culverts and Catchbasins - cleaning, maintenance & replacement	343,000	-	-	343,000	-
		Curb & gutter replacements	15,000	-	-	15,000	-
		Vegetation Control	1,037,000	(1,000)	-	1,036,000	(1,000)
		Storm Sewer & outfall Inspection, Maintenance, cleaning and repair	207,000	10,000	-	217,000	10,000
		Traffic signals/systems-emergency and preventative maintenance/repairs	1,711,000	112,000	(93,000)	1,730,000	19,000

Adaptation Goal	Adaptation Objectives	Priority Adaptation Initiatives	Restated 2015 Budget	Base Increase	Program Increase	Approved 2016 Budget	Total Increase/ Decrease
Adaptation-related cost estimates within all programs, including estimates for emergency response, security, exterior repair, snow and salting & extraordinary maintenance. Adaptation-related costs may can represent a varied proportion of total budgeted costs within these categories.		Traffic - Roadside sign, steel beam/cable rail repair and maintenance and weather protection	694,000	6,000	(122,000)	578,000	(116,000)
		Traffic Engineering & Control Systems - MTCS maintenance, engineering studies and data management	2,424,000	-	94,000	2,518,000	94,000
4 Increase Public Awareness of Environmental Health Risks and Projected Impacts from Environmental Health issues.	**Enhance community resilience through regular inspections of water facilities, settings and sewage systems; investigations & risk assessments of environmental health hazards; response to public inquiries & provision of information on environmental health issues; & development & education plans for health issues during**	Food Safety	2,094,000	48,000	14,000	2,156,000	62,000
		Water Safety	1,472,000	(21,000)	1,000	1,452,000	(20,000)
		Sewerage Systems Inspections and Safety	356,000	4,000	57,000	417,000	61,000
		Vector Borne Diseases Prevention/Management	617,000	3,000	-	620,000	3,000
		Health Hazard Prevention/Management	1,075,000	37,000	55,000	1,167,000	92,000
		Emergency Preparedness Programs	708,000	59,000	-	767,000	59,000
TOTAL ADAPTATION RELATED OPERATIONS			**51,680,219**			**55,540,948**	**3,860,729**

Attachment 3: 2015 and 2016 Approved Construction of Municipal Services (CMS) Budgets and the 2017 to 2025 Capital Forecast (subject to future Council approvals)

Adaptation Goal	Adaptation Objectives	Priority Adaptation Actions	2015 Restated Budget	2016 Approved	Forecast 2017-2020	2021-2025	Total 2016-2025
1 Reduce the infiltration of groundwater or storm water into the sanitary sewer collection system.	**a. Address sanitary sewer pipe capital repair and replacement requirements.**	i. Replace identified deficient linear sanitary sewerage infrastructure [1]	5,955,000	6,380,000	33,612,050	43,951,750	83,943,800
		ii. Existing Linear asset twinning (to enhance system security)	5,800,000	200,000	9,500,000	42,530,000	52,230,000
		iii.Inflow/infiltration studies and remedial works in various locations	300,000	500,000	2,000,000	2,500,000	5,000,000
	b. Comprehensive assessment of sewer system capacity to accommodate extreme precipitation, frequency and intensity.	iv. Asset condition assessments, planning and engineering studies.	553,350	150,000	2,200,000	2,750,000	5,100,000
2 Continue to improve the quality of sanitary sewerage effluent through treatment process improvements and water pollution control plant upgrades/ replacements	**a. Process improvements**	i. New lagoon (Sunderland), Corbett WPCP headworks	3,700,000	900,000	-	-	900,000
		ii. Liverpool Road Overflow Condition Assessment	300,000	-	-	-	300,000
		iii Pringle Creek WPCP - demolition and greensite restoration		2,000,000	-	-	2,000,000
	b. WPCP and sanitary sewerage system upgrades	iv. P2 Upgrades at Harmony Creek WPCP		3,441,800	-	-	3,441,800
		v. Duffin Creek WPCP					
		- Digester mixing improvements	524,000	1,310,000			
		- Replacement of Reactor 1 & 2	262,000		1,572,000	22,532,000	24,104,000
		- Modifications to receiving station	-	100,000	-	-	100,000
		vi. Water St. SSPS upgrades		508,350	4,485,000		4,993,350
	c. WPCP Optimization and phosporous reduction studies	vii. Uxbridge WPCP optimization study (2015) and phospherous reduction studies (north)	450,000		2,100,000	-	2,100,000

Attachment 3: 2015 and 2016 Approved Construction of Municipal Services (CMS) Budgets and the 2017 to 2025 Capital Forecast (subject to future Council approvals)

Adaptation Goal	Adaptation Objectives	Priority Adaptation Actions	2015 Restated Budget	2016 Approved	Forecast 2017-2020	2021-2025	Total 2016-2025
3 Maintain effective and up-to-date emergency plans for natural and human-caused emergencies.	**a. New Standby Power and replacements**	i. Liverpool Road SSPS and Madawaska SSPS	1,200,000		-	-	-
		ii. Ajax WSP Diesel Generator			2,000,000	-	2,000,000
		iii.Replacement of diesel standby power at Harwood Avenue water pumping station	400,000	-	-	-	-
		iv. Installation of standby power at Whitby water supply plant			-	3,100,000	3,100,000
		v. Replacement of Standby Power at Municipal Wells #3 and #4 (Clarington)	200,000	-	-	-	-
	b. Improved alerts, response, communication and control e.g. SCADA systems	vi. SCADA improvements (water/sewer TCA)	-	580,000	6,000,000	-	6,580,000
	c. Emergency planning	vii. Works Department Emergency Planning Update	200,000	-	300,000	-	300,000
4 Protect water quality, prevent water losses and implement Source Water Protection Plans for the region, including proposed policies/actions to mitigate drinking water threats.	**a. Source Water Protection and wellhead protection**	i. Well interference works and wellhead protection	1,200,000	1,200,000	5,400,000	9,000,000	15,600,000
	b. Pipe failure mitigation	ii. Water linear asset rehabilitations and replacements (includes meters, valves and hydrants)[(1)]	12,678,000	13,159,480	52,431,500	61,514,800	127,105,780
		iii. Polybutylene connection replacement program	13,486,000	14,500,000	58,800,000	14,900,000	88,200,000
	c. Improvements to enhance system security	iv. Feedermain in Newcastle to provide looping and security to system	-	-	950,000	-	950,000

Adaptation Goal	Adaptation Objectives	Priority Adaptation Actions	2015 Restated Budget	2016 Approved	Forecast 2017-2020	2021-2025	Total 2016-2025
4 Protect water quality, prevent water losses and implement Source Water Protection Plans for the region, including proposed policies/actions to mitigate drinking water threats. **CONTINUED**		v.Watermain in Whitby to provide looping and security to the system	-	-	750,000	-	750,000
		vi. New water storage facilities to provide security (Ajax Zone 1/Whitby Zone 4/Oshawa Zone 4/Bowmanville Zone 1/Newcastle Zone 1 & Zone 2 / Orono Zone 1/ Port Perry	1,100,000	500,000	47,750,000	15,150,000	63,400,000
		vii. New well and pumphouse for system security - Cannington & Sunderland	-	-	4,180,000	-	4,180,000
		viii. Valve replacement at Oshawa WSP for Interconnection Capabilities	-	-	625,000	-	625,000
		ix. Automatic bulk water dispensing system	-	-	1,480,000	900,000	2,380,000
	d. Water system rehabilitations	x. Decommissioning of Mackie Creek and Skinner Springs (Bowmanville)	410,000	-	-	-	-
	e. Water Supply Plant algae risk mitigation	xi. Algae Plate Settling Tanks at Whitby WSP	-	-	-	9,400,000	9,400,000
	f. Source new water supplies	xii. New well and pumphouse (Uxbridge)		-	3,300,000	-	3,300,000
		xiii. New Water Supply Source - Port Perry	-	-	17,800,000	-	17,800,000
	g. Comprehensive water supply system studies and condition assessments	xiv. Water supply system assessments and studies	1,350,000	150,000	3,000,000	2,750,000	5,900,000

Attachment 3: 2015 and 2016 Approved Construction of Municipal Services (CMS) Budgets and the 2017 to 2025 Capital Forecast (subject to future Council approvals)

Adaptation Goal	Adaptation Objectives	Priority Adaptation Actions	2015 Restated Budget	2016 Approved	Forecast 2017-2020	2021-2025	Total 2016-2025
5 Formally expand asset management planning to consider and address risk, including climate & optimize asset life-cycles ensuring Regional facilities, sites, fleets, equipment and transportation, water supply and sanitary sewerage systems continue to operate safely and effectively.	**a. Invest proactively in preventative maintenance and rehabilitation when most beneficial[1]**	i. Regional Road Rehabilitation (non-growth related)	23,807,000	23,729,000	124,000,000	155,000,000	302,729,000
		ii. Bridges, CSP Culvert Invert Lining Rehabilitation, miscellaneous Spall Repair and Deck Waterproofing Projects, Expansion Joint Replacement Program & Concrete Head Walls Program	5,260,000	5,495,000	40,055,000	37,120,000	82,670,000
		iii. Bridge Deck Condition Surveys Program	100,000	45,000	500,000	625,000	1,170,000
		iv. Miscellaneous Road and Storm Sewer Reconstruction	500,000	420,000	1,550,000	2,000,000	3,970,000
		v. Traffic Signals installation and modernization	2,195,000	2,300,000	10,675,000	12,165,000	25,140,000
ADAPTATION-RELATED CONSTRUCTION OF MUNICIPAL SERVICES (CMS)			**81,930,350**	**77,568,630**	**437,015,550**	**437,888,550**	**951,462,730**

NOTE: The table estimates capital related to identified adaptation risks and goals. Linear rehabilitations and replacements do not distinguish between funds addressing capacity enhancements and those which address other deficiencies which could lead to breaks, water losses, sewage leaks and/or infiltration.

Specific Regional Programs and Climate Adaptation Actions

Asset Management

Ensure asset management planning consistency with and support for the approved Adaptation Plan. Continue to consult other corporate teams as appropriate, including the Corporate Climate Change Staff Working Group and its Adaptation Sub-committee.

Implement measures and studies based on 2016 budget approvals to further enhance asset management planning to consider and address risk more comprehensively in the planning and optimization of Regional asset life-cycles. The 2016 Facilities program operations budget included $0.2 million to enhance condition assessments conducted annually at Regional facilities. (essential to establishing consistent/ accurate baseline condition and risk profile data).

Review staff asset risk workshop materials to update asset-related vulnerabilities and risks, including climate change and determine priorities for additional review of potential mitigation control improvements to inform 2017 business planning.

Review the inventory of assets and existing critical asset listings to establish rankings of asset criticality and assist asset management and risk planning objectives, which include ensuring critical assets are maintained at appropriate levels, with adequate redundancies, inventories, work-a-rounds and business continuity measures.

Monitor and review required service levels, performance and potential risks to ensure the long-term sustainability and effective and efficient performance of the Region's assets.

Erosion Protection: Watermains and Sewers at Creek Crossings

The Region has major water distribution and sewer infrastructure crossing or adjacent to water courses throughout its area. As river and creek beds erode and meander over time, especially during large storm events, infrastructure can be exposed and left unprotected, potentially resulting in failure. The Region has developed an inventory of all water and sewer infrastructure currently crossing creek and river valleys.

A condition assessment program is underway to ensure the protection of water distribution assets at these crossings. This program has synergies and co-benefits as well. Not only could it reduce water losses, it will also be of benefit in meeting anticipated future requirements under Source Protection Plans for drinking water. Approximately 50 per cent of the inspections have been completed for the water supply system. The program will continue with prioritization of remediation work managed through the design and business planning process.

A condition assessment program is also underway to ensure the protection of sewer infrastructure at water crossings. Approximately 75 per cent of the required inspections have been completed for the sanitary sewerage system. If any remediation work is found to be required during these inspections, it is subsequently programmed as a repair or programmed as a larger capital project. Once the first round of inspections is complete, an annual inspection will be done at locations that are deemed to be at higher risk of erosion. The remaining crossings will be inspected at a less frequent interval.

Algae Control at Water Supply Plants

Algae can affect the quality and quantity of the potable water produced at the water supply plants especially in the hot summer months and during the fall. A study was conducted to assess and document: the impact of the algae on the filter runs; plant capacity; and, recommended process modifications that would alleviate or prevent the algae from clogging the filter resulting in shorter filter run and reduction in plant capacity. The proposed 10-year forecast includes $9.4 million to modify the process equipment at the Whitby Water Supply Plant to prevent algae clogging the filters and maintain the plant capacity.

Water loss prevention and conservation:
Polybutylene water service connection replacement program

Polybutylene is a form of plastic resin used extensively by the development industry for water service connections throughout the 1980's. Numerous issues were subsequently identified with the material and its use was discontinued. Given the need to replace deficient polybutylene service water connections, Regional Council approved a financing plan to replace an estimated 25,000 polybutylene water service connections over a 10-year period. The 10-year, $131.6 million polybutylene water services connection replacement program includes an estimated $73.7 million required between 2017 and 2021. The 2016 Water Supply Capital Budget includes $14.5 million for the replacement of the deficient polybutylene connections.

Water loss prevention and conservation:
The water meter replacement initiative

The Region's water meter inventory for 2015 included approximately 171,111 meters at an estimated total replacement value of $28.9 million. The Region established a water meter replacement program to replace residential-sized water meters every 20 years for the purposes of maintaining data accuracy, preventing under-billing and the potential loss of revenues, and assuring accuracy in support of water conservation efforts. The 2015 and 2016 approved Water Supply Capital Budget included $6.2 million ($3.1 million each year) to implement the water meter replacement program.

Source Water Protection

The *Clean Water Act (CWA) 2006* and the first phase of related regulations were proclaimed into force on July 3, 2007 and established Source Protection Areas (SPAs) and watershed regions. Source Protection Committees (SPCs) were established for each SPA.

With support from local conservation authorities, SPCs are responsible for assessment reports and source protection plans (SPPs) for their respective source protection region (SPR). Each committee represents municipalities, the public, agricultural, golf courses, aggregate and other industries. In Durham three assessment reports correspond to three SPRs: The Credit Valley, Toronto and Region, Central Lake Ontario (CTC); South Georgian Bay Lake Simcoe (SGBLS); and, The Trent Conservation Coalition (TCC).

Each SPR has sub-committees e.g. technical, planning and municipal working groups. Technical groups work with the Conservation Authorities to support the consistency of scientific work across watershed boundaries, a major concern of Durham with three SPRs. Staff participated in technical and municipal working groups at each SPR and SPA to provide technical advice and peer review from a Regional perspective. Durham facilitates sharing of information on source protection activities affecting Durham with area municipalities through periodic joint meetings that include both Regional and Source Protection Authority staff.

The MOECC announced approval of the TCC SPPs for the Ganaraska and Kawartha SPAs in October 2014. The SGBLS and CTC SPPs were approved in January 2015 and August 2015. Subsequently, municipalities are responsible for implementation and enforcement of the SPPs through land use planning approvals and regulatory requirements. In addition, municipal official plans and operations must conform to the SPPs. A key challenge is managing participation and information flow and demands related to having three separate SPRs. Durham appointed a Risk Management Official and two Risk Management Inspectors to implement the SPPs. The Region’s internal Source Protection working group is reviewing the requirements in order to plan for the implementation of the three SPPs in Durham.

Wellhead Protection Management Program

Under the *Clean Water Act (CWA)* the Region must implement and enforce Source Protection Policies included in each SPP affecting Durham. The Region has delineated vulnerable areas, including Wellhead Protection for each municipal well, Intake Protection Zone (IPZ) for each lake based water system, the Highly Vulnerable Aquifers (HVA) and Significant Groundwater Recharge Areas (SGRA). The Region identified Significant Drinking Water Threats (SDWT) within each vulnerable area.

The next steps of the program are as follows:

- Update and maintain the numerical model and re-delineate the WHPAs for existing and new municipal wells;
- Public consultation and education programs to show newly delineated Wellhead Protection Areas (WHPA);
- Detailed contamination source inventories within newly delineated WHPAs;
- Regular meetings with local municipalities with communities relying on municipal wells and with the Health, Works and Planning Departments to review construction activities, drilling programs and deep excavations; waste disposal sites and de-icing activities within newly delineated WHPAs;
- Well decommissioning programs and upgrade of private wells within WHPAs;
- Purchase lands/easements within WHPAs where the highest risk to contamination exists;
- Add wellhead protection area signs on roads if the new delineated WHPA cross it to assist in identifying WHPAs;
- Maintain existing sentry wells and implement a Water Quality Monitoring Program for early detection;
- Install new sentry wells within delineated WHPAs according to the SPP; and
- Determine alternative groundwater sources.

Reduce the infiltration of ground water or stormwater into the sanitary sewer collection system to mitigate flooding, inflow and infiltration risk

Localized and intense rainfall activity has resulted in stormwater entering/overloading the sanitary collection system, and burdening sanitary sewer infrastructure/treatment facilities. Significant steps have been taken to reduce inflow and infiltration (I/I): assessment of existing systems; gathering information on the sewer system; and, understanding system performance under extreme storm events.

The 2016 Sanitary Sewerage Capital Budget included $0.5 million to conduct I/I studies across the Region and the capital forecast proposes $500,000 annually (subject to future assessments and approvals) to ensure a continued understanding of where the Regional sanitary sewerage system may be at risk, and to implement appropriate plans to mitigate risks as part of the Region's overall long-term asset management strategy.

As part of this work, the Region has installed additional flow monitoring equipment to gather data on sanitary sewage flows and analyse flows in conjunction with rain events. Tests are also being performed, including smoke testing, closed circuit television (CCTV) inspections and dye testing to determine occurrence of I/I.

Household drainage surveys have been collected at Public Information Centres to gain information on service areas which have experienced multiple basement floods, while educational brochures have been distributed within affected service areas. There have been minor repairs to the system as well, including the installation of backflow gates in diversion chambers at sanitary sewage pumping stations and localized repair and sealing of pipe joints.

Major projects have been initiated or completed in three areas deemed vulnerable:

- Upgrades on Lawrie Road in the Town of Ajax (completed 2013) consisted of a relief sanitary sewer and the construction of a detention tank ($2.9 million);
- System upgrades on Annes Street in the Town of Whitby include replacing the existing sewer with a 600 millimeter (mm) sanitary sewer (completed 2011) and the construction of a detention tank (completed 2015 at a cost of $5.9 million);
- Infrastructure upgrades in the City of Pickering West Shore Neighbourhood required to reduce the risk of basement flooding. Phase 1 of the project included the construction of the sanitary sewer in Rotary Frenchman's Bay West Park, between Sunrise Avenue and Beachpoint Promenade (completed 2015); and
- Phase 2 will involve completing sanitary sewers and road restoration work in coordination with the City of Pickering with construction proposed in 2016 and to be completed in 2017. The total project cost is $6.0 million.

Pollution Prevention and Effluent Improvements

The Region's 11 WPCPs prevent human waste and other contaminants from polluting the environment and entering the receiving water bodies. In 2013, the Region strengthened its Sewer Use Bylaw regulating industrial wastewater entering the sanitary sewerage system.

Capital improvements also strengthen the goals of pollution prevention and effluent improvements, including:

- Upgrades completed at Harmony Creek WPCP and underway at Nonquon River WPCP; and
- System improvement initiated in Pickering, Whitby and Courtice including upgrades to Stages 1 and 2 at Duffin Creek WPCP.

Risk and Asset Management & DEMO & all programs
Business Continuity Initiative & Emergency Planning

The Region is committed to maintaining effective emergency and business continuity plans for natural, technical and human-caused events. Departmental emergency response plans are developed within the general framework of the Durham Region Emergency Master Plan. The Risk Management section of the Finance Department is also working in consultation with program areas and the Asset Management Group in regards to business continuity planning to: identify critical business functions and support services across program areas; rank criticality; and, address any gaps identified in level three critical functions (defined as those requiring restored availability within minutes to hours of an interruption).

Several asset-related initiatives have been budgeted or forecasted to maintain effective business continuity and response capabilities, including: watermain twinning, looping and expansions and sewer forcemain twinning and expansions, which enhance system security and reduce risk; new standby power and replacements; and, improved alerts, response time, communication and control. In addition, timely asset preventative maintenance and rehabilitation investments enhance system security, ensuring all the Region's infrastructure assets remain in a state of good repair. The asset management staff working group is ensuring that asset management plans are consistent with and support approved plans including the Regional program CDM and adaptation plan.

Climate Adaptation Proactive Maintenance & Building Standards

The Facilities Division has responsibilities which include:

- Operating, securing, maintaining, upgrading and repairing Regional facilities with a total estimated floor area exceeding 230,000m^2;
- Condition audit and inspection programs to identify and prioritize work based on system requirements, age, condition and risk;
- Facility site activities including salting, snow removal, backflow prevention and energy management; and Facility design and construction, including consideration of climate adaptation as part of design development (e.g. energy and water efficiencies, green opportunities, stormwater management, erosion control, standby power management)

Facilities

The Region's building standards ensure new facilities are built at a level comparable to or higher than Leadership in Energy and Environmental Design (LEED) Silver Certification, through construction to the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1 (2007) Energy Standard. On a case by case basis, staff also consider elements of ASHRAE 189.1 (2009) for the design of new buildings.

Recent construction projects, as well as major site and system renovations have incorporated significant features which improve facility and site climate resiliency including:

- On-site stormwater management systems and controls;
- Water recovery systems and water loss control plans;
- Green irrigation systems and water efficiency fixture replacements; and,
- Building envelope and site improvements which mitigate erosion and/or flooding risk.

Regional Roads, Maintenance Operations and Transit

In the area of transportation (Regional roads, Works Depots and Durham Region Transit) climate risk is addressed through:

- Maintenance of operational benchmarks;
- Employment of effective proactive maintenance, refurbishment and rehabilitation programs for roads and bridges/culverts, equipment, DRT facilities, bus stops and shelters;
- Proactive measures to keep roads, parking and DRT stops free of frost and ice; and
- Coating shoulders with liquid asphalt to control dust/erosion issues and utilize asphalt grindings.

Use of state-of-the-art road weather information systems to monitor weather/pavement conditions (e.g. infrared road temperature sensors) and ensuring proper training to effectively utilize the technology and analyze results; and,

- Adequate ditch and road maintenance to reduce deterioration and increase drainage.

In addition, a strategic road safety program and action planning process is currently underway including the Works and Finance Departments who are collaborating to set the direction for road safety investments.

Works Maintenance Operations is responsible for maintaining 2,151 lane kilometres of paved Regional road surfaces and 216 bridges and culverts greater than three metres in size. Activities and costs influenced by higher precipitation (e.g. shoulder erosion, storm sewers), freeze/thaw cycles (pavement heaving) summer drought (dust treatments), extreme storms (cleaning, clearing vegetation), and a longer growing season (increased vegetation) include:

- Patching of potholes, ruts and depressions (approximately 4,000 tonnes of cold and hot mix asphalt per year);
- Treatment of road shoulders, including liquid calcium chloride and liquid asphalt to control dust and erosion;
- Maintenance of roadside visibility and safety, including tree removal and trimming;
- Cleaning/re-grading of ditches and catch basins and cleaning of entrance culverts (on a cost-recovery basis);
- Mowing of rural roadside grass one swath wide (two per cutting season) and mowing of 85 hectares of urban boulevards (12 times per cutting season);
- Repair of storm sewer maintenance holes, cleaning, installing and repair of storm sewer service connections within the road allowance and visual and closed circuit camera inspection of maintenance holes and sewers; and,
- Tracking and recovery for services provided for storm sewer connections.

Winter maintenance operating costs are influenced by: the frequency and severity of winter storm events; the extent of the road network located in urban areas; and, the municipality's service level standard.

The Region has implemented innovative programs including road patrol vehicles equipped with infrared road temperature sensors and plow and sander/salter units, which provide rapid response to developing road conditions (since 2007). New technologies are also identified within the Region's Salt Management Plan, including use of liquid salt brine for pre-wetting and anti-icing. The pre-wet salt application enables salt to work more efficiently. Anti-icing operations include hills, curves, bridges and sheltered areas prone to frost and "black ice" at intersections.

Transportation system risks continue to be monitored and assessed, with mitigation controls addressed as needed through annual business planning processes. Asset management planning continues to address risk, including climate risk, and optimize asset life-cycles. As an example, in 2016 Traffic Control Uninterrupted Power Supply (UPS) installation and retro-fitting began to ensure adequate backup power at key Regional intersections.

Solid Waste Management

The Region's Solid Waste Management Division monitors, inspects, and remediates closed Regional landfill sites, while ensuring environmental protection. Adaptation-related activities include: the inspection of former and active landfill sites; environmental monitoring and reporting; well water testing adjacent to all Regional landfill sites; and, undertaking repairs or improvements to protect groundwater and environmental resources.

A key goal is to maintain water quality through the prevention of rainfall infiltration and the prevention of leachate springs around Regional landfills, a risk which could rise with increased intense precipitation.

In 2016 work continues for the implementation of the remediation (landfill mining) of the Blackstock landfill in the Township of Scugog (approved in the 2015 Solid Waste Management Capital Budget at $0.96 million). The solid waste management forecast also includes $2.8 million to remediate or reclaim the Scugog and Scott landfill sites (subject to future reviews and approvals).

Planning and Development Approvals

The Durham Regional Official Plan is the principal planning instrument to guide the Region's growth and development to 2031. Official Plan policies also promote a more sustainable community design, providing for more compact communities with increased densities, and a more efficient use of the transportation network. Key elements of the Official Plan that will assist the Region in adapting to changes in climate include:

- An urban system with mixed-use centres and corridors that support transit use and pedestrian movements;
- Prime agricultural areas which help community food security;
- A transportation system that is efficient and reliable and supports all modes, including transit and active transportation; and,
- A green land system that protects the area's highest concentration of significant ecological and hydrological features and functions.

The Official Plan protects ground and surface water resources through wellhead protection, high aquifer vulnerability, and stormwater management policies. Policies regarding development restrictions in natural hazard areas also help to protect people and property from damage caused by flooding, as do programs funded annually through the Region's five Conservation Authorities.

The Durham Regional Official Plan requires Environmental Impact Studies (EIS), as part of the evaluation of development proposals that are in proximity to lands designated as a key natural heritage feature or key hydrologic feature. The EIS must evaluate adverse potential impacts and establish appropriate actions to mitigate those impacts. The scope and process for a particular EIS will depend on the nature of the proposed development, its location, and the sensitivity of the site's environmental conditions. EIS reports and other forms of environmental review may consider the impacts of climate change, trends, as well as specific localized risk factors.

Durham Region Heat Alert and Response System

As a result of climate change, Durham Region can expect an increase in the frequency, duration, and severity of extreme heat events. During extreme heat events there is an increase in heat-related morbidity and mortality. During 2015, the Health Department participated in a pilot 'Harmonized Heat Alert and Response System' with Environment Canada and nine public health units. As a participant the Health Department implemented a new Durham Region heat alert and response system (DRHARS) to:

- Communicate heat warnings to local municipalities, community partners and the public;
- Raise awareness about heat-related illness;
- Promote protective actions to take before and during a heat event; and,
- Identify, engage and support community partners who work with vulnerable populations that are at increased risk from heat and heat related illnesses.

The development and implementation of DRHARS is a key adaptation step to increase resiliency among residents of Durham Region, build capacity among community partners and reduce excess morbidity and mortality related to heat in Durham Region.

Emergency Prevention and Preparedness

Durham Emergency Management maintains a strong community program to prepare for and respond to natural and/or human caused emergencies including:

- An effective and up-to-date emergency response structure;
- Coordinated emergency plans and procedures;
- Regular tests of communications and alerting systems;
- Annual Regional Control Group response training;
- An on-call Duty Officer on a 24/7 basis;
- A designated Emergency Information Officer;
- Emergency notifications to Regional staff;
- Operation of the Regional Emergency Operations Centre;

Public education materials to promote preparedness;

- Up-dated emergency contact lists and databases;
- Courses for Regional employees; and,
- An annual Emergency Operations Centre exercise.

Regional programs together or individually are also involved in emergency planning and management including the following initiatives:

- Ensuring reliable back-up power for critical facilities and systems;
- Contingency and business continuity planning;

- Regional policies and procedures for extreme weather events;
- The Pandemic Plan detailing actions and resources required to maintain operations and essential services;
- The Contingency Plan detailing departmental responsibilities for services to be maintained in the event of work stoppage; and,

Individual Departmental or program emergency planning documents and the broader Emergency Master Plan prepared for the Region by DEMO, prescribing the emergency organization and response management framework.

Adaptation, Preventative Maintenance & Climate Monitoring

The projection for the construction of adaptation-related municipal services over the 2017 to 2025 forecast period includes priority adaptation actions to:

- Replace deficient linear infrastructure to reduce the infiltration of groundwater or stormwater into the sanitary sewer collection system;
- Twinning, looping and expansion of linear water and sewer infrastructure, including new water supply and sanitary sewerage system capacity to enhance system security and address deficiencies;
- Inflow and infiltration studies, including remedial works;
- Asset condition assessments, planning and engineering studies;
- Treatment process improvements at water pollution control plants (WPCPs) to improve effluent quality;
- New standby power and replacements and improved alerts, response, communication and control; and,
- Preventative maintenance and rehabilitation investments.