AGENDA

SPC ON UTILITIES AND CORPORATE SERVICES

June 13, 2018, 9:30 AM
IN THE COUNCIL CHAMBER
Members

Councillor W. Sutherland, Chair
Councillor P. Demong, Vice-Chair
Councillor D. Colley-Urquhart
Councillor D. Farrell
Councillor J. Gondek
Councillor S. Keating
Councillor J. Magliocca
Mayor N. Nenshi, Ex-Officio

1. CALL TO ORDER

2. OPENING REMARKS

3. CONFIRMATION OF AGENDA

4. CONFIRMATION OF MINUTES

   4.1 Minutes of the Regular Meeting of the SPC on Utilities and Corporate Services, 2018 May 09

5. CONSENT AGENDA

   5.1 Integrated Civic Facility Planning Program 2017 Status Update Deferral, UCS2018-0739

   5.2 Status of Outstanding Motions and Directions, UCS2018-0764

6. POSTPONED REPORTS
   (including related/supplemental reports)

   None

7. ITEMS FROM OFFICERS, ADMINISTRATION AND COMMITTEES

   7.1 Climate Resilience Strategy and Action Plans, UCS2018-0688

7.2 Energy Reporting for Commercial Buildings, UCS2018-0314

7.3 Pay-as-you-throw Program for Residential Black Cart Collection, UCS2018-0656

8. ITEMS DIRECTLY TO COMMITTEE

8.1 REFERRED REPORTS
None

8.2 NOTICE(S) OF MOTION
None

9. URGENT BUSINESS

10. CONFIDENTIAL ITEMS

10.1 ITEMS FROM OFFICERS, ADMINISTRATION AND COMMITTEES

10.1.1 Proposed Lease (Downtown East Village) – Ward 07 (800 3 ST SE), UCS2018-0740
Held confidential subject to Sections 23, 24 and 25 of *FOIP*.

10.1.2 Proposed Sale (Bridlewood) – Ward 13 (249 Bridlerange PL SW), UCS2018-0741
Held confidential subject to Sections 23, 24 and 25 of *FOIP*.

10.1.3 Proposed Extension to Building Commitment and Exercise of Option to Repurchase Ward 2 (2 Royal Vista LI NW), UCS2018-0743
Held confidential subject to Sections 23, 24 and 25 of *FOIP*.

10.1.4 Proposed Extension to Building Commitment (Lincoln Park) – Ward 08 (50 Peacekeepers DR SW), UCS2018-0744
Held confidential subject to Sections 23, 24 and 25 of *FOIP*.

10.1.5 Surplus School Sites, UCS2018-0745
Held confidential subject to Sections 23, 24 and 25 of *FOIP*.

10.1.6 Summary of Real Estate Transactions for the First Quarter 2018, UCS2018-0746
Held confidential subject to Sections 23, 24 and 25 of *FOIP*.

10.2 URGENT BUSINESS

11. ADJOURNMENT

MINUTES

SPC ON UTILITIES AND CORPORATE SERVICES

May 9, 2018, 9:30 AM
IN THE COUNCIL CHAMBER

PRESENT:	Councillor W. Sutherland, Chair Councillor P. Demong. Vice-Chair Councillor D. Colley-Urquhart Councillor D. Farrell Councillor J. Gondek Councillor S. Keating Councillor J. Magliocca
ALSO PRESENT:	Acting City Clerk D. Williams Legislative Assistant T. Rowe

1. CALL TO ORDER

Councillor Sutherland called the Meeting to order at 9:32 a.m.

2. OPENING REMARKS

Councillor Sutherland provided opening remarks at today's Meeting.

3. CONFIRMATION OF AGENDA

Moved by Councillor Gondek

That the Agenda for the 2018 May 09 Regular Meeting of the SPC on Utilities and Corporate Services be confirmed.

MOTION CARRIED

4. CONFIRMATION OF MINUTES

4.1 Minutes of the Regular Meeting of the SPC on Utilities and Corporate Services, 2018 April 18

Moved by Councillor Demong

That the Minutes of the Regular Meeting of the SPC on Utilities and Corporate Services held on 2018 April 18, be confirmed.

MOTION CARRIED

5. CONSENT AGENDA

None

6. POSTPONED REPORTS

None

7. ITEMS FROM OFFICERS, ADMINISTRATION AND COMMITTEES

7.1 Update on Upstream Bow River Flood Mitigation, UCS2018-0600

Distributions with respect to Report UCS2018-0600:

- A PowerPoint presentation was distributed entitled "Update on Bow River Flood Mitigation", dated 2018 May 09; and
- Speaking notes from Charlie Lund.

SPEAKER

Charlie Lund

Moved by Councillor Farrell

That with respect to Report UCS2018-0600, the following be approved, **after amendment**, as follows:

That the SPC on Utilities and Corporate Services recommend that Council:

Send a letter to the Province requesting:

a. The Province reconvene the Bow River Working Group with a renewed governance framework as soon as possible;
b. All projects in The City's 2017 Alberta Community Resilience Program application be approved and funded as submitted; and
c. The Province work with Administration to develop a proposed scope of work for a bi-lateral Task Force to address The City's flood mitigation, policy, and watershed management issues.

And further, that Council hold a strategic meeting with respect to integrated watershed management and the resiliency plan, no later than the fall of 2018.

MOTION CARRIED

8. ITEMS DIRECTLY TO COMMITTEE

8.1 REFERRED REPORTS

None

8.2 NOTICE(S) OF MOTION

None

9. URGENT BUSINESS

10. CONFIDENTIAL ITEMS

Moved by Councillor Keating

That the SPC on Utilities and Corporate Services move into Closed Meeting at 10:45 a.m., in the Council Lounge, to consider confidential matters with respect to the following items, subject to Sections 23, 24 and 25 of the Freedom of Information and Protection of Privacy Act:

• 10.1.1 Proposed Approval of Expropriation – Ward 09 (1020 9 ST SE), UCS2018-0570;

• 10.1.2 Proposed Approval of Expropriation – Ward 09 (1024 9 ST SE), UCS2018-0571;

• 10.1.3 Proposed Approval of Expropriation – Ward 09 (1002 8 ST SE), UCS2018-0572; and

• 10.1.4 Summary of Green Line Real Property Transactions Q3 2015 to Q1 2018, UCS2018-0573.

MOTION CARRIED

Committee moved into Public Meeting at 11:06 a.m. with Councillor Sutherland in the Chair.

Moved by Councillor Demong

That Committee rise and report.

MOTION CARRIED

10.1 ITEMS FROM OFFICERS, ADMINISTRATION AND COMMITTEES

10.1.1 Proposed Approval of Expropriation – Ward 09 (1020 9 ST SE, UCS2018-0570

Distributions with respect to Reports UCS2018-0570 and UCS2018-0571 which are to remain confidential subject to Sections, 23, 24 and 25 of the *Freedom of Information and Protection of Privacy Act*:

- A PowerPoint presentation, dated 2018 May 09; and
- A document containing amendments to Reports USC2018-0570 and UCS2018-0571.

Administration in attendance during the Closed Meeting discussions with respect to Report UCS2018-0570:

Clerk: D. Williams, T. Rowe Advice: K. Stewart, S. Wheeler, E. Kortje, K. Colbran, M. Gray, S. Quayle, D. Cassidy, J. Cullen, B. Stevens, S. Alexander, E. Lee.

Moved by Councillor Farrell

That with respect to Report UCS2018-0570, the following be approved, as amended:

That the SPC on Utilities and Corporate Services recommend that Council:

1. Approve the Administration Recommendations, contained in Report UCS2018-0570, **as amended, as contained in the distribution at today's Meeting**;

2. Request the Recommendations, Report, **Distribution** and Attachments remain confidential under Sections 23, 24 and 25 of the *Freedom of Information and Protection of Privacy Act*, unless The City of Calgary is required to disclose pursuant to the Expropriation Act (Alberta).

MOTION CARRIED

10.1.2 Proposed Approval of Expropriation – Ward 09 (1024 9 ST SE), UCS2018-0571

Administration in attendance during the Closed Meeting discussions with respect to Report UCS2018-0571:

Clerk: D. Williams, T. Rowe Advice: K. Stewart, S. Wheeler, E. Kortje, K. Colbran, M. Gray, S. Quayle, D. Cassidy, J. Cullen, B. Stevens, S. Alexander, E. Lee.

Moved by Councillor Farrell

That with respect to Report UCS2018-0571, the following be approved, as amended:

That the SPC on Utilities and Corporate Services recommend that Council:

1. Approve the Administration Recommendations, contained in Report UCS2018-0571, **as amended, as contained in the distribution at today's Meeting**;

2. Request the Recommendations, Report, **Distribution** and Attachments remain confidential under Sections 23, 24 and 25 of the *Freedom of Information and Protection of Privacy Act*, unless The City of Calgary is required to disclose pursuant to the Expropriation Act (Alberta).

MOTION CARRIED

10.1.3 Proposed Approval of Expropriation – Ward 09 (1002 8 ST SE), UCS2018-0572

Administration in attendance during the Closed Meeting discussions with respect to Report UCS2018-0572:

Clerk: D. Williams, T. Rowe Advice: K. Stewart, S. Wheeler, E. Kortje, K. Colbran, M. Gray, S. Quayle, D. Cassidy, J. Cullen, B. Stevens, S. Alexander, E. Lee.

Moved by Councillor Farrell

That with respect to Report UCS2018-0572, the following be approved:

That the SPC on Utilities and Corporate Services recommend that Council:

1. Approve Administration Recommendation 1 contained in Report UCS2018-0572; and

2. Request the Recommendations, Report and Attachments remain confidential under Sections 23, 24 and 25 of the *Freedom of Information and Protection of Privacy Act*, unless The City of Calgary is required to disclose pursuant to the Expropriation Act (Alberta).

MOTION CARRIED

10.1.4 Summary of Green Line Real Property Transactions Q3 2015 to Q1 2018, UCS2018-0573

Administration in attendance during the Closed Meeting discussions with respect to Report UCS2018-0573:

Clerk: D. Williams, T. Rowe Advice: K. Stewart, S. Wheeler, E. Kortje, K. Colbran, M. Gray, S. Quayle, D. Cassidy, J. Cullen, B. Stevens, S. Alexander, E. Lee.

Moved by Councillor Keating

That with respect to Report UCS2018-0573, the following be approved:

That the SPC on Utilities and Corporate Services recommend that Council:

1. Approve Administration Recommendation 1 contained in Report UCS2018-0573; and

2. Request the Recommendations, Report and Attachments remain confidential under Sections 23, 24 and 25 of the *Freedom of Information and Protection of Privacy Act*, unless The City of Calgary is required to disclose pursuant to the Expropriation Act (Alberta).

MOTION CARRIED

10.2 URGENT BUSINESS

None

11. ADJOURNMENT

Moved by Councillor Demong

That this meeting adjourn at 11:09 a.m.

MOTION CARRIED

The following items have been forward to the May 28 Regular Meeting of Council:

CONSENT:

Update on Upstream Bow River Flood Mitigation, UCS2018-0600

CONFIDENTIAL CONSENT:

Proposed Approval of Expropriation – Ward 09 (1020 9 ST SE), UCS2018-0570

Proposed Approval of Expropriation – Ward 09 (1024 9 ST SE), UCS2018-0571

Proposed Approval of Expropriation – Ward 09 (1002 8 ST SE), UCS2018-0572

Summary of Green Line Real Property Transactions Q3 2015 to Q1 2018, UCS2018-0573

The next Regular Meeting of the SPC on Utilities and Corporate Services has been scheduled for 2018 June 13.

CONFIRMED BY COMMITTEE ON 2018 JUNE 13.

CHAIR ACTING CITY CLERK

Integrated Civic Facility Planning Program 2017 Status Update Deferral

EXECUTIVE SUMMARY

Council directed Administration to coordinate The City's approach to facility planning in order to achieve economies of scale, build multi-use facilities when appropriate, foster economic resiliency, consider opportunities to work collaboratively with the private sector, and improve services to citizens. In response to Council's direction, Administration created the Integrated Civic Facility Planning (ICFP) Program. In 2016 Q3, Council directed Administration to report back annually with a status update on the ICFP Program.

The ICFP Program is set to complete a number of key program deliverables in 2018 Q1 including the realization of the Corporate Facility Planning Framework and related facility strategies to guide The City's facility planning process. To complete additional internal engagement, Administration is recommending deferral of the ICFP Program 2017 Status Update to no later than 2018 Q3.

ADMINISTRATION RECOMMENDATION:

That the SPC on Utilities and Corporate Services recommends that Council defer the Integrated Civic Facility Planning Program 2017 Status Update report to no later than 2018 Q3.

PREVIOUS COUNCIL DIRECTION / POLICY

On 2016 September 29, Council adopted Administration's recommendation contained in LAS2016-76 Integrated Civic Facility Planning Program 2016 Status Update report as follows: that "Council direct Administration to report back to Council annually through the Land and Asset Strategy Committee with an update on the Integrated Civic Facility Planning Program status no later than Q4 2017."

BACKGROUND

In 2015 Q1, Council directed Administration to coordinate The City's approach to facility planning in order to achieve economies of scale, build multi-use facilities wherever appropriate, consider opportunities to work with the private sector and improve services to citizens. In response to Council's direction, Administration has developed the Integrated Civic Facility Planning (ICFP) Program. Through this cross-corporate transformational change program, ICFP is developing a coordinated, corporate approach for the planning and delivery of City facilities through the following four work streams:

1) **Corporate Facility Planning Framework (CFPF)** – The CFPF provides the processes, tools and organizational structure required to ensure the integration of facility planning across the corporation.

2) **Facilities Strategies** – The program has developed 16 strategies to guide planning and decision-making. The primary objective of these strategies is to ensure City planning of facilities is as efficient and effective as possible while also enhancing service delivery.

3) **Learning Projects** – The Learning Projects are in-flight projects that are being leveraged to demonstrate desired outcomes and to inform the ICFP framework.

4) **Corporate Facility Portfolio Plan** – This plan is a set of short, mid and long-term plans that will identify which facilities The City should build, demolish, renovate, acquire and relinquish.

Program progress along with research and stakeholder engagement indicates significant benefits to the implementation of integrated facility planning and delivery of multi-use facilities, including:

- A focus on citizen needs by developing City facilities within communities that include broader services such as health, daycare, non-market housing, and education.
- The opportunity to deliver and partner with other private and public entities to reduce risk and share costs;
- Increase equity of access to City services through multi-use civic facilities combined with supportive transit infrastructure;
- Improve The City's ability to strategically locate civic facilities to create service clusters that attract people, private development and provide economic resiliency; and
- Enhance the use of facilities resources through shared facilities to avoid redundancies seen in a single-use model

INVESTIGATION: ALTERNATIVES AND ANALYSIS

The Integrated Civic Facility Planning (ICFP) Program is a corporate wide approach to planning and delivering facilities while addressing structural barriers and gaps that need to be overcome to achieve success. As a change initiative, the Program is focused on developing a common approach, vision, and culture to the planning and delivery of facilities.

The program has made significant progress to date including the development of the Corporate Facility Planning Framework and related facility strategies to guide The City's facility planning process and associated decision making. Work is ongoing to further refine the Corporate Facility Planning Framework and these strategies including working with internal and external stakeholders regarding streamlining and potential modifications. To complete additional internal engagement, Administration is recommending deferral of the ICFP Program 2017 Status Update to no later than 2018 Q3.

The requested deferral of this report will not affect the timelines for any of the four work streams identified in the Background section of this report.

Stakeholder Engagement, Research and Communication

There is no stakeholder engagement required for the deferral request.

Strategic Alignment

The deferral request will not impact strategic alignment.

Integrated Civic Facility Planning Program 2017 Status Update Deferral

Social, Environmental, Economic (External)

There are no social, environmental or external economic impacts associated with the deferral request.

Financial Capacity

Current and Future Operating Budget:

Current and future operating budgets are not impacted by the deferral request.

Current and Future Capital Budget:

Current and future capital budgets are not impacted by the deferral request.

Risk Assessment

There are no significant risks associated with the deferral request.

REASON(S) FOR RECOMMENDATION(S): A deferral for the Integrated Civic Facility Planning Program 2017 Status Update to 2018 Q2 will provide the time to complete additional internal engagement, Administration is recommending deferral of the ICFP Program 2017 Status Update to no later than 2018 Q3.

Status of Outstanding Motions and Directions

EXECUTIVE SUMMARY

This report summarises the status of Utilities and Environmental Protection's outstanding Motions and Directions for Standing Policy Committee (SPC) on Utilities and Corporate Services.

ADMINISTRATION RECOMMENDATION:

That the Standing Policy Committee on Utilities and Corporate Services receive this report for information.

PREVIOUS COUNCIL DIRECTION / POLICY

On 2007 February 06, Personnel and Accountability Committee approved PAC2007-05 Status of Outstanding Motions and Directions, directing Administration to bring forward as an item of business to each Standing Policy Committee a list of tabled and referred motions and reports for each committee; such lists to be reviewed by each Standing Policy Committee, to be dealt with on a quarterly basis.

BACKGROUND

None.

INVESTIGATION: ALTERNATIVES AND ANALYSIS

None.

Stakeholder Engagement, Research and Communication

None.

Strategic Alignment

This report is in alignment with the mandate of the SPC on Utilities and Corporate Services.

Social, Environmental, Economic (External)

None.

Financial Capacity

Current and Future Operating Budget:

None.

Current and Future Capital Budget:

None.

Status of Outstanding Motions and Directions

Risk Assessment

None.

REASON(S) FOR RECOMMENDATION(S):

This report assists the SPC on Utilities and Corporate Services to proactively track and manage outstanding motions and directions.

ATTACHMENT(S)

1. Attachment 1 – Status of Outstanding Motions and Directions for SPC on Utilities and Corporate Services

ITEM	DATE OF REQUEST	APPROVAL	SUBJECT	MEETING DATE
Annual Stormwater Strategy update	2006 January 16	UE2005-62	Administration to report back to the SPC on Utilities and Corporate Services with yearly updates on progress in meeting the goals of the Stormwater Management Strategy.	March 2019
Annual Water Efficiency Plan update	2005 December 12	UE2005-55	Administration to report back to the SPC on Utilities and Corporate Services annually with updates on progress towards "30 in 30" goal.	March 2019
Flood Resiliency and Mitigation annual report	2014 December 02	PFC2015-0777	Administration to report back to the SPC on Utilities and Corporate Services annually on progress related to the recommendations from the Expert Management Panel on River Flood Mitigation. (Expert panel recommendation 6f).	March 2019
Corporate Environment, Health & Safety Performance Annual Report	2009 March 25	UE2009-07	Administration to report to SPC on Utilities and Corporate Services semi-annually on Corporate environment and safety performance, including audit results.	October 2018
Scoping Report for Significant Reduction of Avoidable Plastic Waste and Single-Use Items	2018 May 18	UCS2018-0153	Administration to undertake a scoping report that investigates options and unintended consequences for significantly reducing waste, “avoidable” plastic waste, and single-use items, engage citizens and waste generators, and the costs of doing this work, and report back to the SPC on Utilities and Corporate Services with a scoping report no later than Q2 2019.	Q2 2019

Climate Resilience Strategy and Action Plans

EXECUTIVE SUMMARY

The purpose of this report is to seek Council support of the Climate Resilience Strategy and Action Plans (Attachment 1).

In partnership with service owners and business units, Environmental & Safety Management (ESM) developed a renewed, corporate-wide commitment and approach to carbon and energy management and climate risk through the development of a Climate Resilience Strategy (the Strategy). The Strategy provides the overview and main direction for Climate Resiliency in Calgary. It defines The City's role in reducing greenhouse gas (GHG) emissions and adapting to the impacts of climate change. It will also set policy to guide climate resilience plans to achieve immediate to long-term resilience objectives. These action plans include the following:

- Climate Mitigation Action Plan – this plan identifies the role and actions of The City to ensure services, enabling activities, regulations and operations are provided to reduce GHG emissions and enable the low carbon economy. This plan is built around five themes (buildings and energy systems; transportation and land use; consumption and waste; natural infrastructure; and leadership).

- Climate Adaptation Action Plan – this plan identifies the risks and vulnerabilities from severe weather events and involves an iterative process of risk assessment. This plan is also built around five themes (people; infrastructure; natural infrastructure; water management; and governance).

These plans contain defined actions over the next 10 years, which will begin during the 2019 – 2022 business cycle. Alignment and integration with existing business planning processes was started in 2017 through the development of these two plans.

ADMINISTRATION RECOMMENDATION:

That the SPC on Utilities and Corporate Services recommend that Council:

1. Approve the Climate Resilience Strategy and Action Plans.

PREVIOUS COUNCIL DIRECTION / POLICY

The 2011 Calgary Community GHG Emissions Reduction Plan was developed in support and consideration of the 2020 Sustainability Direction.

Action Plan 2015 – 2018 includes key actions of community engagement on greenhouse gas reduction, partnerships, adaptation, the development of climate plans, and ongoing education efforts. The City's current and future actions on climate change mitigation and adaptation support Council's priorities. Key actions led by ESM on behalf of the Corporation include:

- H2.1 - Design and deliver programs to engage the community to advance the goal of reducing community greenhouse gases.

- H2.2 - Identify partnership and funding opportunities for energy efficiency and air quality-related initiatives throughout the community.
- H3.2 - Develop a comprehensive climate adaptation plan and implementation tools to reduce future impacts.
- H6.1 - Assume leadership role in educating and engaging the public to create awareness of links between energy consumption and GHGs, air quality, and climate change.
- H10.1 - Minimize the environmental impacts from City operations and capital projects, showcasing innovative and practical solutions to show leadership.
- H10.3 - Reduce GHG emissions from corporate sources to be an example for other corporations and municipalities.

On 2017 February 22 (UCS2017-0064 – A Climate Program for The City of Calgary) Administration provided an update on activities taken to date including the development of the Climate Program and the approach to be utilized.

On 2018 March 21 (C2018-0340 – Guiding Principles for Climate Resilience) Council approved a set of guiding principles to enable climate change and carbon and energy management to be considered in decisions.

BACKGROUND

As a member of the 100 Resilient Cities network, The City of Calgary and its partners are striving to increase the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt and grow, no matter what kinds of chronic stresses and acute shocks they experience. The changing climate poses a challenging risk to The City's ability to deliver its services to Calgarians. The increasing frequency and magnitude of extreme weather events is a risk multiplier, and requires an integrated, corporate-wide approach to climate resilience.

The City's current and future actions on climate change mitigation and adaptation support Council's priorities. Action Plan 2015 – 2018 includes key actions of community engagement on greenhouse gas reduction, partnerships, adaptation, the development of climate plans, and ongoing education efforts.

On 2018 May 15 (ALT2018-0537 – Climate Resilience Strategy and Action Plans) the Administrative Leadership Team provided direction to Administration to support the Climate Resilience Strategy and Action Plans, and to consider them in One Calgary service plans and budgets.

INVESTIGATION: ALTERNATIVES AND ANALYSIS

The Climate Program evolved in several key areas over the past year including outreach and education, alignment with federal and provincial policy, risk integration into operations and services, and the development of strategies and actions. During 2017, in-depth research and targeted stakeholder engagement also occurred to establish baselines and analyse the risk and vulnerability of infrastructure, people and the natural environment and to identify carbon and energy opportunities.

Climate Resilience Strategy and Action Plans

Recent research has found that the shift towards a lower carbon development path for Calgary is economically and technologically viable and poses opportunities. Energy efficiency upgrades in buildings improve comfort and lower costs. These investments create jobs, especially for local businesses, while making the city more resilient to future shocks. The transition to a low carbon economy will occur through strong collaborative efforts with industry and partners.

The report includes The Strategy, the Climate Mitigation Action Plan and the Climate Adaptation Action Plan. The Strategy provides the strategic overview and main direction for Climate Resilience in Calgary. It focuses on defining The City's role in reducing GHG emissions and adapting to the impacts of climate change. It will also set policy to guide climate resilience plans and actions to achieve immediate to long-term resilience objectives and highlight the need for collaborative governance, informed and prioritized investment, innovative funding, appropriate timing and annual monitoring and reporting.

The Climate Mitigation Action Plan presents five themes: buildings and energy systems; transportation and land use; consumption and waste; natural infrastructure; and leadership. These themes cover the largest areas of impact for emissions and energy in Calgary. Ten programs focus on the specific outcomes to be pursued with 69 actions identified as the first steps in the process.

The Climate Adaptation Action Plan presents five themes: people; infrastructure; natural infrastructure; water management; and governance and identifies two to three programs within each theme. Actions within this plan were developed to reduce the risk and potential effects of actual and projected climate impacts.

Alignment and integration with existing business planning processes started in 2017 through the development of the mitigation and adaptation plans. New funded and unfunded actions were proposed by business units through the stakeholder engagement process defined below. These were included and will be delivered as part of the business unit's One Calgary service plans and budgets process.

Administration will continue to formulate and implement the other pillars of the Climate Program, including leadership, capacity building, integration and alignment and education.

Stakeholder Engagement, Research and Communication

Climate resilience in Calgary requires a combined and collaborative initiative by The City of Calgary alongside a diverse cross section of industry, academics, environmental organizations and citizens. Over 200 City staff participated and contributed to the development of the actions contained in the Climate Resilience Strategy and Actions, which also received approval from Directors.

The development of the Climate Mitigation Action Plan followed a process of scenario development for a low carbon future and the analysis of possible initiatives. Three external working groups with representatives from industry, technical experts, academia, and the environmental sector were asked to focus on the top three areas to reduce greenhouse gas emissions in the community:

- Buildings and Energy Systems
- Land-use and Transportation
- Waste and Consumption

Climate Resilience Strategy and Action Plans

Five workshops were held from June 2017 to May 2018 and contributed to all aspects of the Mitigation Action Plan, including shaping the technical analysis, offering feedback about current challenges when working with The City to implement climate innovations, and developing the strategies, programs and actions contained within the Plan. This opened a dialogue between industry and City staff to identify mutually supportive actions where The City could fulfill its municipal role in supporting a low carbon future.

The Climate Adaptation Project Team was comprised of Climate Program staff and City staff from Corporate Analytics & Innovation (CAI), Transportation, Water Resources, Environmental & Safety Management (ESM), and Planning & Development (P&D).

Two special advisory groups were also created to provide technical input to the research:

- The Climate Change Risk Management Group (RMG) was comprised of City of Calgary managers and subject matter experts from across 27 business units, and focused on providing input and review to the risk assessment and adaptation actions research.
- The Climate Change Risk Advisory Group (RAG) was also comprised of City staff, in this case with substantive expertise and responsibilities in risk management across seven business units. They provided overall guidance to the risk matrix development and scoring process.

Strategic Alignment

The Guiding Principles for Climate Change are aligned in achieving the outcomes of 100 Resilient Cities (100RC), One Calgary and Council Directives.

The goals of Calgary Economic Development (CED) and of the Climate Mitigation Action Plan overlap in that both support development of a low carbon economy. Actions in the Climate Resilience Strategy will look to align with that of the new CED Economic Strategy for Calgary.

The recently approved Council Directives for One Calgary include “A Healthy and Green City: Calgary is a leader in caring about the health of the environment and promotes resilient neighborhoods where residents connect with one another and can live active, healthy lifestyles”. The need for climate resiliency is further emphasized:

> *“Calgary needs to address climate change in a way that engages Calgarians, resonates with the majority, and doesn’t alienate people. We need to lever incentives that focus on the economic benefits of addressing climate change (such as business diversification, job creation, opportunities for small businesses and all Calgarians) and align The City’s climate change strategies with other orders of government and industry initiatives. Calgary and The City should become nationally and internationally competitive by embracing a low carbon economy, fostering alternative energies and developing strategies to reduce adverse impacts and vulnerabilities resulting from climate change.”*

The development of The Strategy and plans has been intentionally aligned with the development of service plans and budgets for One Calgary (2019-2022).

Social, Environmental, Economic (External)

It is often the most vulnerable in society who are most affected by climate impacts and who will, therefore, most benefit from municipal action to develop climate resilience. Developing greater

resilience to climate impacts can help to avoid costs to municipalities and lead to savings in the costs of service provision which in return could see households and businesses have significant decrease in energy spending.

The natural environment can play a key role in developing resilience, for example through tree canopy expansion or flood and/or drought alleviation. Research and practice has shown a wide range of potential benefits for water sensitive urban design and integrated catchment management, including combating of extreme heat and improving air quality.

Climate-related risks to sites and infrastructure can hinder economic growth, but a focus on climate resilience can generate economic opportunities. The cost of managing impacts is typically greater than the cost of climate-compatible development. Capitalizing on growing the clean technology market, creating high quality local jobs, and the attraction and retention of businesses are all areas that benefit from a low carbon economy.

Financial Capacity

Current and Future Operating Budget:

Climate related programs and projects will be included as part of One Calgary submissions. Any specific operating budget changes will be reported to ALT and Council, as required.

Current and Future Capital Budget:

Climate Resilience is being considered as one of the criteria for the 2019 – 2022 Corporate Prioritization/Coordination Criteria for capital projects. Climate related programs/projects will be included as part of One Calgary submissions. Any capital budget adjustments resulting from provincial, federal or other grants/funds will be reported to ALT and Council, as required.

Risk Assessment

Doing nothing in the face of climate change would expose an organization's assets, services, customers and employees to the full force of extreme weather events and climate change, while increasing carbon emissions and energy costs. It would impede the ability to meet organizational objectives and the expectations of other levels of government, investors, taxpayers, customers and employees.

Calgarians who depend on municipal services have a growing expectation that decision-makers will take climate change into account when planning, building and operating infrastructure.

While significant risks will arise from climate change, adaptation and mitigation measures could also create new opportunities for job growth and prosperity, such as innovative engineering solutions.

REASON(S) FOR RECOMMENDATION(S):

The City has a role in carbon and energy management and in reducing climate risks for Calgary.

The Climate Resilience Strategy and Actions Plans are presented to Council to provide direction for Climate Resiliency in Calgary. They will guide The City's plans to achieve immediate to long-term climate resilience objectives.

Climate Resilience Strategy and Action Plans

ATTACHMENT(S)

1. Attachment 1 – Climate Resilience Strategy and Action Plans – UCS2018-0688

Climate Resilience Strategy

Mitigation & Adaptation Action Plans

Calgary **2018**

EXECUTIVE SUMMARY

The consequences of climate change are widespread and well known in Calgary, and include increasing frequency and magnitude of extreme weather events causing floods and outages. The inevitability of future climate change requires The City of Calgary (The City) to integrate climate resiliency across the organization to maintain the level of services and minimize costs.

The Climate Program evolved in several key areas over the past year including outreach and education, alignment with federal and provincial policy, risk integration into operations and services, and the development of strategies and actions. In-depth research and targeted stakeholder engagement was conducted in 2017 to establish baselines and analyze the risk and vulnerability of infrastructure, people and natural environment. Economic and greenhouse gas (GHG) modelling was also completed to identify GHG reductions and economic development opportunities. A vulnerability and risk assessment was conducted to provide the basis for City business units to identify the adaptive actions necessary to build climate resiliency for their infrastructure, operations and services.

The GHG modelling concluded that GHG emissions will increase in Calgary over time. When comparing low carbon development options with “business as usual” trends, research has found that the shift towards a lower carbon development path for Calgary is economically and technologically viable. Climate change also poses opportunities. Energy efficiency upgrades in buildings improve comfort and lower costs. These investments create jobs, especially for local businesses, while making the city more resilient to future shocks.

This report has three sections: The Climate Resilience Strategy (the Strategy), The Climate Mitigation Action Plan, and The Climate Adaptation Action Plan.

- The Strategy provides the main direction for Climate Resiliency in Calgary.
- The Climate Mitigation Action Plan identifies the role and actions of The City to ensure services, enabling activities, regulations and operations are provided to reduce emissions and enable the low carbon economy. The Plan identifies the actions in collaboration with stakeholders across the community and over the next one to two business cycles, and presents five themes (buildings and energy systems, land use and transportation, consumption and waste, natural infrastructure and leadership) that cover the largest areas of impact for emissions and energy in Calgary.
- The Climate Adaptation Action Plan identifies the risks and vulnerabilities from severe weather events and involves an iterative process of risk assessment. City business units identified a series of actions to manage the climate risks for Calgary grouped into a series of five themes (people, infrastructure, natural infrastructure, water management and governance).

The plans also contain the actions over the next ten years that will begin during the 2019 – 2022 business cycle. Alignment and integration with existing business planning processes was started in 2017 through the development of the two plans. In the spirit of One Calgary, each

business unit will deliver on their clearly defined roles in the Mitigation and Adaptation Action Plans.

Climate resilience in Calgary requires combined and collaborative initiative by The City alongside a diverse cross section of industry, academia, environmental organizations and citizens. By the same token, actions to reduce GHGs and climate risks, must be taken in all parts of The City's administration. It will include finance and funding, collaboration with partners and the measurement of results.

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LIST OF TERMS

Adaptation	The process and actions to manage the actual and projected climate impacts and risk to reduce the effects on built systems, the natural environment and people
ALT	Administrative Leadership Team
AQHI	Air Quality Health Index
BOMA	Building Owners and Managers Association
°C	Degrees Celsius
C40 Cities	The C40 Cities Climate Leadership Group connects more than 90 of the world's greatest cities, representing over 650 million people and one quarter of the global economy
CEMA	Calgary Emergency Management Agency
Climate	Weather conditions prevailing in an area in general or over a long period
Climate Risk	Risk resulting from climate change affecting natural and human systems
CO_2	Carbon dioxide is the most common heat-trapping (greenhouse) gas, released through human activities such as deforestation and burning fossil fuels, as well as natural processes such as respiration and volcanic eruptions
CO_2e	Carbon dioxide equivalent is a standard unit for measuring the contribution of different greenhouse gases such as methane and nitrous oxide, which have different warming effects on the atmosphere. The impact of each different greenhouse gas is expressed in terms of the amount of CO_2 that would create the same amount of warming.
COP21	United Nations 21st Climate Change Conference of the Parties
CRAZ	Calgary Regional Airshed Zone
CTP	Calgary Transportation Plan
DALY	Disability Adjusted Life Year
ESM	Environmental & Safety Management
GHG	Greenhouse Gas is any gas in the atmosphere that absorbs infrared radiation, thereby trapping heat in the atmosphere

GHG Sink	An activity or process that tends to remove greenhouse gases from the atmosphere (e.g. planting trees)
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
IBC	Insurance Bureau of Canada
ICIP	Investing in Canada Infrastructure Plan
ICLEI	International Council for Local Environmental Initiatives
km/h	Kilometres per Hour
LRT	Light Rail Transit
MDP	Municipal Development Plan
Mitigation	The processes and actions that stabilize or reduce the greenhouse gas concentration in the atmosphere
mm	Millimetre
Mt	Megatonne
NRCan	Natural Resources Canada
NRTEE	National Round Table on the Environment and the Economy
OHS	Occupational Health and Safety
P&D	Planning and Development
PV	Photovoltaic
RCPs	Representative Concentration Pathways are scenarios that describe alternative trajectories for carbon dioxide emissions and the resulting atmospheric concentration from the year 2000 to 2100. The RCPs describe 4 different scenarios from low to high, namely RCP 2.6, RCP 4.5, RCP 6 and RCP 8.5.
UNFCCC	United Nations Framework Convention on Climate Change
Urban Resilience	The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow despite chronic stresses (e.g. water shortages) and acute shocks they experience (e.g. floods)
Weather	The state of the atmosphere at a place and time regarding heat, dryness, sunshine, wind, rain, etc.

CLIMATE RESILIENCY IN CALGARY

1. THE CLIMATE PROGRAM

The Climate Program was developed in 2017 and is the broad administrative umbrella that provides strategic oversight to climate related activities at The City. It guides The City's compliance with current legislation, anticipated regulatory changes, and builds mitigation and adaptation considerations into existing and new plans, policies and projects. The Climate Program uses an approach that aligns with five key best practice areas in climate change planning for municipalities to ensure success (Figure 1).

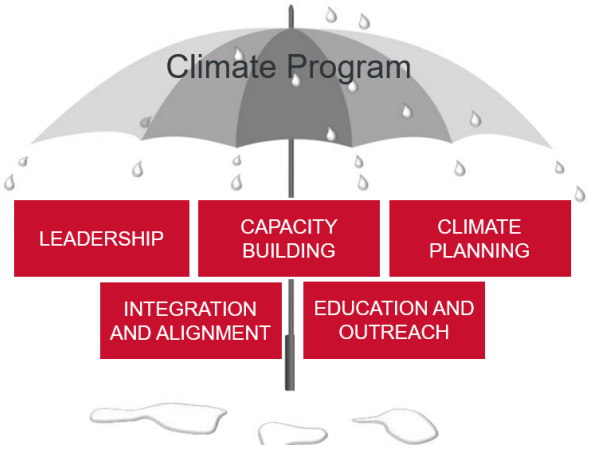


FIGURE 1 – THE CLIMATE PROGRAM

a) Leadership - At The City, both Council and Administrative Leadership Team (ALT) are informed of the risks and opportunities related to climate change that will enable them to lead and make informed decisions. The Climate Program will, through research, communication and with corporate collaboration, ensure that Council and ALT are updated on the most relevant information available.

b) Capacity Building - Municipalities have competing priorities that require constant reprioritization to maximize resources and provide the services expected by the community. Staff and financial capacity should be continuously developed to ensure analysis, evaluation and recommendations are made that consider the risks of climate change and GHG emissions reductions. Vulnerability and risk assessment is done via cross-corporate collaboration. Consistent with risk management, responsibility for action lies with each business unit.

c) Climate Planning - Integrated long-term planning (the focus of this Strategy) provides strategic oversight to climate actions within The City and in the community. The principles will enable Council to determine the most valuable investment of the resources available to deliver services to Calgarians that will achieve Council's vision for Calgary. Climate Planning will include:

- A Strategy to guide decision-making for climate resiliency.
- A Climate Adaptation Action Plan identifying actions to reduce the impacts from the changing climate.
- A Climate Mitigation Action Plan to give direction on City and community GHG and energy management.

d) Alignment with various projects and processes including Connect 4, 100 Resilient Cities, City Charter and Legislative Change Strategy, to name a few, provides the legislative framework and opportunity to integrate climate resiliency into business planning and budgeting. Supporting external strategies through partner agencies such as Calgary Economic Development and industry stakeholders ensures broad alignment with economic initiatives.

e) Public Awareness through Education and Public Outreach provides a strong foundation for collaborative action. Public engagement and robust communications will be required to provide input into the development of a strategy that effectively coordinates the actions of both external and internal stakeholders. Research and targeted engagement will continue to occur to better understand perceptions, identify opportunities for future engagement and develop appropriate communication tools.

2. CLIMATE PLANNING - THE CLIMATE RESILIENCE STRATEGY

The aim of the Strategy is to maximize the resilience of Calgary in the context of a changing climate guided by local and global policy settings and specific mitigation and adaptation actions to address climate change.

The Strategy will focus on supporting a low carbon future while reducing the impacts of a changing climate by:

- Defining The City's role in reducing GHG emissions, improving energy management, and adapting to the impacts of climate change
- Setting policy directions to guide implementation of the climate plans and actions
- Achieving long-term climate resilience objectives
- Setting out the next steps for implementation of climate resiliency by The City

The first phase (this Strategy and Plans) is to identify The City's role in ensuring continued efficient and effective services to Calgarians in a changing climate. In collaboration with the industrial, commercial and institutional sectors (Industry), it will also ensure that The City is able to foster a collaborative effort to transition to a low carbon economy.

The second phase of climate resilience is working directly with Calgarians to build capacity and provide choices to manage the impacts of severe weather events and to improve energy management and reduce emissions. It will also include the implementation of the actions identified in the first phase.

3. INTERNATIONAL TO LOCAL CONTEXT

In Canada, the temperature has already increased by 1.6°C over the last 70 years, a higher rate of warming than in most other regions of the world. The international community and all levels

of government in Canada have already started to take action to mitigate and adapt to climate change and to strengthen their local economies. The international, federal and provincial policy direction as well as the components of the recent City Charters for Calgary and Edmonton are discussed in detail in Attachment 1, Chapter 1 of this report.

4. THE CHALLENGE

The burning of fossil fuels and land use changes have released large amount of GHG's into the atmosphere that trap heat, and affect weather patterns and climate. The Earth's atmosphere today contains 40 per cent more carbon dioxide (CO_2) than 200 years ago.

Urban centres consume nearly 80 per cent of global energy and account for more than 70 per cent of global GHG emissions. The increase in GHGs is directly equated to the use of carbon-intensive energy for heating, cooling, building and transportation. Calgarians currently spend $2.6 Billion on energy each year, equating to 3 per cent of all money earned in the city. By 2030 this could rise to $6 Billion and 4 per cent of all money earned in the city through expected increases in energy prices and the growth of economic activity. Reducing emissions directly translates to reduced energy use and energy bills across the city.

As atmospheric GHG concentrations continue to rise at an increasing rate, some degree of climate change is inevitable, and extreme weather events such as droughts and rainstorms will become more frequent and intense worldwide. As a northern, cold-weather country, Canada will see its climate change more than the global average. From the Arctic sea ice cover melting, to rising sea levels on coastlines in Vancouver and Halifax, to extreme weather events experienced in Calgary – the higher rate of warming will bring unexpected changes.

The changing climate poses a serious risk to The City to deliver on its services to Calgarians. The consequences of climate change are widespread and well known in Calgary, including increasing frequency and magnitude of extreme weather events causing floods and service outages. The inevitability of future climate change means that preserving services and minimizing costs requires The City to consider and integrate climate resiliency across the organization.

5. THE OPPORTUNITY - CLIMATE RESILIENCE IN CALGARY

As a member of the 100 Resilient Cities network, The City and its partners are striving to increase capacity of individuals, communities, institutions, businesses, and systems within the city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks are experienced. Climate resilience plays a critical part of Calgary's overarching resilience framework given how climatic disruptions impact many aspects of Calgary's operations and services.

Economic opportunities – The City, and Calgary residents and businesses could significantly enhance their energy security through investments in energy efficiency and low carbon options.

Calgary's green economy is growing. There are already more than 15,000 Calgarians employed in this sector, from transportation to green buildings and energy efficiency in the commercial sector. In a recent study conducted by Calgary Economic Development, it was reported that this industry already brings in more than $3 Billion of investment into Calgary. By investing in a low carbon, cost-effective economy, we not only generate jobs, but also keep investments in energy (fuel, energy efficiency and electricity) local.

Risk management – Climate change is a risk multiplier. Floods, hail storms, extensive heat days and more frequent and intense storms all have an impact on our services and operations.

There are many reasons for an organization, particularly a municipality, to enhance resiliency and adaptive capacity in the face of climate change. Canada's National Round Table on the Environment and the Economy (NRTEE) suggested that action is justified for three reasons (adapted):

- First — Doing nothing would expose an organization's assets, services, customers and employees to the full force of extreme weather events and climate change, as well as increasing GHG emissions and rising energy cost. It impedes the ability to meet organizational objectives and the expectations of investors, customers, employees and taxpayers.
- Second — Canadians who depend on municipal services have a growing expectation that decision-makers will take climate change into account when planning, building and operating infrastructure to maintain services into the future.
- Third — While significant risks will arise from climate change, adaptation measures could also create new opportunities for job growth and prosperity, such as drought resistant tree breeds, and innovative engineering solutions. Communities expect opportunities for growth and prospects to be realized.

For NRTEE, the key to success in managing risks and seizing opportunities in a changing climate is an agency's ability to raise awareness, assess and manage risks and opportunities, and build resiliency across the enterprise. While these action areas are largely internal, agencies are encouraged to also share best practices and work in partnership with external stakeholders.

The Global Commission on the Economy and Climate reported that well designed policies in resource efficiency, low carbon infrastructure investment and stimulating low carbon innovation will make growth and climate objectives mutually reinforcing both in the short and medium term. In the long term if climate change is not tackled, growth and prosperity itself will be at risk.

Being prepared is key in providing the services Calgarians need and rely on, to continue the quality of life they have here in Calgary. Strengthening the role of The City in climate resilience equips the corporation with tools and actions to address climate change risks, seize the opportunity and support the community.

6. FROM VISION TO ACTIONS

The City of Calgary has a long history of developing actions to reduce emissions and build resiliency to climate change. To manage the effects of climate change effectively, a coordinated approach is required that will result in effective management practices, business and budget prioritization and strategic oversight. From vision to actions, the strategy aligns with The City's direction toward resilience and sustainable future.

The City's **Vision** sets the primary direction for all systems, plans and actions. To build a city's resilience, systems will be designed and function in a way to withstand, respond to, and adapt more readily to shocks and stresses. The transition to a climate resilient city will require a clear view of the ideal future state.

VISION	A great place to make a living, a great place to make a life
PRINCIPLES	Five guiding principles for climate resilience
GOALS	• Reduce vulnerabilities and risks to severe weather and long-term climate effects • Improve energy use and reduce GHG emissions • Support the low carbon economy
TARGET	80 per cent GHG reduction by 2050

The **Principles,** approved by Council on March 21, 2018 (C2018-0340) will guide the mainstreaming of climate-specific decision-making into policies, programs and projects. The Climate **Goals** stipulate the key aspects to achieve over time to reach the 2050 **Target** of 80 per cent reduction in GHG emissions.

GUIDING PRINCIPLES FOR CLIMATE RESILIENCY

Innovation – The City will play an active role in the process of climate innovation.

Inclusiveness – The City will involve multiple stakeholders in planning and implementation at a city, regional and inter-governmental scale.

Integration – The City will integrate both mitigation and adaptation considerations in all investments to improve energy use, reduce GHG emissions, reduce disaster risks and strengthen resilience for future climate conditions.

Relevance – The City will develop locally-relevant solutions to address local climate-risks and vulnerabilities, and low carbon energy opportunities.

Commitment – The City will provide strong governance to assess and sustain progress, adequately fund and ensure ongoing meaningful partnerships.

The City's role in climate change involves enabling a culture of climate resiliency actions which are supported through regulation, service provision, enabling activities, and leadership. Integrating climate specific decision-making into policies, programs and projects ensures that The City services and operations are safe guarded against risks related to climate change and make use of opportunities. Guiding Principles enable the integration of climate resilience into decision-making. They create a line of sight for Council and Administration between climate risk reduction and effective service provision.

The main climate-resilient actions, described in Figure 2, are emission reduction and managing climate risks.

- Mitigation means reducing GHG emissions through better energy management (e.g. conservation and efficiency), implementing renewable energy projects, and supporting a low carbon economy.
- Adaptation means coping with an uncertain future and taking measures to reduce the negative effects of climatic changes.

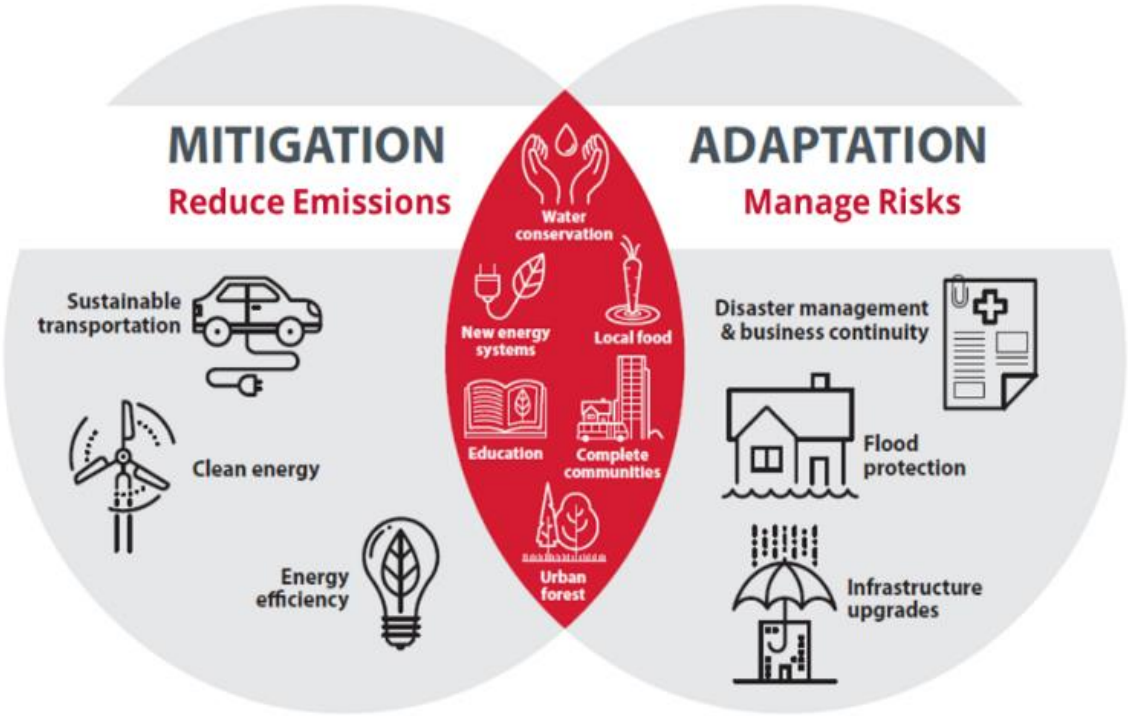
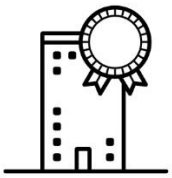


FIGURE 2 - MITIGATION AND ADAPTATION

Mitigation and adaptation actions need to be designed to mutually benefit each other, as effective mitigation can reduce climate impacts and therefore reduce the level of adaptation required by communities. Many mitigation actions also help to adapt to climate change, such as natural infrastructure, naturalization of green spaces, and neighbourhood scale renewable energy generation.

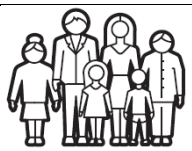
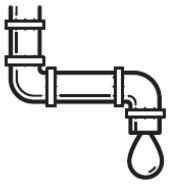
6.1 THE CLIMATE MITIGATION ACTION PLAN

The Climate Mitigation Action Plan for Calgary (Attachment 1) identifies the role and actions of The City to ensure services, enabling activities, regulations and operations are provided to reduce emissions and enable the low carbon economy. These are only the first steps. The Plan identifies the actions in collaboration with stakeholders across the community and over the next one to two business cycles, and presents five themes that cover the largest areas of impact for emissions and energy in Calgary. Ten programs focus on the specific outcomes to be pursued, and the actions are shown as the first steps in the process. The identified program areas and actions will focus on GHG emissions reductions that can be achieved in the following themes: Buildings and Energy Systems, Transportation and Land-use, Consumption and Waste, Natural Infrastructure and Leadership.

	Theme	Program
	**Buildings and Energy Systems**	• Energy Performance standards in new and existing buildings • Energy consumption information • On-site and neighbourhood scale renewable and low carbon energy systems
	**Transportation and Land Use**	• Electric and low-emissions vehicles • Low or zero-emissions transportation modes • Land-use and transportation planning
	**Consumption and Waste**	• Consumption and waste reduction • Waste management to minimize greenhouse gas emissions
	**Natural Infrastructure**	• Green spaces and natural areas to support mitigation
	**Leadership**	• The City of Calgary as a leader in climate change mitigation

6.2 THE CLIMATE ADAPTATION ACTION PLAN

The Climate Adaptation Action Plan for Calgary (Attachment 2) identifies the risks and vulnerabilities from severe weather events to City services and operations. It involves an iterative process of risk assessment. Based on the vulnerability and risk assessment done for the most severe climate impacts in Calgary, City business units identified a series of actions to manage the climate risks for Calgary. The actions are grouped into a series of five themes that reflect the interdisciplinary and comprehensive nature of climate change adaptation.

	Theme	Program
	**People: A city where people can thrive** Reducing Calgarians' vulnerability to the impacts of climate change	• Air Quality Management • Extreme Heat Management • Staff and Citizen Outreach
	**Infrastructure: The backbone of the city** Strengthening the built environment to 'weather the storms'	• Backup Power for Critical Infrastructure • Design Standards and Practices
	**Natural Infrastructure: The root of resilience** Maximizing the services provided by natural systems	• Natural Assets Management • Natural Assets Adaptation
	**Water Management: Every drop counts** Preparing for increasing risks of flooding, drought and declining water quality	• River Flood Management • Stormwater Management • Long Term Water Supply
	**Governance: Pro-active leadership** Preparing for our climate-altered future through collaborative decision making	• Budgeting and Investment Priorities • Urban Planning and Processes • Severe Weather Response and Recovery Management

A wide variety of adaptation actions, ranging from low cost and easily implementable projects, to larger and more complex projects, is to be initiated over the next five years (2018 to 2022), with feasible and "no-regret" actions first.

7. THE WAY FORWARD

There is a growing awareness and acknowledgement that climate resilience is the responsibility of all levels of governments, industry, businesses, and citizens working collaboratively. Climate resilience in Calgary requires combined and collaborative initiative by The City alongside a diverse cross section of industry, academia, environmental organizations and citizens. By the same token, actions to reduce GHGs and climate risks, must be taken in all parts of The City's administration. It will include finance and funding, collaboration with partners and the measurement of results.

Alignment and integration with existing business planning processes already started in 2017 through the development of the mitigation and adaptation plans. Over 200 staff were involved in developing the actions with sign-off from directors.

On 2018 May 15 (ALT2018-0537) The City's Administrative Leadership Team provided direction to Administration to support the Climate Resilience Strategy and Action Plans, and to consider them in One Calgary service plans and budgets.

Each of the Plans contain their own sections for implementation. This section outlines the overarching aspects for Climate Resilience including governance, budget and investment, timing, measurement and reporting that will be coordinated and implemented by Environment & Safety Management (ESM).

7.1 GOVERNANCE

The processes utilized to develop the Climate Mitigation and Adaptation Action Plans created the foundation for implementation through a transparent and collaborative approach. The building blocks for such a collaborative approach include but are not limited to evidence-based decision making that include climate modelling and appropriate energy and GHG reduction measures, risk management and the inclusion of asset management. Meeting the climate resilience objectives will require:

- Prioritization of climate resilience as an ongoing, elevated strategic priority at The City including appropriate resources for implementation
- Alignment of City strategy, policy, regulation, and procedures
- Integrated decision making and responsibility embedded across departments
- Collaborative action from The City, industry and citizens

Building on existing models for climate governance, a group will be established to bring together key organizations and actors from across The City and from the public, private and third-party sectors. ESM will work with partners and City business units to establish the following objectives:

- Seek to be an independent voice in the city, providing authoritative advice on steps towards a low carbon, climate resilient future to inform policies and shape the actions of local stakeholders and decision makers.
- Monitor progress towards meeting The City's climate resilience goals to keep on track
- Advise on the assessment of the climate-related risks and adaptation opportunities in the city and on progress towards climate resilience.
- Foster collaboration on projects that result in measurable contributions towards meeting The City's GHG reduction targets and the delivery of enhanced climate resilience.
- Promote best practice in public engagement on climate change and its impacts to support robust decision-making.
- Act as a forum where organizations can exchange ideas, research findings, information and best practice on GHG reduction and climate resilience.
- Generate a report that will feed into the annual reporting of the Climate Resilience Strategy to Council.

ACTIONS:
Coordinating Business Unit – Environmental & Safety Management

- Work with industry to establish a Climate Resilience group that will aim to meet the above-mentioned objectives.
- Apply the Climate Resilience Principles as part of the implementation of actions.

7.2 PLANNING AND INVESTMENT

There are many opportunities to embed climate resiliency measures through business planning, investment and operating cycles. Managing risks when resources are constrained involves balancing the expense of higher design standards against the costs of an asset failing. Investment decisions require integration of risk trade-offs, and may be constrained by the status of a given project (i.e. between conception and construction). It is generally easier, less costly and less disruptive to build resiliency into a capital project in the planning stages, compared to incorporating resiliency into the construction phase.

Existing infrastructure can be problematic because it has been designed and constructed for a past or present climate, and may not be resilient to future climate conditions. New infrastructure provides an opportunity to embed lifelong resiliency into its design, operation and maintenance; doing so may require designing and building to higher standards, or embedding flexibility into the design so future adjustments can be made cost-effectively when climate conditions change.

The Federal Government's "Investing in Canada Infrastructure Plan" (ICIP) is a twelve year, over $180 Billion national infrastructure funding plan that includes a proposed requirement to use a climate lens. The scope includes all the streams in ICIP, plus the Disaster Mitigation and Adaptation Fund. Under the Climate Lens, municipalities will be required to:

- Assess GHG emissions associated with the asset, including a Business-as-Usual or baseline assessment;
- Report on GHG emissions associated with the asset, including a quantification of any reductions achieved;
- Assess climate risks associated with the asset;
- Define their locally determined risk-tolerance; and
- Report on measures taken to address stated climate risks.

The City has already started to integrate the resilience decision-making into infrastructure investment. The City's capital investments should be managed in a way which provides maximum value to the community. An integrated and coordinated approach to capital planning, prioritization and funding, administered at the corporate level, refines investments, identifies efficiencies and achieves economies of scale. The City's Corporate Capital Infrastructure Investment Criteria incorporates climate resilience criteria and aligns with Federal guidelines. The work currently underway will ensure that specific criteria, including mitigation and adaptation, are applied when projects are proposed for capital investments.

ACTIONS:
Coordinating Business Unit – Environmental & Safety Management

- Evaluate and support opportunities for climate resilient budgeting, investment and efficiencies.
- Develop tools to support decision-making in mitigation and adaptation for business units.

7.3 FUNDING

Capital and operating funding will be required to implement the Climate Plans. Several funding programs from the Provincial and Federal Governments have been used in the past to secure infrastructure investment. A range of opportunities exist for cities to collaborate and invest in climate resilience. Coordinating and directing these funding opportunities for climate resilience enables The City to target actions and work collaboratively with industry.

Regional and national governments control a range of incentives and financing that both directly and indirectly affect cities. For example, energy efficiency standards for buildings and vehicles are often defined at the national level. Similarly, financing of major municipal infrastructure investments such as mass transit projects is also often controlled by regional or national governments. These types of large infrastructure investments lay the foundation for more efficient, productive, and accessible cities.

Procurement strategies. Cities and networks of cities can influence the supply of energy efficiency or GHG reduction products and services by communicating a near-term increase in demand to manufacturers and providers. They can also collaborate with private companies to foster innovative solutions for citizens, industry or The City of Calgary.

Innovative financing approaches. Cities have developed creative ways to finance infrastructure investments including debt financing, public–private partnerships, and land value capture. Other cities are increasingly exploring green bonds.

The private sector will play a critical role in the ability of cities to achieve emission reductions and improve energy management in buildings, industrial processes, and waste, but they also stand to benefit. Many of the actions building owners can take will pay back quickly in lower utility bills, but barriers include cash constraints for the up-front investments, and split incentive problems where building owners invest but their tenants benefit. Financing solutions (both from private as well as public providers) can help overcome the initial investment hurdle.

ACTIONS:

Coordinating Business Unit – Environmental & Safety Management

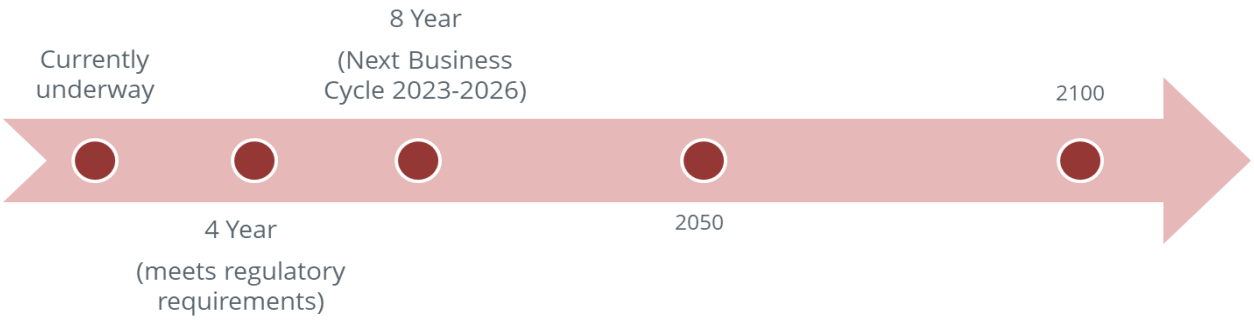
- Explore innovative funding and financing opportunities
- Evaluate and coordinate external funding for climate resilience initiatives as per the Climate Mitigation and Adaptation Action Plans
- Foster new ways to procure innovation that will increase climate resilience

7.4 TIMELINE

The Climate Resilience Strategy will consider a long-term view of climate change that overlaps with various business management cycles such as the four-year business planning and budget cycle, lifecycle management, maintaining the state of good repair, and capital investment planning.

Budgets and resources are applied where a combination of design and operations over the planning horizon would generate the most cost-effective outcome to reduce risk and increase resiliency and adaptive capacity. Good examples of this work would be flood resiliency and the proposed investment in corporate energy management.

Moving beyond the average lifespan of infrastructure (2100) will ensure that infrastructure investments are based on multiple bottom lines. 2050 is a key date that aligns with the



international community and major private companies to reduce emissions, structure investments, measure and report. Allocating budgets and directing resources into business management cycles could follow several approaches, ranging from: incremental decisions and improvements on a continuous basis; transformative, proactive and anticipatory measures that result in an immediate upgrade in design standards; or delaying transformative change until monitoring determines that such action is necessary.

The One Calgary process (business and budget planning 2019 – 2022) describes several modules for the creation of service-based budgets and business plans. Mitigation and adaption actions were created and integrated by business units to support the service lines. Some of the climate resilience actions are currently underway such flood mitigation and electric vehicle charging network, while other actions have been newly identified based on the vulnerability and risk assessment or by industry and The City to enhance the low carbon economy and reduce GHGs. These and other ongoing actions will be included and presented by business units as part of the One Calgary process. Many actions are also being implemented as a result of anticipated Federal and Provincial guidelines and regulations.

Necessary actions from previously approved plans were initiated or continued in 2018. Major new actions will be brought to Council as part of One Calgary in November 2018 for action in the next budget cycle. The remaining new actions will require either further analysis and development of new business cases before they can proceed, or require new sources of capital or operating funding.

City business units will review new information and actions in advance of the 2023 – 2026 business cycle for potential implementation. Many actions identified in the plans will involve further engagement with internal and external stakeholders, which will be conducted by the Coordinating business unit.

ACTIONS:
Coordinating Business Unit – Environmental & Safety Management

- Ensure the timely delivery of programs and projects
- Embed the Climate Resilience, Climate Mitigation and Climate Adaptation Actions in One Calgary submissions

7.5 MONITORING AND REPORTING

An important part of this Plan is to monitor, measure, report and publicly communicate Calgary's progress in implementing the actions of the Climate Resilience Strategy and Climate Mitigation and Climate Adaptation Action Plans. Efforts to build resiliency would benefit from a common reporting protocol and information repository. The City, in collaboration with its partners, will monitor progress. The City will report annually, and learn from experiences, insights, and from others. Unplanned or disruptive changes and unforeseen circumstances, such as shocks and

stresses, will shape our approach, including amongst other impacts, energy price changes, climatic changes, technological developments and funding availability, all of which will be considered in future recommendations and updates.

ACTIONS:

Coordinating Business Unit – Environmental & Safety Management

- Develop and update measures for climate actions where possible with relevant agencies and partners
- Report annually on the progress of the Climate Plans to Council
- Regularly review and update Climate Plans one year in advance of the four-year budgetary cycles
- Include climate resilience analysis (vulnerability and emissions) as part of risk reporting

Climate Mitigation Action Plan
for Calgary

Attachment 1

EXECUTIVE SUMMARY

Calgary's local climate is already changing. The trends demonstrate that our current trajectory for greenhouse gas (GHG) emissions poses risks to our economy, environment and collective health. The longer we wait to begin decreasing emissions, the more drastic and severe the climate change impacts will become, and the more expensive it will be to reduce emissions to safe levels and recover from extreme events.

Climate mitigation is the reduction of GHG emissions through better energy management (e.g. conservation and efficiency), implementing renewable energy projects, and supporting a low carbon economy. The key purpose of the Climate Mitigation Plan is to provide direction for The City on how to address GHG emissions.

The Council approved GHG reduction targets of 20 per cent below 2005 levels by 2020 and 80 per cent below 2005 by 2050 represent the emissions reductions necessary to limit global temperature increase to less than 2°C warming. Between 2005 and 2017, Calgary's overall GHG emissions have increased. This trend indicates the need to focus on emissions in Calgary and it is one of the primary drivers for the creation of the Mitigation Action Plan for Calgary.

Within Calgary, energy use in buildings, primarily electricity, accounts for approximately 65 per cent of the GHG emissions community-wide, and this sector represents major opportunities for emission reductions. Transportation generates about a third of Calgary's GHG emissions through the use of diesel and gasoline. To reduce vehicle emissions there are three broad approaches: switch vehicle fuels to a cleaner, lower carbon vehicle fuel; switch to transportation modes that use less energy; and build city infrastructure to minimize travel distances.

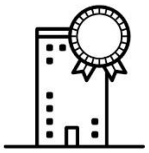
Modeling by the Leeds University and the University of Calgary for the Climate Mitigation Action Plan has shown that between 2018 and 2050 Calgary could reduce its baseline emissions by 70 per cent through cost neutral investments that could be adopted at no net cost to the city's economy if the benefits from cost effective measures were captured and re-invested in further low carbon measures. An economically and technologically viable transition to a low carbon Calgary is entirely possible. Calgarians can immediately benefit from their efforts to reduce emissions. Energy efficiency upgrades in buildings save money, improve comfort, and lower housing costs for families. These investments create jobs, especially for local businesses, while making the city more resilient to future shocks.

The Climate Mitigation Action Plan actions proposed to be undertaken over the next one to two business cycles were identified in collaboration with stakeholders across the community. Five themes (buildings and energy systems, transportation and land use, consumption and waste, natural infrastructure, and leadership) cover the largest areas of impact for emissions and energy in Calgary. Ten programs focus on the specific outcomes to be pursued, and the 69 actions are the first steps in the process.

Climate change mitigation is a continuous process, with this plan acting as a starting point for The City. Successful implementation will require participation and engagement across all business units/service lines, as well as collaboration with community stakeholders in order to successfully achieve Calgary's climate resilience objectives.

Progress on the Climate Mitigation Action Plan will be reported annually. This report will be presented to Council, and will be publicly reported through the Carbon Disclosure Project.

CLIMATE MITIGATION ACTION PLAN SUMMARY

	Theme	Program
	**Buildings and Energy Systems**	1. Energy performance standards in new and existing buildings 2. Energy consumption information 3. On-site and neighbourhood scale renewable and low carbon energy systems
	**Transportation and Land Use**	4. Electric and low-emissions vehicles 5. Low or zero-emissions transportation modes 6. Land-use and transportation planning
	**Consumption and Waste**	7. Consumption and waste reduction 8. Waste management to minimize greenhouse gas emissions
	**Natural Infrastructure**	9. Green spaces and natural areas to support mitigation
	**Leadership**	10. The City of Calgary as a leader in climate change mitigation

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CHAPTER 1: CLIMATE MITIGATION

Introduction

Scientists, business leaders and heads of government around the world are in agreement: climate change is one of the most serious challenges facing society today. Our climate is projected to become more unpredictable and extreme, posing significant risks to our communities, health and well-being, economy and the natural environment. Calgary's climate is already changing.

Climate Resilience means taking action to reduce Calgary's contribution to the problem of climate change, while also adapting our City to be better able to withstand the shocks that already know will occur. In the Climate Resilience Strategy, The City of Calgary uses new research results to better understand, reduce, and prepare for the impacts of a changing climate. This research takes a close look at the energy use forecast to 2050 and identifies cost-effective opportunities for shrinking Calgary's energy budget and GHG emissions. This new information supports better decisions about investment and the benefits we can expect through our actions.

Climate mitigation is the reduction of GHG emissions through better energy management (e.g. conservation and efficiency), implementing renewable energy projects, and supporting a low carbon economy.

Calgary and Climate Change

Over the past century, Alberta's average temperature has increased by 1.4°C, with most of that increase occurring since 1970. One or two degrees may not sound like much but prior to the industrial revolution this scale of temperature change occurred over thousands of years. A global rise of just a couple degrees has a big impact on our climate and weather.

Weather records show that the number of heat waves in the province has doubled since 1950, and this trend is forecast to increase over time. Calgary is projected to become drier during the summer, but wetter during autumn, winter and spring. During winter, precipitation could fall as heavy snow or rain, with the potential for ice storms in Calgary like those more common in eastern Canada. The potential for major river flooding, like the 2013 flood, or local flooding due to intense storms will also increase.

The trends demonstrate that our current trajectory poses risks to our economy, environment and collective health. The longer we wait to begin decreasing emissions, the more drastic and severe the climate change impacts will become, and the more expensive it will be to reduce emissions to safe levels and recover from extreme events. Over time, responding to these extreme events will undermine The City of Calgary's ability to maintain high quality services and infrastructure.

Past Work

The City has a long history of addressing climate change, from planning and preparation, to mitigation and adaptation, through to recovery. In 1994, Calgary was one of the first cities in Canada to participate in Partners for Climate Protection, a network of Canadian municipal governments committed to developing emission reduction plans.

In October 2009, Calgary was among nine members of the World Energy Cities Partnership to sign the Calgary Climate Change Accord. These cities committed to being environmental leaders and catalysts for change by utilizing official policies and plans to reduce municipal GHG emissions.

To meet the challenges of the Calgary Climate Change Accord, in November 2011, City Council adopted the Calgary Community GHG Reduction Plan. The Plan provides in-depth measurement of city-wide emissions sources and outlines actions with proven results in other jurisdictions for reducing those emissions. As part of the plan, Council also approved reduction targets of:

- 20 per cent below 2005 levels by 2020
- 80 per cent below 2005 levels by 2050

These targets apply for both corporate and community-wide GHG emissions. The plan also identified the potential for GHG reductions in Calgary, and the initial steps to make progress towards implementation.

A Changing Policy Context

The framework in which Calgary operates is in transition due to actions by governments, communities and business to limit the increase in global temperatures and adapt to a changing climate.

International Policy Direction

In December 2015 at the 21st Conference of the Parties (COP21), Canada was among 195 countries that agreed on the Paris Agreement within the United Nations Framework Convention on Climate Change. The key objectives of the Paris Agreement include:

- a goal to limit the increase in global temperatures to well below 2°C and pursue efforts to limit the rise to 1.5°C
- a commitment to achieve net-zero emissions, globally, by the second half of the century
- differentiated expectations for developed nations, including Canada, that they will reduce their emissions sooner than developing nations
- a five-year review and ratchet process which is likely to lead to more ambitious commitments from countries in the future.

Federal Policy Direction

In December 2016, Canada's federal government released the Pan-Canadian Framework on Climate Change. This framework aligns Canada's actions with that of the international community through COP21. The framework recommends several policy planks that support climate change mitigation, these include:

- Model Energy Requirements for existing buildings by 2022[1]
- Model Net Zero Energy Ready Codes for Homes and Buildings by 2022[2]
- National Online Platform for Labelling and Sharing Energy Use Data[3]
- National Zero-Emissions Vehicle Strategy by 2018[4]

Additionally, the federal government also introduced a mandatory floor price on carbon of $10 per tonne of carbon dioxide equivalent (CO_2e) in 2018, rising to $50 per tonne CO_2e in 2022. A price on carbon will be imposed on those provinces that either do not adopt a carbon pricing system or fail to meet this federal minimum price of carbon.

Provincial Policy Direction

In November 2015, the Government of Alberta announced its Climate Leadership Plan. This plan focuses on reducing GHG emissions and energy use. Key elements of the plan are:

- Carbon Levy: $20 per tonne CO_2e (2017), $30 per tonne CO_2e (2018)
- Financial support for energy efficiency, infrastructure GHG reduction
- Phasing out emissions from coal-generated electricity by 2030 and developing more renewable energy

Further details of the levy were provided in June of 2016 with the approval of Bill 20 – the Climate Leadership Act. The purpose of the Act is to influence the choices of energy users by imposing a price on carbon across all sectors. In addition, financial support will be provided for energy-efficiency measures, green infrastructure development and GHG emission reductions.

City Charter for Calgary and Edmonton

The City of Calgary and the City of Edmonton have negotiated with the Government of Alberta to establish City Charters, which will be enacted as regulations under the *Municipal Government Act* in Spring 2018. A City Charter is a legislative tool that gives cities greater flexibility and authority intended to cover a range of issues from simple administrative efficiencies to complex regulatory changes.

The City Charters for Calgary and Edmonton will enable the cities to modify or replace provisions in the *Municipal Government Act* or any other provincial Act or regulation, where the

[1] Source: NRCan Build Smart Canada's Buildings Strategy https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/BuildSmart-infographic_EN_accessible.pdf
[2] Source: NRCan Build Smart Canada's Buildings Strategy https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/BuildSmart-infographic_EN_accessible.pdf
[3] Source: NRCan Build Smart Canada's Buildings Strategy https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/BuildSmart-infographic_EN_accessible.pdf
[4] Source: Transportation Canadahttps://www.canada.ca/en/transport-canada/news/2017/05/government_of_canadatodevelopanationalzero-emissionsvehiclestrat.html

province has specifically granted it authority to do so. City Charters also include a collaboration agreement to support ongoing, long-term coordination between the two cities and the Government of Alberta. Environment and climate change has been identified as one of three policy and planning tables for ongoing collaboration.

Within the charters, there are enabling provisions that allow The City of Calgary to enact regulations that were not previously allowed under the *Municipal Government Act* in helping to achieve climate change objectives. The Charter requires that The City undertake the creation of climate change adaptation and mitigation plans by 2020.

CHAPTER 2: EMISSIONS INVENTORY AND PROJECTIONS FOR CALGARY

The City measures and reports on city-wide greenhouse gas emissions every year and follows the Global Protocol for Cities to guide our emissions reporting. This means that we report on all energy used within Calgary's boundaries in buildings (heating, cooling, lighting and power), and in the transportation systems (diesel and gasoline). The inventory also reports methane emissions from The City's waste and wastewater treatment facilities.

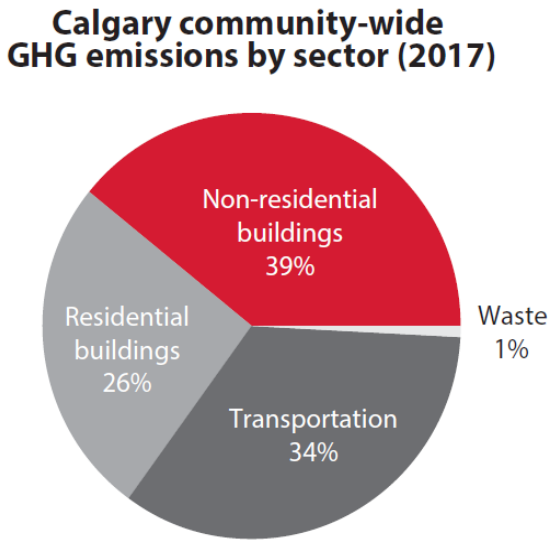


FIGURE 1 – COMMUNITY-WIDE GHG EMISSIONS BY SECTOR (2017)

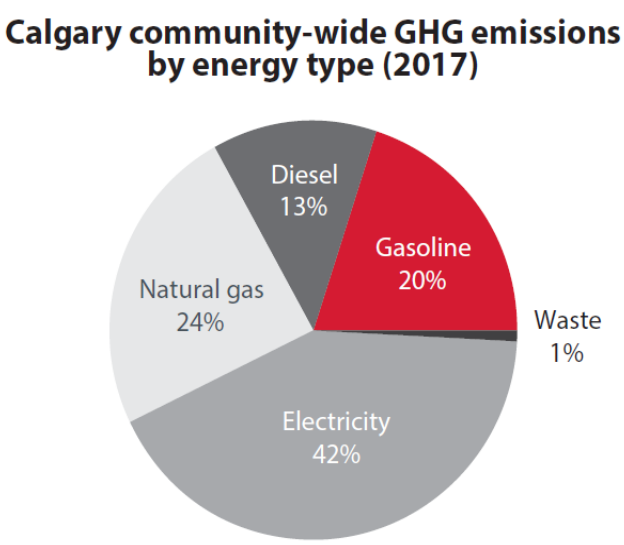
Current Emissions

Energy is used in Calgary by households, businesses, and organizations to heat and power buildings, to provide services, and to move goods through and around the city (see Figure 1). Within Calgary, energy use in buildings accounts for approximately 65 per cent of the GHG emissions community-wide, and this sector represents major opportunities for emission reductions. Transportation generates about a third of Calgary's GHG emissions. Waste-related emissions are a combination of organic waste decomposing in municipal landfills and wastewater processing at Calgary's wastewater treatment plants, accounting for 1 per cent of Calgary's total.

Another way to report on Calgary's emissions is by fuel type (see Figure 2). In Calgary, electricity consumption accounts for 42 per cent of total GHG emissions. While electricity in Alberta is heavily reliant upon fossil fuels, Alberta's electricity grid is projected to improve, particularly as coal-powered generation is phased out. In 2016, 47 per cent of our power was supplied from coal, 40 per cent from natural gas, and the remaining 13 per cent from renewable sources.[5]

Natural gas is the main heating fuel for almost all buildings in Calgary. Natural gas use accounts for 24 per cent of total community-wide GHG emissions.

[5] National Energy Board, Government of Canada
https://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/nrgsstmprfls/ab-eng.html



Buildings are the source of roughly two-thirds of emissions by sector, and electricity is currently the largest contributor within those buildings. Gasoline and diesel consumption account for 20 per cent and 13 per cent of community-wide GHG emissions respectively. Taken together, vehicles contribute about a third of Calgary's overall GHG emissions.

FIGURE 2 – COMMUNITY-WIDE GHG EMISSIONS BY ENERGY TYPE (2017)

Between 2005 and 2017, Calgary's overall GHG emissions have increased by 2.5 megatonnes (Mt) CO_2e (a 16 per cent increase). The upward trend over this period can be seen in each sector individually in Figure 3. In that time Calgary's population has grown from 955,998 to 1,246,231 and the city's overall geographic footprint has expanded. The GHG reduction targets of 20 per cent below 2005 levels by 2020 and 80 per cent below 2005 by 2050 represent the emission reductions necessary to limit global temperature increase to less than 2°C warming and have been adopted by cities around the world. In Calgary, these reductions correspond with absolute targets of 12.6 Mt CO_2e in 2020 and 3.2 Mt CO_2e in 2050. The most recent year-end data for 2017 indicates that Calgary's current GHG emissions of 18.3 Mt CO_2e are about 5.7 Mt CO_2e above the target for 2020, and 15.2 Mt CO_2e above the target set for 2050. This trend indicates the need to focus on emissions in Calgary and it is one of the primary drivers for the creation of the Mitigation Action Plan for Calgary.

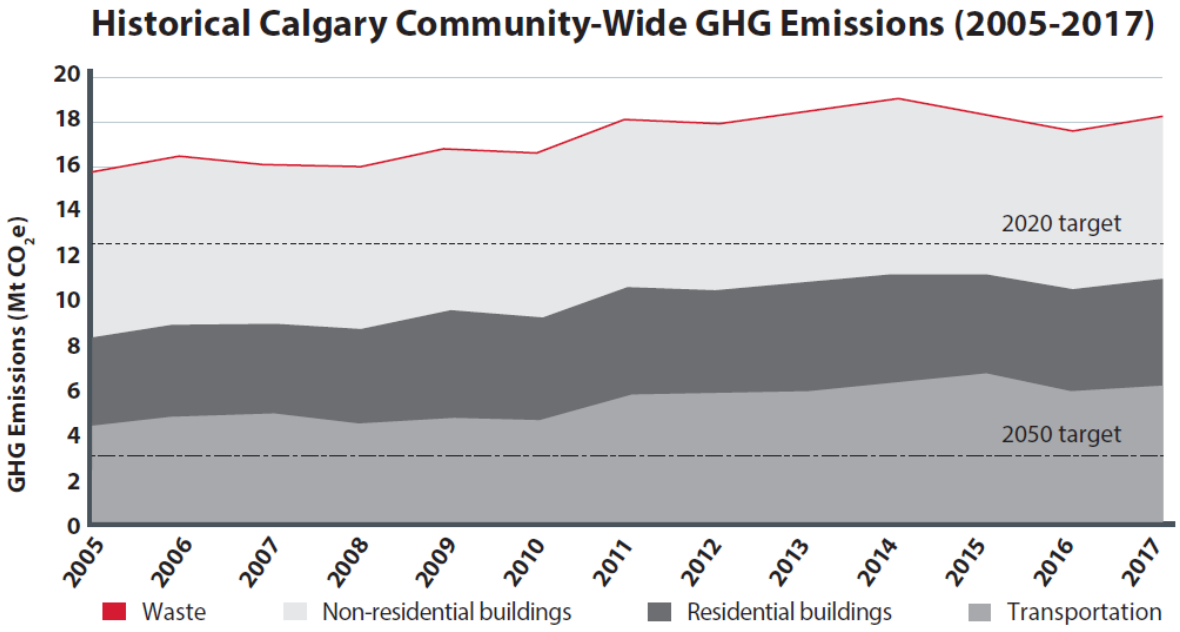


FIGURE 3 – COMMUNITY-WIDE GHG EMISSIONS FROM 2005 TO 2017

Consumption-Based Emissions

Some potentially significant sources of emissions are not reported in our current inventory. Consumption-based accounting of emissions (i.e., both the direct and indirect emissions due to consumption of goods and services in a specific jurisdiction) encompasses the full lifecycle emissions of goods and services: production, pre-purchase transportation, wholesale and retail sale, use, and post-consumer disposal. For example, the emissions that are embedded in the products we use (e.g., food or clothing) are not currently accounted for in our inventory.

Research in other leading municipalities shows that consumption-based emissions can as much as double the total community-wide GHG inventory. This is significant, and actions have been identified later in this plan to begin to quantify the impact of consumption-based emissions in Calgary.

The Challenge and Opportunity

Calgary is a city of more than one million people, with a gross domestic product of more than $100 Billion a year and total annual expenditure on energy of $2.6 Billion per year. On the path to GHG reductions, energy plays a dominant role. Our city's population is growing and is projected to increase by 1.3 per cent on average annually until 2050. Historically, as population grows, so too does demand for energy.

The University of Leeds and University of Calgary in 2018 published a report entitled "The Economics of Low Carbon Development: Calgary, Canada"[6]. It examines the economic case for

[6] Source: http://climatesmartcities.org/case-studies

Calgary switching to a more energy efficient and lower carbon development path, and it provides both economic and broader evaluations on the desirability of different options and pathways. The evidence base generated is intended to provide policymakers, businesses and individuals in Calgary with reliable, locally relevant evidence so that they can take informed decisions on how best to switch to a lower carbon development path.

At a macro-level, the evidence shows that there is a strong economic case for switching to a lower carbon development path in the short to medium term, and that doing this would enable Calgary to be on track by 2030, but it also highlights some significant longer-term challenges in reaching Calgary's 2050 target. Preparing to meet these challenges in the short to medium term could significantly improve the chances and reduce the costs of meeting them in the longer term.

To inform the discussion on how Calgary could shape its future energy use and GHG emissions, the report assesses a long list of the measures that a range of actors in Calgary could take. Ranging from changing light bulbs to rebuilding offices, this analysis assesses the cost and GHG implications of single actions and of programs of action that could be implemented across the city. Individually, many of these actions have only a small impact on energy use and GHG emissions. Collectively, however, the findings show that thousands of small actions, and some broader programs, could generate massive savings in cost and GHG emissions, with significant additional impacts in areas such as job creation, cleaner air, reduced energy poverty, and improved mobility.

The report highlights both the opportunity presented to Calgary, and the challenges that need to be overcome if the opportunity is to be taken. Low carbon measures can require large investments, coordination between policymakers, businesses, and individuals, and changes to the ways in which we live and work. However, the analysis shows that the benefits of many actions can far outweigh the costs. A low carbon future for Calgary will not just improve the global climate, but bring economic and social benefits to the lives of Calgarians.

The report established the following projections for Calgary:

> **Baseline** – The baseline scenario is what Calgary's emissions are projected to be with no action beyond business-as-usual. The baseline scenario is projected out to 2050 by combining (1) data on historical trends in Calgary's prosperity, energy use and GHG emissions, (2) population and economic growth projections, (3) provincial-level GHG emissions and energy price projections to 2050, and (4) a base assumption that Calgary's Municipal Development Plan (MDP) targets are achieved.
>
> **Cost-neutral** – The cost-neutral scenario identifies the GHG reductions that can be achieved with no net negative effect on the economy. This scenario assumes deployment of all measures that could be afforded if the benefits from the cost-effective measures were captured and reinvested in further low carbon options. This scenario achieves the largest GHG reductions with the internal rate of return for the scenario remaining greater than zero.

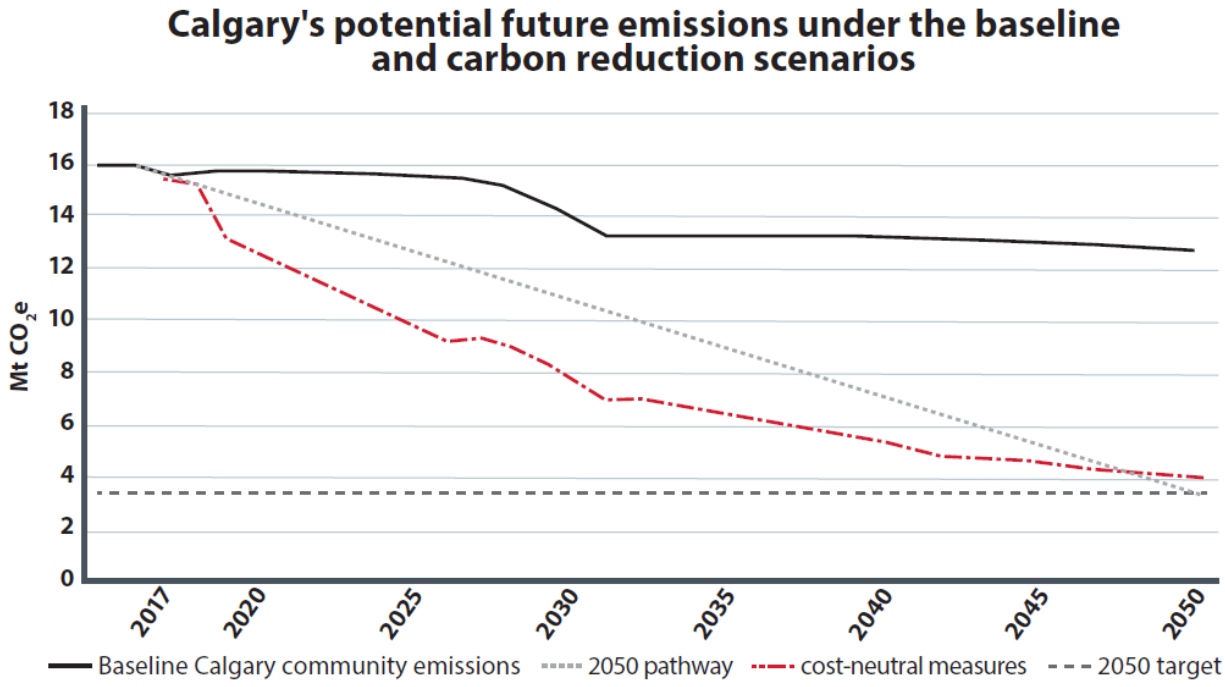


FIGURE 4 – CALGARY BASELINE AND CARBON REDUCTION SCENARIOS 2018 TO 2050

Figure 4 shows that between 2018 and 2050 Calgary could reduce its baseline emissions by:

70 per cent through cost neutral investments that could be adopted at no net cost to the city's economy if the benefits from cost effective measures were captured and re-invested in further low carbon measures. This would require cumulative investment of $113 Billion, generating savings of up to $5.6 Billion per year. Using net present values, the investment is paid back in 17 years with savings continuing over the lifetime of the measures still in place. Nearly 860,000 job-years could be generated by investing in cost neutral options.[7] See Table 1 below for sectoral breakdown, potential reductions and economics of Cost Neutral projections.

[7] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report

Category	Total potential GHG reductions to 2050 (Mt)	Total Investment (Billion $)	Annual Energy Savings (Billion $)	Total Job Creation Potential (Thousand job years)	Payback period on original investment (Years)
Residential	129	32.8	1.4	427	23
Commercial	76	6.9	0.5	69	13
Industrial	10	5.8	0.176	4	24
Transportation	63	59.9	3.2	291	18
Distributed Energy	24	7.5	0.27	67	15
Total Potential	**302**	**112.9**	**5.6**	**858**	**17**

TABLE 1 – POTENTIAL REDUCTIONS AND ECONOMICS OF COST NEUTRAL PROJECTIONS

When comparing low carbon development options with “business as usual” trends, the report found that the shift towards a lower carbon development path for Calgary cannot be dismissed on technical or economic grounds. An economically and technologically viable transition to a low carbon Calgary is entirely possible.

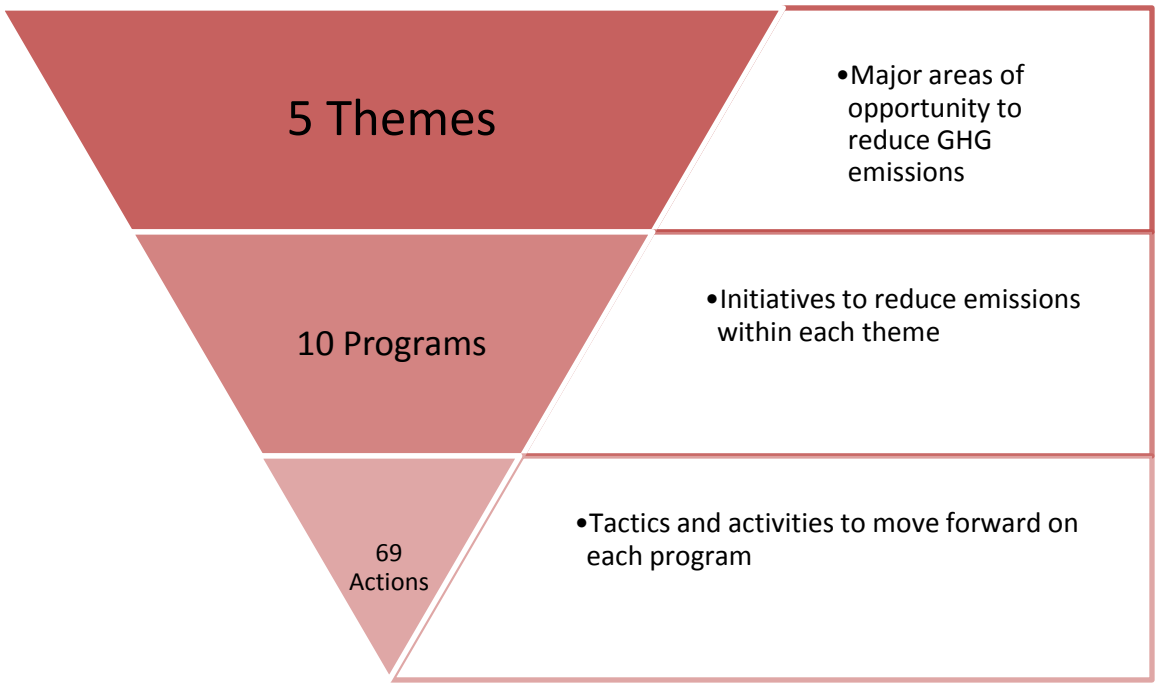
Despite the anticipated progress that will be made in reducing emissions due to the greening of Alberta’s electricity sector, the strength of the local economy and sustained population growth will continue to drive emissions in Calgary. The Climate Mitigation Action Plan for Calgary is moderate in its level of ambition but it puts in place actions that will start to decouple population and economic growth from overall emissions. However, further aggressive action will be required along the way to guide Calgary to a low carbon future. Though the task of GHG reductions seems daunting, the analysis in this report has shown that it is possible to get Calgary on the right trajectory to meet our targets.

CHAPTER 3: CLIMATE MITIGATION THEMES AND ACTIONS

Setting the Path to a Low Carbon Calgary

Plan Structure

The Climate Mitigation Action Plan for Calgary identifies the top actions to be undertaken over the next one to two business cycles to make progress to reduce emissions. Internal and external stakeholders reported to The City that these are the best opportunities to begin the transition of a low carbon future. The work is presented in five themes that cover the largest areas of impact for emissions and energy. Ten programs focus on the specific outcomes to be pursued, and the 69 actions become the first steps in the process.



These actions will result in both immediate and cumulative reductions in emissions from buildings, transportation, materials management, process emissions and industrial process sources. Although actions will need participation by all stakeholders across the community to achieve our GHG reduction targets, this plan focuses on actions that can be undertaken by The City directly through our roles: regulation, enabling activities, service provision, and operations. The relevant City business units identified a series of actions that will start to turn the curve on greenhouse gas emissions in Calgary.

Participating Business Units

For each program, there is a list of actions with one or more Participating Business Units identified as the implementer of each action. In general, the Participating Business Unit is responsible for most actions within the program, but are also responsible for coordinating actions occurring in other business units. Each action also has a funding status and a specific timeline for implementation.

Funding

Each of the programs include a wide variety of mitigation actions, ranging from low cost and easily implementable projects, to larger and more complex projects. For new actions, ESM will support other City Business Units as they develop new business cases and detailed funding requirements for these actions. Approved business cases will be submitted to One Calgary budgeting process in 2018 for a coordinated allocation of corporate funding through future business plan and budget updates.

City Role

While climate change is a global issue, cities play a crucial role in tackling climate change. Each level of government has a different level of jurisdiction and different tools to turn the curve in the right direction.

This plan is focused on The City's role to reduce city-wide greenhouse gas emissions. As a municipal government, The City can directly and indirectly influence city-wide emissions in four key ways:

- **Operational Control:** This is where The City has direct ownership over the initiatives, from capital and service delivery including the type of fuel we use in City vehicles to the how we build or the reduction of energy use in buildings to the design of roads to withstand severe flooding and heat exposure.
- **Educate, Inform, and Encourage**: These are creative and intelligent programs to support improved energy management behaviours and decision-making as well as actions that provide information and choice e.g. working with the Insurance industry and other cities on best practices for industry and home owners with regards to severe weather events. Helping citizens with information on buying storm resistant shingles for their roofs.
- **Influence:** These are actions where The City can promote and support the desired energy management opportunities and climate risk reduction (e.g. collaborating with other levels of government on policy design) or programs such as energy labelling.
- **Regulation:** The City uses its jurisdictional powers to ensure a clear path toward energy management, carbon reduction, risk reduction, and societal benefits. It is also the place where The City complies with provincial and federal mandated actions such as energy labelling or energy step codes.

Targeted Stakeholder Engagement

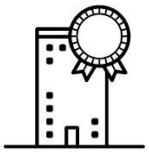
The City of Calgary established three external working groups with individuals representing industry, technical experts, academia, and the environmental sector to focus the top three areas to reduce greenhouse gas emissions in the community as listed in Table 2.

Buildings and Energy System	Land-use and Transportation	Consumption and Waste
• ATCO • Begin with Design • BILD Calgary • BOMA • Brookfield Residential • Canada Green Building Council • ENMAX Power • Flechas Architecture • KCP Energy • Mission Green Buildings • Morrison Hershfield • Pembina Institute • Southern Alberta Institute of Technology	• ATCO • BILD Calgary • Brookfield Residential • Calgary Airport Authority • Calgary Parking Authority • Canada Land Corporation • Car2Go • Electric Vehicle Association of Alberta • ENMAX Power • Federation of Calgary Communities • McElhanney Consulting Services • NAIOP • RKP Consulting • University of Calgary	• Alberta Food Processors Association • AWR Recycle • BILD Calgary • Blu Planet • Calgary Co-op • Green Calgary • Green Event Services • Leftovers YYC • Recycling Council of Alberta • University of Calgary

TABLE 2 – MEMBER COMPANIES OF THE CLIMATE CHANGE MITIGATION WORKING GROUPS

The working groups gathered for five workshops from June 2017 to May 2018 and contributed to all aspects of the Mitigation Action Plan, including shaping the technical analysis, offering stories and feedback about current challenges when working with The City to implement climate innovations, and developing the strategies, programs and actions contained within the Plan.

Themes and Programs

	Theme	Program
	**Buildings and Energy Systems**	1. Energy performance standards in new and existing buildings 2. Energy consumption information 3. On-site and neighbourhood scale renewable and low carbon energy systems
	**Transportation and Land Use**	4. Electric and low-emissions vehicles 5. Low or zero-emissions transportation modes 6. Land-use and transportation planning
	**Consumption and Waste**	7. Consumption and waste reduction 8. Waste management to minimize greenhouse gas emissions
	**Natural Infrastructure**	9. Green spaces and natural areas to support mitigation
	**Leadership**	10. The City of Calgary as a leader in climate change mitigation

Buildings and Energy Systems

Energy use in buildings is the largest opportunity for GHG reductions in Calgary. From heating to cooling, from cooking to lighting, our buildings provide many energy intensive services. Natural gas and electricity used in Calgary's residential, commercial, institutional and industrial buildings make up almost 65 per cent of total emissions generated in the community. Improving the overall energy performance of buildings and making sure energy comes from clean, low-carbon sources are steps to reducing our emissions.

Investments in building energy efficiency and clean energy also present an unparalleled opportunity. By reinvesting in building stock and renewable energy systems, Calgarians will save money on utility bills, benefit from more comfortable and higher quality buildings, and support local job growth in the energy efficiency and clean energy sectors.

The actions within this theme are organized into three program areas:

- Energy performance standards
- Energy consumption information
- On-site and neighbourhood scale renewable and low carbon energy systems

Each program is explained in further detail below.

Program 1: Energy Performance Standards

Background

Energy performance standards refer to the minimum energy performance requirements that are regulated for new and existing buildings. Minimum energy performance standards for new buildings have been recently defined in the Energy Code, a subsection of the Alberta Building Code. This energy code has been in force since November 2016, and outlines both prescriptive and performance requirements for energy performance in new buildings. There are currently no energy performance requirements for existing buildings in any jurisdiction in Canada.

The federal government has indicated that there will be a strong push to continue to improve the energy performance standards of new buildings, and to begin to develop an energy code for existing buildings.

Natural Resources Canada[8] has specified the following changes are expected to be brought forward in the building codes. In particular:

- Winter 2018 Launch ENERGY STAR certification for commercial and institutional buildings.
- 2018 to 2019 Launch a new program to ensure that energy codes are implemented properly when they are adopted.
- Winter 2019 Develop an online platform and framework for labelling and sharing home and building energy use data.
- Fall 2022 Publish additional tiers of Net Zero Energy Ready codes for buildings.
- Fall 2022 Publish model energy requirements for existing homes and buildings.

The provisions of the new Calgary City Charter enable The City to implement building code requirements beyond the current provincial building code. However, rather than utilizing this regulatory ability, this program focuses on supporting regulation at the provincial and federal level, and supporting energy performance beyond code through incentives and access to financing.

Why is this Priority?

Energy use in buildings makes up about 65 per cent of GHG emissions generated in the community.[9] The new provincial energy code ensures that new buildings' energy performance will improve, however, to meet our GHG reduction targets standards in Calgary must improve more quickly than the energy code currently dictates. Importantly, a significant portion of the buildings that will exist in Calgary in 2050 have already been built today. Approximately 50 per cent of buildings will still be in use in 2050, depending on Calgary's growth.[10] Energy performance of the existing building stock will need to improve through energy efficiency of equipment and conservation through improved building envelopes.

[8] Source: NRCan Build Smart Canada's Buildings Strategy https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/BuildSmart-infographic_EN_accessible.pdf
[9] Source: The City of Calgary 2017 GHG Inventory
[10] Source: Calgary Growth Strategies

Even with a strong economic case for energy efficiency and improved energy performance, many residential and commercial building owners are not investing in better energy performance. Despite the economic benefits, there are other barriers to building or renovating buildings to improve energy performance. These actions attempt to reduce those challenges.

Potential emissions reductions and cost savings

This program examines opportunities to go beyond current energy standards for both existing and new buildings. The highlighted actions will assist to significantly reduce energy consumption by going beyond the existing energy codes, and by exploring innovative financing incentive and incentive programs.

Improve energy performance standards in new and existing buildings[11]					
Building type	Total potential GHG reductions to 2050 (Mt)	Total Investment (Billion $)	Annual Energy Savings (Billion $)	Total Job Creation Potential (Thousand job years)	Payback period on original investment (Years)
Residential	129	32.8	1.4	427	23.4
Commercial	76	6.9	0.5	69	13.8
Industrial	10	5.8	0.176	4	24
Total Potential	**215**	**45.3**	**2.076**	**500**	**21.8**

[11] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report

What The City will do

The following actions have been identified as critical first steps to achieving improved energy performance standards in new and existing buildings. The actions are to:

Improve building performance requirements beyond current building code

ACTION	PARTICIPATING BUSINESS UNITS
1.1 Support the implementation of energy step codes for new buildings	Calgary Building Services
1.2 Prepare Calgary for the implementation of a retrofit building code	Calgary Building Services

Investigate incentives

ACTION	PARTICIPATING BUSINESS UNITS
1.3 Investigate policy approaches to provide monetary and non-monetary incentives to improve building performance.	Environmental & Safety Management Calgary Building Services Water Utility

Enable innovative financing mechanisms

ACTION	PARTICIPATING BUSINESS UNITS
1.4 Enable innovative financing mechanisms to fund improved energy performance.	Environmental & Safety Management

Program 2: Energy Consumption Information

Background

Energy use is often invisible to energy users. Many citizens and commercial building managers are unaware of how much energy their everyday activities require. By making energy consumption information more readily available and easily understood, we help provide the tools to make better decisions about how energy is used in specific buildings, and we also allow better comparisons between buildings.

Currently, most people in Calgary only get information on how much energy their home or building uses through monthly utility bills. However, this information is often difficult to decipher, and may not be readily available when buying, selling or renting a home or commercial space. The difference in energy costs between buildings that appear similar on the surface can actually be quite significant. This program is focused on making energy information more readily available and more easily understood for all building types in Calgary.

Building labelling (for residential buildings) and benchmarking (for commercial buildings) are ways to make energy information publicly available. A building energy label is a way to give a score to a home's energy performance, based on an assessment. This score can be made publicly available, and can be useful in understanding the opportunities to improve the energy performance of the home, and can also be useful in comparing the energy efficiency of similar homes.

Similarly, energy benchmarking is a system for comparing the energy performance between similar buildings, for instance offices or retail stores in the commercial sector.

Other options for providing improved access to energy consumption information can include publishing energy performance maps or building information, or redesigning utility bills to promote energy conservation.

Natural Resources Canada[12] has indicated that the following changes are expected to be brought forward in the building codes with regard to improving access to energy information:

- Winter 2018 Launch ENERGY STAR certification for commercial and institutional buildings.
- Winter 2019 Develop an online platform and framework for labelling and sharing home and building energy use data.
- Fall 2020 Complete national survey of commercial and institutional building energy use.

[12] Source: NRCan https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/BuildSmart-infographic_EN_accessible.pdf

Why is this Priority?
Understanding and managing the energy consumption in buildings is important for building owners and users to save energy and money in the long term, because buildings have a long service life.

Research has shown that simply increasing awareness of energy consumption can realize improved energy savings.

According to the Building Owners and Managers Association (BOMA) Best Certified Buildings (Commercial), a commercial building benchmarking program, registered buildings show on average a 15 per cent reduction in energy use.[13]

BOMA Best Certified Buildings (Commercial) also show other environmental benefits such as a 52 per cent reduction in water use, 18.7 per cent higher occupancy rate, 7 per cent higher tenant satisfaction score, and a 5.6 per cent higher lease renewal rate[14]

Perhaps most significantly, these programs can achieve these emission reductions at a relatively low cost.

What The City will do
The following actions have been identified as critical first steps to improving access to energy consumption information. The key actions are:

Implement building labelling and benchmarking for new and existing buildings

ACTION	PARTICIPATING BUSINESS UNITS
2.1 Develop a residential building labelling program for Calgary	Environmental & Safety Management
2.2 Develop a commercial building benchmarking program for Calgary	Environmental & Safety Management Corporate Analytics & Innovation

[13] Source: 2017 BOMA BEST National Green Building Report http://bomacanada.ca/wp-content/uploads/2017/05/2017-NGBR-Full-Report.pdf
[14] Source: 2017 BOMA BEST National Green Building Report http://bomacanada.ca/wp-content/uploads/2017/05/2017-NGBR-Full-Report.pdf

Improve energy literacy and capacity building

ACTION	PARTICIPATING BUSINESS UNITS
2.3 Develop and publish energy consumption information for all stakeholder groups to improve energy knowledge and stakeholder capacity to capitalize on energy efficiency opportunities, and to improve The City GHG reduction program design	Environmental & Safety Management Calgary Building Services
2.4 Partner with ENMAX and other energy retailers to expand the pilot of providing enhanced billing information to residential customers	Environmental & Safety Management

Program 3: Renewable and Low-carbon Energy Systems

Background

Reaching the city's emission reduction goals requires actions beyond increasing energy efficiency. On-site renewable energy systems and district energy systems are important strategies to transition away from fossil fuels. District energy systems, which supply heating and cooling to multiple buildings, can use waste heat and improve overall system performance. Renewables can provide a localized source of low carbon energy.

While energy efficiency measures and programs will be prioritized, replacing conventional energy sources with renewable and low carbon energy sources will eventually be required to meet The City's emissions reduction commitments. Each building owner will need to consider unique financial criteria, whether at the utility scale, neighbourhood scale, or within individual buildings. The City will encourage uptake of renewable and low carbon energy in Calgary by reducing barriers to implementation and supporting informed decision making for investment.

In 2015 to 2016, the Government of Alberta developed the Climate Leadership Plan.[15] This plan focuses on reducing GHG emissions and energy use. Key elements of the plan are:

- Carbon Levy: $20 per tonne CO_2e (2017), $30 per tonne CO_2e (2018)
- Financial support for energy efficiency, infrastructure carbon reduction
- By 2030, phasing out emissions from coal-generated electricity, and providing 30 per cent of Alberta's electricity from renewable sources
- The creation of Energy Efficiency Alberta that is providing subsidies for solar installations.

Why is this Priority?

Local and distributed low carbon and renewable energy helps to decrease GHG emissions and energy usage in buildings and neighbourhoods, thereby reducing energy costs and improving local resilience.

Potential emissions reductions and cost savings

Increase the implementation of on-site and neighbourhood scale renewable and low-carbon energy systems [16]				
Total potential GHG reductions to 2050 (Mt)	Total Investment (Billion $)	Annual Energy Savings (Billion $)	Total Job Creation Potential (Thousand job years)	Payback period on original investment (Years)
17	7.5	0.27	67	15.0

[15] Source: Province of Alberta Climate Leadership Plan https://www.alberta.ca/climate-leadership-plan.aspx
[16] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report

What The City will do

The following actions have been identified as critical first steps to increase the implementation of renewable and low carbon energy systems. The key action areas are:

Enable the implementation of onsite renewable and low-carbon energy systems

ACTION	PARTICIPATING BUSINESS UNITS
3.1 Develop an approach to ensure large scale developments consider the feasibility of low-carbon energy systems as part of the approvals process including: solar photovoltaics, combined heat and power, and district energy (and other technologies where appropriate)	Community Planning Corporate Analytics & Innovation
3.2 Support the implementation of solar photovoltaics	Environmental & Safety Management Calgary Growth Strategies
3.3 Support the implementation of district energy systems	Community Planning Environmental & Safety Management
3.4 Support the implementation of combined heat and power	Environmental & Safety Management

Support alternative ownership models for renewable and low carbon energy systems

ACTION	PARTICIPATING BUSINESS UNITS
3.5 Support community ownership of renewable energy generation	Environmental & Safety Management

Transportation and Land-use

Where people live, work, and access amenities within Calgary impacts how they choose to get around Calgary. Currently, emissions associated with transporting people and goods account for one third of Calgary's emissions.[17] How we design our neighbourhoods and city have a significant impact on the need for energy to be used in moving goods and people around.

Emissions from the transportation sector come from the use of two main transportation fuels: diesel and gasoline. To reduce these emissions there are three broad approaches: switch vehicle fuels to a cleaner, lower carbon vehicle fuel; switch to transportation modes that use less energy; and build city infrastructure to minimize travel distances.

This theme is organized into three program areas:

- Electric and low-emissions vehicles
- Low or zero-emissions transportation modes
- Land-use and transportation planning

While reducing emissions and energy costs are the primary purpose of this plan, these initiatives can also provide a number of other community benefits. Residents who can meet many of their daily needs by walking, bicycling, or riding transit also benefit from improved health, thriving local business districts, and increased opportunities for diverse housing and jobs.

The details of these programs are outlined below.

[17] Source: The City of Calgary 2017 GHG Inventory

Program 4: Electric and Low-Emissions Vehicles

Background

While many of the Plan's actions support the need to reduce auto travel, cars and freight vehicles will remain part of our transportation system. In addition, the number of transit vehicles and trips will grow. Therefore, it is important that we reduce the impacts of the remaining cars, buses, and trucks through cleaner vehicles and fuels.

The Government of Canada is currently in the process of creating Transportation 2030: Green and Innovative Transportation. Part of this initiative is the creation of a National Zero-Emissions Vehicle Strategy by the end of 2018.[18]

Why is this Priority?

Fuel switching for vehicles for both privately-owned and commercial fleets is the most significant opportunity to reduce emissions and energy costs in the transportation sector. Electric and hybrid vehicles are the leading technology for emissions reductions and cost savings for privately-owned vehicles, whereas commercial fleets may shift to renewable diesel, renewable compressed natural gas or electric.

Potential emissions reductions and cost savings

The most cost effective of these actions is shifting private vehicles owners to hybrid and electric vehicles.

Accelerate the shift to low emissions vehicles projections[19]				
Total potential GHG reductions to 2050 (Mt)	Total Investment (Billion $)	Annual Energy Savings (Billion $)	Total Job Creation Potential (Thousand job years)	Payback period on original investment (Years)
60.3	59	3.2	291	18.4

What The City will do

The following actions have been identified as critical first steps to increase the implementation of low emissions vehicles. The key action areas are:

[18] Source: NRCan Transportation 2030 https://www.tc.gc.ca/eng/future-transportation-canada-green-innovative-transportation.html
[19] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report

Support and enable the uptake of electric vehicles

ACTION	PARTICIPATING BUSINESS UNITS
4.1 Partner with the private sector and other government agencies to implement local and regional electric vehicle charging infrastructure	Environmental & Safety Management
4.2 Work with the private sector and non-profit organizations to develop an electric vehicle education program for the general public and businesses	Environmental & Safety Management
4.3 Collaborate with the City of Edmonton, the Province, local development industry and utility companies to identify and analyze options to improve access to home charging for electric vehicles	Environmental & Safety Management
4.4 Monitor and provide input to new electric vehicle policies and regulations developed by other orders of government	Environmental & Safety Management
4.5 Streamline municipal and utility processes to support public and private electric vehicle projects and reduce barriers	Environmental & Safety Management
4.6 Partner with post-secondary institutions and the private sector to advance research and field testing of low emission technologies, supporting infrastructure and policy direction	Environmental & Safety Management

Support and enable the uptake of low emissions vehicles in commercial fleets

ACTION	PARTICIPATING BUSINESS UNITS
4.7 Monitor and provide input to new medium- and heavy-duty low emission vehicle policies and regulations developed by other orders of government	Transportation Planning
4.8 Develop a program to support the assessment of alternative fuel technologies for commercial vehicle fleets, and provide education information and emerging regulations from other orders of government	Environmental & Safety Management
4.9 Partner with post-secondary institutions to advance Calgary-specific research into goods movement GHG reduction and energy efficiency actions and supportive policies	Environmental & Safety Management

Program 5: Low or Zero-emissions Transportation Modes

Background

There are many choices for Calgarians to get around Calgary. It is The City's responsibility to provide transportation infrastructure for Calgarians that is convenient, affordable, attractive and safe. High quality transit, bike, pedestrian and car-pooling networks provide the underlying backbone of a low carbon transportation system. In recent years, The City has made much progress in this area. By continuing to prioritize safety, accessibility, and mobility for people to allow walking, cycling, and transit we can meet the needs of a growing population while significantly reducing emissions.

Why is this Priority?

Shifting Calgarians out of single-occupancy vehicles to lower or no emissions transportation modes is a key opportunity to reduce emissions. This strategy encompasses actions to directly shift Calgarians out of vehicles, or could more indirectly achieve this strategy through the development of higher-density complete communities.

Potential emissions reductions and cost savings

It is important to note that all Council approved actions in this sector such as the Calgary Transportation Plan, Route Ahead, the Cycling Strategy and the Pedestrian Strategy are included in the baseline calculations for this report. The potential GHG reductions for the aforementioned Council approved low or zero-emissions transportation modes are 15 Mt CO_2e by 2050.[20]

Accelerate the shift to low or zero-emissions transportation modes[21]	
Actions Beyond Council approved actions (Municipal Development Plan, Calgary Transportation Plan, Route Ahead, Cycling Strategy, Pedestrian Strategy included in the baseline projections)	Total potential GHG reductions to 2050 (Mt)
Expansion of Transit (25 per cent coverage)	2.1
Carpooling	0.7
Expanded non-motorized transport (biking and walking)	0.2
Total Potential	3.0

[20] Source: 2011 PlanIt Calgary & Calgary Metropolitan Plan Scenario Series report by Transportation Planning (Forecasting)
[21] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report

What The City will do

The following actions have been identified as critical steps to shifting Calgarians to low or zero-emissions transportation modes. It should be noted that these actions have been previously approved by Council through the following strategies: Step Forward, Cycling Strategy, Complete Streets and Route Ahead Strategy. The actions are reiterated here to demonstrate the alignment with the climate change objectives of the Mitigation Action Plan. The key actions are:

Enable increased walking and cycling

ACTION	PARTICIPATING BUSINESS UNITS
5.1 Continue to implement Step Forward, the Cycling Strategy and Complete Streets	Transportation Planning
5.2 Enhance the safety and accessibility of walking and cycling for all citizens	Transportation Planning Calgary Transit Parks Roads Urban Strategies
5.3 Support the utilization of new and innovative bicycle technologies and programs	Transportation Planning

Enable increased use of Calgary Transit

ACTION	PARTICIPATING BUSINESS UNITS
5.4 Continue to implement the RouteAhead 30-year strategic plan for Calgary Transit	Calgary Transit Green Line
5.5 Coordinate with regional transit partners to make transit service a more viable choice for regional travel	Calgary Transit
5.6 Enable transit oriented development along the Green, Red and Blue LRT lines	Planning & Development Real Estate & Development Services
5.7 Increase implementation of transit priorities and yield-to-bus measures	Calgary Transit

Enable increased use of ride-sharing, car-pooling, and working from home

ACTION	PARTICIPATING BUSINESS UNITS
5.8 Support businesses and the development industry to implement transportation demand management plans in new and existing communities or buildings	Transportation Planning
5.9 Monitor demand for loading or special parking zones for commercial vehicles as well as demand for special parking zones for rideshare services	Transportation Planning Calgary Parking Authority
5.10 Pilot partner ships with alternative mobility providers to provide mobility services	Calgary Transit
5.11 Develop a high occupancy vehicle strategy to support high-occupancy vehicles and buses, as well as consideration of electric vehicles	Transportation Planning

Program 6: Land-use and Transportation Planning

Background

How we design our neighbourhoods has a significant impact on the energy needed to move goods and people around Calgary. The City can tailor plans and policies for existing and future neighbourhoods to reduce the impact of emissions and energy consumption. Through the policies of the Municipal Development Plan (MDP) and the Calgary Transportation Plan (CTP), it is possible to build low carbon planning into land uses and transportation system.

Why is this Priority?

Planning and policy decisions on land use, transportation, city infrastructure and services can exacerbate emissions and energy consumption in Calgary. Integrating climate change considerations into land-use and transportation planning decisions, strategies, plans and processes plays a crucial role in understanding the impacts of development in relation to emissions and energy use.

Potential emissions reductions and cost savings

It is important to note that all Council approved actions in this sector such as the MDP are included in the baseline calculations for this report. By 2050, if The City were to adhere to maintaining the MDP targets, Calgary could avoid 12 Mt of emissions, save $20 Billion dollars in avoided infrastructure costs and reduce energy bills by $91 Million annually.[22] The savings outlined in the table will be realized if we go beyond the current targets in the MDP.

Integrate climate change considerations into land-use and transportation planning and development decisions, strategies, plans and processes (beyond the current MDP)[23]		
Total potential GHG reductions to 2050 (Mt)	Net Savings in Infrastructure (Billion $)	Annual Energy savings (Billion $)
7	9	0.046

[22] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report
[23] Source: University of Leeds and University of Calgary, The Economics of Low Carbon Development: Calgary Report

What The City will do

The following actions have been identified as critical first steps to achieve GHG reductions in land-use and transportation planning. The key actions are:

ACTION	PARTICIPATING BUSINESS UNITS
6.1 Incorporate policies regarding climate risks and greenhouse gas reductions that may impact land use development and transportation infrastructure or services into the update of the Municipal Development Plan and Calgary Transportation Plan	Calgary Growth Strategies Transportation Planning
6.2 Develop methodologies to integrate GHG reduction potential into growth management decisions and transportation assessments	Calgary Growth Strategies Transportation Planning
6.3 Investigate the impact of disruptive transportation technologies on Calgary's transportation GHG emissions	Transportation Planning

Consumption and Waste

The waste we create and how we dispose of it can have a significant impact on GHG emissions. Currently, our GHG inventory only accounts for methane emissions from our waste and wastewater facilities, which accounts for about 1 per cent of the GHG emissions in Calgary.[24] However, there are GHG emissions that are embedded in the products that we use and dispose of in Calgary. We don't currently measure these emissions, but based on analysis from other cities, embedded emissions could double the emissions that we account for in our inventory.

Recognizing that "you can't manage what you don't measure", this theme is focused on improving Calgary's measurement of consumption-based emissions, and reducing the creation of waste in the first place. Once waste creation has been minimized as much as possible, this theme area also aims to divert as much waste from our landfills as possible, particularly organic waste.

In recent years, The City has taken significant action in reducing GHG emissions from the waste sector by implementing a series of programs and actions surrounding waste reduction, recycling, GHG capture and composting. This plan aims to strengthen its commitment to reduce GHGs associated from waste emissions while starting to consider the embodied GHGs from the goods and services we consume.

Actions in this theme are organized into two key programs:

- Reduce overall consumption and waste generation
- Waste management to minimize greenhouse gas emissions

Each program is explained in further detail below.

[24] Source: The City of Calgary 2017 GHG Inventory

Program 7: Consumption and Waste Reduction

Background

Traditionally, climate change mitigation plans address waste emissions (i.e., methane) by capturing or managing the emissions once they are created. This program attempts to take a more proactive approach to reducing these emissions by reducing the amount of waste that is created in the first place.

While recycling and composting are helpful steps in reducing emissions associated with the things we buy, these actions only reduce disposal emissions. The majority of GHG emissions are generated before we even purchase the products. To achieve emissions reduction goals, The City's goal is to better understand the role of individuals, businesses, governments, and other organizations to make more sustainable purchasing, production and conservation decisions.

The City uses the international standard for GHG accounting called "The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories," or the GPC. This Protocol was developed in partnership by World Resources Institute, C40 Cities Climate Leadership Group and International Council for Local Environmental Initiatives (ICLEI), and provides a robust and clear framework for calculating and reporting community-wide GHG emissions.[25]

Currently, The City reports scope 1 emissions (GHG emissions from sources located within the city boundary) and scope 2 emissions (GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and cooling within the city boundary), but does not track or report scope 3 consumption-based emissions (such as emissions from the production of goods used in Calgary, but manufactured elsewhere, or the emissions due to shipping goods to Calgary). A relatively small amount of GHG emissions come in the form of methane emissions from landfills.

Within the North American context, the City of Portland has been the first city to publish a consumption-based emissions inventory.[26]

Why is this Priority?

[25] Source: GHG Protocol for Cities http://www.ghgprotocol.org/sites/default/files/ghgp/standards/GHGP_GPC_0.pdf
[26] Source: Portland 2015 Climate Action Plan https://www.portlandoregon.gov/bps/article/531984

Consumption-based emissions (scope 3) have not been quantified or included in previous climate mitigation plans. However, this is a growing area of focus in leading municipalities, and based on initial research has the potential to represent a significant portion of Calgary's overall emissions. In Portland, Oregon, a consumption-based inventory doubled the total overall emissions in the inventory. [27]

Waste reduction and waste management is a core service that The City is responsible for providing to citizens. There are existing services that can further integrate GHG emissions considerations into how we minimize and manage waste in Calgary.

What The City will do

The following actions have been identified as critical first steps to reducing overall consumption and waste. The key actions are:

Reduce total waste generation in the residential and commercial sectors

ACTION	PARTICIPATING BUSINESS UNITS
7.1 Quantify the composition, scale and impact of consumption and waste on GHG emissions in Calgary	Environmental & Safety Management Waste & Recycling Services
7.2 Implement a “pay-as-you-throw” black cart program for residential waste	Waste & Recycling Services
7.3 Investigate options and develop a strategy for significantly reducing avoidable plastic waste and single-use items	Waste & Recycling Services
7.4 Work with the province to move forward extended producer responsibility regulations	Waste & Recycling Services
7.5 Focus on waste reduction in education programs for waste management	Waste & Recycling Services

[27] Source: Portland 2015 Climate Action Plan https://www.portlandoregon.gov/bps/article/531984

Improve access to local food

ACTION	PARTICIPATING BUSINESS UNITS
7.6 Review CalgaryEATS! Food Action Plan with enhanced climate resilience lens and develop a Food Resilience Plan	Calgary Growth Strategies
7.7 Conduct systems-level research on climate impacts across range of food systems activities and identify critical linkages among systems components and processes	Calgary Growth Strategies
7.8 Work with Provincial and Federal Governments and the private sector on a multi-level approach to climate programs and policies as it relates to food systems	Calgary Growth Strategies
7.9 Raise awareness of, and address, food loss and disposal to reduce wasted food	Calgary Growth Strategies
7.10 Promote urban and regional food production and support farmers through programs and policy	Calgary Growth Strategies
7.11 Review and update City and institutional food procurement policies	Calgary Growth Strategies
7.12 Support the regionalization and diversification of food supply chains	Calgary Growth Strategies

Program 8: Waste Management to Minimize Greenhouse Gas Emissions

Background

As part of achieving our GHG emission reduction targets, our aim is to remove as much as possible GHG emissions from the waste sector. The City's goal is to avoid landfilling all recyclables, discarded food and yard organic materials, where possible. Methane is an extremely potent greenhouse gas that is produced when organic waste decomposes in anaerobic conditions. In a municipal context, methane is generated from solid waste in landfills and in wastewater treatment.

Calgary's landfills and wastewater treatment facilities represent 1 per cent of city emissions.[28] While emissions from solid waste and wastewater are the result of citizens' activities in the wider community, The City has ownership and operational control over the waste handling facilities. There are opportunities to work with the citizens of Calgary to reduce waste before it gets into the collection and landfill stream, and to convert waste streams into value-added end products such as compost and biogas for use at our facilities. The actions that relate directly to the management of City-owned water and wastewater facilities have been detailed in the Leadership theme.

Why is this Priority?

Methane is an extremely potent greenhouse gas generated by Calgary's waste management and wastewater facilities that is reported annually in Calgary's GHG Inventory. In addition to existing mitigation efforts to reduce the environmental risk of these emissions, further reduction of organic waste disposed of in the landfills can minimize methane generation.

[28] Source: The City of Calgary 2017 GHG Inventory

What The City will do

The following actions have been identified as critical first steps to reducing methane emissions from landfills. The key action is:

ACTION	PARTICIPATING BUSINESS UNITS
8.1 Continue to educate and support Calgarians to divert organic waste away from landfills through the Residential Green Cart Program, the disposal surcharge rates at City landfills, and as required for all industrial, commercial, and industrial organizations under The City's bylaws.	Waste & Recycling Services

Natural Infrastructure

This theme focuses on gaining a greater understanding of the mitigation value of the natural environment in Calgary. It is important that this effort be conducted in unison with climate change adaptation work in order to gain a better understanding on the environmental stresses on our local environment, while building knowledge and expertise in areas that will deliver opportunities for better holistic management of our natural systems.

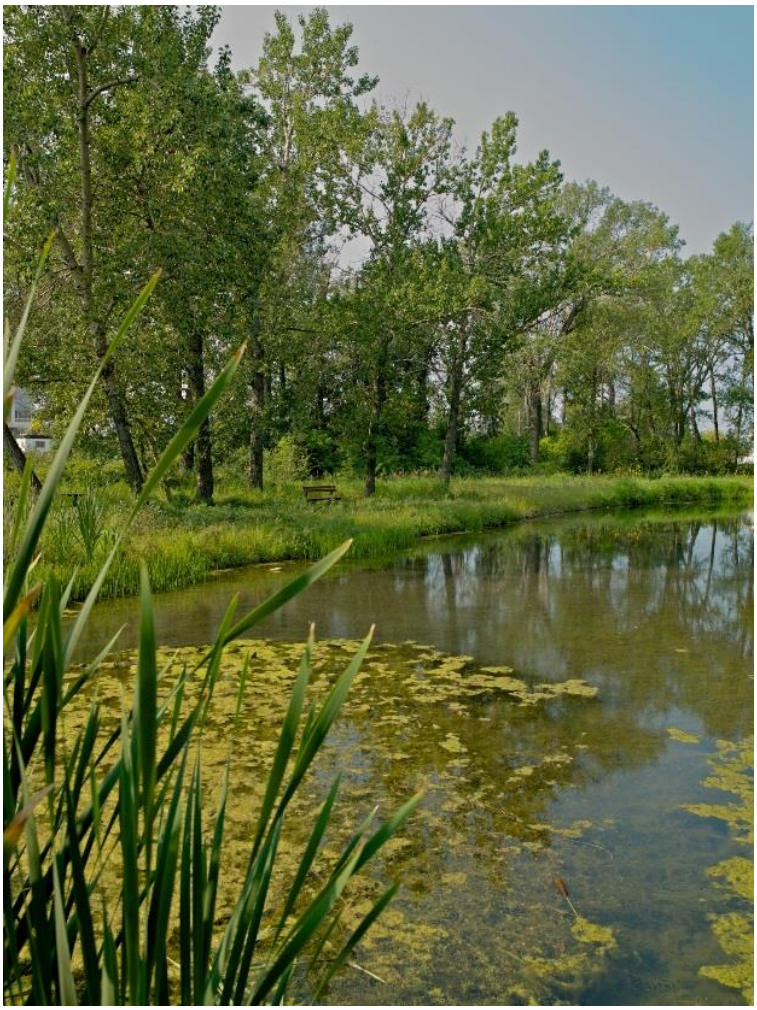
There is one program in this theme area:

- Conserve and manage green spaces and natural areas to support climate change mitigation

The details of this program are outlined below.

Program 9: Green Spaces and Natural Areas to Support Mitigation

Background



Natural assets include wetlands, river banks, trees and other 'green' infrastructure that provide similar services to hard infrastructure. In addition to providing a critical role in preparing for climate change, trees and other green infrastructure help by sequestering carbon dioxide and reducing building energy use through cooling and shading in summer and lessening heat loss in winter.

Protecting and maximizing the use of these natural assets can also offset costly investments in new hard infrastructure by absorbing emissions and providing additional benefits that reduce energy consumption within Calgary.

Why is this Priority?

The greenhouse gas impact of the disruption of our natural systems has not been previously included in Calgary's GHG mitigation plans. It is becoming an increasingly important area for consideration, as the conservation of natural areas, the restoration of disrupted systems, and the types of developments we permit in our city will directly impact the potential of these systems to act as a carbon sink, and to provide other environmental benefits.

The aim of these actions is to coordinate efforts across multiple City Business Units to develop processes to conserve and understand the mitigation properties of The City's natural assets in conjunction with the climate change adaptation work.

What The City will do

The following actions have been identified as critical first steps to valuing our natural systems. The key actions are:

ACTION	PARTICIPATING BUSINESS UNITS
9.1 Develop a methodology to quantify the value of natural systems (i.e., parks, riparian areas, natural areas, urban forest, etc.) as a greenhouse gas sink, and incorporate into our annual GHG inventory reporting	Environmental & Safety Management
9.2 Develop a formal working group to increase understanding of The City's natural assets for City staff and external stakeholders, including the integration of climate change mitigation considerations	Environmental & Safety Management
9.3 Incorporate the value of natural systems as a greenhouse gas sink into triple bottom line analysis and other business processes where necessary	Water Utility
9.4 Incorporate climate change mitigation considerations into existing strategies	Parks Water Utility
9.5 Remove regulatory policy barriers that prevent the effective conservation of wetlands in the city	Parks
9.6 Continue to promote the restoration of native habitat and naturalization of existing open space to augment the ability of Parks and Open Spaces to sequester carbon	Parks
9.7 Collaborate with the Province to develop a carbon offset program for natural systems	Environmental & Safety Management

Leadership

Demonstrating leadership is a critical role for The City. Leadership can take the form of setting an example through actions, providing information and education, or by enabling innovation and collaboration.

There is one program in this theme area:

- The City of Calgary as a leader in climate change mitigation

The details of this program are outlined below.

Program 10: The City of Calgary as a Leader in Climate Change Mitigation

Background

The City of Calgary has a responsibility to "walk the talk" on climate change mitigation. We cannot expect citizens, business or other stakeholders to take action without demonstrating our commitment to action. This leadership program is focused on demonstrating how The City of Calgary is leading by example in our own operations, improving The City of Calgary's communication and engagement on climate change mitigation, as well as enabling innovation and collaboration with citizens and the private sector.

Why is this Priority?

We consistently heard from stakeholders that demonstrating leadership should be a top priority for The City of Calgary. The City is not able to achieve our climate change mitigation targets through our own activities. This Strategy is designed to better communicate climate change information and education, and to improve collaboration opportunities between The City and the private sector. This includes implementing and raising the profile of pilot projects, and creating structures to invite industry collaboration.

What The City will do

The following actions have been identified as critical first steps to demonstrating leadership on climate change mitigation. The key actions are:

Lead by example in our operations

ACTION	PARTICIPATING BUSINESS UNITS
10.1 Demonstrate leadership in the construction, operations, and maintenance of City-owned buildings, facilities, infrastructure and fleet to minimize GHG emissions by continuing the implementation of the Corporate Energy Plan 2016-2026	Corporate Analytics & Innovation Transportation Department Water Utility
10.2 Demonstrate leadership by installing low-carbon and renewable energy systems at City facilities and land	Corporate Analytics & Innovation Water Utility
10.3 Update the Corporate Energy Plan to fully integrate corporate GHG management, and establish a Corporate Energy and Emissions Plan	Corporate Analytics & Innovation Environmental & Safety Management
10.4 Evaluate and incorporate fully-electric, electric hybrid, and other low carbon vehicle technologies into City fleets and facilities	Environmental & Safety Management Corporate Analytics & Innovation Calgary Transit Fleet Services Waste & Recycling

Become a trusted source for Calgarians to access leading climate change mitigation information and education

ACTION	PARTICIPATING BUSINESS UNITS
10.5 Develop and implement a comprehensive climate change education program	Environmental & Safety Management
10.6 Integrate climate messages into existing City of Calgary public education programs	Environmental & Safety Management
10.7 Establish targeted and relevant communications material for key stakeholder groups	Environmental & Safety Management

Establish support and resources to enable innovation and collaboration by citizens, businesses, and other stakeholders

ACTION	PARTICIPATING BUSINESS UNITS
10.8 Develop and implement a public engagement plan to support the implementation of the Climate Resilience Strategy, the Mitigation Action Plan and the Adaptation Action Plan	Environmental & Safety Management
10.9 Establish resources to enable citizens to take action	Environmental & Safety Management
10.10 Develop a program to support large industrial energy users	Environmental & Safety Management Calgary Building Services Corporate Analytics & Innovation
10.11 Establish a structure and resources to enable innovation between The City and the private sector	Calgary Approvals Environmental & Safety Management
10.12 Establish a structure to ensure ongoing collaboration between The City, the private sector and academia	Environmental & Safety Management
10.13 Identify additional funding opportunities to support implementation of actions in the Mitigation Action Plan	Environmental & Safety Management

CHAPTER 4: PLAN IMPLEMENTATION AND NEXT STEPS

Implementation

Climate change mitigation is a continuous process, with this plan acting as a starting point for The City. Successful implementation will require participation and engagement across all business units/service lines, as well as collaboration with community stakeholders in order to successfully achieve Calgary's climate resilience objectives. The Climate Mitigation Action Plan is a 'living document' where future revisions of the plan are improved by accounting for new economic realities, new and improved technologies and overall ambition on reducing emissions.

The business units identified as accountable for actions in the Plan will be leading the action implementation. The Climate Program will provide coordination among business units and deliver on selected actions on behalf of Environmental & Safety Management that are identified in the Plan. Details and prioritization of the actions may change to reflect emerging challenges and opportunities, as well as funding made available through different levels of government or partnership with the private sector and institutions.

The effectiveness of the plan implementation is dependent on the extent to which the emissions reductions and plan actions are incorporated into existing plans, policies, standards and programs. Unplanned or disruptive changes and unforeseen circumstances will also shape our approach, including technological advancements, energy price changes, grant funding, which will all be considered in future recommendations and updates as well.

Updating the Climate Mitigation Action Plan

The City should review and evaluate the effectiveness of the Climate Mitigation Action Plan every four years to guide business planning and budget decisions, incorporating the advancements in reducing GHGs and an evaluation of the effectiveness of recommended actions. This revision cycle will also satisfy the Provincial Government's requirements for updates every five years. The review and evaluation should include:

- a summary of any observed or projected changes in emissions,
- a report on successfully implemented actions,
- a dashboard on implementation progress of the ten programs,
- proposed revisions to the mitigative actions or programs given updated trends and projections,
- identification of the economics of reducing emissions,
- potential new funding sources for mitigative projects, and
- updated tracking of progress on the GHG targets to 2050.

Monitoring and Reporting

Progress on the Climate Mitigation Action Plan will be reported annually. This report will be presented to Council, and will be publicly reported through the Carbon Disclosure Project.[29]

The primary metrics used to evaluate The City's progress towards climate mitigation will be:

- impact on energy efficiency as an indicator of effective resource use,
- reduction in GHG emissions, and
- cost of energy in relation to the alternatives in Calgary.

These metrics may be used at a community or project level, and in combination or separately, depending on action being pursued. Some actions will be challenging to report on, primarily when the alternative outcome is unknowable, or the life cycle costs are estimated over a long period. Specific metrics will need to be developed for some actions to adequately report on results.

[29] The City of Calgary has been reporting annually to the Carbon Disclosure Project since 2014. This is a publicly-accessible portal to report on greenhouse gas emissions and climate risks, and the climate mitigation and actions The City of Calgary has taken. https://www.cdp.net/en

UCS2018-0688
Attachment 1

Climate Adaptation Action Plan
for Calgary

Attachment 2

EXECUTIVE SUMMARY

Climate has a major influence on the way we live and Canadians and Calgarians have had plenty to “weather” as of late. In response, Calgary and cities around the world are focusing on developing policies, programs, infrastructure designs and leadership strategies to increase the climate resilience of their natural, built, socio-economic, political and administrative systems.

Climate adaptation is the process and actions to manage the actual and projected climate impacts and risk to reduce the effects on built systems, the natural environment and people. A key purpose of the Climate Adaptation Action Plan is to provide direction for The City of Calgary (The City) on how to address climate change impacts in the context of uncertainty. The Adaptation Action Plan is an essential document for communicating The City’s understanding of climate change and its commitment to improving climate resilience to protect local citizens, the environment, and the economy.

A vulnerability and risk assessment was conducted to provide the basis for City business units to identify the adaptive actions necessary to build climate resiliency for their infrastructure, operations and services. City business units identified a series of actions that should be implemented to manage the climate risks for Calgary. The wide range of actions are grouped into a series of five themes that reflect the interdisciplinary and comprehensive nature of climate change adaptation. Within each theme, two-to-three programs have been designed to ensure alignment and coordination of actions and outcomes.

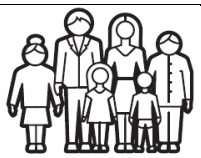
Climate change adaptation is a continuous process, with this plan acting as a starting point for Calgary. The majority of the actions in the Climate Adaptation Action Plan should be initiated within the next business cycle 2019-2022, except ongoing actions that are already underway. Successful implementation will require participation and engagement across all business units/service lines, as well as collaboration with community stakeholders in order to successfully achieve Calgary’s climate resilience objectives.

The Climate Adaptation Action Plan will be updated every four years, in advance of each City business planning and budget cycle, with ongoing monitoring occurring between updates.

CLIMATE CHANGE ADAPTATION ACTION PLAN OUTCOMES SUMMARY

A total of 175 adaptation actions that should be initiated over next five years (2018-2022) have been identified by City business units. These actions are grouped into a series of five themes that reflect the interdisciplinary and comprehensive nature of climate change adaptation. Within each theme, two-to-three programs have been designed to ensure alignment and coordination of actions and outcomes.

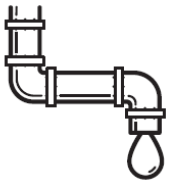
The following table summarizes the outcomes for each program area:

Theme	Program Outcomes
 **People:** **A city where people can thrive:** Reducing Calgarians' vulnerability to the impacts of climate change	**Air Quality Management** • Reduced airborne emissions in Calgary from high-impact sources • Updated management plans to respond to high risk air quality events. **Extreme Heat Management** • Extreme heat management plans and actions are in place to support citizens and outdoor city workers. • Priority locations are identified for implementation of cooling and shading infrastructure or programs. **Staff and Citizen Outreach** • The City staff, Civic Partners, citizens and businesses have the resources they need to take action on climate change, enabling Calgary to adapt to more extreme weather events and long term climatic changes
 **Infrastructure**: **The backbone of the city** Strengthening the built environment to 'weather the storms'	**Backup Power for Critical Infrastructure** • The City staff has identified the infrastructure that is most essential for continuity of service delivery • Back-up power requirements of these mission critical City facilities have been prioritized based on a climate change vulnerability assessment • Specific upgrades, new backup power systems, or plans to provide mobile power in response to power outages, have been identified in collaboration with partners **Design Standards and Practices** • Expansion and maintenance of detailed climate data to inform infrastructure design decisions. • Updated design guidelines and practices across City business units, including infrastructure design specifications, building code and other City guidelines

Natural Infrastructure:
The root of resilience
Maximizing the services provided by natural systems

Natural Assets Management
- A coordinated approach to conserve and enhance natural assets as part of The City's ongoing asset management processes
- Management and protection of natural assets and systems, such as soils and stormwater

Natural Assets Adaptation
- Increased number of healthy, well adapted natural assets in Calgary
- Updated planning and development practices for soil and vulnerable locations such as river banks and flood prone areas



Water Management:
Every drop counts
Preparing for increasing risks of flooding, drought and declining water quality

River Flood Management
- Enhanced long-term vision for flood resilience in Calgary to reflect changing climate conditions
- Aligned land use planning processes with flood risks and management practices

Stormwater Management
- Assessed design guidelines for stormwater management to deal with more intense summer storms.
- Flood warning systems and response plans in place to address more frequent localized flooding situations.

Long Term Water Supply
- Advanced drought management and response plans to manage the risk of declining water supply
- Strategic investments in water supply infrastructure and water demand management programs.

Governance:
Pro-active leadership
Preparing for our climate-altered future through collaborative decision making

Budgeting and Investment Priorities
- Leaders and project managers are aware of climate change risks and potential resilience solutions
- Corporate and departmental risk management and budgeting processes explicitly include climate change resilience criteria

City Planning and Processes
- City plans and policies ensure that communities, neighbourhoods, infrastructure and services are designed to respond to anticipated climate changes

Severe Weather Response and Recovery Management
- Systematically updated disaster risk reduction strategies that consider how climate change will increase the frequency and severity of extreme weather events
- Civic Partners are supported by The City in developing their own response and recovery plans

TABLE OF CONTENTS

Chapter 1 – Climate Adaptation

The Climate Resilience Strategy identifies a series of guiding principles that requires City policies and programs consider climate resilience (mitigation and adaptation) into all decision-making process. This will include service delivery, infrastructure, purchasing decisions and The City's regulations and policies.

The City has a long history of taking actions to reduce greenhouse gas (GHG) emissions, as well as adapting to climate change. The City's Climate Resilience Strategy continues this legacy of action by establishing a coordinated approach for City business units to act directly or to enable citizens and businesses to make Calgary a more climate resilient city. To become climate resilient, ambitious actions are required both to adapt to climate impacts, and to limit emission of greenhouse gases.

Mitigation and adaptation actions need to be designed to mutually benefit each other, as effective mitigation can reduce climate impacts and therefore reduce the level of adaptation required by communities. Many adaptation actions also help to mitigate climate change, such as natural infrastructure, naturalization of green spaces, neighborhood scale renewable energy generation, etc.

It is important to be aware that there is a significant time lag between mitigation activities and their effects on climate change. If not well planned, mitigation and adaptation measures can conflict with each other. An example would be air conditioning, which can help people to cope during a heat wave, but also increases energy use that in turn can increase energy use and GHG emissions.

Current Climate Adaptation Activities

In addition to the actions identified in this Climate Resilience Strategy, some adaptation initiatives are already underway at The City. They have not typically been called adaptation activities, but have been funded and actioned in large part to the recognition and pressures of a changing climate. Examples of such activities, broken down by the 100-Resilience Framework used by The City, include:

100-Resilience Framework Categories	Projects
Infrastructure & Environment	• Flood mitigation and resiliency initiatives • Assessments of local ecology and biodiversity • Asset management and assessment, including previous work using the Engineers Canada PIEVC protocol • The City's energy efficiency initiatives • Ongoing work to better monitor weather and climate for operational applications such as high winds
Leadership & Strategy	• The City's Resilience Program • Business continuity planning • Coordinated emergency response planning and resourcing by Calgary Emergency Management Agency (CEMA)

	• Ongoing corporate and environmental risk management processes
Economy & Society	• Community networks of service providers and coordination of social services • Public and partner engagement on emissions reduction and adaptation • Expert stakeholder engagement on the Climate Mitigation Action Plan
Health & Wellbeing	• Participation in regional air quality management programs (e.g. Calgary Region Airshed Zone (CRAZ) Board)

Direction from Other Orders of Government

The Cities of Calgary and Edmonton have negotiated City Charters with the Government of Alberta. The City Charter is a legislative framework that gives the two cities greater flexibility and authority on a range of issues from simple administrative efficiencies to complex regulatory changes. Climate Change has been a specific focus of the Charter negotiations for the environment and energy policy areas. The Charter made the development of climate change mitigation and adaptation plans mandatory for the cities of Calgary and Edmonton. The plans must be established by December 31, 2020 and a review of the plans is required at least once every five years.

The Federal Government released the Pan-Canadian Framework on Clean Growth and Climate Change in 2016. The Framework includes a high-level discussion on climate change adaptation for Canada as a whole. The City will monitor Federal projects and subsequent guidance or direction that should be implemented at a municipal level.

Targeted Stakeholder Engagement

Development of the Climate Adaptation Action Plan was conducted by The City's Climate Program, housed within Environmental & Safety Management (ESM) business unit, with other stakeholders within The City. The following business units participated directly in the development of The City's climate adaptation actions, including development of actions specific to their areas of responsibility that will help to address the climate impacts projected for Calgary.

Environmental & Safety Management (ESM)
Calgary Approvals Coordination
Calgary Building Services
Calgary Emergency Management Agency
Calgary Growth Strategies
Calgary Fire Department
Calgary Housing
Calgary Parks
Calgary Neighborhoods
Calgary Recreation
Calgary Transit
Community Planning
Corporate Analytics & Innovation
Facility Management
Fleet Services
Finance
Fleet Services
Infrastructure & Resilience
Information Technology
Law
Roads
Transportation Infrastructure
Transportation Planning
Water Resources Water Services
Waste & Recycling Services

Chapter 2 – Climate Risks for Calgary

Why Climate Adaptation?

Climate change has become one of the defining issues of our time, given the effect communities across the country continue to experience, from more extreme heat waves to increased winter storms and flooding, to advancing invasive species and vector borne diseases. In response to these changes, cities and countries around the world are focusing on developing policies, programs, infrastructure designs, and leadership strategies to increase the climate resilience of natural, built, socio-economic, political and administrative systems.

The most recent international effort to agree on climate change actions and GHG reduction targets occurred at the 2015 Paris conference (COP21). The voluntary GHG reduction commitments made by nations, shown in Figure 1, would result in average global temperature increase of approximately 3.5°C by the year 2100. This is well above the Paris Agreement's aim to keep global temperature rises this century well below 2.0°C above pre-industrial levels. Right now, global GHG emissions are trending along the highest 'No Action' line, which is projected to result in an increase of 4.5°C by 2100.

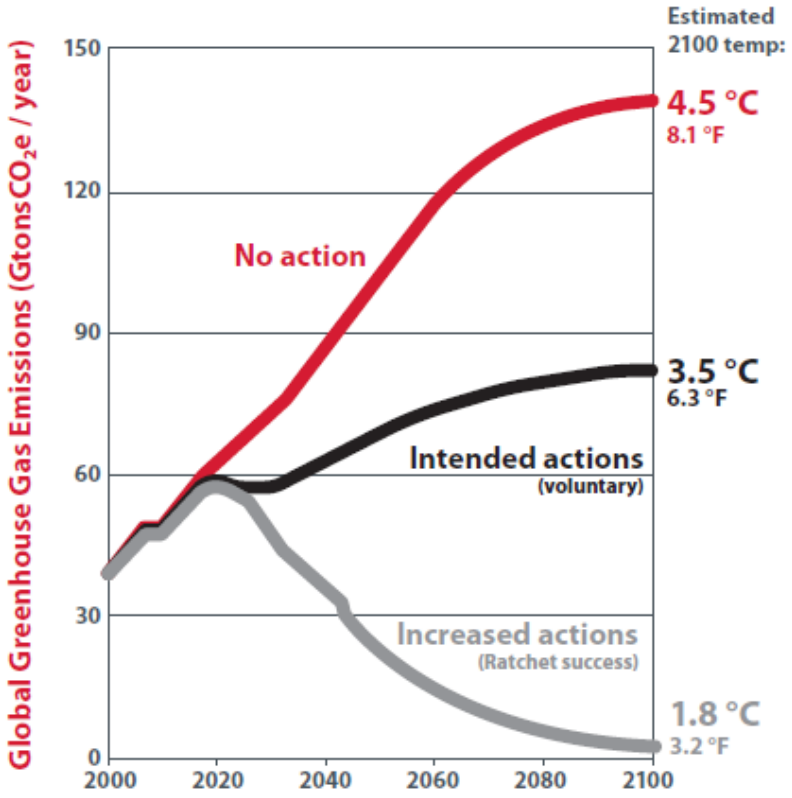


FIGURE 1 – GREENHOUSE GAS EMISSIONS (FRIEDLINGSTEIN ET AL. 2014)

Adaptation is not a new concept, Canadians have developed many approaches to deal with an extremely variable climate. For example, communities in the prairie provinces have already been designed to withstand extreme differences in seasonal temperatures. However, the

amount and rate of climate change is posing new challenges. Climate science now allows communities to anticipate a range of new and more extreme climate conditions, and therefore take action before the worst impacts are incurred.

Temperature increases for Calgary are projected to be higher than the global average, as northern regions are warming faster than the rest of the globe. Calgary is already facing more extreme and frequent severe weather events, and needs to pro-actively adapt to further changes.

In order to understand the specific impacts on Calgary, The City completed a vulnerability and risk assessment to analyze the major climate and weather changes expected over the next 30 to 60 years. The assessment used a combination of literature-based research, projections based on the latest climate projection models, input from City business units and analysis of local climate data.

Calgary's Key Climate Risks

Figure 2 illustrates the projected climate and extreme weather risks identified for Calgary through the vulnerability and risk assessment process with statistical data. Risks further to the right are projected to occur more frequently (higher likelihood), while the ones closer to the top will have more significant impacts on people, infrastructure, services and natural systems (higher consequence).

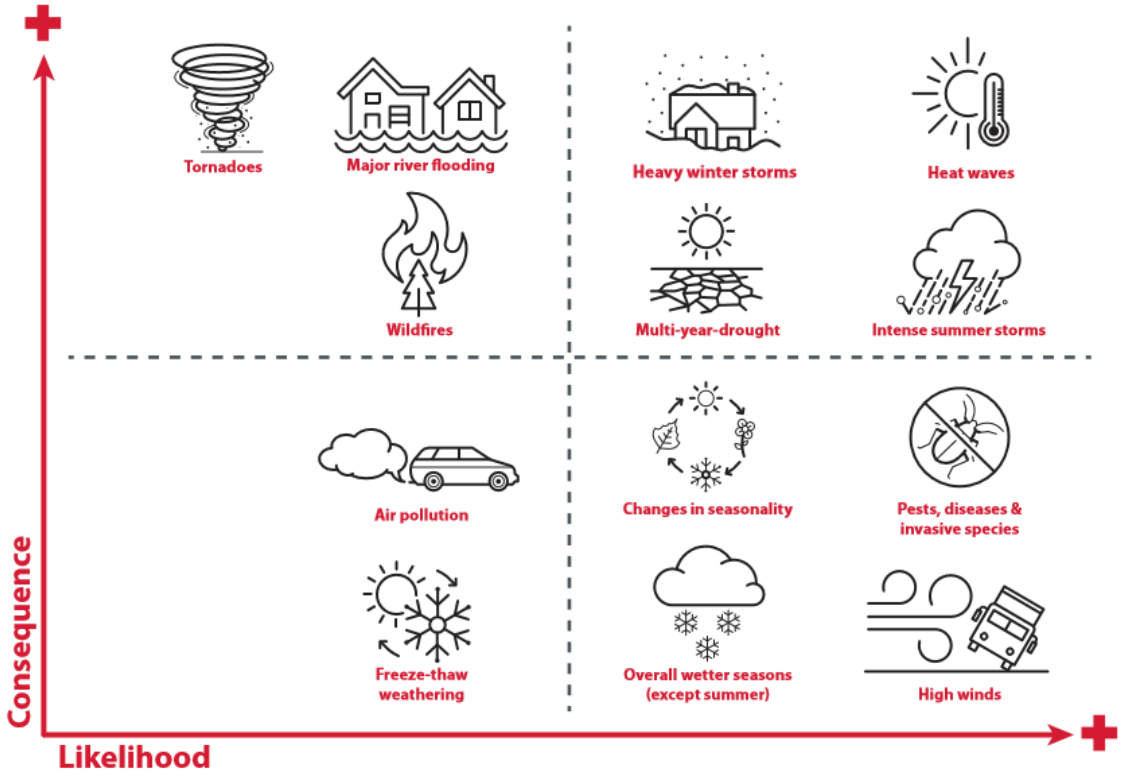


FIGURE 2 - CALGARY'S CLIMATE RISKS

For most of these climate risks, the likelihood or consequence will be worse in the decades to come than experienced in Calgary today.

The likelihood of each climate risk was determined through an evidence-based risk assessment process, which determined the annual frequency of an event occurring in two future time periods (centred on 2050 and 2080). The consequence of each climate risk was calculated based on The City data and staff input for the following five categories:

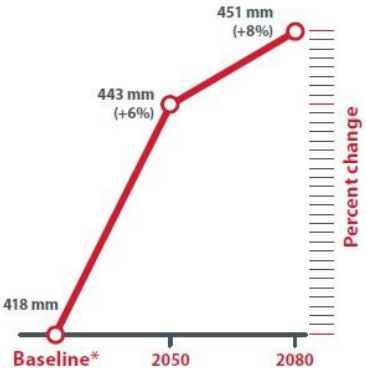
- **City asset damage** – based on an analysis of the infrastructure that would be affected by each climate risk, using historic data when available
- **City service disruption** – based on an analysis of The City services that would be affected by each climate risk, using historic data when available
- **Environmental effects** – based on the loss of rare or endangered species, transformation of landscapes and productive habitat, reduction in water supply, and decrease in water and air quality
- **Community effects** - considered access to services and community assets, along with community macroeconomic losses
- **Human health & safety (public and occupational)** - used a modified version of the disability adjusted life year (DALY) approach to determine the relative health impact of different risks

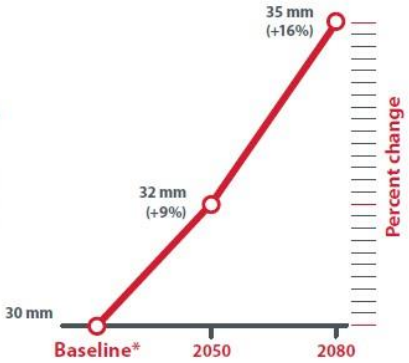
Each of the climate and extreme weather risks from Figure 2 are described in more detail below.

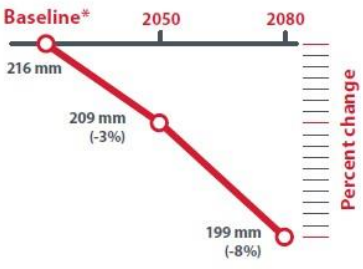
Projected Climate Changes for Calgary

To guide the development of the climate adaptation risks, and resulting actions, forty Global Climate Models were used to provide a highly robust characterization of the uncertainty in future projections of the high emission scenario (Representative Concentration Pathway 8.5) given the current path. Each of the Global Climate Models is a different representation of the physical processes that govern earth-atmosphere interactions (i.e., different models have different mathematical formulas and frameworks for representing physical processes). This approach was selected based on guidance from the Intergovernmental Panel on Climate Change, which suggests that, where possible, the maximum number of models should contribute to an ensemble. Projected changes for six climate variables for Calgary are shown below. These provide an indication of the impacts in the 2050s and 2080s.[30]

[30] Source: *Climate Change Adaptation Research: Vulnerabilities, Risks and Adaptation Action, Technical Report.* Prepared for the City of Calgary by WaterSMART Solutions Ltd., June 2017.



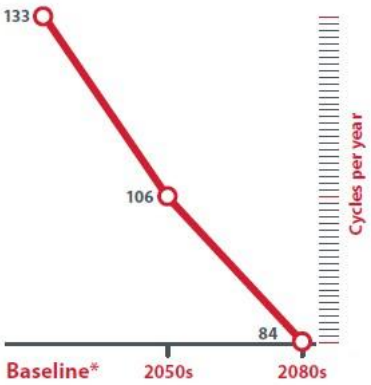


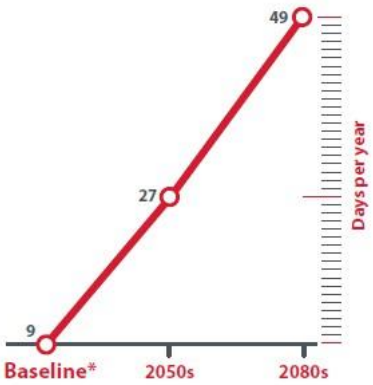


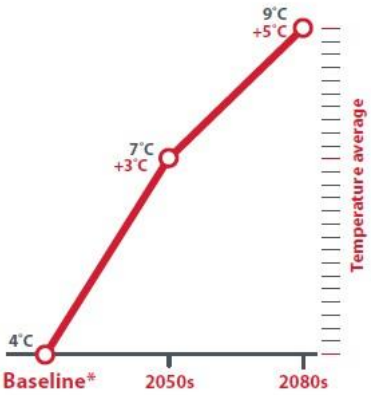
Annual precipitation

Winter precipitation

Summer precipitation







Freeze-thaw cycles

Hot days 29˚C ≥

Annual average

HIGH LIKELIHOOD, HIGH CONSEQUENCE RISKS

Heat Waves

Description: Days with temperature greater than or equal to 29°C.

Impact: Climate change will significantly impact the frequency, duration, and intensity of heat waves in Calgary. This may increase heat-related illnesses and fatalities, especially for outdoor workers, people with health conditions, children and seniors. Heat waves can also result in increased electricity demand for cooling, which can lead to brownouts during periods of peak demand, further increasing health risks. Additional impacts include reduced ground-level air quality, reduced water quality, increased odours from waste and waste facilities, and heat-expansion damage to steel structures and infrastructure such as rail tracks and roadways.

Heat Days will increase from 9 per year to an average of 27 days by the 2050s.

Examples: In 2017 Environment Canada issued several heat warnings during the summer months. During the prolonged heat waves in British Columbia (July 2009) and in Quebec (July 2010), public-health officials stated that there were an estimated 156 and 280 deaths, respectively, from heat-related causes.

Intense Summer Storms

Description: Rainfall of 50 millimetres (mm) or more in an hour, often accompanied by localized flooding, damaging hail and lightning.

Impact: Summer precipitation presents a particular challenge. Even though evidence suggests that summers will become drier on average, when rainfall occurs it will more often happen as intense rainfall and thunderstorms. These storms can cause significant and costly damage when they strike homes and other buildings, can block drainage systems and cause localized flooding, or make key transportation corridors briefly impassable. Calgary and southern Alberta are also already impacted by severe hailstorms each year, as highlighted in Figure 3. Whether more intense summer storms will result in larger hail is unclear, but more frequent storms increase the risk of more frequent hail accompanying those storms.

Examples: In June 2016 Calgary experienced near record rainfall of 206.1 mm, causing an estimated $50 Million in insured property damage. In addition to the torrential rains, the whole of Alberta experienced above average 576,721 lighting strikes, compared to an average 400,000 strikes over the summer.

Between 2005 and 2016, Alberta averaged approximately 78 hail storms, 28 wind storms and 7 rain storms per year, as seen in Figure 3.

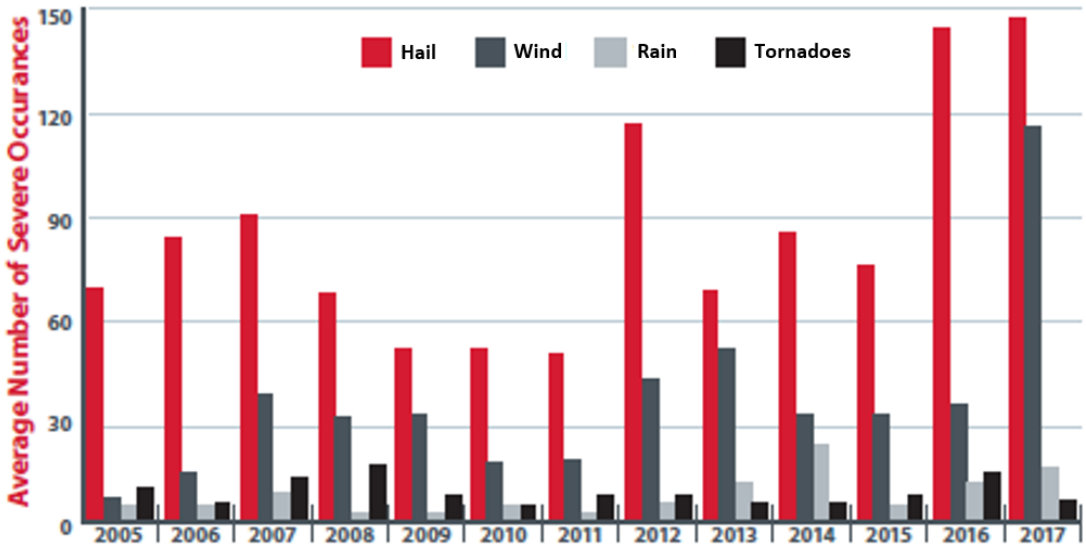


FIGURE 3 - NUMBER OF REPORTED SEVERE HAIL, WIND, RAIN AND TORNADOES EVENTS IN ALBERTA (ENVIRONMENT AND CLIMATE CHANGE CANADA, 2017)

Heavy Winter Storms

Description: Days with more than 10 centimetres (cm) of snow fall or freezing precipitation.

Impact: Winter is projected to have the most significant seasonal increase in precipitation for Calgary, falling as a mix of snow and rain. As the climate warms and more moisture can be held in the atmosphere, individual winter storms will become heavier with more snowfall per storm. Ice storms, like those experienced in eastern Canada today, will also begin to occur in Calgary. Ice storms in particular can damage infrastructure and cause power failures (e.g. downing of overhead power lines), increase the chance of multi-day service disruptions, and result in more injuries due to increased traffic accidents, or slipping and falling. The latter is a particular concern as Calgary's population ages and is more at risk of serious injury due to falls.

Examples: In 2014, the "*Snowtember*" event brought heavy snowfall in late summer and damaged half of the trees in the city. The 28 cm of snow that fell during Calgary's three-day September snowstorm cost the city $17.4 Million in insured costs alone — nearly as much as the entire annual snow and ice control budget.

Winter and spring precipitation will increase up to 18 per cent by the 2050s, posing concerns for river flood risks, especially when in in combination with mountain snowmelt.

Multi-Year Drought

Description: Below average annual precipitation and dry conditions lasting one to three years (or more).

Impact: Although annual precipitation is generally expected to roughly remain the same in Calgary, summers are projected to be drier due to potential decrease in summer rainfall and higher evaporation rate.

The potential for multi-year drought conditions will increase as well. As precipitation becomes more sporadic and variable, annual swings in total precipitation are more likely to occur, with prolonged drought conditions for up to several years at a time.

The consequences of a multi-year drought are far reaching. In addition to the impact on local agriculture, droughts affect the health of plants, wildlife, wetlands, forests, parks, open spaces, recreational facilities and private yards. Drying out of forests increases the risk of wildfires, which impact both local air quality and even water quality if they occur upstream of the source of Calgary's water supply. Trees and plants also become more susceptible to pest and disease outbreaks (e.g. pine beetles) since lack of water can stress trees, limiting their ability to react to these attacks.

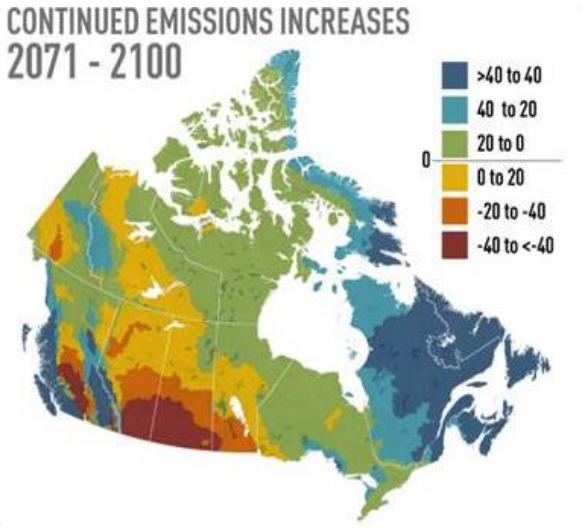


FIGURE 4 - CLIMATE MOISTURE INDEX, NRCAN – CFS, 2016

The climate moisture index by Natural Resources Canada (NRCan), shown in Figure 4, measures the difference between annual precipitation and the potential water evaporation from landscape covered by vegetation. Below the zero line (yellow, orange and red areas), the conditions may be too dry to support a forest. This projection is for the years 2071-2100 assuming the world continues to increase GHG emissions.

Examples: In 2017, much of southern Saskatchewan experienced the driest July in over 130 years of record-keeping. In Regina, less than 2 mm of rain fell that month, far below the usual average of 60 mm. For farmers in the region, the heat and dryness conditions were especially damaging because they followed a rainy spring that had been so wet they'd been unable to properly seed their fields.

HIGH CONSEQUENCE, LOW LIKELIHOOD RISKS

Major River Flooding

Description: Major river flooding events that have a five per cent, or less, chance of happening in a given year.

Impacts: Major river flooding in Calgary can be triggered by a range of climate changes including intense summer storms, rain-on-snow, ice jamming, or combinations of all these events. These events all increase river and water table levels, leading to overland or groundwater flooding. Although these floods can last only a few days, the flood impacts on people and communities can remain for months to years. Some of the more significant impacts of floods include injuries and the risk of fatalities, power outages, dislocation of residents from their homes and communities, service disruptions, stormwater backups and basement flooding, costly damage to buildings and infrastructure, and long-term changes to rivers including erosion and reduced river bank stability.

Examples: The 2013 flood washed across one-quarter of the province and through the core of Calgary. The disruptive flood cut off dozens of communities throughout the province and prompted the largest evacuation across Canada in more than 60 years with nearly 120,000 people temporarily evacuated from their homes, power shut off to the downtown core for a week. Damage losses and recovery costs from the flood exceed $6 Billion, including a record $1.72 Billion in insured losses. This included 1,000 kilometres of destroyed roads, hundreds of washed-away bridges and culverts, and thousands of damaged or destroyed cars and homes.

Wildfires

Definition: A large-scale wildfire within or adjacent to Calgary city limits, lasting several days to weeks.

Impact: Calgary is less exposed to physical damage from local wildfires than communities like Fort McMurray or Waterton due to the limited amount of forest in close proximity to the city. Calgary has experienced multiple grass fires however, such as those on Nose Hill, and some communities in Calgary adjacent to urban forests and grassland areas have an elevated risk from wildfires.

Wildfires upstream along the Elbow and Bow Rivers could also impact drinking water supply and quality for years after a fire due to wildfire's tendency to destroy natural features that assist in protecting water sources from runoff contamination (chemicals, erosion and turbidity).

Examples: In 2016, the Fort McMurray wildfire resulted in approximately $3.7 Billion in insured damage. This was more than twice the value of the previous costliest Canadian natural disaster on record. This was followed by the 2017 wildfire in and around Waterton National Park, which forced hundreds of people leave as fire burned over 38,000 hectares. In the aftermath of the

2016 Fort McMurray wildfire, the town has experienced a 50 per cent increase for water treatment expenses to avoid contamination of drinking water from post-fire pollutants washed into the river.

Tornadoes

Description: Significant tornadoes are rated EF2 or stronger on the Enhanced Fujita Scale ranging from EF0 to an extreme EF5 (EF2 tornadoes have wind speeds up to 217 kilometres per hour (km/h), while EF5 tornadoes have wind speeds greater than 322 km/h).

Impact: While the probability of a tornado striking a particular site is relatively low, the consequences of a tornado depend on its location and the number of people present. Infrastructure impacts can include loss of power, severe damage to buildings and transportation corridors with possible loss of lives, as well as the potential for water service disruptions or sewage backup. Longer-term impacts could include the temporary displacement of people from their homes, injuries and deaths, loss of business revenue, and ongoing psychological trauma. Given the extreme difficulty in upgrading infrastructure to survive a tornado impact, improvements to weather monitoring and advance public warning systems are critical. Based on the available scientific data, it is not yet clear to what extent climate change could increase the frequency or severity of tornadoes in Alberta.

Examples: The most recent example of a larger scale tornado striking a large urban centre in Alberta is the 1987 Edmonton Tornado. The day came to be known as Black Friday after 27 people were killed and 300 people injured by the peak intensity EF-4 tornado that also caused more than $330 Million in damage.

LOW CONSEQUENCE, HIGH LIKELIHOOD RISKS

High Wind Events

Description: High winds producing gusts greater than or equal to 90 km/h.

Impact: High winds can damage a wide variety of infrastructure including buildings, traffic signals, streetlights, and signs and can overturn heavy vehicles. Overhead power lines are also at risk during high wind events to power interruptions or outages. Areas of the city, such as the downtown core, could also be closed periodically during extreme high wind events. Injuries or fatalities as a result of such high wind events in Calgary have been rare, but have occurred on occasion.

Examples: Recent examples include multiple events in Calgary in October, 2017 that toppled trees, downed power lines, damaged roofs, and broke windows on a number of buildings in the downtown core.

Changes in Seasonality, Overall Wetter Seasons, and Pests, Diseases & Invasive Species

Description: A combination of above normal annual temperatures, increasing wet events with more than eight days of consecutive rainfall, and the spread of pests, diseases & invasive species that previously could not survive in the Alberta climate.

Impact: Projections indicate that average air temperatures in Calgary will increase across all of the seasons. With higher average temperatures, this can create ideal conditions for pest and disease outbreaks. This can directly impact people's health as new diseases migrate further north, as has already been seen with Lyme disease and the West Nile virus. Outdoor workers and those who enjoy outdoor activities will be most at risk. Growth of invasive species, such as the pine beetle, can wipe out entire forests, with potential impacts to the food chain and local wildlife, as well as negative impacts on forestry and tourism. Increased moisture would also lead to increased weathering of infrastructure, delays and disruptions to scheduled seasonal construction and maintenance, and increased costs for park and greenspace maintenance.

Examples: Figure 5 shows the projected rapid change that is projected for Alberta from 2015 to 2071-2100. Today the majority of central and northern Alberta is covered by boreal forest. However, projections show that the majority of Alberta would become inhospitable for such forest by as early as 2071. Grasslands, as seen in the southeast corner of the province today, are projected to expand into central and northern Alberta instead.

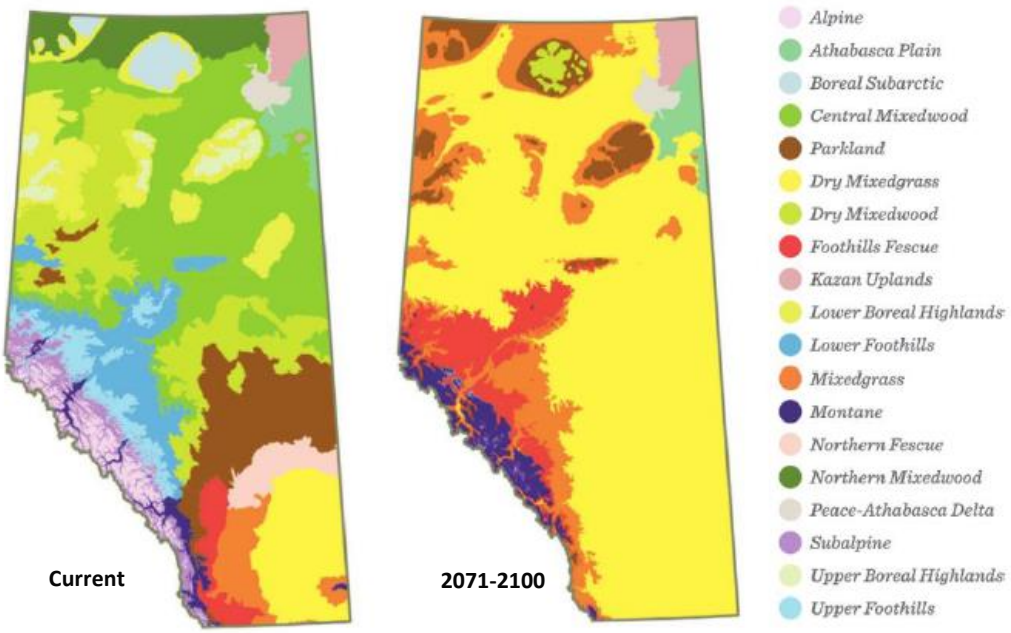


FIGURE 5 - PROJECTED CHANGE IN ALBERTA'S ECOSYSTEMS BY THE END OF THE CENTURY USING THE CURRENT EMISSION PATHWAY (NIXON ET AL., 2015), ABMI, EDMONTON

LOW CONSEQUENCE, LOW LIKELIHOOD RISKS

Air Pollution

Definition: Elevated air pollution events with an Air Quality Health Index (AQHI) value of 7 or greater.

Impact: Air quality is influenced by both human activities and natural events. Large cities like Calgary may have poor air quality due to pollution from vehicle exhaust or emissions from industry and buildings. This can cause a variety of health impacts, including worsening of respiratory diseases. In Calgary, the worst air quality conditions often occur in winter when emissions from the city become trapped by an inversion (colder, stable air is trapped at the surface with warmer air above). Inversions can inhibit the normal mixing of emissions in the atmosphere, resulting in higher ambient air concentrations for pollutants. Forest fires are also a common cause of elevated air pollution, and can impact communities hundreds of kilometers away.

2017 was the smokiest year since 1953, with 321 hours of smoke due to wildfires.

Examples: In 2017, Calgary endured 321 hours of smoky conditions resulting from wildfires in the Rocky Mountains and the interior of British Columbia. This was by far the smokiest year since air-quality records began in 1953.

Freeze-Thaw Weathering

Description: Freeze-thaw refers to the stress on infrastructure caused by repeated temperature fluctuations just above or below the freezing point. This is further exacerbated by fluctuations in wind, precipitation, ice, snow and humidity.

Impact: An assessment of these conditions from climate models suggests that freeze-thaw conditions over the course of a year will decrease over the long-term, but remain significant in mild-winter months. It remains an important risk to consider in the short and moderate term, especially in late autumn and early spring as well as during the mild-winter months. Freeze-thaw can damage a wide range of infrastructure, including roadways, pathways, light rail transit (LRT) tracks and infrastructure buried in the roadway (e.g. water pipes). Weathering is causing frequent water supply main breaks, cracks and leaks from sewer systems, and compromises stormwater drainage systems performance from either line breaks or increased gravel deposition, and disrupts water supply or sewage services.

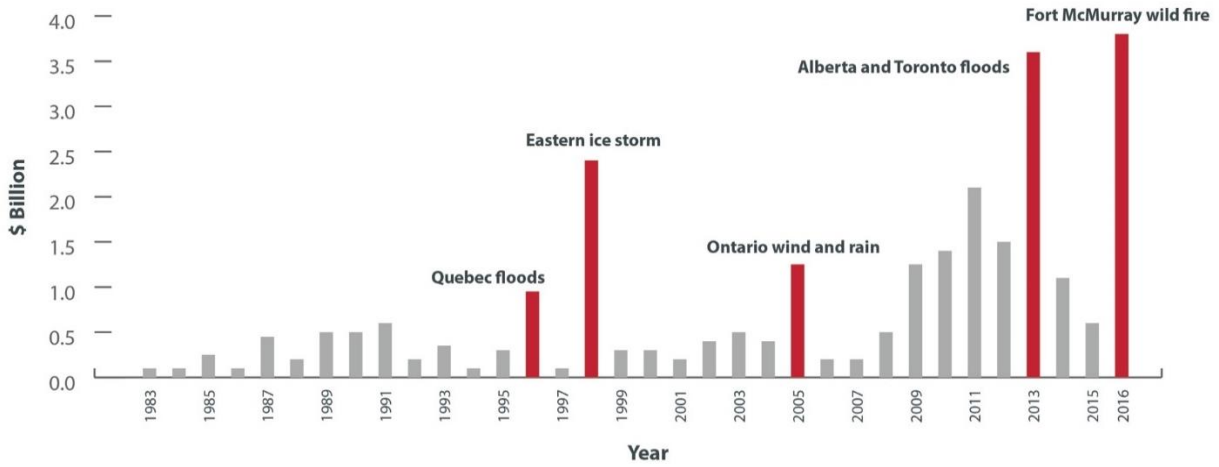
Examples: In January 2018 many homes, business and a number of schools experienced pipe bursts inside the buildings caused by freeze-thaw and fluctuating frost depth activity. The Calgary Fire department responded to more than 100 calls within 24 hours related to burst water pipes on January 1 and 2, 2018.

The Costs of Climate Change

Climate change impacts are being felt in Calgary, and across Canada and internationally. These impacts will grow over time, posing significant risks to our communities, health and well-being, economy and the natural environment.

Severe weather due to climate change is already costing Canadians billions of dollars annually according to the Insurance Bureau of Canada (IBC), with record insured damages of $5 Billion reported in 2016. Figure 6 shows the growth in climate-related catastrophic insured losses in Canada between 1993 and 2016.

FIGURE 6 – CANADIAN CATASTROPHIC INSURED LOSSES (INSURANCE BUREAU OF CANADA)



Canada is not alone. IBC data shows that the annual economic cost of disasters around the world has increased five-fold since the 1980s. From an average of $25 Billion a year in the 1980s, insured losses grew to an average of $130 Billion a year in the 2000s. For most extreme weather events, uninsured losses exceed the value of insured losses, further adding to the burden on communities and the economy.

Figure 7 illustrates the ratio between insured and uninsured losses adjusted for inflation and exchange rate fluctuations worldwide. In the case of Canada, floods cause annual average economic losses of more than $1.2 Billion with $800 Million of those uninsured. As a result, Canada's insurance industry is calling on governments across the country to implement expansive climate actions that will better prepare Canadians and their communities for the impacts of climate change.

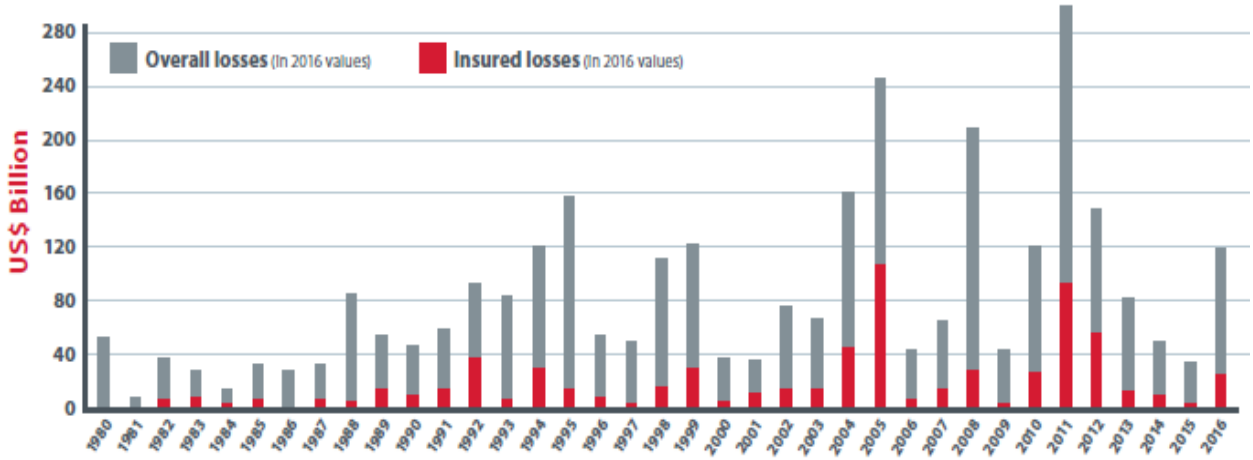


FIGURE 7 - INSURED AND UNINSURED NATURAL CATASTROPHIC LOSSES WORLDWIDE (MUNICHRE NATCATSERVICE, 2017)

In order to avoid excessive recovery and repair costs to government, residents and businesses, Calgary must adapt to the projected impacts of climate change. Investing in adaptation actions today helps to minimize both short and long-term damage and disruptions. According to the United Nations Development Programme, from a global perspective it is estimated that every dollar spent today on adaptation results in $7 saved in emergency response.

Climate impacts can cause a range of problems, including temporary loss of services, minor and major infrastructure repairs, loss of natural spaces, reduced economic growth, and a range of impacts on people and communities. More problematic for cities, is the fact that climate impacts in one area of services or operations can cascade through other interconnected city systems. Some specific examples of local and global climatic changes that could impact Calgary include:

Local	• Increasing number of heat days that affect the health and productivity of citizens, the natural environment and the lifespan of infrastructure • Infrastructure damage due to severe summer and winter storms causing financial losses, long-term physical and mental distress for individual and businesses • Crop losses for nearby farms due to pest and/ or severe weather events, • Potential tax increases to fund response & recovery costs due to increasing severe weather events • Increased insurance and maintenance costs in areas prone to stormwater and river flooding • More wildfires and air pollution during the fire season affecting the health of Calgarians and negatively impacting tourism • Melting glaciers that will reduce river flows, compromising our water supply and water quality • Increasingly disrupted and stretched municipal services, as a result of all of the above impacts
National	• Sea level rise in Canada leading to potential migration to cities such as Calgary, which would increase demands on local services and infrastructure • The spread of mountain pine beetles into Alberta increasing the threat to local forests and making them more prone to wildfires • Melting permafrost damaging infrastructure such as pipelines, buildings and roads owned by natural resources companies based in Calgary
International	• Increases in local food prices due to droughts in California or other food growing regions • Slowing of the global economy and demand for local resources and products due to damage and disruption from severe weather events • Shortages of imported products due to production and transportation interruptions caused by climatic changes • Increased migration of people due to climate change displacement, increasing demands on Canadian federal, provincial and municipal resources

Chapter 3 – Climate Adaptation Themes and Actions

Climate Change Adaptation Themes

Based on the vulnerability and risk assessment discussed in Chapter 2, City business units identified a series of actions that should be implemented to manage the climate risks for Calgary. The wide range of actions are grouped into a series of five themes that reflect the interdisciplinary and comprehensive nature of climate change adaptation. Within each theme, two-to-three programs have been designed to ensure alignment and coordination of actions and outcomes, as shown in Figure 8.

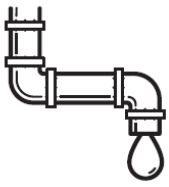
	Theme	Programs
	**People: A city where people can thrive** Reducing Calgarians' vulnerability to the impacts of climate change	1. Air Quality Management 2. Extreme Heat Management 3. Staff and Citizen Outreach
	**Infrastructure: The backbone of the city** Strengthening the built environment to 'weather the storms'	4. Backup Power for Critical Infrastructure 5. Design Standards and Practices
	**Natural Infrastructure: The root of resilience** Maximizing the services provided by natural systems	6. Natural Assets Management 7. Natural Assets Adaptation
	**Water Management: Every drop counts** Preparing for increasing risks of flooding, drought and declining water quality	8. River Flood Management 9. Stormwater Management 10. Long Term Water Supply
	**Governance: Pro-active leadership** Preparing for our climate-altered future through collaborative decision making	11. Budgeting and Investment Priorities 12. Urban Planning and Processes 13. Severe Weather Response and Recovery Management

FIGURE 8 - CLIMATE ADAPTATION THEMES AND PROGRAMS

The full list of recommended adaptation actions was identified during the targeted stakeholder engagement process, with selected 'priority' actions highlighted in the remainder of Chapter 3. All of the actions should be initiated over the next five years (2018 – 2022) in order to increase Calgary's climate resilience in response to the projected climate risks. Additional actions that

were identified by City business units should be reviewed as the Climate Adaptation Action Plan is updated in advance of the 2023 – 2026 business cycle for potential implementation.

Climate Actions

Each of the 175 actions is attributed to one of the 13 programs which are described in the following pages. Each program includes a wide variety of adaptation actions, ranging from low cost and easily implementable projects, to larger and more complex projects. An important principle in developing the Climate Adaptation Action Plan was to focus first on feasible and "no-regret" actions.

The three to four priority actions listed in each of the programs are critical to managing climate impacts in Calgary, and lay the foundation for the rest of adaptation actions that have been identified.

Many adaptation actions identified in this plan will involve further engagement with internal and external stakeholders, which will be conducted by the Lead business unit.

Some of the adaptation actions are already underway (identified as 'ongoing'). Other actions have been newly identified based on the vulnerability and risk assessment. The City is prepared to begin implementation of some new actions immediately, with at least partial funding having been secured. The remaining new actions will require further analysis and the development of new business cases before they can proceed, or require new sources of capital or operating funding.

Environment & Safety Management (ESM) will support other City business units as they develop new business cases and detailed funding requirements for many of the new actions. Approved business cases will be submitted to One Calgary for a coordinated allocation of corporate funding through future business plan and budget updates. ESM will also track the availability of new funding sources targeted for climate adaptation projects, and provide summary information to One Calgary and Infrastructure Calgary for consideration.

PEOPLE: A city where people can thrive

Reducing Calgary's vulnerability to the impacts of climate change

Although all people will be affected to some degree by climate impacts, some groups are more at risk. Vulnerable populations, including seniors, youth and some people with chronic illnesses are all more at risk of health complications from climate impacts such as heat waves, air pollution, pests and diseases. Calgary, like other North American cities, will also see a significant increase in the number of elderly citizens over time, increasing the health impacts of climate change and putting more strain on the health care system. Some healthy adults will also be more at risk from climate risks, including outdoor workers as well as athletes and outdoor enthusiasts. For workers this may require changes to job-site practices, or even the hours scheduled for outdoor work. And for outdoor athletes and enthusiasts this may require an adjustment of training and recreational hours.

The City will need to take direct action to address health risks to citizens, particularly around air quality and heat waves. In addition, it will be important to provide education and awareness programs for citizens and businesses. Such programs will enable people to prepare themselves and take their own actions in response to climate change.

Program 1: Air Quality Management

Background

Human activities, such as emissions from vehicles and buildings, and natural events like winter inversions and wildfires all affect Calgary's air quality. The impact on human health is considered 'high risk' when the Air Quality Health Index (AQHI) rises (a number used to communicate to the public how polluted the air currently is) to 7 or greater. Air quality in Calgary is generally good, with low risk to health. However, winter inversions can trap air over the city for days, allowing contaminants to accumulate and raise the AQHI. Smoke from recent wildfires have also resulted in poor air quality in Calgary.

Why is this a priority?

The number of premature death caused by air pollution is close to 7,700 people a year in Canada. There is a moderate likelihood that climate change is increasing the number of high risk air quality events in Calgary, as high temperatures increase the production of secondary airborne contaminants (e.g. ozone), and trap air over the city. Increased heat and drought conditions during the summer will also increase the chance of wildfire smoke from British Columbia and the United States moving into Calgary.

Anticipated outcomes

- Reduced airborne emissions in Calgary from high-impact sources.
- Updated management plans to respond to high risk air quality events.

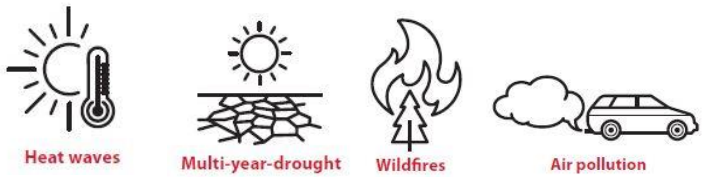
The City is already undertaking air quality management through participation on the Calgary Region Airshed Zone (CRAZ) Board, and the Clean Air Strategic Alliance (CASA) Non-Point Source Project.

Actions in this program are closely linked to the Extreme Heat Management program, as heat waves degrade air quality. Some actions in the Low Carbon Plan will also help to improve air quality in Calgary.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
1.1 Continue to collaborate across the region and province on air quality management	Environmental & Safety Management
1.2 Develop messaging and response plans, in coordination with regional and provincial agencies, to provide information to Calgarians during poor air quality events	Environmental & Safety Management
1.3 Investigate the feasibility of implementing and enforcing bylaw restrictions or fire bans on backyard fire pits and wood burning during periods of poor air quality	Environmental & Safety Management
1.4 Support the adoption of electric vehicles and alternative fuels that minimize local air pollution	Transportation

Program 2: Extreme Heat Management



Background

Calgary typically has 8 to 9 extreme heat days per year, where the temperature is over 28°C. In the summer of 2017, Calgary experienced roughly double the number of heat warnings issued by Environment Canada. As a result of climate change, Calgary is projected to experience an average of:

- 27 annual extreme heat days by the 2050s (up to 43 days), and
- 49 annual extreme heat days by the 2080s (up to 76 days).

Why is this a priority?

Heat increases health risks for seniors, young children, and people with chronic illnesses as well as athletes and outdoor enthusiasts. Extreme heat can also cause a range of minor or serious heat-related illnesses, such as heat exhaustion, rashes and heat stroke. This is of particular concern for outdoor workers, whose ability to provide services may be negatively impacted.

During prolonged heat waves in British Columbia (July 2009) and in Quebec (July 2010), public-health officials stated that there were an estimated 156 and 280 deaths, respectively, from heat-related causes. Examples such as this, point to the need for improved private and public cooling opportunities, coordinated support for vulnerable people, and updated heat management plans.

Anticipated outcomes

- Extreme heat management plans and actions are in place to support citizens and outdoor city workers.
- Priority locations are identified for implementation of cooling and shading infrastructure or programs.

Several actions under the Infrastructure Theme also help to address the impact of extreme heat on built infrastructure.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
2.1 Ensure that heat alerts reach all Calgary Housing tenants, and provide advice on how to keep cool	Calgary Housing
2.2 Develop corporate standard and procedures for heat management to support business units in the development of their own plans	Environmental & Safety Management
2.3 Install and/or enhance shade structures and water stations in public parks as a part of capital lifecycle programs	Parks
2.4 Scope out and develop an urban heat island map to identify areas vulnerable to heat extremes, and develop measures to reduce impacts on citizens and staff	Environmental & Safety Management

Program 3: Staff and Citizen Outreach

Background

Feedback from The City-led climate change engagements and focus groups has identified a desire from Calgarians for The City to take a stronger role in fostering discussions about actions individuals, communities and businesses can take to tackle climate change.

Why is this a priority?

A key prerequisite for effective climate change adaptation and mitigation is that The City, businesses, communities and individuals work together. However, much of the climate data that is available for Calgary is not readily accessible or understandable, and many of the opportunities and benefits that can result from climate change actions have not been sufficiently communicated.

The aim of this program is to engage citizens and staff in The City-led climate change decisions and to share information on managing climate risks. The program will focus is on neighbourhood and city-wide planning processes relevant to citizens and community organisations, and on promoting learning opportunities. The program also includes public education aimed at increasing understanding of climate change so that individuals and businesses can take action on their own.

Anticipated outcomes

- The City staff, Civic Partners, citizens and businesses have the resources they need to take action on climate change, enabling Calgary to adapt to more extreme weather events and long term climatic changes.

This program will be fully integrated with outreach actions contained in the Climate Mitigation Action Plan.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
3.1 Develop and implement public and internal climate change education plans	Environmental & Safety Management
3.2 Develop a Climate Action Community Toolkit, and update communications plans to share climate change information with community groups, Civic Partners and private sector organizations	Environmental & Safety Management
3.3 Support Civic Partner's strategic and business continuity planning to address climate change risks, including sharing of The City research and plans	Calgary Neighbourhoods and Recreation
3.4 Coordinate with external agencies to increase safety and security checks of seniors and vulnerable tenants during extreme weather events	Calgary Housing

INFRASTRUCTURE: The backbone of the city

Strengthening our built environment to ‘weather the storms’

Municipal services make use of a wide range of infrastructure, ranging from roadways and light rail transit (LRT) tracks to recreation centres and power distribution systems. Disruption or damage to this infrastructure can have significant impacts on both municipal services and citizen’s daily routines.

The design parameters that go into planning and building Calgary’s infrastructure are often based on historic climate and weather patterns. As the climate change intensifies, historic data is no longer a useful guide to ensure future infrastructure can withstand the impact of chronic changes or extreme weather events. These parameters must be updated to account for the latest climate projections in order to provide reliable service, and to avoid costly and frequent repairs.

Water infrastructure, including stormwater systems and water treatment plants, are particularly vulnerable to climate and extreme weather changes. As this infrastructure is critical to the health and viability of people and businesses, programs and actions specific to water are summarized in a dedicated Water Management section.

Program 4: Backup Power for Critical Infrastructure

Background

Critical infrastructure refers to facilities and equipment that are essential to providing critical services. It supports the health, safety, security, economy and overall well-being of Calgarians. The 2013 flood demonstrated how the disruption of critical infrastructure affected the community. This could range from reduced quality and strength of wireless service due to increased rainfall, all the way to a complete power outage affecting an entire community.

Why is this a priority?

For The City of Calgary, access to power is essential for maintaining services to citizens. Some facilities and infrastructure play a key role in supporting the community, such as water treatment, transportation, protective services, and public housing. Behind the scenes, data centres and repair facilities are needed as well. During some events, The City facilities are used as muster points or shelters for displaced people.

Power loss can be triggered by various types of extreme weather events. It can be a wind or ice storm bringing tree branches down on power lines, extreme heat causing a blackout, or widespread flooding damaging electrical equipment. The City should prepare for various scenarios for maintaining services.

Anticipated outcomes

- The City staff has identified the infrastructure that is most essential for continuity of service delivery.
- Back-up power requirements of these mission critical City facilities have been prioritized based on a climate change vulnerability assessment.
- Specific upgrades, new backup power systems, or plans to provide mobile power in response to power outages, have been identified in collaboration with partners.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
4.1 Assess condition of power supplies in critical City facilities with priority given to facilities serving vulnerable populations	Facility Management
4.2 Determine backup power requirements for City systems and infrastructure in preparation for cascading power losses in the event of multiple extreme weather events	All business units
4.3 Evaluate mobile power plants for Calgary Housing Corporation properties with ENMAX to protect tenants and buildings against freezing	Calgary Housing

Program 5: Design Standards and Practices

Background

The City of Calgary has a wide range of standards and practices, aligned with national or international standards, which determine the design of infrastructure projects from bridges to stormwater pipes. Additional policies and bylaws influence the design of private developments like office towers and new communities.

The City's design standards and practices are based on extensive analysis, and in some cases national or provincial requirements. However, current standards and practices generally do not consider future climate, assuming instead that past climate conditions will continue into the future. Climate change fundamentally changes that assumption; therefore design standards and practices must be updated to ensure infrastructure and services can endure future climate and extreme weather events throughout their intended service life.

Why is this a priority?

Several of the climate risks for Calgary outlined in Chapter 2 impact how infrastructure or buildings need to be designed. Some examples include:

- more intense rainfall that exceeds current stormwater infrastructure capacity and can temporarily flood buildings and roadways;
- major river floods, like 2013, that can destroy riverbanks and bridges;
- increased temperatures and extreme heat that can deform infrastructure; and
- stronger winter storms that can increase roof snow loads or knock out power.

Design standards and practices must be updated to withstand these impacts to ensure reliable service, and minimize the risk of costly repairs after extreme weather events.

Anticipated outcomes

- Expansion and maintenance of detailed climate data to inform infrastructure design decisions.
- Updated design guidelines and practices across City business units, including infrastructure design specifications, building code and other City guidelines.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
5.1 Continue to drive improved energy code for buildings with additional focus on deployment of renewable energy. Work is in consultation with Provincial authorities and industry	Calgary Building Services
5.2 Collaborate with external partners to develop regionally-appropriate climate data to inform new design standards for City infrastructure	Environmental & Safety Management
5.3 Facilitate a cross-corporate working group to scope out and determine a corporate approach to collaboratively update City design standards for buildings	Corporate Analytics & Innovation
5.4 Update design guidelines and standards for City infrastructure (such as bridges, buildings and water systems) to ensure resilience to extreme weather events and chronic climate changes	All capital investing business units and Corporate Analytics & Innovation

NATURAL INFRASTRUCTURE: The root of resilience

Maximizing the services provided by our natural systems

Natural assets such as bio-swales, forests, fields, green roofs, rivers, rain gardens, streams, wetlands and river banks can provide municipalities with essential services equivalent to those from many engineered assets. Some examples include water supply, water purification, flood protection, climate regulation, soil quality and stability, as well as providing landscaping and natural amenities for communities. Natural infrastructure can serve two different purposes, and in some situations can achieve both:

- everyday service provision (e.g. park space, water conveyance), and
- adaptation to climate change (e.g. tree canopy shading, absorption of storm water).

Some natural assets are best protected in place as native habitat, while others are designed and engineered to mimic natural function and processes. Both types of natural assets have multiple benefits, and have some ability to self-adapt to climate change. The functionality of traditional engineered assets tends to decline as they age. In contrast, with appropriate maintenance and rehabilitation, the functionality of natural assets can improve as they age and mature.

Infrastructure Canada has identified natural infrastructure as a critical element of climate adaptation and is a component of the effort to support Canada's ongoing transition to a clean growth economy. The Federal 2017 budget lays out the Government's plan to invest $12.9 Billion in natural infrastructure.

Program 6: Natural Assets Management

Background

Natural assets include prairie, wetlands, river banks, trees and other natural infrastructure that provide similar services to hard infrastructure such as water conveyance, runoff water quality treatment or shading structure. These may be naturally occurring assets, or engineered assets that mimic nature. Natural assets have additional benefits beyond traditional service delivery, including biodiversity and providing ecosystem habitat.

Current City processes do not fully account for the benefits of natural assets, putting their maintenance and protection at risk. The operation and maintenance of natural assets is also very different from the approach taken to maintaining hard infrastructure.

Why is this a priority?

Natural assets are better able to self-adapt to changes in Calgary's climate than hard infrastructure. Protecting and maximizing the use of these natural assets can also offset costly investments in new hard infrastructure, helping Calgary to efficiently manage the risk of increasingly intense storms and flooding.

In order to maximize their benefit in managing climate risks, natural assets need to be accounted for in City asset management programs, capital funding made available, and appropriate maintenance programs put in place.

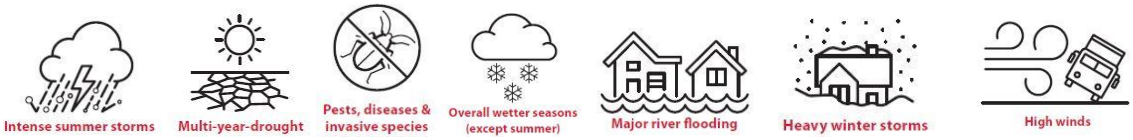
Anticipated outcomes

- A coordinated approach to conserve and enhance natural assets as part of The City's ongoing asset management processes.
- Management and protection of natural assets and systems, such as soils and stormwater.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
6.1 Continue to support and advocate for the priority protection of environmentally significant areas in accordance with the Municipal Development Plan (MDP)	Parks
6.2 Develop a formal working group to align environmental programs, develop objectives and associated instruments for integration of natural infrastructure in the urban form	Environmental & Safety Management
6.3 Develop a program to increase understanding of the value of natural infrastructure for City staff and external stakeholders	Resilience & Infrastructure Calgary Environmental & Safety Management
6.4 Integrate natural infrastructure into planning and corporate asset management	Resilience & Infrastructure Calgary Environmental & Safety Management

Program 7: Natural Assets Adaptation



Background

Based on current climate change trends, by mid-century the climate of southern Alberta is projected to become similar to Amarillo, Texas. For example, the number of extreme heat days over 28°C in Calgary is projected to increase from a current average of 9 days to 27 days per year in the 2050s and to 49 days by the 2080s on average. Although natural assets can self-adapt to climate changes better than hard infrastructure, this rate of change will still be too rapid for some local populations of species.

Why is this a priority?

If climate changes occur more quickly than some natural assets can handle, the benefits of these natural assets to Calgary may be reduced. Poorly maintained natural assets can also pose risks to Calgary. For example, unhealthy trees and shrubs pose a greater wildfire risk during extreme heat and drought conditions, or may break during extreme wind events and damage infrastructure such as power lines. In addition, natural assets under stress are more susceptible to invasive species which can be economically and ecologically damaging

Natural asset management practices from other municipalities will not necessarily work in Calgary due to local differences in soil conditions, rainfall patterns, wind and other factors. As a result, Calgary must evaluate the best approach to help at-risk natural assets either adapt to climate changes, or even to accelerate the replacement of some species with new species better suited to our future climate.

Anticipated outcomes

- Increased number of healthy, well adapted natural assets in Calgary.
- Updated planning and development practices for soil and vulnerable locations such as river banks and flood prone areas.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
7.1 Continue and expand naturalization programs for City Parks and green space	Parks
7.2 Conduct a city-wide ecological analysis to develop a plan to build the resiliency of Calgary's natural systems	Parks
7.3 Develop new guideline for soil management to provide a functional support system for healthy green spaces and natural infrastructure	Parks
7.4 Implement Riparian Action Program to protect and enhance natural river areas and wetlands	Water Resources

WATER MANAGEMENT: Every drop counts

Preparing for increasing risks of flooding, drought and declining water quality

How and *when* we receive precipitation will change. Our future water supply will be further restricted being more prone to multi-year drought conditions. Integrated watershed management will be essential to ensure a reliable, secure and high-quality water supply for Calgary. Water supply and demand will both need to be managed effectively, and water storage capacity will be an increasing priority in response to drought and other climate impacts.

The spring season and mountain snowmelt are projected to occur earlier in the year. The growing season is also expected to become longer and hotter, putting higher demands on water supply. Warming temperatures will affect water quality, impacting the ability of water and wastewater treatment facilities to meet Calgary's needs. Precipitation will fall with more intensity, increasing the risk of river flooding as well as localized flooding overwhelming the drainage systems. Flood management will also be a priority with all citizens, businesses and governments having a role to build resilience.

Program 8: River Flood Management

Background

Calgary has suffered two major flood events in recent years. In June of 2005, Calgary received what was then a record rainfall of 248 mm, resulting in flood damage to 40,000 homes costing about $75 Million. The impact of the June, 2013, flood was even more significant, with over 80,000 people temporarily evacuated from their homes, power shut off to the downtown core for a week, and over $1.72 Billion in insured losses.

With the frequency and severity of storms and flood events projected to increase, Calgary must adapt to minimize the impact of future floods.

Why is this a priority?

More intense rainfall over longer durations will increase the potential for larger river flooding events than Calgary has experienced in the past. This includes both more severe surface flooding and elevated groundwater levels that can lead to basement flooding.

The City of Calgary is already taking action to protect the communities most vulnerable to major flooding, and is working with the Province to explore upstream water storage options. Overall, Calgary is making progress to be prepared for another 2013-scale flooding event, but additional planning and investment is required to adapt to even larger flood events.

Anticipated outcomes

- Enhanced long-term vision for flood resilience in Calgary to reflect changing climate conditions.
- Aligned land use planning processes with flood risks and management practices.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
8.1 Collaborate with other levels of government to advance river flood hazard mapping to include climate change	Water Resources
8.2 Continue to work with other levels of government on upstream storage to manage both river flood and drought risks exacerbated by climate change	Water Resources
8.3 Develop flood damage reduction policies including consideration of appropriate land uses and long term management of flood protection infrastructure	Calgary Growth Strategies Water Resources
8.4 Develop cross-corporate implementation and resourcing plans for river flood response actions taking future climate extremes into account	Water Services

Program 9: Stormwater Management

Background

The projected increase of intense summer storms increases the risk that local stormwater drainage systems will be overwhelmed. This will increase potential for localized surface flooding, elevated groundwater and backup of sewer systems leading to basement flooding in different communities. It will also lead to increased pollutants entering rivers and creeks. The precise location of these storms is currently impossible to forecast, so advance warning is limited but could be improved using new technologies.

Why is this a priority?

According to the Insurance Bureau of Canada, basement flooding is the number one cause of insurable damage in Canada. This tends to be worse in older, established communities where construction of stormwater ponds to manage overland flow were not common practice at that time. The risks of flooding are increasing in areas with active redevelopment due to decreased area of permeable space to absorb water, causing more surface runoff. Increased rainfall intensity due to climate change will further increase the risk for localized flooding.

Given that more frequent and severe summer storms are a high risk for Calgary, innovative solutions to manage stormwater volumes and to incorporate natural infrastructure will be required.

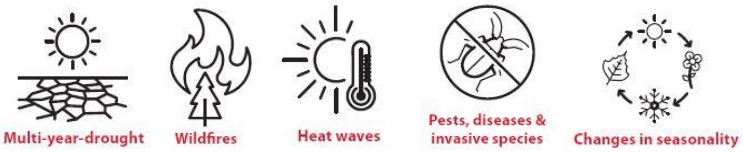
Anticipated outcomes

- Assessed design guidelines for stormwater management to deal with more intense summer storms.
- Flood warning systems and response plans in place to address more frequent localized flooding situations.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
9.1 Assess climate change impacts to rainfall intensity, duration and frequency to inform new development	Water Resources
9.2 Include climate change impacts in the development of the Stormwater Management Strategy and implementation planning to guide water management in development and redevelopment areas	Water Resources
9.3 Assess stormwater design guidelines to account for climate change in collaboration with stakeholders as part of the Stormwater Management Strategy	Water Resources
9.4 Develop localized flood warning system and response plan to proactively deploy resources to the community and to wastewater treatment facilities.	Water Services

Program 10: Long Term Water Supply



Background

A warmer global atmosphere can hold a larger amount of water vapour and can hold it for longer. This means that Calgary will be more prone to multi-year drought conditions, but when we get precipitation it will fall with great intensity and volume leading to flooding. It is both extremes of drought and flood that will be further exacerbated by climate change.

An earlier spring and warmer temperatures will result in longer growing seasons, providing opportunities for agriculture, recreation, and longer construction seasons. Warmer temperatures will also lead to rapid glacier melt decreasing the flow in mountain rivers, increases evaporation rates, and increases in river water temperatures. Collectively, these will result in decreased river water quality and volume. Therefore, the implications of long term changes to water supply and demand will need to be assessed for management of stormwater, and for operating water and wastewater treatments plants.

Why is this a priority?

Given the risk of reduced water supply during periods of peak demand, policies and programs to manage water demand across the entire Bow River watershed must be re-assessed for future climate conditions. This should include a review of water licenses, source water protection and integrated water supply management.

Citizens, business and government must work together to manage the Bow River watershed over the long-term. With climate change increasing the risk of drought, extreme temperatures and high winds, the risk of wildfires within our watershed increases and must be pro-actively managed.

Anticipated outcomes

- Advanced drought management and response plans to manage the risk of declining water supply.
- Strategic investments in water supply infrastructure and water demand management programs.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
10.1 Collaborate with other levels of government and regional stakeholders to analyze long term river flow and water quality in the Bow and Elbow Rivers	Water Resources
10.2 Advance the Drought Management Plan to enhance response tools and minimize impacts during multi-year droughts	Water Resources
10.3 Incorporate climate change in strategic plans and policies to manage long term water supply, wastewater treatment and stormwater management	Water Resources
10.4 Evaluate climate change impacts to water supply and demand to inform Water Efficiency Plan and water sustainability targets	Water Resources

GOVERNANCE: Pro-active leadership

Working together to prepare for climate change now and in the future

The City has a critical role to play in adapting to climate change and preparing the community to take appropriate actions. The City must consider the implications of Calgary's urban form and growth decisions, how services delivery needs to be modified, and the coordination of response and recovery to extreme weather events such as floods or winter storms.

A key prerequisite for effective adaptation to climate change is that The City, organizations, business associations, institutions and private individuals work together. However, many decision-makers are not yet sufficiently aware of the climate adaptation actions that are required, or the associated benefits. In addition, the available information is not easily accessible, or in some cases, understandable. This can lead to climate adaptation actions being initiated too late to ensure reliable services, or being uncoordinated and not taking into account important information. The programs and actions within this thematic area are designed to maximize the coordination and effectiveness of climate adaptation actions undertaken by The City.

Program 11: Budgeting and Investment Priorities

Background

At The City of Calgary, capital budgets are used to construct new infrastructure, or for major reconstruction of ageing infrastructure. Operating budgets are used to cover the costs for staff to operate and maintain City infrastructure and services.

Budget and investment decisions are guided by City Council goals and a variety of technical prioritization criteria. Most capital and operating prioritization processes at The City do not currently include climate change criteria to ensure that climate risks are being properly considered in budget decisions.

Why is this a priority?

In order to minimize the disruption of City services, managing the risks associated with climate change requires adequate capital and operating budgets. This Climate Adaptation Action Plan includes a number of projects (e.g. updating infrastructure design guidelines) that are specially designed to manage climate risks. Many other proposed City projects are not directly related to climate change, but would also help to manage climate risks.

Incorporating climate change criteria into budget and investment decisions will increase funding allocated to projects that manage climate risks. This should be combined with existing economic, social or environmental criteria to ensure balanced budget priorities.

Anticipated outcomes

- Leaders and project managers are aware of climate change risks and potential resilience solutions.
- Corporate and departmental risk management and budgeting processes explicitly include climate change resilience criteria.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
11.1 Advocate for amendments to current disaster funding models with different levels of government to reflect the increased climate risks	Calgary Emergency Management Agency (CEMA)
11.2 Integrate climate resilience criteria within capital budget processes and funding allocation decisions	Resilience and Infrastructure Calgary all asset owning business units Environmental & Safety Management
11.3 Incorporate monitoring and tracking of corporate climate adaptation actions into existing environmental risk management monitoring processes	Environmental & Safety Management
11.4 Enhance awareness of leadership, project managers and business planners on climate change resilience actions and investments to manage climate risks	Environmental & Safety Management Finance

Program 12: City Planning and Processes

Background

Planning and policy decisions on land use, transportation, city infrastructure and services can help to build overall resilience to climate changes. The City can tailor plans and policies for existing and future neighbourhoods to reduce the impact of extreme weather events and long-term climatic changes that are expected to affect each area. Through the policies of the Municipal Development Plan (MDP) and the Calgary Transportation Plan (CTP), it is possible to build resiliency in planning land uses, water infrastructure and transportation connections. These plans' performance indicators will allow us to track progress toward increased resilience.

Why is this a priority?

Climate change poses a long-term risk to Calgary and its citizens. Since planning and policy decisions regarding land use, transportation, and city infrastructure shape the long-term growth of the city, these decisions can also help to manage the risks associated with climate change through proactive and responsive policies and climate-resilient design choices.

Anticipated outcomes

- City plans and policies ensure that communities, neighbourhoods, infrastructure and services are designed to respond to anticipated climate changes.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
12.1 Develop or join a community of researchers and practitioners to support information sharing on the management of climate change risks	Environmental & Safety Management
12.2 Update the Municipal Development Plan and Calgary Transportation Plan to address climate risks that may impact land development and transportation infrastructure or services	Calgary Growth Strategies Transportation
12.3 Align Local Area Plans policies with areas identified by Water Resources as disaster prone and undertake consultation and policy amendments to reduce potential damage to life and goods, and manage risks	Calgary Growth Strategies Community Planning
12.4 Conduct an ongoing evaluation of City policies against climate resiliency criteria to ensure alignment	Environmental & Safety Management

Program 13: Severe Weather Response and Recovery Management

Background

During an emergency, The City of Calgary's priorities are life safety, critical infrastructure, environment, and the economy. Calgary has effectively managed extreme weather events in the past, such as the 2013 flood, and is learning from those events to enhance its ability to manage extreme weather events in the future.

Climate change acts as a risk multiplier by increasing the frequency, variability, and intensity of hazards. An expected overall increase in the number of severe weather events will put further stress on operational budgets while challenging the city's ability to provide essential services, damaging critical infrastructure, and increasing the risk of injuries/fatalities. Response and recovery from extreme weather events can be very costly in terms of repair costs and staff time. The toll on citizens' physical and mental wellbeing can be severe and linger many years after the event.

Why is this a priority?

Preparing for a likely increase in the frequency, severity, and complexity of extreme weather events requires a coordinated cross-departmental and multidisciplinary approach. While the time horizons and scope are different, there is close alignment between disaster risk reduction and climate change adaptation. Climate change exacerbates weather-induced hazards, therefore, reducing disaster risk for those hazards is also a critical component of adaptation planning. Both fields are focused on assessing risk, reducing vulnerability, increasing capacity, mitigating potential damage, and enhancing resilience in order to achieve long-term sustainability goals. There is an opportunity to align disaster risk reduction and climate change adaptation in order to ensure both activities are working towards long-term societal resilience objectives.

Anticipated outcomes

- Systematically updated disaster risk reduction strategies that consider how climate change will increase the frequency and severity of extreme weather events.
- Civic Partners are supported by The City in developing their own response and recovery plans.

Highlighted Actions

ACTION	PARTICIPATING BUSINESS UNITS
13.1 Review capacity of Calgary Emergency Management Agency (CEMA) to provide local and regional support during response and recovery from identified climate impacts	Calgary Emergency Management Agency (CEMA)
13.2 Support Civic Partners as they build internal capacity, obtain resources and develop their own adaptive actions	Calgary Neighbourhoods
13.3 Review business continuity plan and integrate identified risks of more frequent and intense extreme weather events	All business units
13.4 Integrate climate adaptation programming into disaster risk reduction strategies in order to increase resilience	Calgary Emergency Management Agency (CEMA)

Chapter 4 – Plan Implementation and Next Steps

Implementation

Climate change adaptation is a continuous process, with this plan acting as a starting point for Calgary. The majority of the actions in the Climate Adaptation Action Plan should be initiated within the next business cycle 2019-2022, except ongoing actions that are already underway. Successful implementation will require participation and engagement across all business units/service lines, as well as collaboration with community stakeholders in order to successfully achieve Calgary's climate resilience objectives. The Climate Adaptation Action Plan is a 'living document', much like an Emergency Response Plan, where future revisions of the plan are improved by accounting for new data, analysis on successful risk reduction measures and understanding thresholds for triggering certain damaging climate impacts.

The City of Calgary's adaptation actions were developed by all impacted business units through a series of stakeholder workshops, and are tailored to address Calgary-specific climate risks.

The business units identified as accountable for actions in the Plan will be leading the action implementation. The Climate Program will provide coordination among business units and deliver on selected actions on behalf of Environmental & Safety Management that are identified in the Plan. Details and prioritization of the actions may change to reflect emerging challenges and opportunities, as well as funding made available through different levels of government or partnership with the private sector and institutions.

The effectiveness of the plan implementation is dependent on the extent to which the climate risks, impacts and actions are incorporated into existing plans, policies, standards and programs (e.g. the Municipal Development Plan (MDP)). Continued research into best practices and collaboration with external stakeholders will also help to guide successful implementation of the actions that are presented in this plan.

Having identified the primary climate risks for Calgary, this Climate Adaptation Action Plan identifies actions that need to be undertaken by The City to increase the resilience of municipal infrastructure and services.

Updating the Climate Adaptation Action Plan

The City should review and evaluate the effectiveness of the Climate Adaptation Action Plan every four years to guide business planning and budget decisions, incorporating the latest climate data and an evaluation of the effectiveness of recommended actions. The review and evaluation should include:

- a summary of any observed or projected changes in climate risks,
- a report on successfully implemented actions,

- a dashboard on implementation progress of the 13 programs,
- proposed revisions to the adaptation actions or programs given the updated observations or projections,
- frequency of reaching specific impact thresholds
- identification of potential new funding sources for climate adaptation projects, and
- updated tracking of progress on the Core Climate Adaptation Indicators.

Monitoring and Reporting

The Climate Adaptation Action Plan will be updated every four years, in advance of each City business planning and budget cycle, with ongoing monitoring occurring between updates. The primary metric used to evaluate The City of Calgary's progress towards climate adaptation will be the percentage of climate adaptation actions identified that have been initiated within the recommended timeframes.

Successful adaptation means that some impacts are avoided or reduced, so it can be difficult to directly measure the effectiveness of pro-active adaptation actions against events that have been avoided or minimized. Climate adaptation indicators generally cannot be used independently, but must be combined to measure whether The City's actions are leading toward climate resilience on a city-wide scale. A set of potential climate adaptation indicators, linked to each of the program, are provided in Table 1, and these potential indicators can be used to evaluate whether The City's climate adaptation actions are achieving their desired goals. These should be reviewed further to establish a set of Core Climate Adaptation Indicators that can be reported to Council in advance of each business planning and budget cycle and evaluated to determine whether they will assist with implementation of the adaptation actions.

Due to the complexity of climate change adaptation, 13 indicators are not enough to fully establish whether The City is achieving comprehensive climate resilience. As a result, each business unit will monitor additional indicators specific to their actions to inform future business planning and budget recommendations.

TABLE 1 – POTENTIAL ADAPTATION INDICATORS

THEMES	PROGRAMS	CORE INDICATOR	METRIC
PEOPLE A city where people can thrive	1. Air Quality Management	Airborne emissions reduction	Per cent time Air Quality Health Index rated high risk (greater than 6)
	2. Extreme Heat Management	Heat waves	Per cent city area mapped as high risk of heat island effect
	3. Staff and Citizen Outreach	Climate literacy	Per cent increase in community awareness on climate adaptation Per cent of staff aware of climate projections Number of climate related partnership with partners
INFRASTRUCTURE The backbone of the city	4. Backup Power for Critical Infrastructure	Power supply for Critical Infrastructure	Per cent of City critical infrastructure with backup power
	5. Design Standards and Processes	Design Standards	Per cent of design standards updated to include climate change
NATURAL INFRASTRUCTURE The root of resilience	6. Natural Assets Management	Natural assets	Per cent of natural assets incorporated in the City's Asset Management Plans Dollars invested in natural assets
	7. Natural Assets Adaptation	Vulnerable areas	Per cent decrease of vulnerable areas Riparian health index

THEMES	PROGRAMS	CORE INDICATOR	METRIC
WATER MANAGEMENT Every drop counts	8. River Flood Management	Reduce risk, resilience	Number of properties at risk of river flooding for 1-in-2, 1-in-5, 1-in-20, 1-in-100 return period
	9. Stormwater Management	Reduce risk, resilience	Number of properties at risk of localized flooding for 1-in-2, 1-in-5, 1-in-20, 1-in-100 return period
	10. Long Term Water Supply	Reduce risk, resilience	Elbow River annual low flow (cubic metres per second (m^3/s)) Nose Creek annual low flow (m^3/s)
GOVERNANCE Pro-active leadership	11. Budgeting and Investment Priorities	Budget Integration	To be determined
	12. Urban Planning and Processes	Climate Resilience	Per cent of Local Area Plans that contain policies explicitly addressing climate risk management
	13. Severe Weather Response and Recovery Management	Business Continuity Planning	Per cent of business requirements that have an effective processes to allow business units to continue providing their services during severe weather events Total losses (in dollars) due to weather-related events incurred by The City

Energy Reporting for Commercial Buildings

EXECUTIVE SUMMARY

This report provides information on a potential energy reporting mechanism for commercial buildings, as requested through Notice of Motion NM2017-35 (Attachment 1).

Energy reporting for large buildings is a key enabling activity for the reduction of energy use, energy costs, and greenhouse gas emissions in the building sector. Commercial buildings spend approximately $420 Million per year on energy, and contributed 39 per cent of Calgary's community-wide greenhouse gas emissions in 2017.

Cataloguing of information and benchmarking of building performance for comparison has been shown to motivate building owners to pursue energy efficiency upgrades. Industry supports a voluntary energy benchmarking program for commercial buildings as long as the program is delivered throughout the community at the same time, and the program applies to both new and existing buildings equally.

This report provides an overview of options explored to implement energy reporting in commercial buildings. The recommended option is a three-year pilot, with no financial incentives provided, and with voluntary participation.

ADMINISTRATION RECOMMENDATION:

That the Standing Policy Committee on Utilities and Corporate Services recommends that Council receive this report for information.

PREVIOUS COUNCIL DIRECTION / POLICY

An amended Notice of Motion (NM2017-35) was carried on 2017 September 11, directing Administration, in consultation with stakeholders, to develop an energy reporting mechanism for commercial buildings, and return with a scoping report on energy efficiency to Council through the Standing Policy Committee on Utilities and Corporate Services, no later than Q2 2018.

Energy reporting for buildings relates to Council priorities laid out in "Action Plan 2015-2018". The priorities include strategic actions under "A Healthy and Green City":

- **H2:** Encourage a broader range of innovative and clean energy technologies
- **H6:** Continue to build public awareness and understanding of our shared responsibility to conserve and protect the environment
- **H10:** Lead by example and manage regulatory risks to protect public health and the environment

These Council priorities remain consistent in the 2019-2022 plan under One Calgary. An added focus for "A Healthy and Green City" in 2019-2022 is to address climate change in a way that levers incentives that focus on the economic benefits of addressing climate change.

BACKGROUND

Energy consumption in commercial, industrial, and institutional buildings in Calgary is valued at approximately $420 Million annually. The non-residential buildings sector also represents the largest contributor (39 per cent) to Calgary's greenhouse gas emissions.

Energy Reporting for Commercial Buildings

Action on decreasing emissions from the buildings sector is being driven from the federal government through the "Pan-Canadian Framework on Clean Growth and Climate Change" published in 2017. The Pan-Canadian Framework indicates that "Federal, provincial, and territorial governments will work together with the aim of requiring labelling of building energy use by as early as 2019".

The City can play a key role to support and advise building owners and managers on energy use and cost reduction opportunities. Energy reporting has been identified by the building industry as an effective program to support energy efficiency.

INVESTIGATION: ALTERNATIVES AND ANALYSIS

A barrier to improving energy efficiency in buildings is the lack of information on energy performance. A starting point to address this barrier is energy benchmarking, which means comparing the energy performance of a building against similar buildings.

The de-facto standard software used in North America for large building energy benchmarking is Energy Star® Portfolio Manager. This free software was developed by the US Environmental Protection Agency, and has been revised for the Canadian context and made available for free through Natural Resources Canada.

Portfolio Manager is a secure online tool that allows building owners to input their building's local climate, space use, occupancy and other data for comparison to similar buildings. Building owners find value in using Portfolio Manager for a variety of reasons, including:

- Tracking energy usage year-over-year to highlight anomalies
- Comparing building performance against similar buildings outside the organization
- Prioritizing the list of energy efficiency projects across all buildings
- Verifying results of energy efficiency projects

Portfolio Manager is already successfully being used in Calgary, Edmonton, Toronto, Vancouver and other cities across North America. Natural Resources Canada confirmed that significant numbers of industrial, commercial, and institutional buildings in Calgary over 20,000 square feet already use Portfolio Manager as a benchmarking tool. Based on floor area, the number of large buildings in Calgary reporting their energy use to Portfolio Manager include:

- 225 buildings (of a total of 2,008) between 20,000 square feet and 50,000 square feet
- 200 buildings (of a total of 889) between 50,000 square feet and 100,000 square feet
- 425 buildings (of a total of 685) above 100,000 square feet

This voluntary action by 23 per cent of buildings in Calgary over 20,000 square feet indicates there is interest from the building industry in energy benchmarking programs. The Building Owners & Managers Association (BOMA) indicated that buildings that report energy use see an average of 15 per cent energy reduction over the next three years of reporting.

Energy Reporting for Commercial Buildings

Program Design Options

Option 1: Basic Option

The City of Calgary could be involved in commercial building energy benchmarking by providing a link to Natural Resources Canada's Portfolio Manager on Calgary's municipal website. This option would not likely raise awareness significantly.

Option 2: Voluntary Energy Benchmarking – no financial incentives

A step above the basic option would be to develop a voluntary program that actively engages the building owner and operator community. This would include: hosting workshops to demonstrate how to use the Portfolio Manager software, helping owners if they run into problems, and publishing an annual summary report. The City of Calgary would lead by example by benchmarking municipally owned buildings.

Option 3: Voluntary Energy Benchmarking – financial incentives

The City of Calgary could offer financial incentives to attract participants to the program. The City of Edmonton, for example, offers 25 grants of $5,000 each year towards energy audits in their voluntary program called the "Large Building Energy Reporting and Disclosure Program". Edmonton's program is run by an external company, and a project manager from the City of Edmonton oversees the program.

Option 4: Mandatory Energy Benchmarking

A mandatory energy benchmarking program designed and run by The City would require the highest level of involvement. The program could be linked to existing municipal bylaws, such as adding a rider to the Building Maintenance Bylaw (Bylaw Number 33M2016) to compel owners of commercial buildings to have an account on Portfolio Manager and submit their utility data with their next facility inspection report. A mandatory municipal program would require a database to track compliance, and a system to enforce compliance, increasing resourcing costs.

Recommended Option

Option 2, Voluntary Energy Benchmarking without financial incentives, is preferred. This approach is built on highlighting potential energy cost savings and environmental benefits rather than being compliance driven. Option 2 could be piloted through a three-year voluntary program targeting progressively smaller buildings each year. The next steps for the program after the initial three-year voluntary phase would be assessed at the conclusion of the third year.

Energy Reporting for Commercial Buildings

Stakeholder Engagement, Research and Communication

This report was developed in consultation with stakeholders active at both the local and national levels. Interviews were conducted with other municipalities across Canada (Edmonton, Vancouver, Saskatoon, Toronto), federal government agencies (Natural Resources Canada), and key local stakeholders including building owners and operators (BOMA, the Calgary Board of Education, Strategic Group, First Capital, Mount Royal University, SAIT, the University of Calgary), the building development industry (BILD Calgary Region, Scott Builders, Remington Development Corp.), the Association of Energy Engineers Calgary Chapter, and local utilities (ENMAX, ATCO). The responses from stakeholders tended toward several common themes:

There was support for an energy benchmarking program for commercial buildings in Calgary that would be applied uniformly across the city without geographic staging. Key outcomes of this engagement include:

- The building industry supported the idea of phasing-in a voluntary energy benchmarking program over a number of years based on floor area. Large buildings (100,000+ square feet) would be engaged first, and smaller buildings (50,000 square feet, and then 20,000 square feet) would be engaged in subsequent years.
- If energy reporting is to be a mandatory requirement, then industry advised that the program should be accompanied by financial incentives.
- There was a desire to work collaboratively with The City on program design.

Strategic Alignment

Addressing climate change is a Council priority in the 2019-2022 One Calgary plan. Energy benchmarking for commercial buildings is a key action that The City can take to engage the buildings industry in reducing energy use, operational costs, and greenhouse gas emissions. By implementing a program, The City would help to prepare industry for mandatory energy reporting requirements, which are likely to be imposed by the federal government between 2019 and 2026.

Energy benchmarking is an action included in Calgary's "Climate Resilience Strategy and Action Plans" (UCS2018-0688) and supports the economic diversification goals in the Green Buildings sector, as described in Calgary Economic Development's recent report entitled "Green Energy Economy" (2016).

Social, Environmental, Economic (External)

Statistics collected by BOMA indicate that when building management reports energy use into a benchmarking program, they achieve energy and cost savings in subsequent years by pursuing continuous improvement in energy efficiency. Reducing energy use also reduces environmental impact through decreasing greenhouse gas emissions.

Financial Capacity

Current and Future Operating Budget:

The City of Calgary does not have an energy benchmarking program or operating budget. This work, if approved, would be included in Calgary's Climate Resilience Program in the 2019-2022 budget cycle.

Energy Reporting for Commercial Buildings

Current and Future Capital Budget:

There will be no impact to current or future capital budget.

Risk Assessment

Cities that focus on energy efficient buildings may be more attractive places to set up offices for innovative companies. There is also a reputational risk if The City is not seen to be taking action on reducing community-wide greenhouse gas emissions, or failing to help the buildings industry prepare for upcoming mandatory energy reporting requirements arising from higher levels of government.

REASON(S) FOR RECOMMENDATION(S):

This report is intended to provide information on a potential energy reporting mechanism for commercial buildings, as requested through Notice of Motion NM2017-35.

ATTACHMENT(S)

1. Attachment 1 – ENERGY REPORTING FOR COMMERCIAL BUILDINGS COUNCIL NM2017-35

THE CITY OF
CALGARY
CITY CLERK'S OFFICE

NM2017-35
NM
RECEIVED

2017 AUG 31 AM 9:46

THE CITY OF CALGARY
CITY CLERK'S

NOTICE OF MOTION

CC 661 (R2009-05)

2017 09 11

RE: ENERGY REPORTING FOR COMMERCIAL BUILDINGS
Councillor Pincott

WHEREAS, The City of Calgary has a responsibility to protect our economic engine by supporting our local businesses;

AND WHEREAS, the cost to Calgarians to supply energy to commercial buildings was half a billion dollars, as last reported in 2011;

AND WHEREAS, Calgary is home to many innovators in building science, who are embracing energy savings measures;

AND WHEREAS, commercial building owners who invest in energy saving technologies should have a standardized means for the energy efficiency of their building to be recognized;

AND WHEREAS, commercial tenants, especially small businesses, should be able to have a clear understanding of their energy costs;

AND WHEREAS, many of the sustainable building measures currently used do not provide a clear picture to tenants as to the direct energy benefits of the technologies and techniques employed;

AND WHEREAS, the industry itself has indicated that a standardized reporting would be extremely beneficial,

NOW THEREFORE BE IT RESOLVED that Council direct Administration, in consultation with stakeholders, develop an energy reporting mechanism for commercial buildings, and return to Council through the Standing Committee on Planning and Urban Development, no later than Q4 2018.

Signature of Member(s) of Council

Pay-as-you-throw Program for Residential Black Cart Collection

EXECUTIVE SUMMARY

The rollout of the Green Cart residential composting program in 2017 provided Calgarians with a full suite of residential diversion programs, enabling Calgarians to minimize the amount of garbage they put-out in their black carts. A pay-as-you-throw (PAYT) program will allow residents to right-size their black cart and therefore be financially accountable for the garbage they produce.

A municipal scan of four Canadian and four American municipalities identified a wide range of program options and key learnings including: most variable cart programs also have a tag-a-bag component (pay for excess garbage set-out for collection); as the number of choices provided to residents increases, so do program costs; and PAYT programs have mixed impacts on diversion rates, and can increase the potential for contamination within recycling and organics programs.

In order to balance the trade-off between increasing customer choice and higher program costs, Waste & Recycling Services (WRS) is recommending a PAYT program that includes a choice of three black cart sizes (120L, the current 240L, and 360L) and a tag-a-bag program for occasional excess garbage placed outside the black cart.

If approved by Council, the next step towards a PAYT program is the development of a detailed implementation plan, which will be brought back to Council Q2 2019. If approved, the proposed rollout of a PAYT program would occur in 2020.

ADMINISTRATION RECOMMENDATION:

That the Standing Policy Committee on Utilities & Corporate Services recommend that Council direct Administration to develop a detailed implementation plan for a pay-as-you-throw program that includes three black cart sizes and a tag-a-bag program and report back no later than Q2 2019.

PREVIOUS COUNCIL DIRECTION / POLICY

In 2014, the Collection Service Delivery Review (UCS2014-0262) presented third-party recommendations on operational performance and fleet management. One of the recommendations was for WRS to no longer allow residents to set-out excess material beyond what fits in the black cart container provided, or to implement a tag-a-bag system where residents must pay to set-out excess material.

On 2018 May 28, Council approved the Waste & Recycling Services Outlook for 2018 to 2025 (UCS2018-0153). The key trend identified in this report was Increasing Customer Expectations. One of the initiatives identified to respond to this trend was to provide options for residential customers through a variable pricing program that would allow residents to choose a black cart size option and an opportunity to pay for occasional excess materials outside the black cart. Pricing, education and enforcement were also identified in this report as a step towards 70 per cent waste diversion by 2025.

BACKGROUND

With the rollout of the Green Cart Residential Composting Program in 2017, Calgary implemented a full suite of residential diversion programs, enabling Calgarians to minimize the amount of garbage they put out in their black carts. A PAYT program will allow residents to right-size their black cart and therefore be financially accountable for the garbage they produce.

Pay-as-you-throw Program for Residential Black Cart Collection

PAYT is a program where residents pay for the amount of garbage they put out. Typical PAYT programs include a choice of black cart size, and a requirement to pay for excess garbage set out for collection using either City-branded bags or tags for each extra bag (tag-a-bag), or a combination of both. WRS is proposing implementing a PAYT program in 2020, following Council approval.

INVESTIGATION: ALTERNATIVES AND ANALYSIS

A PAYT program introduces choice to residential customers. Not all households produce the same amount of garbage and, not all households require the same level of service. Customers prefer to be charged for the level of service they require and a PAYT program allows residents to make decisions to divert more material or generate less waste to lower their service costs. This typically results in a higher level of customer satisfaction.

In considering a Black Cart PAYT program, WRS developed four program objectives:

1. Provide residential customers choice in black cart size;
2. Minimize program costs and residential customer rates;
3. Minimize blue and green cart contamination; and
4. Promote waste diversion and reduction.

A scan of other municipalities shows a wide range of program options (Figure 1). The key learning from reviewing programs in other municipalities is that as the number of choices provided to residents increases, so do program costs.

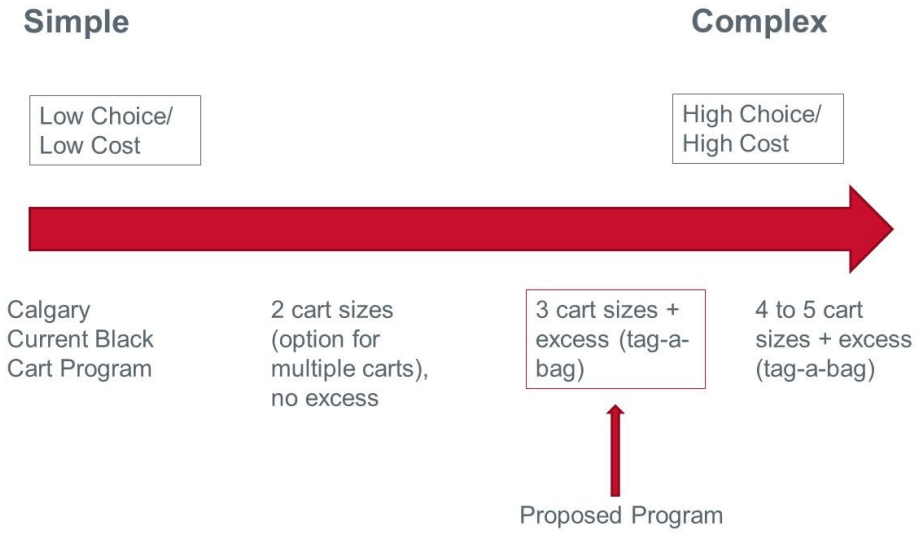


Figure 1: Range of Pay-as-You-Throw Options Investigated

Pay-as-you-throw Program for Residential Black Cart Collection

The PAYT Program scan included four Canadian and four American municipalities (cities of Coquitlam, Toronto and Vancouver, Region of Peel, and cities of Grand Rapids, Minneapolis, Portland and San Francisco). Detailed summaries for each municipality are included as Attachment 1. Key findings include:

1. Customers were often offered a choice of cart size when automated collection was implemented, minimizing costs.
2. Tag-a-bag programs are commonly offered to residents to manage excess waste.
3. Increasing the number of cart sizes available increases program costs in terms of inventory management, cart maintenance and switching carts.
4. The impact of a PAYT program on diversion is mixed. Some municipalities experience increased diversion rates, while others experience increased contamination in their diversion programs.

Calgary faces a couple of challenges in implementing a PAYT program. The first is managing Calgary's existing inventory of 240L black carts. The second is that Calgary's Black Cart Program is largely comprised of fixed costs (73%), with 27% of the rate accounting for the handling and disposal of the garbage. Based upon WRS' new rate model and the indicative rates for 2019 this equates to a pricing window of approximately $6.75 to $6.85 per month for residential customers in 2019 for the current single-sized black cart program. Adding additional black cart size options for residents will increase the overall program costs. With program approval, WRS will undertake a financial evaluation and develop a pricing structure for the variable cart program for Council's approval during the 2019 budget adjustment process.

In order to balance the trade-off between increasing customer choice and higher program costs, WRS is recommending a PAYT program that includes a choice of three black cart sizes (120L, the current 240L and 360L). It is further recommended that a tag-a-bag program be implemented at the same time as the roll out of the variable cart program. Combining a choice of black cart size with a tag-a-bag program allows the resident to choose the cart size that meets their needs most of the time and provides an outlet for the occasional extra bag placed outside the cart.

Rollout of a PAYT program will be a significant undertaking that will require development of a detailed implementation plan.

Elements of this implementation plan will include:

- Developing tools and resources to help residents make an informed decision about appropriate cart size;
- Citizen engagement to understand the potential demand for each of the three black cart sizes;
- Developing a process to connect with residents who want a different cart size;
- Undertaking a financial evaluation and developing a pricing structure for the program;
- Developing a pricing structure and distribution plan for either bags or tags; and
- Ongoing management of the existing inventory of 240L black carts.

Program cost considerations include:

- Cart purchase, inventory tracking, and management;
- Printing and distribution of tags or bags; and

Pay-as-you-throw Program for Residential Black Cart Collection

- Education and enforcement options to mitigate the potential for increased contamination to the blue and green cart programs.

Stakeholder Engagement, Research and Communication

Calgarians will require access to information, tools and resources in order to choose the appropriate black cart size that will meet their needs for most collection periods and enable WRS to purchase the right number of small and large black carts. WRS will present these details to Council as part of the implementation plan in 2019 Q2.

Strategic Alignment

The Leadership Strategic Plan includes commitments to strengthen The Corporation's financial position. Action Plan 2015-2018 includes Strategic Action W2 – Be as efficient and effective as possible, reducing costs and focusing on value-for-money and related Business Unit Action W2.1 – Continually improve on plans and practices to manage financial health.

Social, Environmental, Economic (External)

Social

Diverting materials from landfill requires changes in behaviour by residents, industry and businesses. A PAYT program will allow residents to right-size their black cart and be financially accountable for the garbage they produce.

Environmental

A PAYT program provides an incentive to residents to optimize the diversion of waste from their black cart. Diverting waste reduces greenhouse gas emissions, redirects natural resources back into the economy, reduces environmental liability, and increases the life of landfills.

Economic (External)

Implementing a variable black cart program will allow residents to choose a black cart size that matches the amount of garbage they produce and to be charged for the service they receive.

Financial Capacity

Current and Future Operating Budget:

There is no impact on WRS' 2018 operating budget. If approved, the PAYT program will impact WRS' One Calgary 2019-2022 operating budget. Program implementation and sustainment costs will be reported back as part of the 2020 Budget Adjustment Process (2019 November).

Current and Future Capital Budget:

This report does not impact WRS' 2018 capital budget. Implementation of a variable cart program, if approved, will require the capital purchase of additional sizes of carts. Assuming that fewer than 50 per cent of residents choose a different black cart size, the estimated total cost is approximately $10 million. Cart purchases following implementation will be included in the growth plan for all cart based residential services.

Pay-as-you-throw Program for Residential Black Cart Collection

To streamline the purchase of additional black cart sizes, WRS can include alternate cart sizes in the existing procurement plan for 2019. To take advantage of this opportunity, WRS needs to include the capital budget for various carts in WRS' infrastructure investment plan (WRIIP) as part of One Calgary 2019-2022 service plans and budgets. Carts will not be purchased without Council's approval of the full implementation plan.

Risk Assessment

There is a risk that if a significant proportion of residents choose a small cart (120L), the price differential between the small and medium size cart might not meet their expectations for a low cost option.

Residents who generate more waste will be paying more and may not have budgeted for the expense.

There is a risk that some customers may choose the smallest black cart option based upon cost alone and dispose of additional garbage by putting it in their blue or green cart, resulting in additional contamination and costs for those programs.

REASON(S) FOR RECOMMENDATION(S):

To balance increasing customer choice and increased program costs, WRS is recommending three black cart sizes (120L, the current 240L, and a larger 360L) and a tag-a-bag program for occasional excess garbage placed outside the black cart.

ATTACHMENTS

1. Attachment 1 – Municipal Scan of Pay-As-You-Throw Practices
2. Attachment 2 – Presentation

WASTE & RECYCLING SERVICES

MUNICIPAL SCAN OF PAY-AS-YOU-THROW PRACTICES

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

Pay-as-you-throw (PAYT) refers to an approach where customers are charged based on waste collected from their homes/ sites. It can be implemented in different ways, with most municipalities choosing program elements best suited to their priorities and needs.

This report provides an overview of PAYT programs offered in other municipalities. The municipalities included represent a wide range PAYT programs. However, there are some consistent learnings from these programs. Most municipalities introduced a variable cart program in conjunction with rolling-out automated collection, which saves money at the time of implementation. Also, most have a tag-a-bag program which is a requirement to pay for excess garbage set out for collection using either City-branded bags or tags for each extra bag. One critical learning is that as the number of cart sizes that residents can choose increases, so do program costs. The third key learning was that some municipalities have experienced increased diversion rates, while others have experienced significant increases in contamination in their diversion programs.

These key learnings have informed the PAYT program recommended for Calgary.

2. INTRODUCTION

This document summarizes findings from an external scan of select municipalities with PAYT programs for residential solid waste collection. Information included in this report is based on:

1. A technical memo provided to Waste & Recycling Services (WRS) by Tetra Tech in 2015;

2. A review by WRS for recent updates from the municipalities included in the 2015 technical memo; and

3. A scan of two additional municipalities in Canada (City of Toronto and Region of Peel) conducted by WRS.

2.1 BACKGROUND

PAYT refers to an approach where customers are charged based on waste collected from their homes/ sites. It can be implemented in different ways, with most municipalities choosing program elements best suited to their priorities and needs. A summary of the most common programs are presented below:

1. **Variable Cart Number/Size**: In this system, residents select a specific size and/ or number of containers for their standard collection period.

2. **'Bag and/or Tag-a-Bag'**: Customers purchase bags customised with a municipality's or hauler's logo or tags for their garbage bags. The price of the bag/ tag may recover some or all of the cost of

collection and disposal. For convenience, bags/tags are usually sold online, at convenience and grocery stores and/ or at municipal facilities.

3. **Hybrid Programs**: Customers only pay for waste if they exceed a specified 'base' set-out volume (typically a first cart and/or bag of garbage) . Any waste additional to this fixed fee amount is charged on a per cart/bag/tag system, as described above. This system is a "hybrid" between historical garbage programs and the new incentive-based approach, and minimizes billing and collection changes.

4. **Weight-Based**: With this method, disposal cans or carts are weighed by retrofitted collection trucks, and the customer is charged based on the weight of waste collected. This system is more equitable, and tends to provide a strong diversion incentive. Some studies have shown that weight-based systems can decrease waste disposed by up to 20% more than volume-based[1].

5. **Set-Out Systems**: Customers only set-out their carts when they have waste/recycling/composting that needs to be picked-up. They are charged a set fee for pick-up only if they set-out their cart or bag for collection.

6. **Other Variations**: Waste drop-off programs, charging by the bag, punch cards or other customer tracking systems are also being used in some communities, particularly rural areas[2].

There are two intended outcomes of implementing a PAYT program for The City:

1. With The City moving to a customer-centric, service-based model, a PAYT program gives the customer flexibility in choosing the level of waste collection and disposal service they need from The City.

2. This approach also supports our 2025 waste diversion goal. One of the benefits of implementing a PAYT program is that it can be an influencing factor to changing customer behavior, diverting more materials from our landfills by reducing the amount of waste generated, and increasing recycling and composting.

[1] Dahlen, Lisa, et al. "Pay as you throw: Strengths and weaknesses of weight-based billing in household waste collection systems in Sweden." Waste Management 30 (2010): 23-31. (http://www.researchgate.net/publication/38014779_Pay_as_you_throw_strengths_and_weaknesses_of_weight-based_billing_in_household_waste_collection_systems_in_Sweden)
[2] Skumatz & Freeman – PAYT in the US: 2006 Update and Analyses; Funded by USEPA OSW and SERA; December 2006.

3. PAY AS YOU THROW IN OTHER MUNICIPALITIES

This section summarizes how some Canadian and American municipalities have implemented variable pricing. Municipalities covered in the report include:

Table 1: Municipalities reviewed as part of the PAYT municipal scan

Canada	USA
City of Coquitlam	City of Grand Rapids
City of Toronto	City of Minneapolis
City of Vancouver	City of Portland
Region of Peel	City of San Francisco

Additional information on variable pricing in these Canadian and American municipalities is provided in Appendix 1 and 2 respectively.

3.1 CITY OF COQUITLAM

The City of Coquitlam (Coquitlam) implemented a variable cart program program in conjunction with automated collection and every-other-week garbage collection in 2014.

Customers have the option to choose from three cart sizes (120L, 240L and 360L) for both garbage and organics. 240L is the standard cart size offered by Coquitlam. During rollout of this program in 2014, residents were allowed to change their carts for free once and charged $50 for subsequent changes. Most residents did not change their cart from the standard size offered. Coquitlam does not allow for extra bags of garbage to be set out for collection. There is also a weight limit on the contents of each cart size. Coquitlam allows collection of extra yard trimmings in bags or old garbage cans at no cost.

Garbage is collected every-other-week, while recycling and organics are collected weekly. Recycling services are provided by Recycle BC, the operator of British Columbia's Extended Producer Responsibility (EPR) program. Recycle BC is a non-profit organization responsible for residential recycling in the province. It is funded primarily through retailers and manufacturers. That is, program costs are covered by the producers of the goods/packaging, not residents. The waste collection fee is only charged for the garbage cart. Organics and recycling are considered no cost services.

At implementation, Coquitlam's overall diversion rate increased by 8% in a single year compared to the previous four years when diversion rate increased by less than one per cent.

3.2 CITY OF TORONTO

The City of Toronto (Toronto) introduced a PAYT program in conjunction with automated cart collection in 2008.

Residential customers have the option to select from four garbage and recycling cart sizes (75L, 120L, 240L and 360L) and one size for organics (100L). 120L is the standard cart size offered for garbage. The fees paid by residents depends on the size of their garbage cart. Customers are charged a $23.40 fee to switch to a bigger garbage cart, however, switching to a smaller garbage cart or any recycling cart is free. Toronto also allows customers to tag and put out extra bags of garbage, subject to a weight limit of 20kg per bag. Toronto previously sold garbage bags in addition to garbage tags, but has since stopped the sale of garbage bags. Customers may also request an additional garbage cart, however this is not common practice. Residents are also allowed to put out excess recycling, which is picked up for free. Food waste is collected and processed separately from yard waste, with food waste collected in green bins while yard waste is collected in paper bags.

Garbage and recycling are picked up every-other-week, while organics are picked up weekly. Yard waste is collected every other week from mid-March to mid-December and Christmas trees are collected in January. The fee for waste management is applied on the garbage cart only.

The link between the PAYT program and increased waste diversion in Toronto cannot be determined at this time. However, there has been a significant increase in contamination in their recycling program after variable cart pricing was introduced. This was possibly a result of residents placing extra garbage that will not fit in their garbage cart into their recycling carts.

3.3 CITY OF VANCOUVER

The City of Vancouver (Vancouver) introduced a variable cart program in conjunction with automated collection in 2005.

Customers were allowed to choose from five cart sizes for garbage (75L, 120L, 120L, 240L and 360L) and four cart sizes for organics (120L, 180L, 240L and 360L) during rollout of the automated carts. The annual cost of garbage collection is linked to the size of cart. Customers are also allowed to switch their cart sizes for free once a year and are charged $25 if they request an additional switch in the year. In addition to the flexibility offered with the cart sizes, Vancouver also allows customers to put out extra bags of garbage if needed, provided an “extra garbage sticker” is purchased and placed on each extra bag.

Garbage is collected every-other-week, while organics and recycling are collected weekly. Like Coquitlam, recycling services for Vancouver residents are provided by Recycle BC, the operator of British Columbia’s EPR program.

The link between PAYT and increased waste diversion in Vancouver cannot be determined as it was implemented with other programs such as automated collection containers and the green bin program.

3.4 REGION OF PEEL

The Region of Peel (Peel) introduced both variable carts sizes and alternating every-other-week garbage and recycling collection in 2015. Peel does not have variable pricing as waste collection in Peel is tax funded.

Customers have the option to choose from three cart sizes (120L, 240L and 360L) for both garbage and recycling, while 100L carts are offered for food waste. The standard cart sizes offered are different for each type of residential dwelling: 360L is the standard for single family homes; 240L for semi-detached homes; and 120L for row/town homes. 90 days after the initial rollout of variable carts, residents were allowed free cart exchanges. Subsequent cart exchanges cost $25. Peel also allows residents to set out extra garbage for collection, provided a tag is attached to the extra garbage bag and it meets weight and size limiations. There are also "exemption periods" when excess garbage is collected for free with no limit set on the amount of excess. There is no limit on the amount of yard waste provided it is set-out in paper bags or plastic containers. Residents are also allowed to request an extra cart for recycling.

Garbage and recycling are collected alternately every-other-week, while organics (food and yard waste) are collected weekly.

There has been a significant increase in recycling contamination with variable cart sizes. Currently Peel's recycling contamination is approximately 20 per cent and the region is investigating enforcement approaches.

3.5 CITY OF GRAND RAPIDS, MICHIGAN

The City of Grand Rapids (Grand Rapids) started a PAYT program in 1973. In 2012, Grand Rapids transitioned from a fixed collection schedule to a variable cart set-out program for garbage collection, which allows customers to set out their garbage cart only as needed on collection day. With this model, the carts are tracked by a Radio Frequency Identification tag (RFID), which links customer cart sizes to the customer account.

Grand Rapids currently offers customers a choice from three cart sizes for garbage (120L, 240L, 360L), two cart sizes for recycling (240L and 360L), while a 360L cart is offered for yard waste. Customers are allowed one free cart swap every year and are charged an extra $15 for any additional change requested. Grand Rapids does not offer a residential green cart program. Grand Rapids collects excess garbage and yard waste through the use of City-branded bags that customers can purchase.

Garbage is collected weekly, while recycling is collected every other week. Yard waste is also collected weekly, but only on a seasonal basis. Residents pay for garbage and yard waste collection, but recycling collection is offered at no additional cost to the customer. Customers are required to set-up and pay into an account with Grand Rapids for waste, recycling or yard waste and this account is debited each time their garbage or yard waste cart is tipped (the price for waste collection is per tip). The truck has a stopper that prevents carts from being tipped when the account balance is zero. Customers are responsible for managing their account balance.

While Grand Rapids has had success with this option from a garbage reduction and waste diversion standpoint, it has also had some challenges with its costing and revenue forecasting for the variable cart set-out program which include; balancing fixed operating costs of driving the trucks for garbage collection every week with the number of carts set out weekly.

3.6 CITY OF MINNEAPOLIS, MINNESOTA

The City of Minneapolis (Minneapolis) implemented a PAYT program and automated cart collection in 1995.

Customers can choose between two cart sizes for garbage (120L and 360L) and one standard size for organics depending on the number of dwelling units per property (120L for two dwelling units or less and 240L for more than two dwelling units). Minneapolis offers a 360L cart as a standard cart size for recycling, but also has 240L size carts for customers who prefer a smaller cart size. Yard waste is collected separately from organics either in paper bags, compostable bags or reusable containers. Customers are allowed to set out extra bags of garbage and recycling, however there is a limit on the amount of material per set out (garbage: up to two bags and recycling: up to one box or bag). For organics, only two pizza boxes can be set out as excess and occasional excess of other organic items can be taken to a drop off location. If customers consistently set out excess materials for any of the carts, they receive an additional cart and their monthly fee is revised to include fees for the additional cart.

Garbage is collected weekly, while recycling and organics are collected every-other-week. Minneapolis recently began yard waste collection which is collected weekly. Waste collection rates are charged only on garbage, but includes the costs for organics and recycling.

3.7 CITY OF PORTLAND, OREGON

Unlike other municipalities, The City of Portland (Portland) operates a franchising system with private haulers that service Portland through a subscription service. The haulers introduced a PAYT program in 1992 through manual collection before implementing variable cart sizes and a food scraps collection program in 2008-2009.

Portland provides customers with four cart sizes for garbage (75L, 130L, 230L and 340L) and one cart size for organics and recycling (230L). Some customers still use cans.

Portland has every-other-week garbage collection (implemented in 2011) and an every-four-week collection option for customers using the 130L cart. The every-four-week option was originally intended to give low generators a way to have less frequent garbage collection. However, there are challenges with truck routing when materials are collected so infrequently. Portland and haulers would prefer to phase out the every-four-week collection; however, it remains due to the political support for reduced frequency of service. All of their program costs are recovered through the charge on garbage.

After implementing every-other-week garbage collection in 2011, garbage generation was initially reduced by 38%. As of 2015, Portland had a 70% diversion rate.

3.8 CITY AND COUNTY OF SAN FRANCISCO, CALIFORNIA

The City and County of San Francisco (San Francisco) implemented a PAYT program in 1989 with manual collection. Automated collection carts were introduced in 1997 as a pilot program, with a full program roll-out between 1999 and 2001. All of San Francisco's waste collection services are provided by their legislated hauler, Recology.

Customers are provided with standard cart sizes for garbage (60L), recycling (240L) and organics (120L) respectively. Customers also have the option to choose from three additional black cart sizes (120L, 240L and 360L), and two additional blue cart sizes (240L and 360L), depending on their needs. To encourage garbage reduction and waste diversion, the standard garbage cart sizes were reduced in 2017 from 75L to 60L, while the recycling cart size was increased from 120L to 240L. Customers are allowed to set-out extra recycling, however the hauler may charge additional fees for this service.

Garbage, recycling and organics are collected weekly. The waste collection fee for garbage is higher compared to recycling and organics. In addition to the waste collection fee, an "Excess Trash Premium" is charged on the 240L and 360L garbage cart sizes.

Waste diversion increased following the roll-out of the three-cart program, however it is not clear if the diversion rate increased as a result of introducing variable cart sizes.

4. SUMMARY

There are three key learnings from reviewing PAYT programs in other municipalities.

1. Most municipalities introduced a variable cart program in conjunction with rolling-out automated collection, which saves money at the time of implementation. Also, most have a tag-a-bag program.
2. As the number of cart sizes that residents can choose increases, so do program costs in terms of inventory management, cart maintenance and switching carts.
3. The impact of a PAYT program on diversion is mixed. Some municipalities have experienced increased diversion rates, while others have experienced significant increases in contamination in their diversion programs.

These key learnings have informed the PAYT program recommended for Calgary.

APPENDIX 1: VARIABLE PRICING IN SELECT CANADIAN MUNICIPALITIES

Municipality	Coquitlam, BC	Toronto, ON	Vancouver, BC	Peel, ON
		General Information		
Service(s) Provided	Waste/Recycling/Food-Yard	Waste/Recycling/Food-Yard	Waste/Recycling/Food-Yard	Waste/Recycling/Food-Yard
Hauler	Contractor	City	City (garbage and organics), Recycle BC (recycling)	Region
Variable Carts	Y	Y	Y	Y
Variable Set-Out/Subscriptions	N	N	N	N
Billing Structure	Utility Tax	Utility - Monthly/Quarterly Billing and Annual Tax Rebates	Property Tax	Property Tax (No Variable Pricing)
Cart Change Policy	$50 per change	$23.40 per change to a larger cart size. No fee on changes to smaller carts or recycling carts	Up to one change per year, $25 per additional exchange, property tax adjusted accordingly	$25 per change
		Available Cart Sizes		
Garbage Sizes/ Fee	120L ($244/yr)	75L ($254.66/yr. - $227.01 rebate)	75L ($84/yr)	120 L
	240L ($323/yr)	120L ($309.14/yr. - $163.76 rebate)	120L ($96/yr)	240L
	360L ($457/yr)	240L ($419.85/yr - $72.41 rebate)	180L ($114/yr)	360L
		360L ($486.99/yr - $0 rebate)	240L ($131/yr)	
			360L ($165/yr)	
Organics/ Fee	120L (incorporated in garbage fee)		120L ($119/yr)	
	240L (incorporated in garbage fee)	100L (No fee - only food waste collected in bin)	180L ($140/yr)	100L (No fee - only food waste collected in bin)
	320L (incorporated in garbage fee)		240L ($161/yr)	
			360L ($203/yr)	
Recycling/ Fee	N/A (bins and bags used to collect recycling)	75L (No fee)	N/A (bins and bags used to collect recycling)	120L
		120L (No fee)		240L
		240L (No fee)		360L
		360L (No fee)		
		Extra Set Outs		
Excess Permitted	Y, yard trimmings only	Y	Y	Y
Description	Allowed in the fall and spring	**Garbage:** Must be tagged. Weight must not exceed 20kg **Recycling:** Allowed for free **Food Waste:** Residents are encouraged to request an additional bin if excess generated **Yard Waste**: No limit set	**Garbage**: Provided garbage bag is used and an "extra garbage sticker" is placed on the bag. **Organics**: Allowed seasonally for leaf set out in paper bags	**Garbage:** Must be tagged and not weigh more than 20kg. Free pick ups offered after Victoria day, Labour day and Christmas holidays **Recycling:** Collected for free in clear or blue transparent recycling bags **Yard Waste:** Collected for free in compostable bags or labelled bins
Fee	No fee	$5/ garbage tag sold online, at Shoppers Drug Mart and Canadian Tire	$2/garbage sticker sold at Safeway, Community Centre and City Hall	$1/ tag sold online, phone, or City partnership centers in Brampton, Caledon or Mississauga

APPENDIX 2: VARIABLE PRICING IN SELECT U.S. MUNICIPALITIES

Municipality	Grand Rapids, MI	Minneapolis, MN	Portland, OR	San Francisco, CA
		General Information		
Service(s) Provided	Waste /Recycling/Yard	Waste/Recycling/Food-Yard	Waste/Recycling/Food-Yard	Waste/Recycling/Food-Yard
Hauler	City	City	Franchised to 15 haulers	Legislated one hauler
Variable Carts	Y	Y	Y	Y
Variable Set-Out/Subscriptions	Y (Truck drives around weekly to pick up garbage set out, customers pay only if their cart is tipped).	N	Every other week. Customers using 130L cart can request every four week collection.	N
Billing Structure	Utility - Load a pre-paid account	Utility - Monthly billing	Utility - Monthly billing	Utility - Monthly billing (A base fee of $15 is charged per dwelling unit)
Cart Change Policy	Not available	Can change, and bill adjusted accordingly	$12.25 delivery charge/cart (if second or more delivery for composting and recycling or second or more delivery within a one year period for garbage). Also charged if customer requests a clean cart	Can change, and bill adjusted accordingly
		Available Cart Sizes		
Garbage Sizes/ Fee	120L	120L ($24/yr)	75L ($325.60/yr)	60L ($75.12/yr))
	240L	360L ($60/yr)	130L ($381.60)	120L ($150.24/yr)
	360L		230L ($451.80)	240L ($300.48/yr)
			340L ($529.80/yr)	360L ($450.72/yr)
			Note (some customers still use cans but are being grandfathered in)	
Organics/ Fee	360L (yard waste only, no food scraps collection)	120L (up to two dwellings or less) (No fee)	230L	120L ($75.12/yr)
		240L (for more than two dwellings) (No fee)		240L ($150.24/yr)
Recycling/ Fee	240L	360L (No fee)	230L	120L ($75.12/yr)
	360L	240L (available on request) (No fee)		240L ($150.24/yr)
				360L ($225.36/yr)
		Extra Set Outs		
Excess Permitted	Y	Y	Y	Y
Description	**Garbage:** Allowed to use city branded bags. **Yard Waste**: Allowed to use city bags or tags for bundles or carts.	**Garbage:** Up to 2 bags **Organics:** Up to 2 pizza boxes **Recycling:** must weigh less than 40LBS	Can set out additional garbage with cart for a fee	Can leave additional garbage, organics or recycling for collection
Fee	**Garbage:** $3/bag **Yard Waste:** $2.50/bag or tag (for bundled items)	Free, however if customer continually sets out extra items, an additional cart is provided to the customer and waste collection fees (where applicable) are adjusted to include the extra cart	**Garbage:** $5/extra bag or can **Yard Debris:** $3.75 per extra bag or can **Extra composting**: $12.35 **Extra recycling**: $3.75	Charged by hauler based on amount

Pay-as-you-throw program for Residential Black Cart Collection

Standing Policy Committee on Utilities and Corporate Services
UCS2018-0656
2018 June 13
ICS: Unrestricted

Previous Council Direction

On 2018 May 28, Council approved the Waste & Recycling Services Outlook for 2018 to 2025 (UCS2018-0153).

- Initiative identified to provide options for residential black cart customers

PAYT Program Objectives

- Provide residential customers choice
- Minimize program costs and customer rates;
- Minimize blue and green cart contamination; and
- Promote waste diversion and reduction.

Municipal Scan

Municipality	# of Cart Sizes	Annual Fee (240L cart)	Type of Programs
Calgary (indicative rate for 2019)	1	$287 to $292	Black, Blue and Green
Coquitlam*	3	$323	Black and Green
Toronto*	4	$347	Black and Green
Vancouver*	5	$292	Black and Green
Region of Peel	3	Tax funded	
Edmonton	bags/cans	$550	Black/Green and Blue
Airdrie	bags	$360	Black, Blue and Green
Cochrane	1	$260	Black, Blue and Green

* Ontario and British Columbia have producer-funded recycling programs (EPR) for blue carts

Program Cost Considerations

- Variable price for black carts
- Cart purchase / management
- Tag-a-bag
- Customer education
- Enforcement options

Handling and Processing Costs

Fixed Collection Costs

Proposed Program – 3 Cart Sizes and Tag-a-bag

120L 240L 360L Tag-a-bag

Potential Risks

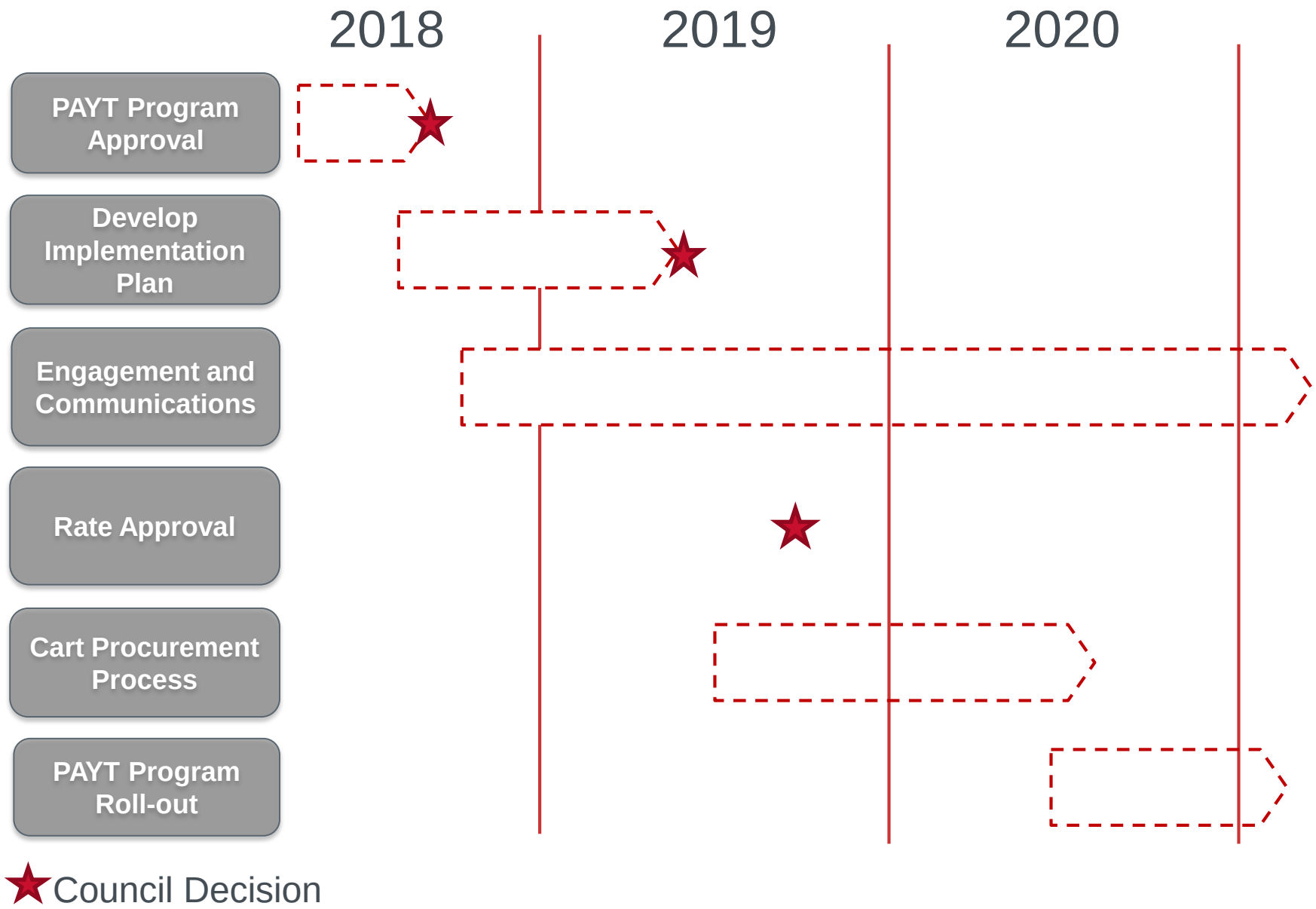
- Reputational
  - The price differential between small and medium carts may not meet customer expectations.
  - Residents who generate more may not be willing to pay more.

- Environmental
  - Blue and green cart contamination may increase

Implementation Plan

- Citizen tools and resources
- Citizen engagement and communication
- Cart selection process
- Price structure for carts and tags
- Cart inventory management

Proposed Timeline



Recommendation

That the SPC on Utilities & Corporate Services recommend that Council direct Administration to:

develop a detailed program design and implementation plan for a pay-as-you-throw program with three black cart sizes and a tag-a-bag program and report back no later than Q2 2019.