



CLIMATE
CHANGE

action plan

© 2019, The Corporation of the City of Mississauga. All Rights Reserved.

The preparation of this plan was carried out with assistance from the Government of Canada, the Federation of Canadian Municipalities, and the Province of Ontario. Notwithstanding this support, the views expressed are the personal views of the authors, and the Province of Ontario, the Federation of Canadian Municipalities, and the Government of Canada accept no responsibility for them.

TABLE OF CONTENTS

MAYORS MESSAGE.....	II
ACKNOWLEDGEMENTS	IV
EXECUTIVE SUMMARY	V
INTRODUCTION	1
MISSISSAUGA’S VISION	3
1.0 BUILDINGS AND CLEAN ENERGY	17
2.0 RESILIENT & GREEN INFRASTRUCTURE	25
3.0 ACCELERATING DISCOVERY & INNOVATION	35
4.0 LOW EMISSIONS MOBILITY	41
5.0 ENGAGEMENT & PARTNERSHIPS	49
IMPLEMENTATION CONSIDERATIONS.....	57
GLOSSARY	60
REFERENCES.....	63
APPENDIX A – MISSISSAUGA’S CARBON FOOTPRINT	65
APPENDIX B – CLIMATE CHANGE RISK ASSESSMENT	71
APPENDIX C – PUBLIC CONSULTATION SUMMARY.....	80



Mayors Message



Climate change is one of the most pressing issues of our time. We have certainly felt the impacts first hand here in Mississauga as we have experienced severe flooding, storms and extreme heat and cold conditions in recent years. Damage to our homes, businesses, shorelines, roads and other infrastructure is costing us millions of dollars in cleanup and repairs and impacting the lives of countless residents.

Climate change is an issue that can no longer be ignored, denied or pushed aside - it must be made a top priority. Mississauga is proud of what we have already accomplished to be part of the climate solution. We consider ourselves climate leaders.

City Council is committed to finding real solutions to address climate change and have already passed several strategies, bylaws and policies that are having a meaningful impact in our community. We have built more efficient buildings, replaced our street lights with LEDs, reduced our use of single-use plastics, installed solar panels, initiated our One Million Trees program, and introduced a stormwater levy to help us build more resilient infrastructure city-wide.

With that said, we know that more needs to be done. As we look towards building Mississauga's future, we know we need to take a bold stance on climate. That is why in 2017, Mississauga joined more than 10,000 cities and local governments around the world as a member of the Global Covenant of Mayors. Together, we are working to advance our long-term vision of combatting climate change and creating resilient, low-carbon communities around the world. Earlier this year, Mississauga also joined cities across the world in declaring a climate emergency, signalling the severity that the climate crisis is having on our environment, our health and our future.

In response to this global challenge, and on behalf of City Council, I am pleased to share with you Mississauga's Climate Change Action Plan. This plan is our 10-year roadmap to reduce greenhouse gas emissions and make our city more resilient. It



outlines concrete actions that we have initiated or will initiate that directly support building a greener, smarter, and more prosperous city.

This detailed plan has been two years in the making. I want to thank everyone who participated in its development including our dedicated staff, experts and residents, and local businesses. Thank you to everyone who shared their ideas, advice, and expertise to help make our plan the best it can be.

Climate change requires each and every one of us to take action. There are steps you can take today to decrease your carbon footprint and become more resilient to the impacts of climate change. As Dianne Saxe, former Environmental Commissioner of Ontario, once said “no one can do everything, but everyone can do something.”

Our aspiration is for Mississauga to be a net-zero City. I hope that you will join me in our efforts to get us there.

You can find out more, including how you can get involved in our climate change initiatives by following us on Facebook ([@SaugaGreen](#)) and Twitter ([@MiLivingGreen](#)).

Sincerely,

A handwritten signature in black ink that reads "Bonnie Crombie". The signature is fluid and cursive, with the first name "Bonnie" and the last name "Crombie" clearly distinguishable.

*Bonnie Crombie
Mayor of Mississauga*



Acknowledgements

We would like to acknowledge the many individuals and organizations who participated in the development of this Plan. We truly appreciate your time and commitment. Your contributions added tremendous value and helped to shape and improve the final Climate Change Action Plan. Thank you.

City of Mississauga

Leadership Team

Janice Baker, City Manager

Andrew Whittemore, Commissioner,
Planning & Building

Gary Kent, Commissioner, Corporate
Services

Geoff Wright, Commissioner,
Transportation & Works

Paul Mitcham, Commissioner,
Community Services

Climate Change Core Team

Brent Reid

Daniela Paraschiv

Eniber Cabrera

Gordon Cowan

John Fasitsas

Mary Bracken*

Mary George

Michelle Berquist*

Muneef Ahmad

Olav Sibille

Patrick Murphy

Rae Parker

Ryan McHugh

Sarah Piette

Sumeet Jhingan

Tim Lindsay

Walter Garrison

Committees & Panels

Environmental Action Committee

Partnership Panel

Stakeholder Panel (see Appendix C)

Consulting Groups

A Kennedy Consulting

Dillon Consulting

Siemens

Project Steering Committee

Geoff Marinoff

Michael Cleland*

Helen Noehammer

Mickey Frost

Jason Bevan

Raj Sheth

Jodi Robillos

Jeff Jackson

John Crozier

Climate Change Team

Julius Lindsay*

Leya Barry

Samantha Dilorio

Teresa Chan

We would also like to thank the following:

Andrea J. McLeod

Anthea Foyer

Aiysha Syed

Brenda Osborne*

Community Green
Leader Volunteers

Diana Suzuki-Bracewell

Dianne Zimmerman

Edward Nicolucci

Environment Summer
Students

Heliya Babazadeh-
Olegghi

John MacKinnon

Katherine Culbert

Lisa Urbani

Michelle Charbonneau

Tim Lai

*Now with a different organization



Executive Summary

The City of Mississauga is committed to decreasing our carbon footprint and to preparing the community for the effects of a changing climate. We know there are practical and proven steps that we can take to help create a low carbon and resilient Mississauga. This Climate Change Action Plan contains our ambitious, yet practical, plan.

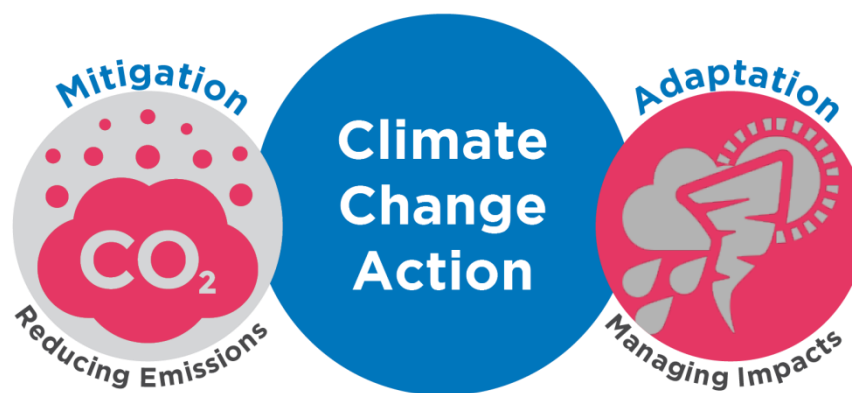
Around the world, there is scientific consensus that our climate is changing. A recent report on climate change, from Natural Resources Canada (2019), shows that Canada is warming at twice the rate of the rest of the world. The City of Mississauga has already felt the effects of climate change, signalled by an increase in the frequency of extreme weather events including seasonal flooding, extreme rainfall, ice storms, and some of the hottest summers on record.

Events of this nature have become “the new normal,” creating new pressures around infrastructure planning and management, property damage, service disruption, human injury, and economic setbacks, human injury, and economic setbacks.

The cost implications of not taking action on climate change are significant, and the City is committed to working with the community across all levels to address the risks climate change presents.

We know we all have a role to play. As Ontario’s third largest city, Mississauga recognizes the important role that cities play in fighting climate change.

As residents, corporations, and organizations, we can all make a difference. There are two types of actions we can take to combat climate change:



The Climate Change Action Plan includes actions to both **mitigate and **adapt** to climate change.**



The Climate Change Action Plan contains the following guiding elements:

VISION

The Climate Change Action Plan is built around the central vision the Mississauga will be a low carbon and resilient community. This vision is the long-term outcome and end-state that the City aims to achieve over the next 30+ years.

GOALS

Goal: Mitigation

Reduce greenhouse gas emissions 80% by 2050 below 1990 levels and position the City competitively in the emerging low carbon economy, with a long-term goal of becoming a net zero community.

Goal: Adaptation

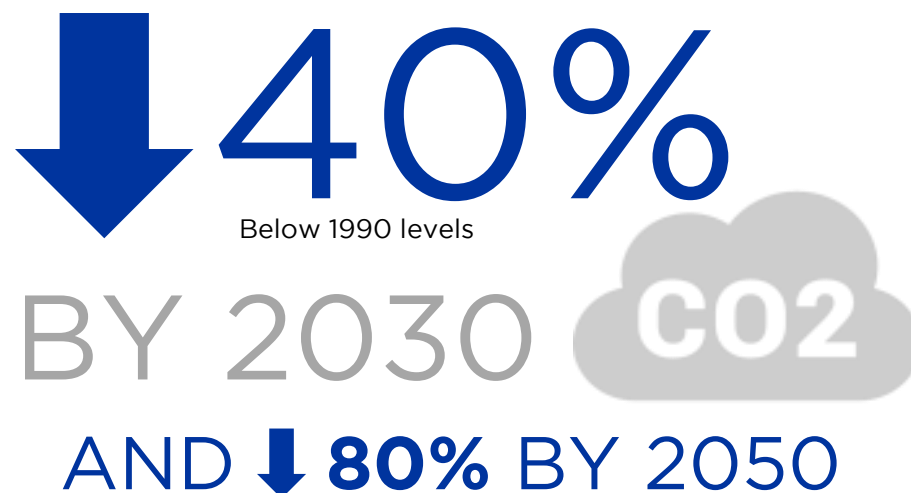
Increase resilience and the capacity of the city to withstand and respond to current and future climate events by taking action on the highest climate-related risks.

ACTION PATHWAYS

Action Pathways are specific areas of focus with supporting actions that the City plans to accomplish within the next 10 years. They are the mechanisms for working towards the Goals.

1. Buildings and Clean Energy;
2. Resilient and Green Infrastructure;
3. Accelerating Discovery and Innovation;
4. Low Emissions Mobility; and
5. Engagement and Partnerships.

GHG Reduction Target



Introduction

Climate change is real, and everyone has a role to play.

Around the world, there is scientific consensus that our climate is changing, signalled by rising temperatures, increased precipitation, and an increase in the frequency of extreme weather events. A recent report from Environment and Climate Change Canada, Fisheries and Oceans Canada, and Natural Resources Canada notes that Canada is warming at twice the rate as the rest of the world (Bush, E. and Flato, G. 2018). More than half of the world's carbon emissions originate in cities and urban areas are facing the increasing costs of adapting to the impacts of a changing climate.

The City of Mississauga has already begun to feel the impacts of climate change, including increased seasonal flooding, extreme rainfall, ice storms, and some of the hottest summers on record.

By 2050, Mississauga is expected to be hotter at all times of the year, with changes to seasonal precipitation patterns, more rainstorms and more heat waves. Winter, spring, and fall will likely be wetter, while summer will be hotter and drier on average, with an increase in storm activity (Tu, C., Milner, G., Lawrie, D., Shrestha, N., Hazen, S. 2017).

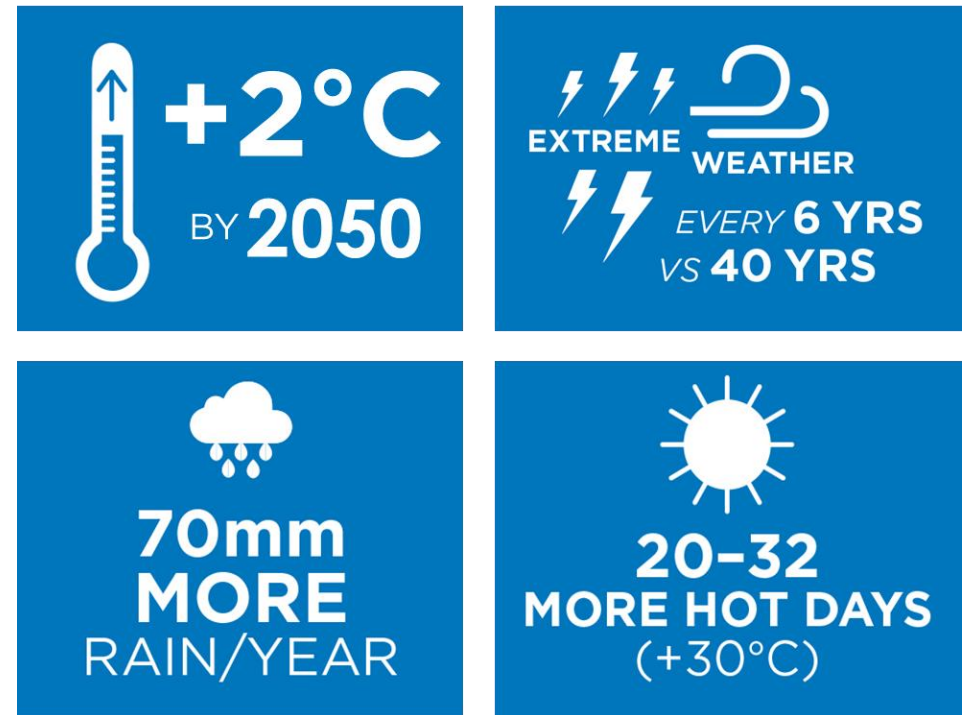


Figure 1 City of Mississauga's climate projections for 2050 (2010 Baseline)



Mississauga has experienced a number of extreme weather events to date (Figure 2). The ice storm of 2013 left thousands without power and resulted in over \$25 million in damages, cleanup and recovery costs for the City and its residents (Caledon Enterprise, 2014). Flooding was again experienced by Mississauga residents and businesses in 2017 when high-water levels exceeded the capacity of the local stormwater systems.

Events of this nature have become the new normal, creating new pressures around infrastructure planning and management, property maintenance, service delivery, human health and safety, and economic prosperity.

In 2015, a study was completed by the Insurance Bureau of Canada (IBC) to examine the financial impacts of two types of severe weather events in Mississauga – ice storms and flooding. The report notes that, if current trends continue, the average ice storm will cost approximately \$9 million per year (Figure 3).

With a moderate increase in greenhouse gas emissions, this number can jump to \$12 million a year. The study also found that a single ice storm of severe magnitude could cost the city anywhere between \$23 and \$38 million (IBC, 2015).

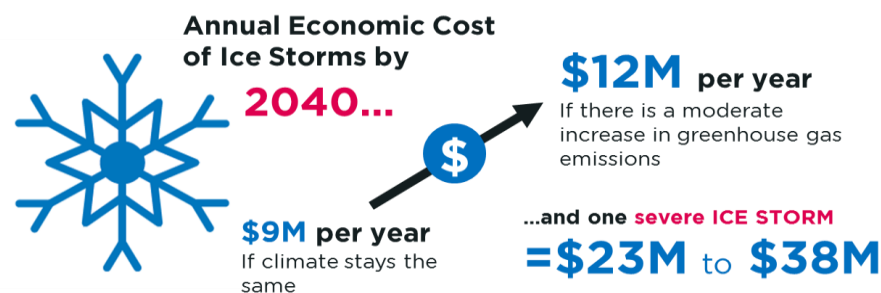


Figure 3 Annual economic cost of ice storms by 2040 (IBC, 2015)

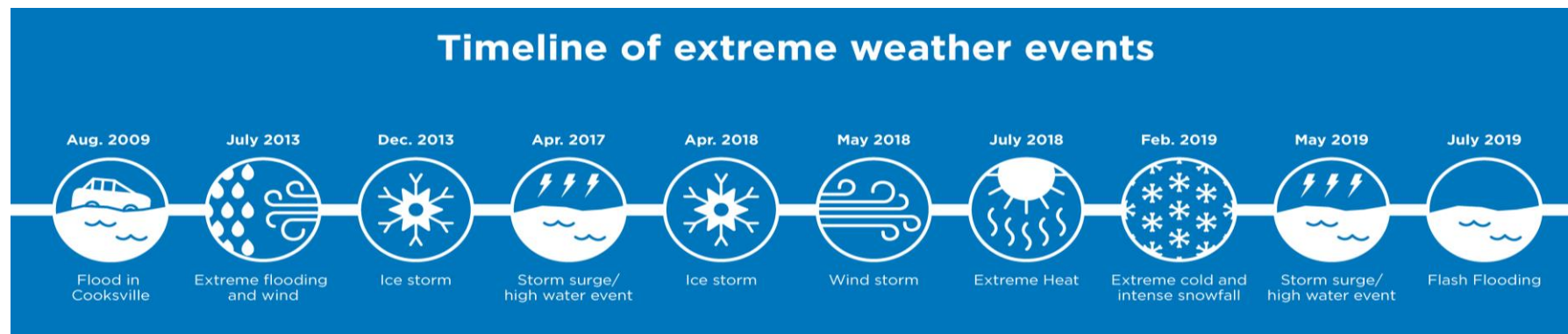


Figure 2 Recent history of extreme weather events in Mississauga: 2009 - 2018



Mississauga's Vision

As a City, Mississauga is committed to doing its part towards securing a better future by transforming into a low carbon and resilient city. Taking steps towards this goal will be achieved through actions taken by the wider community including residents, business owners, and visitors, as well as actions taken by the City of Mississauga as an organization to reduce the carbon footprint of its operations and services.

This Climate Change Action Plan (CCAP) is built around the central vision that **Mississauga will be a low carbon and resilient community**. The CCAP presents a way forward over the next ten years, providing an incremental process to take action, measure progress, adjust to changing technologies and conditions, and continue to build towards the ultimate 30-year vision.

Strong Goals

Supporting the Vision are the Goals, which further define how progress on the Vision will be measured.

Goal: Mitigation

Reduce greenhouse gas emissions 40% by 2030 and 80% by 2050 below 1990 levels and position the City competitively in the emerging low carbon economy, with a long-term goal of becoming a net-zero community.

Goal: Adaptation

Increase resilience and the capacity of the Corporation and the community to withstand and respond to current and future climate events by taking action on the highest climate-related risks.

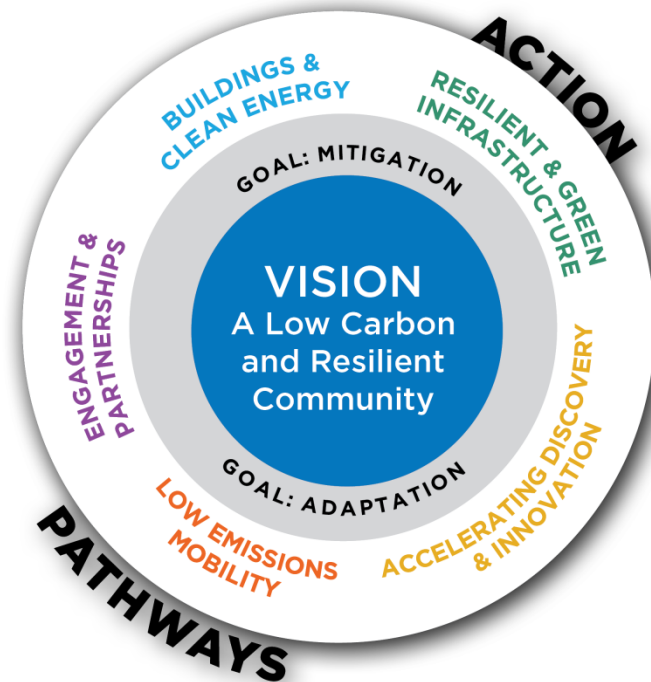



Figure 4 The Climate Change Action Plan Framework





**The cost implications
of not taking action
on climate change
are significant, and
the City has
committed to
working with the
community across all
levels to address the
risks that climate
change presents.**

Imagine 2050 Photo Contest Submission. Photo Credit: David Coulson (2018)



The Role of Cities

Climate change is a local, national and global issue affecting individuals and systems around the world. Although the responsibility to act is collective, cities in particular play a significant role in minimizing their carbon footprint and making their communities more resilient.

Currently, over half of the world's population resides in cities and this number is forecasted to increase in the years to come (Figure 5). In Canada, over 80% of the population lives in urban areas. Cities are major contributors to the production of greenhouse gas emissions. They consume large amounts of energy to heat and cool homes and buildings and experience larger traffic volumes than their rural counterparts.

While municipalities are directly responsible for 5-10% of greenhouse gas emissions as a result of municipal operations, they indirectly control over 40% of greenhouse gas emissions in the community.

Urban populations are 'ground zero' for the impacts of climate change such as temperature changes, extreme weather events, and precipitation. The systems, infrastructure, and population characteristics that contribute to a functioning city are dynamic and often interconnected; failure of one system can have a cascading effect on the failure of other systems. For example, localized flooding can saturate and exceed the capacity of local stormwater infrastructure leading to disruptions in the road network - such as road closures, washout conditions, road blockages (e.g. downed trees), and slippery road conditions - which in turn can impact local emergency services. These

impacts, if not mitigated or planned for in advance, can have substantial economic, environmental, and social consequences.

Municipalities can also educate and empower residents to take action and can implement a wide range of measures to directly and indirectly influence behaviours and decision-making. As a growing and prosperous city Mississauga is a prime example of a municipality with the potential to lead the way in creating a more resilient future.

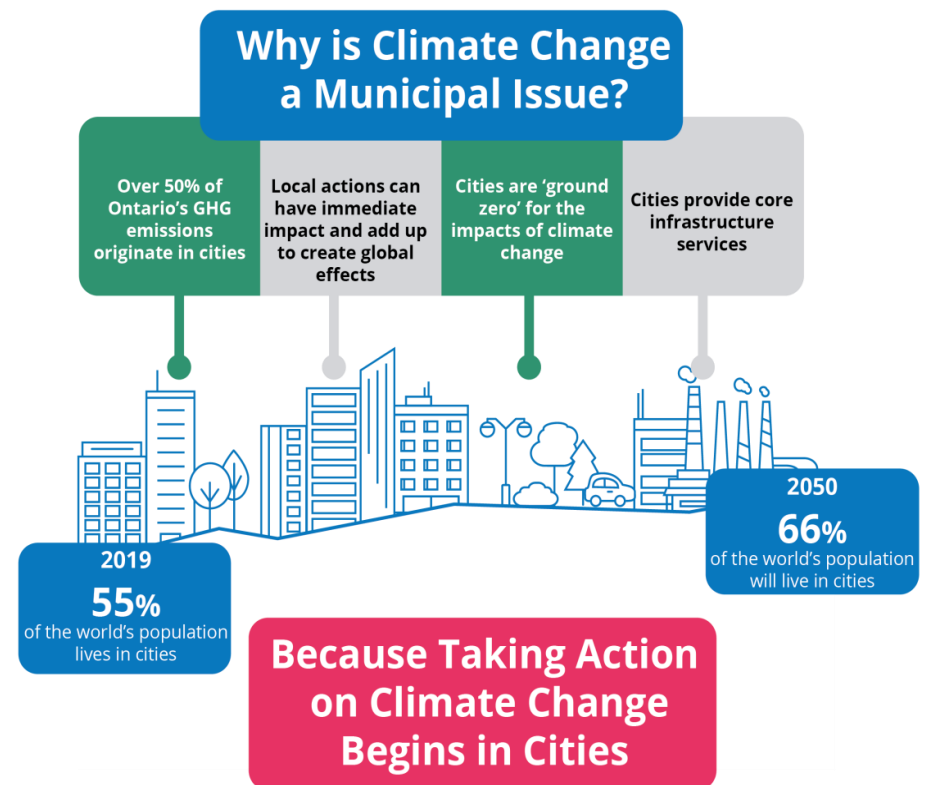


Figure 5 Climate Change Imperative for Cities



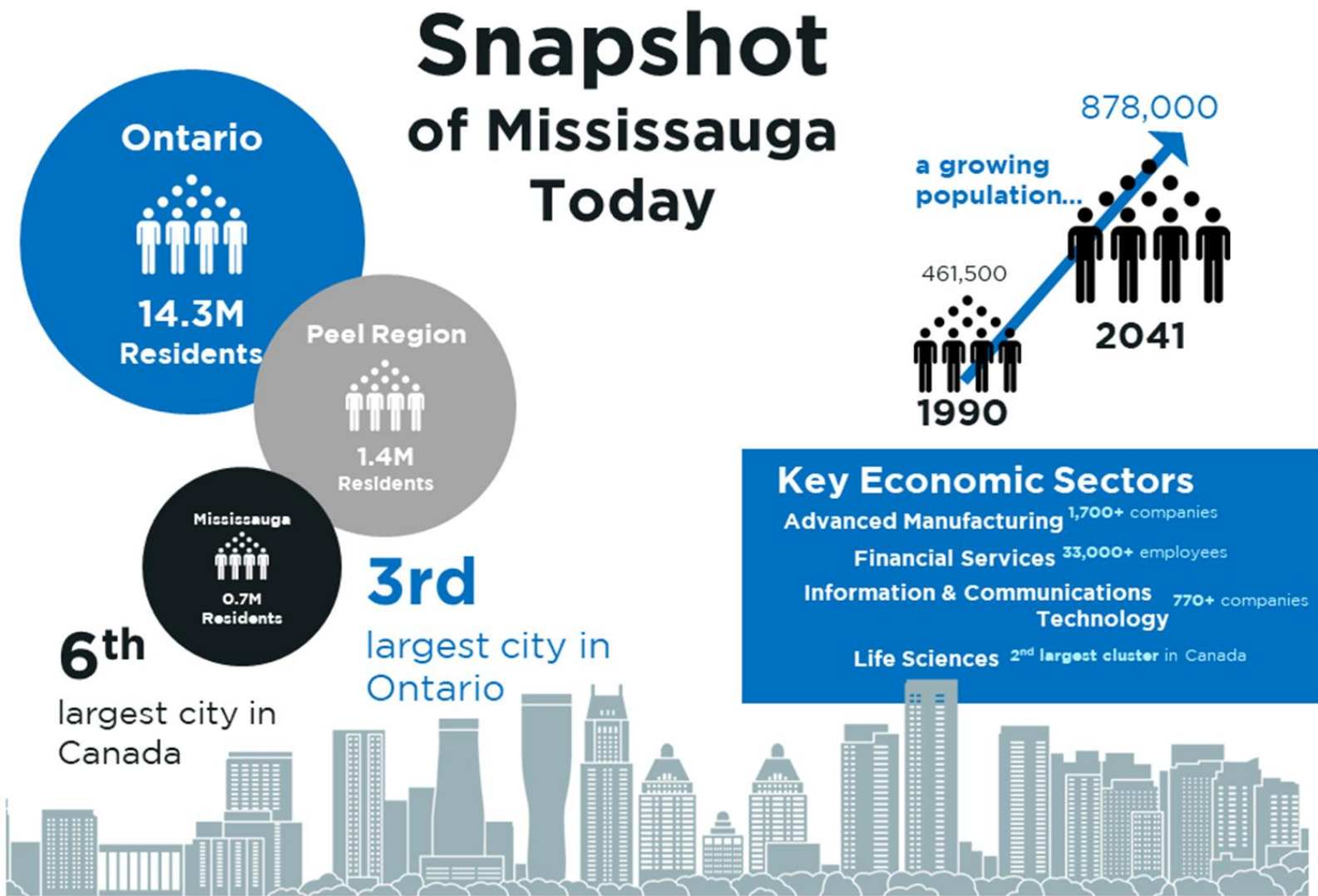


Figure 6 Snapshot of Mississauga Today and into the Future (based on Long-Range Forecasts for the City of Mississauga)



Building on the pillars of change towards a sustainable future...

Mississauga's Strategic Plan (2009) identifies five key Pillars for Change, and the CCAP builds on all of these:



Move

developing a
transit-oriented City



Belong

ensuring youth, older adults
and new immigrants thrive



Connect

completing our
neighbourhoods



Prosper

cultivating creative and
innovative businesses



Green

living green

One of the key goals of the Strategic Plan is to promote a green culture and **"...transform Mississauga into a "net-zero" carbon city to become a leader in green initiatives by reducing greenhouse gas emissions..."**

The CCAP represents a significant step towards achieving meaningful emission reductions and the long-term goal of becoming a net-zero city.

...with clear Council leadership

1999: The City joined the Partners for Climate Protection program, a joint initiative with ICLEI-Local Governments for Sustainability and the Federation of Canadian Municipalities (FCM)

2009: Passed a resolution supporting an "ambitious, fair and binding international climate agreement."

2017: Became a signatory to the Global Covenant of Mayors for Climate and Energy

2019: City of Mississauga declared a climate emergency



A Strong Foundation

Mississauga has been proactive in sustainability and climate change governance for over two decades. Council has been consistently committed to making progress on climate action, integrating climate change and environmental considerations into the City's Strategic Plan in 2009.

In 2017, the City became a signatory to the Global Covenant of Mayors for Climate and Energy, joining an international coalition of over 9,000 cities and governments with a shared long-term vision of advancing voluntary action to combat climate change and create resilient and low-carbon communities.

There is a growing understanding of the impacts of climate change in Canada and the planning framework around climate change action has expanded to include guidance and support from Federal, Provincial, and Regional bodies, including the Region of Peel's Climate Change Strategy (2011), the Federal Pan-Canadian Framework on Climate Change (2016), amendments to the Provincial Growth Plan (2017, 2019), and the Provincial Made in Ontario Environment Plan (2018), among other legislative and policy guidance (Figure 7). There is collective recognition of the need for improved collaboration and partnerships towards the achievement of climate change goals and targets across all levels of government.

At the local policy level, the City has developed and implemented its Living Green Master Plan, Green Development Standards, and the Stormwater Charge to enhance local sustainability and resilience to flooding.

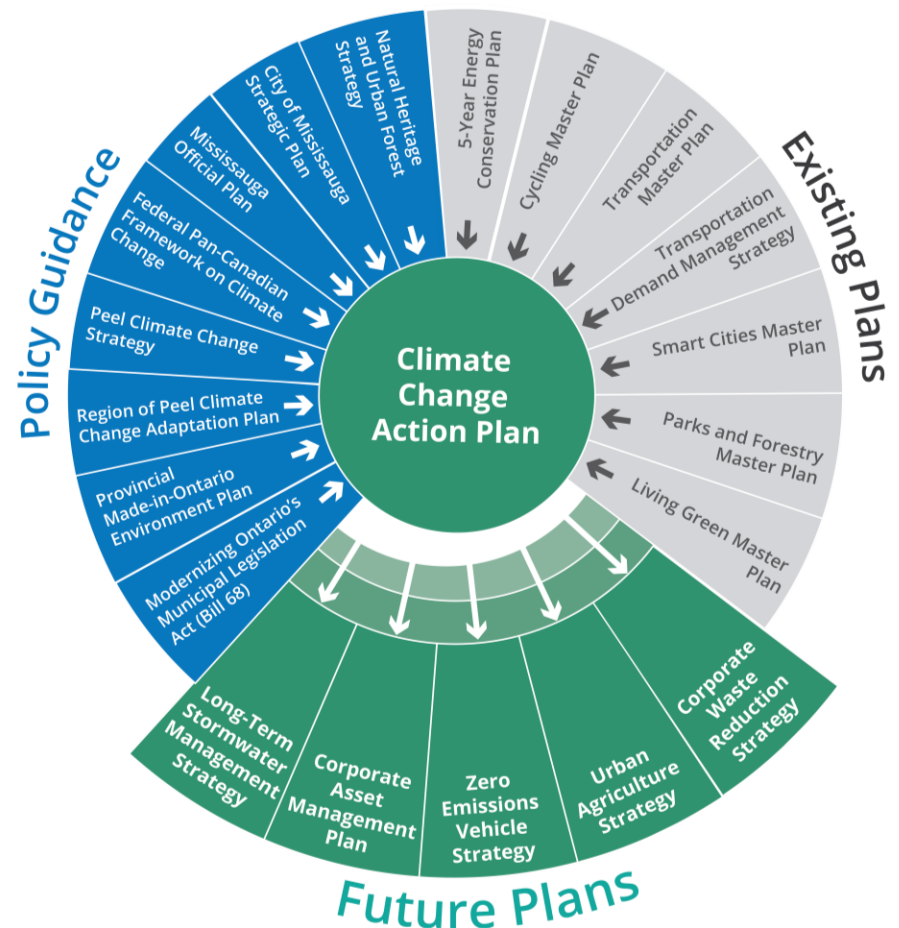


Figure 7 The Planning and Policy Framework for the Climate Change Action Plan



Mississauga's Carbon Footprint

This section provides an overview of greenhouse gas (GHG) emissions in Mississauga. This includes emissions for the city as a whole (also referred to as “community emissions”), as well as emissions related to municipal operations and services (also referred to as “corporate emissions”). See Appendix B for a more detailed description of GHGs, including trends and how the CCAP targets fit into this picture.

Community Profile

Total GHG emissions for the community are 6.2 million tonnes of CO₂ equivalent (eCO₂). The majority of GHG emissions in Mississauga come from buildings (see Figure 8). This includes residential, commercial, and industrial buildings, with emissions coming primarily from the burning of natural gas to heat indoor spaces and water. Over 30% of GHGs come from transportation.

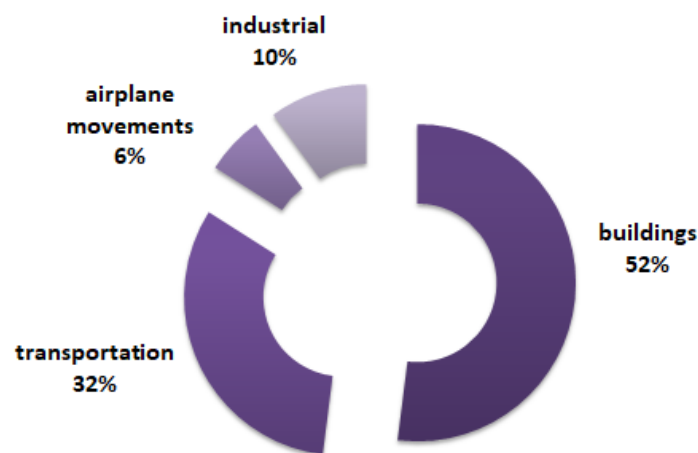


Figure 8 Community Greenhouse Gas Emissions Profile (2015)

Profile of the City as a Corporation

There are five main sources of GHG emissions from the City's municipal operations: (1) municipal buildings; (2) corporate fleet; (3) transit fleet; (4) fire fleet; and (5) street lighting. While single-tier municipal inventories also include solid waste and water and wastewater, these are within the Region of Peel's jurisdiction and are therefore excluded. Total emissions for municipal operations are 72,000 tonnes of eCO₂.

As Figure 9 shows, the vast majority of emissions from municipal operations are the result of operating the transit fleet, which accounts for nearly 70% of total emissions. Municipally-owned and operated buildings account for almost 30% of emissions, with the City's corporate vehicle fleet, fire services trucks and vehicles, and street lighting accounting for the rest.

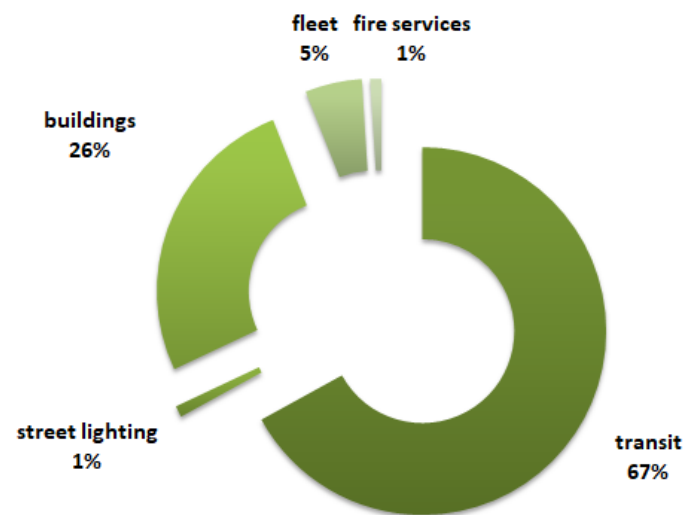


Figure 9 Corporate Greenhouse Gas Emissions Profile (2015)



Setting a Greenhouse Gas Reduction Target

Mississauga is the sixth largest city in Canada and is growing quickly. With the population projected to be over 900,000 by 2050, the city will remain one of the biggest economic centres in the Greater Toronto Area (GTA).

In 2018, the City undertook a study to evaluate technology pathways for deep carbon reductions using Siemens' City Performance Tool (CyPT). Over 350 data points from Mississauga's transportation, building, and energy sectors were collected to establish an emissions baseline for 2016 and a projected baseline for 2050 using the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*. More general characteristics, such as population growth, the supply mix of electricity generation, transportation modalities and travel patterns, building energy use, and the built environment footprint, were then layered on to the analysis.

The CyPT then quantified the performance of over 70 policies and technologies against five key performance indicators: GHG emissions, nitrogen oxides (NOx), particulate matter (PM10), gross full-time equivalents (FTE), and capital and operating expenses.

Based on this analysis, it is clear that the City of Mississauga can achieve ambitious emission reductions and lower emissions **80% by 2050** relative to 1990, with a long-term goal of becoming net-zero while creating a greener, smarter, and more prosperous city.

The path forward will require significant commitments from residents, local government, as well as all private and public stakeholders. By investing in renewable energy (such as solar), electrifying heating (with air-sourced heat pumps), and shifting our modes of travel, the City can have a significant impact on emissions, while improving air quality and creating jobs.

The City is committed to reducing its greenhouse gas emissions and has set an ambitious and achievable greenhouse gas reduction target of **80% below 1990 levels by 2050 with a long-term goal of becoming net-zero.**



Charting the Course: The Climate Change Action Plan

The process to develop the Climate Change Action Plan (CCAP) has been extensive and has involved thousands of people and dozens of studies.

In the fall of 2017, Mississauga initiated its Climate Change Project to create a framework to reduce greenhouse gases and manage risks related to climate change over the coming decades.

This **Climate Change Action Plan (CCAP)** is the City's first comprehensive climate change plan, and lays out a clear course for Mississauga over the next ten years to tackle climate change. By integrating mitigation and adaptation mechanisms into social, economic, and environmental systems now, the City will increase its capacity to prepare for and respond to the impacts of climate change.

The CCAP includes actions for both the City of Mississauga and the community at large, and takes a critical step in the ongoing journey towards a low carbon and resilient Mississauga.

The need to act quickly and with purpose is recognized throughout the Climate Change Action Plan, both for the City and its residents.

An Informed Approach

Recognizing the complexity of climate change, the CCAP is the result of an in-depth, systematic process. This includes a technical review of current conditions, gap analysis to identify critical climate change risks and information needs, visioning on progress over the next 30+ years, and creating an outcome-oriented Action Plan for Mississauga for the next ten years.

A number of key steps were involved in the planning process, including the following:



Technical Studies were undertaken to answer key questions about the City's current energy consumption, as well as infrastructure risks and innovation opportunities. These included:

- **Energy Mapping** to identify the patterns in energy consumption (including electricity and natural gas consumption) in residential buildings;
- **Fleet Analysis** of the City's corporate vehicle and transit fleet emissions;
- **Park Infrastructure Assessments** of Jack Darling Memorial Park, Streetsville Memorial Park, and Saint Lawrence Park to assess climate risks and vulnerabilities;
- A **Cleantech Sector Assessment**, to analyze the opportunities for growth and innovation; and
- **Risk and Vulnerability Assessments** to understand where the highest priority areas are for adaptation action (see Appendix B for more details on the corporate and community climate risk assessments).





Supporting Initiatives developed by the City of Mississauga and the Region of Peel were reviewed to provide guidance and insight into the planning process including the Transportation Master Plan, Cycling Master Plan, and Smart City Master Plan. Additional strategies by the Insurance Bureau of Canada (IBC), the Toronto and Region Conservation Authority (TRCA), and Credit Valley Conservation (CVC) were also reviewed.



Benchmarking and Gap Analysis provided an in-depth look at current practices and policies at the City, and best practices from leading cities facing similar climate change challenges.

The CCAP integrated the results of all these preceding steps and was informed by in-depth action planning workshops with key stakeholders from across the community as well as within City departments (see Figure 10).

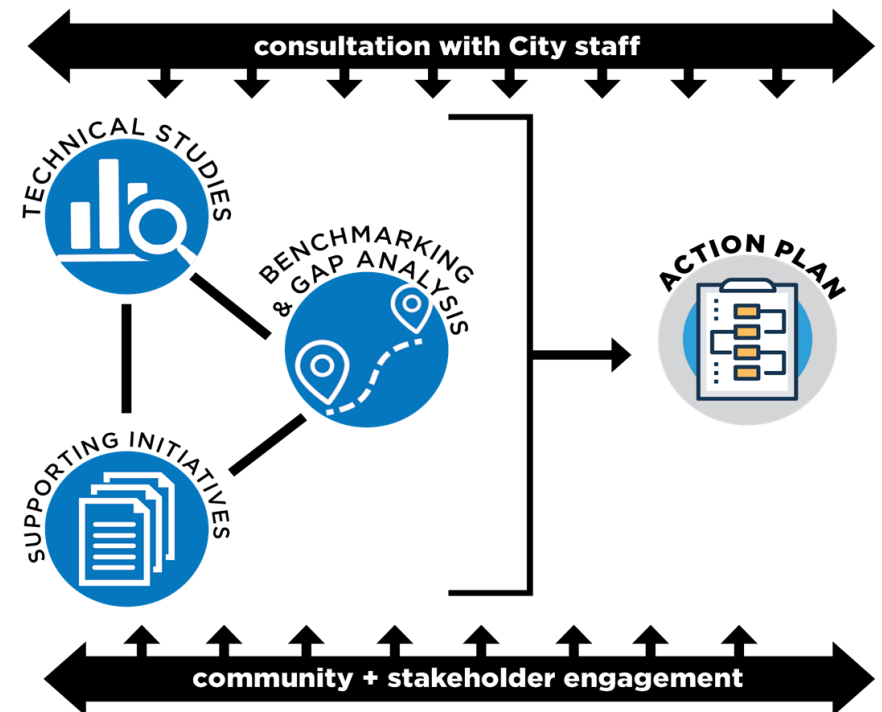


Figure 10 Key Steps in the Development of the Climate Change Action Plan



Spotlight on Engagement

The City worked closely with community partners, stakeholders, and residents to develop an Action Plan that reflects the ideas, interests, and strong partnerships of the community.

Early on in the planning process, stakeholder engagement was recognized as a central tenet for the development of a successful Action Plan. As shown in Figure 10, there were a number of inputs into this Action Plan. Feedback was sought in two main ways: consultation with City staff; and engagement with community stakeholders (e.g., representatives from the business, academic and not-for-profit sectors).

Community representatives were consulted through the creation of a Climate Change Stakeholder Panel. The Panel met on a regular basis at key decision-points

and milestones throughout the project process and development of the Action Plan, including the visioning, climate risk assessment, and action planning stages. Members from a range of organizations participated in the Panel, including utility companies, conservation authorities, academic organizations, school boards, the Mississauga Board of Trade, Metrolinx, and other community organizations.

Fun, creative, and engaging tactics were also deployed at a range of public events to get the community talking about climate change and the ways that residents and business owners could make a difference through individual and collective action (see Appendix C for more information on public engagement including a full list of Stakeholder Panel members).

Throughout September and October 2019, City staff engaged the public more broadly through a public consultation process. Throughout this period, the City received 100s of responses to the online survey, and spoke to over 500 residents at a series of workshops and public open houses.

Including social media impressions, **the Climate Change Project reached over 165,000 community members.** The Climate Change Action Plan aims to harness the energy and passion expressed by the community to create a more resilient future for Mississauga.



Photos of Engagement Activities from the Climate Change Project



Action Pathways

Action pathways are specific areas of focus with supporting actions that the City plans to accomplish within the next five to ten years.

The action pathways are categorized into the following categories:



**Buildings &
Clean Energy**



**Resilient & Green
Infrastructure**



**Accelerating Discovery
& Innovation**



**Low Emissions
Mobility & Transportation**



**Engagement &
Partnerships**

Action Characterization

Supporting actions are categorized based on the following action types:

- **Plans and Studies:** Conduct research or strategic planning projects to establish direction on new or emerging areas of interest.
- **Policies, Guidelines, and Standards:** Establish or update rules and regulations to provide direction for projects, initiatives, or programs.
- **Procedures:** Develop and implement new ways of doing business or adapt existing practices and procedures to enhance low carbon resilience.
- **Programs and Projects:** Develop new programs or projects to advance climate action, with proof-of-concept pilot projects as needed.
- **Partnerships and Engagement:** Collaborate with stakeholders (both internal and external) to advance climate action for the Corporation and in the community and advocate on behalf of the City to other levels of government to advance and support local climate action.

Cost

The estimated cost of implementing each action has been characterized based on a relative scale as follows:

- N/A - Cost is covered by existing staff capacity or operating budgets
- Low Cost - **\$** (\$0-\$100,000)
- Medium Cost - **\$\$** (\$100,000 - \$500,000)
- High Cost - **\$\$\$** (\$500,000+)



Timeline

The supporting actions provide a roadmap for the next ten years. In the tables below, the timing of actions is identified as short-, medium-, or long-term as follows:

- Short Term (1-3 years): ■□□
- Medium Term (4-7 years): ■■■□
- Long Term (7+ years): ■■■■
- Recurring: Actions which happen on an ongoing basis

Status

The status of each action is included for each supporting action and will continue to be updated as the Climate Change Action Plan is implemented. The status of an action is defined as follows:

- Not Initiated – not begun yet
- Planned – the intention to complete the action is part of current or future work plans and/or budgets
- Underway – includes actions which have been initiated, are already funded, and/or are part of the business-as-usual operations of a team or division within the City.
- Complete

Roles and Responsibilities

Roles and responsibilities are identified, to provide greater ownership and oversight through the implementation process. Additional stakeholders, whose partnership is central to the implementation of each action, are also noted.

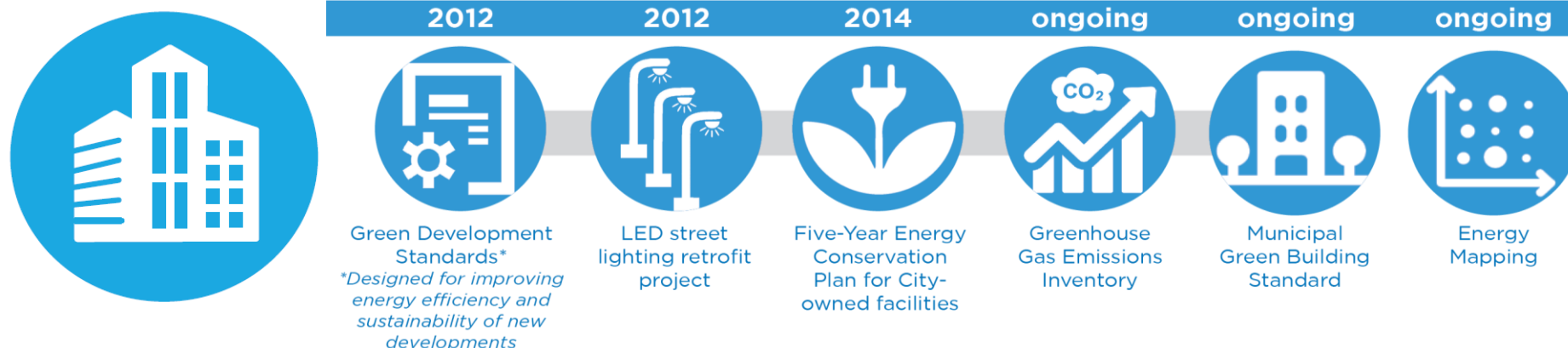




Community members engaging with the Climate Change Project at the Erin Mills Town Centre



Figure 11 Building on Progress to Date: Buildings and Clean Energy



1.0 Buildings and Clean Energy

Overview

As a rapidly growing city, sustainable building design and the incorporation of clean energy solutions to meet building energy demands are key considerations in the effort to minimize the impacts of climate change in Mississauga.

Buildings of all types (residential, commercial and industrial) require energy for cooling and heating, lighting, and operating equipment and appliances. The amount of energy consumed is influenced by the number of occupants, the activities taking place within the building, the age or construction of the building itself, and the materials within them.

By transitioning towards more energy-efficient and climate resilient materials, for new and existing buildings, the GHG emissions from the built environment can be reduced and the risks associated

with climate change mitigated. Diversification of building energy supply through the use of renewable resources (wind, solar, etc.) will also reduce the City's carbon footprint, and improve air quality.

This chapter provides a roadmap for addressing climate change in the area of Buildings and Clean Energy and identifies actions that will guide progress over the next ten years. The main focus areas are:

- Reduction of GHG emissions from existing and newly developed buildings;
- Increasing the use and supply of renewable energy;
- Advancement of low carbon community energy systems; and
- Encouraging building occupants and owners to implement energy conservation measures.



Connecting to the Future

Today

To date, the City has implemented a number of actions to address the reduction of carbon emissions within the built environment (Figure 11). In 2010, the Green Development Strategy was adopted by City Council which focused on environmental responsibility and incorporating sustainable mechanisms into proposed building development initiatives. As part of the Strategy, new development applicants are encouraged to achieve Leadership in Energy and Environmental Design (LEED) certification, which encourages developers to use sustainable green building and development practices in the design and construction of their buildings.

In addition, Mississauga has integrated renewable energy retrofits (primarily solar-based) into many of its City-owned facilities including the Paramount Fine Foods Centre, and Huron Park and Burnhamthorpe Community Centres. The City has also been developing and executing Energy Conservation Plans since 2001, which includes both capital-intensive projects, such as energy upgrades for lifecycle replacements, lighting upgrades, and controls upgrades, as well as low- or no-cost improvements such as operation optimization in City-owned facilities.

By 2030

Progress towards a more prosperous and sustainable future will mean that, by 2030, all new buildings are energy-efficient and resilient and significant reductions in the carbon footprint of existing buildings and facilities across Mississauga has been achieved.

By 2030, Mississauga's buildings and energy sector will be more reliant on low-carbon energy sources, making strides towards energy security through distributed energy (i.e. renewables). The City will be a leader in integrating renewable energy into the city's energy profile.

As more energy efficient and climate resilient building designs are implemented, community and City-owned properties will have stronger safeguards against climate change impacts. This means greater protection from the economic, social, and psychological costs of property damage from severe weather events.

The outcomes of key initiatives will mean advanced community and district energy planning programs, a stronger and more directive policy and regulatory framework for new and existing development, a larger stock of buildings that can withstand climate change impacts, and a more empowered network of residents and building owners taking action towards achieving a net zero city with a built environment that is protected and secure in the face of climate change impacts.



Action #1: Advance Renewable Energy and Low Carbon Energy Systems

The City will work with partners towards supplying 75% of community energy needs through renewable or low-carbon sources (e.g., geothermal, district energy) by 2050.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
1-1	Support and encourage developer-led efforts to include low carbon energy systems in new development	Partnerships and Engagement	Recurring	N/A	Underway	Parks, Forestry & Environment (Environment)	City Planning Strategies, Development and Design	Utilities, Property Owners/Management/Developers
1-2	Conduct a district energy feasibility study in the downtown for community and municipal buildings to advance low carbon energy systems in Mississauga	Plan/Study	▬□□	\$	Planned	Parks, Forestry & Environment (Environment)	City Planning Strategies	Utilities, Property Owners/Management/Developers
1-3	Conduct a study to identify mechanisms to enhance community energy planning through the Official Plan or other planning tools (i.e. Development Master Plan) particularly in growth areas and areas for major redevelopment	Plan/Study	▬□□	\$	Not initiated	Parks, Forestry & Environment (Environment)	City Planning Strategies	Utilities, Property Owners/Management/Developers



Action #2: Update Mississauga's Official Plan to Strengthen Existing Climate Change Imperative

The City's commitment to a low-carbon future will be strengthened in the City's Official Plan and will create the supporting land-use planning framework to advance climate action in Mississauga.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
2-1	Include policy direction in the City's Official Plan to support the Climate Change Action Plan	Policy	■□□	\$	Underway	City Planning Strategies	Parks, Forestry & Environment (Environment), Development and Design, Infrastructure Planning and Engineering Services	
2-2	Incorporate a climate impact lens in to streetscape design in the Downtown Public Realm Strategy and, once complete, consider applicability city-wide	Plan/Study	■□□	N/A	Underway	Development and Design	Parks, Forestry & Environment (Environment)	Utilities, Property Owners/ Management/ Developers
2-3	Revise the development application requirements and update the complete application criteria in the Official Plan to align with the updated Green Development Standards (See Action 3-1)	Procedure	■□□	\$	Not initiated	City Planning Strategies/ Development and Design* *Co-Lead	Parks, Forestry & Environment (Environment), Legal Services, Infrastructure Planning and Engineering Services	



Action #3: Improve the Energy Efficiency and Climate Resilience of New Buildings

The City will work to advance the sustainability and resilience of new private developments to encourage the use of renewable and district energy, reduce stormwater runoff, protect and enhance ecological functions, and reduce urban heat island.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
3-1	Update the Green Development Standard to include energy and resilience considerations within building, site features, and boulevard design	Plan/Study	▬▬▬	\$\$	Planned	Development and Design/ Parks, Forestry & Environment (Environment)* *Co-Lead	Legal, Infrastructure Planning and Engineering Services	Utilities, Property Owners/ Management / Developers
3-2	Identify opportunities to introduce new legal and/or policy tools, including by-laws, to require implementation of climate resilience measures (e.g., green roof by-law) in new buildings	Plan/Study	▬▬▬	N/A	Not initiated	Parks, Forestry & Environment (Environment)	Legal Services, City Planning Strategies	



Action #4: Increase the Use and Supply of Renewable Energy at Municipally-Owned Facilities

All new municipal buildings will be designed to accommodate future connections to solar energy sources and have on-site renewable energy devices. Solutions that move towards low carbon energy sources such as solar, wind, or district energy will be investigated and installed where possible.

Goals Supported
Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
4-1	Conduct a GHG Reduction and Solar Feasibility Study for Corporate Buildings	Plan/Study	▬□□	\$\$	Planned	Facilities & Property Management (Energy)/ Parks, Forestry & Environment (Environment)* *Co-Lead		
4-2	Explore models to finance investment in renewable capacity to meet City facility needs	Plan/Study	▬□□	N/A	Not initiated	Parks, Forestry & Environment (Environment)	Facilities & Property Management (Energy), Finance	
4-3	Identify and advance opportunities for renewable energy generation and storage at City-owned facilities to supply the needs of existing and future City-owned facilities and buildings	Partnerships and Engagement	▬□□	N/A	Not initiated	Facilities & Property Management (Energy)	Parks, Forestry & Environment (Environment)	Utilities



Action #5: Advance Energy Efficiency and Climate Resilience of Municipally-Owned Buildings

The City will lead by example by implementing low carbon and resilient technologies and processes in municipally-owned buildings to reduce energy consumption in corporate buildings by 25% below 2008 levels by 2030. Emerging technologies that work towards affordable and highly efficient solutions will also be encouraged, particularly those which reduce natural gas consumption.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
5-1	Build all new municipally-owned buildings to be more energy efficient and near net-zero	Policy	Recurring	N/A	Underway	Facilities & Property Management (Energy)	Parks, Forestry & Environment (Environment)	
5-2	Retrofit municipally-owned buildings to reduce natural gas and electricity consumption	Procedure	Recurring	\$\$	Not initiated	Facilities & Property Management (Energy)	Parks, Forestry & Environment (Environment)	Utilities
5-3	Develop municipal resilient design guidelines to complement existing Energy Design Guidelines to apply to retrofits and lifecycle replacements of municipal buildings	Policy	---	\$\$	Not initiated	Parks, Forestry & Environment (Environment)/ Facilities & Property Management* *Co-Lead	Fire and Emergency Services (Office of Emergency Management)	



Action #6: Develop a Low Carbon and Resilient Retrofits Program

The City will pursue opportunities to educate land owners and promote the retrofitting of existing buildings (including residential and commercial) with low carbon and resilient technologies to support improved energy efficiency (e.g., through heat pumps, wall insulation, etc.) and resilience while extending the life of existing structures.

Goals Supported

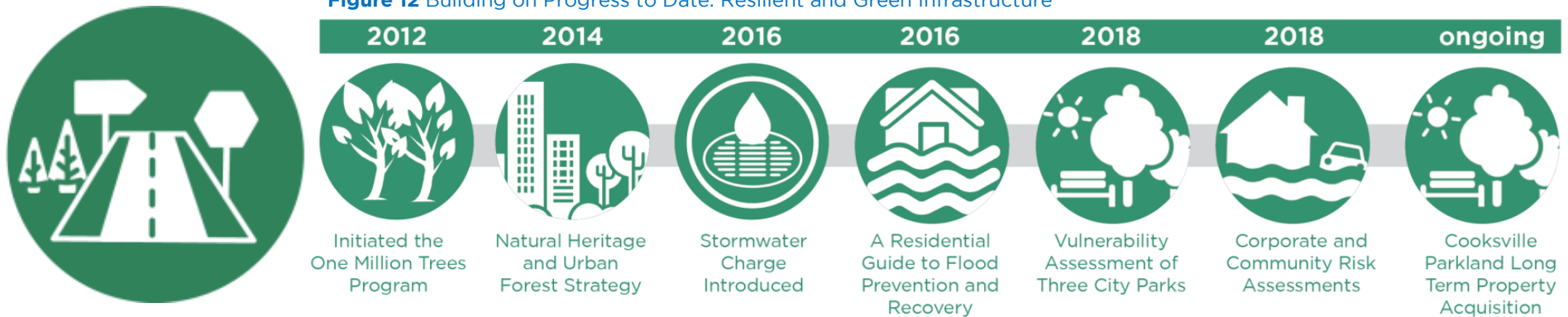
Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
6-1	Support new Sustainable Neighbourhood Retrofit Action Plans or other neighbourhood level action planning that focuses on retrofitting multi-unit residential buildings to be more energy efficient and resilient	Program/Project	---□	\$	Underway	Parks, Forestry & Environment (Environment)		Conservation Authorities
6-2	Develop energy and resilience retrofit programs for homeowners and landlords to promote opportunities, existing programs, incentives, and technologies that improve resilience, drive energy efficiency, and reduce greenhouse gas emissions	Program/Project	---□	N/A	Planned	City Planning Strategies/ Parks, Forestry & Environment (Environment)* *Co-Lead		The Atmospheric Fund, Utilities
6-3	Develop targeted programming based on energy maps and community greenhouse gas emissions inventories and continue to update data sets on regular cycles (e.g., annually/every five years)	Program/Project	---□	\$	Not initiated	Parks, Forestry & Environment (Environment)	Strategic Communications	Utilities, Partners in Project Green, Conservation Authorities
6-4	Encourage the use of low carbon heating and cooling technologies (e.g., heat pumps) for space and water heating and cooling	Procedure	---□	\$	Not initiated	Parks, Forestry & Environment (Environment)	Information Technology (Geospatial Solutions)	Utilities
6-5	Promote building envelope upgrades (e.g. wall insulation, energy efficient windows) in residential, commercial, and industrial buildings	Program/Project	---□	N/A	Not initiated	Parks, Forestry & Environment (Environment)		Utilities



Figure 12 Building on Progress to Date: Resilient and Green Infrastructure



2.0 Resilient & Green Infrastructure

Overview

Climate change impacts, such as extreme weather events, can cause damage to both physical infrastructure and natural systems and can disrupt municipal services, which poses a multitude of challenges.

Natural systems also provide a wide range of goods and services that benefit humans, such as drinkable water, pollination, flood regulation, and clean air. These ecosystem services support us in many ways, by enriching our health and well-being, offering recreational, aesthetic and spiritual opportunities, and strengthening our economy (Tu, C., Milner, G., Lawrie, D., Shrestha, N., Hazen, S. 2017). Protecting and enhancing Mississauga's Natural Heritage System builds resilience and can allow for natural and built resources to better cope with the impacts of climate change and help to minimize disruptions to municipal services.

By enhancing the resiliency of the built environment, protecting ecosystem services, and reducing risk to some of the City's most critical services now, Mississauga will be better positioned to cope with the impacts of climate change into the future.

The main focus areas for this Action Pathway are to:

- Enhance community level resilience and preparedness for known climate risks, including flooding, extreme heat, wind, and ice storms;
- Monitor and implement improvements to local air quality; and
- Support the development of green infrastructure and naturalized areas to improve resilience.



Connecting to the Future

Today

Residents, workers, and visitors to Mississauga all rely on the ecosystem and infrastructure services that are provided by the City's Natural Heritage System, infrastructure, and assets. Recognizing the importance of improving the resilience of the Natural Heritage System, infrastructure assets, and services, Mississauga has taken steps to better understand and plan for disruptions and damage caused by severe weather events, while also expanding green infrastructure across the city (Figure 12).

Additionally, the City has recognized the importance of managing its stormwater drainage system due to the risk of flooding and implemented a Stormwater Charge to generate funding for ongoing stormwater system management and investment.

By 2030

Resilience is a cornerstone of infrastructure management and planning in Mississauga and the municipality has taken proactive measures to mitigate, prepare for, and respond to a range of climate change scenarios.

The City has a robust climate risk management program in place that takes into account all members of the community including the city's most vulnerable populations. The practices in place have decreased exposure to the impacts of climate change and increased the adaptive capacity of the entire community.

Policies, programs, and investments in green infrastructure, ecosystem services, and natural heritage have built resilience in Mississauga, and climate considerations are routinely taken into account in decision-making processes. Existing datasets for tree canopy, habitats, and other natural systems have been expanded to guide actions and decision-making. Progress has been made towards establishing a long-term stormwater management strategy, and a plan for urban agriculture has been established.





Imagine 2050 Photo Contest Submission. Photo Credit: Jojo Santa Ana (2018)



Action #7: Create a Municipal Green Infrastructure Management Program

Create a City-wide green infrastructure program which will include the development of an inventory, management plan, and performance tracking mechanisms, and will establish and drive service levels in a coordinated and holistic way.

Goals Supported

Adaptation

Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
7-1	Create a targeted municipal green infrastructure program, which includes developing a Geographic Information System (GIS) based inventory, and monitoring assets with a particular focus on the impact of climate change over time	Program/Project	■ ■ ■ □	\$	Not initiated	Parks, Forestry & Environment (Environment)	Information Technology (Geospatial Solutions), Smart City/Information Technology, Infrastructure Planning and Engineering Services (Environmental Services)	Conservation Authorities
7-2	Develop an Asset Management Plan for all municipally-owned and/or managed natural assets	Procedure	■ ■ ■ □	\$	Not initiated	Parks, Forestry & Environment (Environment)	Finance. Infrastructure Planning and Engineering Services	Conservation Authorities
7-3	Develop a mechanism to value green infrastructure assets and the benefits of these assets to the community	Procedure	■ ■ ■ □	\$	Planned	Parks, Forestry & Environment (Environment)	Infrastructure Planning and Engineering Services (Environmental Services)	Conservation Authorities



Action #8: Integrate Climate Change Considerations into the Municipal Park Standards

The ongoing development of parks and parks facilities will include measures to address climate change risk and resiliency. These may include: increasing permeability of surfaces; increasing vegetation around stormwater management areas and adjacent areas that have low permeability; hardy species lists; and targets for tree canopy/soft landscape areas and naturalization.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
8-1	Explore options to enhance resilience in City-owned spaces and parks (e.g., walking pathways in parks) as opportunities arise on a site-by-site basis	Procedure	■■■	N/A	Underway	Parks, Forestry & Environment		
8-2	Develop and continuously update City design and maintenance standards for trees, shrubs, and perennials in urban locations to include considerations of advanced technology, species selection, and climate impacts (e.g., drought) in line with Recommendation 12 from the City's Parks and Forestry Master Plan	Procedure	■■■	N/A	Planned	Parks, Forestry & Environment		
8-3	Create design guidelines to consider alternative adaptive materials (e.g., more resilient to heat, freeze/thaw, wind) in the engineering and design of public spaces	Policy	■■■	\$	Planned	Parks, Forestry & Environment		



Action #9: Continue to Identify and Mitigate Climate-Related Risks and Enhance Community-Level Resilience and Preparedness

Climate-related risks to the community, including extreme heat, wind, ice storms, health related vulnerabilities, and food security, particularly to vulnerable populations, will be identified and mitigated.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
9-1	Continue to create response plans for climate-related risks (e.g., heat) to ensure suitable warning systems and response procedures are in place during extreme weather events	Plan/Study	---○	N/A	Underway	Fire and Emergency Services (Office of Emergency Management)	Parks, Forestry & Environment (Environment)	
9-2	Update and expand climate-related risk and vulnerability assessments for the community and the Corporation, with a specific focus on vulnerable populations, and develop targeted adaptation plans	Plan/Study	---○	N/A	Planned	Parks, Forestry & Environment (Environment)	Fire and Emergency Services (Office of Emergency Management)	
9-3	Conduct a climate vulnerability assessment of all existing municipal assets as part of the development of asset management plans	Plan/Study	---○	\$\$	Planned	Parks, Forestry & Environment (Environment)	Finance, Facilities & Property Management, Infrastructure Planning and Engineering Services (Environmental Services)	
9-4	Develop an urban agriculture and food security strategy	Plan/Study	---○	\$	Planned	Parks, Forestry & Environment (Environment)	City Planning Strategies, Legal Services	Conservation Authorities, Ecosource



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
9-5	Work with regional partners to enhance existing programs and services to address health impacts from climate change, increase awareness and responsiveness, and identify effective interventions and partnerships	Partnerships and Engagement	Recurring	N/A	Not initiated	Parks, Forestry & Environment (Environment)		Other levels of government



Action #10: Maintain and Enhance the Urban Forest to Improve Air Quality, Reduce Greenhouse Gas Emissions, and Improve Resilience

Climate change considerations will be integrated into existing habitat and tree monitoring and maintenance to ensure thriving natural areas and native species, and a robust tree canopy and proactively prepare for future impacts from pests and disease, changing watering requirements for trees, and other climate change impacts (e.g., extreme heat, wind).

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
10-1	Increase the urban tree canopy and the diversity of tree species being planted on public and private lands	Program/Project	Recurring	\$\$	Underway	Parks, Forestry & Environment	Development and Design	Conservation Authorities
10-2	Finalize and implement invasive species monitoring and control within the context of climate change, as per the Invasive Species Management Plan (2019)	Plan/Study	▬▬▬▢	\$\$	Underway	Parks, Forestry & Environment		Conservation Authorities
10-3	Review existing watering programs based on changing climate conditions and consider alternative sources of water, including potential rain capture or irrigation systems	Procedure	▬▬▬▢	\$	Not initiated	Parks, Forestry & Environment (Forestry)		
10-4	Create a community tree monitoring program to involve residents in the upkeep and maintenance of trees in their neighbourhoods	Program/Project	▬▬▬▢	\$	Not initiated	Parks, Forestry & Environment	Strategic Communications (311)	Conservation Authorities
10-5	Continue to diversify vegetation community types, including meadow, wetlands, and forests, in public spaces	Policy	▬▬▬▢	\$\$	Not initiated	Parks, Forestry and Environment		Conservation Authorities



Action #11: Monitor and Implement Improvements to Local Air Quality

In addition to greenhouse gas emissions, air pollutants, in the form of particulate matter and chemicals, are also released into the atmosphere from industrial processes and combustion engines and have implications for human health, the environment, and the economy. Air quality policies will be updated and a monitoring and modelling program will be developed (with partners).

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
11-1	Work with partners to monitor and model air quality	Partnerships and Engagement	Recurring	N/A	Underway	Parks, Forestry & Environment (Environment)	Information Technology (IT)	Other levels of government
11-2	Update Idling Control By Law and corporate policy (09-00-02 – Unnecessary Vehicle Idling) and explore enhanced enforcement models for personal, municipal, and freight vehicles	Policy	<div><div></div><div></div><div></div><div></div></div>	N/A	Not initiated	Parks, Forestry & Environment (Environment)	Enforcement, Legal Services, Corporate Performance and Innovation, Works Operations and Maintenance (Fleet)	
11-3	Work with other levels of government within the goods movement sector to explore pilot projects in Mississauga that improve local air quality	Program/Project	<div><div></div><div></div><div></div><div></div></div>	\$	Not initiated	Parks, Forestry & Environment (Environment)		Other levels of government, Neighbouring municipalities
11-4	Update the Corporate Smog and Air Health Advisory Response Plan	Plan/Study	<div><div></div><div></div><div></div><div></div></div>	\$	Not initiated	Parks, Forestry & Environment (Environment)		



Action #12: Continue to Enhance Flood Resilience and Stormwater Management in the Context of Changing Climate Conditions

Immediate and long-term actions will be developed to enhance flood resilience and the City's approach to stormwater management to address climate change issues and flood risks.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
12-1	Assess the condition of the existing stormwater system as part of the Stormwater Asset Management Plan	Plan/ Study	▬□□	\$	Underway	Infrastructure Planning and Engineering Services (Environmental Services)		
12-2	Develop a comprehensive long-term stormwater management strategy to reduce surface runoff and enhance flood resilience	Plan/ Study	▬□□	\$\$	Underway	Infrastructure Planning and Engineering Services (Environmental Services)		Conservation Authorities
12-3	Explore the use of green infrastructure to manage stormwater on publicly and privately owned properties (e.g., permeable paving, blue roofs)	Plan/ Study	Recurring	\$	Planned	Infrastructure Planning and Engineering Services (Environmental Services)	Parks, Forestry & Environment (Environment)	Conservation Authorities, Mississauga Board of Trade
12-4	Develop neighbourhood-based flood mitigation plans (for urban overland and sanitary flooding) to identify opportunities to decrease flood risk	Plan/ Study	▬□□	\$\$	Planned	Infrastructure Planning and Engineering Services (Environmental Services)		Conservation Authorities



Figure 13 Building on Progress to Date: Accelerating Discovery and Innovation



3.0 Accelerating Discovery & Innovation

Overview

New technologies and innovative ways of doing business are essential for Mississauga to reach the goals set out in this Action Plan. In recent years, cleantech has emerged as a driving force behind many of the world's leading climate change solutions, making strides in significantly improving efficiencies in energy production and resource management, and preventing and reducing degradation to the environment.

Recognizing that progress to achieve the benefits of a more diverse research, development, and technology sector will take both time and resources, the City will need to take steps to help accelerate discovery and innovation in Mississauga.

The main focus areas for this Action Pathway are to:

- Increase access to funding and resources for climate action and related projects;
- Support growth of the green economy and the cleantech sector in Mississauga through partnerships with local businesses and industry leaders;
- Create policies and procedures that will result in climate considerations being routinely taken into account in decision-making processes within the City; and
- Monitor innovation and change in low carbon and resilient technologies



Connecting to the Future

Today

Mississauga is a Canadian leader in cleantech, with more advanced clusters than any other major comparative city (Mississauga Cleantech Cluster Assessment, MDB Insight, 2018). Mississauga's cleantech sector supports a strong balance between research, development, and manufacturing; suggesting a mix of creative and critical thinking and advanced manufacturing, in addition to leadership in green transit. Mississauga's location, situated between Toronto and Hamilton, has allowed the City to tap into a talent pipeline from 12 publicly funded post-secondary institutions, including the local University of Toronto campus and Sheridan College.

Mississauga's Sustainable Procurement Policy addresses sustainable procurement at all levels of local government and across a variety of roles and levels of seniority. The result is a precedent-setting, comprehensive policy framework to guide sustainable purchasing. In addition, Mississauga's Economic Development Office is one of only three that has developed a strategic focus on the cleantech sector, providing a valuable signal to existing businesses and investors in the sector.

Partnerships, capacity building, and improved sharing of resources and knowledge are needed to remove some of the persistent barriers to system-wide progress and to enable the scaling-up of technologies to meet the needs of a growing population.

By 2030

With strides made in relationship-building with the cleantech sector, Mississauga will continue to be a leader in discovery, innovation, and technological development. Local government, industries, businesses, not-for-profit organizations, and academic institutions will all be working together to create a stronger, more connected, and coordinated system that accelerates discovery and innovation in Mississauga.

The City's policy framework will provide the support for innovation in areas related to climate change, supporting a paradigm shift in the way that mitigation and adaptation are considered in decision-making across all City departments. Mississauga will be a nationally-recognized hub that fosters innovation and nurtures discovery in the arena of clean technology, making it easier for businesses and industries to transition to and adopt new technologies and develop synergies across economic sectors that are geared towards climate change resilience.



Action #13: Encourage Growth and Uptake of Low Carbon and Resilient Technologies

Networks to support the shift towards a green economy will be created and pilot projects to apply innovative ideas and technologies will be explored.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
13-1	Develop a clean energy and innovation network to support cleantech sector growth, facilitate business-to-business connections, and identify top priorities for the sector and the City	Partnerships and Engagement	■■■□	N/A	Not initiated	Parks, Forestry & Environment (Environment), Economic Development Office* *Co-Lead		Mississauga Board of Trade, Partners in Project Green, Conservation Authorities
13-2	Explore partnership opportunities to deploy clean energy technology solutions in Mississauga	Partnerships and Engagement	■■■□	\$	Not initiated	Parks, Forestry & Environment (Environment)	Economic Development Office, Smart City/IT	Partners in Project Green
13-3	Develop innovation challenges to provide opportunities for the public to co-problem solve local issues or problems (e.g., localized flooding), test out new ideas, and connect with the City	Program/Project	■■■□	N/A	Planned	Smart City/IT	Parks, Forestry & Environment (Environment), Economic Development Office	
13-4	Explore innovative pilot projects and opportunities to enhance resilience and reduce greenhouse gas emissions (e.g., heat pump retrofits)	Program/Project	Recurring	\$	Not initiated	Parks, Forestry & Environment (Environment)		The Atmospheric Fund
13-5	Work with industry and businesses to support initiatives to decrease emissions and enhance resilience	Partnerships and Engagement	■■■□	\$	Not initiated	Parks, Forestry & Environment (Environment)	Economic Development Office	Airport, Climate Smart, Partners in Project Green, Conservation Authorities, Mississauga Board of Trade



Action #14: Incorporate Climate Change into Municipal Decision-Making

Climate change will be incorporated into municipal decision-making, including procurement, business planning, and asset management.

Goals Supported

Adaptation Mitigation



Supporting Actions	Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
					Lead	Support	
14-1 Develop a lifecycle cost analysis framework to apply to all lifecycle replacements, equipment, and new buildings	Plan/Study	■■■	\$	Planned	Materiel Management	Parks, Forestry & Environment, (Environment), Facilities & Property Management (Energy), Finance	Ontario Climate Consortium
14-2 Apply a climate lens to Corporate business continuity plans for critical infrastructure sectors to ensure climate impacts are considered	Policy	■■■	N/A	Planned	Fire and Emergency Services (Office of Emergency Management)	Parks, Forestry & Environment (Environment)	
14-3 Develop a climate change decision-making framework or policy to guide municipal decision making	Policy	■■■	\$	Not initiated	Parks, Forestry & Environment (Environment)	Corporate Performance & Innovation	



Action #15: Monitor and Promote Innovation in Low Carbon and Resilient Technologies

Stay up-to-date with available technologies and work with industry and businesses to identify long-term equipment needs and low carbon technologies for the City and its service areas.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
15-1	Work with partners to provide input to industry on emerging low carbon technologies for specific applications to deliver City services	Partnerships and Engagement	Recurring	N/A	Underway	Parks, Forestry & Environment (Environment)	Works Operations & Maintenance (Fleet), Fire & Emergency Services (Fire Capital Assets)	Partners in Project Green, Conservation Authorities
15-2	Research changes and innovation in the transportation and energy sectors to identify low-carbon opportunities for the Corporate fleet	Plan/Study	Recurring	N/A	Planned	Parks, Forestry & Environment (Environment)	Corporate Fleet, Fire & Emergency Services (Fire Capital Assets), Facilities & Property Management (Energy Management)	Partners in Project Green



Action #16: Provide Strategic Direction on the Management and Diversion of Municipal Waste and Litter

The Region of Peel currently provides waste, recycling and organics collection services to the residents of the Region of Peel, which includes single family homes and multi-residential households (rental and condominiums). The City of Mississauga currently manages waste and litter generated by municipal facilities, parks, and on city roads. Policies which promote waste diversion and litter mitigation will continue to be developed and implemented, helping the City achieve a 75% waste diversion goal for City-created waste or bi-products of City business.

Goals Supported
Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
16-1	Develop a Corporate waste reduction strategy	Plan/Study	<div><div></div><div></div><div></div></div>	\$\$	Underway	Parks, Forestry & Environment (Environment)	Recreation, Facilities & Property Management, Works Operations and Maintenance	Other levels of government
16-2	Develop and maintain industry and community partnerships to provide consistency, control operational costs, and improve waste diversion rates	Partnerships and Engagement	<div><div></div><div></div><div></div></div>	N/A	Underway	Parks, Forestry & Environment (Environment)		Partners in Project Green, Conservation Authorities
16-3	Explore opportunities to implement the circular economy to reduce waste	Programs/ Projects	<div><div></div><div></div><div></div></div>	\$	Planned	Parks, Forestry & Environment (Environment)		Other levels of government



Figure 14 Building on Progress to Date: Low Emissions Mobility



4.0 Low Emissions Mobility

Overview

In Mississauga, emissions from transportation account for over 30% of greenhouse gas emissions, second to buildings. Vehicles rely heavily on fossil fuels, which in turn contributes to the release of carbon dioxide emissions into the atmosphere.

There is significant potential to decrease emissions from transportation, particularly with advancements in technology and through encouraging more sustainable forms of transportation (e.g., transit, cycling, walking). The impacts of modern transportation and driving can be reduced starting with the diversification of the types of cars on the road, integrating fuel efficient technologies into existing vehicles and transit fleets, reducing vehicle idling, and expanding existing cycling and walking networks. As a centre for goods movement, there is also a growing interest in the use of clean technologies in freight to reduce transportation related emissions throughout the region.

As transportation technology advances and new forms of mobility emerge, the way Mississauga moves both in terms of people and goods will evolve. Driverless cars, electric vehicles and trucks, car sharing, ridehailing, and e-bikes are but a few examples of some of the ways that traditional vehicle-based transportation is shifting towards a more low carbon future.

The main goals for this Action Pathway are to:

- Support the shift towards lower-emission modes of transportation, such as transit, cycling;
- Accelerate the adoption of zero emissions vehicles (light and heavy duty); and
- Decrease greenhouse gas emissions from the City's corporate and transit fleet and equipment (including light-, medium-, and heavy-duty vehicles).



Connecting to the Future

Today

The City of Mississauga's Transportation Master Plan (2019) notes that in 2016, 71% of trips into, out of, and around Mississauga were completed by drivers, with another 14% of trips taken by a passenger in a personal vehicle, taxi or ride-share. Public transit accounted for 11% of trips with the remaining 4% taken by active transportation modes (e.g., walking and cycling).

The City's MiWay transit service is currently Ontario's third largest municipal transit service provider. In 2015, through expanded bus transit, MiWay replaced up to 11,000 car trips with transit trips. MiWay ridership grew by more than 15% in the five year period from 2011 to 2016, with the second highest ridership per capita of any local transit system in the Greater Toronto Hamilton Area (GTHA), after Toronto.

While the majority of Mississauga residents still use an automobile as their primary mode of transportation, the city is showing signs of lower automobile dependence, particularly in relation to other major urban centres in the GTHA, with fewer cars per household and a vocal desire for high quality transit. With more investments in public transit, cycling infrastructure, pedestrian networks, and zero-emission vehicles, the City will continue to make important strides in reducing the GHG emissions from the transportation sector.

By 2030

The greenhouse gas emissions from the transportation sector in Mississauga are being curbed through advanced efforts and investments in low-emissions transportation options. This includes increased and improved cycling infrastructure (e.g., protected bike lanes), better and more connected pedestrian networks, increased adoption of zero-emission vehicles and trucks, and more public transit options. Expanded transit service with more fuel-efficient vehicles has also reduced emissions per rider.

With these investments in place, a much greater proportion of residents are choosing to take alternative modes of transportation, reducing their dependency on private vehicles. Mississauga is a city where close to half of trips to, from, and within its boundaries are taken by sustainable modes, which include walking, cycling, and transit. Residents are making the choice to take active modes for short trips, and public transportation or zero emission vehicles for long trips. Lower-emissions trucks are delivering our goods and services to our homes and businesses.





The City Centre Transit Terminal is Mississauga's transit hub and a key component of the city's mobility network. Photo Credit: Automazul Sight & Sound Photography (2014)



Action #17: Reduce Emissions from the City's Corporate and Transit Fleet

The City will lead by example by investing in low carbon and fuel efficient technologies and infrastructure, including electric vehicle charging infrastructure, for the City's corporate and transit fleets and equipment.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
17-1	Use improved analytical platforms (e.g., telematics) to monitor driver behaviour and develop a driver training program to reduce fuel consumption and Corporate idling	Procedure	■□□	\$	Underway	Works Operations and Maintenance (Fleet)	Smart City/IT, MiWay-Transit, Parks, Forestry & Environment	
17-2	Develop a green fleet policy to (1) prioritize electrification opportunities for all City fleets and equipment; and (2) continue to identify opportunities for proper vehicle allocation, route optimization, and right-sizing fleet	Policy	■□□	\$\$	Underway	Parks, Forestry & Environment (Environment/ Works Operations and Maintenance (Fleet)* *Co-Lead	MiWay-Transit, Fire and Emergency Services (Capital Assets), Materiel Management, Facilities & Property Management	
17-3	Electrify the light duty transit vehicles and Corporate fleet and equipment and expand use of renewable fuels	Program/ Project	■□□	\$\$	Planned	Works Operations and Maintenance (Fleet)/ MiWay-Transit* *Co-Lead	Parks, Forestry & Environment (Environment, Facilities & Property Management	
17-4	Assess charging infrastructure options for future electrification of transit (e.g., depot vs. on-route charging)	Plan/Study	■□□	\$	Planned	Works Operations and Maintenance (Fleet)/ MiWay-Transit* *Co-Lead	Facilities & Property Management (Energy), Parks, Forestry & Environment (Environment)	



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
17-5	Replace the transit bus fleet with low or zero emission vehicles	Program/Project	---	\$\$\$	Planned	MiWay-Transit	Facilities & Property Management (Energy)	
17-6	Pursue innovative low or zero emissions pilot and partnership opportunities (e.g., hydrogen or electric bus pilots)	Partnerships and Engagement and Program/Project	Recurring	N/A	Not initiated	MiWay - Transit/Parks, Forestry & Environment (Environment)* *Co-Lead	Facilities & Property Management (Energy), Works Operations and Maintenance (Fleet)	The Atmospheric Fund
17-7	Assess infrastructure readiness for electric vehicle charging infrastructure in Corporate and municipal parking facilities to accommodate the electrification of the Corporate and transit fleets	Plan/Study	==	\$	Not initiated	Facilities & Property Management	Works Operations and Maintenance (Fleet), MiWay-Transit, Parks, Forestry & Environment (Environment)	Partners in Project Green



Action #18: Empower Low Carbon and Alternative Modes of Transportation in the Community

Efforts that enable and encourage travellers to choose transit, low carbon, and people-powered transportation alternatives will be advanced. Enhancements to the walkability of the community will also assist in improving air quality and public health. As a centre for goods movement, the City will also work with industry partners and other levels of government to pursue alternative fuels and the integration of clean technologies in the goods movement sector.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
18-1	Encourage and enable micro-mobility systems and establish a policy framework for shared micro-mobility systems (e.g., bike share) in Mississauga	Plan/Study	▬□□	\$	Underway	Infrastructure Planning and Engineering Services (Transportation Infrastructure Management)	Parks, Forestry & Environment (Environment), Enforcement	
18-2	Include climate change considerations (e.g., extreme weather, tree canopy) in the development of the Complete Streets Design Guidelines as per Action 1 of the City's Transportation Master Plan	Policy	▬□□	N/A	Underway	Infrastructure Planning and Engineering Services (Transportation Planning)	Parks, Forestry & Environment (Environment)	
18-3	Develop a zero emissions vehicle strategy to accelerate the adoption of zero emissions vehicles	Plan/Study	▬□□	\$	Underway	Parks, Forestry & Environment (Environment)	Facilities & Property Management, Infrastructure Planning and Engineering Services (Transportation Infrastructure Management and Transportation Planning)	Peel Climate Change Partnership, Utilities, The Atmospheric Fund, Partners in Project Green



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
18-4	Prioritize active transportation improvements in roadway development and re-development	Program/Project	Recurring	\$\$	Underway	Infrastructure Planning and Engineering Services (Transportation Infrastructure Management)		
18-5	Install electric vehicle charging infrastructure at City-owned properties (e.g. city hall) for use by employees and the general public	Program/Project	---□	\$	Underway	Parks, Forestry & Environment (Environment)/ Traffic Management and Municipal Parking* *Co-Lead	Facilities & Property Management	Utilities
18-6	Work with industry partners and other levels of government to promote innovative technologies and pursue alternative fuels initiatives in the goods movement sector	Partnerships and Engagement	Recurring	-	Underway	Parks, Forestry & Environment (Environment)	Economic Development Office	Other levels of government, Mississauga Board of Trade
18-7	Develop transportation demand management requirements for new developments in line with Recommendation #4 in the City's Transportation Demand Management Strategy and Implementation Plan	Policy	---□	\$\$	Planned	Infrastructure Planning and Engineering Services (Transportation Infrastructure Management)		
18-8	Identify and address gaps and inconsistencies in the pedestrian network, consistent with Action 14 of the City's Transportation Master Plan	Program/Project	---□	\$	Planned	Infrastructure Planning and Engineering Services (Transportation Planning)		



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
18-9	Expand the City's bicycle parking supply, including short-term and long-term facilities on commercial, residential, and City-owned properties, consistent with Action 1.4 in the Cycling Master Plan Update (2018)	Program/ Project	■ ■ ■	\$ \$	Planned	Infrastructure Planning and Engineering Services (Transportation Infrastructure Management)		



Figure 15 Building on Progress to Date: Engagement and Partnerships



5.0 Engagement & Partnerships

Overview

The impacts of climate change are evident across many aspects of society, including where people live, work and play. In order to prepare for the complex issue of climate change it is important to take action with a whole-society approach. This can be achieved through continuous engagement with the public, informing them on the issues, changing attitudes and perceptions and through inciting a social change that focuses on a collective response to climate change. For the Climate Change Action Plan to be successful, the City will need to engage and mobilize all residents and stakeholders to garner extensive community support.

To facilitate the participation of a range of groups, it will be important to provide useful and relevant information. This includes information about climate change and its potential effects on Mississauga as set out in the Climate Change Action Plan, and reporting on progress as the Action Plan is implemented.

Building on existing partnerships will expand and strengthen collaboration at all levels of society. This collaboration must happen internally within organizations and communities, but also across sectors, breaking down barriers to information sharing and making it easier for partners from across the community to leverage one another's successes and build momentum.

The main focus areas for this Action Pathway are to:

- Increase education and awareness of climate change;
- Support attitude and behavioural change by providing meaningful engagement opportunities; and
- Encourage action by providing financial and non-financial incentives.



Connecting to the Future

Today

The establishment of outreach teams and a dedicated Community Relations Section at the City in 2017 is part of the ongoing effort to foster an open dialogue with residents and make information and opportunities for participation and collaboration more accessible.

On an annual basis, the City hosts stewardship programs through celebrations such as Earth Days and Bike to Work Day. The After Dark Earth Market, which featured local artists, vendors, and exhibitors, was optimized to inform the public about the actions the City has taken and will be taking to address climate change, how it is striving towards resilience and how citizens can get involved.

Mississauga has also launched One Million Trees, a tree planting program to enhance the City's forested areas and preserve them well into the future. As part of this program, trees continue to be planted by City staff, partners, residents and volunteers on both public and private property. Over 300,000 trees have been planted to date.

Through the development of the Climate Change Action Plan, the City has collaborated with a variety of key stakeholders from a broad range of fields, providing education, insight and project implementation.

By 2030

Mississauga will have strengthened networks across the City to partner on climate action, and is able to leverage the skills, expertise, and efforts of its population to achieve meaningful results. Residents feel empowered to take individual action as well as seek out opportunities to lend their support to collaborative ventures to reduce emissions and enhance local resilience. Businesses will lead in climate efforts that showcase best practices in their own facilities and service offerings.

A number of opportunities for meaningful engagement on climate change issues and solutions are available. This has allowed for a greater understanding of climate change and low-carbon, and environmentally-friendly practices.

The implementation of the actions proposed in this Action Plan have been monitored and evaluated over time enabling the City to identify successes and areas in which improvement and action are needed. By sharing in the successes of all groups, a new energy and drive towards higher achievement and leadership in addressing climate change is being cultivated. The wider Mississauga community realizes that everyone has a role to play in addressing climate change and is taking action.





Hillside Community Garden. Photo Credit: City of Mississauga (2018)



Action #19: Raise Awareness about Climate Change

Information and education will be provided to residents, staff, elected officials, businesses and community groups through outreach activities and campaigns and the City will work with community partners to advocate to other levels of government to support and help accelerate local climate action.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
19-1	Work with partners to support industry and all levels of government in promoting and developing low carbon and resilient standards, policies, and programs	Partnerships and Engagement	■ ■ ■ □	N/A	Underway	Parks, Forestry & Environment (Environment)	City Planning Services, Development and Design	Clean Air Council
19-2	Pursue opportunities to collaborate with community groups and organizations to accelerate climate action	Partnerships and Engagement	Recurring	\$	Underway	Parks, Forestry & Environment (Environment)		Community Groups
19-3	Develop an education program on climate and emergency preparedness	Program/Project	■ ■ ■ □	\$ \$	Planned	Fire and Emergency Services (Office of Emergency Management)	Parks, Forestry & Environment (Environment)	Credit Valley Conservation, Community Groups, Peel Climate Change Partnership
19-4	Assess the public's familiarity with and views on climate change and develop a behaviour change strategy to inform current and future engagement work	Program/Project	■ ■ ■ □	\$	Not initiated	Parks, Forestry & Environment (Environment)		Peel Climate Change Partnership
19-5	Develop climate hubs to establish a centre for climate-related training programs, information, tools, and networks	Program/Project	■ ■ ■ □	\$ \$	Not initiated	Parks, Forestry & Environment (Environment)	Strategic Communications, Fire and Emergency Services (Office of Emergency Management)	Conservation Authorities, ACER, Ecosource



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
19-6	Create targeted programming based on energy usage in residential, commercial, and industrial buildings to promote energy efficiency retrofits	Procedure	Recurring	\$	Not initiated	Parks, Forestry & Environment (Environment)	Facilities & Property Management (Energy)	Utilities
19-7	Work with partners to advocate to the provincial and federal governments for funding to improve low-carbon transit	Partnerships and Engagement	■ ■ ■ □	N/A	Not initiated	Parks, Forestry & Environment (Environment)	MiWay-Transit, Works Operations and Maintenance (Fleet)	Airport



Action #20: Inspire and Showcase Climate Action

Programs and actions that can be taken to reduce greenhouse gas emissions and improve resilience will be developed and highlighted (e.g., use of clean technologies locally, installation of solar panels, etc) throughout the community.

Goals Supported

Adaptation

Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibilities		Additional Stakeholders
						Lead	Support	
20-1	Showcase new and existing climate actions throughout the city through signage, promotional materials, case studies, awards, etc.	Program/Project	—□□	\$	Underway	Parks, Forestry & Environment (Environment)	Strategic Communications	Youth groups, Community groups, Partners in Project Green, Mississauga Board of Trade
20-2	Promote and engage community groups, businesses, and municipal staff in workplace transportation demand management (TDM) programs across Mississauga	Program/Project	Recurring	\$	Underway	Infrastructure Planning and Engineering Services	Parks, Forestry & Environment (Environment), Economic Development Office	Smart Commute, Other levels of government Partners in Project Green, Mississauga Board of Trade
20-3	Develop targeted outreach and engagement opportunities for youth in Mississauga	Program/Project	—□□	\$	Planned	Parks, Forestry & Environment (Environment)	Recreation, MiWay - Transit	Ecosource - Peel Environmental Youth Alliance, School Boards, Youth groups
20-4	Develop and deliver training to 311 staff to connect residents and businesses with new and existing programs to promote and support rebates, incentives, products, and services	Program/Project	—□□	\$\$	Not initiated	Parks, Forestry & Environment (Environment)	Strategic Communications	Environmental Action Committee
20-5	Work with partners to deploy programs to drive climate action in the business sector	Partnerships and Engagement	—□□	\$	Not initiated	Parks, Forestry & Environment (Environment)	Economic Development Office	Environmental Action Committee, Partners in Project Green, Mississauga Board of Trade



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibilities		Additional Stakeholders
						Lead	Support	
20-6	Conduct community action campaigns to promote individual action on climate change	Program/ Project	■ ■ ■	\$\$	Not initiated	Parks, Forestry & Environment (Environment)	Strategic Communications	Ecosource - Peel Environmental Youth Alliance, Youth groups, Community groups



Action #21: Support and Drive Behaviour Changes to Advance Climate Action

Monitoring and evaluation programs and metrics to identify how Mississauga can enhance climate action over time will be developed along with a platform for sharing successes and motivating continued action and achievement.

Goals Supported

Adaptation Mitigation



Supporting Actions		Action Type	Timeline	Cost	Status	Responsibility		Additional Stakeholders
						Lead	Support	
21-1	Develop a climate-themed event as part of the Smart City Centre for Civic Curiosity	Program/ Project	■ ■ ■ □	N/A	Planned	Parks, Forestry & Environment (Environment/ Smart City/IT* *Co-Lead		
21-2	Develop tools and technologies (e.g., surveys, apps) to support and drive behaviour changes in the community	Program/ Project	■ ■ ■ □	\$	Not initiated	Parks, Forestry & Environment (Environment)		Ecosource - Peel Environmental Youth Alliance, Youth Groups, Community and Youth Groups
21-3	Develop a community climate leaders program to encourage, support, and empower key target audiences (e.g., youth, businesses) in Mississauga to take action	Program/ Project	■ ■ ■ □	\$	Planned	Parks, Forestry & Environment (Environment)	Strategic Communications, Economic Development Office	Ecosource - Peel Environmental Youth Alliance, Youth Groups, Partners in Project Green, Mississauga Board of Trade
21-4	Explore opportunities to provide information about financial and non-financial incentives for home energy and resilience retrofits (e.g., energy efficiency upgrades, renewable installations)	Program/ Project	■ ■ ■ □	\$	Not initiated	Parks, Forestry & Environment (Environment)		Utilities



Implementation Considerations

The Climate Change Action Plan includes a series of practical and foundational actions. The City of Mississauga is committed to achieving its vision of a low-carbon and resilient city through sustained implementation of these actions.

Monitoring, Evaluation & Reporting

The City will report annually on progress. The annual report (or “report card”) will:






- Provide a snapshot of progress on action pathways, with direct reference to the indicators mentioned in this section
- Share success stories
- Share areas for improvement or future work/study
- Report on progress towards the goals and targets

Measuring Progress

The City is committed to tangible results. The City will monitor progress towards its climate change goals by reporting annually on key indicators (identified in Figure 16). These indicators are aligned with each of the action pathways.



Figure 16 Suggested Indicators for Measuring Progress on the Climate Change Action Plan

Action Pathway	Suggested Indicators
 Buildings & Clean Energy	<ul style="list-style-type: none"> • Change in greenhouse gas emissions from the City's buildings • Decrease in building and services downtime after major climate events • Renewable energy generated at municipal facilities (in mega watt hours) • Percentage of adoption of heat pumps in Mississauga
 Resilient & Green Infrastructure	<ul style="list-style-type: none"> • Percentage change in Mississauga's tree canopy • Staff time spent on disaster recovery/clean up (e.g., tree damage) • Number of trees planted (total and annual) • Cost to the City of responding to extreme weather events
 Accelerating Discovery & Innovation	<ul style="list-style-type: none"> • Number of cleantech businesses within Mississauga • Number of Smart City challenges held • Inclusion of climate change as a driver in key strategic documents (e.g., Official Plan, Future Directions) • Waste diversion rate in City facilities
 Low Emissions Mobility and Transportation (Fleet)	<ul style="list-style-type: none"> • Change in greenhouse gas emissions from the City's fleet • Percentage of trips taken by sustainable modes • Greenhouse gas emissions (GHGs) per transit rider • Percentage of corporate and transit fleets that are low emission vehicles • Greenhouse gas emissions (GHGs) per kilometre travelled in a corporate fleet vehicle/fuel efficiency • Number of electric vehicle charging stations on public and/or private land • Low emissions vehicle sales in Mississauga
 Engagement & Partnerships	<ul style="list-style-type: none"> • Climate change awareness levels of city staff • Number of participants in climate-related campaigns • Number of participants engaging in climate change hubs



Renewal

The City is committed to updating the Climate Change Action Plan every five years.

The renewal of the Action Plan will:

- Demonstrate achievement/progress towards the targets and goals and revise as appropriate;
- Integrate new climate science and risks;
- Align with other important policy and guidance documents at the City, including:
 - The Official Plan
 - The Strategic Plan
 - Other Master Plans
- Encompass ideas and work from partners and the community.

Staff Time

The majority of actions outlined above will require staff time to implement. This time could be spent implementing the action, overseeing its implementation by a third party, or working in partnership with other organizations to complete the action. Each action has been assigned to a Division within the City that will be responsible for its implementation. Additional staff resources may be required for items that cannot be integrated into annual work plans.

Mississauga Business Plan and Budget

A Council-approved Climate Change Action Plan will have the authorization and approval to implement the actions outlined in order to achieve the City's climate change goals and targets. The Climate Change Action Plan provides the rationale and motivation for the required resources to be allocated as part of the City's annual Business Plan and Budget.

Target Audiences

In order to be successful, the CCAP will require support and buy-in from all stakeholders in Mississauga. Below is a list of possible target audiences, which includes both internal and external stakeholders.

- Residents and homeowners;
- Academic institutions and school boards;
- Youth (under 25);
- Local businesses;
- Industry;
- Developers;
- Community groups and local organizations;
- Indigenous communities;
- Other levels of government;
- Conservation authorities;
- Neighbouring municipalities;
- City staff; and
- Elected officials.



Glossary

Adaptation

Actions in response to actual or projected climate change impacts which reduce the vulnerability of social, environmental, physical and economic systems.

Air Quality

The degree to which the air in a particular area or geography is suitable for inhabitants including humans, animals, or plants to remain healthy.

Asset Management

According to the City of Mississauga's Asset Management Policy, Asset Management is the coordinated activities of an organization to realize optimal value from its assets. It involves balancing costs, opportunities and risks against the desired performance of assets to achieve the City's objectives.

Circular Economy

An alternative to the traditional linear "make-use-dispose" process. The circular economy model aims to minimize the use of raw materials, maximize the useful life of a product, and create value for the product to be used again once it reaches end of life.

Cleantech

Any process, product, or service that reduces environmental impacts through: (1) environmental protection activities that prevent, reduce, or eliminate pollution or any other degradation of the environment; (2) resource management activities that result in a more efficient use of natural resources; or (3) the use of goods that have been modified or adapted to be significantly less energy or resource intensive than the industry standard.

Climate

The prevailing weather conditions including temperature, precipitation, and wind patterns in an area over a long period of time.

Climate Change

Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. Climate change is any systematic change in the long-term statistics of climate elements (such as temperature, sea level, precipitation, humidity, or winds) sustained over several decades or longer.

Environment Community of Practice

An internal group within the City of Mississauga that provides a forum where a variety of environmental practitioners and other interested City staff can come together to learn, share, connect, and innovate to help green the Corporation and the community.



Extreme Weather

Extreme weather events refer to meteorological conditions that are rare for a particular place and/or time, such as an intense storm or heat wave and are beyond the normal range of activity. They can be the result of sudden and drastic changes in temperature, precipitation and sea-level or they may be the result of a more gradual, but prolonged, shift in temperature or precipitation that is beyond the normal range.

Greenhouse Gas (GHG)

Greenhouse gases are a set of gases that absorb infrared radiation that can trap in heat from the sun's rays, which contributes to warming of the earth. Greenhouse gases are naturally occurring and are created by the burning of fossil fuels: gasoline, diesel fuel, natural gas, or propane. The key GHGs of concern are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

Green Infrastructure

An infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs (Per Ontario Regulation 588/17).

Green Leaders

A group of City of Mississauga staff who promote environmental awareness in the corporation, with the aim of achieving environmental sustainability in the workplace.

Lifecycle

Describes the sequential stages connecting a product system, from material extraction or generation to final disposal.

Micro-Transit

A category of transport that refers to modes carrying one or two passengers. Examples can include bicycles, electric scooters, skateboards.

Mitigation

Measures that contribute to the stabilization or reduction of greenhouse gas emissions.

Net Zero

Net zero refers to the balance of either energy consumption or emissions production in a community or building. For energy consumption it is achieved when the consumption of energy is balanced by renewable energy production. For the production of emissions, it is achieved when total production equals zero or greenhouse gas emissions are removed or offset.



Resilience

The ability of systems and communities to absorb the impacts of climate change and maintain an acceptable level of functionality and service.



References

- Bush, E. and Flato, G. (2018). About this report; Chapter 1 in Canada's Changing Climate Report, (ed.) E. Bush and D.S. Lemmen; Government of Canada, Ottawa, Ontario, p. 7-23.
- City of Mississauga. (2013). Long-Range Forecasts. City of Mississauga 2011-2051. Retrieved from http://www5.mississauga.ca/research_catalogue/K_28_Hemson_Long_Range_Forecasts_2011_2051.pdf
- City of Mississauga. (2017). Cleantech is a Human Race. Retrieved from [https://www7.mississauga.ca/documents/business/2018/CoM-Cleantech-Profile\(Q1-2017\).pdf](https://www7.mississauga.ca/documents/business/2018/CoM-Cleantech-Profile(Q1-2017).pdf)
- City of Mississauga. (2018). Cycling Master Plan. Mississauga: City of Mississauga.
- City of Mississauga. (2012). Living Green Master Plan. Retrieved from http://www5.mississauga.ca/marketing/websites/livinggreen/downloads/LGMP2012_Final.pdf
- City of Mississauga. (2009). Strategic Plan. Retrieved from http://www.mississauga.ca/file/COM/StrategicPlan_Web_04_22_2009.pdf
- City of Mississauga. (2019). Mississauga Official Plan. Retrieved from <http://www.mississauga.ca/portal/residents/mississaugaofficialplan>
- Davies Howe. (2019). A Short Guide to the Draft Amendments to the Growth Plan, 2017. Retrieved from <http://www.davieshowe.com/a-short-guide-to-the-proposed-amendments-to-the-growth-plan-2017/>
- Government of Canada. (2017). Pan-Canadian Framework on Climate Change. Retrieved from <https://www.canada.ca/content/dam/themes/environment/documents/weather1/20170125-en.pdf>
- Government of Canada. (2019). Canada's Changing Climate Report. Retrieved from <https://www.nrcan.gc.ca/environment/impacts-adaptation/21177>
- Government of Ontario. (2016). Archived - Air Quality in Ontario 2013 Report. Retrieved from <https://www.ontario.ca/page/air-quality-ontario-2013-report>
- Government of Ontario. (2017). O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure. Retrieved from <https://www.ontario.ca/laws/regulation/r17588>
- Government of Ontario. (2018). A Made-in-Ontario Environment Plan. Retrieved from



<https://www.ontario.ca/page/made-in-ontario-environment-plan>

Insurance Bureau of Canada. (2018). May windstorm largest insured event in Ontario in 5 years. Retrieved from <http://www.ibc.ca/on/resources/media-centre/media-releases/may-windstorm-largest-insured-event-in-ontario-in-5-years>

Insurance Bureau of Canada. (2015). New study estimates future costs of climate change - Study builds case for infrastructure investment. Retrieved from <http://www.ibc.ca/nb/resources/mediacentre/media-releases/new-study-estimates-future-costs-of-climate-change>

MDB Insight. (2018). Mississauga Cleantech Cluster Assessment. For City of Mississauga Climate Change Project.

Region of Peel. (2011). Peel Climate Change Strategy Background Report. Retrieved from <https://www.peelregion.ca/planning/climatechange/reports/pdf/climate-chan-strat-bgr.pdf>

Risk Science International (RSI) (2018). PIEVC Assessment of Three Parks – City of Mississauga. For City of Mississauga Climate Change Project.

Strader, M. (2014). Peel's \$83 million ice storm cost expected to rise: CAO. Retrieved from <https://www.caledonenterprise.com/news->

[story/4307356-peel-s-83-million-ice-storm-cost-expected-to-rise-cao/](https://www.caledonenterprise.com/news-story/4307356-peel-s-83-million-ice-storm-cost-expected-to-rise-cao/)

Tu, C., Milner, G., Lawrie, D., Shrestha, N., Hazen, S. (2017). Natural Systems Vulnerability to Climate Change in Peel Region. Technical Report. Toronto, Ontario: Toronto and Region Conservation Authority and Ontario Climate Consortium Secretariat.



Appendix A – Mississauga's Carbon Footprint

Community Profile

This section provides an overview of greenhouse gas (GHG) emissions in Mississauga (also referred to as “community emissions”). The majority of GHG emissions in Mississauga come from buildings (see Figure A1). This includes residential, commercial, and industrial buildings, with emissions coming primarily from the burning of natural gas to heat indoor spaces and water. Over 30% of GHGs come from transportation. Total GHG emissions for the community are approximately 6.2 million tonnes of carbon dioxide equivalent (eCO₂).

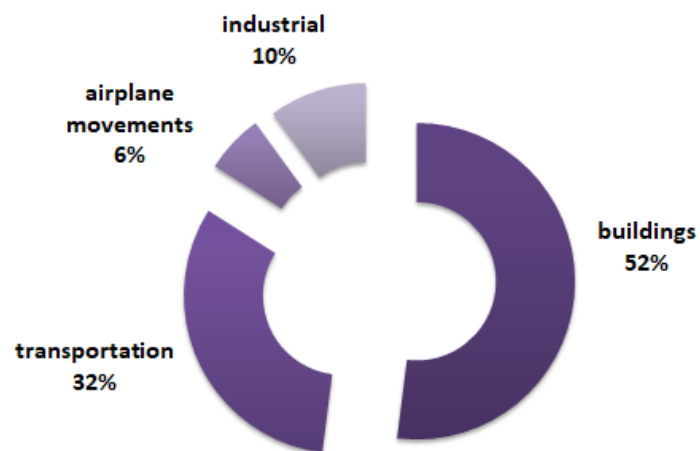


Figure A1: Community GHG Emissions Profile (2015)

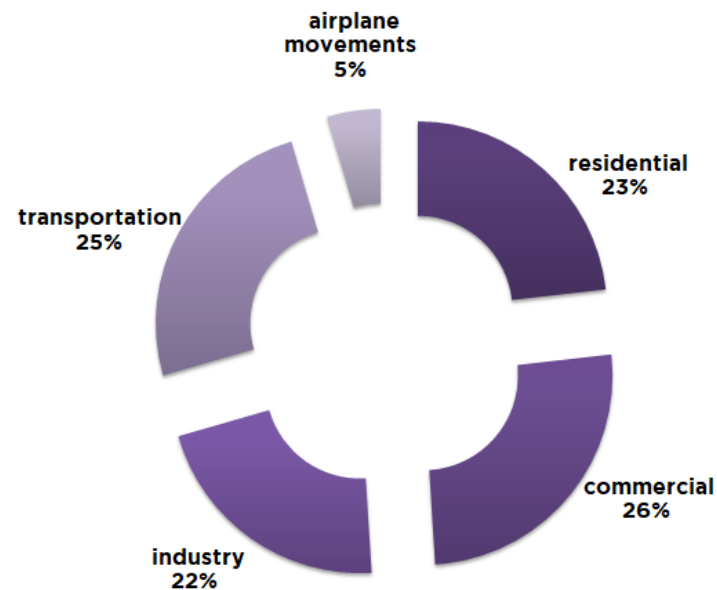


Figure A2: Community Energy Consumption by Sector (2015)

In considering how to decrease GHG emissions, it is useful to consider how energy is consumed in the city. Figure A2 shows energy consumption by sector. As this figure shows, there is a fairly even split among the top four sectors (residential, commercial, industrial, and transportation), with each responsible for approximately a quarter of energy consumption in the city. Considering energy consumption by fuel type (see Figure A3), natural gas is responsible for almost 40% of consumption, with gasoline and electricity around 20% each.

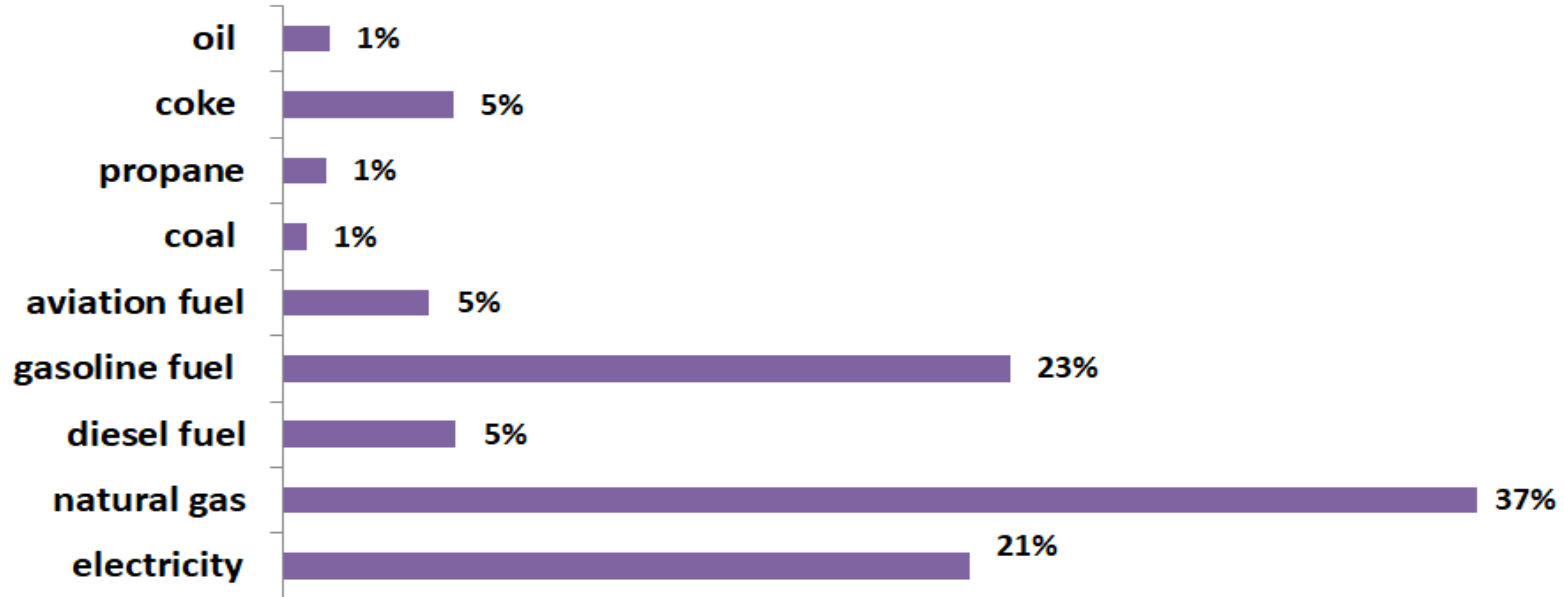


Figure A3: Community Energy Consumption by Fuel (2015)

Trends in Emissions

The amount of GHG emissions in the City have changed over time. Looking back to Mississauga's baseline year of 1990, GHG emissions have decreased (see Figure A4), however it has not been a straight line path. Increases in population growth between 1990 and 2006 led to an increase in emissions during that time, whereas the phase-out of coal-fired power plants between 2003 and 2014 led to a cleaner electricity grid. This phase-out is largely responsible for the 13% reduction in GHG emissions from 1990 to today (see Figure A5).

An examination of the trends in carbon-related emissions over the past three decades also shows that the population of Mississauga has been able to reduce its 'per capita' (or per person) emissions by 45%. This means that residents now use almost half the amount of energy from fossil fuels than they did in 1990 (Figure A5). The progress made to date creates a solid foundation to build on in reducing the City's overall emissions.



Achieving our Climate Change Action Plan Targets

The Climate Change Action Plan (CCAP) sets a goal of reducing community emissions 80% from 1990 levels by 2050, with a long-term goal of becoming net-zero and an interim goal of reducing emissions 40% by 2030. Figure A6 provides an overview of the community GHG reduction targets for 2030 and 2050 and the progress that has been made towards those targets since 1990.

As the figure shows, while there has been a 13% decrease in GHG emissions from 1990, there is still significant progress that needs to be made in order to reach both our 2030 and 2050 targets and ultimate goal of net zero.

This includes meaningful actions in the buildings and transportation sectors. Indeed, as Figure A7 shows, if we are to continue on a business-as-usual path, community emissions from buildings and transportation will increase 14% by 2050. That means that not only will we need to reverse this upward trend, but we will also need focused and sustained actions to reach our interim 2030 target (which requires a further reduction of almost 30% in GHGs from today's levels), as well as our 2050 target.

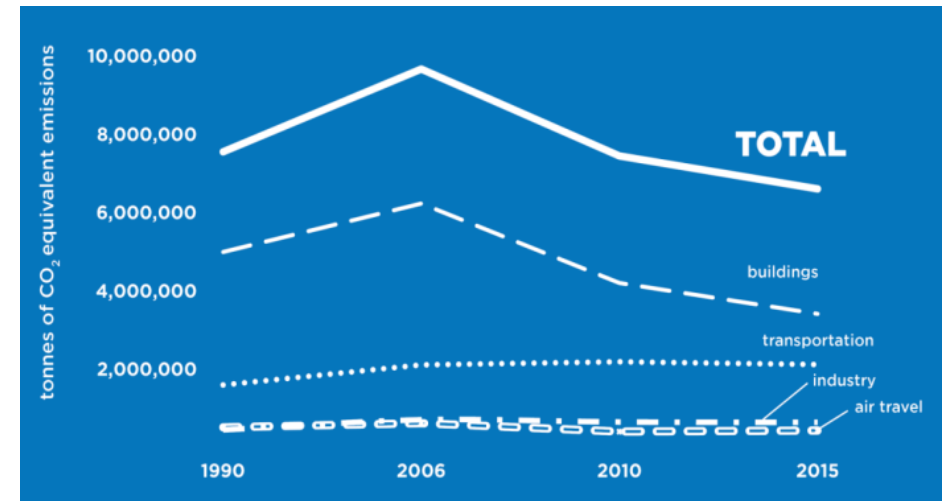


Figure A4: Trends in Emissions from 1990 to 2015

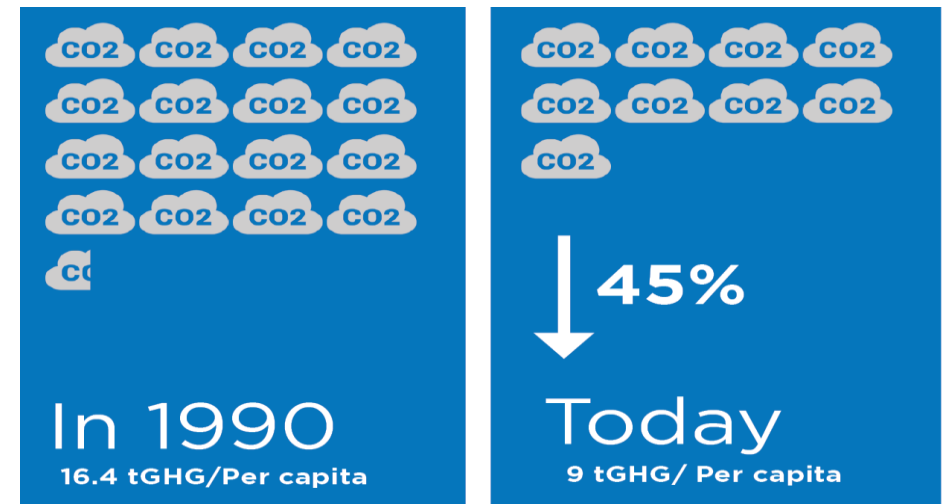


Figure A5: Per Capita Emissions in Mississauga in 1990 and 2015



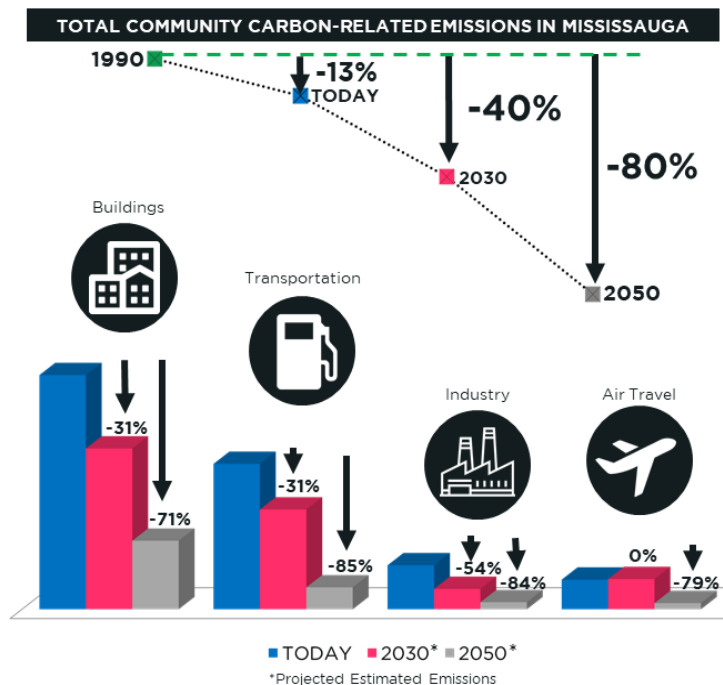


Figure A6: Progress Made and Needed to Reach 2030 and 2050 Targets

Profile of Municipal Operations and Services

Today

This section describes the GHG emissions of the City's municipal operations and services (also referred to as "Corporate emissions"). There are five main sources of Corporate emissions: (1) municipal buildings; (2) Corporate fleet; (3) transit fleet; (4) fire fleet; and (5) street lighting. While single-tier municipal inventories also include solid waste and water and wastewater,

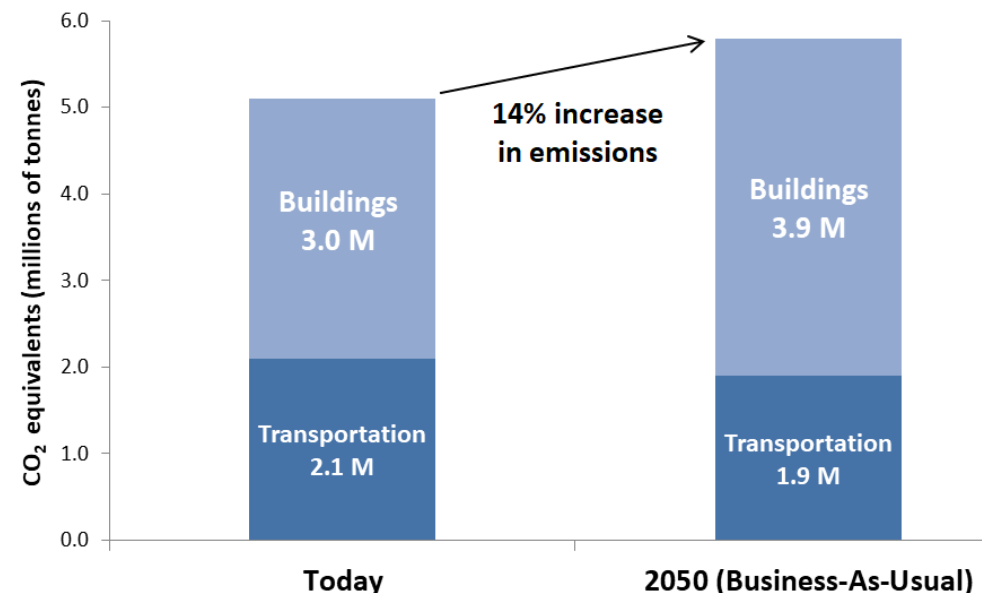


Figure A7: Increase in emissions from 2015 to 2050 under a "business-as-usual" scenario (data from Siemens study)

these are within the Region of Peel's jurisdiction and are therefore excluded from the Corporate GHG inventory. Total emissions for municipal operations are approximately 72,000 tonnes of eCO₂.

As is clear from Figure A8, the vast majority of emissions from municipal operations are the result of operating the transit fleet, which accounts for nearly 70% of total emissions. Municipally-owned and operated buildings account for almost 30% of emissions, with the City's corporate vehicle fleet, fire services trucks and vehicles, and street lighting accounting for the rest.

Another way to look at the impact of municipal operations is to examine energy consumption. Figure A9 shows energy consumption by municipal source. As this figure shows, transit consumes the most amount of energy, and is responsible for almost 50% of energy consumed. Buildings are a close second, accounting for approximately 40% of the City's energy footprint. The total amount of energy consumed through municipal operations is approximately 1,475 terajoules (TJ).

Considering energy consumption by fuel source (see Figure A10), diesel is responsible for over 50% of energy consumption. While the entire municipal fleet (i.e., corporate, fire, and transit) uses diesel fuel, transit consumes the vast majority of this fuel. Both electricity and natural gas are responsible for about 25% of energy consumption, with oil and gasoline contributing a small portion.

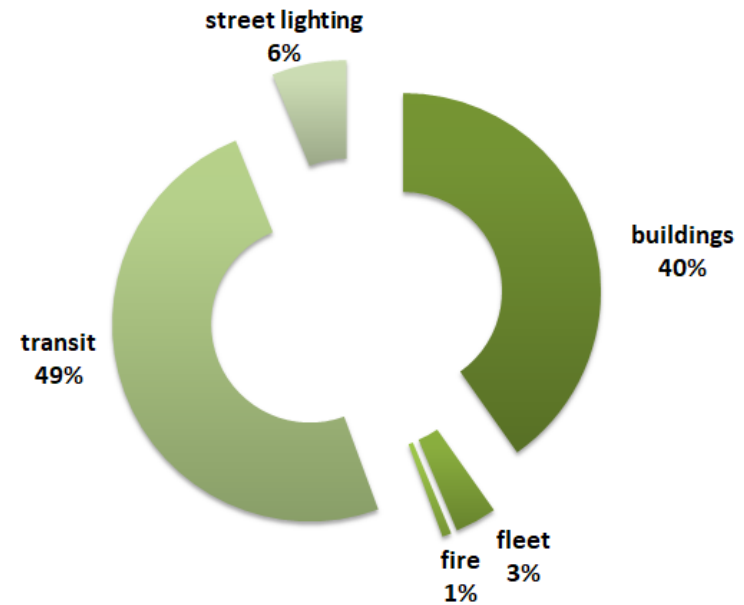


Figure A9: Corporate Energy Consumption by Municipal Operation (2015)

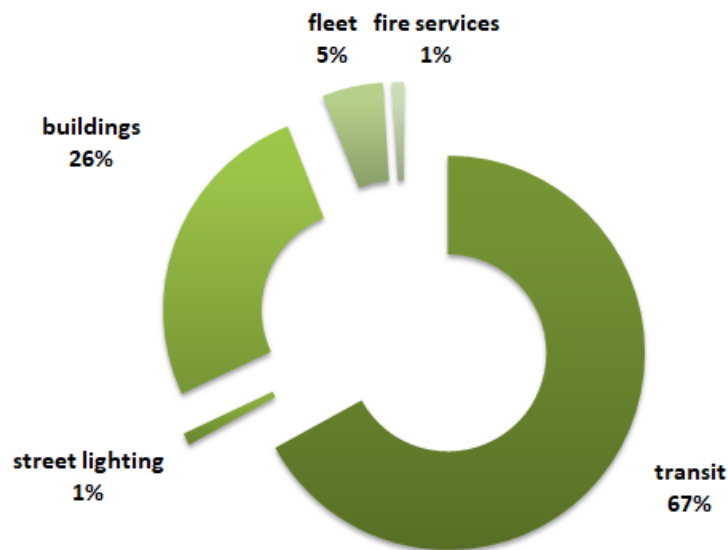


Figure A8: Corporate Greenhouse Gas Emissions Profile (2015)

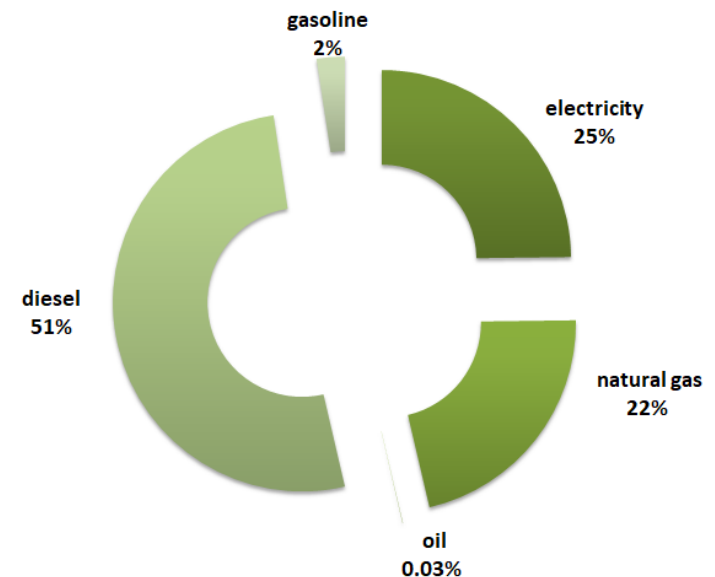


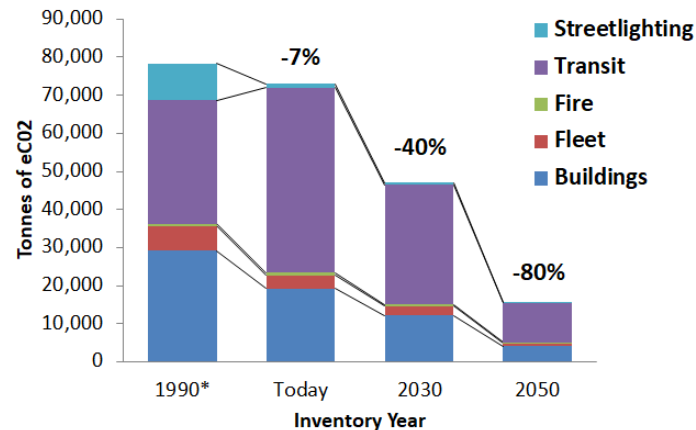
Figure A10: Corporate Energy Consumption by Fuel (2015)



Where We Need to Go

The City has set a goal of reducing its Corporate emissions 80% from 1990 levels by 2050, with a long-term goal of becoming net-zero and an interim goal of reducing emissions 40% by 2030. Figure A11 shows the potential pathway to reaching the targets. To date, the Corporation has reduced its GHG emissions by 7% compared with 1990 levels. That means that the City will need to take significant actions, particularly in regards to its transit fleet and buildings, in order to reach the 2030 and 2050 targets.

The Climate Change Action Plan sets out the actions that the City will take to move us towards these targets.



* 1990 baseline data was taken from 2010 City of Mississauga Corporate Greenhouse Gas and Criteria Air Contaminant Inventory using scaling metrics to estimate 1990

Figure A11: Progress Made and Needed to Reach 2030 and 2050 Targets (2015)



Appendix B – Climate Change Risk Assessment

As part of the development of the Climate Change Action Plan, the City of Mississauga commissioned a series of technical baseline studies and assessments along with stakeholder and community engagement, to understand the City's current initiatives and progress with respect to climate change adaptation and mitigation and to chart a course for climate change action to 2030.

One of the core components of the process to develop the CCAP was the completion of a Climate Change Risk Assessment (CCRA), in order to identify and prioritize the climate-related hazards that pose the greatest risk to the City. The CCRA identified current and future mitigation and adaptation strategies to help the City proactively plan for, and act, according to a changing climate.

Below describes the steps that Mississauga took to complete a CCRA.

Climate Trends and Future Projections

Mississauga has experienced a number of climate change-related weather events over the past decade, including flooding as a result of heavy rainfall events and severe ice and wind storms, leading to property and infrastructure damage across the city.

The climate projections for Peel Region indicate a continued trend in such extreme weather events, with potential for an increase in high-intensity thunderstorms and rainfall, strong wind events, ice storms, and rain events in winter (rain-on-snow and rain-on-frozen ground), as well as an increase in drought events and freezing rain events. Snowfall is likely to continue with similar frequency to present-day conditions in the future, while freeze-thaw cycles could occur occasionally in the future (PIEVC Assessment of Three Parks – City of Mississauga, RSI, 2018).



Identifying and Assessing Climate Risk

The process of identifying the climate risks for Mississauga included three main components:

1. Drawing on previous studies and planning exercises;
2. A Corporate Risk Assessment, focusing on the City's municipal assets and services; and
3. A Community Risk Assessment, casting a net across Mississauga to include all areas of the community.

The results of each of these components is summarised in the following sections.

PREVIOUS STUDIES

Staff from the City participated in the Train the Trainer Initiative of the Great Lakes Climate Change Adaptation Project in 2016, along with other municipalities across southern Ontario. The intent of this exercise was to build capacity and prepare municipal staff for climate adaptation planning and stakeholder engagement within their own communities. Building upon this project, the City of Mississauga conducted local workshops with the support of the International Council for Local Environmental Initiatives (ICLEI) to gain the community's perspective on the vulnerability and risks posed by climate change, with the goal of using those results towards adaptation planning.

These previous studies and planning exercises provided the basis for an initial compilation of potential climate

change impacts in Mississauga. Additional information was drawn from the Cooksville Creek Vulnerability Assessment (Credit Valley Conservation, 2016) and the Economic Impacts of the Weather Effects of Climate Change on the City of Mississauga report (Insurance Bureau of Canada, 2015).

Corporate Risk Assessment Approach and Methodology

A risk assessment was undertaken for each division within the City, beginning with an identification of applicable climate drivers and the impacts to divisional assets and services, followed by a risk calculation based on the following formula:

Risk = Likelihood X Consequence

The Corporate Risk Assessment included reports for each of the following divisions:

- Works, Operations and Maintenance
- Transit
- Transportation Infrastructure Planning
- Revenue and Materiel Management
- Recreation
- Parks and Forestry
- Planning and Building
- Library
- Legislative Services
- Legal Services
- Information Technology



- Human Resources
- Facilities & Property Management
- Fire
- Finance
- Environment
- Enforcement
- Engineering and Construction
- Economic Development
- Culture
- Communications

Outcome

The Corporate Risk Assessment generated outcomes for current and future risk which were incorporated into divisional risk assessment reports. These reports are internal documents that provide a preliminary overview of the impacts that climate change might have on each division by 2050.

These reports and the results of the assessment were utilized to inform the development of adaptation actions identified in the Climate Change Action Plan as well as short-term business plans for each department.

Community Risk Assessment Approach and Methodology

A Community Risk Assessment was undertaken through a combination of technical steps and a multi-stakeholder approach, with the participation of the Climate Change Stakeholder Panel. The Stakeholder

Panel included representatives from a range of sectors. See Appendix C for a full list of organizations.

The steps of the Community Risk Assessment included:

1. Identifying climate change impacts and generating impact statements;
2. A Risk Assessment Workshop, to assign likelihood and consequence levels for each impact, and generating an initial risk level; and
3. Validating the workshop output and risk calculation with technical experts.

STEP ONE: GENERATING IMPACT STATEMENTS

The first step in the community risk assessment process begins with identifying the existing and future impacts of climate change. A list of 26 impacts were generated from a series of background reports and research studies conducted by the City between 2015 and 2018. A total of 26 impact statements were developed and included in the Risk Assessment Workshop.

Climate Change Impact Statements:

1. Changes in precipitation will cause more frequent and severe rainfall, leading to community level flooding;
2. Changes in river/creek temperature, affecting water quality;
3. Decreased summer precipitation will increase the probability of summer drought, leading to increasingly higher tree mortality, affecting urban forest cover;
4. Changes in seasonal temperature will lead to shifting eco-regions for flora and fauna



communities and can lead to increased spread of invasive species, as well as local extinctions;

5. High winds (including tornadoes, microbursts, etc.), ice storms, and lightning, leading to infrastructure and property damage;
6. More extreme heat days leading to stress on urban flora and fauna;
7. Increased extreme weather leading to urban forestry damages;
8. Increased quantity of rain may cause flooding of electrical infrastructure leading to blackouts;
9. Increased intensity of rainfall in the summer may damage personal property;
10. Increased winter precipitation leads to ice storms that cause power failures;
11. Increased incidence of summer storms leading to increased incidences of flooding leading to exposure to illness and pathogens;
12. Increase in winter snowfall may cause a decrease in the availability of transportation systems (e.g., reduced transit routes, sidewalk clearing delayed);
13. Increased ice storms can lead to damage to trees and forests;
14. Change in winter snowfall patterns, leading to increasingly hazardous road conditions;
15. More hot days over 30 degrees Celsius will increase heat related illnesses and result in ecosystem impacts;
16. Extreme precipitation leading to disruption in public transportation services;
17. Increased frequency and duration of rain storms will lead to increased stormwater and storm runoff leading to localized overland flooding,

flooding or washing out roads and basements in low lying areas, with resulting economic impacts;

18. Changes in lake temperature affecting water intake facilities, considered near surface
19. Freezing rain resulting in property and infrastructure damage as well as road hazards, leading to airport, transportation and business disruptions;
20. Increase in fall/spring temperatures may cause quick thaw, which will lead to strain on infrastructure, washouts, flooding, heavy runoff, and property impacts;
21. Increased incidence of summer storms leading to tree impacts on public property;
22. Increased winter rainfall resulting in impacts to natural systems such as groundwater and aquatic ecology;
23. Heavier rainfall over a shorter time will increase stress on built infrastructure and natural systems;
24. Greater frost depth (affecting below grade infrastructure), causing freezing in near-surface pipes;
25. Changes to near-shore flow patterns affecting water quality (through dispersion of pollutants, excess runoff, sewage treatment plant effluent); and
26. Increased incidence of hail storms blocking drainage infrastructure leading to localized flooding.



STEP TWO: COMMUNITY RISK ASSESSMENT WORKSHOP

Stakeholder engagement was a key component of the approach taken towards the development of the community risk assessment. On June 1, 2018, the City hosted a stakeholder workshop which brought together representatives of key stakeholder groups and the public and incorporated their input into the risk assessment process. This event was attended by a total of 45 participants from the City and Region of Peel, community-based organizations, private sector groups and business owners. See Appendix C for a full list of representatives.

During the workshop, participants were assigned to a table and given a set of impact statements to discuss, with some impacts assigned to multiple tables to allow for a cross-check and validation of results across groups.

Effective consultation with community stakeholders was essential to the overall risk assessment process because it was informed by local knowledge, and provided a reciprocal opportunity to obtain valuable input from stakeholders as well as to educate them on climate-related risks. Most importantly, it ensured that those responsible for implementing climate action understood the basis upon which the Climate Change Action Plan would be formed and why certain actions would be required.

The intent of the workshop was to review the local climate impacts identified through previous studies and, through the results of collaborative work, assign a

risk level to each impact. Participants were divided across a number of tables to provide a cross-representation of subject matter familiarity and expertise, with a facilitated discussion to determine the likelihood and consequence level of each of the 26 impacts.

The first step in identifying risk level is assigning likelihood. Likelihood refers to the probability of an impact taking place or how often a climate event may occur. It takes into account historical frequency and potential or projected future trends as well as input from subject matter experts. For example, if a climate hazard has historically occurred more than once per year, then that event is almost certain to occur in subsequent years if current conditions remain the same.

Within the context of this risk assessment, the values of likelihood spanned a scale from 1 to 7 with 1 considered negligible and 7 considered highly probable.



Figure B1 below shows the historical, future 2030, and future 2050 likelihood values that were assigned to community level flooding.

The second step in determining risk level is to assign a consequence value. Consequences refer to the potential losses (e.g., human, social, environmental, financial, etc.) or negative outcomes of a given incident. For the Climate Change Risk Assessment, total consequence was determined based on the sum of values assigned to each of the following five categories:

- **Public Health & Safety** – Public health and safety consequences refer to human impacts involving injuries and fatalities or illness.
- **Local Economy & Growth** – Local economy and growth consequences refer to the financial impacts and dollar losses experienced as a result of a given event.

- **Community & Lifestyle** – Community and lifestyle consequences refer to the potential impacts on the quality of life of the community which may encompass a decline in services, social networks, and community support.
- **Environment & Sustainability** – Environmental and sustainability consequences refer to negative impacts of a hazard on the environment which may include contamination, ecosystem impacts, or physical damage.
- **Public Administration** – Public administration consequences refer to damages incurred to corporate functioning, reputation and the ability to provide public services and continue normal operations.

As shown in Figure B2, consequence values ranging from 1 (Negligible) to 5 (Catastrophic) were assigned to each of five consequence categories.

Impact Statements	Likelihood			
	Climate Hazard/Indicator	Historical Probability	Future Probability 2030	Future Probability 2050
Changes in precipitation will cause more frequent and severe rainfall , leading to community level flooding	Precipitation - Rain [50 mm w/in 1 h (summer)]	5	6	6
	Precipitation - Rain [40 mm w/in 1 hr (winter)]	6	6	6

Figure B1 Sample of Stakeholder Workshop Likelihood Assignment



Consequence Rating	Criteria				
	Public Health & Safety	Local Economy & Growth	Community & Lifestyle	Environment & Sustainability	Public Administration
Catastrophic	Large number of serious injuries or loss of lives	Regional decline leading to wide-spread business failure, loss of employment and hardship	The region would be seen as very unattractive, moribund and unable to support its community	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Public administration would fall into decay and cease to be effective
	5	5	5	5	5
Major	Isolated instances of serious injuries or loss of life	Regional stagnation such that business are unable to thrive and employment does not keep pace with population growth	Severe and widespread decline in services and quality of life within the community	Severe loss of environmental amenity and a danger of continuing environmental damage	Public administration would struggle to remain effective and would be seen to be in danger of failing completely
	4	4	4	4	4
Moderate	Small number of injuries	significant general reduction in economic performance relative to current forecasts	General appreciable decline in services	Isolated but significant instances of environmental damage that might be reversed with intensive efforts	Public administration would be under severe pressure on several fronts
	3	3	3	3	3
Minor	Serious near misses or minor injuries	Individually significant but isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Minor instances of environmental damage that could be reversed	Isolated instances of public administration being under severe pressure
	2	2	2	2	2
Negligible	Appearance of a threat but no actual harm	Minor shortfall relative to current forecasts	There would be minor areas in which the region was unable to maintain its current services	No environmental damage	There would be minor instances of public administration being under more than usual stress but it could be managed
	1	1	1	1	1

Figure B2 Consequence Categories

This exercise resulted in a total aggregate consequence value for each of the ten break-out discussion tables. Average consequence and maximum consequence were then generated for each impact based on the collective table results.

The relationship between likelihood and consequence as it pertains to risk is represented in the following risk equation:

$$\text{Risk} = \text{Likelihood} \times \text{Sum of Consequence across Categories}$$

A risk outcome or risk level is the product of the multiplication of likelihood and consequence. This was the final step in the risk assessment process.

Risk scores were generated by multiplying historical, future 2030, and future 2050 likelihood values by both average and maximum consequence for each impact. If a risk score was greater than 100 for historical, future 2030, or future 2050 risk for both average and maximum risk, then the risk level was high. For impacts with a combined score of greater than 100 in the maximum category only, then the risk score was also high. If any of the impacts met these criteria they were considered to represent the highest priority risks in the City of Mississauga.



STEP THREE: VALIDATION AND RISK CALCULATION

The results of the workshop were reviewed in conjunction with City staff and climate change specialists to develop a completed risk assessment matrix. This was then used to inform the prioritization of impacts that would need to be addressed in the future through the Climate Change Action Plan. Impact statements represent the priority risks identified within studies completed to date, thus no individual risk is considered to be low risk.

The analysis looked at the relative scores between impact statements, rather than the absolute scores generated by each break-out discussion table. This helps to normalize differences in scoring between discussion groups, and helps to create further prioritization among the higher priority list of impacts.

RISK OUTCOMES: HISTORIC, FUTURE 2030, AND FUTURE 2050

As a result of this analysis, the highest priority risks that were identified included:

- Changes in precipitation will cause more frequent and severe rainfall, leading to community level flooding;
- Increased quantity of rain may cause flooding of electrical infrastructure leading to blackouts;
- Increased intensity of rainfall in the summer may damage personal property;
- Increased winter precipitation leads to ice storms that cause power failures;

- High winds (tornadoes, microbursts, etc.), ice storms, and lightning, leading to infrastructure and property damage;
- More extreme heat days leading to stress on urban flora and fauna;
- Increased extreme weather leading to urban forestry damages;
- Changes in river/creek temperature, affecting water quality;
- Decreased summer precipitation will increase the probability of summer drought, leading to increasingly higher tree mortality, affecting urban forest cover; and
- Changes in seasonal temperature will lead to shifting eco-regions for flora and fauna communities and can lead to increased spread of invasive species, as well as local extinctions.

Climate Change Risk and Action Planning

The Corporate and Community Risk Assessments were used as a key reference in the development of the CCAP. The CCAP integrated the results of the Corporate and community risk assessments (in addition to other studies and gap analyses), into an extensive action planning process which generated discussion and actions in response to the highest climate-related risks for Mississauga.



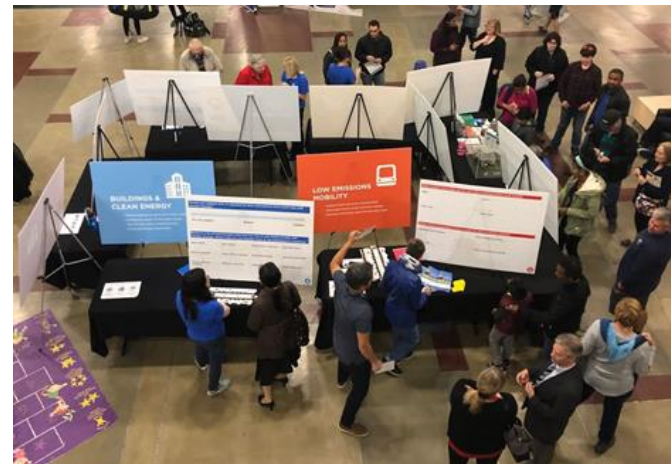
Appendix C – Public Consultation Summary

In order to holistically develop the Climate Change Action Plan (CCAP), engaging with staff, our external stakeholder panel (see Figure C1) and the public was fundamental to ensuring the CCAP was made in Mississauga. As the CCAP was developed, feedback was continuously analyzed and integrated into the Plan, resulting in a refined and improved final product. The engagement process was designed to achieve the following outcomes:

- Collect feedback, commentary and input from various stakeholders;
- Raise awareness and understanding about the impacts of climate change;
- Generate excitement and buy-in among city staff and the community; and
- Empower action and involvement in the development and future implementation of the CCAP.

Additionally, three guiding messages were communicated throughout the engagement process:

- Climate change is real
- The City is taking action
- Everyone has a role to play



Community Engagement 2018

Throughout the development of the CCAP, the City participated in over 60 events and reached over 10,000 residents. Some examples of education and outreach activities included:

- **Imagine2050 Escape Room:** In partnership with Escape From The 6, the City created the Escape Room which provided an immersive and interactive experience for residents to learn about climate change impacts and local action.
- **The After Dark Earth Market:** In partnership with Many Feathers, the City hosted a climate-themed market. The event brought together local businesses, vendors, food trucks and exhibitors, and provided opportunities for residents to learn about the City's Climate Change Action Plan.
- **Imagine 2050 Photo Contest:** In partnership with Visual Arts Mississauga and The Atmospheric Fund, the City asked residents to imagine what a low-carbon and resilient future could look like using photography.
- **Work of Wind: Air, Land, Sea:** The City partnered with the Blackwood Gallery out of the University of Toronto Mississauga to produce a ten-day public art exhibit. The Southdown Industrial Area was transformed into a contemporary art exhibition focusing on the theme of climate change.

- **Online Survey:** An online survey was available throughout June- September, 2018, which provided residents with the opportunity to identify their understanding of and experiences to date with climate change.

Including social media impressions, **the Climate Change Project reached over 165,000 community members.** Some of the key messages heard through the engagement process included:

- The impacts of climate change are affecting the community at a range of scales and residents are keen to get involved in taking action;
- The success of the Climate Change Action Plan is closely linked to working with partners across a range of sectors; and
- Information and data on climate risks and vulnerabilities are crucial to decision-making and sharing information across internal City departments and more widely with stakeholders is a crucial step in resiliency planning and preparedness.

Community representatives were consulted through the creation of a Climate Change Stakeholder Panel at the outset of the Climate Change Project. The Panel met on a regular basis at key decision-points and milestones throughout the project process and development of the Action Plan, including the visioning, climate risk assessment, and action planning stages. Members from a range of organizations participated in the Panel (see Figure C1 for a list of Panel members).



Figure C1 - Climate Change Stakeholder Panel Membership

Name	Organization	Role
Adam Molson	Daniels	Manager of Project Implementation
Ahmed Azhari	University of Toronto Mississauga	Director, Utilities and Sustainability
Brad Bass	City of Mississauga Environmental Action Committee	Citizen Member
Brad Butt	Mississauga Board of Trade	Director, Government Relations
Britt McKee	Ecosource	Executive Director
Bryan Purcell	Toronto Atmospheric Fund	Vice President, Policy and Programs
Carmela Liggio	Daniels	Development Manager
Chandra Sharma	Toronto and Region Conservation Authority	Director, Watershed Strategies
Christine Tu	Region of Peel	Director, Climate Change
Christine Zimmer	Credit Valley Conservation	Senior Manager
Daniel Carr	Alectra Utilities	Head, Smart Cities
David Bangma	CRH Canada Group Inc.	Manager, Technical Services
David Wawrychuk	Orlando	Vice President, Engineering
Erika Lontoc	Enbridge	DSM Collaboration Expert, Market Development
Ersoy Gulecoglu	Metrolinx	Senior Advisor, Sustainability, Enterprise Asset Management
Frank Giannone	FRAM Group	President
Fred Serrafero	FRAM Group	Vice President, Development
Gayle SooChan	Credit Valley Conservation	Director of Watershed Knowledge
Herbert Sinnock	Sheridan College	Manager, Sustainability
Ian Macpherson	Enbridge	Director, Market Solutions and DSM



Name	Organization	Role
Jen Wynne	Trillium Health Partners	Senior Analyst, Facilities
Jeremy Schembri	Region of Peel	Manager, Office of Climate Change and Energy Management
John Haylock	Oxford Properties Group	Manager Operations, Square One
Lachlan MacQuarrie	Oxford Properties Group	Vice President, Operations
Liviu Craiu-Botan	Oxford Properties Group	Manager, Energy & Technical Services
Louise Aubin	Peel Public Health	Manager, Environment Health
Lucy Casacia	Siemens	Vice President
Matt Mahoney	City of Mississauga	Councillor, Ward 8
Phil James	Credit Valley Conservation	Manager, Integrated Water Management
Quentin Chiotti	Metrolinx	Senior Advisor, Sustainability, Regional Planning, Planning and Policy
Richard Lalonde	CRH Canada Group Inc.	Environment Manager
Ron Starr	City of Mississauga	Councillor, Ward 6
Saher Fazilat	University of Toronto Mississauga	Chief Administrative Officer
Shahid Naeem	Peel District School Board	Manager of Energy and Sustainability
Steven Thomas	Greater Toronto Airports Authority	Manager, Environmental Services
Susan Senese	University of Toronto Mississauga	Chief Financial Officer
Tamar Heisler	Alectra	Director, Government and Industry Relations
Tammy-Lynne Peel	Dufferin-Peel Catholic District School Board	Superintendent of Education
Tenley Conway	University of Toronto Mississauga	Professor & Associate Chair, Research, Geography
Todd Ernst	Greater Toronto Airports Authority	Director, Aviation Infrastructure, Energy and Environment
Tracy Appleton	Peel District School Board	Sustainability Specialist



In addition to the Stakeholder Panel, a series of public open houses and workshops were held in September and October 2019 to provide residents with the opportunity to comment and provide feedback on the draft CCAP. Workshops and open houses were held in the following wards: Ward 1, Ward 2, Ward 4, Ward 8, and Ward 9.

The draft CCAP and a feedback survey were also posted online at www.theclimatechangeproject.ca. Over 500 residents attended our open houses and workshops and we received over 400 responses to the online survey. Through the online survey we heard resounding support for the City taking action and being a leader on climate change (~90%), with some (~40%) indicating a desire for the City to be more ambitious, particularly with respect to the GHG reduction targets.

Below are some highlights from the resident feedback that was received through public consultations.



Stakeholder Panel Members Participated in Visioning Exercises for the Climate Change Action Plan



Public Consultation 2019

What We Heard - A selection of ideas, questions and comments from Mississauga residents



Buildings & Clean Energy

- Need to incentivize retrofits and renewable energy
- Need mandatory green building standards
- Should require retrofits in existing buildings



Resilient & Green Infrastructure

- More tree planting programs for residents
- More gardens and green/natural spaces and utilize existing spaces more effectively
- Need to raise more awareness about existing programs (e.g., One Million Trees)
- Increase support for food security and air quality actions



Accelerating Discovery & Innovation

- The City needs to be a leader in this space
- Use innovative financing mechanisms
- Need senior leadership buy-in
- Need to communicate to residents what the City is doing corporately and what the business community is doing



Low Emissions Mobility

- Use incentives and disincentives to influence decisions and behaviours
- Need affordable, safe, clean and smart transit
- Need to accommodate mixed mode transportation – creation of apps to help with trips
- Need low-speed corridors for bikes, mopeds, low-speed electric vehicles (EVs)
- Need education for drivers, cyclists and pedestrians



Engagement & Partnerships

- Need to empower residents on what they can do to take action (e.g., education, mentorship)
- Promote positive climate action stories to increase awareness
- Reward those leading the way
- Create and leverage community partnerships



General Comments

- The City needs to be a leader
- Urgent action is required: The City needs to work on climate change now and not delay
- Let's keep investing in climate change initiatives
- Mississauga is not yet a leader [in climate action] - but COULD BE



