New Rules to Play By: Municipal Asset Management within the Context of Climate Change

Dustin Carey, MCC

MFOA Annual Conference and AGM

September 22, 2017

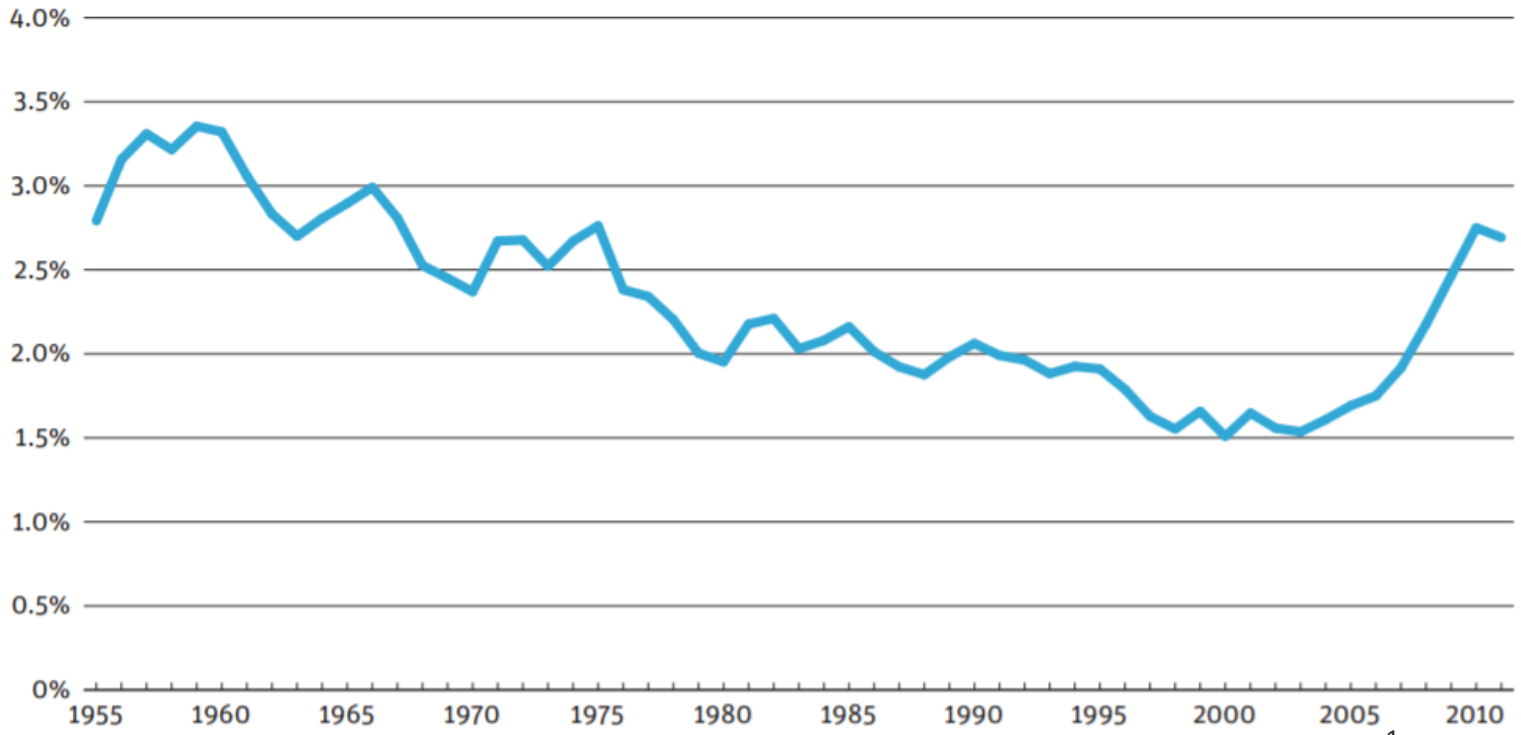
MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- Municipal Asset Management Overview
- Climate Change Implications and Connections
- Climate-Conscious Asset Management
- Example 1: City of Windsor
- Example 2: City of Kitchener
- How You Can Take Action
- Key Takeaway

Outline

"What is your strategy for managing climate-related risk?" – Mark Carney, Governor of the Bank of England

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

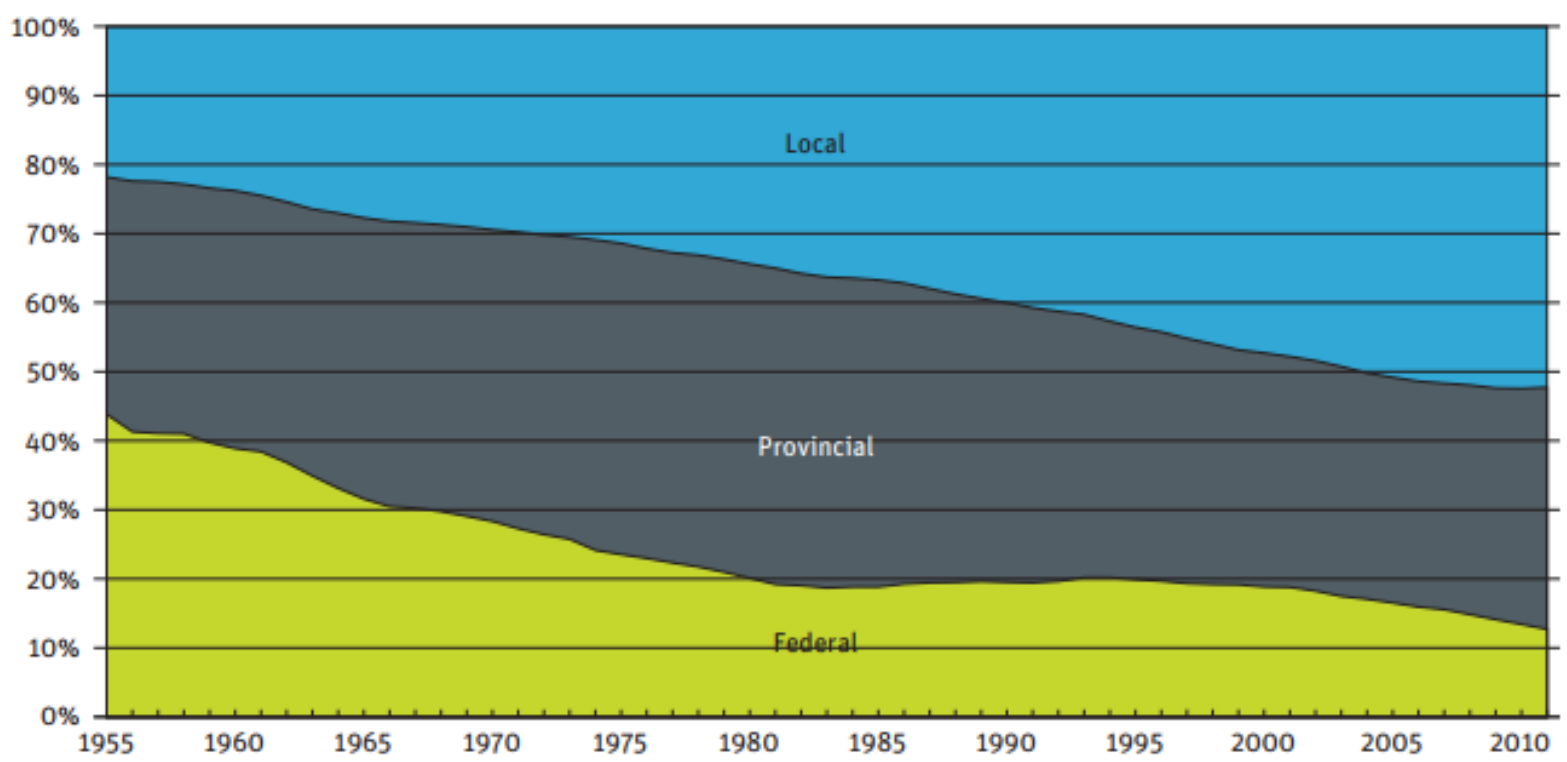


Investment, % of GDP, Canada General Government, 1955-2011[1]

Infrastructure Investment

"I believe that asset management will give us the tools we need to predict our long-term financing needs and that by doing that ensure that we can remain viable and sustainable over the long term." – George Tomporowski, Mayor, Town of Shellbrook

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

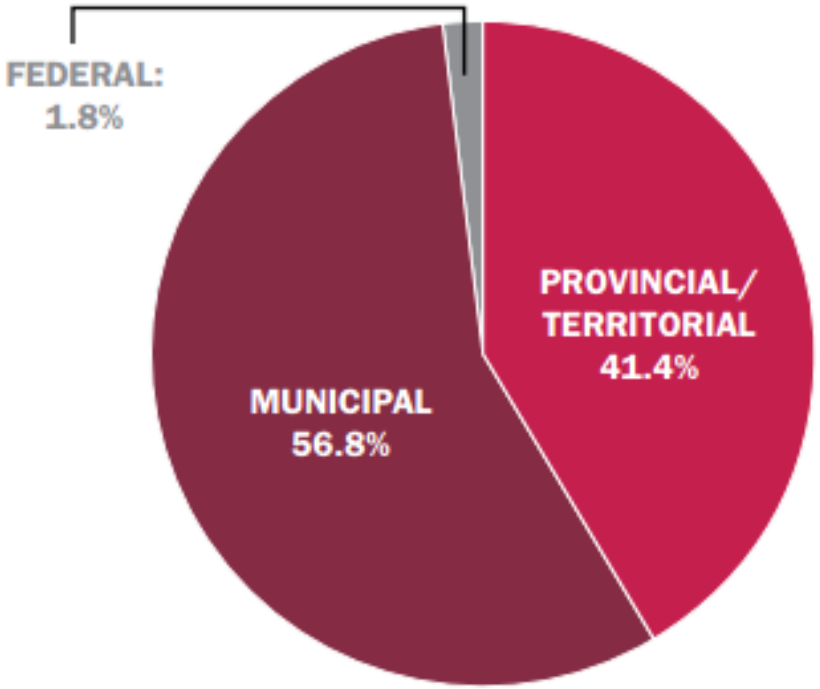


Asset Shares By Order of Government, General Government, 1955–2011[1]

Asset Ownership

"If we don't do some planning now we have a lot of assets that are going to fail on us and we are going to leave that liability for our kids to look after." – Kim Gartner, CAO, Town of Macklin

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO



Net Stock of Core Public Infrastructure by Level of Government[2]

Asset Ownership

"Asset management planning will allow needs to be prioritized over wants. It will help ensure that investments are made at the right time to minimize future repair and rehabilitation costs and maintain municipal assets." - Bob Chiarelli, Ontario Minister of Infrastructure

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Infrastructure	Extrapolated Replacement Value of All Assets	Assets in Very Poor and Poor Condition	Assets in Fair Physical Condition	Anticipated Condition Based on Reported Reinvestment Levels (Improving, Stable, Declining)
		Replacement Value	Replacement Value	
Potable Water	$207 billion	$25 billion (12%)	$35 billion (17%)	Declining
Wastewater	$234 billion	$26 billion (11%)	$56 billion (24%)	Declining
Stormwater	$134 billion	$10 billion (7%)	$21 billion (16%)	Declining
Roads	$330 billion	$48 billion (15%)	$75 billion (23%)	Declining
Bridges	$50 billion	$2 billion (4%)	$11 billion (22%)	Declining
Buildings	$70 billion	$12 billion (17%)	$20 billion (28%)	Declining
Sport and Recreation Facilities	$51 billion	$9 billion (18%)	$14 billion (27%)	Declining
Transit	$57 billion	$9 billion (16%)	$15 billion (27%)	Unavailable
Total	**$1.1 trillion**	**$141 billion (12%)**	**$247 billion (22%)**	
Replacement Value per Household	**$80,000**	**$10,000**	**$18,000**	

Replacement Value and Condition of Canadian Infrastructure [2]

Infrastructure Gap

"To those who say Britain cannot afford to invest in infrastructure, I say we cannot afford not to invest in our future." - Philip Hammond

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- Declining asset condition
- Growth in service demand
- Budgetary pressures
- New legislative requirements
- New physical stresses (climate change)

Changing Landscape

"How do we slow down what matters the most and speed up what benefits change and progress? We don't want to impede progress, but we are seeking reconnection to ourselves, to each other, and with the world." - John Maeda

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

"An integrated business approach involving planning, finance, engineering and operations to effectively manage existing and new infrastructure to maximize benefits, reduce risk and provide satisfactory levels of service to community users in a socially, environmentally and economically sustainable manner."

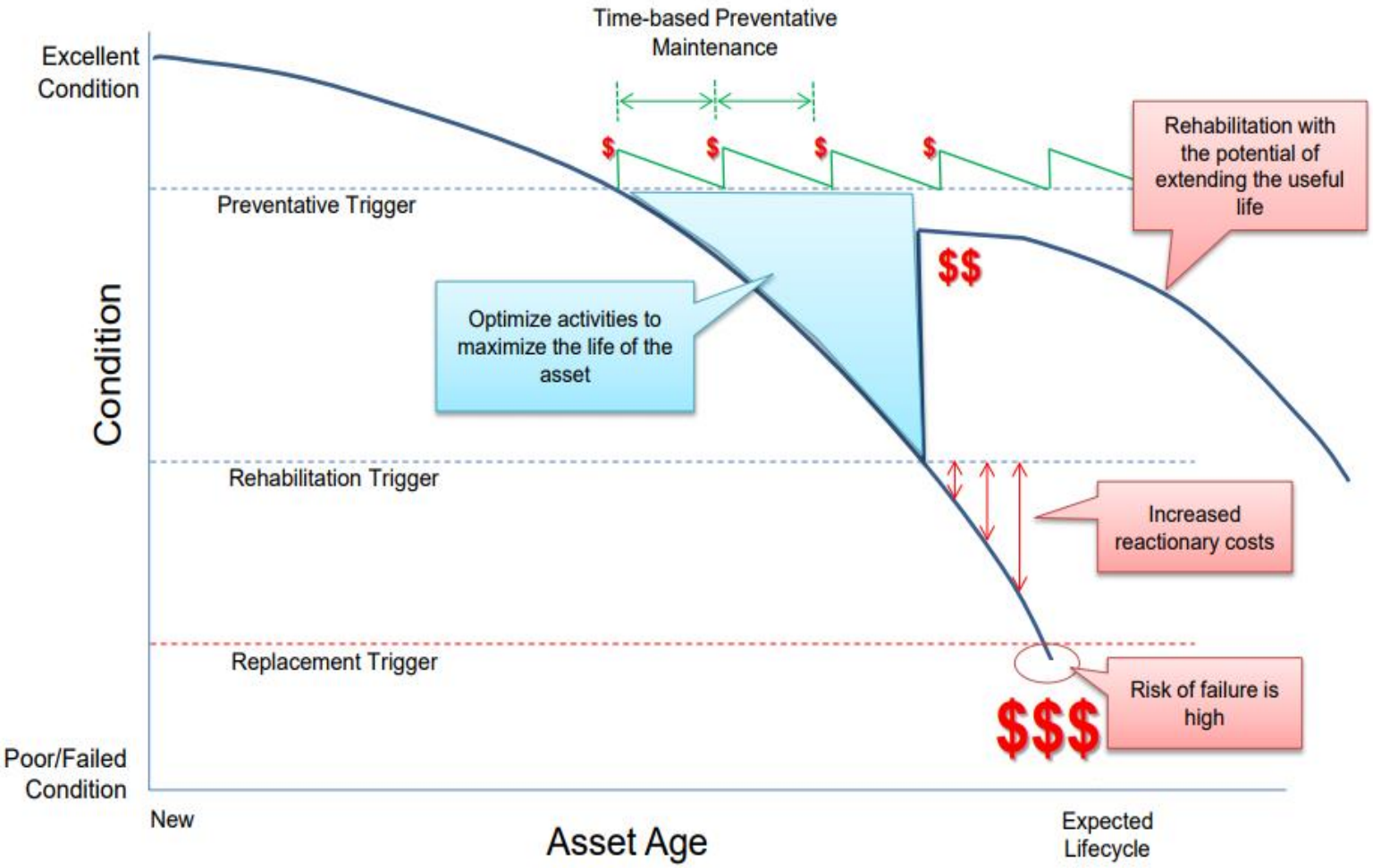
- Canadian National Asset Management
- Working Group of the National Round Table
- on Sustainable Infrastructure

New Challenges; New Strategy

"The mark of a great city isn't how it treats its special places – everybody does that right – but how it treats its ordinary ones." - Aaron M. Renn

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Capital & Maintenance



"Failing to plan for infrastructure renewal and expecting to see results of your community plan is insane."
- Adam Bell, Financial Reporting and Accounting Manager, City of Fredericton

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Asset management helps cities determine service levels, asset priorities and options. It helps clarify future consequences and impacts of different asset and service level decisions by providing decision makers with the information and the decision support tools to:

- make **well-informed, evidence-based** decisions,
- validate priorities in a defensible way,
- understand what factors impact service and their associated costs, and
- reduce the total cost of service over the lifecycle of assets.

Rationale

"Canada's economic growth was made possible by building ambitiously. We must do so again if we are to transform our transit and transportation systems, create more liveable communities, and ensure that we adapt to a changing climate." – Justin Trudeau

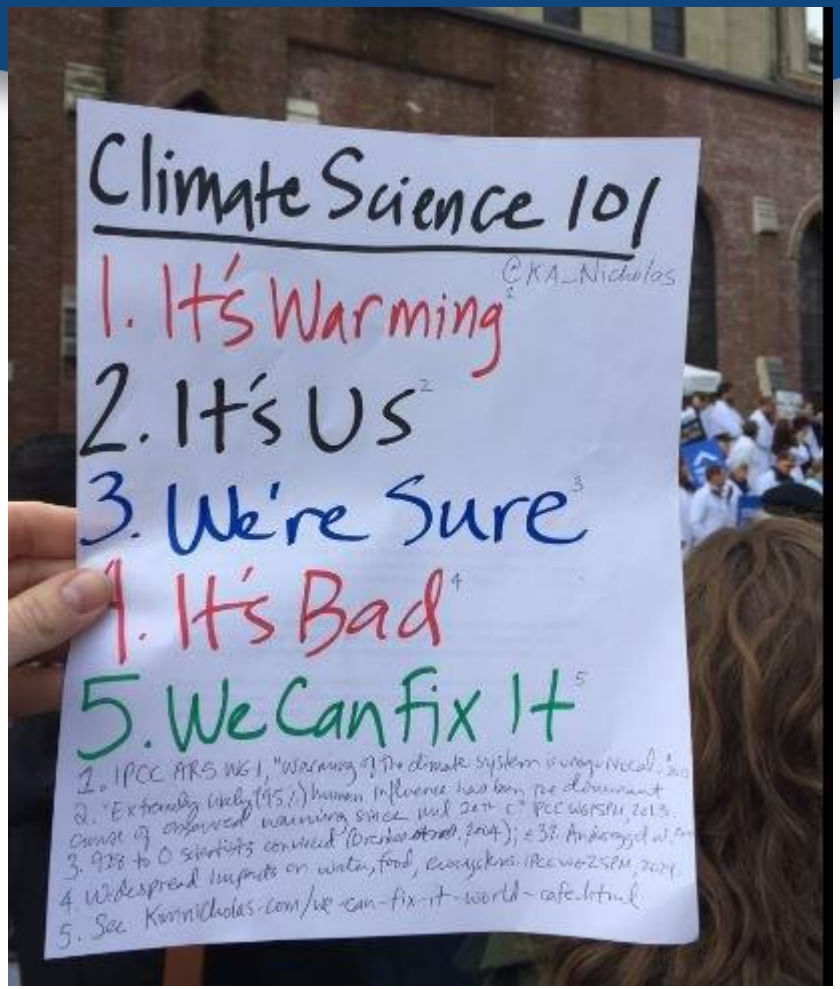
MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Progress to Date

"There's one issue that will define the contours of this century more dramatically than any other, and that is the urgent threat of a changing climate." - Barack Obama

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

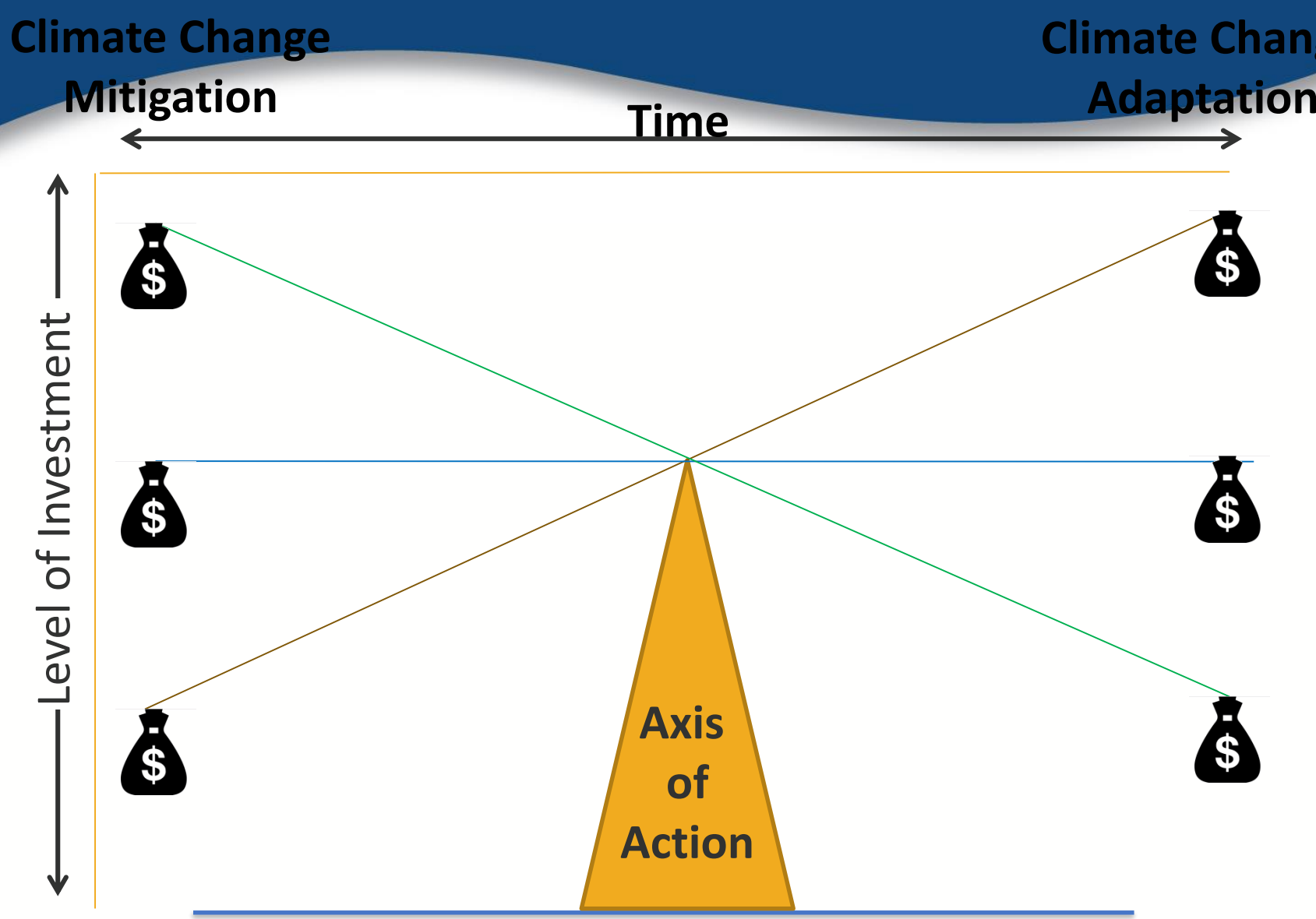
The real debate is not whether climate change is occurring; the debate it is what climate change means for us, and what we should do about it.



Global Climate Change

"On climate change, we often don't fully appreciate that it is a problem. We think it is a problem waiting to happen." - Kofi Annan, Fmr Secretary General of the United Nations

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO



"The measure of intelligence is the ability to change" - Albert Einstein

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

While difficult to estimate, analyses suggest that every **$1** invested in climate change mitigation **today** avoids the necessity for **$3-5** in adaptation costs **later**.

3

For every dollar invested in adaptation today, **$9 to $38** of future damages are **avoidable**.

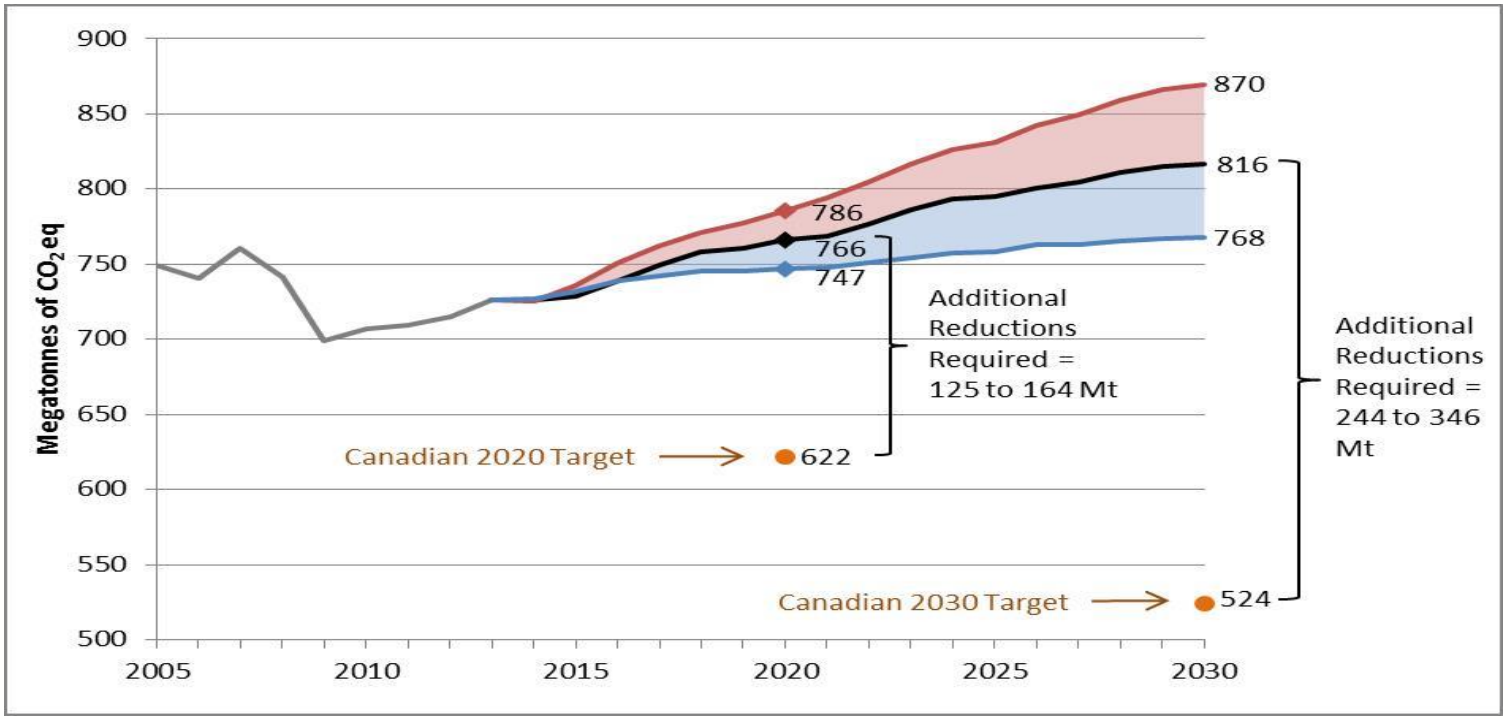
4

Balancing Investment

"By the time we see that climate change is really bad, your ability to fix it is extremely limited"
- Bill Gates

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

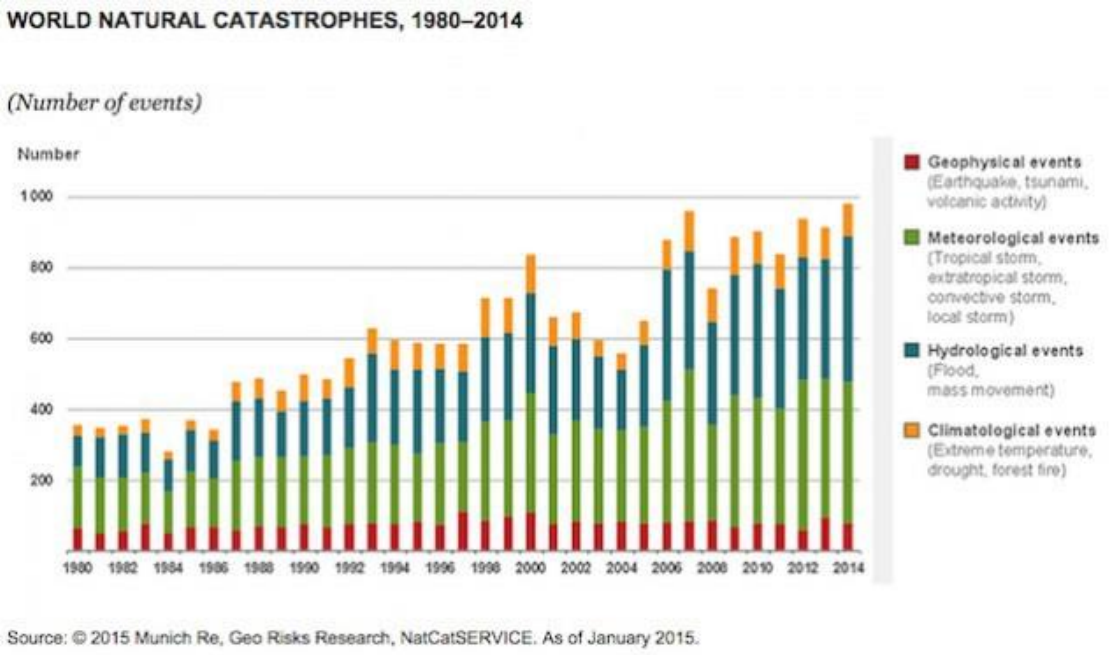
Local governments have direct or indirect control over 40-50% of greenhouse gas emissions in Canada.[5]

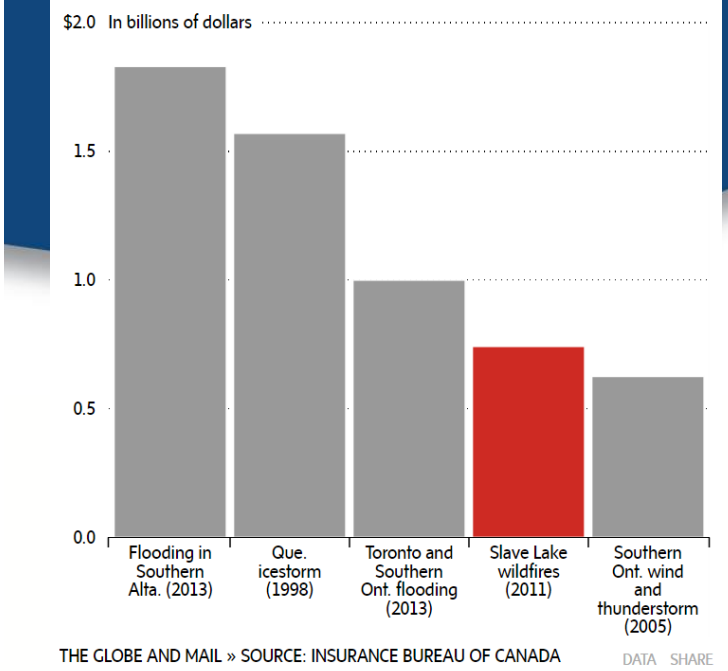


Municipal Responsibility

"It's a collective endeavour, it's collective accountability and it may not be too late." - Christine Lagarde, Director, IMF

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO





Alberta Flood 2013: Comparing Canada's Costliest Natural Disasters

The Huffington Post Alberta

Posted: 01/03/2014 7:10 pm EST | Updated: 01/23/2014 10:52 am EST

ECONOMICS

Jul 7, 2016

Alberta wildfire damage to cost $3.58B, making it Canada's most expensive disaster: Report

The Canadian Press

Natural disasters smashed Canada insurance claims record in 2016: it's only going to get worse

By Tania Kohut

National Online Journalist, Breaking News Global News

"We are entering a world of heightened disaster, thanks to climate change." – Rebecca Solnit

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Thunder Bay hit with $300M lawsuit over flooding

CBC News Posted: Jun 21, 2012 10:07 AM ET | Last Updated: Jun 21, 2012 2:03 PM ET

Christopher Watkins, of WATKINS LAW PROFESSIONAL CORPORATION are filing a class action lawsuit against the City of Thunder Bay for **negligence in the design and maintenance of the city storm, water and sewer systems**.

The recent heavy rains were a **predictable event** and should have been designed for and the City failed to maintain the sewage treatment plant and other storm sewer facilities which resulted in extensive damages for many city residents.

Successive Implications

"Climate change knows no borders. It will not stop before the Pacific islands and the whole of the international community here has to shoulder a responsibility to bring about a sustainable development." – Angela Merkel

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Other lawsuits launched against:

- City of Ottawa ($1.5 million)
- Province of Ontario (Muskoka - $900 million)
- Province of Manitoba (First Nations - $100 million)

Potential Liability

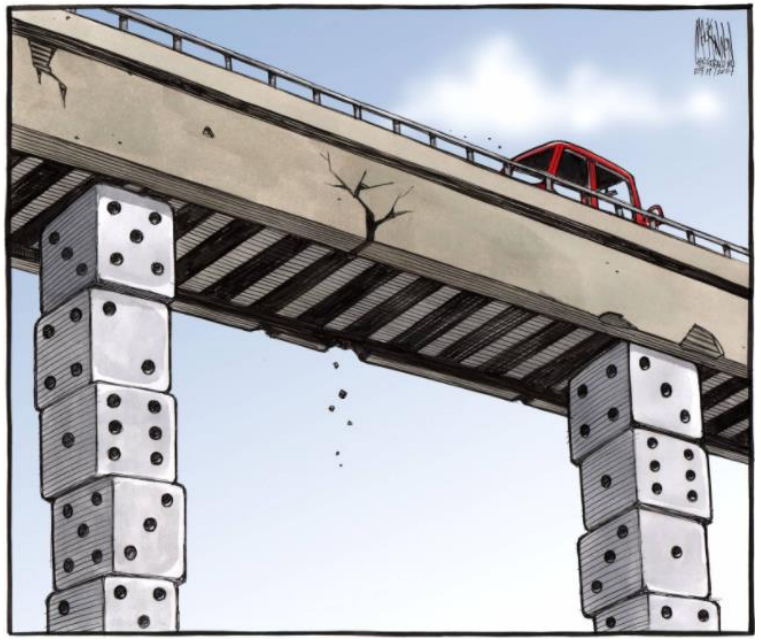
"Typically we don't think of cities as being particularly extreme environments, but few places on earth get as hot as a rooftop or as dry as the corner of a heated living room." - Adam Rogers

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Only about 25% of Canadian municipalities with AM plans formally incorporate climate risks and considerations.[2]

Adaptation strategies were[2] formally factored-in for the following assets:

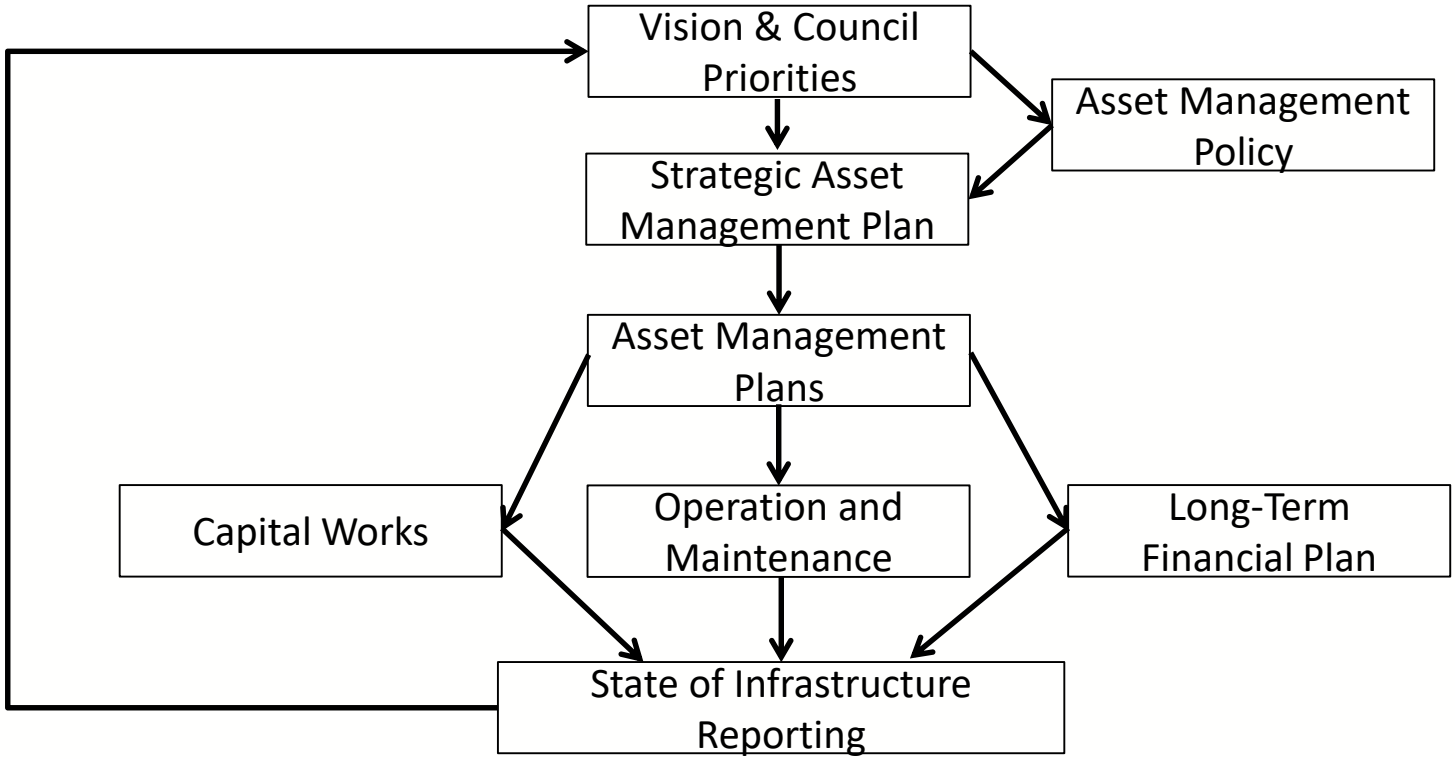
- **Stormwater (16%)**;
- Roads and Bridges (15%);
- Wastewater (16%);
- **Buildings (14%)**;
- Potable Water (14%);
- Sport and Recreation Facilities (13%);
- Public Transit (6%).



New Considerations

"But for settlements like New York City, that's currently not an option. Instead, it's time to design for the worst and hope for the best." – Jamie Condliffe

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO



Bringing Climate Change Into Asset Management

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

High-level commitments:

- Greenhouse gas reduction
- Resilience to extreme events
- Risk management

Asset Policy

"Asset management usually commences after something is built. The challenge is to think about what asset management entails BEFORE the asset is built."
- Asset Management BC

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Asset Management Principles	
Holistic: Asset management is a comprehensive approach that combines the implications of all managed all components.	**Risk-based**: Risk associated with attaining target levels of service is managed by ensuring that resources, expenditures and priorities are assigned based on risk and associated costs/benefits.
Systematic: Asset management is a methodical approach that is formalized, repeatable and consistent.	**Sustainable**: The approach to service delivery is financially achievable over the longterm, is not wasteful of resources, minimizes or reverses environmental damage, and continuously improves social and inter-generational equality.
Systemic: Asset investment decisions should be made in an asset system context, not just optimized for individual assets.	**Integrated**: All of the above principles are coordinated to ensure the delivery of justified services with well-defined outcomes.
Aligned: Asset management contributes to the achievement of the organizational objectives as well as complying with relevant legislation and regulations.	**Optimal**: Asset investment decisions are made by evaluating all options and considering trade-offs between the competing factors of service level benefits, risk and cost over an asset's full lifecycle.

Strategic Asset Management Plan

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- Economic Criteria

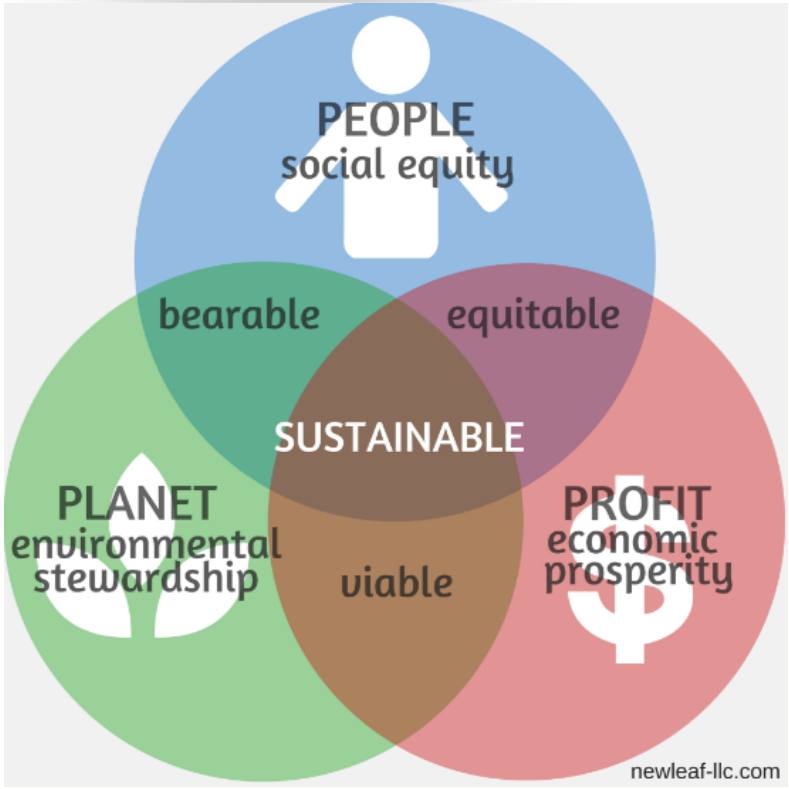
  Capital Costs, Operations & Maintenance Cost, Lifecycle Costs, Ability to coordinate with other projects

- Environmental Criteria

  Severe Weather Resiliency, Energy Demand, Greenhouse Gas Emissions, Water Quality, Wildlife Protection, Greenspace, Waste, Recycled/able Materials

- Social & Cultural Criteria

  Visual Aesthetics, Recreational Opportunities, Cultural/Heritage Resources, **Health & Safety**



Triple Bottom Line

"Sustainability is the key to our survival on this planet and will also determine success on all levels." – Shari Arison

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Why we are true believers

Enthusiasm for the Triple Bottom Line Benefits

Widespread Progress

Economic

- Reduced total lifecycle costs means more funding for important priorities
- Snowball effect of good financial and asset management
- Good infrastructure drives economic vitality

Social

- High quality built environment contributes to high quality of life
- Good roads, good sports & cultural facilities, clean water
- Can't provide clean water with failing infrastructure
- Can't rollerblade on gravel

Environmental

- Reduced energy consumption and reduced GHG emissions
- Better climate adaptation and preparedness
- New infrastructure built to minimize environmental impact and withstand environmental changes

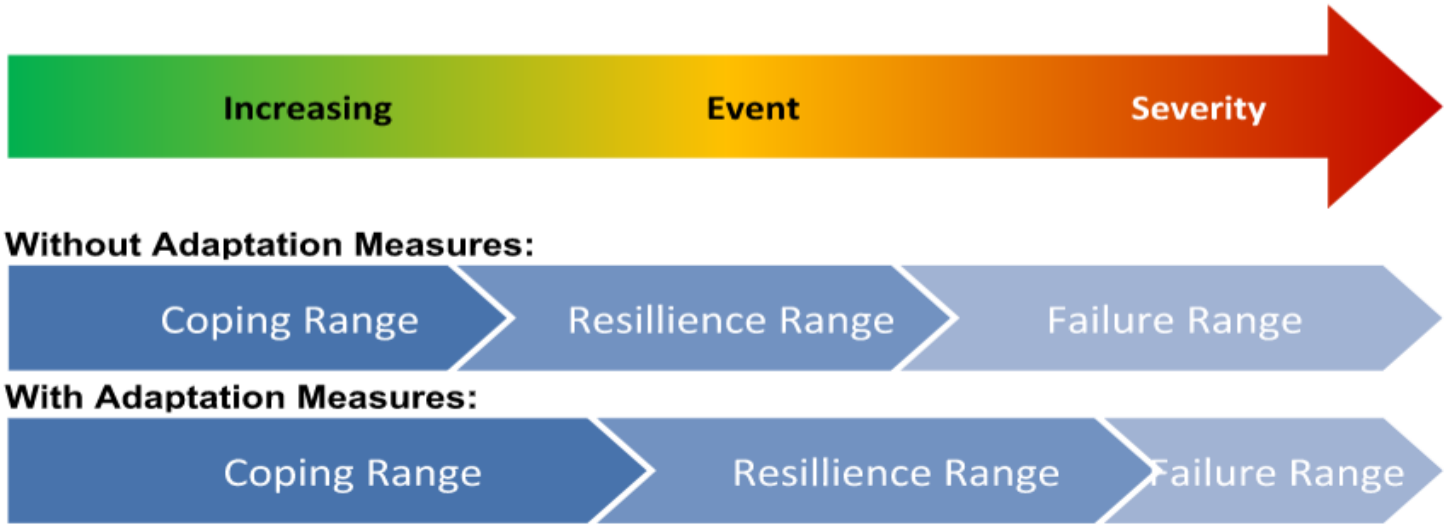
More Commitment Required

FÉDÉRATION CANADIENNE DES MUNICIPALITÉS Fredericton

"[Sustainability is] growth based on forms and processes of development that do not undermine the integrity of the environment on which they depend." – Jim MacNeill, Former Secretary General of the World Commission on Environment and Development

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

While making sustainability a foundational tenet of asset management plans is an important step towards mainstreaming climate considerations into all corporate operations, there is significant **room for experimentation** prior to this milestone.



Room for Experimentation

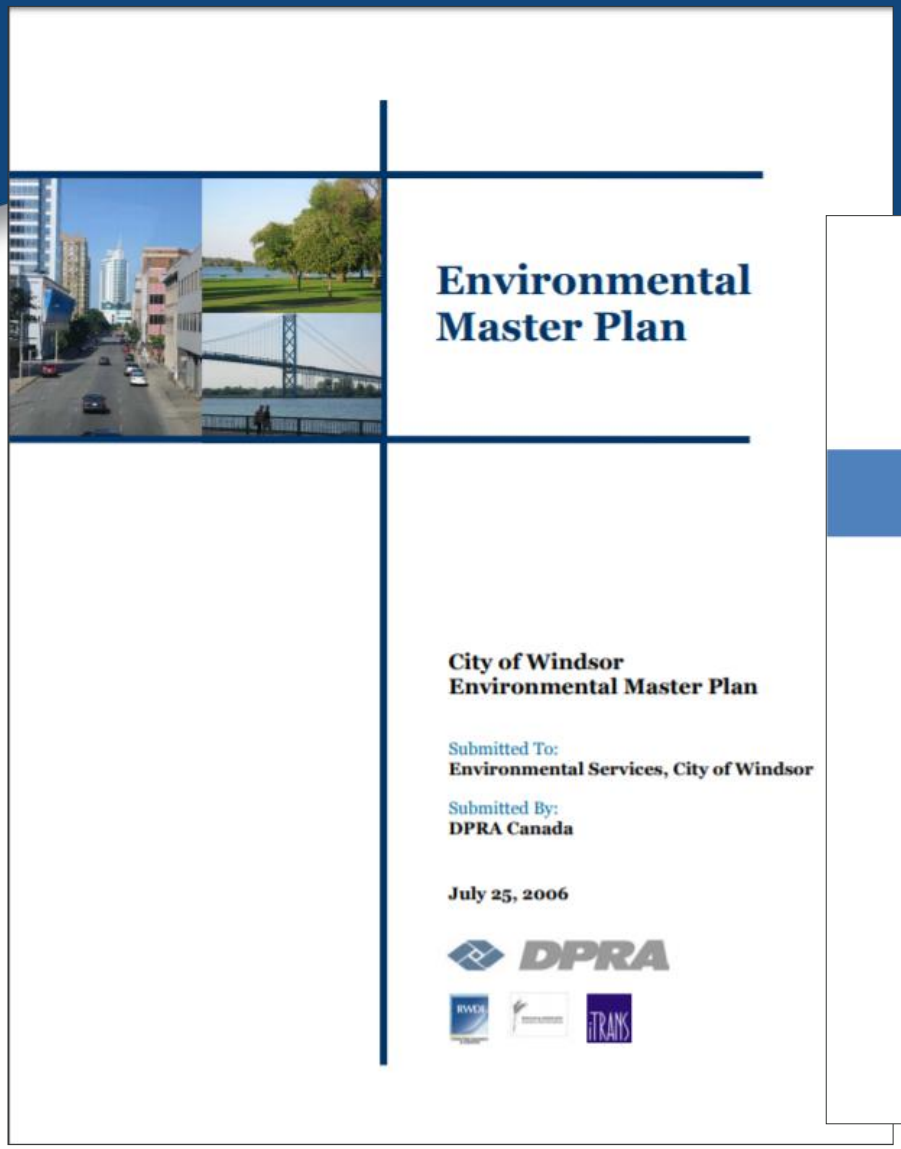
"Taking bold action on climate change simply makes good business sense. It's also the right thing to do for people and the planet." – Richard Branson

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Example 1 – City of Windsor

"Real, sustainable community change requires the initiative and engagement of community members." - Helene D. Gayle

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO



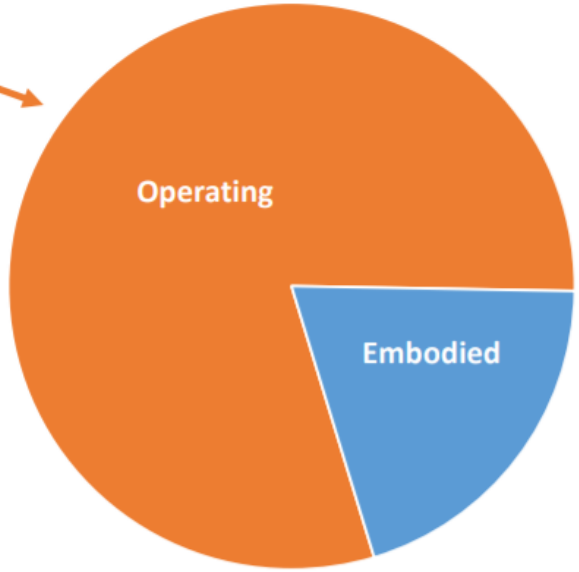
Cultural Entrenchment

"In our view, successful reform is not an event. It is a sustainable process that will build on its own successes - a virtuous cycle of change." - Abdullah II of Jordan

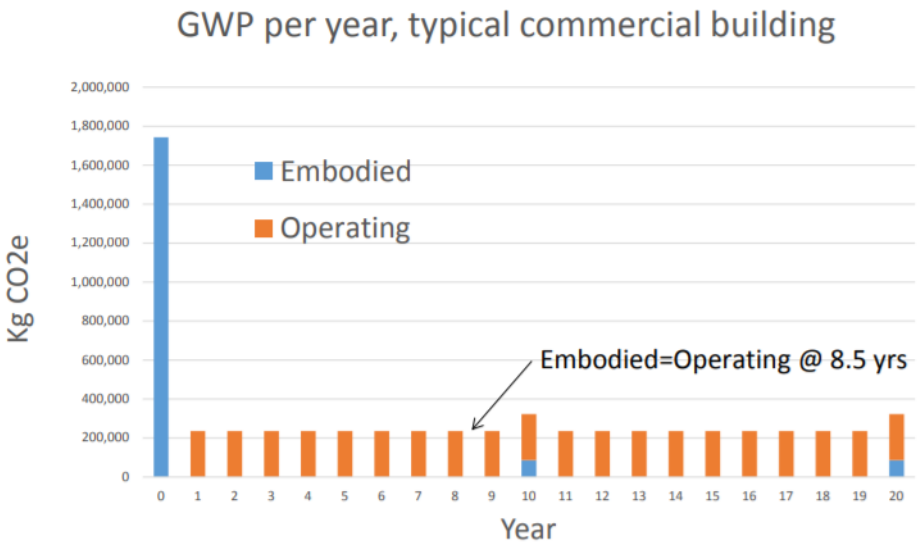
MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Total GHGs over 60 years for a typical building

Over the life of a building, emissions from building operation are the largest part of its carbon footprint and need to be addressed.



Typical Embodied vs. Operating [7]



Lifecycle Approach

"What is the use of a house if you don't have a decent planet to put it on?" – Henry David Thoreau

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Construction, Renovation, Demolition

Construction and Demolition Waste

An Overview

Moving, renovating, and demolishing facilities can generate significant waste. Construction and demolition waste accounts for up to 25% of the waste stream. Reorganizations in offices and facilities both add to the challenge and open new opportunities to apply sound environmental practices. These practices can lead to improved energy efficiency and workplace and public facility standards.

Potential Environmental Impacts

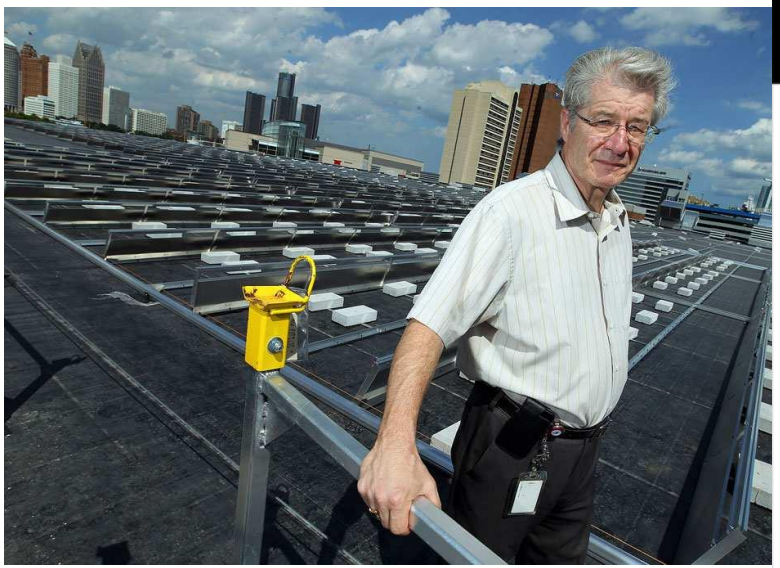
- Poor waste management practices throughout any construction, renovation or demolition project will add to disposal volumes and their impacts on the environment.

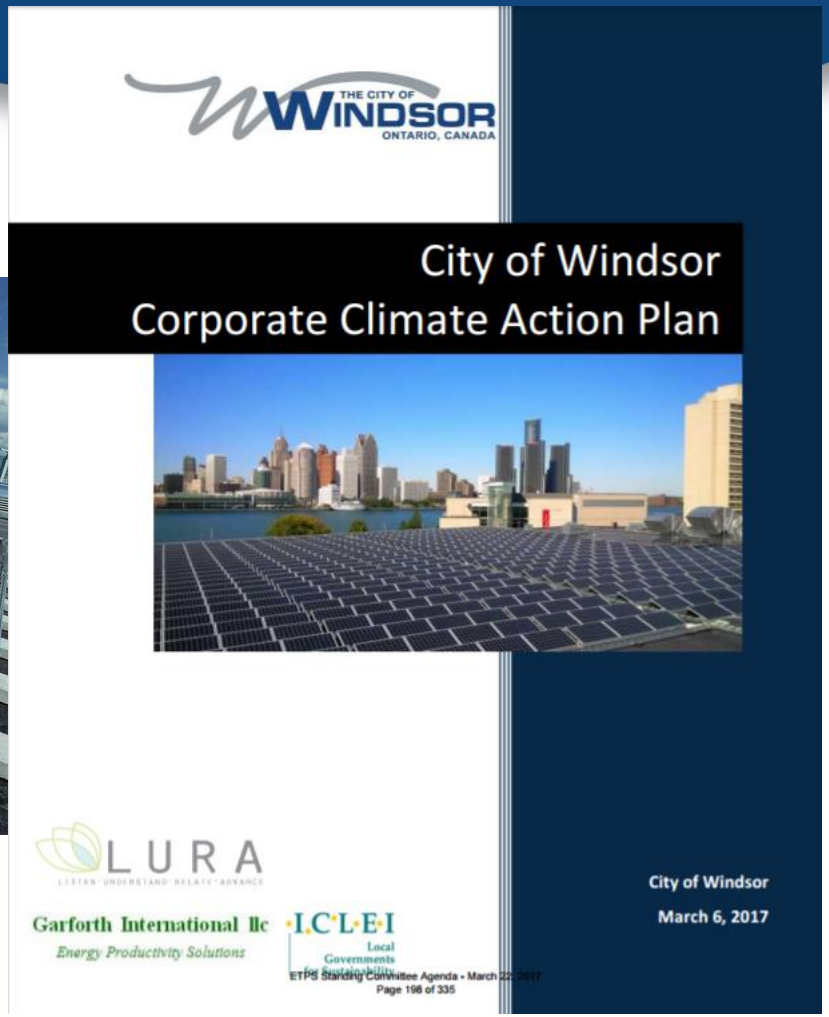
Things to Consider In Your Specifications

Contractors should be required to submit a Waste Management Plan with their quotations. The plan should include:

- Procedures for educating workers and subcontractors in order to ensure adherence to the Waste Management Plan.
- Methods for reducing waste such as ordering material only as required, using up excess material on site where possible, or prefabricating sections off site.
- The percentage of recycled content in construction materials.
- Methods and techniques for collecting, separating, and recycling waste materials and packaging, including a list of materials to be recycled and percentage expected to be recycled or sent to landfills.
- Provisions for dealing with hazardous waste, including procedures for handling, clean-up and disposal.
- A list of carriers and disposal destinations for each material to be disposed of or recycled. The list should be provided initially or at least before the final payment is made. This will ensure that all materials are being recycled and waste is legally disposed of.
- Alternative options for recovering higher percentages of materials and related costs.
- The cost associated with the recovery of the material and the anticipated revenues from the sale of such material.

"Sustainable development requires human ingenuity. People are the most important resource." - Dan Shechtman

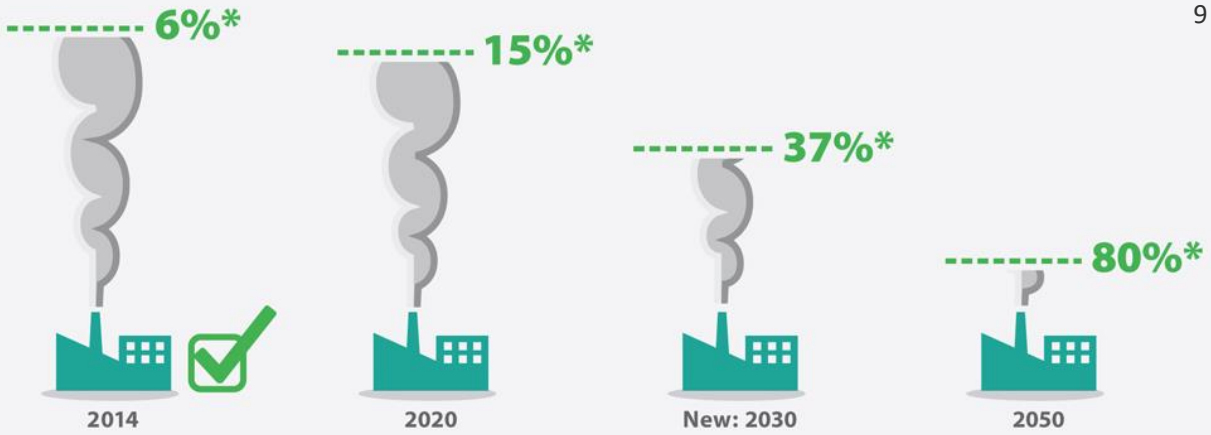




Assets and Energy

"The word 'energy' incidentally equates with the Greek word for "challenge." I think there is much to learn in thinking of our federal energy problem in that light." - Thomas Carr

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO



* below 1990 greenhouse gas emission levels

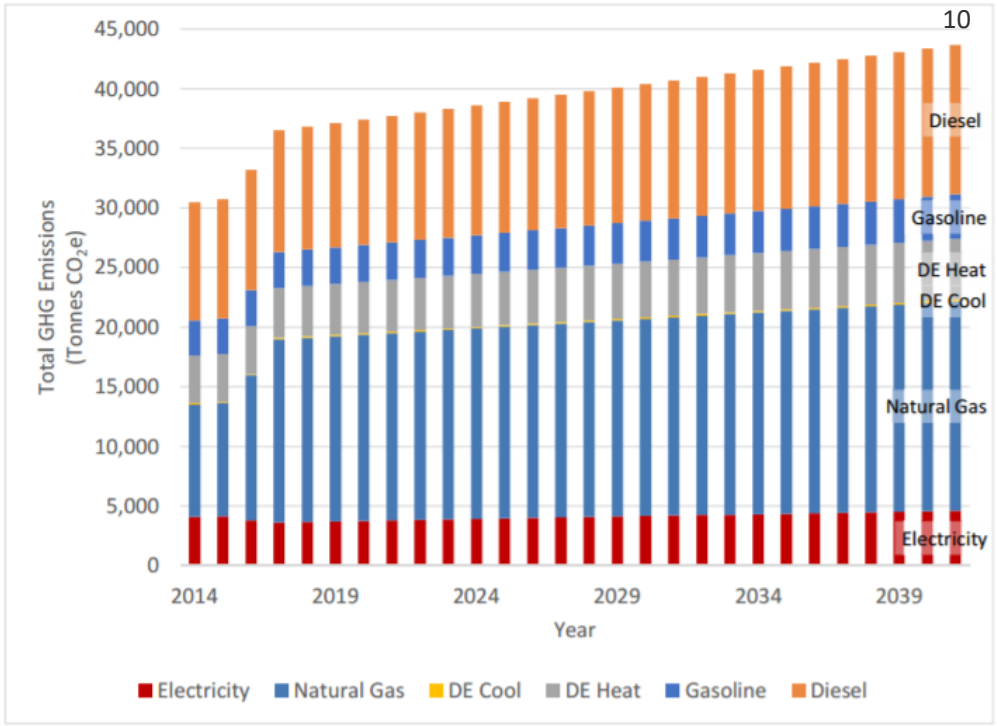


Figure 9: Projected Emissions by Source for the City of Windsor (2014-2041)

"Climate change is not a distant threat: it is already costing the people of Ontario." – Glen Murray, Former Ontario Minister of Environment and Climate Change

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

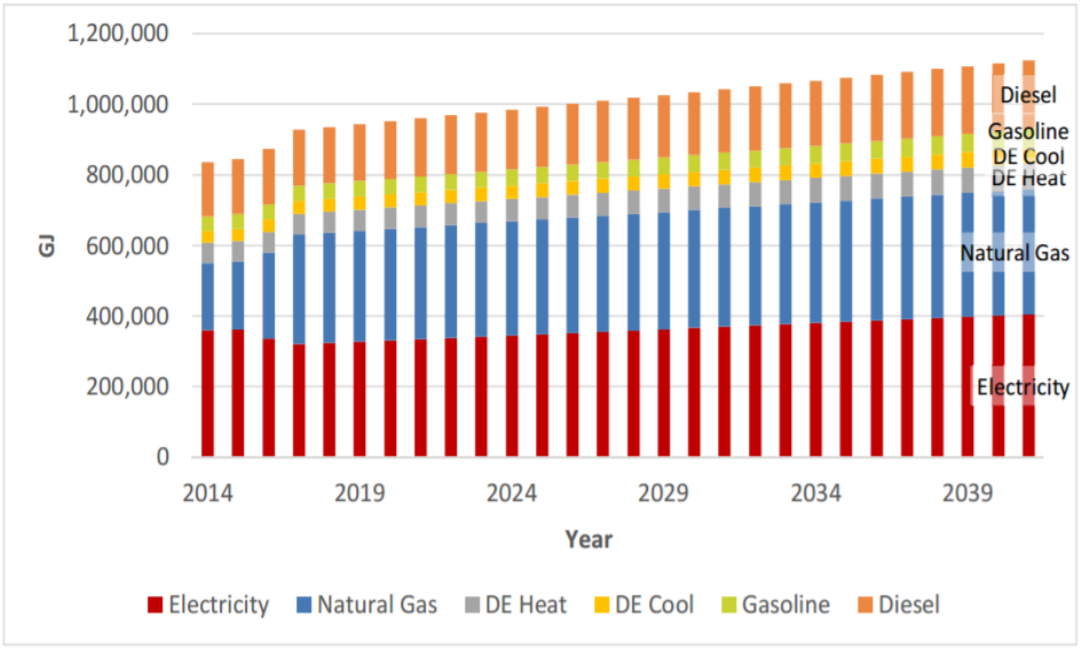


Figure 6: Corporate Business-As-Usual Energy Projection (2014-2041)

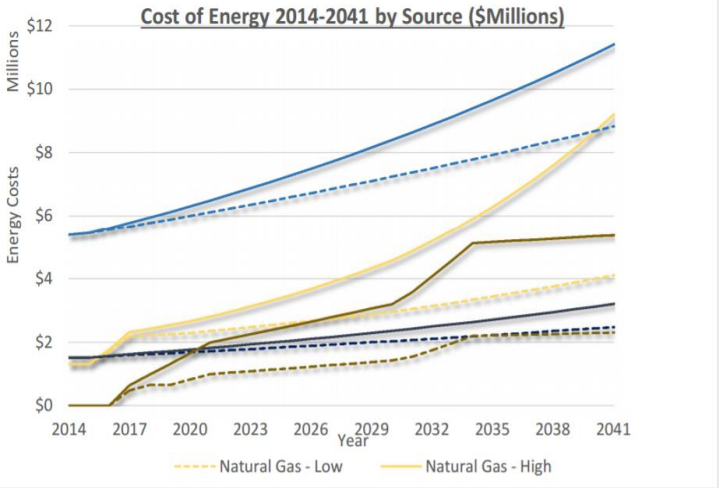


Figure 7: Projected Cost of Energy by Source for the City of Windsor (2014-2041)

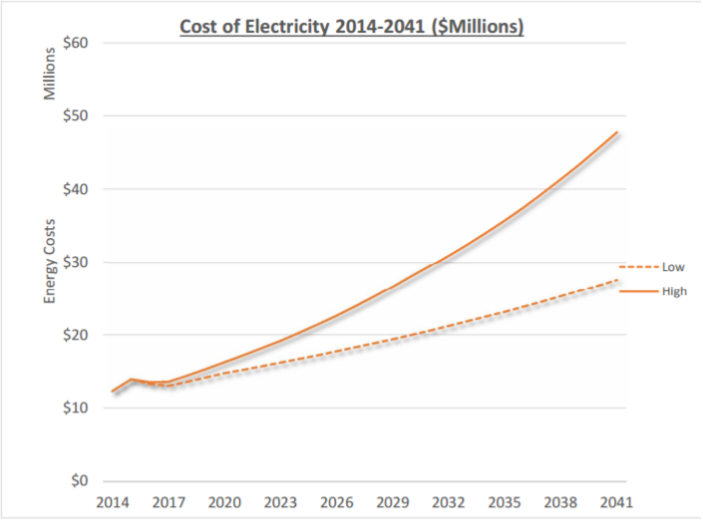


Figure 8: Projected Cost of Electricity for the City of Windsor (2014-2041)

It is anticipated that **energy costs will increase by 120 per cent** at the lower risk range **and by 275 per cent** at the higher risk range by 2041. This would increase annual energy costs from $22 million per year to **$48.8** million at the low end of the range and **$81 million** per year at the high end in 2041. This poses a significant cost risk for all sectors in Windsor.

"The shift to a cleaner energy economy wont happen overnight, and it will require tough choices along the way. But the debate is settled. Climate change is a fact." – Barack Obama

Asset Management Principles

Holistic: Asset management is a comprehensive approach that combines the implications of all managed all components.	**Risk-based**: Risk associated with attaining target levels of service is managed by ensuring that resources, expenditures and priorities are assigned based on risk and associated costs/benefits.
Systematic: Asset management is a methodical approach that is formalized, repeatable and consistent.	**Sustainable**: The approach to service delivery is financially achievable over the longterm, is not wasteful of resources, minimizes or reverses environmental damage, and continuously improves social and inter-generational equality.
Systemic: Asset investment decisions should be made in an asset system context, not just optimized for individual assets.	**Integrated**: All of the above principles are coordinated to ensure the delivery of justified services with well-defined outcomes.
Aligned: Asset management contributes to the achievement of the organizational objectives as well as complying with relevant legislation and regulations.	**Optimal**: Asset investment decisions are made by evaluating all options and considering trade-offs between the competing factors of service level benefits, risk and cost over an asset's full lifecycle.

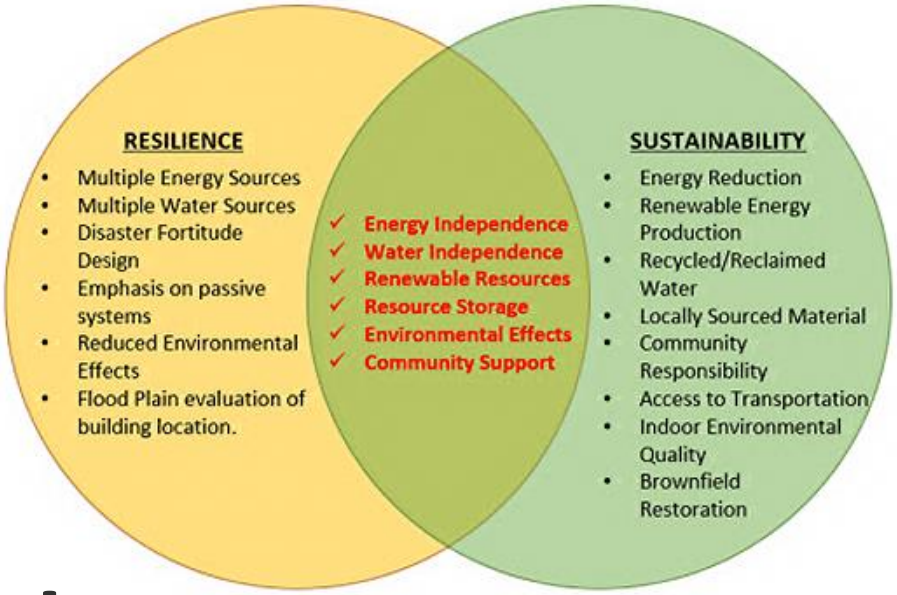
Framework Application

"The clear and present danger of climate change means we cannot burn our way to prosperity. We already rely too heavily on fossil fuels. We need to find a new, sustainable path to the future we want. We need a clean industrial revolution." - Ban Ki-moon, Former Secretary General of the United Nations

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- The Corporate Energy Management Plan sets a target to reduce building energy use by 10 per cent by 2018 from the 2014 baseline.
- The City of Windsor will **reduce its primary energy use** from the 2014 baseline by:
  - 11% by 2030; and
  - 25% by 2041.

"Ensuring the Asset Management Policy and Framework integrates sustainability for community assets including energy infrastructure and ensuring it is implemented thoroughly"



Goals

"Energy Policy will be and should be driven by environmental policy in the future." – Timothy Wirth, Vice Chairman, Better World Fund

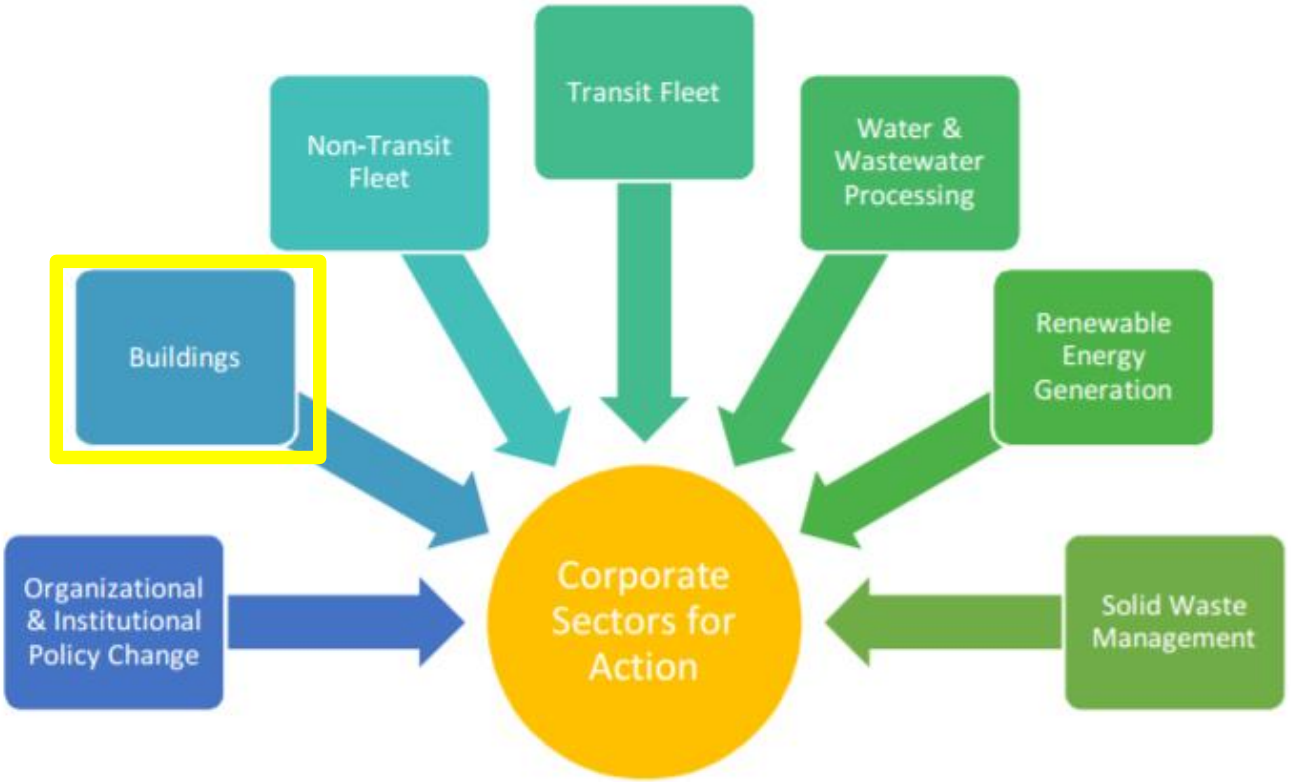


Figure 10: Sectors included in the CCAP

"Our goal is to fundamentally change the way the world uses energy...we want to change the entire energy infrastructure of the world to zero carbon.“ - Elon Musk

B1: Continue Existing Building Retrofits

- **Recommendation**: The City should continue with planned retrofit initiatives, integrate stronger energy efficiency requirements into the retrofits (where feasible), and monitor the energy performance of retrofitted buildings.
- **Recommendation**: The City should complete deep energy efficiency retrofits in buildings with the highest energy intensity in 2018 and beyond in order to achieve significant energy cost savings.

Retrofit Buildings

"Cities are home to the majority of humankind and more than ever a beacon of hope when it comes to climate change". - Michael Bloomberg, UN Special Envoy for Cities and Climate Change

B2: Increase Efficiency through New Building Design

- **Recommendation**: The City's procurement process should outline the requirements for energy standards when designing and constructing new City of Windsor facilities to maximize energy performance and a highest energy performance policy.
- **Recommendation**: The City should continue to conduct building audits and re-commissioning before proceeding with costly building retrofits.

Make the New Better

"We have to do what we can, as mayors, to save the world". - Frank Cownie, Mayor of Des Moines, IA, United States

B3: Continue to Improve Operations, Maintenance, and Monitoring

- **Recommendation**: Energy Demand Management software should continue to be used to identify energy misuse and opportunities for improvement.
- **Recommendation**: The City should continue to install and upgrade BAS systems as needed.
- **Recommendation**: The City should continue to develop energy analytics to alert building operators when City facilities are under-performing with regard to energy consumption.
- **Recommendation**: The City should post Energy Performance Labelling on all City buildings.
- **Recommendation**: Behaviour change and operations and maintenance training should be implemented to optimize energy savings within corporate operations and maintenance.

Improve Procedures

"If you look at all the serious scientists in the world, there is no big disagreement on the basics of this... it would be absolute lunacy to act as if climate change is not occurring". - Nicholas Stern

B4: Integrate Supportive Infrastructure for Existing and New Buildings

- **Recommendation**: The City should continue its commitment to developing cycling infrastructure by including bike racks and cycling-related storage
- **Recommendation**: All new City of Windsor buildings in designated District Energy Areas should be designed to accommodate connection to district energy
- **Recommendation**: High efficiency CHP should be integrated into building design where appropriate, to improve overall fuel efficiency and enhance the economics of the district energy utility.

Leverage Opportunities

"We cannot compromise with the Earth; we cannot compromise with the catastrophe of unchecked climate change, so we must compromise with one another". - Gordon Brown, Former Prime Minister, United Kingdom

Actions	Estimated GHG Reduction (Tonnes CO_2e/yr)	Estimated Energy Reduction Savings (GJ/yr)	Estimated Costs (Total Cost)	Estimated Potential Savings ($/yr)	Suggested Timeframe	Assumptions
P6: Create a Corporate Energy Task Force	Indirect		Nominal	Indirect	2017	
B1: Continue Existing Building Retrofits	4,300	113,860	$15,500,000-$38,600,000	$3,273,000-$5,972,000	Existing retrofits 2016-2020 Deep retrofits 2020+	60% of floor space retrofitted to achieve an average energy reduction between 25%-35%. This recommendation is in line with the recommendations in the Community Energy Plan. Retrofit costs assume $\$10/ft^2 - \$25/ft^2$. Estimated from case studies in: Guide to building the case for deep energy retrofits (RMI); The Economics of Green Retrofits (Nils Kok); How to Calculate and Present Deep Retrofit Value (RMI). In some cases retrofits can cost much higher, estimates range from $\$10\text{-}150\ /ft^2$.
B2: Increase Efficiency through New Building Design and Building Replacement	1,300	25,140	$17,000,000	$2,183,000-$3,447,000	Ongoing	All new buildings are 70% more efficient than baseline by 2041. Cost savings assumes $\$280/ft^2$ construction cost for high efficiency new buildings, and further assumes that additional costs of achieving high efficiency over conventional building represent 8% of the total cost. Cost as listed represents that 8% cost premium.

Evidence Based

"This mandate that I seek is about continuity and sustainability against disruption and stagnation, about moving forward versus regressing. We have to safeguard what we have already achieved. We cannot put at risk what we have; we cannot gamble away our future." - Najib Razak

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

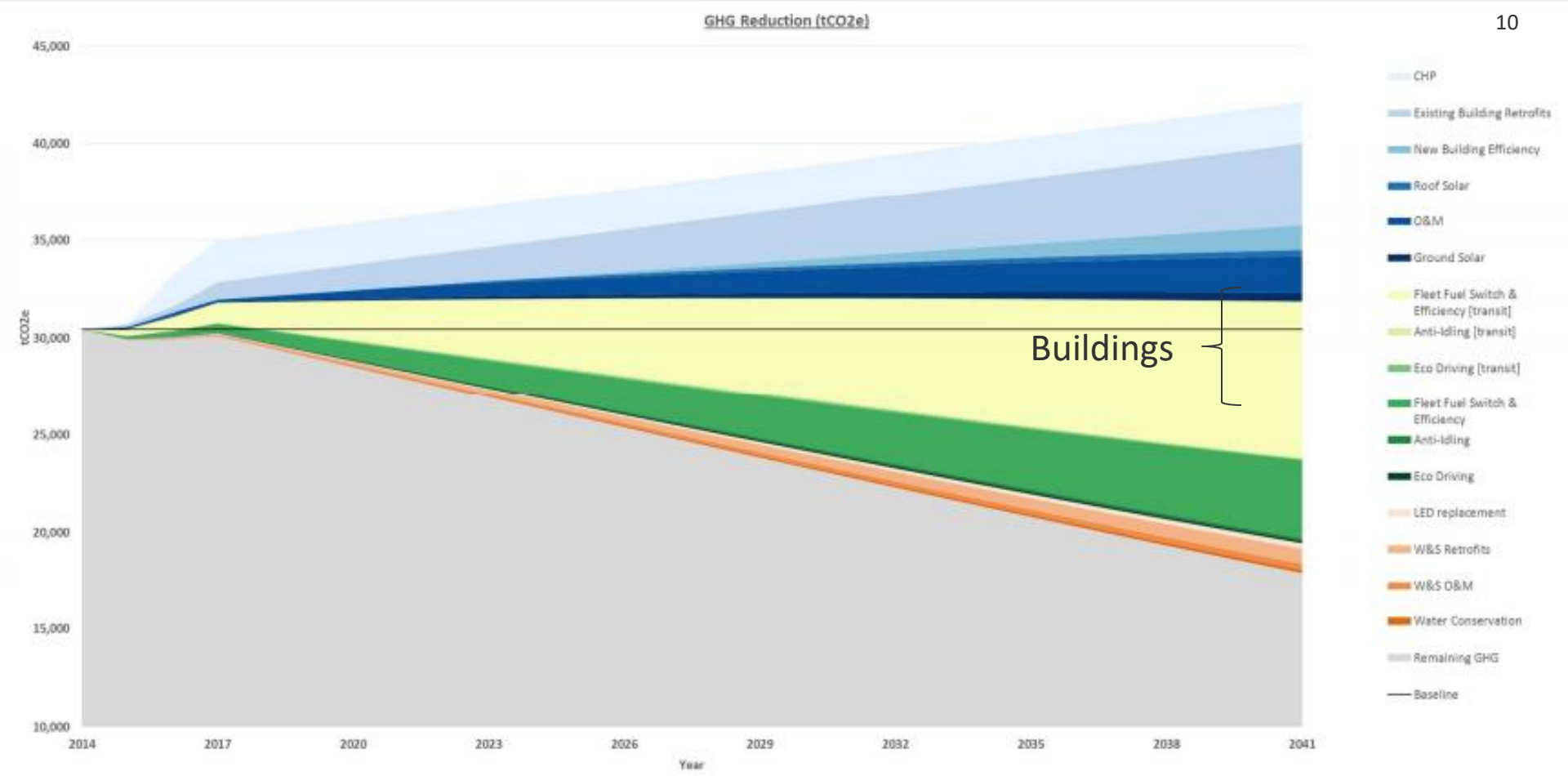


Figure 11: Estimated GHG Emission Reductions from Proposed Actions (2014-2041)

Integrated Approach

"Climate change will test our intelligence, our compassion and our will. But we are equal to that challenge." - Justin Trudeau

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

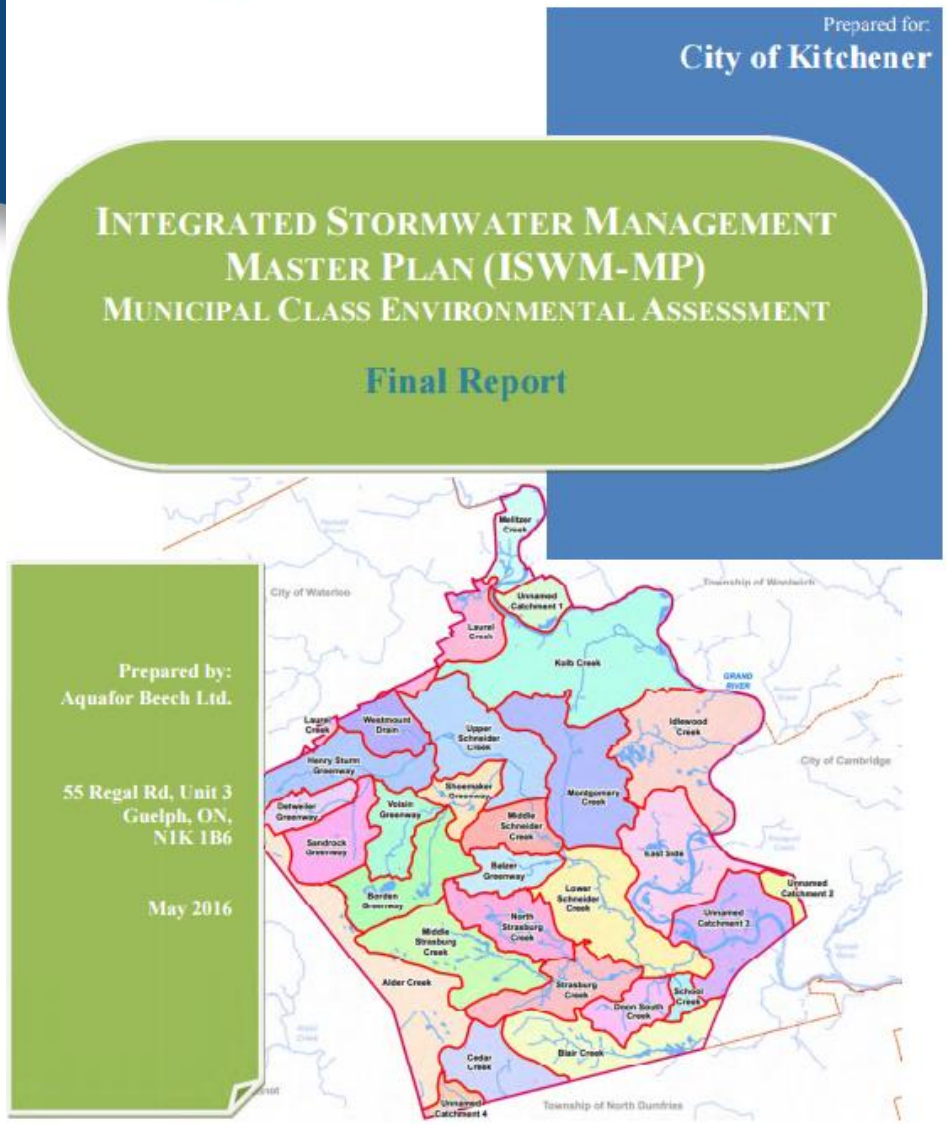
Example 2 – City of Kitchener

"The greatest danger in times of turbulence is not the turbulence – it is to act with yesterday's logic." – Peter Drucker

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

What are the main reasons for undertaking the study?

- Develop an inventory of the existing conditions of the subwatersheds and better understanding City's stormwater infrastructure and assets;
- Being able to prioritize improvements to the infrastructure without the need for separate environmental assessments; and
- Developing new practices to manage climate change as it affects infrastructure and urban areas.



Planning for the Future

"The water issue is critically related to climate change. People say that carbon is the currency of climate change. Water is the teeth." – Jim Yong Kim, President, The World Bank

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

"The City of Kitchener experienced several rainfall events which resulted in basement flooding in the last decade. The storm event overwhelmed the existing sewer system which resulted in over 100 reports of basement flooding."

"The system performance analysis indicates that some portions of the City`s minor storm sewer system are **currently deficient** with respect to the stated of level of service criteria (5-year storm)."

Rationale

"People are seeing the impact of climate change around them in extraordinary patterns of floods and droughts, wildfires, heatwaves and powerful storms." - John Holdren, Former Senior Presidential Science Advisor

Storm sewer standard changed from 2-year to 5-year in early 1970s.

Accelerated Infrastructure Replacement Program in place.

All stormwater pipes over 80 years old to be replaced by 2030.

Pre-Master Plan Baseline

"Resilience is all about being able to overcome the unexpected. Sustainability is about survival. The goal of resilience is to thrive." - Jamais Cascio

Stormwater Utility

The City of Kitchener funds stormwater management through a **user-fee program**.

The stormwater user fee appears on monthly utility bills. The average single dwelling homeowner will be charged about $11.44/per month for stormwater management.

This funding model dedicates dollars **specifically to stormwater management** - a service that is traditionally underfunded through the tax base.

Effective March 1, 2017

Stormwater Classification Code	Basis for Charge	2017 Monthly Charge
Residential Single Detached Small	Detached homes with building footprint* size of 105 m^2 or less	$7.49
Residential Single Detached Medium	Detached homes with building footprint* between 106-236 m^2	$12.49
Residential Single Detached Large	Detached homes with building footprint* size of 237 m^2 or more	$16.42
Residential Townhouse/Semi-Detached	Per dwelling unit	$8.92
Residential Condominium	Per dwelling unit	$4.98
Multi-Residential duplex	Per building	$10.00
Multi-Residential triplex	Per building	$15.02
Multi-Residential four-plex	Per building	$19.98
Multi-Residential five-plex	Per building	$25.00
Multi-Residential (>5 units)	Per property (according to number of dwelling units)	$2.50
Non-Residential Smallest	26 - 1,051 m^2 of impervious area	$23.90
Non-Residential Small	1,052 - 1,640 m^2 of impervious area	$63.91
Non-Residential Medium-Low	1,641 - 7,676 m^2 of impervious area	$167.47
Non-Residential Medium-High	7,677 - 16,324 m^2 of impervious area	$488.87
Non-Residential Large	16,325 - 39,034 m^2 of impervious area	$1,184.85
Non-Residential Largest	39,035 m^2 or greater of impervious area	$2,543.61

Asset Funding

"Persistence and resilience only come from having been given the chance to work though difficult problems." - Gever Tulley

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

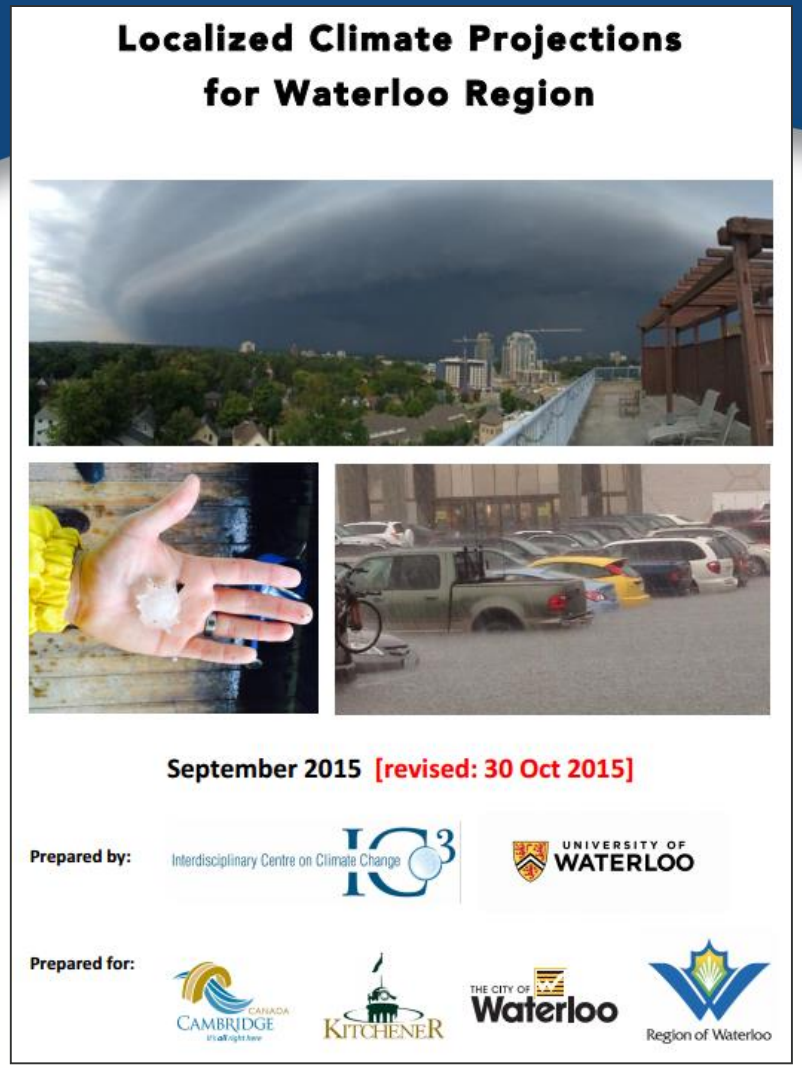
In 2012, Kitchener introduced a stormwater credit policy to **incentivize property owners** who use best management practices to reduce the quantity and improve the quality of stormwater runoff entering the municipal stormwater system.

Property owners are now able to apply for stormwater credits of up to 45 per cent of the stormwater portion of their utility bill.

Stakeholder Incentive

"Sustainability requires maintaining life-supporting natural capital in order for our socioeconomic goals to be met." – Warren Flint

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO



"Rainfall intensities are projected to increase across all scenarios and time periods, with large-magnitude rainfall events expected to occur more frequently than in the historical record."

Future Climate Conditions

"We can no longer use history as a benchmark for what's likely to happen tomorrow. We encourage [city planners and politicians] to take this information and then start adaptation planning." – Dr. Jason Thistlethwaite, study co-author

RETURN PERIODS

Table 10a: Return periods for maximum 1-day total precipitation amounts (mm)

Return Period	Observed	RCP 2.6			RCP 4.5			RCP 8.5		
	1990s	2020s	2050s	2080s	2020s	2050s	2080s	2020s	2050s	2080s
2-yr	50.0	59.6	63.1	61.9	58.8	61.2	60.8	58.5	51.6	51.9
5-yr	66.5	79.8	83.6	83.4	80.7	81.1	82.0	78.0	66.9	67.4
10-yr	78.5	94.6	98.4	99.4	98.3	94.9	97.5	92.5	78.1	80.3
25-yr	94.8	114.9	118.7	121.8	124.9	113.3	118.8	112.6	93.4	100.5
50-yr	107.8	131.2	134.9	140.2	148.4	127.5	136.0	129.2	105.7	118.9
100-yr	121.6	148.6	152.2	160.0	175.4	142.3	154.4	147.0	118.8	140.6

Table 10b: Return periods for maximum 5-day total precipitation amounts (mm)

Return Period	Observed	RCP 2.6			RCP 4.5			RCP 8.5		
	1990s	2020s	2050s	2080s	2020s	2050s	2080s	2020s	2050s	2080s
2-yr	71.9	85.1	92.2	89.5	87.5	90.0	90.2	85.9	79.6	83.8
5-yr	92.0	113.1	120.6	120.1	117.1	118.5	119.4	112.9	102.2	106.7
10-yr	105.7	132.0	140.7	141.5	137.1	138.3	140.8	131.2	122.1	121.9
25-yr	123.5	156.3	167.7	170.2	162.6	164.4	170.3	154.9	154.7	141.0
50-yr	137.1	174.6	188.9	192.6	181.9	184.6	194.2	172.8	185.7	155.1
100-yr	150.8	193.0	211.0	215.9	201.2	205.4	219.7	191.0	223.8	169.0

Precipitation Intensification

"I've never seen anything that intense in the 35 years I've been in this region. This is unprecedented." - Gary McNamara, Mayor, Town of Tecumseh

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

How does the City's current stormwater infrastructure measure up to accommodate future climate change?

- Priority areas at greater risk of flooding;
- 156 additional >600mm storm sewer pipes are expected to surcharge;
- Large portions of city with **no major drainage systems**;
- Of the thirty-one (31) Dry stormwater facilities that were analyzed:
  - **Eight (8) were assessed as High Priority**
  - Two (2) were assessed as Moderate Priority
  - Seven (7) were assessed as Low Priority
- Of the sixty-one (61) Wet stormwater facilities that were analyzed:
  - **Twenty-Two (22) were assessed as High Priority**
  - Three (3) were assessed as Moderate Priority
  - Four (4) were assessed as Low Priority

Preparedness Assessment

"The fact of the matter is we have more water here than we can handle. In fact, it's more water than any system in Canada would be able to handle." - Drew Dilkens, Mayor, City of Windsor

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- **Retrofit** existing facilities where feasible;
- **Remove** sediment from existing facilities that have water quality control significantly impacted by sediment accumulation;
- **Construct** new SWM facilities in urban areas of opportunity which are typically associated with public parks and trails;
- **Enhance** SWM catchment areas with conveyance and source controls to mitigate the impact of infill development and intensification on existing end-of-pipe facilities and the natural environment;
- $40 million in stormwater pipe **upgrades**;
- Higher resolution modeling (<600mm pipes) in areas with residual impacts; and
- Refocused stormwater **monitoring** program established as part of the Implementation Plan

End-of-Pipe

"We won't be able to stop disasters from happening. On the contrary, climate change may increase the frequency and severity of floods, droughts and storms. But we are better equipped today to prepare for them and reduce their impact." - Sri Mulyani Indrawati, Minister of Finance, Indonesia

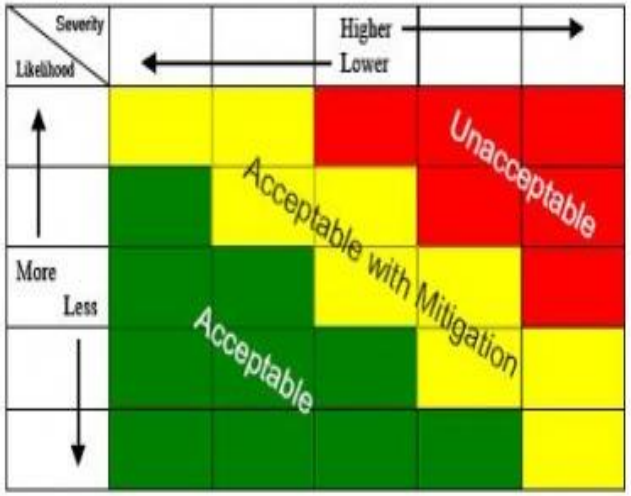
- Acknowledgement that reliance on grey infrastructure upgrades is financially unfeasible.
- New, formalized focus on on-site solutions.
- Stormwater Master Plan mandates a 12.5mm volume infiltration target for new developments, and 10-year pipes where LID unfeasible.
- 12.5mm modeled to roughly offset increase in pipe surcharging due to 5-year storm intensification.

Land Use Planning Augmentation

"Events like Hurricane Katrina and the Minnesota bridge collapse suggest a national infrastructure that has suffered from lack of tending. " – Nina Easton

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- FCM Asset Management Maturity Scale
- FCM Adaptation Maturity Scale (Launching October)
- Determine municipal levels of service
- Build a governing risk assessment model
- Formalize climate change as a key tenet of strategic asset management



What You Can Do

"We would never consider this level of risk in any other walk of life, yet we seem prepared to take this risk with our planet. Conversely, the scientific evidence shows that we can create a positive future, but only with bold action now." - Johan Rockström, Director, Stockholm Resilience Centre

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

- **Green Municipal Fund** (Funding and knowledge services)
- **Partners for Climate Protection** (GHG reduction commitments, support)
- **Municipal Asset Management Program** (Build asset management capacity)
- **Municipalities for Climate Innovation Program** (Adapt existing infrastructure to climate change, integrate climate change into infrastructure planning and management)
  - **Climate & Asset Management Network**

Subscribe today for the latest updates:
fcm.ca/fcmgreen

Opportunities for Support

"Cities are more than the sum of their infrastructure. They transcend brick and mortar, concrete and steel. They're the vessels into which human knowledge is poured."
— Rick Yancey, The Last Star

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Climate change requires a new set of rules for municipalities to play by, given their important role in climate change mitigation and adaptation. Asset management systems offer municipalities a substantial ability to get the most out of municipal assets at the most effective cost, but only systemic risks are appropriately integrated.

Best practices of embedding climate change considerations into asset management are still being developed. In the meantime, there is substantial opportunity for your municipality to use early lessons and build on them. Work with your peers to develop those best practices.

Key Takeaways

"My ambition is not small. I want to save the world's climate, starting with Bristol… and I am prepared to work with fellow Mayors to drive climate action across every nook and corner of the globe." - George Ferguson, Mayor of Bristol, UK

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Thank You

1 Canadian Centre for Policy Alternatives (2013). *Canada's Infrastructure Gap.* Ottawa, Canada

2 Canadian Infrastructure (2016). *Canadian Infrastructure Report Card 2016 – Informing the Future*. Canada

3 Auditor General of Canada (2016). *Reports of the Commissioner of the Environment and Sustainable Development – Report 2, Mitigating the Impacts of Severe Weather*. Government of Canada; Ottawa, Canada

4 Columbia Institute (2014). *Climate Change. Invest (a little) now… or pay (a lot) later.* Centre for Civic Governance; Vancouver, Canada

5 Stockholm Environment Institute (2015). *Low carbon futures in Canada – the role of urban climate change mitigation: Briefing on urban energy use and greenhouse gas emissions.* Seattle, USA

6 Asset Management BC (2014). *Asset Management for Sustainable Service Delivery: A BC Framework*. British Columbia, Canada

Canadian Infrastructure (2014). *Canadian Infrastructure Report Card – Asset Management Primer*. Canada

7 Athena Sustainable Materials Institute (2016). *Embodied Carbon of Buildings: International Policy Review.* Ottawa, Ontario

8 City of Windsor (2012). *Sustainable Purchasing Guide*. City of Windsor; Windsor, Canada

9 Government of Ontario (2015). *Ontario's Climate Change Strategy*. Government of Ontario; Toronto, Canada

10 City of Windsor (2017). *Corporate Climate Action Plan*. City of Windsor; Windsor, Canada

11 City of Kitchener (2016). *Integrated Stormwater Management Master Plan*. City of Kitchener; Kitchener, Canada

12 Cadel, A. et al (2015). *Localized Climate Projections for Waterloo Region. Interdisciplinary Centre on Climate Change, University of Waterloo; Waterloo Canada*

References

"Changes call for innovation, and innovation leads to progress." - Li Keqiang

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO

Dustin Carey, MCC

Capacity Building Officer | Municipalities for Climate Innovation Program

Agent de renforcement des capacités | Programme Municipalités pour l'innovation climatique

T. 343-925-6457

dcarey@fcm.ca

Contact Information

"To me, it underscores our responsibility to preserve and cherish the Pale Blue Dot, the only home we've ever known" – Carl Sagan

MFOA
MUNICIPAL FINANCE OFFICERS' ASSOCIATION OF ONTARIO