

Appendix A: Regional Resilience Workshop: Fostering Collaboration to Address Inter-dependencies of Shared Sector: Thursday May 11th, 2017 - York University

Action Items

- Develop MOECC Submission based on municipal and May 11th workshop feedback
- Further explore what a Regional Resilience Network would look like, what it would do, what it would aim to achieve, etc.
- Undertake research on how other Regional Resilience Networks work, what they work on and what they have achieved thus far
- Inventory and advance Risk Assessments already undertaken; identify risk assessments that are a high priority; identify the transferability of risk assessments across the Region
- What constitutes a Region?
- Promote C40 Inter-Dependencies Study (once released)

Meeting Notes Summary

Presentation # 1: Developing Ontario's Next Adaptation Plan—Karen Clarke, MOECC

Impacts of Climate Change: There are high levels of uncertainty for the consequences of Climate Change, as it is based on various models and this phenomenon has never occurred in the history of this planet. This has made it difficult for economies to prepare for the consequences.

- The year 2016 has been the warmest year ever recorded, the 10 warmest years have occurred since 1988.
- In the past two decades, Ontario has experienced **billions of dollars in losses due to spring frost, dry summers, tornados and severe winds, ice storms, and flooding and thunderstorms. All of these events have been increasing in frequency and intensity over the years.**
- This year, water levels have been the main concern. In 1994, Ontario recorded record-breaking high water levels. In 2003, Ontario experienced record-breaking low water levels. Currently, Ontario is experiencing high water levels matching 1994 levels with signs of continued water level increases.
- The Agriculture sector and the Northern region of Ontario have been the first to be drastically affected by climate change impacts. The former has been affected by the inconsistent temperatures that have also made crops more vulnerable to pests and

frosts. The later has been affected by the diminishing periods of ice road coverage necessary to transport vital goods to northern communities.

Financial Losses:

Insurance Companies are very engaged, as they have been experiencing higher and higher levels of expensive losses because of extreme weather.

Just a Few Examples of Ontario Insured Losses:

- \$76 million in insurance claims within Vaughan and Grey County due to tornado damage in 2009
- \$120 million in insurance claims in Leamington due to wind and thunderstorm event in 2010

Pan-Canadian Insured Losses:

- Experienced their **first billion dollar** environmental disaster in 1996 due to flooding in Quebec.
- Experienced the first environmental disaster above the **\$2 billion dollar** mark in 1998 due to the Eastern Ice Storm.
- In 2013, Canada experienced **+\$3.5 billion dollars** in losses due to the combined Alberta and Toronto flooding events.
- Last year experienced the most expensive insured loss of **\$4.5 billion dollars** caused by the Fort McMurray Fires.

Financial Implications

- The financial sector in Canada is responding to these environmental disasters by requesting long-term risk profile assessments from businesses; failure to comply with this reporting could lead to a decreases in their credit ratings.
- TransAlta & Capital Power have received lower credit ratings after the Alberta forest fire.
- OPTrust, is one of the first pension plan in Canada to release a detailed analysis and disclosure of climate risks to its investment portfolio.
- Internationally, there has been an overall increasing trend to consider climate risks. Some have even provided a detailed analysis and recommendations relating to climate change risks. This direction was discussed by major Institutional Investors in the 2017 Globe Capital Summit and the Task Force on Climate-Related Financial Disclosures. Black Rock, the largest investment firm already assesses companies on how they disclose climate-related risks and how well the board understands these risks.

Steps Taken to Incorporate Climate Change Resiliency

- Canada's First Ministers released the Vancouver Declaration on Clean Growth and Climate Change to demonstrate their commitment to tackling Climate Change which also speaks to adaptation and resilience.
- Ontario released their first adaptation plan called Climate Ready: Ontario's Adaptation Strategy and Action Plan in 2011 and is now in the process of updating that Plan. Updates from the first plan include:
 - Adaptation strategies are now required in the Provincial Parks Planning Manual, Far North Land Use Strategy, Provincial Policy Statement (2014), and The Infrastructure for Jobs and Prosperity Act (2015).
 - **The Provincial Policy Statement (2014)** promotes resilient and efficient development and land use practices, infrastructure planning, while encouraging green infrastructure (especially regarding stormwater management requirements)—all these components must consider the impacts associated with risks from climate change.
 - **The Infrastructure for Jobs and Prosperity Act (2015)** supports long-term infrastructure planning and investments with a climate change adaptation focus.
 - **Land Use Planning Tools** were incorporated when the Growth Plan, Greenbelt Plan, Oak Ridges Moraine Conservation Plan, and the Niagara Escarpment Plan were reviewed.
 - Tools consisted of:
 - Greenhouse gas emissions inventories and reduction plans
 - Infrastructure vulnerability risk assessments
 - Enhanced requirements for watershed and stormwater planning
 - Guidance Material to support the implementation of PPS policies (to be released after the completion of the Coordinated Plans Review)
 - **Infrastructure Risk (Vulnerability) Assessments** have been done on three government buildings and on the water supply system in Leamington.
 - **EA Guidance on Climate Change** draft created by the MOECC incorporates climate change considerations into Environmental Assessments (EA) and highlights how proponents and the public would be made aware of these implications.

Building a NEW Ontario Adaptation Action Plan for 2017

1. The priority is to include as many provincial ministries as possible in the Plan.
2. Includes all sectors (ex. infrastructure, land-use planning, health, economic resilience and risk/emergency management).
3. Includes vulnerable northern indigenous communities.

4. Increase integration of climate considerations into programs and policies and subsequent capacity building measures to ensure understanding and compliance to the proponents and the public.
5. Increase municipal role/responsibility in implementing climate change resiliency approaches within their jurisdiction.
6. Establish a **Climate Modelling Collaborative** that would ensure standardized climate *information and services* be made available in order to enable effective adaptation action and decision-making at the community level.

Potential mandate and scope of services of emerging Collaborative (final name yet to be determined):

- Advance the science & communicate the science – Identify and communicate what we know.
- Understand Climate Risk - create the ability to assess risk
- Inform decision-making when considering risk and developing strategies and actions to become more resilient.
- Communication and Outreach – increasing awareness of services/actions to stakeholder and the public as well.
- The more stakeholders there are contributing information to the Collaborative the better able it will be to enhance its proficiency as a tool/service.

Next Steps

- Finalizing the draft Adaptation Plan and details of the modeling collaborative for public consultation and comments around summer time.
- The final plan and launch of the modeling collaborative is scheduled to be released at the end of 2017 on the Environmental Bill of Rights Registry [website](#).

Which ministries would be responsible for assessing which communities would be the most vulnerable to migration?

This is largely going to be the federal government’s responsibility to assess the risk of displacement due to climate change. Canada does have communities that will be affected by sea level rise; an event that is not limited to the most commonly discussed islands. “Climate Refugees” is a term that has been active and used by the international community (especially the UN) when addressing island/coastal communities that are most likely to be displaced by rising sea levels. At the international level, the displaced communities/individuals would most likely be classified as Refugees. Current Canadian

policies regarding refugees have not been effective when put under stress/extreme weather/climate change case scenarios, therefore Refugee Policies will likely have to undergo future changes in light of climate change's likely role in displacement and the creation of climate refugees.

What has the government done to spread the credibility of the effects caused by climate change to the public?

Ministry of the Environment has been developing and releasing marketing materials. Primarily, they have been broadcasting YouTube ads using the "Save the ..." platform that has been trending in social media. These videos talk about the impacts of climate change as to how it would relate to topics the public cares about. **Watch *Save the Snowbanks Climate Change* YouTube ad [here](#).**

There has been a lot of effort put forward to embedding climate change resilience policies within various plans spreading across various ministries; have you noticed a lot of traction in regards to increasing climate change resiliency actions taking place?

Yes, but not as much as there needs to be. The traction is slowly starting, which has been a positive sign, as more and more conversations across ministries regarding climate change are occurring. These conversations were not as popular a decade ago. This is why there is a lot of interest and support to develop the Climate Collaborative.

What are some examples of the tools the Climate Collaborative will develop to help with the decision-making process at the municipal level?

One tool being developed relates to the issue of translation. The Ministry has a wealth of climate modeling data, which is very technical/scientific in nature. The goal is to make this information meet practical needs whereby a municipal member, with limited knowledge about climate change implications, would be able to maneuver easily through climate change information relating to their scope of work in order to learn how climate change applies and how they could and should act accordingly.

Has there been any plans to develop a Transnational Climate Change Adaptation Plan between Canada and the US?

At the national level, there has not been much work undertaken in joint development of adaptation plans between Canada and the US.

Ontario has developed relationships with various states in the US that has allowed for sharing information and best practices, but a specific forum around climate change adaptation has not been developed. The conservation of the Great Lakes between Ontario and the States bordering us to the south however has allowed for many conversations on efforts indirectly relating to climate change impacts.

Presentation # 2: City of Toronto: Climate Change Resilience and Interdependencies—Dave MacLeod

One of the goals of this workshop is to explore the value of a Regional Climate Change Adaptation Collaborative amongst municipalities and other infrastructure/stakeholder groups. The goals are to:

- Increase efficiency and outcomes
- Reduce the duplication of effort
- Save money
- Achieve the purpose of serving citizens and enabling prosperity within and across jurisdictional boundaries.

Background

The Environment and Energy Division in City of Toronto focuses on energy conservation, reducing greenhouse gas emissions, protecting and maintaining energy security and supply, and developing a resilient city.

- There are a lot of transboundary information sharing taking place between Toronto and other progressive cities in the United States through the platform of the Urban Sustainability Directors Network.
- Toronto is also involved in transnational conversations occurring through C40.

The Creeping Effects of Climate Change

- There are three areas of focus involved when considering extreme weather events; Resilience Planning and Action (which takes place before the extreme weather event occurs); Emergency response; and Business Continuity (with the latter two taking place after the extreme weather occurs).

- Resulting in two main approaches to management; advanced planning and reactionary planning. This presentation highlights the importance of advanced planning and its capability to influence urban regions bouncing back from extreme weather events.

Urban Resilience Definition:

The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience.

List of Reports from the City of Toronto on Resilience Efforts:

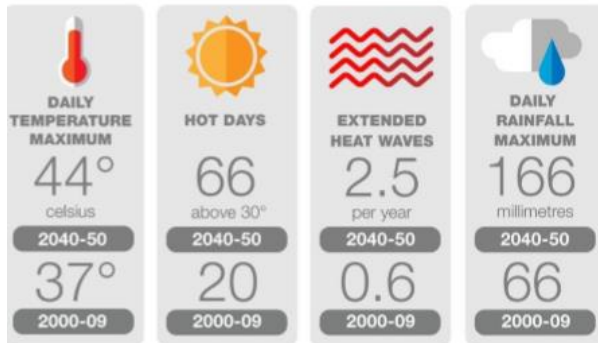
- [Change is in the Air \(2007\)](#)
- [Ahead of the Storm \(2008\)](#)
- [Climate Change Risk Tool \(2010\)](#)
- [Climate Drivers Study \(2011\)](#)
- [Resilient City- Preparing for Extreme Weather \(2013\)](#)
- [Resilient City-Preparing for Climate Change \(2014\)](#)
- [Resilient City- Preparing for Climate Change, Update and Next Steps \(2016\)](#)

Toronto Climate Change Risk Assessment Tool

- Toronto used this assessment tool and worked with the roads department to undertake the risk assessment. The Tool has been internationally recognized and is the first in this class to consider social programs into its analysis.
- Used ISO 31000 risk management decision-making tool to prioritize actions in a consistent and robust manner across transportation services, social programs, and social housing administration. The risk assessment addresses 90 classes of assets and services, 17 different weather predictions, and compares two different time periods (current and 2050).
- The Transportation Association of Canada is developing a web-enabled version of this tool in order to increase the abilities of the wide group of stakeholders to access and use this resource. If one person develops a risk assessment for a specific road, the information could be transferrable to other roads that have similar factors within that region.
- Engineers Canada has been extremely helpful in undertaking detailed risks assessment regarding the engineering perspectives of Toronto Hydro, 3 culverts within the City of Toronto, 2 dams within the TRCA watershed, Toronto Community Housing Buildings, Pearson International Airport, and 6 Assets within Metrolinx.

Climate Change Risk Management Policy (2014)

Toronto's **Future Weather***



The summary of Toronto's future weather was converted to this visual that illustrates the changes we are currently seeing and what people will experience in 2050.

The projections estimated in 2050 are conservative estimates and it is important that this is not only speaking to future conditions but speaks to already recently experienced circumstances (such as rainstorms and

flooding).

- It is the intense rainfall within short periods that often create many problems within the city due to the stormwater and sewage systems being overwhelmed.
- TRCA is responsible for flooding occurring around rivers, it is the City's responsibility to deal with flooding within the city. Currently, there is not a mandate in place to reduce the potential of flooding within the City but there is a mandate on how the sewage system should be managed.

The Aim

- The Climate Change Risk Management Policy established a governance structure that aims to collaborate with the private and broader public sector to implement collective actions towards increasing Toronto's resilience.
- Hydro One and Metrolinx have been added to the Climate Change Risk Management Policy Board and have incorporated the Climate Change Risk Management Policy within their respective organizations.

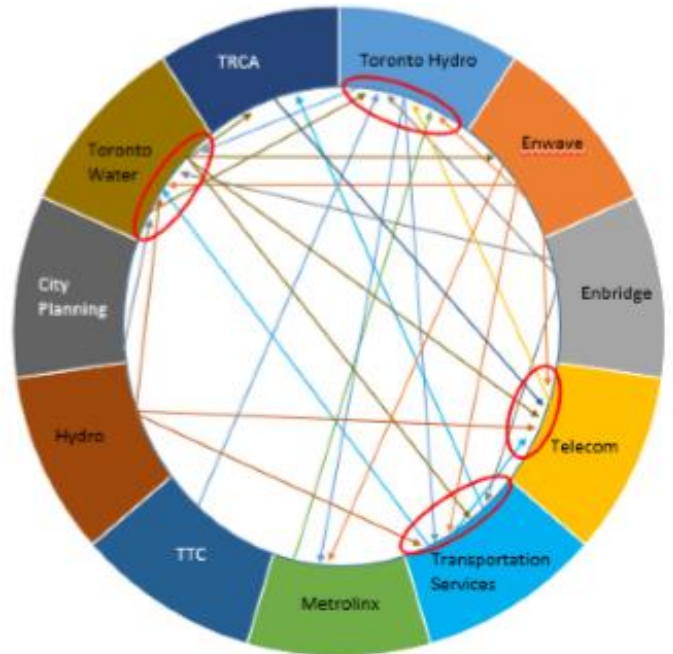
High-Level Risk Assessment (HLRA)

- The City of Toronto has reached out to the utilities, the water sector, and the transportation sector and these sectors have undertaken high-level risk assessments.
- The City of Toronto is now looking to the building sector and the food system sector to start developing their own High-Level Risk Assessment.

- The food system has been a focus because it is very dependent on one Food Terminal and this poses an issue for vulnerability as well as an issue to Toronto’ increasing urban density projections.

Key Findings & Lessons Learned from HLRA Process

- Toronto is highly dependent on Toronto Hydro, Toronto water, Telecom, and Transportation Services.
- This diagram highlights the interdependencies of services within the Toronto region. There are organizations that are not a part of the municipal jurisdiction but cross various municipal jurisdictions—this makes resilient planning more complicated. The common denominator that brings all these sectors together is the fact that they all face the same climatic changes.



C40 Interdependencies Study April 2017

More diagrams were generated and are found in the report, which will be released publicly shortly. The report also highlights five case studies of how climate hazards affect multiple sectors. The report highlights:

- The effects of extreme precipitation to various sectors
- How the energy sector (if/when affected) affects other sectors.

Toronto has developed voluntary guidelines for multi-unit residential buildings regarding backup power. The City has also noticed that any impairment to the energy sector would have negative consequence in particular to aging populations, or those with mobility issues, making them even more vulnerable during the recovery stage. The objective is to develop policies mandating buildings to be “stand alone,” meaning that the building would have its own independent energy source when backup energy demands are necessary.

Fire code states that a building should have enough backup energy to power the building for at least two hours for evacuation purposes. The City of Toronto is stating that this regulation is not

enough. Where will these populations go in the case of an extended need for alternative shelter?

Why a Regional Climate Resilience Collaboration?

There have been plenty of studies undertaken in the US to prove the value of a Climate Resilience Collaboration. Results show that collaboration increases overall synergies and reduces duplication of efforts. Increases in collaborative work helps to:

- Provide support to the small amount of staff often dedicated to resilience.
- Increase efficiency of efforts associated with interdependent stakeholder/infrastructure groups that often serve across jurisdictions.
- Streamline requests for federal/provincial guidance/regulation due to the common data/approaches.

In the USA, they have incorporated a neutral body that can convene across municipal boundaries providing assistance to organizations that do not have the staff power to follow through with risk assessments by themselves.

Who is doing this?

- In the USA, there are over nine regional adaptation collaboratives representing 5-15 cities currently; and the number of cities getting involved is increasing. The governance models differ between regional adaptation collaboratives but one aspect that stays constant is their “neutral” status—this limits the ability of large cities to dominate discussions and actions and better reflects the circumstances, needs and experiences of a wider variety of municipalities and sector capacities.
- Example: Bay Area Resilience Collaborative (San Francisco). This collaborative has subdivided based on different facets of resilience (ex. coastal hazards, transportation climate resilience, resiliency by design challenge, Governments Resilience Program)
- Collaboratives also provide a better mechanism for bringing in expert assistance in a way that benefits a wider region and more municipalities and stakeholders. Steve Adams in charge of the Institute for Sustainable Cities is sought after by collaboratives in the United States to assist them in setting up regional governance platforms, benefiting a larger group of municipalities that would be unlikely to be able to benefit from expert advice without a regional resilience effort being in place.

How do we do this/pay for this?

- We know that municipalities on their own won't be able to pay for the collaborative on their own and most certainly paying for the impacts associated with extreme weather on their own will likely significantly tax the financial budgets of even the largest cities.
- Feedback from this Workshop will be submitted as input to the Provincial Climate Adaptation Strategy and gather feedback and suggestions for the value of a Regional Resilience Collaborative.
- There would likely need to be several regional collaboratives since there is a large variance of geographical/climatic differences within the Province of Ontario.
- Everyone participating in the collaborative would have to contribute to financing the collaborative (municipalities, province, feds & private sector)

Who might be involved?

- Small neutral convenors+ Toronto + Regional Municipalities + Conservation Authorities, key infrastructure groups + Key provincial Ministries + Insurance Bureau of Canada + Municipal Association.

What could it accomplish?

- Sharing of risk assessment results
- Identification of resilience strategies across interdependent sectors
- Unified approach within all levels of government
- More consistent messaging for public and businesses promoting resilience actions

100 Resilient Cities (Rockefeller Foundation)

- The Chief Resilience Officer will be announced by the end of this month. They would be responsible for four key dimensions: Health & Wellbeing; Economy & Society; Infrastructure & Environment; and Leadership & Strategy.
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Presentation # 3: Climate Change Adaptation Action in the GTHA: Teresa Cline – York Region; Brian Kelly – Durham Region; and Gabriella Kalapos, Clean Air Partnership

Presentation Goals:

- Highlight the state of adaptation in Southern Ontario.
- Explore the interdependencies that occur within this region.
- Address the rationale for regional collaboration.

City of Hamilton

Has developed a Community Climate Change Plan in 2015. It highlights 10 priority actions that would increase Hamilton's resiliency regarding the changing climate.

Two of the priority actions identified:

- Considering Climate Change Adaptation strategies for their food systems; risks assessments would be undertaken to understand the threats climate change presents.
- Initiated a Flooding and Drainage Master Servicing Study, which looks at the planned future growth/intensification and climate change implications when considering flooding potential in Hamilton.

Halton Region

One of the first regions to identify Climate Adaptation as a priority in their Strategic Action Plan (2015-2018), in which there are six key focus areas. This document has a clear focus, which is very helpful for the Council as it decreases any ambiguity in action, and requires regular reporting of progress.

The priority actions identified:

- Increase resiliency of programs and infrastructure.
- Developed an emergency preparedness piece to respond to community needs resulting from severe weather.

Halton Region has also completed a Flood Mitigation Strategy (2015) that analyzed their sewage system. The goal is to limit basement flooding through spreading awareness of back-flow valve installations and disconnecting sewage drainage pipes (Flood Prevention Program).

Peel Region

Developed a Climate Change Strategy in 2011, which is set to be a long-term approach to address climate change and reduce greenhouse gas emissions. To achieve implementation of the strategy, the Region of Peel collaborated with Brampton, Mississauga, Caledon, TRCA, and the Credit Valley Conservation Authority to oversee the Plan development and implementation process.

The Climate Change Strategy resulted in numerous high-level vulnerability assessments in areas of public health, natural ecosystems, agriculture, water infrastructure, near shore assets and the economy.

The Region of Peel is developing a framework around a corporate policy that integrates climate change into the decision making process.

York Region

Has identified Climate Adaptation as a key priority in their Sustainability Strategy, Vision 2051, and the Official Plan. Have been working on a draft Adaptation Action Plan but the Plan has not yet been finalized.

Has developed a Joint Municipal Climate Change Working Group, which encourages adaptation practitioners to participate in information sharing (guests outside of the Region have been invited to present and participate in conversations). This working group developed a Vulnerability and Risk Assessment Framework using locally developed tools, primarily borrowed from the City of Toronto and the Region of Peel.

Region of Durham

Acknowledges and commends the incredible work that the City of Toronto has done on adaptation because the materials they have developed have been able to be transferred and have provided significant support for Durham Region's efforts. This imitation and transferability increases the capacity as well as the speed and scale that municipalities need to work at in order to incorporate climate change into their resilience planning.

Durham Region developed a Community Climate Adaptation Plan (2016) as a result of a 3-year long process involving Durham region, eight local municipalities, five CAs and four electrical utilities. The Report highlights seven sectors with 18 programs (human health, roads, buildings, electricity, flooding, natural environment). Currently, the Plan is moving into its third phase which deals with program approval and funding. 18 programs found within Durham's Community Climate Adaptation Plan and these actions are highly transferable to other Regions.

Informal Collaborations

- Municipalities have been collaborating informally through CAP, OCC and through working groups.
- It would be beneficial to highlight opportunities where these organizations can leverage their work with each other to achieve the most effective resources for municipalities. Addressing the formal process to how this would be done is key to increasing synergistic outcomes.

Adaptation Goals as Identified by the Clean Air Council:

Integrate a "Greenhouse gas reduction and adaptation lens" to funding, infrastructure processes and decision making, including technical support for municipalities in the development of climate change adaptation plans.

How are Municipalities going to achieve this?

- Data on future climate projections and impacts is necessary but data in itself is insufficient to ensure it gets factored into decision making;
- Increased support and capacity building for analysis of the data and integration of that data into decision making is greatly needed;
- A framework and requirements associated with taking consideration of future climate into municipal decision making is also required to ensure that it is considered in an accountable and transparent manner and ensures implementation progress; and
- Climate change considerations being integrated into infrastructure funding and decision making is needed and required to be publicly reported on in an accountable and transparent manner; and
- A financing mechanism will be required to ensure that no one level of government is unduly burdened with financing resilience in an inequitable manner.

Education and Capacity Building needs to be advanced:

- Ministry of Health and Long Term Care just released a Health and Climate Change Methodology and Toolkit.
http://health.gov.on.ca/en/common/ministry/publications/reports/climate_change_toolkit/climate_change_toolkit.aspx
- This type of framework/toolkit is required for various sectors: including but not limited to Public Health, Public Works & Infrastructure Services, Planning, Emergency Services, Transportation, Finance Officers, Council, etc..
- Training and capacity programs (online/in-person) should accompany these Toolkits and they should be aligned with professional accreditation wherever possible.
- Further exploration is to identify cross dependency between these various sectors and their various Action Plans.
- Education and awareness building for the public is also key to being able to increase the ability for climate change to be factored into decision making.
- Other sectors would also need to be able to advance their decision making taking climate change into consideration within their decision making (for example telecom, transportation, utilities, etc..)
- Further exploration is necessary to identify cross dependency between various sectors and their various Action Plans.

Break Out Group # 1: Natural Gas

Summary of Presentation from Jeffrey Mazzei, Enbridge

Overview of the Natural Gas System and its features; highlighting the difference between high-pressure natural gas mains (analogous to highways that provide gas across the region of Ontario), and street level gas mains that provide gas to customers.

The highest gas pipe density is located within the Greater Toronto/Hamilton region, which is owned by Enbridge and Union Gas.

Background:

The natural gas is distributed throughout the network via differential pressures in the transmission lines. The major sources of this natural gas come from Western Canada and the United States.

There are several mains in the outskirts of the Toronto and Hamilton region that could serve as a back-up resource to ensure customers continue to receive energy in the case of any disruptions.

The regulating equipment for the network is primarily mechanical. If a power outage to the grid were to occur, the natural gas system would not be compromised as the mechanical equipment would self regulate according to the differential pressures of the pipes. The concern regarding natural disasters is primarily oriented around the integrity of the infrastructure. Prolonged power outages would have an effect on support equipment though as comms and heaters rely on grid power

Key Features

- The infrastructure is buried, this protects the system against ice storms.
- The large network of pipes makes the energy service more resilient as back-up energy sources can be re-routed into the affected areas.
- There is not a threat to outside contaminants going into the pipes that would cause further damage downstream or upstream of the system—this is due to it's pressurized/valve regulated mechanisms—the recovery stage will be easier to remediate as it would generally be point specific.
- “Make Safe” refers to customer home visits by the utility to ensure no/limited damage to the natural gas supply; the usual procedure is to turn the natural gas meter/valves off to cut the energy supply to the customer. This process is very time and resource intensive therefore it is considered a last resort solution to natural gas system malfunctions.

- Significant Mapping and Forecasting of the natural gas network is analyzed in order to ensure customers receive continued energy supply, especially when an unprecedented event occurs.
- Resolving erosion and any depth related maintenance issues are considered a priority and are remediated as soon as possible.

Climate Scenarios Experienced in the Past and the Subsequent Impact on the Network:

1. **Ice Storm (2013):** The natural gas system was not negatively impacted by this event. The reason why the affected population did not have access to heat was because the blower motor for the furnaces were not able to function without an electrical supply.
 - The gas utility uses a metric called “line pack” which measures the amount of cubic metres of gas available in the system at any given time. The line pack usually measures a higher energy supply than what the system requires—this feature is also referred to as a *capacity battery* because it is able to supply energy to customers for hours/days depending on how many customers and how much energy is being used within the electrical blackout period.
 - EOC (Emergency Operation Centre) was triggered and infiltrated throughout this event; this incorporated *Make Safe* procedures, relaying energy supplies to customers in need of the service, and critically managing peak demand when all customers reintegrate back into the natural gas system (atypical high demand of natural gas for long periods of time to heat back homes to comfortable temperatures).
 - The natural gas utility worked with hydro companies to manage the amount of customers accessing energy supply so as to not override the system.
2. **Fort McMurray Forest Fire (2016):** The natural gas system was not affected nor involved in any way to the magnitude of this disaster.
 - Prolonged effects of massive heat cycling of steel buried infrastructure is unknown, this event would make the natural gas system in Ontario very vulnerable.
3. **Flooding in Gatineau (2017):** EOC in Ottawa has been activated. “Make Safe” procedures are still being undertaken to ensure unoccupied flooded homes have their natural gas meters shut off; this is necessary to ensure the safety of homeowners and emergency responders. Dispatch services are essential to confirm homes are structurally sound before affected homes reintegrate back into the natural gas energy supply.
 - If the basement of a home has been flooded, making the pilot light not visible for appropriate action, the presence of water does not automatically shut off the

natural gas supply into the home. The natural gas utility is working on developing strategies (through their mapping and forecasting analysis, emergency personnel, government agencies etc.) to shut off natural gas supplies to affected areas before water levels reach such high levels.

- Natural gas systems have not been affected by most environmental disasters events up to date; mass erosion and washout pose the biggest concern because it poses the possibility of emergency personnel not able to close out the mechanical valves if natural gas pipes become exposed. Wild fires also have the potential to be disastrous but is less of a concern in Ontario natural gas infrastructure areas.
- All natural gas pipe shut-offs are manually done for all natural gas users (residential, commercial etc.). Usually, the pipes are shut-off upstream the affected area and then *Make Safe* is carried out within the area itself.

Future Integration with Municipalities

- Utilities are interested in integration possibilities with municipalities in regards to data sharing and communication avenues. Ex: identifying stand-alone multi-residential buildings that require natural gas to run their generator, especially regarding older buildings that have been retrofitted.
- Utilities rely heavily on GIS data and information overlays. Currently, the natural gas utility is using municipal, regional, and provincial growth census data. Municipalities have been made aware of Conversion Area overlay data generated to highlight flood plains, this information could be an asset.
- This information is what the Utilities are interested in—what municipalities are using in order to inform/manage future environmental risks to their infrastructure, ex: where their designated warming stations would be during the wintertime etc.
- Pinpointed data specifically with addresses associated would be ideal.
- Enbridge's Emergency Programs Office is responsible for emergency planning and management, they offer opportunities to meet with municipalities to inform them about what their processes consist of - information sharing is encouraged.
- Public and Government Affairs Office has a municipal planning representative and a long range planning representatives that are interested in working alongside municipal representatives.

Questions/Discussions:

If you were to make the shut off valves more accessible, especially in case of emergency response, what would stop the public from accessing and manipulating the energy flow as has happened in Sarnia?

The Utility relies on their safeguard “security through obscurity,” if people are not made to be aware of where the gas pipe valves are, they would be less likely to manipulate them. The large gate station valves, that provide natural gas from the utility power supplier *TransCanada*, are very difficult to tamper with. The valves are very complex and can only be activated through several simultaneous means, not just physically--it has some electrical components, a gas over hydraulic system, and responds to a specific type of key.

In case of an emergency where access to manually shut off the natural gas pipe valves becomes increasingly more difficult, how would the utility be able to manage this situation?

The Utility would not wait until the disaster escalated to a point where access to the shut off valve would not be feasible. Personal are located nearby the valves and a proactive approach is always enforced in lieu of extreme weather events.

What are the vulnerabilities associated with Dawn Hub (the largest underground natural gas storage facility in Canada)?

Dawn Hub is not the only source of natural gas. The system would be able to rely on natural gas supplied by TCPL and another gas pipe coming from the Niagara region. Dawn Hub would be more of an issue if there was a compounding event where two natural gas sources were jeopardized. Dawn Hub is primarily used during the wintertime to meet increased natural gas demand.

Has the utility looked into the uptake of onsite natural gas generation due to the public's awareness of increased electrical power failure?

Due to Enbridge's deregulation in the late 90's, the customer service arm it once had was converted to a separate entity. This separation caused a gap in information relating to what customers bought for their homes (information related to the size of their furnace, size of their water heater, the presence of a fire place, BBQ's, and onsite generation).

The utility is working on accessing data relating to how much gas is being used in homes as this information would highlight what type of equipment would be responsible for that amount of natural gas usage.

To date, the penetration of onsite natural gas generators has been quite low and therefore has not sparked too much of a concern for the utility. It is mainly within rural areas that this backup energy source has been prevalent.

Some clients have diesel gas generators. The natural gas utility representatives would not shut down this backup generator through their *Make Safe* home visits; unless otherwise directed by the homeowner or if implications of it causing greater hazard become present.

What are other scenarios that would lead to the shutting off natural gas pipes?

Anything that could affect the natural gas system Enbridge is very aware/proactive in maintaining control over. There was once a sinkhole created in downtown Ottawa, the natural gas did not need to be shut off immediately but was shutoff once all the logistical analysis of the situation became apparent.

The EOC is very active and is aware of any potential risks to the system; erosion, terrorist attacks, cyber attacks etc. If there are any threats to either of these instances than the natural gas pipes would be turned off immediately.

What about tornados?

Yes, tornados would negatively affect the parts of the system that are found above ground, it would not be sufficient enough to damage the entire system as the affected areas would likely be isolated and natural gas could be rerouted through alternative natural gas energy supplies.

In Barrie, there are many surface feeder pipes that connect the homes to the main street natural gas pipes. Would these exposed gas lines be a foreseen vulnerability to the system if threats of extreme winds (tornados) continue to be a problem?

This situation would be out of the scope for the utility, once the gas leaves the meter it is up to the customer to decide what they are able to do with the pipes when problems arise. This should be a concern for the residents; they should not be found in the basement and should consider evacuating when faced with extreme winds. Ultimately, this should not affect the natural gas network as a whole.

What vulnerabilities arise with the increased pressures of intensification in the urban areas? Especially, when considering other underground assets i.e. wastewater systems and potential breaks in the sewage line that could lead to flooding.

Intensification is a big concern for the utility as well, they have been aware to plan their natural gas networks under roads and not under any residential homes (it is also important to note that the water systems also use the same methodology and therefore are usually always near gas infrastructure). In emergencies, the utility would definitely need to coordinate and communicate with other agencies that have assets underground, there has not been much work developed in this area and more work in that areas is warranted.

What are the key vulnerabilities?

- The natural gas distribution system is driven by differences in pressure and does not rely on compression (other than for storage);
- The shut-off (or regulating) system is largely mechanical rather than electrically-activated (contrary to common assumption). Mechanical safety valves are located underground at the neighbourhood level. These are operated by Enbridge personnel who are dispatched in response to problems;
- Only communications and support equipment require grid power;
- Natural gas distribution system is much less vulnerable to extreme weather than the electricity distribution system due to the buried nature of almost all the infrastructure;
- After a shut-off, there is an intensive process to safe/purge and re-light equipment (especially pilot lights);
- Massive erosion (as in the Finch Avenue washout on Aug. 19, 2005) resulting in undermining of gas pipelines and possible collapse/rupture of the line;
- Effects of tornados/high winds on above-ground gas transmission facilities;
- Effects of flooding on above-ground gas transmission facilities;
- Impeded access for service personnel to shut-off valves due to extreme weather events; and
- Incomplete knowledge of location of NG emergency generation equipment and cogeneration equipment which will become “stranded” if gas is shut off in an emergency situation.

Who Needs to Be Involved? What should their roles be?

Who	Roles
NG Distribution Utilities	Sharing current system capabilities and emergency management plans Integrate mapping with municipal governments Link emergency office with municipal/regional emergency offices
Emergency responders	Communicate with utility about locations of NG generators for emergency backup power Educate public about NG availability during extreme weather and NG safety issues
Transportation Agencies	Shared mobility services during critical events
Municipalities	Communicate with utility re location of NG generators and evacuation centres for emergency backup power
Conservation Authorities	Updated flood mapping and overlay with gas lines and control equipment

What are the interdependencies?

- Communication equipment and a small proportion of control equipment are reliant on grid power and therefore are affected by power outages;
- Possible escape of NG from pilot lights in flooded situations (e.g. in flooded basements resulting in explosion hazard);
- Road access for personal to reach shut-off valves;
- Emergency backup power and cogeneration may be unavailable if NG supply has also been cut for any reason;
- There is a need to integrate mapping between municipalities and the gas utilities to identify locations of emergency backup power, cogeneration and evacuation/warming/cooling centres so that gas supply is maintained to these facilities.

Rationale for Regional Approach

- Extreme weather events don't respect municipal or regional boundaries;
- Natural Gas distribution infrastructure (pipelines) cross municipal and regional boundaries;
- Risks and responses are likely to be similar across jurisdictions.

Break Out Session # 2: Telecommunications

Summary of Presentation from Tony D'Agostino, Canadian Telecom Resilience Working Group

Telecom Sector – Issues and Challenges

1. Understand the role Telecom plays in a disaster (support of both the response and recovery phases), the need for expedited services and/or repair, and the logistics surrounding that support in order to designate and/or appoint Telecom service personnel first responder designations for such things as road access, etc.
2. Standardize across all provinces/territories a number of policies and processes which will aid in the Telecom industry's ability to respond to a disaster, such as: Access to fuel and refuelling; Vehicle Access to the roadways]; Access to security personnel (police/military)
3. Standardize the definition of "essential services" across federal, provincial, and local levels
4. Standardize critical infrastructure prioritization across all levels of government
5. Develop common and agreed to protocols for the sharing of critical infrastructure information at the appropriate times during a disaster
6. Understand under what circumstances the government would intervene to prioritize service or service levels during an emergency
7. Understand if the CRTC will consider making concessions proactively versus following regular procedures for extraordinary circumstances, such as a pandemic, if metrics are not met during any emergency
8. Understand what level of support is expected at the Federal Government EOC during a National Disaster from CTEPA or its membership
9. Help to facilitate the positioning of Industry Canada to act as a Telecom Sector liaison within provincial EMO operations

What are the key vulnerabilities?

- Telecommunications depends on fuel; electricity; HVAC; water; regional emergency management office, road access.
- All critical infrastructure has a generator attached to it as a back up to power and if it doesn't have one then there is the ability to bring in portable generators.
- There are places called telecom hotels where there is a large amount of telecom infrastructure that if flooded out could significantly disrupt service.
- Major Concerns: Access to energy supplies (Fuel and Power); Critical information sharing with Utilities and EMO. Road access and gaining site access.

- Flooding is a critical vulnerability as in heat waves (power is required to cool the towers). What opportunity does shading have to reduce cooling requirements , that may be something to consider.
- A key vulnerability is that telecommunications is often forgotten as critical infrastructure and telecom is not often brought to the table. A key take away is that telecom should be invited to the EMO working group for each of the regions and brought in with other critical infrastructure (ex. electricity).
- The Red Cross role of helping people has shown how critical telecom is. They used telecommunications to reach those in need (ex. social media was used to reach out to people in need).

Possible resilience intervention:

- Update CSA Standards as it relates to telecom. How can standards be improved to improve telecom resilience? This would be better explored at a larger scale than one government (federal is the logical level to deal with that however the Province can play a role in advancing that).
- Better sharing of telecom infrastructure and vulnerable areas? This can be better addressed at the local/regional level.

Who Needs to Be Involved? What should their role be?

- Increase the recognition of telecommunications as critical infrastructure.
- It would be of value to better integrate EMOs with Telecommunications.
- Toronto and each of the Regions has their own Emergency Management Office. Other provinces have co-located their EM Offices (ex. New Brunswick) does that lend a lesson for the GTHA and Region?
- Promote the Tips to Stay Connected Messages

Rationale for Regional Approach

- Most of the infrastructure is co-located. The pipes, fibres, train tracks, wires and roads are often integrated together. Telecom is not considered a critical service (it isn't just about business continuity) so they are not considered first responders (which makes sense) but it is important to realize that telecommunications facilitate communications and are becoming much more necessary to the general population (but often first responders too).

- The Achilles heel of each sector would better be addressed regionally since infrastructure does not respect municipal boundaries.
- Do Telecom companies compete on resilience? Yes and No. Telecom companies compete on reliable and consistent service but in the case of an emergency, companies will often work together. The Telecom Resilience Working Group brings all the telecom companies together.

Next Steps

- OEM/EMD to bring Telecom Resilience Working Group to Table
- Publicize Tips to Stay Connected
- Telecom, Conservation Authorities, Municipalities identify flood risk to critical telecom infrastructure
- Update national standards for Telecom to incorporate climate change risk
- Put telecom assets on priority list for restoration
- Share best climate risk info
- Telecom and electrical utility to share location risk information
- Engage telecom regulators on resilience

Break Out Group # 3: Transportation

Summary of Presentation from Steve Winkelman, Green Resilience Strategies

- When critical infrastructure systems are working we can go about our business. But climate and weather impacts can cause physical damage and operational disruptions.
- A variety of interventions can reduce vulnerabilities and enhance resilience: mechanical, operational, improved design, network efficiency and redundancies and green infrastructure. See presentation for example images of vulnerabilities and solutions.
- Transportation systems are highly dependent on other infrastructure systems working properly – and vice versa. Power outages can disrupt public transportation and the information technology systems we rely upon for navigation. Multiple infrastructure systems (pipes, wires, cables) are often located along transportation right-of-way increasing co-vulnerabilities. Extreme events can spark cascading impacts such as flooding → infrastructure damage → power outages → signal outages, which can be exacerbated by increased demand for information services during extreme events.
- Transportation resilience requires: protection of transportation infrastructure, protection of the infrastructure that transportation depends upon, and planning and design of transportation systems to function during disruptions in other sectors.

- See Steve’s presentation for information on examples of regional collaboration on transportation resilience in the US.
- There are a variety of strategies for funding resilience measures, including leveraging infrastructure funding, GHG mitigation funding and “green resilience” measures that reduce GHGs and enhance resilience.

What are the key vulnerabilities?

- Define Transportation – what does it entail – air, rail, transit, marine and roads.
- Public Transit is often a key refuge in an emergency situation
- Flooding
- Think of roads as a tool to increase resiliency. What if they were designed differently?
- Roads increase vulnerability because of the imperviousness
- Safety – lack of redundant routes (only 1 route)
- Ice Roads
- Extreme Heat (rail kinks)
- Freeze thaw
- Aging infrastructure
- Evacuation – surge in demand
- Food
- Public Health Vulnerabilities (i.e. injury – ice road conditions)
- State of Repair Asset Management Approach
- Turn an Extreme weather event into an opportunity to build support for future resilience options.

Who Needs to Be Involved? What should their role be?

Who	Role
Elected Official	Give priority to addressing climate change and fund actions
Public Health	Information and Advocacy
Professional/Industry Organizations	Establish Best Practices/Frameworks/Guidance/Education
Business	Ensure Continuity of Service/Economic Case
Vulnerable Populations	Become increasingly vulnerable
Emergency responders	Communicate with Public about how to prepare/what to do in the event of an extreme weather event
Provincial Ministries	Funding – information, research, projects

Public	Local knowledge (eyes on street to report maintenance issues)
Transportation Agencies	Shared mobility services during critical events
Municipalities	Making design decisions/Regional direction to adapt helpful for local municipalities to act in this area as well
Community Organizations	
Conservation Authorities	Environmentally sensitive areas, updated flood mapping

What Don't I know? Who Haven't I talked to?

- Don't get hung up on the need for technical information. You can start with documenting past events and gathering hands on operational knowledge of your system.
- We have to be careful about how we frame the adaptation conversation (i.e as a positive thing to do to increase resiliency).

Rationale for Regional Approach

- Extreme weather events don't respect municipal or regional boundaries.
- Many jurisdictional layers and intersecting systems – a very difficult process to collaborate on. Have to think clearly about how this might happen.
- Mandate challenge – many different organizations have different mandates. Those mandates may make true collaboration difficult.
- Who defines the geographic (regional) approach? Rural municipalities may not have the same vulnerabilities and issues that urban municipalities might have. Need to figure out how to best define the Region that needs to collaborate.
- An emergency often brings people together – regional approach would move that relationship building from reactive to proactive.

How might we do it?

- Scenario Planning
- Framing and Phasing – working group at first – then move to elevate status of group by defining a champion and getting political involvement (or people who can bring resources to get the work done).
- Spend money on developing the process of how you are going to collaborate regionally.

Appendix B: Regional Collaboratives Summary (provided by presentation from Steve Winkelman from May 11th Regional Resilience Workshop)

1. [Southeast Florida Regional Climate Compact](#): Modifying design standards for transportation infrastructure located in vulnerable areas
2. [Los Angeles Regional Collaborative for Climate Action](#): Developing a model ordinance incorporating best adaptation practices and providing draft language for land-use plans, zoning, and other municipal policies
3. [Sacramento Region Transportation Climate Adaptation Plan](#): Planning, design & maintenance strategies for infrastructure; and Incorporation of climate adaptation into transportation funding decisions, long-term transportation & land use plan, and monitoring.
4. [San Francisco region](#): Conducting climate resilience studies on impacts to specific communities, coastlines and transportation assets.
5. [St. Paul Minnesota](#), Capitol Region Watershed District, Metropolitan Council, Greening the Greenline: 11 mile light rail system, 111 acre drainage area (highly developed); and Rain gardens, stormwater planters, infiltration trenches, 1,000 trees over 5 miles of tree trenches -- reduces runoff by more than 50%
6. [Australian Cross Dependency Initiative](#): developed a data sharing platform that allows infrastructure organisations to assess their integrated risks, and build collaborative adaptation strategies with other vested interest parties.