

# **2018** Metrolinx Climate Adaptation Strategy



# Message from the Chief Planning & Development Officer

We are proud to introduce Metrolinx's first Climate Adaptation Strategy.

At Metrolinx, we are fully aware that climate change provides a serious challenge for us. After all, scientists are predicting a greater number of more severe weather events such as heatwaves and flooding for the Greater Toronto and Hamilton Area (GTHA). That is important to acknowledge as scorching hot days can warp our train tracks and cause delays, and freezing rain shuts down roads and train signals, while flooding will stop any moving vehicle.

In operating a transit agency, we must be prepared for increased severe weather, and take action to reduce the risk that it presents to our customers, employees and infrastructure. Customer experience, safety, and providing faster and more reliable service are our priorities. To meet these challenges and expectations we are taking a proactive, systematic approach to investment, design, construction and operations to ensure

resiliency. As a result, all of our planning, whether for our ambitious transit expansion projects or for operating our daily services, includes policies that anticipate and prepare for climate change.

Our recently adopted *Regional Transportation Plan*, as well as our *Sustainability Strategy*, consider the growing realization that we must act to safeguard our infrastructure and the communities we connect. Therefore, we have made significant commitments towards climate resiliency. As the mobility provider in the GTHA, Metrolinx has a keen interest in ensuring that we make informed decisions that maintain our service delivery.

We must take a thoughtful approach to acknowledge our changing climate with its severe weather events, and how these can affect our customers. That is why we engaged experts, scientists and many external

stakeholders to develop this *Climate Adaptation Strategy*.

The *Climate Adaptation Strategy* outlines an integrated approach to how Metrolinx will embed climate resiliency into how we plan, build, and operate regional transportation in the face of a changing climate. I am grateful to everyone who contributed to this effort.

Yet we cannot do it alone. Collaboration is needed with many partners from both the public and private sectors. With changing climate patterns we all have a role to play and we look forward to working with you to adapt.

Sincerely,

**Leslie Woo**  
Chief Planning and  
Development Officer  
Metrolinx

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# **Executive Summary**





## PLANNING FOR RESILIENCY

Metrolinx takes climate change seriously.

In 2016, we consulted with experts and scientists on how to deal with the changing climate as a transit agency.

The resulting report, Planning for Resiliency: Toward a Corporate Climate Adaptation Plan, outlines the broader context and rationale for climate resiliency and adaptation, and provides overarching direction on how we manage the effects of climate change.



# Executive Summary

We know with certainty that the Greater Toronto and Hamilton Area (GTHA) will experience the impacts of climate change. In fact, we already are. And we can expect more of these impacts: increased temperatures, more precipitation, higher wind gusts, and increased freezing rain. All these can affect our services in moving people around the GTHA.

**As Metrolinx embarks on a \$43 billion infrastructure program to expand transit service, we need to be ready for the changing climate. Our trains, buses and Light Rail Transit (LRT) need to keep running regardless of the weather, so we can keep serving our costumers and communities.**

This Metrolinx *Climate Adaptation Strategy* describes our commitment and approach to operate climate resilient transportation services. With this *Strategy*, we will have the ability to anticipate, accommodate and recover from extreme events quickly and efficiently.

Metrolinx has already started to take actions to respond to the changing climate. For example, we have built embankments to reduce flooding, improved monitoring to reduce vulnerabilities, and changed new rail installations to avoid track warping.

With this *Strategy*, our climate resiliency program will help manage the uncertainties associated with climate change by applying robust solutions that are effective, economical and efficient under a wide range of climate scenarios. Metrolinx's infrastructure will move people quickly and safely, and provide critical support during times of emergency and weather-related disasters.

This *Strategy* outlines 40 key actions we are taking to keep the trains, buses and LRTs running on time. They include:

- preparing adaptation implementation plans for each business unit;
- obtaining better data and understanding of climate projections and climate change vulnerability;
- including climate resiliency within technical standards, manuals and project agreements as we build new transportation infrastructure;
- ensuring alignment with Provincial and Federal policies on climate change;
- prioritizing climate resiliency in our operations and maintenance procedures;
- ensuring operating budgets account for climate resiliency needs;
- refining our existing governance structure and reporting protocols to ensure organizational integration of climate resiliency actions;
- reviewing health and safety protocols that consider changing climate conditions;
- creating greater awareness of climate resilience within our operations and with our stakeholders;
- collaborating with our external partners to share key information and to conduct joint studies; and
- reporting our actions and results to our customers and stakeholders.



# About Metrolinx

**Metrolinx, an agency of the Government of Ontario under the Metrolinx Act, 2006, was created to improve the coordination and integration of all modes of transportation in the Greater Toronto and Hamilton Area (GTHA).**

The organization's mission is to champion, develop and implement an integrated transportation system for our region that enhances prosperity, sustainability and quality of life. Metrolinx published the *2041 Regional Transportation Plan* (2041 RTP) in March 2018. The *2041 RTP* is a blueprint for creating an integrated, multimodal regional transportation system that will serve the needs of residents, businesses and institutions

## OUR VISION

**Getting you there better, faster, easier.**

## OUR MISSION

**We connect our communities**

## OUR VALUES

**Serve with Passion**

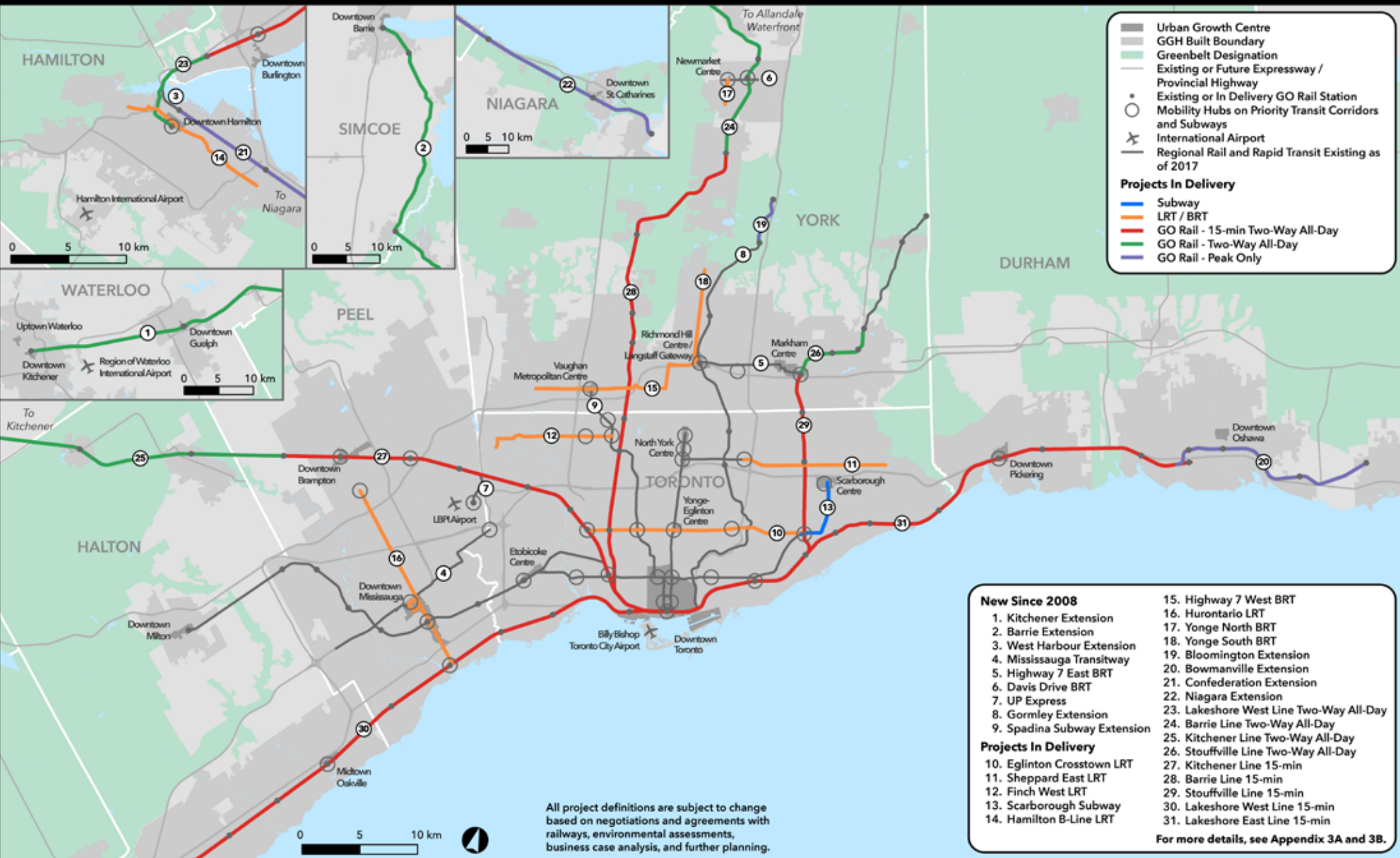
**Think Forward**

**Play as a Team**

Metrolinx currently manages over \$19.5 billion in transportation infrastructure and will invest \$43 billion over the next decade or more (Figure 1). The expansion of GO rail alone, through GO Expansion will quadruple the number of weekly trips from 1,500 to 6,000. This work also includes new stations, track, maintenance and storage facilities and the infrastructure required for the electrification of a significant portion of the rail network.



**FIGURE 1: EXISTING AND IN-DELIVERY REGIONAL RAIL AND RAPID TRANSIT NETWORK**





# The Big Picture

**The climate across the GTHA has been changing for some time now. Recent extreme weather events, such as severe rainstorms and flooding across the GTHA, the ice storm of 2013, and the heatwaves of 2016, have highlighted varying degrees of vulnerability of stations and facilities, rail corridor infrastructure, stormwater management systems, and electrical transmission networks.**

In the years to come and as a result of a changing climate, it is expected that the GTHA will experience further increases of temperature, precipitation, periods of drought, high wind gusts and freezing rain. These changes will occur over the lifespan of the infrastructure that is currently in delivery so we must act now.

Future climate change projections for the GTHA predict that:

- Winters will become warmer and freeze-thaw cycles will almost disappear during the shoulder season months of April and November by 2080.
- Summers will become much hotter and the number of hot days ( $>32^{\circ}\text{C}$ ) will double by 2020, quadruple by 2050, and increase eight times by 2080 (compared to the baseline average from 1981-2010).
- The GTHA will experience at least one day with a maximum temperature over  $40^{\circ}\text{C}$  by 2050.
- Severe weather events will increase with higher levels of freezing rain, wind gusts, and more intense and frequent rainstorms.

As a result, owners and managers of infrastructure assets and the agencies responsible for delivering essential services need to plan for climate change and more extreme weather events. This requires having a strategy that is evidence-based and informed by accepted definitions and practices regarding vulnerability, resiliency, adaptation and adaptive capacity (please see the Glossary at the end for definitions).



# We Are On the Right Track

At Metrolinx our infrastructure assets are intended to last for several generations, and consequently are expected to operate during a period of climate conditions that are projected to change significantly. It is critical that existing assets and future projects be managed and designed in a manner that ensures they will be resilient to extreme climate events, or easily adaptable to changing climate conditions.

In 2014 the Metrolinx *Five-Year Strategy (2015-2020)* committed to establishing a Corporate Climate Adaptation Plan covering facilities, practices and protocols. Since then, there has been considerable progress advancing climate resiliency, including the completion of a climate change vulnerability assessment of six of our assets in February 2016, and the release of a 2017 report called *Planning for Resiliency*, which benchmarks Metrolinx to best practices.

Working on its own or in collaboration with other key partners, Metrolinx has already started to take action to respond to extreme weather and changes in the climate. These steps include:

- **Improvements in infrastructure** such as embankment enhancement and monitoring, increases in culvert size and stormwater capacity, to reduce vulnerability to flooding and washouts;
- **Higher Preferred Rail Laying Temperature** of 37.8°C for new track to reduce the risk of track warping and sun kinks during heat waves;
- **Improved monitoring** such as weather forecasting, ballast integrity sensors, real time stream levels, and flood conditions at track level, to reduce our vulnerability to extreme precipitation events;
- **Development of a Corporate Winter Plan** to prepare for severe snowfall, freezing rain, and extreme winter temperatures;
- **Enhanced emergency response and operating procedures** during and after extreme weather events;
- **Updated operational train protocols** in case of high water conditions caused by extreme precipitation events and flooding; and
- **Upgraded standards for back-up generation** at stations and facilities to ensure power supply during prolonged blackouts caused by extreme weather events.

# Adaptation Strategy Development Approach

Metrolinx has done considerable work to date leading to the establishment of this *Adaptation Strategy*. This work has been documented in the background and benchmarking report *Planning for Resiliency: Toward a Corporate Climate Adaptation Plan* (2017).

*Planning for Resiliency* is an essential companion document to this *Adaptation Strategy*, as it outlines the broader context and rationale for climate resiliency and adaptation, and provides overarching direction for the *Strategy*'s structure and key areas. The report can be found at [metrolinx.com/sustainability](http://metrolinx.com/sustainability).

## VISION FOR RESILIENCY

Our vision for a Resilient Metrolinx considers a future where the impacts of climate change are even more substantial than those experienced in the past.

Our Climate Resiliency Program will help manage the uncertainties associated with climate change by applying robust solutions that are effective, economical and efficient under a wide range of climate scenarios. Metrolinx's infrastructure will move people quickly and safely, and provide critical support during times of emergency and weather-related disasters.

Timely and informed planning and investment decisions will look beyond immediate needs in order to safeguard our infrastructure over the long term.

*Planning for Resiliency* describes four key pillars that have been used to guide the development of the *Adaptation Strategy* as an outcome of the Climate Resiliency Program. They are consistent with best practices and reflect the type of activities that leading municipalities and transit agencies are undertaking to address climate resiliency and adaptation:

### **I. Awareness, education and communication**

Increasing internal and external awareness through education is an essential component of an adaptation strategy, and ensures that Metrolinx is on top of best practices and showcasing where it is leading on climate resiliency.

### **II. Assessing risks and opportunities**

Understanding vulnerability and risks of infrastructure assets, people and services to various climate parameters is essential for managing climate risks and capitalizing upon opportunities effectively.

### **III. Building climate resiliency across the enterprise**

Resiliency will be addressed in several key functional areas including planning, design and construction; enterprise asset management; environmental assessment; design standards; risk management and insurance; communications; and operations and maintenance, including extreme weather readiness and emergency response protocols.

### **IV. Monitoring and adaptive management**

Efforts to build resiliency benefit from a common reporting protocol and information repository, as well as ongoing monitoring of relevant developments in science, policy, technology, best practices and the parallel efforts of Metrolinx's peers and partners.

The development of this *Adaptation Strategy* included significant stakeholder engagement discussions, interviews and workshops with decision-makers and staff familiar with day-to-day



operations. External subject matter experts also provided feedback on the *Strategy*.

The *Adaptation Strategy* supports the implementation of the Metrolinx *Five-Year Strategy* and Metrolinx *Sustainability Strategy* and provides a link to annual business planning, infrastructure investment and operations.

## Key Areas and Deliverables

This *Strategy* applies to a wide range of existing and planned assets, practices and protocols and outlines 40 key actions. While accountabilities for specific actions lie with individual Metrolinx Business Units, sponsors and champions across the organization will ensure that resiliency measures are implemented.

The actions are presented according to the framework of Plan, Build, Operate and Connect. Applying our unique perspective to climate resiliency, we will:

1. Plan for regional transportation needs, in the short, medium and long term, using evidence-based criteria to recommend priority projects and services where climate resiliency measures are needed.
2. Build new regional rapid transit throughout the GTHA that reduces vulnerability and risk, and are more resilient and adaptive to climate change and extreme weather events.
3. Operate regional transit services including GO Transit and the UP Express, and programs such as Smart Commute, in addition to LRT and Bus Rapid Transit (BRT) lines that are operated in conjunction with Municipal Service Providers, in a manner that reduces our vulnerability to extreme weather events and climate change, and increases our climate resiliency and adaptive capacity.
4. Connect the region, and internal Business Units by coordinating work and enabling stronger and more comprehensive solutions than what could be achieved individually, especially among interdependent infrastructure such as transportation, stormwater management systems, and electricity generation and transmission.

Our *Adaptation Strategy* and the following 40 key actions will guide us moving forward.





**Plan**

# 1. PLAN

## 1.1 – Adaptation Implementation Plans

Responsibility for the actions in this *Adaptation Strategy* lie across the Metrolinx enterprise. To ensure progress, accountable Business Units will each develop their own rolling implementation plans.

Each implementation plan will outline the steps needed to complete relevant actions and describe, as needed, the use of cost-benefit analysis, budget and resource availability, and a process for monitoring and reporting progress.

In order to ensure that each Business Unit delivers their actions, the *Adaptation Strategy* includes a Key Action to:

### KEY ACTION

- 1.1.1 Develop an adaptation implementation plan that outlines Key Performance Indicators (KPIs), timelines, estimated completion dates, and resources required to deliver Business Unit key actions.

## 1.2 – Climate Trends and Projections

Effective planning for adaptation requires access to, and a sound understanding of, current and future best practices regarding weather forecasting, climate projections, and interpretation.

Currently, Metrolinx relies upon Environment Canada and Climate Change and AccuWeather for weather forecasts, supplemented by flood monitoring from the Toronto and Region Conservation Authority. It is important to periodically evaluate these practices to ensure that Metrolinx has access to the best and most up-to-date weather information.

Climate projections are required to make informed decisions about design standards for existing and future infrastructure. As part of our Public Infrastructure Engineering Vulnerability Committee (PIEVC) vulnerability assessment in 2015, climate change projections representing the 50<sup>th</sup> percentile were developed based on historical trends from Toronto Pearson International Airport and outputs from over 40 global climate models from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report.

These projections provide good guidance about how changes in specific climate parameters vary across the Metrolinx network, but a fuller complement of projections from a wider range of weather stations would provide a stronger foundation to inform decision making. Further, micro-scale analysis may be required, on an as needed basis for site specific climate parameters (e.g. blowing snow, high wind gusts).

The Sixth Assessment Report (AR6) of the IPCC is currently underway, and is anticipated to be released in 2021, with new global climate models available earlier. Metrolinx will need to update our projections based on the new information and should look at a wider range of percentiles for key parameters to account for uncertainty.

In order to ensure that Metrolinx has the weather services, and climate trends and projections needed to deliver our mandate, the *Adaptation Strategy* includes Key Actions to:



## KEY ACTIONS

- 1.2.1 Evaluate and review current use and application of weather and climate services in terms of improving operational performance and service delivery.
- 1.2.2 Compile updated climate change projections for key climate parameters based on various percentiles (e.g. 25<sup>th</sup> and 75<sup>th</sup> percentile), for different timelines (2030, 2050 and 2080).
- 1.2.3 Update climate change projections based on best available science from the IPCC AR6.

## 1.3 – Climate Change Vulnerability and Risk



Understanding the vulnerability of our infrastructure assets to extreme weather conditions and climate change is essential for effective planning and design, as well as operations and maintenance.

Future flood risk is of particular concern, not only for rail corridors, but also for maintenance facilities, stations and surface parking lots. Typically, Conservation Authorities provide flood risk information as part of the Environmental Assessment process, but information from across the GTHA has not yet been compiled into a central depository.

More collaboration with Conservation Authorities can help determine the risk of riverine flooding, for individual assets and on a system-wide basis. The same can be said of urban and overland flooding, working with Municipalities. Many local and regional municipalities across the GTHA have also produced maps of the urban heat island and of populations most at risk to heat stress. This understanding can be used to support station planning, design and operations, and to understand the impact of our infrastructure on surrounding neighbourhoods.

Building upon the PIEVC vulnerability assessment from 2015, which assessed six representative infrastructure assets, a system-wide vulnerability assessment would provide a more comprehensive baseline to inform the implementation of resiliency measures and confirm the assets that are most critical for maintaining safe and reliable service.

In order to ensure that Metrolinx has the data and understanding to continually assess our vulnerability and risk to climate change the *Adaptation Strategy* includes Key Actions to:

## KEY ACTIONS

- 1.3.1 Engage Conservation Authorities to obtain flood mapping data for the GTHA in Geographical Information System (GIS) format and assess riverine flood risk for existing and planned infrastructure assets across the Metrolinx network.
- 1.3.2 Engage municipalities to estimate urban flood risk from different storm events and climate change projections, as well as estimates of the urban heat island effect.
- 1.3.3 Explore options for conducting a system-wide climate vulnerability assessment.





# 1.4 – Climate Resiliency in Regional Transportation Planning

An integrated multi-modal transportation system that is resilient to extreme weather and climate change contributes to a more resilient region.

Metrolinx has recently released the *2041 RTP* which includes four priority actions to build climate resiliency. Building a resilient GTHA will require effort and collaboration from a wide set of stakeholders in the public and private sectors.



Federal and Provincial policy related to climate change, resiliency and adaptation will continue to evolve and create new requirements and opportunities for delivery of the *2041 RTP* and regional transit. It is important to monitor, track and report upon significant regulatory changes.

Tools need to be further developed to evaluate the effectiveness of resiliency measures. Business Case Analysis, cost-benefit analysis, and triple bottom line comparison can be used to understand the costs of implementation versus the cost of inaction. Business case guidance needs to include a process for integrating resiliency. It is also important to monitor and calculate the costs of weather related delays and cancellations.

The incorporation of real-time information about extreme weather disruptions into Triplinx will allow travellers to find the best route to their destinations as events occur and provide them with safe and reliable alternatives. Accessibility planning should also account for climate vulnerability and risk, where travel options for persons with disabilities may be affected.

In order to ensure that climate resiliency is incorporated into regional transportation planning the *Adaptation Strategy* includes Key Actions to:

## KEY ACTIONS

- 1.4.1 Implement and report on the four climate resiliency priority actions from the *2041 RTP*.
- 1.4.2 Monitor changes in Provincial and Federal Policy and ensure that the *Adaptation Strategy* is in alignment.
- 1.4.3 Define an approach and suite of tools for integrating risk and vulnerability assessments into decision-making and business case analyses, that includes cost-benefit or triple bottom line analysis.
- 1.4.4 Initiate support for the integration of climate resiliency into Metrolinx's Business Case Guidance to mainstream resiliency into the decision-making process.
- 1.4.5 Incorporate extreme weather disruptions into Triplinx.
- 1.4.6 Explore and map out a pathway to incorporate climate resiliency into accessibility planning.



## 1.5 - Climate Change in Extreme Weather Planning



One effect of climate change is increased frequency and intensity of extreme weather events which will require a reassessment of emergency management capabilities and protocols.

Metrolinx already has a number of protocols that respond reasonably well to historical extreme weather events, but future performance under climate change may decline unless adaptive measures are adopted.

Incorporating changing climate conditions into maintenance contracts and protocols across Metrolinx is a necessary but insufficient requirement to ensure resiliency during extreme weather conditions. Emergency response preparedness, including communication protocols, is also required in the event of asset failure.

Metrolinx has a revised and updated Corporate Snow Plan, and recently undertook an exercise to verify its processes and identify areas for continuous improvement. In the future, similar exercises that take climate change projections into account, can present scenarios that are even more severe than those experienced in the past.

There is an opportunity to develop a Summer Readiness Plan to address hot temperatures, flood risk, high wind gusts, and other summer season conditions. The plan can include key risks during adjacent shoulder seasons (e.g. spring flood risk) as the next step towards developing a year-round all season readiness plan.

The senior manager for Business Continuity will need to consider developing plans that include extreme weather events projected with climate change.

In order to ensure that climate resiliency is integrated into extreme weather planning the *Adaptation Strategy* includes Key Actions to:

### KEY ACTIONS

- 1.5.1 Integrate climate resiliency into emergency response planning, including communication protocols before, during and after extreme weather events.
- 1.5.2 Build upon previous exercises to test protocols such as the Corporate Snow Plan and Emergency Response Plans under extreme weather conditions expected with climate change, and continue to do so on a regular basis.
- 1.5.3 Develop a Summer Readiness Plan that includes consideration of other adjacent seasonal risks (e.g. spring flood risk).
- 1.5.4 Embed climate resiliency considerations into Business Continuity Planning.



**Build**

# 2. BUILD

## 2.1 – Climate resiliency within technical standards, manuals, guidelines and AFP project agreements

With \$43 billion of new infrastructure investment on its way, there is a significant opportunity to ensure that capital projects include requirements to embed climate resiliency.

Design practices and protocols allow for the integration of climate resiliency through the Design Excellence Guidelines, the Design Requirements Manual, and the Design Criteria Manual.

Many existing standards are based upon past climate conditions and may not be adequate to function safely or reliably as our climate changes. A national process by the National Research Council and the Standard Council of Canada is underway to develop new standards about weather and climate change. Both offer opportunities for Metrolinx to engage and provide input into standards setting.

In order to accommodate our procurement timelines, Metrolinx still needs to advance our own standards setting process, with priority given to Alternative Financing and Procurement (AFP) project agreements, specifically schedule 15: Project Specific Output Specifications (PSOS).

At the Provincial level, guidelines regarding environmental assessments and stormwater management systems have been proposed with implications for climate resiliency. There are expectations that Metrolinx demonstrate how climate change is considered in the Environmental Assessment (EA) process and Transit Project Assessment Process (TPAP).

A sustainability ratings framework could be adopted to evaluate the planning and design of new infrastructure. For example, ENVISION has been used by other transit agencies to evaluate the sustainability and climate resiliency of new projects, including heavy rail and light-rail transit.

In order to ensure that Metrolinx embeds climate resiliency within technical standards, guidelines, and AFP project agreements the *Adaptation Strategy* includes Key Actions to:

### KEY ACTIONS

- 2.1.1 Embed climate resilience and sustainability as a key principle within Capital Projects Group technical standards and specifications (AFP + non-AFP). Update resilience language that can be embedded into project agreements, contract and procurement processes (i.e., AFP), for example Schedule 15 (PSOS) and any other relevant project agreement schedules.
- 2.1.2 Develop climate parameters and critical thresholds applicable to Metrolinx infrastructure assets.
- 2.1.3 Demonstrate how climate change is considered in the EA process and TPAP.
- 2.1.4 Evaluate the viability of adopting a sustainability ratings framework (e.g. ENVISION) to a linear asset, station and/or facility.





**Operate**

An example of continuous reliable power for electricity and heat; Natural gas co-generation system at Streetsville Bus Maintenance Facility.



# 3. OPERATE

## 3.1 – Climate Resiliency in Operations and Maintenance Procedures

Many of Metrolinx's services are vulnerable to extreme weather and climate change and operational and maintenance procedures should consider resiliency to minimize risk.

Real-time monitoring and collection of data through the SCADA (Supervisory Control and Data Acquisition) system informs adjustments in repair and maintenance activities. Other initiatives to inspect, record and inventory key assets, including culverts and bridges, also provides information for assessments of vulnerability and risk.

Track snow clearing and platform snow melting devices are important for delivering safe and reliable service during snow events. However, these devices require energy and generate greenhouse gas emissions. Weather forecasts are being used to inform the devices' operation and ongoing assessment will ensure that cost savings are maximized.

Stations and facilities are also exposed to extreme weather conditions, and operational procedures may have to be adjusted in order to reduce vulnerability. Both stations and facilities were examined in the PIEVC vulnerability assessment and the recommendations could inform the development and implementation of a detailed Adaptation Action Plan.

A review of health and safety protocols can account for the challenges faced by crews and staff from intense rainfall, flooding, freezing rain, ice storms and extreme heat.

Budgets for operations also need to be reviewed to account for potentially higher costs associated with enhanced operations and maintenance requirements.

Enterprise Asset Management (EAM) helps organizations better manage their assets, by providing a holistic view into operations and maintenance throughout the asset's lifecycle. It provides a tool to document and track the condition of our assets, develop a comprehensive inventory of existing and future assets, and support lifecycle asset management.

In order to ensure that Metrolinx embeds climate resiliency into operations and maintenance practices the *Adaptation Strategy* includes Key Actions to:

### KEY ACTIONS

- 3.1.1 Enhance real-time measurement, monitoring and collection of data most relevant for climate resiliency through the SCADA system to guide operations and maintenance activities.
- 3.1.2 Prioritize culverts, bridges and embankments most vulnerable to climate extremes for increased monitoring and maintenance.
- 3.1.3 Incorporate weather forecast information into operational procedures, e.g. operation of snow clearing devices for track switches.
- 3.1.4 Build upon the PIEVC climate vulnerability assessment for selected assets and develop an Adaptation Action Plan.



- 3.1.5 Initiate review and modification of health and safety protocols that consider changing climate conditions (e.g. heat stress).
- 3.1.6 Review operational procedures for stations and facilities and recommend cost effective measures that enhance resiliency and adaptive capacity.
- 3.1.7 Ensure that operating budgets account for climate resiliency needs.
- 3.1.8 Explore opportunities with the EAM program and asset owners to embed climate resiliency into asset management.

Green roof at Streetsville Bus Maintenance Facility, reduces the cooling load and serves a storm water management function.





**Connect**

# 4. CONNECT

## 4.1 – Governance for Climate Resiliency

Climate resiliency is an issue that cuts across the organization. No one division or business unit can be solely responsible for ensuring resiliency.

The current governance structure supported the development of the *Adaptation Strategy*, but may need to be reviewed to support implementation.

Mainstreaming the actions of the *Adaptation Strategy* into other corporate strategies and plans will create accountability for the implementation of the *Strategy's* actions. It is important to establish clear roles, responsibilities and accountabilities for specific business units.

Sponsors will be responsible for ensuring resiliency of projects and programs for which they are accountable through the Benefits Management Framework.

It is anticipated that many key actions can be accommodated by refining existing work plans, with minimal cost. Project prioritization and business case analysis will be needed for some individual projects and initiatives.

Progress towards climate resiliency will be reported publicly through the Annual Sustainability Report.

In order to ensure that Metrolinx has the appropriate governance structures to support climate resiliency the *Adaptation Strategy* includes Key Actions to:

### KEY ACTIONS

- 4.1.1 Refine existing governance structure and reporting protocols to ensure delivery and ongoing integration of the *Adaptation Strategy* across Business Units.
- 4.1.2 Incorporate the *Adaptation Strategy* into key corporate strategies, plans, and reports, including but not restricted to the Metrolinx Five-Year Strategy, Annual Business Plans, and specific projects as part of the new Benefits Management and Sponsorship Model being implemented across the organization.
- 4.1.3 Periodically review costs associated with the *Adaptation Strategy*, relative to updated understanding of vulnerability and risk.
- 4.1.4 Provide updates on progress for inclusion in the Annual Sustainability Report.



## 4.2 – Awareness, Education and Communications

Metrolinx has an opportunity and responsibility to act as a catalyst and facilitator of regional resiliency by sharing knowledge internally between staff and externally with regional partners, other levels of government and other organizations.

Metrolinx should showcase the positive actions that are already underway, and those planned for the future, such as new design standards for GO Expansion Regional Express Rail (RER) and other infrastructure projects, to demonstrate leadership and encourage further action to develop greater adaptive capacity in the GTHA.

Internal engagement to increase awareness and educate staff within Metrolinx will help to effectively manage extreme weather and climate related risks. For example, currently offered courses in emergency management could be modified to incorporate climate change risks and adaptation options.

It is also important for Metrolinx to engage with, and remain aware of, developments in government policy, climate science, new technologies, best practices in resiliency options and innovations in assessment and evaluation methods.

Collaborative relationships and strategic partnerships with national transportation organizations, government agencies (i.e. Transportation Association of Canada, Canadian Urban Transit Association, Transport Canada), Provincial ministries, municipalities, transit providers, and universities are essential. Metrolinx is already contributing to international initiatives to share expertise such as Accounting for Sustainability (A4S) and ARISE.

In order to ensure that Metrolinx is able to increase internal and external awareness about climate resiliency and establish essential partnerships the *Adaptation Strategy* includes Key Actions to:

### KEY ACTIONS

- 4.2.1 Build broad awareness and education among staff, such as incorporating extreme weather risks into health, weather and safety communication materials.
- 4.2.2 Collaborate with external partners (e.g. international, national, and regional stakeholders, including universities and research centres) to share information and conduct joint studies.
- 4.2.3 Deliver an internal and external communication strategy that supports the ongoing delivery of climate resiliency measures.
- 4.2.4 Collaborate with external partners (e.g. international, national, and regional stakeholders, including universities and research centres) to share information and conduct joint studies.
- 4.2.5 Deliver an internal and external communication strategy that supports the ongoing delivery of climate resiliency measures.

## 4.3 – Risk Management and Reporting

A strategic approach for building resiliency across an enterprise is to frame the issue of climate change adaptation within a risk management context.

Efforts to manage the risks of climate change and extreme weather will benefit from a reporting protocol and central information repository. There are currently a number of practices and protocols being adopted across Metrolinx that could be expanded to address extreme weather and climate change, including incident reporting and the risk registry.

Corporate level risks related to extreme weather events and climate change are included in the corporate risk report to the Board on a regular basis. Additional risks will be incorporated when they are identified.

In order to ensure that climate resiliency is incorporated into risk management and reporting the *Adaptation Strategy* includes Key Actions to:

### KEY ACTIONS

4.3.1 Continue updating climate change risks in the Risk Registry.

4.3.2 Increase consideration of climate-related risks in insurance coverage planning.



# Summary of Key Actions

Metrolinx has identified 40 Key Actions we will undertake to deliver on our commitments to become climate resilient, organized by the framework Plan, Build, Operate and Connect.

The table below describes the priority activities for Business Units in each of these mandated areas, their status ("in-progress/ongoing, new (yet to be started)") and estimated completion date.

Action number <i>(relevant to Operations business unit)</i>	Key actions	Accountability	Status	Current Estimated Completion Date
<b>1. PLAN</b>				
<b>1.1 ADAPTATION IMPLEMENTATION PLANS</b>				
1.1.1	Develop an adaptation implementation plan that outlines KPIs, timelines, target dates, and resources required to deliver Business Unit key actions	ALL	New	2018
<b>1.2 CLIMATE TRENDS AND PROJECTIONS</b>				
1.2.1	Evaluate and review current use and application of weather and climate services that inform operations performance.	Planning & Development	New/ Ongoing	Annually
1.2.2	Compile updated climate change projections for key climate parameters based on various percentiles (e.g. 25 <sup>th</sup> and 75 <sup>th</sup> percentile), for different timelines (2030, 2050 and 2080).	Planning & Development	In Progress	2018
1.2.3	Update climate change projections based on best available science from the IPCC AR6.	Planning & Development	New/ Ongoing	2022 or when AR6 projections become available
<b>1.3 CLIMATE CHANGE VULNERABILITY AND RISK</b>				
1.3.1	Engage Conservation Authorities to obtain flood mapping data for the GTHA in GIS format and assess flood risk for existing and planned infrastructure assets across the Metrolinx network.	Capital Projects Group (Environmental Programs and Assessment), Planning & Development	In Progress	2018 Phase I 2019 Phase II 2020 Phase III
1.3.2	Engage municipalities to estimate urban flood risk from different storm events and climate change projections, as well as estimates of the urban heat island effect.	Planning & Development	New	2020
1.3.3	Explore options for conducting a system-wide climate vulnerability assessment.	Planning & Development	New	2020
<b>1.4 CLIMATE RESILIENCY IN REGIONAL TRANSPORTATION PLANNING</b>				
1.4.1	Implement and report on the four climate resiliency priority actions from the 2041 RTP.	Planning & Development	In Progress	2019



1.4.2	Monitor changes in Provincial and Federal Policy and ensure that the <i>Adaptation Strategy</i> is in alignment.	Planning & Development	New/ Ongoing	Updated quarterly, or as needed
1.4.3	Define an approach and suite of tools for integrating risk and vulnerability assessments into decision-making and business case analyses, that includes cost-benefit or triple bottom line analysis.	Planning & Development	In Progress	2018, reviewed as needed
1.4.4	Initiate support for the integration of climate resiliency into Metrolinx's Business Case Guidance to mainstream resiliency into the decision-making process.	Planning & Development	New/ Ongoing	2018
1.4.5	Incorporate extreme weather disruptions into Triplinx.	Planning & Development	New/ Ongoing	2018
1.4.6	Explore and map out a pathway to incorporate climate resiliency into accessibility planning.	Planning & Development	New	2018

## 1.5 CLIMATE CHANGE IN EXTREME WEATHER PLANNING

1.5.1	Integrate climate resiliency into emergency response planning, including communication protocols before, during and after extreme weather events.	Operations (Safety and Security), Communications and Public Affairs	New	2018
1.5.2	Build upon previous exercises to test protocols such as the Corporate Winter Plan and Emergency Response Plans under extreme weather conditions expected with climate change, and continue to do so on a regular basis.	Operations (Safety and Security)	In Progress/ Ongoing	2018
1.5.3	Develop a Summer Readiness Plan that includes consideration of other adjacent seasonal risks (e.g. spring flood risk).	Operations (Transit Operations)	New	2020
1.5.4	Embed climate resiliency considerations into Business Continuity Planning.	Operations (Safety and Security)	New/ Ongoing	TBD

## 2. BUILD

### 2.1 CLIMATE RESILIENCY WITHIN TECHNICAL STANDARDS, MANUALS, GUIDELINES & AFP PROJECT AGREEMENTS

2.1.1	Embed climate resilience and sustainability requirements within CPG technical standards and specifications (AFP + non-AFP). Update resilience language that can be embedded into Project Agreements, contracts and procurement processes (i.e., AFP), for example Schedule 15 (PSOS) and any other relevant PA schedules.	Capital Projects Group, Planning & Development (Design Excellence)	New	2018, as per deadlines for major RT + GO Expansion procurements
2.1.2	Develop climate parameters and critical thresholds applicable to Metrolinx infrastructure assets.	Capital Projects Group	In Progress	2018, revised as needed

2.1.3	Demonstrate how climate change is considered in the EA process and TPAP.	Capital Projects Group (Environmental Programs and Assessment)	In Progress	2018
2.1.4	Evaluate the viability of adopting a sustainability ratings framework (e.g. ENVISION) to a linear asset, station and/or facility.	Planning & Development	In Progress	2018
<b>3. OPERATE</b>				
<b>3.1 CLIMATE RESILIENCY IN OPERATIONS AND MAINTENANCE PROCEDURES</b>				
3.1.1	Enhance real-time measurement, monitoring and collection of data most relevant for climate resiliency through the SCADA system to guide operations and maintenance activities.	Operations (Transit Operations)	New	2018 - 2020
3.1.2	Prioritize culverts, bridges and embankments most vulnerable to climate extremes for increased monitoring and maintenance.	Operations (Transit Operations)	New	2018
3.1.3	Incorporate weather forecast information into into operational procedures, e.g. operation of snow clearing devices for track switches.	Operations (Transit Operations) (Customer Service Delivery)	In Progress	2018
3.1.4	Build upon the PIEVC climate vulnerability assessment for selected assets and develop an Adaptation Action Plan.	Operations (Transit Operations) (Customer Service Delivery)	In Progress	2020
3.1.5	Initiate review and modification of health and safety protocols that consider changing climate conditions (e.g. heat stress).	Operations (Safety and Security)	New/ Ongoing	2018-2019
3.1.6	Review operational procedures for stations and facilities and recommend cost effective measures that enhance resiliency and adaptive capacity.	Operations (Transit Operations) (Customer Service Delivery)	New/ Ongoing	2018-2019
3.1.7	Ensure that operating budgets account for climate resiliency needs.	Finance	New/ Ongoing	2018 Reviewed Annually as part of developing the annual business plan
3.1.8	Explore opportunities with the EAM program and asset owners to embed climate resiliency into asset management.	Planning & Development	New	2020
<b>4. CONNECT</b>				
<b>4.1 GOVERNANCE FOR CLIMATE RESILIENCY</b>				
4.1.1	Refine existing governance structure and reporting to ensure delivery and ongoing integration of the <i>Adaptation Strategy</i> across business units.	Planning & Development	In Progress	2018

4.1.2	Incorporate the <i>Adaptation Strategy</i> into key corporate strategies, plans, and reports, including but not restricted to the Metrolinx Five-Year Strategy, Annual Business Plans, and specific projects as part of the new Benefits Management and Sponsorship Model being implemented across the organization.	Planning & Development	In Progress	2018 Reviewed Annually
4.1.3	Periodically review costs associated with the <i>Adaptation Strategy</i> , relative to updated understanding of vulnerability and risk.	Finance	New	2018 Reviewed Annually as part of developing the annual business plan
4.1.4	Provide updates on progress for inclusion in the Annual Sustainability Report.	Planning & Development	New	2018
<b>4.2 AWARENESS, EDUCATION AND COMMUNICATIONS</b>				
4.2.1	Build broad awareness and education among staff, such as incorporating extreme weather risks into health, weather and safety communication materials.	Operations (Safety and Security)	In Progress/ Ongoing	TBD
4.2.2	Add a climate resiliency perspective to internal working groups overseeing key assets, practices and processes, e.g. track standards committee.	Planning & Development	New/ Ongoing	2018
4.2.3	Add climate resiliency considerations to complementary training initiatives.	Planning & Development	New/ Ongoing	2020
4.2.4	Collaborate with external partners (e.g. international, national, and regional stakeholders, including Universities and research centres) to share information and conduct joint studies.	Planning & Development	In Progress/ Ongoing	TBD
4.2.5	Deliver an internal and external communication strategy that supports the ongoing delivery of climate resiliency measures.	Communications and Public Affairs	New	2019, reviewed as needed
<b>4.3 RISK MANAGEMENT AND REPORTING</b>				
4.3.1	Continue updating climate change risks in the Risk Registry.	Planning & Development	In Progress/ Ongoing	TBD
4.3.2	Increase consideration of climate-related risks in insurance coverage planning.	Finance	New	2018-2020



# Appendix

## Driving Adaptation – A Policy Perspective

This *Adaptation Strategy* and other work at Metrolinx is aligned to, and supports, several initiatives at all levels of government that are directed at addressing climate change from both a mitigation and adaptation perspective, including:

- The *Sendai Framework for Disaster Risk Reduction* (2015) is a voluntary agreement endorsed by the UN General Assembly. Metrolinx is a member of ARISE, a UN Office for Disaster Risk Reduction network, whose members agree to advance the Sendai Framework by sharing knowledge on the implementation of disaster risk reduction.
- The Canadian Chapter of the Accounting for Sustainability (A4S) CFO Leadership Network seeks to integrate economic, environmental and social issues into businesses strategy and decision making. Metrolinx is a founding member.
- The *Vancouver Declaration on Clean Growth and Climate Change* (2016) builds upon the international Paris Agreement (on climate change) and federal, provincial and territorial actions being taken to achieve Canada's international commitments through the *Pan-Canadian Framework on Clean Growth and Climate Change*. The Framework outlines a commitment for stronger action on adaptation and climate resiliency including building climate resilience through infrastructure.
- National climate resiliency standards are being developed by the National Research Council, the Standards Council of Canada and the Canadian Standards Association.
- *Ontario's Climate Change Strategy* (2015) has established greenhouse gas (GHG) emission reduction targets of 15% below 1990 levels by 2020, 37% by 2030, and 80% by 2050. It also recognizes the importance of adapting and managing the risks of climate change. By 2030, Ontario will be better prepared for the impacts of climate change, as consideration will be given to investing in infrastructure that can stand up to the test of extreme weather and on-going changes to seasonal weather patterns.
- The *Infrastructure for Jobs and Prosperity Act, 2015* provides a planning and implementation framework for \$130 billion in public investments in infrastructure over the next decade. This includes expectations for public sector agencies to ensure that infrastructure is designed to be resilient to the effects of climate change.
- *Ontario's Five Year Climate Change Action Plan, 2016-2020* (2016) outlines the Province's intention to publish a guide for considering climate change in environmental assessments, regarding both climate change mitigation and adaptation. It is expected to become part of the Environmental Assessment program's *Guides and Codes of Practice*.
- The *Growth Plan for the Greater Golden Horseshoe* (2017), *Greenbelt Plan* (2017), *Oak Ridges Moraine Conservation Plan* (2017) and *Niagara Escarpment Plan* (2017) outline expectations for municipalities to protect ecosystems and manage stormwater systems through land use planning and resiliency measures.
- Many local and regional municipalities across the GTHA have completed studies on climate change vulnerability and are developing their own climate resiliency and adaptation plans.
- The City of Toronto has recently hired a Chief Resiliency Officer (CRO), funded through the Rockefeller Foundation's *100 Resilient Cities Initiative*. Metrolinx is a member of the City of Toronto's Resilient City Working Group, which supports the activities of the CRO, especially collaborative, multistakeholder initiatives to reduce vulnerability and enhance resiliency and adaptive capacity to extreme weather and climate change.







# Glossary

For the purpose of the *Metrolinx Climate Adaptation Strategy* we have modified definitions outlined by the *Intergovernmental Panel on Climate Change* (IPCC). From Metrolinx's perspective, these terms can be defined as:

**VULNERABILITY:** The propensity or predisposition to be adversely affected. Vulnerability to climate change is the degree to which Metrolinx infrastructure assets, our passengers, employees and contractors, and the region within which we provide transit services, are susceptible to, or unable to cope with, the adverse impacts of climate change.

**RESILIENCE:** The ability of Metrolinx, its infrastructure assets, and the component parts of its regional transit system to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

**ADAPTATION:** The process of adjustment through the application of soft (operations) or hard (infrastructure) measures to actual or expected climate and its effects, in order to moderate harm or reduce vulnerability and to capitalize upon beneficial opportunities.

**ADAPTIVE CAPACITY:** The combination of the strengths, attributes, and resources available to an individual, communities that we serve, the Greater Toronto and Hamilton Area (GTHA), or Metrolinx itself as an organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.



The Streetsville Bus Maintenance Facility achieved Silver LEED certification.



# Acronyms

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**2041 RTP:** 2041 Regional Transportation Plan

**A4S:** Accounting for Sustainability

**AFP:** Alternative Financing and Procurement

**AR6:** Sixth Assessment Report (of the IPCC)

**BRT:** Bus Rapid Transit

**CRO:** Chief Resiliency Officer

**EA:** Environmental Assessment

**EAM:** Enterprise Asset Management

**GHG:** Greenhouse Gas

**GIS:** Geographic Information Systems

**GTHA:** Greater Toronto and Hamilton Area

**IPCC:** Intergovernmental Panel on Climate Change

**KPIs:** Key Performance Indicators

**LRT:** Light Rail Transit

**PIEVC:** Public Infrastructure Engineering Vulnerability Committee

**PSOS:** Project Specific Output Specifications

**RER:** Regional Express Rail

**SCADA:** Supervisory Control and Data Acquisition

**TPAP:** Transit Project Assessment Process