City of Toronto

Climate Change Risk and Vulnerability Assessment (CCRVA)

Prepared by
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Prepared for
City of Toronto

November 7th, 2025

Technical Report

TORONTO

Sustainability Solutions Group

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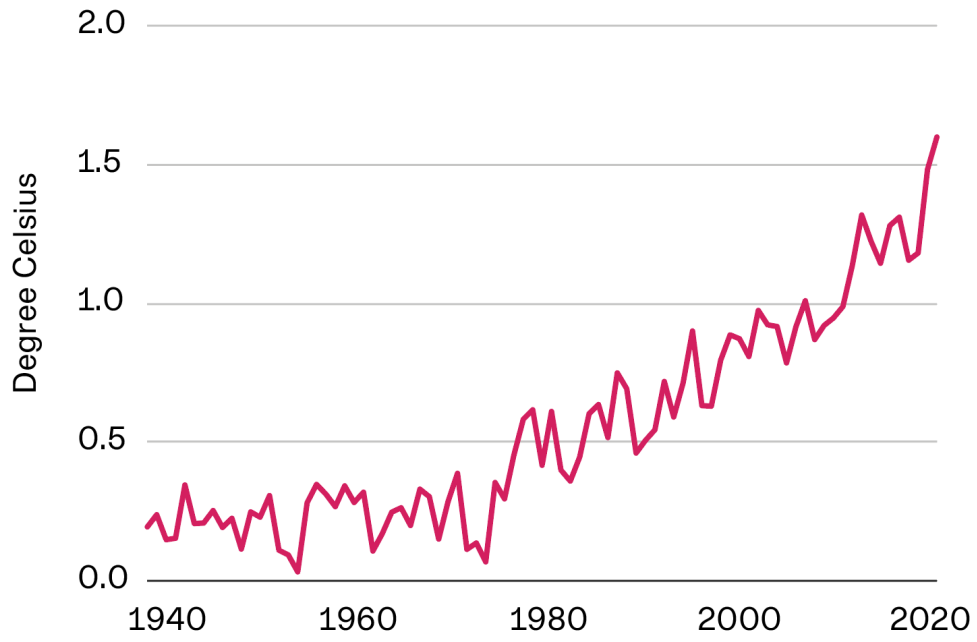
Executive Summary

Toronto's Climate Risk Assessment comes at a pivotal moment. In 2024, global average temperatures exceeded 1.5 °C above pre-industrial levels for the very first time (Figure ES-1), highlighting the changing climate risk landscape that affects our city. While annual fluctuations remain, climate scientists project that sustained warming above 1.5 °C will occur within the next decade,[1] underscoring the urgency of adaptation planning.

Extreme heat is now more frequent. By the end of summer 2025, Toronto recorded 24 days above 30 C, more than double the historical annual average.[2] Precipitation patterns have shifted to include more rain overall, including more frequent intense storms. Over the past two decades, several areas of Toronto have experienced multiple storms exceeding the historical 100-year threshold, overwhelming infrastructure designed for past climate conditions. Heat waves, flooding and wildfire smoke are no longer rare — they reflect current climate realities.

Figure ES-1. Annual global average temperature increase relative to 1850-1900 reference level (C).



[1] Intergovernmental Panel on Climate Change, "Summary for Policymakers," in Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, ed. Core Writing Team, H. Lee and J. Romero (Geneva: IPCC, 2023), 12, https://www.ipcc.ch/report/ar6/syr/.

[2] Environment and Climate Change Canada, Daily Climate Data for Toronto City (Station 31688), Government of Canada, accessed October 24, 2025, https://climate.weather.gc.ca/climate_data/daily_data_e.html?StationID=31688&Prov=ON

Emissions Scenarios

The frequency and severity of climate hazards depend on how global emissions increase over time. For Toronto, risks were assessed under two emissions scenarios (called Shared Socio-economic Pathways, or SSPs) that are defined by the Intergovernmental Panel on Climate Change (IPCC): SSP2-4.5, a medium emissions pathway and SSP5-8.5, a very high emissions pathway. These scenarios were chosen because global emissions are currently tracking between them. This report focuses on SSP2-4.5 as the planning case, while SSP5-8.5 is used to stress test risk results and evaluate the robustness of adaptation actions under faster and more severe climate change. Risks were assessed for both the current climate and the 2050s to identify today's priority concerns and how the risk landscape is expected to evolve over a longer planning horizon. Although hazards are projected to intensify more quickly and severely under SSP5-8.5, priority risks and adaptation actions are consistent across both scenarios. However, under SSP5-8.5, the same risks are expected to have much more severe and widespread consequences as the century progresses, underscoring the urgency of accelerated adaptation.

Drawing on Toronto's Current and Future Climate, a recent analysis of current and future climate projection data prepared by the Toronto and Region Conservation Authority (TRCA) for the City of Toronto, Toronto's annual average temperature is projected to rise about 3 °C above late 20th-century levels by the 2050s and 4 °C by the 2080s under a medium emissions scenario. The number of days hotter than 30 °C is expected to increase from the current average of 18 days per year to 36 per year by mid-century and 46 by the 2080s. Under a very high emissions scenario, this number could reach 78 days annually by the 2080s, meaning most Toronto summers would be characterized by extreme heat conditions.

The maximum amount of precipitation in one day is projected to increase by around 14 per cent by mid-century and 18 per cent by the 2080s under a medium emissions climate scenario and could climb to 27 per cent by the 2080s in a very high emissions scenario. These increasing extreme precipitation events will pose challenges for aging and undersized stormwater systems designed for historical patterns, elevating flood risks.

Changing Climate Hazards

To understand how the climate is expected to change in Toronto, it is helpful to understand how the frequency and severity of relevant different climate hazards are expected to change over time. Table ES-1 identifies the 11 hazards included in the risk assessment and shows how each is projected to change under a medium emissions scenario. Hazards like extreme heat and extreme precipitation are increasingly likely to occur over time, while others, such as winter storms and drought, remain constant. Very cold days and freeze-thaw cycles decrease in likelihood as temperatures rise.

Table ES-1. Projected changes in climate hazard likelihood for different time periods under a medium emissions scenario. ↑↑ indicates a large increase in likelihood, ↑ indicates a moderate increase, ↓ indicates a decrease and - indicates that the likelihood of the climate hazard occurring will remain relatively similar to present conditions.

Hazard	2030s	2050s	2080s
Extreme Heat and Very Hot Days	↑↑	↑↑	↑↑
Increase in Temperatures	↑	↑	↑↑
Ecosystem Changes	↑	↑	↑
Climate-Related Air Quality	-	↑	↑↑
Extreme Precipitation	-	↑	↑
Total Precipitation	-	-	↑
High Winds/Tornadoes	-	-	-
Drought	-	-	-
Winter/Ice Storms	-	-	-
Very Cold Days	↓	↓	↓
Freeze-thaw Cycles	↓	↓	↓

City Systems

The impacts of these hazards were analyzed across four overarching urban systems.

- **Population and Local Economy** considers demographics, equity indicators, employment, key trade sectors and household affordability.
- **Infrastructure Systems** includes electricity distribution and generation, natural gas supply, digital and telecom networks, transportation systems, and green and natural infrastructure, including landscaping, buildings and energy assets.
- **Municipal Services** covers emergency response, public health, social services, waste management, parks and forestry, water supply and wastewater and stormwater operations.
- **Natural Systems and Green Spaces** encompasses creeks, rivers, ravines, wetlands, urban forests, shoreline habitats and Lake Ontario's nearshore ecology.

The systems include elements within and beyond the City's direct authority. Each system is composed of interlinked subsystems shaped by vulnerability drivers that influence how they respond to climate hazards. These drivers reflect underlying socio-economic, demographic and structural factors that affect life in Toronto, such as the cost of living, shifting demographics, mobility challenges and aging infrastructure.

Risk Assessment Results

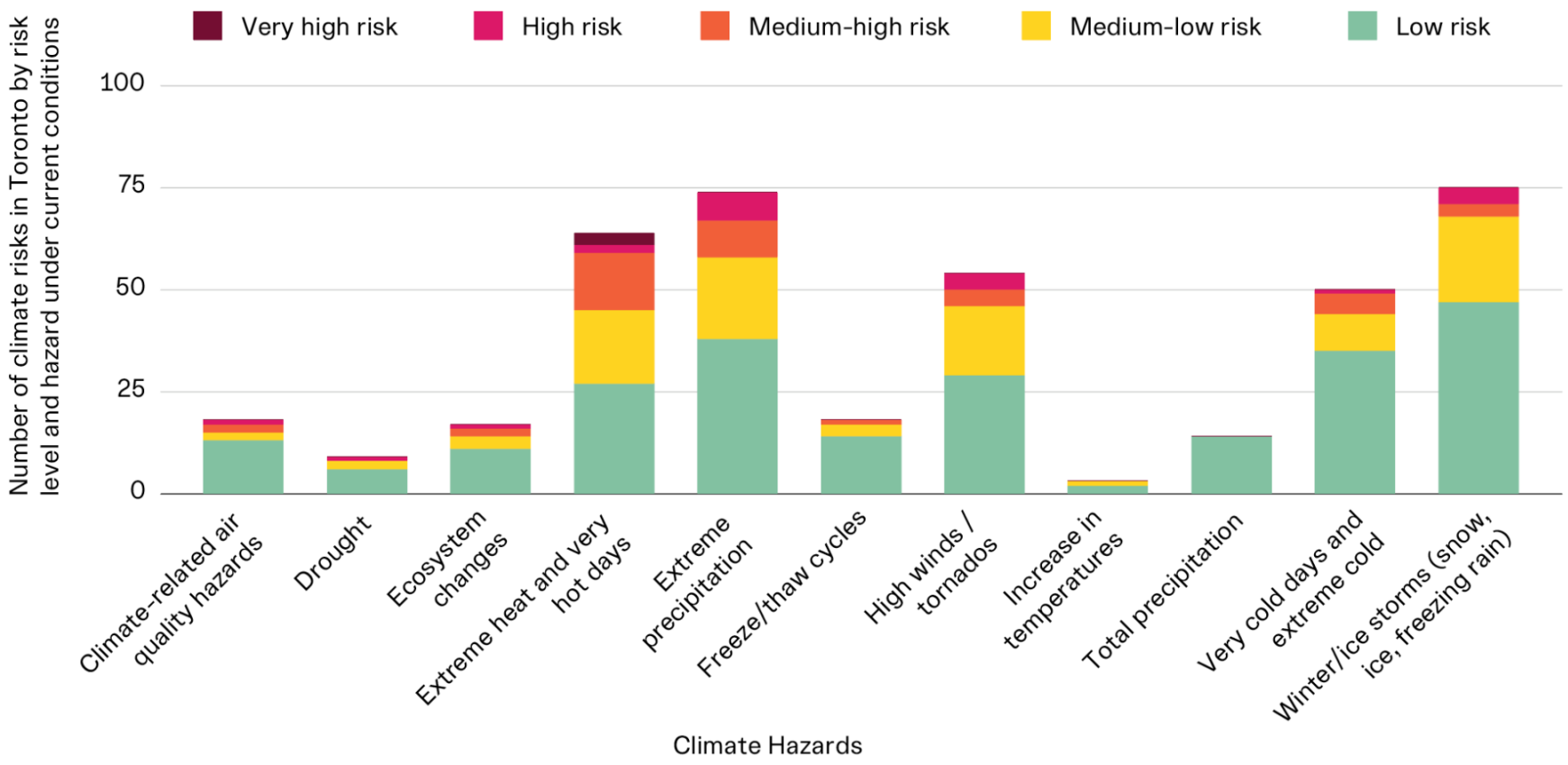
The risk associated with each impact statement was evaluated in alignment with established risk assessment approaches that consider the **likelihood** of exposure now and in the future, the **vulnerability** to each hazard and the potential **consequences** if the impact occurred. These components served as the foundation of the risk assessment process and are shown in Figure ES-2.

Figure ES-2. Components of risk.

This assessment analyzed more than 400 current and potential impacts from 11 climate hazards across Toronto's interconnected systems. It drew on extensive input from city divisions, agencies, corporations and key organizations. Risk scores were calculated using a function of likelihood, vulnerability and consequence.

Each risk was assigned to one of five categories based on its score: low, medium-low, medium-high, high or very high. Risks rated medium-high to very high were considered **priority risks** for the City. This technical report documents every priority risk and, for each, provides the full impact statement, the applicable system and subsystem and the risk rankings for current and mid-century conditions. Figure ES-3 presents risk score summaries under current conditions. Sixty-four impact statements are considered priority risks, with 19 linked to extreme heat. Sixteen additional priority risks stem from extreme precipitation.

Figure ES-3. Risks assessed by climate hazard and risk level, current climate.



Under the SSP2-4.5 pathway, the Climate Change Risk and Vulnerability Assessment (CCRVA) projects that by mid-century the number of risks above the priority threshold will grow markedly, rising to 99 in total, while the count of very-high risks also increases. Extreme heat has the sharpest escalation, accounting for a large share of future risks. In contrast, the number of priority risks associated with very cold days and freeze-thaw cycles declines.

Compounding Heat, Health and Cost Pressures

The impact of extreme heat on health is Toronto's most urgent climate threat. Older adults, low-income households, people experiencing homelessness and people living in older buildings without air conditioning face disproportionate exposure to rising temperatures and more frequent heat events, with direct effects on health. Rising summer cooling costs and broader challenges such as meeting basic needs and maintaining secure housing further compound these risks, linking health pressures with affordability challenges. At the same time, worsening wildfire seasons degrade air quality, and when smoke coincides with heat, health risks multiply, intensifying respiratory and cardiovascular impacts.

Infrastructure Disruptions and Cascading Impacts

Climate change is placing growing stress on Toronto's infrastructure. Flood-prone transit and road networks, as well as aging buildings in legacy riverine flood zones, are already vulnerable, and disruptions will become more frequent and costly. The greatest concern is the failure of critical assets during extreme events. For example, a power grid failure during a severe heat wave could cut off access to cooling — and in some cases, access to water — resulting in consequences that ripple across homes, workplaces and essential services.

Emergency and Municipal Services Under Strain

Municipal services will face escalating pressure as extreme weather becomes more frequent and severe. Shelters for people experiencing homelessness already operate at or near capacity, and surges in demand during heat waves, air quality events and storms outpace available space and staff. The City's outdoor workers face direct exposure to climate hazards, and as demand for their services increases, they must often divert their attention from regular duties (such as during cleanup of storm debris). In the face of increasingly volatile weather, the existing plans, processes and resources of a broad range of city divisions, agencies and corporations will face strain, increasing the need for enhanced response coordination. When demand peaks, cascading effects follow: emergency responders face overwhelming call volumes and longer response times, hospitals and community health services back up, and outreach teams are stretched precisely when conditions are most dangerous.

Degradation of Natural Areas and Habitat and Tree Canopy Loss

Urban forests, green spaces, wetlands, streams and ravines provide cooling and carbon sequestration, absorb/slow down stormwater and sustain biodiversity. However, they are increasingly stressed by urbanization, storm events, heat, drought, invasive species, development and habitat degradation. Losing natural features and the tree canopy erodes Toronto's natural defenses, raising neighbourhood temperatures, increasing flood volumes, decreasing habitat and natural area functions and compounding wear on infrastructure.

Equity

Climate risks in Toronto are not experienced evenly. Climate impacts are shaped by individual factors such as older age, disability, living alone and pre-existing health conditions and by systemic inequities, including racism, ableism, poverty, isolation, precarious work, insecure housing and language barriers. These conditions limit people's ability to prepare for, withstand and recover from extreme heat, flooding, poor air quality and power disruptions, turning climate hazards into compounding health and affordability crises.

Populations most at risk include people experiencing homelessness; renters, especially in older apartment buildings without adequate cooling; lower-income households; older adults and people with disabilities; racialized communities; newcomers facing language barriers; and outdoor, shift, gig and care workers whose jobs increase their exposure to risks but who have limited benefits or paid leave. Place also matters: risks accumulate in neighbourhoods with higher social marginalization, hotter microclimates, aging buildings and limited transit access. Indigenous communities may experience climate change impacts due to colonialism and capitalism and dispossession/removal from traditional lands and ecosystems, including impacts on ceremonies, traditional lifestyle practices and the ability to exercise other cultural rights.

The CCRVA directly accounts for how climate risks and impacts may differ across population groups in its risk scoring. Sensitivity and adaptive capacity are scored with indicators that reflect who is most affected and least able to cope, including income, housing conditions, age, health status, mobility and language barriers, reliance on social services and access to cooling or shelter. Together, these indicators form the vulnerability score, which feeds into the overall risk score. Impact statements that primarily affect equity-deserving groups receive higher vulnerability scores, which directly influence risk prioritization.

Cascading Impacts

Climate impacts do not occur in isolation. Systems are interconnected, and climate hazards can produce ripple effects through many pathways. The assessment includes a cascading impact analysis that identified seven categories with high potential to amplify risks across multiple systems: heat event blackouts, flood-related transport disruption, heat-related illness, telecommunications outages, social isolation, rising household energy costs and natural area and tree canopy loss.

For example, heat-driven power outages in dense neighbourhoods can close public cooling spaces when residents need them most. Telecommunications failures can interrupt dissemination efforts to direct vulnerable seniors to safe locations. Flooded transit routes can isolate mobility-impaired evacuees, while natural area and tree canopy loss reduces shade and intensifies ground-level heat.

These findings were reflected in the risk scoring for both upstream and downstream impacts, underscoring the interconnected nature of the systems considered in the City's risk prioritization.

Adaptation Actions

The risk assessment identified more than 80 existing actions that contribute to resilience. A key insight is that while much is underway or planned, without stronger coordination and interdivisional collaboration, efforts risk becoming ineffective, remaining siloed and falling short of their full potential. This report also highlights more than 60 potential adaptation actions the City can pursue to further strengthen resilience, including the following potential system-level actions:

- Expand the City's carbon budget into a broader **climate budget** with indicators and guidance to prioritize projects based on emissions and resilience outcomes.
- Apply an enhanced **resilience lens** to capital projects and extend this lens to programs and operating budgets, ensuring climate resilience is consistently considered and prioritized in all City decisions.
- Embed resilience into **asset management** so climate risks and impacts are systematically integrated into asset, design, planning and decisions.
- Strengthen existing **natural asset management programs**, treating green infrastructure, including Toronto's ravines, wetlands and urban forest, as essential city infrastructure to match its critical role in climate resilience.

These approaches should be complemented with Indigenous climate solutions to ensure the continuation of Indigenous knowledge and the effective stewardship of the lands and waters that has been ongoing for millennia.

A Multi-System Approach

Climate challenges do not exist in isolation. Each event cascades through interconnected systems, exposing and amplifying existing vulnerabilities. The cross-cutting nature of hazards can strain and overwhelm city systems.

At the same time, this interconnectedness offers opportunity. Climate risk touches every aspect of a dynamic city; therefore, it can serve as a unifying lens, encouraging collaboration across city divisions and economic sectors. This perspective allows Toronto to address root causes of vulnerability rather than treating symptoms in isolation.

With careful planning and coordination, resilience can move beyond reactive responses to extreme weather. It can drive solutions to some of Toronto's most pressing challenges that affect quality of life, including housing affordability, inequity, aging infrastructure and traffic congestion.

Acknowledgements

We would like to extend our sincere gratitude to all those who contributed to this study, including the City of Toronto staff and additional organizations and individuals whose support, expertise and dedication were invaluable in shaping this work.

Land Acknowledgement

We respectfully acknowledge that the land we are situated on is the traditional territory of many nations, including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and the Wendat peoples and is now home to many diverse First Nations, Inuit and Métis peoples. Toronto is covered by Treaty 13 with the Mississaugas of the Credit. We appreciate and respect the history and diversity of these lands and are grateful to have the opportunity to work and meet in this territory.

This risk assessment takes a Western-science-based perspective and does not include Indigenous perspectives on climate risk and resilience in the lands now known as Toronto. As we seek to restore balance in the systems that sustain us and all living beings, the information generated in this Climate Change Risk and Vulnerability Assessment should be complemented by Indigenous knowledge of the lands and waters and approaches that centre on reciprocity, kinship with all beings and collective prosperity.

African Ancestral Acknowledgment

We are committed to continually acting in support of and in solidarity with Black communities seeking freedom and reparative justice in light of the history and ongoing legacy of slavery that continues to impact Black communities in Canada. As part of this commitment, we acknowledge that not all people came to these lands as migrants and settlers. Specifically, we wish to acknowledge those of us who came here involuntarily, particularly those brought to these lands as a result of the transatlantic slave trade and slavery. In support of the City of Toronto's ongoing efforts to confront anti-Black racism, we pay tribute to those ancestors of African origin and descent.

We also acknowledge and support all efforts to identify and address the anti-Black racism that is still embedded in Canadian institutions through policies and practices that influence the way climate change risks and adaptation resources and supports are experienced by the African diaspora in Toronto.

General Acknowledgement

Project Advisory Group

The Advisory Group consists of Bofa Udisi (Parks and Recreation); Hazel Breton (Engineering and Construction Services); Heather Marshall (Social Development); Iris Zhang (Insurance and Risk Management); Janet Lo (Transportation Services); Jessica Harris (Toronto Emergency Management); Lisa King (City Planning); Loren Vanderlinden (Toronto Public Health); Melissa Ferreira (Insurance and Risk Management); Natalie Salkauskis (Toronto Water); and Stewart Dutfield and Teresa Bosco (Environment, Climate and Forestry).

Interdivisional Climate Resilience Team

The project team acknowledges the inputs and insights contributed by the City's Interdivisional Climate Resilience Team during the development of the risk assessment and potential actions. This group included a diverse membership from across city divisions, agencies and corporations, as well as key city partners, including the following:

City Planning
Corporate Real Estate Management
Insurance and Risk Management
Engineering and Construction Services
Environment, Climate and Forestry
Fleet Services
Financial Planning
Housing Secretariat
Indigenous Affairs Office
Municipal Licensing and Standards
Parks and Recreation
Toronto Shelter and Support Services
Social Development
Strategic Public and Employee Communications
Technology Services
Toronto Emergency Management
Toronto Paramedic Services
Toronto Public Health
Toronto Water
Transportation Services
Toronto and Region Conservation Authority
Toronto Community Housing
Toronto Fire Services
Toronto Hydro
Toronto Public Library
Toronto Transit Commission

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Disclaimer

Reasonable skill, care and diligence have been exercised to assess the information acquired during the preparation of this analysis, but no guarantees or warranties are made regarding the accuracy or completeness of this information. This document, the information it contains, the information and basis on which it relies and the associated factors are subject to changes that are beyond the control of the authors. The information provided by others is believed to be accurate but has not necessarily been verified.

This analysis includes strategic-level estimates of climate risk and vulnerability that should not be relied upon for design or other purposes without verification. The authors do not accept responsibility for the use of this analysis for any purpose other than that stated below and do not accept responsibility to any third party for the use, in whole or in part, of the contents of this document. This analysis applies to the City of Toronto and cannot be applied to other jurisdictions without analysis. A summary report presenting the key findings of this study is also available.

This Technical Report presents a detailed analysis of the results from the City of Toronto's Climate Change Risk and Vulnerability Assessment. For a high-level summary of findings, refer to the accompanying Summary Report.

1. About This Document

This Climate Change Risk and Vulnerability Assessment represents a critical milestone in the City of Toronto's journey toward climate resilience. As Toronto faces increasingly severe climate impacts, from extreme heat events and flooding to ice storms and ecosystem changes, this assessment provides the evidence-based foundation needed to protect residents, infrastructure, and natural systems from current and future climate risks.

Purpose and Scope

This document presents the findings of Toronto's first comprehensive climate change risk and vulnerability assessment, conducted between 2024 and 2025. The CCRVA systematically evaluates how climate change affects the city's people, infrastructure, municipal services and natural environment. By combining updated climate projections with detailed vulnerability and risk analyses, this assessment identifies which populations, assets and services face the greatest threats and require the most urgent adaptation action.

The assessment examines 11 climate hazards, from extreme heat and precipitation to ecosystem changes and air quality impacts. It evaluates over 400 potential impact statements across four major systems: Population and Local Economy, Municipal Services, Infrastructure Systems, and Natural Systems and Green Spaces. This comprehensive approach ensures that no critical vulnerability is overlooked and that adaptation planning addresses the full spectrum of climate risks facing Toronto.

Methodology and Approach

The CCRVA follows international best practices for climate risk assessment, specifically ISO 31000 (Risk Management) and ISO 14091 (Climate Change Adaptation). The assessment employs a systematic methodology that evaluates:

- **Vulnerability** through sensitivity and adaptive capacity scoring;
- **Likelihood** based on climate projections for different time periods (2015-2040, 2041-2070, and 2071-2100); and
- **Consequences** across five categories: service functionality, economy, health and security, environment, and social cohesion.

Climate projections are based on two Shared Socio-economic Pathways: SSP2-4.5 (the "middle-of-the-road" scenario) and SSP5-8.5 (the high emissions scenario). These scenarios, used in the analysis by the Toronto and Region Conservation Authority (TRCA), provide scientifically robust projections of how Toronto's climate will change over the coming decades.

Key Components

This report is organized into several interconnected components:

1. **Climate Hazards Analysis** - Details current and projected climate conditions based on TRCA's modelling.
2. **Vulnerability Assessment** - Identifies which systems and populations are most susceptible to climate impacts.
3. **Risk Assessment** - Prioritizes risks by combining vulnerability, likelihood and consequence scores.
4. **Adaptation Actions** - Recommends targeted measures to reduce priority risks.

How to Use This Document

Different stakeholders can use this assessment in various ways:

- **City divisions, agencies and corporations** can identify risks to their assets and services, informing capital planning and operational decisions.
- **Emergency management personnel** can better prepare for climate-related emergencies.
- **Community organizations** can understand vulnerabilities in the populations they serve.
- **Residents and businesses** can learn about climate risks in their areas and available adaptation resources.

The risk rankings and vulnerability scores provide a clear prioritization framework, helping decision-makers allocate limited resources to areas of greatest need.

2. Introduction and Context

The global climate is already changing at a significant rate, with global surface temperatures increasing over 1.5 C. Given the tremendous size and heat capacity of the global oceans, it takes a massive amount of added heat energy to raise Earth's average yearly surface temperature even a small amount. The roughly 1 °C increase in global average surface temperature that has occurred since the pre-industrial era (1850-1900) might seem small, but it means a significant increase in accumulated heat.[3]

According to the IPCC , human activities have unequivocally caused global warming that is causing rising temperatures, changes in precipitation, more frequent and intense extreme events, declines in permafrost and ice cover, ocean warming, sea-level rise, and many other impacts on natural, built, social, economic and ecological systems.[4]

The changing climate is already affecting most aspects of life in Canada. Our national annual average temperature has warmed by 1.7 °C since 1948,[5] resulting in increased frequency and severity of urban flood risk, wildfires, storms and extreme heat events; increases in average sea level rise; less snow and ice; and warmer lake and ocean temperatures across Canada. These changes in climate are significantly affecting Canadian communities in terms of mental health, injuries, death, disruptions to food and distribution systems, water resources, air pollution and increased demand on health systems.[6]

[3] NOAA. 2024. Climate Change: Global Temperature https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature

[4] IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001

[5] Bush, E., and D. S. Lemmen. *Canada's Changing Climate Report*. Government of Canada, Environment and Climate Change Canada, 2019, http://publications.gc.ca/collections/collection_2019/eccc

[6] Berry, P., & Schnitter, R. (Eds.). (2022). Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. Ottawa, ON: Government of Canada.https://changingclimate.ca/health-in-a-changing-climate/chapter/headline-statements/

City of Toronto's Climate Change Resilience and Readiness

The City of Toronto is experiencing many of these impacts, including extreme heat, rain storms and winter storms, that are impacting its infrastructure, residents, public health, natural systems and economy.[7] Significant climate-related impacts over the last decade included major floods, ice storms, an increase in vector-borne diseases (West Nile virus and Lyme disease)[8] and longer duration of heat waves. These climate-related hazards are projected to increase in variability, frequency and intensity over the next 25 years, which will result in economic, social and environmental costs to the City and residents.

Tackling climate change and building resilience is identified as one of the City's four strategic priorities. This priority is reflected by the City's actions, including city council's unanimous approval of the City's TransformTO climate action strategy in 2017 and city council's vote to declare a climate emergency and accelerate its net-zero emissions reduction target by 10 years from 2050 to 2040. In 2021, city council adopted the TransformTO Net Zero Strategy, which includes a set of low-carbon goals and short-term actions to reduce Toronto's greenhouse gas (GHG) emissions while improving health, encouraging economic growth, improving social equity, increasing climate resilience and establishing community-wide goals for greenhouse gas emissions reduction.

The City has an increasingly sophisticated ecosystem of policies and programs designed to implement the actions in TransformTO Net Zero Strategy that address the main sources of GHG emissions across the city: buildings, transportation-related emissions, and waste. Steps to address climate adaptation and build resilience against the projections for increasingly severe impacts thread throughout the City's existing programs and policies (e.g. the Heat Relief Strategy; the Toronto Green Standards; Green Streets; Wet Weather Flow Master Plan; Ravine Strategy and the Toronto Biodiversity Strategy). However, the City does not have a comprehensive climate change risk and vulnerability assessment and climate change adaptation plan in place.

A systematic, comprehensive and evidence-based plan to advance climate adaptation for the City's corporate operations, assets and services and across the city's communities is required to protect residents, infrastructure and the economic, social and environmental well-being of the city. Over the years, the City has undertaken some key studies that inform this process. In 2012, the City first assessed the key climate

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[7] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. *Toronto's Current and Future Climate*. Toronto and Region Conservation Authority, 2024. City of Toronto. Accessed [today's date]. https://www.toronto.ca/wp-content/uploads/2024/12/949f-TorontosCurrentandFutureClimate-REPORT-Final.pdf.

[8] Climate Change and Vector-Borne Diseases in Toronto. https://climateconnections.ca/app/uploads/2017/01/Kavalpreet-Grewal.pdf; and City of Toronto. Lyme Disease. https://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/lyme-disease/

hazards and impacts that could be expected in terms of the changing climate (City of Toronto's Future Weather and Climate Drivers Study). The findings included increases in annual average and maximum temperatures, more heat waves and more intense rain events, particularly in the summer.

In 2019, the City developed its Climate Resilience Framework and Toronto's First Resilience Strategy, providing a contextual description of Toronto's resilience challenges and a vision for its aspirations to build a resilient Toronto. The strategy identified three focus areas: 1) people and neighbourhoods, 2) infrastructure and 3) leadership. These address five resilience challenges: equity, climate and environment; civic engagement; communities and neighbourhoods; housing; and mobility.

Toronto's Environment, Climate and Forestry Division (ECF) is currently refreshing its approach to climate resilience and adaptation to update its understanding of the present and potential future climate risks for the city, support improved coordination across divisions and ensure that climate considerations are embedded into decision-making across the City.

In March 2024, the City released Toronto's Climate Change Readiness: Updates on commitments and a refreshed mandate for coordinating resilience activities. The report confirms that Toronto is hotter than it used to be and that it is likely to get hotter and wetter over the coming decades. The report identified four priority areas for action, including the need for more access to evidence, information, expertise and advice to guide the City's priorities and actions. The report specified that ECF would undertake a climate change risk and vulnerability assessment to update local climate projections for the City and identify the people, assets and services, including natural systems, that are vulnerable to climate impacts.

In December 2024, the City released Toronto's Current and Future Climate, which included updated climate projections for Toronto. These identified that the number of days per year with temperatures above 30 °C (extreme heat days) has increased from an average of 10 days in the 1980s to about 14 days per year today.[9] Data suggests that this could increase to 36-44 days by the 2050s (2041-2070) and 45-78 days by the 2080s (2071-2100), depending on the emissions scenario. As well, by the 2080s Toronto could experience an increase in annual precipitation of 11-16 per cent, with an up to 27 per cent increase in the amount of rain falling on the wettest day each year. These updated projections, developed by the Toronto and Region Conservation Authority, will inform the climate hazards information used in this CCRVA.

[9] As of mid-September 2025, there were 24 days above 30 °C in Toronto.

While many divisions across the City are taking action to reduce risks from climate change, the City of Toronto does not currently have a council-adopted climate resilience or adaptation plan. This CCRVA assesses and quantifies the city's most important climate hazards, risks and vulnerabilities and identifies gaps and priority areas in climate adaptation and resilience in order to better prepare the city for its current and future impacts of climate change.[10]

[10] Environment and Climate Division, City of Toronto. 2024. Toronto's Climate Change Readiness: Updates on commitments and a refreshed mandate for coordinating resilience activities. https://www.toronto.ca/legdocs/mmis/2024/ie/bgrd/backgroundfile-244181.pdf

3. Methodology Overview

Assessment Scope

An important first step in a CCRVA is to determine the level of detail and the boundaries of the assessment for the City of Toronto at the corporate and community levels. The following sections provide a list of the potential climate hazards and examples of indicators and identify the City's systems (e.g. sectors), associated assets and services.

3.1 Developing a List of Relevant Climate Hazards

In order to develop the draft list of hazards for the CCRVA, a scan of relevant and historical climate hazards was undertaken by reviewing the following reports:

- Toronto's Future Weather and Climate Driver Study
- Evaluating Risk of City of Toronto Park Natural Assets
- Resilient Food Systems
- Resilient Cities
- Ontario Provincial Climate Change Impact Assessment[11]
- 2024 Report on Toronto's Current and Future Climate by the City of Toronto and the Toronto and Regional Conservation Authority[12]

3.1.1 Overview of Historical Hazards

We reviewed potential types of extreme weather events and climate hazards that have occurred in the City of Toronto using several media and government sources, including Toronto's Current and Future Climate Report, City of Toronto's Future Weather and Climate Drivers Study and the Ontario Provincial Climate Change Impact Assessment. A total of 27 major historical events were identified, representing seven hazard types (Table 1).

[11] https://www.ontario.ca/files/2023-08/mecp-ontario-provincial-climate-change-impact-assessment-en-2023-08-17.pdf

[12] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate Report. Toronto and Region Conservation Authority. Toronto, ON.

Table 1. Summary of climate hazards and historical events for the city of Toronto (1944-2024).

Climate Hazard Type	Number of Historical Events (Year)
Severe Storm and Flooding	8 (1954, 2000, 2005, 2013, 2018, 2019, 2024)
Winter/Ice Storms	7 (1944, 1999, 2013, 2019, 2022)
Extreme Cold	4 (2017, 2018, 2023)
Extreme Heat[13]	3 (2005, 2010, 2024)
Ecosystem Change	2 (2023, 2024)
Wildfire/Smoke/Air Quality	1 (2023, 2025)
Windstorms/Tornado	1 (2018)

In addition, feedback from city staff included adding a separate category to better capture gradual changes in precipitation patterns, and high heat was added alongside extreme heat to reflect the gradual effects of increasing temperature trends, particularly in relation to cooling demand. Based on the results, a proposed list of relevant hazards is presented in Table 2. The most important hazards and thresholds for indicators are established in the CCRVA Hazards section.

Table 2. List of relevant climate hazards.

Climate Hazards	Description of Hazard
Increase in Temperature	Temperature is a direct indicator of climate change as a result of the rise in greenhouse gas concentrations from human activities. Changes in temperature affect agriculture, infrastructure, people's health, water availability, energy use, recreation, and ecosystem health.
Extreme Heat and Very Hot Days	Increasing temperatures and days with temperatures of 30 °C and above.[14]

[13] Note that heat incidents have often been unreported, especially between 2010 and 2024.

[14] Very hot days are defined as days with maximum temperatures above 30 C, according to the Climate Atlas of Canada. Climate Atlas of Canada. "Days Above 30 °C: Canada, 2060 (RCP 8.5)." Climate Atlas of Canada. Prairie Climate Centre, University of Winnipeg. Accessed November 7, 2025. https://climateatlas.ca/map/canada/plus30_2060_85

Climate Hazards	Description of Hazard
Extreme Cold and Very Cold Days	The definition of extreme cold weather varies across Canada due to local climate and the adaptations of the community for cold weather. In general, cold temperatures can be defined as those that lead to unsafe conditions for people and/or impacts to infrastructure, operations and natural systems. For people who are outside for long periods of time without adequate protective clothing, the risk of hypothermia and frostbite is present at a wind chill of -10 °C and below. At a windchill of -28 °C and below, frostbite can occur in minutes and the risk of hypothermia is high if outside for long periods, especially without adequate clothing.[15]
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Refers to winter conditions where snow and/or ice builds up as solid precipitation. Snow and ice accumulation is possible where there is precipitation on days 0 °C or lower. During these events, winds may cause blowing snow that reduces outdoor visibility, while wet surfaces can create slippery conditions. Ice accumulation may also occur during mild weather where snow begins to melt and become subject to a flash freeze.
Total Precipitation	Changes in average total amount of annual and seasonal precipitation.
Extreme Precipitation	Extreme precipitation is defined as events that have increased frequency and intensity in a region or location in which the amount of rain/snow substantially exceeds normal. Extreme precipitation events can increase the risk of flooding, which can directly affect infrastructure, buildings, and people's health and safety (e.g. flooded lands, erosion, landslides, sinkholes). Extreme precipitation can also increase the amount of stormwater runoff that enters waterways, especially in urban areas, which may, in turn, affect the health of aquatic systems.

[15] The Toronto 2024/2025 Cold Weather Response Plan describes a new process for opening warming centres. The Toronto Shelter and Support Services plays a significant role in supporting people experiencing homelessness. They activate warming centres when temperatures reach -5 °C and/or when Environment and Climate Change Canada issues a winter weather event warning. Additional warming centres and other surge capacity activated when temperatures hit -5 C. The City no longer issues extreme cold alerts. Environment and Climate Change Canada issues extreme cold alerts across Canada. An extreme cold weather alert is issued for Southern Ontario (including Toronto) when the temperature or wind chill is forecasted to reach -30 °C for at least two hours.

Climate Hazards	Description of Hazard
Freeze-thaw Cycles	A freeze-thaw cycle occurs when the daily maximum temperature is higher than 0 °C and the daily minimum temperature is less than or equal to -1 C. The minimum temperature of -1 °C (rather than 0 C) is used as the threshold for freezing to raise the likelihood that water actually froze at the surface.
Drought and Dry Days	Drought is defined as a shortage of precipitation over an extended period, usually a season or more, resulting in insufficient water availability that adversely impacts vegetation, animals and people.
Wildfire Hazards	Very hot temperatures and extreme heat can worsen air pollution, as well as wildfire smoke. Wildfire events can occur north of Toronto, wherein winds can spread wildfire smoke, presenting a hazard for the city.
High Winds/ Tornadoes	High winds pose a significant hazard to land and water activities and can cause damage to people, buildings and infrastructure. Environment Canada issues a wind warning using the threshold of 70 km/hour or higher sustained wind, and/or gusts to 90 km/hour.
Ecosystem Changes	Climate impacts and extreme weather events affect ecosystem functions and ecosystem health, which impacts biodiversity. In addition, changes in temperature impact the environment and habitat for species. Changes and disturbances in ecosystems alter their biodiversity.

3.2 Developing a List of Relevant Sectors and Sub-classes

This section demonstrates our approach to organizing information about the City's assets, services and people, showing how the relevant sectors and sub-classes within the City of Toronto's jurisdiction can be categorized.

Criteria Used to Organize the City's Sectors, Assets and Services

We developed an approach that categorizes and organizes the City's sectors and sub-classes for assets, services and people according to systems for which the City holds direct responsibility, regulatory authority or significant influence in alignment with its mandates and areas of jurisdiction. To determine this, we reviewed the existing structure and make-up of the city departments, services and assets, as well as community services, along with systems that significantly influence the ability of the City and its residents to function effectively. We developed the following criteria to guide the proposed systems and sub-classes for undertaking Toronto's CCRVA:

- Relevant sub-classes identified in the review of four other frameworks (e.g. municipal buildings, disaster resilience, cross-sectoral themes, equity);
- Sensitivity and exposure to climate-related impacts;
- City's organizational structure; and
- Direct responsibility/regulatory authority by the City (corporate and community assets, people and services).

Identifying Sectors and Sub-classes for the CCRVA

Based on these criteria, we identified the following themes as the four systems for the CCRVA for the City of Toronto (corporate and community):

- Population and Local Economy
- Municipal Services
- Infrastructure Systems
- Natural Systems and Green Spaces

Table 3 illustrates the hierarchical structure used in this analysis, where systems represent the highest level of grouping, followed by sectors and then sector sub-classes. Each sub-class includes related people, assets and services. With input from the City's project team and advisory group, these categories form the foundation for how the rest of the City's CCRVA analysis is organized.

Table 3. Relevant systems/sectors and sub-classes for the City of Toronto's CCRVA.

System/Sector	Sector Sub-cl	People, Assets and Services
Population and Local Economy 	Residents Non-residents Businesses and Socio-economic Activities	<u>Residents</u> Local Residents Students Indoor Workers Outdoor Workers Vulnerable Populations Populations experiencing homelessness Indigenous Peoples <u>Non-residents</u> Commuters Visitors/Tourists <u>Businesses and Socio-economic Activities</u> Industrial Local Business Non-Profit Organizations Other Government Construction Services and Trades Banking and Financial Information and Technology

Municipal Services 	Municipal Workers Community and Social Services Public Health and Safety Public Works Emergency Management Municipal Fleet	<u>Municipal Workers</u> Indoor Workers Outdoor Workers <u>Community and Social Services</u> Community Development Social Services Employment and Training Services Education and Daycares Libraries Community and Recreation Centres Affordable and Social Housing Homeless Shelters Parks and Outdoor Activities Cultural and Heritage <u>Public Health and Safety</u> Public and Environmental Health Paramedic Services Fire Services Police Services Social Cohesion Long-Term Care and Seniors Services <u>Public Works</u> Policy and Planning Finance and Treasury Road and Sidewalk Maintenance and Safety Climate and Environment Engineering Construction Technology Services <u>Emergency Management</u> Prevention and Mitigation Emergency Planning and Preparedness Emergency Response Coordination Emergency Social Services Public Education and Outreach Recovery and Continuity <u>Municipal Fleet</u> Fleet Vehicles Fleet Operations

Infrastructure Systems 	Municipal Buildings Residential Buildings Commercial and Industrial Green Infrastructure Systems Public Transportation Road Networks Active Transportation Regional Transportation Information, Banking, Communications and Technology Electricity Supply and Distribution Natural Gas Supply Food Supply Systems Stormwater and Water Systems Waste Management and Residuals Materials Systems	<u>Municipal Buildings</u> Foundations Building envelopes Roofs Plumbing and Heating, Ventilation and Air Conditioning (HVAC) Equipment <u>Residential Buildings</u> Single-Family Homes Townhouses Multi-Unit Residential Buildings (MURBs) <u>Commercial and Industrial</u> Commercial Buildings Non-Profit Organizations and Other Government Buildings Banking and Financial Sector Buildings Supply Chain and Logistics Urban Shipping and Goods Movement <u>Road Networks</u> Roads and Highways Tunnels and Bridges Traffic Systems (Traffic Lights, Traffic Control) Street Lights <u>Green Infrastructure (GI) Systems</u> Enwave Heating/Cooling Systems (Lake Ontario) Permeable Surfaces Services, Bioswales and GI Storm Drainage and Water Storage Urban Forest Shading Services Urban Agriculture and Food Provision Services <u>Public Transportation</u> Local Ferries Local Public Transit Regional Public Transit Train Stations and Regional Bus Hubs Operations and Services Ride-hailing, Car Share, Car Rental, and Community Shuttle Services <u>Active Transportation</u> Pedestrian and Cycling Infrastructure Bike Share Operations and Services

Infrastructure Systems 		<u>Regional Transportation</u> Railways and Light Rail Airports and Services Ships, Docks and Ferries Operations and Services <u>Food Supply Systems</u> Food Distribution Centres Food Banks Other Food Services <u>Information, Banking and Communications Technology</u> Banking Systems and Information Communication Technology (ICT) Phone (Land and Cell) Cable Satellite Internet systems Data Centres and Servers <u>Electricity Supply and Distribution</u> Electricity Generation and Supply Network (IESO/Hydro One) Local Electricity Distribution (Toronto Hydro) Electricity Storage <u>Natural Gas Supply</u> Natural Gas Supply Network <u>Stormwater and Water Systems (Assets, Operations and Services)</u> Stormwater Water Supply Wastewater <u>Waste Management and Residual Materials Systems (Assets, Operations and Services)</u> Waste Collection and Separation Recycling Organics Composting Waste Disposal

Natural Systems and Green Spaces 	Natural Environment Biodiversity Parks and Protected Areas	<u>Natural Environment</u> Watersheds Wetlands, Rivers, Meadows and Creeks Beaches and Lakes Urban Forests and Ravines Ecosystem Services <u>Biodiversity</u> Native Plants, Wildlife, Aquatic Species and Ecosystems <u>Parks and Protected Areas</u> Forests Public Parks, Conservation Areas, Forests, Ravines and Nature Reserves

Risk Assessment Framework

With the relevant hazards and systems defined for the project scope, we have systematically analyzed how these hazards impact each system through the risk assessment framework. This analysis began with developing impact statements — specific descriptions of how a climate hazard affects a particular system or population (for example, "heat-related illnesses for vulnerable populations" or "damage to road infrastructure from extreme precipitation"). These impact statements serve as the foundation for risk assessment, as each one is evaluated through the framework to assign numerical values for vulnerability, likelihood and consequence. This scoring enabled us to rank and prioritize Toronto's most critical climate risks. The following section describes the methodology underlying this framework, while subsequent sections demonstrate its application and present the resulting risk rankings.

This risk assessment follows international best practices for risk and climate vulnerability assessments, specifically:

- ISO 31000: Risk Management – Principles and Guidelines
- ISO 14091: Adaptation to Climate Change – Vulnerability, Impacts and Risk Assessment

The assessment integrates the structured risk management process from ISO 31000 and follows ISO 14091 to incorporate climate adaptation considerations, ensuring that climate-related risks are assessed as a function of vulnerability, likelihood and consequence.

The following definitions were taken from ISO 31000 and ISO 14091 and serve as foundational concepts for the risk assessment:

- **Risk (R):** Effect of uncertainty.
- **Hazard (H):** Potential source of harm.
- **Exposure (E):** Presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social or cultural assets in places and settings that could be affected.
- **Vulnerability (V):** Intrinsic properties of something resulting in susceptibility to a risk source.[16]
- **Likelihood (L):** Chance of something happening.
- **Consequence (C):** Outcome of an event.

The general risk formula[17] is expressed as:

$$R = f(H, E, V)$$

And the hazard component is a function of likelihood and consequence:

$$H = f(L, C)$$

Risk Scoring Methodology

The general risk formula from IPCC's risk framework can be applied in different ways in order to derive risk scores. The following specific risk formula was employed for the risk scoring component of Toronto's CCRVA, where risk is defined as the product of vulnerability, likelihood and consequence:

$$R = V * L * C$$

Note that in some risk assessment frameworks, risk is defined as likelihood × consequence, omitting vulnerability. For the Toronto CCRVA, vulnerability is included in the risk scoring formula to align with the IPCC's AR6 concept of risk.[18][19]

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[16] "It is important to recognize that climate vulnerability is not a label for communities or populations. Rather, it occurs when long-standing and systemic patterns of inequity drive differential exposure, sensitivity and adaptive capacity to climate hazards." Public Health Agency of Canada. (2022, October 25). *Mobilizing public health action on climate change in Canada: Chief Public Health Officer's report on the state of public health in Canada 2022*. Government of Canada. https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/state-public-health-canada-2022/report.html#sec14

[17] From the IPCC AR5 framework as presented in ISO 14091

[18] See p.54 of: Zebisch, M., Schneiderbauer, S., Renner, K., Below, T., Brossmann, M., Ederer, W., & Schwan, S. (2017). *Risk supplement to the vulnerability sourcebook: Guidance on how to apply the Vulnerability Sourcebook's approach with the new IPCC AR5 concept of climate risk*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.adaptationcommunity.net/wp-content/uploads/2017/10/GIZ-2017_Risk-Supplement-to-the-Vulnerability-Sourcebook.pd

[19] The J-100 risk and resilience standard developed by the American Water Works Association also defines risk as the product of vulnerability, likelihood and consequence: Risk = Threat Likelihood × Consequence

Vulnerability Scoring

The following definitions were taken from ISO 31000 and ISO 14091 and serve as foundational concepts for vulnerability scoring:

- **Vulnerability (V):** Intrinsic properties of something resulting in susceptibility to a risk source.[20]
- **Sensitivity (S):** Degree to which a system or species is affected, either adversely or beneficially, by climate variability or change.
- **Adaptive Capacity (AC):** Ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences.

Vulnerability scores are determined by multiplying sensitivity and adaptive capacity:[21]

$$V = S * AC$$

Sensitivity Scoring

Sensitivity for each sector sub-class was evaluated based on local historical evidence; calculations based on data, published studies and relevant literature; or subject matter expertise.

Sensitivity was evaluated on a one to five scale as defined in Table 4.

Table 4. Sensitivity scale.

Sensitivity Value	
1	Very Low
2	Low
3	Moderate
4	High

× Vulnerability. See: Chen, T. Y.-J., Washington, V. N., Aven, T., & Guikema, S. D. (2020). Review and evaluation of the J100-10 risk and resilience management standard for water and wastewater systems. Risk Analysis, 40(3), 608–623. https://doi.org/10.1111/risa.13421

[20] "It is important to recognize that climate vulnerability is not a label for communities or populations. Rather, it occurs when long-standing and systemic patterns of inequity drive differential exposure, sensitivity, and adaptive capacity to climate hazards." Public Health Agency of Canada. (2022, October 25). *Mobilizing public health action on climate change in Canada: Chief Public Health Officer's report on the state of public health in Canada 2022*. Government of Canada. https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/state-public-health-canada-2022/report.html#sec14

[21] For additional information on the concept of vulnerability within the CCRVA framework, see the Vulnerability Assessment Memo.

Sensitivity Value	
5	Very High

Adaptive Capacity Scoring

The capacity of each system to respond to climate stressors was assessed in a similar manner, considering the following:

1. Previous adaptations and emergency response plans;
2. Financial and human resources available for adaptation; and
3. Social networks and institutional capacity to support vulnerable groups.

Adaptive capacity was evaluated on a one to five scale defined as defined in Table 5.

Table 5. Adaptive capacity scale.

Adaptive Capacity Value	
1	Very High
2	High
3	Moderate
4	Low
5	Very Low

Vulnerability Score Matrix

The multiplication of sensitivity and adaptive capacity scores results in the vulnerability score and determines the vulnerability ranking. As shown in Table 6, the scoring is inverse for sensitivity versus adaptive capacity. For example, a "Very High" sensitivity gets a score of 5, but a "Very Low" adaptive capacity gets a score of 5 so that the conditions leading to high vulnerability are represented by the highest scores in both cases.

Table 6. Vulnerability matrix scoring used for ranking impact statements.

		Sensitivity				
		Very Low	Low	Moderate	High	Very High
Adaptive	Very High	1	2	3	4	5

		Sensitivity				
Capacity	High	2	4	6	8	10
	Moderate	3	6	9	12	15
	Low	4	8	12	16	20
	Very Low	5	10	15	20	25

Table 7. Vulnerability score ranges by vulnerability ranking categories.

Vulnerability Score Range	Vulnerability Ranking
1-2	Very Low
3-4	Low
5-9	Moderate
10-16	High
20-25	Very High

Likelihood Scoring

Likelihood scoring is used to assess the likelihood that a specific climate hazard, such as extreme heat, flooding or winter storms, will occur within a defined future timeframe. In the context of Toronto's CCRVA, likelihood scores were derived based on how climate indicators driving the hazards in scope are projected to change under two climate scenarios (SSP2-4.5 and SSP5-8.5) across four time periods: current climate, 2015 to 2040, 2040 to 2070, and 2070 to 2100. This approach helps distinguish between risks that are imminent and those that are more uncertain or long-term. Likelihood scores are then combined with assessments of vulnerability and consequence to generate overall risk scores, which support the prioritization of risks across systems and timeframes.

Climate indicators were assigned as hazard drivers for each of the 11 hazards in scope based on the TRCA's Toronto's Current and Future Climate Report.[22] Likelihood scores

[22] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate. Toronto and Region Conservation Authority (TCA). Prepared for the City of Toronto.

were assigned to each indicator following the likelihood scoring scale in Table 8.[23] Final likelihood scores were assigned to each of the 11 related climate hazards by taking the average likelihood score for all underlying climate drivers. Table 9 presents the likelihood scores by hazard for each climate scenario and time horizon in scope.[24] Likelihood scores are increasing for extreme heat, climate-related air quality hazards, ecosystem changes, extreme precipitation, increase in temperatures, and total precipitation. Climate indicators related to drought, high winds and winter/ice storms remain relatively similar, resulting in no change in likelihood score, while freeze-thaw cycles and very cold days and extreme cold see their likelihood scores decrease over time for both climate scenarios.

Table 8. Likelihood scoring scale.

Climate Indicator Change	Likelihood Score
50–100 per cent reduction in frequency or intensity with reference to the baseline mean	1
10–50 per cent reduction in frequency or intensity with reference to the baseline mean	2
Baseline mean conditions or a change in frequency or intensity of ±10 per cent with reference to the baseline mean	3
10–50 per cent increase in frequency or intensity with reference to the baseline mean	4
50–100 per cent increase in frequency or intensity with reference to the baseline mean	5

Table 9. Projected changes in climate hazard likelihood for different time periods under a medium emissions scenario. ↑↑ indicates a large increase in likelihood, ↑ indicates a moderate increase, ↓ indicates a decrease and - indicates that the likelihood of the climate hazard occurring will remain relatively similar to present conditions.

Hazard	2030s	2050s	2080s

[23] Likelihood score scales were based on the approach described in the PIEVC High Level Screening guide: Public Infrastructure Engineering Vulnerability Committee (PIEVC). (2022). *PIEVC High Level Screening Guide: A guide to completing screening level climate change risk assessments using the PIEVC process*. International Climate Initiative. https://www.international-climate-initiative.com/PUBLICATION1695-1

[24] Likelihood scores for historic climate conditions are set to a baseline value of three.

Extreme Heat and Very Hot Days	↑↑	↑↑	↑↑
Increase in Temperatures	↑	↑	↑↑
Ecosystem Changes	↑	↑	↑
Climate-related Air Quality	-	↑	↑↑
Extreme Precipitation	-	↑	↑
Total Precipitation	-	-	↑
High Winds/Tornadoes	-	-	-
Drought	-	-	-
Winter/Ice Storms	-	-	-
Very Cold Days	↓	↓	↓
Freeze-thaw Cycles	↓	↓	↓

Consequence Scoring

Consequence scoring is used to assess the severity of each impact across five consequence categories: service functionality; economy; health and security; environment; and disruption and social cohesion. Each category is assigned a score from one to five, based on definitions drawn from *Climate Change Adaptation Planning: A Guide for Municipal Bodies* by Ouranos[25] and Toronto's Hazard Identification and Risk Assessment (HIRA) method.[26]

[25] Ouranos. (2024). Climate change adaptation planning: A guide for municipal bodies. Ouranos. Retrieved from https://www.ouranos.ca

[26] City of Toronto. (2021). *Emergency Plan* (2020 Update). https://www.toronto.ca/wp-content/uploads/2021/01/9740-Emergency-Plan-2020-Update-2021-01-21-AODA-Compliance.pdf

Two sets of definitions are used to ensure consistency while allowing flexibility in interpretation. The Ouranos scale provides broader definitions suitable for city-level risk assessments, while the HIRA scale offers more detailed definitions from an emergency management perspective.

This dual approach allows for nuanced scoring across a wide range of impact statements, depending on the nature of the impact being assessed. Consequence scores by category for each impact statement are included in the risk register and consequence scale definitions for each category are presented in Appendix D.1

Table 10. Example consequence score definitions for health and security.

Risk Score Range	Risk Ranking	Ouranos Definition	HIRA Definition[27]
1	Negligible	No significant health consequences. No potential for deaths or other consequences that irreversibly reduce the quality of life.	Not likely to result in significant impacts to individuals' mental and emotional well-being.
2	Minor	Engenders quickly reversible health consequences. No potential for death or other consequences that irreversibly reduce the quality of life.	Localized, short-term impacts to individuals' mental and emotional well-being that can be addressed immediately with psychosocial supports.
3	Moderate	Low potential for deaths. Significant potential for other consequences that irreversibly reduce the quality of life.	Localized, moderate, and/or medium-term impacts to individuals' mental and emotional well-being.
4	Major	Significant potential for deaths and other consequences that irreversibly reduce the quality of life	Significant long-term but localized impacts to individuals' mental and emotional well-being.
5	Very High	Deaths anticipated and consequences that are hard to avoid that irreversibly reduce the quality of life.	Widespread, potentially long-term impacts to individuals' mental and emotional well-being, including those not directly affected by the incident.

[27] The HIRA scale for psychosocial well-being was used to complement the physical consequence scales from Ouranos. Although HIRA also includes a scale for injury or illness, it was considered more applicable to emergency management contexts than to a city-wide CCRVA.

Risk Scoring

Risk scores are calculated for each impact statement by multiplying the vulnerability score by the consequence score and then by the likelihood score for each time period and climate scenario considered. This process generates seven risk scores per impact statement: one for the current period, three under the SSP2-4.5 scenario, and three under the SSP5-8.5 scenario. A risk ranking is then assigned based on the scale presented in Table 11.

The full list of impact statements, along with their associated vulnerability, consequence and likelihood scores, is summarized in an Excel-based risk register.

Table 11. Risk score ranges by risk ranking categories.

Risk Score Range	Risk Ranking
1-19	Low
20-29	Medium-Low
30-39	Medium-High
40-59	High
60+	Very High

Engagement Approach

The engagement approach for the CCVRA involved working with an internal Advisory Group and internal Working Group. The process involved their technical review and the development of decision-making criteria to support the design and implementation of the risk assessment. A key goal of the engagement was to ensure input was being captured by city staff who are involved with divisions that manage assets, programs or services that are likely to be affected by the impacts of climate change. Their involvement in the process supports the development and use of results that are relevant to departmental priorities.

The Working Group was composed of the City's Climate Resilience Team, including representatives from 22 city divisions and five city agencies that manage assets, deliver policy and programs and work with communities to plan for and respond to climate change. Members of the Working Group are tasked with acting as expert advisors on behalf of their organization. The Advisory Group represented a subset of the Climate Resilience Team more involved in shaping the risk assessment work.

The groups were engaged through a series of four online and two in-person workshops, and their feedback was collected both at the sessions and asynchronously. The workshops typically included a presentation, collaborative group work, and discussion on various deliverables within the CCVRA process. These included, but were not limited to, a Boundary of Assessment; a Hazards, Risk and Impact Memo; and an Adaptation Actions Memo.

Limitations of the Risk Assessment

It is important to acknowledge that the risk assessment process is not an exact science. Rather, it is a subjective methodology that reflects participants' perceptions of the risks associated with climate change impacts in the city of Toronto. The outcomes of the assessment are inherently influenced by the knowledge, experience and perspectives of those who contributed.

Although considerable effort was made to engage a diverse and representative group of key stakeholders from across the community, the findings may not fully capture the breadth of perspectives that exist within the region. Furthermore, while the impact statements used in the assessment are not without limitations, substantial care was taken to ensure the list was comprehensive and inclusive, reflecting a wide range of potential climate-related and extreme weather impacts relevant to the city of Toronto.

4. Climate Change and Hazards

The following section incorporates information on how Toronto's climate has changed over the past century and how local climate change scenario projections will impact climate variables over the coming century (provided by the TRCA's Toronto's Current and Future Climate Report).[28]

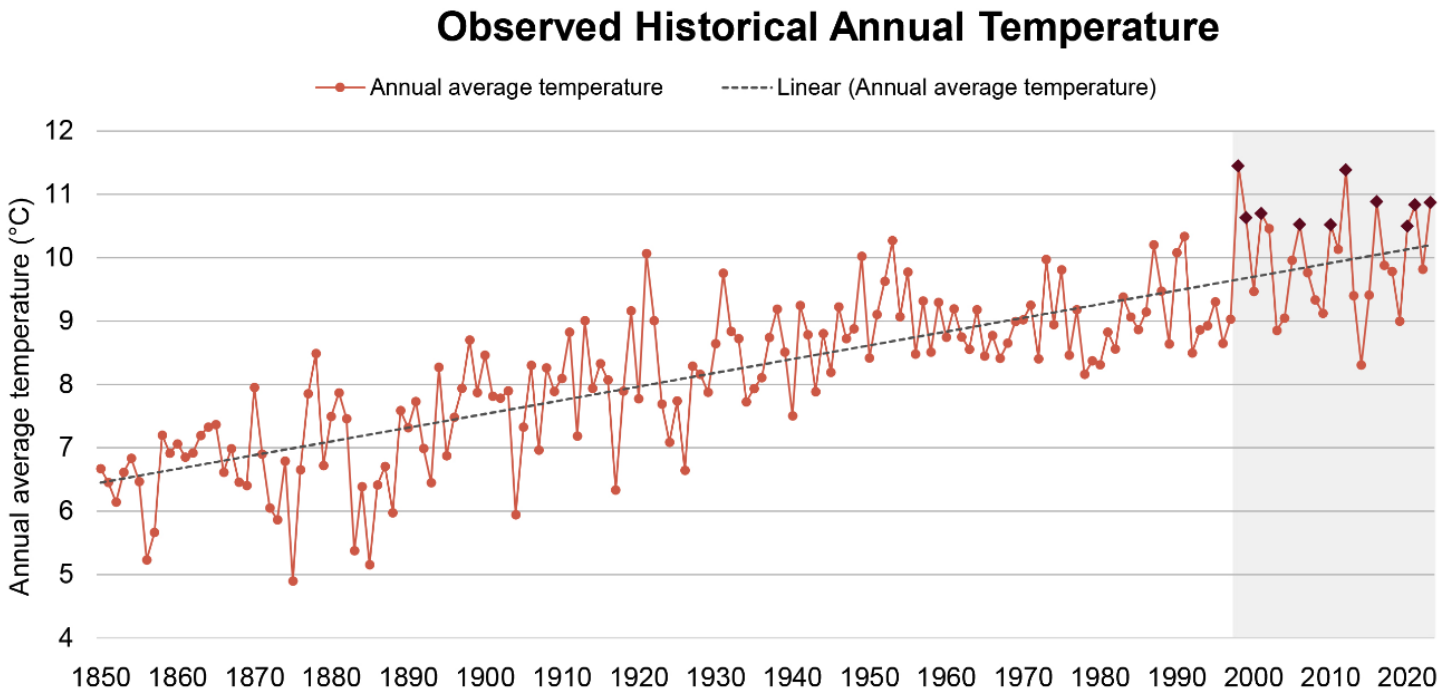
4.1 Toronto's Climate is Changing

The impacts of extreme weather and climate-related events can be wide-ranging, affecting people's daily lives, their health and safety and their homes, as well as infrastructure, businesses, the economy and the natural environment. In the last 20 years, Toronto has seen at least four intense storms (August 2005, July 2013, August 2018, and July 2024) that have resulted in significant impacts for the city. In addition, monthly temperatures and the number of very hot days (e.g. daily maximum temperature above 30 C) have increased, with warmer winters and earlier spring onset. For example, between 1961 and 1990 and 1991 and2020, December temperatures have warmed by 1.4 C, and the average number of very hot days has increased by approximately four days, reaching an average of 14 very hot days per year.

Toronto's annual average temperature is increasing, with warmer-than-average years in recent decades. Since 1850, Toronto's annual average temperature has been increasing by approximately 0.2 °C per decade, with the 10 warmest years all occurring since 1998. Since 1980, each decade has been warmer than the last. This warming trend is expected to continue over the course of this century. The linear trend of annual temperature over the past 170 years demonstrates this steady increase in the city's annual average temperature (Figure 1).

[28] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate. Toronto and Region Conservation Authority (TRCA). Prepared for the City of Toronto.

Figure 1. Observed historical annual average temperature (1850-2023) based on data from the Toronto City climate station. Source data: Historical Climate (Toronto City climate station) (Source: TRCA)



Rank	Year
1	1998
2	2012
3	2016
4	2023
5	2021
6	2001
7	1999
8	2006
9	2010
10	2020

Climate change is putting people's health, safety and livelihoods at increasing risk, and the costs of climate change are rising across Canada.[29] According to the Insurance Bureau of Canada, insured damages from catastrophic weather events exceeded $3 billion in 2023 and $8.5 billion in 2024.[30] Some of Canada's costliest severe weather events based on insured losses have occurred in Toronto and its surrounding areas.

[29] Berry, P. and Schnitter, R. (Eds.). (2022). Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. Ottawa, ON: Government of Canada.

[30] Insurance Bureau of Canada, "2024 Shatters Record for Costliest Year for Severe Weather-Related Losses in Canadian History at $8.5 Billion," *Insurance Bureau of Canada* (news release, January 13, 2025), accessed September 2, 2025, https://www.ibc.ca/news-insights/news/2024-shatters-record-for-costliest-year-for-severe-weather-related-losses-in-canadian-history-at-8-5-billion.

4.2 Climate Change Scenarios and Climate Indicators

4.2.1 Future Climate Scenario Projections

In December 2024, the City of Toronto released Toronto's Current and Future Climate report.[31] This study, undertaken by the TRCA, examines how Toronto's climate has changed, and how the city's climate conditions could look in the near, mid- and long-term future. Shared Socio-economic Pathways, or SSPs, were used as climate scenarios for analyzing the impact of climate change from 2015 to 2100.[32] SSPs are emissions-based narratives that provide different characteristics of country-level population, gross domestic product (GDP), socio-economic development and urbanization projections, which can be used to derive climate change projections. They are used by the IPCC and are related to the previous generation of global GHG emissions scenarios (RCPs).

The SSPs climate simulations are based on the sixth phase of the Coupled Model Intercomparison Project (CMIP6), an international climate modelling project designed to better understand past, present and future climate changes.[33] The SSPs include:

- SSP1-1.9 (Limit Warming to 1.5 C);
- SSP1-2.6 (Sustainability: Taking the Green Road);
- SSP2-4.5 (Middle of the Road);
- SSP3-7.0 (Regional Rivalry: A Rocky Road); and
- SSP5-8.5 (Fossil-fueled Development: Taking the Highway).[34]

Only the very low emissions SSP scenario (SSP1-1.9) would meet the Paris Agreement goal (i.e. hold the increase in the global average temperature to well below 2 °C and pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels).[35] Currently, the world is tracking somewhere between the medium (SSP2-4.5) and the very high (SSP5-

[31] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate: Appendices. Toronto and Region Conservation Authority. Prepared for the City of Toronto.

[32] Ibid.

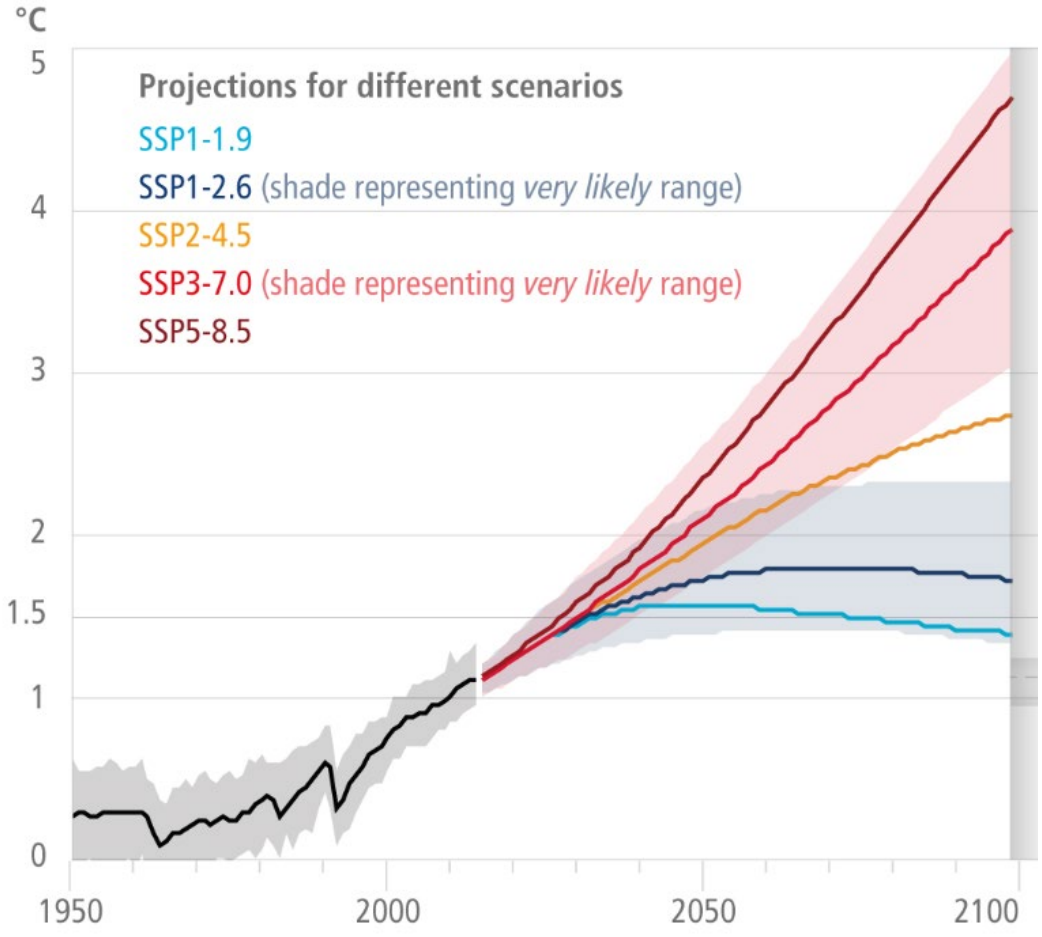
[33] CMIP is a project of the World Climate Research Programme (WCRP)'s Working Group of Coupled Modelling (WGCM). Since 1995, CMIP has coordinated climate model experiments involving multiple international modelling teams worldwide. Phases of CMIP have historically been designed to align with IPCC assessment reports. CMIP model simulations have also been regularly assessed as part of the IPCC Climate Assessments Reports and various national assessments. https://wcrp-cmip.org/cmip6/

[34] The Shared Socio-Economic Pathways (SSPs): An Overview. https://unfccc.int/sites/default/files/part1_iiasa_rogelj_ssp_poster.pdf; Government of Canada. CMIP6 climate scenarios. https://climate-scenarios.canada.ca/?page=cmip6-scenarios

[35] UNFCCC. (2015). The Paris Agreement. https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf; UNFCCC. https://unfccc.int/process-and-meetings/the-paris-agreement

8.5) emissions scenarios, which translate to an estimated increase of global average temperature by 2.7 °C and 4.4 °C of global warming by the end of the century (Figure 2), respectively.[36] The TRCA study chose to focus on the medium and very high emissions scenarios to illustrate possible climate futures for Toronto.

Figure 2. Projected changes in global surface temperature (C) compared to 1850-1900 under five illustrative climate scenarios: very low emissions (SSP1-1.9), low emissions (SSP1-2.6), medium emissions (SSP2-4.5), high emissions (SSP3-7.0) and very high emissions scenario (SSP5-8.5). Source: IPCC Sixth Assessment Report, Working Group II, Technical Summary



[36] Intergovernmental Panel on Climate Change (IPCC). (2023) Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.; International Energy Agency (IEA). (2023). Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach, IEA, Paris. https://www.iea.org/ reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach

Two climate scenarios (SSP2-4.5and SSP5-8.5) and 54 modelled climate variables were used in the study to illustrate the impacts of possible climate change pathways and differing GHG emissions reduction targets for the city of Toronto. These scenarios are described in more detail below:[37] [38]

1. **The SSP2-4.5 Scenario** illustrates a "middle-of-the-road" socio-economic development pathway that looks similar to historical development patterns wherein global population growth is moderate and levels off in the second half of the century; income growth is uneven across different countries; some limited cooperation between countries; environmental systems face some degradation; and there is slow progress in achieving sustainable development goals. Carbon dioxide (CO_2) emissions are expected to peak around 2040 and decline over the remainder of the century.

2. **The SSP5-8.5 Scenario** illustrates a fossil-fueled development pathway with intensive exploitation of fossil fuels, a high percentage of coal use and energy-intensive lifestyles worldwide; global markets increasingly integrated leading to innovations and technological progress; and some local environmental problems being tackled successfully, such as air pollution. CO_2 emissions are expected to continue to climb and peak around 2090 before they start to decline.

4.2.2 TRCA Climate Scenario Analysis

Toronto's Current and Future Climate report updated climate projections for the city by modelling historical and future projections to derive a comprehensive set of 12 climate parameters and 54 climate variables. These variables help to illustrate how Toronto's climate is changing already and how future climate may change across key climate change indicators such as temperature, extreme heat, extreme cold, precipitation, extreme precipitation, frost-free season and growing degree days.[39]

[37] For this report, modelled historical and future daily projections were obtained through PAVICS (Power Analytics and Visualization for Climate Science). Climate data for the latest SSP climate scenarios as used in the IPCC's most recent Sixth Assessment Report were added to PAVICS in January 2023. Statistically downscaled daily data from 26 GCMs were used to derive almost all of the 54 climate variables included in this study, except for the humidex variables which were based on 19 GCMs. Daily climate projections were obtained from PAVICS and then exported to R Studio to produce summary data tables for one historical reference period (1971-2000) and three future periods (2015-2040, 2041-2070, and 2071-2100). The short-term future period starts in 2015 because this is the year that the future projections begin for the latest SSP climate scenarios. Although 2015-2040 is slightly less than 30 years, it aligns with when the modelling of future emissions begins. The short-, medium- and long-term projected futures are compared against the historical 1980s period to help characterize the extent, direction and magnitude of change that we may see in the future.

[38] Riahi et al.. 2017. The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global Environmental Change. https://doi.org/10.1016/j.gloenvcha.2016.05.009

[39] Almost all of these climate variables were derived from a total of 26 GCMs, except for the humidex variables, which were based on 19 GCMs.

At the request of the City of Toronto, much of the information presented in Section 4.1 and 4.2, including figures, captions and some text, is excerpted directly from the TRCA report.[40] This was done for clarity and consistency, reflecting that a primary purpose of the TRCA climate projections project was to provide inputs to the CCRVA.

Key Projected Changes in Climate Variables

The key projected trends over this century under SSP2-4.5 and SSP5-8.5 scenarios for the city of Toronto include:

- **Warmer temperatures and intensified heat events**: Average annual temperature will continue to rise and there will be more extreme heat days above 30 C.
- **Increases in extreme precipitation events**: Increases in extreme precipitation is expected with an increase in severe rainfall over short periods of time, increasing the occurrence of flooding and erosion.
- **Fewer cold days and less snow**: A decline in cold days below – 20 °C is expected. Less cold weather will also result in less precipitation falling as snow.
- **Longer frost-free season**: Extended warm-weather periods will benefit agricultural production but will increase the growth and spread of insects and pests.

Detailed Scenario Projections for Climate Indicators

The TRCA study examined possible future climate scenarios for Toronto over the course of this century using two SSP climate scenarios: SSP2-4.5 and SSP5-8.5, as described above. Extreme heat and extreme precipitation variables are expected to increase under both climate scenarios. Extreme cold is expected to decrease, along with heating demand for buildings. Meanwhile, cooling demand for buildings is expected to increase. The detailed key changes in climate variables are outlined below.

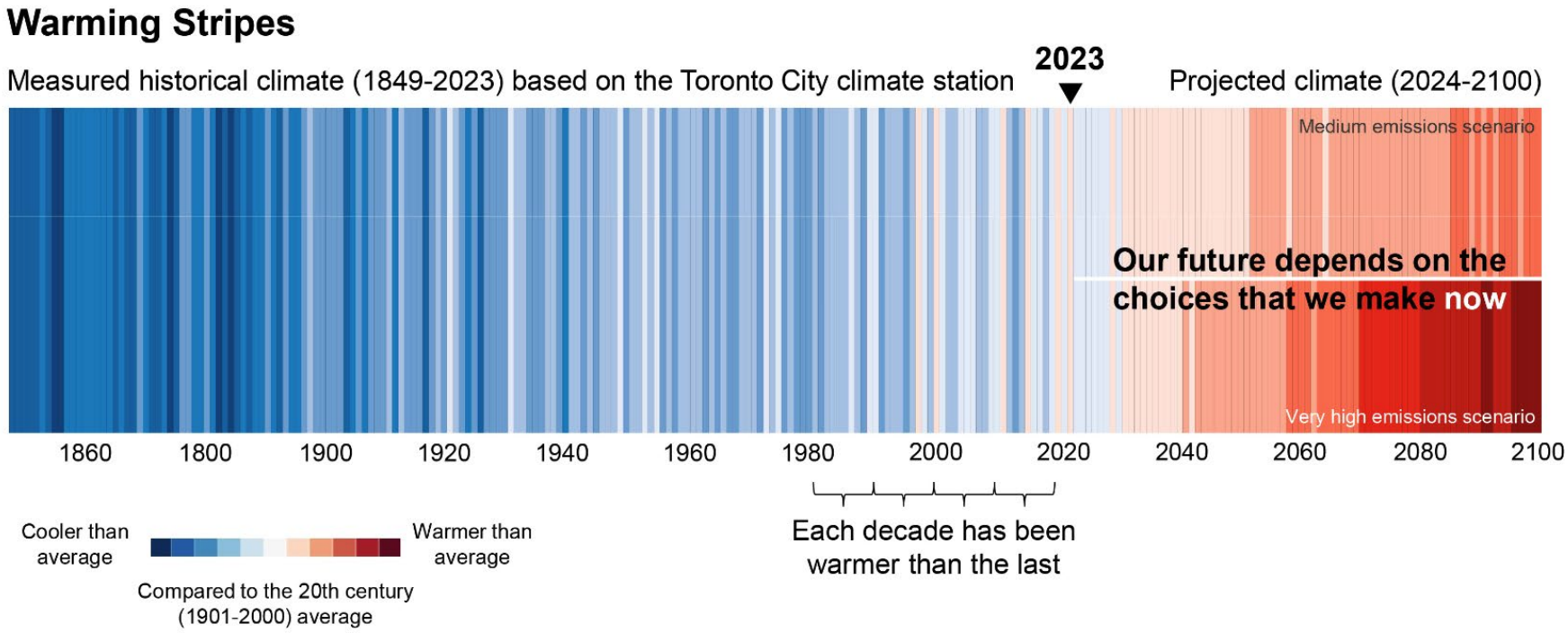
Trends in Temperature

Over the short- to mid-term (2030s to 2040s), annual average temperature warming trends are anticipated under the SSP2-4.5 and the SSP5-8.5 scenarios. By the 2050s, average temperatures heat up more under the very high emissions scenario (SSP5-8.5). By the end of the century, the temperature differences between the two scenarios increase — leading to a future Toronto that may be 6 °C warmer by the end of the century under SSP5-8.5 (2 °C temperature greater than under SSP2-4.5).

[40] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. 2024. Toronto's Current and Future Climate: Appendices. Toronto and Region Conservation Authority. Prepared for the City of Toronto.

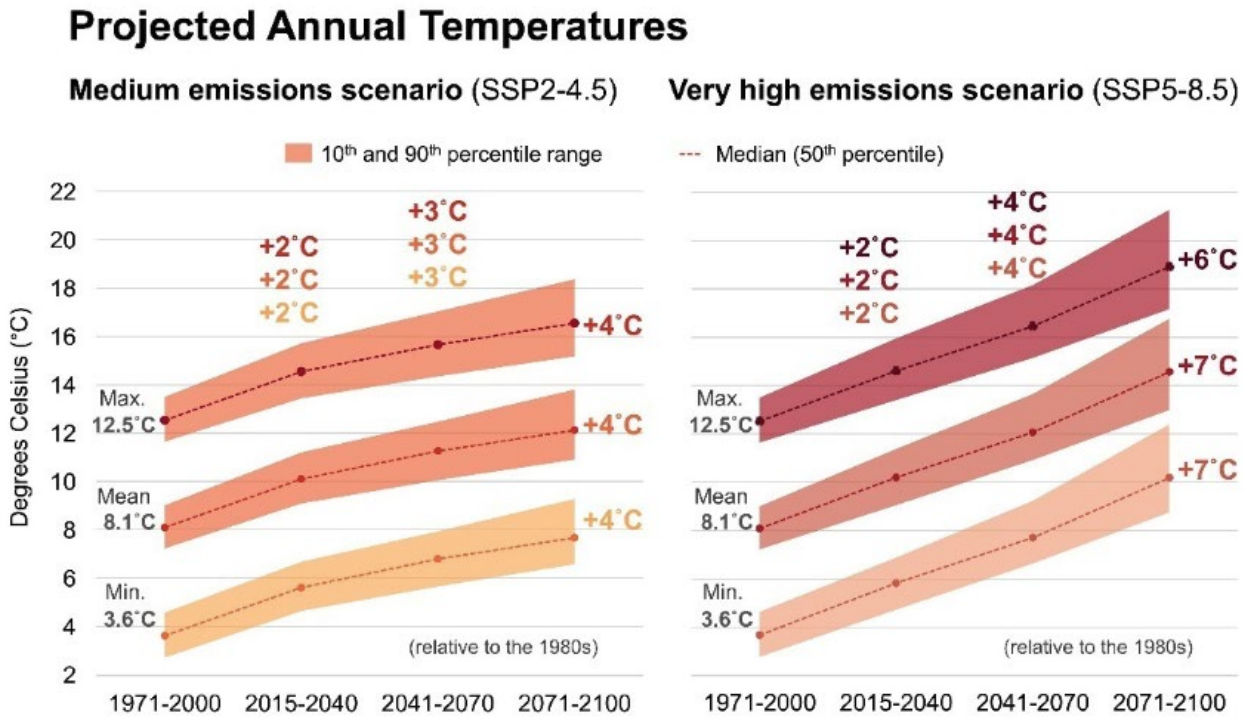
This is illustrated in Figure 3, where each bar in the figure shows the difference in annual average temperature for each year compared to the average temperature over the 20th century (1901-2000). Warmer than average years are represented by red stripes and cooler years are represented by blue stripes. The darker the stripe colour, the greater the difference from the 20th century average.

Figure 3. Warming stripes represent the change in historical annual average temperature (1849-2023) based on data from the Toronto city climate station and projected annual average temperature (2024-2100) under the medium emissions (SSP2-4.5) and very high emissions scenarios (SSP5-8.5).



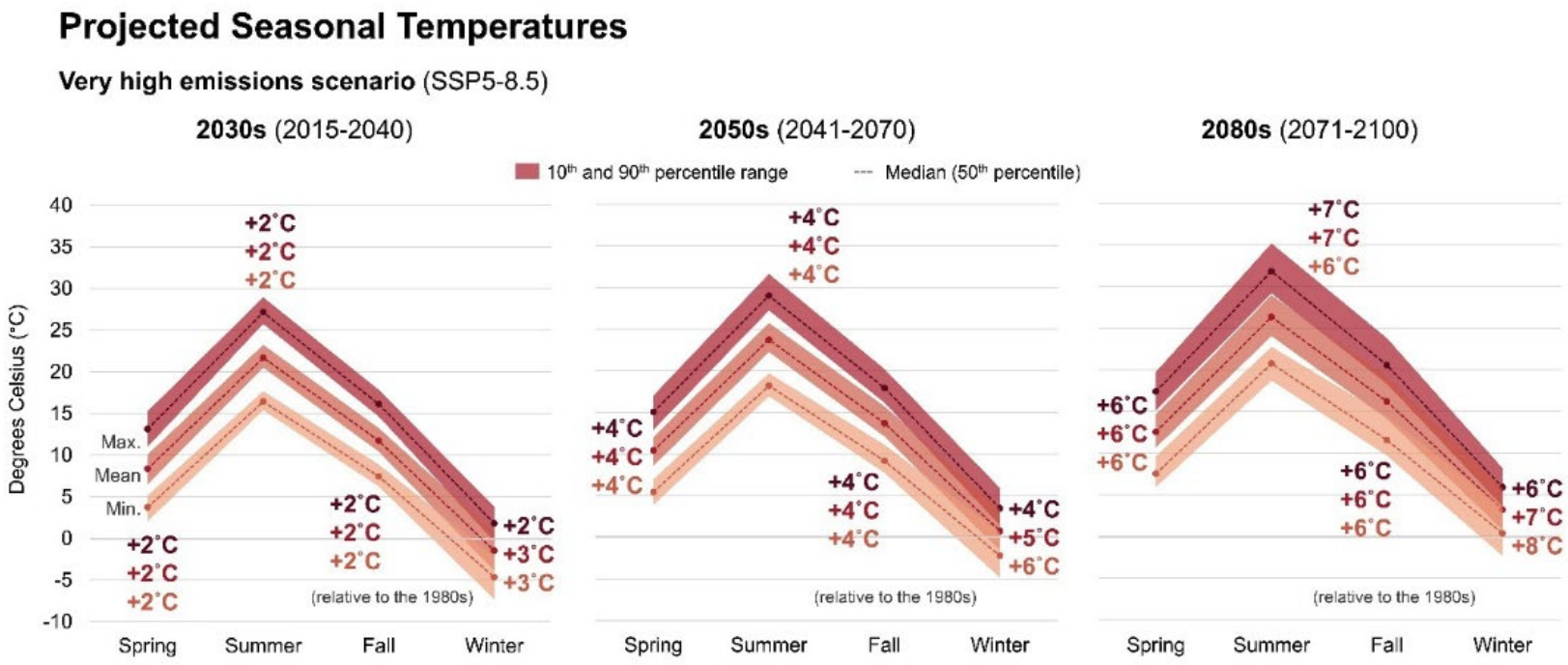
The gradient of projected annual average temperatures is illustrated in Figure 4 for SSP2-4.5 and SSP5-8.5. In the medium emissions scenario, the projected increase in annual mean, minimum and maximum annual temperatures is 2 °C (2015-2040), 3 °C (2041-2070) and 4 °C (2071-2100), respectively. In the very high emissions scenario, projected annual temperatures are higher by the 2040s, with increases of 4 °C (2041-2070) and 6 °C to 7 °C by 2071 to 2100.

Figure 4. Projected annual temperatures (maximum, mean and minimum) under the medium emissions (SSP2-4.5) and very high emissions scenarios (SSP5-8.5), with differences in median values compared to 1971-2000 (modelled historical).



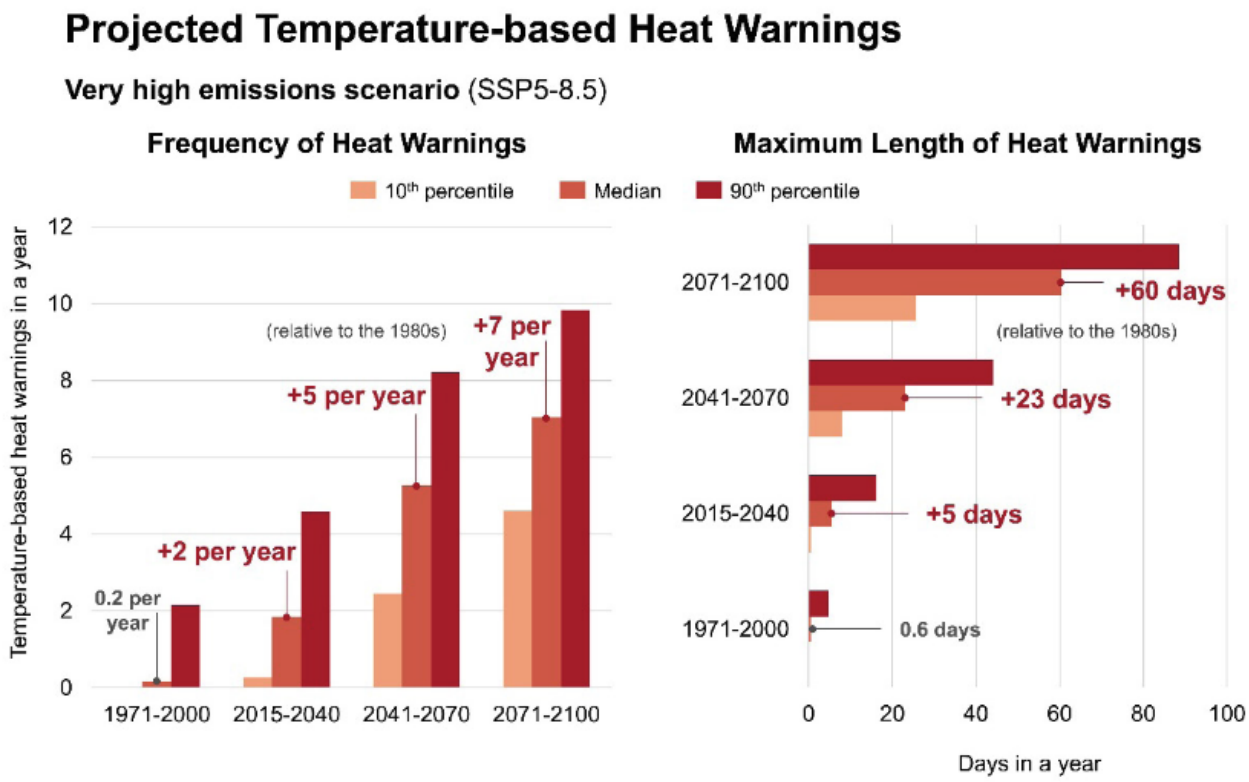
Seasonal temperatures are expected to increase under both scenarios. Warmer maximum, mean and minimum temperatures are expected across all seasons, bringing hotter summers, warmer winters and greater variability in temperatures (Figure 5). Under SSP5-8.5, winter temperatures are expected to increase the most compared to the 1980s, with greater increases in winter mean and minimum temperatures (2 °C to 3 °C in 2030s; 4 °C to 6 °C in 2050s; and 6 °C to 8 °C in 2080s). This may, in turn, influence energy management, recreation, agriculture, infrastructure, the spread of pests and diseases, water availability and ecosystem health.

Figure 5. Projected seasonal temperatures (maximum, mean, and minimum) under the very high emissions scenario (SSP5-8.5), with differences in median values compared to 1971-2000 (modelled historical)



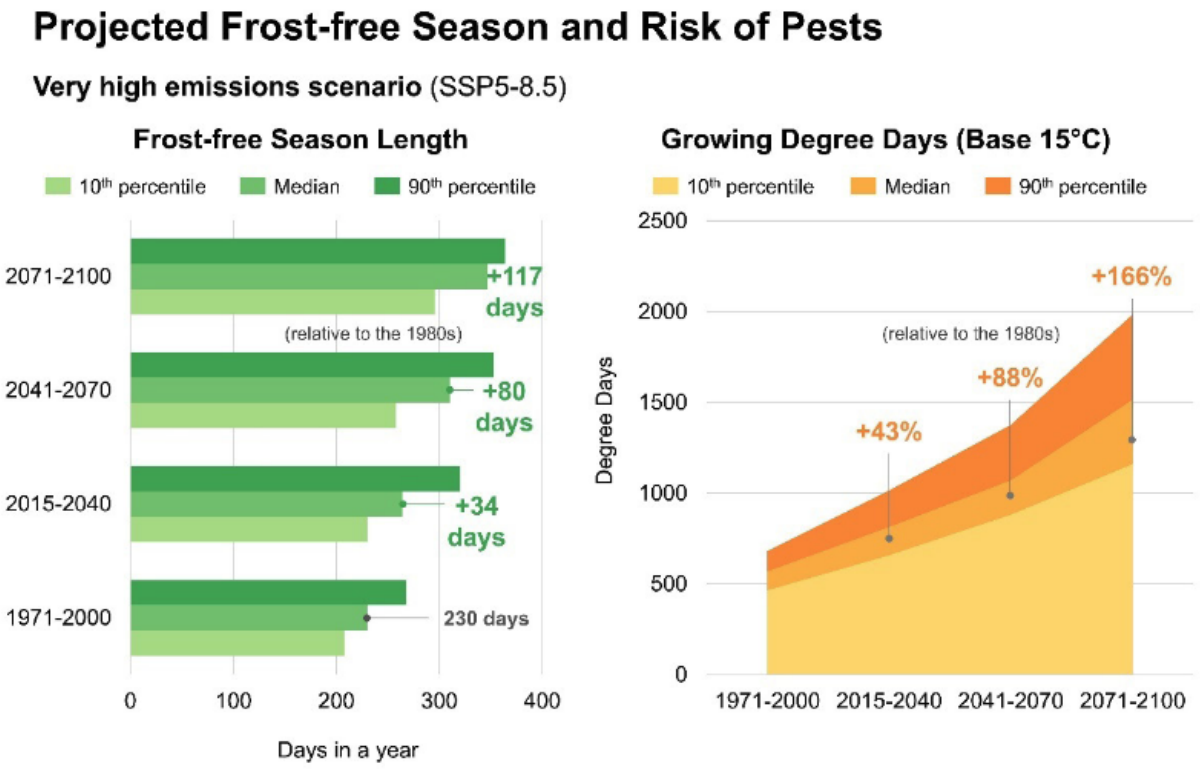
Extreme heat is expected to become more frequent and intense and last longer. Under both scenarios (SSP2-4.5 and SSP5-8.5), the number of very hot days with daily maximum temperatures above 30 °C and 35 °C is anticipated to increase. Greater increases are anticipated under the very high emissions scenario wherein days above 30 °C could increase by more than two months' time by the end of the century compared to the 1980s (Figure 6). The number of days with high humidity is also anticipated to increase, bringing more uncomfortable and dangerously hot conditions.

Figure 6. Projected number of temperature-based heat warnings in a year (left) and maximum consecutive temperature-based heat warning days (right) under the very high emissions scenario (SSP5-8.5), with differences in median values compared to 1971-2000 (modelled historical).



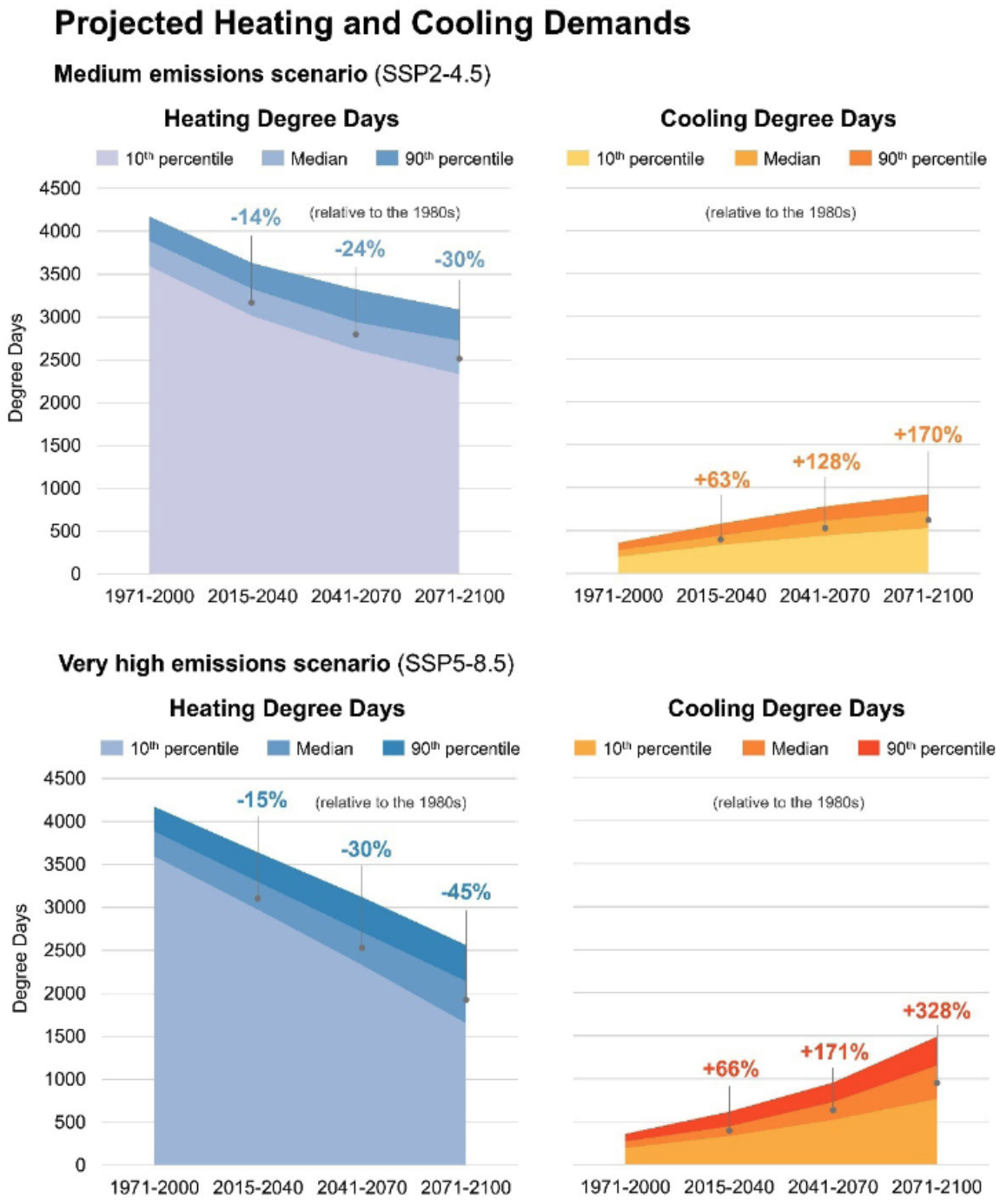
The total number of dry days in a year is expected to increase under both scenarios and dry conditions are also anticipated to last longer. With warmer temperatures anticipated, the frost-free season is expected to stretch over a longer period under both scenarios, starting earlier and ending later. The amount of heat available to support the growth of different crops is anticipated to increase under both scenarios (Figure 7).

Figure 7. Projected frost-free season length (left) and growing degree days with base temperature of 15 °C (right) under the very high emissions scenario (SSP5-8.5), with differences in median values compared to 1971-2000 (modelled historical).



Under both climate scenarios, heating demand for buildings is expected to decrease, while cooling demand is expected to increase. Cooling demand is anticipated to increase more significantly under SSP5-8.5 compared to SSP2-4.5. By the end of the century, heating demand may decrease by 30-45 per cent compared to the 1980s, while cooling demand may nearly triple or more than quadruple compared to the 1980s, depending on the climate scenario (Figure 8).

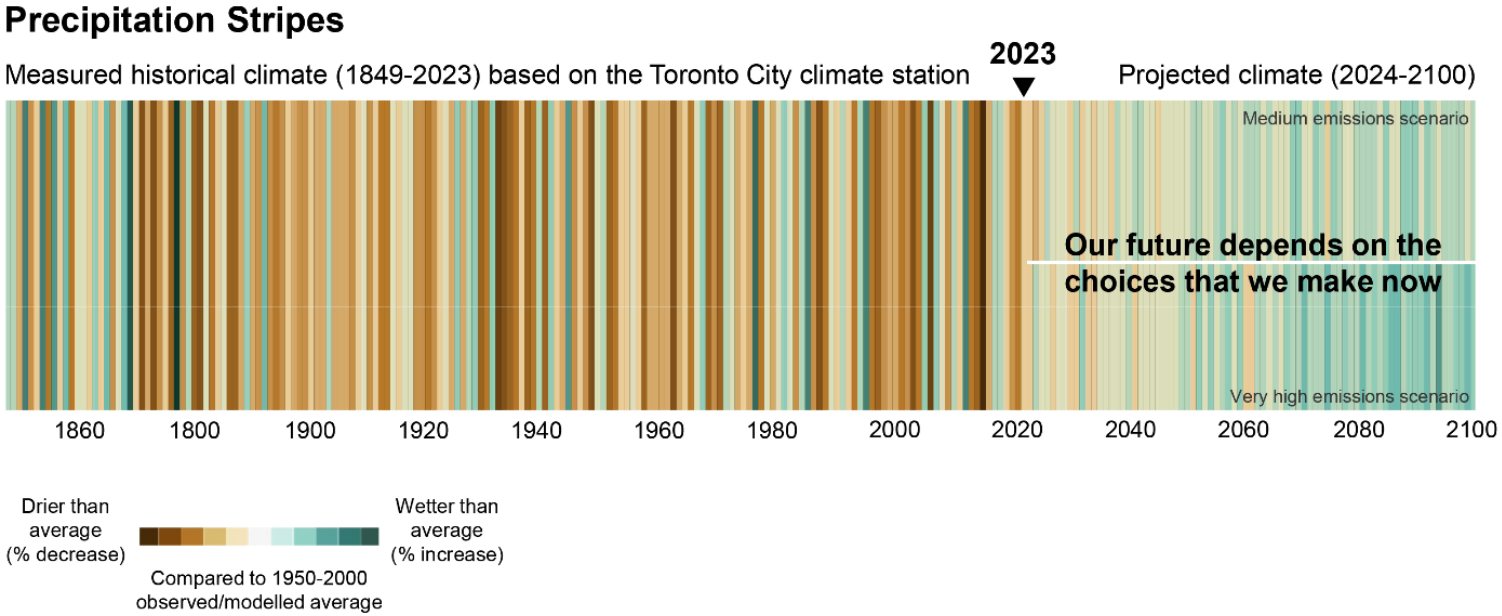
Figure 8. Projected changes in heating and cooling degree days under the medium emissions scenario (SSP2-4.5) and very high emissions scenario (SSP5-8.5), with percentage differences in median values compared to 1971-2000 (modelled historical).



Trends in Precipitation

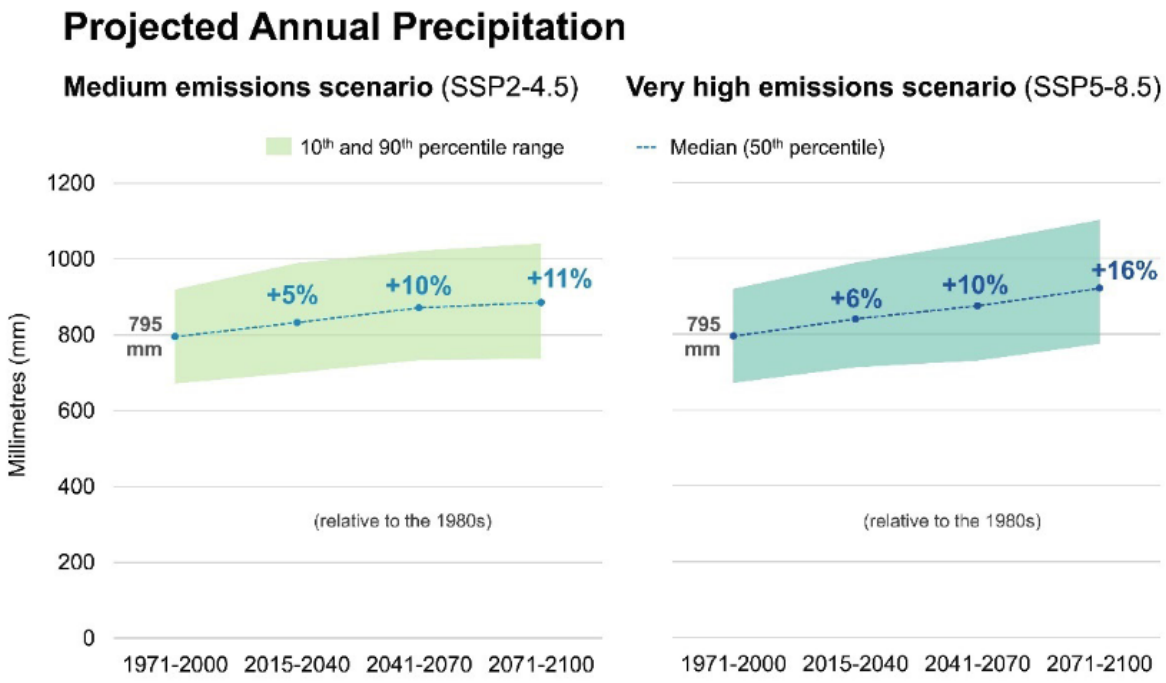
Annual precipitation and extreme precipitation are anticipated to increase under both scenarios, with greater increases in wetter-than-average conditions anticipated under SSP5-8.5 compared to SSP2-4.5. Figure 9 illustrates measured historical precipitation up until 2023 and projected annual total precipitation for 2024 to 2100. Each bar shows the percentage increase or decrease in annual total precipitation for each year compared to the average precipitation between 1950 and 2000. Measured historical precipitation (1849-2023) is compared to the observed average, while projected future precipitation (2024-2100) is compared to the modelled historical average. Wetter-than-average conditions are represented by green stripes and drier-than-average conditions are represented by brown stripes. The darker the stripe colour, the greater the difference from the 1950-2000 average (either observed or modelled).

Figure 9. Precipitation stripes showing changes in measured historical annual total precipitation (1849-2023) based on data from the Toronto city climate station and projected annual total precipitation (2024-2100) under the medium emissions (SSP2-4.5) and very high emissions scenarios (SSP5-8.5).



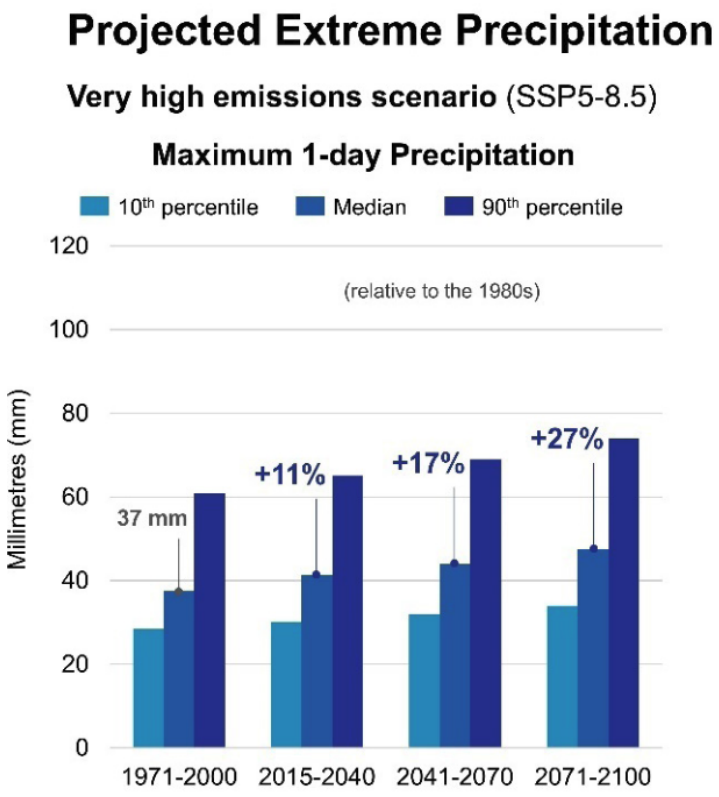
Under both scenarios, annual total precipitation is anticipated to increase compared to the 1980s, with a 5-6 per cent increase by the 2030s and a 10 per cent increase by the 2050s. By the 2080s, annual total precipitation is expected to increase by approximately 11 per cent under SSP2-4.5 and 16 per cent under SSP5-8.5 (Figure 10).

Figure 10. Projected annual total precipitation under the medium emissions scenario (SSP2-4.5) and very high emissions scenario (SSP5-8.5), with percentage differences in median values compared to 1971-2000 (modelled historical).



Extreme precipitation is anticipated to have greater increases under the SSP5-8.5 scenario, especially by the 2080s when maximum one-day precipitation could increase by 27 per cent (Figure 11).

Figure 11. Projected maximum one-day precipitation under the very high emissions scenario (SSP5-8.5), with percentage differences in median values compared to 1971-2000 (modelled historical).



High-Level Trends for Other Climate Variables

In addition to the scenario projections analysis, a literature review of other relevant climate variables was included in the TRCA report to capture other climate-related impacts (e.g. lake level and ice cover changes for Lake Ontario, snow loads, thunderstorms, wind events, wild fire events). The findings include the following:

- Annual average lake levels for Lake Ontario are expected to increase under both scenarios (SSP2-4.5 and SSP5-8.5), with more extreme high and extreme low levels possible.
- Ice cover and ice season length are expected to decrease. Winter over-lake precipitation is also anticipated to increase under the medium emissions scenario (SSP2-4.5).

- Future 50-year return levels of snow loads are anticipated to decrease for southern Canada with more rain-on-snow anticipated during winter under both scenarios.[41]
- The frequency of freezing rain is anticipated to increase over parts of central Canada under the high emissions scenario (SSP5-8.5).[42]
- The number of days with conditions favourable for thunderstorms in Southern Ontario is expected to increase under the high emissions scenario (SSP5-8.5).[43]
- Mean wind speed is expected to increase under the medium emissions scenario (SSP2-4.5) and high emissions scenario (SSP5-8.5) over northern and eastern parts of Canada.[44] Some increases in the future 50-year return levels of three-hourly wind speed and hourly wind gusts over North America are anticipated, as well as increases in the future 50-year return levels of wind speed and pressure, particularly for central and eastern Canada, under both scenarios.[45]
- Increases in the frequency of fire spread days, area burned, fire severity ratings, and risk of poor air quality days due to fire smoke are expected across Canada's forested regions under future climate scenarios.[46]

4.3 Toronto's Climate Hazards and Indicators

Mapping TRCA's Climate Parameters and Indicators by Climate Hazard

As reported in Section 4.2, the TRCA modelled climate scenarios to assess possible future impacts for climate parameters (hazards) and indicators to evaluate how they are expected to change over the short, medium, and long term (2015-2100) in comparison to the 1980s. These were derived from modelled and historical daily climate projections available

[41] Jeong, D. I., & Sushama, L. (2018). Projected changes to extreme wind and snow environmental loads for buildings and infrastructure across Canada. Sustainable Cities and Society, 36, 225–236. https://doi.org/10.1016/j.scs.2017.10.004

[42] Singh, H., Najafi, M. R., & Cannon, A. (2022). Evaluation and joint projection of temperature and precipitation extremes across Canada based on hierarchical Bayesian modelling and large ensembles of regional climate simulations. Weather and Climate Extremes, 36, 100443. https://doi.org/10.1016/j.wace.2022.100443

[43] Huryn, S. M., Mohsin, T., Gough, W. A., & Butler, K. (2020). Determining future thunderstorm-prone environments in Southern Ontario by using statistical downscaling to project changes in convective available potential energy (CAPE). Theoretical and Applied Climatology, 141(3), 1235–1249. https://doi.org/10.1007/s00704-020-03260-x

[44] Jeong, D. I., & Sushama, L. (2018). Projected changes to extreme wind and snow environmental loads for buildings and infrastructure across Canada. Sustainable Cities and Society, 36, 225–236. https://doi.org/10.1016/j.scs.2017.10.004

[45] Ibid.

[46] Wang, X., Parisien, M.-A., Taylor, S. W., Candau, J.-N., Stralberg, D., Marshall, G. A., Little, J. M., & Flannigan, M. D. (2017). Projected changes in daily fire spread across Canada over the next century. Environmental Research Letters, 12(2), 025005. https://doi.org/10.1088/1748-9326/aa5835; Coogan, S. C. P., Robinne, F.-N., Jain, P., & Flannigan, M. D. (2019). Scientists' warning on wildfire—A Canadian perspective. Canadian Journal of Forest Research, 49(9), 1015–1023. https://doi.org/10.1139/cjfr-2019-0094

through PAVICS (Power Analytics and Visualization for Climate Science). Table 12 provides a summary of the TRCA's climate variables (indicators) mapped to the climate hazards that were identified for the city of Toronto.

Table 12. Identification of relevant climate indicators (variables) mapped by climate hazard (climate indicators from the 2024 TRCA Toronto's Current and Future Climate report).

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Temperature Temperature is a direct indicator of climate change as a result of the rise in greenhouse gas concentrations from human activities. Changes in temperature affect agriculture, infrastructure, people's health, water availability, energy use, recreation and ecosystem health.		
Increase in Temperature	**Annual Mean Temperature (C):** Characterizes average temperature conditions over a year. It describes how hot, temperate or cold a place generally is, which drives what plants and animals may grow and thrive and the general temperature conditions that people may experience.	Since 1980, each decade has been increasingly warmer than the last. This increase in temperature is expected to continue under both scenarios. Annual mean temperature could be 4 °C to 6 °C (median) or warmer by the end of the century (median SSP2-4.5 and SSP5-8.5, respectively).
Increase in Temperature	**Seasonal Mean Temperature (C):** Seasonal mean temperature characterizes average temperature conditions within a season. It describes how different seasons may feel, which may, in turn, influence energy management and recreation. It can also influence agriculture, infrastructure, the spread of pests and diseases, water availability and ecosystem health.	Seasonal temperatures are expected to increase under both scenarios. Warmer maximum, mean and minimum temperatures are expected across all seasons, bringing hotter summers, warmer winters and greater variability in temperatures.
Increase in Temperature	**Annual Maximum Temperature (C):** Annual maximum temperature characterizes the highest daily temperature conditions over a year.	Increasing trend from 12.5 °C to 16.6 °C by the end of the century for SSP2-4.5 and 18.9 °C for SSP5-8.5.
Increase in Temperature	**Annual Minimum Temperature (C):** Annual minimum temperature characterizes the lowest daily temperature conditions over a year.	Increasing trend for both scenarios: Annual minimum temperature could be 4 °C to 7 °C (median) or warmer by the end of the century (median for SSP2-4.5 and SSP5-8.5, respectively).

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Extreme Heat and Very Hot Days	**Days Above 35 °C (days/year):** Days above 35 °C describes the number of extremely hot days in a year. Extreme heat puts everyone's health at risk, especially seniors, young children, people with pre-existing conditions, people with limited access to cooling and people who must spend long hours outdoors.	Extreme heat is expected to become more frequent and intense and last longer. The number of very hot days per year with daily maximum temperature above 35 °C is anticipated to increase from 0.0 to 0.5 days (median) under SSP2-4.5 and to 22.6 days (median) under SSP5-8.5.
Extreme Heat and Very Hot Days	**Days Above 30 °C (days/year):** Days above 30 °C describes the number of very hot days in a year. Extreme heat puts everyone's health at risk, especially seniors, young children, people with pre-existing conditions, people with limited access to cooling and people who must spend long hours outdoors.	Days per year above 30C could increase by more than two months' time by the end of the century compared to the 1980s. Under SSP2-4.5, the number of days could increase from 9.9 to 26.6 days, and under SSP5-8.5, the number of days could increase to 77.9 days above 30 °C (median).
Extreme Heat and Very Hot Days	**Days Above 25 °C (days/year):** Days above 25 °C describes the number of hot days in a year.	Days per year above 25 °C could increase by more than two months' time by the end of the century compared to the 1980s (e.g. from 57.6 days to 87.6 days under SSP2-4.5 and up to 130.6 days per year [median values] under SSP5).
Extreme Heat and Very Hot Days	**Humidex > 40 (days/year):** The number of days in a year when the maximum humidex exceeds 40, which would lead to intense discomfort for the average person.	Days per year when the humidex is >40 could increase from 0.2 days to 2.9 days (median) under SSP2-4.5 and up to 39.5 days per year under SSP5-8.5 (median).
Extreme Heat and Very Hot Days	**Humidex > 35 (days/year):** The number of days in a year when the maximum humidex exceeds 35, which would lead to evident discomfort for the average person.	Days per year when the humidex is >35 could increase from 8.7 days to 49.3 days (median) under SSP2-4.5 and up to 80.5 days (median) per year under SSP5-8.5.
Extreme Heat and Very Hot Days	**Humidex > 30 (days/year):** The number of days in a year when the maximum humidex exceeds 30, which would lead to some discomfort for the average person.	Days per year when the humidex is >30 could increase from 41 days to 71.5 days (median) under SSP2-4.5 and up to 116.9 days (median) per year under SSP5-8.5.

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Extreme Heat and Very Hot Days	**Hottest Day Temperature (C):** Hottest day temperature represents the hottest daytime temperature that may occur in any year.	On average, the temperature on the hottest day per year in the 1980s used to be around 33 C. By the end of the century, the hottest day temperature could reach 35 °C (median) under SSP2-4.5 and 36.8 °C (median) to 40 °C (90th percentile) under SSP5-8.5.
Extreme Heat and Very Hot Days	**Temperature-based Heat Warning Frequency (Warnings/Year):** A heat warning is issued for Southern Ontario when there is a forecast of two or more consecutive days with daytime maximum temperatures of 31 °C or warmer, together with nighttime minimum temperatures of 20 °C or when there is a forecast of two or more consecutive days with humidex values expected to reach 40 °C or higher.	The number of temperature-based heat warnings will increase. Under SSP2-4.5, warnings could increase from 0.2 to 2.3 per year, and up to seven warnings per year under SSP5-8.5 (median).
Extreme Heat and Very Hot Days	**Maximum Consecutive Temperature-based Heat Warning Days (Days/Year):** The maximum number of consecutive days where there is a forecast of two or more consecutive days with daytime maximum temperatures of 31 °C or warmer, together with nighttime minimum temperatures of 20 °C or warmer.	Maximum consecutive temperature-based heat warning days (days/year) are expected to increase. Days per year could increase from 0.6 to 7.4 under SSP2-4.5;] and to 60.4 days (median) and up to 88.5 days (90th percentile) under SSP5-8.5.
Extreme Heat and Very Hot Days	**Cooling Degree Days (CDD):** The degree to which average daily temperatures are above 18 °C or greater. Often used to represent the demand for air conditioning for buildings.	CDD are expected to increase. Under SSP2-4.5, CDD could increase from 269.6 to 729.2. Under SSP5-8.5, CDD could reach 1,154.9 (median) and up to 1,488.5 (90th percentile).
Extreme Cold and Very Cold Days	**Days Below -20 °C (Days/Year):** The number of days in a year when daily minimum temperature drops below -20 °C (or < -20 C).	The number of very cold days per year (below -20 C) is expected to decrease as temperatures continue to rise. The number of very cold days is expected to become increasingly rare by the 2030s, 2050s and 2080s compared to the 1980s.

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Extreme Cold and Very Cold Days	**Days Below -10 °C (Days/Year):** The number of days in a year when daily minimum temperature drops below -10 °C (or < -10 C).	The number of cold days per year (below -10 C) is expected to decrease as temperatures continue to rise. Falling from a median of 36.3 days to 17.7 days per year by the 2030s and 0.7 days per year by the 2080s.
Extreme Cold and Very Cold Days	**Days Below 0 C/Frost Days (Days/Year):** The number of days in a year when daily minimum temperature is lower than 0 °C (or < 0 C). Under these conditions frost may form on the ground or on cold surfaces.	The number of frost days per year (below 0 C) is expected to decline. The number of days per year could decline by nearly a months' time by the 2030s, nearly two months' time by the 2050s and nearly three months' time by the 2080s (compared to the 1980s).
Extreme Cold and Very Cold Days	**Frost-free Season Start/End Date (Date):** The frost-free season start is the last date in a year when the daily minimum temperature stays above 0 °C after five consecutive days (before July 15) and the frost-free season end date is the first date in a year when daily minimum temperature falls below 0 °C after five consecutive days (after July 15).	The frost-free season start date is expected to come earlier in the year as the temperature increases. The start day could change from April 5th to March 25th by the 2030s, to March 15th by the 2050s and to February 27th by the 2080s (median). The frost-free season end date could change from November 18th to November 25th by the 2030s, to December 6th by the 2050s and to December 13th by the 2080s (median).
Extreme Cold and Very Cold Days	**Frost-free Season Length (Days/Year):** The number of days in a year between the start of the frost-free season (when daily minimum temperature stays above 0C after five consecutive days before July 15) and the end of the frost-free season (when daily minimum temperature falls below 0 °C after five consecutive days after July 15).	The length of the frost-free season (days/year) is expected to increase. The length could change from 230 days/year to 264 days/year by the 2030s, 310 days/year by the 2050s, and 347 days/year by the 2080s (median).
Extreme Cold and Very Cold Days	**Heating Degree Days (HDD):** The degree to which average daily temperatures are below 18 °C (or < 18 C). This is often used to represent heating demand for buildings.	HDD are expected to decrease. Under SSP2-4.5, HDD could decrease from about 3890 to 2720 days (median). Under SSP5-8.5, HDD could decline to 2140 days (median) and to as few as 1,650 days (10th percentile).

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Precipitation Precipitation is a key indicator of how human-induced climate change is affecting the Earth's water cycle. Changes in total annual precipitation affect agriculture, infrastructure, people's health, water availability, recreation, biodiversity and ecosystem health. Precipitation is expected to continue to increase overall, with the possibility of more intense variability leading to increasing wetter and drier conditions at different times. With increasing precipitation, what used to be a 1-in-100-year storm can be expected to occur more frequently, as suggested by climate-adjusted intensity-duration-frequency (IDF) curves.[47]		
Total Precipitation	**Annual Total Precipitation (mm):** The sum of the total rainfall and the water equivalent of the total snowfall (mm) at the location during a specified time interval.	Annual total precipitation is anticipated to increase by 5-6 per cent by the 2030s and by 10 per cent by the 2050s compared to the 1980s. By the 2080s, it is expected to increase by approximately 11 per cent under the medium emissions scenario and by 16 per cent under the very high emissions scenario compared to the 1980s.
Total Precipitation	**Seasonal Total Precipitation (mm):** Seasonal total precipitation characterizes the total amount of precipitation (rain or snow) that falls within a season. It describes how wet or dry a place generally is in different seasons.	Winter total precipitation is anticipated to increase the most under both scenarios, followed by spring precipitation. As more precipitation is expected to fall as rain instead of snow, more rain may fall on frozen ground during winter and spring, which may cause increased flooding and ice jams.
Total Precipitation	**Annual Mean Lake Levels (m IGLD85):** Annual mean lake levels for Lake Ontario.	Annual mean lake levels for Lake Ontario are expected to increase. Levels could increase from 74.8 m IGLD85 (1961-2000) to 75 m IGLD85 (under RCP4.5 and RCP8.5).[48]
Extreme Precipitation	**Maximum one-day or Wettest Day Precipitation (mm):** Extreme precipitation is defined as events that have increased frequency and intensity in a region or location in which the amount of rain/snow substantially exceeds normal.	Extreme precipitation is anticipated to increase. Under the very high emissions scenario, the maximum amount of precipitation that would typically fall in a day may increase by 11 per cent by the 2030s, 17 per cent by the 2050s and 27 per cent by the 2080s compared to the 1980s.

[47] "IDF Data and Climate Change," ClimateData.ca, accessed November 5, 2025, https://climatedata.ca/resource/idf-data-and-climate-change/

[48] Lam, S., and Dokoska, K. 2022. Climate Change in the Great Lakes Basin: Summary of Trends and Impacts. https://binational.net/wp-content/uploads/2022/11/Climate-Change-in-the-Great-Lakes-Basin_English-1.pdf Based on projections developed by Environment and Climate Change Canada

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Extreme Precipitation	**Maximum Three-day Precipitation (mm):** Maximum three-day precipitation describes the maximum amount of total precipitation (rain or snow) that falls over three consecutive days. Extreme precipitation can increase the risk of flooding, increase the amount of stormwater runoff that enters waterways and affect the health of aquatic systems.	The maximum three-day precipitation (mm) is anticipated to increase. Three-day maximum precipitation could increase from 55.2 mm to 63.5 mm under SSP2-4.5 and to 69.4 mm (104.1 mm at 90th percentile) under SSP5-8.5 by the 2080s (median).
Extreme Precipitation	**Simple Daily Intensity Index (SDII) (mm/Day):** Average intensity (mm/day) over a given period of time, calculated as total wet day precipitation (> 0.2 mm) divided by the total number of wet days. The SDII describes the average intensity or rate of precipitation in millimetres per day.	The SDII is expected to increase. The SDII could increase from 5.1 mm/day to 5.6 mm/day under SSP2-4.5, and to 5.9 mm/day by the 2080s under SSP5-8.5 (median).
Extreme Precipitation	**Maximum Consecutive Wet Days (Days/Year):** The maximum number of consecutive days when precipitation was greater than 0.2 mm (or > 0.2).	The maximum consecutive wet days per year is anticipated to increase. Under SSP2-4.5, the days could increase from 5.4 to 5.7 days/year (median), and under the very high emissions scenario (SSP5-8.5), the days per year could increase from 5.4 to 5.8 (median) and up to 7.8 (90th percentile).
Extreme Precipitation	**95th/99th Percentile Precipitation (mm):** The 95th percentile precipitation characterizes heavy precipitation with daily amounts greater than or equal to 95 per cent of all storms. Ninety- five per cent of the time, total daily precipitation will fall under this value. Above this value represents the top 5 per cent in daily amounts. The 99th percentile precipitation characterizes very heavy precipitation with daily amounts greater than or equal to 99 per cent of all storms. Ninety-nine per cent of the time, total daily precipitation will fall under this value. Above this value is the top 1 per cent in daily amounts.	The 95th and 99th percentile precipitation are expected to increase. The 95th percentile precipitation could increase from 11.9 mm to 13.9 mm by the 2080s under SSP2-4.5 and the 99th percentile precipitation could increase from 22.8 mm to 27.4 mm (median) and up to 34.2 (90th percentile) under SSP5-8.5 by the 2080s.

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Winter and Ice Storms Blizzards are winter storms that produce several inches of snow. They occur with strong winds that cause blowing snow and whiteout conditions. Ice storms or freezing rainstorms are defined by the accumulation of ice on exposed surfaces.		
Snow Loads	**Annual Maximum Snow Load (50-year Return Period) (kPa)**	Climate-adjusted infrastructure design values developed by PCIC show cold weather design temperatures and snow loads are expected to decrease. Annual maximum snow loads (50-year return period) are expected to decrease (e.g, under a 2.5 C- global-warming-level scenario could decline from 1.4 kPa in 1986-2016 to 0.9 kPa, and under a 3.5 C-global-warming- level scenario could decline to 0.7 kPA).[49]
Snow Loads	**Annual Maximum Rain-on-Snow Load (50-year Return Period) (kPa):**	Annual maximum rain-on-snow loads (50-year return period) are expected to decrease (e.g. under a 2.5 C- global-warming-level scenario could decline from 0.4 kPa in 1986-2016 to 0.3 kPa, and under a 3.5 C-global- warming-level scenario could decline to 0.2 kPA).[50]
Snow Loads	**Freezing Rain Potential (Days/Year):** The number of days in a year when daily minimum temperature is greater than -2˚C and daily maximum temperature is below 2˚C. Freezing rain can create slippery road and sidewalk conditions that endanger people's health and safety. Changes in freezing rain patterns also affect infrastructure, recreation and ecosystem health.	The number of days with freezing rain potential is expected to vary widely year to year. Under SSP5-8.5, the mean number of days/year with freezing rain potential could increase from 2.1 (1980s) to 2.4 in the 2030s and to 3.1 in the 2050s, and then could slightly decrease to 2.3 in the 2080s. However, at the 90th percentile, the days/year could be 6.1 in the 2030s, 8.8 in the 2050s and 7.9 in the 2080s.

[49] Climate-adjusted infrastructure design values have been developed by the Pacific Climate Impacts Consortium (PCIC) in collaboration with ECCC and the National Research Council (NRC). Using the online Design Value Explorer tool (version 2.4.0), available historical and projected future design values for the Toronto City Hall location. (Cited in Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate. Toronto and Region Conservation Authority (TCA). Prepared for the City of Toronto.)

[50] Western University - IDF_CC tool Version 7.5 (June 2024)

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Freeze-thaw Cycle A freeze-thaw cycle occurs when the daily maximum temperature is higher than 0 °C and the daily minimum temperature is less than or equal to -1 C. Freeze-thaw cycles can have major impacts on infrastructure. Water expands when it freezes, so the freezing, melting and re-freezing of water can cause significant damage to roadways, sidewalks and other outdoor structures over time. Freeze-thaw cycles can create slippery road and sidewalk conditions that increase the risk to people's health and safety. It can also affect infrastructure, recreation and ecosystem health.		
Freeze-thaw and Freezing Rain Potential	**Freeze-thaw Cycles (Cycles/Year):** A simple count of the number of days when temperature fluctuates between freezing and non-freezing temperatures — when daily minimum temperature is equal to or below -1 °C and maximum temperature is above 0 C. Under these conditions, it is likely that some water at the surface was both liquid and ice at some point during the 24-hour period.	The number of freeze-thaw cycles in a year is anticipated to decrease as winters get shorter and warmer. However, a shorter season could also lead to more freeze-thaw cycles occurring over a shorter period of time. Under SSP5-8.5, the number of cycles/year could decrease from 61.9 to 44.4 by the 2050s and reach 29.3 by the 2050s.
Drought and Dry Days Drought is defined as a shortage of precipitation over an extended period, usually a season or more, resulting in insufficient water availability that adversely impacts vegetation, animals and people.		
Drought and Dry Days	**Annual Total Dry Days (Days/Year):** The number of days in a year when precipitation was less than 0.2 mm (or < 0.2). This characterizes the total number of days with virtually no precipitation in a year and is an indicator of drought risk.	The annual number of dry days per year is expected to remain about the same. Under SSP2-4.5 and SSP5-8.5, the annual number of dry days is about 207 across all periods modelled (1980s, 2030s, 2050s and 2080s).
Drought and Dry Days	**Maximum Consecutive Dry Days (Days/Year):** The maximum number of consecutive days when precipitation was less than 0.2 mm (or < 0.2). This describes the maximum length of a dry period that can extend over multiple days and is an indicator of drought risk.	The maximum consecutive dry days (days/year) is expected to remain about the same. Under SSP2-4.5 and SSP5-8.5, the maximum consecutive dry days is about 12 across all periods modelled (1980s, 2030s, 2050s and 2080s).

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
High Winds and Tornadoes High winds are a significant hazard for land and water activities and can cause damage to people, buildings and infrastructure. Environment Canada issues a wind warning using the threshold of 70 km/hour or higher wind and/or gusts to 90 km/hour.		
Wind Loads	**Annual Maximum Hourly Wind Pressures (10-year Return Period) (kPa)** **Annual Maximum Hourly Wind Pressures (50-year Return Period) (kPa)** **Annual Maximum Driving Rain Wind Pressures (5-year Return Period) (Pa)**	Wind loads can be challenging to project and have greater uncertainty. Climate-adjusted infrastructure design values have been developed by the Pacific Climate Impacts Consortium in collaboration with ECCC and the National Research Council (NRC). Using the online Design Value Explorer tool (version 2.4.0), with each 0.5 °C increase in global warming, various design values are anticipated to increase, including July (hot weather) design temperatures, rainfall loads, humidity and most wind loads (except driving rain wind pressures, which are expected to vary).[51]
Wildfire Hazards Air pollution can be worsened by very hot temperatures and extreme heat and from smoke that can spread from regional wildland fires. Wildfire events can occur north of Toronto. When combined with high winds, wildfire smoke can spread to the city, presenting a health hazard for residents. For example, in June 2023, Toronto experienced the impacts of wildfire smoke, which reduced its air quality. In response, Toronto Public Health developed a Wildfire Smoke Response Strategy.[52] Wildfires occurring much farther from the city can also degrade Toronto's air quality, as experienced during the widespread smoke events of 2023 and 2025.		

[51] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate. Toronto and Region Conservation Authority (TCA). Prepared for the City of Toronto; https://www.pacificclimate.org/analysis-tools/design-value-explorer

[52] https://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/air-quality/wildfire-air-quality-strategy/

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Wildfire	**Potential Regional Fire Spread Days (Days/Year):** A potential spread day is a day where fire will grow if an ignition occurs and there are sufficient wildland and/or built fuels and embers to burn.	The frequency of seasons with potential fire spread days is expected to increase for most parts of Canada's forested regions under future climate scenarios (Wang et al., 2017).[53] Wildfire studies have found that fire spread days, area burned and seasonal severity rating are anticipated to increase across Canada (Coogan et al., 2019).[54] These increases are expected to intensify the risk of poor air quality days from wildfire smoke, which has already impacted Southern Ontario.
Ecosystem Changes Climate impacts and extreme weather events affect ecosystem functions and ecosystem health, which impacts biodiversity. In addition, changes in temperature impact the environment and habitat for species. Changes and disturbances in ecosystems alter the biodiversity.		
Ecosystem Change	**Frost-free Season Start Date (Date of Last Spring Frost):** The frost-free season start is the last date in a year when daily minimum temperature stays above 0 °C after five consecutive days (before July 15).	The frost-free season start date is expected to come earlier in the year as the temperature increases. The start day could change from April 5th to March 25th by the 2030s, to March 15th by the 2050s and to February 27th by the 2080s (median).
Ecosystem Change	**Frost-free Season Length (Days/Year):** The number of days in a year between the start of the frost-free season (when daily minimum temperature stays above 0 C after five consecutive days before July 15) and end of the frost-free season (when daily minimum temperature falls below 0 °C after five consecutive days after July 15).	The length of the frost-free season (days/year) is expected to increase. The length could change from 230 days/year to 264 days/year by the 2030s, 310 days/year by the 2050s and 347 days/year by the 2080s (median).

[53] Wang, X., Parisien, M.-A., Taylor, S. W., Candau, J.-N., Stralberg, D., Marshall, G. A., Little, J. M., and Flannigan, M. D. (2017). Projected changes in daily fire spread across Canada over the next century. Environmental Research Letters, 12(2), 025005. https://doi.org/10.1088/1748-9326/aa5835 (Cited in Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate. Toronto and Region Conservation Authority (TCA). Prepared for the City of Toronto.)

[54] Coogan, S. C. P., Robinne, F.-N., Jain, P., and Flannigan, M. D. (2019). Scientists' warning on wildfire—A Canadian perspective. Canadian Journal of Forest Research, 49(9), 1015–1023. https://doi.org/10.1139/cjfr-2019-0094 (Cited in Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. (2024). Toronto's Current and Future Climate. Toronto and Region Conservation Authority (TCA). Prepared for the City of Toronto.)

Climate Hazard	Climate Indicator (Unit)/ Description	Key Indicator Trends 2015-2100
Ecosystem Change	**Growing Degree Days (Base 15 °C):** Growing degree days (GDDs) provides an index of the amount of heat available for the growth and development of plants and insects. Different base temperatures (0, 4, 5, 10, 15 C) are used to capture results for organisms that demand different amounts of heat.	As temperature increases, GDDs will increase. Generally, GDDs with a base temperature of 15 °C support the growth and development of insects and pests.

The prioritized hazards identified above provide the foundation for the vulnerability analysis presented in Section 5.

5. Vulnerability Assessment

Over the short, medium and long term, Toronto can expect to see a wide range of changes in climate, such as warmer temperatures, intensifying heat events, a longer growing season, more precipitation and more extreme weather events. It is well understood that these changes will impact the city's systems — people; economy; infrastructure; municipal, natural and green spaces; business; and socio-economic activities. The impacts of the changing climate could include more disruption to infrastructure and services, increased maintenance and operations costs, detrimental impacts on people's health and well-being, increased spread of invasive species and pests, more flooding and erosion, gains and losses in species and ecosystems, more poor air quality days from wildfire smoke, supply chain impacts, increased cost of living, loss of economic productivity and increased damage to property and infrastructure.[55]

These impacts could be unequally distributed, affecting some people more than others. In particular, extreme weather and hardships place more of a burden on people who already face multiple overlapping stressors due to systemic and long-standing inequities.

> "Vulnerability of ecosystems and people to climate change differs substantially among and within regions, driven by patterns of intersecting socioeconomic development, unsustainable ocean and land use, inequity, marginalization, historical and ongoing patterns of inequity such as colonialism, and governance." — United Nations Intergovernmental Panel on Climate Change[56]

The IPCC defines vulnerability as "the propensity or predisposition to be adversely affected…[which] encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt." By analyzing the vulnerabilities of and risks to Toronto's services, assets and communities, the City will be able to develop a more comprehensive and coordinated approach to prioritize adaptation actions and opportunities to reduce the impact of climate change on the people, assets, systems, and services that may be most vulnerable.

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[55] Lam, S., Demirbas Caglayan, S., Mahya, M., and David, Y. 2024. Toronto's Current and Future Climate. Toronto and Region Conservation Authority. Prepared for the City of Toronto.

[56] IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3-33, doi:10.1017/9781009325844.001.

As part of the City's CCRVA, we have developed a vulnerability assessment (VA) based on local information and sources to identify the systems and sub-classes that are most vulnerable to the impacts of climate change specifically in Toronto. To assess the city's key vulnerabilities, we have developed impact statements by hazard and system sub-class. Using vulnerability scoring, we have evaluated and ranked the priority of these impact statements to identify the key drivers of vulnerability by system sub-class. The Vulnerability Assessment will support more proactive and effective adaptation and resilience-building efforts across the city. It is a key step in the CCRVA to help the City develop a better understanding of how to reduce the impacts of climate change. Following this analysis, the findings from the Vulnerability Assessment are combined with likelihood estimates derived from current conditions and future climate projections to assess climate risks for the city.

This Vulnerability Assessment section includes the following elements:

1. Potential impact statements that were developed for each sector sub-class by climate hazard and their assigned vulnerability rankings (e.g. low, moderate, high, very high).
2. The key drivers of vulnerability by sector sub-class.
3. The vulnerability scores for each impact statement, which we ranked to prioritize potential climate impacts.

For the methods used to generate the vulnerability rating matrix and the standardized scoring for sensitivity, adaptive capacity and vulnerability, refer to Chapter 3: Methodology Overview.

5.1 Impact Statements

Potential impact statements[57] were developed for each climate hazard and system, drawing from subject-matter expertise and input from city divisions. These statements reflect multiple impacts for each system, based on the intersections of sector sub-classes with people, assets and services. This generated over 400 potential impact statements distributed across the four key systems, as summarized in Table 13. Each potential impact statement was evaluated for sensitivity and adaptive capacity by reviewing local historical evidence, industry best practices, relevant literature, subject matter expertise and input from past city staff and community consultation reporting.[58]

Table 13. Number of impact statements evaluated by system and vulnerability ranking categories.

System	Very High	High	Moderate	Low	Very Low	Total
Population and Local Economy	23	47	28	4	0	**102**
Municipal Services	6	47	54	1	0	**108**
Infrastructure Systems	20	84	50	21	1	**177**
Natural Systems and Green Spaces	4	15	18	7	0	**44**
						431

[57] Impact definition from ISO 14091: In the context of climate change (3.5), the term "impact" is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change.

[58] In particular, Toronto's Resilience Strategy and the Ontario Provincial Climate Change Impact Assessment (OPCCIA).

5.2 Vulnerability Rankings

In this section, we summarize the impact statements that were scored as having moderate vulnerability or higher, organized by system. The full list is documented in a vulnerability matrix (spreadsheet developed by SSG). The complete vulnerability matrix provides justification and sources for each impact statement and the underlying sensitivity and adaptive capacity scores that were combined to assign a vulnerability score. The impact statements are organized by systems—Population and Local Economy, Municipal Services, Infrastructure Systems, and Natural Systems; sub-classes; and according to relevant climate hazards, as defined in the Boundary Definition Memo. In addition, we present the vulnerability scores and rankings for the potential impact statements that were assessed for each system subclass-hazard combination, determined based on our assessment of sensitivity and adaptive capacity scores.

Some impact statements are relevant to multiple systems or sub-classes. As a result, cross-system impacts may appear under different contexts, depending on the specific system or sub-class being considered (e.g. impacts related to emergency management are applicable across several system sub-classes).

The following sections describe each system and the main considerations in developing the impact statements for that system and list the individual impact statements and final vulnerability scores.

Population and Local Economy

The Population and Local Economy system includes local residents, students, indoor and outdoor workers, populations that experience vulnerabilities, unhoused populations, equity-deserving populations and Indigenous Peoples. When climate change hazards such as extreme weather impact the city, they can elevate existing vulnerabilities for Toronto's population, including impacts on mental health, housing and shelter, living conditions, working conditions (especially outdoor workers), travel and activity opportunities, access to goods and services and physical well-being.

We assessed the vulnerability of the city's people and communities as it pertains to the risk of climate change and as a component of the next step of risk assessment in the CCRVA. According to the IPCC, "In the context of climate change, risk provides a framework for understanding the increasingly severe, interconnected and often irreversible impacts of climate change on ecosystems, biodiversity, and human systems. These risks can arise from

the dynamic interactions among climate-related hazards, the exposure and vulnerability of affected human and ecological systems."[59] These impacts on human health, well-being and mental health are unevenly distributed and inequitably experienced due to differences in exposure and vulnerability.[60] Given the intersectionality of determinants of health, amongst other factors, Indigenous Peoples and unhoused populations are considered among populations that experience relatively higher vulnerability and inequalities, with each having distinct sensitivity and adaptive characteristics.

Residents and Non-residents

Our assessment included analyzing the climate hazards that impact Toronto's residents and non-residents, including tourists and people visiting for work, in a variety of ways. For example, our findings include impact statements for extreme precipitation, which can impact populations in terms of access to transit and roads, ability to commute to work, provision of essential services, property damage or loss and displacement from home; extreme heat, which can cause heat-related illnesses (e.g. heat exhaustion, heatstroke), impose particular hardships on unhoused populations and those living without air conditioning, tenants, low-income populations, the elderly and children; and multiple other climate hazards.

The impact statements and our evaluation of the vulnerability level are presented in Table 14. Based on our findings, the scores for impact statements related to vulnerable people are especially elevated. Vulnerable populations include people who are members of groups with experiences of discrimination, racism and historical trauma, including women, Indigenous Peoples, people of colour and 2SLGBTQ2 people (two spirit, lesbian, gay, bisexual, transgender, queer). Vulnerable populations also encompass people who are clinically vulnerable from a health perspective (e.g. seniors, infants and children, pregnant women, people with pre-existing health conditions). Populations who are made more vulnerable when their access needs are not met are also included as vulnerable populations (e.g. people with disabilities, people with low-income, people experiencing homelessness, people who do not speak English fluently or who are new to Canada and people without digital access). For example, people with compromised physical health and/or who are medically dependent are more vulnerable to changes in their day-to-day routines (e.g. people with conditions affecting heart, lungs, kidneys and/or immune system; people who use substances). Climate hazards like winter ice storms that reduce or eliminate access to caregivers (e.g. home

[59] IPCC, 2022: Summary for Policymakers. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3–33, doi:10.1017/9781009325844.001.

[60] Cissé, G., R. McLeman, H. Adams, P. Aldunce, K. Bowen, D. Campbell-Lendrum, S. Clayton, K.L. Ebi, J. Hess, C. Huang, Q. Liu, G. McGregor, J. Semenza, and M.C. Tirado, 2022: Health, Wellbeing, and the Changing Structure of Communities. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1041–1170, doi:10.1017/9781009325844.009.

support) and health services (e.g. dialysis or pharmacies/clinics for witnessed ingestion of opioid agonist therapy) can be especially challenging for this population.

People with physical and/or neurological disabilities are among the most vulnerable populations due to their reliance on caregivers and/or mobility devices that cannot easily "adapt" to a change in circumstance (e.g. power outage that shuts down an elevator in a multi-story building). Their income can be highly dependent on social service programs that are often inadequate to meet the basic cost of living in Toronto, and they can face further challenges securing financial resources to invest in adaptive capacity or post-event recovery.[61]

The high cost of living is a key driver for vulnerability in Toronto. In 2024, 40 per cent of residents reported that they struggle to get by, indicating that household income is not enough. This represents 2.7 million people across the city of Toronto — an increase of almost 700,000 people since 2023. At the same time, Canada-wide prices have increased 18 per cent since the onset of the pandemic, with even larger increases in food prices (25 per cent) and rent (23 per cent). These increases, and particularly food and shelter costs, have a disproportionate impact on people experiencing vulnerability.[62]

The condition of housing in Toronto also drives vulnerability. The aging infrastructure of the city's high-rise rental apartment towers was identified as the single most pressing priority in Toronto's Resilience Strategy.[63] Over 500,000 people in Toronto live in high-rise apartment buildings over 40 years old. Many of these buildings lack updated heating systems and windows, as well as sufficient backup power, and 94 per cent do not have central air conditioning. If a major heat wave or winter storm happened to coincide with an extended electricity outage, residents of those buildings could be without heat, water, elevators and lighting, preventing residents from sheltering in their homes.[64] Beyond the lack of shelter, there are also serious health risks, especially for individuals with pre-existing medical conditions, disabled people, seniors and other vulnerable populations. These groups may rely on electrically powered medical equipment, refrigeration for medications or mobility supports like elevators or electric wheelchairs.

Key Vulnerability Drivers: Physical health; mental health; mobility; age; historical and current inequities due to race or sexual orientation; unaffordable housing, cost of living; access to health services; access to emergency/essential services

[61] The Additional Costs of Disability: Why Canada's Poverty Measure Falls Short – Inclusion Canada; It can cost up to 39 per cent more to thrive in the GTA if you have a disability: research (2024)

[62] https://torontofoundation.ca/vital-signs-2024-income-and-wealth/

[63] https://www.toronto.ca/ext/digital_comm/pdfs/resilience-office/toronto-resilience-strategy.pdf

[64] https://www.cbc.ca/news/canada/toronto/heat-experts-cooling-centres-1.6899857

Table 14. Impact statements and vulnerability rankings by climate hazard — Residents and Non-residents.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Adverse health consequences for vulnerable populations due to poor air quality	Very High
	Disruption to outdoor activities	High
	Increase in respiratory illnesses for general population	Moderate
	Increase in respiratory illness for people who are visiting the city	Moderate
Ecosystem Changes	Increase in allergies for vulnerable populations	Moderate
	Increase in vector-borne diseases or allergies for general population	Moderate
	Increase in vector-borne diseases for vulnerable populations	Moderate
	Increase in vector-borne diseases or allergies for outdoor workers	Moderate
	Increase in vector-borne disease or allergies for unhoused population	High

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Heat-related illnesses for vulnerable populations (e.g. infants and children, older adults, pregnant people and people with chronic conditions or prescriptions that make them more sensitive to heat)	Very high
	Heat-related pregnancy complications for vulnerable populations	Very high
	Mental health impacts for vulnerable populations (e.g. people with less access to cooling; older adults who experience cognitive decline with increased heat)	Very high
	Increased road safety incidents due to damaged roads	Very high
	Heat-related illnesses for outdoor workers	High
	Decrease in cognitive function for older adults	High
	Physical harm for people who are visiting the city	High
	Increased energy costs for vulnerable populations	High
	Disruption of daily activities for children and students	Moderate
	Mental health impact for general population	Moderate
	Increased energy costs for general population	Moderate
	Potential for increased interpersonal violence	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Precipitation	Psychosocial and mental health impacts for vulnerable populations	Very high
	Loss of access to essential services for vulnerable populations	Very high
	Loss of assistive devices and medical supplies due to water damage/contamination/displacement	Very high
	Displacement of unhoused population	Very high
	Financial stress from increased insurance cost/ loss of coverage	High
	Unsanitary living conditions	High
	Financial stress from property damage	High
	Displacement of residents	High
	Physical harm for people who are visiting the city	High
	Psychosocial and mental health impacts for the general population	High
	Health risks from exposure to contaminated water	Moderate
	Injury or drowning for residents	Low
Freeze-thaw Cycles	Trips and falls, particularly for elderly residents and individuals with mobility challenges	High
	Dangerous travel conditions for active transportation	High
	Dangerous travel conditions for vehicles	High
	Dangerous conditions for outdoor workers: icy surfaces	High
High Winds/	Injury or death due to flying debris	Very high
	Displacement of unhoused population	Very high
	Displacement of residents	High
	Loss of access to essential services	High
	Physical harm for people who are visiting the city	High
	Financial stress due to property damage	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Physical harm for people who are medically dependent and unable to access treatment	Very high
	Increased energy costs	High
	Social Isolation for older adults	High
	Social isolation for vulnerable populations	High
	Physical harm for people who are visiting the city	High
	Dangerous travel conditions for active transportation	High
	Financial stress from flooding and water damage to homes from burst pipes	High
	Hypothermia and frostbite for outdoor workers	High
	Interruption of household water supply from burst pipes	High
	Social isolation for people without easy access to personal transportation	High
	Physical harm for people who may not have access to reliable, current information about the weather/dangers of extreme cold	Moderate
	Social isolation for children and youth	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Physical harm for people who are medically dependent and unable to access treatment	Very high
	Loss of access to essential services for vulnerable populations	Very high
	Dangerous travel conditions for vehicles	High
	Social Isolation for older adults	High
	Dangerous travel conditions for active transportation	High
	Social isolation for vulnerable populations	Very high
	Physical harm for people who are visiting the city	High
	Financial stress from flooding and water damage to homes from burst pipes	High
	Increased energy costs	High
	Interruption of household water supply from burst pipes	High
	Social isolation for people without easy access to personal transportation	High
	Trips and falls from icy conditions	High
	Dangerous conditions for outdoor workers: icy surfaces, low visibility	High
	Social isolation for children and youth	Moderate
	Physical harm for people who may not have access to reliable, current information about the weather/dangers of extreme cold	Moderate
	Loss of access to essential services	Moderate
Total Precipitation	Increase in vehicle accidents	Low

Unhoused Population

The cost of living; lack of affordable housing; financial, mental, cognitive and health challenges; etc. have contributed to the growing number of houseless people on the street and in shelters. According to Fred Victor, a social services organization in Toronto, there are over 12,000 houseless people each night.[65] City of Toronto data estimates that 10,580 people experience houselessness on an average night. The number of unhoused people in the city continues to increase due to many factors, including dramatic inflation, unaffordable housing and lack of social and mental health services.[66] In 2024, an average of 198 individual callers per day were not matched to a shelter bed through Central Intake. This persistent gap between demand and available shelter space contributes to the rise in encampments and the number of people living unsheltered across the city.[67] Extreme weather and lack of access to services can impact the livelihood and well-being of unhoused people. In the first half of 2024, 135 people experiencing houselessness died in Toronto. While drug toxicity remained the leading cause (54 per cent of deaths), a significant proportion of deaths were attributed to cardiovascular disease, cancer, respiratory illnesses and other chronic conditions. Cardiovascular disease, in particular, is a major contributor to mortality in this population, and its risks are exacerbated by prolonged exposure to extreme heat, cold and air pollution.[68] Based on our analysis, additional impact statements and vulnerability rankings for unhoused residents are shown in Table 15.

Key Vulnerability Drivers: Lack of affordable housing, lack of access to shelters, exposure to heat, exposure to cold, mental and physical health complications, cost of living

Table 15. Additional impact statements and vulnerability rankings by climate hazard — Unhoused Residents.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Increase in respiratory illnesses for unhoused population	Very high
Drought	Increase in fire potential for unhoused population related to makeshift housing/encampments	High

[65] https://www.fredvictor.org/facts-about-homelessness-in-toronto/

[66] CBC News. (2024, January 30). Toronto's winter homelessness plan for 2024-2025 won't meet shelter demand, advocates say. CBC News. https://www.cbc.ca/news/canada/toronto/toronto-winter-homelessness-plan-2024-2025-won-t-meet-shelter-demand-1.7359367

[67] City of Toronto. (2025). Shelter System Requests for Referrals. https://www.toronto.ca/city-government/data-research-maps/research-reports/housing-and-homelessness-research-and-reports/shelter-system-requests-for-referrals/

[68] Toronto Public Health. (2024). Deaths of people experiencing homelessness. Tableau Public. https://public.tableau.com/app/profile/tphseu/viz/DeathsofPeopleExperiencingHomelessness2_0/HomelessDeaths3_0

Climate Hazard	Impact Statement	Vulnerability Ranking
Ecosystem Changes	Increase in vector-borne disease or allergies for unhoused population	Very high
Extreme Heat and Very Hot Days	Heat-related illnesses for unhoused population	Very high
	Heat-related pregnancy complications for vulnerable populations	Very high
Extreme Precipitation	Displacement of unhoused population	Very high
	Physical and mental health impacts for the unhoused population	High
High Winds/	Displacement of unhoused population	Very high
Winter/Ice Storms (Snow, Ice, Freezing Rain) and Very Cold Days and Extreme Cold	Hypothermia, frostbite and other cold-related injuries for unhoused population	Very high

Indigenous Peoples

Indigenous communities across Canada are more likely to experience the adverse effects of climate change due to colonialism and capitalism, dispossession/removal from traditional lands and ecosystems, relocation and assimilation and refusal of basic human rights (such as safe drinking water). Adverse effects across Canada include impacts on ceremonies, traditional lifestyle practices and the ability to exercise other cultural rights. Other inherent rights, such as rights to self-government, to the land and resources can also be negatively impacted, in addition to the ability to access essential resources and services such as clean drinking water. Adverse impacts to diet are more likely to occur as a result of ecosystem changes, while disasters such as wildfires, droughts and floods can compromise harvesting, hunting and fishing. Housing can be adversely impacted by damage from extreme weather events. Changes in modes and pathways of transportation are also possible.[69] In Toronto, there are at least 70,000-100,000 Indigenous people living in the city.[70] Toronto's Indigenous population consists of First Nations people (85 per cent), Métis (14 per cent) and Inuit (0.4 per cent). Most First Nations Peoples in Toronto are Anishinaabe and Haudenosaunee. Ojibway and Cree are the two most common Indigenous languages spoken in Toronto.[71]

[69] Indigenous Climate Hub. The Impacts of Climate Change on Indigenous Communities. https://indigenousclimatehub.ca/effects-on-indigenous-communities/

[70] https://www.cbc.ca/news/canada/toronto/toronto-urban-indigenous-census-1.6192449

[71] https://www.toronto.ca/wp-content/uploads/2023/07/9869-IG-TNO-Online-Compressed.pdf

Indigenous people are identified among vulnerable populations, given the myriad factors that can contribute to their vulnerability. For the purpose of this vulnerability assessment, many impact statements that apply to the city's vulnerable populations also could apply to Indigenous Peoples as residents of the city. However, developing a separate initiative co-created with local Indigenous Peoples would be consistent with direction outlined in the City of Toronto's *2022-2032 Reconciliation Action Plan* that maps and guides "the actions that the City will take to achieve truth, reconciliation, and justice to the extent that it remains consistent with the self-identified needs of Indigenous communities in Toronto." This approach would better recognize Indigenous knowledge and leadership in the stewardship of lands and waters now being impacted by climate change, as well as the holistic perspectives of many Indigenous worldviews that centre on reciprocity, kinship with all beings, and collective prosperity, while confronting the root causes of climate change, including colonialism and capitalism. In addition, this would reflect key messages in Toronto's 2018 Indigenous Climate Report Action Summary Report that highlighted the need for "more meaningful Indigenous engagement" on climate action, especially on terms that honour the integrity of their own cultural and knowledge systems.[72] This is an identified gap in the vulnerability assessment and impact statements developed for the CCRVA.

Businesses and Socio-economic Activities

Ontario is experiencing a persistent labour shortage, with up to 20,000 unfilled construction jobs and a looming wave of retirements, as 20 per cent of Canada's construction workforce is set to retire within the next decade. Industries reliant on outdoor labour, particularly construction, are especially vulnerable to extreme weather. High temperatures can reduce worker productivity by up to 60 per cent,[73] while extreme cold and winter storms further disrupt worksite efficiency and project timelines. With construction accounting for 6.3 per cent of Toronto's workforce and 40 per cent of Ontario's total construction employment,[74] these climate-related challenges pose significant risks to the economy. An aging workforce also increases susceptibility to extreme weather conditions, compounding industry-wide vulnerabilities.

Toronto's economy relies on uninterrupted supply chains, making businesses highly vulnerable to disruptions. Extreme precipitation and ice storms, such as the 1998 event,

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[72] "There was general agreement that Indigenous peoples have essential, far-reaching knowledge and practices that are missing today…and that consulting Indigenous peoples in relation to climate work cannot be an 'add on' process." (p.3). Indigenous Climate Action Summary Report (2018) p.3
"Indigenous peoples will determine our own future - not merely as vulnerable people, but people with knowledge, who have ways to solve our own problems and contribute to broader strategies for addressing what is coming. Indigenous forms of knowledge need to be engaged meaningfully in addressing climate change. The knowledge is misunderstood and incomplete if non-Indigenous researchers merely "extract the knowledge." Indigenous Climate Action Summary Report (2018) p.5.

[73] Han, S., Dong, L., Weng, Y., & Xiang, J. (2024). Heat exposure and productivity loss among construction workers: A meta-analysis. *BMC Public Health*, 24, Article 3252. https://doi.org/10.1186/s12889-024-20744-x

[74] Job Bank. (2024). *Sectoral profile: Construction in Ontario*. Retrieved from https://www.jobbank.gc.ca/trend-analysis/job-market-reports/ontario/sectoral-profile-construction

have historically caused significant transportation delays.[75] High winds and storms further hinder supply chains by delaying shipments and reducing operational efficiency.

Property damage from extreme weather events poses an increasing risk to businesses. Flooding alone has resulted in over $1 billion in damages in Toronto.[76] High winds, extreme precipitation and flooding contribute to structural damage, while climate volatility drives up operational costs for energy and insurance. Ice storms have also caused widespread infrastructure damage, with the 2013 Toronto ice storm severely disrupting business operations across the city.[77]

Retail and service industries are heavily dependent on customer foot traffic, which declines during extreme weather events. Heavy rainfall, extreme cold, and poor air quality discourage in-person visits, reducing revenue for brick-and-mortar businesses. While e-commerce provides some resilience, many businesses still rely on physical storefronts, making them vulnerable to shifting consumer patterns driven by climate-related disruptions.

Disruptions to the business sector can also have cascading effects on the cost of living and the ongoing housing crisis by directly leading to increased prices for consumer goods and delays to new home construction. Based on our analysis, the impact statements and vulnerability rankings for businesses and socio-economic activities are shown in Table 16.

Key Vulnerability Drivers: Dependence on supply chain, direct exposure of outdoor workers, aging workers, labour shortage, dependence on customer foot traffic

Table 16. Impact statements and vulnerability rankings by climate hazard - Businesses and Socio-economic Activities.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Decreased customer foot traffic	Moderate
	Disruption and/or impairment to service productivity	Moderate

[75] Campbell, A. (2025, January 10). *Looking back on Canada's costliest winter disaster: The ice storm of January 1998*. Instant Weather. https://instantweatherinc.com/article/canada/2025/1/10/1998-ice-storm

[76] Canadian Underwriter. (2024). *Toronto flooding damages could surpass $1 billion, industry says*. Retrieved from https://www.canadianunderwriter.ca/insurance/toronto-flooding-damages-could-surpass-1-billion-industry-says-1004248451

[77] Casaletto, L. (2023, December 19). Tuesday marks 10 years since Toronto's devastating ice storm. CityNews. https://toronto.citynews.ca/2023/12/19/toronto-ice-storm-2013-anniversary-10-years-ago/

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Disruption and/or impairment to service productivity	Very high
	Decreased customer foot traffic	Moderate
	Increased variability or reduction of key inputs and costs (e.g. materials, commodities, water, electricity, insurance)	Moderate
Extreme Precipitation	Disruption and/or impairment to service productivity	Very high
	Loss and damage to materials and equipment	Very high
	Disruptions to supply chains	High
	Increased variability or reduction of key inputs and costs (e.g. materials, commodities, water, electricity, insurance)	Moderate
High Winds/ Tornadoes	Disruptions to supply chains	High
	Disruption and/or impairment to service productivity	High
	Property damage	High
	Decreased customer foot traffic	Moderate
Total Precipitation	Disruption and/or impairment to service productivity	Moderate
	Decreased customer foot traffic	Moderate
Very Cold Days and Extreme Cold	Disruptions and/or impairment to service productivity	High
	Decreased customer foot traffic	Moderate
	Disruptions to supply chains	Low
	Increased variability or reduction of key inputs and costs (e.g. materials, commodities, water, electricity, insurance)	Low

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Disruptions to supply chains	High
	Disruption and/or impairment to service productivity	High
	Decreased customer foot traffic	Moderate
	Property damage	Moderate

Municipal Services

The municipal services system consists of the City's workers and staff, assets, and services. In this section, we present the vulnerability assessment for the six sub-classes: Municipal Workers, Community and Social Services, Public Health and Safety, Public Works, Emergency Management, and Municipal Fleet.

Municipal Workers

The City of Toronto employs nearly 6,000 staff that work outdoors on road maintenance, waste collection, parks, forestry and emergency response.[78] These workers face increasing exposures to extreme weather events due to the changing climate, while staff shortages are straining operations and reducing response and adaptive capacity.[79] As extreme weather events become more frequent, the physical demands and safety risks of these jobs will continue to escalate, increasing the risk of burnout, injury and gaps in service delivery. Outdoor municipal workers are exposed to extreme heat, severe storms and poor air quality. Heatwaves increase the risk of heat exhaustion and stroke, particularly for waste collectors, road crews and landscapers working in direct sunlight for extended hours. Additionally, studies show that outdoor workers experience significant productivity declines in extreme heat, with work slowing by up to 30 per cent in extreme cases.[80] Flood events can also cause injury or death, although this is rare.[81] City of Toronto

[78] CUPE. (2024). City of Toronto outside workers ratify new contract. https://cupe.ca/city-toronto-outside-workers-ratify-new-contract

[79] Rider, D. (2023). Traffic snarls, cyber threats, program cuts: Why low-pay, high-stress jobs at City Hall remain unfilled. Toronto Star. https://www.thestar.com/news/gta/traffic-snarls-cyber-threats-program-cuts-why-low-pay-high-stress-jobs-at-city-hall/article_76847a4e-7f37-5914-a1bb-a6b055e092fa.html

[80] Wang, X., Zhang, Y., Li, H., & Zhao, X. (2024). The impact of extreme heat on construction worker productivity: A meta-analysis. BMC Public Health, 24. https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-024-20744-x

[81] CityNews. (2024). Construction worker killed in flash flood after storm passes through King City. https://toronto.citynews.ca/2024/07/31/king-city-construction-worker-dead-flash-flood/

staff are provided with health and safety training, which should incorporate resilience from the impacts of exposure to extreme weather events.[82]

Climate hazards endanger workers and significantly increase service demands, forcing employees into longer shifts and emergency response roles. Winter storms require rapid snow clearance and/or removal and fallen-tree clearing, while heatwaves increase the need for sanitation services, cooling infrastructure maintenance and emergency repairs. Heavy rainfall and flooding strain road maintenance crews, stormwater managers and emergency repair teams, further intensifying workloads.

Key Vulnerability Drivers: Direct exposure to climate hazards due to the nature of work, staff shortages further strain workers, especially during surges in service demand.

Table 17. Impact statements and vulnerability rankings by climate hazard — Municipal Workers.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Outdoor workforce exposure	Moderate
	Delays in critical activities and operational and regulatory requirements not met, which increases liability	Moderate
	Increase in workload	Moderate
	Loss of productivity	Moderate
Ecosystem Changes	Increased exposure to vector-borne diseases and allergens for outdoor workers	Moderate
	Delays in critical activities and operational and regulatory requirements not met, which increases liability	Moderate
	Increase in workload	Moderate
	Loss of productivity	Moderate

[82] City of Toronto. Orientation Training – Program Standards. https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/corporate-policies/people-equity-policies/orientation-training/orientation-training-program-standards/

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Heat-related illnesses	High
	Decreased productivity	High
	Delays in critical activities and operational and regulatory requirements not met, which increases liability	Moderate
	Increase in workload	Moderate
Extreme Precipitation	Increased workload during storms	High
	Injury or death from flood events	Moderate
	Delays in critical activities and operational and regulatory requirements not met, which increases liability	Moderate
	Loss of productivity	Moderate
Freeze-thaw Cycles	Hazardous driving conditions, leading to an increase in accidents and injury	High
	Trips and falls from icy conditions	Moderate
High Winds/ Tornadoes	Injury or death from high-wind events	High
	Increased workload during storms	High
	Delays in critical activities and operational and regulatory requirements not met, which increases liability	Moderate
	Loss of productivity	Moderate
Total Precipitation	Outdoor workforce exposure	Low
Very Cold Days and Extreme Cold	Hypothermia and frostbite	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Increased workload during storms	High
	Hazardous road and sidewalk conditions, leading to an increase in accidents and injury	High
	Hypothermia and frostbite	Moderate
	Trips and falls from icy conditions	Moderate
	Delays in critical activities and operational and regulatory requirements not met, which increases liability	Moderate
	Loss of productivity	Moderate

Community and Social Services

Toronto's community and social services support residents through social services, employment programs, education and daycare, libraries, recreation centres and parks, affordable housing, homeless shelters, and cultural and heritage programs.

Toronto Community Housing (TCHC) provides homes to nearly 93,000 residents in approximately 41,000 low- and moderate-income households, making it the largest social housing provider in the city. In 2021, Toronto Seniors Housing Corporation (TSHC) was established, offering subsidized rental housing for approximately 15,000 low- and moderate-income seniors. The combination of aging infrastructure, energy poverty and climate stressors puts many tenants at risk of exposure to potentially dangerous temperatures during heatwaves and cold snaps. Currently, demand for community housing far exceeds supply, with estimated wait times of up to 10 years for a rent-geared-to-income studio apartment and 15 years for a three-bedroom or larger unit.[83]

The assessment highlights significant vulnerabilities to services for unhoused populations and low-income tenants, primarily driven by extreme heat, cold and severe storms.[84] The most critical vulnerability is the capacity for shelter services to accommodate individuals experiencing homelessness during extreme weather events. Shelter capacity has been an ongoing issue, with an average of 200 individuals being turned away each month in 2024.[85] city-administered shelters for unhoused people, including base and emergency shelters, 24-hour respite sites and women's drop-ins, serve an average of 7,195 individuals per

[83] Yahoo News. (2023, December 22). Homeless shelters in Toronto pushed to the limit as demand skyrockets. Yahoo. Retrieved from https://ca.news.yahoo.com/homeless-shelters-toronto-pushed-limit-225928079.html

[84] Note that Toronto Shelter and Support Services (TSSS) opens pre-planned warming centres at -5 °C and additional contingency spaces and measures at -15 C.

[85] "Average daily number of unmatched individual callers" from the Sheller System Request for Referrals dashboard: City of Toronto. (n.d.). Shelter system requests for referrals. https://www.toronto.ca/city-government/data-research-maps/research-reports/housing-and-homelessness-research-and-reports/shelter-system-requests-for-referrals/

month, including men (1,813/month), women (748/month), youth (528/month), co-ed shelters (706/month) and families (3,400/month). Chronic undercapacity leaves many vulnerable to extreme weather conditions.[86]

The demand for cool spaces[87] ranks very high, reflecting the strain on resources in the city during heatwaves. Toronto's Heat Relief Strategy is a protocol for hot weather response that aims to reduce the incidence of heat-related illness and death due to extreme heat by providing education and services to vulnerable groups at increased risk for heat-related illnesses.[88] Toronto's Heat Relief Network provides additional capacity during heat events by formalizing and promoting the use of existing public air-conditioned and other cool spaces, such as libraries, community centres, shopping malls and YMCA locations, which are accessible during their regular business hours throughout the summer. During heat warnings issued by ECCC, select pools and civic centres extend their hours to offer additional relief. However, these public spaces may not feel welcoming for people experiencing houselessness, as they are often subjected to harassment or restrictive policies.[89] This issue is exacerbated by the growing need for heat relief among social housing residents, particularly seniors, children, individuals with chronic illnesses and those with mental health conditions. The Heat Relief Strategy also recognizes that a heat emergency may arise when the severity and/or duration of a heat event means that the activities provided to the public under the Heat Relief Strategy no longer ensure adequate well-being and safety. In this case, there is additional planning in place to coordinate the City's response to an extreme heat emergency.

Beyond immediate shelter needs, demand for social services, including health assessments, mental health support and financial assistance, rises during extreme weather events. While these impacts are rated moderate, they place additional strain on municipal support systems that are already operating at capacity.

Key vulnerability drivers: shelter capacity constraints, heat relief network/cool spaces capacity and accessibility, lack of affordable and subsidized housing supply, emergency planning and services for extreme weather events, energy poverty in social housing.

[86] Statistics from past internal consultations at the City.

[87] City of Toronto. Cool Spaces Near You. https://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/hot-weather/cool-spaces-near-you/#location=&lat=&lng=&zoom=

[88] City of Toronto. 2024. City of Toronto Heat Relief Strategy. https://www.toronto.ca/wp-content/uploads/2024/05/9635-PublicHealthHeatReliefStrategy.pdf

[89] CBC News. (2023, July 14). Heat experts say Toronto's cooling centres aren't enough to protect vulnerable people. CBC. Retrieved from https://www.cbc.ca/news/canada/toronto/heat-experts-cooling-centres-1.6899857

Table 18. Impact statements and vulnerability rankings by climate hazard - Community and Social Services.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Disruption of service delivery in shelters for unhoused population due to overcrowding	High
	Increased need for city outreach services such as Streets to Homes	Moderate
Extreme Heat and Very Hot Days	Disruption of service delivery in shelters for unhoused population due to overcrowding	Very high
	Increased demand for cool spaces through the Heat Relief Network	Very high
	Increased need for city outreach services such as Streets to Homes	High
	Increased energy costs on affordable and social housing tenants	High
	Increased demand for social services, including health assessments, mental health support and financial assistance programs for vulnerable populations	Moderate
Extreme Precipitation	Disruption of service delivery in shelters for unhoused population due to overcrowding	High
	Increased need for city outreach services such as Streets to Homes	Moderate
High Winds/ Tornadoes	Disruption of service delivery in shelters for unhoused population due to overcrowding	Very high
	Increased need for city outreach services such as Streets to Homes	Moderate
Total Precipitation	Disruption of service delivery in shelters for unhoused population due to overcrowding	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Disruption of service delivery in shelters for unhoused population due to overcrowding	Very high
	Increased need to activate warming centres and other contingency measures	High
	Increased need for city outreach services such as Streets to Homes	High
	Increased energy costs on affordable and social housing tenants	High
	Increased demand for social services, including health assessments, mental health support and financial assistance programs for vulnerable populations	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Disruption of service delivery in shelters for unhoused population due to overcrowding	Very high
	Increased need to activate warming centres and other contingency measures	Moderate
	Increased demand for social services, including health assessments, mental health support and financial assistance programs for vulnerable populations	Moderate
	Increased need for city outreach services such as Streets to Homes	Moderate

Public Health and Safety

Climate-related hazards such as extreme heat, cold, storms and flooding drive surges in the demand for public health and emergency services that increase pressure on first responders, healthcare infrastructure, and community and public safety services. The Municipal Services' Public Health and Safety sub-class comprises several divisions across the City of Toronto:

1. Toronto Public Health (TPH) delivers and implements health service programs and public policy and practices. Their services meet community health needs, comply with Ontario Public Health Standards, support the reduction of health inequities, and support health outcomes for the City's population. TPH's key service areas are Chronic Diseases and Injuries, Emergency Preparedness, Environmental Health, Family Health, Infectious Diseases and Public Health Foundations. TPH also plays a leadership role in responding to climate-related health risks through initiatives such as the Wildfire Smoke Strategy, the Heat

Relief Network (HRN), health surveillance for vector-borne diseases and heat-related illness, health hazard response, and prevention of waterborne illnesses linked to drinking and recreational water sources.[90]

2. Seniors Services and Long-Term Care is responsible for service planning and strategic integration of city services for seniors. The scope of services includes community support programs, such as adult day programs, supportive housing services, tenancy supports and homemakers and nurses services for vulnerable individuals who reside in the community; directly operating 10 long-term care homes that provide 24-hour resident-focused care for permanent and short-stay admissions; and care, services and programs that enhance quality of life by responding to individual resident needs.

3. Toronto Paramedic Services (TPS) provides 24-hour pre-hospital and out-of-hospital emergency and non-emergency care and transportation to and between hospitals for ill or injured individuals, as well as public education programs to promote rapid and appropriate use of emergency medical resources.

4. Toronto Fire Services (TFS) is the City's only all-hazards emergency response organization. They provide Toronto residents, visitors and businesses with protection against loss of life, property and the environment from the effects of fire, illness, accidents, and all other hazards through preparedness, prevention, public education and emergency response. In addition, the Fire Prevention Division of Toronto Fire Services provides information and public education about emergencies, fire safety programs and regulations, home inspections and the Alarm for Life program for residential smoke and carbon monoxide alarms.

5. The Toronto Police Service (TPS) is the City's police service that works in partnership with communities to keep Toronto safe through:

    a. Establishing community-based crime prevention initiatives;

    b. Enforcing all applicable laws in Toronto, including provincial offenses, the Highway Traffic Act and City bylaws;

    c. Maintaining public order to ensure safe and secure communities; and

    d. Providing emergency response to major threats and public safety risks.

[90] See Toronto Public Health. (2024). *Strategic Plan 2024–2028*. City of Toronto. https://www.toronto.ca/city-government/accountability-operations-customer-service/long-term-vision-plans-and-strategies/toronto-public-health-strategic-plan/

6. Toronto Emergency Management (TEM) is responsible, through the direction of the Toronto Emergency Management Program Committee, for coordinating emergency preparedness, response and recovery for the City of Toronto. Working with city divisions, agencies and corporations (DACs) and external partners, TEM ensures a well-organized approach to managing emergencies and major events. TEM's key responsibilities include:

    a. Providing tools and information to the public on emergency readiness;

    b. Developing and maintaining the City's Emergency Plan, emergency support functions and hazard-specific plans;

    c. Conducting training and exercises;

    d. Maintaining the City's Toronto Emergency Operations Centre (TEOC) in a state of readiness;

    e. Facilitating the City's Business Continuity Management Program;

    f. Delivering the City's Emergency Social Services Program;

    g. Maintaining a 24/7 on-call function to assess risks and provide support to DACs, enabling them to escalate emergency management structures when necessary; and

    h. Coordinating city-wide emergency response and recovery efforts through TEOC activation.

(TEM is a crossover between public health and safety and emergency management sub-classes).

Extreme weather may significantly impact demand for emergency response services. Some examples include heatwaves and extreme cold that could drive up ambulance calls, and dispatches for fire and police services, leading to spikes in emergency department visits,[91] with unhoused people 18 times more likely to require emergency care for frostbite and hypothermia during extreme cold events.[92] Similarly, flooding events can overwhelm emergency responders with increased tasks, including evacuating long-term care homes and retirement homes[93] and emergency calls from submerged vehicles and flooded

[91] Williams, A. A., Allen, J. G., Catalano, P. J., Buonocore, J. J., & Spengler, J. D. (2020). The Influence of Heat on Daily Police, Medical, and Fire Dispatches in Boston, Massachusetts: Relative Risk and Time-Series Analyses. American journal of public health, 110(5), 662–668. https://doi.org/10.2105/AJPH.2019.305563

[92] Institute for Clinical Evaluative Sciences (ICES). (2024). *Patients experiencing homelessness in Toronto up to 18 times more likely to visit emergency departments for cold-related injuries.* https://www.ices.on.ca/news-releases/patients-experiencing-homelessness-in-toronto-up-to-18-times-more-likely-to-visit-emergency-departments-for-cold-weather-related-injuries-unity-health-study-finds/

[93] Insauga. (2024). *116 residents evacuated from long-term care home over 12 hours in Mississauga.* https://www.insauga.com/116-residents-evacuated-from-long-term-care-home-over-12-hours-in-mississauga/

buildings.[94] Additionally, impacts of wildfire smoke on air quality (e.g. from wildfires outside of the city) can exacerbate existing respiratory and cardiovascular diseases such as asthma and worsen mental health issues, including anxiety, depression and general distress.

Extreme weather and its impacts also heighten the likelihood of a complex or city-wide emergency requiring the activation of the City's TEOC to coordinate response. Events such as winter storm alerts, flood watches and prolonged heat warnings for the city of Toronto trigger additional Toronto Emergency Management activities and increase demand on TEM and other DACs involved in the response to the hazard in question.

These challenges and other climate-related impacts and extreme events are compounded by other stressors, such as staffing shortages, aging infrastructure and funding constraints, which reduce the City's ability to manage emergencies efficiently and to protect the city's communities, especially the most vulnerable populations. For example, Toronto's long-term care facilities face increasing risks from extreme weather due to the vulnerability of their residents (total capacity of 2,641 beds) and the rising demand for services (e.g. expected to increase by 44,810 people by 2031), adding significant pressure on these facilities.[95]

Capacity constraints across police, fire, paramedics and long-term care services limit Toronto's ability to respond effectively to climate-driven emergencies. Toronto police currently have 168 officers per 100,000 residents, a ratio below the national average of 178, which may affect their capacity to respond during extreme heat, cold and major storms.[96] Toronto Fire and Paramedic Services face similar challenges due to aging infrastructure and rising service demands. The fire department operates 85 stations across the city, but a growing backlog of state-of-good-repair (SOGR) projects is leading to deferred maintenance and underfunding. Of the department's 10-year capital budget, 51 per cent is allocated to maintenance projects, yet ongoing funding shortfalls mean that critical upgrades to stations and response facilities are often delayed.[97] Paramedic services are also working to keep pace with Toronto's changing demographics. The city's senior population is projected to grow from 16 per cent to 21 per cent by 2041,[98] increasing the dependency ratio and placing additional strain on paramedic services.

Key Vulnerability Drivers: Staffing shortages, aging infrastructure, funding backlog, aging population.

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[94] Canadian Firefighter. (2024). *Toronto Fire Service processed nearly 1,700 calls in response to daily rain record.* https://www.cdnfirefighter.com/toronto-fire-service-processed-nearly-1700-calls-in-response-to-daily-rain-record/

[95] Information from past internal consultations with city staff.

[96] The Star. (2024). *Toronto police board seeks to increase officer-to-population ratio.* https://www.thestar.com/news/gta/toronto-police-board-wants-to-increase-the-cop-to-population-ratio-why-experts-say-that/article_6490908a-a1d0-11ef-a9f8-6352549fe3dc.html

[97] Information from past internal consultations with city staff.

[98] City of Toronto. (2019). *Toronto Seniors Strategy 2.0: Towards an age-friendly city.* https://www.toronto.ca/wp-content/uploads/2019/02/93cd-CoT-seniors-strategy2.pdf

Table 19. Impact statements and vulnerability rankings by climate hazard — Public Health and Safety.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Potential increased demand for paramedic services	High
Ecosystem Changes	Potential increased demand for paramedic services due to vector-borne diseases and allergies	Moderate
Extreme Heat and Very Hot Days	Fire and police services may face increased demands to assist unhoused individuals and enforce safety in public spaces under extreme heat conditions	High
	Potential increased demand for paramedic services due to heat-related illnesses	High
	Safety risks in long-term care facilities, retirement homes and supportive housing	High
Extreme Precipitation	Safety risks in long-term care facilities	High
	Increased demand for Emergency Medical Services (EMS)	High
	Challenge in responding to emergencies due to road inaccessibility	Moderate
Freeze-thaw Cycles	Increase in hospital visits due to slips and falls from icy conditions	Moderate
High Winds/ Tornadoes	Potential increased demand for paramedic services due to wind-related illnesses and injuries	High
	Fire and police services may face increased demands from medical calls, for traffic management and to assist unhoused individuals and enforce safety in public spaces	High
Total Precipitation	Potential increased demand for emergency services	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Potential increased demand for paramedic services due to cold-related illnesses and injuries	High
	Fire and police services may face increased demands to assist unhoused individuals and enforce safety in public spaces under extreme cold conditions	High
	Difficult conditions for fire services to respond to fire	High
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Potential increased demand for paramedic services due to cold-related illnesses and injuries	High
	Police services may face increased demands to assist unhoused individuals and enforce safety in public spaces under winter storm conditions	High
	Increased demand for services due to an increase in vehicle collisions related to poor driving conditions and other traffic management support required due to road disruptions	High
	Challenge in responding to emergencies due to road inaccessibility	Moderate

Public Works

Toronto's public works divisions include Engineering and Construction Services, Transportation Services, Transit Expansion, and Toronto Water and Solid Waste Management Services, as well as the Toronto Transit Commission. These divisions and agencies are responsible for planning, building and maintaining transit, roads, bridges, the public realm sidewalks and biking lanes/paths and critical infrastructure. In addition, other divisions (e.g. Parks and Recreation) lead capital projects that involve construction and maintenance of important city assets. This section focuses on impacts to infrastructure construction and maintenance, while the Infrastructure Systems section addresses impacts to the provision and accessibility of services provided by these assets. Climate change is increasing the frequency and severity of weather-related disruptions, which strain municipal resources, delay construction projects and exacerbate infrastructure deterioration. The City's aging infrastructure and backlog of maintenance projects further compound these vulnerabilities and risks.

Toronto's road and infrastructure systems face escalating stress from extreme weather, increasing repair needs and operational costs. Heatwaves soften asphalt and cause rutting, shoving and pavement deformation, particularly under heavy vehicles like buses and trucks. As temperatures rise, prolonged heat exposure could lead to widespread pavement failures, requiring costly repairs.[99] Freeze-thaw cycles present another major challenge. Repeated freezing and thawing weakens road surfaces, leading to cracks, potholes and structural instability.

Public Works crews must respond to these challenges while facing significant budget constraints. As infrastructure deterioration worsens, Toronto may struggle to allocate sufficient resources for routine maintenance and emergency repairs. Toronto's aging infrastructure and insufficient funding for state-of-good-repair projects hinder adaptation efforts. The City's 2025 capital budget report highlights a backlog of infrastructure repairs, particularly in road maintenance, bridges and stormwater systems.[100] Furthermore, extreme weather events, including heatwaves, extreme cold, high winds and winter storms, reduce productivity by compromising worker safety, impairing equipment functionality, delaying construction projects and exacerbating infrastructure maintenance backlogs.

Severe storms, high winds, winter storms and extreme precipitation create spikes in demand for Public Works services, increasing the workload for road maintenance, debris clearance and emergency infrastructure repairs. During winter storms, Toronto Hydro and Forestry crews work around the clock to clear fallen trees, repair transmission lines and restore the transportation system.[101]

Key Vulnerability Drivers: Municipal funding backlog, aging infrastructure, rapid population increase, increasing demand for public works services, increase in impacts from extreme weather

[99] City of Toronto. (2016). Resilient City – Preparing for a Changing Climate Status Update and Next Steps. https://www.toronto.ca/legdocs/mmis/2016/pe/bgrd/backgroundfile-98049.pdf

[100] CBC News. (2024). *Toronto capital budget aims to flatten curve of growing infrastructure repair backlog.* https://www.cbc.ca/news/canada/toronto/toronto-2025-capital-budget-state-of-good-repair-1.7440967

[101] City of Toronto. (2014). *Impacts from the December 2013 Extreme Winter Storm Event on the City of Toronto.* https://www.toronto.ca/legdocs/mmis/2014/cc/bgrd/backgroundfile-65676.pdf

Table 20. Impact statements and vulnerability rankings by climate hazard — Public Works.

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Increased workload during and following heat waves, loss of productivity, increased absenteeism/sick days and project delays	Very high
	Extreme heat can halt or delay construction projects, as high temperatures affect worker safety, equipment functionality and the quality of materials like concrete and asphalt	High
	Extreme heat can cause damage and rutting, increasing maintenance/replacement costs for the City	High
Extreme Precipitation	Increased workload during storms, loss of productivity, increased absenteeism/sick days and project delays	Moderate
Freeze-thaw Cycles	Increase in maintenance due to infrastructure damage from freeze-thaw cycles	High
High Winds/ Tornadoes	Increased workload during storms	High
	Wind storms can halt or delay construction projects	Moderate
Total Precipitation	Increased maintenance requirements due to road infrastructure degradation	Moderate
	Increase maintenance on stormwater management systems	Moderate
Very Cold Days and Extreme Cold	Prolonged extreme cold can halt or delay construction projects, as low temperatures affect worker safety, equipment functionality and the quality of materials like concrete and asphalt	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Increased workload during storms	High
	Winter storms can halt or delay construction projects	Moderate

Emergency Management

Emergency management consists of five core components — prevention, mitigation, preparedness, response and recovery — that work together as a continuous cycle to manage and address risks.[102] Just as emergency management is a shared responsibility across all sectors of society,[103] a variety of city divisions, agencies and corporations are involved in the City's emergency management capability.

The City's emergency services (Toronto Police Service, Toronto Fire Services and Toronto Paramedic Services) and other DACs manage many incidents that occur on a day-to-day basis. As the magnitude of an emergency increases, the need for additional support from within the City will also grow. Depending on the situation, DACs such as Toronto Shelter and Support Services, Transportation Services, Toronto Water and Toronto Hydro may be involved. The Toronto Emergency Operations Centre may be activated to provide support and coordinate across the various roles and resources. If the City's response capabilities are exceeded, the City may also call upon the provincial government to provide additional resources and support.[104]

Toronto Emergency Management acts as a central coordination hub for the City's emergency preparedness and response to larger-scale emergencies. This includes providing tools and information to the public on emergency readiness; providing city DACs with planning tools and guidance where needed; working with emergency services partners and other city DACs to coordinate emergency response when scenarios exceed their day-to-day response processes; and coordinating recovery efforts. TEM is responsible for emergency support functions, as well as the City's Emergency Plan and supporting documents such as hazard-specific plans, which delineate common response activities and DAC responsibilities. TEM also maintains and runs the City's Emergency Operations Centre, is responsible for delivering the City's Emergency Social Services Program and facilitates the City's Business Continuity Management Program.

Climate hazards can create emergencies on a scale that increases demand on emergency services and other city DAC operations and necessitates activation of the City's TEOC. Both the federal framework and the provincial strategy recognize climate change as a risk driver that must be considered in emergency preparedness planning. Extreme weather can endanger life, stress the emergency services' capacity, disrupt transportation

[102] Government of Ontario. (n.d.). A Safe, Practiced and Prepared Ontario: Provincial Emergency Management Strategy and Action Plan. https://www.ontario.ca/page/a-safe-practiced-and-prepared-ontario

[103] AMinisters Responsible for Emergency Management. (2017). An Emergency Management Framework For Canada (Third Edition). https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/2017-mrgnc-mngmnt-frmwrk/index-en.aspx

[104] City of Toronto. (2024). City of Toronto Emergency Plan. https://www.toronto.ca/wp-content/uploads/2024/09/96d4-Emergency-Plan-2024-2024-09-24-FINAL.pdf

systems, damage property and the City's urban forest and natural spaces, impact critical infrastructure such as Toronto Hydro and Toronto Water, increase demand on shelters and services for people experiencing homelessness, and temporarily displace other residents due to damage or loss of vital services. The City has developed hazard-specific plans for extreme winter weather, extreme heat emergencies and flooding that identify weather-related triggers for TEOC activation, and various response plans and processes are in place across relevant DACs, along with Business Continuity Plans. However, the possibility of system overwhelm due to multiple hazards occurring simultaneously or in rapid succession and ongoing challenges with day-to-day capacity, such as chronic shelter shortages, limits the surge capacity to deal with larger-scale events.

The third edition of *An Emergency Management Framework for Canada* notes that "Traditionally, emergency management in Canada has focused on preparedness and response," and that the modern hazardscape requires additional attention to prevention and mitigation as well as recovery measures.[105] While activities related to prevention and mitigation relevant to climate change are underway in multiple city DACs, emergency management has not traditionally served as a central coordination hub for these activities, and the approach to coordination of such efforts in the city is still evolving.

Key Vulnerability Drivers: Lack of homeless shelter capacity; current pressures on existing plans, processes, capabilities and resources

Table 21. Impact statements and vulnerability rankings by climate hazard — Emergency Management.

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Increased demand for emergency cleaner air spaces	High
Extreme Heat and Very Hot Days	Increased demand for public communications and cooling locations during an extreme heat event	High
	Increased need to activate an Incident Management Team or the City Emergency Operations Centre to coordinate a complex or city-wide response	High

[105] Ministers Responsible for Emergency Management. (2017). An Emergency Management Framework For Canada (Third Edition). https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/2017-mrgnc-mngmnt-frmwrk/index-en.aspx

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Precipitation	Increased demand for emergency shelters for individuals experiencing homelessness	High
	Increased demand for emergency social services for individuals affected by power outages or displaced from their homes due to flooding damage	Moderate
	Increased need to activate an Incident Management Team or the City Emergency Operations Centre to coordinate a complex or city-wide response involving multiple DACs	High
High Winds/ Tornadoes	Increased demand for shelters, straining resources and capacity to accommodate unhoused populations	High
	Increased demand for emergency social services for individuals affected by power outages or displaced from their homes due to widespread damage	Moderate
	Increased need to activate an Incident Management Team or the Toronto Emergency Operations Centre to coordinate a complex or city-wide response involving multiple DACs	High
Very Cold Days and Extreme Cold	Increased demand for warming centres, straining resources and capacity to accommodate unhoused populations or individuals affected by power outages	High
	Increased need to activate an Incident Management Team or the City Emergency Operations Centre to coordinate a complex or protracted response involving multiple DACs	High

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Increased demand for warming centres, straining resources and capacity to accommodate unhoused populations	High
	Increased demand for emergency services (fire, police, paramedic)	High
	Increased need to activate an Incident Management Team or the City Emergency Operations Centre to coordinate a complex or city-wide response involving multiple DACs	High
	Increased demand for emergency social services for individuals impacted by power outages or displaced due to widespread damage	Moderate

Municipal Fleet

Toronto's municipal fleet which, includes 5,000 vehicles across the City's divisions, agencies and corporations, plays a critical role in delivering public services, emergency response and infrastructure maintenance. The City's fleet is managed by the Fleet Services Division, which is responsible for the procurement, maintenance and training of all city staff who operate vehicles or equipment to deliver services for the residents of Toronto.

Extreme weather conditions directly impact fleet performance and reliability. Flooding and winter storms further increase the risk of vehicle damage and road accidents, disrupting emergency response and public works operations.

Surging demand for fleet services during extreme weather, such as snow removal, emergency response, and road maintenance, may exceed available resources, delaying critical services.

Extreme weather and temperatures may impact the well-being of operational staff who drive vehicles and ferries, operate heavy machinery and service/repair vehicles in garages across the city. During these events, the City will need to consider how to support its staff to continue to deliver its services.

Toronto's fleet is changing. The Sustainable City of Toronto Fleets Plan sets zero-emission vehicle targets of 20 per cent by 2025 and 50 per cent by 2030 and covers more than 10,000 vehicles and equipment managed by the City.[106] Extreme temperatures impact both

[106] City of Toronto. (2023). Sustainable City of Toronto Fleets Plan. https://www.toronto.ca/wp-content/uploads/2023/05/8f83-Sustainable-City-of-Toronto-Fleets-Plan.pdf

electric vehicles (EV) and gas- and diesel-powered vehicles. In the case of EVs, it reduces range, while extreme cold affects battery efficiency, charging speeds and engine reliability — key factors to consider for Toronto's transition to electric vehicles. EVs have battery management systems that prevent the battery from overheating; however, during extreme heat events the batteries may struggle to cool, and in worse-case scenarios this could lead to a fire. Many of these issues may be addressed as EV technology continues to improve and additional low- emission vehicles and equipment become available in the North American market.

The shift to low-emission vehicles and EVs will require access to additional power sources and back-up solutions when the City faces power outages due to extreme weather events. It will be important for the City's fleet to consider resilience strategies for powering EVs and assets during power outages and investing in alternative energy systems (e.g. hydrogen).

The Fleet Services Division is working to transition the City's fleets to low-emission/zero-emission vehicles and equipment. The transition considers market availability, cost and overall asset performance to ensure that City operations can be effectively delivered. Fleet Services is looking into resilience strategies to adapt to the changes in climate. This includes exploring options that will support the fleet to operate during extreme weather events. Options include securing back-up energy storage solutions and natural-gas-powered generators so there is no interruption of critical services and exploring the use of alternative fuel sources, including hydrogen, that do not rely on the electrical grid.

Key Vulnerability Drivers: Demand for services during extreme weather, energy capacity, access to energy/fuel during extreme weather events

Table 22. Impact statements and vulnerability rankings by climate hazard — Municipal Fleet.

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	EV range decrease during hot weather EV battery may be at risk of overheating	Moderate
Extreme Precipitation	Direct damage to fleet vehicles from flooding	Moderate
High Wind/ Tornadoes	Direct damage from high-wind events on fleet vehicles	Moderate
Total Precipitation	Increase in vehicle collisions	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Extreme cold may affect the performance of EVs	Moderate
	Increased risk of vehicle malfunctions such as battery failures and engine problems, impacting the reliability of fleet vehicles	Low
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Increased risk of accidents due to poor road conditions	Moderate
	Increased surge in demand for fleet vehicles (police, paramedic, snow clearing and removal, public works)	Moderate

Infrastructure Systems

Active Transportation[107]

Toronto's active transportation networks, including cycling infrastructure, pedestrian routes, and bike-share services, are exposed to increasing challenges due to the impacts of extreme weather. Heatwaves and very hot days, heavy precipitation and flooding, and winter storms directly affect the condition of active transportation infrastructure, access to infrastructure for users (e.g. cyclists, pedestrians) and user safety. These stressors can disproportionately impact the people using these systems because of their exposure to extreme weather.

[107] Note that impacts- and vulnerabilities-related damage and deterioration of cycling infrastructure are captured in the Road Network sub-class section.

Extreme weather events often discourage active transportation by making cycling and walking feel difficult, uncomfortable or unsafe. For example, extreme heat reduces cycling, particularly when temperatures exceed 27–28 C.[108] This is due to increased heat stress and dehydration risks, especially for those commuting long distances.

Bike share Toronto, Toronto's bike share service, is similarly highly sensitive to weather conditions, with ridership fluctuating based on temperature, precipitation and extreme weather events.[109] Service interruptions due to storms, heatwaves, or infrastructure damage can reduce overall accessibility, discouraging cycling as a primary transportation mode.

While heat waves and other extreme weather may reduce cycling during peak summer months, increasingly moderate temperatures in spring and fall could extend the active transportation season and increase overall ridership. Additionally, as Toronto's winters become milder due to climate change, active transportation use may rise year-round, with shorter, less severe winters encouraging more cycling and walking.

Key Vulnerability Drivers: Exposure of cyclists and pedestrians to impacts of extreme weather; higher relative vulnerability of active outdoor users to extreme heat, extreme cold, icy conditions, and heatwaves

Table 23. Impact statements and vulnerability rankings by climate hazard — Active Transportation (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Reduced use of active transportation (due to negative health impacts on users)	Moderate
Extreme Heat and Very Hot Days	Reduced use of active transportation (e.g. impacts on bike lane and road pavement and adverse health impacts for users caused by heat stress)	High
Extreme Precipitation	Reduced use of active transportation (e.g. disruptions due to flooding and potentially unsafe cycling conditions)	Moderate

[108] Wang, K., Akar, G., & Chen, Y. (2021). *Effects of weather on bikeshare ridership: A global analysis.* Transportation Research Part D: Transport and Environment, 96, 102882. https://www.sciencedirect.com/science/article/abs/pii/S0966692321002088

[109] El-Assi, Wafic, Mohamed Salah Mahmoud, and Khandker Nurul Habib. 2017. "Effects of Built Environment and Weather on Bike Sharing Demand: A Station Level Analysis of Commercial Bike Sharing in Toronto." Transportation 44, no. 3: 589-613. https://doi.org/10.1007/s11116-015-9669-z

Climate Hazard	Impact Statement	Vulnerability Ranking
Freeze-thaw Cycles	Reduced use of active transportation (e.g. freeze-thaw cycles create icy conditions, potholes/uneven surfaces, which are dangerous for micromobility, reducing the safety and accessibility of active transportation networks; and increasing risks for cyclists and pedestrians navigating poorly maintained or untreated bike lanes, paths and sidewalks)	Moderate
	Increased cost of claims from unsafe active transportation infrastructure	Moderate
High Winds/Tornadoes	Reduced use of active transportation and increased risks (e.g. high winds negatively impact the safety and efficiency of active transportation networks, bike-share services and traffic control systems).	Moderate
Total Precipitation	Reduced active transportation	Moderate
Very Cold Days and Extreme Cold	Reduced use of active transportation (e.g. extreme cold imposes higher degree of difficulty and discomfort, as well as reduced safety for active cyclists and pedestrians)	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Reduced use of active transportation (e.g. winter/ice storms impose extreme safety hazards for active transportation infrastructure and those who use it, including risk of injury and possibly death due to road accidents, and health impacts of extreme cold)	Moderate
	Increased cost of claims from unsafe active transportation infrastructure	Moderate

Buildings

There are approximately 517,000 residential and 45,000 non-residential buildings in Toronto,[110]covering more than 150 million square meters. The City owns and insures 2,223 buildings across 1,060 locations, adding up to about 4 million square meters. A majority of Toronto's buildings were constructed before 1960, making them particularly vulnerable to climate hazards.[111] Many lack modern insulation, ventilation and flood protection measures, increasing their susceptibility to heat stress, water damage and structural deterioration.

[110] As of September 2025.

[111] Based on buildings assessment data.

Retrofitting is costly, and financial constraints limit adaptation efforts, particularly for smaller businesses and municipal facilities. Additionally, the significant state-of-good-repair (SOGR) backlog further restricts the City's capacity to implement resilience-focused retrofits for city-owned infrastructure.

Extreme heat significantly increases indoor temperatures in older buildings, particularly those with poor ventilation and outdated HVAC systems. This affects worker productivity, energy efficiency and occupant comfort. Municipal buildings, including community centres and administrative offices, face similar challenges, with high cooling demands straining aging HVAC systems. There are nearly 1,200 older high-rise apartment towers built between 1945 and 1984 that house approximately 500,000 residents, and the majority of them do not have central air conditioning. Window air conditioners can place significant strain on building electrical systems and may be restricted by landlords, exacerbating heat exposure risks during extreme weather events.[112]

Toronto's aging buildings are also highly vulnerable to flooding, with extreme precipitation events causing costly structural and operational disruptions. The 2024 floods caused over $1 billion in damages[113] to residential and non-residential buildings, including a damaged ceiling at Toronto City Hall.[114]

Extreme cold increases heating demand and the risk of frozen pipes, particularly in older commercial, municipal and residential buildings. A majority of Toronto's residential buildings were constructed before 1960, making them more susceptible to cold-related damage. Frozen pipes can lead to severe water damage, and certain areas, such as North York, Scarborough and Etobicoke, experience higher risks due to acidic clay soil and aging cast iron pipes.[115] Freeze-thaw cycles further contribute to structural deterioration, with older buildings experiencing cracking in walls, roofs and foundations, requiring frequent repairs. High winds and winter storms cause direct damage to rooftops, signage and HVAC systems, while falling tree limbs pose additional risks. Residential buildings, particularly older structures, are vulnerable to wind damage and storm impacts. Winter storms can also lead to power outages, compounding heating challenges for households relying on electric heating.

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[112] Toronto Public Health. (2015). *Reducing health risk from extreme heat in apartment buildings*. City of Toronto. https://www.toronto.ca/legdocs/mmis/2015/hl/bgrd/backgroundfile-81510.pdf

[113] Canadian Underwriter. (2024, July 16). *Toronto flooding damages could surpass $1 billion, industry says*. Canadian Underwriter. https://www.canadianunderwriter.ca/insurance/toronto-flooding-damages-could-surpass-1-billion-industry-says-1004248451

[114] Toronto Star. (2024, July 16). *Here's what was damaged by flooding in Toronto*. The Star. https://www.thestar.com/news/gta/heres-what-was-damaged-by-flooding-in-toronto/article_dfff5e06-4454-11ef-8efc-4be661a1be80.html

[115] Toronto Star. (2025, April 17). Avoid being outside if you can: Toronto under extreme cold warning as a blast of Arctic air grips city. https://www.thestar.com/news/gta/avoid-being-outside-if-you-can-toronto-under-extreme-cold-warning-as-a-blast-of/article_51b4dc70-d815-11ef-81e0-5b5aeac6c373.html

Key Vulnerability Drivers: Aging infrastructure, funding backlog, lack of cooling in older apartment buildings

Table 24. Impact statements and vulnerability rankings by climate hazard — Commercial and Industrial Buildings (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Hospital service disruption due to air quality	High
Extreme Precipitation	Damage from extreme precipitation events	Very high
	Hospital service disruption due to flooding	High
Extreme Heat and Very Hot Days	Increased indoor temperatures	High
	Hospital service disruption due to extreme heat	High
Freeze-thaw Cycles	Structural damage and increased maintenance cost	High
High Winds/ Tornadoes	Direct damage to buildings	High
Very Cold Days and Extreme Cold	Freezing temperatures can cause pipes to freeze and burst	High
	Increased heating demand	High
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Direct damage to buildings	High

Table 25. Impact statements and vulnerability rankings by climate hazard — Municipal Buildings (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Precipitation	Damage from extreme precipitation events	High
Extreme Heat and Very Hot Days	Increased indoor temperatures	High
Freeze-thaw Cycles	Structural damage and increased maintenance costs	High
High Winds/ Tornadoes	Direct damage to buildings	High

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Freezing temperatures can cause pipes to freeze and burst	High
	Increased heating demand	High
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Direct damage to buildings	High

Electricity Supply and Distribution

In 2015, Toronto Hydro conducted a comprehensive climate change vulnerability assessment to evaluate the resilience of its electricity distribution infrastructure against projected climate impacts. Following the Public Infrastructure Engineering Vulnerability Committee (PIEVC) protocol developed by Engineers Canada, this assessment identified several key vulnerabilities.

The assessment highlighted that Toronto's electricity grid is highly sensitive to extreme heat. Elevated temperatures increase the demand for cooling and reduce the efficiency of transformers and transmission lines. Specifically, daily maximum temperatures exceeding 40 °C and daily averages above 30 °C were identified as critical thresholds. To manage these conditions, Toronto Hydro may implement load shedding — temporary power outages in specific areas — to balance demand, which poses significant risks during heatwaves. Additionally, power transformers and transmission lines experience reduced efficiency at high temperatures.

The electrical distribution system is vulnerable to high winds, ice storms and freezing rain. Wind gusts surpassing 90 km/hour can exceed the design limits of overhead systems, leading to equipment failures. Freezing rain, with accretions as low as 15 mm, can cause tree limbs to break and can damage power lines, resulting in outages. Accumulations of 25 mm or more pose significant risks to the structural integrity of the infrastructure.

Extreme precipitation events can lead to flooding of below-grade electrical components, especially in areas where drainage systems are overwhelmed. Non-submersible equipment in underground vaults is particularly susceptible, and access for repairs can be delayed until water is cleared, prolonging outages.

Ontario's electricity demand is projected to grow by 75 per cent by 2050, reaching 265 TWh, primarily due to electrification in transportation, heating and industry, as well as the expansion of data centres and new technologies.[116] This surge increases grid vulnerability by straining aging infrastructure, heightening the risk of overloads and blackouts and requiring significant investments in transmission, distribution and smart-grid technology. Without proactive upgrades and investment, the grid may struggle to sustain the increasing energy needs, particularly during extreme weather events that further stress the system.

Toronto Hydro conducted a system-wide vulnerability assessment in 2015, identifying these extreme weather-related system vulnerabilities that require planning. In 2022, this study was updated to identify whether any further work was required to update its adaptation measures. Under its 2025-2029 investment plan, Toronto Hydro plans to spend more than $5 billion to expand, modernize and sustain the local electricity grid to serve the current and future electricity needs of Toronto's homes and businesses.

Key Vulnerability Drivers: Increasing electricity demand, infrastructure not designed for temperature extremes

Table 26. Impact statements and vulnerability rankings by climate hazard —Electricity Supply and Distribution (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Compounding effect of high demand (cooling) and reduced power transformer capacity and electrical transmission efficiency can cause service disruptions	Very high
Extreme Precipitation	Flood damage to infrastructure, leading to power outages	Moderate
Freeze-thaw Cycles	Freeze-thaw cycles can cause premature degradation of infrastructure	Low
High Winds/ Tornadoes	Infrastructure damage from high winds, leading to power outages	Very high
Increase in Temperature	Increase in electricity demand for cooling	Moderate
Very Cold Days and Extreme Cold	Increased demand for electricity for heating during cold weather events can strain the grid and cause blackouts	Low

[116] Independent Electricity System Operator (IESO). (2024, October). Electricity demand in Ontario to grow by 75 per cent by 2050. Retrieved from https://www.ieso.ca/Corporate-IESO/Media/News-Releases/2024/10/Electricity-Demand-in-Ontario-to-Grow-by-75-per-cent-by-2050

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Damage to grid infrastructure from failing equipment and falling trees, leading to power outages	Very high

Food Supply Systems

Toronto's food system is highly vulnerable to climate-related disruptions, particularly in food distribution, retail infrastructure and emergency preparedness. The 2018 *Resilient Food Systems, Resilient Cities*[117] assessment identified key vulnerabilities from extreme weather, power outages and infrastructure failures, which could significantly impact food access and availability.

One of the key vulnerabilities previously identified in Toronto's food system was its reliance on the Ontario Food Terminal, which supplies an estimated 35-40 per cent of the city's produce. At the time of the report, the terminal had a business continuity plan but lacked a permanent backup generator and the capability to connect to mobile generators. This leaves the facility highly susceptible to power outages, which could lead to large-scale food spoilage and supply chain disruptions. Given that much of Toronto's food supply passes through this single hub, disruptions at the terminal could have cascading effects across grocery stores, markets and restaurants.

Toronto's food retail sector is also highly vulnerable to power outages. Many supermarkets, grocery stores and restaurants lack backup generators, meaning that extended outages would force closures and lead to widespread food spoilage. While some distribution centres have backup power, inconsistencies across the retail sector mean that certain neighbourhoods would be disproportionately affected.

Congestion presents an additional layer of vulnerability. Toronto has historically struggled with traffic congestion, ranking among the most gridlocked cities in North America. The number of vehicles in the Greater Toronto and Hamilton Area (GTHA) has increased by 37 per cent since 2001, compared to a 17 per cent rise outside the region. GTHA commuters experience "heavy congestion" three or more times per week, nearly double the rate elsewhere in Ontario.[118] This congestion already poses logistical challenges for food deliveries, and extreme weather events, such as heavy rainfall, snowstorms or high winds, could further exacerbate delays, creating bottlenecks in food distribution.

[117] City of Toronto. (2018). Resilient food systems, resilient cities: A vulnerability assessment of Toronto's food system. https://www.toronto.ca/legdocs/mmis/2018/hl/bgrd/backgroundfile-118076.pdf

[118] CTV News. (2024). A traffic crisis: Economic, social impact of congestion cost Ontario more than $50B in 2024, study finds. Retrieved from https://www.ctvnews.ca/toronto/article/a-traffic-crisis-economic-social-impact-of-congestion-cost-ontario-more-than-50b-in-2024-study-finds/

Toronto's dependence on external food sources reduces its vulnerability to climate-related disruptions affecting regional food producers but increases its exposure to climate impacts in other key supply regions. With less than 10 per cent of its food produced locally, disruptions to global or regional supply chains could significantly impact food availability. However, as the city aims to increase local food production to reduce its carbon footprint, support regional economies and improve access to healthy, sustainable food, climate change within the region remains a critical concern. Urban agriculture initiatives, such as the Black Creek Community Farm on TRCA land, also play an important role in supporting food security for high-need communities and may face growing climate-related challenges.

Additionally, extreme weather events could lead to price volatility, making nutritious food less affordable for many households. Research shows that Ontario's food banks, already strained by rising food prices, are struggling to meet demand, and disruptions to the food system could push even more residents into food insecurity.[119]

Key Vulnerability Drivers: Dependence on Ontario Food Terminal, congestion, increasing food prices, food insecurity, reliance on electricity, lack of backup generators, reliance on national and global supply chains

Table 27. Impact statements and vulnerability rankings by climate hazard — Food Supply Systems (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Drought	Food production disruption	Low

[119] CP24. (2024, December 2). Ontario food banks cutting back amid 'unprecedented surge in demand'. CP24. https://www.cp24.com/news/canada/2024/12/02/ontario-food-banks-cutting-back-amid-unprecedented-surge-in-demand

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Food insecurity increases during extreme heat as vulnerable populations face higher expenses (e.g. increased food waste and increased cooling costs), leaving less income for food[120]	High
	Disruption to the Ontario Food Terminal due to power outage	Moderate
	Disruption to restaurants due to power outage	High
	Disruption to food retailers and food banks due to power outage	High
	Food distribution and delivery disruption due to power outages	Low
	Food production disruption	Low
Extreme Precipitation	Disruption to the Ontario Food Terminal due to power outage	Very high
	Food distribution and delivery disruption from congestion or road closures	High
	Disruption to food retailers and food banks due to congestion or road closures	High
	Disruption to food retailers and food banks due to power outage	High
	Disruption to restaurants due to power outage	High
	Food distribution and delivery disruption due to power outages	Moderate
	Flood damage and disruption to the Ontario Food Terminal	Moderate
	Food production disruption	Low
	Food processing disruption	Low

[120] Food Banks Canada. (2023, December 16). *How temperature extremes are forcing many Canadians to cut back on basic necessities*. https://foodbankscanada.ca/how-temperature-extremes-are-forcing-many-canadians-to-cut-back-on-basic-necessities/

Climate Hazard	Impact Statement	Vulnerability Ranking
High Winds/ Tornadoes	Food distribution and delivery disruption from congestion or road closures	High
	Disruption to food retailers and food banks due to congestion or road closures	High
	Disruption to food retailers and food banks due to power outage	High
	Disruption to restaurants due to power outage	High
	Disruption to the Ontario Food Terminal due to power outage	High
	Food distribution and delivery disruption due to power outages	Moderate
	Food production disruption	Low
	Food processing disruption	Low
Total Precipitation	Food production disruption	Low
Very Cold Days and Extreme Cold	Demand for food banks often increases during extreme cold as vulnerable populations face higher expenses (e.g. heating costs), leaving less income for food[121]	High

[121] Food Banks Canada. (2023, December 16). *How temperature extremes are forcing many Canadians to cut back on basic necessities*. https://foodbankscanada.ca/how-temperature-extremes-are-forcing-many-canadians-to-cut-back-on-basic-necessities/

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Disruption to the Ontario Food Terminal due to power outage	High
	Food distribution and delivery disruption from congestion or road closures	High
	Disruption to food retailers and food banks due to power outage	High
	Disruption to restaurants due to power outage	High
	Disruption to food retailers and food banks due to congestion or road closures	Moderate
	Food distribution and delivery disruption due to power outages	Moderate
	Food production disruption	Low
	Food processing disruption	Low

Fuel Supply Systems

Toronto's fuel supply system has critical vulnerabilities stemming from its reliance on electricity for fuel distribution, limited backup power at retail gas stations and susceptibility to infrastructure damage. These structural weaknesses create risks for transportation, emergency services and businesses, particularly during disruptions.

A major vulnerability is the reliance on electricity to operate fuel pumps. While fuel depots typically have backup generators, most retail gas stations do not. This means that during a power outage, personal vehicles, delivery trucks and emergency responders may be unable to refuel. In past widespread outages, such as the 2003 blackout, fuel shortages rapidly emerged as demand surged while supply was constrained.[122]

The city's natural gas pipelines, often located near other underground infrastructure like water mains and sewers, are susceptible to damage from ground shifting and erosion. Pipeline failures or leaks, particularly in densely populated areas, can lead to service disruptions and safety hazards.[123] Aging infrastructure further exacerbates these risks, increasing the likelihood of failures.

[122] City of Toronto. (2018). Resilient food systems, resilient cities: A vulnerability assessment of Toronto's food system. https://www.toronto.ca/legdocs/mmis/2018/hl/bgrd/backgroundfile-118076.pdf

[123] City of Toronto. (2018). Resilient food systems, resilient cities: A vulnerability assessment of Toronto's food system. https://www.toronto.ca/legdocs/mmis/2018/hl/bgrd/backgroundfile-118076.pdf

Key Vulnerability Drivers: Reliance on electricity to operate fuel pumps, natural gas pipeline proximity to water mains and sewers, aging infrastructure

Table 28. Impact statements and vulnerability rankings by climate hazard — Fuel Supply - Natural Gas/Gasoline/Diesel (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Fuel shortage from extended power outage	High
Extreme Precipitation	Fuel shortage from extended power outage	High
	Damage to gas pipelines	High
High Winds/ Tornadoes	Fuel shortage from extended power outage	High
Very Cold Days and Extreme Cold	Fuel shortage from extended power outage	High
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Fuel shortage from extended power outage	High

Green Infrastructure Systems

The City's Official Plan defines Green Infrastructure (GI) as "natural and human-made elements that provide ecological and hydrological functions and processes".[124] Examples of GI include green roofs, bioretention assets, rain gardens, trees and other vegetation, and permeable paving. The City has developed direction from provincial policies, the City's Official Plan, and design standards (e.g. Toronto Green Standard, Green Streets Technical Guidelines) to enhance the urban forest, mitigate the urban heat island effect, manage stormwater runoff to mitigate flooding and enhance water quality, promote infiltration for groundwater systems and slow runoff, and enhance air quality.[125]

The City's Green Streets Technical Guidelines (GSTG) provide guidance, standards and selection tools for the planning, design, integration and maintenance of green infrastructure and green streets options.[126] The GSTG provide a tool to assist with integrating GI into the City's network of streets. Two of the key goals are to mitigate stormwater runoff and flooding, as well as pollutant concentrations in the stormwater runoff.

[124] https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/official-plan/

[125] City of Toronto. Green Infrastructure & Environmental Policy Objectives. https://www.toronto.ca/services-payments/streets-parking-transportation/enhancing-our-streets-and-public-realm/green-streets/green-infrastructure-resources/

[126] City of Toronto. 2017. Green Streets Technical Guidelines. Version 1.0. Prepared by Schollen & Company Inc. Urban Forest Innovations, TMIG, and DPM.

Currently, the city's tree canopy coverage is about 31 per cent across public and private lands, representing about 11.5 million trees, and the City has a goal of 40 per cent canopy cover (i.e. planting about 140,000 trees each year). According to the City's tree canopy study, street tree condition improved significantly with a 25 per cent increase in trees rated as good or excellent between 2008 and 2018. Although this trend shows an increase in health and resilience of the city's canopy cover, some of the main threats to maintaining and increasing a healthy urban forest canopy include the ongoing rapid growth of the city's population, its housing crisis, and the need to build 285,000 homes by 2031, aside from threats related to climate hazards.

Urban trees and canopy cover provide numerous benefits and ecosystem services for residents and urban wildlife. The structural value of the city's urban forest has been estimated to be worth over $7 billion, including $55 million per year in total annual benefits, including:[127]

- $8.3 million in energy savings;
- $37.9 million in pollution removal;
- $4.0 million in carbon sequestration; and
- $4.8 million in avoided stormwater runoff.

If the canopy cover or the biological integrity of this canopy cover declines, then the quantity, value and quality of services provided by this green infrastructure declines.

As the City invests in green infrastructure, including networks of urban trees, proactive planning will require consideration of the types of GI implemented, including selecting the plants and biological attributes necessary to reduce vulnerability and sensitivity to the projected impacts of climate change scenarios. Climate conditions such as heavy rainfall, temperature increases, drought, winter warm spells and freeze-thaw cycles, and intense frequent storms can affect vegetation, depending on the species' sensitivities. Climate change can also impact the environmental components affecting the health and function of the GI (e.g. shifts in the range of habitat, increases in and introduction of new pests and diseases).[128]

Key Vulnerability Drivers: Urban development, compacted soils with poor soil drainage in urban built-up areas, lack of pervious cover, increase in pests, increasing urban heat island effect due to increasing temperatures, poor water quality from stormwater runoff, air pollution, invasive species

[127] City of Toronto. 2018. CanopyTO: 2018 Tree Canopy Study. Attachment 1. https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173552.pdf (Full Tree Canopy Study: City of Toronto (Revised October 2021).

[128] https://www.environnement.gouv.qc.ca/programmes/oasis/balises-resilience-infrastructure-vertes-en.pdf

Table 29. Impact statements and vulnerability rankings by climate hazard — Green Infrastructure Systems (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Drought	Loss of natural areas from drought	Very high
Ecosystem Changes	Loss of natural areas from insects or disease	High
Extreme Heat and Very Hot Days	Damage to urban forest, reducing shading	Moderate
Extreme Precipitation	Damage to green infrastructure	Moderate
Freeze-thaw Cycles	Damage to permeable materials and water retention systems	Moderate
High Winds/ Tornadoes	Damage to urban tree canopy	Very high
Total Precipitation	Green infrastructure systems can become overwhelmed with frequent rainfall events	Low
Very Cold Days and Extreme Cold	Extreme cold weather can inhibit the function of green infrastructure for stormwater management through ice blockages or frozen soil	Moderate
	Salt used to manage ice can leach into soil and water, harming plants and altering the soil chemistry	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Damage to urban tree canopy	Very high
	Salt used to manage ice can leach into soil and water, harming plants and altering the soil chemistry	Moderate

Information, Banking, Communications and Technology

Toronto's digital infrastructure is critical for economic activity, financial transactions and emergency response. However, the sector faces key vulnerabilities related to cooling system failures, power dependency and exposure to extreme weather events.

The reliability of Toronto's data centres heavily depends on cooling systems, which are highly sensitive to extreme heat. In 2022, data centres in the UK experienced major

outages as cooling failures forced companies like Google and Oracle offline.[129] Similar risks exist in Toronto, where heat waves could lead to system shutdowns or reduced processing capacity. Given the increasing reliance on digital infrastructure, cooling system resilience is critical to ensuring continuous service availability.

Toronto's major data hubs rely on electricity for operations and backup cooling. During the 2013 Toronto floods, the city's largest telecommunications data centre, housing over 150 major clients, including Rogers, TELUS, IBM, and Verizon, experienced a power outage. While generator backup maintained operations, cooling systems briefly failed, highlighting the risk of cascading failures when backup systems are not fully equipped to handle extreme weather conditions.[130] Widespread power outages could similarly disrupt banking networks, digital transactions and emergency communications, emphasizing the need for robust backup power infrastructure.

Key Vulnerability Drivers: Dependency on cooling systems, cascading failures

Table 30. Impact statements and vulnerability rankings by climate hazard — Information, Banking, Communications and Technology (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Data centres can overheat during a heatwave and cause a system failure	Very high
	Extended telecom outage, leading to service disruption	High
	Extended power outage, leading to depleted phone batteries and widespread communication network disruption	High
Extreme Precipitation	Extended power outage, leading to depleted phone batteries and widespread communication network disruption	High
	Loss of power for data centres	Moderate
High Winds/ Tornadoes	Extended power outage, leading to depleted phone batteries and widespread communication network disruption	High
	Loss of power for data centres	Low

[129] Telecom Review. (2022). *Heatwaves: A major telecommunications industry threat*. Retrieved from https://www.telecomreview.com/articles/reports-and-coverage/8236-heatwaves-a-major-telecommunications-industry-threat

[130] City of Toronto. (2018). *Resilient food systems, resilient cities: A vulnerability assessment of Toronto's food system*. Retrieved from https://www.toronto.ca/legdocs/mmis/2018/hl/bgrd/backgroundfile-118076.pdf

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Extended power outage, leading to depleted phone batteries and widespread communication network disruption	High
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Extended power outage, leading to depleted phone batteries and widespread communication network disruption	High
	Loss of power for data centres	Low

Public and Regional Transportation

Toronto's public transportation network, operated primarily by the Toronto Transit Commission (TTC), plays a critical role in urban mobility, particularly for low-income populations who depend on transit for access to employment and essential services. With 47 per cent of long-distance mobility during the morning peak and 68 per cent of trips to downtown relying on public transit, disruptions to this network have widespread implications. The network comprises subway, streetcar and bus services, with over 800 million boardings recorded in 2024.[131] However, the aging infrastructure, funding constraints and increasing exposure to extreme weather events heighten the system's vulnerabilities.

Transit dependency is highest in Toronto's lowest-income neighbourhoods, where residents rely on public transportation to access jobs and essential services. Approximately 20 per cent of Toronto's population falls below the low-income threshold, and studies show that residents in designated Neighbourhood Improvement Areas (NIAs) are disproportionately reliant on transit. Disruptions due to climate hazards could therefore have an outsized impact on marginalized communities, further exacerbating economic and social inequities.

A significant portion of TTC infrastructure is aging and in need of repair, contributing to service reliability challenges. By 2034, the TTC is expected to face a $4.3 billion state-of-good-repair project backlog.[132] This backlog limits the agency's ability to proactively upgrade assets to withstand climate hazards.

An in-depth assessment found that urban flooding and sewer overload were the primary risks, with station service disruptions lasting multiple days in past events. The July 2013 flood caused severe delays, including a two-day shutdown of the Kipling-Islington section

[131] Information from past internal consultations with city staff.

[132] City of Toronto. (2025). *State of Good Repair Backlog and Funding Challenges*. Retrieved from https://www.toronto.ca/legdocs/mmis/2025/bu/bgrd/backgroundfile-251986.pdf

of Line 2. The GO Transit's Richmond Hill rail corridor was also impacted, with 1,400 passengers stranded for over six hours due to a flooded commuter train.[133]

High temperatures pose a significant risk to Toronto's transit infrastructure. Heatwaves can lead to rail expansion and buckling, causing slow orders or service reductions on subway and commuter rail lines.[134] Past incidents have required reduced speeds on the TTC and GO Transit networks to prevent rail damage. In some cases, vehicle cooling systems have failed due to extreme temperatures.[135] Passengers, particularly older adults, are at risk of heat-related illnesses. Seniors accounted for approximately 4 per cent of ticket sales,[136] a figure expected to rise as the population ages.

Toronto's transit system is also vulnerable to winter storms, with snow accumulation and freezing rain causing delays or mechanical failures. The 2013 ice storm disrupted service across multiple transit modes, while a 6-9 cm snowfall event caused widespread delays for GO Transit and TTC buses.[137] Cold weather impacts include streetcars going out of service due to frozen components[138] and GO Transit delays caused by frozen switches and stalled equipment.[139]

Regional transportation systems, including GO Transit and VIA Rail, face similar vulnerabilities. Extreme heat can lead to track damage, prompting slow orders to reduce train speeds and prevent accidents. For example, in July 2023, hot weather affected GO and VIA Rail trains, leading to slow orders along the network to mitigate track damage risks.[140] Winter storms and extreme cold further disrupt operations, as seen during the February 15–16, 2025, weekend, when severe weather caused major air travel disruptions across several airports, including Toronto Pearson International Airport.

Key Vulnerability Drivers: Lower-income neighbourhoods are disproportionately reliant on transit, aging infrastructure, funding backlog, aging population.

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[133] City of Toronto. (2018). Resilient food systems, resilient cities: A vulnerability assessment of Toronto's food system. Retrieved from https://www.toronto.ca/legdocs/mmis/2018/hl/bgrd/backgroundfile-118076.pdf

[134] Metrolinx. (2023, August 16). *How summer weather can affect GO service*. Retrieved from https://www.gotransit.com/en/travelling-on-go/how-summer-weather-can-affect-go-service

[135] CBC News. (2016, August 9). TTC slows subway trains in extreme heat. *CBC News*. Retrieved from https://www.cbc.ca/news/canada/toronto/ttc-slow-heat-1.3714674

[136] Information from past internal consultations with city staff.

[137] The Toronto Star. (2024, February 7). *6-9cm of snow leads to GO Train and TTC delays*. Retrieved from https://www.thestar.com/news/gta/gta-sees-6-9-cm-of-snow-as-multiple-go-buses-delayed-ttc-taking-dozens/article_3e8893d4-cbc9-11ee-a44a-3b43cf9dd85e.html

[138] CBC News. (2015, January 7). Some TTC streetcars out of service due to cold weather. *CBC News*. Retrieved from https://www.cbc.ca/news/canada/toronto/some-ttc-streetcars-out-of-service-due-to-cold-weather-1.2893670

[139] GO Transit. (2023). *How winter weather can affect GO service*. Retrieved from https://www.gotransit.com/en/travelling-on-go/how-winter-weather-can-affect-go-service

[140] CBC News. (2024, July 17). *Hot weather affecting GO, VIA Rail trains. Here's what to expect*. CBC News. https://www.cbc.ca/news/canada/toronto/go-train-metrolinx-hot-weather-delays-1.7238556

Table 31. Impact statements and vulnerability rankings by climate hazard — Public and Regional Transportation (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Climate-related Air Quality Hazards	Decreased transit use	Moderate
Drought	Reduced ship cargo due to low water levels	Moderate
Extreme Heat and Very Hot Days	TTC subway network can experience slowdown malfunctions due to extreme heat	High
	GO trains/buses can experience delays and malfunctions due to extreme heat	High
	Decreased transit use	Moderate
	Airport operation disruption from extreme heat	Moderate
	VIA trains can experience delays and malfunctions due to extreme heat	High
Extreme Precipitation	Disruption to TTC service	Very high
	Disruption to GO train	Very high
	Disruption to VIA train service	Very High
	Decreased transit use	High
High Winds/ Tornadoes	Public transportation TTC service disruption	Moderate
	Regional GO trains/buses service disruption	Moderate
	Decreased transit use	Moderate

Climate Hazard	Impact Statement	Vulnerability Ranking
Very Cold Days and Extreme Cold	Decreased transit use	High
	TTC streetcars can experience malfunctions due to extreme cold	Moderate
	GO trains can experience malfunctions due to extreme cold	Moderate
	Airport operation disruption from extreme cold	Moderate
	VIA trains can experience malfunctions due to extreme cold	Moderate
	Ships can be delayed due to ice formation on lakes	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Public transportation TTC service disruption	High
	Airport operation disruption from winter storms	High
	Decreased transit use	High
	VIA trains can experience malfunctions due to winter storms	Moderate

Road Networks

Toronto's road infrastructure is extensive, comprising 5,600 km of roads; 900 bridges and culverts; 7,400 km of sidewalks; 2,542 traffic control signals; 490 pedestrian crossovers; and an 817 km bikeway network.[141] Many roads, bridges and culverts are already in poor condition, with a significant backlog of repairs limiting the City's ability to keep up with ongoing wear and tear. These vulnerabilities are compounded by increasing traffic volumes and heavy vehicle loads, which accelerate pavement deterioration and structural fatigue.

Traffic congestion in Toronto is worsening, with commute times increasing and road capacity often exceeded during peak hours.[142] Any disruptions — whether from weather-related events, infrastructure failures or accidents — exacerbate congestion, leading to increased emissions, widespread delays in moving people and goods and economic losses. The lack of alternative routes for many major corridors limits mobility when primary roads are impacted.

[141] City of Toronto. (2025). *State of Good Repair Backlog and Funding Challenges*. Retrieved from https://www.toronto.ca/legdocs/mmis/2025/bu/bgrd/backgroundfile-251986.pdf

[142] The Globe and Mail. (2024). *Toronto Traffic Getting Worse: A Growing Crisis*. Retrieved from https://www.theglobeandmail.com/canada/article-toronto-traffic-getting-worse/

Extreme heat softens asphalt, causing rutting, warping and road buckling, particularly in high-traffic areas such as major highways and arterial roads. Highway 401 in Toronto has experienced pavement failures during heat waves, requiring emergency closures and repairs.[143] Buckling roads disrupt traffic flow and pose a serious safety risk, increasing the likelihood of hydroplaning and vehicle accidents.

Toronto's roads are also vulnerable to extreme precipitation, which can overwhelm drainage systems and cause flooding, particularly in low-lying areas. The risk of culvert and bridge washouts is increasing due to aging infrastructure and higher stormwater loads. Sinkholes, embankment erosion and roadway collapses have also occurred following major storms, further reducing mobility and straining emergency response efforts.

Key Vulnerability Drivers: Congestion, increased volume of vehicle trips, aging infrastructure, state-of-good-repair backlog, funding backlog

Table 32. Impact statements and vulnerability rankings by climate hazard — Road Networks (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Damage to road infrastructure, including severe rutting of roads and failure of traffic control systems	Very high
	Increased travel times and supply chain disruptions due to heavy vehicle restrictions and road closures due to damaged roads	Very high
	Compromised emergency access/routes due to damaged roads	Very high
	Vehicle damage due to damaged roads	Very high
	Increased liability and cost of claims due to damaged roads	Very high

[143] City of Toronto. (2018). *Resilient Food Systems, Resilient Cities: A Vulnerability Assessment of Toronto's Food System.* Retrieved from https://www.toronto.ca/legdocs/mmis/2018/hl/bgrd/backgroundfile-118076.pdf

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Precipitation	Damage to road infrastructure and disrupted road networks from extreme precipitation	Very high
	Extreme precipitation events can cause sinkholes, soil and embankment erosion, undermined structures, and road and bridge collapse, resulting in road damage and closures	High
	Increased travel times and supply chain disruptions due to ponding and flash flooding on road segments	High
	Increased liability and cost of claims due to ponding and flash flooding on road segments	High
Freeze-thaw Cycles	Infrastructure damage from freeze-thaw cycles	High
	Increased liability and cost of claims due to trips, falls and vehicle damage from hazardous conditions (e.g. ice, uneven surfaces, etc.)	High
High Winds/ Tornadoes	Hazardous conditions for all road users, leading to an increase in accidents and congestion	High
	Blocked roads and access to/from homes/businesses from fallen trees and infrastructure	High
	Damage or failure to traffic control systems	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Hazardous conditions for all road users, leading to an increase in accidents and congestion and an increased workload for first responders	High
	Increased liability and cost of claims due to trips, falls and vehicle damage from hazardous conditions (e.g. ice, uneven surfaces, etc.)	High
	Increased travel times and supply chain disruptions due to ponding and flash flooding on road segments	High
	Damage or failure to traffic control systems	Moderate

Stormwater, Wastewater and Water Systems

Toronto's water, wastewater and stormwater infrastructure is vast, comprising four water treatment plants, 18 pumping stations, 11 underground reservoirs, four elevated storage tanks and over 6,000 km of water mains. Additionally, the City operates 10,200 km of sanitary sewers, combined sewers and storm sewers.[144] These systems serve more than 3.6 million residents and businesses across Toronto and parts of the York and Peel regions.[145] However, aging infrastructure, high population density and climate change-driven stressors create critical vulnerabilities that threaten water supply reliability, wastewater treatment and flood resilience.

Toronto's water distribution network is aging, with 11 per cent of water mains between 80 and 100 years old and 13 per cent older than 100 years. This aging infrastructure contributes to an estimated 10-15 per cent of freshwater supply losses due to leakage. Additionally, all water treatment facilities were built before 1979, with some dating back to the 1930s, making them more prone to operational inefficiencies and maintenance challenges. While there is no direct overlap of water treatment plants with flood-prone areas, wastewater infrastructure is more vulnerable — two of the city's four wastewater treatment plants (Humber and North Toronto) are located in floodplains.[146]

The lack of full separation between stormwater and sewage systems remains a significant vulnerability, with approximately 23 per cent of the city's sewer network consisting of combined sewers. During heavy rainfall events, these systems release untreated sewage with stormwater into Toronto's creeks, rivers and Lake Ontario when the system capacity is exceeded. These overflows pose risks to public health, water quality and aquatic ecosystems. Additionally, low-lying wastewater treatment plants are particularly vulnerable to disruptions caused by flooding.

Toronto experiences frequent freeze-thaw cycles, which accelerate pavement and pipe degradation. Water main breaks are common, particularly in North York, Scarborough and Etobicoke, where older cast iron pipes in acidic clay soil are more prone to failure.[147]

Toronto's high population density (4,334 people per km², the highest in Canada) places additional strain on water, wastewater and stormwater infrastructure. Vulnerability is particularly acute in flood-prone communities such as Jane-Wilson and Rockcliffe-Smythe, where an estimated 36,600 residents live in flood-vulnerable areas.

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[144] City of Toronto. (2021). Core Infrastructure Asset Management Report. https://www.toronto.ca/wp-content/uploads/2022/07/90a1-Core-Infrastructure-Management-Report.pdf

[145] Information from past internal consultations with city staff.

[146] Information from past internal consultations with city staff.

[147] Toronto Star. (2025, April 17). *Avoid being outside if you can: Toronto under extreme cold warning as a blast of Arctic air grips city.* https://www.thestar.com/news/gta/avoid-being-outside-if-you-can-toronto-under-extreme-cold-warning-as-a-blast-of/article_51b4dc70-d815-11ef-81e0-5b5aeac6c373.html

Key Vulnerability Drivers: Aging infrastructure, high population density, growing population, two wastewater treatment plants located in floodplains, combined sewers

Table 33. Impact statements and vulnerability rankings by climate hazard — Stormwater and Water Systems (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Increased water demand	Moderate
Extreme Precipitation	Combined sewer overflows	High
	Service disruption due to flooded facilities	High
	Supply chain disruptions (chemicals, etc.)	High
	Stormwater system capacity exceeded	High
	Increased maintenance/repair to SWM system	High
	Decreased water quality	Moderate
	Wastewater treatment plant bypass	Moderate
	Loss of power	Moderate
Freeze-thaw Cycles	Water main breaks from freeze-thaw	High
High Winds/ Tornadoes	Supply chain disruptions (chemicals, etc.)	High
	Loss of power	Moderate
	Damage to facilities	Moderate
Very Cold Days and Extreme Cold	Water main breaks from cold weather	High
	Supply chain disruptions (chemicals, etc.)	High
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Loss of power	Moderate

Waste Management and Residuals Materials Systems

Toronto's waste management system is generally resilient, with frequently travelled collection routes and contingency processing and disposal capacity. However, extreme weather can disrupt operations and impact worker safety. Heavy snow, ice storms and flooding can delay waste collection, particularly in areas with difficult road access. While extreme weather may cause short-term service disruptions, the frequency of waste collection can help reduce long-term service disruptions. Extreme heat increases the risk of heat exhaustion for collection crews, while icy conditions elevate injury risks. Adjustments to schedules and protective measures help mitigate these impacts, but service delivery can still be affected.

Key Vulnerability Drivers: Congestion, road access, worker shortages

Table 34. Impact statements and vulnerability rankings by climate hazard — Waste Management and Residuals Materials Systems (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Extreme Heat and Very Hot Days	Increased odour and pest activity	Low
	Altered waste decomposition rates	Low
Extreme Precipitation	Disruption to collection service	Low
High Winds/ Tornadoes	Disruption to collection service	Low
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Disruption to collection service	Low

Enwave District Energy System

Toronto's Enwave District Energy System, which includes both Deep Lake Water Cooling (DLWC) and steam-based heating, is generally resilient to many climate hazards. However, certain climate-related events can still negatively affect its performance and operational stability.

As climate change contributes to longer and more intense extreme heat and the increasing number of very hot days, the demand for cooling services in Toronto's downtown core is expected to rise. Enwave has anticipated about a 35 per cent increase in its customers' cooling demands in the near future.[148] Although Enwave has already begun to expand its

[148] City of Toronto. (n.d.). *Deep Lake Water Cooling Supply Expansion*. Retrieved from https://www.toronto.ca/community-people/get-involved/public-consultations/infrastructure-projects/deep-lake-water-cooling-expansion-study/

cooling capacity by adding lake intake pipes, further adaptation will be necessary to ensure the system's capacity under future climate scenarios.

The temperature of Lake Ontario's deep waters, particularly at depths around 83 metres, remains relatively stable and is not significantly influenced by short-term increases on hot summer days. However, over the long term, increased temperature may still lead to gradual warming of the deep water. While studies have observed that surface water temperatures in Lake Ontario have increased by approximately 1.6 °C over the past four decades, deepwater temperatures of Lake Ontario are lacking in direct data. However, a global study revealed that some lakes are experiencing increases of up to 0.65 °C per decade.[149] This means that the cooling efficiency might be reduced over the long period.

Extreme precipitation poses significant risks to both the cooling and heating operations of Toronto's Enwave District Energy System.

For cooling, flash flooding at the Lower Simcoe underpass can force Enwave to isolate its infrastructure to protect condensers, leading to temporary reductions in cooling capacity. Once reactivated, contaminated storm and sanitary water can impair condenser performance, as seen during flooding events in 2013 and 2016.[150] The City of Toronto completed a flood protection study to address flooding issues;[151] however, mitigating measures have not been confirmed or published.

On the heating side, heavy rain can flood steam tunnels, where the contact between cold water and steam pipes may cause rapid condensation that can rupture pipes and valves. This not only risks public safety but can also interrupt service. Additionally, water main breaks can flood maintenance holes, also causing steam leaks and requiring coordinated emergency repairs with multiple city departments. Although Enwave has monitoring and response systems in place, such events can still lead to temporary service disruptions for customers.

Key Vulnerability Drivers: Infrastructure located in the area that is easy to flood, combined sewer overflows, increased cooling demand, dependency on cold and clean water

[149] Rachel M. Pilla et al. (2020). Deeper waters are changing less consistently than surface waters in a global analysis of 102 lakes. *Scientific Reports*, *10*(1), 20514. https://doi.org/10.1038/s41598-020-76873-x

[150] Officer, C. C. (2016). *Resilient City update and next steps*. https://www.toronto.ca/legdocs/mmis/2016/pe/bgrd/backgroundfile-98049.pdf

[151] Toronto, C. O. (2024, October 17). *Lower Simcoe underpass flood protection study*. City of Toronto. https://www.toronto.ca/community-people/get-involved/public-consultations/infrastructure-projects/lower-simcoe-flood-protection-study/

Table 35. Impact statements and vulnerability rankings by climate hazard — Enwave District Energy Systems (Infrastructure Systems).

Climate Hazard	Impact Statement	Vulnerability Ranking
Ecosystem Changes	Reduced cooling efficiency	High
Extreme Heat and Very Hot Days	Increased cooling demand	High
Extreme Precipitation	Damage to the facilities	High
	Reduced cooling efficiency	Moderate
	Loss of power, leading to Enwave service disruption	Moderate
Freeze-thaw Cycles	Damage to the surface-level infrastructure	High
High Winds/Tornadoes	Loss of power, leading to Enwave service disruption	Moderate
Increase in Temperatures	Reduced cooling efficiency	Low
Total Precipitation	Damage to the facilities	Low
	Reduced cooling/heating efficiency	Low
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Loss of power, leading to Enwave service disruption	Moderate

Natural Systems

Natural Heritage System

Prior to European settlement, the Toronto region, which is situated within two forest zones (Great Lakes-St. Lawrence and Carolinian forest zones), consisted of combinations of rich biodiversity and habitat types. Like most urban areas, much of Toronto's original biodiversity was lost as the city grew and most natural areas were urbanized. In recent decades, the City has invested in restoring and enhancing ravine habitats, the urban tree canopy, and biodiversity. Despite these efforts, urban development, densification and population growth continue to place pressure on local biodiversity.[152]

Most of the remaining natural areas are found in its network of ravines, wetlands, grasslands, watercourses and shoreline. These areas make up the city's Natural Heritage System (8,595 hectares; 13.5 per cent of the city area). These natural areas connect green corridors that link ecosystem habitats and enable dispersal and movement for a variety of plants, animals and fungi species.[153]

These natural spaces are deeply vulnerable to climate change impacts, with impacts expected to intensify over the coming decades. Understanding the vulnerabilities of existing natural systems can help build knowledge about how climate drivers may affect different natural systems and prioritize actions to help mitigate the impacts on people, ecosystems, wildlife and the services provided to communities.

The key vulnerabilities of natural systems to climate change and extreme weather impacts can be identified by the systems' health, function and attributes, which provide information regarding the adaptive capacity of an ecosystem or green space to respond to a climate-induced impact. For example, vegetation and wildlife that are highly sensitive to increasing seasonal temperatures and variability in precipitation will likely be negatively affected by climate change.[154]

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[152] City of Toronto. 2019. Wild, Connected And Diverse: A Biodiversity Strategy For Toronto. Prepared by Toronto City Planning and Parks, Forestry and Recreation with the Toronto and Region Conservation Authority.

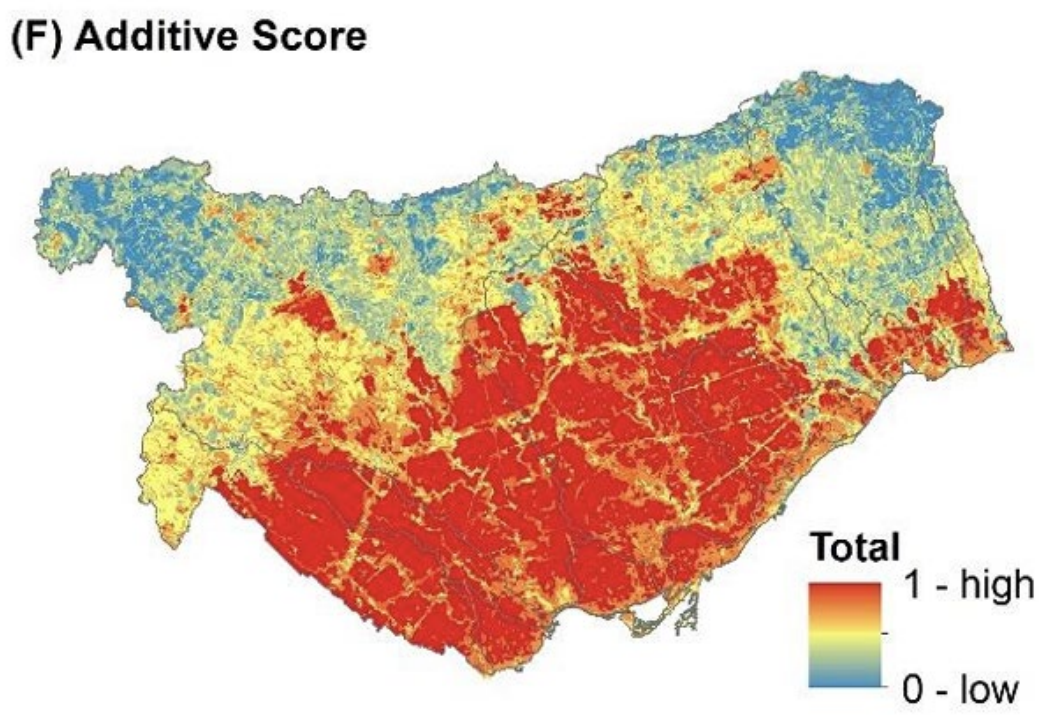
[153] City of Toronto. 2019. Wild, Connected And Diverse: A Biodiversity Strategy For Toronto. Prepared by Toronto City Planning and Parks, Forestry and Recreation with the Toronto and Region Conservation Authority.

[154] Toronto and Region Conservation Authority (TRCA). 2022. TRCA Updated Target Natural Heritage System: A Summary Report. Prepared by the Watershed Planning and Ecosystem Science Development and Engineering Services.

In urban areas, natural systems are often small and disconnected and provide low habitat quality, which means that these systems have less options for adaptive capacity and fewer options to migrate through connective corridors as species' habitats shift due to changes in temperatures and water availability.

The TRCA undertook a terrestrial system climate change vulnerability assessment. The additive scores of all the vulnerability indicators (habitat patch, sensitive vegetation, wetland, soil drainage and ground surface temperature) show that 52 per cent of the TRCA jurisdiction is highly vulnerable (red colour; Figure 12), including most of the area that falls within the city boundary.

Figure 12. Additive score summary of climate vulnerability indicators (habitat patch score, climate sensitivity of native vegetation, wetland hydrological stability, soil drainage rating, ground surface temperature) in the TRCA jurisdiction (total score 1 is the highest vulnerability). Note that the boundary of the city of Toronto is contained within the TRCA boundary. (Source: 2022 TRCA Updated Target Natural Heritage System: A Summary Report.



Key vulnerability drivers: urban development, population growth, climate sensitivity of species, poor soil drainage, increasing temperatures and heatwaves, heat island stress on urban trees and wildlife, changes to water quality and quantity, high winds, invasive species, low habitat connectivity

Table 36. Impact statements and vulnerability rankings by climate hazard — Natural Environment.

Climate Hazard	Impact Statement	Vulnerability Ranking
Drought	Loss of trees from drought	Very high
	Wetlands are damaged or lost	Moderate
Ecosystem Changes	Loss of trees from insects or disease	High
Extreme Heat and Very Hot Days	Heat stress on aquatic ecosystems	Very high
	Heat stress on vegetation and trees	Moderate
Extreme Precipitation	Adverse impacts on water quality and aquatic ecosystem health	High
	Slope erosion	Moderate
High Winds/ Tornadoes	Damage to urban tree canopy	Very high
	Slope erosion	Moderate
Total Precipitation	Impacts on water quality	High
	Impacts on soil health	High
	Slope erosion	Moderate
Very Cold Days and Extreme Cold	Damage to natural environment	Low
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Damage to urban tree canopy	Very high

Biodiversity

Toronto's ravines contain the greatest variety of ecosystem, species and genetic diversity. In addition, biodiversity is found across the city in its extensive urban tree canopy, back yards, parks and freshwater waterfront.[155] The City recognizes the importance of ecosystem services provided by the city's natural systems and biodiversity. The City has established a Biodiversity Strategy,[156] a Toronto Ravine Strategy, the Toronto Pollinator

[155] City of Toronto. Biodiversity in the City. https://www.toronto.ca/explore-enjoy/parks-recreation/places-spaces/ravines-trails-natural-parklands/biodiversity-in-the-city/

[156] City of Toronto. 2019. Wild, Connected And Diverse: A Biodiversity Strategy For Toronto. Prepared by Toronto City Planning and Parks, Forestry and Recreation with the Toronto and Region Conservation Authority.

Protection Strategy,[157] an Urban Tree Canopy Study,[158] and municipal land-use policies that protect a natural heritage system and significant natural areas.

The primary stressors to the health and function of the city's natural systems and biodiversity are habitat loss due to urban development, ecological degradation, population growth and increasing recreational use of natural areas, impacts on species and natural systems due to ongoing changes in climate, and invasive species displacing native species.[159] These pressures need to be considered when assessing the vulnerability of the city's natural systems and biodiversity, as well as the resilience and adaptive capacity of its urban natural systems to withstand and adapt to the expected impacts of the changing climate.

Many species cannot adapt or migrate quickly enough to tolerate new climate conditions. This can cause population declines, and even extinction in some species, while allowing other species to thrive. Changing the balance of species in an ecosystem can disrupt ecological functions, change habitat availability and disrupt the balance of natural systems. In addition, climate change is enabling invasive species to enter new environments, which places pressure on native species in already stressed ecosystems. Invasive species often introduce other new stressors, such as diseases that can affect humans, animals or plants. The impacts of these diseases can have serious impacts on human health, as well as on the ecological and economic systems that rely on the natural world. In Toronto, the spread of two vectors of disease are being monitored for their spread.[160] Ticks carry a number of diseases, including Lyme disease, anaplasmosis, babesiosis and Powassan virus. Mosquitos carry several diseases, including West Nile Virus.

TRCA identifies and works with the City of Toronto to manage key invasive species of concern threatening Toronto: European buckthorn, dog-strangling vine, garlic mustard, wild parsnip, Japanese knotweed and phragmites among plants; emerald ash borer; and pathogens of concern such as oak wilt.[161]

Key Vulnerability Drivers: Urban development and densification, increasing population and recreational use of natural areas, ongoing climate change impacts, habitat loss and degradation, invasive species displacing native species

[157] City of Toronto. 2018. Toronto Pollinator Protection Strategy

[158] https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173552.pdf

[159] City of Toronto. 2019. Wild, Connected And Diverse: A Biodiversity Strategy For Toronto. Prepared by Toronto City Planning and Parks, Forestry and Recreation with the Toronto and Region Conservation Authority.

[160] Public Health Ontario. "Vector-Borne and Zoonotic Diseases | Public Health Ontario," n.d. https://www.publichealthontario.ca/en/diseases-and-conditions/infectious-diseases/vector-borne-zoonotic-diseases

[161] Toronto and Region Conservation Authority (TRCA). "Invasive Species - Toronto and Region Conservation Authority (TRCA)," May 17, 2024. https://trca.ca/conservation/environmental-monitoring/invasive-species/.

Table 37. Impact statements and vulnerability rankings by climate hazard — Biodiversity.

Climate Hazard	Impact Statement	Vulnerability Ranking
Drought	Heat stress in sensitive ecosystems can impact biodiversity	High
	Water quality concerns from lack of flushing	Moderate
Ecosystem Changes	Invasive species threaten native species and biodiversity	Very high
	Loss of fish and wildlife habitat	Moderate
	Decline in pollinator population	Moderate
Extreme Heat and Very Hot Days	Heat stress on wildlife	Moderate
	Heat stress on vegetation	Low
Extreme Precipitation	Adverse impacts on water quality and aquatic ecosystem health	High
	Increased spread of invasive species from ecosystem stress	Moderate
	Habitat disruption and damage	Low
High Winds/ Tornadoes	Damage to trees	High
	Loss of old growth trees or mature forest habitats	High
Increase in Temperature	Loss of natural areas from increasing temperatures	High
	Wetlands are damaged or lost	Moderate
Total Precipitation	Impacts on soil health lead to ecosystem stress	High
	Increased runoff can affect water quality	High
Very Cold Days and Extreme Cold	Wildlife injury and death from extreme cold	Moderate
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Damage to habitats and wildlife	High
	Damage to trees	Moderate

Parks and Recreation Lands

Toronto's public parks offer recreational facilities, essential access to outdoor spaces and nature for its residents and visitors. These parks also act as nodes and patches of habitat that can support smaller or less diverse biodiversity.[162]

Parks are used for play, relaxation, adventure and physical and mental health. These places can include pools, rinks, fields, playgrounds or just open green spaces for community use.

The vulnerabilities of the natural heritage system and biodiversity are echoed in city parks.

Key Vulnerability Drivers: Population growth and increasing recreational use, low connectivity of habitat and natural systems, invasive species, lower-quality habitat patches, heat island stress on urban trees and wildlife, degraded habitat

Table 38. Impact statements and vulnerability rankings by climate hazard — Parks and Protected Areas.

Climate Hazard	Impact Statement	Vulnerability Ranking
Drought	Reduced water availability	High
	Loss of green space and urban canopy	Moderate
Ecosystem Changes	Damage and disruption from invasive species	High
Extreme Heat and Very Hot Days	Heat stress on vegetation	Low
Extreme Precipitation	Flood damage to ravines	Moderate
	Flood damage to park infrastructure	Low
Freeze-thaw Cycles	Premature degradation of park infrastructure	Low
High Winds/ Tornadoes	Damage to trees and infrastructure	Moderate
Total Precipitation	Blue-green algae or poor water quality in recreational water	Moderate
Very Cold Days and Extreme Cold	Damage to natural environment	Low

[162] City of Toronto. 2019. Wild, Connected And Diverse: A Biodiversity Strategy For Toronto. Prepared by Toronto City Planning and Parks, Forestry and Recreation with the Toronto and Region Conservation Authority.

Climate Hazard	Impact Statement	Vulnerability Ranking
Winter/Ice Storms (Snow, Ice, Freezing Rain)	Accessibility and safety of parks can be compromised by snow and ice accumulation on pathways and broken tree limbs from freezing rain	Moderate

5.3 Summary of Key Vulnerability Drivers

While Section 5.2 provided a detailed analysis of specific potential climate-related impacts and their vulnerability rankings across Population and Local Economy, Municipal Services, Infrastructure Systems, and Natural Systems, this section summarizes those findings and outlines the underlying systemic factors and trends that drive these vulnerabilities, many of which span multiple systems.

Climate vulnerability in Toronto is not the result of isolated events but rather the product of interconnected factors spanning rapid population growth, socio-economic pressures, limited resources for essential services, infrastructure capacity and environmental resilience. The findings of this assessment underscore how key drivers of vulnerabilities — whether to extreme heat, flooding, winter storms or deteriorating air quality — are shaped by a set of interconnected factors, including housing insecurity, increasing cost of living, energy poverty, an aging population, traffic congestion, deteriorating infrastructure and climate-sensitive design constraints. These drivers are not independent; rather, they compound one another, intensifying risks for the city's residents and especially for its most vulnerable populations.

The impacts of climate hazards often disproportionately affect residents who lack financial and social buffers, forcing them to cope with worsening conditions with limited means. At the same time, the state of the city's systems, including aging infrastructure, congested transportation networks, underfunded public services and fragmented natural spaces reduce the City's overall ability to manage climate stresses effectively. As these systems intersect, vulnerabilities are amplified, creating cascading risks that make Toronto's adaptation efforts more urgent and complex.

The Socio-economic Dimensions of Climate Vulnerability

Many of Toronto's residents and at-risk populations are not simply facing the impacts of climate change, they are also contending with financial instability, substandard housing, and barriers to accessing health and emergency services. These factors shape sensitivity to climate hazards and adaptive capacity, determining whether individuals and communities can withstand or recover from extreme weather events.

- More than 40 per cent of residents report struggling to meet basic expenses, meaning that many households lack the financial resources to make their homes more resilient — whether by installing air conditioning, reinforcing insulation or relocating from flood-prone areas.
- Energy poverty leads residents to ration cooling or heating during temperature extremes. This issue disproportionately affects low-income households, tenants in older apartment buildings, and social housing residents, many of whom lack access to efficient climate control systems.
- Over 500,000 people in the Greater Toronto Area live in high-rise buildings that are at least 40 years old, structures that often suffer from poor insulation, outdated heating and cooling systems, aging plumbing and reliance on elevators, all of which can become critical failure points during extreme heat or cold events.
- Already facing severe health and safety challenges, individuals experiencing houselessness are disproportionately exposed to extreme heat, extreme cold, and air quality hazards, with limited access to cooling, heating or shelter during severe weather events. Shelter space is consistently at or near capacity, leaving many without refuge during climate extremes.
- By 2041, one in 5 residents will be over the age of 65. Seniors are at higher risk of heat-related illness, cold stress and injury during extreme weather events due to both physiological sensitivity and limited mobility.
- Disruptions to public transit disproportionately impact Toronto's most socially vulnerable residents, particularly low-income individuals, seniors and people with disabilities, who rely on transit for daily essentials like work, healthcare and groceries.
- The construction sector, already short on skilled workers, faces further delays as extreme weather disrupts work schedules and supply chains, driving up costs. As climate hazards intensify, housing availability and affordability will be further constrained.

Infrastructure Challenges and Service Gaps

Beyond individual and household-level vulnerabilities, Toronto faces significant infrastructure and service-related constraints that heighten climate vulnerabilities. Aging assets, deferred maintenance, congestion and single points of failure in key systems make it harder for the City to absorb and respond to extreme weather events.

- Many of Toronto's roads, bridges, stormwater and energy systems were designed for a historical climate that no longer reflects present-day realities. The City's infrastructure funding backlog — estimated in the billions — further exacerbates these vulnerabilities by delaying critical upgrades and resilience measures.
- The province-wide electricity demand is projected to grow by 75 per cent by 2050, adding pressure to a system that is increasingly relied upon for cooling, heating and essential services. Many critical systems lack sufficient backup power, making them highly vulnerable to outages during grid failures. A blackout during a heatwave can leave thousands without cooling, disrupt transit operations, shut down food supply chains, and overwhelm emergency services.
- Toronto already has one of the most congested road networks in North America, with traffic delays costing billions annually in lost productivity. These delays impact economic productivity and slow down emergency response times, making it more difficult for paramedics, firefighters and police to reach those in need during climate-related disasters. Additionally, congestion disrupts food and supply chains, making essential goods less accessible, especially in marginalized communities.
- Under-resourced emergency services and social support systems add to the city's vulnerabilities. Long waiting lists for social housing, chronic shelter shortages and overburdened emergency response teams limit Toronto's ability to protect its most at-risk populations.

The Interplay Between the Built and Natural Environment

While infrastructure and public services define much of Toronto's response capacity, the natural environment plays a crucial role in shaping climate vulnerability.

- The city's urban heat island effect — exacerbated by widespread pavement, high-rise buildings and limited vegetation — intensifies the impact of extreme heat, particularly in low-income and densely built-up areas.
- Toronto's tree canopy and green infrastructure provide valuable cooling and stormwater management services, but these systems are under strain. Warmer winters and changing precipitation patterns have accelerated the spread of invasive species and pests, threatening the health of the urban forest. At the

same time, fragmented natural habitats reduce their ecological resilience and the ability of ecosystems to adapt to shifting climate conditions.

- Green infrastructure such as rain gardens, bioswales and permeable pavements play a role in reducing flooding, but repeated exposure to extreme weather events can degrade their effectiveness over time. Ice storms, prolonged droughts and salt contamination all weaken these systems, limiting their ability to mitigate future hazards.

The vulnerability scores are combined with likelihood and consequence, following the methodology in Section 3, to generate the risk rankings shown in Section 6.

6. Risk Assessment

A risk assessment derives risk scores based on combining information about vulnerability to specific climate hazards with consequence and likelihood. This risk assessment builds on the previous chapter on vulnerability to explain the concepts of likelihood and consequence and how they are used with vulnerability scores to calculate risk.

Risk scores provide a high-level prioritization of the most significant climate-related risks facing Toronto. They identify which climate risks currently pose the greatest threats to the city and which are expected to become more severe in the future. This information is crucial for decision-makers, as it helps determine which risks require the most immediate attention and where to allocate resources for climate adaptation and resilience measures.

By highlighting the risks with the highest scores, this analysis sets the stage for the next chapter of the report: identifying and prioritizing adaptation measures. The results help focus attention on the most pressing vulnerabilities and climate threats, guiding a targeted response. In some cases, high-risk areas may warrant further investigation or detailed assessment to fully understand their implications and ensure that proposed actions are effective and appropriate.

The risk assessment section includes:

- Priority risks organized by climate hazard and how these risks are expected to change over time under the SSP2-4.5 climate scenario;
- Key risk themes emerging from the analysis of priority risks;
- Escalating risks projected for the 2040–2070 time horizon; and
- The methodology used to generate vulnerability, likelihood and consequence scores, and how these were combined to produce risk scores.

Findings: Ranked Climate Risks for Toronto

This section provides an overview of risk scores for each impact statement. Impact statements are organized by climate hazard, with hazards ordered according to the number of current priority risks, defined as those with a risk score of 30 or higher. Table 39 presents the hazards in order from those with the highest number of current priority risks to those with the fewest.

Table 39. Number of priority risks by hazard

	Current Risk	Future Risk
Extreme Heat and Very Hot Days	19	37
Extreme Precipitation	16	35
High Winds/Tornadoes	8	8
Winter/Ice Storms	7	7
Very Cold Days	6	1
Ecosystem Changes	3	4
Climate-related Air Quality	3	5
Drought	1	1
Freeze-thaw Cycles	1	0
Increases in Temperature	0	1
Total Precipitation	0	0

Risk scores are presented for two key time periods. Current Risk reflects scores based on Toronto's historical climate, while Future Risk represents projected scores for the 2040–2070 period under the SSP2-4.5 climate scenario. This time frame was selected because it provides a long enough outlook to assess how the city's climate risk profile may evolve in the coming decades. The SSP2-4.5 scenario — often referred to as the "middle-of-the-road" or most likely pathway — was chosen because it aligns well with current global trends and is appropriate for planning purposes. For completeness, risk scores were also calculated for the 2015–2040 and 2070–2100 periods, as well as all periods under the SSP5-8.5 scenario. These additional projections are included in the accompanying risk register.

Each climate hazard section in this report is structured to highlight priority and escalating risks associated with that hazard. Within each section, **risk themes** summarize the most significant and recurring patterns observed across these high-risk impact statements — for example, impacts on health, infrastructure or essential services.

Where a hazard is projected to become more frequent or intense due to climate change, the **Climate Change Impact on Risk** subsection discusses how these changes are expected to affect current priority risks over time. This includes a comparative look at how risk scores are projected to evolve and the implications for the City.

Additionally, for impact statements that currently score below 30 but are projected to exceed this threshold in the future, **escalating risks** are identified and described. These risks reflect new or intensifying threats that may require proactive monitoring and adaptation planning. This subsection also identifies new risk themes that emerge from these changes.

Table 40 Risk score ranges by risk ranking categories.

Risk Score Range	Risk Ranking
1-19	Low
20-29	Medium-low
30-39	Medium-high
40-59	High
60+	Very High

6.1 Likelihood Overview

Table 41 provides an overview of how hazard likelihood is expected to change over time under the different climate scenarios and time horizons included in the assessment. Likelihood scores are based on the rate of change of underlying climate indicators.

Climate projections indicate that several hazards in Toronto are becoming increasingly likely under the SSP2-4.5 and SSP5-8.5 scenarios. Hazards such as extreme heat, extreme precipitation, ecosystem changes, climate-related air quality, rising temperatures and total precipitation all show rising likelihood scores over time. In contrast, winter ice storms, high winds/tornadoes and drought are projected to maintain a constant likelihood throughout the century. Meanwhile, very cold days and freeze-thaw cycles show a declining likelihood, with the rate of decrease slightly faster under SSP5-8.5.

It is important to note that likelihood scores are largely consistent between the two climate scenarios, with differences appearing only in the pace of decline for cold-related hazards.[163]

[163] This does not imply identical changes in the underlying climate indicators across scenarios, but rather that the projected values fall within the same defined thresholds for scoring.

Table 41. Projected changes in climate hazard likelihood for different time periods under a medium emissions scenario. ↑↑ indicates a large increase in likelihood, ↑ indicates a moderate increase, ↓ indicates a decrease and - indicates that the likelihood of the climate hazard occurring will remain relatively similar to present conditions.

	2030s	2050s	2080s
Extreme Heat and Very Hot Days	↑↑	↑↑	↑↑
Increase in Temperatures	↑	↑	↑↑
Ecosystem Changes	↑	↑	↑
Climate-Related Air Quality	-	↑	↑↑
Extreme Precipitation	-	↑	↑
Total Precipitation	-	-	↑
High Winds/Tornadoes	-	-	-
Drought	-	-	-
Winter/Ice Storms	-	-	-
Very Cold Days	↓	↓	↓
Freeze-thaw Cycles	↓	↓	↓

6.2 Risk Landscape

Figures 13 and 14 illustrate how Toronto's climate risk landscape is expected to evolve under the SSP2-4.5 scenario by presenting all priority risks organized by climate hazard for both the current climate and the future climate scenario. Priority risks are those defined as having impact statements with risk scores above 30, meaning risks that had a ranking of medium high, high or very high. Risks with scores below 30 — those with rankings of low or medium-low — are excluded from the analysis below.

Under current climate conditions (Figure 13), 64 impact statements exceed the priority risk threshold. The majority are associated with extreme heat and very hot days and extreme precipitation, followed by winter/ice storms, high winds/tornadoes and very cold days.

In the SSP2-4.5 future scenario (Figure 14), the number of priority risks increases significantly to 99. The largest increases are observed for extreme heat and very hot days and extreme precipitation. In contrast, the number of priority risks associated with very cold days and freeze-thaw cycles declines. The number of very high risks rises from three under current conditions to 20 in the future scenario, indicating a substantial intensification of climate threats over time.

Figure 13. Priority risks by climate hazard — current.

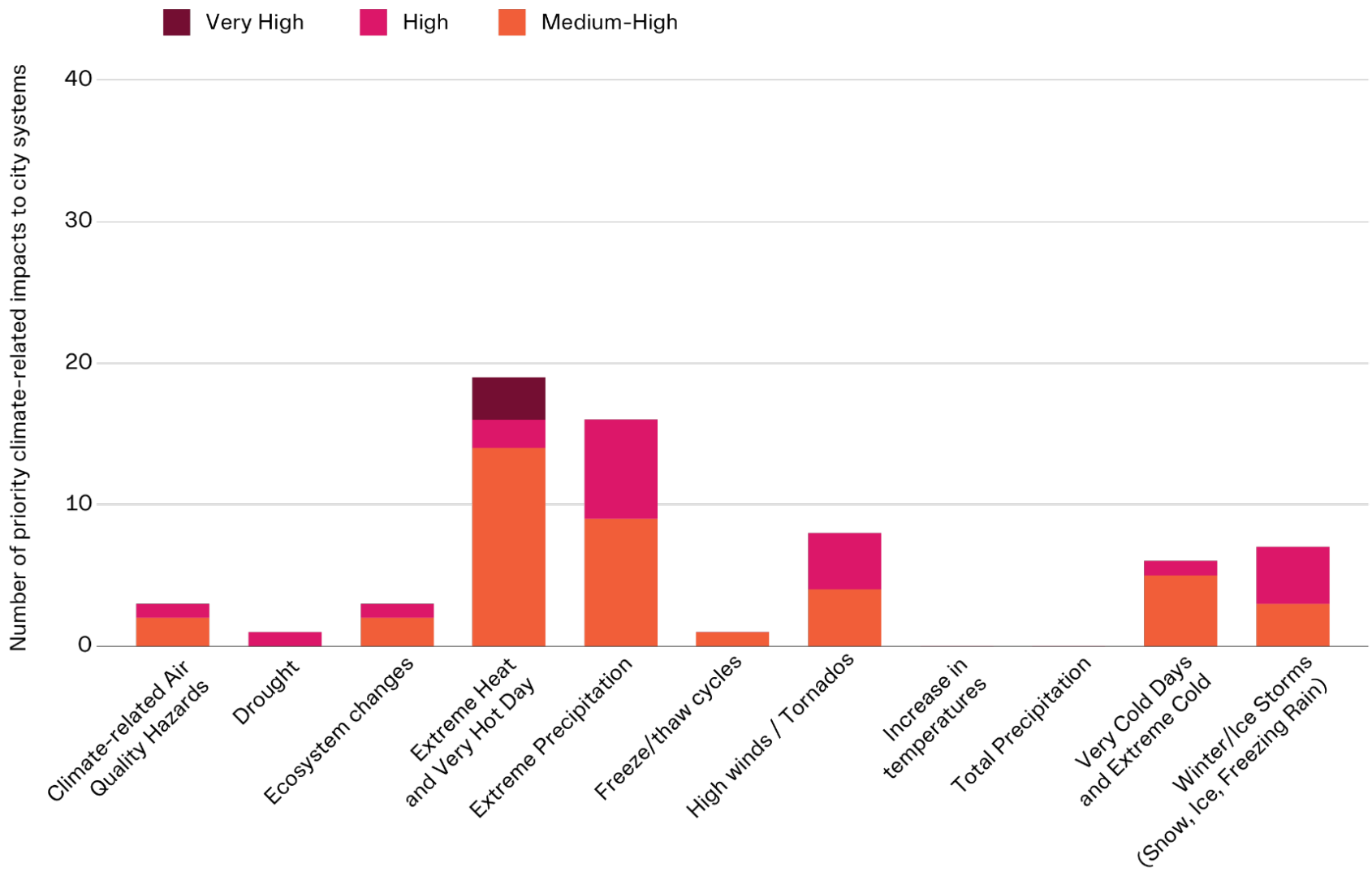
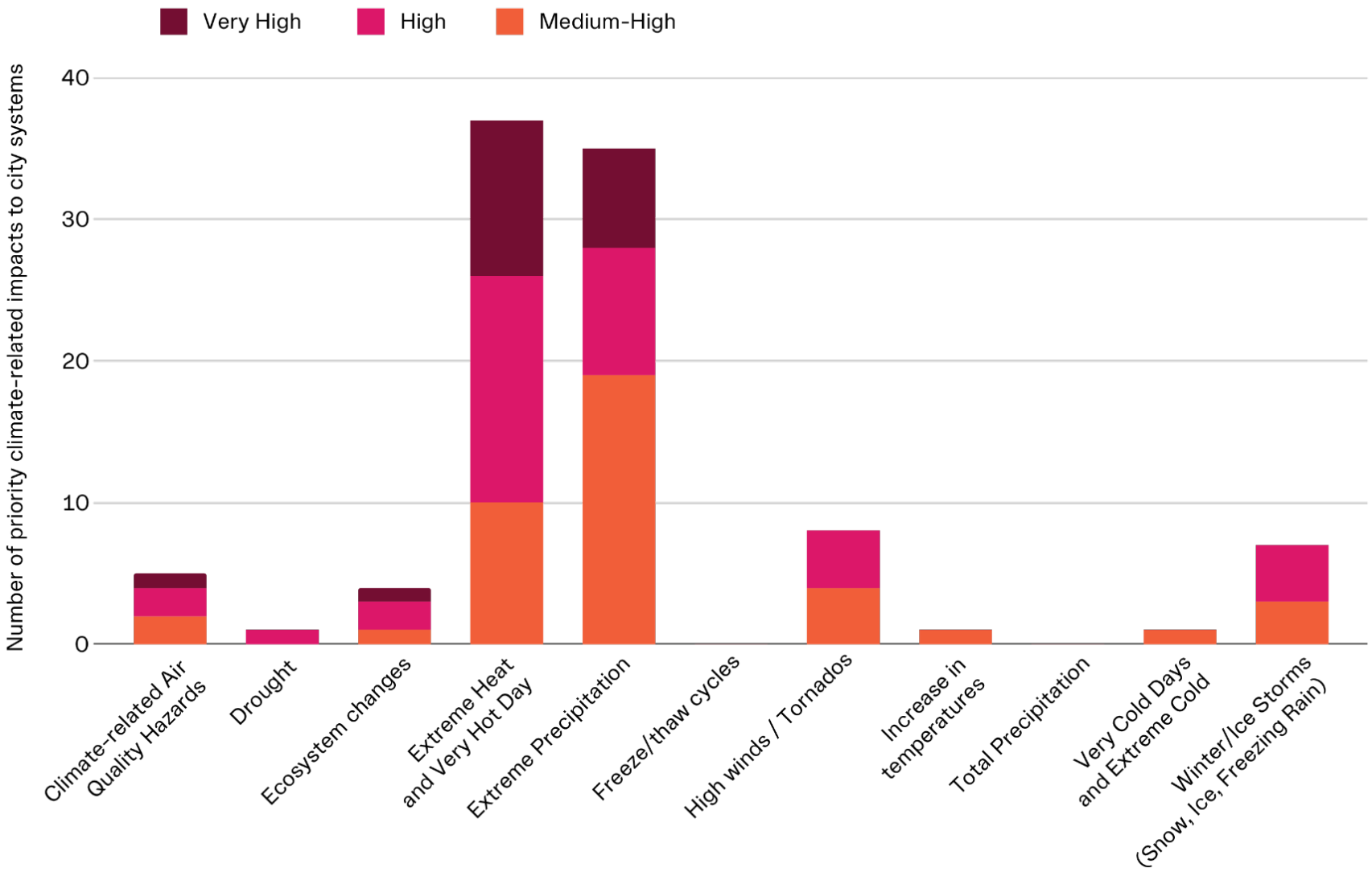


Figure 14. Priority risks by climate hazard — 2050s (under the SSP2-4.5 climate scenario).



This shift in the risk landscape underscores the urgency of preparing for a hotter, wetter and more volatile climate. The sharp increase in the number and severity of priority risks — particularly those linked to extreme heat and precipitation — highlights the need to focus adaptation planning on systems most exposed to these hazards. At the same time, the decline in risks from cold-related hazards presents an opportunity to reallocate resources and capacity toward emerging threats. These findings will inform the next phase of the project, guiding the identification and prioritization of targeted adaptation measures.

6.3 Priority Risks by Hazard

6.3.1 Extreme Heat and Very Hot Days

Extreme heat is one of Toronto's top climate priority hazards, alongside extreme precipitation. It is associated with a high number of priority impact statements — 19 in total — including several of the highest-ranked risks in both the current and future periods. Over the coming decades, extreme heat is also projected to drive one of the most significant increases in very high-risk impacts across all hazards assessed. While already causing considerable stress on health systems, infrastructure and essential services, the frequency, duration and severity of extreme heat events are expected to intensify substantially. As exposure grows, risks that were previously assessed as moderate,such as infrastructure degradation, service delivery challenges and workforce impacts, are projected to escalate into high or very high concern. These impacts will disproportionately affect vulnerable populations, particularly those with limited access to cooling, healthcare or secure housing.

Risk Themes

The following risk themes highlight the key ways extreme heat affects health, infrastructure, mobility, services and affordability in Toronto. Heat-related impacts associated with a risk score above 30 for the current period are summarized in Table 42, following this thematic overview. This provides a prioritized view of the most consequential impacts identified through the assessment. Impact statements that do not appear in the tables below were ranked low or moderate risk for current conditions and therefore were not included.

Compounding Heat, Health and Cost Pressures

The impact of extreme heat on health is Toronto's most urgent climate threat. Older adults, low-income households, people experiencing homelessness and people living in older buildings without air conditioning face disproportionate exposure to rising temperatures and more frequent heat events, with direct effects on health. Rising summer cooling costs and broader challenges such as meeting basic needs and maintaining secure housing further compound these risks, linking health pressures with affordability challenges. At the

same time, worsening wildfire seasons degrade air quality, and when smoke coincides with heat, health risks multiply, intensifying respiratory and cardiovascular impacts.

Infrastructure Disruptions and Cascading Impacts

Climate change is placing growing stress on Toronto's infrastructure. Flood-prone transit and road networks, as well as aging buildings in legacy riverine flood zones, are already vulnerable and disruptions will become more frequent and costly. The greatest concern is the failure of critical assets during extreme events. For example, a power grid failure during a severe heat wave could cut off access to cooling — and in some cases, access to water — resulting in consequences that ripple across homes, workplaces and essential services.

Emergency and Municipal Services Under Strain

Municipal services will face escalating pressure as extreme weather becomes more frequent and severe. Shelters for people experiencing homelessness already operate at or near capacity, and surges in demand during heat waves, air quality events and storms outpace available space and staff. The City's outdoor workers face direct exposure to climate hazards, and as demand for their services increases, they must often divert their attention from regular duties (such as during cleanup of storm debris). In the face of increasingly volatile weather, the existing plans, processes and resources of a broad range of city divisions, agencies and corporations will face strain, increasing the need for enhanced response coordination. When demand peaks, cascading effects follow: emergency responders face overwhelming call volumes and longer response times; hospitals and community health services back up; and outreach teams are stretched precisely when conditions are most dangerous.

Degradation of Natural Areas and Habit and Tree Canopy Loss

Urban forests, green spaces, wetlands, streams and ravines provide cooling and carbon sequestration, absorb/slow down stormwater and sustain biodiversity. However, they are increasingly stressed by urbanization, storm events, heat, drought, invasive species, development and habitat degradation. Losing natural features and the tree canopy erodes Toronto's natural defenses, raising neighbourhood temperatures, increasing flood volumes, decreasing habitat and natural area functions and compounding wear on infrastructure.

Climate Change Impact on Risk

Under an SSP2-4.5 scenario, Toronto is expected to face a dramatic rise in the frequency, duration, and intensity of extreme heat events. These shifts carry serious consequences for public health, urban infrastructure, ecosystems, and the overall functioning of the city. Prolonged exposure to high temperatures can lead to widespread health impacts, strain critical infrastructure and disrupt essential services. Vulnerable populations, such as

unhoused residents and low-income households, face particularly acute risks due to limited access to cooling, secure shelter and reliable healthcare. The compounding nature of these impacts makes extreme heat one of the most consequential climate hazards facing Toronto in the coming decades.

This escalating hazard is reflected in the risk assessment. All 19 priority impacts associated with extreme heat are projected to worsen. Sixteen these risks are expected to shift into either the high or very high risk categories, with several crossing into the highest level of concern. This includes direct health threats such as heat-related illnesses and mental health strain, as well as cascading risks to infrastructure, service delivery, food security and affordability. The breadth and severity of this shift highlight the urgent need for targeted adaptation strategies to reduce exposure, improve resilience and protect the most affected residents.

Table 42. Priority risks related to extreme heat and very hot days.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Heat-related illnesses for unhoused population	Residents and Non-residents	Very High	Very High
Heat-related illnesses for vulnerable populations (e.g. infants and children, older adults, people with low income, people with limited access to cooling, pregnant people, people with chronic conditions or prescriptions that make them more sensitive to heat)	Residents and Non-residents	Very High	Very High
Power outages caused by high demand and reduced power transformer capacity	Electricity Supply and Distribution	Very High	Very High
Mental health impacts for vulnerable populations (e.g. people with less access to cooling and older adults who experience cognitive decline with increased heat)	Residents and Non-residents	High	Very High
Increased indoor temperatures for residential buildings	Residential Buildings	High	Very High
Heat stress on aquatic ecosystems	Natural Environment	Medium-high	Very High
Data centres overheating during a heatwave and causing a system failure	Information, Banking, Communications and Technology	Medium-high	Very High

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Disruption of service delivery in shelters for unhoused population due to overcrowding	Community and Social Services	Medium-high	Very High
Heat-related pregnancy complications for vulnerable populations (e.g. people with lower incomes and/or less access to cooling)	Residents and Non-residents	Medium-high	Very High
Increased road safety incidents due to damaged roads	Residents and Non-residents	Medium-high	Very High
TTC subway network can experience slowdown malfunctions due to extreme heat	Public Transportation	Medium-high	High
Food insecurity increases during extreme heat as vulnerable populations face higher expenses (e.g. increased food waste and increased cooling costs), leaving less income for food	Food Supply Systems	Medium-high	High
Extended telecom outage leading to service disruption	Information, Banking, Communications and Technology	Medium-high	High
GO trains can experience delays and malfunctions due to extreme heat	Public Transportation	Medium-high	High
VIA trains can experience delays and malfunctions due to extreme heat	Regional Transportation	Medium-high	High
Increased indoor temperatures for commercial and industrial buildings	Commercial and Industrial Buildings	Medium-high	High
Increased energy costs on affordable and social housing tenants	Community and Social Services	Medium-high	High
Increased energy costs for vulnerable populations (e.g, people with lower incomes and/or who are experiencing energy poverty)	Residents and Non-residents	Medium-high	High
Increased indoor temperatures for municipal buildings	Municipal Buildings	Medium-high	High

Escalating Risks

While current assessments categorize several impacts from extreme heat as low or medium-low risks, many of these are projected to cross into the medium-high or high risk range in the coming decades, as shown in Table 43. These escalating risks reflect both expanding exposure to extreme heat and growing strain on services, infrastructure and workforce systems.

This trend signals more than just worsening conditions, it reflects a broadening landscape of risk. As extreme heat intensifies, the number of impacts the City must monitor, respond to and plan for is growing. This expanding scope will place added strain on systems already vulnerable to disruption, reinforcing the need for comprehensive strategies that account for worsening and newly emerging threats.

Workforce Capacity and Continuity

While health risks to vulnerable populations are a key existing theme, the escalating risks introduce a broader operational dimension, specifically the impacts of heat on municipal workers, outdoor workers and public works. These include heat-related illness, absenteeism, productivity loss and delayed service delivery. This highlights workforce resilience as a growing area of concern, particularly for essential city operations during heatwaves.

Emergency Response System Overload

Existing priority risks touch on health system strain, but the cumulative demand on emergency responders — paramedics, fire, and police — emerges more clearly in the new risks. These services may face compound pressure from medical calls, public safety enforcement and the support required for unhoused populations during extreme heat events, creating a theme of emergency system saturation and increasing the likelihood that the City's Emergency Response Plan would need to be activated and the Emergency Operations Centre set up to coordinate a larger city response to coordinate resources.

Communication System Vulnerability

Power outages affect personal and public communication networks by causing depleted phone batteries and service blackouts, introducing a digital and communication risk theme that was not as prominent in the initial priority risks. This reflects how interconnected systems can create cascading disruptions during heat events.

Transportation and Supply Chain Disruption

Although road safety was already noted in the priority risks, the broader consequences of road degradation, including travel delays, compromised emergency access and supply chain interruptions, add a new emphasis on urban logistics and access that extends beyond individual road safety incidents. Public transit and rail systems can also face service disruptions and malfunctions due to extreme heat.

Table 43. Escalating risks related to extreme heat and very hot days.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Hospital service disruption due to extreme heat	Commercial and Industrial Buildings	Medium-low	High
Fuel shortage from extended power outage	Fuel supply (gasoline and diesel)	Medium-low	High
Damage to road infrastructure, including severe rutting of roads and failure of traffic control systems	Road Networks	Medium-low	High
Increased demand for cool spaces through the heat relief network	Community and Social Services	Medium-low	High
Heat-related illnesses for municipal workers	Municipal Workers	Medium-low	High
Potential increased demand for paramedic services due to heat-related illnesses	Public Health and Safety	Medium-low	High
Increased workload during and following heat waves, loss of productivity, increased absenteeism/sick days and project delays	Public Works	Medium-low	High
Heat-related illnesses for outdoor workers	Residents and Non-residents	Medium-low	High
Extended power outage leading to depleted phone batteries and widespread communication network disruption	Information, Banking, Communications and Technology	Medium-low	Medium-high
Increased demand for public communications and emergency cooling locations during an extreme heat event	Emergency Management	Medium-low	Medium-high
Fire and police services may face increased demands from medical calls, for traffic management and to assist unhoused individuals and enforce safety in public spaces	Public Health and Safety	Medium-low	Medium-high
Physical harm for people who are visiting the city	Residents and Non-residents	Medium-low	Medium-high
Increased travel times and supply chain disruptions due to heavy vehicle restrictions and road closures due to damaged roads	Road Networks	Low	Medium-high

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Compromised emergency access/routes due to damaged roads	Road Networks	Low	Medium-high
Vehicle damage due to damaged roads	Road Networks	Low	Medium-high
Increased liability and cost of claims due to damaged roads	Road Networks	Low	Medium-high
Safety risks in long-term care facilities, retirement homes and supportive housing	Public Health and Safety	Low	Medium-high
Disruption and/or impairment to service productivity	Business and Socio-economic Activities	Low	Medium-high

6.3.2 Extreme Precipitation

Extreme precipitation is one of Toronto's top climate hazards, alongside extreme heat. It is associated with a high number of priority impact statements for the current time period — 16 in total — that affect multiple interconnected systems, including buildings, roads, social services, utilities and public health. Several of these risks are already assessed as high or moderate in the current period and are projected to escalate further in the coming decades as precipitation events become more frequent and intense.

Risk Themes

The following themes summarize how extreme precipitation affects key systems and population groups in Toronto. Impact statements with a risk score above 30 in the current period are presented in Table 44 after this thematic overview, providing a prioritized snapshot of the most consequential flooding-related risks identified through the assessment.

Health and Well-being

Extreme precipitation events threaten physical and mental health, especially for unhoused populations and individuals with disabilities or chronic health conditions. Flooding and water damage can destroy assistive devices, medical supplies and personal belongings, compounding health risks and making recovery more difficult. For unhoused residents, the risk of displacement and associated health impacts is particularly severe. Mental health consequences, including psychosocial stress, are also prominent, especially among low-income renters who may lack the means to rectify flood damage.

Access to Services and Mobility

Service disruptions are a major concern during heavy rainfall events. Flooded roads and public transit interruptions (including TTC, the GO train and VIA Rail) can prevent vulnerable individuals from accessing healthcare, social supports and daily necessities. These mobility limitations have cascading effects on health, safety and overall well-being, particularly for people with limited transportation options or mobility challenges.

Infrastructure Vulnerability

Residential, commercial, industrial and municipal buildings are at high risk of water damage from extreme precipitation. These impacts are widespread and can lead to costly repairs, operational shutdowns or long-term structural degradation. Road networks are similarly at risk, with flooding causing damage to pavement and increasing the likelihood of road safety incidents and broader transportation disruption.

Overburdened Social Services

Shelters and other community services may become overwhelmed during precipitation events due to overcrowding and increased demand. These facilities are critical for supporting the unhoused population and other at-risk groups, and service disruptions can leave individuals without safe refuge or support during extreme weather.

Financial Pressure and Displacement

Flooding and water damage often result in out-of-pocket expenses for repairs and temporary relocation. For renters and lower-income residents, these costs can create significant financial stress and increase the risk of housing instability or displacement. These pressures deepen existing socio-economic vulnerabilities and can delay recovery, especially in the absence of insurance or emergency assistance.

Environmental and Utility Strain

Combined sewer overflows during extreme precipitation events present environmental and public health risks. These overflows can lead to the release of untreated wastewater, contaminating local waterways and increasing the risk of exposure to harmful pathogens, especially in areas with aging infrastructure or insufficient stormwater capacity.

Climate Change Impact on Risk

Under an SSP2-4.5 scenario, Toronto is projected to experience more frequent, intense, and prolonged extreme precipitation events. These shifts carry serious consequences for the city's buildings, transportation systems, public health services and essential services. Heavy rainfall increases the risk of widespread flooding, damaging homes, disrupting mobility and overwhelming stormwater systems. Vulnerable populations, especially unhoused residents, renters and individuals with limited mobility, face heightened exposure to displacement,

property loss and health impacts. The cascading nature of these disruptions makes extreme precipitation a growing hazard for the functioning and livability of the city.

This trend is clearly reflected in the risk assessment. Several identified risks are expected to shift into a higher risk category in the 2040-2070 timeframe. Impacts such as damage to municipal buildings, overcrowded shelters and health risks for unhoused residents are all projected to move from medium-high to high risk. Others, including building damage, service disruptions, and sewer overflows, are becoming more frequent and more disruptive. These changes signal not only deepening risks, but also a broader set of systems and populations that will be affected. As the number of high-priority impacts grows, the city will face mounting pressure to address overlapping vulnerabilities across infrastructure, public health and social support networks.

Table 44. Priority risks related to extreme precipitation.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Damage to road infrastructure and disrupted road networks from extreme precipitation	Road Networks	High	Very High
Damage from extreme precipitation events	Residential Buildings	High	Very High
Damage from extreme precipitation events	Commercial and Industrial Buildings	High	Very High
Disruption to TTC service from extreme precipitation	Public Transportation	High	Very High
Disruption to GO train	Public Transportation	High	Very High
Disruption to VIA service	Regional Transportation	High	Very High
Displacement of unhoused population	Residents and Non-residents	High	Very High
Combined sewer overflows	Stormwater and Water Systems	Medium-high	High
Increased road safety incidents	Residents and non-residents	Medium-high	High

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Loss of assistive devices and medical supplies due to water damage/contamination/displacement	Residents and Non-residents	Medium-high	High
Loss of access to essential services for vulnerable populations (e.g. people with physical and/or neurological disabilities may not receive care if their support worker cannot safely travel; people who are medically dependent may not access health clinic or facility if travel is difficult and/or facility is closed)	Residents and Non-residents	Medium-high	High
Psychosocial and mental health impacts for vulnerable populations (e.g. people with lower incomes and/or renters may not be able to repair or remediate these effects)	Residents and Non-residents	Medium-high	High
Damage from extreme precipitation events	Municipal Buildings	Medium-high	High
Disruption of service delivery in shelters for unhoused population due to overcrowding	Community and Social Services	Medium-high	High
Financial stress from property damage	Residents and Non-residents	Medium-high	High
Physical and mental health impacts for the unhoused population	Residents and Non-residents	Medium-high	High

Escalating Risks

While this assessment categorizes several impacts from extreme precipitation as currently being medium-low, all 19 of these risks are projected to increase into the medium-high range in the coming decades (see Table 45). These escalating risks reflect the growing reach of flooding impacts across a wider range of sectors, including infrastructure, critical services, housing and public health.

This trend signals more than just worsening individual outcomes; it marks a broadening of the city's climate risk landscape. As extreme precipitation becomes more frequent and intense, the number of systems that must be monitored, maintained and supported during flood events will expand. This growing scope will place additional strain on already stressed systems and services, reinforcing the need to address existing and newly emerging threats.

Infrastructure and System Disruption

Several escalating risks point to deepening vulnerabilities in infrastructure and essential systems. These include hospital service disruption due to flooding, disruptions to GO Transit and extended power outages affecting fuel supplies and communication networks. While these systems are not currently among the highest risk categories, their increasing exposure to flood-related disruptions will raise their profile as key areas of concern.

Housing and Displacement

Escalating risks such as displacement of residents, unsanitary living conditions, and flood-related damage to supportive housing facilities illustrate how extreme precipitation will exacerbate housing instability, particularly for low-income and medically vulnerable populations. These impacts overlap with public health and affordability concerns and may escalate in severity as more residential areas become flood prone.

Public Health and Emergency Services

Although health-related precipitation risks are not yet high priority, several are projected to worsen, including increased demand to accommodate displaced people, emergency services call volumes and safety risks in long-term care and retirement homes. These trends suggest that emergency systems may become increasingly overwhelmed, even outside of heat events, creating compounding demand across hazard types.

Economic and Operational Impacts

Flood-related disruption to the Ontario Food Terminal, supply chain delays and loss or damage to business equipment and facilities point to rising risk for Toronto's economic infrastructure. These impacts may strain small businesses, increase financial recovery costs and reduce productivity in key sectors.

Table 45. Escalating risks related to extreme precipitation.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Hospital service disruption due to flooding	Commercial and Industrial Buildings	Medium-low	Medium-high
Disruption to the Ontario Food Terminal due to power outage	Food Supply Systems	Medium-low	Medium-high
Fuel shortage from extended power outage	Fuel Supply (Gasoline and Diesel)	Medium-low	Medium-high

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Extreme precipitation events can cause sinkholes, soil and embankment erosion, undermined structures and road and bridge collapse, resulting in road damage and closures	Road Networks	Medium-low	Medium-high
Disruption and/or impairment to service productivity	Business and Socio-economic Activities	Medium-low	Medium-high
Loss and damage to materials and equipment	Business and Socio-economic Activities	Medium-low	Medium-high
Displacement of residents	Residents and Non-residents	Medium-low	Medium-high
Extended power outage, leading to depleted phone batteries and widespread communication network disruption	Information, Banking, Communications and Technology	Medium-low	Medium-high
Damage to gas pipelines	Natural Gas Supply	Medium-low	Medium-high
Increased travel times and supply chain disruptions due to ponding and flash flooding on road segments	Road Networks	Medium-low	Medium-high
Service disruption due to flooded facilities	Stormwater and Water Systems	Medium-low	Medium-high
Increased demand for emergency shelters for individuals experiencing homelessness	Emergency Management	Medium-low	Medium-high
Potential increased demand for paramedic services	Public Health and Safety	Medium-low	Medium-high
Safety risks in long-term care facilities, retirement homes and supportive housing	Public Health and Safety	Medium-low	Medium-high
Adverse impacts on water quality and aquatic ecosystem health	Biodiversity	Medium-low	Medium-high
Adverse impacts on water quality and aquatic ecosystem health	Natural Environment	Medium-low	Medium-high
Disruptions to supply chains	Business and Socio-economic Activities	Medium-low	Medium-high
Unsanitary living conditions from water damage	Residents and Non-residents	Medium-low	Medium-high

6.3.3 Winter/Ice Storms (Snow, Ice, Freezing Rain)

Winter and ice storms are a consistently high-priority hazard for Toronto, with several impacts, such as power outages, service disruptions and cold-related health risks, rated among the highest in the assessment. Seven impact statements related to this hazard received risk scores above 30 in the current period, reflecting the wide-ranging and persistent consequences of winter storm events. Despite projections showing a general decline in extreme cold days over time, the frequency of winter and ice storms is not expected to change significantly, and their impacts remain substantial, especially due to the continued threat of freezing rain, grid failure and cascading service disruptions.

Risk Themes

The following risk themes summarize the ways winter and ice storms affect health, infrastructure, essential services and vulnerable populations in Toronto. Impact statements with a current risk score above 30 are listed in Table 46 following this thematic overview, providing a prioritized view of the most pressing winter-storm-related risks.

Access to Essential Services

Winter and ice storms pose a significant threat to residents' ability to access essential services, especially for those with limited mobility or specialized care needs. Travel disruptions caused by icy roads, snow accumulation or power outages can prevent support workers from reaching clients and make it difficult for individuals to obtain groceries, attend school or reach workplaces. These disruptions disproportionately affect people with disabilities, older adults and caregivers with dependents.

Health and Well-being

Winter storms pose distinct health risks that go beyond cold temperatures alone. While cold-related injuries such as hypothermia and frostbite are a concern, particularly for unhoused individuals, winter storms also introduce compounding threats like high winds, ice accumulation and heavy snowfall that can disrupt mobility, damage infrastructure and delay emergency response. These disruptions are especially dangerous for people who are medically dependent, such as those requiring dialysis, oxygen or refrigerated medications.

Infrastructure Resilience

Winter storms continue to pose a serious risk to Toronto's electricity grid infrastructure. Equipment failures and tree damage, especially from falling branches laden with ice, can cause widespread power outages, disrupting heating systems and other critical services. Water infrastructure is also vulnerable, with freeze-thaw cycles and prolonged cold snaps increasing the risk of burst municipal pipes, leading to household water supply interruptions.

Natural Systems and Urban Environment

The urban tree canopy, already stressed by pests and drought, faces further degradation due to ice accumulation during winter storms. Broken limbs and uprooted trees reduce canopy cover and contribute to additional infrastructure damage and service interruptions. The loss of canopy has long-term consequences for urban biodiversity, shade provision and stormwater management.

Shelter and Social Services

Social services and shelters are strained during winter storms, as demand spikes and capacity limits are reached. Overcrowding in shelters can reduce the quality and consistency of support for unhoused populations. Staff shortages and transportation challenges further hinder service delivery, leaving vulnerable individuals at higher risk of exposure to dangerous conditions.

Table 46. Priority risks related to winter/ice storms.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Loss of access to essential services for vulnerable populations (e.g. people with physical and/or neurological disabilities may not receive care if their support worker cannot safely travel; people with limited mobility may have difficulty getting groceries, bringing their children to school and/or attending school or work themselves)	Residents and Non-residents	High	High
Damage to urban tree canopy	Natural Environment	High	High
Physical harm for people who are medically dependent and unable to access treatment	Residents and Non-residents	High	High
Damage to grid infrastructure from failing equipment and falling trees, leading to power outages	Electricity Supply and Distribution	High	High
Disruption of service delivery in shelters for unhoused population due to overcrowding	Community and Social Services	Medium-high	Medium-high
Hypothermia, frostbite and other cold-related injuries for unhoused population	Residents and Non-residents	Medium-high	Medium-high
Interruption of household water supply resulting from burst municipal pipes	Residents and Non-residents	Medium-high	Medium-high

6.3.4 High Winds/Tornadoes

High winds and tornadoes present a persistent and widespread risk to public safety, infrastructure and urban ecosystems in Toronto. Eight impact statements associated with this hazard received risk scores above 30 in the current period, including risks of physical injury, displacement and infrastructure failure. These impacts are especially severe for unhoused populations, residents in structurally vulnerable buildings and those dependent on uninterrupted services such as electricity or emergency shelter. While the frequency of high- wind events is not projected to increase significantly over time, their ability to cause rapid, large-scale disruption ensures they remain a priority concern for resilience planning.

Risk Themes

The following risk themes highlight the key ways in which high wind and tornado events affect vulnerable populations, essential services, infrastructure systems, and natural environments in Toronto. Impact statements with a current risk score above 30 are summarized in Table 47 following this thematic overview, providing a prioritized lens on the city's most pressing wind-related risks.

Health and Physical Safety

High winds and tornadoes pose direct threats to physical safety, with the potential to cause injury or death due to flying debris, falling trees and structural damage. These risks are especially acute for individuals without access to secure shelter, such as unhoused populations, or those in deteriorating buildings. Even short-duration wind events can have life-threatening consequences when debris is carried at high speed or infrastructure fails.

Displacement and Shelter Instability

Unhoused individuals are particularly vulnerable during high-wind events. Inadequate shelter, lack of access to secure indoor spaces and limited communication channels make it difficult to respond to warnings or take protective action. High winds can destroy tents, temporary structures, or encampments, displacing residents and creating cascading needs for emergency services, shelter space and health care.

Infrastructure Resilience and Service Continuity

Electricity distribution systems are vulnerable to damage from strong winds, especially when trees or branches fall on power lines. These outages can disrupt heating, cooling and communications, amplifying risks for medically dependent populations and straining emergency response. As with ice storms, damaged infrastructure often requires complex and time-consuming repairs, extending the duration of service interruptions.

Natural Systems and Urban Environment

Urban and natural tree canopies face widespread damage during high-wind events. Mature trees — already stressed by disease, pests, or extreme weather — can be uprooted or lose large limbs. This not only poses physical hazards but also contributes to biodiversity loss and long-term environmental degradation. In forested areas, high winds can damage old-growth stands and cause significant habitat disruption for sensitive species.

Shelter and Social Services

During high-wind events, social service providers may experience surges in demand, especially as unhoused residents seek emergency shelter. Overcrowding in facilities can limit the ability to deliver safe, effective support. Staffing shortages and transportation delays can further strain service continuity, especially in lower-resourced neighbourhoods or during concurrent emergencies (e.g. wind and rain).

Table 47. Priority risks related to high winds/tornadoes.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Damage to urban tree canopy	Natural Environment	High	High
Displacement of unhoused population	Residents and Non-residents	High	High
Injury or death due to flying debris	Residents and Non-residents	High	High
Infrastructure damage from high winds, leading to power outages	Electricity Supply and Distribution	High	High
Disruption of service delivery in shelters for unhoused population due to overcrowding	Community and Social Services	Medium-high	Medium-high
Loss of old growth trees or mature forest habitats	Biodiversity	Medium-high	Medium-high
Damage to trees and impact on biodiversity	Biodiversity	Medium-high	Medium-high

6.3.5 Very Cold Days and Extreme Cold

Very cold days and extreme cold events continue to pose significant health and infrastructure risks in Toronto, particularly for medically vulnerable and unhoused populations. In the current period, six impact statements related to this hazard received risk scores above 30, reflecting the seriousness of cold-related impacts such as hypothermia, service disruption and heating cost burdens. However, these risks are projected to decline in the coming decades as winter temperatures rise and the frequency of extreme cold events decreases. Under a moderate emissions scenario (SSP2-4.5), four of the five risks fall below the priority threshold in the future period. Despite this overall reduction, occasional extreme cold events are still expected and can lead to severe localized impacts, especially where infrastructure and social services remain vulnerable.

Risk Themes

The following risk themes highlight how extreme cold continues to affect health, housing, infrastructure and affordability for Toronto residents. Impact statements with current risk scores above 30 are summarized in Table 48 after this thematic overview, offering a prioritized view of the cold-related risks that remain of concern today.

Health and Physical Safety

Extreme cold continues to pose serious health risks, particularly for medically vulnerable individuals who rely on timely access to care. Disruptions caused by snow, ice or transportation delays can prevent these individuals from receiving critical treatments, such as dialysis, respiratory support or medication refills. At the same time, unhoused populations face direct threats from prolonged cold exposure, with risks of hypothermia, frostbite and even death during extreme cold events.

Shelter and Social Services

During extreme cold events, shelter systems often face surging demand, leading to overcrowding and reduced service capacity. This can hinder the ability to meet basic needs for warmth, hygiene and safety, especially for unhoused individuals. Overstretched service providers may be unable to accommodate everyone, leaving some individuals without access to adequate protection from the cold.

Infrastructure Resilience

Cold temperatures increase the risk of burst municipal pipes and household water supply interruptions, particularly in older infrastructure systems. Freeze-thaw cycles can cause water mains to crack or rupture, leading to service disruptions and costly repairs. These interruptions disproportionately impact households without backup water access or adequate insulation.

Financial Pressure and Food Insecurity

Extreme cold drives up energy demand and household heating costs, placing financial strain on low-income residents. For many vulnerable populations, this strain forces difficult trade-offs between paying for heat and meeting other essential needs, particularly food. As a result, food bank demand often increases during cold spells, reflecting broader pressures on household resilience.

Climate Change Impact on Risk

As the climate warms, the frequency and severity of very cold days and extreme cold events are projected to decline. As a result, five out of six current priority risks associated with this hazard drop below the priority threshold (risk score of 30) under the SSP2-4.5 climate scenario. This reflects a general reduction in cold-related risk due to warming winter temperatures. However, even with declining frequency, cold extremes can still pose serious localized risks, particularly for unhoused populations, medically dependent individuals and aging infrastructure that remains vulnerable to occasional events.

Table 48. Priority risks related to very cold days and extreme cold.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Physical harm for people who are medically dependent and unable to access treatment	Residents andon-residents	High	Medium-high
Disruption of service delivery in shelters for unhoused population due to overcrowding	Community and Social Services	Medium-high	Medium-low
Hypothermia and frostbite for unhoused population	Residents and Non-residents	Medium-high	Medium-low
Interruption of household water supply resulting from burst municipal pipes	Residents and Non-residents	Medium-high	Medium-low
Increased energy costs on affordable and social housing tenants	Community and Social Services	Medium-high	Medium-low
Demand for food banks often increases during extreme cold events as vulnerable populations face higher expenses (e.g. heating costs), leaving less income for food	Food Supply Systems	Medium-high	Medium-low

6.3.6 Ecosystem Changes

Ecosystem changes driven by climate change are emerging as a growing concern for environmental health and public well-being in Toronto. Three impact statements associated with this hazard received risk scores above 30 in the current period, with all three projected to escalate further in the coming decades. These priority impact statements with current risk are summarized in Table 49. Risks related to tree loss, invasive species, vector-borne disease and allergens are expected to become more severe as climate conditions continue to shift. Warmer temperatures, longer growing seasons and increased pest survival are already straining urban ecosystems, with consequences for biodiversity, air quality and human health, particularly among vulnerable populations with limited access to climate-controlled indoor spaces.

Risk Themes

Environmental Strain

Climate change is intensifying environmental pressures on urban ecosystems. Ecosystem changes threaten biodiversity and the natural environment and can lead to a loss of trees and other vegetation from insects and disease. Biodiversity can also be impacted from invasive species that threaten native species as climate zones shift. Warmer winters allow more insects and pathogens to survive year-round, weakening trees and increasing mortality rates. Combined with drought stress from hotter, drier summers, this threatens the long-term health and function of Toronto's tree canopy.

Climate Change Impact on Risk

Under an SSP2-4.5 scenario, Toronto is projected to experience a range of ecosystem changes. In particular, trees and other vegetation could be lost due to an increase in insects, disease and invasive species. With warmer temperatures, invasive species can have a wider geographical range and become a threat to native species and biodiversity.

Table 49. Priority risks related to ecosystem changes.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Invasive species threaten native species and biodiversity	Biodiversity	High	Very High
Loss of natural areas from insects or disease	Green Infrastructure System	Medium-high	High
Loss of natural areas from insects or disease	Natural Environment	Medium-high	High

Escalating Risks

Invasive species expansion is accelerating as warmer winters and longer growing seasons enable non-native plants, insects and animals to survive and spread. These species outcompete native flora and fauna, disrupting local ecosystems and leading to biodiversity loss, degraded habitat quality and increased maintenance costs for parks and water infrastructure.

In parallel, the loss of trees and other vegetation due to pests, disease, drought and extreme storms is reducing Toronto's natural cooling capacity, intensifying the urban heat island effect, especially in low-canopy neighbourhoods. This exacerbates heat exposure and vulnerability for already at-risk populations, including seniors and unhoused residents.

Table 50. Escalating risks related to ecosystem changes.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Damage and disruption from invasive species	Parks and Protected Areas	Medium-low	Medium-high

6.3.7 Climate-related Air Quality Hazards

Climate-related air quality hazards are already contributing to elevated health risks in Toronto. Three impact statements score 30 or higher in the current time period, underscoring the immediate threat posed to the unhoused population and individuals with chronic health conditions. These include increased respiratory illnesses, overcrowding-related service disruptions in shelters and adverse health effects from poor air quality. As climate change accelerates, these risks are expected to intensify, reinforcing the need for targeted public health and social service interventions.

Risk Themes

Health and Well-being

Climate-related air quality hazards can have many impacts on the health and well-being of the city's residents. The unhoused population in particular will experience adverse effects as air quality declines with climate change. Respiratory illness is likely to increase, as well as adverse health consequences for people living with chronic conditions like chronic obstructive pulmonary disease (COPD) and asthma.

Climate Change Impact on Risk

The future risk of climate-related air quality hazards increases under an SSP2-4.5 scenario. For example, rising temperatures will lead to more frequent and intense heat waves, which can increase ground-level ozone, a major air pollutant. Additionally, warmer and drier conditions are likely to contribute to more wildfires across Canada, with smoke travelling long distances and affecting Toronto's air. These factors, combined with stagnant weather patterns that trap pollutants, could significantly raise the risk of respiratory and cardiovascular problems for residents. As a result, climate-related air quality issues will pose a growing public health concern for the city.

Table 51. Priority risks related to climate-related air quality hazards.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Increase in respiratory illnesses for unhoused population	Residents and Non-residents	High	Very High
Disruption of service delivery in shelters for unhoused population due to overcrowding	Community and Social Services	Medium-high	High
Adverse health consequences from poor air quality for vulnerable populations (e.g. people who are pregnant, infants and children; older adults; people with chronic health conditions, such as COPD or asthma)	Residents and Non-residents	Medium-high	High

Escalating Risks

Health and Well-being

Climate change is expected to contribute to increased pressures on paramedic services due to more frequent and severe air quality events. While current risk levels are low, both the demand on paramedic services and the risk of hospital service disruptions are projected to rise significantly by 2041–2070. Poor air quality can lead to a surge in respiratory and cardiovascular emergencies, potentially impacting paramedic services capacity, while temporary or prolonged hospital service disruptions further reduce access to care, delay treatment and increase health risks for vulnerable populations.

Table 52. Escalating risks related to climate-related air quality hazards.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Hospital service disruption due to air quality	Commercial and Industrial Buildings	Medium-low	Medium-high
Potential increased demand for paramedic services	Public Health and Safety	Medium-low	Medium-high

6.3.8 Drought

Drought presents a growing risk to Toronto's natural systems and urban environment. One impact currently scores 30 or higher, highlighting the threat to the city's tree canopy from prolonged periods of low precipitation.

Risk Themes

Natural Systems and Urban Environment

Drought poses a direct threat to Toronto's urban and natural tree canopy. Prolonged periods of low precipitation weaken trees and other vegetation and increase mortality, especially for species already stressed by pests, disease or extreme heat. The resulting loss of trees reduces shade, cooling and stormwater absorption capacity, diminishing the ecosystem's ability to moderate urban temperatures and support biodiversity. These impacts are particularly concerning in low-canopy neighbourhoods, where the tree cover is already limited.

Table 53. Priority risks related to drought.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Loss of natural areas from drought	Natural Environment	High	High

6.3.9 Freeze-thaw Cycles

Risk Themes

Health and Well-being

Freeze-thaw cycles, where temperatures fluctuate between freezing and thawing, can have a notable impact on the health and well-being of city residents. As snow and ice melt during the day and refreeze at night, sidewalks and roads often become dangerously slippery, increasing the risk of falls, fractures and vehicle accidents. These hazards disproportionately affect older adults and people with mobility challenges, often leading to emergency room visits and longer recovery times.

Climate Change Impact on Risk

As the climate warms, the frequency and severity of freeze-thaw cycles are projected to decline. As a result, the priority risk associated with this hazard drops below the priority threshold (risk score of 30) under the SSP2-4.5 climate scenario. This reflects a general reduction in cold-related risk due to warming winter temperatures. However, even with declining frequency, cold extremes can still pose serious localized risks.

Table 54. Priority risks related to freeze-thaw cycles.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Trips and falls, particularly for elderly residents and individuals with mobility challenges	Residents and Non-residents	Medium-high	Medium-low

6.3.10 Increases in Temperature

No impact statements related to drought currently score 30 or above, indicating relatively lower present-day risk. However, one impact — loss of trees and natural areas from drought — is projected to cross the high-risk threshold in the 2040-2070 period under the SSP2-4.5 scenario.

Escalating Risks

Environmental Strain

Increases in air temperature can lead to a loss of trees and other vegetation and impact the biodiversity of Toronto's ecosystems. Warmer temperatures can shift the natural range of many plant and animal species, leading to changes in local ecosystems. Trees and other

vegetation in Toronto, especially species not adapted to heat stress, may experience increased drought, pests, and disease outbreaks. For example, higher temperatures can support larger populations of tree-damaging insects like the emerald ash borer or spongy moth, which weaken or kill stressed trees. Additionally, prolonged heat and reduced soil moisture can lower tree growth rates, reduce canopy cover and increase tree mortality, ultimately diminishing the cooling, air-cleaning and habitat-providing benefits that urban forests offer. These changes can undermine ecosystem services and reduce the resilience of the city's green spaces to further climate impacts.

Table 55. Priority risks related to increases in temperature.

Impact Statement	Sector Sub-class	Current Risk	Future Risk
Loss of natural areas from increasing temperatures	Biodiversity	Medium-low	Medium-high

Cascading Impacts

Climate hazards do not affect systems in isolation. The impact statements presented so far depict individual siloed risks but neglect the relationships between hazards, impacts and systems. Additional analysis around the interrelated ways in which these impacts unfold and their cascading impacts was undertaken to explain these dynamics.

Cascading impacts are defined as the dynamics present in disasters, in which the impact of a physical event or the development of an initial technological or human failure generates a sequence of events in human subsystems that result in physical, social or economic disruption.[164]

Analytical Approach

Following the methodology from *A Guide to Implementing Systems-Based Approaches to Climate Resilient Infrastructure*,[165] we applied a systems-dynamics mapping framework that:

1. **Identifies nodes** for climate hazards, vulnerability drivers and impact statements drawn from the risk register.=;

2. **Maps interconnections** to reveal three node types: influential (many outward links), vulnerable (many inward links) and central (both directions);

3. **Quantifies influence/feedback** to estimate how much an initial hazard amplifies downstream impacts; and

4. **Re-scores each risk** when cascading effects elevate its impact beyond the initial estimate, raising consequence for influential nodes, vulnerability for vulnerable nodes and both consequence and vulnerability for central nodes.

This approach recognizes interdependencies in energy, transport, health, communications and ecosystems, allowing us to flag hidden choke-points and avoid siloed solutions. Systems maps were developed for three major risk themes: health and well-being, affordability and mobility and communications.

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[164] Pescaroli, Gianluca, and David Alexander. "A Definition of Cascading Disasters and Cascading Effects: Going Beyond the 'Toppling Dominos' Metaphor." *Planet@Risk* 3, no. 1 (2015): 58-67.

[165] British Columbia Ministry of Transportation and Infrastructure. Guide to Implementing Systems-Based Approaches to Climate Resilient Infrastructure. Victoria, BC: Government of British Columbia, 2021. https://www2.gov.bc.ca/assets/gov/driving-and-transportation/environment/climate-action/guide_to_implementing_systems-based_approaches_to_climate_resilient_infrastructure.pdf

Additional insight on cascading impacts came from DAC participants in a March 2025 workshop, where they mapped both upstream triggers and downstream consequences for the top-priority hazards. Their findings reinforce the systems-mapping results, converging on the following seven variables that are either highly vulnerable to upstream shocks or act as powerful drivers of downstream effects:

- Power outages during heat events
- Transportation disruption from extreme precipitation
- Heat-related illness
- Telecom outages
- Social isolation
- Increased energy costs
- Loss of green space and urban tree canopy

Table 56 presents the impact statements with increased risk scores according to this analysis.

Table 56. Impact statements adjusted by cascading impacts analysis.

Hazard	Impact Statement	Key Upstream Variables	Key Downstream Variables
Multiple hazards	Power outages	Damage to electrical grid infrastructure, electricity demand, electrical grid efficiency	Heat-related illness, disrupted hospital function, telecommunication failures, cool area accessibility, access and ability to use cooling equipment, indoor temperatures, transit and traffic system disruption, vehicle fuel service disruption, data centre failure
Extreme Heat and Very Hot Days	Heat-related illnesses for vulnerable populations (e.g. infants and children, older adults, people with low income, people with limited access to cooling, pregnant people and people with chronic conditions or prescriptions that make them more sensitive to heat)	Indoor temperatures, outdoor temperatures, transit vehicle temperatures, cool area accessibility, reduced shelter capacity, mobility and access to essential services, telecommunication failures, power failures	Demand for paramedic services and hospital visits, fire and police services demand, heat-related death

Hazard	Impact Statement	Key Upstream Variables	Key Downstream Variables
Extreme Heat and Very Hot Days	Extended telecom outage, leading to service disruption	Power failures	Heat-related illnesses, disrupted mobility and access to essential services
Extreme Heat and Very Hot Days	Heat-related illnesses for municipal workers	Indoor temperatures, outdoor temperatures, transit vehicle temperatures, cool area accessibility, reduced shelter capacity, mobility and access to essential services, telecommunication failures, power failures	Demand for paramedic services and hospital visits, fire and police services demand, heat-related death
Extreme Heat and Very Hot Days, Very Cold Days and Extreme Cold	Increased energy costs on affordable and social housing tenants	Cooling demand, heating demand	Total housing cost, decrease in food affordability and availability
Extreme Heat and Very Hot Days	Increased indoor temperatures	Building condition, access and ability to use cooling equipment, power failures, outdoor temperatures	Electricity demand, cool area demand, heat-related illness
Extreme Precipitation	Disruption to TTC service from extreme precipitation	Flooded roads, flooded subway stations, power outage	Reduced mobility, reduced access to essential services, social isolation, loss of income, loss of productivity, impact to emergency services response
Extreme Precipitation	Financial stress from increased insurance cost/loss of coverage	Flooded buildings	Total housing cost
High Winds/ Tornadoes	Infrastructure damage from high winds, leading to power outages		Increased indoor temperatures, telecommunication failures

Hazard	Impact Statement	Key Upstream Variables	Key Downstream Variables
Drought, High Winds/Tornadoes, Very Cold Days and Extreme Cold, Winter/Ice Storms (Snow, Ice, Freezing Rain)	Loss of urban tree canopy		Urban heat island effect, outdoor temperature
Very Cold Days and Extreme Cold, Winter/Ice Storms (Snow, Ice, Freezing Rain)	Social isolation for vulnerable populations	Reduced mobility, compromised communication networks	Mental health impacts, reduced access to essential services

The cascading-impacts analysis highlights how climate hazards intersect with Toronto's ongoing challenges, such as housing costs, infrastructure pressures and mobility gaps, rather than occurring in isolation. For example, extreme heat can raise electricity demand, increasing the likelihood of power outages that, in turn, affect health services and transit operations. Similarly, flood-related disruptions can ripple through supply chains, reduce access to essential services and heighten social isolation.

Understanding these chains of cause and effect offers a fuller picture of risk and points to measures that can address multiple issues at once, whether by improving grid reliability, expanding green spaces for cooling and flood management or adapting transport assets to withstand heavy precipitation. Integrating such insights into existing policies can make responses more coherent and durable without adding entirely new layers of work.

These top-ranked risks guide the selection of adaptation measures described in Section 7.

7. Adaptation Actions

This section translates the CCRVAs priority risks into a practical set of adaptation options, organized by hazard. Each hazard subsection summarizes the risks, presents current and potential measures in a table and provides brief action descriptions, and a concluding subsection identifies cross-cutting, system-level actions. Candidate actions draw on project learnings, expert judgment, scans of other jurisdictions, existing city initiatives and input from the June 2025 workshop, and have not yet been assessed by the City for feasibility or cost, serving to guide subsequent evaluation and prioritization.

Extreme Heat

Extreme heat is one of Toronto's top climate priority hazards, alongside extreme precipitation. It is associated with a high number of priority impact statements (19 in total), including several of the highest-ranked risks in both the current and future periods. Over the coming decades, extreme heat is also projected to drive one of the most significant increases in very high-risk impacts across all hazards assessed.

Risk Themes

Health and Well-being

Health impacts from extreme heat are among the most pressing risks identified in the assessment. Unhoused individuals and other vulnerable populations, including infants, older adults, pregnant people and those with chronic conditions, face significant risk of heat-related illness during very hot days. Prolonged exposure to extreme heat can also worsen mental health, particularly for individuals with limited access to cooling or social support. These risks are amplified for residents who already face barriers to healthcare or safe indoor environments. Heat-related disruptions to key services pose additional risks to vulnerable groups. Demand for shelters and social services may rise during extreme events, leaving many vulnerable individuals unable to access the support they need. At the same time, services that are accessed can become overcrowded or strained, particularly during heatwaves, reducing their ability to provide adequate or consistent support to the unhoused population. Within the healthcare system, pregnancy-related complications may also increase for those with limited access to cooling and prenatal care.

Table 57. Actions list for health and well-being risks related to extreme heat and very hot days.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Thermal Comfort Guideline Heat Relief Strategy — Heat Relief Network Heat Relief Strategy — Public messaging Heat Relief Strategy — Annual review and debrief Tree canopy target of 40 per cent by 2050 Tree equity tool Heat Relief Strategy — Extended pool and civic centre hours City of Toronto Green Roof Bylaw Green Streets Parks and open spaces Toronto's Emergency Response Plan, including the Extreme Heat Emergency Annex. Toronto's Corporate Business Continuity Management and Disaster Recovery programs	Improve heat-related public education, outreach and engagement strategies to reach vulnerable populations Evaluate the City's coordinated heat planning to ensure it addresses immediate needs and long-term measures across multiple planning timeframes Continue to evolve the Heat Relief Network, focusing on neighbourhoods and populations at greater risk Enhance development and oversight of heat management and adaptation solutions

Impact Statement	Current Risk	Existing Action	Potential Action
Heat-related illnesses for unhoused population	Very High	Heat Relief Strategy — street outreach Heat Relief Strategy — Contingency spaces Toronto Shelter and Respite Standards — Extreme weather measures and surge capacity Toronto Encampment Strategy and Streets to Homes outreach and support	Explore development and implementation of consistent/minimum standards for primary care and mental health services in shelters
Heat-related illnesses for vulnerable populations (e.g. infants and children, older adults, people with low income, people with limited access to cooling, pregnant people and people with chronic conditions or prescriptions that make them more sensitive to heat)	Very High	Heat Relief Strategy — Cool spaces in apartment buildings Pilot Air Conditioner Assistance Program TPH support for preparedness planning	Establish maximum indoor temperature policy for all leased residential dwellings[166] Leverage existing spaces and programs for targeted cool spaces in addition to the public Heat Relief Network
Mental health impacts for vulnerable populations (e.g. people with less access to cooling and older adults who experience cognitive decline with increased heat)	High	Heat Relief Strategy — Cool spaces in apartment buildings Pilot Air Conditioner Assistance Program Toronto Community Crisis Service	Establish maximum indoor temperature policy for all leased residential dwellings

[166] Work on a maximum temperature policy is currently under development. Report-back on this is planned for Q4 2025. https://secure.toronto.ca/council/agenda-item.do?item=2024.PH17.5

Impact Statement	Current Risk	Existing Action	Potential Action
Increased indoor temperatures for residential buildings	High	Heat Relief Strategy — Cool spaces in apartment buildings Taking action on tower renewal program Home Energy Loan Program Ontario Electricity Support Program (OESP) Low-Income Energy Assistance Program (LEAP) High-Rise Retrofit Improvement Support (Hi-RIS) Toronto Community Housing deep-retrofit pilots Electric Heating Relief Program (TCHC and Toronto Hydro) Toronto Hydro Heat Pump Assistance Program IESO CoolSaver Program Expanded date range for operating air conditioning, when provided by property owner Toronto Green Standard	Establish maximum indoor temperature policy for all leased residential dwellings Coordinate and communicate an energy-savings and retrofit building envelope improvement program Expand air conditioner distribution program focused on additional heat-vulnerable populations

Impact Statement	Current Risk	Existing Action	Potential Action
Increased indoor temperatures for municipal, commercial and industrial buildings	Medium-high	Toronto Green Standard Net Zero Building Retrofit Guides	Municipal building portfolio — overheating, screening and prioritization Advocate for updated provincial workplace heat-safety standards
Disruption of service delivery in shelters for unhoused population due to overcrowding	Medium-high	Heat Relief Strategy — Street outreach Homelessness Services Capital Infrastructure Strategy Toronto Shelter and Respite Standards	Evaluate the need for additional shelter capacity during extreme weather events

Current Actions

Heat Relief Strategy — Cool Spaces in Apartment Buildings[167]

This refers to measures coordinated by the City to ensure cool spaces are readily available in apartment buildings and other multi-unit residences during the hot weather season. Such measures include ensuring landlords understand their obligations to residents and post the necessary heat-related information on their community notification boards, educating tenants on their options to keep cool, providing information to individual residents and sharing beat-the-heat tips through various channels.

Heat Relief Strategy — Public Messaging

Heat relief public messaging includes management and posting of beat-the-heat tips on the City's webpage. During heat warnings, information is shared via City communications channels to ensure the public and media are aware of the heat warning status and the availability of cool spaces through the Heat Relief Network. Strategic public and employee communications will coordinate with various DACs, including Toronto Public Health, to ensure messaging is accurate and relevant spokespeople are available.

[167] City of Toronto, *Heat Relief Strategy* (Toronto: City of Toronto, April 2022), accessed June 12, 2025, https://www.toronto.ca/wp-content/uploads/2022/05/8f66-Heat-Relief-Strategy-2022.pdf.

TPH Support for Preparedness Planning

Certain TPH programs collaborate with clients and families to help them develop a plan to protect themselves during heat warnings, and they maintain lists of the highest-risk families receiving services in order to contact and check in on them during heat warnings and alerts. These programs also promote Beat the Heat and Cool Spaces Near You – City of Toronto services with all clients and families.

Heat Relief Strategy — Heat Relief Network

The Heat Relief Network is a collection of over 500+ publicly accessible facilities across the city that may provide air conditioning, respite from heat and other forms of cooling. The Heat Relief Network is active throughout the summer, even during days in which a heat warning is not issued by ECCC. Cool spaces under the Heat Relief Network include public libraries, civic centres, community centres, public swimming pools, public splash and play pads and wading pools drop-Ins, malls and YMCA centres.

TPH is using heat vulnerability mapping to inform strategic expansion of the Heat Relief Network and community outreach to the areas with highest heat vulnerability.

In addition to the Heat Relief Network sites, shelters and 24-hour respite centres provide cool spaces for individuals experiencing homelessness.

Heat Relief Strategy — Extended Pool Hours and Civic Centre Hours

During active heat warnings, Parks, Forestry and Recreation will provide additional cooling opportunities for the public by extending pool hours until 11:45 p.m. at seven outdoor pool locations. Civic centres also extend their hours to later in the evening.

Heat Relief Strategy — Street Outreach

Toronto Shelter and Support Services (TSSS) provides heat relief support for people experiencing homelessness by:

- Ensuring that heat relief opportunities are available at shelters, drop-ins and 24-hour respite sites;
- Operating the Streets to Homes street outreach program;
- Collaborating with the Downtown Community Outreach Response and Engagement (CORE) Program to encourage hydration, distribute water bottles, assist with and encourage visits to cool spaces, prioritize referrals to emergency shelters and provide naloxone kits for clients in the Sankofa Square (Yonge-Dundas) area; and
- Working with Toronto Water to place water trailers at key locations during heat warnings.

Heat Relief Strategy — Contingency Spaces

During ECCC heat warnings, additional contingency shelter spaces are opened to increase access to cooled spaces within the city's shelter system.

Toronto Encampment Strategy - Streets to Homes Outreach and Support

This strategy is intended to provide services and support to people experiencing outdoor homelessness, including those in encampments, with a focus on well-being and health and safety. Enhanced outreach efforts include increased wellness checks; health, mental health and social support visits; and waste removal in encampment areas. Streets to Homes will also help people locate the nearest cool space, as well as provide housing-related support.

Shelter and Respite Standards — Extreme Weather Measures

The Toronto Shelter Standards and the 24-Hour Respite Site Standards direct that every shelter, respite or 24-hour drop-in should ensure at least one air-conditioned cooling area is available to clients (specific to a heat-based alert), suspend service restrictions, relax admission rules, provide or extend daytime access to sites, help clients obtain appropriate basic clothing and footwear and legally exceed funded bed capacity during any weather alert that endangers clients (including high-wind events).

Homelessness Services Capital Infrastructure Strategy[168]

The City of Toronto is planning to build 20 new and purpose-built shelters to support those experiencing homelessness and to augment the support offered by the shelter system. These new shelters should help to offset some of the increasing need for emergency shelter services.

City of Toronto Green Roof Bylaw[169]

In 2009, Toronto was the first city in North America to adopt a bylaw to require and govern the construction of green roofs. The Green Roof Bylaw sets out a graduated green roof requirement for new development or additions that are greater than 2,000 m² in gross floor area. The requirement ranges from 20 per cent to 60 per cent of the available roof space of a building.

Green Roofs are required on:

- New commercial, institutional and residential development with a minimum gross floor area of 2,000 m²;

[168] City of Toronto, "Homelessness Services Capital Infrastructure Strategy," accessed July 3, 2025, https://www.toronto.ca/legdocs/mmis/2023/ec/bgrd/backgroundfile-239913.pdf/.

[169] City of Toronto, "Green Roof Bylaw," *Official Plan Guidelines – Green Roofs*, City Government – Planning & Development, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/green-roofs/green-roof-bylaw/.

- New additions to commercial, institutional and residential development where the new gross floor area added is greater than 2,000 m²; and
- Industrial buildings greater than 2,000 m² gross floor area.

Green Streets[170]

Green Streets help reduce extreme heat by incorporating plants, trees and other green infrastructure elements to create a cooling effect through shade and evapotranspiration, which offsets the urban heat island while also managing stormwater runoff to mitigate flooding. Transportation Services manages the Green Streets Program that involves the planning, design, construction, maintenance and monitoring of green infrastructure in the public right-of-way. The program is an interdivisional effort with Transportation Services being the asset lead for this infrastructure. Traditional streets were designed to quickly direct stormwater into storm sewer systems (such as gutters, drains or pipes), which then discharge directly into waterways, often carrying contaminants like dirt, oil and grease. In contrast, Green Streets use green infrastructure like bioswales, permeable pavements and street trees to capture, absorb and filter stormwater. This reduces the amount of runoff that enters storm sewer systems or ponds and reduces road ponding and flooding.

Parks and Open Spaces

This includes providing shaded areas, tree canopy and water features in parks and open spaces to offer accessible, no-cost cooling and heat relief for residents during extreme heat events.

Taking Action on Tower Renewal Program[171]

The Taking Action on Tower Renewal Program (TATR) provides a combination of loans and grants to eligible property owners to complete retrofits that increase energy efficiency and reduce greenhouse gas emissions while improving tenant comfort. Such retrofits may enable introduction of equipment such as heat pumps that offer cooling where there was previously none.

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[170] City of Toronto, "Green Streets," *Enhancing Our Streets & Public Realm – Streets, Parking & Transportation*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/services-payments/streets-parking-transportation/enhancing-our-streets-and-public-realm/green-streets/.

[171] City of Toronto, "Taking Action on Tower Renewal Program," *Apartment Building Operators – Tower Renewal*, Community & People, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/community-partners/apartment-building-operators/tower-renewal/taking-action-on-tower-renewal-tatr-program/.

Thermal Comfort Guidelines[172]

City Planning leads implementation of the guidelines for large area studies, public realm capital projects and large site developments, applying them through development review and area studies, while Transportation Services and Parks, Forestry and Recreation use them to inform capital design. The guidelines set design direction and assessment methods that integrate wind, sunlight and other microclimate parameters and were developed with a cross-divisional core team.

Pilot Air Conditioner Assistance Program[173]

In the summer of 2025, the City piloted a program to provide 500 free portable air conditioners to low-income seniors living in multi-unit residential buildings (three or more storeys) with health-related cooling needs.

Toronto Community Crisis Service

The Toronto Community Crisis Service (TCCS) provides free, confidential in-person mental health support city-wide from mobile crisis worker teams. There is a need for mental health support and connecting people to services when there is increased demand during climate emergencies.

Tree Canopy Target of 40 Per Cent by 2050[174]

Council has endorsed a 40 per cent city-wide canopy goal by 2050.

Tree Equity Tool[175]

Toronto's Tree Equity Score Analyzer (TESA) is a free, publicly accessible online tool developed collaboratively by the City of Toronto, American Forests, LEAF, etc., which combines land cover, demographic and socio-economic data to assess and enable strategic planning for neighbourhood-level tree canopy equity in support of the city's 40 per cent canopy goal.

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[172] City of Toronto, "Thermal Comfort Study," *Planning Studies & Initiatives – Thermal Comfort Study*, City Government – Planning & Development, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/city-government/planning-development/planning-studies-initiatives/thermal-comfort-study

[173] City of Toronto, "Air Conditioner Assistance Program for Low-Income Seniors," *Financial & Employment Support – Support for People in Financial Need*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/employment-social-support/support-for-people-in-financial-need/air-conditioning-assistance-for-low-income-seniors/.

[174] City of Toronto, *Growing Space for Trees: Protecting and Enhancing the Tree Canopy While Supporting Infill Housing* (background report to Planning & Housing Committee, November 15, 2023), accessed June 12, 2025, https://www.toronto.ca/legdocs/mmis/2023/ph/bgrd/backgroundfile-240809.pdf.

[175] City of Toronto, "Tree Equity," 311 Toronto — Find Service Information, accessed August 11, 2025, https://www.toronto.ca/home/311-toronto-at-your-service/find-service-information/article/?kb=kA06g000001UnORCA0.

Ontario Electricity Support Program [176]

The OESP is an Ontario Energy Board (OEB) program that lowers electricity bills for lower-income households, helping them afford cooling during extreme heat and thereby reducing health risks from increased indoor temperatures. The OESP provides a monthly credit to eligible customers based on household income and household size. This credit is applied directly to their electricity bills.

Low-Income Energy Assistance Program[177]

Emergency grants to avoid disconnection during peak season due to arrears.

High-Rise Retrofit Improvement Support [178]

The High-Rise Retrofit Improvement Support Program makes low-cost financing available for owners of residential apartment buildings of three or more storeys built before 1990 to make improvements that reduce energy and water consumption. Such improvements may include installing equipment such as a heat pump that can provide cooling where it did not previously exist.

Toronto Community Housing Deep-Retrofit Pilots[179]

To date, TCHC has completed more than a dozen deep building retrofits. Where possible, TCHC will continue to invest in deep building retrofit projects that address many elements of its capital targets, including increasing energy savings, improving building conditions and making housing more accessible.

Electric Heating Relief Program (TCHC and Toronto Hydro)[180]

About 1,500 Toronto Community Housing tenants who pay rent-geared-to-income (RGI) also pay for electric heating. Under commitments in the 2015 *Getting it Done* report, Toronto Community Housing has partnered with Toronto Hydro to support rent-geared-to-income tenants who are responsible for part of their electric heating costs.

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[176] Ontario Energy Board, "Ontario Electricity Support Program," *Bill Assistance Programs* (Ontario Energy Board), accessed June 12, 2025, https://ontarioelectricitysupport.ca/.

[177] Ontario Energy Board, "Low-income Energy Assistance Program," *Bill Assistance Programs*, accessed June 12, 2025, Ontario Energy Board, https://www.oeb.ca/consumer-information-and-protection/bill-assistance-programs/low-income-energy-assistance-program.

[178] City of Toronto, "High-Rise Retrofit Improvement Support Program (Hi-RIS)," Apartment Building Operators – Tower Renewal, Community & People, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/community-partners/apartment-building-operators/tower-renewal/hi-ris/.

[179] Toronto Community Housing Corporation, "Retrofit TCHC Building Will Yield Climate, Affordability, and Community Benefits," *News & Updates*, accessed June 12, 2025, Toronto Community Housing Corporation, https://torontohousing.ca/building-construction-and-revitalization/capital-repairs/deep-building-retrofits#section_2_jump

[180] Toronto Community Housing Corporation, "Energy Relief Program," *Current Tenants – Services and Support*, accessed June 12, 2025, https://torontohousing.ca/current-tenants/services-and-support/electric-heating-relief-program.

Home Energy Loan Program[181]

Through the Home Energy Loan Program (HELP), Toronto homeowners can borrow up to $125,000 to cover the cost of home energy improvements.

Toronto Hydro Heat Pump Assistance Program[182]

Income-eligible single-family households can receive a free cold-climate air-source heat pump.

IESO CoolSaver Program[183]

The Save on Energy CoolSaver Program helps homeowners and tenants in single-family homes upgrade their home cooling systems to reduce their electricity consumption and energy costs.

Expanded Date Range for Operating Air Conditioning, When Provided by Property Owner

Due to the effects of climate change, the months shouldering the winter and summer seasons (i.e. September 15 to October 15 and May 1 to June 1) have become hotter. In response, the Property Standards Bylaw was updated as of 2025 to require landlords to operate air conditioning from June 1 to September 30 for rental units equipped with air conditioning provided by the property owner (instead of June 2 to September 14).

Toronto Green Standard[184]

Toronto Green Standard (TGS V4) adds a resilience measure for new high-rise residential and city buildings to include a refuge area with heating/cooling and 72-hour backup power, and city-owned facilities must meet net zero for new buildings starting 2023.

Net Zero Building Retrofit Guides[185]

Official guidance for owners/managers that frames retrofits as improving comfort and resilience to extreme heat, alongside emissions cuts.

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[181] City of Toronto, "Home Energy Loan Program," *Environmental Grants & Incentives – Water & Environment*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/services-payments/water-environment/environmental-grants-incentives/home-energy-loan-program-help/.

[182] Toronto Hydro, "Heat Pump Assistance Program," *For Home – Offers & Rebates*, accessed June 12, 2025, Toronto Hydro, https://www.torontohydro.com/for-home/heat-pump-assistance-program.

[183] Independent Electricity System Operator, **"CoolSaver Program,"** *Save on Energy – For Your Home*, accessed June 12, 2025, https://saveonenergy.ca/For-Your-Home/CoolSaver#how-the-program-works.

[184] City of Toronto, "Toronto Green Standard Version 4," City of Toronto – Planning & Development, accessed August 11, 2025, https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/.

[185] The sector-specific guide is not yet publicly available; however, the introductory guide can be accessed here: https://www.toronto.ca/wp-content/uploads/2025/05/86a5-P1.1-The-Introductory-Guide.pdf.

Communication on Road Hazards Via 311 and Social Media[186]

The City of Toronto uses 311 and official social media channels to receive reports of road hazards, coordinate repairs and share timely public alerts on closures, restrictions and safety risks.

Toronto's Emergency Response Plan, Including the Extreme Heat Emergency Annex[187]

If a heat event is severe, long-lasting or complex enough, it may escalate to a city-wide emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat, and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a heat event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. The Technology Services Division leads the Disaster Recovery Program, which is designed to support restoration of critical IT systems and data recovery.

Potential Actions

Enhance Development and Oversight of Heat Management and Adaptation Solutions

Enhance governance and planning for extreme heat resilience to connect and coordinate actions with impact in the short, medium, and long term and develop and oversee heat management and adaptation solutions.

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[186] "City says 'nobody is being turned away' as unhoused people seek shelter in extreme cold," *CTV News*, January 17, 2024, accessed August 11, 2025, https://www.ctvnews.ca/toronto/article/city-says-nobody-is-being-turned-away-as-unhoused-people-seek-shelter-in-extreme-cold/.

[187] City of Toronto, "Toronto's Emergency Plan," *Public & Community Safety – Emergency Preparedness*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/public-safety-alerts/emergency-preparedness/torontos-emergency-plan/. toronto.ca+9toronto.ca+9toronto.ca+9

Evaluate Coordinated Heat Action That Includes Long-Term Measures

In addition to the annual review and debrief, perform periodic broader standardized evaluation of the Heat Relief Strategy to assess network effectiveness, identify service gaps and improve accessibility for vulnerable populations. The evaluation could be extended to consider the impact of longer-term measures to reduce heat impacts, such as greening the city, in addition to efforts that are more seasonal.

Improve Heat-Related Public Education Strategies to Reach Vulnerable Populations

Improve public education strategies to reach vulnerable groups and raise awareness of available supports more effectively.

Targeted Outreach Strategies to Reach Vulnerable Populations

Use targeted outreach and support strategies for vulnerable populations (e.g. more cool spaces during extreme heat or financial aid for flood-related damages).

Continue to Evolve the Heat Relief Network With a Focus on Neighbourhoods and Populations at Greater Risk

As the Heat Relief Strategy is reviewed each year, continue to add locations or refine locations for the Heat Relief Network, focusing on locations that are accessible to more vulnerable populations.

Leverage Existing Spaces and Programs for Targeted Cool Spaces in Addition to the Public Heat Relief Network

Explore cooled locations, such as seniors aActive living centres, mental health drop-ins and spaces in Toronto Seniors Housing Corporation buildings, to see if they could be opened in a targeted way for populations not comfortable accessing public Heat Relief Network locations. Additionally, explore community spaces that could be promoted within existing user networks but which do not wish to be publicly listed in the Heat Relief Network map.

Energy-savings Program Coordination and Communication

Coordinate an outreach campaign in the most-at-risk neighbourhoods to boost enrollment and simplify access to available energy-saving programs to enable people to save money on energy needs that could be put towards cooling in very hot weather.

Expanded Air Conditioner Distribution Program Focused on Additional Heat- Vulnerable Populations

Expand air conditioner distribution program to target a broader range of heat-vulnerable populations to reduce indoor heat exposure and related health risks.

Maximum Temperature Policy for All Rental Dwellings[188]

The City of Toronto is exploring implementing a maximum temperature bylaw for rental units that would limit indoor temperatures to 26 °C during hot weather. This policy would complement existing minimum temperature requirements for winter, ensuring year-round safe indoor conditions. Limiting indoor temperatures to a maximum of 26 °C is intended to protect hundreds of thousands of tenants, particularly those in older buildings without air conditioning, from life-threatening indoor heat. Developing a bylaw or other policy presents an opportunity for the City to address the health inequities revealed by the climate assessment, where renters face disproportionate heat risks compared to property owners, who have greater control over their living conditions.

Municipal Building Portfolio Overheating Screening and Prioritization

Assess and rank municipal buildings in the corporate asset portfolio by overheating risk, performance and occupant needs to prioritize upgrades that enhance resilience to extreme heat.

Advocate for Updated Provincial Workplace Heat-safety Standards

Advocate to the Province to modernize Ontario's occupational health and safety rules for heat to reflect climate change impact (e.g. set maximum temperature/WBGT thresholds, require heat-stress plans, rest/water/cooling provisions and enforcement).

Evaluate the Need for Additional Shelter Capacity During Extreme Weather Events

Evaluate current and future demand for shelter and support services, including respites and daytime drop-ins, during extreme heat events to determine if additional capacity, extended hours or new locations are needed to protect vulnerable populations.

Infrastructure, Mobility and Communications

Extreme heat places considerable stress on critical infrastructure systems. High temperatures increase the risk of power outages by reducing transformer efficiency and driving up electricity demand. Data centres and telecommunications systems are also vulnerable to overheating, which can cause cascading service disruptions. Public transit

[188] City council has endorsed the principle of a 26 °C "maximum indoor temperature standard" and directed staff to bring back implementation considerations and recommended next steps by Q4 2025. City of Toronto, *Establishing a Framework to Address Excessive Indoor Temperatures in Leased Residential Premises* (background report to Planning & Housing Committee, November 22, 2024), accessed June 12, 2025, https://www.toronto.ca/legdocs/mmis/2024/ph/bgrd/backgroundfile-250930.pdf.

infrastructure, including rail systems like GO trains, may experience heat-related malfunctions that reduce reliability during times of heightened need. Similarly, there can be equipment malfunctions and failures in traffic management systems due to extreme heat that impact the reliability and safety of the transportation network. In extreme heat, roads can become deformed and damaged, resulting in rutting, cracking and buckling, which could result in lengthy disruption beyond the period of the heat event. Severe road damage affects emergency vehicles, urban goods delivery and commuters (on buses, in passenger vehicles or riding bicycles), leading to delayed response times for first responders, as well as safety hazards and costly repairs. Heat-related disruptions to key services pose additional risks to vulnerable groups. Shelters and social services may become overcrowded or strained during heatwaves, affecting their ability to provide consistent support to the unhoused population. In the healthcare system, pregnancy-related complications can increase for those with limited access to cooling and prenatal care. Service interruptions to power, telecommunications and public transit further reduce residents' ability to access critical supports, especially during emergencies.

Extreme heat also significantly impacts outdoor workers, increasing the risk of heat-related illnesses like heat exhaustion and heat stroke, and potentially leading to injuries due to fatigue, impaired judgment and equipment malfunctions. Prolonged exposure can also affect mental health and productivity and extend service delivery times, creating possible disruptions and delays.

Table 58. Actions list for infrastructure, mobility and communications risks related to extreme heat and very hot days.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto's Emergency Response Plan, including the Extreme Heat Emergency Annex Toronto's Corporate Business Continuity Management Program and Disaster Recovery Programs	

Impact Statement	Current Risk	Existing Action	Potential Action
Power outages caused by high demand and reduced power transformer capacity	Very High	Toronto Hydro's 2025-2029 Investment Plan	Engage with Toronto Hydro to prioritize neighbourhoods for grid resilience improvements and inform Toronto Hydro of any planned demand increases to support capacity investment planning and demand response programming Capital planning to evaluate equipping additional municipal buildings with backup generators, which also support heat and cooling to sustain business continuity for municipal services and provide cool spaces during power outages
Data centres overheating during a heatwave and causing a system failure	Medium-high		Promote heatwave resilience planning for private-sector data centres
Increased road safety incidents due to damaged roads and malfunctioning traffic systems equipment	Medium-high	Upgrade quality of road materials to withstand heat and prevent deformation Installing controller cabinets at signalized intersections that meet industry standards (for operation within a high temperature range)	Reduce state-of-good-repair backlog to extend pavement life, decrease the frequency of repairs and lessen environmental impacts Update inventory of traffic system assets and review industry standards and specifications for any changes to temperate range limits
TTC subway network can experience slowdown malfunctions due to extreme heat	Medium-high	Reduced speed zones Bus deployment for TTC and GO if trains are too slow or not functional	
Extended telecom outage, leading to service disruption	Medium-high	Toronto's Business Continuity Management and Disaster Recovery programs	

Impact Statement	Current Risk	Existing Action	Potential Action
GO trains can experience delays and malfunctions due to extreme heat	Medium-high	Metrolinx track standards for hot weather inspections and hot weather speed restrictions Bus deployment for TTC and GO if the trains are too slow or not functional	
VIA trains can experience delays and malfunctions due to extreme heat	Medium-high	CN hot-weather inspection standard	

Current Actions

Toronto Hydro's 2025-2029 Investment Plan[189]

Toronto Hydro, as the local electricity distributor for the City of Toronto, is responsible for delivering power to nearly 1.7 million households and businesses each day. To maintain safe and reliable service over the coming years, a five-year investment plan covering 2025-2029 has been approved. It is structured around the following key challenges:

- Serving the economic needs of a growing city
- Renewing and upgrading deteriorating infrastructure
- Adapting to changes in the way customers use electricity
- Building resilience in the face of extreme weather and cybersecurity attacks

To manage the risks related to increases in extreme and severe weather due to climate change, Toronto Hydro reviews and updates major equipment specifications to account for ongoing and future changes to the climate and strives to meet and surpass the 2023 Canadian Standard Association (CSA) updates related to climate change adaptation.

[189] Toronto Hydro, 2025–2029 Investment Plan: Executive Summary (Toronto: Toronto Hydro, November 17, 2023), accessed June 12, 2025, https://www.torontohydro.com/documents/d/guest/2025-2029-investment-plan-executive-summary.

Toronto's Emergency Response Plan, Including the Extreme Heat Emergency Annex[190]

If a heat event is severe, long-lasting or complex enough, it may escalate to a city-wide emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a heat event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Upgrade Quality of Road Materials to Mitigate Effects From Increased Temperatures to reduce Premature Pavement Deformation[191]

This strategy involves a comprehensive approach that includes selecting pavement materials and designs better suited to extreme heat and freeze-thaw cycles. Implementation includes the following:

- Revised material specifications, such as updated asphalt cement requirements and the use of low-carbon ready-mix concrete for specific infrastructure elements like concrete road bases, bus pads and sidewalks. Where appropriate, specifications have also been updated to encourage the use of warm-mix asphalt, which lowers energy use and emissions.

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[190] City of Toronto, "Toronto's Emergency Plan," *Public & Community Safety – Emergency Preparedness*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/public-safety-alerts/emergency-preparedness/torontos-emergency-plan/. toronto.ca+9toronto.ca+9toronto.ca+9

[191] Transportation Services, City of Toronto. *Pavement Design and Rehabilitation Guideline*, 2nd ed. (Toronto: City of Toronto, April 2019), accessed July 10, 2025, https://www.toronto.ca/wp-content/uploads/2019/04/9659-TS_Pavement-Design-and-Rehabilitation-Guideline.pdf.

- Adoption of Superpave standards after evaluating its performance against the traditional Marshall mix design, particularly for roads experiencing heavy traffic and climate stress. Superpave (Superior Performing Asphalt Pavements) uses an asphalt binder designed to resist rutting, fatigue and low-temperature cracking, ensuring durability under a range of pavement temperatures.

Install Controller Cabinets at Signalized Intersections That Meet Industry Standards for Operation Within a High Temperature Range

Controller cabinets have thermostat-controlled cooling and heating systems to ensure that the traffic signals do not go down during weather events. Controllers follow industry standards that operate within a temperature range of –34 °C to 74 C.

TTC Reduced Speed Zones[192]

These speed restrictions allow service to continue while track maintenance and upgrades are completed. These safety measures can also be put in place following a temporary repair to the tracks, before a permanent repair is made, as well as during winter months or extreme heat. Subway trains and streetcars will be allowed to return to regular speed once the work has ended and the tracks have been inspected or once the weather has changed.

Metrolinx Track Standards for Hot Weather Inspections and Hot Weather Speed Restrictions[193]

Metrolinx Track Standard 15.20 prescribes hot-weather inspections and speed restrictions to prevent rail buckling.

Bus Deployment for the TTC and GO if the Trains Are Too Slow or Not Functional

During extreme heat events, the TTC and GO Transit may implement bus service alongside or in place of train service due to potential track issues and slower train speeds.

CN Hot-Weather Inspection Standard[194]

To detect signs of thermal stress in rail and to identify areas of track susceptible to buckling, railway workers routinely perform visual inspections by hi-rail vehicles for signs of compressive thermal rail stress. CN's hot weather inspection standard for CWR

[192] Toronto Transit Commission, "Reduced Speed Zones," Riding the TTC – Updates, accessed June 12, 2025, Toronto Transit Commission, https://www.ttc.ca/riding-the-ttc/Updates/Reduced-Speed-Zones.

[193] Metrolinx, Metrolinx Track Standards – Heavy Rail, RC-0506-02TRK, Revision 00, April 2025 (Metrolinx, April 29, 2025), accessed June 12, 2025, https://assets.metrolinx.com/image/upload/Documents/Engineering/Metrolinx_Track_Standards.pdf.

[194] Transportation Safety Board of Canada, Rail Transportation Safety Investigation Report R21M0027: Main-Track Train Derailment, Canadian National Railway Company Train B73041-15, Mile 18.9, Napadogan Subdivision, Pangburn Station, New Brunswick, 21 August 2021 (released 22 January 2025), accessed June 12, 2025, https://www.tsb.gc.ca/eng/rapports-reports/rail/2021/r21m0027/r21m0027.html.

indicates that when ambient temperatures reach or are expected to reach 30 °C or higher, hot weather inspections must be conducted and, if warranted, speed restrictions must be issued for the affected areas.

Potential Actions

Engage with Toronto Hydro to identify priority neighbourhoods

Engage with Toronto Hydro to prioritize neighbourhoods for grid resilience improvements and inform Toronto Hydro of any planned demand increases to support capacity investment planning and demand response programming

Develop Capital Planning to Evaluate Equipping Additional Municipal Buildings With Backup Generators

Develop capital planning to evaluate equipping additional municipal buildings with backup generators, which also support heat and cooling, to sustain business continuity for municipal services and provide cool spaces during power outages.

Reduce State-of-Good-Repair Backlog for the Road Network

The core aim of the SOGR Program is to extend pavement life, decrease the frequency of repairs and lessen the environmental impact of road maintenance activities. By investing in infrastructure upgrades, the transportation system will be better equipped to withstand the stressors of increasing temperatures and other climate hazards, reducing disruptions and ensuring continued functionality.

Update Traffic System Asset Inventory and Review Industry Standards and Specifications for Any Changes to Temperate Range Limits

At major or complex intersections, traffic signals have an Uninterruptible Power Supply (UPS) installed. The UPS ensures the traffic signals stay operational for as long as possible during power outages at major or complex intersections, as well as for railway pre-emption signals and expressway ramp terminals. An updated inventory of traffic systems assets will allow city staff to track and monitor which assets in the transportation system need upgrading to be prepared for extreme weather events.

Promote Heatwave Resilience Planning for Private-sector Data Centres

Encourage private-sector data centre operators to plan for extreme heat resilience while ensuring the City's own data centres are assessed and protected against overheating risks.

Affordability

Extreme heat increases energy consumption for cooling, which can result in substantial cost burdens, particularly for low-income households and those already experiencing energy poverty. The financial strain can extend to food insecurity, as residents face increased food spoilage and must balance rising cooling costs with grocery expenses. These compounded economic pressures make it more difficult for affected populations to manage basic living needs during heatwaves.

Table 59. Actions list for affordability related to extreme heat and very hot days.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto Poverty Reduction Strategy	
Food insecurity increases during extreme heat as vulnerable populations face higher expenses (e.g. increased food waste and increased cooling costs), leaving less income for food	Medium-high	Student Nutrition Program expansion (2025 budget) Food banks	Creation and expanded integration of food hubs Support local food producers growing food in Toronto

Impact Statement	Current Risk	Existing Action	Potential Action
Increased energy costs for vulnerable populations (e.g. people with lower incomes and/or experiencing energy poverty, affordable and social housing tenants)	Medium-high	Ontario Electricity Support Program Low-Income Energy Assistance Program Taking Action on Tower Renewal (TATR) Toronto Community Housing deep-retrofit pilots Electric Heating Relief Program (TCHC and Toronto Hydro Heat Pump Assistance Program IESO CoolSaver Program	Maximum indoor temperature policy for all leased residential dwellings Energy-savings and retrofit program coordination and communication Expansion or replacement of the heat-pump initiative to reach wider population

Current Actions

Toronto Poverty Reduction Strategy[195]

The Toronto Poverty Reduction Strategy is the City of Toronto's long-term strategy to address immediate needs, create pathways to prosperity and drive systemic change for those living in poverty in the city.

[195] City of Toronto, "Toronto Poverty Reduction Strategy," *Long-Term Vision, Plans & Strategies – Poverty Reduction Strategy*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/city-government/accountability-operations-customer-service/long-term-vision-plans-and-strategies/poverty-reduction-strategy/.

Food Banks

There are more than 200 food banks in Toronto, and the number of visits to these centres continue to rise. During extreme heat events and high-energy-cost months, food banks can help vulnerable individuals and families by providing access to free food, resources and community support, as well as assisting with food preservation during power outages or periods of hot indoor temperatures.

Student Nutrition Program Expansion (2025 Budget)[196]

Council-funded rollout of universal morning meal by 2026 and universal lunch by 2030, reducing child hunger throughout the school year, including during hotter, high-energy-cost months where household food provision may be challenged by increased utility expenses.

Ontario Electricity Support Program[197]

The OESP is an Ontario Energy Board program that lowers electricity bills for lower-income households. The OESP provides a monthly credit to eligible customers based on household income and household size. The OESP credits are applied directly to eligible customers' bills.

Taking Action on Tower Renewal Program[198]

The Taking Action on Tower Renewal Program provides a combination of loans and grants to eligible property owners to complete retrofits that increase energy efficiency and reduce greenhouse gas emissions while improving tenant comfort. The program includes prohibitions against passing the cost of improvements on to tenants through above guideline rent increases (AGIs).

Low-Income Energy Assistance Program (LEAP)[199]

Emergency grants to avoid disconnection during peak-season arrears.

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[196] City of Toronto, Building Towards a Universal Student Food Program in Toronto: Background Report for TS4.1 (Toronto: City of Toronto, February 26, 2025), accessed June 12, 2025, https://www.toronto.ca/legdocs/mmis/2025/ts/bgrd/backgroundfile-253417.pdf.

[197] Ontario Energy Board, "Ontario Electricity Support Program," *Bill Assistance Programs* (Ontario Energy Board), accessed June 12, 2025, https://ontarioelectricitysupport.ca/.

[198] City of Toronto, "Taking Action on Tower Renewal Program," *Apartment Building Operators – Tower Renewal*, Community & People, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/community-partners/apartment-building-operators/tower-renewal/taking-action-on-tower-renewal-tatr-program/.

[199] Ontario Energy Board, "Low-income Energy Assistance Program," *Bill Assistance Programs*, accessed June 12, 2025, Ontario Energy Board, https://www.oeb.ca/consumer-information-and-protection/bill-assistance-programs/low-income-energy-assistance-program.

Toronto Community Housing Deep-retrofit Pilots[200]

To date, TCHC has completed more than a dozen deep building retrofits. Where possible, TCHC will continue to invest in deep building retrofit projects that address many elements of our capital targets, including increasing energy savings, improving building conditions and making housing more accessible.

Electric Heating Relief Program (TCHC and Toronto Hydro)[201]

About 1,500 Toronto Community Housing tenants who pay rent-geared-to-income also pay for electric heating. Under commitments in the 2015 *Getting it Done* report, Toronto Community Housing has partnered with Toronto Hydro to help tenants who pay rent-geared-to-income by paying part of their electric heating bills.

Heat Pump Assistance Program[202]

Pilot study where changed income-eligible households can receive a free cold-climate air-source heat pump.

IESO CoolSaver Program[203]

The Save on Energy CoolSaver Program helps homeowners and tenants upgrade their home cooling systems to reduce their electricity consumption and energy costs.

Potential Actions

Creation and Expanded Integration of Food Hubs

Additional food hubs could be created and possibly combined with resilience hubs, providing support to those who need it. Many community hubs/spaces offer food-related programs and services, such as community meals, food banks, food/grocery markets (see grocery market — Rexdale Community Hub) outside of extreme weather events. During extreme weather events, the city's community hubs/spaces can offer more coordinated food-related programs and services and can also potentially incorporate new food-focused programs/services or increase the capacity of existing ones.

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[200] Toronto Community Housing Corporation, "Retrofit TCHC Building Will Yield Climate, Affordability, and Community Benefits," *News & Updates*, accessed June 12, 2025, Toronto Community Housing Corporation, https://torontohousing.ca/building-construction-and-revitalization/capital-repairs/deep-building-retrofits#section_2_jump

[201] Toronto Community Housing Corporation, "Energy Relief Program," *Current Tenants – Services and Support*, accessed June 12, 2025, https://torontohousing.ca/current-tenants/services-and-support/electric-heating-relief-program.

[202] Toronto Hydro, "Heat Pump Assistance Program," *For Home – Offers & Rebates*, accessed June 12, 2025, Toronto Hydro, https://www.torontohydro.com/for-home/heat-pump-assistance-program.

[203] Independent Electricity System Operator, **"CoolSaver Program,"** *Save on Energy – For Your Home*, accessed June 12, 2025, https://saveonenergy.ca/For-Your-Home/CoolSaver#how-the-program-works.

Support Local Food Producers Growing Food in Toronto

Extreme weather will impact crop production, result in crop failures and potentially increase food costs or impact local food supply. Increased support could include offering water management solutions, offering crop insurance, providing funding and training on climate- resilient agricultural techniques and crops and developing new markets for climate- resilient crops.

Maximum Temperature Policy for All Rental Dwellings

The City of Toronto is exploring implementing a maximum temperature bylaw for rental units that would limit indoor temperatures to 26 °C during hot weather. This policy would complement existing minimum temperature requirements for winter, ensuring year-round safe indoor conditions. Limiting indoor temperatures to a maximum of 26 °C is intended to protect hundreds of thousands of tenants, particularly those in older buildings without air conditioning, from life-threatening indoor heat. Developing a bylaw or other policy presents an opportunity for the City to address the health inequities revealed by the climate assessment, where renters face disproportionate heat risks compared to property owners with greater control over their living conditions.

Energy-saving and Retrofit Program Coordination and Communication

Coordinate an outreach campaign in the most-at-risk neighbourhoods to boost enrollment and simplify access to available energy-saving and retrofit programs.

Heat Pump Program Expansion

The City should continue to work with Toronto Hydro to drive the adoption of heat pumps and reach more households. Program examples include Toronto Hydro's Climate Advisory Services, the Heat Pump Assistance Program and the upcoming Furnace Replacement Program.

Extreme Precipitation

Extreme precipitation is one of Toronto's top climate hazards, alongside extreme heat. It is associated with a high number of priority impact statements for the current time period (16 in total) that affect multiple interconnected systems, including buildings, roads, social services, utilities and public health.

Risk Themes

Health and Well-being

Extreme precipitation events threaten both physical and mental health, especially for unhoused populations and individuals with disabilities or chronic health conditions. Flooding and water damage can destroy assistive devices, medical supplies and personal belongings, compounding health risks and making recovery more difficult. For unhoused residents, the risk of displacement and associated health impacts is particularly severe. Mental health consequences, including psychosocial stress, are also prominent, especially among low-income renters who may lack the means to remediate flood damage.

Table 60. Actions list for health and well-being related to extreme precipitation.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto's Emergency Response Plan, including the Flood Annex Toronto's Corporate Business Continuity Management Program Promote and support emergency supplies and preparedness TRCA riverine flood forecasting and warning system and outreach Water quality monitoring West Nile Virus Program	Increase education and community monitoring of standing water (risk of water-borne diseases)

Impact Statement	Current Risk	Existing Action	Potential Action
Displacement of unhoused population living outdoors and in encampments	High	Toronto Encampment Strategy and Streets to Homes outreach	Ensure flooding is incorporated in inclement weather planning and responses for city shelters and outreach Continue to enhance the City's coordinated response between encampment staff and TRCA warning system
Loss of assistive devices and medical supplies due to water damage/contamination/displacement	Medium-high	City of Toronto Hardship Fund Assistive Devices Program	Expand the City's Hardship Fund to cover essential medical equipment lost in storms, with a 48-hour turnaround Advocacy/partnership with provincial supports and systems like the Assistive Devices Program to expand coverage/client base
Psychosocial and mental health impacts for vulnerable populations (e.g. people with lower incomes and/or renters may not be able to repair or remediate these effects)	Medium-high	Toronto Community Crisis Service 211 Help Line	Virtual check-ins, check-in lines, more supports to recognize and address flood-related mental health impacts (e.g. trauma)
Physical and mental health impacts for the unhoused population	Medium-high	Community Crisis Response Program 211 Help Line Streets to Homes outreach and referrals to mental health supports	Consistent implementation, increased rollout of grief and loss programming for shelter clientele Explore development and implementation of consistent/minimum standards for primary care and mental health services in shelters and for people staying outdoors

Impact Statement	Current Risk	Existing Action	Potential Action
Financial stress from property damage	Medium-high	City of Toronto Hardship Fund Rockcliffe No Fault Grant for Basement Flooding Damages Toronto Water Annual Basement Flooding Prevention Education Campaign	Expand education campaigns for flood-proofing
Disruption of service delivery in shelters for unhoused population due to overcrowding	Medium-high	Homeless Shelter Capital Infrastructure Strategy Toronto Shelter Standards — Extreme weather measures	Undertake or expedite retrofits and flood-proofing of existing facilities

Current Actions

Toronto's Response Emergency Plan, Including the Flooding Annex [204] [205]

If a precipitation event is severe, long-lasting or complex enough, it may escalate to an emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

[204] City of Toronto, "Toronto's Emergency Plan," *Public & Community Safety – Emergency Preparedness*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/public-safety-alerts/emergency-preparedness/torontos-emergency-plan/. toronto.ca+9toronto.ca+9toronto.ca+9

[205] City of Toronto, "Toronto's Emergency Plan," *Public & Community Safety – Emergency Preparedness*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/public-safety-alerts/emergency-preparedness/torontos-emergency-plan/. toronto.ca+9toronto.ca+9toronto.ca+9

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a precipitation event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Water Quality Monitoring

Every year between June and September (Labour Day), water samples are collected daily from Toronto's supervised public beaches to be tested for E.coli bacteria. TPH measures E.coli levels to determine the beach water quality (and lifeguards monitor the safety conditions) for public swimming. When E.coli levels exceed the City of Toronto standard of 100 E.coli/100ml of water, TPH posts warning signs against swimming. The Outfall Monitoring Program collects samples from storm sewer outfalls that exit to the city's waterways. This program identifies contaminated flows, such as sanitary cross-connections and spills into catch basins, and these are traced to locate the source for corrective action by the contaminator.

West Nile Virus Program

The City provides education on reducing the risk of West Nile Virus by avoiding bites and eliminating stagnant water on private property, as well as information for horse owners. Toronto Public Health conducts mosquito surveillance from mid-June until mid-September every year. City catch basins are treated with larvicide to prevent mosquito development.

Toronto and Region Conservation Authority Flood Forecasting and Warning Centre[206]

This program aims to mitigate flood risks in the Greater Toronto Area. It monitors weather forecasts and watershed conditions, issuing flood messages to municipalities and the public in accordance with provincial requirements, and provides support to emergency services during events. The TRCA undertakes flood risk outreach to inform residents about flood hazards and how they can prepare.

[206] Toronto and Region Conservation Authority, "TRCA's Flood Forecasting and Warning Centre," accessed July 3, 2025, https://trca.ca/conservation/flood-risk-management/flood-forecasting-warning/

Toronto Encampment Strategy[42] Streets to Homes Outreach and Support[43]

This strategy is intended to provide services and supports to people experiencing outdoor homelessness, including those living in encampments, with a focus on well-being and health and safety. Enhanced outreach efforts include increased wellness checks, health, mental health and social support visits, and waste removal in encampment areas. Streets to Homes will also help people locate the nearest cool space, as well as provide housing-related supports.

Toronto Community Crisis Service

The Toronto Community Crisis Service (TCCS) provides free, confidential, in-person mental health support city-wide from mobile crisis worker teams. There is a need for mental health support and connecting people to services when there is increased demand during climate emergencies.

211 Help Line[207]

The 211 Help Line plays a key role in service navigation and is supported by many city divisions. Additionally, 211Ontario.ca is the number to call for information and referral to over 60,000 community, social, health and related government programs and services in Ontario. In most communities in Ontario, you can dial 211 to access telephone-based information and referral services 24 hours a day, seven days a week in over 100 languages.

The 211Central.ca website lists over 20,000 community, health, social, and related government services, making it a reliable resource for anyone looking for human services in Toronto, Durham, York or Peel.

City of Toronto Hardship Fund[208]

The Hardship Fund is a crucial safety net for replacing medical and mobility equipment destroyed in floods, but its pre-authorization requirement means advance planning and temporary backups are essential to keep vulnerable residents safe and independent during and after extreme-precipitation events.

Rockcliffe No Fault Grant for Basement Flooding Damages[209]

The Rockcliffe No Fault Grant for Basement Flooding Damages is a City of Toronto program that provides eligible homeowners in the Rockcliffe Special Policy Area up to

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[207] Province of Ontario, "211Ontario.ca," accessed July 4, 2025, https://211ontario.ca/

[208] City of Toronto, "Hardship Fund," *Policies & Procedures – Ontario Works*, Community & People – Employment and Social Services, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/community-people/employment-social-support/support-for-people-in-financial-need/assistance-through-ontario-works/policies-and-procedures/hardship-fund/.

[209] City of Toronto, "Rockcliffe No Fault Grant for Basement Flooding Damages Program," City of Toronto – 311 Service Information, accessed August 13, 2025, https://www.toronto.ca/home/311-toronto-at-your-service/find-service-information/article/?kb=kA06g000001UtxaCAC.

$7,500 per storm event to cover uninsured basement flood damage caused by a storm — without requiring proof of fault. It applies only while city-engineered flood remediation projects are pending.

Toronto Water Annual Basement Flooding Prevention Education Campaign

Toronto Water runs an annual multi-pronged educational campaign to guide homeowners on steps they can take to reduce the risks for basement flooding (transit/bus shelters, radio, social media, print, bill inserts, and councilor/targeted mailouts).

Assistive Devices Program[210]

This provincial program helps Ontario Residents to pay for customized medical devices such as hearing aids and wheelchairs and can contribute to the costs of replacing equipment.

Homelessness Services Capital Infrastructure Strategy[211]

The City of Toronto is planning to build 20 new and purpose-built shelters to support those experiencing homelessness and to augment the support offered by the shelter system. These new shelters should help to offset some of the increasing need for emergency shelter services.

Shelter and Respite Standards — Extreme Weather Measures

The Toronto Shelter Standards and the 24-Hour Respite Site Standards direct that every shelter, respite or 24-hour drop-in should ensure at least one air-conditioned cooling area is available to clients (specific to a heat-based alert), suspend service restrictions, relax admission rules, provide or extend daytime access to sites, help clients obtain appropriate basic clothing and footwear and legally exceed funded bed capacity during any weather alert that endangers clients (including high-wind events).

Potential Actions

Monitor Water-borne Diseases

Increase education about and community monitoring of standing water, which can harbour water-borne pathogens such as Giardia, Cryptosporidium, E. coli, and Leptospira, and can support mosquito breeding that can spread diseases such as the West Nile virus.

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[210] Province of Ontario, "Assistive Devices Program", accessed July 3, 2025, https://www.ontario.ca/page/assistive-devices-program

[211] City of Toronto, "New Shelters – Homelessness Services Capital Infrastructure Strategy (HSCIS"), *Homelessness Services Capital Infrastructure Strategy*, accessed July 3, 2025, https://www.toronto.ca/home/311-toronto-at-your-service/find-service-information/article/?kb=kA06g000001Uu6mCAC

Flood-triggered Respite Spaces

Pre-identify and pre-staff indoor locations that open automatically when a rainfall or river-level threshold is met, mirroring cold-weather warming-centre triggers. Respite places should include or be connected to a storage location to store the belongings of unhoused people.

Map Safe Outdoor Spaces Where People Experiencing Homelessness Can Relocate

Maps of less-impacted outdoor places could be made available when there is a risk of floods.

Expand the City of Toronto Hardship Fund

Expand the City's Hardship Fund to cover essential medical equipment lost in storms, with a 48-hour turnaround to avoid hospital admissions.

Establish Partnerships Between Provincial Supports and Programs Like the Assistive Devices Program

Advocate for and partner with provincial supports and systems like the Assistive Devices Program to expand coverage/client base.

Provide Grief and Loss Support for Shelter Clientele

Consistently implement grief and loss programming for shelter clientele and establish consistent/minimum standards for mental health services in shelters.

Expand Outreach on Floodproofing

To address financial stress from property damage due to floods, education campaigns for flood-proofing could be provided in advance of extreme weather events.

Undertake or Expedite Retrofits and Flood-proofing of Existing Shelter Facilities

Provide modular, pop-up shelters and increase retrofits and flood-proofing of existing facilities for people experiencing homelessness.

Infrastructure, Mobility and Communications

Residential, commercial, industrial and municipal buildings are at high risk of water damage from extreme precipitation. These impacts are widespread and can lead to costly repairs, operational shutdowns, or long-term structural degradation. Transportation networks are similarly at risk, with flooding potentially damaging surfaces/pavements and embankments supporting roads, bridges and railways. Such damage can increase the likelihood of road safety incidents and broader or prolonged transportation disruption.

Service disruptions are a major concern during heavy rainfall events. Flooded roads and public transit interruptions (including to TTC, the GO train and VIA Rail) can prevent vulnerable individuals from accessing healthcare, social supports and daily necessities. These mobility limitations have cascading effects on health, safety and overall well-being, particularly for people with limited transportation options or mobility challenges.

Table 61. Actions list for infrastructure, mobility and communications related to extreme precipitation.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		TRCA flood-control infrastructure to reduce impacts TRCA riverine and Lake Ontario shoreline flood maps Wet Weather Flow Master Plan Toronto Green Standards Regulatory Floodplains —Ontario Regulation 41/24 City of Toronto Green Roof Bylaw Green Streets	Pluvial flood data collection and analysis (for capital programming, operations and response planning) Develop additional flood risk remediation and flood reduction projects to address flooding in the transportation network/at the facility level

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting (continued)		Mandatory Downspout Disconnection Erosion Risk Management Ravine Strategy Toronto's Emergency Response Plan, including the Flood Annex Toronto's Corporate Business Continuity Management and Disaster Recovery Programs Port Lands Flood Protection Project (formerly Don Mouth Naturalization Project)	
Damage to road infrastructure and disrupted road networks from extreme precipitation and associated road safety risks	High	Pre-storm preparations, inspections, clearing catch basins and road sweeping Transportation Services' role in Toronto's Emergency Response Plan and Transportation Services' Risk Specific Plan for Flooding Lower Don traffic management system	Enhanced road drainage and stormwater management through targeted improvements, such as upsizing culverts, replacing corrugated steel culverts and implementing green infrastructure Proactive inspection and strengthening of road infrastructure to mitigate flood risk

Impact Statement	Current Risk	Existing Action	Potential Action
Damage from extreme precipitation events for residential buildings	High	Basement Flooding Protection Program Basement Flooding Protection Subsidy Program Mandatory Downspout Disconnection Financial Assistance Program	Coordinated retreat from high-risk areas Building renovations to increase flood-proofing
Damage from extreme precipitation events for commercial and industrial buildings	High	Basement Flooding Protection Program	Building renovations to increase flood-proofing
Disruption to TTC service from extreme precipitation	High	TTC Extreme-Weather and Flood-Response Protocol	Improve real-time customer communications Acquisition of emergency backup generators
Disruption to GO train	High	Metrolinx Climate Adaptation Strategy Flood Forecasting and Warning Response Plans	Collaborate with Metrolinx on an updated Climate Adaptation Plan
Disruption to VIA service	High		

Impact Statement	Current Risk	Existing Action	Potential Action
Combined sewer overflows	Medium -high	Don River and Central Waterfront Wet-Weather Flow System Western Beaches Tunnel Fairbank Silverthorn Storm Trunk Sewer System Wet Weather Flow Management Guidelines Sewer Use Bylaw	
Loss of access to essential services for vulnerable populations (e.g. people with physical and/or neurological disabilities may not receive care if their support worker cannot safely travel; people who are medically dependent may not access health clinic or facility if travel is difficult and/or facility is closed)	Medium -high		Refer to actions under cross-cutting, TTC service, GO trains (Metrolinx) and infrastructure (Transportation Services Division)
Damage from extreme precipitation events for municipal buildings	Medium -high	City property insurance	

Current Actions

TRCA Flood-control Infrastructure[212]

Twelve dams, nine flood channels and six dikes (e.g. G. Ross Lord, Claireville) that attenuate peak river flows before they reach road crossings.

TRCA Riverine Floodplain maps and Lake Ontario Hazard Map[213]

The City uses flood maps and data from the TRCA to identify areas at risk of riverine and Lake Ontario shoreline flooding during extreme precipitation events.

Wet Weather Flow Master Plan[214]

Toronto's Wet Weather Flow Master Plan is the City's long-term strategy for handling stormwater and combined-sewer overflows. It guides investments in engineered and nature-based solutions to reduce flooding, improve water quality in local waterways and Lake Ontario and protect neighbourhoods and infrastructure during heavy rainfall.

Toronto Green Standards[215]

TGS V4 requires the incorporation of green infrastructure features into new development sites. The Standard consists of tiers of performance, with Tier 1 being mandatory and applied through the planning approval process. Included in Tier 1 is the requirement that a minimum of 50 per cent of onsite at-grade plantings be native plants (including trees, shrubs and herbaceous plants). Developers must select from an approved list that includes intensive and biodiverse green roofs, at-grade pollinator habitats, bioretention facilities and reforested sites. The new requirements are driving the installation of biodiverse green roofs across the city.

Maps of Regulated Areas Regulatory Floodplains — Ontario Regulation 41/24[216]

Made under the Conservation Authorities Act, Ontario Regulation 41/24 "Prohibited Activities, Exemptions and Permits" requires conservation authorities, such as TRCA, to develop maps

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[212] Toronto and Region Conservation Authority, "TRCA's Flood Control Infrastructure," *Flood Risk Management – Infrastructure*, accessed June 12, 2025, Toronto and Region Conservation Authority, https://trca.ca/conservation/flood-risk-management/infrastructure/

[213] Toronto and Region Conservation Authority, *Flood Plain Map Viewer*, accessed June 13, 2025, https://trca.ca/conservation/flood-risk-management/flood-plain-map-viewer/.

[214] City of Toronto, "The City's Wet Weather Flow Master Plan," *Managing Rain & Melted Snow – Water & Environment*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/the-citys-wet-weather-flow-master-plan/.

[215] "Cities Play a Key Role in Advancing Green Infrastructure Implementation – A Look at Innovative Policies and Capital Projects in the City of Toronto," *Living Architecture Monitor*, September 21, 2024, accessed June 12, 2025, https://livingarchitecturemonitor.com/articles/innovative-policies-and-capital-projects-in-the-city-of-toronto-fa24.

[216] Ontario Regulation 166/06, "Toronto and Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses," 41/24, "Prohibited Activities, Exemptions and Permits", under the Conservation Authorities Act, approved May 4, 2006, effective April 1, 2024, e-Laws (accessed June 12, 2025published February 16, 2024).

depicting the areas within the authority's area of jurisdiction where development activities are prohibited. The regulated area is made up of lands in or near natural hazards and natural features. For example, TRCA regulates rivers, streams, flood plains, wetlands, valleylands and Lake Ontario shoreline and a permit may be required for work within a regulated area.

Any proposal to "develop, interfere with a wetland or alter a shoreline or watercourse" inside a regulated floodplain or valley requires a TRCA permit. Permits may be refused or conditioned on flood-proofing and safe access.

City of Toronto Green Roof Bylaw[217]

In 2009, Toronto was the first city in North America to adopt a bylaw to require and govern the construction of green roofs. The Green Roof Bylaw sets out a graduated green roof requirement for new development or additions that are greater than 2,000 m² in gross floor area. The requirement ranges from 20 per cent to 60 per cent of the available roof space of a building.

Green Roofs are required on:

- New commercial, institutional and residential development with a minimum gross floor area of 2,000 m²;
- New additions to commercial, institutional and residential development where the new gross floor area added is greater than 2,000 m²; and
- Industrial buildings greater than 2,000 m² gross floor area.

Green Streets[218]

Transportation Services manages the Green Streets Program that involves the planning, design, construction, maintenance and monitoring of green infrastructure in the public right-of-way. The program is an interdivisional effort, with Transportation Services being the asset lead for this infrastructure. Traditional streets were designed to quickly direct stormwater into storm sewer systems, such as gutters, drains or pipes, which then discharge directly into waterways, often carrying contaminants like dirt, oil and grease. In contrast, Green Streets use green infrastructure like bioswales, permeable pavements and street trees to capture, absorb and filter stormwater. This reduces the amount of runoff that enters storm sewer systems or ponds and reduces road ponding and flooding.

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[217] City of Toronto, "Green Roof Bylaw," *Official Plan Guidelines – Green Roofs*, City Government – Planning & Development, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/green-roofs/green-roof-bylaw/.

[218] City of Toronto, "Green Streets," *Enhancing Our Streets & Public Realm – Streets, Parking & Transportation*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/services-payments/streets-parking-transportation/enhancing-our-streets-and-public-realm/green-streets/.

Mandatory Downspout Disconnection

It is mandatory for all property owners in Toronto to ensure their downspouts are disconnected from the City's sewer system. This prevents heavy rain from overloading the sewers and reducing the risk of basement flooding and release of polluted rainwater into local waterways.

Erosion Risk Management Program[219]

This program is one of many ways the TRCA manages risks associated with erosion. The Erosion Risk Management Program identifies and remediates erosion hazards to prevent and manage erosion.

Ravine Strategy[220]

The Toronto Ravine Strategy is a 10-year city framework for managing, protecting, restoring and enhancing the city-wide ravine system.

Basement Flooding Protection Program[221]

The City's Basement Flooding Protection Program is a multi-year program that is helping to reduce the risk of flooding by making improvements to the sewer system and overland drainage routes. Projects are taking place in basement flooding study areas across the city.

Basement Flooding Protection Subsidy Program

Owners of a single-family, duplex, triplex or fourplex residential home can apply online for a subsidy of up to $3,400 per property to install flood protection devices. Eligible work includes installing a backwater valve, installing a sump pump and severing and capping of a home's storm sewer or external weeping tile connection.

Mandatory Downspout Disconnection Financial Assistance Program

This program reimburses the costs of labour and materials for performing downspout disconnection work for a residential property, up to a maximum of $500, for an eligible low-income senior or a low-income person with a disability.

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[219] Toronto and Region Conservation Authority, "Identifying, Monitoring and Remediating Erosion Hazards," *Erosion Risk Management*, accessed July 3, 2025,, https://trca.ca/conservation/erosion-risk-management/#:~:text=TRCA's%20Erosion%20Risk%20Management%20team,along%20the%20Lake%20Ontario%20shoreline.

[220] City of Toronto, *Toronto Ravine Strategy*, *Long-term Vision, Plans and Strategies*, City Government – Accountability & Operations, accessed August 13, 2025, https://www.toronto.ca/city-government/accountability-operations-customer-service/long-term-vision-plans-and-strategies/ravine-strategy/.

[221] City of Toronto, "Basement Flooding Protection Program," *Managing Rain & Melted Snow – Basement Flooding*, Services & Payments, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/basement-flooding/basement-flooding-protection-program/

City of Toronto's Emergency Response Plan, Including the Flood Annex

If a precipitation event is severe, long-lasting or complex enough, it may escalate to an emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the city's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a precipitation event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. The Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Transportation Services' Role in Toronto's Emergency Response Plan and Transportation Services' Risk Specific Plan for Flooding

Transportation Services plays a key role in the City's emergency response to flooding, as outlined in the City's Emergency Response Plan and Flood Annex. Its primary objectives during flooding are to stabilize the continuity of the City's critical transportation routes and infrastructure and facilitate road closures as needed. Transportation Services monitors and responds to flooding on the transportation network, acts as a liaison to the Ministry of Transportation and adjacent road systems and provides traffic management and support to the Toronto Police Service for road closures when roads are no longer passable due to flooding, as well as supporting evacuation, damage assessment and debris management.

Transportation Services' Risk Specific Plan for Flooding complements the City's Emergency Response Plan, including flood preparation activities to help minimize the impact of flooding to roads. These pre-storm activities include patrolling low-lying areas, clearing catch basins, removing debris from the roadway and being stationed at stand-by locations near potential flood-prone areas. Spring and fall clean up operations are also conducted by Operations and Maintenance teams to ensure the drainage infrastructure remains clear.

Lower Don Traffic Management System (LDTMS)

The LDTMS is a system composed of gates, lanes reducers, cameras and electronic signs that allows the closure of Bayview Avenue at key locations during flood events in this area and the detouring of vehicles/traffic diversion in the affected area. The LDTMS system can be triggered remotely from the Traffic Operations Centre (TOC), and it interacts with traffic signals to deploy the system in a safe and secure way. The system also has an Uninterruptible Power Supply in the event of power outages.

TTC Extreme Weather and Flood Response Protocol[222]

Current efforts focus on three main fronts: keeping water out, moving water away quickly and ensuring coordinated responses. State-of-good-repair programs replace aging pumps in several stations each year, rehabilitate roofs, renew facilities and upgrade underground streetcar cables to withstand submersion. Crews proactively clear drains and sewer connections in stations, along subway tracks and across the streetcar network, while routine inspections target roof drains, vent shafts and back-water valves. In parallel, the TTC maintains standing communication channels with Toronto Emergency Management and other agencies to share real-time information on flood-prone assets and align response plans. Together, these measures maintain drainage capacity, hard-seal vulnerable structures and integrate the transit network into the city's broader extreme-weather coordination framework.

Metrolinx Climate Adaptation Strategy[223]

Metrolinx's 2017 Climate Adaptation Strategy reviews Metrolinx's adaptation efforts, including adapting to extreme precipitation, and suggests key areas for future work.

Don River and Central Waterfront Wet Weather Flow System[224]

At 10.5km long and 6.3m in diameter, Phase 1: The Coxwell Bypass Tunnel will intercept combined sewer overflows and stormwater discharges from 23 sewer outfalls, improving beach, river and lake water quality. As of March 2025, the Coxwell Bypass Tunnel (phase 1) is approximately 99 per cent complete.

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[222] Toronto Transit Commission, *Extreme Precipitation Planning: Background Report for TTC Board (Backgroundfile-254729)* (Toronto: TTC, April 16, 2025), accessed June 12, 2025, https://www.toronto.ca/legdocs/mmis/2025/ttc/bgrd/backgroundfile-254729.pdf.

[223] Metrolinx, *Climate Adaptation Strategy* (Toronto: Metrolinx, May 8, 2022), accessed June 12, 2025, https://assets.metrolinx.com/image/upload/v1663237659/Documents/Metrolinx/MX_Climat_Adapt_Str_May8_vs4.pdf.

[224] City of Toronto, "Projects of the Lower Don River, Taylor-Massey Creek and Inner Harbour Program," *Managing Rain & Melted Snow – What the City Is Doing: Stormwater Management Projects*, Services & Payments, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/what-the-city-is-doing-stormwater-management-projects/lower-don-river-taylor-massey-creek-and-inner-harbour-program/projects-of-the-lower-don-river-taylor-massey-creek-and-inner-harbour-program/.

Western Beaches Tunnel[225]

The Western Beaches Tunnel is a major combined sewer overflow (CSO) control project completed in 2002. It diverts and stores combined sewage from Toronto's western waterfront area during wet weather, sending it to Ashbridges Bay Treatment Plant for treatment before release, significantly reducing beach closures and pollution in Lake Ontario.

Fairbank Silverthorn Storm Trunk Sewer System[226]

A large-scale sewer infrastructure project designed to improve stormwater conveyance and reduce basement flooding in the Fairbank–Silverthorn neighbourhood. It provides additional capacity to manage heavy rainfall events and reduce sewer backups.

Wet Weather Flow Management Guidelines[227]

Technical guidelines for developers, engineers and city projects to manage rainwater and snowmelt runoff in a way that mimics the natural water cycle. They set design criteria for quantity, quality and erosion control, and promote green infrastructure solutions.

Sewer Use Bylaw[228]

A municipal bylaw regulating what can be discharged into the City's sewer systems, aiming to protect water quality, prevent damage to infrastructure and ensure compliance with environmental regulations. It applies to residential, commercial and industrial users.

Port Lands Flood Protection Project (Formerly Don Mouth Naturalization Project)[229]

A large-scale engineered flood-risk remediation effort that creates a new, naturalized river valley to protect the Port Lands area, including roads, from flooding events.

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[225] City of Toronto, "Western Beaches Storage Tunnel & Eastern Beaches Detention Tanks," City of Toronto – Services & Payments, accessed August 14, 2025, https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/what-the-city-is-doing-stormwater-management-projects/other-stormwater-management-projects/western-beaches-storage-tunnel-eastern-beaches-detention-tanks/.

[226] Fairbank Silverthorn Storm Trunk Sewer System

City of Toronto, "Fairbank Silverthorn Storm Trunk Sewer System," City of Toronto – Public Consultations, accessed August 14, 2025, https://www.toronto.ca/community-people/get-involved/public-consultations/infrastructure-projects/fairbank-silverthorn-trunk-storm-sewer-system/.

[227] Wet Weather Flow Management Guidelines (Supporting the Wet Weather Flow Master Plan)

City of Toronto, "Wet Weather Flow Management Guidelines," City of Toronto (PDF), accessed August 14, 2025, https://www.toronto.ca/wp-content/uploads/2017/11/9191-wwfm-guidelines-2006-AODA.pdf.

[228] Sewer Use Bylaw (Municipal Code, Chapter 681)

City of Toronto, "Sewers By-law (Municipal Code, Chapter 681)," City of Toronto – Water & Environment, accessed August 14, 2025, https://www.toronto.ca/services-payments/water-environment/water-sewer-related-permits-and-bylaws/sewers-by-law/.

[229] Toronto and Region Conservation Authority, Don Mouth Naturalization and Port Lands Flood Protection Project, TRCA – Infrastructure Projects, accessed August 14, 2025, https://trca.ca/conservation/infrastructure-projects/don-mouth-naturalization-port-lands-flood-protection-project/.

City Property Insurance

The City has a property insurance policy that covers the peril of flood with a limit of $500 million.

Potential Actions

Enhanced Road Drainage and Stormwater Management Through Targeted Improvements

Drainage system improvements include upsizing culverts, bridges, sewers, ditches and catchbasins where necessary to handle increased runoff from severe weather events and reducing runoff reaching sensitive areas (e.g. with properly sized green infrastructure).

Consider opportunities to build on improvements by conducting assessments to identify particularly vulnerable areas that require rehabilitation or upgrading of road infrastructure such as catchbasins, culverts, embankments, and other stormwater management solutions like spillways. The assessment should also explore the strategic use of green infrastructure and potential re-grading and/or redirecting water flows to help mitigate urban flooding.

Proposed methods and tools for evaluating flood risk include using drones to monitor affected areas following storm events, as well as applying topographical, hydrological and hydraulic modelling to identify vulnerable areas within or near the road network that are most susceptible to flooding or erosion due to stormwater runoff.

Proactive Inspection and Strengthening of Road Infrastructure to Mitigate Flood Risks

Flood preparedness and planning for the transportation network should include systematic and proactive inspections and condition assessments of transportation structural and drainage-related assets and their design. This includes low-lying road sections, embankments, bridges, culverts, open ditches and both open and underground watercourses, as well as the underlying soil around these features. Assessments should focus on current conditions and on identifying vulnerabilities under future climate scenarios, particularly with the increasing frequency and intensity of extreme precipitation events.

These evaluations help identify high-risk areas and support targeted improvements to strengthen infrastructure and reduce flood vulnerability. This approach recognizes that flood risk mitigation involves more than just drainage—it must also ensure that transportation infrastructure is structurally sound and resilient in the face of climate change.

Coordinated Retreat From High-Risk Areas

Coordinated retreat (planned permanent relocation) from high-risk areas is a planned process in which the City, agencies and community partners would work together to relocate people, infrastructure and activities away from locations facing severe or recurring flooding.

Building Renovations to Increase Flood-proofing

Building renovations to increase flood-proofing involve upgrading existing structures to reduce flood damage risk, such as sealing foundation cracks, installing backflow prevention valves, elevating utilities, adding sump pumps and using water-resistant materials.

Improve Real-time Customer Communications

Provide timely, multi-channel alerts that immediately inform transit riders of flood-related service disruptions, station or route closures and safe alternatives.

Acquire Emergency Backup Generators for Flood-prone Transit Stations and Operations Centres[230]

Equip flood-prone transit stations and operations centres with portable or permanent generators to keep essential lighting, pumps, communications and fare gates running when grid power is lost during a flood.

Pluvial Flood Data Collection and Analysis

Pluvial flooding occurs when intense rainfall overwhelms drainage systems' capacity or the ground's ability to absorb water and occurs outside flood plains. Pluvial flood data collection and analysis informs and supports city divisions in their work on capital programming (such as for transportation, public transit and green streets), emergency management and operational programs. Such work could help identify priority areas for remediation projects to address urban flood risks during extreme precipitation events.

Winter/Ice Storms (Snow, Ice, Freezing Rain)

Winter and ice storms are a consistently high-priority hazard for Toronto, with several impacts, such as power outages, service disruptions and cold-related health risks,rated among the highest in the assessment. Seven impact statements related to this hazard received risk scores above 30 in the current period, reflecting the wide-ranging and persistent consequences of winter storm events. Despite projections showing a general decline in extreme cold days over time, the frequency of winter and ice storms is not expected to change significantly, and their impacts remain substantial, especially due to the continued threat of freezing rain, grid failure and cascading service disruptions.

[230] City of Toronto. (2025). Emergency power needs at key TTC facilities – Status update (Background file No. 254424). https://www.toronto.ca/legdocs/mmis/2025/ttc/bgrd/backgroundfile-254424.pdf

Risk Themes

Health and Well-being

Winter storms pose distinct health risks that go beyond cold temperatures alone. While cold-related injuries such as hypothermia and frostbite are a concern, particularly for unhoused individuals, winter storms also introduce compounding threats like high winds, ice accumulation and heavy snowfall that can disrupt mobility, damage infrastructure and delay emergency response. These disruptions are especially dangerous for people who are medically dependent, such as those requiring dialysis, oxygen or refrigerated medications.

Social services and shelters are under pressure during winter storms, as demand spikes and capacity limits are reached. Overcrowding in shelters can reduce the quality and consistency of support for unhoused populations. Staff shortages and transportation challenges further hinder service delivery, leaving vulnerable individuals at higher risk of exposure to dangerous conditions.

Table 62. Actions list for health and well-being related to winter/ice storms (snow, ice, freezing rain).

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto's Emergency Response Plan, including the Extreme Winter Weather Annex Toronto's Corporate Business Continuity Management and Disaster Recovery programs Toronto Cold Weather Response Plan Promote and support emergency supplies and preparedness	
Physical harm for people who are medically dependent and unable to access treatment	High	TTC Wheel-Trans Severe-Weather Policy and Service Alerts Toronto Paramedic Services —Community Paramedicine Program	Advocate for/partner with provincial health system partners for enhanced support measures for medically dependent residents during emergencies

Impact Statement	Current Risk	Existing Action	Potential Action
Disruption of service delivery in shelters for unhoused population due to overcrowding	Medium-high	Winter Services Plan for People Experiencing Homelessness 24-hour winter respites and warming centres	Coordinate real-time shelter status Develop surge capacity plans Minimize barriers to access to encourage shelter use in extreme weather
Hypothermia, frostbite and other cold-related injuries for unhoused population	Medium-high	Enhanced street outreach (Streets-to-Homes + Community Paramedics) Warming centres and 24-hour winter respite sites Toronto Shelter and Respite Standards — Extreme Weather Measures	Minimize barriers to access to encourage shelter use in extreme weather

Current Actions

Toronto's Emergency Response Plan, Including the Extreme Winter Weather Annex

If a winter weather event is severe, long-lasting or complex enough, it may escalate to a city-wide emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to respond and reduce the impact of a public emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a winter weather event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment.

Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Cold Weather Response Plan

Outlines the preparedness and response activities of the City that focus on reducing the negative health impacts of cold weather conditions experienced every year. The goal is to enable Toronto residents, including those most vulnerable, to take appropriate precautions to avoid the harmful effects of cold weather and to outline response actions by city divisions and/or agencies that provide services or alter operations to protect vulnerable people from cold weather.

TTC Wheel-Trans Severe-Weather Policy and Service Alerts[231]

Sets service rules for snow/ice events, broadcasting weather advisories, waiving late-cancellation penalties for non-essential trips and prioritizing life-sustaining appointments, such as dialysis.

Toronto Paramedic Services — Community Paramedicine Program[232]

Ability to deploy community paramedics for proactive home visits, remote monitoring and wellness clinics so medically vulnerable residents continue receiving care when travel is disrupted.

Winter Services Plan for People Experiencing Homelessness[233]

Seasonal response (15 Nov – 15 Apr) adds ~530 surge shelter beds, extends daytime drop-ins and fields, extra outreach teams and 24-hour warming capacity whenever storms or extreme cold hit.

Twenty-four-hour Warming Centres[234]

Pet-friendly, low-barrier centres activated at –5 °C or during storm warnings and additional centres activated at –15 °C — offer rest, hot meals and referrals to emergency shelters throughout the event.

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[231] City of Toronto Transportation Services. *Major Snow Event Response Plan Update*. Report for Action, March 13, 2024. Accessed July 3, 2025. https://www.toronto.ca/legdocs/mmis/2024/ie/bgrd/backgroundfile-244182.pdf.

[232] City of Toronto. *Community Paramedicine Program*. Accessed July 3, 2025. https://www.toronto.ca/community-people/public-safety-alerts/community-safety-wellbeing-programs/community-paramedicine-program/.

[233] City of Toronto. *Winter Services Plan for People Experiencing Homelessness*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/about-torontos-shelter-system/winter-services-plan-for-people-experiencing-homelessness/.

[234] City of Toronto. *Toronto Warming Centres*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/toronto-warming-centres/.

Streets-to-Homes Enhanced Street Outreach and Community Paramedics[235]

Joint teams expand wellness checks, distribute warm gear and transport people indoors during extreme-cold alerts, reducing hypothermia and frostbite risk.

Twenty-four-hour Winter Respite Sites

Low-barrier, pet-friendly respite facilities are activated throughout the winter season and supply resting spaces, meals and service referrals, easing excess shelter demand and overcrowding in the shelter system over the winter.

Potential Actions

Advocate for /Partner With Provincial Health System Partners for Enhanced Support Measures for Medically Dependent Residents During Emergencies

Services such as Ontario Care @Home have planning in place for emergencies for individual clients. Opportunities to advocate for additional planning to support existing clients in large-scale emergencies should be explored, and potential partnerships to mitigate impact could be considered.

Develop Shelter Surge Capacity Plans

Develop plans for when there is an increased demand for shelter space and identify overflow spaces to accommodate those in need.

Minimize Barriers to Accessing Shelters

Minimizing barriers to access will encourage shelter use and reduce the chances of cold-related injuries for the unhoused population.

Infrastructure, Mobility and Communications

Winter and ice storms pose a significant threat to goods delivery, and importantly, residents' ability to access essential services, especially for those with limited mobility or specialized care needs. Travel disruptions caused by icy roads, snow accumulation or power outages can disrupt supply chains, prevent essential workers from reaching clients and make it difficult for individuals to obtain groceries, attend school or reach workplaces. These disruptions disproportionately affect people with disabilities, older adults and caregivers with dependents.

[235] City of Toronto. *Streets to Homes Street Outreach & Support Program*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/streets-to-homes-street-outreach-support-program/.

Winter storms continue to pose a serious risk to Toronto's electricity grid infrastructure. Equipment failures and tree damage, especially from falling branches laden with ice, can cause widespread power outages, disrupting heating systems and other critical services. Water infrastructure is also vulnerable, with freeze-thaw cycles and prolonged cold snaps increasing the risk and water main breaks leading to household water supply interruptions.

Already stressed by pests and drought, the urban tree canopy faces further degradation due to ice accumulation during winter storms. Broken limbs and uprooted trees reduce canopy cover and contribute to additional infrastructure damage and service interruptions. The loss of canopy has long-term consequences for urban biodiversity, shade provision and cooling effects, and stormwater management.

Table 63. Actions list for infrastructure, mobility and communications related to winter/ice storms (snow, ice, freezing rain).

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Framework for a Major Snow Event Response Plan Toronto's Emergency Response Plan, including the Extreme Winter Weather Annex Toronto's Business Continuity and Disaster Recovery Programs	Review and updates to the Major Snow Event Response Plan
Loss of access to essential services for vulnerable populations (e.g. people with physical and/or neurological disabilities may not receive care if their support worker cannot safely travel; people with limited mobility may have difficulty getting groceries, bringing their children to school and/or attending school or work themselves)	High	Wheel-Trans Severe Weather Policy	Data-driven approach to prioritize snow and ice clearing for vulnerable residents and to support equity needs

Impact Statement	Current Risk	Existing Action	Potential Action
Damage to urban tree canopy	High	Urban Forestry Storm-Damage Response	Conduct pre-winter tree assessment Plant storm-resilient, native species
Damage to grid infrastructure from failing equipment and falling trees, leading to power outages	High	Toronto Hydro Emergency Storm Response and Mutual-Aid Protocol Automated Power Restoration (Grid Sensors and FLISR) Vegetation Management and Satellite-Monitoring Program	
Interruption of household water supply resulting from frozen pipes	Medium-high	Toronto Water 24-h Water Main Break Response and Renewal Program Winter educational campaign on precautions residents can take to prevent frozen pipes Capital Water Service Replacement Program Toronto Water Customer Service Standards	Expand frozen pipe education initiatives

Current Actions

Framework for a Major Snow Event Response Plan

A 2024 TS staff report provides a framework for a Major Snow Event Response Plan, including a vision, guiding principles, prioritization process, communications strategy and after-action review. This framework modernizes how the City handles >25 cm storms, mandates earlier public alerts, implements 311 emergency-need triage, establishes equity-first snow-removal routes and makes continuous improvements after each event.

Toronto's Emergency Response Plan, Including the Flood Annex

If a winter weather event is severe, long-lasting or complex enough, it may escalate to a city-wide emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to respond and reduce the impact of a public emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a winter weather event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Wheel-Trans Severe Weather Policy[236]

Waives penalties for cancelling non-essential trips, prioritizes dialysis/life-sustaining rides and keeps accessible vehicles on the road.

Urban Forestry Storm-Damage Response[237]

The 311 hotline and rapid-response arborist crews triage hazardous trees, remove fallen limbs and clear blocked streets and power-line corridors after ice storms.

[236] Toronto Transit Commission. Severe Weather Policy. Accessed July 3, 2025. https://www.ttc.ca/wheel-trans/wheel-trans-policies/severe-weather-policy

[237] City of Toronto. Storm Damage to Trees. Accessed July 3, 2025. https://www.toronto.ca/services-payments/water-environment/trees/storm-damage-to-trees/

Toronto Hydro Emergency Storm Response and Mutual-Aid Protocol[238]

Toronto Hydro activates an emergency command centre, pre-positions line crews, uses automated switching to isolate faults and taps Ontario Mutual Assistance Group resources for surge capacity during ice-storm events.

Toronto Water 24-hour Water Main Break Response and Renewal Program[239]

The 311 service dispatches on-call crews to locate, isolate and repair burst mains; the capital program replaces 30–40 km and rehabilitates >100 km of aging water mains annually as part of the State-Of-Good-Repair program.

Winter Educational Campaign on Precautions Residents Can Take to Prevent Frozen Pipes[240]

The City of Toronto delivers an annual winter education campaign through Toronto Water to inform residents and businesses on practical steps, such as insulating pipes, draining outdoor taps and running water during extreme cold, to prevent frozen pipes and minimize service disruptions.

Capital Water Service Replacement Program[241]

Toronto's Capital Water Service Replacement Program proactively replaces aging, substandard or leak-prone service pipes.

Toronto Water Customer Service Standards

Established customer service standards are applied for service interruptions related to reported water main break and no water for water service lines.

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[238] Toronto Hydro. Toronto Hydro Supporting Hydro One's Power Restoration Efforts. News release, April 2, 2025. Accessed July 3, 2025. https://www.torontohydro.com/en/newsroom?_thmodulenewsroom_mvcRenderCommandName=%2FreleaseArticle&_thmodulenewsroom_pageNum=1&_thmodulenewsroom_releaseArticleId=123219&_thmodulenewsroom_startDate=2025-04-04&p_p_id=thmodulenewsroom&p_p_lifecycle=0&p_p_mode=view&p_p_state=normal.

[239] City of Toronto. Water and Sewer Mains. Accessed July 3, 2025. https://www.toronto.ca/services-payments/building-construction/infrastructure-city-construction/understanding-city-construction/water-sewer-mains/.

[240] City of Toronto, "City of Toronto Frozen Pipes Public Education Campaign Encourages Residents to Take Action During Extreme Cold Temperatures," *News Release*, January 4, 2022, *City of Toronto*, accessed August 15, 2025, https://www.toronto.ca/news/city-of-toronto-frozen-pipes-public-education-campaign-encourages-residents-to-take-action-during-extreme-cold-temperatures/.

[241] City of Toronto, "Capital Water Service Replacement Program," *City of Toronto*, accessed August 15, 2025, https://www.toronto.ca/services-payments/water-environment/tap-water-in-toronto/lead-drinking-water/capital-water-service-replacement-program/.

Potential Actions

Data-driven Approach to Prioritize Snow and Ice Clearing for Vulnerable Residents to Support Equity Needs[242]

Apply a data-driven approach to inform route prioritization of snow and ice clearing operations, leveraging qualitative and quantitative data to support vulnerable residents and equity needs, including for people living with disabilities and gender equity; access to transit services; locations with hospital and emergency services; school zones and cycling infrastructure.

Conduct Pre-winter Risk Assessment of Trees

Inspect city-owned trees (especially older and high-risk species) to identify structural weaknesses and prioritize pruning or removal.

Plant Storm-resilient, Native Species

Encourage planting of native or adapted species with flexible limbs and strong root systems.

Expand Frozen Pipe Education Initiatives

Expand the City's frozen pipe education program to reach more residents and businesses through targeted outreach, multilingual resources and seasonal campaigns that provide practical steps to prevent pipe freezing and reduce winter service disruptions.

High Winds/Tornadoes

High winds and tornadoes present a persistent and widespread risk to public safety, infrastructure and urban ecosystems in Toronto. Eight impact statements associated with this hazard received risk scores above 30 in the current period, including risks of physical injury, displacement and infrastructure failure. These impacts are especially severe for unhoused populations, residents in structurally vulnerable buildings and those dependent on uninterrupted services such as electricity or emergency shelter. While the frequency of

high-wind events is not projected to increase significantly over time, their ability to cause rapid, large-scale disruption ensures they remain a priority concern for resilience planning.

[242] Transportation Services Division, Annual Winter Maintenance Report, Background Report, Infrastructure & Environment Committee (City of Toronto, June 18, 2024), 15, in Agenda Item 2024.IE15.3

Risk Themes

Health and Well-being

High winds and tornadoes pose direct threats to physical safety, and they have the potential to cause injury or death due to flying debris, falling trees or tree branches and structural damage. These risks are especially acute for individuals without access to secure shelter, such as unhoused populations, or those in deteriorating buildings. Even short-duration wind events can have life-threatening consequences when debris is carried at high speed or when infrastructure fails.

Unhoused individuals are particularly vulnerable during high-wind events. Inadequate shelter, lack of access to secure indoor spaces and limited communication channels make it difficult to respond to warnings or take protective action. High winds can destroy tents, temporary structures or encampments, displacing residents and creating cascading needs for emergency services, shelter space and health care.

During high-wind events, social service providers may experience surges in demand, especially as unhoused residents seek emergency shelter. Overcrowding in facilities can limit the ability to deliver safe, effective support. Staffing shortages and transportation delays can further strain service continuity, especially in lower-resourced neighbourhoods or during concurrent emergencies (e.g. wind and rain).

Table 64. Actions list for health and well-being related to high winds/tornadoes.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto's Emergency Response Plan Toronto's Business Continuity Management and Disaster Recovery programs	
Displacement of unhoused population	High	Shelter Standards — Extreme Weather Surge Capacity	Explore enhanced mapping for encampments and high-risk locations
Injury or death due to flying debris	High	Urban Forestry Hazard-Tree and Storm-Damage Program Pedestrian- Level Wind Study Requirement	Wind-resilient building standards

Impact Statement	Current Risk	Existing Action	Potential Action
Disruption of service delivery in shelters for the unhoused population due to overcrowding	Medium -high	Shelter Standards — Extreme Weather Surge Capacity	Evaluate the need for additional shelter capacity during weather events

Current Actions

Toronto's Emergency Response Plan, Including the Flooding Annex

If a wind event is severe, long-lasting or complex enough, it may escalate to an emergency requiring enhanced coordination. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

Business Continuity Management Program and Disaster Recovery Programs

If a precipitation event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for City Divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Shelter and Respite Standards — Extreme Weather Surge Capacity[243]

The Toronto Shelter Standards and the 24-Hour Respite Site Standards direct that every shelter, respite or 24-hour drop-in should ensure at least one air-conditioned cooling area is available to clients (specific to a heat-based alert), suspend service restrictions, relax admission rules, provide or extend daytime access to sites, help clients obtain appropriate basic clothing and footwear and legally exceed funded bed capacity during any weather alert that endangers clients (including high-wind events).

[243] City of Toronto, *Toronto Shelter Standards* (Toronto: City of Toronto, March 28, 2023), accessed July 4, 2025, https://www.toronto.ca/wp-content/uploads/2023/03/9828-Toronto-Shelter-Standards230328AODA.pdf.

Urban Forestry Hazard-Tree and Storm-Damage Program[244]

Crews inspect and proactively prune 600,000+ street and park trees on a rolling cycle and run 24-hour emergency call-outs via 311 to remove limbs or whole trees that threaten pedestrians and traffic after wind storms.

Pedestrian-Level Wind Study Requirement[245]

Since 2022, all mid- and high-rise planning applications that trigger height/context thresholds must submit a Computational Fluid Dynamics/Wind-Tunnel study and incorporate wind-control design (podiums, canopies, screens) to keep ground-level gusts within comfort and safety limits, reducing the chance of debris-driven injuries.

Potential Actions

Explore Enhanced Mapping for Encampments and High-risk Locations

Explore maintaining a real-time map of encampment locations, especially in ravines, parks and open spaces vulnerable to wind exposure. Support relocation to safer sites out of high-risk zones (e.g. ravines, waterfront) during windstorm and flooding alerts.

Wind-Resilient Building Standards

Update or enforce municipal codes requiring secure anchoring of signage, awnings, rooftop materials and street furniture.

Evaluate the Need for Additional Shelter Capacity During Extreme Weather Events

Evaluate current and future demand for shelter during extreme heat events to determine if additional capacity, extended hours or new locations are needed to protect vulnerable populations.

Infrastructure, Mobility and Communications

Electricity distribution systems are vulnerable to damage from strong winds, especially when trees or branches fall on power lines. These outages can disrupt heating, cooling and communications, amplifying risks for medically dependent populations and straining emergency response. As with ice storms, damaged infrastructure often requires complex and time-consuming repairs, extending the duration of service interruptions.

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[244] City of Toronto, **"City-Owned Tree Maintenance,"** *Water & Environment – Trees*, City of Toronto, accessed July 4, 2025, https://www.toronto.ca/services-payments/water-environment/trees/city-owned-tree-maintenance/.

[245] City of Toronto. *Pedestrian Level Wind Study Terms of Reference Guide*. Toronto: City of Toronto, March 2022. Accessed July 4, 2025. https://www.toronto.ca/wp-content/uploads/2022/03/8f9c-CityPlanning-ToR-Wind-Guide.pdf.

Table 65. Actions list for infrastructure, mobility and communications related to high winds/tornadoes.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto's Emergency Response Plan Toronto's Business Continuity Management and Disaster Recovery programs	
Infrastructure damage from high winds and falling trees damaging electrical infrastructure, leading to power outages	High	Toronto Hydro Emergency Storm Response and Mutual-Aid Protocol Automated Power Restoration (Grid Sensors and FLISR) Vegetation Management and Satellite-Monitoring Program	Leverage risk-based cost-benefit analysis to identify opportunities for targeted undergrounding of the overhead system

Current Actions

Toronto's Emergency Response Plan

If a high-wind event is severe, long-lasting or complex enough, it may escalate to an emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to respond and reduce the impact of a public emergency and restore the municipality to a normal state as soon as possible.

Business Continuity Management Program and Disaster Recovery Programs

If a high-wind event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program, designed to support restoration of critical IT systems and data recovery.

Toronto Hydro Emergency Storm Response and Mutual-Aid Protocol[246]

Toronto Hydro activates an emergency command centre, pre-positions line crews, uses automated switching to isolate faults, and taps Ontario Mutual Assistance Group resources for surge capacity during ice-storm events.

Automated Power Restoration (Grid Sensors and FLISR)[247]

Toronto Hydro is rolling out grid sensors, automated switches and Fault Location-Isolation-Service Restoration (FLISR) so the system can isolate a fault and reroute power automatically, sharply cutting outage duration after storm damage.

Vegetation Management and Satellite-Monitoring Program[248]

Toronto Hydro completed a pilot to pair routine line-clearance work with satellite imagery that highlights feeders most at risk from tree strikes, reducing wind-related interruptions. Full implementation will begin next year.

Environmental Strain

Urban and natural tree canopies face widespread damage during high-wind events. Mature trees — already stressed by disease, pests, or extreme weather — can be uprooted or lose large limbs. This poses physical hazards and contributes to biodiversity loss and long-term environmental degradation. In forested areas, high winds can lead to the loss of old-growth stands and significant habitat disruption for sensitive species.

Table 66. Actions list for natural environment related to high winds/tornadoes.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto Biodiversity Strategy	
Damage to urban tree canopy	High	Urban Forestry Storm-Damage Response	Plant wind resilient tree species

[246] Toronto Hydro. Toronto Hydro Supporting Hydro One's Power Restoration Efforts. News release, April 2, 2025. Accessed July 3, 2025. https://www.torontohydro.com/en/newsroom?_thmodulenewsroom_mvcRenderCommandName=%2FreleaseArticle&_thmodulenewsroom_pageNum=1&_thmodulenewsroom_releaseArticleId=123219&_thmodulenewsroom_startDate=2025-04-04&p_p_id=thmodulenewsroom&p_p_lifecycle=0&p_p_mode=view&p_p_state=normal.

[247] Toronto Hydro, *Climate Action: 2023 Year-End Status Report* (Toronto: Toronto Hydro-Electric System Limited, [June 2024]), accessed July 4, 2025, https://www.toronto.ca/legdocs/mmis/2024/ex/bgrd/backgroundfile-247685.pdf.

[248] Toronto Hydro, *2023 Toronto Hydro Environmental Performance Report* (Toronto: Toronto Hydro Corporation, March 21, 2024), accessed July 4, 2025, https://www.toronto.ca/legdocs/mmis/2024/ex/bgrd/backgroundfile-247416.pdf.

Impact Statement	Current Risk	Existing Action	Potential Action
Loss of old growth trees or mature forest habitats	Medium-high		Plant windbreaks on forest edges Expand selective pruning and thinning programs to reduce storm damage and power outage risks
Damage to trees and impact on biodiversity	Medium-high	Toronto Nature Stewards — Community Stewardship Program	Create habitat buffers

Current Actions

Toronto Biodiversity Strategy[249]

City-wide plan with 23 actions (protect, restore, design, engage) guides habitat restoration and species protection to reduce biodiversity losses after extreme winds.

Urban Forestry Storm-Damage Response[250]

The 311 hotline and rapid-response arborist crews triage hazardous trees, remove fallen limbs and clear blocked streets and powerline corridors after wind storms.

Toronto Nature Stewards — Community Stewardship Program[251]

Volunteers, supported by Urban Forestry staff, now manage ravine sites, removing invasives and re-planting natives, boosting post-storm ecosystem recovery.

Potential Actions

Plant Wind-resilient Tree Species

Select deep-rooted, flexible native trees for new plantings and increase species and age diversity across the canopy to minimize mass loss from storm events.

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[249] Toronto City Planning and Parks, Forestry and Recreation, with Toronto and Region Conservation Authority, *Wild, Connected and Diverse: A Biodiversity Strategy for Toronto* (Toronto: City of Toronto, September 2019), accessed July 4, 2025, https://www.toronto.ca/legdocs/mmis/2019/ie/bgrd/backgroundfile-136906.pdf.

[250] City of Toronto. Storm Damage to Trees. Accessed July 3, 2025. https://www.toronto.ca/services-payments/water-environment/trees/storm-damage-to-trees/

[251] Howie Dayton and Tom Azouz, "2025 Operating Budget Briefing Note: Toronto Nature Stewards," briefing note prepared for the Budget Committee (Toronto: City of Toronto, January 20, 2025), accessed July 4, 2025, https://www.toronto.ca/legdocs/mmis/2025/bu/bgrd/backgroundfile-252799.pdf

Expand Selective Pruning and Thinning Programs to Reduce Storm Damage and Power Outage Risks

Use ecologically sensitive pruning and thinning to reduce canopy competition, allowing dominant trees to build deeper roots and stronger structures.

Plant Windbreak Buffers Along Old Growth Forest Edges

Plant native shrubs and small trees along the forest edge to reduce wind funneling and gust exposure.

Create Habitat Buffers and Windbreaks

Establish dense plantings of shrubs and understory species to reduce wind penetration and shelter wildlife.

Very Cold Days and Extreme Cold

Very cold days and extreme cold events continue to pose significant health and infrastructure risks in Toronto, particularly for medically vulnerable and unhoused populations. In the current period, six impact statements related to this hazard received risk scores above 30, reflecting the seriousness of cold-related impacts such as hypothermia, service disruption and heating cost burdens. However, these risks are projected to decline in the coming decades as winter temperatures rise and the frequency of extreme cold events decreases. Under a moderate emissions scenario (SSP2-4.5), four of the five risks fall below the priority threshold in the future period. Despite this overall reduction, occasional extreme cold events are still expected and can lead to severe localized impacts, especially where infrastructure and social services remain vulnerable.

Risk Themes

Health and Well-being

Extreme cold continues to pose serious health risks, particularly for medically vulnerable individuals who rely on timely access to care. Disruptions caused by snow, ice or transportation delays can prevent these individuals from receiving critical treatments such as dialysis, respiratory support or medication refills. At the same time, unhoused populations face direct threats from prolonged cold exposure, with risks of hypothermia, frostbite and even death during extreme cold events.

During extreme cold events, shelter systems often face surging demand, leading to overcrowding and reduced service capacity. This can hinder the ability to meet basic needs for warmth, hygiene and safety, especially for unhoused individuals. Overstretched service providers may be unable to accommodate everyone, leaving some individuals without access to adequate protection from the cold.

Table 67. Actions list for health and well-being related to very cold days and extreme cold.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Cold Weather Response Plan Toronto's Emergency Response Plan, including the Extreme Heat Emergency Annex Toronto's Corporate Business Continuity Management and Disaster Recovery programs	
Physical harm for people who are medically dependent and unable to access treatment	High	TTC Wheel-Trans Severe-Weather Policy and Service Alerts Toronto Paramedic Services — Community Paramedicine Program	Advocate for/partner with provincial health system partners for enhanced support measures for medically dependent residents during emergencies
Disruption of service delivery in shelters for unhoused population due to overcrowding	Medium-high	Winter Services Plan for People Experiencing Homelessness 24-hour warming centres and winter respite centres	Evaluate the need for additional shelter capacity during extreme weather events

Impact Statement	Current Risk	Existing Action	Potential Action
Hypothermia and frostbite for unhoused population	Medium-high	Enhanced street outreach (Streets to Homes and Community Paramedics) Warming centres and 24-hour winter respite sites Shelter Standards — Extreme Weather Measures	Evaluate the need for additional shelter capacity during extreme heat events

Current Actions

Cold Weather Response Plan

Outlines the preparedness and response activities of the City that focus on reducing the negative health impacts of cold weather conditions experienced every year, with the goal to enable Toronto residents, including those most vulnerable, to take appropriate precautions to avoid the harmful effects of cold weather and to outline response actions by city divisions and/or agencies that provide services or alter operations to protect vulnerable people from cold weather.

Toronto's Emergency Response Plan, Including the Extreme Winter Weather Annex

If an extreme cold event is severe, long-lasting or complex enough, it may escalate to a city-wide emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If an extreme cold event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

TTC Wheel-Trans Severe-Weather Policy and Service Alerts[252]

Sets service rules for snow/ice events, broadcasting weather advisories, waiving late-cancellation penalties for non-essential trips and prioritizing life-sustaining appointments such as dialysis.

Toronto Paramedic Services — Community Paramedicine Program[253]

Ability to deploy community paramedics for proactive home visits, remote monitoring and wellness clinics so medically vulnerable residents continue receiving care when travel is disrupted.

Winter Services Plan for People Experiencing Homelessness[254]

Seasonal response (15 Nov – 15 Apr) adds ~530 surge shelter beds, extends daytime drop-ins and fields extra outreach teams and 24-hour warming capacity whenever storms or extreme cold hit.

Twenty-Four-hour Warming Centres[255]

Pet-friendly, low-barrier centres activated at –5 °C or during storm warnings, with additional sites activated at –15 C. They offer spaces to rest, hot meals and referrals to emergency shelters throughout the event.

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[252] City of Toronto Transportation Services. *Major Snow Event Response Plan Update*. Report for Action, March 13, 2024. Accessed July 3, 2025. https://www.toronto.ca/legdocs/mmis/2024/ie/bgrd/backgroundfile-244182.pdf.

[253] City of Toronto. *Community Paramedicine Program*. Accessed July 3, 2025. https://www.toronto.ca/community-people/public-safety-alerts/community-safety-wellbeing-programs/community-paramedicine-program/.

[254] City of Toronto. *Winter Services Plan for People Experiencing Homelessness*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/about-torontos-shelter-system/winter-services-plan-for-people-experiencing-homelessness/.

[255] City of Toronto. *Toronto Warming Centres*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/toronto-warming-centres/.

Streets to Homes Enhanced Street Outreach and Community Paramedics[256]

Joint teams expand wellness checks, distribute warm gear and transport people indoors during extreme-cold alerts, reducing hypothermia and frostbite risk.

Shelter and Respite Standards — Extreme Weather Measures[1]

The Toronto Shelter Standards and Toronto Respite Standards direct that every shelter, respite or 24-h drop-in may suspend service restrictions, relax admission rules, provide or extend daytime access to sites, help clients obtain appropriate basic clothing and footwear and legally exceed funded bed capacity during any weather alert that endangers clients (including high-wind events). Further action can be taken to clarify and communicate on this standard to shelter operators.

Twenty-four-hour Winter Respite Sites[257]

Low-barrier, pet-friendly respite facilities are activated throughout the winter season and supply resting spaces, meals and service referrals, easing excess shelter demand and overcrowding in the shelter system over the winter.

Potential Actions

Advocate for/Partner With Provincial Health System Partners for Enhanced Support Measures for Medically Dependent Residents During Emergencies

Services such as Ontario Care @Home have planning in place for emergencies for individual clients; however, opportunities to advocate for additional planning to support existing clients in large-scale emergencies should be explored, and potential partnerships to mitigate impact could be considered.

Evaluate the Need for Additional Shelter Capacity During Extreme wWeather Events

Evaluate current and future demand for shelter during extreme heat events to determine if additional capacity, extended hours or new locations are needed to protect vulnerable populations.

Infrastructure, Mobility and Communications

Cold temperatures increase the risk of burst municipal pipes and household water supply interruptions. Freeze-thaw cycles can cause water mains to crack or rupture, leading to service disruptions and costly repairs. These interruptions disproportionately impact households without backup water access or adequate insulation.

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[256] City of Toronto. *Streets to Homes Street Outreach & Support Program*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/streets-to-homes-street-outreach-support-program/.

[257] City of Toronto. *24-Hour Respite Sites*. Accessed July 3, 2025. https://www.toronto.ca/community-people/housing-shelter/homeless-help/24-hour-respite-sites/.

Table 68. Actions list for infrastructure, mobility and communications related to very cold days and extreme cold.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto's Emergency Response Plan, including the Extreme Winter Weather Annex Toronto's Corporate Business Continuity and Disaster Recovery programs	
Interruption of household water supply resulting from burst municipal pipes	Medium-high	Toronto Water 24-hour Water main Break Response and Renewal Program Winter educational campaign on precautions residents can take to prevent frozen pipes Capital Water Service Replacement Program Toronto Water Customer Service Standard	Expand frozen pipe education initiatives

Existing Action

Toronto's Emergency Response Plan, Including the Flood Annex

If a precipitation event is severe, long-lasting or complex enough, it may escalate to an emergency. The Emergency Response Plan details how the City responds to an emergency impacting Toronto. The Plan follows an all-hazards approach, enabling early and integrated coordination across the City's divisions, agencies and corporations; other levels of government; and external stakeholders who play a critical role in emergency response. The Plan ensures that all players are fully aware of their respective roles and responsibilities during an emergency. The goal is to reduce the impact of an emergency and restore the municipality to a normal state as soon as possible.

The Plan is supported by hazard-specific annexes that provide additional detail regarding how the City would coordinate its response to individual hazards, including extreme winter weather, extreme heat and flooding.

Business Continuity Management Program and Disaster Recovery Programs

If a precipitation event is severe, long-lasting or complex enough to impact city workers, buildings or technology, the City of Toronto has a Business Continuity Management Program for city divisions that is meant to support continued delivery of time-critical services during disruptions to facilities, staffing levels, technology, supplies or equipment. Additionally, the Technology Services Division leads a Disaster Recovery Program designed to support restoration of critical IT systems and data recovery.

Potential Actions

Winter Educational Campaign on Precautions Residents Can Take to Prevent Frozen Pipes[258]

The City of Toronto delivers an annual winter education campaign through Toronto Water to inform residents and businesses on practical steps, such as insulating pipes, draining outdoor taps and running water during extreme cold, to prevent frozen pipes and minimize service disruptions.

Capital Water Service Replacement Program[259]

Toronto's Capital Water Service Replacement Program proactively replaces aging, substandard or leak-prone service pipes.

Affordability

Extreme cold drives up energy demand and household heating costs, placing financial strain on low-income residents. For many vulnerable populations, this strain forces difficult trade-offs between paying for heat and meeting other essential needs — particularly food. As a result, food bank demand often increases during cold spells, reflecting broader pressures on household resilience.

Table 69. Actions list for affordability related to very cold days and extreme cold.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto Poverty Reduction Strategy	

[258] City of Toronto, "City of Toronto Frozen Pipes Public Education Campaign Encourages Residents to Take Action During Extreme Cold Temperatures," *News Release*, January 4, 2022, *City of Toronto*, accessed August 15, 2025, https://www.toronto.ca/news/city-of-toronto-frozen-pipes-public-education-campaign-encourages-residents-to-take-action-during-extreme-cold-temperatures/.

[259] City of Toronto, "Capital Water Service Replacement Program," *City of Toronto*, accessed August 15, 2025, https://www.toronto.ca/services-payments/water-environment/tap-water-in-toronto/lead-drinking-water/capital-water-service-replacement-program/.

Impact Statement	Current Risk	Existing Action	Potential Action
Increased energy costs on affordable and social housing tenants	Medium-high	Low-Income Energy Assistance Program Toronto Community Housing deep-retrofit pilots	Energy-savings program coordination and communication
Demand for food banks often increases during extreme cold events as vulnerable populations face higher expenses (e.g. heating costs), leaving less income for food	Medium-high	Community Fridges TO Second Harvest Food-Rescue Program Student Nutrition Program expansion (2025 budget) Food banks	Expanded integration of food hubs Expand partnerships with food rescue organizations and local businesses to recover near-expiring food and redistribute it

Current Actions

Toronto Poverty Reduction Strategy[260]

The Toronto Poverty Reduction Strategy is the City of Toronto's long-term strategy to address immediate needs, create pathways to prosperity and drive systemic change for those living in poverty in the city.

Low-Income Energy Assistance Program [261]

Emergency grants to avoid disconnection during peak-season arrears.

[260] City of Toronto, "Toronto Poverty Reduction Strategy," *Long-Term Vision, Plans & Strategies – Poverty Reduction Strategy*, accessed June 12, 2025, City of Toronto, https://www.toronto.ca/city-government/accountability-operations-customer-service/long-term-vision-plans-and-strategies/poverty-reduction-strategy/.

[261] Ontario Energy Board, "Low-income Energy Assistance Program," *Bill Assistance Programs*, accessed June 12, 2025, Ontario Energy Board, https://www.oeb.ca/consumer-information-and-protection/bill-assistance-programs/low-income-energy-assistance-program.

Toronto Community Housing Deep-retrofit Pilots[262]

To date, TCHC has completed more than a dozen deep building retrofits. Where possible, TCHC will continue to invest in deep building retrofit projects that address many elements of our capital targets, including increasing energy savings, improving building conditions and making housing more accessible.

Community Fridges TO[263]

Volunteer-run network of free, 24-hour outdoor fridges (eight sites city-wide) that keep perishables available when household cooling fails.

Second Harvest Food-Rescue Program[264]

Diverts surplus perishable food from retailers to more than 250 Toronto agencies, buffering supply spikes when heat spoils donations.

Food Banks

There are more than 200 food banks in Toronto, and the number of visits to food banks continues to rise. During extreme heat, food banks can help vulnerable individuals and families by providing access to resources and community support.

Student Nutrition Program Expansion (2025 Budget)[265]

Council-funded rollout of universal morning meal by 2026 and universal lunch by 2030, reducing child hunger during hotter, high-energy-cost months where there may be challenges around food preservation.

Potential Actions

Energy-savings Program Coordination and Communication

Coordinated outreach campaign in the most-at-risk neighbourhoods to boost enrollment and simplify access to available energy-saving programs.

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[262] Toronto Community Housing Corporation, "Retrofit TCHC Building Will Yield Climate, Affordability, and Community Benefits," *News & Updates*, accessed June 12, 2025, Toronto Community Housing Corporation, https://torontohousing.ca/building-construction-and-revitalization/capital-repairs/deep-building-retrofits#section_2_jump

[263] Community Fridges Toronto, "Community Fridges TO," accessed June 12, 2025, https://communityfridgesto.org/.

[264] Second Harvest, "What We Do," *About*, accessed June 12, 2025, Second Harvest, https://www.secondharvest.ca/about/about.

[265] City of Toronto, Building Towards a Universal Student Food Program in Toronto: Background Report for TS4.1 (Toronto: City of Toronto, February 26, 2025), accessed June 12, 2025, https://www.toronto.ca/legdocs/mmis/2025/ts/bgrd/backgroundfile-253417.pdf.

Expanded Integration of Food Hubs

Food hubs could be further integrated into community hubs and resilience hubs to support those who need it most in times of emergency.

Expand Partnerships With Food Rescue Organizations and Local Businesses to Recover Near-expiring Food and Redistribute It

Expand partnerships with food rescue organizations and local businesses to recover near-expiring food and redistribute it through community hubs, improving equity and strengthening food system resilience during climate disruptions.

Ecosystem Changes

Ecosystem changes driven by climate change are emerging as a growing concern for both environmental health and public well-being in Toronto. Three impact statements associated with this hazard received risk scores above 30 in the current period, with all three projected to escalate further in the coming decades. These priority impact statements with current risk are summarized in Table 70. Risks related to tree loss, invasive species, vector-borne disease and allergens are expected to become more severe as climate conditions continue to shift. Warmer temperatures, longer growing seasons and increased pest survival are already straining urban ecosystems, with consequences for biodiversity, air quality and human health, particularly among vulnerable populations with limited access to climate-controlled indoor spaces.

Risk Themes

Environmental Strain

Climate change is intensifying environmental pressures on urban ecosystems. Ecosystem changes threaten biodiversity and the natural environment and can lead to a loss of trees and other vegetation from insects and disease. Biodiversity can also be impacted from invasive species that threaten native species as climate zones shift. Warmer winters allow more insects and pathogens to survive year-round, weakening trees and increasing mortality rates. Combined with drought stress from hotter, drier summers, this threatens the long-term health and function of Toronto's tree canopy.

Table 70. Actions list for environmental strain related to ecosystem changes.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		Toronto Biodiversity Strategy Toronto's Pollinator Protection Strategy	
Invasive species threaten native species and biodiversity	High	Ravine Strategy —Invasive-Species Management Boost Emerald Ash Borer (EAB) Treatment and Recovery Plan Spongy Moth Integrated Pest-Management (IPM) Program Citizen science programs focused on invasive plants	Ban the sales of invasive species, encourage planting of native species
Loss of natural areas from insects or disease	Medium-high	Emerald Ash Borer (EAB) Treatment and Recovery Plan Spongy Moth Integrated Pest-Management (IPM) Program	Increase monitoring for emerging pests and pathogens

Current Actions

Toronto Biodiversity Strategy[266]

City-wide plan with 23 actions (protect, restore, design, engage) guides habitat restoration and species protection to reduce biodiversity losses after extreme winds.

Ravine Strategy — Invasive-Species Management Boost[267]

City Council approved an extra $2.05 million per year (phased-in) to double invasive-species removal and ecological restoration across 480 ha of ravine parkland, mobilizing staff, contractors and volunteers to hold back aggressive plants and pests.

[266] Toronto City Planning and Parks, Forestry and Recreation, with Toronto and Region Conservation Authority, *Wild, Connected and Diverse: A Biodiversity Strategy for Toronto* (Toronto: City of Toronto, September 2019), accessed July 4, 2025, https://www.toronto.ca/legdocs/mmis/2019/ie/bgrd/backgroundfile-136906.pdf.

[267] City of Toronto, "Ravine Strategy," *Long-Term Vision, Plans & Strategies*, City of Toronto, accessed July 4, 2025, https://www.toronto.ca/city-government/accountability-operations-customer-service/long-term-vision-plans-and-strategies/ravine-strategy/.

Spongy Moth Integrated Pest-Management Program[268]

Urban Forestry tracks egg-mass densities, runs public reporting via 311, and, when warranted, deploys egg scraping, burlap banding and targeted Btk sprays to curb canopy-stripping outbreaks.

Citizen Science Programs Focused on Invasive Species[269]

The TRCA offers a Citizen Science Volunteer Program focused on invasive management. Volunteers receive training to identify and remove invasive plants, helping to restore naturalized areas.

Emerald Ash Borer (EAB) Treatment and Recovery Plan[270]

Each summer the City injects ≈ 5,300 priority ash trees with TreeAzin® and removes/replants dead ash, limiting further mortality and safeguarding mature forest structure.

Potential Actions

Ban the Sale of Invasive Species

Control the spread of invasive species by enforcing local restrictions on invasive plants. Provide resources and incentives for homeowners, developers and institutions to plant native species instead. Mulch, soil and compost can also be monitored to ensure they are free of invasive weeds.

Increase Monitoring for Emerging Pests and Pathogens

Expand surveillance programs for high-risk species such as *emerald ash borer*, *spongy moth* and *oak wilt.* Use early detection and rRapid response protocols and train city staff and community members to identify infestations early and respond before outbreaks become unmanageable.

Toronto's Pollinator Protection Strategy[271]

Toronto's Pollinator Protection Strategy is an ongoing city-wide plan to create, enhance and protect pollinator habitat and reduce threats, engaging residents through programs like PollinateTO, to support native bees and butterflies and strengthen urban biodiversity.

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[268] City of Toronto, "Spongy Moth (Lymantria dispar dispar)," *Threats to Trees: Insects*, *Forest Management*, *Trees in Toronto*, *Water & Environment*, City of Toronto, accessed July 4, 2025, https://www.toronto.ca/services-payments/water-environment/trees/forest-management/threats-to-trees-insects/spongy-moth/.

[269] Toronto and Region Conservation Foundation, "Citizen Scientists Take Action!," last modified October 6, 2021, accessed July 4, 2025, https://foundation.trca.ca/news/2021/10/citizen-scientists-take-action/.

[270] City of Toronto, "City of Toronto Begins Treatment to Protect Vulnerable Ash Trees," *News Release*, May 23, 2025, accessed July 4, 2025, https://www.toronto.ca/news/city-of-toronto-begins-treatment-to-protect-vulnerable-ash-trees/.

[271] City of Toronto, "Pollinator Protection Strategy," *City of Toronto*, accessed August 15, 2025, https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/reports-plans-policies-research/draft-pollinator-strategy/.

Climate-related Air Quality Hazards

Climate-related air quality hazards are already contributing to elevated health risks in Toronto. Three impact statements score 30 or higher in the current time period, underscoring the immediate threat posed to the unhoused population and individuals with chronic health conditions. These include increased respiratory illnesses, overcrowding-related service disruptions in shelters and adverse health effects from poor air quality. As climate change accelerates, these risks are expected to intensify, reinforcing the need for targeted public health and social service interventions.

Risk Themes

Health and Well-being

Climate-related air quality hazards can have many impacts on the health and well-being of the city's residents. The unhoused population in particular will experience adverse effects as air quality declines with climate change. Respiratory illness is likely to increase, as well as adverse health consequences for people living with chronic conditions like COPD and asthma.

Table 71. Actions list for environmental strain related to ecosystem changes.

Impact Statement	Current Risk	Existing Action	Potential Action
Cross-cutting		TPH Wildfire Smoke Response Strategy Cleaner Air Spaces Network	
Increase in respiratory illnesses for unhoused population	High	Increase in respiratory illnesses for unhoused population	
Disruption of service delivery in shelters for unhoused population due to overcrowding	Medium-high	Shelter Standards — Extreme Weather/ Smog Alert Protocol Streets to Homes outreach surge	Open extended-hours centres with air filtration

Impact Statement	Current Risk	Existing Action	Potential Action
Adverse health consequences from poor air quality for vulnerable populations (e.g. people who are pregnant, infants and children; older adults; people with chronic health conditions such as COPD or asthma)	Medium-high	AQHI-based program modifications and public alerts	Upgrade HVAC systems in schools, daycares and other facilities Add air filtration requirements to Toronto Green Standards

Current Actions

TPH Wildfire Smoke Response Strategy[272]

Activates when Environment and Climate Change Canada issues a Special Air Quality Statement or Air Quality Advisory. Actions include targeted outreach to shelters, distribution of N95 masks, health messaging through Streets to Homes teams and promotion of the Cleaner Air Spaces Network.

Cleaner Air Spaces Network[273]

A network of publicly accessible spaces that provide places to go for people who face barriers accessing cleaner air and air filtration during wildfire smoke events.

Shelter and Respite Standards — Extreme Weather/Smog Alert Protocol[274]

The Toronto Shelter Standards and Toronto Respite Standards direct that every shelter, respite or 24-hour drop-in may suspend service restrictions, relax admission rules, provide or extend daytime access to sites, help clients obtain appropriate basic clothing and footwear and legally exceed funded bed capacity during any weather alert that endangers clients (including high-wind events). Further action can be taken to clarify and communicate on this standard to shelter operators.

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[272] City of Toronto, "Wildfire Smoke Response Strategy," *Air Quality*, Health Programs & Advice, Health, Wellness & Care, City of Toronto, accessed July 4, 2025, ttps://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/air-quality/wildfire-air-quality-strategy/

[273] Dr. Michael Finkelstein and Dr. Howard Shapiro, "Update: Wildfire Smoke Response Strategy," briefing document prepared for the Board of Health (Toronto: City of Toronto, 2024), accessed July 4, 2025, https://www.toronto.ca/legdocs/mmis/2024/hl/bgrd/backgroundfile-247466.pdf.

[274] City of Toronto, *Toronto Shelter Standards* (Toronto: City of Toronto, March 28, 2023), accessed July 4, 2025, https://www.toronto.ca/wp-content/uploads/2023/03/9828-Toronto-Shelter-Standards230328AODA.pdf.

Streets to Homes Outreach Surge[275]

During AQHI advisories, outreach teams conduct wellness checks and transport people indoors, easing pressure on fixed-site programs.

AQHI-based Program Modifications and Public Alerts[276]

Toronto Public Health issues guidance via news releases and social media, and city divisions move outdoor recreation, daycare and museum programs indoors or cancel them when AQHI ≥ 7–10 + (aligned with the health messages in the AQHI or the health messages contained in an Air Quality Warning issued by Environment and Climate Change Canada).

Potential Actions

Open Extended-hours Centres With Air Filtration

During peak hazard periods, provide additional spaces equipped with HEPA or other filtration and train staff in respiratory safety.

Upgrade HVAC Systems in Schools, Daycares and Other Facilities

Ensure that the air is safe in buildings where children and other vulnerable people can have access to clean air. Advocate for upgrades for facilities under provincial authority.

Add Air Filtration Requirements to Toronto Green Standards

Update the Toronto Green Standards to include minimum air filtration requirements in new buildings to improve indoor air quality during poor outdoor air conditions.

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[275] City of Toronto, "Toronto Public Health Encouraging Residents to Follow Canada's Air Quality Health Index, City of Toronto Adjusts Some Programming," *News Release*, June 28, 2023, accessed July 4, 2025, https://www.toronto.ca/news/toronto-public-health-encouraging-residents-to-follow-canadas-air-quality-health-index-city-of-toronto-adjusts-some-programming/

[276] City of Toronto, "Toronto Public Health Encouraging Residents to Follow Canada's Air Quality Health Index, City of Toronto Adjusts Some Programming," *News Release*, June 28, 2023, accessed July 4, 2025, https://www.toronto.ca/news/toronto-public-health-encouraging-residents-to-follow-canadas-air-quality-health-index-city-of-toronto-adjusts-some-programming/

System-level Actions

Some actions operate at the system level, influencing multiple departments, programs, or sectors. These actions support proactive decision-making and planning to address a range of climate-related hazards rather than focusing on a single issue.

The City already has system-level initiatives in place, with varying degrees of climate integration, including emergency management, budgeting, urban planning processes and asset management. The following table presents potential actions that build on these existing systems and address multiple risks. Three categories of potential system-level actions are included:

- **Coordination and convening:** Initiatives that include leadership, cross-agency governance structures, and cross-cutting systems that enable coordinated and integrated approaches to climate resilience across the city.
- **Data, monitoring, evaluation and research:** Systems that generate and apply data to evaluate risk, track progress and inform evidence-based decision-making.
- **Community education, outreach and equity:** Programs that build public awareness, preparedness and equitable access to climate resilience resources and support.

Table 72. System-level potential actions.

Potential Action	Category	Description
Resilience lens for capital projects	Coordination and convening	Building on the initial resilience lens introduced in the City's 2025 Corporate Asset Management Plan (EX23.7), ensure capital projects are planned and designed using a resilience lens, including forward-looking climate projections, and develop clear criteria to identify high-priority resilience projects and ensure their inclusion in the Capital Improvement Plan.[277]
Resilience lens for program and operating budgets	Coordination and convening	Embed a resilience lens in the Operating Budget process by requiring service plans and budget submissions to assess climate risks, equity impacts, continuity needs, and co-benefits, and by tagging and tracking resilience expenditures across divisions.

[277] City of Toronto, Office of the Chief Financial Officer and Treasurer, *City of Toronto's 2025 Corporate Asset Management Plan*, Staff Report to Executive Committee, Agenda Item EX23.7 (April 29, 2025), https://www.toronto.ca/legdocs/mmis/2025/ex/bgrd/backgroundfile-255041.pdf.

Potential Action	Category	Description
Natural asset management program	Coordination and convening	Strengthen natural asset management activities to bolster the importance of planning for natural assets, including Toronto's ravines, wetlands and urban forest, building on work done to date, and integrating the value of natural assets into asset management and capital budgeting.[278]
Asset management (AM)	Coordination and convening	Enhance City's Corporate Asset Management Program to more explicitly embed consideration of climate risk and impacts into AM processes.
Climate budget	Coordination and convening	Enhance the City's current carbon budget approach to add indicators and guidance enabling prioritization of projects based on resilience.
Appropriately resource emergency management and business continuity management citywide	Coordination and convening	Ensure all city divisions, agencies and corporations with response roles in major emergencies have sufficient dedicated emergency management funding, facilities and personnel to plan for and respond to the anticipated increase in severe weather emergencies. Ensure all divisions have sufficient funding and personnel to maintain business continuity plans for their critical work to continue with as little disruption as possible during severe weather.
Extreme weather expense tracking	Data, monitoring, evaluation and research	Establish processes to tag and track extreme weather-related expenses across departments.
City-wide resilience KPIs and dashboard (annual)	Data, monitoring, evaluation and research	Define and report KPIs (e.g.exposure days, service disruptions, equity coverage, emergency activations, capital delivery) and schedule periodic risk-assessment updates to inform planning and budgets. KPIs should align to the development of climate-focused levels of service (LOS) to improve efficiency in the data collection process and support integration of climate considerations with asset lifecycle management, renewal investment planning and capital project prioritization.
Continuing to explore the establishment of resilience hubs	Community education, outreach and equity	Expand on initial work to enable trusted spaces that offer a range of services and resources, strengthening communities against various hazards and fostering social cohesion.

[278] Joanna L. Eyquem, Bailey Church, Roy Brooke, and Mike Molnar, Getting Nature on the Balance Sheet: Recognizing the Financial Value Provided by Natural Assets in a Changing Climate (Waterloo, ON: Intact Centre on Climate Adaptation, University of Waterloo, October 5, 2022), accessed August 15, 2025, https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2022/10/UoW_ICCA_2022_10_Nature-on-the-Balance-Sheet.pdf.

Potential Action	Category	Description
Embedding climate risk reduction into existing community resilience processes	Community education, outreach and equity	Leveraging an internal/external city-wide table that will be convened as part of the City's Community Coordination Plan to support risk-reduction actions, including development of community support plans for various hazards.
Risk assessment toolkits	Community education, outreach and equity	Create and disseminate extreme-weather risk assessment toolkits for businesses, community groups, neighbourhoods and other organizations, co-developed and delivered with external partners (e.g. insurance industry, utilities, BIAs) to support self-assessment, preparedness and continuity planning.
Rapid community-relief fund	Community education, outreach and equity	Pre-authorize micro-grants for vetted local groups, automatically released when heat or flood alerts are issued, to provide immediate assistance with welfare checks, food replacement, cooling and temporary shelter.

Potential Actions Table

The following table lists potential actions for the City to consider as it adapts to climate-related risks. Actions are organized into overarching categories: one for system-level actions and others for the hazards they address. A preliminary prioritization was based on the risk level of the underlying hazard and the extent to which the action reduces that risk. As a next step, the City can build on this categorization and prioritization by adding considerations such as required resources, divisional responsibility and timelines for completion, and revising the prioritization accordingly.

The following details are provided for each potential action:

- **Action Category:** Coordination and Convening; Data, Monitoring, Evaluation and Research; Community Education, Outreach and Equity; Policy and Regulation.
- **System Category:** Population and Local Economy, Municipal Services, Infrastructure Systems, Natural Environment.
- **Climate Hazard Addressed:** Indicates which climate hazards are addressed by the initiative.
- **City Role:** Indicates whether the City would lead, collaborate on or advocate for the initiative.
- **Priority:** Indicates the importance of the action, relative to other actions, in building resilience to climate hazards (Very High, High, Medium, Low).

System-Level Actions

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City Role	Priority
S1	Develop a comprehensive climate adaptation plan that builds on this risk assessment and includes a commitment to regular reporting and updates, with clear accountabilities and resourcing for short-, medium- and long-term actions.	Data, monitoring, evaluation and research	All	All	Lead	**Very High**
S2	Use a resilience lens for capital projects	Coordination and convening	All	All	Lead	**Very High**
S3	Use a resilience lens for program and operating budgets	Coordination and convening	All	All	Lead	**Very High**
S4	Enhance the City's current carbon budget approach to add indicators and guidance enabling prioritization of projects based on resilience	Coordination and convening	All	All	Lead	**Very High**
S5	Appropriately resource emergency management and business continuity management city-wide	Coordination and convening	All	All	Lead	**Very High**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City Role	Priority
S6	Enhance City's Asset Management Program to more explicitly embed consideration of climate risk and impacts into the AM planning process and provide guidance on the treatment of green infrastructure as it relates to climate change, as part of the development of AM frameworks	Coordination and convening	Municipal Services	All	Lead	**Very High**
S7	Strengthen the natural asset management program	Coordination and convening	Natural Environment	All	Lead	**High**
S8	Continue to explore the establishment of resilience hubs	Community education, outreach and equity	Population and Local Economy	All	Lead	**High**
S9	Embed climate risk reduction into existing community resilience processes	Community education, outreach and equity	Population and Local Economy	All	Lead	**High**
S10	Establish city-wide resilience KPIs and dashboard (annual)	Data, monitoring, evaluation and research	All	All	Lead	**Medium**
S11	Establish processes to tag and track extreme weather-related expenses across departments	Data, monitoring, evaluation and research	Municipal Services	All	Lead	**Medium**
S12	Create and disseminate extreme-weather preparedness toolkits and resources for businesses, community groups, neighbourhoods and other organizations	Community education, outreach and equity	Population and Local Economy	All	Lead	**Medium**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City Role	Priority
S13	Create a rapid community-relief fund	Community education, outreach and equity	Population and Local Economy	All	Lead	**Medium**

All Hazards

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
A1	Engage with Toronto Hydro to prioritize neighbourhoods for grid resilience improvements and inform Toronto Hydro of any planned demand increases to support capacity investment planning and demand response programming	Coordination and convening	Infrastructure	All	Collaborate	**Very High**
A2	Reduce state-of-good-repair backlog to extend pavement life, decrease the frequency of repairs and lessen environmental impacts	Coordination and convening	Infrastructure	All	Lead	**High**
A3	Collaborate with Metrolinx on an updated Climate Adaptation Plan	Coordination and convening	Infrastructure	All	Collaborate	**High**
A4	Perform capital planning to evaluate equipping additional municipal buildings with backup generators	Data, monitoring, evaluation and research	Municipal Services	All	Lead	**High**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
A5	Source additional resources for protecting private trees	Coordination and convening	Natural Environment	All	Lead	High
A6	Evaluate the need for additional shelter capacity for people experiencing homelessness during extreme weather events	Data, monitoring, evaluation and research	Population and Local Economy	All	Lead	High
A7	Maintain and share up-to-date information on availability of spaces within the City's shelter system for people experiencing homelessness with all partners and the public	Data, monitoring, evaluation and research	Population andLocal Economy	All	Lead	High
A8	Develop shelter surge capacity plans for people experiencing homelessness[279]	Community education, outreach and equity	Population and Local Economy	All	Lead	High
A9	Minimize barriers to access to encourage shelter use by people experiencing homelessness in extreme weather	Community education, outreach and equity	Population and Local Economy	All	Lead	High
A10	Expand selective pruning and thinning programs to reduce storm damage and power outage risks	Coordination and convening	Natural Environment	All	Lead	High
A11	Create and expand habitat buffers to protect the Natural Heritage System, strengthen biodiversity and reduce climate hazard risks	Policy and regulation	Natural Environment	All	Lead	High

[279] Shelters in this context refer to TSSS-supported shelters for people experiencing homelessness, not Emergency Reception Centres.

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
A12	Increase monitoring for emerging pests and pathogens	Data, monitoring, evaluation and research	Natural Environment	All	Lead	**Medium**
A13	Explore development and implementation of consistent/minimum standards for primary care and mental health services in shelters for people experiencing homelessness	Policy and regulation	Population andLocal Economy	All	Lead	**Medium**
A14	Create and expand integration of food hubs	Coordination and convening	Population and Local Economy	All	Lead	**Medium**
A15	Support local food producers growing food in Toronto	Policy and regulation	Population and Local Economy	All	Lead	**Medium**
A16	Consistently implement increased rollout of grief and loss programming for shelter clientele	Community education, outreach and equity	Population and Local Economy	All	Lead	**Medium**
A17	Advocate for/partner with provincial health system partners for enhanced support measures for medically dependent residents during emergencies	Coordination and convening	Population and Local Economy	All	Advocate	**Medium**
A18	Take steps to enhance mapping of encampments and high-risk locations	Data, monitoring, evaluation and research	Population andLocal Economy	All	Lead	**Medium**
A19	Continue to enhance the City's coordinated response between encampment staff and TRCA Warning System	Coordination and convening	Population and Local Economy	All	Lead	**Medium**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
A20	Expand partnerships with food rescue organizations and local businesses to recover near-expiring food and redistribute it	Community education, outreach and equity	Population and Local Economy	All	Collaborate	**Medium**

Extreme Heat

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
H1	Evaluate the City's coordinated heat planning to ensure it addresses immediate needs and long-term measures across multiple planning timeframes	Coordination and convening	Population and Local Economy	Extreme heat	Lead	**Very High**
H2	Continue to evolve the Heat Relief Network with a focus on neighbourhoods and populations at greater risk	Coordination and convening	Population and Local Economy	Extreme heat, climate-related air quality	Lead	**Very High**
H3	Leverage existing spaces and programs for targeted cool spaces in addition to the public Heat Relief Network	Coordination and convening	Population and Local Economy	Extreme heat, climate-related air quality	Lead	**Very High**
H4	Establish maximum indoor temperature policy for all leased residential dwellings	Policy and regulation	Population and Local Economy	Extreme heat	Lead	**Very High**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
H5	Develop a city-wide analysis to map neighbourhood green/cool surfaces baseline and recommend potential targets	Data, monitoring, evaluation and research	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	**Very High**
H6	Develop strategic cooling plans for priority neighbourhoods (building on Green Streets priority areas) that coordinate, prioritize, and monitor green space expansion and green infrastructure through capital programs, incentive programs (eco-roofs, green infrastructure, depaving), land-use planning approvals, identifying and addressing barriers to achieving targets, and community engagement	Data, monitoring, evaluation and research	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	**Very High**
H7	Enhance development and oversight of heat management and adaptation solutions	Coordination and convening	All	Extreme heat	Lead	**High**
H8	Promote heatwave resilience planning for city-owned and private-sector data centres	Coordination and convening	Infrastructure	Extreme heat	Collaborate	**High**
H9	Prioritize municipal building portfolio overheating screening	Data, monitoring, evaluation and research	Municipal Services	Extreme heat	Lead	**High**
H10	Expand air conditioner distribution program focused on additional heat-vulnerable populations	Community education, outreach and equity	Population and Local Economy	Extreme heat, Climate-related air quality	Lead	**High**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
H11	Create a cool surfaces procurement policy – direct identification of options	Policy and regulation	Infrastructure	Extreme heat	Lead	High
H12	Coordinate land-use planning policy, guidelines and standards to prioritize urban heat mitigation (e.g. addressing barriers to tree planting through development)	Policy and regulation	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	High
H13	Review current landscape, green roof and tree-planting requirements to determine potential impacts of extreme heat and make recommendation to adapt requirements, design and maintenance standards	Data, monitoring, evaluation and research	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	High
H14	Develop a public realm design for heat: heat reduction strategy for high pedestrian volume areas to ensure feasibility of walking within neighbourhoods during extreme heat events	Data, monitoring, evaluation and research	Population andLocal Economy	Extreme heat	Lead	High
H15	Develop and update public realm design standards to reduce urban heat and support climate resilience, integrating expanded green space that also contributes to lower carbon emissions	Policy and regulation	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	High

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
H16	Develop an action campaign to keep backyards green/depave TO - responding to concerns that neighbourhood green space, particularly in backyards are declining both growing space for trees and landscape open space	Community education, outreach and equity	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	**High**
H17	Assess the barriers to expanding green space/green infrastructure implementation and identify solutions or prioritizations in heat priority areas (e.g. solids waste requirement for bin space and dimensions resulting in loss of trees)	Data, monitoring, evaluation and research	Population and Local Economy	Extreme heat, Extreme precipitation	Lead	**Medium**
H18	Update transportation system assets inventory and review industry standards and specifications for any changes to temperate range limits	Data, monitoring, evaluation and research	Infrastructure	Extreme heat	Lead	**Medium**
H19	Improve heat-related public education, outreach and engagement strategies to reach vulnerable populations	Community education, outreach and equity	Population and Local Economy	Extreme heat	Lead	**Medium**
H20	Advocate for updated provincial workplace heat-safety standards	Policy and regulation	Population and Local Economy	Extreme heat	Advocate	**Medium**
H21	Coordinate and communicate an energy-savings and retrofit building envelope improvement program	Coordination and convening	Population and Local Economy	Extreme heat, Extreme cold	Lead	**Medium**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
H22	Expand or replace the heat-pump initiative to reach wider population	Coordination and convening	Population and Local Economy	Extreme heat, Extreme cold, Climate-related air quality	Lead	**Medium**
H23	Upgrade HVAC systems in schools, daycares and other facilities	Coordination and convening	Infrastructure	Heat, Extreme cold, Climate-related air quality	Lead, Advocate	**Medium**

Extreme Precipitation

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
P1	Collect and analyze pluvial flood data (for capital programming, operations and emergency preparedness planning)	Data, monitoring, evaluation and research	All	Extreme precipitation	Lead	**Very High**
P2	Develop additional flood risk remediation and flood reduction projects to address flooding in the transportation network/at the facility level	Coordination and convening	Infrastructure	Extreme precipitation	Lead	**High**
P3	Enhance road drainage and stormwater management through targeted improvements to increase flow conveyances and install green infrastructure	Coordination and convening	Infrastructure	Extreme precipitation	Lead	**High**

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
P4	Proactively inspect and strengthen road infrastructure to mitigate flood risk	Data, monitoring, evaluation and research	Infrastructure	Extreme precipitation	Lead	High
P5	Perform building renovations to increase flood-proofing	Coordination and convening	Infrastructure	Extreme precipitation	Lead	High
P6	Acquire emergency backup generators for flood-prone transit stations and operations centres	Coordination and convening	Infrastructure	Extreme precipitation	Lead	High
P7	Expand education campaigns for flood-proofing	Community education, outreach and equity	Population and Local Economy	Extreme precipitation	Lead	High
P8	Undertake or expedite retrofits and flood-proofing of existing shelter facilities for people experiencing homelessness	Community education, outreach and equity	Population and Local Economy	Extreme precipitation	Lead	High
P9	Incorporate existing and proposed greenspaces to enhance large-scale flow conveyance systems to address fluvial and pluvial flooding	Coordination and convening	Infrastructure	Extreme precipitation	Lead	High
P10	Coordinate long-term strategies to permanently relocate individuals and assets from high-flood-risk areas	Policy and regulation	Infrastructure	Extreme precipitation	Lead	Medium
P11	Increase education and community monitoring of standing water (risk of water-borne diseases)	Community education, outreach and equity	Population and Local Economy	Extreme precipitation	Lead	Medium

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
P12	Ensure flooding is incorporated in inclement weather planning and responses for city shelters and outreach responses	Community education, outreach and equity	Population and Local Economy	Extreme precipitation	Lead	**Medium**
P13	Continue to enhance the City's coordinated response between encampment staff and TRCA Warning System	Community education, outreach and equity	Population and Local Economy	Extreme precipitation	Lead	**Medium**
P14	Advocate for/partner with provincial supports and systems like the Assistive Devices Program to expand coverage/client base	Policy and regulation	Population andLocal Economy	Extreme precipitation	Advocate	**Medium**
P15	Establish virtual check-ins, check-in lines, more supports to recognize and address flood-related mental health impacts (e.g. trauma)	Community education, outreach and equity	Population and Local Economy	Extreme precipitation	Lead	**Medium**
P16	Improve real-time customer communications	Coordination and convening	Population and Local Economy	Extreme precipitation	Collaborate	**Medium**
P17	Develop criteria to assess levels of service for stormwater infrastructure (e.g. sewers/ponds/streams/Green Infrastructure/overland flow systems)	Data, monitoring, evaluation and research	Infrastructure	Extreme precipitation	Lead	**Medium**

Other Hazards

ID	Action	Action Category	Systems Category	Climate Hazard Addressed	City role	Priority
O1	Add air filtration requirements to Toronto Green Standards and city-initiated development	Policy and regulation	Infrastructure	Climate-related air quality	Lead	**High**
O2	Open extended-hours centres with air filtration	Coordination and convening	Municipal Services	Climate-related air quality	Lead	**High**
O3	Develop wind-resilient building standards	Policy and regulation	Infrastructure	High wind and tornadoes	Lead	**High**
O4	Expand frozen pipe education initiatives	Community education, outreach and equity	Infrastructure	Very cold days, winter storms	Lead	**High**
O6	Review and update Transportation Services' Major Snow Event Response Plan	Data, monitoring, evaluation and research	Infrastructure	Winter storms	Lead	**Medium**
O7	Develop a data-driven approach to prioritize snow and ice clearing for vulnerable residents and to support equity needs	Data, monitoring, evaluation and research	Population and Local Economy	Winter storms	Lead	**Medium**

8. Conclusion

This assessment evaluated hundreds of climate-related impacts and identified Toronto's priority risk themes, along with key potential actions for each. The **Potential Actions Table** in the previous section presents over 60 options for the City to consider as it adapts to climate-related risks. These actions are not yet funded, and they are not prescriptive; rather, they offer a menu of recommendations to address the City's highest-priority risks and should be further assessed for feasibility, cost, timing and opportunities for coordinated implementation.

The assessment provides a holistic, high-level view of how climate risks cut across interconnected city systems. While this city-wide perspective is critical, each division, agency and external partner will need to undertake more detailed analysis to understand the risks to their specific assets, programs and services.

Moving from assessment to action will require strong governance and deliberate collaboration. The City will need to maintain and strengthen relationships with a wide range of external agencies and community organizations. Building resilience cannot be achieved in silos; it must be coordinated across institutional boundaries and supported by shared data, open communication and joint planning.

A holistic picture of climate resilience requires Indigenous knowledge and leadership. Indigenous worldviews have guided stewardship of lands and waters from time immemorial, emphasizing the interconnectedness of people, lands and waters that centre reciprocity, kinship with all beings and collective prosperity. The City needs to honour this knowledge and work alongside the community to make space for Indigenous climate leadership while addressing systemic barriers that currently limit the empowerment and implementation of these perspectives and solutions. Supporting Indigenous-led climate work in Toronto through partnerships, resourcing and knowledge-sharing will be essential to building resilience that respects this place's history and responsibilities.

The next phase involves embedding resilience into how the City plans, invests, designs and delivers services. This means mainstreaming climate considerations into budgets, asset management and capital planning, while advancing near-term measures that address the highest risks. To ensure this work remains relevant as conditions evolve, the City should develop a comprehensive climate adaptation plan that builds on this risk assessment. This plan should include commitments to regular reporting and updates, clear accountabilities and resourcing for short-, medium- and long-term actions. By coordinating across divisions and with external partners and authorities, Toronto can ensure adaptation actions are cost-effective, equitable and designed to protect residents, infrastructure and ecosystems in a rapidly changing climate.

Appendices

Appendix A: System Scoping Comparison

In order to inform our boundary definition, we reviewed and considered the categorization of sectors and sector sub-classes used by four other key frameworks, including Canada's National Adaptation Strategy (NAS), Ouranos's Guide to Developing a Climate Change Adaptation Plan, the provincial government's Ontario's Provincial Climate Change Impact Assessment, and Toronto's Resilience Strategy (Table A1).

Table A1. Overview of four relevant adaptation/resilience frameworks.

Strategy/ Framework	Systems/Sectors/Areas of Focus	Major Climate Risks	Categories of Sector Sub-classes
National Adaptation Strategy (NAS)	1. Disaster Resilience 2. Health and Well-being 3. Nature and Biodiversity 4. Infrastructure 5. Economy and Workers	• Temperature increase • Changing precipitation • Flooding • Heatwaves • Droughts • Wildfires • Sea-level rise • Permafrost thaw • Ecosystem changes	The NAS does not use sector sub-classes. Rather, it sets targets and goals for each system.

Strategy/ Framework	Systems/Sectors/Areas of Focus	Major Climate Risks	Categories of Sector Sub-classes
Ouranos Guide to Adaptation Planning	1. Infrastructure 2. Population and Local Economy 3. Natural Environment 4. Municipal Services	• Heat waves • Cold waves • Heavy/frequent precipitation • Coastal erosion and flooding • Storm flooding • Forest fires • Landslides • Permafrost thawing • Droughts • Low water • Winter thaws • Extreme weather events • Presence of allergic pollens • Presence of disease vectors	Each system was subdivided into sub-systems: Infrastructure Road network Energy and telecommunications Disaster protection infrastructure Drinking water network Wastewater and stormwater collection and treatment network Municipal buildings Residential buildings Recreational and tourism infrastructure Population and local economy Population Companies and socio-economic activities Natural environment Biodiversity Parks, green spaces and protected areas Water and groundwater Soil Municipal services Public works Public safety Finance Leisure activities

Strategy/ Framework	Systems/Sectors/Areas of Focus	Major Climate Risks	Categories of Sector Sub-classes
Ontario Provincial Climate Change Impact Assessment[280]	1. Food and Agriculture 2. Infrastructure 3. Natural Environment 4. People andCommunities 5. Business and Economy 6. Cross-Sectoral Themes	Extreme Heat Extreme Cold Extreme Precipitation Events Wildfire Drought	Each area of focus was sub-divided to inform greater detail for Level 1 and Level 2 for sub-categories (similar to the North American Industrial Classification System codes) Level 1 Category sub-classes: Food and Agriculture Field crops Fruits and vegetables Livestock Business and Economy Accommodation and Food Services Arts, Entertainment and Recreation Construction Financial and Insurance Forestry, Fishing and Hunting Economies Information and Cultural Industries Manufacturing Mining, Quarrying and Oil/Gas Extraction Retail Trade Transportation Economy Utility Services Infrastructure Buildings Pipeline Transportation Stormwater Management Transportation Utilities Waste Management Natural Environment Aquatic Ecosystems Ecosystem Cultural Services Fauna Flora Provisioning Services Regulating Services Terrestrial Ecosystems People and Communities Health Care Indigenous Communities Population Social Assistance and Public Administration

[280] https://www.ontario.ca/files/2023-08/mecp-ontario-provincial-climate-change-impact-assessment-en-2023-08-17.pdf

Strategy/ Framework	Systems/Sectors/Areas of Focus	Major Climate Risks	Categories of Sector Sub-classes
Toronto Resilience Strategy	1. People and Neighbourhoods 2. Built and Natural Infrastructure 3. City Leadership	Resilience Challenges: equity, climate and environment, civic engagement, communities and neighbourhoods, housing and mobility	The Resilience Strategy did not include sector sub-classes because it was a higher-level assessment for resilience across the city. The Strategy does provide goals that can be used to inform the definition of the people, assets and services that should be included in the boundary definition. The Resilience Strategy Goals for Toronto include: ● More resilient to climate change, including the hazards of flooding and heat; ● Resilient, safe, affordable homes; ● Infrastructure and buildings are resilient to a changing climate; ● Multiple reliable, affordable, and safe mobility options; ● Prioritize the most vulnerable and highest risk in decision-making; ● Provide Indigenous communities with a leadership role; ● Institutionalize resilience into the City's decision-making and take leadership on resilience; and ● Poverty is eliminated and equity is improved.

Based on the review of these comparative frameworks, we identified the following key take-aways and additional considerations for the organization of the City's sectors and sub-sectors:

1) **In the NAS:**

    a) Disaster resilience was identified as a first-tier system separate from the other systems that include infrastructure, health and well-being, nature and biodiversity, and economy and workers and

    b) Workers were identified as part of the economic system.

2) **In the Ouranos guide:**

    a) The systems differentiated between infrastructure and municipal services as separate systems alongside population and economy, and natural environment systems;

    b) Two sector sub-classes were missing from the City's original list (municipal buildings, disaster protection infrastructure);

    c) Water infrastructure was integrated into the infrastructure systems; and

    d) Municipal services was identified as a system of sub-classes including public works, public safety, finance and leisure activities.

3) **In the Ontario climate change impact assessment:**

    a) Sectors (systems) included a cross-sectoral themes system that captured cross-sectoral issues, including food security, energy security, water security and community function;

    b) The natural environment system identified six sub-classes: aquatic ecosystems, ecosystem cultural systems, fauna and flora, provisioning services, regulating services, and terrestrial ecosystems; and

    c) Indigenous communities were identified as a Level 1 sub-class within the People and Communities sector/system.

The Toronto Resilience Strategy does not provide systems/sectors and sub-classes at the detail required for the CCRVA; however, the Areas of Focus provide a good high-level framework for systems (e.g. people and neighbourhoods, built and natural environments; and city leadership). Equity, civic engagement, people and communities, housing and mobility are identified as major resilience challenges for the City and should be integrated into the sector and sub-classes considerations.

Appendix B: List of Key Vulnerability Drivers

Assessing the city's vulnerabilities is an important step in the CCRVA in terms of understanding the existing vulnerabilities, sensitivities, inequities and adaptive capacity of the city's systems in regards to its capacity to be resilient and able to adapt to the impacts of the changing climate. The key drivers of vulnerability identified in this assessment by system are as follows:

People and Local Economy

- Aging population (high vulnerability to extreme weather especially extreme heat)
- Access to health care
- Lack of availability/access to shelter for unhoused population
- Number of unhoused residents
- Access to health and other essential services for unhoused population
- Unaffordable housing crisis (i.e. high rents, real estate prices)
- Increasing cost of living
- Energy poverty
- Increase in mental health risks

Municipal Services

- Increasing demands and financial constraints on providing
    - Shelter capacity for unhoused;
    - Emergency shelters;
    - Cooling centre capacity and accessibility;
    - Lack of affordable and subsidized housing supply; and
    - Emergency planning and services for extreme weather events
- Energy poverty in social housing
- Direct exposure of outdoor worker to extreme weather and impacts of the changing climate due to the nature of work
- Staff shortages further strain workers, especially during surges in service demand
- Aging infrastructure of municipal facilities (e.g. long-term healthcare facilities)
- Funding backlog
- Aging population

- Increased demand for health and emergency medical services
- Aging workforce and labour shortage
- Local businesses vulnerable to disruptions in supply chains

Infrastructure Systems

- Active transportation network direct exposure to extreme weather conditions and events
- Aging commercial, industrial and institutional buildings
- A significant state-of-good-repair (SOGR) backlog further restricts the City's capacity to implement resilience-focused retrofits
- Increasing electricity demand, i.e. Toronto's electricity grid is highly sensitive to extreme heat
- Infrastructure not designed for temperature extremes
    - The electricity distribution system is vulnerable to high winds, ice storms and freezing rain.
- Ontario's electricity demand is projected to grow by 75 per cent by 2050
- Aging infrastructure of natural gas pipelines and proximity to water mains and sewers
- Impacts of rapid urban development on green infrastructure
- Reduction in pervious cover impacts on soil drainage, urban heat island effect and contaminated stormwater runoff
- Traffic congestion poses logistical challenges for emergency services and food distribution and delivery during extreme weather events such as heavy rainfall, snowstorms or high winds
- High proportion of aging/degraded infrastructure
- Toronto's digital infrastructure (e.g. data centres) is heavily dependent on cooling systems, which are highly sensitive to extreme heat
- Toronto's major data hubs rely on electricity for both operations and backup cooling
- Significant portion of TTC infrastructure is aging and in need of repair, contributing to service reliability challenges
- Toronto's transit system vulnerable to extreme heat and winter storms; and 10 TTC subway stations (13 per cent of the network) are located in flood-prone areas
- Lower income neighbourhoods are disproportionately reliant on transit
- Toronto's roads are vulnerable to extreme heat (risk of road buckling), and extreme precipitation (e.g. risk of flooding, risk of culvert and bridge washouts, sinkholes and roadway collapses)
- Lack of full separation between stormwater and sewage systems remains a significant vulnerability, with approximately 23 per cent of the city's sewer network consisting of combined sewers
- Aging infrastructure of water mains and water treatment facilities

- Two wastewater treatment plants located in floodplains
- Vulnerability to cascading infrastructure failures
- Lack of adequate emergency and backup systems

Natural Systems

- Urban stress on natural systems (e.g. urban heat island effect, air pollution)
- Population growth and increase in recreational use of natural areas and parks
- Need for housing and urban densification
- Habitat and ecosystem fragmentation
- Contaminated stormwater runoff
- Urban tree species, wildlife and wetland sensitivity to climatic change and ecosystem changes (e.g. extreme heat stress)

From Vulnerability assessment memo

Appendix C: Vulnerability Scales

Sensitivity

People		
Score	**Definition**	
5	Very High	**Examples of sensitivity factors to consider:** ● age, e.g. infants and children; vulnerable youth (age 18-29); older adults (age 65+) ● women ● people with physical and/or neurological disabilities (e.g. neurodevelopmental disorders such as autism spectrum disorder) ● general health status, e.g. pregnancy, chronic diseases, substance use, comorbidity factors, and mental health status ● income and social status, e.g. socially and economically disadvantaged ● individuals, the unemployed, single-parent families ● level of mobility, e.g. level of access to transportation and/or physical mobility constraints ● educational/literacy level ● digital literacy and access to online information, resources and/or services, including equipment, private and safe spaces in which to receive confidential services ● level of access to health and social supports, e.g. members of groups with experiences of discrimination, racism and historical trauma including women, Indigenous Peoples, people of colour ● and 2SLGBTQ2 people (two spirit, lesbian, gay, bisexual, transgender, queer). ● living environment, e.g. salubrity of the living space or dwelling unit ● being a tenant/renter, e.g. lacking control over aspects of housing to improve health and safety ● certain occupational groups, e.g. outdoor workers, emergency responders ● language(s) spoken and understood, e.g. if different from language(s) in which services/supports are available ● immigration status, e.g. being a newcomer to Canada or temporary foreign worker
4	High	
3	Moderate	
2	Low	
1	Very Low	

Infrastructure		
Score	**Definition**	
5	Very High	**Examples of sensitivity factors to consider:** • state of repair • design • construction materials • the architectural quality • the heritage value • the level of obsolescence
4	High	
3	Moderate	
2	Low	
1	Very Low	

Municipal Services		
Score	**Definition**	
5	Very High	**Examples of sensitivity factors to consider:** • service capacity • service delivery mechanisms • community dependence on service • interconnectedness of services
4	High	
3	Moderate	
2	Low	
1	Very Low	

Natural Systems		
Score	**Definition**	
5	Very High	**Examples of sensitivity factors to consider:** • temperature sensitivity • water sensitivity • pollution sensitivity
4	High	
3	Moderate	
2	Low	
1	Very Low	

From Vulnerability assessment memo

Adaptive Capacity

People		
Score	**Definition**	
5	Very Low	**Examples of adaptive capacity factors to consider:** ● being physically and mentally healthy ● access to financial resources/ability to allocate funds towards adaptation actions, e.g. insurance, savings ● likelihood of access to a safe, comfortable home environment (either as an owner or tenant) ● access to strong social networks ● access to health and social services ● level of education/literacy and ability to evaluate the benefits of adaptation actions against the cost ● digital literacy and access to online information, resources and/or services ● speaking and understanding the language(s) in which services/supports are available
4	Low	
3	Moderate	
2	High	
1	Very High	

Infrastructure		
Score	**Definition**	
5	Very Low	**Examples of adaptive capacity factors to consider:** ● previous adaptations ● previous experience during similar events ● staff training
4	Low	
3	Moderate	
2	High	
1	Very High	

Municipal Services		
Score	**Definition**	
5	Very Low	**Examples of adaptive capacity factors to consider:** ● previous adaptations ● previous experience during similar events ● staff training
4	Low	
3	Moderate	
2	High	
1	Very High	

Natural Systems		
Score	**Definition**	
5	Very Low	Examples of adaptive capacity factors to consider: ● biodiversity and ecosystem complexity ● connectivity between habitats ● genetic diversity ● ecosystem health and integrity ● ecosystem service resilience
4	Low	
3	Moderate	
2	High	
1	Very High	

Appendix D: Consequence Scales

Table D1. Example consequence score definitions for service functionality.

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
1	Negligible	Negligible impact on service functionality	Delivery of essential services not disrupted
2	Minor	Low impact on service functionality	Minor disruption of essential services
3	Moderate	Moderate impact on service functionality	Localized, short-term, or moderate disruption of essential services
4	Major	High impact on service functionality	Severe but localized and/or short-term disruption of essential services
5	Very high	Severe impact on service functionality	Severe, long-term and/or widespread disruption of essential services

Table D2. Example consequence score definitions for the economy.

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
1	Negligible	Negligible additional in costs for the municipal body, individuals, businesses, the government	Not likely to disrupt business or financial activities
2	Minor	Low additional costs for the municipal body, individuals, businesses, the government	Days-long disruptions and/or loss to businesses, industry, or livelihoods
3	Moderate	Moderate increase in costs for the municipal body, individuals, businesses, the government	Weeks-long disruptions and/or loss to businesses, industry, or livelihoods

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
4	Major	Substantial increase in costs for the municipal body, individuals, businesses, the government	Months-long disruptions and/or losses to businesses, industry, or livelihoods
5	Very high	Severe increase in costs for the municipal body, individuals, businesses, the government	Widespread or permanent loss of businesses, industry or livelihoods

Table D3. Example consequence score definitions for health and security.

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
1	Negligible	No significant health consequences No potential for deaths or other consequences that irreversibly reduce the quality of life	Not likely to result in significant impacts to individuals' mental and emotional well-being
2	Minor	Engenders quickly reversible health consequences No potential for death or other consequences that irreversibly reduce the quality of life	Localized, short-term impacts to individuals' mental and emotional well-being that can be addressed immediately with psychosocial supports
3	Moderate	Low potential for deaths Significant potential for other consequences that irreversibly reduce the quality of life	Localized, moderate and/or medium-term impacts to individuals' mental and emotional well-being
4	Major	Significant potential for deaths and other consequences that irreversibly reduce the quality of life	Significant, long-term but localized impacts to individuals' mental and emotional well-being
5	Very high	Deaths anticipated and consequences that are hard to avoid that irreversibly reduce the quality of life	Widespread, potential long-term impacts to individuals' mental and emotional well-being, including those not directly affected by the incident

Table D4. Example consequence score definitions for the environment.

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
1	Negligible	None or very limited environmental impacts	No damage to the local ecosystem.
2	Minor	Few environmental impacts	Localized and reversible damage to the ecosystem. Full remediation possible within hours to days.
3	Moderate	Moderate environmental impacts	Moderate but reversible damage to the local ecosystem. Remediation possible within weeks.
4	Major	High environmental impacts	Major and potentially permanent damage to the local ecosystem. Remediation possible but may be intensive and/or take several months to years
5	Very high	Severe environmental impacts	Severe permanent damage to the local ecosystem. Remediation not possible or could take decades.

Table D5: Example consequence score ranges for disruption and social cohesion.

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
1	Negligible	Insignificant overall impacts for the municipal body and citizens	Not likely to impact access to supports or networks. Community reciprocity, trust, and cooperation are unaffected.
2	Minor	Minor overall impacts for the municipal body and citizens	Hours to days-long disruption to daily life. Likely result in some localized reduced access to supports or networks. Community reciprocity, trust and cooperation are affected.

Risk Score Range	Risk Ranking	Ouranos definition	HIRA definition
3	Moderate	Moderate overall impacts for the municipal body and citizens.	Days-long disruption to daily life. Likely to result in reduced access to supports or networks. Community reciprocity, trust and cooperation are affected.
4	Major	Major overall impacts for the municipal body and citizens	Weeks- or months-long disruption to daily life. Significantly reduced access to supports or networks. Community reciprocity, trust and cooperation are severely affected.
5	Very high	Catastrophic overall impacts for the municipal body and citizens	Months- to years-long disruptions to daily life. Support or networks may be permanently changed.

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