PARSONS

Transforming and Re-Energizing Ontario
Impact Assessment for Low Carbon Future

Presentation to the OAIA Conference

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Introduction

Presentation title: Evaluating Resiliency of Transportation Investments within Environmental Assessments

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Overview

Part A: Climate Change & Environmental Assessment Policy Context

Part B: Integrating Climate Change Considerations into Environmental Assessments

Part C: Assessing Vulnerability of Transportation Projects & Users in the Face of Extreme Weather

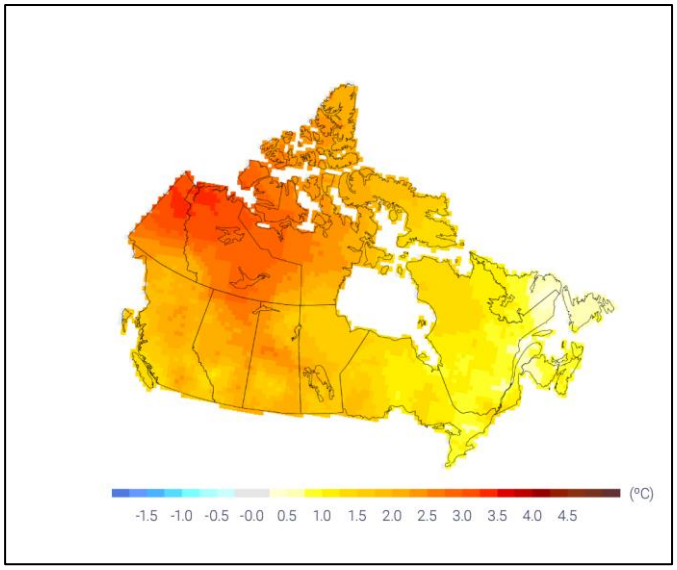
Key Themes

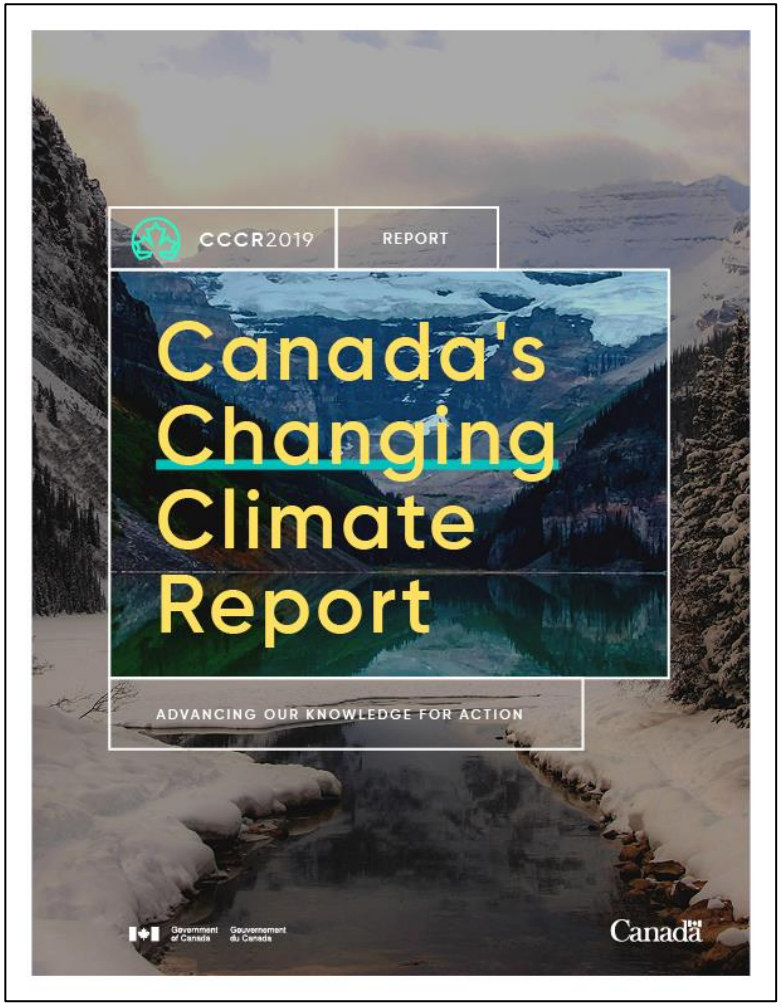
- Focus the climate change discussion on transportation infrastructure
- Integrate climate change consideration of the EA process at every step
- Differentiate between “adaptation” and “mitigation”
- Highlight the importance of assessing the vulnerability of both the physical project and its users
- Illustrate how transportation projects and users may be at risk to extreme weather

Part A: Climate Change Environmental Assessment Policy Context

Canada's Changing Climate

- Report released April 2 2019
- Confirms current thinking on climate change in Canada

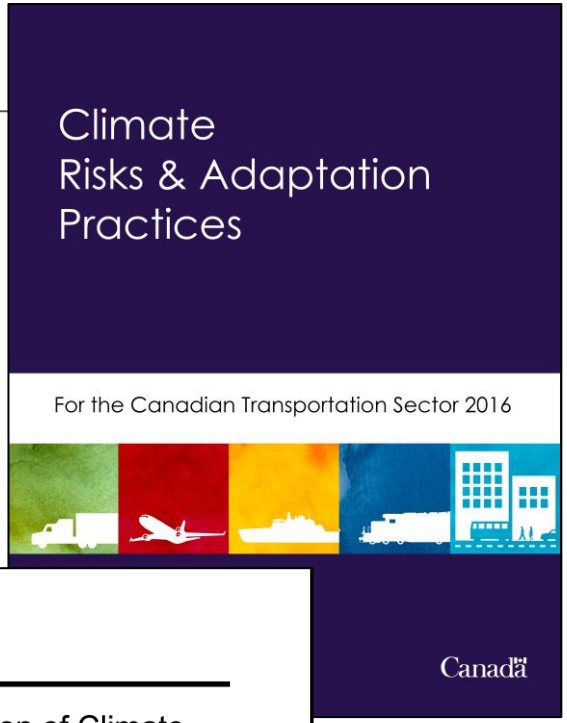


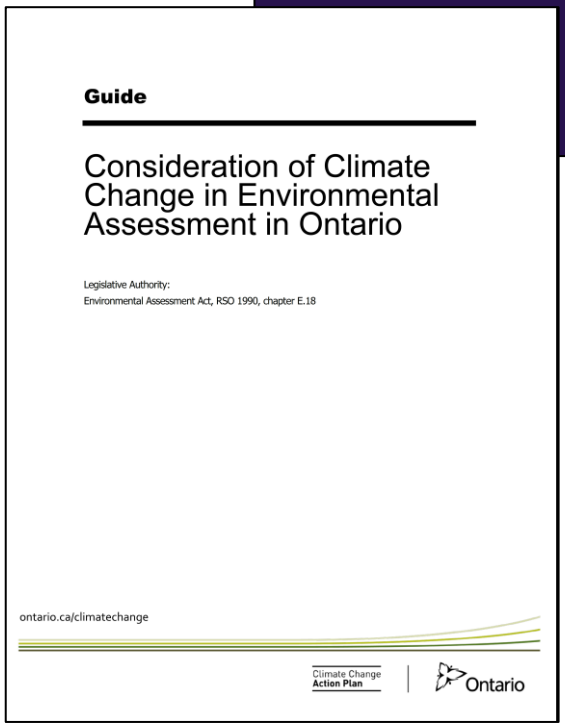


Existing Policies and Guidelines

1. Climate Risks and Adaptation Practices for the Canadian Transportation Sector. NRCan, 2016

2. Considering Climate Change in the EA Process. Ontario MECP, 2017





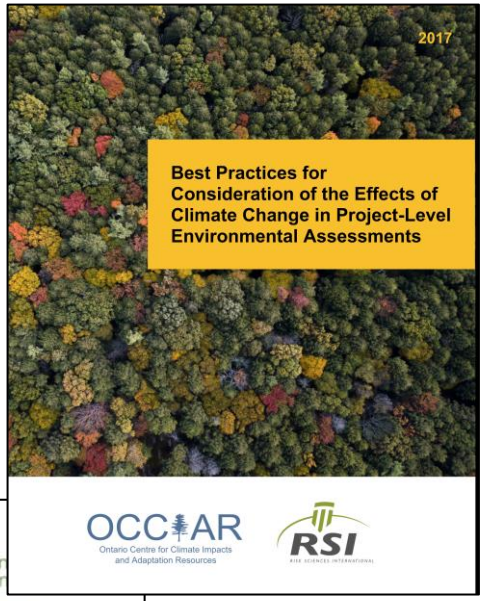
City of Ottawa

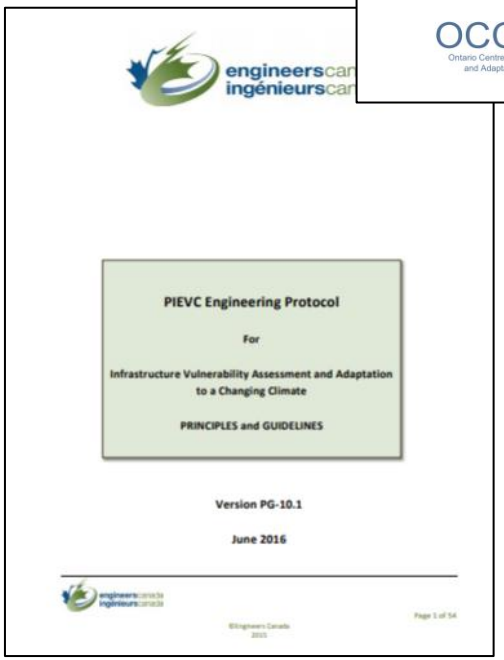
- Air Quality and Climate Change Management Plan (2014) identifies broad goals
- City declares “Climate Emergency” in April 2019
- New Official Plan and Transportation Master Plan in process

Adaptation Evaluation Tools/Protocols

- Best Practices for Consideration of the Effects of Climate Change in Project-Level Environmental Assessments. OCCIAR, RSI, 2017

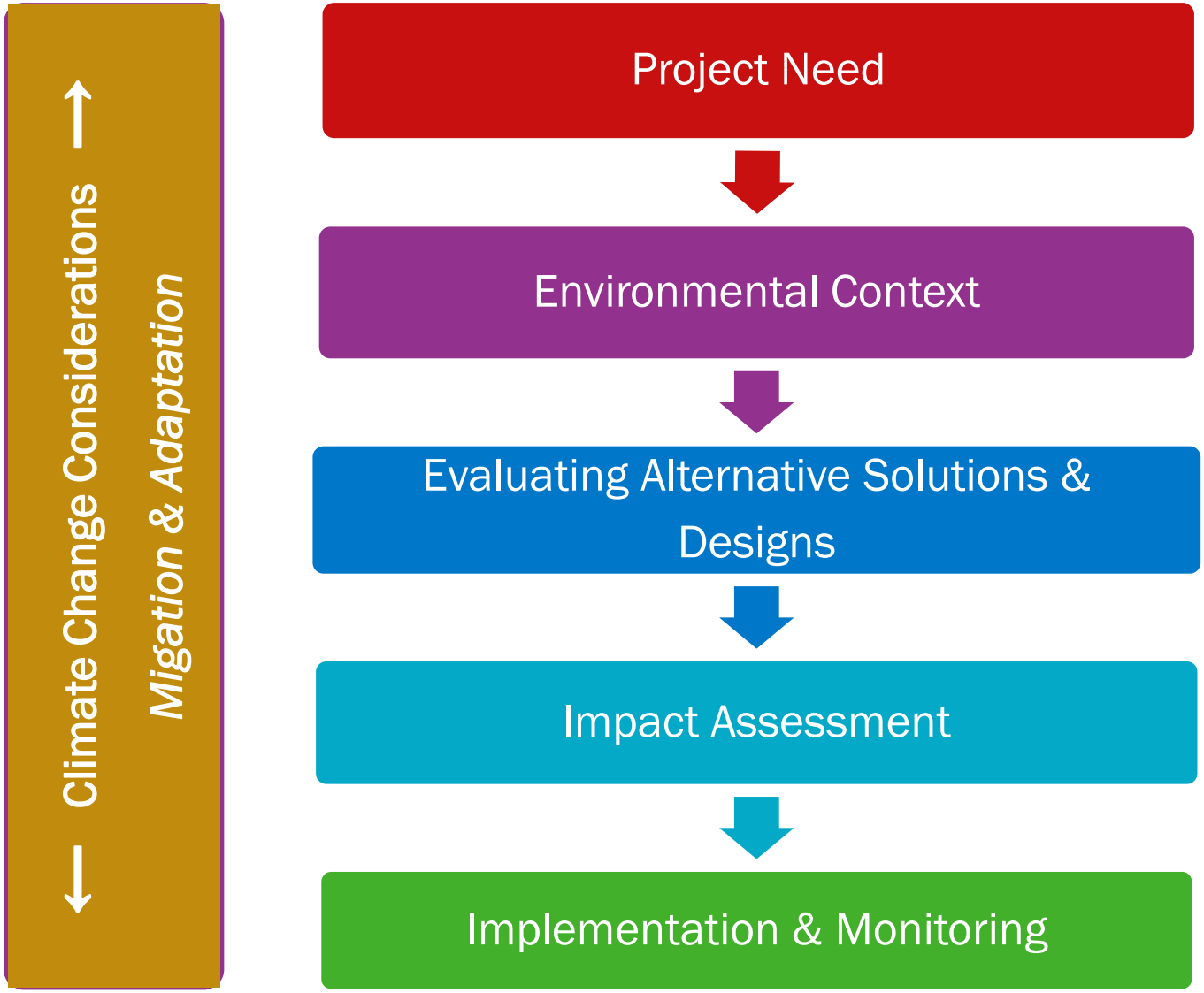
- Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate. PIEVC, 2011





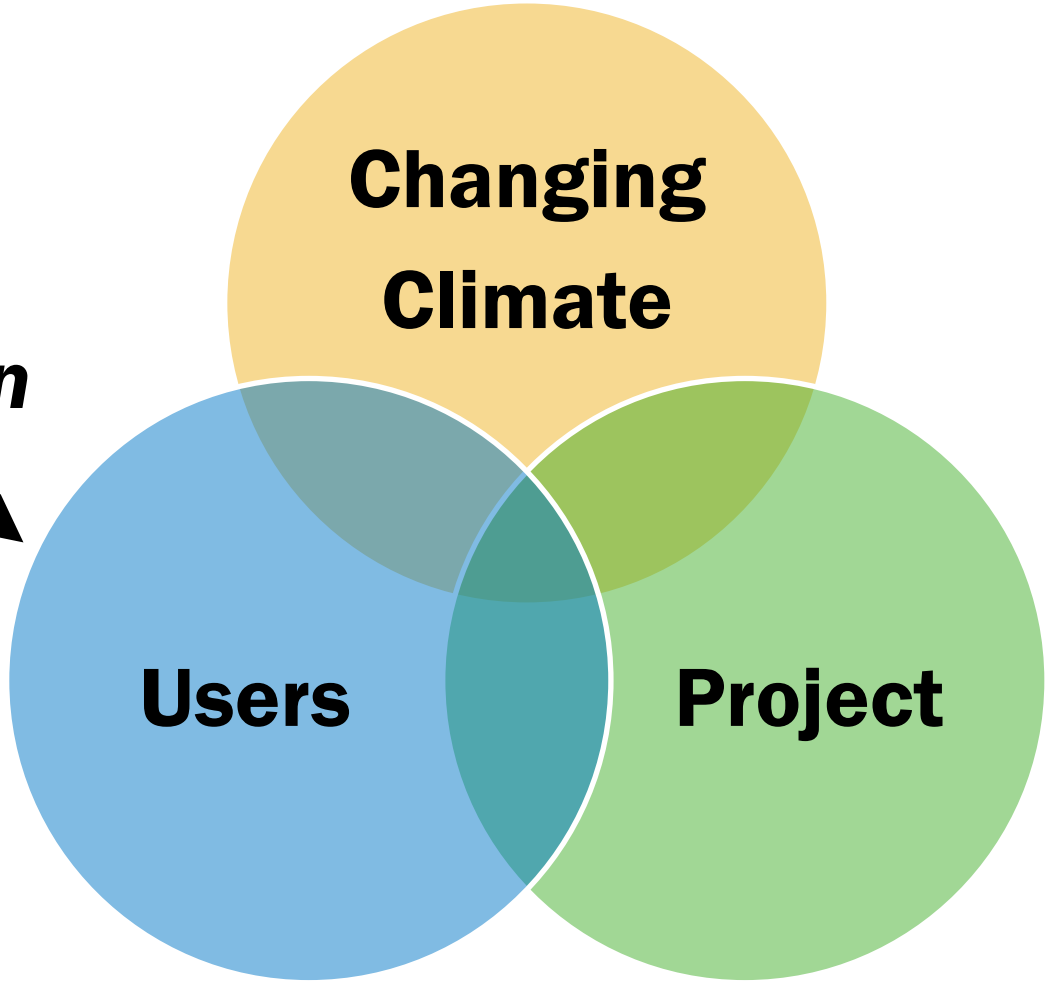
Part B: Integrating Climate Change Considerations into Environmental Assessments

Infrastructure EA Planning Process in Ontario



Considering Vulnerability of Transportation Projects *and* Users

Putting vulnerable people into the equation



Project Need

Mitigation

- Is this project part of a strategy to adapt to climate change?
- Considering our changing climate, is there a need for this project?

Adaptation

- Can the project be designed to be more resilient to climate change?

Environmental Context

Mitigation

- How is the climate influenced by transportation projects
- What are the environmental features that may be affected by a changing climate or help reduce impacts

Adaptation

- What is the geographic context of the project
- How may climate change in the future?

Evaluating Alternatives

Mitigation

- What project choices or components or users may contribute to climate change?
- How do the alternatives rate vis a vis reducing contributions to climate change?

Adaptation

- What project choices or components are vulnerable to a changing climate?
- Which options are more resilient?
- How will the users be affected?

Design

Mitigation

- What design measures can help ***mitigate*** the contribution of the project and its users to climate change?

Adaptation

- What design measures can help the project ***adapt*** to be more resilient to a changing climate and minimize risk to project and its users ?

Implementation & Monitoring

Mitigation

- What construction measures can help ***mitigate*** the contribution of the project and its users to climate change?
- What about operation & maintenance?
- What should be monitored?

Adaptation

- What construction measures can help the project ***adapt*** to a changing climate and minimize risk to project end users?
- What activities can extend resiliency?

Part C: Assessing Vulnerability of Transportation Projects & Users in the Face of Extreme Weather

Weather … What Can We Expect?

- Warmer Temperatures
- More Precipitation
- More Extreme Weather!

Source: cbc.ca

Source: Climate Risks and Adaptation Practices for the Canadian Transportation Sector 2016

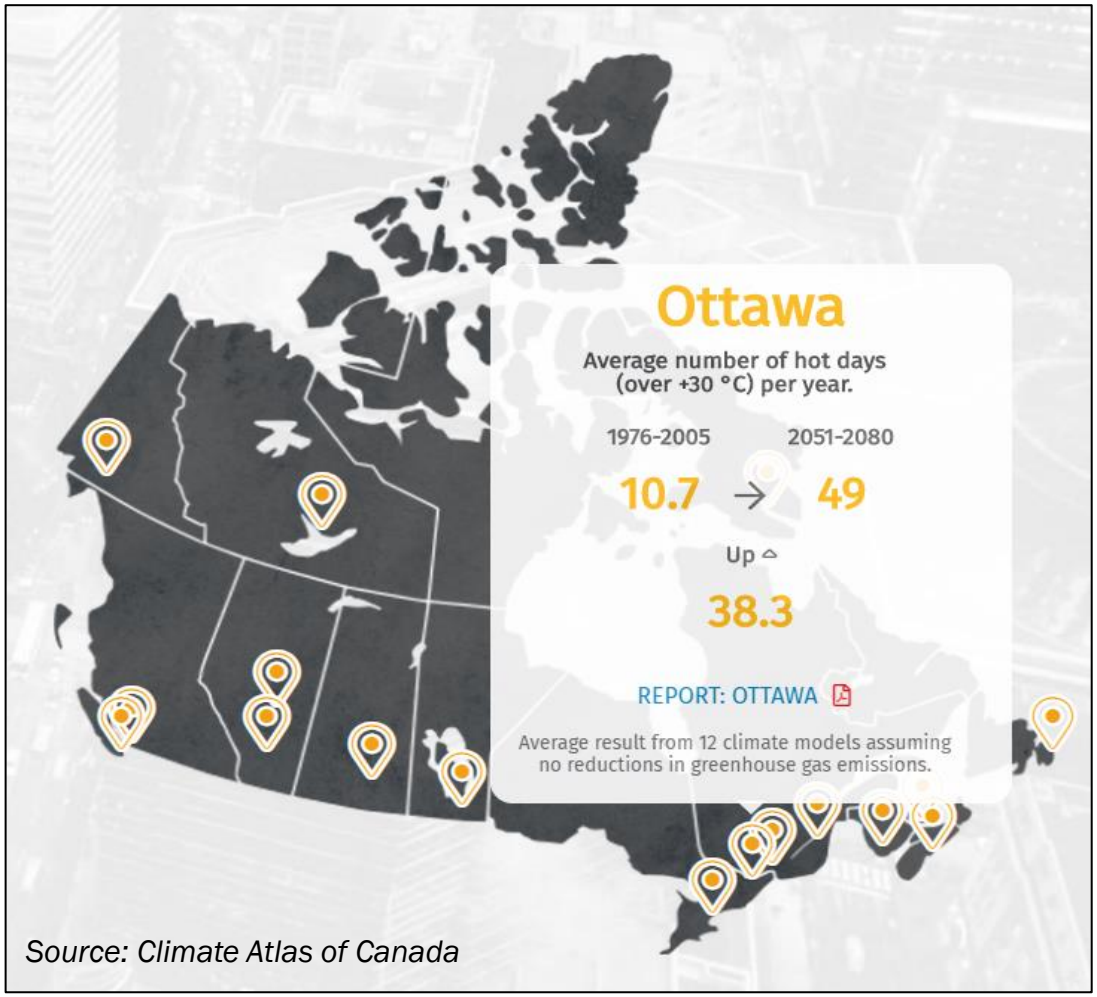
Extreme Weather = Vulnerability

- Extreme Heat Days
- Drought and Wildfires
- Wind Gusts
- Lightning
- Extreme Rainfall Events
- Seasonal Flooding
- Freezing Rain & Ice Storms
- Extreme Snowfalls
- Freeze Thaw Events

Extreme Heat Days

The Trend:

- Extreme heat events are anticipated to increase in intensity, duration and frequency



Source: Climate Atlas of Canada

Extreme Heat Days

Project Vulnerability:

- Excessive road expansion could result in displacement of material: Softening, rutting, flushing, and bleeding of asphalts
- Reduced lifespan of roads, bridges, and culverts
- Limits of bridge deck, expansion joints & bearings could be exceeded, resulting in cracking of deck components & unseating of girder bearings
- Malfunctioning traffic control signals
- Increased electrical demand may cause power outages
- Reduced maximum loads on municipal roadways

User Vulnerability:

- Exposure to heat and sun
- Decreased active trips, shift to vehicles and public transit
- Reduced ride quality and vehicle performance
- Heat stress for construction workers

Source: CBC.ca

Drought and Wildfires

The Trend:

- Prolonged hot periods with little precipitation
- Increased risk of wildfire

Source: thepeterboroughexaminer.com

Drought and Wildfires

Project Vulnerability:

- Risk of lowering water tables and differential settlement
- Risk of vegetation die off
- In case of clay foundation, impacts to foundation of the structure
- Landscape fire risks

User Vulnerability:

- Reduced air quality
- Risk to life and safety
- Route detours and closures

Extreme Wind

The Trend:

- Extreme wind speed that impacts infrastructure and users

Source: blackburnnews.com

Source: thenationalobserver.com

Source: inquinte.com

Extreme Wind

Project Vulnerability:

- Signs and tall mast blow overs
- Bridge sway and component /appurtenance vibration
- Increased risk of material spills
- Increasing bridge component and foundation for strength

User Vulnerability:

- Airborne and fallen debris impacting user comfort and safety
- User discomfort
- Drifting snow reduces visibility and traction
- Vehicle roll overs
- Route detours and closures

Lightning

The Trend:

- More frequent summer storms and potential for lighting strikes

Lightning

Project Vulnerability:

- Increase in lightning strikes on tall structures
- Impacts on electrical systems and reliability

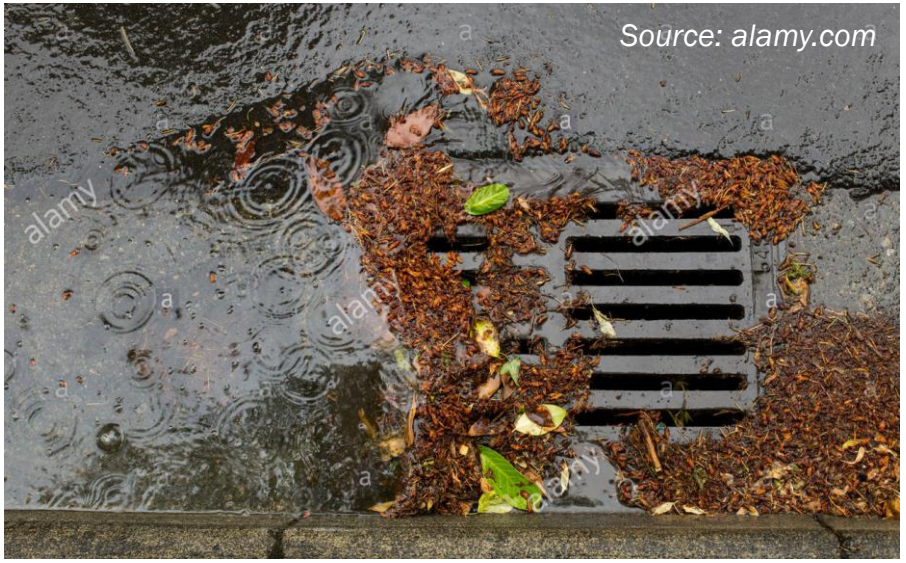
User Vulnerability:

- Personal injury from falling debris and infrastructure

Extreme Rainfall Events

The Trend:

- Increasing rainfall event intensity and frequency
- More non-summer events



Extreme Rainfall Events

Project Vulnerability:

- Overloading of stormwater management infrastructure
- Exceedance of natural watercourse capacity
- Short term ponding
- Soil erosion
- Washouts (due to soil/slope instability)
- Asphalt/concrete deterioration/scour
- Submergence of power to traffic signals and other supporting infrastructure (ex: storm water pump station)

User Vulnerability:

- Increased risk of user accidents (all modes)
- Route closures and detours

Seasonal Flooding

The Trend:

- More seasonal rain and melt events causing flooding of streams, creeks, and rivers

Ottawa Hydro, 2019

Seasonal Flooding

Project Vulnerability:

- Flooding of assets
- Submergence of equipment
- Washouts
- Sinkholes
- Erosion/scour

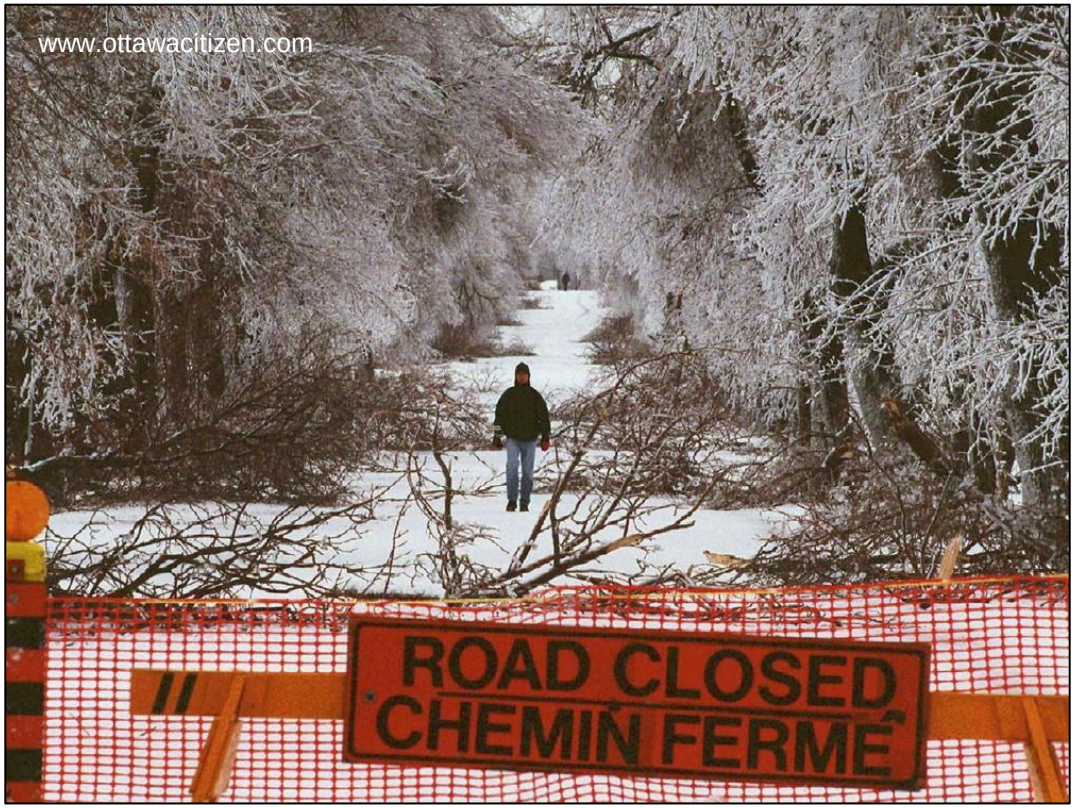
User Vulnerability:

- Personal Risk
- Closures and detours

Freezing Rain and Ice Storms

The Trend:

- More frequent freezing rain conditions



Freezing Rain and Ice Storms

Project Vulnerability:

- Overhead powerline damage
- Component overloading due to increased thickness of ice accretion
- Concrete degradation from increased salt usage
- Tree damage from increased weight from ice
- Vegetation impacts from increased salt usage

User Vulnerability:

- Greater risk of icy sidewalks and pathways
- Falling ice from overhead structure on users
- Reduced active trips

Extreme Snowfall

The Trend:

- Greater single-day snowfall accumulation
- Increasing frequency

Source: www.mandatory.com

Extreme Snowfall

Project Vulnerability:

- Larger space requirement for snow storage and/or requirements for snow removal
- Increased use of salt/sand
- Greater snow loads on structures
- Tree damage from heavy snow
- Increased maintenance costs

User Vulnerability:

- Pedestrian and cycling routes temporarily unavailable
- Reduced transit reliability and delay
- Vehicle traction/control and collision risk

Freeze Thaw Cycles

The Trend:

- Increased frequency of freeze thaw cycles

Freeze Thaw Cycles

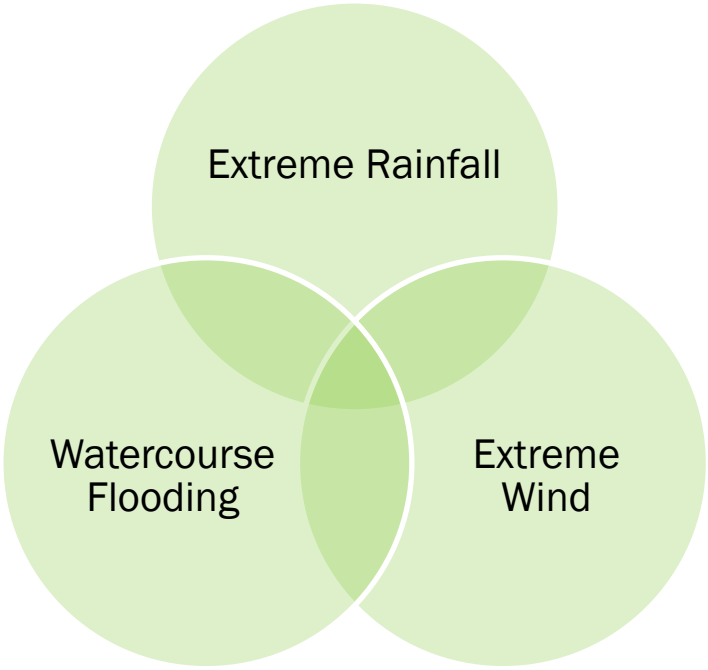
Project:

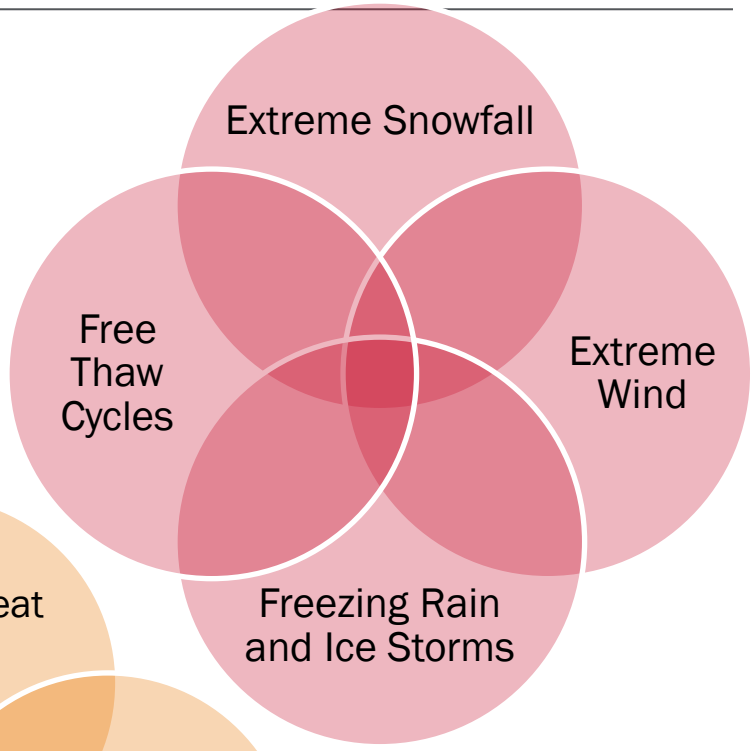
- Asphalt pavement deformation and shearing reducing strength and stability of roadways
- More potholes and crack maintenance
- Damaged Stormwater Management features
- Shortened lifespan of concrete and asphalt
- More frost heaving

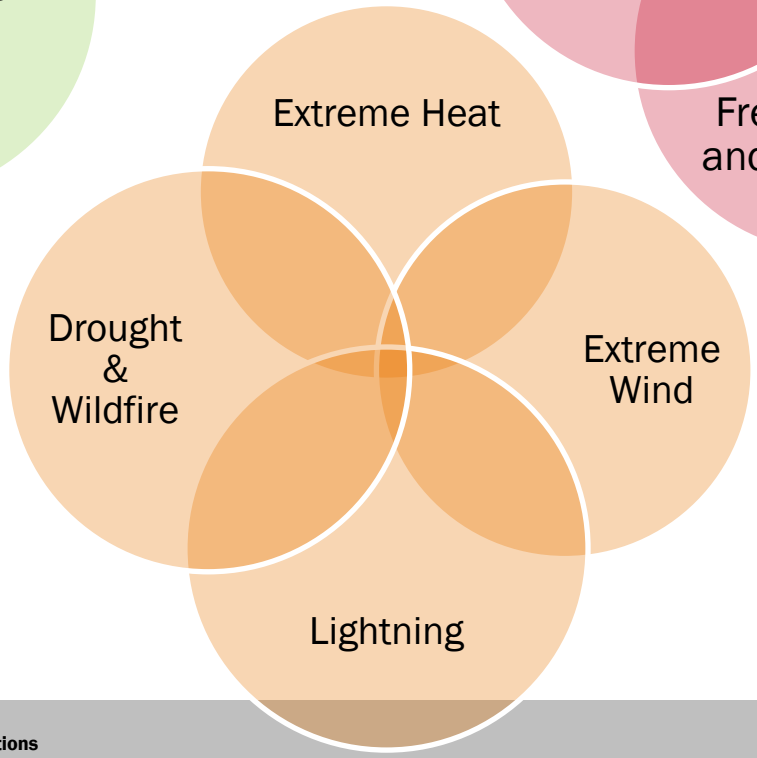
Users:

- Greater risk of icy sidewalks and pathways
- Vehicle wheel and suspension damage
- Trip hazards from frost heaving

Combined Extreme Weather Events







Influencing our Practice

- Climate Change consideration can be incorporated into each step of an environmental assessment process
- Consider both mitigation and adaptation factors
- Consider both of how the project interacts with climate change factors as well as the users of the infrastructure

Discussion