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REPORT
Meeting Date: 2022-03-03
Audit and Risk Committee

For Information

REPORT TITLE:	**Climate Change Risks to the Movement of Goods in Peel Region**
FROM:	Gary Kent, CPA, CGA, ICD.D, Chief Financial Officer and Commissioner of Corporate Services

OBJECTIVE

To provide a summary of preliminary research findings regarding the potential impacts of climate change hazards to the movement of goods over-land in the Great Lakes Region, generally, and within the Region of Peel, specifically.

REPORT HIGHLIGHTS

- Climate-related hazards in the form of extreme precipitation, extreme heat, and freeze-thaw cycles are increasing in frequency and magnitude across the Region of Peel.
- Transportation related infrastructure like roads, bridges, rail lines, train stations and terminals are increasingly vulnerable to impacts from these hazards.
- As was observed following a catastrophic flood event in British Columbia in 2021, climate related impacts can cause significant damage to transportation related infrastructure, destabilize local economies, disrupt supply chains, increase the cost of goods and services, and affect the health and wellbeing of residents.
- Research conducted in collaboration with Toronto and Region Conservation Authority (TRCA) and the University of Waterloo in 2021 found numerous climate-related hazards, including extreme precipitation, extreme heat, freeze-thaw cycles, and compounding events may expose a broad range of transportation-related infrastructure (such as roads, railway, train stations and terminals), systems (economy), and people (workforce, health) to increased risks of impacts within the goods movement sector.
- An economic assessment framework was developed to assess the cumulative economic impacts of climate change to physical infrastructure, people, and economy within the goods movement sector in the Region of Peel.

DISCUSSION

1. Introduction

The Region of Peel's Audit and Risk Committee (ARC-5/2019) requested staff to report back on the impacts of climate change to non-domestic property and goods movement in Peel Region. In response, the Region of Peel's Office of Climate Change and Energy Management collaborated with TRCA and the University of Waterloo's Terrametrics Research Lab in 2021 to conduct a literature review of key climate change hazards and impacts to the movement of goods within the Great Lakes Region and propose a framework to evaluate the economic costs of impacts. The following summarizes results of the

research, a description of the economic assessment framework and next steps. Peel Region employees from transportation planning and operations, land use planning, and finance; and staff from TRCA and Credit Valley Conservation Authority participated in reviews of the research and provided input into the proposed assessment framework.

2. Background

a) Context

According to long-range climate change projections, the Region of Peel will likely face increased wilder, wetter and warmer weather the coming years and decade. We're already starting to see what the future may look like. Climate-related disasters are on the rise, disrupting supply chains and increasing economic and uninsured losses around world. As observed in November 2021 after an "atmospheric river" brought intense rainfall across southern British Columbia, impacts can be devastating. The unprecedented rain event caused catastrophic flooding leaving thousands of people stranded on highways or cut off from food and supplies for days due to road and rail lines being washed out. The event disrupted supply chains by halting road and rail transport increasing the cost of goods across Canada and led to infrastructure damage amounting to $7.5 billion.

Maintaining efficient and uninterrupted movement of goods into and out of the Region of Peel is critical to the local economy, employment, and broader economic stability of the Great Lakes region. The goods movement sector adds $49 billion annually to Ontario's GDP with $1.8 billion being moved through the Region of Peel every day. If we include manufacturing, the sector accounts for four out of nine jobs in the Region of Peel. Goods are moved through a variety of modes which are distributed through several intermodal hubs across the GTA, including the CN Brampton Yard.

3. Research Results

a) Methods and limitations

Researchers from Waterloo's Terrametrics Research Lab conducted a scan of scholarly and grey literature published in North America focusing on climate change impacts to goods movement within the Great Lakes Region, which includes the Region of Peel. Key climate change hazards and related impacts were grouped thematically and described qualitatively in a summary report. Assessment methods were reviewed, and a framework developed with stakeholder review and input. While this effort has produced important information to guide future assessments in Peel Region, the more granular location and sector-based results appropriate to inform municipal policy or prioritize climate adaptation actions in the community are not in scope of this report.

b) Summary

The research completed to-date identifies likely negative correlation between climate change and goods movement in the Great Lakes Region. More specifically, the goods movement sector in Peel Region is at-risk from a range of climate-related hazards. Most notably, extreme precipitation, extreme heat, freeze-thaw cycles, and compounding events are likely to expose roads, railway, train stations and terminals to increased damage. These impacts will likely affect the local economy, health, wellbeing, and productivity of the workforce. See the full report titled, "Evaluating Climate Change Risks to the Movement of Goods in Peel Region: Review of Key Risks and Assessment Frameworks" (Appendix I).

Climate Change Risks to the Movement of Goods in Peel Region

The following are key climate-related hazards most likely to impact the movement of goods over-land in Peel Region.

i) Extreme Precipitation, Flooding and Erosion

The Region of Peel can expect more frequent and intense periods of extreme precipitation that will overwhelm stormwater and riverine systems, causing overland flooding to impact road and rail infrastructure. These effects are likely to result in serious disruption to traffic, the movement of goods, and increase public health and safety risks. Increases in flooding resulting from more sudden intense rainfall will accompany greater erosion impacting adjacent infrastructure.

ii) Higher than Average and Extreme Heat Days

The Region of Peel can expect more frequent extreme heat days, as well as average increases in year-round temperatures leading to impacts on infrastructure, workforce, and users of the intermodal transportation system in Peel Region. Heatwaves are likely to affect economic activity both in the transportation of time-sensitive goods and increase transportation costs. Increased labor and equipment will be required to repair and maintain roads affected by buckling and cracking. Extreme heat will also increase the likelihood for transport equipment, like tires, to wear and fail faster.

Productivity of the workforce may be affected by higher temperatures due to increased heat stress and the need for more frequent breaks or time off. Deteriorating working conditions at workplaces such as warehouses, mobile units, trucks and freight trailers can reduce the available working hours, causing labor shortages and reduced productivity, thereby impacting the profitability of the goods movement sector as a whole.

The transport of time-sensitive goods and services, such as food or medicine, is likely to be affected during hot summer days if cooling equipment fail to maintain proper temperatures. Any delays in the delivery of goods due to equipment failure would be problematic if the goods need to be processed or stored within a certain timeframe.

iii) Freeze-thaw cycles and other rapid temperature variations

The Region of Peel can expect to see an increase in the number of freeze-thaw cycles within the next 5-10 years exacerbating the degradation of transportation infrastructure, increasing repair costs and maintenance.

iv) Compound Extreme Events

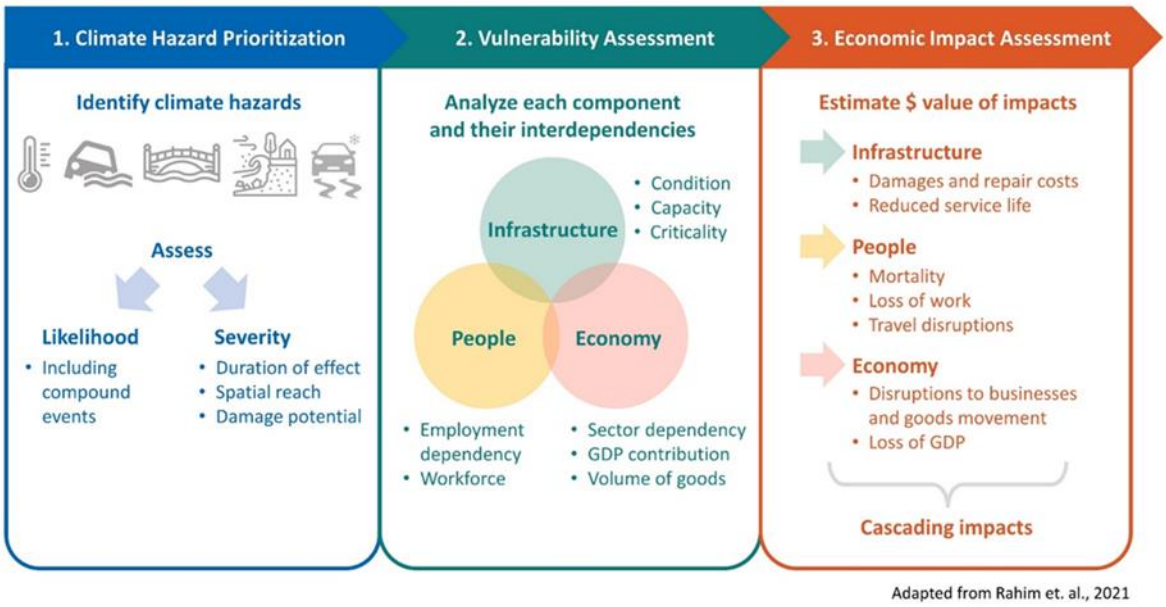
The Region of Peel can expect to experience increased compounding extreme events such as high-water levels in and around Lake Ontario coupled with flooding from extreme precipitation events. A combination of drought and heatwaves may also result in increased energy demand, and food supply issues within the Great Lakes Region leading to higher cost of living. As current supply chain systems in the Region of Peel are already under stress due to a lack of needed investment in intermodal transportation infrastructure, compounding climate change hazards will further exacerbate the situation.

c) Framework to Assess Economic Impacts

To assist with quantifying the economic impact of future climate change hazards across Peel Region, an economic impact assessment framework was developed and is consistent with best practices. The framework is designed to assess the cumulative costs from climate change impacts on infrastructure, people, and the broader economy (see Figure 1).

Based on key climate-related hazards that could affect goods moment in Peel Region over the coming decades, the framework outlines a process to conduct detailed analysis of Peel-specific data (to the extent available) and to generate cost estimates of damage to infrastructure, loss of productivity and health impacts on people as well as disruption to businesses and resulting economic losses.

Figure 1 – Economic Impact Assessment Framework



Adapted from Rahim et. al., 2021

CONCLUSION

Through this research and review of available literature, the impacts of climate hazards to the goods movement sector in Peel Region have clear implications to the local economy, health, wellbeing, and productivity of the workforce. This information and implementation of the assessment framework can be used to help anchor or otherwise inform community-scale planning and other initiatives that are addressing climate change concerns around the movement of goods and supply chain disruption in the Great Lakes Basin.

APPENDICES

Appendix I- Evaluating Climate Change Risks to the Movement of Goods in Peel Region: Review of Key Risks and Assessment Frameworks

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