

Adaptive Management To Address Climate Change Uncertainty in EA Process – A Case Study of the Don Mouth Naturalization and Port Lands Flood Protection Project EA (DMNP EA)

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Member of Conservation Ontario



Overview of why Don Mouth Naturalization and Port Lands Flood Protection Project EA (DMNP EA) occurred

Use of Objective Based EA and Adaptive Management in DMNP EA

Description of the Preferred Alternative for the DMNP EA

Description of Climate Change considerations in the DMNP EA



## <u>GOAL</u>:

To establish and sustain the form, features, and functions of a natural river mouth within the context of a revitalized City environment while providing flood protection up to the Regulatory Flood.

#### **Objectives of the DMNP EA**



- 1. Naturalize and rehabilitate mouth of the Don River
- 2. Provide Regulatory Flood protection for the Port Lands & S. Riverdale
- 3. Manage sediment, debris and ice
- 4. Integrate infrastructure
- 5. Encourage recreation, cultural heritage opportunities and accessibility
- 6. Contribute to revitalization and sustainability of waterfront
- 7. Design and implement this project in a sustainable manner



## **Project Location**



#### **Regulatory Flood Risk – Port Lands**



#### Flood Plain

Flood Protected

Flood Protection Landform & Railway Bridge Extension

#### **Existing Conditions**



- Don River and Keating Channel provides poor aquatic habitat
- 35-40 m<sup>3</sup> of sediment dredged/year
- 100s of tonnes of floating debris removed/year
- Contaminated soil and groundwater from past lakefilling & industrial uses
- Poor to absent terrestrial habitat
- Mostly derelict industrial lands
- Lack of infrastructure
- Very little recreational space





Objectives Based EA Evaluations used to :

- Develop and evaluate alternatives against the project goal and objectives
- Provide a framework to monitor project performance with goal and objectives
- Provide consistent measures in the decision-making for project amendments during design and construction to address uncertainty and change
  - Uncertainty and change can relate to planning, engineering, socioeconomic and/or environmental factors (including Climate Change)

Adaptive Management was incorporated in the DMNP EA and linked to the project goal and objectives to better respond to uncertainty and change.

## What is Adaptive Management?

- A systematic, rigorous approach for deliberately learning from management actions with the intent to improve subsequent management policy or practice
- Adaptive Management recognizes that:
  - Our understanding of ecosystems is evolving
  - Healthy ecosystems are subject to variability and change
  - Project planning is influenced by changes in political, developmental, socioeconomic, and environmental priorities





## Need to ensure that river functions as designed

Ultimately, Adaptive Management has been established to:

- Ensure that the river functions as intended OR in an unexpected but acceptable manner.
- Accommodate a range of "acceptable" functionality
- Allow for the inclusion of passive and active response mechanisms to allow the river to adapt to future uncertainty that may otherwise precipitate "unacceptable" functionality



## The Preferred Alternative for the DMNP EA

- 3 valleys with different functions created through cut and fill
- Sediment and debris management north of Lake Shore
- Adaptive weir system at Lake Shore
- Low flow channel with small protected wetlands within the levees
- Larger levee separating Ship Channel wetland from Don River





Early in EA (2003), both MOECC and CEAA directed the Team to consider Climate Change

"How" to incorporate Climate Change was left up to the team.

Team first explored "How" Climate Change could impact the Project:

- Larger Regulatory Floods
- Changes in baseflow and the size and frequency flood events (e.g. 2, 10, 25, 50 yr return)
- Changes in Lake Ontario Water levels (lower, higher?)
- Connectivity of creative wetlands and ability to respond to changes in baseflows, flood events, and lake levels.

## Addressing Climate Change in the DMNP EA



Challenges with addressing Climate Change:

- Natural rivers are dynamic and adaptive
- DMNP project will not respond naturally due to:
  - Hardening of valleys to protect future development,
  - Underlying barriers preventing remaining contaminated soils/groundwater from entering naturalized habitats
  - Need to protect infrastructure and river levees from scour since sediment must be removed upstream of the naturalized areas for navigation and flood protection purposes.
  - Created aquatic habitats, while appearing natural, will not be dynamic and will require passive and active means to respond to Climate Change in their design
- Quantifying the amount of change to occur is difficult as Climate Change Models were and remain at a coarser resolution than the variables influencing weather and hydrology at the Don Watershed scale.

#### Some of the Features Considered in Conceptual Detail



### **Passive Design Consideration to Address Climate Change**

Designing for worst-case flood scenario and then some more:

- Valley design system will convey Regulatory Flood flows which are based on a very conservative design standard (Hurricane Hazel)
- Climate Change modeling suggests more frequent and larger hurricanes. To address uncertainty, the Flood Design includes at least an additional 0.5m of freeboard (through all three valley sections).



#### **Active Design Consideration to Address Climate Change**

- DMNP EA considers active design elements to address changes in size and frequency of floods and variable lake levels
- Adaptive weir north of Lake Shore proposed to help manage distribution of flood flows between Keating Channel and naturalized valleys to address uncertainty of future Don River hydrology and Lake Ontario water levels resulting from Climate Change



## Other Passive and Active Design Consideration Used in DMNP EA



- Multiple Levels of Wetland Resiliency
- Reduced shear stresses during flood on naturalized habitats with 3 valley configuration.
- Variable wetland topography and bathymetry allows vegetation communities to respond naturally to changes in long-term changes in Lake water levels.
- Wetlands protected by water/carp control gates to add resiliency to impacts by unusually high or low lake water levels and carp.





## Monitoring, Analysis and Adaption is Key

TRCA's commitment to monitoring and management is key to the Project:

- Lake water level and Don Mouth discharge monitoring to inform design and operation of adaptable weir system – for existing and future hydrological regime
- Fish, wildlife and vegetation monitoring to track habitat trajectory and control invasives – to ensure acceptable species use is occurring
- Long-term tracking of changes in local weather due to Climate Change, and the resulting impacts on stream flows, lake levels and local ecology





# **QUESTIONS**