

Facilitators' Notes for Module 4 – Climate Change Risk Assessment (2 Hours)

Objectives:

- Understand the main steps in conducting a climate change risk assessment
- Participate in a simple risk assessment, and discuss with colleagues the strengths and limitations of the climate change risk assessment process.

Description	Expected Time
<p>Powerpoint Presentation and Discussion</p> <p><i>(Note: This session may be conducted by an invited expert in risk assessment for climate change adaptation.)</i></p> <p>The facilitator will begin this session with a review of the material contained in the backgrounder for the module, outlining the key stages of conducting a climate change risk assessment for a municipality:</p> <ul style="list-style-type: none"> ▪ Analyzing the hazard ▪ Estimating the risk ▪ Evaluating the risk. <p>Examples of different kinds of climate change risk assessments relevant to municipalities that have been conducted recently will be included in the presentation (examples from Halifax and Toronto).</p>	25 minutes
<p>Small Group Exercise</p> <p>Participants will be divided into three small groups to work with the attached materials. Each will be assigned a Risk Scenario and will be asked to:</p> <ul style="list-style-type: none"> ▪ Conduct an Impact Rating for four risks identified in the scenario vulnerable ▪ Assess the Frequency/Probability of the occurrence of these impacts ▪ Evaluate risks by combining the Impact Rating and Frequency/Probability Assessment <p>Facilitators will be available to answer questions and provide guidance as necessary during this work.</p>	40 minutes
<p>Report Back and Discussion</p> <p>Each group will report back on their results, and on their experience of using these tools to conduct a climate change risk assessment and prioritize areas for adaptation activities.</p>	10 minutes
<p>Guest Speaker Presentation and Discussion</p> <p>A guest speaker who has participated in a climate change risk assessment for a community in the region will present on their experience with the process, and discuss it with participants.</p>	45 minutes

Risk Scenario 1 – High Intensity Rains (>50 mm/hr)

(August 19, 2005 Toronto storm had rains of up to 175 mm in 2-3 hours)

Actual and Potential Hazard

- Short duration, high intensity rains are becoming more frequent and severe, expected to increase ~5% per decade, especially in springtime

Risk Issues for a Municipality

- Extreme rainfall can overwhelm stormwater, sewer and sewage treatment systems, resulting in local basement flooding and sewer back-ups
- Rapidly increased streamflow can lead to washouts of culverts and roads
- Contaminated stormwater runoff and streambank erosion has the potential to degrade local water bodies
- Disruption of transportation routes and systems from flooding

Current Stresses

- Stormwater system, especially in low-lying areas of the city, already taxed by intense or long-duration rains, with basement flooding episodes
- In intense rainfall, combined sewer and stormwater systems in parts of the community release raw sewage to receiving water bodies to avoid overwhelming sewage treatment plants
- Existing and new construction in flood zones
- Suburban sprawl and infill have both increased impermeable surfaces in the area

Potential Stakeholders

- Emergency services
- Water /stormwater department
- Roads / transportation department
- Conservation Authority
- Others?

Risk Scenario 2 – Lower Water Levels

Actual and Potential Hazard

- Increased air temperatures, reduced snowpack and earlier snowmelt, more precipitation falling as rain in winter, summers with less precipitation, mean that surface and groundwater levels are going down

Risk Issues for a Municipality

- Lower water levels reduce water availability for some communities
- Greater demand for water increases water extraction, lowers the water table, and drives up costs
- Conflicts may arise over water allocation
- Distribution pumps work harder when lake and well levels are lower, increasing wear and the possibility of failure
- Low water levels and increased temperatures contribute to algal blooms

Current Stresses

- Expanding populations and new housing developments have increased demand for groundwater
- Some aquifers being depleted
- Storage systems have inadequate capacity to buffer increased demands and reduced supplies
- Existing distribution systems are old or nearing the end of their service lifespan
- Algal blooms are leading to taste and odour problems in municipal water supply

Potential Stakeholders

- Water / stormwater department
- Planning department
- Conservation Authority
- Other?

Risk Scenario 3 – Extended Heat Waves

Actual and Potential Hazards

- Increased number and intensity of long-duration heat waves anticipated
- Daytime highs > 30°C; Night-time temperatures > 25°C; 3 days or more in length

Risk Issues for a Municipality

- Increased incidence of heat-related morbidity and mortality especially for low-income seniors living alone, people with chronic illnesses and infants
- Peak loads on electrical systems increase, with potential to cause brownouts and blackouts
- Importation of electricity from coal-fired generating stations in Ohio Valley to meet peak demand, resulting in increased airborne particulates and smog
- Increased water demand that taxes the water pumping/distribution system
- Heat-related rutting in asphalt

Current Stresses

- Aging population with chronic illnesses
- Greater numbers of children and adults with respiratory problems
- Grid at capacity in some areas
- Water supply, treatment, and pumping systems at capacity in some communities
- Road maintenance requirements increasing with increased traffic, especially on local highways

Potential Stakeholders

- Public health
- Local distribution companies
- Water department
- Roads department
- Others?

Impact Rating Matrix

Risk 1: _____

Impact / Degree	Logistics (supply chain, utilities, transport infrastructure)	People (municipal employees, community members)	Municipal Functions and Services	Premises / Infrastructure Assets	Cost / Time and Reputation	Environment (air, land, water, ecosystems)
Very low / Insignificant						
Low / Minor						
Moderate						
Major						
Extreme / Catastrophic						

Risk 2: _____

Impact / Degree	Logistics (supply chain, utilities, transport infrastructure)	People (municipal employees, community members)	Municipal Functions and Services	Premises / Infrastructure Assets	Cost / Time and Reputation	Environment (air, land, water, ecosystems)
Very low / Insignificant						
Low / Minor						
Moderate						
Major						
Extreme / Catastrophic						

Risk 3: _____

Impact Degree	Logistics (supply chain, utilities, transport infrastructure)	People (municipal employees, community members)	Municipal Functions and Services	Premises / Infrastructure Assets	Cost / Time and Reputation	Environment (air, land, water, ecosystems)
Very low / Insignificant						
Low / Minor						
Moderate						
Major						
Extreme / Catastrophic						

Risk 4: _____

Impact Degree	Logistics (supply chain, utilities, transport infrastructure)	People (municipal employees, community members)	Municipal Functions and Services	Premises / Infrastructure Assets	Cost / Time and Reputation	Environment (air, land, water, ecosystems)
Very low / Insignificant						
Low / Minor						
Moderate						
Major						
Extreme / Catastrophic						

Assessing Severity of Impacts/Consequences *Source: City of Toronto*

	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Premises / Infrastructure / Assets	<ul style="list-style-type: none"> ▪ No or very limited damage or loss of physical assets ▪ Isolated assets affected 	<ul style="list-style-type: none"> ▪ Limited damage or loss of physical assets ▪ Isolated or a few assets affected 	<ul style="list-style-type: none"> ▪ Loss of large but replaceable physical assets ▪ Many assets affected but impact on broader system / network is moderate 	<ul style="list-style-type: none"> ▪ Loss of significant physical assets ▪ System / network wide impact leading to some loss of infrastructure / premises/ asset function 	<ul style="list-style-type: none"> ▪ Loss of key physical assets ▪ System / network wide impact leading to total loss of infrastructure / premises/ asset function
Cost/Time (Including Reputation)	<ul style="list-style-type: none"> ▪ Costs / damages incurred represent <1% capital / operating budget variance ▪ No or very minor media attention 	<ul style="list-style-type: none"> ▪ Minor costs / damages incurred representing 1-5% capital / operating budget variance ▪ Localized community/ interest group/ stakeholder concern and some media attention 	<ul style="list-style-type: none"> ▪ Moderate costs / damages incurred representing 5-10% capital / operating budget variance ▪ Localized community/ interest group/ stakeholder concern and moderate media attention 	<ul style="list-style-type: none"> ▪ Significant costs / damages incurred representing 10-25% capital / operating budget variance ▪ Significant loss of confidence in City services and considerable media attention 	<ul style="list-style-type: none"> ▪ Massive costs / damages incurred representing >25% capital / operating budget variance ▪ Complete loss of confidence in City products and services and sustained media attention. ▪ Public / media outcry for change in administration
Environment	<ul style="list-style-type: none"> ▪ Very minor, non-permanent environmental damage requiring clean-up measures ▪ No regulatory action 	<ul style="list-style-type: none"> ▪ Non-permanent environmental damage requiring limited clean-up / repair / replacement ▪ Regulatory warning or order 	<ul style="list-style-type: none"> ▪ Moderate environmental damage with moderate clean-up required, no permanent damage. ▪ Charges leading to fines 	<ul style="list-style-type: none"> ▪ Major environmental damage / extended clean-up required/ some permanent damage ▪ Charges leading to fines and/or criminal liability 	<ul style="list-style-type: none"> ▪ Irreparable, significant damage to environment ▪ Criminal charges and/or civil liability

	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Logistics (Supply Chain, Utilities and Transport Infrastructure)	<ul style="list-style-type: none"> ▪ No disruption of City supplies ▪ Utilities and transport system continue to function as usual, with no impact on City operations 	<ul style="list-style-type: none"> ▪ Limited disruption of supply chain due to isolated events, with City inventory able to cope ▪ Isolated incidents of power / water outages / transport system delays, with limited impacts 	<ul style="list-style-type: none"> ▪ Suppliers experience moderate delays, with City and others experiencing shortages ▪ Numerous/localized incidences of power / water outages / transport system delays, with moderate impact on City and other operations 	<ul style="list-style-type: none"> ▪ Suppliers are unable to provide materials for a prolonged period of time, inventory shortages leading to temporary disruption of services ▪ Widespread power / water outages / transport system delays, with significant impact on City operations, residents and businesses 	<ul style="list-style-type: none"> ▪ Suppliers unable to provide materials for extensive period of time, with City inventory shortages leading to lengthy disruption of services ▪ Total failure of power water / transport system, leading to shut-down of City operations and massive disruption of clients
Members of the Community	<ul style="list-style-type: none"> ▪ No injuries/ medical treatment ▪ No impairment of well-being / quality of life 	<ul style="list-style-type: none"> ▪ Minor injuries / first aid or minor illness ▪ Minor discomfort or displacement 	<ul style="list-style-type: none"> ▪ Serious injuries to clients or staff resulting in non-permanent injury / lost time incident ▪ Workplace/living conditions are temporarily unusable/ unlivable, with moderate disruption (e.g. temporary shelter) 	<ul style="list-style-type: none"> ▪ Serious injuries to clients or staff resulting in some permanent disability ▪ Staff/ residents are unable to use City facilities and services for a sustained period – with significant impact on work and living arrangements 	<ul style="list-style-type: none"> ▪ Death and/ or significant permanent disability of clients or staff ▪ Staff/ clients/ residents are permanently unable to use City facilities and services –with catastrophic impact on work and living arrangements
Municipal Processes and Functions, and Service Delivery	<ul style="list-style-type: none"> ▪ No or very minor disruption in delivery of essential services, projects or processes ▪ No increase in demand for services 	<ul style="list-style-type: none"> ▪ Minor disruption in delivery of essential services, projects or processes ▪ Minor increase in demand for services, but manageable within existing budget 	<ul style="list-style-type: none"> ▪ Moderate disruption in delivery of essential services, projects or processes ▪ Moderate increase in demand for services, requiring increasing frequency of delivery and minor budget provision 	<ul style="list-style-type: none"> ▪ Significant disruption in delivery of essential services, projects or processes ▪ Significant increase in demand for services, requiring large increase in frequency/breadth of delivery and moderate budget provision 	<ul style="list-style-type: none"> ▪ Unable to perform essential services , projects or processes for extended period

Frequency / Probability Rating Matrix

Frequency / Event	Rare / Unlikely	Occasional Occurrence/ Possible	Moderately Frequent/ Likely	Occurs Often/ Very Likely	Virtually Certain to Occur
Events / vulnerabilities identified in the impact rating matrix (list each)	Not likely to occur during the planning period <5% probability	May occur sometime but not often during the planning period 5-30% probability	Likely to occur at least once during the planning period 30-55% probability	Likely to occur several times during the planning period 55-90% probability	Happens often and will happen again during the planning period 90-100% probability

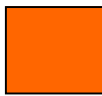
Source: Black, Bruce and Egener, 2009 p. 14

Risk Evaluation

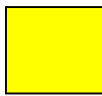
SUMMARY OF IMPACT SEVERITY	Extreme					
	Major					
	Moderate					
	Low					
	Very Low					
		Very Unlikely to Happen	Occurs Occasionally	Moderately Frequent	Occurs Often	Virtually Certain to Occur
FREQUENCY / PROBABILITY						



Extreme Risk:
Immediate controls required



High Risk:
High priority controls required



Moderate Risk:
Some controls required to reduce risks to lower levels



Low Risk:
Some actions such as public education desirable



Negligible Risk:
Scenarios do not require action at this time

Adapted from Bruce, Egener and Noble, 2006, p. 21