



The Risk Management Approach to Climate Change Adaptation

Al Douglas

Director

Ontario Centre for Climate Impacts and Adaptation Resources

Moving Toward Adaptation
October 28, 2010
Sudbury, ON

Risk Management

Risk management is a systematic process for selecting the best course of action in uncertain situations.

In the context of climate change...

Risk management provides a framework for developing strategies to respond to potential climate changes that create or increase risk.

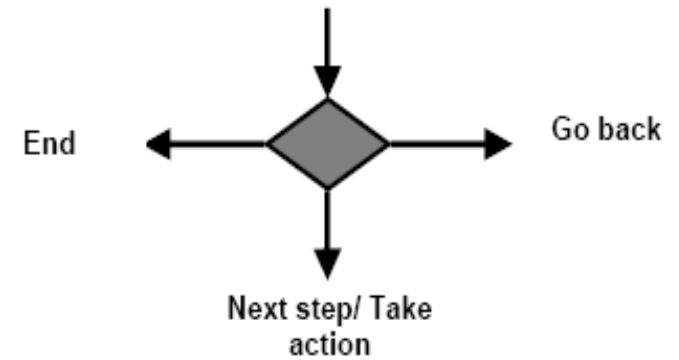
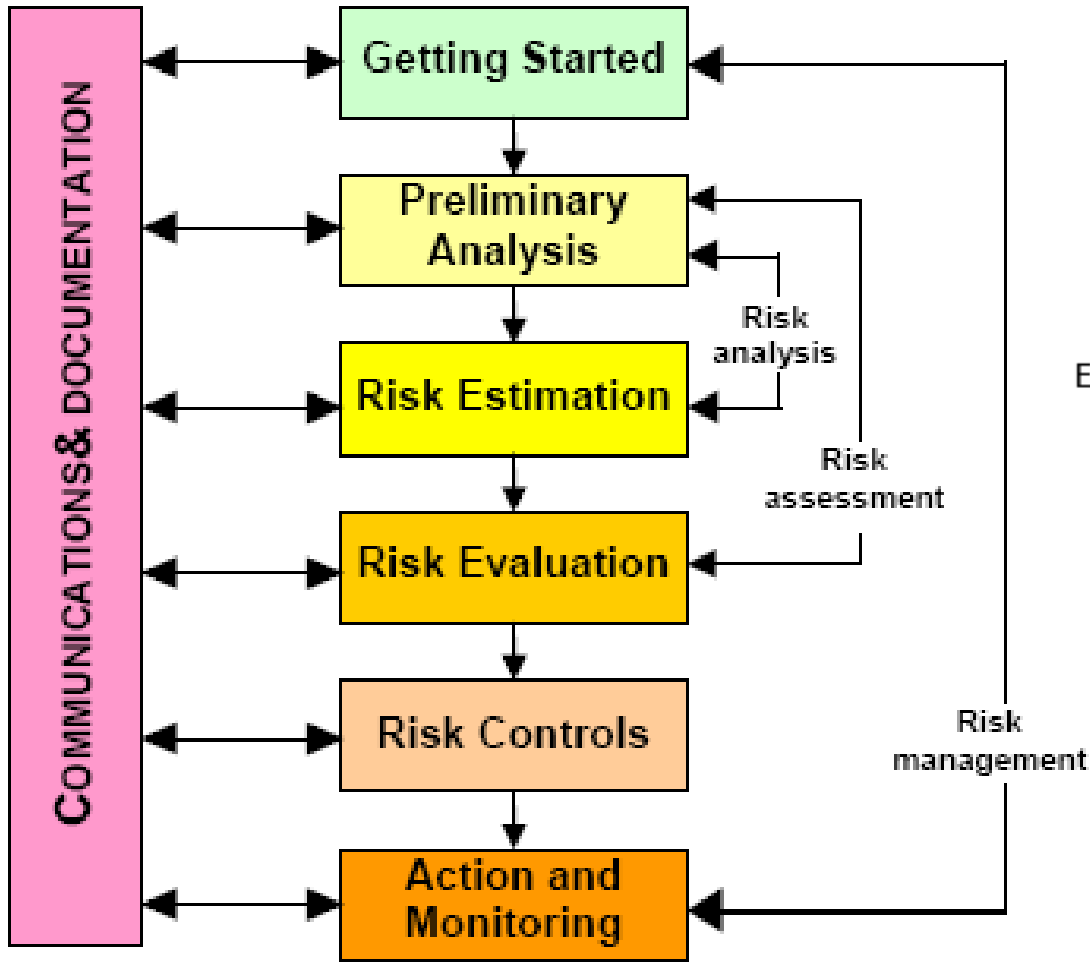


Climate Change and Risk Management

- framework is understood by stakeholders and decision-makers – quantifiable;
- appropriate for quick scans or large adaptation projects;
- deals with uncertainty relatively well;
- development of feasible adaptation options;
- collaboration between multiple departments / centres / sectors;
- considered alongside multiple stressors – not just climate, rather climate mainstreamed;
- proof of action/due diligence – legalities.



Risk Management Process



Guiding Principles of Risk Management

- Engaging important or affected or involved groups
- Communication
- Documentation
- Use of existing tools, human and technical resources
- Public education and awareness



Risk Assessment Process

- Break-out sessions component of OCCIAR workshops
- Facilitated
- Step by step through process
- Use a fictitious community case study

Case Study 1 - Setting the Stage Municipal Infrastructure

As the City's chief infrastructure engineer you are required to be on call in case of emergencies as they pertain to city infrastructure. At 2:00 am you receive a phone call from the police stating that a section of a municipal road is flooded. Upon arrival, you notice that the road, surrounded by residential neighbourhoods on either side, has a torrent of water rushing down it and where there were once 4 lanes of blacktop is now a small river. A combination of melting snow and heavy spring rain has resulted in copious amounts of water unable to escape via over-land drainage routes. You also notice that pieces of debris are blocking other large catch basins thus prohibiting water from entering the storm-water system. ...

Step 1: Getting Started

1. Define the hazards and vulnerabilities
2. Establish a project team with defined roles and responsibilities
3. Identify the resources required to undertake the project
4. Identify the stakeholders
5. Develop a plan for communicating with stakeholders
6. Start a risk information library

Expected results and outputs

- ✓ Risk issues and potential management implications are defined.
- ✓ Project team established.
- ✓ Terms of reference and budget for project team developed and approved.
- ✓ Modalities for communication established.
- ✓ Stakeholders identified and preliminary analysis of their needs, concerns and probable issues completed.
- ✓ Collection of documentation begun for the risk information library.

Extreme rain event in winter

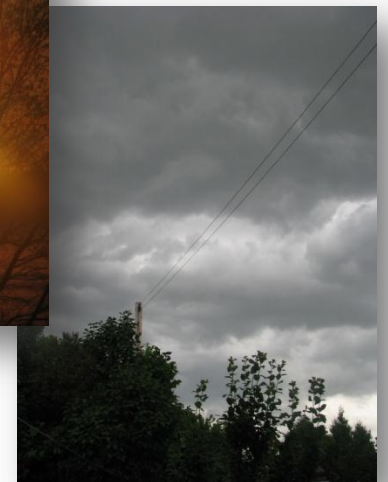
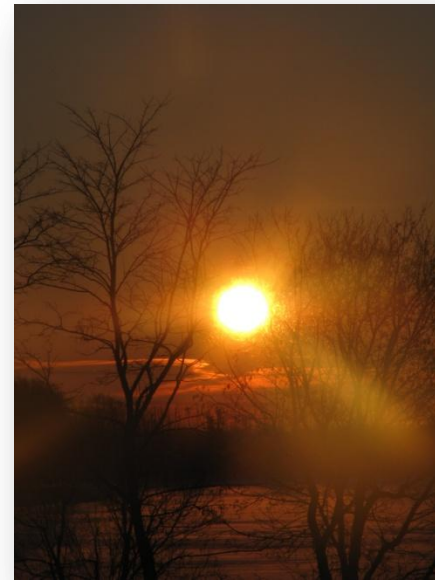
Example: Extreme rain event in winter – municipal infrastructure

Actual and potential hazards identified include:

- ◆ Extreme storms (rain, thunder and lightning)
- ◆ Increased temperatures
- ◆ Drought
- ◆ Increased precipitation

Project Team:

- ◆ Emergency personnel (police, fire, etc.)
- ◆ City departments (environment, public utilities, planners, health)
- ◆ Mayor
- ◆ Conservation authority
- ◆ Academics
- ◆ NGO's



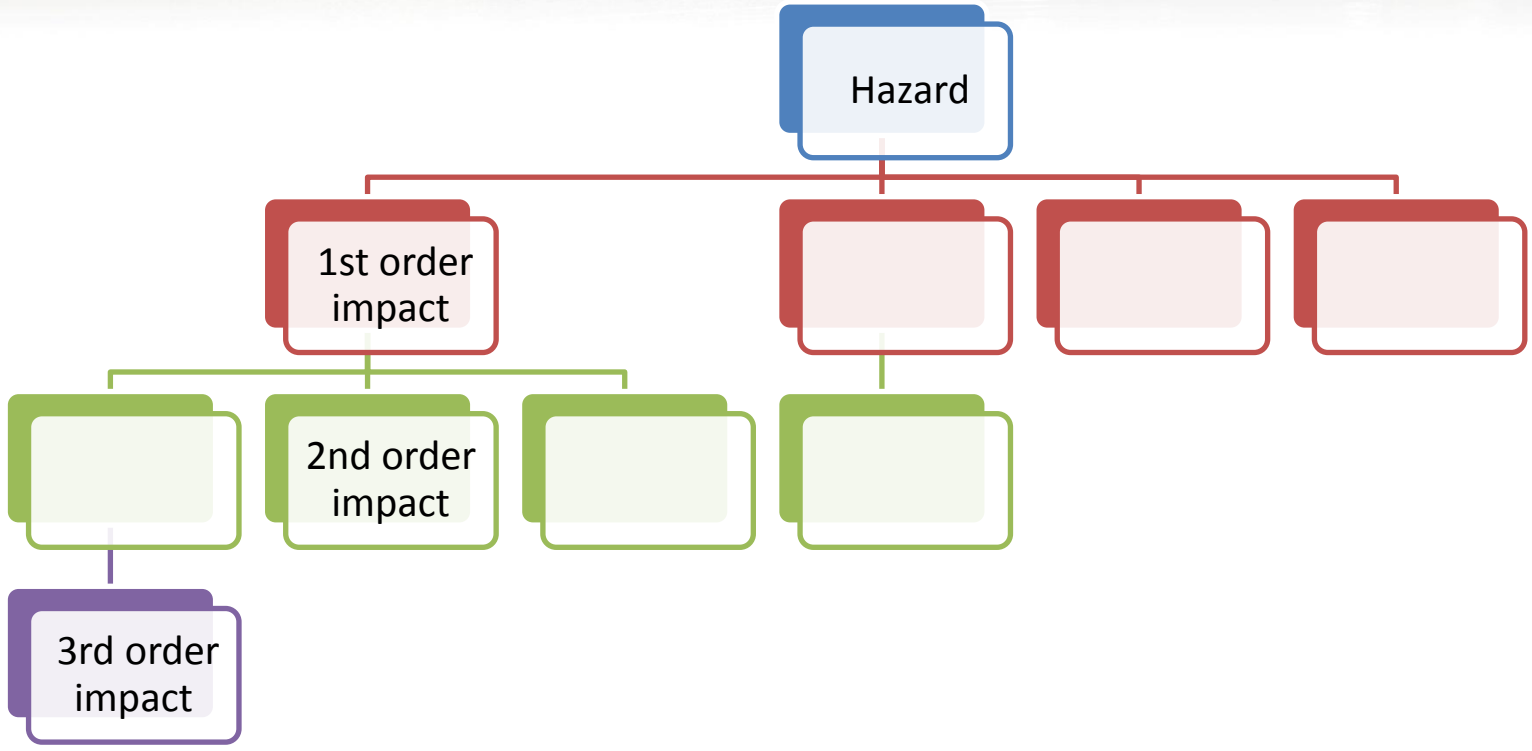
Steps 2: Preliminary Analysis

1. Develop risk scenarios based on hazards and vulnerabilities identified in step 1.
2. Collect data and identify project baseline.
3. Assign initial estimates of frequency and severity to risk scenarios.
4. Continue the stakeholder analysis.
5. Outline risk communication plan and initiate risk communications with stakeholders.
6. Update risk information library.

Expected results and outputs

- ✓ Risk scenarios are developed and a preliminary analysis is completed for each, showing potential losses
- ✓ Baseline information has been collected, or plans in place to collect additional baseline information
- ✓ Additional stakeholder analysis completed
- ✓ Stakeholder communications initiated
- ✓ Risk information library is started and rules for document collection are established;
- ✓ Important reference material is documented and stored
- ✓ Outline of risk communications plan has been completed

Impact Tree

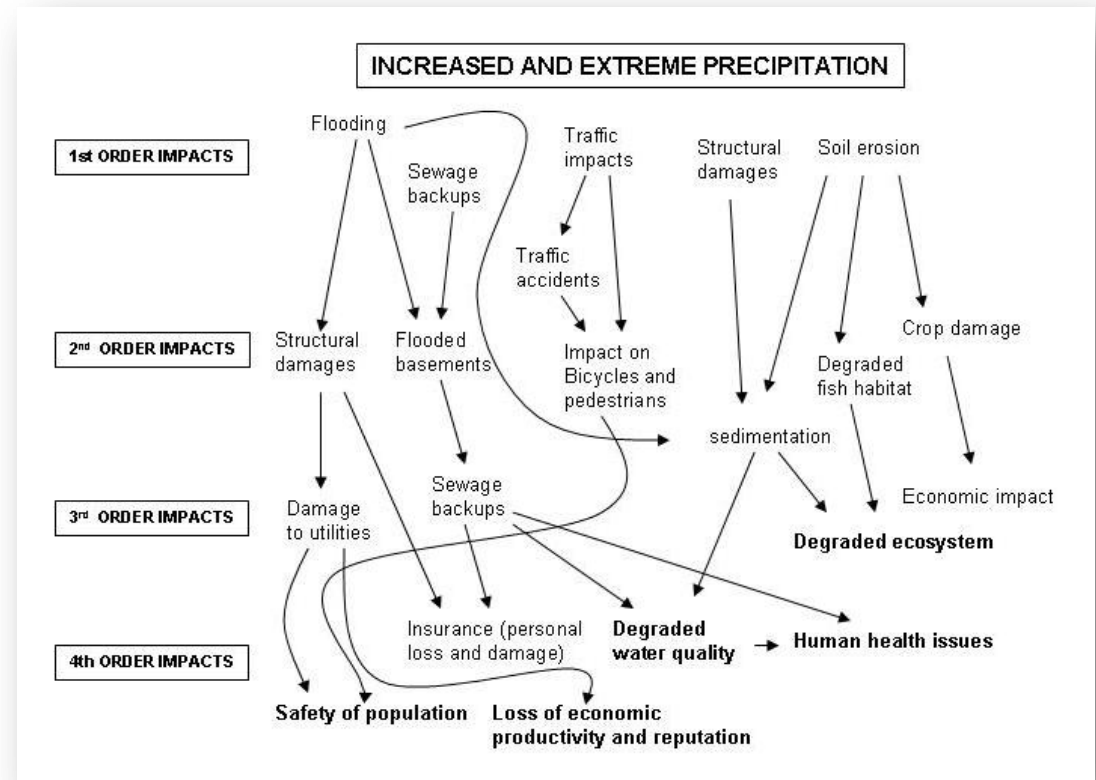


Step 2: Preliminary Analysis

Example: Extreme rain event in winter – municipal infrastructure

Possible hazard: Increased and extreme precipitation

Preliminary analysis of risk:



DECISION: GO TO NEXT STEP

Steps 3: Risk Estimation

1. Select methods for estimating frequency and severity.
2. Estimate the frequency or likelihood of possible outcomes.
3. Estimate the consequences of possible outcomes.
4. Assess stakeholders perceptions of risk.
5. Display the frequency and consequence estimates in tabular or graphical format.
6. Consult with stakeholders and refine the stakeholder analysis.

Expected results and outputs

- ✓ Estimates of frequency and consequences of risk scenarios, and estimate of expected consequences for each scenarios
- ✓ Frequency and consequence estimates presented in format that is easy-to-understand by non-experts
- ✓ Estimates of the acceptance by stakeholders of risk, or a record of reasons for non-acceptance, based on dialogue with the stakeholders and a careful documentation of their perception of the risks.

Step 3: Risk Estimation

Example: Estimate the risk of each of the high order impacts
Risk Assessment Matrix (increase and extreme precipitation)

		Safety of Population	Degraded water quality	Degraded ecosystem	Human Health issues	Loss of economic impact and reputation
Severity of Impact (H, M, L)	Economic	L	H	M	M	M
	Social	H	M	M	H	L
	Environmental	L	M	H	L	L
Probability of Occurrence (H, M, L)		H	H	M	H	M

L = low M = medium H = high

Steps 4: Risk Evaluation






1. Develop the costs and benefits to each risk scenario.
2. Analyse risk perceptions of key stakeholders.
3. Assess the acceptability of risk associated with the risk scenarios and potential outcomes.
4. Compare the risk using appropriate criteria
5. Identify plausible risk control options.
6. Update risk information library.

Expected results and outputs

- ✓ Risk evaluated in terms of probability, consequence, costs and benefits
- ✓ Risk prioritized
- ✓ Unacceptable risks identified
- ✓ Meaningful dialogue with stakeholders about acceptability of risks
- ✓ Risk information library updated

Risk Evaluation Matrix

		FREQUENCY/PROBABILITY				
		Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain to Occur
IMPACT SEVERITY	Extreme	Yellow	Light Orange	Light Orange	Dark Orange	Dark Orange
	Major	Blue	Yellow	Light Orange	Light Orange	Dark Orange
	Moderate	Blue	Blue	Yellow	Light Orange	Light Orange
	Low	Green	Blue	Blue	Yellow	Light Orange
	Very Low	Green	Green	Blue	Blue	Yellow

-  **Extreme risk:** Immediate controls required
-  **High risk:** High priority control measures required
-  **Moderate risk:** Some controls required to reduce risks to lower levels
-  **Low risk:** Controls not likely required. Some actions, such as public education, may be desirable
-  **Negligible risk:** Scenarios do not require further consideration

Risk Evaluation

Impact Severity	Extreme	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain
	Major	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain
	Moderate	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain
	Low	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain
	Very Low	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain
		Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain
		Frequency/Probability				

Extreme risk: Immediate controls required	High risk: High priority control measures required	Moderate risk: Some controls required	Low risk: Controls not likely required	Negligible risk: Do not require further consideration

Step 4: Risk Evaluation

Example: estimate and evaluation the risk of each of the high order impacts (increased and extreme precipitation)

		Safety of Population	Degraded water quality	Degraded ecosystem	Human Health issues	Loss of economic impact and reputation
Severity of Impact (H, M, L)	Economic	L	H	M	M	M
	Social	H	M	M	H	L
	Environmental	L	M	H	L	L
Probability of Occurrence (H, M, L)		H	H	M	H	M
Prioritized Risk (subjective assessment)		15	21	14	18	8

$$\text{Risk} = \text{Severity} \times \text{Probability}$$

Steps 5: Risk Controls and Adaptation Decisions

1. Identify feasible adaptation or risk control options.
2. Evaluate the adaptation or risk control options (effectiveness, cost, residual risks and stakeholder acceptance)
3. Develop the implementation plan for adaptation or risk control measures.
4. Develop a risk communications plan related to residual risks.
5. Update risk information library.

Expected results and outputs

- ✓ Feasible risk control options identified
- ✓ Adaptation plan completed based on priority risks/hazards identified in earlier steps
- ✓ Strategies for financing implementation of adaptation measures
- ✓ Risks and residual risks accepted by stakeholders
- ✓ Risk information library updated

ADAPTATION			
Based on	Type of adaptation		
Intent	Spontaneous		Planned
Timing (relative to climate impact)	Reactive	Concurrent	Anticipatory
Temporal scope	Short term		Long term
Spatial scope	Localized		Widespread

Risk Controls and Adaptation Measures

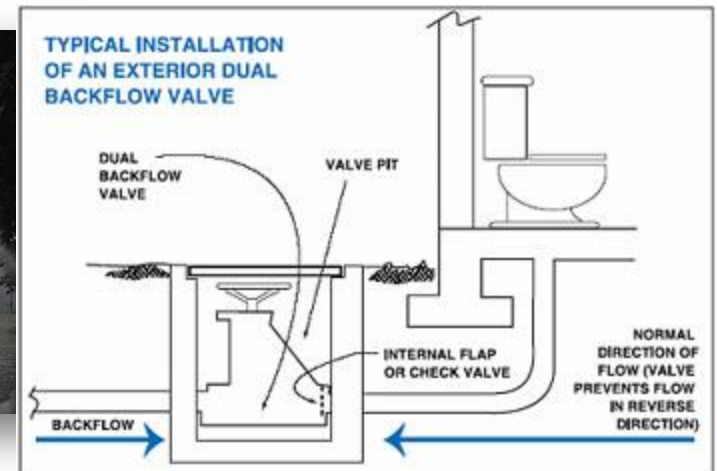
Risk	Control or Adaptation Measure

Step 5: Risk Controls and Adaptation Decisions

Example: Adaptation actions

Adaptive strategies to reduce the risk of degraded water quality as a result of increased and extreme precipitation:

- ◆ installation of sewer backflow prevention valves
- ◆ Re-think design of storm-water management and drinking water systems
- ◆ Source-controls – increased filtration capacity, increase resiliency
- ◆ Re-think building by-laws e.g. swales versus curbs
- ◆ Develop a communication plan (quicker response)
- ◆ Educate public

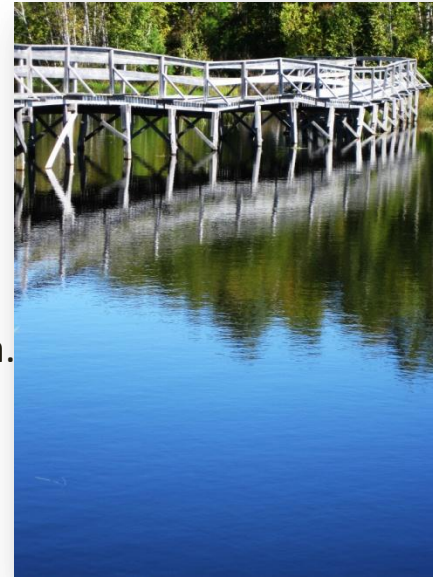


Step 6: Implementation and Monitoring

1. Develop the implementation plan.
2. Develop and establish the monitoring process.
3. Submit the plan for approval and when approved begin implementation.
4. Continue to communicate with stakeholders.
5. Review and reiterate the process, as needed.

Expected results and outputs

- ✓ Comprehensive implementation plans
- ✓ Factors that may influence implementation.
- ✓ Implementation initiated
- ✓ Risk information library updated



Process Shortcomings

- Perceived linearity
- Application in small communities
- Dealing with critical thresholds
- Flexibility of adaptive measures
- Speed of responses due to changes in climate or other factors
- Economy vs. Ecology value

