CLIMATE CHANGE ADAPTATION RISK MANAGEMENT:

A GUIDE FOR LOCAL GOVERNMENT

Bob Black

Outline

- What is climate change?
- Why should emergency managers care?
- What can we do about it?

What is climate change?

Simply put, climate change is about:

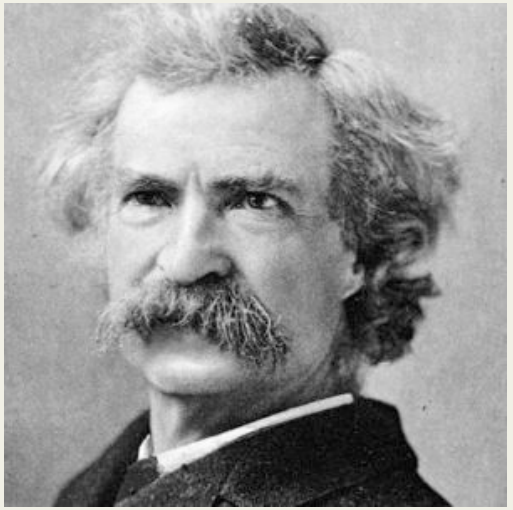
- **Temperature** – warming of the air and oceans
- **Extreme Weather** – an increase in the frequency and intensity of some extreme weather events
- **Ocean Effects** – sea level rise due to thermal expansion and the melting of glaciers and ice sheets and a change in ocean acidity

Climate versus Weather

“The difference between weather and climate is a measure of time. Weather is what conditions of the atmosphere are over a short period of time, and climate is how the atmosphere "behaves" over relatively long periods of time.” *NASA*

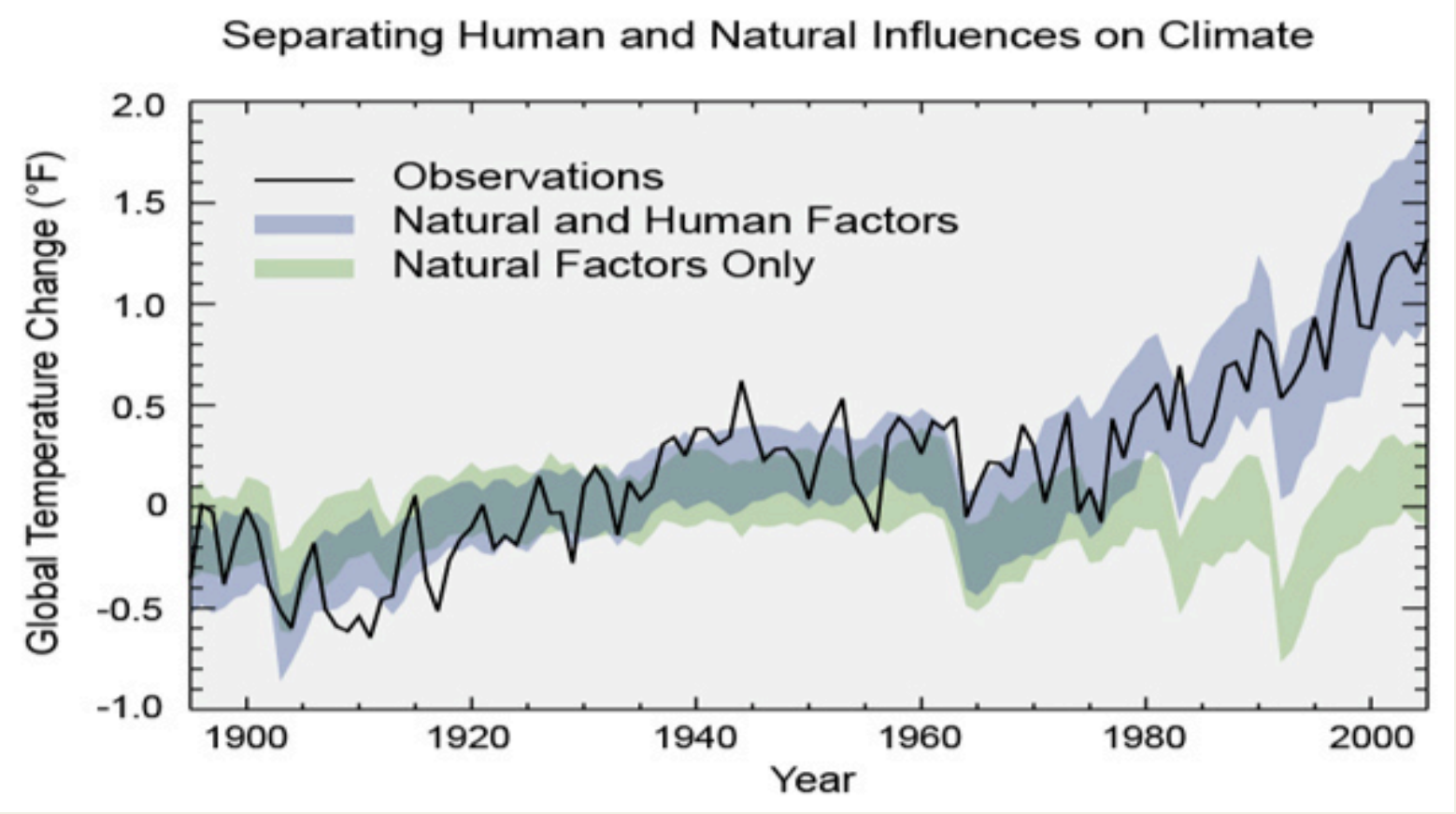
“There are three kinds of lies: lies, damned lies, and statistics”

Mark Twain



But we’re doing the best with what we’ve got

Is the climate changing?



The U.S. Global Change Research Program: 3RD National Climate Assessment May 6, 2014

Why?

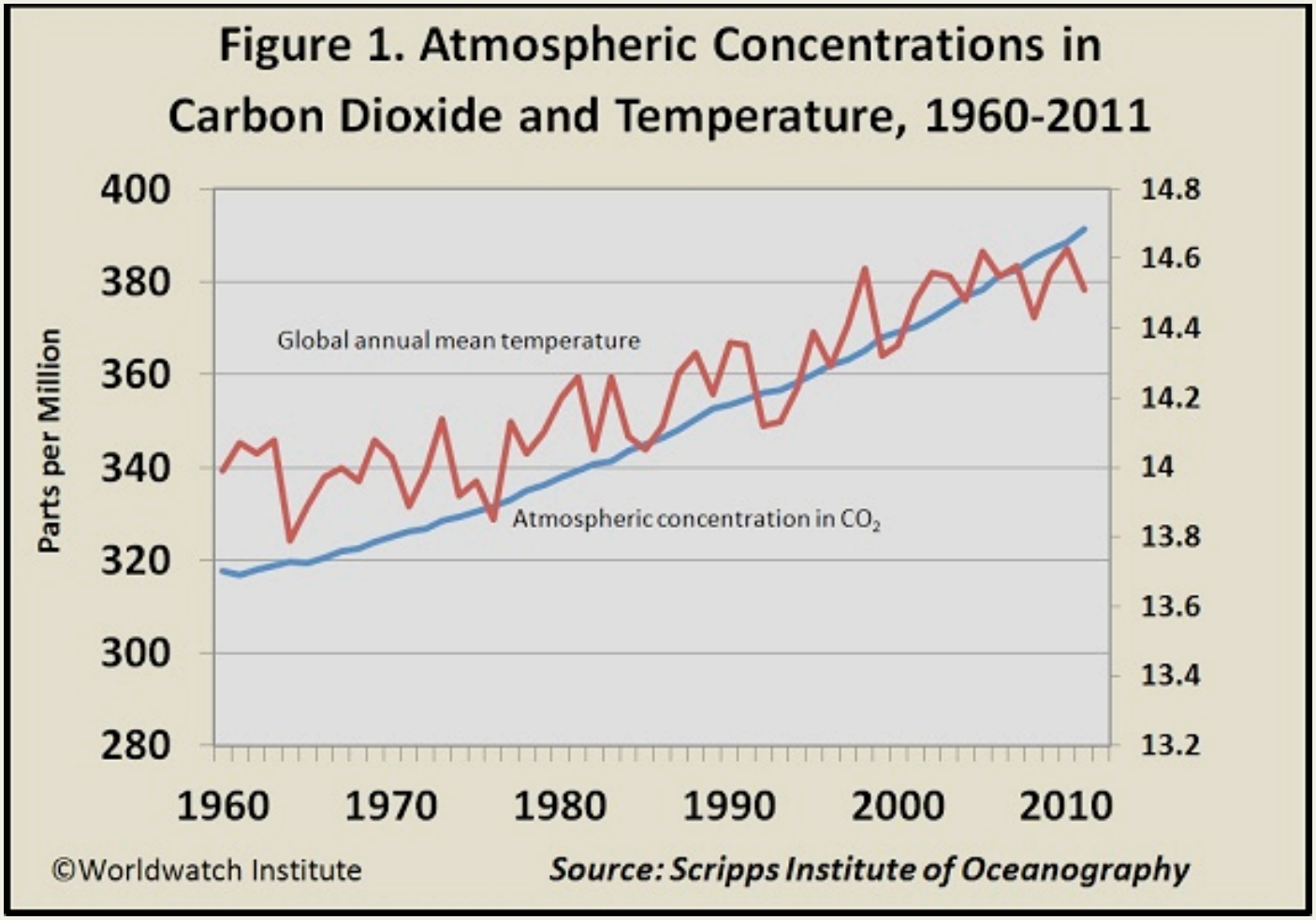
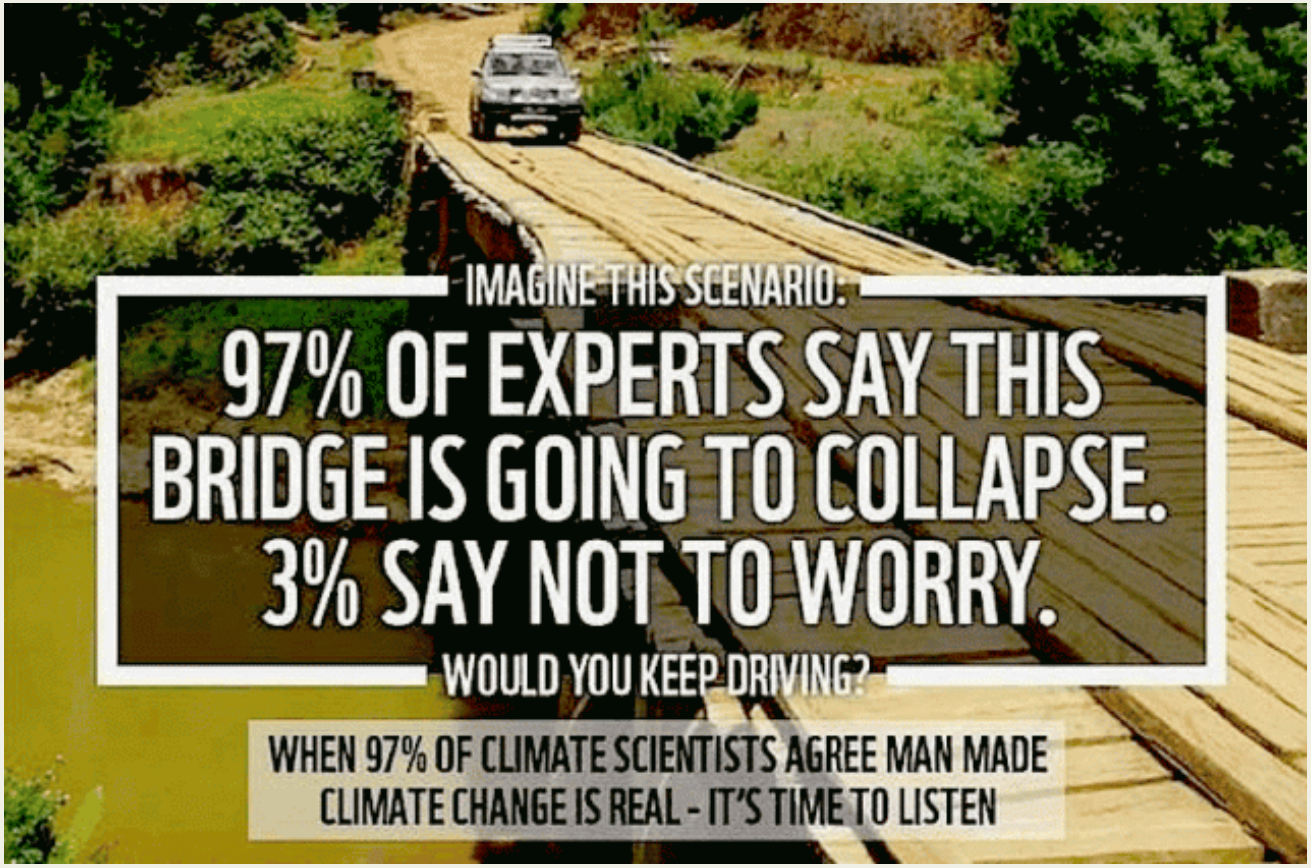


Figure 1. Atmospheric Concentrations in Carbon Dioxide and Temperature, 1960-2011
Parts per Million
400
380
360
340
320
300
280
14.8
14.6
14.4
14.2
14
13.8
13.6
13.4
13.2
Global annual mean temperature
Atmospheric concentration in CO_2
1960
1970
1980
1990
2000
2010
©Worldwatch Institute
Source: Scripps Institute of Oceanography

Should we believe the science?



What will climate change look like in BC by 2050?

Change	From 1950 to 2008	By 2050
Mean annual temperature	+ 1 to 2˚ C	+ 2 to 3˚ C coastal Up to + 4˚ C interior
Precipitation – annual (Southern Interior – summer)	+ 10 to 25% - 10 to - 30 %	+ 10% North + 5% South - 15 to – 20%
Rain intensities	Heavy precip days: + 30 to 40%	+ 5% to 15%
River flows	Increased winter and spring Declined summer and fall	Peak 15 to 40 days earlier
Snowpack April 1	20 to 60% decline	Continued decline
Sea level	Rise 4 to 12 cm over century	+ 1.2 metres by 2100 (maybe!)
Intense winter storms	+ 10% frequency	+ 13% frequency

Courtesy Dr. Jim Bruce

Why Should Emergency Managers Care?

Considering the changes noted above, some of the following potential climate change effects could be of concern to emergency managers in BC:

Increase in the Mean Annual Temperature

- Drier forests, northward movement of animal pests leading to increased interface fires
- In some areas, reduction in snow cover, glaciers and water flow may lead to water shortages
- Public health may be effected, either directly by higher temperatures, or indirectly, such as from the effects of interface fire-related smoke

Increase in Severe Weather Events

- Increased intense precipitation in “wet” areas leading to soil instability, flash flooding and river flow issues
- An increase in severe summer storms, including high winds and increased lightning, adding to the interface fire risk
- More severe winter storms with heavy snowfall and ice storms

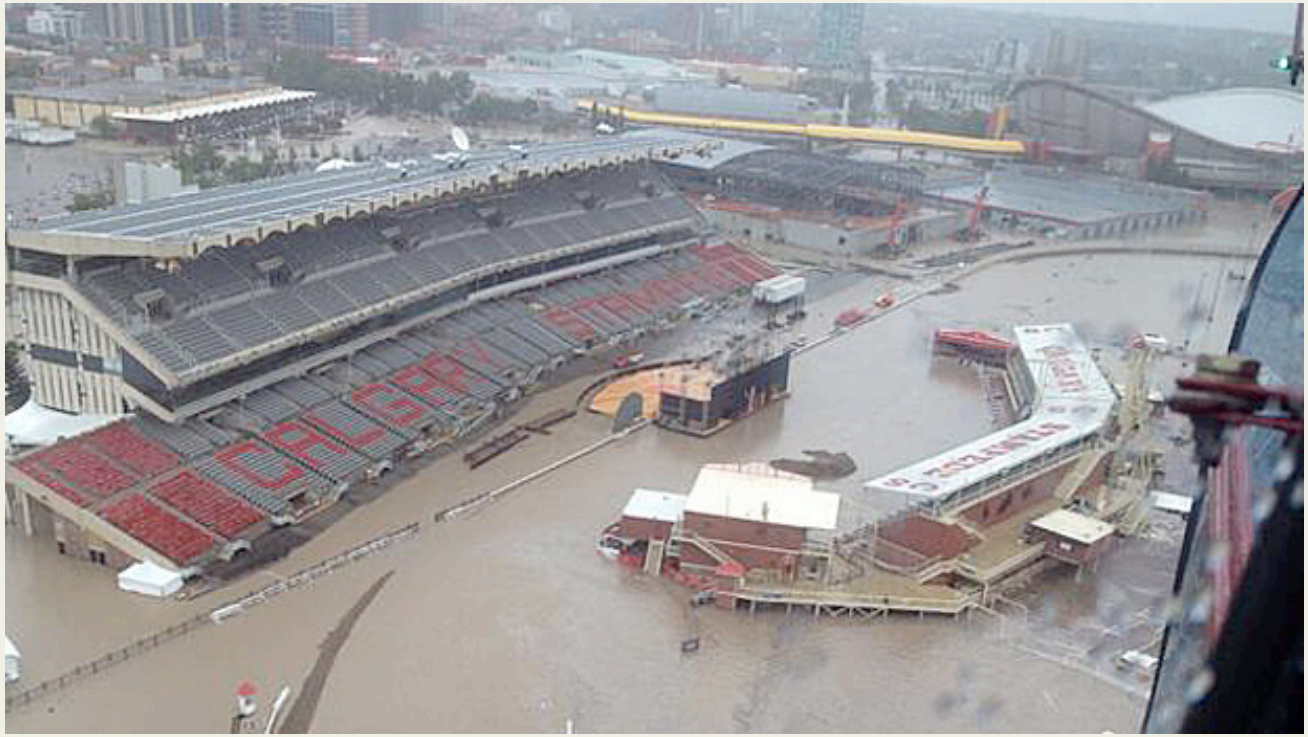
Higher Sea Levels

- Coastal flooding, threatening habitation and critical infrastructure and eroding shorelines
- Coupled with high tides and higher winds, storm surge – The Perfect Storm

Are these Emergency Management Issues?

- “Its not an emergency management problem, its for environmentalists and urban planners”
- “This is too far in the future, I’ve got ‘right now’ problems to deal with”
- “There’s no money in the budget to deal with this”
- “Thinking about this gives me a headache”

Calgary Floods 2013



Slave Lake Fire 2011

Kelowna Fires 2003

Kamloops Flash Flooding 2014

Were these events climate change related?

Probably

Were they “right now” issues for emergency managers?

Duh

Is there going to be more of this?

Undoubtedly

What can we do about it?

- Its probably too late to totally mitigate the problem (i.e. carbon emission reduction) – political issue
- If you can't mitigate, you must adapt
- So, we have to figure out how to adapt to climate change

Canadians are experts at climate adaptation

How Should We Approach Adaptation?

- The issues are complex, complicated and uncertain
- Most present some risk to humans, ecosystems, property and the environment
- We are looking for optimal answers in terms of economics, benefits, acceptability, level of effort
- Perceptions play a large role
- This suggests that a risk management approach would be useful in dealing with adaptation issues

Climate Change Adaptation Risk Assessment

If we are going to consider how we can adapt to and reduce the impacts of a changing climate, it seems essential that we have to begin by comprehensively assessing the risk

Risk Management

- Historically used by insurance and financial industries
- Now adopted into engineering, health, environment and climate change adaptation
- Two key international standards:
  - ISO 31000 – Risk Management: Principles and Guidelines; and
  - ISO 31010 – Risk Management: Risk Assessment Techniques

Climate Change Risk Management Tools

- The ICLEI (International Council for Local Environmental Initiatives) and the new BARC (Building Adaptive and Resilient Communities) program focuses on sustainable communities and is used by several Canadian municipalities.
- Public Infrastructure Engineering Vulnerability Committee (PIEVC) developed by Engineers Canada focuses mostly on infrastructure.
- The Frazer Basin Council climate risk assessment tool.

Climate Change Adaptation Risk Management:

A Guide for Local Government

“The Guide”

The Development Team

- Dr. Jim Bruce – Climate Lead 
- Mark Egener – Risk Management Lead 
- Bob Black – Emergency Management Lead 

Development Challenges

- Climate change not well understood
- Climate change not usually addressed by strategic or long-range plans
- Emergency planners typically focused on current hazards, difficult to project 50 years into the future

Guide Principles

- Easy to use
- Results oriented
- Strategically focused
- Affordable
- Standards based (ISO 31000)

Iterations of the Guide

- 2001 - 2004 CARICOM (Caribbean Community)
- 2005 - 2010 Canadian Federal Government sponsored projects for Arctic and Northern Communities and the provinces of Alberta and British Columbia
- 2010 Province of Ontario
- 2012 Province of Alberta

Lessons Learned During Development

- Customize for users
- Offer simplified climate predictions
- Rely on templates
- Consult with stakeholders

Description of the CCARM Guide and Process

Guide Summary

Step 1: Establishing the Context

Purpose:

- Decide on the specific risk sources;
- Identify timelines, staff and other resource requirements;
- Select the risk management team;
- Review team terms of reference; and
- Identify affected stakeholders.

Step 2: Risk Identification

- Analyze climate change impacts and identify risk events
- Conduct preliminary estimation of likelihood and consequences
- Discard lower-level risk events

Impact/Event	Vulnerability	Likelihood			Consequences			Comment or Control Measures
		L	M	H	L	M	H	

Likelihood: 1 – Unlikely to Occur
2 – Moderately Frequent to Occur
3 – Almost Certain to Occur

Consequences: 1 – Low
2 – Moderate
3 – High

Step 2: Risk Identification Template

Impact/Event	Vulnerability	Likelihood			Consequences			Comment or Control Measures
		L	M	H	L	M	H	

Likelihood: 1 – Unlikely to Occur
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Consequences: 1 – Low
2 – Moderate
3 – High

Step 2: Risk Identification Template

Risk Scenario	Vulnerabilities	Frequency			Consequences			Control Measures
		L	M	H	L	M	H	
Increased Temperature (+2 degree warming over most of BC, possibly higher in coastal regions)								
T1. Increased Park Usage	• Overburdened infrastructure • Negative impact on environment • Public pressure for more amenities • Increased costs • Increased enforcement issues		X			X		• Parks Management Program • Parks Bylaw and Regulations • Parks 10 Year Capital Development Plan • (P) Ecological Health Plan • (P) Future Parks Capital Development Plans
T2. Increased wildfires 	• Safety of parks visitors and staff • Restrictions on public activities • Impact to regular staff operations • Increased costs • Damage to lands and infrastructure • Risk to interface areas • Impact on air quality		X	X			X	• Static Wildfire RMS • Site & Dept emergency plans • Staff training and practices • Centralized fire equipment trailer • Interagency response training & procedures • Natural Resource Management Program framework • Posting of fire danger ratings and restrictions on Parks website • Mutual Aid Agreement with BCFS • (P) Dynamic Wildfire RMS • (P) Train & implement advanced system fire suppression team • (P) Evacuation planning for all parks sites • (P) Dynamic GIS emergency mapping • (P) Enhanced training and planning with local authorities
	•							•
T4. Increased demand on water and sewer systems	• More SSOs and CSOs in the sewer • Reduced water pressure • Increased costs for water treatment chemicals • Climate change		X	X		X	X	• Infrastructure designed to accommodate increased demands • Preventative maintenance • Water shortage response plan • Public education • Operating strategies – fill lakes before

Step 3: Risk Analysis

- Conduct a more detailed estimate of the likelihood of the risk events identified in Step 2
- Frequency template addresses single or ongoing/cumulative events
- Consequence template customized for client use
- Consider stakeholder perceptions

Likelihood Range Type of Event	Very Low	Low	Moderate	High	Very High
Significant Single Event; or	Not likely to occur in period	Likely to occur once between 30 and 50 years	Likely to occur between 10 and 30 years	Likely to occur at least once a decade	Will occur once or more annually
On-going / Cumulative Occurrence	Not likely to become critical in period	Likely to become critical in 30-50 years	Likely to become critical in 10-30 years	Likely to become critical in a decade	Will become critical within several years

Step 3.a: Risk Likelihood Template

Factor / Degree	People				Economic		Environment			
	Health and Safety	Displacement	Loss of Livelihood	Reputation	Infrastructure Damage	Financial Impact	Air	Water	Land	Ecosystems
Very Low										
Low										
Moderate										
High										
Very High										

Step 3.b: Risk Consequence Template

T2: Increased Wildfires

Preliminary Likelihood: Moderate/High Preliminary Consequence: High

Likelihood Range / Type of Event	Very Low	Low	Moderate	High	Very High
Significant Single Event; or	Not likely to occur in period	May occur once between 30 and 50 years	May occur between 10 and 30 years	Likely to occur at least once a decade	Likely to occur once or more annually
					x
On-going / Cumulative Occurrence	Not likely to become critical in period	May become critical in 30-50 years	Likely to become critical in 10-30 years	Likely to become critical in a decade	Will become critical within several years

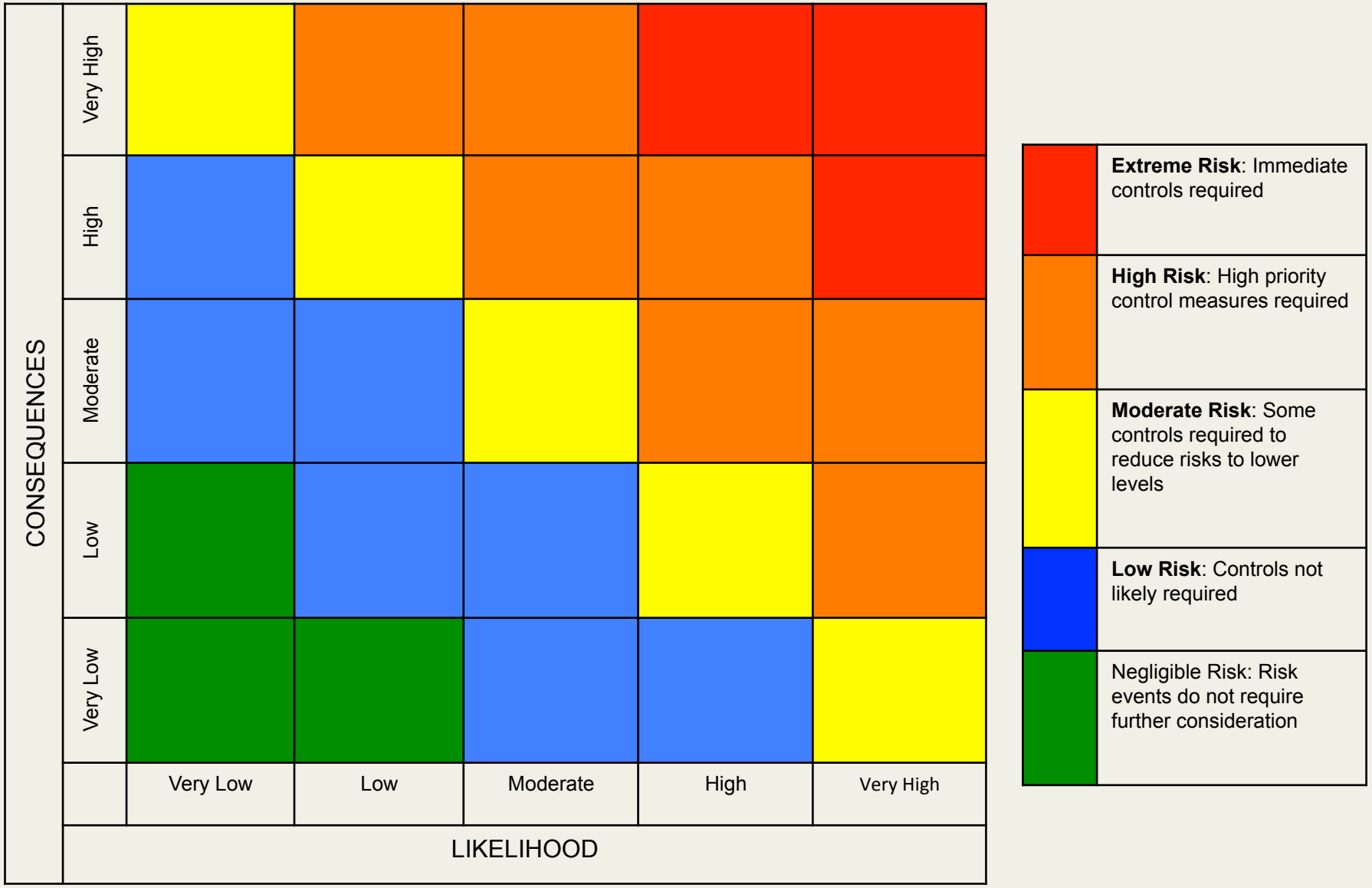
Final Likelihood Rating: Very High

Factor / Degree	People				Economic		Environment			
	Health and Safety	Displacement	Loss of Livelihood	Reputation	Infrastructure Damage	Financial Impact	Air	Water	Land	Ecosystems
Very Low										
Low				x						
Moderate			x							
High	x	x			x	x		x	x	
Very High							x			

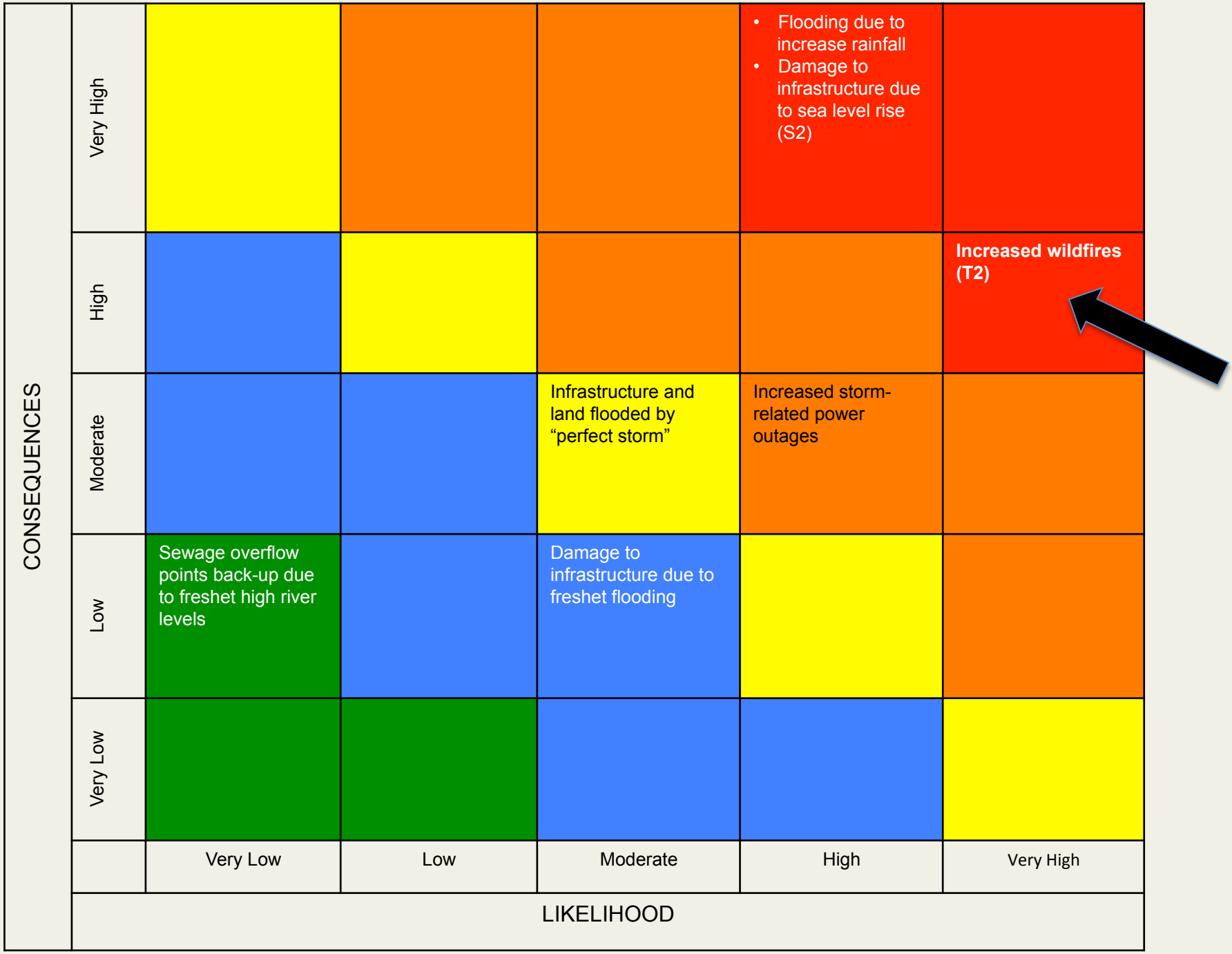
Final Consequence Rating: High

Step 4: Risk Evaluation

- Compare the risk levels estimated in Step 3
- Discard low-level risks and rank remaining risks



Step 4: Risk Evaluation Template


CONSEQUENCES
Very High
High
Moderate
Low
Very Low
• Flooding due to increase rainfall
• Damage to infrastructure due to sea level rise (S2)
Increased wildfires (T2)
Infrastructure and land flooded by “perfect storm”
Increased storm-related power outages
Sewage overflow points back-up due to freshet high river levels
Damage to infrastructure due to freshet flooding
Very Low
Low
Moderate
High
Very High
LIKELIHOOD

Step 5: Risk Treatment or Adaptation Measures

For those risks assessed as unacceptable in Step 4:

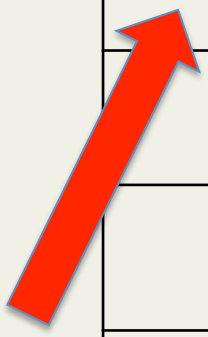
- Identify adaptation measures or risk control strategies to reduce risks to acceptable, practicable levels.
- Evaluate the effectiveness of the adaptation measures, including costs and benefits.
- Select optimal adaptation measures and the acceptability of residual risks is considered.

Risk	Control or Adaptation Measure	Time Frame	Cost	Effectiveness	Acceptability	Comment/ Evaluation

Time Frame	Cost	Effectiveness	Acceptability
Short – can be implemented within 10 years	**$** - can be completed within existing or planned budget allocation	**Low** – will have minor effect on risk event	**Low** – significant public/corporate/ stakeholder resistance
Medium- can be implemented within 10-20 years	**$$** - will require additional funding	**Moderate** – will have moderate effect on risk	**Moderate** – moderate public/corporate/ stakeholder resistance
Long – can be implemented within 20 – 50 years	**$$$** - will require major additional funding/ major capital program	**High** – will virtually overcome risk event	**High** – little or now public/corporate/ stakeholder resistance

Step 5: Risk Treatment or Adaptation Measures Template

Risk	Control or Adaptation Measure	Time Frame	Cost	Effectiveness	Acceptability	Comment/ Evaluation
Increased wildfires (T2)	Train and implement advanced fire suppression team	S	$$	M	H	
	Evacuation planning for all parks sites	S	$	M	H	
	Enhanced training and planning with local authorities	S	$	M	H	
	Dynamic GIS emergency mapping	S	$$	L	H	
Damage to infrastructure due to sea level rise (S2)	New outfalls and pump stations	M	$$$	H	L	
	Protect existing infrastructure with dykes	S	$$$	H	M	



Step 6: Implementation

Consider:

- how adaptation measures could be implemented
- how opportunities could be exploited
- how both should be monitored

User Feedback

- Strategic level of this process leads to more detailed analysis of high-priority areas
- Users require some form of workshop or knowledge “champion” to make process work
- Long-term approach of this process (40-50 years) creates useful inputs to shorter-term strategic and enterprise risk management plans
- Useful to educate senior management and leadership in climate change issues

Ongoing Challenges

- Can be difficult to get local governments to focus on long-term risk assessment
- “Champions” are vital to the success of the process
- Use of non-standardized risk assessment processes leads to confusion
- The results need to be continually monitored

Where can you find The Guide?

http://blackshieldps.com/resources/

Where can you find me?

bob@blackshieldps.com

Questions?