

What the

CENSORED

Just happened?

THOMPSON WATERSHED DISASTER MITIGATION

COMMUNITY FORUM

FEBRUARY 14, 2018

Dwayne Meredith, P.Ag.

Agenda

- ▶ Historic context and recent events
- ▶ Policy and scientific information
- ▶ Why this is happening
- ▶ What can be done



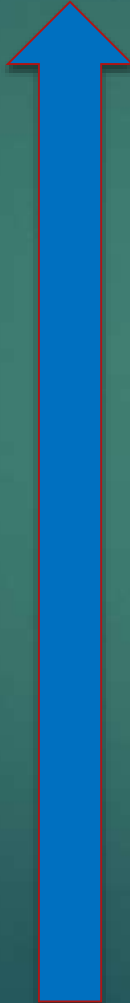
Skeena River 2007

Take Away Message

- ▶ Flood and Debris Flows (maybe other natural hazards!) will be occurring more often.
- ▶ Risk Assessments are a valuable tool and are needed to complete mitigation efforts.
- ▶ To address these hazards, a wide range of individuals need to be involved.

History of Flood Costs

Year	Province	Event	2016 (Millions)
2013	AB	Calgary	\$6,200
1954	ON	Southern ON (Hurricane Hazel)	\$6,124
1948	BC	Fraser River	\$5,875
1950	MB	Winnipeg	\$5,284
1996	QC	Saguenay	\$3,066
2005	ON	Southern Ontario	\$1,803
2005	AB	High River, Southern AB	\$1,725
1997	MB	Southern Manitoba	\$1,397
1948	ON	Southern Ontario	\$802
1993	MB	Winnipeg	\$702
1937	ON	Southern Ontario	\$534
1923	NB	Saint John River Basin	\$526
1955	SK/MB	Manitoba and Saskatchewan	\$526
2004	AB	Edmonton	\$344
1995	AB	Southern Alberta	\$324
1934	NB	Plaster Rock	\$225
1936	NB	New Brunswick	\$214
1999	MB	Melita	\$185
1916	ON	Central Ontario	\$183
1909	NB	Chester	\$169
1961	NB	Saint John River Basin	\$168
1987	QC	Montréal	\$167
1996	QC	Montréal and Mauricie Region	\$165
1920	ON	Southwestern Ontario	\$150
1920	BC	Prince George	\$149
2004	ON	Peterborough	\$147
1972	QC	Richelieu River	\$141
1983	NF	Newfoundland	\$131
1974	QC	Maniwaki	\$117



© Environment Canada, 2013

Calgary 2013



© Environment Canada, 2013



Andy Clark / Reuters

High River, 2013

Flood 2017



Lumby, May 5 and June 21, 2017
Floodwaters are once again rising



Armstrong, May 5, 2017



Vancouver, October 12, 2017

Flood 2017



Helmer Lake Dam



Cache Creek



Guichon Creek



BC Flood Management

- ▶ 2003/4 Amended Legislation to “Local Authority” from Province
- ▶ 2004 BC Flood Hazard Area Land Use Guidelines
- ▶ Designated FPs 30 years ago no longer considered designated
- ▶ Province retained authority for diking oversight
- ▶ Prepared flood guidelines but no standards/regulations ever produced
- ▶ Local Authority responsible for hazard mapping and development approval

Landslides 2017



May 6: Debris flow into Shuswap Lake



May 14: evacuation order has been issued for 17 properties near West Kelowna



Nov 23: Rainfall warning issued for Vancouver, Fraser Valley with up to 150mm expected

Landslide – Debris Flow Management

- ▶ 2004 BC Flood Hazard Area Land Use Guidelines
- ▶ Province considers protective works to be authorized under DMA
- ▶ No Provincial landslide guidelines
- ▶ Local Authority (or Provincial Approving Officers) responsible development approval



Terrace 2007

Landslide – Debris Flow Management

Land Use Management Guidelines (2004)

3.4 Areas Subject to Debris Flows

Development should be discouraged in areas where local knowledge, experience or studies indicate concern that there may be a debris flow hazard.

3.4.1 Professional Evaluation

Consent to develop may be granted, with standard requirements as established for alluvial fans in section 3.3, where:

- There is no other land available, and
- Where an assessment of the land by a suitably qualified professional indicates that development may occur safely.



Chilcofin River, August 29, 2004

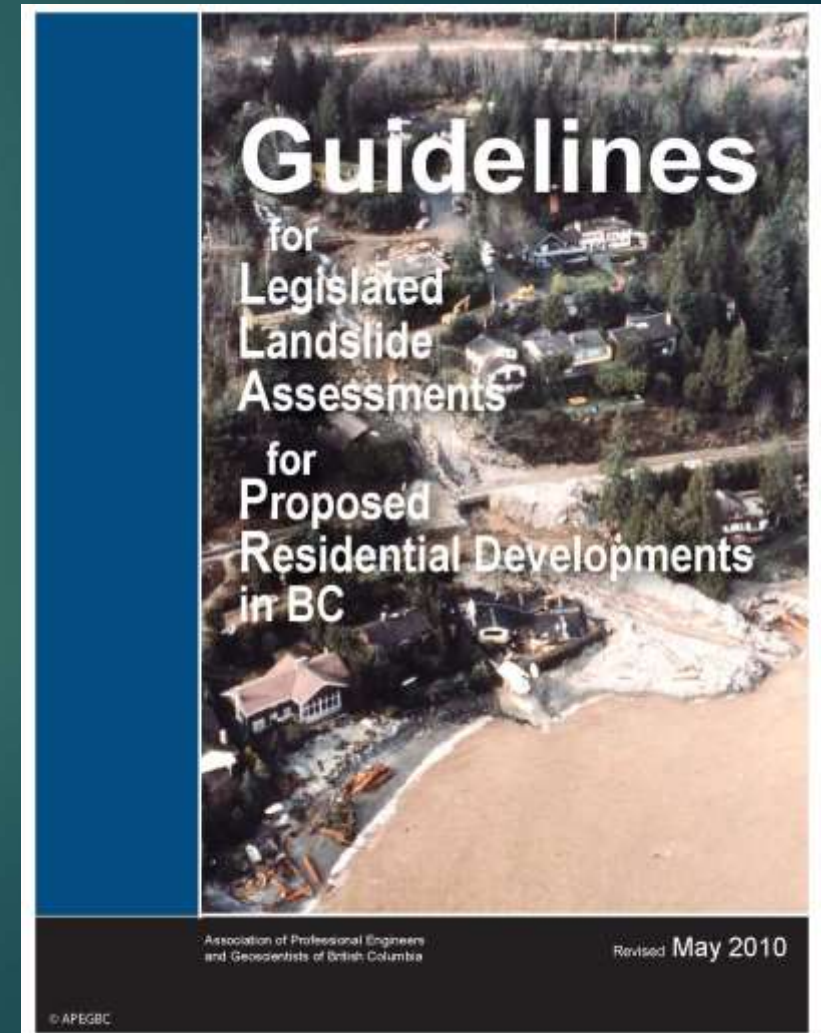
Landslide – Debris Flow Management

What is a Landslide? Debris Flow?

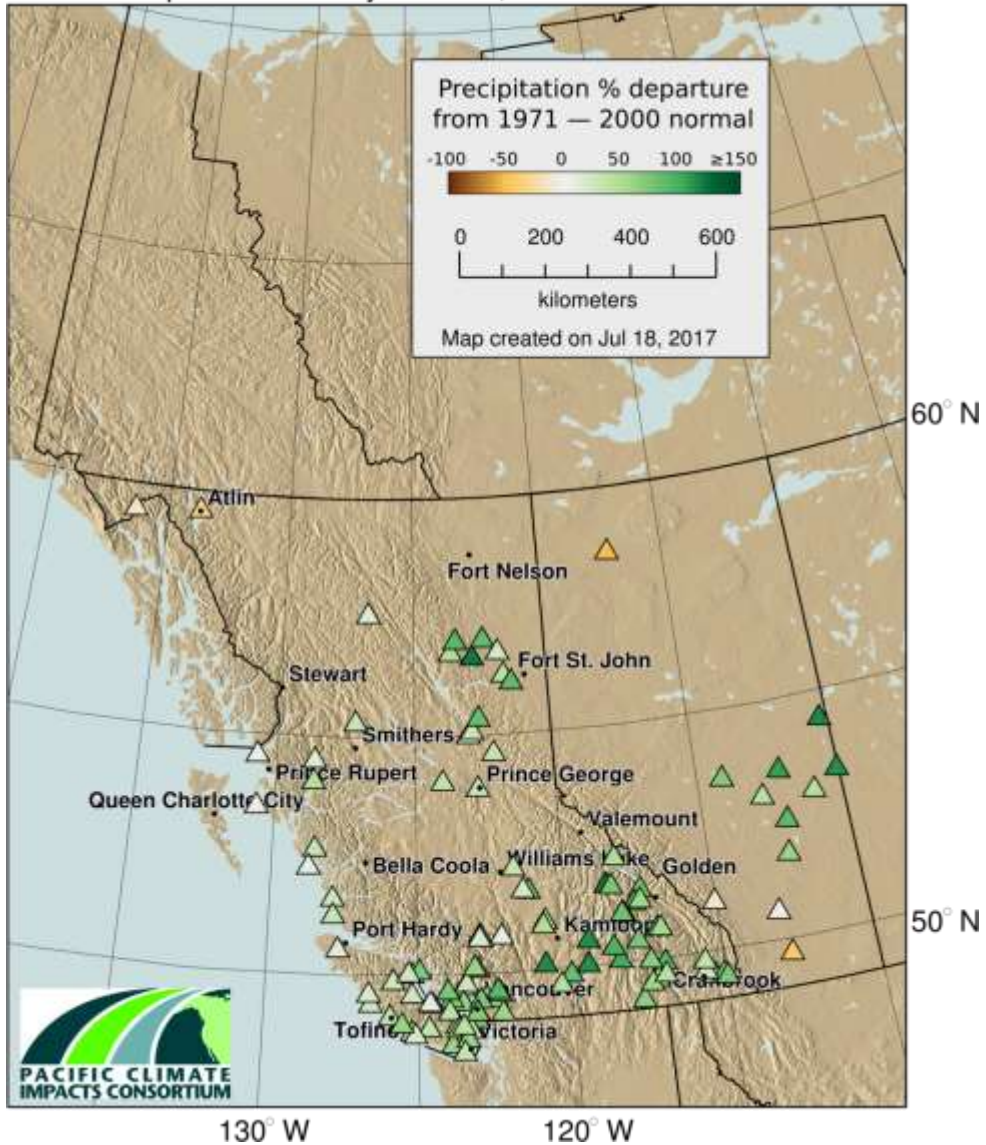
“Landslide A movement of a mass of rock, debris, or earth down a slope” (Cruden 1991).

Usual triggering mechanism:

- ▶ Water
- ▶ Seismic Activity
- ▶ Volcanic Activity

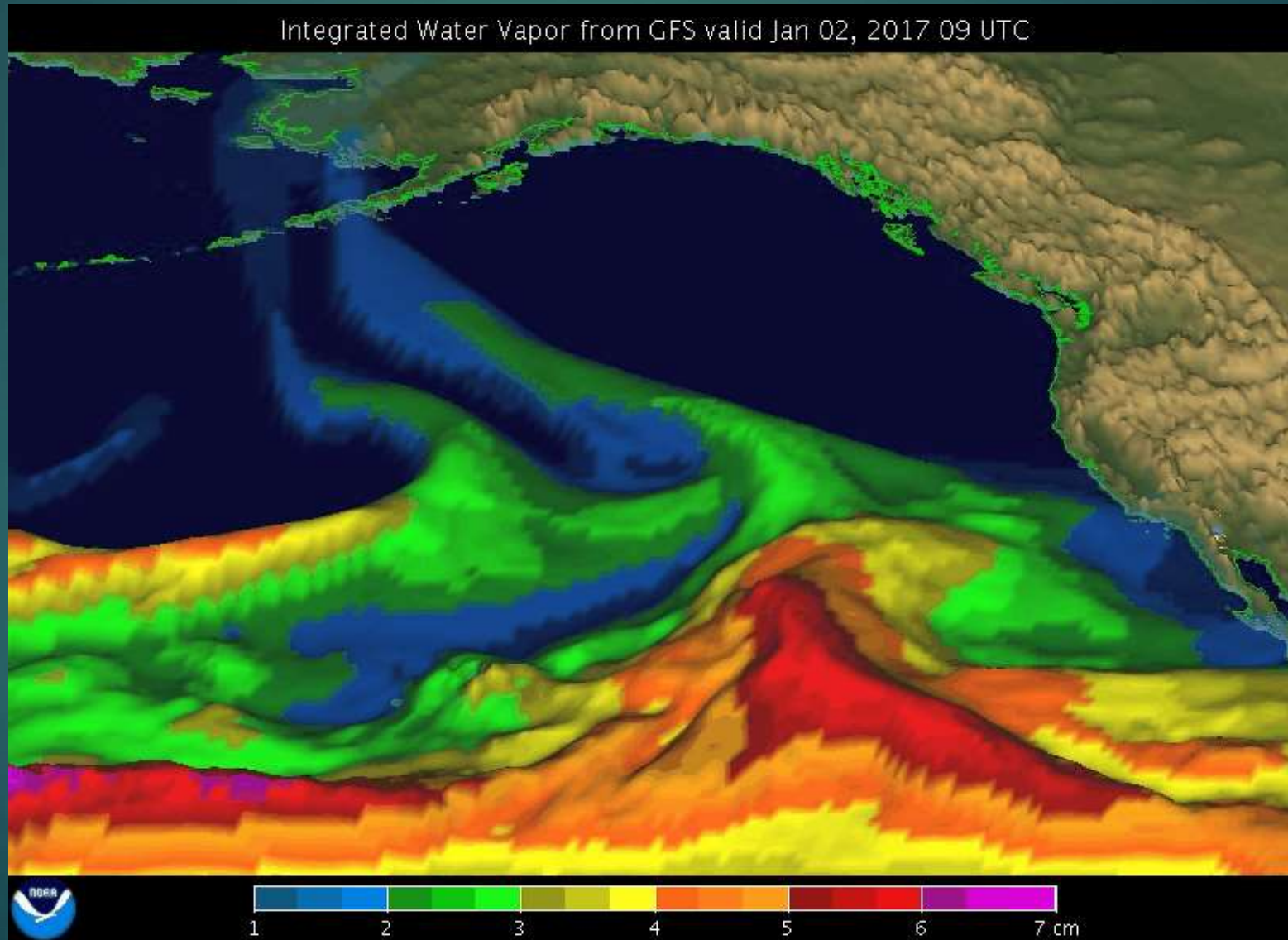


Mean Precipitation Anomaly for MAM, 2017



Why is this happening?

Why is this happening?



Why is this Happening?

- ▶ Find the susceptible areas or system weak points:
 - ▶ Post wildfire – changed hydrology, hydrophobic soils
 - ▶ Exposed streambanks following past flood.
 - ▶ Tufa or other calcareous deposits
 - ▶ Past forest practices
 - ▶ Culvert placements
 - ▶ Systems with little/no redundancies
 - ▶ Systems with design compromises
 - ▶ Etc.

What's Involved

Starting Point:

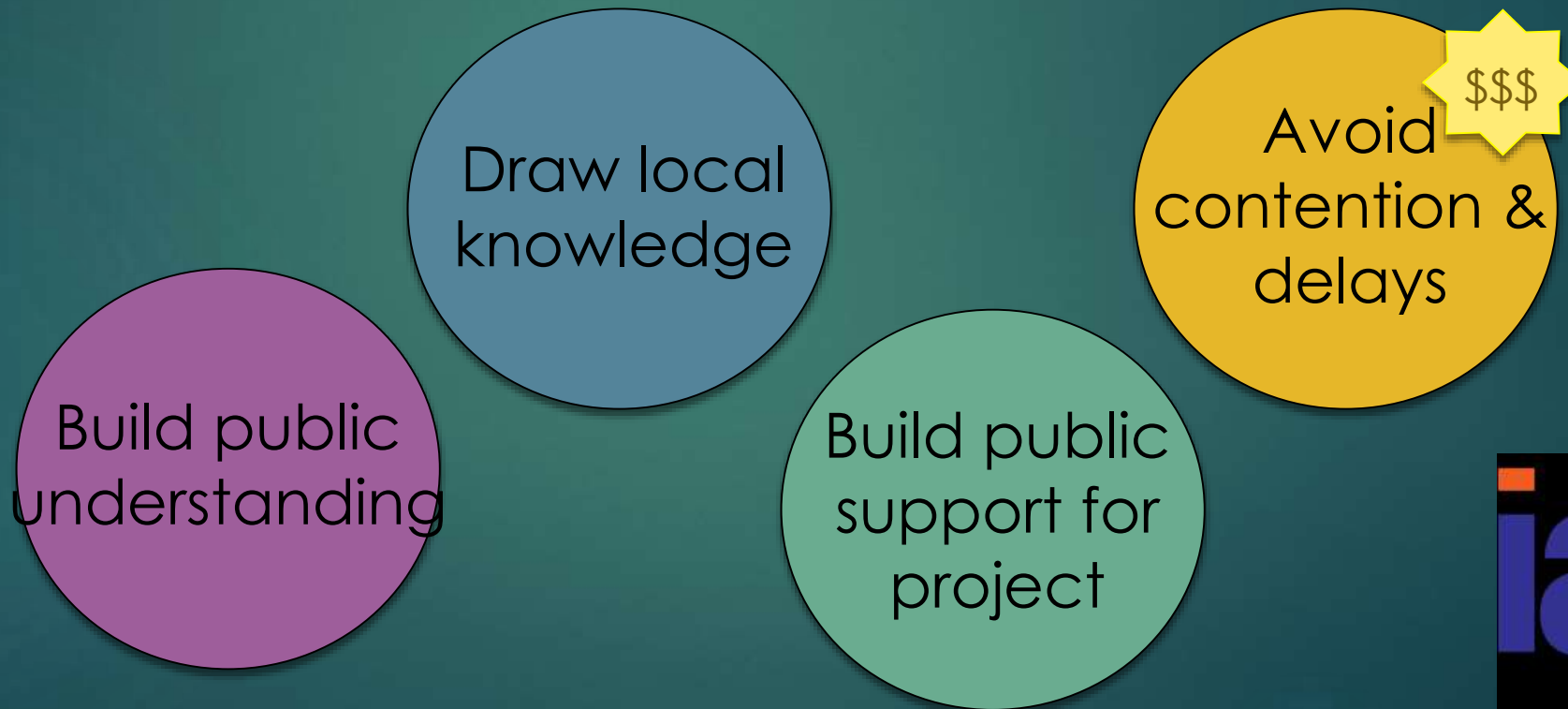
- ▶ Understanding the Hazard
- ▶ Understanding the Consequences – or at least what we currently value.

$$\text{Risk} = \text{Hazard} \times \text{Consequence}$$

What's Involved

Included in the process: determine who's included.

Engagement: involving the right people to influence project outcomes

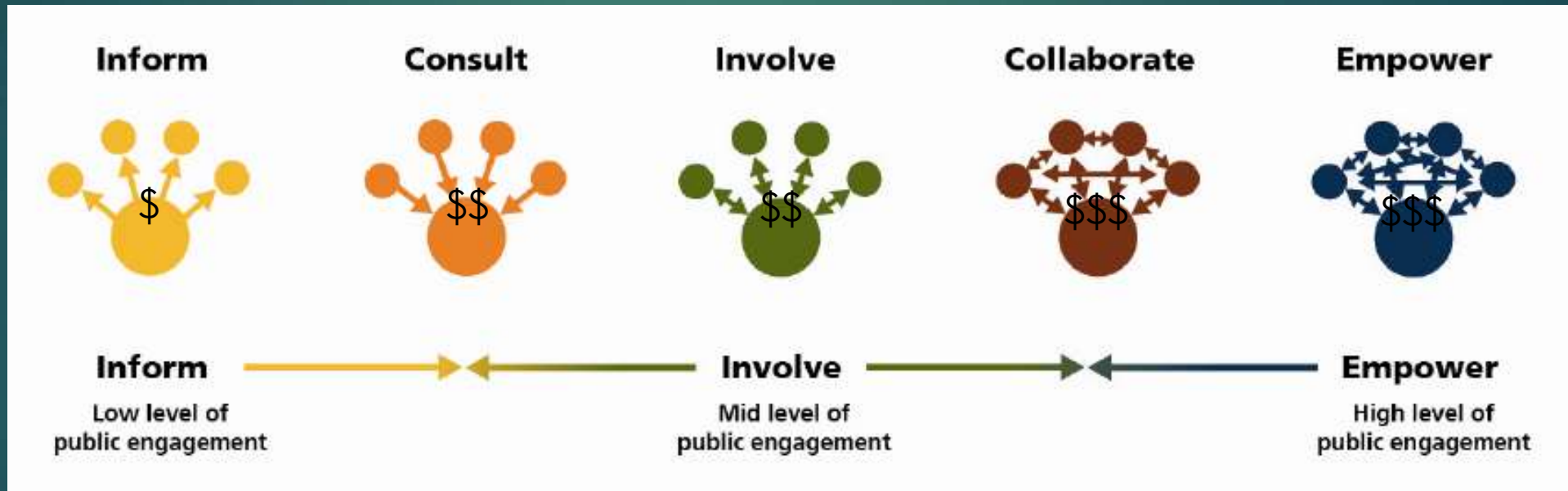


What's Involved

▶ Participation

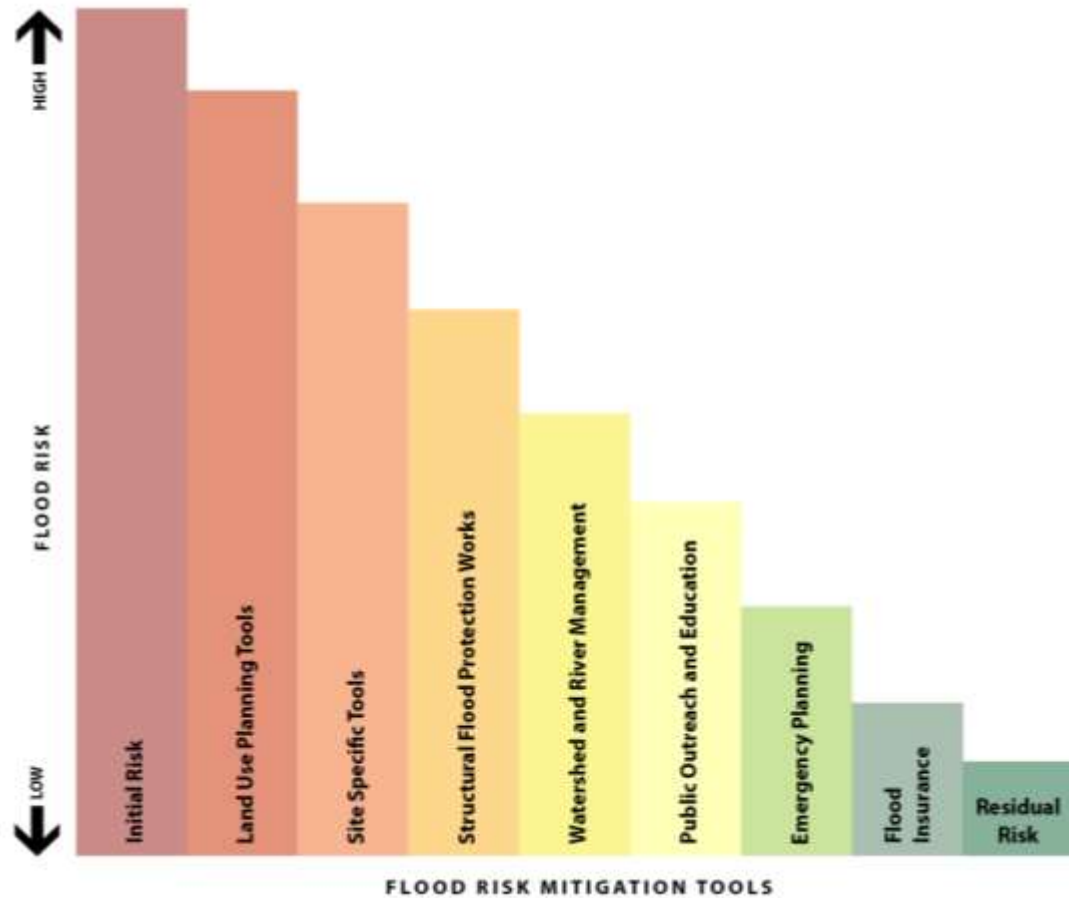
Select your level of Engagement

1. Client expectations & tolerance (early buy-in)
2. Engagement objectives (desired outcomes)
3. Who is your audience? (skills, absent voices)
4. What are public concerns/expectations? (who cares?)



Mitigation Strategies

Strategy	Description	Examples
Protect	Protect existing development in its current form and location, balancing costs and increasing vulnerability against societal cost and risk associated with other strategies.	<ul style="list-style-type: none"> • Construct and maintain dikes to keep floodwater within the river floodway • Provide erosion protection works to mitigate the potential for channel migration toward developed areas • Construct dams and diversions that can attenuate or bypass peak flows
Accommodate	Accommodate the potential consequences of ongoing changes by changing human activities and/or infrastructure to increase resilience.	<ul style="list-style-type: none"> • Raise land elevation with structural fill • Raise elevation of habitable uses above riverine flood risk • Provide floodproofed ground floor parking below residential/commercial uses • Require flood resistant building materials for commercial uses at ground level • Allow water dependent industrial uses (e.g., log sort)
Retreat	Manage Retreat by gradually withdrawing potentially-vulnerable infrastructure and services from hazard areas in recognition of their increasing vulnerability.	<ul style="list-style-type: none"> • Reclaim developed area to natural state as a community amenity
Avoid	Avoid increasing the presence or density of potentially-vulnerable populations, infrastructure or services within hazard areas.	<ul style="list-style-type: none"> • Existing river floodway • Areas where a dike breach would result in unacceptable risk or consequence • Areas where development could exacerbate hazards or risk for others



Adapted from: FEMA (USA) & Sea Level Rise Primer (Arlington Group)

Risk Management:

Stepping Down the Risk

I have a dream!

What is an Integrated Flood Management Framework?

- Builds on existing templates: Metro Vancouver Integrated Stormwater Management, Squamish IFMP
- Considers Science, Safety, Environment, Community Values, Economics
- Is Holistic and Inclusive
- Balances risks, consequences and costs

Assessing Hazards

- River and creek
- Lake
- Stormwater
- Groundwater
- Debris flow/flood
- Seismic
- Coastal

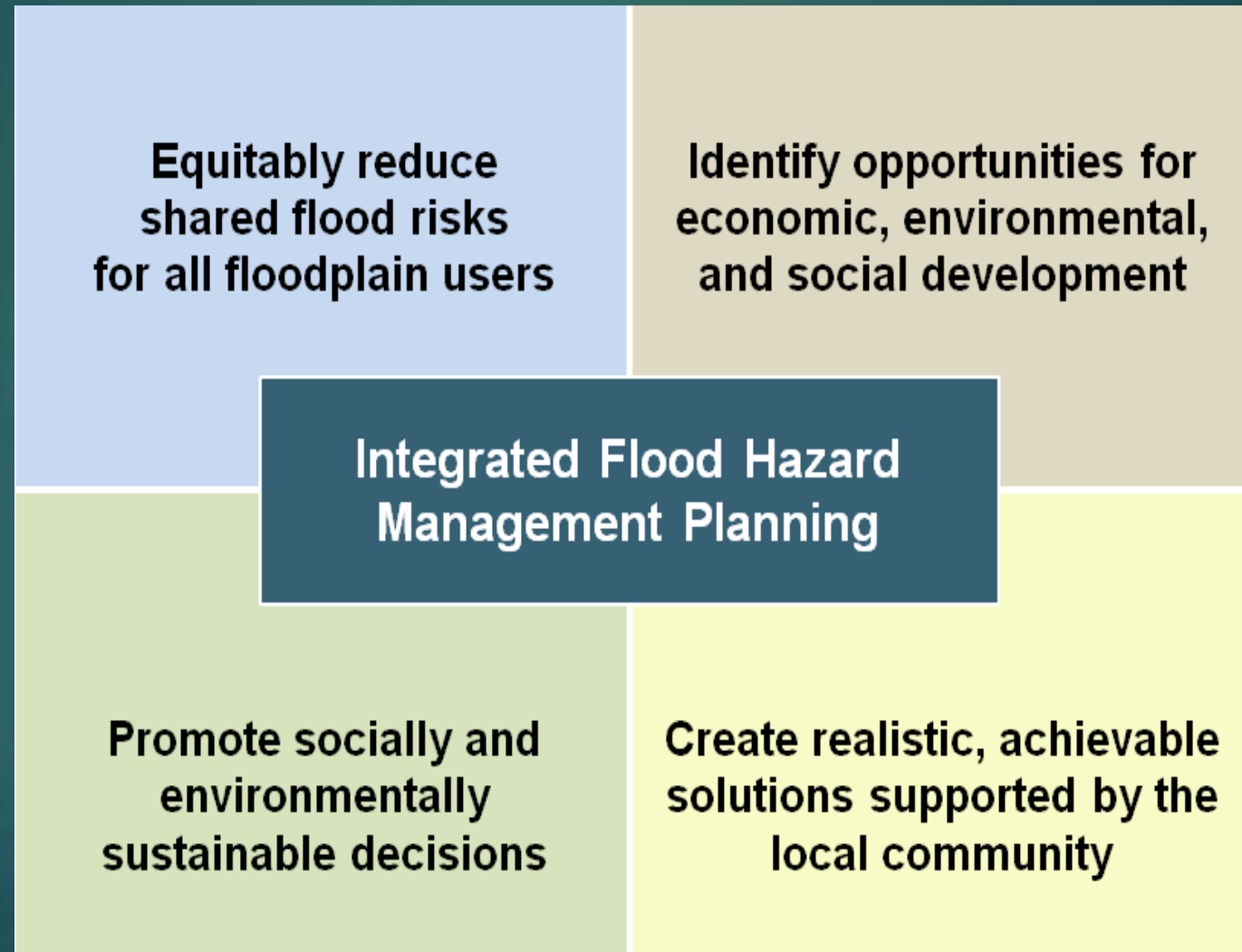
Mitigation

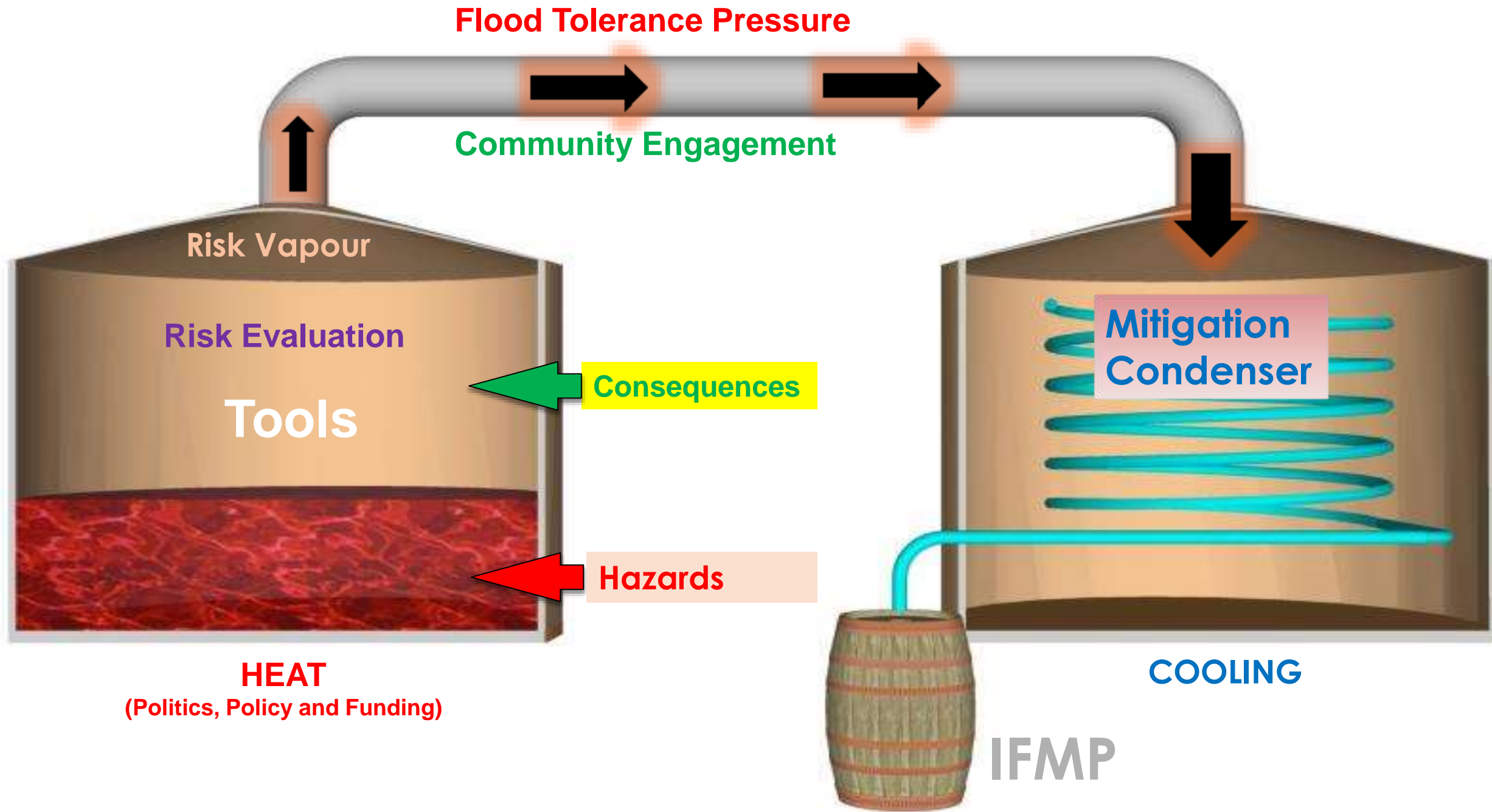
Best available to balance risk and consequences

Decision Making

- Look at full range of impacts and benefits
- Cost to people
- Benefits to community and environment

IFMP Principles





Take Away Message

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Dwayne Meredith, P.Ag.
Kerr Wood Leidal Associates

DMeredith@kwl.ca

250-550-6762