Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study (R3) Appendices

R3 List of Appendices

Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix A: Workshop 1 Participant List and Photos

Workshop 1 Title: *tik̓t* (flood) in the S*yilx* Okanagan Territory

Participant List

Participant Name	Organization - Role
Amanda Shatzko	RDNO – Chair
Anna Warwick Sears	OBWB
Arnie Baptiste	PIB – Knowledge Keeper
Bill Cohen	OKIB – Knowledge Keeper
Chris Forster	Penticton
Colleen Marchand	OKIB
Cory McGregor	Palmer
Dale Kronebush	PIB
Erica Crawford	SHIFT
Gail Given	RDCO – Councillor
Harron Hall	En'owkin Centre
Janet Terbasket	LSIB – Councillor
Jerry Marcellay	WFN – Knowledge Keeper
John Vassilaki	Penticton – Mayor
Jonathan Ford	WFN
Karla Kozakevich	RDOS – Chair
Lisa Wilson	ONA
Mike Allison	USIB – Knowledge Keeper
Mike Noseworthy	FLNRORD - Dam Safety
Robert Larson	Ebbwater
Robin Irwin	USIB
Rod Maclean	Kelowna
Sarah Alexis	OKIB
Sean Vaisler	RDOS
Skyeler Folks	ONA
Tamsin Lyle	Ebbwater
Terry Olsen	EMBC
Tessa Terbasket	ONA
Todd Cashin	RDCO

Photos from Mapping Exercise (Credits: Ebbwater)







EXIT


Mapping Direct & Indirect Impacts

Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix B: Watershed Tour 1 Participant List and Photos

Watershed Tour 1 Location: *snpintkton* (Penticton)

Participant List

Participant Name	Organization - Role
Amanda Shatzko	RDNO – Chair
Anna Warwick Sears	OBWB
Brody Eneas	PIB
Brody Armstrong	PIB – Knowledge Keeper
Chris Eneas	PIB – Knowledge Keeper
Gina Mackay	Osoyoos
Gail Given	RDCO – Councillor
Gerry Marcellay	WFN – Knowledge Keeper
Grouse Barnes	WFN – Knowledge Keeper
Heather Murdock	Ebbwater
Jonathan Ford	WFN
Michael Bezener	En'owkin Center
Mike Noseworthy	FLNRORD - Dam Safety
Richard Armstrong	PIB - Knowledge Keeper
Robert Larson	Ebbwater
Skyeler Folks	ONA
Taylor Carpenter	ONA
Terry Olsen	EMBC
Tessa Terbasket	ONA
Zoe Kirk	RDOS
Dallas Goodwater	OKIB
Luke Dempsey	Kelowna
Thomas Pierre	PIB – Knowledge Keeper

Photos (Credits: Ebbwater)

Stop 1: View west at the snowy, low-lying landscape at Upper Shingle Ck (HM)

Stop 2: Participants carefully walk down the Penticton Channel's West Dike (RL)

Stop 2: An Elder talks about the importance of fish habitat at the outlet of Shingle Creek (RL)

Stop 2: An Elder talks about the importance of fish habitat at the outlet of Shingle Creek (RL)

Stop 2: An Elder talks about the changes experienced by Shingle Creek due to damming and channelization (RL)

Stop 2: Participants learn about aquatic habitat needs, and the changes that have occurred in this section of the river (RL)

Stop 2: Participants learn about aquatic habitat needs, and the changes that have occurred in this section of the river (RL)

Stop 3: Lunchtime discussions at the En'owkin Centre (RL)

Stop 3: An Elder experiences the Penticton Virtual Tour (HM)

Stop 3: Participants share ideas about flood maps (RL)

Stop 4: An Elder explains plans to restore the floodplain on locatee lands (RL)

Stop 4: An Elder shares stories about the significance of the floodplain to *syilx* people (RL)

Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix C: Watershed Tour 2 Participant List and Photos

Watershed Tour 2 Location: *nmələqaytkw* (Similkameen River)

Participant List

Participant Name (photo credits)	Organization - Role
Arden Holley	Keremeos - Councillor
Cory McGregor	Palmer
George Bush	RDOS – Director
Glen Burgess	FLNRORD - Wildfire
Jerry Marcellay	WFN - Knowledge Keeper
Karla Kozakevich	RDOS – Chair
Laurie	RDOS
Lavern Jack	PIB – Knowledge Keeper
Leon Louis	LSIB – Knowledge Keeper
Lisa Wilson	ONA
Mike Allison	USIB – Knowledge Keeper
Mike Noseworthy	FLNRORD – Dam Safety
Peter Prendergast	EMBC
Robert Larson	Ebbwater
Robert Warner	FLNRORD – Wildfire
Robin Irwin	USIB
Sarah Alexis	OKIB
Sean Vaisler	RDOS
Tessa Terbasket	ONA
Tim Roberts	RDOS – Director
Trudy Peterson	LSIB
Wendy Hawkes	LSIB
Zoe Kirk	RDOS
Arden Holley	Keremeos – Councillor
Cory McGregor	Palmer
George Bush	RDOS – Director
Glen Burgess	FLNRORD – Wildfire

Photos (Credits: Ebbwater and Palmer)


View upstream (west) of the icy Similkameen River (CM)


View downstream (east) of the Similkameen River (CM)


View downstream of the Similkameen River (CM)


Stop 1: The group completes introductions and reviews project objectives (CM)


Stop 1: Group photo of participants, standing at the edge of the landslide (RL)


Stop 1: View west down the path of the landslide (RL)

Stop 1: A participant looks over the edge of the slide path (RL)

Stop 1: The group debriefs and prepares to travel to the next stop (CM)

Stop 2: New culvert replaced on downstream side of Hedley Road (RL)

Stop 2: New culvert and headwall installed on upstream side of Hedley Road (CM)

Stop 2: The group discusses recent flood and debris flow impacts and their various causes, including uplands logging activity and wildfires (RL)

Stop 2: View upstream from replaced culvert, where debris flows occurred with flooding (RL)

Stop 3: The group contemplates the history and lack of local knowledge about this mine waste site (RL)

Stop 3: The was site is located approximately 30 m from the Similkameen River (CM)

Stop 3: The group learns about the history of this mine waste site (RL)

Stop 4: An Elder shares stories, including about how this land that was taken away from the *syilx* people (RL)

Stop 4: Signs of beaver activity on a tree along the left bank of the Similkameen River (CM)

Stop 4: View downstream of the Similkameen River; recent wildfire effects can be seen on forest slopes of the right bank (RL)

Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix D: Workshop 2 Participant List and Photos

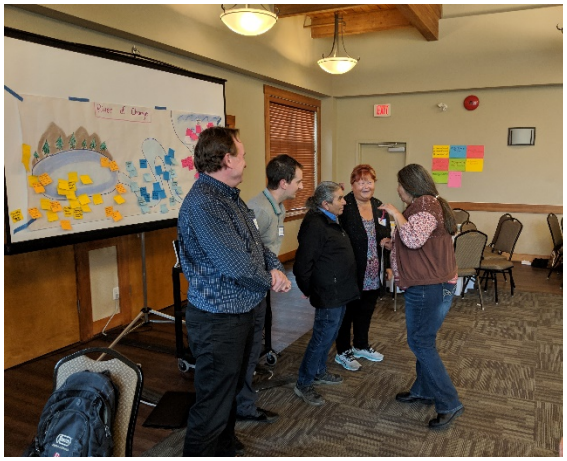
Workshop 2 title: Moving from *t̓ik̓t* (flood) Risk to Adaptation

Participant List

Participant Name	Organization - Role
Amanda Shatzko	RDNO – Chair
Anna Warwick Sears	OBWB
Carson Xia	FLNORD – Dam Safety
Colleen Marchand	OKIB
Dale Kronebusch	PIB
Danika Dudzik	RDCO
Erica Crawford	SHIFT Collaborative
Geoff Mulligan	Vernon
George Bush	RDOS – Director
Grouse Barnes	WFN – Knowledge Keeper
Jerry Marcellay	WFN – Knowledge Keeper
Jonathan Ford	WFN
Karla Kozakevich	RDOS – Chair
Kelly Terbasket	IndigenEYEZ
Leon Lewis	LSIB – Knowledge Keeper
Lisa Wilson	ONA
Mathew Keast	Vernon
Michael Hodges	Penticton
Mike Allison	USIB
Mike Noseworthy	FLNRORD – Dam Safety
Mirjam Glass	Peachland
Richard Armstrong	PIB
Robert Larson	Ebbwater
Rod MacLean	Kelowna
Shaun Reimer	FLNFORD – Dam Safety
Shawn Goodsell	Oliver
Shelley Martens	Fortis BC
Sherry Philpott-Adhikary	Keremeos – Councillor
Skyeler Folks	ONA

Participant Name	Organization - Role
Stephanie Paul	WFN
Tamsin Lyle	Ebbwater
Terry Olsen	EMBC
Tessa Terbasket	ONA
Trevor Scott	Vernon
Wendy Hawkes	LSIB

Photos from Mapping Exercise (Credits: Ebbwater)



Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix E: Watershed Tour 3 Participant List and Photos

Watershed Tour 3 Location: *nk'mapəlqs* (Head of the Lake)

Participant List

Participant Name	Organization - Role
Amanda Shatzko	RDNO – Chair
Anna Warwick Sears	OBWB
Barb Marchand	OKIB – Knowledge Keeper
Burt Marchand	OKIB – Knowledge Keeper
Colin Marchand	OKIB
Colleen Marchand	OKIB
Craig Moore	Rider Ventures
Geoff Mulligan	Vernon
Keith Louis	OKIB – Knowledge Keeper
Louis Ghostkeeper	Rider Ventures
Mark Dowhaniuk	Vernon
Matt Vader	Lake Country
Mike Reiley	Coldstream
Mirjam Glass	Peachland
Perry jo Williams	PIB – Knowledge Keeper
Rod MacLean	Kelowna
Sandra Saddleman	OKIB
Skyeler Folks	ONA
Stephanie Paul	WFN
Subrina Monteith	RDOS
Tara Stanley	ONA
Taylor Carpenter	ONA
Terry Olsen	EMBC
Tessa Terbasket	ONA
Tony Antoine	Rider Ventures
Trevor Scott	Vernon
Wilke John	OKIB – Knowledge Keeper
William Marchand	OKIB – Knowledge Keeper

Photos (all credits: ONA)

Stop 1: Group introductions at the New Horizons building.

Stop 2: Photo of a flower on Equesis Creek (Photo credit).

Stop 2: Section of Equesis Creek where flow path has changed.

Stop 2: Group discussion about flow path change on Equesis Creek where flow path has changed.

Stop 2: View of new water flow path landscape on Equesis Creek.

Stop 4: Whiteman Creek bridge.

Stop 4: Whiteman Creek bridge.

Stop 5: Whiteman Creek, view from right bank at water level and upstream.

Stop 5: Whiteman Creek, view from top of right bank and upstream.

Stop 5: Whiteman Creek, group shot. Staff from Rider Ventures (look it up)

Stop 5: Flooded field on Whiteman Creek.

Stop 6: Group discussion at the mouth of Equesis Creek.

Stop 6: Group discussion at the mouth of Equesis Creek.

Stop 6: Near the mouth of Equesis Creek.

Stop 6: Mouth of Equesis Creek at Okanagan Lake.

Stop 7: Group discussion at washed-out area on Equesis Creek.

Stop 8: Debris in Bouleau Creek.

Stop 8: Close-up of debris in Bouleau Creek bridge.

Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix F: Workshop 1 Presentation Slides

Setting the Stage:

tik̓t (flood) in the *Syilx* (Okanagan) Territory

Workshop 1, February 13th, 2018

Source: similkameenvalley.com

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SHIFT shift to a better world

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

syilx Okanagan Nation Alliance

Agenda

Time	Section
Morning	Registration/Welcome
	Introduction to the Study Area and the Project
	Break
	Two-Eyed Seeing Approach and Overview of Flood and Debris Flow
Lunch Break	
Afternoon	What is Resilience and Where Do We See Impacts?
	Mapping Exercise to Identify Past and Future Impact Areas
	Reflections and Closing

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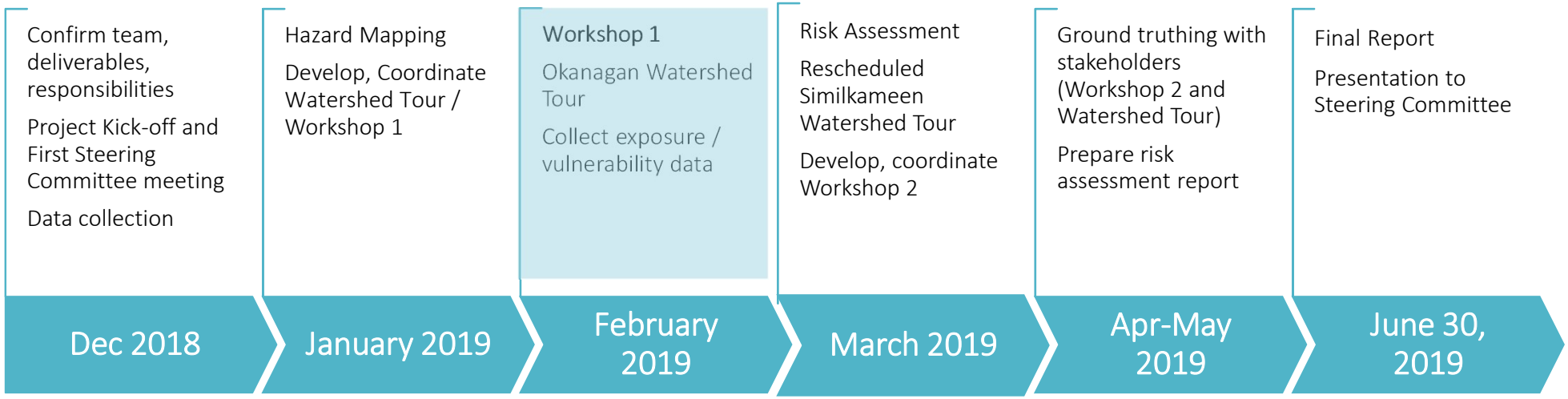
Workshop Objectives

- Provide an opportunity for flood resilience community-building in the region.
- Share perspectives on flood resilience, including positive and negative implications.
- Review maps of likely flood and debris flow occurrences in the study area.
- Identify what's in the path of the water and what matters to people who live in the Okanagan.

Source: Heather Murdock

Project Timeline



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Introductions Around the Room

Introduction to the Land and Waters of the *Syilx* Territory

Arnie Baptiste

Bill Cohen

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Introduction to the Project

Tessa Terbasket | ONA

Tamsin Lyle | Ebbwater

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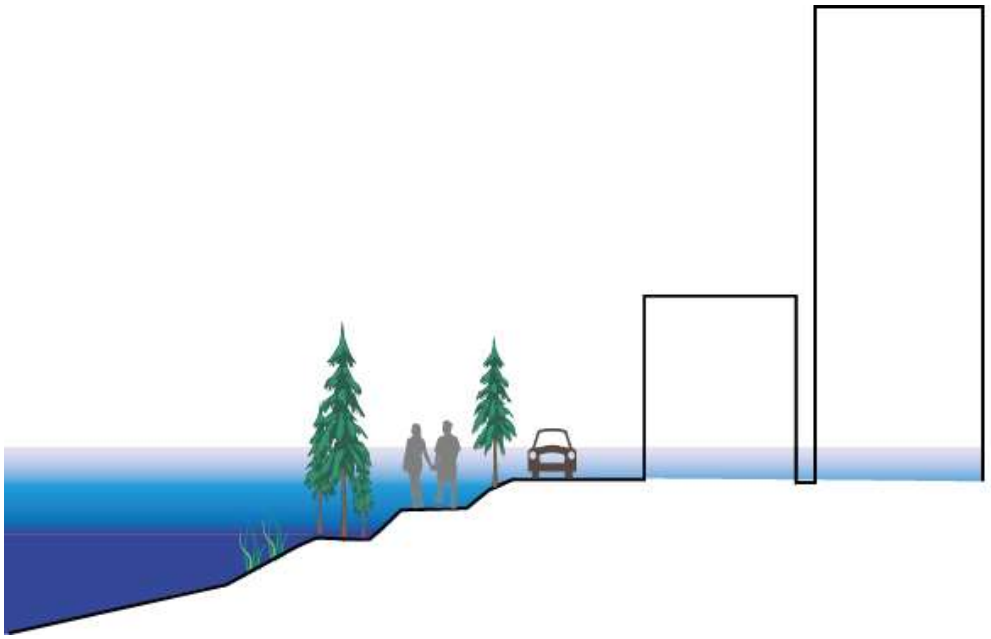
siwɬkʷ (water) Declaration

Dallas Goodwater

Flood is a wicked problem

- High degree of technical complexity
- Multiple dimensions of uncertainty
- Multiple objectives
- High stakes, high emotions
- Intense political scrutiny
- High expectations for quality and transparency
- Limited resources in terms of time, money and personnel.



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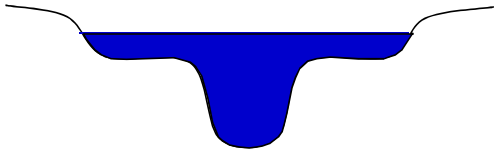
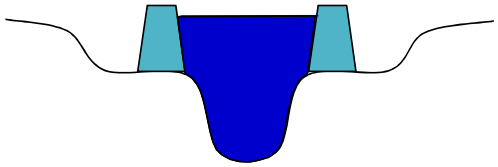
That historically settlers have managed with arrogance

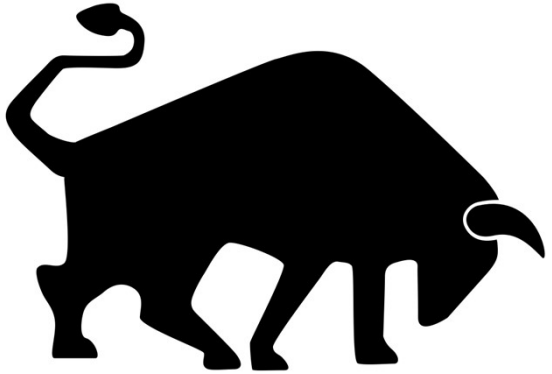
Man Will Conquer Nature

Natural Condition



Dike Confinement





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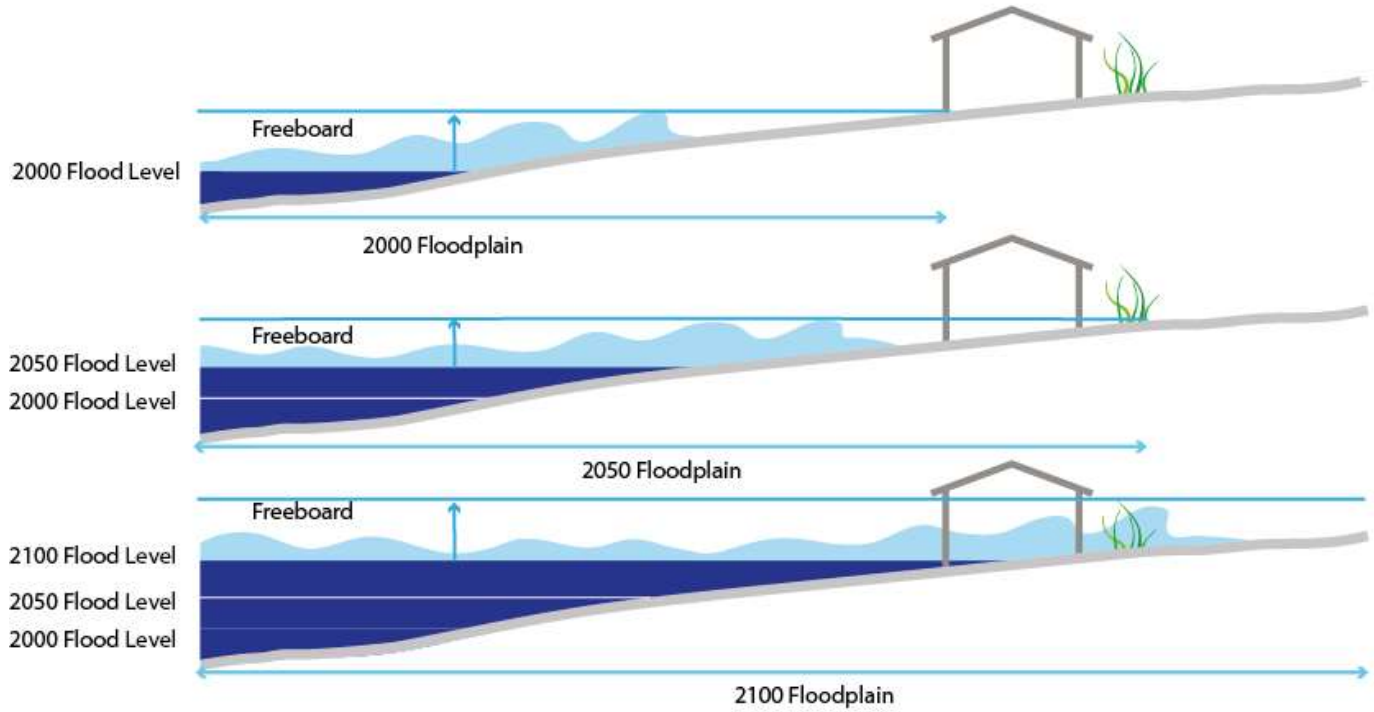
Our hazard is Increasing with climate change



In the US, a 45% increase in spatial extent of the 100-Year floodplains is projected by the year 2100 (NFIP 2014).

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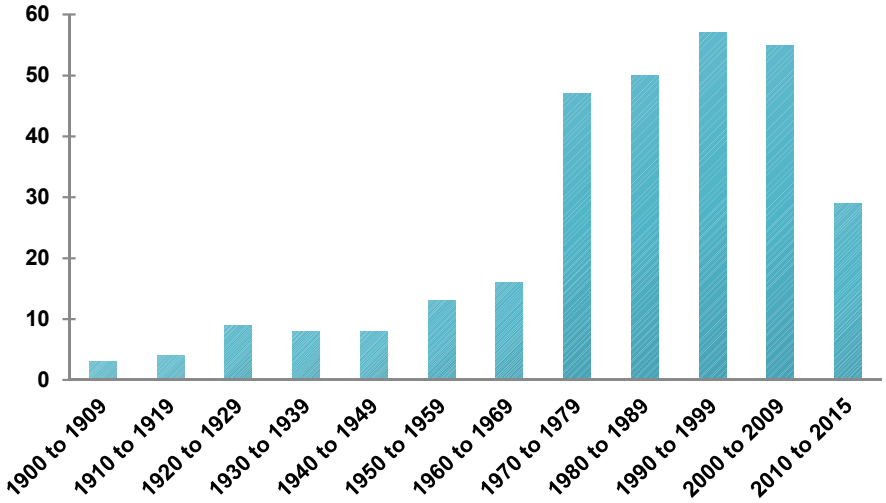
And is causing more and more losses



Flood Disaster Occurrences in Canada 1900-2015
(Canadian Disaster Database)

$2.4Bn losses annually
$673M paid by DFAA

Annual Loss Estimate from Government of Canada
(Parliamentary Budget Office 2016)

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Forcing a change:
The evolution of flood management

A willingness to live with floods	•Individual and small communities adapt to natures rhythm.
A desire to use the floodplain	•Fertile land in the floodplain is drained for food production. •Permanent communities are established on the floodplain. •Local (uncoordinated) levees start to be constructed.
A desire to control flood flows and defend against flooding	•Large scale structural approaches (levees ,dams and other controls) are planned and implemented through organized governance.
A desire to reduce flood damages	•A recognition that engineering alone has limitations. •Effort is devoted to increasing the resilience of communities should a flood occur. •Effort is devoted to mitigate lost of ecosystem services.
A desire to manage risks efficiently	•A recognition that budgets are limited and not all problems are equal. •Risk management is seen as a means to target limited resources.
A desire to promote opportunities and manage risks adaptively	•Adaptive management is seen as effective in managing the severe uncertainties in future climate change, funding and demographics. •Working with natural processes is encouraged to both reduce risks efficiently and achieve gains in ecosystem services.

The last 50+ years

Sayers et al. 2014

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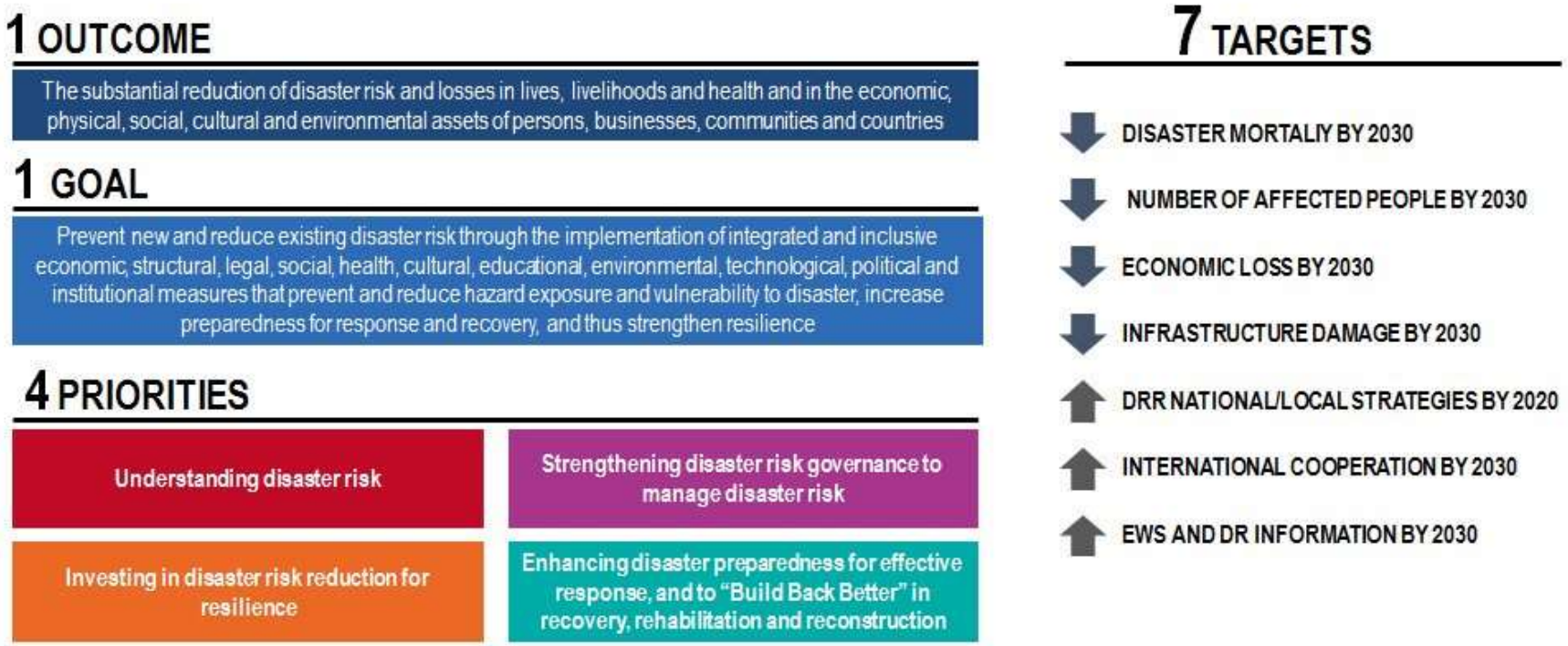
Sendai Framework

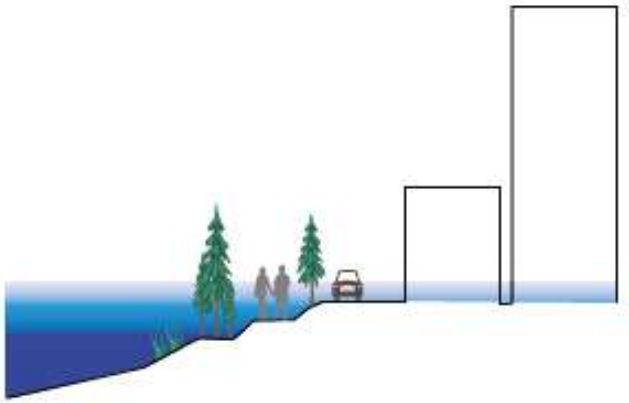
Canada AND British Columbia are signatories



United Nations Office of Disaster Risk Reduction 2015.

Western Science

Or at least the leading edge of it



The 10 Golden Rules of Flood Management

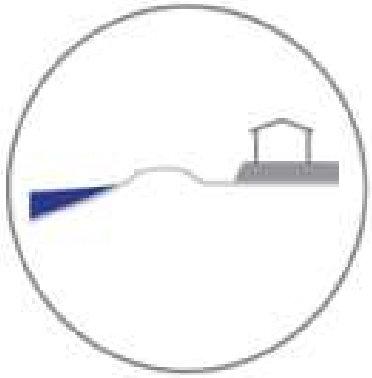
Sayers et al. 2014

1 Accept that absolute protection is not possible and plan for exceedance.

Cornerstone Idea

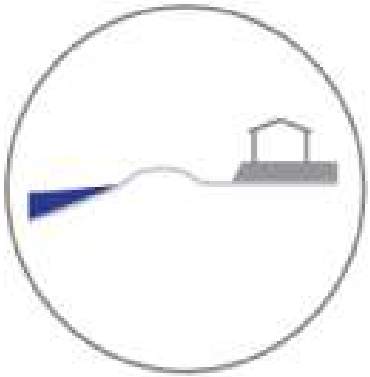
e.g. A dike

Brick Idea



complemented with property-level-protection

Brick Idea



improved with habitat enhancement and a bike path

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2 Promote some flooding as desirable

Nile River Delta

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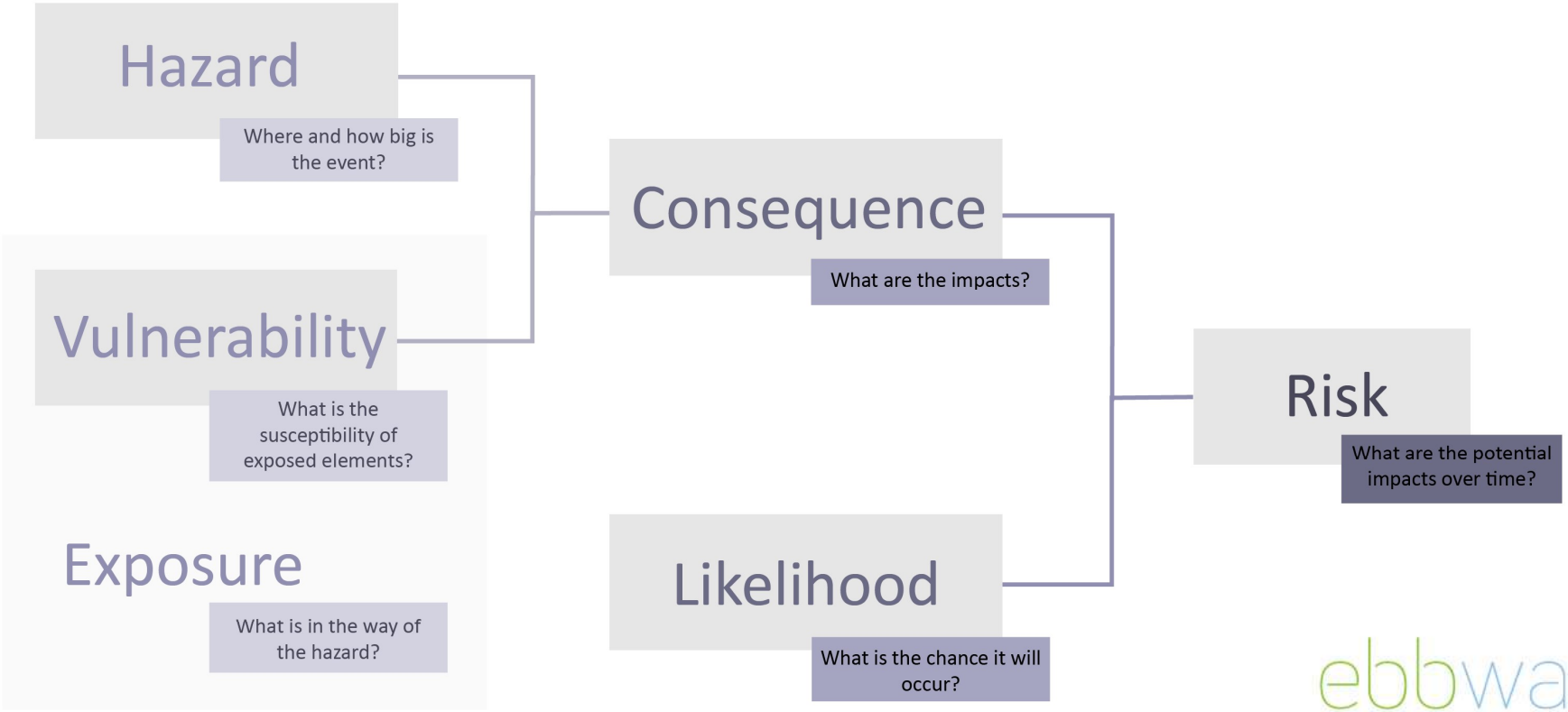
3 Base decisions on an understanding of risk and uncertainty



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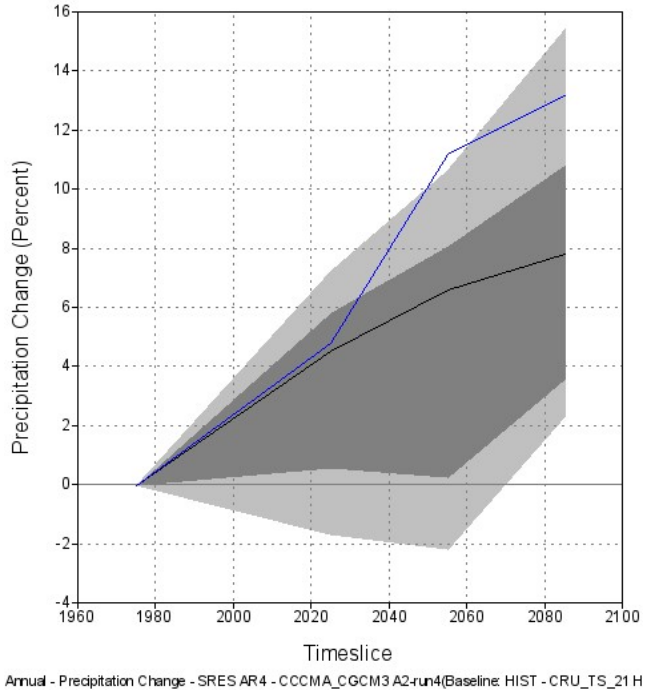
4 Recognize that the future will be different from the past



% increase in annual precipitation in the Central Okanagan

Data from Plan2Adapt.ca

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5 Do not rely on single measure but implement a portfolio of options

Do Nothing

Adapt

Protect

Retreat

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6 Utilize limited resources efficiently and fairly to reduce risk

7 Be clear on responsibilities for governance and action

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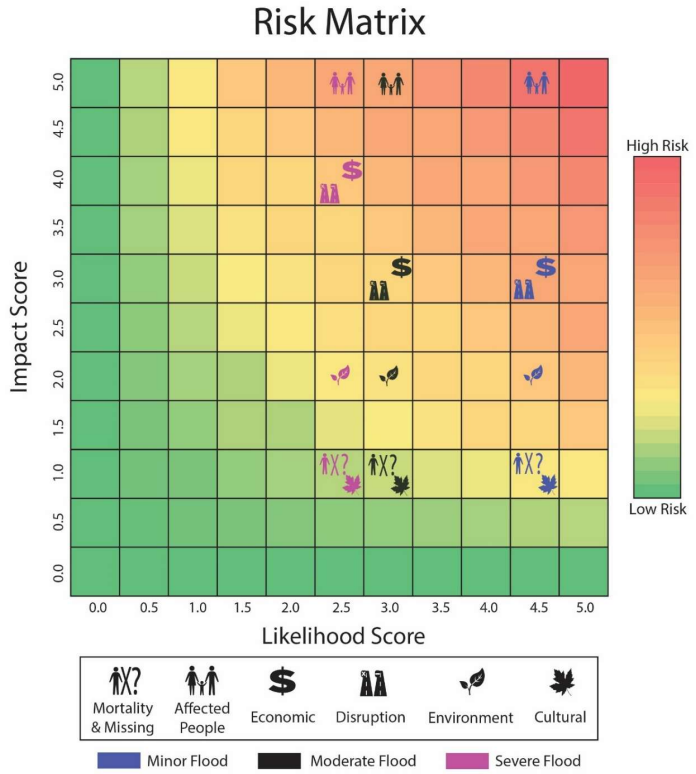
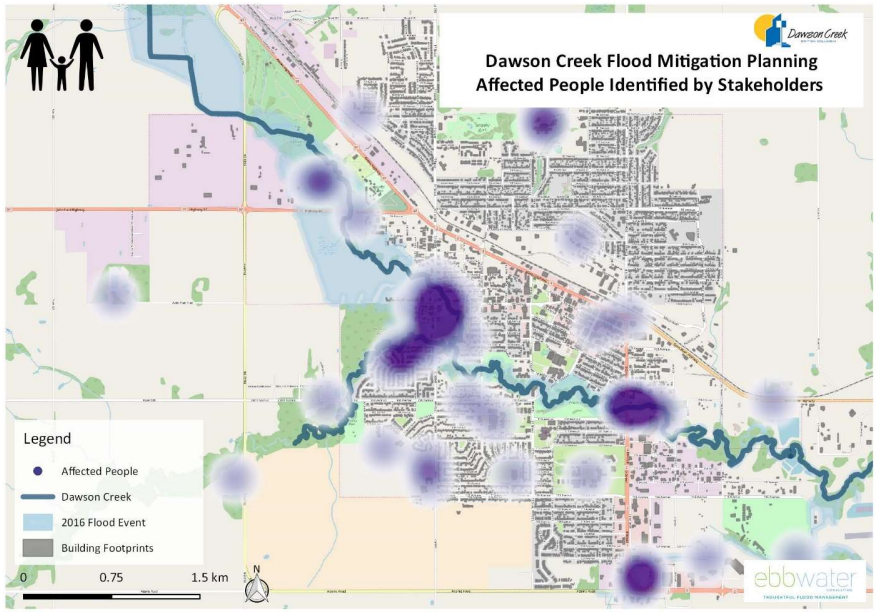
8 Communicate risk and uncertainty effectively and widely.



City of Dawson Creek Risk Assessment



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9 Promote stakeholder participation in the decision process

Talk to people; not just those you like

Image sources: West Coast Environmental Law

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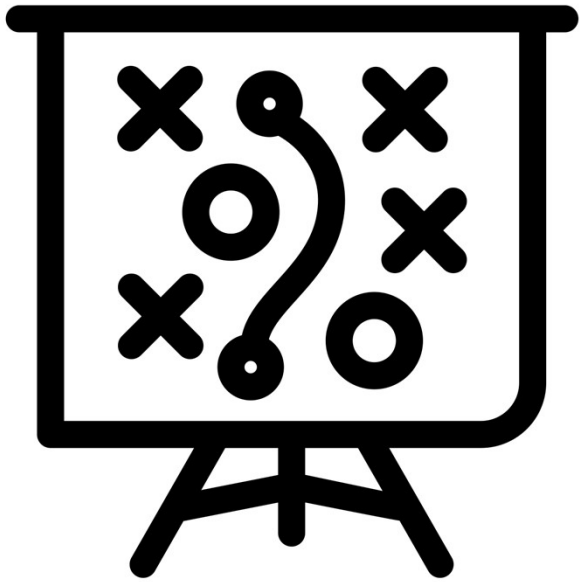
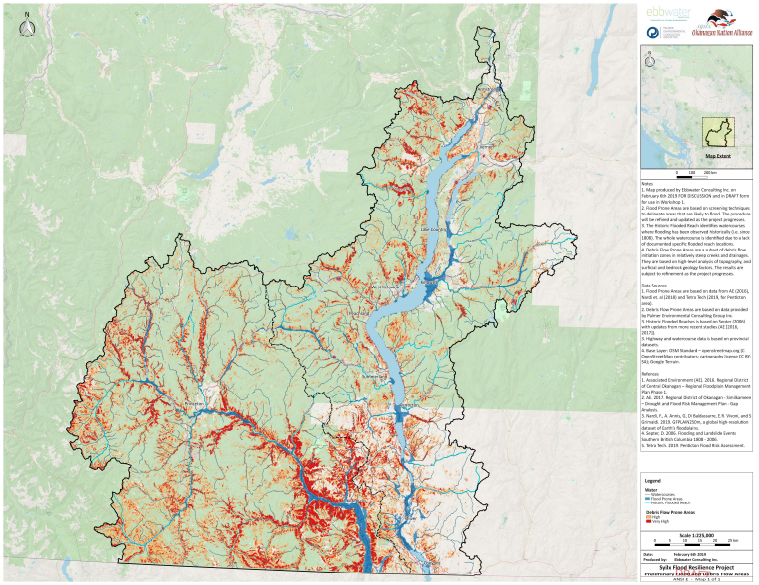
10 Reflect local context and integrate with other planning processes





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Break

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Two-Eyed Seeing

Erica Crawford | SHIFT

Tessa Terbasket | ONA

1. Discuss the first lens with a partner

2. Discuss the second lens with a different partner (same side of the room)

3. Find another partner, discuss strengths of two eyes together

4. Choose an image or phrase to describe what emerges from seeing through two eyes together

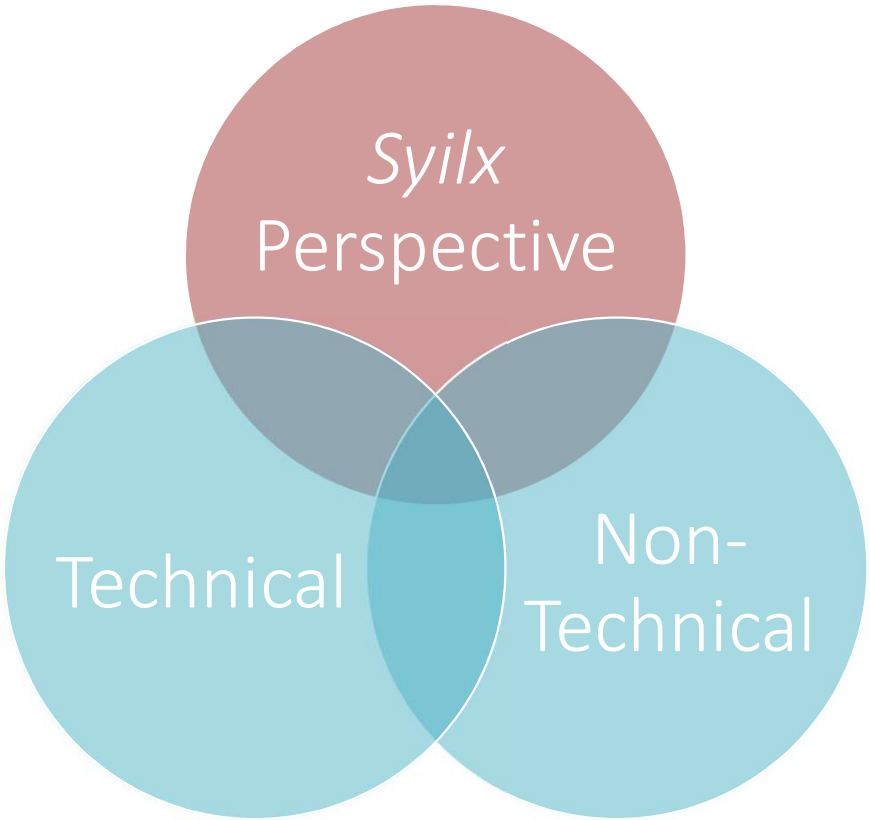
Two-Eyed Seeing

Overview of Flood and Debris Flow in the Study Area

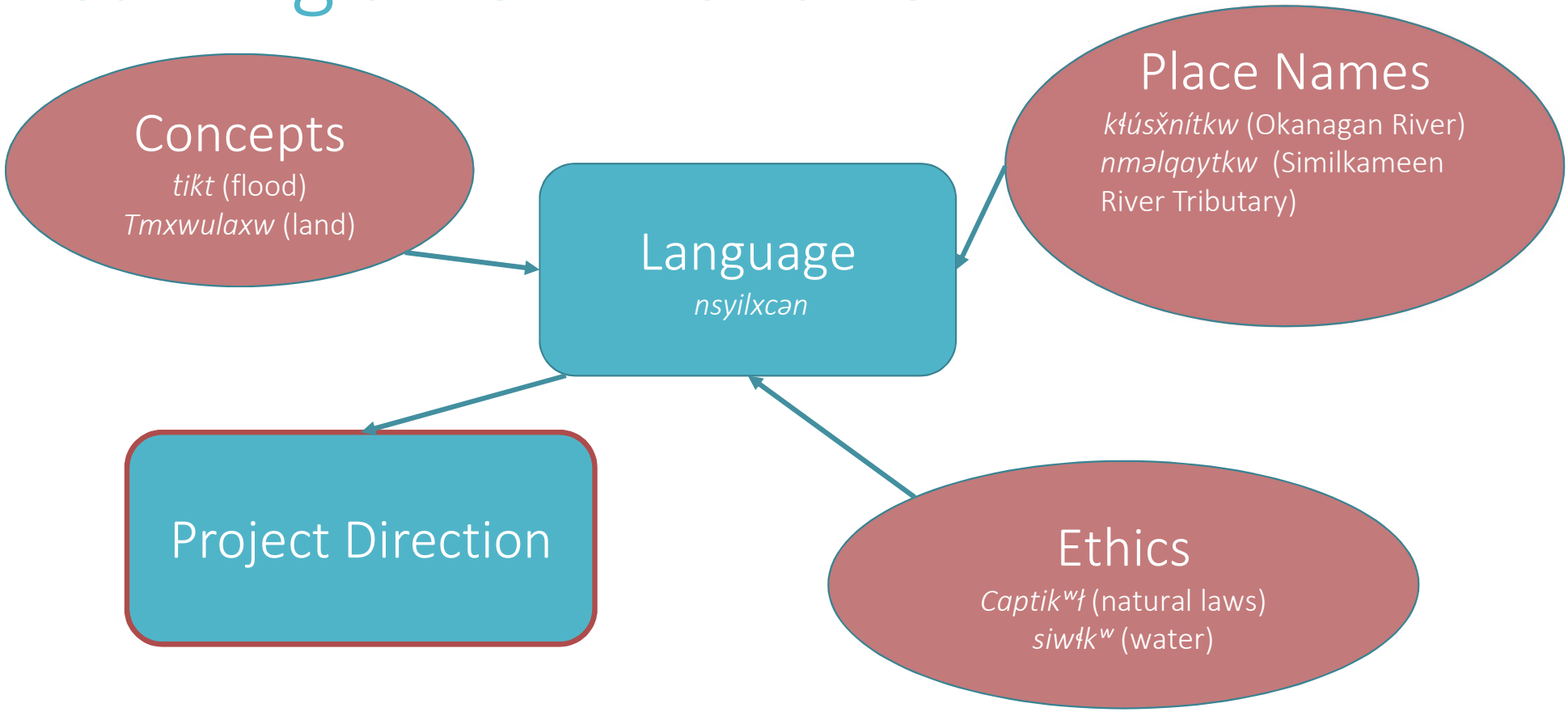
Robert Larson| Hydrologist| Ebbwater Consulting

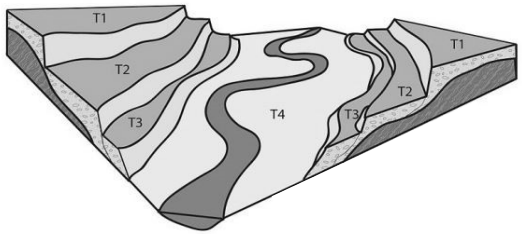
Cory McGregor| Geoscientist| Palmer Environmental Consulting Group

Communication Challenge



Learning a New Worldview



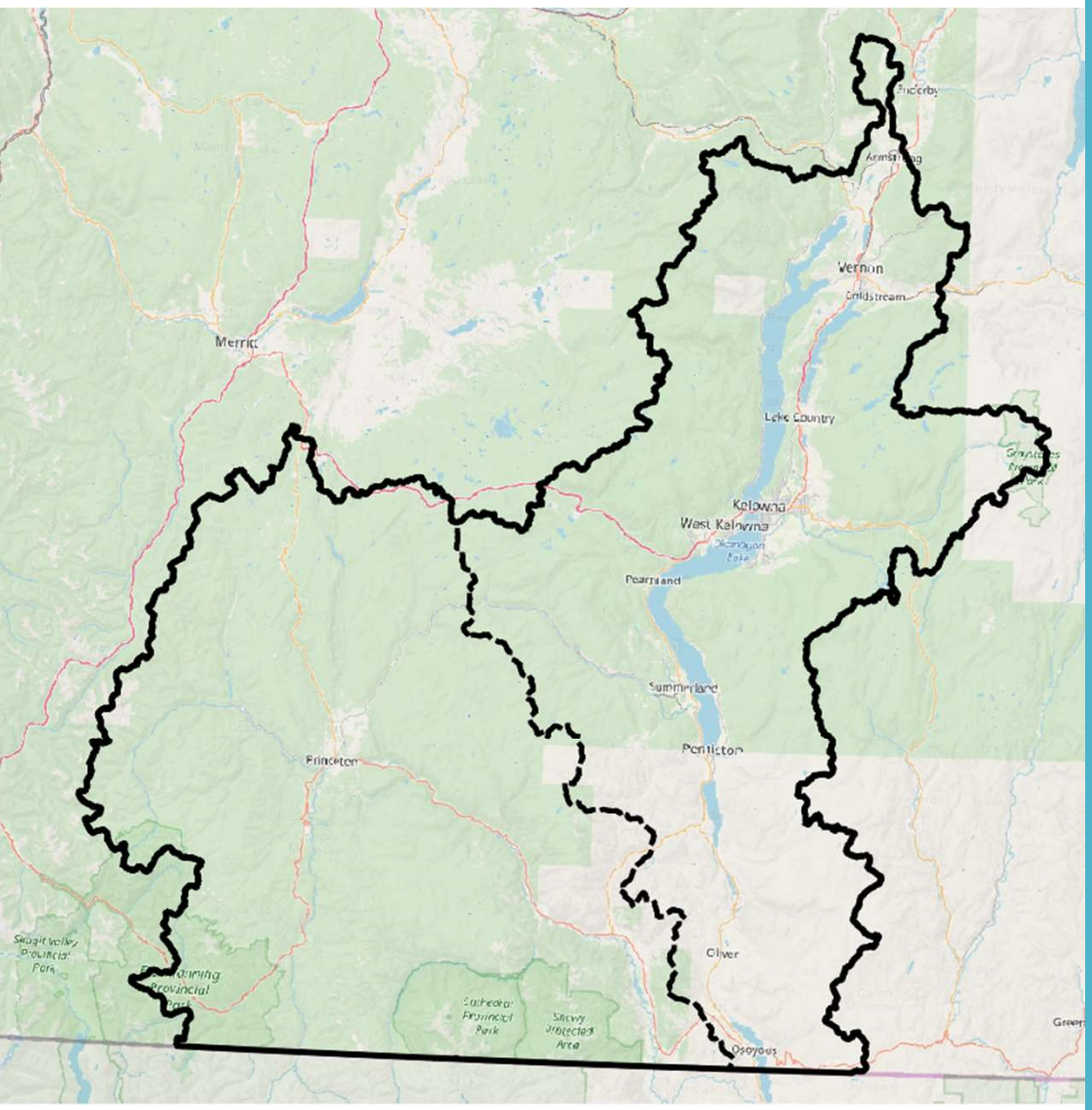


What is a Flood?

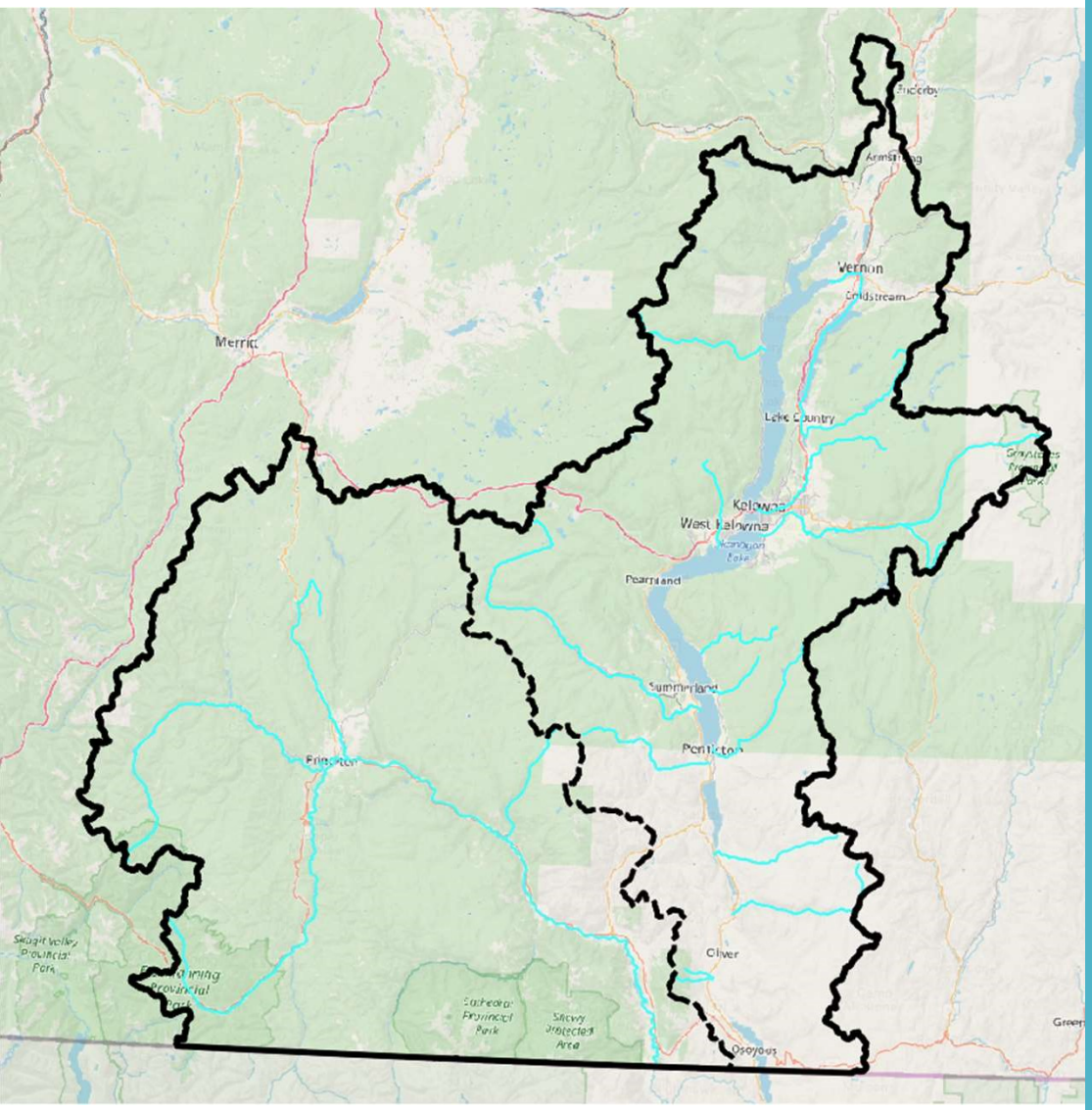
Flood Characteristics:

- Driven by climate processes that have influence on the watershed scale.
- Mechanisms can include heavy rain and rain-on-snow; snowmelt; rising water table; debris blockages and ice jams; breaking or breaching of flood defenses; and high lake levels.
- Can be linked to reservoir regulation.

Kelowna, May 8, 2018 (Source: Kelowna Now)



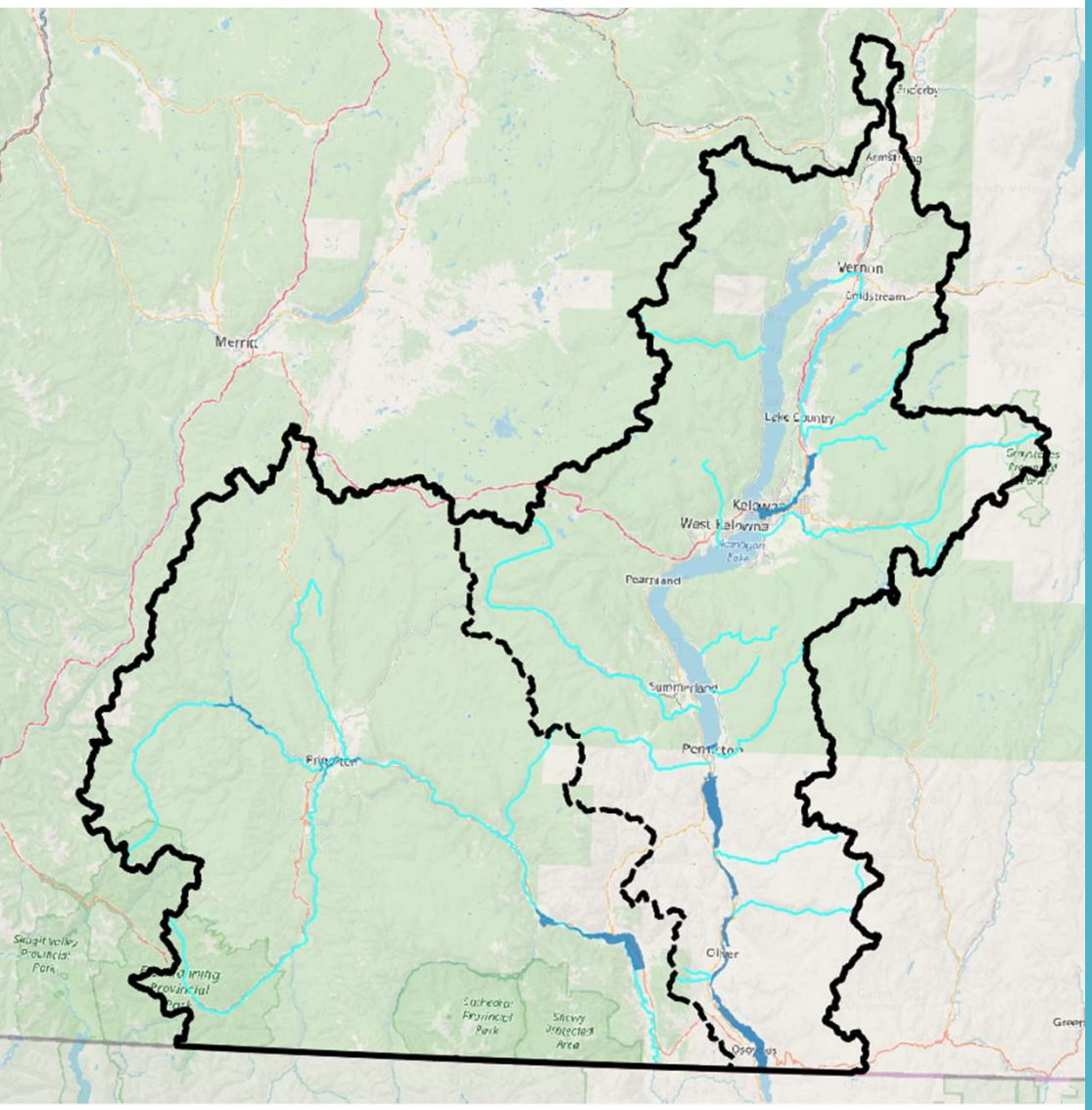
Building a Flood and Debris Flow Information Library for the Territory



Flood Prone Reaches

- Observations of watercourses that have historically flooded
- Septer (2006) and AE (2016, 2017)

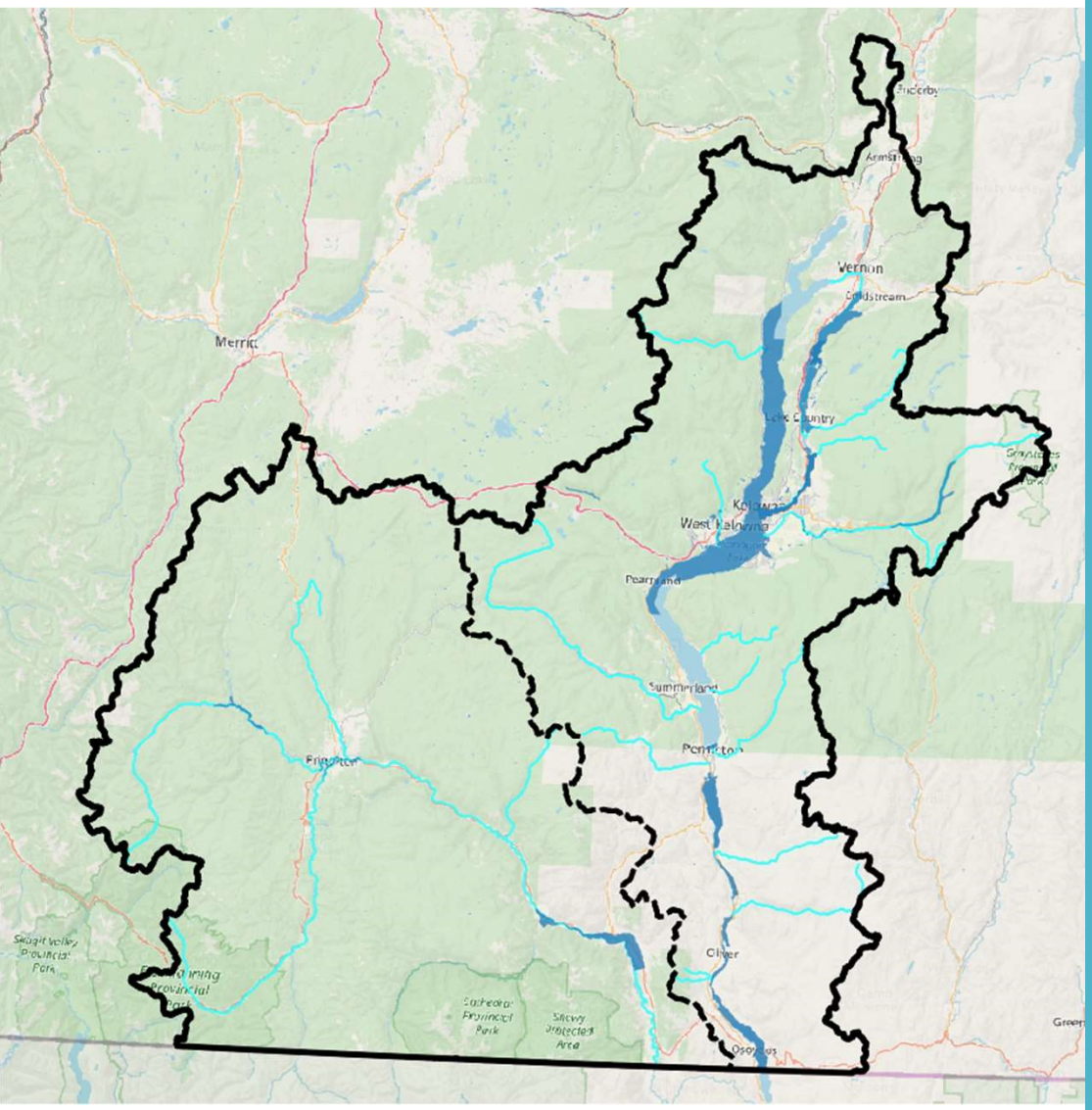
1808 - 2016



Flood Mapping

- Federal Disaster Reduction Program
- Floodplain bylaws (RDOS, Kelowna)

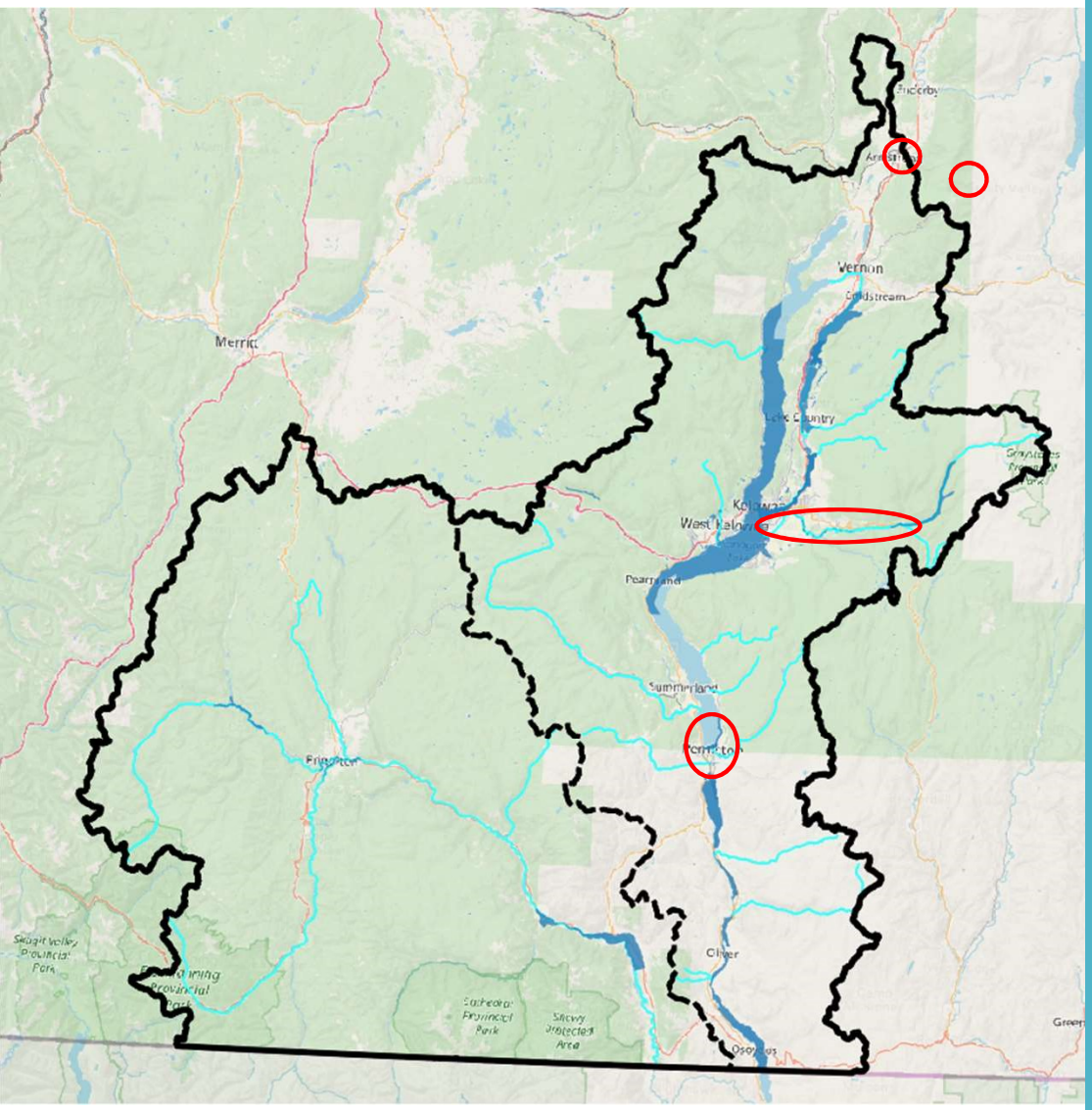
Approx. 1980-2010



Flood Prone Areas

- Screening-level mapping
- Based on geological and soils mapping

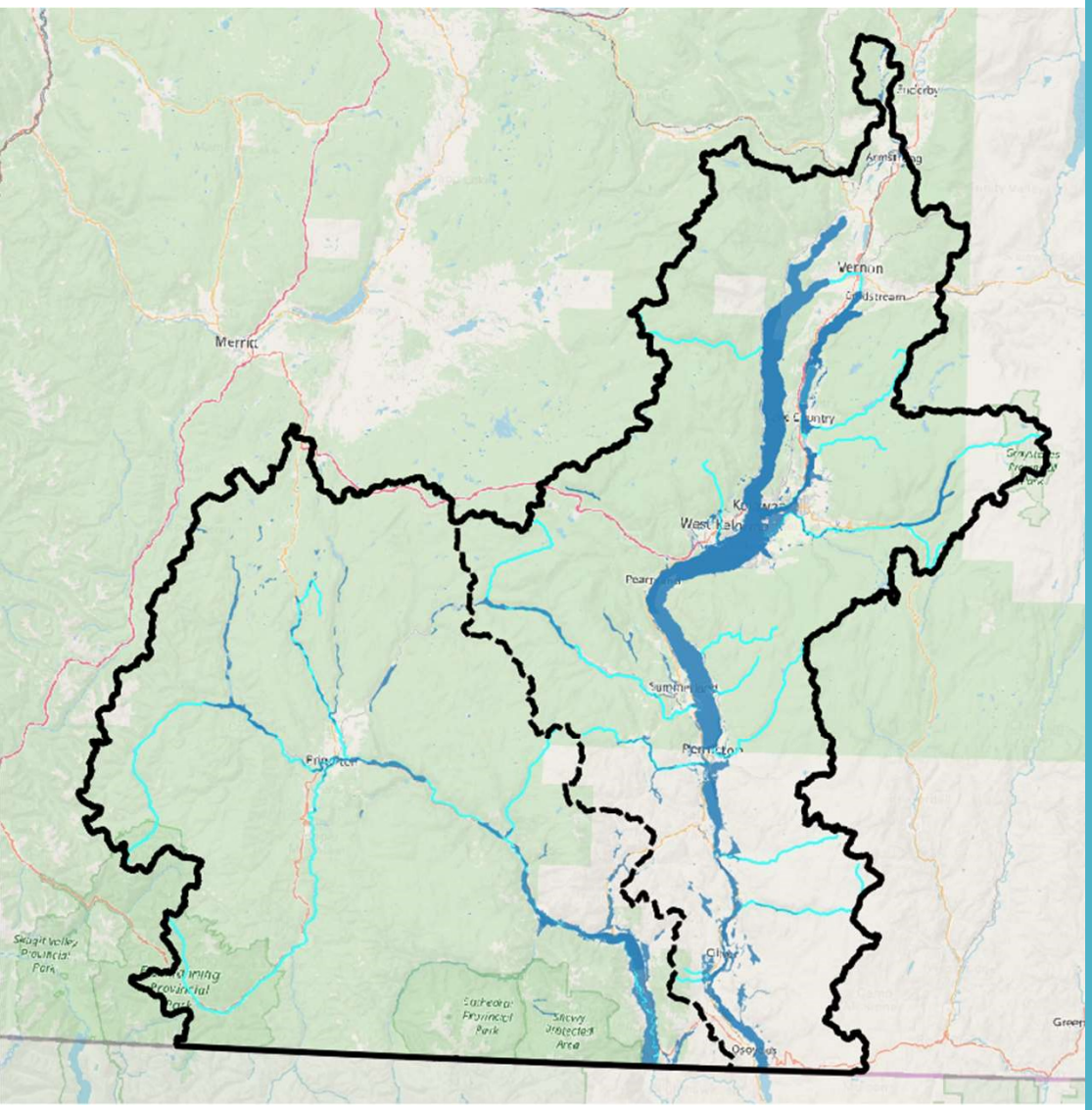
2016



Recent/Current Flood Mapping

- Penticton, Armstrong, Lumby (Done)
- Kelowna Mission Creek (ongoing)
- Others?

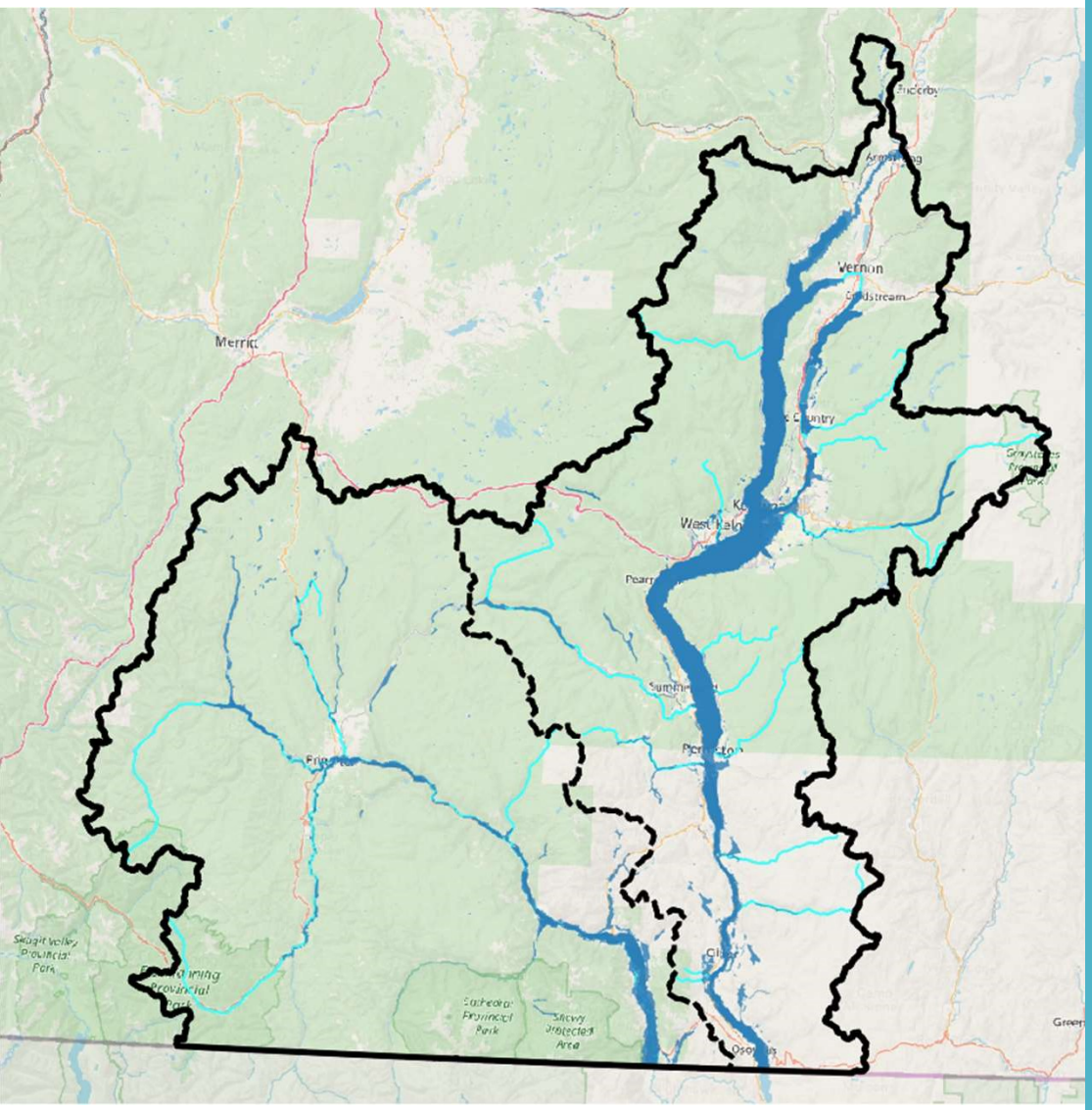
2017-present



Flood Prone Areas

- We applied AE (2016) method to entire study area

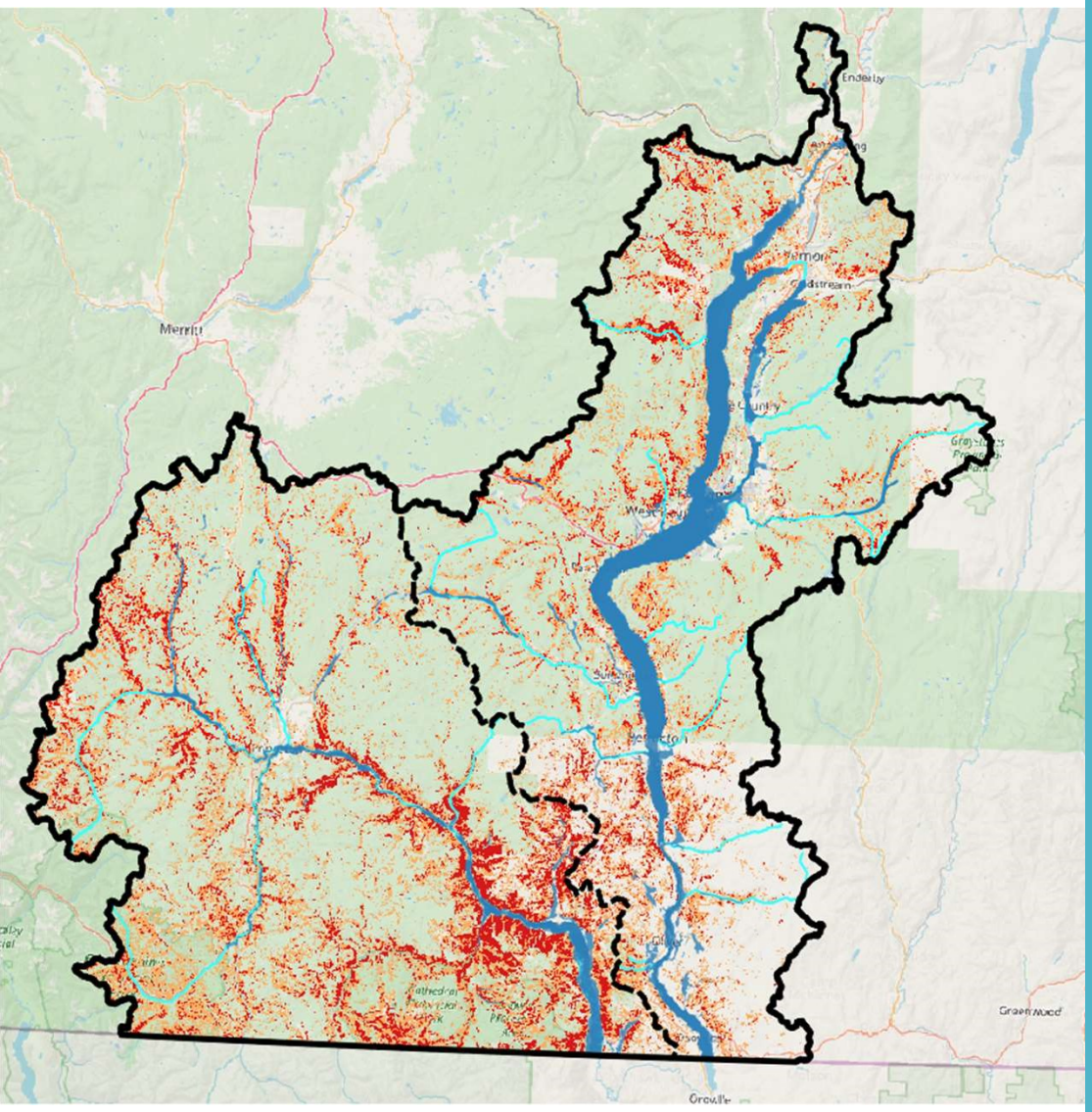
2018



Terrain Analysis Methods

- Global Floodplain Map
- Geomorphic Flood Index (to be completed)

2018

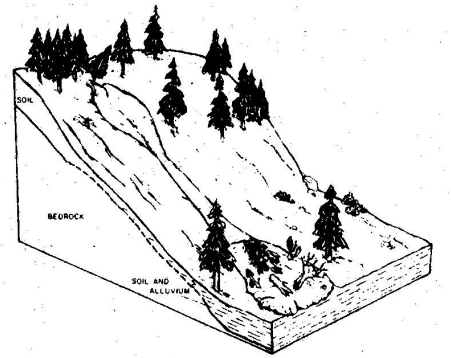


Terrain Analysis Methods

- Debris Flow Susceptibility

2018

What is a Debris Flow?

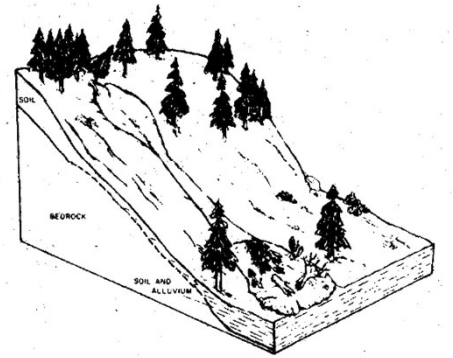


Debris Flow Characteristics:

- Composed of saturated, loose material or 'debris'
- Moves as a flowing slurry that can resemble wet concrete
- Rapid velocity
- High discharge
- Failures typically channelized and recurring
- Can grow in size as flow picks up new material and water
- Commonly triggered by addition of water (e.g. heavy precipitation, rapid snowmelt, human activity)

Testalinden Creek Debris Flow, June 2010
(Source: Oliver Daily News)

How Debris Flows Move



Terrain Susceptibility to Debris Flows

Debris Flow Initiation Factors:

- Slope steepness
- Surface material type
- Proximity to steep creeks and drainages
- Regional geology
- Sediment availability

External Factors

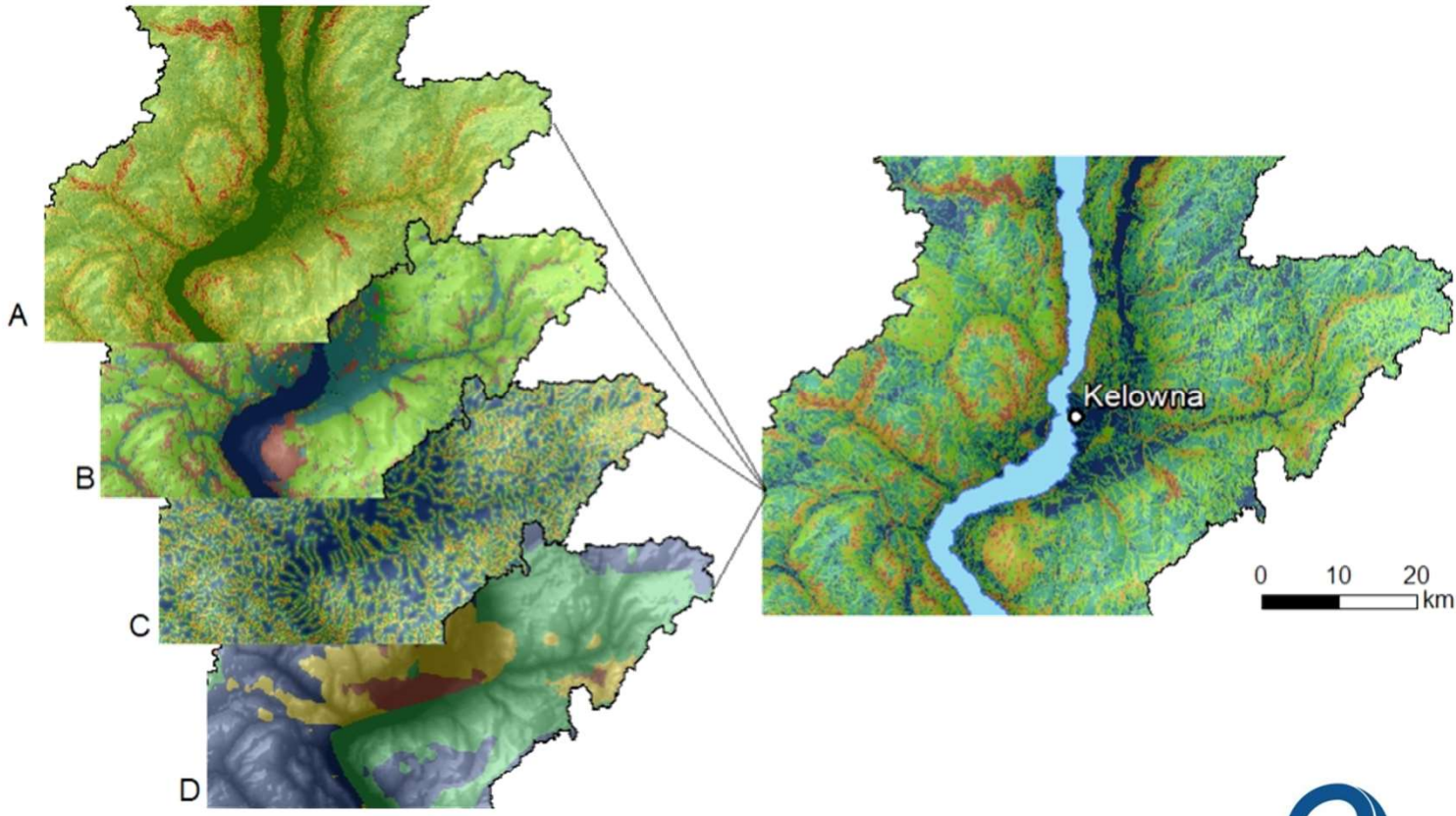
- Precipitation
- Deforestation (e.g. forest fire)

Johnsons Landing Debris Flow, July 2012
(Source: The Tyee)

Modelling Debris Flow Susceptibility

Model approach:

- Selection of predictive layers
- Determination of values within layers
- Layer ranking and weighting and combination
- Validation and adjustment

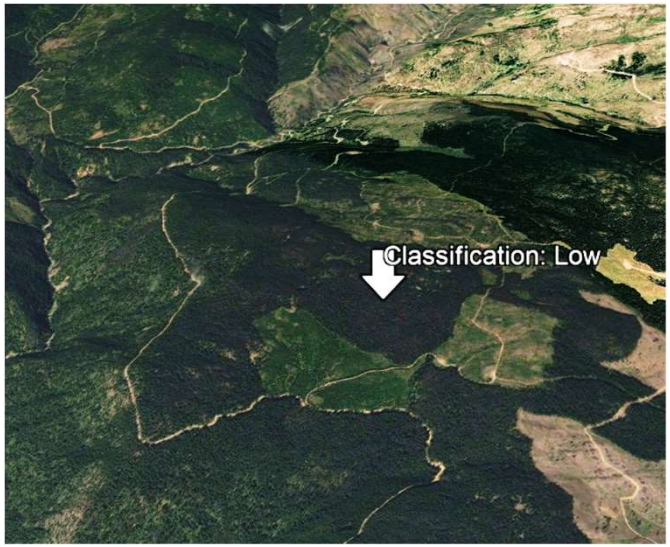


A. Slope gradient (40%) + B. Surface Material (30%) + C. Distance to creeks (20%) + D. Bedrock Geology (10%)

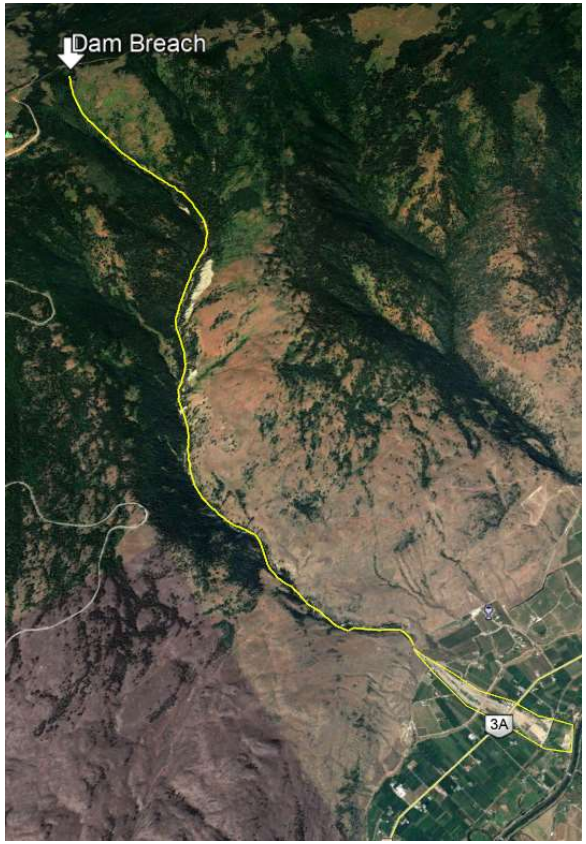
Debris Flow Susceptibility Classification

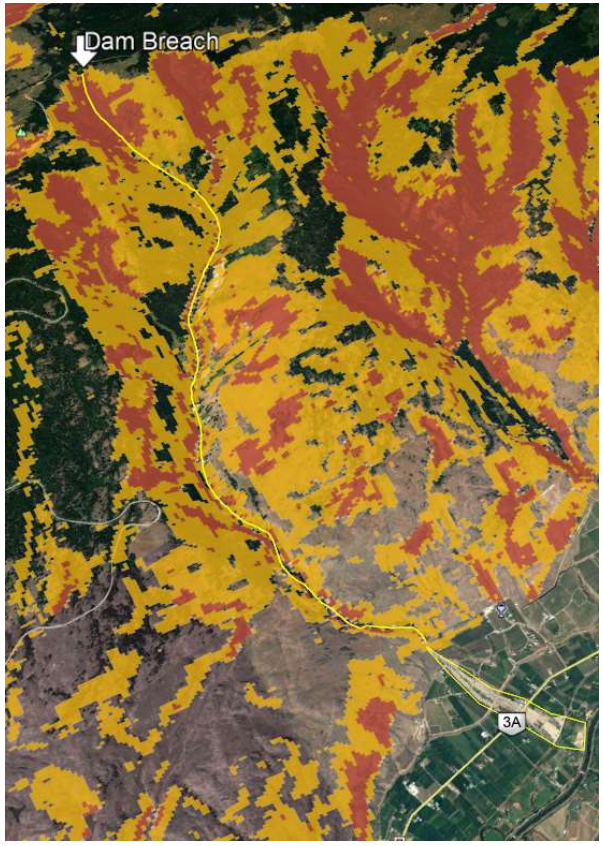
- Qualitative 5-class system (Very Low to Very High)
- Combination of model inputs

Type	Layer	Type
35° (High)	Slope Gradient (40%)	10° (Low)
Loose Material (High)	Surface Material (30%)	Till (Moderate)
30 m (High)	Distance to Creek (20%)	360 m (Low)
Granite (Low)	Bedrock Geology (10%)	Volcaniclastic (Moderate)
Very High (0.9)	**Susceptibility Class**	**Low (0.4)**



Debris Flow Validation:



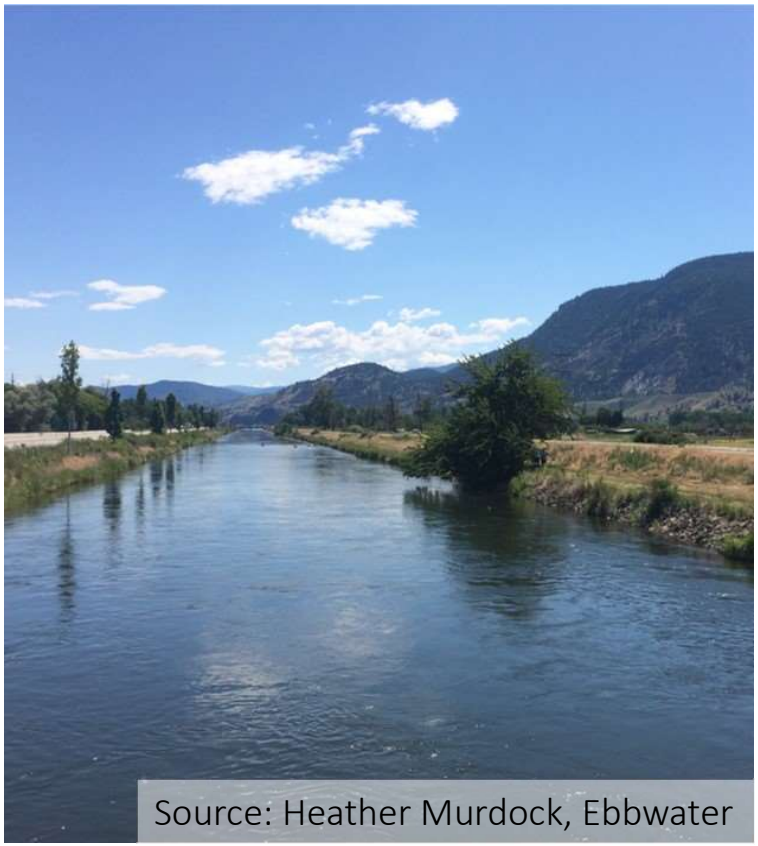


Testalinden Creek Debris Flow, June 2010

- Trigger: Dam breach in part due to high snowmelt
- Water travels through Very High (red) and High (yellow) class terrain
- Loose debris is entrained by water and combines to form a debris flow
- Debris flow travels downslope and onto fan

Linked Watershed Factors

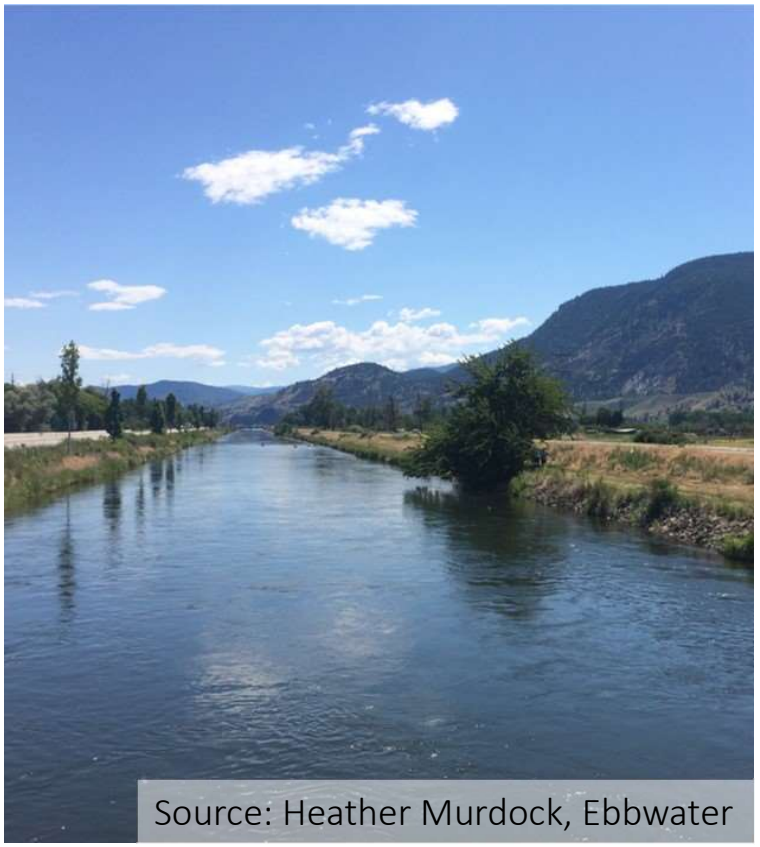
- Climate Change
- Landcover Change
- Groundwater
- Wildlife



Source: Heather Murdock, Ebbwater

Linked Watershed Factors

- Climate Change
- Landcover Change
- Groundwater
- Wildlife



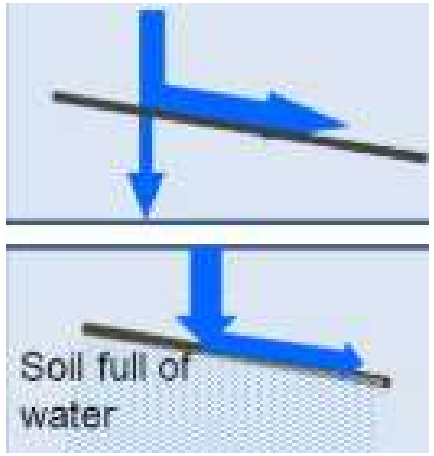
Source: Heather Murdock, Ebbwater

Watershed Factor: Landcover Change

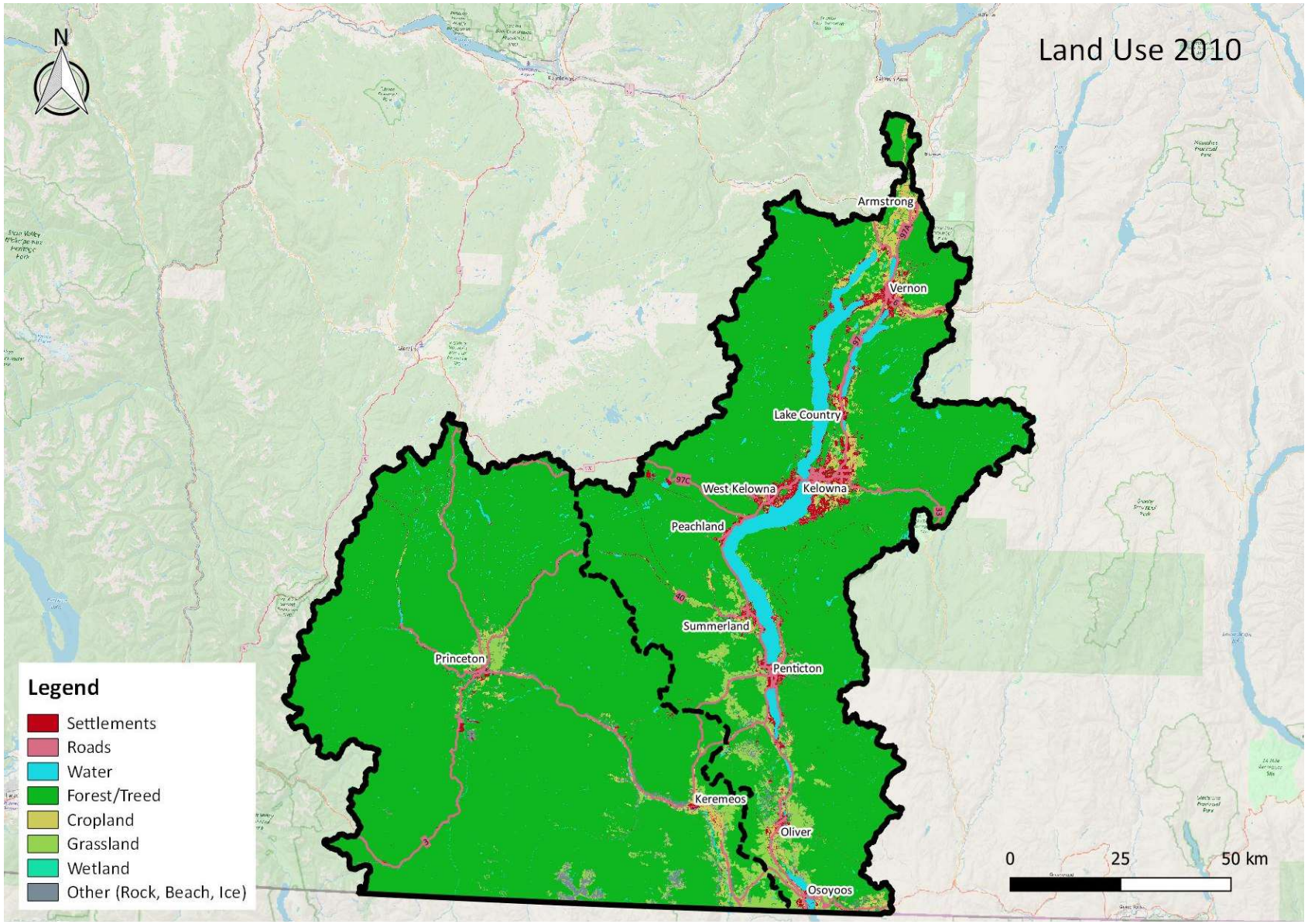
Basics of Surface Runoff

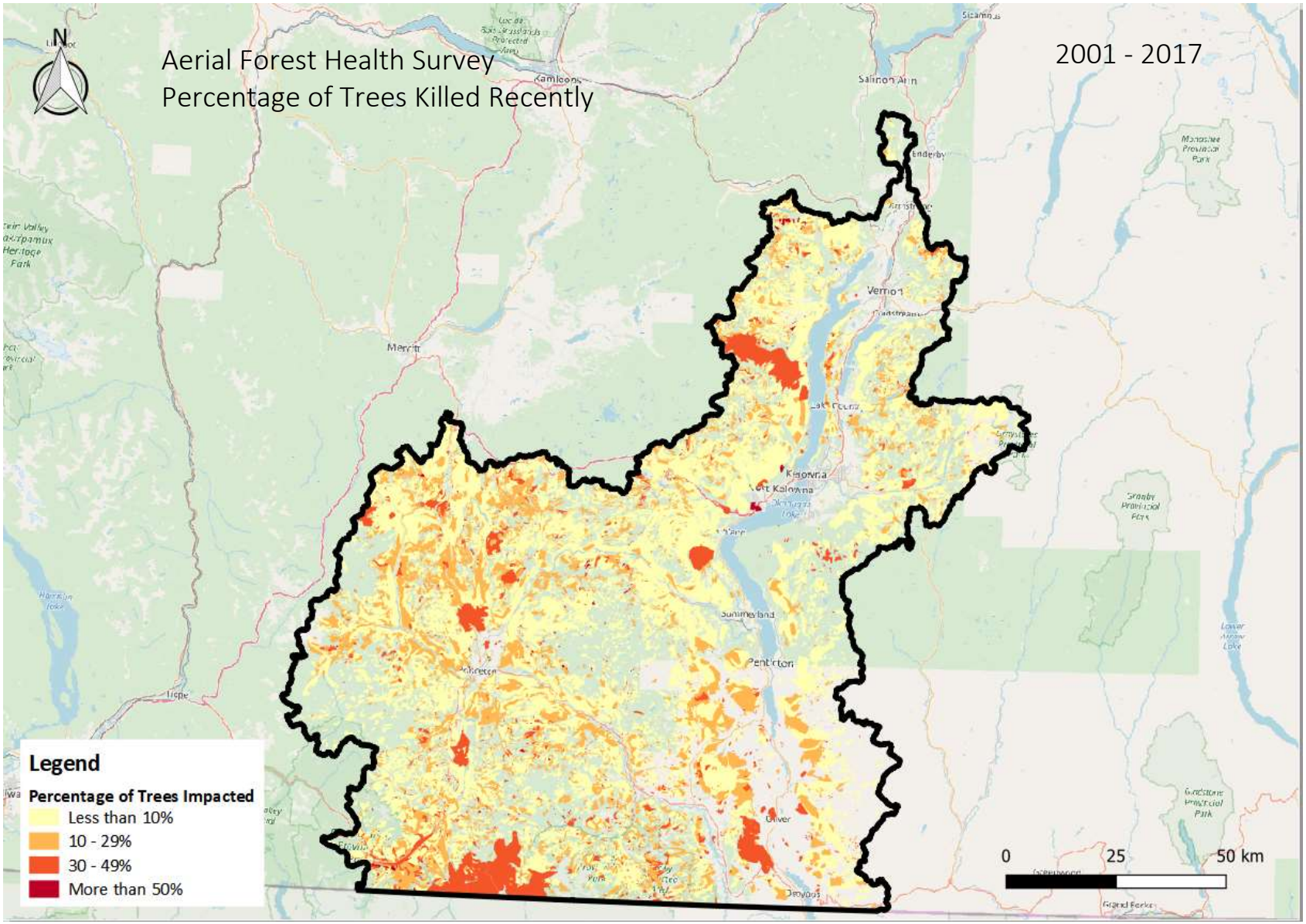
a) **Infiltration excess:**
volume of rain > than soil infiltration

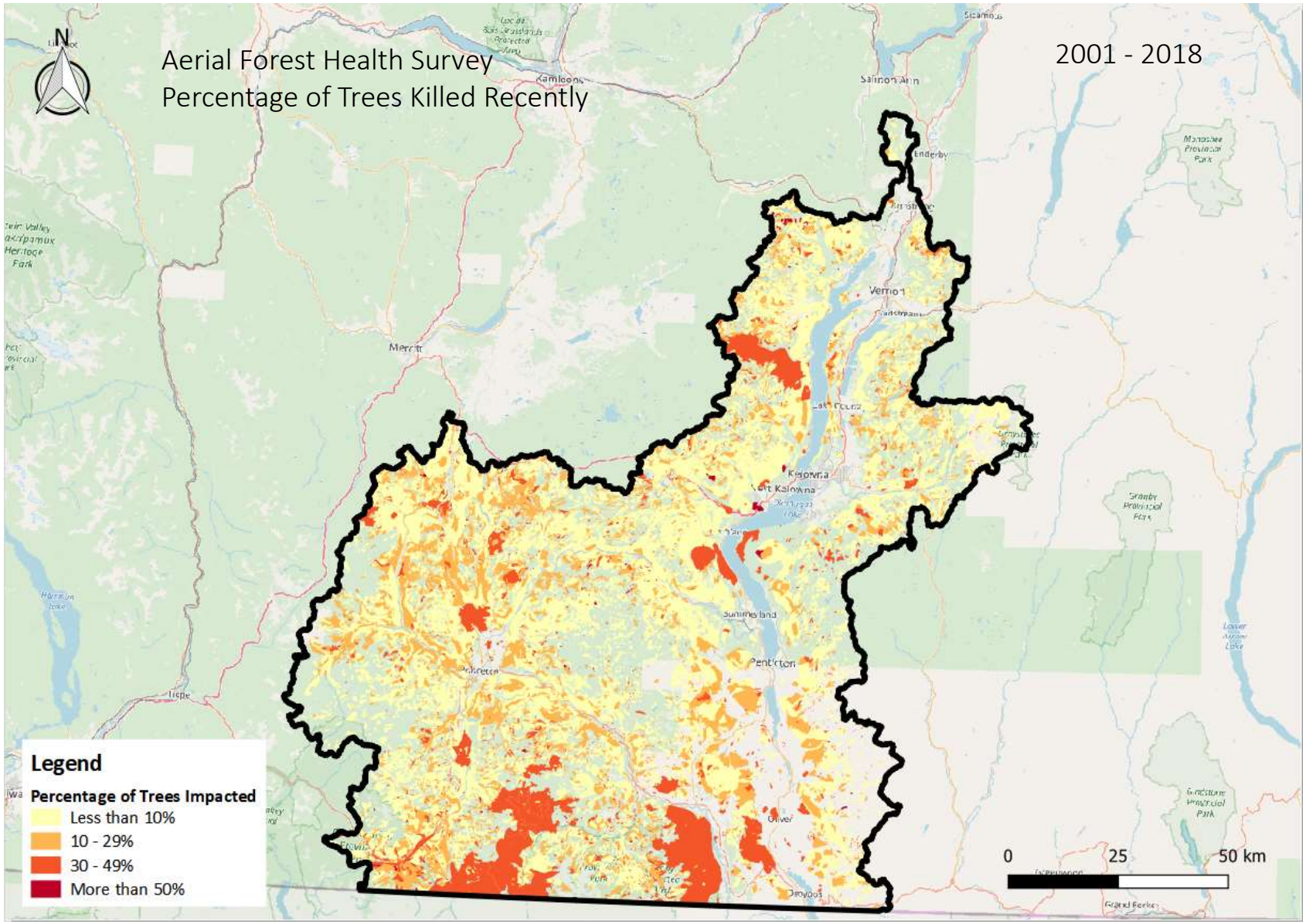
b) Saturation excess (mainly winter)
water holding capacity is full

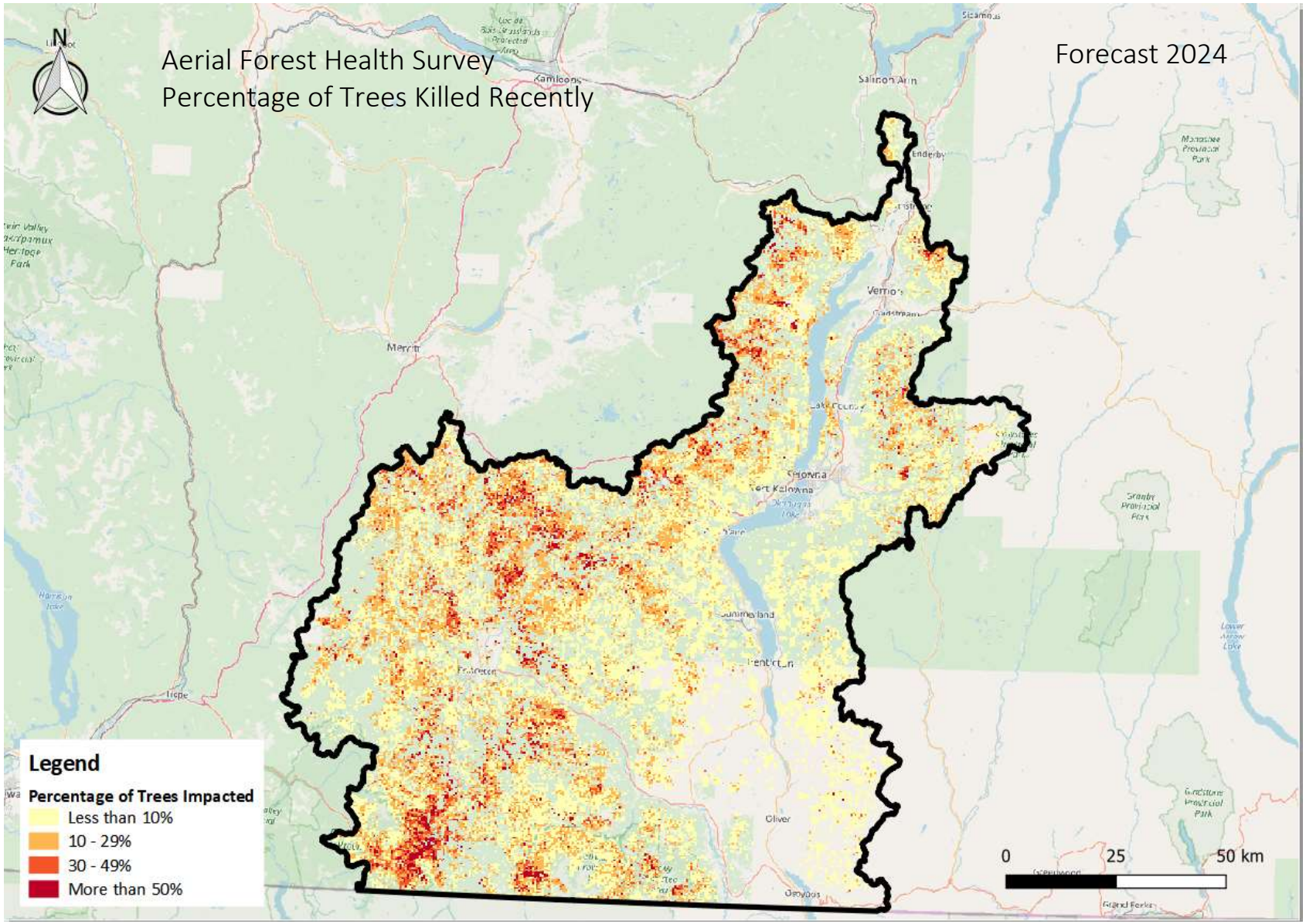


Source: DIAGNOSIS Training Course
https://slideplayer.com/slide/1448184/


N
Land Use 2010
Armstrong
Vernon
Lake Country
West Kelowna
Kelowna
Peachland
Summerland
Princeton
Penticton
Keremeos
Oliver
Osoyoos
Legend
Settlements
Roads
Water
Forest/Treed
Cropland
Grassland
Wetland
Other (Rock, Beach, Ice)
0
25
50 km

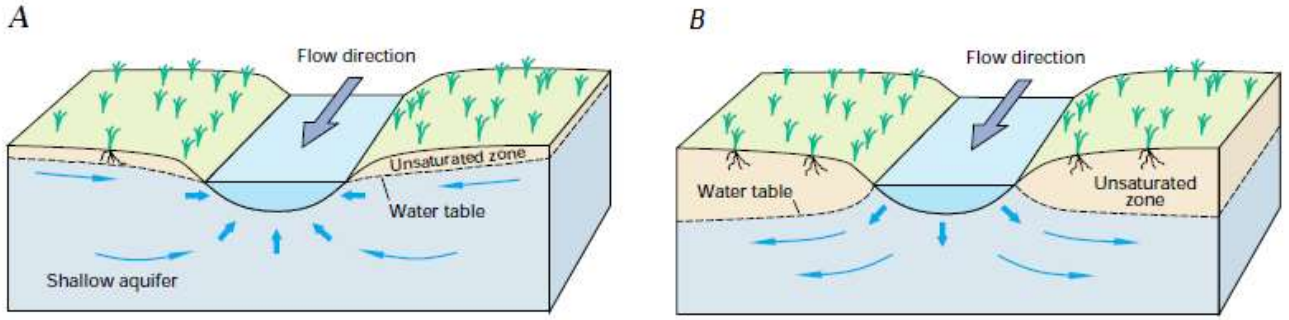

Aerial Forest Health Survey
Percentage of Trees Killed Recently
2001 - 2017
N
Kamloops
Salmon Arm
Vernon
Merritt
Kelowna
West Kelowna
Penticton
Oliver
Legend
Percentage of Trees Impacted
Less than 10%
10 - 29%
30 - 49%
More than 50%
0
25
50 km


Aerial Forest Health Survey
Percentage of Trees Killed Recently
2001 - 2018
N
Kamloops
Salmon Arm
Vernon
Merritt
Kelowna
West Kelowna
Penticton
Summerland
Oliver
Osoyoos
Legend
Percentage of Trees Impacted
Less than 10%
10 - 29%
30 - 49%
More than 50%
0
25
50 km


Aerial Forest Health Survey
Percentage of Trees Killed Recently
Forecast 2024
N
Kamloops
Salmon Arm
Merritt
Vernon
Penticton
Oliver
Osoyoos
Legend
Percentage of Trees Impacted
Less than 10%
10 - 29%
30 - 49%
More than 50%
0
25
50 km

Watershed Factor: Groundwater

Basics of groundwater / surface water interactions



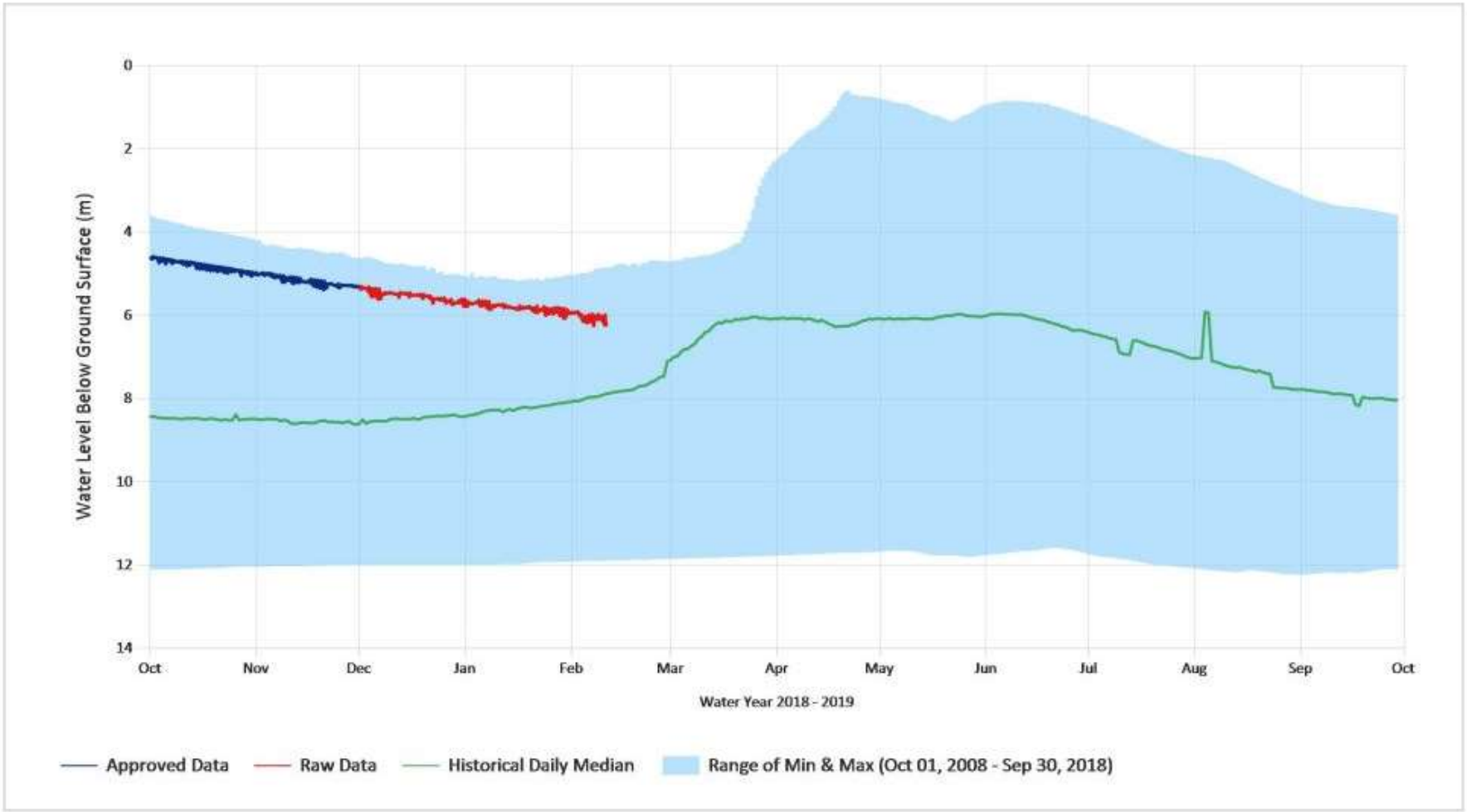
Source: **USGS Circular 1139** https://pubs.usgs.gov/circ/circ1139/pdf/circ1139.pdf

Groundwater Level Statistics Chart

Plot created: February 11, 2019 03:06

OW282: OBS WELL 282 - WILLOWBROOK/MEYERS FLATS (MEYERS RD.)

Latitude: 49.263133 Longitude: -119.591708



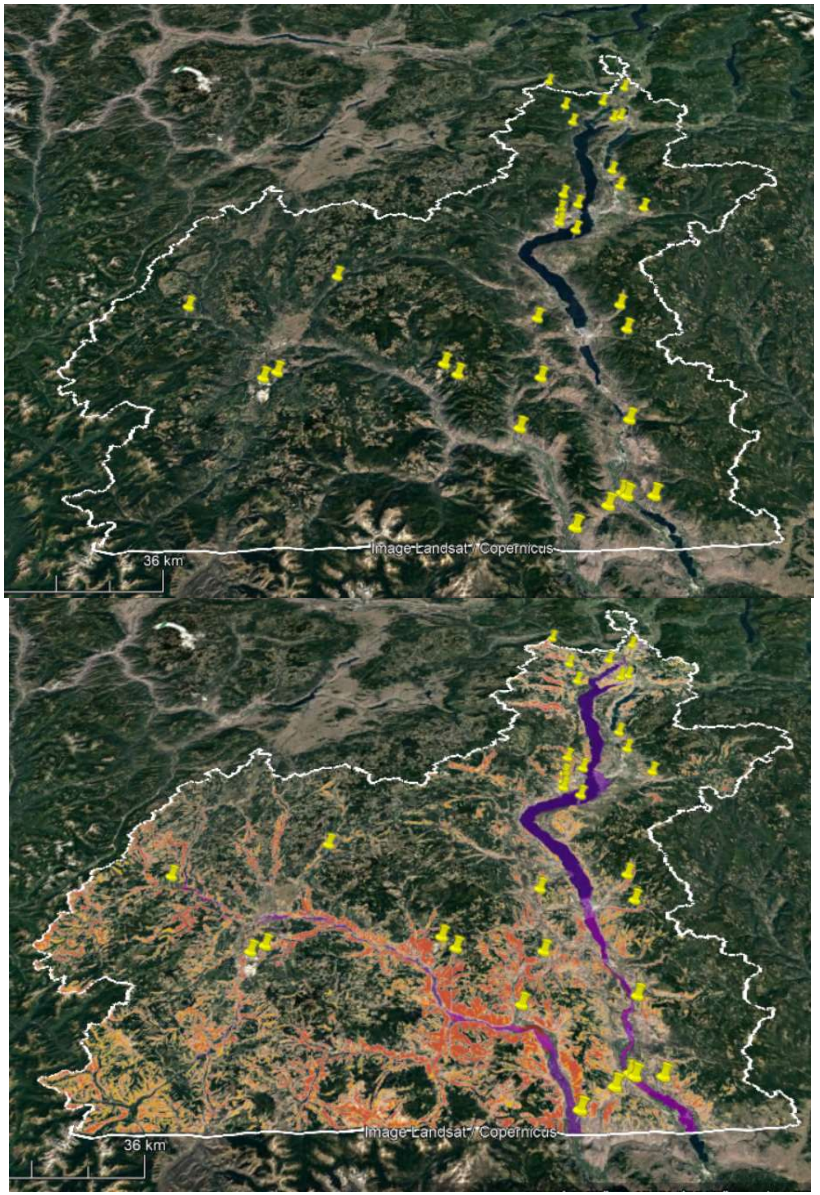
Watershed Factor: Groundwater

How does this translate to potential flooding?

1. More water is at the surface.
2. Water in the ground can flood low-lying/underground assets.
3. Rain or snowmelt exacerbates above conditions.

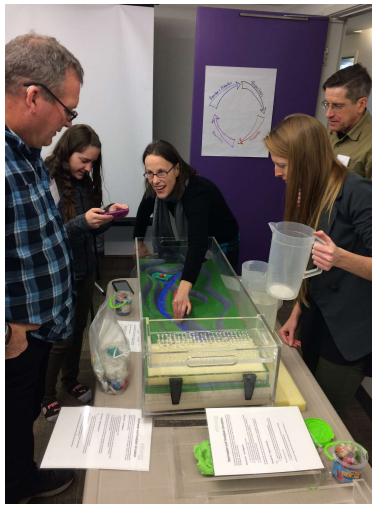
Overall Picture

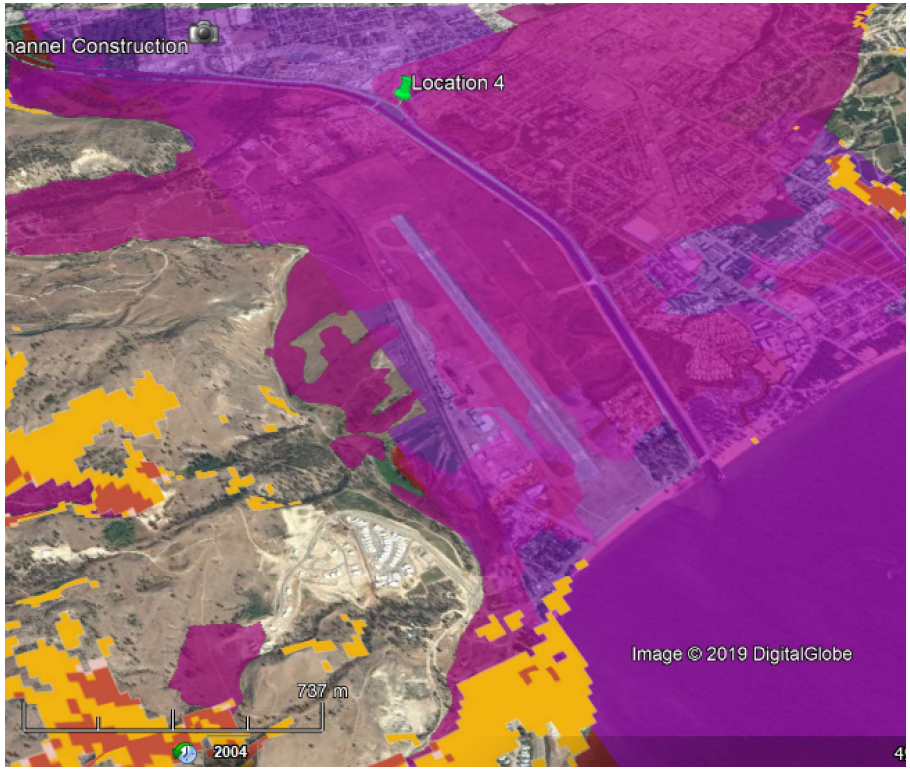
- Creating a mosaic of information and building a common understanding of *t̓ikt*.
- After lunch, we will delve deeper into considering the impacts of flood and debris flow.
- Help inform future priority-setting.



Lunchtime Fun!

- Experience the Penticton Virtual Tour
- Interact with the River Model





Lunch Break

What is Resilience?

Interactions with Flood and Debris Flows: Mapping Exercise

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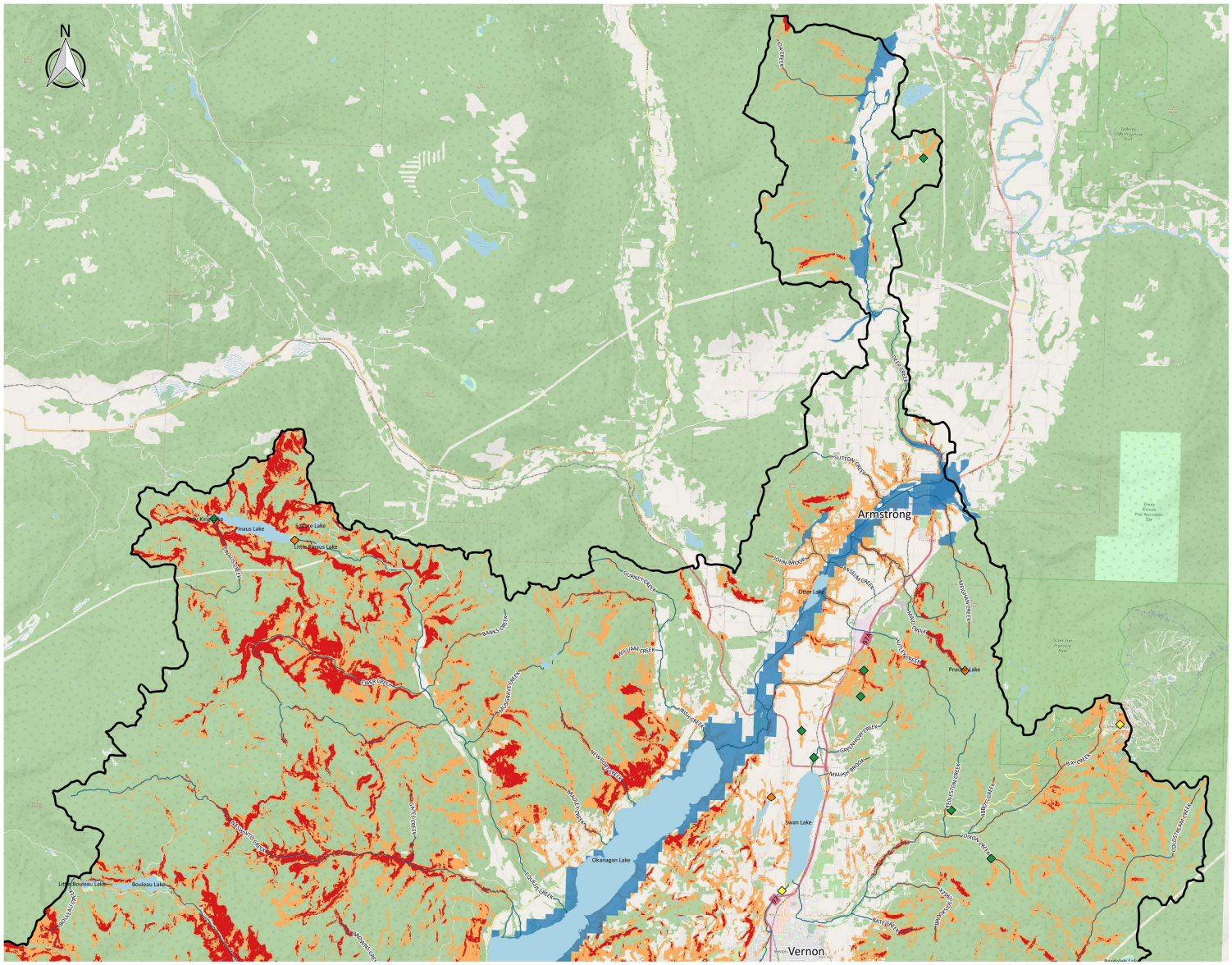

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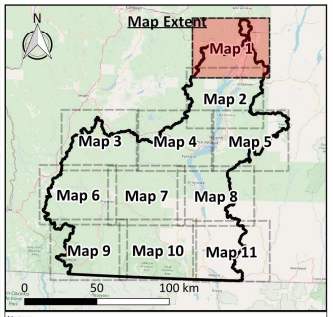
Syilx Okanagan Nation Alliance



Notes
1. Map produced by Ebbwater Consulting Inc. on February 6th 2019 FOR DISCUSSION and in DRAFT form for use in Workshop 1.
2. Flood Prone Areas are based on screening techniques to delineate areas that are likely to flood. The procedure will be refined and updated as the project progresses.
3. The Historic Flooded Reach identifies watercourses where flooding has been observed historically (i.e. since 1808). The whole watercourse is identified due to a lack of documented specific flooded reach locations.
4. Debris Flow Prone Areas are a subset of debris flow initiation zones in relatively steep creeks and drainages. They are based on high-level analysis of topography, and surficial and bedrock geology factors. The results are subject to refinement as the project progresses.

Data Sources
1. Flood Prone Areas are based on data from AE (2016), Nardi et. al (2018) and Tetra Tech (2019, for Penticton area).
2. Debris Flow Prone Areas are based on data provided by Palmer Environmental Consulting Group Inc.
3. Historic Flooded Reaches is based on Septer (2006) with updates from more recent studies (AE [2016, 2017]).
3. Highway and watercourse data is based on provincial datasets.
4. Base Layer: OSM Standard – openstreetmap.org (C OpenStreetMap contributors; cartography license CC DY-SA); Google Terrain.

Refences
1. Associated Environment (AE). 2016. Regional District of Central Okanagan – Regional Floodplain Management Plan Phase 1.
2. AE. 2017. Regional District of Okanagan - Similkameen – Drought and Flood Risk Management Plan - Gap Analysis.
3. Nardi, F., A. Annis, G. Di Baldassarre, E.R. Vivoni, and S Grimaldi. 2019. GFPLAIN250m, a global high-resolution dataset of Earth's floodplains.
4. Septer, D. 2006. Flooding and Landslide Events Southern British Columbia 1808 - 2006.
5. Tetra Tech. 2019. Penticton Flood Risk Assessment.

Scale 1:75,000
0 2 4 6 8 km

Legend

Water
- Watercourses
- Flood Prone Areas
- Historic Flooded Reach

Dikes
- Orphan Dikes
- Dikes

Debris Flow Prone Areas
- High
- Very High

Dam - Failure Consequence
- None/Low
- Significant
- High/Very High
- Extreme

Date: February 6th 2019
Produced by: Ebbwater Consulting Inc.

Syilx Flood Resilience Project
Preliminary Flood and Debris Flow Areas

DRAFT

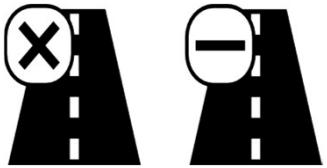
ANSI D - Map 1 of 11

High-level impact categories
National Risk Profile

Mortality & Missing

Affected People

Economic



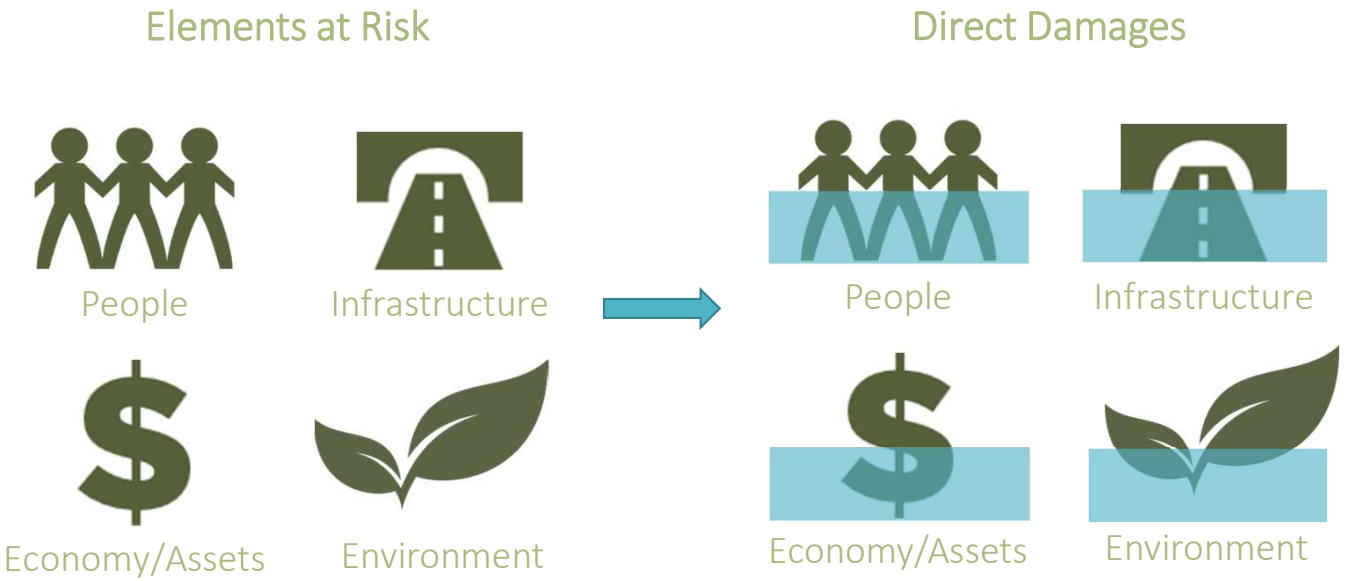
Disruption

Environment

Cultural*

Risk Assessment

A Multi-Disciplinary Task



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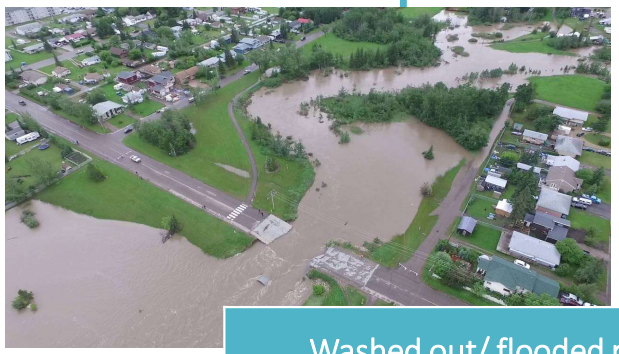
Flood Impacts - Direct



Washed out/ flooded roads

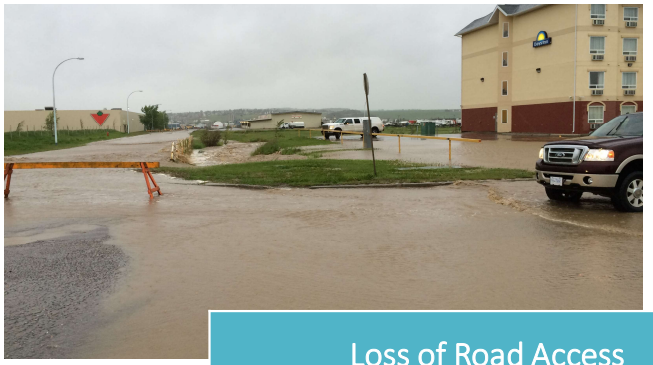
Exposed utilities

Backed-up sewage system

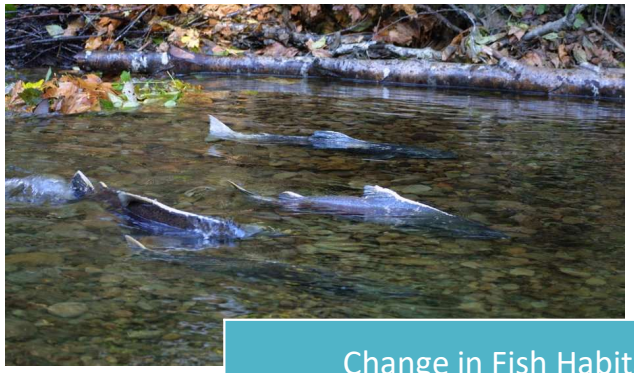
Bridge collapse

Flood Impacts - Indirect

Lost Access to Sacred Areas



Loss of Road Access



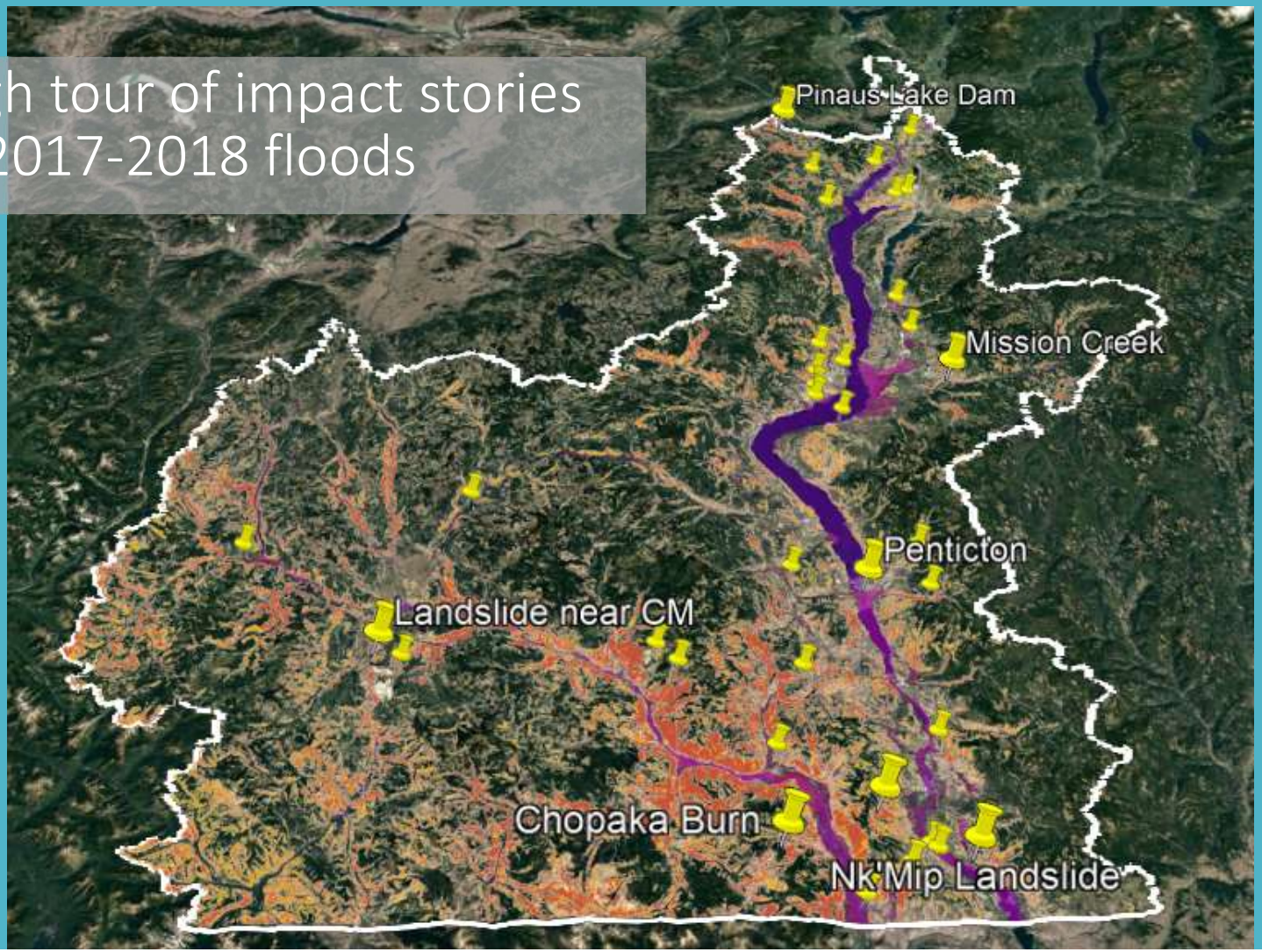
Change in Fish Habitat

Loss of Utility Service

Syilx Models

Contents from this slide removed

Fly-through tour of impact stories from the 2017-2018 floods



Flood & Debris Flow Mapping Exercise

Mapping Direct & Indirect Impacts

- What is the **path of the water and earth** during times of flood and debris flow? [Anything not on the maps that is important to note]

- How does flood and debris flow **interact** with the land, people, the built environment and all tmix[w]?

- What about our past and current **actions, traditions, practices, livelihoods, relationships and interactions** with water and land, impact or are impacted by flood & debris flow?

(consider positive and negative types of interactions or impacts)

Mapping Direct & Indirect Impacts

- What else matters if we think of flood & debris flow from the **perspective of water** itself, and of **future generations** of people and all tmix^{w}?

(consider positive and negative types of interactions or impacts)

Debrief / Reflection

Erica Crawford | Adaptation Planner | SHIFT Collaborative

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1. One **positive** interaction with flood and debris flow

2. One **challenging** interaction with flood and debris flow

3. One consideration from the perspective of water and/or future generations

Report Back

Source: maxpixel.net

What stood out?

What matters the most?

What do we (consultants) need to know?

Closing

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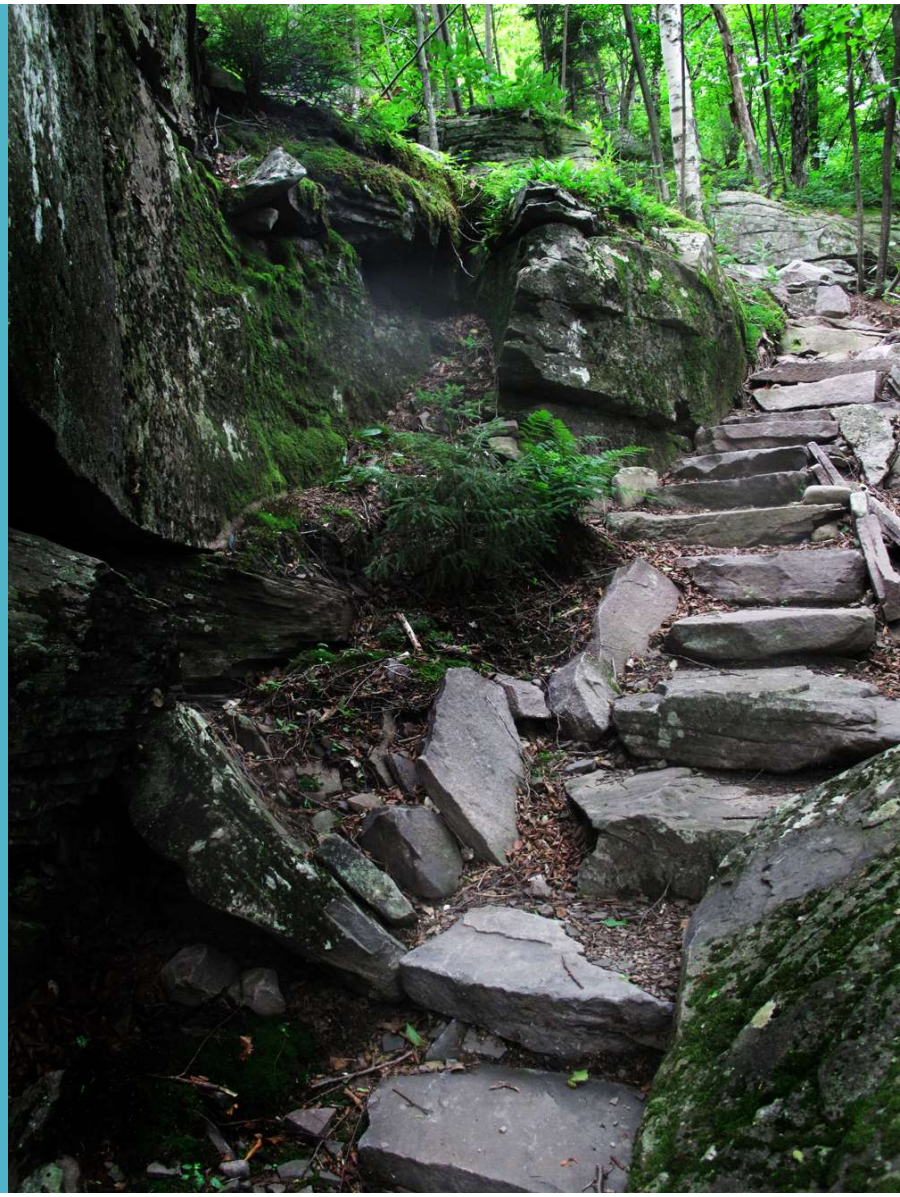
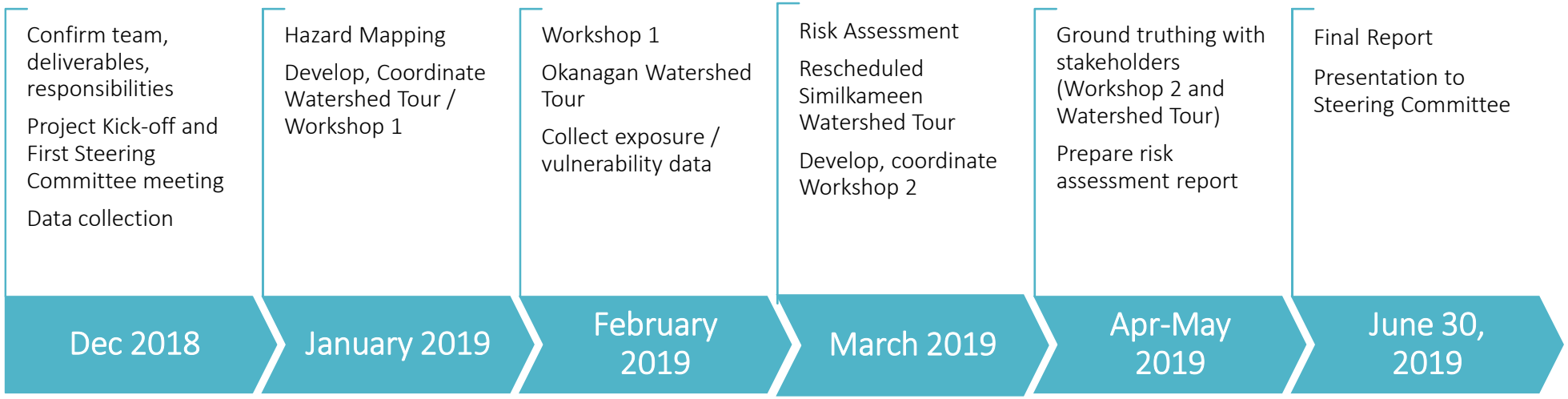
Next Steps…

- Compile information gathered today
- Okanagan Watershed Tour: Friday, February 22nd.
- Similkameen Watershed Tour: Early March (Date TBD soon)
- Collect exposure / vulnerability data



Looking ahead….we'll be back to make sure we heard you right.



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Source: similkameenvalley.com

THANK YOU

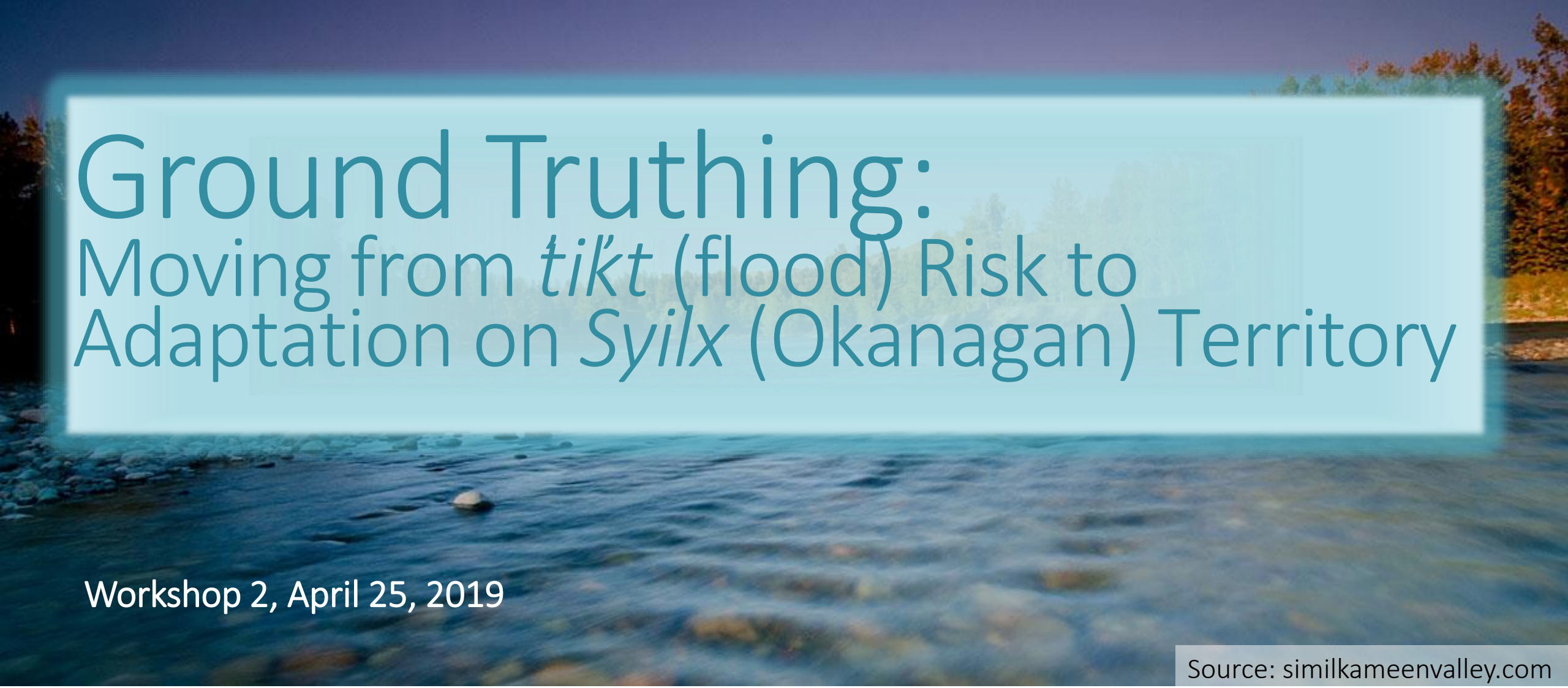
Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix G: Workshop 2 Presentation Slides

Ground Truthing:
Moving from *tiʔkt* (flood) Risk to Adaptation on *Syilx* (Okanagan) Territory

Workshop 2, April 25, 2019



Source: similkameenvalley.com

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SHIFT shift to a better world

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ENGAGE | INSPIRE | MOBILIZE IndigenEYEZ Empowering People—Strengthening CommUNITY

syilx Okanagan Nation Alliance

Agenda

Time	Section
Morning	Welcome
	Framing our work together
	Reflect on watershed tours and first workshop
	Review of impact information gathered in earlier engagement
	Break
	Share preliminary risk assessment information and identify gaps
Lunch Break	
Afternoon	Exploring opportunities for building resilience
	Visioning with the four Food Chiefs
	Reflections and closing

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Goals and Agreements

1. Learn about the Syilx perspectives on flood, including positive and negative implications
2. Review qualitative information that has been gathered and mapped to date
3. Review preliminary quantitative findings to refine the process and obtain meaningful results
4. Strengthen relationships and prepare for next phase of work related to adaptation and resilience
5. Have fun together!

Setting the Stage: Reflecting on Early Engagement Activities

Rob Larson

Tessa Terbasket

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THOUGHTFUL FLOOD MANAGEMENT

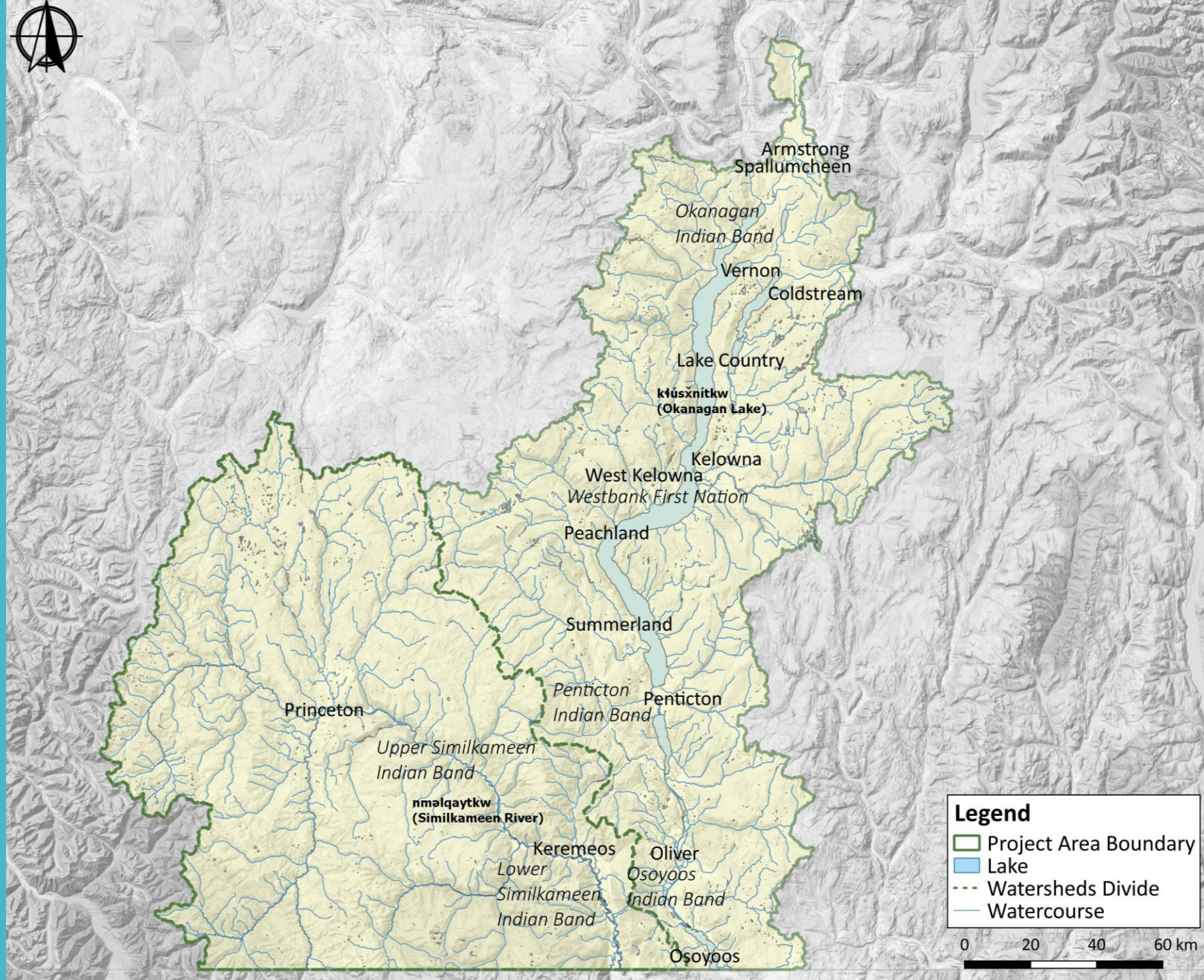
Project Objective

Understand risk due to flood and debris flows within the Okanagan-Similkameen region, to support priority-setting of future work

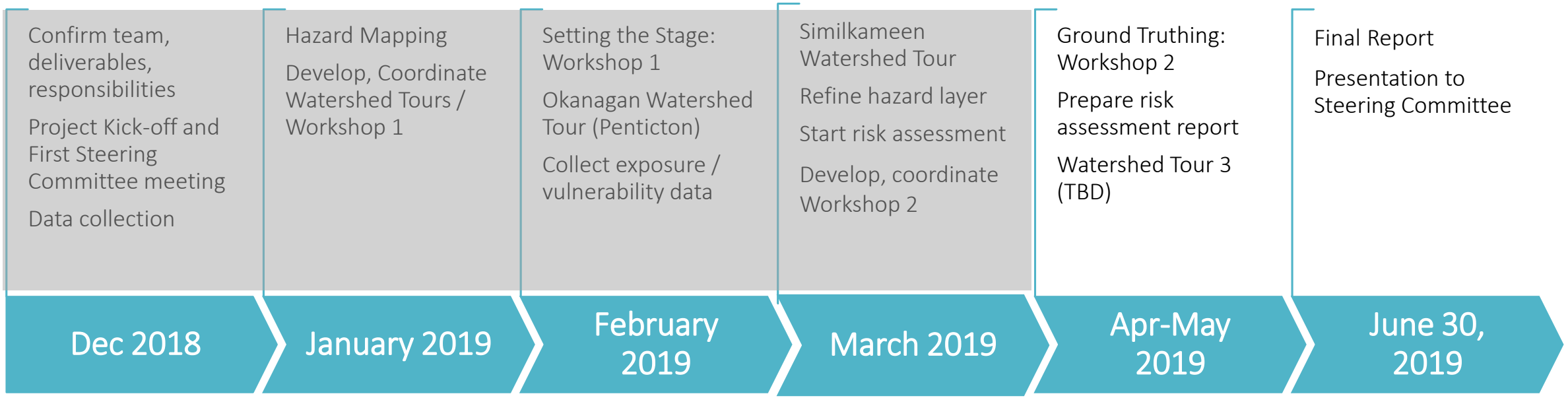
Source: Heather Murdock

Study Area

15,519 km^2



Project Timeline



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Water is life.

Water is our relation.

Water bonds us to our ancestry, our descendants and our land.

siwɬkʷ will always take the lowest path in its humility, yet of all the elements, it is the most powerful.

siwɬkʷ will always find a way around obstructions: under, over and through.

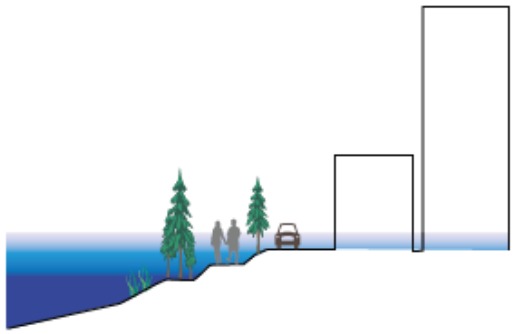
Syilx Nation Siwɬkʷ Declaration

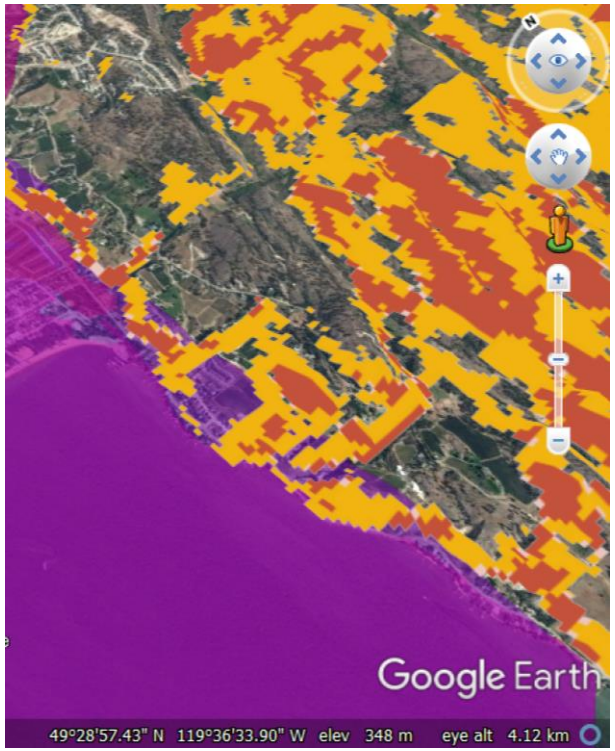
syilx Okanagan Nation Alliance

1. Plan for exceedance
2. Promote flooding
3. Understand risk and uncertainty
4. Acknowledge future change
5. Implement a portfolio of options
6. Utilize resources efficiently and fairly
7. Establish governance responsibilities
8. Communicate risk and uncertainty
9. Promote participation
10. Reflect local context

The 10 Golden Rules of Flood Management

Sayers et al. 2014





Sharing with various tools

- Workshop 1
- River Model
- Penticton Virtual Tour
- Watershed Tours

Sharing and listening (Workshop 1)

Penticton

Stop 4: Former location of oxbow lakes on locatee lands

Stop 1: Upper Shingle Creek near Shingle Creek Rd.

Stop 2: Mouth of Shingle Creek at the Penticton Channel

Stop 3: En'owkin Centre

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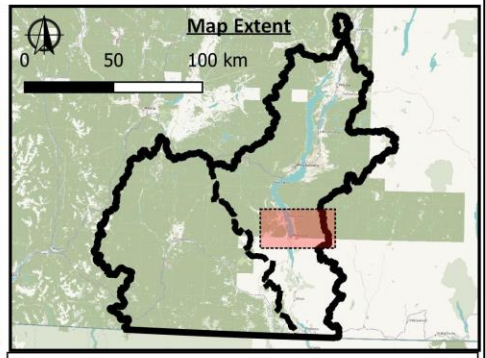


Notes
1. Map produced by Ebbwater Consulting Inc. on March 22 2019 as DRAFT.
2. Flood Prone Areas are from three studies/methods.
3. Debris Flow Prone Areas are a subset of debris flow initiation zones in relatively steep creeks and drainages.

Data Sources
1. Flood Prone Areas are based on data from the Federal Disaster Reduction Program (FDRP), flood mapping for Penticton (Tetra Tech, 2019), and a screening-level method based on geology and soils mapping (AE, 2016).
2. Debris Flow Prone Areas are based on data provided by Palmer Environmental Consulting Group Inc.
3. Highway and watercourse data is based on provincial datasets.
4. Base Layer: OSM Standard.

References
1. FDRP Floodplain Maps. GEO BC.
2. Tetra Tech. 2019. Penticton Flood Risk Assessment.
3. Associated Environmental (AE). 2016. Regional District of Central Okanagan - Regional Floodplain Management Plan: Phase 1.

Penticton Tour Stops
Penticton Tour Track
Reserve Lands

Debris Flow Prone Areas
High
Very High

Flood Prone Areas
FDRP Study
Penticton Study
GSM Screening

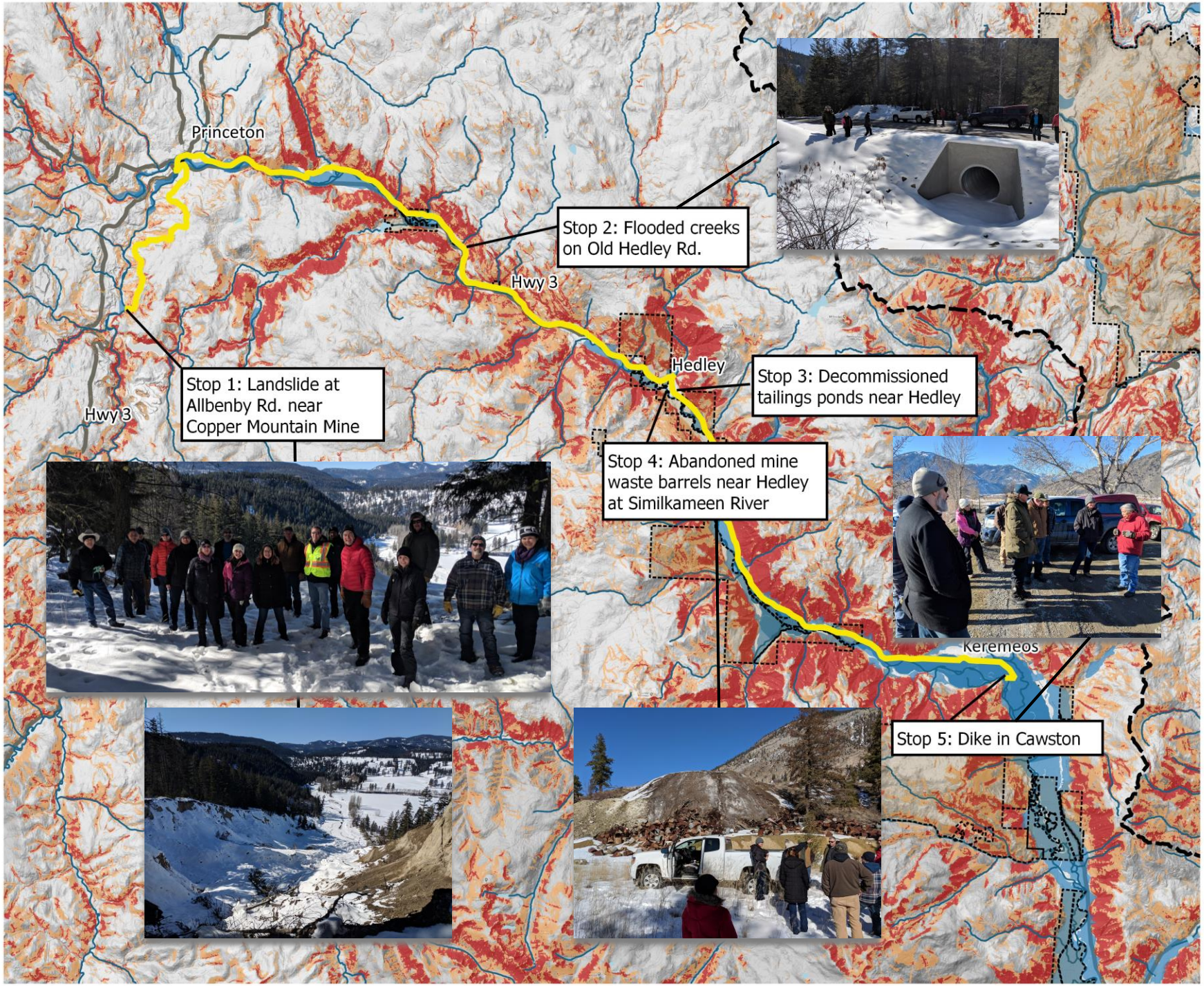
Water
Watercourses

0 0.5 1 1.5 km

Date: March 22 2019
Produced by: Ebbwater Consulting Inc.

Syilx Flood Resilience Project
Watershed Tour - Penticton

11 x 17 MAP



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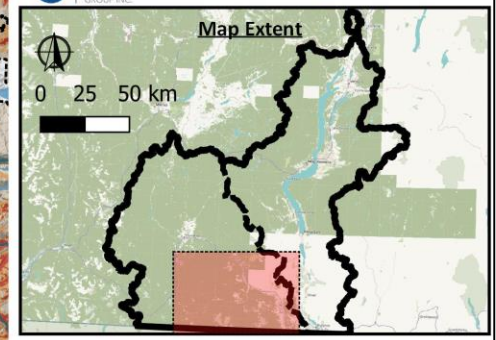
PALMER ENVIRONMENTAL CONSULTING GROUP INC.

syilx Okanagan Nation Alliance



Notes
1. Map produced by Ebbwater Consulting Inc. on March 22 2019 as DRAFT.
2. Flood Prone Areas are from two studies/methods.
3. Debris Flow Prone Areas are a subset of debris flow initiation zones in relatively steep creeks and drainages.

Data Sources
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2. Debris Flow Prone Areas are based on data provided by Palmer Environmental Consulting Group Inc.
3. Highway and watercourse data is based on provincial datasets.
4. Base Layer: Google Terrain. 2019.

References
1. Nardi et al. 2018. GFPlain250.
2. Associated Environmental (AE). 2016. Regional District of Central Okanagan - Regional Floodplain Management Plan: Phase 1.

Similkameen Tour Stops
Similkameen Tour Track
Road
Reserve Land

Debris Flow Prone Areas
High
Very High

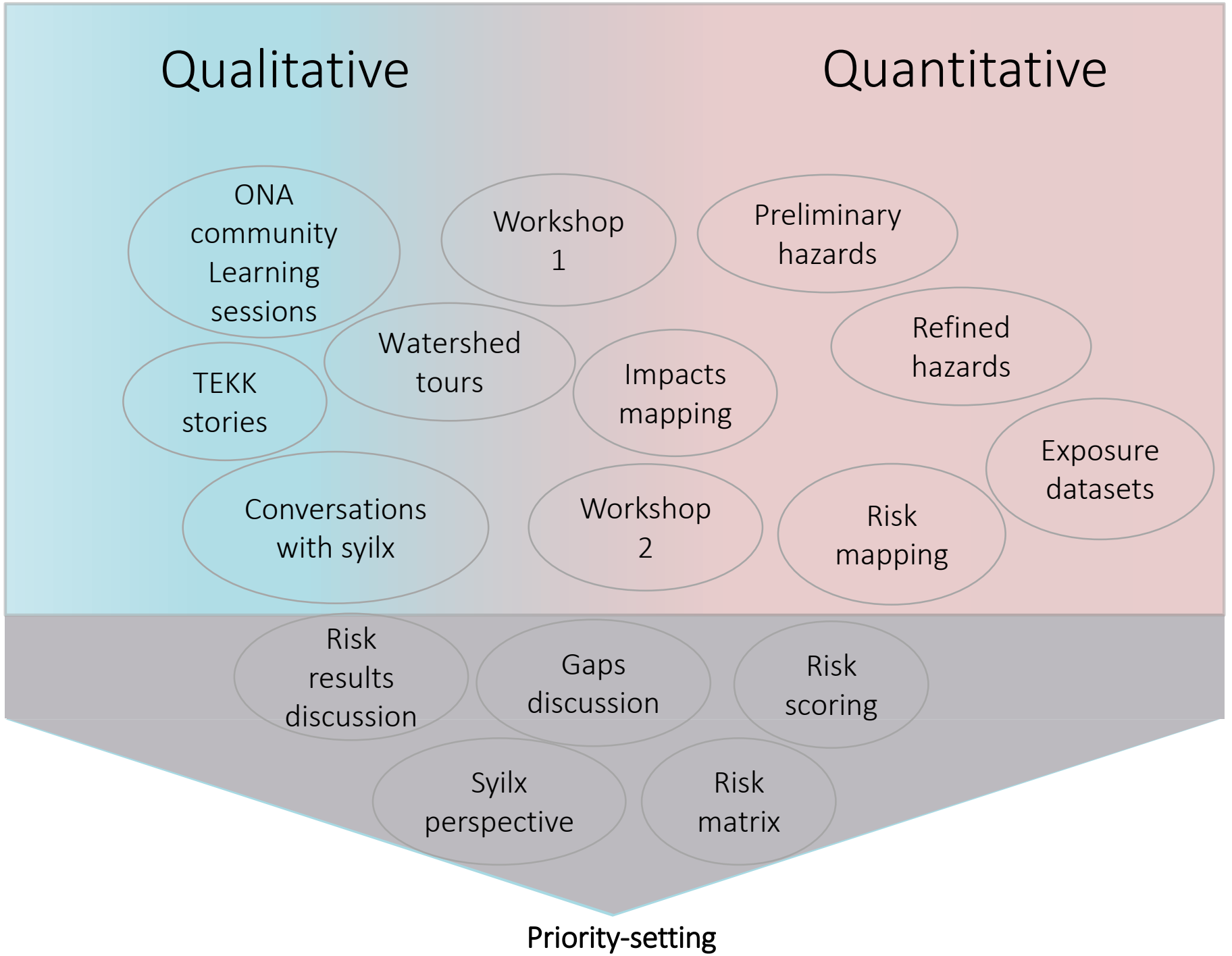
Flood Hazard Maps
Flood Prone Area
GSM Complete

Water
Watercourses
Watershed Boundary

0 5 10 km

Date: March 22 2019
Produced by: Ebbwater Consulting Inc.

Syilx Flood Resilience Project
Watershed Tour - Similkameen


Qualitative
Quantitative
ONA community Learning sessions
Workshop 1
Preliminary hazards
Refined hazards
Watershed tours
TEKK stories
Impacts mapping
Exposure datasets
Conversations with syilx
Workshop 2
Risk mapping
Risk results discussion
Gaps discussion
Risk scoring
Syilx perspective
Risk matrix
Priority-setting

Mapped vs. Unmapped Information

Maps are static tools

Flood and debris flow are dynamic

Impacts mapping is a ‘bridge’

Review of Qualitative Impacts

Tamsin Lyle

Rob Larson

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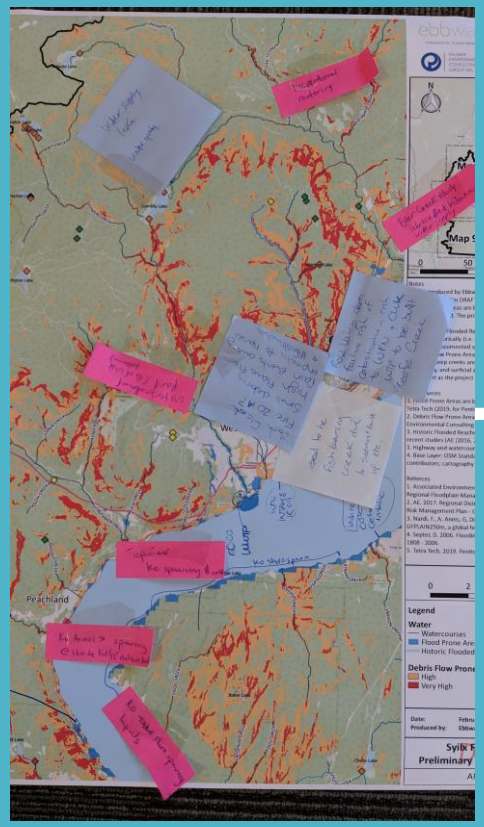
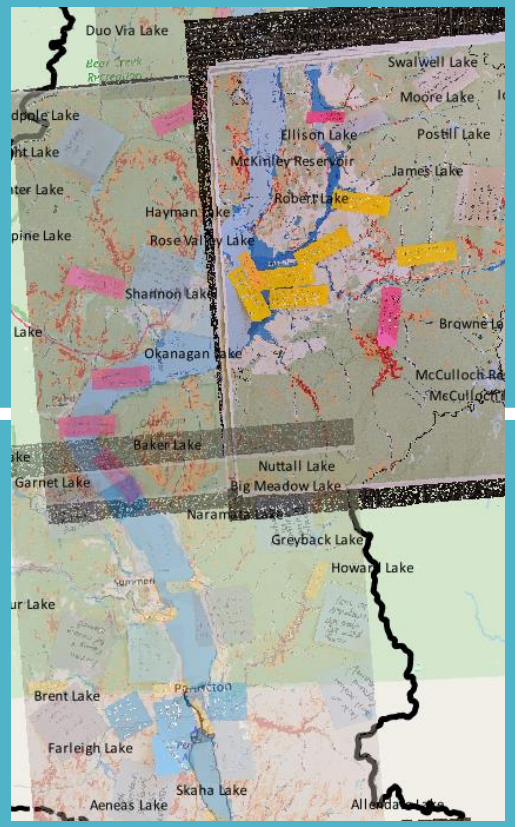
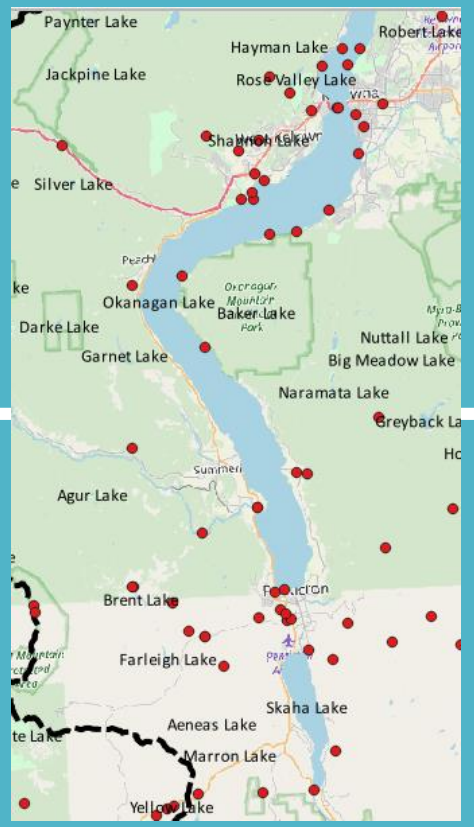
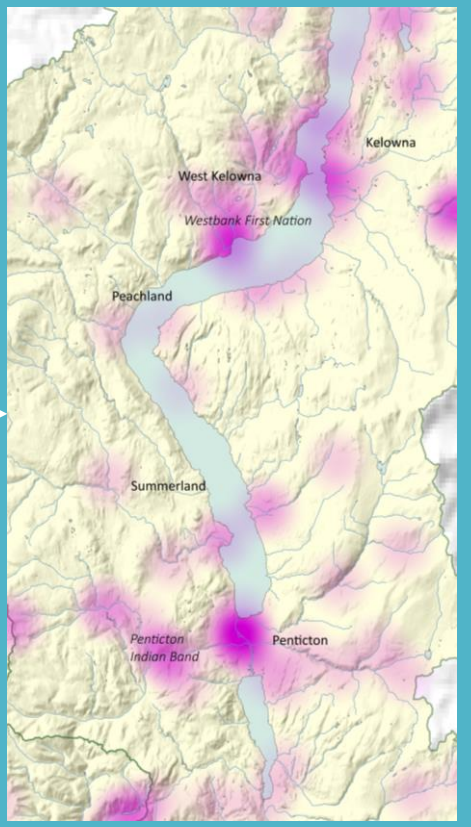
Mapping Qualitative Impacts



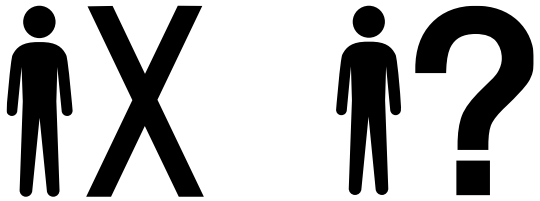




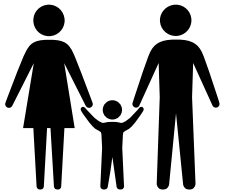


High-level impact categories

National Risk Profile

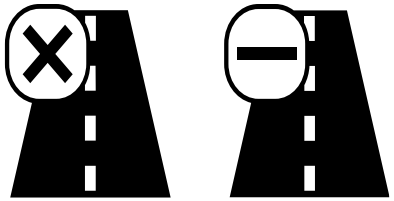


Mortality & Missing



Affected People

Economic

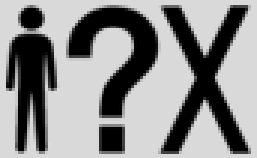
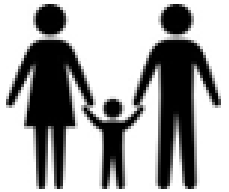
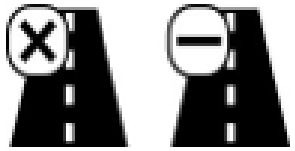


Disruption

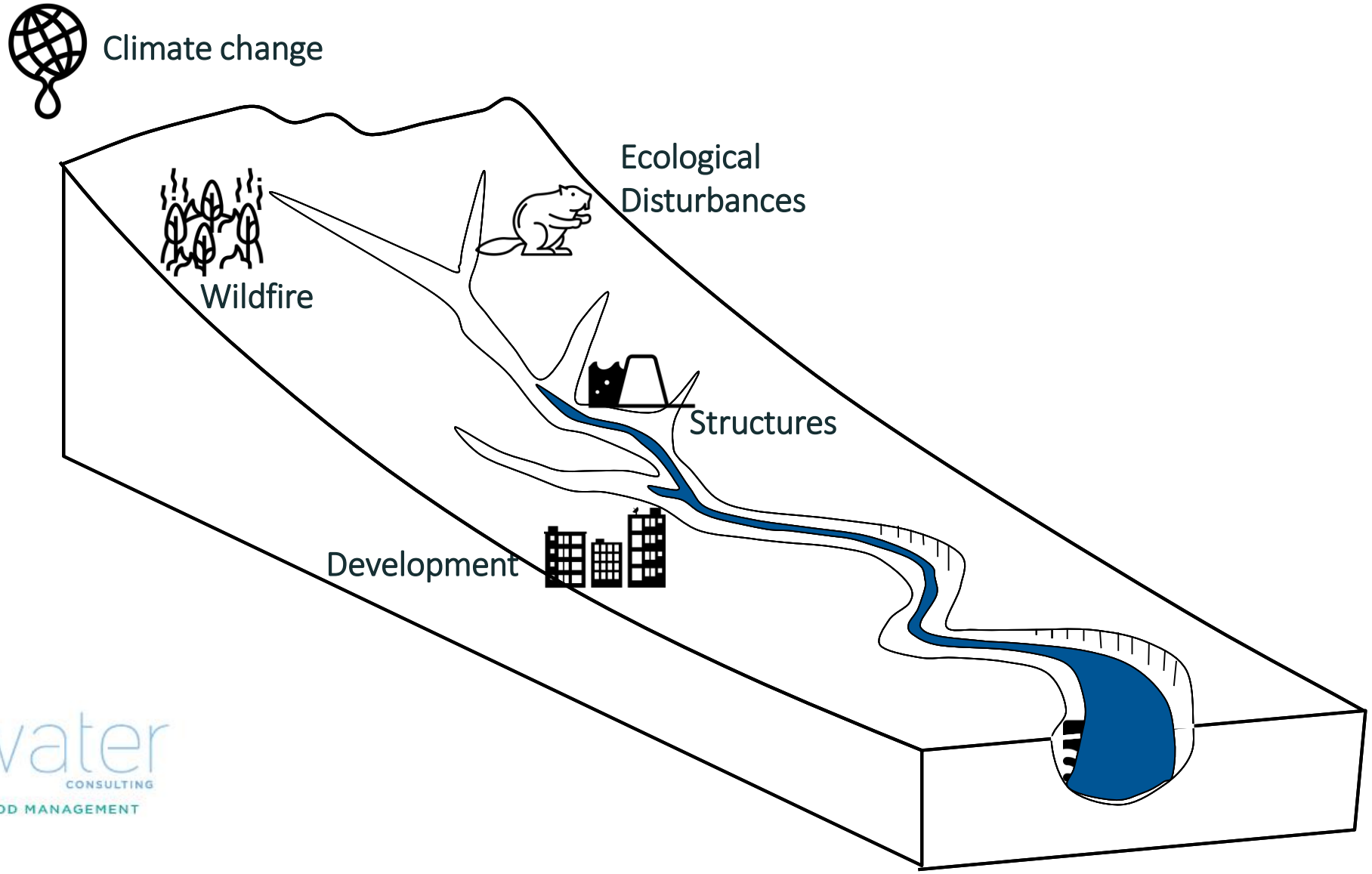
Environment

Cultural

Impact Categories

Impact Category	What Is Described
	People that go missing or die as a result of the event. *Not used in the qualitative analysis.*
	People impacted because they have had their homes, schools, businesses, and/or other services lost (e.g. from a damaged public amenity).
	Direct losses, which primarily includes damage and reconstruction costs to public and private structures. This also can include the cost of response.
	Describes the potentially more widely spread impacts that can result from an event (e.g., when a transportation network such as a road is cut off).
	Impacts to environmentally sensitive areas that are directly exposed, and the effects of contaminants that are released into the area when hazardous sites are affected.
	Impacts to sites of cultural significance including harvesting, sacred, and recreational areas.

Human-Induced Stressors



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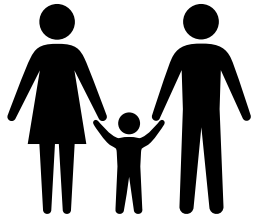
landmark
contamination
airport
spawners
industries
harvesting
beavers
agriculture
anoxic
manure
flowpath
landslide
blocked
wastewater
habitat
ranchlands
destroyed
lakeshore
collapse
washout
access
sewage
trails
repair
culvert
assets
dam
benefits
road
fish
wetland
fire-induced
upstream
leaching
riparian
recovery
reservoir
hospital
erosion
realignment
tourism
evacuation
aquatic
life
health
closure
climate
reserve
recreation
home
bridge
houses
sediment
drinking
wildfire
archaeology
tailings
cattle
cottonwood
downstream
emergency

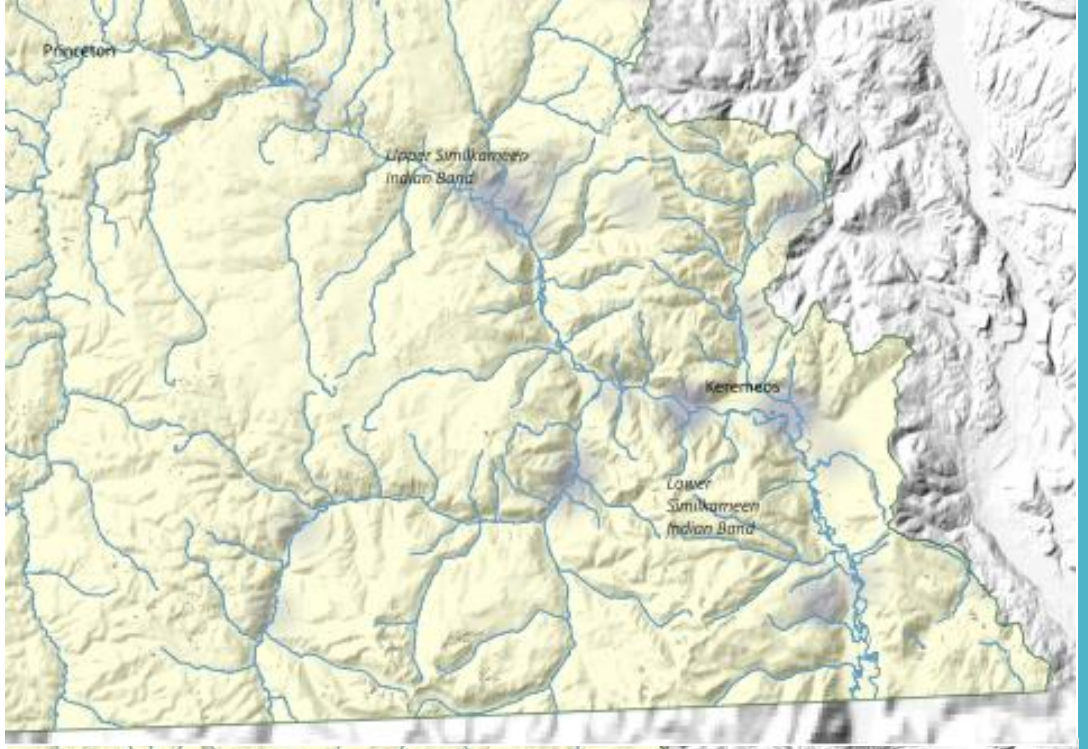
Undesirable vs. Desirable Consequences

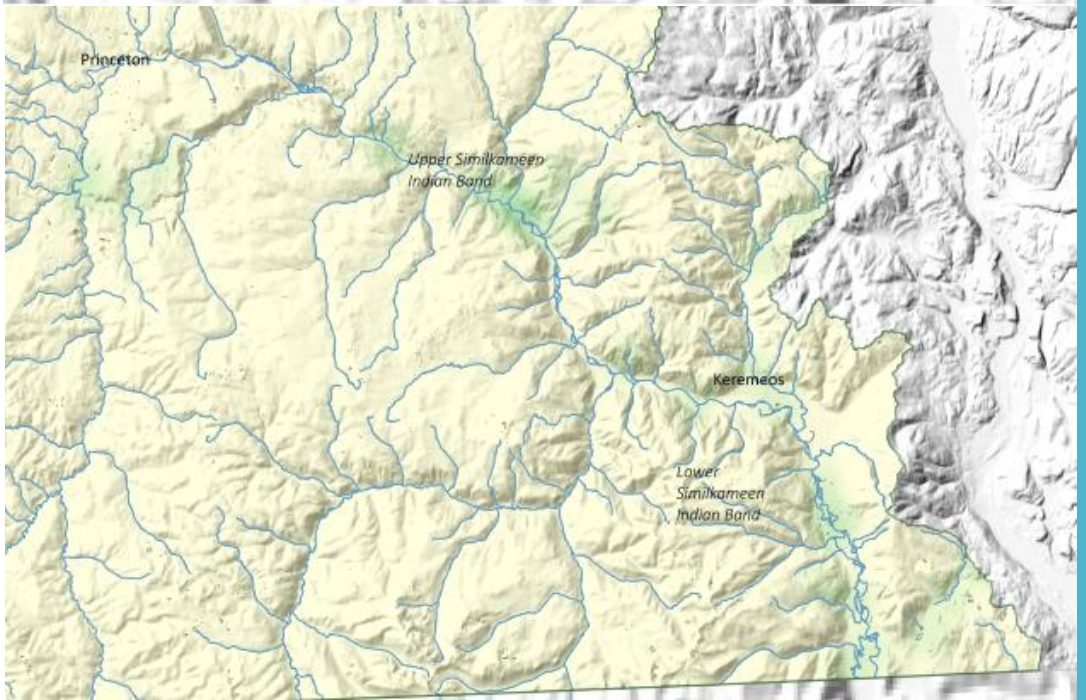
Some flooding is good for fish

Flood infrastructure is problematic

Seek opportunity gains







Similkameen Watershed

Preliminary

Qualitative Results:

- Not all areas equally represented
- Some overlap between categories

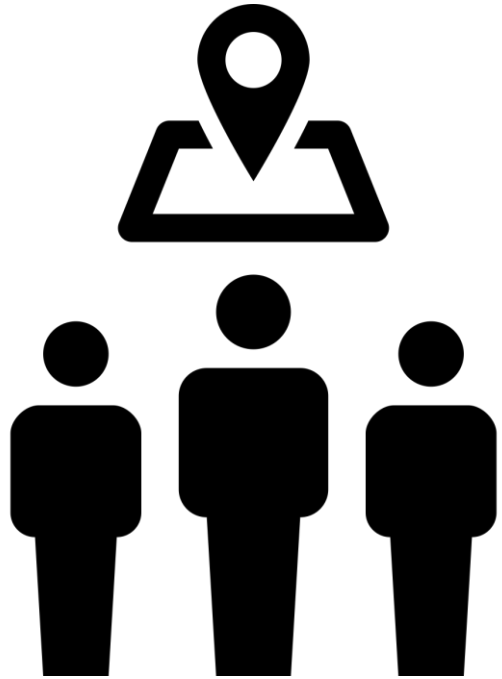
Okanagan Watershed

Preliminary Qualitative Results:

- Impacts are distributed but close to water
- Some overlap between categories

Exercise (15 min): Impacts Mapping Review

- 2 Watersheds, 5 Impact categories
- Did we miss specific areas?



Break

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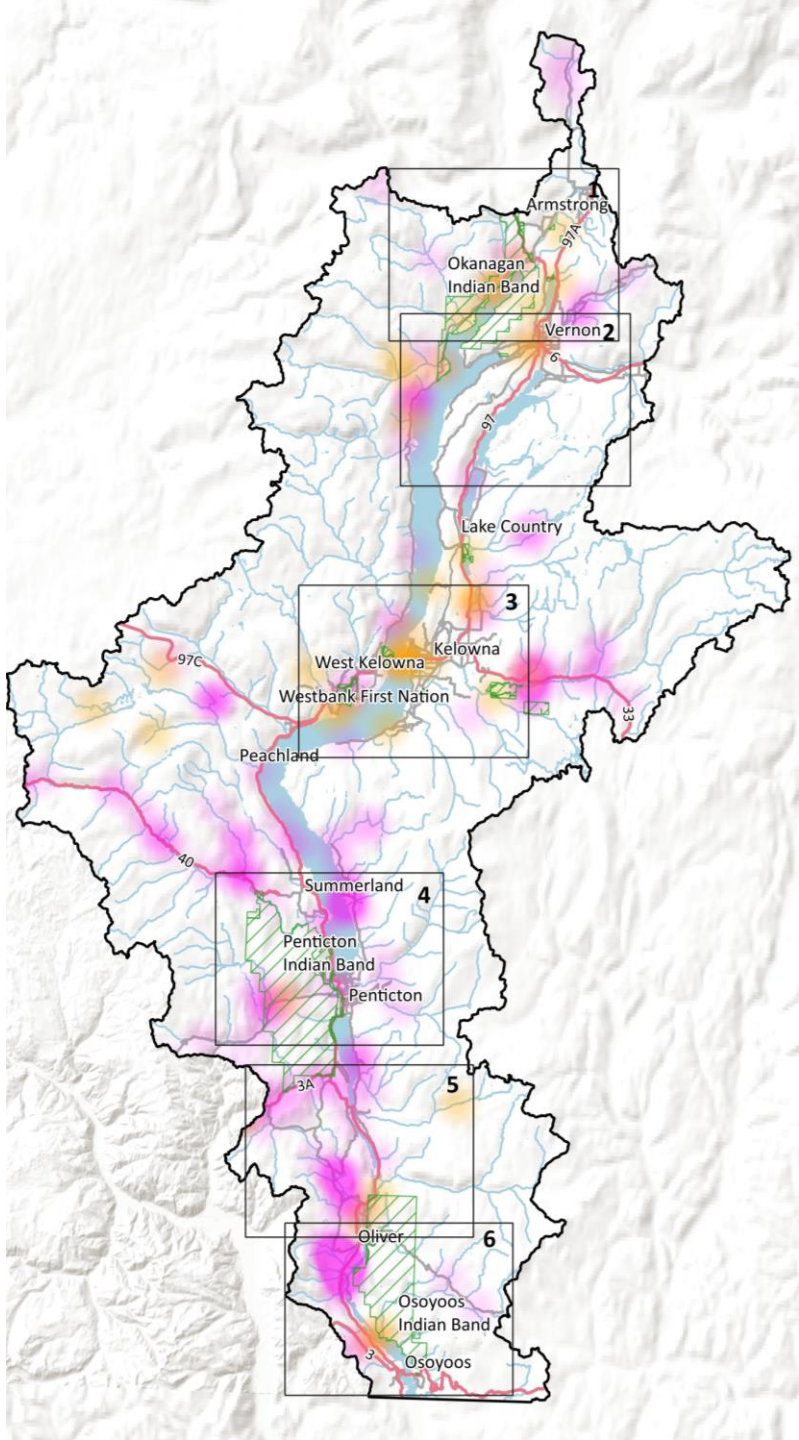
Complementary Qualitative and Quantitative Datasets

- Disruptions as indicated by you (orange)
- Events recorded by MOTI (pink)



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Preliminary Quantitative Results

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Rob Larson

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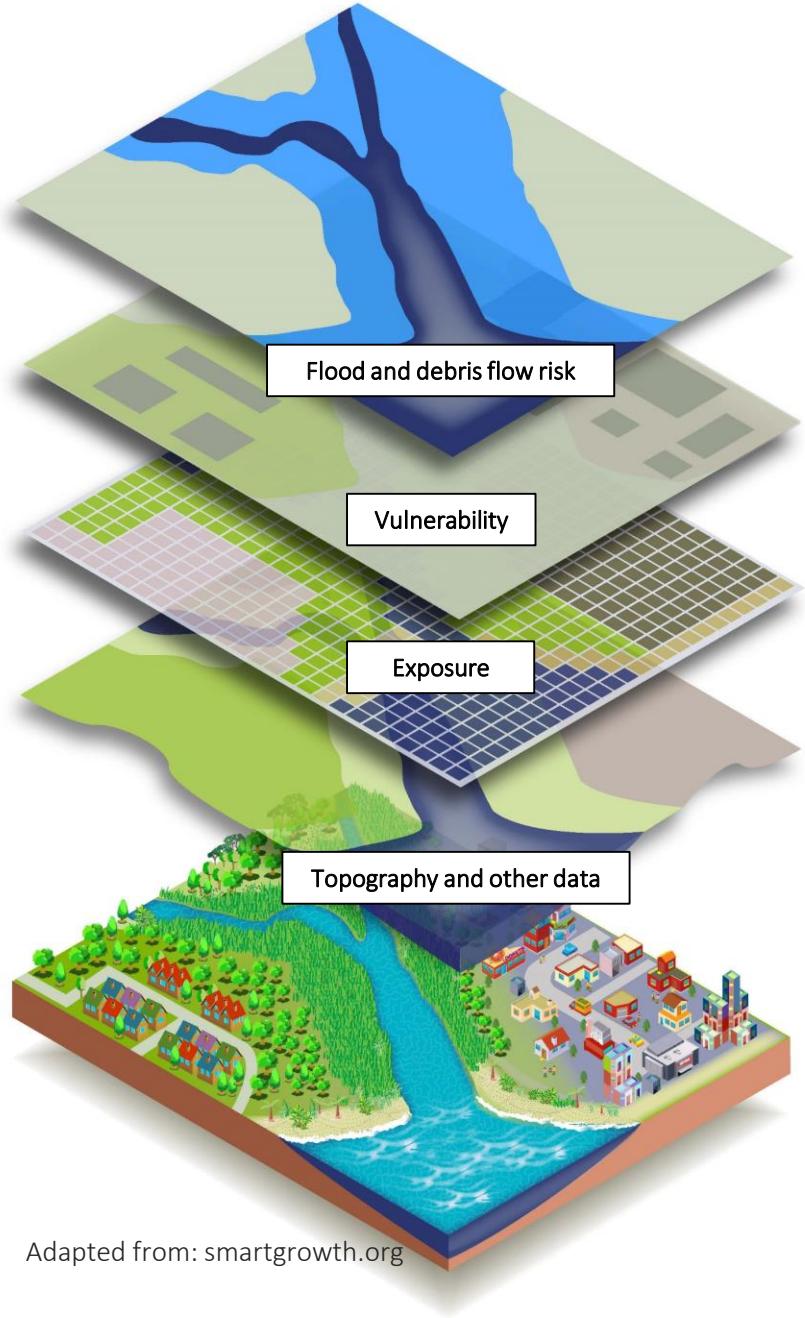
Process of Risk Assessment

- Understand and map components of risk
- Overlay the elements to see where they intersect



Adapted from: smartgrowth.org

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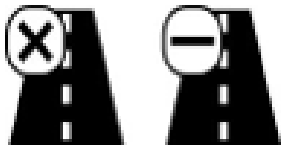
Impact Categories

Quantitative

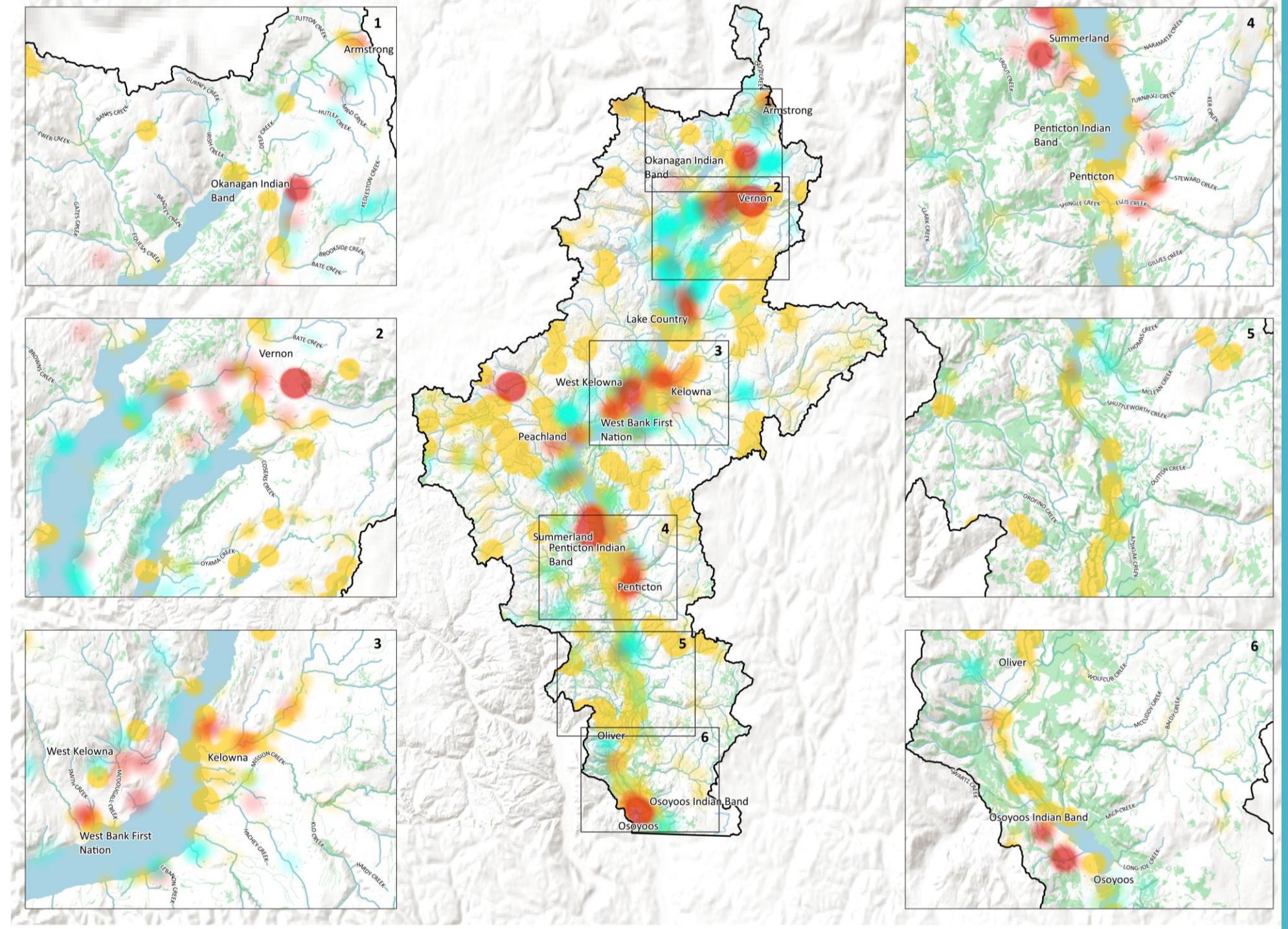
Impact Category	Data Sources		Impact Category	Data Sources
	Building footprints			Major and minor roads
	Census dissemination areas			Contamination Sources Fish observations, drinking water wells, and high biodiversity areas
	Property assessments Building footprints as proxy			Cultural buildings

Flood vs. Debris Flow

Modelling and data analysis

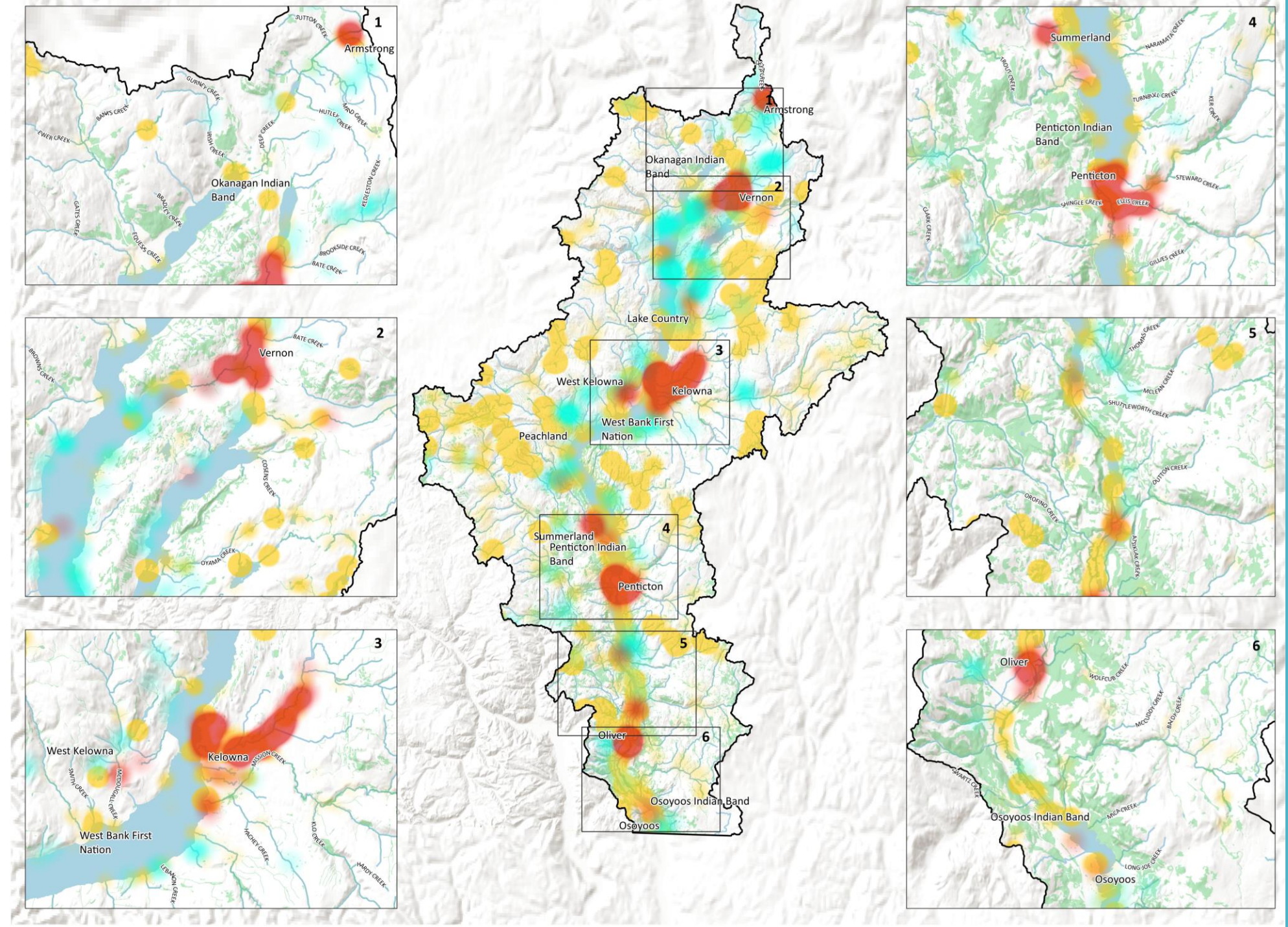
Spatial distribution

Consequences



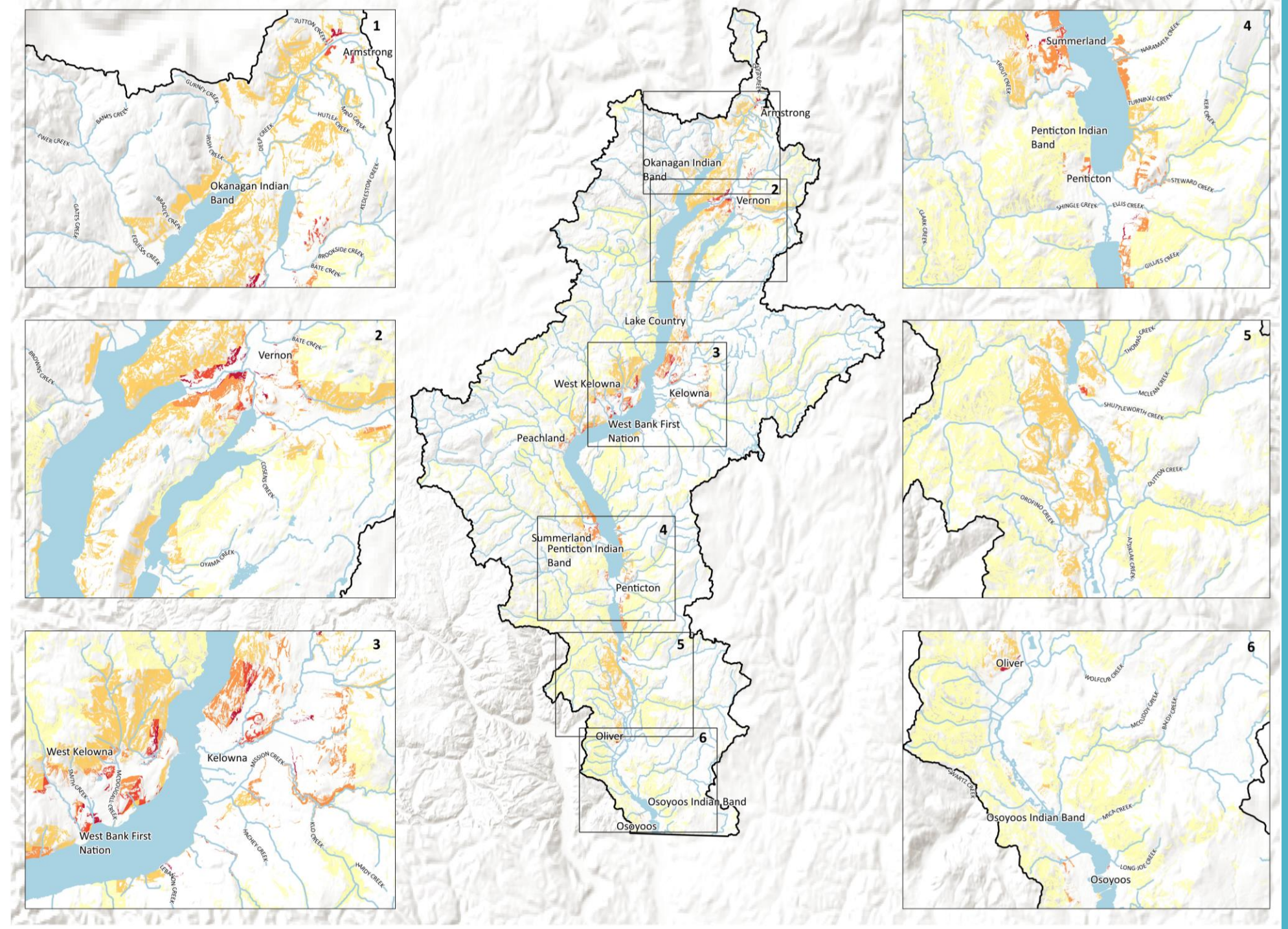
Preliminary Quantitative Finding:

- Potential for source / receptor contact



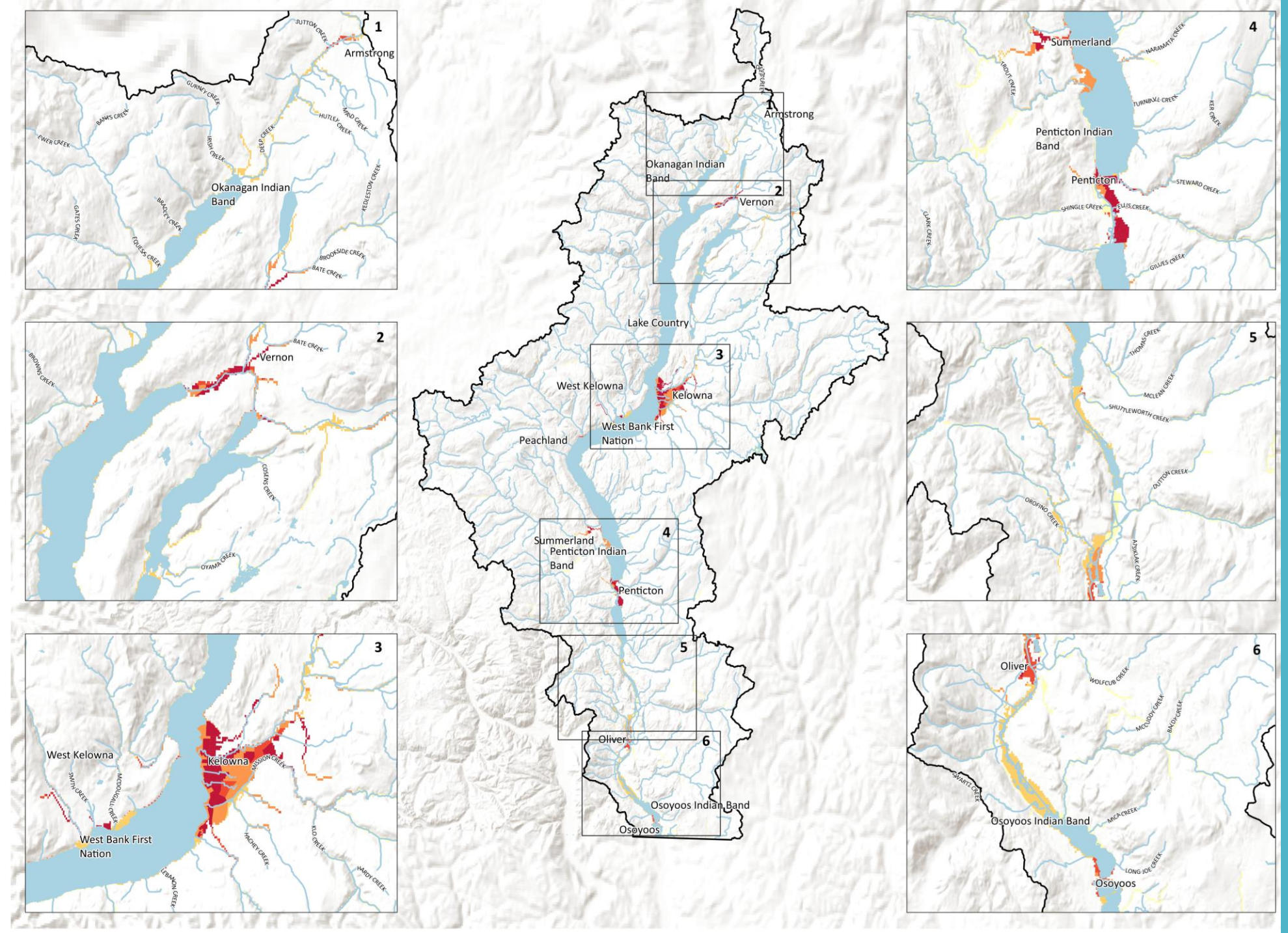
Preliminary Quantitative Finding:

- More intense hazard areas



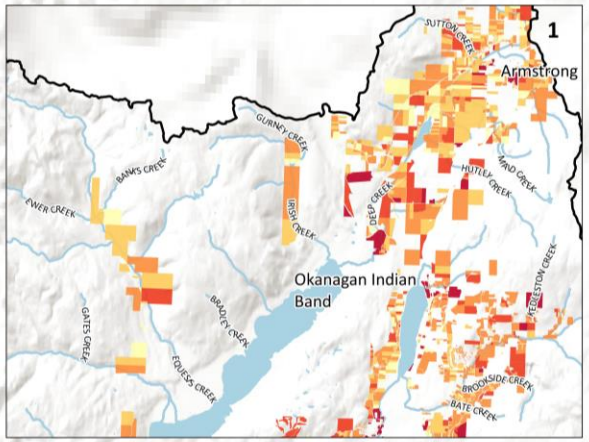
Preliminary Quantitative Results:

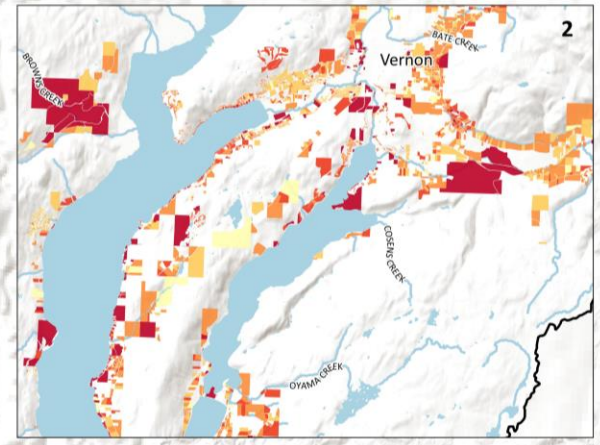
- More and different areas affected, but few with high likelihood

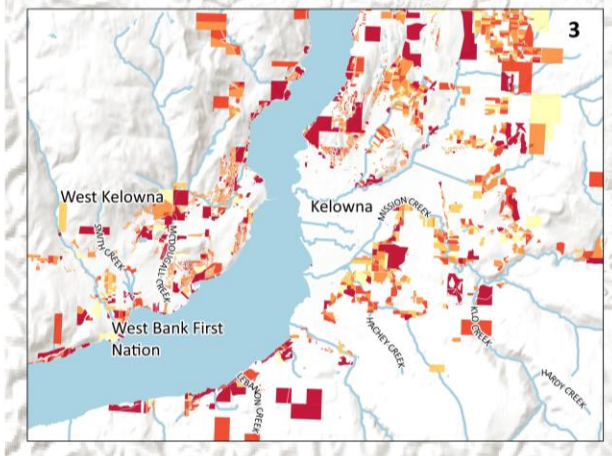


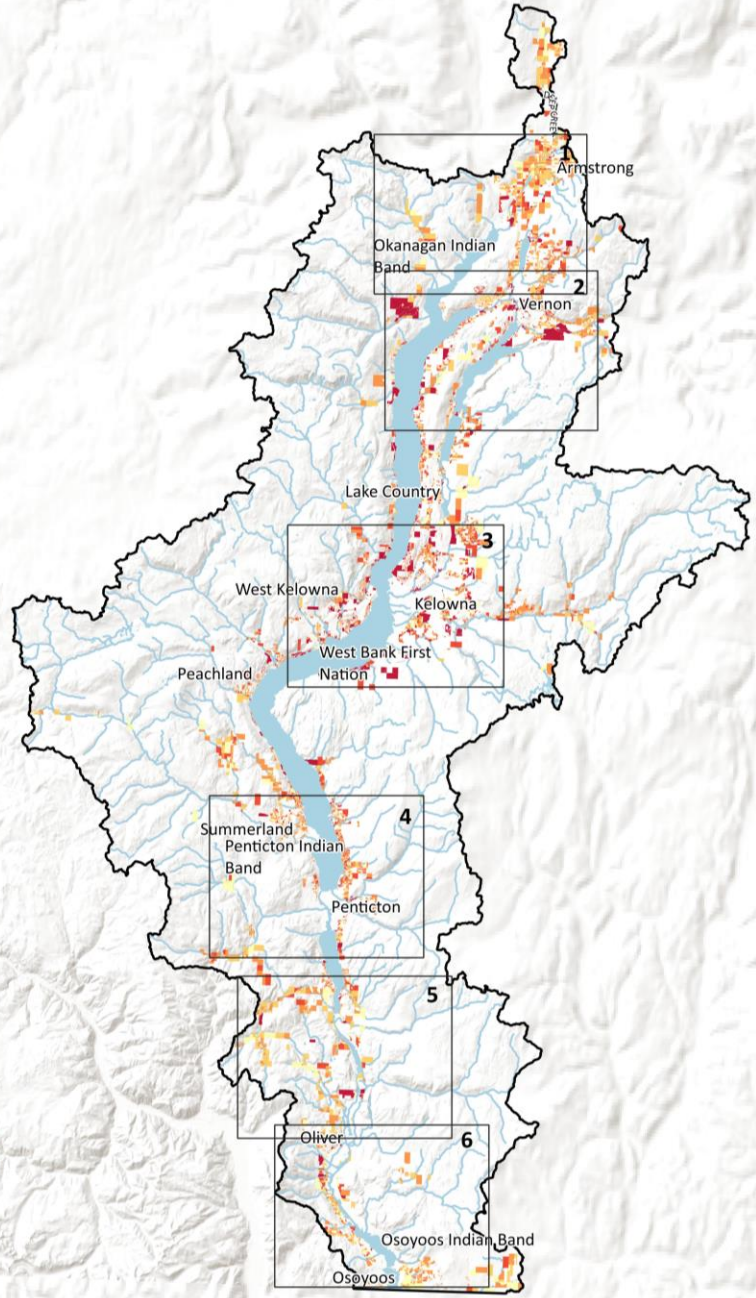
Preliminary Quantitative Results:

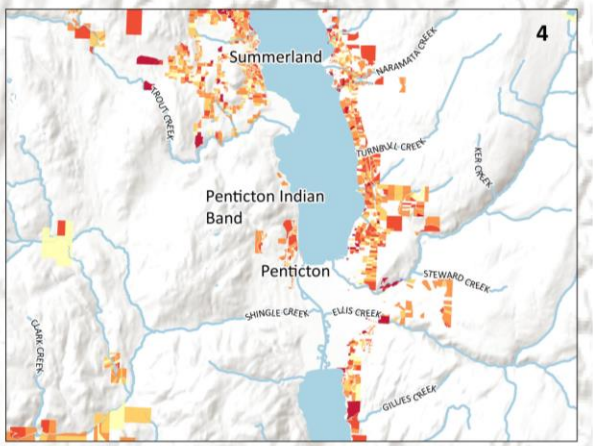
- Significant population centres in high hazard areas

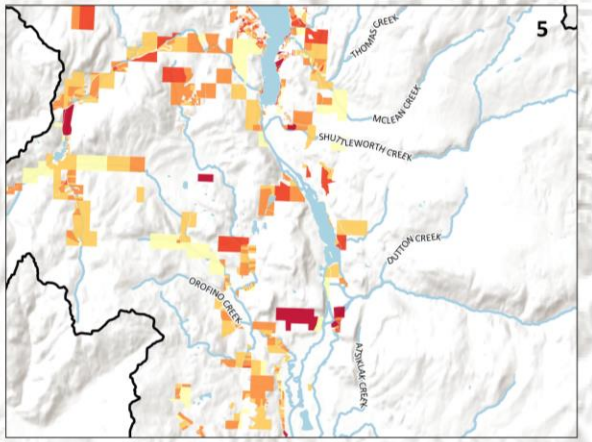


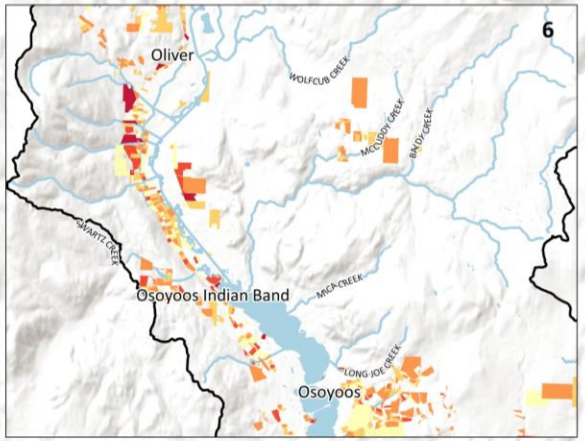






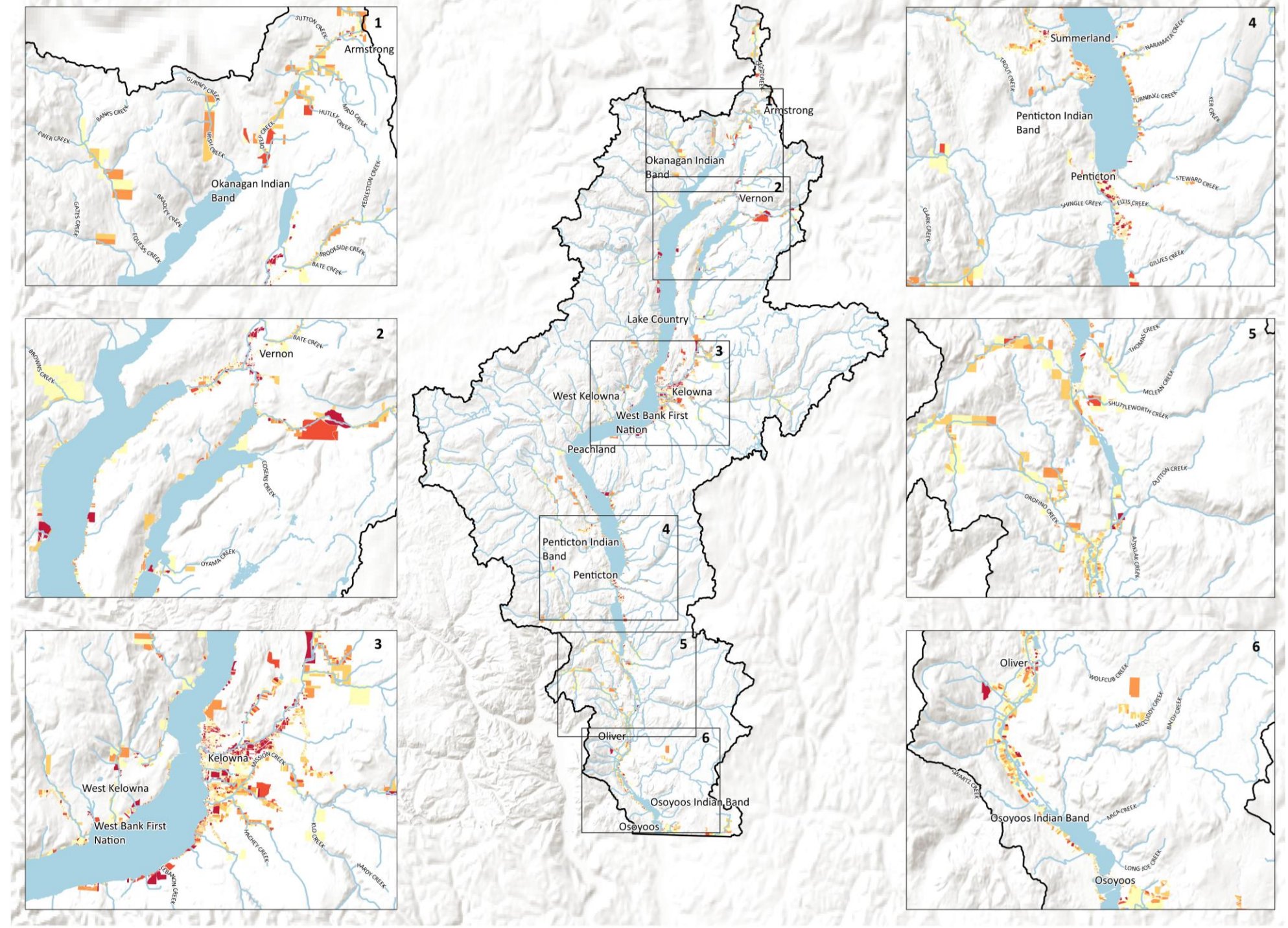






Preliminary Quantitative Results:

- Numerous areas affected
- $19.5bn

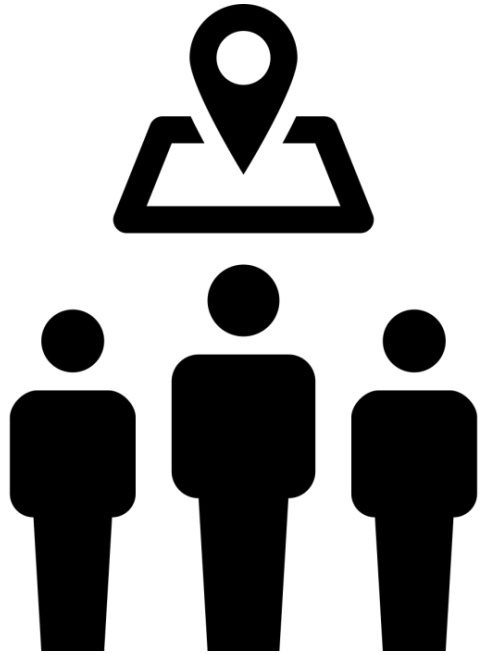


Preliminary Quantitative Results:

- Areas affected are less widespread
- $13.1 bn

Exercise (15 min): Preliminary Risk Map Review

- Which regions do we want to show close-up, if any others?
- Are there any gaps? What is missing?
- Are there any errors that you notice, from your direct experience/knowledge of the area?
- Are we representing the right information? (would other data sets be more relevant?)



Syilx Okanagan Flood and Debris Flow Risk Assessment

Report 3 of 4 – Qualitative Study

Appendix H: Workshop 2 Feedback

Report for Syilx (Okanagan) Flood & Debris Flow Workshop #2 Feedback

Response Counts

Completion Rate:	100%	
	Complete	13

Totals: 13

1. On a scale of 1-5 (1= Not at all; 5 = Very much), please rate the following statements:

	Not at all	-	Somewhat	-	Very much	Responses
I improved my understanding of flood and debris flow risk in the Okanagan and Similkameen watersheds (Syilx traditional territory) Count Row %	1 7.7%	1 7.7%	3 23.1%	6 46.2%	2 15.4%	13
I learned about the Syilx perspective on flood and debris flow phenomena Count Row %	0 0.0%	1 7.7%	2 15.4%	6 46.2%	4 30.8%	13
I strengthened relationships with other stakeholders in the region Count Row %	0 0.0%	0 0.0%	2 15.4%	6 46.2%	5 38.5%	13
I improved my understanding of how to work together to adapt to flood and debris flow phenomena in this region Count Row %	0 0.0%	1 7.7%	5 38.5%	4 30.8%	3 23.1%	13
Totals Total Responses						13

2. What was one key insight or take-away for you, from this session?

ResponseID	Response
2	Ask First Nations communities to provide information on impacts to their members, culture and heritage. Acknowledge and respect the thousands of years of experience First Nations peoples are able to contribute.
3	A key insight was the understanding that the entire Syilx watershed is connected (through rivers and now through dams, and spillway etc), and that changes made to a singular drainage can affect the entire watershed below. Having all the stakeholders be a part of decision making processes is vital to the health of our region.
5	There is definitely a human impact to a lot of flooding problems.
6	There is opportunity to combine our efforts and work together. There needs to be a bit of flexibility to meet each other's goals. I see it as possible.
7	The value of listening.
8	I think the focus on letting areas flood and the importance of flooding rather than the focus on limiting and control of floodwater
9	The value of in person meetings
10	I learned about the Syilx perspective on flood and debris flow phenomena.
12	That we as a people living in the Okanagan and the Similkameen are connected by water
13	Further collaboration is needed and we are on our way.
14	Key people are relatively uninformed about threats to the water and people.

3. What is an example of how this session may impact your work or practice in the near future?

ResponseID	Response
2	Invite First Nations representatives to our local government table.
3	Studies are inherently data-centric in nature and are typically not based enough on historical information. This session struck home to me that modeling natural environments is very complex and land based knowledge (such as that provided by elders) is not being considered thoroughly enough.
5	To be aware of building in potential flood areas and changes on land can affect or contribute flooding.
6	If we can come out of this process with a mechanism for moving forward, and not always repeating it, then I believe this will have a huge impact as we move forward. There is opportunity to incorporate some of the Syilx traditions into our processes.
7	At each of the workshops and site visits I gained a better understanding of community member's perspective of how floods impact their lives.
9	How to develop working tools to encourage open communication between in office teams
10	Honestly not sure how to bring this into my current job.
12	Look more into traditional mitigation
13	Relationship building and moving forward on other regional projects