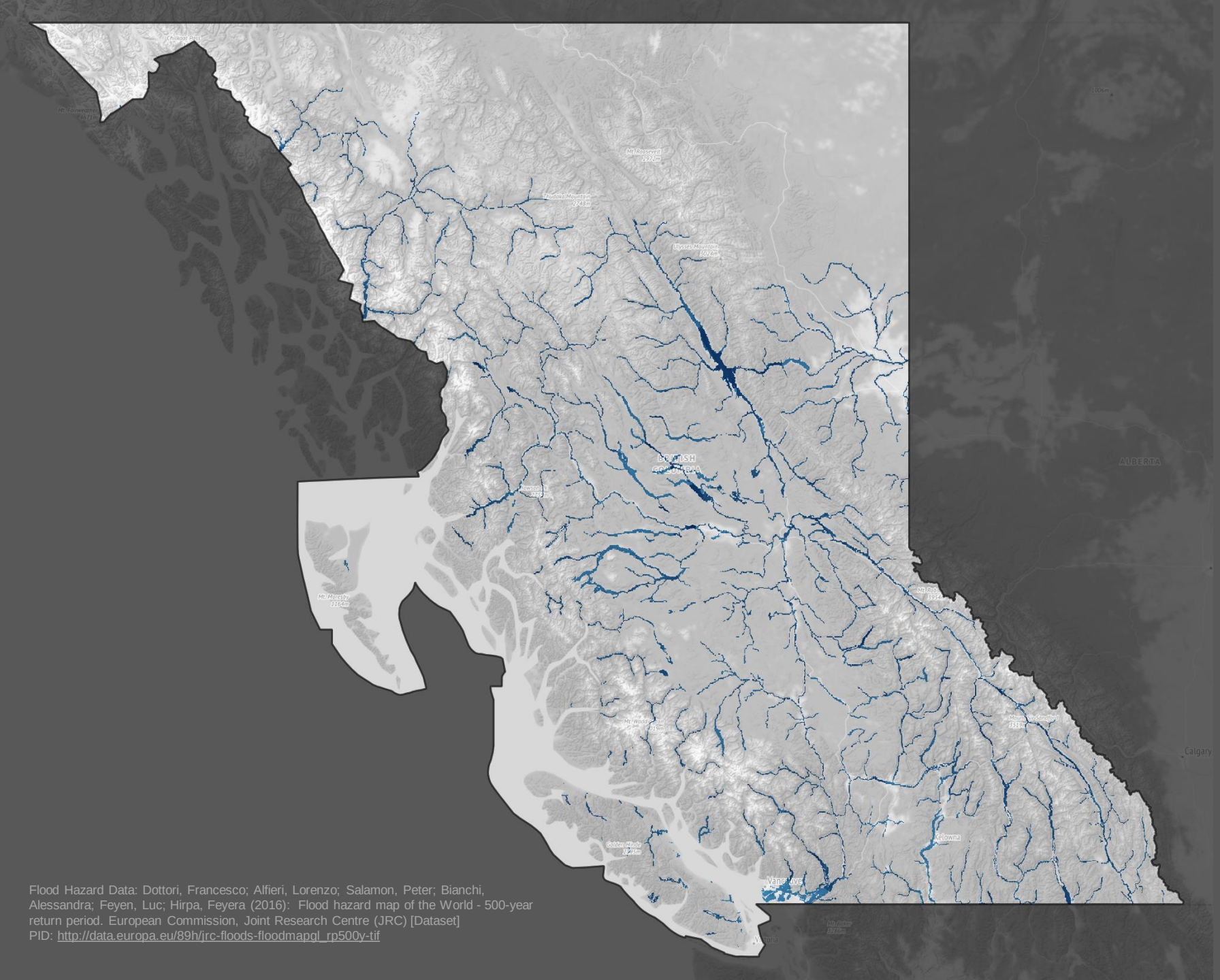

An evolution in flood management

Flood Hazard Data: Dottori, Francesco; Alfieri, Lorenzo; Salamon, Peter; Bianchi, Alessandra; Feyen, Luc; Hirpa, Feyera (2016): Flood hazard map of the World - 500-year return period. European Commission, Joint Research Centre (JRC) [Dataset] PID: http://data.europa.eu/89h/jrc-floods-floodmapgl_rp500y-tif

ebbwater

Concept from Sayers et al. 2014

A willingness to live with floods

- Individual and small communities adapt to nature's rhythm.

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Concept from Sayers et al. 2014

A desire to use the floodplain

- Fertile land in the floodplain is drained.
- Permanent communities are established.
- Local uncoordinated dikes are constructed.

ebbwater CONSULTING

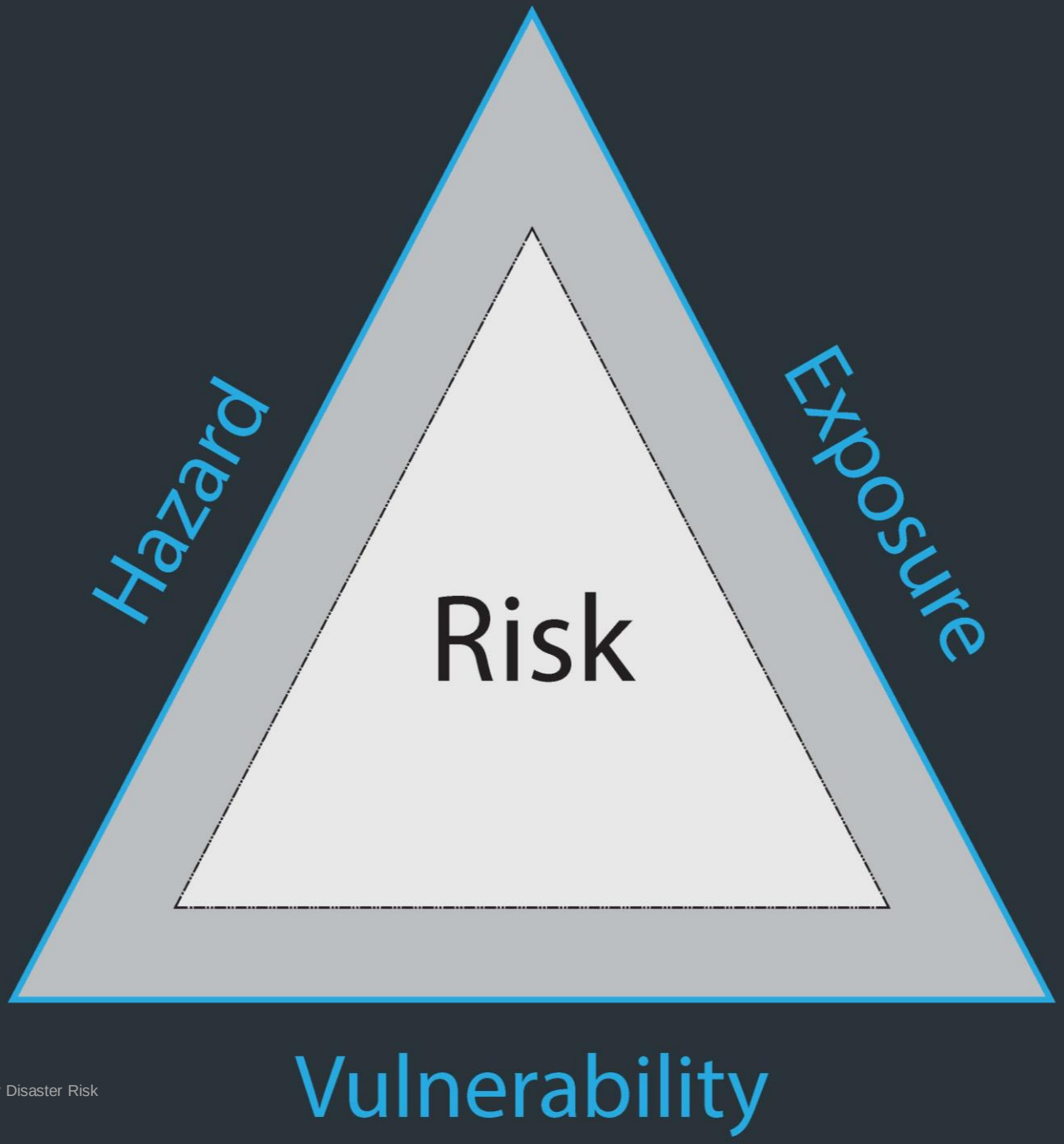
Concept from Sayers et al. 2014

A desire to control and defend

- Large-scale structural approaches (dikes, dams and other controls) are planned and implemented.

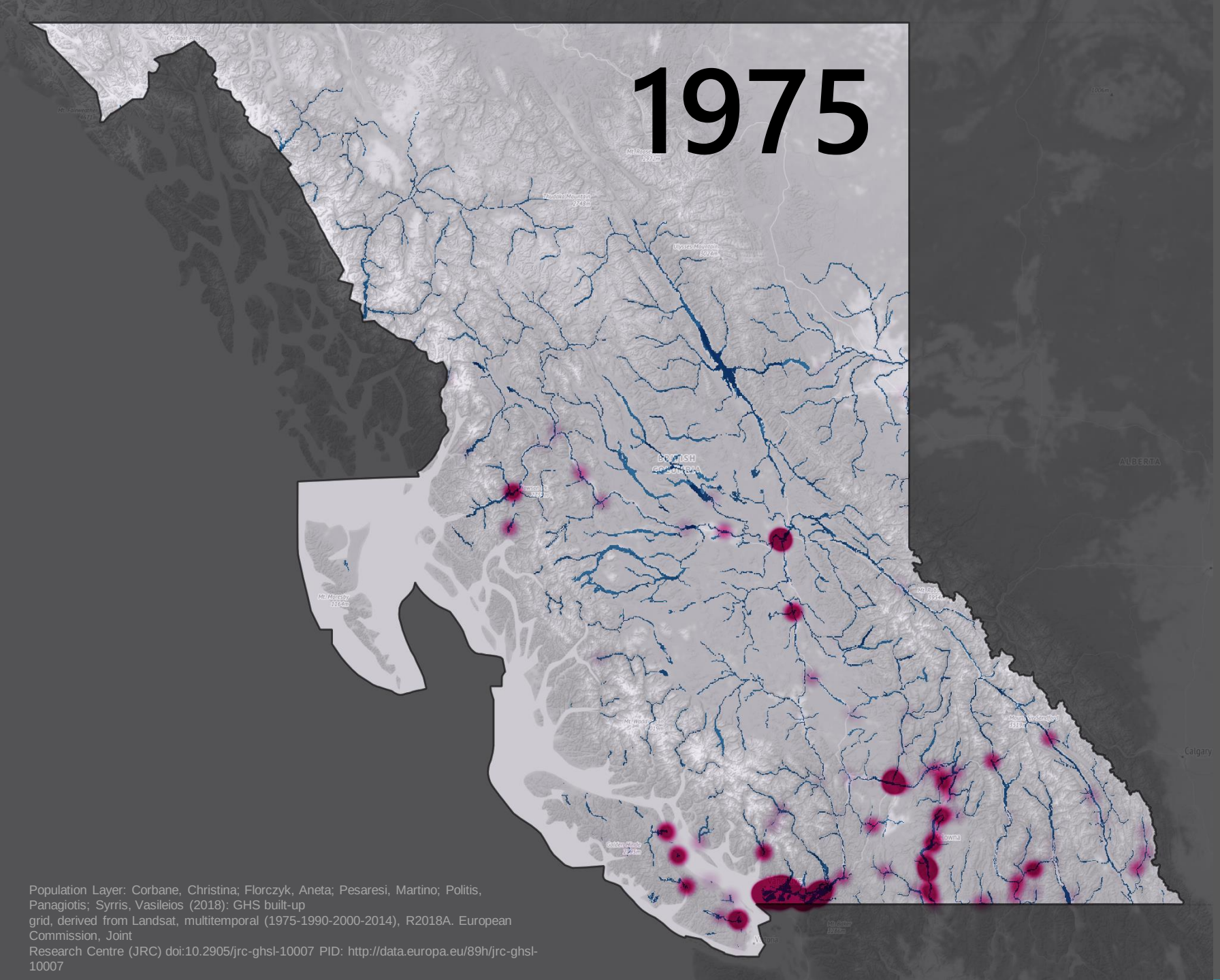
ebbwater CONSULTING

An evolution in flood risk



Concept: Global Facility for Disaster Risk Reduction 2016

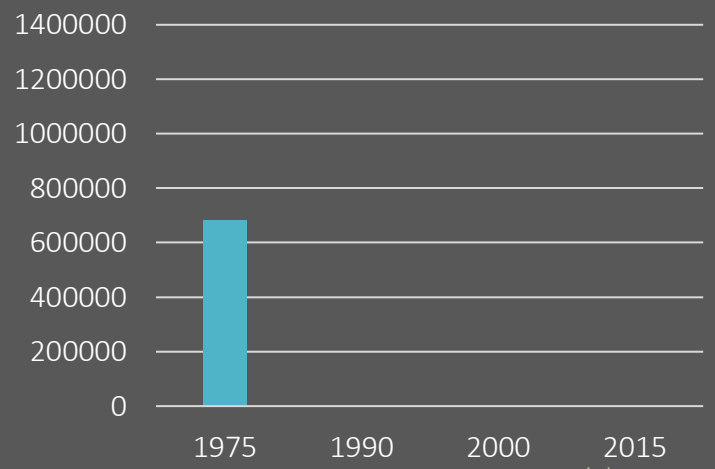
ebbwater



0.2 % AEP Flood

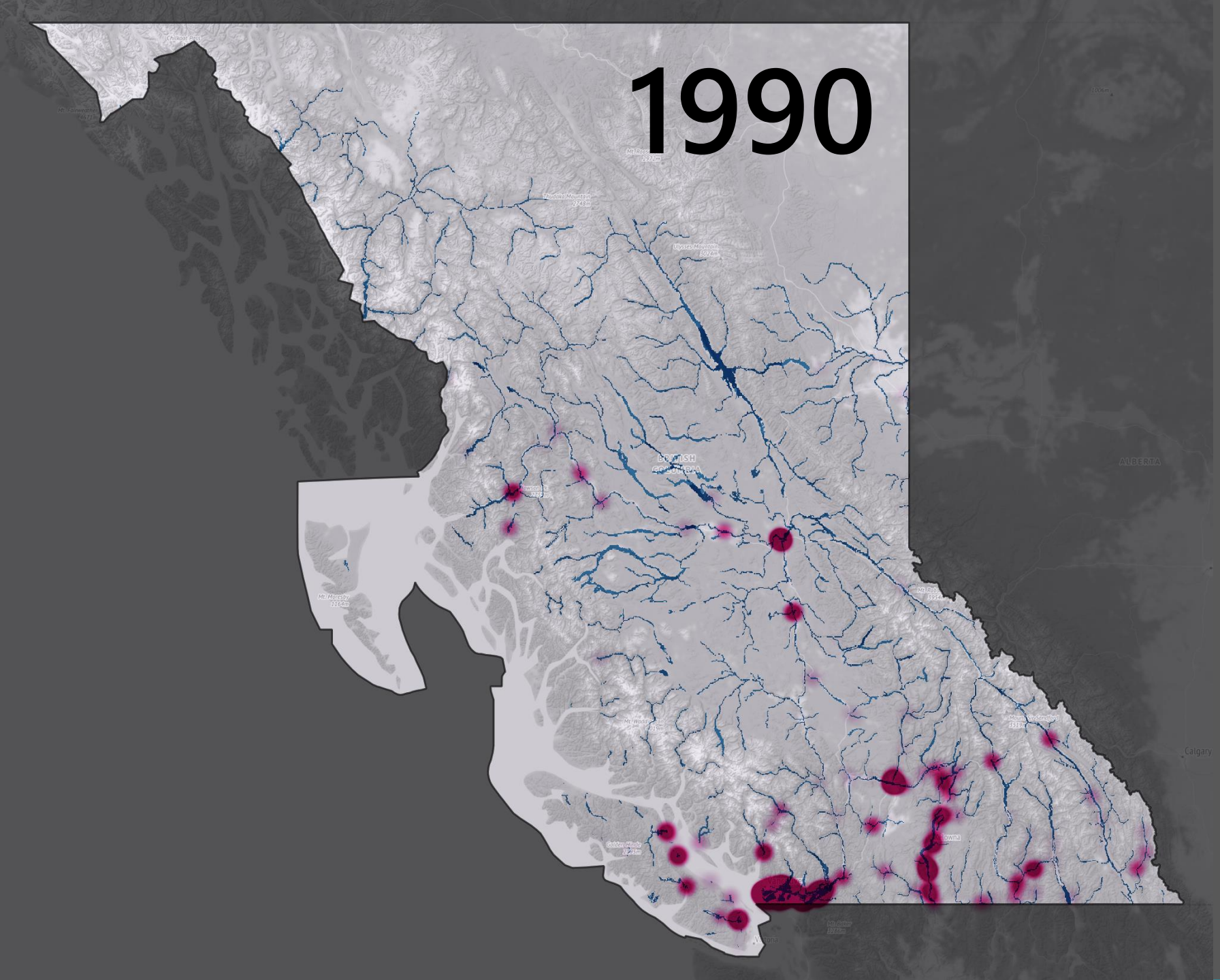
Exposed Population

683,000



ebbwater

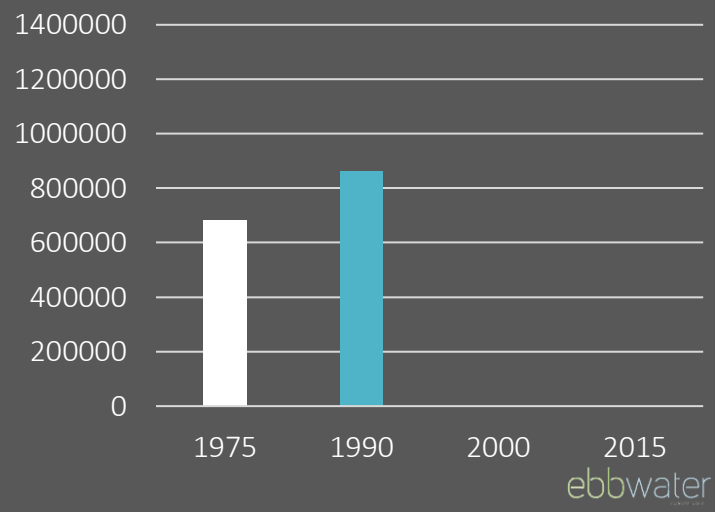
Population Layer: Corbane, Christina; Florczyk, Aneta; Pesaresi, Martino; Politis, Panagiotis; Syrris, Vasileios (2018): GHS built-up grid, derived from Landsat, multitemporal (1975-1990-2000-2014), R2018A. European Commission, Joint Research Centre (JRC) doi:10.2905/jrc-ghsl-10007 PID: http://data.europa.eu/89h/jrc-ghsl-10007



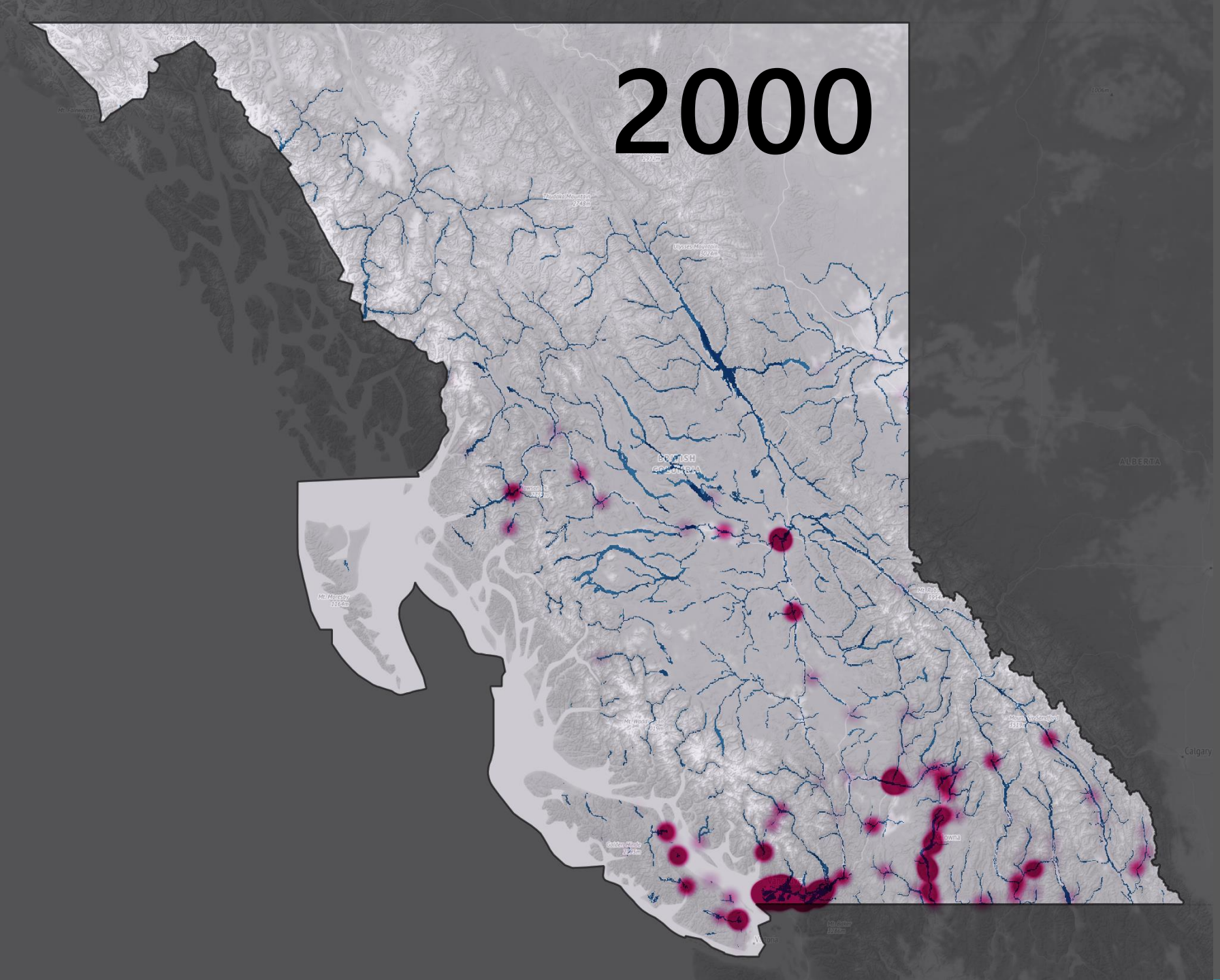
0.2 % AEP Flood

Exposed Population

864,000



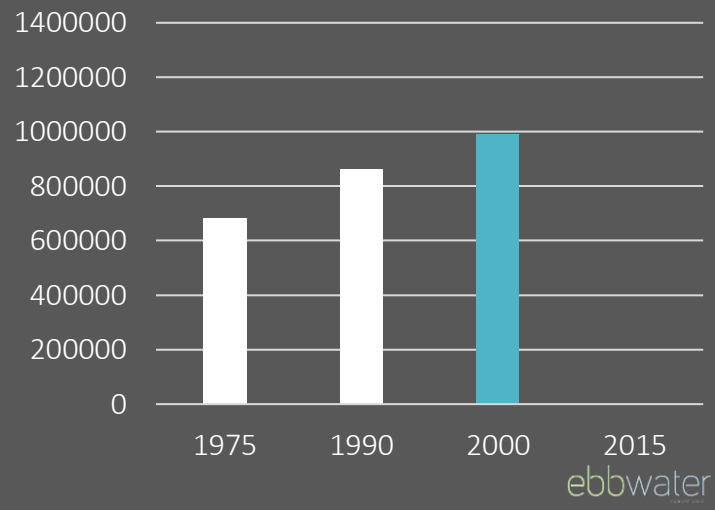
ebbwater



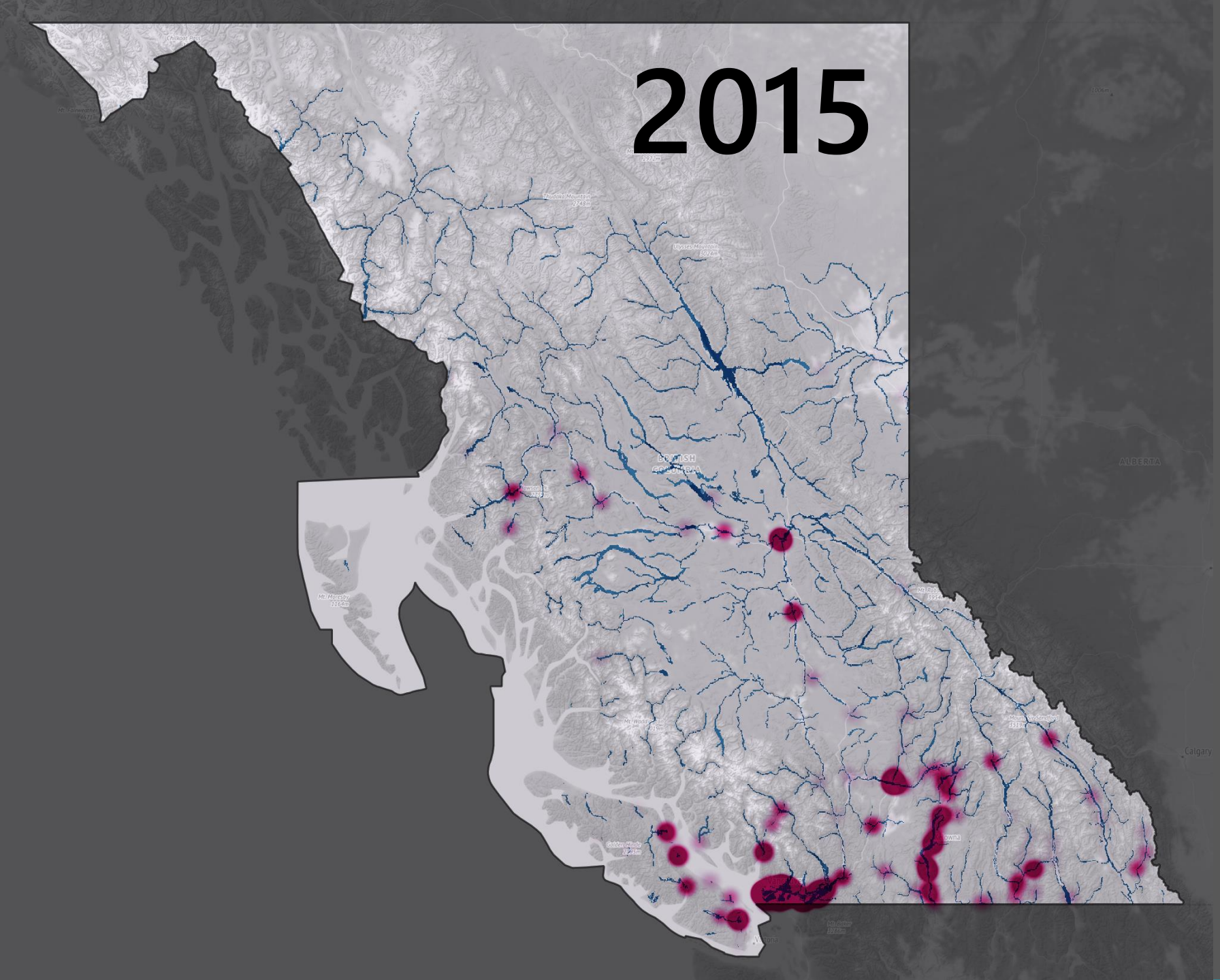
0.2 % AEP Flood

Exposed Population

991,000



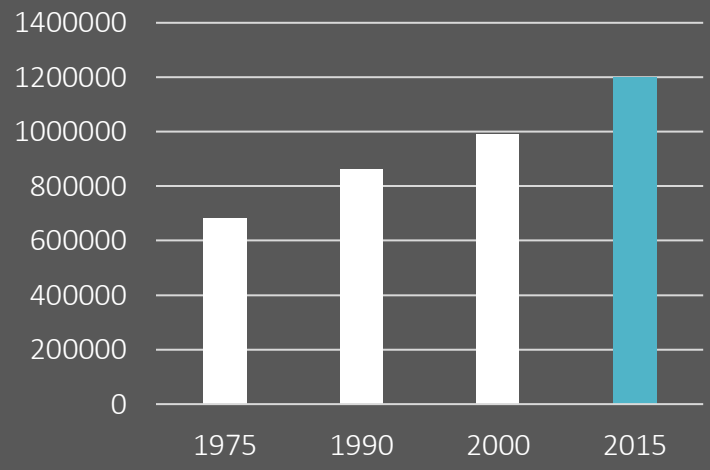
ebbwater



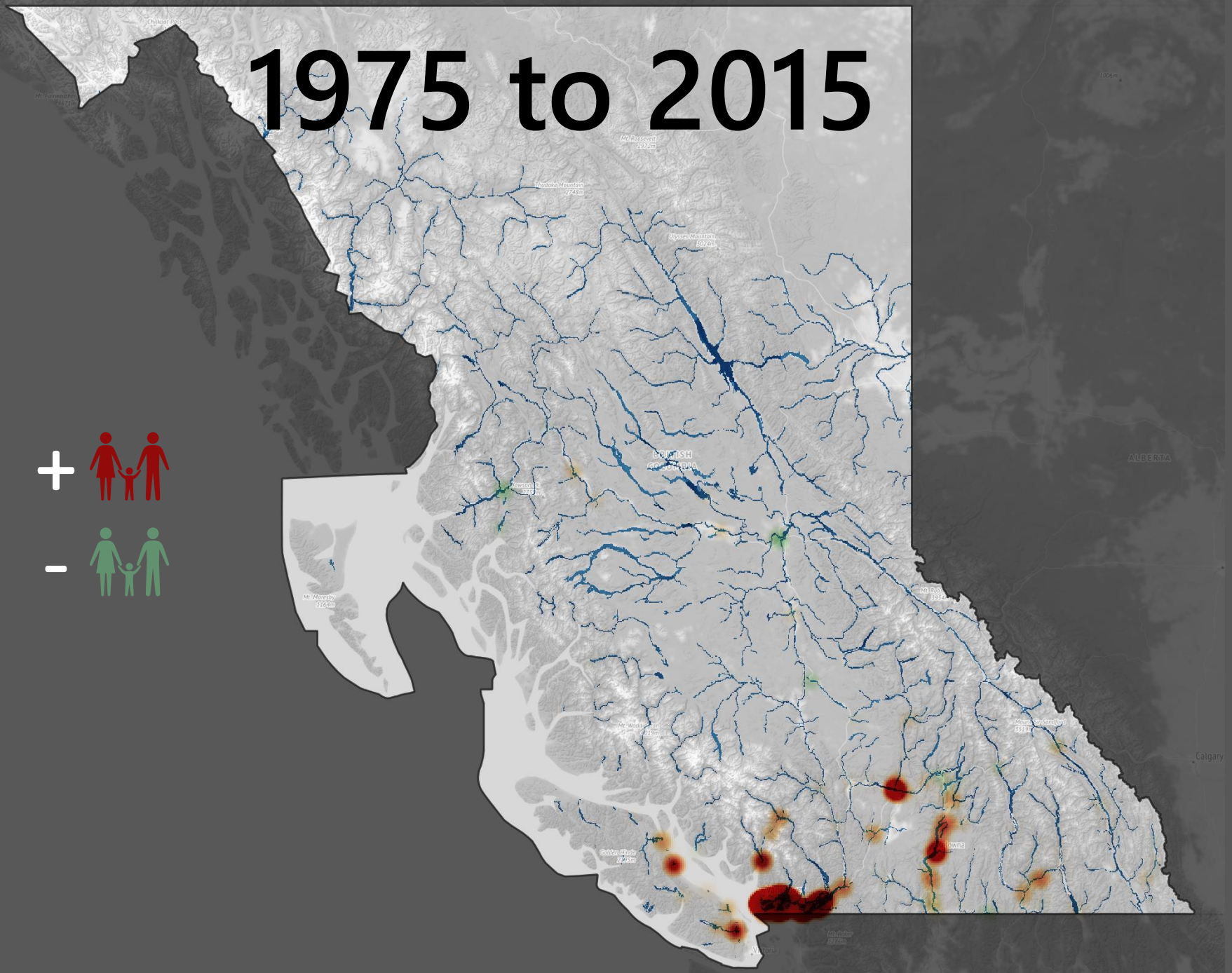
0.2 % AEP Flood

Exposed Population

1,200,000



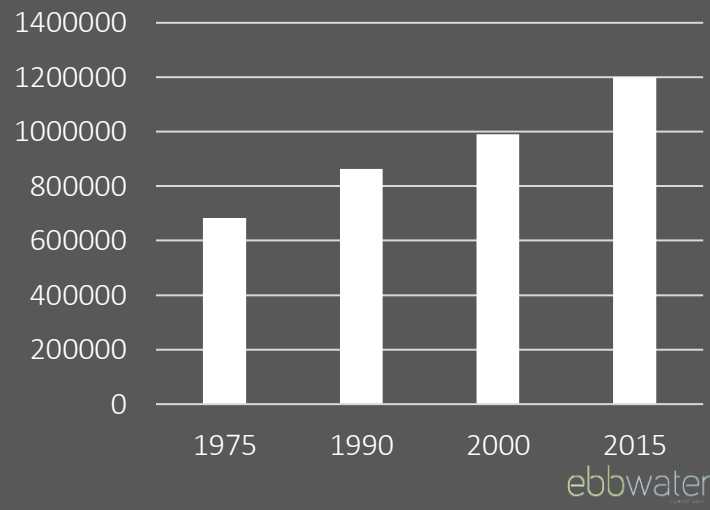
1975 to 2015



0.2 % AEP Flood

Exposed Population

+517,000



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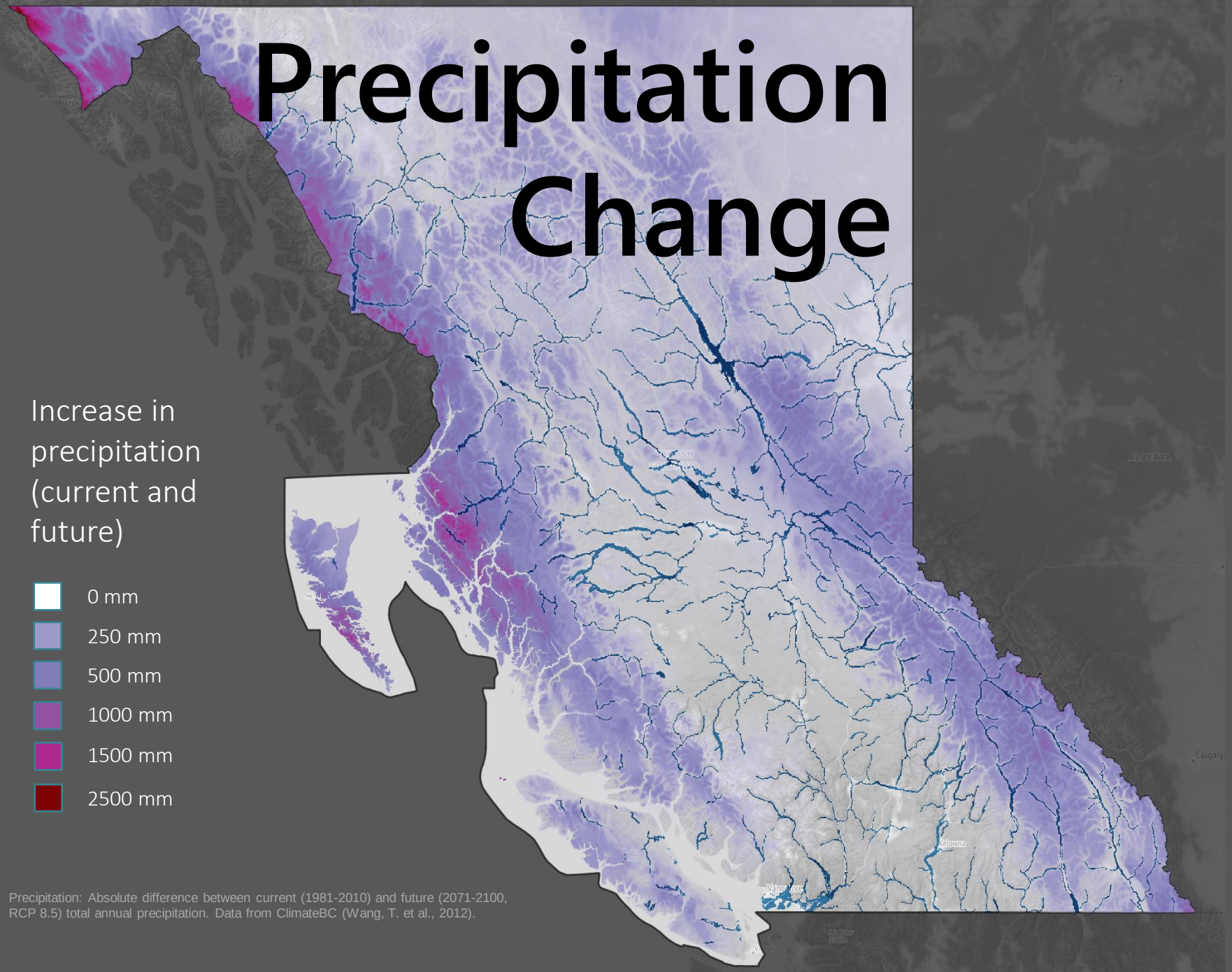
Precipitation Change



Precipitation: Absolute difference between current (1981-2010) and future (2071-2100, RCP 8.5) total annual precipitation. Data from ClimateBC (Wang, T. et al., 2012).

Climate Change

Flood Hazard will INCREASE overall

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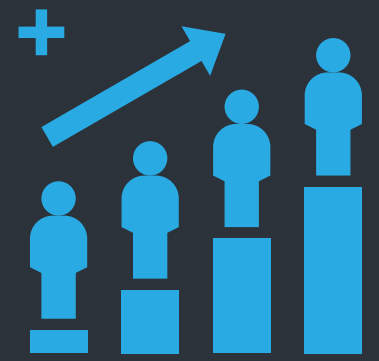
Climate Change

Future Hazard

Future Exposure

Risk



Development

Vulnerability

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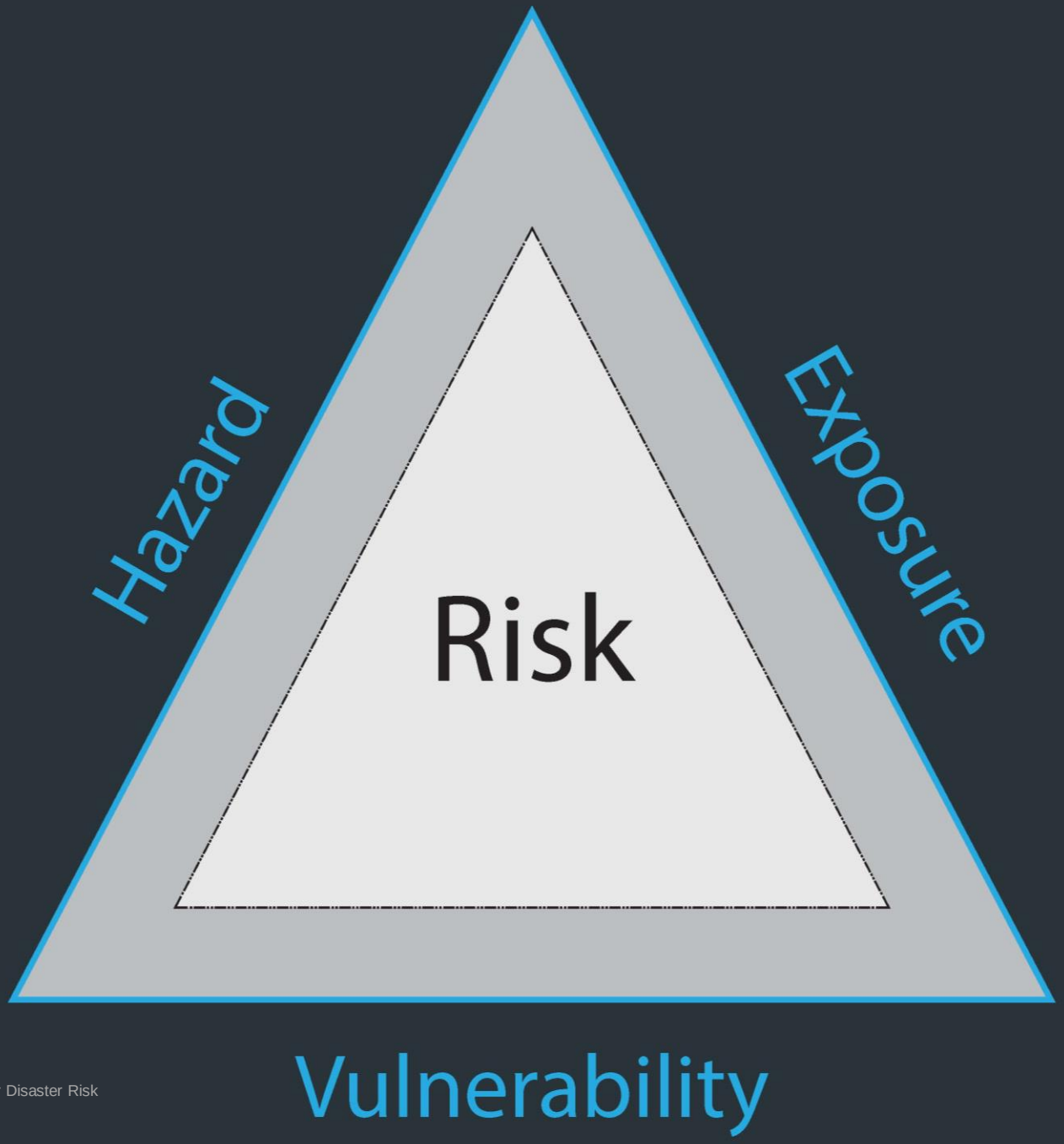

An evolution in flood risk science and practice

Concept: Global Facility for Disaster Risk Reduction 2016

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Detailed Building Damages

IBI SCP | Lower Mainland Flood Risk Assessment

Select Geography
- (•) Census Subdivision
- ( ) Census Tract
- ( ) Dissemination Area

Select Scenario
- (•) Freshet - 0.2% AEP (500-y...
- ( ) Freshet - 0.5% AEP (200-y...
- ( ) Freshet - Estimated Annu...
- ( ) Winter - 0.2% AEP (500-y...
- ( ) Winter - 0.5% AEP (200-y...
- ( ) Winter - Estimated Annua...
- ( ) Combined - 0.2% AEP (50...
- ( ) Combined - 0.5% AEP (20...
- ( ) Combined - Estimated An...

Please Note

Map navigation options available on hover including pan

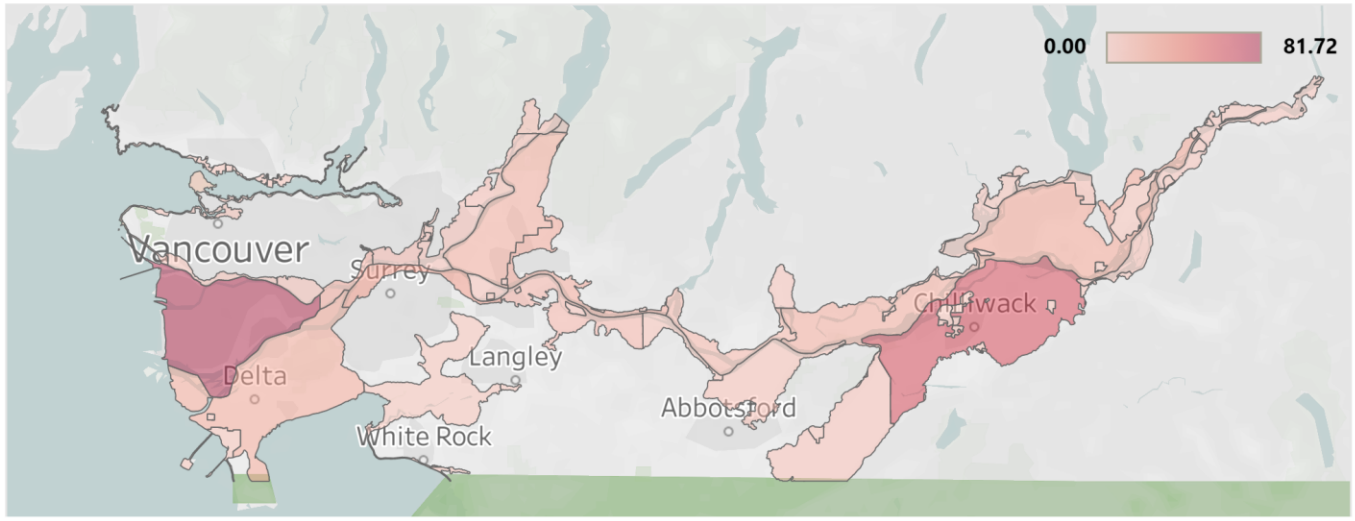
Click selected geography a second time to show all again

Default weighting is from advisory group workshop

Tangible Direct Damage 25%	Community Impacts 10%	Lifeline Disruptions 31%	Social Vulnerability 15%	Environment 19%

Weigting Categories — Select Value: 2 — Reset — Default

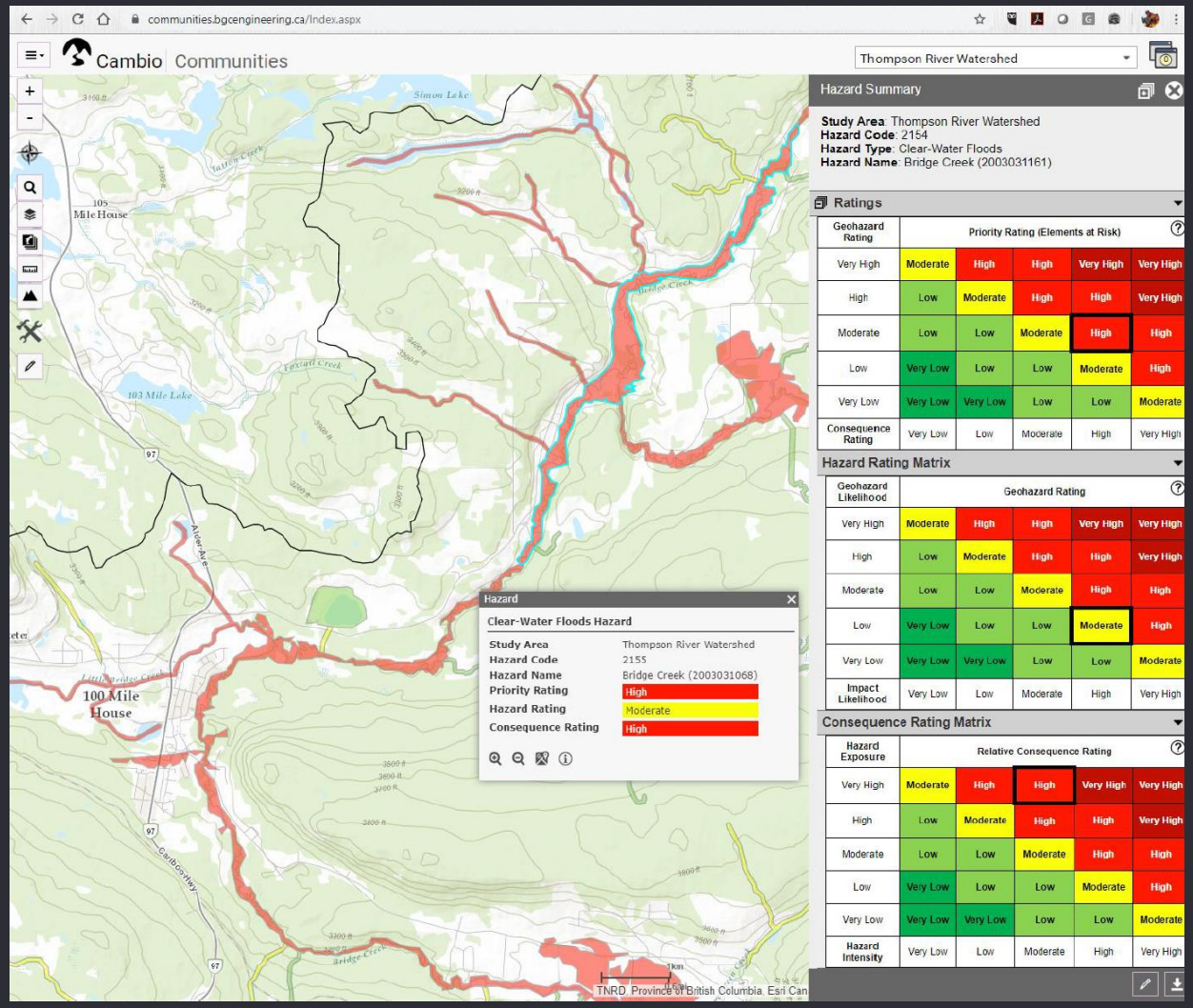
Agricultural	6	Archaeolog..	2	Electrical S..	6	Financial Ca	3	Sensitiv..	6
Non-Resi..	6	Heritage	2	Road Netwo	6	Social Servi..	3	Hazardou	7
Public	6	Communit..	3	Trips	6	Shelter	3	Sewage	6
Residenti..	7	Education and Culture	3	Emergency	7	Exposed Population	6		
				Health Servi	6				

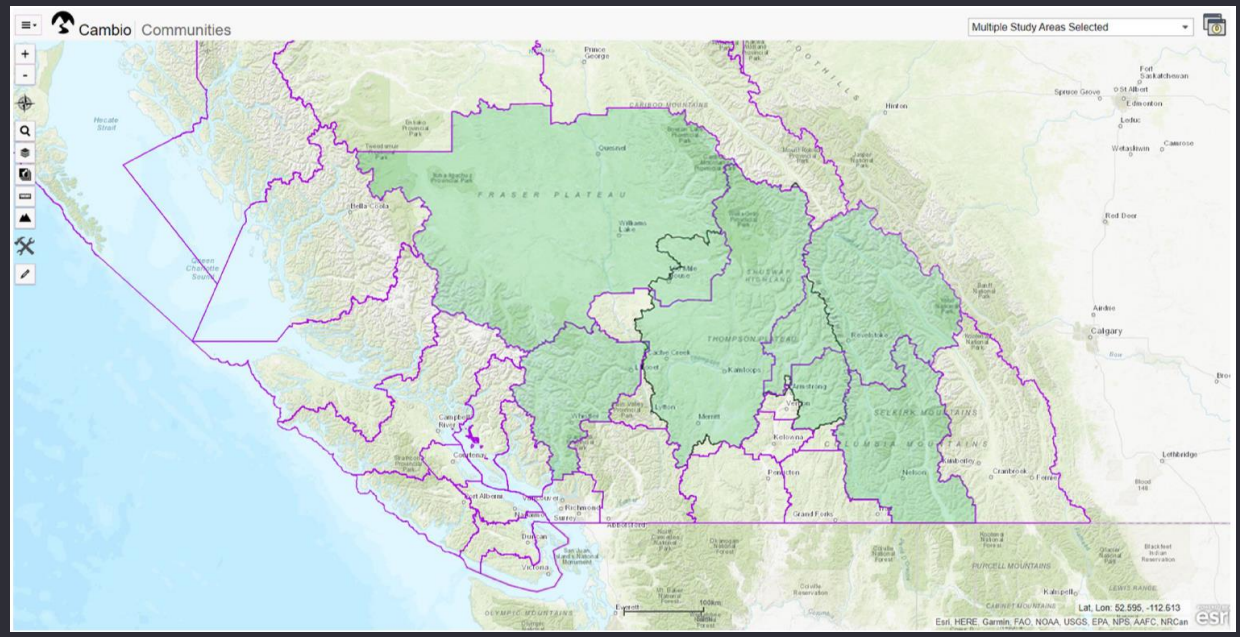


Ranking

Ra..	ID	Census Subdivi..	Weighted Total
1	CSD42	Richmond	81.72
2	CSD103	Chilliwack	63.60
3	CSD50	Surrey	21.14
4	CSD3	Kent	16.29
5	CSD62	Maple Ridge	14.47
6	CSD102	Delta	14.20
7	CSD94	Pitt Meadows	13.23
8	CSD134	Fraser Valley G	13.05
9	CSD9	New Westminst..	11.13
10	CSD58	Langley	7.82

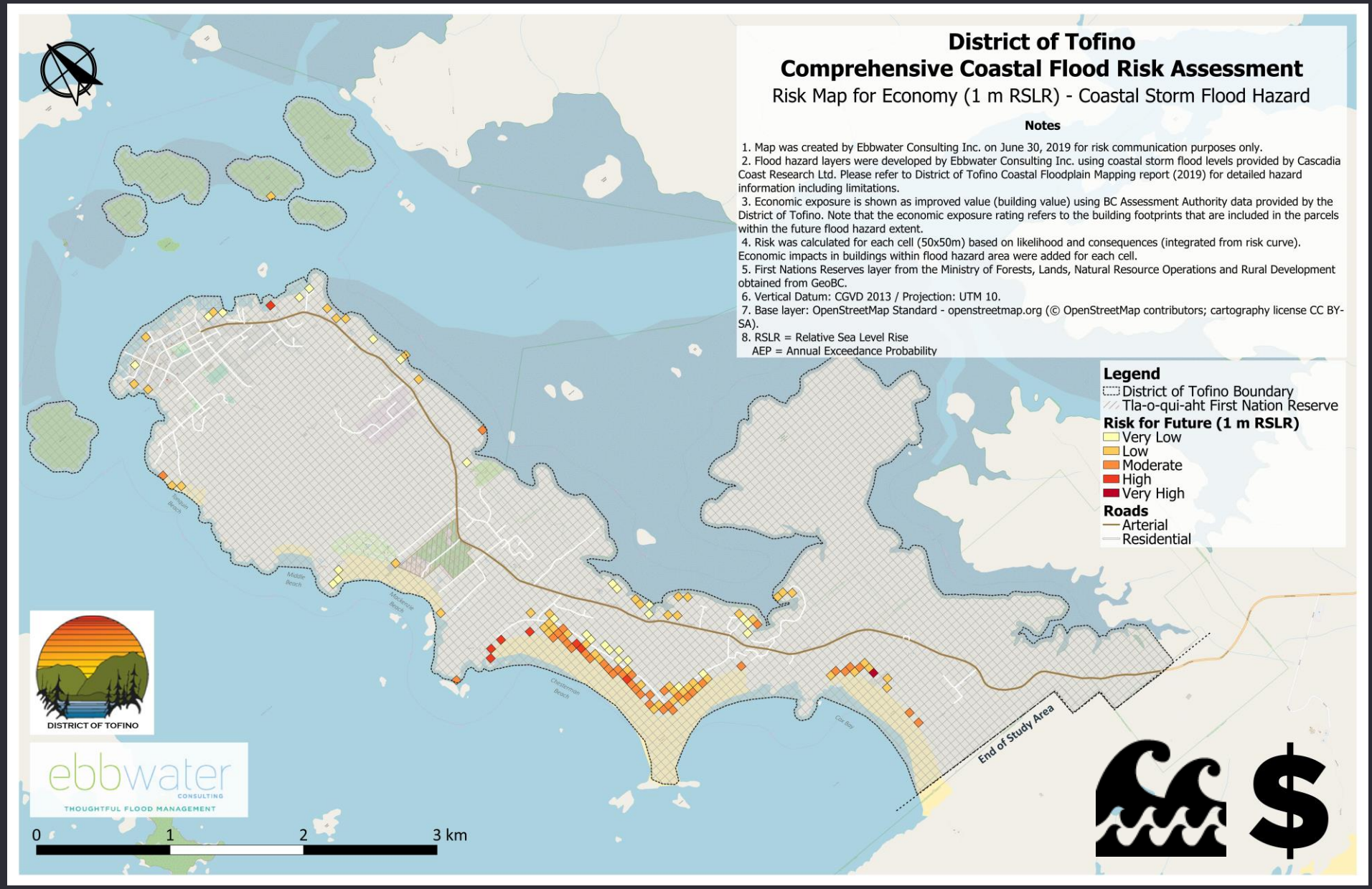
Efficient Large-Scale Risk

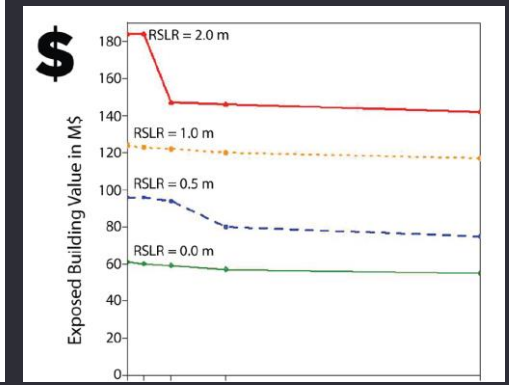




BGC

Detailed Fully Probabilistic Risk





Weaving of Quantitative and Qualitative Risk

Learning

Weaving

Synthesizing

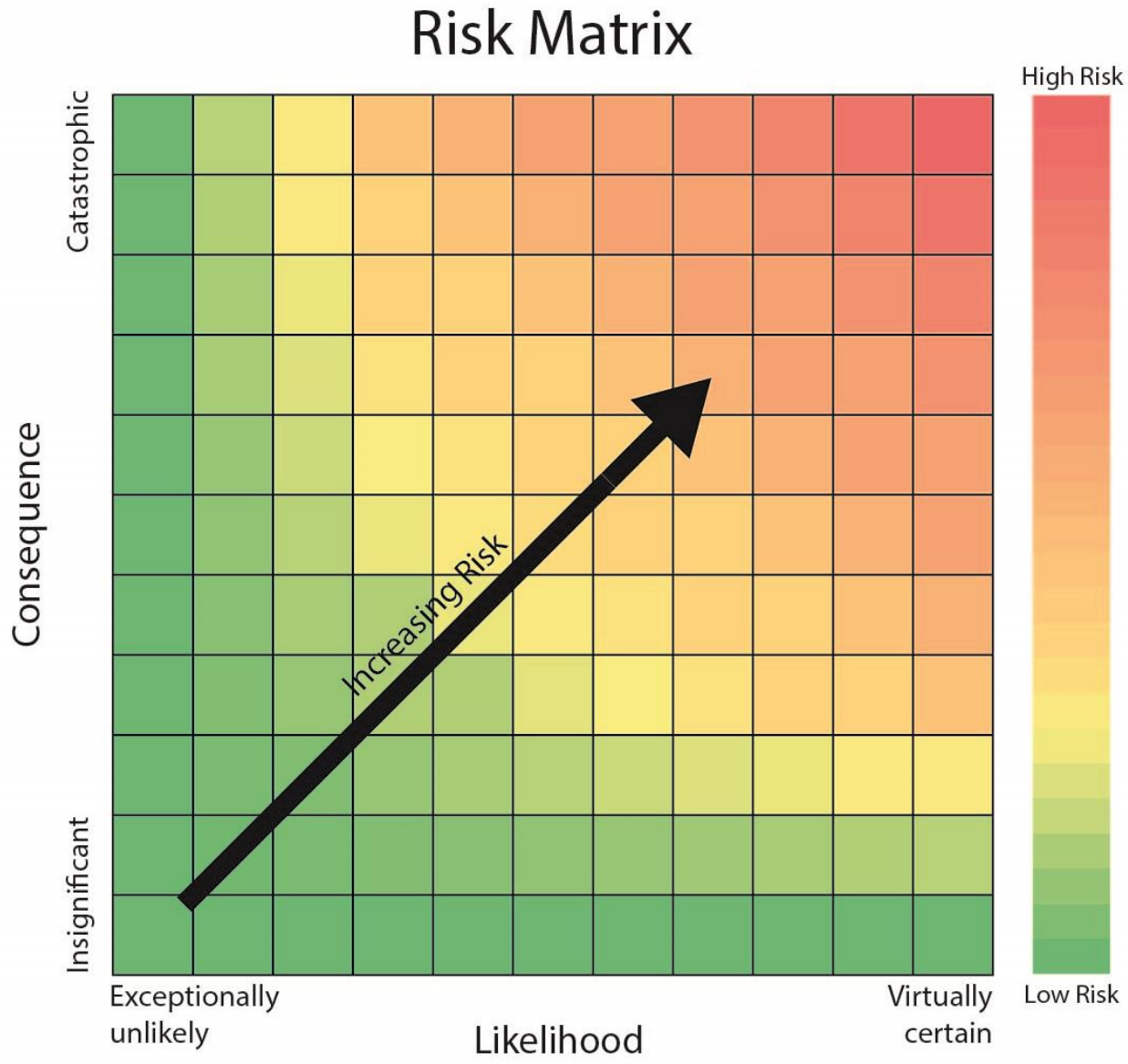
syilx Okanagan Nation Alliance

SHIFT shift to a better world

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

ENGAGE | INSPIRE | MOBILIZE IndigenEYEZ Empowering People—Strengthening CommUNITY

ebbwater CONSULTING



And yet…we are paralyzed on action

It’s too scary

It’s too uncertain

It’s too complex

It’s too much

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We can continue to evolve

A desire to reduce flood damages

- A recognition that engineering alone has limitations.
- Effort is devoted to increasing resilience of communities.

A desire to manage risks effectively

- 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 used to work with uncertainties in future climate change, demographics and funding.

Concept from Sayers et al. 2014

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THOUGHTFUL FLOOD MANAGEMENT

We can take baby steps…

Indicators (and measuring them) are a good start.

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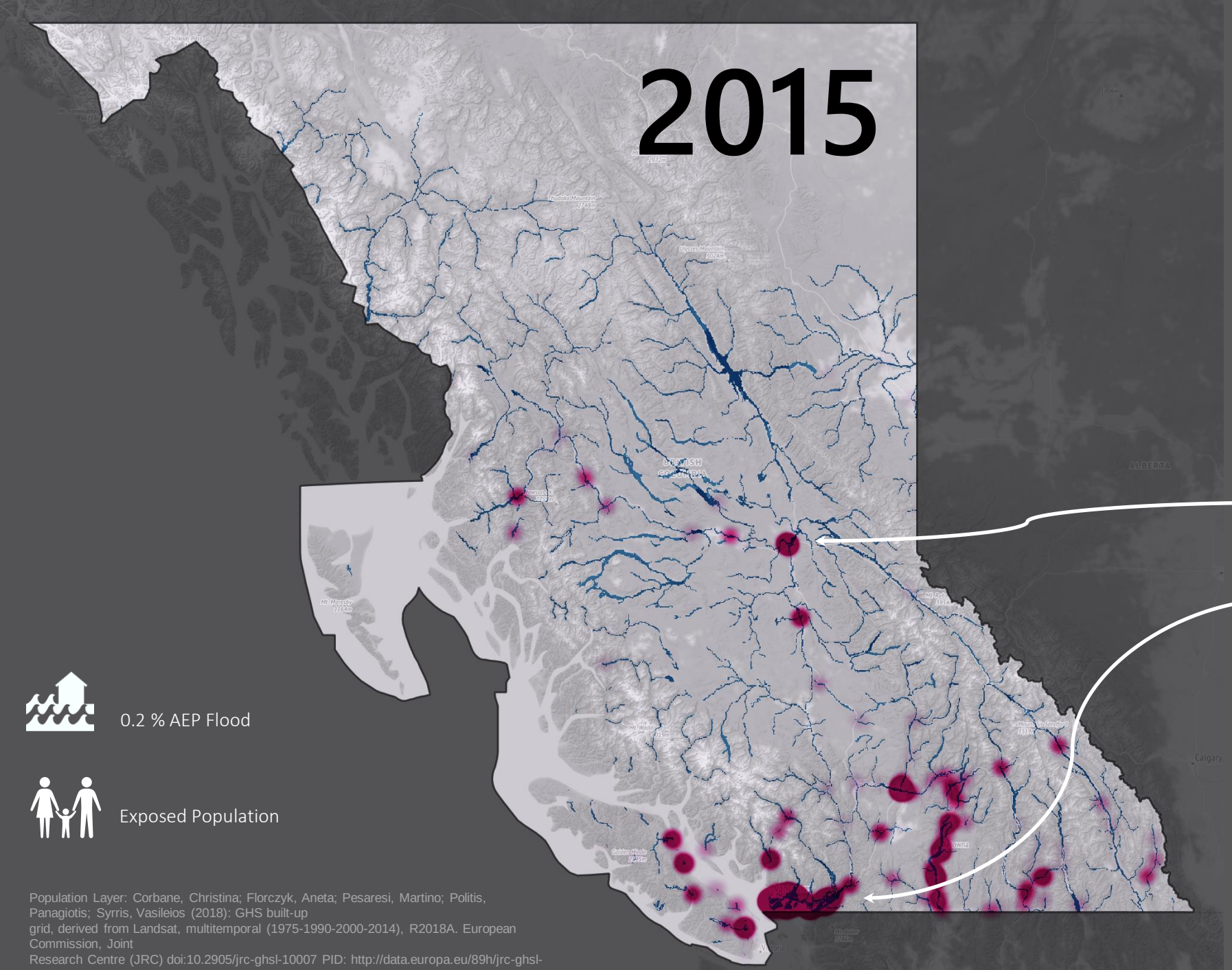

Prioritize Risk Reduction

By considering risk reduction potential AND Avoiding increased exposure

Population Layer: Corbane, Christina; Florczyk, Aneta; Pesaresi, Martino; Politis, Panagiotis; Syrris, Vasileios (2018): GHS built-up grid, derived from Landsat, multitemporal (1975-1990-2000-2014), R2018A. European Commission, Joint Research Centre (JRC) doi:10.2905/jrc-ghsl-10007 PID: http://data.europa.eu/89h/jrc-ghsl-10007

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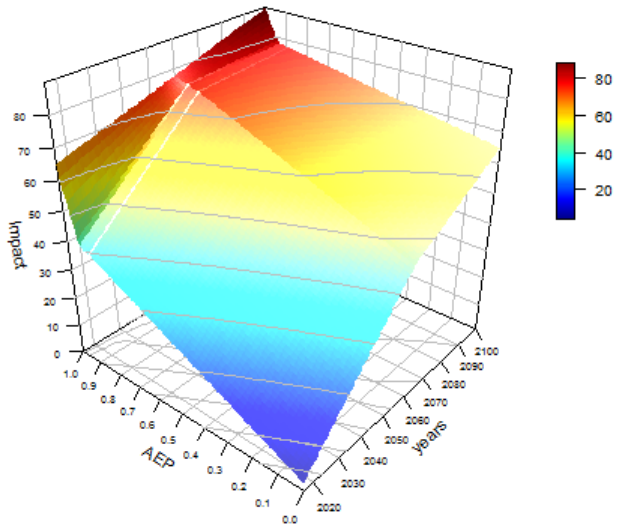
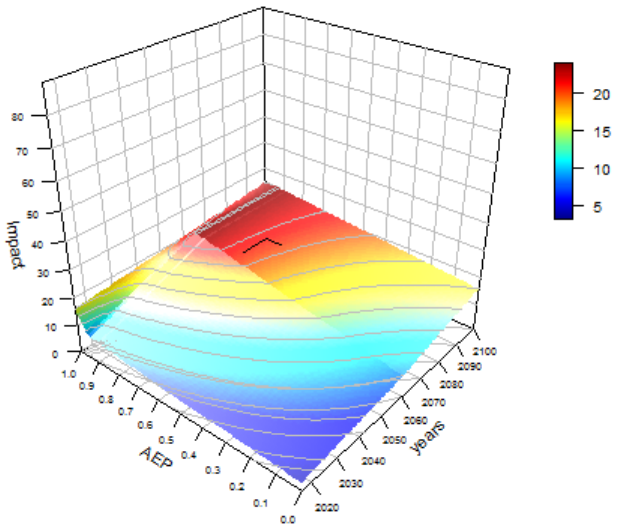
Evaluate Mitigation Measures with Risk

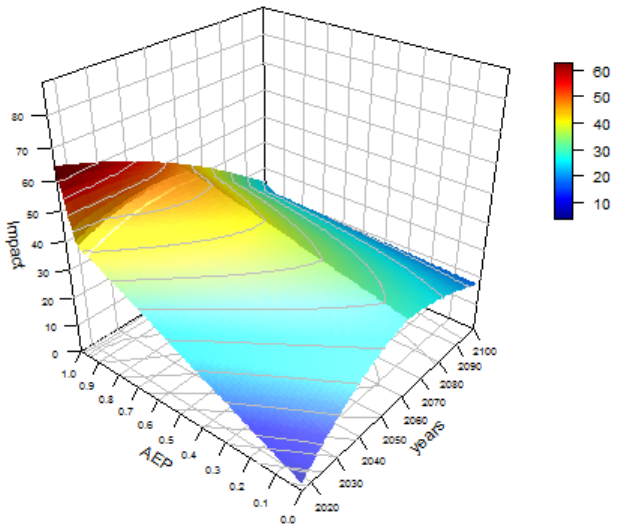
Baseline



Protect



Adapt



Project: City of Vancouver Coastal Flood Risk Assessment (Phase 2).
Research: Lyle et al. 2016. Society of Risk Analysis Symposium, San Diego

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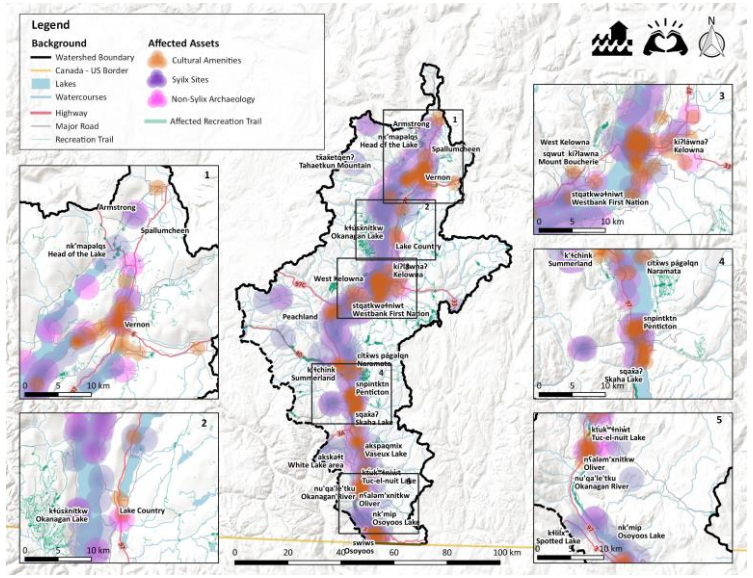
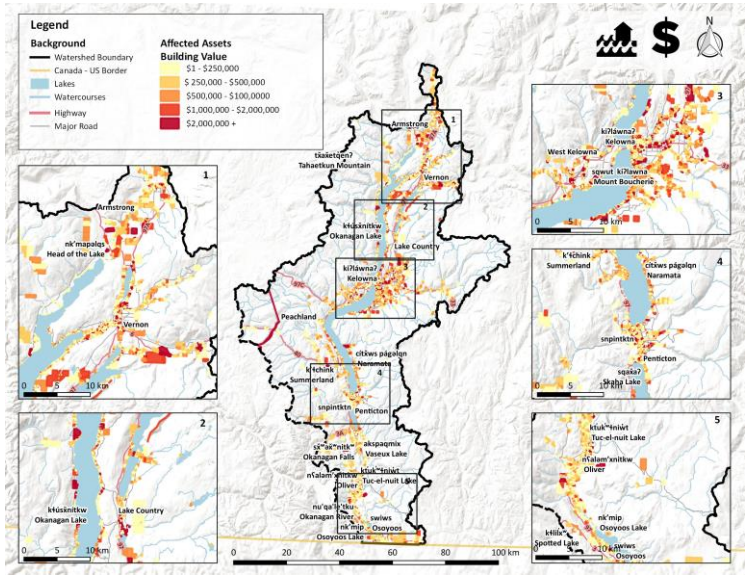
Evaluate Mitigation Measures with Risk

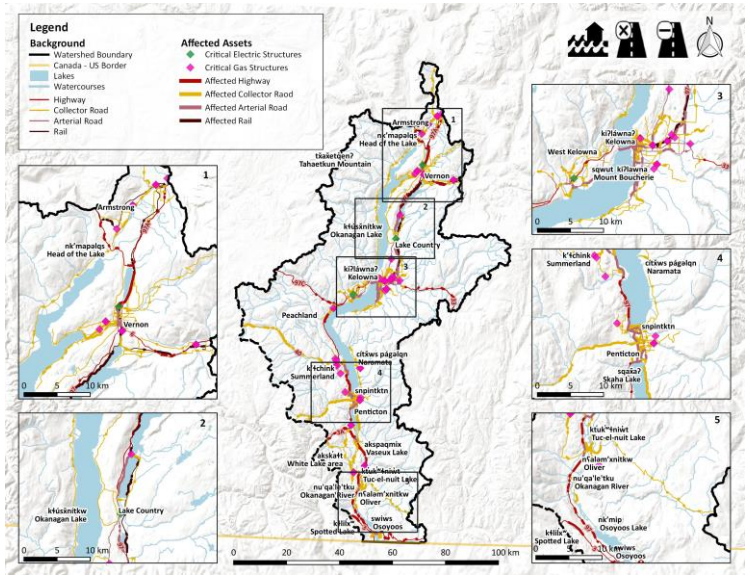
Qual. Quant.

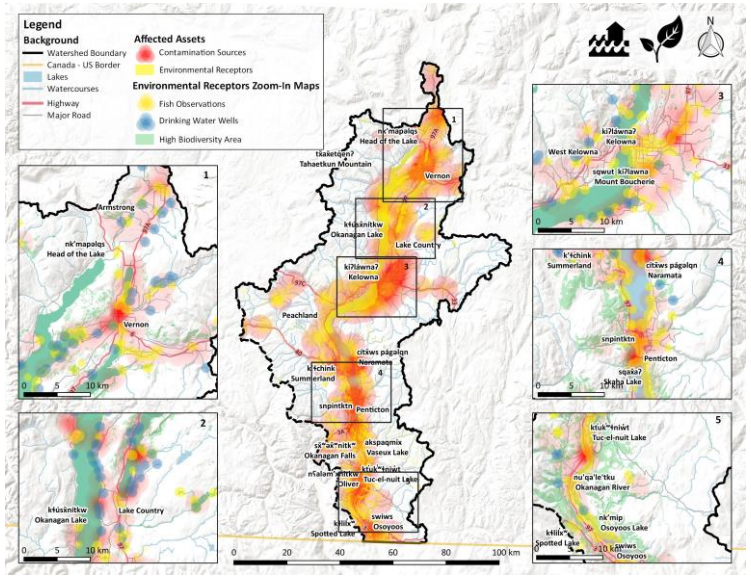
Risk Summary – Flood

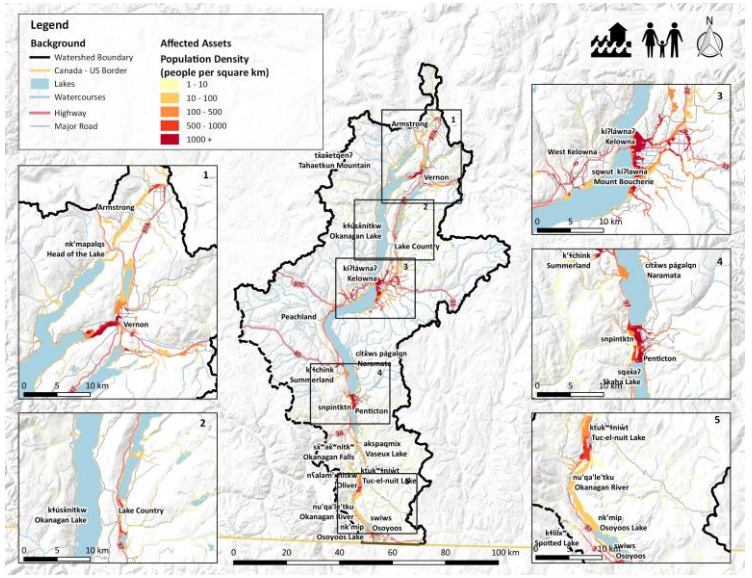
Watershed	Scenario	Extreme	High	Medium
Okanagan	High			
	Moderate			
	Low			
Similkameen	High			
	Moderate			
	Low			



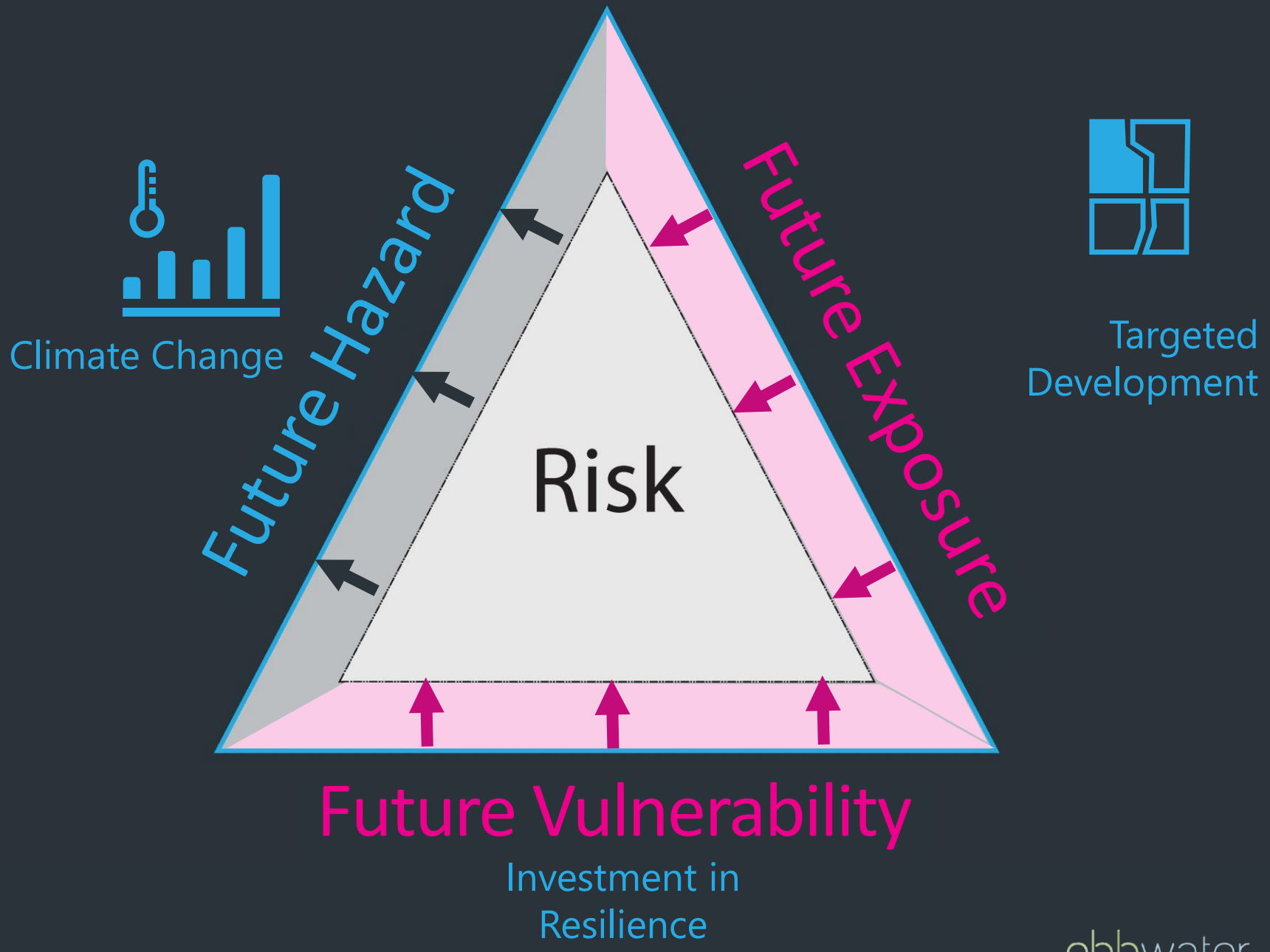








Our current risk is human-caused…and so with a bit of humility can be human-solved



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Thank you

14 September 2020

Understanding Risk BC

Tamsin Lyle, P.Eng | Principal | Ebbwater Consulting Inc.

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THOUGHTFUL FLOOD MANAGEMENT