

Modeling the Impacts of a Tailings Dam Failure at the Pebble Mine

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Cameron Wobus

Ryan Spies

Bill Szafranski

Dave Albert

James DePasquale



Overview

- The Pebble Mine Draft EIS dismisses the risk of a tailings dam failure, despite clear risks
- To fill this gap, we developed a hydrologic model to evaluate the potential impacts of a tailings dam failure
 - We used software that has been used by the mining industry for similar studies
 - We developed failure scenarios based on site specific and historical data
 - We used a sensitivity analysis to bracket potential outcomes
- In all scenarios, a tailings dam failure would directly impact hundreds of miles of anadromous waters



What is a Tailings Dam?



Highland Valley Copper Mine, Logan Lake, British Columbia, Canada

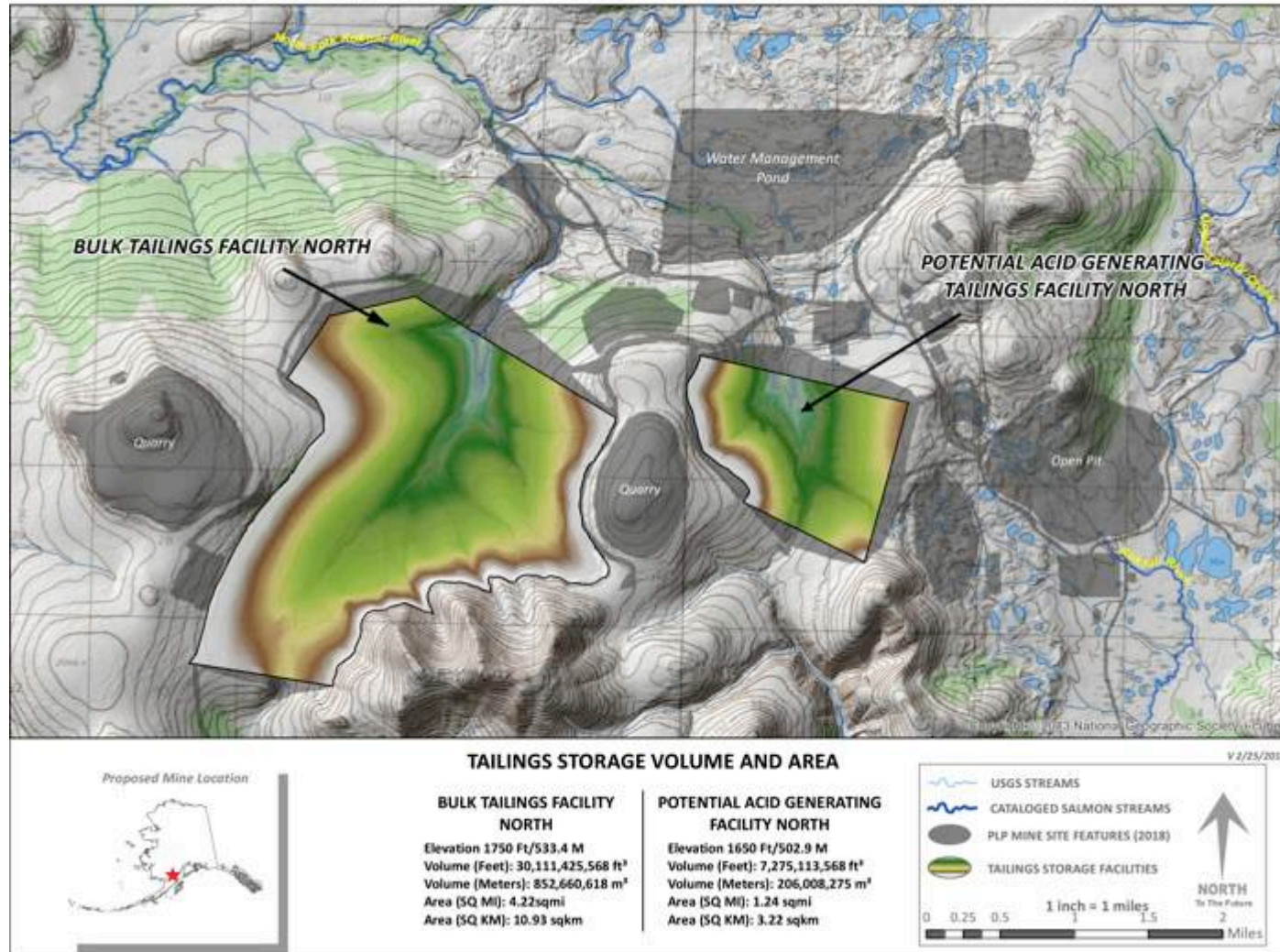
Image 1: Klohn Crippen Berger: <https://ambriefonline.com/tailings-dam-inspection-and-monitoring/>

Image 2: Mccosker Contracting Ltd: <http://www.mccoskers.com.au>



Pebble Tailings Storage Facilities (TSFs)

PROPOSED TAILINGS STORAGE FACILITIES FOR THE PEBBLE MINE - CURRENT PROPOSAL



Recent Tailings Dam Failures



Brumadinho, Brazil, 2019



Samarco, Brazil, 2015



Mt. Polley, BC 2014 (Knight Piésold design)

<http://www.mining.com/tailings-breach-at-imperial-metals-mount-polley-mine-40156/>
<https://slate.com/news-and-politics/2015/12/brazil-mining-dam-disaster-toxic-sludge-and-irreversible-environmental-damage.html>
<https://www.theguardian.com/world/2019/jan/25/brazil-dam-collapse-news-latest-mining-disaster-brumadinho>



PLP's Proposed tailings dam uses inferior design

“Dams designed with downstream construction methods are less likely to fail than dams using centerline construction methods, especially under seismic shaking (ICOLD 2018).”

“The centerline construction method was selected for the bulk TSF north embankment to limit the footprint and volume of materials required for construction”

- Pebble Mine Draft EIS, p. 4.27-73



Draft EIS is Misleading about Failure Probability

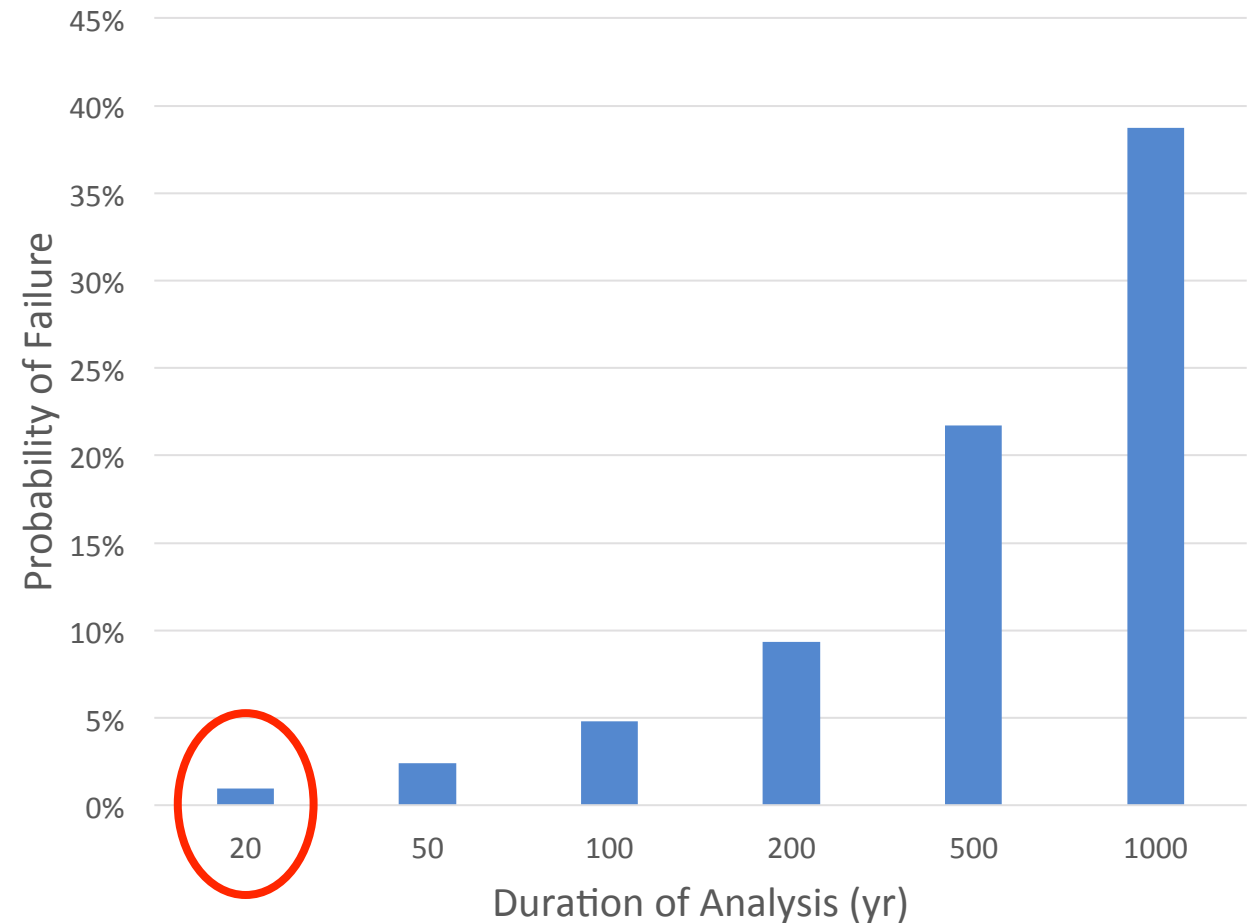
“The probability of a full breach of the bulk or pyritic TSF tailings embankments was assessed to be extremely low”

- DEIS p. 4.27-72

“[a full tailings breach was] ruled out as remote **during the 20-year operational life** due to likelihood of successful detection and intervention”

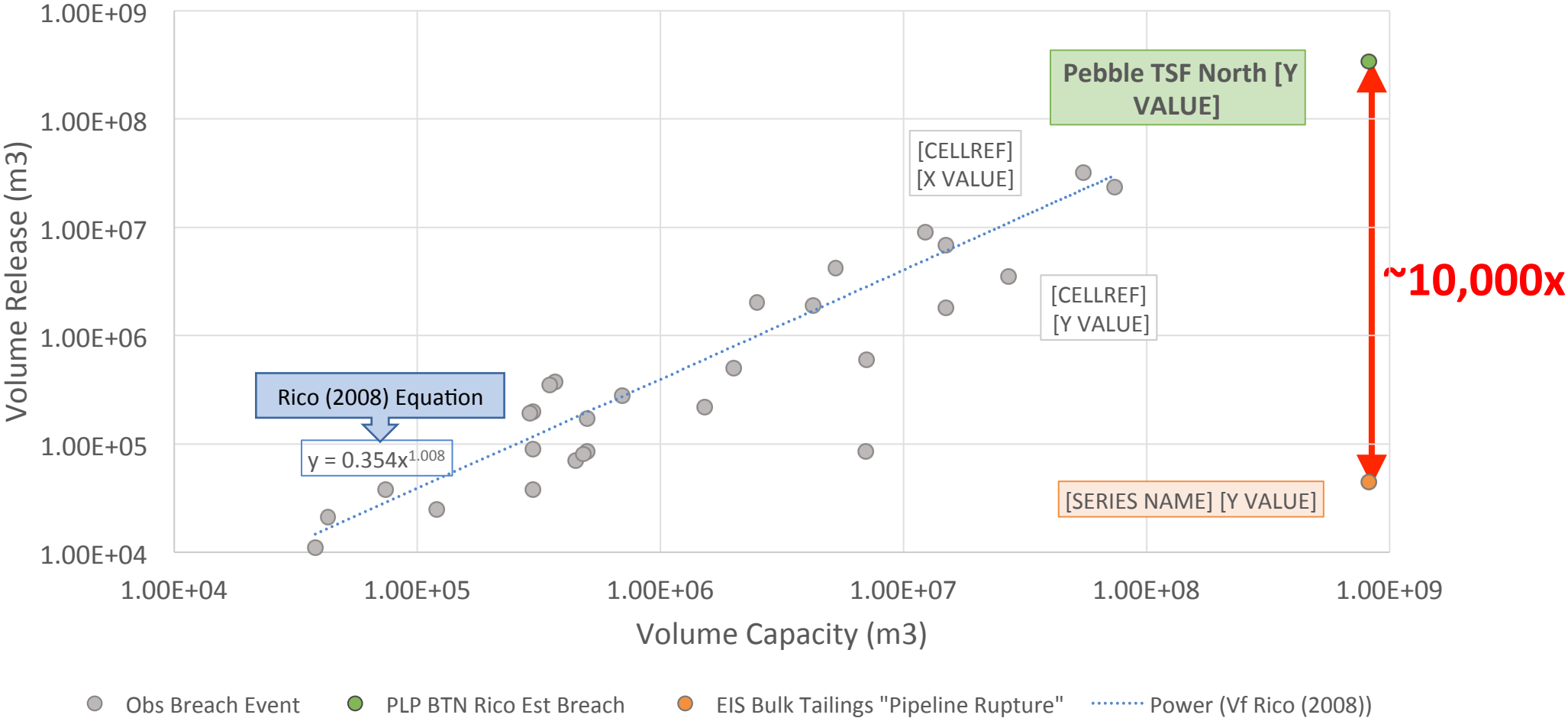
- FMEA, October 2018

Probability of "1 in 2000" Event vs Duration of Analysis



Draft EIS Did NOT consider a TSF failure

Breach Volume Released vs Tailings Storage Facility Capacity

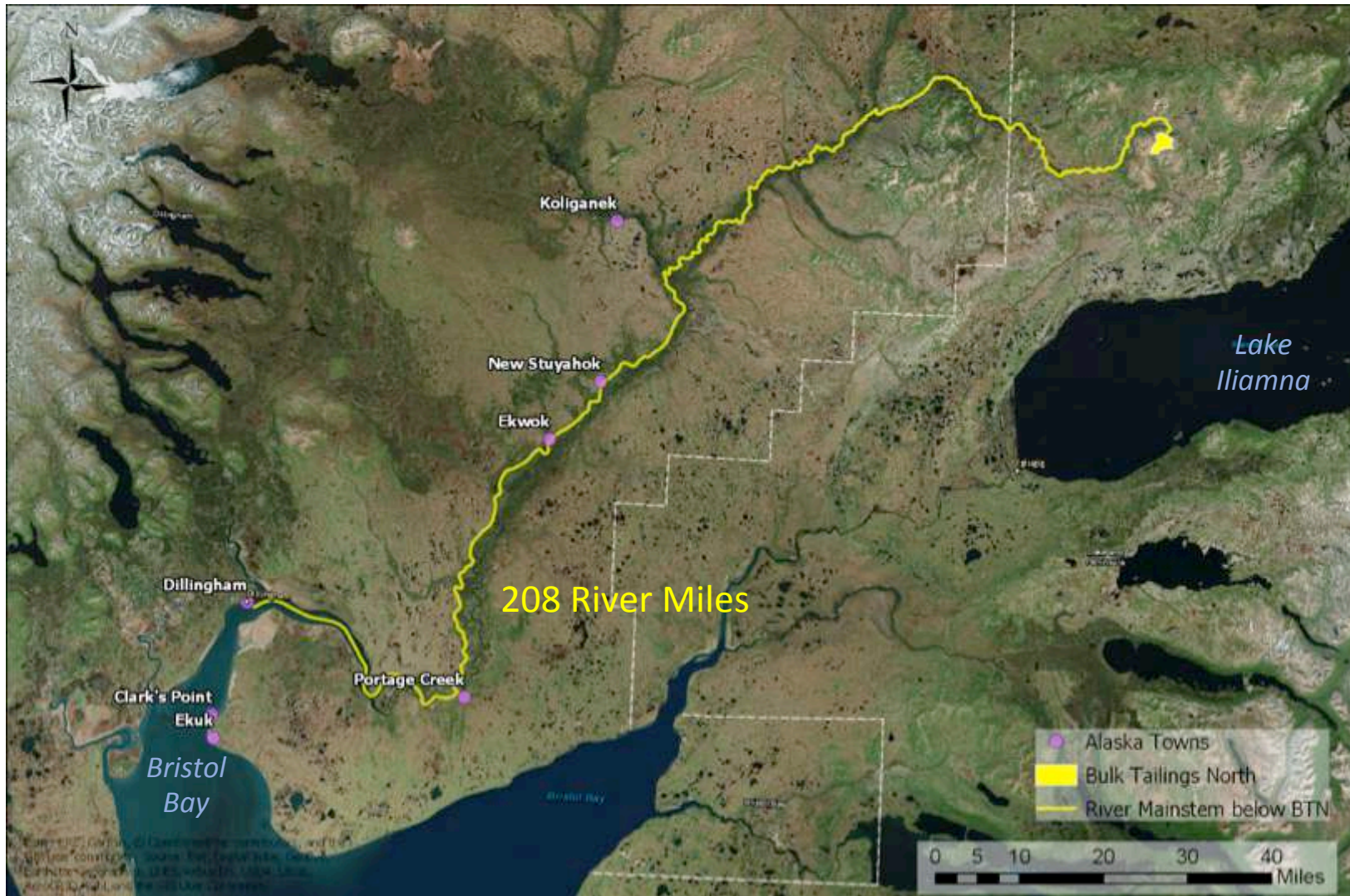


Our Goals and Approach

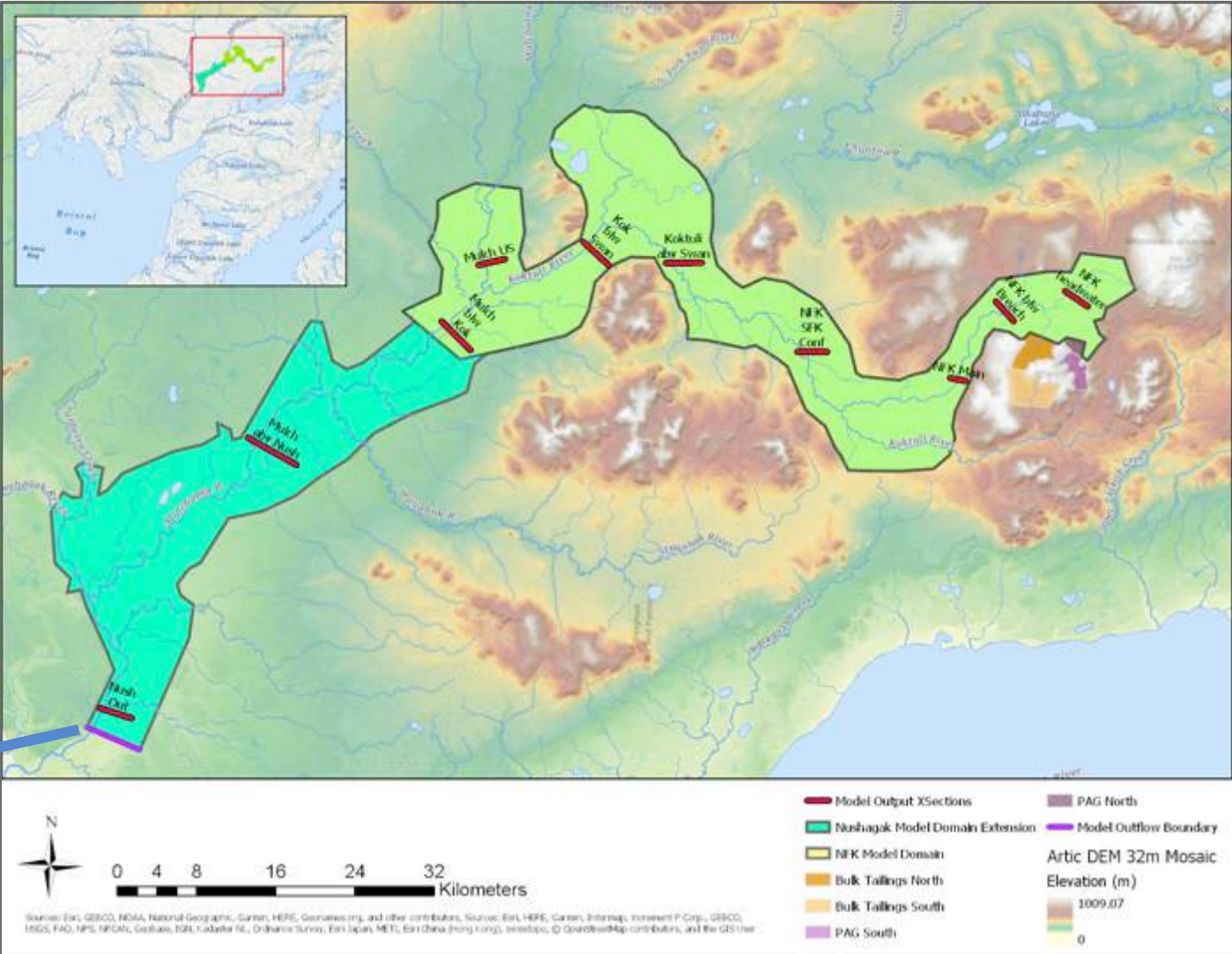
- Simulate the spatial extent of impacts in the event of a tailings dam failure at the Pebble Mine
- Develop scenarios based on historical TSF failures
- Use modeling framework consistent with prior industry practice (e.g., Knight Piesold, 2014; TetraTech, 2015)
- Examine results in the context of impacts to salmon habitat



Study Area – Regional View



Model Domains



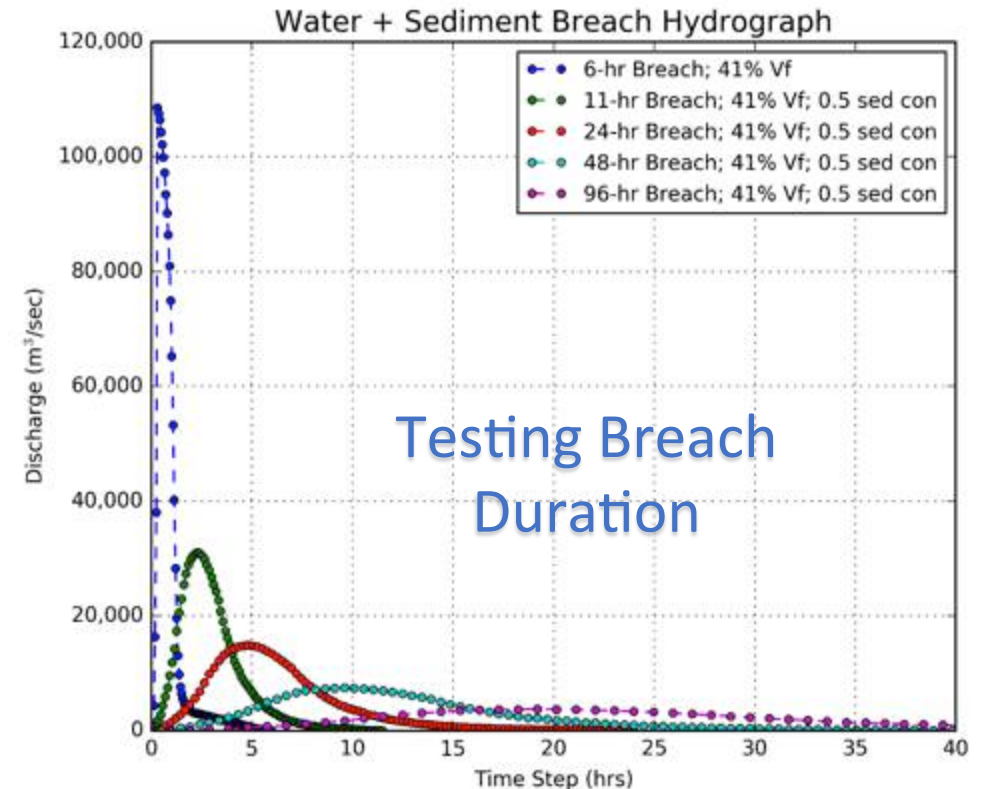
~125 miles to Dillingham



Breach Scenario Simulations

Model runs explored a range of breach scenarios:

- Tailings volume released
 - Rico et al. (2008) → 41% release
 - Low estimate → 10% release
 - High estimate → 60% release
- Duration of breach event
 - Varied from 6hr to 96hr
 - Influences peak discharge rate
- Max sediment concentration
 - Varied from 35%-50%
 - Influences flow properties



Result: 24-hour Breach, 50 hr simulation



Sensitivity: Total volume released

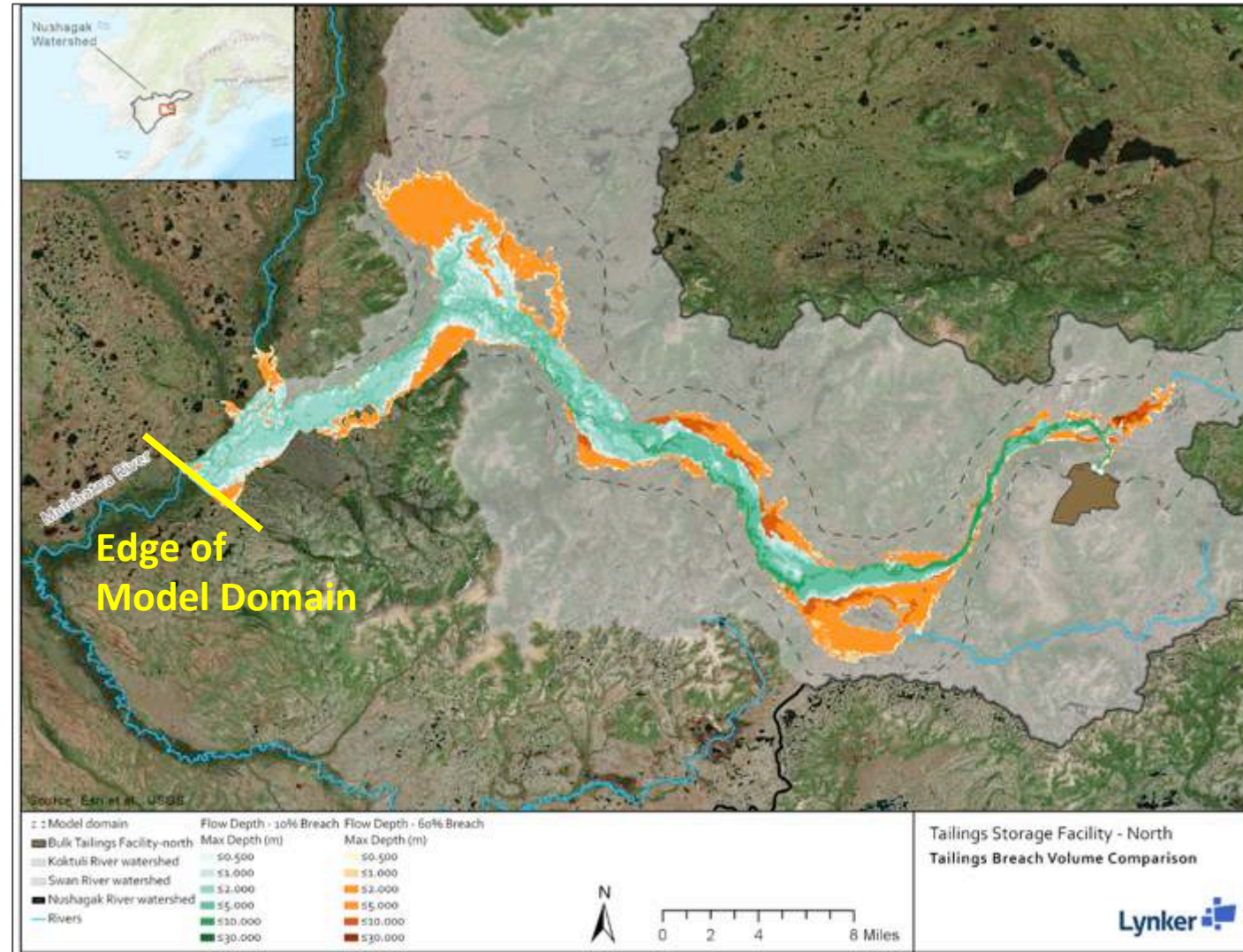
Breach Volume Comparison

10% breach volume (green)

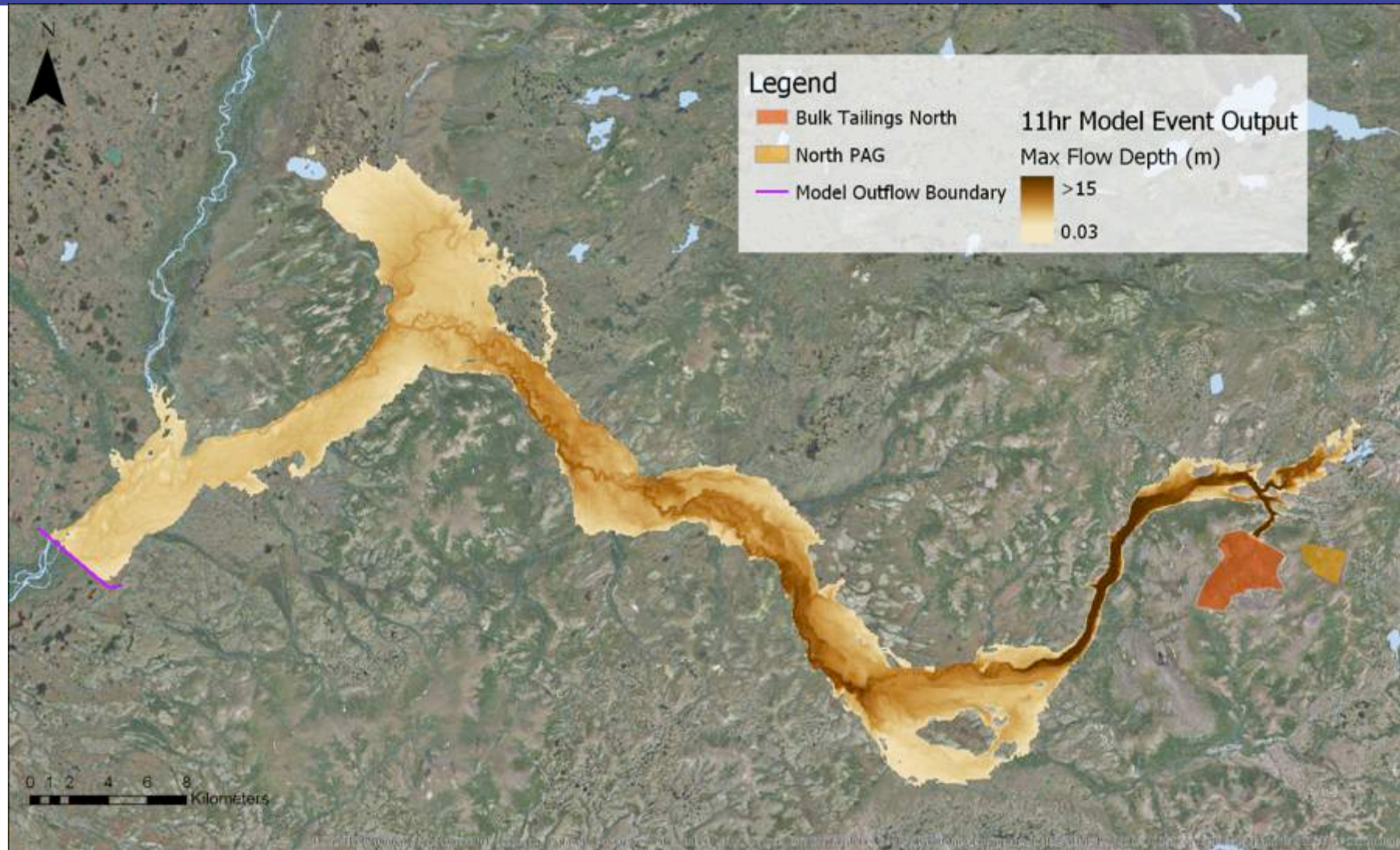
- Inundated Area: 60.9 mi²

60% breach volume (orange)

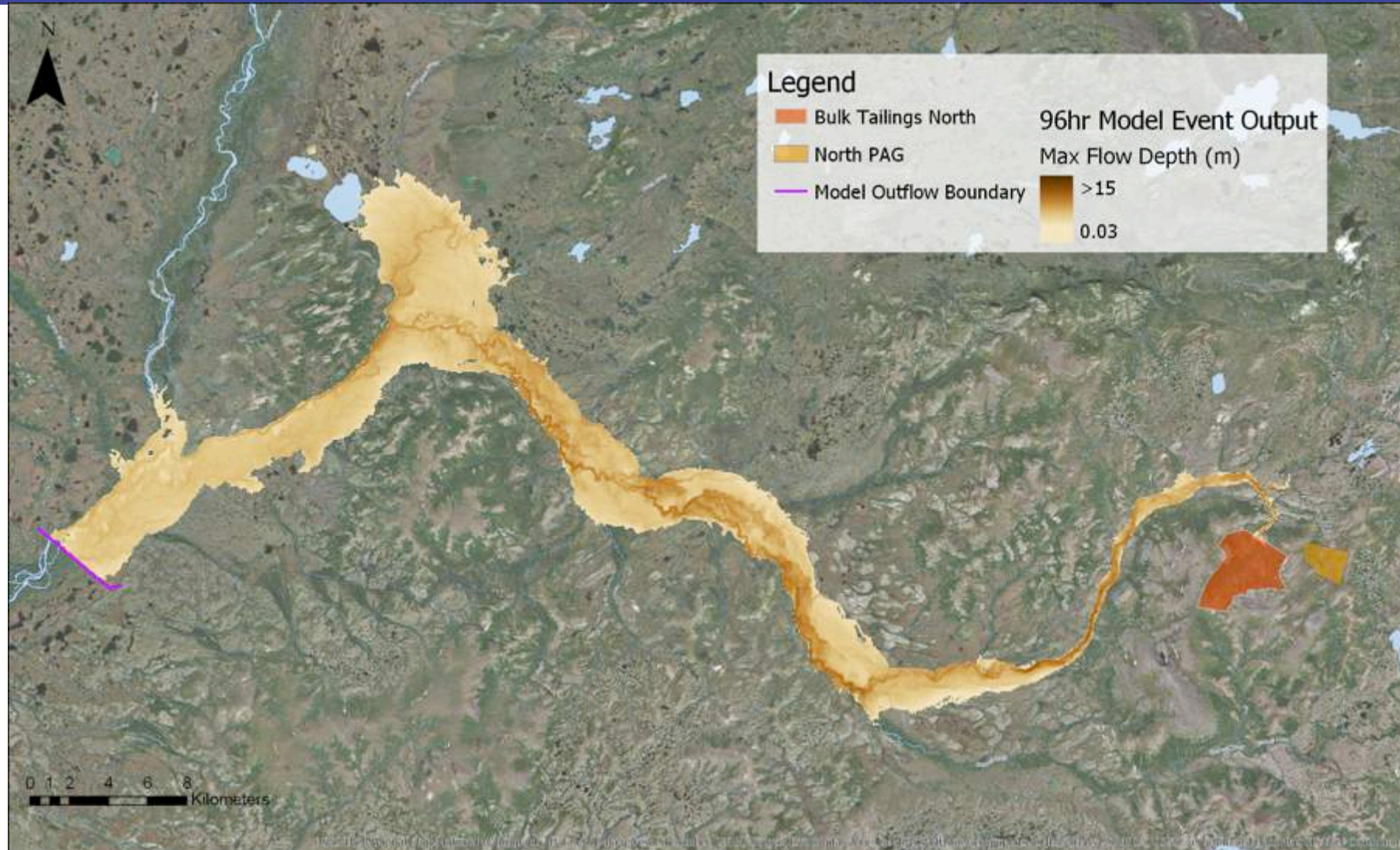
- Inundated Area: 110.3 mi²



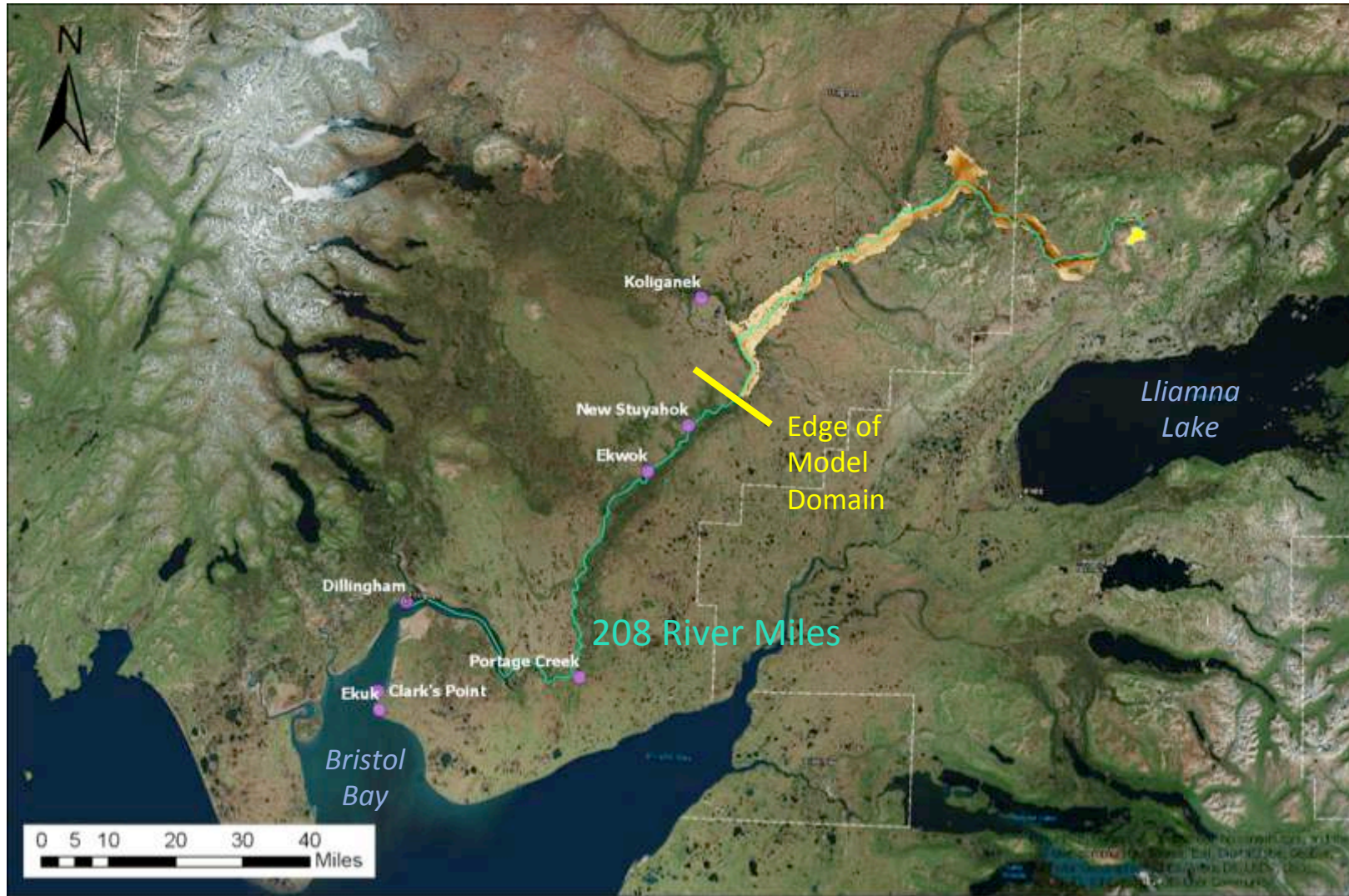
Sensitivity – Duration of Breach (11 hr)



Sensitivity – Duration of Breach (96 hr)



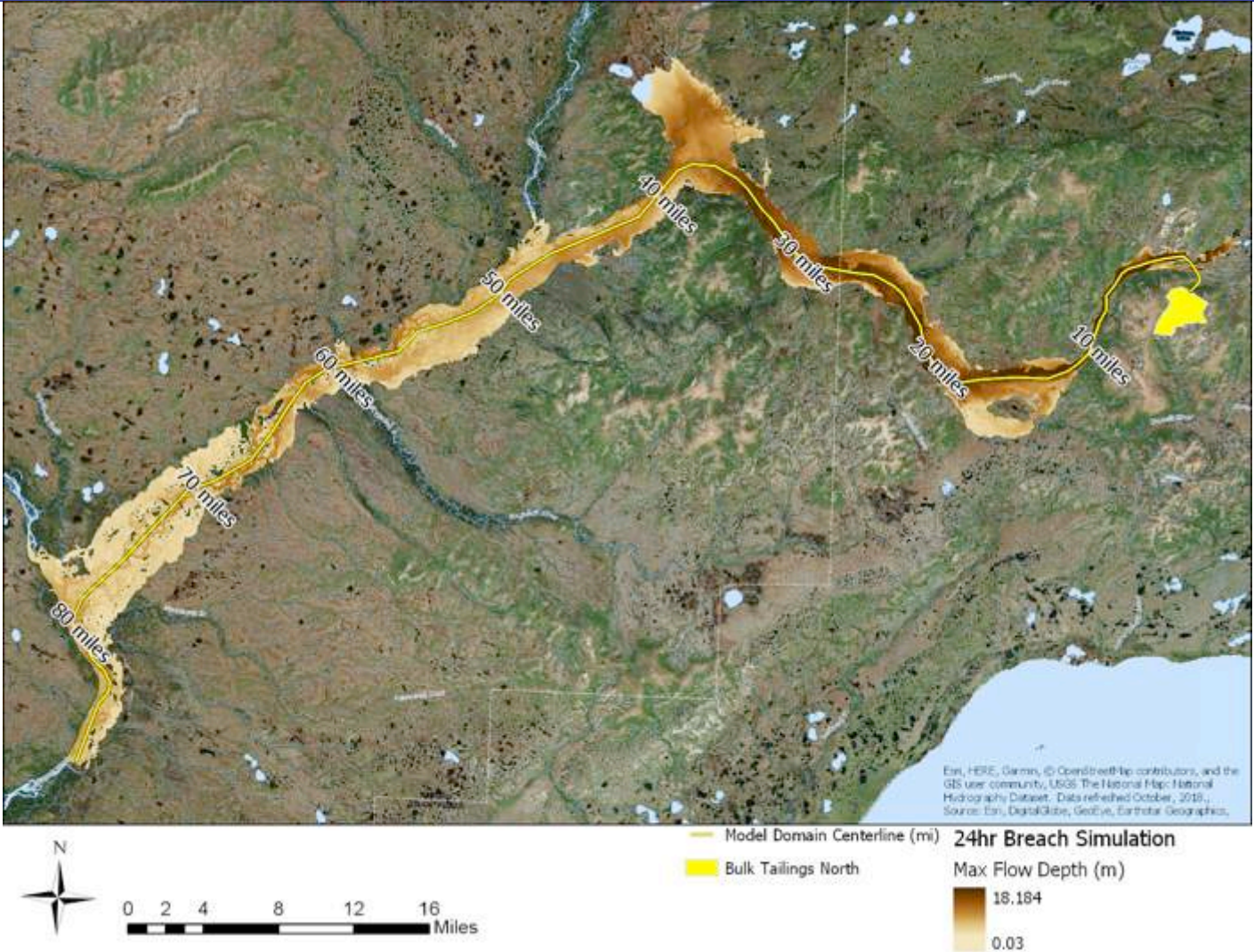
24-hour Breach: Larger Model Domain



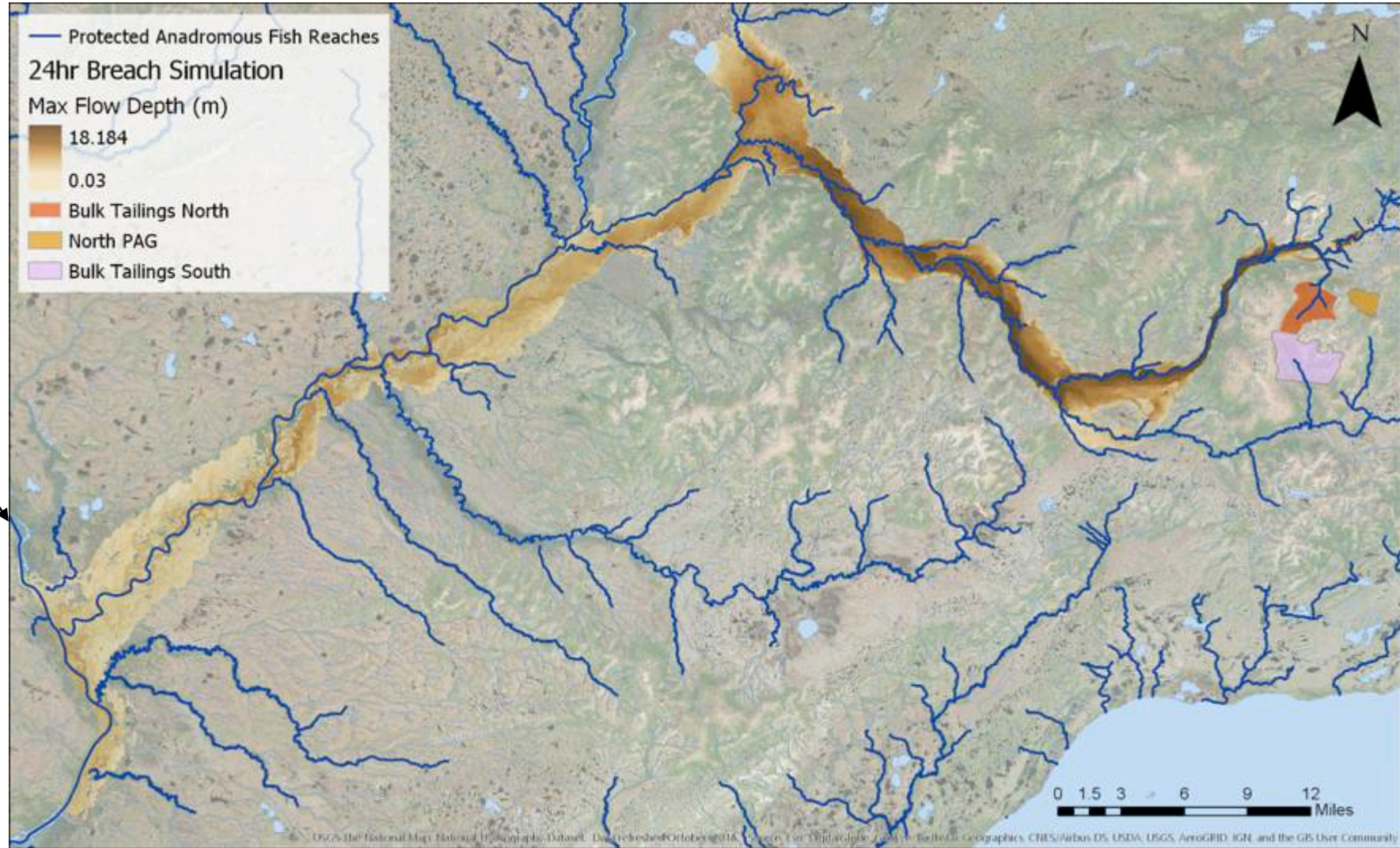
Larger Model Domain: 24-hour Breach

Model extends from TSF to Nushagak-Mulchatna Confluence

- ~45% of tailings are deposited within the model floodplain
- ~55% of tailings flow past the model boundary



Anadromous Waters Affected – 24 Hour Event



- Tailings would directly impact >219 miles of anadromous waters



Potential impacts to the fishery

- Deposition of fine-grained tailings in spawning habitat could decrease emergence success (e.g., Chapman, 1988; Kondolf, 2000)
- Leaching of metals from tailings could create acute or chronic toxicity to salmonids

Chapman, D. W. (1988). Critical review of variables used to define effects of fines in redds of large salmonids. *Transactions of the American Fisheries Society*, 117(1), 1-21.

Kondolf, G. M. (2000). Assessing salmonid spawning gravel quality. *Transactions of the American fisheries Society*, 129(1), 262-281.



<https://www.salmonography.com/Salmonid-Topic/Covering-the-redd/>



Long-term impacts

“Unrecovered tailings that are exposed to oxygen could generate acid on a timescale of years to decades...acid and heavy metals that accumulate in streambed sediments, wetland soils, or isolated waterbodies could impact water quality on a timescale of decades.”

- Pebble DEIS, page 4.27-65

“Recovery of a massive release, especially one that reaches flowing water, would be extremely difficult.”

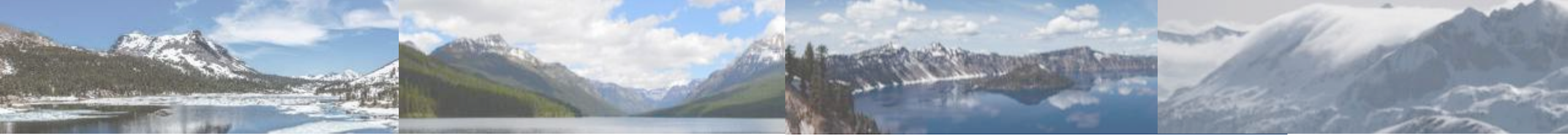
- Pebble DEIS, page 4.27-65



“The only common factor in all major TSF failures has been human error, including errors in design, construction, operations, maintenance, and regulatory oversight.”

- Pebble DEIS, p. 4.27-71





Questions

Cameron Wobus, PhD: cwobus@lynkertech.com

Ryan Spies, MS: rspeis@lynkertech.com

Bill Szafranski, MS: bszafranski@lynkertech.com

