

Contamination and Its Management in the Context of Ecological Restoration

Musings and Disaster Related Case Studies

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Science Advisory Board for Contaminated Sites
in BC

Objectives

- Convince you: when you manage contamination *you are doing* ecological restoration
- Sketch out some conceptual approaches to see contaminant management as part of ecological restoration (in the context of disaster)
- Connect current day contamination management, everyday and during disasters, to broader discussions about future states of wildlands ecosystems

Outline

- Focus and challenges
- Ecological restoration
- “Leaning into” considering ecological restoration in contamination management
- Case Studies 1 –2021 Merritt, BC Flooding
- Case Study 2 – 2014 Mount Polley Mine
- Inspirations

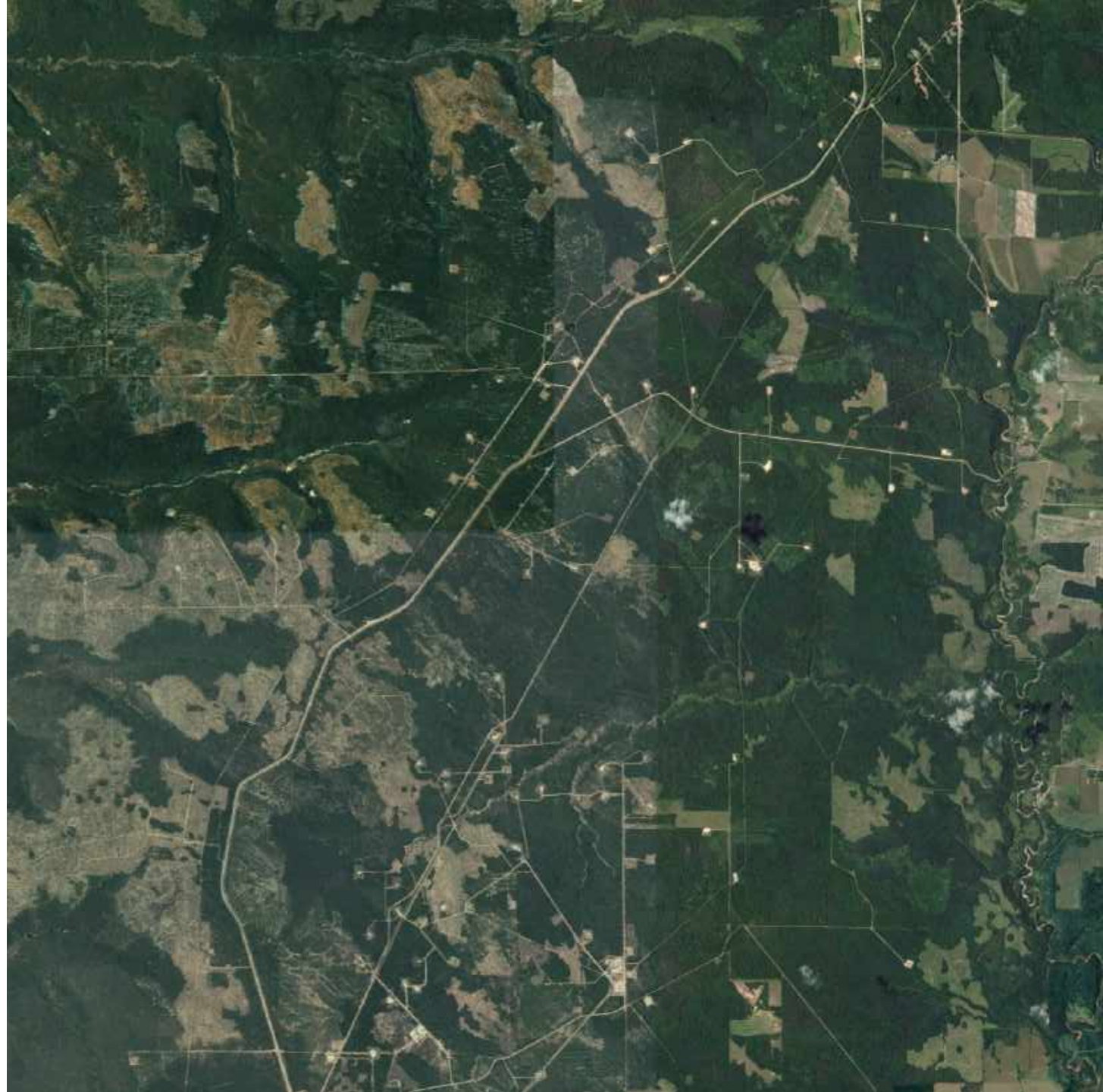
Focus

- Focus today is on ecological systems in wildland settings where land is being remediated → restored
- Typically in our world, the work spans:
 - Site investigation
 - [Risk assessment]
 - Site remediation
- We work under specific guidance (CSR, FCSAP)



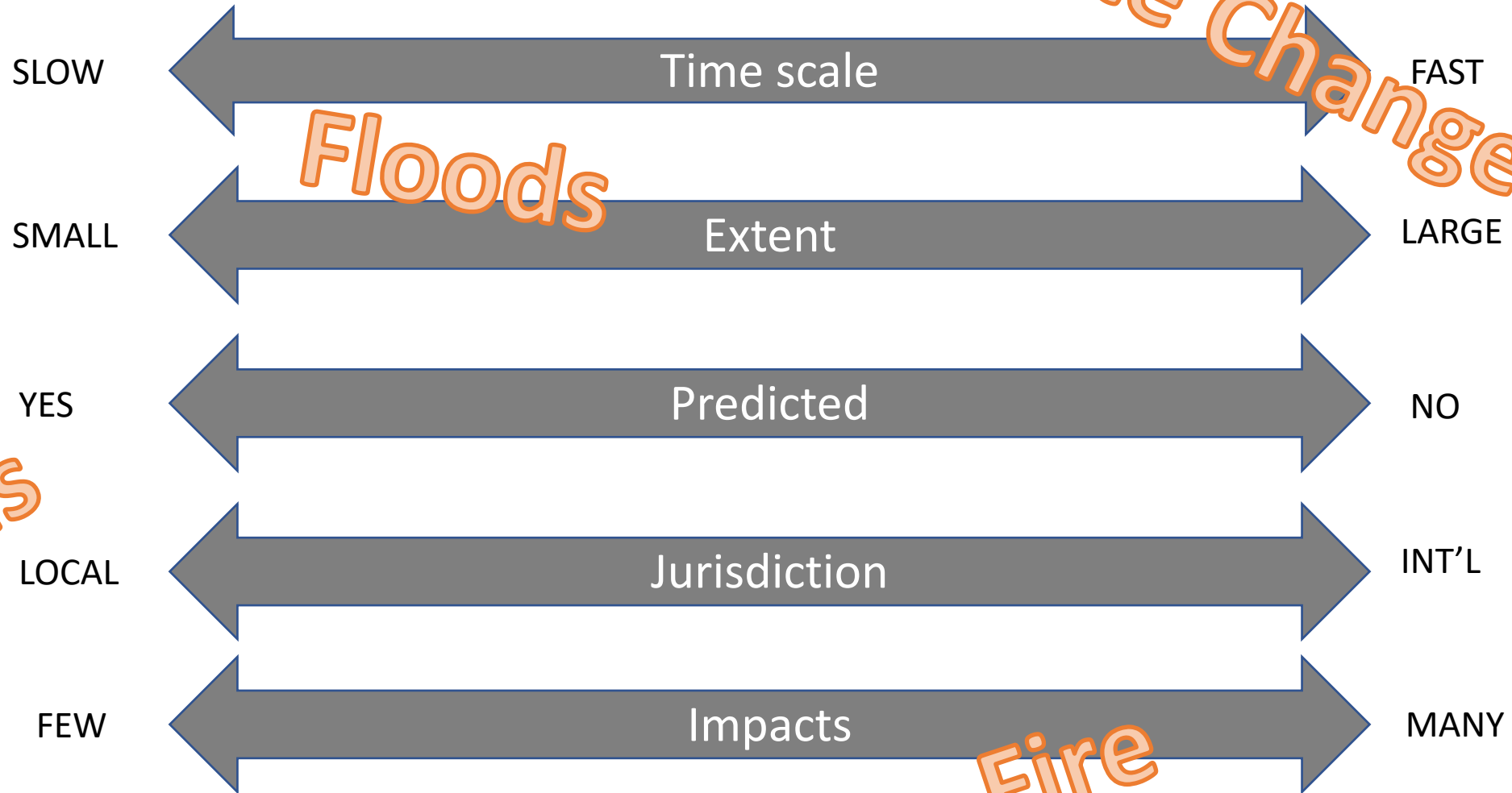
Challenges

- Contaminant focus
- Physical scale (challenge and opportunity?)
- Limits on regulatory breadth
- Limited impetus for long-term continuity
- Patchy land use planning



Add Disasters!

Spills

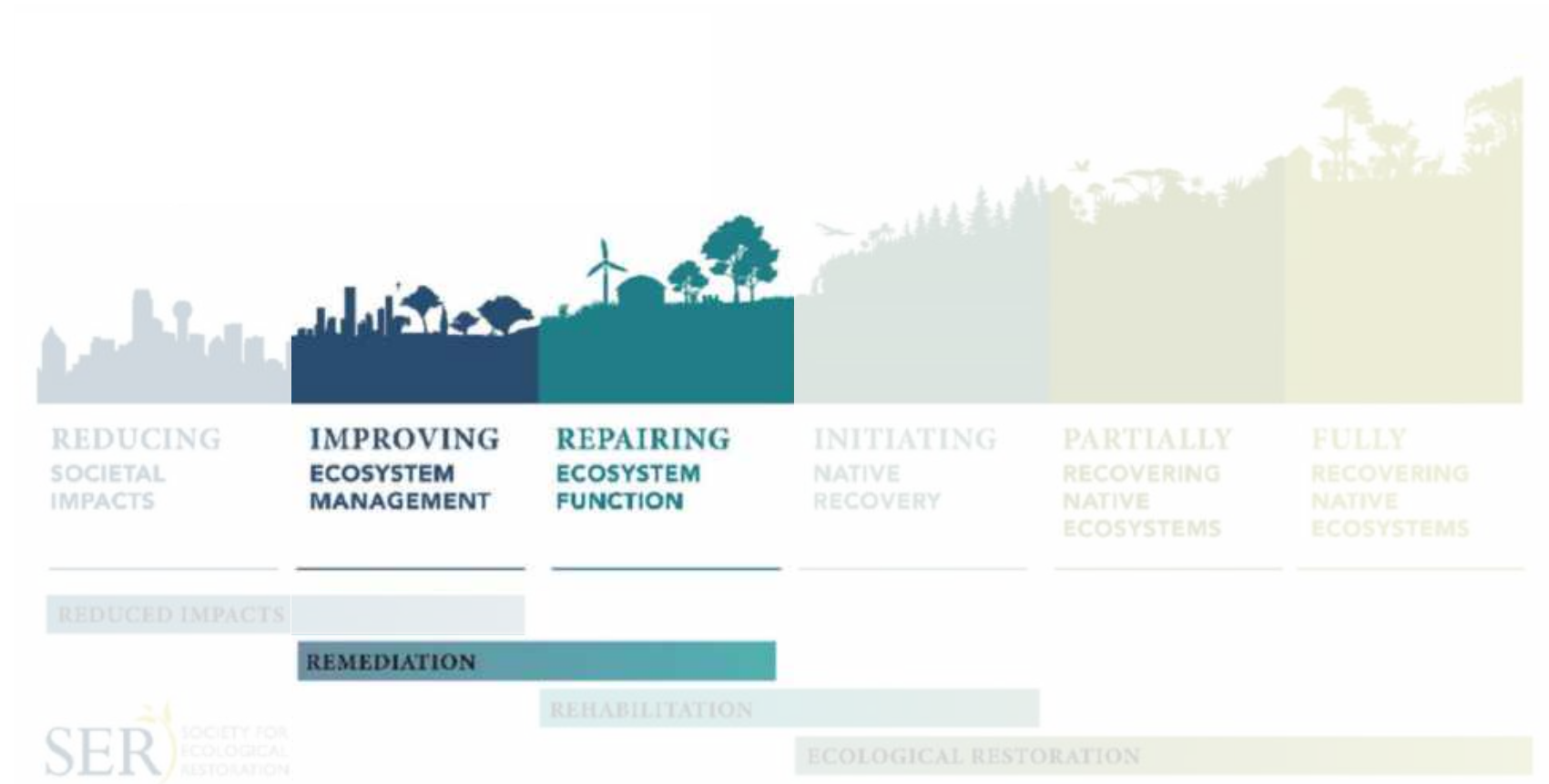


Opportunities - 1

- “Begin with the end in mind” (Steve Covey)
 - Start from where we are with vision of future – 50 years
 - Lift a level or two from your specific scope of work – think bigger
- Step outside of “contaminated lands-land”
- Diverse teams and inclusive process
- Ecosystem services

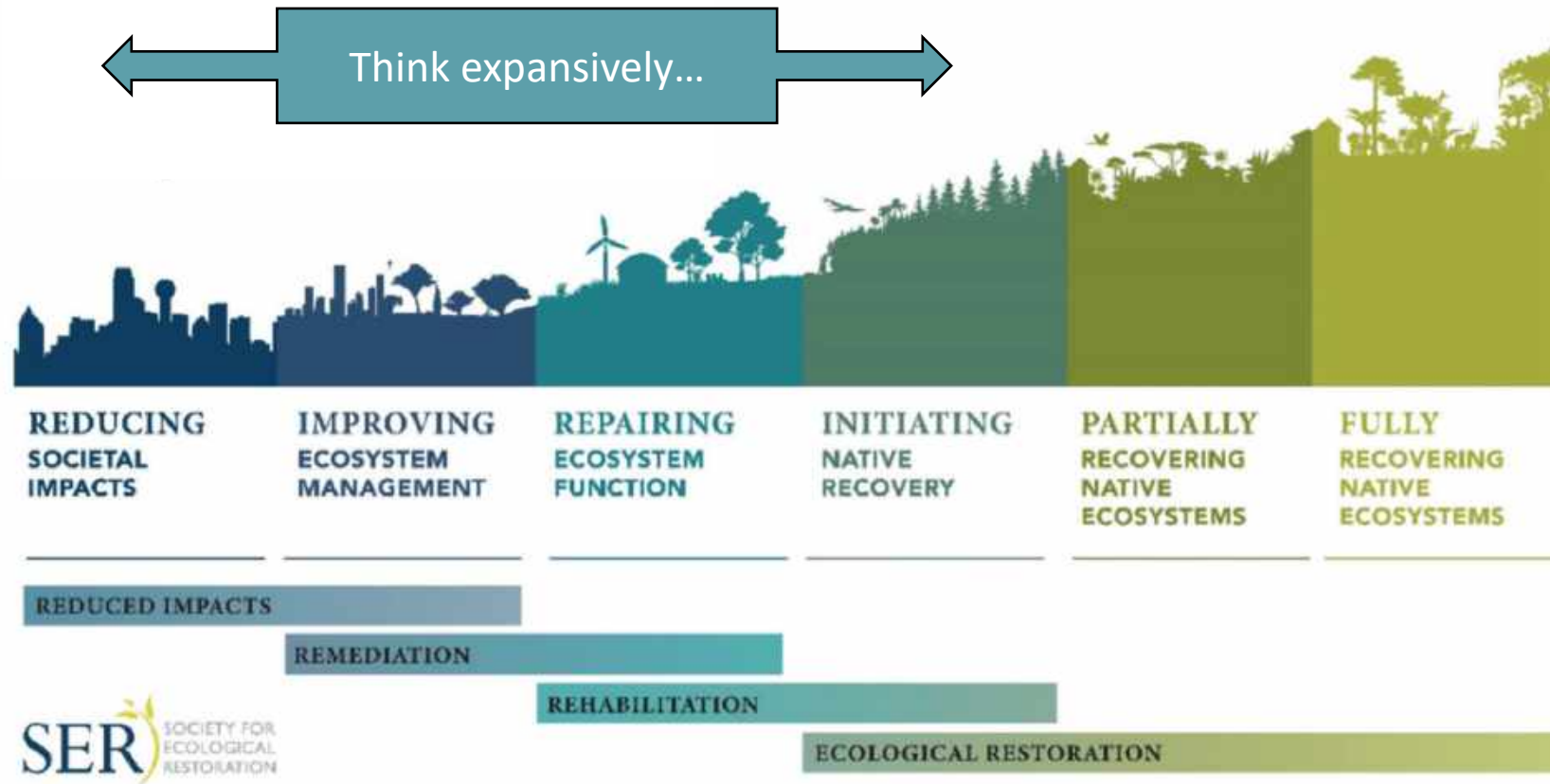


Managing Contamination *is* Ecological Restoration



(Gann et al. 2019)

Managing Contamination *is* Ecological Restoration



(Gann et al. 2019)

Ecological Restoration

- Ecological Restoration is *“the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.”* (Gann et al. 2019)
 - Emphasis on **native ecosystems** and **ecosystem integrity**
- Ecological Restoration is *“is a solutions-based approach that engages communities, scientists, policymakers, and land managers to repair ecological damage and rebuild a healthier relationship between people and the rest of nature.”* (Gann et al. 2019)
- UN Decade on Ecosystem Restoration: 2021-2030

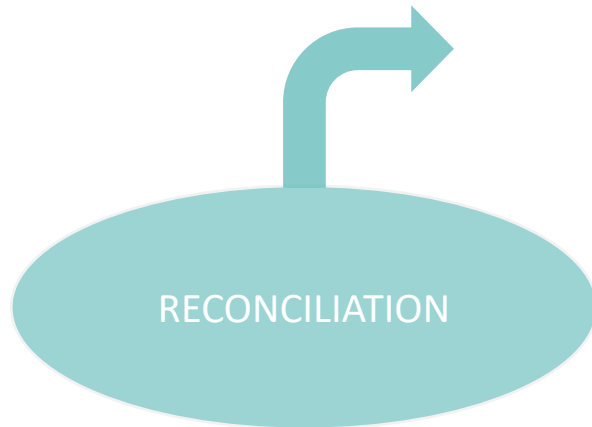


Opportunities - 2

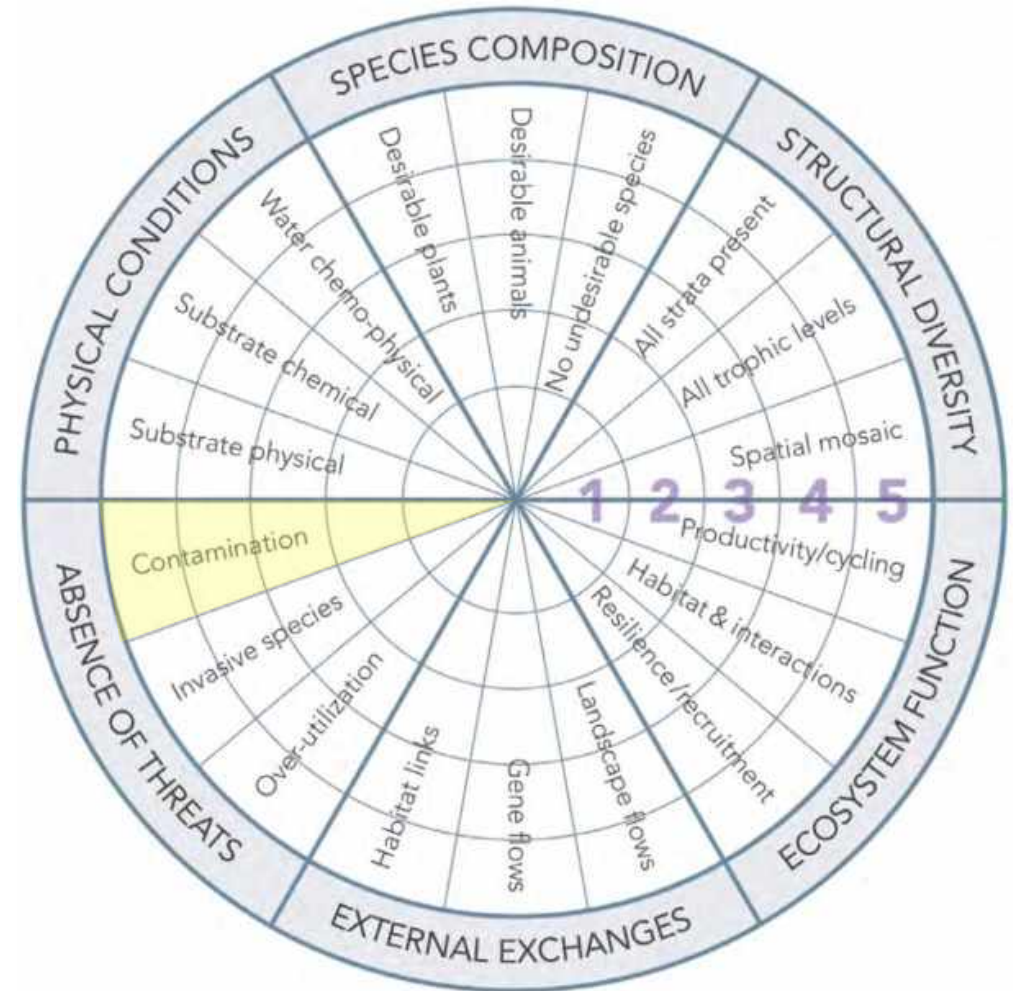
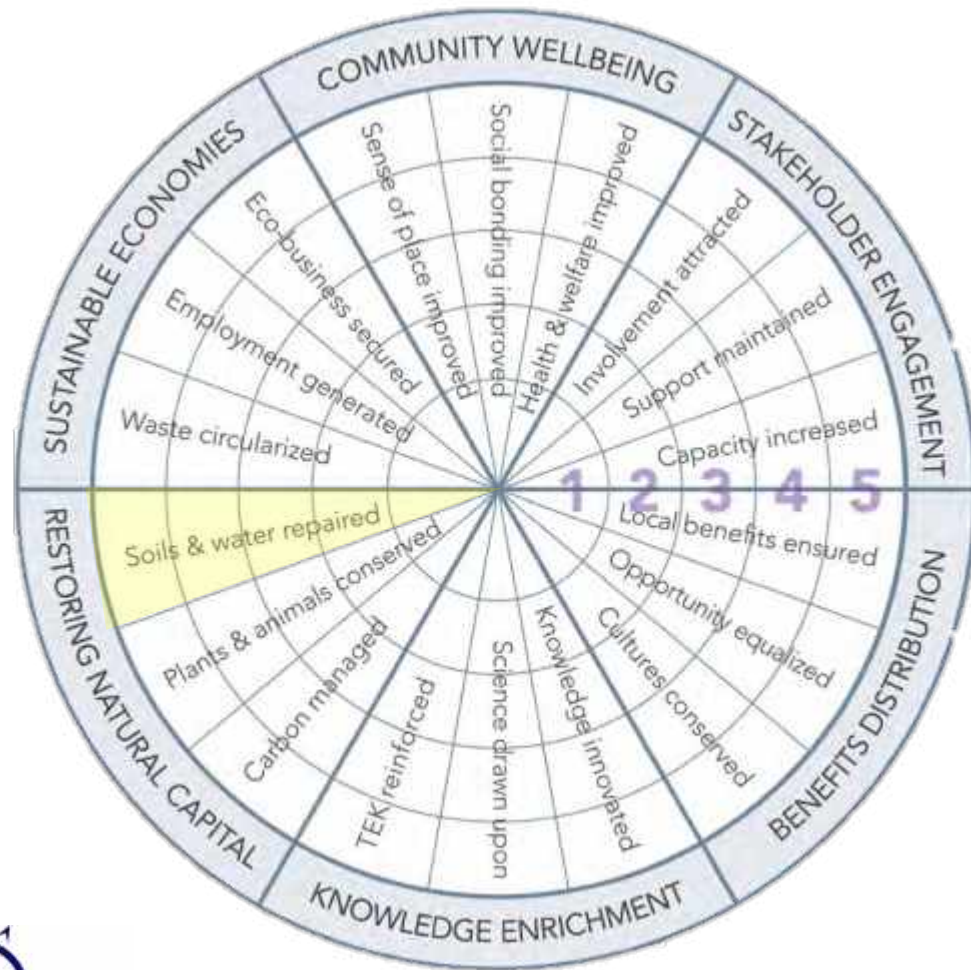
- Increase resilience in face of climate change
- Support reconciliation
- Greater opportunities to take this approach in some situations than others



Ecological Restoration



Social Ecological Restoration Technical





Home > Environmental protection and sustainability > Air, Land & Water > Water > Drought, Flooding, Dikes & Dams >

Flood response and the environment

In November 2021, large rainfall events known as atmospheric rivers caused flooding in the Sumas Prairie to Hope, Merritt and Princeton areas. Floods have the potential to release and deposit contaminants into the environment. This can affect human health and the environment.

The Province is responding to these floods in several ways. This includes providing information and guidance on the environmental impact of these recent floods.

Popular resources

Debris map

Visit the [interactive debris map](#) for more information on response efforts.



Report debris

Use our online [debris reporting tool](#) to report debris that is not reflected on the debris map.



Project updates

See the latest [information bulletins](#) and [news releases](#) regarding the flood response efforts.



Interactive Map



Our interactive debris map shows real time location of debris removal caused by Atmospheric River Events.

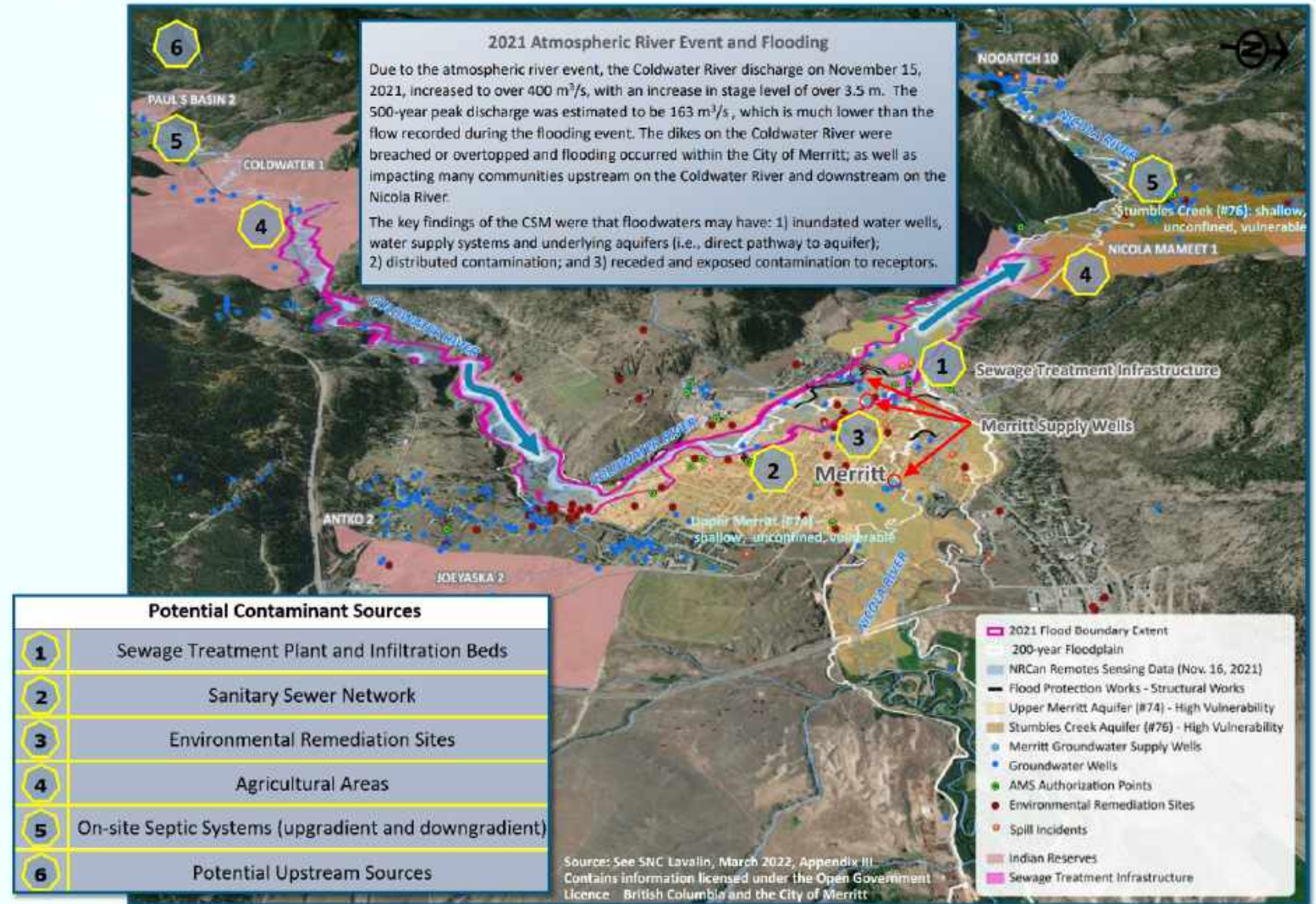
On Twitter

B.C. Spill Response
@SpillsInfo
Follow



Merritt Conceptual Site Model (CSM) – 2021 Atmospheric River and Related Potential Contamination Impacts

**Nov 2021 Flooding:
Merritt, BC:**
entire town
evacuated, 1,000
homes flooded
Province responded
on multiple fronts to
identify, understand
and manage risks –
including for
contaminants



(SNC-Lavalin 2022)



Home > Environmental protection and sustainability > Air, Land & Water > Spills and Environmental Emergencies > Spill incidents > Past Spill Incidents >

Environmental Emergency Program

- ▶ Report a spill
- ▼ Spill incidents
 - Past Spill Incidents
- ▶ Roles and responsibilities
- ▶ Environmental emergency legislation
- ▶ Planning, prevention & response
- Regulations
- Engagement
- Annual reports

Mount Polley Mine Tailing Dam Breach



Incident Description

Location	Polley Lake, Hazeltine Creek and Quesnel Lake
Product/Quantity	Loss of about 17 million cubic meters of water and 8 million cubic meters of tailings/materials
Source	Tailings dam failure.
Time/Date of Incident	1:00 AM / August 4, 2014

Summary

A tailings dam failure at the Mount Polley Mine occurred on August 4, 2014

Key Information

Further details are available on the [Key Information](#) page.

Sampling Data



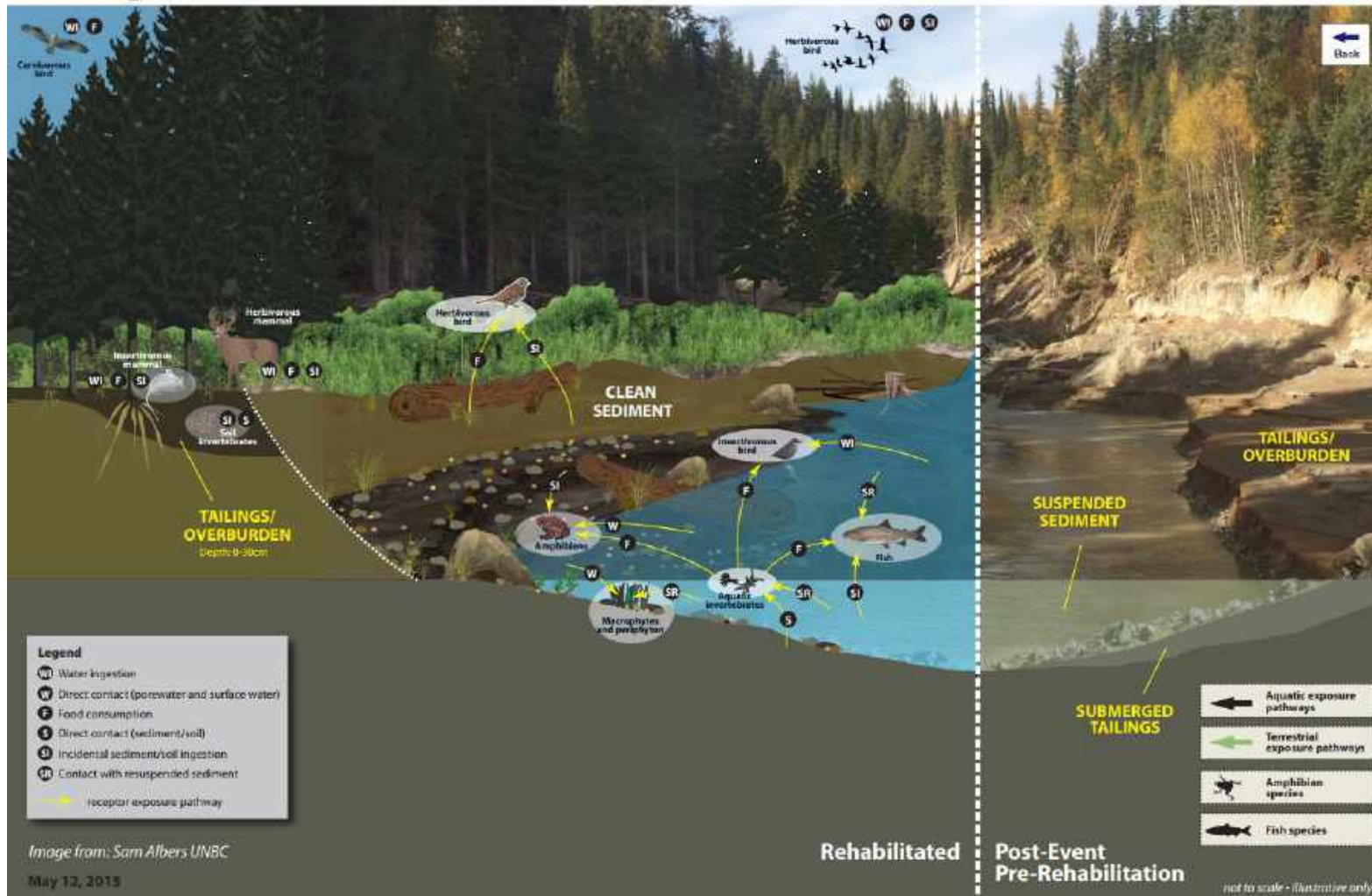
Follow this link to view a [map of the sampling sites](#).

Site Location



Mount Polley Mine Tailings Dam Breach Example Conceptual Model

Conceptual Model: Hazeltine Creek



Prepared for BC MOE (now ENV) by Azimuth

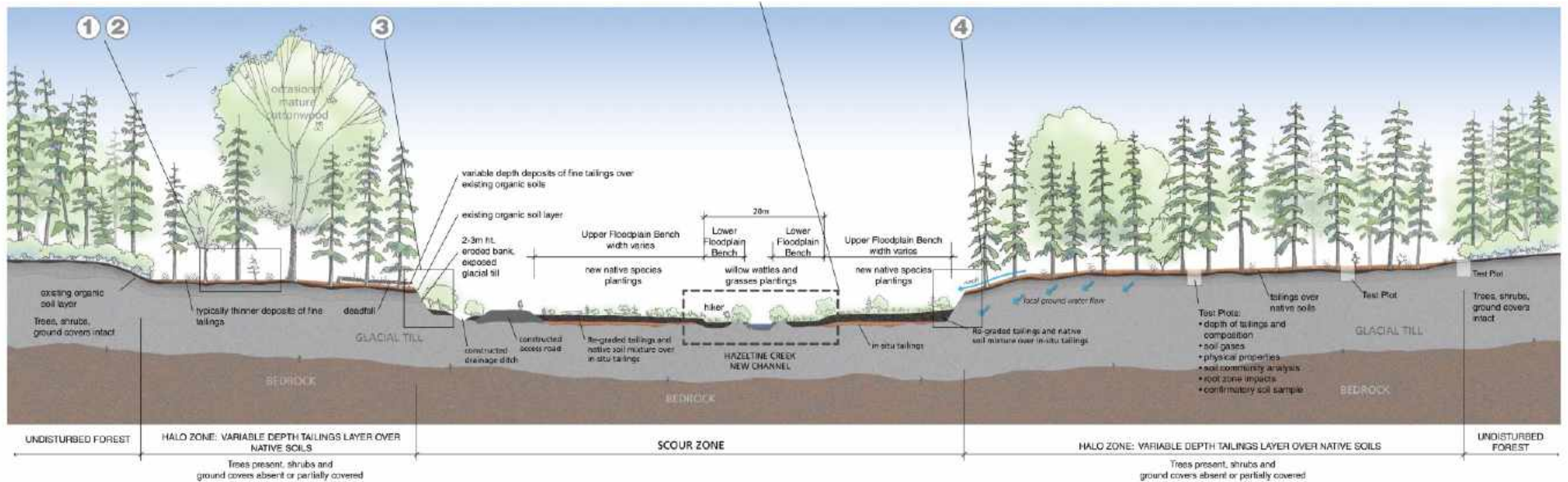


Mount Polley – Rehabilitation & Remediation Strategy



(Golder Associates 2016)

Mount Polley Tailings Dam Failure Example Conceptual Model



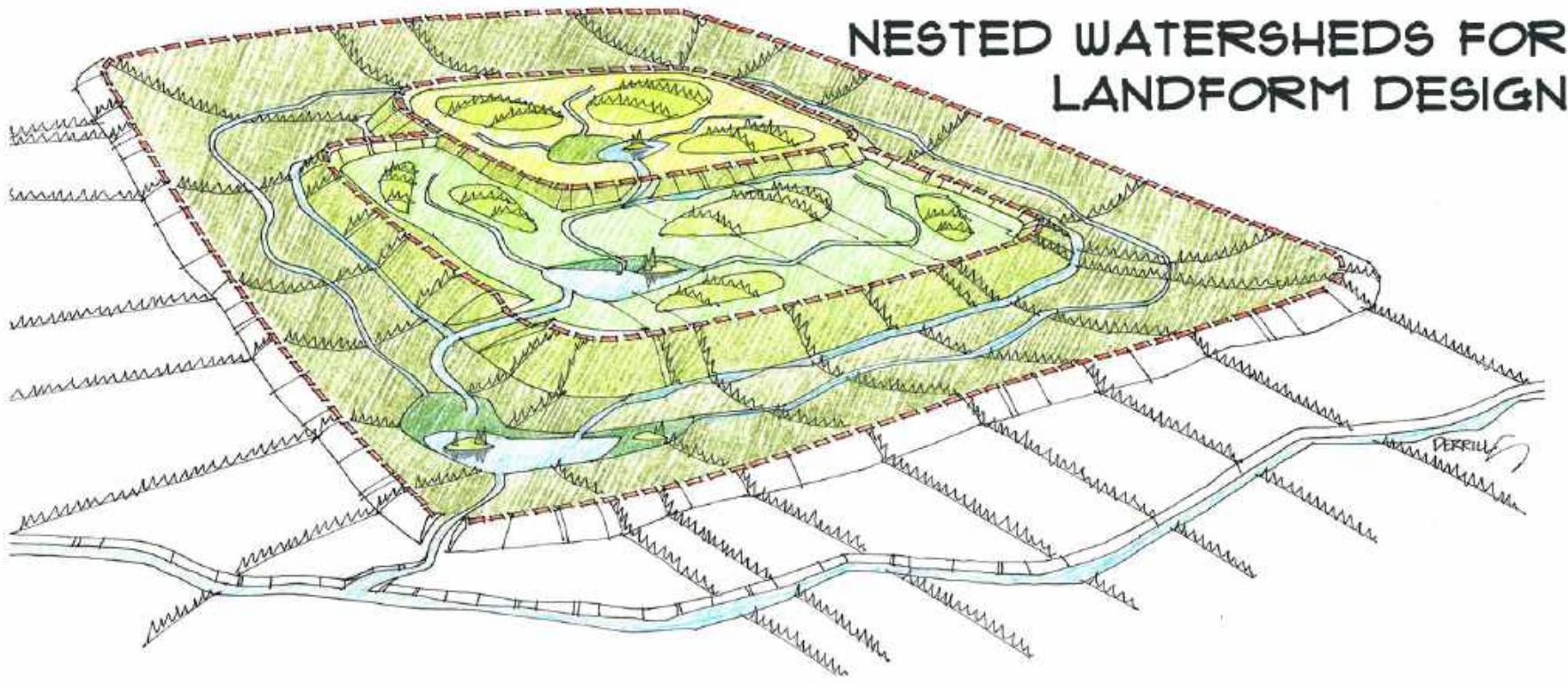
(Golder Associates 2015)

Five spatial scales of landform design

Landform design and construction occurs simultaneously at five embedded spatial scales.

- 1 Region** 100km scale. Governed by regulatory policy and regional plans; involves non-mining activities, built over hundreds of years. Cumulative effects, socioeconomic, and wildlife habitat issues at the forefront of design.
- 2 Landscale lease minesite** 10km scale. "Everything you can see from a point." A single mine lease or property. Life of mine plan, closure plan, landscape ecology. 50 to 100 years of construction. The main scale for design collaboration with local communities.
- 3 Landform** 1km scale. A single mining landform with a facility-scale design. This scale is the fundamental building block for landform design. Built over 10 to 20 years with large mining equipment.
- 4 Element** 1 to 100m scale. A single feature (such as a toe berm, a bench, a wetland) on a landform. Usually a smaller scale reclamation design to support a specific land use. Built with mining equipment or smaller reclamation equipment over a construction season.
- 5 Microsite** 1m scale. Small feature (such as a hummock, rock pile, a boulder, soil mound) for a specific reclamation purpose. Often field fit with small equipment over a few hours.

Inspiration for Restoration: Landform Design Institute



(LDI 2021)

<https://www.landformdesign.com/igraphics/LDI-Infographic-06-Scales.jpg>



Inspiration for Restoration: Urban Settings



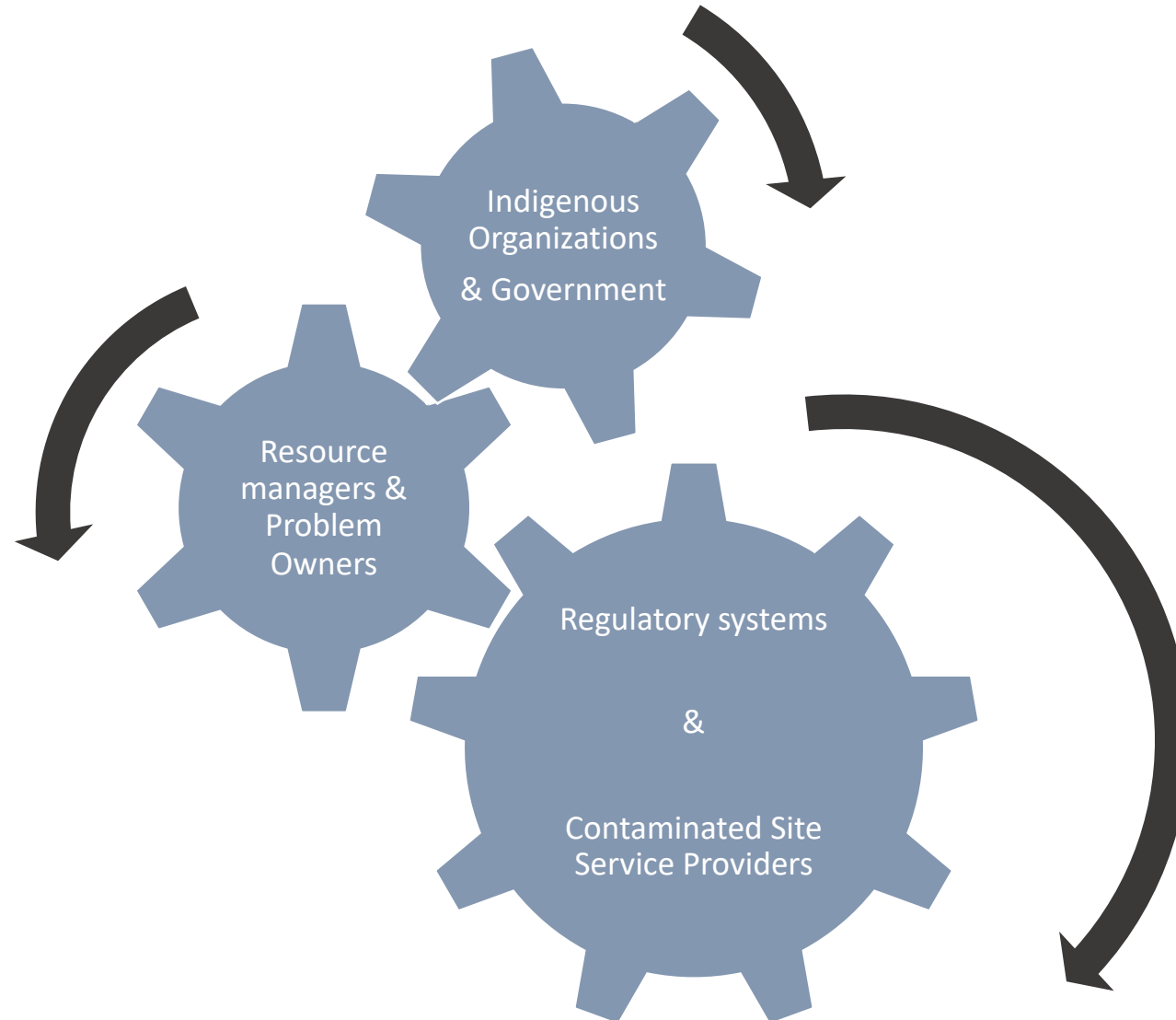
Green Shores for Shoreline Development "Gold" project: New Brighton Park shoreline restoration, Vancouver, BC. (Port of Vancouver).

(Stewardship Centre for BC 2020)



(Klaus and Kiehl 2021)

Responsibilities of Audience



References Cited

- George D. Gann, Tein McDonald, Bethanie Walder, James Aronson, Cara R. Nelson, Justin Jonson, James G. Hallett, Cristina Eisenberg, Manuel R. Guariguata, Junguo Liu, Fangyuan Hua, Cristian Echeverría, Emily Gonzales, Nancy Shaw, Kris Decler, and Kingsley W. Dixon. 2019. International Principles and Standards for the Practice of Ecological Restoration. 2nd Ed. Society for Ecological Restoration. November 2019.
- Golder Associated Ltd. (Golder). 2015. Post-Event Environmental Impact Assessment Report – Key Findings Report. Submitted to Mount Polley Mining Corporation. June 15, 2015.
- Golder Associated Ltd. (Golder). 2016. Post-Event Environmental Impact Assessment Report – Key Findings Report. Submitted to Mount Polley Mining Corporation. Klaus, V.H. and Kiehl, K., 2021. A conceptual framework for urban ecological restoration and rehabilitation. *Basic and Applied Ecology*, 52, pp.82-94.
- LDI. 2021. Mining with the end in mind: Landform design for sustainable mining. Position Paper 2021-01. March 2021. Landform Design Institute. Delta, BC, Canada. 78 pp.
- SNC-Lavelin (SNC). 2022. Preliminary Conceptual Site Models of Potential Contamination Related to the 2021 Atmospheric River Event in BC Hope, Sumas Prairie, Princeton and Merritt. Prepared for Ministry of Environment and Climate Change Strategy. March 30, 2022.
- Stewardship Centre for BC. 2020. Green Shores for Shoreline Development Credits and Ratings Guide. Updated 2020 by Coastal Geologic Services Inc. for the Stewardship Centre for British Columbia.
http://stewardshipcentrebc.ca/PDF_docs/greenshores/Resources/GSSD_PilotEditionApril2020.pdf

Sources of Resource Materials

1. **Landform Design Institute:** <https://www.landformdesign.com/index.html> (and thanks to Derrill Shuttleworth for graphics, slide 18)
2. **International Council on Mining and Metals (ICMM):**
 1. Responsible Mine Closure: https://www.icmm.com/website/publications/pdfs/environmental-stewardship/2021/briefing_responsible-mine-closure.pdf
 2. Integrated Mine Closure <https://www.icmm.com/en-gb/guidance/environmental-stewardship/2019/integrated-mine-closure>
3. **GreenShores:**
http://stewardshipcentrebc.ca/PDF_docs/greenshores/Resources/GSSD_PilotEditionApril2020.pdf
4. **Society for Ecological Restoration:** <https://www.ser.org/>
5. **UN Decade on Ecosystem Restoration:** <https://www.decadeonrestoration.org/>



Thank you

