

MINING AND INTEGRATED WATER MANAGEMENT

SMA Forum, October 20, 2016



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The business of sustainability

Why Water?

World Business Council for
Sustainable Development



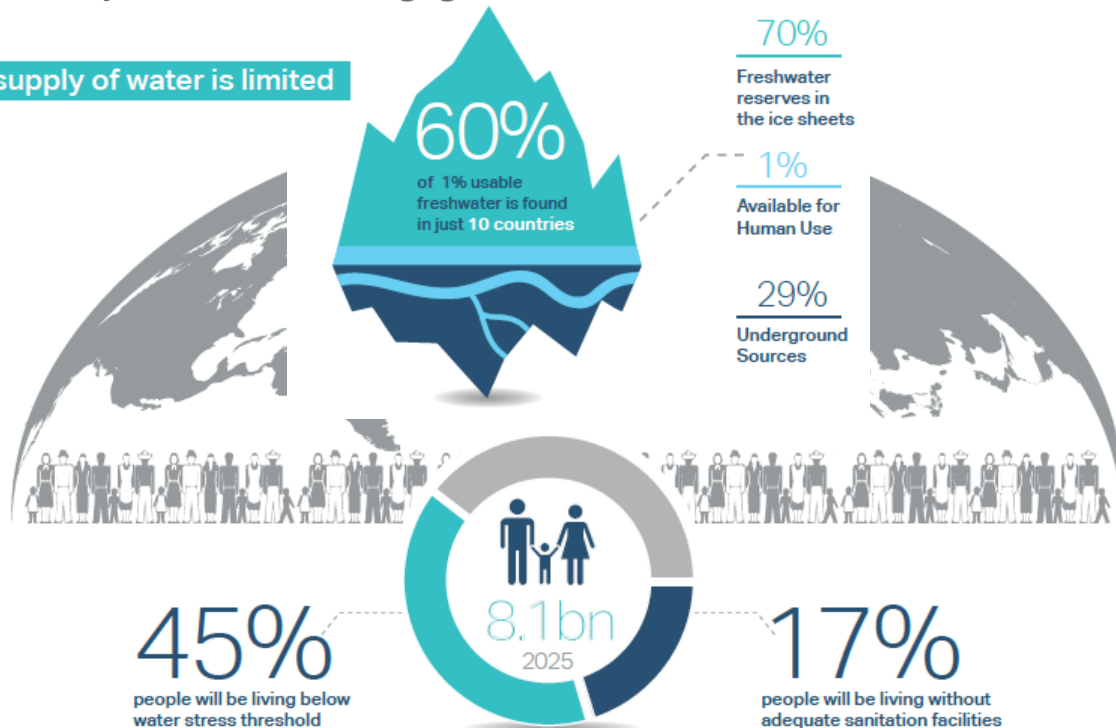
Debate Topic:

“Which is the greater business imperative:
Water or Carbon?”

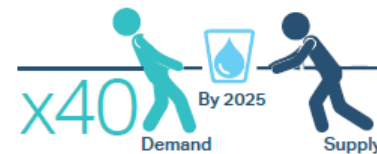
Why Water?

Water is a high priority, cross-cutting global issue for business and society.

The global supply of water is limited



The demand for water is increasing

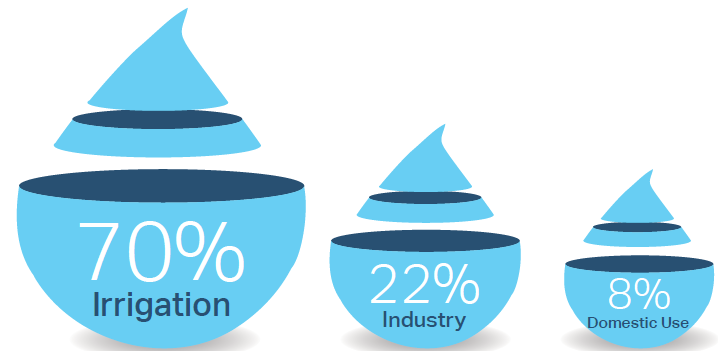


Why Water?

Whereas greenhouse gas emissions generally have the same impact, regardless of where they are emitted (based on CO₂ equivalents)...



...water impacts take place locally. A liter of water used in one location cannot be offset by a liter saved somewhere else.

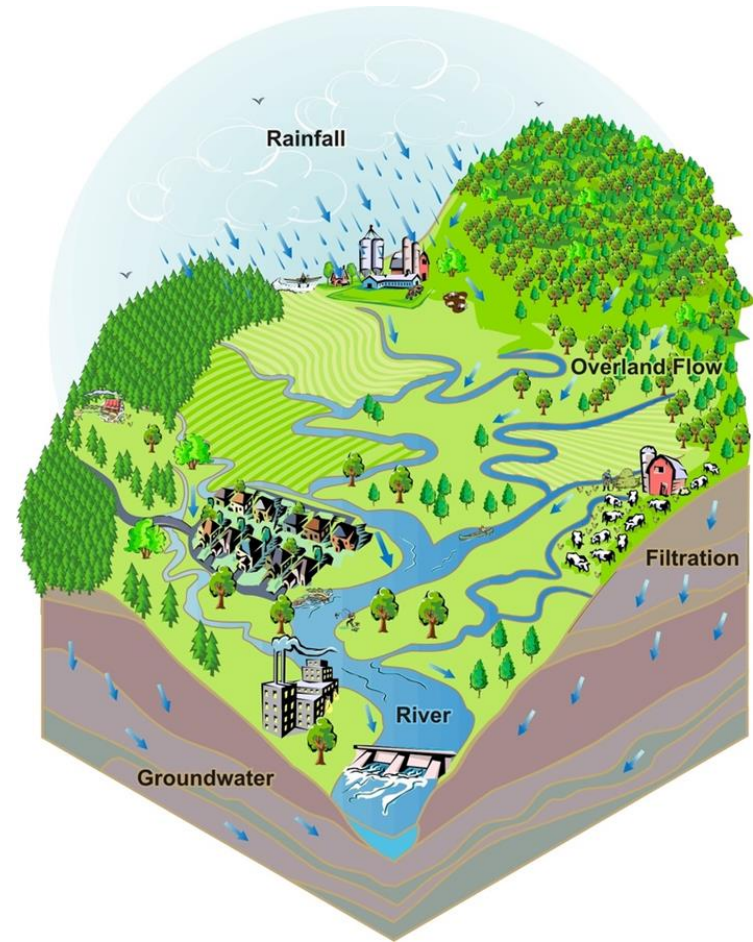


Why Water?

Water impacts are driven from upstream to downstream within a catchment.

A company/site's water risks can depend as much on what happens outside their fence line as what happens within it.

Therefore, water management requires greater context informed by local conditions and stakeholder considerations.



Why Water?

Recent water-related incidents are top of mind...



Presentation Structure

A practical guide to
catchment-based
water management
for the mining and
metals industry



<http://www.icmm.com/publications/pdfs/8329.pdf>

1. Awareness

Catchment activities, processes and regimes – SK context

2. Assessment

Water issues across mining life-cycle

3. Response

Examples of water risk mitigation from recent project work

1. Awareness

Mining projects are generally long-life facilities. Water management structures need to be designed accordingly.

Saskatchewan has Canada's most variable climate, with a high degree of variability between seasons, years, and across decades.



1. Awareness

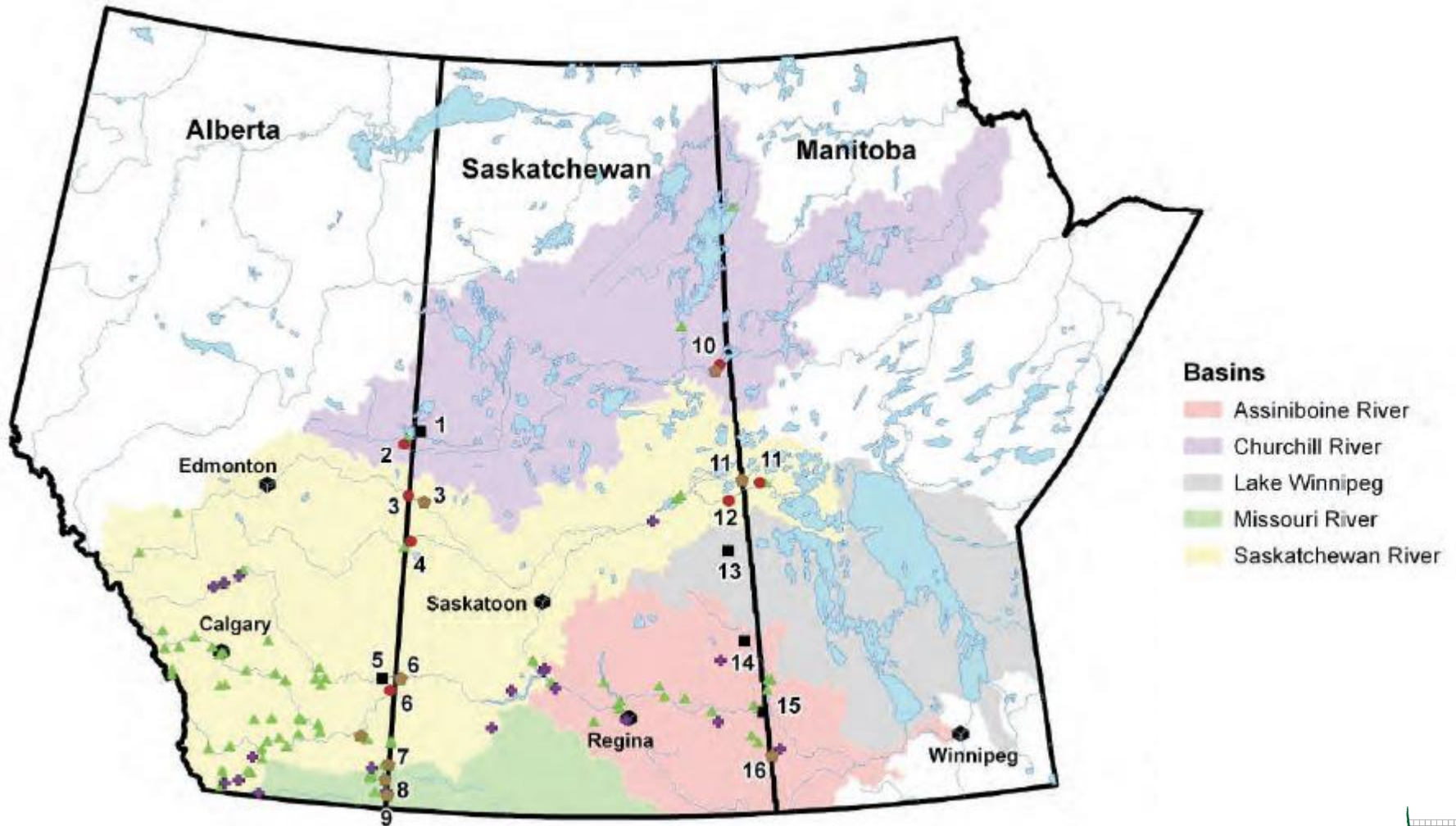
Key impacts of climate change in Saskatchewan are expected to be:

- drier summers;
- shorter, warmer winters;
- higher inter-annual variability in temperature and precipitation, possibly leading to worse and longer droughts or unseasonably wet years;
- increased risk of extreme rainfall events.



1. Awareness

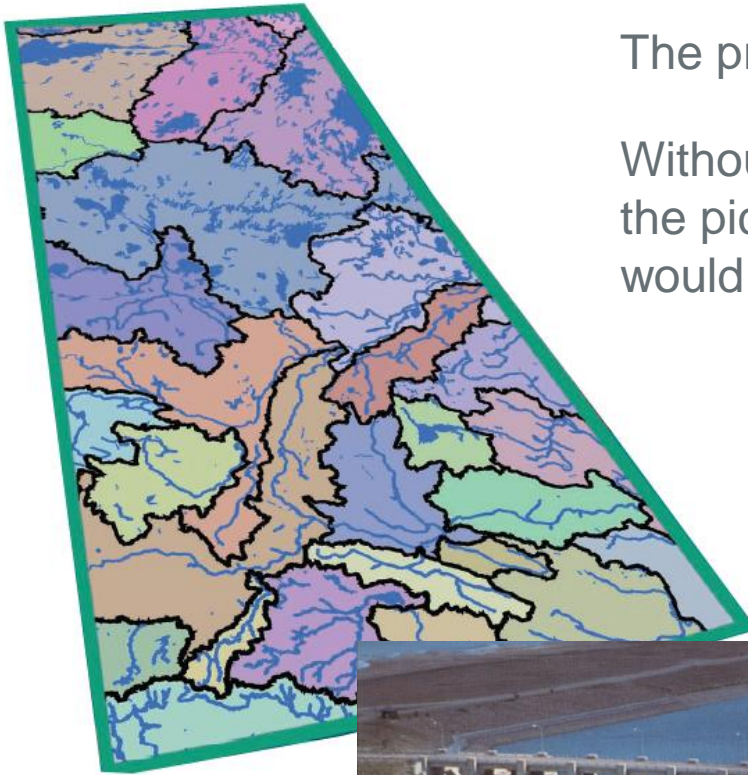
Saskatchewan's water is a shared resource



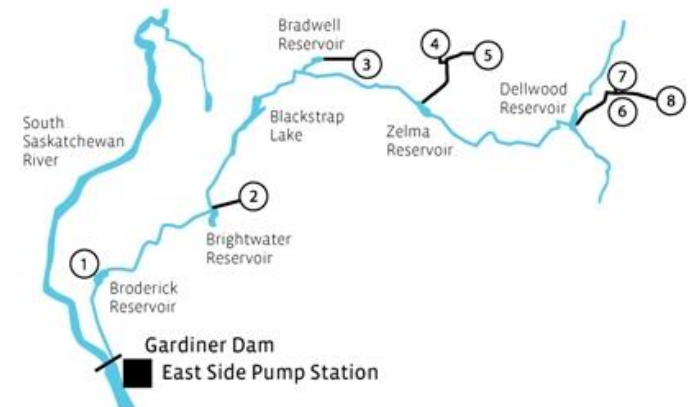
1. Awareness

The province has 29 major watersheds.

Without the existing water distribution network, the picture of water security across the province would be much different.



**Saskatoon Southeast:
Non-Potable Water Supply System**



- | | |
|-------------------------------|----------------|
| 1. Broderick | 5. Viscount |
| 2. Brightwater Pipeline | 6. PCS Lanigan |
| 3. PCS Allan | 7. Guernsey |
| 4. Mosaic Potash Colonsay ULC | 8. Lanigan |

2. Assessment

Common Water Risks for Mining	Mining Life Cycle				
	Concept	Feasibility	Construction	Operations	Closure
Water security in catchment					
Water supply system reliability					
Regulatory compliance					
Flooding					
Impact on receiving environment WQ					
Impacts from overlapping land uses					
Community concern					
Increasing cost of water					

2. Assessment

Case Study: Zelma East Expansion Project

- Initial goal = secure and reliable year-round water delivery of up to 7 Mm³ to BHP Billiton's Jansen Potash Project (70 year mine life)
- Water supply study completed by WSA
 - Confirmed system-wide water availability
 - Confirmed Zelma Reservoir as best source
 - Identified bottle-necks in canal system; winter supply limitations; and changes in reservoir water levels
- SaskWater engaged Engineering-Environment-Lands team to support design and construction of new system



2. Assessment

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2. Assessment

ERM recently conducted a strategic water management review for one of our global mining clients.

We reviewed incidents recorded in their incident management system from the past 5 years across multiple sites, and identified the following key findings:

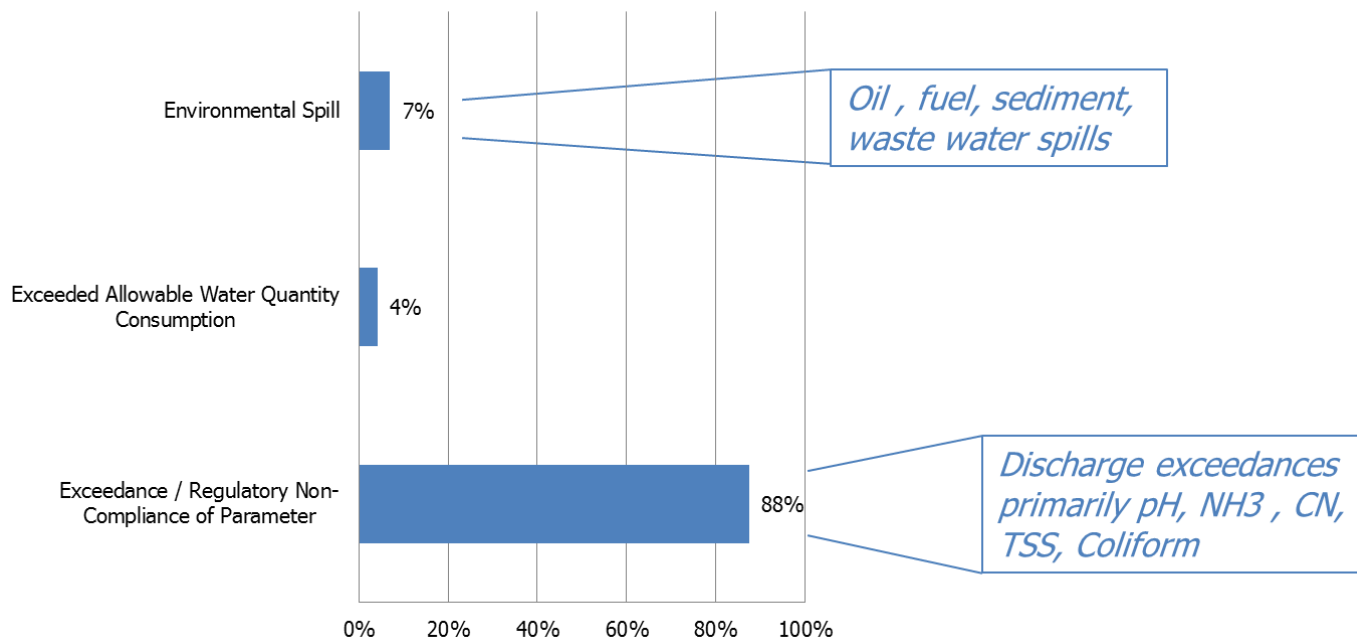
1. 65% of all reported incidents were water-related.

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2. Incidents by type were primarily WQ exceedances.

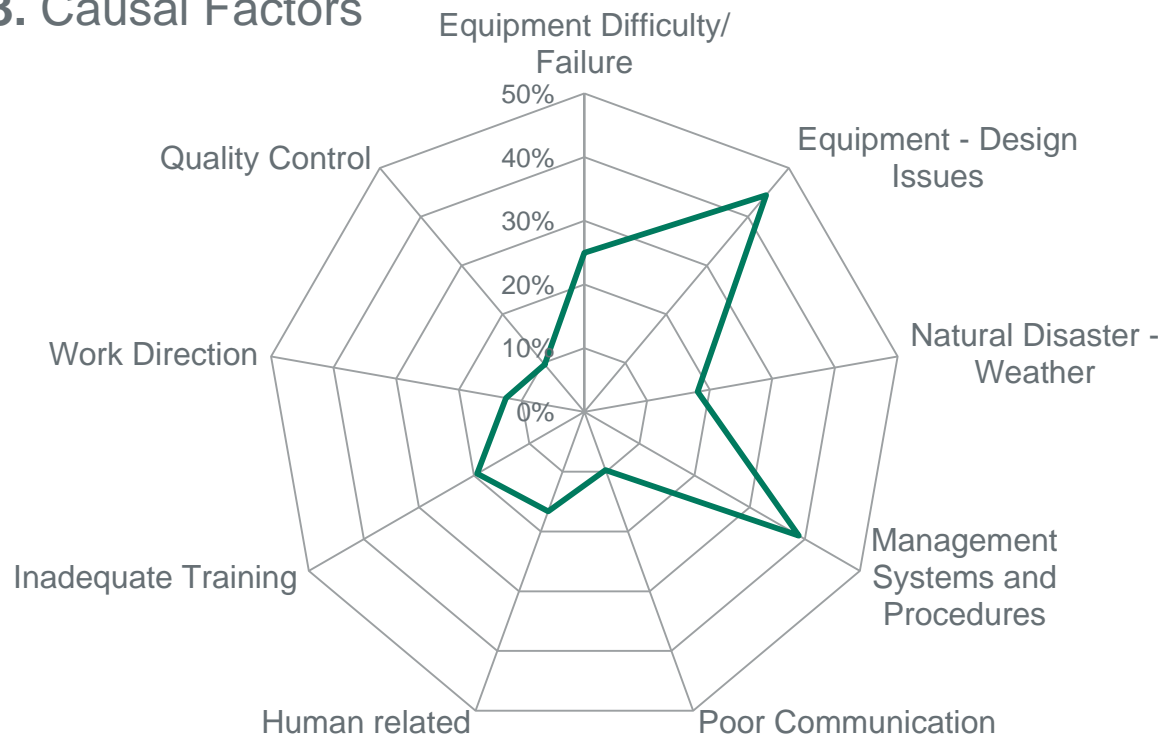


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3. Causal Factors

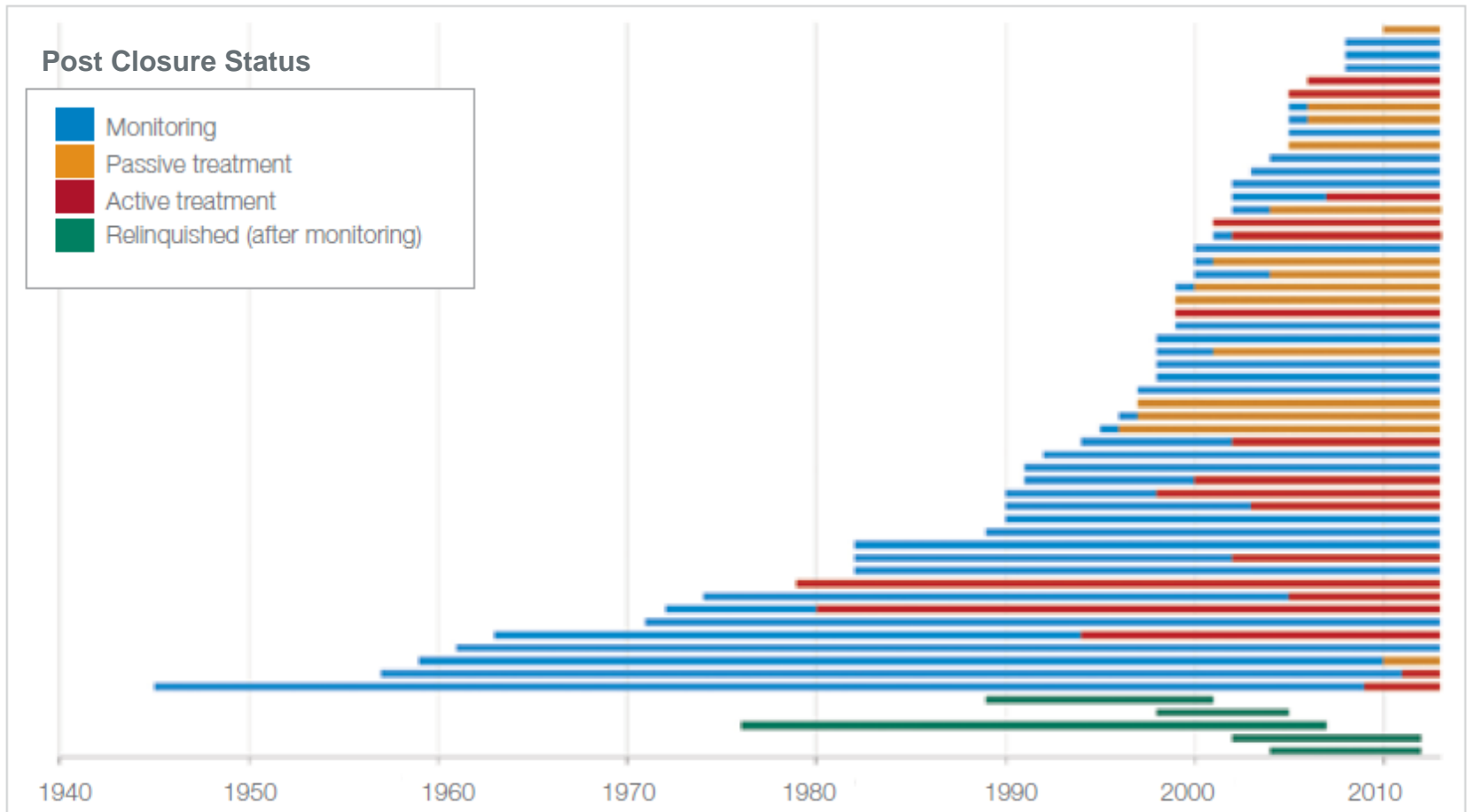


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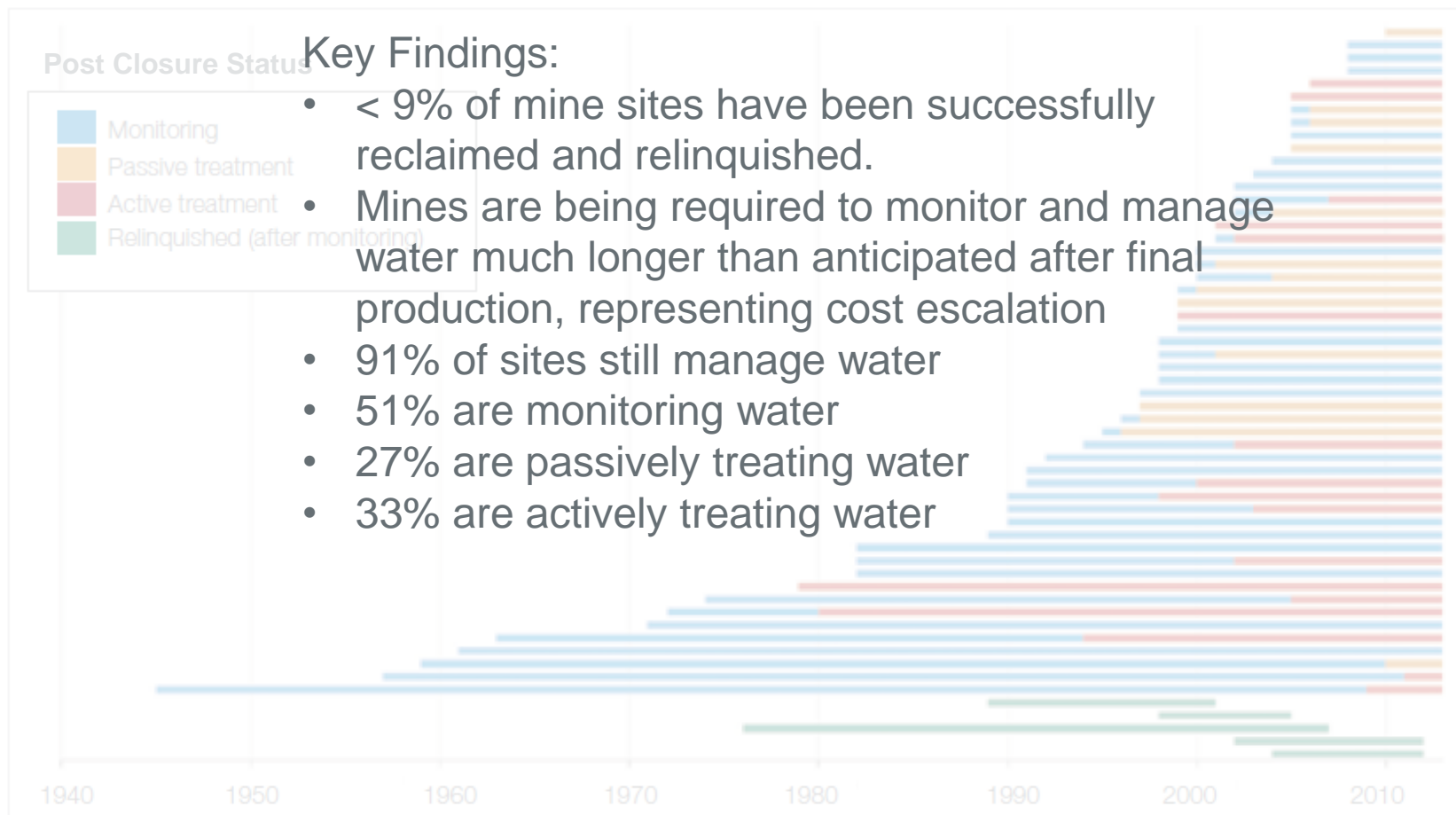
2. Assessment

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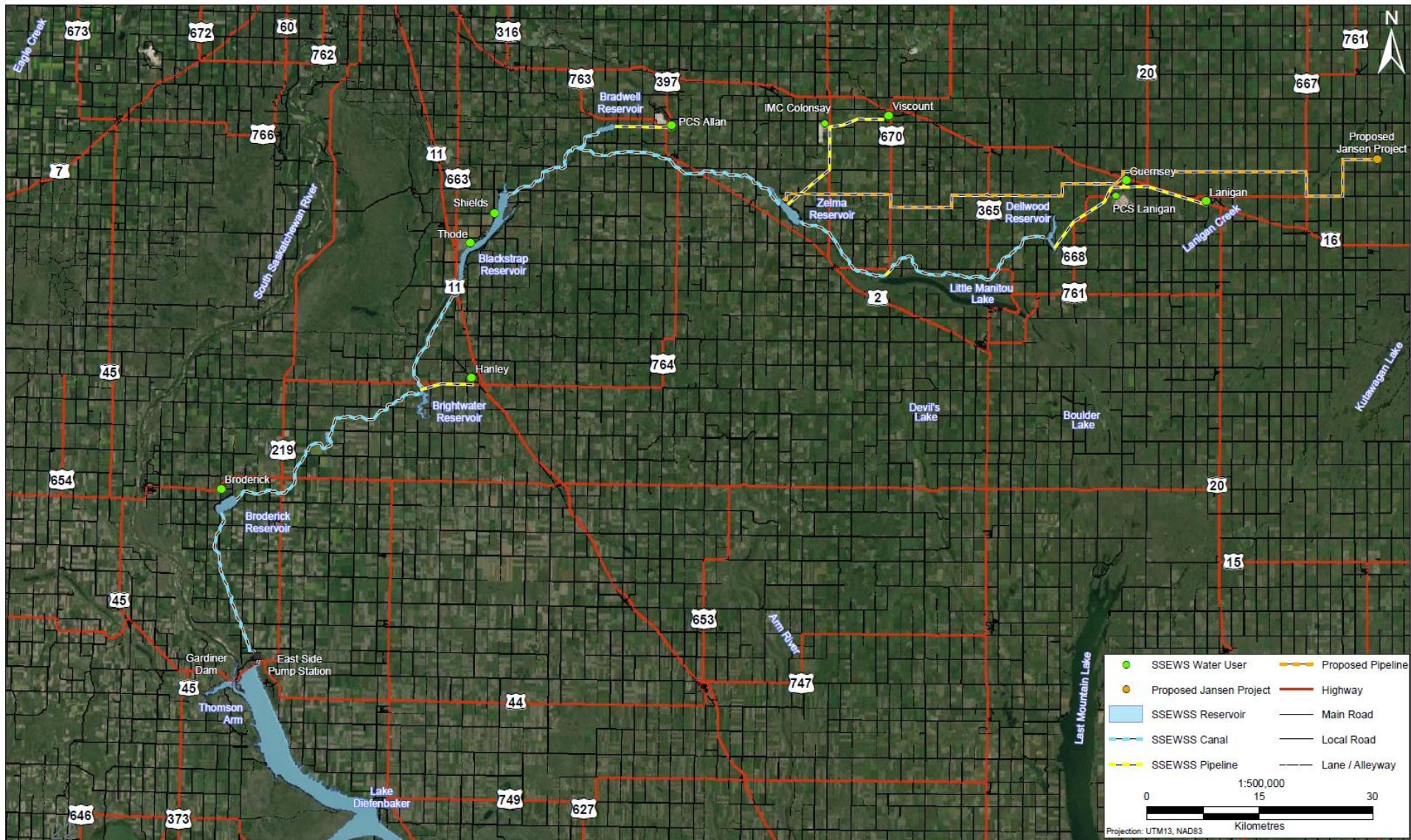


3. Response

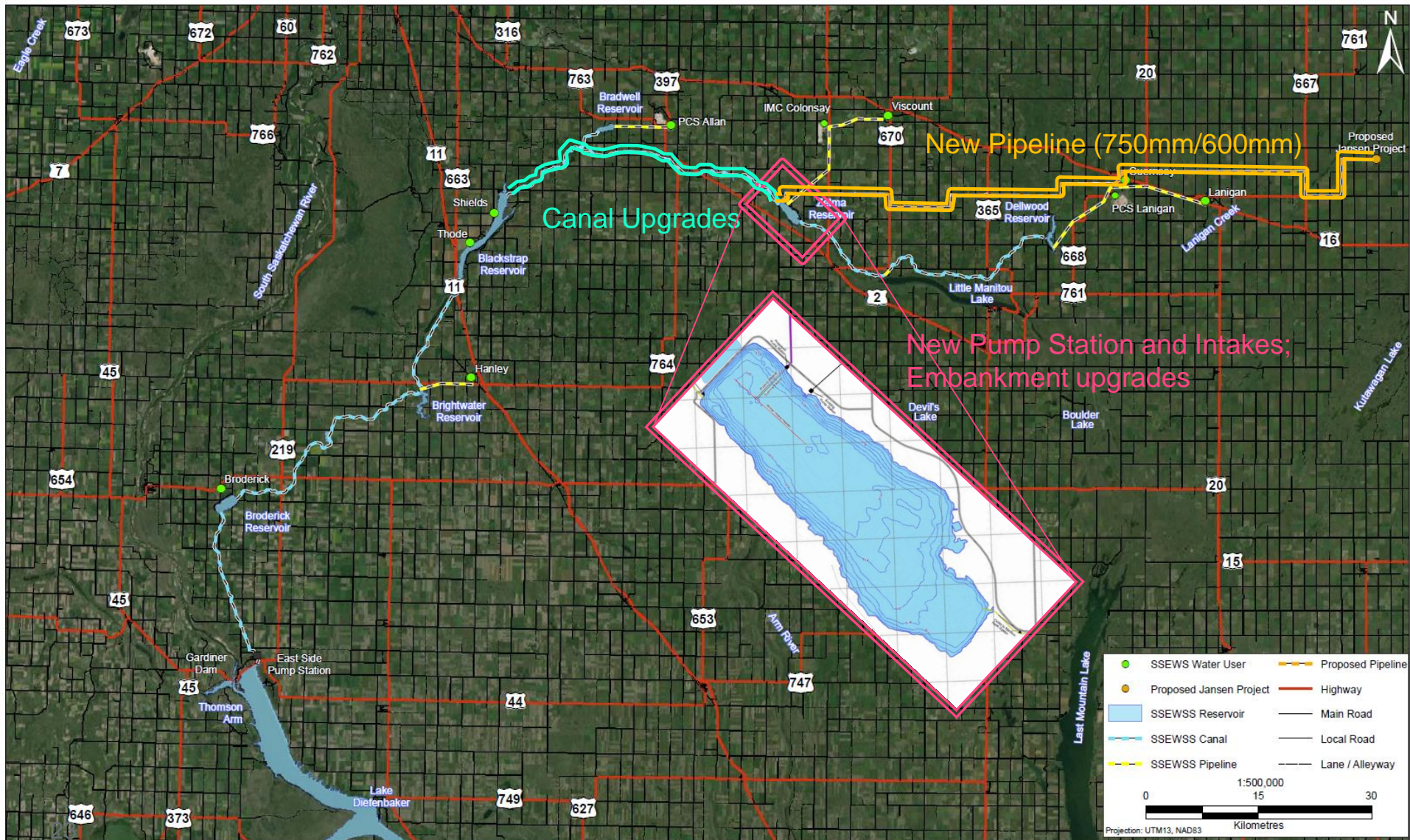
Case Study: Zelma East Expansion Project

- The initial need:
 - Secure and reliable year-round water delivery of up to 7 Mm³ to the Jansen Potash Project (70 year mine life)
- The net result:
 - An overall improved water delivery system, not just for Jansen Project, but for existing/new users on the system, that include:
 - Irrigation/agriculture
 - Industrial
 - Municipal
 - Recreation
 - Conservation

3. Response



3. Response



3. Response

Case Study: Zelma East Expansion Project

- The context:
 - This system has been fully constructed and commissioned prior to a final investment decision on the Jansen Potash Project – highlighting the business imperative of water security

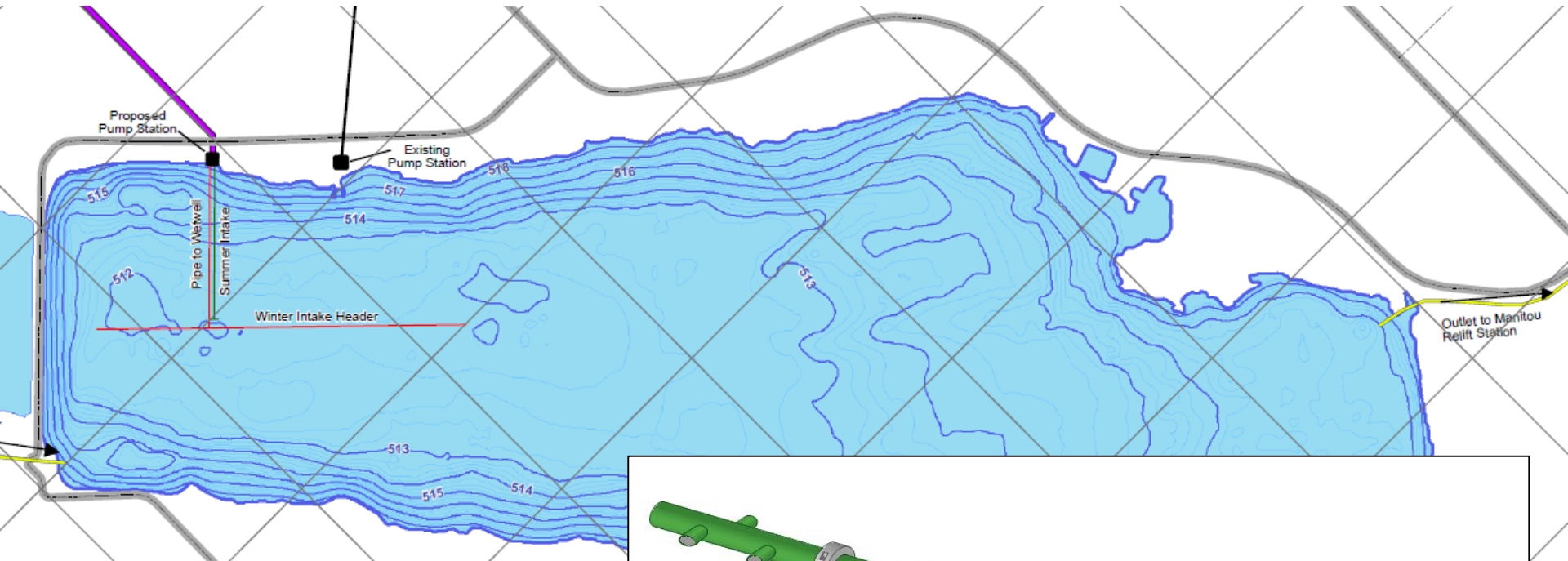
3. Response

Case Study: Zelma East Expansion Project

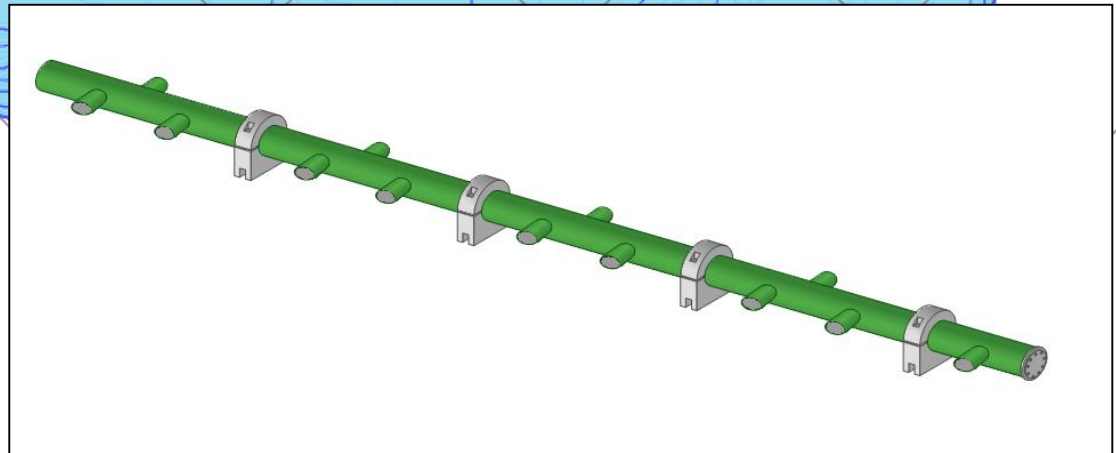
- Some important aspects of catchment-scale water management that have been successfully integrated into the Project:
 - Adjustments to canal operation schedule to manage storage capacity through winter
 - Intake design at Zelma Reservoir
 - Fish screens at Blackstrap and Zelma outlets
 - Upgrades to Zelma embankments
 - Pipeline routing (avoidance)
 - Construction phase management of wetlands
 - Tie-ins for potential future users

3. Response

'Winter' intake design at Zelma Reservoir



to preferentially draw water with low dissolved oxygen in deepest part of reservoir, and leave water with higher dissolved oxygen for overwintering fish



3. Response

'Winter' intake design at Zelma Reservoir



3. Response

‘Winter’ intake design at Zelma Reservoir



3. Response

Case Study: Zelma East Expansion Project

- Constructed through 39 permanent wetlands under frozen conditions (avoided many others)

BEFORE



3. Response

Case Study: Zelma East Expansion Project

- Constructed through 39 permanent wetlands under frozen conditions (avoided many others)

**POST
INSTALLATION**



3. Response

Case Study: Zelma East Expansion Project

- Constructed through 39 permanent wetlands under frozen conditions (avoided many others)

**NEXT GROWING
SEASON**



3. Response

Case Study: Zelma East Expansion Project

- Reservoir inlet replacement and embankment upgrades



Closing

1. Awareness

Water security and water risk are globally important topics, and business drivers for all mining companies. However, water must be managed at the regional or catchment scale – and in our case, must address the SK hydrologic setting.

2. Assessment

Water risks are present throughout the mining life-cycle. Site-level experience shows that the majority of environmental incidents are water related. Equipment design needs to account for natural variability; and vigilance is needed in terms implementing management systems.

3. Response

The Zelma East Project highlights some good examples of the implementation of catchment-scale water management. This project has resulted not only in benefit for the Jansen Potash Project (establishing a secure and reliable water supply), but in an upgraded water delivery system for users across the region.

Acknowledgements

Thank you for the opportunity to present today.

The contents of this presentation reflect my perspectives on this broad topic of water management and mining. However, the project-specific information is compiled from the work of a much larger team.

In particular, I am proud to have been part of the Zelma East Project's Engineering-Environment-Lands (EEL) team, consisting of representatives from SaskWater, AECOM, AMEC, Watson Land, and ERM, who have stewarded the Project from concept through commissioning.