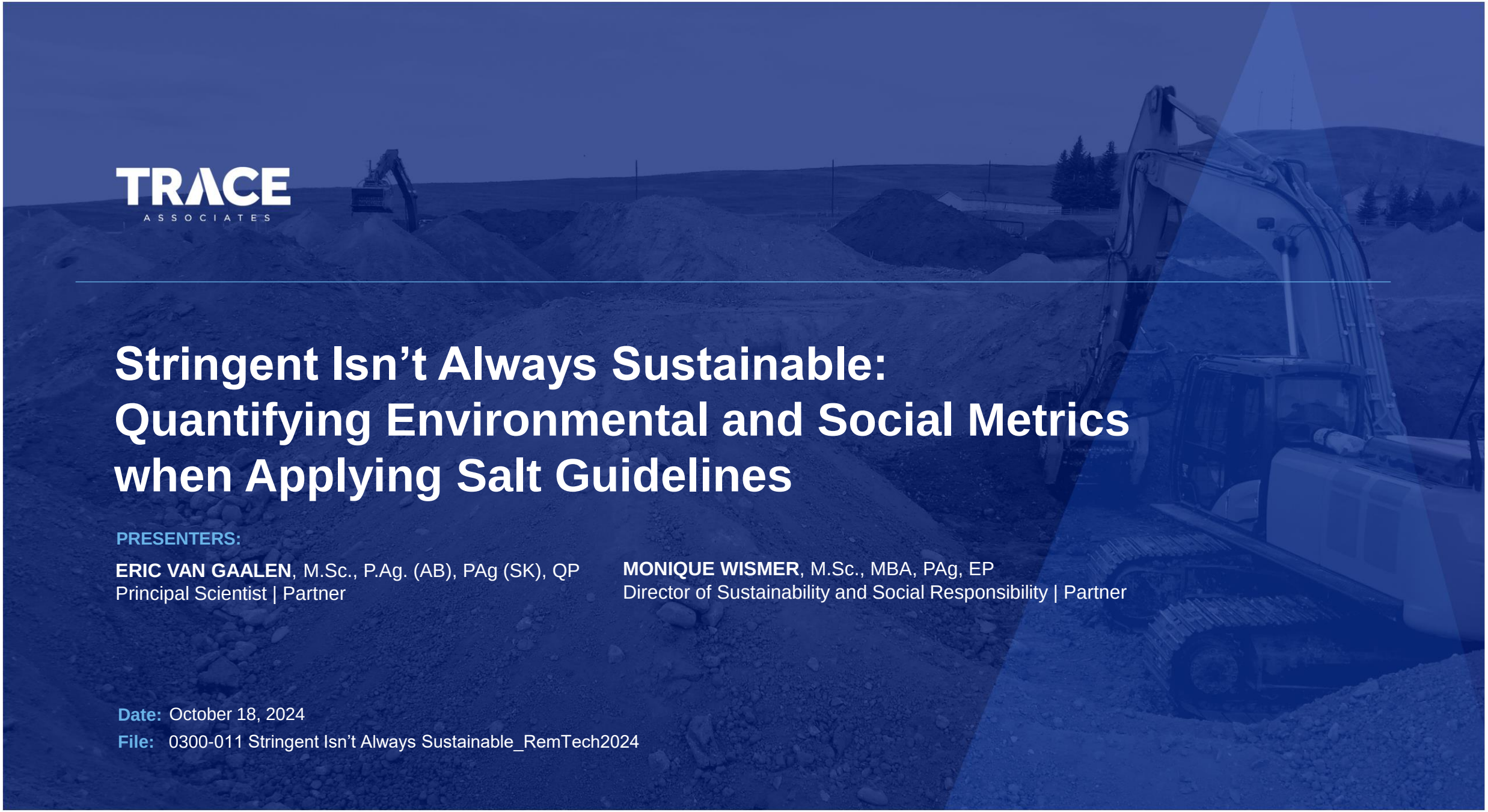

Stringent Isn’t Always Sustainable: Quantifying Environmental and Social Metrics when Applying Salt Guidelines

PRESENTERS:

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Director of Sustainability and Social Responsibility | Partner

Date: October 18, 2024

File: 0300-011 Stringent Isn’t Always Sustainable_RemTech2024

Land Acknowledgement

In the spirit of reconciliation, Trace respectfully acknowledges the Town of Banff is located on traditional Treaty 7 territory.

These lands continue to be the gathering place for the Blackfoot Confederacy which is comprised of Siksika, Piikani, and Kainai. Treaty 7 also includes the Tsuut'ina First Nation and the Îyârhe Nakoda First Nations Bearspaw, Chiniki and Good Stoney First Nations. We also respectfully acknowledge the Métis people of Alberta as well as the unceded territory of the Ktunaxa and Secwépemc First Nations.

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Agenda

1. Introductions
2. The Challenge: Salt-affected Sites
3. Case Studies
4. Conclusions

Introductions

ERIC VAN GAALEN
M.Sc., P.Ag. (AB, SK)

MONIQUE WISMER
M.Sc., MBA, PAg, EP

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SUSTAINABILITY

Project Summary

traceassociates.ca/sustainability

Soil Avoiding Landfill

Avoided Travel

Reduced Fuel Consumption

Avoided Emissions

Cost Savings

Prevented Land Use Loss

Reduced Risk to Native Wildlife

PROJECT SUSTAINABILITY SUMMARY

9,972 m^3
Soil Avoiding Landfill

383,866 km
Avoided Travel

146,700 L
Reduced Fuel Consumption

397 tonnes CO_2 equivalent
Avoided GHG Emissions

2,380 trees
Planting Equivalent

$1,994,400
Cost Savings

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400-705-08| January 4, 2024
traceassociates.ca/sustainability

Dig at all? If so, how much is best?

- Realistic protection of receptors balanced with lowest possible footprints
- Tier 1+ initial Tier 2 = prohibitive outcome
- Refined Tier 2 Closure (Vol. <10x)
- Appropriate guidelines unlock remedial options

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The Challenge:
Salt-affected Sites

The Challenge: Salt-affected Sites

Pathways - Receptors

- Root Zone - Vegetation
- Groundwater
  - Discharge to Freshwater Aquatic Life
  - Potable Water Aquifer
  - Irrigation
  - Livestock

Assessment Considerations

- Tier 1: site-specific, regional
- Logic-based (MEJ, SSRA)
- Similar jurisdiction rationale
- SK PNG045 Guidelines
- Tier 2 (AB&SK) and 3 (SK):
  - Landuse Pathway Exclusion (DUA, RZ)
  - FCSAP proximity adjustment factors
  - Native Prairie Protocol
  - Dilution Factors
  - Subsoil Salinity Tool
- Modelling
- Remote sensing + Ground truth
- RA-DSA
- Etc…

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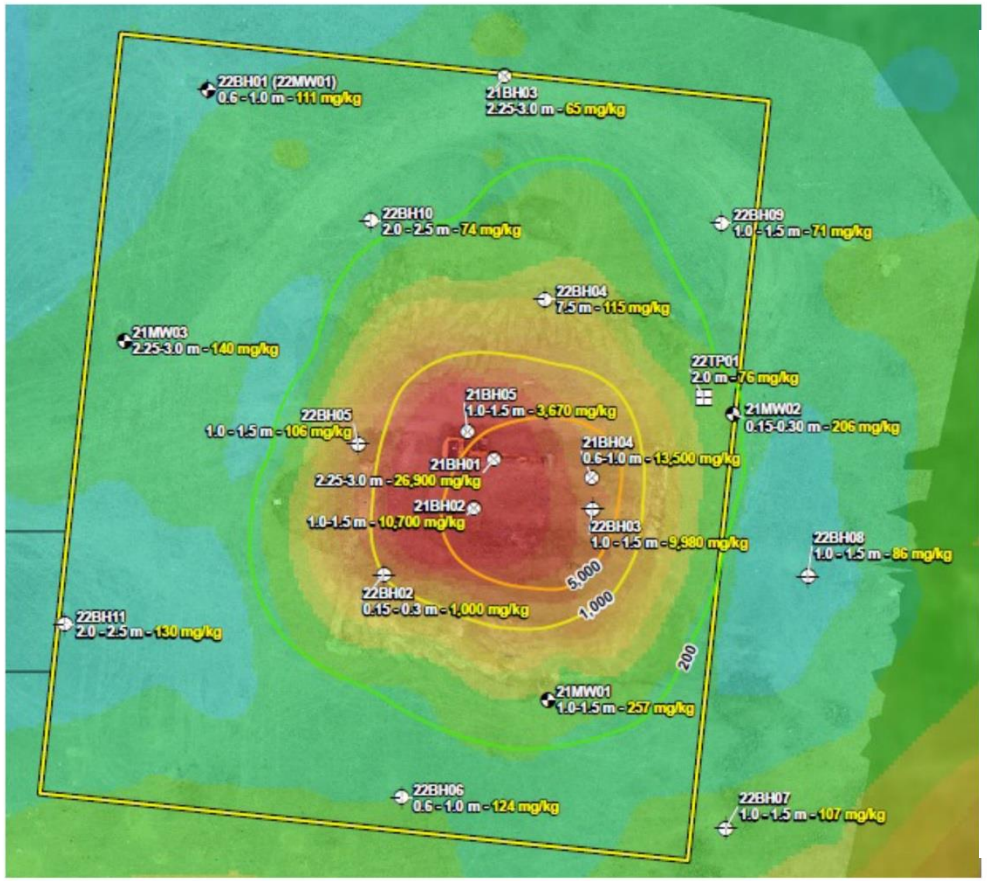
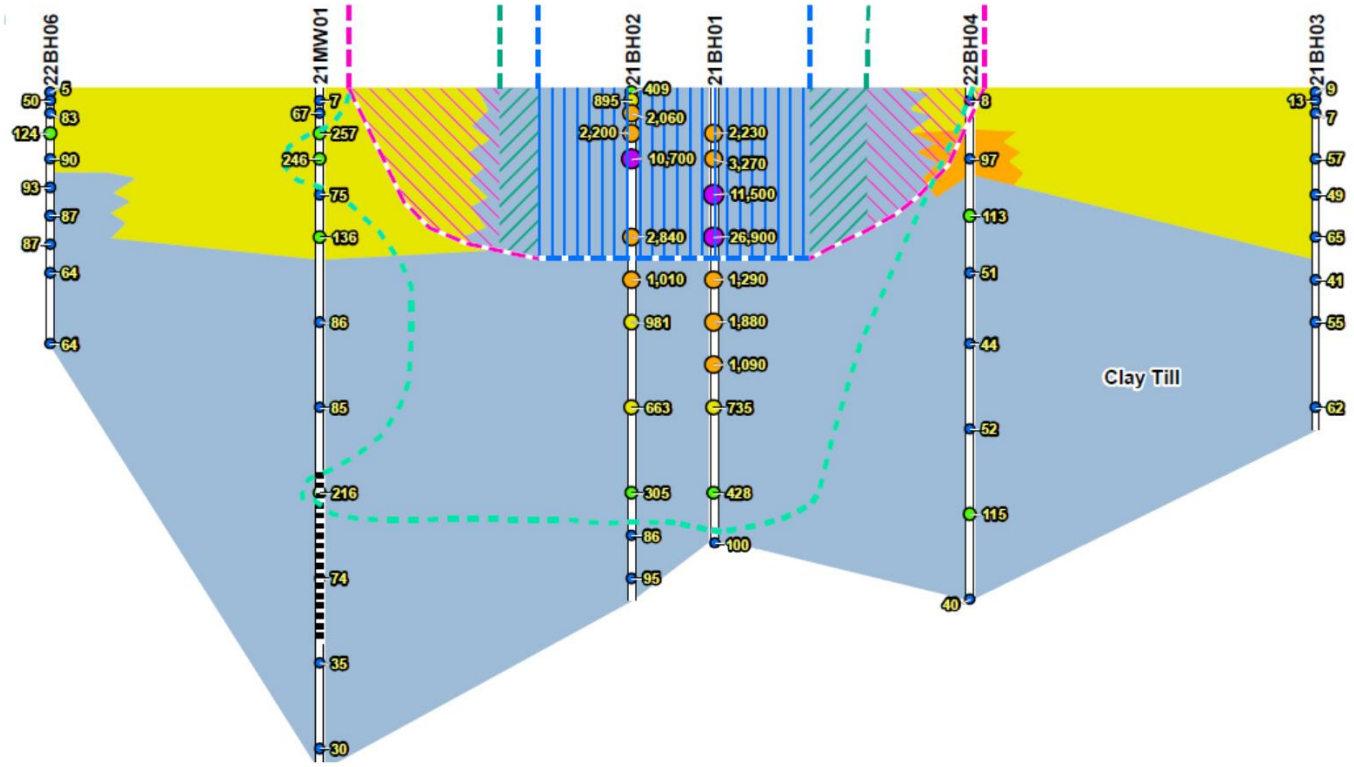
Case Study 1

Case Study 1





Source: Trace Associates Inc.

Case Study 1

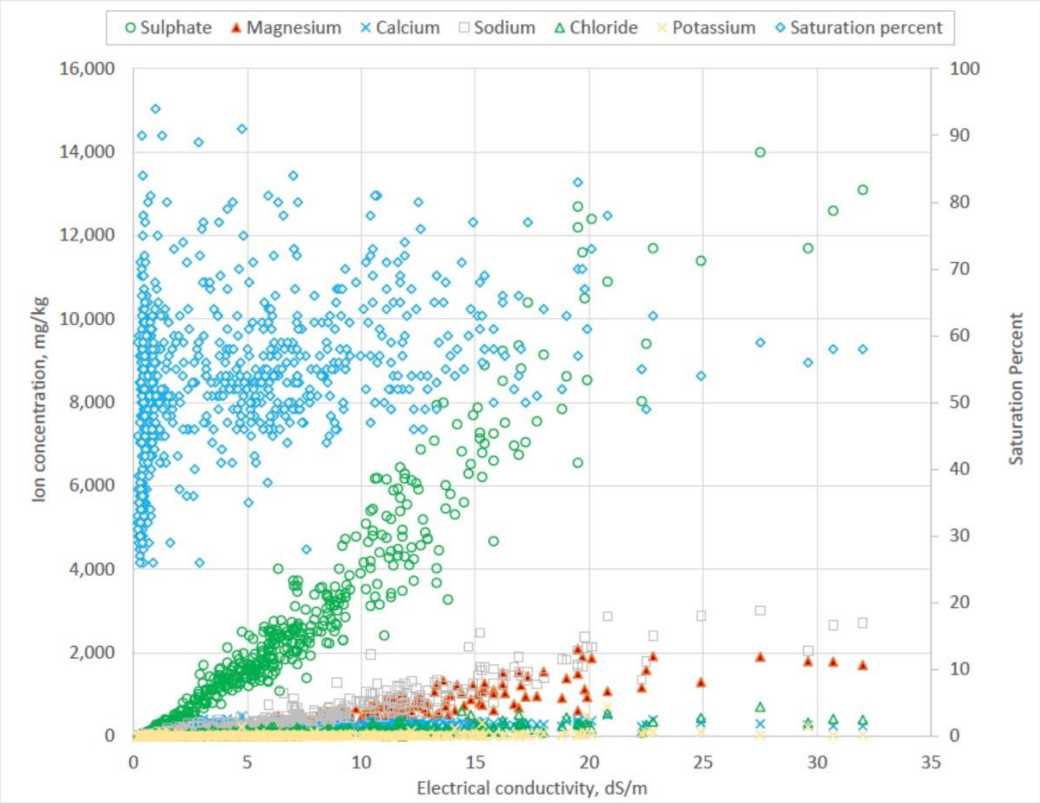


Chart A: Background control soil ion concentrations (and percent saturation) relative to EC (n = 726).
Notes: dS/m = deci Siemens per metre
mg/kg = milligrams per kilogram

Source: Trace Associates Inc.

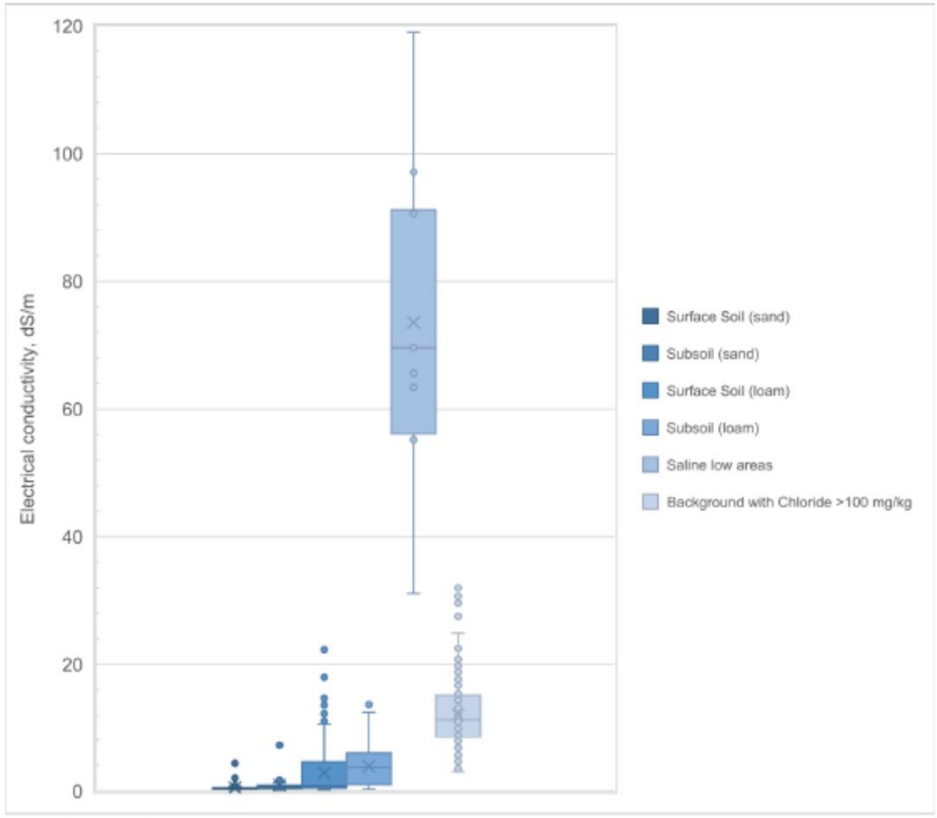


Chart D: EC descriptive statistics (i.e., range, quartiles, mean, and quartile outliers) from soil samples collected from background control soils. Surface soil (sand) n = 44, subsoil (sand) n = 25, surface soil (loam) n = 311, subsoil (loam) n = 207.

Source: Trace Associates Inc.

Case Study 1

Soil Avoiding Landfill

14,300 m³

Avoided Travel

600,000 km

$$\boldsymbol{Soil\ Avoiding\ Landfill} = \boldsymbol{Stringent\ Scenario_{Volume} - Project\ Scenario_{Volume}}$$

$$\boldsymbol{Avoided\ Travel} = \boldsymbol{Stringent\ Scenario_{Mileage} - Project\ Scenario_{Mileage}}$$

Where:

$$Stringent\ Scenario_{Mileage} = \sum^{n}(Project_{Consultant\ Mileage} + Project_{Subcontractor\ Mileage} + Project_{Trucking\ Landfill\ Mileage} + Project_{Trucking\ Fill\ Mileage})$$

$$Project\ Scenario_{Mileage} = \sum^{n}(Project_{Consultant\ Mileage} + Project_{Subcontractor\ Mileage} + Project_{Trucking\ Landfill\ Mileage} + Project_{Trucking\ Fill\ Mileage})$$

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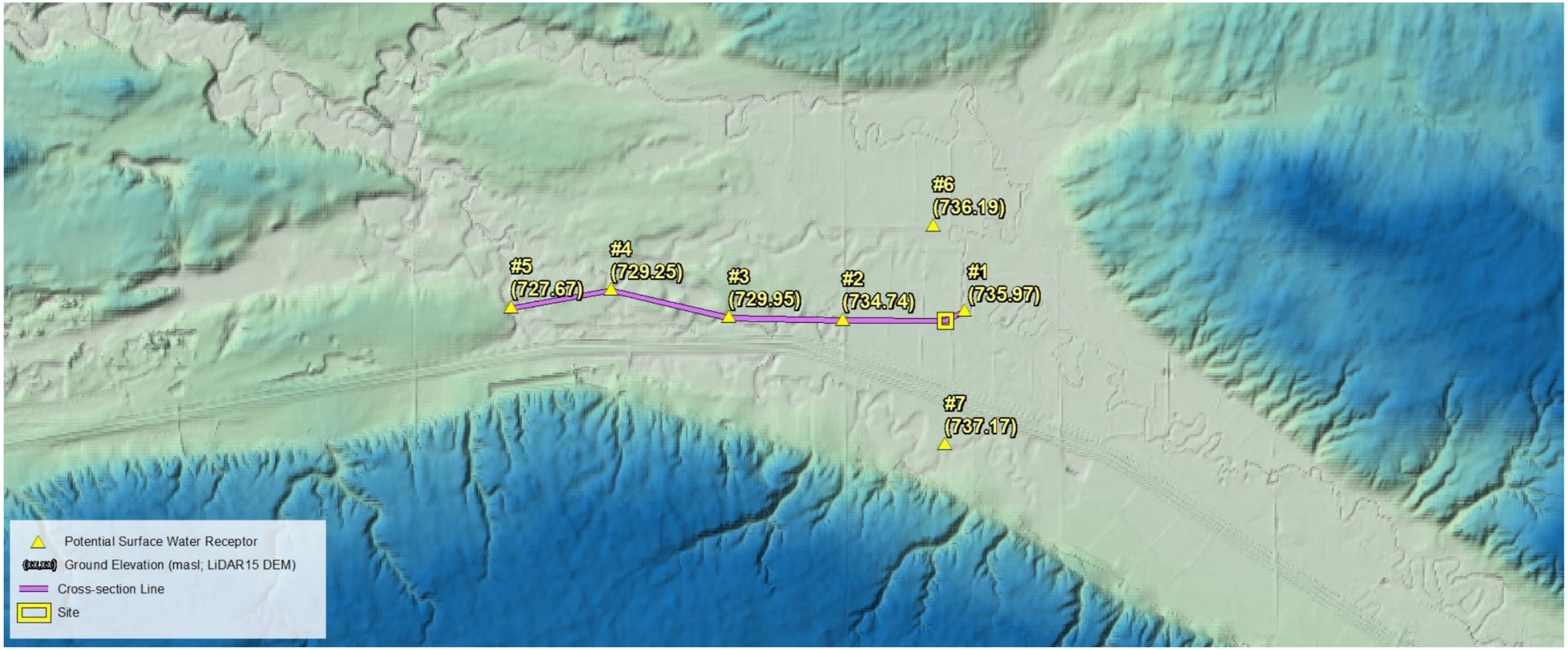
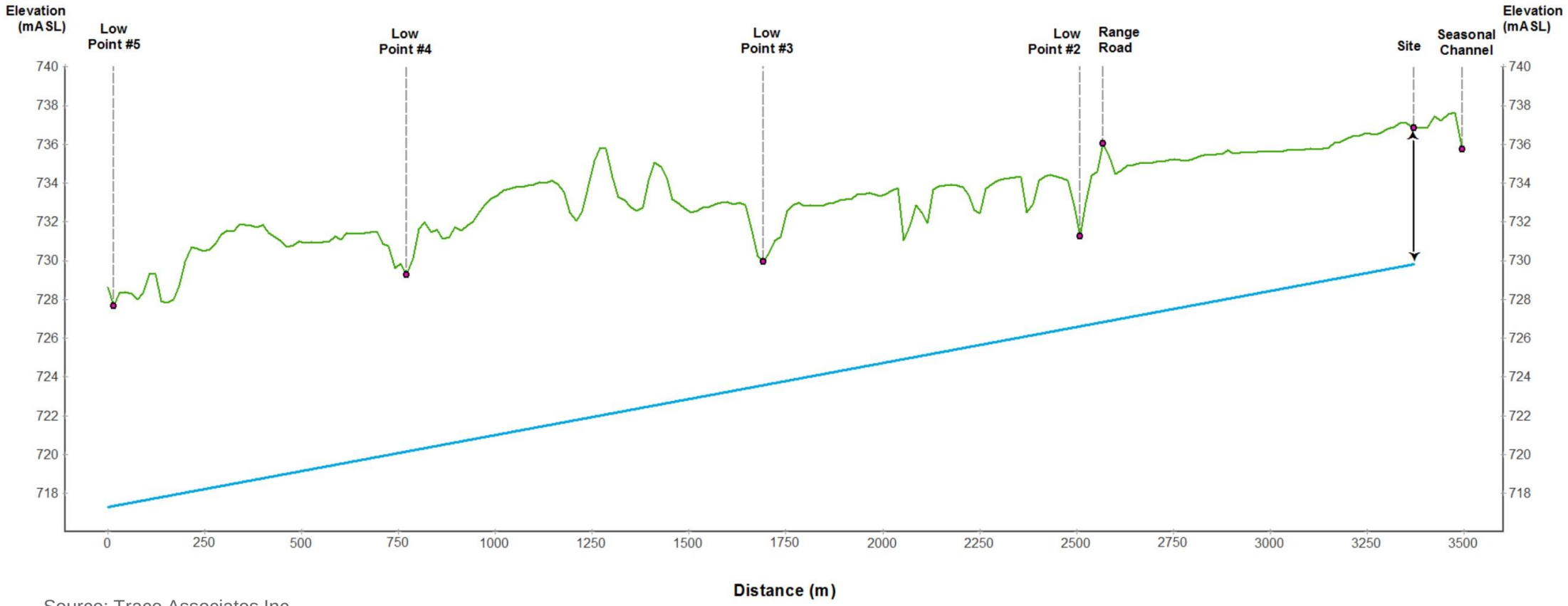
Case Study 2

Case Study 2



Data Source: Altalis LiDAR15 DEM. Image processed by Trace Associates Inc., i.e., Relative Elevation Model blended with DEM Hillshade

Case Study 2



Source: Trace Associates Inc.

Case Study 2

Reduced Fuel Consumption

34,950 L

Avoided Emissions

94 tonnes

$$\boldsymbol{Avoided\ Emissions} = \boldsymbol{Stringent\ Scenario_{Emissions} - Project\ Scenario_{Emissions}}$$

Where:

$$Stringent\ Scenario_{Emissions} = \sum Project_{Total\ Mileage} * Project_{Fuel\ Use} * Emissions\ Factor_x * Global\ Warming\ Potential_x$$

$$Project\ Scenario_{Emissions} = \sum Project_{Total\ Mileage} * Project_{Fuel\ Use} * Emissions\ Factor_x * Global\ Warming\ Potential_x$$

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Case Study 3

Case Study 3

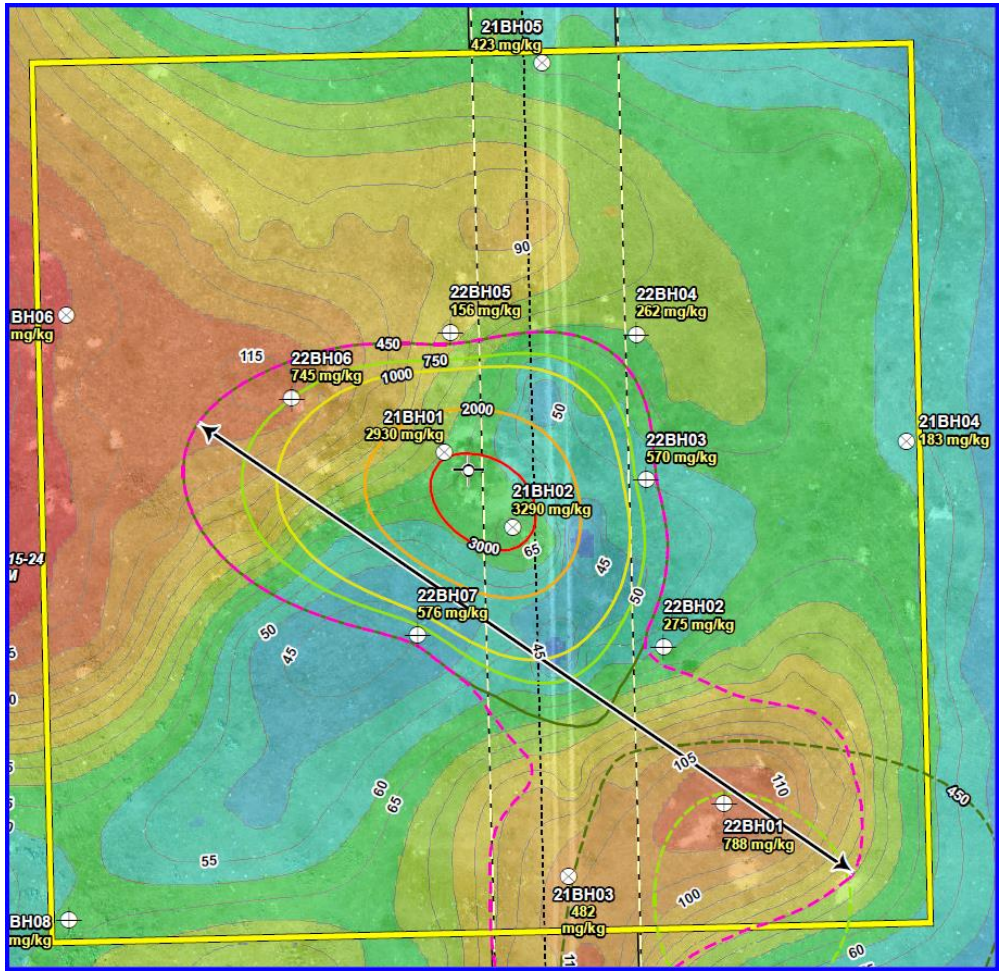
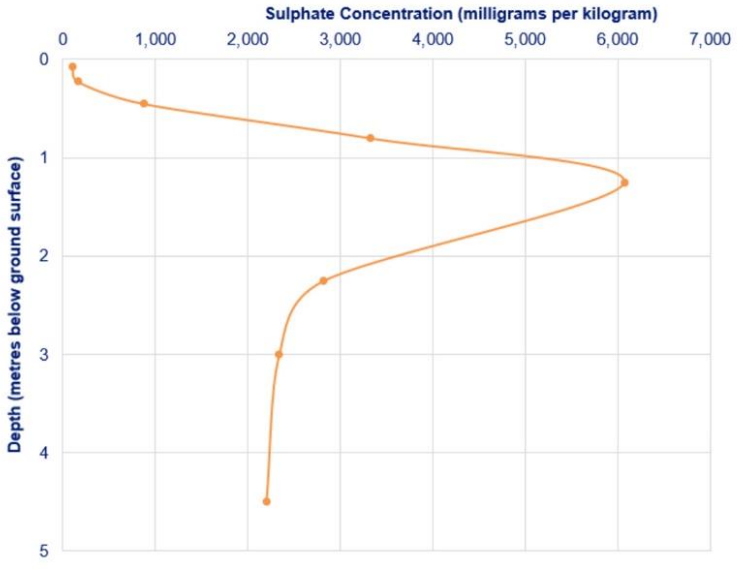
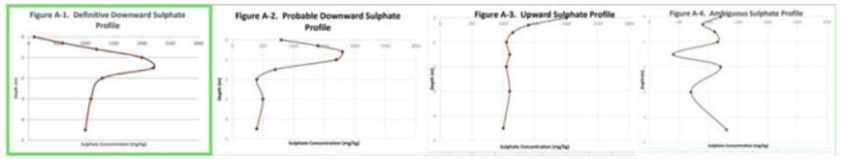


Chart G7: Soil Sulphate Profile for Borehole 22BH##



Comparison to possible outcomes from the Native Prairie Protocol (AEP, 2019)



Profile Interpretation using the Native Prairie Protocol (NPP)

Borehole ID	Test A	Test B	Test C	Outcome – Salt Movement Direction
22BH##	Pass	Pass	Pass	Definitive Downward

Source: Trace Associates Inc.
Subset Graphics: Alberta Environment and Parks, 2019

Case Study 3

Prevented Land Use Loss

8,000 m²

$$Prevented\ Land\ Use\ Loss = Stringent\ Scenario_{Footprint} - Project\ Scenario_{Footprint}$$

Source: Trace Associates Inc.

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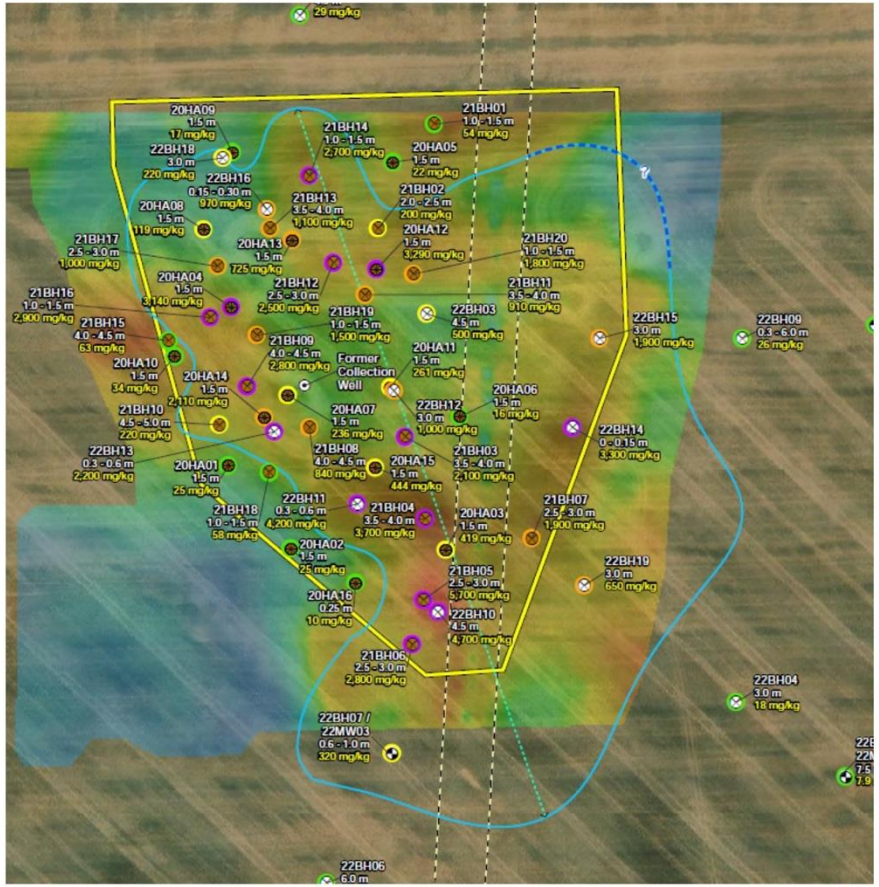
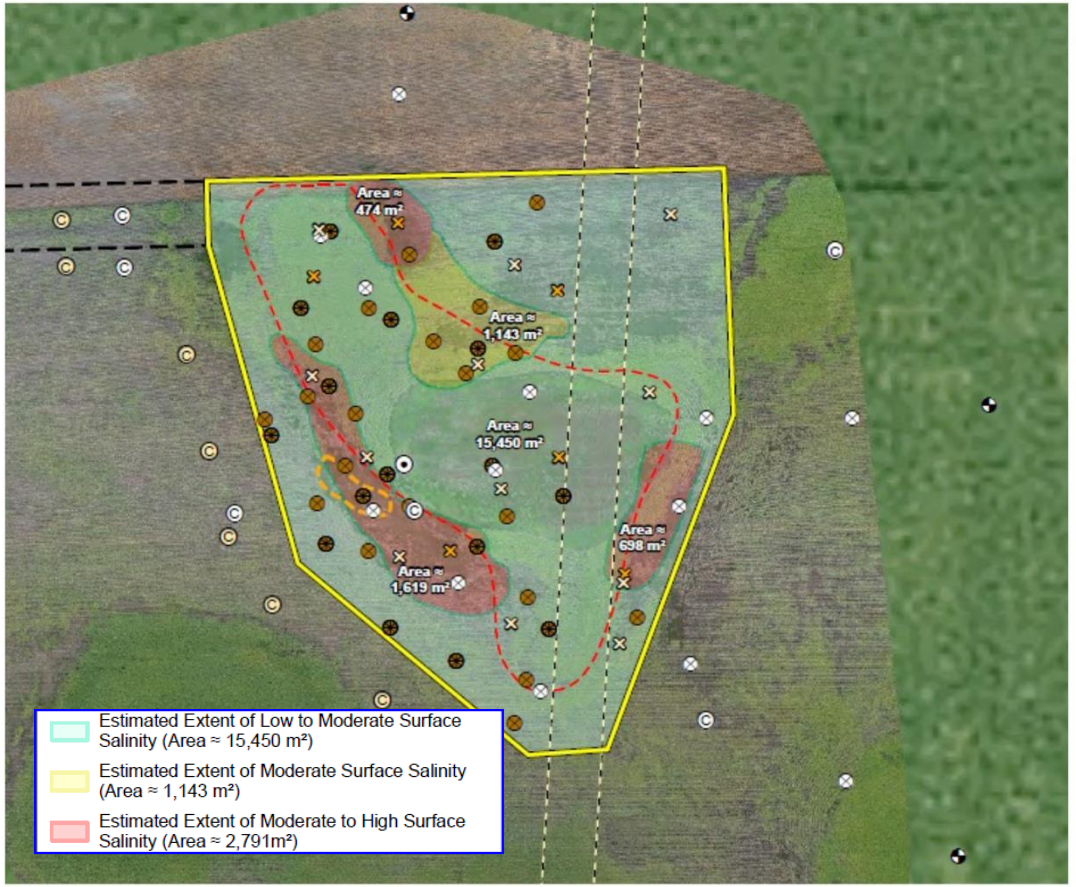
Case Study 4

Case Study 4



Base Imagery Source: Trace Associates Inc. (EM31 Conductivity)
Vivid Maxar Source: ESRI World Imagery, 2021



Base Imagery Source: Trace Associates Inc. Unmanned Aerial Vehicle
Air Photo Source: AbaData 2020

Case Study 4

Cost Savings

~$12M

$$\boldsymbol{Cost\ Savings} = \boldsymbol{Stringent\ Scenario}_{\boldsymbol{Remediation\ Cost}} - \boldsymbol{Project\ Scenario}_{\boldsymbol{Remediation\ Cost}}$$

Where:

$$Stringent\ Scenario_{Remediation\ Cost} = Project_{Assessments} + Project_{Line\ Locates} + Project_{Hydrovac} + Project_{Excavating} + Project_{Soil\ Analysis} + Project_{Trucking} + Project_{Tipping\ Fees} + Project_{Fill} + Project_{Compaction} + Project_{On\ site\ Supervision}$$

$$Project\ Scenario_{Remediation\ Cost} = Project_{Assessments} + Project_{Line\ Locates} + Project_{Hydrovac} + Project_{Excavating} + Project_{Soil\ Analysis} + Project_{Trucking} + Project_{Tipping\ Fees} + Project_{Fill} + Project_{Compaction} + Project_{On\ site\ Supervision}$$

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Case Study 5

Case Study 5

Source: Trace Associates Inc.

- Containment
- Surface mgt.
- GW low risk
- RZ exclusion
- Root Zone Future Considerations

Case Study 5

Increased Safety from Reduced Travel

>90%

Saskatchewan has an average of 6.8 fatalities and 311 injuries / billion vehicle-km travelled

$$\boldsymbol{Increased\ Safety\ from\ Reduced\ Travel} = \boldsymbol{Stringent\ Scenario_{Travel\ Risk} - Project\ Scenario_{Travel\ Risk}}$$

Where:

$$Stringent\ Scenario_{Travel\ Risk} * Provincial\ Traffic\ Collision\ Statistic$$

$$Project\ Scenario_{Travel\ Risk} * Provincial\ Traffic\ Collision\ Statistic$$

Summary

Source: Trace Associates Inc.

Conclusions

Many creative **assessments tools**

Assessment and remediation is **not zero impact**

Adding sustainability assessment **allows better decisions**

Critical thinking is key when **diagnosing challenges**

QUESTIONS? We're Here to Help.

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