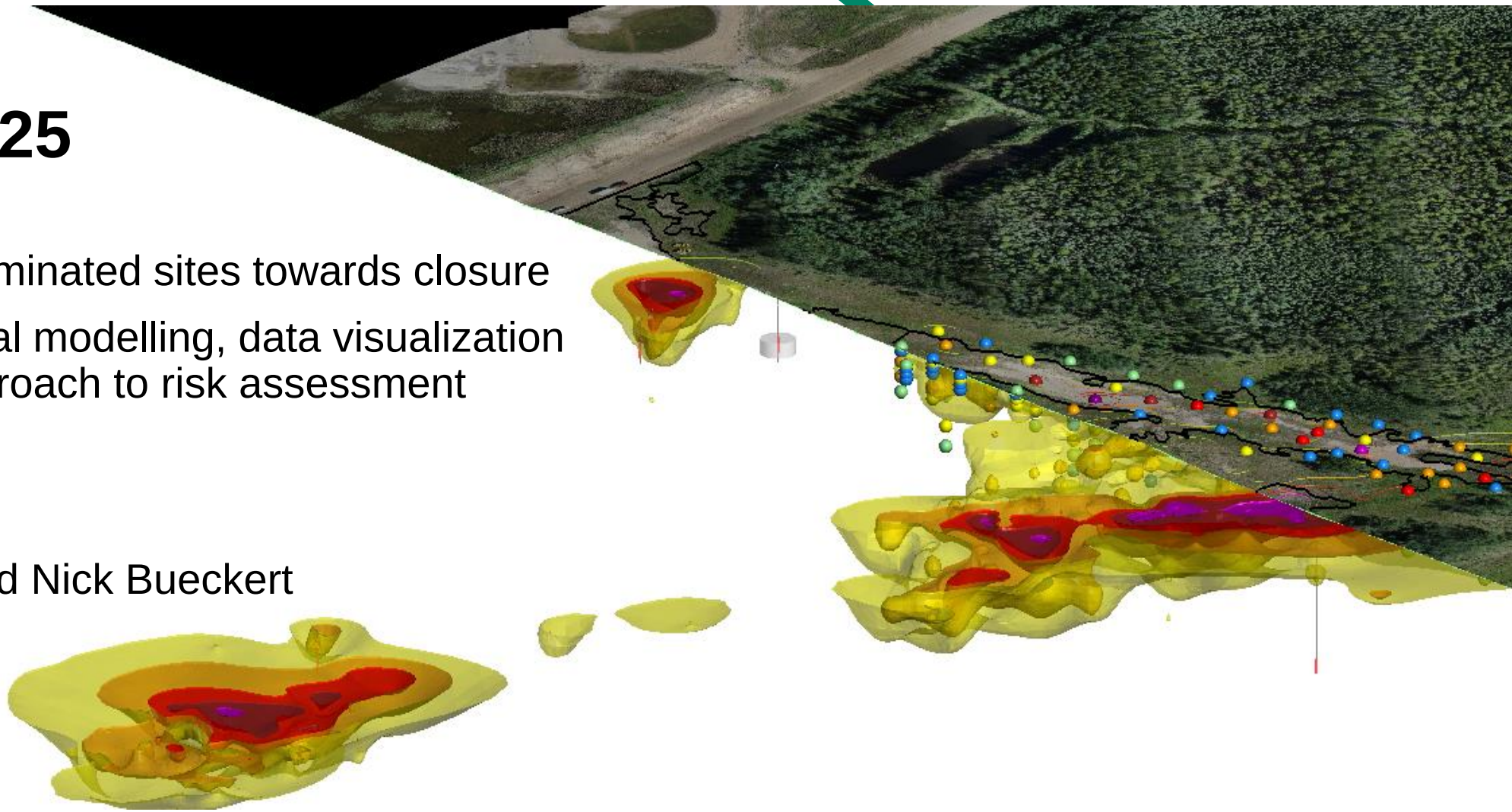
RemTech 2025

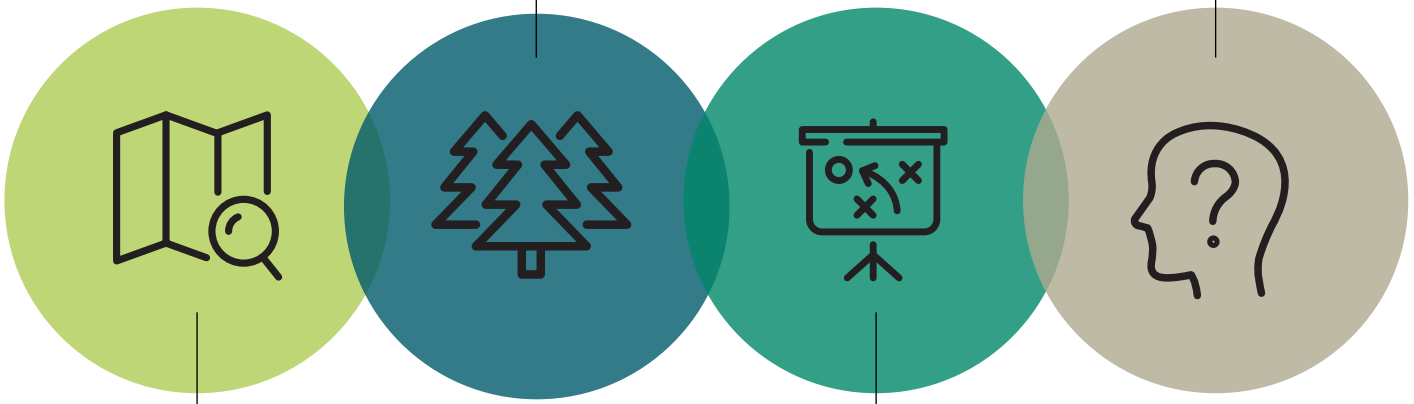
Driving legacy contaminated sites towards closure

Uses of 3D geological modelling, data visualization and a pragmatic approach to risk assessment

Heather Murdoch and Nick Bueckert



Case Study - The Problem



Large remote site

Long history of monitoring data – soil, groundwater, surface water, vegetation

Little to no movement toward remediation/reclamation/closure, stuck in risk management

Large scale remediation to generic Tier 1 guidelines not feasible

The Site

Project History

Spills and Early Management

1986-1990 Brine spills along pipeline ROW

Environmental Management Plan

2016 AECOM took on environmental consultant activities

Remedial Activities

2024-2025
RAP, remedial/ reclamation programs were initiated and are ongoing

Characterization, Delineation, and Risk Management

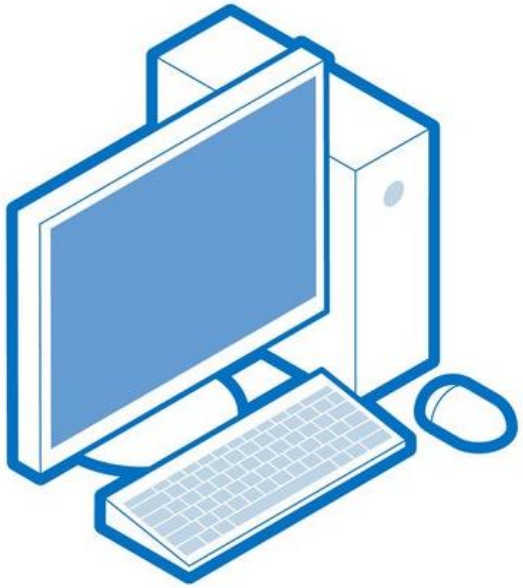
2001-2015 RMP developed and updated, further assessment work completed to delineate and characterize.

CSM, Risk Assessment and Data Gap Closure

2021-2025 Problem Formulation, Data Gap, SSRA

Data Management – Development of the CSM

Legacy Site Reporting
(High Volume of Data)



Data Digitization
(Distill Measured Data)

End Uses

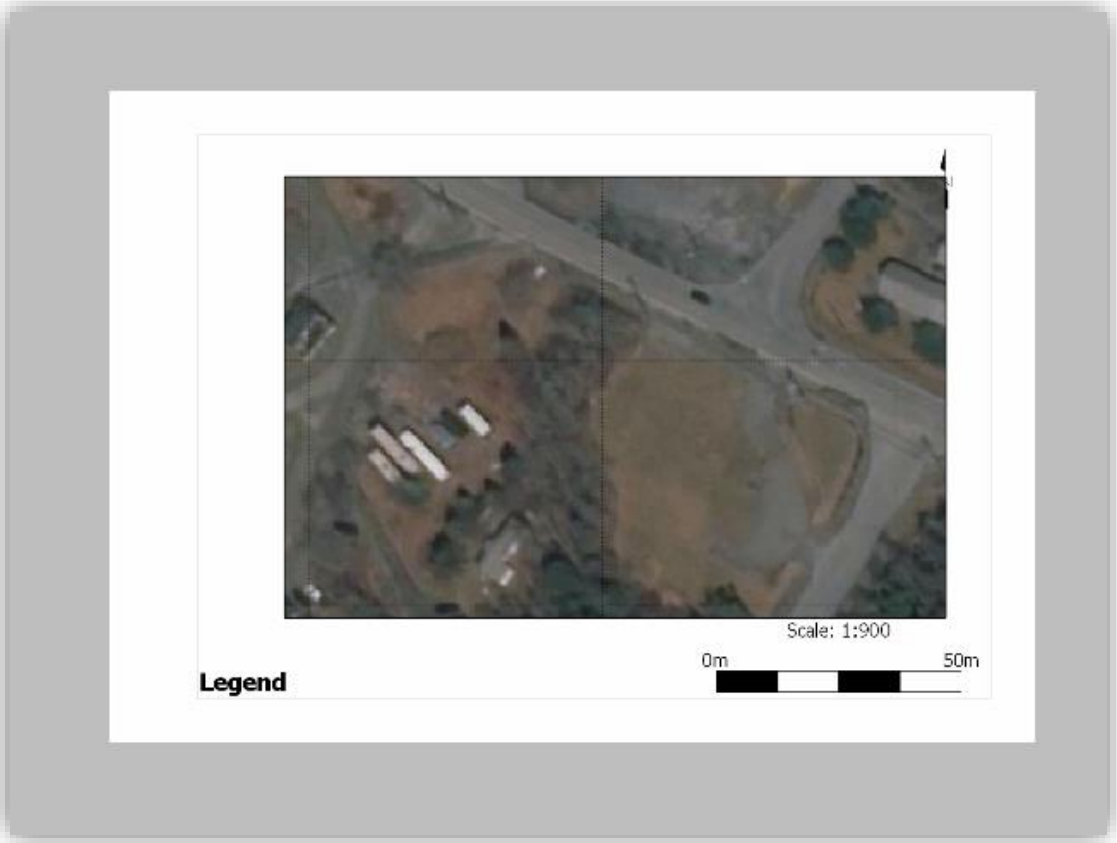
Half Step Back: How We Use Geological Modelling

How It Used to Be:

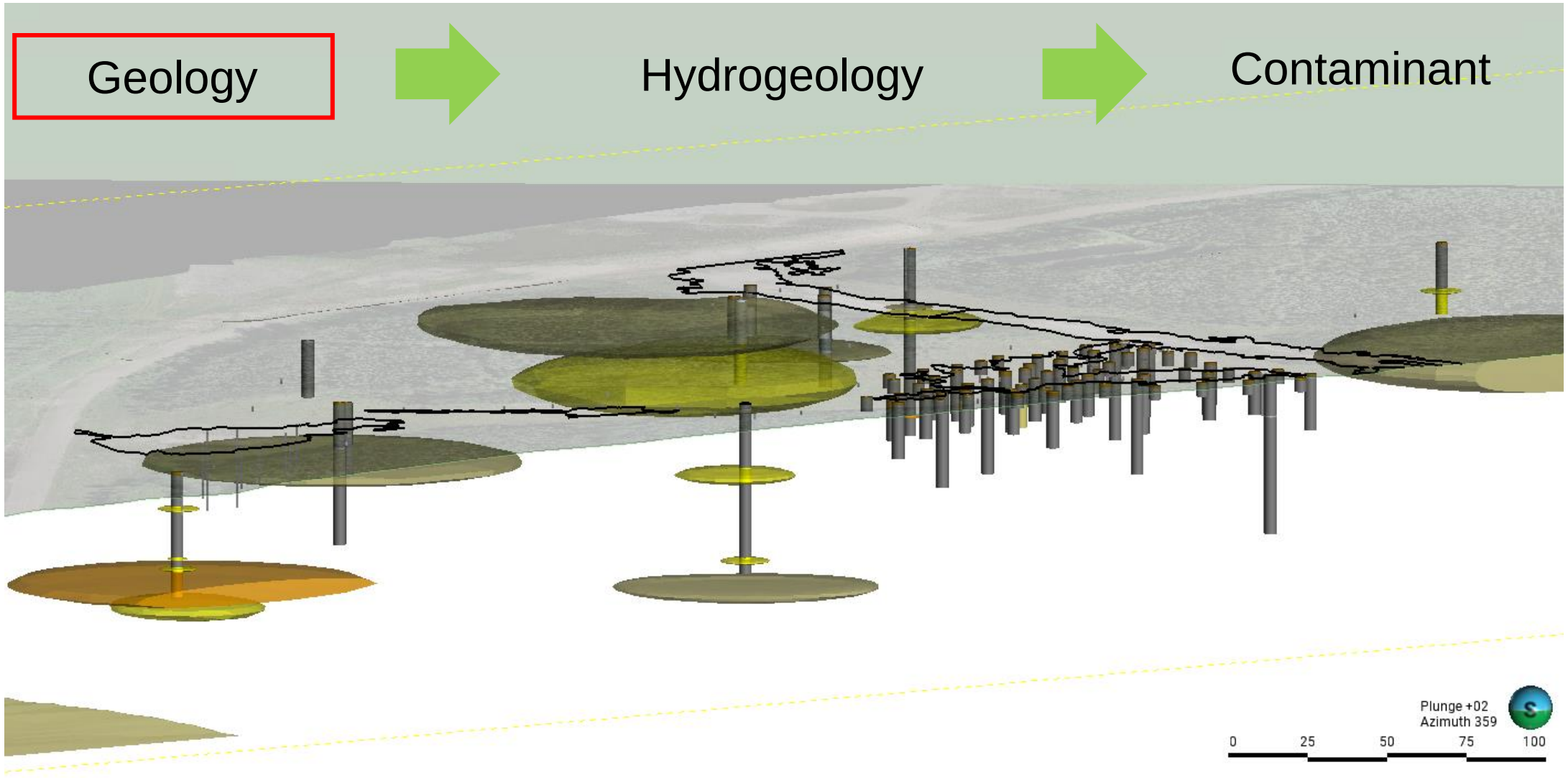
Site Investigation → 2D Cross-Sections → 3D Knowledge

How It Is Now:

Site Investigation → 3D Knowledge → 2D Cross-Sections+



Data Management – Development of the CSM



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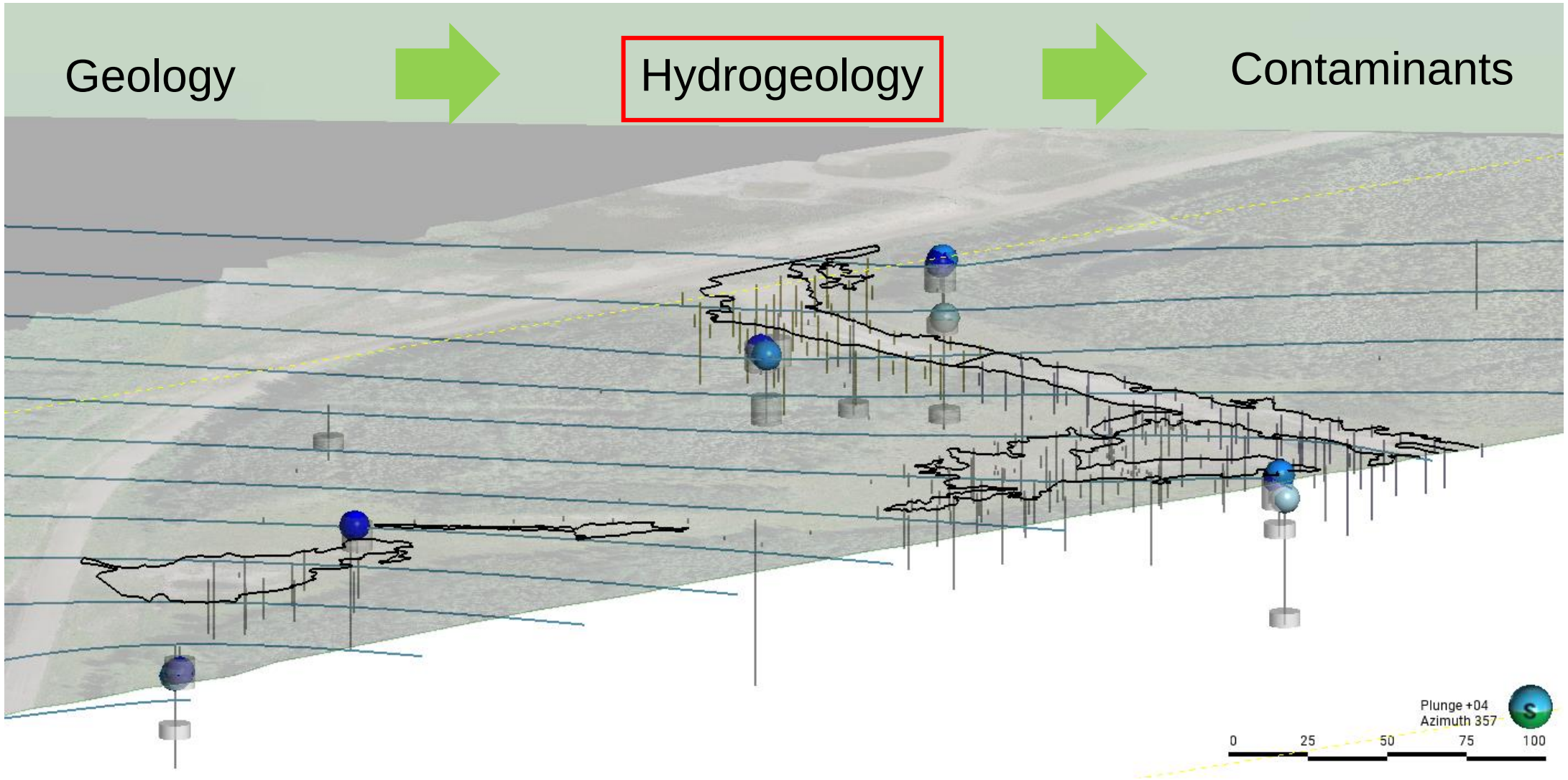

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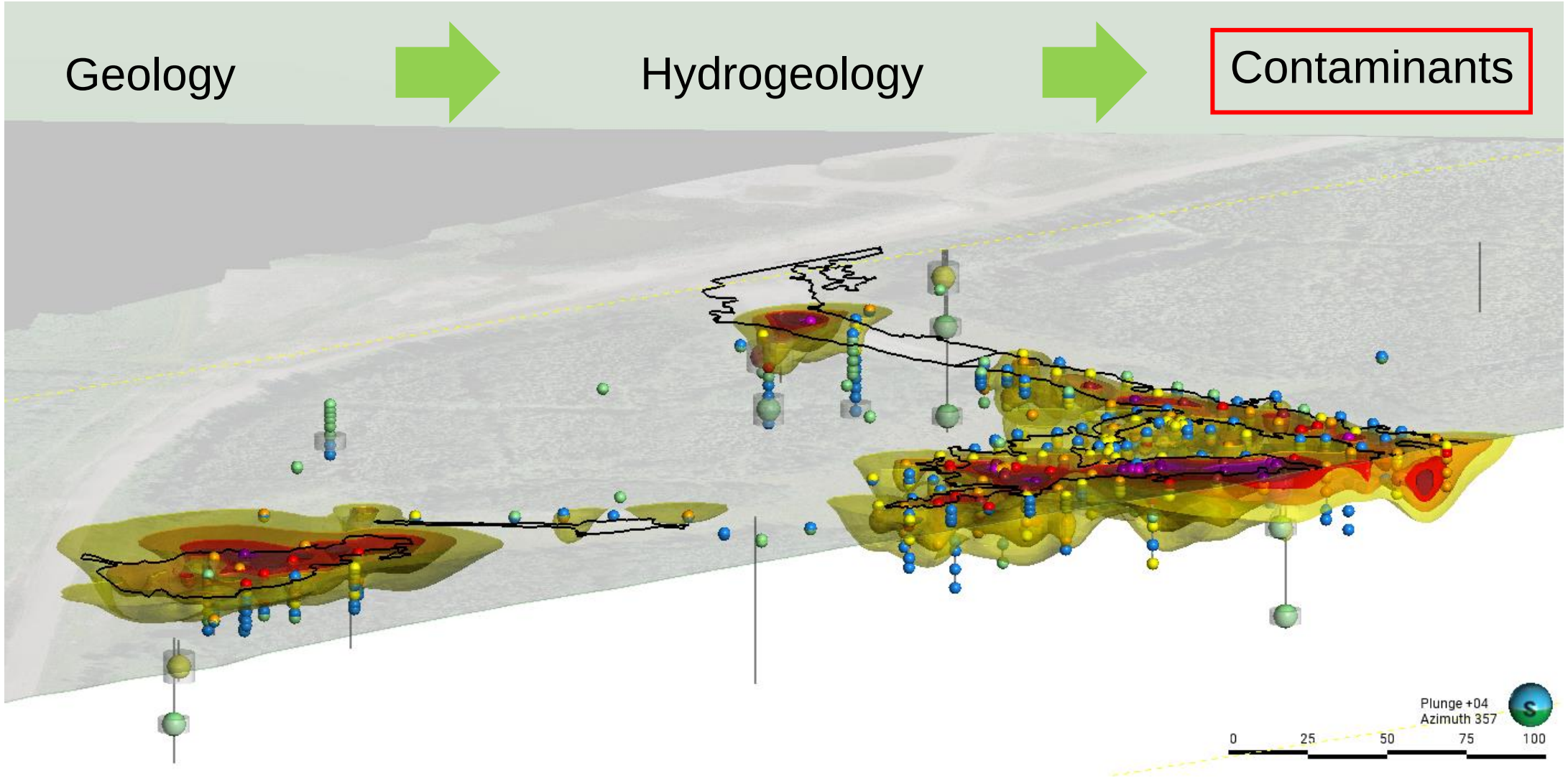
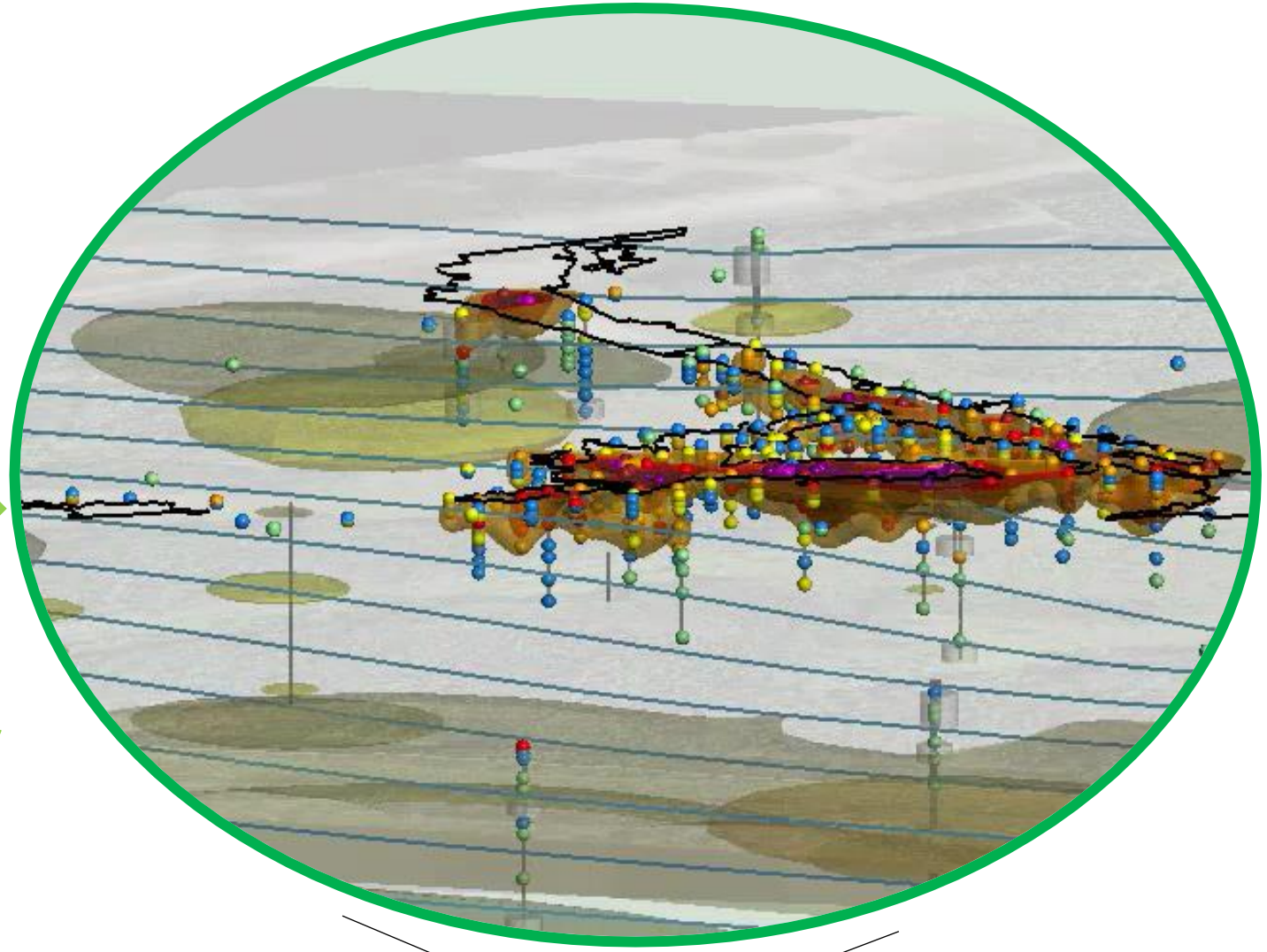


Data Management – Development of the CSM

Geology

Hydrogeology

Contaminants



Additional Field Investigation Work

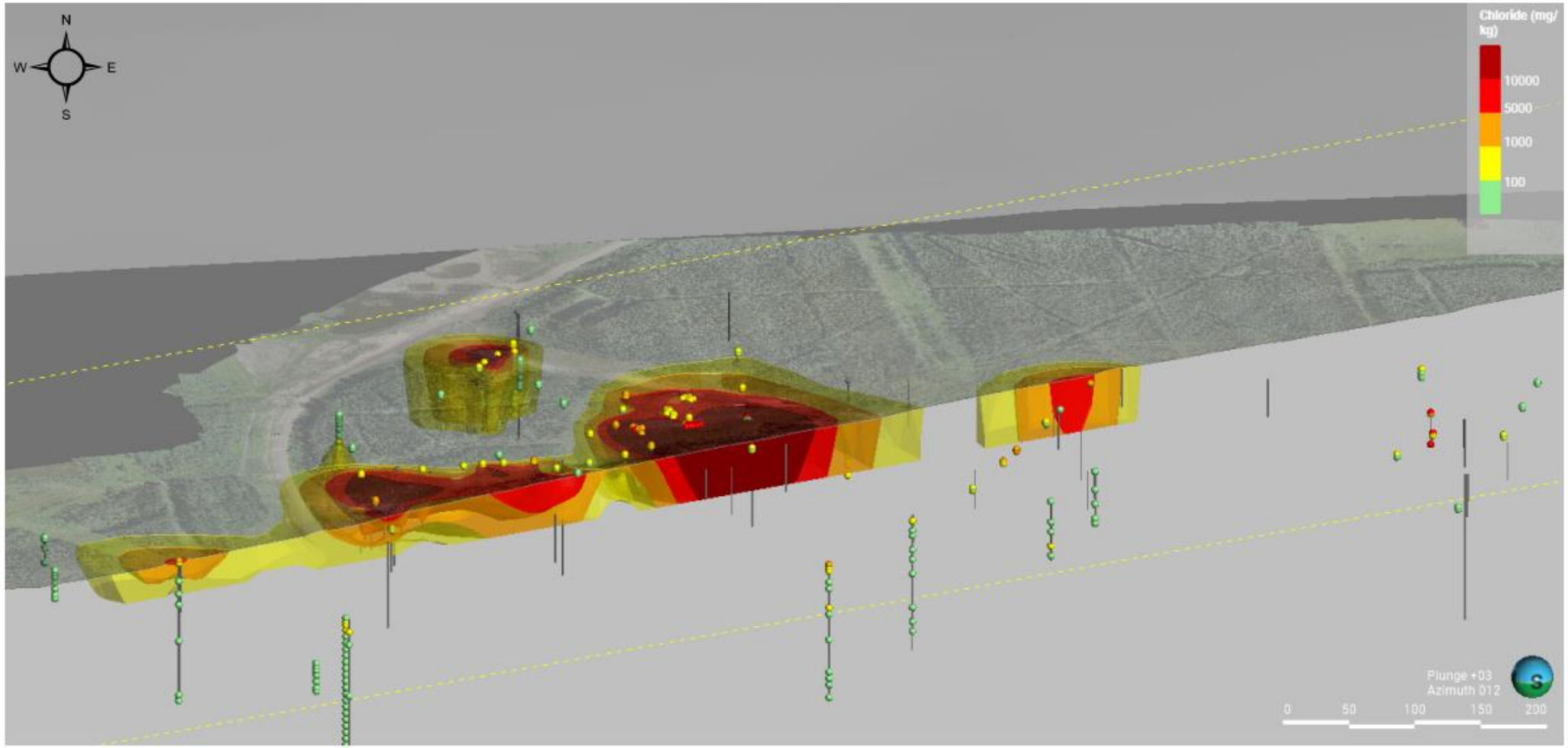
Site Specific Risk Assessment

Remedial Design

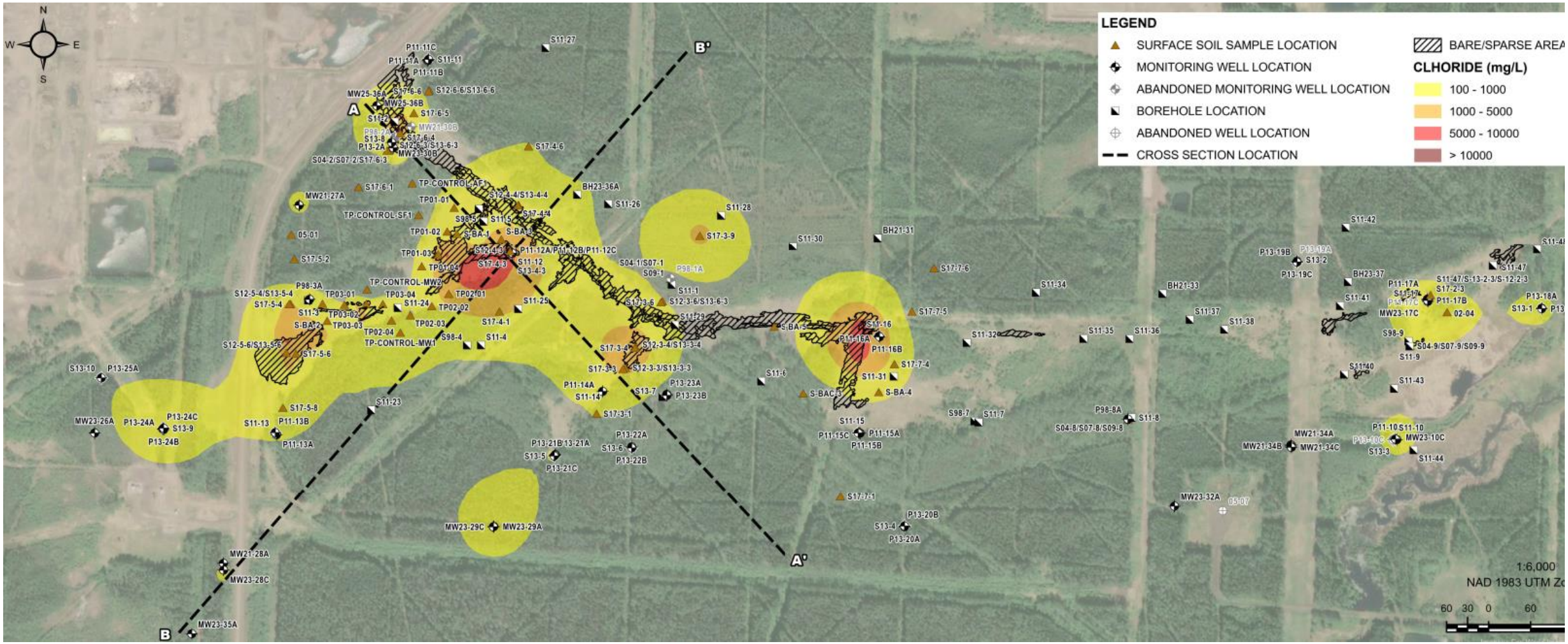
Remedial Activities

CSM

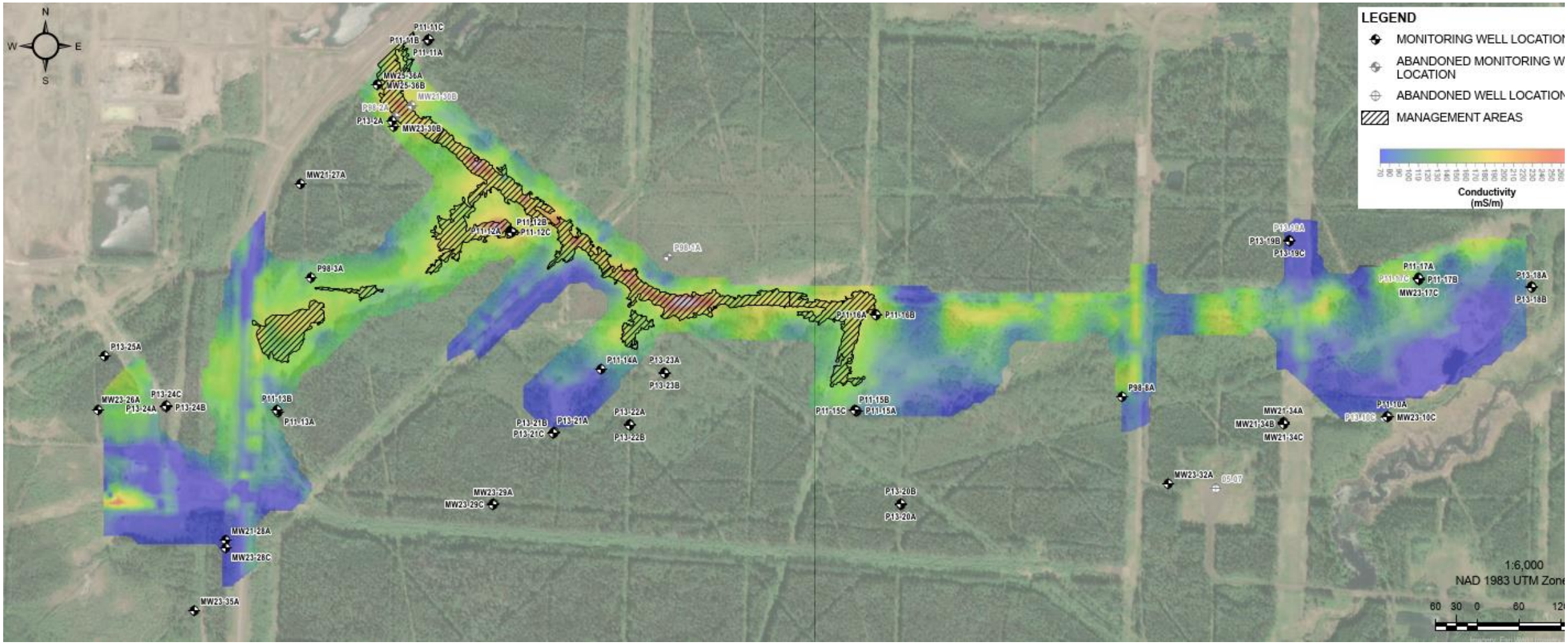
ISOVIEW
CHLORIDE IN SOIL



Chloride in Soil



Geophysics

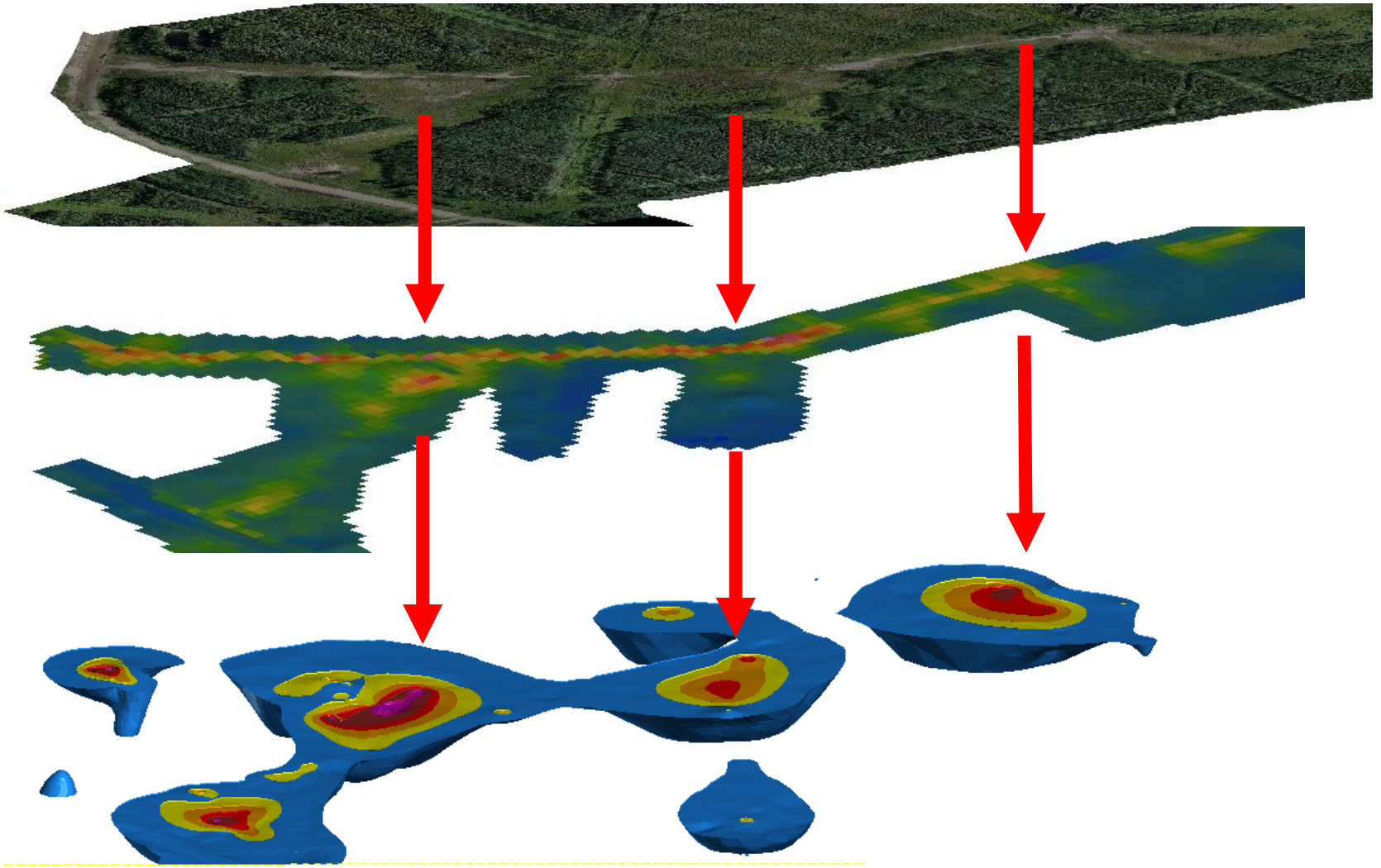

N
W
E
S
LEGEND
MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
ABANDONED WELL LOCATION
MANAGEMENT AREAS
Conductivity (mS/m)
1:6,000
NAD 1983 UTM Zone
60 30 0 60

SSRA Conclusions

Bare/Sparse Areas →

Geophysics →

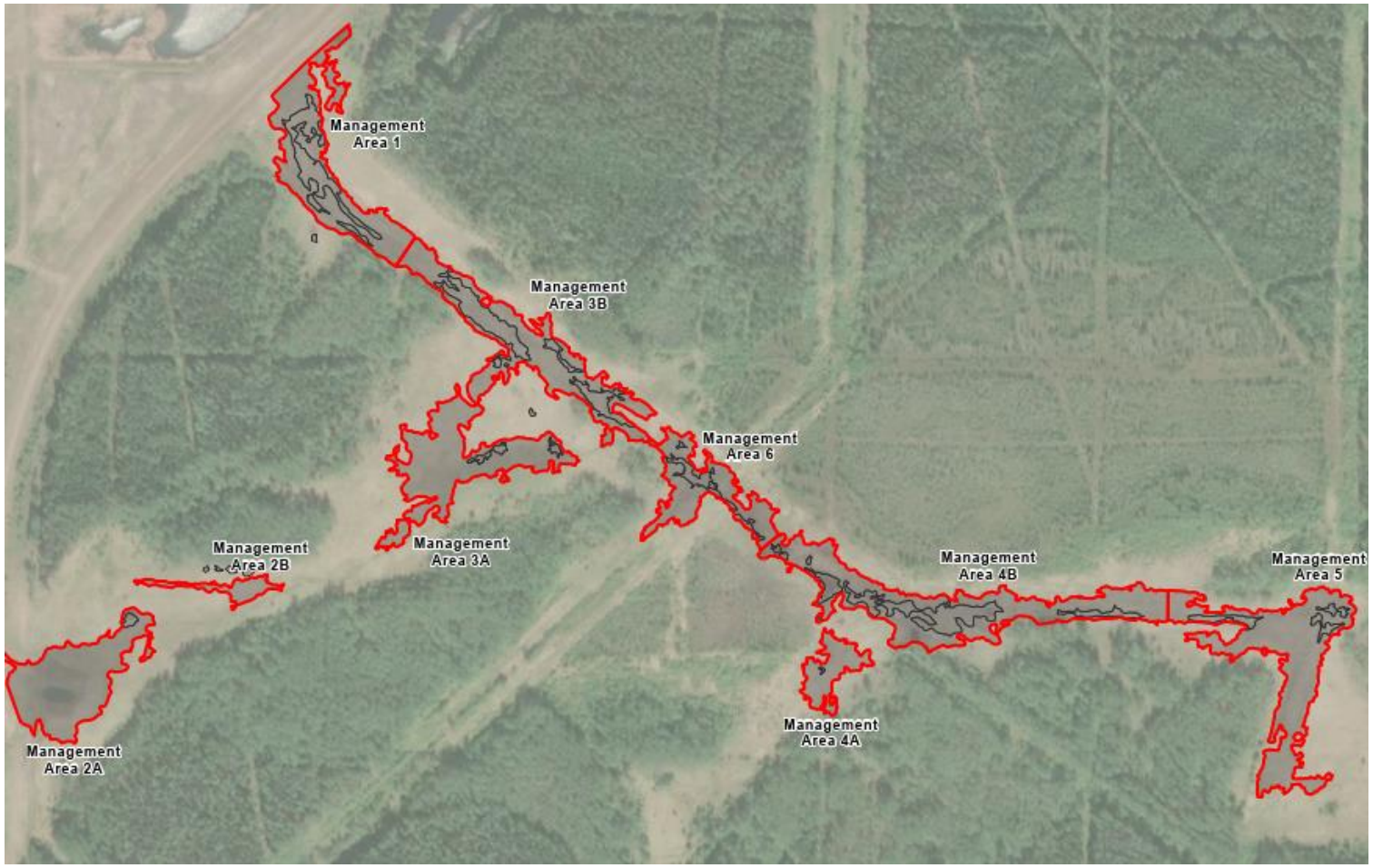
Chloride in Soil →



SSRA Conclusions

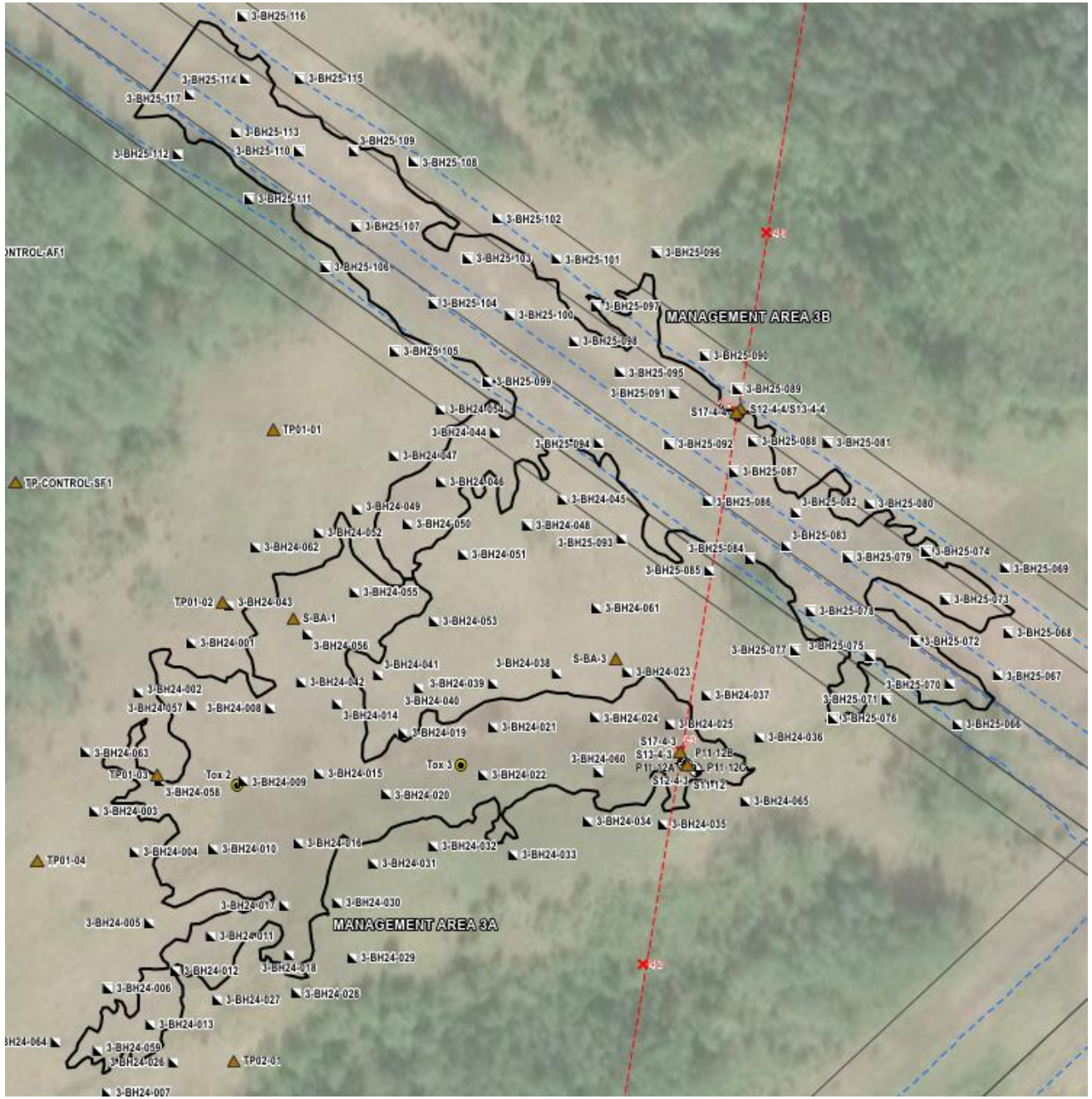
Eco-contact in the rooting zone → Prominent unacceptable pathway within the bare and sparsely vegetated areas of the site.

Site-specific remedial objective: 1000 – 2000 mg Cl/kg



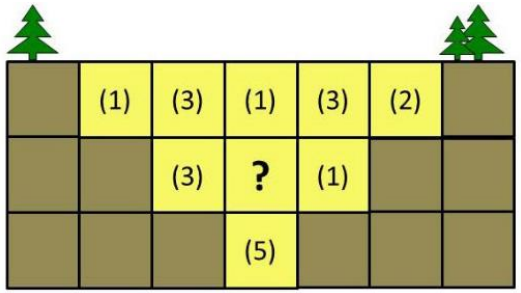
Remedial Design Management Area 3

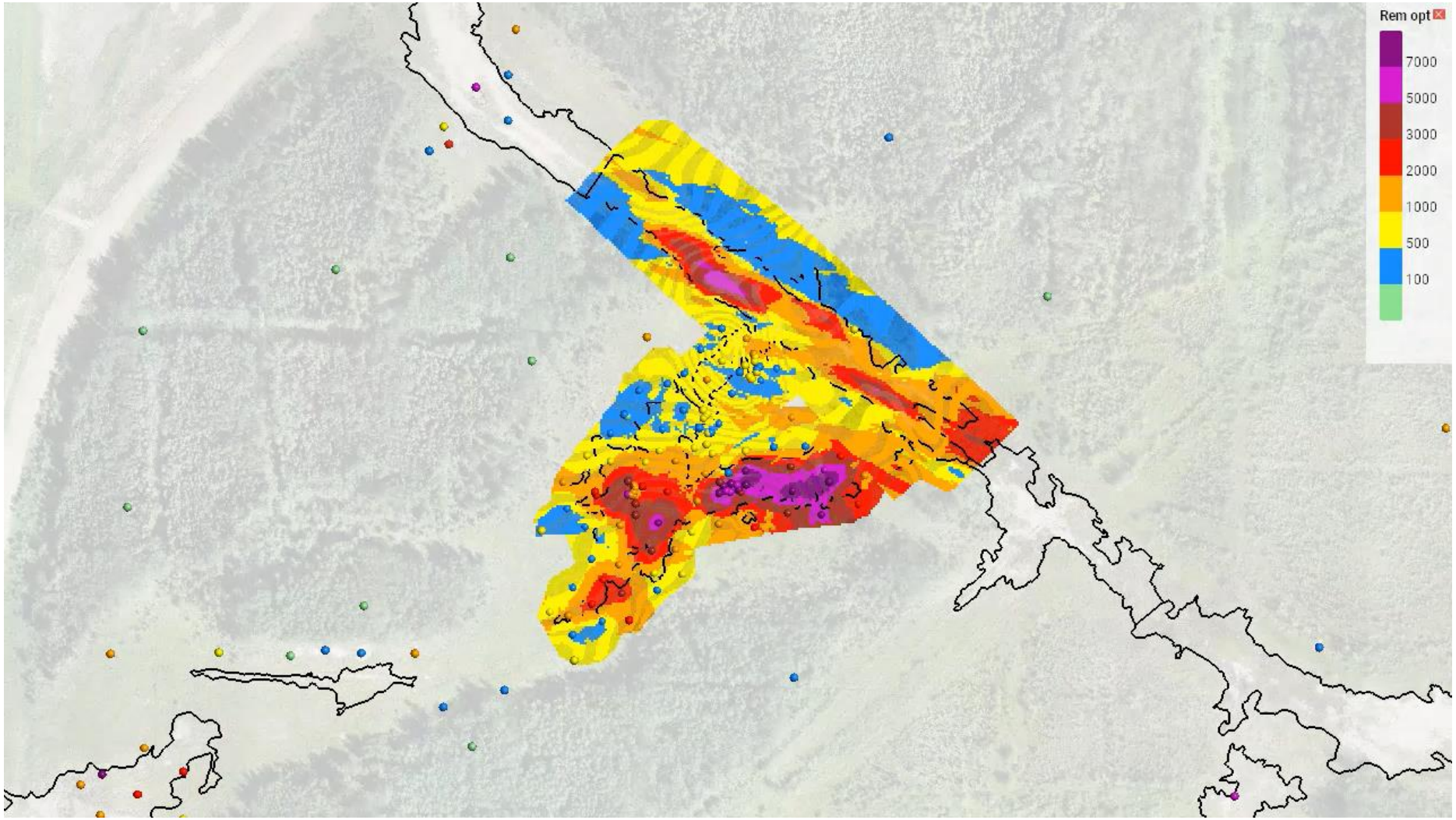
Pre-remedial soil characterization in specific management areas



Block Model – Chloride Concentrations

1. Quantify Distribution
2. Spatial Understanding
3. Optimize Extraction





Remedial Design

Chloride mass was converted to percentages of the whole. This data allowed us to target mass removal of unacceptable chloride concentrations from the rooting zone and in some cases from below to help prevent future recontamination into the rooting zone.

Table 7. MA3B (North) Average Chloride Concentration x Volume as a percent

Concentration Range (mg Cl/kg) →	100-500	500-1000	1000-2000	2000-3000	3000-5000	5000-7000	>7000
Depth (mBGS) ↓	mg Cl/kg * m3 as a percent of total in MA3 ↓						
0.5	0.14%	1.02%	2.78%	1.74%	1.61%	0.63%	-
1	0.12%	0.75%	3.12%	2.11%	1.88%	0.72%	-
1.5	0.08%	0.46%	3.05%	3.28%	2.35%	0.46%	-
2	0.01%	0.34%	2.90%	4.19%	2.74%	0.12%	-
2.5	-	0.16%	3.25%	4.97%	1.83%	-	-
3.0	0.00%	0.20%	3.98%	4.11%	1.15%	-	-
3.5	0.01%	0.62%	4.32%	2.54%	0.53%	-	-
4.0	0.05%	1.36%	3.89%	0.63%	0.32%	-	-
4.5	0.36%	1.68%	1.92%	0.38%	0.23%	-	-
5.0	0.47%	1.83%	1.09%	0.26%	0.06%	-	-
5.5	0.56%	1.92%	0.68%	0.05%	-	-	-
6.0	0.66%	1.70%	0.45%	-	-	-	-
6.5	0.75%	1.65%	0.34%	-	-	-	-
7.0	0.79%	1.69%	0.10%	-	-	-	-
7.5	1.15%	1.25%	-	-	-	-	-
8.0	1.50%	0.61%	-	-	-	-	-
8.5	1.64%	0.19%	-	-	-	-	-
9.0	1.58%	0.13%	-	-	-	-	-
9.5	1.21%	0.11%	-	-	-	-	-
10.0	0.46%	0.01%	-	-	-	-	-

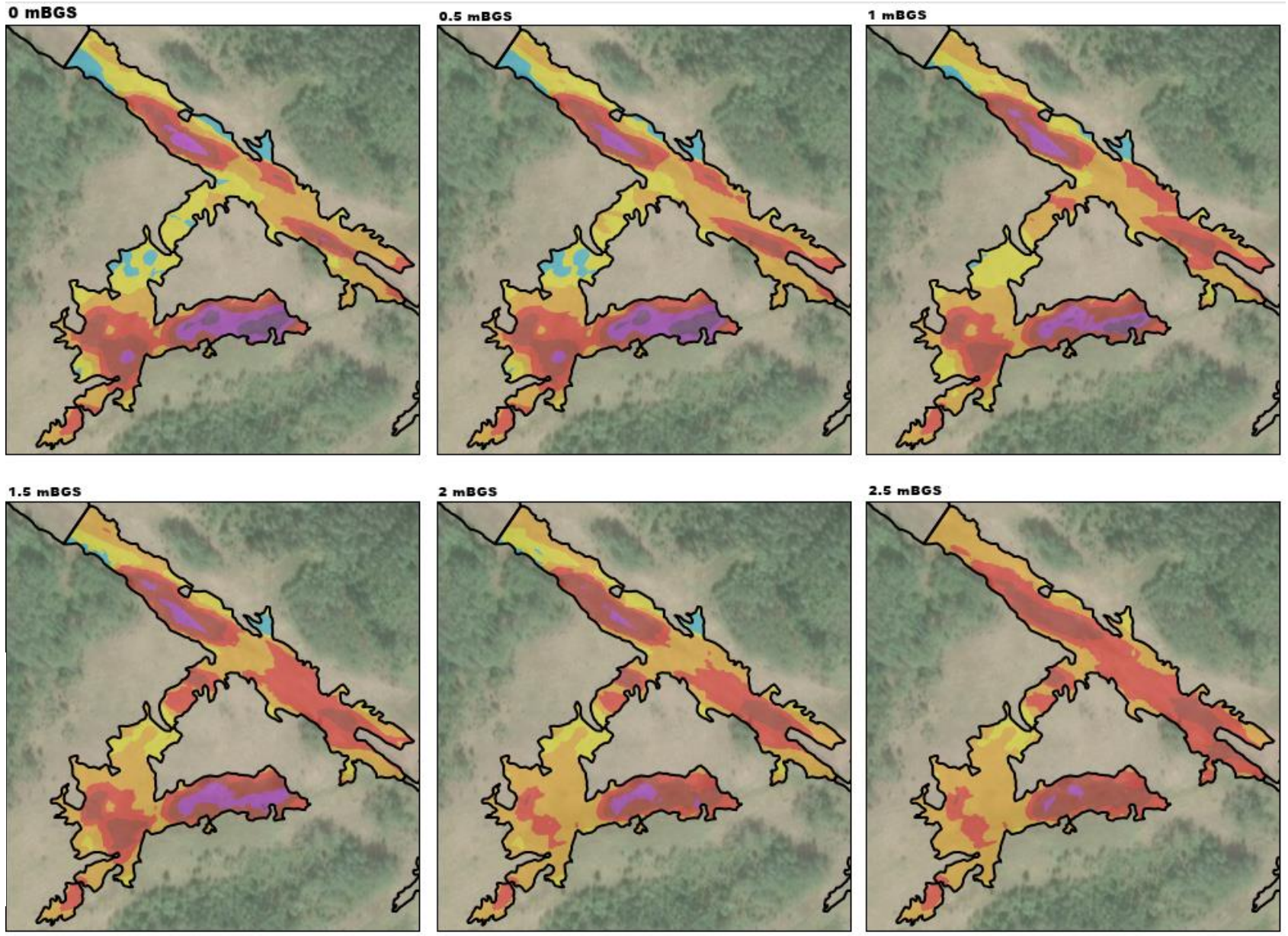
Notes:

Highlighted cells represent depths and concentration ranges proposed for excavation (0-1.5 mbgs)

Highlighted cells represent depths and concentration ranges proposed for excavation (1.5-2.5 mbgs)

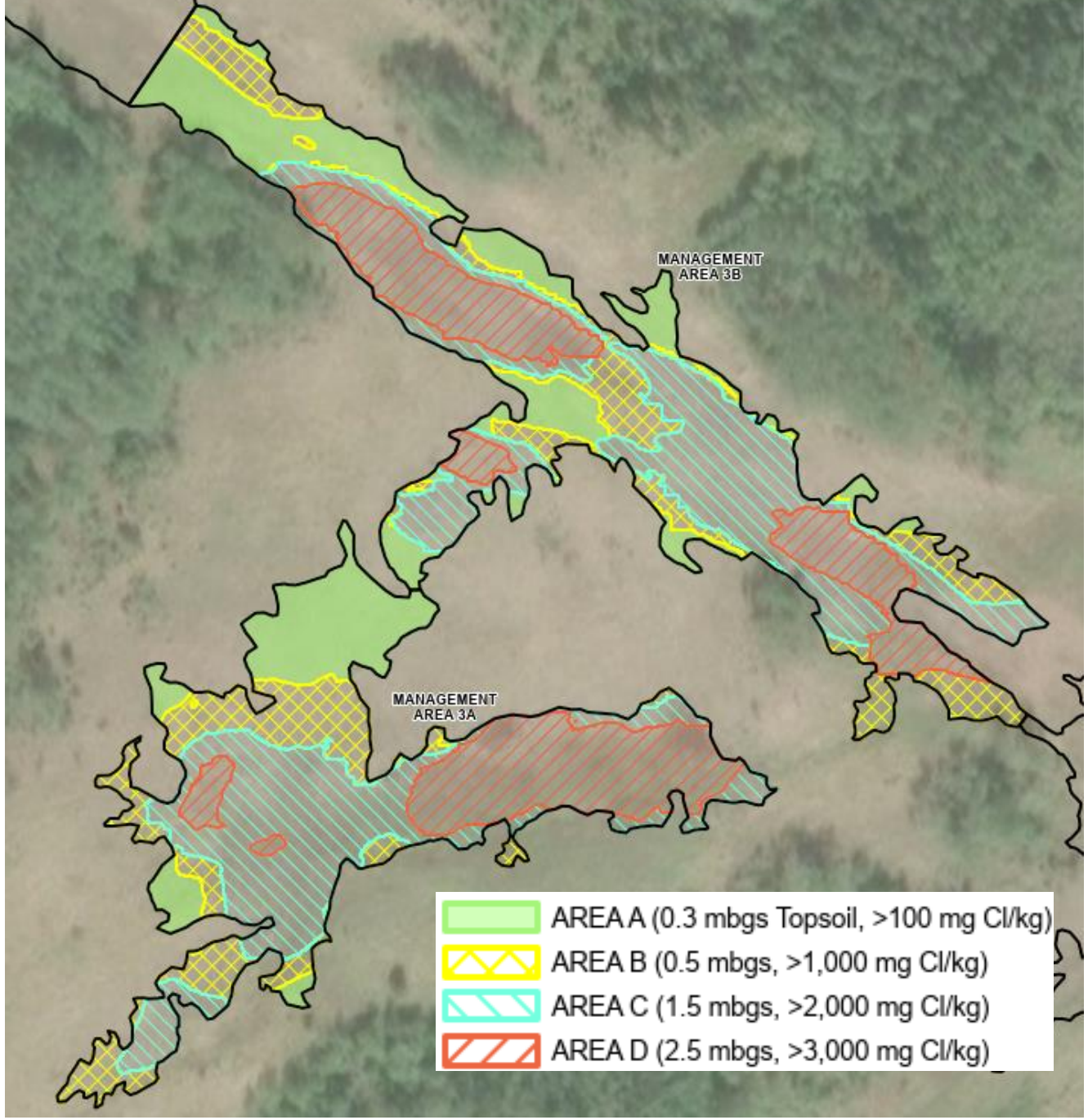
Remedial Design

Soil data modelled at various depth intervals to plan remedial dig



Remedial Design

Plan view of excavation plan to target chloride mass removal



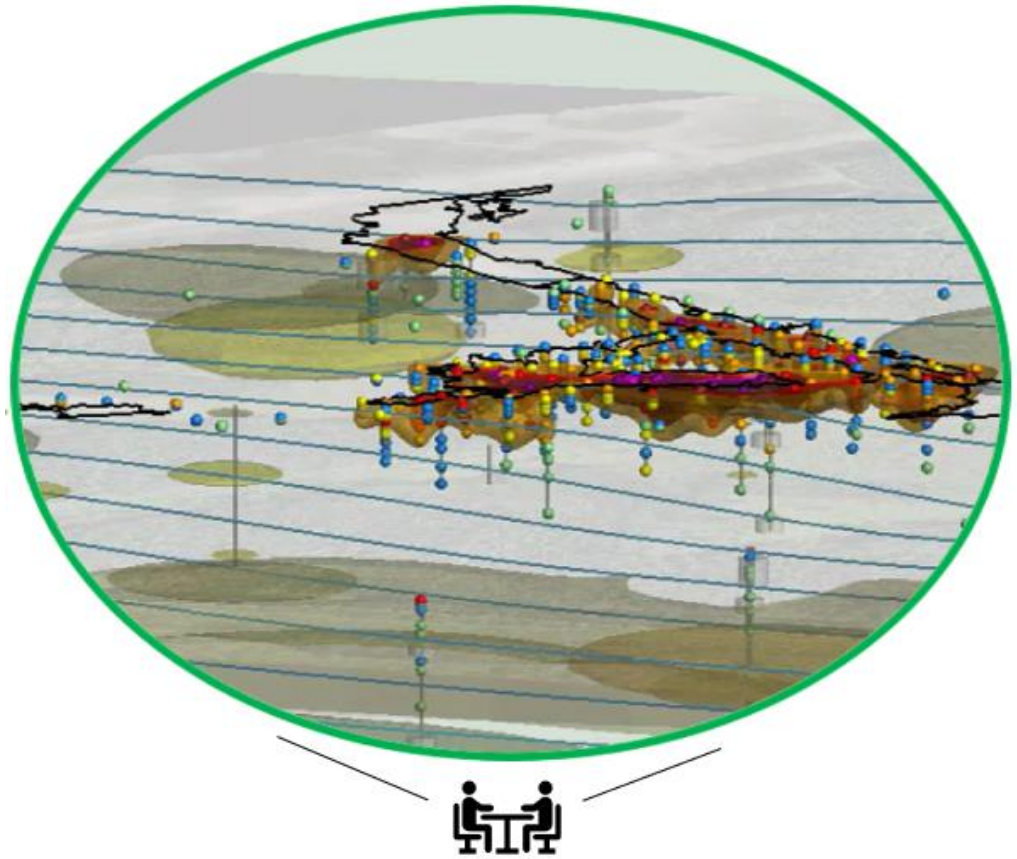
On Site – Excavation

Ongoing Works

- Post remedial soil monitoring is planned to monitor any potential recontamination of the excavated areas
- Further excavation work at planned management areas
- Continual improvements/lessons learned are incorporated with each phase of remediation
- Post remedial SSRA will be completed
- Reclamation has started in previously remediated areas and will continue as new areas are excavated
- Regulatory engagement ongoing

Summary - Moving Legacy Contaminated Sites to Closure

1. Leveraged large historical datasets to develop holistic conceptual site models.
2. Updated 3D CSMs at each stage of data collection to utilize the most up to date data in decision making and form team consensus.
3. Used risk assessment to target source control and identify unacceptable risks.
4. Planned remedial programs in pragmatic effort to reduce environmental and financial risks and move the site towards closure.



Thank you!

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AECOM

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