

An Innovative Remediation Approach to an Emergency Spill Response – Part One

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Presentation Summary and Key Items

Review the Incident History

Site setting, CoCs, oiling distribution, containment, wildlife deterrents

Initial Remediation

5 Primary Ways of PSC Recovery

ESA results to date

Review soil, groundwater, surface water and sediment data



Incident Overview and Site Setting

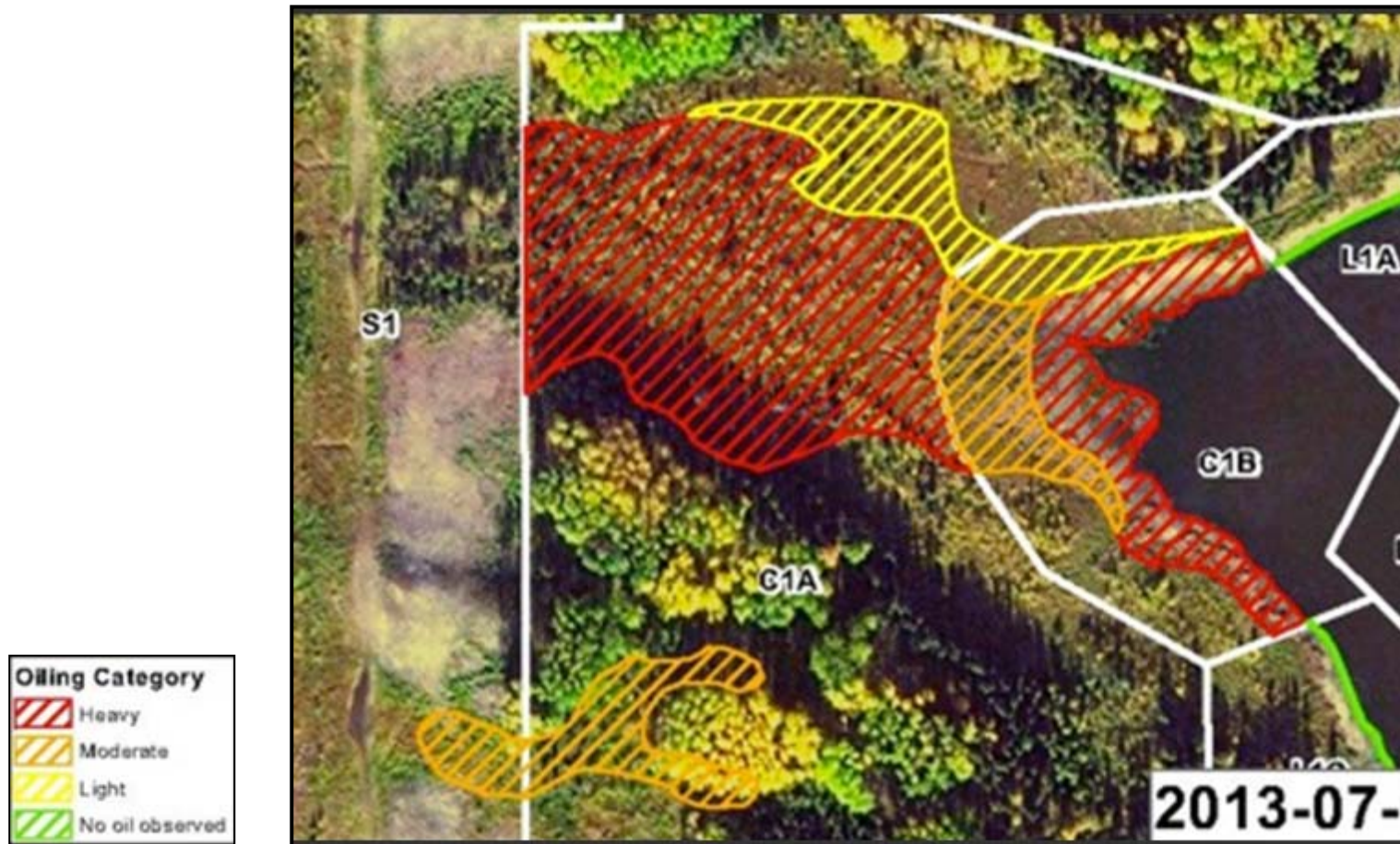


Contaminants of Concern (CoCs)

CoCs were identified by:

- Sampling and analysis of raw PSC product, recovered product, soil, groundwater, surface water and sediment analysis
- CoCs: BTEX, PHC F1 to F4, and PAHs
- Metals were not present in the analytical results and were not considered in additional sampling

Initial SCAT Oiling Distribution Mapping



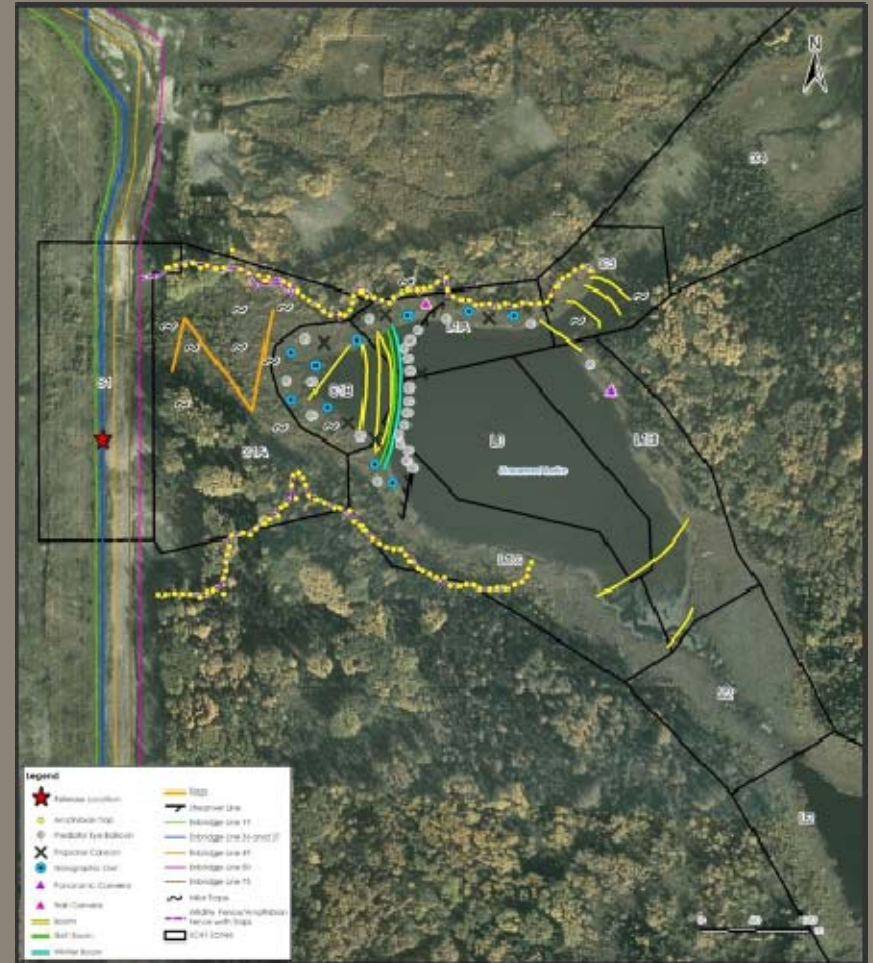
Containment and Wildlife Deterrents

Primary Objectives



Containment and Wildlife Deterrents

Primary Objectives



Pathway to Closure



The objective of the remediation program is to reduce the concentration of the CoCs in the media, to levels that are protective of long-term human and ecological health, while minimizing additional impacts to the environment.

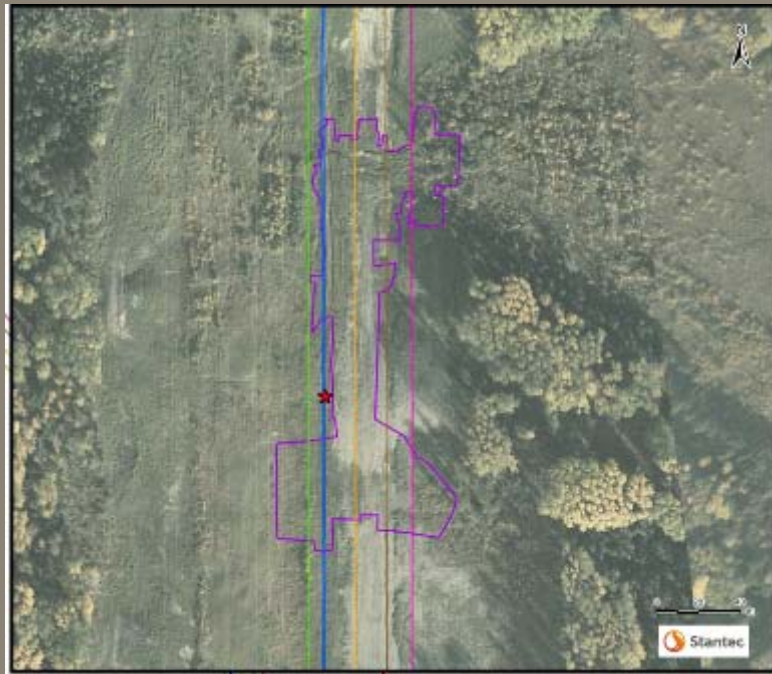
Initial Remediation – Five Primary Ways PSC Recovered



Removal of Free Phase
Product from the Lake

Initial Remediation – Five Primary Ways PSC Recovered

Surface soil excavation



Initial Remediation – Five Primary Ways PSC Recovered

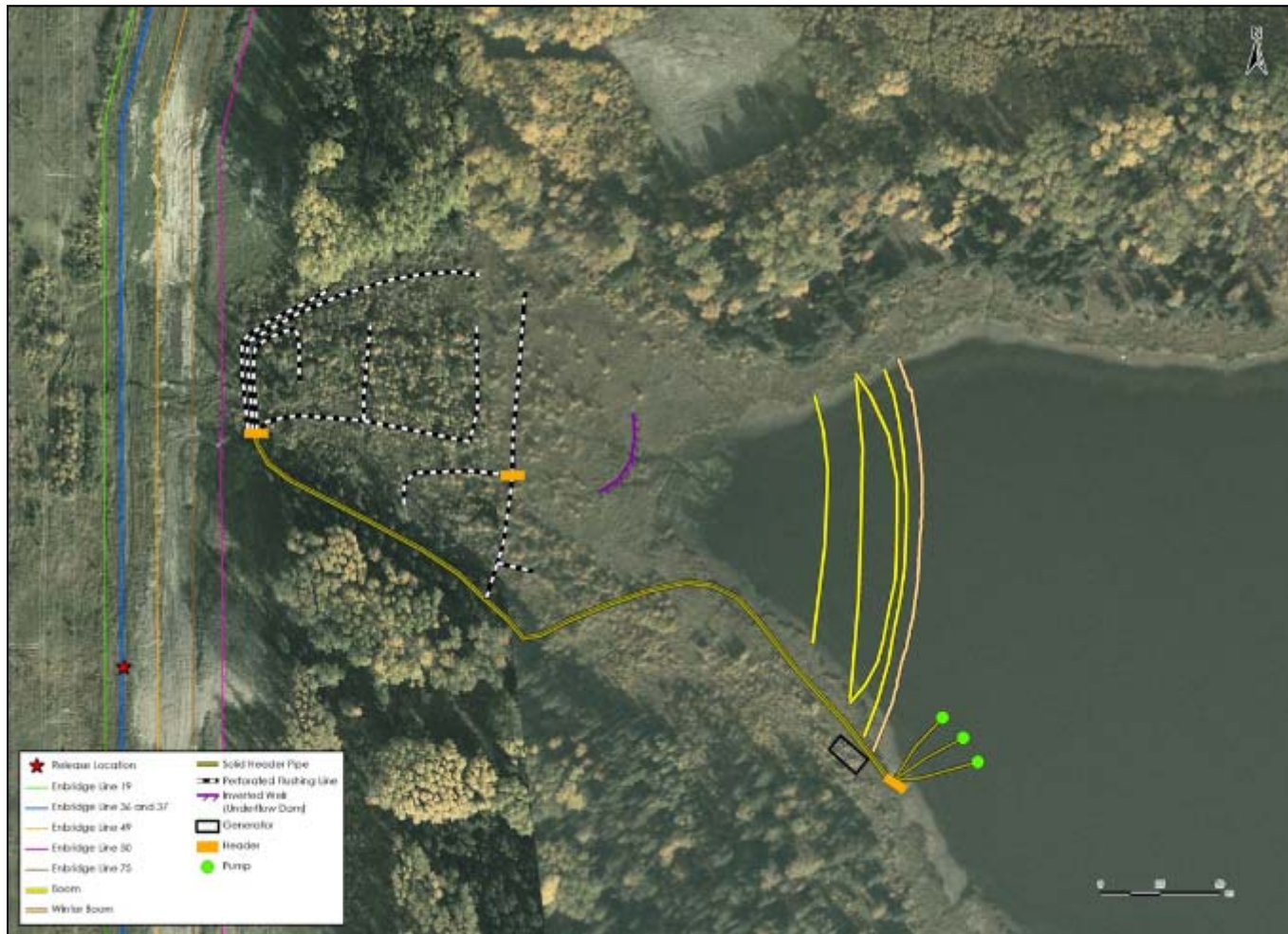


**Fen remediation: Targeted
and Broad Flushing**



Targeted and Broad Flushing in the fen

Increase water flow through the fen:



Targeted and Broad Flushing in the Fen

Increase water flow through the fen:



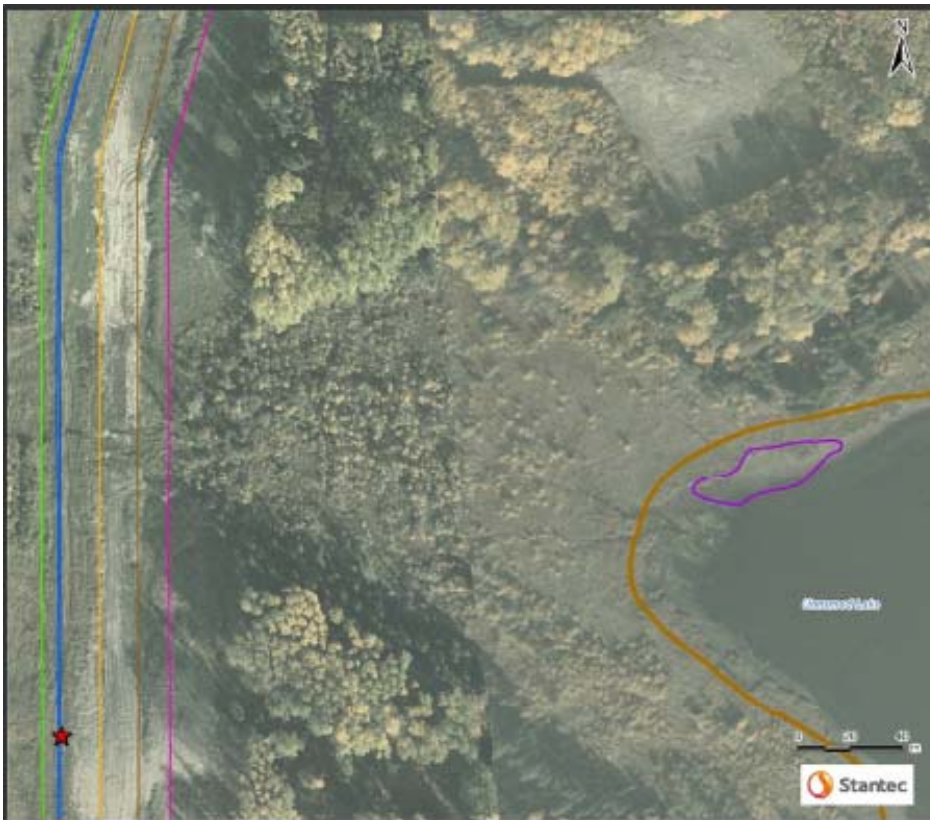
Targeted and Broad Flushing in the Fen

Increase water flow through the fen:



Initial Remediation – Five Primary Ways PSC Recovered

Surface Sediment Excavation

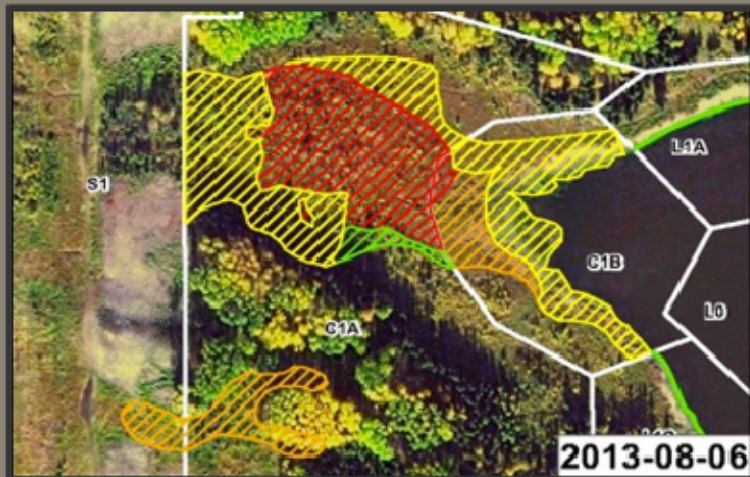
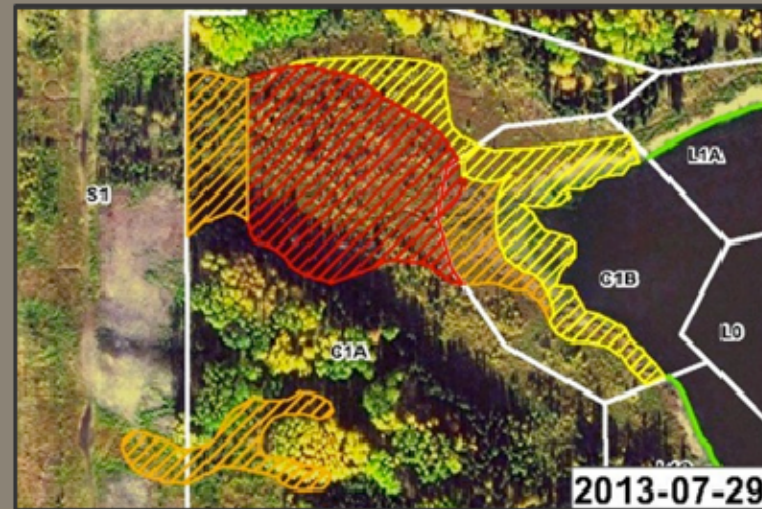
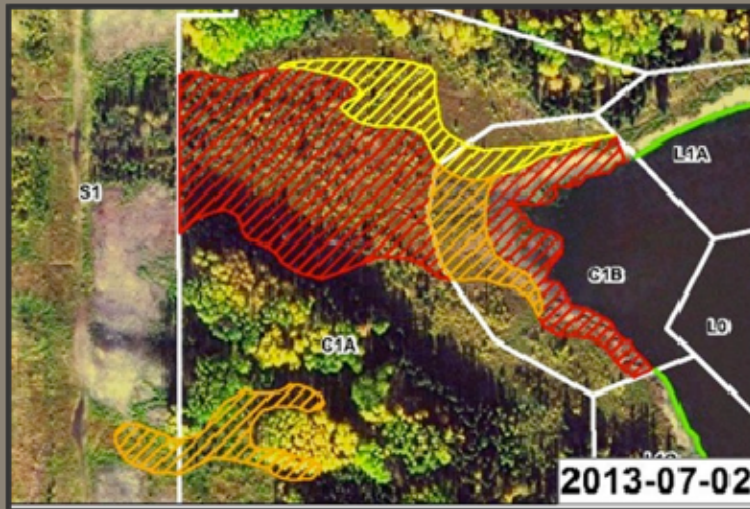


Initial Remediation – Five Primary Ways PSC Recovered

Three Phase Water Treatment System



Oiling Distribution Through Time



Evolution of Oiling Conditions

South Section of the fen



Evolution of Oiling Conditions

West Shore of the lake

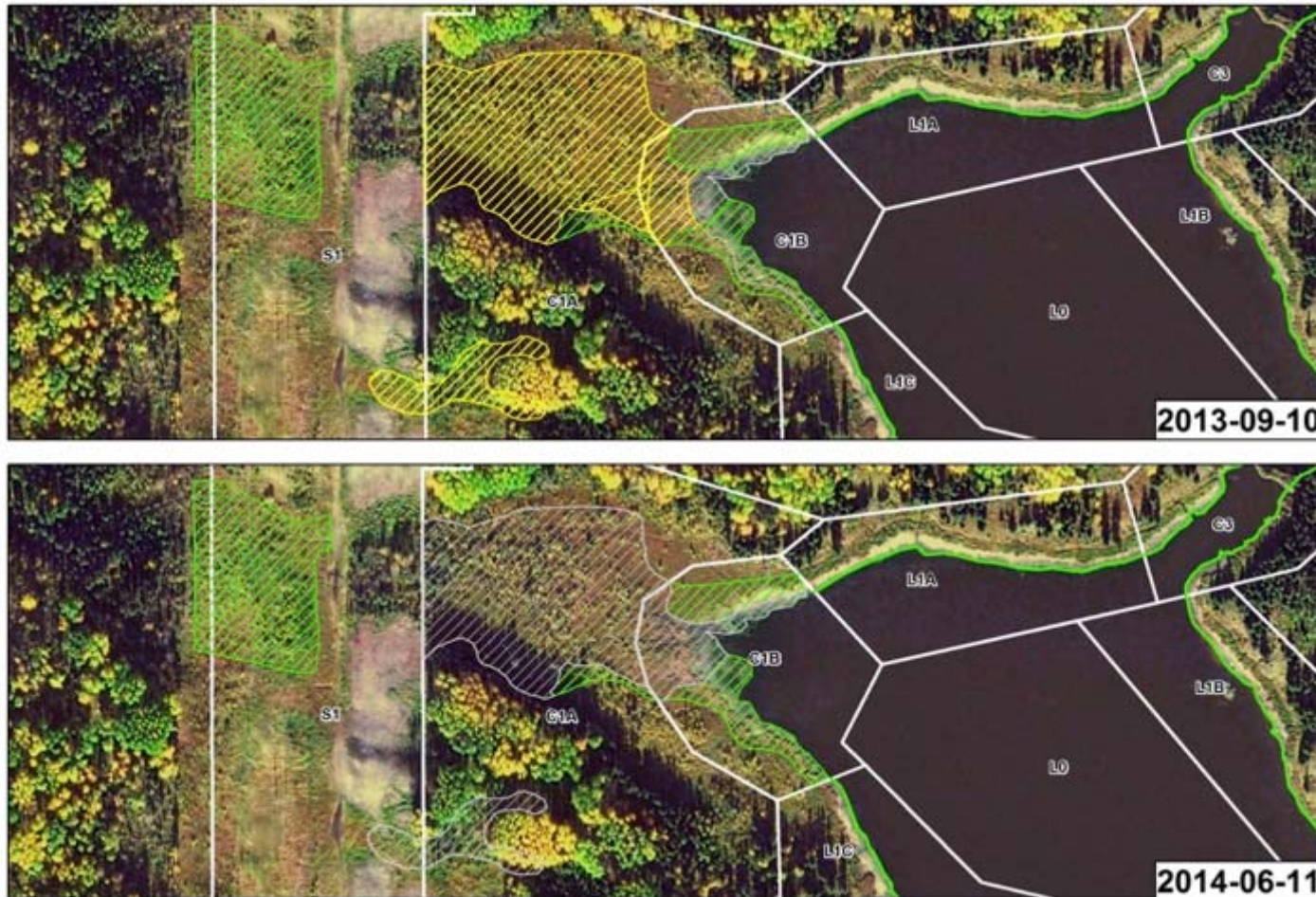


Site Conditions, Oct. 2013 – Lake

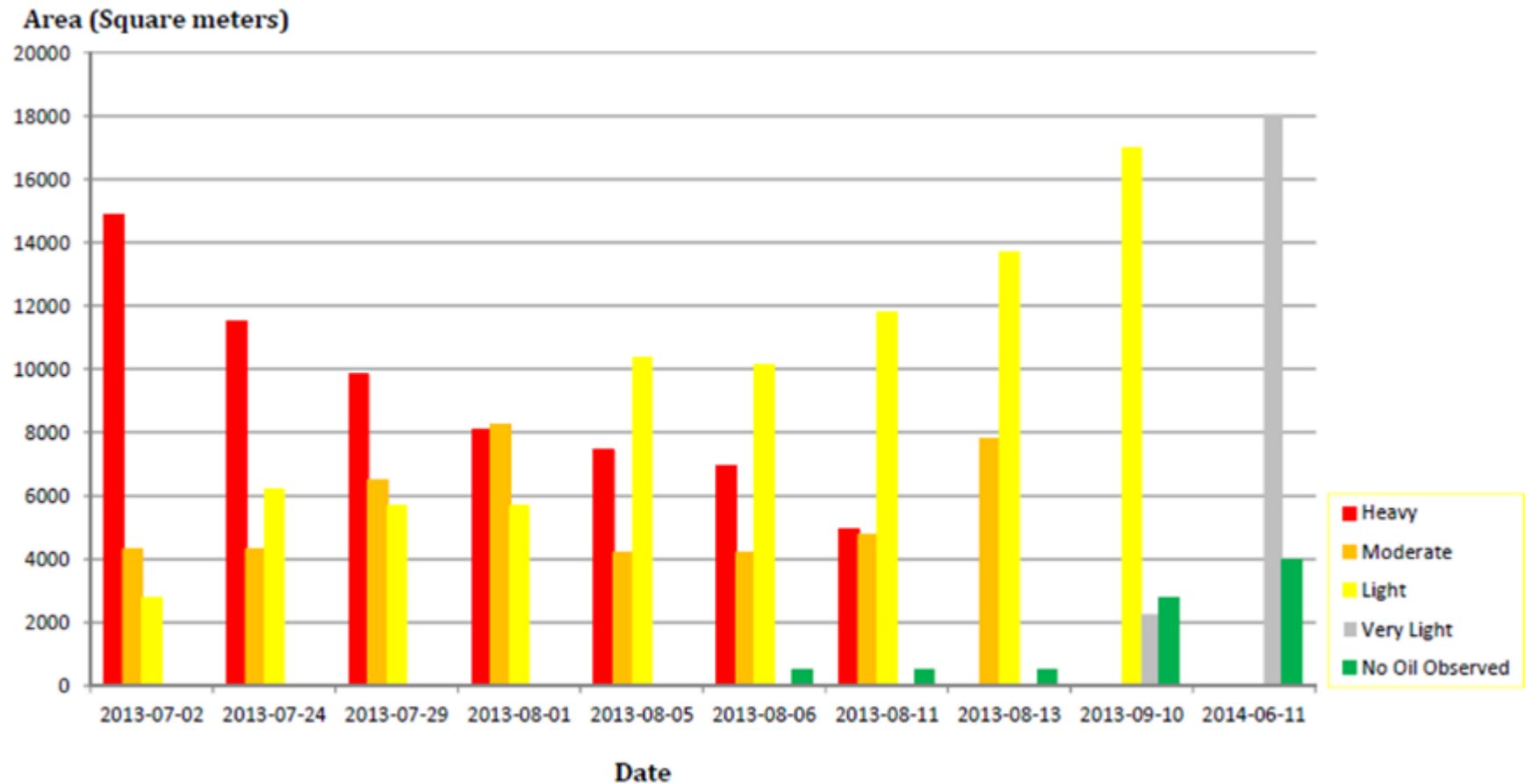
Hard boom construction and deployment



Oiling Distribution Through Time – June 2014



Evolution of Oiling Conditions Through Time



Evolution of Oiling Conditions



Southeast shore of the lake



Evolution of Oiling Conditions



Northeast shore of the lake



Evolution of Oiling Conditions



West shore of the lake



Summary of Assessments – 2013

- Surface water sampling
- Air monitoring and sampling
- Two ESAs (soil and groundwater)
- Sediment assessment
- Aquatic sampling programs (stickleback)
- Vegetation survey
- Wetland assessment and delineation



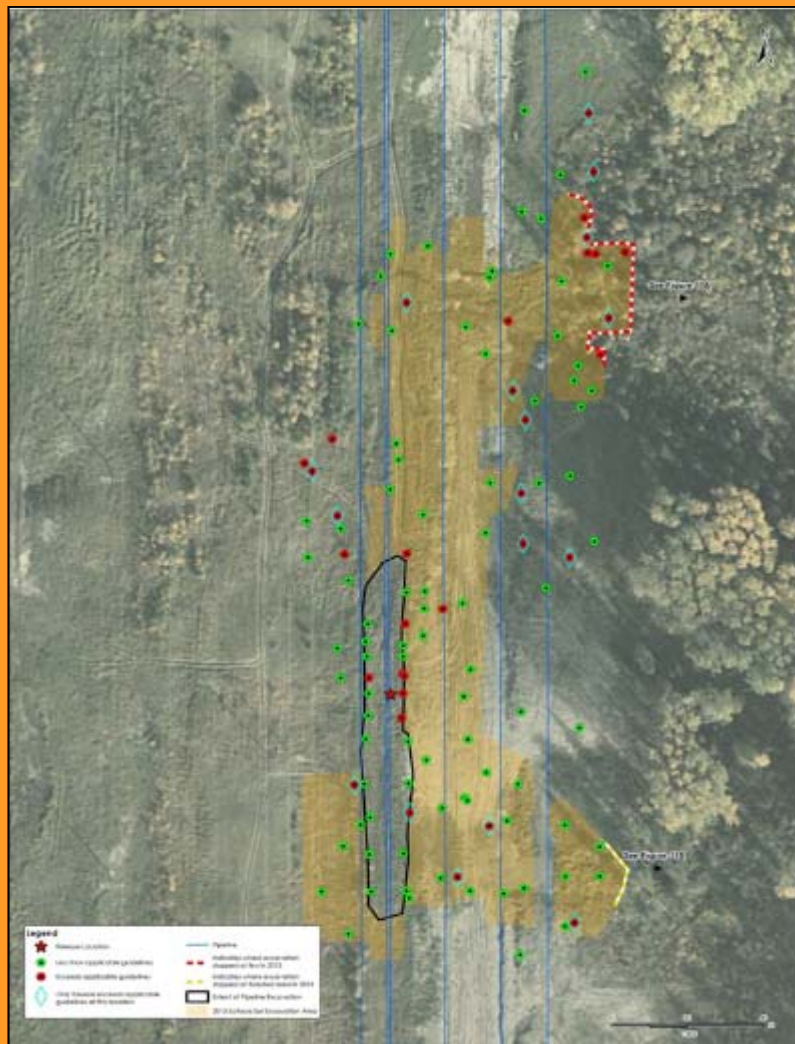
Summary of Assessments – 2014

- Delineation drilling (soil and groundwater)
- Sediment and baseline assessment
- MNA Program
- Hydraulic conductivity testing
- Surface water sampling
- Vegetation survey

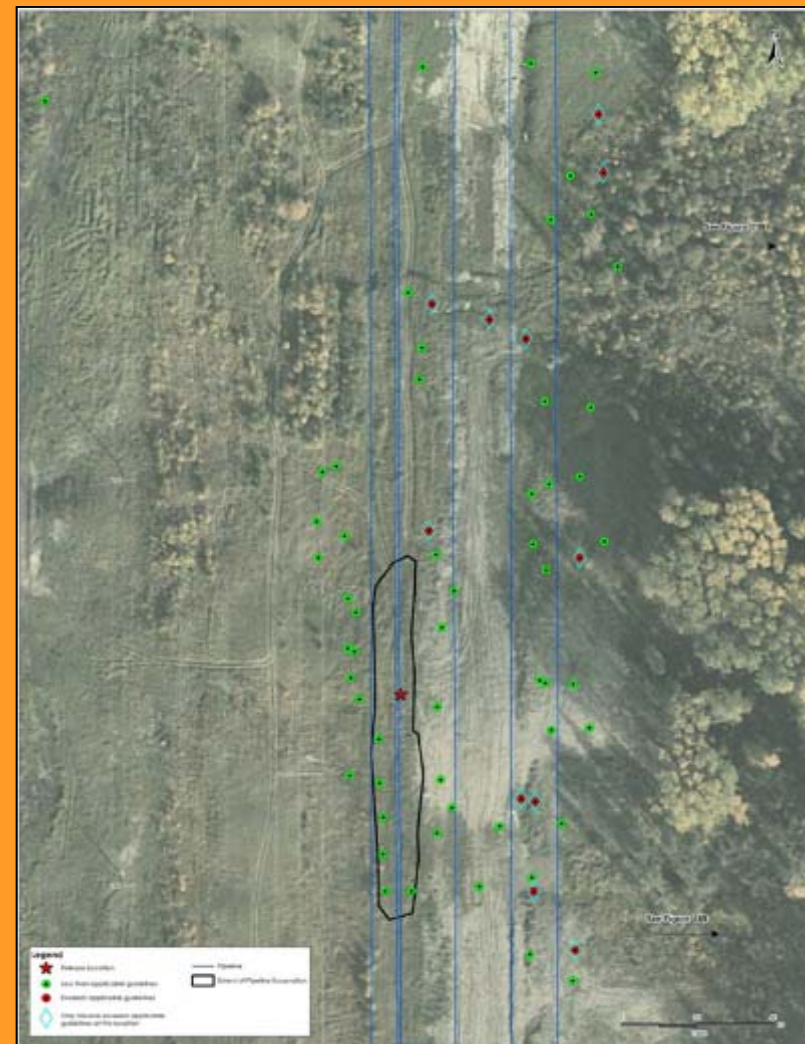


Soil Characterization - ROW

Soil: surface to 0.6 mbg

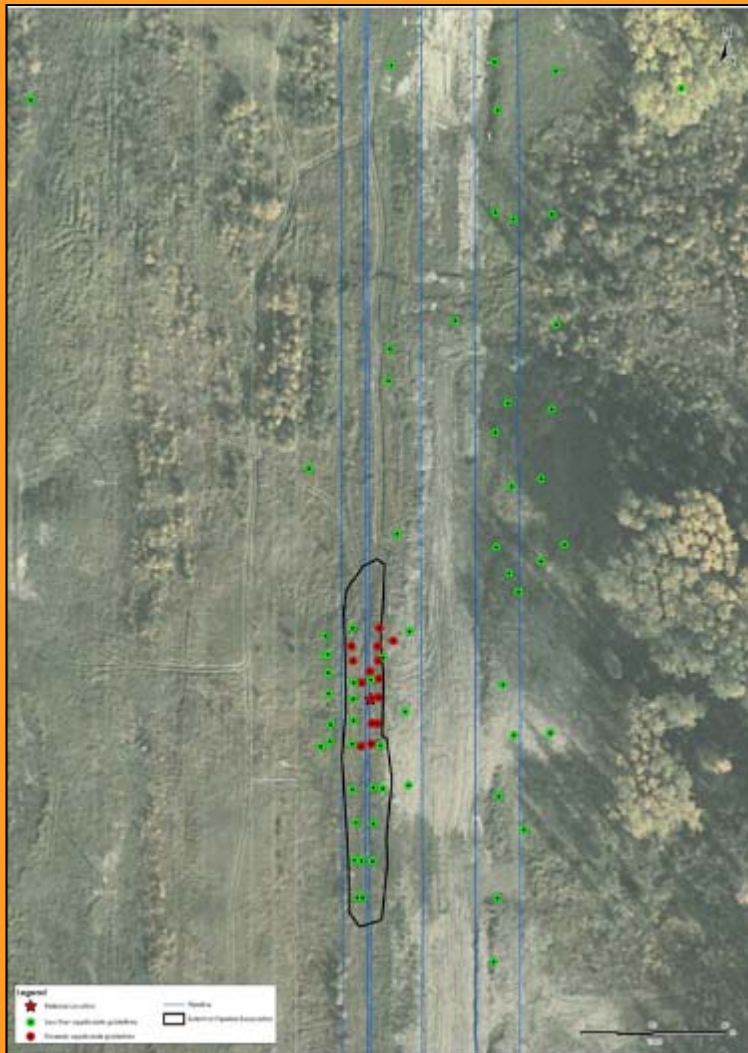


Soil: 0.6 to 1.5 mbg

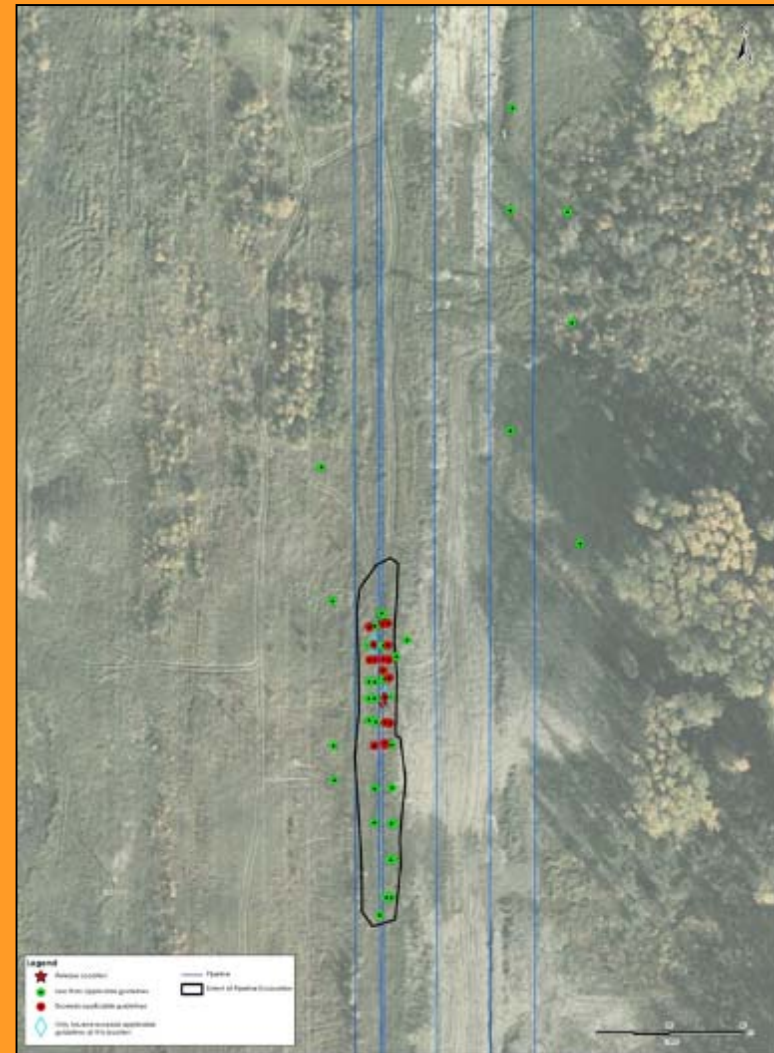


Soil Characterization - ROW

Soil: 1.5 to 3.0 mbg

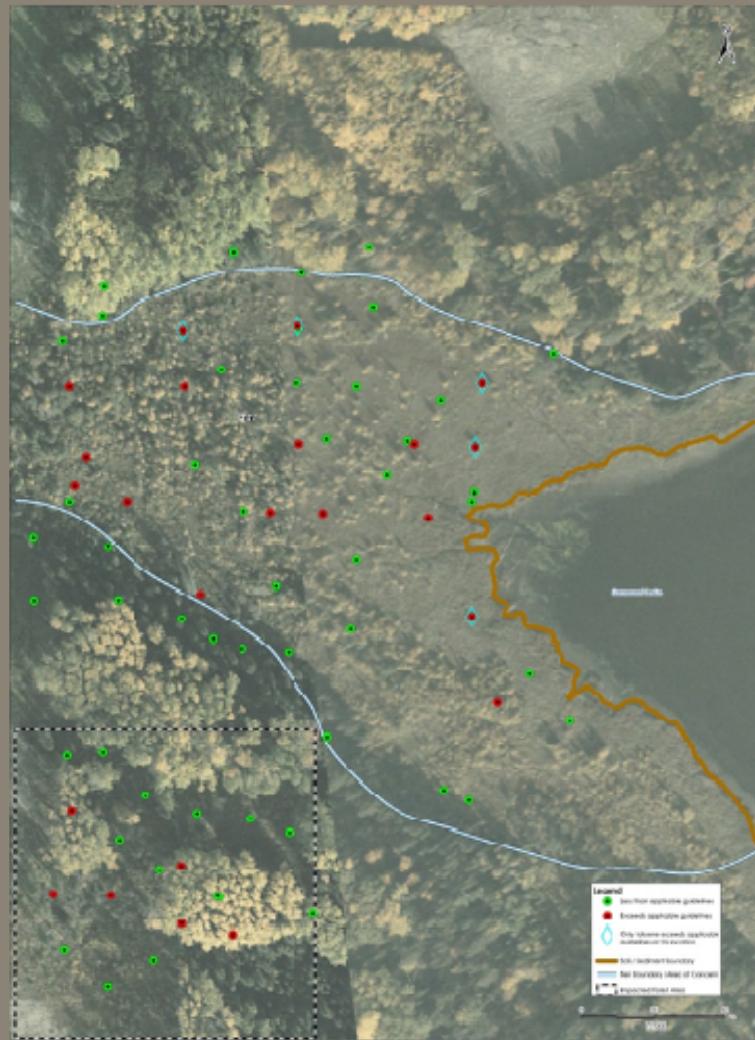


Soil: > 3.0 mbg

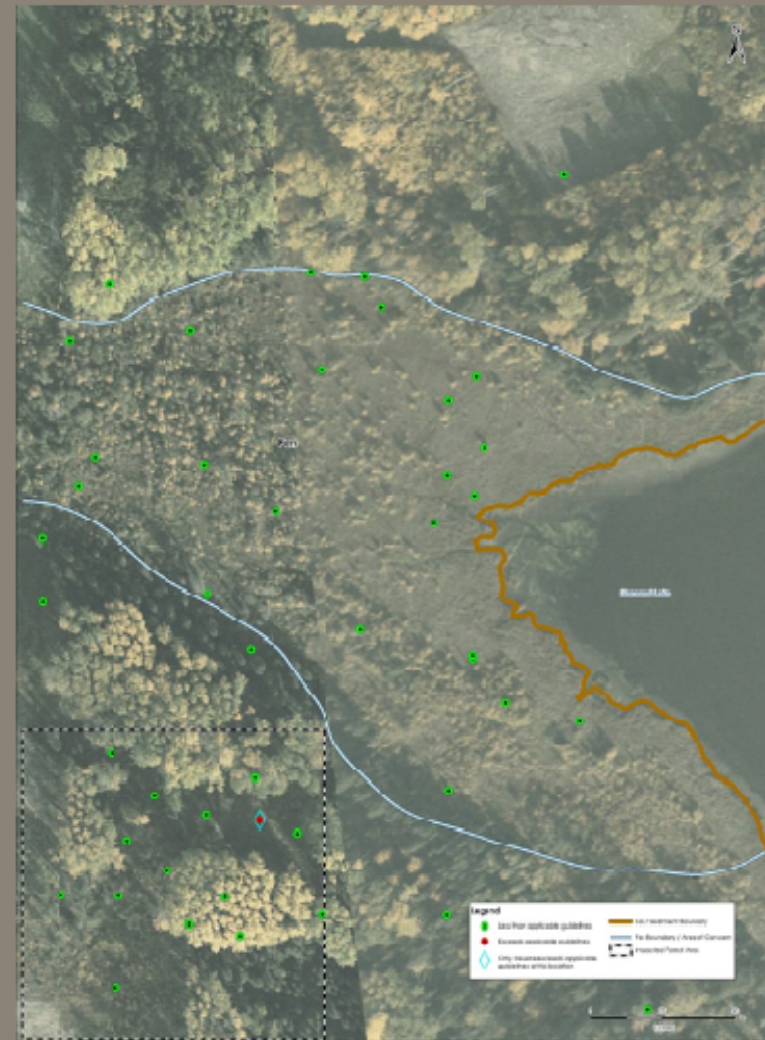


Soil Characterization - Fen

Fen: 0 to 0.6 mbg



Fen: 0.6 to 1.5 mbg

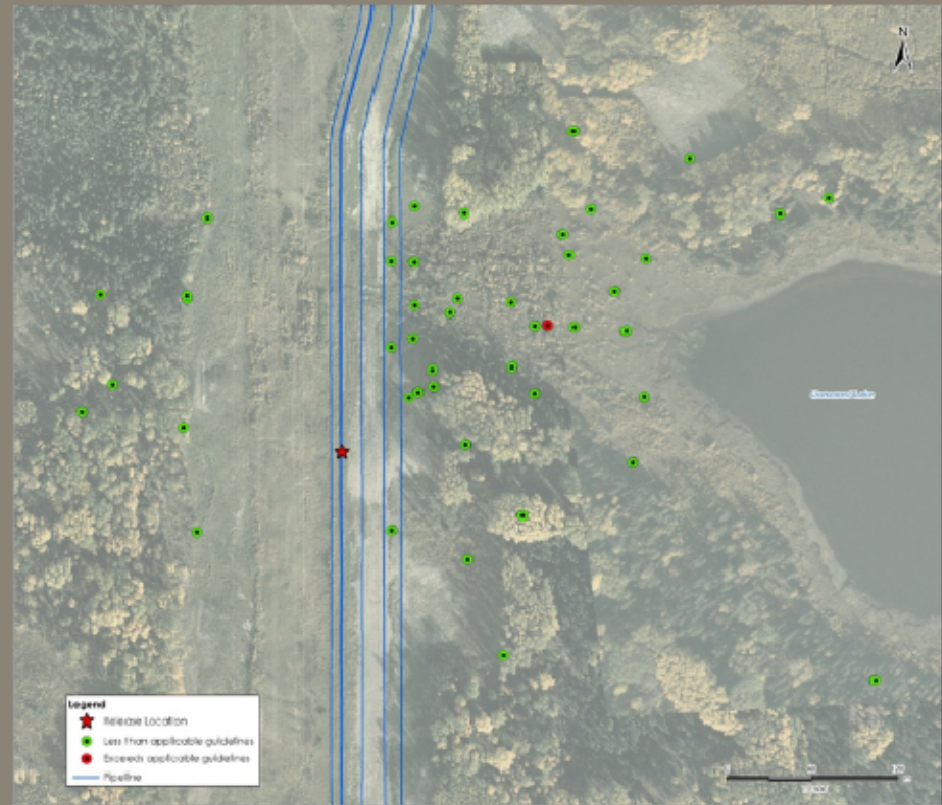


Groundwater and Surface Water Characterization

Surface water

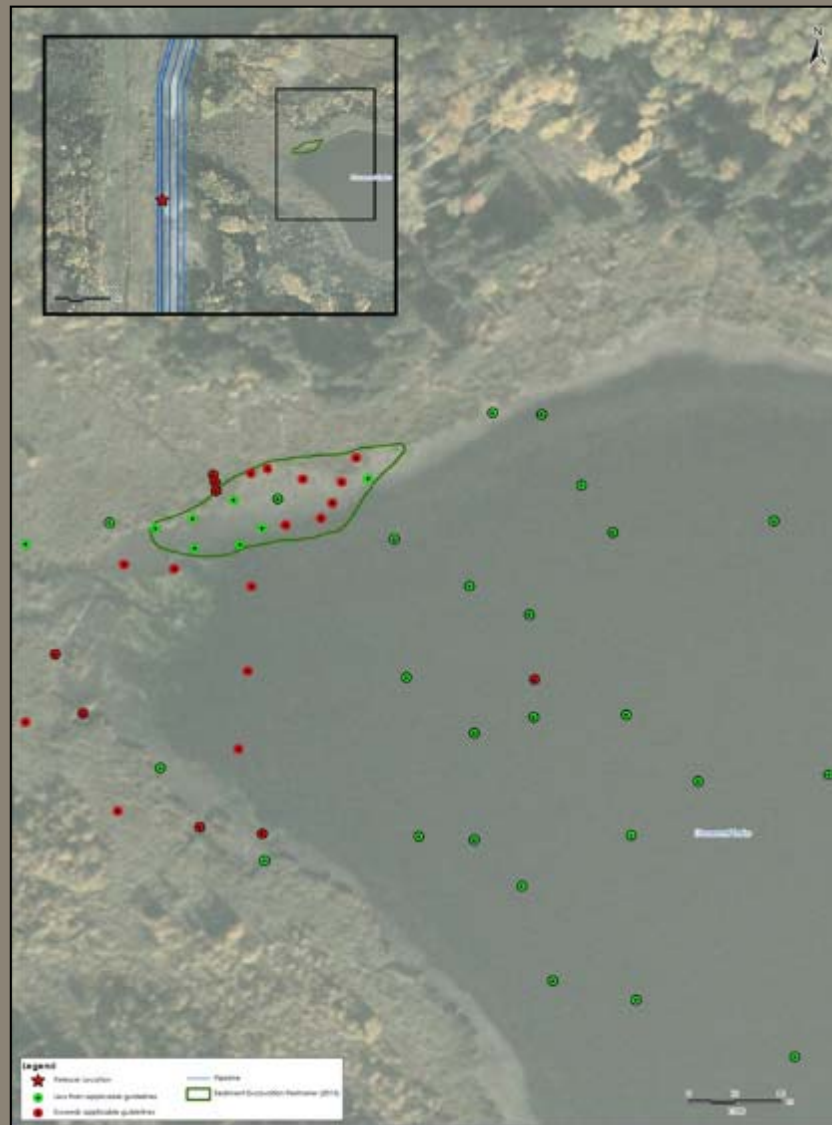


Groundwater



Sediment Characterization

Sediment: 0 to 0.45 mbg



Pathway to Closure

Summary of Initial Remediation:

- Removed approximately 193 m³ of the released PSC (approximately 93% of the oil released)



Acknowledgements

- Enbridge Pipelines
- Focus Wildlife
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- Sequoia Environmental Remediation
- Trimedia
- Ketek Group
- Challenger Geomatics
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- Maxxam Analytics
- Barry Zajdlik
- 350 + Stantec staff across Canada and US (over 25 offices)

Discussion and Questions



October 2013