Residential Redevelopment of a Former Multi-well Pad and Battery Site within an Urban Environment

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Outline

1. Site Background and History
2. Environmental Site Assessment (ESA) – Phase I and Phase II ESAs
3. Risk Assessment – Tier 2 Assessment (Guidelines Adjustment and Subsoil Salinity Tool [SST]) and Soil Vapour Assessment
4. Soil Remediation
5. Conclusions

Site Background

- Former oil and gas multi-well pad and battery
- Three wells drilled between 1981 and 1990 and suspended between 2005 and 2015
- Undeveloped agricultural land surrounded by residential / residential redevelopment
- Licensee and developer jointly pursue Reclamation Certificate for residential redevelopment

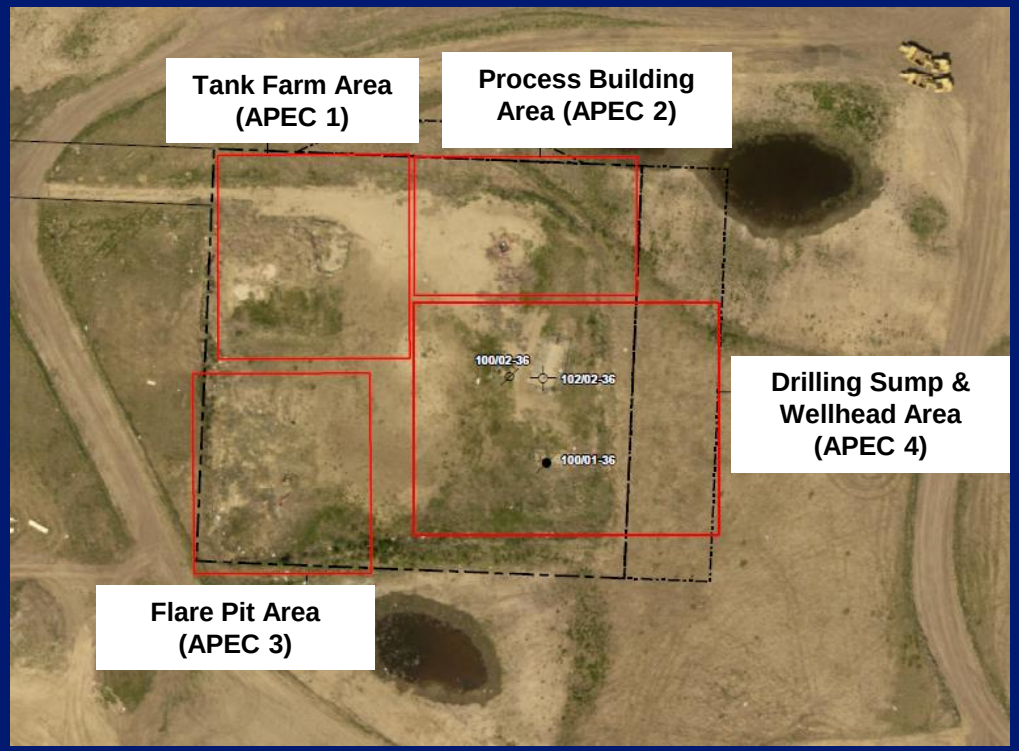
Base Photos: Google Earth

Environmental Site Assessments - History

- Phase I ESA (Matrix, 2011)
- Phase II ESA (Matrix, 2012)
- Groundwater Monitoring and Sampling (Matrix, 2013-2015)
- Phase I ESA (Hoggan, 2017)
- Phase II ESA (Trace, 2018)
- Phase I ESA Update (Trace, 2020)
- Supplemental Phase II ESA (Trace, 2021)
- Phase I ESA Greenfield Site Update (Trace, 2022)

Environmental Site Assessments – Phase I ESAs

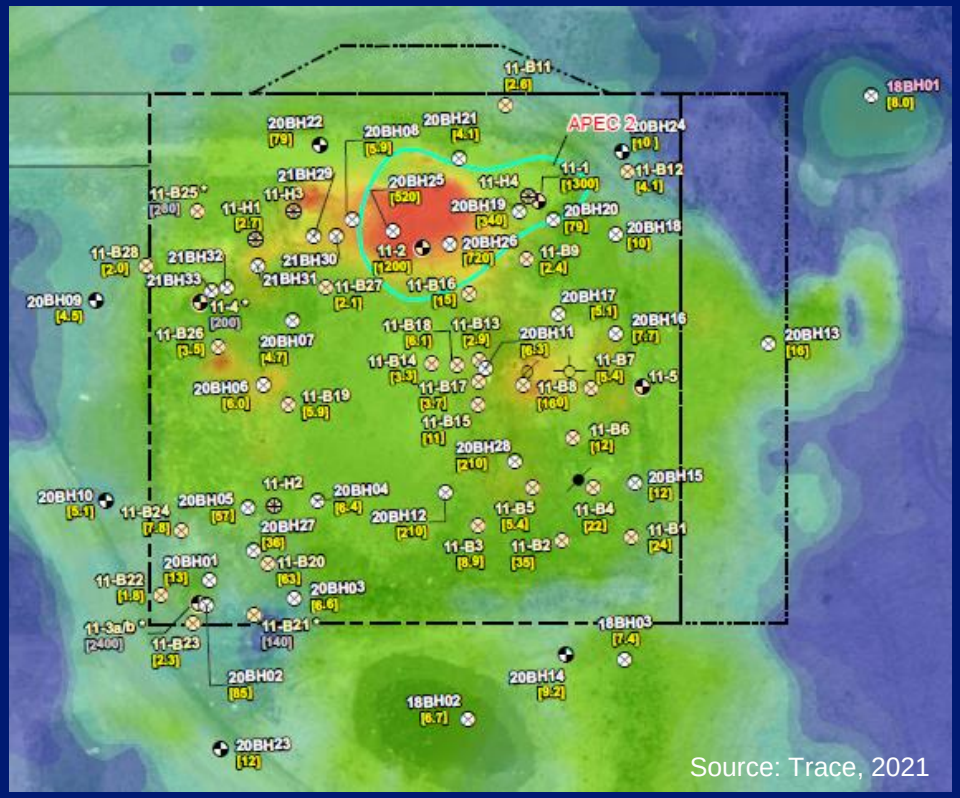
- Phase 1 ESA (Matrix, 2011)
  - Four Areas of Potential Environmental Concern (APECs)
  - Four Spills (<5 m^3 oil and 70 m^3 drilling fluids)
- Phase I ESA Updates
  - 2017 on behalf of developer as buyer
  - 2020 & 2022 updates required for land development application
  - No new APEC



Source: Trace, 2021

Environmental Site Assessments - Phase II ESAs

- Phase II ESA (Matrix, 2012)
- Groundwater Monitoring and Sampling (Matrix, 2013-2015)
- Phase II ESA (Trace, 2018)
- Supplemental Phase II ESA (Trace, 2021)

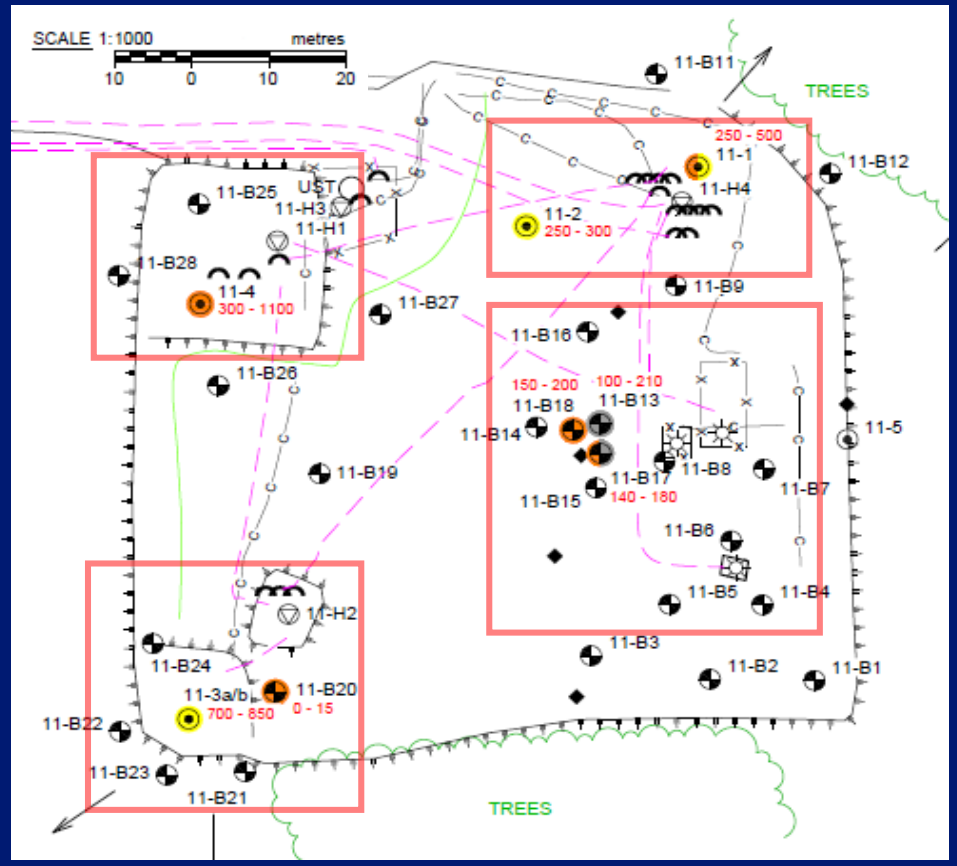


Source: Trace, 2021

Phase II ESAs – Matrix, 2012

Tank Farm Area (APEC 1): 700 m^3 of petroleum hydrocarbon (PHC)-impacted soil (max. depth of 11 metres below ground surface [mbgs])

Flare Pit Area (APEC 3): >700 m^3 of salinity-impacted soil (max. depth of 12 mbgs)



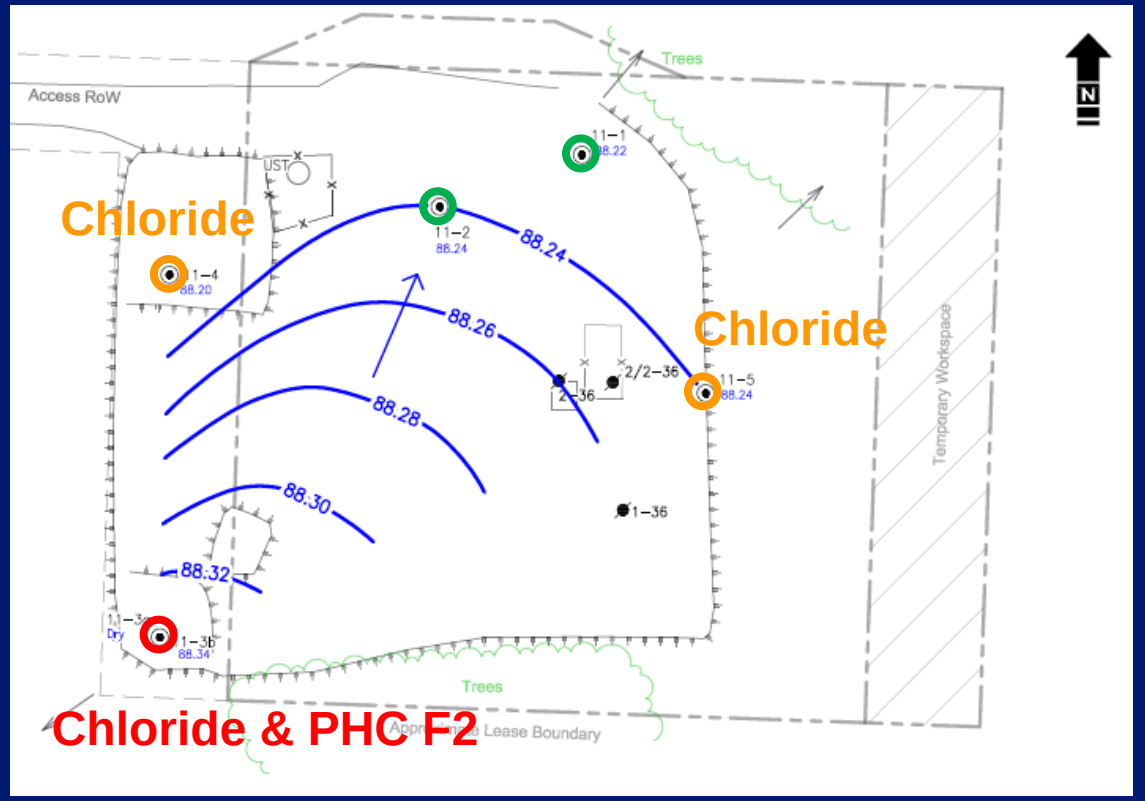
Modified from Matrix, 2012

Process Building Area (APEC 2): 2,800 m^3 of PHC- and salinity-impacted soil (max. depth of 5 mbgs)

Drilling Sump & Wellhead Area (APEC 4): 200 m^3 of metal- and heavy-end PHC-impacted soil (max. depth of 2.5 mbgs)

Groundwater Monitoring and Sampling (Matrix, 2013-2015)

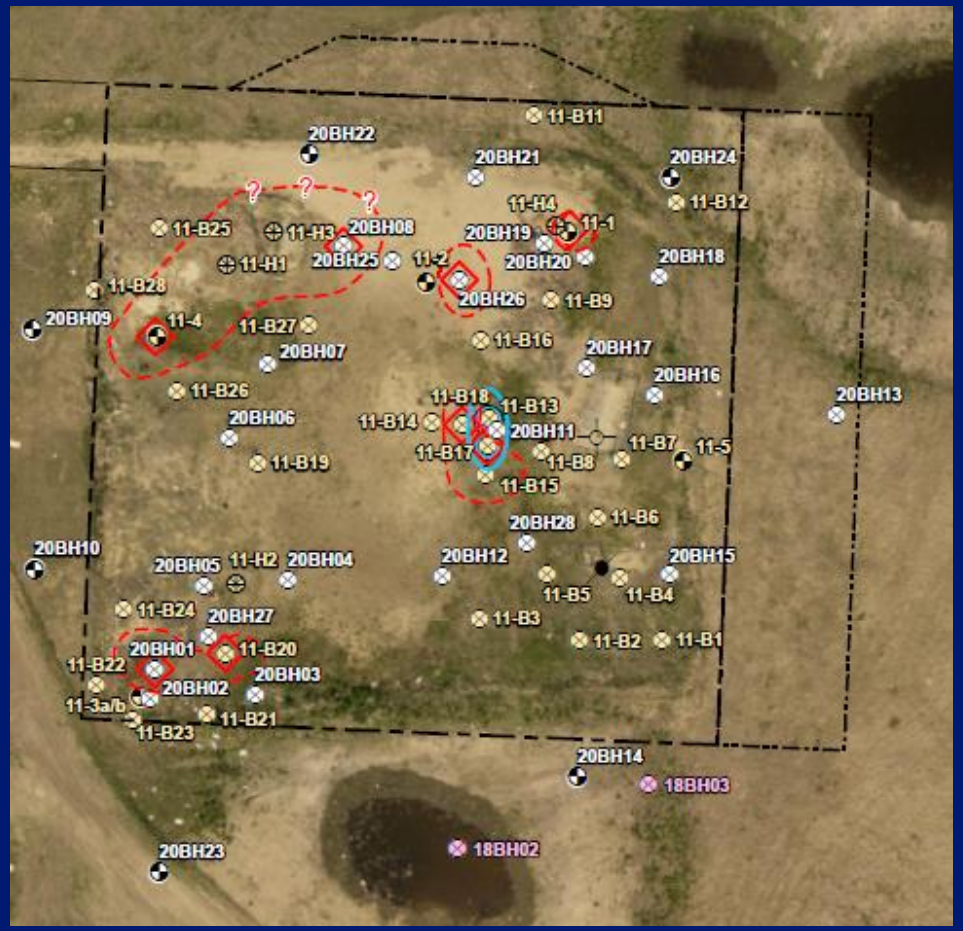
- Elevated chloride in groundwater in the Tank Farm area (APEC 1), the Flare Pit area (APEC 3), and the Drilling Sump and Wellhead Area (APEC 4)
- PHC exceedances identified in 2014 in the Flare Pit area (APEC 3)



Modified from Matrix, 2015

Supplemental Phase II ESAs (Trace 2018 & 2021) - PHC

Tank Farm Area (APEC 1): extended PHC-impacted area (max. depth of 11 mbgs)



Source: Trace 2021

Process Building Area (APEC 2): extended PHC-impacted area (max. depth of 2.5 mbgs)

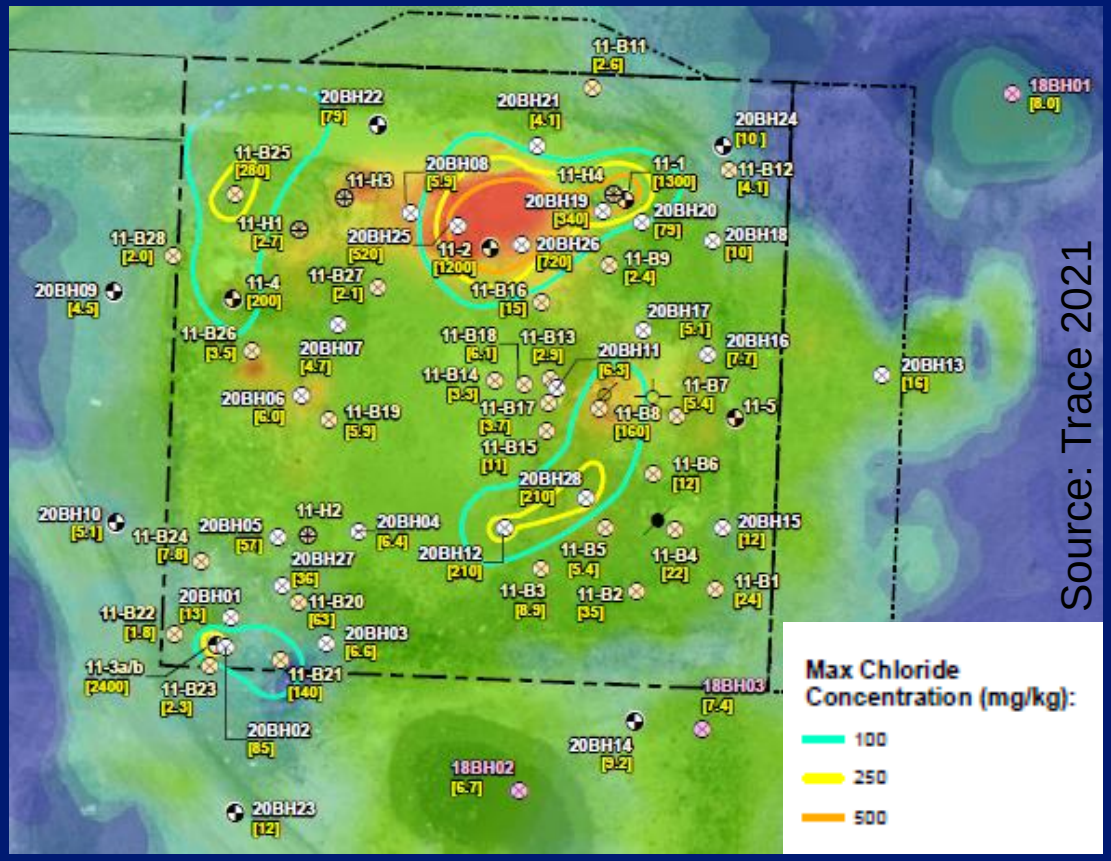
Flare Pit Area (APEC 3): extended PHC-impacted area (max. depth of 2.25 mbgs)

Drilling Sump & Wellhead Area (APEC 4): same extent for PHC- and metal-impacted area (max. depth of 2.0 mbgs)

Supplemental Phase II ESAs (Trace 2018 & 2021) - Salinity

Tank Farm Area (APEC 1): chloride impact at depth (no electrical conductivity [EC] or sodium adsorption ratio [SAR] exceedance)

Flare Pit Area (APEC 3): historical salinity exceedances not confirmed



Process Building Area (APEC 2): refined salinity-impacted area (max. depth of ~~5.0~~ 6.0 mbgs)

Drilling Sump & Wellhead Area (APEC 4): historical salinity exceedances not confirmed

Supplemental Phase II ESAs (Trace 2018 & 2021) - Groundwater

- Concentrations of PHCs in groundwater met the applicable guidelines across the Site.
- Chloride in groundwater marginally above applicable guideline in Tank Farm Area (APEC 1) (max. of 260 milligrams per litre).

Source: Trace, 2021

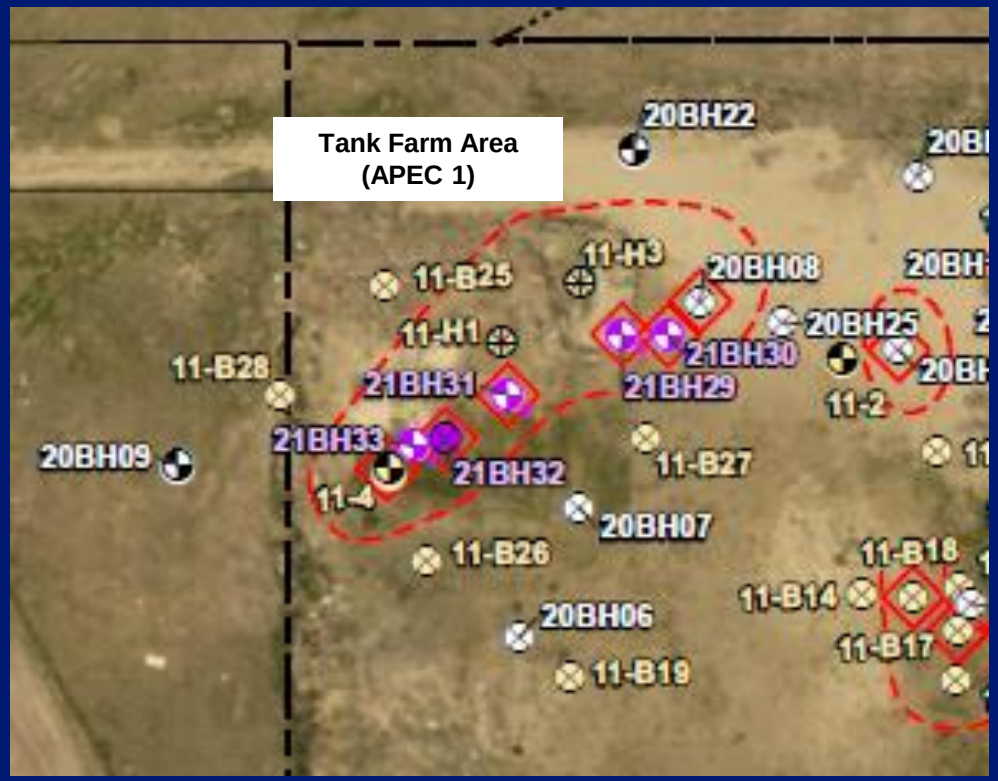
Risk Assessment – PHCs Tier 2 Assessment

Contaminant of Potential Concern	Human Exposure Pathways			Ecological Exposure Pathways		Management Limit
	Direct Contact	Vapour Inhalation	Domestic Use Aquifer	Direct Contact	Freshwater Aquatic Life	
Benzene	-	X	X	-	Excluded	NA
Toluene	-	-	X	-	Excluded	NA
Ethylbenzene	-	X	X	-	Excluded	NA
Xylenes	-	X	X	-	Excluded	NA
PHC F1	-	X	X	X	Excluded	X
PHC F2	-	X	X	X	Excluded	X
PHC F3	X	NA	NA	X	Excluded	X
PHC F4	-	NA	NA	X	Excluded	X

Tier 2 site-specific guideline for vapour inhalation and domestic use aquifer pathways using vertical distance between impact and receptor (Intrinsik, 2021)

Soil Vapour Assessment

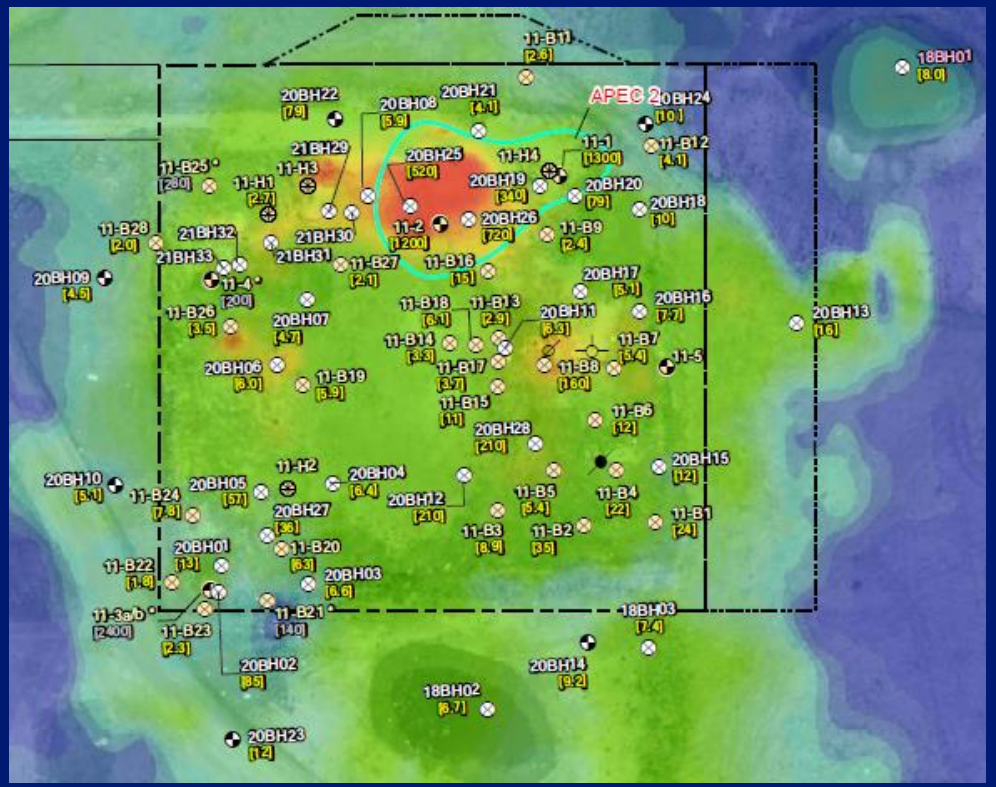
- Objective: Refine risk assessment for future residential area (including basements)
- Five soil vapour probes
- Development of site-specific soil vapour guidelines
- Guideline exceedances in soil (2.5 to 6.0 mbgs) and soil vapour



Source: Trace, 2021

Risk Assessment – Salinity Tier 2 Assessment (SST)

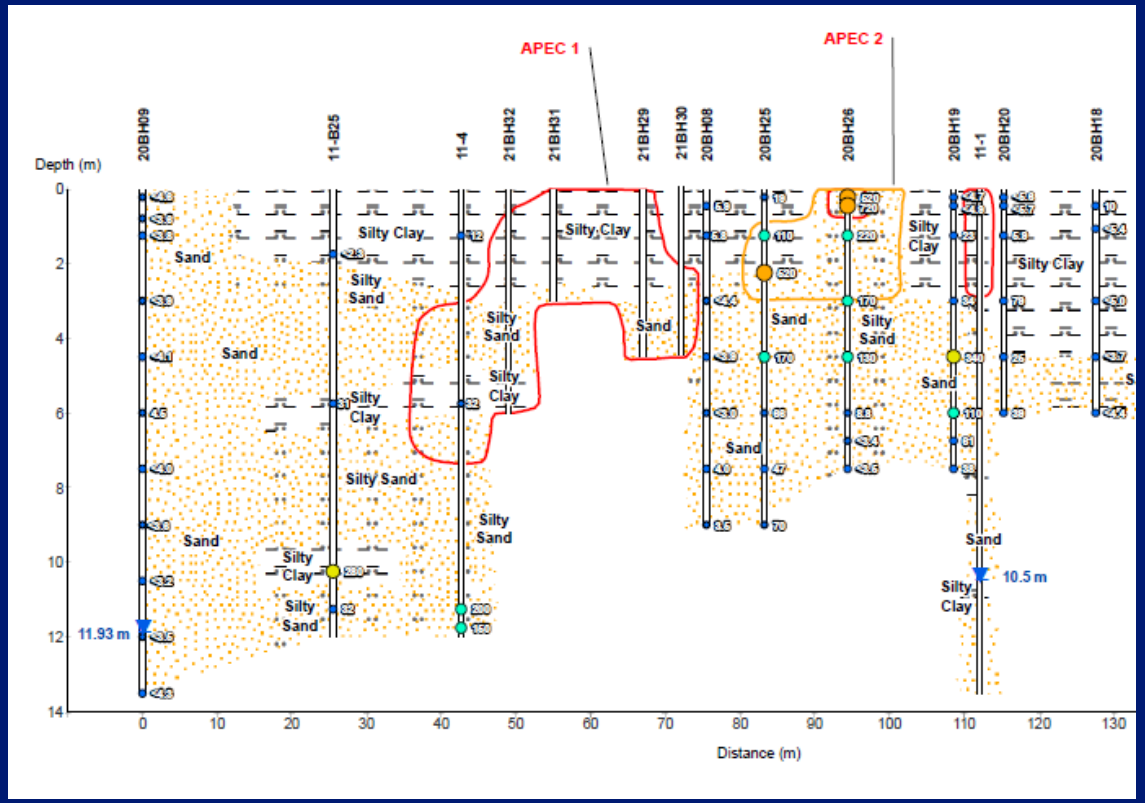
- Tank Farm Area (APEC 1): no Tier 1 EC or SAR exceedance (low risk) – no remediation
- Process Building Area (APEC 2): remediation required to at least 3.0 mbgs
- Former Flare Pit (APEC 3) and Drilling Sump and Wellhead (APEC 4) areas: salinity exceedances not confirmed in 2020 – no remediation



Source: Trace 2021

Remedial Action Plan

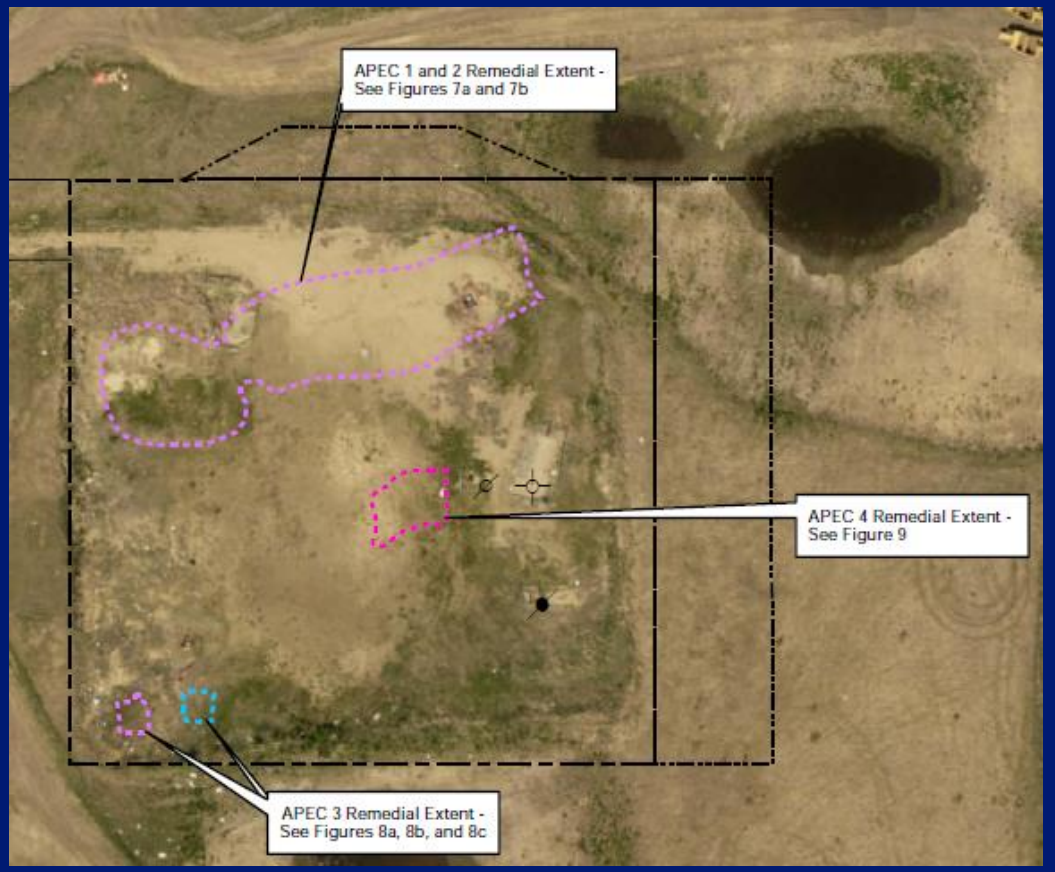
- PHC and salinity Tier 2 Site-Specific Remediation Objectives were developed
- Estimated volume of 7,500 m^3 requiring remediation
- Excavation and transport to a temporary storage location (former site owner property)



Source: Trace 2021

Remediation Activities

- Excavation was deeper than expected (estimated depth was 8.0 mbgs and final extents were 11.0 mbgs at the deepest point)
- Updated Salinity Tier 2B guidelines using excavation data (two sub-areas were developed)
- Excavated volume was 6,475 m^3
- Backfilled using segregated overburden, and stockpiled material from development activities



Source: Trace 2022

Conclusions

- ESA activities for the development application began in 2018
- Original estimated impacted volume on Site was >15,000 m^3
- Development of Site-specific Guidelines for PHC and salinity (risk assessment)
- Estimated remediation volume decreased to 7,500 m^3

Source: Trace 2022

Conclusions

- Remediation activities conducted in Fall 2021 with guidelines updated based on field conditions observed
- Final excavated volume was 6,475 m^3
- Backfilled using segregated overburden, and stockpiled material from development activities (substantial cost savings)
- Reclamation Certificate Application in February 2022 and approved within 30 days

Source: Trace 2022

Questions? We're here to help

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