



Tier 2 Pathway Elimination and Guideline Modification for Remediation Certificate Application

Remediation Technologies Symposium 2017

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PRESENTATION OVERVIEW

- Site Details
- Previous Site Assessments
- Conceptual Site Model
- Tank Farm Excavation
- Exposure Pathway Evaluation and Tier 2 Guideline Derivation
- Assessment Results and Conclusions
- Remediation Certificate Application

SITE DETAILS

- Industrial property first developed and utilized in 1970's
- Historical activities:
 - Trucking terminal
 - Maintenance shop
 - Farm equipment storage and retail
 - Oilfield equipment storage and retail
 - Tank farm
 - 1 historical Underground Storage Tank (UST)
 - Up to 23 historical Aboveground Storage Tanks (ASTs)
 - Petroleum hydrocarbon (PHC) compounds (drilling and hydraulic fracturing fluids)

SITE DETAILS

- Most recent activity:
 - Truck yard (maintenance and storage)
 - Oilfield equipment storage
 - Tank farm (PHC compounds, transfer of fluids)
- Surrounding Land Use
 - North: industrial (recycling facility)
 - West: industrial (county road and maintenance yard)
 - East: industrial (continuation of truck yard)
 - South: commercial (motel and highway)
- The most sensitive land use (commercial) property boundary is more than 30 m from the area of impact; therefore the industrial land use is applicable.

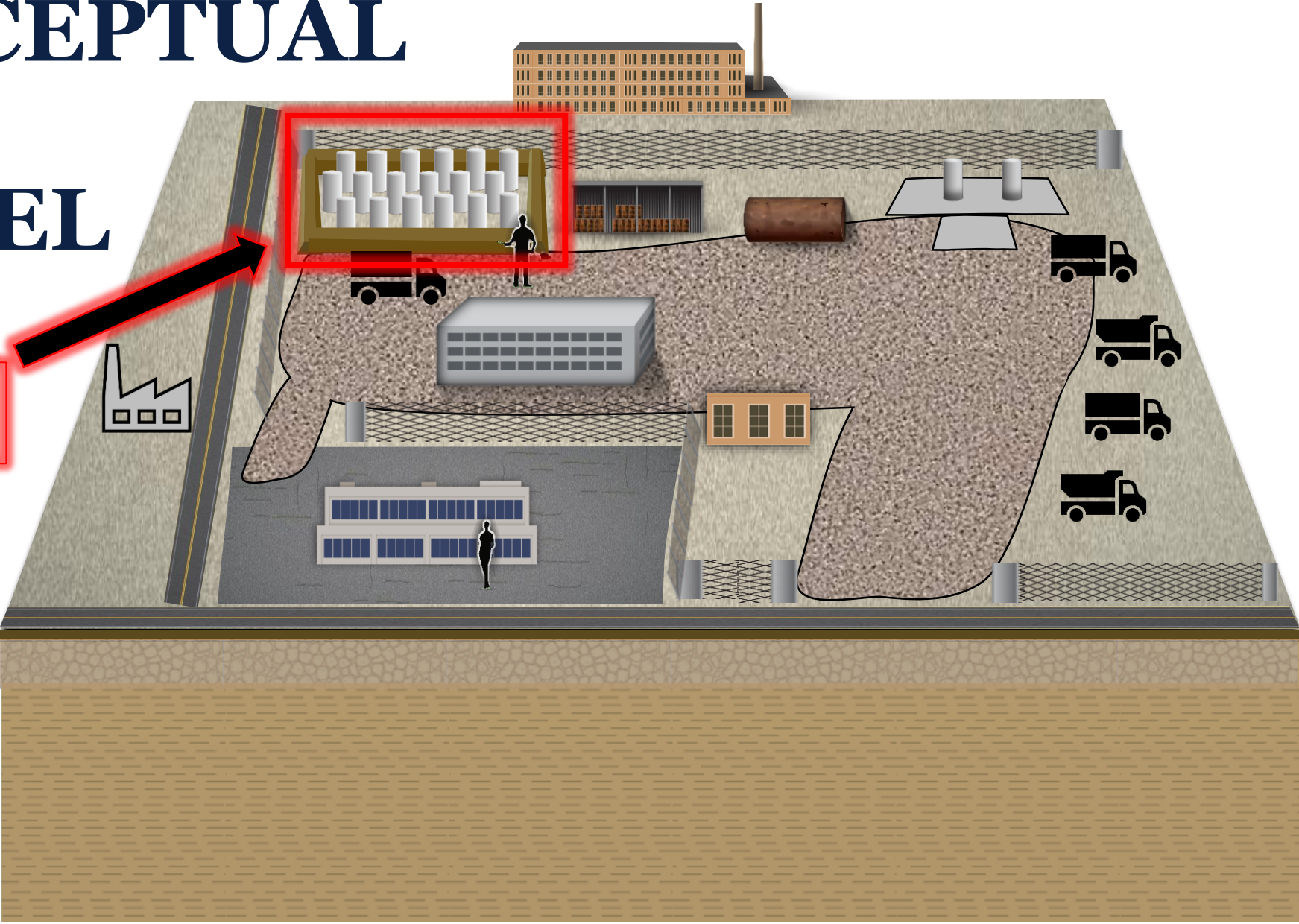
PREVIOUS SITE ASSESSMENTS

Phase 1 Findings

- No record of environmental actions/enforcement
- No history of oilfield development (wells, pipelines, facilities)
- Aerial photos confirm site history and development
- No record of reported spills. Minor stains evident at loading areas
- Primary APEC- bermed tank farm in NW corner



CONCEPTUAL SITE MODEL

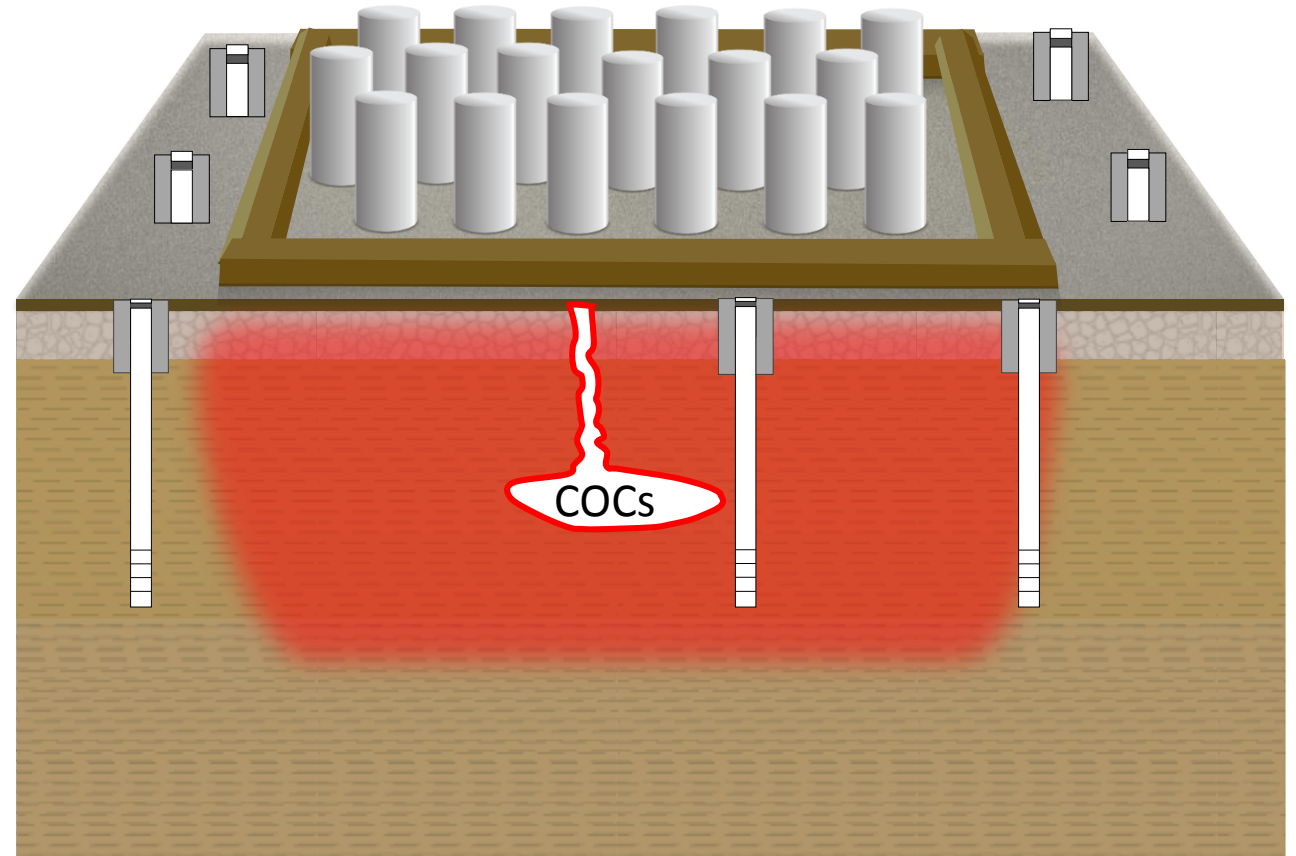


Area of Concern
Tank Farm

PREVIOUS SITE ASSESSMENTS

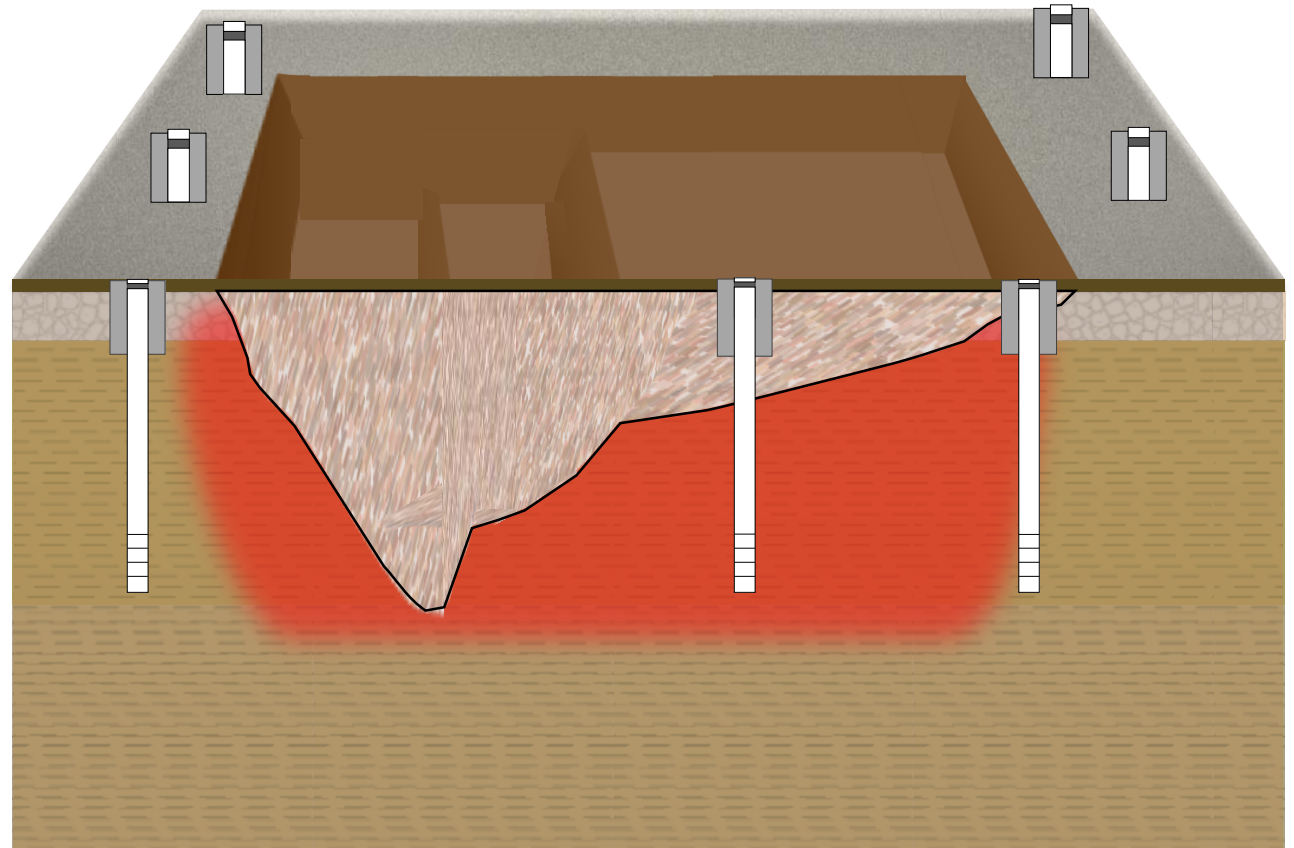
Phase 2 Results

- Tank Farm Area – Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), petroleum hydrocarbon (PHC) fractions F2 and F3, arsenic, nickel, electrical conductivity, pH
- Complete investigation of the area not possible due to the presence of earthen berms, ASTs, above ground piping and surface water within the berms



TANK FARM EXCAVATION

- Decommissioning commenced in 2013
- Visible hydrocarbon product during removal of pilings
- Excavation reached approximately 34 m x 20 m



TANK FARM EXCAVATION

- Ridgeline retained to conduct confirmatory sampling of excavation
 - Elevated BTEX and PHC F1 – F4, naphthalene, phenanthrene concentrations > Alberta Tier 1 guidelines
 - Salinity and metals < Tier 1 guidelines
- Feasibility of further excavation unlikely due to on-site infrastructure
- Development of Tier 2 Guidelines required



EXPOSURE PATHWAY EVALUATION

Governing Exposure Pathways for Tier 1 Guidelines

- Domestic Use Aquifer
 - BTEX and PHC F1 – F4
 - Available Tier 2 Adjustments?
 - Pathway exclusion
 - > 5 m undisturbed or unfractured fine-grained material with hydraulic conductivity < 1.0×10^{-7}
- Freshwater Aquatic Life
 - Naphthalene and Phenanthrene
 - Available Tier 2 Adjustments?
 - Pathway exclusion
 - > 300 m to nearest surface waterbody
 - Guideline modification calculations
 - < 300 m to nearest surface waterbody

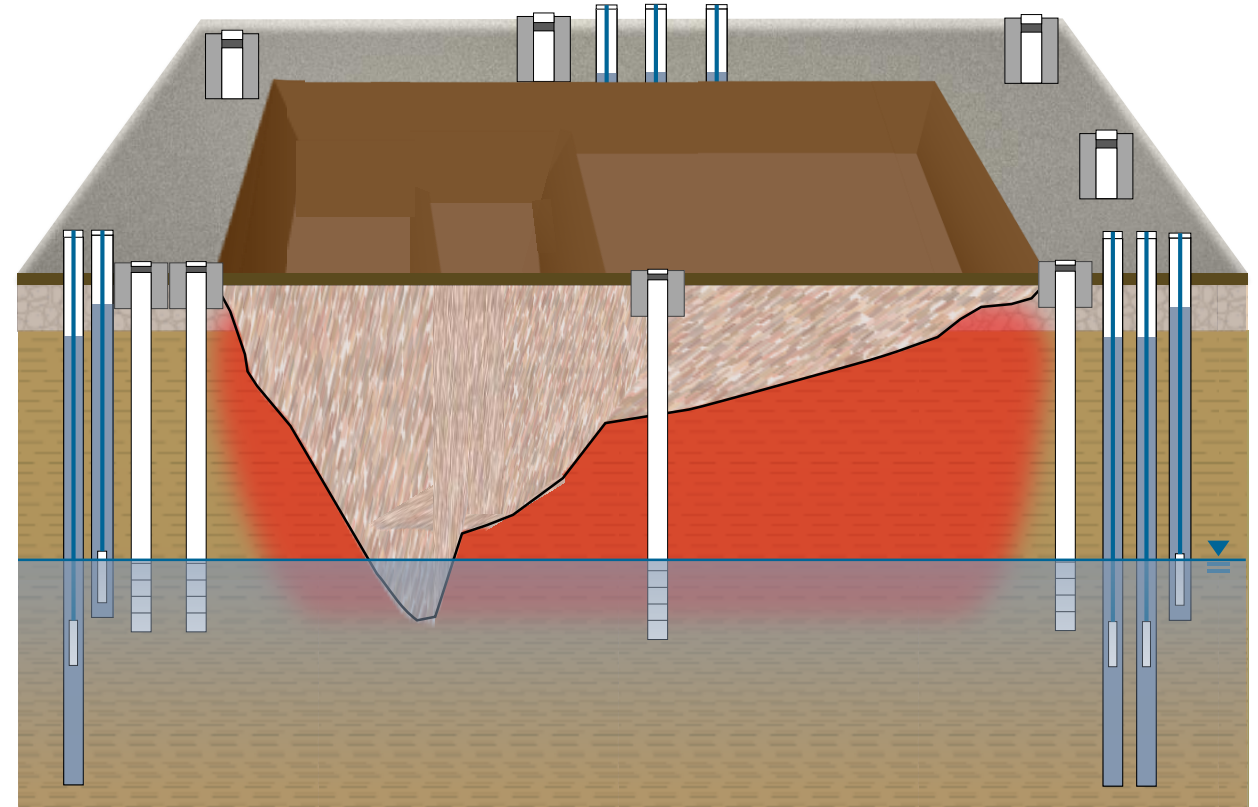
TIER 2 FIELD WORK

Available information

- Geological/soils – lithology to 5.5 mbg (previous assessments)
- Groundwater - not available

Field Scope

- Advance boreholes to install monitoring wells and delineate impacts
 - 3 shallow monitoring wells
 - 10.5 – 12.0 mbg
 - determine if DUA present within zone of COCs
 - 5 deep monitoring wells
 - 19.5 – 22.5 mbg
 - determine if DUA present beneath zone of COCs
 - Additional boreholes for delineation to 13.5 mbg



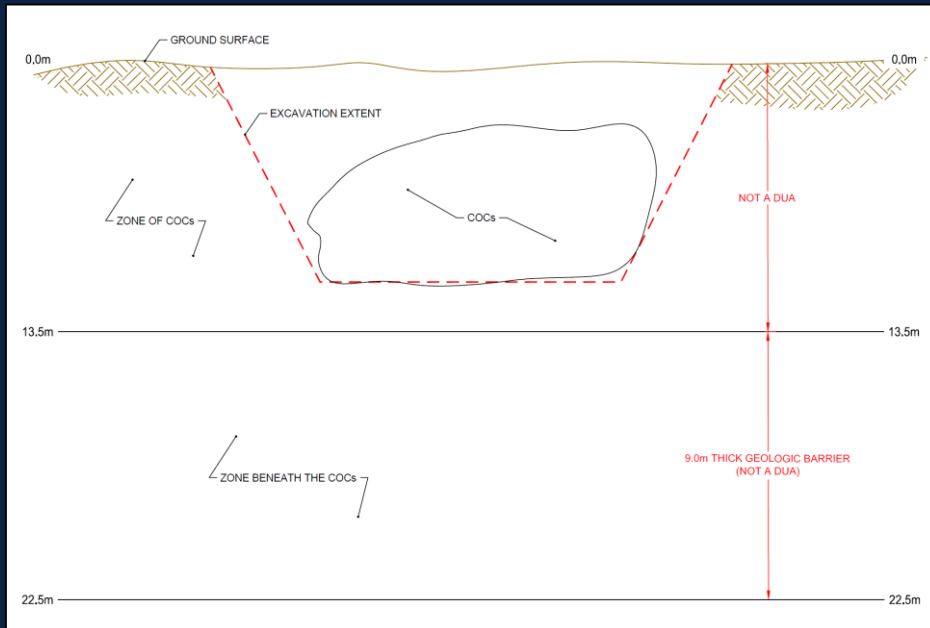
LITHOLOGY AND GROUNDWATER

- Lithology
 - Fine grained geologic material beneath tank farm (to 22.5 mbg)
- Groundwater
 - Hydraulic Conductivity
 - Zone of COCs – (to 13.5 mbg) – 1.28×10^{-9} m/s to 8.80×10^{-8} m/s
 - Zone beneath COCs (13.5 – 22.5 mbg) – 1.33×10^{-9} m/s to 1.88×10^{-7} m/s
 - at least 9 m of unfractured suitable geologic material to act as a natural barrier beneath the COCs
 - Sustainable yield for wells - 0 L/min – 0.045 L/min

PATHWAY EXCLUSION AND MODIFICATION

- Domestic Use Aquifer

- 9 m thickness with hydraulic conductivity not indicative of DUA
- Sustainable yield < 0.74 L/min



- Freshwater Aquatic Life

- Nearest surface water body 185 m (ephemeral creek)



GUIDELINES - TIER 1 vs. TIER 2

COC	Tier 1 Guideline (mg/kg) (surface/subsoil)	Tier 2 Guideline (mg/kg) (surface/subsoil)
Benzene	0.046	11 * 11 **
Toluene	0.52	330 * 2,100 **
Ethylbenzene	0.11	430 * 1,600 **
Xylenes	15	230 * 930 **
F1-BTEX	320 640	320 * 800 **
F2	260 520	260 * 1,000 **
F3	2,500 3,500	2,500 * 4,300 **
F4	6,600 10,000	6,600 * 10,000 **
Naphthalene	0.016	0.057 ***
Phenanthrene	0.051	0.19 ***

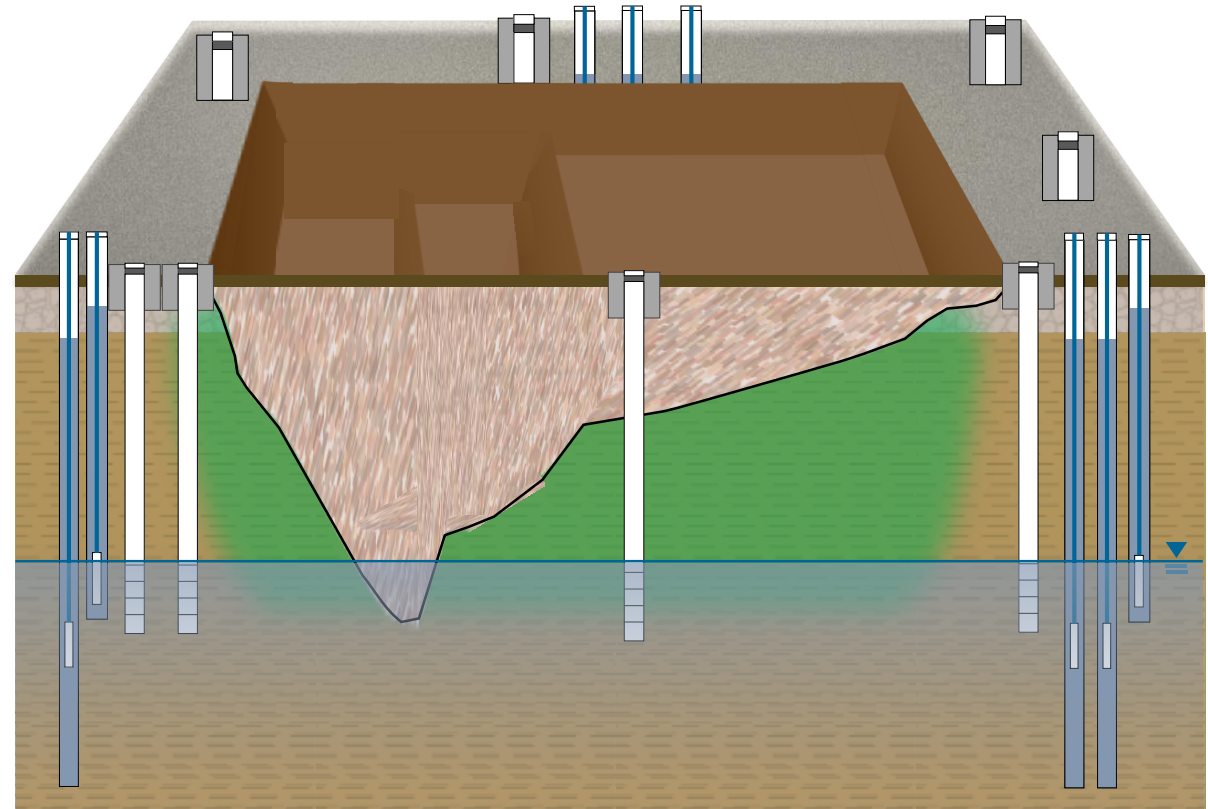
* Eco direct soil contact

** Management limit

*** Freshwater aquatic life

ASSESSMENT RESULTS

- Confirmatory soil results < Tier 2 Guidelines
 - BTEX, PHC fractions F1 to F4
 - Naphthalene, phenanthrene
- Confirmatory soil results < Tier 1 Guidelines
 - metals, salinity
- Laboratory results indicate COCs non-detectable in groundwater samples



ASSESSMENT CONCLUSIONS

- COCs remediated to Tier 2 guidelines
 - No further excavation required!!
 - Final volume transported to landfill reduced by $\sim 1,500 \text{ m}^3 - 2,000 \text{ m}^3$

Next Step?

- Apply for Remediation Certificate for Tank Farm Area



REMEDIATION CERTIFICATE

- Two Remediation Certificate Programs:
 - Remediation certificates for general contaminated sites
 - Includes approved facilities, facilities under Codes of Practice, and other commercial and industrial contaminated sites.
 - Remediation certificates for upstream oil and gas sites
 - Contaminated areas on oil and gas sites in Alberta, includes wellsites, pipelines, and batteries.
 - Effective method for reducing liability on active sites.
 - Does not apply to downstream operations or facilities operating under AEP approval sour gas processing facilities.
- Approved certificates are publicly available
- Remediation Certificate Application for the Tank Farm Area submitted
 - Awaiting review and approval.
 - Confident obtaining certificate – similar to other successful Ridgeline applications

QUESTIONS?