



Risk Assessment and Site Re-Development

Changing the Paradigm

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Introduction



Context:

Efficient brownfield redevelopment is a necessity
Large sites can be problematic – many issues, variability across site, slows down property sales or development

Financial considerations – costly remediation, but vacant land doesn't generate revenue/value



Objectives:

Change how we use and look at risk assessment to accelerate redevelopment and maximize land use while minimizing costs

Traditional Risk Assessment Approach

Calculate risks for site

Land use – what receptors are allowed, what pathways could be operative

Often based on unrestricted land use

Risks lead to remediation and/or risk management plans

Example

Engaged for 2nd opinion on site. Large historical release. Development planned on several affected properties including residential community. SSRA had been conducted.

Risks to plants, invertebrates, wildlife, livestock, construction workers, site workers, nearby farmers (vapour inhalation), outdoor air, buried infrastructure

Hazard quotients up to 690,000; Cancer risks up to 3.4×10^{-2} (vs target of 1×10^{-5})

Conclusion: multiple high risks, extensive Site-wide management proposed

Our conclusions: this is not helpful, does not move site forward

What we found

Direct human contact risks limited to small area under operator care and control

Ecological soil contact risks and livestock/wildlife soil & food ingestion risks limited to similar area

No risk to nearby surface water (delineation/no connection)

Soil vapour delineated, risk limited to an even smaller area

Small strip along one adjacent property where utility installation may require management

Drinking water guideline exceedances in one bedrock unit extended beneath proposed residential development – but municipal supply intended

Most of affected area can be safely redeveloped in accordance with owner intentions with few restrictions

Our Approach



Look at intended use of land



Evaluate data spatially (laterally & vertically)



Identify locations where there may be risks for intended (or current) use, and mitigations required to get there



Also identify locations where there is no barrier to intended or current use



Progressively close out parts of the site to enable redevelopment

A Different Way – Progressive Closure



Look for opportunities to redevelop parts of a larger site while other areas are managed



Align management requirements with development goals: do risks vs unrestricted land use actually impede intended development?

Accelerating Redevelopment Options Analysis

Key Priorities:

- Manage risk to human health and the environment
- Reduce corporate environmental liability through accelerated site divestment
- Repurpose sites to optimize value for stakeholders

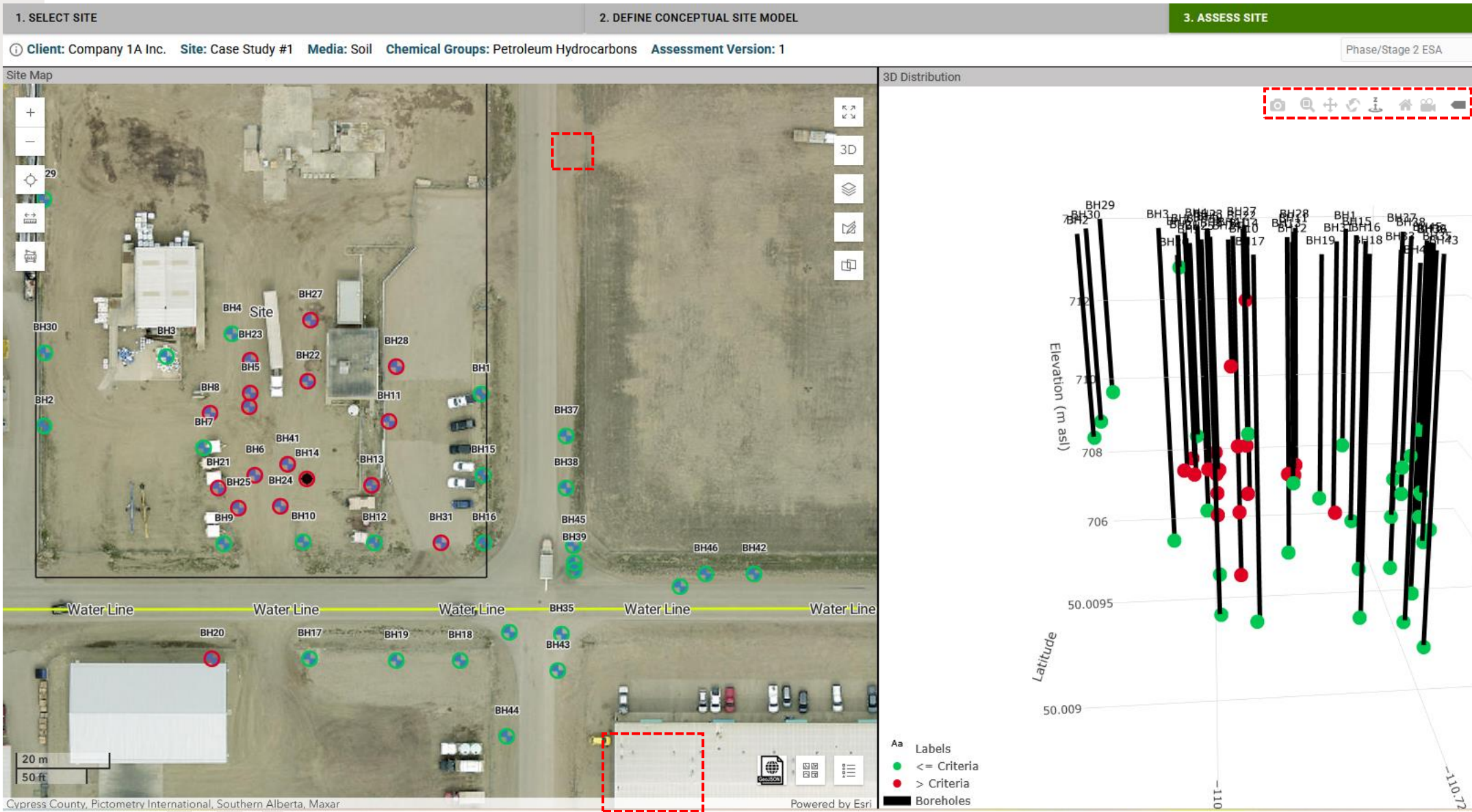


Progressive Closure

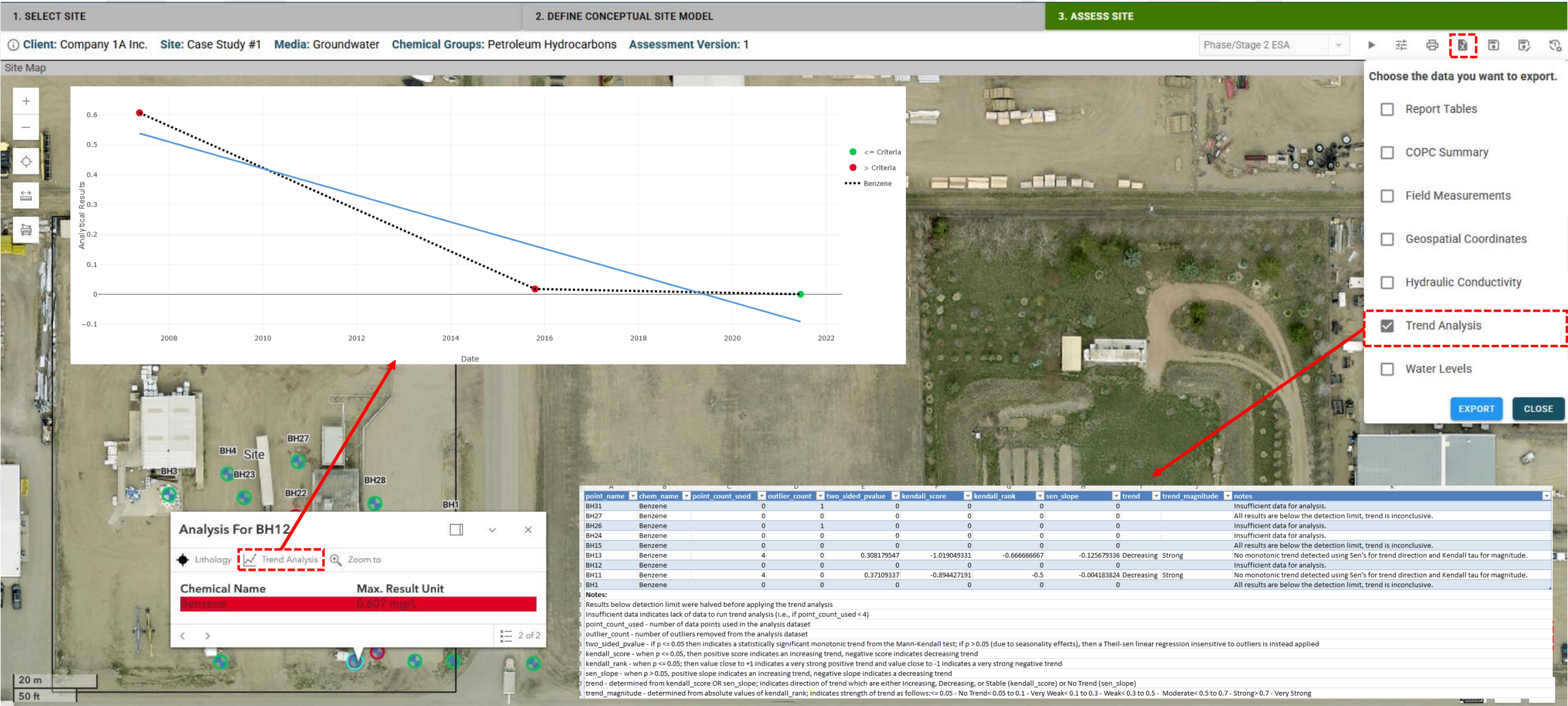


Assess, Visualize,
and Move
Forward – with fit
for purpose

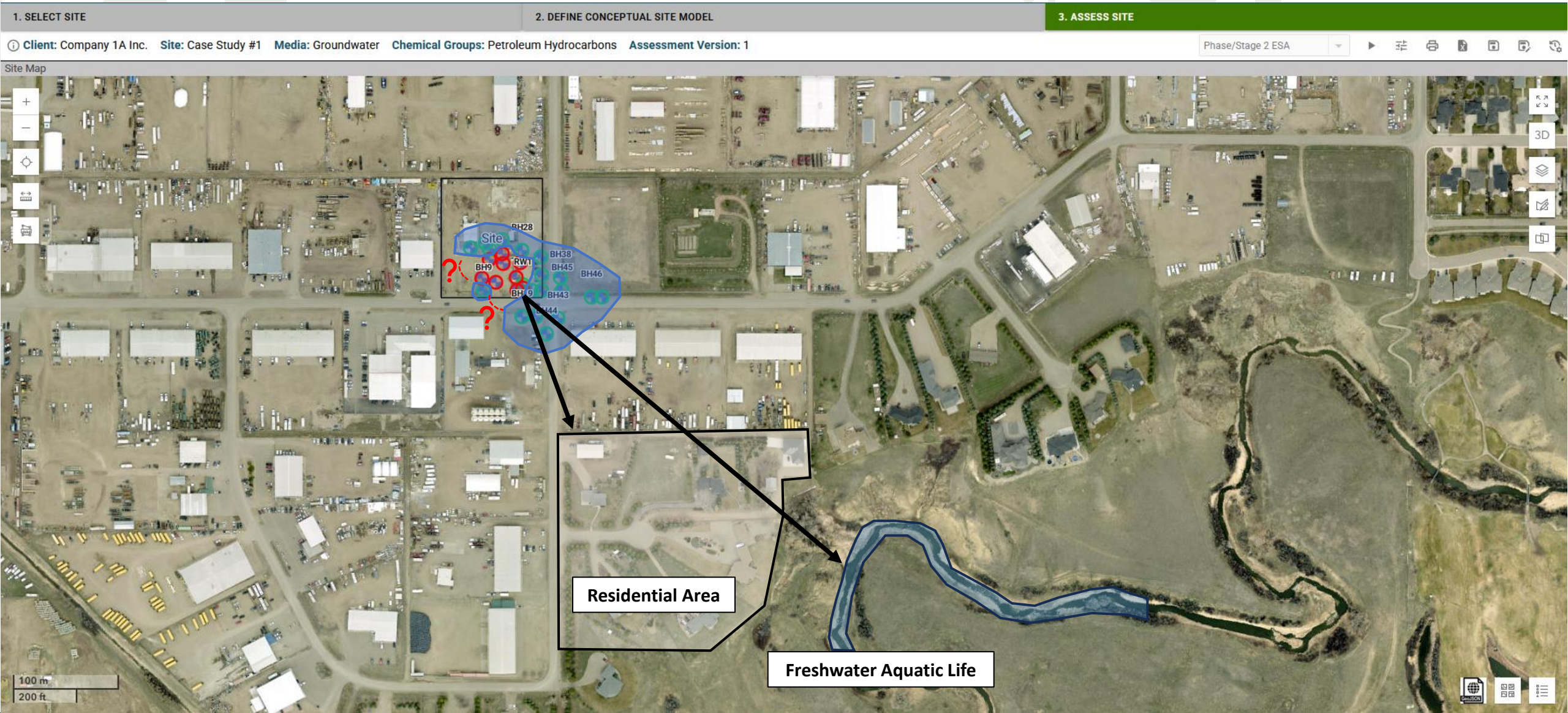
Understand Site Data – in 3 Dimensions



Understand Temporal Trends

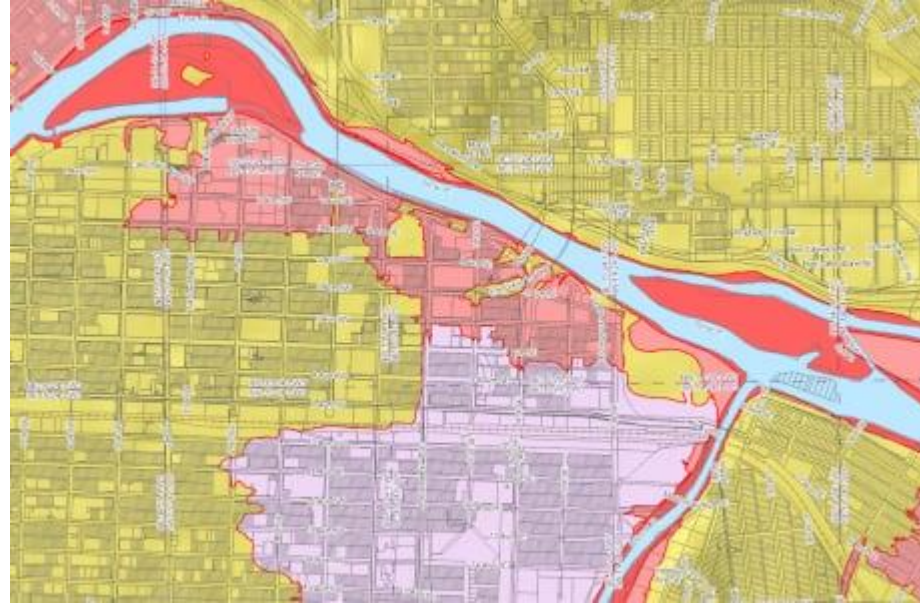


Identify Receptors



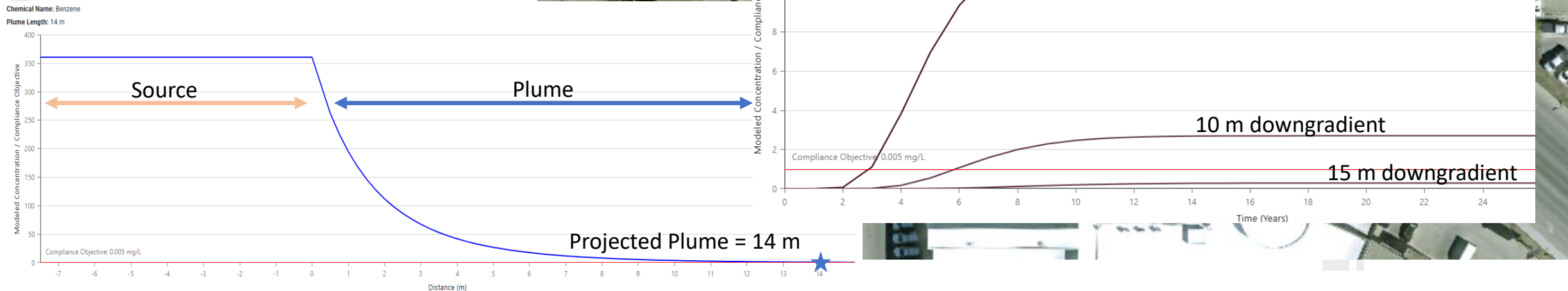
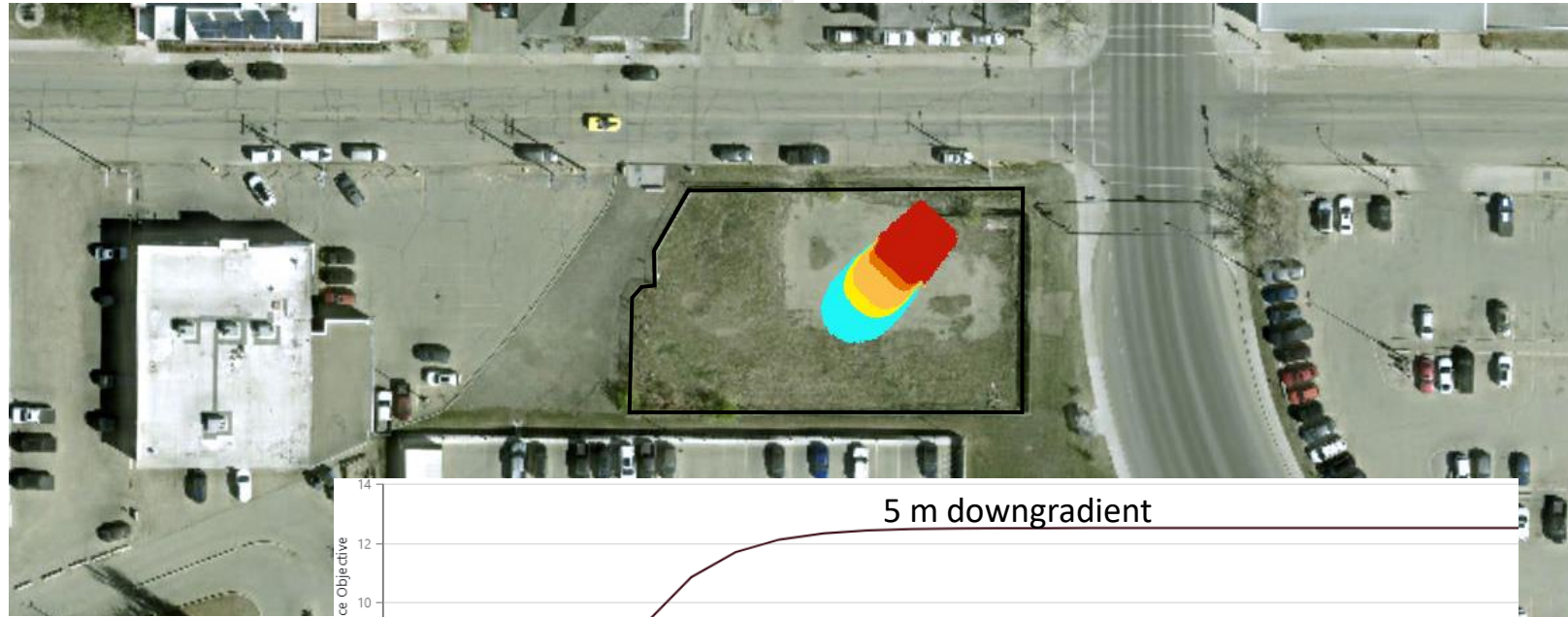
Layering External Constraints

- Add zoning layers (e.g., residential, commercial zoning)
- Add physical constraints (e.g., floodplains, utilities)
- Understand development limitations beyond contamination



Need to understand – future movement of contaminants

NAT Output –
supporting divestment
(potential buyer
concerns, GW
monitoring not
required)



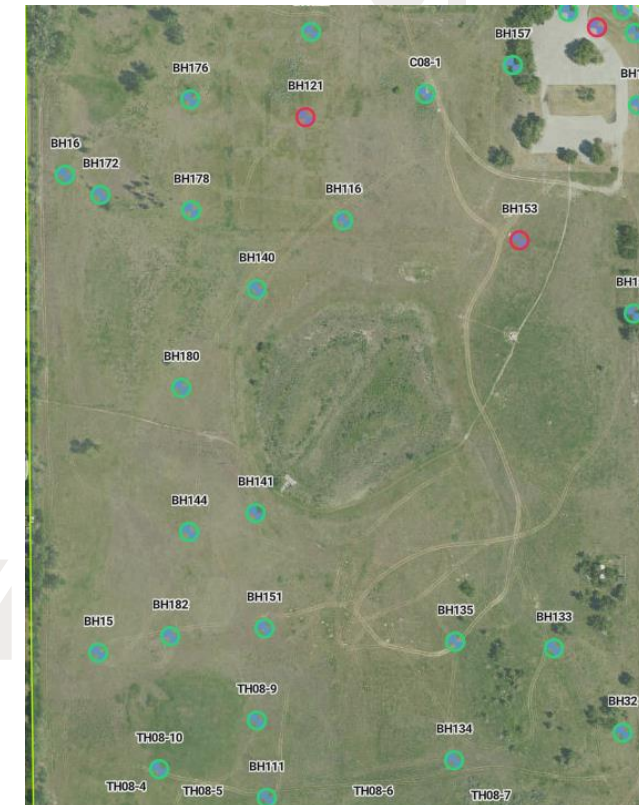
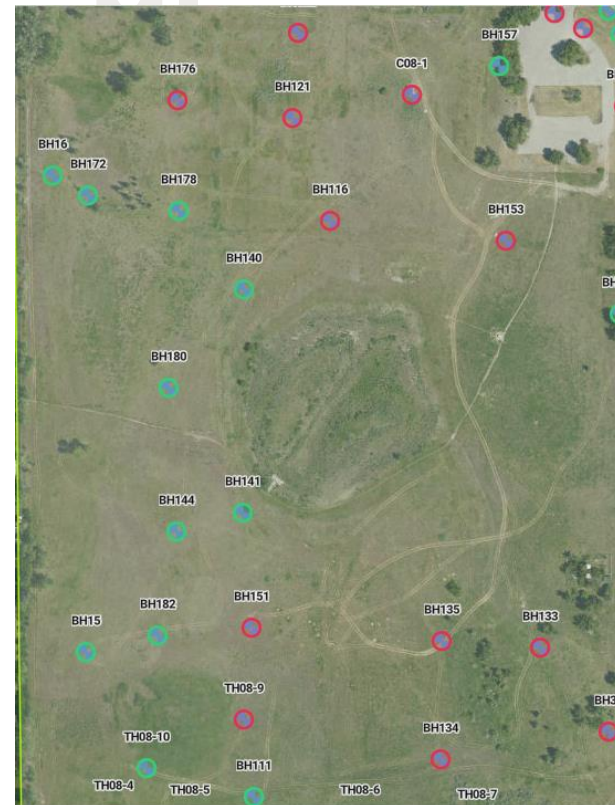
Identify Risk Drivers Under Different Land Uses

- For residential: highlight exceedances (e.g., vapour inhalation, eco-contact)
- For commercial: same analysis under less stringent guidelines
- Pinpoint limiting pathways that delay or prevent development

Vapour Inhalation Pathway Guidelines:

Residential

Commercial



Use data to inform any land use restrictions

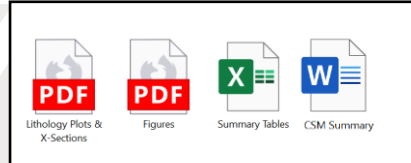


Table X. Analytical Summary

APEC	Point Name	Depth (m bgs)	Date	Sample Type	Petroleum Hydrocarbons							
					Benzene	Toluene	Ethylbenzene	Xylenes Total	F1-BTEX	F2	F3	F4

Table X. COPC

APEC	Chemical Group	Chemical	Sample Depth (m bgs)	Concentration	Units	Criteria Applied	No. of Samples	Depth Range of Exceedances (m bgs)	Limiting Pathways
UST Nest	Petroleum Hydrocarbons	Benzene	8.5 - 9.1	290	mg/kg	0.046	51	1.2 - 11.6	DUA, VI_s, FAL
UST Nest	Petroleum Hydrocarbons	Ethylbenzene	8.5 - 9.1	650	mg/kg	0.073	29	1.2 - 13.7	DUA
UST Nest	Petroleum Hydrocarbons	Toluene	8.5 - 9.1	2000	mg/kg	0.52	17	1.2 - 11.6	DUA, EDC, HDC
UST Nest	Petroleum Hydrocarbons	Xylenes Total	8.5 - 9.1	3900	mg/kg	0.99	22	1.2 - 11.6	DUA, EDC, HDC, OME, VI_s
UST Nest	Petroleum Hydrocarbons	F2	8.5 - 9.1	2900	mg/kg	520	5	8.5 - 9.1	EDC, ML, DUA, OME
UST Nest	Petroleum Hydrocarbons	F1-BTEX	8.5 - 9.1	19000	mg/kg	640	5	8.5 - 9.1	EDC, ML, DUA, OME, VI_s

Notes:

DUA = Protection of Domestic Use Aquifer

VI_s = Vapour Inhalation (Slab)

FAL = Protection of Freshwater Aquatic Life

EDC = Ecological Direct Soil Contact

HDC = Human Direct Soil Contact

OME = OffSite Migration (Ecological)

ML = Management Limit

Regulatory Considerations

- Understand environmental regulations and policies
 - Closure mechanisms – e.g. Alberta Limited Remediation Certificate
 - Risk management and brownfield redevelopment requirements
- Understand options to maintain controls
 - Municipal bylaws
 - Land use zoning
 - Land title restrictions

A Simple Example...

Former industrial facility

Vacant for many years, ongoing cost for owner with no revenue

Remaining petroleum hydrocarbon impacts, also chloride (believed to originate offsite)

LNAPL remains on south part of site

Owner would like to redevelop

Example site

- Initial look: concentrations above guidelines across the site
- But: most exceedances related to drinking water/surface water protection
- Municipal controls on wells
- Only nearby surface water is stormwater treatment, no risk



Example site

- Site-specific guidelines: reduced impacts but still widespread



Example site

- Considering temporal trends and decreasing concentrations
- Only 1 area above guidelines, marginal
- Residual LNAPL still an obstacle, also limited soil data
- Plan: start development on north end of site
- Constraints on land use – surface capped



Conclusions



Classical risk assessment is not solution/development focused



Progressive site closure and redevelopment is feasible – allows sale/redevelopment to proceed before complete remediation



Requires strong understanding of CSM, tools for visualization