



Hazardous is the New Clean – Contaminant Management Supported Redevelopment

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A large yellow excavator is shown in the background, working on a construction site. The excavator's arm is extended, and its bucket is positioned over a large, circular concrete structure that appears to be a manhole or a small tunnel entrance. The ground is uneven and covered in dirt and debris. The sky is a mix of orange, yellow, and blue, suggesting a sunset or sunrise. The overall scene is one of industrial activity in a natural setting.

BATTELLE

AGENDA



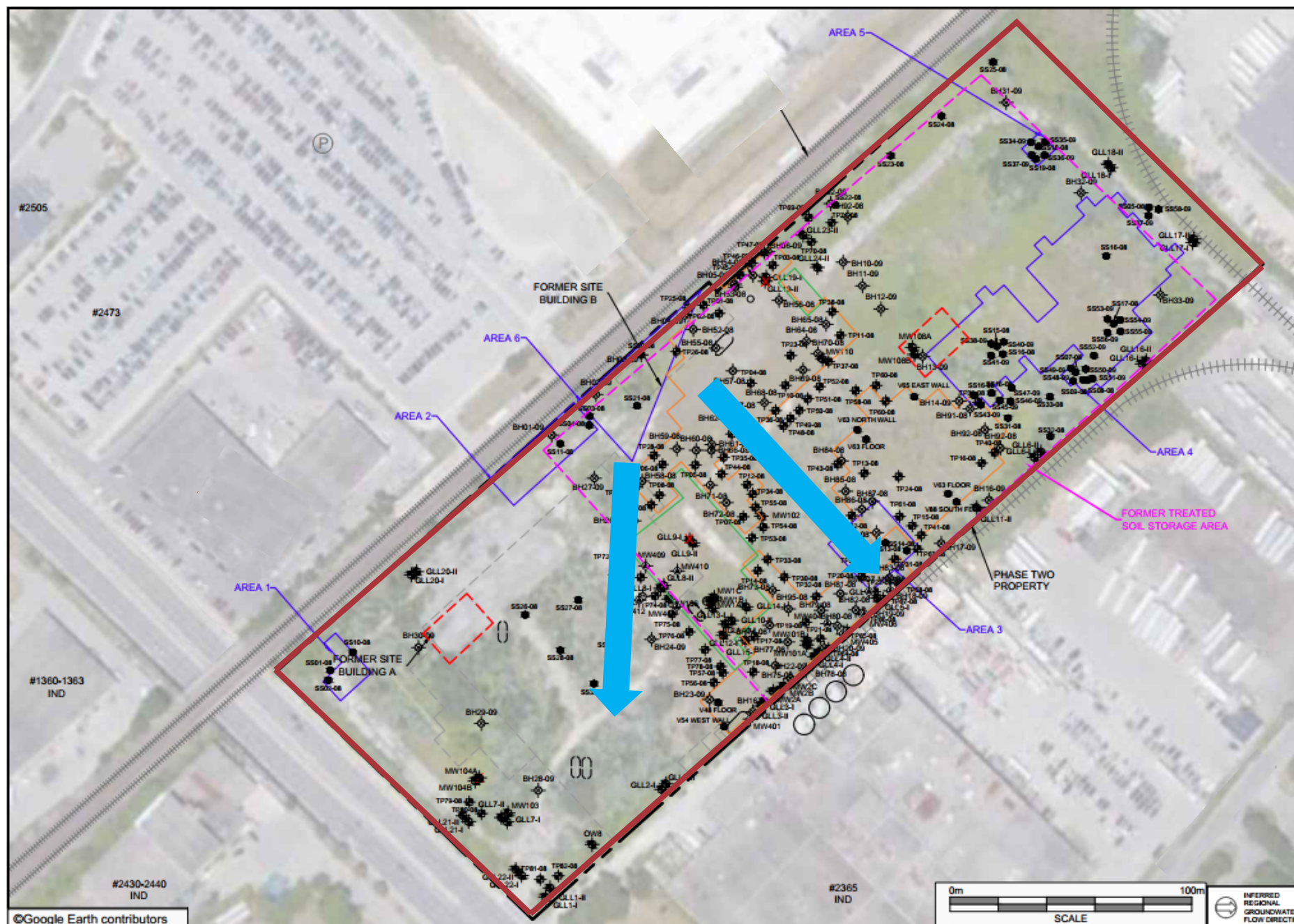
FRAMING THE PROBLEM



DESIGN AND BENCH SCALE
TESTS



INSTALLATION /
IMPLEMENTATION



Groundwater Maximums

TCE: 290 ppb

Cis-1,2-DCE: 1,100 ppb

VC: 210 ppb

1,4-DCB: 920 ppb

PCBs: 1,200,000 ppb

GRO: ~500 ppb

DRO: 1,900,000 ppb

Soil Maximums

TCE: 1.5 ppm

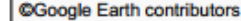
VC: 0.26 ppm

PCBs: 18,000 ppm

GRO: ~1,800 ppm

DRO: 17,000 ppm





AGENDA



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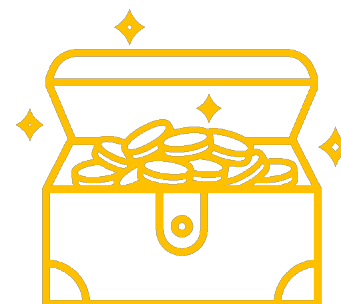


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INSTALLATION /
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- Full Remediation **>\$100 Million!**



Treat and Manage



RISK ASSESSMENT AND RMMS

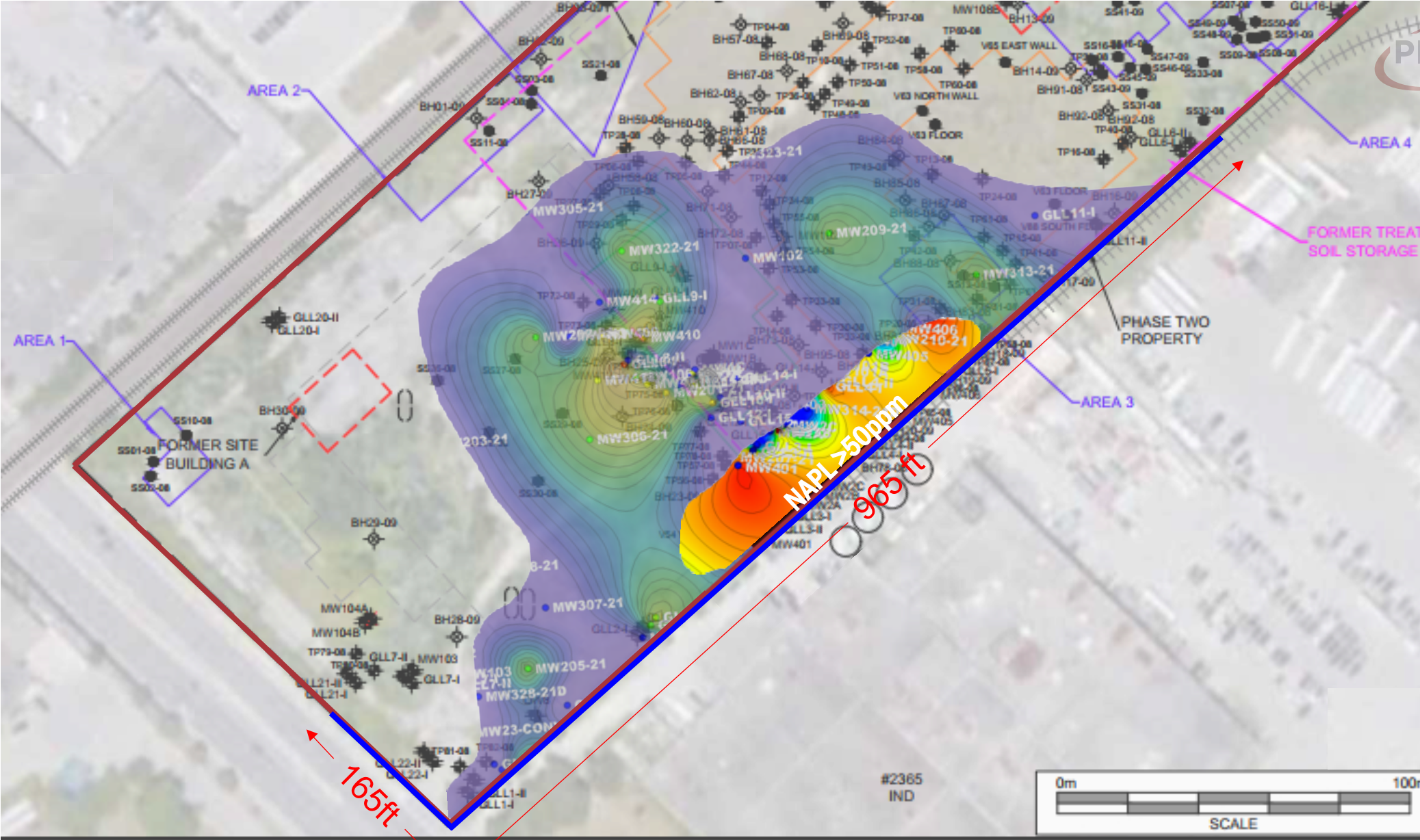


Risks:

- Indoor Vapour Intrusion
- Ingestion/Contact
- Offsite Migration

Management:

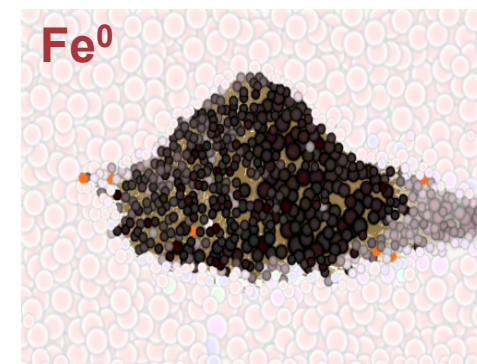
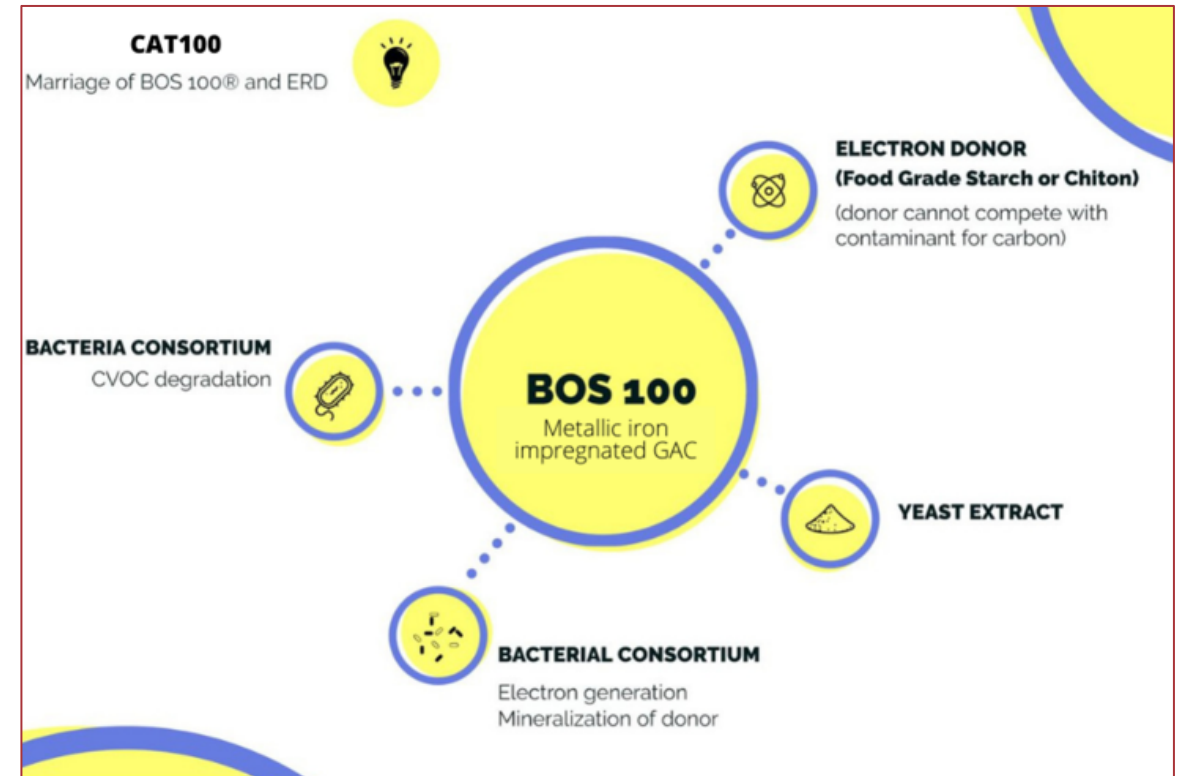
- SSDS
- Hard-caping/HASP
- Boundary Control

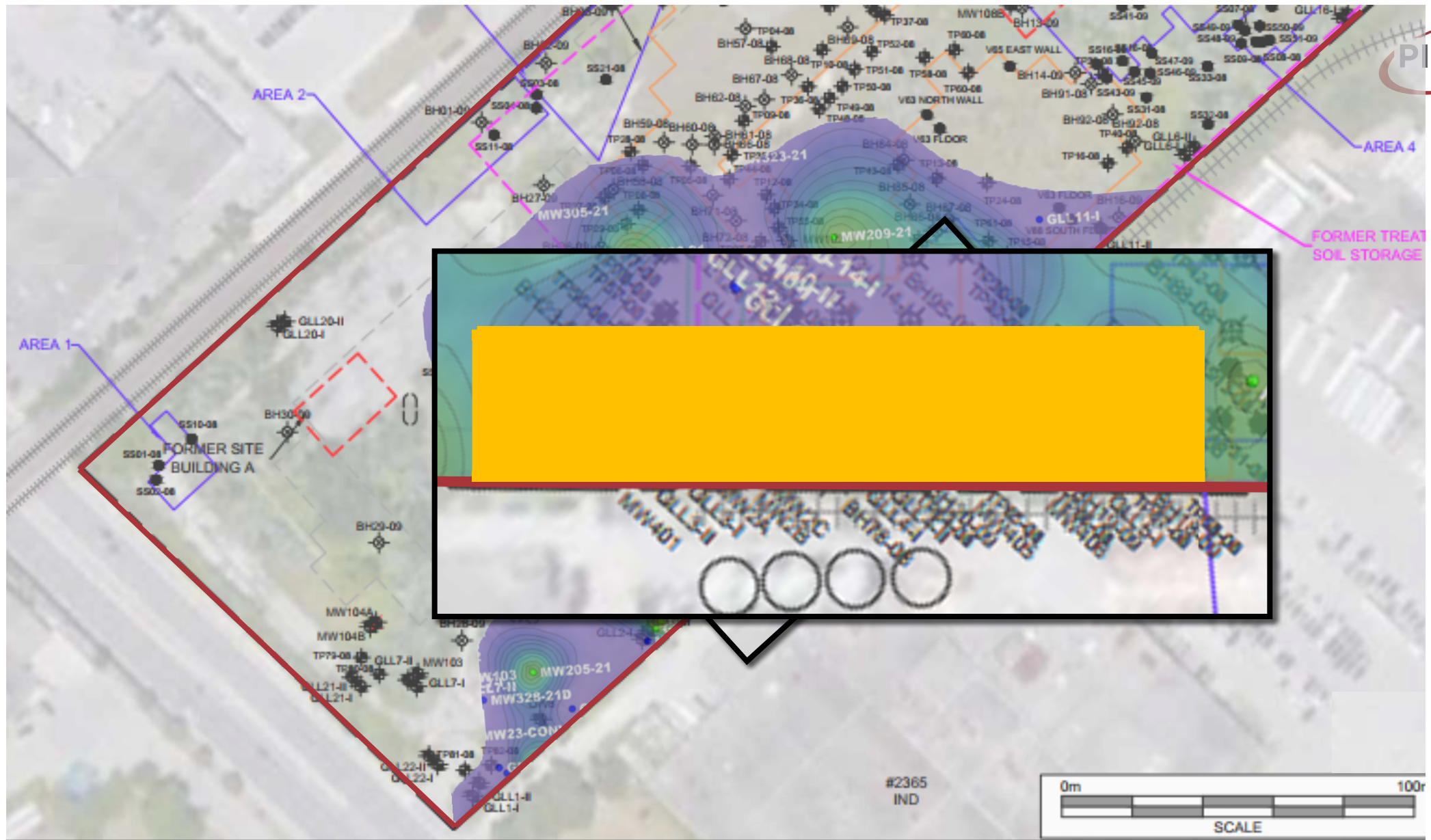


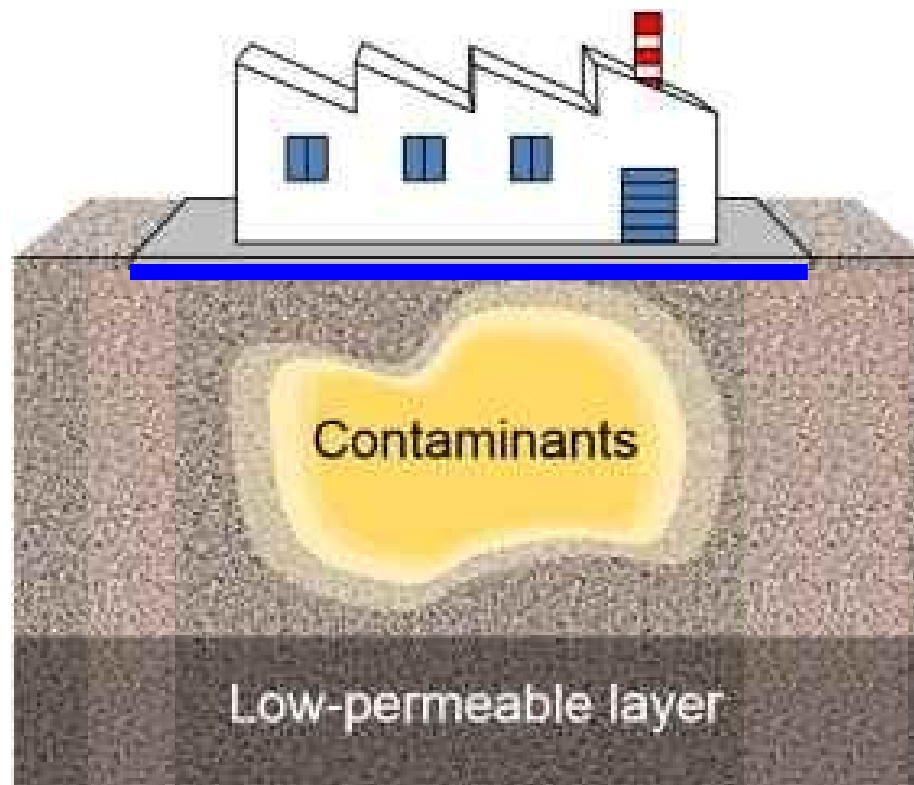
CAT100

Key Elements

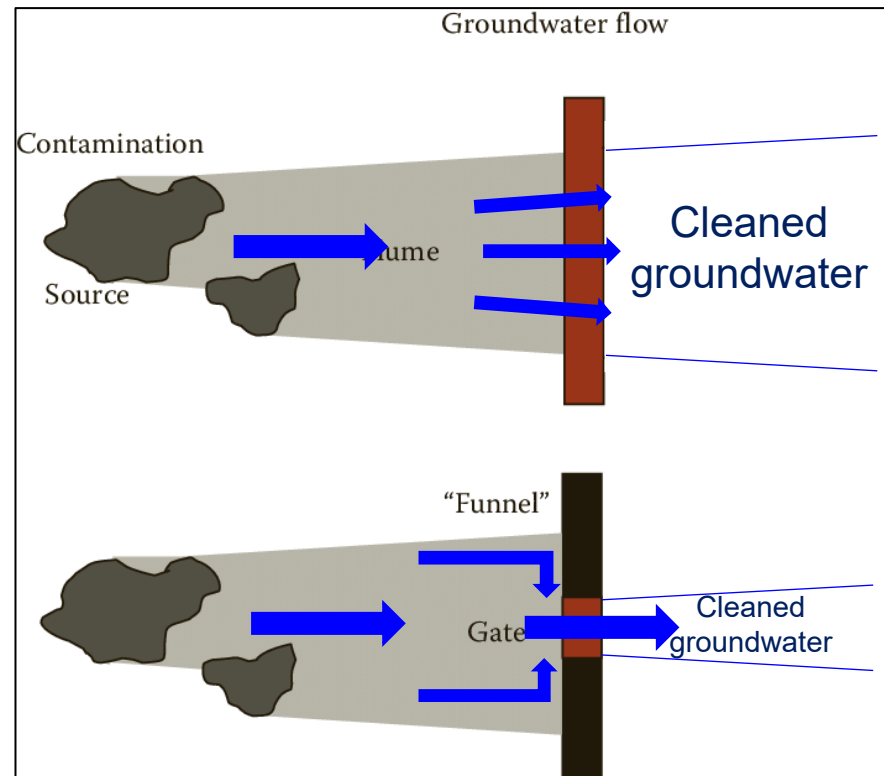
- Activated Carbon Impregnated with Metallic Iron (BOS 100®)
- Complex Carbohydrate – Food Grade Starch
- One Set of Microorganisms Designed to Degrade CVOCs
- Second Set of Microorganisms Designed to break down the Carbohydrate (e.g. acetate)
- Yeast extract (nutrients)







USING IMPERMEABLE AND PERMEABLE BARRIER WALLS

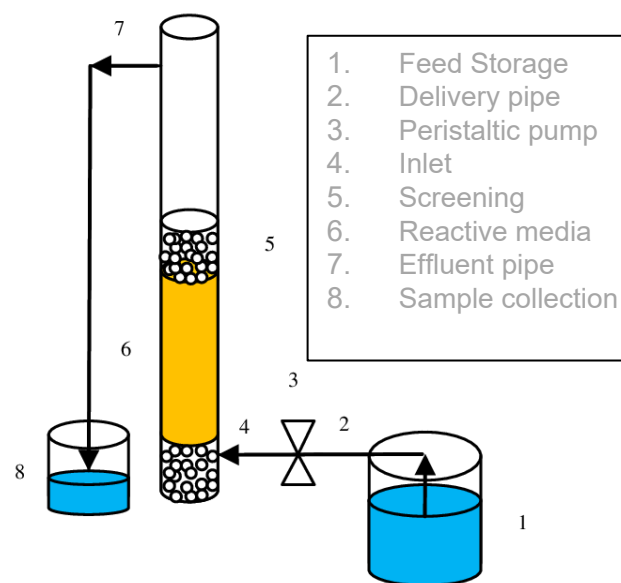


Cutoff Wall with PRB 'Gates'

BENCH SCALE TREATABILITY STUDIES

Column Study – Test Set-up

- Designed to model a discrete section of PRB and assess effectiveness of chosen reactive media to degrade contaminant over a given residence time
- Two different tests were run:
 - Model Average Concentration Areas
 - Control column – silica sand
 - Reactive column – 1% BOS100
 - Model High Concentration Areas
 - Control column – silica sand
 - Reactive column – 1% BOS100 combined with gypsum and Petro-Clear



BENCH SCALE TREATABILITY STUDIES

Column Study – Results

Analyte:	“High” Spiked (µg/L)	“Average” Spiked (µg/L)
TCE	504	161
cis-1,2-DCE	2,660	143
VC	242	70.4
*PHC F1	119	61
*PCBs	1,180	352
**PHC F2	310	100
**PHC F3	580	250

*Influent values not spiked prior to commencement of Column Test

** concentrations used for the modelling and PRB design |

“High”

Parameter	TCE	Cis-1,2-DCE	VC	PCBs
Half-Life (Days)	0.43		0.47	0.31

“Average”

Parameter	TCE	Cis-1,2-DCE	VC	PCBs
Half-Life (Days)	0.57		0.43	0.21

BOS 100® and Gypsum Demand Loading Rates				
Amendment Required (wt./wt.)	Average Area		High Area	
	Bedrock	Overburden	Bedrock	Overburden
BOS 100®	1.00%	1.00%	4.00%	2.50%
Gypsum	1.00%	0.50%	5.00%	2.00%

k values measured on site from: 1.2×10^{-6} m/s to 7.6×10^{-7} m/s 2.3×10^{-6} m/s to 1.6×10^{-7} m/s

BENCH SCALE TREATABILITY STUDIES

Permeability Study

- Designed to determine ideal mixing ratio to achieve in-situ impermeability (ASTM D5048 Hydraulic Conductivity of Porous Saturated Materials)
- Multiple tests were run with different percentages of bentonite with target permeability of 10^{-7} cm/s

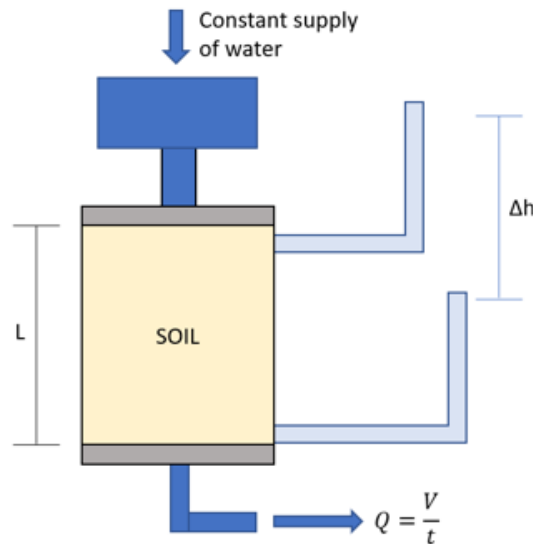
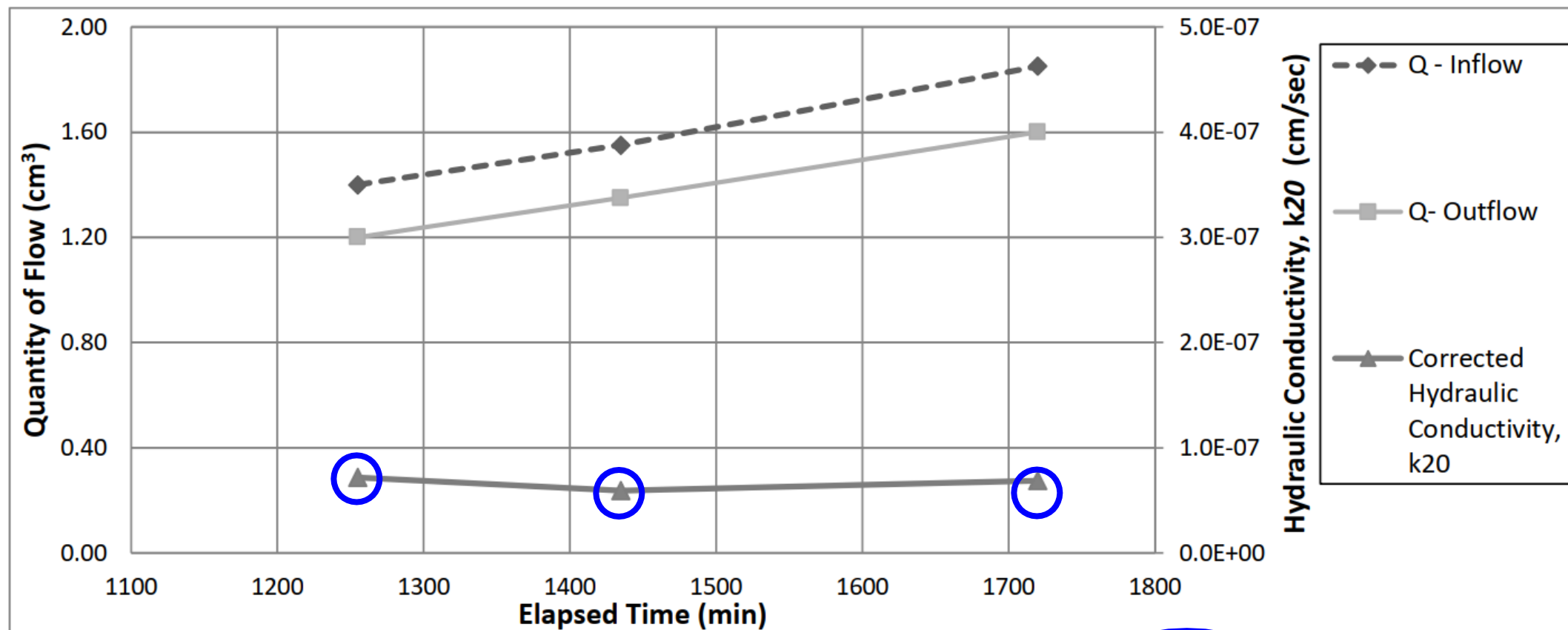


Figure 1: Schematic representation for Constant head Permeability test



BENCH SCALE TREATABILITY STUDIES

Test Results: Hydraulic conductivity



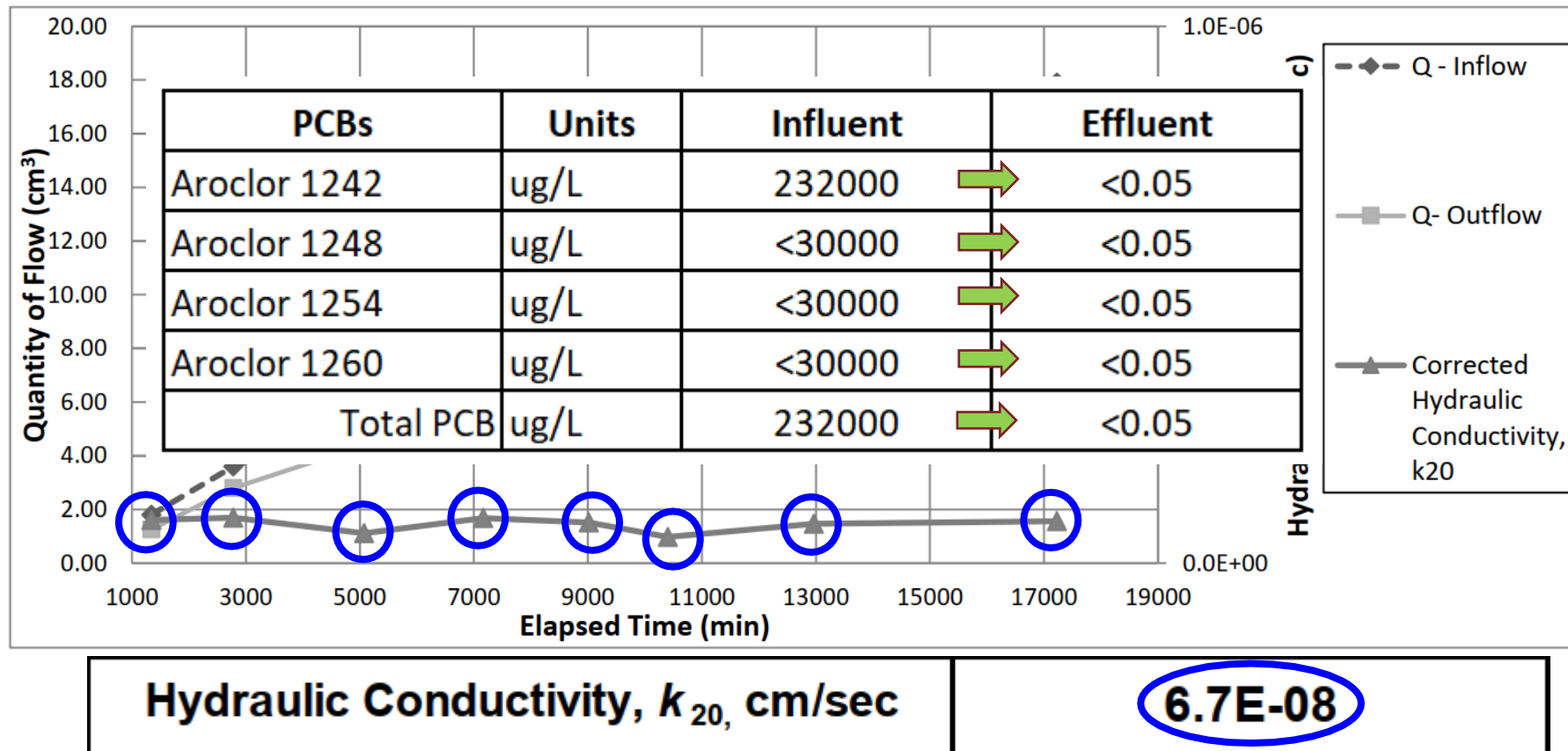
Hydraulic Conductivity, k_{20} , cm/sec

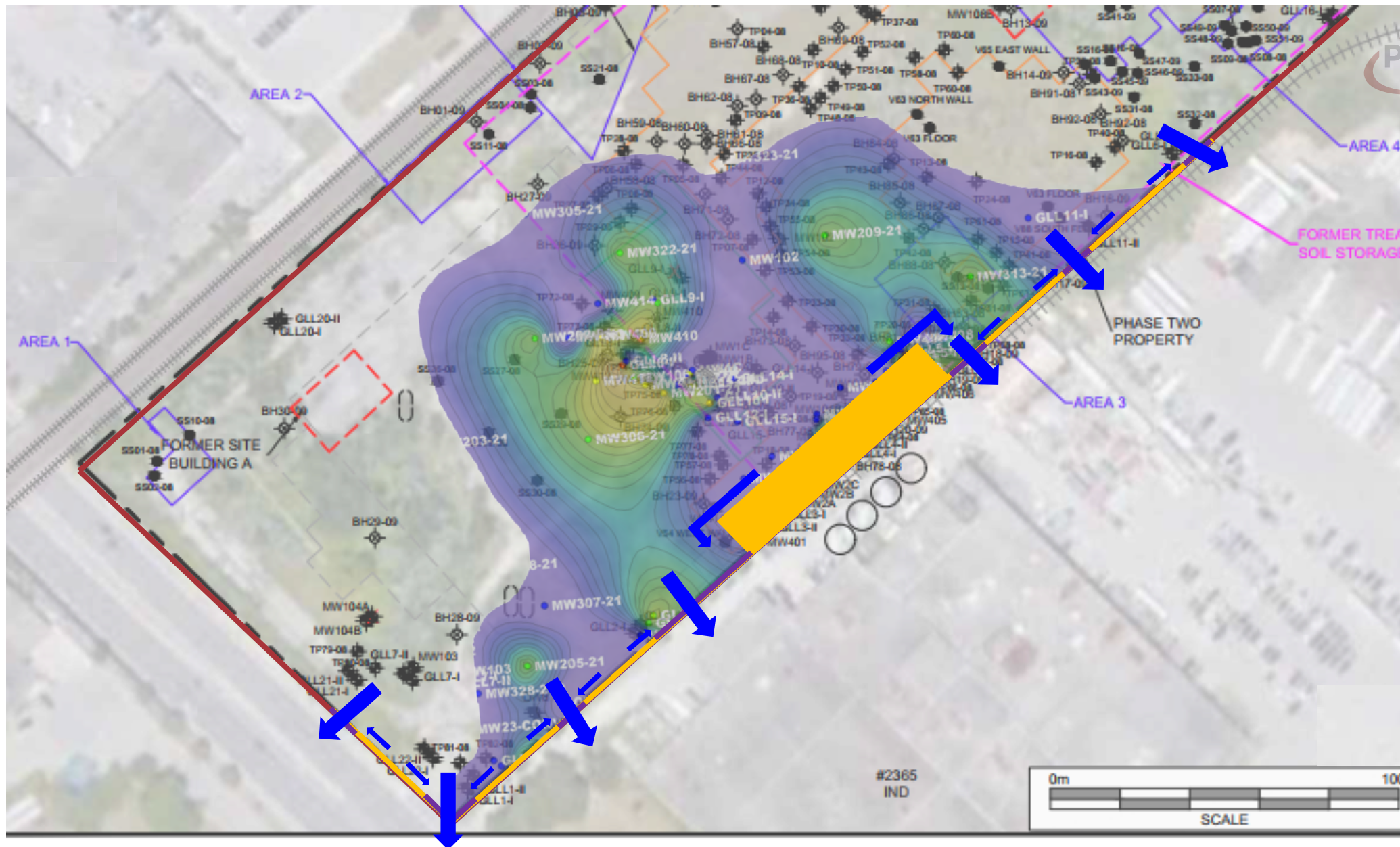
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BENCH SCALE TREATABILITY STUDIES

PCB Permeability Study

- Designed to assess PCB permeability through Slurry Wall Design





AGENDA



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Timelines

Bench Studies	3 – 4 months
Design and Approvals	2 – 3 months
Installation	6 months for boundary control
Total	<1.5 years

CONCLUSIONS

- Full scale clean up to generic values not necessary
 - Contaminant Management supported rehabilitation of urban environments possible
- Final cost ~\$10 million vs. original estimate of full remediation at >\$100 million
- Completed in a fraction of the time
- Contaminant Management supported redevelopment is viable even in the most impacted of scenarios
 - A vital and readily available tool to redevelop brownfields in a cost effective and timely way

Special Thanks

EDR	HydroG	GEO	OHS	RA	CPM
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Questions?

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