

PROJECT HIGHLIGHT

CHLORINATED SOLVENT SOURCE AND PRB GROUNDWATER REMEDIATION

The site was leased from 1925-2003 to industrial tenants including a manufacturer of asphaltic membranes and mixtures. Chemicals used at the operation include alcohols, solvents, pesticides, and petroleum hydrocarbon products. In 2003 the site was vacated, and all structures were removed. The challenge was three target intervals including silty clay sandwiched between coarse grained soils.

LOCATION: Oakland, CA

PROJECT: Full-scale implementation of Cascade Chemistries

CONTAMINANTS: Chlorinated Solvents - PCE, TCE, DCE, and VC

SERVICE: Turnkey Solvent Remediation

COST: \$1.6 Million



While preliminary approach, identified in the RFP, was injection of carbon substrates through injection wells, Cascade proposed and implemented an alternative approach using DPT injection for better distribution and contact using our Colloidal iZVI, microscale ZVI and bioaugmentation.

Cascade's approach and design provided longer persistent chemistries required for a PRB, better contact in the fine grained intermediate interval, and no risk of biofouling well screens, plus lower overall cost.

EXECUTION

Due to injection of microscale and colloidal ZVI chemistries, both high pressure piston and lower pressure positive displacement pumps manifolded to multiple locations were used. To achieve target depths up to 80 ft. and multiple Geoprobe 8040 DPT rigs were utilized. Prior to full-scale injection an ROI test was performed to verify iZVI distribution in coarse grained zones at the PRB location.



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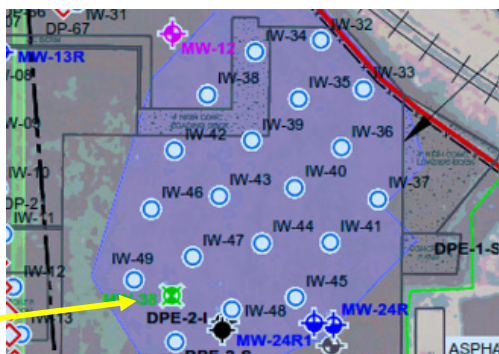
RESULTS - MCLS ACHIEVED

After four quarters of post monitoring events, MCLs were met in MWs downgradient of PRB and significant reduction in source area concentrations. Ongoing monitoring will determine if the persistence of iZVI and ZVI in the PRB is adequate to treat incoming upgradient flux from the source areas or back diffusion within the PRB.

South Central Source Area

Source Zone	Dates	Well	TCE ug/l)	All Other VOCs (ug/l)
Deep (iZVI)	June – Dec 23	38	3.49 to ND	cDCE 5.6 to 0.443
	Jan – June 24	38	0.259 J	PCE 5.28

MW-41S
MW-43S
Intermediate Zone
DPE-1-I
DPE-2-I
MW-13R
MW-17R1
MW-24R1
MW-26R
MW-27
MW-30
MW-32
MW-34
MW-39I
MW-43I
Deep Zone
MW-21R
MW-23R1
MW-25R
MW-28
MW-29R
MW-31
MW-33
MW-35
MW-38
MW-40



MW-18 Source

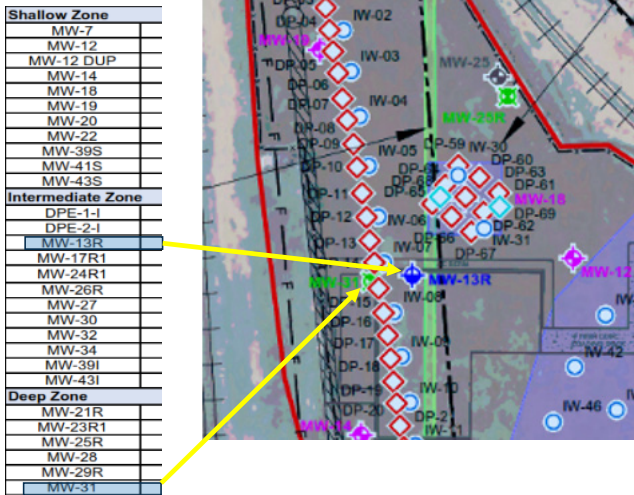
Shallow Zone
MW-7
MW-12
MW-12 DUP
MW-14
MW-18
MW-19
MW-20
MW-22
MW-39S
MW-41S
MW-43S
Intermediate Zone
DPE-1-I
DPE-2-I
MW-13R
MW-17R1
MW-24R1
MW-26R
MW-27
MW-30
MW-32
MW-34
MW-39I
MW-43I



Source Zone	Date	Well	TCE (ug/l)	All Other VOCs (ug/l)
Intermediate (ZVI)	June – Dec 23	13R	3.49 to ND	cDCE 7.77 to 0.204 J VC 12 to ND
	Jan – June 24		ND	cDCE ND VC ND
Shallow (iZVI)	June – Dec 23	18	ND	cDCE 63.9 to ND VC 121 to ND
	Jan – June 24		ND	cDCE ND VC ND

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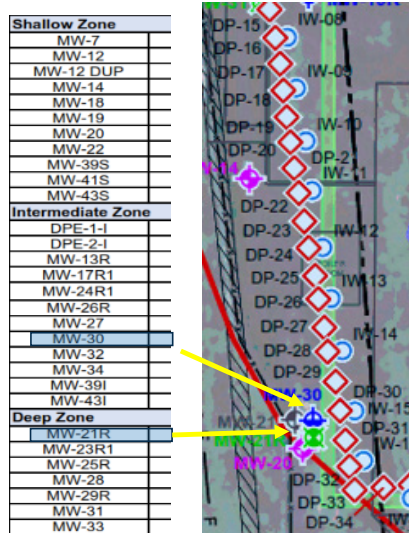
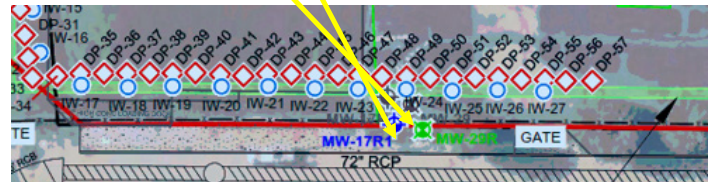
ZVI (Intermediate) / IZVI (Deep) PRB



PRB Zone	Dates	Well	TCE (ug/l)	All Other VOCs (ug/l)
Deep (iZVI)	June – Dec 23	31	55.7 to 0.331	PCE 0.427 J to ND cDCE 1.7 to ND
	Jan – June 24		0.953 J	cDCE 0.135
Intermediate (ZVI)	June – Dec 23	13R	58.4 to ND	cDCE 7.7 to 0.204 VC 12 to ND
	Jan – June 24		cDCE 0.524 J VC ND	

ZVI (Intermediate) / IZVI (Deep) Barrier SE Boundary

Shallow Zone	PRB Zone	Date	Well	TCE (ug/l)	All Other VOCs (ug/l)
MW-7	Deep (iZVI)	June – Dec 23	29R	ND to 0.309	cDCE ND to 3.72
MW-12					
MW-12 DUP					
MW-14					
MW-18					
MW-19					
MW-20					
MW-22					
MW-39S					
MW-41S					
MW-43S	Intermediate (ZVI)	Jan – June 24	17R	0.421 J	cDCE to 2.88
DPE-1-1					
DPE-2-1					
MW-13R					
MW-17R1					
MW-24R1					
MW-26R					
MW-27					
MW-30					
MW-32					
MW-34					
MW-39I					
MW-43I					
	Deep Zone				
MW-21R					
MW-23R1					
MW-25R					
MW-28					
MW-29R					
MW-31					
MW-33					
MW-35					
MW-38					
MW-40					
MW-42					



ZVI (Intermediate)/ IZVI (Deep) Barrier Central Boundary

PRB Zone	Date	Well	TCE (ug/l)	All Other VOCs (ug/l)
Deep (iZVI)	June – Dec 23	21R	0.367J	ND
	Jan – June 24		ND	ND
Intermediate (ZVI)	June – Dec 23	30	58.4 to ND	cDCE 135 to 3.35 VC 25.1 to 1.55
	Jan – June 24		0.357 J	cDCE 5.64 VC 2.28