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MCB CAMP LEJUENE
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PARTNERING TEAM MEETING TECHNOLOGY EVALUATION SITE 93 PRESENTATION SLIDES FEBRUARY 2003 MCB CAMP LEJEUNE NC

2/1/2003

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Technology Evaluation
Site 93

Partnering Meeting
MCB Camp Lejeune
CTO 253
February 2003

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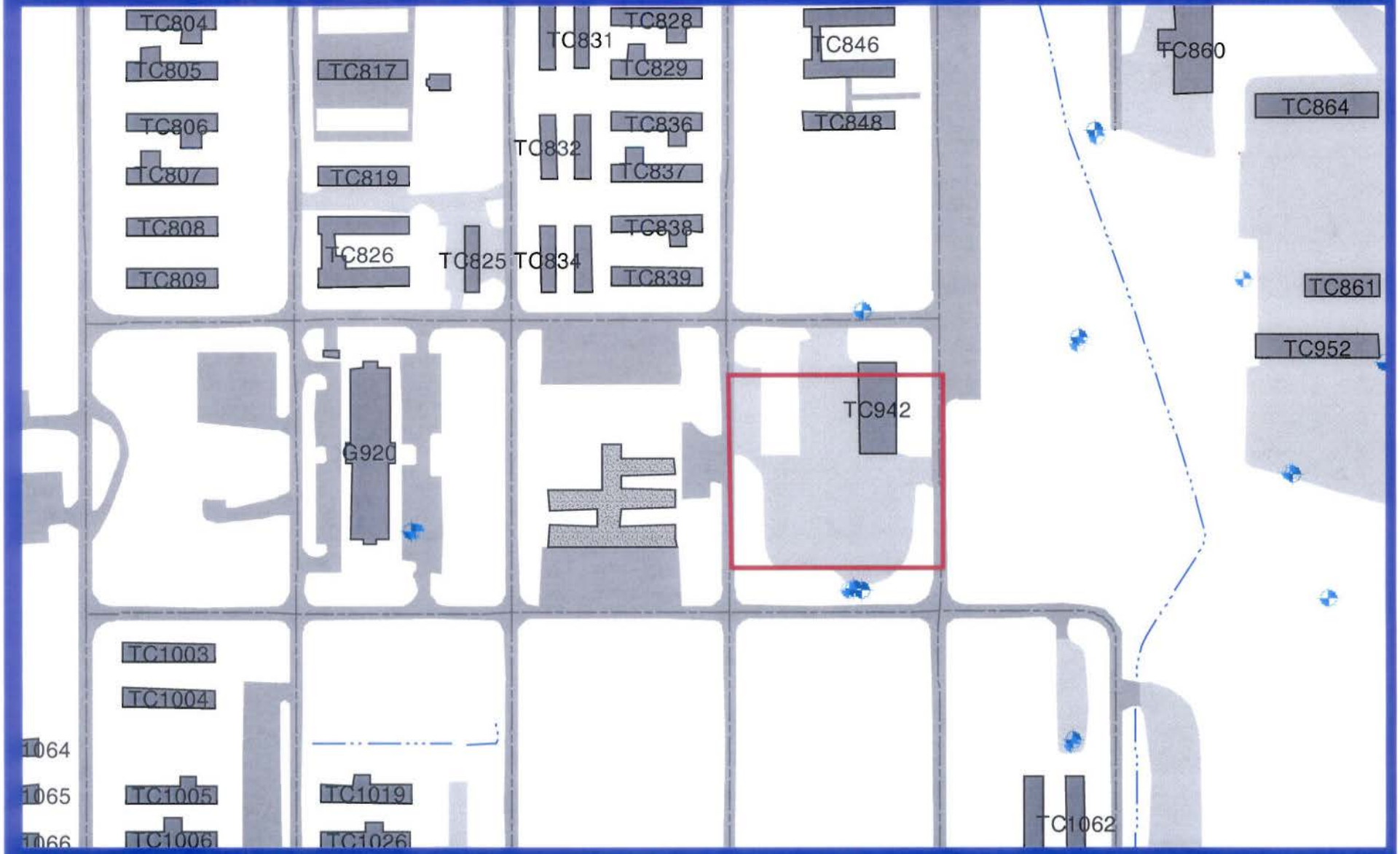
Purpose of Technology Evaluation

- Provide technical analysis of potential remedial options for a pilot study

Site 93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RI Summary

- Hydrogeology and Geology
  - no confining layer between surficial and Castle Hayne aquifers
  - Castle Hayne is transmissive with relatively high conductivity
- Contaminants of Concern
  - PCE,TCE, trans-DCE, cis-DCE, and vinyl chloride
- Nature and Extent of Contamination
  - see following figures

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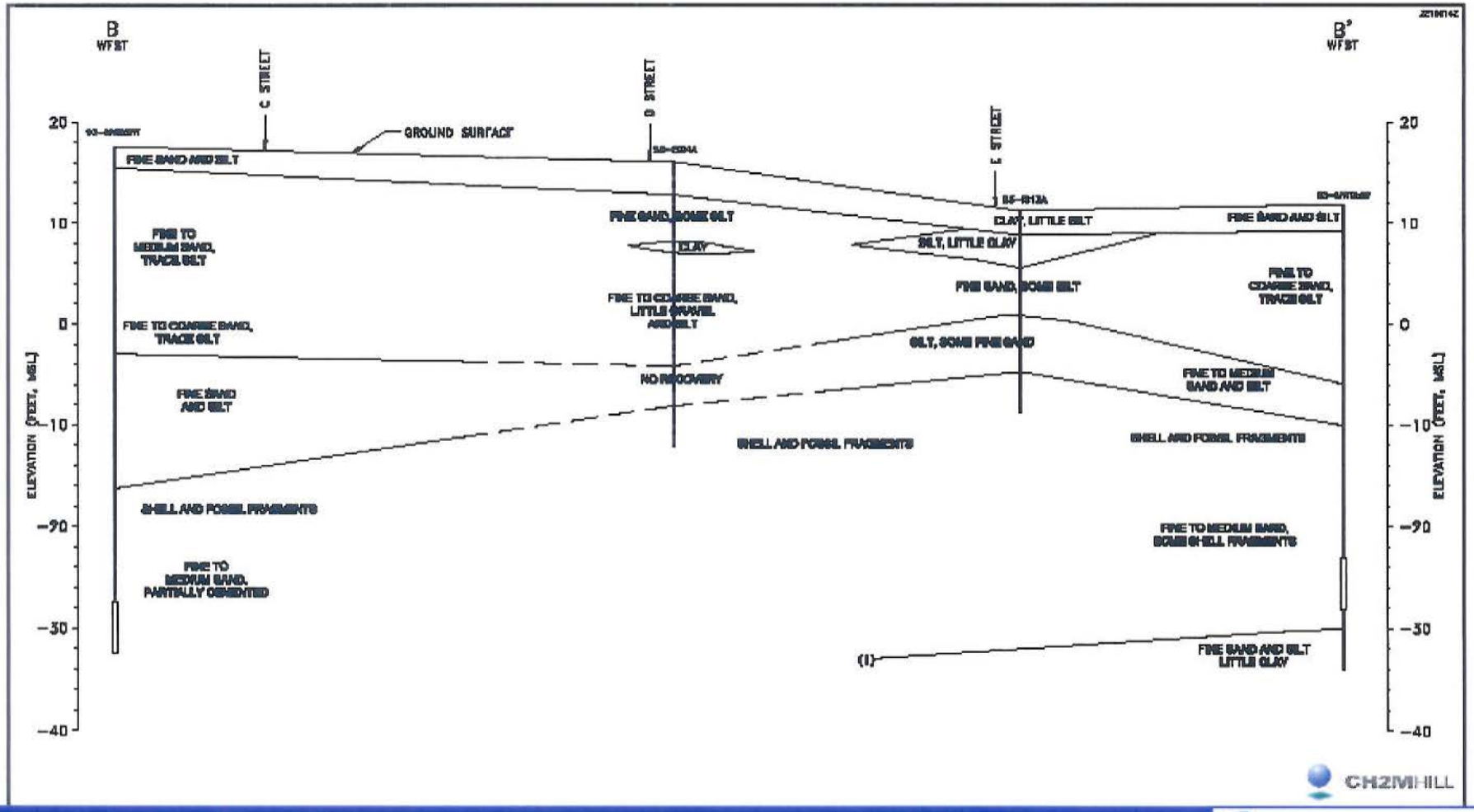
Subsurface Conditions



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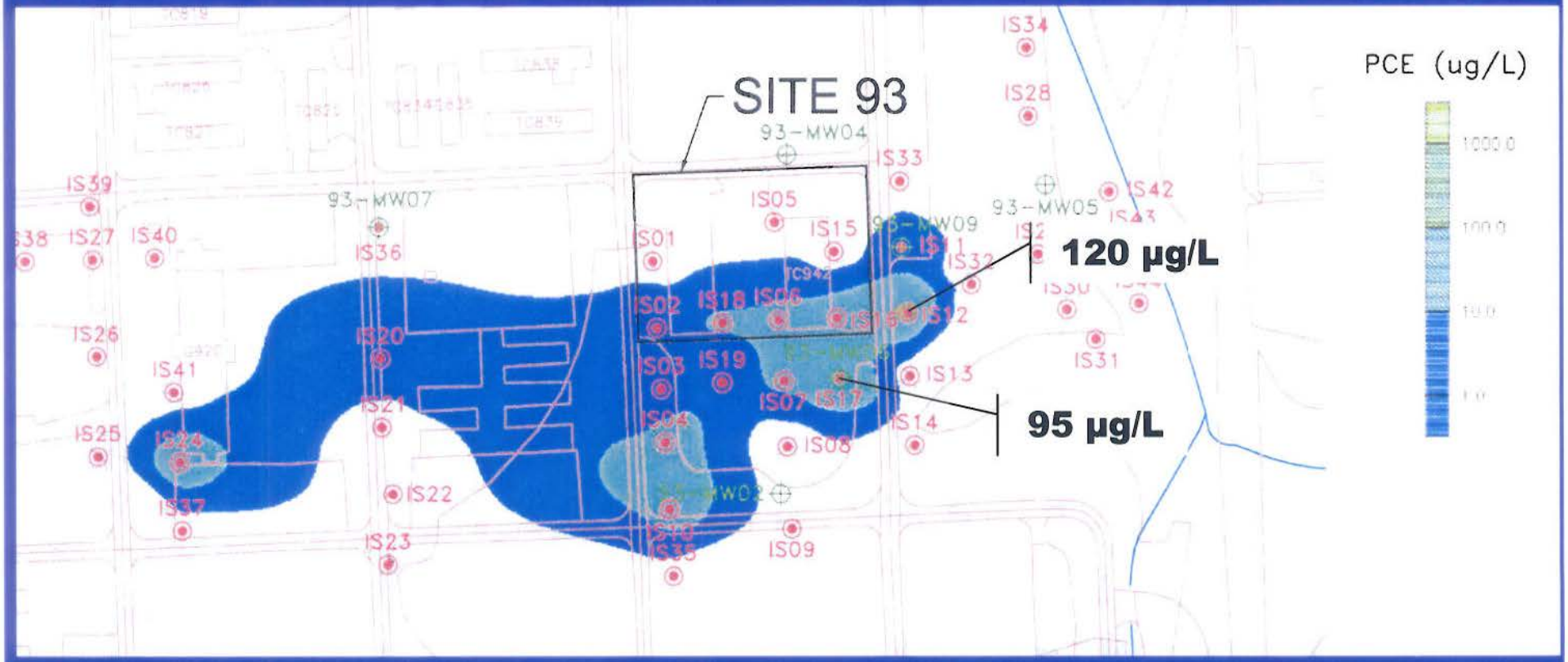
PCE Horizontal Distribution



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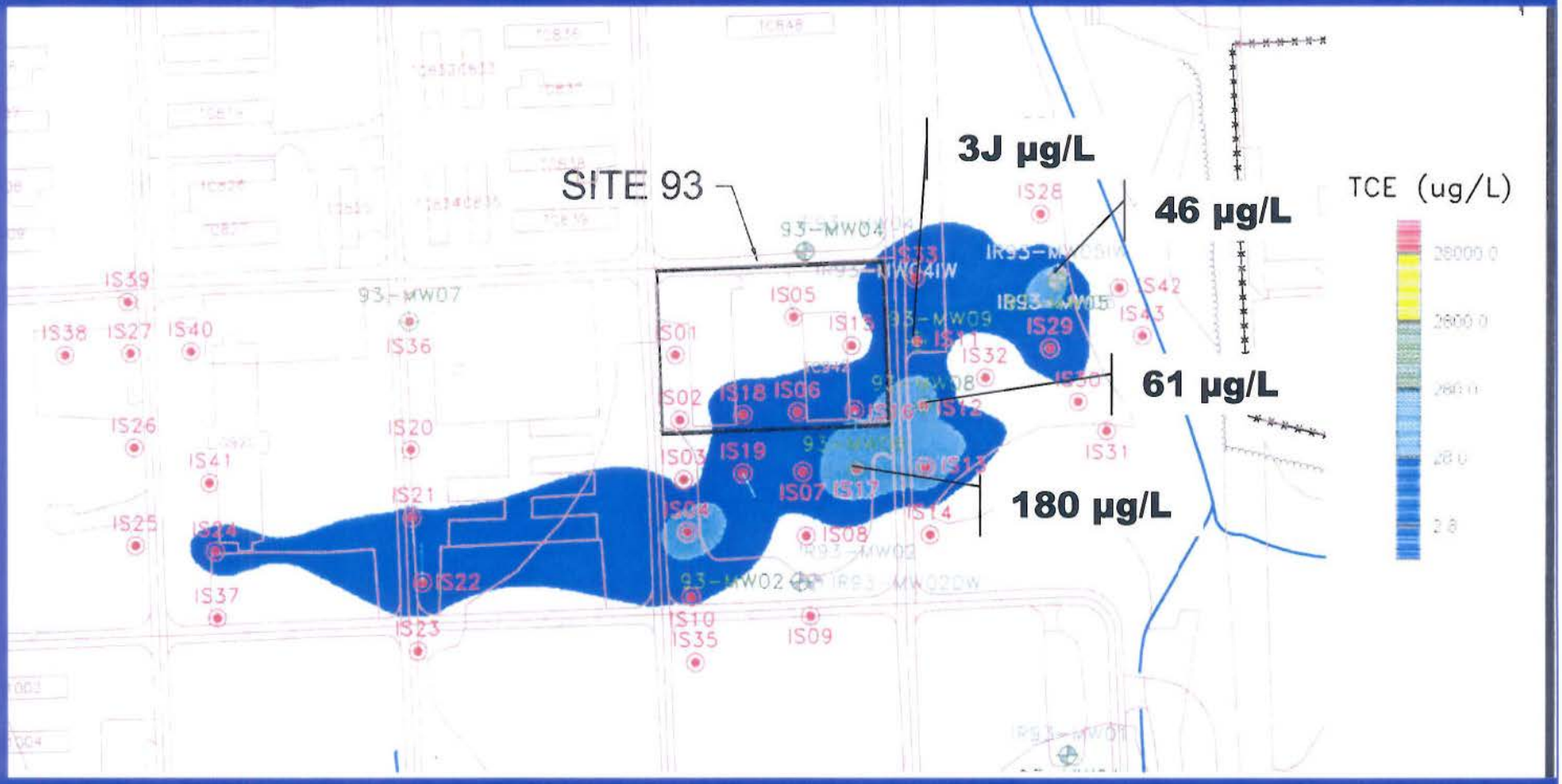
TCE Horizontal Distribution



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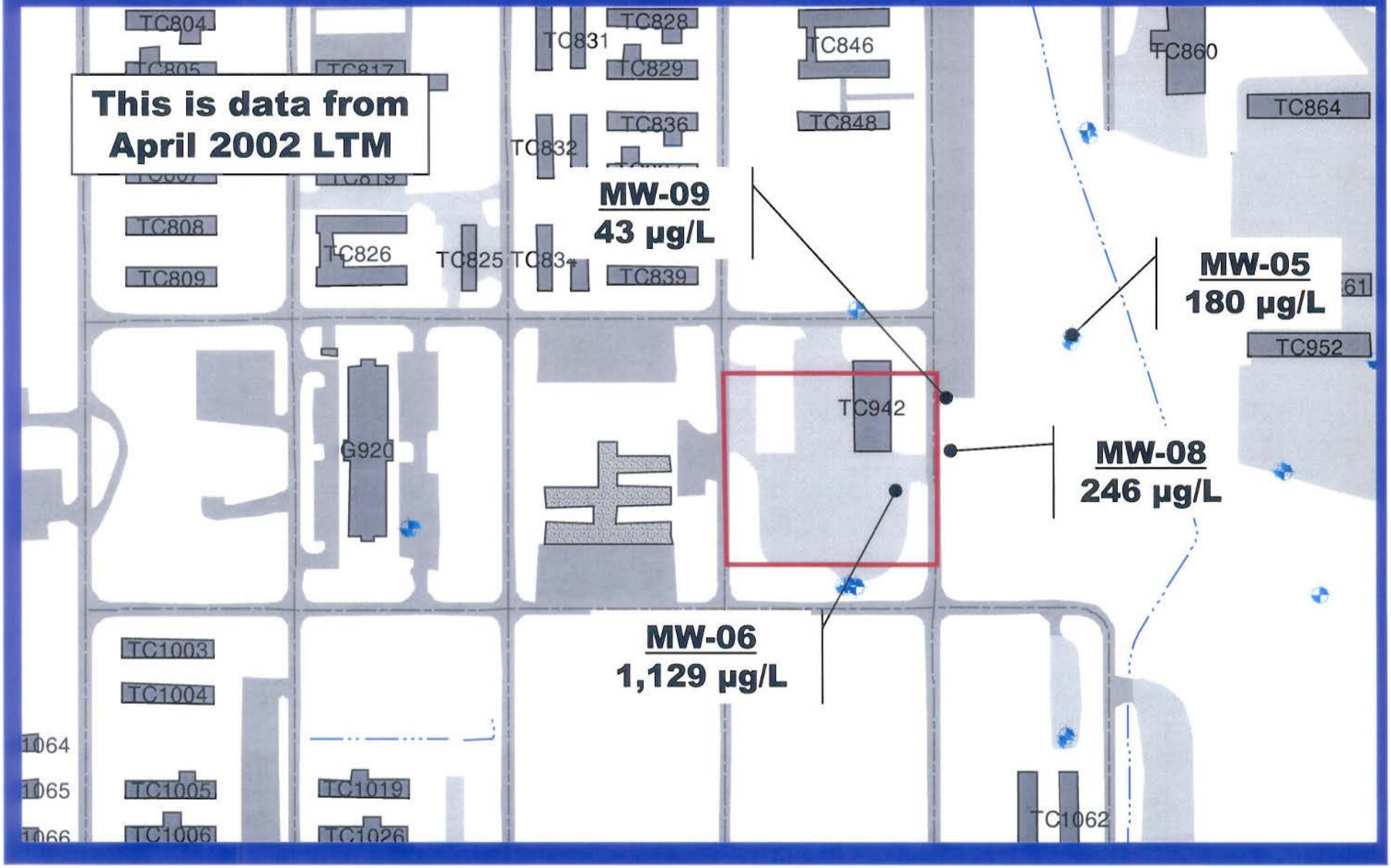
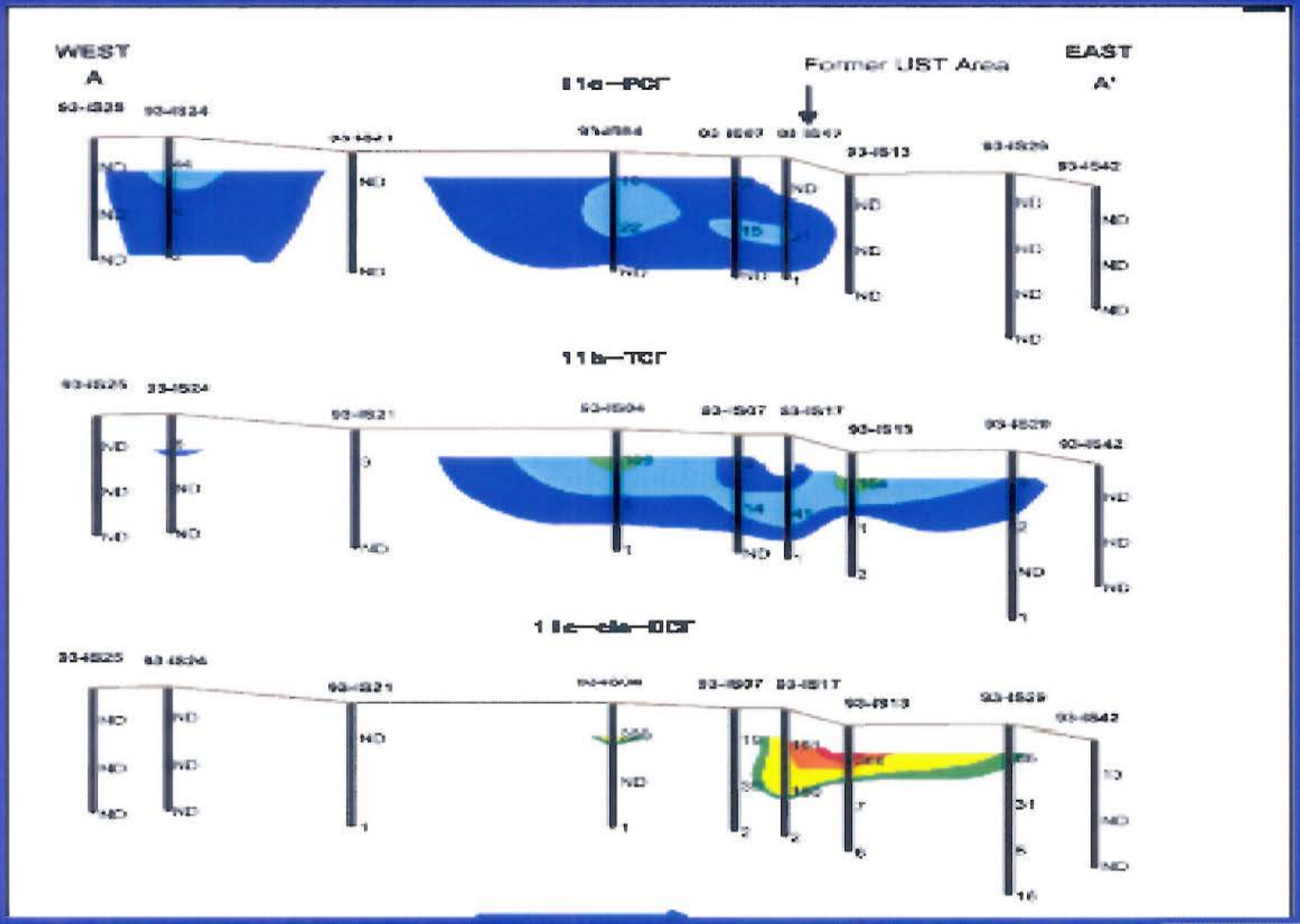
Site 93 - Total CVOCs



Vertical Distribution of Contaminants



Defining Hot Spot

- 1-2 orders of magnitude over 2L, or
- Fixed number (100 or 500 or 1,000 μg/L)

	2L STD.	MW05	MW06	MW08	MW09
Cis-1,2-DCE	70	91	580	130	32
Trans-1,2-DCE	70	43	220	51	8
TCE	2.8	46	180	61	3 J
PCE	0.7	5 U	95	120	5 U
1,1,2,2-PCA	0.17	5 U	34	5 U	5 U
1,1,2-TCA	---	5 U	10	5 U	5 U
VC	0.015	2 U	10	4	2 U
Total CVOCs	---	180	1,129	246	43

From April 2002 LTM

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Factors in Technology Selection

- Site Conditions
- Nature and Extent of Contamination
- Site Constraints

Technology Identification and Screening

- *In Situ* Categories
  - Biodegradation
  - Mass Transfer (Stripping)
  - Chemical Treatment
- Remedial Approaches
  - Chemical/Substrate Delivery
  - Chemical/Substrate Selection

Chemical/Substrate Delivery

- Horizontal Well
  - more effective for large, deeper plumes
  - have broader treatment influence
  - more cost effective for larger treatment areas
- Vertical Well
  - more effective for shallow plumes
  - more conventional technology
- Direct Injection through Borings or Fracturing
  - enables focused substrate delivery

Chemical/Substrate Selection

- Hydrogen Sparging - Injects hydrogen to induce reductive dechlorination
- Zero Valent Iron - Injects iron powder to stimulate reductive dechlorination under anaerobic conditions
- Permanganate - Injects permanganate salts to oxidize contaminants
- Enhanced Bioremediation - Inject emulsified vegetable oil or lactate to provide a carbon source to stimulate reductive dechlorination

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Technology Comparison

Option	Effectiveness	Implementability	Cost
Hydrogen Sparging	Effective, relies on biodegredation	Low maintenance, risk of fugitive gas or by-product buildup	$382,000
Zero Valent Iron	Effective, reduces contaminants	No maintenance, one dose, low risk of by-product buildup	$227,000
Permanganate	Effective, oxidizes contaminants	Reacts quickly, risk of by-product buildup	$240,000
Vegetable Oil	Effective, provides carbon source that enhances reductive dechlorination	Provides lasting carbon source. Components readily available.	$224,000
Sodium Lactate	Effective, provides carbon source that enhances reductive dechlorination	Provides carbon source that is used up quickly. May require additional injections.	$266,000

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Biochlor Modeling

Source Reduction	Time to Steady State (yr)	Distance to 2L Standards (ft)			
		PCE	TCE	DCE	VC
No Treatment	14	1,400	650	450	625
50%	13	1,175	500	350	500
75%	10	950	350	225	400
90%	7	650	225	100	250

Distance from source area to creek is approximately 450 ft

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Recommendation

- Enhanced bioremediation using emulsified vegetable oil
  - Inject at the two hot spots (MW06 and MW08)
  - Use pneumatic fracturing at one location and geoprobe injection at other
- Evaluate:
  - effectiveness of vegetable oil
  - effectiveness of pneumatic fracturing
  - any rebound issues
  - overall treatment costs

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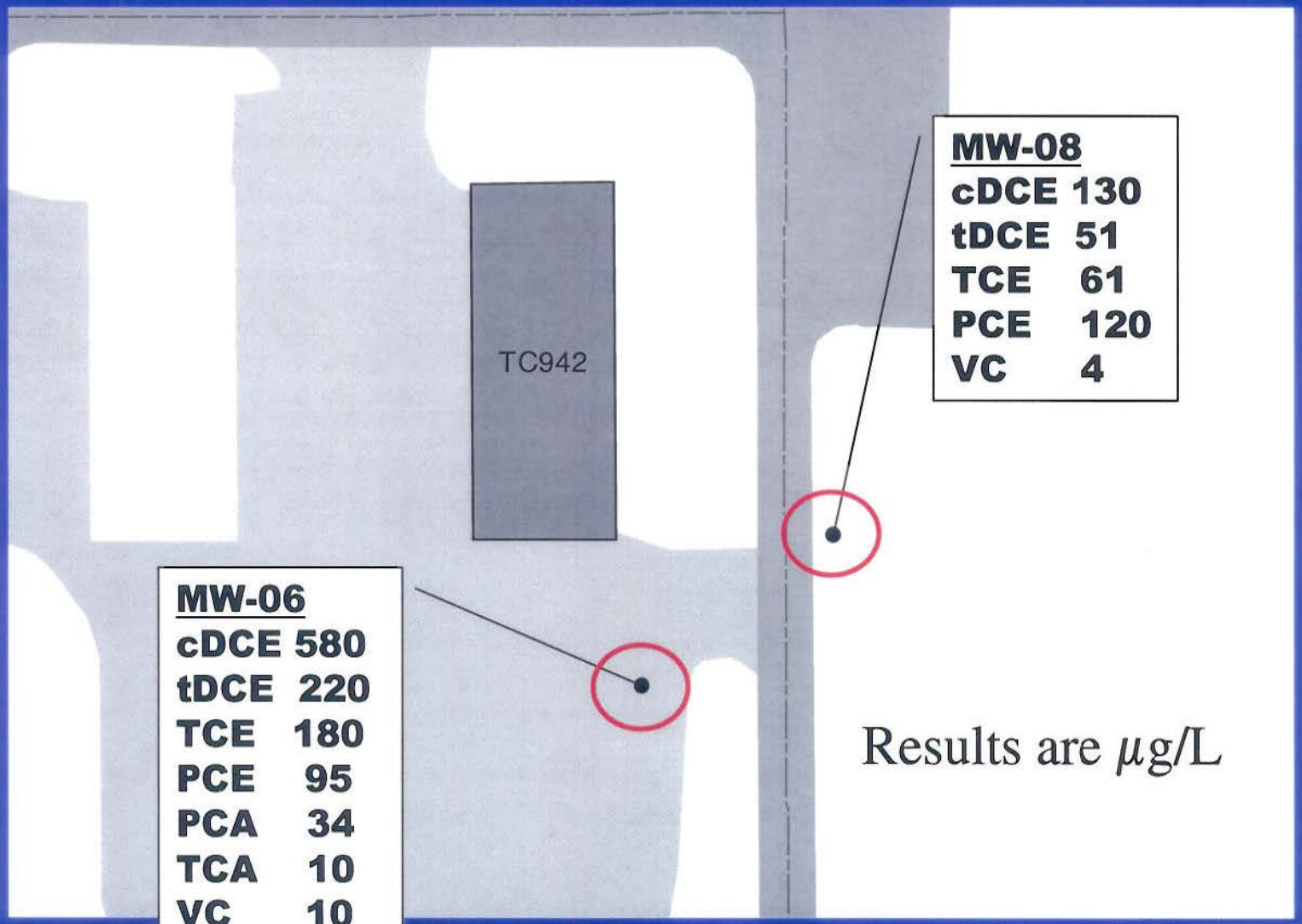
Test Target Areas



Results are μg/L

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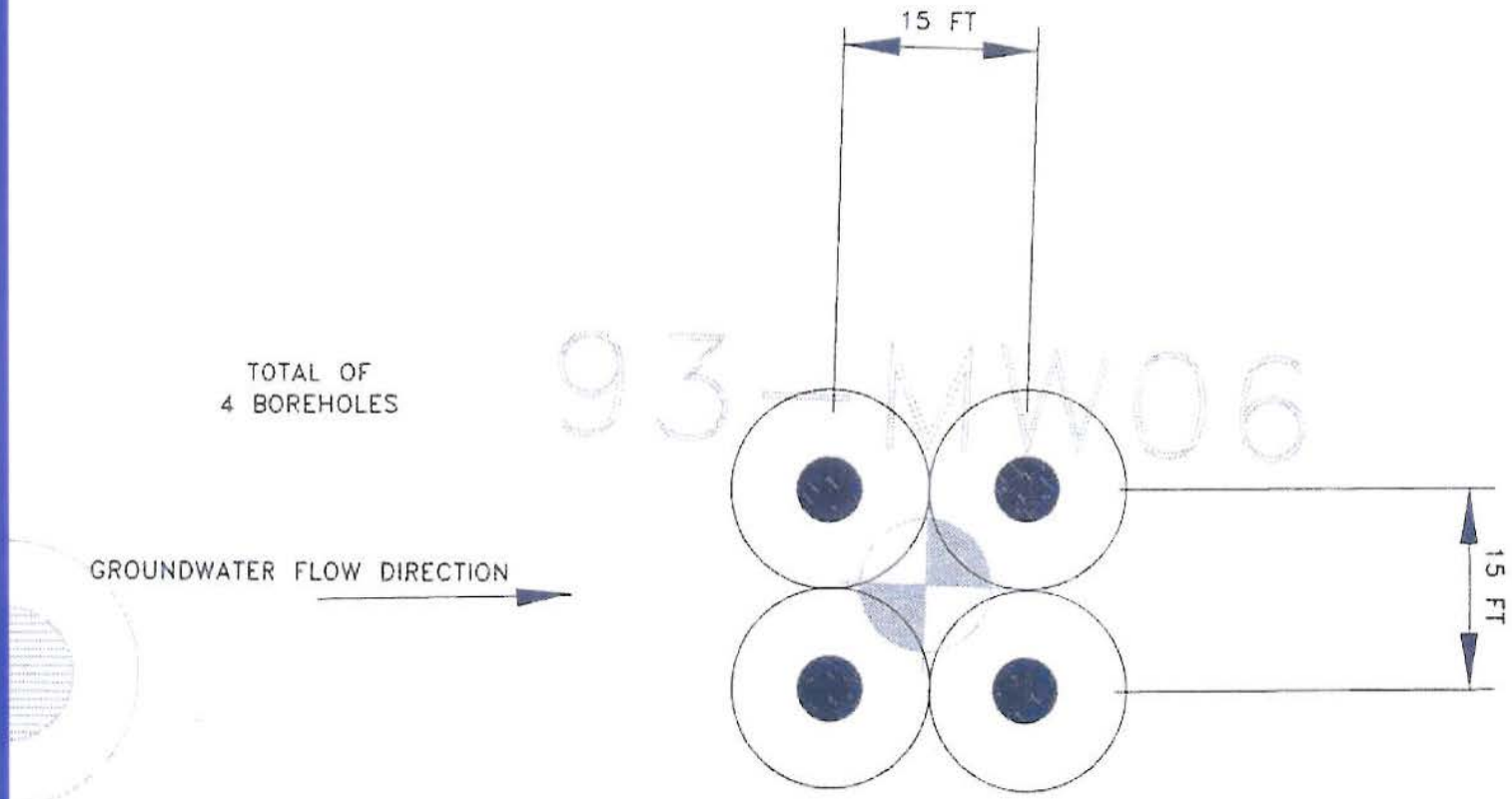
Injection Points