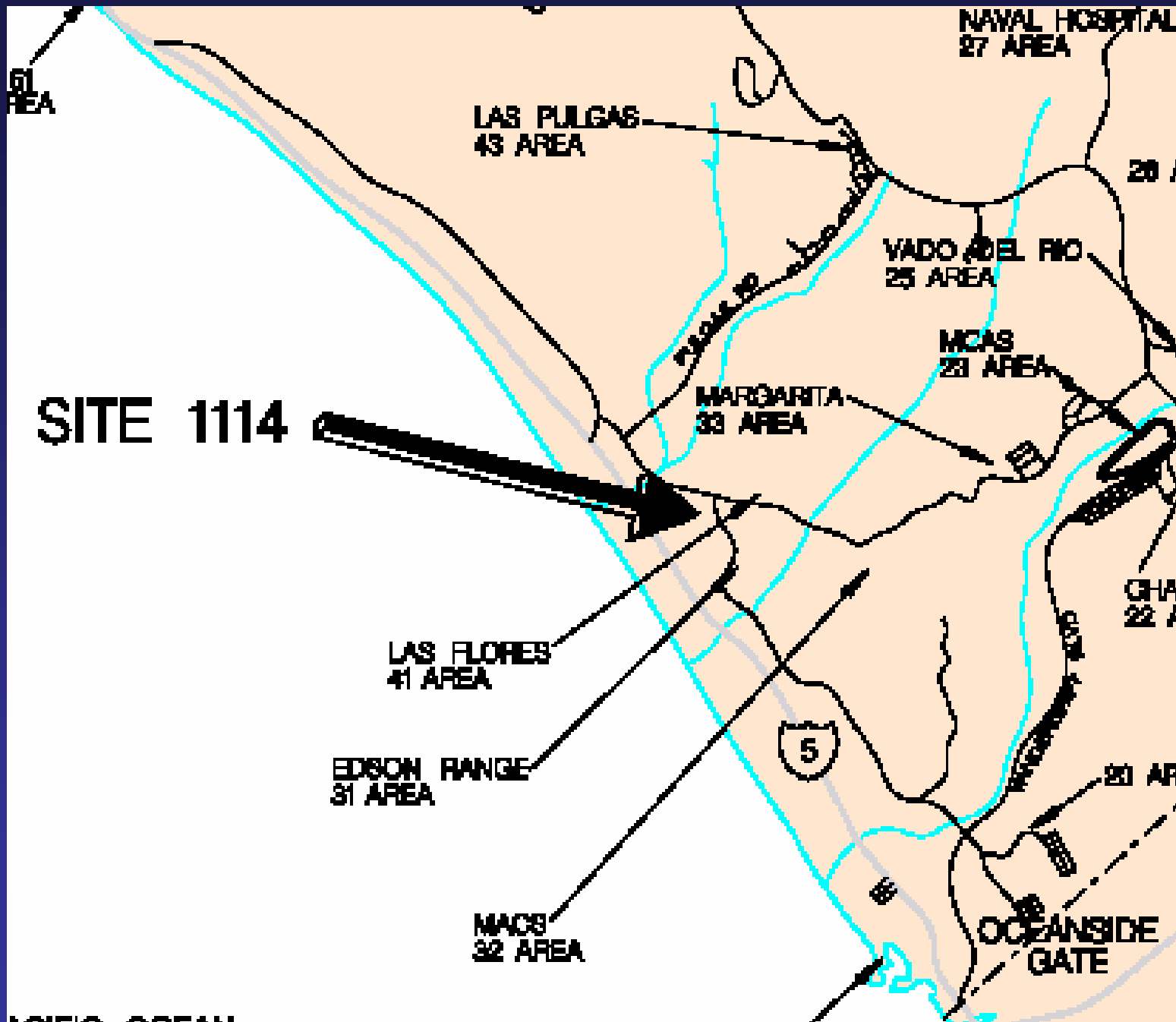


***Conference on Accelerating Site Closeout,  
Improving Performance, and Reducing Costs  
Through Optimization***

**Accelerated VOC Source Investigation  
Pairing SCAPS/MIP with EPA Triad,  
Marine Corps Base Camp Pendleton,  
California**

**Karen Collins, San Diego Navy Public Works Center**

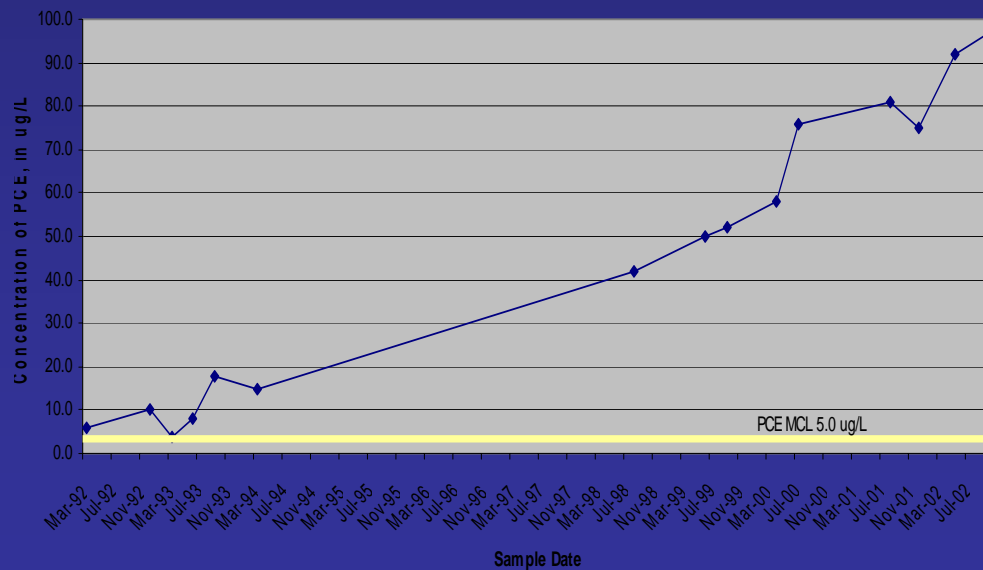




# Site 1114 Background

- Site 1114 identified in 2003 because PCE concentrations in well at adjacent site increased from 4 ug/L to 97 ug/L between 1993 when LTM ROD was signed and 2002
- MW 9W-07A is a cross-gradient perimeter well for Site 9, the former Waste Stabilization Pond

Figure 2-1. Water Quality Hydrograph,  
PCE in 9W-07A Groundwater  
IR Site 9 MCB Camp Pendleton, California

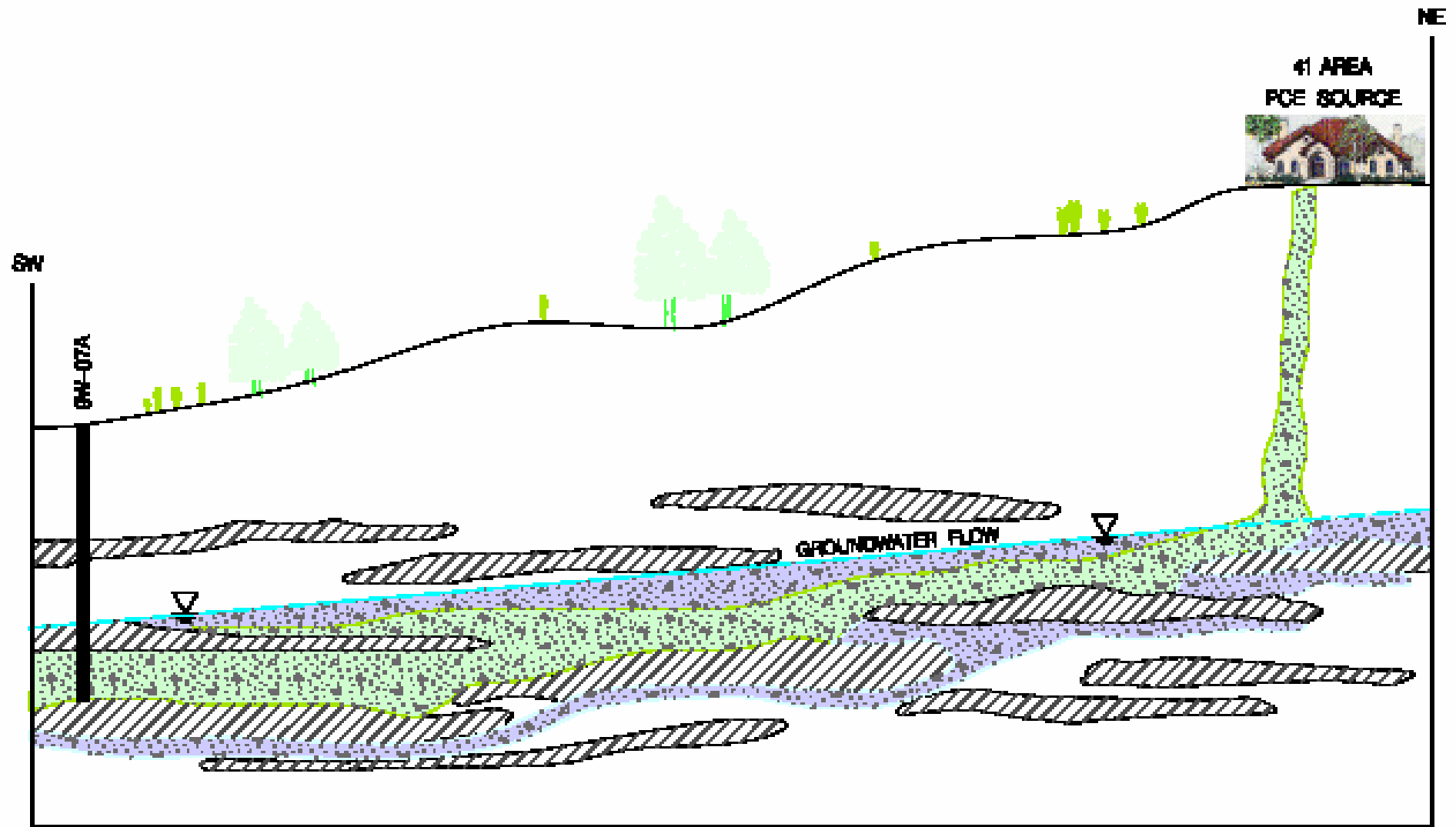


- Located on base in undeveloped canyon
- Approximately 0.5 mile upgradient from non-beneficial use boundary
- Site used for Marine Corps training
- Endangered species habitat precludes future development

## Site Description

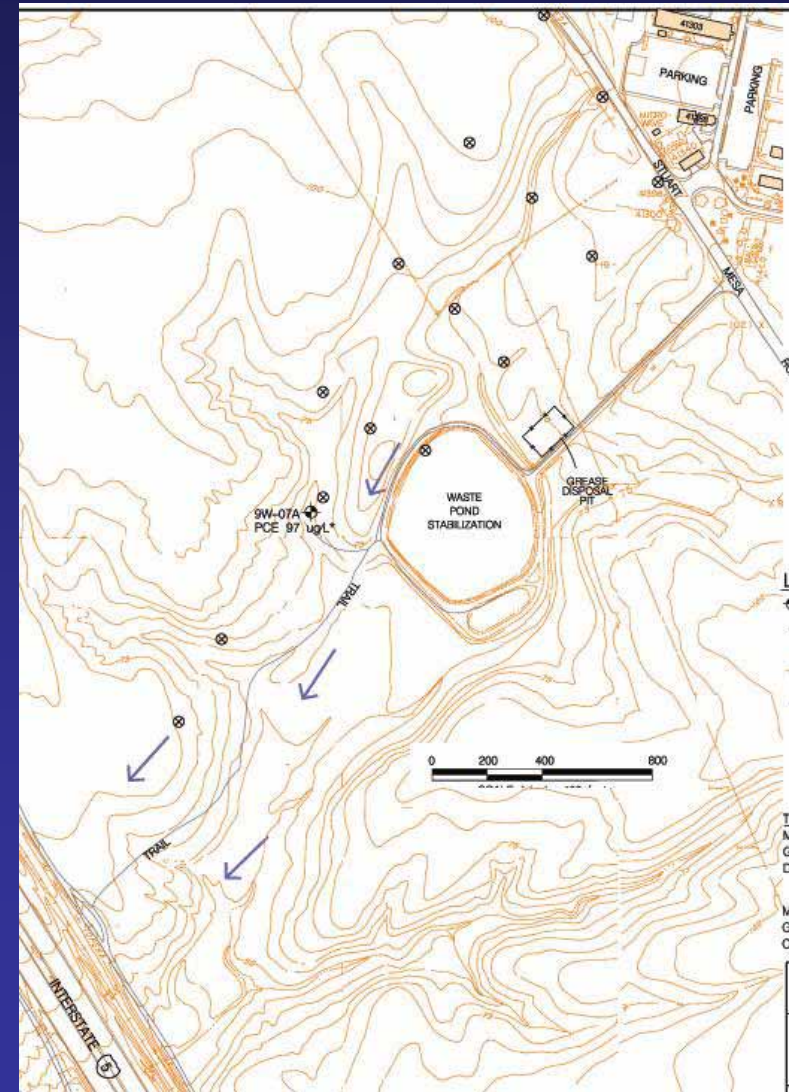


# Working Conceptual Site Model



# Planned Site 1114 Investigation

- Four phases of investigation planned within one Dynamic Work Plan / reporting cycle:
  - Phase I – File and Records Review, Interviews
  - Phase II – Lithologic and Groundwater Investigation
  - Phase III – Focused Source Area Investigation
  - Phase IV – Installation of Permanent Monitoring Wells

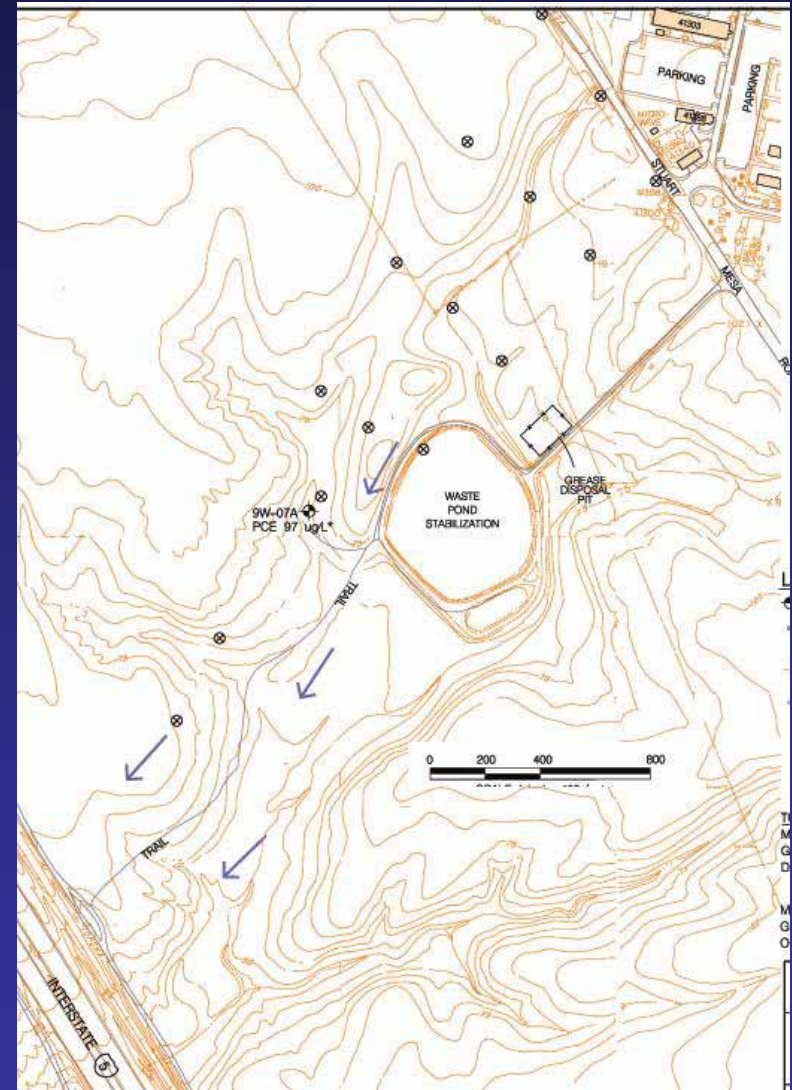


# Triad at Site 1114

- Systematic Planning – Project end goals are the identification of the VOC source area and plume extent
- Dynamic Work Plan – Flexibility to determine sample locations and numbers in the field to meet project end goals and optimize CSM, as necessary.
- On-Site Analytical Tools – SCAPS, CPT, mobile laboratory, MIP, EPA 8265.

# Project Objectives

- Identify potential VOC source areas
  - Target VOCs include PCE and related degradation products TCE, DCE and VC
- Delineate area where VOCs exceed MCLs in groundwater
- Investigation conducted following U.S. EPA's Triad approach with goal of streamlining sampling, analysis, and decision making





# Mobilization Tasks

- Obtained permits
- Utility clearance
- Conducted GPS survey of planned sample locations
- Constructed access roads to sample locations
- Set up FTP site for data communication
- Established field technical team (FTT)



# Project Personnel

## CORE FFA TEAM

Beatrice Griffey  
RWQCB RPM  
Agency Point of Contact

Martin Hausladen  
U.S. EPA RPM

Bill Mabey

Tayseer Mahmoud  
DTSC RPM

Mark Bonsavage  
MDBCP IR Branch Manager

Michael Bilodeau  
SWDIV RPM

Patricia Underwood, PhD  
SWDIV RTM

Ed Miranda  
SWDIV RPM

Nars Ancog  
SWDIV QAO



## FIELD TECHNICAL TEAM

Geoff Buckner  
Registered Geologist

Karen Collins  
Project Manager

Timothy Shields  
SCAPS Manager

Adrienne Saboya  
PWC QA Manager

Bill Davis, PhD  
DSITMS Chemist

Fred Essig  
SCAPS Geologist

Bill Hagen  
SCAPS Operator

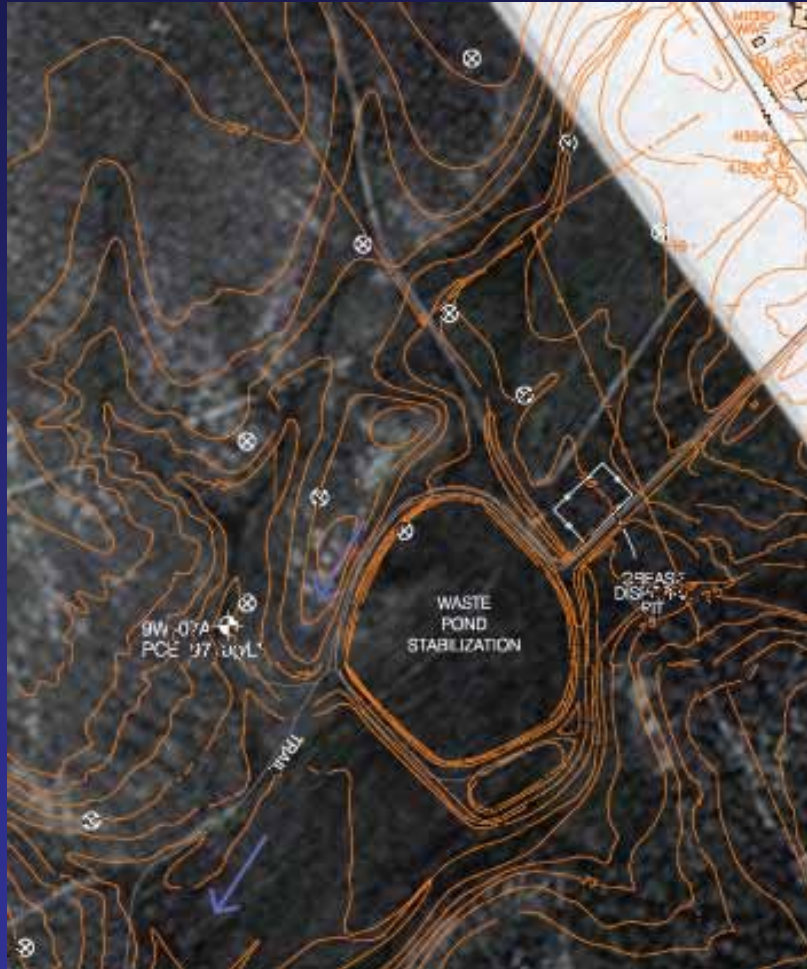
Craig Haverstick  
PWC Health and Safety

# Phase I – File and Records Review, Interviews

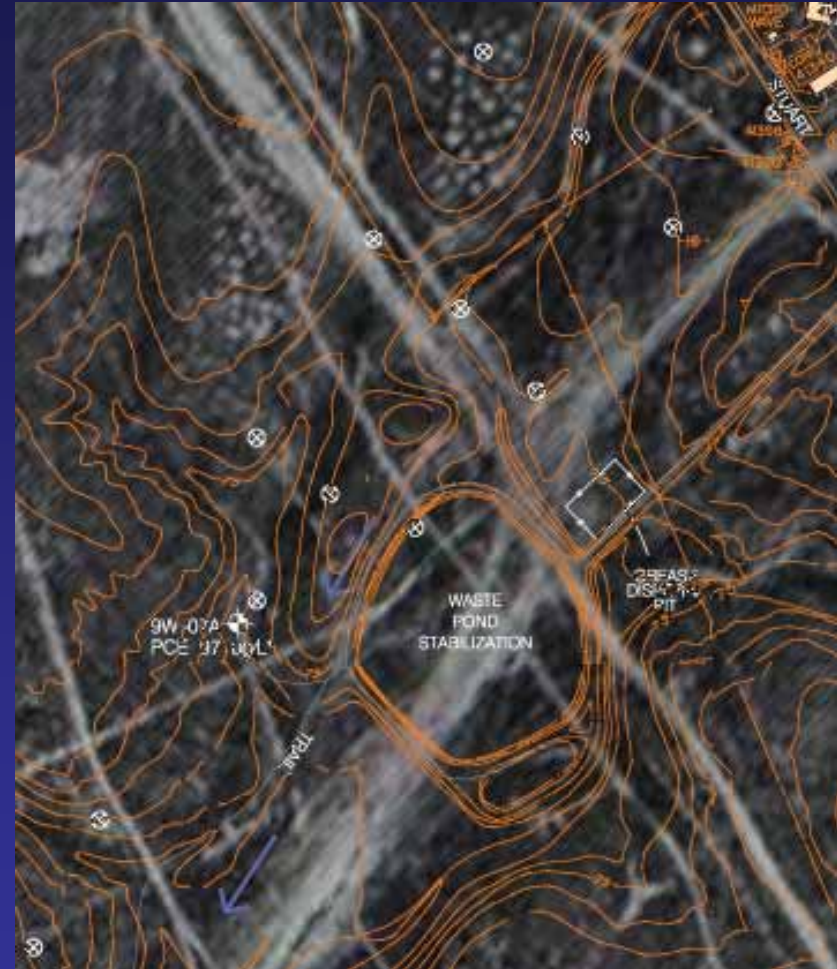
- Compiled and reviewed available historical information on upgradient operations.
  - Archives of Base Historian
  - Historical air photos
  - Utility maps
  - Site visits
  - Interviews with key facility personnel

# Phase I – Preliminary Assessment

1932



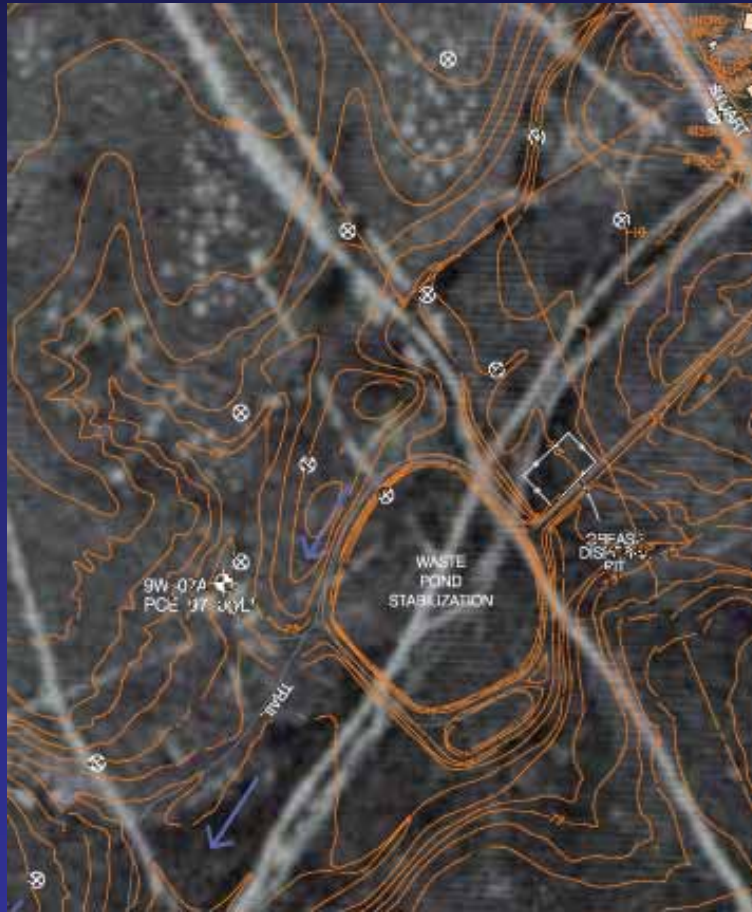
1953



- No history of industrial operations southwest of Stuart Mesa Road.

# Phase I – Preliminary Assessment

1958

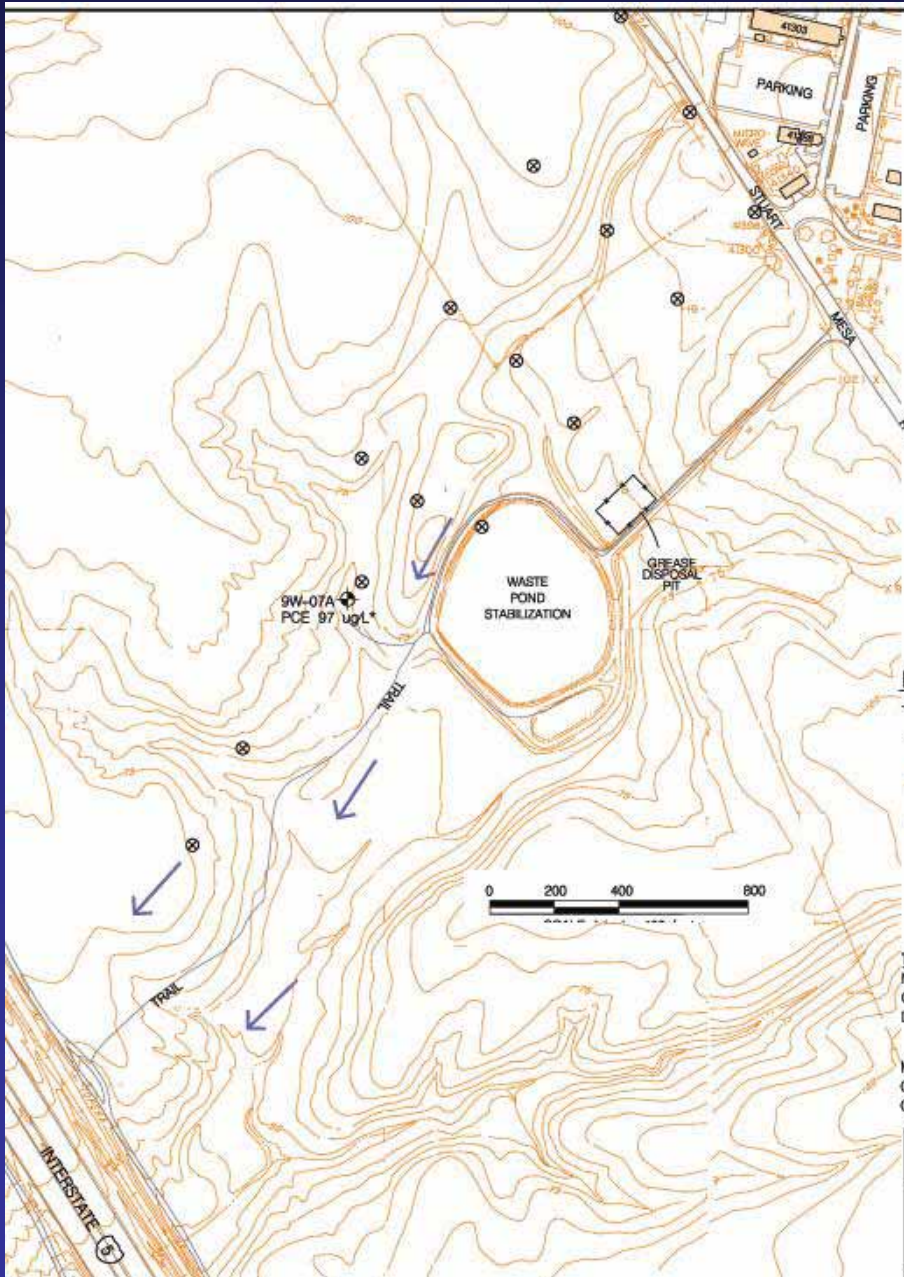


1993



- Development NE of road consists of barracks, NEX, fire station, medical/dental clinic, mess hall, training facilities, equipment storage areas.

# Phase I – PA Investigation Results



- Two areas of interest identified.
  - Tank maintenance facility in 41 Area
  - Equipment disassembly north of IR Site 9



# Phase I – PA Investigation Results

## Tank Maintenance Facility

- West of Bldg. 41312
- Military tanks serviced from mid-1950s through 1990s.
- Cleaning chemicals reportedly used, type undetermined
- No VOCs reported in groundwater samples from UST wells at B41312



# Phase I – PA Investigation Results

## Area North of IR Site 9

- Rumored to have been used for equipment disassembly
- Specifically, hovercraft fuel tanks reportedly dismantled in this area
- Equipment parts not identified in site walks
- No supporting facility, tools, or equipment located in area



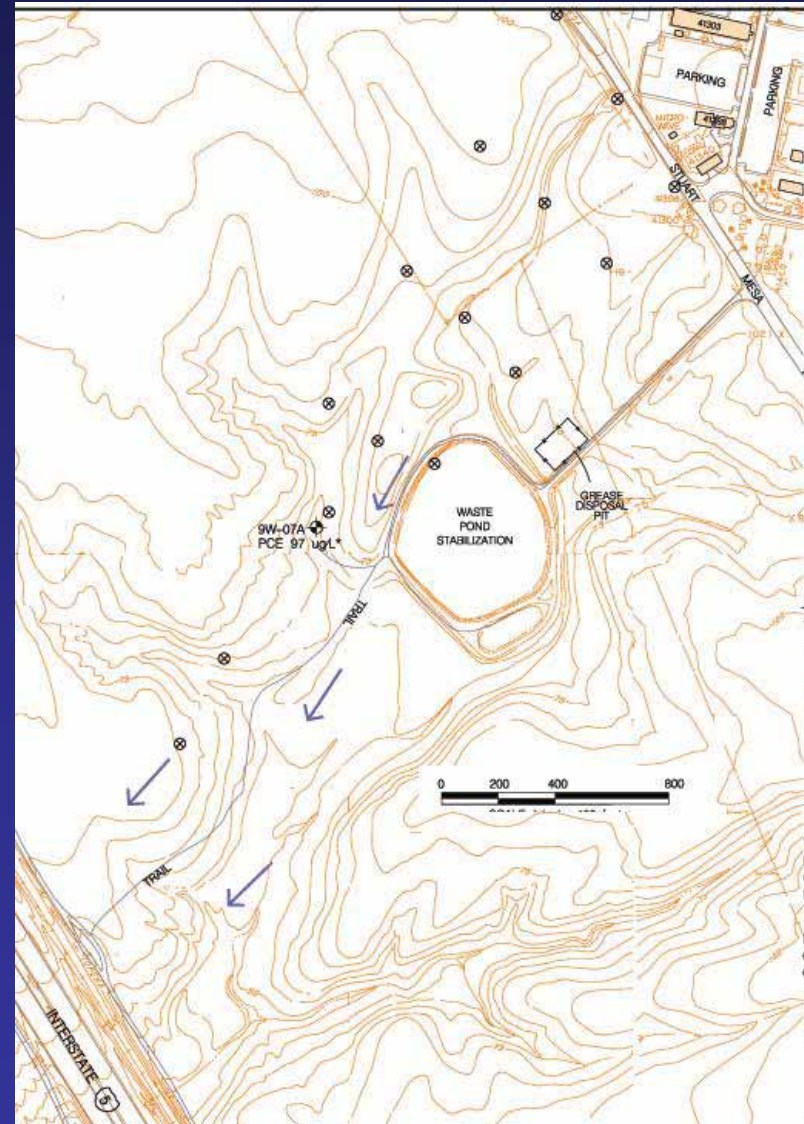
# Phase II – Lithologic and Groundwater Investigation

- Lithologic and groundwater quality data collected adjacent to and upgradient of 9W-07A
- CPT data collected at 12 locations provided continuous lithologic characterization
- Discrete groundwater samples collected from 12 temporary microwells at 10 locations.

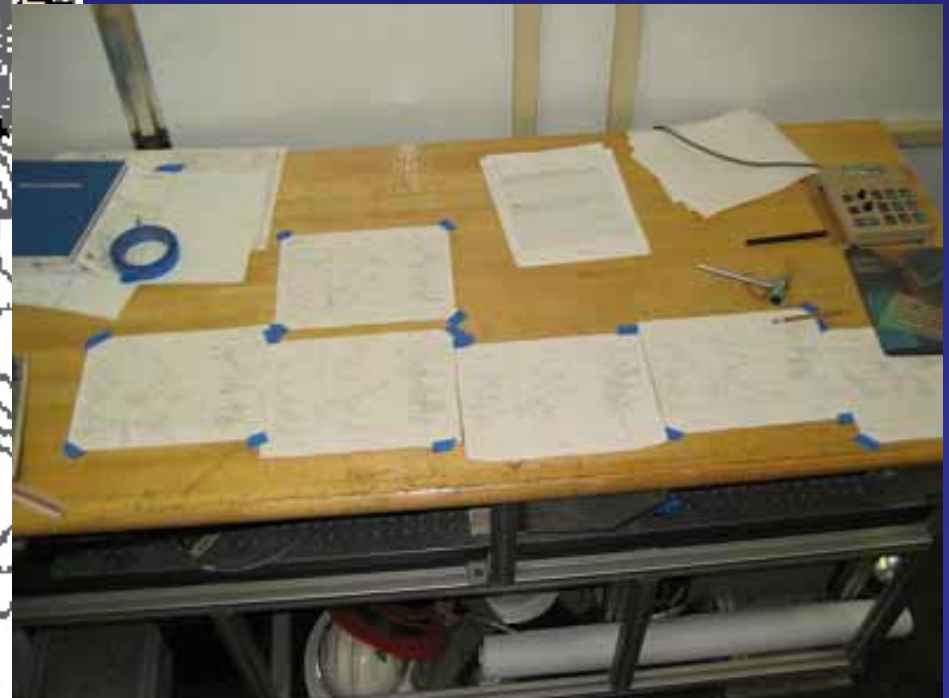
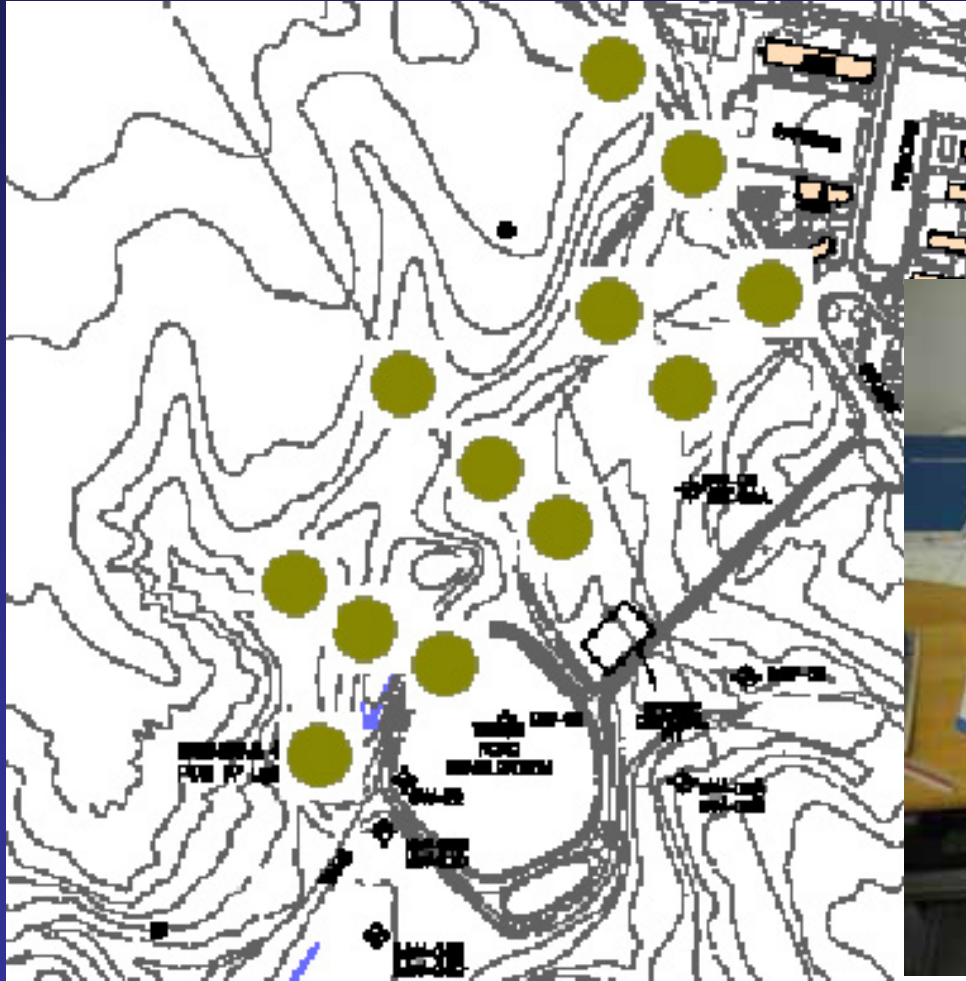


# Phase II – Lithologic and Groundwater Investigation

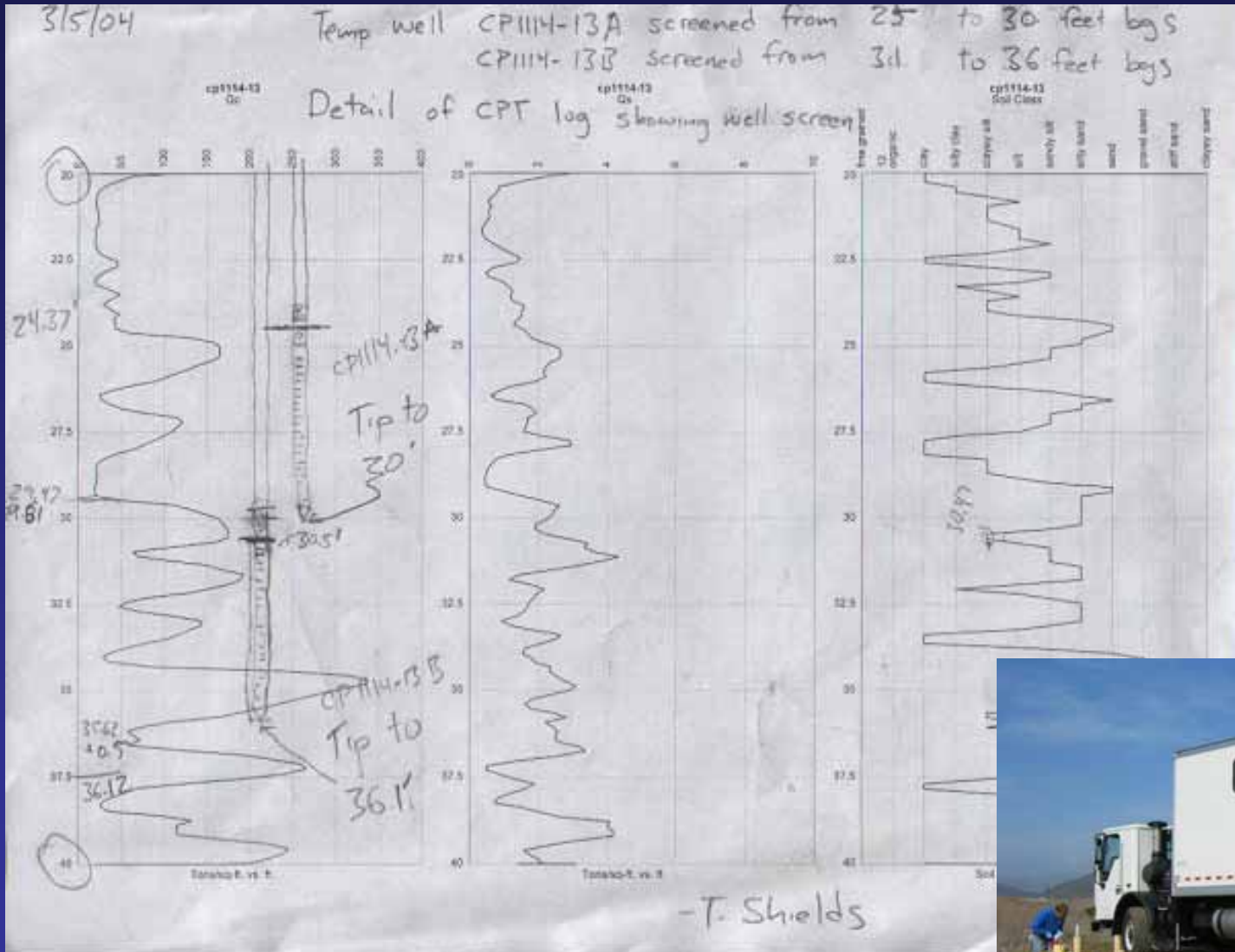
- Three sampling transects initiated, radiating out- and up-gradient from 9W-07A
- Five locations problematic: roads to 4, 14, and 15 were impassable, and shallow refusal at 1 and 3 prohibited well construction.



# SCAPS CPT POINTS



# CPT Log CP1114-13



# Designing Well Screen

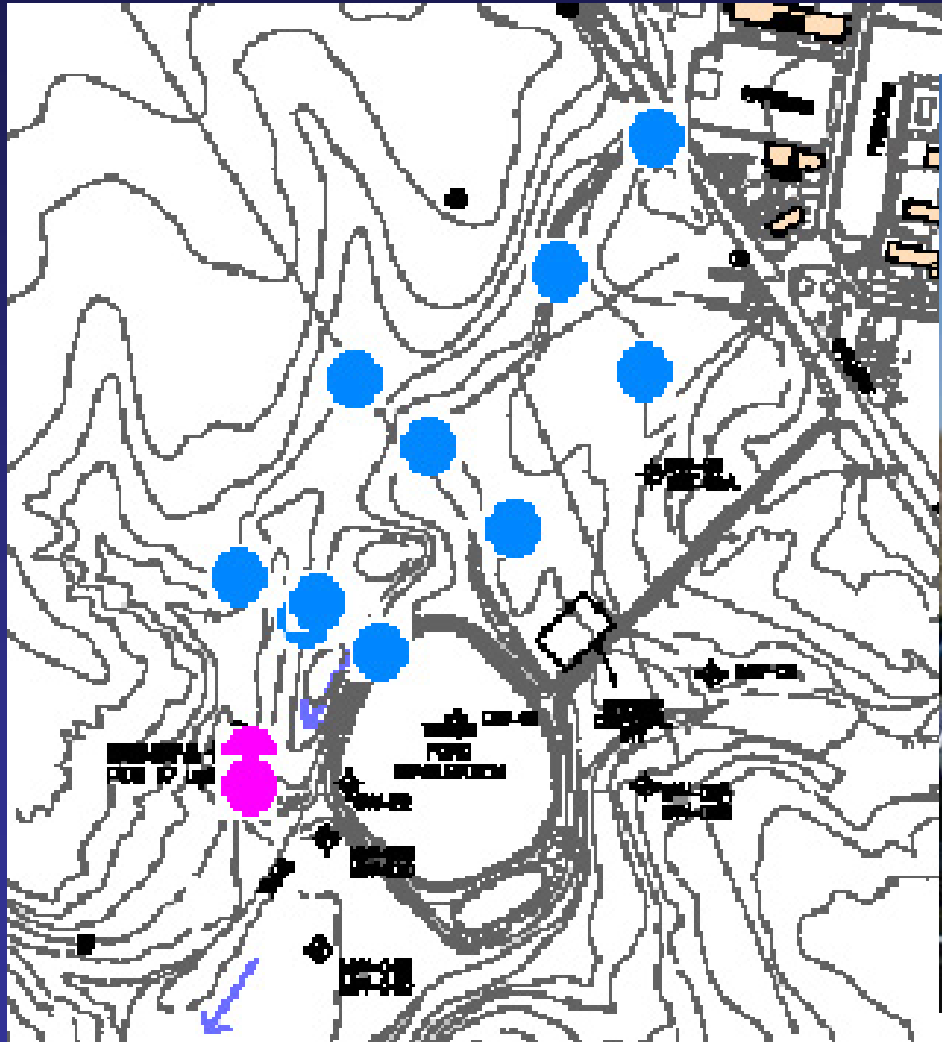


# Phase II – Groundwater Investigation

## SCAPS Microwells

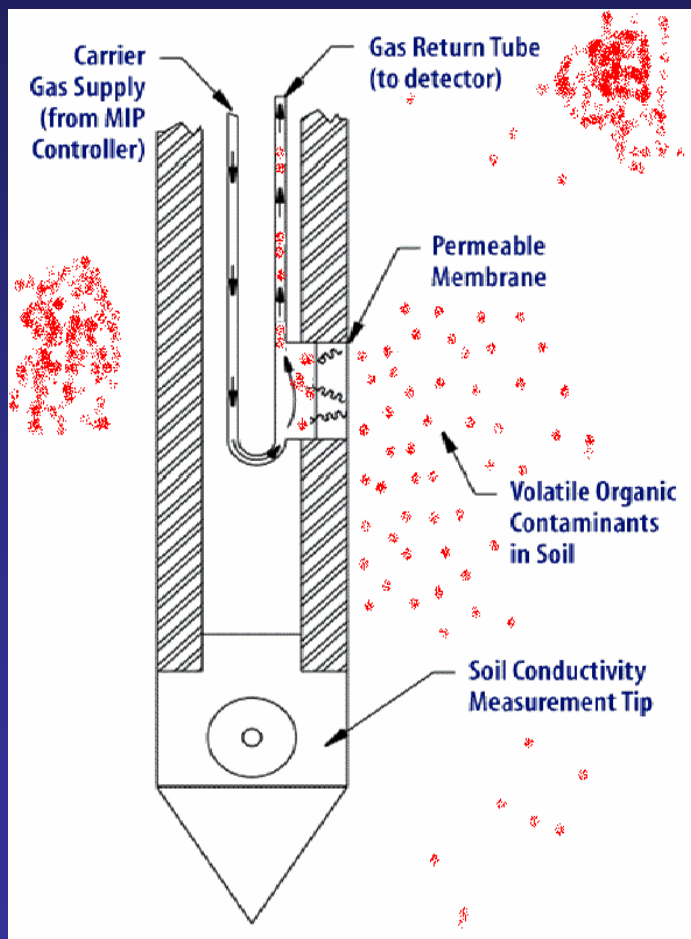
- 12 temporary microwells constructed and sampled at 10 locations
- Each well constructed with a 5 foot screen
- Groundwater samples analyzed by HP Labs with MDL of 1.0 ug/L
- Target VOCs not detected in microwells 2, 5, 6, 7, 8, 10, 11A, 11B, and 12.
- PCE and TCE reported in 13A and 13B.

# Temporary Microwell Data



# Phase III – Focused Source Area Investigation

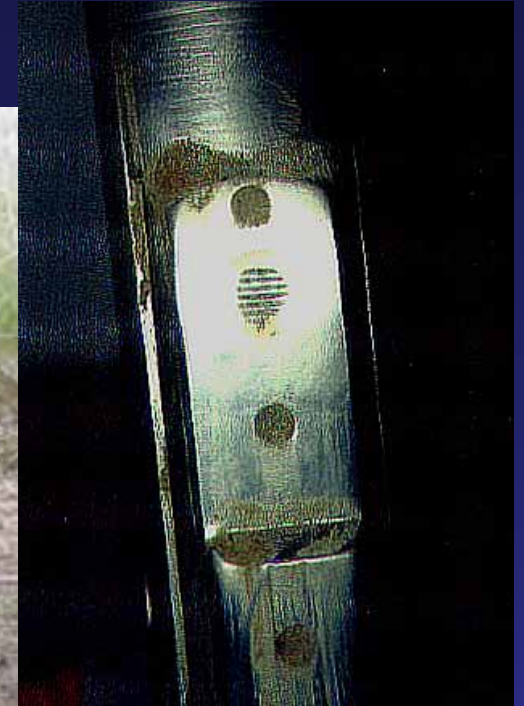
## Geoprobe® Systems Membrane Interface Probe (MIP)



- An inert ultrapure helium carrier gas is sent down to the probe, sweeps behind the membrane, and returns to the surface to be analyzed.
- A temperature controller allows the membrane to be heated, which may optimize membrane performance.
- When the membrane is heated, VOCs advect away from the membrane. However, some of the VOCs pass through the membrane and are brought to the surface with the carrier gas to be analyzed.
- SCAPS analyzes the gas stream with a Direct Sample Ion Trap Mass Spectrometer (DSITMS)

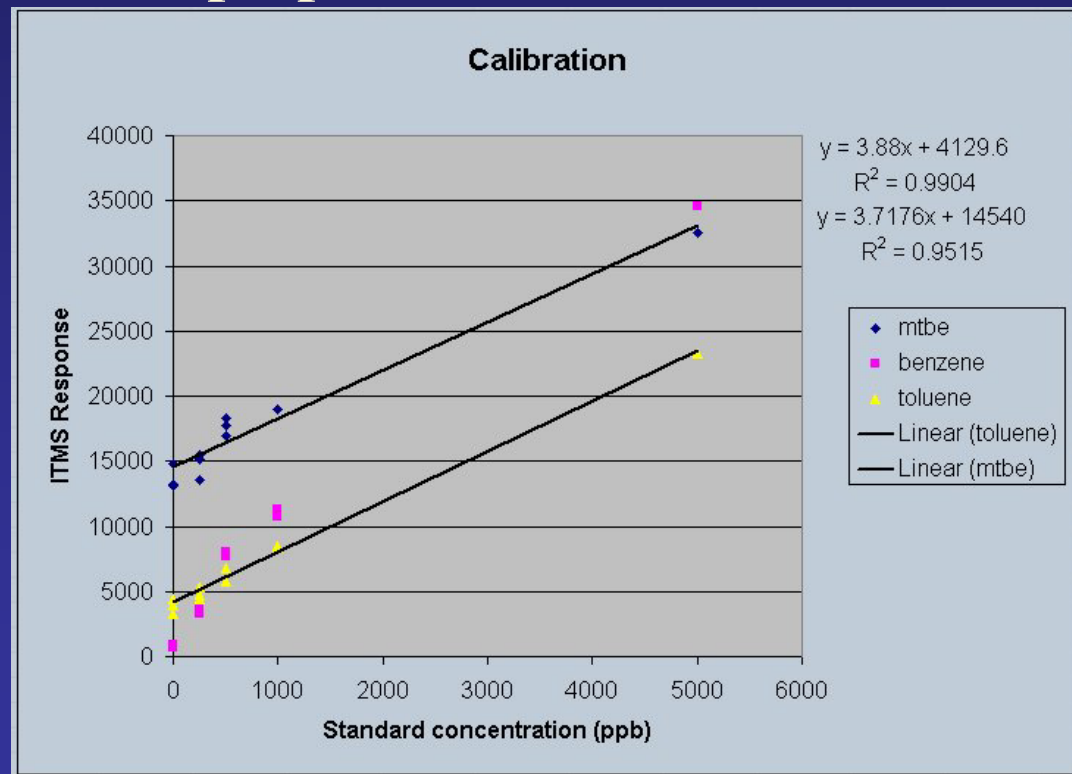


# MIP Probe

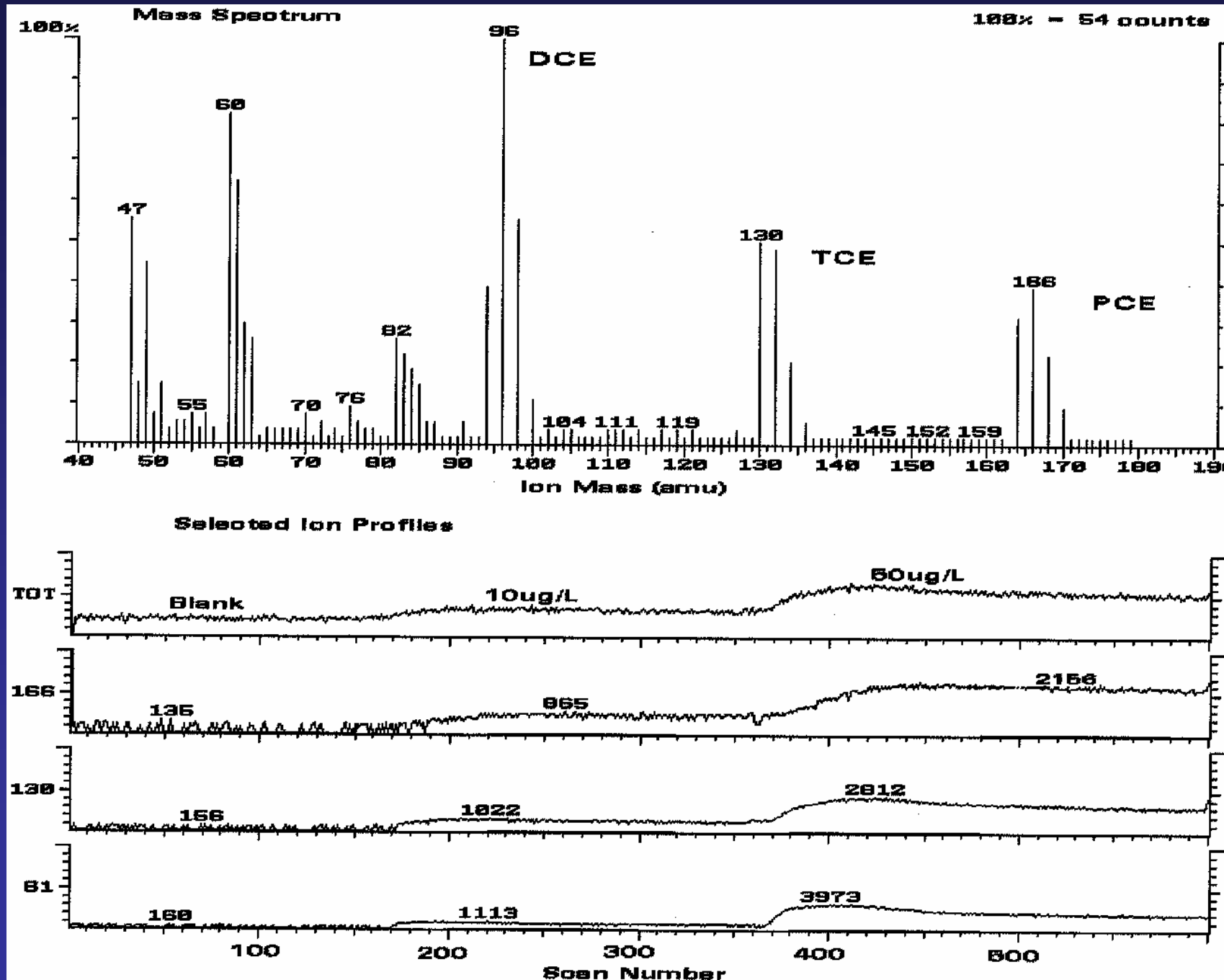


# Calibrating the system.

- Samples of water containing a known concentration of contaminant are added to sand in a calibration jig and measured with the MIP/DSITMS.
- The results are used to prepare a calibration curve.



# Typical DSITMS Response



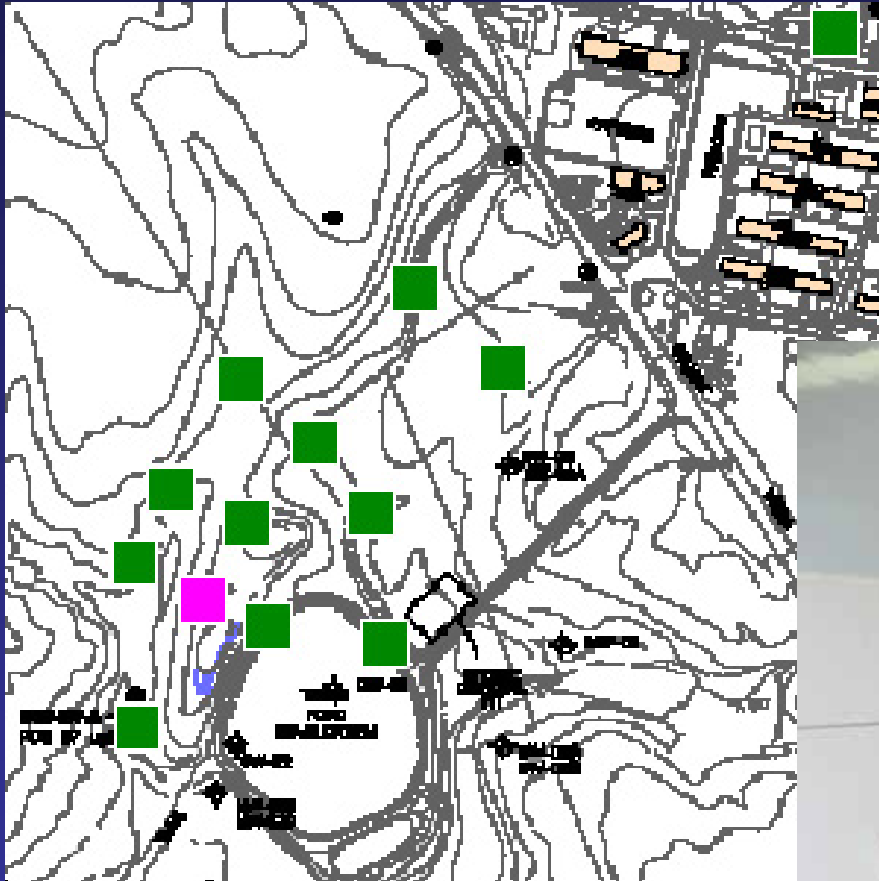
# Phase III – Source Area Investigation

## SCAPS MIP

- Thirteen SCAPS/MIP borings advanced
- 12 sample locations positioned along three transects upgradient from 9W-07A, southwest of Stuart Mesa Road
- 1 location northeast of Stuart Mesa Road near former tank maintenance facility by Bldg. 41312



# MIP Results



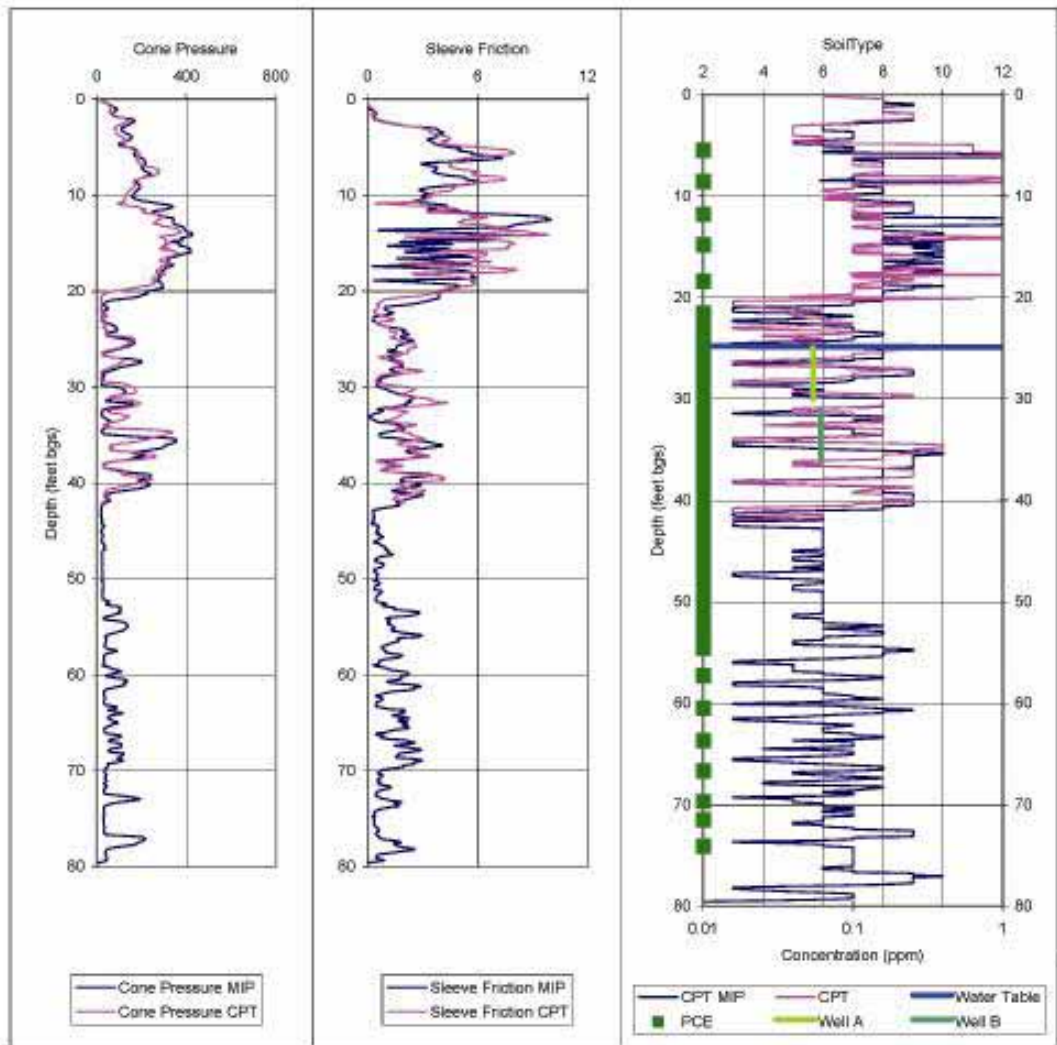
# Phase III – Source Area Investigation

## SCAPS MIP

- Over 690 linear feet of site area assessed for VOCs
- MIP-11 was the single location where target VOCs were detected

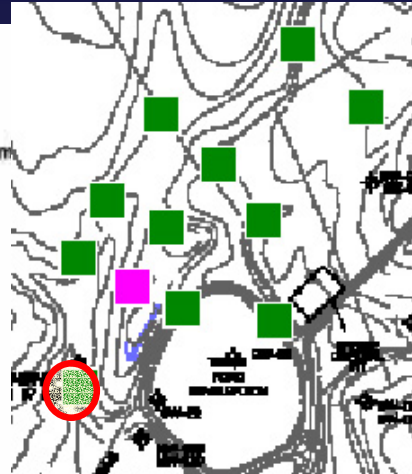


CP-1114-13



Depth	PCE by MIP/DSITMS (ppm)
5.5	<0.25
8.6	<0.25
11.8	<0.25
14.8	<0.25
18.4	<0.25
21.5	<0.25
22.4	<0.25
23.5	<0.25
24.5	<0.25
25.5	<0.25
26.5	<0.25
27.6	<0.25
28.6	<0.25
29.6	<0.25
30.5	<0.25
31.5	<0.25
32.5	<0.25
33.6	<0.25
34.7	<0.25
35.7	<0.25
36.7	<0.25
37.6	<0.25
38.6	<0.25
39.6	<0.25
40.6	<0.25
41.6	<0.25
42.6	<0.25
43.6	<0.25
44.6	<0.25
45.6	<0.25
46.5	<0.25
47.6	<0.25
48.6	<0.25
49.5	<0.25
50.5	<0.25
51.4	<0.25
52.5	<0.25

Well ID	Groundwater Analytical (µ/L)		
	PCE	TCE	DCE
13A	54	4.6	<1
13B	61	5.3	<1

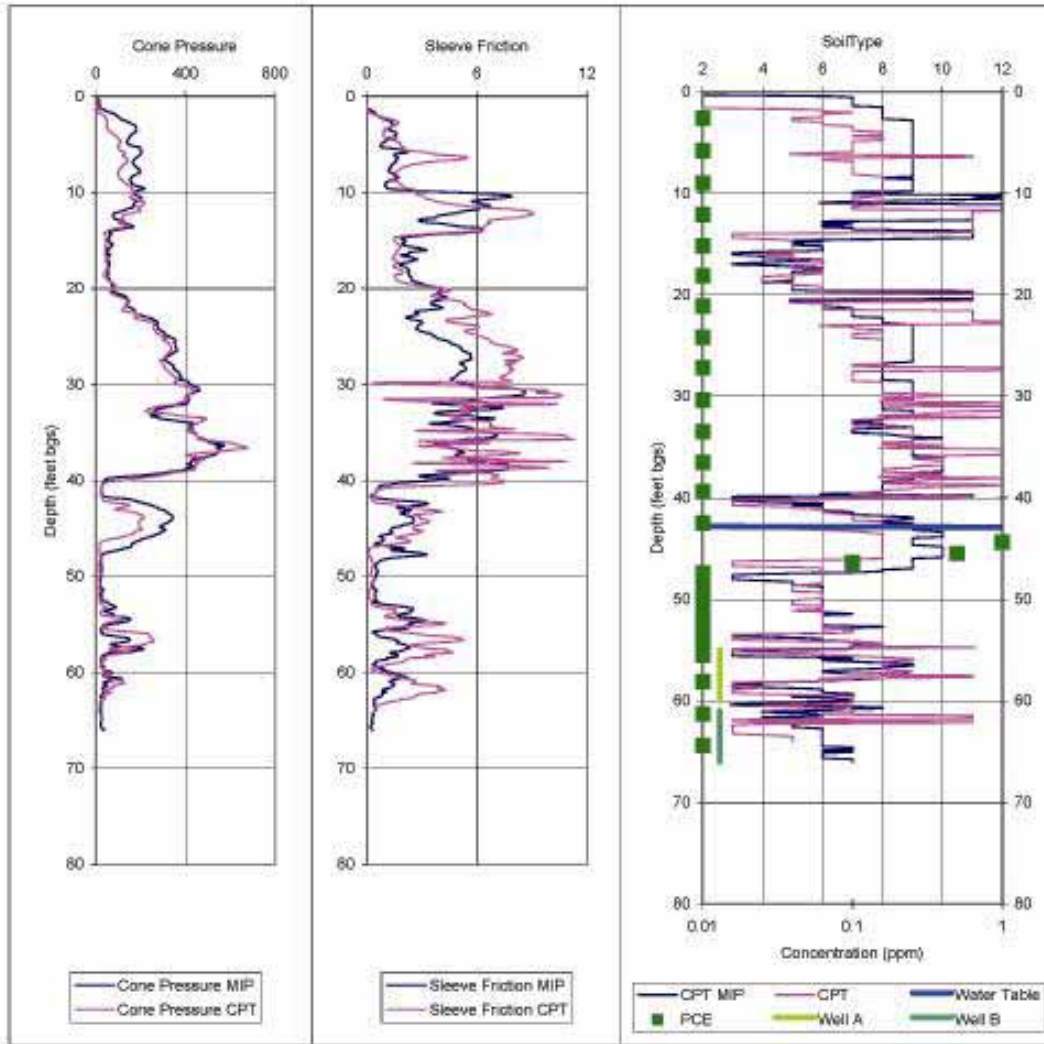


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MIP DATE 3/16/04

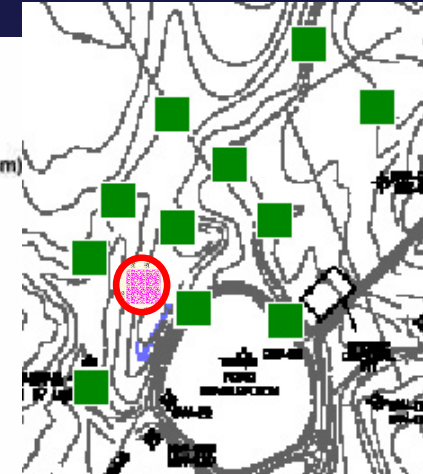
MCBCP IR Site 1114

CP-1114-11



Depth	PCE by MIP/DSITMS (ppm)
2.6	<0.25
5.8	<0.25
9	<0.25
12.1	<0.25
15.2	<0.25
18.1	<0.25
21.1	<0.25
24.2	<0.25
27.2	<0.25
30.4	<0.25
33.5	<0.25
36.5	<0.25
39.4	<0.25
42.5	<0.25
44.4	1
45.5	0.5
46.4	0.1J
47.4	<0.25
48.5	<0.25
49.4	<0.25
50.4	<0.25
51.3	<0.25
52.4	<0.25
53.4	<0.25
54.4	<0.25
55.5	<0.25
58.1	<0.25
61.3	<0.25
64.4	<0.25

Well ID	Groundwater Analytical (µ/L)		
	PCE	TCE	DCE
11A	<1	<1	<1
11B	<1	<1	<1



PCE @ about 1ppm  
 PCE @ about 0.5 ppm  
 PCE <0.5 ppm present

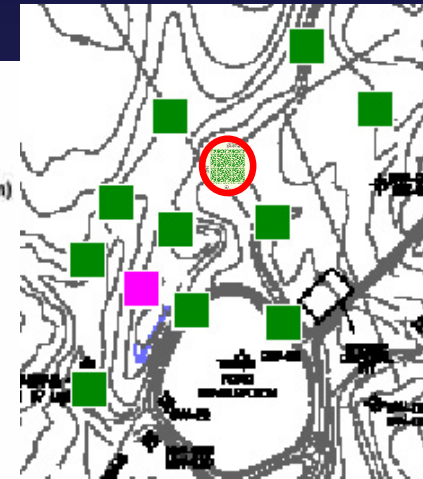
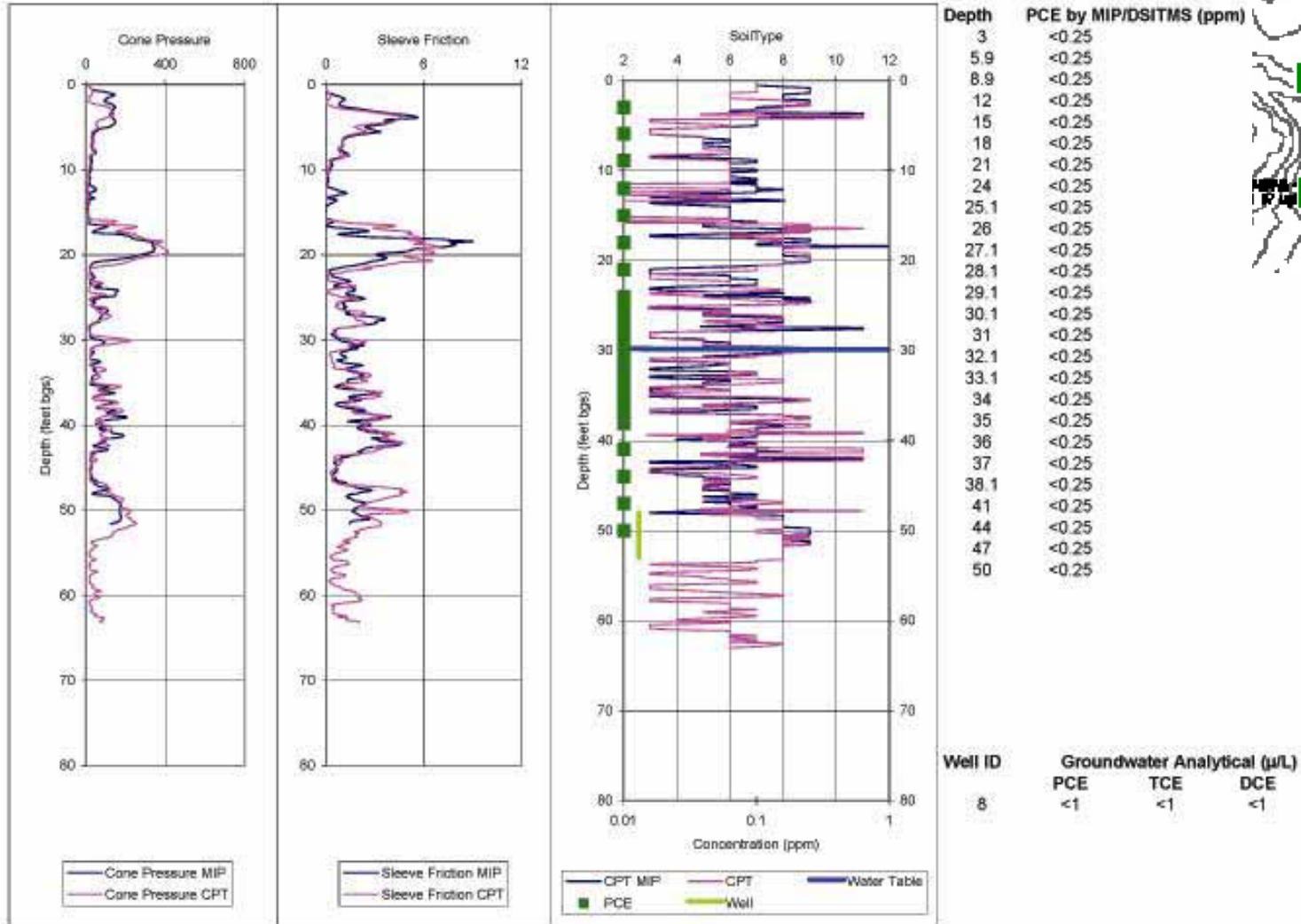
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MIP DATE 3/17/04





CP-1114-08

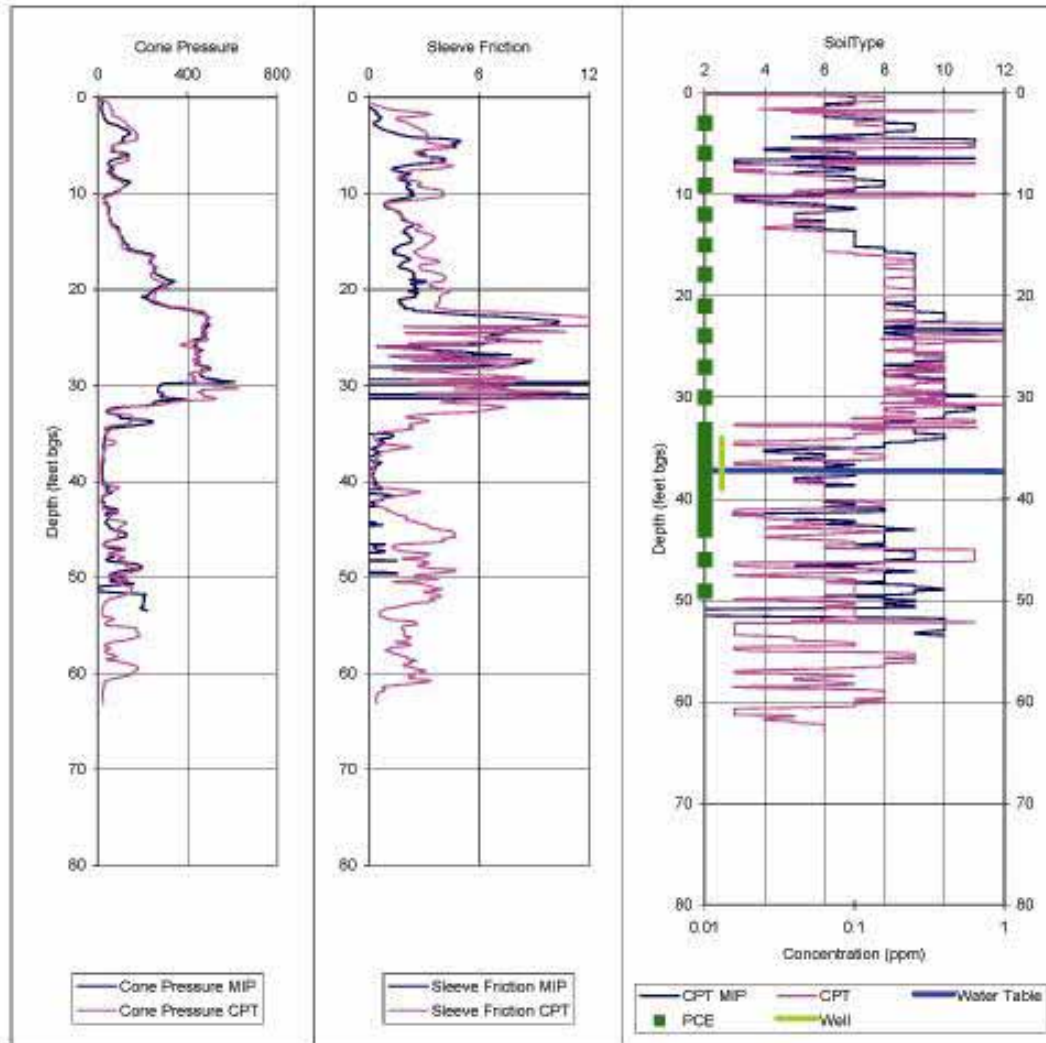


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MIP DATE 3/17/04

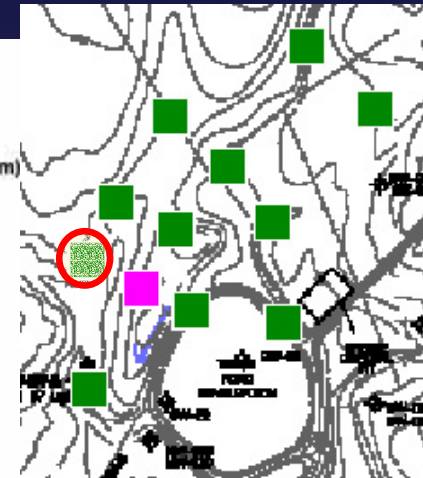
MCBCP IR Site 1114

CP-1114-10



Depth	PCE by MIP/DSITMS (ppm)
3	<0.25
6	<0.25
9.1	<0.25
12	<0.25
15	<0.25
17.9	<0.25
21	<0.25
23.9	<0.25
27	<0.25
30	<0.25
33.2	<0.25
34	<0.25
35	<0.25
36.1	<0.25
37	<0.25
38	<0.25
39	<0.25
40	<0.25
41	<0.25
42.1	<0.25
43.1	<0.25
46	<0.25
49.1	<0.25

Well ID	Groundwater Analytical (µ/L)		
	PCE	TCE	DCE
10	<1	<1	<1



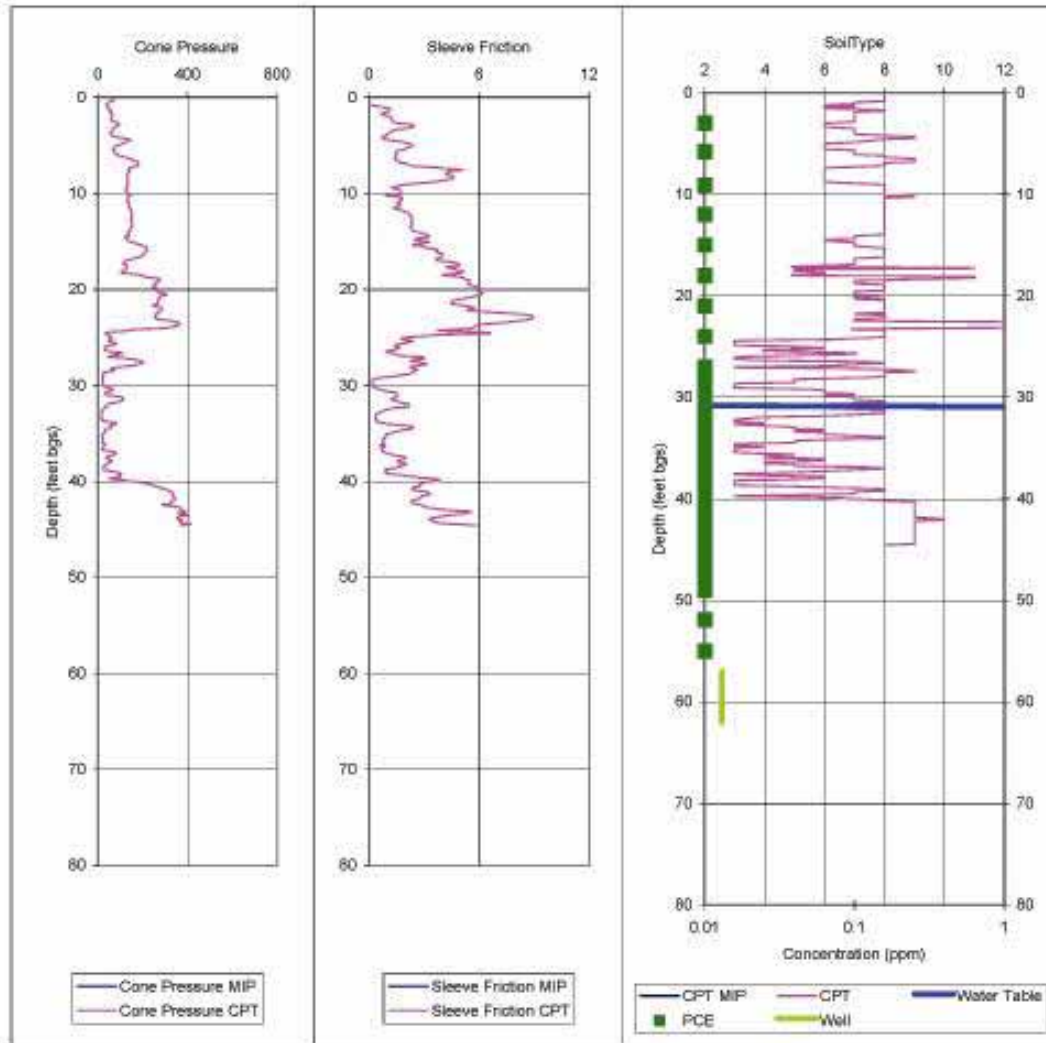
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MIP DATE 3/17/04

MCBCP IR Site

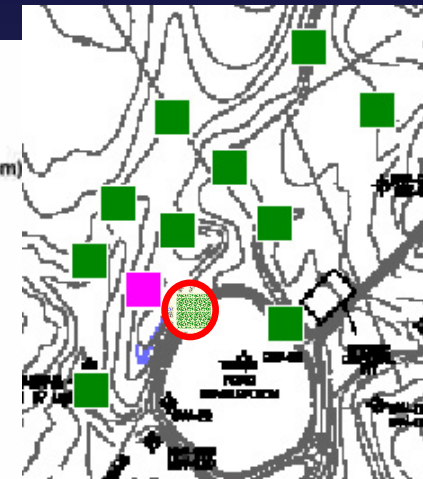


CP-1114-12



Depth	PCE by MIP/DSITMS (ppm)
3	<0.25
5.8	<0.25
9.1	<0.25
12	<0.25
15	<0.25
18	<0.25
21	<0.25
24	<0.25
27	<0.25
28	<0.25
29	<0.25
29.9	<0.25
31	<0.25
32	<0.25
33	<0.25
34	<0.25
35	<0.25
36	<0.25
37.1	<0.25
38	<0.25
39	<0.25
40	<0.25
41	<0.25
42	<0.25
43	<0.25
44.1	<0.25
45	<0.25
46	<0.25
46.9	<0.25
48	<0.25
49	<0.25
51.9	<0.25
55	<0.25

Well ID	Groundwater Analytical (µ/L)		
	PCE	TCE	DCE
12	<1	<1	<1

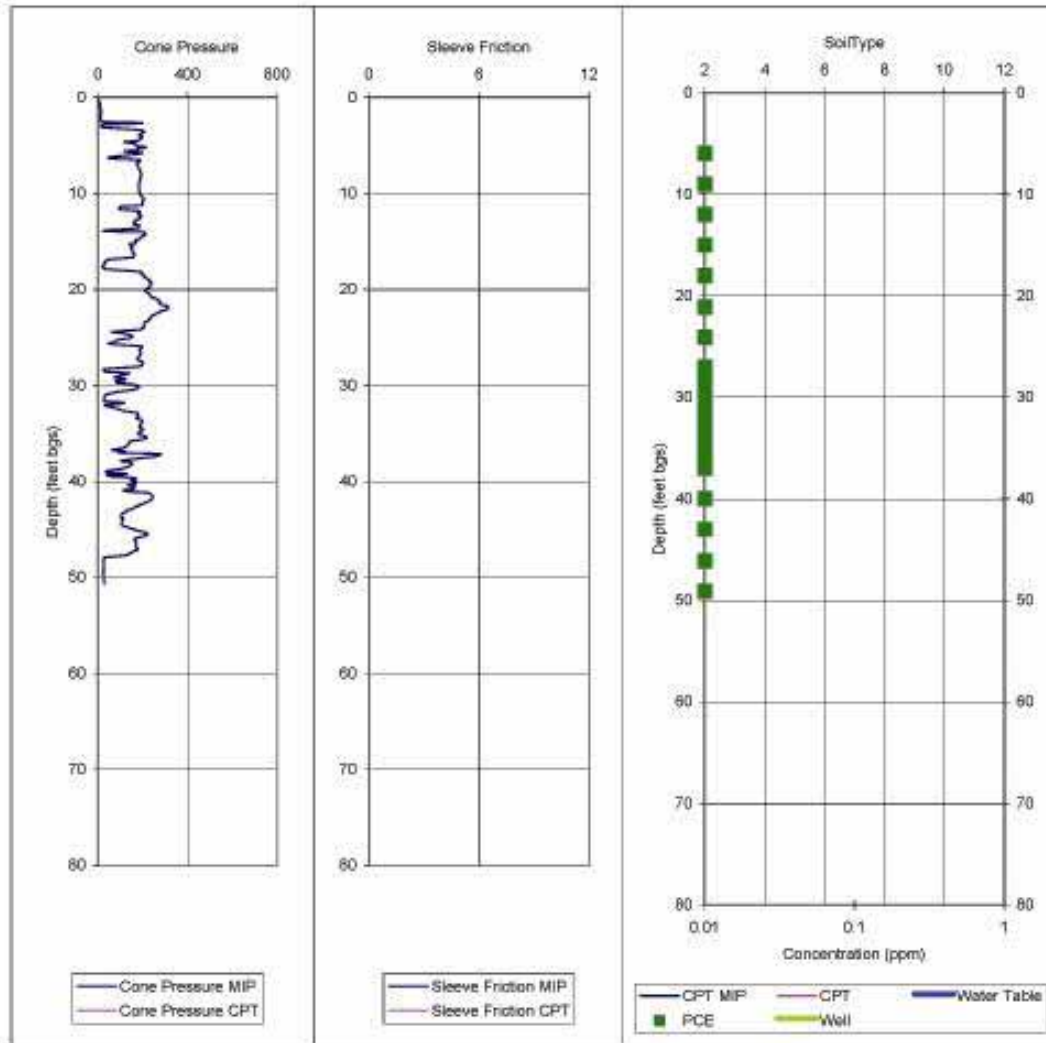


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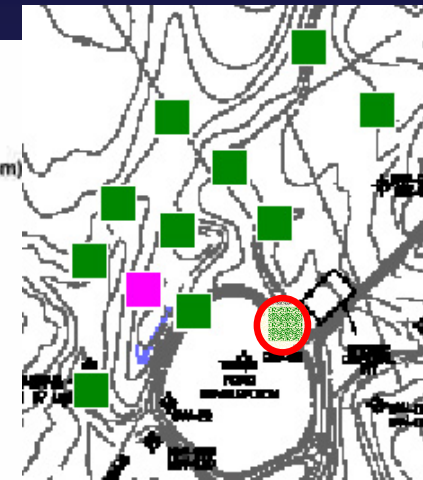
MIP DATE 3/19/04

MCBCP IR Site 1114

CP-1114-15



Depth	PCE by MIP/DSITMS (ppm)
6	<0.25
9	<0.25
12	<0.25
15	<0.25
18	<0.25
21.1	<0.25
24.1	<0.25
27	<0.25
28	<0.25
29	<0.25
30	<0.25
31	<0.25
32	<0.25
33	<0.25
34	<0.25
35	<0.25
36	<0.25
37	<0.25
40	<0.25
43	<0.25
46.1	<0.25
49.1	<0.25

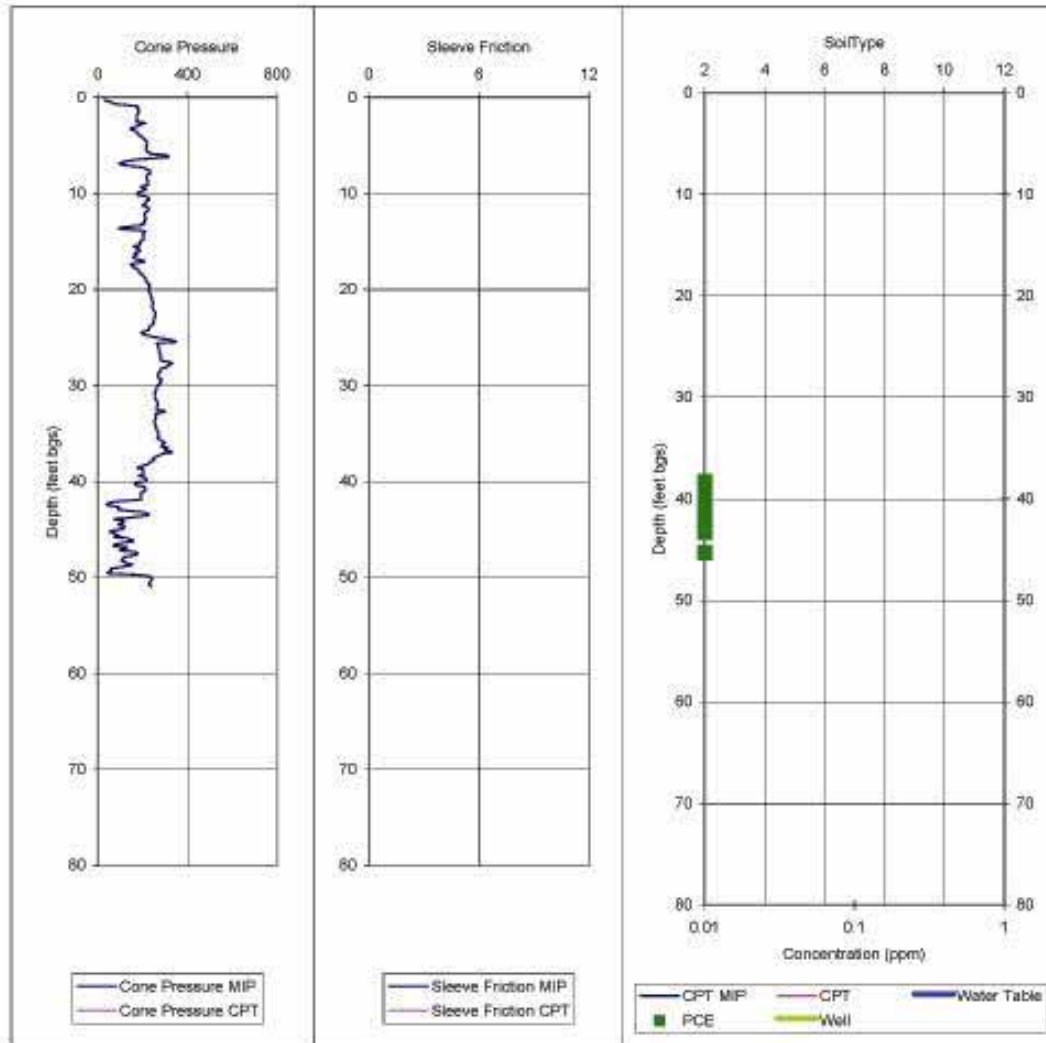


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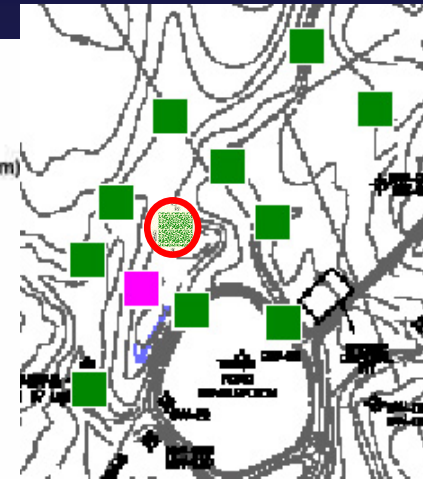
MIP DATE 3/18/04

MCBCP IR Site 1114

CP-1114-16



Depth	PCE by MIP/DSITMS (ppm)
38.3	<0.25
39.3	<0.25
40.3	<0.25
41.3	<0.25
42.3	<0.25
43.3	<0.25
45.3	<0.25

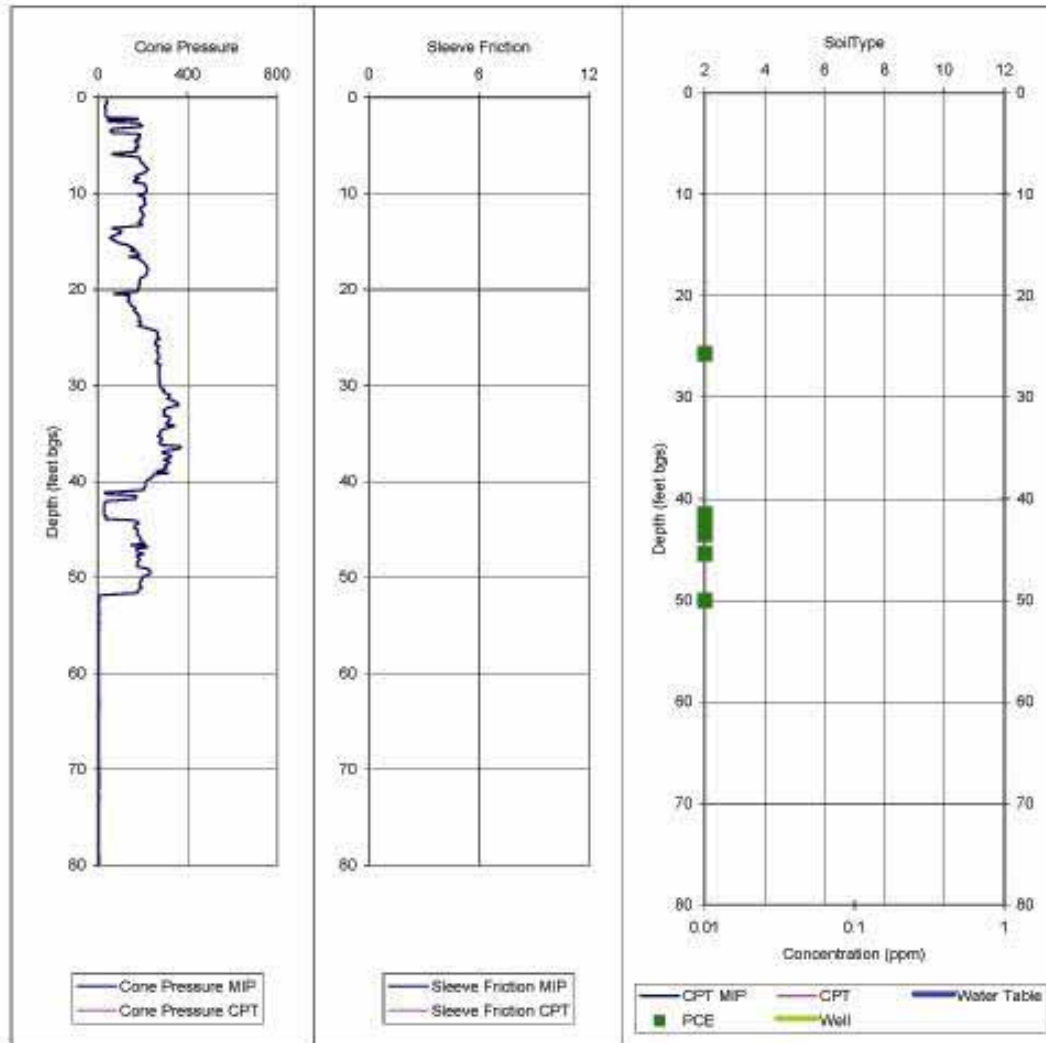


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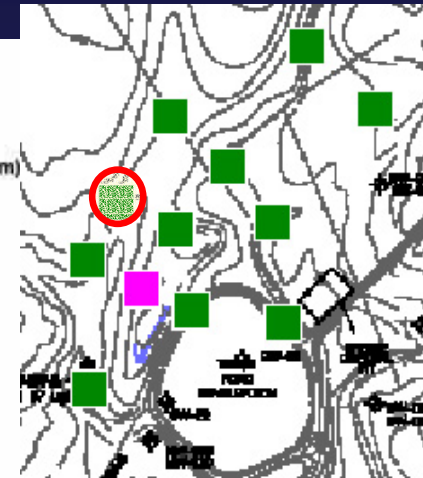
MIP DATE 3/19/04

MCBCP IR Site 1114

CP-1114-17



Depth	PCE by MIP/DSITMS (ppm)
25.7	<0.25
41.5	<0.25
42.5	<0.25
43.5	<0.25
45.4	<0.25
50	<0.25



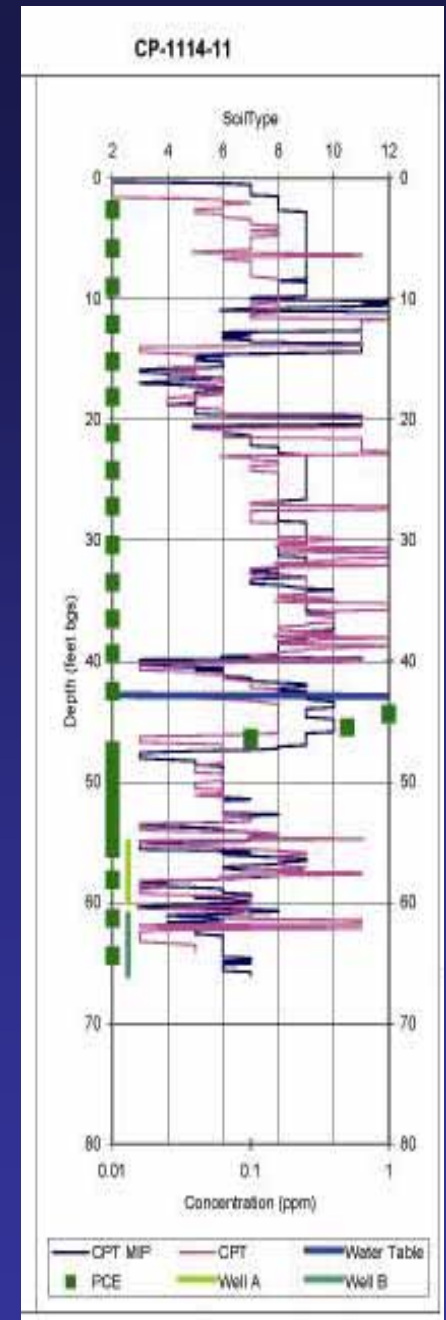
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MIP DATE 3/19/04

MCBCP IR Site 1114

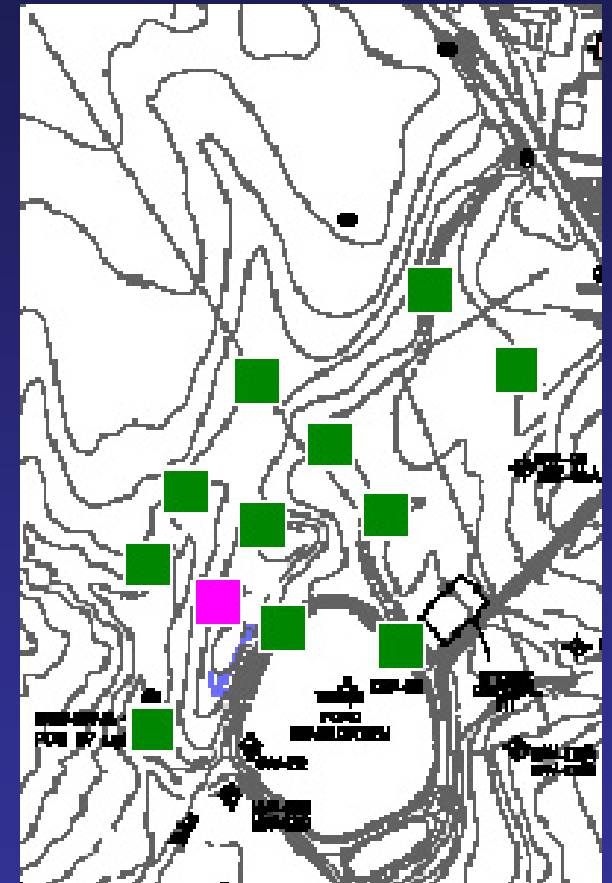
# Conclusions

- Detailed conceptual site model produced identifying:
  - Site 1114 lithologic conditions
  - Well-delimited VOC presence
- Greatest PCE concentration was 1,000 ppb at MIP-11 between 42.5 and 44.4' bgs
- PCE concentration at MIP-11 declines sharply with depth, dropping order of magnitude within 2 feet



# Conclusions

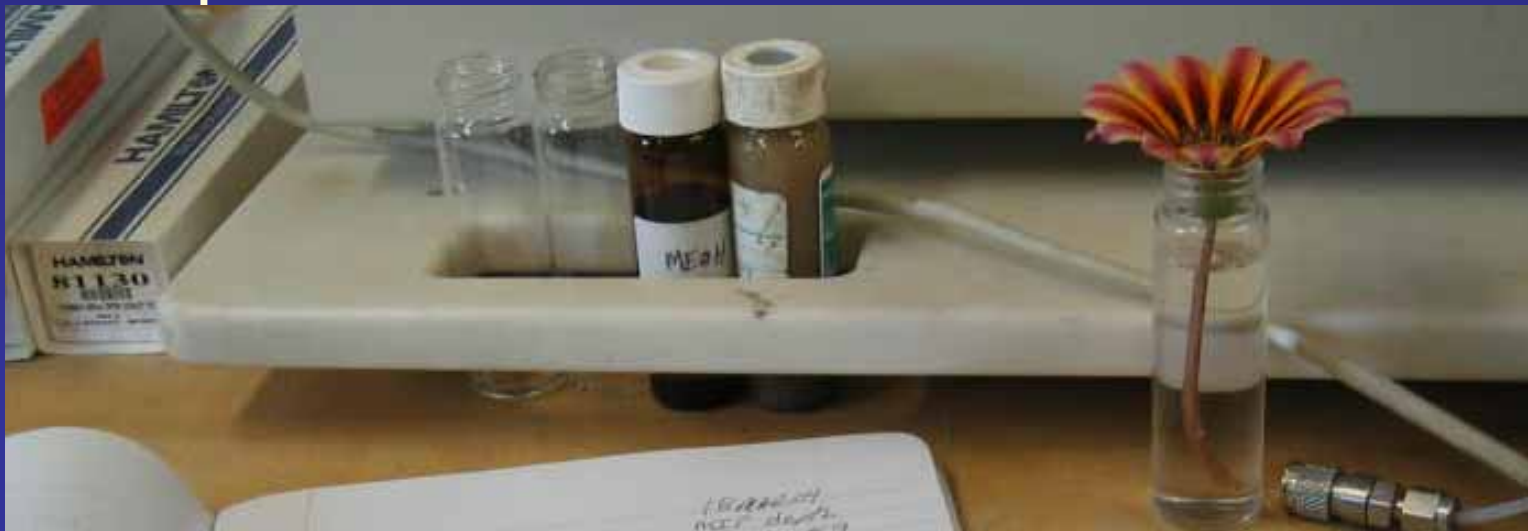
- VOC source area is well bounded
  - Laterally within ~200 feet
  - Vertically within 10 feet
  - Groundwater samples from microwells confirm vertical boundary
- DNAPL conditions and product-level concentrations were not encountered
- Data suggests small volume of initial release.





# Conclusions

- No complete pathways linking PCE at Site 1114 with receptors
- Site 1114 is overlain by protected habitat, therefore not subject to development
- Site is located ~1/2 mile upgradient from non-beneficial use boundary
- FFA team concurred with No Further Action; ROD planned



# Project Milestone Schedule

- Project Initiated July 2003
- FFA Triad Planning Meeting Oct. 2003
- Final Work Plan Issued Feb. 2004
- Fieldwork Conducted Mar. 2004
- FFA Meeting -NFA Apr. 2004
- Issue Site Closure Report July 2004

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Total Time – 12 Months  
Average Federal Facility – 15 Years