



DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser OPAE.TM/523
October 29, 2012

Ms. Cheryl Prowell
California Environmental Protection Agency
California Regional Water Quality Control Board
Mitigation & Cleanup Unit
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

Mr. Tayseer Mahmoud
California Environmental Protection Agency
Department of Toxic Substances Control
Brownfields and Environmental Restoration Program
5796 Corporate Avenue
Cypress, CA 90630

Mr. Martin Hausladen
U. S. Environmental Protection Agency
Region IX, Code SFD-8-B
75 Hawthorne Street
San Francisco, CA 94105-3901

Subject: MEETING MINUTES FOR THE 108th FEDERAL FACILITIES
AGREEMENT (FFA) MEETING DATED SEPTEMBER 17th, 2012,
MARINE CORPS BASE CAMP PENDLETON

Dear Ms. Prowell, Mr. Mahmoud, Mr. Hausladen:

Enclosed are the minutes to the Marine Corps Base, Camp Pendleton Federal Facilities Agreement (FFA) meeting Number 107, held on September 17th, 2012. Should you have questions, please call me at (619) 532-1502.

Sincerely,

A handwritten signature in blue ink that reads "Theresa L. Morley".

THERESA MORLEY
Lead Remedial Project Manager
By direction

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October 29, 2012

- Enclosures:
- (1) 108th FFA Meeting Minutes
 - (2) 108th FFA Meeting Agenda
 - (3) Sign in Sheet
 - (4) Deliverables/Fieldwork Spreadsheets
 - (5) FFA Schedule
 - (6) Pre-RA Optimization Sampling Results IR Site
1114
 - (7) Non Time-Critical Removal Action Completion and
Path Forward - IR Site 33
 - (8) Proposed Installation Restoration (IR) Sites:
Site 1120 - Stuart Mesa Pesticide Maintenance
Area, Site 1121 - Site 1D Groundwater Status
 - (9) Update ZVZ Design Study Site - 22/23 Area
Groundwater
 - (10) Update for Planned Remedial Investigation - IR
Site 1D
 - (11) Remedial Investigation - IR Site 150
 - (12) Landfill Gas Mitigation System - IR Site 7

Copy to: CG, MCB Camp Pendleton (Attn: ACOS, Environmental
Security - Mr. Joe Murtaugh)

PROJECT NOTE NO. 58

SUBJECT: Marine Corps Base (MCB) Camp Pendleton Federal Facilities Agreement (FFA) Meeting (No. 108)

DATE HELD: September 17, 2012

Attendees:

Theresa Morley (Naval Facilities Engineering Command Southwest [NAVFAC SW]), Susan Hulbert (NAVFAC SW Legal Council), Adam Hill (NAVFAC SW), Derral Van Winkle (NAVFAC SW), Tracy Sahagun (MCB Camp Pendleton), Lieutenant Colonel (Lt. Col.) Mike Tencate, (MCB Camp Pendleton Legal Council) Joseph Murtaugh (MCB Camp Pendleton), Martin Hausladen (United States Environmental Protection Agency [USEPA or EPA]), Letitia Moore (USEPA Legal Council), John Chesnutt (USEPA), Bill Mabey (Tech Law), Tayseer Mahmoud (California [Cal] EPA/Department of Toxic Substances Control [DTSC]), Kimberly Day (Cal EPA/DTSC), Cheryl Prowell (San Diego Regional Water Quality Control Board [RWQCB or Water Board]), Bob Breglio (Trevet), Amy Estey (Shaw), Steve Griswold (Parsons), and Josh Sacker (Parsons).

Introduction and Status of Deliverables and Fieldwork

A meeting was held in Santa Rosa, California to update the FFA Team (Team) on program status. Refer to attached sign-in sheet and agenda (attached).

Following introductions, Ms. Morley discussed the deliverables spreadsheet and fieldwork spreadsheet (attached), followed by the FFA Schedule (attached).

Ms. Morley summarized the status of each of the items on the deliverable spreadsheet. Comments were made about some of the items as follows:

Item 2 – Record of Decision (ROD) for No Further Action (NFA) at Site 1111: The responses to comments (RTCs) and revised ROD will be provided soon.

Item 6 – ROD for 22/23 Groundwater: The EPA responses are in progress, but it is likely to be at least several weeks before they will be provided.

Item 7 – Sampling and Analysis Plan (SAP) for Well Siting Study for 22/23 Area Groundwater: The RTCs for this document will be provided to the agencies in a day or two after this meeting.

Item 11 – Data Gap Analysis Report for Site 1D Burn Ash Site: DTSC provided comments, but still awaiting comments from the other agencies.

Item 16 – Remedial Investigation (RI) Work Plan for Site 1D Groundwater: This RI Work Plan will be on time (Oct 10).

Item 17 – RI Work Plan for IR Site 1119 will be focused on looking for the source at the site.

Item 18 – Needed to push out the schedule in order to put in more wells at the site (IR Site 1116).

For the fieldwork spreadsheet, the following comments were made:

Item 1 – 22/23 Area Groundwater Zero-Valent Zinc (ZVZ) Pilot Study: The Study is currently on hold. One of the presentations today will discuss the plan forward.

Item 5 – Site 21 Pilot Study remobilization: Injection wells will be installed by the Oct 12 date shown on the table.

Item 6 – Site 1115 Data Collection: Emails in the past week have discussed the recent data from the site, and a summary email will be provided on the specific new well locations in accordance with the criteria in the SAP.

Item 12 – Extended Site Inspection (ESI) Report for Site 62 Asphalt Batch Plant: The excavation at the site was backfilled before confirmation sample results were available, and the results indicated one sample was above project action levels. After some discussion, Ms. Moore summarized the status on this site as follows: 1) the Navy's Contractor did not perform the work contracted by the Navy; 2) the Navy would like to properly complete the scope; 3) and the EPA does not object to the Navy continuing the work using the same work plan. The RWQCB and the DTSC agreed to this approach. The draft ESI is currently with the agencies for review, but will be revised to include the additional work. The current ESI should not be reviewed as is.

FFA Schedule Update

Ms. Morley summarized the status of each of the items on the FFA Schedule. Several of the planned documents have a brief explanation of any changes in planned document dates. The status of 12 Area Site 13 was discussed briefly. The site still has one well with chemicals of concern (COCs) above remedial goals. The Base plans to build facilities at the site, but not at the affected well location. The next step in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for the site is a Feasibility Study (FS).

Site 1114 Presentation, Pre-Removal Action Optimization Sampling Results

Mr. Breglio presented the sampling and geophysical results for the Installation Restoration (IR) Site 1114 Pre-Removal Action optimization completed in August 2012 (refer to attached slides). The removal action optimization sampling was conducted in order to define the locations of possible soil excavations, and to evaluate the geochemical environment for possible use of bioremediation/bioaugmentation.

A geophysical survey was conducted to identify potential utilities or release points, but no metallic objects were found during this survey. Soil sampling was also conducted, but no soil source was identified. Tetrachloroethene (PCE) was only detected in the

capillary fringe samples, which would be representative of the underlying groundwater conditions, rather than the overlying soil. The microbial census indicated low native populations of the most beneficial microorganisms.

During discussion of the site, Mr. Breglio noted that the soils are tight and that groundwater flow is therefore limited. The current plan is to excavate two relatively large areas (shown on Slide 30). The excavations are planned to extend 5 to 10 feet into groundwater (depth to groundwater is approximately 22 feet below ground surface [bgs]).

Once the excavations are in place, gravel would be added to the bottom of the excavations to allow for introduction of dehalococoides and geochemical amendments as needed.

Dr. Mabey asked about the possibility of PCE between the two excavations. Mr. Breglio noted that the final design may have three trenches instead in order to intercept impacted groundwater. It was noted that this is not a soil removal action, but is designed to allow for more efficient removal and treatment of contaminated groundwater. Mr. Hausladen asked to see the revised excavation plans during the agency review. Mr. Breglio said comments are still coming in, so all revisions will be made in the final version. Mr. Mabey asked about the rate of groundwater flow. Mr. Breglio said they will have survey data soon from the temporary wells, but currently he did not have site specific groundwater gradient or velocity information. Mr. Breglio indicated regional flow is slow. Ms. Prowell emphasized that the excavation is not to remove a soil source, but to remove elevated concentrations in groundwater. The dewatering during excavation will provide a "pump and treat" type action removing the greatest concentrations in groundwater. .

Completion of Non-Time Critical Removal Action and Path Forward at IR Site 33, 52 Area Armory

Ms. Estey presented the status of the IR Site 33 Non-Time Critical Removal Action and the path forward for the site (refer to attached slides). The removal action is essentially complete, but there is one more utility installation that needs to be completed. Ms. Estey summarized the RI, FS, and Engineering Evaluation/Cost Analysis (EE/CA) for the site. She noted that the installation of a bioreactor in the bottom of the excavation was not implemented due to the concern of possible settlement of the soils in the excavation, and that the removal action should be sufficient to take care of the groundwater issue at the site. During dewatering, approximately 40,000 gallons of water per week were extracted (572,110 gallons total removed during the removal action). Total dissolved solids (TDS) in the discharged water were high, but within Base treatment plant requirements.

The removal action activities were conducted from November 2011 to September 2012, when the site was paved with asphalt. Photographs in the attached slides show various phases of the remediation, including shoring installation, groundwater dewatering and treatment system, utility relocation, excavation, transportation and disposal, backfill, and site restoration.

Dr. Mabey asked if there were analytical data available for the PCE concentrations in the water from the dewatering wells. Ms. Estey said the composite concentration of the pumped water from all the dewatering wells was a maximum of about 4 microgram per liter ($\mu\text{g/L}$). Ms. Morley indicated that the plume beneath the gun cleaning area still needs to be addressed. Mr. Hausladen noted that this was a very successful remedial action.

Discussion of Potential New IR Site 1120 (Stuart Mesa Pesticide Maintenance Area), and Site 1121 (Site 1D Groundwater)

Site 1120 - Mr. Murtaugh summarized the site conditions at Site 1120 (see attached presentation). The site is a maintenance facility compound (MFC), which is within a former 10.8 acre agricultural field. Since the lease held by Singh and Sons expired in January 2011, the site has been vacant. Singh and Sons are currently performing limited excavation activities ("hotspot removal") in accordance with their lease agreement. The environmental Areas of Concern (AOCs) include the MFC, two concrete wash pads ("wash racks") and aboveground storage tanks (AST) throughout the property.

Site 1121 - Mr. Murtaugh summarized the site conditions at Site 1121, which is the groundwater portion of IR Site 1D. Note that the soil for Site 1D has been closed out, and the groundwater will be addressed as a new site once the Navy receives approval to add the site to the program. During the soil remedial action, sampling confirmed that groundwater in the excavation at Cell G-9 was impacted with metals (primarily arsenic), pesticides, and volatile organic compounds (VOCs).

Mr. Murtaugh described past investigations, including the Data Gap Analysis Investigation, as documented in the Technical Memorandum, July 2012. The planned activities include an RI Work Plan, field work, an RI/FS Report, Proposed Plan, and Record of Decision. The work plan for the Groundwater RI is scheduled for October 2012, with field work scheduled for March 2013, as outlined in the schedule shown in the presentation (attached). Mr. Mabey commented on the occurrence of naturally occurring arsenic in site soils at Camp Pendleton, and the difficulty in some cases in attributing arsenic in groundwater to a man-made source.

Ms. Prowell asked if the skeet range at the northern end of the Base is also planned to be an IR site. The range is located on private land, but the overshoot (lead shot) falls primarily onto Camp Pendleton property. This area of the Base is characterized by steep slopes and chaparral vegetation. Lt. Col. Tencate said that site is still being reviewed to determine how best to proceed.

Status Update of the ZVZ Design Study at 22/23 Area

Mr. Griswold presented the results to date of the Brady ZVZ Design Study, and also a path forward for the site based on Department of Navy (DON) input (slides attached). The objectives of the study are to determine the in situ effectiveness of ZVZ for reducing 1,2,3-trichloropropane (TCP) concentrations in groundwater under site-specific conditions. Data from the design study will be used to determine final design of an in situ remediation system.

Brady installed four new monitoring wells as the initial step for the ZVZ Design Study, and obtained information on groundwater flow directions, laboratory results of groundwater samples, and geology in the immediate area of the design study.

The analytical results show that samples from well 220205-MWX have the highest detections in both current and historical data (concentrations of 1,2,3-TCP were 4.6 µg/L in the latest [2012] data, compared to 6.5 µg/L in 2008 and 10 µg/L in 2007). Results from the four new wells are lower, from 0.011 µg/L to 1.3 µg/L.

Additional data gathering at the site will be focused on refining groundwater flow directions, and refining the configuration of 1,2,3-TCP concentrations to determine best placement of injection points. Six phases of planned work were discussed, including additional monitoring wells, more hydraulic characterization, injection well installation, and injection of reactant, followed by monitoring. Specific placement of wells and other details of the planned approach are outlined in the presentation slides (attached).

Additional data are needed on the groundwater flow direction so that the ZVZ barrier will be installed in the correct orientation. In addition, pumping discharge rates and drawdown data will be recorded during well development to provide estimates of aquifer parameters and groundwater velocity. Additional tasks will include checking for the presence of surface water, the testing of groundwater for geochemical properties, and the possible use of a tracer study, if need, to better define groundwater flow. Ms. Prowell suggested checking the records of groundwater elevations from nearby sites in the underground storage tank (UST) program.

Depending on the groundwater flow direction and velocity, the injection points may be placed as a grid rather than a linear barrier. Dr. Mabey suggested that a grid would need to be placed at the proper scale to avoid creating gaps in treatment.

Discussion of Well Placement Rationale and Previous Work Conducted for IR Site 1D Groundwater

Mr. Van Winkle provided an overview of historical investigations at Site 1D, the current conceptual site model, and the planned elements of the upcoming RI field investigation (refer to attached slides). The history of investigations and remediation at the site include the Group C RI of 1993 to 1995, supplemental RI sampling in 1997, the FS data gap sampling conducted in 2001, remedial action in 2008 to 2010, groundwater extraction in 2009 to 2011, a hydropunch study in 2008, and most recently, a data gaps investigation in 2012. A summary of each of these events is provided in the slides.

Regarding the data gaps in the site conceptual model, Mr. Van Winkle noted that certain areas of the site may have soils that could leach metals to the underlying groundwater, and that further definition is needed of VOCs in soil gas. In addition, hydraulic gradient and extent of VOCs, pesticides, and metals need to be better defined. The planned field work will entail soil gas sampling, soil sampling, cone penetrometer testing (CPT), membrane interface probe (MIP), shallow and deep temporary wells, and permanent monitoring wells, as outlined on the attached slides. This additional data gathering will refine the CSM and allow completion of the RI for site groundwater.

Mr. Mahmoud noted that DTSC provided comments on the Site 1D Data Gap Analysis Investigation (dated September 6, 2012), and that those comments should be

addressed as part of this upcoming RI field investigation. Some of the issues raised in those comments included the need to include additional COCs, and provide a more thorough analysis of groundwater flow based on measurements from different screened intervals. In addition, the characterization to date has not provided adequate delineation of metals in groundwater, and also the vertical extent of VOCs, pesticides, and metals remains undefined.

Presentation on Results of Site 150 Site Inspection (SI) Report and Work Planned for Remedial Investigation

Mr. Breglio summarized the results of the discovery Site Report and the Site Inspection Report for Site 150 (refer to attached slides). During the SI, VOCs were detected above project screening levels in soil, soil gas, and groundwater.

A limited hydrologic tidal study was also conducted to better understand the interaction of groundwater beneath the site with the adjacent surface water of the Del Mar Boat Basin. The results of the tidal study indicated that the groundwater under the site was tidally influenced, and the hydraulic gradient during the study was toward the Del Mar Boat Basin.

RI fieldwork will be conducted at Site 150, including direct push drilling for the collection of soil, groundwater, and soil gas samples, installation of up to five monitoring wells, and four quarterly groundwater monitoring events. Following this planned data collection, an RI Report will be prepared.

Ms. Day said that the DTSC Human Health Note # 3 table with screening criteria is now in line with the Spring Regional Screening Level (RSL) table, and that she will email the latest Note # 3 to the Team. Naphthalene was detected in soil gas, so it will be necessary to let the lab know that detection limits need to be low enough to meet screening criteria.

Presentation on Dropping Gas Levels at IR Site 7

Mr. Hill presented a summary of the Site 7 landfill gas mitigation system (slides attached). The technical approach includes the use of injection wells, extraction wells, solar powered vent flares, and monitoring wells.

Air injection was conducted for two days at two injection wells, and soil gas composition trends were monitored at two depths each at GP-09 and GP-10. The results indicated that oxygen concentrations decrease as oxygen is used to degrade methane, and that reinjection will likely be needed about every three months or so.

The extraction wells have solar powered vent flares, which became operational in June 2012. The vent flares were fitted with a thermocouple to ensure that methane would not be passively vented. Going forward, the vent flares will be shut down during photovoltaic (PV) panel installation for the next three to four months. Once flares are relit, air injection and vent flare options will be evaluated.

Mr. Hausladen asked about the presence of VOCs in the gas being burned, and said that the stack temperature may not be high enough to burn VOCs. Mr. Hill said he would evaluate that issue and provide feedback.

Schedule for Next Meeting and Site Visits

The next FFA Meeting is tentatively scheduled to be held in Pasadena at Parsons' office on January 17, 2013.

**MCB Camp Pendleton
108th FFA Meeting Agenda**

Santa Rosa, CA - September 17th, 2012

- | | |
|--------------------|--|
| 0900 – 0915 | Welcome and Introductions (Navy) |
| 0915 – 0930 | Project Deliverables, FFA Schedule Update and Planned/In Progress Field Work Status (Navy) |
| 0930 – 1030 | Presentation on Results of Pre-Removal Action Optimization Study at IR Site 1114, 41 Area Arroyo (Trevet) |
| 1030 – 1045 | Break |
| 1045 – 1145 | Presentation on Completion of Non-Time Critical Removal Action and Path Forward at IR Site 33, 52 Area Armory (Shaw/Navy) |
| 1145 – 1300 | Lunch |
| 1300 – 1400 | Discussion of Two New IR Sites – 1121 (Site 1D Groundwater): 1122 (Stuart Mesa Pesticide Maintenance Area) (Marine Corps) |
| 1400 – 1430 | Presentation on 22/23 Pilot Study for ZVZ (Parsons) |
| 1430 – 1530 | Discussion of Well Placement Rationale and Previous Work Conducted for IR Site 1D Groundwater (Navy) |
| 1530 – 1545 | Break |
| 1545 – 1630 | Presentation on Results of Site 150 SI Report and Work Planned for Remedial Investigation (Trevet) |
| 1630 – 1700 | Presentation on Dropping Gas Levels at IR Site 7 (Navy) |
| 1700 – 1715 | Meeting Conclusion / Action Items |

CLIENT SIGN IN SHEET
 SUBJECT FFA MEETING
SANTA ROSA

JOB NO. _____ SHEET _____ OF _____
 BY _____ DATE 9/17/12
 CKD. _____ REVISION _____

NAME	ORGANIZATION	PHONE / E-MAIL
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MCB Camp Pendleton Deliverables Spreadsheet

Date: 9/17/12

Item	Document	Contractor	Status	Date Due	Agency Comments	Response Received From:		
				to Agencies	Due By	EPA	DTSC	RWQCB
1	Action Memorandum for Site 1116 - 3 subsites (EE/CA as an appendix)	SDV	FINAL	11/21/11	1/20/12	24-Jan	18-Jan	20-Jan
2	ROD for NFA at Site 1111	SDV	EPA requires rewrite	12/22/11	2/20/12	28-Mar	15-Feb	17-Feb
3	Annual Maintenance Report - Site 7 Box Canyon	Trevet	FINAL	1/27/12	3/27/12	NC	29-Mar	22-Mar
4	Report for NMOCs - Site 7 Box Canyon	Trevet	Responding to agency comments	2/21/12	4/23/12	NC	23-Apr	26-Apr
5	Work Plan to Collect Data - Site 1115 FSSG Lot	Parsons	FINAL	2/28/12	4/30/12	NC	17-Apr	9-May
6	ROD for 22/23 Area Groundwater	Parsons	Responding to agency comments	5/8/12	7/9/12	25-Jun	27-Jun	9-Jul
7	SAP for Well Siting Study - 22/23 Area Groundwater	Parsons	Responding to agency comments	5/23/12	7/23/12	23-Jul	3-Jul	20-Jul
8	Work Plan for EISB - 22/23 Area Groundwater	Battelle	Responding to agency comments	6/1/12	7/31/12	1-Aug	24-Jul	23-Jul
9	Annual Groundwater Monitoring Report - Site 7 - Box Canyon	Trevet	Responding to agency comments	6/8/12	8/7/12	NC	2-Aug	6-Aug
10	SI Report for Site 150 - SEERMA Site	TEC	Responding to agency comments	6/15/12	8/14/12	NC	9-Aug	10-Aug
11	Data Gap Analysis Report for Site 1D - Burn Ash Site	SDV	With agencies	7/23/12	9/21/12		10-Sep	
12	ESI Report for Site 62 - Asphalt Batch Plant	RBA	With agencies	8/16/12	10/15/12			
13	EE/CA and AM for Site 1114 - 41 Area Arroyo	Battelle	With agencies	8/22/12	10/22/12			
14	Project Completion Report - 12 Area Site 13	SDV	With agencies	9/12/12	11/12/12			
15	ESI Work Plan for Site 1118 - 21/26/52 Area Groundwater	ECM	With agencies	9/17/12	11/16/12			
16	RI Work Plan - Site 1D Groundwater	SDV	Preparing pre-draft	10/10/12				
17	RI Work Plan Addendum for Site 1119 - 26 Area Groundwater	Parsons	Preparing pre-draft	1/3/13				
18	ESI Report for Site 1116 - 14 Area Groundwater	ECM	After Field Work	3/23/13				
19	Removal Action Work Plan - Site 1116 14 Area Groundwater	ECM	Preparing pre-draft	3/23/13				
20	RI/FS for Site 1115 - FSSG Lot	Parsons	After Field Work	4/30/13				

Agencies have commented

MCB Camp Pendleton Fieldwork Spreadsheet

Date: 9/17/12

Item	Field Work	Planned Start Date	Planned Completion Date
1	Field Work for 22/23 Area Groundwater ZVZ Pilot Study	2/6 - 2/8: Well Installations 2/13 - 2/15: Well Develop/Survey 2/20 - 2/24: Baseline GW Event/Slug Test April - Install PRB	on hold
2	Field Work for Site 33 Remedial Action	6-Feb-12	18-Sep-12
3	Field Work for Site 1116 ESI	12-Mar-12	late October
4	Install GCCS System Site 7	complete	
5	Field Work for Site 21 Pilot Study (remob)	1-Oct-12	12-Oct-12
6	Field Work for Site 1115 Data Collection	13-Aug-12	26-Oct-12
7	Field Work for Site 1118 ESI		

Date: 9/17/12

Item	Document	Contractor	RTCs to agencies	RTC Approved		
				EPA	DTSC	RWQCB
1	ROD for NFA at Site 1111	SDV				
2	Report for NMOCs - Site 7 Box Canyon	Trevet	working on risk assessment	N/A	25-Jun	addl comments 6/21/12
3	ROD for 22/23 Area Groundwater	Parsons	addl RTCs sent 9/4		31-Aug	4-Sep
4	SAP for Well Siting Study - 22/23 Area Groundwater	Parsons				
5	Work Plan for EISB - 22/23 Area Groundwater	Battelle				
6	Annual GW Monitoring Report - Site 7 - Box Canyon	Trevet	RTCs to agencies 9/13			13-Sep
7	SI Report for Site 150 - SEERMA Site	TEC				
8	Project Completion Report - 12 Area Site 13	SDV				
9	Data Gap Analysis Report for Site 1D - Burn Ash Site	SDV				
10	Work Plan Addendum for Site 1119 - 26 Area GW	Parsons				
11	ESI Report for Site 62 - Asphalt Batch Plant	RBA				
12	ESI Work Plan for Site 1118 - 21/26/52 Area GW	ECM				
13	RI Work Plan - Site 1D Groundwater	SDV				
14	RI/FS for Site 1115 - FSSG Lot	Parsons				
15	Removal Action Work Plan - Site 1116 14 Area GW	ECM				
17	EE/CA and AM for Site 1114 - 41 Area Arroyo	Battelle				

FFA Schedule for Draft Documents – September 17, 2012

Original schedule was agreed to by all FFA signatories at the May 17, 2011 FFA meeting. Updates are made every four months, prior to the FFA meetings. Dates marked with an asterisk are tentative, based on funding and subject to change. Once funding becomes available for a site, the date will be updated and the asterisk removed. Items in italics represent field work and are not enforceable.

Site 6 (Site number is for funding purposes only) – 22/23 Area Groundwater

This site consists of VOC plumes in the groundwater under the 22 and 23 Areas. Various industrial activities have historically taken place in the 22 and 23 Areas. An RI/FS was completed in January 2011. The Proposed Plan outlined the various alternatives from the FS and proposed the preferred alternative which is a combination of alternatives 2, 3 and 4. Alternative 2 includes Land Use Controls and Long-Term Monitoring, Alternative 3 involves an Alternate Water Supply and Alternative 4 is Source Area Treatment via In-Situ Technologies. A public comment period and public meeting for the Proposed Plan were held in July/August 2011. A Record of Decision is being reviewed by the agencies. To evaluate the effectiveness of the remedies proposed for Alternative 4, two pilot studies are planned: a Zero Valent Zinc (ZVZ) Permeable Reactive Barrier is planned for the TCP plume; and, Enhanced InSitu Bioremediation (EISB) is planned for the TCE plume. The DoN has finalized the work plan for the ZVZ pilot study, but the EISB work plan is currently in agency review.

- | | |
|---|-------------------|
| – Proposed Plan | complete |
| – Geotechnical and Design Information for ZVZ PRB Pilot Study | complete |
| – <i>Implementation of ZVZ PRB Pilot Study</i> | in progress |
| – Record of Decision | 5/8/2012 |
| – Well Siting Study Sampling and Analysis Plan | 5/23/2012 |
| – <i>Field work for Well Siting Study</i> | <i>11/15/2012</i> |
| – Work Plan for Enhanced InSitu Bioremediation (EISB) | 6/1/2012 |
| – <i>Field work for EISB Pilot Study</i> | <i>11/12/2012</i> |

Extension for Record of Decision requested to incorporate multiple Navy and Marine Corps comments and for Sampling and Analysis Plan to accommodate changes in Navy Quality Assurance Officer

****POST ROD Site 7 – Box Canyon Landfill**

This site is a CAMU situated above an old municipal landfill. This site is post-ROD. The selected remedy was an EvapoTranspiration (ET) cap with land use controls. The site must be fenced and signed. Annual inspections are made in relation to the monitoring systems, cover maintenance, drainage/erosion control, cracks, settlement and movement and vegetation growth. Additionally, groundwater monitoring wells are sampled every year and gas probes are sampled according to the percent of methane in the probe. The groundwater monitoring results and the annual maintenance activities are summarized in annual reports. The methane results are emailed to the FFA team monthly. A Gas Collection and Control System (GCCS) was recently installed.

- Memo to File for Site 7 (pv panels) complete
- Fieldwork for Non Methane Organic Compounds complete
- Memo To File complete
- Annual Post Closure Maintenance Report (for CY11) complete
- Report for Non Methane Organic Compounds in review
- Annual Groundwater Monitoring Report in review

12 Area Site 13 – Former Building 1280 and 1283

This site is the site of a former UST and has some low level concentrations of VOCs in groundwater. An RI/FS has been completed for the site but the site has not progressed further in the CERCLA process. Due to an impending construction project through the site, contaminated soil and groundwater were removed from the area to be impacted by construction. A year of groundwater monitoring has been completed and a Project Completion Report is in agency review. The report recommends further action for the site.

- Groundwater Monitoring Report complete
 - **Project Completion Report for Soil and Groundwater 9/12/2012**
 - **Feasibility Study 5/30/2013***
 - **Proposed Plan 5/30/2014***
 - **Record of Decision 5/30/2014***
- Dates changed as a result of the May 10, 2012 FFA Meeting**

Site 21 – 14 Area Surface Area Impoundment

This site was a former oxidation pond near a maintenance facility which has some low levels of VOCs in groundwater. A Remedial Investigation has been completed for the site, but not a Feasibility Study. Currently a pilot study to evaluate the effectiveness of in-situ bioremediation of chlorinated solvents at low concentrations in groundwater is in planning. A Technical Memorandum reporting on the effectiveness of the first year of the pilot study was recently finalized, as was the Pilot Study Addendum. Currently, the second phase of the pilot study is underway.

- Pilot Study Tech Memo complete
 - Site 21 Pilot Study Work Plan Addendum complete
 - *Second Phase of Pilot Study Field Work* in progress
 - **Feasibility Study 11/15/2013***
 - **Proposed Plan 11/15/2014***
 - **Record of Decision 11/15/2015***
- Dates were changed as a result of the September 15, 2011 FFA meeting**

Site 33 – 52 Area Armory

Gun cleaning in the armory contributed to a PCE plume downgradient of the armory. A Remedial Investigation and Feasibility Study have been completed for this site. An Engineering Evaluation/Cost Analysis and Non-Time Critical Action Memorandum have also been completed. The preferred remedy is excavation of the source material, including groundwater which would then be treated and disposed of in the sanitary sewer system and is almost complete.

- | | |
|--|-------------|
| – Removal Action Work Plan | complete |
| – <i>Removal Action (geophysical work started 15 Nov 11)</i> | in progress |
| – Removal Action Completion Report | 10/25/2013* |
| – Proposed Plan | 11/15/2014* |
| – Record of Decision | 11/15/2015* |

Site 150 – 21 Area, Location 1

This site became an IR site recently after a discovery investigation conducted based on information gained from a former Marine stationed at Camp Pendleton. During the discovery investigation, one location had vinyl chloride in soil gas that exceeded risk screening criteria. Field work for the Site Inspection has located groundwater contamination. This will move the site to the Remedial Investigation phase.

- | | |
|---|-------------------|
| – Fieldwork | complete |
| – Site Inspection Report | in review |
| – Remedial Investigation Work Plan | 4/21/2013* |
| – <i>Field Work for Remedial Investigation</i> | 4/21/2014* |
| – Remedial Investigation Report | 2015* |
| – Proposed Plan | 2016* |
| – Record of Decision | 2017* |
- Dates changed (RI added) as a result of the SI field work**

Site 1003 (Site number is for funding purposes only) – Site 1D Groundwater

This site is a former burn ash site and has undergone a Remedial Investigation and Feasibility Study for soil only. A ROD was signed documenting the selected remedy consisting of excavation and off-base disposal of contaminated soil. During the remedial action a cell with 90 drums and drum fragments containing liquid and solid chemicals was discovered. The drums were removed but the material in the drums had reached groundwater. A Remedial Action Closure Report was completed to close out the soil portion of the site, but the groundwater contamination remains to be addressed. As an interim measure, until funding could be secured for further investigation, 650,000 gallons of the groundwater was pumped from the site, treated and disposed of in the base sanitary sewer system. This lowered the concentrations of contaminants in groundwater, however, additional work is planned. A Remedial Investigation Work Plan is in preparation.

- Data Gap Analysis for Groundwater Work Plan complete
 - *Fieldwork* complete
 - Data Gap Analysis Report in agency review
 - **Remedial Investigation for Groundwater Work Plan** **10/10/2012**
 - ***Field work for RI*** **3/9/2013***
 - **RI/FS Report** **3/11/2014***
 - **Proposed Plan** **2015***
 - **Record of Decision** **2016***
- Dates changed (RI added) as a result of agency comments**

Site 1111 – 26 Area Ash and Debris Disposal Area

This burn ash site was remediated and four quarters of groundwater monitoring have been completed. The site was revegetated and a report was written summarizing the actions that had been completed to date, and why the site qualified for unrestricted land use.

- Proposed Plan for No Further Action complete
- Record of Decision for NFA in review

Site 1114 – 41 Area Arroyo

This site was created to investigate the PCE concentrations in one well that used to be associated with IR Site 9 (closed). A Site Inspection was carried out and described low-level concentrations of TPH and vinyl chlorides in soil gas and groundwater. A Remedial Investigation was conducted to validate the findings of the SI and to complete a risk assessment for the site. The EPA did not agree with the proposed NFA, therefore the site will move to the remediation phase.

- Remedial Investigation Report complete
 - **Engineering Evaluation/Cost Analysis & Action Memorandum** **in review**
 - **Removal Action Work Plan** **2013***
 - ***Removal Action*** **2013***
 - **Removal Action Completion Report** **2014***
 - Proposed Plan 2015*
 - Record of Decision 2016*
- Dates were changed as a result of NFA rejection**

Site 1115 – 13 Area FSSG Lot

There are two plumes underneath the parking lot at this site, one shallow and one deep, containing chlorinated solvents and benzene. A Remedial Investigation and Feasibility Study are needed for the site. A

pilot study to evaluate the effectiveness of in-situ bioremediation of chlorinated solvents in groundwater was completed. The technology was successful, but the site geology limited its effectiveness. A Technical Memorandum detailing the pilot study is complete. A work plan to collect more data is final and the contractor is currently in the field; the results will be included in a Remedial Investigation/Feasibility Study.

- Tech Memo complete
 - **Work Plan to collect additional data for site** complete
 - **Field work to collect additional data** in progress
 - **Remedial Investigation/Feasibility Study** 4/30/2013
 - **Proposed Plan** 4/30/2014*
 - **Record of Decision** 4/30/2015*
- Dates were changed as a result of the September 15, 2011 FFA meeting**

Site 1116 – 14 Area Groundwater

Nine USTs were transferred from the UST Program to the IR Program due to low-levels of chlorinated solvents. A Site Inspection was completed and six of the sites do not warrant further action under the IR Program. The three other sites will be remediated. An EE/CA and Action Memo were sent, along with a work plan for limited investigation to close data gaps, to the agencies for review. Once the field work for the limited investigation is complete, a work plan to remediate the sites will be prepared.

- Engineering Evaluation/Cost Analysis(3 subsites – Moving Forward) appendix to Action Memo
 - Action Memorandum (3 subsites – Moving Forward) complete
 - Expanded Site Inspection WP (3 subsites – Moving Forward) complete
 - *Field Work for Site Inspection* (3 subsites – Moving Forward) in progress
 - **Expanded Site Inspection Report (3 subsites – Moving Forward)** 3/23/2013
 - **Removal Action Work Plan (3 subsites – Moving Forward)** 3/23/2013
 - **Interim Removal Action (3 subsites – Moving Forward)** 8/14/2013*
 - Removal Action Completion Report (3 subsites – Moving Forward) 2014*
 - Proposed Plan for No Further Action (6 subsites – NFA) 2015*
 - Record of Decision (6 subsites – NFA) 2016*
- Dates were changed as a result of the September 17, 2012 FFA meeting.**

Site 1117 – 15/16 Area Groundwater

Six USTs were transferred from the UST Program to the IR Program due to low-levels of chlorinated solvents. The agencies have reviewed the Site Inspection Report recommending the site move into the Remedial Investigation phase.

- Fieldwork complete
- Site Inspection Report complete
- **Remedial Investigation Work Plan** 3/27/2013*

- Remedial Investigation Field Work 9/27/2013*
 - Remedial Investigation Report 2014*
 - Proposed Plan 2015*
 - Record of Decision 2016*
- Remedial Investigation added based on agency comments on Site Inspection

Site 1118 – 21/26/52 Area Groundwater

Three USTs were transferred from the UST Program to the IR Program due to low-levels of chlorinated solvents. The Site Inspection report was reviewed by the regulatory agencies and additional work, including a soil gas investigation, is needed to verify if no further action is appropriate for these sites. An Extended Site Inspection Work Plan to address agency concerns with the Site Inspection Report is in agency review.

- Extended Site Inspection (ESI) Work Plan 9/17/2012
- Field work 2/27/2013*
- ESI Report 9/27/2013*
- Proposed Plan 5/27/2014*
- Record of Decision 1/27/2015*

Dates changed as a result of document quality issues

Site 1119 – 26 Area Groundwater

This site was created to investigate the source or sources of chlorinated solvents in the 26 Area production wells. Field work for the Remedial Investigation has been completed and lab data is in data validation. TCE had been discovered at two of the wells and further investigation is needed to delineate extent of contamination and to locate the source, if possible. An addendum to the Remedial Investigation Work Plan is currently in preparation.

- Fieldwork complete
- Work Plan Addendum to Delineate Source 1/3/2013
- Additional Field Work 2013*
- RI/FS Report 2013*
- Proposed Plan 2014*
- Record of Decision 2015*

Dates changed as a result of the Jan 19, 2011 FFA meeting

Site 62 – Asphalt Batch Plant

This site was created when a transformer containing PCBs tipped over and spilled. A Site Inspection was performed, however data was missing and further investigation was needed. An Extended Site Inspection was conducted and the report is being reviewed by the agencies. The report recommends further action.

- Extended Site Inspection Work Plan complete
- Fieldwork complete
- Extended Site Inspection Report in review
- Proposed Plan 5/1/2013*
- Record of Decision 5/1/2014*



**Pre-RA Optimization Sampling Results
IR Site 1114
MCB Camp Pendleton**

17 September 2012



- **IR Site 1114 initiated in 2004 to address VOCs, primarily PCE, in groundwater**
- **SI and RI completed 2004 to 2010**
- **Draft EE/CA and AM submitted for FFA team review in June 2012**
- **Pre-Removal Action optimization sampling completed in August 2012**

IR Site 1114 – View to the Northeast



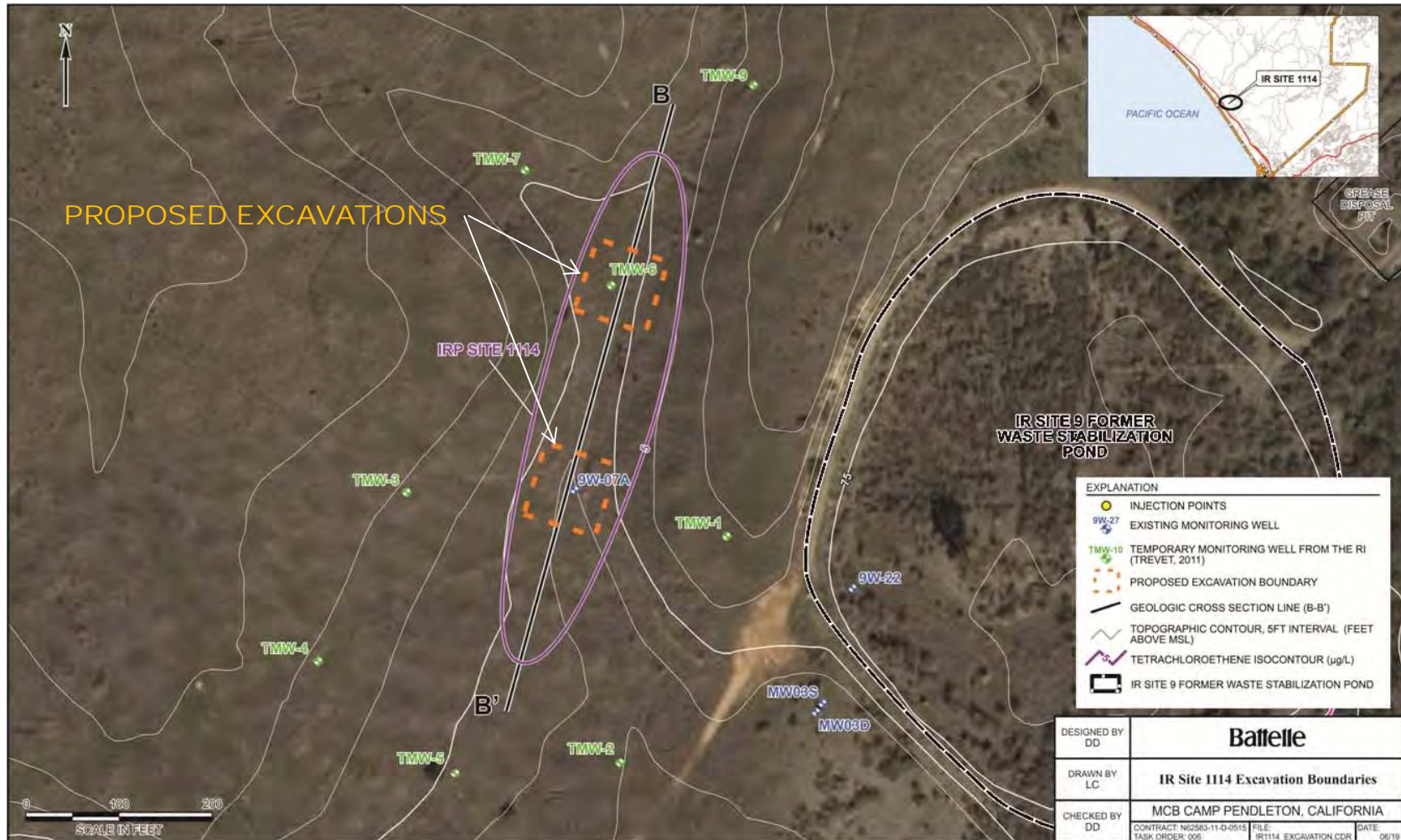
Monitoring Well
9W-07A

Objectives of the Pre-RA Optimization

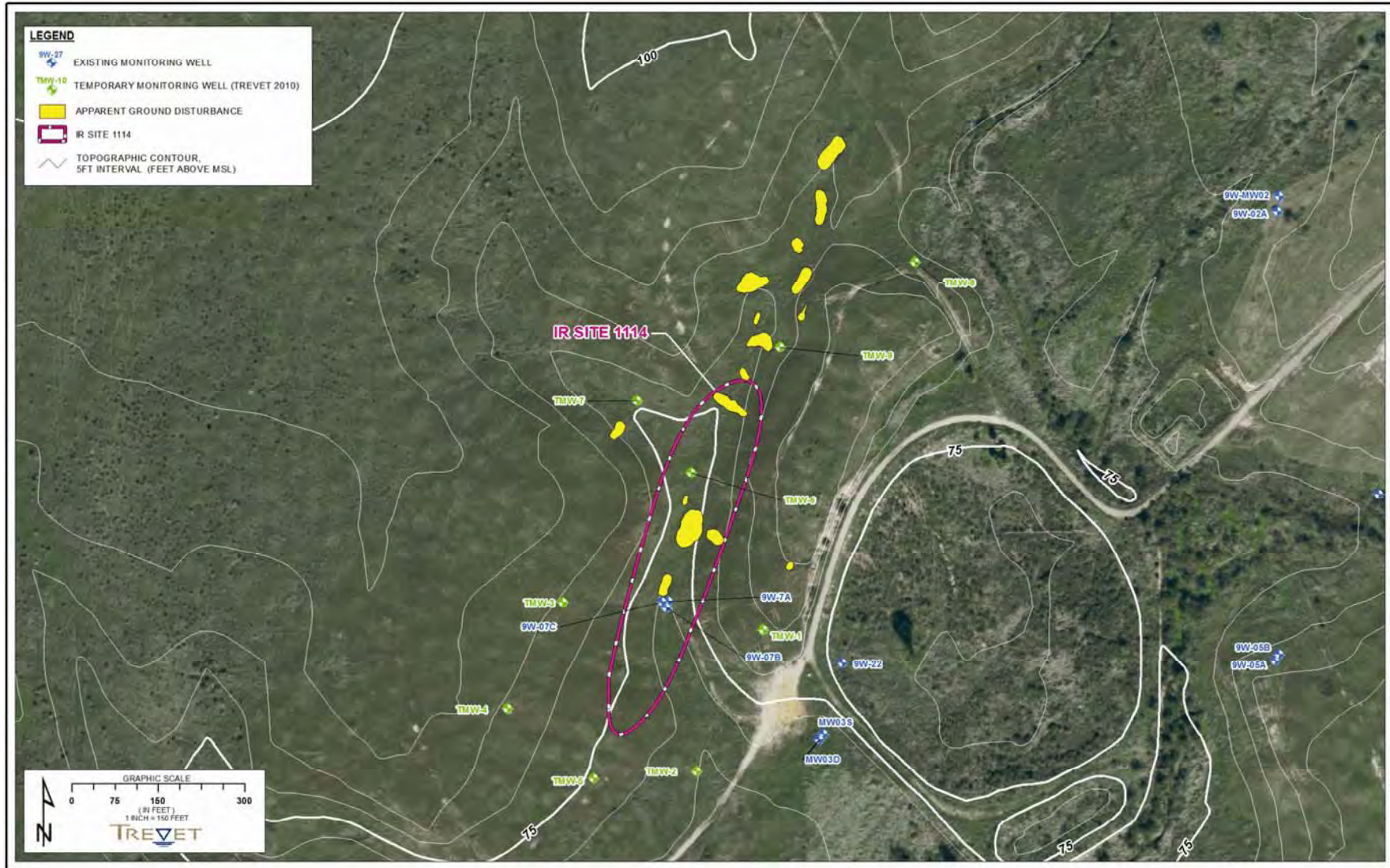


- **Optimize the limits and location of remedial soil excavations**
- **Evaluate geochemical environment and microbial populations to optimize biostimulation agent (excavation backfill)**
 - **Oxidizing/reducing environment?**
 - **Microbial populations available?**
 - **What substrate to use when backfilling?**

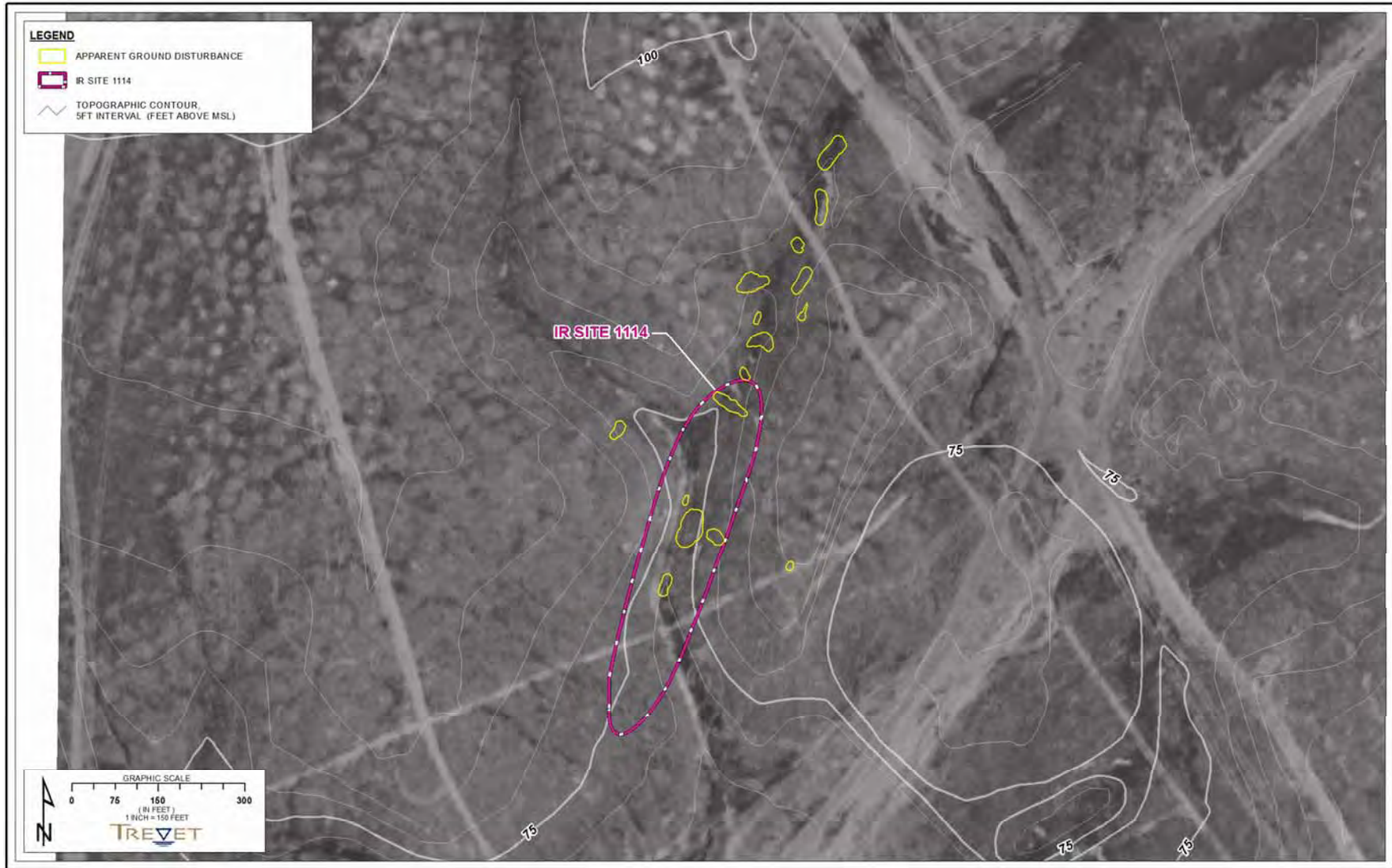
Selected Removal Action (EE/CA)



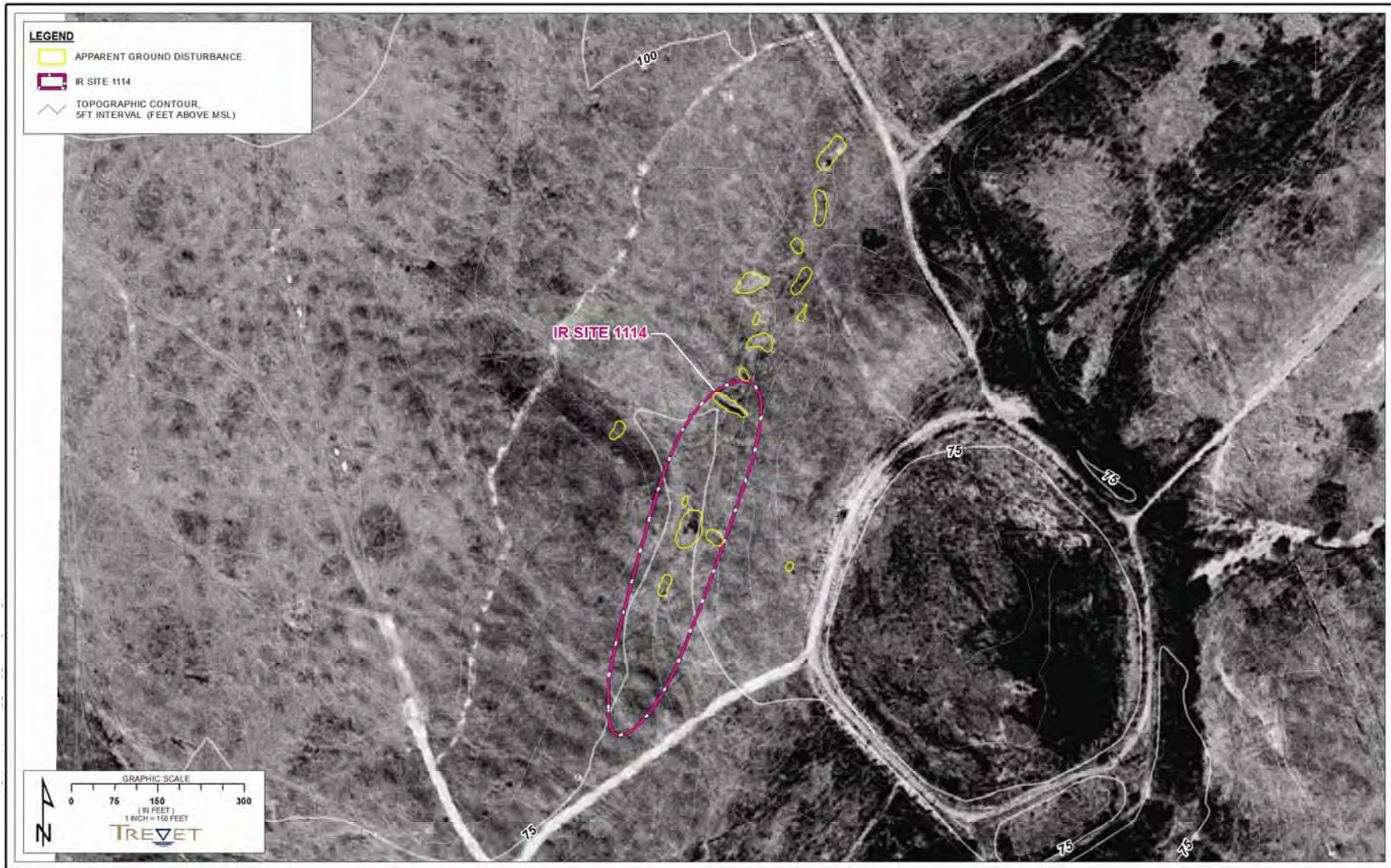
Ground Disturbances/Depressions



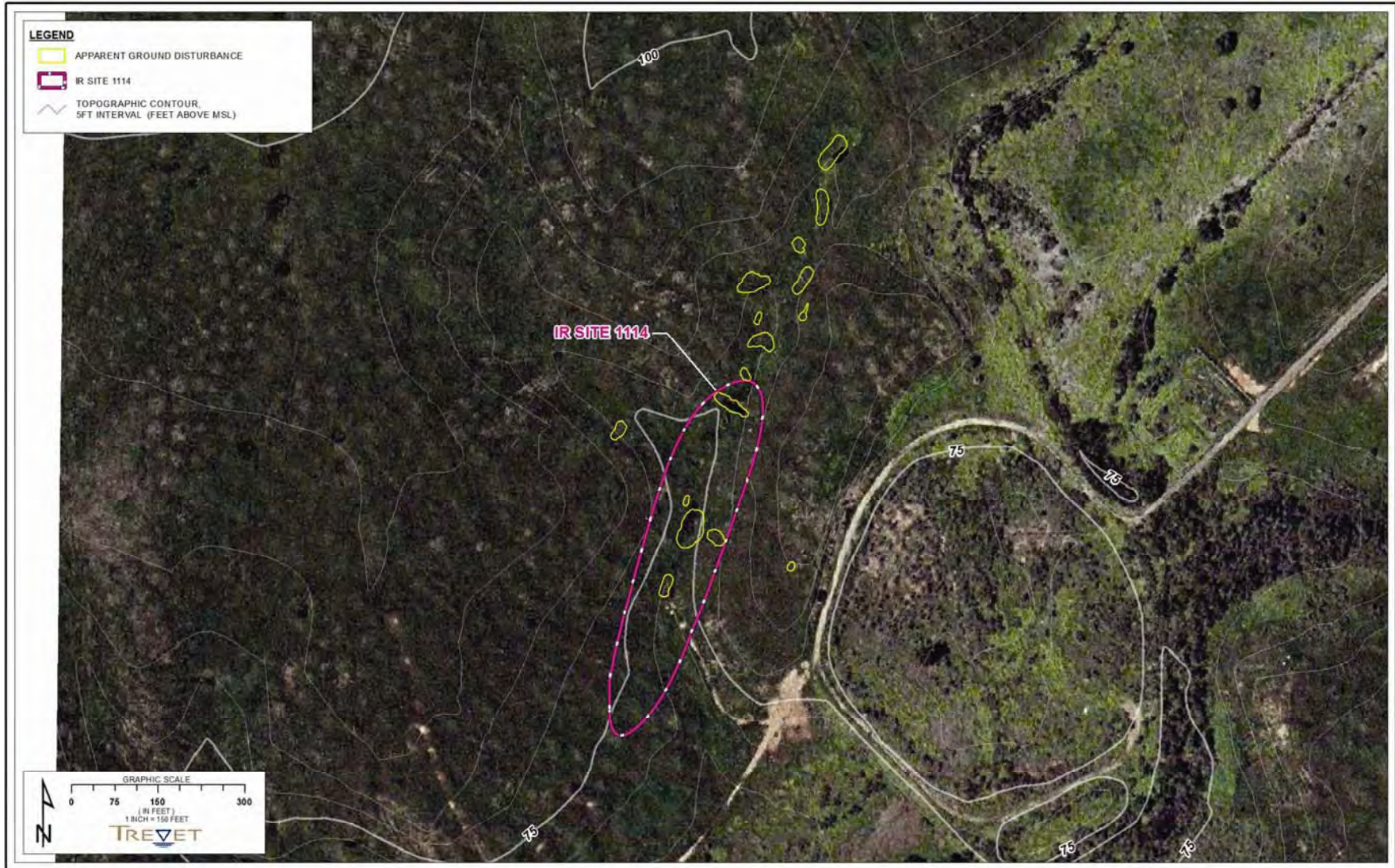
Aerial Photo - 1953



Aerial Photo - 1981



Aerial Photo - 2003

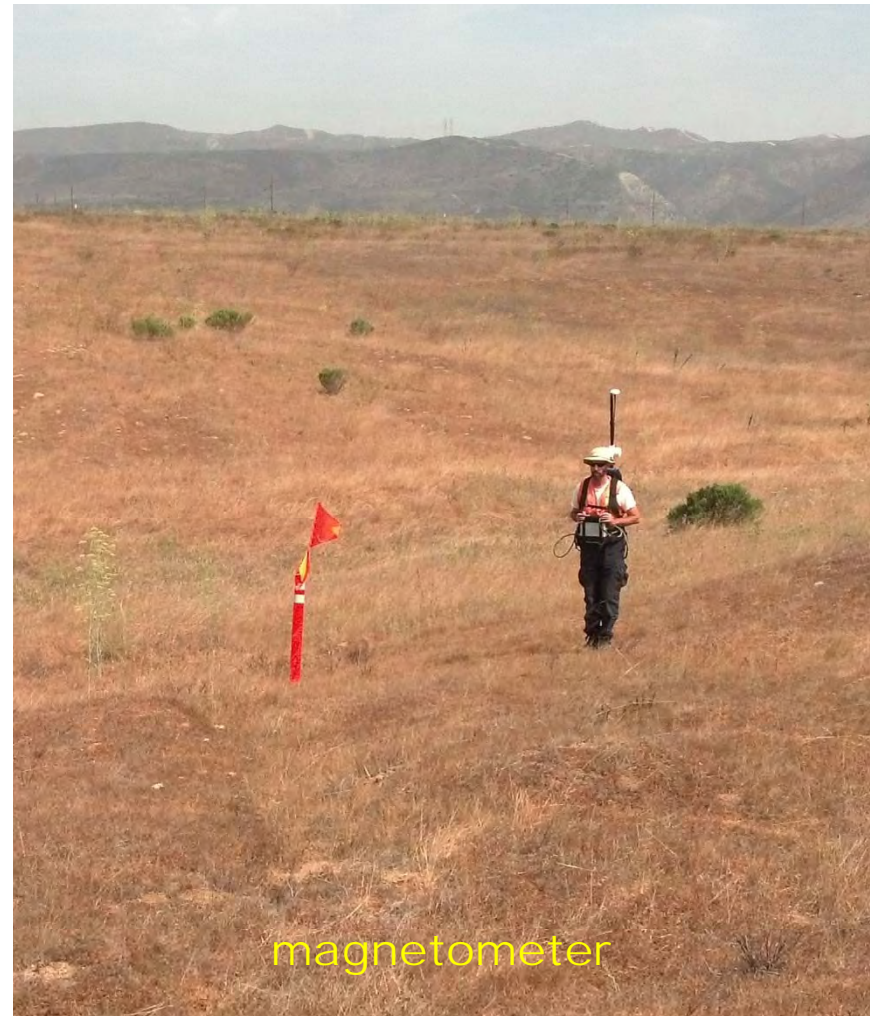


Pre-RA Optimization Scope of Work

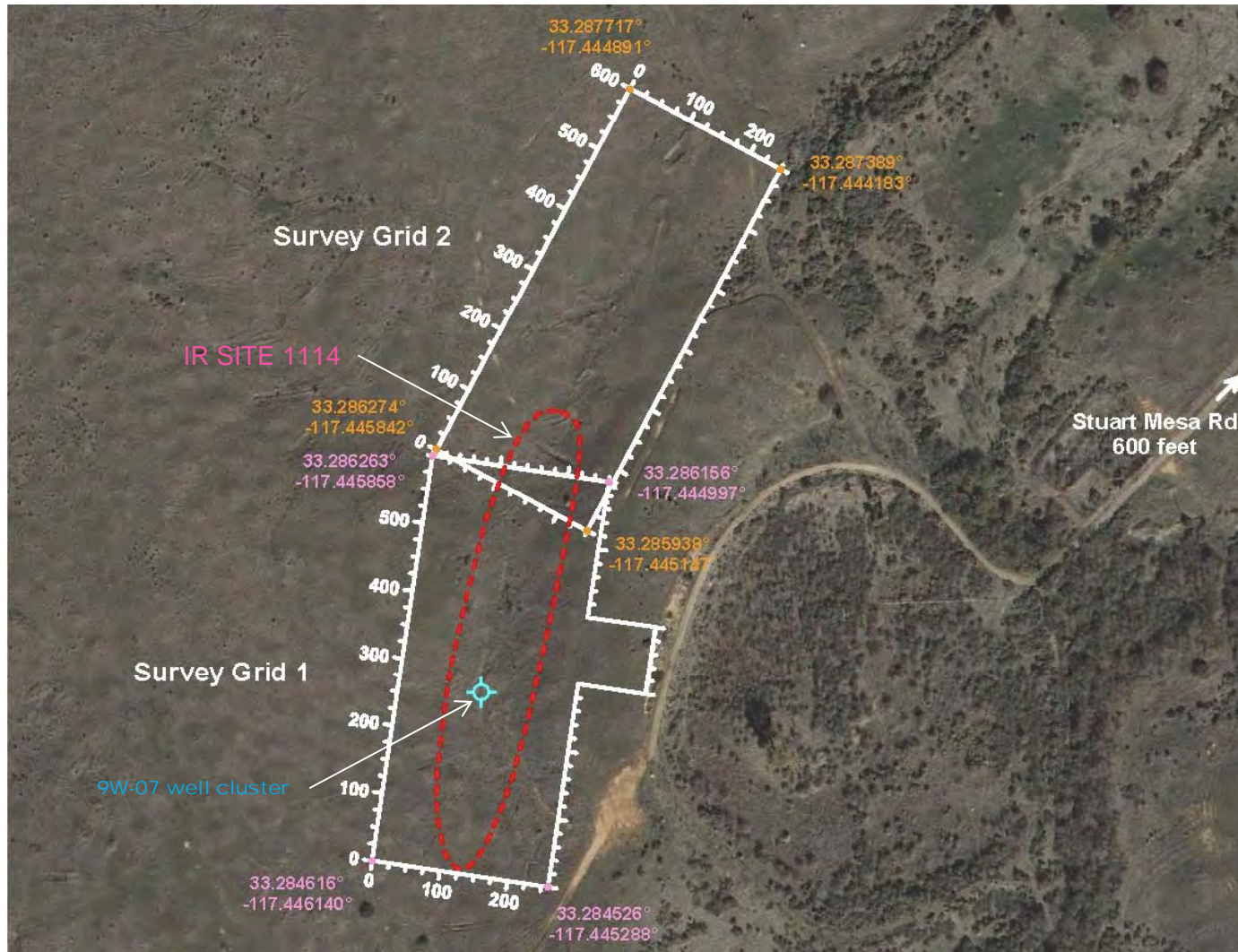


- **Geophysical survey** to identify potential utilities and anomalies indicating materials related to historical PCE release (drums, pipes, excavations, etc.)
 - magnetic and terrain conductivity survey over ~7 acre arroyo area on 10 x 10 ft grid
- **Soil sampling** to focus RA on potential soil source area(s)
 - advance soil borings in ground disturbances
 - collect soil samples at 5 ft intervals
 - analyze for VOCs and microbial census
- **Groundwater sampling** to better delineate core of dissolved plume
 - sample temporary wells
 - sample existing wells 9W-07A, B, C
 - analyze for VOCs and geochemistry (sulfate, nitrate, nitrite, chloride, TOC, methane, alkalinity, dissolve iron & manganese)

Geophysical Survey



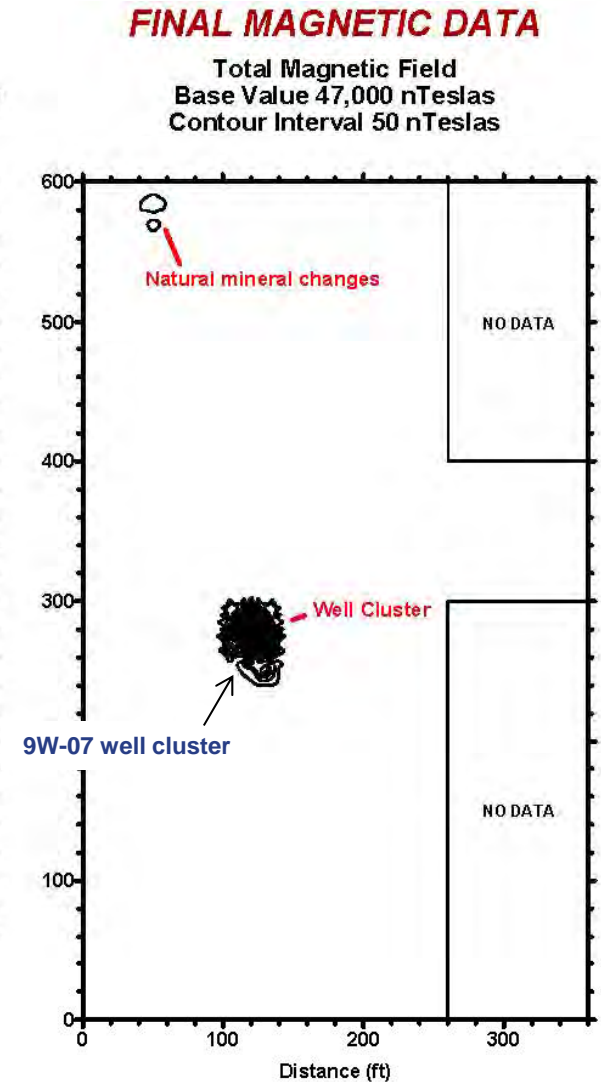
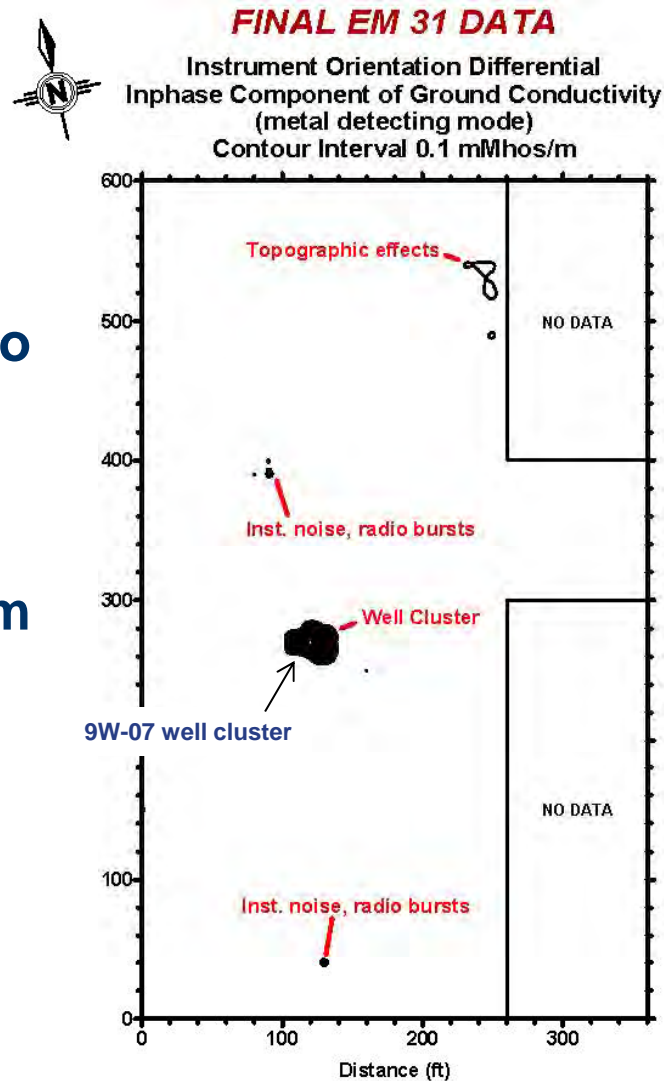
Geophysical Survey Grid



Geophysical Survey Results – South Grid



- EM-31 and magnetometer data indicate no unexplained subsurface anomalies
- Only metal from well completions detected



Geophysical Survey Results – North Grid

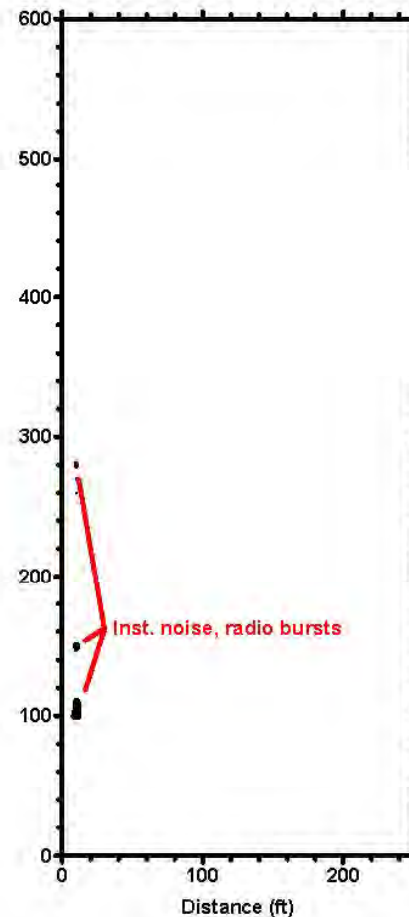


- EM-31 and magnetometer data indicate no unexplained subsurface anomalies



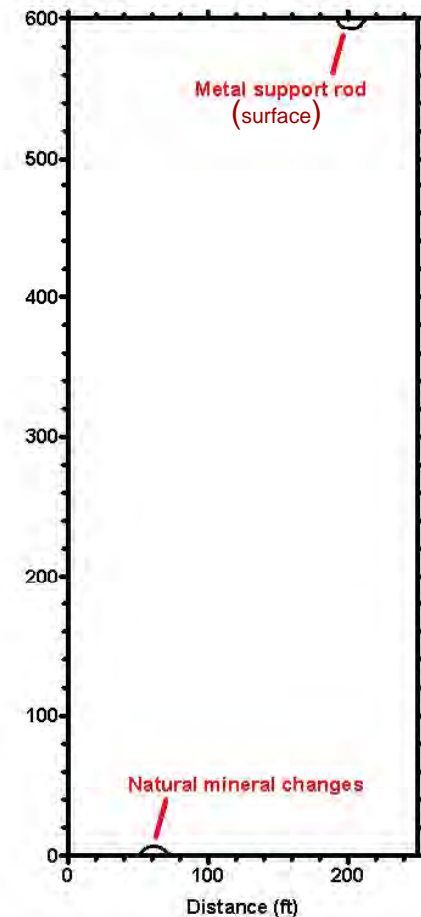
FINAL EM 31 DATA

Instrument Orientation Differential
Inphase Component of Ground Conductivity
(metal detecting mode)
Contour Interval 0.1 mMHos/m

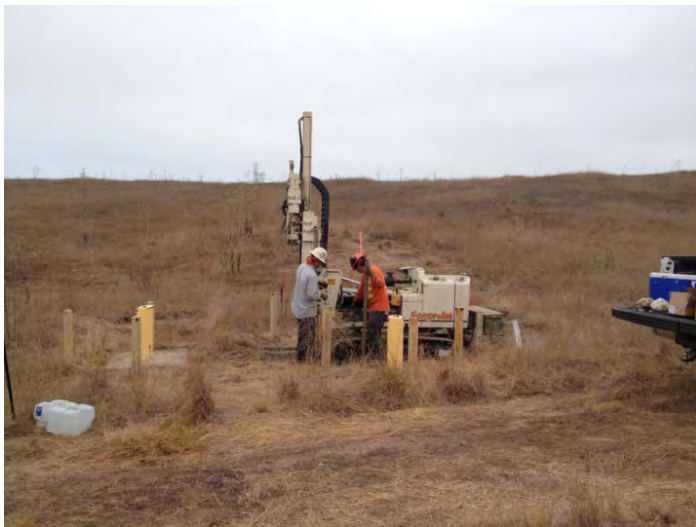
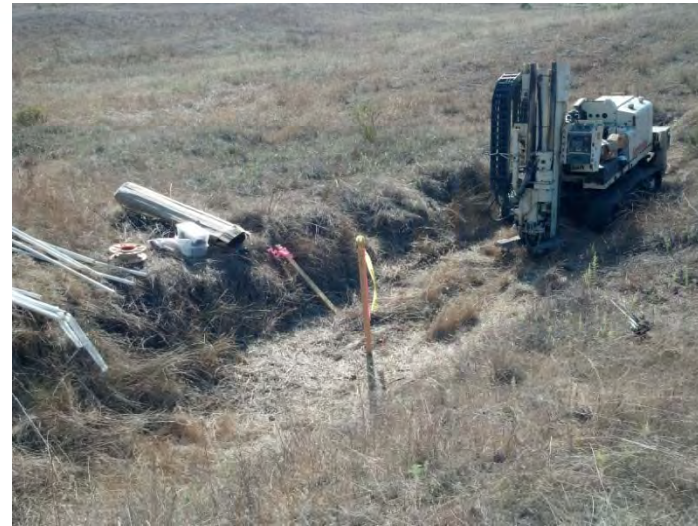


FINAL MAGNETIC DATA

Total Magnetic Field
Base Value 47,000 nTeslas
Contour Interval 50 nTeslas



Soil Sampling

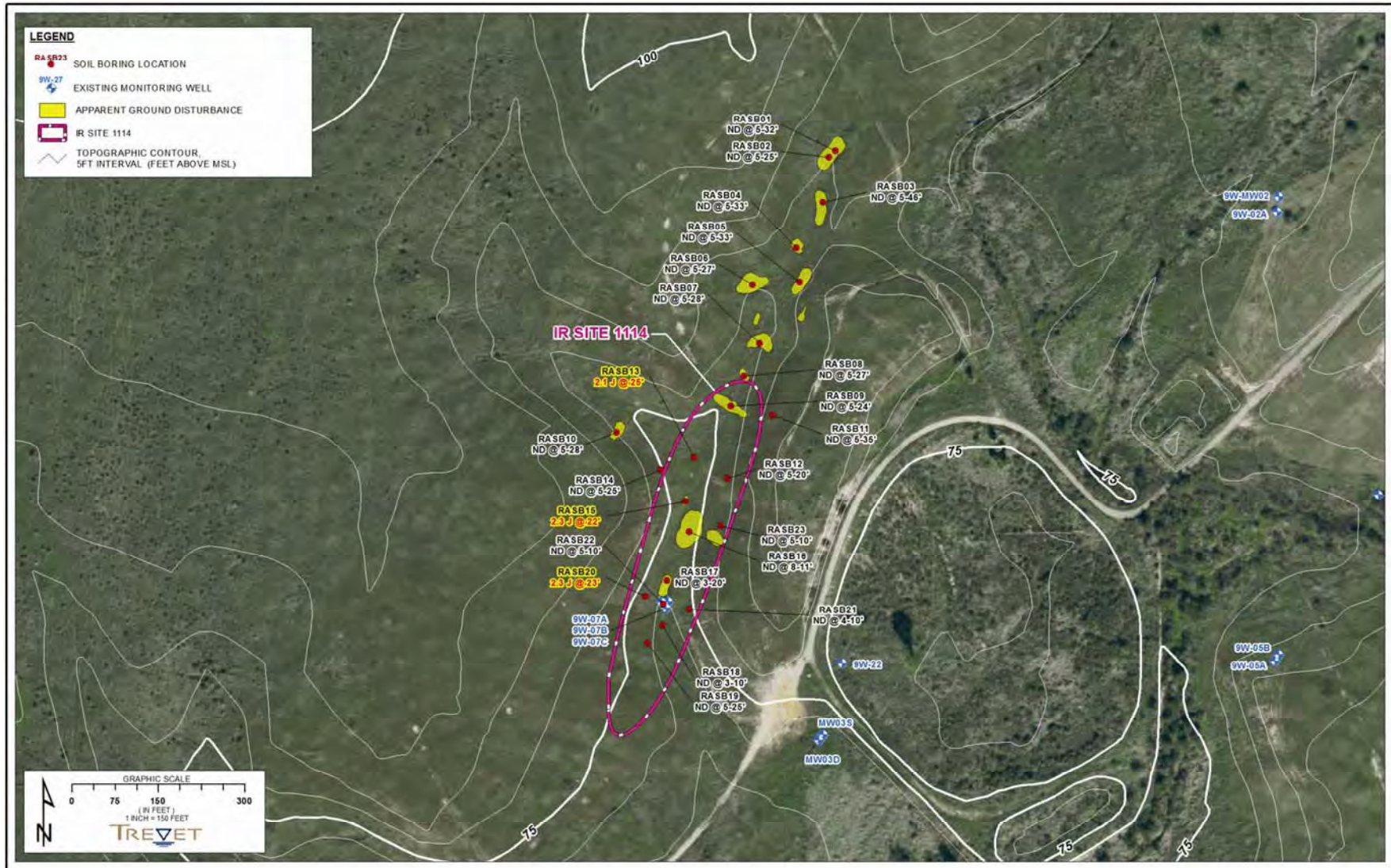


Soil Results - COCs

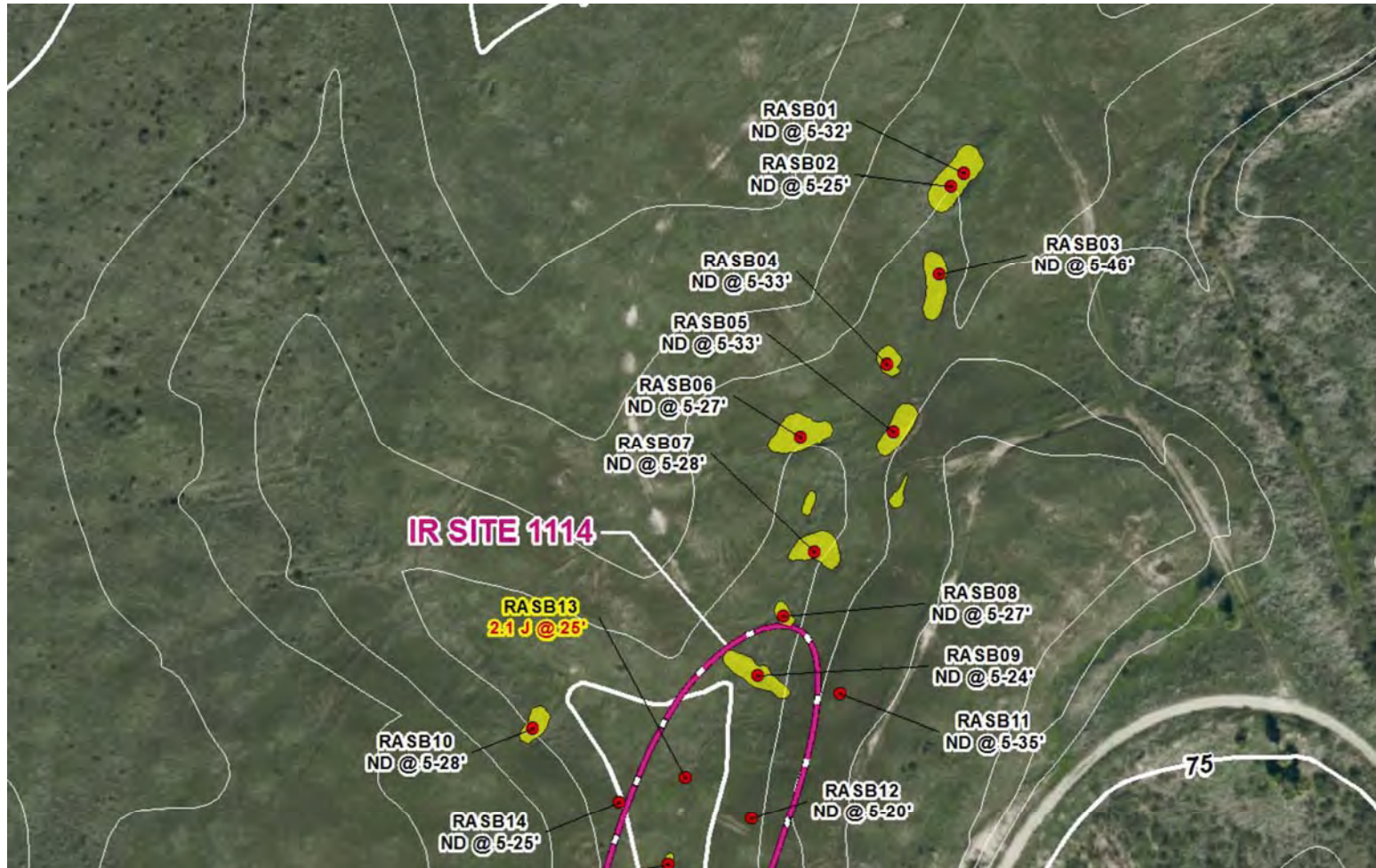


- **97 soil samples analyzed**
- **PCE only analyte reported**
- **Reporting limits for all VOCs were well below current RSLs (reporting limits ranged from 5 to 10 µg/kg)**
- **PCE detected in three soil samples at maximum concentration of 2.3J µg/kg**
- **PCE reported only in capillary fringe samples**
- **Soil hits correlate to dissolved PCE**
- **No soil source indicated**

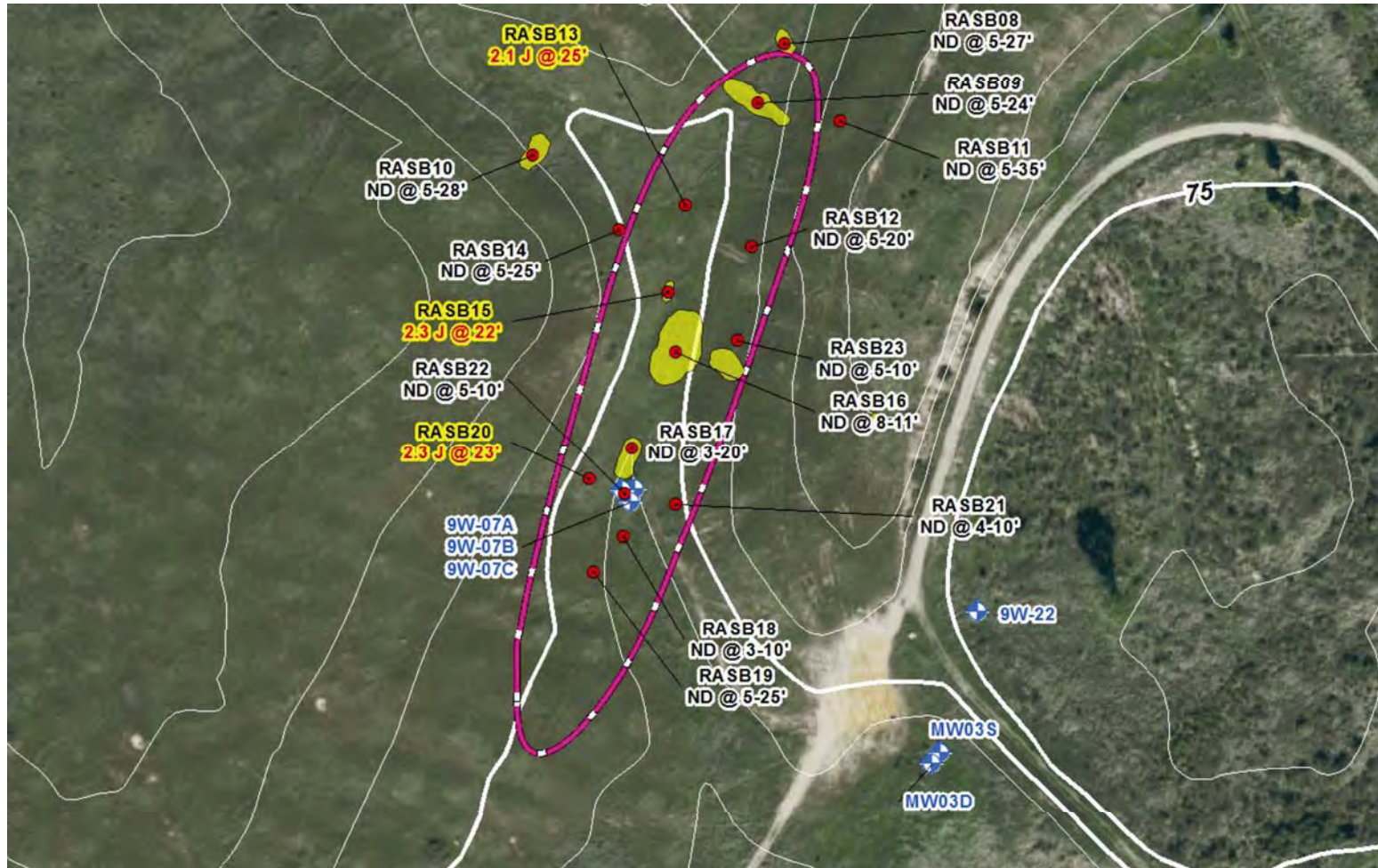
Soil Results Map – PCE Overview



Soil Results Map – North Area Blow-up



Soil Results Map – South Area Blow-up



Soil Results – Microbial Census



- Three soil samples analyzed for microorganisms that metabolize chlorinated hydrocarbons
- Dehalococcoides (best reducer) not reported
- Desulfitobacterium reported at RASB17 (capable of reduction to cis-1,2-DCE)
- Results indicate low native populations of the most beneficial microorganisms

Sample Information

	1114-RASB15-30	1114-RASB17-30	1114-RASB19-30
Client Sample ID:	1114-RASB15-30	1114-RASB17-30	1114-RASB19-30
Sample Date:	08/23/2012	08/23/2012	08/23/2012
Units:	cells/g	cells/g	cells/g

Dechlorinating Bacteria

		1114-RASB15-30	1114-RASB17-30	1114-RASB19-30
<i>Dehalococcoides spp.</i>	DHC	<9.26E+02	<9.09E+02	<9.43E+02
<i>Dehalobacter spp.</i>	DHBt	<5.56E+03	<5.45E+03	<5.66E+03
<i>Desulfitobacterium spp.</i>	DSB	<1.85E+03	1.95E+05	<1.89E+03

Phylogenetic Group

		1114-RASB15-30	1114-RASB17-30	1114-RASB19-30
Methane Oxidizing Bacteria	MOB	<1.85E+03	<1.82E+03	<1.89E+03

Groundwater Sampling





- **18 temporary wells sampled**
- **Three existing wells sampled (9W-07 cluster)**
- **Samples collected using low-flow purge/sample method**

Groundwater Results – COCs



- **PCE reported in 13 temp wells up to 62 µg/L**
 - **Reported in 3 wells below MCL (5 µg/L)**
 - **Reported in 10 wells above MCL**
- **TCE reported in 6 temp wells up to 1.1 µg/L**
- **PCE and TCE reported in 9W-07A at 37 and 1.0 µg/L**
- **PCE/TCE daughter products not reported**
- **Chlorinated ethenes LOQ was 1.0 µg/L, LOD was 0.20 µg/L**
- **Trihalomethanes reported in 5 upgradient temp wells up to 2.0 µg/L (chloroform)**

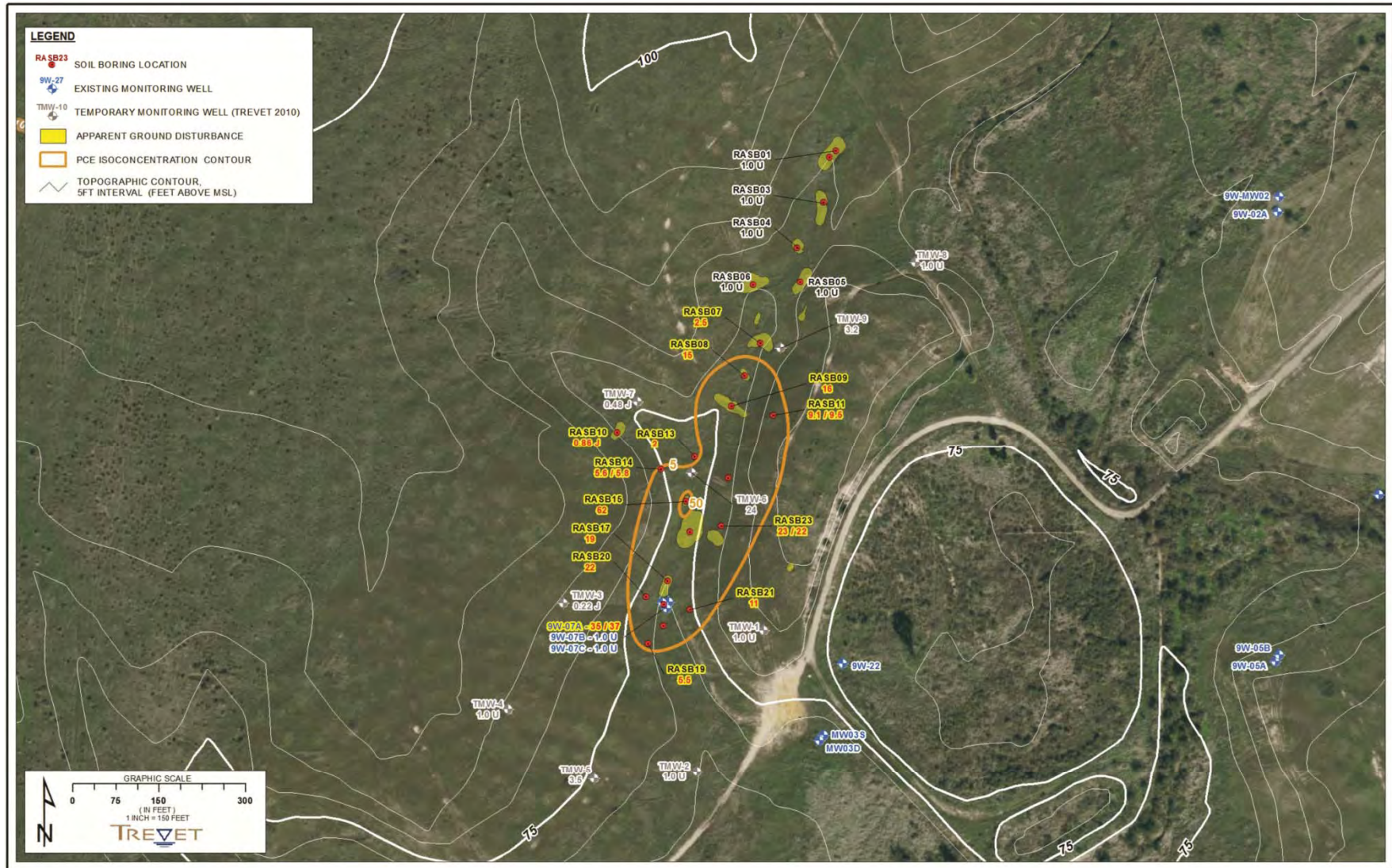
Groundwater Results – COCs



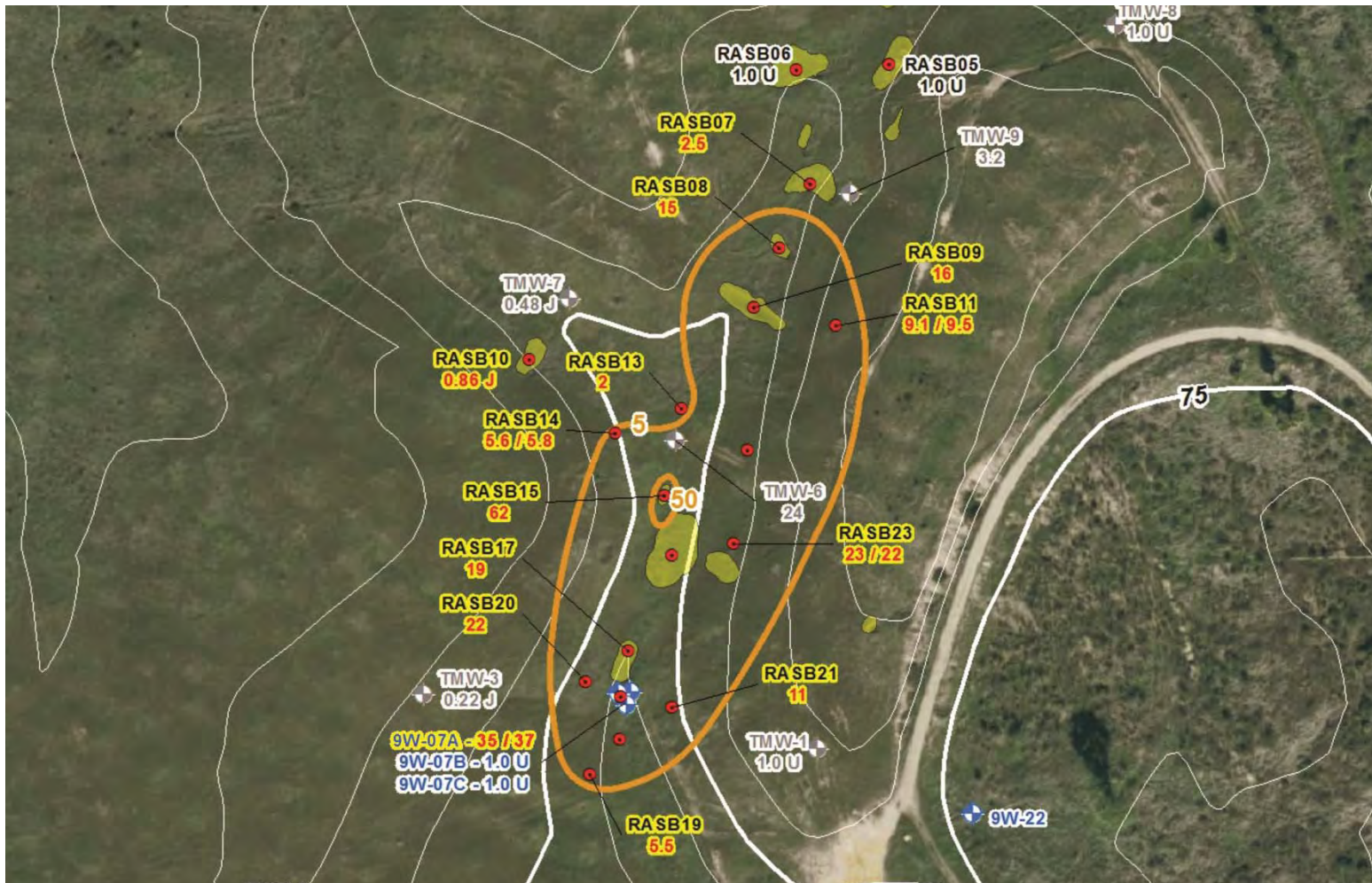
Unvalidated Groundwater Analytical Results

Boring Identification	Sample Depth (ft bgs)	Date Sampled	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	Bromodichloro methane (µg/L)	Chloroform (µg/L)	Dibromochloro methane (µg/L)	Trichlorofluoro methane (µg/L)
RASB01	45	8/20/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0	2.0	0.22 J	0.36 J
RASB03	45	8/20/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.78 J	1.3	0.18 J	0.36 J
RASB04	35	8/21/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB05	40	8/21/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.38 J	1.0 U	1.0 U
RASB06	35	8/21/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.31 J	1.0 U	1.0 U
RASB07	29	8/21/2012	2.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB08	30	8/22/2012	15	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB09	25	8/22/2012	16	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB10	35	8/22/2012	0.86 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB11	40	8/22/2012	9.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB11 (dup)	40	8/22/2012	9.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB13	30	8/23/2012	2.0	1.0 U	1.0 U	1.0 U	1.0 U	0.11 J	0.14 J	1.0 U	1.0 U
RASB14	30	8/24/2012	5.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB14 (dup)	30	8/24/2012	5.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB15	28	8/23/2012	62	0.13 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB17	28	8/24/2012	19	0.45 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB19	28	8/24/2012	5.5	0.57 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB20	25	8/24/2012	22	1.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB21	30	8/24/2012	11	0.80 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB23	35	8/24/2012	23	0.88 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
RASB23 (dup)	35	8/24/2012	22	0.94 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
9W-07C	85	8/22/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
9W-07B	63	8/23/2012	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
9W-07A	35	8/23/2012	35	0.97 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
9W-07A (dup)	35	8/23/2012	37	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Groundwater Results Map – PCE Overview



Groundwater Results – Blow-up



Groundwater Results – Geochemistry



- **Reducing conditions present**
 - **DO generally low and consistently negative ORP**
 - **Methane reported 3/3 samples, average 1.7 µg/L**
 - **Low dissolved iron and manganese**
- **Nitrate average 7.7 mg/L**
- **Sulfate average 144 mg/L**
- **TOC average 3.1 mg/L**

Summary Findings



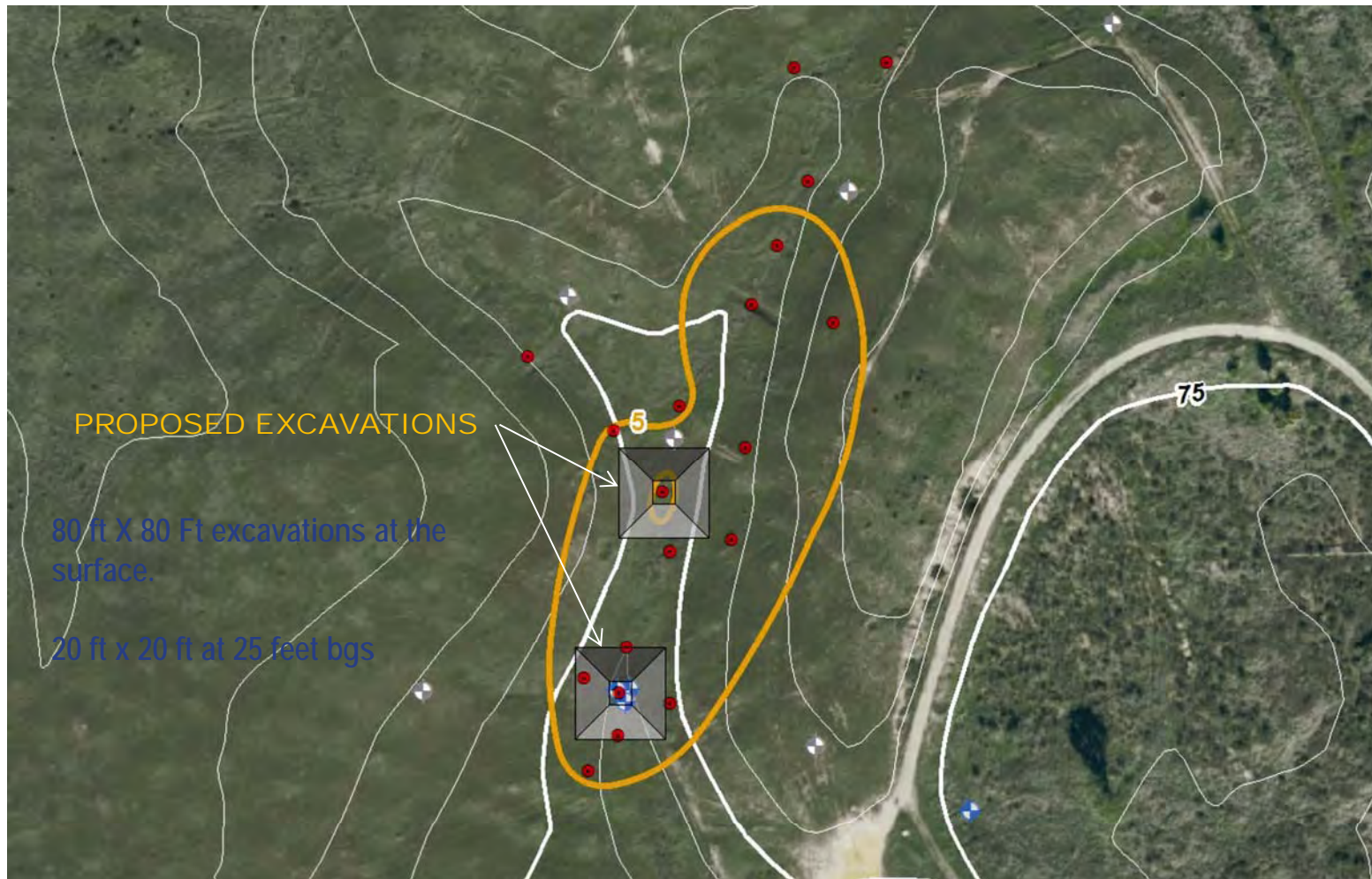
- **No soil source area identified**
- **Groundwater plume approximately 540 x 200 ft.**
- **Upper saturated zone occurs within interbedded clay and sand – tight and heterogeneous lithology**
- **Deeper water-bearing zones NOT impacted**
- **9W-07A (30-40 ft), 9W-07B (56-71 ft), 9W07C (80-9- ft)**
- **Impacts confined to shallow water-bearing zone (approx. 25 to 35 ft)**

Discussion – Excavation Optimization



- **The currently planned two large excavations are located within the core of the PCE plume.**
- **PCE in groundwater appears to be confined to the shallow water-bearing zone.**
- **Depth to water within the planned excavation area is approximately 22-23 feet bgs.**
- **The proposed depths of the excavations are appropriate. Excavation should be able to extend to 5 to 10 feet into groundwater.**

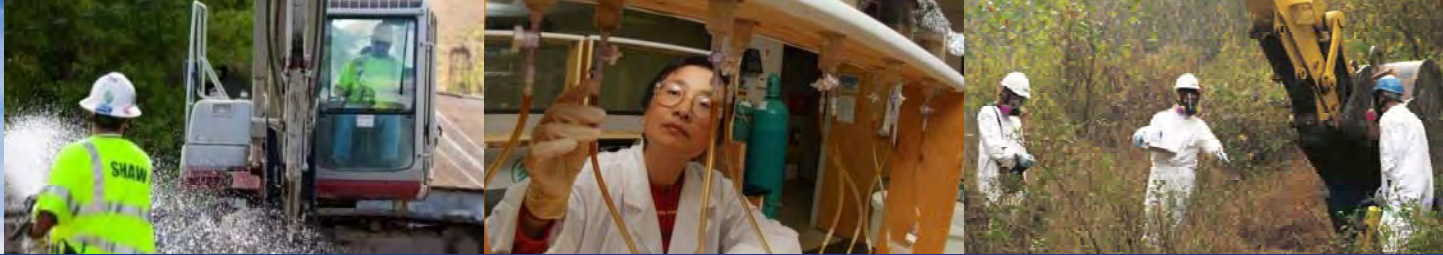
Discussion – Optimized Excavation Locations



Discussion – Biostimulation Optimization



- **Optimal biostimulation works with existing reducing conditions**
- **Biostimulation – soluble product such as lactate/HRC more compatible with heterogeneous, low permeability environment**
- **Bio-augmentation – low native population suggests nutrient addition may be insufficient**
 - **Inoculation with Dehalococcoides**



Non Time - Critical Removal Action and Path Forward
IR Site 33
52 Area Armory
09.17.2012

Amy Estey, CIH, PMP
Shaw Project Manager

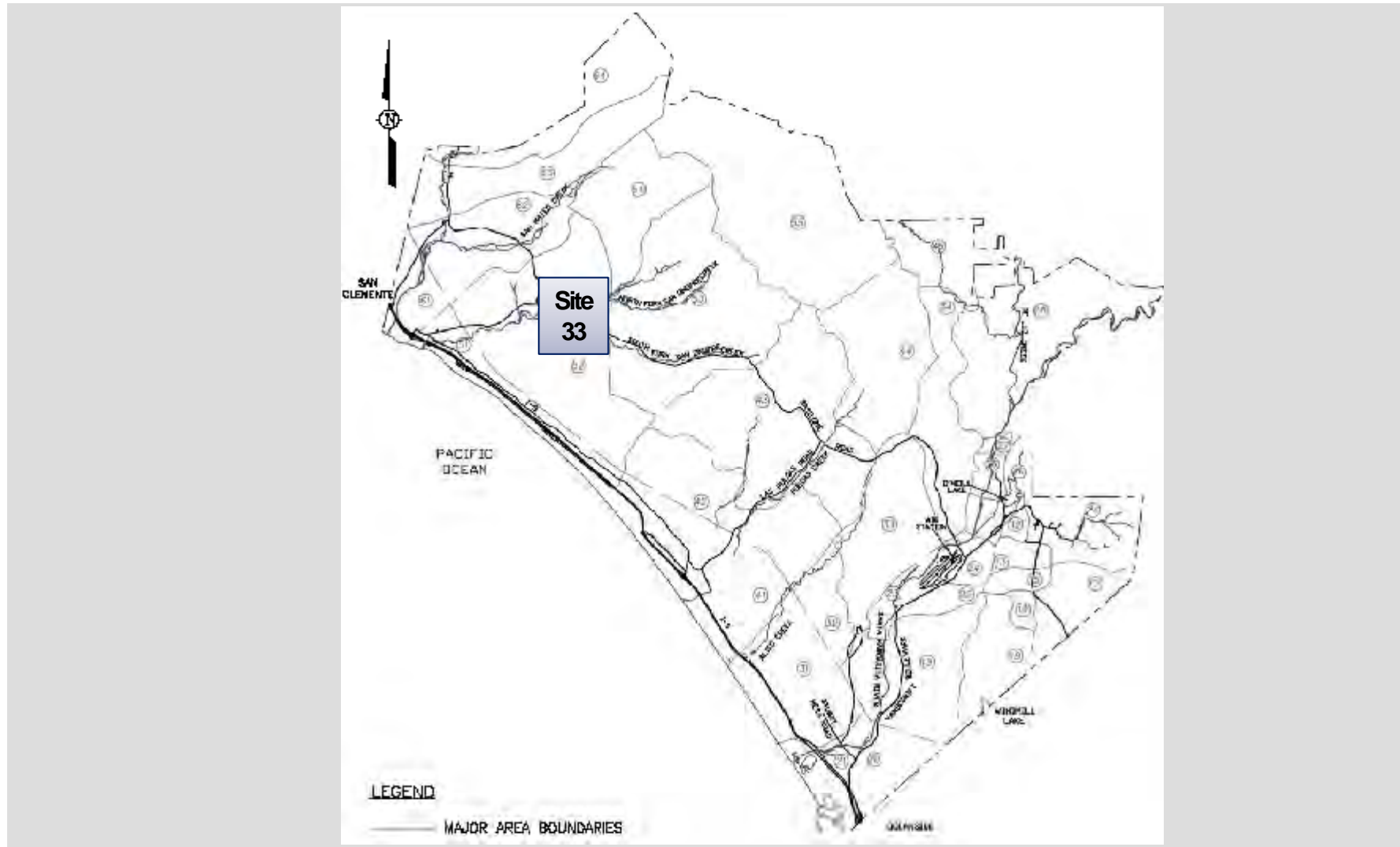


**NON TIME-CRITICAL REMOVAL ACTION COMPLETION
AND PATH FORWARD – IR SITE 33**

Background



Site 33 - Location



Background of IR Site 33 52 Area Armory



Gun Cleaning Area

Hobby Maintenance Shop

Supply Warehouse

Hand to Hand Combat Training Building



Final Site 33 Remedial Investigation Report and Feasibility Study, Marine Corps Base Camp Pendleton, California (Parsons)

Conclusions:

- Volatile Organic Compounds (VOCs), specifically tetrachloroethene (PCE) in groundwater up to 13,000 micrograms per liter ($\mu\text{g/L}$)
- Plume approximately 150 feet by 200 feet in diameter
- PCE significant human health risk (if drinking water)
 - High total dissolved solids (TDS)/low yield
 - Beneficial use in San Diego County Basin Plan
- PCE in soil vapor up to 50,000 micrograms per cubic meter ($\mu\text{g/m}^3$)
 - Highest beneath gun cleaning pad and immediately South
 - Vapor intrusion could pose risk to human health to new buildings
- PCE plume has not migrated more than 200 feet and will persist for decades

Remedial Alternative Proposed in RI/FS

- 33-1 No Action
- 33-2 Land Use Controls, Long-Term Groundwater Monitoring, Monitored Natural Attenuation
- 33-3 Air Sparging Containment Contingency with Alternative 33-2
- 33-4 Contaminant Mass Reduction using Groundwater and Vapor Extraction and Treatment with Alternative 33-2
- 33-5 Excavation of Source Area, Disposal of Excavated Material, Treatment of Contaminated Water, and Placement of Subsurface Bioreactor with Alternative 33-2

Final Engineering Evaluation and Cost Analysis Non Time-Critical Removal Action, Site 33 Marine Corps Base Camp Pendleton, California (Battelle)

Removal Action Objectives:

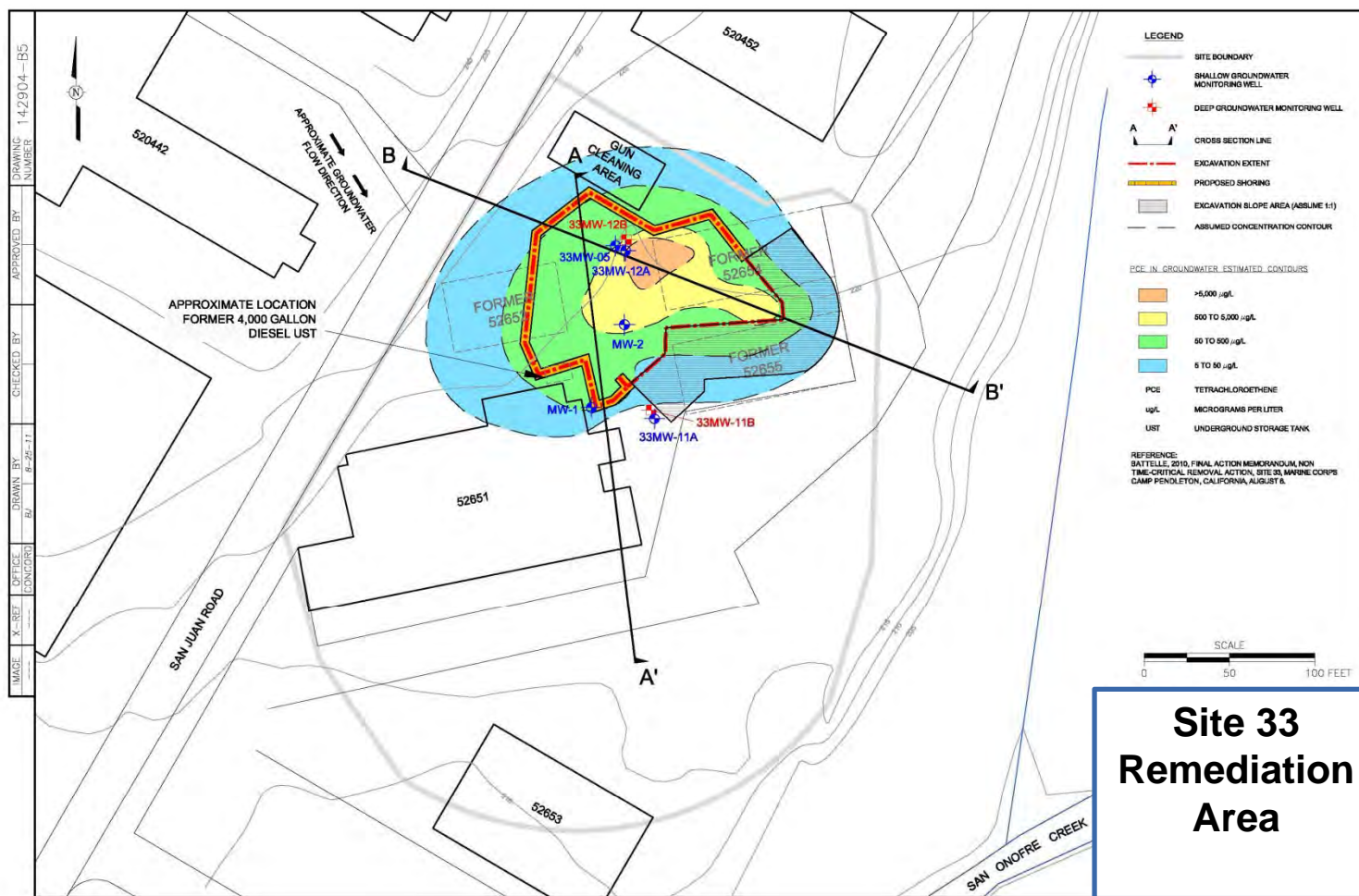
- Reduce the overall risk to human health and the environment by remediating the area of highest concentrations of PCE in the subsurface; and
- Protect the beneficial uses and water-quality objectives of the lower San Onofre Creek

Recommended Removal Action Alternative:

Source area removal excavation with enhanced bioremediation (Alternative 33-4)

- Highly effective
- Readily implementable
- Expected to achieve RAOs
- Provides long-term protection of human health
- Protective of water resources.

Final Action Memorandum, Non Time-Critical Removal Action, Site 33 Marine Corps Base Camp Pendleton, California (Battelle)





 **Shaw**® a world of **Solutions**™

**NON TIME-CRITICAL REMOVAL ACTION COMPLETION
AND PATH FORWARD – IR SITE 33**

Field Work

Before



IR Site 33 Pre-Construction

Non Time-Critical Removal Action – Site Activities



November 2011

- ▶ Well Abandonment

January 2012

- ▶ Work Plan Final

February 2012

- ▶ Waste Characterization Sampling

March 2012

- ▶ Arroyo Toad Survey and Install of Test Dewatering Well
- ▶ Toad Fence Install and Monitoring (continued through Sept 14)
- ▶ Pump Test for Dewatering
- ▶ Test Well for Shoring



NTCRA Site Activities



April 2012

- ▶ Shoring Design Received for Review
- ▶ Kickoff with Base Stakeholders
- ▶ Base Approves Shoring Design
- ▶ Installation of Dewatering Wells
- ▶ Water Line for Base Buildings Relocated
- ▶ Shoring Design Approved
- ▶ Dewatering/Discharge Approved by Base Plant
- ▶ Fiber Optic Line – Placed on temporary poles to eliminate CADEX

May 2012

- ▶ Shoring Photo Survey
- ▶ Soldier Pile Install Begins
- ▶ Transportation & Disposal Begins
- ▶ Water Treatment System Installed
- ▶ On Base Backfill Identified and Sampled



NTCRA Site Activities



June 2012

- ▶ Discharge (based on actual analytical)
Approved to Base Plant

July 2012

- ▶ Excavation Complete to 32 feet below ground surface



August 2012

- ▶ Backfill
- ▶ Restoration of Base Utilities

September 2012

- ▶ Decommission Dewatering Wells
- ▶ Asphalt Paving of the Site



Excavated: 27,108 tons of soil

Transported: 1,166 loads to Yuma Landfill
(CERCLA)

Removed: 14,433 cubic yards (in place)

Discharged: 572,110 gallons of treated water
to sanitary plant

Soldier Beam Installation



Subsurface Obstructions



Placing Beam in Drilled Hole



Concrete to Set Piles

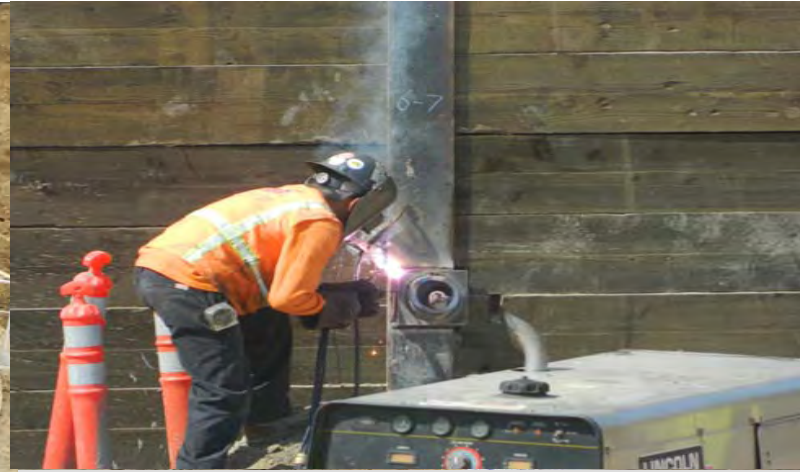


Line of Beams

Tie Back Install – at 7 feet and 20 feet



Drilling for Tie Backs



Welding Tie Backs



Tie Back Cable and Grout Tube



Seven Foot Tie Backs Installed

Dewatering, Treatment and Discharge



Power for Treatment System



DW-04 – Dewatering Well



Treatment System – Bag Filters and Granular Activated Carbon



Discharge to Sanitary Sewer

Utility Relocation



Utility Relocation



Water Provided for Buildings



Temporary Water Line



Telecommunications

Excavation



Dust Monitoring



Ripping



Mini –Excavator to get close to shoring



Covering Stockpile at End of Day

Transportation and Disposal



Loading Trucks



Loading Soil into Trucks



On Site Scales

Backfill



Backfill Arriving



Compacting



Dust Suppression



Backfilling



IR Site 33 Post Construction

Theresa and Joe





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108TH FFA Meeting

Proposed Installation Restoration (IR) Sites:
Site 1120 - Stuart Mesa Pesticide Maintenance Area
Site 1121 - Site 1D Groundwater

Brief to FFA Team
September 17, 2012



Proposed IR Sites Outline



- Site 1120 - Stuart Mesa Pesticide Maintenance Area
 - Background
 - Planned Activities and Schedule
- Site 1121 - IR Site 1D Groundwater
 - Background
 - Planned Activities and Schedule



Site 1120 Background



- Stuart Mesa Pesticide Maintenance Area Only; Agricultural Fields are not included.
- Approximately 10.8 acres.
- The Site was used as a maintenance facility compound (MFC) for farming process functions for growing tomatoes and strawberries and other agricultural uses for at least 70 years.
- The property is currently vacant since the lease held by Harry Singh and Sons has expired as of January 2011.
- Bordered on the west by I-5, Stuart Mesa West Agricultural Field and Marine Corps Tactical Systems Support Activity (MCTSSA), on the south by the Stuart Mesa East Agricultural Field and to the north by Cackleberry Canyon .



Site 1120 Background (Continued)



- Phase I Environmental Site Assessment (ESA) of Stuart Mesa Agricultural Field (March 2011).
 - The MFC at the property contains multiple open-bottom sheds, concrete slab floor sheds, several maintenance buildings, a vehicle wash area, a large produce packing building, a concrete pad with two drains, and a farmhouse.
 - Environmental Areas of Concern (AOCs) at the property include the MFC, two concrete wash pads (“wash racks”) within the MFC, and aboveground storage tank (AST) or former AST locations throughout the entire property.
 - Discolored soil flooring in most maintenance buildings. No evidence of any underground storage tanks or oil water separators on the property.
 - Historical storage and use of Petroleum, Oils, and Lubricants (POL), pesticides and herbicides.



Site 1120

Site Map - Stuart Mesa Agricultural Field





Site 1120

Site Map - Maintenance Facility Compound





Site 1120 Planned Activities and Schedule



- Singh and Sons are currently performing limited excavation activities in accordance with their lease agreement; Excavation is focused on “Hot Spot” removal.



Site 1121 Background



- Proposed IR Site for the groundwater portion of Site 1D .
- This area is a former burn ash site approximately 14.2 acres in size.
- The selected remedy for Site 1D in the signed OU-4 Record of Decision (ROD) was excavation, backfill and off base disposal of contaminated soil.
 - During the remedial action, 38,300 CY of soil was transported for off-Base disposal (2008-2010).
 - 90 drums/fragments containing liquid and solid chemicals were also removed from grid cell G-9.
- Remedial Action Completion Report (RACR) for soil is complete but groundwater contamination remains to be addressed.
- The soil for Site 1D has been closed out and the groundwater will be addressed as a new IR Site.



Site 1121

Background (Continued)



- Interim measure, 650,000-gal of groundwater was pumped from the site, treated and disposed of in the Base Sanitary Sewer System.
- Groundwater grab samples in Grid G-9 indicated the groundwater was impacted with metals (primarily arsenic), pesticides and volatile organic compounds (VOCs) above maximum contaminant levels (MCLs).
- Draft Data Gap Analysis Investigation - IR Site 1D (Tech Memo, July 2012).
 - Installation of 31 temporary wells, which included 11 dual clustered wells and five permanent monitoring wells (Total of 8 permanent wells for the site).
 - Depth to groundwater ranges from 13 to 21 ft below ground surface.
 - The source area at Grid G-9 contained highest concentrations of VOCs, pesticides and metals (including arsenic). Pesticides are generally confined to Grid G-9. Chlorinated VOCs are present in shallow and deep groundwater and extend northwest. Arsenic is present in Grid G-9 and extends north.



Site 1121 - Site 1D Groundwater Site Figure Showing Well Locations and Groundwater Elevations





Site 1121

Planned Activities and Schedule



- Remedial Investigation for Groundwater Work Plan – October 2012.
- Field work for RI – March 2013.
- RI/FS Report – March 2014.
- Proposed Plan – 2015.
- Record of Decision – 2016.

Status Update ZVZ Design Study

17 September 2012
108th FFA Meeting



ZVZ Design Study

Presentation Agenda

- ❖ Objectives
- ❖ Data Collected to Date
- ❖ Path Forward



ZVZ Design Study

Overall Objectives

- ❖ Quantify the in situ effectiveness of ZVZ for reducing TCP concentrations in groundwater under site-specific in situ conditions.
- ❖ Use data from the design study to determine final design of in situ remediation system.



ZVZ Design Study

Data to Date

- ❖ Brady installed four new monitoring wells as the initial step for the ZVZ Design Study. Information was gathered regarding the following elements:
 - Groundwater Flow
 - Lithology
 - Analytical Results



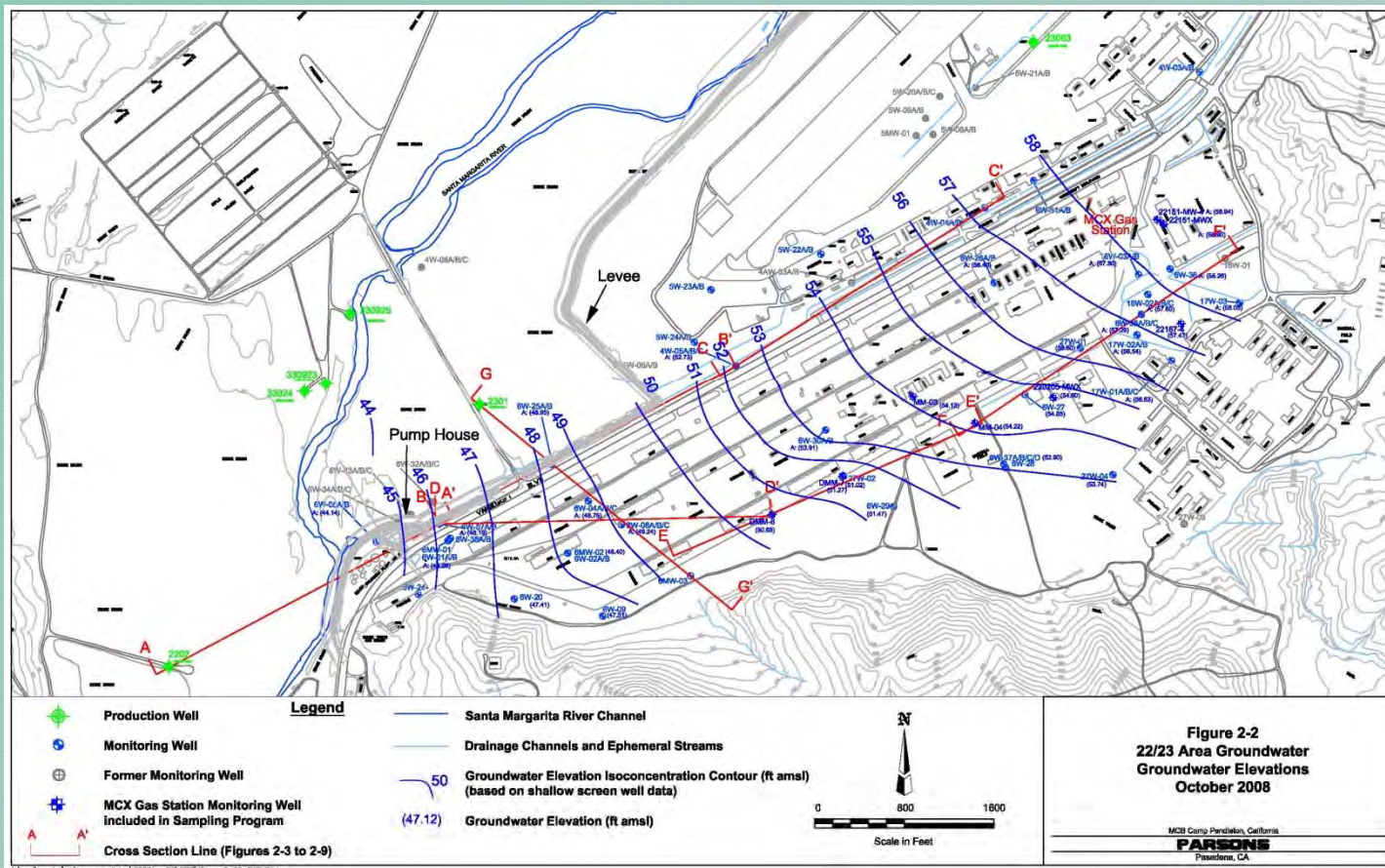
ZVZ Design Study

Groundwater Flow

- ❖ Based on historical data, groundwater flow at the design study area is towards the south-southwest.
- ❖ Brady measured water levels in the new and existing wells in the design study area.
- ❖ February 2012 results showed relatively flat water table with flow slightly to east.
- ❖ June 2012 results showed flow is generally towards the south-southwest.
- ❖ The groundwater elevations were approximately 0.8 foot higher in February than in June, and only about a 2.5 inch difference in elevations across the design study area in both events.

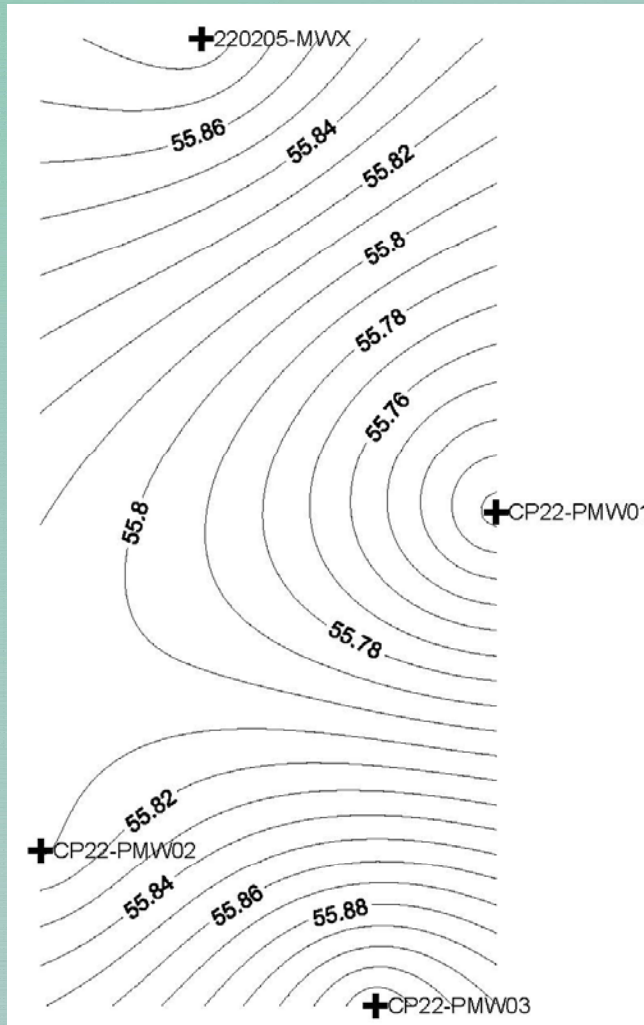
ZVZ Design Study

Groundwater Contour Map from RI/FS (please see attached 11 x 17 version)



ZVZ Design Study

Brady Groundwater Contour Map from February 2012





ZVZ Design Study

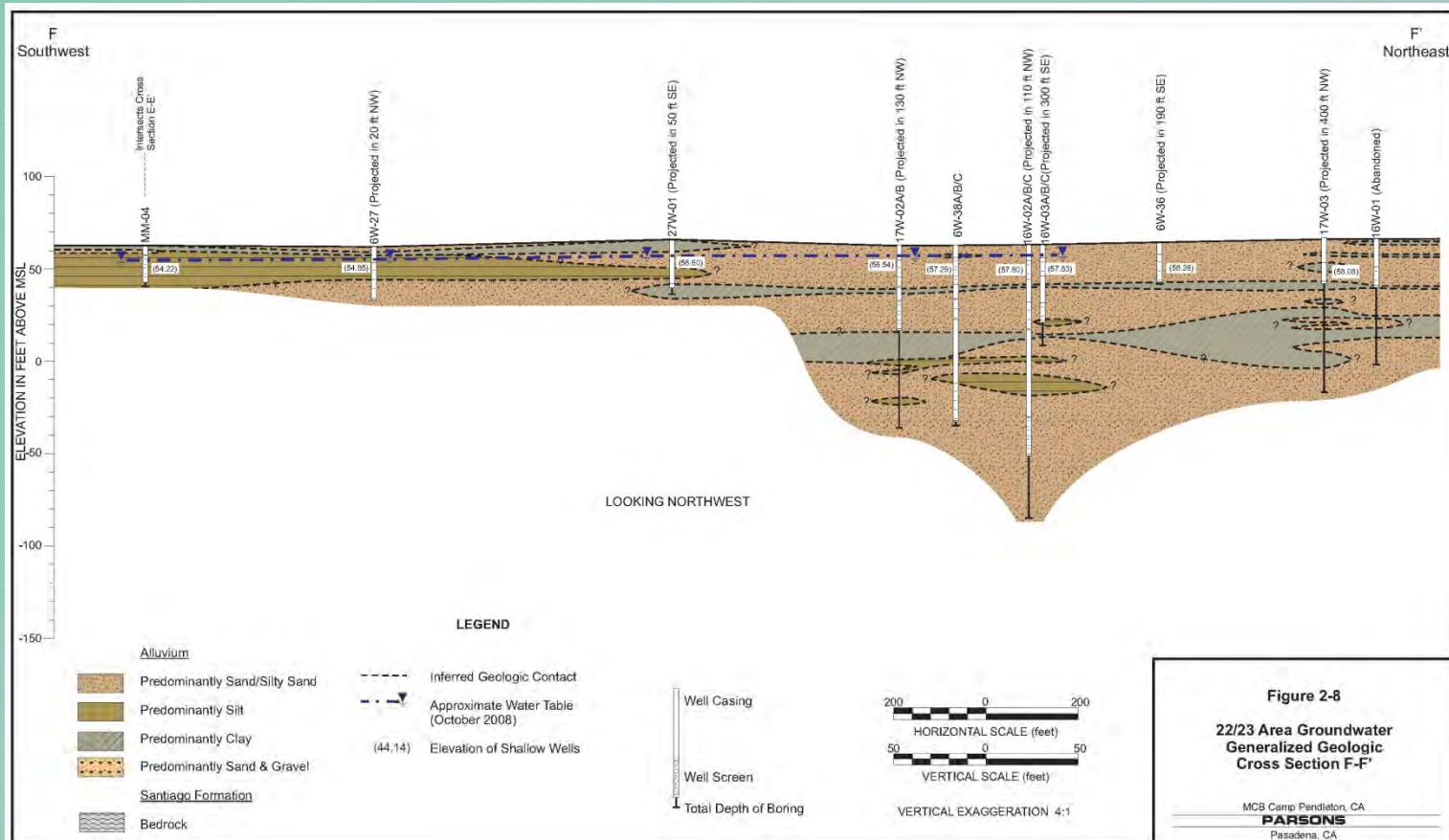
Lithology

- ❖ Previous cross sections show the design study area to consist of interbedded sand, silts, and clays.
- ❖ The draft cross section based on the new Brady boring logs also show interbedded sand, silts, and clays.
- ❖ Site-specific lithology is consistent with regional lithology.

ZVZ Design Study

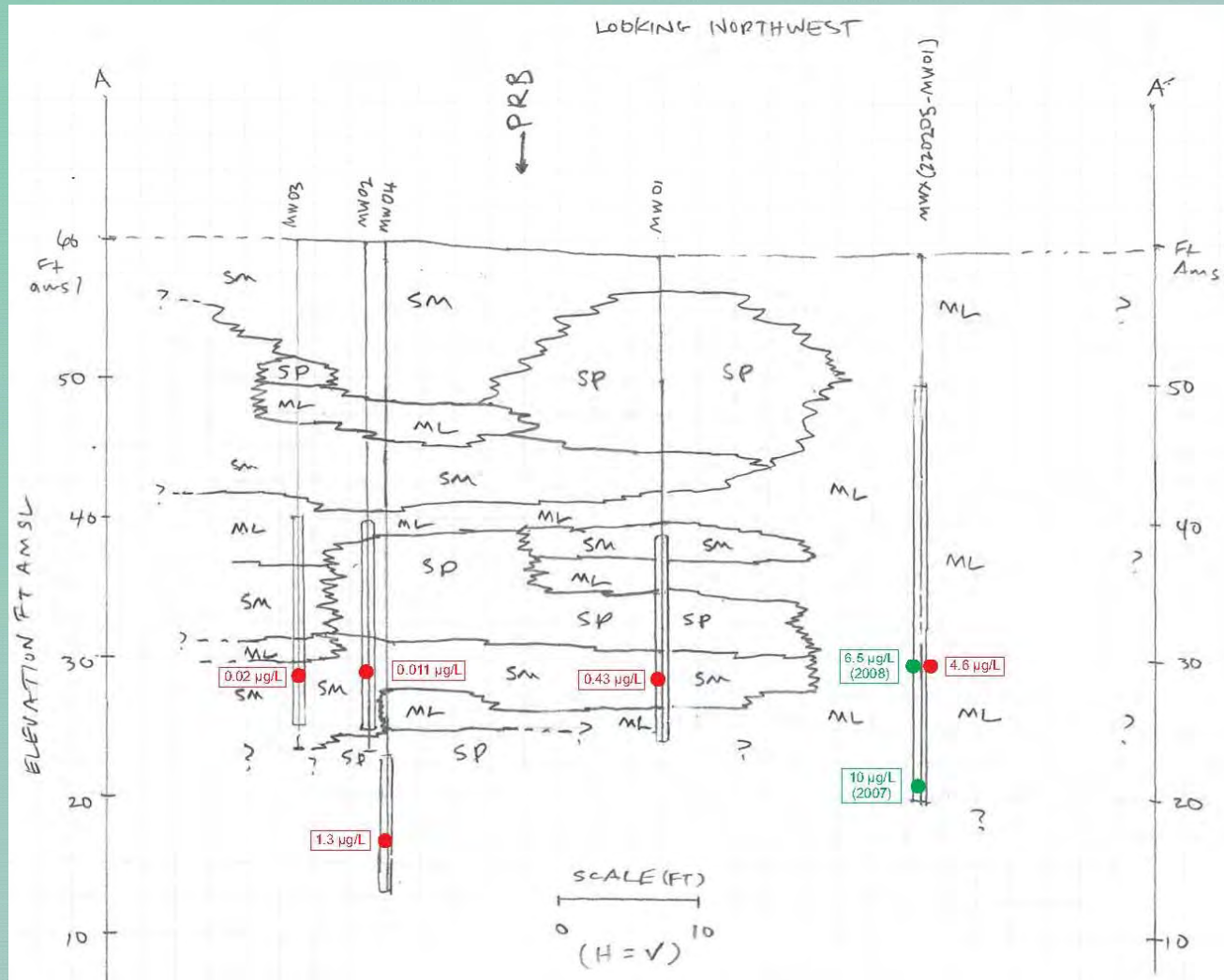
Cross Section F-F' from RI/FS

(please see attached 11 x 17 version)



ZVZ Design Study

Preliminary Cross Section of ZVZ Injection Area





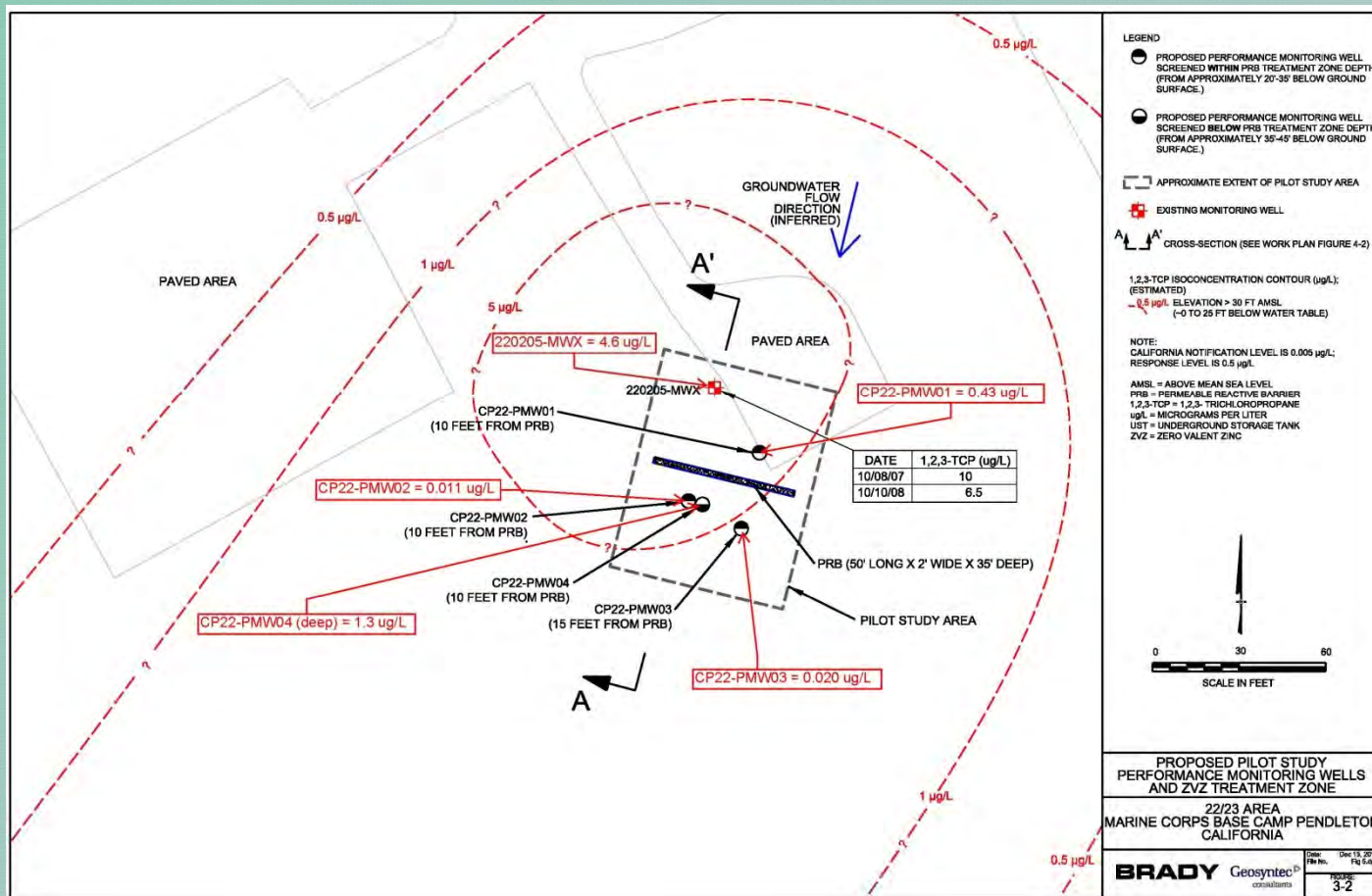
ZVZ Design Study

Analytical Results

- ❖ Groundwater analytical data was collected from the four new Brady wells and 220205-MWX.
- ❖ Results show that 220205-MWX has the highest detections, 4.6 $\mu\text{g/L}$ (compared to 6.5 $\mu\text{g/L}$ in 2008 and 10 $\mu\text{g/L}$ in 2007).
- ❖ Results in new wells are lower, from 0.011 to 1.3 $\mu\text{g/L}$.
- ❖ The highest analytical results are from the deepest sample locations at 220205-MWX and CP22-PMW04.

ZVZ Design Study

Baseline 1,2,3-TCP Results (please see attached 11 x 17 version)





ZVZ Design Study

Additional Data Needed to Refine ZVZ Injection

- ❖ Need to refine groundwater flow directions in pilot study area, including factors that may influence (e.g., surface water infiltration, lift station, seasonal variations).
- ❖ Refine 3D configuration of 1,2,3-TCP concentrations to determine best placement of injection points.



ZVZ Design Study

Path Forward - Six Phases (Planned):

- ❖ Initial Data Collection
- ❖ Additional Monitoring Wells
- ❖ Hydraulic Characterization
- ❖ Injection Well Installation
- ❖ Injection of Reactant
- ❖ Monitoring



ZVZ Design Study

Initial Data Collection

- ❖ Obtain "as-builts" of the lift station and piping and any associated structures.
- ❖ Test groundwater in selected wells for geochemical properties.
- ❖ Obtain a new round of groundwater elevation data; compare to historical groundwater elevation data to track historical and seasonal trends, and variations in gradient.
- ❖ Measure extent and depth of nearby surface water, if present, and continue to monitor surface water presence, since this could affect seasonal recharge, gradient, and possibly chemical concentrations.



ZVZ Design Study

Additional Monitoring Wells

- ❖ Based on the geochemical and gradient data, determine best locations for approximately 6 new monitoring wells.
- ❖ Three to four of these new wells would be "stepped-out" from the immediate small area where the prior monitoring wells were placed (CP22-PMW01 through CP22-PMW04).
- ❖ The wells will each have 2-3 separate 2" casings installed at different depths.



ZVZ Design Study

Additional Monitoring Wells (continued)

- ❖ The two to three remaining wells will be drilled closer to 220205-MWX (about 20 feet) and will be used to precisely decide the locations and depths of injection. These wells will also be part of the monitoring network, along with the recently installed wells (CP22-PMW01 through CP22-PMW04). New wells will be installed at multiple depths for vertical profile of contaminants.
- ❖ After the new monitoring wells are installed, continue to check all water levels monthly to get the groundwater gradients as well-defined as possible and to assess any seasonal fluctuations; produce basic contour maps of every data set.
- ❖ Update cross-sections with the new data.



ZVZ Design Study

Hydraulic Characterization

- ❖ Based on the flow data obtained in the initial steps, it may be value-added to conduct:
 - additional water level measurements
 - data collection during/after precipitation events and/or operation of the lift station
 - tracer study, if necessary



ZVZ Design Study

Injection Wells

- ❖ Number and spacing of injection points will be based on data from new and existing monitoring wells.
- ❖ All new wells continuously-cored. Screen, sand-pack, and seals based on lithology.
- ❖ Pumping discharge rates and drawdown data continuously recorded during well development.



ZVZ Design Study

ZVZ Injection

- ❖ Would include mirco-scale ZVZ particles in suspension.
- ❖ Injection material, volume, and loading rates to be determined in consultation with University of Oregon.



ZVZ Design Study

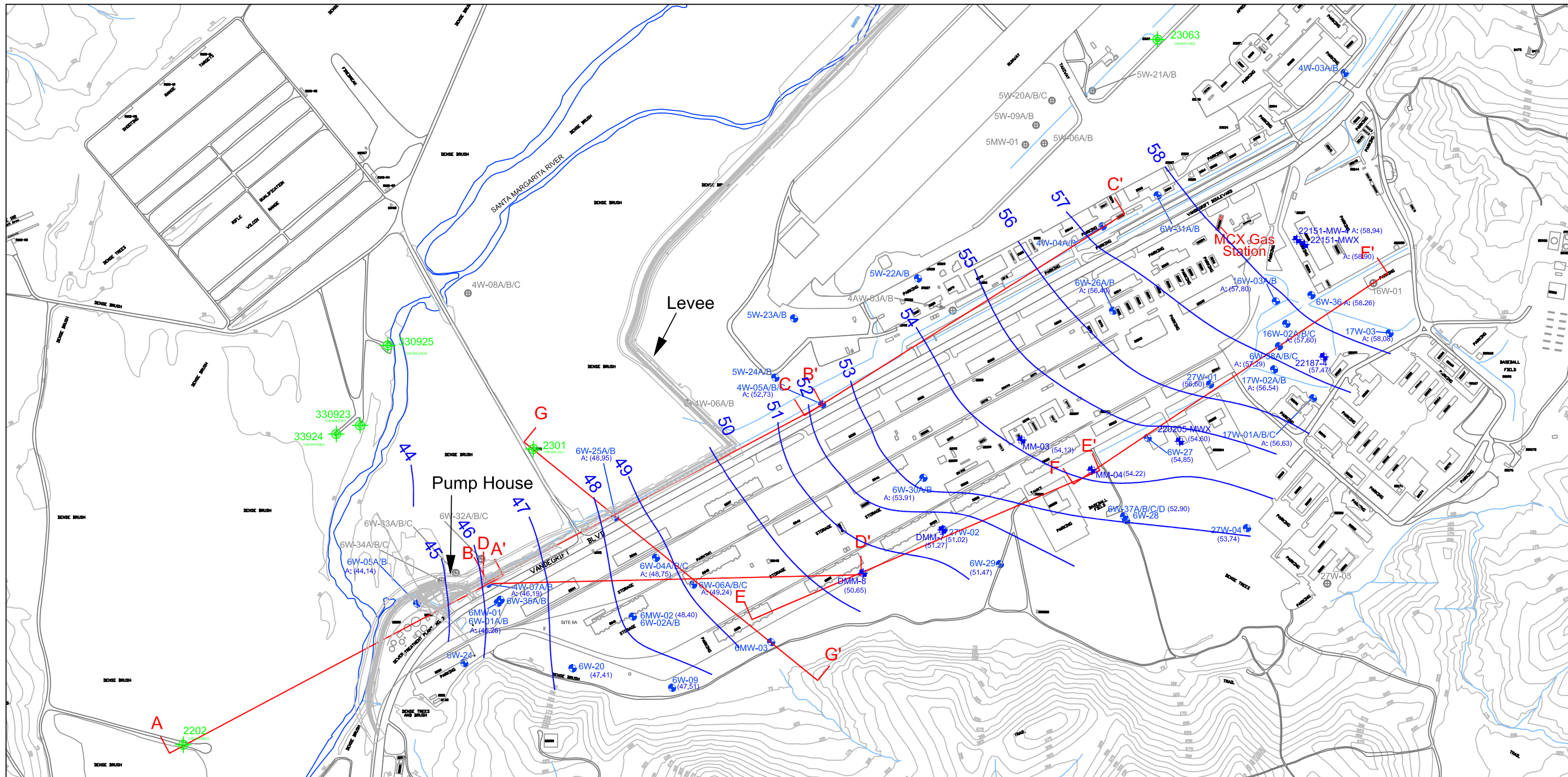
Monitoring

- ❖ Following injection, selected wells will be tested periodically to determine effectiveness of the ZVZ reaction in reducing TCP concentrations.
- ❖ Baseline sampling round will establish geochemistry and contaminant concentrations.
- ❖ Monitoring frequency to be evaluated based on performance of system.



ZVZ Design Study

Questions?

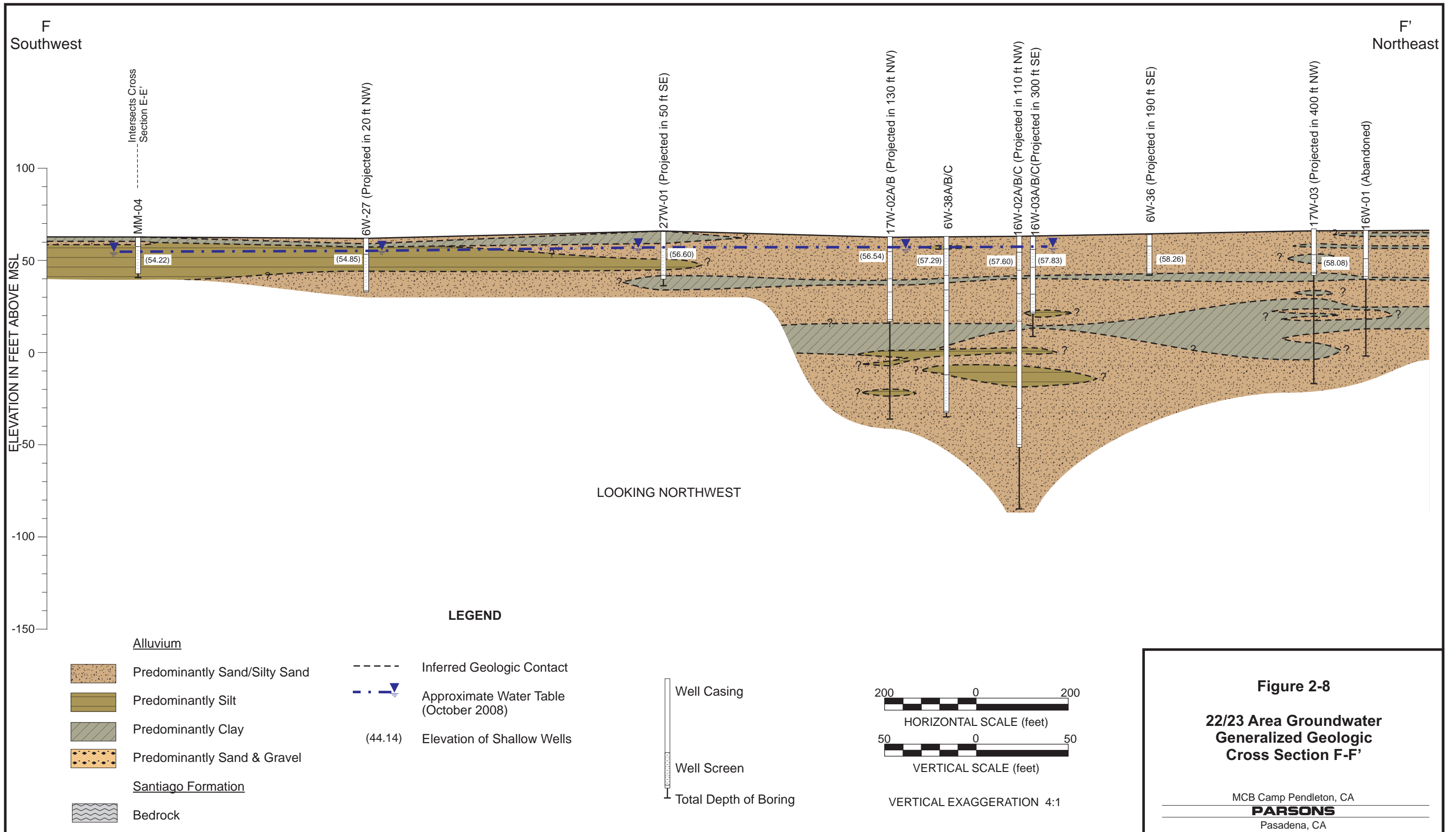


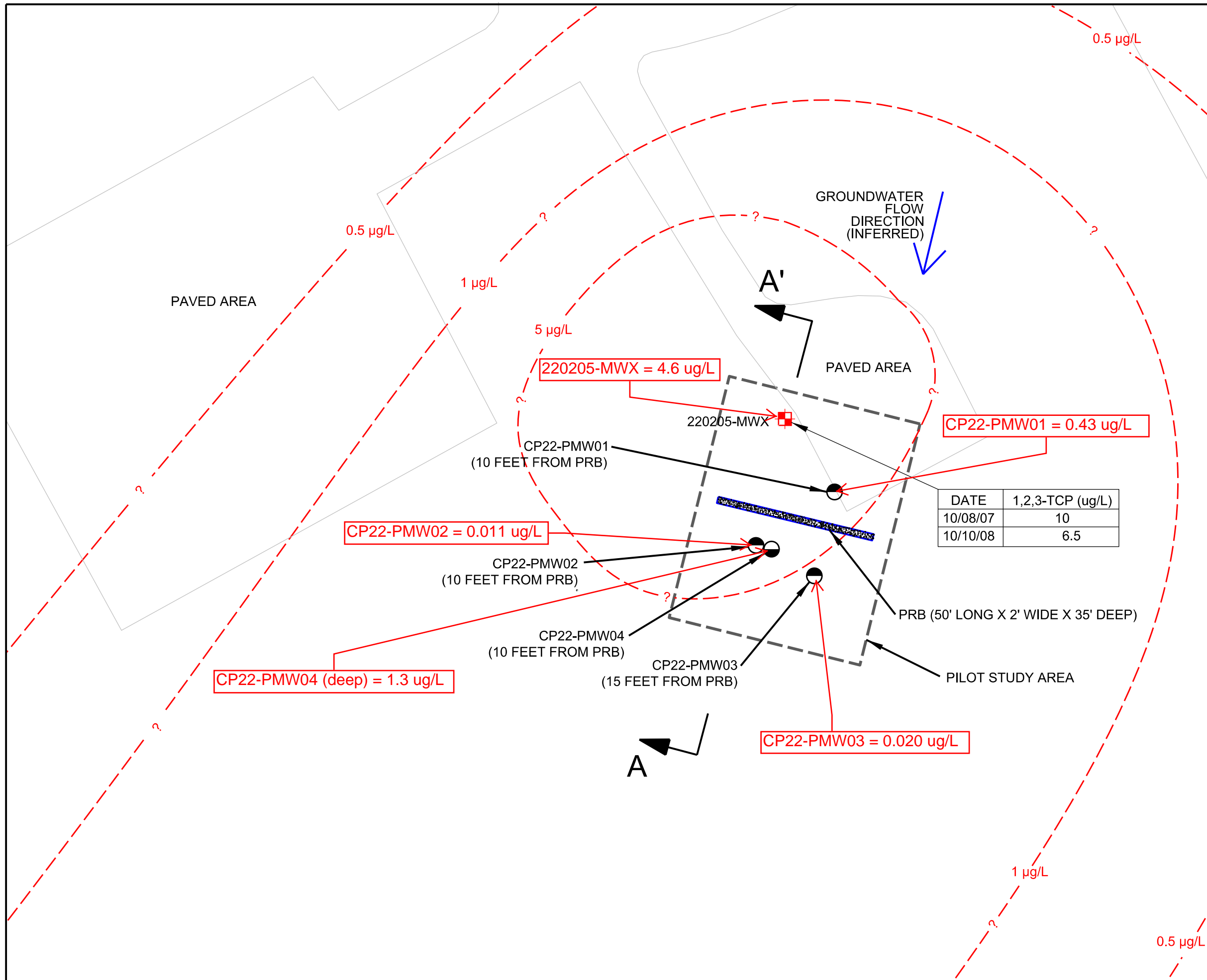
	Production Well		Santa Margarita River Channel
	Monitoring Well		Drainage Channels and Ephemeral Streams
	Former Monitoring Well		Groundwater Elevation Isoconcentration Contour (ft amsl)
	MCX Gas Station Monitoring Well included in Sampling Program		Groundwater Elevation (ft amsl)
	Cross Section Line (Figures 2-3 to 2-9)		

Scale in Feet

Figure 2-2
22/23 Area Groundwater
Groundwater Elevations
October 2008

MCB Camp Pendleton, California
PARSONS
 Pasadena, CA





LEGEND

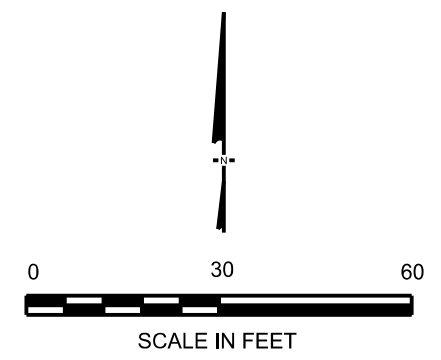
- PROPOSED PERFORMANCE MONITORING WELL SCREENED **WITHIN** PRB TREATMENT ZONE DEPTH (FROM APPROXIMATELY 20'-35' BELOW GROUND SURFACE.)
- PROPOSED PERFORMANCE MONITORING WELL SCREENED **BELOW** PRB TREATMENT ZONE DEPTH (FROM APPROXIMATELY 35'-45' BELOW GROUND SURFACE.)
- APPROXIMATE EXTENT OF PILOT STUDY AREA
- EXISTING MONITORING WELL
- A-A' CROSS-SECTION (SEE WORK PLAN FIGURE 4-2)

1,2,3-TCP ISOCONCENTRATION CONTOUR (µg/L); (ESTIMATED)

- 0.5 µg/L ELEVATION > 30 FT AMSL (~0 TO 25 FT BELOW WATER TABLE)

NOTE:
CALIFORNIA NOTIFICATION LEVEL IS 0.005 µg/L;
RESPONSE LEVEL IS 0.5 µg/L

AMSL = ABOVE MEAN SEA LEVEL
PRB = PERMEABLE REACTIVE BARRIER
1,2,3-TCP = 1,2,3- TRICHLOROPROPANE
ug/L = MICROGRAMS PER LITER
UST = UNDERGROUND STORAGE TANK
ZVZ = ZERO VALENT ZINC



PROPOSED PILOT STUDY
PERFORMANCE MONITORING WELLS
AND ZVZ TREATMENT ZONE

22/23 AREA
MARINE CORPS BASE CAMP PENDLETON
CALIFORNIA

Site Update
Planned Work
Remedial Investigation

IR SITE 1D
MCB CAMP PENDLETON

108th FFA MEETING
17 SEPTEMBER 2012



Agenda/Objectives

- Historical Investigation Overview
- Conceptual Site Model
- Investigation Focus
- Proposed Approach
- Summary

Site Investigation Remediation History

- Remedial Investigation (1993 - 1995) – Group C – Former burning ground area
 - Surface and subsurface soil, groundwater , and biological sampling
 - 22 soil samples from 4 boring locations
 - 3 Monitoring wells installed
 - Analysis for VOCs, SVOCs, metals, PCB, dioxin, TPH, pesticides/herbicides
 - Soil - No organic compounds detected above PSLs; metals above PSLs = Sb, As, Be, Cr, Pb
 - Groundwater – 1,2 DCA exceeding MCL; As, Be, Mn exceed Tap water RSL (PRG)
- Supplemental RI Sampling (1997)
 - Additional 19 samples – metals
 - Confirmed metals in soil from previous RI sampling and added B, Cd, Hg, Zn to list of COPCs
 - Most contamination found was less than 5 feet below grade

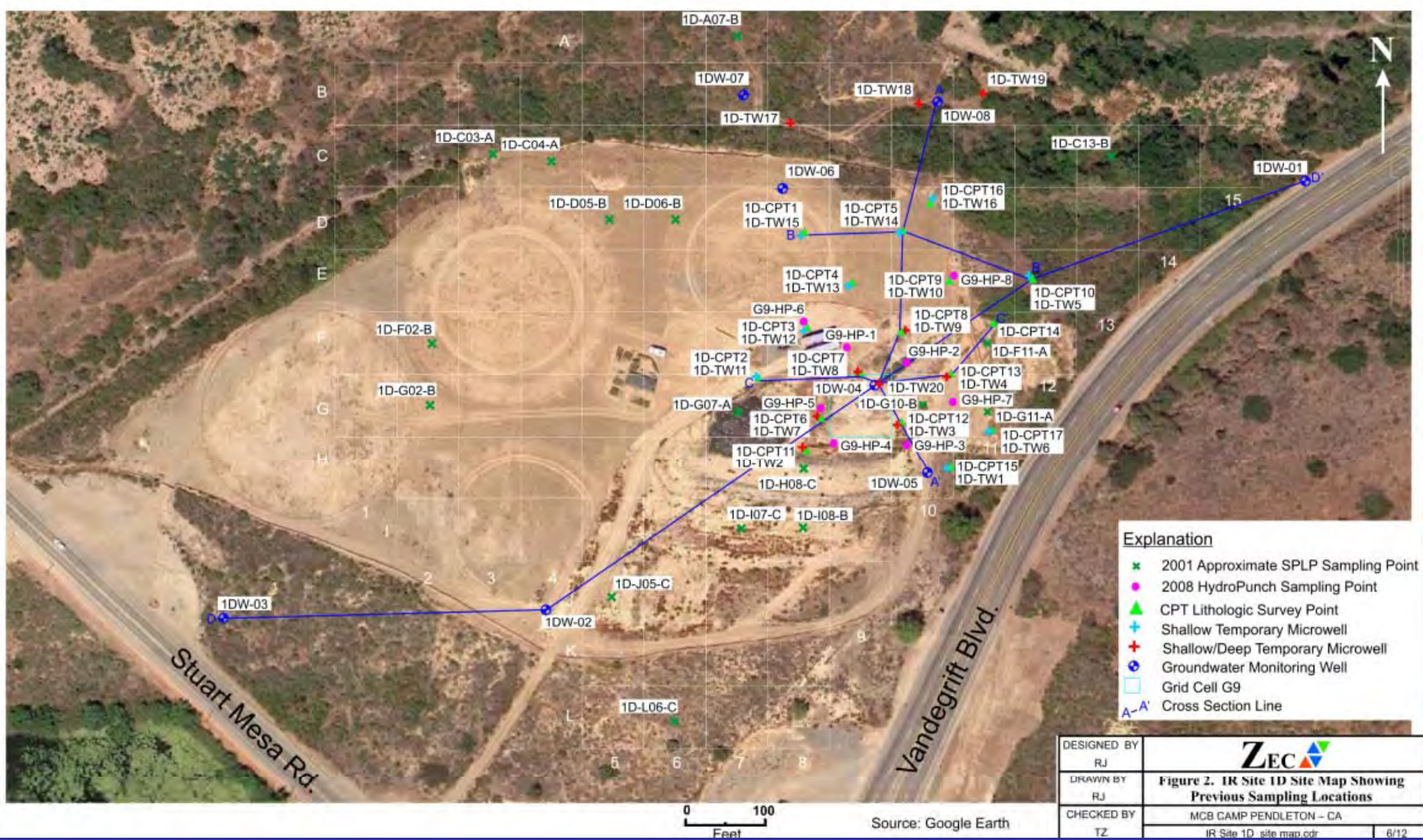
Site Investigation/Remediation History (cont)

- Feasibility Study Data Gap Sampling (2001)
 - 330 borings, 363 soil samples from multiple depths on grid to define lateral and vertical extent of COPCs
 - Metals, SVOCs, dioxin/furans all detected
 - Defined risk (6×10^{-5})
 - Approximated impacted soil volume (31,300 cy)
- Remedial Action (2008 - 2010)
 - 38,300 cy soil removed
 - Grid cell G9: 85 – 90 steel drums found leaking; deeper excavation in that cell
 - Groundwater encountered – VOCs, metals, and pesticides above RSLs
 - Pumping in grid cell G9 – 12,000 gallons removed

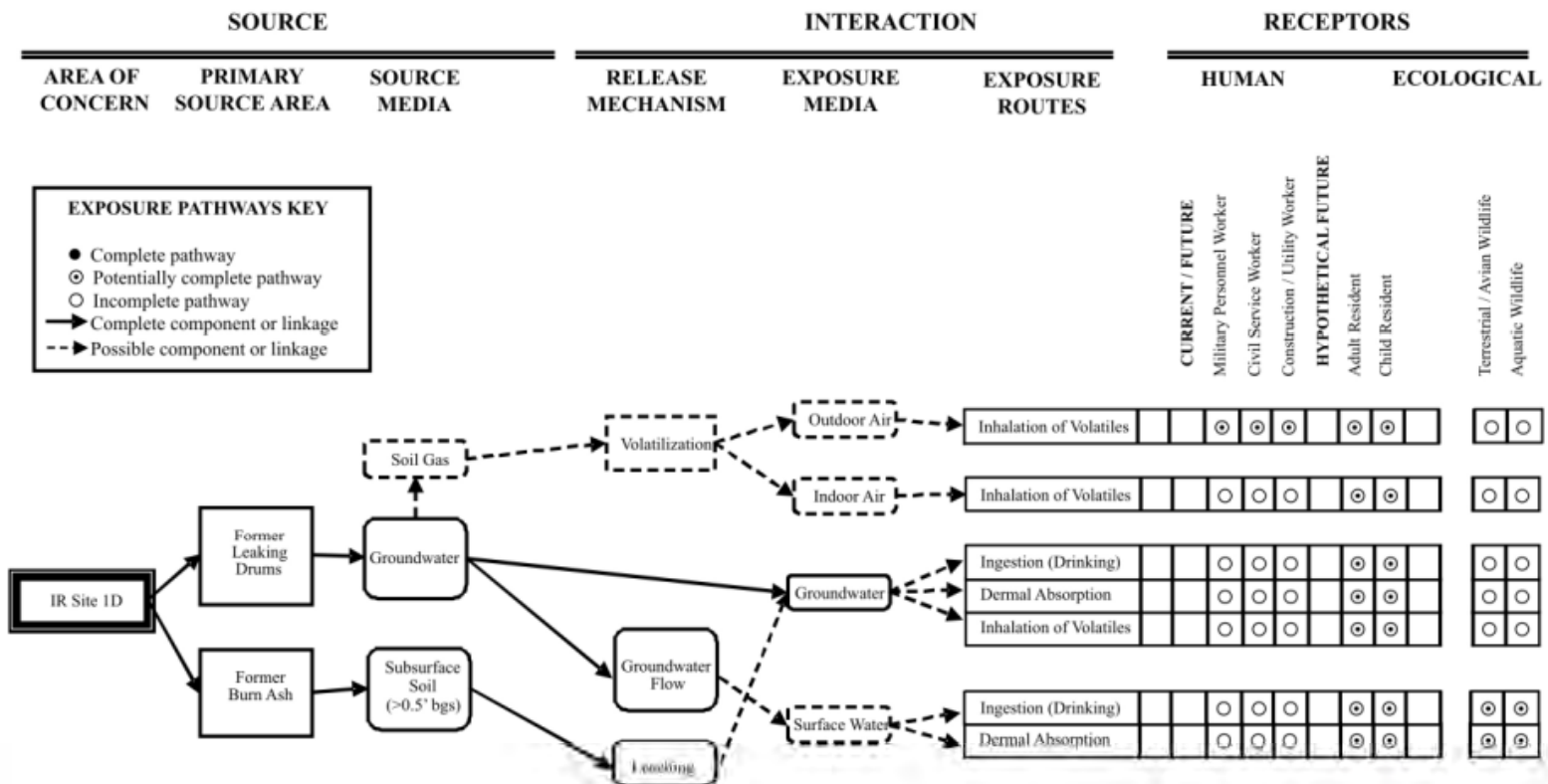
Site Investigation/Remediation History (cont)

- Groundwater Extraction (Sept 09 – Jan 11)
 - Trench extended from Grid cell G9: 50 by ~200 feet long – started during remedial action – extended due to decreasing concentrations
 - ~650,000 gallons removed
 - Decreasing concentrations observed
- Hydropunch Study (2008)
 - Eight locations near G9 to define extent of VOCs in GW
 - VOCs (TCE, 1122 PCA, 112 TCA, cis & trans 1,2-DCE); metals = As, Sb, Cr, Co; and pesticides all exceed RSLs
- Data Gaps Investigation (2012)
 - 16 CPT locations (to 40 feet bgs); 15 + 3 temporary wells (22 – 45 feet bgs, 8 locations included dual nested shallow and deep screens); five permanent monitoring wells (~13 to 24 feet bgs)
 - VOCs, arsenic, and pesticides (4,4'-DDD, 4,4'-DDT) detected in groundwater above RSLs.

Overall Site Map



Conceptual Site Model




EXPOSURE PATHWAYS KEY

- Complete pathway
- ⊙ Potentially complete pathway
- Incomplete pathway
- Complete component or linkage
- - → Possible component or linkage

CURRENT / FUTURE
 Military Personnel Worker
 Civil Service Worker
 Construction / Utility Worker

HYPOTHETICAL / FUTURE
 Adult Resident
 Child Resident

Terrestrial / Avian Wildlife
 Aquatic Wildlife

DESIGNED BY RJ	 Figure 17. IR Site 1D Graphical Conceptual Site Model
DRAWN BY RJ	
CHECKED BY AC	MCB CAMP PENDLETON - CA IR Site 1D CSM.cdr 7/12

Conceptual Site Model Data Gaps (cont)


- Soil – leaching; properties
- Groundwater: volatilization of VOCs to soil gas; gradient and hydraulic properties need definition
- Groundwater – lateral and vertical migration of VOCs, pesticides and metals
- Surface water – not a complete pathway

Groundwater Gradient



Explanation

- Monitoring Well
- (7.14) Groundwater Elevation (in feet above mean sea level)
- Estimated Contour Lines

DESIGNED BY RJ	 Figure 5. IR Site 1D Groundwater Surface Map, March 2012	
DRAWN BY RJ		
CHECKED BY AC	MCB CAMP PENDLETON - CA	IR Site 1D_gwsrfc.cdr
		7/12

RI Focus

- Refining Conceptual Site Model
- Filling additional data gaps
 - Soil gas – none yet collected
 - Soil – leaching and physical properties
 - Groundwater – lateral and vertical extent of COPCs; define hydraulic properties
- Iterative approach with team decision points based on data obtained and shared in real time

Planned RI Field Investigation Elements

➤ Soil Gas

- 23 locations – 5 and 10 feet
- Five locations - 5 foot only (shallow groundwater)

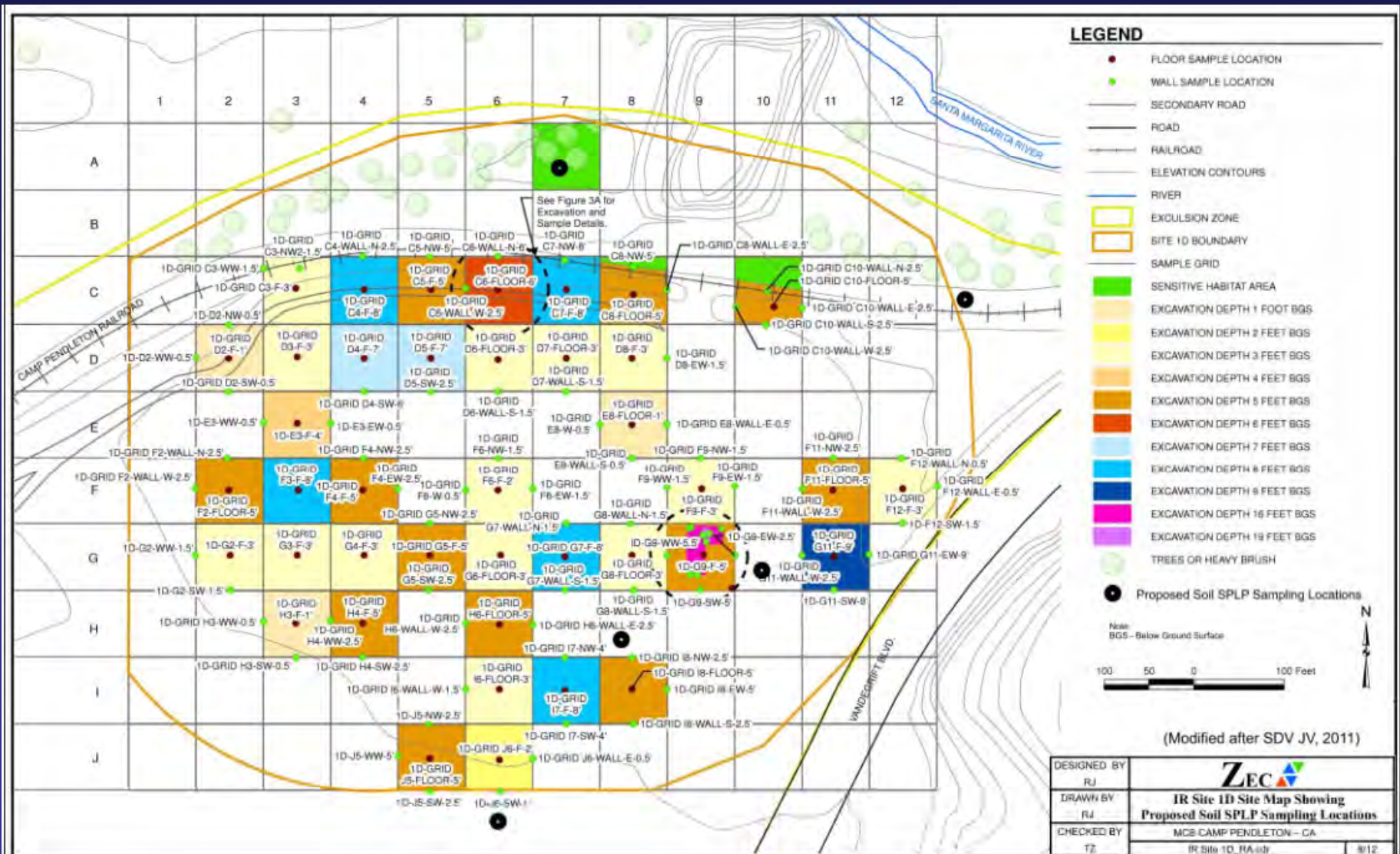
➤ Soil – Leaching and physical properties

- Five locations/SPLP analysis – from previous grid sampling locations
- Four locations from permanent monitoring well locations – physical properties

Planned Investigation – Soil Gas



Planned Investigation Soil Leaching

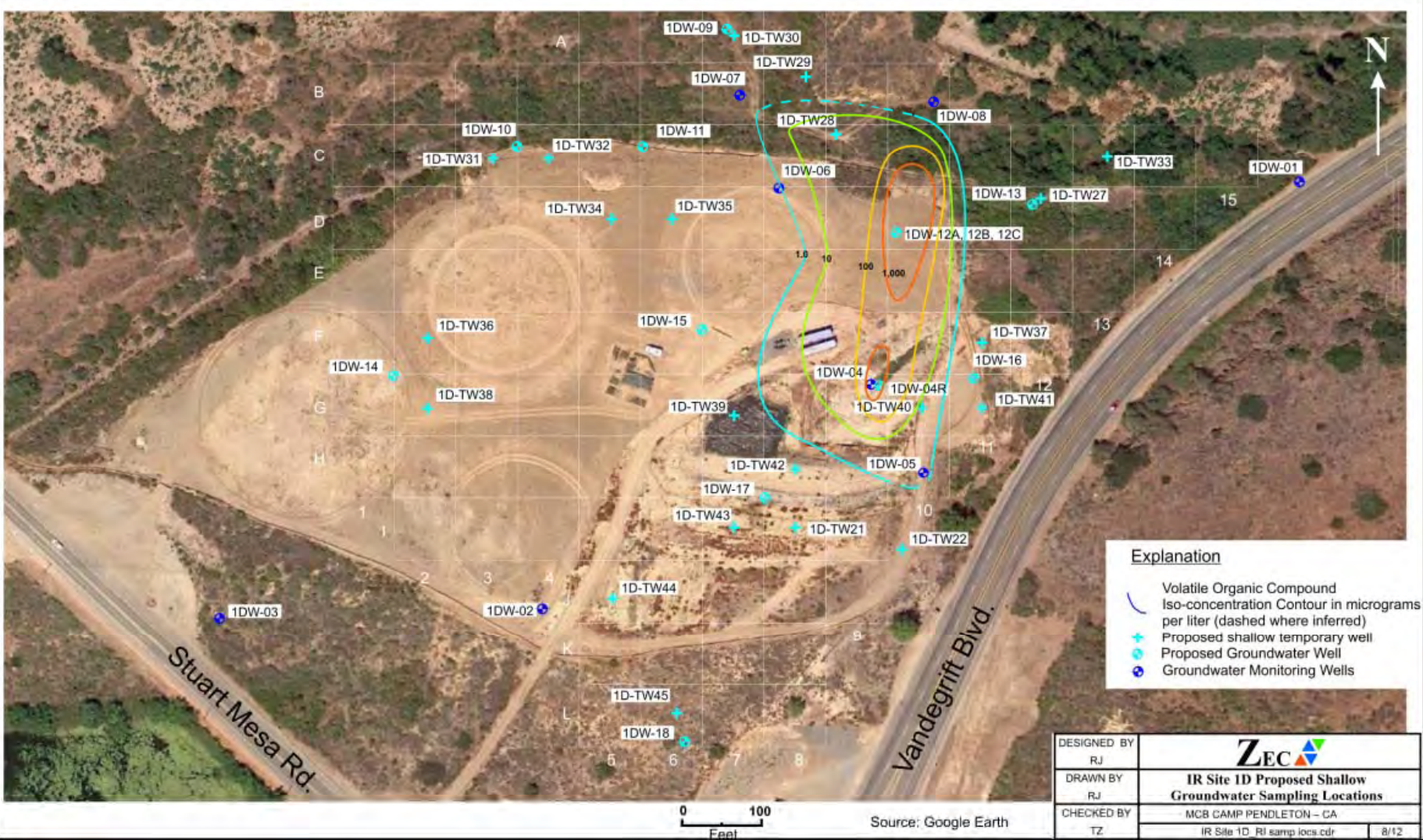


Planned RI Field Investigation Elements (continued)

➤ Groundwater

- CPT – Define lithology
- Shallow temporary wells
 - 17 Locations based on CPT
 - Lateral extent of VOCs/metals
 - Well screen 5 - 15 feet below grade
- Deep – Temporary Wells
 - Four locations and screen depth based on MIPS - DNAPL
 - Well screen anticipated between 26 to 50 feet below grade
- Permanent Monitoring Wells
 - 12 locations
 - Includes one replacement well (1DW-4R)
 - Shallow and deeper

Planned Investigation – Shallow Groundwater



Explanation

- Volatile Organic Compound Iso-concentration Contour in micrograms per liter (dashed where inferred)
- Proposed shallow temporary well
- Proposed Groundwater Well
- Groundwater Monitoring Wells

DESIGNED BY	RJ	
DRAWN BY	RJ	
CHECKED BY	TZ	IR Site 1D Proposed Shallow Groundwater Sampling Locations
		- MCB CAMP PENDLETON - CA
		IR Site 1D_RI samp locs.cdr
		8/12

Planned Investigation – Deep Groundwater



Planned RI Field Investigation Elements

- Analytical

- CPT – Lithology
- MIPS - DNAPL
- Soil Gas
 - VOCs – TO-15
- Soil
 - Leaching – SPLP (EPA 1312/6010B)
 - Physical Properties (pH, soil buffering capacity, bulk density, TOC)
- Groundwater
 - VOCs (EPA 8260B)
 - Metals, (EPA 6010B/7000 series)
 - Pesticides
 - MNA: dissolved gases (e.g., CH₄); D.O., ORP, ferrous iron; TDS
 - Groundwater Quality: Anions (Cl, SO₄, NO₃/NO₂, alkalinity)
 - Aquifer Test (hydraulic conductivity) and water levels

Summary

- Multiple studies/remedial actions have revealed a complex site
- Remedial Investigation includes
 - Soil gas – examine concentrations from GW
 - Soil – leaching and physical properties
 - Groundwater – horizontal and vertical extents
 - Multiple team consultations
- RI will fill data gaps to refine CSM and determine what additional Remedial Actions may be necessary



MARINES
THE FEW. THE PROUD.

MARINE CORPS BASE
CAMP PENDLETON

*COMMENTS/
QUESTIONS?*



**Remedial Investigation
IR Site 150
Marine Corps Base Camp Pendleton**

17 September 2012



- **IR Site 150 is a possible former disposal pit**
- **IR Site 150 is located at the northwestern corner of the intersection of 9th St. and Boat Basin Rd. of 21 Area**
- **Was discovered following a Freedom of Information Act (FOIA) request to the USEPA regarding use of chemicals at Camp Pendleton to support a claim by a Vietnam Veteran**
- **In response, NAVFAC conducted a Site Discovery Assessment and consequently a Site Inspection**

IR Site 150

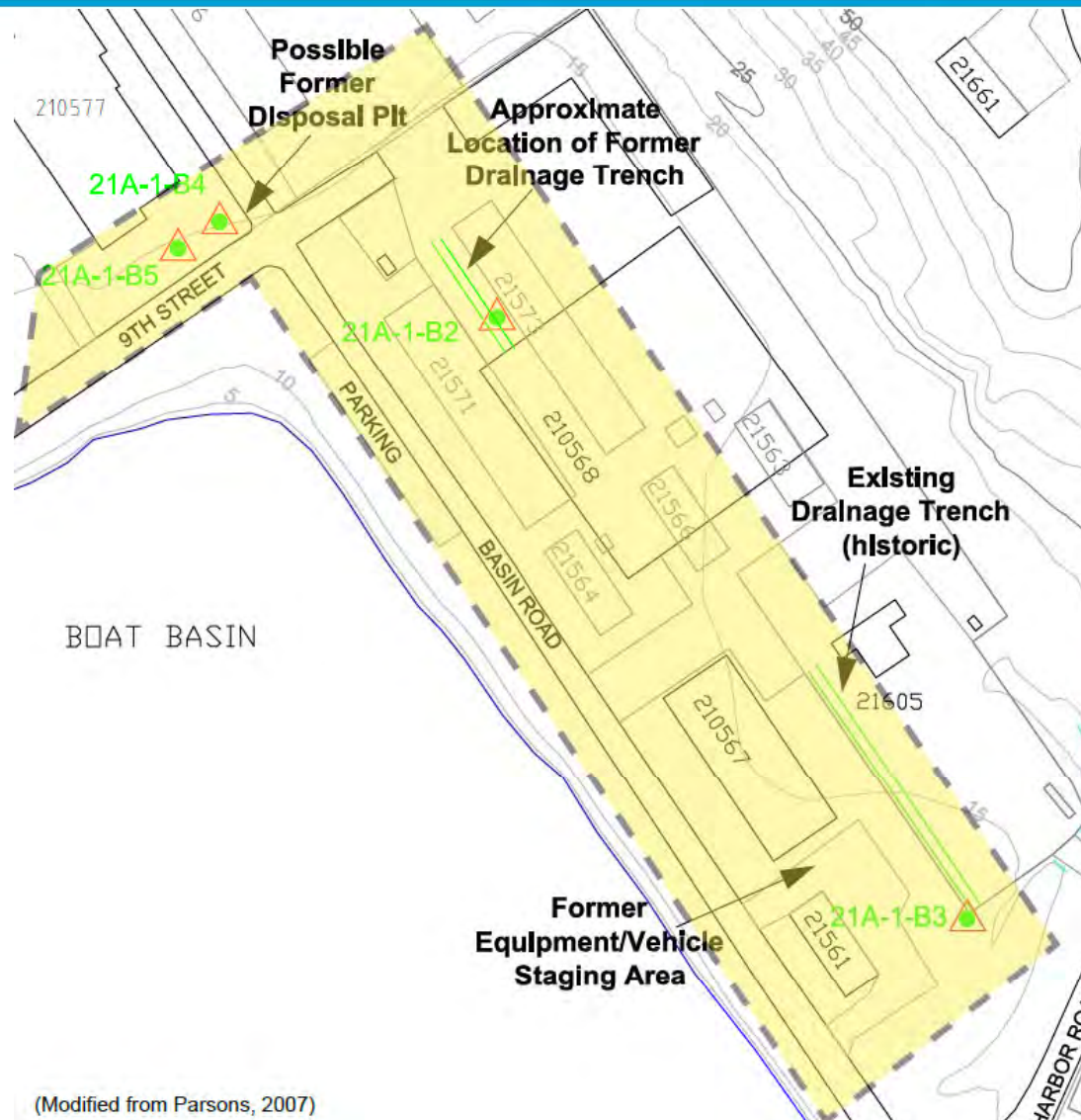


Discovery Site Report Overview

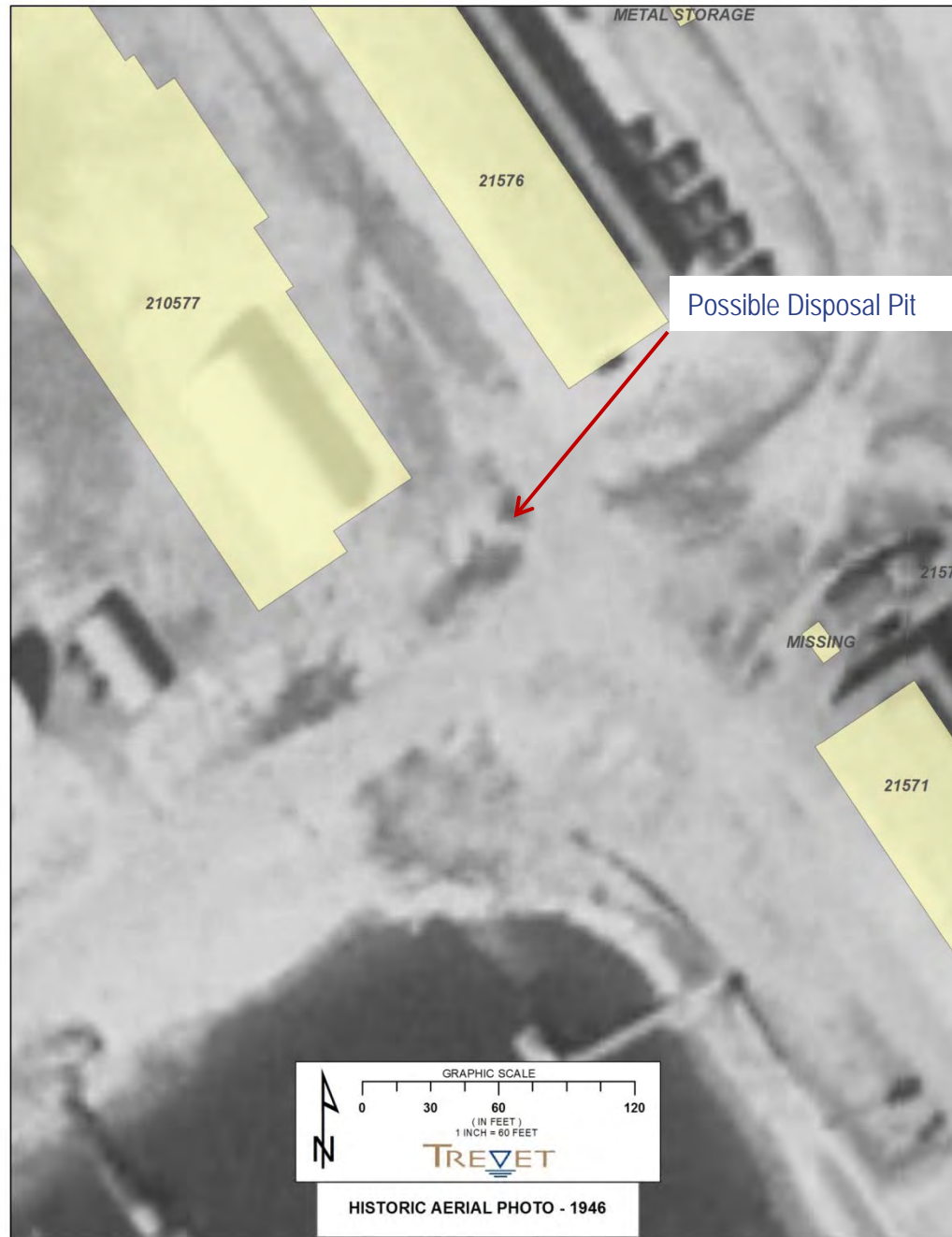


- **Site Discovery Assessment conducted by Parsons in December 2007 and January 2008 at the 21 Area and Camp de Luz.**
- **Four borings were drilled for soil and soil gas sampling at Location 1, 21 Area. Two of the borings within IR Site 150 (as shown on next slide).**

Discovery Site Report Overview



(Modified from Parsons, 2007)









Soil Gas

- **Two soil gas samples collected. Vinyl Chloride was detected above the residential soil gas CHHSL in one location (21A-1-B5)**
- **PCE, TCE, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, and 1,1-DCA were also detected (but below CHHSL) in the gas sample collected from the same location**
- **The VC detection in soil gas is likely to be related to a historical release of PCE or TCE that has degraded over time**



Soil

- **Ten soil samples collected from the two borings at the “Possible Former Disposal Pit” (IR Site 150). Samples collected from ground surface to 10.5 feet bgs.**
- **Soil samples analyzed for VOCs, SVOCs, dioxins/furans, TPH, and metals.**
- **No soil samples had detected concentrations of VOCs, SVOCs, or dioxins/furans above residential or industrial soil RSLs.**
- **TPH in soils were detected in 2 samples from boring 21A-1-B4 (2.0-2.5 feet and 5.0-5.5 feet); the highest concentration was 130 mg/kg.**



Soil

- **Arsenic was the only metal detected at concentrations above its residential soil RSL of 0.39 mg/kg.**
- **The highest detection of arsenic at the site was 8.48J mg/kg in boring 21A-1-B5 (10-10.5 feet).**
- **Detections of arsenic in soil at the site are considered to be within naturally occurring background concentrations for southern California. The upper-bound concentration is 12 mg/kg.**

Site Inspection Report Overview



- **Conducted by TEC Inc, and SDV JV in January and February 2012**
- **The SI was designed to assess concentrations of VOCs in soil gas, soil, and groundwater and to provide data to assess the potential for risk to human health and the environment from chemicals associated with the former disposal pit**

Site Inspection Report Overview



- **The Project Screening Levels identified were:**
 - **US EPA RSLs in conjunction with the CA Modified values documented in DTSC's Human Health Risk Assessment (HHRA) for soil**
 - **California Toxics Rule (CTR) human health exposure concentrations for the consumption of organisms only for groundwater**
 - **DTSC-modified Johnson and Ettigner (J&E) Soil Gas Vapor Model for Migration of VOCs to indoor air that include CA Health Criteria for soil gas**

- **The PSLs for soil and soil gas were based on the residential use scenario**

SI Report Overview Continued



- **10 soil borings drilled for collection of groundwater grab samples and soil vapor samples (2 per boring) – analyzed for VOCs**
- **Soil samples collected from 5 borings (sample interval between 10-12 feet bgs) – analyzed for VOCs and TPH**
- **5 temporary soil vapor monitoring points were installed along southern perimeter of Building 210577. One near ST150BH10 – soil vapor samples analyzed for VOCs**
- **3 monitoring wells installed – groundwater analyzed for VOCs**

SI Report Overview Continued



Site Layout Map, Sample Locations
 Site Inspection Report
 IR Site 150
 Camp Pendleton MCB, California

LEGEND

- ST150MW03
 Monitoring well
- Groundwater/soil vapor borehole
- Shallow soil vapor monitoring point
 ST150SW03

Graticule scale is in feet.
 Coordinate system is NAD83
 California State Plane, Zone 6.





- **VOCs were detected above the project screening levels in soil, soil gas, and groundwater**

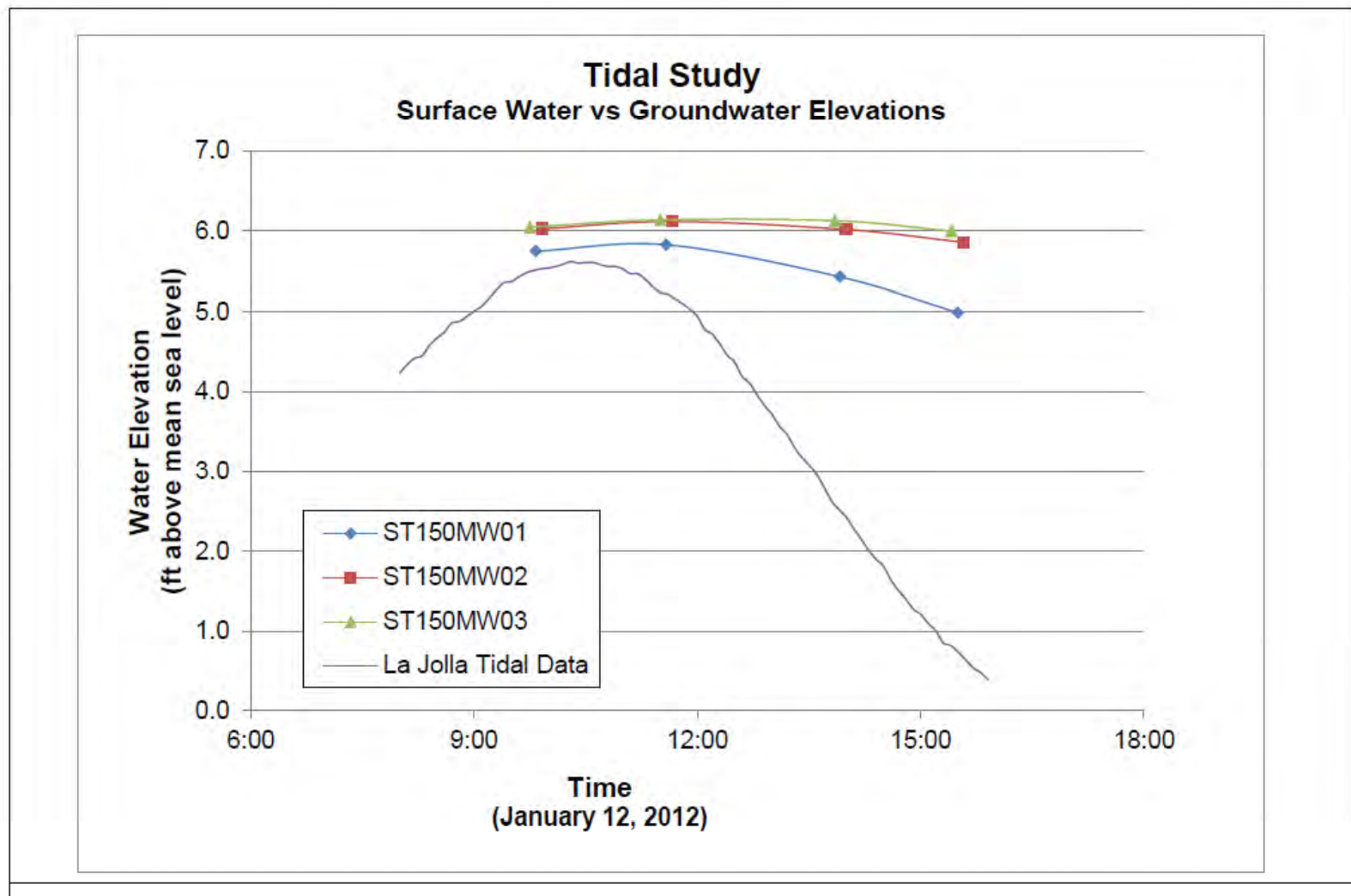
- **COPCs detected above project screening levels included:**
 - **PCE, 1,1,1-TCE, 1,1-DCA, naphthalene, and xylenes in groundwater;**
 - **VC and naphthalene in soil vapor; and**
 - **PCE in subsurface soil samples**

SI Report Overview Continued



- **A limited hydrologic tidal study was also conducted to better understand the interaction of groundwater beneath the site with the adjacent surface water of the Del Mar Boat Basin**
- **Results of the limited tidal study indicated that the groundwater under the site was tidally influenced and the hydraulic gradient during the study was toward the Del Mar Boat Basin**

SI Report Overview Continued



SI Report Overview Continued



SI Report Findings Continued



- A secondary source area of chlorinated VOCs was identified based on subsurface soil samples in the vicinity of sampling location ST150BH10/ST150MW02



- However, based on review of aerial photographs provided in this presentation, a secondary source area is unlikely. ST150BH10 located very close to disposal pit (refer to slide 16).

SI Report Recommendations



- **No COPCs exceeded screening levels in the downgradient sample location ST150BH09 and ST150MW01, providing evidence of a localized plume extending southward in the direction of the Del Mar Boat Basin.**
- **Additional information be collected at the site to better quantify the risk to human health and the environment associated with the contaminants that remain onsite**

Proposed Remedial Investigation



- **Conduct the RI fieldwork for IR Site 150 which will include:**
 - **direct push drilling for the collection of soil, groundwater, and soil gas samples**
 - **installation of up to five monitoring wells**
 - **four quarterly groundwater monitoring events**

- **Prepare the RI Report for IR Site 150**

RI Fieldwork Continued



- **Installation of 8 soil gas boring locations and collection of 16 soil gas samples (2 per location at anticipated depths of 5 ft and 10 ft bgs) for VOC analysis by Method TO-15**
- **Installation of 9 direct push borings and collection of 45 soil samples (5 soil samples per boring) and 9 groundwater grab samples (1 sample per boring) for analysis of VOCs plus oxygenates by Method 8260B**
- **Convert up to 5 of the 9 direct push borings to permanent monitoring well locations based on results from direct push sampling**
- **Develop up to 8 monitoring wells (5 newly installed wells and 3 existing wells)**

RI Fieldwork Continued



- **Conduct 4 rounds of groundwater sampling (including the 5 new wells and 3 existing monitoring wells) and analyze samples for VOCs/oxygenates, methane, and general chemistry parameters**
- **Collection of applicable quality control samples**
- **Data validation at 80% Level III and 20% Level IV**
- **Waste characterization sampling and appropriate investigation-derived waste disposal within 60 days per MCB Camp Pendleton policy**

Proposed Sampling Locations for RI



- Conduct an RI Level HHRA and SLERA
- Human receptors will include future potential residential receptors, industrial receptors, and construction workers (including trench analysis)

Box Canyon Landfill

Landfill Gas Mitigation System

Adam Hill

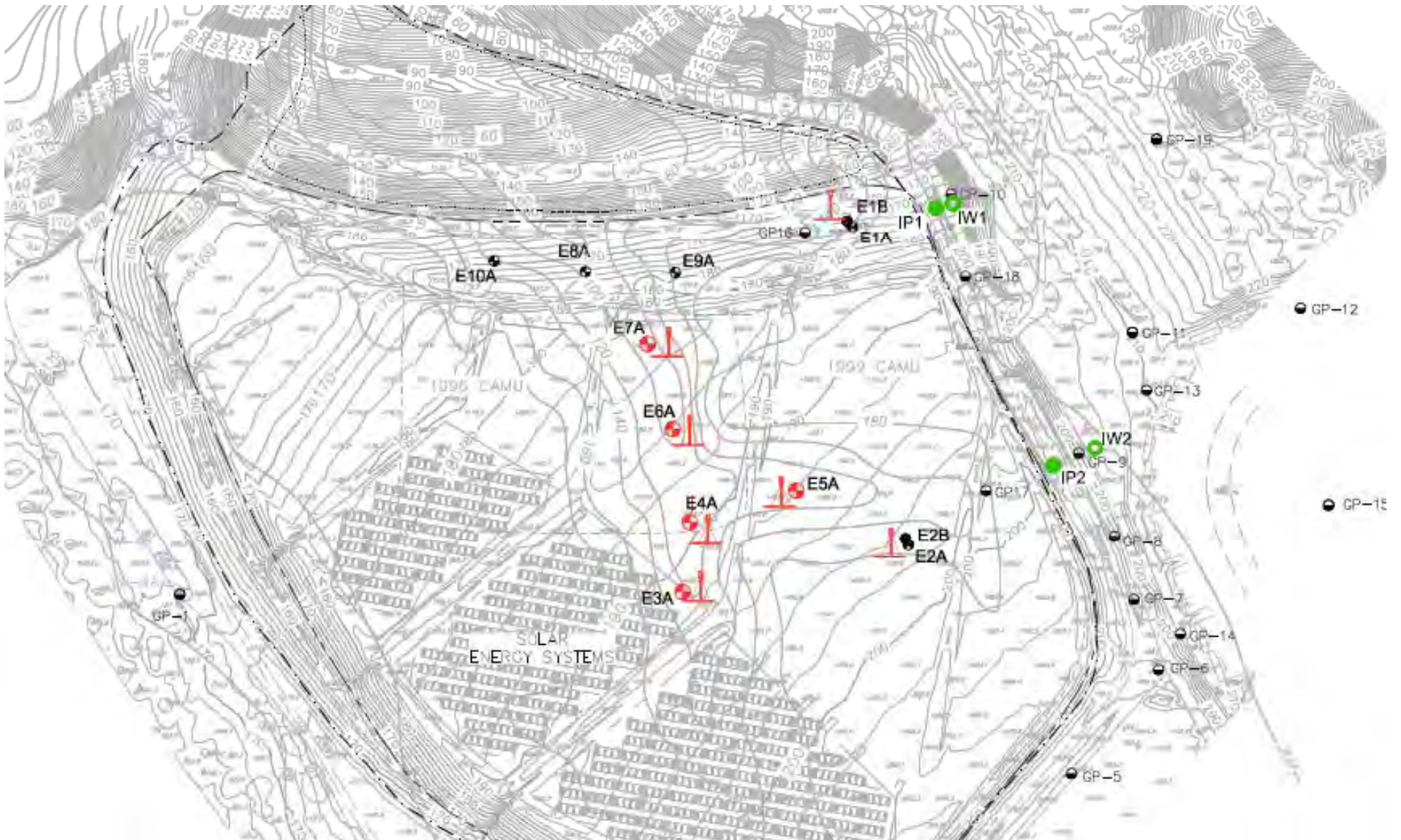
September 17, 2012



Technical Approach

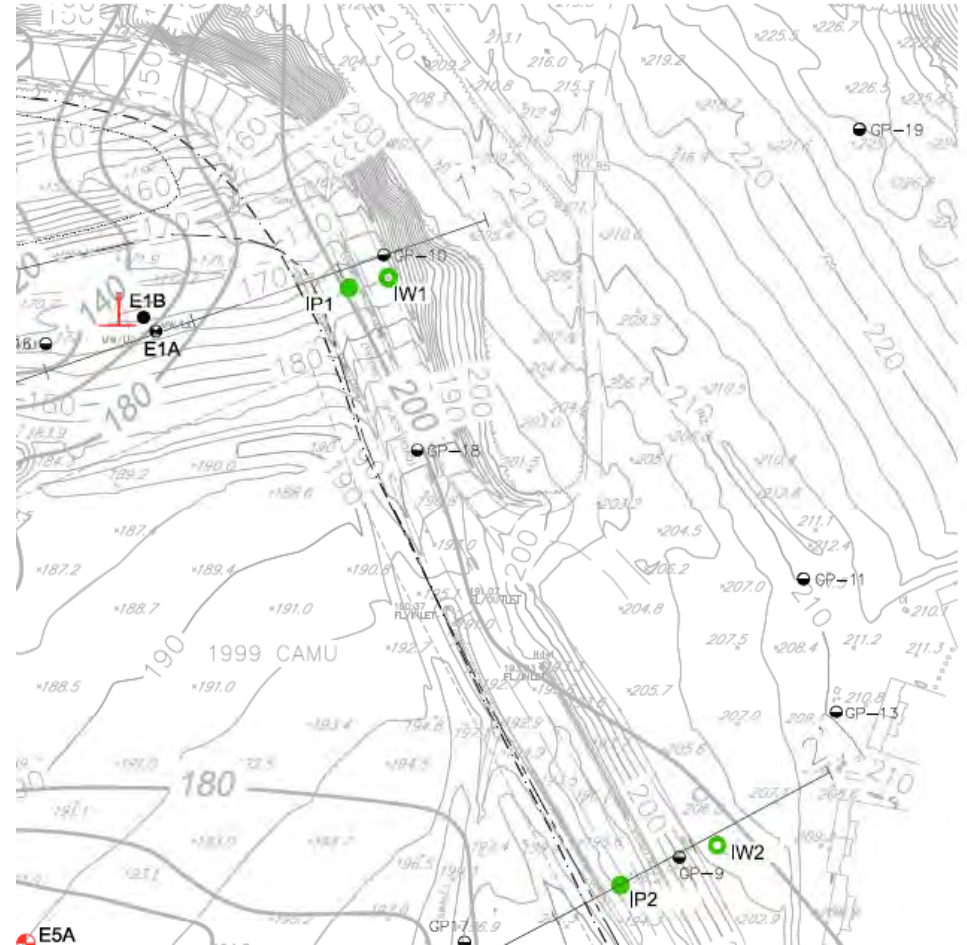
- Air Injection
 - 2 Injection wells
 - 2/2012
 - 2 Monitoring wells
 - 2/2012
- Solar Spark Vent Flares
 - 5 new extraction wells
 - 4: 12/2011
 - 1: 1/2012
 - 2 existing extraction wells

Technical Approach



Injection & Monitoring Wells

- Injection wells (IW)
 - 3 depths, 15' screens
- Monitoring wells (IP)
 - 3 depths, 10' screens

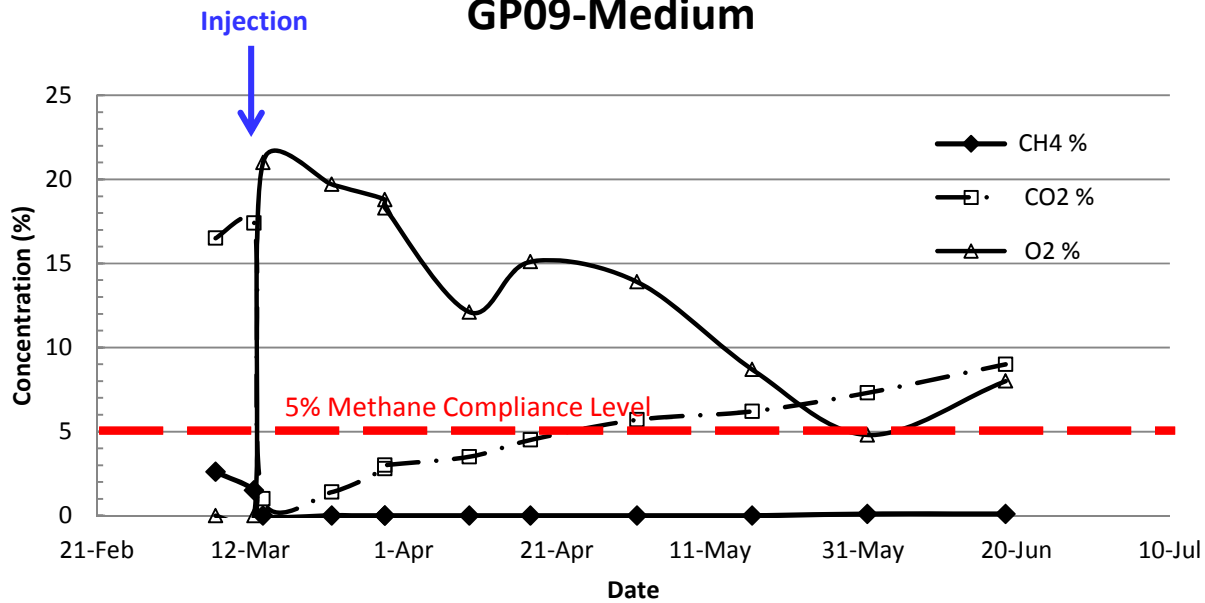


Air Injection

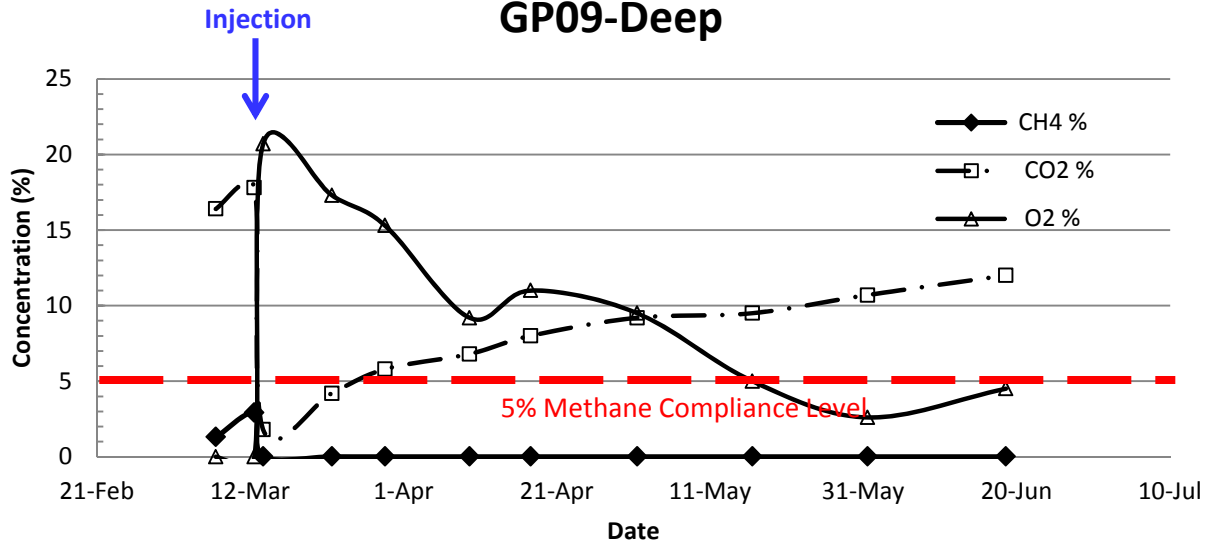
- Two day injections
 - IW1: 3/14 & 3/15
 - IW2: 3/12 & 3/13
 - 5 – 30 psi
 - 25 – 55 cfm
- Monitored IP and GP:
 - Pressure, temp, CH₄, CO₂, CO, O₂, N₂
- Surface CH₄



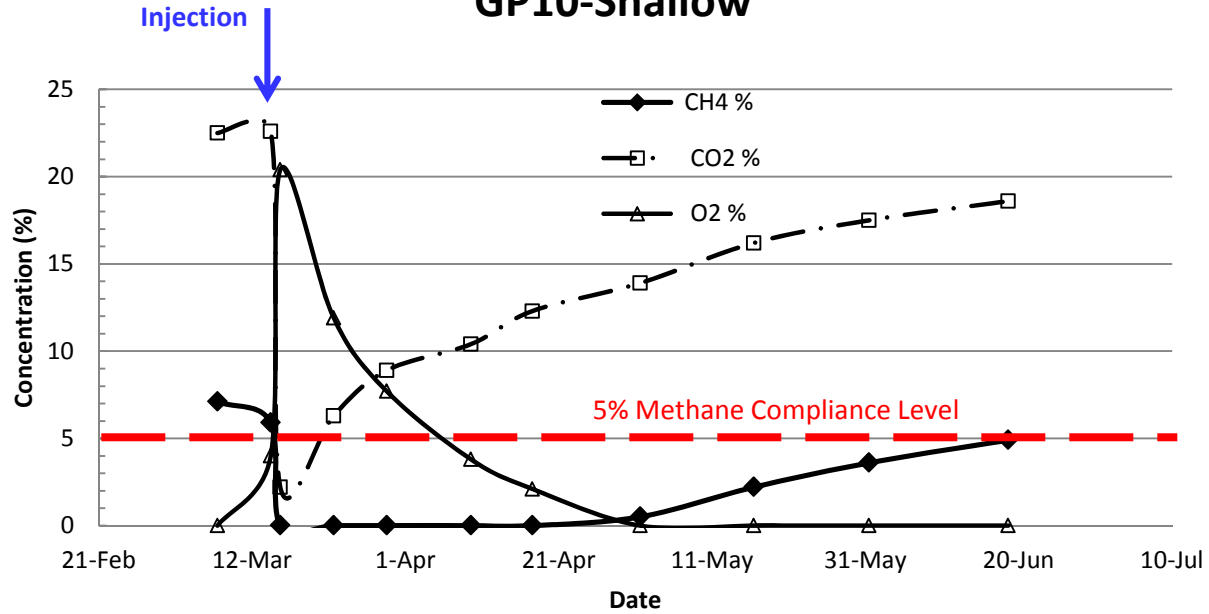
Soil Gas Composition Trends GP09-Medium



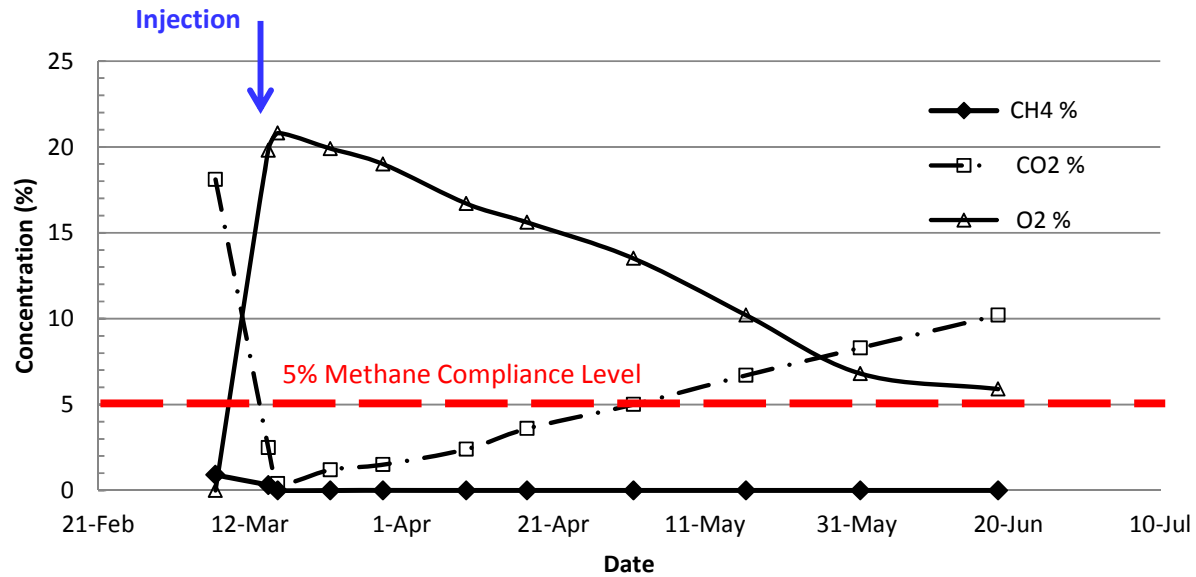
Soil Gas Composition Trends GP09-Deep



Soil Gas Composition Trends GP10-Shallow



Soil Gas Composition Gas Trends GP10-Medium



Extraction Wells

- 36" boring
- 6" casing
- 60' to 90' deep



Solar Power Vent Flares

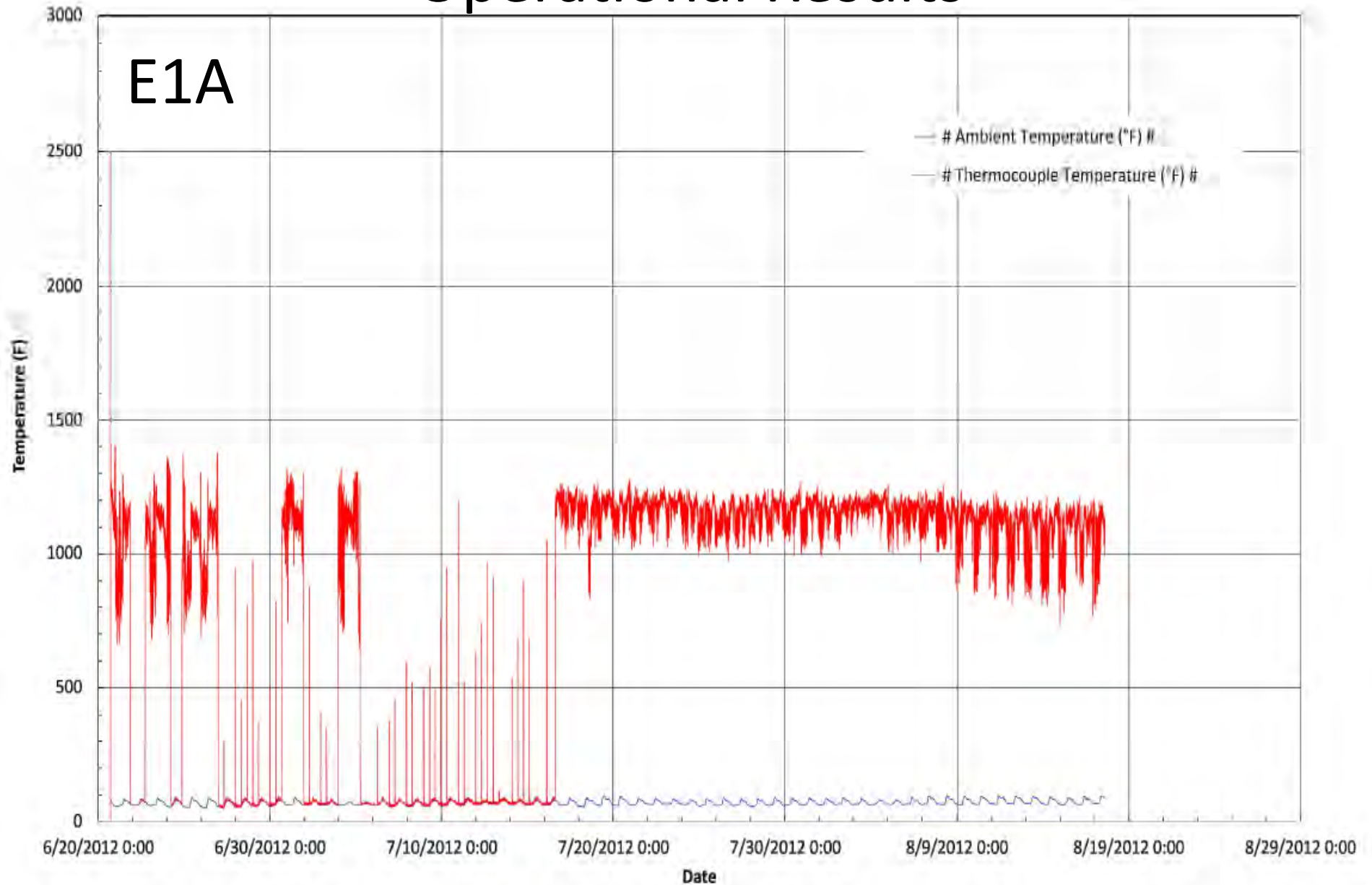
- Installation: 6/18
- Operational: 6/22
- Automated valve
 - Opens $>200^{\circ}\text{F}$
 - 5 min ignition
 - Closes $<200^{\circ}\text{F}$
 - 8 hour delay



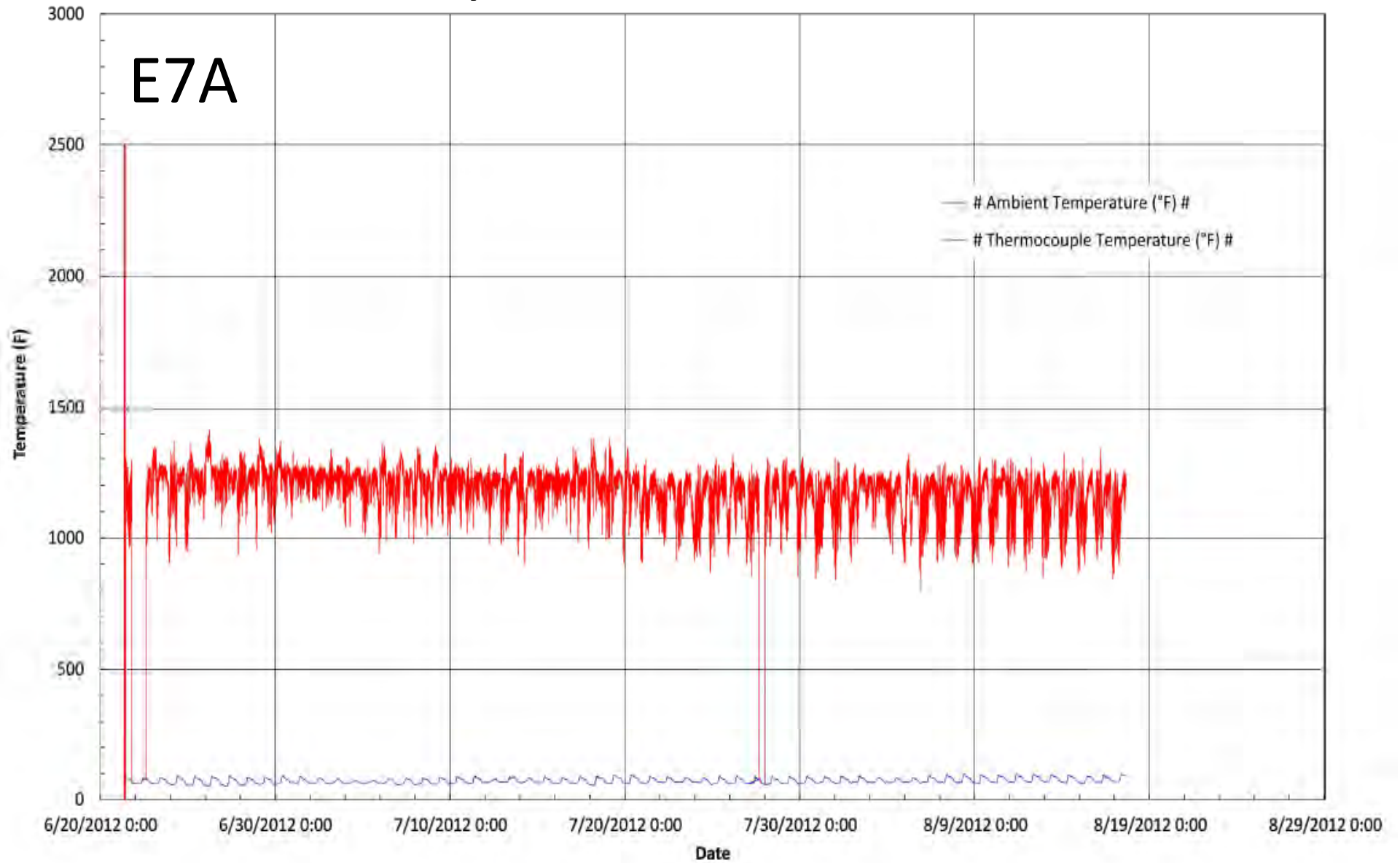
Operational Results

- Flow: 20 to 50 CFM total
- Pressure: 0.5 to 3 inches of water
- Methane: 47% - 70%
 - Average 58%
- Up time: 70% - 99%
 - Average 86%

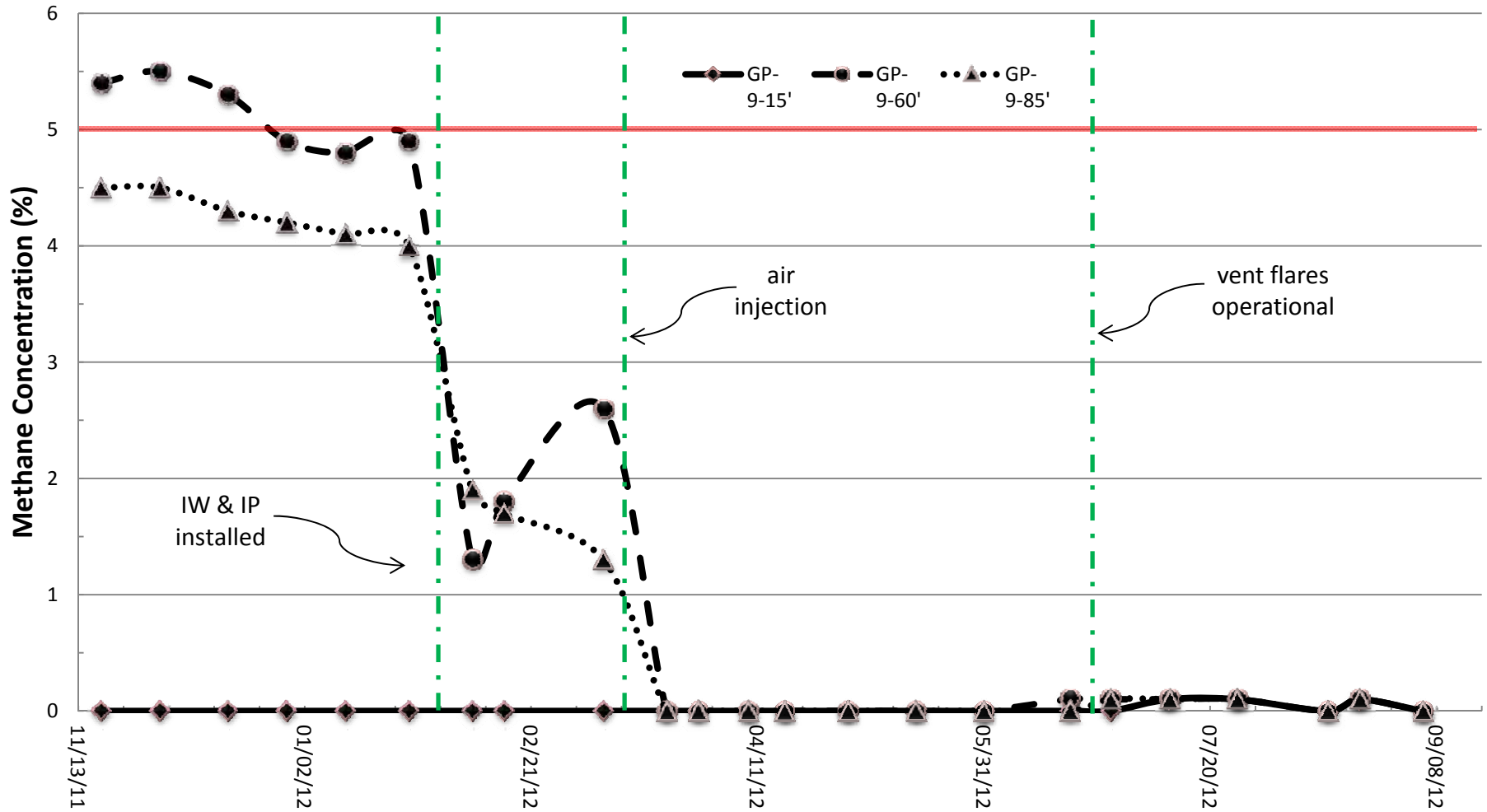
Operational Results



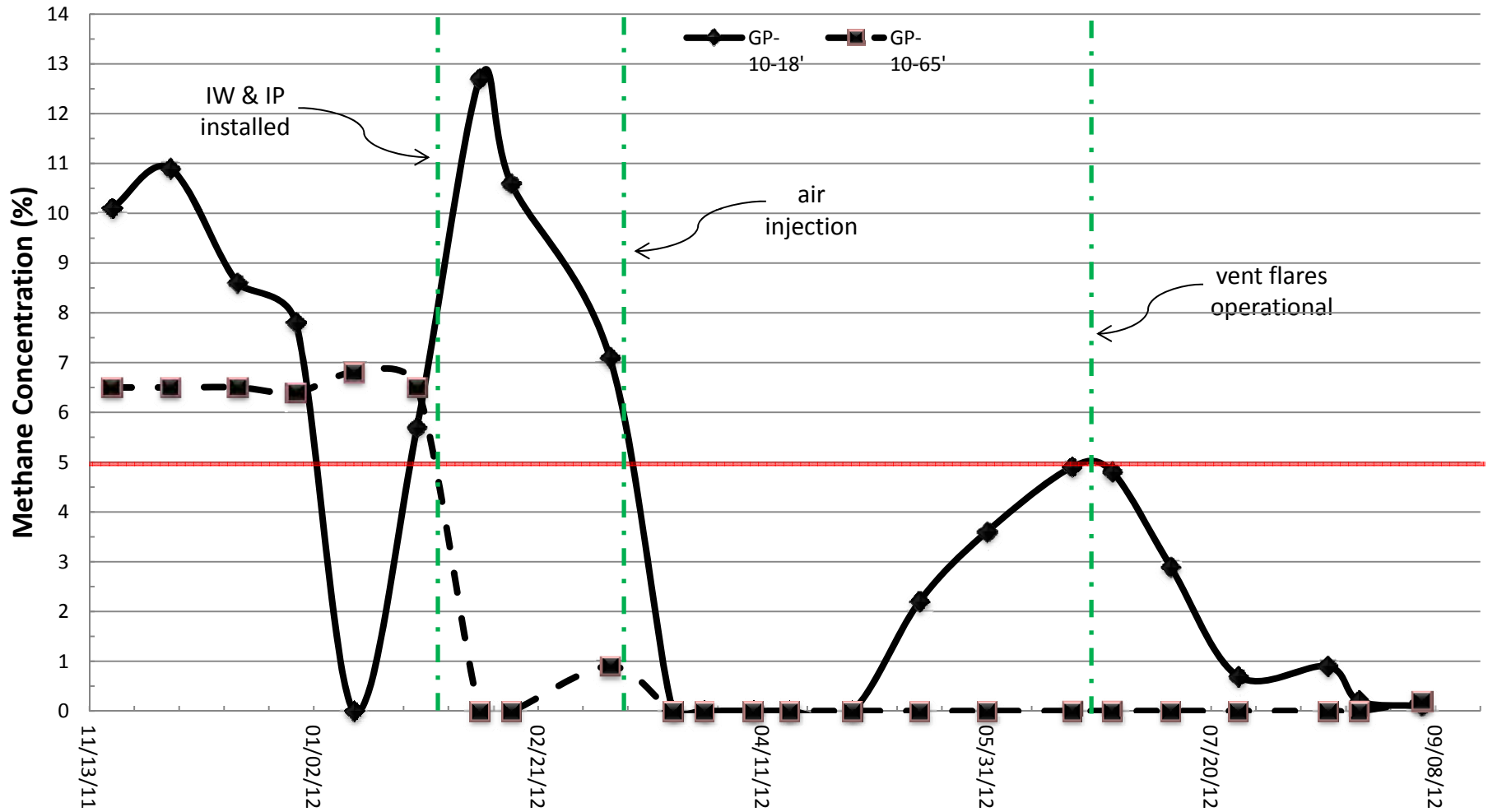
Operational Results



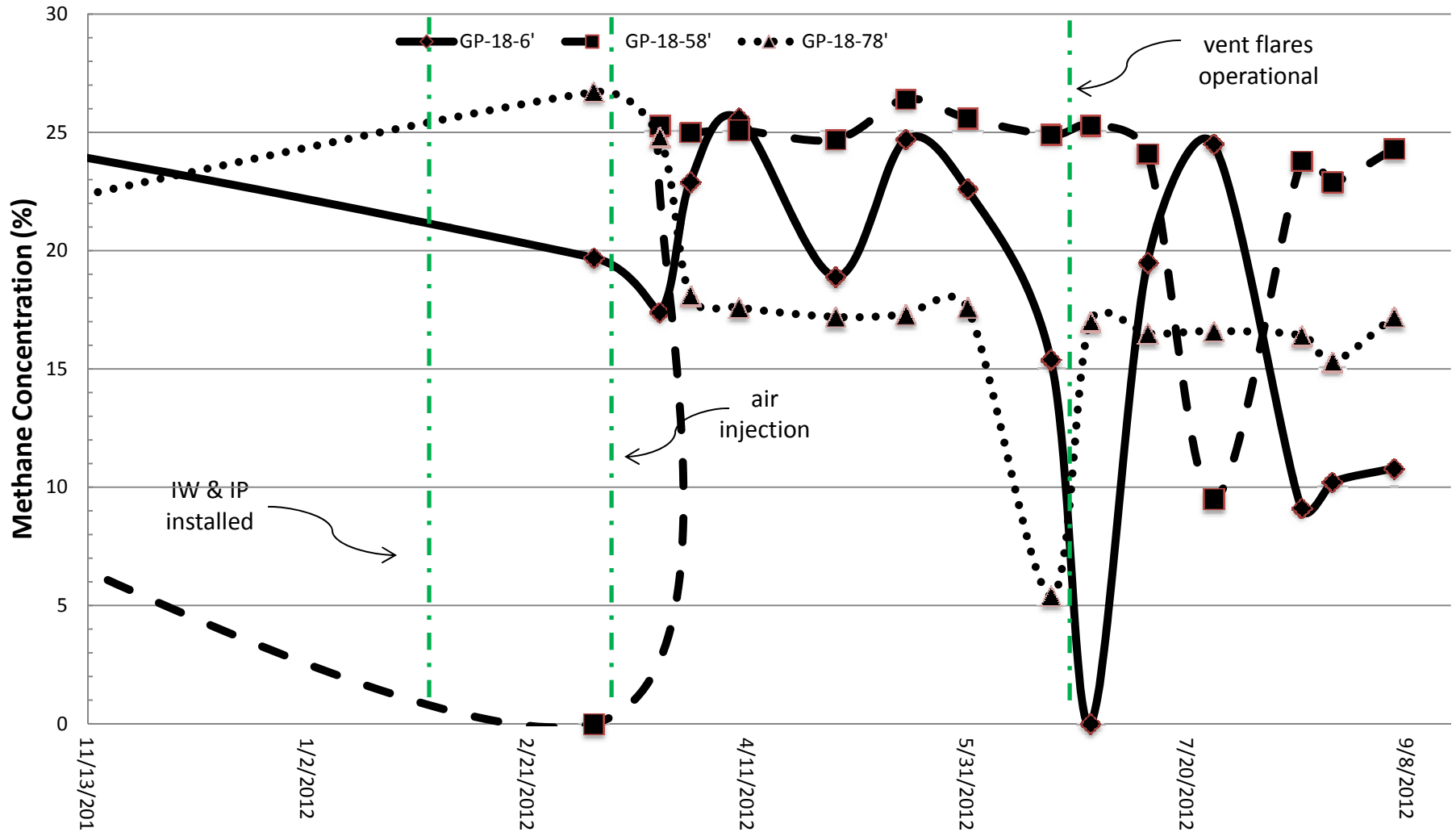
Compliance Probe Results GP-9



Non-Compliance Probe Results GP-10



Non-Compliance Probe Results GP-18



Outlook

- Relight E2A and E5A following PV Panel install
- Implement O&M
- Evaluate air injection and/or vent flare options

Questions

