Naval Facilities Engineering Command Southwest
San Diego, CA

MEETING MINUTES FOR THE 127TH FEDERAL FACILITIES AGREEMENT (FFA) MEETING HELD JUNE 20, 2019

MARINE CORPS BASE CAMP PENDLETON, CA

August 22, 2019

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FOR THE 127TH FEDERAL FACILITIES AGREEMENT (FFA) MEETING
HELD JUNE 20, 2019

MARINE CORPS BASE CAMP PENDLETON, CA

August 22, 2019

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
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San Diego, CA 92132

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PROJECT NOTE NO. 77

SUBJECT: Marine Corps Base (MCB) Camp Pendleton Federal Facilities Agreement (FFA) Meeting (No. 127)

DATE HELD: June 20, 2019

Attendees**:**

- Ralph Pearce (Naval Facilities Engineering Command Southwest [NAVFAC SW])
- Steve Griswold (NAVFAC SW)
- Jennifer Sullivan (MCB Camp Pendleton Environmental Security [ES])
- Luis Ledesma (MCB Camp Pendleton ES)
- Mark Ripperda (United States Environmental Protection Agency [USEPA])
- Gregory Shaffer (California [Cal] EPA/Department of Toxic Substances Control [DTSC])
- Ted Peng (DTSC)
- Roger Mitchell (San Diego Regional Water Quality Control Board [RWQCB or Water Board])
- Tanya Nelson (RWQCB)
- Sophie di Campalto (RWQCB)
- Bryce Bartelma (NAVFAC SW)*
- Dan Griffiths (Parsons)

Attendees via Conference Call:

- Kimberly Gettmann, PhD (DTSC)
- Lauri Roché (Parsons)

* denotes partial attendance

Introduction

The 127th Camp Pendleton FFA Meeting was held at Parsons' Offices in San Diego, CA to update the FFA Team (Team) on program status. The agenda, sign-in sheet, Deliverables Spreadsheet (including status on fieldwork and responses to agency comments), updated FFA Schedule, and the meeting presentations are attached.

San Onofre Nuclear Generating Station (SONGS) Environmental Update

Mr. Bartelma provided an environmental update on the SONGS facility (attached). Southern California Edison (SCE) is seeking a real estate lease extension or new lease agreement to plan powerplant decommissioning efforts and to evaluate the future of an Independent Spent Fuel Storage Installation (ISFSI). The existing easement was executed in 1963 and expires 12 May 2024 and they would like to extend that to return

to the Department of the Navy (DON) in 2051 (a 26 year extension). Mr. Bartelma said that the DON wants to encourage maximum participation by regulatory agencies to ensure the site meets the requirements for unrestricted use/unrestricted exposure (UU/UE) with no issues in the future. Dr. Gettmann asked if they have a toxicologist on the project. Dr. Gettmann went on to say the DTSC has a toxicologist specializing in this and would provide that information to Mr. Shaffer. Mr. Bartelma asked if there was an interest by the FFA team for further information and Mr. Mitchell said he thought the Water Board would want to be involved. Mr. Bartelma said he would be sending out a letter and provided a schedule in the presentation. The critical path item is to remove the spent fuel from the site and then they will proceed with investigation, cleanup (if required), and closure.

Deliverables Schedule Discussion

Mr. Pearce and Mr. Griswold discussed the items on the Deliverables Spreadsheet (attached) and noted that the ones marked as final will be removed from the next version of the spreadsheet. There was some additional team discussion on specific items as follows:

- Item 1, Record of Decision (ROD) for Site 33: The ROD is being circulated to the FFA Team for signature. Mr. Mitchell indicated that the RWQCB would like the reference to State Water Resources Control Board (SWRCB) Resolution 88-63 removed, which establishes criteria to help identify potential sources of drinking water. The RWQCB says that SWRCB Resolution 88-63 should only pertain to modifying basin plans to designate water as non-drinking water and is not applicable for Land Use Controls (LUCs) and/or Monitored Natural Attenuation (MNA). This also applies to the other RODs and Land Use Control Implementation Plans (LUCIPs) on the Deliverables Spreadsheet, Items 7, 8, 9, 10, and 12. Mr. Mitchell further clarified that RWQCB had no issue with the ROD language pertaining to lack of current or future water use and language pertaining to LUCs but the reference to 88-63 should be struck as 88-63 does not apply in this case.

Following the discussion of the documents, Ms. Nelson asked for some clarification on the document progression from Draft to Final. Mr. Pearce explained that based on the FFA Agreement, the agencies have 60 calendar days to review, then the Navy responds to the comments and will issue a response to comments and/or a Draft Final document, and if there are no objections in 30 calendar days then the Navy will issue a Final Document. But in some cases, particularly with documents that are relatively straight forward, comments on the draft are addressed in detailed responses to comments matrices and once the RTCs are approved DON proceeds to final.

Site 1116 Remediation Update

Mr. Griffiths reviewed the site history and provided an update on the Site 1116 TCRA Remediation (please refer to attached presentation). The presentation included baseline sampling results, details on the TCRA enhanced in-situ bioremediation (EISB) injection work, and groundwater monitoring results three months after injection. It was noted that there are gaps in the plume since injection. Indoor air sampling also continued at Building 14010 and results continue to indicate that volatile organic

compounds (VOCs) from the groundwater plume are not impacting indoor air quality. Mr. Ledesma commented that the buildings are not currently being used for housing. The buildings are scheduled for refurbishment and may be remodeled into offices for civilian contractors. The buildings are currently unoccupied, but in-door air sampling continues.

Based on the eighteen wells installed upgradient of the plume, it appears that the source area has been identified as an outdoor storage area next to Building 1132. A small building was present based on the 1980 aerial photograph but has since been removed. The plume extends approximately 1,100 feet further upgradient than previously known and 75 TCRA injection points are proposed for additional EISB injection (same substrate used previously) and three additional performance monitoring wells are proposed. Mr. Peng asked if any soil gas data had been collected to support the supposition that this is the source area. Mr. Pearce replied that additional sampling is planned. Dr. Gettmann commented that additional indoor air sampling may be needed if the buildings are empty and then reoccupied because vapors could build up in the unoccupied buildings.

There was further discussion about the source and the possibility that someone may have dumped a single small container of trichloroethene (TCE) based on concentrations in the plume. TCE volume estimates conducted by TetraTech indicate that the TCE mass within the plume equates to approximately 1 gallon of raw TCE. Mr. Ledesma said there were no official records of spills. Dr. Gettmann said she attended a Department of Defense (DoD) presentation recently that indicated that chlorinated solvent based degreasers are still used for critical functions. Not necessarily at MCB Camp Pendleton, but still used at some military bases for specific applications. Mr. Ledesma stated that chlorinated solvents are no longer used at Camp Pendleton and that solvents in use are now very controlled on base. Recruits are also much more knowledgeable and sensitive to environmental issues than they used to be. If they see anything environmentally questionable then they report it.

22/23 Area Groundwater Hotspot Remediation

Mr. Griffiths provided a summary of the site history of the 22/23 Area Groundwater site, a description of the preferred alternative in the ROD, and discussed ongoing remediation projects at the site (please see attached presentation). He discussed the step-out sampling in the TCE plume area that was used to improve the understanding of the hot spot extent. A remedial action work plan for EISB is scheduled to go to the FFA team in Fall 2019. He also briefly discussed the Zero Valent Zinc (ZVZ) technology being used to treat the 1,2,3-trichloropropane hot spot. The next groundwater sampling event is scheduled for August/September 2019 and the data will be shared with the FFA Team when it is available. Mr. Griffiths also discussed the details and the success of the in situ chemical oxidation (ISCO) pilot study at the 1,4-dioxane hot spot. Based on the successful treatment, the Navy is proceeding to full scale ISCO which is currently in planning stages with the RAWP in preparation and based on the results and conclusions drawn from the pilot study. DTSC previously noted in comments/approval of the ISCO pilot study that the treatment results were inconclusive because of the nature of the fast moving 1,4-dioxane plume. DTSC wouldn't describe the treatment as

"successful" due to the data gap/uncertainties involved in the completion report and previously discussed in comments and FFA meetings. However, the DTSC has no issue with the Navy taking the lessons learned and designing a full-scale treatment with ISCO at the Site. Based on a question from Ms. di Campalto, Mr. Griffiths said they plan to move forward with treatment and then do more confirmation sampling in the areas with uncertainty.

Site 1115 LNAPL Characterization

Mr. Griffiths presented the site history and updated the FFA Team on the upcoming Light Non-Aqueous Phase Liquid (LNAPL) Removal and VI Study at Site 1115 (please refer to attached presentation). He briefly summarized previous investigations and interim actions at the site, the proposed soil gas sampling work, and the LNAPL characterization and removal testing that is currently ongoing. The LNAPL from former underground storage tanks (USTs) is thought to remain in localized pockets that serve as secondary sources for VOC contamination. Questions were asked about treating the groundwater at the site and Mr. Griffiths explained the stratigraphy is very tight and pilot studies in the shallow zone have not been very effective. The LNAPL removal study began in May 2019 and is expected to continue for the next 11 months. Results of the recent soil gas sampling and LNAPL removal study will be provided to the FFA Team in approximately Summer 2020.

Site 33 Site Remediation Update

Mr. Griffiths talked about the site history and gave an update on the results of recent groundwater and soil gas sampling at Site 33 (please refer to attached presentation). Semiannual sampling shows an overall decreasing trend for VOCs in soil vapor across the site except for soil vapor monitoring well 33SG-10 (southern-most well), where tetrachloroethene (PCE) concentrations have steadily increased since 2015 from 200 milligram per cubic meter ($\mu g/m^3$) to 1,400 $\mu g/m^3$ (December 2018). The most recent semi-annual sampling event, including indoor air sampling, was conducted a week before the meeting and the results will be provided to the FFA team once they are available.

Schedule for Next FFA Meeting

The next FFA Meeting is tentatively scheduled to be held on October 10, 2019 at the Parsons Office in San Diego, California.

Attachments

- Agenda
- Sign-In Sheet
- San Onofre Nuclear Generating Station (SONGS) Environmental Update
- Deliverables Spreadsheets
- FFA Schedule
- Site 1116 Remediation Update

- 22/23 Area Groundwater Hotspot Remediation
- Site 1115 LNAPL Characterization
- Site 33 Site Remediation Update

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Final

MCB Camp Pendleton
127th FFA Meeting Agenda

Parsons San Diego Office Main Conference Room
525 B Street, Suite 1600
San Diego, CA 92101

June 20, 2019

0945 – 1000	**Welcome and Introductions**
1000 – 1045	**Project Deliverables, FFA Schedule Update and Planned / In Progress Field Work Status**
1045 – 1105	**San Onofre Nuclear Generating Station (SONGS) Environmental Update**
1105 – 1135	**Site 1116 Remediation Update**
1135 – 1220	**22/23 Area Groundwater Hotspot Remediation**
1220 – 1310	**Lunch**
1310 – 1330	**Site 1115 LNAPL Characterization**
1330 – 1400	**Site 33 Site Remediation Update**
1400 – 1430	**Closing Discussion and Wrap-up**

Name	Affiliation	Phone #	Email Address
Dan Griffiths	Parsons	303-764-1940	~~drgriffiths~~ daniel.r.griffiths@parsons.com
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Phone

Kim Gettman

Lacri Roche

San Onofre Nuclear Generating Station (SONGS) Environmental Update

20 June 2019

MCB-CPEN FFA Meeting

SONGS Plant Easement Overview

- **Presentation not included due to potentially sensitive material.**

MCB Camp Pendleton Deliverables Spreadsheet

Current as of 6/20/2019

					Date Due	Agency Comments	Comments Received From:		
Item	**Site**	**Document**	**Contractor**	**Status**	**to Agencies**	**Due By**	**EPA**	**DTSC**	**RWQCB**
1	33	Record of Decision for Site 33 (52 Area Armory)	ECM	ROD out for signature	12/14/15	2/12/16	**2/25/17**	**2/11/16**	**1/25/16**
2	1120	RI/FS Report for Site 1120 (Stuart Mesa Pesticide Maintenance Areas)	Tidewater	Resolving RWQCB Issues	3/31/16	5/31/16	**8/4/16**	**5/31/16**	**10/20/16**
3	1115	Pilot Study Report Site 1115 TTZ-2S and 2L	ECC-Insight	FINAL	10/12/16	12/13/16	**11/30/16**	**12/6/16**	**1/5/17**
4	22/23	22/23 Groundwater ESD	Bodhi	Resolving EPA Issues	8/30/17	10/29/17			**10/30/17**
5	22/23	2017 Annual Groundwater Monitoring Report for Post-ROD LTM at the 22/23 Area	Tidewater	FINAL	9/28/17	11/28/17	**3/19/18 NC**	**11/30/17**	**2/7/18**
6	1116	Site 1116 Technical Memo Implementation Report	WSI-IO	FINAL	10/11/17	12/11/17	**NC**	**12/11/17**	**NC 1/16/18**
7	1114	Site 1114 ROD	Trevet	Responding to Agency Comments	4/5/18	6/4/18	**In Legal Review**	**5/31/2018; 10/4/18**	**7/2/18**
8	21	Site 21 LUCIP	Bodhi	Responding to Agency Comments	6/29/18	8/24/18	**8/8/18**	**8/22/18**	**11/2/18**
9	33	Site 33 LUCIP	Bodhi	Waiting for RWQCB to Review 2nd Set of RTCs	6/29/18	8/24/18	**8/8/18**	**8/22/18**	**1/7/19**
10	1119	Site 1119 LUCIP	Bodhi	Responding to Agency Comments	6/29/18	8/24/18	**8/8/18**	**8/22/18**	**10/22/18**
11	22/23	22/23 Groundwater ISCO Pilot Study Report for 1,4-Dioxane	ECC-Insight	FINAL	7/26/18	9/26/18	**NC**	**9/24/18**	**12/13/19**
12	1117	Site 1117 ROD	Tidewater	Responding to Agency Comments	8/6/18	10/5/18	**10/24/18**	**10/9/18**	**1/23/19**
13	33	2018 Performance Monitoring Report with Long Term Monitoring Plan for Site 33	TtEC	FINAL	11/1/18	1/1/19	**N/C 2/20/19**	**12/31/19**	**3/6/19**
14	1118	Data Gap Report for Site 1118 (Subsite 520400)	WSI-IO	FINAL	1/9/19	3/11/19	**3/26/19 NC**	**3/18/19**	**3/26/19**
15	All	Five Year Review	Bodhi	FINAL	1/10/19	2/10/19	**3/6/19**	**2/11/19**	**4/15/19**
16	7	2018 Annual Inspection and Site Maintenance Report - Site 7 (Box Canyon)	KMEA	Responding to Agency Comments	2/12/19	4/15/19	**NC**	**4/15/19**	**3/26/19**

MCB Camp Pendleton Deliverables Spreadsheet

Current as of 6/20/2019

					Date Due	Agency Comments	Comments Received From:		
Item	**Site**	**Document**	**Contractor**	**Status**	**to Agencies**	**Due By**	**EPA**	**DTSC**	**RWQCB**
17	150	Site 150 ROD	Trevet	Draft in Agency Review	3/12/19	5/12/19		**5/16/19 NC**	**6/11/19**
18	1119	Work Plan for Full Scale EISB System	Bodhi	Draft in Agency Review	4/11/19	6/11/19			
19	22/23	2017 Annual Groundwater Monitoring Report for Post-ROD LTM at the 22/23 Area	Bodhi	Responding to Agency Comments	4/15/19	6/15/19			**5/31/19**
20	1118	Tech Memo for Site 1118 (Subsite 21565)	Trevet	Draft in Agency Review	5/13/19	7/15/19			
21	7	2018 Annual Groundwater Monitoring Report - Site 7 (Box Canyon)	KMEA	Preliminary Draft in Progress	6/21/19	8/22/19			
22	1118	Streamlined RI/FS Work Plan	Bodhi	Preliminary Draft in Progress	mid-July				
23	1119	Site 1119 PRB RACR	Aptim	Preliminary Draft in Progress	mid-July				
24	22/23	22/23 Area Groundwater EISB Work Plan	WSI-IO	Preliminary Draft in Progress					

Agencies have commented

NC = No Comments

MCB Camp Pendleton Response to Comment Spreadsheet

Current as of 6/20/2019

			RTCs	RTCs Approved			Final
Item	**Document**	**Contractor**	**to Agencies**	**EPA**	**DTSC**	**RWQCB**	**to Agencies**
2	RI/FS Report for Site 1120 (Stuart Mesa Pesticide Maintenance Areas)	Tidewater	**12/16/16 RWQCB 9/12/17**	**1/10/17**	**1/3/17**	**5/3/17 addl comments**	**Draft Final 10/17/17**
3	Pilot Study Report Site 1115 TTZ-2S and 2L	ECC-Insight	**2/7/17; addl RTCs to DTSC 3/21/17**	**11/30/16**	**5/5/2017, add'l comment on Final 6/14/17**	**1/5/17**	**5/10/17, Revision sent 5/7/19**
4	22/23 Groundwater ESD	Bodhi	**RTCs RWQCB 11/17/17**	**Comments rec'd, resolution pending**	**7/19/18 Sig. Page**	**8/8/18 11/8/18 Sig. Page**	
6	Site 1116 Technical Memo Implementation Report	WSI-IO	**11/30/18**		**3/13/19**	**3/26/19**	
7	Site 1114 ROD	Trevet	**9/11/18; Revised DTSC 2/6/19**		**2/7/19 approve, 4/1/19 Sig Page**	**10/4/18**	
8	Site 21 LUCIP	Bodhi	**10/15/18, 1/24/19 & 6/3/19 (RWQCB)**	**10/24/18**	**11/19/18**	**5/30/19 add'l comments**	
9	Site 33 LUCIP	Bodhi	**10/15/18 & 5/1/19 (RWQCB)**	**10/24/18**	**11/19/18**	**4/16/19 add'l comments**	
10	Site 1119 LUCIP	Bodhi	**10/15/18 & 1/2/19 (RWQCB)**	**10/24/18**	**11/19/18**		
11	22/23 Groundwater ISCO Pilot Study Report for 1,4-Dioxane	ECC-Insight	**RWQCB&DTSC 2/5/19**			**4/16/19; 5/20/19 add'l comments on Final**	**4/19/19**
12	Site 1117 ROD	Tidewater	**USEPA&DTSC 10/31/18; RWQCB 3/22/19**		**11/19/18**		
13	2018 Performance Monitoring Report with Long Term Monitoring Plan for Site 33	TtEC	**3/14/19**		**4/9/19**		
14	Data Gap Report for Site 1118 (Subsite 520400)	WSI-IO	**4/25/19**		**5/14/19**		
15	Five Year Review	Bodhi	**DTSC 2/28/19**		**3/5/19**		

*Additional Comments were submitted

MCB Camp Pendleton Fieldwork Spreadsheet **Current as of 6/20/2019**

Item	Field Work	Contractor	Planned Start Date	Planned Completion Date
1	Site 1115 DNAPL Removal	Bodhi	May-2018	Sep-2019
2	Site 1120 TCRA	Aptim	Dec-2018	Jul-2019
3	Site 7 - 2019 Annual GW Sampling	KMEA	Apr-2019	Apr-2019
4	Site 33 Semiannual GW Sampling/Soil Vapor Sampling	TetraTech EC	June 2019 and Dec 2019	Dec-2019
5	22/23 Area GW LTM Sampling	Bodhi	Jul-2019	Jul-2019
6	22/23 Area and 12 Area Site 13 - post ZVZ sampling	Brady/GCE/ Geosyntec	Jul-2019	Jul-2019
7	Site 1119 Full-Scale EISB	Bodhi	Sep-2019	Dec-2019
8	Site 1121 Pilot Study	Aptim	Sep-2019	Nov-2019
9	Site 1116 TCRA Well Installation and Upgradient Injection	TetraTech EC	Est. Sep-2019 (with agency approval)	Dec-2019
10	Site 1116 Source Area Investigation	TetraTech EC	Est. Nov 2019	Nov-2019
11	Site 7 - Landfill Gas Monitoring	KMEA	ongoing	N/A
12	Site 7 - Cover and Mitigation System Operation, Maintenance and Monitoring	KMEA	ongoing	N/A

SIOH Bearing

FFA Schedule for Draft Documents – Updated June 20, 2019

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. Dates in **green** have changed since the February 21, 2019 FFA schedule.

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. A Remedial Investigation/Feasibility Study (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 has been completed. To evaluate the effectiveness of the remedies proposed for Alternative 4, two pilot studies were completed: a Zero Valent Zinc (ZVZ) Permeable Reactive Barrier for the TCP plume; and an Enhanced In Situ Bioremediation (EISB) for the TCE plume. The production well has been installed. The remedial action for EISB is in progress for treatment of the TCE plume. A pilot study to remediate the 1,4-dioxane plume, which is an issue now that the screening level criteria for 1,4-dioxane was reduced, is underway with an Explanation of Significant Difference currently under agency to account for the changed 1,4-dioxane goal.

- Proposed Plan — complete
- Geotechnical and Design Information for ZVZ PRB Pilot Study — complete
- *Implementation of ZVZ PRB Pilot Study* — complete
- Record of Decision — complete
- Well Siting Study Sampling and Analysis Plan — complete
- *Field Work for Well Siting Study* — *complete*
- Work Plan for Enhanced In Situ Bioremediation (EISB) — complete
- *Field Work for EISB Pilot Study* — *complete*
- Work Plan to Install Wells and Conduct Groundwater Monitoring — complete
- *Installation of Alternative Water Supply Well* — *complete*
- Land Use Control Implementation Plan — complete

- Tech Memo to Implement Alternate Water Supply — complete
- Baseline LTM Groundwater Monitoring Tech Memo — complete
- ZVZ Pilot Study for TCP Report — complete
- EISB Pilot Study for TCE Report — complete
- Annual LTM Groundwater Monitoring Report — complete
- Work Plan for ISCO Pilot Study — complete
- *ISCO (dioxane) pilot study* — *On-going*
- Remedial Design for EISB at TCE Plume — complete
- *EISB Investigation at TCE Plume* — *On-going*
- Annual LTM Groundwater Monitoring Report Year 2 — complete
- ESD — complete
- GW Monitoring SAP for LTM — complete
- Remedial Design for TCP Plume (ZVZ) — complete
- ISCO Pilot Study Report for 1,4-Dioxane — complete
- *Remedial Action for ZVZ for TCP Plume* — *fall 2018*
- Five Year Review (2019) — complete
- RACR for ZVZ for TCP Plume — 2019
- Remedial Design for 1,4 Dioxane Plume — 2019
- LTM Groundwater Monitoring Report — Annual

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

This site is a Corrective Action Management Unit (CAMU) situated above an old municipal landfill. This site is post-Record of Decision (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 installed and has reduced methane concentrations to below compliance standards. Long Term Monitoring is continuing, which includes annual reports.

- Memo to File for Site 7 (pv panels) — complete
- *Field Work for Non-Methane Organic Compounds* — *complete*
- Memo to File — complete

- Report for Non-Methane Organic Compounds — complete
- Five Year Review (2014) — complete
- *Field Work for Groundwater Monitoring, Landfill Gas Monitoring, and Cover and Mitigation System Operation, Maintenance and Monitoring* — *Annual*
- Groundwater Monitoring Report — Annual
- Inspection and Site Maintenance Report — Annual
- Five Year Review (2019) — complete

12 Area Site 13 – Former Building 1280 and 1283

This site is the site of a former Underground Storage Tank (UST) and has some low-level concentrations of Volatile Organic Compounds (VOCs) in groundwater. An RI/FS has been completed. 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 complete. A Soil Vapor Extraction system has reduced concentrations in groundwater; only one well has levels barely above the Maximum Contaminant Level (MCL). A ZVZ pilot study is planned.

- Groundwater Monitoring Report — complete
- Project Completion Report for Soil and Groundwater — complete
- *Field Work for AS/SVE Pilot Study* — *complete*
- Post SVE Closure Report — complete
- ZVZ Pilot Study Work Plan — complete
- ***Field Work for ZVZ Pilot Study*** — ***Spring 2019***
- ZVZ Pilot Study Report — TBD*
- Proposed Plan — TBD*
- Record of Decision — TBD*

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. A pilot study to evaluate the effectiveness of in-situ bioremediation of chlorinated solvents at low concentrations in groundwater is complete. Technical Memorandums reporting on the effectiveness of both phases of the pilot study were finalized and the Feasibility Study is in agency review. A Proposed Plan is final and a Record of Decision is being finalized with the following preferred alternatives: land use controls and long-

term monitoring; biosparging/venting for the shallow plume; and, enhanced in situ bioremediation for the deep plume.

- Pilot Study Tech Memo — complete
- Site 21 Pilot Study Work Plan Addendum — complete
- *Second Phase of Pilot Study Field Work* — *complete*
- Feasibility Study — complete
- Proposed Plan — complete
- Record of Decision — complete
- Remedial Design — complete
- *Remedial Action* — *In progress*
- Land Use Control Implementation Plan (LUCIP) — 6/29/2018
- Five Year Review (2019) — complete
- RACR — 2020*

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 a Non-Time Critical Action Memorandum have also been completed. The selected remedy was excavation of the source material, and treatment of groundwater from the site. Two interim Removal Actions were completed, concentrating on the worst part of the plume and the source area. Groundwater monitoring, Enhanced In Situ Bioremediation (EISB) injections, and soil gas sampling are currently in progress. A Proposed Plan is complete and a Record of Decision is in agency review. The recommended alternatives are: land-use controls, long-term monitoring and monitored natural attenuation.

- Removal Action Work Plan for plume — complete
- *Plume Removal Action (geophysical work started 15 Nov 11)* — *complete*
- Plume Removal Action Completion Report — complete
- Removal Action Work Plan for source — complete
- *Source Removal Action/EISB Injection* — *complete*
- SAP Addendum for Soil Gas Monitoring — complete
- Source Removal Action Completion Report — complete
- Proposed Plan — complete
- Record of Decision — 12/14/2015
- Post- NTCRA Groundwater Monitoring & Soil Gas Report — complete
- Additional EISB Injection Work Plan — complete

- Land Use Control Implementation Plan (LUCIP) 6/29/2018
- Performance Monitoring Report with Long Term Monitoring Plan complete
- *Field Work for Groundwater Monitoring and Cover and Mitigation System Operation, Maintenance and Monitoring* *Annual*
- Annual Groundwater Monitoring Report Fall 2018*

Site 150 – 21 Area, Location 1

This site became an IR site 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 site Remedial Investigation/Feasibility Study is being finalized.

- *Site Inspection Field Work* *complete*
- Site Inspection Report complete
- Remedial Investigation Work Plan complete
- *Field Work for Remedial Investigation* *complete*
- Remedial Investigation Report/Feasibility Study complete
- Proposed Plan complete
- Record of Decision 3/12/2019

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 (SI) 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 No Further Action (NFA) recommendation, so an interim Removal Action was completed to address elevated concentrations in groundwater. Performance monitoring to examine the effectiveness of the substrate injected during the removal action is underway and a Proposed Plan (Monitored Natural Attenuation and Land Use Controls) has been submitted for review.

- Remedial Investigation Report complete
- Engineering Evaluation/Cost Analysis & Action Memorandum complete
- Removal Action Work Plan complete
- *Removal Action* *complete*
- Work Plan for Performance Monitoring complete

- Removal Action Completion Report — complete
- *Performance Monitoring* — *complete*
- Performance Monitoring Report (Yr 1) — complete
- NTCRA Performance Monitoring Report (Yr 2) — complete
- Proposed Plan — complete
- Record of Decision — 4/5/2018

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 pilot study to evaluate the effectiveness of in-situ bioremediation of chlorinated solvents in groundwater was completed. The technology was successful at reducing contaminant concentrations, 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 results have been included in a Remedial Investigation/Feasibility Study. The Feasibility Study identified remedial alternatives for various Target Treatment Zones (TTZs) throughout the site. TTZ-1S was excavated and an EISB pilot study is in progress at TTZ-1D. A pilot study to evaluate the effectiveness of in situ thermal conductive heating was recently completed at TTZ-2S. Once groundwater recharges in the thermal study area, samples will be collected and the results will be presented in a report. Soil vapor and LNAPL studies are also planned to provide updated site conditions.

- Tech Memo — complete
- Work Plan to collect additional data for site — complete
- *Field Work to collect additional data* — *complete*
- Remedial Investigation/Feasibility Study Report — complete
- Pilot Study Work Plan for TTZ-2L and TTZ-2S — complete
- Pilot Study Work Plan for TTZ-1S — complete
- *Field Work for TTZ-2L and TTZ-2S Pilot Study* — *complete*
- *Field Work for TTZ-1S Pilot Study* — *complete*
- Pilot Study Report for TTZ-2L and TTZ-2S — complete
- Pilot Study Report for TTZ-1L and TTZ-1S (Site 1 Area) — complete
- Vapor Intrusion Letter Work Plan — complete
- *Field Work for Vapor Intrusion Study* — *Summer 2018*
- Proposed Plan — 2019*
- Record of Decision — 2020*

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 subsites do not warrant further action under the IR Program. The three other subsites will be remediated. An Engineering Evaluation/Cost Analysis (EE/CA) and Action Memo has been completed for this site. A Removal Action Work Plan, with a report detailing the results of a limited investigation to close data gaps as an appendix, is complete. The removal action addressed the mainly petroleum sources at the old USTs, along with Dual-Phase Extraction (DPE) at one subsite and an Enhanced In Situ Bioremediation (EISB) pilot study at another subsite. A Removal Action Completion Report (RACR) for the excavations and pilot studies is complete; however, a performance monitoring report for the pilot studies is in agency review. The limited investigation that was conducted in 2012 indicated that the TCE plumes at the site are not likely associated with the USTs. Therefore, an additional investigation was completed to delineate the TCE plumes and to find a source, if possible. The investigation resulted in conducting indoor air sampling to assess potential VOC exposure a change in approach to an Action Memo and Time Critical Removal Action to more immediately address this potential issue.

- EE/CA and 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)* *complete*
- Expanded Site Inspection Report (3 subsites – Moving Forward) appendix to RAWP
- Removal Action Work Plan (RAWP) (3 subsites – Moving Forward) complete
- *Interim Removal Action (3 subsites – Moving Forward)* *in progress*
- Additional Investigation Work Plan complete
- Performance Monitoring SAP complete
- *Additional Investigation Field work* *complete*
- *Performance Monitoring Field Work* *complete*
- Removal Action Completion Report (3 subsites – Moving Forward) complete
- Additional Investigation Report complete
- Performance Monitoring Report complete
- Optimization/Characterization Tech Memo for Site Groundwater complete
- Tech Memo Implementation Report complete
- Indoor Air Monitoring Report complete
- Time Critical Removal Action Memo complete

- *Time Critical Removal Action for TCE Plume (EISB)* *in progress*
- Time Critical Removal Action Report 2019*
- Proposed Plan 2019*
- Record of Decision 2020*
- Groundwater Monitoring Report 2020*

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 concurred with the Site Inspection Report recommending the site move into the Remedial Investigation phase. A Remedial Investigation Report justifying No Further Action at all subsites is currently under agency review.

- *Field Work for Site Inspection* *complete*
- Site Inspection Report complete
- Remedial Investigation Work Plan complete
- *Remedial Investigation Field Work* *complete*
- Remedial Investigation Report complete
- NFA Proposed Plan complete
- NFA Record of Decision 8/6/2018

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. A Site Inspection and Extended Site Inspection have been completed for this site, resulting in No Further Action for one subsite, 2664. Additional investigation is needed at Subsite 520400 and a pilot study at Subsite 21565 is in progress.

- Extended Site Inspection (ESI) Work Plan complete
- *Field Work for Site Inspection* *complete*
- Extended Site Inspection Report complete
- EE/CA and Action Memo Subsite 21565 complete
- Work Plan/SAP for Subsite 520400 complete
- *Field Work for Subsite 520400* *in progress*
- Tech Memo for Subsite 520400 complete
- Pilot Test Work Plan for Soil Gas and GW Treatment Subsite 21565 complete
- *Field Work for Soil Gas and Groundwater Treatment Pilot Test* *in progress*

- **Pilot Test Report for Soil Gas and GW Treatment Subsite 21565** **5/13/19**
- **RI/FS Work Plan for Subsite 21565** **Mid-July 2019***
- Proposed Plan 2020*
- Record of Decision 2021*

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. TCE had been discovered at two of the wells and further investigation was needed to delineate the extent of contamination and to locate the source. The results of the additional investigation and proposed remedial alternatives were included in the Remedial Investigation/Feasibility Study Report. The preferred alternative has been documented in a Proposed Plan, and the Record of Decision is currently in agency review. There are three preferred alternatives: land use controls and long-term monitoring; enhanced in-situ bioremediation at the source area; and, a permeable reactive barrier downgradient of the plume and upgradient of the production wells.

- *Field Work for Remedial Investigation* *complete*
- Work Plan Addendum to Delineate Source complete
- *Additional RI Field Work* *complete*
- RI/FS Report complete
- Proposed Plan complete
- Record of Decision complete
- EISB Pilot Study Work Plan complete
- Design Study Tech Memo complete
- *EISB Pilot Study Field Work* *in progress*
- Permeable Reactive Barrier (PRB) Work Plan complete
- *PRB Field Work* *2018**
- PRB Completion Report 2018*
- Land Use Control Implementation Plan (LUCIP) 6/29/2018
- **Work Plan for Full Scale EISB System (EISB Tech Memo Appendix)** **4/11/2019**
- **RD for EISB for TCE Plume** **April 2019***
- Five Year Review (2019) complete
- **PRB RACR** **Mid-July 2019**

Site 1120 – Stuart Mesa Pesticide Maintenance Areas

This site was created in 2012 to address pesticide contamination due to releases from agricultural maintenance activities. A Phase II Environmental Assessment was completed for this site in support of real estate agreement closure. The Environmental Assessment is analogous to a Site Inspection, so this site entered the Installation Restoration Program at the Remedial Investigation stage. The field work for the Remedial Investigation is complete and the Remedial Investigation/Feasibility Study Report is in progress. A Time Critical Removal Action is planned for Site 1120.

- Remedial Investigation Work Plan — complete
- *Remedial Investigation Field Work* — *complete*
- Remedial Investigation/Feasibility Study Report — 3/31/2016
- Time Critical Removal Action Memorandum — 5/21/2018
- Time Critical Removal Action Work Plan — 5/21/2018
- ***Time Critical Removal Action Field Work*** — ***Winter-Spring 2019***
- Proposed Plan — 2019*
- Record of Decision — 2020*

Site 1121 – Site 1D Groundwater

This site was created in 2012 to differentiate Site 1D groundwater from Site 1D soil, which was closed with a previous remedial action and Record of Decision. There is a groundwater plume consisting of elevated concentrations of VOCs, with a localized area of metals and pesticides. A Remedial Investigation is complete and a Pilot Study is planned.

- Remedial Investigation Work Plan — complete
- *Remedial Investigation Field Work* — *complete*
- Remedial Investigation Report — complete
- Pilot Study Work Plan — 6/20/2018
- ***Pilot Study Field Work (delayed due to sensitive species)*** — ***Fall 2019***
- Pilot Study Completion Report — 2020*
- Proposed Plan — 2020*
- Record of Decision — 2021*

SITE CLOSED 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, including trenching, has been completed. The ESI Report recommended No Further Action (NFA) at the site and a Proposed Plan has been completed. The NFA Record of Decision is final and signed.

- Extended Site Inspection Work Plan complete
- *Field Work for Extended Site Inspection* *complete*
- Extended Site Inspection Report complete
- Proposed Plan complete
- Record of Decision complete

SITE CLOSED Site 1003 (Site number is for funding purposes only) – Site 1D Soil

This site was 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 (RACR) 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 under a new site, IR Site 1121 Site 1D Groundwater. This site is for soil only; and was closed through the ROD and the RACR.

- Data Gap Analysis for Groundwater Work Plan complete
- *Data Gap Analysis Field Work* *complete*
- Data Gap Analysis Report complete

SITE CLOSED 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. A No Further Action Record of Decision (ROD) was signed on April 19, 2013.

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

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MCB CAMP PENDLETON
SITE 1116
SITE REMEDIATION UPDATE

20 June 2019

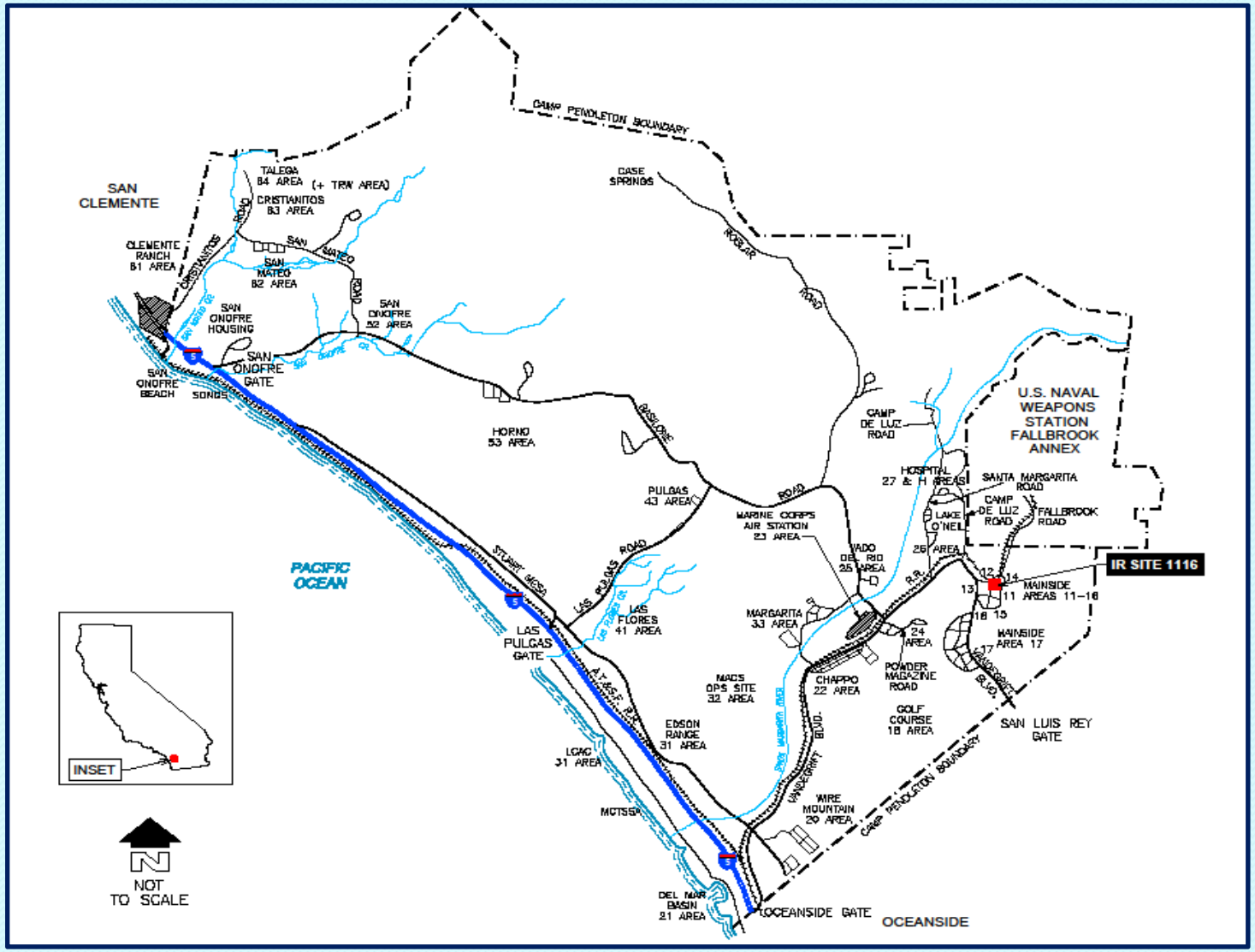
127th FFA Meeting

Site 1116 Remediation

- Location
- Site History
- Time Critical Removal Action (TRCA)
- Indoor Air Sampling
- Contaminant Source
- Future Site Activities

Site 1116 Remediation

Location (14 Area)



Site 1116 Remediation

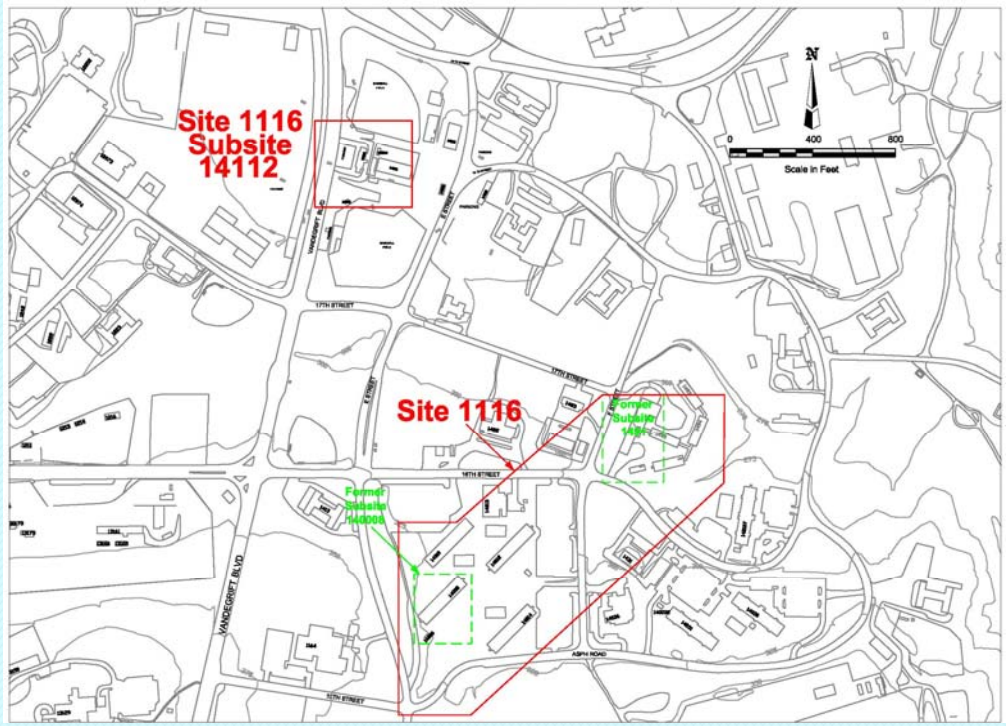
Site History

- On March 28, 2007 NAVFAC SW transferred nine UST sites to the IR Program and designated this group of UST sites as IR Site 1116.
- Former UST Sites 14121, 14125, and 14127 were recommended for closure with no further action based on the results of the risk evaluation and no detections of VOCs above of MCLs.
- Former UST Sites 1441, 14131, an 14137 had only sporadic low levels of VOCs detected below MCLs in groundwater, and remained closed under the UST program.
- Former UST Sites 14112, 1491, and 140008 were recommended for further investigation under the IR Program because of detected concentrations of VOCs in groundwater exceeding MCLs and/or risk-based standards.

Site 1116 Remediation

Site History (Continued)

- The former Subsites 1491 and 140008 are now together referred to as Site 1116 because of the discovery of a single VOC groundwater plume connecting between the two Subsites. Subsite 14112 is separated from Site 1116, and is located approximately 2,000 feet to the northwest of Site 1116.
- Groundwater impacts at Subsite 14112 are limited to low-risk TPH constituents.
- Treatment of VOCs at Site 1116 is the subject of the Time-Critical Removal Action



Site 1116 Remediation

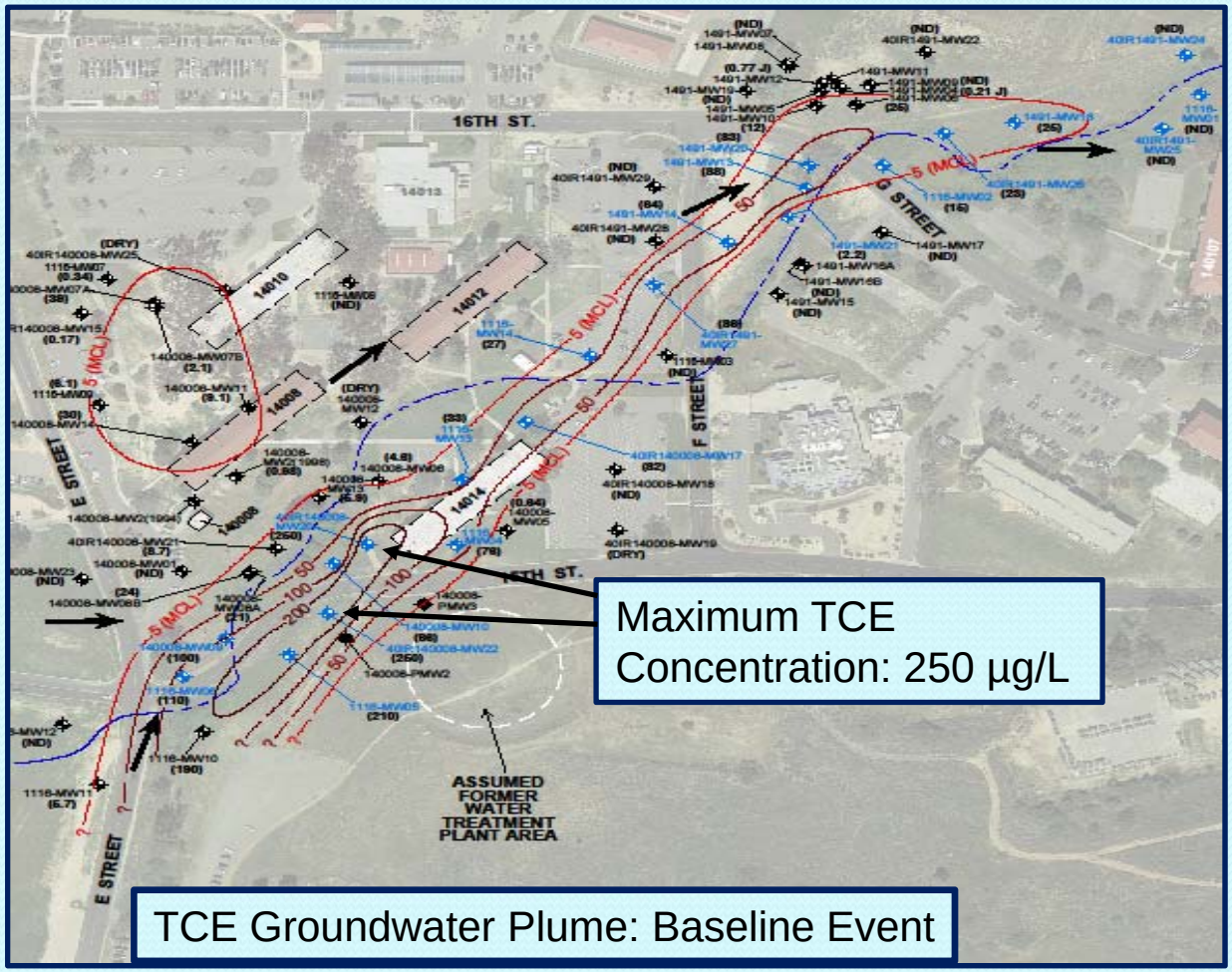
Time-Critical Removal Action (TRCA)

- The Site 1116 TCRA included injecting a food grade substrate into the aquifer to enhance reductive dechlorination, and installing upgradient monitoring wells in a phased approach to locate the contaminant source.

Site 1116 Remediation

TCRA Baseline Groundwater Sampling (TCE)

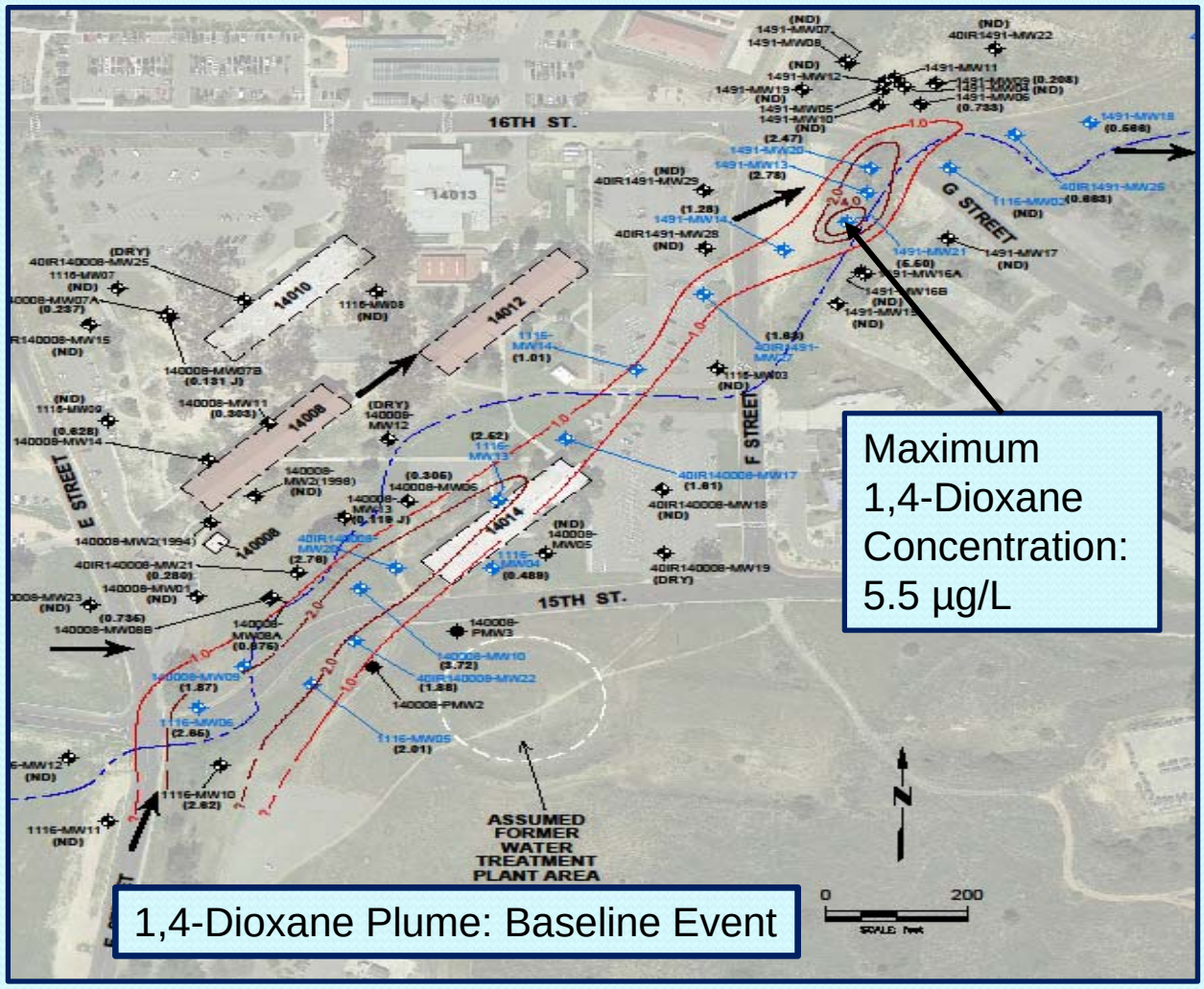
- **Before the EISB injections began a Baseline groundwater sampling event was completed. The maximum TCE concentration was 250 µg/L reported in two wells near the upgradient end of the plume.**



Site 1116 Remediation

TCRA Baseline Groundwater Sampling (1,4-Dioxane)

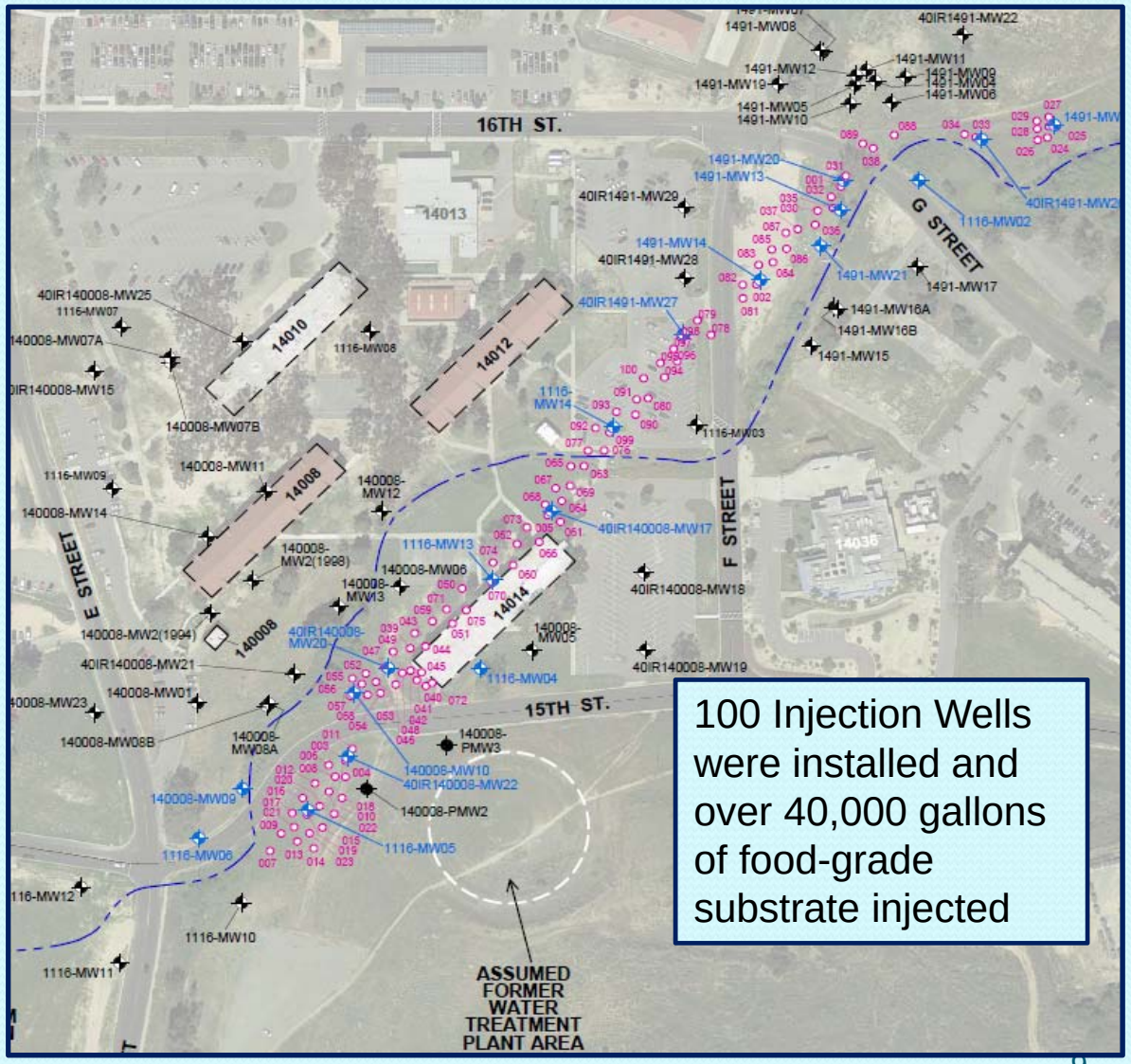
- **Baseline groundwater sampling included analysis for 1,4-Dioxane for the first time. The maximum concentration was 5.5 µg/L.**



Site 1116 Remediation

TCRA EISB

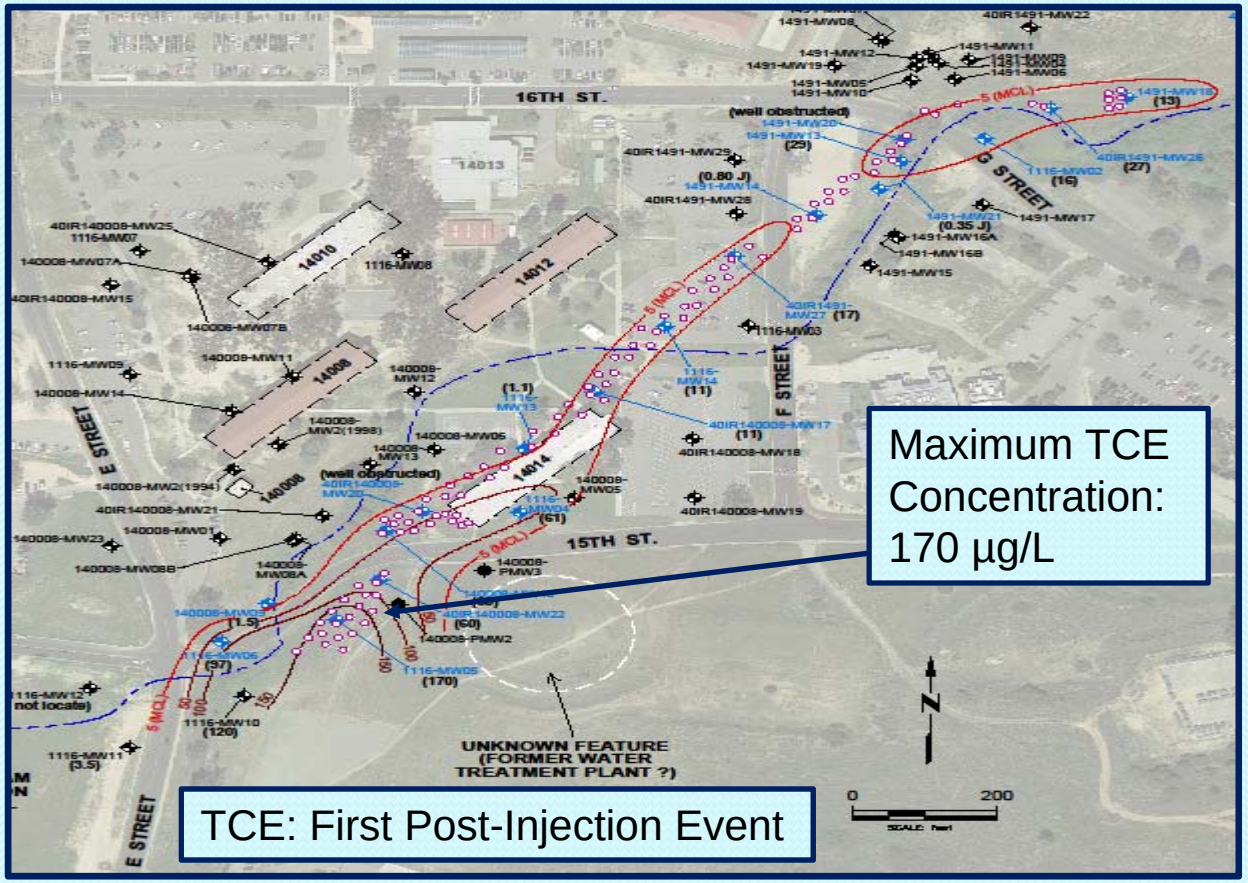
- Between August and December 2018, 100 injection wells were installed and over 40,000 gallons of Emulsified Lecithin Substrate (ELS), with a dehalococcoides (Dhc)-containing microbial consortium, were injected into the aquifer.



Site 1116 Remediation

TCRA First Post-Injection Event (TCE)

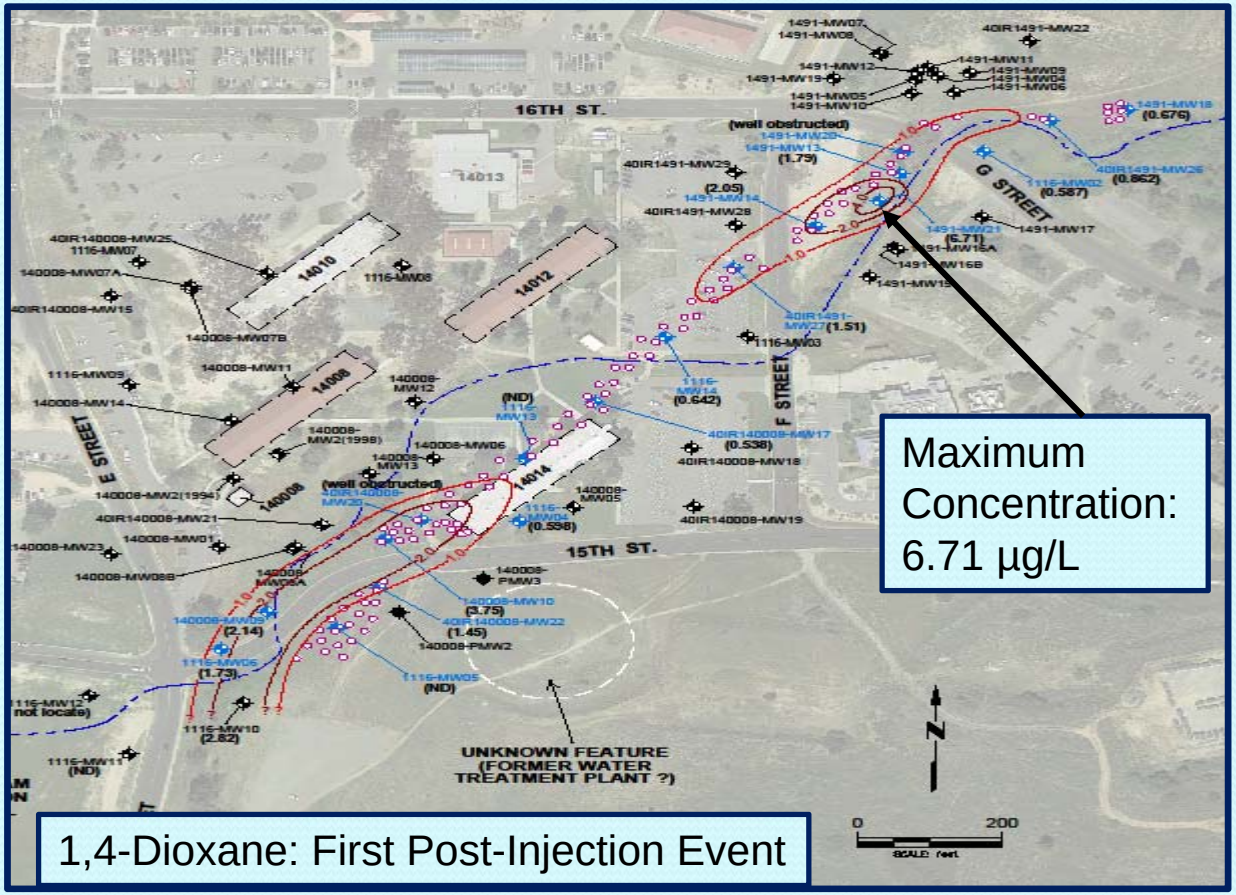
- Three months after the EISB injections were completed the first post-injection groundwater sampling event was completed. The maximum TCE concentration decreased from 250 to 170 µg/L.



Site 1116 Remediation

TRCA First Post-Injection Event (1,4-Dioxane)

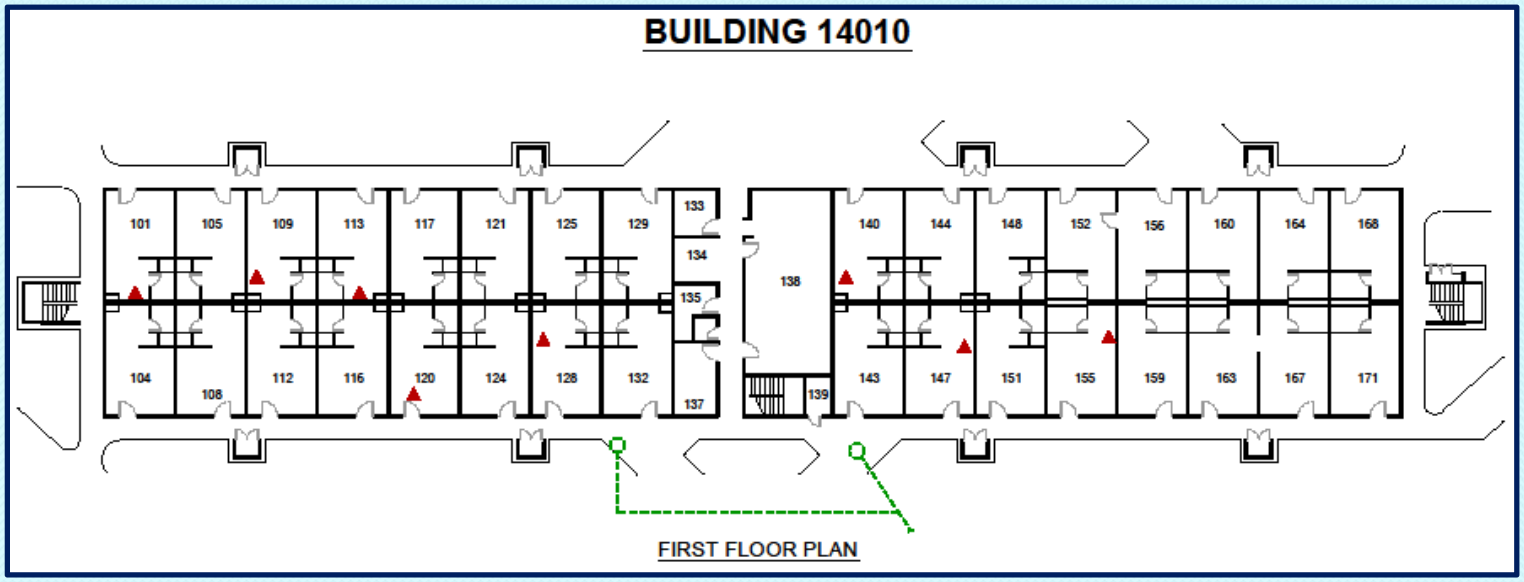
- Three months after the EISB injections were completed the first post-injection groundwater sampling event was completed (March 2019).
- The maximum 1,4-dioxane concentration was 6.71 µg/L.



Site 1116 Remediation

TCRA Indoor Air Sampling

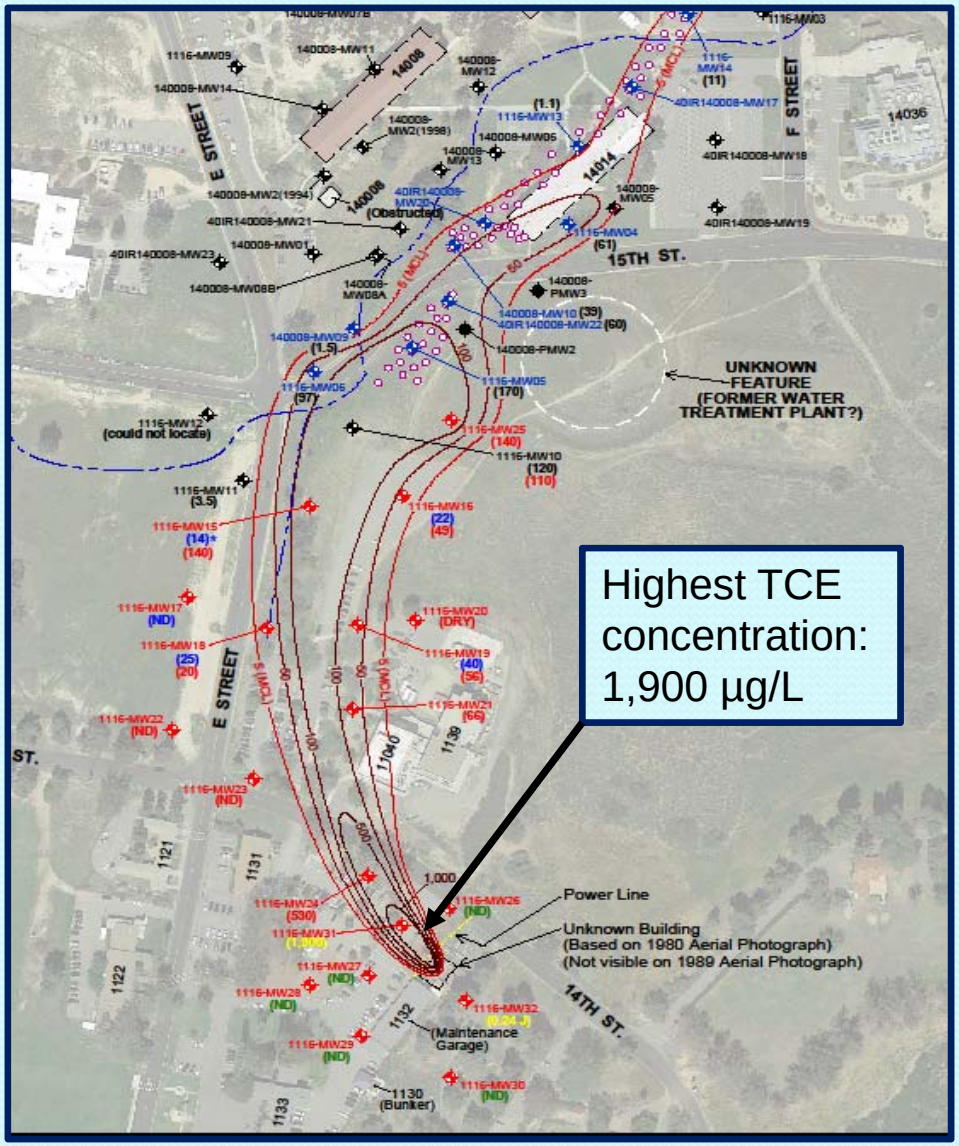
- As part of the TCRA, the third and fourth indoor air sampling events were completed. Samples were collected from the same four barracks and rooms sampled previously.
- Results continue to indicate that VOCs from the groundwater plume are not impacting indoor air quality in nearby buildings.



Site 1116 Remediation

Contaminant Source

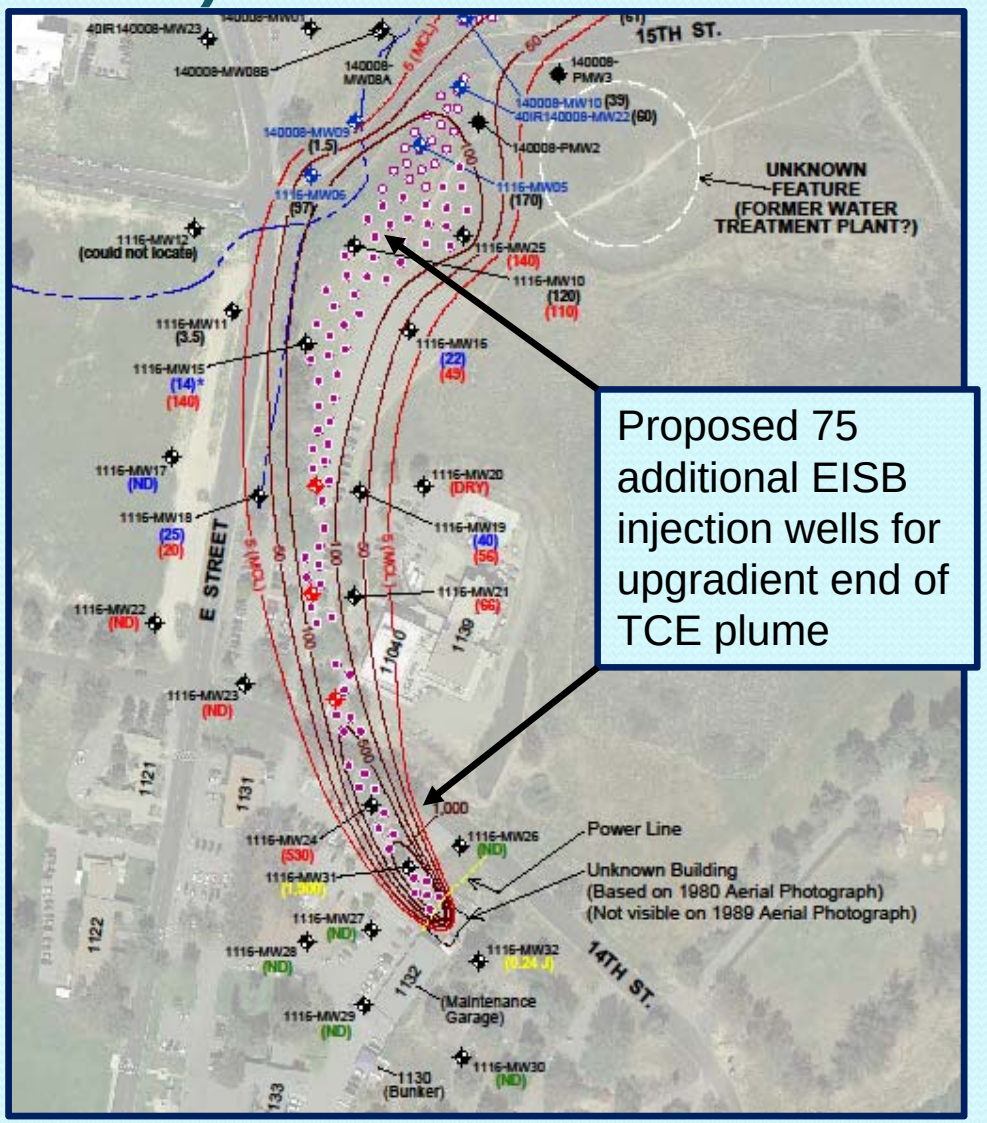
- During the TCRA additional monitoring wells were installed to trace the TCE plume upgradient to its source.
- 18 upgradient wells were installed and sampled in four phases (red well symbols).
- The source of groundwater contamination was identified as an outdoor storage area next to Building 1132. A small building was at one time present at the location (1980 aerial photograph).



Site 1116 Remediation

Contaminant Source (Continued)

- The newly identified upgradient end of the TCE plume extends approximately 1,100 feet further upgradient than previously known.
- To remediate the upgradient end of the plume another 75 injection wells are proposed for additional EISB injection (same substrate used for previously).
- Three additional performance monitoring wells are also proposed.



Site 1116 Remediation

Future Site Activities

- Complete the Draft TCRA Report and submit it to the FFA team for review (estimated July 2019).
- Complete the next post-injection quarterly groundwater performance monitoring event (June 2019).
- Complete the next semiannual indoor air sampling event (September 2019).

Site 1116 Remediation

Future Site Activities (continued)

- Submit a Field Change Request to the FFA team to complete EISB injection at the upgradient end of the TCE groundwater plume (75 additional injection wells and three additional performance monitoring wells).
- Prepare an Addendum to the TCRA Work Plan proposing a soil and soil gas investigation at the contaminant source area (outdoor storage area next to Building 1132) to determine the nature and extent of vadose zone contamination and determine if vadose zone remediation is required.

22/23 Area Groundwater Hotspot Remediation

June 2019

127th FFA Meeting

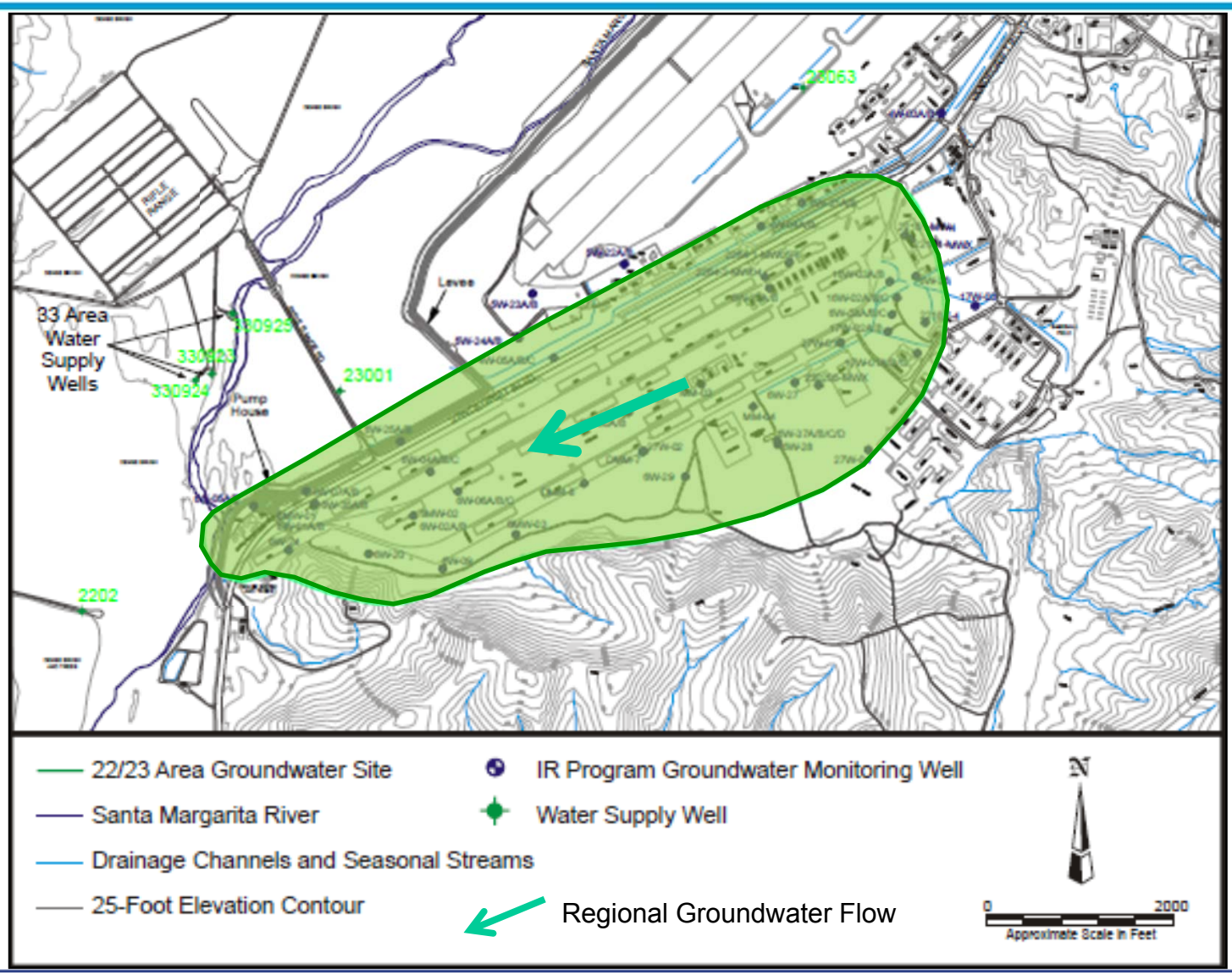
Presentation Outline

- Site Background
- 22/23 Area ROD Review
- 1,4-Dioxane Hotspot Remedy
- TCE Hotspot Remedy
- Questions / Discussion

Site Background

- Site on MCAS within the Chappo Hydrologic Subarea of the Ysidora Hydrologic Area of the Santa Margarita Hydrologic Unit
- Facilities within the 22/23 Area include industrial operations, warehouses, office buildings, an airfield, and associated air base complex

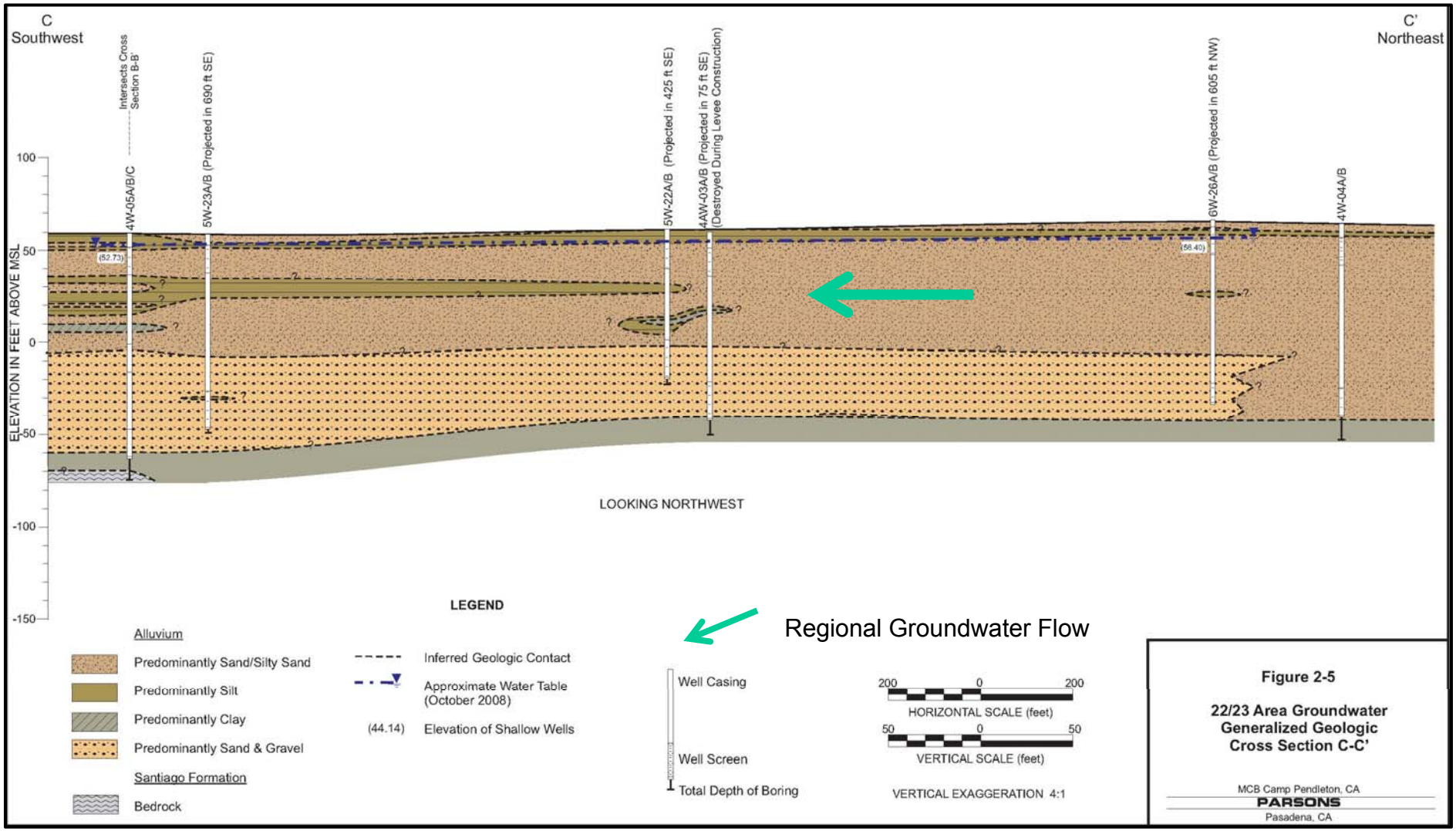
22/23 AREA BACKGROUND



Site Background (continued)

- Groundwater is found in alluvial and flood plain deposits, which occur to a total depth of approximately 110 feet below ground surface
- At the site, there are interbedded layers of silty sand, sand and silt down to 55 feet (very minor clay layers), and between 55 and 110 primarily clean sand
- Santiago Formation occurs at ~ 110 feet

22/23 AREA BACKGROUND

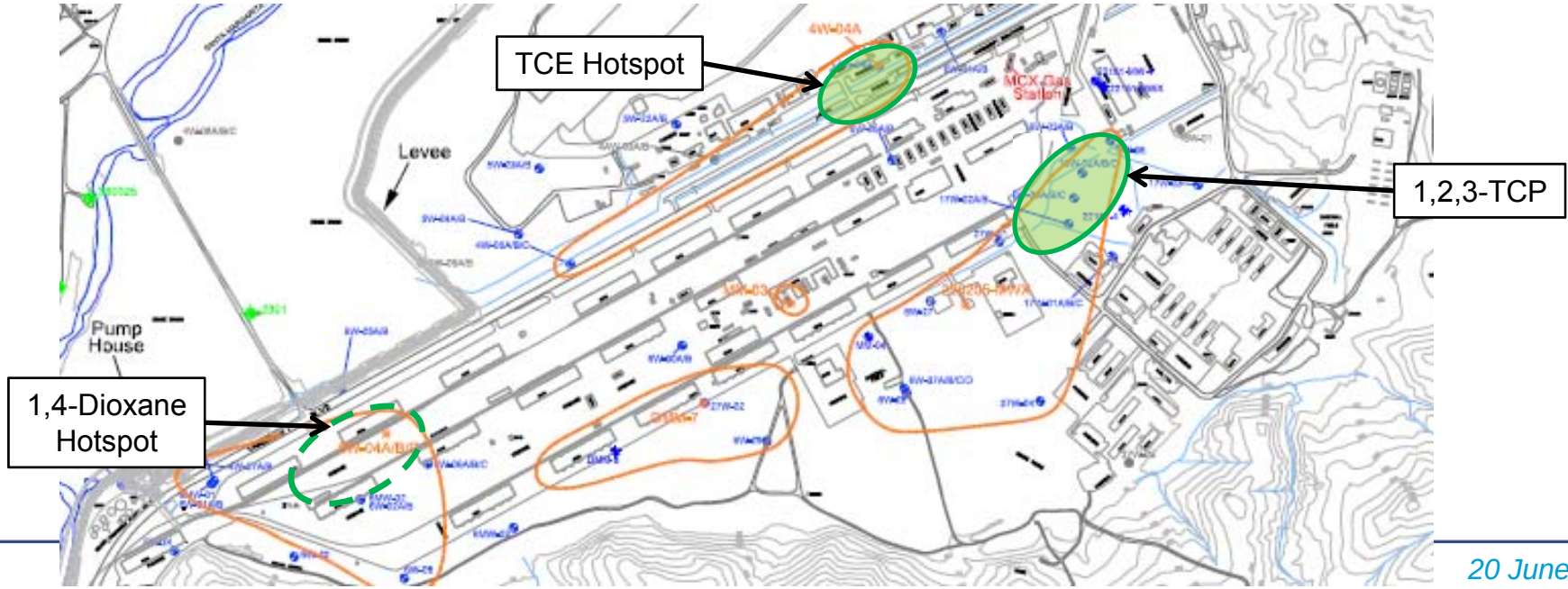


FS Alternatives

- Alternative 1: No Action
- Alternative 2: Land Use Controls and Long Term Monitoring
- Alternative 3: Alternate Water Supply by Installing New Base Well or Wells
- Alternative 4: Source Area Treatment via In Situ Technologies
- Alternative 5: Ex Situ Wellhead Treatment at Well 2202
- Alternative 6: Wellhead Treatment at Well 2202 and Reinjection of Treated Water

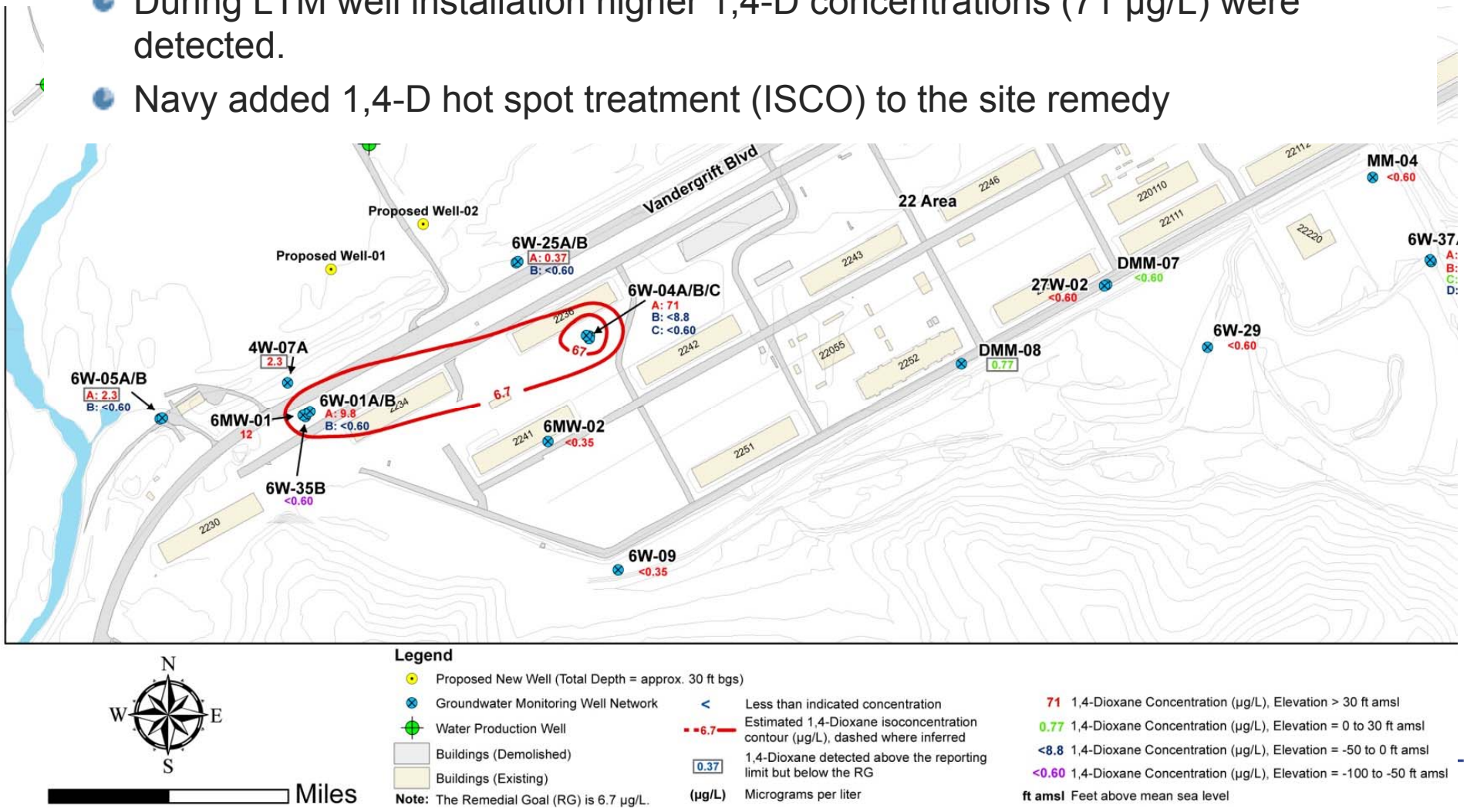
22/23 Area ROD Review

- Selected and approved remedy elements:
  - LUCs and Long Term Monitoring (Alt 2)
  - Alternate water supply development (Alt 3)
  - In-situ hot spot treatment (Alt 4)
    - EAB at the TCE hotspot
    - ZVZ at the 1,2,3-TCP hotspot
    - LTM and LUCs for the remainder of the dilute plume



Post ROD discovery: 1,4-Dioxane

- During LTM well installation higher 1,4-D concentrations (71 µg/L) were detected.
- Navy added 1,4-D hot spot treatment (ISCO) to the site remedy



22/23 Area TCE Hotspot Investigation Overview

- Background Information
- Performance Monitoring Well Installation, Sampling, and Analytical Results
- Performance Monitoring Well Data Gaps
- DPT Step Out Sampling – 2018
- Summary of PMW and DPT Groundwater Data
- Next Steps and Schedule

TCE Hotspot Background Information

- Primary objective: Implementation of a full-scale EISB injection system to treat the TCE hotspot in 22/23 Area groundwater in the area surrounding well 4W-04A in accordance with the ROD
  - EISB Work Plan was finalized August 2017 based on most recent groundwater data available, from 2013 and 2015
  - Final remedial design subject to optimization based on baseline groundwater analytical data from newly-installed performance monitoring wells
  - EISB performance monitoring wells were installed, developed, and sampled in September 2017
  - Final analytical results provided and data validated in November 2017
  - Performance monitoring well data summarized in following Figures

Performance Monitoring Well Sampling – September 2017
TCE Results Zone A

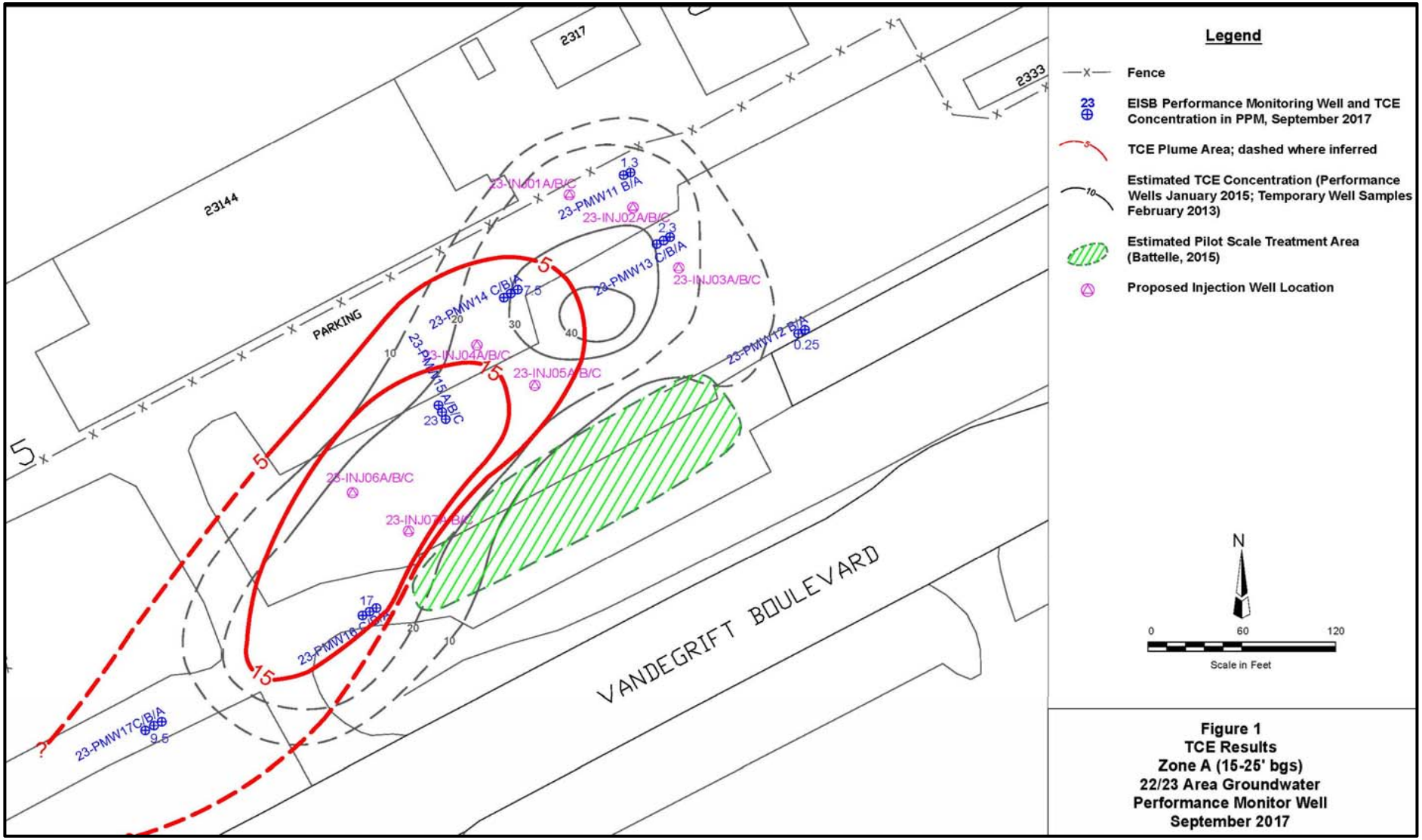
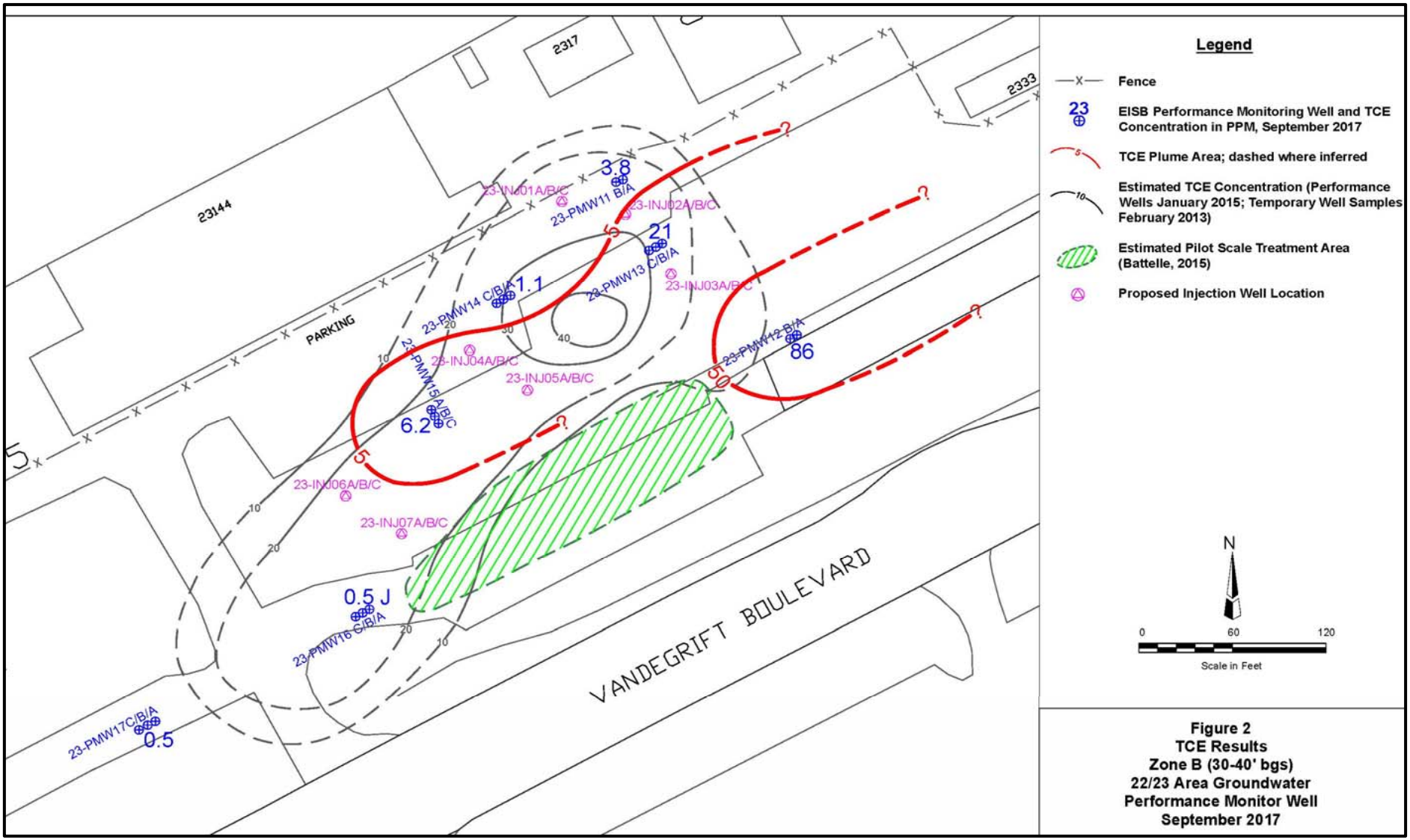
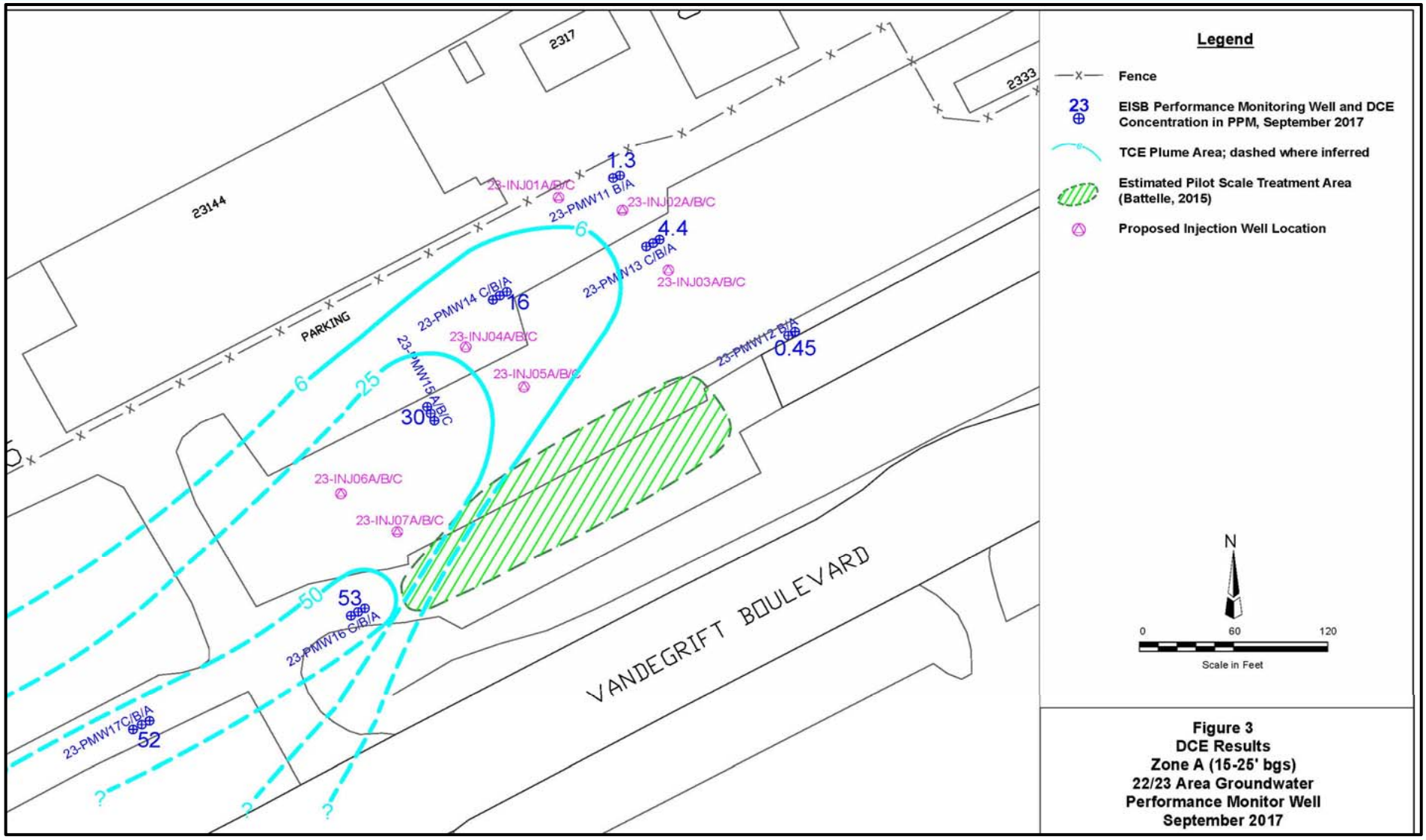


Figure 1
TCE Results
Zone A (15-25' bgs)
22/23 Area Groundwater
Performance Monitor Well
September 2017

Performance Monitoring Well Sampling – September 2017
TCE Results Zone B



Performance Monitoring Well Sampling – September 2017
1,2-DCE Results Zone A



Performance Monitoring Well Sampling – September 2017
1,2-DCE Results Zone B

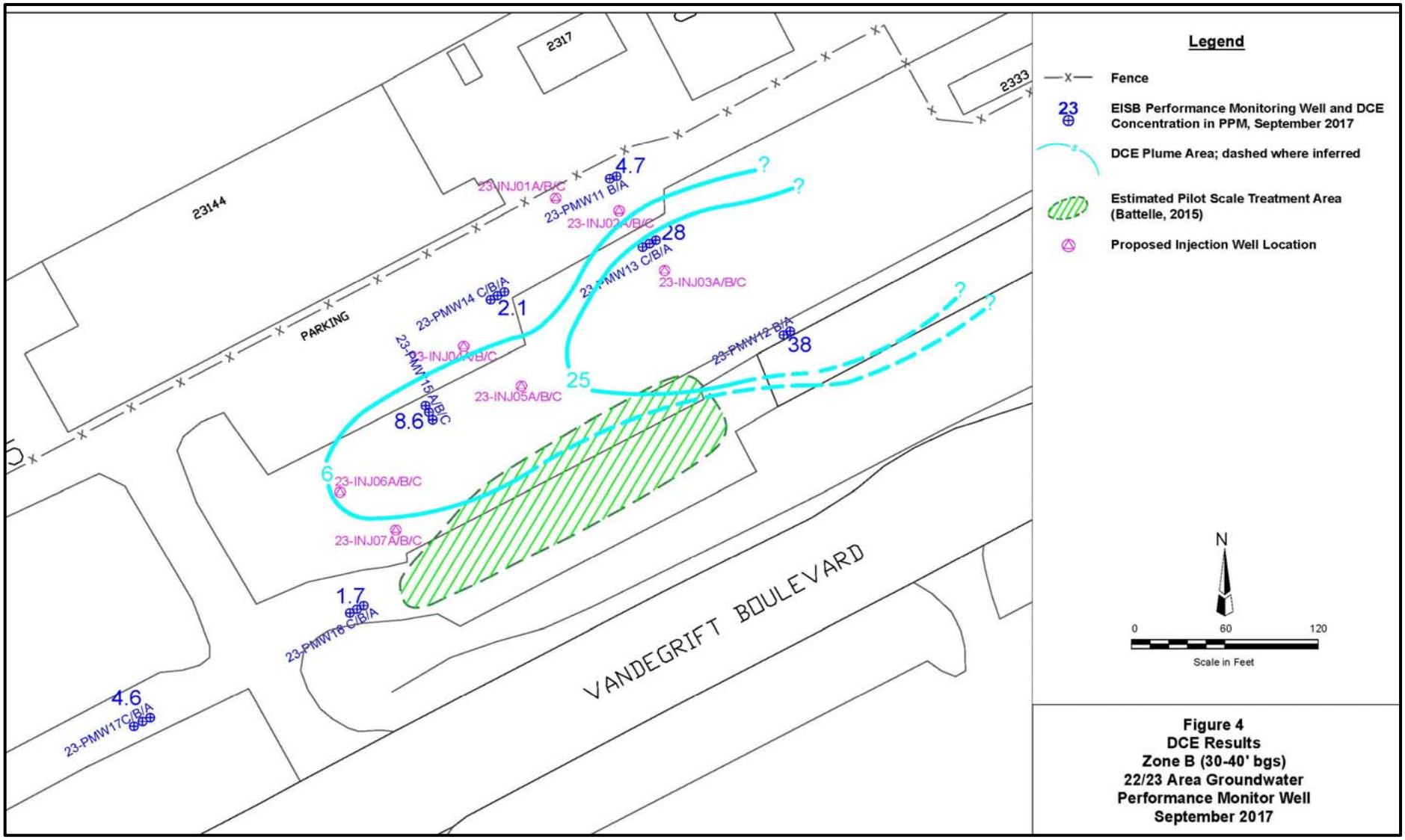


Figure 4
DCE Results
Zone B (30-40' bgs)
22/23 Area Groundwater
Performance Monitor Well
September 2017

Performance Monitoring Well Data Gaps

- Data collected from performance monitoring wells did not provide delineation of the plume in the upgradient or downgradient directions to support placement of proposed injection wells. Additionally, data did not sufficiently address the following primary data quality objective (DQO):

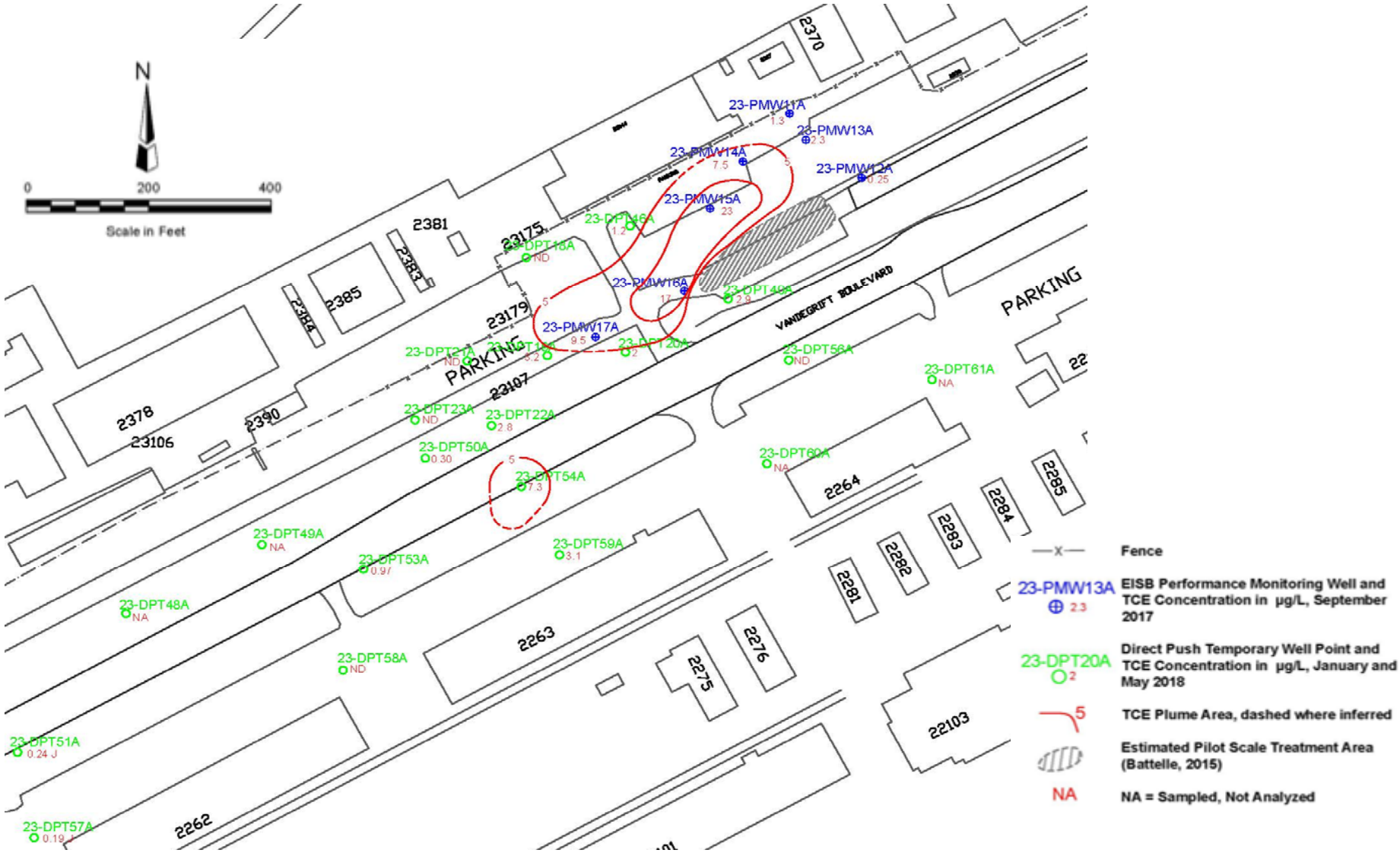
  "Does the data obtained from the EISB performance monitoring wells adequately bound the extent of the plume for design purposes, including both upgradient and downgradient directions?"

- Baseline performance monitoring well groundwater data indicated that:
  - The downgradient extent of both TCE and cis-1,2-DCE in the A zone was not bounded laterally
  - The extent of both TCE and cis-1,2-DCE in the B zone was not delineated laterally
  - The upgradient extent of both TCE and cis-1,2-DCE in the B zone was not delineated

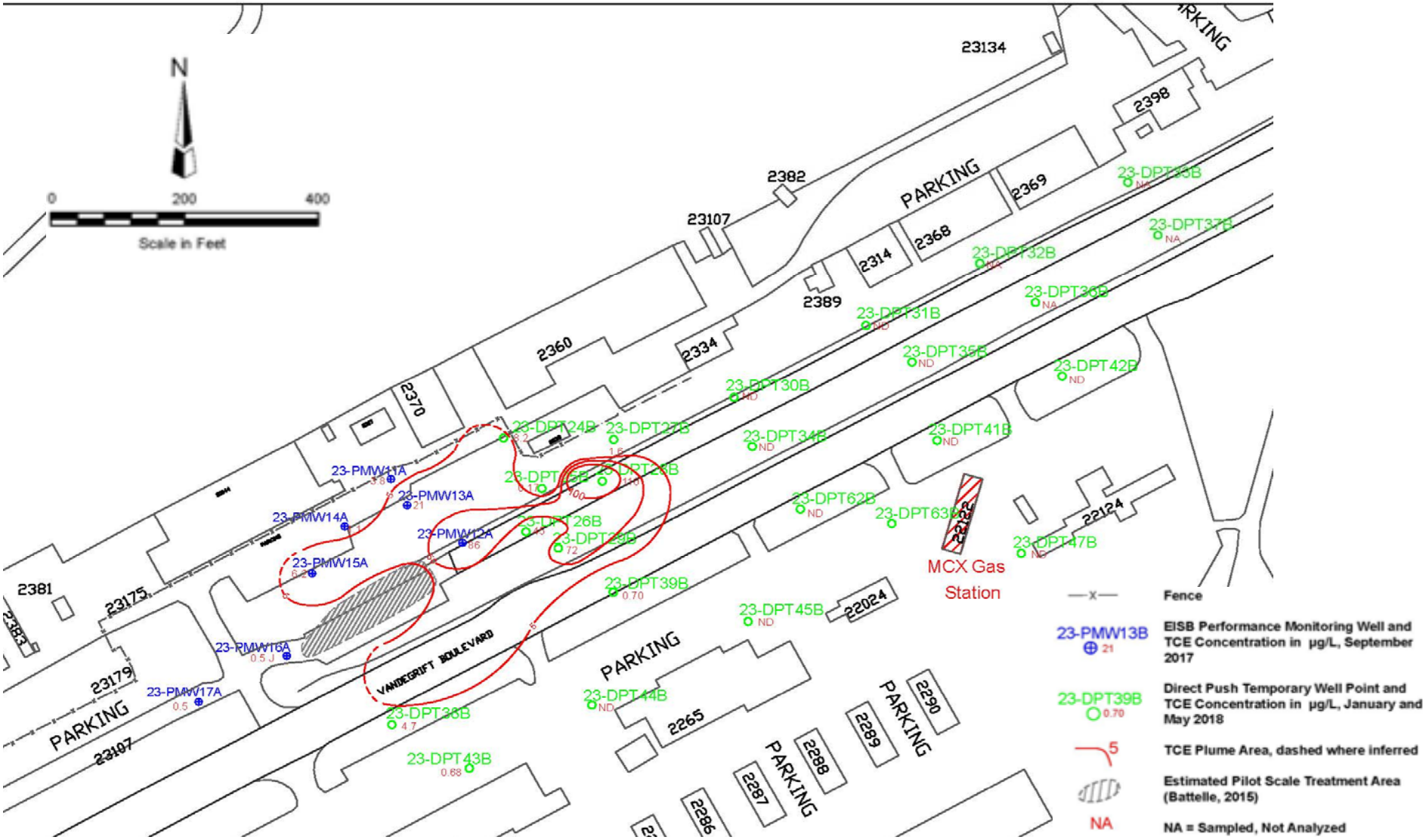
Step Out Sampling – January 2018 and May 2018

- To optimize placement and construction of EISB injection wells, address outstanding data quality objectives, and ensure protection of Production Well 2301 (located ~4,500 feet downgradient), a supplemental groundwater delineation effort was conducted.
- A Field Change Request Form for step out sampling using DPT grab sampling was submitted to the NAVFAC SW QAO in December 2017 and provided to FFA team members.
- In January, an initial phase of DPT sampling was conducted. In May, a second phase of DPT sampling was conducted. Groundwater grab samples were collected and analyzed, and analytical results were validated.
- Results were used to improve our understanding of plume extents.

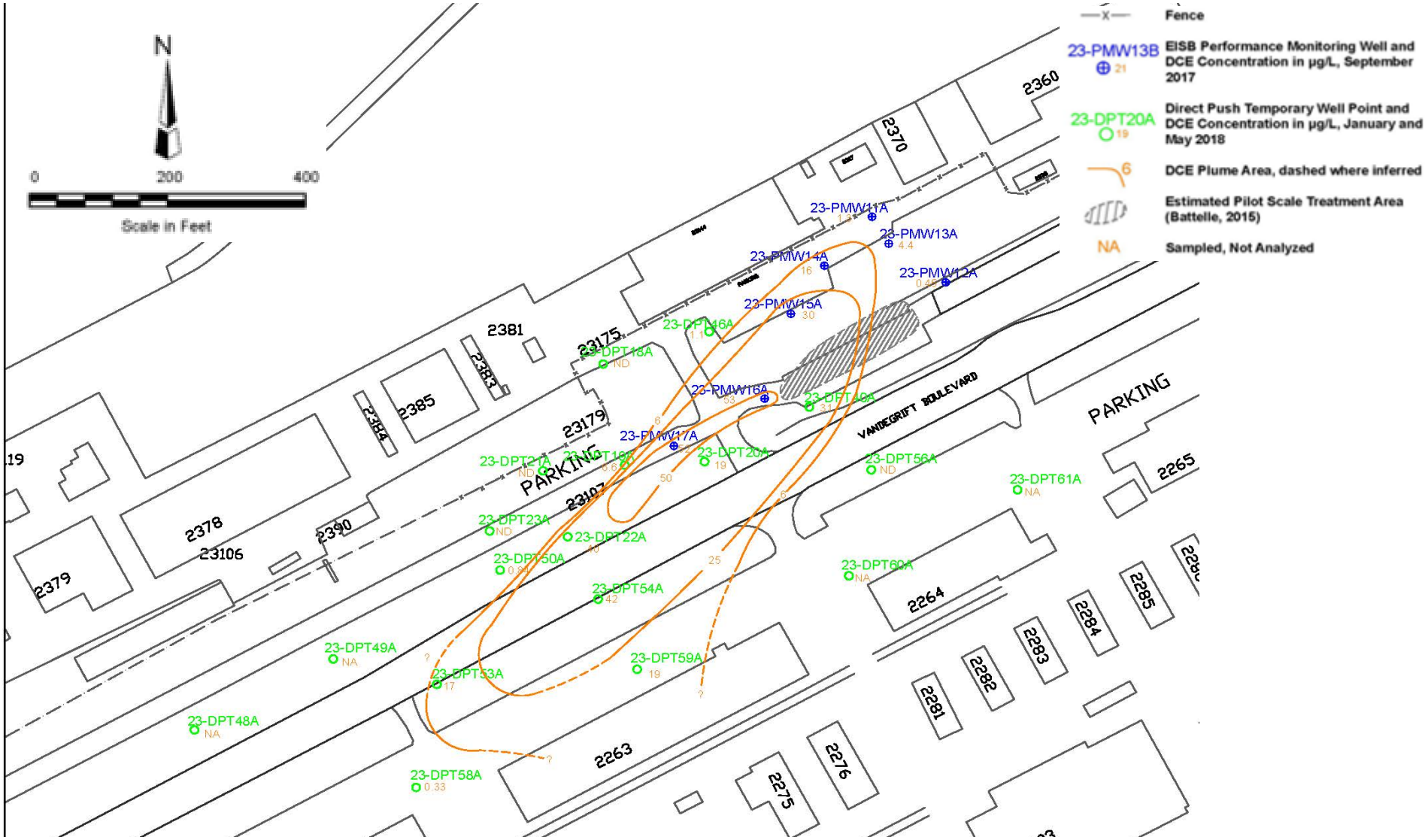
Step Out Sampling – Phases 1 and 2
TCE Results Zone A



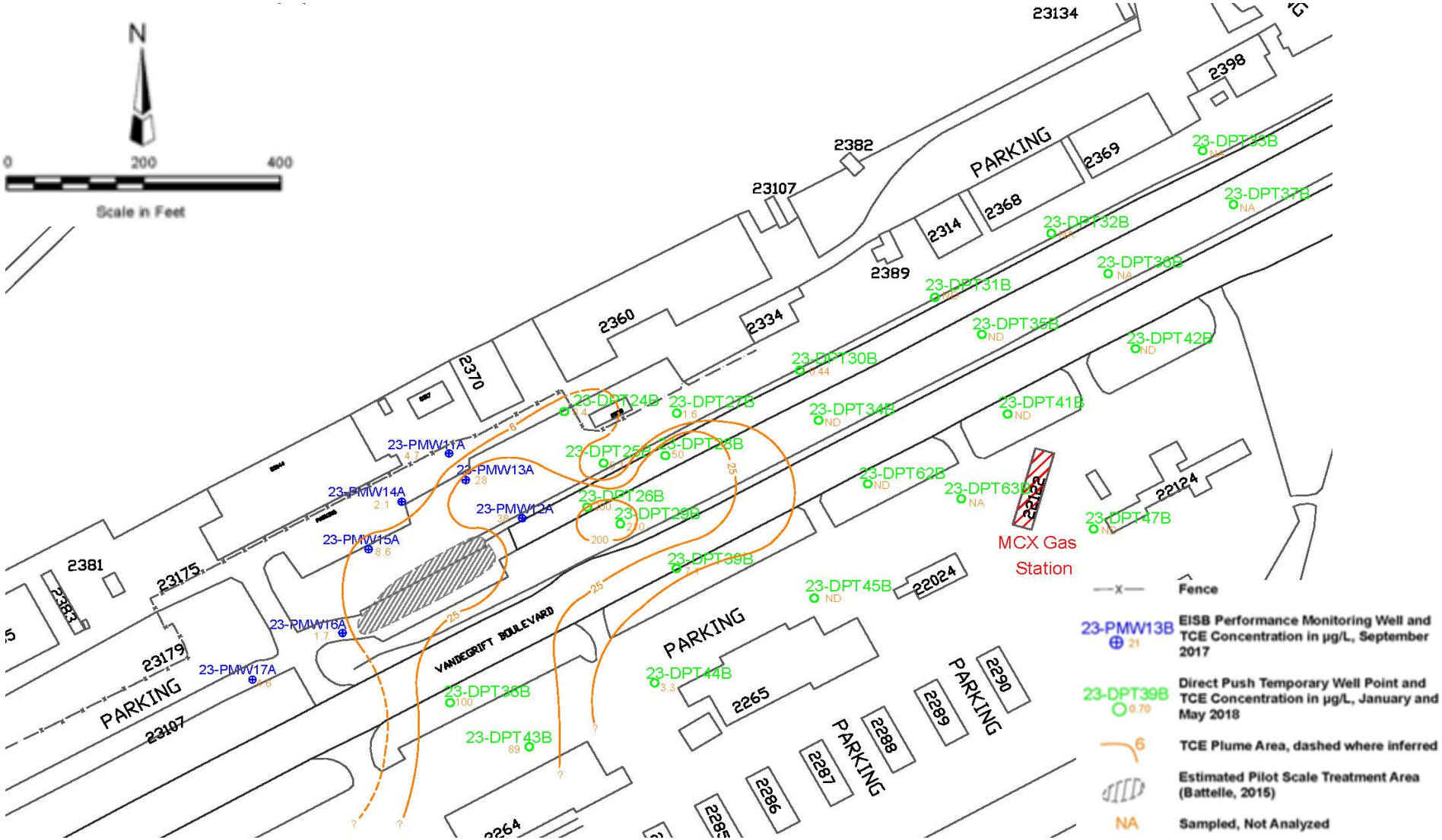
Step Out Sampling – Phases 1 and 2
TCE Results Zone B



Step Out Sampling – Phases 1 and 2
1,2-DCE Results Zone A



Step Out Sampling – Phases 1 and 2
1,2-DCE Results Zone B

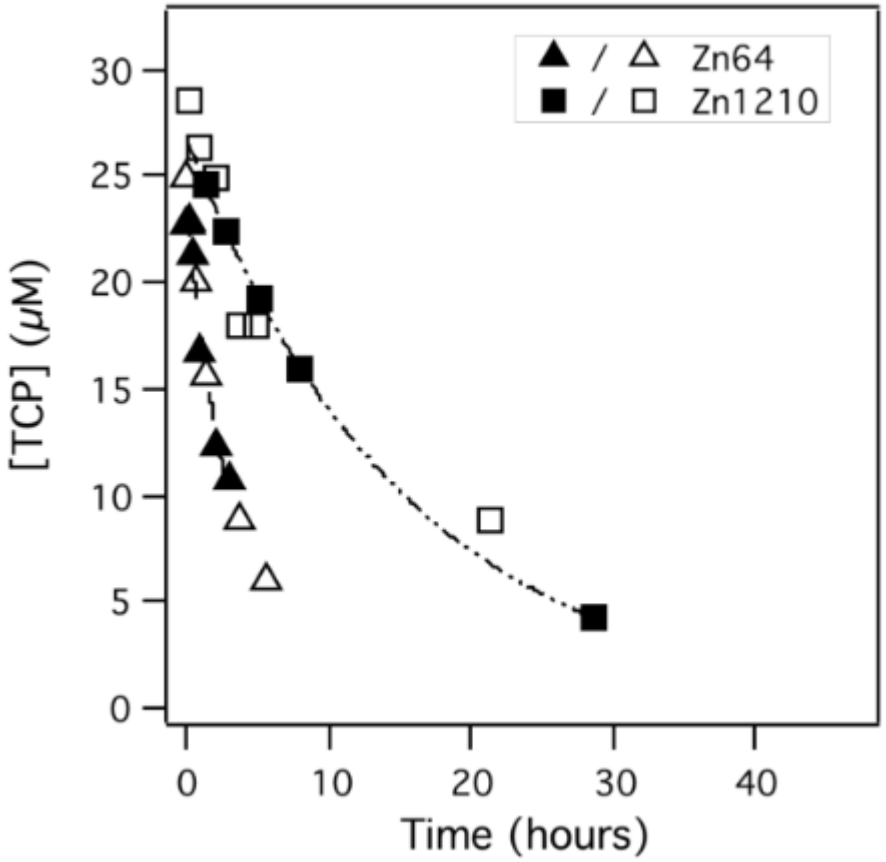


TCE Hotspot Planned Next Steps and Schedule

- Prepare Work Plan/Remedial Action Plan addressing updated conceptual site model
- Preliminary Draft Work Plan/Remedial Action Plan scheduled for submittal to NAVFAC late summer 2019
- Draft Work Plan/Remedial Action Plan planned for submittal to FFA partners fall 2019

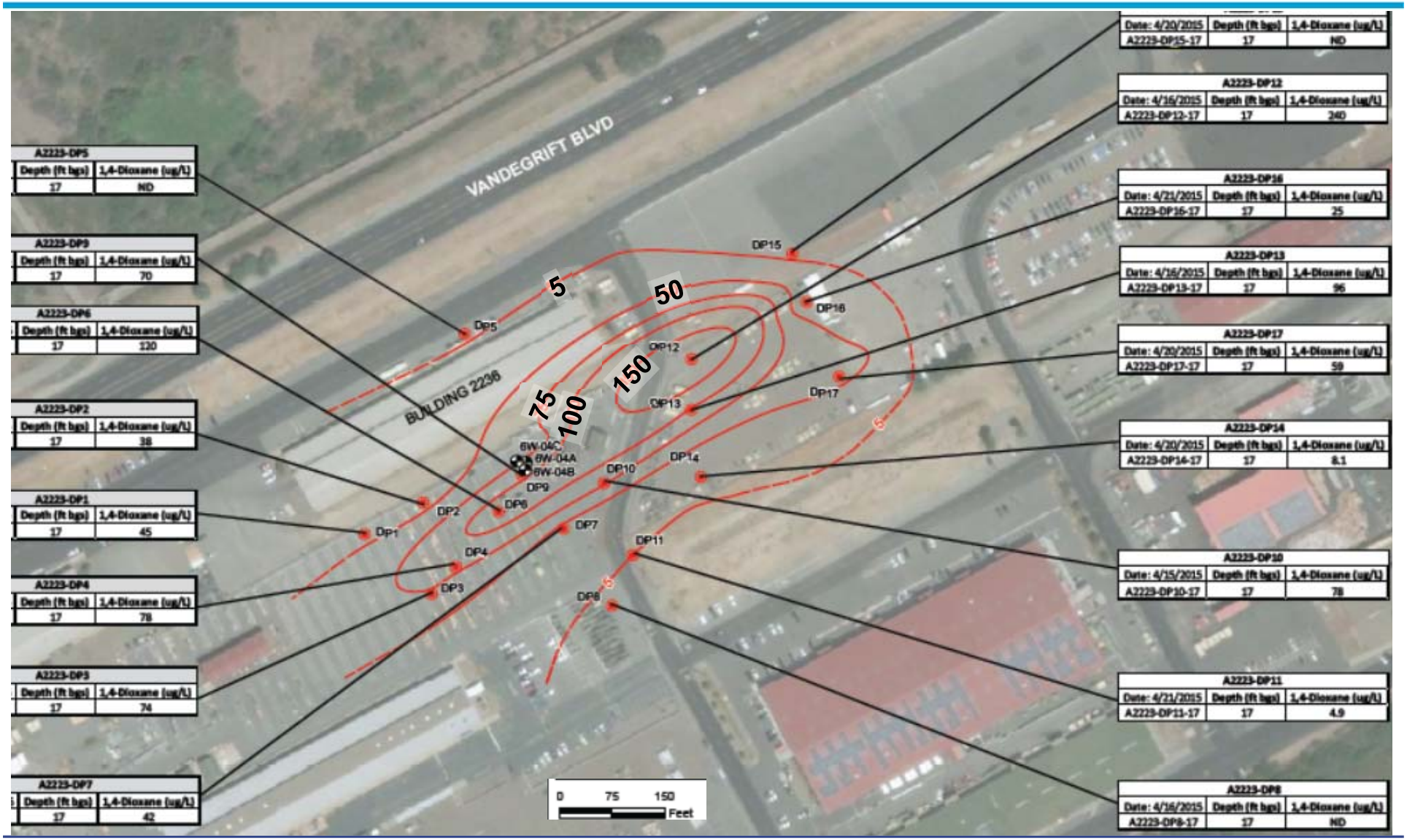
1,2,3-TCP Hotspot Remedy

- 1,2,3-TCP Hotspot will be remedied through application of injected zero valent zinc.
  - Zero Valent Zinc injections were conducted in January-February 2019 (completed February 29th)
  - First round of performance sampling is scheduled to occur in August/September 2019
  - Data will be shared when it is available



*From Tratnyek, P.G. and Johnson, R.L., 2010

1,4-DIOXANE HOTSPOT BACKGROUND



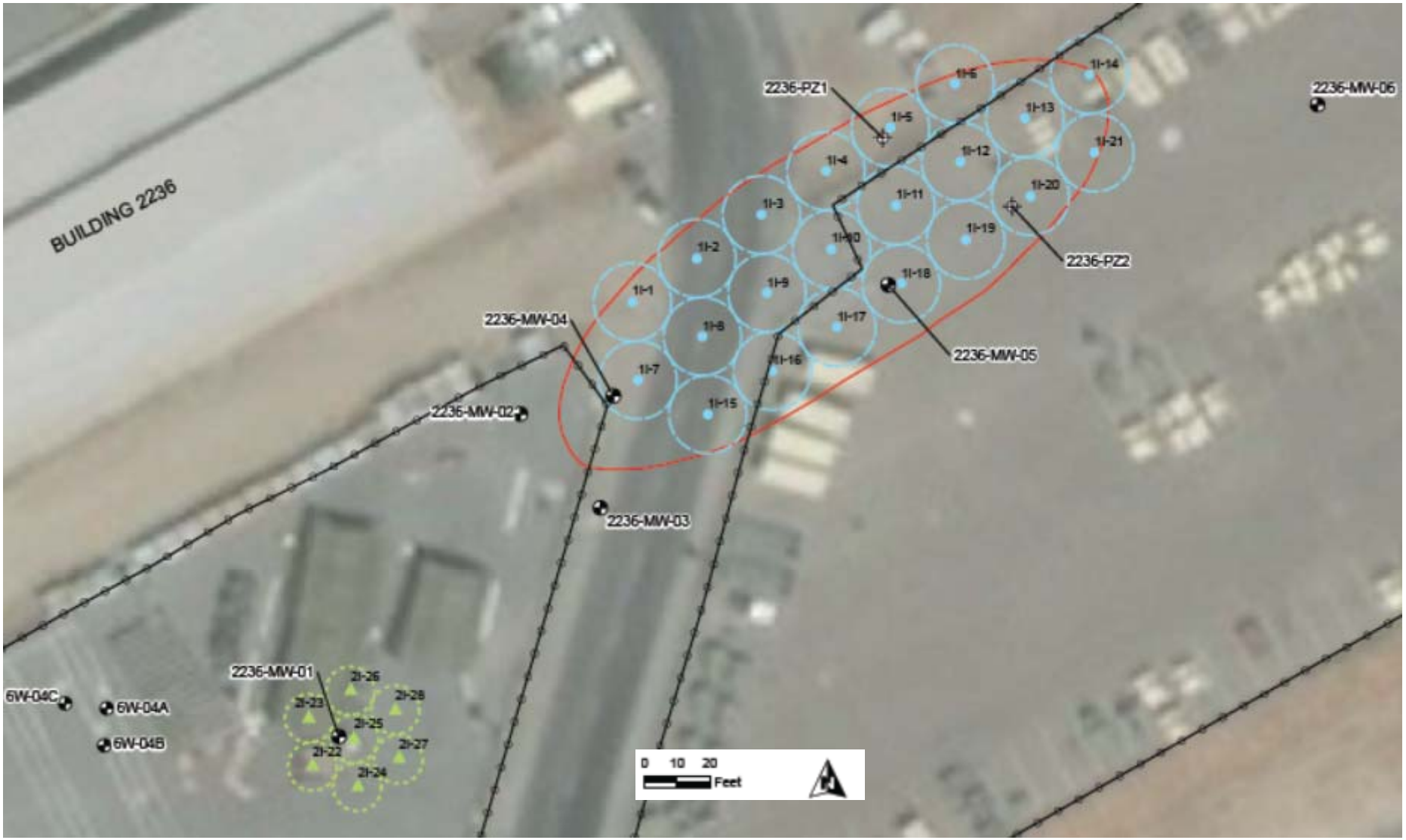
ISCO Pilot Study

- An ISCO pilot involved injecting a pH neutral mixture of chelated iron catalyst and stabilized 6% hydrogen peroxide into the subsurface using direct-push to generate hydroxyl radicals capable of degrading 1,4-dioxane in groundwater.
- The pilot study included installing a network of performance monitoring wells to document the effectiveness of the ISCO treatment in degrading 1,4-dioxane.
- The ISCO pilot study was conducted across a treatment area of approximately 10,600 ft^2 around DPT hydro-punch sample location DP12. The treatment area was designed to be located within the portion of the 22/23 Area Site where 1,4-dioxane was detected at concentrations greater than 150 µg/L based on the April 2015 DPT hydro-punch groundwater sampling data.

ISCO Pilot Study (continued)

- Pilot study occurred July 2017 to February 2018 in accordance with the approved Final Pilot Study Work Plan for In-Situ Chemical Oxidation.
- 21 DPT injection points and 9 MWs were installed. The injection interval for the ISCO Pilot Test was 13 to 21 feet bgs. The injection locations were distributed in a grid-like pattern across the entire extent of the 150 µg/L 1,4-dioxane contour.
- The sampling events included:
  - baseline sampling;
  - 7 days post-injection;
  - 2 weeks post-injection;
  - 4 weeks after injection; and
  - 12 weeks after injection.
- Baseline concentrations of 1,4-dioxane in the pilot study area were significantly lower than those observed during the 2015 DPT sampling event.
- A second round of injections was performed in the vicinity of 2236-MW-1 where 1,4-dioxane concentrations were similar during the baseline sampling event as was observed in the pilot study treatment area in 2015 (~150 µg/L).
- Performance samples were collected 3 weeks and 8 weeks after the second injection event.

ISCO PILOT STUDY FIELD ACTIVITIES



ISCO Pilot Study Results and Path Forward

- The follow-up injections near 2236-MW-1 effectively caused a decline in 1,4-dioxane concentrations of approximately 30% within nine weeks.
- Based on the follow-up post-injection sampling results, ISCO appears to have degraded 1,4-dioxane within the treatment area around 2236-MW-1 though this is complicated by concentration declines observed in upgradient wells and potential hotspot migration during the study.
- Navy is proceeding to full scale ISCO which is currently in planning stages with the RAWP in preparation.

1,4-Dioxane Full Scale Hotspot Planning

- A 3-dimensional representation of the 1,4-dioxane hotspot stratigraphy and plume are being prepared
- Hot spot stratigraphy and flow dynamics are complex
- Full scale ISCO remedy will be designed to work with site conditions and will account for natural migration to destroy 1,4-dioxane mass in-situ
- RAWP is under preparation with pre-draft submittal for Navy review July 2019 and Agency submittal ~September 2019
- Stay Tuned!

1,4-Dioxane Hotspot Full Scale ISCO

Switch to 3D representation

MCB CAMP PENDLETON
SITE 1115
LNAPL CHARATERIZATION

20 June 2019

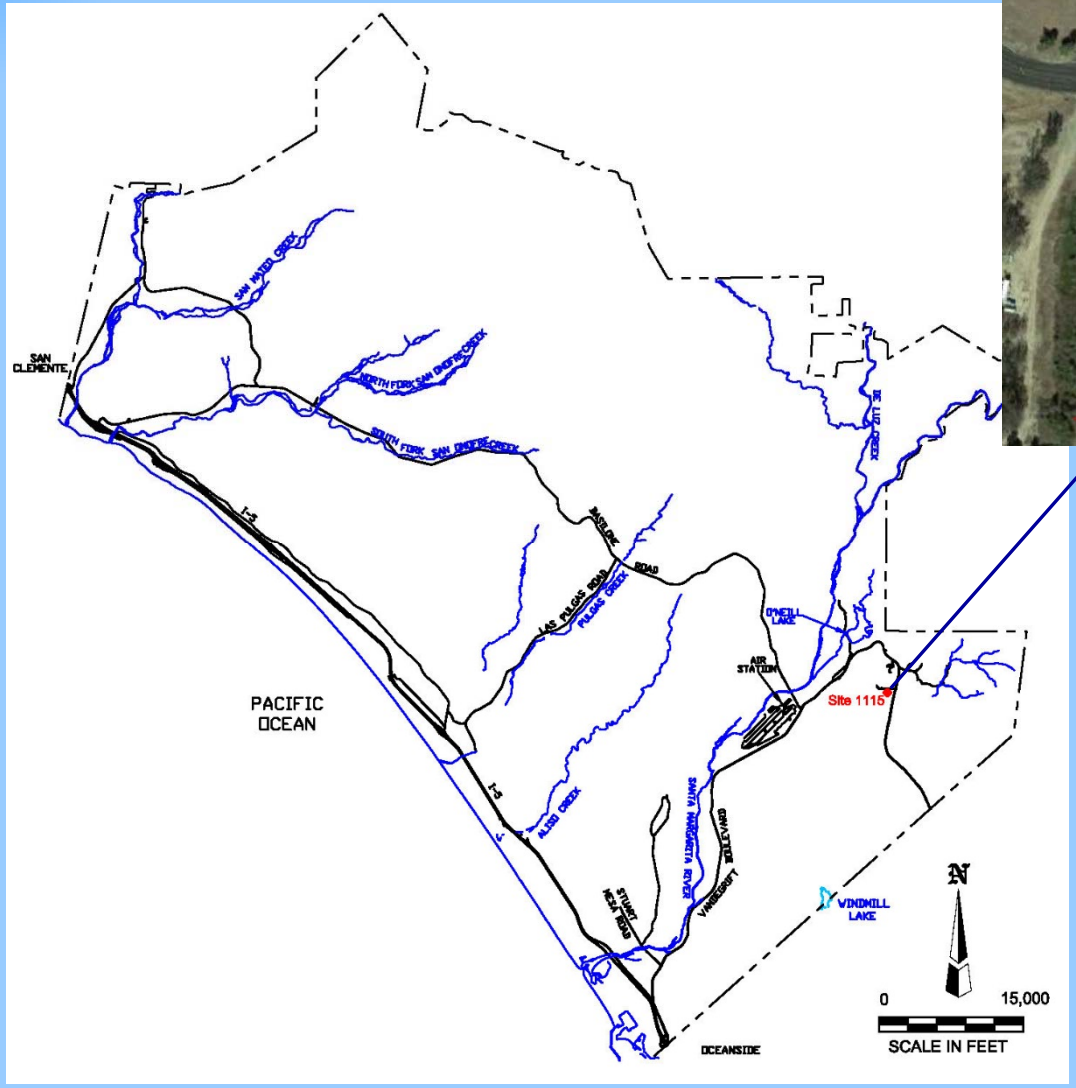
127th FFA Meeting

Site 1115 LNAPL Characterization

- Site Location
- Previous Investigations and Interim Actions
- Proposed Light Non-Aqueous Phase Liquid (LNAPL) Removal
- Proposed Vapor Intrusion Study

Site 1115 LNAPL Characterization

Site Location



- Located in "Mainside" Base Area
- Extent of plume above MCLs is approximately 4.5 acres
- Relatively steep topography (sloping to north)

Site 1115 LNAPL Characterization

Previous Investigations and Interim Actions

- Multiple investigations under Base UST Program starting in 1986 before being transferred to IR program in 2002 due to presence of CVOCs
- IR Program investigations leading up to RI/FS:
  - Final Soil Investigation Report for the OU 5 sites (FWENC, 2002)
  - Action Memorandum For Non-Time Critical Removal Action, Operable Unit 5, Site 1115, 13 Area (2003)
  - Draft Final OU 5 RI prepared for Sites 1A-1, 6A, 21, 1111, and 12 (Appendix M) (2004)
- Pre-RI/FS Interim Actions:
  - Pilot scale testing of SVE conducted at Former UST Site 1 in 2000
  - Soil removal action at Former UST Site 1 in 2002
  - Pilot scale testing of in situ bioremediation at Site 5/8/19/17 in 2009/2010
- The Final RI/FS was published in 2012

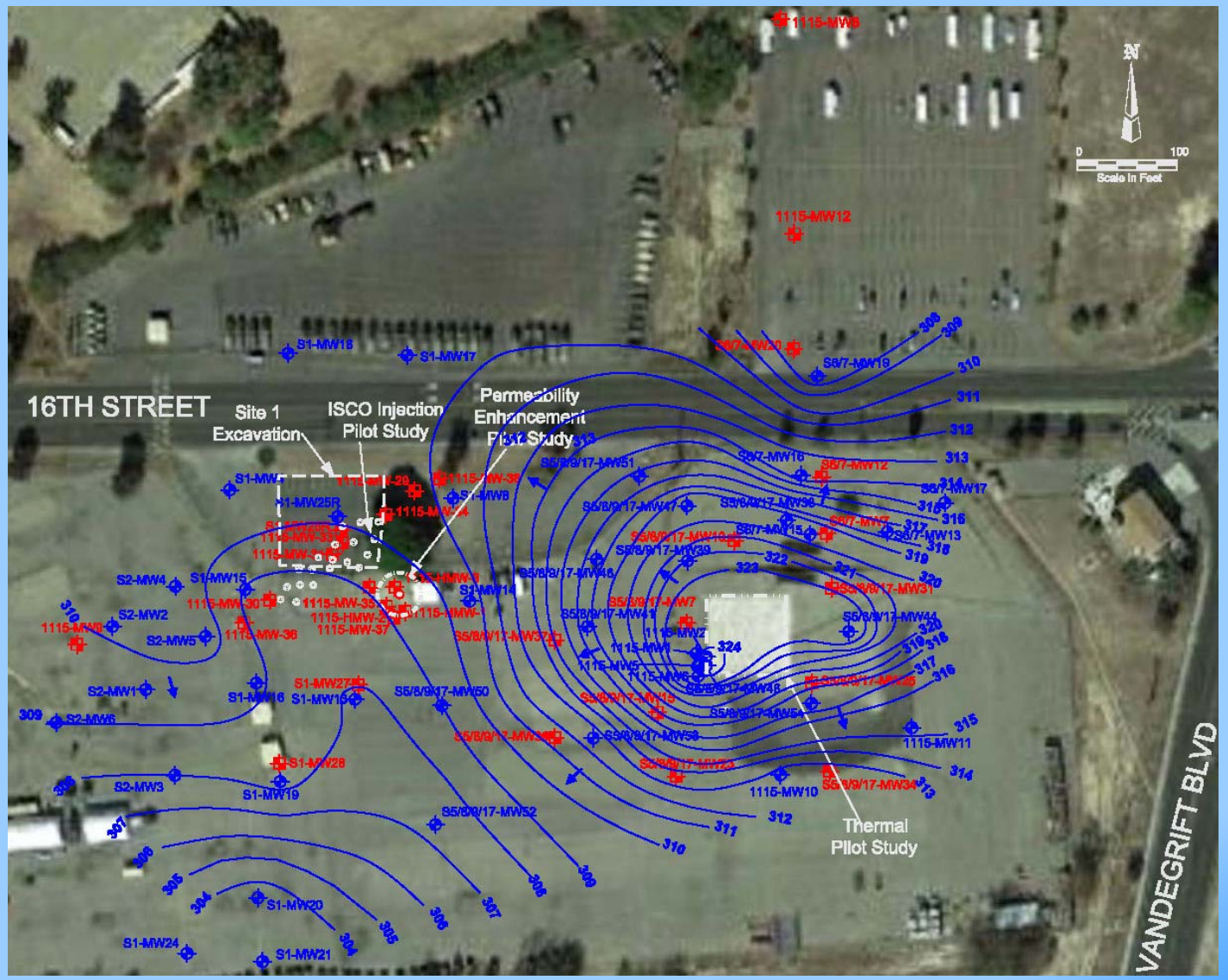
Site 1115 LNAPL Characterization

Previous Investigations and Interim Actions (continued)

- Post RI/FS Pilot Studies
  - In Situ Thermal Remediation (ISTR) Pilot Study at Former UST Site 9 (TTZ-2L and TTZ-2S), which is part of Former Site 5/8/9/17
  - Excavation to address shallow impacts at Former UST Site 1 (TTZ-1S), followed by introduction of chemical oxidant in excavation and ISCO injection into the deep aquifer at Former UST Site 1 (TTZ-1D)
  - "Fracking" Pilot Study at Former UST Site 1 (TTZ-1D) "Permeability Enhancement Technology" using hydraulic fracturing technique
- Other Post RI/FS Activities:
  - Sitewide water level elevation measurements
  - Groundwater sampling select wells
  - Free product thickness measurements
- Pilot study reporting is on-going

Site 1115 LNAPL Characterization

Shallow Groundwater Contours March 2017



Site 1115 LNAPL Characterization

Proposed LNAPL Removal

- LNAPL released from the USTs and pipeline, travelled downward through the vadose zone, and accumulated on the shallow water table.
- LNAPL at the site is thought to exist in localized “pockets” that serve as ongoing secondary sources, providing dissolved-phase mass to the shallow groundwater and partitioning into soil gas. These LNAPL “pockets” will continue to serve as secondary sources until the LNAPL is removed or eventually depleted over time (Parsons, 2014).

Site 1115 LNAPL Characterization

Proposed LNAPL Removal (Continued)

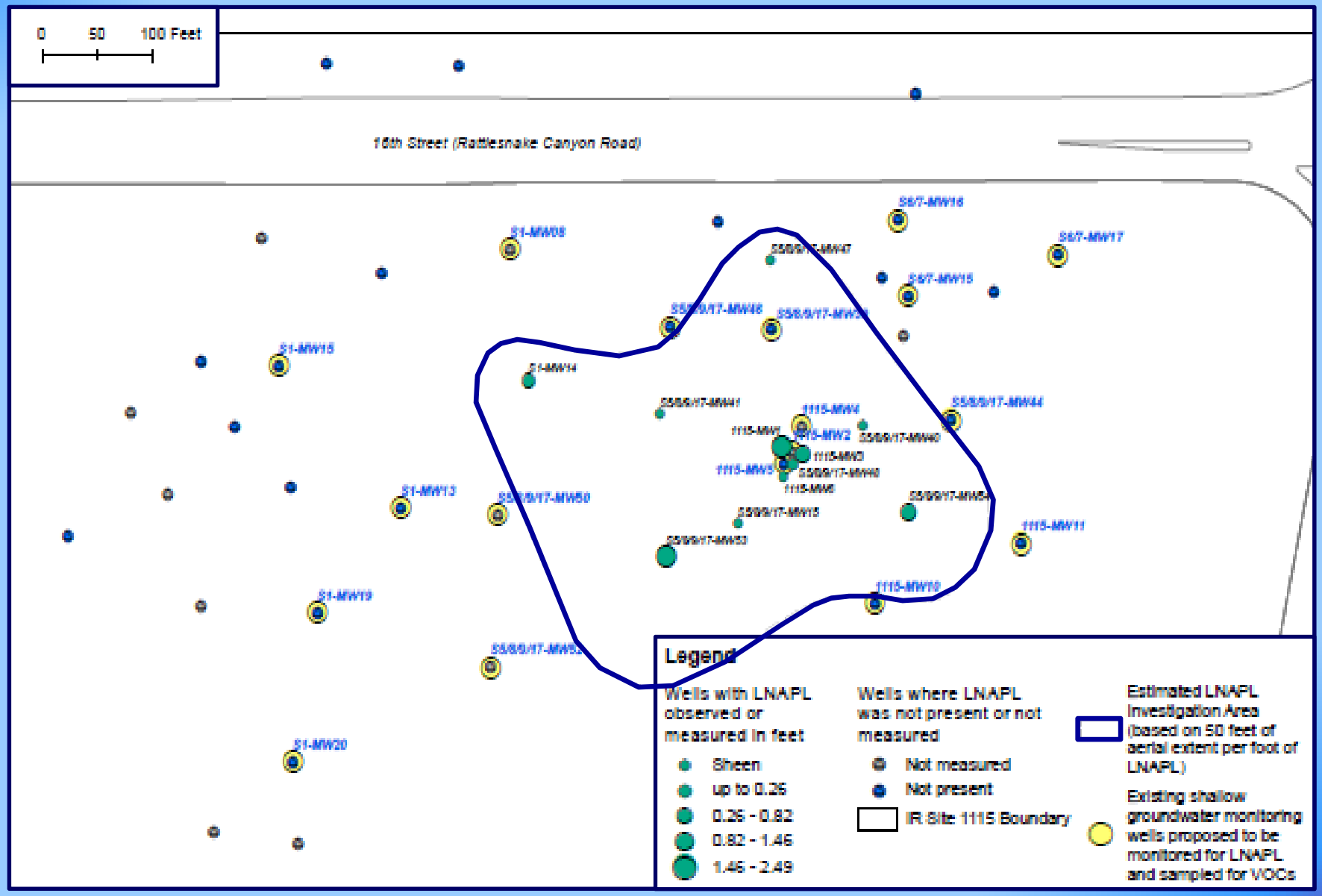
- LNAPL has historically been found in 13 wells, including 10 currently existing wells.
- Recent max LNAPL thickness was 2.49 feet.

LNAPL Thickness

Well Identification	LNAPL Thickness												
	Jul-09	Feb-10	Jul-10	Nov-10	Dec-10	Jun-11	Jan-12	Jul-12	Jan-13	Jul-13	Jan-14	Mar-17	Maximum of 4 most recent measurements
Shallow													
1115-MW1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2.49	2.49
1115-MW3	NM	NM	NM	1.27	NM	NM	NM	NM	NM	NM	NM	NM	1.27
S1-MW14	0.41	0.66	0.60	NM	0.46	NM	0.42	0.06	0.02	0.02	0.00	0.82	0.82
S5/8/9/17-MW40	7.91	1.91	4.56	2.96	1.78	NM	0.88	NP	0.01	0.00	0.00	NM	0.01
S5/8/9/17-MW41	NM	0.04	NM	NM	NM	NM	NM	NM	NM	NM	NM	NP	0.04
S5/8/9/17-MW47	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.01	0.01
S5/8/9/17-MW48	0.26	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.02	0.26
S5/8/9/17-MW53	2.26	0.68	0.03	0.20	0.44	NM	0.25	0.39	0.42	0.10	0.53	2.07	2.07
S5/8/9/17-MW54	2.19	0.71	0.62	0.10	0.80	0.00	NP	NP	0.03	0.00	NP	1.46	1.46
Deep													
S5/8/9/17-MW15	0.14	0.05	0.02	NM	NP	0.00	NP	NP	0.00	NP	NP	NP	0.00

Site 1115 LNAPL Characterization

Proposed LNAPL Removal (Continued)



Site 1115 LNAPL Characterization

Proposed LNAPL Removal (continued)

- New 2018 LNAPL Thickness Measurements

Well Identification	Casing Diameter (inches)	Total Depth (ft bgs)	Screened Interval (ft bgs)		Depth to LNAPL (ft below TOC)	Depth to Water (ft below TOC)	Date of Depth to Water Measurement
1115-MW1	4" PVC	35.5	25.0	35.0	19.38	21.90	9/11/2018
1115-MW5	4" PVC	35.5	25.0	35.0	Not Present	18.80	9/11/2018
1115-MW6	4" PVC	35.3	24.8	34.8	Not Present	21.06	9/11/2018
1115-MW10	4" PVC	42.0	26.5	41.5	Not Present	32.55	9/11/2018
1115-MW11	4" PVC	42.0	26.5	41.5	Not Present	35.22	9/11/2018
S1-MW08	4" PVC	35.0	14.0	34.0	Not gauged (obstruction at 18 feet)		9/11/2018
S1-MW13	4" PVC	40.0	24.0	39.0	Not Present	32.85	9/11/2018
S1-MW14	4" PVC	32.5	16.5	31.5	25.05	28.20	9/11/2018
S1-MW15	4" PVC	36.0	20.0	35.0	Not Present	26.85	9/11/2018
S1-MW19	4" PVC	50.0	33.5	48.5	Not Present	38.30	9/11/2018
S1-MW20	4" PVC	61.0	40.5	60.5	Not Present	47.90	9/11/2018
S5/8/9/17-MW07	4" PVC	64.5	43.5	63.5	Not Present	46.70	9/11/2018
S5/8/9/17-MW10	4" PVC	60.0	44.0	59.0	Not Present	40.75	9/11/2018
S5/8/9/17-MW15	4" PVC	78.0	57.0	77.0	Not Present	52.01	9/11/2018
S5/8/9/17-MW25	4" PVC	65.0	49.0	64.0	Not Present	47.52	9/11/2018
S5/8/9/17-MW31	4" PVC	65.0	49.0	64.0	Not Present	47.29	9/11/2018
S5/8/9/17-MW37	4" PVC	66.0	50.0	65.0	Not Present	47.18	9/11/2018
S5/8/9/17-MW39	4" PVC	31.0	15.0	30.0	Not Present	12.08	9/11/2018
S5/8/9/17-MW41	4" PVC	33.0	17.0	32.0	19.83	19.86	9/11/2018
S5/8/9/17-MW44	4" PVC	30.0	14.0	29.0	Not Present	13.40	9/11/2018
S5/8/9/17-MW46	4" PVC	30.0	14.0	29.0	Not Present	15.07	9/11/2018
S5/8/9/17-MW47	4" PVC	34.0	13.0	33.0	Not Present	9.79	9/11/2018
S5/8/9/17-MW50	4" PVC	36.0	15.5	35.5	Not Present	31.75	9/11/2018
S5/8/9/17-MW52	4" PVC	55.0	40.0	54.5	Not Present	43.95	9/11/2018
S5/8/9/17-MW53	4" PVC	40.5	30.0	40.0	28.90	32.48	9/11/2018
S5/8/9/17-MW54	4" PVC	35.5	20.0	35.0	17.89	20.13	9/11/2018
S6/7-MW15	4" PVC	30.0	14.0	29.0	Not Present	14.63	9/11/2018
S6/7-MW16	4" PVC	29.0	13.5	28.5	Not Present	15.74	9/11/2018
S6/7-MW17	4" PVC	33.0	17.5	32.5	Not Present	19.35	9/11/2018

2.52’

3.15’

0.03’

3.58’

2.24’

Site 1115 LNAPL Characterization

Newly Collected LNAPL Thickness Data:

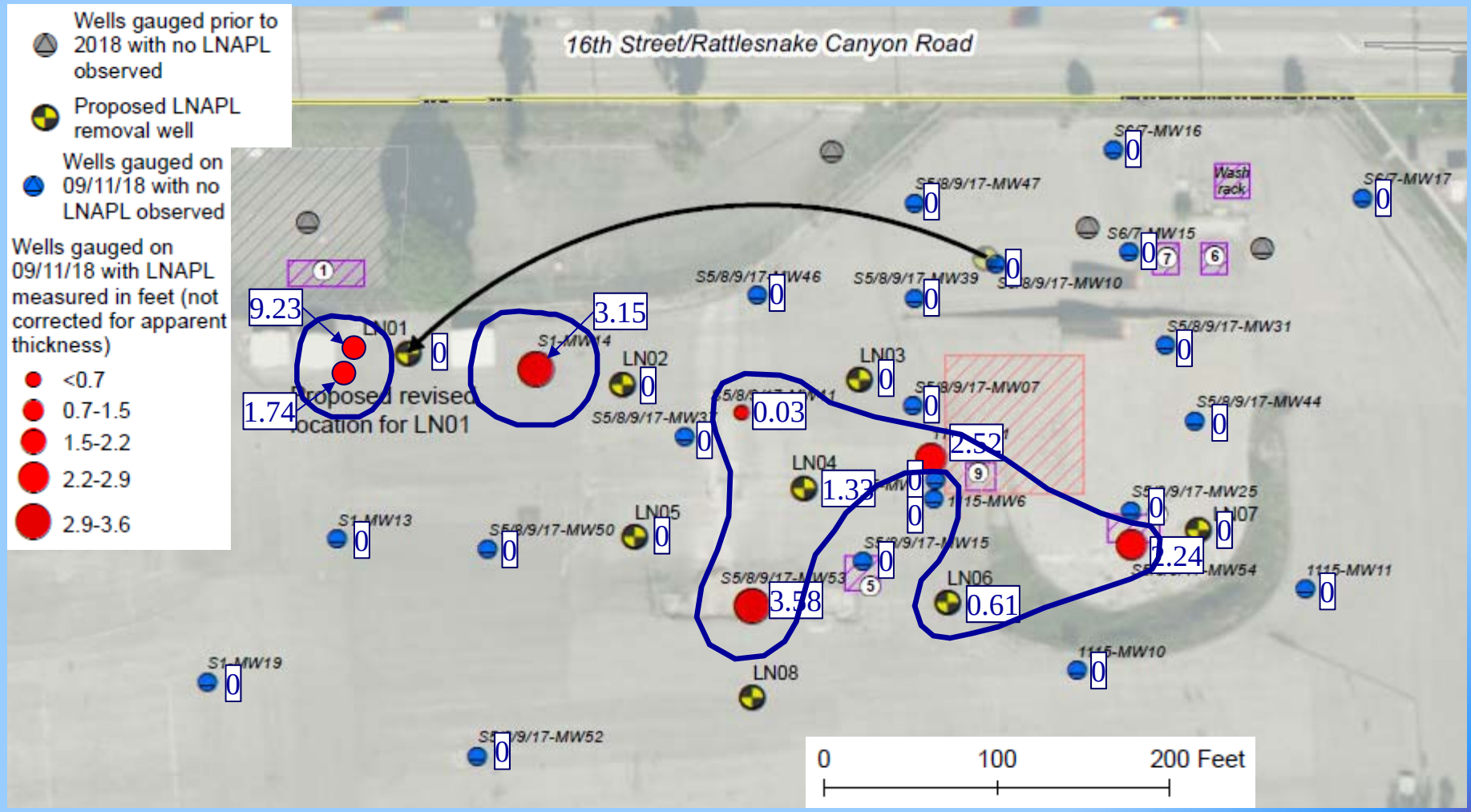
- Frac Study MW-01: 9.23 feet
- Frac well: 1.74 feet
- MW-53: 2.00 feet
- MW-41: 0.01 feet
- LN04 (new well): 1.33 feet
- MW-01: 0.08 feet
- LN06 (new well): 0.61 feet
- MW-54: 2.31 feet
- MW-14: 4.23 feet

LNAPL free wells: LN01, LN02, LN03, LN05, LN07, LN08, MW-37, MW-35, frac study MW-02, MW-05, MW-06

Site 1115 LNAPL Characterization

Proposed LNAPL Removal (Continued)

- 2018 and 2019 LNAPL thickness combined datasets



Site 1115 LNAPL Characterization

LNAPL Recovery Testing Next Steps

- LNAPL recovery testing started in May, 2019
- Recovery testing expected to continue for the next 11 months
- Data from LNAPL Recovery testing will be incorporated into the FS addendum to be prepared in the summer of 2020

Site 1115 LNAPL Characterization

Questions?

MCB CAMP PENDLETON
IR SITE 33

Site Remediation Update

June 2019

FFA Meeting

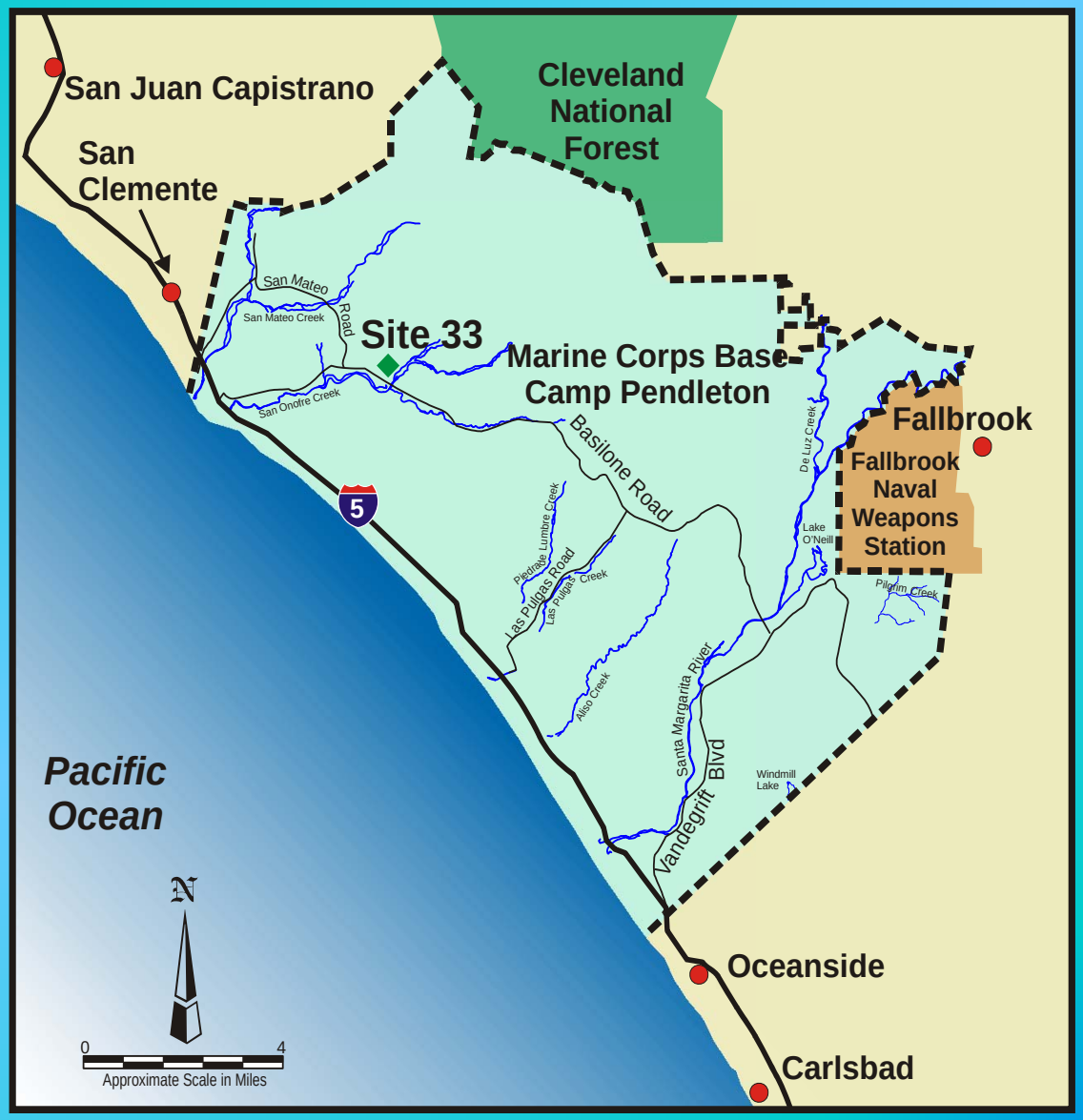
IR Site 33 Remediation Update

- Site Location
- Site History
- Groundwater Remediation Progress Update
- Soil Gas Current Conditions Update
- Future Site Activities

IR Site 33 Remediation

Location:

- IR Site 33 is located in the northwest portion of the Base within an open area off San Juan Road between Building 520452 (52 Area Armory and Gun Cleaning Area) and Building 52651 (52 Area School of Infantry)



Site 33 Groundwater Remediation Update

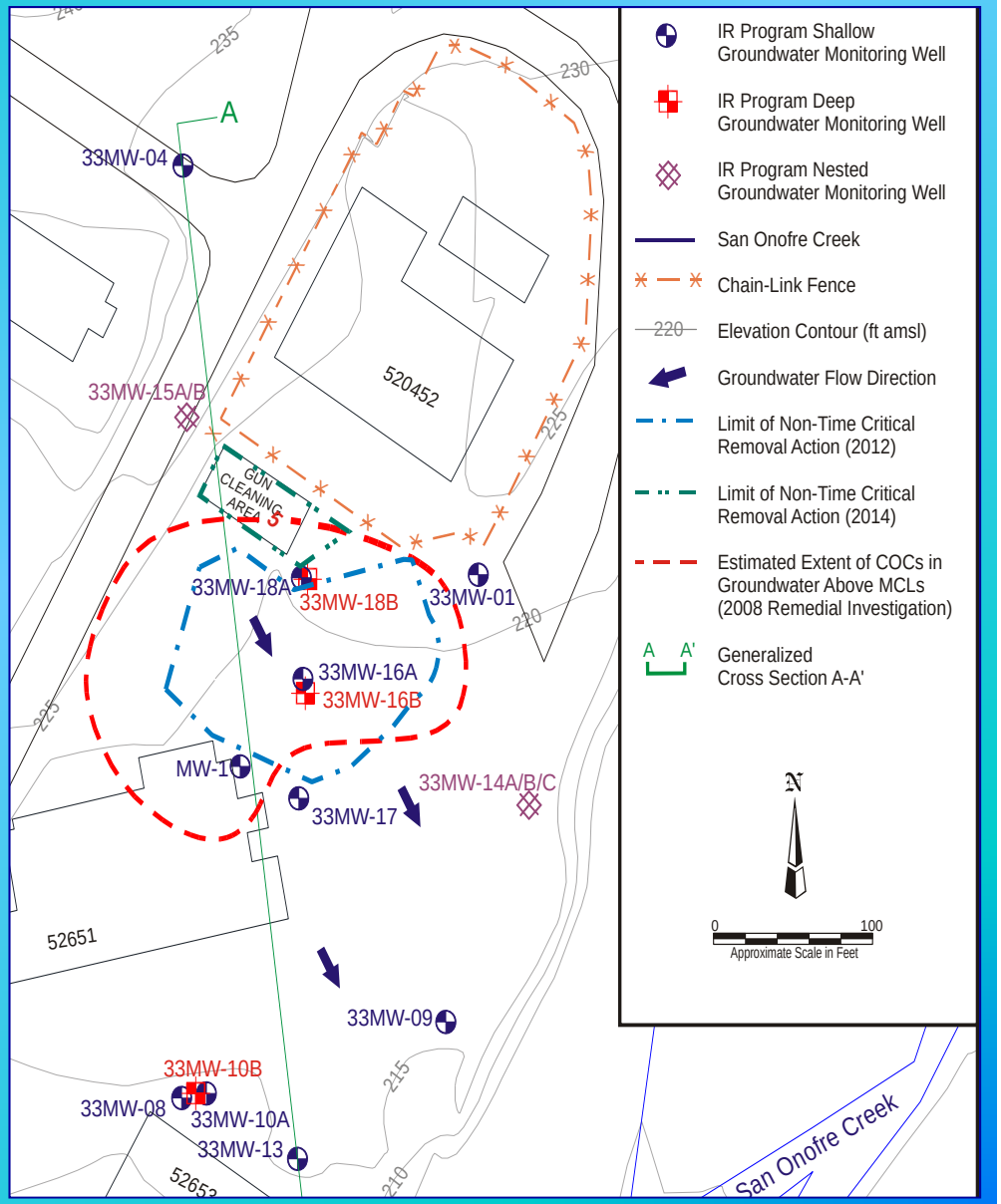
Remedial Path Summary

- RI/FS completed in 2008. Primary COC is PCE in Groundwater.
- FS Alternatives:
  - 33-1: No Action
  - 33-2: Land Use Controls, Long-Term Groundwater Monitoring, and 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

Site 33 Groundwater Remediation Update

Remedial Summary

- Navy performed source removal and risk reduction and the 2010 EE/CA identified source area excavation with enhanced bioremediation as the preferred removal alternative (similar to FS Alternative 33-5).
- Two Non-Time Critical Removal Actions were completed in 2012 and 2014.
- Groundwater remediation (Enhanced Bioremediation) and monitoring is ongoing.
- Soil gas samples have been collected historically and as recently as 2018.



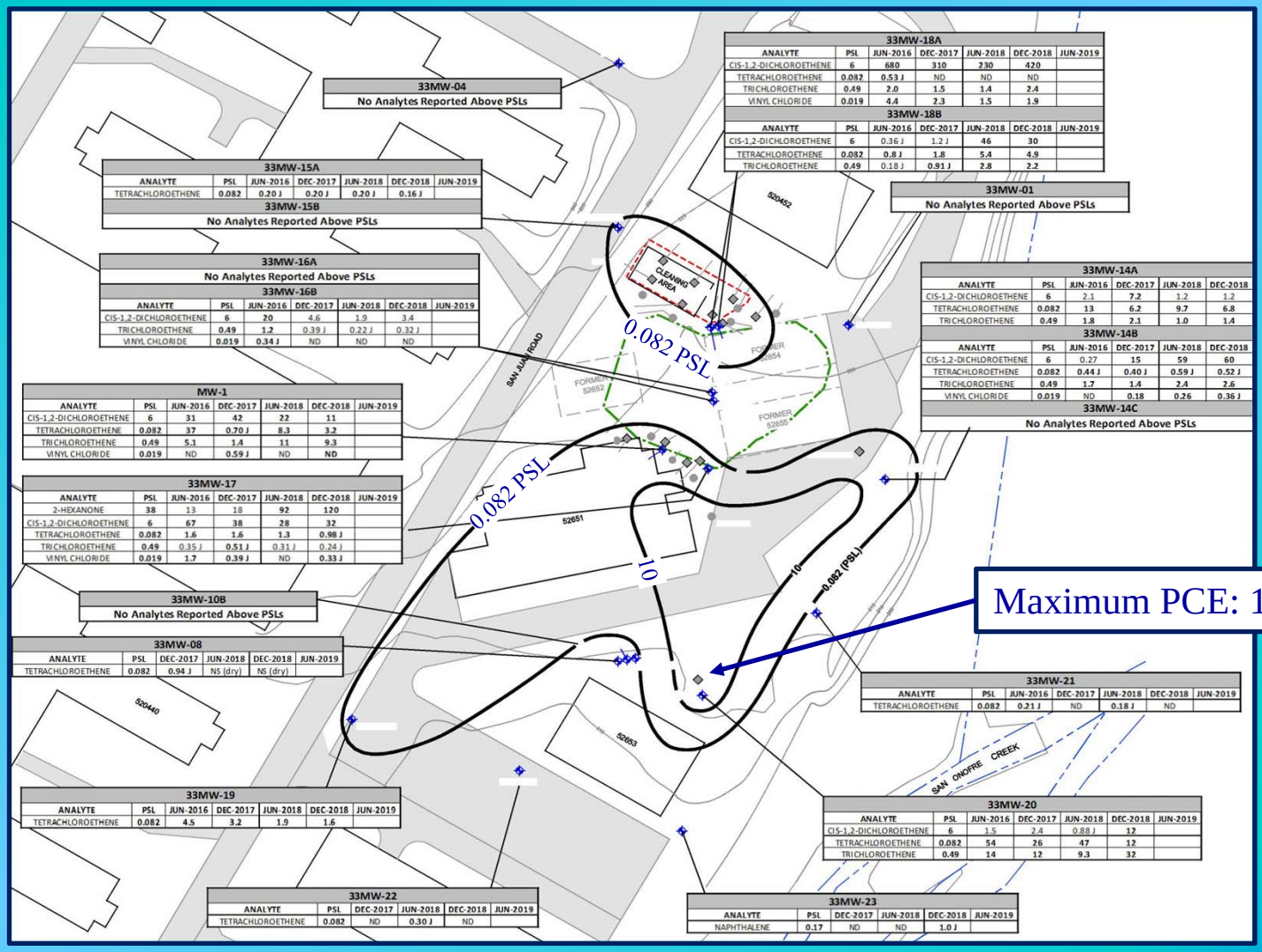
IR Site 33 Remediation

Groundwater Update

- Groundwater is impacted with tetrachloroethene (PCE) and associated breakdown products.
- Three Enhanced In Situ Bioremediation (EISB) injection events have been completed to support the reductive dechlorination of PCE (2014, 2015, and 2017).
- Since 2014 the maximum PCE concentration in groundwater has been reduced from 1,200 µg/L to 12 µg/L (last semiannual event was completed in December 2018).
- Currently the maximum TCE concentration is 32 µg/L, the maximum 1,2-DCE concentration is 420 µg/L, and the maximum vinyl chloride concentration 1.9 µg/L.
- Ethene and ethane are present in groundwater indicating complete reductive dechlorination of PCE is occurring.

IR Site 33 Remediation

PCE in Groundwater – December 2018 Sampling Event



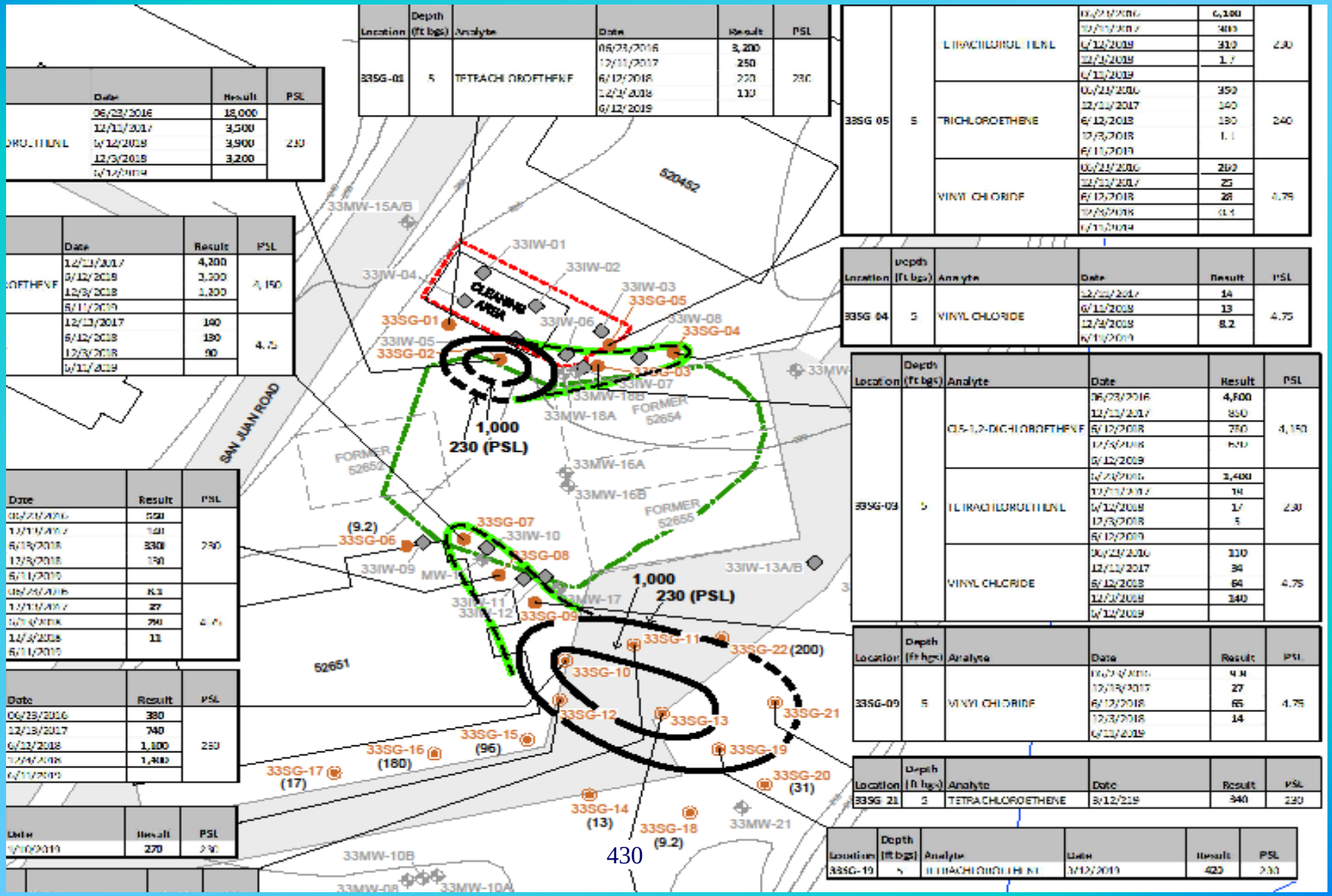
IR Site 33 Remediation

Soil Gas Update

- 20 soil gas wells were installed in 2014 to monitor VOCs in soil near the Sniper Training School and a hypothetical building near the gun cleaning area.
- Semiannual sampling has shown an overall decreasing trend for VOCs in soil gas across the site except for well 33SG-10-S, where PCE concentrations have been steadily increasing since 2015, from 200 µg/m^3 to 1,400 µg/m^3 (most recent December 2018).
- In January 2019 7 new shallow soil gas wells (5 ft) were installed around 33SG-10-S to investigate the horizontal extent of PCE in soil gas in this area.
- New well 33SG-13, installed to the southeast of 33SG-10-S, contained 4,100 µg/m^3 PCE, the highest PCE concentration currently present on site.
- In April 2019 5 additional soil gas step-out wells were installed and the highest PCE concentration in these wells was 420 µg/m^3, indicating the area of elevated PCE in soil gas is relatively small and is now bounded.
- The elevated PCE in soil gas could potentially be the result of off-gassing from a small PCE hotspot in groundwater. The next soil gas sampling event (June 10, 2019) will help determine if additional investigation or remediation in this area is required.

IR Site 33 Remediation

PCE Concentrations in Soil Gas



Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG-01	5	TETRACHLOROETHENE	06/23/2016	3,200	230
			12/11/2017	250	
			6/12/2018	220	
			12/3/2018	110	
			6/12/2019		

	Date	Result	PSL
ORO-ETHENE	06/23/2016	18,000	230
	12/11/2017	3,500	
	6/12/2018	3,900	
	12/3/2018	3,200	
	6/12/2019		

	Date	Result	PSL
ROETHENE	12/11/2017	4,200	4,150
	6/12/2018	3,200	
	12/3/2018	1,200	
	6/11/2019		
	12/13/2017	140	4.75
	6/12/2018	180	
	12/3/2018	90	
	6/11/2019		

Date	Result	PSL
06/23/2016	520	230
12/11/2017	140	
6/12/2018	330	
12/3/2018	130	
6/11/2019		
06/23/2016	83	4.75
12/11/2017	27	
6/12/2018	250	
12/3/2018	11	
6/11/2019		

Date	Result	PSL
06/23/2016	380	230
12/13/2017	740	
6/12/2018	1,100	
12/3/2018	1,400	
6/11/2019		

Date	Result	PSL
6/12/2019	270	230

Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG 05	5	TRICHLOROETHENE	06/23/2016	6,100	230
			12/11/2017	400	
			6/12/2018	310	
			12/3/2018	1.7	
			6/11/2019		
			06/23/2016	350	230
			12/11/2017	140	
			6/12/2018	130	
			12/3/2018	1.1	
			6/11/2019		
		VINYL CHLORIDE	06/23/2016	260	4.75
			12/11/2017	25	
			6/12/2018	28	
			12/3/2018	0.4	
			6/11/2019		

Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG 04	5	VINYL CHLORIDE	12/11/2017	14	4.75
			6/11/2019	13	
			12/3/2018	8.2	
			6/11/2019		

Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG-09	5	CIS-1,2-DICHLOROETHENE	06/23/2016	4,800	4,150
			12/11/2017	850	
			6/12/2018	750	
			12/3/2018	620	
			6/12/2019		
		TETRACHLOROETHENE	06/23/2016	1,400	230
			12/11/2017	14	
			6/12/2018	17	
			12/3/2018	5	
			6/12/2019		
		VINYL CHLORIDE	06/23/2016	110	4.75
			12/11/2017	34	
			6/12/2018	64	
			12/3/2018	140	
			6/12/2019		

Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG-09	5	VINYL CHLORIDE	06/23/2016	9.8	4.75
			12/13/2017	27	
			6/12/2018	65	
			12/3/2018	14	
			6/11/2019		

Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG 21	5	TETRACHLOROETHENE	6/12/219	940	230

Location	Depth (ft bgs)	Analyte	Date	Result	PSL
33SG-19	5	TETRACHLOROETHENE	6/12/2019	420	230

IR Site 33 Remediation

Current and Future Site Activities

- Due to the increasing PCE concentrations in soil gas well 33SG-10, located near Building 52651, three indoor air samples and one outdoor ambient air sample were collected June 8 to 9, 2019. Results will be forwarded to the regulatory agencies when available.
- Continue semiannual groundwater and soil vapor sampling as described in the Long-Term Monitoring Plan. The next semiannual event is scheduled to begin June 10, 2019.
- After completing the June 2019 event evaluate the soil gas data and determine if additional site investigation or remediation is required.
- After completing the June 2019 event prepare the 2019 Annual Performance Monitoring Report summarizing the results from the December 2018 and June 2019 semiannual sampling events.