FINAL
WORK PLAN
Supplemental Investigation
Former Building 88 and Traffic Island Areas
Installation Restoration Site 28
Former Naval Air Station Moffett Field
Moffett Field, California

Environmental Services Contract Number: N62473-10-D-4009
Contract Task Order: 0046

Document Control Number: SHAW-4009-0046-0776.R1

June 2012

Submitted to:

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Program Management Office West Naval Facilities Engineering Command
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Acronyms and Abbreviations

µg/kg	microgram per kilogram
µg/L	microgram per liter
µV	microvolt
bgs	below ground surface
CE	chlorinated ethene
cis 1,2-DCE	cis 1,2-dichloroethene
COC	chemical of concern
CPT	cone penetrometer test
CSM	conceptual site model
DNAPL	dense non-aqueous phase liquid
DSITMS	direct sample ion-trap mass spectrometer
ECD	electron capture detector
EPA	U.S. Environmental Protection Agency
ERS-JV	ERS Joint Venture
ESD	Explanation of Significant Differences
ft/day	feet per day
IR	Installation Restoration
MCL	maximum contaminant level
MIP	membrane interface probe
Moffett	Former Naval Air Station Moffett Field
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
Navy	U.S. Department of the Navy
PCE	tetrachloroethene
PID	photoionization detector
PRC	PRC Environmental Management, Inc.
RL	reporting limit
ROD	*Record of Decision for the Fairchild, Intel, and Raytheon Sites, Middlefield/Ellis/Whisman Study Area*, *Mountain View, California*
ROICC	Resident Officer in Charge of Construction
SAP	Sampling and Analysis Plan
SCAPS	Site Characterization and Analysis Penetrometer System
Shaw	Shaw Environmental, Inc.
Shaw E&I	Shaw Environmental & Infrastructure, Inc.
TCE	trichloroethene
TtECI	Tetra Tech EC, Inc.
TtFWI	Tetra Tech FW, Inc.
VC	vinyl chloride
VOC	volatile organic compound
WATS	West-Side Aquifers Treatment System
WP	Work Plan

1.0 Introduction

This Work Plan (WP) describes the approach and activities to perform a supplemental investigation of chlorinated ethenes (CEs) in the A- and B-Aquifers in two specific areas at Installation Restoration (IR) Site 28, the Former Building 88 Area and Traffic Island Area, of Former Naval Air Station Moffett Field (Moffett), California (Figure 1). This WP has been prepared by Shaw Environmental & Infrastructure, Inc. (Shaw E&I) on behalf of the U.S. Department of the Navy (Navy) under Environmental Services Contract No. N62473-10-D-4009, Contract Task Order 0046.

This WP constitutes one of five documents that comprise the project plans for the proposed activities. The other four documents include: the Sampling and Analysis Plan (SAP) (Appendix A), the Construction Quality Control Plan (Appendix B), the Traffic Control Plan (Appendix C), and the Accident Prevention Plan (submitted under separate cover). These documents provide the rationale, methodologies, and procedures for completing the supplemental investigation.

1.1 Background

IR Site 28 is the aquifers below the area generally bounded by Hangar 1 to the east, McCord Avenue to the west, King Road to the north, and a line approximately 300 feet south of Wescoat Road to the south, as shown on Figure 1. Beneath this area, the A-Aquifer is impacted by volatile organic compounds (VOCs), primarily CEs including tetrachloroethene (PCE), trichloroethene (TCE), cis 1,2-dichloroethene (cis 1,2-DCE), and vinyl chloride (VC). Minor amounts of CE contamination have also been reported within the B-Aquifer. The contamination at IR Site 28 resulted from on-flow of contamination from upgradient CE sources, primarily TCE, at the Fairchild, Intel, and Raytheon sites collectively known as the Middlefield-Ellis-Whisman Superfund Site and on-site Navy sources. Historical dry cleaning activities conducted at former Building 88 were determined to be the source of PCE along with the associated sanitary sewer line (Tetra Tech EC, Inc. [TtECI], 2008).

In 1993, the Navy agreed to adopt the *Record of Decision for the Fairchild, Intel, and Raytheon Sites, Middlefield/Ellis/Whisman Study Area, Mountain View, California* (ROD; U.S. Environmental Protection Agency [EPA], 1989) and to remediate contamination attributable to Navy sources (Navy, 1993). To comply with the ROD requirements, the Navy removed Building 88 in 1994, excavated contaminated soil, and installed a groundwater source control measure referred to as the Building 6 Treatment System. The Building 6 Treatment System was operated until 1997 when it was replaced with a plume-wide groundwater control system referred to as the West-Side Aquifers Treatment System (WATS). Operation of the

WATS has been ongoing since November 1998 (ERS Joint Venture [ERS-JV] and Brown and Caldwell, 2011).

In 2005, the Navy implemented an investigation to evaluate whether the residual PCE in the vadose zone at the former Building 88 location was a continuing source of contamination for groundwater, whether the extent of saturated soil with PCE concentrations could be a source of groundwater contamination, and whether the PCE source area was treatable. It was concluded in the *Final Former Building 88 Investigation Report, Former Naval Air Station Moffett Field, Moffett Field, California* (TtECI, 2008) that residual contamination in the saturated zone in two areas, the Former Building 88 Area and the Traffic Island Area, acts as ongoing PCE sources to groundwater contamination in the upper and lower portion of the A-Aquifer (ranging from approximately 0 to 35 feet below ground surface [bgs] and 35 to 65 feet bgs, respectively). These areas of interest are shown on Figure 2. The investigation report recommended further source removal to meet the requirements of the ROD (EPA, 1989) and to expedite the cleanup of contaminated groundwater. Further characterization of the PCE contamination in the saturated zone soil and/or groundwater was also recommended. The vadose zone soil remedy was completed in 1994, and fully meets the cleanup standards set forth in the ROD (EPA, 2009).

Consequently, in 2010, additional site work was completed to further characterize the identified potential source areas and to investigate possible dense non-aqueous phase liquids (DNAPLs) in support of field testing three in situ CE treatment technologies. CE delineation and DNAPL assessments were completed through the use of membrane interface probe (MIP) analysis, visual examination and field/laboratory testing of soil cores, and hydrophobic flexible membrane testing (Shaw E&I, 2010). This characterization effort further defined the nature and extent of the source area contamination, but additional characterization is needed to refine the understanding of the lateral and vertical extent of the high concentration CEs and soil stratigraphy in these areas.

The EPA is currently preparing a Supplemental Sitewide Groundwater Feasibility Study for the Middlefield-Ellis-Whisman Superfund Study Area to evaluate the ability of several remedial alternatives to reduce concentrations of CEs and to remediate the regional plume. All of the alternatives that will be evaluated in the feasibility study include source treatment. Although prior investigations have provided valuable insight into the nature and extent of the Navy's source areas, several key data gaps remain in the conceptual site model (CSM) for the Former Building 88 and Traffic Island Areas that need to be addressed before further remediation can be designed. Specifically, additional characterization is needed to:

- Further delineate the distribution of PCE and its daughter products (TCE, DCE, and VC) in the A-Aquifer within and around the Former Building 88 and Traffic Island source areas

- Confirm the depth to and lateral continuity of the A/B-Aquitard in the Traffic Island Area
- Verify the depth to the top of the B2-Aquifer in the Traffic Island Area
- Confirm whether existing well W-88-1 is screened in the B2-Aquifer
- Confirm whether the B-Aquifer beneath the Traffic Island Area is impacted with CEs above the ROD cleanup standards and MCLs (EPA, 1989)

The new data will reduce uncertainties and strengthen the CSM for these two source areas.

1.2 Purpose and Objectives

The purpose of this supplemental investigation is to augment the characterization of IR Site 28 CE contamination at the Former Building 88 and Traffic Island Areas. This investigation will provide information needed to respond to EPA's request to "evaluate and characterize containment of a second smaller, higher-concentration area of contamination in the B2-aquifer" (EPA, 2012a).

The primary objective of the investigation is to refine the understanding of the soil stratigraphy and to further characterize the lateral and vertical extent of PCE and its daughter products (TCE, cis 1,2-DCE, and VC) in the saturated zone at the former Building 88 and Traffic Island source areas.

Decision criteria for achieving this objective have been developed using a project quality objectives process. The project quality objectives are presented in Worksheet #11 of the SAP (Appendix A).

1.3 Technical Approach

This supplemental investigation will be implemented in two phases. Phase I will involve a preliminary qualitative to semi-quantitative screening survey to further assess the distribution of CEs and soil lithology in the investigation areas. The data generated by Phase I, along with existing data, will be used to identify where monitoring wells should be installed during Phase II.

The Phase I screening survey will use the Navy's Site Characterization Analysis Penetrometer System (SCAPS) outfitted with a MIP and direct sample ion-trap mass spectrometer (DSITMS) to generate vertical profiles of relative VOC concentrations in the subsurface at up to 52 locations. In conjunction with the MIP/DSITMS equipment, the SCAPS will also be outfitted with cone penetrometer test (CPT) equipment to concurrently profile the associated soil strata at each location.

Phase II will include installing and developing up to 12 new monitoring wells and collecting groundwater samples from these wells. The location of each new well and screen interval will be determined during the evaluation of the Phase I results and existing data. The new wells will be installed, developed, and sampled after the proposed well locations and screen intervals are presented to the regulatory agencies. Sonic drilling techniques will be used to install the wells, and groundwater sampling will be completed through the use of low-flow purging techniques. The new wells will be sampled during two separate events to establish concentrations of CEs in groundwater at these locations. The groundwater samples will be analyzed for VOCs and dissolved gases.

1.4 Project Schedule

A schedule for implementing the supplemental investigation at IR Site 28 is presented as Figure 3. The schedule highlights the main project activities, including those previously described in the technical approach for this supplemental investigation. The Phase I effort, including the SCAPS survey, is expected to commence in August 2012 after submittal of the final project plans. Upon completion of Phase I activities, Phase II well installations will be planned; and once approved, the wells will be installed in December 2012. The first and second groundwater sampling events will follow and are tentatively scheduled for late January and late April 2013, respectively. A technical memorandum that summarizes the results of the supplemental investigation will be submitted after the second sampling event is completed.

1.5 Work Plan Organization

This WP is organized as follows:

- Section 1.0, Introduction: Presents the project purpose, objectives, technical approach, schedule, and organization of the WP
- Section 2.0, Site Description and Background: Provides general background information including a site description, a brief summary of site history, a description of the geology and hydrogeology, and a summary of the results from previous investigations and remedial actions
- Section 3.0, Supplemental Investigation Approach: Provides a brief description of the approach and the technologies proposed
- Section 4.0, General Site Activities and Requirements: Summarizes general activities to be conducted in support of the field effort
- Section 5.0, Site Characterization and Analysis Penetrometer System Survey: Presents the activities and procedures for SCAPS surveying at the Former Building 88 and Traffic Island Areas

- Section 6.0, Monitoring Well Installation: Presents the plan for installing new groundwater monitoring wells
- Section 7.0, Groundwater Sampling: Provides details regarding the groundwater sampling events and data analysis and reporting
- Section 8.0, Technical Memorandum: Presents the plan for evaluating and reporting the investigation results
- Section 9.0, References: Provides a list of all the cited documents within the text, figures, and tables

Figures and tables are presented after Section 9.0. The following appendices are included after the figures and tables:

- Appendix A, Sampling and Analysis Plan
- Appendix B, Construction Quality Control Plan
- Appendix C, Traffic Control Plan
- Appendix D, Select Drawings from Previous Reports
- Appendix E, MIP Logs from 2010 – 2011 Treatability Study

2.0 Site Description and Background

This section presents a brief description of relevant background information that includes a site description and history, highlights of previous remedial response actions, local geology and hydrogeology, and the nature and extent of contamination. The information presented in this section was compiled primarily from the following documents:

- *Final Former Building 88 Investigation Report, Former Naval Air Station Moffett Field, Moffett Field, California* (TtECI, 2008)
- *Draft, West-Side Aquifers Treatment System, Site 28 Optimization Evaluation Report, Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California* (SES-TECH, 2008)
- *Final 2010 Annual Groundwater Report for Installation Restoration Sites 26 and 28, Former Naval Air Station Moffett Field, Moffett Field, California* (ERS-JV and Brown and Caldwell, 2011)

Further details about the facility history, previous investigations, remedial actions, and studies at IR Site 28 are also provided in the following documents:

- *Initial Assessment Study of Naval Air Station Moffett Field, Sunnyvale, California Field* (Naval Energy and Environmental Support Activity, 1984)
- *Confirmation Study (Verification Step), Moffett Naval Air Station, California* (Earth Sciences Associates, Inc. and James M. Montgomery, Consulting Engineers, Inc., 1986)
- *Hazardous Materials Underground Storage Tank Study, NAS Moffett Field, California* (ERM-West and Aqua Resources, Inc., 1986)
- *Investigation of Potential Soil and Ground Water Contamination Near Tanks 19 and 20, Tank 66 (sump), and Tanks 67 and 68, Moffett Naval Air Station, California* (ERM-West, 1987)
- *Remedial Investigation Report, Remedial Investigation/Feasibility Study, Middlefield-Ellis-Whisman Area, Mountain View, California* (Harding Lawson Associates, 1988)
- *Characterization Report, Phase I Remedial Investigation, Naval Air Station, Moffett Field, California* (IT Corporation, 1991)
- *Draft Tank and Sump Removal Summary Report* (PRC Environmental Management, Inc. [PRC], 1991)

- *Technical Memorandum: Geology and Hydrogeology, Final Draft* (PRC Environmental Management, Inc. and James M. Montgomery, Consulting Engineers, Inc., 1992)
- *Final Westside Groundwater Site Characterization Report, NAS Moffett Field, California* (International Technology Corporation, 1993)
- *Federal Facilities Agreement Amendment of December 17, 1993, NAS Moffett Field, California* (Navy, 1993)
- *Final Additional Investigation of Inferred Sources Technical Memorandum, Naval Air Station Moffett Field, California* (PRC, 1994)
- *Final Horizontal Conduit Study Technical Memorandum, Moffett Federal Airfield, California* (PRC, 1995a)
- *Final Operable Unit 2-West (Building 88) Project Summary Report* (PRC, 1995b)
- *Draft Wash Rack Area Investigation, Technical Memorandum, Moffett Federal Airfield, California (Formerly Naval Air Station Moffett Field)* (PRC, 1996)
- *Draft Final Interim Remedial Action Report, West-Side Aquifers Treatment System (WATS), Moffett Federal Airfield, California* (Tetra Tech EM, Inc., 2001)
- *Technical Memorandum for Conceptual Model for Groundwater Flow and Chemical Fate and Transport Simulations, Former Naval Air Station Moffett Field, Moffett Field, California* (Tetra Tech FW, Inc. [TtFWI], 2004a)
- *West-Side Aquifers Treatment System Optimization Completion Report, Former Naval Air Station Moffett Field, Moffett Field, California* (TtFWI, 2005a)
- 1999 through 2009 annual groundwater reports for WATS and East-Side Aquifer Treatment System (Foster Wheeler Environmental Corporation, 2002 and 2003; TtFWI, 2004b, 2005b, and 2005c; TtECI, 2006; TN & Associates, 2007 and 2008; and SES-TECH, 2009 and 2010)
- *Draft Site-Wide Focused Feasibility Study and Technical Impracticability Evaluation, Middlefield-Ellis-Whisman Study Area Regional Groundwater Remediation Program* (Northgate, 2008)
- *Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site 28, Former Naval Air Station Moffett Field, Moffett Field, California* (Shaw E&I, 2010)
- *Final Technical Memorandum, In Situ Anaerobic Biotic/Abiotic Treatability Study, Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California,* (Shaw Environmental, Inc. [Shaw], 2012)

2.1 Site Description and History

Moffett is located 35 miles south of San Francisco at the northern end of the Santa Clara Valley Basin, approximately 1 mile south of San Francisco Bay (Figure 1). Prior to development in the early 1930s, the surrounding area was used for agriculture, and portions of Moffett consisted of tidal mudflats that had been filled in. Moffett was originally commissioned as Naval Air Station (NAS) Sunnyvale in 1933 to support the West Coast lighter-than-air dirigibles program, and was transferred to the U.S. Army Air Corps in 1935 for training purposes. In 1939, a permit was granted to Ames Aeronautical Laboratory to use a portion of the base. NAS Sunnyvale was returned to Navy control in 1942 and was renamed NAS Moffett Field. In 1994, NAS Moffett Field was closed under the U.S. Department of Defense Base Realignment and Closure Program. The operational area of NAS Moffett Field was transferred to the National Aeronautics and Space Administration (NASA), and the military housing portions were transferred to the U.S. Air Force on July 1, 1994 (SES-TECH, 2009). The housing areas were subsequently transferred to the United States Army in 2000. The facility is presently referred to as the NASA Ames Research Center and Moffett Federal Airfield, and includes airfield operations, NASA research facilities, and a golf course operated by NASA. Moffett is on the National Priorities List, and site cleanup is conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. Twenty-nine sites have been identified as IR Program sites at Moffett.

IR Site 28 is the aquifers below the area generally defined by the outline shown on Figure 1. Current primary uses of this area include airfield operations, administrative offices, and various storage buildings. The A-Aquifer at IR Site 28 is impacted by VOCs, primarily CEs, which resulted from on-site Navy sources and on-flow of contamination from upgradient VOC sources originating primarily from the Middlefield-Ellis-Whisman Superfund Site. The requirements for the remediation of impacted groundwater at IR Site 28 are set forth in the ROD (EPA, 1989). The Navy adopted the ROD in 1993, which is documented in the *Federal Facilities Agreement Amendment of December 17, 1993, NAS Moffett Field, California* (Navy, 1993). The selected remedy for groundwater at IR Site 28 is extraction and ex situ treatment to restore groundwater to the cleanup standards specified in the ROD. The EPA's Explanations of Significant Differences (ESDs) for the ROD were submitted in September 1990 and April 1996. The September 1990 ESD clarified that the cleanup goals constituted final cleanup standards and that the remedial activity must meet the final cleanup standard of 5 micrograms per liter (µg/L) for TCE in the upper and lower portions of the A-Aquifer (EPA, 1990). TCE was selected as an indicator chemical assuming that by remediating TCE, the other chemicals of concern (COCs) would be remediated simultaneously. The April 1996 ESD clarified that the groundwater remedy includes the use of liquid-phase granular activated carbon as a treatment option for extracted groundwater (EPA, 1996).

Previous investigations at Moffett determined that historical dry cleaning activities conducted at former Building 88 were the source of PCE released to the subsurface at IR Site 28 (TtECI, 2008). Building 88 served as a dry cleaning and laundry facility from approximately 1945 until its closure in 1987. It was located south of Wescoat Road between Severyns Avenue and Dugan Avenue (Figure 2). The building occupied approximately 13,500 square feet and was constructed with a concrete floor, which contained numerous floor drains, floor trenches (assumed to be concrete-lined, but construction specifics could not be verified), and subsurface steel piping for wastewater collection, as shown on Figure 2. The floor drains and piping in the main portion of the building drained into Sump 91, a 700-gallon, single-chamber concrete sump used to collect and store wastewater. The floor drains and piping near the equipment room (northeast portion of the building) received and drained wastewater from the dry cleaning machine area into Sump 66, a 100-gallon concrete sump that was reportedly connected to the sanitary sewer. The equipment room had collection floor trenches that may have drained waste dry cleaning fluids into Tank 68, a 2,000-gallon concrete tank. The sumps, tank, and former Building 88 were removed between 1990 and 1994 as described in Section 2.2. Currently, the former Building 88 footprint is a vacant lot.

The branch of the sanitary sewer system that collected wastewater from former Building 88 conveyed the wastewater by gravity: east through the Wescoat Road line, north through the Cummins Avenue line, and eventually to a pump station on the east side of the base (Figure 2). The sanitary lines along Wescoat Road and Cummins Avenue are constructed of vitrified clay pipe with invert elevations ranging from 15 to 9 feet above mean sea level (6 to 8 feet bgs). The section of line along Cummins Avenue immediately downstream of the Wescoat Road line reportedly collapsed and was bypassed with a new line according to the *Final Horizontal Conduit Study Technical Memorandum, Moffett Federal Airfield, California* (PRC, 1995a) as illustrated on Figure 2. Wastewater from the Hangar 1 former aircraft wash rack was also discharged to the sanitary sewer line that collapsed along Cummins Avenue (Figure 2). The wastewater originating at the wash rack was collected in a catchment basin and routed to the Sump 25 oil/water separator, which, in turn, discharged to the Cummins Avenue sanitary sewer line (Figure 2). Wash water from the wash rack could have contributed to the CE contamination in the Traffic Island Area via the sanitary sewer conduit because chlorinated VOCs were commonly used to clean aircrafts before the Navy switched to citrus-based solvents in the early 1990s. Sump 25 was removed in May 1994 (PRC, 1996), as described in Section 2.2.

2.2 Previous Remedial Response Actions

This subsection highlights remedial actions conducted at IR Site 28 in response to the ROD and ESD requirements (EPA, 1989 and 1990). Initially, remedial actions were completed to address the following: primary and secondary sources of groundwater contamination at the site, sump and tank removals, building demolition, and vadose zone soil removal. Subsequent remedial actions involved the installation and operation of groundwater pump-and-treat systems to contain and treat the contaminated groundwater.

2.2.1 Sump and Tank Removals

Two sumps (66 and 91) and one underground storage tank (Tank 68) associated with former Building 88 were removed between 1990 and 1994. Sump 66, a 100-gallon concrete sump approximately 3 feet deep, received wastewater from floor drains and sinks near the dry cleaning equipment area of former Building 88, and reportedly drained to the sanitary sewer along Wescoat Road. The sump was inspected in 1990 and found to be cracked from the top to the bottom. Subsequently, Sump 66 was removed by excavation. Groundwater was not encountered in the removal excavation. Three soil samples were collected from the excavation: one from the west wall, one from the north wall, and one from the excavation bottom. PCE was detected in the west wall soil sample at a concentration of 20 micrograms per kilogram (μg/kg). PCE concentrations in the other two excavation soil samples were below analysis reporting limits (RL) (PRC, 1991).

Tank 68, a 2,000-gallon concrete tank, was used to store waste, dry cleaning solvents. The tank was emptied of liquids, filled with sand, and closed in place in 1987. Later, in 1994, Tank 68 was removed by excavation. The tank, which appeared to be intact, was broken up and removed using a backhoe. The maximum excavation depth was approximately 9 feet bgs. Initially, groundwater was not observed, but eventually it accumulated in the bottom of the excavation. Three soil samples and one groundwater sample were collected from the excavation bottom. Reported PCE soil concentrations ranged from 8 μg/kg to 130 μg/kg. PCE was detected in the groundwater sample at a concentration of 200 μg/L (PRC, 1995b).

Sump 91, a 700-gallon concrete sump, received wastewater from the former Building 88 floor drains and sinks. It was removed by excavation in 1994. The sump was empty at the time of removal, and there were no signs of cracks or leaks. The maximum excavation depth was approximately 6 feet bgs. Four soil samples were collected from the excavation sidewalls and bottom to evaluate potential contamination. PCE was detected in one soil sample at an estimated concentration of 3 μg/kg. PCE was not detected above RLs in the other three samples (PRC, 1995b).

In May 1994, the Sump 25 oil/water separator, which collected wastewater from the former aircraft wash rack located east of Cody Road, was removed. Sump 25 was a 2,000-gallon concrete, dual-chamber oil/water separator that used an oil skimmer system for oil recovery. The sump discharged to the Cummins Avenue sanitary sewer line. After Sump 25 was removed in 1994, and the aircraft wash rack was no longer used, the drain line from the catchment basin at the former aircraft wash rack was connected to the storm sewer system. Sump 25 and the wash rack area were both investigated in 1995 to see if they were potential sources of VOCs to the regional plume. According to the *Draft Wash Rack Area Investigation Technical Memorandum* (PRC, 1996), results of the soil and groundwater samples collected from the wash rack area indicated it was a potential source of TCE contamination to the regional groundwater plume. Consequently, a decision was made to install extraction well EA1-2 as a source control measure downgradient of the wash rack area. The results of the groundwater samples collected near Sump 25 indicated that it was not a source of VOCs to groundwater and, therefore, a source control measure was not implemented at this former sump. EPA reviewed the draft technical memorandum and had no comment (EPA, 1995). The chlorinated VOC contamination related to these former features was sufficiently defined and, therefore, no further investigation is planned.

2.2.2 Unsaturated Zone Source Removal

In 1994, Building 88 was demolished, and the vadose zone soil contamination was excavated. At that time, the foundation, floor, floor drains, collection trenches, and subsurface piping were removed by excavation. One hundred and nineteen pre-excavation soil samples were collected at locations throughout the building footprint, including under the floor, drains, piping and trenches, and foundation (PRC, 1995b). Based on the results of these samples, approximately 400 cubic yards of soil were excavated from two areas (northern excavation and southern excavation) where PCE concentrations exceeded the ROD cleanup standard of 500 μg/kg (Figure 2). The excavations extended down to the water table at approximately 7 to 8 feet bgs. Seven post-excavation bottom samples were collected from the two areas. PCE was detected at a concentration of 1,100 μg/kg in the samples from the northern excavation. No additional excavation was performed because groundwater was encountered.

2.2.3 Saturated Zone Contaminant Removal

A groundwater source control measure, referred to as the Building 6 Treatment System, was installed in 1994 to provide hydraulic control of potential residual saturated zone contamination from the former Building 88 (Tetra Tech EM, Inc., 2001). The system extracted and treated contaminated groundwater from converted groundwater monitoring well W9-46 (Figure 2). Between 1994 and 1997, the system extracted and treated roughly 800,000 gallons of groundwater and recovered approximately 2.4 pounds of VOCs. The Building 6 system was shut down in 1997 and replaced with the WATS.

The WATS went online in November 1998 and remains in operation currently. The system includes six extraction wells screened in the upper portion of the A-Aquifer and three extraction wells screened in the lower portion of the A-Aquifer. These extraction wells recover contamination from on-site sources and contamination that migrates from sources upgradient of the WATS area. As of December 31, 2010, the WATS had extracted and treated 406,083,820 gallons of groundwater and storm drain water, and approximately 5,058 pounds of VOCs had been recovered (ERS-JV and Brown and Caldwell, 2011). The average WATS influent VOC concentrations have generally declined since system startup in 1998 with the exception of fluctuations in PCE concentrations. Nonetheless, the normalized CE mass removal (the amount of mass being removed by WATS for every gallon of groundwater removed) has been relatively constant.

2.3 2010 In Situ Anaerobic Biotic/Abiotic Treatability Study

In 2010, Shaw completed three pilot tests at IR Site 28 to assess potential in situ biotic/abiotic CE treatment technologies. The pilot test studies evaluated the use of lactate and SDC-9™ at the Former Building 88 Area, emulsified vegetable oil and SDC-9™ at the Traffic Island Area, and EHC® in the area of well W9-18 to treat saturated zone CEs. The lateral and vertical treatment zones varied by location and were defined by previous characterization studies (TtECI, 2008) and pre-study MIP testing. Existing and newly installed observation wells were used to monitor the effectiveness of each pilot test (Shaw, 2012).

Based on the test results, each treatment process was determined to be effective in degrading PCE, TCE, and cis 1,2-DCE to below the maximum contaminant levels (MCLs), and the ROD and ESD cleanup standard (EPA, 1989 and 1990) within the performance monitoring period for the treatability study. Although substantial degradation of VC was also observed in each treatment area, VC concentrations remained above its MCL in each test area at the end of the performance monitoring period. It was considered likely that ongoing degradation will continue in each of the areas where substrate is present (Shaw, 2012).

2.4 Site Geology and Hydrogeology

The following subsection provides a brief description of the local geology and hydrogeology at IR Site 28. Information was compiled from the *Final Former Building 88 Investigation Report, Former Naval Air Station Moffett Field, Moffett Field, California* (TtECI, 2008) and *Draft West-Side Aquifers Treatment System, Site 28 Optimization Evaluation Report, Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California* (SES-TECH, 2008).

2.4.1 Local Geology

The native subsurface in the IR Site 28 area is characterized by interbedded coarse-grained soil (sand and gravel) and fine-grained soil (silt and clay). Sediments that make up the A-Aquifer represent the distal end of a Holocene-aged coalescing alluvial fan complex and tidal mud flats (estuarine deposits). Near the bay, fine-grained alluvium is replaced by bay mud (dark-gray silt and clay). The sand and gravel represent anastomosing stream channel deposits between interchannel alluvium and bay mud. Fluvial channel deposits typically display fining-upward sequences that begin with a poorly sorted mixture of gravel and coarse sand at the bottom, overlain by a fining-upward sequence of coarse-to-fine sand, silt, or clay. These channel deposits have been interpreted to generally trend northwest to southeast, and become more northerly in the vicinity of the WATS (TtFWI, 2005a).

From the surface to approximately 20 feet bgs, mostly fine-grained soil with isolated coarse-grained deposits is present. Anastomosing, coarse-grained channel deposits are present from approximately 20 feet to approximately 32 feet bgs and are interbedded with fine-grained interchannel deposits. These coarse-grained channel deposits are encased in fine-grained soil, and are present at depth intervals of approximately 20 to 25 feet bgs and 29 to 32 feet bgs. The deposits have been interpreted to represent distinct and continuous channels, but may alternatively represent a series of laterally and vertically interconnected coarse-grained segments of channel fill material. The thickness of the coarse-grained material varies spatially, but averages approximately 2 feet. There appears to be no continuous coarse-grained layer vertically connecting these two intervals (TtECI, 2008).

Two relatively continuous units of coarse-grained channel deposits have been interpreted to be present from approximately 40 to 46 feet bgs and 45 to 52 feet bgs in the western portion of the study area (TtECI, 2008). However, these deposits may represent a series of laterally and vertically interconnected coarse-grained segments of channel-fill material and not distinct channels. The coarse-grained material ranges in thickness from approximately 1 to 6 feet and are separated by approximately 1 to 4 feet of silt.

To better understand the relationships between the interbedded permeable (coarse-grained) and non-permeable (fine-grained) soil layers located beneath and hydraulically downgradient of the Former Building 88 Area, lithologic data obtained from the soil core and CPT borings were correlated, and a series of geologic cross-sections were generated (TtECI, 2008). The cross-section location maps and stratigraphic cross-sections for the Former Building 88 Area and Traffic Island Area are provided in Appendix D.

An additional cross-section location map and cross-sections depicting the site specific soil beneath the Former Building 88 Area and the Traffic Island Area are provided on Figures 4, 5, and 6, respectively. These cross-sections are based on the 2010 MIP survey results (Shaw, 2012).

2.4.2 Local Hydrogeology

The focus of this supplemental investigation is the A- and B-Aquifers. The A-Aquifer extends from grade to approximately 65 feet bgs at IR Site 28. The A-Aquifer is divided into two portions: an upper portion above 35 feet bgs (sometimes referred to as the A1 zone) and a lower portion below 35 feet bgs (sometimes referred to as the A2 zone) (TtECI, 2008). Based on the absence of a continuous aquitard separating them, these horizons are considered to be portions of the same A-Aquifer rather than independent, discrete aquifers (SES-TECH, 2008). An approximate 10-foot-thick aquitard (refered to as the A/B-Aquitard) separates the A- and

B-Aquifers at depths ranging from 45 to 80 feet bgs. The B-Aquifer is present below the A/B-Aquitard and extends to depths as great as 160 feet bgs. The B-Aquifer can be distinguished from the A-Aquifer by the lack of permeable zones, although discontinuous sand and gravel lenses are present.

Historically, groundwater levels in IR Site 28 monitoring wells in the upper portion of the A-Aquifer exhibited short-term seasonal fluctuations. The high groundwater level typically occurs at the end of the wet season (March). The low groundwater level typically occurs at the end of the dry season (November). Potentiometric surface maps have been prepared biannually to evaluate flow directions and hydraulic gradients using groundwater elevation data collected during March and November. The 2010 groundwater potentiometric surface maps for the upper and lower A-Aquifers are provided in Appendix D. As depicted on these maps, the general groundwater flow direction in the upper and lower A-Aquifer is generally to the north-northeast across Moffett at an average gradient of approximately 0.005 foot per foot between U.S. Highway 101 and Hangar 1. The gradient in the general vicinity of Hangar 1 is affected by the WATS pumping; however, the overall flow is north/northeast from Hangar 1 toward the NASA Ames Research Center at a gradient of approximately 0.003 foot per foot (ERS-JV and Brown and Caldwell, 2011).

2.4.3 Upper Portion of the A-Aquifer

Aquifer tests of the upper A-Aquifer indicate unconfined to leaky-confined conditions. The hydraulic conductivity calculated from historic slug and pumping tests range from 0.3 to 173 feet per day (ft/day) (TtFWI, 2005a). The high end of this range, with an arithmetic average of 50 ft/day, is indicative of clean sand channels. The low range, with an arithmetic average of 11 ft/day, is indicative of silts (Freeze and Cherry, 1979). Total porosities for sand and silt range from 25 to 50 percent, and 35 to 50 percent, respectively. Based on the lithology, the estimated average effective porosity is 25 percent for the coarse-grained soils and 12 percent for the fine-grained soil (McWorter and Sunada, 1977). The average groundwater horizontal hydraulic gradient is approximately 0.006 foot per foot in the plume area as measured from the 2010 potentiometric maps. Based on these hydraulic parameters and using Equation 3-1 in Section 3.3.3.1 of *Groundwater* (Freeze and Cherry, 1979), a groundwater seepage velocity for the coarse-grained soil of 1.2 ft/day was calculated, and a seepage velocity of 0.6 ft/day was calculated for the fine-grained soil.

2.4.4 Lower Portion of the A-Aquifer

Aquifer tests of the lower A-Aquifer indicate leaky-confined conditions. The hydraulic conductivity calculated from historic slug and pumping tests range from 0.1 to 494 ft/day (TtFWI, 2005a). The high end of this range, with an arithmetic average of 136 ft/day, is indicative of clean sand (Freeze and Cherry, 1979). The low range, with an arithmetic average of

11 ft/day, is indicative of silts. The porosity and hydraulic gradient are roughly the same as in the upper A-Aquifer (ERS-JV and Brown and Caldwell, 2011). A groundwater seepage velocity for the coarse-grained soil of 3.3 ft/day was calculated, and a seepage velocity of 0.6 ft/day was calculated for the fine-grained soil.

2.4.5 A/B-Aquitard and B-Aquifer

Based on available information, the B-Aquifer is separated from the overlying A-Aquifer by a continuous clay and clayey silt layer of varying thickness that forms the A/B-Aquitard. The A/B-Aquitard has been encountered at depths ranging from 45 feet bgs to greater than 80 feet bgs (TtECI, 2008). Generally, the minimum thickness of the A/B-Aquitard appears to be about 10 feet. In the areas of investigation targeted by this WP, only two historical soil borings (W88-1 and W9-12) have been completed deep enough to encounter the A/B-Aquitard. Based on logs for these borings and how the associated B-Aquifer wells were constructed, the A/B-Aquitard appears to have been encountered at approximately 65 feet bgs, was characterized as clay to silty clay with interbedded sandy silt, and ranged from 6 to 14 feet in thickness.

The B-Aquifer extends from approximately 60 feet bgs to 160 feet bgs across IR Site 28. The B-Aquifer is divided into two permeable zones: an upper zone referred to as the B2-Aquifer and a lower zone referred to as the B3-Aquifer that are separated by a laterally discontinuous aquitard (referred to as the B2/B3-Aquitard) encountered at depths ranging from 95 to 111 feet bgs. The B-Aquifer is underlain by the C and deeper aquifers (ERS-JV and Brown and Caldwell, 2011). Limited discontinuous interbedded sands and gravels characterize permeable deposits in the B-Aquifer (TtECI, 2008). Silt and clay predominate in the B-Aquifer underlying IR Site 28. However, the limited number of permeable layers present in the B-Aquifer appear to be thicker and laterally more continuous than those found in the A-Aquifer. In the areas of investigation targeted by this WP, only two historical soil borings (W88-1 and W9-12) extended into the upper zone of the B-Aquifer to total depths of 97 and 100 feet bgs, respectively. Boring log interpretations indicate that the upper portion of the B-Aquifer was encountered at approximately 71 and 79 feet bgs, respectively, and was characterized as silts and sands interbedded with sandy, silty clays.

2.5 Nature and Extent of Contamination

As previously discussed, the COCs are VOCs, primarily PCE and related degradation products within the upper and lower A-Aquifer. Continuing sources of PCE contamination to groundwater were identified in the area of former Building 88 and in the Traffic Island Area beneath the sanitary sewer alignment downstream from former Building 88. A brief summary of the PCE, TCE, cis 1,2-DCE, and VC contamination in these two areas is provided in the following subsections. PCE is specifically described because this was the parent compound originally released to the subsurface at the Former Building 88 Area and Traffic Island Area, making it a key indicator for delineating the Navy's source areas within the regional plume. TCE is specifically described because it is a degradation product of PCE and is the parent compound flowing into IR Site 28 from the upgradient Middlefield-Ellis-Whisman sites. Therefore, TCE concentrations are also useful for delineating the Navy's source areas within the regional plume. Similarly, concentrations of the degradation compounds of PCE and TCE (1,2-DCE and VC) are also useful for delineating the Navy's source areas within the regional plume. The summary was derived from the *Final Former Building 88 Investigation Report, Former Naval Air Station Moffett Field, Moffett Field, California,* (TtECI, 2008) and is supplemented by recent data collected as presented in the *Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California* (Shaw E&I, 2010) and the *Final Technical Memorandum, In Situ Anaerobic Biotic/Abiotic Treatability Study, Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California* (Shaw, 2012).

2.5.1 Former Building 88 Area Soil

The former dry cleaning facility (former Building 88) had numerous wastewater collection trenches, floor drains, subsurface piping, and sumps that released PCE into the subsurface. Releases appear to have occurred in two areas: the area of Sump 66 and the former dry cleaning equipment room of former Building 88.

The following description is based on the results of 133 pre- and post-excavation soil samples collected during the 1994 unsaturated zone source removal action (PRC, 1995), 92 soil samples collected from 14 borings during the 2005 site investigation (TtECI, 2008) and 1 soil sample collected from 1 boring during the 2010 – 2011 treatability study (Shaw E&I, 2010). The remaining concentrations of PCE in soil greater than 500 μg/kg (the soil cleanup standard identified in the ROD [EPA, 1989 and 1990]) were only detected in the upper portion of the A-Aquifer from approximately 7 feet bgs (water table) down to 20 feet bgs beneath the former equipment room and down to approximately 35 feet bgs in the vicinity of former Sump 66. The highest concentration of PCE (14,000 μg/kg) was detected in a sample from continuous core IR28SB-01 (April 2010) at a depth of 18 feet bgs, beneath the former equipment room. Much lower concentrations of PCE (less than 250 μg/kg) were detected outside these areas and did not appear to extend very far beyond the former building footprint.

Similar to PCE, concentrations of TCE above 500 μg/kg (ranging from 530 to 4,400 μg/kg) were detected in the upper portion of the A-Aquifer from 10 feet bgs down to approximately 20 feet bgs beneath the former equipment room and down to approximately 40 feet bgs in the vicinity of former Sump 66. TCE concentrations greater than 500 μg/kg in the upper portion of the A-Aquifer were also detected beneath the former Building 88 southern excavation and former Sump 91 at depths ranging from 11 to 13 feet bgs. The highest concentration of TCE

(4,400 μg/kg) encountered in the upper portion of the A-Aquifer was detected in continuous core CC-88-3 at 14 feet bgs beneath the former equipment room. Additionally, concentrations of TCE greater than 500 μg/kg (ranging from 510 to 1,900 μg/kg) were also detected in the lower A-Aquifer in samples from borings located beneath and to the north of the former building footprint at various depths between 37 and 55 feet bgs. The highest concentration of TCE encountered in the lower A-Aquifer (1,900 μg/kg) was detected at approximately 48 feet bgs in continuous core CC-88-2.

Concentrations of cis 1,2-DCE above 500 μg/kg (ranging from 530 to 4,700 μg/kg) were only detected in the upper portion of the A-Aquifer at depths ranging from 10 feet bgs down to approximately 28 feet bgs beneath and in the vicinity of the former equipment room and former Sump 66. Cis 1,2-DCE concentrations greater than 500 μg/kg were also detected beneath the former Building 88 southern excavation and former Sump 91 at depths between 11 and 16 feet bgs. The highest concentration of cis 1,2-DCE (4,700 μg/kg) was detected at a depth of 18 feet bgs in boring IR28-SB01, beneath the former equipment room.

VC was only detected in 3 samples at concentrations ranging from an estimated value of 2.7 μg/kg to 9 μg/kg, with the highest concentration also detected in direct-push boring CPT-88-15 at a depth of 17 to 18 feet bgs. Appendix D provides isoconcentration maps and cross-sections from the 2005 site investigation (TtECI, 2008) that illustrate the distribution of PCE, TCE, cis 1,2-DCE, and VC in soil at the Former Building 88 Area.

To evaluate for the potential presence of DNAPLs at the Former Building 88 Area, during the 2010 – 2011 treatability study (Shaw E&I, 2010), a soil core to 65 feet bgs and a non-aqueous phase liquid FLUTe™ test to 28 feet bgs were completed within the footprint of the former equipment room adjacent to IR28SB-01 and 28MIP-29 where the greatest concentration of CEs in soil were detected (Figure 7). The soil core assessment and FLUTe™ test results provided no indications of DNAPL within the soil core or on the FLUTe™ liner. This included no observations of staining, odor, elevated photoionization detector (PID) responses (greater than 100 parts per million by volume), nor positive OilScreenSoil (Sudan IV™) test results (Shaw E&I, 2010). The negative results, along with previous soil and groundwater samples, indicate that the amount of potential DNAPL was minimal if present.

Historically, only one boring in the Former Building 88 Area has been drilled into the B2-Aquifer. In 1990, the boring for well W9-12 was advanced to a total depth of 100 feet bgs. This boring is located adjacent to CPT-88-14 in front of Building 6, which is across the street from former Building 88 to the north (Figure 4). No soil samples were collected from the B2-Aquifer for chemical analysis.

2.5.2 Former Building 88 Area Groundwater

The following description is based on the results of 56 discrete-depth groundwater grab samples collected from 10 direct-push borings during the 2005 site investigation (TtECI, 2008), 7 groundwater samples collected from the 6 treatability study observation wells prior to the 2010 – 2011 treatability study in July 2010 (Shaw, 2012), and 7 groundwater samples collected from 7 wells outside the treatability study area during the 2010 annual groundwater monitoring event in November/December 2010 (ERS-JV and Brown and Caldwell, 2011). PCE concentrations in A-Aquifer groundwater beneath the Former Building 88 Area ranged from less than the RL of 0.5 μg/L to 19,000 μg/L. Concentrations of PCE in groundwater greater than 1,000 μg/L were detected in the vicinity of the former dry cleaning equipment room and former Sump 66 at depths ranging from 13 feet bgs (1,100 μg/L; CPT-88-1) to 57 feet bgs (2,100 μg/L; CPT-88-15), with the highest concentration (19,000 μg/L) detected between 35 and 40 feet bgs in a sample from well 28OW-23. In the southern and western portion of the former Building 88 footprint, PCE concentrations are less than 20 μg/L in the upper 30 feet bgs (upper portion of the A-Aquifer), and less than the MCL of 5 μg/L in samples collected from below 30 feet bgs (lower portion of the A-Aquifer). Within 200 feet upgradient of former Building 88, PCE was not detected in any of the A-Aquifer well samples collected during the 2010 annual groundwater monitoring event.

Within 200 feet upgradient of former Building 88, TCE was detected in groundwater in the upper portion of the A-Aquifer at concentrations ranging from 39 μg/L (81A) to an estimated value of 810 μg/L (CPT-88-4). In the vicinity of former Building 88, concentrations of TCE in the upper A-Aquifer groundwater ranged from non-detect to 1,400 μg/L. Concentrations of TCE greater than the highest concentration upgradient (810 μg/L) were detected between 11 to 26 feet bgs in the vicinity of former Sump 66 (1,300 μg/L; CPT-88-1) and 32 to 34 feet bgs adjacent to Building 6 (1,400 μg/L; CPT-88-14). Within 200 feet upgradient of former Building 88, TCE was detected in groundwater in the lower portion of the A-Aquifer at concentrations ranging from 560 μg/L (46B1) to 1,800 μg/L (W9SC-20). In the vicinity of former Building 88, concentrations of TCE in lower A-Aquifer groundwater ranged from an estimated value of 270 μg/L to 10,000 μg/L. Concentrations of TCE greater than the highest concentration upgradient (1,800 μg/L) were detected in the vicinity of and downgradient of the former dry cleaning equipment room, former Sump 66, and former Sump 91 at depths ranging from 35 feet bgs (3,600 μg/L; 29OW-19) to 62 feet bgs (4,300 μg/L; 28OW-20). The highest concentration (10,000 μg/L) was detected at 46 feet bgs in a grab sample from CPT-88-14, located adjacent to Building 6, roughly 75 feet northwest of the former equipment room and Sump 66.

Within 200 feet upgradient of former Building 88, cis 1,2-DCE was detected in groundwater in the upper portion of the A-Aquifer at concentrations ranging from an estimated value of 340 μg/L (CPT-88-4) to 1,500 μg/L (81A). In the vicinity of former Building 88, concentrations of cis 1,2-DCE in the upper A-Aquifer groundwater ranged from 120 µg/L to 3,300 µg/L. Concentrations of cis 1,2-DCE greater than the highest concentration upgradient (1,500 µg/L) were detected between 16 and 25 feet bgs in the vicinity of and downgradient of former Sump 66. The highest concentration (3,300 µg/L) was detected at 17 to 19 feet bgs in a grab sample from CPT-88-14, located adjacent to Building 6. Within 200 feet upgradient of former Building 88, cis 1,2-DCE was detected in groundwater in the lower portion of the A-Aquifer at concentrations ranging from 160 µg/L (46B1) to 460 µg/L (W9SC-20). In the vicinity of former Building 88, concentrations of cis 1,2-DCE in lower A-Aquifer groundwater ranged from 33 µg/L to 5,200 µg/L. Concentrations of cis 1,2-DCE greater than the highest concentration upgradient (460 µg/L) were detected between 35 and 40 feet bgs beneath the former equipment room (5,200 µg/L; 28OW-23) and in the vicinity of former Sump 66 (680 µg/L; CPT-88-1).

Within 200 feet upgradient of former Building 88, VC was detected in groundwater in the upper portion of the A-Aquifer at concentrations ranging from 1.1 to 2.9 µg/L (CPT-88-4). In the vicinity of former Building 88, concentrations of VC in upper A-Aquifer groundwater ranged from 0.57 µg/L to an estimated value of 410 µg/L. Concentrations of VC greater than the highest concentration upgradient (2.9 µg/L) were detected at depths between 10 and 20 feet bgs downgradient of the former equipment room (6.6 to 34 µg/L; CPT-88-15), in front of Building 6 (3.8 µg/L;CPT-88-14), and approximately 45 feet west-northwest of former Sump 91 (estimated 410 µg/L; W9-37). Within 200 feet upgradient of former Building 88, VC was detected in groundwater in the lower A-Aquifer at concentrations of 0.76 µg/L and 0.77 µg/L (CPT-88-4). In the vicinity of former Building 88, concentrations of VC in lower A-Aquifer groundwater ranged from non-detect to 2.2 µg/L. Concentrations of VC greater than the highest concentration upgradient (0.77 µg/L) were detected between 35 and 62 feet bgs beneath and downgradient of the former equipment room and in vicinity of former Sump 66. The highest concentration (2.2 µg/L) was detected in a sample from well 28OW-23, located beneath the former equipment room.

Appendix D provides cross-sections that illustrate the distribution of PCE, TCE, cis 1,2-DCE, and VC in groundwater at the Former Building 88 Area based on discrete depth grab samples collected during the 2005 site investigation (TtECI, 2008). Appendix D also contains isoconcentration maps that illustrate the distribution of PCE, TCE, cis 1,2-DCE, and VC in the upper and lower portions of the A-Aquifer based on well samples collected in November/December 2010 after initiation of the 2010 – 2011 treatability study (ERS-JV and Brown and Caldwell, 2011).

MIP data collected during the 2010 – 2011 treatability study (Shaw E&I, 2010) confirmed that the greatest mass of CEs resides in the northeast portion of the Former Building 88 Area with the greatest electron capture detector (ECD) response recorded at 28MIP-29 beneath the former dry cleaning equipment room (northeast corner of former Building 88). Maximum ECD responses (above the detector calibration range) at this location were recorded from approximately 7 to 56 feet bgs, and the greatest PID responses were recorded between approximately 7 and 17 feet bgs. These elevated detector responses correspond with the highest concentrations of CEs detected in soil and groundwater samples collected previously in and around the former dry cleaning equipment room and Sump 66 (Appendix D). The next greatest detector responses were recorded downgradient of 28MIP-29 toward the north-northeast at 28MIP-26 and 28MIP-23. Copies of the MIP logs from the 2010 – 2011 treatability study are provided in Appendix E.

Isopleth maps of the cumulative ECD response to CEs for the Former Building 88 Area were generated to depict the relative lateral distribution of CEs in three separate depth intervals: 0 to 25 feet bgs, 25 to 49 feet bgs, and 49 to 65 feet bgs (Figures 7, 8, and 9, respectively). The distribution of CEs in each of these depth intervals is based on the interval-specific sum of the ECD responses for each MIP test performed in 2010 (Shaw E&I, 2010). As illustrated on Figure 5, these intervals represent three coarser-grained soil intervals (paleochannels) separated by two distinct horizons of fine-grained soil that are stratigraphic features suspected of influencing the distribution and migration of CEs in the subsurface.

Figure 7 shows the highest cumulative ECD response at 28MIP-29 with elevated responses trending toward the northwest in the 0-to-25-feet-bgs interval. Figure 8 also shows the highest cumulative ECD response at 28MIP-29 but exhibits a northeasterly contaminant orientation in a down hydraulic gradient direction in the 25-to-49-feet-bgs interval. CE distribution between 49 and 65 feet bgs is less defined by the MIP results (Figure 9), with the greatest ECD responses adjacent to Building 6 at 28MIP-21 and centered around 28MIP-29 in the northeast portion of the former Building 88 footprint.

Only one well in the Former Building 88 Area is screened in the B2-Aquifer: well W9-12, which is screened from 85 to 95 feet bgs. It was constructed in 1990 and has been sampled 17 times between 1992 and 2010. PCE has not been detected in any of the samples. TCE has been detected in 11 of the samples at a maximum concentration of 2.8 µg /L (2005), below the ROD cleanup standard (5 µg/L) (EPA, 1989). Cis 1,2-DCE has been detected in 8 of the samples at a maximum concentration of 1.3 µg/L (2009), below its MCL (6 µg/L). VC has not been detected in any of the samples**.**

2.5.3 Traffic Island Area Soil

Wastewater containing PCE was reportedly discharged from Sump 66 into the sanitary sewer system. Previous investigations determined there was a leak in the sewer line downstream from former Building 88 in the Traffic Island Area. As described in Section 2.1, the sewer line reportedly collapsed and resulted in the release of PCE into the subsurface.

The following description is based on the results of 50 soil samples collected from 8 borings during the 2005 site investigation (TtECI, 2008) and 1 soil sample collected from 1 boring during the 2010 – 2011 treatability study (Shaw E&I, 2010). Concentrations of PCE in A-Aquifer soil greater than 500 μg/kg (the unsaturated soil cleanup standard identified in the ROD [EPA, 1989 and 1990]) were detected from 8 feet bgs (water table) down to 60 feet bgs along the sanitary sewer alignment beneath the traffic island where the sewer line had reportedly collapsed. The highest concentration of PCE in soil (7,000 μg/kg) was detected in a sample from direct-push boring CPT-88-13 at a depth of 8 to 9 feet bgs beneath the traffic island.

A TCE concentration greater than 500 μg/kg in A-Aquifer soil was only detected in a sample from direct-push boring CPT-88-13 (770 μg/kg) at a depth of 8 to 9 feet bgs beneath the traffic island. Cis 1,2-DCE concentrations greater than 500 μg/kg in A-Aquifer soil were detected between 8 to 19 feet bgs in direct-push boring CPT-88-13 (700 to 3,700 μg/kg) and between 11 to 12 feet bgs in direct-push boring CPT-88-23 (1,100 μg/kg). VC was only detected in two samples from direct-push borings CPT-88-13 and CPT-88-16 at an estimated concentration of 2 μg/kg (15 to 16 feet bgs) and 14 μg/kg (8 to 9 feet bgs), respectively. Appendix D provides isoconcentration maps and cross-sections from the 2005 site investigation (TtECI, 2008) that illustrate the distribution of PCE, TCE, cis 1,2-DCE, and VC in soil at the Traffic Island Area.

To evaluate for the potential presence of DNAPLs in the lower portion of the A-Aquifer at the Traffic Island Area, during the 2010 – 2011 treatability study (Shaw E&I, 2010), a continuous soil core (IR28SB-02) and a non-aqueous phase liquid FLUTe™ test were completed to a total depth of 65 feet bgs, adjacent to the MIP boring with the greatest ECD and PID response, 28MIP-12 (Appendix E). No indications of DNAPL were noted in the soil core nor were present on the liner. This included no observations of staining, odor, elevated PID responses (greater than 100 parts per million by volume), nor positive OilScreenSoil (Sudan IV™) test results. In addition, a second non-aqueous phase liquid FLUTe™ test was performed adjacent to 28MIP-05, where the greatest combined ECD and PID responses were detected in the upper portion of the A-Aquifer (Figure 11). The liner was deployed to a total depth of 30 feet bgs targeting the upper portion of the A-Aquifer. No indications of DNAPL were present on the liner. Based on the negative results for the non-aqueous phase liquid FLUTe™ tests along with previous soil and groundwater samples from the A-Aquifer, it was concluded that the potential amount of DNAPL PCE beneath the Traffic Island Area, if present, is sufficiently small.

Historically, only one boring in the Traffic Island Area has been drilled into the B2-Aquifer. During the 2005 site investigation, direct-push boring CPT-88-13 was overdrilled by the boring for well W88-1 to a total depth of 97 feet bgs. This boring/well is located adjacent to the sanitary sewer line that reportedly collapsed beneath the traffic island (Figure 4). Only two soil samples were collected from W88-1, at depths of 70 and 73 feet bgs. PCE was detected in both samples at concentrations of 10,000 μg/kg and 8,700 μg/kg, respectively. TCE was detected at 1,900 μg/kg and 1,300 μg/kg, respectively. Cis 1,2-DCE was detected at 18 μg/kg and 6 μg/kg, respectively. VC was detected at 8.7 μg/kg and an estimated value of 2.3 μg/kg, respectively.

2.5.4 Traffic Island Area Groundwater

The following description is based on the results of 53 discrete-depth groundwater grab samples collected from 8 direct-push locations during the 2005 site investigation (TtECI, 2008), 15 groundwater samples collected from the 14 treatability study observation wells prior to the 2010 – 2011 treatability study in July 2010 (Shaw, 2012), and 4 groundwater samples collected from 4 wells outside the treatability study area during the 2010 annual groundwater monitoring event in November/December 2010 (ERS-JV and Brown and Caldwell, 2011). PCE concentrations in A-Aquifer groundwater ranged from less than the RL of 0.5 μg/L to 28,000 μg/L. Concentrations of PCE in groundwater greater than 1,000 μg/L were primarily detected along the sanitary sewer alignment beneath and north of the traffic island at depths ranging from 14.5 feet bgs (9,200 μg/L; CPT-88-13) to 65 feet bgs (28,000 μg/L; 28-OW-12). Within 200 feet upgradient (south) of the traffic island, PCE concentrations ranged from less than the RL of 0.5 μg/L (CPT-88-16 and CPT-88-17) to 5.2 μg/L (28-OW-10) between 8 and 51 feet bgs.

Within 200 feet upgradient of the traffic island, TCE was detected in groundwater in the upper portion of the A-Aquifer at concentrations ranging from 21 μg/L (28OW-09) to 900 μg/L (CPT-88-16). In the vicinity of the traffic island, concentrations of TCE in upper A-Aquifer groundwater ranged from non-detect to 2,400 μg/L. Concentrations of TCE greater than the highest concentration upgradient (900 μg/L) were only detected between 14 and 19 feet bgs beneath the traffic island at direct-push boring CPT-88-13, located adjacent to the sanitary sewer line that reportedly collapsed. Within 200 feet upgradient of the traffic island, TCE was detected in groundwater in the lower portion of the A-Aquifer at concentrations ranging from 6.9 μg/L (CPT-88-17) to 620 μg/L (CPT-88-16). In the vicinity of the traffic island, concentrations of TCE in lower A-Aquifer groundwater ranged from lower than the RL of 0.5 μg/L to 12,000 μg/L. Concentrations of TCE greater than the highest concentration upgradient (620 μg/L) were detected beneath, to the west-southwest (CPT-88-20 and CPT-88-21), and north-northwest (CPT-88-19) of the traffic island at depths ranging from 39 to 65 feet bgs. The highest concentration (12,000 μg/L) was detected in a sample from well 28OW-04 (55 to 65 feet bgs), located adjacent to the sanitary sewer line that reportedly collapsed and directly above the A/B-Aquitard.

Within 200 feet upgradient of the traffic island, cis 1,2-DCE was detected in groundwater in the upper portion of the A-Aquifer at concentrations ranging from 190 μg/L (28OW-10) to 1,700 μg/L (28OW-09). In the vicinity of the traffic island, concentrations of cis 1,2-DCE in upper A-Aquifer groundwater ranged from non-detect to 11,000 μg/L. Concentrations of cis 1,2-DCE greater than the highest concentration upgradient (1,700 µg/L) were only detected between 14 and 19 feet bgs beneath the traffic island at direct-push boring CPT-88-13, located adjacent to the sanitary sewer line that reportedly collapsed. Within 200 feet upgradient of the traffic island, cis 1,2-DCE was detected in groundwater in the lower portion of the A-Aquifer at concentrations ranging from 1.8 µg/L (CPT-88-17) to an estimated value of 120 µg/L (CPT-88-16). In the vicinity of the traffic island, concentrations of cis 1,2-DCE in lower A-Aquifer groundwater ranged from non-detect to 5,000 µg/L. Concentrations of cis 1,2-DCE greater than the highest concentration upgradient (120 µg/L) were detected beneath, to the west-southwest (CPT-88-20 and CPT-88-21), and north-northwest (W9-21) of the traffic island at depths ranging from 35 to 65 feet bgs. The highest concentration (5,000 µg/L) was detected in a sample from well 28OW-04 (55 to 65 feet bgs), located adjacent to the sanitary sewer line that reportedly collapsed and directly above the A/B-Aquitard.

Within 200 feet upgradient of the traffic island, VC was detected in groundwater in the upper portion of the A-Aquifer at concentrations ranging from an estimated value of 0.28 µg/L (28OW-10) to 170 µg/L (WNX-2). No concentrations of VC greater than 170 µg/L (the highest upgradient concentration) were detected in the vicinity of the traffic island. Concentrations of VC in vicinity of the traffic island ranged from non-detect to 140 µg/L, with approximately half of the concentrations less than 1 µg/L. Concentrations above 1 µg/L were detected beneath, to the west-southwest (CPT-88-20 and CPT-88-21), and to the north-northwest (CPT-88-23 and CPT-88-19) of the traffic island at depths ranging from 7 to 39 feet bgs. The highest concentration (140 µg/L) was detected in a sample from well W9-42 (29 to 39 feet bgs), located beneath the traffic island, approximately 25 feet northeast of the sanitary sewer line that reportedly collapsed. Within 200 feet upgradient of the traffic island, VC was not detected in groundwater in the lower portion of the A-Aquifer. In the vicinity of the traffic island, concentrations of VC in lower A-Aquifer groundwater ranged from non-detect to 600 µg/L. Concentrations of VC greater than the RL (0.5 µg/L) were detected beneath, to the southwest (CPT-88-20), and to the north-northwest (W9-21) of the traffic island at depths ranging from 39 to 65 feet bgs. The highest concentration (600 µg/L) was detected in a sample from well 28OW-04 (55 to 65 feet bgs), located adjacent to the sanitary sewer line that reportedly collapsed and directly above the A/B-Aquitard.

Appendix D provides cross-sections that illustrate the distribution of PCE, TCE, cis 1,2-DCE, and VC in groundwater at the Traffic Island Area based on discrete depth grab samples collected during the 2005 site investigation (TtECI, 2008). Appendix D also contains isoconcentration maps that illustrate the distribution of PCE, TCE, cis 1,2-DCE, and VC in the upper and lower portions of the A-Aquifer based on well samples collected in November/December 2010 after initiation of the 2010 – 2011 treatability study (ERS-JV and Brown and Caldwell, 2011).

Directly beneath the traffic island, there is an apparent increase in PCE and TCE concentrations with depth as indicated by pre-treatment groundwater sample results from the 2010 – 2011 treatability study wells (Shaw, 2012). The results indicate higher PCE and TCE concentrations at depth, notably within the 40-to-50-feet-bgs and 55-to-65-feet-bgs intervals. The highest observed PCE concentrations, 15,000 and 28,000 µg/L, were detected in samples from wells 28OW-04 and 28OW-12, respectively. Both of these wells are screened from 55 to 65 feet bgs. TCE in these samples were 12,000 and 7,800 µg/L, respectively. PCE and TCE concentrations in samples from wells screened in shallower intervals (12 to 17 feet bgs [28OW-01 and 28OW-05] and 24 to 29 feet bgs [28OW-02 and 28OW-06]) ranged from 19 to 230 µg/L and from 17 to 370 µg/L, respectively.

MIP data collected during the 2010 – 2011 treatability study (Shaw E&I, 2010) confirmed that the greatest mass of CEs resides below the alignment of the collapsed sanitary sewer line. The greatest ECD response profile(s) from the 19 MIP tests performed in the Traffic Island Area were recorded at 28MIP-09, 28MIP-11, and 28MIP-12, which are located along the former collapsed sanitary sewer alignment at the southwest corner of the Traffic Island Area. Maximum ECD responses (above the detector calibration range) at these locations were recorded from approximately 7 to 65 feet bgs, and the greatest PID responses were recorded from approximately 7 to 25 feet bgs and 47 to 55 feet bgs. These test locations correspond with the high concentrations of CEs detected in groundwater samples collected at CPT-88-13, 28OW-04, and 28OW-12, along the upstream portion of the former collapsed sanitary sewer alignment. Down hydraulic gradient of these locations, the ECD responses decline in the upper portion of the A-Aquifer but remain high in the lower portion of the A-Aquifer, below 35 feet bgs. Copies of the MIP logs from the 2010 – 2011 treatability study are provided in Appendix E.

Similar to the Former Building 88 Area, isopleth maps of the cumulative ECD response for the Traffic Island Area were generated to depict the relative lateral distribution of CEs in three separate depth intervals: 0 to 23 feet bgs, 23 to 46 feet bgs, and 46 to 65 feet bgs (Figures 10, 11, and 12, respectively). As illustrated on Figure 6, these intervals represent three coarser-grained soil intervals (paleochannels) separated by two distinct horizons of fine-grained soil that are stratigraphic features suspected of influencing the distribution and migration of CEs in the subsurface.

Figure 10 shows the highest cumulative ECD responses in the 0-to-23-feet-bgs interval (greater than 4×10^9 microvolts [µV]) aligned in a north-northwest orientation along the western side of the former collapsed sanitary sewer line. Similarly, Figure 11 also exhibits a north-northwest alignment of the highest cumulative ECD responses in the 23-to-46-feet-bgs interval (greater than 6×10^9 µV) along the former collapsed sanitary sewer line. Figure 12 shows the highest cumulative ECD responses in the 46-to-65-feet-bgs interval (greater than 5×10^9 µV) aligned in a northern orientation along the former collapsed sanitary sewer line.

It should be noted that at test location 28MIP-01, between 15 and 25 feet bgs, high PID and flame ionization detector responses were observed but with only a slight ECD response. Based on these responses and considering the detection capabilities of each instrument, it is possible that an organic compound other than CEs was detected at this location/interval.

Only one well in the Traffic Island Area is screened in the B2-Aquifer: well W88-1, which is screened from 72 to 82 feet bgs. It was constructed in 2005 and has been sampled four times between 2005 and 2010. PCE was initially detected at an estimated concentration of 69 μg/L (2005); and by 2010, it had increased to a maximum estimated concentration of 3,300 μg/L. Similarly, TCE was initially detected at an estimated concentration of 31 μg/L (2005); and by 2010, it had increased to a maximum estimated concentration of 2,200 μg/L. Conversely, cis 1,2-DCE was initially detected at 9,700 μg/L; but by 2010, it had decreased to an estimated concentration of 4,500 μg/L. VC was not detected initially in 2005 but was detected in all subsequent samples; and by 2010, it had increased to a maximum estimated concentration of 290 μg/L.

3.0 Supplemental Investigation Approach

This supplemental investigation will be completed in two phases: a preliminary screening survey (Phase I) followed by installing groundwater monitoring wells and groundwater sampling (Phase II). The investigation activities will be conducted at the Former Building 88 and Traffic Island Areas (Figure 2). Phase I will be completed to further refine the understanding of the distribution of CEs and soil lithology in the investigation areas. Results from this first phase of work, along with existing data, will be used to identify the location and properly design new wells to be installed during Phase II. Once the new wells are constructed, groundwater samples will be collected from the wells during two separate sampling events. The following sections summarize the general approach for the supplemental investigation.

3.1 Triad Approach

The investigation will be implemented using the EPA's Triad approach (2001) in coordination with the Navy, EPA, and Regional Water Quality Control Board, San Francisco Bay Region. The Triad approach embraces scientific and process improvements in three areas: systematic project planning, dynamic work strategies, and real-time measurement technologies (Interstate Technology & Regulatory Council, 2003). The use of the Triad approach will accomplish the following objectives:

- To reduce uncertainties in the CSM by further characterizing the lateral and vertical extent of PCE and its daughter products (TCE, cis 1,2 DCE, and VC) and the soil stratigraphy in the saturated zone at the former Building 88 and Traffic Island source areas in order to support decisions for locating and designing new groundwater monitoring wells, and for source area remediation in the future

- To increase communication and consensus between project decision makers with regard to project constraints, decisions, and the accepted level of uncertainty in the project data and analyses

- To use real-time methods to quickly provide data to the Triad team that can be used collaboratively to analyze samples and evaluate the data in order to adjust the locations of subsequent samples, thus reducing uncertainty through the acquisition of a larger quantity of optimal data without a significant increase in project duration and cost

During the course of the fieldwork, Shaw E&I will prepare reports that briefly summarize field activities, present current data, and document field decisions. The reports will be delivered electronically to the Triad team on a weekly basis to allow team members to follow the investigation and to provide input to the dynamic investigation process. Additionally, the Triad team will meet between Phase I and Phase II to discuss and finalize well location and design.

3.2 Phase I—Preliminary Screening Survey

The Phase I screening survey will be performed using the Navy's SCAPS MIP/DSITMS and CPT equipment to provide a vertical profile of the distribution of CEs and soil lithology in the subsurface at each investigation area. Details on implementation of the SCAPS survey are presented in Section 5.0.

The MIP is a qualitative to semi-quantitative screening device used to rapidly generate a real-time log of the relative concentration of VOCs in the subsurface at multiple depths within a single penetration. It is used in conjunction with a direct-push platform to drive the MIP to discrete depth(s) of interest to collect samples of vaporized compounds for real-time measurement at the surface (EPA, 2012b). For this investigation, the MIP will be driven into the subsurface by the Navy's SCAPS rig, which is a direct-push platform that uses a hydraulic ram to advance (push) various sampling and in situ measuring devices into the ground.

The MIP data are considered qualitative to semi-quantitative due to inherent in-situ sampling limitations and possible matrix effects. The MIP is a bulk matrix sampling device used to vaporize VOCs from both soil and groundwater simultaneously and can be subject to variations in system response due to grain size changes within the soil matrix. For example, VOC measurements tend to be biased high in fine-grained sediments such as silts and clays. Additionally, the MIP samples VOCs in direct contact with its heated membrane surface but the sample size or area influenced by the heated membrane is uncertain. Because the mass and volume of the sampled matrix are not known, the MIP data are only considered to be estimates (U.S. Army Corps of Engineers, 2002). The results produced by a MIP at any location are relative and should be compared to soil and groundwater analytical data for a better understanding of the results (EPA, 2012b). Therefore, several of the MIP tests are planned at locations adjacent to previous MIP borings, discrete-depth groundwater samples, and groundwater monitoring wells that were not affected by the 2010 – 2011 treatability study. This allows the new MIP results to be compared relative to previous MIP results and groundwater results produced by more conventional sampling and analytical methods. A qualitative comparison between the new MIP data and the previous MIP data will be performed to evaluate the correlation between the two data sets. The new MIP data will also be compared with the discrete-depth groundwater data and well groundwater data through straightforward linear regression analyses.

The MIP tool consists of a thin, polymer (tetrafluoroethene) membrane that is permeable to gas but impermeable to liquids. The membrane is impregnated into a small stainless steel screen mounted to a heated block that is attached to a direct-push probe. The screen is mounted flush to the exterior surface of the probe to allow direct contact with the subsurface (soil and groundwater). The block is heated to between 100 and 120 degrees Celsius to accelerate the diffusion of VOCs in the soil and groundwater across the membrane into a tube where clean helium carrier gas conveys the liberated VOCs to an analytical device at the surface.

For this investigation, a DSITMS will be used as the analytical device to identify and quantify the specific VOCs in μg/L of MIP calibration solution by EPA Method 8265 rather than using the ECD, PID and FID detectors, which do not speciate the detected compounds. Speciation of the detected compounds for this effort will be useful to further define the extent of the Navy's source area within the regional plume and for attempting to differentiate between contaminants from the Navy's source area and those migrating on site from upgradient sources. Initially, the DSITMS will be calibrated for the target VOCs (i.e., PCE, TCE, 1,2-DCE, and VC), although the DSITMS will indicate the presence or absence of non-target VOCs. If non-target VOCs are detected, then the DSITMS can be calibrated for the additional compounds. Although it is variable, the MIP/DSITMS screening sensitivity is expected to range between approximately 500 and 1,000 μg/L of calibration solution for each target compound. In addition to semi-quantitative measurements at prescribed sampling depths, the DSITMS is also capable of continuous (lower sensitivity) VOC monitoring as the MIP is advanced between discrete sampling depths allowing identification of intervals with high concentrations of VOCs that could also be targeted for discrete-depth measurements. Only the higher sensitivity data from the discrete-depth samples will be recorded.

In addition to the VOC measurements, continuous lithologic data will also be collected during each of the MIP penetrations to correlate contaminant distribution with soil lithology and to further characterize the lateral and vertical extent of significant stratigraphic features such as paloechannels and low permeability units that may affect the distribution and migration of the target VOCs (i.e., A/B-Aquitard, paleochannel deposits, etc.). To continuously log lithologic data, the SCAPS MIP tool is outfitted with CPT piezo elements to measure resistance to penetration as the tool is advanced in the subsurface. Cone resistance and sleeve friction are measured simultaneously in units of tons per square foot. The ratio of sleeve friction to cone resistance, combined with the cone resistance value, corresponds to soil behavior classifications using Robertson and Campanella's method (1988). The CPT measurements will be relatively continuous at a resolution of approximately one reading per every 1-inch interval. The SCAPS equipment provides an on-board, real-time display of CPT data, including the inferred soil classification, which will be useful for targeting specific intervals to collect MIP/DSITMS measurements. Several of the SCAPS CPT/MIP tests are planned at locations adjacent to previous MIP borings, a CPT boring, a continuous soil core, and groundwater monitoring wells, so the new CPT lithologic logs can be qualitatively compared to previous manually logged boreholes, CPT lithologic logs, and MIP soil electrical conductivity logs. The lithologic data from the CPT will be integrated with the MIP/DSITMS data to both refine the CSM and support placing and designing the planned monitoring wells.

Each area will have a set of designated locations to initiate the SCAPS survey, identified as Tier 1 test locations. Based on the real-time data and the evolving CSM, additional step-out/step-in (Tier 2) locations may be completed. The step-out/step-in sampling will occur after the Tier 1 tests have been completed. A review of the results for the Tier 1 tests, along with previously collected data, will be performed to identify potential locations for the Tier 2 tests. A Triad meeting will be held to review, refine, and mutually agree on the Tier 2 test locations.

Individual SCAPS-profile depths will vary by location, but the maximum depth is expected to be approximately 100 feet bgs, which is also the maximum depth the SCAPS CPT/MIP can achieve due to a limited cable length. Actual borehole depths may also be limited by penetration refusal due to dense or cemented soil.

3.3 Phase II—Monitoring Well Installation and Soil and Groundwater Sampling

Upon completion of Phase I activities, the SCAPS and previous site investigation data will be evaluated to determine the locations and screen intervals for new monitoring wells. The proposed locations and screen intervals will be presented to the Triad team before installing the new wells. Up to 12 new monitoring wells are planned to be installed in the A-Aquifer and B-Aquifer to a maximum depth ranging from 65 feet bgs at the Former Building 88 Area to 95 feet bgs at the Traffic Island Area. New wells are tentatively planned for the following locations at the Former Building 88 Area:

- Within the upper portion of the A-Aquifer in the area of the equipment room of former Building 88, to further define and monitor concentrations of CEs in groundwater where historical MIP data (Shaw, 2012) and discrete soil data (TtECI, 2008) have indicated elevated concentrations of residual CEs persist
- Within the upper and lower portions of the A-Aquifer immediately downgradient of the equipment room of former Building 88 near existing wells 28OW-19 and 28OW-20, to further define and monitor concentrations of CEs in groundwater immediately downgradient of where historical MIP data (Shaw, 2012) and discrete soil data (TtECI, 2008) have indicated elevated concentrations of residual CEs persist
- Within the upper and lower portions of the A-Aquifer upgradient of the former Building 88 source area, outside the area where data indicate elevated concentrations of residual CEs persist, to further define and monitor the on flow of CEs from upgradient regional contaminant sources

At the Traffic Island Area, new wells are tentatively planned for the following locations:

- Within the lower portion of the A-Aquifer, immediately above the A/B-Aquitard (approximately 55 to 65 feet bgs), upgradient of the emulsified vegetable oil pilot test area near existing wells 28OW-09, 28OW-10, and 28OW-11 to further define and monitor the on flow of CEs from upgradient regional contaminant sources

- Within the B2-Aquifer, upgradient and downgradient of existing well W88-1, to define the lateral extent of CEs in the B2-Aquifer beneath the Traffic Island Area
- Within the silty sand between 87 and 90 feet bgs, below existing well W88-1, to define the vertical extent of CEs beneath the Traffic Island Area

Sonic drilling techniques will be used to complete each borehole and to install the monitoring wells. Before constructing each well, continuous soil cores will be collected from each well borehole to visually log the soil and collect discrete depth soil samples for fixed-base laboratory analysis of VOCs by EPA Method 8260. The samples will be collected from the depth of the highest CE concentration as indicated by nearby MIP tests and as measured with field instruments (i.e., PID) while logging the soil core. If indications of DNAPL are indicated by nearby MIP tests (response >50,000 µg/L of calibration solution) or observed when logging the soil core (i.e. visually or by field PID screening measurements), then select soil sample aliquots will be field screened using an OilScreenSoil (Sudan IV)® field screening kit, which uses a hydrophobic dye to produce a qualitative colorimetric response to indicate the presence of DNAPL in soils. Following construction, the wells will be developed by surging and bailing and then sampled during two separate groundwater sampling events that are a minimum of three months apart. The groundwater samples will be collected using low-flow purging and sampling techniques, and then analyzed for VOCs and dissolved gases.

4.0 General Site Activities and Requirements

This section describes general activities and requirements associated with implementing the planned investigation activities at the site. These include permitting and notification, mobilization, utility clearance, decontamination, surveying, waste management, site security, and traffic control.

4.1 Permits and Notifications

Necessary permitting and notifications will be completed prior to intrusive activities. A construction permit will be filed with NASA to obtain authorization to perform any subsurface activities, such as drilling and well installation at the site. The permit will be obtained from the Moffett Field Permit Board of NASA Ames Research Center in Moffett Field, California. The permit application will be submitted via the Navy Resident Officer in Charge of Construction (ROICC) Office. Coordination will be made with the ROICC for activities that will be conducted on site.

Well permit applications will be submitted to the Santa Clara Valley Water District prior to mobilization. Shaw E&I will notify Underground Service Alert at least two working days prior to initiation of drilling and excavation activities. The soil borings and wells will be installed by a C-57-licensed subcontractor and in accordance with Santa Clara Valley Water District requirements and California-Department of Water Resources regulations (1981 and 1991).

4.2 Mobilization

Mobilization for the fieldwork will include procuring all necessary equipment and subcontractor services, designating a decontamination area, and conducting preparatory inspections. A preparatory meeting will be held prior to mobilization to discuss project scope, health and safety requirements, drilling procedures, sampling procedures, status of submittals and procurements, and quality control protocols. Equipment staging areas will be established, and a temporary decontamination pad will be constructed. Temporary security fencing will be installed around work areas, as necessary.

4.3 Land Surveys

The proposed SCAPS boring and monitoring well locations will initially be acquired and marked using a global positioning system receiver to within approximately 1-foot accuracy prior to utility clearance and intrusive activities. Upon completion of well installation activities, a final as-built survey of the locations and elevations of each SCAPS boring and new well will be surveyed by a State of California-certified Land Surveyor. Vertical elevations of each survey point will be determined to the nearest 0.01 foot and referenced to the North American Vertical

Datum of 1988. For wells, the top-of-casing measurement point will be clearly and permanently marked. The horizontal location of each point will be determined to the nearest 0.1 foot and referenced to the California State Plane Coordinate System, Zone III, North American Datum of 1983 in U.S. Survey Feet. If not already present, a minimum of one permanent control monument will be installed within a distance of 1,000 feet of each point to be surveyed.

4.4 Utility Clearance

Utility clearance surveys will be conducted to help locate and avoid subsurface hazards (e.g., encounters with live utility lines) during drilling activities. Surface geophysical methods that may be used include, but are not limited to, electromagnetic induction and geomagnetics. Clearance will be performed at every SCAPS and well location. Prior to utility clearance, existing site utility maps will be obtained from NASA via the ROICC office and reviewed with due diligence. All preliminary boring and subsurface work areas will be marked. Marking will consist of painting or staking the ground surface or pavement at the proposed locations. The stake or ground marking will identify the boring by number. Marking will be done using either a permanent waterproof marker or paint.

The subcontractor will note each cleared sampling location with paint or with a stake immediately upon clearing it. All suspected underground utility conduits and structures will be marked with color-coded marking paint according to standards established by the American Public Works Association. If utilities or other obstructions or hazards are identified at any proposed intrusive location, then a Shaw E&I field representative will identify a new location to be surveyed.

In addition to the utility clearance surveys, prior to drilling or driving any tools into the subsurface, each boring location shall be cleared by excavating the borehole to a minimum depth of 5 feet bgs and to a diameter greater than or equal to the maximum outside diameter of any tools planned for use to complete the borehole (i.e., drill rod casing). The excavation shall be completed using a vacuum excavation tool (a.k.a. air knife) or a hand auger. Once a borehole has been cleared, it will be backfilled to grade with the soil cuttings.

4.5 Concrete Coring/Cutting

Immediately following the utility clearance survey(s), boring locations covered with concrete will be cored to allow the installation of SCAPs test borings or saw cut to allow the installation of monitoring wells. The cores for the SCAPS borings will be approximately 3 to 4 inches in diameter and the saw cut for monitoring wells will be square measuring approximately 2 feet on a side. The cored or saw cut concrete will be left in place until borehole clearance by vacuum excavation or hand auger is performed. The coring and saw cutting will be performed by a saw cutting subcontractor.

4.6 Site Security and Traffic Control

IR Site 28 is located partially within one of the highly secured areas of Moffett Field. Therefore, access to investigation locations within this area (inside of the airfield fence line along Cummins Avenue) will be restricted to authorized personnel. To comply with airfield security requirements, all Shaw E&I employees and its subcontractors that require access to this area will obtain site access authorization and will follow the facility regulations governing access, including work hours and access routes, while within the airfield limits.

Shaw E&I will also coordinate with the ROICC office and NASA in establishing traffic control during the performance of the site investigation when the work areas encroach on a street. Appendix C describes the Traffic Control Plan. At a minimum, traffic control signs and cones will be used to demarcate work areas, and warning signs will be set up and maintained each day to notify drivers of lane closures and detours. Additional site access and traffic issues will be discussed during the preconstruction conference with the Navy and NASA representatives.

4.7 Equipment Decontamination

Drilling, well development, and heavy construction equipment in contact with subsurface soil and groundwater will be decontaminated after each use. Additionally, drill rigs and equipment will be decontaminated before mobilization to the field, between boreholes, and prior to demobilization from the field. A decontamination station will be set up in an area exclusively for decontamination of drilling, well development, and heavy equipment. The station will be constructed such that all rinsates, liquid spray, soil, and other wastes are fully contained and may be collected for disposal. Fluids and sediment generated at the portable decontamination pad will be contained in portable tanks or drums. Sampling equipment will also be decontaminated to ensure the quality and integrity of the samples collected.

4.8 Waste Management

All non-expendable equipment and materials such as skid units, tanks, hoses, and pipes that come in contact with site contaminants will be decontaminated in the equipment decontamination area. Primary waste streams will be generated during the implementation of the treatability tests, including the following:

- Personal protective equipment
- Soil cuttings from boring and well installation
- Asphalt concrete and debris generated during boring and well installation
- Well development and sampling purge water
- Water generated during equipment decontamination

These waste materials will be segregated and temporarily stored on site in labeled drums or roll-off bins. After being characterized and profiled, the solid waste materials will be transported off site by a licensed waste hauler for disposal to a permitted disposal facility or facilities. Well development, decontamination, and sampling purge water will be transported to and treated through the WATS. Waste sampling and analysis procedures are described in the SAP (Appendix A). Storage locations will be designated by the Navy ROICC office in consultation with NASA Ames Research Center.

Prior to disposal off site, the Shaw E&I Transportation and Disposal Coordinator will prepare one manifest package for each waste stream. Each manifest package will be signed by a representative of the Navy (ROICC or Caretaker Site Office).

5.0 Site Characterization and Analysis Penetrometer Survey

A Site Characterization and Analysis Penetrometer System (SCAPS) screening survey will be completed in, and around, the Former Building 88 and Traffic Island Areas. As discussed in Sections 1.0 and 3.0, the SCAPS survey will use CPT, MIP, and DSITMS equipment to quickly define location-specific soil lithology and the distribution of the individual target CEs in real-time allowing reassessment and adjustment of test locations during the field effort. Prior to initiating the SCAPS survey, the proposed SCAPS test locations will be scouted to identify any access restrictions. They will then be field-located to within approximately 1-foot accuracy; the subsurface will be cleared of utilities (Section 4.4); and concrete coring or cutting will be completed as necessary (Section 4.5).

Initially, SCAPS tests will be performed at 28 predetermined (Tier 1) locations that were selected based on a review of existing soil and groundwater data. The Tier 1 test locations proposed for the Former Building 88 Area are shown on Figures 7, 8, and 9 and the Tier 1 test locations proposed for the Traffic Island Area are shown on Figures 10, 11, and 12. The distribution of CEs in each of the depth intervals presented on these figures was evaluated separately when selecting the Tier 1 test locations. The rationale for selecting each of the proposed Tier 1 SCAPS test locations is presented in Table 1. Several of the test locations (SCAPS-01 through SCAPS-04 in the Former Building 88 Area and SCAPS-15 through SCAPS-17 in the Traffic Island Area) are located adjacent to previous MIP test borings and historical soil and groundwater sample locations in order to compare the SCAPS MIP/DSITMS and CPT data with previously collected soil and groundwater data.

The Tier 1 tests will be performed in the numbered sequence listed in Table 1 and shown on Figures 7 through 12, starting with SCAPS-01. The tests at the Former Building 88 Area will be completed before initiating the tests at the Traffic Island Area. While the Tier 1 tests are being performed at the Traffic Island Area, the results of the Tier 1 tests at the Former Building 88 Area, along with previously collected data, will be evaluated to identify potential step-out and/or step-in (Tier 2) locations following the decision rules described in Worksheet #11, Step 5 of the SAP (Appendix A). A Triad meeting will be held to review, refine, and mutually agree on any proposed Tier 2 test locations. Prior to initiating Tier 2 testing, the proposed test locations will be scouted to identify any access restrictions. Then they will be field-located to within approximately 1-foot accuracy; the subsurface will be cleared of utilities (Section 4.4); and concrete coring or cutting will be completed as necessary (Section 4.5). Tier 2 testing at the Former Building 88 Area will be initiated once all of the Tier 1 tests at the Traffic Island have been completed. Following the same process described for the Former Building 88 Area, Tier 2 tests for the Traffic Island Area will be determined and approved by the Triad team, while Tier 2 tests are being performed at the Building 88 Area. Based on available funds, up to 24 Tier 2 tests may be performed, as necessary.

At a minimum, all of the SCAPS tests will be completed to a depth that extends 2 feet into the top of the A/B-Aquitard (approximately 67 feet bgs) to confirm the depth to and lateral continuity of the aquitard. The SCAPS tests in the Former Building 88 Area will only extend to the top of the A/B-Aquitard, whereas the SCAPS tests in the Traffic Island Area are planned to extend into the B2-Aquifer to a maximum depth of 100 feet bgs to characterize the soil lithology of the A/B-Aquitard and B2-Aquifer, and to confirm the presence or absence of target CEs at the sensitivity threshold of the MIP/DSITMS. However, at the Traffic Island Area, if a MIP/DSITMS result for PCE or TCE is greater than 50,000 µg/L of the MIP calibration solution in the A-Aquifer, then mobile DNAPL is possibly present and the MIP/DSITMS test will be terminated at the top of the A/B-Aquitard to prevent cross-contamination of the B2-Aquifer. In this case, a continuous core will be completed adjacent to the MIP boring (within 3 feet) and the specific interval will be sampled for chemical analysis of VOCs by EPA Method 8260 at a fixed-base laboratory, and OilScreenSoil (Sudan IV™) field tests will be performed to evaluate for the presence or absence of DNAPL.

In general, for this investigation, discrete-depth MIP/DSITMS measurements will be made at a frequency of once per every 3-foot interval from the water table (approximately 7 feet bgs) to the total depth of investigation (67 feet bgs in the Former Building 88 Area and 100 feet bgs in the Traffic Island Area). Although, the prescribed discrete-depth sampling frequency may be adjusted by the field crew as the CSM evolves. For example, a few specific depths may be targeted for more tightly spaced readings (i.e., every foot) such as higher permeability intervals that may function as contaminant migration pathways or directly above lower permeability units where peak contaminant concentrations may occur (e.g., the interval above the A/B-Aquitard at the Traffic Island Area). Alternatively, some intervals may be tested less frequently than every 3 feet where data already strongly support a CSM in which target CE concentrations are below MIP sensitivity.

Based on available site information, it is anticipated that the SCAPS boreholes will be destroyed by injecting under pressure a cement-bentonite grout through the probe tip as it is retracted from the borehole. The backup method for destroying a SCAPS test borehole will be to re-enter the hole with a dedicated grouting tool and tremie grout under pressure. Each borehole will be grouted from the bottom up and checked the following day for settlement. If grout settlement is observed, then the borehole will be "topped off" with additional grout. Borehole locations within paved areas will be completed with 4 inches of cold-patch asphalt or concrete, as appropriate.

6.0 Monitoring Well Installation

Upon completion of the Phase I activities, the SCAPS data, along with existing site investigation data, will be assessed to determine locations and screen intervals for new monitoring wells. Based on current available funds, a total of up to 12 new wells are planned for the two investigation areas. The locations, depth, and screen intervals for the proposed wells will be presented to the regulatory agencies prior to well installation. The wells will be used to monitor water quality in and around the potential source areas.

The well installation activities will include the following:

- Continuous core drilling and discrete soil sampling
- Monitoring well construction
- Monitoring well development

The following sections provide additional detail describing the monitoring well installation activities.

6.1 Drilling and Soil Sampling

The wells will be installed using sonic drilling techniques by a State of California C-57 Licensed Water Well Contractor. While drilling, the ground surface around each well boring will be covered with plastic to prevent soil or fluids from contacting the surrounding ground surface. For wells that will be installed in the A-Aquifer, a 6-inch diameter drive casing will be used to create the well borehole. For wells that will be installed in the B-Aquifer, a combination of 6-inch diameter and 8-inch diameter drive casings will be used in a telescoping approach to isolate A-Aquifer contaminants from the B-Aquifer during well construction. The telescoping approach entails advancing the 8-inch diameter drive casing into the A/B-Aquitard, setting a bentonite plug, allowing the plug to adequately hydrate for one hour, and then advancing the 6-inch diameter drive casing through the 8-inch diameter casing and bentonite plug down to the total planned well depth. Each well boring will be continuously cored to total depth with 4-inch diameter core barrels advanced ahead of the outer drive casing. The soil cores will be logged by a field geologist with oversight by a State of California-licensed Professional Geologist. The logs will include Unified Soil Classification System descriptions, soil color, depth of first encountered groundwater, and any field indications of contamination (odor or staining). A PID will be used to screen the soil core for VOCs. **The core logs will be compared to any nearby CPT lithologic logs to evaluate the correlation between the CPT lithologic logs and manually logged boreholes.** Soil samples will be collected from the depth of the highest CE concentration as indicated by nearby MIP tests and as measured with field instruments (i.e., PID) while logging the soil core. The samples will be analyzed at a fixed-base laboratory for VOCs. The remaining core material and any other potential soil waste will be properly containerized for waste characterization and future disposal.

6.2 Monitoring Well Construction

Each well will be constructed of 2-inch diameter Schedule 40 polyvinyl chloride with a maximum 10-foot long, 0.010-inch slotted screen. A filter pack consisting of #2/16 (16 × 30 sieve size) clean silica sand will be placed in the borehole annulus from the bottom of the well screen up to 2 feet above the top of the screen interval. A minimum 2-foot layer of 3/8-inch bentonite pellets will then be placed above the filter pack and hydrated. Next, a cement bentonite grout will be tremied in place up to 1 foot bgs to leave room to install a well box. Every well will be completed at the surface with a traffic-rated, flush mounted, well box and concrete collar. Figure 13 presents the preliminary design details for the wells to be installed.

6.3 Monitoring Well Development

Following installation, each well will be developed no sooner than 48 hours after construction of the grout seal. The wells will be developed by a process of surging, bailing, and purging. A surge block will be lowered into the well and gently moved up and down within the saturated zone to induce movement of residual fine-grained material from the filter pack through the well screen where it can be removed by bailing or pumping. The well will be bailed periodically during the surging process. During development, general water quality parameters, including turbidity, pH, temperature, conductivity, dissolved oxygen, and oxidation reduction potential, will be measured (at a minimum every 15 minutes) and recorded. Development will continue until a minimum of three well volumes have been removed, the well water is free of excessive turbidity (5 nephelometric turbidity units or less), and the indicator water quality parameters (pH, temperature, and conductivity) have stabilized. Additionally, the final measured well depth should be in reasonable agreement with the estimated well completion depth. Monitoring and sampling of new wells shall be performed no sooner than 72 hours following well development activities.

Purge water will be stored in a mobile tank or in U.S. Department of Transportation-approved 55-gallon drums. At the end of each day, the liquid waste will be transported to the temporary waste staging area to allow the solids to settle. Periodically, the accumulated waste water will be transported to the WATS for treatment and disposal.

7.0 Groundwater Sampling

As part of Phase II activities, groundwater samples will be collected from each of the newly installed wells during two separate sampling events. The first event will be performed shortly after the wells have been installed but no sooner than 72 hours following well development activities, and the second event will be performed approximately three months later. The samples will be laboratory-analyzed for VOCs and dissolved gases. In addition, general water quality parameters (pH, temperature, conductivity, turbidity, dissolved oxygen, and oxidation reduction potential) will be measured in the field during sampling. Prior to each event, depth-to-water-level measurements will be recorded from all wells to be sampled. Water levels will be measured from the marked survey notch on the polyvinyl chloride well casings with an electronic water-level meter.

Groundwater sampling will be performed using low-flow purging and sampling techniques. Further details of the sampling and analytical requirements are provided in the SAP (Appendix A).

8.0 Technical Memorandum

Upon conclusion of the Phase I and Phase II field activities, a Technical Memorandum will be prepared that documents the implementation, results, and other pertinent observations of the supplemental investigation. At a minimum, the report will provide the following:

- MIP/DSITMS logs, CPT logs, soil boring logs, and well construction diagrams
- Map(s) showing the surveyed locations of the SCAPS tests and the new monitoring wells
- Descriptions of any significant difficulties or deviations from the WP while performing the field work
- A summary of the investigation activities and results
- An updated description of the nature and extent of contamination
- Results of the project quality objectives set forth in the SAP (Appendix A)
- Cross-sections that present the subsurface conditions in the investigation area and the vicinity
- Figures that present the SCAPS test results, analytical results for soil and groundwater samples collected in the investigation area, and isoconcentration contours for the primary COCs (PCE, TCE, cis 1,2-DCE and VC) in groundwater and soil, where appropriate
- Appendices with copies of any permits, access agreements, or other documentation needed to perform the investigation and pictures of the fieldwork
- A recommended path forward

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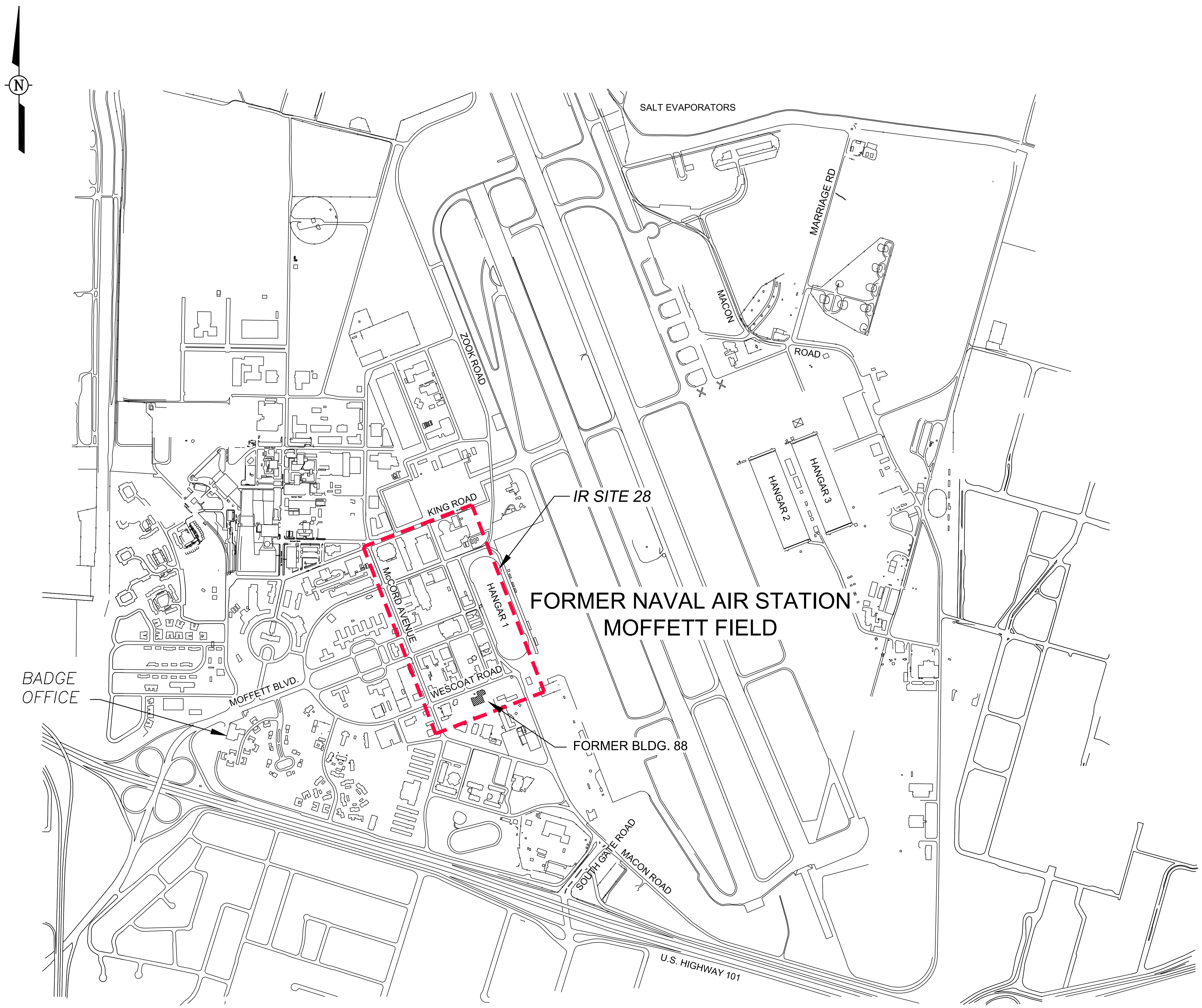
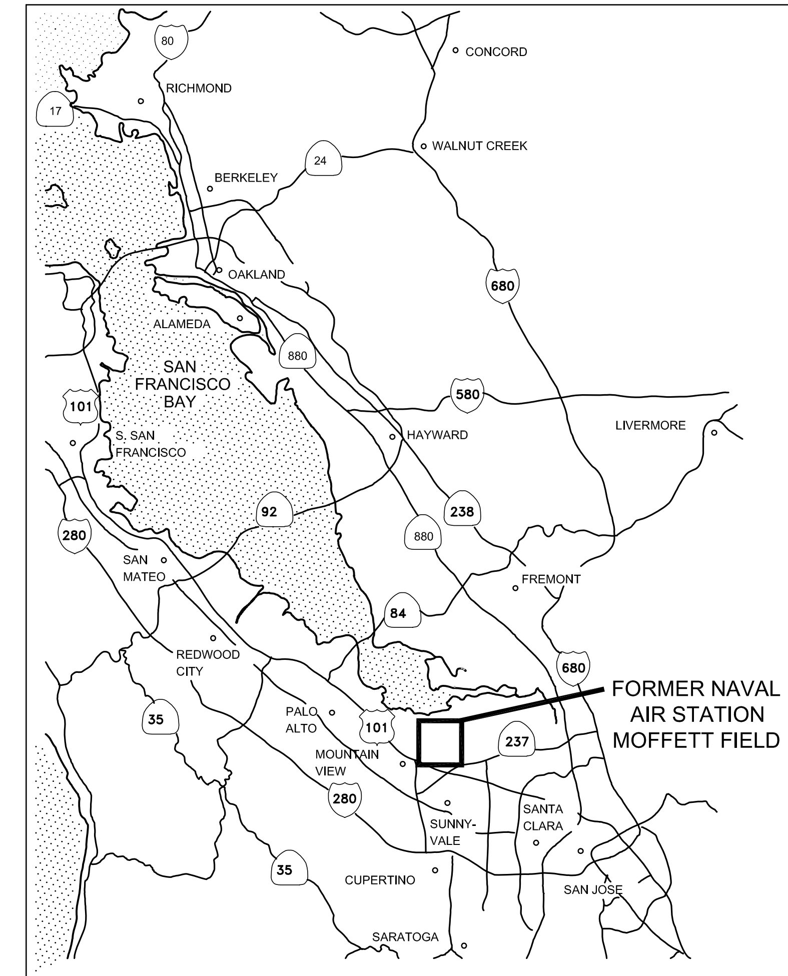
Figures



SITE LOCATION MAP

600' 0 600' 1200'



VICINITY MAP

5 0 5 10 MILES

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ENGINEERING COMMAND
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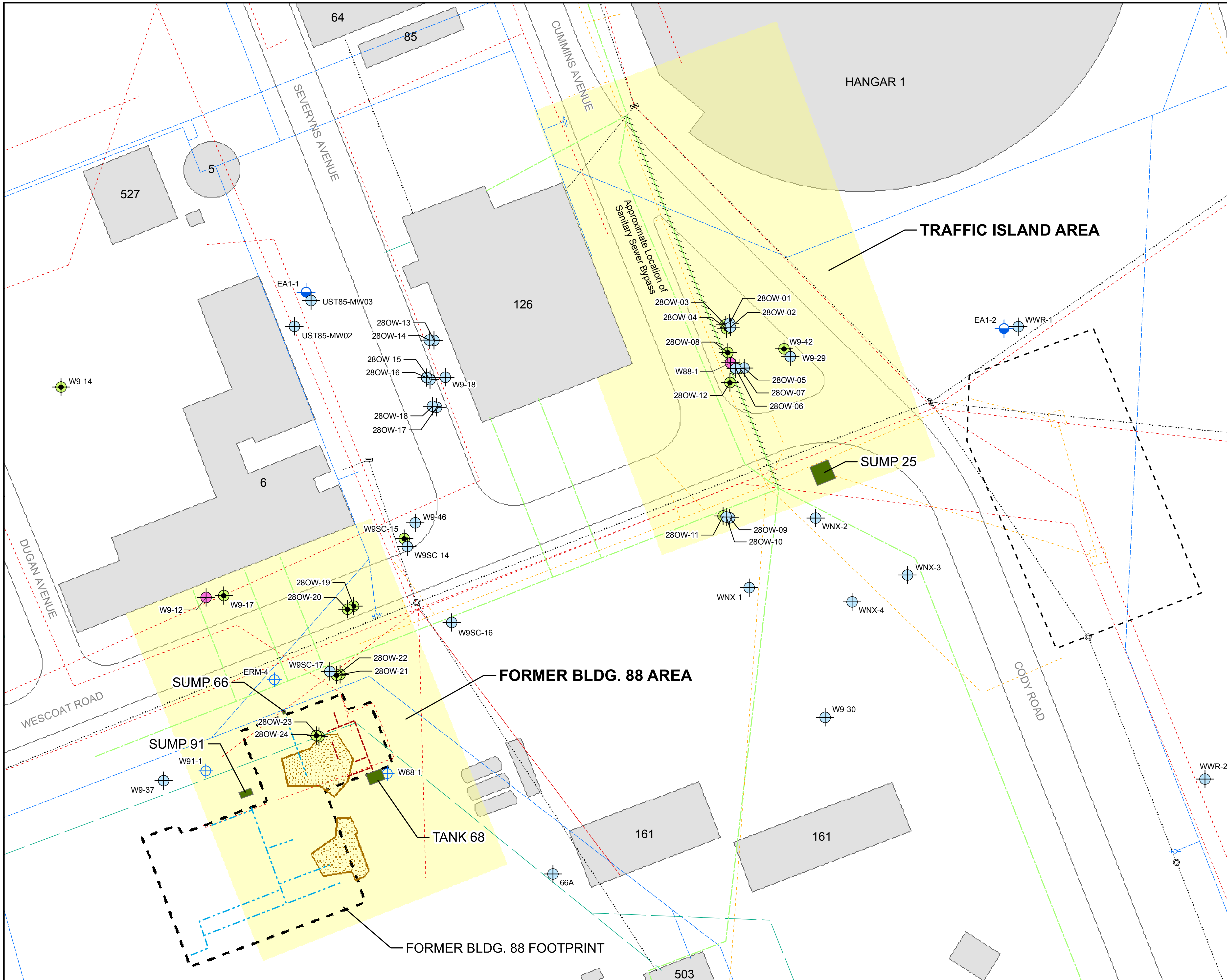
FIGURE 1

SITE LOCATION MAP

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE	X-REF	IMAGE
144002-B2	NH 03/10/10	DL 03/10/10	KAB 02/25/10	CONCORD	---	---



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Legend

- UPPER A-AQUIFER MONITORING WELL
- LOWER A-AQUIFER MONITORING WELL
- B2-AQUIFER MONITORING WELL
- A-AQUIFER EXTRACTION WELL
- FORMER GROUNDWATER MONITORING WELL LOCATION
- STORM DRAIN LINE
- SANITARY SEWER LINE
- SECTION OF THE SANITARY SEWER LINE THAT REPORTEDLY COLLAPSED (PRC, 1995)
- COMMUNICATION
- ELECTRIC
- GAS
- WATER
- CONCRETE-LINED WASTEWATER COLLECTION TRENCH (REMOVED)
- FLOOR DRAIN PIPING (REMOVED)
- FORMER AIRCRAFT WASH RACK
- PREVIOUS REMEDIAL EXCAVATION AREA (7 TO 8 FT. BGS)
- AREA OF INTEREST
- SUMP, TANK, OR OIL/WATER SEPARATOR (REMOVED)
- 503 BUILDING AND BUILDING NUMBER

PRC, 1995 - *Final Horizontal Conduit Study Technical Memorandum Text, Tables, and Figures*, August 4

0 60 120
Feet

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SAN DIEGO, CALIFORNIA

FIGURE 2

SITE FEATURES MAP

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

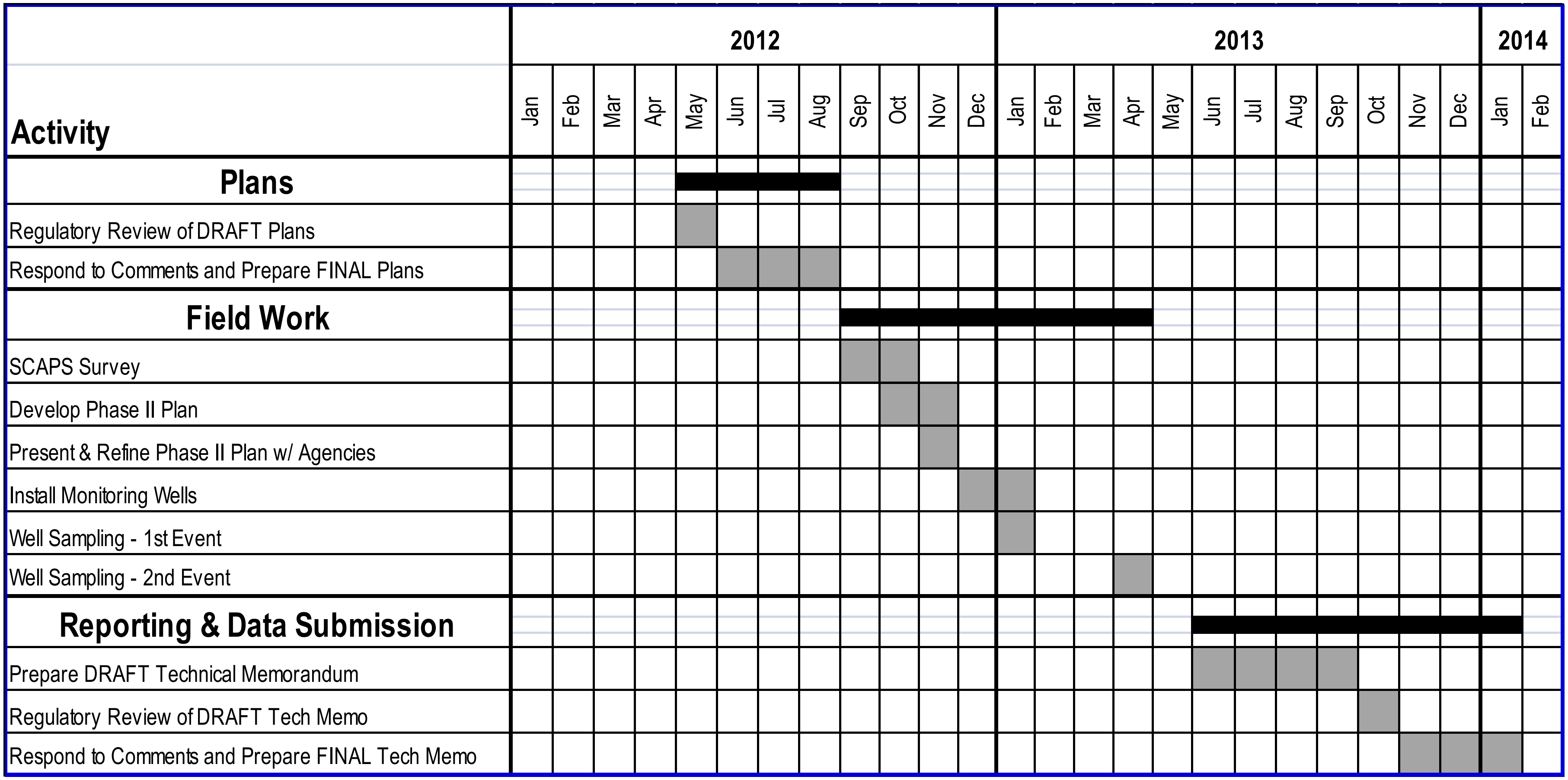

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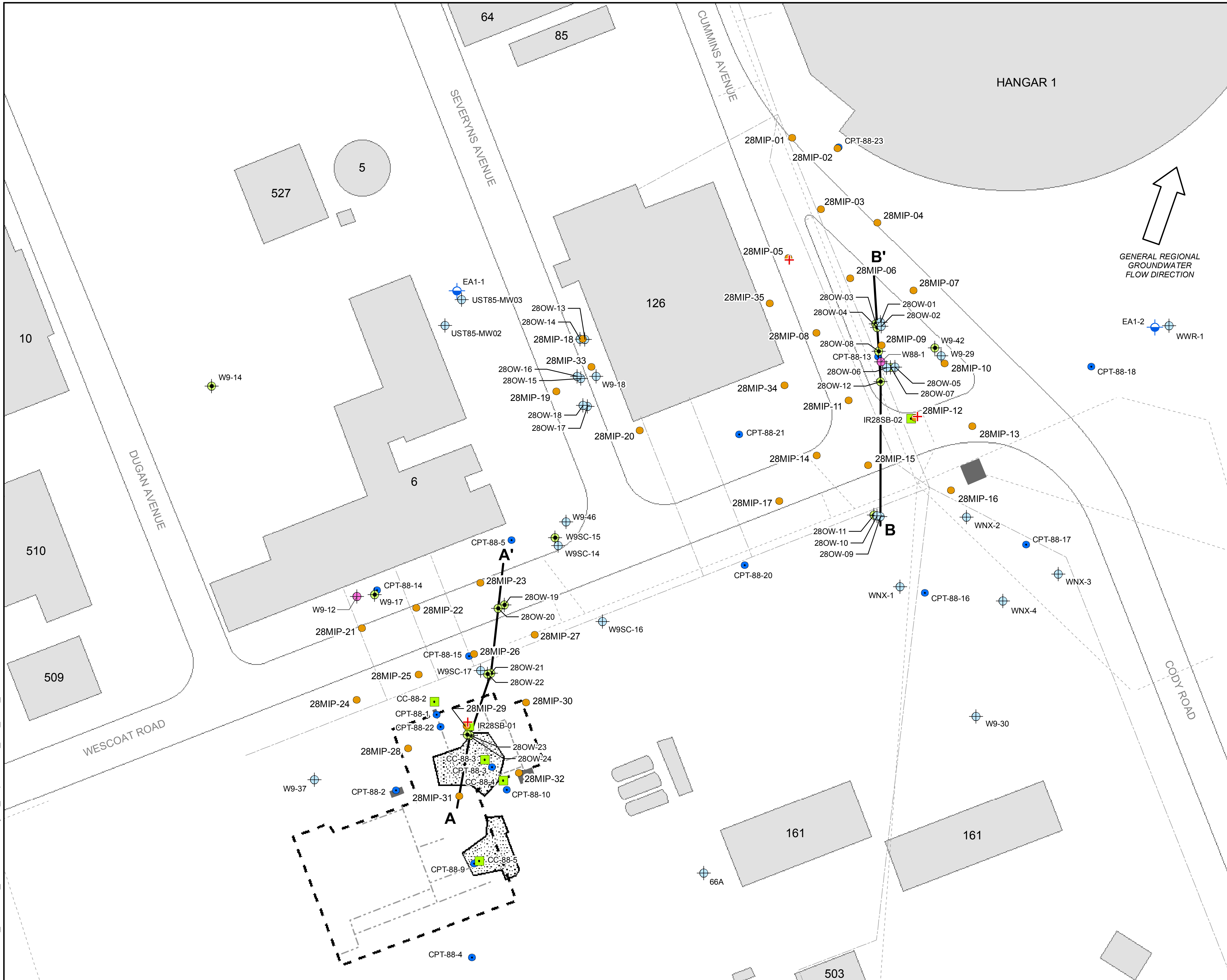
FIGURE 3

SCHEDULE

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA



Legend

- MIP LOCATION (SHAW, 2010)
- NAPL FLUTe™ TEST LOCATION (SHAW, 2010)
- CONTINUOUS CORE LOCATION (TtECI, 2008; SHAW, 2010)
- UPPER A-AQUIFER MONITORING WELL
- LOWER A-AQUIFER MONITORING WELL
- B2-AQUIFER MONITORING WELL
- A-AQUIFER EXTRACTION WELL
- CPT LOCATION (TtECI, 2008)
- LINE OF CROSS SECTION (SEE FIGURES 5 AND 6)
- STORM DRAIN LINE
- SANITARY SEWER LINE
- CONCRETE-LINED WASTEWATER COLLECTION TRENCH (REMOVED)
- FLOOR DRAIN PIPING (REMOVED)
- PREVIOUS REMEDIAL EXCAVATION AREA
- SUMP, TANK, OR OIL/WATER SEPARATOR (REMOVED)
- 503 BUILDING AND BUILDING NUMBER
- FORMER BUILDING 88

NOTES:
CPT - CONE PENETROMETER TEST
MIP - MEMBRANE INTERFACE PROBE

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SHAW, 2011, *DRAFT TECHNICAL MEMORANDUM, IN SITU ANAEROBIC BIOTIC/ABIOTIC TREATABILITY STUDY, IR SITE 28*, DECEMBER 16

N

0 60 120 Feet

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FIGURE 4

CROSS SECTION LOCATION MAP

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

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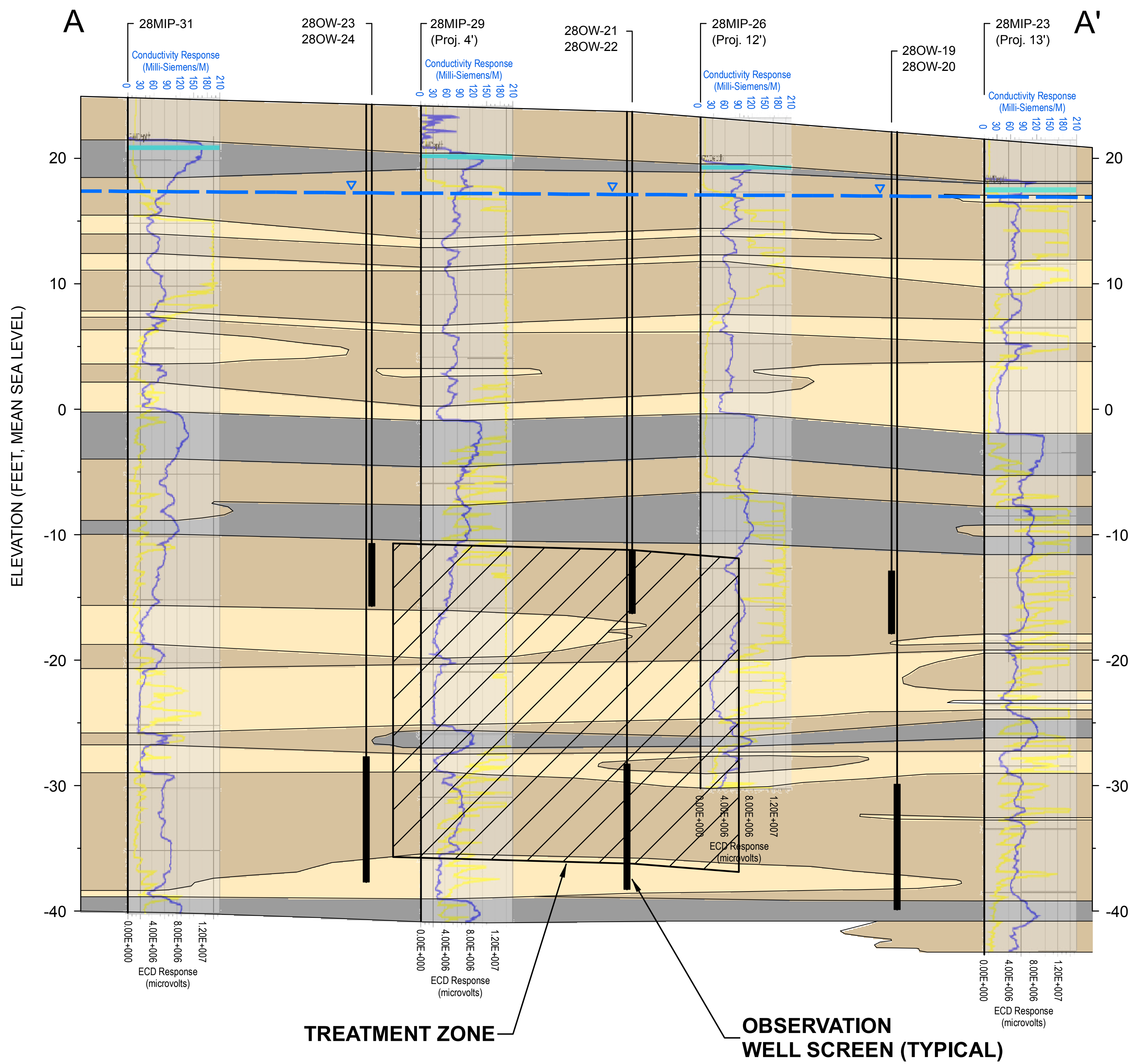

Legend

COARSE GRAINED UNITS (GRAVEL, SAND, SILTY SAND)

MEDIUM GRAINED UNITS (SANDY SILT, SILT, CLAYEY SAND, AND CLAYEY SILT)

FINE GRAINED UNITS (SANDY CLAY, SILTY CLAY, CLAY)

WATER TABLE (NOV. 2010)

Notes:

1. The soil types for 28MIP-23, -26, -29, and -31 are interpreted based on electrical conductivity responses (blue line in Milli-Siemens per meter) from membrane interface probe (MIP) tests and correlation with soil types between co-located borings IR28SB-01 and 28MIP-29 (Figure 4).
2. The yellow line represents the electron capture detector response (in microvolts) from the MIP tests.
3. Data collected during the 2010 In Situ Anaerobic Biotic/ Abiotic Treatability Study (Shaw, 2011).

Shaw, 2011, *Draft Technical Memorandum, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site28,* December 16

HORIZONTAL SCALE

0 20 40 FEET

VERTICAL SCALE

0 10 20 FEET

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FIGURE 5
CROSS SECTION A-A'
FORMER BUILDING 88 AREA

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

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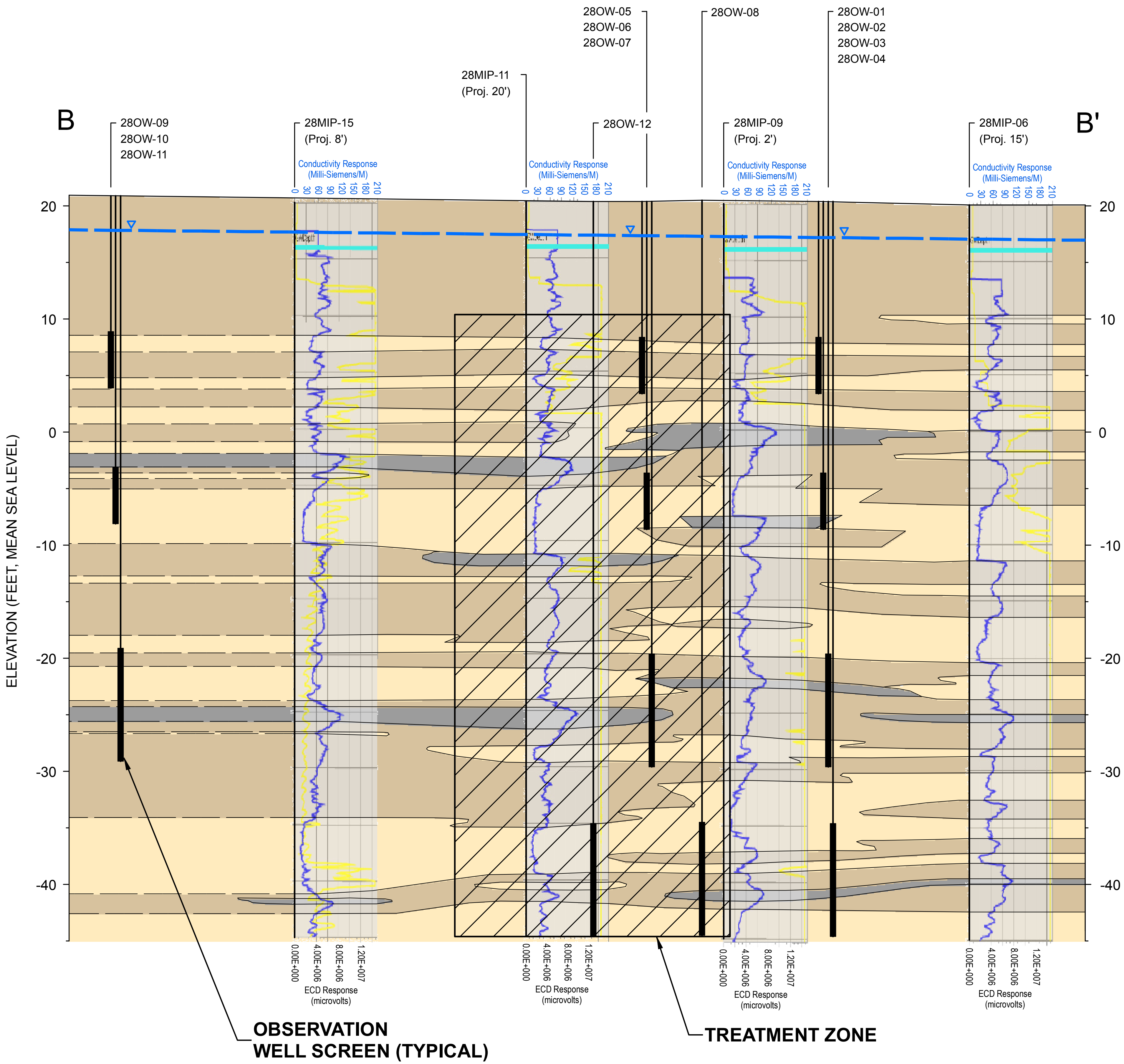

Legend

- COARSE GRAINED UNITS (GRAVEL, SAND, SILTY SAND)
- MEDIUM GRAINED UNITS (SANDY SILT, SILT, CLAYEY SAND, AND CLAYEY SILT)
- FINE GRAINED UNITS (SANDY CLAY, SILTY CLAY, CLAY)
- WATER TABLE (NOV. 2010)

Notes:

1. The soil types for 28MIP-06, -09, -11, and -15 are interpreted based on electrical conductivity responses (blue line in Milli-Siemens per meter) from membrane interface probe (MIP) tests and correlation with soil types between co-located borings IR28SB-02 and 28MIP-12 (Figure 4).
2. The yellow line represents the electron capture detector response (in microvolts) from the MIP tests.
3. The stratigraphy left of 28MIP-15 is extrapolated based on the stratigraphy between 28MIP-15 and 28MIP-06.
4. Data collected during the 2010 In Situ Anaerobic Biotic/ Abiotic Treatability Study (Shaw, 2011).

Shaw, 2011, *Draft Technical Memorandum, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site28,* December 16

HORIZONTAL SCALE

0 20 40 FEET

VERTICAL SCALE

0 10 20 FEET

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FIGURE 6
CROSS SECTION B-B'
TRAFFIC ISLAND AREA

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

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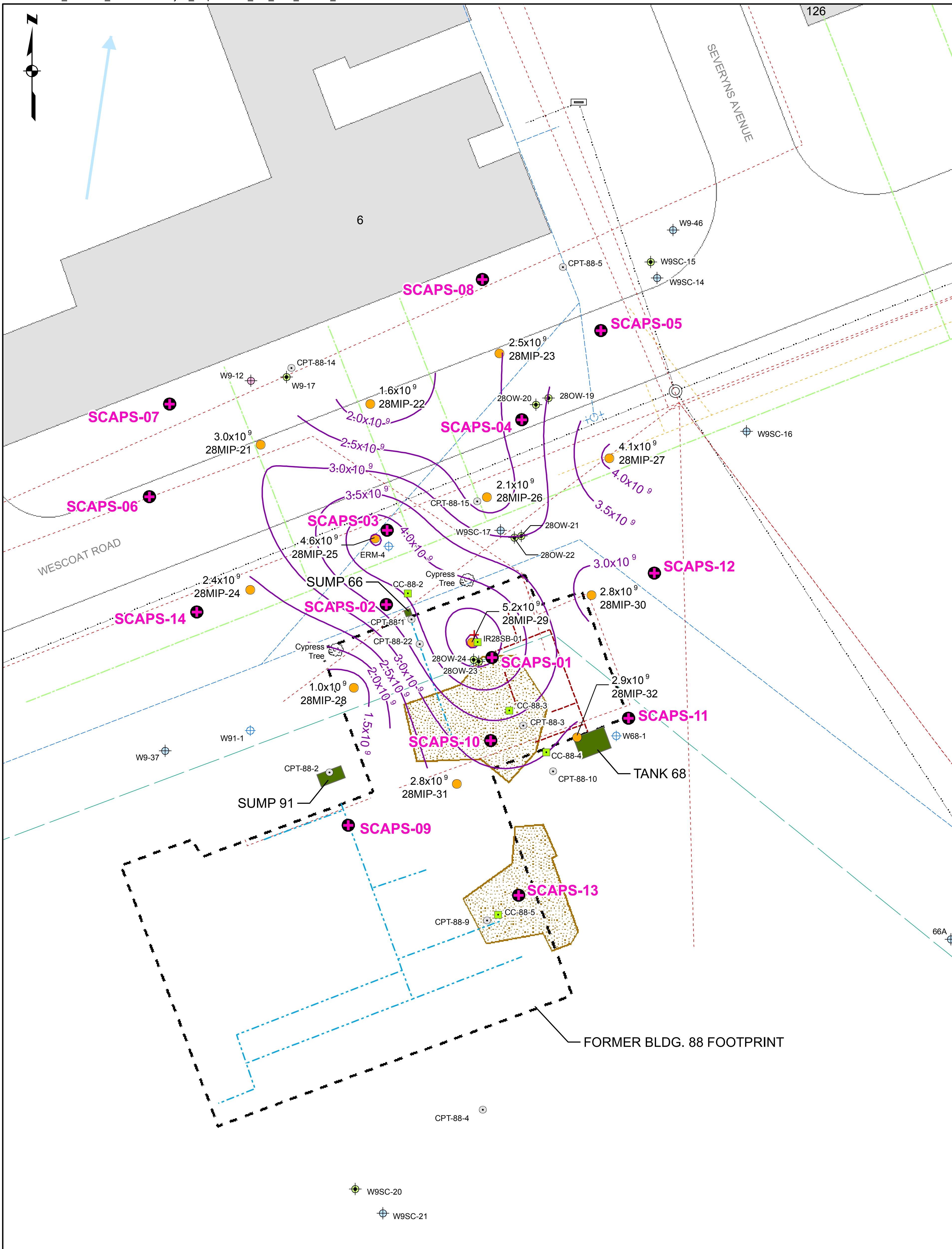

Legend

- MIP Location[1]
- 1.4x10[9] Sum of ECD Response in Microvolts for 0 to 25 ft bgs Interval
- ECD Response Isopleth (µV)
- NAPL FLUTe™ Test Location[1]
- Continuous Core Location[1, 2]
- Upper A-Aquifer Monitoring Well
- Lower A-Aquifer Monitoring Well
- B2-Aquifer Monitoring Well
- A-Aquifer Extraction Well
- Former Groundwater Monitoring Well
- CPT Location[2]
- Storm Drain Line
- Sanitary Sewer Line
- Communication
- Electric
- Gas
- Water
- Concrete-lined Wastewater Collection Trench (Removed)
- Floor Drain Piping (Removed)
- Fence
- Groundwater Flow Direction[3]
- Proposed Tier 1 SCAPS Location
- Previous Remedial Excavation Area (7 to 8 ft. bgs)[2]
- Sump or Tank (Removed)
- 503 Building and Building Number

[1] *Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site 28 (Shaw, 2010).*
[2] *Final Former Building 88 Investigation Report (TtECI, 2008).*
[3] *Based on March 2010 Potentiometric Surface Data for the Upper A-Aquifer (Brown and Caldwell, 2011).*

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FIGURE 7
SCAPS TEST LOCATIONS
CONCEPTUAL LAYOUT
BUILDING 88 AREA - 0 TO 25 FT BGS
IR SITE 28, FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

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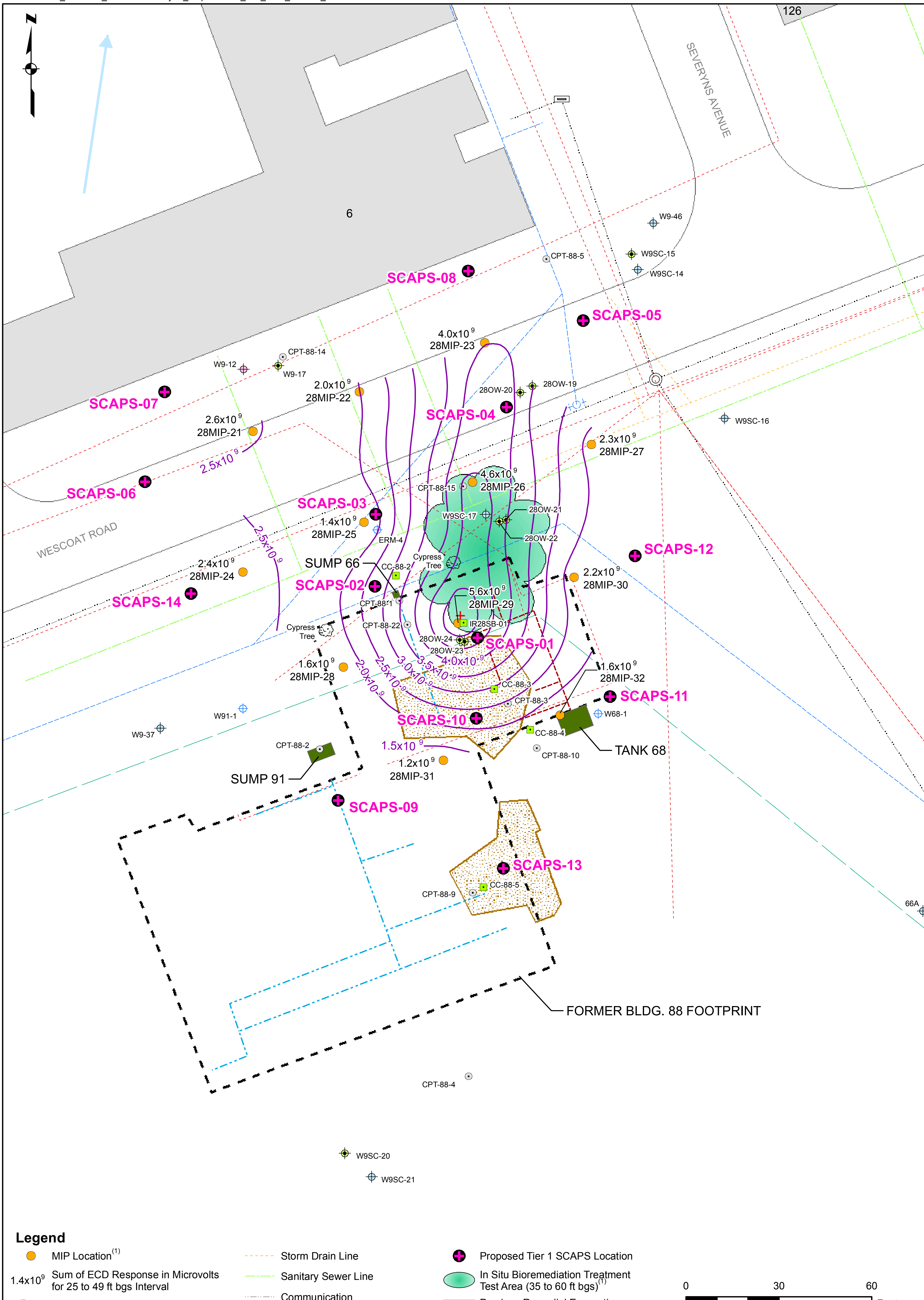

Legend

- MIP Location[1]
- 1.4x10^9 Sum of ECD Response in Microvolts for 25 to 49 ft bgs Interval
- ECD Response Isopleth (µV)
- NAPL FLUTe™ Test Location[1]
- Continuous Core Location[1, 2]
- Upper A-Aquifer Monitoring Well
- Lower A-Aquifer Monitoring Well
- B2-Aquifer Monitoring Well
- A-Aquifer Extraction Well
- Former Groundwater Monitoring Well
- CPT Location[2]
- Storm Drain Line
- Sanitary Sewer Line
- Communication
- Electric
- Gas
- Water
- Concrete-lined Wastewater Collection Trench (Removed)
- Floor Drain Piping (Removed)
- Fence
- Groundwater Flow Direction[3]
- Proposed Tier 1 SCAPS Location
- In Situ Bioremediation Treatment Test Area (35 to 60 ft bgs)[1]
- Previous Remedial Excavation Area (7 to 8 ft. bgs)[2]
- Sump or Tank (Removed)
- 503 Building and Building Number

[1] *Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site 28 (Shaw, 2010).*
[2] *Final Former Building 88 Investigation Report (TtECI, 2008).*
[3] *Based on March 2010 Potentiometric Surface Data for the Upper A-Aquifer (Brown and Caldwell, 2011).*

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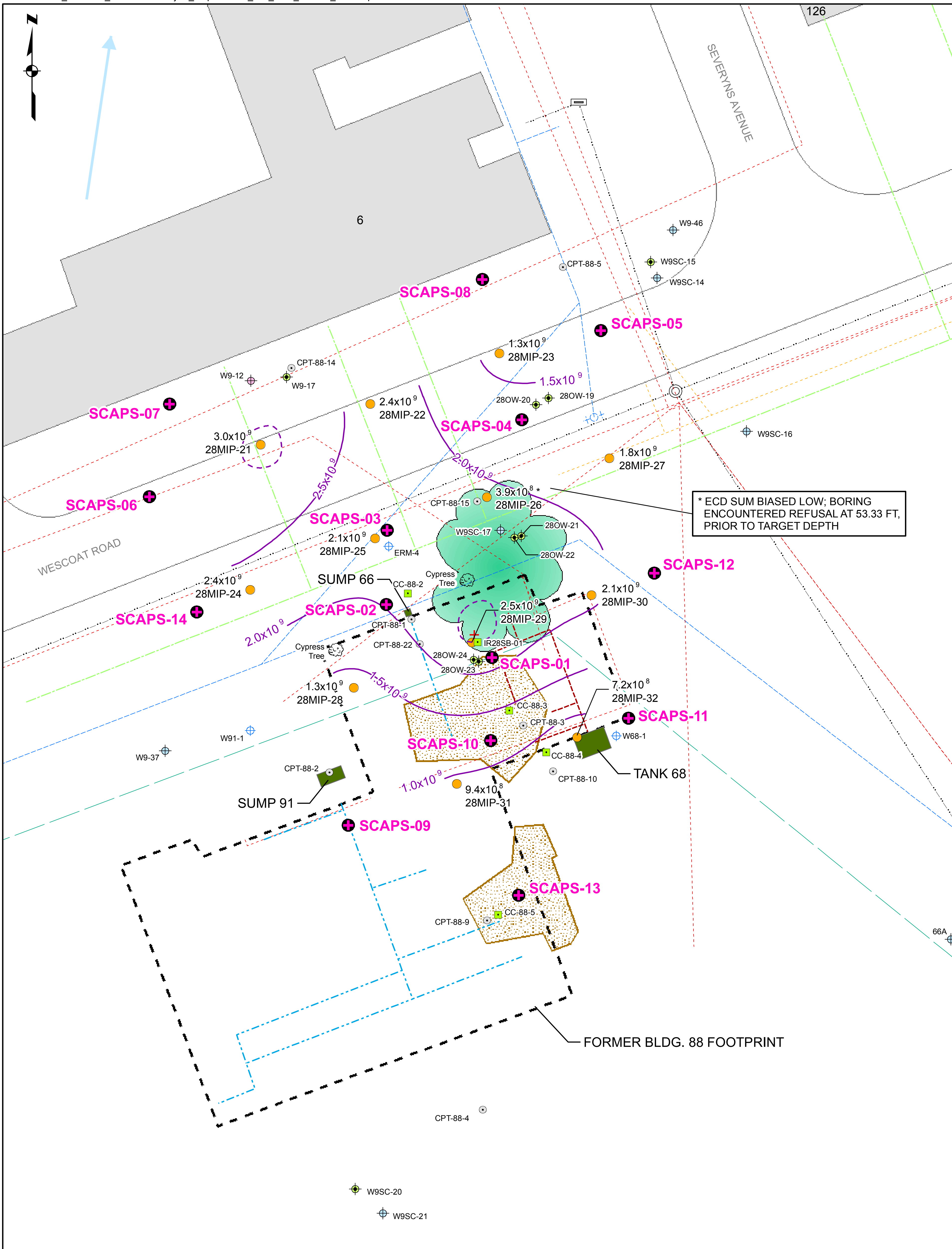
ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

FIGURE 8
SCAPS TEST LOCATIONS
CONCEPTUAL LAYOUT
BUILDING 88 AREA - 25 TO 49 FT BGS
IR SITE 28, FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

C:\GIS\Moffett_NAS\GIS_Documents\Project_Maps\Moffett_085_IR28_SCAPS_B88deep.mxd Karen.Black 03/29/12



Legend

- MIP Location[1]
- 1.4x10^9 Sum of ECD Response in Microvolts for 49 to 65 ft bgs Interval
- ECD Response Isopleth (µV)
- NAPL FLUTe™ Test Location[1]
- Continuous Core Location[1, 2]
- Upper A-Aquifer Monitoring Well
- Lower A-Aquifer Monitoring Well
- B2-Aquifer Monitoring Well
- A-Aquifer Extraction Well
- Former Groundwater Monitoring Well
- CPT Location[2]
- Storm Drain Line
- Sanitary Sewer Line
- Communication
- Electric
- Gas
- Water
- Concrete-lined Wastewater Collection Trench (Removed)
- Floor Drain Piping (Removed)
- Fence
- Groundwater Flow Direction[3]
- Proposed Tier 1 SCAPS Location
- In Situ Bioremediation Treatment Test Area (35 to 60 ft bgs)[1]
- Previous Remedial Excavation Area (7 to 8 ft. bgs)[2]
- Sump or Tank (Removed)
- 503 Building and Building Number

[1] *Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site 28 (Shaw, 2010).*
[2] *Final Former Building 88 Investigation Report (TtECI, 2008).*
[3] *Based on March 2010 Potentiometric Surface Data for the Upper A-Aquifer (Brown and Caldwell, 2011).*

0 30 60 Feet

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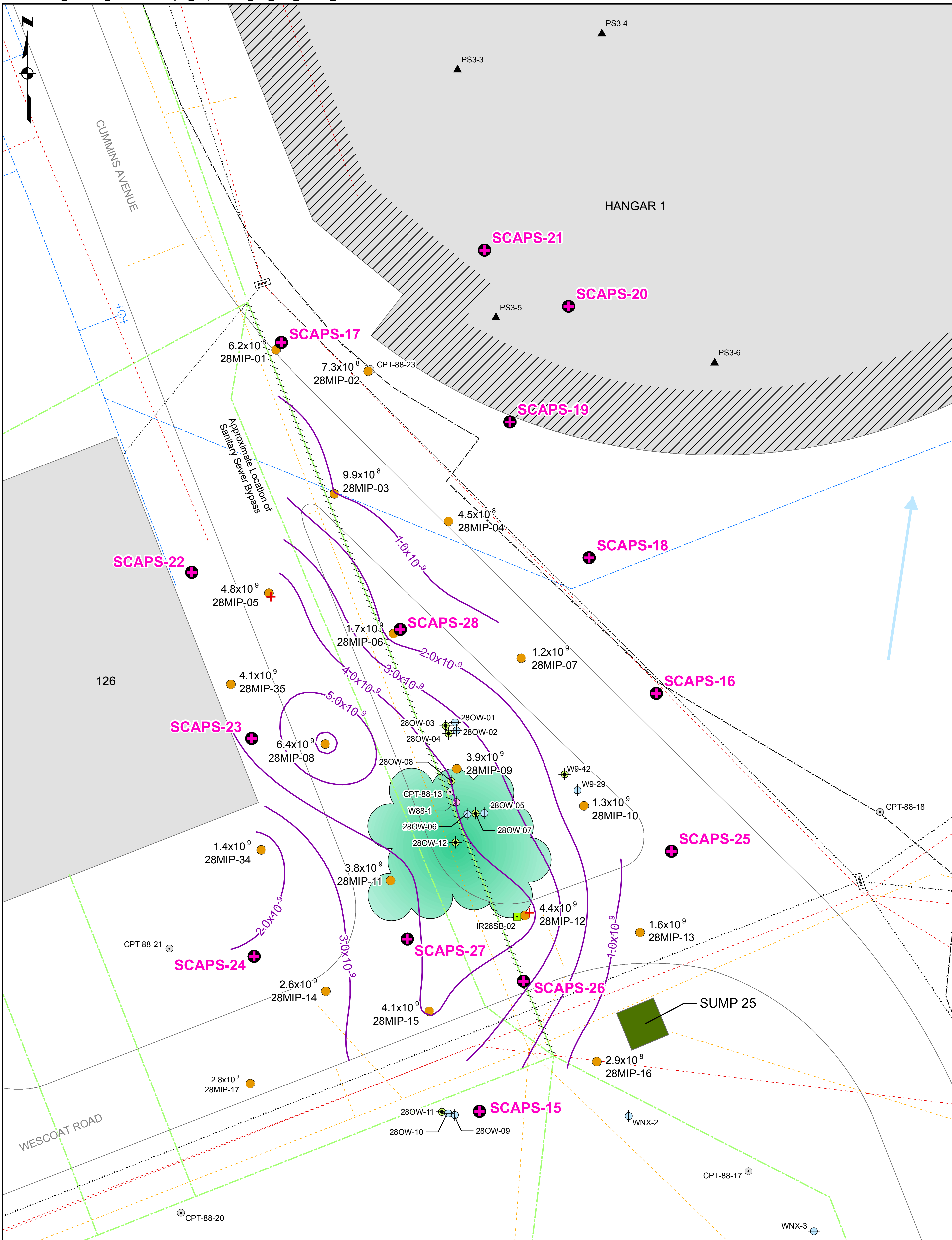
NAVAL FACILITIES
ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

FIGURE 9
SCAPS TEST LOCATIONS
CONCEPTUAL LAYOUT
BUILDING 88 AREA - 49 TO 65 FT BGS
IR SITE 28, FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

C:\GIS\Moffett_NAS\GIS_Documents\Project_Maps\Moffett_086_IR28_SCAPS_TIshallow.mxd Karen.Black 03/29/12



Legend

- MIP Location[1]
- 1.4x10⁹ — Sum of ECD Response in Microvolts for 0 to 23 ft bgs Interval
- ECD Response Isopleth (µV)
- NAPL FLUTe™ Test Location[1]
- Continuous Core Location[1]
- Upper A-Aquifer Monitoring Well
- Lower A-Aquifer Monitoring Well
- B2-Aquifer Monitoring Well
- A-Aquifer Extraction Well
- CPT Location[2]
- NASA Sample Location[3]
- Storm Drain Line
- Sanitary Sewer Line
- Sanitary Sewer Line that Reportedly Collapsed[4]
- Communication
- Electric
- Gas
- Water
- Fence
- Groundwater Flow Direction[5]
- Proposed Tier 1 SCAPS Location
- In Situ Bioremediation Treatment Test Area (10 to 65 ft bgs)[1]
- No Drilling - Surface Obstruction
- Oil/Water Separator (Removed)
- 503 Building and Building Number

0 30 60 Feet

[1] *Final Progress Report, In Situ Anaerobic Biotic/ Abiotic Treatability Study, IR Site 28 (Shaw, 2010).*
[2] *Final Former Building 88 Investigation Report (Tetra Tech, 2008).*
[3] *NASA Sensitive but Unclassified Information*
[4] *Final Horizontal Conduit Study Technical Memorandum Text, Tables, and Figures (PRC, 1995).*
[5] *Based on March 2010 Potentiometric Surface Data for the Upper A-Aquifer (Brown and Caldwell, 2011).*

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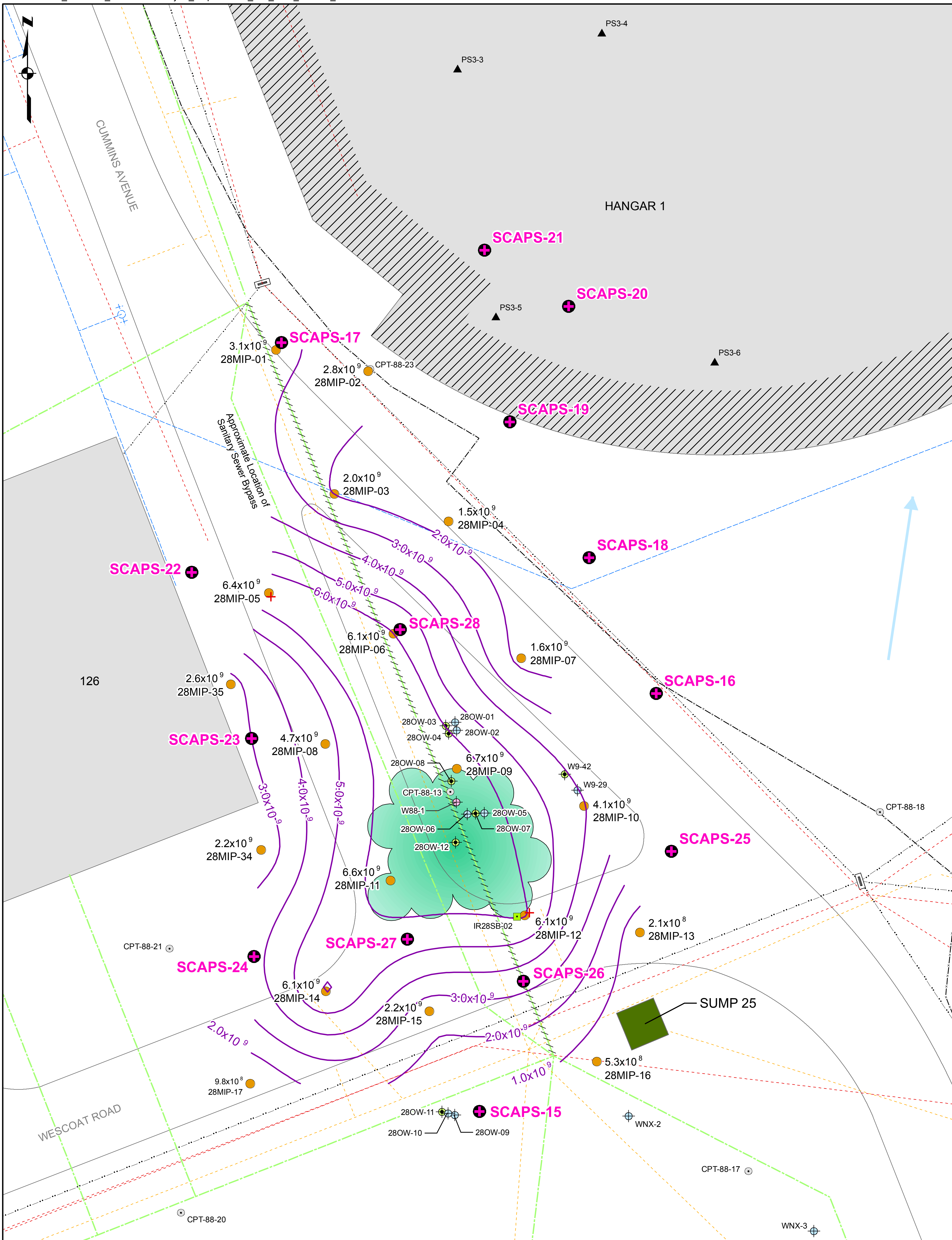
ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

FIGURE 10
SCAPS TEST LOCATIONS
CONCEPTUAL LAYOUT
TRAFFIC ISLAND AREA - 0 TO 23 FT BGS
IR SITE 28, FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

C:\GIS\Moffett_NAS\GIS_Documents\Project_Maps\Moffett_087_IR28_SCAPS_TImiddle.mxd Karen.Black 03/29/12



Legend

- MIP Location[1]
- 1.4x10⁹ — Sum of ECD Response in Microvolts for 23 to 46 ft bgs Interval
- ECD Response Isopleth (µV)
- NAPL FLUTe™ Test Location[1]
- Continuous Core Location[1]
- Upper A-Aquifer Monitoring Well
- Lower A-Aquifer Monitoring Well
- B2-Aquifer Monitoring Well
- A-Aquifer Extraction Well
- CPT Location[2]
- NASA Sample Location[3]
- Storm Drain Line
- Sanitary Sewer Line
- Sanitary Sewer Line that Reportedly Collapsed[4]
- Communication
- Electric
- Gas
- Water
- Fence
- Groundwater Flow Direction[5]
- Proposed Tier 1 SCAPS Location
- In Situ Bioremediation Treatment Test Area 10 to 65 ft bgs)[1]
- No Drilling - Surface Obstruction
- Oil/Water Separator (Removed)
- 503 Building and Building Number

0 30 60 Feet

[1] *Final Progress Report, In Situ Anaerobic Biotic/ Abiotic Treatability Study, IR Site 28 (Shaw, 2010).*
[2] *Final Former Building 88 Investigation Report (Tetra Tech, 2008).*
[3] *NASA Sensitive but Unclassified Information*
[4] *Final Horizontal Conduit Study Technical Memorandum Text, Tables, and Figures (PRC, 1995).*
[5] *Based on March 2010 Potentiometric Surface Data for the Upper A-Aquifer (Brown and Caldwell, 2011).*

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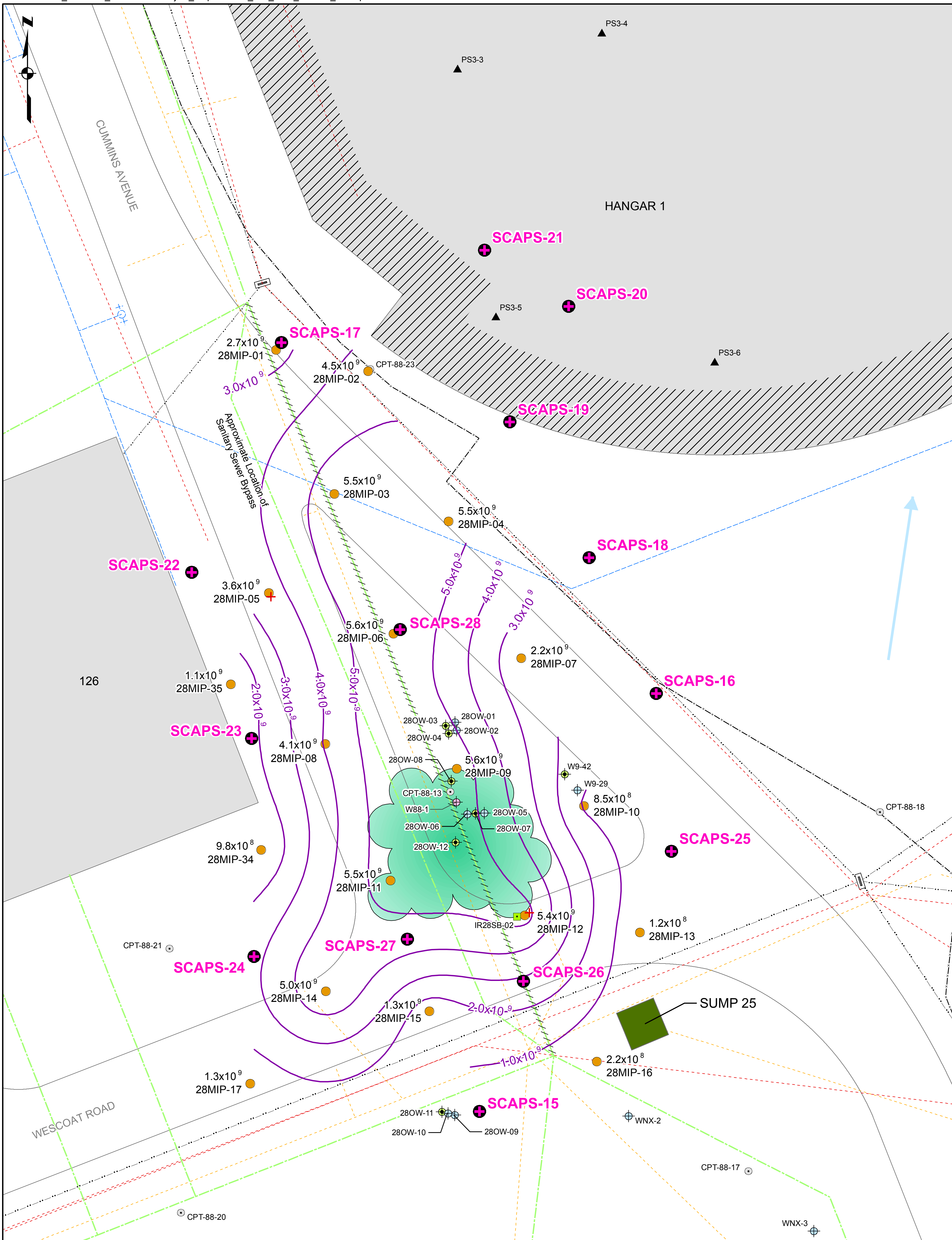
ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

FIGURE 11
SCAPS TEST LOCATIONS
CONCEPTUAL LAYOUT
TRAFFIC ISLAND AREA - 23 TO 46 FT BGS
IR SITE 28, FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

C:\GIS\Moffett_NAS\GIS_Documents\Project_Maps\Moffett_088_IR28_SCAPS_TIdeep.mxd Karen.Black 03/29/12



Legend

- MIP Location[1]
- 1.4×10^9 Sum of ECD Response in Microvolts for 46 to 65 ft bgs Interval
- ECD Response Isopleth (µV)
- NAPL FLUTe™ Test Location[1]
- Continuous Core Location[1]
- Upper A-Aquifer Monitoring Well
- Lower A-Aquifer Monitoring Well
- B2-Aquifer Monitoring Well
- A-Aquifer Extraction Well
- CPT Location[2]
- NASA Sample Location[3]
- Storm Drain Line
- Sanitary Sewer Line
- Sanitary Sewer Line that Reportedly Collapsed[4]
- Communication
- Electric
- Gas
- Water
- Fence
- Groundwater Flow Direction[5]
- Proposed Tier 1 SCAPS Location
- In Situ Bioremediation Treatment Test Area (10 to 65 ft bgs)[1]
- No Drilling - Surface Obstruction
- Oil/Water Separator (Removed)
- 503 Building and Building Number

0 30 60 Feet

[1] *Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site 28 (Shaw, 2010).*
[2] *Final Former Building 88 Investigation Report (Tetra Tech, 2008).*
[3] *NASA Sensitive but Unclassified Information*
[4] *Final Horizontal Conduit Study Technical Memorandum Text, Tables, and Figures (PRC, 1995).*
[5] *Based on March 2010 Potentiometric Surface Data for the Upper A-Aquifer (Brown and Caldwell, 2011).*

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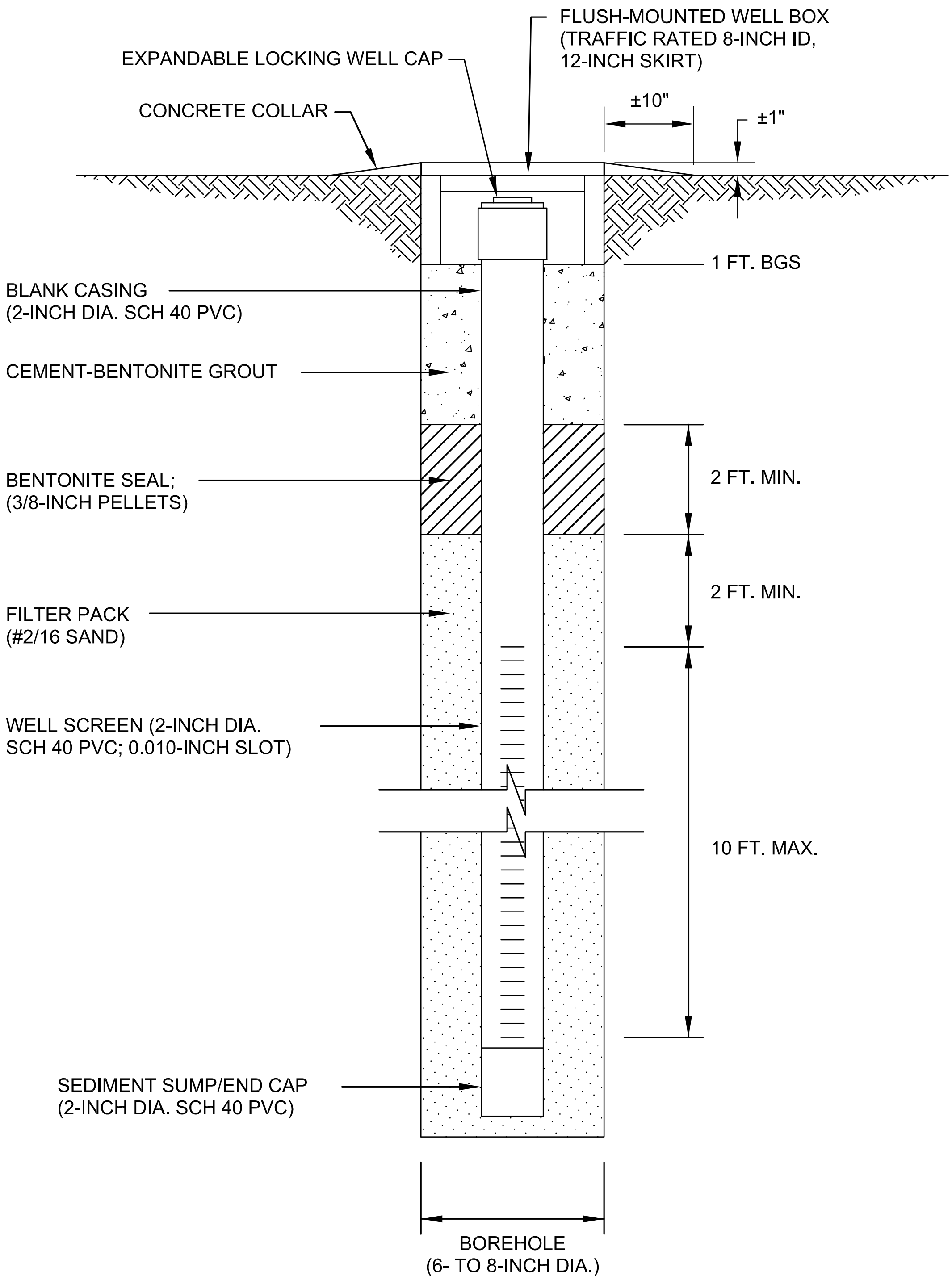
SAN DIEGO, CALIFORNIA

FIGURE 12
SCAPS TEST LOCATIONS
CONCEPTUAL LAYOUT
TRAFFIC ISLAND AREA - 46 TO 65 FT BGS
IR SITE 28, FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA



NOT TO SCALE

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PROGRAM MANAGEMENT OFFICE WEST
NAVAL FACILITIES
ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

FIGURE 13

TYPICAL MONITORING WELL
CONSTRUCTION DIAGRAM

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA

IMAGE	X-REF	OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
---	---	Concord	KAB 01/13/12	TB 01/13/12	NH 01/19/12	144002-A1

Table

Table 1
SCAPS Test Location Rationale
Supplemental Investigation
Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California

SCAPS Location ID	Rationale
Former Building 88 Area	
SCAPS-01	Evaluate the correlation between the SCAPS MIP/DSITMS results and the MIP/ECD/PID results at 28MIP-29 (Appendix E) and the groundwater results for wells 28OW-23 and 28OW-24, where the highest concentrations of PCE in groundwater have been detected in the Former Building 88 Area (Figure 8). Also, compare the SCAPS CPT lithologic log with the manual logs for borings IR28SB-01 and 28OW-24, and with the soil electrical conductivity log for 28MIP-29.
SCAPS-02	Evaluate the correlation between the SCAPS MIP/DSITMS results and the discrete-depth soil and groundwater results from direct-push boring CPT-88-1 and continuous core CC-88-2, in the vicinity of former Sump 66 where significant PCE concentrations have been previously detected (Figure 7). Also, compare the new SCAPS CPT lithologic log with the manual log for continuous core CC-88-2 and the CPT lithologic log for CPT-88-1.
SCAPS-03	Evaluate the correlation between the SCAPS MIP/DSITMS results and the MIP/ECD/PID results at 28MIP-25 (Appendix E; Figure 7). Also, compare the SCAPS CPT lithologic log with the soil electrical conductivity log for 28MIP-25.
SCAPS-04	Evaluate the correlation between the SCAPS MIP/DSITMS results and the groundwater results for wells 28OW-19 and 28OW-20, immediately downgradient of the lactate treatment area[1] and the former dry-cleaning equipment room (Figure 8). Also, compare the SCAPS CPT lithologic log with the manual log for boring 28OW-20.
SCAPS-05	Characterize the relative concentrations of individual CEs east-northeast (crossgradient) of the high MIP/ECD responses at 28MIP-23 (Appendix E) between 5 and 17 feet bgs (Figure 7) and between 29 and 54 feet bgs (Figures 8 and 9).
SCAPS-06	Characterize the relative concentrations of individual CEs west-southwest (crossgradient/upgradient) of the high MIP/ECD responses at 28MIP-21 (Appendix E) between 8 and 24 feet bgs (Figure 7) and between 35 and 64 feet bgs (Figures 8 and 9).
SCAPS-07	Characterize the relative concentrations of individual CEs west-northwest (crossgradient) of the high MIP/ECD response at 28MIP-21 (Appendix E) between 8 and 24 feet bgs (Figure 7). and between 35 and 64 feet bgs (Figures 8 and 9).
SCAPS-08	Characterize the relative concentrations of individual CEs north (downgradient) of the high MIP/ECD responses at 28MIP-23 (Appendix E) between 5 and 17 feet bgs (Figure 7) and between 29 and 54 feet bgs (Figures 8 and 9)..
SCAPS-09	Characterize the relative concentrations of individual CEs west-southwest (crossgradient/upgradient) of the high MIP/ECD/PID response at 28MIP-31 (Appendix E) between 10 and 18 feet bgs (Figure 7), and upgradient (south-southwest) of the former dry cleaning equipment room, where the highest PCE concentrations in groundwater have been detected in the Former Building 88 Area (Figures 7, 8, and 9). Additionally, confirm that former floor drain piping to Sump 91 was not a source to the Former Building 88 Area (Figure 7).

Table 1 (continued)
SCAPS Test Location Rationale
Supplemental Investigation
Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California

SCAPS Location ID	Rationale
SCAPS-10	Further characterize the relative concentrations of individual CEs beneath the northern remedial excavation[2], immediately upgradient of 28MIP-29 and wells 28OW-23 and 28OW-24, where the highest concentrations of PCE in groundwater have been detected in the Former Building 88 Area (Figure 8).
SCAPS-11	Characterize the relative concentrations of individual CEs east-northeast (crossgradient) of the high MIP/ECD response at 28MIP-32 (Appendix E) between 5 and 15 feet bgs (Figure 7) and between 41 and 48 feet bgs (Figure 8).
SCAPS-12	Characterize the relative concentrations of individual CEs east-northeast (crossgradient) of the high MIP/ECD response at 28MIP-30 (Appendix E) between 7 and 14 feet bgs (Figure 7). and between 45 and 48 feet bgs (Figure 8).
SCAPS-13	Further characterize the relative concentrations of individual CEs beneath the southern remedial excavation[2] and flowing into the Former Building 88 Area (Figures, 7, 8, and 9).
SCAPS-14	Characterize the relative concentrations of individual CEs west-southwest (crossgradient/upgradient) of the high MIP/ECD responses at 28MIP-24 (Appendix E) between 8 and 13 feet bgs (Figure 7), between 38 and 48 feet bgs (Figure 8), and between 59 and 64 feet bgs (Figure 9).
Traffic Island Area	
SCAPS-15	Evaluate the correlation between the SCAPS MIP/DSITMS results and the groundwater results for wells 28OW-09, 28OW-10, and 28OW-11, not affected by the emulsified vegetable oil treatment[1] (Figures 10, 11, and 12). Characterize the relative concentrations of individual CEs in the lower A-Aquifer (below 50 feet bgs) and the upper portion of the B2-Aquifer, upgradient of where the highest concentrations of CEs in groundwater have been detected in the Traffic Island Area (Figures 10, 11, and 12). Compare the SCAPS CPT lithologic log with the manual log for boring 28OW-11. Initially characterize the depth to and the lithology of the A/B-Aquitard and the upper portion of the B2-Aquifer, upgradient of where the highest concentrations of CEs in groundwater have been detected in the Traffic Island Area, and upgradient of B2-Aquifer monitoring well W-88-1.
SCAPS-16	Initially characterize the depth to and the lithology of the A/B-Aquitard and the upper portion of the B2-Aquifer, outside the area where the highest concentrations of CEs in groundwater have been detected in the Traffic Island Area. Also, characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, east-southeast of the high MIP/ECD responses at 28MIP-07 (Appendix E) between 43 and 44 feet bgs (Figure 11) and between 60 and 64 feet bgs (Figure 12) and northeast of the high MIP/ECD response at 28MIP-10 (Appendix E) between 20 and 31 feet bgs (Figures 10 and 11), and east-northeast of B2-Aquifer monitoring well W-88-1 (Figure 12).

Table 1 (continued)
SCAPS Test Location Rationale
Supplemental Investigation
Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California

SCAPS Location ID	Rationale
SCAPS-17	Evaluate the correlation between the SCAPS MIP/DSITMS results and the MIP/ECD/PID results at 28MIP-01 (Appendix E; Figure 10). Also, compare the SCAPS CPT lithologic log with the soil electrical conductivity log for 28MIP-01. Identify the specific chemical(s) that caused the high PID and FID responses at 28MIP-01 between 17 and 23 feet bgs. Also, characterize the depth to and the lithology of the A/B-Aquitard and the upper portion of the B2-Aquifer, outside the area where the highest concentrations of CEs in groundwater have been detected in the Traffic Island Area (Figures 10, 11, and 12).
SCAPS-18	Initially characterize the depth to and the lithology of the A/B-Aquitard and the upper portion of the B2-Aquifer, outside the area where the highest concentrations of CEs in groundwater have been detected in the Traffic Island Area. Also, characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, east of the high MIP/ECD responses at 28MIP-04 (Appendix E) between 46 and 65 feet bgs and at 28MIP-07 (Appendix E) between 43 and 44 feet bgs (Figure 11) and between 60 and 64 feet bgs (Figure 12), and northeast of B2-Aquifer monitoring well W-88-1 (Figure 12).
SCAPS-19	Characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, north-northeast (downgradient) of the high MIP/ECD responses at 28MIP-04 (Appendix E) between 46 and 65 feet bgs and north-northeast of B2-Aquifer monitoring well W-88-1 (Figure 12), respectively.
SCAPS-20	Characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, east of NASA's groundwater sample location PS3-5 where an elevated concentration of PCE was detected in a grab groundwater sample from 40 feet bgs (Figure 11), and further downgradient of the high MIP/ECD responses at 28MIP-04 (Appendix E) between 46 and 65 feet bgs.(Figure 12).
SCAPS-21	Characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, north of NASA's groundwater sample location PS3-5 where an elevated concentration of PCE was detected in a grab groundwater sample from 40 feet bgs (Figure 11), and further downgradient of the high MIP/ECD responses at 28MIP-04 (Appendix E) between 46 and 65 feet bgs.(Figure 12)..
SCAPS-22	Characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, west-northwest of the high MIP/ECD/PID responses at 28MIP-05 (Appendix E) between 7 and 46 feet bgs (Figures 10 and 11) and between 58 and 61 feet bgs (Figure 12), and north-northwest of the high MIP/ECD responses at 28MIP-35 (Appendix E) between 7 and 23 feet bgs (Figure 10), and northwest of B2-Aquifer monitoring well W-88-1, respectively.
SCAPS-23	Characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, south-southwest of the high MIP/ECD/PID responses at 28MIP-35 (Appendix E) between 7 and 23 feet bgs (Figure 10) and west of the high MIP/ECD/PID responses at 28MIP-08 (Appendix E) between 5 and 35 feet bgs (Figures 10 and 11) and between 42 and 65 feet bgs (Figures 11 and 12), and west-northwest of B2-Aquifer monitoring well W-88-1, respectively.

Table 1 (continued)
SCAPS Test Location Rationale
Supplemental Investigation
Installation Restoration Site 28, Former Naval Air Station Moffett Field, Moffett Field, California

SCAPS Location ID	Rationale
SCAPS-24	Characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, northwest of the high MIP/ECD responses at 28MIP-14 (Appendix E) between 7 and 11 feet bgs (Figure 10) and between 21 and 65 feet bgs (Figures 10, 11 and 12), and west-southwest of B2-Aquifer monitoring well W-88-1, respectively.
SCAPS-25	Initially characterize the depth to and the lithology of the A/B-Aquitard and the upper portion of the B2-Aquifer, outside the area where the highest concentrations of CEs in groundwater have been detected in the Traffic Island Area. Also, characterize the relative concentrations of individual CEs in the A-Aquifer and the upper portion of the B2-Aquifer, east-southeast of the high MIP/ECD response at 28MIP-10 (Appendix E) between 20 and 31 feet bgs (Figures 10 and 11), and east of B2-Aquifer monitoring well W-88-1 (Figure 12), respectively.
SCAPS-26	Characterize the relative concentrations of individual CEs in the A-Aquifer, south (upgradient) of the high MIP/ECD/PID response at 28MIP-12 (Appendix E) between 6 and 65 feet bgs (Figures 10, 11, and 12).
SCAPS-27	Characterize the relative concentrations of individual CEs in the A-Aquifer, south (upgradient) of the high MIP/ECD/PID responses at 28MIP-11 (Appendix E) between 7 and 14 feet bgs and between 19 and 65 feet bgs (Figures 10, 11, and 12).
SCAPS-28	Evaluate the correlation between the SCAPS MIP/DSITMS results and the MIP/ECD/PID results at 28MIP-06 (Appendix E; Figures 11 and 12). Also, compare the SCAPS CPT lithologic log with the soil electrical conductivity log for 28MIP-06. Establish correlation with 28MIP-06 and confirm the soil stratigraphy and the depth to the A/B-Aquitard.

Notes:

[1]*Final Progress Report, In Situ Anaerobic Biotic/Abiotic Treatability Study, IR Site 28, Former Naval Air Station Moffett Field, Moffett Field, California, (Shaw Environmental & Infrastructure, Inc., 2010)*

[2]*Final Former Building 88 Investigation Report, Former Naval Air Station Moffett Field, Moffett Field, California (Tetra Tech EC, Inc., 2008)*

bgs	*below ground surface*	*ID*	*identification*
CE	*chlorinated ethene*	*MIP*	*membrane interface probe*
CPT	*cone penetrometer test*	*NASA*	*National Aeronautics and Space Administration*
DSITMS	*direct sample ion-trap mass spectrometer*	*PCE*	*tetrachloroethene*
ECD	*electron capture detector*	*PID*	*photoionization detector*
FID	*flame ionization detector*	*SCAPS*	*Site Characterization and Analysis Penetrometer System*

Former Building 88 Area

Vironex .com Environmental Field Services

5292 Pacheco Blvd
Pacheco, CA 94553
P: 925-521-1490
F: 925-521-1494
www.vironex.com

Boring Name : 28MIP-21

Total Depth (ft): 64.95

Notes: **Building 88. Hand auger to 5 feet bgs.**

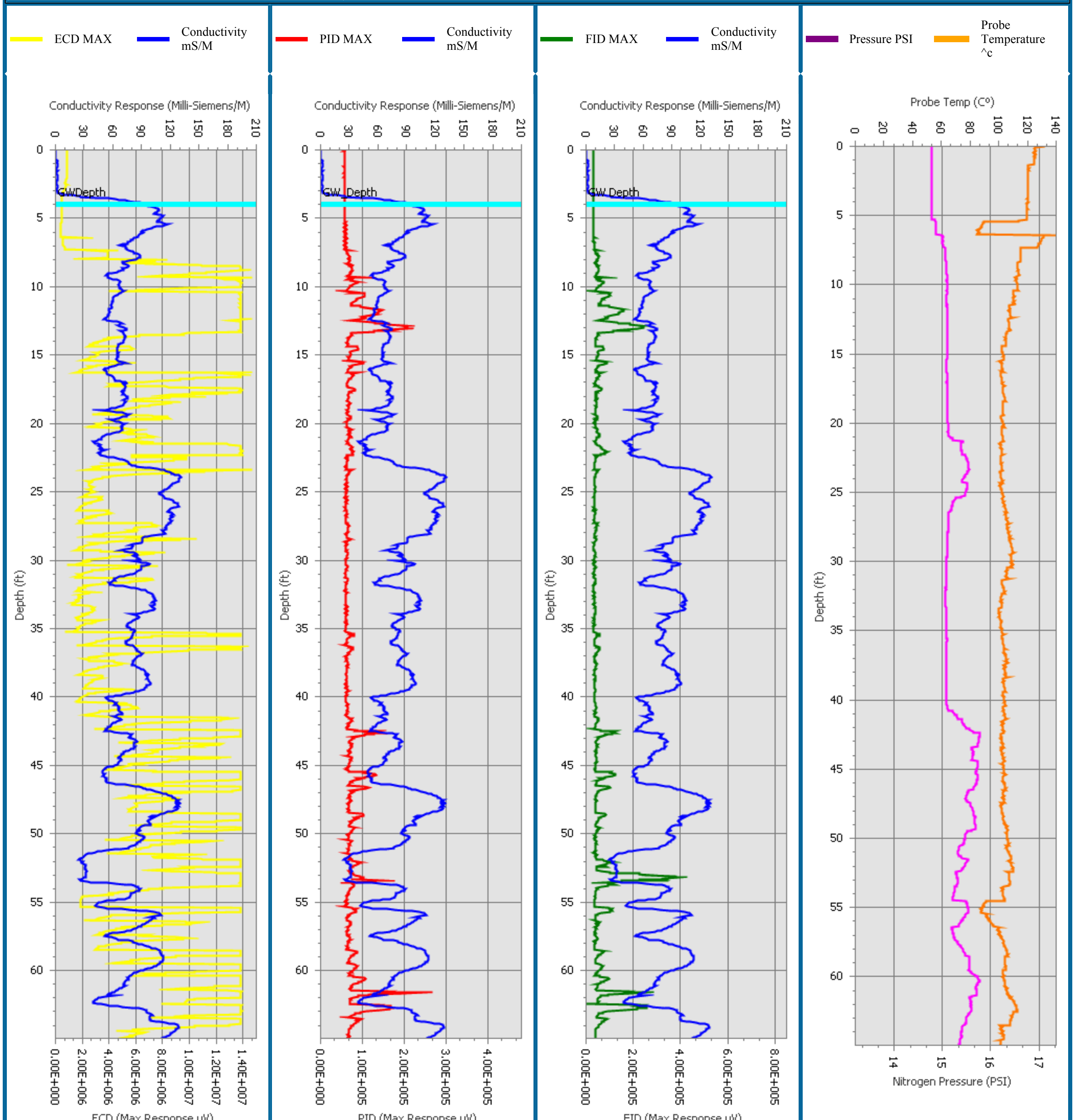
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 01 2010 13:16
Probe Type :	6520	End Boring Time :	Thu Apr 01 2010 14:23
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



5292 Pacheco Blvd
Pacheco, CA 94553
P: 925-521-1490
F: 925-521-1494
www.vironex.com

Boring Name : 28MIP-22

Total Depth (ft): 64.6

Notes: **Building 88. Hand auger to 5 feet bgs.**

GW Detph (Ft) 4
Depth of GW Provided by Client

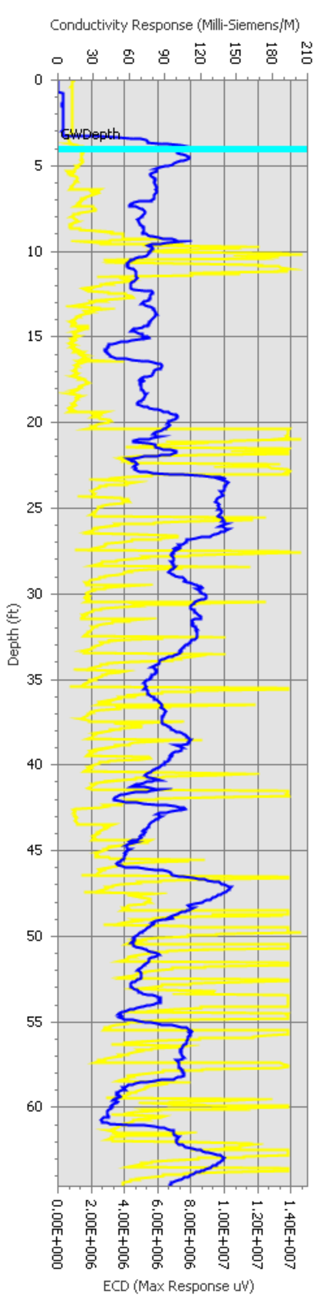
Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

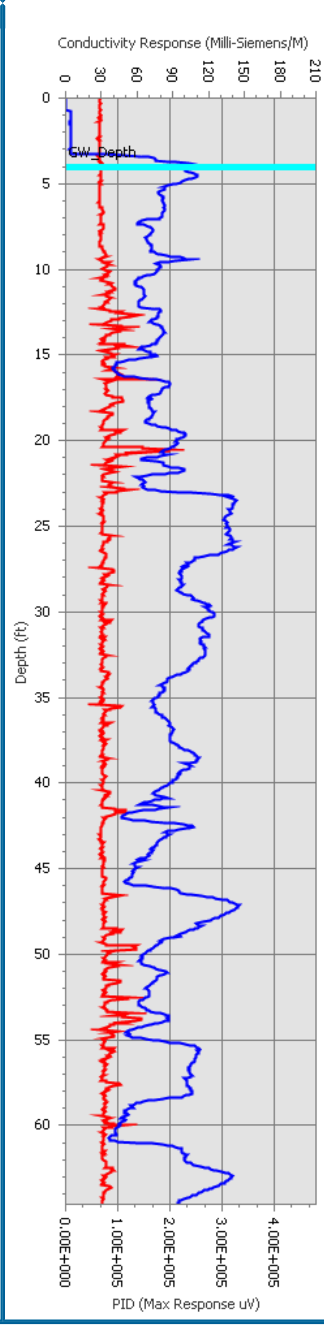
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 01 2010 09:46
Probe Type :	6520	End Boring Time :	Thu Apr 01 2010 10:53
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi

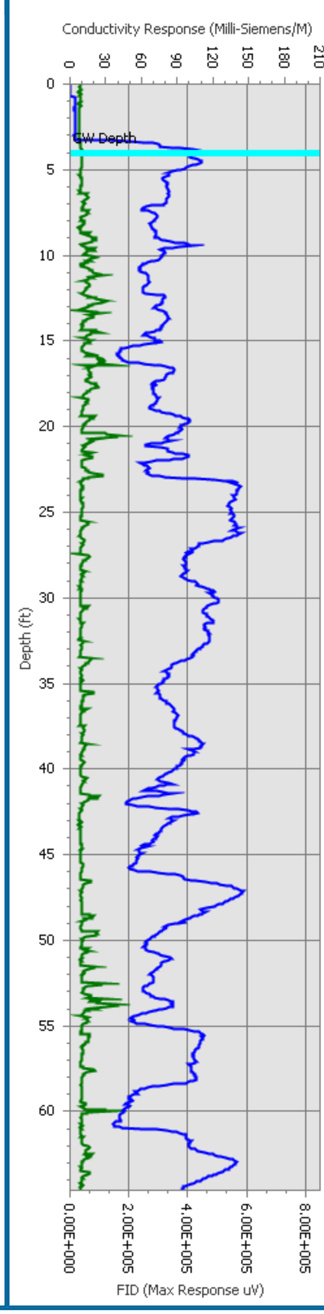
ECD MAX — Conductivity mS/M



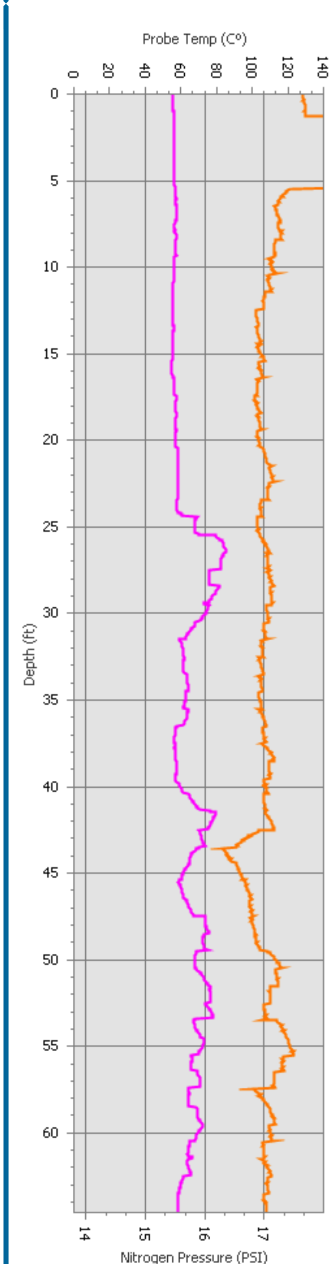
PID MAX — Conductivity mS/M



FID MAX — Conductivity mS/M



Pressure PSI — Probe Temperature ^c



5292 Pacheco Blvd
Pacheco, CA 94553
P: 925-521-1490
F: 925-521-1494
www.vironex.com

Boring Name : 28MIP-23

Total Depth (ft): 64.75

Notes: **Building 88. Hand auger to 8 feet bgs.**

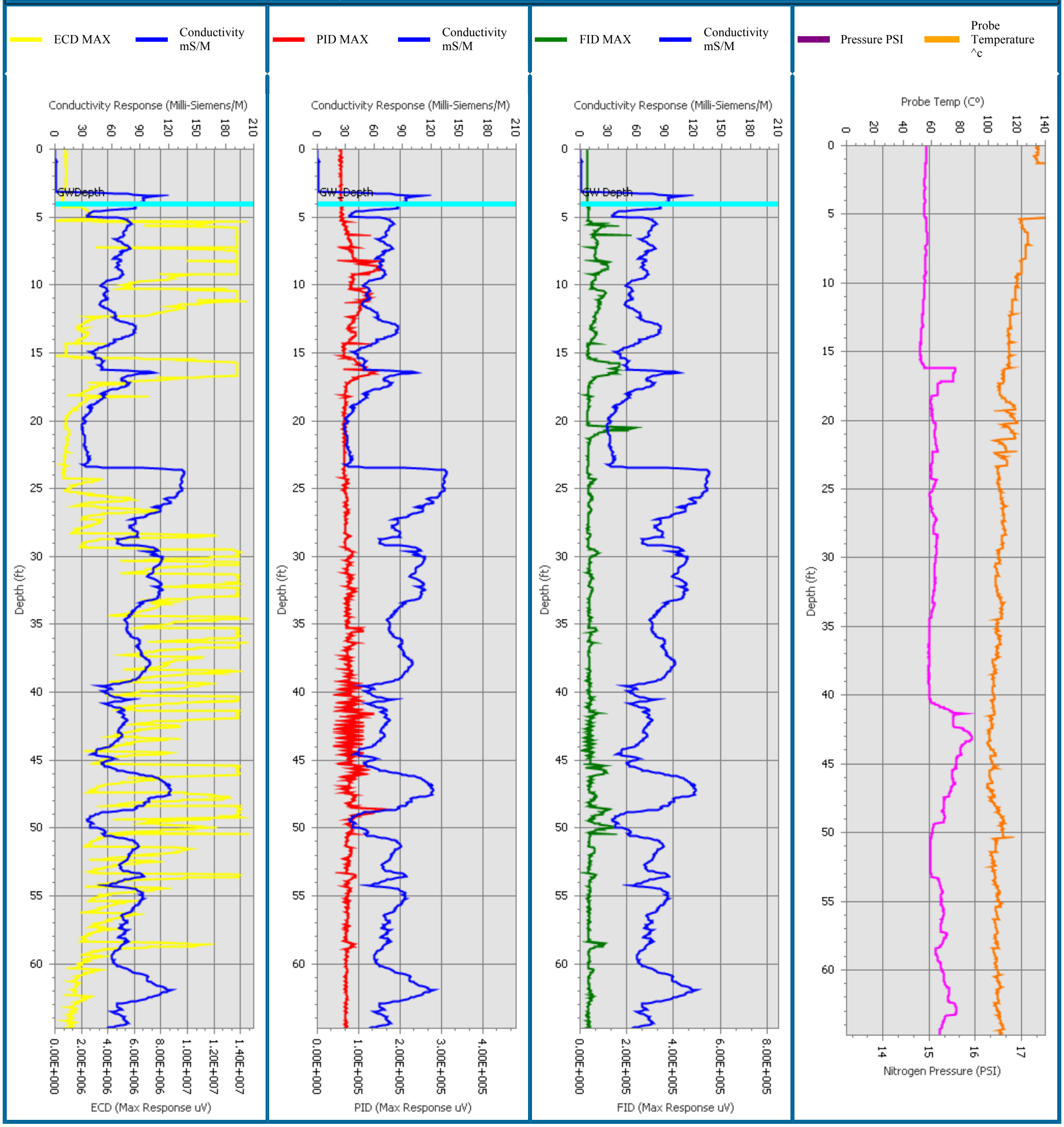
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 01 2010 07:56
Probe Type :	6520	End Boring Time :	Thu Apr 01 2010 09:00
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



5292 Pacheco Blvd
Pacheco, CA 94553
P: 925-521-1490
F: 925-521-1494
www.vironex.com

Boring Name : 28MIP-24

Total Depth (ft): 65.15

Building 88.

Notes:

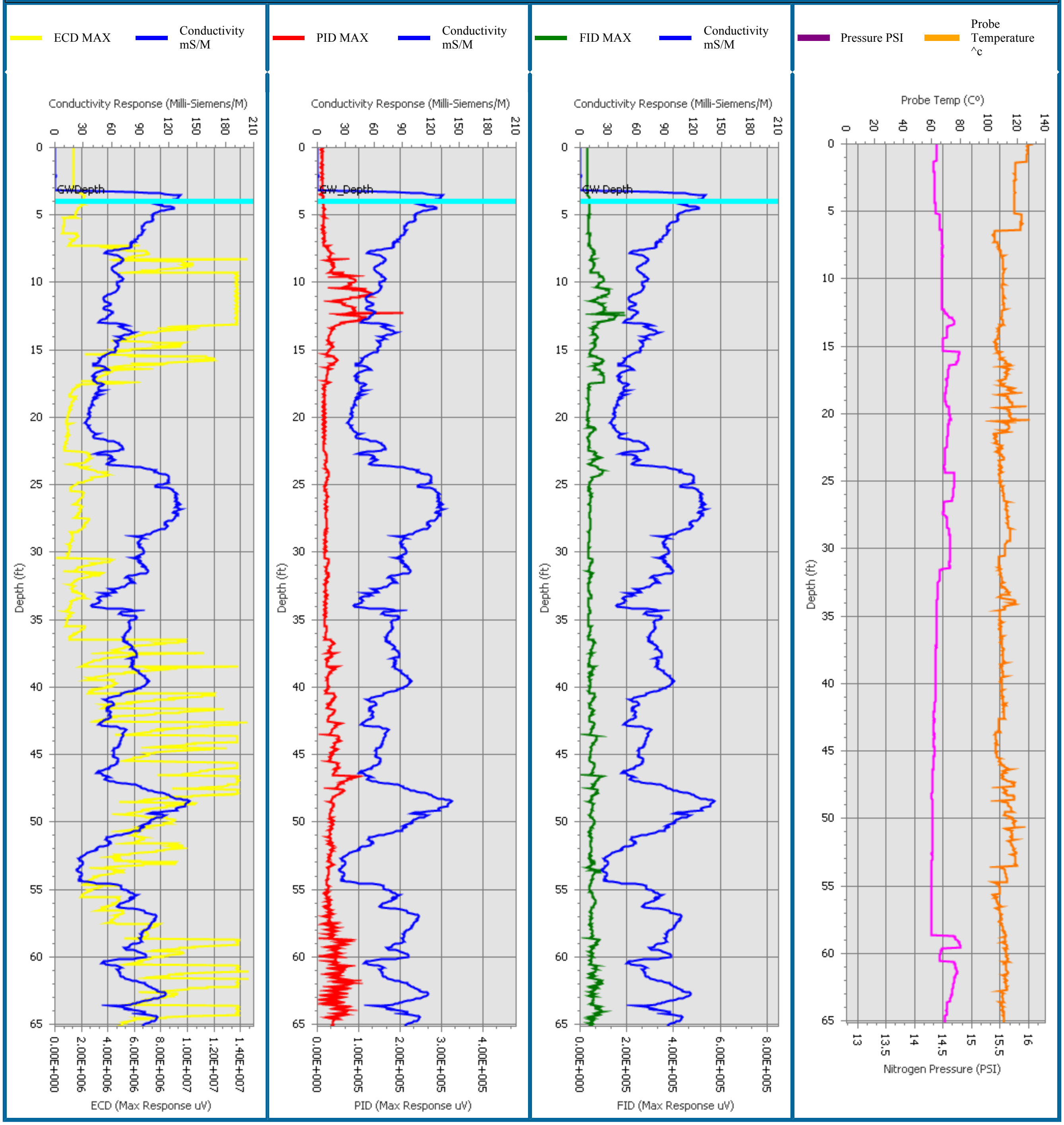
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Mar 31 2010 08:04
Probe Type :	6520	End Boring Time :	Wed Mar 31 2010 09:05
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



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Boring Name : 28MIP-25

Total Depth (ft): 65.05

Notes: **Building 88. Hand auger to 5 feet bgs.**

GW Detph (Ft) **4**
Depth of GW Provided by Client

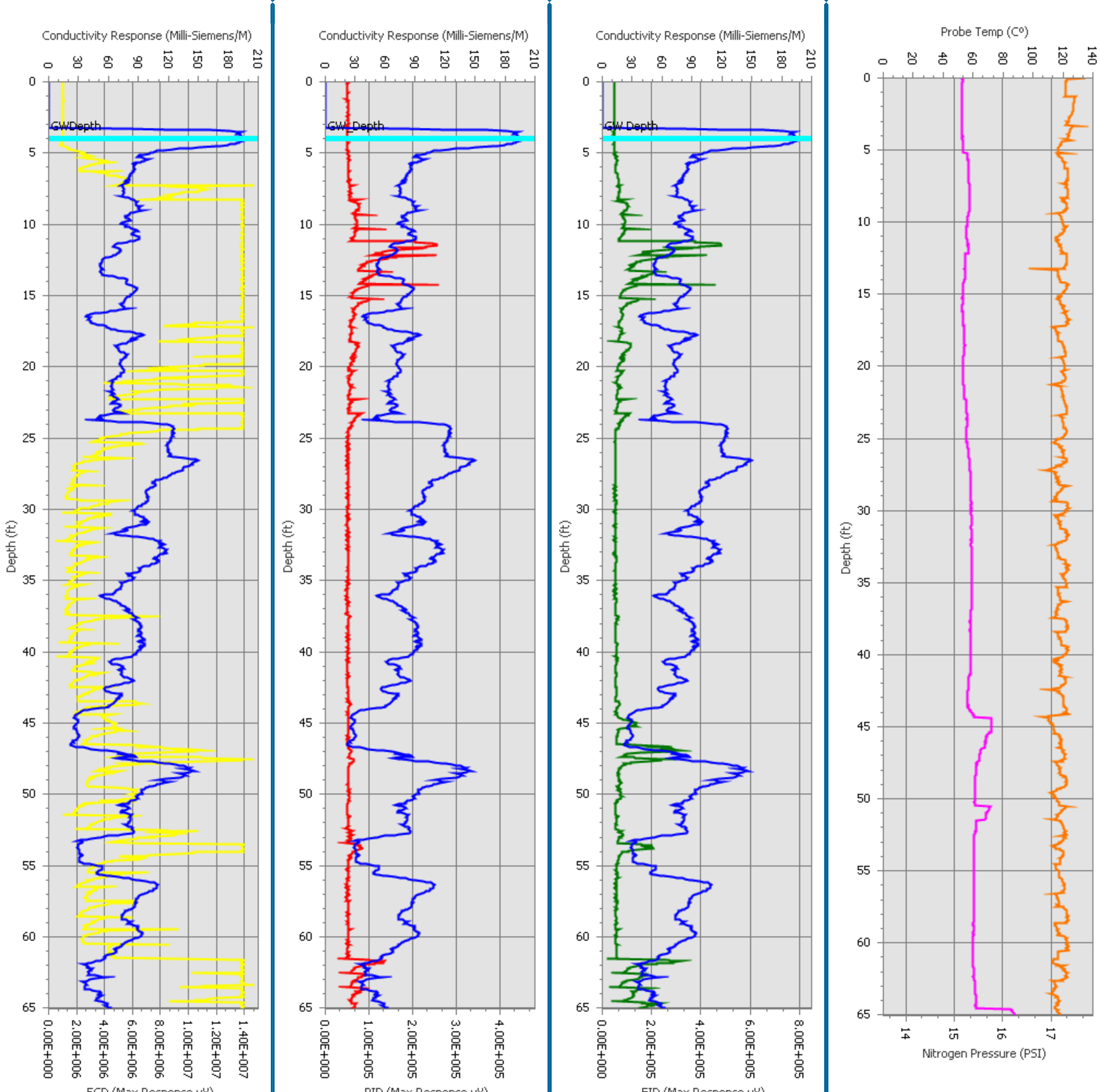
Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Mon Mar 29 2010 10:15
Probe Type :	6520	End Boring Time :	Mon Mar 29 2010 11:22
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi

ECD MAX — Conductivity mS/M | PID MAX — Conductivity mS/M | FID MAX — Conductivity mS/M | Pressure PSI — Probe Temperature ^c



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Boring Name : 28MIP-26

Total Depth (ft): 53.55

Notes: **Building 88. Hand auger to 5 feet bgs. Refusal at 53.33 feet bgs.**

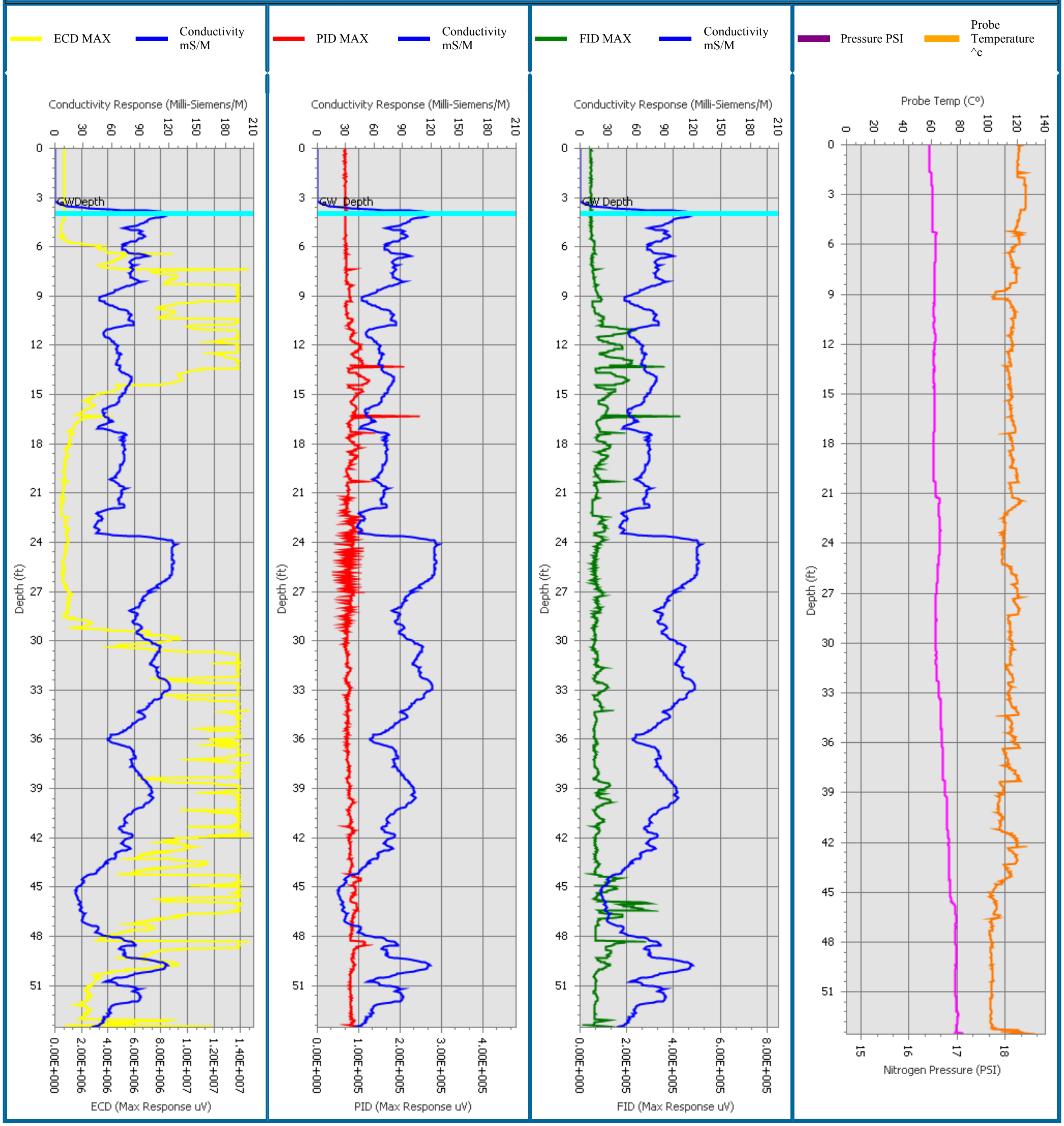
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Mar 30 2010 07:40
Probe Type :	6520	End Boring Time :	Tue Mar 30 2010 08:59
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



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Boring Name : 28MIP-27

Total Depth (ft): 64.95

Notes: **Building 88.**

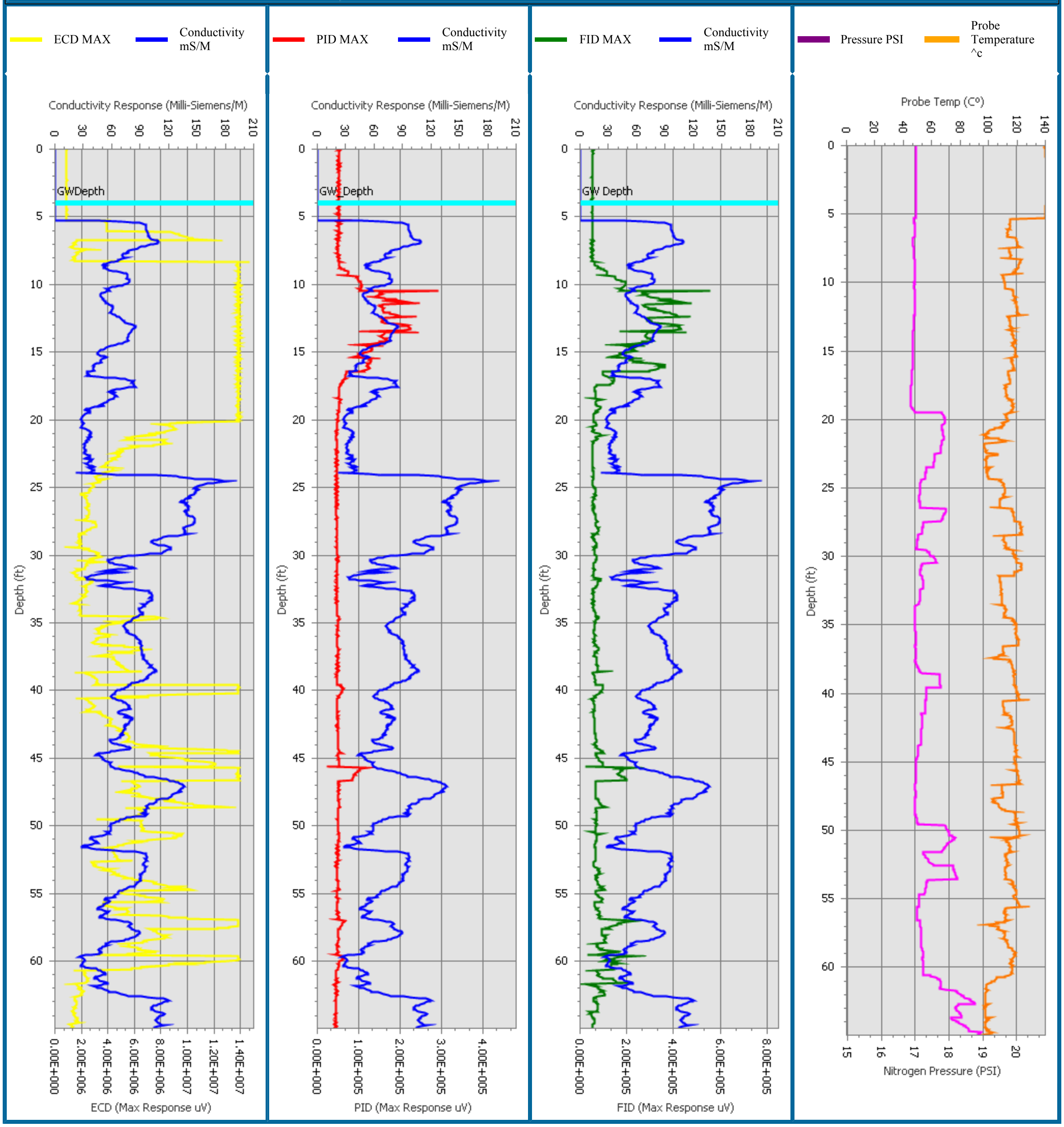
GW Detph (Ft) 4
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Mar 30 2010 09:35
Probe Type :	6520	End Boring Time :	Tue Mar 30 2010 10:38
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



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Boring Name : 28MIP-28

Total Depth (ft): 65.05

Building 88. Hand auger to 5 feet bgs.

Notes:

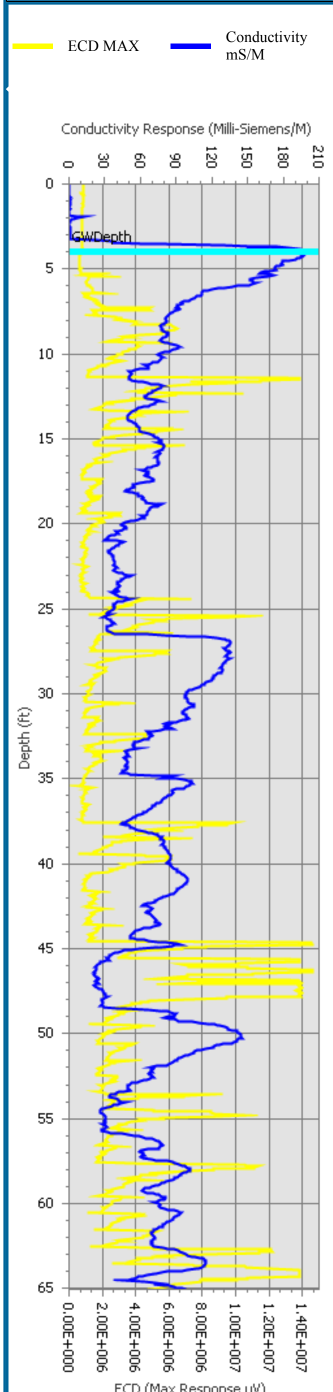
GW Detph (Ft) **4**
Depth of GW Provided by Client

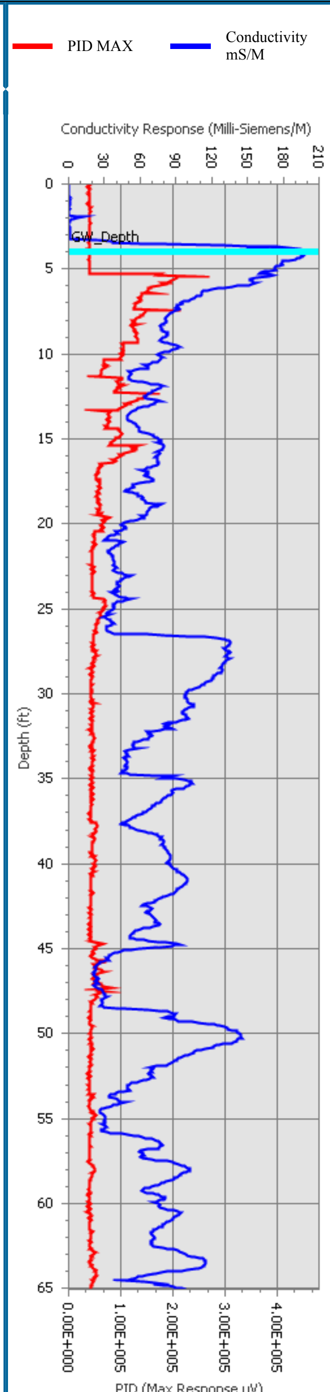
Job Information

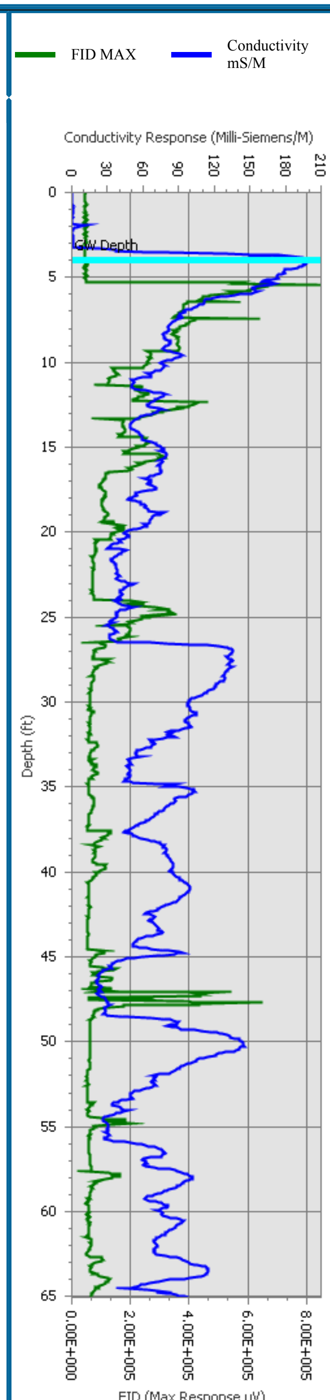
Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

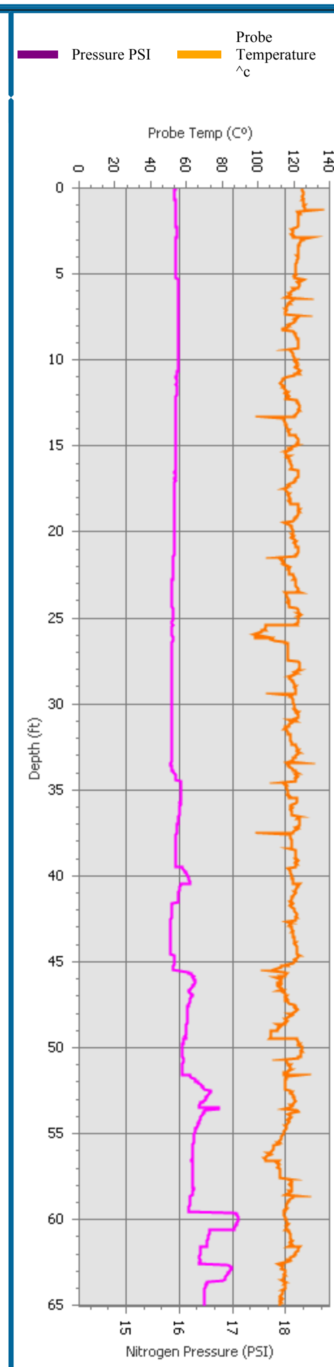
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Mon Mar 29 2010 13:44
Probe Type :	6520	End Boring Time :	Mon Mar 29 2010 14:50
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi









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Boring Name : 28MIP-29

Total Depth (ft): 64.95

Building 88.

Notes:

GW Detph (Ft) 4
Depth of GW Provided by Client

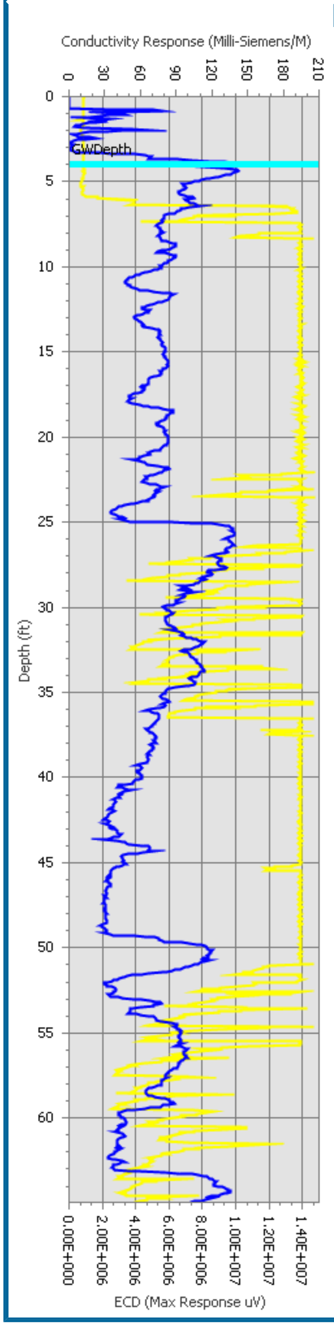
Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

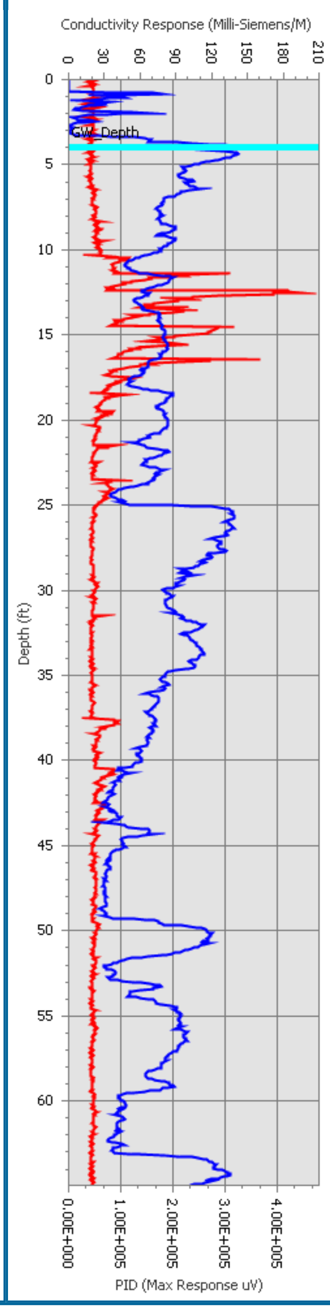
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Mon Mar 29 2010 08:22
Probe Type :	6520	End Boring Time :	Mon Mar 29 2010 09:29
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi

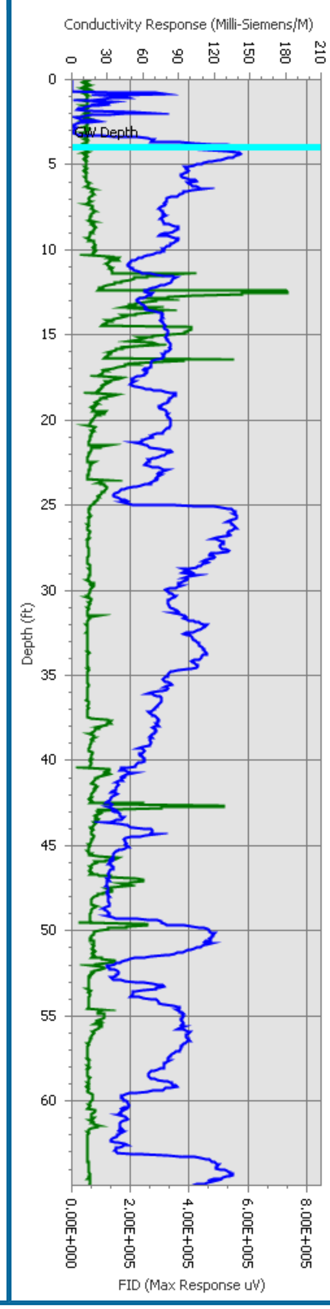
ECD MAX — Conductivity mS/M



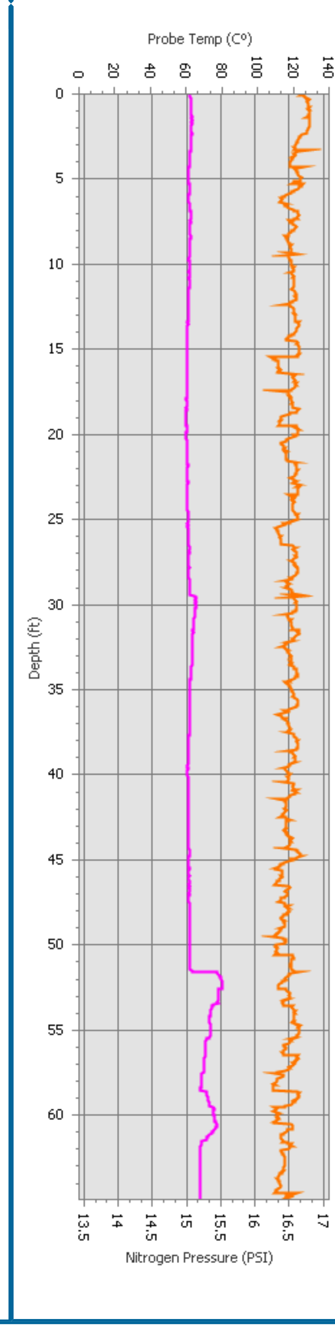
PID MAX — Conductivity mS/M



FID MAX — Conductivity mS/M



Pressure PSI — Probe Temperature ^c



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Boring Name : 28MIP-30

Total Depth (ft): 64.95

Notes: **Building 88. Pressure increased at 24 and 34 feet bgs. Stopped for approximately 1 minutes each time to allow to equilibrate. FID spikes at those depths are not correc**

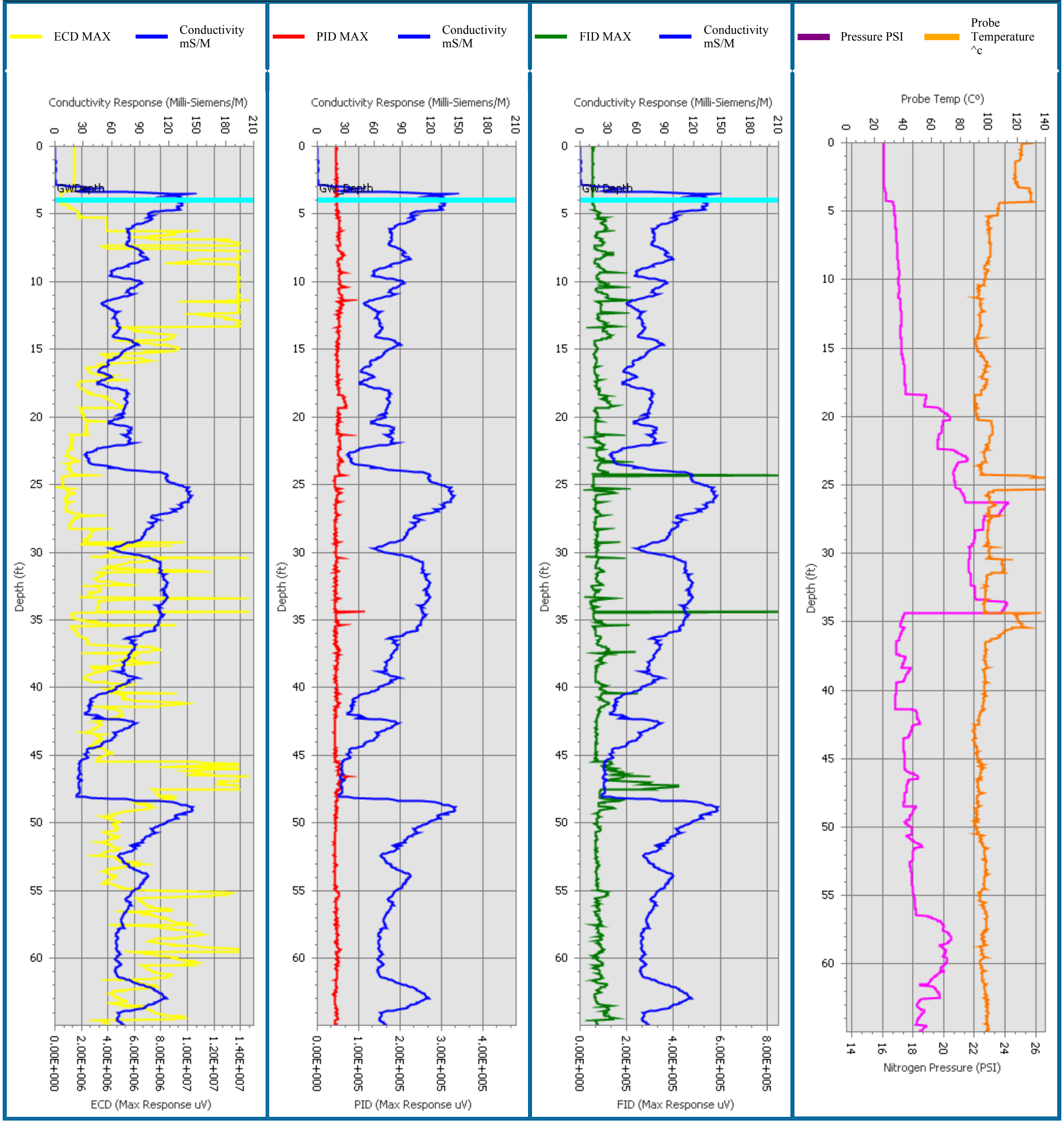
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Mar 30 2010 12:15
Probe Type :	6520	End Boring Time :	Tue Mar 30 2010 14:04
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



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Boring Name : 28MIP-31

Total Depth (ft): 65.05

Notes: **Building 88. Hand auger to 8 feet bgs.**

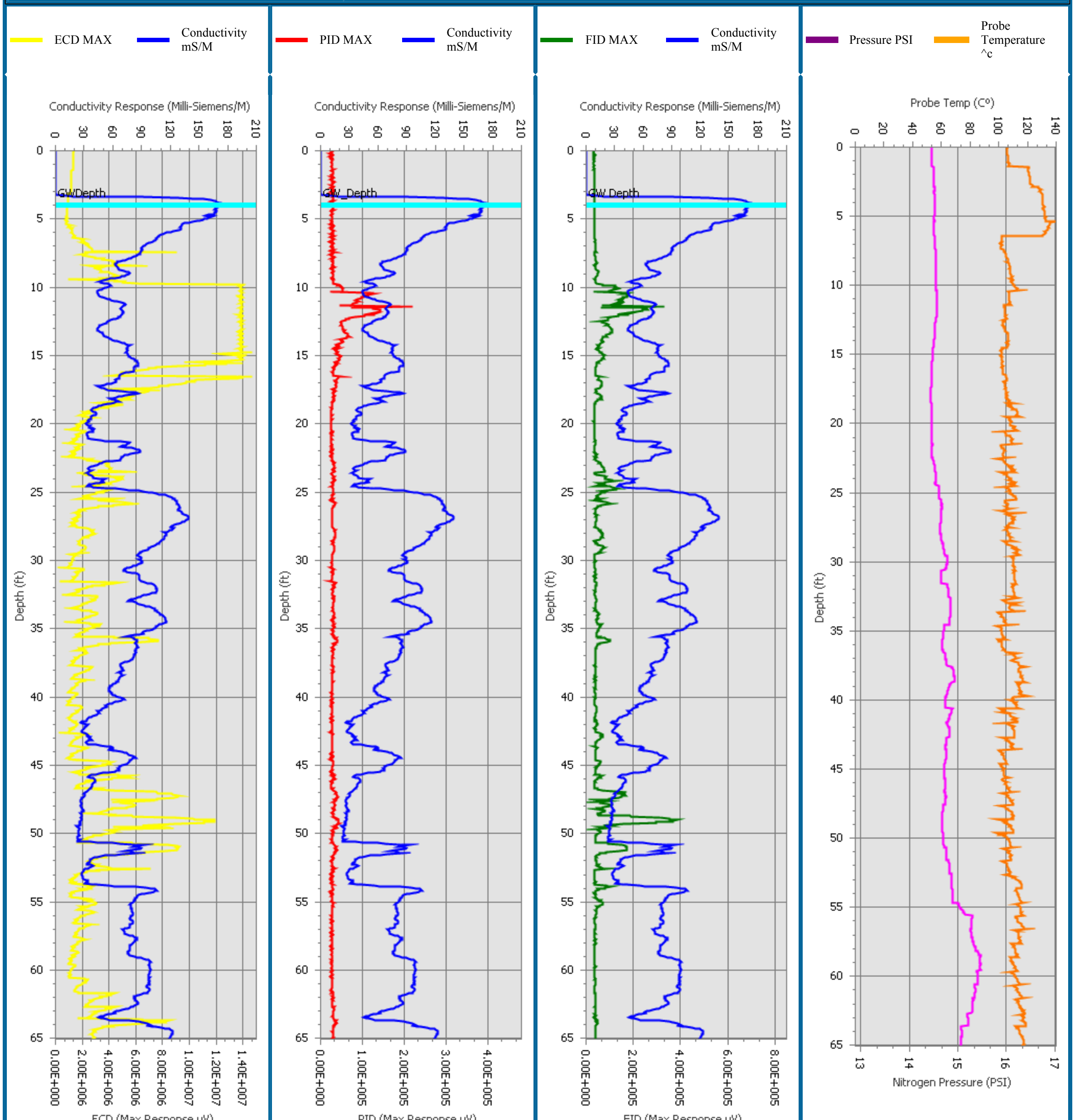
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Mar 31 2010 09:51
Probe Type :	6520	End Boring Time :	Wed Mar 31 2010 10:56
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



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Boring Name : 28MIP-32

Total Depth (ft): 65.05

Notes: **Building 88. Hand auger to 8 feet bgs.**

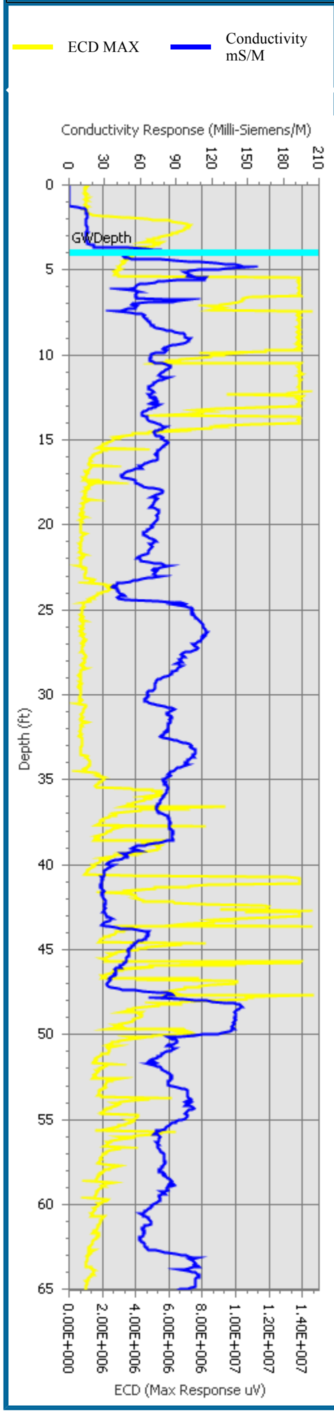
GW Detph (Ft) **4**
Depth of GW Provided by Client

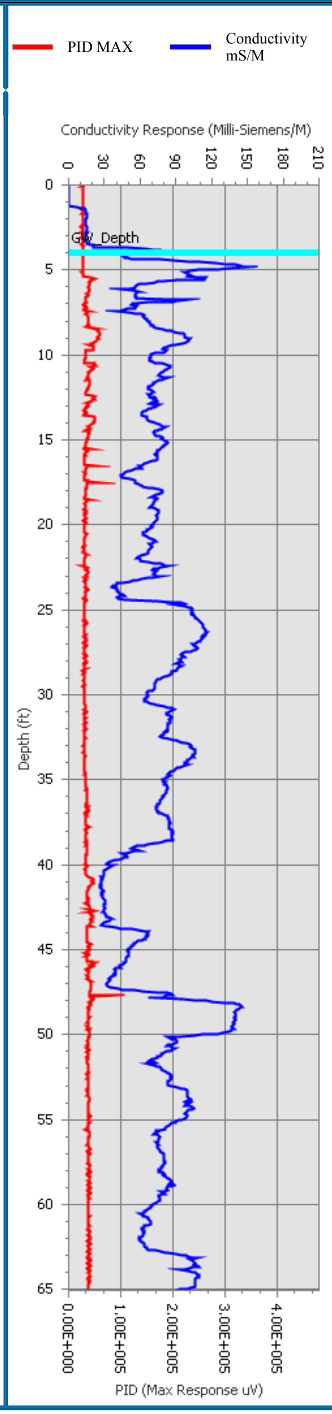
Job Information

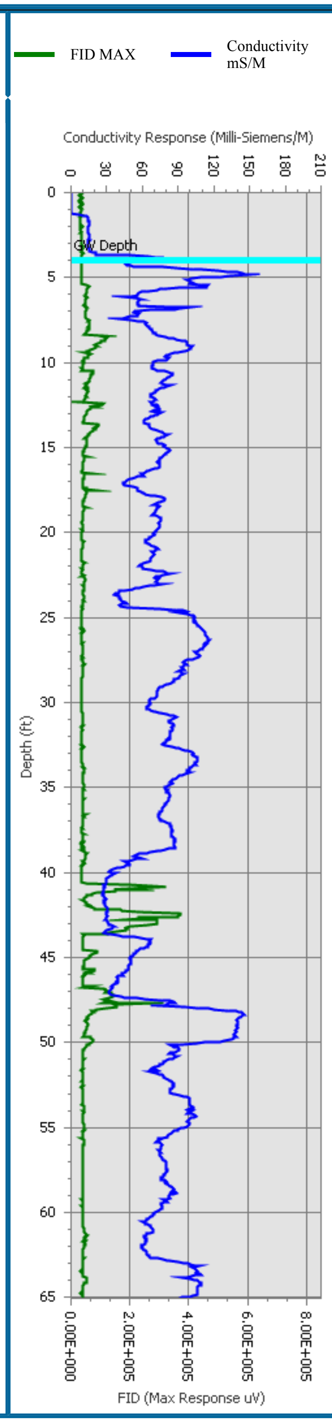
Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

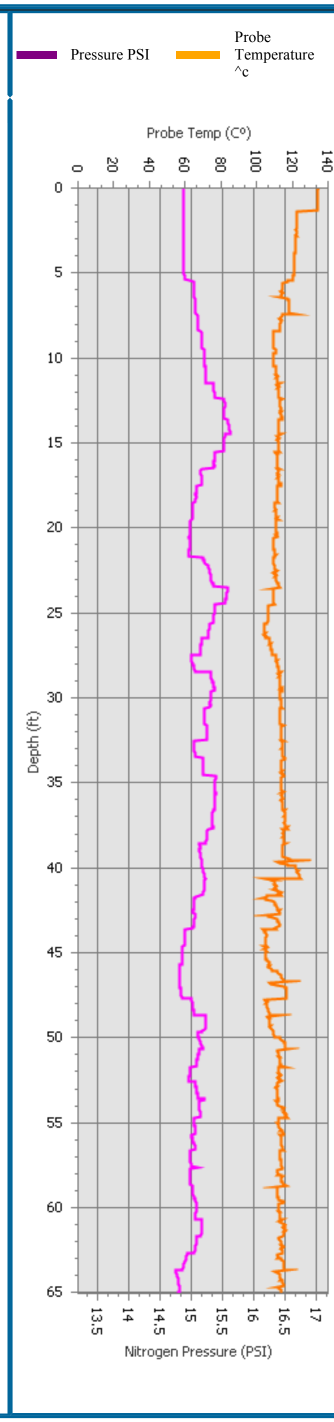
MIP Sampling Information

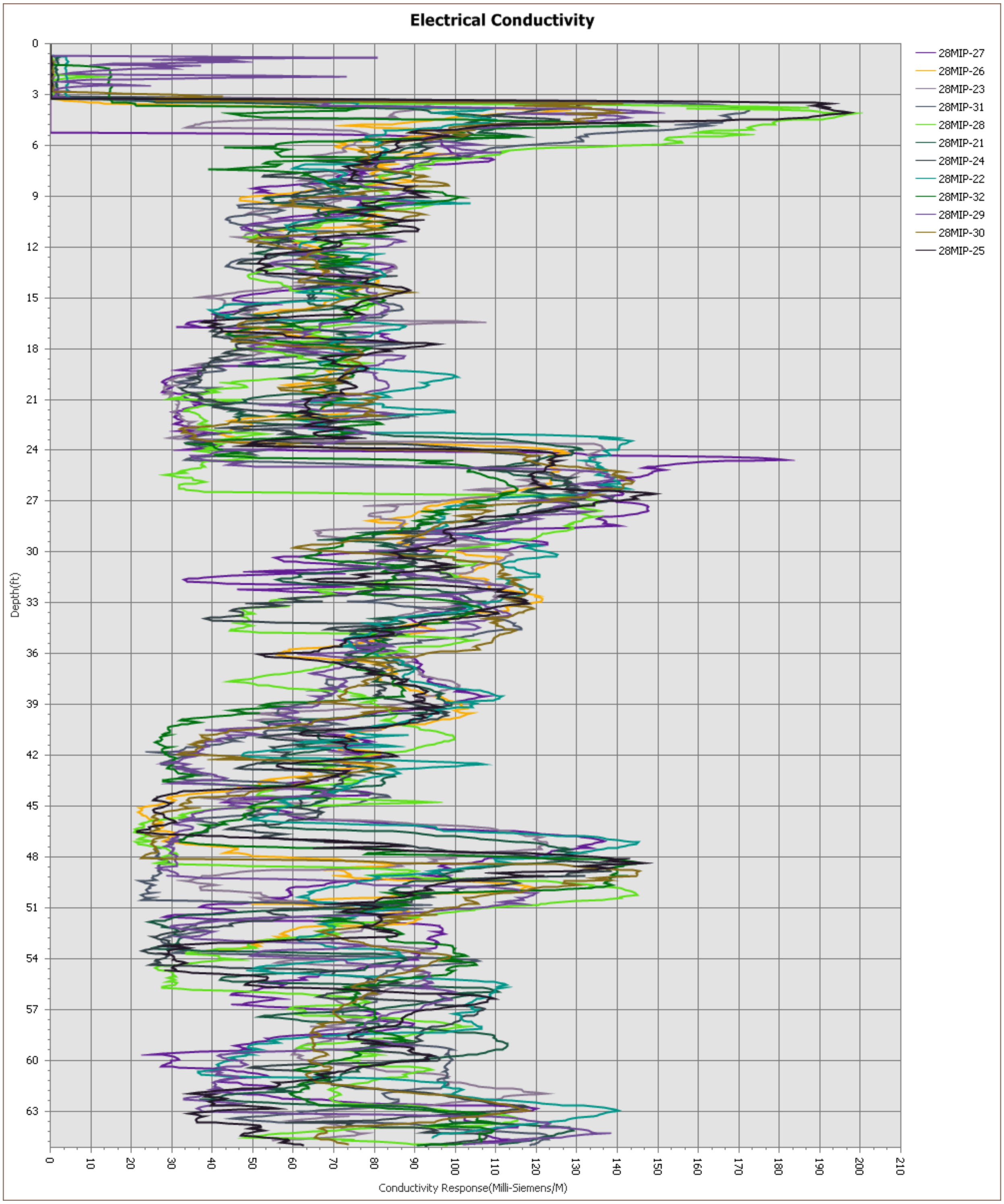
Trunkline length :	150	Start Boring Time :	Wed Mar 31 2010 11:48
Probe Type :	6520	End Boring Time :	Wed Mar 31 2010 12:52
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi











Electrical Conductivity
Depth(ft)
Conductivity Response(Milli-Siemens/M)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
51
54
57
60
63
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
28MIP-27
28MIP-26
28MIP-23
28MIP-31
28MIP-28
28MIP-21
28MIP-24
28MIP-22
28MIP-32
28MIP-29
28MIP-30
28MIP-25

Traffic Island Area

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Boring Name : 28MIP-01

Total Depth (ft): 65

Notes: **Traffic Island. Hand auger to 5 feet.**

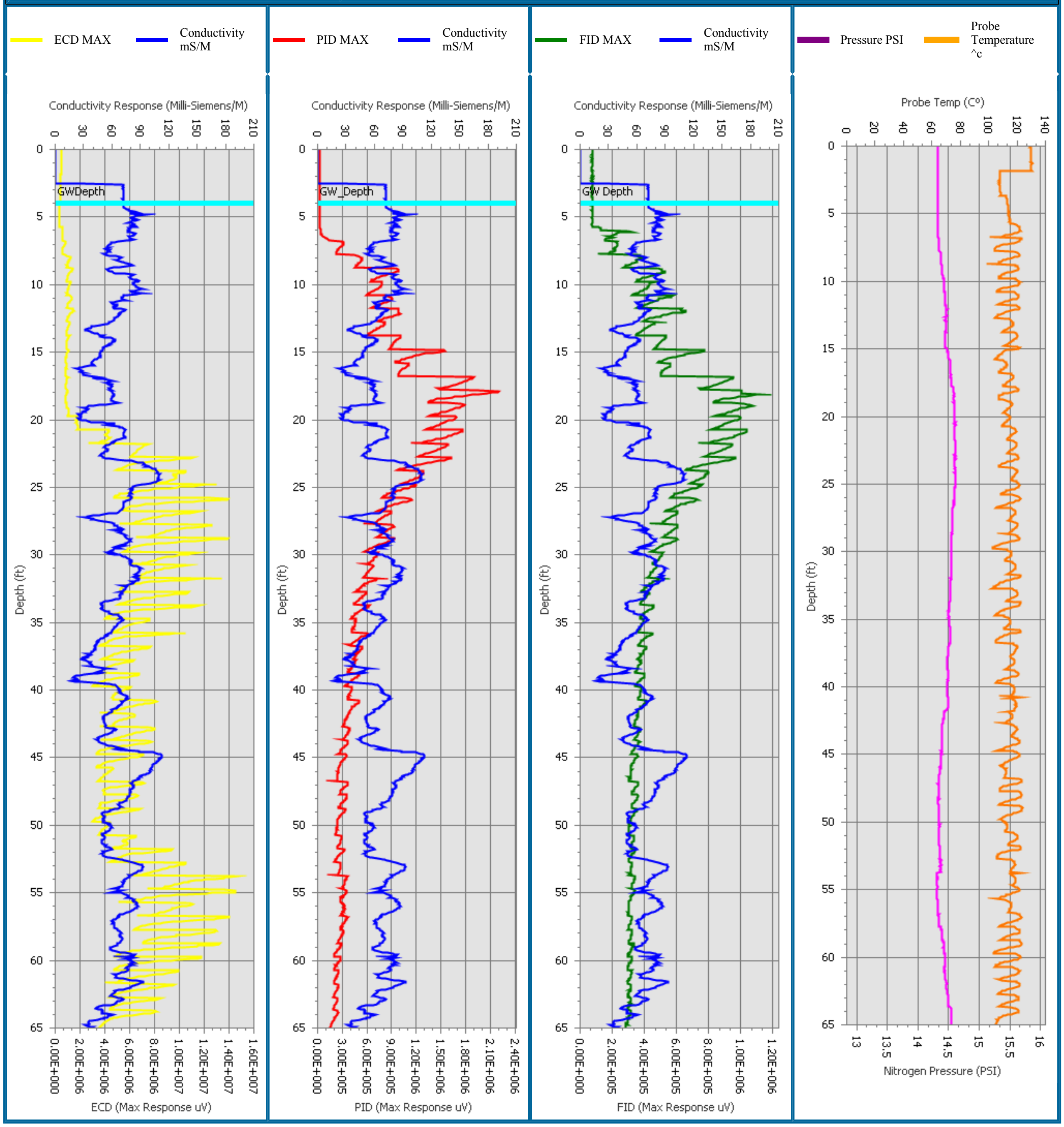
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 08 2010 13:37
Probe Type :	6520	End Boring Time :	Thu Apr 08 2010 14:39
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Boring Name : 28MIP-02

Total Depth (ft): 65.05

Notes: **Traffic Island. Hand auger to 5 feet bgs.**

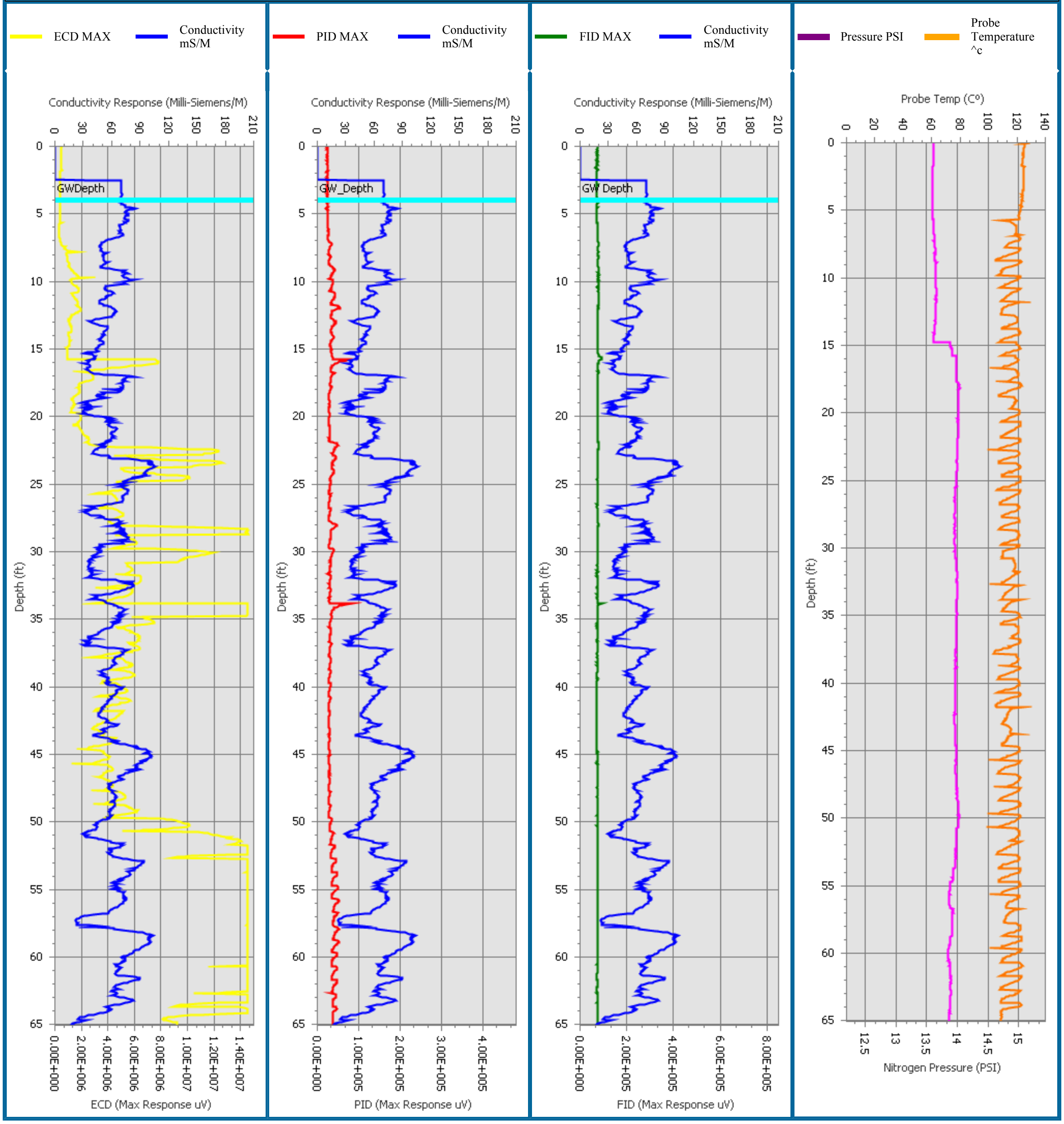
GW Detph (Ft) 4
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 14 2010 12:21
Probe Type :	6520	End Boring Time :	Wed Apr 14 2010 13:25
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Boring Name : 28MIP-03

Total Depth (ft): 65

Notes: **Traffic Island. Hand auger to 5 feet.**

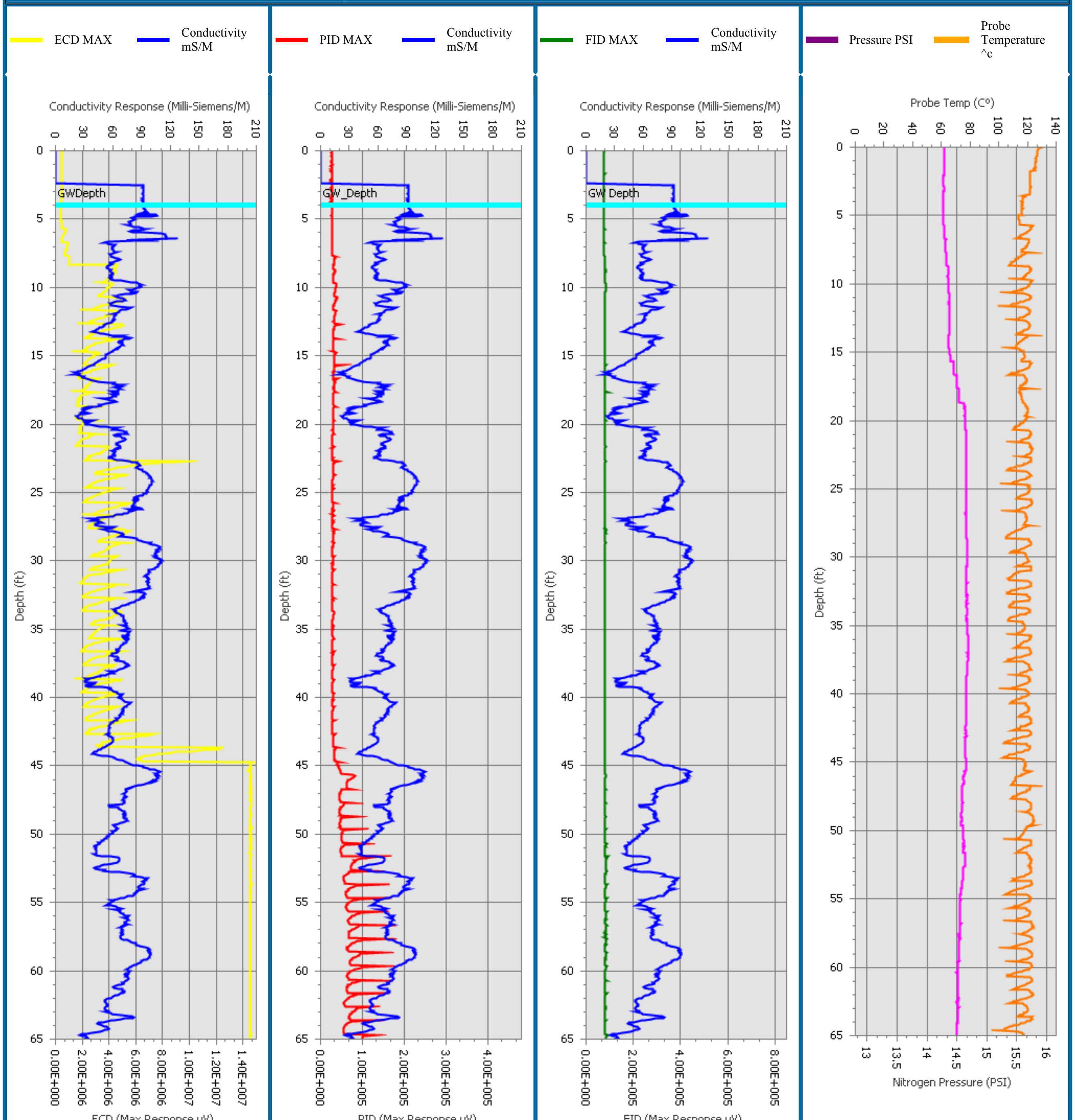
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 08 2010 11:28
Probe Type :	6520	End Boring Time :	Thu Apr 08 2010 12:33
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Boring Name : 28MIP-04

Total Depth (ft): 65.05

Notes: **Traffic Island. Hand auger to 5 feet.**

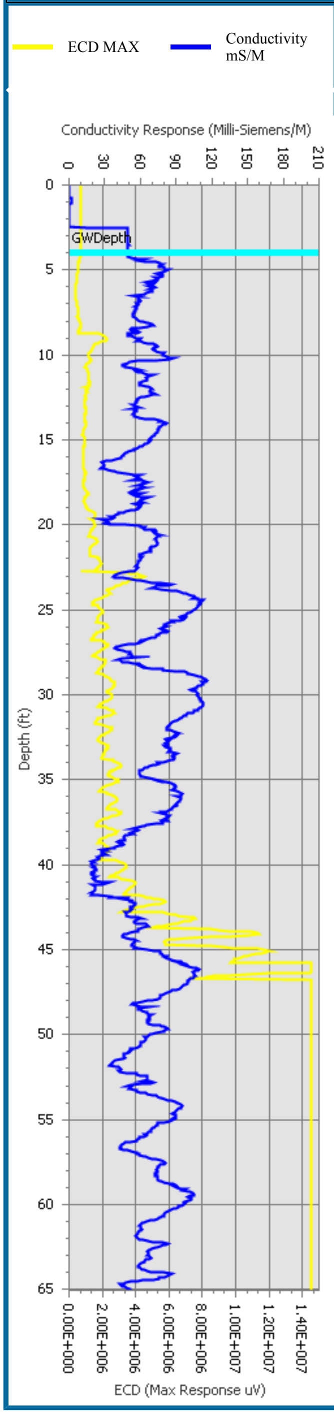
GW Detph (Ft) **4**
Depth of GW Provided by Client

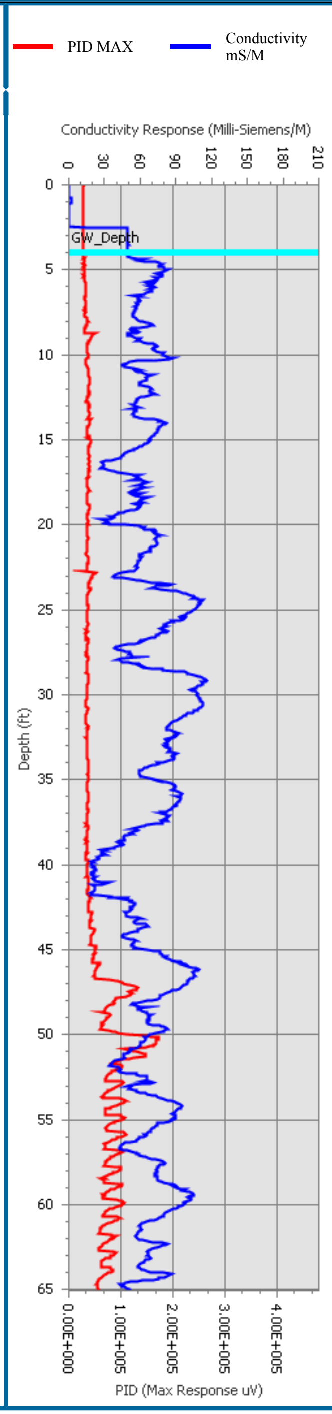
Job Information

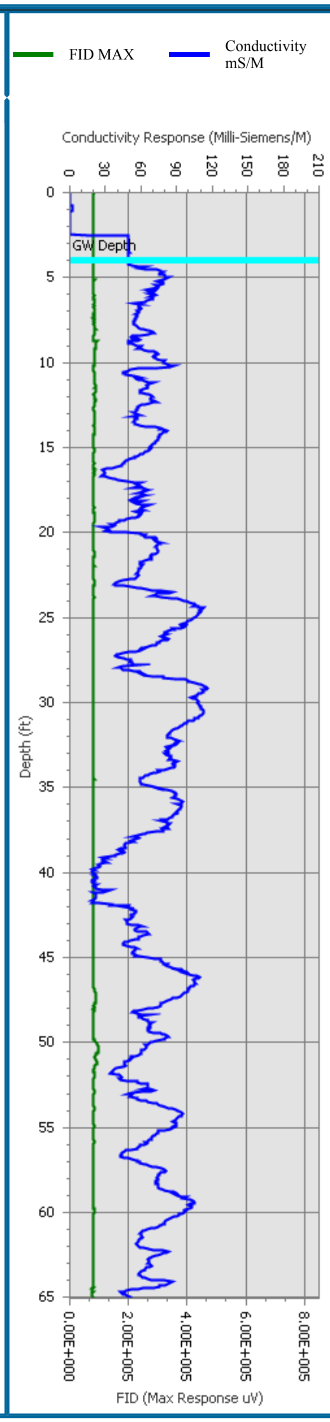
Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

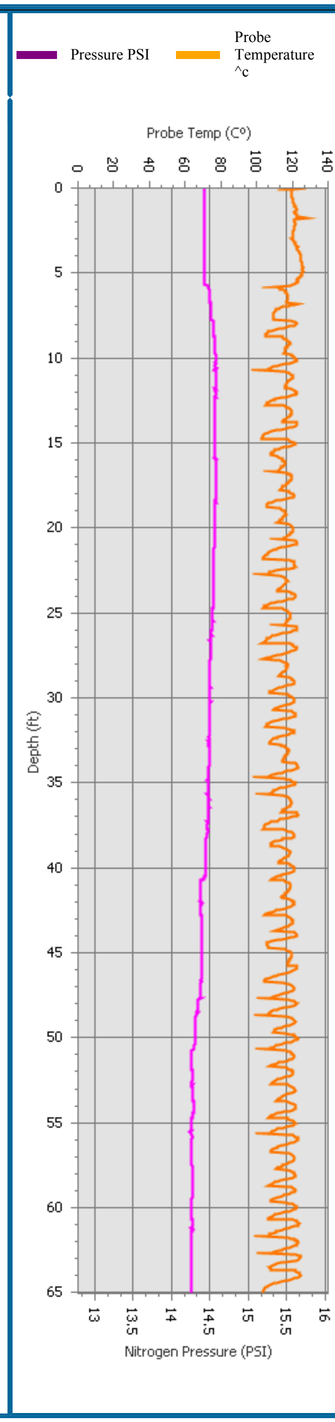
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 08 2010 09:40
Probe Type :	6520	End Boring Time :	Thu Apr 08 2010 10:47
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul









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Boring Name : 28MIP-05

Total Depth (ft): 65.1

Notes: **Traffic Island. Hand auger to 5 feet.**

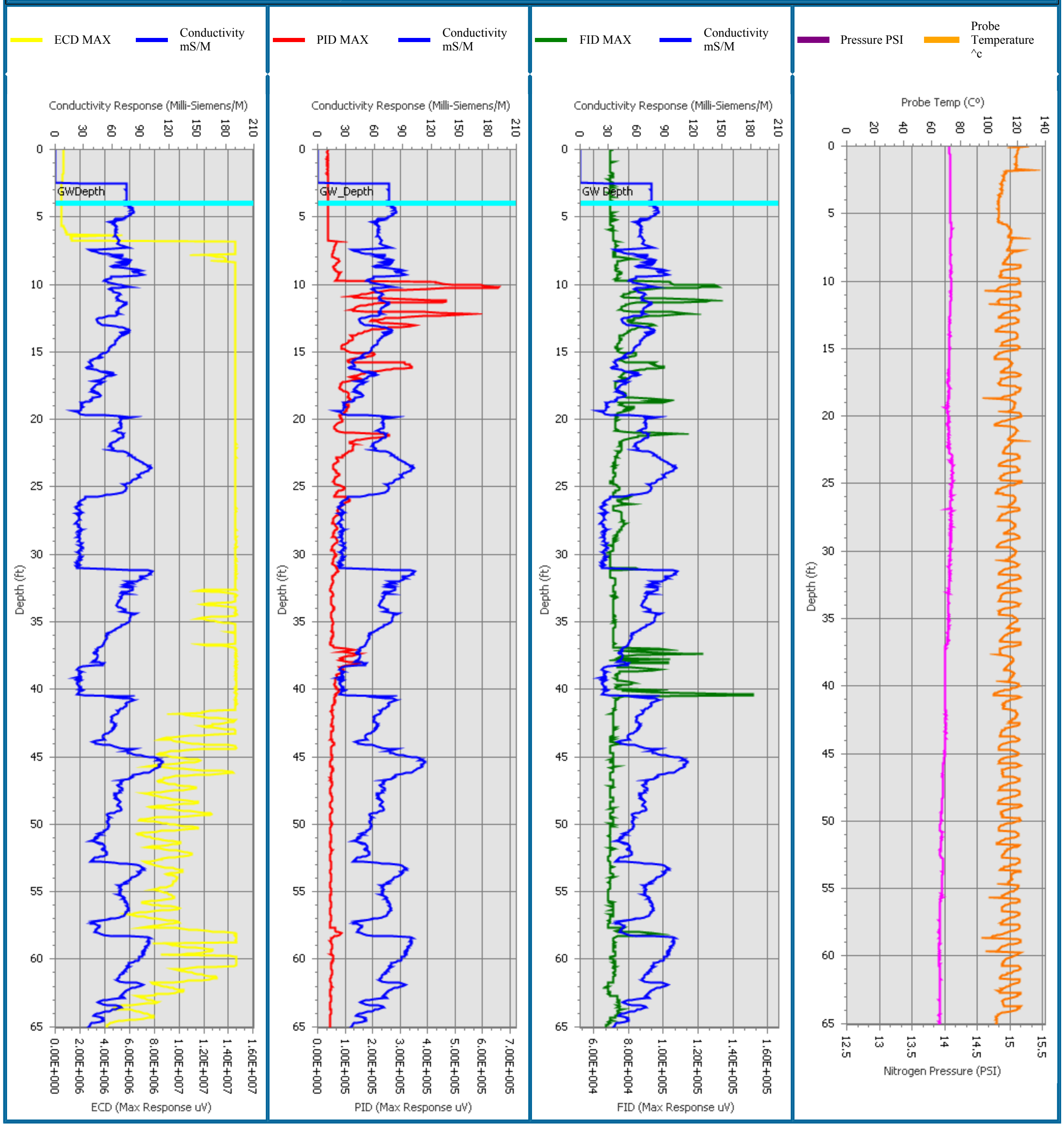
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 07 2010 13:22
Probe Type :	6520	End Boring Time :	Wed Apr 07 2010 14:27
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Boring Name : 28MIP-06

Total Depth (ft): 65.05

Notes: **Traffic Island. Hand auger to 8 feet.**

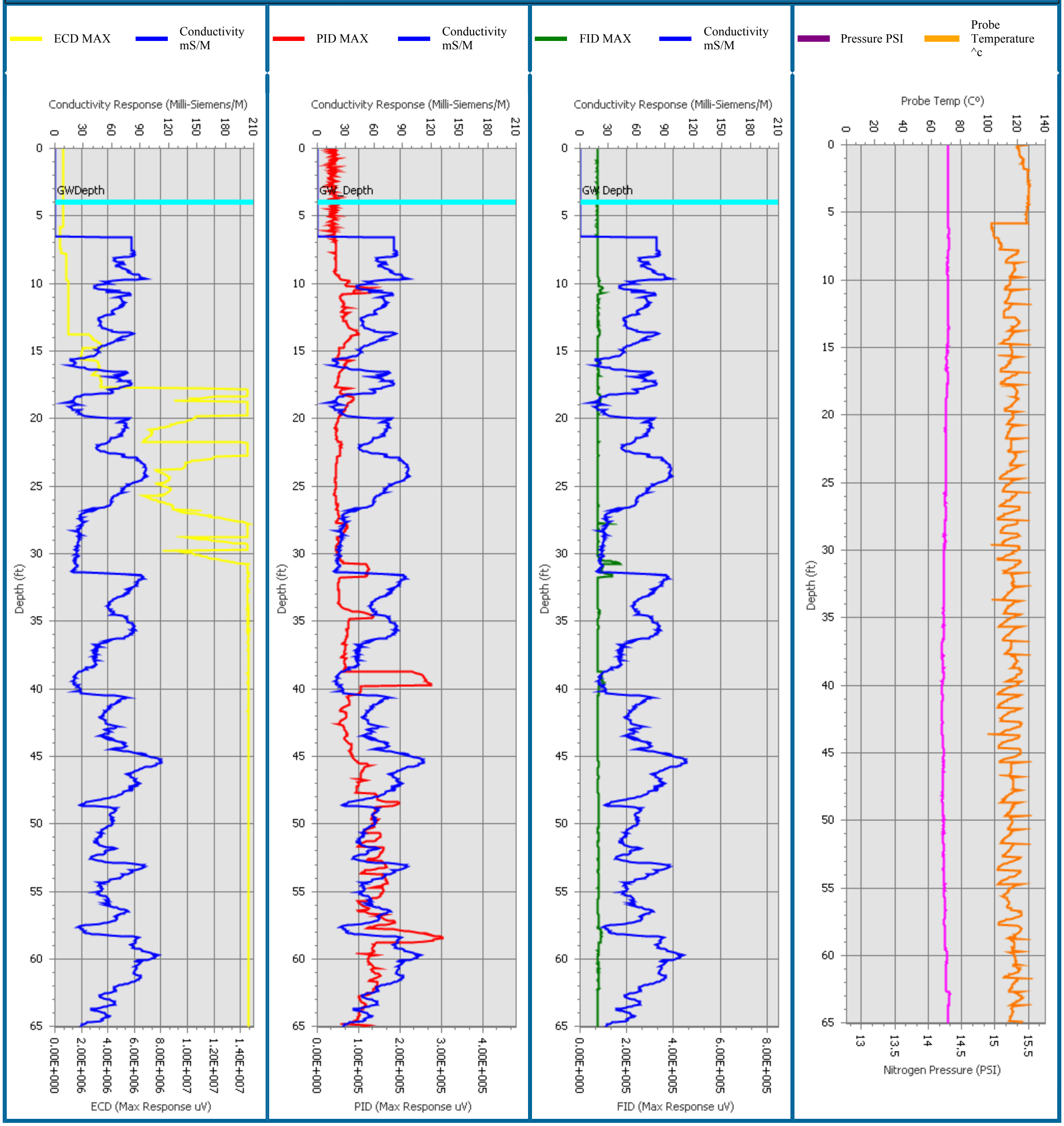
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Apr 06 2010 13:10
Probe Type :	6520	End Boring Time :	Tue Apr 06 2010 14:14
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Boring Name : 28MIP-07

Total Depth (ft): 63.7

Notes: **Traffic Island. Hand auger to 5 feet.**

GW Detph (Ft) **4**
Depth of GW Provided by Client

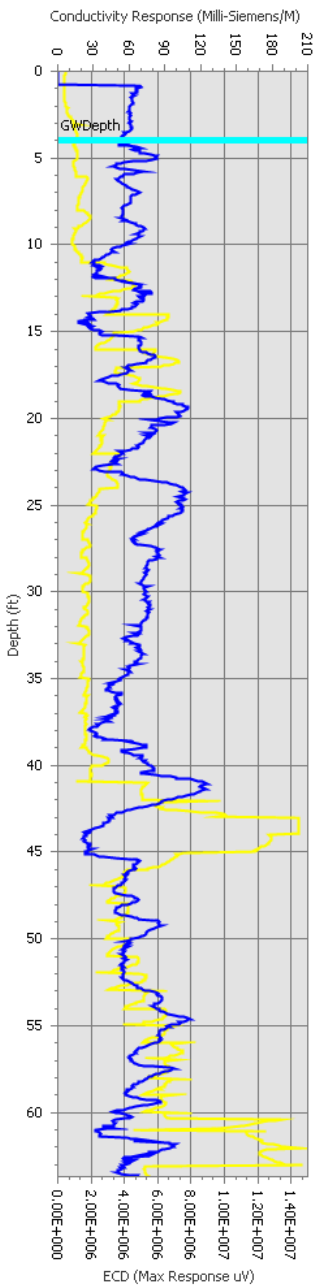
Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

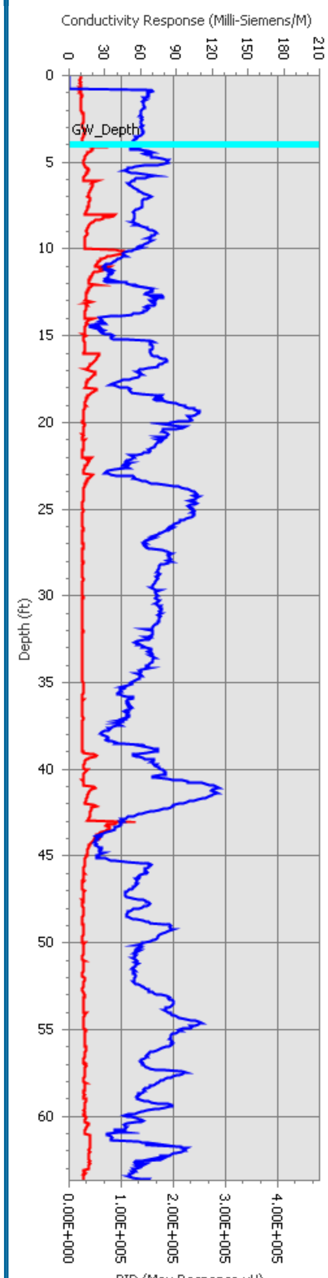
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Thu Apr 08 2010 07:25
Probe Type :	6520	End Boring Time :	Thu Apr 08 2010 08:36
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul

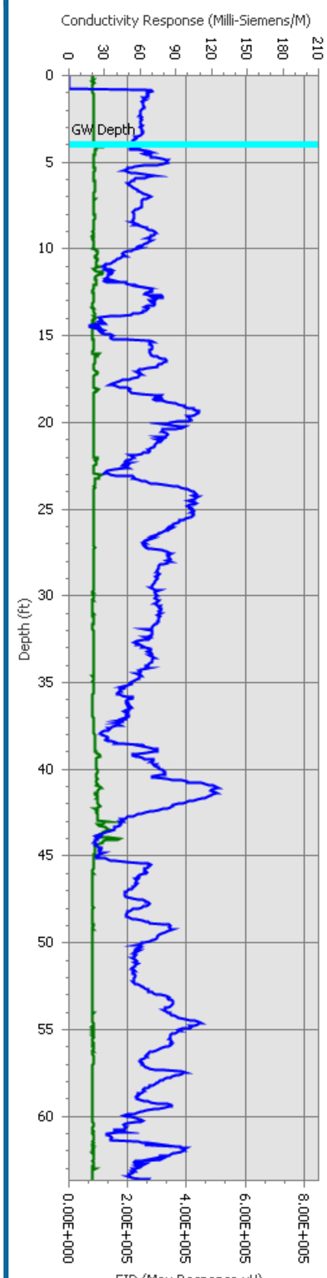
ECD MAX — Conductivity mS/M



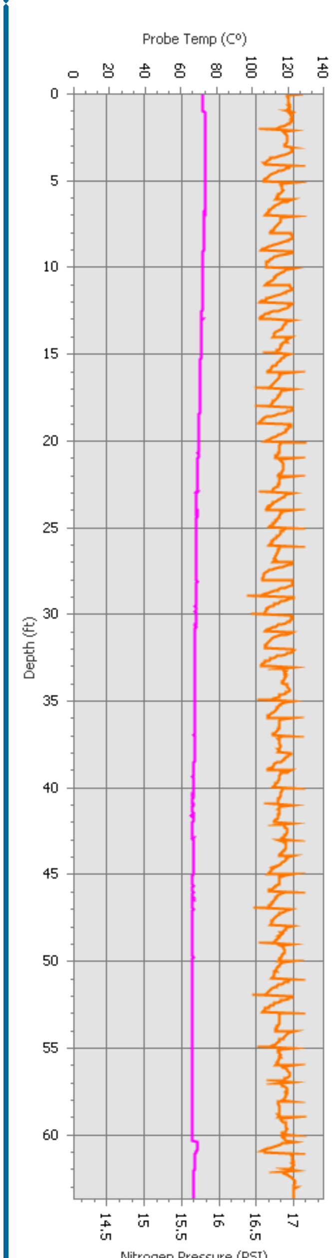
PID MAX — Conductivity mS/M



FID MAX — Conductivity mS/M



Pressure PSI — Probe Temperature ^c



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Boring Name : 28MIP-08

Total Depth (ft): 65

Notes: **Traffic Island. Hand auger to 5 feet.**

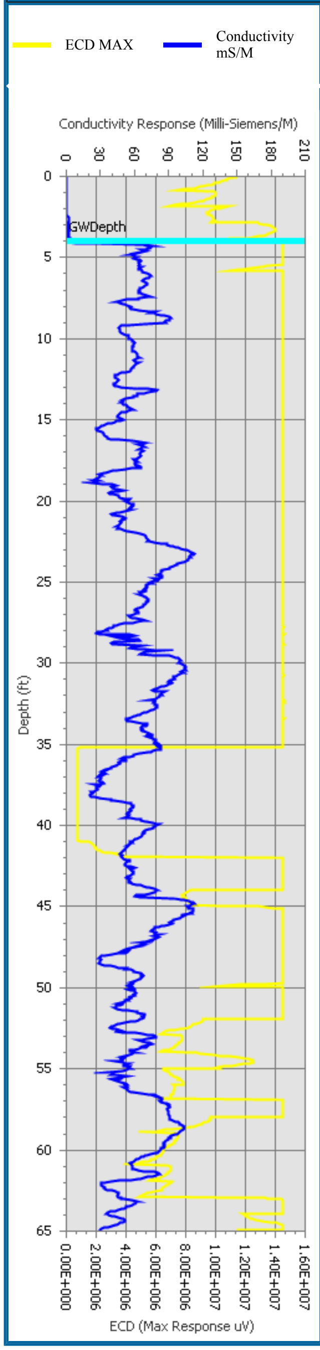
GW Detph (Ft) **4**
Depth of GW Provided by Client

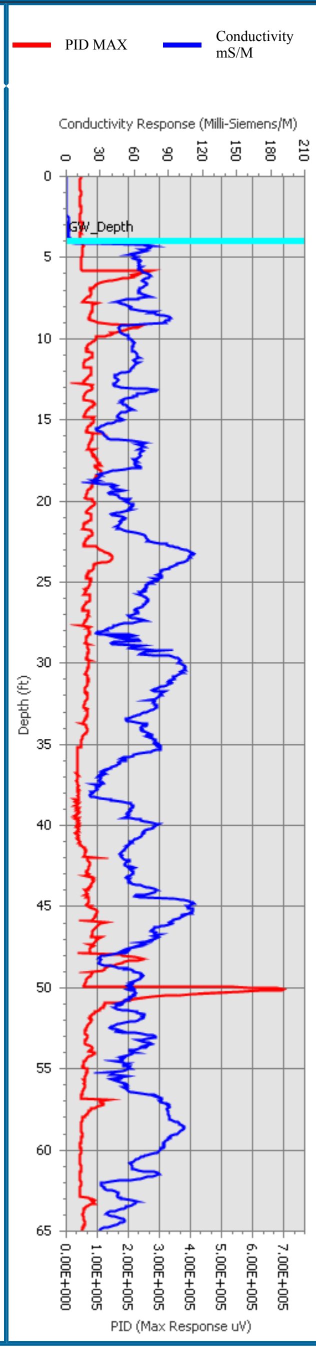
Job Information

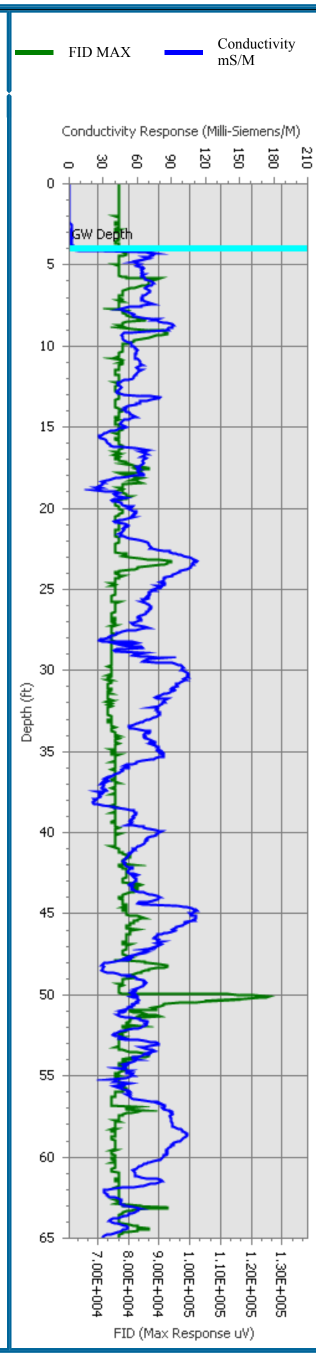
Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

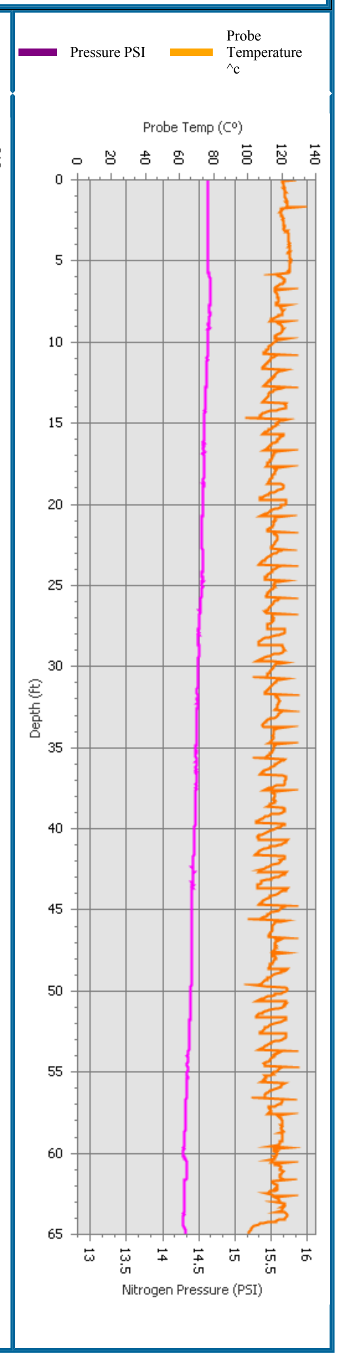
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 07 2010 10:53
Probe Type :	6520	End Boring Time :	Wed Apr 07 2010 11:56
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul









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Boring Name : 28MIP-09

Total Depth (ft): 65.3

Notes: **Traffic Island. Hand auger to 8 feet.**

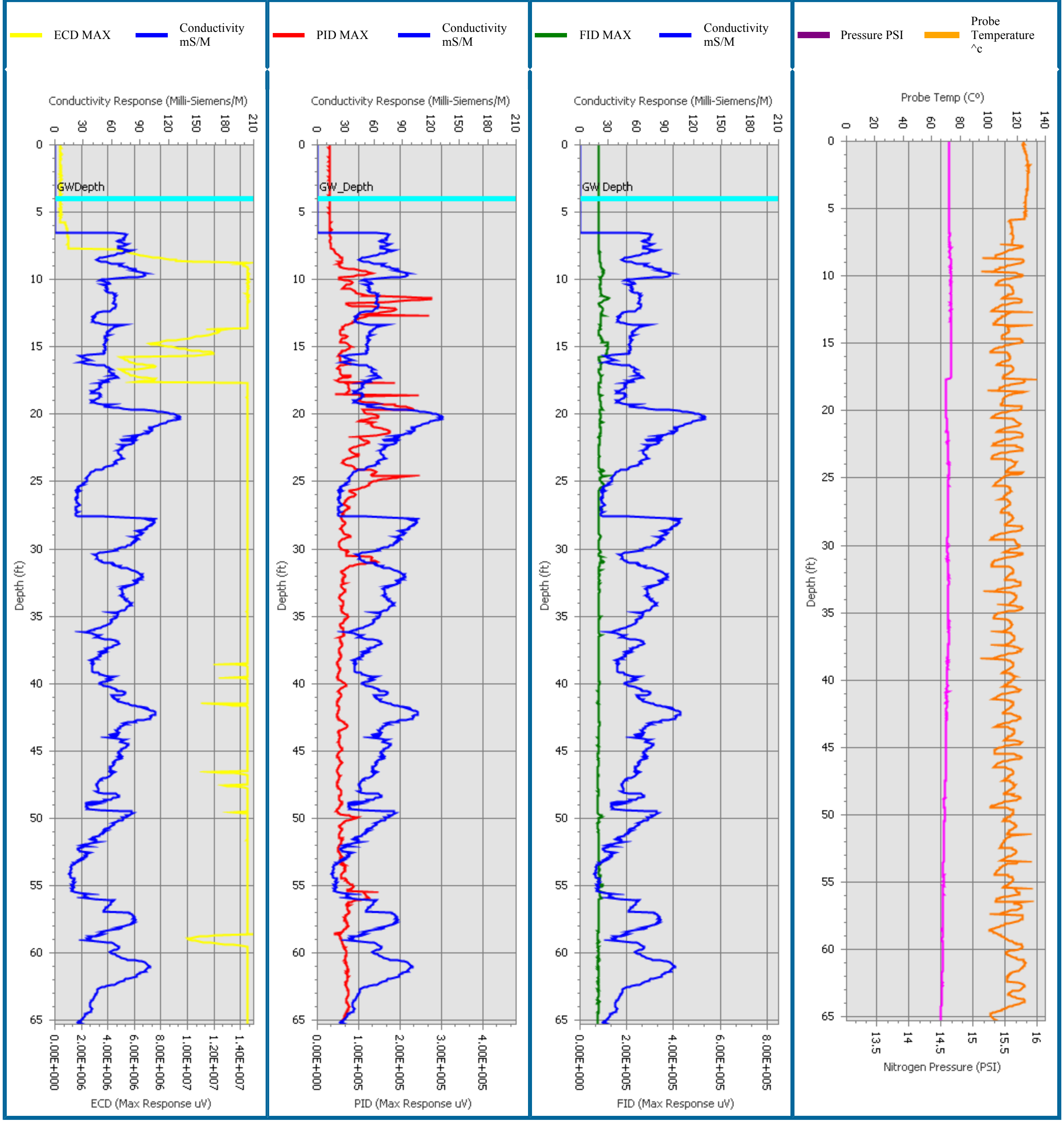
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Apr 06 2010 10:12
Probe Type :	6520	End Boring Time :	Mon Apr 12 2010 14:05
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



5292 Pacheco Blvd
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www.vironex.com

Boring Name : 28MIP-10

Total Depth (ft): 65

Notes: **Traffic Island. Hand auger to 5 feet.**

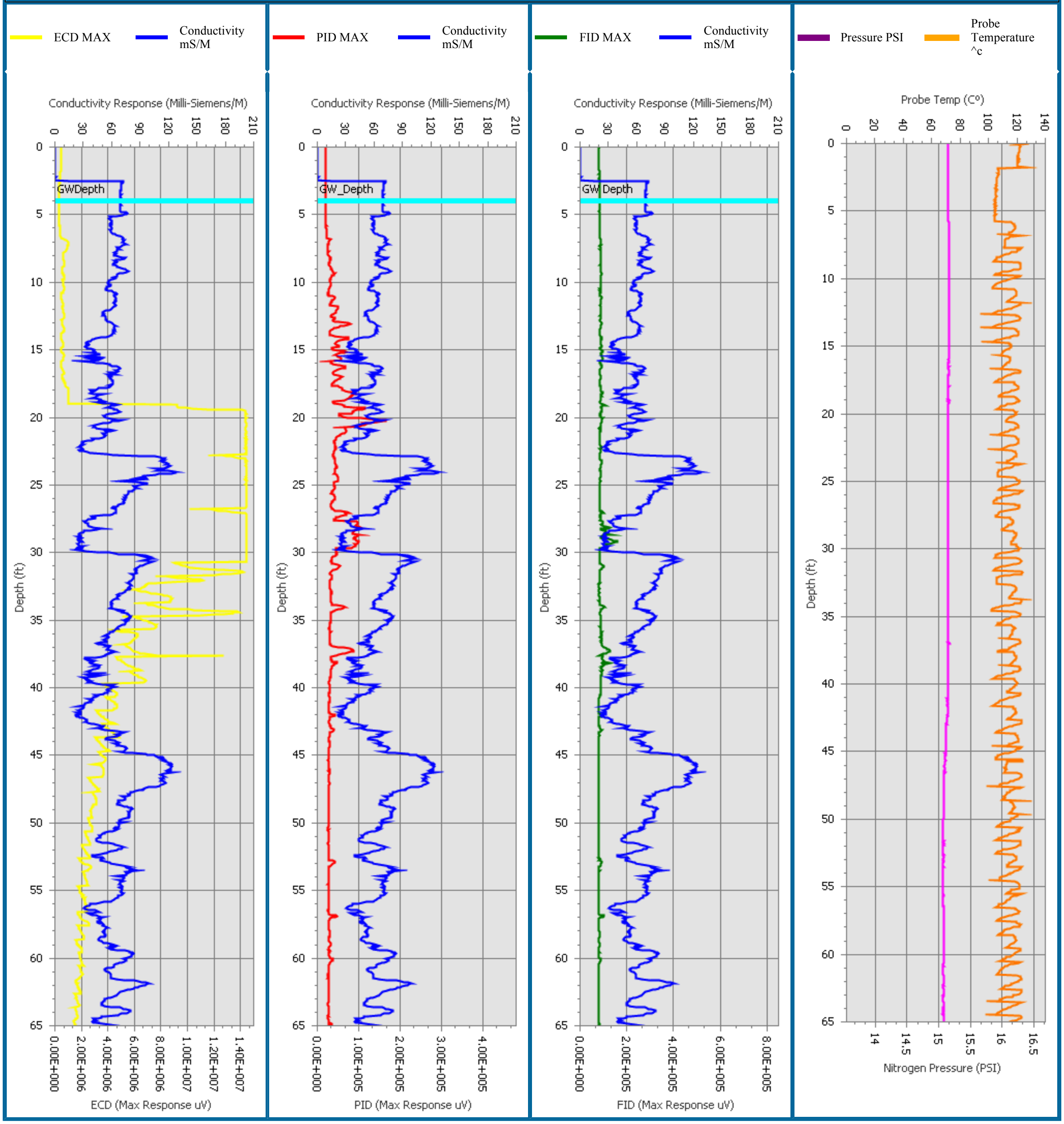
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 07 2010 07:25
Probe Type :	6520	End Boring Time :	Wed Apr 07 2010 08:31
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



5292 Pacheco Blvd
Pacheco, CA 94553
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F: 925-521-1494
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Boring Name : 28MIP-11

Total Depth (ft): 65

Notes: **Traffic Island. Hand auger to 5 feet.**

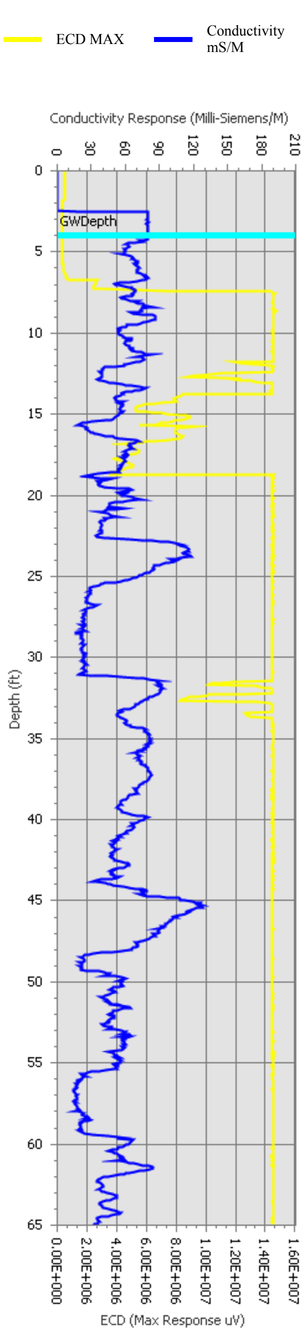
GW Detph (Ft) **4**
Depth of GW Provided by Client

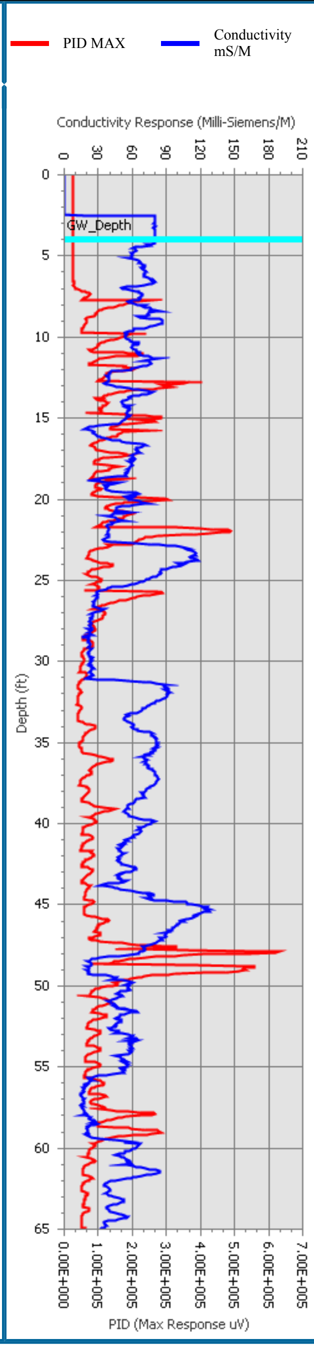
Job Information

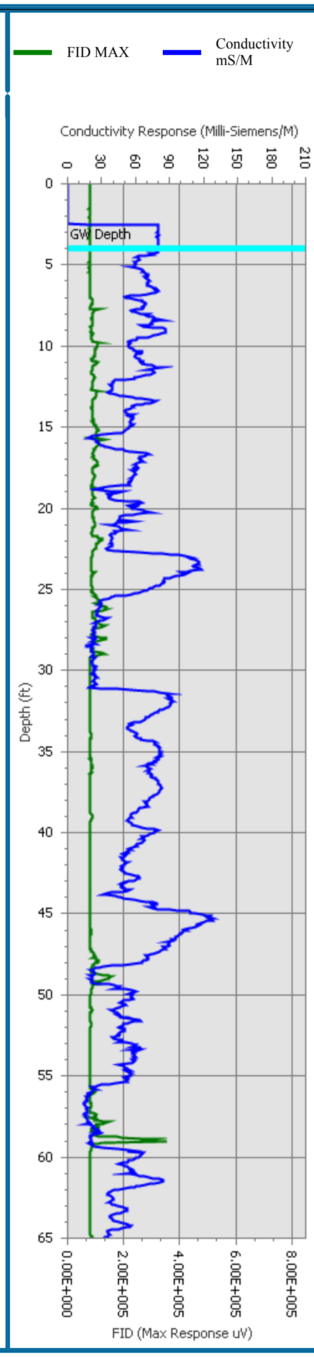
Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

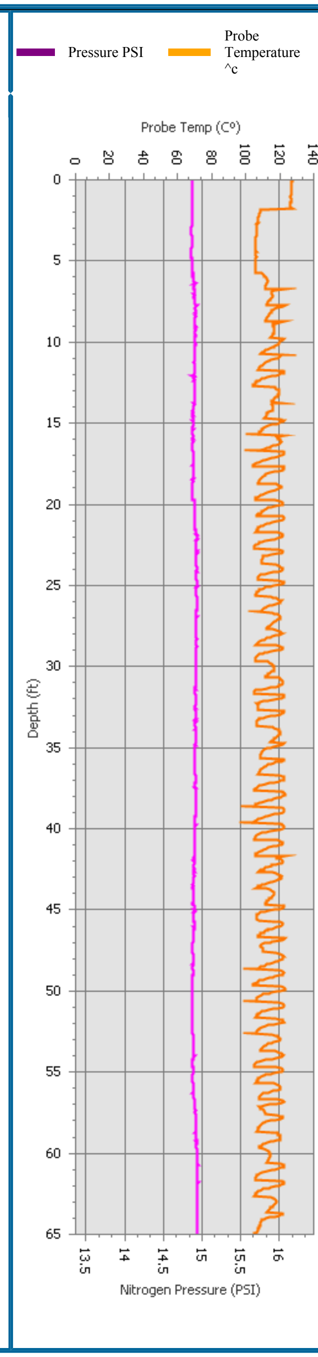
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 07 2010 09:09
Probe Type :	6520	End Boring Time :	Wed Apr 07 2010 10:17
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul









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Boring Name : 28MIP-12

Total Depth (ft): 65.55

Notes: **Traffic Island. Hand auger to 5 feet bgs.**

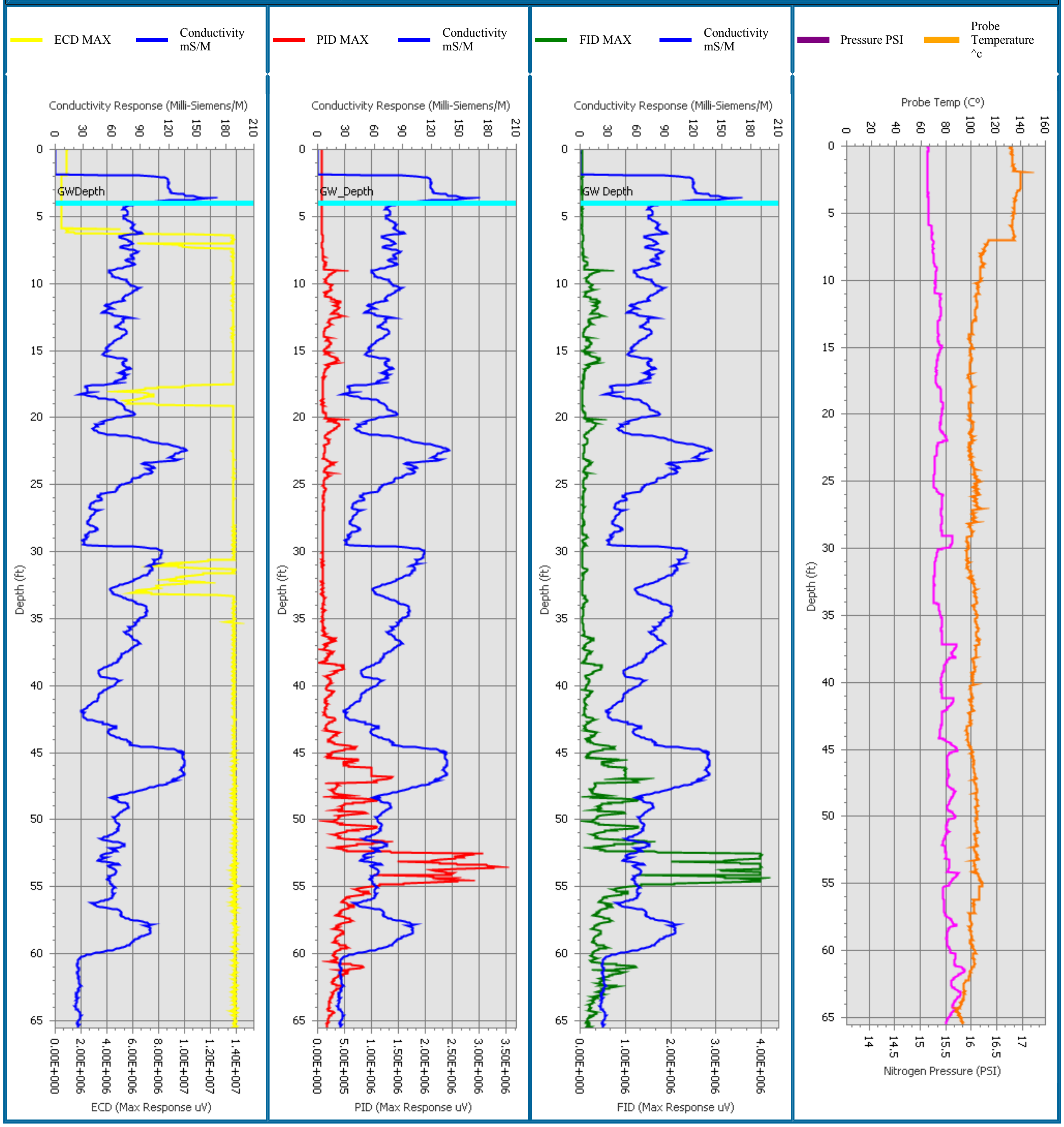
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Apr 13 2010 08:30
Probe Type :	6520	End Boring Time :	Tue Apr 13 2010 09:37
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



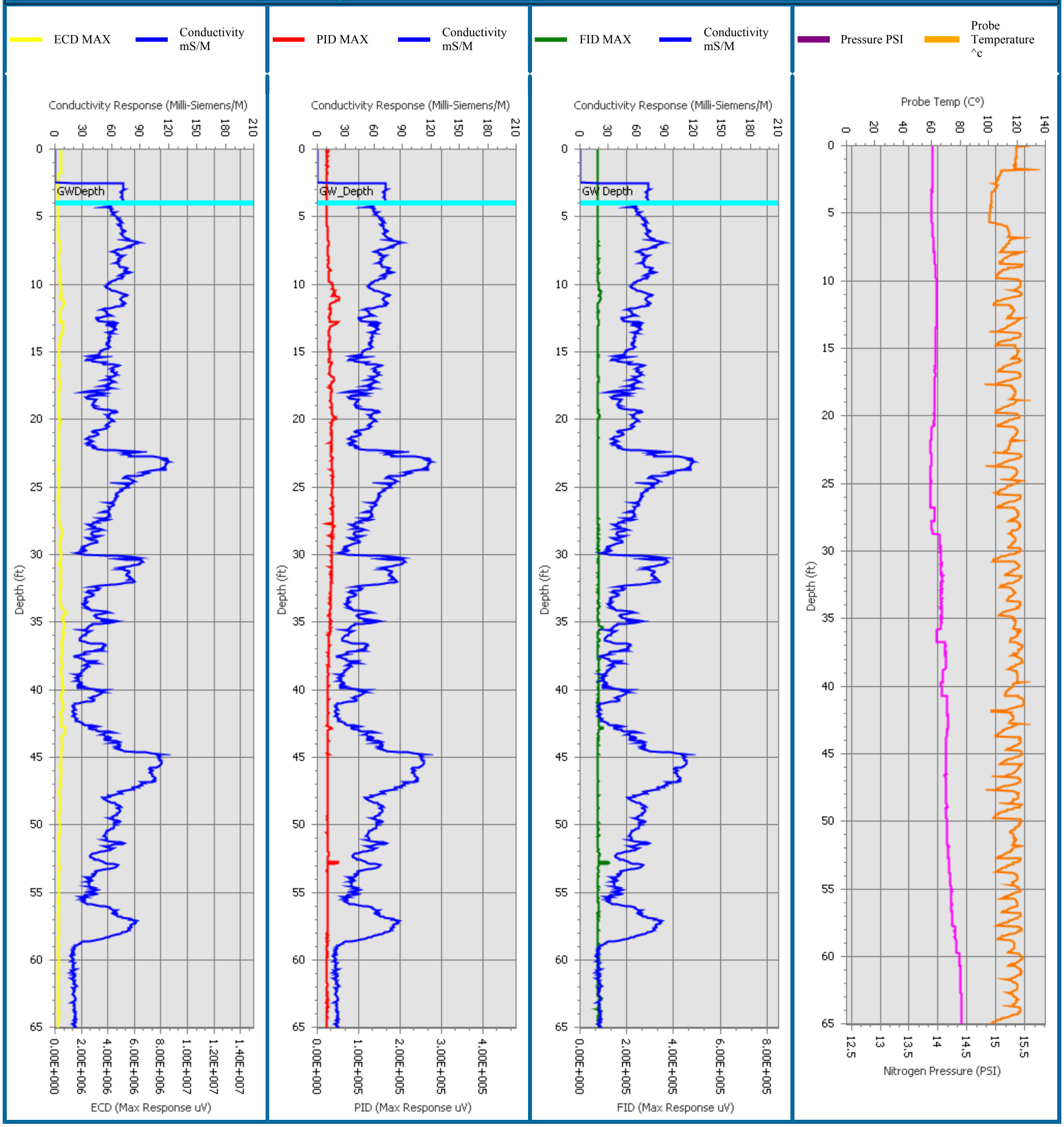
5292 Pacheco Blvd Pacheco, CA 94553 P: 925-521-1490 F: 925-521-1494 www.vironex.com	**Boring Name : 28MIP-13**	**Total Depth (ft): 65.05**
	Notes: **Traffic Island. Hand auger to 5 feet bgs.**	**GW Detph (Ft)** 4 **Depth of GW Provided by Client**

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Mon Apr 12 2010 13:01
Probe Type :	6520	End Boring Time :	Mon Apr 12 2010 14:05
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



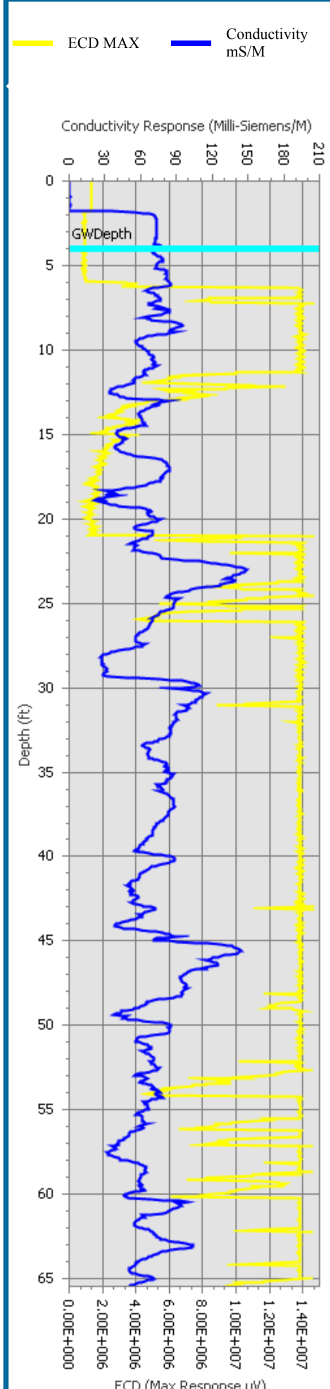
Vironex.com Environmental Field Services 5292 Pacheco Blvd Pacheco, CA 94553 P: 925-521-1490 F: 925-521-1494 www.vironex.com	**Boring Name : 28MIP-14**		**Total Depth (ft): 65.45**
	Notes: **Traffic Island. Hand auger to 5 feet bgs.**		**GW Detph (Ft) 4** **Depth of GW Provided by Client**

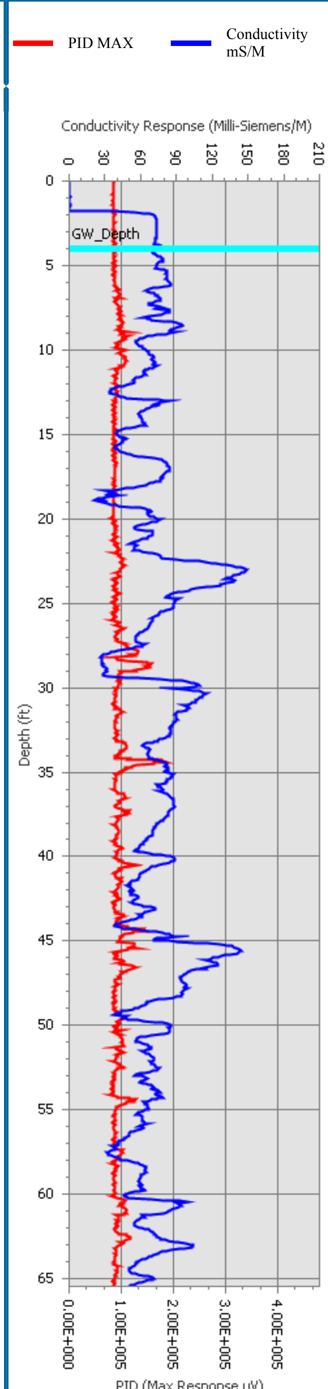
Job Information

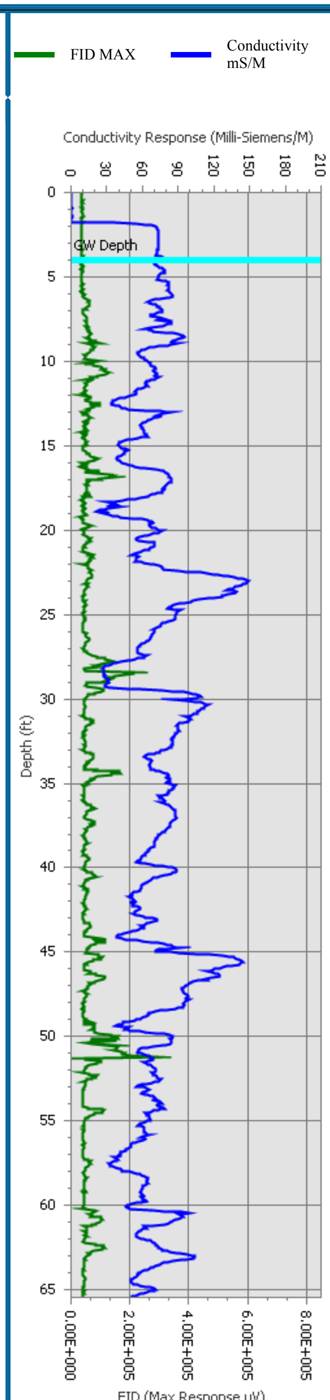
Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

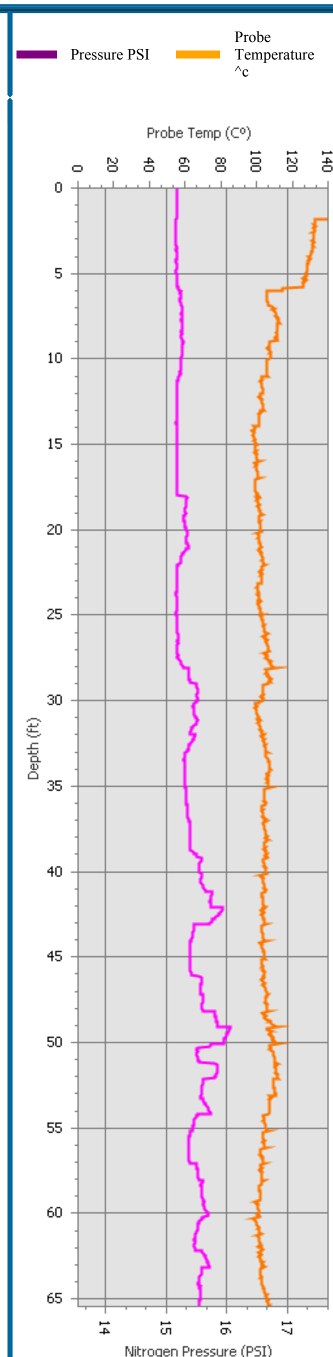
MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Tue Apr 13 2010 10:33
Probe Type :	6520	End Boring Time :	Tue Apr 13 2010 11:37
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi









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Boring Name : 28MIP-15

Total Depth (ft): 64.95

Notes: Traffic Island. Hand auger to 5 feet.

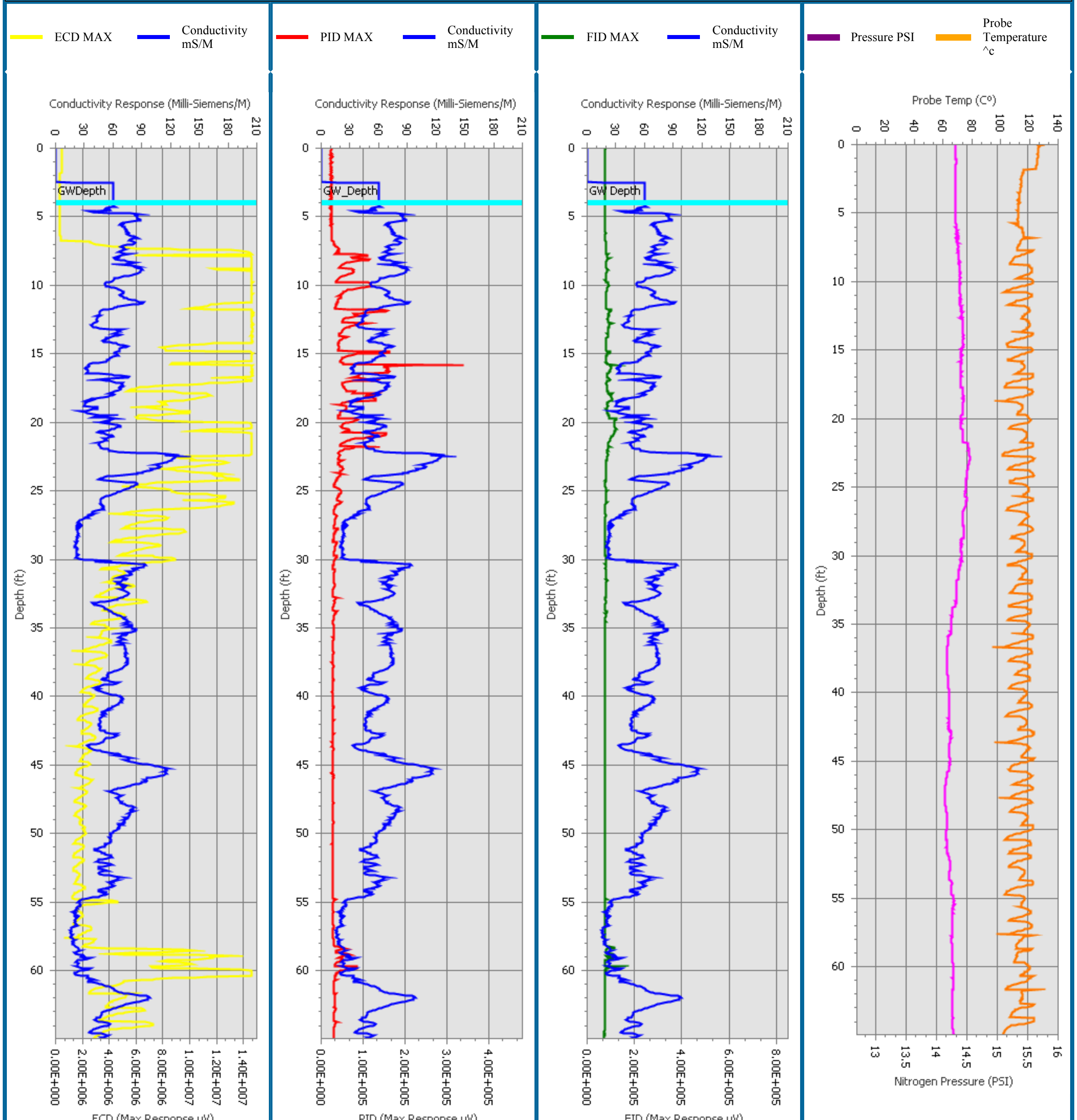
GW Detph (Ft) 4
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Mon Apr 12 2010 10:21
Probe Type :	6520	End Boring Time :	Mon Apr 12 2010 11:25
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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F: 925-521-1494
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Boring Name : 28MIP-16

Total Depth (ft): 64.75

Notes: **Traffic Island. Hand auger to 8 feet bgs.**

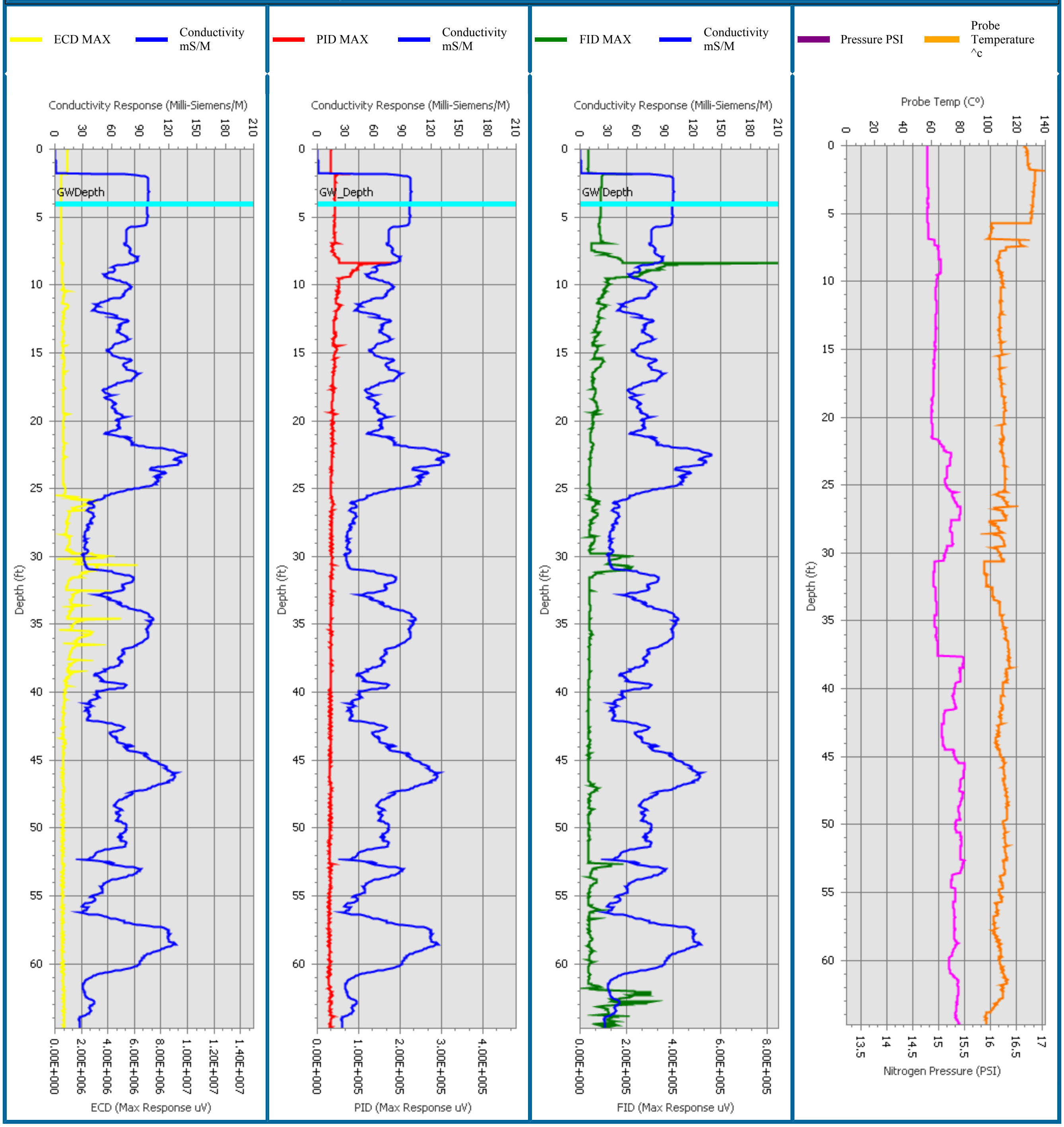
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Mar 31 2010 13:41
Probe Type :	6520	End Boring Time :	Wed Mar 31 2010 14:47
Rig Type :	Geoprobe 6600	MIP Specialist :	Frank Stolfi



Boring Name : 28MIP-17

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Total Depth (ft): 65.05

Notes: **Traffic Island. Hand auger to 5 feet.**

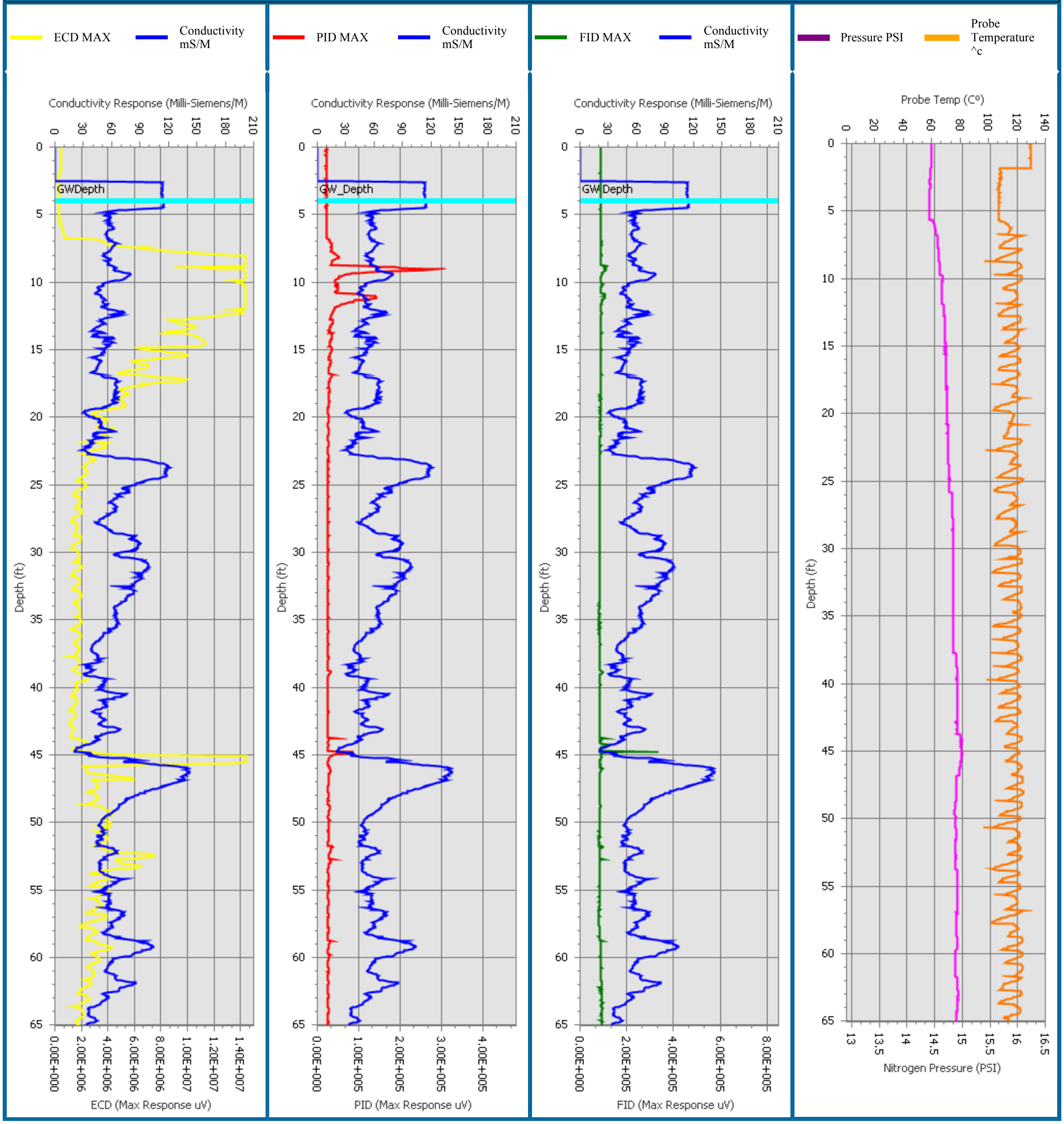
GW Detph (Ft) 4
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Mon Apr 12 2010 08:17
Probe Type :	6520	End Boring Time :	Mon Apr 12 2010 09:21
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Boring Name : 28MIP-34

Total Depth (ft): 65

Notes: **Traffic Island. Hand auger to 5 feet bgs.**

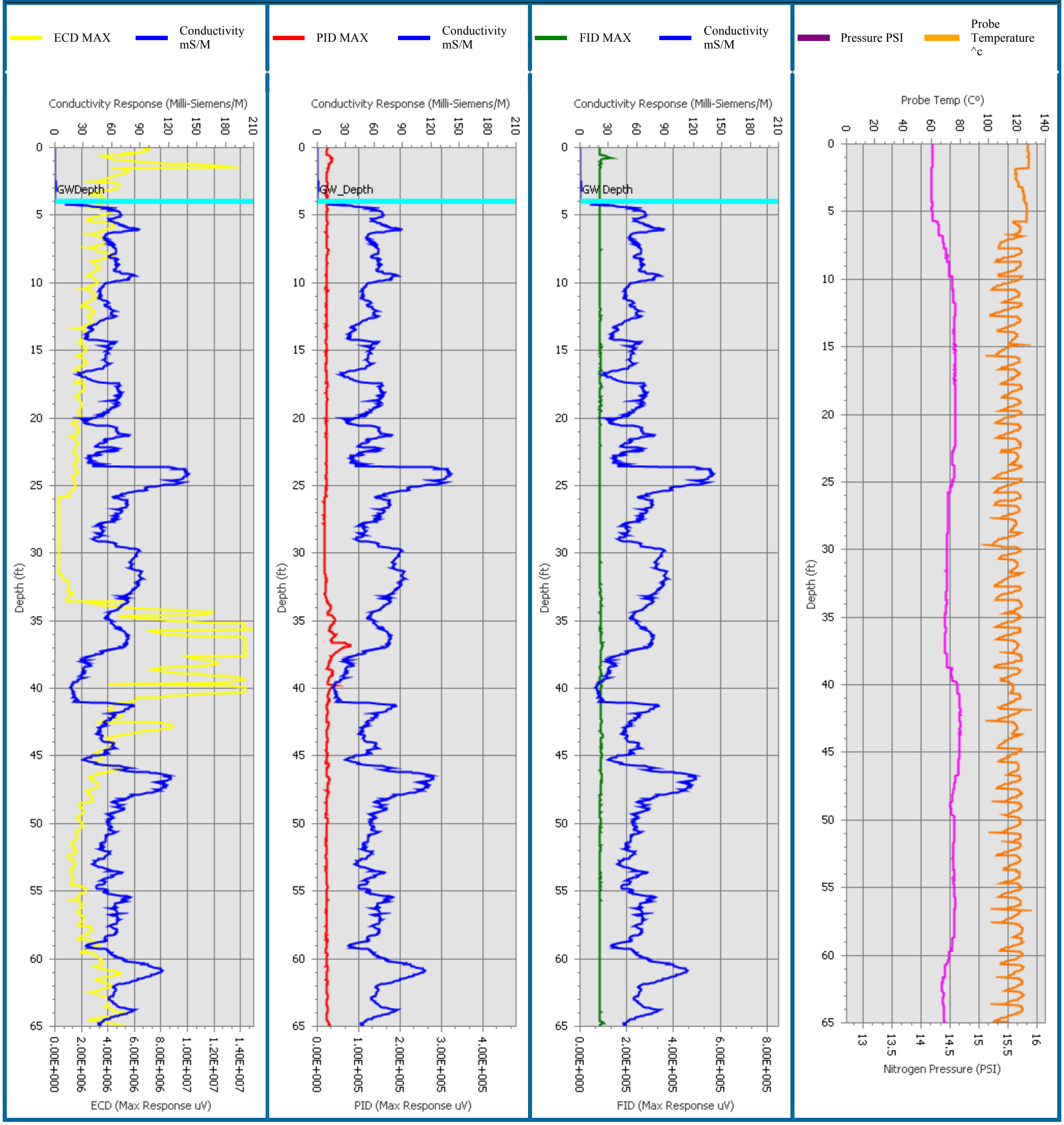
GW Detph (Ft) **4**
Depth of GW Provided by Client

Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 14 2010 08:06
Probe Type :	6520	End Boring Time :	Wed Apr 14 2010 09:09
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul



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Pacheco, CA 94553
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F: 925-521-1494
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Boring Name : 28MIP-35

Total Depth (ft): 65.05

Notes: **Traffic Island. Hand auger to 5 feet bgs.**

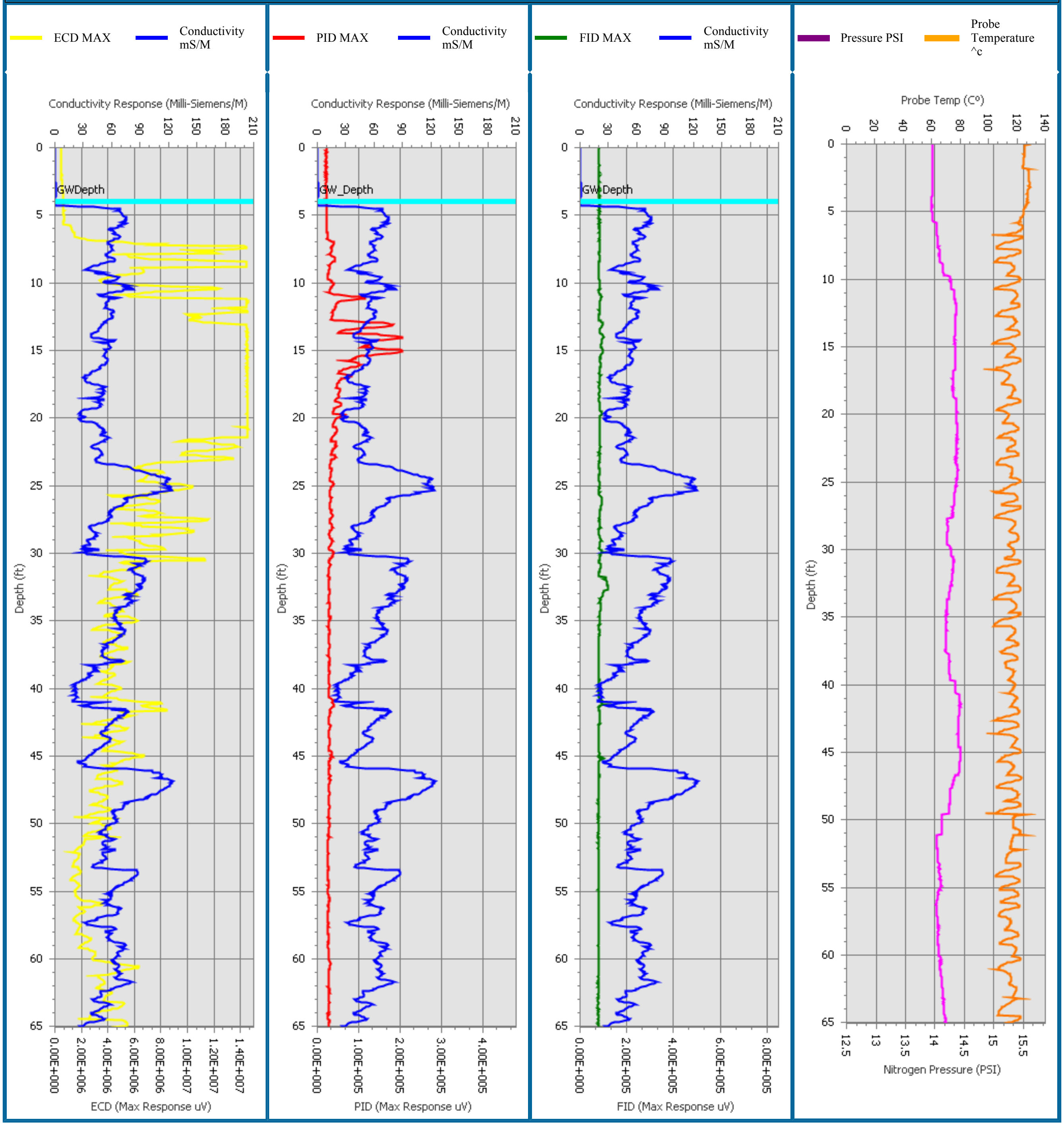
GW Detph (Ft) **4**
Depth of GW Provided by Client

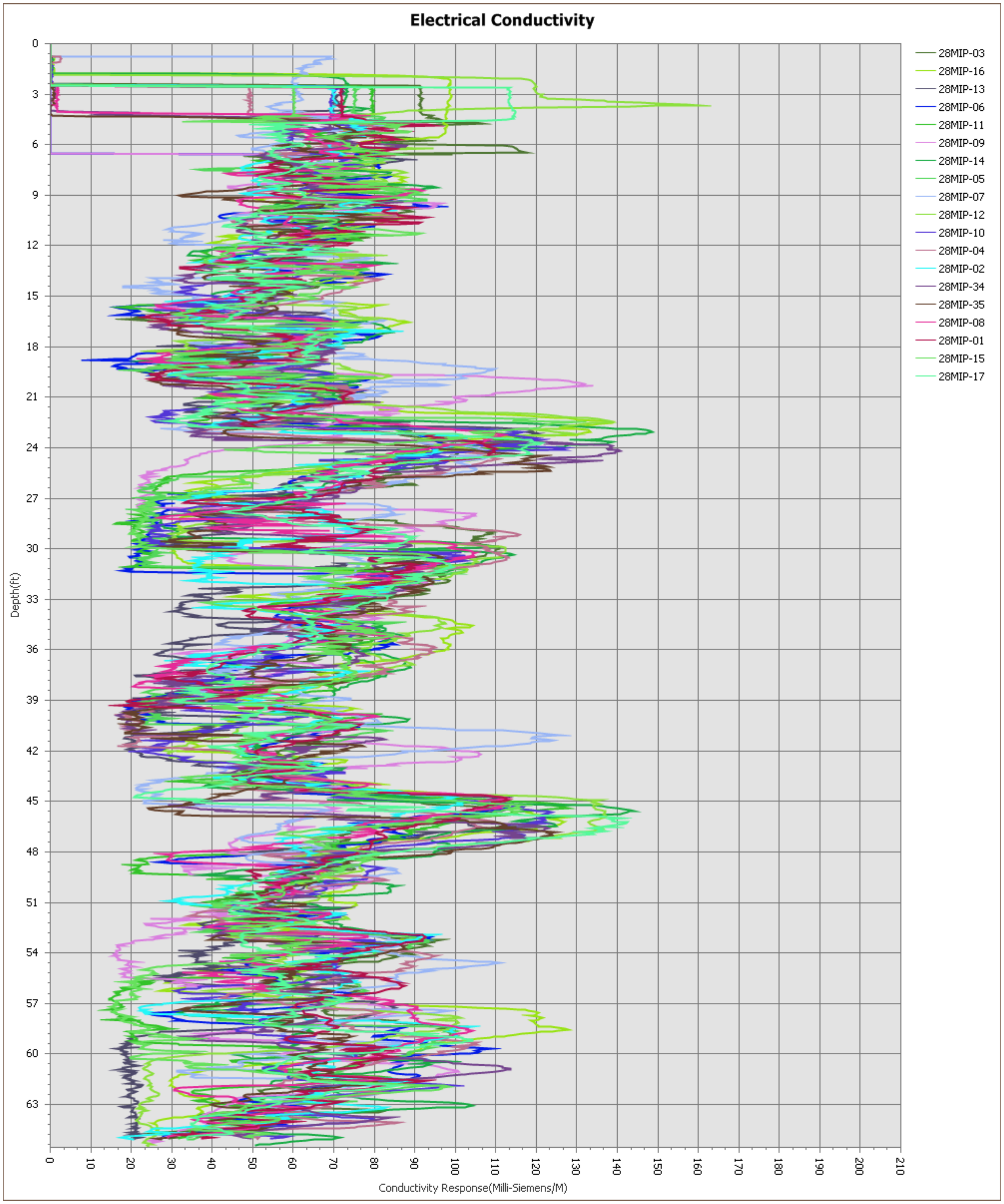
Job Information

Client Company :	Shaw Environmental and Infrastructure
Project Name :	CT04 MIP Biotic/Abiotic TS
Site Address :	Wescoat & Severyns Ave, Mountain View, CA

MIP Sampling Information

Trunkline length :	150	Start Boring Time :	Wed Apr 14 2010 09:52
Probe Type :	6520	End Boring Time :	Wed Apr 14 2010 11:06
Rig Type :	Geoprobe 6600	MIP Specialist :	Jeff Paul





Electrical Conductivity
Depth(ft)
Conductivity Response(Milli-Siemens/M)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
51
54
57
60
63
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
28MIP-03
28MIP-16
28MIP-13
28MIP-06
28MIP-11
28MIP-09
28MIP-14
28MIP-05
28MIP-07
28MIP-12
28MIP-10
28MIP-04
28MIP-02
28MIP-34
28MIP-35
28MIP-08
28MIP-01
28MIP-15
28MIP-17