SOIL REMEDIAL ACTION PLAN

DEFENSE FUEL SUPPORT POINT NORWALK
15306 Norwalk Boulevard
Norwalk, California

04-NDLA-007

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LIST OF ACRONYMS

DLA	Defense Logistics Agency
SGI	The Source Group, Inc.
DFSP	Defense Fuel Support Point
LARWQCB	California Regional Water Quality Control Board, Los Angeles Region
JP-5	Jet Propellant Number 5
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
MTBE	Methyl tertiary-Butyl Ether
TBA	Tertiary-Butyl alcohol
SFPP	Santa Fe Pacific Pipelines Partners, L.P.
SVE	Soil Vapor Extraction
GWE	Groundwater Extraction
LNAPL	Light Non-Aqueous Phase Liquid
VES	Soil Vapor Extraction System
GWETS	Groundwater Extraction and Treatment System
GAC	Granular Activated Carbon
VOCs	Volatile Organic Compounds
SCAQMD	South Coast Air Quality Management District
NPDES	National Pollutant Discharge Elimination System
OM&M	Operations, Maintenance, and Monitoring
ELAP	Environmental Laboratory Accreditation Program
TPH	Total Petroleum Hydrocarbons
EPA	United States Environmental Protection Agency
TPHg	Total Petroleum Hydrocarbons as Gasoline
TPHd	Total Petroleum Hydrocarbons as Diesel
SM	Standard Method
MBAS	Methylene Blue Active Substances
BOD	Biological oxygen demand
DTP	Depth to Product
DTW	Depth to Groundwater
TOC	Top of Casing
gpm	Gallons per Minute
PID	Photoionization Detector

1.0 INTRODUCTION

On behalf of our client, Defense Logistics Agency - Energy (DLA Energy), The Source Group, Inc. (SGI) is submitting this *Soil Remedial Action Plan (Soil RAP*) for the Defense Fuel Support Point (DFSP) Norwalk facility, located at 15306 Norwalk Boulevard, Norwalk, California (Figure 1). Strategies for the remediation of contaminated soil and associated soil gas present at the site will be discussed herein. A separate remedial action plan for the restoration of groundwater will be submitted at a later date. The "decoupling" of the remedial action plans for soil and groundwater was presented to and discussed with the Los Angeles Regional Water Quality Control Board (RWQCB) in a meeting held in their offices on November 21, 2014; a representative of the city of Norwalk was in attendance at that meeting.

The following summarizes the soil remediation approach described in this Soil RAP:

- Expansion of the remedial actions described in Parsons' RWQCB-approved Conceptual Site Model (CSM);
- Refinement of areas of shallow (0 to 10 feet) soil to be remediated in accordance with Parsons' January 29, 2014, presentation to the RWQCB;
- Excavation and biotreatment of shallow soil (0 to 10 feet) to meet numeric cleanup gaoslprovided by the RWQCB;
- After cleanup goals have been reached, treated soil will be reused on Site in accordance with the conditions of a Waste Discharge Requirement permit to be issued by the RWQCB;
- Extension of some excavations to groundwater to remove soils that contribute to the degradation of groundwater. Not all deeper soils with contaminant concentrations exceeding cleanup goals will be excavated; the residual concentrations of contaminants will be treated via traditional *in situ* methods (e.g., vapor extraction); and
- Treatment of shallow "oily sand" present near the former oil/water clarifier.

1.1 Background to this Soil Remedial Action Plan

In a letter dated October 17, 2014, RWQCB requested the preparation of a revised Remedial Action Plan and Soil Management Plan. This Soil RAP is the second revision to the original RAP for DFSP Norwalk that was submitted in 1995 by Groundwater Technology Services, Inc. Parsons submitted the first revision in 2006. Parsons submitted a letter on January 10, 2012, as a progress update on the implementation of the 2006 RAP.

In 2013, Parsons prepared a conceptual site model (CSM) describing the occurrence of contaminants of concern (principally petroleum hydrocarbons) present as adsorbed phase contaminants in vadose zone soil, dissolved in groundwater, and as light non-aqueous phase liquid (LNAPL) in the saturated zone. The *Conceptual Site Model and Remedial Action Evaluation for Soil, Groundwater, and LNAPL* (Remedial Plan; Parsons, 2013a) was approved by the RWQCB on February 26, 2014; a copy of the CSM is included in Appendix A.

Based on the evaluation of the relative cost, technology effectiveness, typical timeframe required for treatment, implementability, and third-party impacts for each of the potentially applicable screening technologies, the CSM included plans for the remediation of the upper 10 feet of soil by excavating the soil and transporting the soil for off-site disposal. The removal of the upper 10 feet of soil would be done in accordance with site cleanup goals negotiated with the RWQCB that would allow sale or conveyance of the property to either a developer or to the city of Norwalk for redevelopment of a portion of the site as a public park.

In addition to the excavation and off-site disposal of the upper 10 feet of soil, the 2013 CSM included strategies for the remediation of the remaining contaminants present in the deeper soil. These strategies entailed the *in situ* treatment of remaining contaminated soil through the use of deep soil mixing and oxidants. The oxidants were proposed to serve as a mechanism for accelerating the degradation of the deeper contaminants.

The purpose of this Soil RAP is to update the planned remedial actions based on the CSM, and formally incorporate modifications to the accepted remedies identified in the CSM. The following table provides a summary of remedial activities described in the 2013 CSM and DLA Energy's proposed remedial strategy. Please note that for completeness, strategies designed for groundwater are included in Table 1. However, as discussed above, this Soil RAP pertains specifically to the restoration of soil at the site; a separate, forthcoming groundwater RAP will provide details regarding future strategies for remediating contaminated groundwater.

Table 1: Comparison of CSM Selected Remedies and Current RAP Remedies

Media	Parsons' 2013 CSM Proposed Remedy	SGI 2014 Revised RAP Proposed Remedy
Groundwater *	Continued operation of Groundwater Treatment System	No Change
Groundwater *	In-Situ Chemical Oxidation Pilot Study	No Change
Soil 0' to 10' Remedy	Excavation	No Change
Soil 0' to 10' Disposition	Off-site Disposal	On-site, *ex situ* treatment (minimal off-site disposal may be required)
Contaminated Soil 10' to groundwater	Vadose zone soil mixing with ISCO, if pilot study at former AST 80008 demonstrates effectiveness	Where applicable, continue excavation to groundwater with ex-situ treatment of soil

(* Groundwater remedies will be discussed in detail in a separate Groundwater Remedial Action Plan)

The purpose of Parsons' CSM was to summarize and integrate all information relevant to fuel products released into the environment, and the physical, biological, and chemical processes that determine the transport of these contaminants to environmental receptors. The CSM also presented information on the remedial strategies employed to mitigate those risks. Accordingly, the CSM included a comprehensive evaluation of existing remediation systems. Further remedial alternatives were evaluated and remedies were selected. As a result, the CSM serves as the foundation of this RAP revision.

Previous investigations, physical and source characterization, and current system performance will be summarized in this document. For a more detailed description of previous site assessment and current remedial efforts the readers are referred to Parsons' 2013 CSM. Additionally, this Soil RAP will not revisit all the remedial alternatives and selection criteria except to provide additional information as to why the approach to a specific remedy has been modified, when appropriate.

1.2 Site Description and Background

The DFSP Norwalk site encompasses approximately 50 acres. Figure 2 is a site map showing historical features. The facility is currently bordered on the north, south, and west by residential properties and on the east by a city park (Holifield Park). The DFSP Norwalk facility was constructed in 1923 and was operated by at least four owners, including Tidewater Oil, Jolly Oil Company, Wilshire Oil, and Texaco until it was acquired by the Air Force in 1951. In 1951, the Air Force added manifolds, gravel sumps, truck loading racks and aboveground and underground piping. The gravel sumps were located next to each storage tank and believed to have been used as discharge points for water drawn from the bottom of the tanks. Facility ownership was transferred from the Air Force to the DLA Energy in 1968.

The site previously contained ten 80,000-barrel and two 55,000-barrel aboveground storage tanks (ASTs) that were used to store and distribute jet propellants 5 and 8 (JP-5 and JP-8). Aviation gasoline and JP-4 were also reportedly stored at the site. The former truck-loading racks are located in the south-central portion of the site and occupy approximately one acre. In the past, fuel was transferred from the facility via tanker trucks filled at the loading racks, but by the early 1990s, jet fuel was no longer being routinely transferred from the facility via tanker trucks. Subsequently, a 10-inch-diameter, government-owned, multi-product pipeline carried fuel from DFSP San Pedro to DFSP Norwalk and a 6-inch diameter pipeline carried fuel from DFSP Norwalk to the former El Toro Marine Corp Air Station. Investigations at the site found that releases had occurred at several locations at the facility.

The site was decomissioned in 1999 and the ASTs were drained, cleaned, and marine- chemist certified. Within the tank farm, the individual tank lateral pipes were drained, disconnected, and individually cleaned. The main pipe laterals running from the Powerine Basin to the Air Force and El Toro manifolds were also drained and individually cleaned.

The ASTs, concrete pads, and connecting pipeline systems were demolished and removed in 2011 and 2012. Following removal of the tanks and pads, soil confirmation samples were collected from beneath the AST locations and included in the *Concrete Demolition and Soil Confirmation Sampling Completion Report* (Parsons, 2013b).

Santa Fe Pacific Pipelines, L.P. (SFPP), an operating partner of Kinder Morgan Energy Partners, L.P. (KMEP) leases portions of DFSP Norwalk. The lease includes pipeline easements that traverse the southern and eastern property lines. An-out-of-service pump station located along the southern, central property boundary occupies approximately 2 acres. The pump station has been decommissioned but three pipelines remain in service. KMEP is currently responsible for the operation and maintenance of a remediation system that is cleaning affected soils and groundwater underlying and extending laterally from the SFPP pump station lease area and in the vicinity of a 24-inch block valve located in the southeast corner of the DFSP Norwalk facility.

1.3 Scope of Proposed Remedial Actions

The scope of this Soil RAP is compatible with Parsons' 2013 CSM and previous remediation strategies that were designed to treat source-area contaminated soil and to treat residual concentrations of petroleum hydrocarbons in deeper soil and groundwater. Previous site assessments have identified soil contamination at various locations throughout the facility. This Soil RAP is intended to provide the RWQCB with details of the proposed approach to remediate vadose zone soils that have been affected by past site operations.

This Soil RAP will be applied to soil contamination associated with the tank farm area, the Powerine basin, the vehicle maintenance area to the east, the former truck rack, the water tank area near the truck fill stand (TFS), the holding/settling pond in the northeastern corner, the pump control house to the west, and shallow oily sands located adjacent to the former oil/water separator.

The site has been characterized extensively with the resulting data indicating that soil and groundwater in the above-mentioned areas are impacted with hydrocarbons mainly consisting of JP-4, JP-5 and JP-8, and benzene, toluene, ethylbenzene and xylenes (BTEX).

For completeness, it should be mentioned that, to a lessor degree, methyl tertiary-butyl ether (MTBE), tertiary-butyl alcohol (TBA), and 1,2-dichloroethane (1,2-DCA) are present in some locations at the site. However, the fuel oxygenates MTBE and TBA and the fuel additive 1,2-DCA occur in soil and groundwater at and proximal to SFPP operations, and remediation of these impacts is being addressed by SFPP. Nevertheless, the proposed remedial actions to be performed by DLA Energy and as described in this RAP will be effective at remediating any fuel oxygenates contained in soil and groundwater located in DLA Energy controlled areas of the site; 1,2-DCA is not present in the soil to be treated.

Figure 2-2 from the CSM (Appendix A of this Soil RAP) depicts the areas of concern (AOC) and also identifies the boundaries of the conceptual site model associated with remedial actions as identified in the CSM and this RAP. Areas outside those boundaries are actively being remediated under the management of SFPP.

A maximum of 100,000 cubic yards of soil exceeding site cleanup goals will be excavated for either on-site treatment (the majority of the soil) or transport to an off site facility for treatment or disposal (less than 2% of the soil); soils to be transported off-site will include soils containing a high degree of debris or containing recalcitrant contaminants (such as heavily degraded, tarry soil) that will make on-site treatment challenging.

1.4 Updates to the CSM contained in the Revised RAP

Table 1 provides a summary of the primary differences between the Parsons' 2013 CSM and remedial strategy as proposed in this revised RAP.

The CSM developed conceptual site models for soil, soil vapor, groundwater, and LNAPL by integrating all historical site investigation data. Included in the CSM were evaluations of current remediation remedies, evaluated alternatives, and selected remedies for the path forward to meet cleanup goals. In general, this Soil RAP adopts the conclusions of the CSM with some variations to the final approach. The most significant modifications to the remedial approach result from the fundamental decisions to:

1. Treat excavated soil on site as an alternative to the transport and off-site disposal of contaminated soil; and
2. The use of treated soil as backfill; import soil is not expected to be required.

1.5 Soil Remediation Objectives

The objectives of the soil remediation actions described in this Soil RAP are:

- Obtain "clean" no further action closure for shallow soils (<10 feet);
- Remove accessible deeper contaminated soil that is a continuing source of groundwater degradation; and
- Where practical and safe, extend deepest excavations to groundwater to remove contaminated source-area and smear-zone soil.

To the extent practical, existing remediation processes (vapor extraction using horizontal vapor extraction wells) will be operated to continue the reduction of site contaminant mass while implementing this Soil RAP. By remediating the upper 10 feet of soil, the eastern one-third of the site will be readied for conveyance to the city of Norwalk for use as parkland and the remaining land for conveyance by the Air Force/General Services Agency (GSA) for future commercial redevelopment.

2.0 SITE GEOLOGY AND HYDROGEOLOGY

2.1 Site Geology

DFSP Norwalk is located between the Montebello Forebay and the Downey Plain in the Central Basin pressure area. Approximately 50 to 60 feet of alluvium (primarily sand, gravel, silt, and clay) cover the underlying Lakewood Formation in this area. Alluvial sediments exposed in the area of the site include mixtures and layers of sand, gravel, silt, and clay. The underlying Lakewood Formation consists of marine and continental gravel, sand, silt, and clay deposits, under which the San Pedro Formation, approximately 300 feet below grade, consists of marine and continental gravel, sandy silt, silt, and clay deposits.

Lithologic logs of borings drilled during previous investigations indicate that sediments beneath the site consist of clayey silt, sandy silt, silty sand, fine- to coarse-grained sand, and deeper coarse-grained sand with granitic cobbles. The top of a clay layer, preliminarily identified as the uppermost sediment layer of the Bellflower Aquitard, was encountered at a depth of approximately 55 to 65 feet during previous investigations.

2.2 Site Hydrogeology

A shallow semiperched aquifer, consisting of silt and fine- to coarse-grained sand, exists in the alluvial sediments underlying the site. Groundwater from this semiperched aquifer was reported to occur between 24 and 34 feet bgs and has been declining recently in response to the ongoing California drought. The water level data indicate that the static groundwater gradient within this aquifer is generally toward the northwest, but is contained by the active groundwater extraction systems operating at the site. This shallow aquifer is approximately 30 to 35 feet thick based on the reported presence of a clay layer at approximately 55 to 65 feet below grade. The Exposition Aquifer underlies the Bellflower Aquitard. Groundwater depths within the Exposition Aquifer range between 49 and 56 feet below grade with a reported gradient toward the southeast.

3.0 SUMMARY OF CURRENT SITE CONDITIONS AND REMEDIAL EFFORTS

A detailed and comprehensive summary of previous and recent investigations is included in the CSM. Details of investigation within specific areas and the associate findings are explained in the CSM. This section provides a summary of current site conditions.

The subsurface soil and groundwater in and around the DFSP Norwalk facility have been extensively studied. Since 1986, environmental assessments and remedial actions have been performed at the site by several consultants on behalf of DLA Energy. During these investigations, wells were installed for monitoring and as components of groundwater remediation activities. These investigations evaluated and defined the extent of liquid-phase, adsorbed-phase, soil vapor, and dissolved-phase hydrocarbons in soil and groundwater beneath the site and off site to the south, west, and east.

As previously discussed, the soil and groundwater AOC's are impacted with hydrocarbons mainly consisting of jet propellants 5 and 8 (JP-4 and JP-5), methyl-tertiary butyl ether (MTBE); and benzene, toluene, ethylbenzene and total xylenes (BTEX), with TBA and 1,2-DCA present at the site but being addressed by SFPP. Remediation systems were installed to treat these hydrocarbon impacts in soil and groundwater.

In addition to soils contaminated by site fuel handling operations, an area of buried "oily sands" is present in the southwestern portion of the site. Previously, DLA Energy successfully petitioned the Los Angeles Regional Water Quality Control Board (RWQCB) for no-further action status of this material. At the time, it was demonstrated that, in spite of high concentrations of petroleum hydrocarbons present in the oily sands (with concentrations in excess of 50,000 milligrams per kilogram – mg/kg), the hydrocarbons were not mobile nor very volatile and thus did not represent a risk to site use as a petroleum storage facility or to groundwater. However, the presence of the approximately 6,000 cubic yards of the material, at a depth as shallow as 3 feet below the surface, covering nearly an acre, impedes future development of the site.

The remediation of soil and groundwater and the removal of light non-aqueous phase liquids (LNAPL, also referred to as free phase hydrocarbons or free product) has been ongoing since 1994 and has resulted in the removal and containment of the majority of the LNAPL from the shallow aquifer and the removal and destruction of thousands of pounds of hydrocarbons present in soil and groundwater using extractive and *in situ* treatment methods.

However, a significant mass of hydrocarbons remains present in shallow and deep soil. The presence of hydrocarbons in the shallow soil limits the reuse of the site. The presence of hydrocarbons in the deeper soils remains a source of potential further groundwater contamination. To achieve the short-term goal of readying the site for redevelopment and re-use and to reach the ultimate goal of obtaining closure from the RWQCB, a change in remedial approach was deemed necessary.

3.1 Site Investigations

Previous investigations evaluated and defined the extent of liquid-phase, adsorbed-phase, and dissolved-phase hydrocarbons in soil and groundwater beneath the site and off site to the south, west, and east. There is more than adequate understanding of the types of contaminants and their vertical and areal distribution both on and off of the DFSP Norwalk facility. Figure 2-2 of the CSM shows the primary areas of concern as identified as north-central, eastern, water tank, and truck loading area. Figure 2-3 of the CSM presents a map showing soil sampling locations conducted by Parsons between 2009 and 2013.

3.1.1 Aboveground Storage Tank Farm Area

The Powerine Basin is located in the north-central portion of the facility in between former ASTs 80002 and 80004. The Powerine Basin was historically used as an effluent discharge area for the previous oil-water separator. Effluent discharge ceased in 1982, when the current oil-water separator (near the oily waste area) was brought on line. An abandoned water well in the Powerine Basin was found to contain JP-5 fuel; in 1981, approximately two barrels of product was extracted from the well, and the well was abandoned under supervision of State personnel. The Powerine Basin also contained a 500-gallon UST used for storage of jet fuel. The steel tank was removed in December 2005 during which the integrity of the tank was observed to be satisfactory. Furthermore, no staining or discoloration of soil was observed on the sidewalls of the bottom of the UST excavation.

Within the tank farm area, the earliest recorded release occurred in 1968 when an unknown quantity of unspecified petroleum product was released from a former slop tank located adjacent to AST 55003. In 1996, site remediation activities in the tank farm area were initiated. The remediation system consisted of an SVE system, and a free-product removal and groundwater extraction treatment (FPR/GWT) system. The SVE system became fully operational in May 1996, and the FPR/GWT system began full time operation in June 1996.

In July 1998, GTI identified the western portion of the facility, where the southern and northern plumes commingle, and the northwestern corner of the site as main areas of concern for optimization of mass removal and for containment and recovery of the dissolved-phase plume.

In May 1999, a Rapid Optical Screening Tool (ROST) analysis was conducted to assess the hydrocarbon impacts in the subsurface zone. Additionally, the locations of the cone penetrometer test (CPT) locations CPT-1 through CPT-10, and direct-push (DP) technology locations DP-10 through DP-51 were assessed for the presence of petroleum hydrocarbons in soil in the northern tank farm area and for evaluating the success of remedial efforts conducted in this area since May 1996. In addition, soil sample collection for chemical, physical, and/or biological analysis using DP technology at 57 locations in the tank farm area were conducted. It was concluded that the bulk of the remaining contamination was found to occur at and below the groundwater surface.

The initial remediation system consisted of 16 vertical total fluid recovery wells (TF-8 through TF-11, and TF-13 through TF-24); eight vertical groundwater recovery wells (GW-1 through GW-7, and GW-12); two 30-foot deep vertical vapor extraction wells (VE-01 and VE-02); and four horizontal vapor extraction wells (HW-1, HW-3, HW-5 and HW-7).

In November 2003, Parsons evaluated the effectiveness of the remediation systems targeting the central-plume area at the site. Performance of the SVE and thermal oxidation system, the groundwater pumping system, the TFE system, and the biosparge system were assessed during this evaluation. Based on the observed results, Parsons recommended expanding biosparging to enhance aerobic biodegradation within the dissolved-phase plume by optimizing total fluid recovery; continuing vapor extraction from the horizontal wells with treatment through the thermal oxidizer; allowing periodic monitoring of the horizontal vapor extraction wells remedial progress; and installing vapor monitoring probes (VMP) in selected areas containing elevated soil vapor concentrations.

In August 2004, ten sparge points were installed within the tank farm area near ASTs 80002, 80006, and 80007 and were connected to the existing central plume SVE treatment system located in the northern portion of the facility. Nine additional biosparge wells were installed in the eastern boundary near monitoring wells GMW-60 and GMW-61 to treat the dissolved hydrocarbon plume in this area.

In 2004, the SVE system was expanded and 12 VEWs and 16 multiple-depth VMPs were installed to treat and monitor impacted soils below the ASTs and were connected with other targeted cleanup areas to the existing central plume and truck fueling area SVE treatment system. An additional 28 vertical soil borings within and around the tanks and 11 angled borings underneath the tanks were installed. In the spring of 2011, the aboveground steel storage tanks were demolished. From May 2011 through October 2012, the concrete AST foundations, all associated tank farm underground concrete structures and piping, asbestos-containing material, pump stations, oil-water separator, storm drain system, fire water/foam prevention system, and the septic tanks were demolished and removed. Subsequently, soil confirmation sampling was conducted from all areas to further define extent of vadose zone impacts (Figure 2-3 of the CSM).

3.1.2 Truck Loading and Water Tank Areas

The truck loading area is located in the south-central portion of the site and occupies approximately one acre. In the past, fuel was transferred from the facility via tanker trucks filled from this area, but in the early 1990s jet fuel was no longer being routinely transferred from the facility via tanker trucks. The discussion below describes the past investigation and remedial activities performed at the truck-fueling and the water tank areas.

In April 1999, a fuel release from an underground pipeline was discovered in the southern area of the facility west of the water tank and north of the truck-loading racks. Approximately 80 cubic yards of impacted soil were removed. In addition to the deeper excavation that exposed the leaking pipe, approximately 1 foot of impacted soil was removed west and south of the water tank. The excavation was backfilled with clean soil in April 1999, and 23 soil samples were collected and analyzed for TPH as JP-5. Fourteen DP samples were analyzed for volatile organic compounds

(VOCs) to assess the impact of fuel releases north of the truck-loading racks. In addition to TPH as JP-5, BTEX compounds were reported in soil samples. Additional field activities were performed in May 1999 that consisted of collecting soil samples at the water tank release area using hand auger and DP technology. It was concluded that the bulk of the remaining contamination was found to occur at and below the groundwater surface.

Additional soil investigation was conducted at the truck loading area in September 2001, during which the vertical extents of hydrocarbon contamination in subsurface soils were evaluated for the truck-filling racks, vehicle maintenance, vapor-recovery UST, and septic tank areas. The extent of commingling of releases from truck-filling racks and other known adjacent sources was also evaluated using data collected from current and previous investigations. During this investigation, 15 DP continuous core samples were logged and sampled in and around the truck-loading area. The investigation at the truck-loading area revealed evidence of past fuel releases. The data suggested that the release occurred at or around the western and central truck-loading islands. An area approximately 80 feet by 260 feet, extending from near the surface to the water table at 28 feet below grade, had been impacted by releases at the truck loading area. The maximum concentrations detected during the September 2001 investigation were between 26 feet and 27 feet below grade at 21,000 milligrams per kilogram (mg/kg) TPH as gasoline (C8-C12) and 10,000 mg/kg TPH as jet fuel. However, the soil data near the eastern-most truck loading island did not indicate that significant releases occurred from that stand.

In 2003, fuel samples were collected from four locations (GMW-4, GMW-10, MW-9, and MW-15) in and around the truck loading area, one from the eastern area (GMW-58), and one from the tank farm area just north of AST 55004 (TF-18). The analytical data for these samples suggested a varying degree of weathered or degraded fuels, and mixtures of fuels already identified as being historically stored or transported on site. The results also indicated the absence of gasoline range hydrocarbons and BTEX constituents, but did indicate the presence of jet fuel hydrocarbons in soils and most likely in groundwater.

In 2004, seven SVE wells and three multi-depth VMPs were installed in the truck loading area and connected via piping to the main SVE system in the north-central site area. The results of the installation, monitoring, and investigation activities were reported in September 2004 (Parsons, 2004). Elevated TPH and VOC concentrations were confirmed within the truck loading area. Other miscellaneous activities at the truck-loading area involved removal and hauling of the 500-gallon UST located near the truck fill rack in June 2004. The thermal oxidizer located to the west of the truck fill rack was also removed at this time.

3.1.3 Eastern and Northeastern Boundary Plume

From 1990 to 1992, several soil borings were installed by Woodward-Clyde at the site. TPH impacts as high as 14,000 mg/kg were observed in the northeastern corner of the site at 3 feet (boring BH103). The TPH impacts were below the laboratory reporting limit at 8 feet below ground surface (bgs) in the same boring. The TPH impacts in the eastern boundary soil borings were all below laboratory reporting limits.

In November 1996, the groundwater monitoring and sampling results indicated elevated levels of free product and dissolved hydrocarbon concentrations in the eastern portion of the site. Monitoring well GMW-48 was reported to contain high dissolved-phase TPH (gasoline range) concentrations. Subsequent to the November 1996 sampling event, monitoring well GMW-48 was found to contain free product with an odor described by the field technician as a "strong gasoline smell." A product sample collected from GMW-48 was interpreted to be JP-4. As a result, a DP technology assessment of the eastern portion was conducted in June 1997. The Parsons sample results suggested a lack of evidence of significant hydrocarbon impacts to soil and groundwater at locations DP-7 through DP-9.

In order to further evaluate the vertical and lateral extent of adsorbed-phase and dissolved-phase hydrocarbon contamination in subsurface soils and groundwater in the northeastern portion of the site, four borings (GMW-56 through GMW-59) were drilled and completed as groundwater monitoring wells in August 1998. To further determine the eastern extent of the plume and to identify whether impacts extend beyond site boundaries, two groundwater monitoring wells (designated GMW-60 and GMW-61) were installed along the eastern site boundary in April 2004. Groundwater within monitoring wells GMW-60 and GMW-61 showed elevated concentrations of TPH and VOCs. Results of TPH as gasoline were higher than TPH as JP-5 or TPH as "fuel product." VOCs included lighter end petroleum compounds typical of gasoline, including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene.

Additional drilling and sampling activities were performed in the northeastern area in July 2004. A total of 12 DP borings were installed to either 10 feet bgs or 20 feet bgs.

TPH as JP-5 was detected in a groundwater sample collected from GMW-60 at 1,100 mg/L. However, BTEX compounds were not detected in the samples. Based on these groundwater sample results, it appeared that there may have been a source of TPH contamination near GMW-60. However, no impacts were detected during the step-out soil investigation conducted west of the well. In July 2005 and August 2006, Parsons performed investigations in the eastern boundary and adjacent off-site area in Holifield Park (Parsons, 2006b). Results indicated generally higher hydrocarbon impacts in deeper groundwater samples collected from 31 to 35 feet bgs than those observed either in the vadose zone soil or the shallower groundwater samples. These deeper groundwater impacts primarily consisted of TPH as fuel product (reported as JP-5 during the July 2005 investigation), TPH as gasoline, and/or BTEX compounds. These groundwater impacts could not be attributed to any specific source. The presence of fuel constituents in the easternmost Hydropunch™ sample (approximately 100 feet from the boundary; B-22) suggested the need for additional groundwater delineation in the area beneath Holifield Park. Data from borings B-12 and B-19 suggested that the extent of impacted groundwater was limited to the north and south. No historical data was available to indicate soil and groundwater impacts east of B-22.

The RWQCB required that DLA Energy further evaluate the occurrence of LNAPL present in off-site groundwater monitoring well GMW-62 (near Holifield Park). Recent gauging of this well showed that greater than one foot of LNAPL is present. Although, recovery of LNAPL is ongoing, additional investigation of the area to the east of GMW-62 is justified to determine whether recoverable LNAPL is present. SGI has submitted a *Revised Work Plan for Further Evaluation of GMW-62 LNAPL Plume* (Work Plan) on behalf of the DLA Energy; final revisions to this work plan are currently being made and field work is expected to begin in early 2015.

3.2 On Going Remedial Actions

A remedial action plan (RAP) was submitted in 1995 for the DFSP Norwalk site (GSI, 1995) and a revised RAP was submitted in 2006 (Parsons, 2006a). The 1995 plan was to address impacts in the shallow aquifer underlying the tank farm only. The purpose of revised 2006 plan was to evaluate whether the objectives of the initial RAP were achieved and to assess the effectiveness of the existing remedial systems.

The DLA Energy has installed remediation systems to treat the hydrocarbon impacted soil and groundwater environmental media. The purposes of these remediation systems are to reduce contaminant concentrations in soil and groundwater to cleanup goals. The ultimate goal is to achieve site closure. The DLA Energy remediation systems at the site consist of soil vapor extraction (SVE), groundwater extraction (GWE), biosparging, localized bioslurping for free product recovery, absorbent sock installations for passive recovery of free product, total fluids extraction (TFE), and soil vapor and groundwater treatment (GWT). DLA Energy is currently conducting GWE in the northwestern corner of the property from two pumping wells (GW-2 and GW-13), and also from two wells (GW-15 and GW-16) in the northeastern area bordering Holifield Park. The purpose of the GWE system is to contain and reduce the extent of the free product and dissolved plumes. SVE is also underway from the four horizontal wells that span the entire former tank farm area and from the northeastern boundary area.

The remediation system operated by SFPP consists of SVE, TFE, GWE, and treatment of extracted soil vapor and groundwater to address three specific areas at and near the site: the south-central area, the southeastern area, and the western area. SFPP discussed their remediation systems and impacted areas in their CSM and proposed an alternative remedy (CH2M HILL, 2013).

3.3 Overview of Active Remedial systems

The remediation technologies utilized at the Site have consisted of soil vapor extraction (SVE), groundwater extraction (GWE), biosparging, and light non-aqueous phase liquid (LNAPL) removal. The remediation system layout (well and piping locations) is presented on Figure 3.

Remedial system optimization is ongoing to ensure most effective operation for cleanup at the site. Effectiveness of remedial measures are reported quarterly.

For the VES, during the second quarter 2014, influent vapor-phase VOC concentrations remained low and reached asymptotic levels. A rebound test of residual soil vapor hydrocarbons was conducted beginning July 9, 2014, after the system had been off-line since May 29, 2014, and confirmed low residual hydrocarbon concentrations.

Groundwater monitoring continues to report an overall lower groundwater elevation and a higher number of wells with measurable free product. The overall area of impacts and plumes were similar to previous events. As indicated by the non-detect, stable, or declining dissolved groundwater analytical data from off-site wells (as illustrated in previous semiannual groundwater monitoring reports) and from the previous aquifer pump testing and groundwater capture zone analysis, the current GWETS with wells in the northeastern area and northwestern corner have been successful in preventing impacted groundwater from flowing off site and have captured and treated a significant portion of impacted groundwater under Holifield Park and in the northwestern corner. GWE in the northwestern and northeastern areas will continue to assist with contaminant containment. Additionally, absorbent sock installation and vacuum truck recovery will continue, as needed, for LNAPL recovery and the use of passive LNAPL skimmers in selected wells will be implemented. The following subsections provide additional detail regarding each remediation system/method and evaluation of effectiveness.

3.3.1 Soil Vapor Extraction System

3.3.1.1 System Description

The SVE well network for hydrocarbon extraction from vadose zone subsurface impacts historically includes wells installed in the following areas as illustrated on Figure 3: AST 80001 area (VEW-23), AST 80006 and 80007 areas (VEW-20, VEW-21, VEW-22, HW-1, and HW-3), AST 80008 area (VEW-24, VEW-25, VEW-26, VEW-27, HW-5, and HW-7), AST 55004 area (VEW-28, VEW-29, VEW-30), eastern boundary area (VEW-32, VEW-33, VEW-34, VEW-35, VEW-36, and VEW-37), water tank area (VEW-31), and truck fueling area (VW-07, VW-09, VW-10, VW-11, VW-12, VW-13, VW-14, VW-15, and VW-16). The soil vapor extraction system (VES) utilizes a blower to remove soil vapors from the subsurface. The extracted vapors are then conveyed through a knockout tank that separates entrained moisture from the soil vapors. Accumulated moisture in the knockout tank is treated by the groundwater extraction and treatment system (GWETS) as described below. Following the knockout tank, the soil vapors are treated through four granular activated carbon (GAC) vessels where volatile organic compounds (VOCs) are adsorbed onto the GAC within the vessels. The primary and secondary GAC vessels, each 5,000 pounds, are installed in series with each other and with a pair of tertiary vessels, each 2,000 pounds. Operation of the VES is conducted in accordance with South Coast Air Quality Management District (SCAQMD) Permit to Operate G12863, A/N 518989.

3.3.1.2 SVE Mass Removal Progress

The total mass of VOCs removed by SVE since April 1996 is approximately 1.53 million pounds. Mass recovery by the SVE system has become asymptotic or “flat lined” since approximately 2008. For the VES, during the third quarter 2014, influent vapor-phase VOC concentrations remained low and reached asymptotic levels.

Rebound of VOC concentrations in the SVE wells was evaluated by collecting vapor samples upon restarting the VES on July 9, 2014, after it had been off line since May 29, 2014. BTEX, MTBE, and TPH were not detected in process vapor samples collected on May 16, 2014, prior to shutting down the VES on May 29, 2014. TPH was detected at a concentration of 7.0 parts per million by volume (ppmv) in the rebound process vapor sample collected on July 9, 2014. BTEX and MTBE were not detected in the July 9, 2014, process vapor sample. TPH was detected at a concentration of 8.4 ppmv in the August 13, 2014, process vapor sample and not detected in the September 17, 2014, process vapor sample. Individual well vapor concentrations were measured with a photoionization detector (PID) on July 7, July 18, and August 27, 2014, and initially spiked to a maximum of 15,000 ppmv in well HW-3, but declined to approximately 5 ppmv on August 27, 2014.

3.3.2 Groundwater Extraction and Treatment System

3.3.2.1 System Description

The GWE well network for groundwater containment and hydrocarbon extraction from dissolved-phase subsurface contamination included wells installed in the northwestern area (GW-2 and GW-13), central tank farm area (GW-14), and eastern boundary area (GW-15, GW-16, and GMW-58). The GWETS utilizes electric pumps in each of the GWE wells to pump groundwater in to a shared surge tank. Groundwater is transferred via a transfer pump from the surge tank through three bag filter vessels in series (BF1, BF2, and BF3), two MYCELX vessels in series (MX-7, MX-21), three GAC vessels in series (2,000 pound GAC-1, 2,000 pound GAC-2, and 1,500 pound GAC-3) and two ion exchange vessels (for arsenic treatment) in series prior to being discharged to the storm drain. Operation of the GWETS is conducted in accordance with National Pollutant Discharge Elimination System (NPDES) permit CAG994004, CI No. 7585 and SCAQMD Permit to Operate G6962, A/N 501180.

3.3.3 Biosparge System

The biosparge wells for hydrocarbon removal from dissolved-phase subsurface impacts are located in areas throughout the tank farm area and eastern boundary area. The biosparge system is currently off line following removal of equipment during site decommissioning and pending excavation. DLA Energy will propose to recommission and expand the air sparge network as part of future groundwater remediation efforts.

3.3.4 LNAPL Removal

Historically, LNAPL was removed through the action of the total fluids (product and groundwater) recovery well network. Total fluids extraction successfully removed all residual thicknesses of LNAPL in the majority of site wells. Subsequently, residual LNAPL removal has been conducted via vacuum truck, passive skimming, and absorbent socks. Wells are gauged periodically and LNAPL removal is conducted based on the measured LNAPL thickness in each target well. This method is effective for capturing LNAPL that is contained in each well, however, the remaining residual LNAPL is generally not highly mobile and therefore the LNAPL recovery is limited through the use of the existing product recovery network. In addition to the proposed localized deep soil excavations that will extend to LNAPL smear zones, DLA Energy is currently developing plans for enhancing the recovery of LNAPL at the site. These plans will be submitted as pilot test work plans and a groundwater remedial action plan.

4.0 REMEDIATION OBJECTIVES, GOALS AND PERFORMANCE METRICS

This Soil RAP has been designed with the goal of remediating the upper 10 feet of soil throughout the site to allow for property transfer and redevelopment. This level of closure will allow the site to be developed for commercial and recreational uses and can be accomplished within approximately 12 months of active on-site remedial efforts. In addition, this Soil RAP also proposes targeted, deep soil removal as effective removal of on-going groundwater degradation sources. The remediation of groundwater following soil excavation will be addressed in a separate remedial action plan, and will likely entail ISCO, biosparging and continued groundwater treatment system operations.

The remediation goals, objectives, and performance metrics remain unchanged from the CSM, with the following media-specific cleanup levels:

4.1 REMEDIATION GOALS AND METRICS

Remediation goals specify the condition or endpoint to be achieved to satisfy the remediation objectives for the site. Numeric performance metrics are measureable characteristics that relate to the remedial progress of a technology in abating the concern. The performance metrics used to demonstrate progress toward and achievement of the LNAPL, vadose zone, and groundwater remediation goals are dependent on the technology used.

This section summarizes the cleanup levels for soil and soil vapor; groundwater cleanup goals will be provided in the forthcoming groundwater remedial action plan for the site.

4.1.1 Soil

Soil cleanup goals (SCGs) were previously calculated for the site according to the methods provided in the RWQCB Interim Site Assessment and Cleanup Guidebook (Guidebook) (RWQCB, 1996). SCGs were calculated for TPH, BTEX compounds, and other detected VOCs from Parsons' soil investigations at the site. TPH and BTEX cleanup goals were calculated based on the values provided in Table 4-1 of the *Guidebook, Maximum Soil Screening Levels for TPH and BTEX Above Drinking Water Aquifers*. Cleanup goals for other VOCs detected in soil were calculated based on established Maximum Contaminant Levels (MCLs) and attenuation factors provided in Table 5-1 of the *Guidebook, Average Attenuation Factor for Different Distance Above Groundwater and Lithology*. For other VOCs without MCLs, SCGs were established using a hierarchy of groundwater objectives, as outlined in comments provided by the RWQCB. Calculations were based primarily on average lithologic types and thicknesses between the sampling depths and the underlying groundwater.

On July 12, 2012, RWQCB approved site-specific SCGs for the DFSP Norwalk site (Table 2). Parsons provided the SCG calculations and assumptions for the final approved SCGs. The SCGs were calculated using the procedures described in the *Interim Site Assessment & Cleanup Guidebook* (RWQCB, 1996), and are site-specific goals calculated to be protective of groundwater quality. The SCGs are calculated by multiplying an attenuation factor by a water quality standard. The attenuation factor is calculated by using a soil to groundwater leaching model which takes into consideration the physical properties of the site-specific soil types, physical properties of the chemicals, the average infiltration rates through the site-specific lithology, and the distance to groundwater. SCGs were calculated in five-foot intervals and are based on depths to groundwater of 25.5 feet, 21 feet, 16 feet, 11 feet, 6 feet, and 1 foot.

4.1.2 Soil Vapor

Soil vapor cleanup levels have not been established for the site. Soil vapor results thus far have been compared to California Human Health Screening Levels (CHHSLs), under commercial scenarios, using indoor air attenuation factors derived from the Department of Toxic Substances Control's (DTSC) most current guidance as shown in Table 5-3 of the CSM. Soil gas screening levels have been calculated for each compound at 5 feet bgs and 15 feet bgs as shown on the table. Soil gas VOC data collected at the site was directly compared to the proposed commercial worker screening levels. Under most circumstances, chemicals in soil or soil gas at concentrations below screening levels can be assumed to pose an acceptable risk to people who may work at the site. The presence of chemicals of concern at concentrations in excess of screening levels does not necessarily indicate that adverse impacts to human health are occurring but indicates that a potential for adverse risk may exist and that additional evaluation is warranted.

5.0 PROPOSED SELECTED REMEDY FOR SOIL

Section 6.0 of the Parsons CSM described the technology screening and selection of remedies. Table 6-2 of the CSM lists all retained remedies. As indicated previously, this Soil RAP incudes variations on the remedies selected in the CSM. This section provides the details and justification associated with those variations.

5.1 Excavation

In the Parsons CSM, excavation was the selected remedy for shallow soil contamination between 0 and 10 ft bgs. This Soil RAP includes the excavation of the shallow soil excavation and also extends excavation further to deeper contaminated soil that may contribute to groundwater contamination. In addition, on-site treatment of soil was determined to be a preferable alternative to transporting contaminated soil to an off-site facility for treatment or disposal (note that a limited of amount of soil – less than 2% of the total mass of contaminated soil – may need to be transported off site to a treatment or disposal site).

5.1.1 Excavation Modification

The CSM selected the remedy of excavation and disposal of the first 10 feet of soil. Upon further evaluation, DLA Energy and SGI retained excavation as a preferred remedy with two modifications in this Soil RAP:

1. Deeper excavations (as deep as 30 feet) are proposed as being more cost-effective, faster, and more reliable than *in situ* treatment. Economies of scale will also be realized since shallow excavations are already being conducted.
2. As potentially more cost effective and “greener” alternatives to transportation and off-site disposal, with the corresponding need to import new clean fill, *ex situ* treatment options were evaluated. It was determined through pilot testing that the contaminated soil present at DFSP Norwalk can be cost-effectively treated on site with either bioremediation or evaporative desorption. Additional benefits include reduced traffic impact to local residents and the elimination of a minimum of 3,000,000 pounds of CO_2 emissions that would be released during off-site transport of the contaminated soil. These emission estimates exclude CO_2 that would be generated during the transport of clean backfill soil to the site after the contaminated soil has been removed.

5.1.2 Off-Site Disposal versus On-Site Treatment Evaluation of Options

SGI evaluated several alternatives to the excavation and disposal or off-site treatment (“dig and haul”) of contaminated soils. Although the cost of dig and haul has decreased over the years, due primarily to competition between the receiving facilities, SGI evaluated on-site treatment options for several reasons. First and foremost, on-site treatment avoids the risks and community concerns associated with the movement of trucks through the city. Second, on-site treatment allows for on-site backfilling of treated soil, eliminating the need for trucking of backfill soil. Third, on-site operations daily schedule will allow for longer working hours than likely schedule restrictions imposed by the city for trucking hours. And finally, on-site treatment provides the opportunity for a "greener" remediation through the elimination of the production of greenhouse gases associated with on-road trucking:

> *Environmental Foot-print of Dig and Haul*: Assuming that 100,000 cubic of yards of contaminated soil may be generated during site remediation and that one truck can carry 25 cubic yards of soil and, considering that each gallon of diesel produces 22 pounds of CO_2, that a tractor-trailer travels approximately 6 miles on a gallon of diesel, and that the likely soil treatment facility is located in Adelanto, California, 90 miles away, each round trip of 180 miles will require 30 gallons of diesel and will generate over 725 pounds of CO_2. Through the use of on-site treatment, 4,000 truck trips will be avoided with a net reduction of 3,000,000 pounds of CO_2 emissions.

The following provides a summary of soil treatment options that were evaluated for possible use at DFSP Norwalk. Note that dig and haul was retained for use as it is likely that at least a portion of the contaminated soil generated will be removed from the site via truck for off-site treatment and/or disposal due to logistics, scheduling, or contaminant characteristics.

5.1.2.1 Excavation and Off-site Treatment and Disposal

This traditional approach for removal of contaminated soil entails the excavation and then off-site transportation of the soil to a disposal or recycling facility. It is a straightforward approach as it simply requires the coordination of the excavation and off-site transport for treatment of the soil but with the downside that more than 4,000 truck trips through the local city streets would be required should all soil be treated using this approach. The soil is transported to a disposal site or an off-site fixed facility where it is treated in a fixed rotary kiln to desorb and destroy the hydrocarbons. Although the treated soil is typically used for daily municipal landfill cover, SGI has discussed with the facility the possibility of returning the treated soil to the site for use as excavation backfill.

As described in the introduction above, this soil treatment option was retained as an alternate to be used due to project schedule restrictions, or for soil that is either too wet, heavily contaminated, or that contains contaminants other than TPH that will make on-site re-use impractical.

5.1.2.2 Evaporative Desorption

Evaporative desorption technology (EDT) is a remediation technique recently refined by Rettero, Inc. Integral to their process, Reterro's method entails placing excavated contaminated soil into Evaporative Desorption Units ("EDUs") fitted with vapor extraction lines coupled with a vacuum extraction system. The EDU is a thermally-insulated treatment chamber. Heated air is pulled through the soil bed via a vacuum system to evaporate and remove the contaminants. The mobilized contaminants are adsorbed on to vapor-phase, granular, activated carbon beds. Soil treatment time is determined based on site-specific parameters and is controlled by endpoint analysis using real time operational and emissions data. In general, treatment time for hydrocarbons and VOCs is between 1 and 4 hours per EDU batch (approximately 40 tons of soil are treated in each batch).

Following treatment, soil is emptied from the EDU in accordance with permit criteria from the local air quality management district. Treated soil is then spread out to cool and rehydrate which takes approximately 1 to 2 hours to complete. After treated soil has been cooled to ambient temperature and rehydrated, a post-treatment sample is collected for treatment verification. During the final stage of soil hydration and pre-backfill handling, naturally occurring bacteria will further reduce the concentrations of hydrocarbons, if present.

An EDT treatability study has confirmed that the technology would be effective on DFSP Norwalk soil. Two batches of representative soil were treated using off-site test equipment. The tested soil contained initial concentrations of TPH as gasoline (TPH-g) and TPH as diesel (TPH-d) ranging to 205 mg/kg and 1,390 mg/kg, respectively. After treatment, the TPH-g and TPH-d concentrations were reduced to concentrations significantly below the site cleanup goals: TPH-g was reduced to non-detect (at a detection limit of 10 mg/kg) and TPH-d was reduced to 47 mg/kg. A copy of Reterro's treatability study completed for DFSP Norwalk soil is provided in Appendix B.

5.1.2.3 On-Site Biotreatment

The F4 Remediation technology consists of a proprietary blend of biology (different strains of naturally occurring *Pseudomonas* bacteria and nutrients) and chemistry (surfactants and compounds) that have been proven to clean soil contaminated by petroleum hydrocarbons (PHCs). The technology entails excavation of the soil, processing of the soil to add surfactants to reduce volatility and desorb hydrocarbons from the soil matrix, and the addition of bacteria to facilitate bio-treatment. Once treated with the surfactants and bacteria, the soil is placed into biotreatment soil piles to provide adequate time (several weeks) for the bacteria to destroy the hydrocarbons.

A pilot study of soil obtained from the central portion of the site (near the truck track and "water tank" area) and the oily sands was started using "F4" technology on June 24, 2014. After 16 days of treatment, progress soil samples indicated an 80% concentration reduction in the truck rack/water tank soils and a 65% concentration reduction of TPH in the oily sands. After 90 days of treatment, gasoline range organics (GRO) was eliminated from both the "water tank" and oily sands soil. Diesel range organics (DRO) were reduced by a minimum of 95%. There were no detectable volatile organic compounds (VOC's). A copy of F4 Remediation's treatability study completed for DFSP Norwalk soil is provided in Appendix C.

5.1.2.4 Summary of Proposed Disposition of Soil

Based on performance and cost considerations, the F4 Remediaiton technology has been selected for use at DFSP Norwalk. Plans and associated permitting are being prepared to begin excavation and treatment using the on-site bioremediation approach. On November 5, 2014, SGI submitted a

Soil Management Plan (SMP); *Soil Management Plan: Treatment Cell Operation and Site Excavation* (SGI, 2014). This SMP presents the design, construction, and management of the of the on-site treatment areas. It also explains the excavation treatment process, soil monitoring, and post-remediation closure of the areas used for soil treatment. Using a mix of surfactants and laboratory-cultured, naturally occurring, bacteria, soil will be pretreated and then placed into lined and covered "bio-cells." Over the course of approximately 6 to 12 weeks, the bacteria will reduce the contaminant levels to below site cleanup goals.

Approximately 20,000 to 30,000 tons of soil will be treated in engineered treatment cells at any given time during the project. As confirmation soil sampling is conducted, soil will be removed from the treatment cells and relocated on site for either immediate use as backfill or for stockpiling for later use on site. After removal of the treated soil, additional soil will be added to the treatment cells and a new batch of soil will be treated. Details of the construction and operation of the treatment cells are provided in the Soil Management Plan provided in Appendix D.

5.1.2.5 Soil Treatment Contingencies

The pilot testing of the evaporative desorption technology (EDT) has shown this approach to be a technically acceptable alternative to the F4 Remediation, but at a higher cost. Therefore, this technology has been retained as a contingency method for treatment of the soil. If the DLA Energy determines that a change in treatment technology is warranted, the RWQCB will be apprised before implementing the EDT approach.

Additionally, the transportation for off-site treatment of at least some portion (estimated at less than 1% to 2% of the total soil mass) may be required. Off-site transportation and disposal/recycling will be used for those soils that are not amenable to on-site treatment (soils not amenable to on-site treatment may include soils with a high degree of debris or soils that contain a large fraction of extremely long-chain – asphaltic – hydrocarbons); this soil will be removed from the site within 30 days of generation and will be stored in accordance with South Coast Air Quality Management District (SCQAMD) Rule 1166 conditions. The RWQCB and the city of Norwalk will be notified at least one week prior to the removal of contaminated soils from the site.

6.0 REGULATORY REQUIREMENTS

The following sections describe the permits that are in process In preparation for the planned remediation activities.

6.1.1 Los Angeles Regional Water Quality Control Board

On October 2, 2014, SGI, on behalf of DLA Energy, submitted the required Form 200 and supporting information to apply for a Waste Discharge Requirement (WDR) under General WDR, Order No. 90-148; General Waste Discharge Requirements for Land Treatment of Petroleum Hydrocarbon Contaminated Soil in Los Angeles and Santa Clara River Basins.

6.1.2 South Coast Air Quality Management District

A permit application (Application Number 566483) has been submitted for the excavation and handling of VOC-contaminated soil in accordance with Rule 1166 Contaminated Soil Mitigation Plan (1166 Plan). In addition, a modification to the existing permit to operate the existing SVE system (PTO G12863) application number 518989, has been submitted for approval to allow the operation and maintenance of the soil treatment cells.

Dust levels at site perimeters will also be monitored during excavation and loading activities. If the monitoring data at the site perimeter indicate that dust levels are above the SCAQMD Rule 403 limit of 50 micrograms per cubic meter ($\mu g/m^3$), based on the difference between upwind and downwind measurements, engineering control measures (including additional water application on haul roads and at areas of soil excavation and handling) will be implemented to reduce the dust level.

6.1.3 Other Permitting Requirements

The City of Norwalk requires an excavation plan in order to obtain an excavation permit. The plan is currently in the process of being finalized and will be submitted to the city of Norwalk in December 2014.

The DSFP Norwalk site already has an active Storm Water Pollution Prevention Plan.

7.0 IMPLEMENTATION OF SOIL REMEDIAL STRATEGY

To meet project objectives, up to 100,000 cubic yards of petroleum hydrocarbon contaminated soil will be excavated and treated on site. It is anticipated, based on existing assessment data, that approximately 55,000 cubic yards of soil from the upper ten feet of soil will require excavation treatment to meet site cleanup goals. An additional approximately 45,000 cubic yards of soil from deeper soils, extending to groundwater, will also be excavated and treated. Soil will be treated so that hydrocarbon concentrations are reduced to below site cleanup requirements provided by the RWQCB on July 12, 2012.

7.1 Excavation Preparation Activities

7.1.1 Selection of Excavation Areas

Areas proposed for soil excavation and on-site treatment were selected based on existing site data. The locations and expected dimensions and depths of excavations are provided in Figure 4. The locations proposed for excavation were determined by integrating soil analytical data, field observations (PID readings, geologist's observations of stained or odorous soil, etc.), ROST data, and the occurrence of free product on the underlying groundwater.

The location of all proposed excavation areas will be pre-marked by a survey crew. Existing survey data will be used to ensure that planned excavation areas are centered on known contaminated areas. The bounds of the proposed excavation areas will be maintained and used to generate as-built maps at the completion of the removal of soil and to track the expansion of excavations should progress soil samples indicate that additional soil removal is required to achieve Site cleanup goals.

VOCs have been detected Site soil in excess of 50 parts per million, when measured in the field with a organic vapor analyzer. Therefore, the use of a SCAQMD Rule 1166 permit will be required during the excavation and handling of soil. A photoionization detector will be used to measure the concentrations of VOCs during soil excavation activities. In the event that soil containing VOCs in excess of 50 ppm (as defined in Rule 1166) are encountered, the SCAQMD will be contacted and vapor mitigations measured, as dictated by the Rule 1166 conditions, will be followed.

Storm water controls and dust mitigation best management practices (BMPs) will also be implemented.

7.1.2 Health and Safety Planning

The site-specific health and safety plan (HASP – Appendix E), prepared in accordance with Federal (29 CFR 1910.120) and State (California Code of Regulations, [C.C.R.] Title 8, Section 5192) describes methods for protection of site workers and visitors during the remedial activities. The following information is contained in the HASP:

- List of COCs, their characteristics, and potential exposure routes;

- Action levels for various COCs;
- Methods for field monitoring of COCs;
- Emergency procedures and contact information;
- Identification and routes to emergency facilities;
- Identification of potential physical hazards and response actions for specific remedial tasks (job hazard analyses); and
- Personal protective equipment (PPE) for specific remedial tasks.

PPE will generally consist of Level D equipment, including hard hats, steel-toed boots, ear protection, eye protection, and reflective orange vests. Respiratory protection is not anticipated, but will be available should particulate dust or vapor monitoring indicate such precautions are necessary. Particulate dust monitoring is detailed in the Section 4.6.3 of the SMP.

Adequate protection will be provided to protect personnel from loose soil that could pose a hazard by falling, toppling, or sliding from an excavation face. Such protection will consist of dressing of excavation walls remove loose material and/or benching excavation sidewalls for stability.

In addition, personnel shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavation, or by a combination of both if necessary.

7.1.3 Utility Clearance

Once all excavation areas are marked, Underground Services Alert (USA) will be contacted and a ticket number obtained. The USA ticket will remain active during all phases of subsurface excavation or any intrusive activities.

Geophysical surveys will be completed in the areas proposed for excavation. The objective of this survey will be to determine whether buried structures or other interferences to excavation are present. During the survey, identified structures will be marked on the ground, and designated as to whether the structure is a storm drain (green), water line (blue), electrical conduit (red), natural gas line (yellow), or unknown (white). The structures will also be mapped and compared to existing infrastructure maps to ensure that, to the extent practical, all buried infrastructure are identified prior to the initiation of intrusive work.

Note that active buried utilities may be identified during this process. Depending on the nature of the utility, a decision will be made to either relocate, remove, or avoid the structure. The location of all identified buried utilities will be field marked and recorded on maps.

7.1.4 Removal of Selected Wells

Well removal will be required prior to proceeding with soil excavation and biotreatment at DFSP Norwalk. Details of the wells to be removed and procedures are documented in the *Work Plan for Well Abandonment* (SGI, 2014). Table 3 of this Soil RAP was excerpted from the well abandonment work plan and provides details of the 42 wells to be removed. The wells proposed for abandonment are located within the excavation footprints throughout the site. The following provides a summary of wells to be removed:

- 8 groundwater wells that are a part the DLA Energy MRP;
- 5 groundwater wells that are a part of the SFPP MRP;
- 4 groundwater wells that not part of either DLA or SFPP MRP's;
- 1 groundwater extraction well that is part of the SFPP groundwater extraction/treatment system;
- 1 groundwater well that is gauged annually;
- 9 inactive sparging wells; and
- 14 vapor extraction/monitoring wells that are currently inactive.

Eight of the groundwater monitoring wells are included in the DLA Energy Groundwater Monitoring and Reporting Program (MRP), and five wells are included in the SFPP MRP. Groundwater monitoring wells will be removed in accordance with a well decommissioning permit obtained from the Los Angeles County Public Works Department. These wells were most recently sampled during the Fall 2014 groundwater monitoring and sampling event. Once removed, these wells will not be accessible for sampling. Routine sampling of these wells will resume after soil remedial efforts have been completed and replacement wells installed.

DLA Energy commits to preparation of a work plan describing the reinstallation and optimization of the groundwater extraction/treatment and groundwater monitoring wells upon completion of the soil remedial efforts described in this Soil RAP. Air sparge and vapor extraction wells will also be replaced, as necessary, and the numbers expanded to facilitate groundwater remediation; details of the expanded air sparge network will be provided in the forthcoming groundwater RAP.

7.1.5 Regulatory and Community Notification

Prior to the initiation of fieldwork, the city of Norwalk, RWQCB, and SCAQMD will be provided a minimum of a five days notice to alert them of the planned site activities. Additionally, a Fact Sheet will be prepared and mailed to residents located within a quarter mile of the DFSP Norwalk facility. The Fact Sheet will provide details of the planned work, work schedules, and contact phone numbers for residents to voice concerns or ask questions.

7.2 Excavations

Appendix D provides a copy of the Soil Management Plan (SMP). The SMP provide details of the design, construction, operation, and closure of areas used for soil treatment by means of bioremediation. The SMP also provides methods and means to be employed while completing the excavation and trenching planned for contaminated areas present at the Site.

Planned activities consist of shallow (0 to 10 feet below grade) and deep (10 to 30 feet below grade) excavations (Figure 4). The purpose of the proposed excavations is to remove soil containing contaminants with concentrations above the cleanup goals from the shallow soil and to remove contaminants that are a significant source of long-term groundwater degradation from the deeper soils. Current excavation plans do not anticipate that shoring of any excavation will be required; the deeper excavations will be step-sloped or benched. After removal of contaminated soil and completion of confirmation sampling, all excavations will be backfilled and graded.

Soil will be excavated and temporarily stockpiled on plastic sheeting and covered with plastic sheeting in accordance with WDR and SCAQMD Rule 1166 conditions. The stockpiles will be field labeled and sampled for either treatment or if, clean, for later use for on-site backfilling. Details of proposed sampling frequency of soil stockpiles is provided in the SMP. The sample analytical protocol will include (at a minimum) analysis of total petroleum hydrocarbon by EPA Method 8015M (hydrocarbon chain) and volatile organic compounds by EPA Method 8260B.

7.2.1 Field Methods – Shallow Soil (0 to 10 Feet)

Soil excavation will start on the eastern portion of the site with the intent to first remove and treat contaminated soil present on land intended for future park use. Heavy equipment, including excavators, backhoes, loaders, and dump trucks will be used for the excavation and handling of soil. Water trucks will be used on haul roads and at the excavations to moisten soil with the objective of reducing dust emissions and, when present, to mitigate hydrocarbon vapor emissions. After completion of the shallow excavations on land slated for redevelopment as parkland, work will shift to the southcentral portion of the site. Excavations will progress until all areas with known shallow contamination have been completed. It is anticipated that approximately 55,000 cubic yards of soil requiring treatment will be generated during this process.

An on-site geologist, environmental scientist, or engineer, working under the supervision of a California Registered Geologist, will be on site during all phases of soil excavation. The geologist will be responsible for recording the condition of soils exposed in the excavation, collecting and recording VOC readings with a calibrated photoionization detector (PID), and for the collection of progress soil samples. PID readings and geologist observations will be used to segregate clean soil from contaminated soil. This segregation will be conducted using the criteria of PID readings (PID readings greater than 50 parts per million (ppm) will be indicative of soil requiring treatment), soil coloration (sandy soil exhibiting gray coloration will be suspected of being contaminated and placed into soil piles intended for treatment), and odors (hydrocarbons in soil result in a characteristic odor and will be a factor in determining soil that will require treatment).

Soils will be placed on plastic during excavation and will be segregated based on field evidence of contamination (and thus soil that will require treatment) and soil that is expected to be clean. Regardless of whether the soil is suspected to be contaminated or clean, field handling and storage methods will be similar. All soil will be placed on plastic to eliminate contact with the ground surface, water mist will be used as a vapor and dust suppression technique, and the stockpiles will be covered with secured plastic to further mitigate vapor and dust emissions.

As described in the SMP, soil samples will be collected at a frequency of 16 samples per 2,000 cubic yards of soil placed into clean stockpiles. Soil samples will be collected at a frequency of 10 samples per 400 cubic yards for suspected contaminated soil; the 10 samples will be composited by the laboratory to obtain a representative analysis of soil contained within the stockpile to serve as a baseline prior to treatment. The samples will be collected as soil is added to the piles to ensure that the samples are representative of the soil throughout the piles. Samples will be analyzed for total petroleum hydrocarbons, speciated by carbon chain range using EPA Method 8015 and for VOCs and fuel oxygenates using EPA Method 8260. The results will be compared against soil cleanup standards. Based on this comparison, a determination will be made as to the future disposition of the soil:

1. Soil treatment is necessary;
2. Soil contains low concentrations of petroleum hydrocarbons but cleanup standards are met and thus soil may be used for backfill in the upper 10 feet of soil within portions of the site planned for commercial redevelopment; and
3. Soil is clean and can be used without restriction, including shallow excavations at land planned for park use or in the deepest excavations.

During the first phase of soil removal, the excavations will not exceed 10 feet in depth. As shown on Figure 4, a number of excavations, including those to be completed in the northeast portion of the site are expected to be shallow, not exceeding 5 feet. Upon completion of each shallow soil excavation, progress confirmation samples will be collected and analyzed in accordance with the Soil Management Plan (Section 4.6.2 of the SMP).

Once excavation work has been completed and soil samples have been collected, the base of the excavation will be lined with plastic. The plastic will serve several purposes: elimination of VOC emissions at locations where contaminated soil is present at the base of the excavation, reduction in dust, and mitigation of the downward migration of contaminants caused by the infiltration of groundwater. A low-point sump will be included in the floor of the excavation. This plastic-lined sump will allow collection and removal of rainwater that may accumulate in the excavation. Any extracted rainwater will be transferred to and treated in the on-site groundwater treatment system. Prior to backfilling, the plastic liners will be removed from the excavations.

Prior to excavation, several tasks will be implemented to ensure the safety, effectiveness, and proper documentation of the proposed remediation.

7.2.2 Field Methods – Deep Soil (Greater than 10 Feet)

Contaminated soil present at depths greater than 10 feet will be removed from a subset of the shallow excavations. The determination as to where the excavations will be deepened will be made on a prioritized basis with the objective of maximizing contaminant mass removal and limiting the lateral expansion of the excavations.

Due to funding limitations and the requirements of the WDR, the maximum amount of contaminated soil that will be excavated and treated is 100,000 cubic yards for the entire project. Therefore, the volume of soil that will require treatment in the upper 10 feet will dictate the amount of soil that can be removed and treated from the deeper soil intervals. It is currently assumed that approximately 55,000 cubic yards of contaminated soil will require treatment from the upper 10 feet of soil. Correspondingly, it is estimated that 45,000 cubic yards of contaminated soil will be removed from soils extending from 10 feet below grade to the water table (currently at approximately 30 feet below surface grade).

Existing soil analytical data and data collected during excavation bottom confirmation sampling will be used to determine where the greatest mass of soil containing the highest concentrations of TPH is present and representing the greatest threat of long-term groundwater degradation. This determination will be communicated with the RWQCB prior to extending the depths of the excavations.

Field monitoring measures as described for the shallow soil excavation will be used to monitor and segregate clean and contaminated soil. Similarly, sidewall and confirmation samples will be collected and analyzed as described in the SAP and the following section.

7.3 Excavation Confirmation Sampling

The collection and analysis of post-excavation confirmation samples and stockpile characterization samples are outlined in detail in Section 6.1 of the SMP. To summarize, sidewall samples will be collected every 25 linear feet, and excavation bottom samples will be collected at a frequency of one sample per 800 square feet of excavation bottom. Each excavation will be sampled at least along the four cardinal direction sidewalls, and at least one excavation floor sample will be collected, resulting in a minimum of 5 samples per excavation. Quality Control/Quality Assurance samples, including field duplicates samples, will be collected and analyzed. Split samples for agency verification will also be provided, if requested.

All confirmation samples will be analyzed for total petroleum hydrocarbons, speciated by carbon chain range using EPA Method 8015 and for VOCs and fuel oxygenates using EPA Method 8260B.

7.4 Exploratory Trenching

Exploratory trenching to 10 feet bgs is planned in paths as shown in Figure 4. This includes Treatment Cell #1 (Powerine Basin) and Treatment Cell #2 (location of tank 80004) and the majority of the former tank basins. The objective is to ensure the absence of soil contamination in areas that did not require excavation. Excavations will be advanced to a depth of 10 feet in an "X" pattern at tank basins identified in Figure 4. An excavator will be used to remove soil from a trench 10 feet deep from corner to corner. As the soil is being removed, it will be field screened using a PID and will be inspected for stain and odor by an on-site environmental professional.

If contamination is not observed, soil samples will be collected from the bucket of the excavator at approximate depths of 5 and 10 ft bgs and spaced at approximately 25-ft intervals. Depending on the location of utilities and existing remediation infrastructure, trenching may not be continuous for the planned paths. In the event contaminated soil is observed, a sample will be taken. The location and depth will be logged. Additional trenching will continue until all contaminated soil has been removed and routed for treatment on site.

Soil assumed clean will be stockpiled and sampled per EPA SW-486. Soil will be analyzed for TPH (GRO and DRO) using EPA Method 8015 and VOCs using EPA Method 8260B. If soil meets cleanup goal criteria it will be reused to backfill the trenches. Treatment Cell #1 will be the last area for trenching. If contaminated soil is found, that soil will be disposed off site.

7.5 Treatment Cell Construction and Operation

Figure 5 provides a schematic drawing of a typical soil treatment cell. The attached SMP provides details of the design and construction of the treatment cell areas that incorporate requirements and permit conditions as specified by the South Coast Air Quality Management District (SCAQMD). The SMP describes procedures to be employed during the segregation of soil, monitoring of soil treatment, monitoring of VOC emissions and dust, and management of stockpiles. This also includes the verification and management of stockpiles of clean soil, the characterization of soil designated for treatment, and soil designated for off-site disposal.

Once confirmation samples demonstrate that contaminant concentrations have been reduced to below site cleanup goals, the treated soil will be removed from the treatment cell and staged for backfilling on site.

7.6 Soil Vapor Monitoring

A network of vapor extraction wells will be integrated into the treatment cell construction. The vapor extraction slotted piping will be connected to the existing soil vapor extraction and treatment system operated by DLA Energy at DFSP Norwalk. The vapor extraction piping will allow the extraction and treatment of volatile hydrocarbon vapors present in the soil treatment cells. Monitoring of the soil gas during operation of the treatment cells will provide data as to the progress of soil treatment and predictive data as to when confirmation soil sampling will begin. Specifically, California Human Health Screening Levels (CHHLS) for residential sites will be used as benchmarks for extracted vapor concentrations.

7.7 Excavation Backfilling

Excavation backfilling will be conducted after confirmation analytical results have been transmitted to and reviewed by the RWQCB. With RWQCB concurrence that backfilling of an excavation can commence, treated soil and and/or clean overburden soil will be used for excavation backfilling. The cleanest overburden soil generated at the site will be used to backfill excavations on property to be conveyed for park use. Additionally, clean overburden soil will be used to fill deepest portions of excavations where soil cleanup requirements are most stringent. All soil will be compacted to a minimum of 90 percent and backfill operations will be certified by an on-site soils technician.

7.8 Field Documentation

The following paragraphs discuss the field documentation procedures for this work.

7.8.1 Field Logbooks

Field activity logs will document where, when, how, and from whom project information was obtained. Log entries will be complete and accurate enough to permit reconstruction of field activities. Entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology which might prove inappropriate. If an error is made, a line will be made through the error and the correct information will be entered. Corrections will be dated and initialed. No entries will be obliterated or rendered unreadable.

7.8.2 Chain-of-Custody Records

Chain-of-custody records are used to document sample collection and shipment to laboratory(ies) for analysis. Sample shipments will be accompanied by a chain-of-custody record. Forms will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, chain-of-custody forms will be completed and sent with the samples for each cooler. The chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to unauthorized personnel. Until receipt by the laboratory, the custody of the samples will be the responsibility of the sample collector.

7.8.3 Photographs

Photographs will be taken at selected locations and at other areas of interest on the site. They will serve to complement information entered in the field activity logbooks. When a photograph is taken, the following information will be written in the activity logbooks or will be recorded in a separate field photography log:

- Time, date, location, direction, and if appropriate, weather conditions;

- Description of the subject photographed; and
- Name of person taking the photograph.

7.9 Best Management Practices

Detailed procedures on health and safety and air monitoring, treatment cell management, and soil confirmation sampling and analysis are presented in individual plans included as Appendices:

Appendix D Soil Management Plan - Treatment Cell Operation Plan

Appendix E Health and Safety Plan

7.10 Reporting

At the completion of each excavation, SGI will prepare a summary of work completed including volume of clean soil excavated, volume of contaminated soil excavated and placed into soil treatment wells, confirmation sampling data (from excavation sidewalls, bottoms, clean, and contaminated soil stockpiles), and scaled drawings depicting the final configuration (lateral extent and depth) of the excavation. These individual excavation summary reports will be submitted to the RWQCB with a request for authorization to backfill.

At the conclusion of the field activities, SGI will prepare a comprehensive remedial action completion report (RACR) summarizing the work completed. The report will include details of the soil excavation, sampling, treatment, and backfilling work completed. Detailed maps depicting locations of confirmation samples (from excavations as well as treatment cells) and tabulated analytical data will be provided. Electronic copies of laboratory reports, project permits, and manifests will be provided as appendices.

In addition, preliminary confirmation sample results will be communicated to the RWQCB to allow for effective field decisions on lateral or vertical expansions of excavations or step-out sampling.

7.11 Future Soil and Groundwater Remediation

After implementation of soil remedial measures described herein, the existing groundwater treatment system will be reconfigured with the replacement of groundwater monitoring, vapor extraction, and air sparge wells to be removed to facilitate the excavation of soil. The SVE system will also be operated continuously during the planned soil remediation, with focus on extracting vapors from the soil treatment cells and the four existing horizontal extraction wells.

Once soil remedial measures have been initiated, DLA Energy will prepare and submit plans for the pilot testing of technologies designed to further the remediation of site groundwater. It is anticipated that the pilot testing will include technologies developed to enhance LNAPL removal and saturated soil remediation through *in situ* applications. At the conclusion of the field pilot testing and technology evaluations, a groundwater remedial action plan will be submitted to the RWQCB.

7.12 Schedule

A conceptual schedule depicting the sequence of events is included in Figure 5. This schedule is for the excavation and soil treatment and dates will be revised upon approval of this Soil RAP and issuance of required permits.

8.0 REFERENCES

Groundwater Technology Government Services, Inc. 1995. Focused Remedial Investigation Report, Tank Farm Area, Defense Fuel Support Point. May 12.

LARWQCB. 2012. *Correspondence to DLA Installation Support - Energy: Review of Proposed Cleanup Goals; Defense Fuel Support Point Norwalk 15306 Norwalk Boulevard, California SCP NO. 0286A, Site No. 16638.*

LARWQCB. 2013. *Correspondence to DLA Installation Support - Energy: Requirement to Submit Progress Reports Defense Fuel Support Point Norwalk 15306 Norwalk Boulevard, California SCP NO. 0286A, Site No. 16638.*

Parsons. 2006. *Revised Remedial Action Plan.*

Parsons. 2010. *LARWQCB Correspondence: Remedial Action Plan Addendum for Soil Update Defense Fuel Support Point Norwalk 15306 Norwalk Boulevard, California SCP NO. 0286A, Site No. 16638.* January 10.

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Parsons. 2012. Second Semi-Annual 2011 Soil Vapor Monitoring.

Parsons. 2013a. *Conceptual Site Model and Remedial Action Evaluation for Soil, Groundwater and LNAPL*.

Parsons. 2013b. *Concrete Demolition and Soil Confirmation Sampling Report.* February.

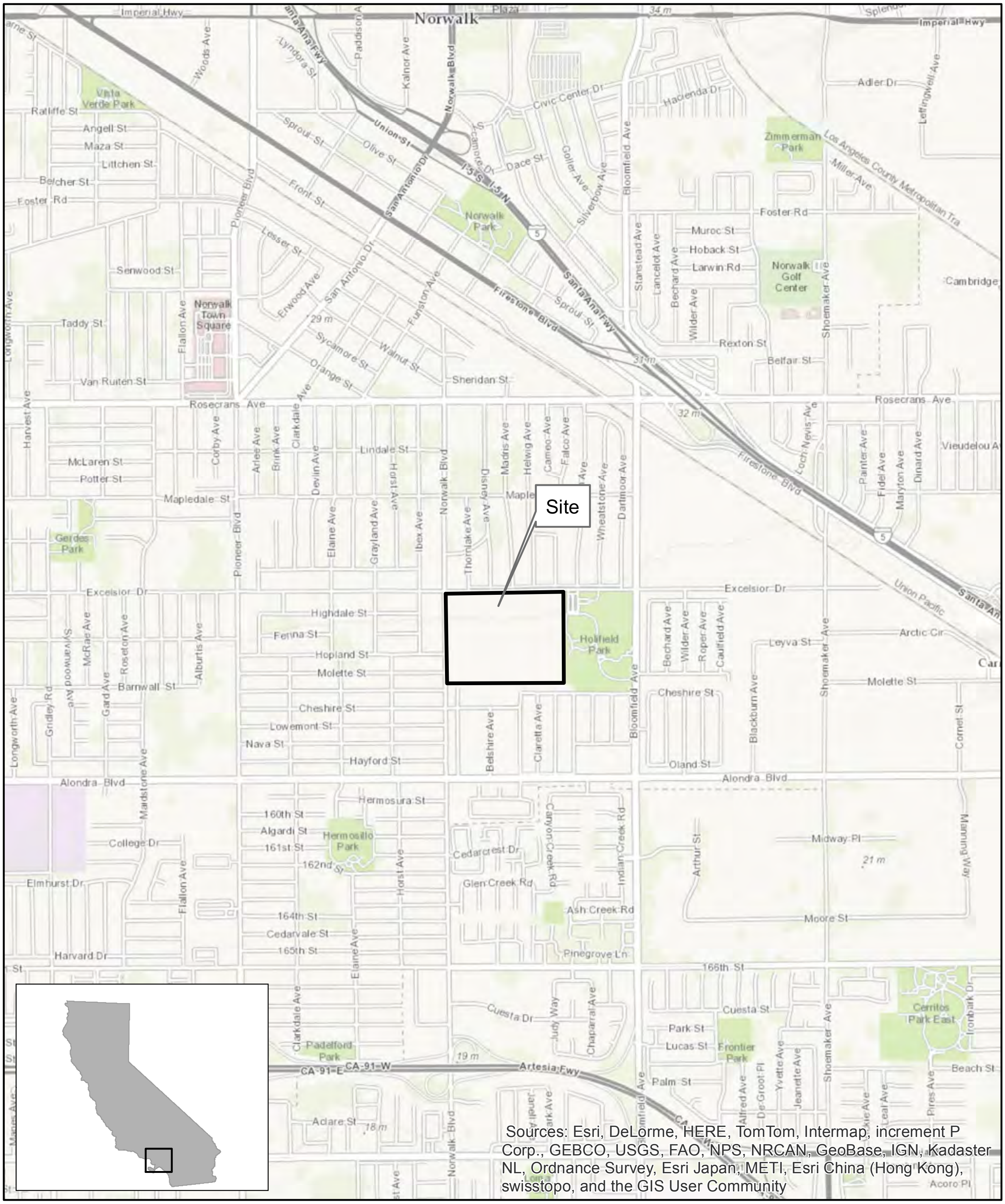
The Source Group, Inc. 2014. Revised Work Plan for Further Evaluation of GMW-62 LNAPL Plume.

The Source Group, Inc. 2014. Remediation Status Report – Third Quarter 2014.

9.0 LIMITATIONS

This document was prepared for the exclusive use of the Defense Logistics Agency - Energy (DLA Energy) and the California Regional Water Quality Control Board, Los Angeles Region (RWQCB) for the express purpose of complying with a client or regulatory directive for environmental investigation or restoration. SGI and DLA Energy must approve any re-use of this work product in whole or in part for a different purpose or by others in writing. If any such unauthorized use occurs, it shall be at the user's sole risk without liability to SGI or DLA Energy. To the extent that this report is based on information provided to SGI by third parties, including DLA Energy, their direct contractors, previous workers, and other stakeholders, SGI cannot guarantee the completeness or accuracy of this information, even where efforts were made to verify third-party information. SGI has exercised professional judgment to collect and present findings and opinions of a scientific and technical nature. The opinions expressed are based on the conditions of the Site existing at the time of the field investigation, current regulatory requirements, and any specified assumptions. The presented findings and recommendations in this report are intended to be taken in their entirety to assist DLA Energy and RWQCB personnel in applying their own professional judgment in making decisions related to the property. SGI cannot provide conclusions on environmental conditions outside the completed scope of work. SGI cannot guarantee that future conditions will not change and affect the validity of the presented conclusions and recommended work. No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, conclusions, and recommendations.

FIGURES



Document Name: Fig-1 Norwalk Topo Site Location Map

SOURCE: ESRI 7.5 MINUTE TOPOGRAPHIC MAP. http://resources.esri.com/arcgisonlineservices	PROJECT NO.: 04-NDLA-001	DATE: 5/28/2014	DR.BY: JK	APP.BY: PP	SCALE= 1:24,000 (0, 1,000, 2,000, 4,000 Feet)	N

SGI environmental
THE SOURCE GROUP, INC.
1962 FREEMAN AVENUE
SIGNAL HILL, CA 90755
(562) 597-1055

DEFENSE FUEL SUPPORT POINT NORWALK

15306 NORWALK BOULEVARD
NORWALK, CALIFORNIA

SITE LOCATION MAP

FIGURE
1

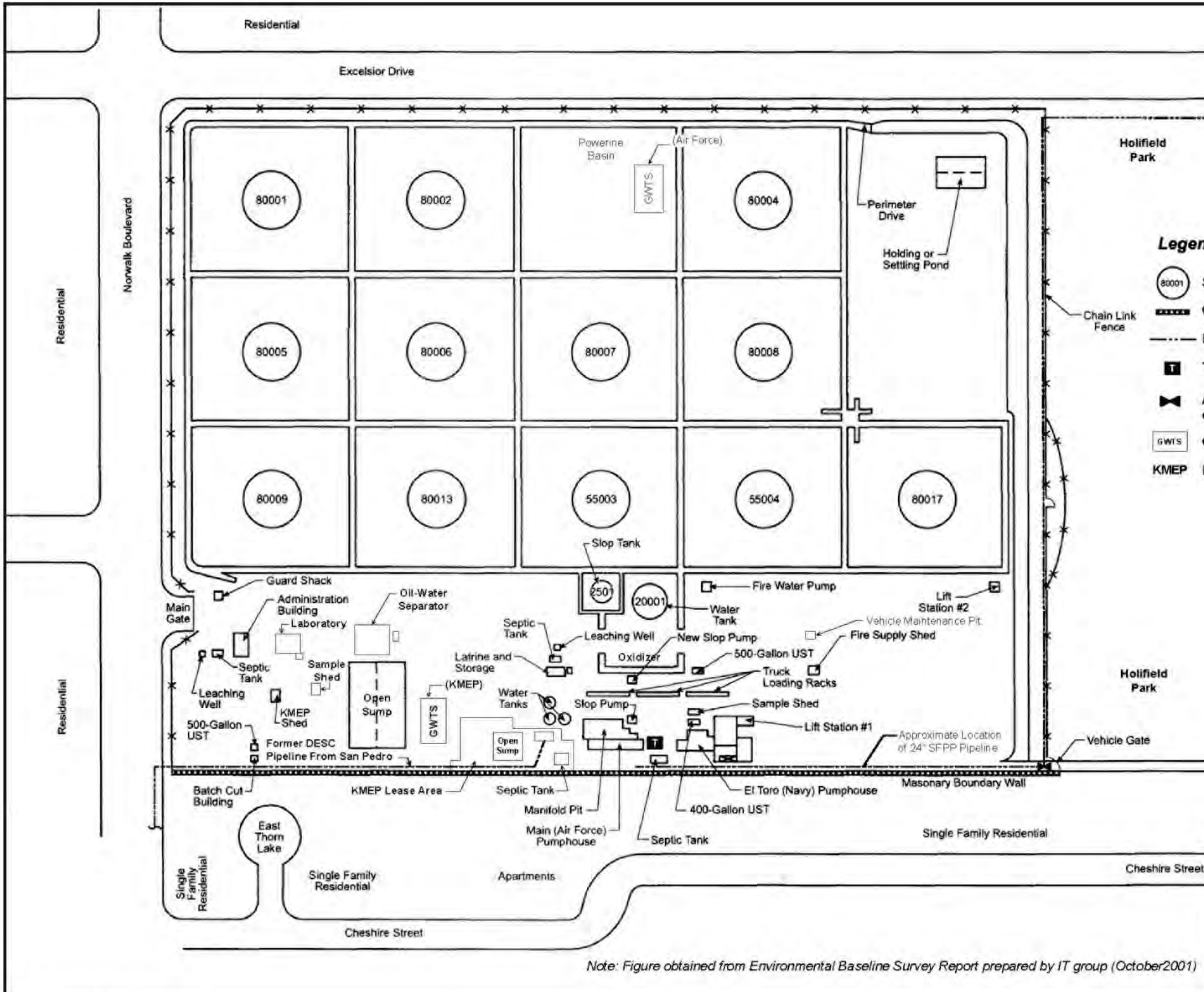
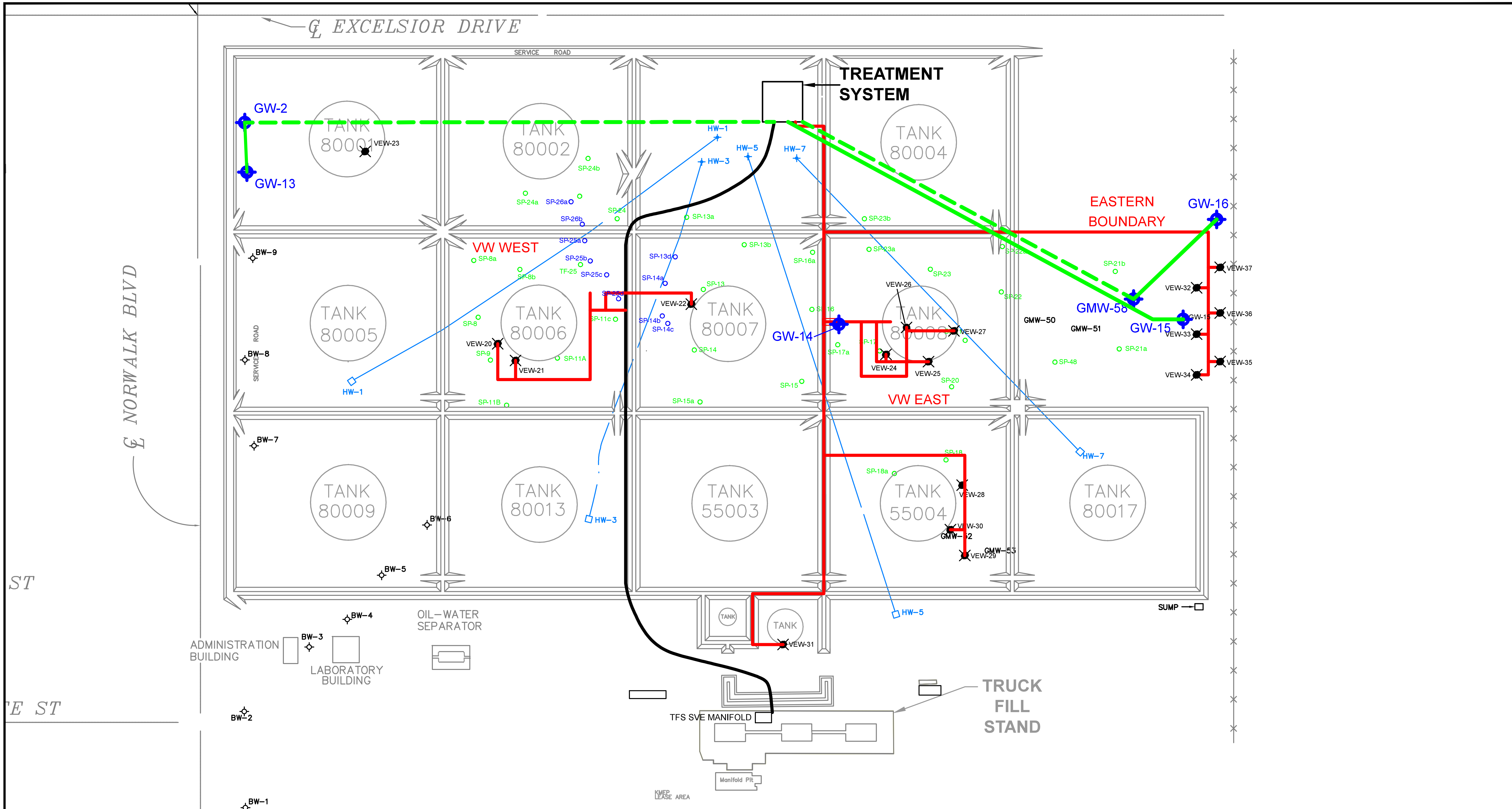


FIGURE 2
HISTORICAL SITE FEATURES

Defense Fuel Support Point
Norwalk, California

THE SOURCE GROUP, INC.



NOTES

Base map and piping from Parsons' *First Quarter 2014 Remediation Progress Report*, dated May 15, 2014

DEFENSE FUEL SUPPORT POINT NORWALK
15306 NORWALK BOULEVARD
NORWALK, CALIFORNIA

PROJECT	DATE		
04-NDLA	08/15/2014		

0 160 320
HORIZONTAL SCALE IN FEET

SITE MAP SHOWING REMEDIATION WELL AND PIPING LOCATIONS

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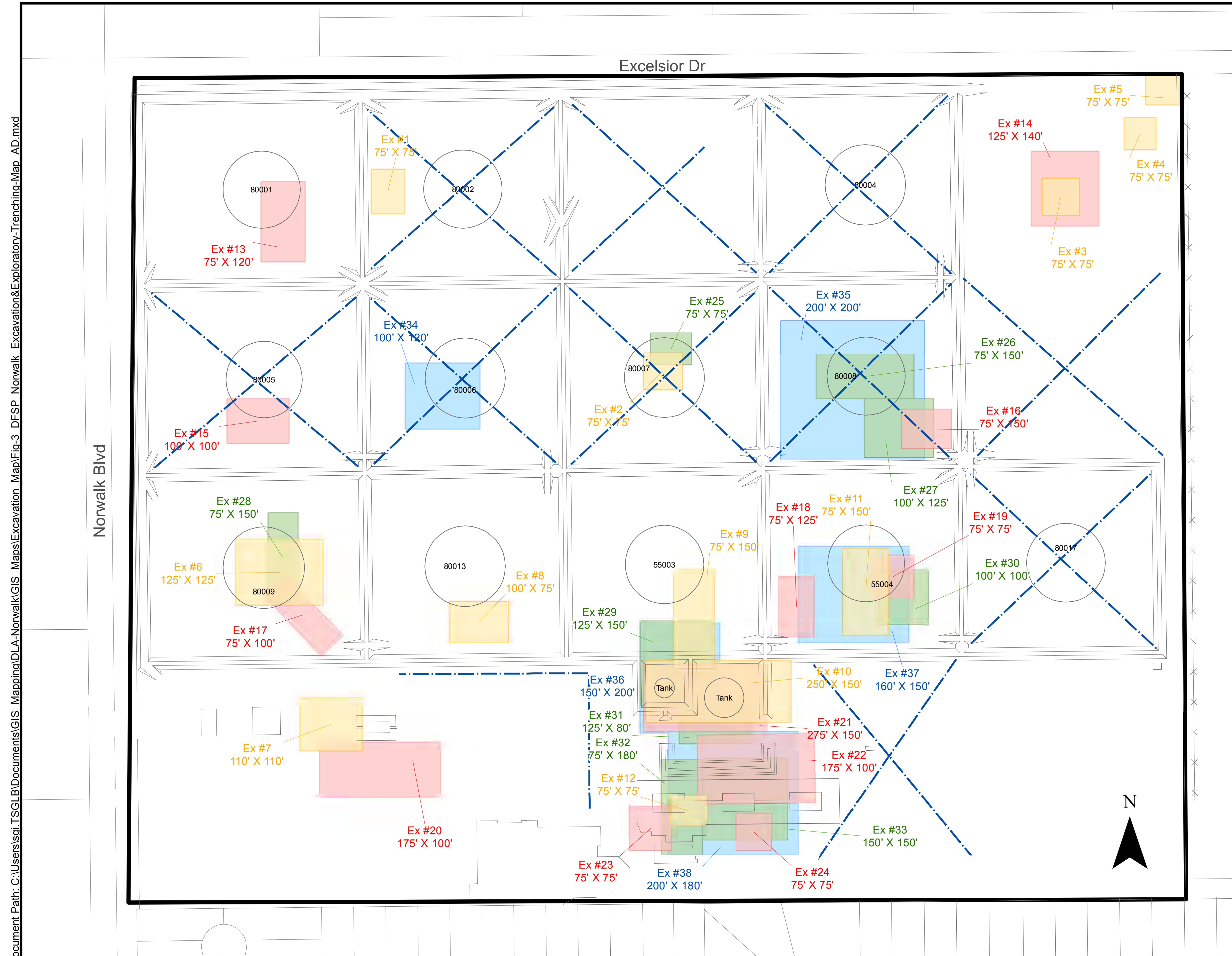
N

FIGURE 2



Legend

- Former Above Ground Storage Tanks
- DFSP Norwalk Border
- Exploratory Trenching
- Excavation 0-5ft
- Excavation 5-10ft
- Excavation 10-15ft
- Excavation 15-25ft

DFSP Norwalk
15306 Norwalk Boulevard
Norwalk, California

Project Number:	Date:	Drawn By:	Approved By:
04-NDLA-007	10/16/2014	A. Czuba	K. Wall

0 75 150 300 Feet

Excavation and Exploratory Trenching Map

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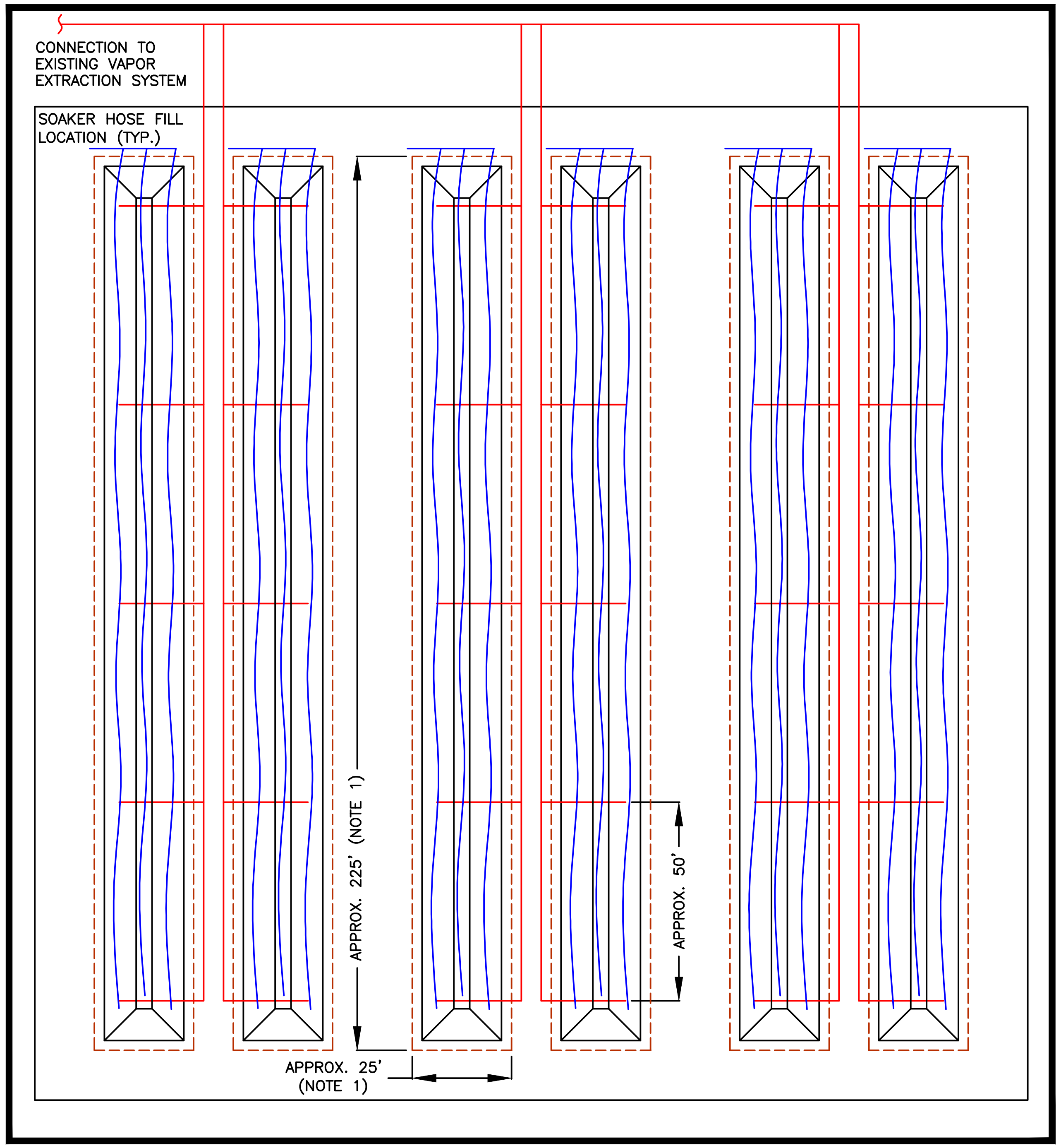
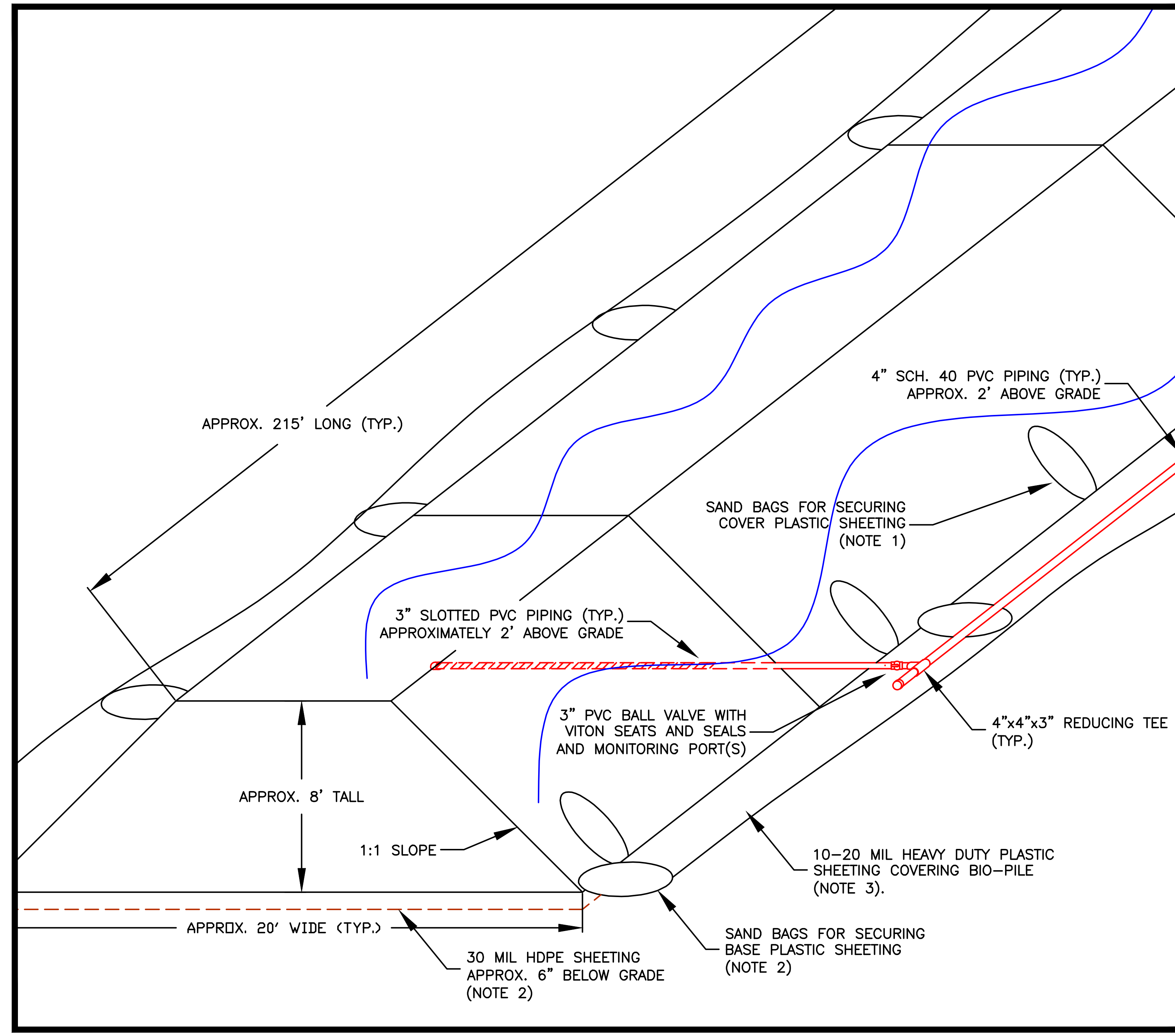
(562) 597-1055

Figure 4



PLAN VIEW
SINGLE BASIN BIO-PILE LAYOUT
TYPICAL

0 40 80
HORIZONTAL SCALE IN FEET



ISOMETRIC VIEW
BIO-PILE CONSTRUCTION DETAIL
TYPICAL - NOT ALL LATERALS SHOWN

0 6 12
HORIZONTAL SCALE IN FEET

LEGEND

- APPROXIMATE LOCATION OF PROPOSED VES CONVEYANCE PIPING (50' SPACING BETWEEN LATERALS)
- APPROXIMATE LOCATION OF PROPOSED SOAKER HOSE
- HDPE SHEETING BENEATH BIO–PILE

1. HIGH DENSITY POLYETHYLENE (HDPE) SHEETING FOOTPRINT IS APPROXIMATELY 225' X 25'.
2. 30 MIL HDPE TO BE PLACED BENEATH BIO–PILE APPROXIMATELY 6" BELOW GRADE (TO PROTECT LINER INTEGRITY DURING PILE CONSTRUCTION AND DESTRUCTION).
3. 10–20 MIL HEAVY DUTY PLASTIC SHEETING TO COVER BIO–PILE.

DFSP NORWALK
15306 NORWALK BLVD
NORWALK, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
04-NDLA-002	09/19/14	AD	NI

TREATMENT CELL DESIGN DETAILS

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SIGNAL HILL, CA 90755

N

FIGURE 5

/Volumes/Data/DFSP Norwalk/04–NDLA–007/Bio–pile Design.dwg

ID	Task Name	Duration	Start	Finish
1	**Preparatory Tasks - Plan Development and Project Permitting**	**49 days**	**Mon 9/22/14**	**Thu 11/27/14**
2	Resource Assignment/Kick-off	1 day	Mon 9/29/14	Mon 9/29/14
3	**Select/Activate Sub-Contractors**	**5 days**	**Mon 9/29/14**	**Fri 10/3/14**
9	**SCAQMD 1166 Permit - Vapor monitoring**	**43 days**	**Mon 9/22/14**	**Wed 11/19/14**
10	Draft Permit	0 days	Mon 9/22/14	Mon 9/22/14
11	SCAQMD Review	40 days	Mon 9/22/14	Fri 11/14/14
12	Final Permit	3 days	Mon 11/17/14	Wed 11/19/14
13	**SCAQMD Modify Permit to Operate**	**43 days**	**Mon 9/22/14**	**Wed 11/19/14**
14	Draft Permit	0 days	Mon 9/22/14	Mon 9/22/14
15	SCAQMD Review	40 days	Mon 9/22/14	Fri 11/14/14
16	Final Permit	3 days	Mon 11/17/14	Wed 11/19/14
17	**LARWQCB WDR - Soil Reuse**	**44 days**	**Mon 9/22/14**	**Thu 11/20/14**
18	Draft Permit	20 days	Mon 9/22/14	Fri 10/17/14
19	LARWQCB Review	21 days	Mon 10/20/14	Mon 11/17/14
20	Final Permit	3 days	Tue 11/18/14	Thu 11/20/14
21	**LA County Public Works- Well Abandonment**	**15 days**	**Fri 11/7/14**	**Thu 11/27/14**
22	Prepare permits	5 days	Fri 11/7/14	Thu 11/13/14
23	LA County Review & Approval	7 days	Fri 11/14/14	Mon 11/24/14
24	Final Permit	3 days	Tue 11/25/14	Thu 11/27/14
25	**Storm Water Pollution Protection Plan (SWPPP) Update**	5 days	Mon 11/10/14	Fri 11/14/14
26	**City of Norwalk-Access Agreement**	**33 days**	**Wed 9/24/14**	**Fri 11/7/14**
27	Draft Agreement	20 days	Wed 9/24/14	Tue 10/21/14
28	City of Norwalk Review	10 days	Wed 10/22/14	Tue 11/4/14
29	Final Permit	3 days	Wed 11/5/14	Fri 11/7/14
30	**City of Norwalk-Excavation Plan**	**43 days**	**Wed 9/24/14**	**Fri 11/21/14**
31	Draft	30 days	Wed 9/24/14	Tue 11/4/14
32	City of Norwal Review	10 days	Wed 11/5/14	Tue 11/18/14
33	Final Permit	3 days	Wed 11/19/14	Fri 11/21/14
34	**Field Preparatory Tasks**	**20 days**	**Fri 11/21/14**	**Thu 12/18/14**
35	Mobilization	5 days	Fri 11/21/14	Thu 11/27/14
36	Geophystical Survey - Ultility clearance	5 days	Fri 11/28/14	Thu 12/4/14
37	Site Survey - excavation limits and infrastructure location	2 days	Fri 11/21/14	Mon 11/24/14
38	Well Removal	15 days	Fri 11/28/14	Thu 12/18/14
39	Treatment Cells 1&2 Set-Up	4 days	Fri 11/21/14	Wed 11/26/14
40	**Soil Excavation/Treatment and Fill**	**264 days**	**Thu 11/27/14**	**Tue 12/1/15**
41	**Excavation Event #1 (20,000 cy)**	**81 days**	**Thu 11/27/14**	**Thu 3/19/15**
42	Excavations 0'-5'	14 days	Thu 11/27/14	Tue 12/16/14
43	Stockpile Treatment	60 days	Wed 12/17/14	Tue 3/10/15
44	Prep Treatment Cells #3 and #4	3 days	Wed 12/17/14	Fri 12/19/14
45	Back-Fill	7 days	Wed 3/11/15	Thu 3/19/15
46	**Excavation Event #2 (20,000 cy)**	**85 days**	**Mon 12/22/14**	**Fri 4/17/15**
47	Excavations '0-5'/0'-10'	14 days	Mon 12/22/14	Thu 1/8/15

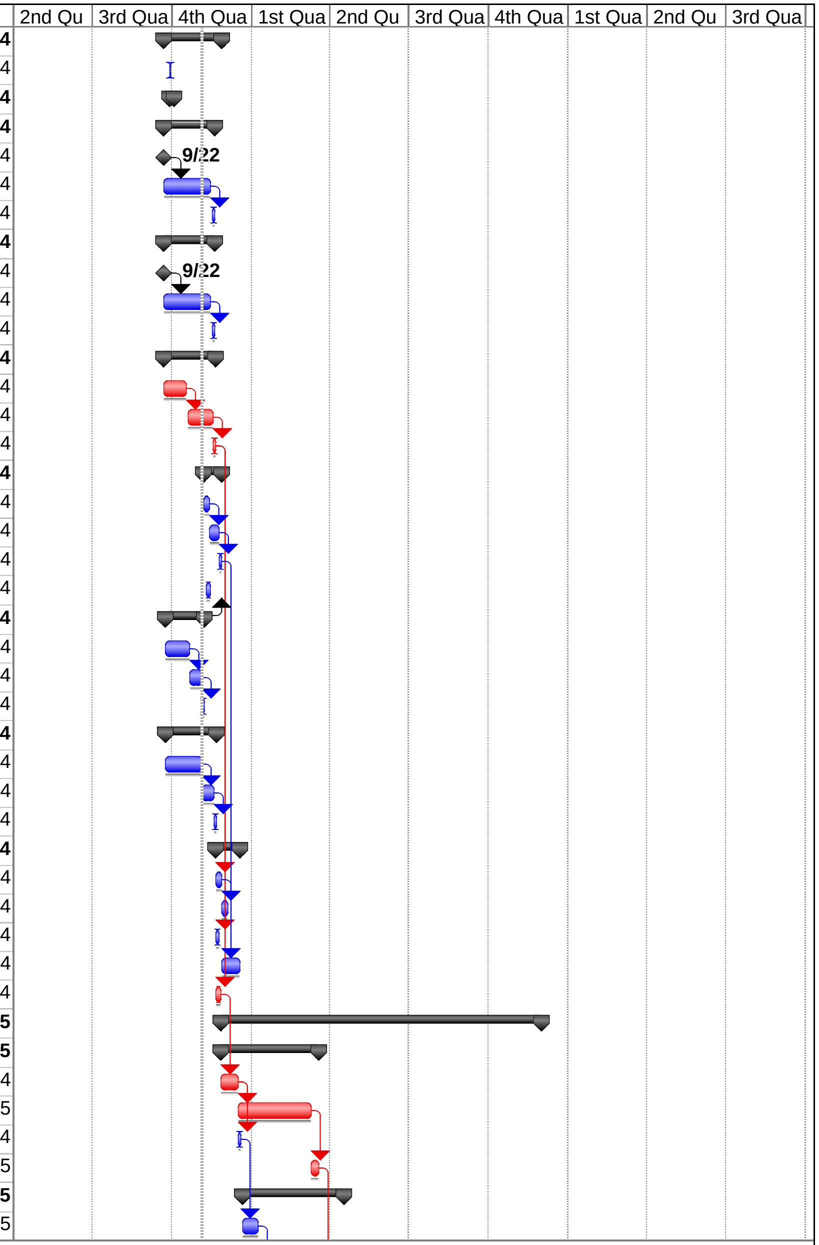

Figure 4 - Project Schedule
DSFP Norwalk ExcavationTreatment

Legend					
Task		Rolled Up Task		External Tasks	
Critical Task		Rolled Up Critical Task		Project Summary	
Progress		Rolled Up Milestone	◇	Group By Summary	
Milestone	◆	Rolled Up Progress		Deadline	⇩
Summary		Split			

FIGURE 6 - SEQUENCE OF EVENTS

ID	Task Name	Duration	Start	Finish
48	Stockpile Treatment	60 days	Fri 1/9/15	Thu 4/2/15
49	Back-Fill	7 days	Thu 4/9/15	Fri 4/17/15
50	**Excavation Event #3 (20,000 cy)**	**81 days**	**Fri 3/20/15**	**Fri 7/10/15**
51	Excavation 0'-10'	14 days	Fri 3/20/15	Wed 4/8/15
52	Stockpile Treatment	60 days	Thu 4/9/15	Wed 7/1/15
53	Back-Fill	7 days	Thu 7/2/15	Fri 7/10/15
54	**Excavation Event #4 (20,000 cy)**	**81 days**	**Mon 4/20/15**	**Mon 8/10/15**
55	Excavations 10'-15'	14 days	Mon 4/20/15	Thu 5/7/15
56	Stockpile Treatment	60 days	Fri 5/8/15	Thu 7/30/15
57	Back-Fill	7 days	Fri 7/31/15	Mon 8/10/15
58	**Excavation Event #5 (20,000 cy)**	**81 days**	**Mon 7/13/15**	**Mon 11/2/15**
59	Excavations 15'-25'	14 days	Mon 7/13/15	Thu 7/30/15
60	Stockpile Treatment	60 days	Fri 7/31/15	Thu 10/22/15
61	Back-Fill	7 days	Fri 10/23/15	Mon 11/2/15
62	**Excavation Event #6 (20,000 cy)**	**81 days**	**Tue 8/11/15**	**Tue 12/1/15**
63	Excavations 15'-25'	14 days	Tue 8/11/15	Fri 8/28/15
64	Stockpile Treatment	60 days	Mon 8/31/15	Fri 11/20/15
65	Back-Fill	7 days	Mon 11/23/15	Tue 12/1/15
66	**Exploratory Trenching**	**20 days**	**Tue 11/3/15**	**Mon 11/30/15**
67	Exploratory Trenching	20 days	Tue 11/3/15	Mon 11/30/15
68	**Cell Closures**	**26 days**	**Tue 11/3/15**	**Tue 12/8/15**
69	Cell 1 and 2	5 days	Tue 11/3/15	Mon 11/9/15
70	Cell 3 and 4	5 days	Wed 12/2/15	Tue 12/8/15
71	**Well Replacement**	**115 days**	**Tue 12/1/15**	**Mon 5/9/16**
72	**LA County Public Works- Well Replacement Permit**	**70 days**	**Tue 12/1/15**	**Mon 3/7/16**
73	Prepare application and well designs	30 days	Tue 12/1/15	Mon 1/11/16
74	LA County Review & Approval	30 days	Tue 1/12/16	Mon 2/22/16
75	Final Permits	10 days	Tue 2/23/16	Mon 3/7/16
76	**Install Wells**	45 days	Tue 3/8/16	Mon 5/9/16
77	Final Report	60 days	Tue 5/10/16	Mon 8/1/16

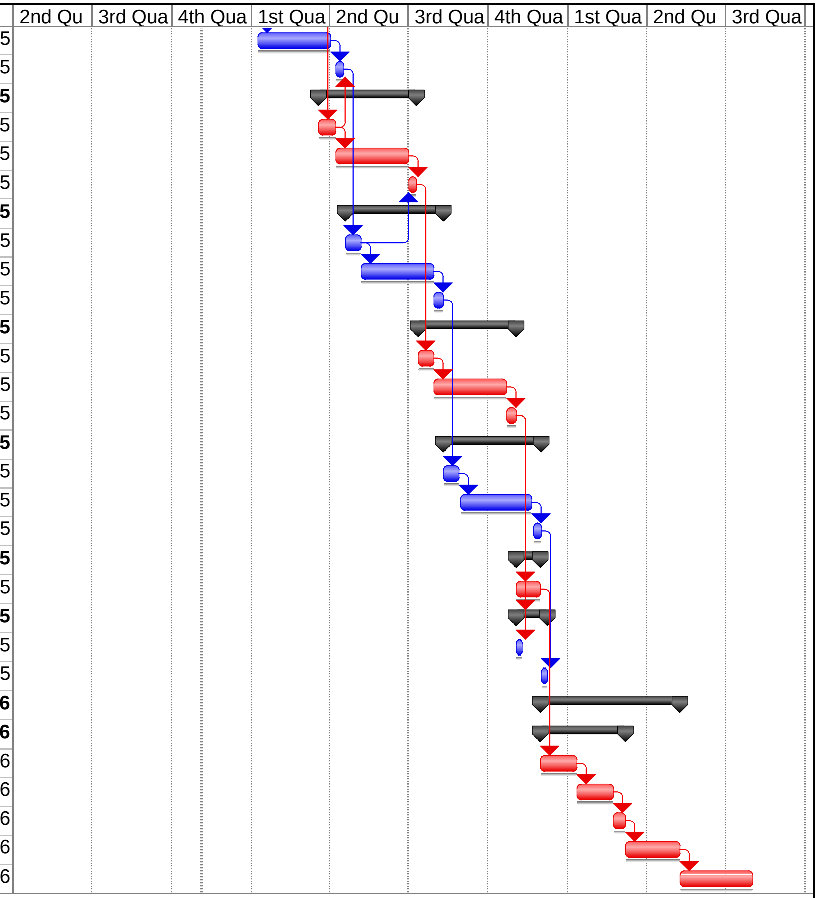

Figure 4 - Project Schedule
DSFP Norwalk ExcavationTreatment

Task		Rolled Up Task		External Tasks	
Critical Task		Rolled Up Critical Task		Project Summary	
Progress		Rolled Up Milestone		Group By Summary	
Milestone		Rolled Up Progress		Deadline	
Summary		Split			

FIGURE 6 - SEQUENCE OF EVENTS

TABLES

Table 1: Comparison of CSM Selected Remedies and Current RAP Remedies

Media	Parsons' 2013 CSM Proposed Remedy	SGI 2014 Revised RAP Proposed Remedy
Groundwater *	Continued operation of Groundwater Treatment System	No Change
Groundwater *	In-Situ Chemical Oxidation Pilot Study	No Change
Soil 0' to 10' Remedy	Excavation	No Change
Soil 0' to 10' Disposition	Off-site Disposal	On-site, ex situ treatment (minimal off-site disposal may be required)
Contaminated Soil 10' to groundwater	Vadose zone soil mixing with ISCO, if pilot study at former AST 80008 demonstrates effectiveness	Where applicable, continue excavation to groundwater and ex-situ treatment of soil

(* Groundwater remedies will be discussed in detail in a separate Groundwater Remedial Action Plan)

Table 2

Soil Cleanup Goals

DFSP Norwalk Site, Norwalk California

	(feet below ground surface)					
Depth Below Ground Surface	**0.5**	**5**	**10**	**15**	**20**	**25**
Depth to Groundwater	**25.5**	**21**	**16**	**11**	**6**	**1**
Constituent	**Soil Cleanup Goal (mg/kg)**					
TPH as Gasoline (C4-C12)	500	500	100	100	100	100
TPH as JP-5 (C8-C17)	500	500	100	100	100	100
TPH as Diesel (C5-C25)	1,000	1,000	100	100	100	100
Benzene	0.015	0.013	0.012	0.013	0.011	0.012
Toluene	0.614	0.440	0.391	0.423	0.356	0.367
Ethylbenzene	2.07	1.44	1.19	1.33	1.07	1.10
Xylenes	5.55	3.77	3.09	3.47	2.76	2.84
1,1,2,2-Tetrachloroethane	0.0023	0.0020	0.0015	0.0012	0.0006	0.0002
1,1,2-Trichloroethane	0.0032	0.0029	0.0023	0.0020	0.0012	0.0008
1,2,3-Trichlorobenzene	0.0740	0.0634	0.0467	0.0356	0.0162	0.0034
1,2,3-Trichloropropane	8.74E-07	7.66E-07	5.87E-07	4.79E-07	2.56E-07	1.23E-07
1,2,4-Trimethylbenzene	2.10	1.80	1.34	1.03	0.478	0.120
1,2-Dibromo-3-chloropropane	2.50E-04	2.19E-04	1.68E-04	1.37E-04	7.31E-05	3.52E-05
1,2-Dibromoethane	3.05E-06	2.78E-06	2.27E-06	2.04E-06	1.30E-06	9.60E-07
1,2-Dichloroethane	1.06E-04	1.04E-04	9.37E-05	9.60E-05	7.29E-05	6.92E-05
1,3,5-Trimethylbenzene	2.06	1.77	1.31	1.01	0.470	0.118
2-Butanone	0.557	0.607	0.617	0.713	0.612	0.661
2-Chlorotoluene	0.558	0.481	0.358	0.278	0.132	0.039
2-Hexanone	0.0073	0.0072	0.0065	0.0066	0.0050	0.0047
4-Chlorotoluene	0.547	0.472	0.351	0.273	0.130	0.038
Acetone	0.994	1.17	1.28	1.57	1.42	1.60
Bromomethane	0.0015	0.0014	0.0013	0.0013	0.0010	0.0010
Carbon disulfide	0.049	0.046	0.039	0.038	0.026	0.023
Chlorobenzene	0.119	0.104	0.079	0.063	0.032	0.013
Chloroethane (Ethyl Chloride)	2.23	2.47	2.55	2.98	2.59	2.83
Chloroform	7.38E-05	6.82E-05	5.67E-05	5.25E-05	3.48E-05	2.75E-05
Dichlorodifluoromethane	0.984	0.868	0.672	0.559	0.309	0.167
Diisopropyl Ether (DIPE)	0.449	0.424	0.364	0.350	0.246	0.212
Isopropylbenzene	5.56	4.78	3.53	2.71	1.26	0.303
Methylene Chloride	7.78E-04	7.99E-04	7.61E-04	8.27E-04	6.69E-04	6.82E-04
Methyl-t-Butyl Ether (MTBE)	9.07E-04	9.10E-04	8.43E-04	8.89E-04	6.97E-04	6.86E-04
Naphthalene	0.270	0.231	0.170	0.130	0.059	0.012
n-Butylbenzene	3.97	3.40	2.50	1.91	0.867	0.179
n-Propylbenzene	2.18	1.87	1.39	1.06	0.489	0.114
p-Isopropyltoluene	2.82	2.42	1.79	1.37	0.636	0.154
sec-Butylbenzene	2.59	2.22	1.64	1.26	0.576	0.129
Styrene	0.463	0.399	0.296	0.229	0.108	0.030
Tert-Butyl Alcohol (TBA)	0.0010	0.0012	0.0013	0.0016	0.0014	0.0016
tert-Butylbenzene	2.07	1.78	1.32	1.01	0.465	0.110
Trichloroethene	0.0070	0.0061	0.0047	0.0038	0.0020	0.0009

Notes:

mg/kg = milligram per kilogram

NA = not applicable

Table 3

Well Removal List

Area	Well	X_NAD83	Y_NAD83	Installation Date	Casing Elevation (ft msl)1	Total Depth (ft bgs)2	Diameter	Screen Interval (ft bgs)	Remediation Well Function	Well Operation Status at End of Third Quarter 2014	Well Removal Excavation-EX Over Drill - OD	Well to be Replaced (Y/N)
AST 80001	VEW-23	6539807.906460	1783947.298930	8/3/04	76.2	25	2	15 - 25	SVE	OFF	EX	N
AST 80002	GW-5	6539957.6500000	1783975.1900000	6/15/95	77.09/76.99	63	1 and 4	25.5 - 60.5	GWE	Non-MRP/Guaged annually	OD	Y
AST 80006	SP-08	6539993.895040	1783677.726310		76.3	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-09	6540014.181510	1783607.946410		76	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-11a	6540123.480130	1783611.811410		76	50	2	48 - 50	Biosparge	OFF	OD	N
	VEW-20	6540025.893090	1783634.686940	8/2/04	75.95	25	2	15 - 25	SVE	OFF	EX	N
	VEW-21	6540055.112380	1783607.510690	8/2/04	75.75	25	2	15 - 25	SVE	OFF	EX	N
	GMW-17	6540085.3900000	1783583.5700000	8/1/91	74.66	50	4	25 - 50	GWE	DLA-MRP	OD	Y
	TF-9	6539993.8596000	1783582.5945000	9/22/95	75.27	63	4	25-60	GWE	DLA-MRP	OD	Y
	TF-11	6540094.4800000	1783583.6400000	9/27/95	74.95/74.4	63	1.5 and 4	25 - 60	TFE,GWE	Non-MRP	OD	Y
AST 80008	SP-17	6540649.382330	1783626.260590		77.5	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-17a	6540580.951360	1783635.946750		77.2	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-20	6540767.172840	1783568.341780		76.9	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-20a	6540851.669870	1783607.369480		76.4	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-21	6540788.834370	1783644.171330		77.3	50	2	48 - 50	Biosparge	OFF	OD	N
	SP-23	6540731.467490	1783759.927570		77.2	50	2	48 - 50	Biosparge	OFF	OD	N
	VEW-24	6540659.780070	1783620.527260	8/2/04	76.13	25	2	15 - 25	SVE	OFF	EX	N
	VEW-25	6540729.265700	1783609.096120	8/2/04	76.14	25	2	15 - 25	SVE	OFF	EX	N
	VEW-26	6540693.062160	1783664.737530	8/4/04	77.5	25	2	15 - 25	SVE	OFF	EX	N
	VEW-27	6540770.526010	1783659.597290	8/4/04	77.07	25	2	15 - 25	SVE	OFF	EX	N
	TF-17	6540641.1000000	1783567.3100000	9/29/95	74.88	63	2	25 - 60	TFE, GWE	DLA-MRP	OD	Y
	TF-20	6540830.1100000	1783558.3300000	10/3/95	75.59	63	2	25 - 60	TFE,GWE	DLA-MRP	OD	Y
	TF-22	6540787.3500000	1783732.7900000	10/2/95	74.76	63	2	25 - 60	TFE, GWE	Non-MRP	OD	Y
	GW-14	6540587.7000000	1783659.9000000	4/26/07	76.54	67	1	25 - 65	GWE	DLA-MRP	OD	Y
	GMW-35	6540789.6895000	1783741.2268000	6/4/93	76.12	50	4	20 - 50	GWE	DLA-MRP	OD	Y

Table 3

Well Removal List

Area	Well	X_NAD83	Y_NAD83	Installation Date	Casing Elevation (ft msl)1	Total Depth (ft bgs)2	Diameter	Screen Interval (ft bgs)	Remediation Well Function	Well Operation Status at End of Third Quarter 2014	Well Removal Excavation-EX Over Drill - OD	Well to be Replaced (Y/N)
AST 80009	BW-5	6539839.4900000	1783256.4900000	5/23/96	73.59	52.5	5	27 - 45.5	GWE	SFPP Extraction Well	OD	Y
AST 55004	VEW-28	6540785.313520	1783407.829640	8/3/04	75.67	25	2	25-Oct	SVE	OFF	EX	N
	VEW-29	6540790.195020	1783293.055780	8/3/04	75.25	25	2	10 - 25	SVE	OFF	EX	N
	VEW-30	6540766.427630	1783335.000850	8/3/04	75.65	25	2	10 - 25	SVE	OFF	EX	N
	GMW-32	6540002.7200000	1782960.1800000	8/2/91	74.62	50	4	20 - 50	GWE	MRP	OD	Y
	GMW-52	6540814.0800000	1783326.8600000	12/19/94	75.03	41.5	4	15 - 40	GWE	Non-MRP	OD	Y
South West corner	GWR-1	6540014.4900000	1783045.7000000	7/11/91	77.4	50	4	25 - 50	GWE	SFPP_MRP	OD	Y
	GMW-27	6539886.1600000	1783013.7300000	1/10/92	74.41	50	4	25 - 50	GWE	SFPP_MRP	OD	Y
	HL-4	6540033.2400000	1783194.1300000	10/16/86	75.75	39	4	18 - 38.5	GWE	Non-MRP	OD	Y
South Central	VMP-2	6540436.781430	1782989.560610		75.2		1			OFF	EX	N
	VW-09	6540530.082700	1782968.315380	3/15/91	75.77	30	3	05-29	SVE	OFF	EX	N
	VW-11	6540513.577930	1783023.238880	3/23/04	75.55	25	2	20 - 25	SVE	OFF	EX	N
	VW-12	6540400.957250	1782984.608740	3/23/04	75.79	30.5	2	15 - 30	SVE	OFF	EX	N
	MW-15	6540509.2806000	1783073.6266000	8/7/1990	76.99	50	4	18-48	GWE	SFPP_MRP	OD	Y
	GMW-4	6540586.6700000	1782954.4400000	5/21/91	75.45	50	4	20-50	GWE	SFPP_MRP	OD	Y
	GMW-14	6540642.7844000	1783066.7785000	7/10/91	74.2	50	4	20 - 50	GWE	SFPP_MRP	OD	Y
North East	GMW-66	6541123.6475000	1784012.1225000	9/8/09	77	40.5	4	20-40	GWE	DLA-MRP	OD	Y

APPENDIX A

CONCEPTUAL SITE MODEL AND REMEDIAL ACTION EVALUATION FOR SOIL, GROUNDWATER, AND LNAPL **(REMEDIAL PLAN; PARSONS, 2013)**

CONCEPTUAL SITE MODEL AND REMEDIAL ACTION EVALUATION FOR SOIL, GROUNDWATER, AND LNAPL

DEFENSE FUEL SUPPORT POINT NORWALK
15306 NORWALK BOULEVARD
NORWALK, CALIFORNIA

Prepared for

Defense Logistics Agency Energy
8725 John J. Kingman Road
Fort Belvoir, Virginia 22060-6222

September 30, 2013

Prepared by

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CONCEPTUAL SITE MODEL AND REMEDIAL ACTION EVALUATION FOR SOIL, GROUNDWATER, AND LNAPL

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APPENDIX

A LNAPL Transmissivity Calculation, LNAPL Recovery Test Data, and LNAPL Laboratory Reports

ACRONYMS AND ABBREVIATIONS

μg/L	micrograms per liter
1,2-DCA	1,2-dichloroethane
amsl	above mean sea level
API	American Petroleum Institute
AS	air sparging
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CHHSL	California Human Health Screening Level
COPC	chemical of potential concern
CPT	cone penetrometer testing
CSM	conceptual site model
DFSP	Defense Fuel Support Point
DLA	Defense Logistics Agency
DO	dissolved oxygen
DP	direct-push
DPLE	dual pump liquid extraction
EDB	ethylene dibromide
EVS	Environmental Visualization System
EXP	Exposition aquifer
FPR	free product removal
ft^2/day	square feet per day
ft/day	feet per day
ft/ft	foot per foot
GAC	granular activated carbon
GWE	groundwater extraction
GWT	groundwater treatment
HHSE	human health screening evaluation
ISCO	in situ chemical oxidation
ITRC	Interstate Technology & Regulatory Council
JP-4	jet propellant 4
JP-5	jet propellant 5
JP-8	jet propellant 8
KMEP	Kinder Morgan Energy Partners, L.P.
LCSM	light non-aqueous phase liquid conceptual site model
LNAPL	light non-aqueous phase liquid
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MTBE	methyl tertiary-butyl ether
NSZD	natural source zone depletion
ppm	parts per million

ACRONYMS AND ABBREVIATIONS

RAB	Restoration Advisory Board
RAP	remedial action plan
ROI	radius of influence
ROST	Rapid Optical Screening Tool
RWQCB	Regional Water Quality Control Board, Los Angeles
SESR	surfactant enhanced subsurface remediation
SFPP	Santa Fe Pacific Pipeline, L. P.
SCG	soil cleanup goal
SVE	soil vapor extraction
TBA	tertiary-butyl alcohol
TFE	total fluids extraction
the site	Defense Fuel Support Point Norwalk tank farm facility
TPH	total petroleum hydrocarbon
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UVOST	ultraviolet optical sensing tool
VEW	vapor extraction well
VMP	vapor monitoring probe
VOC	volatile organic compound
WDR	waste discharge requirements

1. INTRODUCTION

Parsons was contracted by the Defense Logistics Agency (DLA) Energy to prepare this conceptual site model (CSM) and remedial action evaluation for soil, groundwater, and light non-aqueous phase liquid (LNAPL) at the Defense Fuel Support Point (DFSP) Norwalk tank farm facility (the site) located at 15306 Norwalk Boulevard, Norwalk, California. The site location and vicinity are shown on Figure 1-1.

This CSM has been prepared in response to the letters dated April 10, 2012, March 20, 2013, and August 7, 2013 from the California Regional Water Quality Control Board (RWQCB). The April 10, 2012, letter requested a soil CSM (RWQCB, 2012). The March 20, 2013 letter (RWQCB, 2013a), requested requirements to provide a workplan for LNAPL CSM (LCSM) and estimations of LNAPL transmissivity. The workplan and addendum were submitted on June 27, 2013 (Parsons, 2013a) and July 30, 2013, respectively. The August 7, 2013 letter (RWQCB, 2013b), approved the workplan for the LCSM and requested submittal of CSM on September 30, 2013.

1.1 BACKGROUND AND PREVIOUS CONCEPTUAL SITE MODEL

The RWQCB initially requested a CSM in a letter dated November 25, 2008 (RWQCB, 2008). The draft CSM was submitted on February 13, 2009 (Parsons, 2009). The 2009 draft CSM summarized and integrated all information relevant to released fuel products into the environment, and the physical, biological, and chemical processes that determined the transport of these contaminants to environmental receptors.

The soil CSM was submitted on September 4, 2012 (Parsons, 2012a), following the April 10, 2012 RWQCB's request. The soil CSM updated the initial CSM with all available soil data and interpretations pertaining to the physical, chemical, transport, and receptor characteristics present at the site. It also provided remedial design and the evaluation of onsite soil reuse as backfill and offsite disposal of soil.

This CSM reflects current understanding of site conditions based on information reviewed to date and focuses on soil vapor, soil, groundwater, and LNAPL impacts beneath the site and adjacent offsite areas. This CSM updates previous submittals and adds the corrective action decision framework requested by the RWQCB.

1.2 OBJECTIVES AND REPORT OUTLINE

The objective of this CSM is to integrate all the available site data and interpretations pertaining to the physical, chemical, transport, and receptor characteristics present at the site. The CSM will be used to aid in remediation efforts and future remedial design and implementation. A more current understanding of the groundwater, soil, and soil vapor hydrocarbon impacts beneath the site and adjacent offsite areas will be described to facilitate effective remedial efforts.

The CSM was developed using guidance provided in the following documents and as requested by the RWQCB:

- *Standard Guide for Development of Conceptual Site Models and Remediation Strategies for Light Nonaqueous-Phase Liquids Released to the Subsurface*, ASTM E2531-06 (ASTM, 2006);
- *Standard Guide for Estimation of LNAPL Transmissivity*, ASTM E2856-12 (ASTM, 2012);
- *Evaluating LNAPL Remedial Technologies for Achieving Project Goals* (Interstate Technology & Regulatory Council [ITRC], December 2009a); and
- *In-situ Chemical Oxidation Engineering Issue Paper*, (USEPA, Huling and Pivetz, 2006).

These documents provide guidance in developing an LCSM upon which a decision framework is applied to assist in selecting remedial actions. The CSM includes complete data set to evaluate soil, groundwater, and LNAPL. The ITRC document provides a detailed framework that uses LCSM information to identify appropriate LNAPL remedial objectives suited to achieve remediation goals and addresses 17 LNAPL remediation technologies that focus primarily on the LNAPL body, or “source zone”.

This report is organized into eight sections including this introductory section which also includes the background and previous CSMs and objectives. Section 2 presents site description and summarizes previous investigations and remedial action. Section 3 provides a discussion about the physical and source characterization. Section 4 provides the details of the CSM including the nature and extent of impacts in the vadose zone, LNAPL, and groundwater and summarizes exposure pathways and potential receptors. Sections 5 through 7 present the remedial action evaluation and proposed action. The references are listed in Section 8.

2. SITE DESCRIPTION AND BACKGROUND

The DFSP Norwalk site encompasses approximately 50 acres (Figure 2-1). The facility is currently bordered on the north, south, and west by residential areas and on the east by a city park (Holifield Park). The DFSP Norwalk facility was constructed in 1923 and was operated by at least four owners, including Tidewater Oil, Jolly Oil Company, Wilshire Oil, and Texaco, until it was acquired by the Air Force in 1951. In 1951, the Air Force added manifolds, gravel sumps, truck loading racks and aboveground and underground piping to the facility. The gravel sumps were located next to each storage tank and are believed to have been used as discharge points for water drawn from the bottom of the tanks. Facility ownership was transferred from the Air Force to the DLA Energy in 1968.

The site previously contained ten 80,000 and two 55,000-barrel aboveground storage tanks (ASTs) that were used to store and distribute jet propellants 5 and 8 (JP-5 and JP-8). Aviation gasoline and JP-4 were also reportedly stored at the site. The former truck loading racks are located in the south-central portion of the site and occupy approximately one acre (Figure 2-1). In the past, fuel was transferred from the facility via tanker trucks filled at the loading racks, but by the early 1990s jet fuel was no longer being routinely transferred from the facility via tanker trucks. Subsequently, a 10-inch diameter, government owned multi-product pipeline, carried fuel from DFSP San Pedro to DFSP Norwalk and a 6-inch diameter pipeline carried fuel from DFSP Norwalk to the former El Toro Marine Corp Air Station. Investigations at the site found that releases had occurred at several locations at the facility.

The site was shut down in 1999 and the ASTs were drained, cleaned, and marine-chemist certified. Within the tank farm, the individual tank lateral pipes were drained, disconnected, and individually cleaned. The main pipe laterals, running form the Powerine Basin to the Air Force and El Toro manifolds, were also drained and individually cleaned.

The ASTs, concrete pads, and connecting pipeline systems were demolished and removed in 2011 and 2012. Following removal of the tanks and pads, soil confirmation samples were collected from beneath the AST locations and included in the *Concrete Demolition and Soil Confirmation Sampling Completion Report* (Parsons, 2013b).

An approximate 2-acre area is leased by SFPP, L.P. (SFPP), an operating partner of Kinder Morgan Energy Partners, L.P. (KMEP), along the southern and eastern property lines (Figure 2-1). Previously, SFPP operated a pump station at the site. The pump station has been decommissioned but three pipelines remain in service.

2.1 REMEDIAL ACTION

A remedial action plan (RAP) was submitted in 1995 for the DFSP Norwalk site (GSI, 1995) and a revised RAP submitted in 2006 (Parsons, 2006a). The 1995 plan was to address impacts in the shallow aquifer underlying the tank farm only. The purpose of the revised 2006 plan was to evaluate if the objectives of the initial RAP were achieved and to assess the effectiveness of the existing remedial systems. The areas of the revised RAP were limited to the tank farm area, the Powerine basin, the vehicle maintenance area to the east, the vapor recovery underground storage tank (UST) to the north-west (located to the south of the thermal oxidizer), the water tank area near just to the north of the truck loading area, the holding/settling pond in the northeast corner, and the pump control house to the west (Figure 2-1).

The DLA Energy has installed remediation systems to treat the hydrocarbon impacted soil and groundwater environmental media. The purposes of these remediation systems are to reduce contaminant concentrations in soil and groundwater to cleanup goals. The ultimate goal is to achieve site closure. The remediation systems at the site by DLA Energy consists of soil vapor extraction (SVE), groundwater extraction (GWE), biosparging, localized bioslurping for free product recovery, absorbent sock installations for passive recovery of free product, total fluids extraction (TFE), and soil vapor and groundwater treatment (GWT). DLA Energy is currently conducting GWE in the northwest corner of the property from two pumping wells (GW-2 and GW-13), and also from two wells (GW-15 and GW-16) in the northeast area bordering Holifield Park. The operation of the GWE system is to contain and reduce the extent of the free product and dissolved plumes. SVE is also underway from the four horizontal wells that span the entire former tank farm area and from the north eastern boundary area. Additionally, localized bioslurping vacuum recovery is conducted as needed from wells exhibiting free product thicknesses greater than 1 foot.

Details of the remediation system operation are presented quarterly to the RWQCB and Restoration Advisory Board (RAB). DLA Energy created a web site (*Norwalkrab.com)* to house project information, which includes agendas, minutes, and presentations from RAB meetings dating back to 1994. In addition, all historical project information and reports can be located in the information repository at the Norwalk Regional Library.

The remediation system operated by SFPP consists of SVE, TFE, GWE, and treatment of extracted soil vapor and groundwater to address three specific areas at and near the site: the south-central area, the southeastern area, and the western area. SFPP discussed their remediation systems and impacted areas in their CSM and proposed alternative remedy (CH2M HILL, 2013).

Figure 2-2 shows the DLA Energy areas of concern and also the CSM boundary. It also shows SFPP's areas of concern which are discussed in detail in the CSM and proposed alternative remedy (CH2M HILL, 2013).

2.2 PREVIOUS INVESTIGATIONS

The subsurface soil and groundwater in and around the DFSP Norwalk facility has been extensively studied. Since 1986, environmental assessments and remedial action have been performed at the site by several consultants on behalf of DLA Energy. During these investigations, wells were installed for monitoring and as components of groundwater remediation activities. These investigations evaluated and defined the extent of liquid-phase, adsorbed-phase, and dissolved-phase hydrocarbons in soil and groundwater beneath the site and offsite to the south, west, and east. There is more than adequate understanding of the types of contaminants and their vertical and areal distribution both on and off of the DFSP Norwalk facility. Figure 2-2 shows the primary areas of concern as identified as north-central, eastern, water tank, and truck loading area. Figure 2-3 presents a map showing all the soil sampling locations used during the preparation of this CSM.

2.2.1 Aboveground Storage Tank Farm Area

The Powerine Basin is located in the north-central portion of the facility in between former ASTs 80002 and 80004. The Powerine Basin was historically used as an effluent discharge area for the previous oil-water separator. Effluent disposal ceased in 1982, when the current oil-water separator (near the oily waste area) was brought on line. An abandoned water well in the Powerine Basin was found to contain JP-5 fuel; in 1981 approximately two barrels of product was extracted from the well, and the well was abandoned under supervision of State personnel. The Powerine Basin also contained a 500-gallon UST used for storage of jet fuel. The steel tank was removed in December 2005 during which the integrity of the tank was observed to be satisfactory. Furthermore, no staining or discoloration of soil was observed around and at the bottom of the excavation activity.

Within the tank farm area, the earliest recorded release occurred in 1968 when an unknown quantity of unspecified petroleum product was released from a former slop tank located adjacent to AST 55003.

In 1996, site remediation activities in the tank farm area were initiated. The remediation system consisted of an SVE system, and a free-product removal and groundwater extraction treatment (FPR/GWT) system. The SVE system became fully operational in May 1996, whereas the FPR/GWT system began full time operation in June 1996.

In July 1998, GTI identified the western portion of the facility, where the southern and northern plumes commingle, and the northwestern corner of the site as main areas of concern for optimization of mass removal and for containment and recovery of the dissolved-phase plume.

In May 1999, a Rapid Optical Screening Tool (ROST) analysis was conducted to assess the hydrocarbon impacts in the subsurface zone. Additionally, the locations of the cone penetrometer test (CPT) locations CPT-1 through CPT-10, and direct-push (DP) technology locations DP-10 through DP-51 were assessed for the presence of petroleum hydrocarbons in soil in the northern tank farm area and for evaluating the success of remedial efforts conducted in this area since May 1996. In addition, soil sample collection for chemical, physical, and/or biological analyses using a DP technology at 57 locations in the tank farm area were conducted. It was concluded that the bulk of the remaining contamination was found to occur at and below the groundwater surface.

The initial remediation system consisted of 16 vertical total fluid recovery wells (TF-8 through TF-11, and TF-13 through TF-24); eight vertical groundwater recovery wells (GW-1 through GW-7, and GW-12); two 30-foot deep vertical vapor extraction wells (VE-01 and VE-02); and 4 horizontal vapor extraction wells (HW-1, HW-3, HW-5 and HW-7).

The results of chemical, physical, and/or biological analyses conducted in the tank farm area during May and June 1999 suggested lack of oxygen within and outside the plume boundaries, because biofouling of well screens and pumps were observed in the plume boundaries. In August 1999 biosparging was proposed in the northern tank farm area. The objectives of the biosparge system were to enhance the aerobic biodegradation of hydrocarbons in the saturate zone and to aerate and volatilize the liquid hydrocarbon trapped in the fine pores within the product/water saturated zone. The biosparge system was also intended to mechanically displace and mobilize liquid hydrocarbons trapped below the water table and increase the dissolved oxygen (DO) above 4 milligrams per liter (mg/L). 16 sparge wells were installed in October 1999 (SP-8, SP-9, SP-11a and SP-11b, SP-13 through SP-18, SP-20 through SP-24 and SP-48). The locations of these wells were selected to provide optimal oxygen enhancement while ensuring that mobilized liquid phase hydrocarbon and vapors would be contained and recovered through the existing TFE wells and the horizontal vapor extraction wells (VEWs). In July 2001, an additional 16 biosparge wells were installed to increase DO in the saturated zone outside the liquid hydrocarbon plume. The system expansion was completed, and the biosparge system restarted in December 2001.

In November 2003, Parsons evaluated the effectiveness of the remediation systems targeting the central-plume area at the site. Performance of the SVE and thermal oxidation system, the groundwater pumping system, the TFE system, and the biosparge system were considered during this evaluation. Based on the observed results, Parsons recommended expanding biosparging to enhance aerobic biodegradation within the dissolved-phase plume by optimizing total fluid recovery; continuing vapor extraction from the horizontal wells with treatment through the thermal oxidizer; allowing periodic monitoring of the horizontal vapor extraction wells remedial progress; and installing vapor monitoring probes (VMP) in selected areas containing elevated soil vapor concentrations.

In order to optimize the removal of residual free-phase liquid hydrocarbons and the dissolved hydrocarbon plume in groundwater at the bulk fuel tank farm, in June 2004 Parsons proposed installation of additional biosparge wells. The operating goals of the biosparging system were to provide oxygen to stimulate aerobic biodegradation of hydrocarbons present in groundwater and vadose zone soils at the site, and to volatilize fuel hydrocarbons in the capillary fuel “smear zone”. The first phase of system expansion consisted of ten sparge wells localized in an area with the highest dissolved total petroleum hydrocarbon (TPH) concentrations and where residual free product remained. In August 2004, ten sparge points were installed within the tank farm area near ASTs 80002, 80006, and 80007 and were connected to the existing central plume SVE treatment system located in the northern portion of the facility.

Nine additional biosparge wells were installed in the eastern boundary near monitoring wells GMW-60 and GMW-61 to treat the dissolved hydrocarbon plume in this area.

In 2004, the SVE system was expanded and 12 VEWs and 16 multiple-depth VMPs were installed to treat impacted soils below the ASTs and were connected with other targeted cleanup areas to the existing central plume and truck fueling area SVE treatment system. An additional 28 vertical soil borings within and around the tanks and 11 angled borings underneath the tanks were installed.

In spring of 2011, the aboveground steel storage tanks were demolished. From May 2011 through October 2012, the concrete AST foundations, all associated tank farm underground concrete structures and piping, asbestos-containing material, pump stations, oil-water separator, storm drain system, fire water/foam prevention system, and the septic tanks were demolished and removed. Subsequently, soil confirmation sampling was conducted from all areas to further define extent of vadose zone impacts (Figure 2-3).

2.2.2 Truck Loading and Water Tank Areas

The truck loading area is located in the south-central portion of the site and occupies approximately one acre. In the past, fuel was transferred from the facility via tanker trucks filled from this area, but by early 1990s jet fuel was no longer being routinely transferred from the facility via tanker trucks. The discussion below describes the past investigation and remedial activities performed at the truck fueling and the water tank areas.

In April 1999, a fuel release from an underground pipeline was discovered in the southern area of the facility west of the water tank and north of truck loading racks. Approximately 80 cubic yards of impacted soil was removed. In addition to the deeper excavation that exposed the leaking pipe, approximately 1 foot of impact soil was removed west and south of the water tank. The excavation was backfilled with clean soil in April 1999, and 23 soil samples were collected and analyzed for TPH as JP-5. Fourteen DP samples were analyzed for volatile organic compounds (VOCs) to assess the impact of fuel release north of truck loading racks. Both TPH as JP-5 and benzene, toluene, ethylbenzene, and total xylenes (BTEX) compounds were reported in soil samples.

Additional field activities were performed in May 1999, which consisted of collecting soil samples at water tank release area using hand auger and DP technology. It was concluded that the bulk of the remaining contamination was found to occur at and below the groundwater surface.

Additional soil investigation was conducted at the truck loading area in September 2001, during which the vertical extents of hydrocarbon contamination in subsurface soils were evaluated for the truck filling racks, vehicle maintenance, vapor recovery UST, and septic tank areas. The extent of commingling of releases from truck filling racks and other known adjacent sources was also evaluated using data collected from current and previous investigations. During this investigation, 15 DP continuous core samples were logged and sampled in and around the truck loading area. The investigation at the truck loading area revealed evidence of past fuel releases. The data suggested that the release occurred at or around the western and central truck loading islands. An area approximately 80 feet by 260 feet, extending from near the surface to the water table at 28 feet below grade had been impacted by releases at the truck loading area. The maximum concentrations detected during the September 2001 investigation were between 26 feet and 27 feet below grade at 21,000 milligrams per kilogram (mg/kg) TPH as gasoline (C8-C12) and 10,000 mg/kg TPH as jet fuel. However, the soil data near the eastern-most truck loading island did not indicate that significant releases occurred from that stand.

In 2003, fuel samples were collected from four locations (GMW-4, GMW-10, MW-9, and MW-15) in and around the truck loading area, one from the eastern area (GMW-58), and one from the tank farm area just north of AST 55004 (TF-18). The analytical data for these samples suggested a varying degree of weathered or degraded fuels, and mixtures of fuels already identified as being historically stored or transported on site. The results also indicated absence of gasoline range hydrocarbons and BTEX constituents, but did indicate the presence of jet fuel hydrocarbons in soils and most likely in groundwater.

In 2004, seven SVE wells and three multi-depth VMPs were installed in the truck loading area and connected via piping to the main SVE system in the north-central site area. The results of the installation, monitoring, and investigation activities were reported in September 2004 (Parsons, 2004). Elevated TPH and VOC concentrations were confirmed within the truck loading area.

Other miscellaneous activities at the truck fueling area involved removal and hauling of the 500-gallon UST located near the truck fill rack in June 2004. The thermal oxidizer located to the west of the truck fill rack was also removed at this time.

2.2.3 Eastern and Northeastern Boundary Plume

From 1990 to 1992, several soil borings were installed by Woodward-Clyde at the site. TPH impacts as high as 14,000 mg/kg were observed in the northeast corner of the site at 3 feet (boring BH103). The TPH impacts were below the laboratory reporting limit at 8 feet below ground surface (bgs) in the same boring. On the contrary, the TPH impacts in the eastern boundary soil borings were all reported below laboratory reporting.

During November 1996, the groundwater monitoring and sampling results indicated elevated levels of free product and dissolved hydrocarbons concentrations in the eastern portion of the site. Monitoring well GMW-48 was reported to contain high dissolved-phase TPH (gasoline range) concentrations. Subsequent to the November 1996 sampling event, monitoring well GMW-48 was found to contain free product with an odor described by the field technician as a “strong gasoline smell”. A product sample collected from GMW-48 was interpreted to be JP-4. As a result, a DP technology assessment of the eastern portion was conducted in June 1997. The sample results suggested a lack of evidence of significant hydrocarbon impacts to soil and groundwater at locations DP-7 through DP-9. Eight Hydropunch™ samples (HP-1 through HP-8) from the eastern portion of the site were subsequently collected, which indicated high TPH impacts in the HP-8 location. HP-8 was reported to contain 35,000 micrograms per liter (µg/L) TPH as jet fuel, 64,000 µg/L TPH as gasoline, and 11,000 µg/L as benzene. Furthermore, HP-20 had 0.310 mg/kg of gasoline at 20 feet bgs.

In order to further evaluate the vertical and lateral extent of adsorbed-phase and dissolved-phase hydrocarbon contamination in subsurface soils and groundwater in the northeast portion of the site, four borings (GMW-56 through GMW-59) were drilled in the northeast area of the site, and completed as groundwater monitoring wells in August 1998. To further determine the eastern extent of the plume and to identify whether impacts extend beyond site boundaries, two groundwater monitoring wells (designated GMW-60 and GMW-61) were installed along the eastern site boundary on April 2004. Groundwater within monitoring wells GMW-60 and GMW-61 showed elevated concentrations of TPH and VOCs. Results of TPH as gasoline were higher than TPH as JP-5 or TPH as fuel product. VOCs included lighter end petroleum compounds typical of gasoline, including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene.

Additional drilling and sampling activities were performed in the northeastern area in July 2004. A total of 12 DP borings were installed to either 10 feet bgs or 20 feet bgs. TPH as JP-5 was detected in GMW-60 at 1,100 mg/L. However, BTEX compounds were not detected in the samples. Based on these soil sample results, it appeared that there may have been a source of TPH contamination near GMW-60. However, no impacts were detected during the step-out soil investigation conducted west of the well.

In July 2005 and August 2006, Parsons performed investigations in the eastern boundary and adjacent off-site area in Holifield Park (Parsons, 2006b). Results indicated generally higher hydrocarbon impacts in deeper groundwater samples collected from 31 to 35 feet bgs than those observed either in the vadose zone soil or the shallower groundwater samples. These deeper groundwater impacts primarily consisted of TPH as fuel product (reported as JP-5 during the July 2005 investigation), TPH as gasoline, and/or BTEX compounds. These groundwater impacts could not be attributed to any specific source. The presence of fuel constituents in the easternmost Hydropunch™ sample (approximately 100 feet from the boundary; B-22) suggested the need for additional groundwater delineation in the area beneath Holifield Park. Data from borings B-12 and B-19 suggested that the extent of impacted groundwater was limited to the north and south. No historical data was available to indicate soil and groundwater impacts by these VOCs east of B-22.

Additional soil gas, soil, and groundwater investigations were conducted in December 2006 and June/July 2007. The investigation included 168 soil gas samples, 71 soil boreholes, 40 Hydropunch™ groundwater locations, and 15 CPT locations. In addition, a human health screening evaluation (HHSE) was performed. The results of the HHSE indicate that adverse health effects are not expected from exposure to chemicals of potential concern (COPC) in soil gas, soil, and groundwater beneath the main park area under current site conditions. The results of the investigations indicate that select fuel-related VOCs and TPH as gasoline and fuel product in groundwater have migrated off DLA Energy property and into the subsurface beneath the park. The lateral extent of groundwater impacts above screening/action levels is limited to approximately 90 feet east of the property beneath the main park area. Groundwater impacted above screening/action levels does not extend beneath Dolland Elementary School property. In addition, the northern and southern extents of groundwater impacts in Holifield Park are limited to 120 feet to the south and 200 feet to the north of GMW-62. Soil gas and soil have not been impacted with site-related VOCs above screening levels in the main park area.

3. PHYSICAL AND SOURCE CHARACTERIZATION

Physical characterization of contaminants and sources are presented in this section.

3.1 PHYSICAL CHARACTERIZATION

The following subsections describe the geological and hydrogeological settings of the site.

3.1.1 Regional Geology Setting

DFSP Norwalk is located between the Montebello Forebay and the Downey Plain in the Central Basin pressure area. Approximately 50 to 60 feet of alluvium (primarily sand, silt, and clay) cover the underlying Lakewood Formation in this area. The Lakewood Formation is composed of marine and continental gravel, sand, silt, and clay deposits. The San Pedro Formation underlies the Lakewood Formation, approximately 300 feet below grade, and consists of more than 800 feet of Pleistocene marine and continental gravel, sandy silt, silt, and clay deposits (CDWR, 1961).

3.1.2 Local Hydrogeology Setting

Lithologic logs of borings drilled during previous investigations indicate that sediments beneath the site consist of clayey silt, sandy silt, silty sand, medium to coarse-grained sand, and deeper coarse-grained sand with granitic cobbles. The top of a clay layer (preliminarily identified as the uppermost sediment layer of the Bellflower Aquitard) was encountered at a depth of approximately 55 to 65 feet during previous investigations. Figure 3-1 shows the locations of geologic cross sections. Geologic profiles shown on Figures 3-2 and 3-3 indicate areas and depths with more permeable sandy deposits in yellow, orange, and brown; whereas, the green and pink colors indicate finer grained and less permeable silty and clayey materials. These figures were generated by establishing a stratigraphic hierarchy based on all of the borehole lithologic data available into the Environmental Visualization System (EVS) modeling software.

The potentiometric surface is shown in dark blue on the geologic profiles. The vadose zone is the unsaturated sandy and silty soils from the ground surface to this blue (potentiometric) surface. Groundwater below the site occurs at depths between 23 to 33 feet bgs. A hydrograph for GMW-57 (the longest water level record available) shows that water level was about 48 feet above mean sea level (amsl) in 2003, quickly rose to about 52.8 feet amsl in early 2005. From 2005 to 2009, the water level has gradually dropped back to about 48 feet amsl, where it has remained about the same since. Thus, there is a potential for a 5-foot LNAPL smear zone between these two extremes. Since 2009, there has been about a one foot seasonal fluctuation.

The shallow semi-perched unconfined alluvial aquifer, consisting of silts, fine to medium sands, and coarse sands, is approximately 30 to 35 feet thick, and overlies the Bellflower Aquitard at approximately 55 to 65 feet bgs. The Bellflower Aquitard is composed of approximately 70 feet of interbedded silts and clays with minor gravel and sand. The aquitard separates the shallow semi-perched groundwater from the deeper Exposition and Gage aquifers of the Lakewood Formation. Near the site, the Exposition and Gage aquifers are found at 150 and 250 feet bgs, respectively (GTI, 1994). The potentiometric surface in the Exposition aquifer is approximately 20 feet lower than the semiperched uppermost groundwater zone. This relatively consistent difference in hydraulic heads between the upper groundwater zone and the Exposition aquifer indicates that the Bellflower aquitard is effective at inhibiting vertical groundwater migration. Due to low well yields, local water service companies do not make extensive use of aquifers in the Lakewood Formation. The deeper San Pedro Formation includes the following aquifers, listed from shallowest to deepest: Hollydale, Jefferson, Lynwood, and Silverado.

3.1.3 Groundwater Flow Conditions

Figure 3-4 shows the configuration of the potentiometric surface based on measurements from October 2012. The overall flow in the upper groundwater zone is to the north, with an estimated horizontal hydraulic gradient of approximately 0.003 foot per foot (ft/ft) in the south-central plume area to nearly flat in the truck loading and tank farm north-central areas. Hydraulic conductivity of the unconfined alluvial aquifer has been reported to range between 12 and 73 feet per day (ft/day) in the south-central area to 20 to 60 ft/day in the southeastern area.

Groundwater flow in the Exposition aquifer is generally to the east-southeastward with a horizontal hydraulic gradient of approximately 0.0003 ft/ft. This southeastward flow direction in the Exposition aquifer is roughly opposite the general groundwater flow direction of the uppermost groundwater zone. These distinctly different hydraulic conditions, consistently interpreted over time above and below the Bellflower aquitard, support the interpretation that the Bellflower aquitard in this area is laterally continuous and has a relatively low vertical hydraulic conductivity.

3.1.4 Groundwater Capture Zones

A joint groundwater capture zone memorandum was prepared by Parsons and AMEC on July 22, 2010, on behalf of DLA Energy and SFPP, respectively, in order to simulate typical long-term groundwater flow conditions at the site in response to groundwater extraction by the remediation system. The primary objective was to assess the “capture zones” that exist in response to groundwater extraction and verify that dissolved-phase contamination is being contained within the remediation target areas. A two-dimensional analytical groundwater flow model (Win Flow) was used to meet this objective.

Figure 3-5 presents a simulated flow model and capture zones under typical pumping conditions in the DLA Energy and SFPP remediation areas. Extraction from remediation wells in the northwest, northeast, south-central, and southeastern areas was assumed for this simulation. The capture zones shown by the groundwater flow simulations indicate that dissolved-phase hydrocarbon constituents are being effectively contained within the remediation target areas. The general south-to-north direction of groundwater flow in the uppermost groundwater zone and the reversal in groundwater flow associated with the capture zones is shown in the general CSM block diagram (Figure 3-6). Additional details regarding the modeling effort are included in reports prepared by Parsons (2010).

3.2 IDENTIFICATION OF POTENTIAL CONTAMINANTS

Historical records and forensic testing of petroleum products recovered from boreholes and monitoring wells at many locations on the site have indicated that soil and groundwater are impacted with hydrocarbons mainly consisting of JP-4, JP-5, JP-8, and gasoline. JP-4 is a 50-50 blend of kerosene and gasoline. JP-5 is similar to JP-4, but has some napthalenes added. JP-8, which is kerosene based, was introduced in 1990 and completely replaced JP-4 in 1996. JP-8 contains less benzene and hexane than JP-4, but still contains some benzene, toluene, xylenes and naphthalene, as well as other additives (e.g., diethylene glycol monomethyl ether or ethylene glycol monomethyl ether). Gasoline constituents include BTEX; and methyl tertiary-butyl ether (MTBE). In addition, tertiary-butyl alcohol (TBA) has been detected in samples collected in the past few years and, along with other fuel oxygenates, was added to the monitoring program at the site by the RWQCB in March 2009. Ethylene dibromide (EDB) and 1,2-dichloroethane (1,2-DCA) were also integral parts of the tetraethyl lead-based antiknock gasoline additives used through the 1980s. EDB and 1,2-DCA were added to gasoline to prevent buildup of lead oxide deposits within internal combustion engines at an average concentration of about 300 mg/L (Falta, 2004). Because of their high aqueous solubilities, this would be expected to produce equilibrium groundwater concentrations of thousands of µg/L.

The principal COPC at the site are TPH, including TPH quantified as gasoline, diesel fuel, jet fuel, and jet propellant 5 (TPH as JP-5); BTEX; 1,2-DCA; MTBE, and TBA.

3.3 IDENTIFICATION AND CHARACTERIZATION OF SOURCES

Environmental investigations began in the mid-1980s and full-scale cleanup at the site started in 1995. Figure 2-1 shows the site infrastructure and facilities and Figure 2-2 shows areas of concern. The AST area in the northern portion of the site experienced several leaks and spills from the tanks and connecting pipeline system throughout the operational history of the site, and are described below.

3.3.1 Oily Waste Material

In 1985, buried oily wastes were encountered in the southwestern portion of the site. The wastes were located approximately 80 feet southeast of the southeastern corner of the laboratory building and extend to about 25 feet southeast of the southeastern corner of the oil-water separator. The areal extent of the buried material is nearly 28,000 square feet and a depth of approximately 10 feet below grade, with a total volume of approximately 5,000 cubic yards. From 1997 through 2003, various investigations were conducted of this area. The RWQCB issued a No Further Action for the oily waste area on March 28, 2005.

3.3.2 Aboveground Storage Tank Releases

Numerous AST releases led to the contamination in the north central portion of the facility. Aerial photographs from 1958 and 1959 showed discolored soil near AST 80004 and in the western portion of AST 80008; ponded liquid in the southwest corner of the berm surrounding AST 80002; and two areas of discolored soil in the bermed areas surrounding ASTs 80002 and 80008. A spill was reported at AST 80002 in the early 1970s due to overflow of which the amount of product lost is unknown. Aerial photographs also indicate the possible presence of a former settling pond in the northeastern portion of the facility.

Direct evidence of jet fuel leaks from the ASTs is not available. Data suggests subsurface hydrocarbons in the areas of ASTs 80001, 80007, 80008, and 80009 originated from leaks in the bottom of these tanks. Another possible source is a major pipeline junction in the Powerine Basin, but this junction has not been identified as a release point of hydrocarbons. The total volume of fuel in the soil and groundwater underlying the tank farm was calculated during a 2001 Environmental Baseline Survey (IT Corp, 2001) to be approximately 400,000 gallons. To date, 429,000 gallons of hydrocarbons have been removed and destroyed by DLA Energy remediation systems.

An unknown quantity of petroleum product was released to the subsurface in 1968 from the slop tank south of AST 55003. In 1969, an unknown quantity of JP-4 fuel was released from AST 55004.

3.3.3 Truck Loading Racks and Water Tank Area

In 1975 and 1986, abandoned 4- and 12-inch-diameter pipelines (reportedly contained a heavy, viscous, tar-like substance) were discovered near the loading racks and were left in place and backfilled with soil. A former sump located southeast from the water tank was removed in about 1982, at which time observations were reported that underlying soil contained petroleum hydrocarbons. Reportedly, a leaking flange also caused contamination in the south-central section. Surface soil stains were observed by two different environmental contractors in 1984 and again in 1989/90, suggesting that releases have occurred in the past. Investigations show that soil immediately adjacent to the southwestern portion of the loading racks has been impacted by site operations.

The investigation from 2001 at the loading racks revealed evidence of past fuel releases. The data suggested that the release occurred at or around the western and central truck loading islands. An area approximately 80 feet by 260 feet, extending from near the surface to the water table at 28 feet below grade had been impacted by releases at the loading racks. However, the soil data near the eastern-most truck loading island did not indicate that significant releases occurred from that facility.

In 1998, a new release of fuel was observed in the area of the water tank. Impacted soils were excavated and taken offsite for treatment; however, the excavation revealed that underlying soils had been impacted by older releases. Further investigation showed impacted soils surrounded the eastern and southern portions of the water tank.

In 1999, a fuel release from an underground pipeline was discovered in the southern area of the facility west of the water tank and north of loading racks. The terminal operator secured the area, stopped the leak, and removed 80 cubic yards of impacted soil. In addition to the deeper excavation that exposed the leaking pipe, approximately 1 foot of impact soil was removed west and south of the water tank. Confirmation samples were collected from the surrounding area and below the excavated area to assess the impact of the fuel release. Both TPH as JP-5 and BTEX compounds were reported in soil samples.

4. CONCEPTUAL SITE MODEL

This section provides details on the CSM including, soil and soil vapor conditions, LNAPL and groundwater conditions, and a summary of exposure pathways and receptors relating to impacted media. Figure 3-6 presents a generalized CSM block diagram for impacted areas from DLA Energy's known releases. Impacted media from SFPP operations are not detailed in this report as these areas are described in SFPP's CSM (CH2M HILL, 2013). The primary contaminants of concern for this site have been shown to be related to releases of various fuel products. Two constituents were considered representative of the plume extents for fuel related constituents. EVS models were generated for TPH as diesel and benzene. This CSM considers contamination in all media (soil, soil vapor, LNAPL, and dissolved in groundwater) and also confirms non-impacted areas.

As stated above, soil sampling to identify fuels contamination began in 1986. However, only soil samples collected since September 2009 were used for the EVS modeling because this CSM is intended to delineate current conditions (Figure 2-3). Remedial actions including soil excavation, SVE, and product extraction have modified original conditions. Groundwater analytical results from samples collected in April 2013 were used for the EVS modeling the current conditions of dissolved phase contamination. The thickness of the LNAPL in the EVS model is based on actual product thicknesses measured in monitoring wells in April 2013. For the EVS model, the depth of soil contamination was limited to 5 feet below the water table. This assumption is based on the fact that very few soil samples were collected from below the water table and that no fuel product reflectance was observed deeper than the water table smear zone in ultraviolet optical sensing tool (UVOST) logs from 17 boreholes broadly distributed across the site. Without this assumption, the EVS modeling software would have projected soil contamination to extend to the base of the model in the Exposition Aquifer, as there are no soil samples below the smear zone to limit the interpretation.

4.1 NATURE AND EXTENT OF VADOSE ZONE CONTAMINATION

The vadose zone is comprised of the unsaturated soil section from below the ground surface to the water table. In an effort to determine the current extent of soil contamination, only soil borehole data collected within the last 4 years (since September 2009) were utilized for the CSM. A total of 936 soil samples were evaluated from 203 borehole locations positioned to delineate known release areas and areas with elevated concentrations of dissolved-phase hydrocarbons. Soil analytical results for contaminants of concern are summarized in Table 4-1.

4.1.1 Total Petroleum Hydrocarbon as Diesel

As discussed above, several constituents were selected as representative of the nature and extent for all COPCs at the site. TPH in the diesel range (C13 – C22) is probably the most representative of petroleum hydrocarbons remaining at this site.

Figure 4-1 shows the spatial distribution of TPH as diesel in soil with yellow, orange, and brown hues, and the underlying groundwater plumes are shown with blue and purple hues. Green hues are used to designate LNAPL. Several “hot spots” for soil contamination are indicated. The largest area with soil contamination is located north or the tanker truck loading racks and the former slop tank and water tank (Figure 2-1), with a smaller “hot spot” at the western end of the truck loading rack. Figure 4-2 shows a profile view of this contaminated area from an eastern perspective. The model shows that the soil contamination extends from the ground surface to the water table in this area.

Two other areas of TPH as diesel contamination in soil are shown on Figure 4-1 in the northeastern portion of the facility in the vicinity of former AST 80008 and extending to the east-southeast. The profile view shown on Figure 4-3 from a northeastern perspective shows that TPH as diesel occurs in near surface soils, and then again in deeper soils near the water table, but not at intermediate depths. The other northeastern area of contamination is shown on the extreme northeast corner of Figure 4-1, and in the near surface soil on the right edge of the Figure 4-2 profile. The EVS model most likely overestimated the size of the plume in this northeastern area, as there are several limiting boreholes (Figure 2-3) that were not analyzed for TPH as diesel, but had no TPH as gasoline, benzene or other VOC contamination (Table 4-1). Both Figures 4-1 and 4-2 show that there is no groundwater contamination below this northeastern-most soil contaminated area, as defined by groundwater monitoring control points shown on Figure 3-4.

A few smaller areas of TPH as diesel in soil occur in the western half of the tank farm area, as shown on Figure 4-1. These TPH as diesel occurrences in soil are limited both horizontally and vertically as shown on the profile view from the south-southwest perspective on Figure 4-4.

4.1.2 Benzene

Benzene was selected as the most representative VOC because it has the broadest spatial distribution, higher concentrations, and the lowest cleanup goal. Other detected VOCs are less prevalent with smaller spatial distributions. The spatial distribution of benzene is shown on Figure 4-5. A comparison of Figure 4-5 with Figure 4-1 shows that the extent of benzene contamination in soil is less than diesel, but the two “hot spot” areas (truck loading area/slop tank/water tank and AST 80008) are consistent. Note that the EVS model does not show any soil contamination in SFPP’s southern and southeast areas because there were no soil data available from those areas and were not included in soil database for model. Figures 2-3 and 3-4 show there are ample data to delineate contamination on DLA Energy’s area of responsibility.

In the truck loading area, benzene contamination in soil is limited to near surface soil and again near the water table, as shown on the profile view from a southeast perspective on Figure 4-6. In the vicinity of AST 80008, a larger benzene plume occurs from about 15 feet below the ground surface to the water table, as shown on profile Figure 4-6 from the southeast (at the geologic cross-section intersection) and Figure 4-7 from the northeast.

Two smaller benzene plumes in soil are located on the west side of the former storage tank area (Figure 4-5). Both of these plumes have limited horizontal and vertical extent, as shown on Figure 4-8, from a southwest perspective.

4.2 SOIL VAPOR CONDITIONS

This section presents the soil gas investigations, vapor monitoring program, and risk assessments.

4.2.1 2006 and 2007 Soil Vapor Investigation

Soil gas investigations were conducted in the north-eastern onsite area and Holifield Park in 2006 and 2007. COPCs were detected in soil gas samples collected from some specific locations; however, human health risk assessments indicated no adverse effects to human health from exposure to air through potential vapor intrusion (Parsons, 2008).

4.2.2 2010 and 2011 Soil Vapor Monitoring Program

Soil vapor monitoring was conducted for five consecutive quarters from December 2010 through December 2011 and semiannual reports were submitted on August 29, 2011 (Parsons, 2011a) and February 13, 2012 (Parsons, 2012b). The two semiannual reports provided the air laboratory data collected at the site for the vapor monitoring program as requested by the RWQCB and also presented the site-specific calculated soil gas screening levels for the detected site compounds.

The soil vapor samples were collected from seven VMPs that border the northern site property boundary (VMP-32 through VMP-38) and three vapor monitoring locations in Holifield Park along the eastern park boundary (VMP-29, VMP-30, and VMP-31), bordering Dolland Elementary School (Figure 4-9). Soil gas was sampled from each vapor monitoring location at two depths, 5 and 15 feet bgs. Therefore during each quarter, 20 VMPs were purged and sampled.

Table 4-2 presents a summary of the VOCs laboratory analytical results for those chemicals that were detected above the laboratory reporting limit for the five quarterly events. All other chemicals were below the laboratory reporting limit. Specifically looking at the third and fourth quarters 2011, there were 23 compounds detected at low concentrations above their laboratory reporting limit. The VOC detected at the highest concentration was isobutane at 0.45 µg/L in VMP-31 at 15 feet bgs from the fourth quarter 2011. Benzene was not detected during the third and fourth quarters 2011.

Table 4-3 presents a summary of the laboratory fixed gases results for carbon dioxide, carbon monoxide, methane, nitrogen, oxygen plus argon, and total gaseous nonmethane organics. During the third and fourth quarters 2011, methane was detected at one probe, VMP-32 at 5 feet bgs (16 parts per million [ppm]) and at the field blanks.

Concentrations of detected VOCs in soil gas from the five consecutive quarters from December 2010 through December 2011 were all well below their respective proposed screening levels. Based on the CalEPA soil gas advisory (CalEPA 2010), the proposed methane screening level is 1,000 ppm. The highest methane detected was 16 ppm which is well below the screening level.

4.3 NATURE AND EXTENT OF LNAPL

This section presents LNAPL delineation and characteristics, including transmissivity and recoverability.

4.3.1 LNAPL Delineation

Scientific research has demonstrated that, when released to the ground, LNAPL exists as the Vertical Equilibrium Model; in which, saturation and migration potential are a function of the capillary pressure curve of the geologic formation and LNAPL properties (ITRC, 2010). Therefore, within the context of LNAPL delineation, it should be understood that there is a gradation of saturation of LNAPL (both vertically and horizontally) and LNAPL delineation includes varying degrees of LNAPL saturation. In areas of low to moderate saturation, the LNAPL is residual and does not migrate. In areas of high saturation, LNAPL may accumulate in wells, or potentially migrate. However, accumulation of LNAPL in monitoring wells cannot unequivocally indentify LNAPL migration.

Site investigation data to date (such as CPT, UVOST, soil samples, and groundwater samples), have been integrated for the purpose LNAPL delineation (including both free and residual). Figure 3-4 demonstrates the horizontal extent of the LNAPL at the site, and is consistent with other LNAPL delineation efforts (Parsons 2011b, Parsons 2012c, CH2MHILL, 2013). There are two main areas where LNAPL exists: one in the south central section of the site related to the former truck loading area (as well as offsite sources), and another in the central and eastern section of the site. Additionally there are two smaller areas where LNAPL was identified: towards the western central and north-west area of the site.

UVOST borings provide detailed account of LNAPL occurrence at various locations at the site and provide details of percent saturation with depth (Parsons 2011b). Most LNAPL identified at the site is limited to near the water table, with the exception of shallow soils where the LNAPL was released. The vertical extent of the LNAPL impacted areas varies from several feet above the water table to approximately 2 feet below the water table. In associated CSM figures, the LNAPL thickness is based on actual depth to product and water measurements from May 2013, as explained above in Section 4.0. Site investigation data including UVOST supports this assumption.

4.3.2 LNAPL Chemical and Physical Properties

Samples of LNAPL were collected at MW-9 and GMW-4 in 2007 and analyzed for VOC constituents (See Appendix A). Chemical results from MW-9 and GMW-4 are indicative of a low boiling point petroleum distillate such as JP-4, or a mixture of gasoline condensate, JP-4 and a middle distillate such as kerosene, Jet A or JP-5. These results agree with soil and groundwater concentrations.

Physical properties of LNAPL were collected at GMW-62 in 2011 and 2013 (see Appendix A). The NAPL from GMW-62 was approximately 0.77 g/cc and the viscosity varied from 0.607 centipoise to 0.876 centipoise (both at 80 degree Fahrenheit).

4.3.3 LNAPL Body Stability and Declining Percent Saturation

LNAPL stability at the site has been maintained through geological integrity of the soils and large scale LNAPL recovery systems. Site observations indentifying LNAPL stability include:

- Significant reduction in observed in-well LNAPL attributable to recovery systems;
- Lack of new wells with sustained LNAPL observations;
- LNAPL recovery system reduction over time;
- Groundwater plume retraction; and
- Groundwater concentrations over time.

LNAPL gauging has been conducted on a routine basis (semiannual or more frequent) throughout the site since approximately the mid-1990s. Gauging measurements are provided on Figures 4-10 and 4-11, and demonstrate that there has been a significant reduction in product in-well thickness due to the LNAPL recovery systems, and natural degradation of the LNAPL. The in-well thicknesses at numerous wells (both the north-central / northeastern portion of the site and wells in the south-central truck depot area) have decreased from consistently above 2-3 feet (with locations up to as thick as 16 feet) to very low thickness ranging less than 0.2 feet. While the figures show recent increases of in-well thickness, these are likely attributable to the long term decreasing water levels and the recent re-initiation of LNAPL recovery efforts (now conducted manually at specified locations). These recent changes in pore pressure have likely freed LNAPL that was previously suspended under static conditions. These thicknesses will likely depreciate quickly during the intermittent manual extraction. These significant long-term decreases of LNAPL gauging observations are direct evidence of stable LNAPL body and declining percent saturation (ASTM, 2006).

Recent groundwater and LNAPL gauging observations indicated there are relatively few locations where LNAPL currently accumulates in monitoring wells. Furthermore there are no wells where LNAPL is observed consistently in recent events where it was not observed in the past. LNAPL was observed in 12 of the 192 wells measured during the second 2012 semiannual monitoring event, and apparent free product thicknesses ranged from 0.01 foot (TF-22) to 1.02 feet (MW-15). At 6 of these twelve locations the product thickness was less than 0.1 feet. Historical data indicate the second 2012 semiannual monitoring event generally represents current conditions at the site. By comparison, LNAPL has been observed in approximately 73 locations (excluding the southeastern 24-inch block valve area) during pre-2004 events. The lack of new wells with observed LNAPL and the large decrease in wells with LNAPL indicates that the LNAPL body is stable and declining in saturated thickness (ASTM, 2006).

Well recovery data from the former active recovery system provides supporting information regarding the conclusion that the LNAPL body is stable (Parsons 2011b). The site remedy included a formally active LNAPL recovery system which operated from 1996 to 2003. This system was discontinued in 2005 as the system was no longer effective of removing LNAPL. This is likely due to the total amount of LNAPL recovered as well as weathering. Currently there are four locations where LNAPL is extracted via vacuum extraction on a routine basis, approximately once every three weeks. Based on 2013 extraction data the current extraction rate from the four wells is conservatively less than 20 gallons per day, meanwhile the total extraction of LNAPL systems is greater than 50,000 gallons. This equates to a conservative rate of less than 0.04% of the total extraction.

The groundwater concentrations over time indicate a retracting plume, which is likely due to groundwater recovery and natural attenuation (Parsons 2011b and 2012c). A stable or retracting plume indicates a stable LNAPL body (ASTM, 2006).

In addition to the above observations, there are active groundwater extraction systems onsite continuously containing groundwater from various impacted areas at the site. These extraction systems create an inward hydraulic gradient to the site (Figure 3-5). Therefore, if any mobile LNAPL were present at the site, the mobile LNAPL would likely migrate to the extraction wells and remain controlled.

4.3.4 LNAPL Recoverability

4.3.4.1 Extent of Residual and Mobile LNAPL and Magnitude of LNAPL Mobility

The site remedy includes a formally active LNAPL recovery system which operated from 1996 to 2003. This system was discontinued in 2005 as the system was no longer effective of removing LNAPL likely due to the amount recovered and reduction of recovery rates due to weathering. As mentioned above, the recoverability has been demonstrated as very low by the past active and current intermittent extraction systems.

Transmissivity estimates confirm that the recoverably is low (see transmissivity section below).

4.3.4.2 LNAPL Transmissivity Estimate

Transmissivity was calculated by baildown test methods described in ASTM E2856-11 as part of the LCSM development (as referenced in ASTM E2531-061 rev 2009). The data were analyzed using the American Petroleum Institute (API) LNAPL transmissivity workbook with the accompanying Microsoft Excel™ spreadsheets. Although a quantification of the data was attempted, the results of the transmissivity calculation provided herein should be considered qualitative due to LNAPL character at the site (i.e. slow recovery time and complexities of conforming to the test requirements). Furthermore, Batu 2011 discusses certain difficulties with applying slug test methods to LNAPL baildown test data, as given in Huntley 2000. Transmissivity is one component of a multifaceted approach to describing LNAPL risk and remedial strategies. Therefore, although the results are imperfect, they support the overall CSM.

Previously (Parsons, 2012c) a baildown test was conducted at GMW-62 in order to estimate LNAPL transmissivity. Results from this previously reported baildown test indicated that LNAPL transmissivity analysis was impractical due to in-well thickness and recovery rates which were below the threshold needed for analysis. For example, the product thickness immediately recovered 0.02 feet (0.24-inches) and remained that thickness for the first hour, which is a nearly unmeasureable. Over the next five days, the product thickness increased to a maximum thickness of 0.04 feet before decreasing to a thickness of 0.01 feet (Parsons, 2012c).

Due to the lack of usable recovery data from the previous test, an additional baildown test was performed at GMW-62. Appendix A provides the field data of water elevations and product thickness before and during the test. The LNAPL recovery data were analyzed with API baildown spreadsheets. Appendix A provides the tabulated data and API spreadsheet printouts. Results from the GMW-62 test indicate that the transmissivity is low, at approximately 0.1 ft^2/day.

Transmissivity values are used to access recoverability as part of the CSM. For context, Beckett and Lundegard (1997) suggest transmissivity of less than 0.014 ft^2/day is unrecoverable, meanwhile ITRC technical guidance suggests a range of 0.1 to 0.8 ft^2/day for recoverability. The transmissivity value of 0.1 ft^2/day from GMW-62 indicates that the LNAPL is near the range of non-recoverable. This is further supported by the recovery methods currently and the previous operation of a large scale multi-phased recovery system, which was shut down in 2003 due to low recovery rates.

4.4 DISSOLVED-PHASE CONDITIONS

The COPCs for groundwater beneath the site include TPH and several VOCs including BTEX compounds, MTBE, TBA, and 1,2-DCA. Concentrations of TPH as diesel and benzene were utilized as representative of the extents of contamination for the groundwater conceptual site model of dissolved-phase COPCs. The extents of these other constituents are delineated in each groundwater monitoring report submitted to RWQCB semiannually. Groundwater samples from 100 monitoring wells, collected during April 2013, were used for this CSM evaluation of current conditions that may require remedial activities. Table 4-4 provides details of the depths and screen intervals of the wells sampled and utilized for this report. Depths to groundwater and product thickness measurements are summarized in Table 4-5; and groundwater analytical results used for this CSM are summarized in Table 4-6.

4.4.1 Total Petroleum Hydrocarbons

Figure 4.1 shows the lateral extents of TPH as diesel, as interpreted by the EVS modeling software, based on the April 2013 sampling results. Two large plume areas are closely associated with overlying soil contamination source areas.

The plan view image shown on Figure 4-1 shows an underlying contaminated groundwater plume in the vicinity of the truck loading stand and slop tank areas. Only the outer (blue) shell is visible in the profile view shown on Figure 4-2, but the higher concentration core of this plume is visible below the LNAPL layer shown on Figure 4-1. The profile view on Figure 4-2 shows that the groundwater plume is associated with coarser grained (higher permeability) sandy lithologic units. The southern-most groundwater hot spot is associated with the SFPP operations, for which no soil analytical results were included for this CSM.

Figure 4-1 also indicates several hot spots (purple) within a large TPH as diesel groundwater plume in the former AST area, with the primary focus in the AST 80008 containment cell. Figure 4-1 also shows that there is overlying soil contamination (brown) and LNAPL (green) associated with this plume. These groundwater hot spots are not visible in the profile views shown on Figures 4-2 through 4-4 because of the masking by the outer shell of the plume.

A smaller groundwater TPH as diesel plume emanates from AST 80006 (Figure 4-1). Figure 4-4 shows that there is surface soil contamination at this location, but that contamination does not go deeper, and there is no LNAPL associated with this plume.

4.4.2 Benzene

Two major areas with dissolved-phase benzene exceeding its MCL are indicated on Figure 4-5. The large southern plume is primarily associated with operations on the SFPP lease, but extends northward (downgradient) to the vicinity of the truck loading and slop tank areas. Figure 4-6 shows that there is some near surface and deep benzene contamination in the overlying soil in the truck fill stand area, and a thin LNAPL layer is also indicated on Figures 4-5 and 4-6.

A groundwater benzene plume in the AST 80008 area (Figure 4-5) has a smaller aerial extent than the TPH as diesel plume in this area. The highest benzene concentrations in this plume are located in the cell east of former AST 80008 (Figure 4-5). Although there is no overlying surface soil contamination over this hot spot (Figures 4-6 and 4-7), there is deeper soil contamination and LNAPL present at the water table (Figure 4-7).

Two small dissolved-phase plumes are situated in the western portion of the former AST area, as shown on Figure 4-5. These two groundwater plumes do not have overlying benzene contaminated soil (Figures 4-5 and 4-8).

4.5 EXPOSURE EVALUATION

This section presents exposure pathways that describe migration pathways, exposure routes and possible current and future exposure scenarios.

4.5.1 Migration Path Descriptions

A CSM block diagram is shown on Figure 3-6. The profile illustrates two probable source areas where contaminants have been released to the environment. A leaking AST is shown on the left and a surface spill at the truck loading racks is depicted on the right. These releases of petroleum products into the environment have allowed contaminants to infiltrate through the vadose (unsaturated) soil and percolate downward to the water table. Downward migration of the contaminants is interrupted at the water table and, because petroleum is lighter than water, it begins to accumulate as LNAPLs in pore spaces at the water table. Some of the constituents in the petroleum slowly begin to dissolve (partition) into the groundwater and are subsequently transported northward with the groundwater flow. The dissolved contaminant plumes are believed to be slowly migrating northwest due to the fine grained nature of the aquifer and low hydraulic gradient (0.001 ft/ft).

Figure 3-6 also shows that the dissolved contaminants may continue to migrate downward through the Bellflower Aquatard and into the underlying Exposition Aquifer. To date, no contamination has been detected in the Exposition Aquifer.

As the groundwater continues to migrate downgradient, some of the constituents will volatilize and rise back up through the vadose zone and are released at the surface into either the ambient air or into overlying buildings. A diagram showing the various migration pathways to potential receptors is shown on Figure 4-12.

4.5.2 Receptor Indentification and Discussion

This section identifies environmental receptors currently or potentially exposed to site contaminants. This includes humans and the environmental receptors that are in direct contact with the source of contamination, potentially present along the migration pathways, or located in the vicinity of the site.

Risk assessments are conducted to analyze the potential for adverse human health effects or adverse effects to ecological receptors and habitats caused by the COPC to determine the need for remedial action.

4.5.2.1 Human Receptors

The DFSP Norwalk Facility is a 50-acre facility previously occupied by 12 inactive aboveground fuel storage tanks, a truck loading area, and associated piping and facilities. The facility has been decommissioned since 2001 and is no longer used to handle fuel. While the DFSP Norwalk facility is no longer operational, the SFPP leased area contains active 24-inch diameter pipeline. SFPP currently has workers maintaining their pipeline and remediation systems. There are also environmental contractor’s onsite performing remediation activities at the DFSP Norwalk facility.

Neither the SFPP staff nor environmental contractors working at the DFSP Norwalk facility are at the site on a full time basis. However, the DFSP Norwalk facility currently has a full-time security guard. Thus, under current conditions, the only human receptors at the site are industrial workers. Additionally, trespassers may occasionally visit the site. However, it should be noted that trespasser exposures are considerably lower than industrial workers and, therefore, trespasser exposures are generally not evaluated.

In the future, the site will be redeveloped into commercial and light industrial areas and the park to the east of the site will be expanded to cover part of the eastern portion of the site. Thus, future human receptors at the site include construction workers (i.e., to redevelop the site), commercial/industrial workers, and park visitors.

As shown in Figures 4-1 and 4-5, there is some contamination in surficial soils at the site. Thus, under present conditions, human receptors at the site could be exposed to contaminants in soils via direct contact; i.e., incidental ingestion, dermal contact, and the inhalation of dusts. Additionally, some of the contaminants in both soils and groundwater are volatiles. These volatiles can migrate upwards through the soil column until, eventually, they are released into either outdoor air or into overlying buildings. Human receptors at the site may then breathe in those volatiles.

As shown in Figures 1-1 and 2-1, there are residential areas on the northern, western, and southern property boundaries. To the east, the site is bordered by Holifield Park. Dolland Elementary School is located to the east of Holifield Park and is approximately 500 feet from the eastern fence line of the facility. Volatiles in groundwater and soils at the site may be emitted to outdoor air which then may migrate to the park, school, and nearby residences, where the receptors there may be exposed. The nonvolatile contaminates in surface soils at the site may also be picked up by the wind and carried to the adjacent properties in the wind. However, the amount of exposure to volatiles and dusts in outdoor air is generally expected to be relatively minor. The northeastern groundwater plume at the site has migrated offsite to the east underneath Holifield Park. There, the contaminants may migrate upwards and be released to ambient air in the park where the park users may be exposed via inhalation. Volatiles in subsurface contamination may also migrate off-site and be released to indoor air of off-site structures.

Since there are no land use covenants or deed restrictions at the site, groundwater may be used as a drinking water source. Therefore, human receptors may also be exposed via the potable uses of water; i.e., drinking water ingestion, dermal contact during showering/bathing, and inhalation of volatiles emitted during showering or other domestic uses of water.

There is no surface water at the site. Further, the nearest surface water bodies are San Gabriel River, located approximately 2 miles west of the site, and North Fork Coyote Creek, located approximately 3 miles to the east of the site. Based on these distances, surface water is not considered a current or future exposure medium for current and future receptors.

In summary, the following human receptors may be exposed to the COPCs in soil and groundwater (either directly or indirectly via environmental transport):

- Current onsite receptors (trespassers and workers);
- Current and future offsite receptors (residents, park users, and school students and staff); and
- Future onsite receptors (construction workers and industrial workers).

These receptors and exposure pathways are summarized in Figure 4-12.

4.5.2.2 Ecological Receptors

At present, the site is undeveloped and consists of almost entirely unvegetated dirt. The site will be redeveloped in the future and the property is zoned for commercial, light industrial, and park expansion. For the commercial and industrial zones, there will be no ecological receptors, as the area will consist of buildings and parking lots. The park will be maintained by the City of Norwalk and, as such, does not represent suitable habitat for wildlife species. Therefore, under both current and future conditions, there will be no ecological receptors at the site and an ecological risk assessment is not warranted.

5. REMEDIATION OBJECTIVES, GOALS, AND PERFORMANCE METRICS

This section identifies the project remediation objectives, goals, and performance metrics. This is the first step in the decision framework for identifying the appropriate remedial action for the site, based on the ASTM Standard Guide and ITRC guidance document for evaluating LNAPL remediation technologies to achieve project goals (Screening Step 1 in Figure 1-2). A discussion of media-specific cleanup levels is also provided below.

5.1 CONCERNS AND REMEDIATION OBJECTIVES

The concerns that are associated with the LNAPL, adsorbed- and gas-phases in the vadose zone, and dissolved-phase in groundwater present at the site and the remediation objectives developed to address these concerns are provided in Table 5-1.

5.2 REMEDIATION GOALS AND METRICS

The remediation goals specify the condition or endpoint to be achieved to satisfy the remediation objectives for the site. Performance metrics are measureable characteristics that relate to the remedial progress of a technology in abating the concern. The performance metrics used to demonstrate progress toward and achievement of the LNAPL, vadose zone, and groundwater remediation goals are dependent on the technology used. A summary of the remediation goals and metrics are provided in Table 5-1.

5.3 CLEANUP LEVELS

This section summarizes the cleanup levels for soil, soil vapor, and groundwater at the site.

5.3.1 Soil

Soil cleanup goals (SCGs) were calculated for the site according to the methods provided in the RWQCB Interim Site Assessment and Cleanup Guidebook (Guidebook) (RWQCB, 1996). SCGs were calculated for TPH, BTEX compounds, and other detected VOCs from Parsons' soil investigations at the site. TPH and BTEX cleanup goals were calculated based on the values provided in Table 4-1 of the Guidebook, Maximum Soil Screening Levels for TPH and BTEX above Drinking Water Aquifers. Cleanup goals for other VOCs detected in soil were calculated based on established Maximum Contaminant Levels (MCLs) and attenuation factors provided in Table 5-1 of the Guidebook, *Average Attenuation Factor for Different Distance above Groundwater and Lithology*. For other VOCs without MCLs, SCGs were established using a hierarchy of groundwater objectives, as outlined in comments provided by the RWQCB. Calculations were based primarily on average lithologic types and thicknesses between the sampling depths and the underlying groundwater.

RWQCB approved site-specific SCGs for the DFSP Norwalk site as shown in Table 5-2. Parsons provided the SCG calculations and assumptions for the final approved SCGs. The SCGs were calculated using the procedures proscribed in the Interim Site Assessment & Cleanup Guidebook (RWQCB, 1996), and are site specific goals calculated to be protective of leaching to groundwater pathway. The SCGs are calculated by multiplying an attenuation factor by a water quality standard. The attenuation factor is calculated by using a soil to groundwater leaching model which takes into consideration the physical properties of the site specific soil types, physical properties of the chemicals, the average infiltration rates through the site specific lithology, and the distance to groundwater. SCGs were calculated in five foot intervals and are based on depths to groundwater of 25.5 feet, 21 feet, 16 feet, 11 feet, 6 feet, and 1 foot.

5.3.2 Soil Vapor

Soil vapor cleanup levels have not been established for the site. Soil vapor results thus far have been compared to California Human Health Screening Levels (CHHSLs), under commercial scenarios, using indoor air attenuation factors derived from DTSC's most current guidance as shown in Table 5-3. Soil gas screening levels have been calculated for each compound at 5 feet bgs and 15 feet bgs as shown on the table. Soil gas VOC data collected at the site was directly compared to the proposed commercial worker screening levels. Under most circumstances, chemicals in soil or soil gas at concentrations below screening levels can be assumed to pose an acceptable risk to people who may work at the site. The presence of chemicals at concentrations in excess of screening levels does not necessarily indicate that adverse impacts to human health are occurring but indicates that a potential for adverse risk may exist and that additional evaluation is warranted.

5.3.3 Groundwater

Cleanup goals for groundwater constituents have not been established for the site. For the purpose of this CSM, the assumed water quality cleanup goals were the most conservative of the values from the:

1) California Drinking Water MCLs;
2) California drinking water notification levels; and
3) US EPA Tapwater Regional Screening Levels.

These presumed groundwater cleanup levels were used because they were used as the basis for developing the SCGs and are estimated to be conservative values.

6. TECHNOLOGY SCREENING AND SELECTION OF ALTERNATIVE REMEDY

This section evaluates the effectiveness of the existing remediation system at achieving the project remediation objectives, goals, and performance metrics identified in Section 5.

This section also identifies and screens remedial technologies provided in ITRC guidance documents for evaluating LNAPL, dissolved-phase, and insitu chemical oxidation remediation technologies to achieve project goals; and selects LNAPL remediation technologies for an alternate interim remedy that best meets the project remediation objectives, goals, and performance metrics identified in Section 5. The feasibility of each potential technology was evaluated during the screening process.

6.1 EVALUATION OF CURRENT REMEDIATION SYSTEM

The objectives of the existing remediation system are to contain and control the migration of hydrocarbon constituents in groundwater and soil vapor, and to remove hydrocarbon mass from soil and groundwater.

DLA Energy currently operates remediation systems consisting of SVE, GWE, and treatment of extracted soil vapors and groundwater to address the entire former tank farm, the former water tank, former truck fueling, and pump house areas.

The GWE system consists of five vertical extraction wells (including one 4-inch and four 6-inch diameter wells). The groundwater treatment system includes process units in the following order: a 2,000 gallon surge tank, three bag filter vessels, two MYCELX vessels, three granular activated carbon (GAC) vessels, and two ion exchange vessels. Four wells (GW-2, GW-13, GW-15, and GW-16) are currently in operation and extracting groundwater for treatment at the site. The groundwater is treated and discharged in accordance with the NPDES permit No. CAG994004, CI No. 7585.

In general, the GWE wells have been in operation since 1996. Improvements, including the installation and extraction from additional wells, have been conducted over time to improve the effectiveness of the system at removing LNAPL, dissolved-phase mass, and vapor-phase mass from the subsurface.

With reference to Figure 6-1, approximately 430,000 equivalent gallons of TPH have been removed by the SVE and GWE systems since 1996. The cumulative mass removed by SVE does not include the mass removed by biodegradation. As shown in Figure 6-1, mass recovery by the SVE and GWE systems have become asymptotic or “flat lined” since approximately 2008.

Since 1996, approximately 66 million gallons of groundwater have been extracted from the GWE wells; and about 1,400 gallons of free product have been recovered from the GWE and TFE wells. System operations data indicate that dissolved phase and free product recovery rates have decreased to extremely low levels and have become asymptotic. From the dissolved phase alone, only about 0.125 pounds of TPH product have been removed in the past two years. The decrease in the product extraction rate appears to correspond to the significant decreases in the extent and thickness of LNAPL at the site and the decrease in transmissivity. Free product recovery was substantial when recovery operations first commenced in the mid-1990s through early 2000. From about 2008, product recovery has been negligible, indicating that transmissivity is reduced and the LNAPL is at or near residual saturation and can no longer be recovered effectively using the current removal and treatment system.

Performance data indicate that continued operation of the existing SVE and GWE systems will not achieve the remediation objectives, goals, or performance metrics outlined in Section 5.

6.2 IDENTIFICATION OF POTENTIALLY APPLICABLE TECHNOLOGIES

The remediation technologies identified in the referenced guidance documents were screened and evaluated relative to meeting the remedial objectives, goals, and performance metrics described in Section 5. The technologies are listed and described in Table 6-1. LNAPL skimming, dual pump liquid extraction (DPLE), multi-phase extraction with SVE, water flooding, surfactant-enhanced subsurface remediation, co-solvent flushing, steam hot-air injection, radio frequency heating, and electrical resistance heating were immediately screened out relative to the site objectives and goals. Note that radio frequency heating and electrical resistance heating (three- and six-phase) were also screened out due not only to their lesser inefficiencies with the coarser-grained lithology present beneath the site, but also due to their elevated capital and operational costs.

The potentially applicable technologies retained for achieving project goals are presented in Table 6-2.

6.3 TECHNOLOGY SCREENING

For the initial screening, each technology was evaluated based on effectiveness, relative cost, implementability, and third-party impacts. A brief description of each technology, its respective advantages and disadvantages, and the results of the screening evaluation are summarized in Table 6-2. A discussion of the results is presented below.

6.3.1 Physical Liquids Recovery

Of the remediation technologies provided in ITRC guidance documents, several mass recovery (that is, physical liquids removal) technologies were considered to achieve project remediation goals. These include DPLE, multiphase extraction using single or dual pumps, bioslurping/enhanced fluid recovery, and LNAPL skimming. These technologies generally include the use of one or two pumps to remove mobile LNAPL and/or groundwater. Multiphase extraction and enhanced fluid recovery can also employ the use of vapor extraction to enhance mass recovery in the unsaturated zone. These technologies address mobile LNAPL but not residual LNAPL. Capital cost is relatively low, but the cost for treatment and discharge of treated groundwater is high. Time to achieve project goals is very long since these technologies do not address residual LNAPL, which can serve as a source for dissolved-phase constituents for many years.

DLA Energy is currently implementing SVE removal and gas-phase GAC treatment along with GWE and associated groundwater treatment as described previously. The systems have essentially been operational since the mid-1990s and were successful in reducing LNAPL, dissolved phase vadose zone TPH concentrations and containment of the groundwater TPH dissolved phase. LNAPL is essentially at residual saturation as indicated by asymptotic mass removal data. Continuation of operations with these technologies would be high in cost and would not sufficiently meet cleanup goals in the next three to five years as is targeted by DLA Energy.

The above mass recovery technologies were not retained as potential interim remedies to achieve remediation project goals. Continued operation of DLA Energy's SVE and GWE systems will be contingent on the effectiveness of the selected remedy and whether it can be used in parallel to enhance mass removal or contain vapor- or dissolved-phase migration of constituents.

6.3.2 Water Flooding

Water flooding was also considered as a mass recovery technology to achieve project goals. Water flooding involves groundwater recirculation in a combined injection/extraction well configuration, where groundwater flow is directed through the LNAPL zone to increase the hydraulic gradient and enhance LNAPL flow, displacement, and removal. The mobilized LNAPL is recovered via hydraulic recovery. Hot water also may be injected to reduce interfacial tension and viscosity of the LNAPL to further enhance LNAPL removal by hydraulic recovery. Water flooding has the potential for a short timeframe to achieve project goals; however, this technology was not retained due to high capital and energy costs, and potential vapor intrusion to nearby residents. Water flooding would probably also not be effective due to the fine grained and lenticular nature of the aquifer strata, yielding low hydraulic conductivity and resulting in poor sweep efficiency. The residual TPH is most likely in the finer grained stratigraphic units, which would be bypassed by flooding.

6.3.3 Surfactant Enhanced Subsurface Remediation (SESR)

SESR involves the use of injection wells to deliver a surfactant solution to the LNAPL smear zone while extraction wells capture mobilized/solubilized LNAPL. SESR enhances LNAPL mobility and recovery by significantly reducing LNAPL/water interfacial tension; it can potentially have a short to moderate timeframe to achieve project goals. Project costs would be moderate to high due to injectate and treatment system costs. This technology was screened out, however, primarily due to its limited success rate and access restrictions.

Injection well coverage may not be adequate, and access for additional well construction would be limited. A waste discharge requirement (WDR) permit, possible UIC registration, and a modification to the existing NPDES permit also may be required. SESR was not retained as a potential interim remedy to meet project objectives.

6.3.4 Steam/Hot Air Injection

Steam/hot air injection (or thermal remediation) removes LNAPL and the dissolved phase by forcing steam into the aquifer to vaporize, solubilize, and induct LNAPL flow. The mobilized LNAPL and dissolved phase is recovered from extraction wells, and volatilized LNAPL is collected via vapor extraction wells. The timeframe to achieve project goals can be very short and this technology treats both mobile and residual LNAPL. Disadvantages to this technology would be very high capital and energy costs associated with the new and existing treatment systems. Potential vapor intrusion, extensive process controls, and safety issues associated with the system operation would be problematic. Therefore, this technology was not retained as a potential interim remedy.

6.3.5 Co-Solvent Flushing

Co-solvent flushing involves the use of injection wells to add a solvent to the aquifer that increases LNAPL solubilization and LNAPL mobility. The dissolved-phase and mobile LNAPL are then recovered by means of hydraulic recovery. This technology was not retained as an interim remedy due to the reasons cited above for SESR. Co-solvent flushing has had a limited success at other similar sites, and the use of a solvent would also further complicate permitting and waste management under this remedy.

6.3.6 Air Sparging (AS)/SVE and Biosparging

AS technology involves the injection of ambient air or other gases (for example, oxygen) into groundwater, typically beneath the smear zone, to increase dissolved oxygen levels that enhance naturally occurring biodegradation of hydrocarbon constituents. The air injection also may volatilize some LNAPL constituents that migrate upward through the vadose zone. Volatilized constituents can then be captured using SVE wells and the vapors treated using aboveground technologies (for example, thermal or catalytic oxidizers).

SVE can also increase the oxygen content of the unsaturated zone, which enhances aerobic respiration of heavier-phase LNAPLs. Heterogeneity within the subsurface may result in preferential pathways that prevent injected air from contacting contaminated areas. More shallow SVE systems, such as the DFSP Norwalk site, also operate more favorably and efficiently at in conjunction with a cap system, a naturally impermeable surficial soil layer, or the equivalent; otherwise ambient air tends to diffuse more immediately from the soil surface which “short circuits” and leads to a more direct pathway to SVE well screened sections. These factors affect the number and spacing of AS wells, flow rates, and length of time required for treatment. AS also has the potential to cause lateral spread of dissolved- or separate-phase contaminant plumes. For example, in formations of laterally oriented clays interbedded with sand, there is a possibility of spreading the contamination when using AS.

Biosparging, a form of AS, generally utilizes the same principles as traditional AS but at a lower and/or "pulsed" air injection rate. In addition, the primary mechanism for reducing residual LNAPL is through enhanced biodegradation rather than stripping or volatilization of constituents. The decreased delivery rate of air reduces the potential for "off-gassing" (upward migration of volatilized constituents), which could cause vapor intrusion issues beneath nearby buildings or residential homes.

AS/SVE is effective on only the volatile fraction of the LNAPL. AS/SVE performed on an LNAPL or dissolved phase with a small volatile fraction (e.g., jet fuel or a strongly weathered gasoline) does not result in significant volatile mass removal, but may contribute to aerobic biodegradation as briefly presented above. Because the site does not have an impermeable cap layer or equivalent, AS/SVE has a high tendency to short circuit. In addition, USEPA suggests AS not be used if free product exists (i.e., free product must be removed prior to AS), which may increase potential for inducing migration of constituents. AS is highly dependent not only on the soil type, but the volatility of the TPH. Heavier TPH, such as TPH as diesel and jet fuel require more time to remediate – typically greater than five years.

Based on the *CSM and Proposed Alternate Interim Remedy for Soil, Groundwater, and LNAPL* report (CH2M HILL, 2013), it is understood that a pilot study may be conducted on the SFPP site and that this information would be shared with DLA Energy. DLA Energy wishes to evaluate the results and effectiveness of the pilot study and applicability to the site. Therefore, air and biosparge technology with SVE was retained as a potential interim remedy to meet project objectives.

6.3.7 In Situ Chemical Oxidation (ISCO)

ISCO is a technology in which an oxidant, and other amendments as necessary, is introduced into contaminated media to react with hydrocarbon constituents, converting them to innocuous products such as carbon dioxide and water. The oxidant must be matched to the site conditions and the project goals. Effective oxidant delivery and contact with the target treatment media as well as delivery of an adequately aggressive and stoichiometrically correct oxidant dose are requisites for effective ISCO application. Typical oxidants that have been used to treat hydrocarbon-impacted media include hydrogen peroxide, ozone, permanganate, or activated persulfate. All of these compounds react, either directly or through generation of highly reactive free radicals, with organic compounds to break down hydrocarbon bonds and form degradation products such as alcohols, carbon dioxide, and water.

ISCO is a proven technology to treat residual LNAPL and dissolved phases in the vadose zone and groundwater. It should be noted that oxidant costs are typically high. However, the timeframe required to achieve project goals can be very short, i.e., typically less than one year. Additionally, running costs for equipment operations and a support/monitoring team are also reduced.

The typical radius of influence (ROI) for ISCO injections range from 2.5 feet for tight clays to 25 feet in permeable saturated and unsaturated soils. In addition to lithology, the ROI varies based on the oxidant properties, the injection technique, and pressure. Based on a conservatively high coverage of 16 acres for the site (about 1/3 of the total site area) and an estimated average ROI of 20-feet, an estimated 440 to 550 injection (conservatively high) point locations would be potentially needed. Each injection point does not necessarily need to be an injection well. DP injection is often used where the depth to contamination is less than 100 feet and there are no geologic barriers that result in refusal. The advantages of DP injection are that it is easy to move the injection locations during additional treatment events to target specific hot spots. Additionally, injection tools can target 1-foot intervals, ensuring uniform vertical distribution of reagents in the treatment zone. Where injections are required in public streets or through building floors, DP injection can result in less disturbance in daily operations and more advantageous site access conditions. DP injection is very cost effective as compared to the use of more permanent injection wells and can utilize a high-oxidant loading or iterative oxidant loading approach.

Due to the effectiveness of ISCO and its typical short remedial time frame, this technology was retained as a primary remedy to meet project goals.

6.3.8 Natural Source Zone Depletion (NSZD)

NSZD is a combination of processes that acts to physically redistribute LNAPL components to the aqueous or gaseous phase and biologically break down source zone components. These processes include the dissolution of LNAPL constituents into groundwater and, in some cases, volatilization of LNAPL constituents into the vadose zone. In turn, LNAPL constituents dissolved to groundwater and volatilized to the vadose zone can be biodegraded by microbial and/or enzymatic activity. Biodegradation of hydrocarbons in groundwater and the vadose zone is well documented in ITRC's guidance document on NSZD (ITRC, 2009b).

NSZD is likely not a stand-alone technology with current LNAPL saturations/composition and dissolved phase soil and groundwater conditions, but it may be viable as a residual long-term stand-alone technology without the need for hydraulic containment once primary cleanup objectives of the LNAPL, dissolved phase vadose zone, and partial dissolved-phase of the groundwater are addressed.

6.3.8.1 Groundwater

Multiple microorganisms are capable of biodegrading not only hydrocarbon constituents in the dissolved phase, but also with MTBE, TBA, and other oxygenates. Where these microbes are present, natural biodegradation or limited biostimulation, are effective in reducing the concentrations of hydrocarbons in impacted groundwater. Typically, only those sites that have aerobic conditions because of shallow water tables and high rates of groundwater recharge achieve significant natural biodegradation of hydrocarbons. These conditions are present at the site.

In general, hydrocarbon constituents are relatively biodegradable in contrast to oxygenate constituents, which are more resistant to biodegradation. The rate at which biodegradation of hydrocarbons and oxygenates will occur at a site is affected by a number of site conditions, including groundwater chemistry, presence of other contaminants, and number of native microbes capable of degrading constituents of concern. Conditions that will determine what types of microbes may be able to grow and what type of biodegradation pathway may be followed include:

1. If aerobic or anaerobic conditions (i.e., nitrate-reducing, iron-reducing, sulfate-reducing, or methanogenic) are more prominent in the contaminated zone; and
2. The levels or concentrations of other chemical parameters (e.g., pH, alkalinity, and inorganic content) at the site.

Previous groundwater sampling at the site for electron acceptor chemistry data has demonstrated that biodegradation is actively occurring.

6.3.8.2 Vadose Zone

It is understood that previous soil gas sampling has indicated relatively high oxygen and low carbon dioxide and methane content in the upper 15 feet of the vadose zone, which would indicate an aerobic environment. It is likely that aerobic biodegradation of hydrocarbon constituents in soil vapor has been occurring. This is further supported by the lack of measurable hydrocarbons in soil gas samples previously collected in 2012.

NSZD will not be retained as the sole interim remedy primarily due to the very long timeframe required to achieve project goals. However, NSZD could be used to supplement a more aggressive approach, such as ISCO, to further reduce constituent concentrations in impacted media to acceptable cleanup levels.

6.4 SELECTION OF ALTERNATE INTERIM REMEDY

Based on the evaluation of the relative cost, technology effectiveness, typical timeframe required for treatment, implementability, and third-party impacts for each of the potentially applicable screening technologies, ISCO coupled with shallow excavation and in-situ soil mixing of the excavation bottom with chemical oxidant is selected as the suggested remedy approach for achieving project goals.

DLA Energy tentatively plans to conduct a pilot study in the former AST 80008 plume area to evaluate the effectiveness of ISCO using DP injection of activated persulfate with a chelated iron (III) activator as the ISCO agent. It is estimated that an initial 30 to 60 day treatability study would be conducted to determine suggested dosage parameters. Thereafter, pilot testing data would be collected during ISCO injection activities over a period of approximately three to four months. Pilot study test data would be used to support the full ISCO design coupled with excavation followed by in-situ chemical oxidation mixing at the bottom excavation interface for full-scale implementation at the site.

Monitoring along with NSZD testing would be implemented in parallel and series with ISCO activities to demonstrate enhanced mass removal at the site via chemical oxidation and potentially natural biodegradation and other natural attenuation mechanisms. NSZD monitoring also would assist with the evaluation of ISCO effectiveness and potential for off-gassing beneath the residential area.

Only peripheral operation of the current remediation system would continue during pilot testing. The current system would be operated to continue to contain the dissolved phase groundwater plume at the perimeter areas of the site.

As stated in Section 6.3.6 above, the results of the SFPP biosparge pilot study will be evaluated. Based on results, the technology will be evaluated to DLA Energy's areas of concern for its effectiveness and applicability and if technology will meet project objectives.

7. IMPLEMENTATION PLAN OF PROPOSED REMEDY

This section provides the plan and schedule for implementing the interim remedy - ISCO coupled with shallow excavation and in-situ soil mixing of the excavation bottom with chemical oxidant and initiation of monitoring at the site. Details for implementation of the pilot-scale and full-scale systems are also presented below.

7.1 PERSULFATE OXIDATION SYSTEM

Implementation of the interim remedy would include the installation and testing of a pilot-scale activated persulfate oxidation system in the former AST 80008 area of the site. The pilot test system would include an estimated 12 DP injection points for a total estimated vertical depth of approximately 40 feet bgs each. Existing nearby vadose zone, soil gas, and groundwater monitoring wells would be used for periodic monitoring. Additional monitoring wells may be needed, but would be further assessed during development of the pilot study workplan.

Operation of the existing GWE system would only continue at the east and west portions of the site and operation of the SVE system would cease. Further details would be provided in the workplan as discussed below.

7.1.1 Workplan

A workplan would be prepared and submitted to the RWQCB for review prior to implementation of the pilot system. It would include design and execution details for the activated persulfate application and aboveground appurtenances required for pilot testing. A vadose zone and groundwater monitoring plan would also be included. Common field monitoring parameters and suggested analyte techniques are summarized as follows:

- Contaminants, EPA SW 846 8260B (BTEX);
- Oxidant, field test kit;
- Metals, EPA Method 200.7 (ICP), SM 3120B;
- Major ions (Na, K, Ca, Mg, Fe), EPA Method 200.7 (ICP) SM 3120B;
- Nitrate, sulfate, and chloride, EPA Method 300—ion chromatography;
- Alkalinity, as CaCO, EPA Method 310.1, SM 2320B;
- Oxidation reduction potential (Eh) field measurement, SM 18 ED 2580B;
- pH, hydrogen ion field measurement EPA Method 150.1, 18 ED;
- Temperature, field measurement EPA Method 170.1, 18 ED; and
- Specific conductance, field measurement EPA Method 120.1, 18 ED.

Groundwater samples would additionally be analyzed for VOCs including fuel oxygenates (for example, MTBE and TBA) using EPA Method 8260B, and TPH as gasoline, TPH as diesel, and TPH as jet fuel using EPA Method 8015M.

7.1.2 Schedule

Figure 7-1 presents a draft and tentative conceptual schedule for implementation of the pilot-scale and full-scale ISCO system. This is an approximate schedule and is subject to change based on contractor availability, unforeseen implementation or startup issues, and performance of the system during pilot testing. It also may change based on other site pilot test results, client preference, and/or regulatory concerns or permitting issues.

It is anticipated that the pilot test workplan would be completed mid-first quarter 2014. Site implementation activities would commence after formal approval from the RWQCB, anticipated to be one month following completion and submittal of the workplan. Treatability and subsequent pilot testing activities would commence at the end of the first quarter 2014 and continue for a duration of approximately four months.

7.1.3 Evaluation Report

After sufficient pilot test data have been collected, the data would be compiled into an evaluation report that would include tabulated summaries of chemical oxidant injection quantities, groundwater and soil vapor analytical data, evaluation of results, and recommendations regarding implementation of a full ISCO treatment system for the remainder of the site. The evaluation report is anticipated to be submitted to the RWQCB in mid 2014.

7.2 REMEDY EXPANSION

After it has been determined whether ISCO technology and complete remedy is effective at meeting the remediation goals and performance metrics (based on pilot test results), DLA Energy tentatively plans to expand the treatment methodology to the impacted areas in the remainder of the site, e.g., the truck fill area, the northeastern area, and other selected areas of the site. This would require additional DP injection points both onsite and offsite areas. The proposed layout of the excavation and ISCO expansion system would be included in a design and execution plan provided to the RWQCB prior to implementation. It is anticipated that the design and execution plan would be submitted to the RWQCB in the third quarter of 2014. Subsequent evaluation or progress reports would be submitted to the RWQCB on a quarterly basis, at a minimum, while the system is fully operational.

7.3 MONITORING

Monitoring including NSZD testing and monitoring would be performed to evaluate the potential future use of this technology as a stand-alone remedy once all concerns and objectives are addressed with the fully implemented remedy. This testing and monitoring would include the following, as described in the ITRC (2009b) guidance document:

- **Groundwater Zone Testing:** Collection of groundwater samples from key monitoring wells located upgradient and downgradient of the plume centers.

Samples also would be collected from wells located in the plume centers and plume edges. Samples would be analyzed for parameters as referenced in Section 7.1.1. The frequency of monitoring would be quarterly or potentially semiannual and would likely occur during routine semiannual sampling at the site.

- **Vadose Zone Testing:** Installation and collection of soil vapor samples from multi-depth soil VMPs completed to the top of the water table at or near the source areas (for example, within the plume core, upgradient, or downgradient). Multiple screen intervals may be required in order to establish the soil gas profiles necessary to evaluate oxidation and biodegradation rates in the vadose zone. Soil vapor samples would be analyzed for VOCs using EPA Method 8260 or TO-15, TPH as gasoline using EPA Method TO-3, and fixed gases (carbon dioxide, oxygen, and methane) using ASTM D1946.

Additional details regarding monitoring, NSZD testing, including soil vapor probe construction, would be provided in the pilot test workplan.

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TABLES

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-1	10	65.26	36 [4/]	2400	-- [5/]	0.075	0.095	0.07	8.5
DPT-1	20	55.26	36.5	2400	--	0.08	0.1	0.075	9
DPT-1	25	50.26	34	2400	--	0.1	0.125	0.095	11
DPT-2	15	60.18	25.5	2400	--	0.065	0.08	0.065	7.5
DPT-2	20	55.18	34.5	2400	--	0.075	0.09	0.07	8
DPT-2	25	50.18	33	2400	--	0.075	0.095	0.075	8.5
DPT-3	15	60.30	28.5	2400	--	0.06	0.08	0.06	7
DPT-3	20	55.30	24	2400	--	0.05	0.065	0.05	6
DPT-3	25	50.30	33	2400	--	0.08	0.1	0.08	9
DPT-4	5	70.21	480000	3100000	--	6	7.5	6	700
DPT-4	10	65.21	31.5	15000	--	0.07	0.09	0.07	8
DPT-4	15	60.21	33	2400	--	0.07	0.09	0.07	8
DPT-4	20	55.21	850000	640000	--	5.5	7	5.5	650
DPT-4	25	50.21	11000000	6100000	--	390	7.5	6	700
DPT-5	10	65.27	28.5	2400	--	0.07	0.09	0.07	8
DPT-5	15	60.27	32.5	2400	--	0.075	0.095	0.07	8.5
DPT-5	20	55.27	2000000	2800000	--	5.5	7	5.5	600
DPT-6	15	60.61	34	2400	--	0.075	0.09	0.07	8
DPT-6	20	55.61	3100000	8600000	--	7	9	7	800
DPT-6	25	50.61	1300	2400	--	6	7.5	6	650
DPT-7	15	60.43	26000	15000	--	0.09	0.11	0.085	10
DPT-7	20	55.43	4400000	2000000	--	29.5	37.5	29	3350
DPT-7	25	50.43	16000000	11000000	--	75	90	70	8000
DPT-8	10	65.39	770000	2700000	--	7.5	9.5	7.5	850
DPT-8	15	60.39	870000	2000000	--	7.5	9	7	800
DPT-8	20	55.39	5500	1000000	--	1.5	0.08	0.065	7
DPT-8	25	50.39	460	2400	--	1.1	0.065	0.05	6
DPT-9	10	65.29	1200	2400	--	2	0.07	0.055	6
DPT-9	15	60.29	8200	39000	--	0.075	0.095	0.075	8.5
DPT-9	20	55.29	850000	1200000	--	7	9	7	800
DPT-9	25	50.29	9800000	4300000	--	140	175	135	15500
DPT-10	15	60.82	240000	490000	--	0.075	0.09	0.07	8
DPT-10	20	55.82	2800000	3200000	--	28	35.5	27.5	3200
DPT-10	25	50.82	830000	990000	--	7.5	9.5	7.5	850
DPT-11	15	61.09	34	2400	--	0.05	0.065	0.05	6
DPT-11	20	56.09	1900000	1800000	--	6	7.5	5.5	650
DPT-11	25	51.09	1200	2400	--	1.2	0.075	0.055	6.5
DPT-12	10	66.15	540000	1600000	--	6.5	8.5	6.5	750
DPT-12	15	61.15	3500000	5600000	--	6.5	8	6.5	750
DPT-12	20	56.15	130000	87000	--	1.9	0.065	0.05	6
DPT-12	25	51.15	570	2400	--	0.075	0.095	0.075	8.5
DPT-13	5	72.24	32.5	2400	--	0.075	0.09	0.07	8
DPT-13	10	67.24	25.5	2400	--	1.9	0.075	0.055	6.5
DPT-14	5	72.48	29	2400	--	0.065	0.085	0.065	7.5
DPT-14	10	67.48	27.5	2400	--	0.06	0.08	0.06	7
DPT-15	5	72.13	33.5	2400	--	0.08	0.1	0.075	9
DPT-15	10	67.13	34	2400	--	0.075	0.095	0.07	8.5
DPT-16	5	72.31	30	2400	--	0.065	0.085	0.065	7.5
DPT-16	10	67.31	28.5	2400	--	1.4	0.085	0.065	7.5
DPT-17	5	70.51	14000000	11000000	--	70	85	65	7500
DPT-17	10	65.51	5000000	6800000	--	6.5	8.5	6.5	750
DPT-17	15	60.51	7200000	10000000	--	75	95	75	8500
DPT-17	20	55.51	860	7000	--	3.1	0.08	0.06	7
DPT-17	25	50.51	370000	200000	--	6.5	8	6.5	750
DPT-18	15	60.59	630	2400	--	0.07	0.09	0.07	8

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-18	20	55.59	160000	23000	--	6	7.5	5.5	650
DPT-19	10	65.61	830000	910000	--	6	7.5	5.5	650
DPT-19	15	60.61	720	2400	--	0.075	0.095	0.07	8.5
DPT-19	20	55.61	450	2400	--	1.2	0.07	0.055	6
DPT-20	25	49.31	1600	2400	--	0.1	0.13	0.125	11
DPT-21	10	64.90	210	12000	--	0.1	0.13	0.125	11
DPT-21	15	59.90	6900	8400	--	0.1	0.13	0.125	11
DPT-21	20	54.90	5100	11000	--	0.1	0.13	0.125	11
DPT-21	25	49.90	210	2400	--	0.1	0.13	0.125	11
DPT-22	20	55.40	210	2400	--	0.1	0.13	0.125	11
DPT-22	25	50.40	970000	1700000	--	36	13	12.5	1100
DPT-23	10	65.27	1200000	2100000	--	10	13	12.5	1100
DPT-23	15	60.27	4000	2400	--	0.1	0.13	0.125	11
DPT-23	20	55.27	210	2400	--	0.1	0.13	0.125	11
DPT-23	25	50.27	3100	6000	--	0.1	0.13	0.125	11
DPT-24	10	65.29	210	2400	--	0.1	0.13	0.125	11
DPT-24	15	60.29	2700000	5200000	--	20	26	24.5	2200
DPT-24	20	55.29	780000	1300000	--	10	13	12.5	1100
DPT-24	25	50.29	70000	74000	--	0.1	0.13	0.125	11
DPT-25	10	65.38	2600000	150000	--	10	13	12.5	1100
DPT-25	15	60.38	2700000	3800000	--	20	26	24.5	2200
DPT-25	20	55.38	680000	720000	--	10	13	12.5	1100
DPT-25	25	50.38	190000	520000	--	10	13	12.5	1100
DPT-27	25	50.64	210	2400	--	0.1	0.13	0.125	11
DPT-28	25	50.78	17000	53000	--	10	13	12.5	1100
DPT-29	20	55.78	1600000	580000	--	10	13	12.5	1100
DPT-29	25	50.78	770000	520000	--	10	13	12.5	1100
DPT-30	15	59.84	840000	1300000	--	10	13	12.5	1100
DPT-30	20	54.84	770000	2900000	--	10	13	12.5	1100
DPT-30	25	49.84	1700000	8000	--	0.1	0.13	0.125	11
DPT-31	12	63.27	210	5200	--	0.1	0.13	0.125	11
DPT-33	25	50.00	1700000	2200000	--	10	13	12.5	1100
DPT-34	20	55.06	650	2400	--	0.1	0.13	0.125	11
DPT-34	25	50.06	8400000	12000000	--	10	13	12.5	1100
DPT-35	15	60.03	570	2400	--	0.1	0.13	0.125	11
DPT-35	20	55.03	6400	14000000	--	0.1	0.13	0.125	11
DPT-35	25	50.03	1400000	2000000	--	10	13	12.5	1100
DPT-36	20	54.66	1100	8800	--	0.1	0.13	0.125	11
DPT-36	25	49.66	900	14000	--	0.1	0.13	0.125	11
DPT-37	15	59.51	210	2400	--	0.1	0.13	0.125	11
DPT-37	20	54.51	520000	440000	--	10	13	12.5	1100
DPT-37	25	49.51	1000	2400	--	0.31	0.13	0.125	11
DPT-38	15	59.52	210	2400	--	0.1	0.13	0.125	11
DPT-38	20	54.52	530	2400	--	0.1	0.13	0.125	11
DPT-38	25	49.52	13000000	11000000	--	45	26	24.5	2200
DPT-39	20	54.57	1700	11000	--	0.1	0.13	0.125	11
DPT-40	20	54.79	210	2400	--	0.1	0.13	0.125	11
DPT-40	25	49.79	670	2400	--	0.1	0.13	0.125	11
DPT-41	0.5	74.32	2400000	5300000	8700000	370	7.5	7	125
DPT-41	5	69.82	2200	2400	2400	15	0.28	0.26	27
DPT-41	12	62.82	1800	2400	2400	26	0.145	0.14	7
DPT-41	15	59.82	7500	2400	2400	86	8	7.5	130
DPT-41	20	54.82	31.5	2400	2400	1	0.165	0.155	2.7
DPT-42	0.5	74.38	2300000	3400000	7600000	3900	45.5	43	750
DPT-42	5	69.88	910000	2400	2400	340	6.5	6	110

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-42	10	64.88	2800	2400	2400	120	7	6.5	115
DPT-42	16	58.88	23000	2400	2400	70	8.5	8	135
DPT-42	19	55.88	49000	42000000	40000000	990	7	7	120
DPT-42	24	50.88	15.5	2400	2400	0.47	0.16	0.15	2.65
DPT-43	0.5	75.01	32.5	2400	74000	5.4	0.17	0.16	2.75
DPT-43	5	70.51	30.5	2400	2400	1.8	0.155	0.15	2.6
DPT-43	10	65.51	28	2400	2400	32	0.14	0.135	2.35
DPT-43	15	60.51	32.5	2400	2400	0.07	0.17	0.16	2.8
DPT-43	20	55.51	25.5	2400	2400	0.53	0.12	0.115	2
DPT-43	25	50.51	31.5	2400	2400	0.47	0.16	0.15	2.65
DPT-44	0.5	74.84	30	2400	18000	6	0.165	0.155	2.7
DPT-44	5	70.34	29.5	2400	2400	1.2	0.155	0.145	2.6
DPT-44	10	65.34	26	2400	2400	2.7	0.14	0.135	2.35
DPT-44	15	60.34	31	2400	2400	0.8	0.165	0.155	2.7
DPT-44	20	55.34	30	2400	2400	0.18	0.175	0.16	2.85
DPT-44	25	50.34	27	2400	240000	0.57	0.125	0.12	2.05
DPT-45	0.5	74.72	24.5	2400	2400	6.2	0.135	0.13	2.25
DPT-45	5	70.22	29.5	2400	2400	0.94	0.155	0.15	2.6
DPT-45	10	65.22	26	2400	6300	0.96	0.135	0.125	2.2
DPT-45	15	60.22	33	2400	2400	0.07	0.17	0.16	2.8
DPT-45	20	55.22	30.5	2400	2400	0.29	0.155	0.145	2.55
DPT-45	25	50.22	25	12000	580000	0.48	0.12	0.11	1.95
DPT-46	0.5	75.63	29	2400	340000	2.5	0.145	0.14	2.4
DPT-46	5	71.13	25	2400	2400	2.1	0.13	0.125	2.15
DPT-46	10	66.13	29.5	2400	260000	2	0.145	0.135	2.35
DPT-46	15	61.13	29	2400	2400	0.67	0.145	0.135	2.35
DPT-46	20	56.13	24.5	2400	2400	1.4	0.15	0.14	2.5
DPT-46	28	48.13	29	2400	2400	0.18	0.155	0.145	2.55
DPT-46	33	43.13	33	17000	380000	0.91	0.13	0.125	2.15
DPT-47	0.5	74.93	29	2400	2400	5.6	0.15	0.14	2.5
DPT-47	5	70.43	24	2400	2400	2	0.13	0.12	2.1
DPT-47	10	65.43	26	2400	2400	1.1	0.12	0.115	1.95
DPT-47	15	60.43	31.5	2400	2400	0.24	0.16	0.15	2.65
DPT-47	20	55.43	24.5	2400	2400	0.97	0.13	0.125	2.2
DPT-47	24	51.43	27.5	2400	2400	0.28	0.135	0.125	2.2
DPT-48	0.5	75.06	32	2400	13000	8.2	0.165	0.155	2.7
DPT-48	5	70.56	29	2400	2400	1.2	0.15	0.14	2.45
DPT-48	10	65.56	27.5	2400	2400	3.2	0.13	0.125	2.15
DPT-48	15.5	60.06	29.5	2400	2400	0.19	0.155	0.145	2.55
DPT-48	20	55.56	23.5	2400	2400	0.21	0.145	0.135	2.4
DPT-48	23.5	52.06	24.5	2400	2400	1.9	0.12	0.115	2
DPT-49	0.5	75.60	28.5	2400	59000	6.3	0.14	0.13	2.3
DPT-49	5	71.10	32	2400	2400	1.2	0.15	0.14	9.4
DPT-49	10	66.10	5300	13000	13000	21	0.125	0.115	420
DPT-49	15	61.10	6600	9000	8600	42	0.16	0.15	210
DPT-49	18	58.10	1500000	520000	490000	300	13	12	210
DPT-49	20	56.10	2200	14000	14000	240	0.12	0.11	22
DPT-49	27.5	48.60	490	2400	2400	49	0.14	0.13	7.3
DPT-50	0.5	76.06	29	2400	2400	7.1	0.17	0.16	2.8
DPT-50	5	71.56	27.5	2400	2400	1.5	0.13	0.12	2.15
DPT-50	10	66.56	29.5	2400	2400	0.89	0.165	0.155	2.7
DPT-50	16	60.56	27	2400	2400	1.2	0.15	0.14	2.45
DPT-50	20	56.56	1300	2400	2400	1.4	0.33	0.14	63
DPT-50	25	51.56	1000	14000	170000	1.4	0.135	0.125	12
DPT-51	0.5	75.60	28.5	7400	100000	6.9	0.17	0.16	2.8

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-51	5	71.10	28	2400	17000	1.1	0.15	0.14	2.45
DPT-51	10	66.10	27	2400	9100	2.3	0.12	0.11	1.95
DPT-51	14	62.10	31	2400	2400	0.61	0.15	0.145	2.5
DPT-51	20	56.10	6000000	4300000	4100000	1200	75	70	1250
DPT-52	0.5	75.68	30.5	2400	2400	8.9	0.17	0.16	2.8
DPT-52	5	71.18	26.5	2400	2400	2	0.13	0.125	2.2
DPT-52	12	64.18	440	2400	2400	4.4	0.15	0.14	12
DPT-52	15.5	60.68	1100	2400	2400	2.5	0.175	0.165	100
DPT-52	20	56.18	2600	2400	2400	16	1.4	0.14	18
DPT-52	24	52.18	450	2400	2400	2.3	1	0.14	14
DPT-53	0.5	76.85	32	2400	36000	3.5	0.165	0.155	2.7
DPT-53	6	71.35	33	2400	2400	2	0.2	0.19	3.3
DPT-53	12	65.35	29	2400	2400	0.94	0.16	0.15	2.65
DPT-53	16	61.35	26.5	2400	2400	0.65	0.16	0.15	2.65
DPT-53	20	57.35	33	2400	2400	0.43	0.17	0.16	2.75
DPT-54	0.5	76.84	33	2400	2400	6	0.16	0.15	2.65
DPT-54	6	71.34	34	2400	2400	0.61	0.175	0.165	2.85
DPT-54	12	65.34	26	2400	2400	1.9	0.135	0.13	2.25
DPT-54	16	61.34	28.5	2400	2400	0.65	0.165	0.155	2.75
DPT-54	20	57.34	31.5	2400	2400	0.065	0.16	0.15	2.65
DPT-55	0.5	77.41	30.5	2400	70000	1.7	0.155	0.145	2.55
DPT-55	5	72.91	35.5	2400	2400	1	0.165	0.155	2.7
DPT-55	11.5	66.41	27	2400	2400	1	0.13	0.125	2.15
DPT-55	15	62.91	33.5	2400	2400	0.17	0.15	0.145	2.5
DPT-55	20	57.91	35.5	2400	2400	0.07	0.165	0.155	2.7
DPT-55	24	53.91	26	2400	2400	0.75	0.125	0.12	2.1
DPT-56	0.5	77.14	31.5	2400	200000	3	0.15	0.145	2.5
DPT-56	5	72.64	38.5	2400	2400	1.1	0.165	0.155	2.7
DPT-56	11.5	66.14	25	2400	2400	0.72	0.145	0.135	2.35
DPT-56	15	62.64	33	2400	2400	0.06	0.145	0.135	2.35
DPT-56	20	57.64	31.5	2400	2400	0.45	0.175	0.165	2.85
DPT-57	0.5	75.41	25.5	2400	20000	8.8	0.16	0.15	2.65
DPT-57	5	70.91	26.5	2400	2400	2.2	0.145	0.135	2.35
DPT-57	11	64.91	27.5	2400	2400	4.2	0.14	0.13	2.3
DPT-57	15	60.91	32	2400	2400	0.21	0.14	0.13	2.3
DPT-57	19.5	56.41	460000	9500	9000	37	7	6.5	115
DPT-57	23	52.91	8200	2400	2400	23	0.16	23	15
DPT-58	0.5	76.12	30.5	2400	2400	8.7	0.14	0.13	2.3
DPT-58	5	71.62	32.5	2400	2400	2.2	0.175	0.165	2.85
DPT-58	10.5	66.12	25	2400	2400	1	0.14	0.13	2.3
DPT-58	15	61.62	30.5	2400	2400	0.31	0.16	0.15	2.6
DPT-58	20	56.62	25.5	2400	2400	2.2	0.125	0.12	2.1
DPT-58	24	52.62	340	2400	2400	0.33	0.145	0.68	2.4
DPT-59	0.5	75.68	33	2400	2400	5.9	0.17	0.16	2.75
DPT-59	5	71.18	23.5	2400	2400	1.4	0.125	0.115	2.05
DPT-59	10	66.18	30	2400	2400	0.14	0.165	0.155	2.75
DPT-59	15	61.18	31	2400	2400	0.23	0.175	0.165	2.9
DPT-59	20	56.18	38	2400	2400	0.31	0.165	0.155	2.7
DPT-59	24	52.18	790	2400	2400	0.97	0.165	0.76	2.7
DPT-59	28	48.18	4600	2400	2400	4.4	0.13	1.2	2.15
DPT-60	0.5	75.28	31	2400	27000	6.5	0.175	0.16	2.85
DPT-60	5	70.78	39	2400	2400	1.2	0.16	0.15	2.65
DPT-60	11.5	64.28	28.5	2400	2400	4.4	0.16	0.15	2.6
DPT-60	15	60.78	34	2400	2400	0.07	0.17	0.16	2.75
DPT-60	19	56.78	220000	180000	170000	2.9	7	6.5	115

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) 1/
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH /2 as Gasoline	TPH as JP-5 3/	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-61	0.5	74.98	28	2400	31000	6.6	0.14	0.135	2.35
DPT-61	5	70.48	25	2400	2400	0.91	0.125	0.12	2.1
DPT-61	10.5	64.98	29	2400	2400	0.06	0.145	0.14	2.4
DPT-61	15	60.48	32.5	2400	2400	13	0.175	0.165	2.9
DPT-61	20	55.48	24.5	2400	2400	3.2	0.125	0.115	2.05
DPT-61	23.5	51.98	32.5	2400	2400	10	0.25	0.235	4.1
DPT-62	0.5	74.64	30	2400	12000	0.24	0.165	0.155	2.7
DPT-62	6	69.14	32.5	2400	2400	0.31	0.165	0.155	2.75
DPT-62	10	65.14	28.5	2400	2400	2.8	0.14	0.135	2.35
DPT-62	15	60.14	15	2400	2400	0.33	0.155	0.145	2.55
DPT-62	20	55.14	26	2400	2400	1.3	0.125	0.12	2.05
DPT-62	24	51.14	26.5	2400	2400	0.34	0.13	0.125	2.15
DPT-63	0.5	74.72	34	2400	2400	13	0.135	0.13	2.25
DPT-63	6	69.22	30.5	2400	2400	1.1	0.155	0.145	2.5
DPT-63	11	64.22	26.5	2400	2400	5.3	0.135	0.125	2.2
DPT-63	15	60.22	27.5	2400	2400	0.14	0.16	0.15	2.6
DPT-63	19.5	55.72	25.5	2400	2400	1.7	0.125	0.12	2.1
DPT-63	24	51.22	31.5	2400	2400	0.065	0.16	0.15	2.6
DPT-64	0.5	74.93	31.5	2400	2400	16	0.225	0.21	3.65
DPT-64	6	69.43	27	2400	2400	1.4	0.135	0.125	2.2
DPT-64	11	64.43	25	2400	2400	5.4	0.14	0.135	2.35
DPT-64	16	59.43	34	2400	2400	0.27	0.16	0.15	2.6
DPT-64	20	55.43	22	2400	2400	0.84	0.13	0.125	2.15
DPT-64	24	51.43	37	2400	2400	0.33	0.185	0.175	3.05
DPT-65	0.5	74.59	33	160000	2600000	1.3	0.18	0.17	2.95
DPT-65	5	70.09	32.5	2400	23000	1.2	0.17	0.16	2.8
DPT-65	10	65.09	8300000	9400000	8700000	600	330	310	5500
DPT-66	0.5	76.59	33	340000	5900000	0.69	0.17	0.16	2.8
DPT-66	6	71.09	31.5	2400	2400	0.97	0.165	0.155	2.7
DPT-66	12	65.09	29	2400	2400	8.2	0.165	0.155	2.75
DPT-66	15	62.09	29.5	2400	2400	0.35	0.155	0.145	2.55
DPT-66	20	57.09	34.5	2400	2400	0.27	0.175	0.165	2.9
DPT-66	26.5	50.59	28	2400	2400	0.92	0.165	0.155	2.75
DPT-67	0.5	76.66	31	2400	2400	0.15	0.155	0.145	2.6
DPT-67	5	72.16	29.5	2400	2400	0.72	0.155	0.15	2.6
DPT-67	12	65.16	29.5	2400	2400	0.49	0.145	0.135	2.4
DPT-67	16	61.16	33	2400	2400	0.075	0.185	0.175	3.05
DPT-67	20	57.16	34.5	2400	2400	0.15	0.175	0.165	2.9
DPT-67	27.5	49.66	30	2400	2400	9.1	0.21	0.2	3.45
DPT-68	0.5	76.41	28.5	2400	2400	0.66	0.155	0.145	2.55
DPT-68	5	71.91	26.5	2400	2400	2.8	0.145	0.135	2.35
DPT-68	11.5	65.41	26.5	2400	2400	14	0.125	0.12	2.05
DPT-68	16	60.91	31.5	2400	2400	0.39	0.16	0.15	2.65
DPT-68	20	56.91	31.5	2400	2400	0.065	0.16	0.15	2.65
DPT-68	28	48.91	22.5	2400	2400	240	0.13	3.4	2.15
DPT-69	0.5	76.75	34	6800	260000	0.28	0.17	0.16	2.75
DPT-69	5.5	71.75	35	2400	2400	0.15	0.175	0.165	2.9
DPT-69	10	67.25	36	2400	2400	3.1	0.14	0.13	2.3
DPT-69	15	62.25	30	2400	2400	0.24	0.165	0.155	2.7
DPT-69	20	57.25	33	2400	2400	0.16	0.165	0.155	2.7
DPT-69	28	49.25	1800	6600000	6300000	2	0.135	0.125	2.2
DPT-70	0.5	74.57	27	2400	2400	3.1	0.145	0.14	2.4
DPT-70	6.5	68.57	26.5	2400	2400	3.7	0.15	0.14	2.45
DPT-70	11	64.07	25.5	2400	2400	0.55	0.145	0.135	2.4
DPT-70	15.5	59.57	33	2400	2400	0.2	0.16	0.15	2.65

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) 1/
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH /2 as Gasoline	TPH as JP-5 3/	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-70	19	56.07	23	2400	2400	2.1	0.12	0.115	1.95
DPT-70	26	49.07	34	2400	2400	0.065	0.16	0.15	2.65
DPT-71	0.5	74.85	28	2400	2400	3.1	0.155	0.145	2.5
DPT-71	6	69.35	33	2400	2400	2.1	0.14	0.13	2.3
DPT-71	10	65.35	30	2400	2400	0.65	0.145	0.135	2.4
DPT-71	15	60.35	33.5	2400	2400	0.07	0.17	0.16	2.75
DPT-71	20	55.35	24	2400	2400	4.6	0.1	0.095	1.65
DPT-71	26.5	48.85	29	2400	2400	0.23	0.15	0.14	2.5
DPT-72	16	58.50	27.5	38000	1300000	1.8	0.13	0.125	2.15
DPT-72	20	54.50	26	2400	48000	1.6	0.13	0.125	2.15
DPT-72	23	51.50	25	2400	2400	2.5	0.14	0.135	2.35
DPT-73	15	59.37	26	7900	170000	1.5	0.13	0.12	2.15
DPT-73	22	52.37	26.5	2400	2400	2.2	0.13	3.4	14
DPT-74	0	75.31	33.5	920000	14000000	0.81	0.145	0.135	2.4
DPT-74	0.5	74.81	27	2400	39000	5	0.16	0.15	2.6
DPT-74	6	69.31	33.5	2400	2400	0.075	0.175	0.165	2.9
DPT-74	11	64.31	27	2400	2400	1.4	0.14	0.135	2.35
DPT-74	16	59.31	33	2400	2400	0.065	0.155	0.15	2.6
DPT-74	20	55.31	24.5	2400	2400	3.8	0.13	0.12	2.15
DPT-74	27	48.31	32	2400	2400	0.07	0.175	0.16	2.85
DPT-75	0.5	74.95	31.5	25000	330000	2	0.16	0.15	2.6
DPT-75	7	68.45	26.5	2400	2400	1.9	0.14	0.135	2.35
DPT-75	11	64.45	26.5	2400	2400	2.8	0.135	0.125	2.2
DPT-75	15	60.45	32.5	2400	2400	0.065	0.16	0.15	2.6
DPT-75	18.5	56.95	31	2400	2400	0.37	0.175	0.165	2.9
DPT-75	23	52.45	32.5	2400	2400	0.07	0.17	0.16	2.75
DPT-75	27	48.45	26.5	2400	24000	0.64	0.135	0.13	2.25
DPT-75	31	44.45	31	2400	2400	0.065	0.155	0.145	2.55
DPT-76	0.5	75.83	31.5	2400	6300	3.2	0.16	0.15	2.65
DPT-76	7	69.33	28	2400	2400	1.6	0.135	0.125	2.2
DPT-76	11	65.33	26.5	2400	2400	0.96	0.135	0.125	2.2
DPT-76	15	61.33	34.5	2400	2400	0.075	0.185	0.175	3.05
DPT-76	19.5	56.83	24.5	2400	2400	1.6	0.13	0.125	2.15
DPT-76	23.5	52.83	32	2400	2400	0.075	0.18	0.17	2.95
DPT-76	26.5	49.83	33.5	2400	2400	0.33	0.2	0.19	3.3
DPT-77	0.5	75.87	32	2400	75000	1.6	0.155	0.145	2.6
DPT-77	5.5	70.87	34	2400	2400	0.08	0.19	0.175	3.1
DPT-77	11	65.37	23	2400	2400	1.1	0.125	0.115	2.05
DPT-77	15	61.37	22	2400	2400	1	0.14	0.13	2.25
DPT-77	20	56.37	26.5	2400	2400	0.74	0.13	0.125	2.2
DPT-77	26.5	49.87	25.5	2400	2400	0.31	0.125	0.115	2.05
DPT-78	0.5	75.98	31	2400	140000	0.22	0.155	0.145	2.6
DPT-78	5.5	70.98	35.5	2400	2400	0.22	0.175	0.165	2.85
DPT-78	11	65.48	25.5	2400	2400	0.64	0.145	0.135	2.35
DPT-78	15	61.48	26.5	2400	2400	0.92	0.12	0.11	1.95
DPT-78	20	56.48	23.5	2400	2400	1.1	0.155	0.145	2.55
DPT-78	27	49.48	26	2400	2400	0.97	0.12	0.115	2
DPT-79	0.5	76.15	34	2400	28000	1.3	0.17	0.16	2.75
DPT-79	6	70.65	36	2400	2400	0.075	0.175	0.165	2.9
DPT-79	11.5	65.15	24	2400	2400	1.9	0.12	0.115	2
DPT-79	16	60.65	30.5	2400	2400	0.86	0.15	0.14	7.3
DPT-79	20	56.65	23	2400	2400	0.61	0.125	0.12	2.05
DPT-79	26	50.65	24.5	2400	2400	1.7	0.165	0.155	2.7
DPT-80	0.5	76.24	35.5	2400	54000	1.3	0.175	0.16	2.85
DPT-80	6	70.74	34.5	2400	2400	0.18	0.185	0.175	3.1

TABLE 4-1
Summary of Soil Analytical Results (μg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-80	11	65.74	24	2400	2400	0.61	0.13	0.125	2.15
DPT-80	15	61.74	25.5	2400	2400	0.48	0.135	0.125	2.2
DPT-80	20	56.74	27.5	2400	2400	0.47	0.13	0.12	2.15
DPT-80	24	52.74	24	2400	2400	1.1	0.115	0.11	1.9
DPT-81	0.5	74.04	25.5	2400	15000	1.4	0.135	0.125	2.2
DPT-81	6	68.54	810000	3200000	10000000	14	7.5	7	120
DPT-81	10.5	64.04	360000	200000	240000	2.7	6.5	6	105
DPT-81	15	59.54	590	2400	2400	0.07	0.17	0.16	2.8
DPT-81	18	56.54	480000	1500000	1600000	3.65	9	8.5	145
DPT-81	20	54.54	690000	170000	180000	5	12.5	11.5	205
DPT-81	24	50.54	1500000	870000	910000	25	8	7.5	135
DPT-82	0.5	74.22	31	370000	2200000	1.8	0.155	0.145	2.55
DPT-82	6	68.72	470000	1800000	6100000	0.83	0.15	0.14	2.45
DPT-82	11	63.72	33000	2400	2400	2.3	0.145	0.135	2.4
DPT-82	16	58.72	970	2400	2400	3.8	0.125	0.115	2.05
DPT-82	20	54.72	4500000	1800000	1900000	21	9.5	9	155
DPT-82	23	51.72	2200000	2700000	2800000	19	8.5	8	140
DPT-83	0.5	74.19	390	1300000	3700000	0.9	0.135	0.125	2.2
DPT-83	6	68.69	420000	3200000	10000000	8.3	7	7	120
DPT-83	11	63.69	250	2400	2400	0.96	0.135	0.13	2.25
DPT-83	15	59.69	330	2400	2400	0.075	0.18	0.17	3
DPT-83	18	56.69	1300	13000	12000	1.6	0.13	0.12	2.15
DPT-84	0.5	74.43	36	2400	82000	5.8	0.175	0.165	2.85
DPT-84	5	69.93	30	9500	11000	0.6	0.17	0.16	2.8
DPT-84	10	64.93	2200000	3400000	3200000	3.75	9	8.5	150
DPT-84	16	58.93	1300000	3000000	2800000	3.5	8.5	8	140
DPT-84	20	54.93	2100000	5100000	4900000	4.65	11	10.5	185
DPT-84	23	51.93	2100000	4300000	4100000	3.55	8.5	8	140
DPT-85	0.5	74.42	36	630000	9900000	2.4	0.16	0.15	2.65
DPT-85	5.5	69.42	33	12000	51000	0.95	0.16	0.15	2.65
DPT-85	10.5	64.42	560000	1300000	1300000	3.35	8	7.5	135
DPT-85	15	59.92	1600000	3700000	3500000	3.35	8	7.5	135
DPT-85	20	54.92	1000	2400	2400	1	0.125	0.12	2.05
DPT-85	24	50.92	7200000	3500000	3300000	12	28.5	27	475
DPT-86	0.5	73.59	32.5	2400	47000	6.6	0.175	0.165	2.85
DPT-86	6	68.09	3400000	11000000	13000000	3.1	7.5	7	125
DPT-86	10	64.09	860000	3000000	3100000	0.2	0.155	0.145	2.55
DPT-86	16	58.09	950000	2900000	2800000	3.45	8.5	8	135
DPT-86	20	54.09	340000	120000	120000	2.65	6.5	6	105
DPT-86	24	50.09	1100000	1300000	1300000	3.5	8.5	8	140
DPT-87	0.5	73.93	31.5	13000	810000	3.2	0.16	0.15	2.65
DPT-87	6	68.43	25	2400	2400	0.37	0.12	0.115	2
DPT-87	10.5	63.93	29	2400	2400	0.22	0.17	0.16	2.8
DPT-87	15	59.43	33.5	2400	2400	0.07	0.175	0.165	2.85
DPT-87	20	54.43	34	2400	2400	0.14	0.16	0.15	2.65
DPT-87	24	50.43	29	2400	2400	0.37	0.145	0.135	2.35
DPT-88	0.5	75.67	31	11000	240000	1.6	0.165	0.155	2.7
DPT-88	5	71.17	25	2400	2400	3.1	0.205	0.195	3.4
DPT-88	10	66.17	23	2400	2400	0.64	0.12	0.11	1.95
DPT-88	15	61.17	28	2400	2400	2	0.13	1.4	5.5
DPT-88	19	57.17	2800000	1900000	1900000	17000	135	125	2200
DPT-88	23	53.17	1400000	7300000	7600000	19000	12	11.5	200
DPT-88	26	50.17	570000	2200000	2400000	22000	13.5	400	220
DPT-89	0.5	76.02	34	2400	11000	0.95	0.16	0.15	2.6
DPT-89	5	71.52	33	2400	2400	1.2	0.14	0.135	2.35

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-89	10	66.52	22.5	2400	2400	3.8	0.13	0.125	2.15
DPT-89	14	62.52	27.5	2400	2400	0.34	0.15	0.14	2.45
DPT-89	18	58.52	2500000	1900000	2000000	780	55	55	950
DPT-89	25	51.52	29000	2400	2400	1700	6	18	95
DPT-90	0.5	77.21	38.5	2400	2400	0.47	0.18	0.17	2.95
DPT-90	5	72.71	36.5	2400	2400	1.3	0.175	0.16	2.85
DPT-90	8.5	69.21	24	2400	2400	2.2	0.13	0.125	2.15
DPT-90	14	63.71	270	2400	2400	1.7	0.13	0.125	2.15
DPT-90	20	57.71	860000	240000	250000	6300	6.5	6	105
DPT-90	26	51.71	1800000	150000	180000	1800	7	6.5	115
DPT-91	0.5	76.00	30	2400	2400	1.2	0.155	0.145	2.55
DPT-91	5	71.50	27	2400	2400	6.3	0.14	0.13	2.3
DPT-91	10	66.50	23.5	2400	2400	1.3	0.125	0.12	2.1
DPT-91	16	60.50	31	2400	2400	0.4	0.165	0.155	2.7
DPT-91	18	58.50	1700000	320000	300000	3800	65	65	1100
DPT-91	25	51.50	5000000	20000000	18000000	140000	335	315	5500
DPT-92	0.5	75.27	31	57000	1100000	0.47	0.155	0.145	2.6
DPT-92	5	70.77	34	2400	2400	0.58	0.185	0.175	3.1
DPT-92	10	65.77	540	2400	2400	3.8	0.15	0.145	2.5
DPT-92	15	60.77	34	2400	2400	0.21	0.175	0.165	2.9
DPT-92	20	55.77	730	2400	2400	1.6	0.125	0.12	2.05
DPT-92	25.5	50.27	600	2400	2400	1.3	0.15	0.14	2.45
DPT-93	0.5	75.14	29.5	2400	2400	0.69	0.15	0.14	2.5
DPT-93	5	70.64	32.5	2400	2400	0.22	0.17	0.16	2.8
DPT-93	10	65.64	25	2400	2400	1.5	0.105	0.1	1.7
DPT-93	14.5	61.14	24.5	2400	2400	0.66	0.125	0.12	2.05
DPT-93	22	53.64	2500	2400	2400	0.57	0.135	0.125	2.25
DPT-93	25	50.64	13000	340000	320000	0.72	0.12	0.115	2
DPT-94	0.5	75.29	33	2400	14000	0.26	0.175	0.16	2.85
DPT-94	5	70.79	36	2400	18000	0.07	0.17	0.16	2.8
DPT-94	10	65.79	380000	3300000	5200000	2.65	6.5	6	105
DPT-94	14.5	61.29	1700	2400	6900	0.065	0.165	0.155	2.7
DPT-94	20	55.79	1500	2400	2400	1.5	0.14	0.13	2.25
DPT-94	25	50.79	500000	480000	480000	8.9	9	8.5	145
DPT-95	0.5	75.28	30	2400	47000	0.25	0.15	0.145	2.5
DPT-95	5	70.78	34.5	2400	2400	0.065	0.165	0.155	2.7
DPT-95	10	65.78	24	2400	2400	0.73	0.12	0.11	1.95
DPT-95	14.5	61.28	31	2400	2400	0.065	0.165	0.155	2.7
DPT-95	20	55.78	210	2400	2400	1.3	0.13	0.125	2.15
DPT-95	25	50.78	26	2400	2400	1.7	0.14	0.135	2.35
DPT-96	0.5	74.03	30	32000	420000	7.8	0.145	0.135	2.35
DPT-96	5	69.53	34.5	2400	2400	0.075	0.18	0.17	2.95
DPT-96	10	64.53	23	2400	2400	0.66	0.14	0.13	2.3
DPT-96	16	58.53	24	2400	2400	0.95	0.135	0.125	2.2
DPT-96	20	54.53	26	2400	2400	0.39	0.13	0.125	2.15
DPT-96	25.5	49.03	28.5	2400	2400	1.4	0.135	0.13	2.25
DPT-97	0.5	73.86	31	7400	120000	8.4	0.16	0.15	2.6
DPT-97	5	69.36	34.5	2400	13000	0.48	0.165	0.155	2.75
DPT-97	10	64.36	27	2400	2400	1	0.135	0.13	2.25
DPT-97	16	58.36	23.5	2400	2400	0.79	0.125	0.115	2.05
DPT-97	20	54.36	24	2400	2400	0.85	0.12	0.115	2
DPT-98	0.5	74.03	32.5	2400	17000	6.9	0.155	0.15	2.6
DPT-98	5	69.53	33	2400	2400	0.075	0.175	0.165	2.9
DPT-98	10	64.53	26.5	2400	2400	0.25	0.15	0.145	2.5
DPT-98	16	58.53	32.5	2400	2400	0.07	0.165	0.155	2.75

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-98	20	54.53	27.5	2400	2400	0.57	0.14	0.13	2.3
DPT-99	0.5	73.83	35.5	2400	2400	4.1	0.165	0.155	2.75
DPT-99	5	69.33	31.5	2400	2400	0.19	0.185	0.175	3.05
DPT-99	10	64.33	28.5	2400	2400	0.79	0.135	0.13	2.25
DPT-99	16	58.33	25	2400	2400	1.4	0.13	0.125	2.15
DPT-99	20	54.33	28.5	2400	2400	0.58	0.165	0.155	2.75
DPT-99	24	50.33	25	2400	2400	0.89	0.13	0.125	2.15
DPT-100	0.5	75.97	31	28000	160000	1.2	0.175	0.165	2.85
DPT-100	5	71.47	30.5	2400	2400	0.39	0.145	0.14	2.4
DPT-100	10	66.47	34	2400	2400	0.18	0.185	0.175	3.05
DPT-100	16	60.47	37.5	2400	2400	0.18	0.18	0.17	2.95
DPT-100	26	50.47	3300	50000	48000	2.6	0.135	0.13	2.25
DPT-101	0.5	73.68	34.5	64000	750000	0.48	0.18	0.17	3
DPT-101	5	69.18	26	2400	2400	1.5	0.15	0.14	2.45
DPT-101	10	64.18	35	2400	2400	0.075	0.18	0.17	2.95
DPT-101	16	58.18	36.5	2400	2400	0.28	0.18	0.17	2.95
DPT-101	21.5	52.68	27	2400	2400	0.52	0.14	0.135	2.35
DPT-101	24	50.18	26.5	2400	2400	0.31	0.13	0.125	2.15
DPT-102	0.5	74.81	33	2400	5200	0.67	0.215	0.2	3.55
DPT-102	5	70.31	38.5	2400	2400	0.99	0.185	0.175	3.05
DPT-102	10	65.31	31	2400	2400	0.19	0.17	0.16	2.8
DPT-102	17	58.31	26.5	2400	2400	1.6	0.135	0.125	2.2
DPT-102	20	55.31	33.5	2400	2400	0.07	0.17	0.16	2.8
DPT-102	25	50.31	1700	2400	2400	9.2	0.12	0.115	2
DPT-103	5	70.40	27.5	2400	800	0.24	0.165	0.155	2.75
DPT-103	10	65.40	27.5	2400	800	0.25	0.165	0.155	2.7
DPT-103	15	60.40	27	2400	800	0.075	0.175	0.165	2.9
DPT-103	22	53.40	21	16000	15000	1.2	0.125	0.115	2.05
DPT-103	26.5	48.90	21	2400	800	0.74	0.065	0.06	1.05
DPT-104	5	69.49	25	2400	30000	0.065	0.16	0.15	2.65
DPT-104	10	64.49	1300000	1200000	1300000	3.35	8	7.5	135
DPT-104	15.5	58.99	1300000	13000000	13000000	3.35	8	7.5	135
DPT-104	18	56.49	21000	210000	210000	2.6	6	6	105
DPT-105	6	69.25	26	2400	800	0.76	0.17	0.16	2.75
DPT-105	10	65.25	25	2400	800	0.91	0.15	0.14	2.45
DPT-105	15	60.25	27	2400	800	0.55	0.165	0.155	2.75
DPT-105	20	55.25	19.5	5800	44000	1.2	0.13	0.12	2.15
DPT-106	0.5	74.81	800000	3000000	14000000	150	14.5	13.5	240
DPT-106	5	70.31	23.5	2400	800	1.5	0.14	0.13	2.3
DPT-106	10	65.31	25.5	5900	59000	0.07	0.17	0.16	2.75
DPT-106	16	59.31	21	10000	79000	0.26	0.14	0.135	2.3
DPT-106	19.5	55.81	270000	380000	400000	2.65	6.5	6	105
DPT-106	25	50.31	30000	2400	800	3.4	8	7.5	135
DPT-107	12	62.57	450000	760000	790000	3	7.5	7	120
DPT-107	16	58.57	5600000	7000000	6600000	290	700	650	11500
DPT-107	20	54.57	670	2400	800	0.79	0.16	0.15	2.6
DPT-107	24.5	50.07	1100000	1300000	1200000	3.35	8	7.5	135
DPT-108	0.5	74.66	26.5	--	74000	0.19	0.155	0.15	2.6
DPT-108	5	70.16	27	--	800	0.37	0.175	0.16	2.85
DPT-108	10	65.16	25.5	--	23000	0.45	0.165	0.155	2.7
DPT-108	15	60.16	25	--	800	1.2	0.165	0.155	2.7
DPT-108	19	56.16	25.5	--	800	1.1	0.135	0.125	2.2
DPT-108	22	53.16	25.5	--	800	0.07	0.175	0.16	2.85
DPT-109	0.5	74.02	30	--	77000	0.61	0.18	0.17	3
DPT-109	5	69.52	28	--	800	0.23	0.175	0.165	2.9

TABLE 4-1
Summary of Soil Analytical Results (μg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-109	10	64.52	25	--	6100	0.33	0.17	0.16	2.8
DPT-109	15	59.52	25	--	800	0.64	0.155	0.145	2.55
DPT-109	22	52.52	26.5	--	800	0.075	0.175	0.165	2.9
DPT-109	23.5	51.02	21.5	--	800	1.6	0.15	0.14	2.45
DPT-110	0.5	73.84	24	--	6000	1.1	0.155	0.145	2.55
DPT-110	5	69.34	27.5	--	800	0.32	0.175	0.165	2.9
DPT-110	10.5	63.84	22	--	800	0.63	0.15	0.14	2.5
DPT-110	15	59.34	27.5	--	800	0.54	0.155	0.145	2.55
DPT-110	19	55.34	20	--	800	1.3	0.13	0.12	2.1
DPT-110	23	51.34	27	--	800	0.42	0.17	0.16	2.8
DPT-111	0.5	74.08	25	--	190000	1.2	0.155	0.145	2.5
DPT-111	6.5	68.08	26.5	--	800	0.95	0.16	0.15	2.6
DPT-111	10	64.58	24	--	800	0.51	0.155	0.15	2.6
DPT-111	15	59.58	24.5	--	800	0.54	0.13	0.125	2.15
DPT-111	19	55.58	21.5	--	800	2	0.13	0.125	2.15
DPT-111	23.5	51.08	21.5	--	800	1.3	0.145	0.14	2.4
DPT-112	0.5	74.60	26	--	390000	1.6	0.155	0.145	2.55
DPT-112	5	70.10	25	--	800	1.1	0.155	0.145	2.55
DPT-112	10	65.10	26	--	800	0.47	0.16	0.15	2.6
DPT-112	15	60.10	19	--	800	1.4	0.115	0.11	1.9
DPT-112	19.5	55.60	26	--	800	0.16	0.165	0.155	2.75
DPT-112	24	51.10	21.5	--	800	1.6	0.135	0.125	2.2
DPT-113	0.5	77.12	23.5	--	800	0.26	0.175	0.165	2.9
DPT-113	5	72.62	24	--	800	1	0.15	0.145	2.5
DPT-113	10	67.62	19.5	--	800	1.1	0.115	0.11	1.9
DPT-113	15	62.62	26	--	800	0.075	0.175	0.165	2.9
DPT-113	19.5	58.12	23.5	--	800	0.17	0.165	0.155	2.7
DPT-113	23	54.62	25.5	--	800	0.075	0.175	0.165	2.9
DPT-114	0.5	76.85	26	--	10000	0.24	0.155	0.15	2.6
DPT-114	5	72.35	28	--	800	0.075	0.185	0.175	3.05
DPT-114	10.5	66.85	20	--	800	4.3	0.13	0.12	2.15
DPT-114	15	62.35	23	--	800	0.79	0.125	0.12	2.1
DPT-114	19	58.35	28	--	800	0.52	0.18	0.17	3
DPT-114	23.5	53.85	22.5	--	800	0.21	0.155	0.145	2.55
DPT-115	0.5	76.47	27.5	--	800	0.075	0.185	0.175	3.05
DPT-115	5	71.97	28	--	800	0.24	0.175	0.165	2.85
DPT-115	10	66.97	26.5	--	800	0.07	0.165	0.155	2.7
DPT-115	14.5	62.47	27.5	--	800	1.5	0.175	0.16	2.85
DPT-115	19.5	57.47	23	--	800	0.25	0.14	0.13	4.7
DPT-115	23	53.97	25.5	--	800	0.24	0.17	0.16	2.8
DPT-116	0.5	76.93	23	--	800	0.45	0.235	0.22	3.9
DPT-116	5	72.43	29.5	--	800	0.075	0.18	0.17	3
DPT-116	10.5	66.93	22	--	800	0.34	0.135	0.125	2.2
DPT-116	15	62.43	27	--	800	0.19	0.16	0.15	2.6
DPT-116	17.5	59.93	21.5	--	800	1.4	0.135	0.13	2.25
DPT-116	23.5	53.93	29	--	800	0.2	0.165	0.155	2.75
DPT-117	0.5	76.20	27	--	5200	0.38	0.16	0.15	2.65
DPT-117	5	71.70	26.5	--	800	0.42	0.16	0.15	2.65
DPT-117	10	66.70	24	--	27000	0.39	0.15	0.14	2.45
DPT-117	15	61.70	25	--	800	0.21	0.175	0.165	2.85
DPT-117	19	57.70	27	--	800	0.15	0.16	0.15	2.6
DPT-117	23	53.70	23	--	800	0.34	0.125	0.12	2.1
DPT-118	0.5	75.85	24.5	--	20000	4.7	0.15	0.14	2.45
DPT-118	5	71.35	26	--	800	2.1	0.15	0.14	2.45
DPT-118	10	66.35	21.5	--	800	0.48	0.14	0.13	2.3

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-118	15	61.35	28	--	800	0.07	0.175	0.165	2.85
DPT-118	20	56.35	320	--	800	6.3	0.125	0.12	2.1
DPT-118	23.5	52.85	25.5	--	800	0.18	0.17	0.16	2.75
DPT-119	0.5	75.72	23.5	--	800	2.9	0.145	0.14	2.4
DPT-119	5	71.22	21.5	--	100000	1.7	0.13	0.125	2.15
DPT-119	10	66.22	23.5	--	800	1.1	0.14	0.13	2.3
DPT-119	15	61.22	28.5	--	800	0.075	0.18	0.17	3
DPT-119	19.5	56.72	19	--	800	3.4	0.12	0.115	2
DPT-119	23	53.22	25	--	800	0.21	0.155	0.145	2.55
DPT-120	0.5	76.78	25	--	1700000	0.99	0.165	0.155	2.7
DPT-120	5	72.28	25.5	--	50000	1.8	0.185	0.175	3.05
DPT-120	10	67.28	23.5	--	800	0.61	0.145	0.135	2.4
DPT-120	15	62.28	27.5	--	800	0.18	0.17	0.16	2.8
DPT-120	20	57.28	28	--	800	0.07	0.17	0.16	2.8
DPT-120	23.5	53.78	21	--	800	0.65	0.11	0.105	1.85
DPT-120-S1	0.5	76.78	--	--	600000	--	--	--	--
DPT-120-S2	0.5	76.83	--	--	1400000	--	--	--	--
DPT-120-S3	0.5	76.63	--	--	2300000	--	--	--	--
DPT-120-S4	0.5	76.60	--	--	1000000	--	--	--	--
DPT-120-S5	0.5	76.88	--	--	330000	--	--	--	--
DPT-120-S6	0.5	76.50	--	--	2000000	--	--	--	--
DPT-121	0.5	75.20	25.5	--	32000	4.3	0.16	0.15	2.6
DPT-121	5	70.70	23.5	--	800	2.8	0.145	0.135	2.35
DPT-121	10	65.70	25	--	800	0.3	0.145	0.135	2.35
DPT-121	15	60.70	26.5	--	800	0.07	0.175	0.165	2.85
DPT-121	18	57.70	21	--	800	2.7	0.125	0.12	2.05
DPT-121	23.5	52.20	25	--	800	0.065	0.155	0.145	2.55
DPT-122	0.5	75.06	27	--	130000	0.7	0.18	0.17	3
DPT-122	5	70.56	22.5	--	800	1.3	0.135	0.13	2.25
DPT-122	8	67.56	20.5	--	800	2	0.13	0.12	2.15
DPT-122	10	65.56	23.5	--	800	0.4	0.145	0.135	2.4
DPT-122	15	60.56	27.5	--	800	0.21	0.165	0.155	2.75
DPT-122	19	56.56	3700000	--	2000000	270	115	105	1900
DPT-122	25.5	50.06	6500000	--	4400000	1300	140	135	2350
DPT-123	0.5	74.53	29.5	--	39000	0.69	0.195	0.185	3.2
DPT-123	5	70.03	22.5	--	800	3.1	0.145	0.135	2.4
DPT-123	10	65.03	24	--	800	0.63	0.145	0.135	2.4
DPT-123	15	60.03	27.5	--	800	0.53	0.18	0.17	3
DPT-123	21.5	53.53	21.5	--	800	0.41	0.135	0.125	2.2
DPT-123	25	50.03	25	--	800	0.16	0.145	0.135	2.35
DPT-124	0.5	73.98	24	--	170000	1.6	0.16	0.15	2.65
DPT-124	5	69.48	20.5	--	800	2	0.13	0.125	2.15
DPT-124	10	64.48	23.5	--	800	0.32	0.145	0.135	2.35
DPT-124	15	59.48	26.5	--	800	0.07	0.175	0.165	2.85
DPT-124	21.5	52.98	24	--	800	0.06	0.15	0.14	2.5
DPT-124	25	49.48	26	--	800	0.065	0.16	0.15	2.6
DPT-125	0.5	74.88	320	--	390000	0.57	0.18	0.17	3
DPT-125	5	70.38	22.5	--	10000	1.3	0.16	0.15	2.65
DPT-125	10	65.38	25	--	800	0.46	0.125	0.12	2.1
DPT-125	15	60.38	29	--	800	0.07	0.175	0.165	2.85
DPT-125	19	56.38	1300	--	800	12	0.135	0.125	2.2
DPT-125	25	50.38	1800	--	800	8.6	0.14	0.13	2.3
DPT-126	0.5	74.85	28	--	410000	5	0.165	0.155	2.7
DPT-126	5	70.35	26.5	--	800	0.92	0.17	0.16	2.8
DPT-126	10	65.35	19.5	--	800	1.3	0.12	0.11	1.95

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-126	15	60.35	27.5	--	800	0.14	0.175	0.16	2.85
DPT-126	19	56.35	26.5	--	800	0.23	0.165	0.155	2.7
DPT-126	25	50.35	21.5	--	800	0.56	0.13	0.125	2.15
DPT-127	0.5	74.43	580	--	350000	1	0.185	0.175	3.1
DPT-127	5	69.93	24.5	--	800	1.2	0.145	0.14	2.45
DPT-127	10	64.93	19	--	800	0.87	0.125	0.12	2.1
DPT-127	15	59.93	21.5	--	800	0.79	0.14	0.13	2.3
DPT-127	19.5	55.43	27.5	--	800	0.15	0.17	0.16	2.8
DPT-127	26	48.93	21.5	--	800	0.56	0.135	0.125	2.25
DPT-128	0.5	73.83	31	--	610000	1.9	0.185	0.175	3.05
DPT-128	5	69.33	30	--	800	1.1	0.175	0.16	2.85
DPT-128	10	64.33	20	--	800	0.62	0.125	0.115	2.05
DPT-128	15	59.33	25	--	800	0.26	0.175	0.16	2.85
DPT-128	19	55.33	27.5	--	800	0.39	0.165	0.155	2.7
DPT-128	25	49.33	19.5	--	800	0.65	0.14	0.13	2.3
DPT-129	0.5	73.51	27	--	190000	1.4	0.155	0.145	2.55
DPT-129	5	69.01	23.5	--	800	1.9	0.155	0.145	2.5
DPT-129	10	64.01	22.5	--	800	0.51	0.135	0.13	2.25
DPT-129	15	59.01	27	--	800	0.31	0.175	0.165	2.9
DPT-129	20	54.01	650	--	800	0.77	0.135	0.125	2.2
DPT-129	25	49.01	27	--	800	0.44	0.18	0.17	3
DPT-130	0.5	74.59	25.5	--	170000	1.7	0.155	0.145	2.6
DPT-130	5	70.09	26.5	--	5700	1.3	0.175	0.165	2.85
DPT-130	10	65.09	20.5	--	800	14	0.125	0.115	2.05
DPT-130	15	60.09	25.5	--	800	0.36	0.17	0.16	2.8
DPT-130	19.5	55.59	28.5	--	800	0.43	0.17	0.16	2.8
DPT-130	24.5	50.59	26	--	800	0.28	0.16	0.15	2.65
DPT-131	0.5	73.80	28.5	--	680000	2.4	0.175	0.165	2.85
DPT-131	5	69.30	23	--	800	1.7	0.15	0.145	2.5
DPT-131	10	64.30	20	--	800	0.8	0.145	0.135	2.35
DPT-131	15	59.30	27	--	800	0.35	0.16	0.15	2.6
DPT-131	19.5	54.80	850	--	800	0.97	0.125	0.115	2.05
DPT-131	24	50.30	28	--	800	0.15	0.175	0.16	2.85
DPT-132	0.5	73.47	29.5	--	350000	1.9	0.17	0.16	2.8
DPT-132	5	68.97	25.5	--	800	1.3	0.175	0.165	2.9
DPT-132	10	63.97	23	--	800	0.45	0.14	0.13	2.25
DPT-132	15	58.97	24	--	800	0.39	0.155	0.145	2.6
DPT-132	18.5	55.47	25.5	--	800	0.065	0.165	0.155	2.7
DPT-132	26.5	47.47	19	--	800	0.38	0.135	0.125	2.2
DPT-133	0.5	73.56	26	--	540000	2.6	0.155	0.15	2.6
DPT-133	5	69.06	24.5	--	800	2.3	0.17	0.16	2.8
DPT-133	10	64.06	22	--	800	2.4	0.125	0.12	2.1
DPT-133	15	59.06	28.5	--	800	0.19	0.185	0.175	3.05
DPT-133	22.5	51.56	25	--	800	0.19	0.15	0.14	2.45
DPT-133	25	49.06	25.5	--	800	0.065	0.165	0.155	2.7
DPT-134	0.5	74.96	24.5	--	460000	0.4	0.15	0.14	2.5
DPT-134	5	70.46	28.5	--	800	1.1	0.17	0.16	2.8
DPT-134	10	65.46	21	--	800	0.38	0.13	0.125	2.15
DPT-134	15	60.46	27	--	800	0.065	0.16	0.15	2.65
DPT-134	19.5	55.96	310	--	800	0.47	0.125	0.115	2.05
DPT-134	25	50.46	430	--	800	0.14	0.155	0.15	2.6
DPT-135	0.5	75.15	22	--	290000	3.7	0.165	0.155	2.7
DPT-135	5	70.65	33	--	800	1.5	0.19	0.18	3.15
DPT-135	10	65.65	22.5	--	800	0.42	0.145	0.135	2.35
DPT-135	15	60.65	28.5	--	800	0.075	0.18	0.17	3

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-135	19	56.65	4500	--	170000	1.5	0.125	0.12	2.1
DPT-135	25	50.65	1100	--	800	3.35	8	7.5	135
DPT-136	0.5	74.75	29	--	320000	2.2	0.19	0.175	3.1
DPT-136	5	70.25	27.5	--	800	2.7	0.18	0.17	2.95
DPT-136	10	65.25	26.5	--	800	0.55	0.155	0.145	2.55
DPT-136	15	60.25	26	--	800	0.23	0.155	0.15	2.6
DPT-136	19	56.25	1500	--	800	7	0.135	0.125	2.2
DPT-136	25	50.25	3300	--	800	7.1	0.155	0.15	2.6
DPT-137	0.5	76.17	29.5	--	770000	1.9	0.17	0.16	2.75
DPT-137	5	71.67	31	--	800	0.82	0.205	0.195	3.4
DPT-137	10	66.67	25	--	800	0.94	0.16	0.15	2.65
DPT-137	15	61.67	27	--	800	0.2	0.16	0.15	2.65
DPT-137	19.5	57.17	25.5	--	800	0.07	0.17	0.16	2.75
DPT-137	25	51.67	30	--	800	0.65	0.205	0.19	3.35
DPT-138	0.5	75.58	24	--	96000	0.61	0.165	0.155	2.7
DPT-138	5	71.08	34	--	800	0.62	0.215	0.2	3.55
DPT-138	10	66.08	21	--	800	1.3	0.125	0.12	2.05
DPT-138	15	61.08	27	--	800	0.07	0.17	0.16	2.8
DPT-138	19.5	56.58	28	--	800	0.07	0.175	0.165	2.85
DPT-138	25	51.08	25.5	--	800	0.065	0.165	0.155	2.7
DPT-139	0.5	75.99	26.5	--	420000	0.29	0.185	0.175	3.05
DPT-139	5	71.49	40.5	--	800	0.16	0.185	0.175	3.1
DPT-139	10	66.49	29	--	800	0.07	0.17	0.16	2.8
DPT-139	15.5	60.99	21	--	800	0.87	0.145	0.14	2.4
DPT-139	19	57.49	26.5	--	800	0.075	0.175	0.165	2.9
DPT-139	25	51.49	25	--	800	0.07	0.17	0.16	2.75
DPT-140	0.5	75.75	27.5	--	310000	0.065	0.165	0.155	2.7
DPT-140	5	71.25	48	--	800	0.21	0.185	0.175	3.1
DPT-140	10	66.25	30	--	800	0.075	0.175	0.165	2.9
DPT-140	15	61.25	24	--	800	0.29	0.16	0.15	2.65
DPT-140	18.5	57.75	550	--	800	0.19	0.175	0.165	2.85
DPT-140	25	51.25	15000000	--	16000000	4100	165	155	2700
DPT-141	0.5	74.99	28	--	290000	0.07	0.165	0.155	2.75
DPT-141	5	70.49	23.5	--	28000	0.28	0.185	0.175	3.05
DPT-141	10	65.49	20.5	--	800	1.7	0.13	0.125	2.15
DPT-141	14.5	60.99	28	--	800	0.27	0.165	0.155	2.7
DPT-141	19.5	55.99	520	--	800	1.6	0.11	0.105	1.85
DPT-141	25	50.49	2300000	--	6300000	1600	75	70	1250
DPT-142	0.5	75.62	25	--	250000	1.6	0.155	0.145	2.55
DPT-142	5	71.12	29.5	--	100000	0.27	0.175	0.165	2.85
DPT-142	10	66.12	19.5	--	800	1.9	0.115	0.11	1.95
DPT-142	15	61.12	26	--	800	0.19	0.16	0.15	2.65
DPT-142	19	57.12	20	--	800	1.9	0.125	0.12	2.1
DPT-142	25	51.12	25.5	--	73000	0.76	0.13	0.12	2.15
DPT-143	0.5	75.82	26	--	560000	0.16	0.17	0.16	2.8
DPT-143	5	71.32	26.5	--	800	0.43	0.155	0.145	2.6
DPT-143	10	66.32	26.5	--	800	0.07	0.17	0.16	2.8
DPT-143	15	61.32	30	--	800	0.16	0.18	0.17	3
DPT-143	19.5	56.82	21.5	--	800	1	0.13	0.12	2.1
DPT-143	25.5	50.82	780	--	800	0.96	0.15	0.14	2.5
DPT-144	0.5	74.87	25	--	780000	0.99	0.155	0.15	2.6
DPT-144	5	70.37	29	--	59000	0.075	0.18	0.17	3
DPT-144	10	65.37	20	--	800	0.49	0.125	0.115	2.05
DPT-144	15	60.37	24.5	--	800	0.49	0.14	0.13	2.3
DPT-144	19	56.37	500	--	800	1.5	0.13	0.12	2.15

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-144	25	50.37	16000	--	800	55	130	125	2150
DPT-145	0.5	74.62	28.5	--	130000	0.075	0.18	0.17	3
DPT-145	5	70.12	30	--	800	0.075	0.185	0.175	3.05
DPT-145	10.5	64.62	21	--	800	1.4	0.135	0.125	2.2
DPT-145	15	60.12	26.5	--	800	0.18	0.165	0.155	2.7
DPT-145	19	56.12	6800000	--	2700000	8200	140	135	2350
DPT-145	25	50.12	7800000	--	4700000	11000	140	135	2350
DPT-146	0.5	76.01	25.5	--	130000	0.63	0.165	0.155	2.7
DPT-146	5	71.51	28	--	800	0.43	0.185	0.175	3.05
DPT-146	10	66.51	280	--	800	2.2	0.125	0.115	2.05
DPT-146	15	61.51	25	--	800	0.81	0.155	0.145	2.55
DPT-146	19	57.51	25	--	800	0.27	0.15	0.14	2.45
DPT-146	25	51.51	21	--	800	1.1	0.125	0.115	2.05
DPT-147	0.5	75.62	27	--	62000	1.2	0.17	0.16	2.8
DPT-147	5	71.12	14.5	--	800	0.57	0.18	0.17	2.95
DPT-147	10	66.12	21	--	800	1.8	0.125	0.12	2.1
DPT-147	15	61.12	26	--	800	0.52	0.155	0.145	2.55
DPT-147	20	56.12	20	--	800	1.1	0.125	0.12	2.1
DPT-147	25	51.12	340	--	800	0.9	0.12	0.115	2
DPT-148	0.5	75.03	29	--	84000	0.8	0.175	0.165	2.9
DPT-148	5	70.53	28.5	--	800	0.26	0.17	0.16	2.8
DPT-148	10	65.53	20	--	800	4.1	0.125	0.115	2.05
DPT-148	15	60.53	21.5	--	800	0.44	0.135	0.125	2.2
DPT-148	19.5	56.03	30	--	800	0.08	0.19	0.18	3.15
DPT-148	25	50.53	28.5	--	800	0.075	0.18	0.17	2.95
DPT-149	0.5	74.70	29	--	110000	1.7	0.175	0.165	2.9
DPT-149	5	70.20	28	--	800	2.5	0.18	0.17	3
DPT-149	9.5	65.70	27.5	--	800	0.07	0.175	0.16	2.85
DPT-149	15	60.20	21	--	800	0.45	0.12	0.115	2
DPT-149	25	50.20	490	--	800	0.76	0.125	0.115	2.05
DPT-150	0.5	73.84	30	--	210000	11	0.16	0.15	2.65
DPT-150	5	69.34	28	--	800	0.46	0.165	0.155	2.75
DPT-150	10	64.34	20	--	800	2.1	0.13	0.12	2.15
DPT-150	15	59.34	20	--	800	0.76	0.13	0.12	2.1
DPT-150	20	54.34	19	--	800	0.81	0.12	0.11	1.95
DPT-150	25	49.34	24	--	5900	1.1	0.155	0.15	2.6
DPT-151	0.5	74.21	24.5	--	68000	2.4	0.165	0.155	2.75
DPT-151	5	69.71	27.5	--	8700	0.41	0.175	0.165	2.85
DPT-151	10	64.71	25	--	800	0.17	0.165	0.155	2.75
DPT-151	15	59.71	20	--	800	0.67	0.125	0.12	2.1
DPT-151	19.5	55.21	20.5	--	800	0.47	0.13	0.12	2.1
DPT-151	25	49.71	19.5	--	6900	0.32	0.13	0.125	2.15
DPT-152	0.5	75.16	26.5	--	850000	0.57	0.16	0.15	2.6
DPT-152	5	70.66	29	--	21000	0.075	0.18	0.17	3
DPT-152	10	65.66	26.5	--	800	0.065	0.155	0.145	2.55
DPT-152	15	60.66	21	--	9900	0.28	0.145	0.135	2.35
DPT-152	20	55.66	28	--	800	0.07	0.165	0.155	2.7
DPT-152	25	50.66	2300000	--	320000	3.6	8.5	8	145
DPT-153	0.5	74.55	24.5	--	1500000	1.2	0.16	0.15	2.65
DPT-153	5	70.05	27	--	64000	0.065	0.155	0.145	2.5
DPT-153	10	65.05	22	--	800	1.4	0.155	0.145	2.55
DPT-153	12	63.05	8200	--	1200000	2.4	6	5.5	95
DPT-153	14.5	60.55	500000	--	280000	32.5	80	75	1300
DPT-153	19.5	55.55	270000	--	790000	2.7	6.5	6	105
DPT-153	25	50.05	30000	--	32000	2.35	5.5	5.5	95

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-154	0.5	74.37	27	--	990000	0.35	0.16	0.15	2.65
DPT-154	5	69.87	28	--	33000	0.075	0.175	0.165	2.9
DPT-154	10	64.87	300000	--	590000	5	12.5	11.5	205
DPT-154	15	59.87	420000	--	2200000	3.4	8	7.5	135
DPT-154	19.5	55.37	2100	--	5500	3.8	9	8.5	150
DPT-154	25	49.87	420	--	800	1.5	0.135	0.125	2.2
DPT-155	0.5	75.85	25	--	160000	0.82	0.15	0.14	2.5
DPT-155	5	71.35	20	--	800	3.2	0.12	0.115	2
DPT-155	10	66.35	26.5	--	800	2.3	0.17	0.16	2.75
DPT-155	15	61.35	22	--	800	0.89	0.145	0.14	2.4
DPT-155	20	56.35	20	--	800	1.4	0.14	0.13	2.25
DPT-155	25	51.35	20	--	800	1.3	0.135	0.125	2.2
DPT-156	0.5	76.49	29.5	--	5300000	2.5	0.17	0.16	2.8
DPT-156	2	74.99	21.5	--	800	2.6	0.19	0.175	3.1
DPT-156	5	71.99	29.5	--	4000000	1.2	0.2	0.19	3.3
DPT-156	10	66.99	21.5	--	800	2.2	0.135	0.13	2.25
DPT-156	15	61.99	28	--	800	0.075	0.185	0.175	3.05
DPT-156	19.75	57.24	31	--	800	0.07	0.165	0.155	2.7
DPT-157	0.5	76.65	36.5	--	930000	1.6	0.135	0.13	2.25
DPT-157	5	72.15	27.5	--	800	0.3	0.17	0.16	2.8
DPT-157	10	67.15	27	--	800	0.2	0.155	0.145	2.55
DPT-157	15	62.15	27	--	800	0.27	0.165	0.155	2.7
DPT-157	19.75	57.40	25.5	--	800	0.065	0.165	0.155	2.7
DPT-157	25	52.15	23.5	--	79000	0.3	0.145	0.135	2.35
DPT-158	0.5	77.08	25	--	330000	2.5	0.155	0.145	2.55
DPT-158	5	72.58	28	--	800	3.9	0.17	0.16	2.8
DPT-158	7	70.58	520000	--	67000000	0.21	0.14	0.135	2.35
DPT-158	10	67.58	29	--	800	0.41	0.165	0.155	2.7
DPT-158	15	62.58	29.5	--	800	0.07	0.175	0.16	2.85
DPT-158	19.5	58.08	29	--	800	0.07	0.175	0.165	2.85
DPT-158	25.5	52.08	24	--	800	1.1	0.15	0.14	2.45
DPT-158-S1	7	70.51	28.5	--	800	0.18	0.185	0.175	3.05
DPT-158-S2	5	72.50	28	--	8300000	3.2	0.185	0.175	3.05
DPT-158-S2	7	70.50	670	--	9300000	0.55	0.155	0.145	2.5
DPT-158-S3	5.5	71.94	2700	--	50000000	0.22	0.205	0.195	3.4
DPT-158-S3	8	69.44	29.5	--	800	0.07	0.165	0.155	2.7
DPT-158-S4	3	74.48	33.5	--	14000000	0.25	0.185	0.175	3.05
DPT-158-S4	7.5	69.98	180000	--	48000000	2.6	6.5	6	105
DPT-158-S5	7	70.39	28	--	800	0.22	0.175	0.165	2.9
DPT-158-S6	7	70.41	29.5	--	800	0.065	0.165	0.155	2.7
DPT-158-S7	0.5	76.87	28	--	--	--	--	--	--
DPT-158-S7	5	72.37	27.5	--	--	3.8	0.17	0.16	2.75
DPT-158-S7	7	70.37	27.5	--	--	0.2	0.175	0.165	2.9
DPT-159	0.5	74.27	25	--	360000	0.63	0.155	0.145	2.55
DPT-159	5	69.77	29.5	--	800	0.075	0.18	0.17	3
DPT-159	10	64.77	23.5	--	800	0.69	0.135	0.13	2.25
DPT-159	15	59.77	20.5	--	800	1.6	0.125	0.115	2.05
DPT-159	19.5	55.27	20	--	800	0.72	0.125	0.12	2.1
DPT-159	25	49.77	25	--	800	0.68	0.155	0.145	2.55
DPT-160	0.5	75.70	26	--	410000	0.4	0.155	0.145	2.5
DPT-160	3	73.20	30	--	800	0.28	0.17	0.16	2.75
DPT-160	10	66.20	20.5	--	800	1.1	0.13	0.125	2.15
DPT-160	15.5	60.70	20.5	--	800	0.73	0.12	0.115	2
DPT-160	21.5	54.70	22.5	--	800	0.31	0.14	0.13	2.3
DPT-160	25	51.20	24	--	800	0.64	0.145	0.14	2.4

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-161	0.5	76.16	27	--	2400000	0.23	0.16	0.15	2.6
DPT-161	5	71.66	29	--	800	0.07	0.17	0.16	2.8
DPT-161	11.5	65.16	19.5	--	800	0.44	0.145	0.14	2.45
DPT-161	15.5	61.16	19.5	--	800	0.85	0.12	0.115	1.95
DPT-161	20	56.66	26	--	76000	0.065	0.155	0.145	2.5
DPT-161	25	51.66	23.5	--	800	0.27	0.135	0.13	2.25
DPT-161-S1	0.5	75.81	--	--	80000	--	--	--	--
DPT-161-S2	0.5	75.69	--	--	15000	--	--	--	--
DPT-161-S3	0.5	75.78	--	--	42000	--	--	--	--
DPT-161-S4	0.5	75.66	--	--	900000	--	--	--	--
DPT-162	0.5	74.66	34.5	--	2100000	0.79	0.19	0.18	3.15
DPT-162	5	70.16	27.5	--	800	1.7	0.18	0.17	3
DPT-162	10	65.16	19	--	800	1.5	0.13	0.125	2.15
DPT-162	15	60.16	29	--	800	0.2	0.17	0.16	2.8
DPT-162	19	56.16	970	--	800	2.6	0.115	0.11	1.9
DPT-162	25	50.16	1300000	--	4400000	17	41	38.5	650
DPT-162-S1	0.5	74.59	--	--	1500000	1.6	0.17	0.16	2.8
DPT-162-S2	0.5	74.58	--	--	2600000	1.2	0.165	0.155	2.7
DPT-162-S3	0.5	74.56	--	--	820000	1.2	0.175	0.165	2.9
DPT-163	0.5	73.81	29.5	--	380000	2.5	0.165	0.155	2.75
DPT-163	5	69.31	31	--	9500	0.98	0.185	0.175	3.05
DPT-163	6.5	67.81	26.5	--	800	0.99	0.165	0.155	2.7
DPT-163	10	64.31	23.5	--	800	0.63	0.155	0.145	2.55
DPT-163	15	59.31	28	--	2500	0.17	0.175	0.165	2.9
DPT-163	19.5	54.81	20000	--	31000	2.45	6	5.5	100
DPT-163	25	49.31	2700000	--	7100000	27.5	65	65	1100
DPT-164	0.5	74.82	27	--	1100000	1.5	0.17	0.16	2.75
DPT-164	5	70.32	28	--	110000	0.51	0.165	0.155	2.7
DPT-164	10	65.32	19.5	--	800	1.3	0.135	0.125	2.2
DPT-164	15	60.32	19.5	--	800	0.69	0.125	0.12	2.1
DPT-164	19	56.32	19	--	800	1.7	0.13	0.12	2.1
DPT-164	25	50.32	24.5	--	6400	0.15	0.155	0.15	2.6
DPT-165	0.5	74.64	24	--	670000	0.87	0.155	0.145	5.2
DPT-165	5	70.14	28	--	49000	0.15	0.175	0.165	2.9
DPT-165	11	64.14	23.5	--	92000	0.62	0.14	0.135	2.35
DPT-165	15	60.14	28.5	--	800	0.075	0.175	0.165	2.9
DPT-165	19	56.14	27.5	--	8000	0.07	0.175	0.165	2.85
DPT-165	25	50.14	61000	--	16000	0.065	0.16	0.15	2.65
DPT-165-S1	0.5	74.70	--	--	760000	0.14	0.115	0.105	1.9
DPT-165-S2	0.5	74.60	--	--	580000	2.7	0.16	0.15	2.65
DPT-166	0.5	74.75	25	--	9500	2.3	0.16	0.15	2.65
DPT-166	5	70.25	24	--	800	0.84	0.165	0.155	2.7
DPT-166	10	65.25	26	--	800	0.075	0.18	0.17	2.95
DPT-166	15	60.25	28.5	--	800	0.075	0.185	0.175	3.1
DPT-166	19.5	55.75	19	--	800	1.9	0.125	0.12	2.05
DPT-166	25	50.25	24	--	800	0.4	0.15	0.14	2.45
DPT-167	0.5	74.26	25.5	--	4600000	0.92	0.155	0.145	2.55
DPT-167	5	69.76	28	--	800	1.4	0.17	0.16	2.75
DPT-167	10	64.76	20.5	--	800	3	0.12	0.115	2
DPT-167	15	59.76	29.5	--	800	0.07	0.175	0.165	2.85
DPT-167	19.5	55.26	280	--	800	1.7	0.115	0.105	1.9
DPT-167	25	49.76	250	--	800	0.28	0.15	0.14	2.5
DPT-167-S1	0.5	74.30	--	--	120000	--	--	--	--
DPT-167-S2	0.5	74.34	--	--	680000	--	--	--	--
DPT-167-S3	0.5	74.29	--	--	720000	--	--	--	--

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-168	0.5	74.96	27	--	390000	1	0.15	0.14	2.45
DPT-168	5	70.46	26.5	--	800	1.9	0.155	0.145	2.55
DPT-168	9.5	65.96	25.5	--	800	0.59	0.15	0.14	2.45
DPT-168	15	60.46	29	--	800	0.075	0.18	0.17	3
DPT-168	19	56.46	29	--	800	0.07	0.165	0.155	2.75
DPT-168	25	50.46	24.5	--	800	0.065	0.16	0.15	2.65
DPT-169	0.5	74.81	28.5	--	140000	5.4	0.165	0.155	2.7
DPT-169	5	70.31	27.5	--	7700	1.1	0.175	0.165	2.9
DPT-169	10	65.31	22	--	800	1.5	0.13	0.12	2.1
DPT-169	15	60.31	28.5	--	800	0.075	0.175	0.165	2.9
DPT-169	19.5	55.81	28.5	--	800	0.68	0.19	0.175	3.1
DPT-169	22	53.31	22	--	800	0.92	0.155	0.15	2.6
DPT-169	25.5	49.81	20.5	--	800	1.3	0.155	0.15	2.6
DPT-170	0.5	75.02	27	--	750000	5.3	0.17	0.16	2.8
DPT-170	5	70.52	21	--	800	1.1	0.155	0.15	2.6
DPT-170	10	65.52	23	--	800	0.26	0.155	0.145	2.55
DPT-170	15	60.52	27.5	--	800	0.075	0.175	0.165	2.9
DPT-170	19	56.52	630	--	5700	0.23	0.145	0.135	2.35
DPT-170	25	50.52	27	--	800	0.07	0.175	0.16	2.85
DPT-171	0.5	75.24	26.5	--	27000	6.8	0.165	0.155	2.7
DPT-171	5	70.74	24.5	--	800	1.5	0.165	0.155	2.7
DPT-171	10	65.74	21.5	--	800	0.3	0.145	0.135	2.4
DPT-171	15	60.74	28.5	--	800	0.14	0.16	0.15	2.65
DPT-171	19.5	56.24	23000	--	23000	52	6	6	100
DPT-171	25	50.74	1700000	--	33000	110	30	28	490
DPT-172	0.5	74.46	23.5	--	200000	1.5	0.155	0.145	2.55
DPT-172	5	69.96	27.5	--	800	0.77	0.2	0.19	3.3
DPT-172	10	64.96	22	--	800	1.4	0.14	0.13	2.3
DPT-172	15	59.96	30.5	--	800	0.075	0.185	0.175	3.05
DPT-172	19.5	55.46	19.5	--	800	0.59	0.12	0.115	2
DPT-172	25	49.96	28	--	800	0.065	0.16	0.15	2.65
DPT-173	0.5	74.12	24	--	650000	0.89	0.165	0.155	2.7
DPT-173	5	69.62	32	--	800	0.98	0.175	0.165	2.85
DPT-173	10	64.62	21	--	800	2.2	0.13	0.125	2.2
DPT-173	15	59.62	23.5	--	800	0.34	0.15	0.14	2.5
DPT-173	19	55.62	21.5	--	800	0.95	0.135	0.125	2.2
DPT-173	27	47.62	25	--	800	0.07	0.17	0.16	2.8
DPT-174	0.5	74.40	31	--	2700000	1.4	0.16	0.15	2.6
DPT-174	1.5	73.40	30	--	4900000	2	0.17	0.16	2.8
DPT-174	5	69.90	29.5	--	800	1.8	0.205	0.195	3.4
DPT-174	10	64.90	24.5	--	25000	5.7	0.14	0.135	2.35
DPT-174	15	59.90	23.5	--	800	0.35	0.16	0.15	2.65
DPT-174	19.5	55.40	23	--	500000	1.3	0.13	0.12	2.1
DPT-174	25	49.90	21.5	--	800	0.87	0.125	0.115	2
DPT-174-S1	0.5	74.37	--	--	840000	4.2	0.165	0.155	2.7
DPT-174-S1	5	69.87	--	--	800	3.4	0.185	0.175	3.05
DPT-174-S1	9.5	65.37	--	--	800	6.2	0.14	0.135	2.35
DPT-174-S2	0.5	74.34	--	--	3800000	5.7	0.18	0.17	2.95
DPT-174-S2	5	69.84	--	--	800	1.3	0.2	0.19	3.3
DPT-174-S2	8	66.84	--	--	800	2.2	0.14	0.13	2.3
DPT-174-S3	0.5	74.43	--	--	3400000	4.9	0.18	0.17	3
DPT-174-S3	5	69.93	--	--	800	1.3	0.18	0.17	3
DPT-174-S3	10	64.93	--	--	800	1.2	0.135	0.125	2.25
DPT-174-S4	0.5	74.47	--	--	980000	4.1	0.155	0.145	2.6
DPT-174-S4	5	69.97	--	--	--	1.1	0.2	0.185	3.25

TABLE 4-1
Summary of Soil Analytical Results (µg/kg) [1/]
DFSP Norwalk Site, Norwalk California

Sample Location	Sample Depth	Sample Elevation	TPH [/2] as Gasoline	TPH as JP-5 [3/]	TPH as Diesel	Benzene	1,2-Dichloro-ethane (1,2-DCA)	Methyl-t-Butyl Ether (MTBE)	Tert-Butyl Alcohol (TBA)
DPT-174-S4	10	64.97	--	--	--	3.2	0.135	0.13	2.25

Notes:

[1/] all results in micrograms per kilogram (µg/kg)
[2/] TPH = Total Petroleum Hydrocarbons
[3/] JP-5 = Jet Propellant 5
[4/] All non-detects are reported at one-half of the method detection limit for use in the EVS modeling program.
[5/] -- = Not analyzed

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

Chemcial Name	Unit	VMP-29-05			VMP-29-15			VMP-30-05			VMP-30-15			VMP-31-05		
		2Q2011	3Q2011	4Q2011	2Q2011	3Q2011	4Q2011	2Q2011	3Q2011	4Q2011	2Q2011	3Q2011	4Q2011	2Q2011	3Q2011	4Q2011
1,2,4-Trimethylbenzene	µg/L	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074
1,2-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	**0.0068**	< 0.0020	< 0.0020	**0.0045**	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	< 0.0044	**0.013**	< 0.0044	< 0.0044	**0.0097**	< 0.0044	< 0.0044	**0.017**	**0.0072**	< 0.0044	**0.017**	**0.0048**	< 0.0044	**0.01**	< 0.0044
2-Hexanone	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025
Acetone	µg/L	**0.02**	**0.026**	< 0.0048	**0.021**	**0.04**	**0.014**	**0.021**	**0.054**	**0.042**	**0.023**	**0.08**	**0.018**	**0.012**	**0.042**	**0.0096**
Benzene	µg/L	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	**0.0043**	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	< 0.0062	**0.014**	< 0.0062	< 0.0062	**0.022**	< 0.0062	< 0.0062	< 0.0062	< 0.0062	< 0.0062	**0.022**	< 0.0062	< 0.0062	**0.017**	< 0.0062
Carbon Tetrachloride	µg/L	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	**0.0063**	**0.011**	**0.0028**	< 0.0024	**0.003**	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	**0.021**	**0.065**	**0.013**
Chloromethane	µg/L	**0.0056**	**0.0047**	**0.0042**	< 0.0010	**0.0084**	**0.0032**	< 0.0010	**0.0034**	**0.0034**	< 0.0010	**0.0048**	< 0.0010	< 0.0010	**0.011**	**0.0029**
e	µg/L	**0.0031**	**0.0027**	**0.0032**	**0.0027**	**0.0027**	**0.0034**	< 0.0025	**0.0025**	**0.0032**	< 0.0025	**0.0027**	**0.0032**	**0.0029**	**0.0028**	**0.0032**
Ethylbenzene	µg/L	< 0.0022	**0.0022**	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	**0.0027**	< 0.0022
Isobutane	µg/L	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	**0.024**	< 0.012	< 0.012	< 0.012	< 0.012	**0.26**	**0.015**	< 0.012	< 0.012	< 0.012
Methylene Chloride	µg/L	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017
o-Xylene	µg/L	< 0.0022	**0.0025**	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	**0.0046**	**0.0068**	< 0.0022
p/m-Xylene	µg/L	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
Tetrachloroethene	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	**0.0042**	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034
Toluene	µg/L	< 0.0019	**0.0061**	< 0.0019	< 0.0019	**0.0029**	< 0.0019	< 0.0019	**0.0044**	**0.0023**	< 0.0019	**0.002**	< 0.0019	< 0.0019	**0.0025**	< 0.0019
Trichloroethene	µg/L	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027
Vinyl Acetate	µg/L	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070

Notes:
4Q2010 = fourth quarter 2010 (sampled in December 2010)
1Q2011 = first quarter 2011 (sampled in March 2011)
2Q2011 = second quarter 2011 (sampled in June 2011)
3Q2011 = third quarter 2011 (sampled in September 2011)
4Q2011 = fourth quarter 2011 (sampled in December 2011)
µg/L = micrograms per liter

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

Chemcial Name	Unit	VMP-31-15			VMP-32-05					VMP-32-15				
		2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	3Q2011	4Q2011
1,2,4-Trimethylbenzene	µg/L	< 0.0074	< 0.0074	< 0.0074	< 0.018	< 0.0074	< 0.018	< 0.0074	< 0.0074	< 0.017	< 0.0089	< 0.0074	< 0.0074	< 0.0074
1,2-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0074	< 0.0030	< 0.0075	< 0.0030	**0.041**	< 0.0071	< 0.0036	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0050	< 0.0020	< 0.0051	< 0.0020	< 0.0020	< 0.0048	**0.011**	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0060	< 0.0025	< 0.0061	< 0.0025	< 0.0025	< 0.0058	< 0.0030	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0074	< 0.0030	< 0.0075	< 0.0030	**0.0031**	< 0.0071	< 0.0036	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0074	< 0.0030	< 0.0075	< 0.0030	**0.012**	< 0.0071	< 0.0036	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	**0.0067**	**0.033**	< 0.0044	< 0.011	< 0.0044	< 0.011	**0.013**	**0.016**	**0.028**	< 0.0054	**0.0074**	**0.015**	< 0.0044
2-Hexanone	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.015	< 0.0061	< 0.015	< 0.0061	< 0.0061	< 0.015	< 0.0074	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0060	< 0.0025	< 0.0061	< 0.0025	< 0.0025	< 0.0058	< 0.0030	< 0.0025	< 0.0025	< 0.0025
Acetone	µg/L	**0.028**	**0.11**	**0.019**	**0.031**	**0.047**	**0.023**	**0.023**	**0.079**	**0.15**	**0.036**	**0.042**	**0.016**	**0.014**
Benzene	µg/L	< 0.0016	< 0.0016	< 0.0016	< 0.0039	< 0.0016	< 0.0040	< 0.0016	< 0.0016	< 0.0038	< 0.0019	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0082	< 0.0034	< 0.0084	< 0.0034	< 0.0034	< 0.0079	< 0.0041	< 0.0034	< 0.0034	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0049	< 0.0020	< 0.0050	< 0.0020	< 0.0020	< 0.0047	< 0.0024	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	< 0.0062	**0.014**	< 0.0062	< 0.015	< 0.0062	< 0.016	**0.014**	**0.0066**	< 0.015	< 0.0075	< 0.0062	< 0.0062	**0.0092**
Carbon Tetrachloride	µg/L	< 0.0031	< 0.0031	< 0.0031	< 0.0077	< 0.0031	< 0.0079	**0.0033**	< 0.0031	< 0.0075	< 0.0038	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	**0.03**	**0.039**	< 0.0024	< 0.0060	< 0.0024	< 0.0061	< 0.0024	< 0.0024	< 0.0058	< 0.0030	< 0.0024	< 0.0024	< 0.0024
Chloromethane	µg/L	< 0.0010	**0.0074**	**0.0035**	< 0.0025	< 0.0010	**0.0042**	**0.007**	**0.0026**	< 0.0024	< 0.0012	**0.0059**	< 0.0010	**0.0034**
e	µg/L	**0.0029**	**0.0027**	**0.0033**	< 0.0061	< 0.0025	< 0.0062	**0.0031**	**0.0028**	< 0.0059	< 0.0030	**0.0026**	< 0.0025	< 0.0025
Ethylbenzene	µg/L	< 0.0022	**0.003**	< 0.0022	< 0.0053	< 0.0022	< 0.0054	**0.0025**	< 0.0022	**0.0064**	< 0.0026	**0.019**	< 0.0022	< 0.0022
Isobutane	µg/L	**0.013**	**0.022**	**0.45**	--	**0.11**	**24**	**0.36**	< 0.012	--	< 0.014	**5.5**	< 0.012	< 0.012
Methylene Chloride	µg/L	< 0.017	< 0.017	< 0.017	< 0.043	< 0.017	< 0.043	< 0.017	< 0.017	< 0.041	< 0.021	< 0.017	< 0.017	< 0.017
o-Xylene	µg/L	**0.0062**	**0.0067**	< 0.0022	< 0.0053	< 0.0022	< 0.0054	**0.0031**	< 0.0022	**0.015**	< 0.0026	**0.0053**	< 0.0022	< 0.0022
p/m-Xylene	µg/L	< 0.0087	< 0.0087	< 0.0087	< 0.021	< 0.0087	< 0.022	< 0.0087	< 0.0087	**0.024**	< 0.011	**0.013**	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.015	< 0.0061	< 0.015	< 0.0061	**0.027**	< 0.014	< 0.0073	< 0.0061	< 0.0061	< 0.0061
Tetrachloroethene	µg/L	< 0.0034	< 0.0034	< 0.0034	**0.11**	**0.073**	**0.014**	< 0.0034	**0.076**	**0.31**	**0.16**	< 0.0034	**0.14**	**0.28**
Toluene	µg/L	< 0.0019	**0.0033**	**0.0036**	< 0.0046	< 0.0019	< 0.0047	**0.006**	**0.0032**	**0.0067**	< 0.0023	**0.002**	**0.0036**	< 0.0019
Trichloroethene	µg/L	< 0.0027	< 0.0027	< 0.0027	< 0.0066	< 0.0027	< 0.0067	< 0.0027	< 0.0027	< 0.0064	**0.015**	< 0.0027	< 0.0027	< 0.0027
Vinyl Acetate	µg/L	< 0.0070	< 0.0070	< 0.0070	< 0.017	< 0.0070	< 0.018	< 0.0070	**0.011**	< 0.017	< 0.0085	< 0.0070	< 0.0070	< 0.0070

Notes:
4Q2010 = fourth quarter 2010 (samplec
1Q2011 = first quarter 2011 (sampled ir
2Q2011 = second quarter 2011 (sample
3Q2011 = third quarter 2011 (sampled i
4Q2011 = fourth quarter 2011 (samplec
µg/L = micrograms per liter

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

Chemcial Name	Unit	VMP-33-05					VMP-33-15					VMP-34-05				
		4Q2010	1Q2011	2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	3Q2011	4Q2011
1,2,4-Trimethylbenzene	µg/L	< 0.019	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.010	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.018	**0.0095**	< 0.0074	< 0.0074	< 0.0074
1,2-Dichlorobenzene	µg/L	< 0.0076	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0041	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0073	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	< 0.0051	**0.0035**	< 0.0020	< 0.0020	< 0.0020	< 0.0028	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0049	< 0.0020	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0062	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0033	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0060	**0.0043**	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0076	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0041	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0073	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0076	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0041	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0073	< 0.0030	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	< 0.011	< 0.0044	< 0.0044	**0.0058**	**0.0071**	< 0.0060	< 0.0044	**0.0051**	**0.0051**	< 0.0044	< 0.011	**0.0051**	**0.0057**	**0.011**	**0.01**
2-Hexanone	µg/L	< 0.016	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0084	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.015	< 0.0061	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0062	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0033	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0060	**0.0025**	< 0.0025	< 0.0025	< 0.0025
Acetone	µg/L	< 0.012	**0.041**	**0.014**	**0.011**	**0.025**	**0.01**	**0.052**	**0.036**	**0.017**	**0.024**	< 0.012	**0.043**	**0.034**	**0.022**	**0.043**
Benzene	µg/L	< 0.0041	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0022	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0039	< 0.0016	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0085	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0046	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0082	< 0.0034	< 0.0034	< 0.0034	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0050	< 0.0020	< 0.0020	< 0.0020	**0.0029**	< 0.0027	< 0.0020	< 0.0020	**0.003**	< 0.0020	< 0.0048	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	< 0.016	< 0.0062	< 0.0062	**0.011**	**0.01**	< 0.0085	< 0.0062	< 0.0062	**0.011**	**0.0069**	< 0.015	< 0.0062	< 0.0062	**0.0069**	**0.0082**
Carbon Tetrachloride	µg/L	< 0.0080	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0043	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0077	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	< 0.0062	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0033	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0060	< 0.0024	< 0.0024	< 0.0024	< 0.0024
Chloromethane	µg/L	< 0.0026	< 0.0010	< 0.0010	**0.0024**	**0.0033**	< 0.0014	< 0.0010	**0.0023**	**0.0041**	**0.0031**	< 0.0025	< 0.0010	**0.0085**	**0.0087**	**0.0052**
e	µg/L	< 0.0063	**0.0027**	**0.0028**	**0.0028**	**0.003**	< 0.0034	< 0.0025	**0.0028**	**0.0028**	**0.0025**	**0.0067**	< 0.0025	**0.0027**	**0.0028**	**0.0026**
Ethylbenzene	µg/L	< 0.0055	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0030	< 0.0022	**0.013**	< 0.0022	< 0.0022	< 0.0053	**0.0051**	< 0.0022	< 0.0022	< 0.0022
Isobutane	µg/L	--	**0.013**	< 0.012	< 0.012	< 0.012	--	**0.013**	**0.9**	< 0.012	< 0.012	--	< 0.012	< 0.012	< 0.012	< 0.012
Methylene Chloride	µg/L	< 0.044	< 0.017	< 0.017	< 0.017	< 0.017	< 0.024	< 0.017	< 0.017	< 0.017	< 0.017	< 0.042	< 0.017	< 0.017	< 0.017	< 0.017
o-Xylene	µg/L	< 0.0055	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0030	< 0.0022	**0.0045**	< 0.0022	< 0.0022	< 0.0053	**0.0028**	< 0.0022	< 0.0022	< 0.0022
p/m-Xylene	µg/L	< 0.022	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.012	< 0.0087	**0.011**	< 0.0087	< 0.0087	< 0.021	**0.013**	< 0.0087	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.015	< 0.0061	< 0.0061	< 0.0061	**0.011**	< 0.0082	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.015	< 0.0061	< 0.0061	< 0.0061	< 0.0061
Tetrachloroethene	µg/L	< 0.0086	**0.0037**	< 0.0034	< 0.0034	**0.0067**	**0.016**	< 0.0034	< 0.0034	**0.0046**	**0.0055**	< 0.0083	< 0.0034	< 0.0034	**0.01**	**0.0091**
Toluene	µg/L	**0.0057**	< 0.0019	< 0.0019	**0.0023**	**0.0028**	**0.0071**	< 0.0019	< 0.0019	< 0.0019	**0.0029**	**0.0051**	< 0.0019	< 0.0019	**0.0023**	**0.0025**
Trichloroethene	µg/L	< 0.0068	**0.0048**	< 0.0027	< 0.0027	**0.41**	< 0.0037	< 0.0027	< 0.0027	< 0.0027	**0.0043**	< 0.0066	< 0.0027	< 0.0027	< 0.0027	< 0.0027
Vinyl Acetate	µg/L	< 0.018	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0096	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.017	< 0.0070	< 0.0070	< 0.0070	**0.0078**

Notes:
4Q2010 = fourth quarter 2010 (samplec
1Q2011 = first quarter 2011 (sampled ir
2Q2011 = second quarter 2011 (sample
3Q2011 = third quarter 2011 (sampled i
4Q2011 = fourth quarter 2011 (samplec
µg/L = micrograms per liter

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

		VMP-34-15						VMP-35-05					
Chemcial Name	**Unit**	**4Q2010**	**1Q2011**	**2Q2011**	**3Q2011**	**4Q2011**	**4Q2011 (dup)**	**4Q2010**	**4Q2010 (dup)**	**1Q2011**	**2Q2011**	**3Q2011**	**4Q2011**
1,2,4-Trimethylbenzene	µg/L	< 0.018	**0.064**	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.018	< 0.020	< 0.0074	< 0.0074	< 0.0074	< 0.0074
1,2-Dichlorobenzene	µg/L	< 0.0074	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0072	< 0.0080	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	< 0.0050	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0048	< 0.0054	< 0.0020	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0060	**0.039**	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0058	< 0.0066	< 0.0025	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0074	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0072	< 0.0080	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0074	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0072	< 0.0080	< 0.0030	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	< 0.011	**0.0063**	**0.028**	**0.0075**	**0.012**	**0.01**	< 0.011	< 0.012	< 0.0044	**0.01**	**0.0096**	< 0.0044
2-Hexanone	µg/L	< 0.015	< 0.0061	**0.0079**	< 0.0061	< 0.0061	< 0.0061	< 0.015	< 0.016	< 0.0061	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0060	**0.016**	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0058	< 0.0066	< 0.0025	< 0.0025	< 0.0025	< 0.0025
Acetone	µg/L	< 0.012	**0.053**	**0.089**	**0.024**	**0.033**	**0.034**	< 0.011	**0.013**	**0.041**	**0.043**	**0.023**	**0.018**
Benzene	µg/L	**0.011**	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0038	< 0.0043	< 0.0016	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0082	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0080	< 0.0089	< 0.0034	< 0.0034	< 0.0034	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0049	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0047	< 0.0053	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	< 0.015	< 0.0062	< 0.0062	< 0.0062	< 0.0062	< 0.0062	< 0.015	< 0.017	< 0.0062	< 0.0062	**0.0085**	**0.0095**
Carbon Tetrachloride	µg/L	< 0.0077	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0075	< 0.0084	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	< 0.0060	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0058	< 0.0065	< 0.0024	< 0.0024	< 0.0024	< 0.0024
Chloromethane	µg/L	< 0.0025	**0.0013**	**0.0054**	**0.0022**	**0.0019**	< 0.0010	< 0.0025	< 0.0028	< 0.0010	**0.0063**	**0.0032**	**0.0045**
e	µg/L	< 0.0061	**0.0028**	**0.0026**	**0.0028**	**0.0033**	**0.0027**	< 0.0059	< 0.0066	**0.0031**	**0.0027**	**0.0027**	**0.0026**
Ethylbenzene	µg/L	< 0.0053	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0052	< 0.0058	< 0.0022	< 0.0022	< 0.0022	< 0.0022
Isobutane	µg/L	--	**0.11**	**0.016**	**0.013**	**0.03**	**0.15**	--	--	**0.015**	< 0.012	< 0.012	< 0.012
Methylene Chloride	µg/L	< 0.043	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.041	< 0.046	< 0.017	< 0.017	< 0.017	< 0.017
o-Xylene	µg/L	< 0.0053	**0.01**	< 0.0022	< 0.0022	**0.0022**	< 0.0022	< 0.0052	**0.0069**	< 0.0022	< 0.0022	< 0.0022	< 0.0022
p/m-Xylene	µg/L	< 0.021	**0.013**	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.021	< 0.023	< 0.0087	< 0.0087	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.015	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.014	< 0.016	< 0.0061	< 0.0061	< 0.0061	**0.03**
Tetrachloroethene	µg/L	**0.013**	< 0.0034	**0.0036**	**0.0045**	**0.013**	**0.011**	< 0.0081	< 0.0091	< 0.0034	< 0.0034	**0.0059**	**0.027**
Toluene	µg/L	**0.026**	**0.0021**	< 0.0019	< 0.0019	**0.0029**	**0.0019**	< 0.0045	**0.016**	< 0.0019	< 0.0019	< 0.0019	< 0.0019
Trichloroethene	µg/L	< 0.0066	< 0.0027	< 0.0027	< 0.0027	**0.047**	**0.075**	< 0.0064	< 0.0072	< 0.0027	< 0.0027	< 0.0027	**0.19**
Vinyl Acetate	µg/L	< 0.017	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.017	< 0.019	< 0.0070	< 0.0070	< 0.0070	< 0.0070

Notes:
4Q2010 = fourth quarter 2010 (samplec
1Q2011 = first quarter 2011 (sampled ir
2Q2011 = second quarter 2011 (sample
3Q2011 = third quarter 2011 (sampled i
4Q2011 = fourth quarter 2011 (samplec
µg/L = micrograms per liter

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

Chemcial Name	Unit	VMP-35-15					VMP-36-05					VMP-36-15					
		4Q2010	1Q2011	2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	2Q2011 (dup)	3Q2011	4Q2011
1,2,4-Trimethylbenzene	µg/L	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074
1,2-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	**0.013**	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	**0.0049**	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	< 0.0044	**0.0088**	**0.011**	**0.014**	**0.0076**	< 0.0044	< 0.0044	**0.0045**	**0.011**	< 0.0044	< 0.0044	< 0.0044	**0.0061**	< 0.0044	**0.014**	< 0.0044
2-Hexanone	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025
Acetone	µg/L	**0.011**	**0.032**	**0.053**	**0.089**	**0.084**	**0.0074**	**0.011**	**0.025**	**0.055**	**0.019**	**0.0071**	**0.02**	**0.041**	**0.023**	**0.083**	**0.017**
Benzene	µg/L	< 0.0016	< 0.0016	< 0.0016	**0.002**	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	**0.0072**	< 0.0062	**0.0093**	**0.031**	**0.028**	< 0.0062	< 0.0062	< 0.0062	**0.023**	< 0.0062	< 0.0062	< 0.0062	< 0.0062	< 0.0062	**0.014**	**0.0076**
Carbon Tetrachloride	µg/L	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	**0.0027**	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024
Chloromethane	µg/L	< 0.0010	**0.0012**	< 0.0010	**0.0065**	**0.017**	< 0.0010	< 0.0010	< 0.0010	**0.0024**	**0.0018**	< 0.0010	< 0.0010	**0.0011**	**0.0015**	**0.0044**	**0.0023**
e	µg/L	< 0.0025	**0.0029**	**0.0028**	**0.0027**	**0.0026**	< 0.0025	**0.003**	**0.0028**	**0.0026**	**0.0028**	< 0.0025	**0.0032**	**0.0027**	**0.0028**	**0.0026**	< 0.0025
Ethylbenzene	µg/L	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022
Isobutane	µg/L	--	< 0.012	**0.019**	**0.014**	**0.025**	--	< 0.012	< 0.012	< 0.012	**0.021**	--	**0.32**	< 0.012	**0.12**	< 0.012	< 0.012
Methylene Chloride	µg/L	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017
o-Xylene	µg/L	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022
p/m-Xylene	µg/L	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.0061	**0.011**	< 0.0061	< 0.0061	**0.0086**	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
Tetrachloroethene	µg/L	**0.0064**	< 0.0034	< 0.0034	**0.0057**	**0.0039**	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	**0.0065**	**0.0036**	< 0.0034	< 0.0034	**0.0038**	**0.0071**
Toluene	µg/L	**0.0039**	**0.0022**	< 0.0019	< 0.0019	< 0.0019	**0.0033**	< 0.0019	< 0.0019	< 0.0019	< 0.0019	**0.003**	< 0.0019	**0.0031**	**0.0045**	< 0.0019	< 0.0019
Trichloroethene	µg/L	< 0.0027	< 0.0027	< 0.0027	< 0.0027	**0.005**	< 0.0027	< 0.0027	< 0.0027	< 0.0027	**0.0031**	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027
Vinyl Acetate	µg/L	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070

Notes:
4Q2010 = fourth quarter 2010 (samplec
1Q2011 = first quarter 2011 (sampled ir
2Q2011 = second quarter 2011 (sample
3Q2011 = third quarter 2011 (sampled i
4Q2011 = fourth quarter 2011 (samplec
µg/L = micrograms per liter

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

Chemcial Name	Unit	VMP-37-05 4Q2010	VMP-37-05 1Q2011	VMP-37-05 2Q2011	VMP-37-05 3Q2011	VMP-37-05 4Q2011	VMP-37-15 4Q2010	VMP-37-15 1Q2011	VMP-37-15 2Q2011	VMP-37-15 3Q2011	VMP-37-15 3Q2011 (dup)	VMP-37-15 4Q2011
1,2,4-Trimethylbenzene	µg/L	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	**0.0077**
1,2-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	< 0.0044	< 0.0044	< 0.0044	**0.0059**	< 0.0044	< 0.0044	< 0.0044	**0.0081**	**0.015**	**0.008**	**0.0062**
2-Hexanone	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	**0.0025**
Acetone	µg/L	**0.0078**	**0.016**	**0.024**	**0.046**	**0.025**	**0.0048**	**0.037**	**0.052**	**0.091**	**0.041**	**0.033**
Benzene	µg/L	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	< 0.0062	< 0.0062	< 0.0062	**0.011**	**0.0073**	< 0.0062	< 0.0062	< 0.0062	**0.01**	< 0.0062	**0.014**
Carbon Tetrachloride	µg/L	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024
Chloromethane	µg/L	< 0.0010	< 0.0010	< 0.0010	**0.0034**	**0.0032**	< 0.0010	< 0.0010	**0.0017**	**0.0041**	**0.0016**	**0.0039**
e	µg/L	**0.0026**	**0.0032**	**0.0028**	**0.0026**	**0.0031**	**0.0028**	**0.003**	**0.0029**	**0.0027**	< 0.0025	**0.0026**
Ethylbenzene	µg/L	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	**0.0025**	< 0.0022	< 0.0022	< 0.0022
Isobutane	µg/L	--	< 0.012	< 0.012	< 0.012	< 0.012	--	**1.1**	**2.4**	**0.028**	**0.012**	**0.033**
Methylene Chloride	µg/L	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	**0.032**
o-Xylene	µg/L	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022	< 0.0022
p/m-Xylene	µg/L	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
Tetrachloroethene	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	**0.0045**	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034
Toluene	µg/L	< 0.0019	< 0.0019	< 0.0019	< 0.0019	< 0.0019	**0.0023**	< 0.0019	< 0.0019	**0.0028**	< 0.0019	< 0.0019
Trichloroethene	µg/L	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027
Vinyl Acetate	µg/L	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070

Notes:
4Q2010 = fourth quarter 2010 (samplec
1Q2011 = first quarter 2011 (sampled ir
2Q2011 = second quarter 2011 (sample
3Q2011 = third quarter 2011 (sampled i
4Q2011 = fourth quarter 2011 (samplec
µg/L = micrograms per liter

TABLE 4-2
Summary of Detected Soil Gas VOC Analytical Results
DFSP Norwalk Site, Norwalk California

Chemcial Name	Unit	VMP-38-05						VMP-38-15				
		4Q2010	1Q2011	1Q2011 (dup)	2Q2011	3Q2011	4Q2011	4Q2010	1Q2011	2Q2011	3Q2011	4Q2011
1,2,4-Trimethylbenzene	µg/L	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	**0.016**	< 0.0074	< 0.0074	< 0.0074
1,2-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,2-Dichloroethane	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
1,3,5-Trimethylbenzene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	**0.0046**	< 0.0025	< 0.0025	< 0.0025
1,3-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
1,4-Dichlorobenzene	µg/L	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030
2-Butanone	µg/L	**0.0081**	**0.007**	**0.0073**	**0.0078**	**0.019**	**0.005**	< 0.0044	< 0.0044	< 0.0044	**0.014**	**0.0067**
2-Hexanone	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
4-Ethyltoluene	µg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	**0.0027**	< 0.0025	< 0.0025	< 0.0025
Acetone	µg/L	**0.0096**	**0.032**	**0.029**	**0.035**	**0.089**	**0.029**	**0.01**	**0.066**	**0.041**	**0.11**	**0.052**
Benzene	µg/L	< 0.0016	**0.0026**	**0.0026**	< 0.0016	< 0.0016	< 0.0016	**0.0036**	**0.0047**	< 0.0016	< 0.0016	< 0.0016
Bromodichloromethane	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034
c-1,2-Dichloroethene	µg/L	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Carbon Disulfide	µg/L	< 0.0062	< 0.0062	< 0.0062	< 0.0062	**0.023**	< 0.0062	< 0.0062	< 0.0062	< 0.0062	**0.0089**	< 0.0062
Carbon Tetrachloride	µg/L	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Chloroform	µg/L	< 0.0024	< 0.0024	< 0.0024	**0.0027**	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024	< 0.0024
Chloromethane	µg/L	< 0.0010	< 0.0010	**0.0014**	**0.001**	**0.0091**	**0.0034**	< 0.0010	< 0.0010	**0.0046**	**0.0022**	< 0.0010
e	µg/L	**0.0029**	**0.0032**	**0.003**	**0.0028**	**0.0027**	**0.0029**	< 0.0025	< 0.0025	**0.0025**	< 0.0025	**0.0028**
Ethylbenzene	µg/L	< 0.0022	**0.0023**	**0.0022**	< 0.0022	< 0.0022	< 0.0022	< 0.0022	**0.0022**	< 0.0022	< 0.0022	< 0.0022
Isobutane	µg/L	--	**0.051**	**0.049**	< 0.012	**0.026**	< 0.012	--	**1.3**	< 0.012	< 0.012	**0.016**
Methylene Chloride	µg/L	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017
o-Xylene	µg/L	< 0.0022	**0.0022**	**0.0022**	< 0.0022	< 0.0022	< 0.0022	< 0.0022	**0.005**	< 0.0022	< 0.0022	< 0.0022
p/m-Xylene	µg/L	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087	< 0.0087
(TBA)	µg/L	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061	< 0.0061
Tetrachloroethene	µg/L	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	< 0.0034	**0.014**	**0.011**	**0.013**	**0.013**	**0.017**
Toluene	µg/L	**0.0032**	**0.0043**	**0.0042**	< 0.0019	< 0.0019	< 0.0019	**0.0097**	**0.0021**	< 0.0019	< 0.0019	< 0.0019
Trichloroethene	µg/L	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027	< 0.0027
Vinyl Acetate	µg/L	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070	< 0.0070

Notes:
4Q2010 = fourth quarter 2010 (samplec
1Q2011 = first quarter 2011 (sampled ir
2Q2011 = second quarter 2011 (sample
3Q2011 = third quarter 2011 (sampled i
4Q2011 = fourth quarter 2011 (samplec
µg/L = micrograms per liter

TABLE 4-3
Summary of Laboratory Fixed Gases Results
DFSP Norwalk Site, Norwalk California

Sample Location	Date Sampled	Carbon Dioxide %V	Carbon Dioxide ppm (v/v)	Carbon Monoxide ppm (v/v)	Methane ppm (v/v)	Nitrogen %V	Oxygen + Argon %V	TGNMO ppm (v/v)
Field Blank	10-Jun-11	--	**570**	< 5.0	**1.9**	**78**	**22**	< 5.0
Field Blank	27-Sep-11	--	**450**	< 5.0	**2.4**	**78**	**22**	< 5.0
Field Blank	22-Dec-11	--	**430**	< 5.0	**2**	**77**	**23**	< 5.0
VMP-29-05	10-Jun-11	**2.3**	--	< 5.0	< 1.0	**78**	**20**	< 5.0
	27-Sep-11	**3.4**	--	< 5.0	< 1.0	**78**	**19**	< 5.0
	23-Dec-11	**2.5**	--	< 5.0	< 1.0	**77**	**21**	< 5.0
VMP-29-15	08-Jun-11	**2.5**	--	< 5.0	< 1.0	**78**	**19**	< 5.0
	27-Sep-11	**3.2**	--	< 5.0	< 1.0	**78**	**19**	< 5.0
	23-Dec-11	**3.4**	--	< 5.0	< 1.0	**77**	**20**	**6**
VMP-30-05	08-Jun-11	**4.2**	--	< 5.0	< 1.0	**77**	**18**	< 5.0
	27-Sep-11	**5.8**	--	< 5.0	< 1.0	**77**	**17**	< 5.0
	23-Dec-11	**4.1**	--	< 5.0	< 1.0	**76**	**20**	< 5.0
VMP-30-15	08-Jun-11	**4.8**	--	< 5.0	< 1.0	**78**	**17**	< 5.0
	27-Sep-11	**5.5**	--	< 5.0	< 1.0	**77**	**18**	< 5.0
	23-Dec-11	**5.5**	--	< 5.0	< 1.0	**75**	**19**	< 5.0
VMP-31-05	08-Jun-11	**3**	--	< 5.0	< 1.0	**78**	**19**	< 5.0
	27-Sep-11	**5.6**	--	< 5.0	< 1.0	**78**	**17**	< 5.0
	23-Dec-11	**4.3**	--	< 5.0	< 1.0	**76**	**19**	< 5.0
VMP-31-15	08-Jun-11	< 0.50	--	< 5.0	< 1.0	**75**	**17**	< 5.0
	27-Sep-11	**5.4**	--	< 5.0	< 1.0	**77**	**18**	< 5.0
	23-Dec-11	**4.1**	--	< 5.0	< 1.0	**76**	**19**	**9.5**
VMP-32-05	09-Jun-11	**1**	--	< 5.0	**1.6**	**78**	**21**	**42**
	26-Sep-11	--	**760**	< 5.0	**16**	**78**	**22**	< 5.0
	22-Dec-11	**5.8**	--	< 5.0	< 1.0	**77**	**17**	< 5.0
VMP-32-15	09-Jun-11	--	**2500**	< 5.0	**1.7**	**78**	**22**	**25**
	26-Sep-11	**13**	--	< 5.0	< 1.0	**79**	**7.9**	< 5.0
	22-Dec-11	**12**	--	< 5.0	< 1.0	**77**	**11**	< 5.0
VMP-33-05	09-Jun-11	**1.1**	--	< 5.0	< 1.0	**79**	**20**	< 5.0
	26-Sep-11	**1.4**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	22-Dec-11	**0.91**	--	< 5.0	< 1.0	**78**	**21**	**9.3**
VMP-33-15	09-Jun-11	--	**720**	< 5.0	**1.7**	**78**	**22**	< 5.0
	26-Sep-11	**2.1**	--	< 5.0	< 1.0	**78**	**20**	< 5.0
	22-Dec-11	**2**	--	< 5.0	< 1.0	**77**	**21**	**8**
VMP-34-05	09-Jun-11	**1.2**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	**0.95**	--	< 5.0	< 1.0	**77**	**22**	< 5.0
	22-Dec-11	**0.98**	--	< 5.0	< 1.0	**77**	**22**	**9.9**
VMP-34-15	09-Jun-11	**2.5**	--	< 5.0	< 1.0	**78**	**19**	< 5.0
	26-Sep-11	**2.8**	--	< 5.0	< 1.0	**77**	**20**	< 5.0
	22-Dec-11	**2.9**	--	< 5.0	< 1.0	**76**	**21**	**5.7**
dup	22-Dec-11	**2.8**	--	< 5.0	< 1.0	**76**	**21**	**7.3**
VMP-35-05	09-Jun-11	--	**4000**	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	--	**4500**	< 5.0	< 1.0	**78**	**22**	**5.4**
	22-Dec-11	--	**4300**	< 5.0	< 1.0	**77**	**23**	**8.6**

TABLE 4-3
Summary of Laboratory Fixed Gases Results
DFSP Norwalk Site, Norwalk California

Sample Location	Date Sampled	Carbon Dioxide %V	Carbon Dioxide ppm (v/v)	Carbon Monoxide ppm (v/v)	Methane ppm (v/v)	Nitrogen %V	Oxygen + Argon %V	TGNMO ppm (v/v)
VMP-35-15	09-Jun-11	**1.2**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	**1.6**	--	< 5.0	< 1.0	**77**	**21**	< 5.0
	22-Dec-11	**1.6**	--	< 5.0	< 1.0	**77**	**22**	**8.5**
VMP-36-05	09-Jun-11	**0.83**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	**0.61**	--	< 5.0	< 1.0	**78**	**22**	< 5.0
	22-Dec-11	--	**3600**	< 5.0	< 1.0	**77**	**23**	**8.9**
VMP-36-15	10-Jun-11	**2.2**	--	< 5.0	< 1.0	**78**	**20**	< 5.0
dup	10-Jun-11	**1.2**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	**2.8**	--	< 5.0	< 1.0	**78**	**20**	< 5.0
	22-Dec-11	**2.7**	--	< 5.0	< 1.0	**77**	**21**	**5.7**
VMP-37-05	09-Jun-11	**1.2**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	**1.1**	--	< 5.0	< 1.0	**77**	**21**	**5.1**
	22-Dec-11	**0.8**	--	< 5.0	< 1.0	**77**	**22**	**8.7**
VMP-37-15	10-Jun-11	--	**2200**	< 5.0	**1.6**	**78**	**22**	< 5.0
	26-Sep-11	**1.4**	--	< 5.0	< 1.0	**77**	**21**	**5.1**
dup	26-Sep-11	**1.4**	--	< 5.0	< 1.0	**77**	**21**	< 5.0
	22-Dec-11	**1.1**	--	< 5.0	< 1.0	**77**	**22**	**8**
VMP-38-05	10-Jun-11	**1.3**	--	< 5.0	< 1.0	**78**	**21**	< 5.0
	26-Sep-11	**0.82**	--	< 5.0	< 1.0	**78**	**22**	< 5.0
	22-Dec-11	**0.6**	--	< 5.0	< 1.0	**77**	**22**	**8.8**
VMP-38-15	10-Jun-11	**5**	--	< 5.0	< 1.0	**79**	**16**	< 5.0
	26-Sep-11	**5.9**	--	< 5.0	< 1.0	**78**	**16**	< 5.0
	22-Dec-11	**5.2**	--	< 5.0	< 1.0	**77**	**18**	< 5.0

Notes:
%V = percent by volume
ppm (v/v) = parts per million
TGNMO = total gaseous nonmethane organics
dup = duplicate
Second quarter 2011 sampled June 8-10, 2011.
Third quarter 2011 sampled September 26-27, 2011.
Fourth quarter 2011 sampled December 22-23, 2011.

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
BW-1	05/16/96	GMX[3]	55	5	31.9 - 51.4	0.01	73.17
BW-2	05/20/96	GMX	53.5	5	27 - 46.5	0.01	73.57
BW-3	05/17/96	GMX	55.5	5	30.6 - 50	0.01	74.16
BW-4	05/20/96	GMX	53.1	5	28.2 - 47	0.01	74.61
BW-5	05/23/96	GMX	52.5	5	27 - 45.5	0.01	73.59
BW-6	05/22/96	GMX	52.4	5	27.6 - 46.9	0.01	73.48
BW-7	05/22/96	GMX	52	5	27.1 - 46.3	0.01	74.65
BW-8	05/21/96	GMX	51.5	5	27 - 46.4	0.01	75.08
BW-9	05/21/96	GMX	52.5	5	26.9 - 46.4	0.01	76.19
EXP-1	03/06/92	WC[4]	128.5	4	82 - 122	0.01	78.44
EXP-2	10/15/92	WC	149	4	90 - 120	0.02	79.43
EXP-3	10/20/92	WC	150	4	85 - 115	0.01	77.58
EXP-4	07/07/98	GMX	118	4	96.1 - 115.2	0.02	79.81
EXP-5	07/08/98	GMX	120	4	94.4 - 113.4	0.02	72.41
GMW-1	05/16/91	GTI[5]	50	4	20 - 50	0.01	74.77
GMW-2	05/16/91	GTI	50	4	20 - 50	0.01	73.57
GMW-3	05/17/91	GTI	50	4	20 - 50	0.01	75.10
GMW-4	05/21/91	GTI	50	4	20 - 50	0.01	75.45
GMW-5	05/21/91	GTI	50	4	20 - 50	0.01	77.61
GMW-6	07/09/91	GTI	50	4	25 - 50	0.01	77.31
GMW-7	07/09/91	GTI	50	4	25 - 50	0.01	75.84
GMW-8	07/10/91	GTI	50	4	25 - 50	0.01	73.20
GMW-9	07/08/91	GTI	50	4	20 - 50	0.01	77.16
GMW-10	07/08/91	GTI	50	4	25 - 50	0.01	74.67
GMW-11	07/09/91	GTI	50	4	20 - 50	0.01	72.90
GMW-12	07/09/91	GTI	50	4	25 - 50	0.01	75.21
GMW-13	07/08/91	GTI	50	4	25 - 50	0.01	74.17
GMW-14	07/10/91	GTI	50	4	25 - 50	0.01	74.72
GMW-15	07/30/91	GTI	50	4	25 - 50	0.01	76.21
GMW-16	08/01/91	GTI	50	4	25 - 50	0.01	77.00
GMW-17	08/01/91	GTI	50	4	25 - 50	0.01	74.66
GMW-18	07/31/91	GTI	50	4	25 - 50	0.01	75.36
GMW-19	07/31/91	GTI	50	4	25 - 50	0.01	76.83
GMW-20	08/01/91	GTI	50	4	25 - 50	0.01	75.10
GMW-21[6]	08/02/91	GTI	50	4	25 - 50	0.01	76.23
GMW-22	08/02/91	GTI	61	4	25 - 60	0.01	77.24
GMW-23	08/02/91	GTI	60	4	25 - 60	0.01	74.85
GMW-24	08/05/91	GTI	60	4	25 - 60	0.01	77.48
GMW-25	01/10/92	GTI	50	6	20 - 50	0.01	78.14
GMW-26	01/07/92	GTI	51.5	4	20 - 50	0.01	74.52
GMW-27	01/10/92	GTI	50	4	20 - 50	0.01	74.41

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
GMW-28	01/07/92	GTI	50	4	20 - 50	0.01	74.68
GMW-29	01/09/92	GTI	50	4	20 - 50	0.01	77.57
GMW-30	01/09/92	GTI	51.5	6	20 - 50	0.01	74.91
GMW-31	06/02/93	GTI	65	4	25 - 65	0.01	76.50
GMW-32	06/01/93	GTI	50	4	20 - 50	0.02	74.62
GMW-33	06/01/93	GTI	50	4	20 - 50	0.02	74.88
GMW-34	06/03/93	GTI	50	4	20 - 50	0.02	75.25
GMW-35	06/04/93	GTI	50	4	20 - 50	0.02	76.12
GMW-36	04/11/94	GTI	50	4	20 - 50	0.01	76.66
GMW-37	04/11/94	GTI	50	4	20 - 50	0.01	77.32
GMW-38	04/12/94	GTI	50	4	20 - 50	0.01	75.47
GMW-39	0'4/12/94	GTI	50	4	20 - 50	0.01	75.05
GMW-40	06/29/94	GTI	50.5	4	20 - 50	0.01	73.13
GMW-41	06/30/94	GTI	50.5	4	20 - 50	0.01	74.46
GMW-42	06/30/94	GTI	50.5	4	20 - 50	0.01	75.50
GMW-43	07/01/94	GTI	50.5	4	20 - 50	0.01	74.44
GMW-44	07/01/94	GTI	50.5	4	20 - 50	0.01	74.45
GMW-45	07/01/94	GTI	50.5	4	20 - 50	0.01	75.67
GMW-46	07/05/94	GTI	50.5	4	20 - 50	0.01	76.10
GMW-47	07/05/94	GTI	50.5	4	20 - 50	0.01	75.98
GMW-48	07/05/94	GTI	50.5	4	20 - 50	0.01	75.03
GMW-49	07/06/94	GTI	50.5	4	20 - 50	0.01	74.75
GMW-50	12/19/94	GTI	46.5	4	15 - 45	0.01	75.51
GMW-51	12/19/94	GTI	41.5	4	15 - 40	0.01	75.93
GMW-52	12/19/94	GTI	41.5	4	15 - 40	0.01	75.03
GMW-53	12/19/94	GTI	46.5	4	15 - 45	0.01	74.90
GMW-54	12/20/94	GTI	46.5	4	15 - 45	0.01	75.16
GMW-55	12/20/94	GTI	41.5	4	15 - 40	0.01	74.60
GMW-56	08/12/98	FDGTI[7]	55	2	20 - 55	0.02	76.50
GMW-56	08/12/98	FDGTI	55	4	20 - 55	0.02	76.52
GMW-57	08/13/98	FDGTI	55	2	19 - 54	0.02	76.66
GMW-57	08/13/98	FDGTI	55	4	19 - 54	0.02	76.66
GMW-58	08/14/98	FDGTI	55	2	20 - 55	0.02	75.46
GMW-58	08/14/98	FDGTI	55	4	20 - 55	0.02	75.48
GMW-59	08/14/98	FDGTI	55	2	20 - 55	0.02	75.28
GMW-59	08/14/98	FDGTI	55	4	20 - 55	0.02	75.28
GMW-60	04/14/04	Parsons	50	4	25 - 40	0.01	76.24
GMW-61	04/14/04	Parsons	50	4	30 - 40	0.01	75.60
GMW-62	07/02/07	Parsons	40.5	4	20 - 40	0.01	76.34
GMW-63	09/29/08	Parsons	41	4	20 - 40	0.02	77.32
GMW-64	09/29/08	Parsons	41	4	19.5 - 39.5	0.02	75.84

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
GMW-65	07/06/09	Parsons	41.5	4	21 - 41	0.02	76.78
GMW-66	09/08/09	Parsons	40.5	4	20 - 40	0.02	77.00
GMW-O-1	03/04/92	GTI	51.5	4	19 - 49.5	0.01	71.45
GMW-O-2	03/02/92	GTI	51.5	4	20 - 50	0.01	72.54
GMW-O-3	03/02/92	GTI	51.5	4	20 - 50	0.01	72.19
GMW-O-4	03/03/92	GTI	51.5	4	20 - 50	0.01	71.95
GMW-O-4 (MID)	03/03/92	GTI	66.5	4	54.5 - 64.5	0.01	72.24
GMW-O-5	03/04/92	GTI	51.5	4	20 - 50	0.01	72.36
GMW-O-6	05/18/92	GTI	51.5	4	20 - 50	0.01	71.41
GMW-O-7	05/19/92	GTI	51.5	4	20 - 50	0.01	70.98
GMW-O-8	05/18/92	GTI	51	4	19.5 - 49.5	0.01	70.91
GMW-O-9	07/29/92	GTI	51.5	4	20 - 50	0.01	73.50
GMW-O-10	07/29/92	GTI	51.5	4	20 - 50	0.01	73.98
GMW-O-11	05/20/92	GTI	51.5	4	20 - 50	0.01	74.17
GMW-O-12	05/21/92	GTI	51.5	4	20 - 50	0.01	73.49
GMW-O-14	05/20/92	GTI	51.5	4	20 - 50	0.01	74.08
GMW-O-15	04/19/94	GTI	50	4	20 - 50	0.02	74.23
GMW-O-16	04/19/94	GTI	50	4	20 - 50	0.02	74.10
GMW-O-17	07/26/94	GMX	41	4	20.4 - 39.5	0.01	73.78
GMW-O-18	07/25/94	GMX	41	4	20.8 - 40.4	0.01	74.36
GMW-O-19	07/29/94	GMX	41.5	4	20.2 - 39.9	0.01	74.46
GMW-O-20	06/15/95	GMX	45.9	4	---[8]	---	73.32
GMW-O-21	06/19/97	GMX	45.9	4	25.5 - 45.5	0.01	71.43
GMW-O-22	---	GMX	41	4	---	---	74.36
GMW-O-23	06/25/07	GMX	44	4	20 - 40	0.02	73.63
GMW-O-24	09/24/12	CH2MHill	45	4	20 - 40	0.01	74.39
GMW-SF-7	07/27/94	GMX	41	4	20.1 - 39.9	0.01	75.26
GMW-SF-8	07/28/94	GMX	41	4	19.5 - 39.5	0.01	76.75
GMW-SF-9	04/01/03	GMX	47	4	36.6 - 46.2	0.02	73.05
GMW-SF-10	04/02/03	GMX	47	4	36.7 – 46.4	0.02	75.77
GW-1	06/12/95	GTI	63	1	25 - 60	0.02	75.46
GW-1	06/12/95	GTI	63	4	25 - 60	0.02	75.97
GW-2	06/12/95	GTI	63	1	25 - 60	0.02	76.39
GW-2	06/12/95	GTI	63	4	25 - 60	0.02	75.78
GW-3	06/13/95	GTI	63	1	25 - 60	0.02	76.56
GW-3	06/13/95	GTI	63	4	25 - 60	0.02	75.79
GW-4	06/13/95	GTI	63	1	24 - 59	0.02	74.77
GW-4	06/13/95	GTI	63	4	24 - 59	0.02	73.86
GW-5	06/15/95	GTI	63	1	25.5 - 60.5	0.02	77.09
GW-5	06/15/95	GTI	63	4	25.5 - 60.5	0.02	76.99
GW-6	06/15/95	GTI	63	1	25 - 60	0.02	77.41

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
GW-6	06/15/95	GTI	63	4	25 - 60	0.02	76.38
GW-7	06/16/95	GTI	63	1	25 - 60	0.02	76.76
GW-7	06/16/95	GTI	63	4	25 - 60	0.02	75.02
GW-8	06/14/95	GTI	63	1	24 - 59	0.02	76.88
GW-8	06/14/95	GTI	63	4	24 - 59	0.02	76.15
GW-13	04/26/07	Parsons	65	1	25 - 65	0.02	77.00
GW-13	04/26/07	Parsons	67	6	25 - 65	0.02	76.85
GW-14	04/26/07	Parsons	65	1	25 - 65	0.02	76.55
GW-14	04/26/07	Parsons	67	6	25 - 65	0.02	76.54
GW-15	04/26/07	Parsons	62.5	1	20.5 - 60.5	0.02	75.36
GW-15	04/26/07	Parsons	60.5	6	20.5 - 60.6	0.02	74.94
GW-16p	07/07/09	Parsons	61.3	1	21 - 61	0.02	76.55
GW-16	07/07/09	Parsons	63	6	20.5 - 60.5	0.02	76.33
GWR-1	07/11/91	GTI	50	4	25 - 50	0.01	77.40
GWR-2	07/12/91	GTI	50	4	25 - 50	0.01	73.66
GWR-3	01/10/92	GTI	50	6	20 - 50	0.01	77.60
HL-1	10/14/86	HLA[9]	39	4	18 - 38	0.01	75.83
HL-2	10/13/86	HLA	39	4	16.5 - 36.5	0.01	76.94
HL-3	10/15/86	HLA	44	4	19 - 39	0.01	76.86
HL-4	10/16/86	HLA	39	4	18 - 38.5	0.01	75.75
HL-5	10/16/86	HLA	39.5	4	18.5 - 39	0.01	76.13
MW-6	08/09/90	WC	50	4	18 - 48	0.01	77.20
MW-7	08/27/90	WC	50	4	19 - 48	0.01	78.13
MW-8	08/24/90	WC	51	4	18 - 48	0.01	76.06
MW-9	08/08/90	WC	50	4	18 - 48	0.01	77.11
MW-10	08/24/90	WC	51	4	18 - 48	0.01	79.12
MW-11	08/09/90	WC	50	4	18 - 48	0.01	78.17
MW-12	08/27/90	WC	50	4	18 - 48	0.01	75.76
MW-13	08/23/90	WC	50	4	18 - 48	0.01	78.25
MW-14	08/07/90	WC	50	4	18 - 48	0.01	78.60
MW-15	08/07/90	WC	50	4	18 - 48	0.01	76.99
MW-16	08/08/90	WC	50	4	18 - 48	0.01	76.87
MW-17	08/06/90	WC	50	4	18 - 48	0.01	77.86
MW-18 (MID)	06/10/91	WC	62.2	4	50 - 60	0.01	75.67
MW-19 (MID)	06/11/91	WC	62.2	4	49.5 - 59.5	0.01	78.14
MW-20 (MID)	06/12/91	WC	65.7	4	43 - 53	0.01	77.19
MW-21 (MID)	06/12/91	WC	62.4	4	47 - 57	0.01	77.55
MW-22 (MID)	06/13/91	WC	57.9	4	42 - 52	0.01	79.57
MW-23 (MID)	06/14/91	WC	57.1	4	42 - 52	0.01	79.59
MW-24	06/14/91	WC	47	4	14 - 44	0.01	78.51
MW-25	06/17/91	WC	47.2	4	22.5 - 42.5	0.01	79.15

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
MW-26	06/17/91	WC	47.3	4	23.5 - 43.5	0.01	77.40
MW-27	06/17/91	WC	52.3	4	18 - 48	0.01	78.46
MW-28	6/19/91	WC	51.5	4	16.5 - 46.5	0.01	78.53
MW-29	06/19/91	WC	52.4	4	17.5 - 47.5	0.01	79.13
MW-O-1	01/22/91	GMX	40	2	25 - 40	0.02	75.48
MW-O-2	01/23/91	GMX	40	2	25 - 40	0.02	71.90
MW-O-3	10/25/91	GMX	41	6	20.5 - 41	0.01	74.53
MW-O-4	10/25/91	GMX	41	4	20.5 - 41	0.01	75.00
MW-SF-1	06/18/90	GMX	40	4	25 - 40	0.02	78.93
MW-SF-2	06/18/90	GMX	40	4	25 - 40	0.02	78.53
MW-SF-3	06/18/90	GMX	40	4	25 - 40	0.02	78.12
MW-SF-4	06/19/90	GMX	40	4	25 - 40	0.02	79.38
MW-SF-5	09/19/90	GMX	40	4	23 - 38	0.02	79.74
MW-SF-6	09/19/90	GMX	40	4	24 - 39	0.02	76.80
MW-SF-9	06/15/95	GMX	40	4	---	---	74.10
MW-SF-10	09/23/03	GMX	30.5	4	10.3 - 29.9	0.02	76.53
MW-SF-11	06/19/07	GMX	44	4	20 - 40	0.02	78.56
MW-SF-12	06/18/07	GMX	44	4	20 - 40	0.02	78.07
MW-SF-13	06/19/07	GMX	44	4	20 - 40	0.02	73.40
MW-SF-14	06/21/07	GMX	44	4	20 - 40	0.02	78.16
MW-SF-15	06/21/07	GMX	44	4	20 - 40	0.02	78.27
MW-SF-16	06/20/07	GMX	44	4	20 - 40	0.02	78.21
PO-7	05/01/89	GW[10]	56	4	29 - 49	0.02	80.26
PW-1	01/06/92	GTI	51.5	4	20 - 50	0.01	75.52
PW-2	01/06/92	GTI	50	4	20 - 50	0.01	74.71
PW-3	01/06/92	GTI	50	4	20 - 50	0.01	73.71
PZ-1	07/12/91	GTI	50	2	25 - 50	0.01	73.74
PZ-2	07/12/91	GTI	50	2	25 - 50	0.01	73.96
PZ-3	06/03/93	GTI	65	2	25 - 65	0.02	76.17
PZ-4	06/02/93	GTI	60	2	25 - 60	0.02	76.13
PZ-5	09/26/00	GMX	40.3	4	20.6 - 39.4	0.01	73.97
PZ-6	09/26/00	GMX	37.5	4	22.8 - 37.8	0.01	73.91
PZ-7A	04/07/03	GMX	32	2	21.5 - 31.2	0.01	73.87
PZ-7B	04/07/03	GMX	47.5	2	42 - 46.7	0.01	73.79
PZ-8A	04/08/03	GMX	31.5	2	21.2 - 31	0.01	75.81
PZ-8B	04/08/03	GMX	47	2	41.4 - 46.2	0.01	75.69
PZ-9A	04/09/03	GMX	32	2	21.6 - 30.9	0.01	76.14
PZ-9B	04/09/03	GMX	47	2	41.5 - 46.2	0.01	76.26
PZ-10	04/10/03	GMX	38.5	2	23.2 - 37.9	0.02	74.34
TF-8	09/22/95	GTI	63	1.5	25 - 60	0.02	75.60
TF-8	09/22/95	GTI	63	4	25 - 60	0.02	74.86

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
TF-9	09/22/95	GTI	63	1.5	25 - 60	0.02	75.27
TF-9	09/22/95	GTI	63	4	25 - 60	0.02	74.47
TF-10	09/25/95	GTI	63	1.5	25 - 60	0.02	74.19
TF-10	09/25/95	GTI	63	4	25 - 60	0.02	73.61
TF-11	09/25/95	GTI	63	1.5	25 - 60	0.02	74.95
TF-11	09/25/95	GTI	63	4	25 - 60	0.02	74.40
TF-13	09/26/95	GTI	63	1.5	25 - 60	0.02	75.90
TF-13	09/26/95	GTI	63	4	25 - 60	0.02	75.47
TF-14	09/27/95	GTI	63	1.5	25 - 60	0.02	74.78
TF-14	09/27/95	GTI	63	4	25 - 60	0.02	74.35
TF-15	09/28/95	GTI	63	1.5	25 - 60	0.02	75.40
TF-15	09/28/95	GTI	63	4	25 - 60	0.02	74.78
TF-16	09/28/95	GTI	63	1.5	25 - 60	0.02	76.48
TF-16	09/28/95	GTI	63	4	25 - 60	0.02	75.89
TF-17	09/29/95	GTI	63	1.5	25 - 60	0.02	75.26
TF-17	09/29/95	GTI	63	4	25 - 60	0.02	74.88
TF-18	07/06/94	GTI	50.5	4	20 - 50	0.02	73.94
TF-19	10/03/95	GTI	63	1.5	25 - 60	0.02	75.61
TF-19	10/03/95	GTI	63	4	25 - 60	0.02	75.07
TF-20	10/03/95	GTI	63	1.5	25 - 60	0.02	75.59
TF-20	10/03/95	GTI	63	4	25 - 60	0.02	75.08
TF-21	09/29/95	GTI	63	1.5	25 - 60	0.02	75.60
TF-21	09/29/95	GTI	63	4	25 - 60	0.02	74.96
TF-22	10/02/95	GTI	63	1.5	25 - 60	0.02	74.95
TF-22	10/02/95	GTI	63	4	25 - 60	0.02	74.76
TF-23	07/05/94	GTI	50.5	4	20 - 50	0.02	75.31
TF-24[11]	09/26/95	GTI	63	1.5	25 - 60	0.02	76.35
TF-24[11]	09/26/95	GTI	63	4	25 - 60	0.02	76.43
TF-25	04/04/01	GTI	47	1.5	41 - 46	0.02	---
TF-25	04/04/01	GTI	47	4	26 - 36	0.02	74.85
TF-26	04/03/01	GTI	47	1.5	41 - 46	0.02	---
TF-26	04/03/01	GTI	47	4	26 - 36	0.02	75.85
WCW-1	02/18/92	WC	52	4	20 - 50	0.01	72.86
WCW-2	02/21/92	WC	52	4	20 - 50	0.01	75.34
WCW-3	02/19/92	WC	56.5	4	19 - 49	0.01	76.16
WCW-4	02/20/92	WC	56.5	4	20 - 50	0.01	78.05
WCW-5	04/30/92	WC	52	4	19 - 49	0.01	73.49
WCW-6	04/20/92	WC	53.5	4	20 - 50	0.01	75.52
WCW-7	04/29/92	WC	53	4	20 - 50	0.01	76.44
WCW-8	04/21/92	WC	53.5	4	20 - 50	0.01	77.34
WCW-9	04/28/92	WC	53.5	4	20 - 50	0.01	77.74

TABLE 4-4
Summary of Monitoring Well Details
DFSP Norwalk Site, Norwalk California

Well	Installation Date	Installed By	Total Depth (ft bgs)[1]	Casing Diameter (inches)	Screen Interval (ft bgs)	Slot Size (inches)	Casing Elevation (ft msl)[2]
WCW-10	09/11/92	WC	56.5	4	25 - 55	0.01	74.06
WCW-11	09/09/92	WC	61.5	4	30 - 60	0.01	75.29
WCW-12	09/08/92	WC	61.5	4	30 - 60	0.01	76.27
WCW-13	09/10/92	WC	61.5	4	30 - 60	0.01	77.70
WCW-14	08/12/98	FDGTI	59	4	24 - 59	0.01	78.81

Notes:

1. ft bgs = feet below ground surface.
2. ft msl = feet above mean sea level.
3. GMX = Geomatrix Consultants.
4. WC = Woodward-Clyde.
5. GTI = Groundwater Technology/Groundwater Technology Government Services.
6. GMW-21 is also referred to as TF-24.
7. FDGTI - Fluor Daniel GTI.
8. --- = information not available.
9. HLA = Harding Lawson Associates.
10. GW = Golden West
11. TF-24 is also referred to as "old TF-24" or "former TF-24". See also Note 6.
12. Biosparge and additional soil vapor extraction wells used for remediation purposes only are not listed here.

TABLE 4-5
Summary of Groundwater Elevations October 2012
DFSP Norwalk Site, Norwalk California

Well	Date	Top of Casing Elevation[1]	Depth to Product (feet)[2]	Depth to Water (feet)[2]	Apparent Product Thickness (feet)	Groundwater Elevation[1]
BW-1	10/15/12	73.17	---[3]	25.26	---	47.91
BW-2	10/15/12	73.57	---	25.58	---	47.99
BW-3	10/15/12	74.16	---	26.19	---	47.97
BW-4	10/15/12	74.61	---	26.93	---	47.68
BW-5	10/15/12	73.59	---	26.11	---	47.48
BW-6	10/15/12	73.48	---	26.00	---	47.48
BW-7	10/15/12	74.65	---	27.15	---	47.50
BW-8	10/15/12	75.08	---	29.61	---	45.47
BW-9	10/15/12	76.19	---	29.22	---	46.97
EXP-1	10/11/12	78.44	---	53.96	---	24.48
EXP-1	10/15/12	78.44	---	53.63	---	24.81
EXP-2	10/11/12	79.43	---	54.09	---	25.34
EXP-2	10/15/12	79.43	---	53.96	---	25.47
EXP-3	10/11/12	77.58	---	52.88	---	24.70
EXP-3	10/15/12	77.58	---	52.80	---	24.78
EXP-4	10/15/12	79.81	---	53.74	---	26.07
EXP-5	10/15/12	72.41	---	47.78	---	24.63
GMW-1	10/15/12	74.77	---	29.49	---	45.28
GMW-2	10/15/12	73.57	---	---	---	---
GMW-3	10/15/12	75.10	---	---	---	---
GMW-4	10/15/12	75.45	29.65	29.80	0.15	NC[6]
GMW-5	10/11/12	77.61	---	31.98	---	45.63
GMW-6	10/11/12	77.31	---	31.52	---	45.79
GMW-8	10/15/12	73.20	---	---	---	---
GMW-9	10/15/12	77.16	---	31.82	---	45.34
GMW-10	10/15/12	74.67	29.02	29.15	0.13	NC
GMW-11	10/15/12	72.90	---	27.05	---	45.85
GMW-12	10/11/12	75.21	---	29.27	---	45.94
GMW-13	10/15/12	74.17	---	27.89	---	46.28
GMW-14	10/15/12	74.72	---	28.91	---	45.81
GMW-15	10/11/12	76.21	---	30.47	---	45.74
GMW-16	10/11/12	77.00	---	31.32	---	45.68
GMW-17	10/11/12	74.66	---	---	---	---
GMW-19	10/11/12	76.83	---	31.09	---	45.74
GMW-21	10/11/12	76.23	---	30.32	---	45.91
GMW-22	10/15/12	77.24	---	31.05	---	46.19
GMW-23	10/15/12	74.85	---	28.45	---	46.40
GMW-24	10/15/12	77.48	---	31.34	---	46.14
GMW-25	10/15/12	78.14	---	31.88	---	46.26
GMW-26	10/15/12	74.52	---	28.40	---	46.12
GMW-27	10/15/12	74.41	---	29.05	---	45.36
GMW-28	10/15/12	74.68	---	28.50	---	46.18
GMW-29	10/15/12	77.57	---	28.41	---	49.16
GMW-30	10/15/12	74.91	---	28.40	---	46.51
GMW-31	10/11/12	76.50	---	30.87	---	45.63
GMW-32	10/11/12	74.62	---	28.69	---	45.93

TABLE 4-5
Summary of Groundwater Elevations October 2012
DFSP Norwalk Site, Norwalk California

Well	Date	Top of Casing Elevation[1]	Depth to Product (feet)[2]	Depth to Water (feet)[2]	Apparent Product Thickness (feet)	Groundwater Elevation[1]
GMW-33	10/15/12	74.88	---	27.43	---	47.45
GMW-34	10/15/12	75.25	---	27.85	---	47.40
GMW-35	10/15/12	76.12	---	28.73	---	47.39
GMW-36	10/15/12	76.66	---	32.11	---	44.55
GMW-37	10/15/12	77.32	---	30.90	---	46.42
GMW-38	10/15/12	75.47	---	29.75	---	45.72
GMW-39	10/15/12	75.05	---	29.58	---	45.47
GMW-41	10/11/12	74.46	---	28.62	---	45.84
GMW-43	10/11/12	74.44	---	29.74	---	44.70
GMW-44	10/11/12	74.45	---	28.98	---	45.47
GMW-45	10/11/12	75.67	---	29.97	---	45.70
GMW-47	10/11/12	75.98	---	30.29	---	45.69
GMW-48	10/11/12	75.03	---	28.50	---	46.53
GMW-56	10/11/12	76.52	---	30.68	---	45.84
GMW-57	10/11/12	76.66	---	30.91	---	45.75
GMW-58	10/11/12	75.48	---	28.78	---	46.70
GMW-59	10/11/12	75.28	---	28.28	---	47.00
GMW-60	10/11/12	76.24	---	30.40	---	45.84
GMW-61	10/11/12	75.60	---	29.84	---	45.76
GMW-62	10/11/12	76.34	30.18	30.67	0.49	46.08[5]
GMW-63	10/11/12	77.32	---	31.03	---	46.29
GMW-64	10/11/12	75.84	---	29.48	---	46.36
GMW-65	10/11/12	76.78	---	30.81	---	45.97
GMW-66	10/11/12	77.00	---	31.14	---	45.86
GMW-O-1	10/15/12	71.45	---	24.33	---	47.12
GMW-O-2	10/15/12	72.54	---	25.50	---	47.04
GMW-O-3	10/15/12	72.19	---	25.33	---	46.86
GMW-O-4	10/15/12	71.95	---	25.14	---	46.81
GMW-O-4 MID	10/15/12	72.24	---	32.25	---	39.99
GMW-O-5	10/15/12	72.36	---	25.68	---	46.68
GMW-O-6	10/15/12	71.41	---	23.41	---	48.00
GMW-O-7	10/15/12	70.98	---	22.83	---	48.15
GMW-O-8	10/15/12	70.91	---	22.87	---	48.04
GMW-O-9	10/15/12	73.50	---	26.74	---	46.76
GMW-O-10	10/15/12	73.98	---	28.40	---	45.58
GMW-O-11	10/15/12	74.17	---	28.12	---	46.05
GMW-O-12	10/15/12	73.49	25.44	25.48	0.04	NC
GMW-O-14	10/15/12	74.08	---	27.96	---	46.12
GMW-O-15	10/15/12	74.23	---	31.82	---	42.41
GMW-O-16	10/15/12	74.10	---	27.38	---	46.72
GMW-O-17	10/15/12	73.78	---	26.62	---	47.16
GMW-O-18	10/15/12	74.36	---	29.73	---	44.63
GMW-O-19	10/15/12	74.46	---	27.46	---	47.00
GMW-O-20	10/15/12	73.32	32.95	32.97	0.02	NC
GMW-O-21	10/15/12	71.43	---	32.50	---	38.93
GMW-O-23	10/15/12	73.63	---	26.48	---	47.15

TABLE 4-5
Summary of Groundwater Elevations October 2012
DFSP Norwalk Site, Norwalk California

Well	Date	Top of Casing Elevation[1]	Depth to Product (feet)[2]	Depth to Water (feet)[2]	Apparent Product Thickness (feet)	Groundwater Elevation[1]
GMW-O-24	10/15/12	74.39	---	27.90	---	46.49
GMW-SF-7	10/15/12	75.26	---	28.93	---	46.33
GMW-SF-8	10/15/12	76.75	---	30.21	---	46.54
GMW-SF-9	10/15/12	73.05	---	34.21	---	38.84
GMW-SF-10	10/15/12	75.77	---	29.88	---	45.89
GW-1	10/11/12	75.97	---	30.32	---	45.65
GW-2	10/11/12	75.78	---	30.06	---	45.72
GW-3	10/11/12	75.79	---	30.18	---	45.61
GW-5	10/11/12	76.99	---	31.33	---	45.66
GW-6	10/11/12	76.38	---	30.74	---	45.64
GW-7	10/11/12	75.02	---	29.44	---	45.58
GW-8	10/11/12	76.15	---	30.48	---	45.67
GW-13	10/11/12	76.85	---	31.32	---	45.53
GW-14	10/11/12	76.54	---	30.96	---	45.58
GW-15	10/11/12	74.94	---	30.17	---	44.77
GW-16	10/11/12	76.33	---	31.03	---	45.30
GWR-1	10/15/12	77.40	---	29.21	---	48.19
GWR-3	10/15/12	77.60	---	31.21	---	46.39
HL-2	10/15/12	76.94	---	30.22	---	46.72
HL-3	10/15/12	76.86	---	30.64	---	46.22
MW-6	10/15/12	77.20	---	30.91	---	46.29
MW-7	10/15/12	78.13	---	31.81	---	46.32
MW-8	10/15/12	76.06	---	29.48	---	46.58
MW-9	10/15/12	77.11	---	31.30	---	45.81
MW-10	10/11/12	79.12	---	33.42	---	45.70
MW-12	10/15/12	75.76	---	30.31	---	45.45
MW-13	10/11/12	78.25	---	32.56	---	45.69
MW-14	10/11/12	78.60	---	32.93	---	45.67
MW-15	10/15/12	76.99	31.36	32.38	1.02	NC
MW-16	10/11/12	76.87	---	30.87	---	46.00
MW-17	10/11/12	77.86	---	32.05	---	45.81
MW-18 MID	10/15/12	75.67	---	33.41	---	42.26
MW-19 MID	10/15/12	78.14	---	34.29	---	43.85
MW-20 MID	10/15/12	77.19	---	33.05	---	44.14
MW-21 MID	10/15/12	77.55	---	31.23	---	46.32
MW-22 MID	10/11/12	79.57	---	35.12	---	44.45
MW-23 MID	10/11/12	79.59	---	33.89	---	45.70
MW-24	10/11/12	78.51	---	32.90	---	45.61
MW-25	10/11/12	79.15	---	33.48	---	45.67
MW-26	10/11/12	77.40	---	31.71	---	45.69
MW-27	10/11/12	78.46	---	32.62	---	45.84
MW-29	10/11/12	79.13	---	33.29	---	45.84
MW-O-1	10/15/12	75.48	---	28.94	---	46.54
MW-O-2	10/15/12	71.90	---	26.89	---	45.01
MW-SF-1	10/15/12	78.93	---	32.23	---	46.70
MW-SF-2	10/15/12	78.53	---	32.11	---	46.42

TABLE 4-5
Summary of Groundwater Elevations October 2012
DFSP Norwalk Site, Norwalk California

Well	Date	Top of Casing Elevation[1]	Depth to Product (feet)[2]	Depth to Water (feet)[2]	Apparent Product Thickness (feet)	Groundwater Elevation[1]
MW-SF-3	10/15/12	78.12	---	32.47	---	45.65
MW-SF-4	10/15/12	79.38	---	34.04	---	45.34
MW-SF-5	10/15/12	79.74	---	33.28	---	46.46
MW-SF-6	10/15/12	76.80	---	31.44	---	45.36
MW-SF-9	10/15/12	74.10	---	---	---	---
MW-SF-10	10/15/12	76.53	---	29.27	---	47.26
MW-SF-11	10/15/12	78.56	---	33.28	---	45.28
MW-SF-12	10/15/12	78.07	---	32.12	---	45.95
MW-SF-13	10/15/12	73.40	---	27.01	---	46.39
MW-SF-14	10/15/12	78.16	---	30.02	---	48.14
MW-SF-15	10/15/12	78.27	---	33.15	---	45.12
MW-SF-16	10/15/12	78.21	---	32.47	---	45.74
PW-1	10/15/12	75.52	---	27.76	---	47.76
PW-2	10/15/12	74.71	---	---	---	---
PW-3	10/15/12	73.71	---	---	---	---
PZ-2	10/15/12	73.96	---	27.76	---	46.20
PZ-3	10/11/12	76.17	30.14	30.37	0.23	45.99
PZ-5	10/15/12	73.97	---	28.25	---	45.72
PZ-6	10/15/12	73.91	---	---	---	---
PZ-7A	10/15/12	73.87	---	27.24	---	46.63
PZ-7B	10/15/12	73.79	---	27.22	---	46.57
PZ-8A	10/15/12	75.81	---	30.01	---	45.80
PZ-8B	10/15/12	75.69	---	30.71	---	44.98
PZ-9A	10/15/12	76.14	---	30.18	---	45.96
PZ-9B	10/15/12	76.26	---	30.54	---	45.72
PZ-10	10/15/12	74.34	---	29.81	---	44.53
TF-8	10/11/12	74.86	---	29.03	---	45.83
TF-9	10/11/12	74.47	---	28.47	---	46.00
TF-10	10/11/12	73.61	---	27.52	---	46.09
TF-11	10/11/12	74.40	---	28.46	---	45.94
TF-13	10/11/12	75.47	---	---	---	---
TF-14	10/11/12	74.35	---	---	---	---
TF-15	10/11/12	74.78	---	29.73	---	45.05
TF-16	10/11/12	75.89	---	29.87	---	46.02
TF-17	10/11/12	74.88	29.00	29.09	0.09	45.87
TF-18	10/11/12	73.94	27.72	28.03	0.31	46.17
TF-19	10/11/12	75.07	---	28.85	---	46.22
TF-20	10/11/12	75.08	29.94	29.96	0.02	45.14
TF-21	10/11/12	74.96	---	28.92	---	46.04
TF-22	10/11/12	74.76	28.94	28.95	0.01	45.82
TF-23	10/11/12	75.31	29.27	29.36	0.09	46.03
TF-24	10/11/12	76.43	---	30.26	---	46.17
TF-25	10/11/12	74.85	---	29.12	---	45.73
TF-26	10/11/12	75.85	---	29.89	---	45.96
VEW-1	10/15/12	---	---	---	---	---
VEW-2	10/15/12	---	---	---	---	---

TABLE 4-5

Summary of Groundwater Elevations October 2012

DFSP Norwalk Site, Norwalk California

Well	Date	Top of Casing Elevation[1]	Depth to Product (feet)[2]	Depth to Water (feet)[2]	Apparent Product Thickness (feet)	Groundwater Elevation[1]
WCW-1	10/11/12	72.86	---	25.80	---	47.06
WCW-2	10/11/12	75.34	---	28.86	---	46.48
WCW-3	10/15/12	76.16	---	29.98	---	46.18
WCW-4	10/11/12	78.05	---	32.18	---	45.87
WCW-5	10/11/12	73.49	---	26.48	---	47.01
WCW-6	10/11/12	75.52	---	29.22	---	46.30
WCW-7	10/15/12	76.44	---	30.41	---	46.03
WCW-8	10/11/12	77.34	---	31.72	---	45.62
WCW-9	10/11/12	77.74	---	32.10	---	45.64
WCW-10	10/11/12	74.06	---	26.24	---	47.82
WCW-11	10/11/12	75.29	---	28.01	---	47.28
WCW-12	10/11/12	76.27	---	29.72	---	46.55
WCW-13	10/15/12	77.70	---	31.38	---	46.32
WCW-14	10/11/12	78.81	---	32.57	---	46.24

Notes:

1. Feet above mean sea level, based on Los Angeles County Datum, 1980.
2. Below top of casing.
3. --- = product not detected or not applicable or not calculated.
4. NA = Groundwater elevations were not calculated from depth to water measurements due to recent changes in well casing elevations. Resurveyed casing elevations are pending.
5. Groundwater elevations were corrected with respect to product thickness measured in the well by means of the following calculation:

'Groundwater Elevation = (Top of Casing Elevation - Depth to Water) + Apparent Product Thickness*0.84

6. NC = Groundwater elevations were not calculated due to the presence of measurable product in the well.

TABLE 4-6
Summary of Groundwater Analytical Results April 2013 (μg/L) [1/]
DFSP Norwalk Site, Norwalk California

Sampling Location	TPH [2/] as Gasoline	TPH as Diesel	Benzene	Toluene	Ethyl Benzene	Xylenes (total)	1,2-Dichloro-ethane (1,2-DCA)	Diisopropyl Ether (DIPE)	Ethyl-t-Butyl Ether (ETBE)	Methyl-t-Butyl Ether (MTBE)	Tert-Amyl-Methyl Ether (TAME)	Tert-Butyl Alcohol (TBA)
EXP-1	24 [3/]	42	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.155	0.25	2.5
EXP-2	24	42	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.155	0.25	2.5
EXP-3	24	42	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.155	0.25	2.5
EXP-4	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
EXP-5	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-1	125	**470**	**2.8**	0.65	0.65	0.65	1.25	1.25	1.25	0.65	1.25	12.5
GMW-10	**14000**	**100000**	**210**	**65**	**48**	**310**	5	5	5	2.5	5	50
GMW-12	-- [/4]	**650**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-13	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-14	12.5	**110**	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-15	--	**6200**	0.07	0.12	0.07	--	0.12	0.165	0.22	**1.1**	0.11	2.3
GMW-16	--	**190**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-17	**1000**	**6700**	**55**	**1.1**	**1.2**	--	0.12	0.165	0.22	0.155	0.11	**31**
GMW-19	--	**1200**	**35**	**0.38**	0.07	--	0.12	0.165	0.22	**58**	0.11	**22**
GMW-27	25	12.5	0.125	0.125	0.125	0.125	0.25	**7.8**	0.25	**0.57**	0.25	**380**
GMW-3	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-31	--	**120**	0.07	0.12	0.07	--	0.12	0.165	0.22	**0.67**	0.11	2.3
GMW-32	--	**1300**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-36	**560000**	**19000**	**7400**	**20000**	**8900**	**50000**	100	100	100	**270**	100	1000
GMW-37	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-38	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-39	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	**0.88**	0.25	**54**
GMW-4	**2100**	**8000**	**56**	1	1	1	2	2	2	1	2	20
GMW-41	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-43	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-44	--	**100**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-45	--	**3400**	**24**	0.12	**1.4**	--	0.12	0.165	0.22	0.155	0.11	**13**
GMW-47	--	**1500**	0.07	0.12	0.07	--	0.12	0.165	0.22	**5.4**	0.11	**150**
GMW-57	--	**180**	0.07	0.12	0.07	--	0.12	0.165	0.22	**0.54**	0.11	2.3
GMW-58	--	**1600**	**6.7**	0.12	0.07	--	0.12	0.165	0.22	**0.46**	0.11	**25**
GMW-58	--	**1600**	**6.7**	0.12	0.07	--	0.12	0.165	0.22	**0.46**	0.11	**25**
GMW-59	**2500**	**8200**	**680**	0.6	**2.2**	--	0.6	0.85	1.1	**6.6**	0.55	11.5
GMW-6	--	**110**	0.07	0.12	0.07	--	0.12	0.165	0.22	**0.44**	0.11	2.3
GMW-60	**1000**	**3200**	**61**	0.12	**1.6**	--	0.12	0.165	0.22	0.155	0.11	**460**
GMW-61	24	**340**	**0.43**	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	**60**
GMW-63	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-64	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-65	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
GMW-66	--	**130**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3

TABLE 4-6

Summary of Groundwater Analytical Results April 2013 (μg/L) [1/]

DFSP Norwalk Site, Norwalk California

Sampling Location	TPH [2/] as Gasoline	TPH as Diesel	Benzene	Toluene	Ethyl Benzene	Xylenes (total)	1,2-Dichloro-ethane (1,2-DCA)	Diisopropyl Ether (DIPE)	Ethyl-t-Butyl Ether (ETBE)	Methyl-t-Butyl Ether (MTBE)	Tert-Amyl-Methyl Ether (TAME)	Tert-Butyl Alcohol (TBA)
GMW-8	12.5	12.5	0.125	0.125	0.125	0.125	**1.4**	0.25	0.25	**0.59**	0.25	2.5
GMW-O-1	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-10	**110**	12.5	**0.54**	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-12	**34000**	**160000**	**13000**	25	25	25	50	50	50	25	50	500
GMW-O-14	**27000**	**3700**	**6900**	**200**	**1800**	**2300**	**61**	**180**	12.5	6.5	12.5	125
GMW-O-15	**460**	**110**	**89**	**2.3**	**4.6**	**5.5**	0.25	0.25	0.25	**36**	0.25	**3600**
GMW-O-16	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-17	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	**26**
GMW-O-18	25	**58**	0.125	**0.51**	0.125	**0.53**	0.25	0.25	0.25	0.125	0.25	**4000**
GMW-O-19	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-2	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-24	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	**4.2**	0.25	2.5
GMW-O-3	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-4	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-5	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-O-9	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-SF-7	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GMW-SF-8	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
GW-13	24	42	0.07	0.12	0.07	--	**9.1**	**2**	0.22	**1.7**	0.11	**19**
GW-14	**1800**	**4800**	**30**	0.12	**8.2**	--	0.12	0.165	0.22	**13**	**0.82**	**10**
GW-2	24	42	0.07	0.12	0.07	--	**11**	**0.46**	0.22	**1.2**	0.11	2.3
GW-2	24	42	0.07	0.12	0.07	--	**11**	**0.46**	0.22	**1.2**	0.11	2.3
GW-3	--	**120**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	**9.6**
GW-3	--	**120**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	**9.6**
GW-6	--	**130**	0.07	0.12	0.07	--	0.12	0.165	0.22	**0.68**	0.11	2.3
GW-6	--	**130**	0.07	0.12	0.07	--	0.12	0.165	0.22	**0.68**	0.11	2.3
GWR-1	125	**330**	0.65	0.65	0.65	0.65	1.25	**13**	1.25	**9.1**	1.25	**68**
HL-2	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
HL-3	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
MW-12	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
MW-13	--	**140**	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
MW-14	--	**120**	0.07	0.12	0.07	--	**12**	**2.4**	0.22	**1.4**	0.11	2.3
MW-15	**890**	**240000**	0.25	0.25	0.25	0.25	0.5	0.5	0.5	0.25	0.5	5
MW-16	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
MW-17	--	42	0.07	0.12	0.07	--	0.12	0.165	0.22	0.155	0.11	2.3
MW-19 MID	**55**	12.5	0.125	0.125	0.125	0.125	**9.2**	**31**	0.25	**2**	0.25	**330**
MW-20 MID	12.5	12.5	0.125	0.125	0.125	0.125	**14**	**6.7**	0.25	**9.8**	0.25	2.5
MW-21 MID	50	**61**	0.25	0.25	0.25	0.25	**2.4**	**3.3**	0.5	0.25	0.5	**22**
MW-22 MID	--	**250**	0.07	0.12	0.07	--	**7**	**1.1**	0.22	**11**	0.11	**14**

TABLE 4-6
Summary of Groundwater Analytical Results April 2013 (μg/L) [1/]
DFSP Norwalk Site, Norwalk California

Sampling Location	TPH [2/] as Gasoline	TPH as Diesel	Benzene	Toluene	Ethyl Benzene	Xylenes (total)	1,2-Dichloro-ethane (1,2-DCA)	Diisopropyl Ether (DIPE)	Ethyl-t-Butyl Ether (ETBE)	Methyl-t-Butyl Ether (MTBE)	Tert-Amyl-Methyl Ether (TAME)	Tert-Butyl Alcohol (TBA)
MW-23 MID	--	**4800**	0.07	0.12	0.07	--	0.12	0.165	0.22	**2.9**	0.11	**13**
MW-24	--	**150**	0.07	0.12	0.07	--	0.12	0.165	0.22	**0.87**	0.11	2.3
MW-25	--	42	0.07	0.12	0.07	--	**3.6**	0.165	0.22	**0.49**	0.11	2.3
MW-26	--	**990**	**2**	**0.36**	**1.5**	--	0.12	0.165	0.22	**0.74**	0.11	2.3
MW-27	--	**310**	0.07	0.12	0.07	--	0.12	0.165	0.22	**3.8**	0.11	**23**
MW-29	--	**2200**	0.07	0.12	**0.64**	--	0.12	0.165	0.22	0.155	0.11	2.3
MW-6	12.5	12.5	0.125	0.125	0.125	0.125	**0.7**	0.25	0.25	0.125	0.25	2.5
MW-7	12.5	12.5	0.125	0.125	0.125	0.125	**1.3**	0.25	0.25	0.125	0.25	2.5
MW-8	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
MW-9	**870**	**4400**	**4.8**	0.65	0.65	0.65	1.25	1.25	1.25	**4.5**	1.25	12.5
MW-O-2	**10000**	**7000**	**5400**	10	**91**	**200**	20	20	20	**190**	20	200
MW-SF-9	**2300**	**4500**	**680**	**25**	**52**	**190**	2.5	**40**	2.5	**20**	2.5	25
PW-3	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
PZ-2	**210**	**940**	**9.9**	0.25	**13**	0.25	0.5	0.5	0.5	0.25	0.5	5
PZ-5	**10000**	**2300**	**4100**	**37**	**300**	**140**	10	10	10	**4800**	10	**83000**
TF-16	**1200**	**2500**	**180**	0.12	**1.5**	--	0.12	0.165	0.22	**4.8**	0.11	**6**
TF-21	**590**	**2700**	**130**	0.12	**0.5**	--	0.12	0.165	0.22	**4.1**	0.11	**13**
WCW-12	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-13	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-14	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-2	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-3	12.5	12.5	0.125	0.125	0.125	0.125	**4.1**	0.25	0.25	0.125	0.25	2.5
WCW-4	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-5	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-6	12.5	12.5	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.125	0.25	2.5
WCW-7	12.5	12.5	0.125	0.125	0.125	0.125	**19**	**1.3**	0.25	**0.61**	0.25	2.5
WCW-8	25	12.5	0.125	0.125	0.125	0.125	0.25	0.25	0.25	0.125	0.25	2.5

Notes:

[1/] all results in micrograms per liter (μg/L)

[2/] TPH = Total Petroleum Hydrocarbons

[3/] All non-detects are reported at one-half of the method detection limit for use in the EVS modeling program.

[4/] -- = Not analyzed

TABLE 5-1
Remediation Objectives, Goals, and Performance Metrics
DFSP Norwalk, Norwalk, California

Obj #	Identify Concerns and Set Remedial Objective		Set Remediation Goals for Each Objective	Set Performance/Remediation Metrics for the Remediation Goal
	Concern	Objective	Goals	Metrics
1	**Reduce LNAPL Saturation.** LNAPL is present in monitoring wells and above residual saturations. Testing of LNAPL in soil cores indicates that LNAPL saturations are sufficiently low so that it is not mobile. LNAPL recovery (bail-down) testing, ref. Section 4.3.4, for wells with LNAPL indicates low transmissivity values (≤ 0.1 ft^2/day) indicates LNAPL is near the range of non-recoverable.	1. Reduce LNAPL saturation until it is no longer above residual saturation or measureable in monitoring wells.	Recover LNAPL mass to the maximum extent practicable using existing wells and to remove volatile fractions of LNAPL using in situ technology and periodic or batch-phase bioslurrping.	Limited or infrequent LNAPL thickness measured in wells. Transmissivity < 0.2 ft^2/d and LNAPL/water ratio is steadily decreasing.
2	**Change LNAPL Phase.** LNAPL is source of the dissolved-phase plume of hydrocarbon constituents (TPH_d, BTEX, and TPH_{jf}) in vadose zone and groundwater that exceed concentrations set by the RWQCB Basin Plan objectives and California Code of Regulations (CCR) Title 22 drinking water standards (Section 4.3.3).	1. Change the phase of LNAPL composition and further reduce LNAPL saturation so that the dissolved-phase plume of hydrocarbon constituents is stable or shrinking and decreasing over time.	Remove volatile fractions of LNAPL using in situ technology (phase-change technology).	Concentrations of dissolved-phase hydrocarbon COCs in groundwater and vapor-phase hydrocarbon constituents in the vadose zone do not pose a threat to human health without the use of active remediation system(s).
3	**Remove Dissolved-Phase Plume.** Dissolved-phase hydrocarbon constituents exceed concentrations set by RWQCB Basin Plan objectives and CCR Title 22 drinking water standards.	1. Remove the plume of dissolved-phase hydrocarbons until Remediation Objectives No. 1 and No. 2 have addressed Concerns No. 1 and No. 2, and then reduce concentrations within the dissolved-phase plume until NSZD can continue to reduce the plume over time.	Remediate dissolved-phase COCs by excavation and in-situ treatment method(s) until the concentrations within the dissolved-phase plume are below dissolved phase cleanup criteria and the plume is shrinking.	Concentrations of dissolved-phase hydrocarbon constituents of concern meet NSZD or cleanup criteria.
4	**Future Site Commercial Use.** In the future, the site will be redeveloped into commercial and light industrial areas and the park to the east of the site will be expanded to cover part of the eastern portion of the site. Thus, future human receptors at the site include construction workers (i.e., to redevelop the site), commercial / industrial workers, and park visitors.	1. Reduce COC concentrations to regulatory levels before future new land use begins.	Remediate dissolved-phase COCs by excavation and in-situ treatment method(s) until the concentrations within the dissolved-phase plume are below dissolved phase cleanup criteria and the plume is shrinking.	Concentrations of dissolved-phase hydrocarbon constituents of concern meet NSZD or cleanup criteria.
		2. Reduce potential for long-term contact with residual COC impacts and allow commercial redevelopment.	Remove presence of COCs to dissolved and gas-phase cleanup levels within shallow vadose zone soils.	Provide a minimum buffer of 10 ft. (via excavation) between land-surface commercial operations and any potentially remaining impacts below ground.
		3. Achieve objectives within 3 to 5 year timeframe for commercial development purposes.	Install tested and proven in-situ technology to actively remove COCs or oxidize existing COCs to non-hazardous byproducts.	Final solution is needed in time to sell and transfer ownership over to a new property owner / developer.

TABLE 5-1
Remediation Objectives, Goals, and Performance Metrics
DFSP Norwalk, Norwalk, California

Obj #	Identify Concerns and Set Remedial Objective		Set Remediation Goals for Each Objective	Set Performance/Remediation Metrics for the Remediation Goal
	Concern	Objective	Goals	Metrics
5	**Vertical VOC Migration in Soils and Resulting Exposure.** VOCs can migrate upwards through the soil column until, eventually, they are released into either outdoor air or into overlying buildings. Human receptors at the site may then breathe in those volatiles.	Minimize or eliminate exposure to human receptors.	Remove or oxidize shallow soil VOCs to below cleanup levels, and if necessary, develop measures or controls to eliminate or bypass pathway for human exposure.	Concentrations of dissolved-phase hydrocarbon constituents of concern meet NSZD or cleanup criteria.
6	**Vertical VOC Migration and Emission.** VOCs in groundwater and soils at the site may be emitted to outdoor air which then may migrate to the park and nearby residences, where the receptors there may be exposed.	Same Objective as Objective for no. 5.	Remove or oxidize shallow soil VOCs to below cleanup levels, and if necessary, develop measures or controls to eliminate or bypass pathway for human exposure.	Concentrations of dissolved-phase hydrocarbon constituents of concern meet NSZD or cleanup criteria.
7	The northeastern groundwater plume at the site has migrated offsite to the east underneath Holifield Park. There, the contaminants may migrate upwards and be released to ambient air in the park where the park users may be exposed via inhalation.	Minimize or eliminate exposure to human receptors.	Excavate, remove, or oxidize shallow soil VOCs to below cleanup levels, and if necessary, develop measures or controls to eliminate or bypass pathway for human exposure.	Concentrations of dissolved-phase hydrocarbon constituents of concern meet NSZD or cleanup criteria.
8	**Upper Zone Groundwater Used as Drinking Water.** If groundwater is used as a drinking water source, human receptors may also be exposed via the potable uses of water; i.e., drinking water ingestion, dermal contact during showering/bathing, and inhalation of volatiles emitted during showering or other domestic uses of water.	Upper groundwater zone has beneficial use; however, not designated as drinking water source zone.	Remove or oxidize shallow soil VOCs to below cleanup levels, and if necessary, develop measures or controls to eliminate or bypass pathway for human exposure.	Reduce, minimize, or eliminate vertical VOC migration pathway.

TABLE 5-2
Soil Cleanup Goals
DFSP Norwalk Site, Norwalk California

	(feet below ground surface)					
Depth Below Ground Surface	**0.5**	**5**	**10**	**15**	**20**	**25**
Depth to Groundwater	**25.5**	**21**	**16**	**11**	**6**	**1**
Constituent	**Soil Cleanup Goal (mg/kg)**					
TPH as Gasoline (C4-C12)	500	500	100	100	100	100
TPH as JP-5 (C8-C17)	500	500	100	100	100	100
TPH as Diesel (C5-C25)	1,000	1,000	100	100	100	100
Benzene	0.015	0.013	0.012	0.013	0.011	0.012
Toluene	0.614	0.440	0.391	0.423	0.356	0.367
Ethylbenzene	2.07	1.44	1.19	1.33	1.07	1.10
Xylenes	5.55	3.77	3.09	3.47	2.76	2.84
1,1,2,2-Tetrachloroethane	0.0023	0.0020	0.0015	0.0012	0.0006	0.0002
1,1,2-Trichloroethane	0.0032	0.0029	0.0023	0.0020	0.0012	0.0008
1,2,3-Trichlorobenzene	0.0740	0.0634	0.0467	0.0356	0.0162	0.0034
1,2,3-Trichloropropane	8.74E-07	7.66E-07	5.87E-07	4.79E-07	2.56E-07	1.23E-07
1,2,4-Trimethylbenzene	2.10	1.80	1.34	1.03	0.478	0.120
1,2-Dibromo-3-chloropropane	2.50E-04	2.19E-04	1.68E-04	1.37E-04	7.31E-05	3.52E-05
1,2-Dibromoethane	3.05E-06	2.78E-06	2.27E-06	2.04E-06	1.30E-06	9.60E-07
1,2-Dichloroethane	1.06E-04	1.04E-04	9.37E-05	9.60E-05	7.29E-05	6.92E-05
1,3,5-Trimethylbenzene	2.06	1.77	1.31	1.01	0.470	0.118
2-Butanone	0.557	0.607	0.617	0.713	0.612	0.661
2-Chlorotoluene	0.558	0.481	0.358	0.278	0.132	0.039
2-Hexanone	0.0073	0.0072	0.0065	0.0066	0.0050	0.0047
4-Chlorotoluene	0.547	0.472	0.351	0.273	0.130	0.038
Acetone	0.994	1.17	1.28	1.57	1.42	1.60
Bromomethane	0.0015	0.0014	0.0013	0.0013	0.0010	0.0010
Carbon disulfide	0.049	0.046	0.039	0.038	0.026	0.023
Chlorobenzene	0.119	0.104	0.079	0.063	0.032	0.013
Chloroethane (Ethyl Chloride)	2.23	2.47	2.55	2.98	2.59	2.83
Chloroform	7.38E-05	6.82E-05	5.67E-05	5.25E-05	3.48E-05	2.75E-05
Dichlorodifluoromethane	0.984	0.868	0.672	0.559	0.309	0.167
Diisopropyl Ether (DIPE)	0.449	0.424	0.364	0.350	0.246	0.212
Isopropylbenzene	5.56	4.78	3.53	2.71	1.26	0.303
Methylene Chloride	7.78E-04	7.99E-04	7.61E-04	8.27E-04	6.69E-04	6.82E-04
Methyl-t-Butyl Ether (MTBE)	9.07E-04	9.10E-04	8.43E-04	8.89E-04	6.97E-04	6.86E-04
Naphthalene	0.270	0.231	0.170	0.130	0.059	0.012
n-Butylbenzene	3.97	3.40	2.50	1.91	0.867	0.179
n-Propylbenzene	2.18	1.87	1.39	1.06	0.489	0.114
p-Isopropyltoluene	2.82	2.42	1.79	1.37	0.636	0.154
sec-Butylbenzene	2.59	2.22	1.64	1.26	0.576	0.129
Styrene	0.463	0.399	0.296	0.229	0.108	0.030
Tert-Butyl Alcohol (TBA)	0.0010	0.0012	0.0013	0.0016	0.0014	0.0016
tert-Butylbenzene	2.07	1.78	1.32	1.01	0.465	0.110
Trichloroethene	0.0070	0.0061	0.0047	0.0038	0.0020	0.0009

Notes:
mg/kg = milligram per kilogram
NA = not applicable

TABLE 5-3
Commercial Worker Soil Gas Screening Levels
DFSP Norwalk Site, Norwalk California

Chemical	5 ft bgs Carcinogen ($\mu g/m^3$)	5 ft bgs Noncarcinogen ($\mu g/m^3$)	5 ft bgs Minimum ($\mu g/m^3$)	5 ft bgs Minimum (μg/L)	15 ft bgs Carcinogen ($\mu g/m^3$)	15 ft bgs Noncarcinogen ($\mu g/m^3$)	15 ft bgs Minimum ($\mu g/m^3$)	15 ft bgs Minimum (μg/L)
1,2,4-Trimethylbenzene	-	8.11E+04	8.11E+04	8.11E+01	-	1.78E+05	1.78E+05	1.78E+02
1,2-Dichlorobenzene	-	2.17E+06	2.17E+06	2.17E+03	-	4.60E+06	4.60E+06	4.60E+03
1,2-Dichloroethane	1.20E+03	6.29E+04	1.20E+03	1.20E+00	2.27E+03	1.19E+05	2.27E+03	2.27E+00
1,3,5-Trimethylbenzene	-	8.14E+04	8.14E+04	8.14E+01	-	1.79E+05	1.79E+05	1.79E+02
1,3-Dichlorobenzene	-	3.78E+04	3.78E+04	3.78E+01	-	8.03E+04	8.03E+04	8.03E+01
1,4-Dichlorobenzene	2.76E+03	8.66E+06	2.76E+03	2.76E+00	5.85E+03	1.84E+07	5.85E+03	5.85E+00
2-Butanone (methyl ethyl ketone)	-	5.01E+07	5.01E+07	5.01E+04	-	1.02E+08	1.02E+11	1.02E+08
2-Hexanone	-	3.21E+05	3.21E+05	3.21E+02	-	6.79E+05	6.79E+05	6.79E+02
Acetone	-	2.59E+08	2.59E+08	2.59E+05	-	4.68E+08	4.68E+08	4.68E+05
Benzene	9.31E+02	2.89E+05	9.31E+02	9.31E-01	1.85E+03	5.76E+05	1.85E+03	1.85E+00
Bromodichloromethane	1.37E+03	1.26E+06	1.37E+03	1.37E+00	3.50E+03	3.24E+06	3.50E+03	3.50E+00
c-1,2-Dichloroethene	-	6.29E+05	6.29E+05	6.29E+02	-	1.31E+06	1.31E+06	1.31E+03
Carbon disulfide	-	6.29E+06	6.29E+06	6.29E+03	-	1.19E+07	1.19E+07	1.19E+04
Carbon tetrachloride	6.80E+02	1.02E+06	6.80E+02	6.80E-01	1.40E+03	2.10E+06	1.40E+03	1.40E+00
Chloroform	4.75E+03	8.77E+05	4.75E+03	4.75E+00	9.01E+03	1.67E+06	9.01E+03	9.01E+00
Chloromethane	-	7.51E+05	7.51E+05	7.51E+02	-	1.35E+06	1.35E+06	1.35E+03
Dichlorodifluoromethane (Freon 12)	-	1.10E+06	1.10E+06	1.10E+03	-	2.37E+06	2.37E+06	2.37E+03
Ethylbenzene	1.16E+04	1.04E+07	1.16E+04	1.16E+01	2.42E+04	2.16E+07	2.42E+04	2.42E+01
Methylene chloride	2.55E+04	5.45E+06	2.55E+04	2.55E+01	4.87E+04	1.04E+07	4.87E+04	4.87E+01
o-Xylene	-	9.69E+05	9.69E+05	9.69E+02	-	1.93E+06	1.93E+06	1.93E+03
p/m-Xylene	-	1.03E+06	1.03E+06	1.03E+03	-	2.12E+06	2.12E+06	2.12E+03
Tert-Butyl Alcohol (TBA)	-	2.90E+08	2.90E+08	2.90E+05	-	5.79E+08	5.79E+08	5.79E+05
Tetrachloroethene (PCE)	5.03E+03	2.88E+06	5.03E+03	5.03E+00	1.06E+04	6.04E+06	1.06E+04	1.06E+01
Toluene	-	4.85E+07	4.85E+07	4.85E+04	-	9.67E+07	9.67E+07	9.67E+04
Trichloroethene	1.42E+04	2.03E+04	1.42E+04	1.42E+01	2.91E+04	4.15E+04	2.91E+04	2.91E+01
Vinyl acetate	-	1.96E+06	1.96E+06	1.96E+03	-	3.93E+06	3.93E+06	3.93E+03

Notes:

ft bgs = feet below ground surface

$\mu g/m^3$ = micrograms per cubic meter

μg/L = micrograms per liter

TABLE 6-1
Remediation Technology Description and Preliminary Screening
DFSP Norwalk Site, Norwalk California

Remedial Technology[1]		Technology Description	Evaluated for Purpose of Meeting Remedial Objective	Comment
1	Excavation	LNAPL body is physically removed and properly treated or disposed (LNAPL mass recovery).	Yes	To minimize/eliminate human exposure, excavation of top 10-ft bgs in impacted areas where soil cleanup criteria are exceeded.
2	Physical or hydraulic containment (barrier wall, French drain, slurry wall, wells, trenches)	Subsurface barrier is constructed to prevent or impede LNAPL migration (LNAPL mass control).	Yes	Based on the projected timeframe and forecast endpoint of 3 to 5 years, this technology would not assist in reaching site objectives and goals including cleanup goals. However, a treatment barrier and/or horizontal gas collection barrier may serve as a secondary "defense" for site areas where human receptors would have a higher likelyhood of exposure and would be considered.
3	In situ soil mixing	LNAPL body is physically/chemically bound within a stabilized mass to reduce mobility (LNAPL mass control).	Yes	BIOX or similar ISCO material considered for placement at bottom and sides of excavation, which would provide a near-perfect opportunity for this application.
4	Natural source zone depletion (NSZD)	LNAPL constituents are naturally depleted from the LNAPL body over time by volatilization, dissolution, absorption and, degradation (LNAPL phase-change remediation).	Yes	---
5	Air sparging (including biosparging option)/ soil vapor extraction (AS/SVE)	AS injects air into LNAPL body to volatilize LNAPL constituents, and vapors are vacuum extracted. AS or SVE can also be used individually if conditions are appropriate (LNAPL phase-change remediation).	Yes[2]	Although SVE has worked effectively from 1996 through ~2008 to assist with the bulk removal of VOCs and volatile portion of TPH, the existing SVE system has reached an asymptotic removal level and mostly serves to contain the dissolved/gas phase. Because the site does not have an impermeable cap layer or equivalent, SVE has a tendency to short circuit. Additionally, USEPA suggests AS not be used if free product exists (i.e., free product must be removed prior to air sparging), which may increase potential for inducing migration of constituents. Stratified soils may cause air sparging to be ineffective.
6	LNAPL skimming	LNAPL is hydraulically recovered from the top of the groundwater column within a well (LNAPL mass recovery).	No	With reference to Section 4.3, the effective site transmissivity is ≤ 0.2 ft^2/day is essentially deemed as non-recoverable by this technology.
7	Bioslurping/enhanced fluid recovery (EFR)	LNAPL is remediated via a combination of vacuum-enhanced recovery and bioventing processes (LNAPL mass recovery).	Yes	---
8	Dual-pump liquid extraction (DPLE)	LNAPL is hydraulically recovered by using two pumps simultaneously to remove LNAPL and groundwater (LNAPL mass recovery).	No	LNAPL transmissivity (as referenced in comment no. 6) and elevated viscosities of typical diesel (THPd) and JP-5 jet fuel (TPHjf) are generally much greater than 6 centipoise; this generally results in limited recoverability of LNAPL for the site. Additionally, this technology would require a much larger scale pump & treat and ex-situ wastewater treatment system and discharge of treated groundwater. The projected timeframe for this technology would be greater than five years.
9 and 10	Multiphase extraction (MPE) (single or dual pump) with SVE	LNAPL and groundwater are removed through the use of one or two dedicated pumps. Vacuum enhancement is typically added to increase LNAPL hydraulic recovery rates (LNAPL mass recovery).	No	Reference explanation provided in comment no. 8.

TABLE 6-1
Remediation Technology Description and Preliminary Screening
DFSP Norwalk Site, Norwalk California

	Remedial Technology[1]	Technology Description	Evaluated for Purpose of Meeting Remedial Objective	Comment
11	Water flooding (including hot water flooding)	Water is injected to enhance the hydraulic LNAPL gradient toward recovery wells. Hot water may be injected to reduce interfacial tension and viscosity of the LNAPL and further enhance LNAPL removal by hydraulic recovery (LNAPL mass recovery).	No	Water-handling equipment to inject, extract, and treat; water-heating equipment, if used, has additional risks. Need to potentially treat water source prior to injection. Water-heating equipment would be needed, which increases energy use; significant scaling of exchangers/heating system would require significant maintenance. Continuous injection and circulation of water, high operation and maintenance costs, heating the water prior to reinjection further increase cost over a relatively short time period.
12	In situ chemical oxidation (ISCO)	LNAPL is depleted by accelerating LNAPL solubilization by the addition of a chemical oxidant into the LNAPL zone (LNAPL phase-change remediation).	Yes	---
13	Surfactant-enhanced subsurface remediation (SESR)	A surfactant is injected that increases LNAPL solubilization and LNAPL mobility. The dissolved phase and LNAPL are then recovered via hydraulic recovery (LNAPL phase-change remediation and LNAPL mass recovery).	No	The success rate is higher for very small areas. Extensive ex-situ treatment required. Implementation experienced at other similar sites indicates a very limited success rate.
14	Co-solvent flushing	A solvent is injected that increases LNAPL solubilization and LNAPL mobility. The dissolved phase and LNAPL are then recovered via hydraulic recovery (LNAPL phase-change remediation and LNAPL mass recovery).	No	The success rate is typically higher for very small areas. LNAPL must be swept by infiltrating or injecting the cosolvent and extracting simultaneously downgradient to maintain hydraulic control, which increases the complexity of the application. TPH and COC extraction from the solvent requires extensive ex-situ treatment and handling. Additionally, the discharge would require a temporary industrial wastewater permit and/or deep well injection registration under the IUC program.
15	Steam/hot-air injection	LNAPL is removed by forcing steam into the aquifer to vaporize, solubilize, and induce LNAPL flow. Vapors, dissolved phase, and LNAPL are recovered via vapor extraction and hydraulic recovery (LNAPL phase-change remediation and LNAPL mass recovery).	No	Preferance is not to induce a phase change. Effective for volatilization and recapture of benzene; however, would potentially cause more dispersion of TPH due to low volatility. Energy, capital, ex-situ process/treatment, on-site team, and process controls are extensive.
16	Radio-frequency heating	Electromagnetic energy is used to heat soil and groundwater to reduce the viscosity and interfacial tension of LNAPL for enhanced hydraulic recovery. Vapors and dissolved phase may also be recovered via vapor extraction and hydraulic recovery (LNAPL phase-change remediation and LNAPL mass recovery).	No	Preferance is not to induce a phase change. Higher-viscosity and/or-lower volatility LNAPL (such as TPH_d and TPH_{jf}) take longer to treat and/or achieve less remedialeffectiveness. Although effective in locations with sand lenses that provide a layer through which fluid flow can occur, it has potentially high operation and maintenance costs to keep the system operational. More difficult to implement on larger sites.
17	Three- and six-phase electrical resistance heating	Electrical energy is used to heat soil and groundwater to vaporize volatile LNAPL constituents and reduce the viscosity and interfacial tension of LNAPL for enhanced hydraulic recovery. Vapors and dissolved phase may also be recovered via vapor extraction and hydraulic recovery (LNAPL phase-change remediation and LNAPL mass recovery).	No	Preferance is not to induce a phase change. Although a very short duration, e.g., 90 to 180 days operation to completion, capital and electrical operation costs are very high.

Notes:

1 From Interstate Technology & Regulatory Council (ITRC). 2009b. Evaluating LNAPL Remedial Technologies for Achieving Project Goals, LNAPL-2. Washington, D.C.: Interstate Technology & Regulatory Council, LNAPLs Team. www.itrcweb.org.

2 It is understood that SFPP will be conducting a pilot study onsite at their areas of impact to determine the effectiveness of AS coupled with SVE and will share the results with DLA Energy. Based on the test results, the effectiveness of this approach will be assessed for use on the DFSP Norwalk site.

--- No Comment

TABLE 6-2
Screened Technologies Assessment Retained and Not-Retained for Further Evaluation
DFSP Norwalk Site, Norwalk California

No.	Technology	Technology Description	Advantages	Disadvantages	Applicable Geology (fine coarse)[1]	Applicable to Unsaturated Zone, Saturated Zone[2]	Applicable Type of LNAPL[3]	Potential Timeframe	Effectiveness	Cost	Implementability	Third-Party Impacts	Retained/ Not Retained
1	Excavation	Targeted areas with shallow impacted soils > cleanup goals is removed from the surface down to 10-ft bgs via excavation.	100% removal time frame; with clean backfill, unquestionably and directly addresses human health exposure.	Cost, 3rd party off-site waste disposal or recycle; depth limited to 10-ft bgs.	F, C	U	LV, LS, HV, HS	Very short	High; treats mobile, diffused, and residual LNAPL	Expensive; need to manage impacted soils off-site for disposal or recycle.	No concerns	Odor/dust control; noise; worker exposure to BTEX emissions; off-site management and transport	Retained
2	Physical or hydraulic containment (barrier wall)	Aerobic vapor migration barrier (beneath future buildings to attenuate vapor migration)	Actively manages / treats any methane or VOC residual gas concentrations below future buildings.	Requires process redundancy and long-term operation & maintenance	F, C	U	LV, LS, HV, HS	Continuous, long or short-term	High; treats methane and/or BTEX residual in subslab air stream	Medium	Only if needed, based on soil-gas testing / monitoring	Vapor intrusion management	Retained
3	In situ soil mixing	Mechanical mixing of soil materials with chemical oxidants or electron acceptors, such as BIOX, at bottom of impacted soil excavation.	Oxidant can be dispersed across the impacted area of the excavation bottom and initiate rapid penetration and oxidation TPH components.	Personal protective safety measures must be utilized during deployment	F, C	U, S	LV, LS, HV, HS	Very short	High; destroys a wide variety of organic contaminants at near neutral pH and at ambient groundwater temperatures.	Medium	Requires WDR and proper PPE for deployment	Little to none	Retained
4	Natural source zone depletion (NSZD)	LNAPL constituents are naturally depleted from the LNAPL body over time by volatilization, dissolution, absorption and, degradation (LNAPL phase-change remediation).	No disruption, implementable, low carbon footprint	Timeframe, long-term monitoring required, containment, perception of no action by public	F, C	U + S	HV, HS	Very long	Low	Low cost; however, long-term monitoring is typically needed	No concerns	None, but public perception of no action	Retained

TABLE 6-2
Screened Technologies Assessment Retained and Not-Retained for Further Evaluation
DFSP Norwalk Site, Norwalk California

No.	Technology	Technology Description	Advantages	Disadvantages	Applicable Geology (fine coarse)[1]	Applicable to Unsaturated Zone, Saturated Zone[2]	Applicable Type of LNAPL[3]	Potential Timeframe	Effectiveness	Cost	Implementability	Third-Party Impacts	Retained/ Not Retained
5	Air sparging (including biosparging option)/ soil vapor extraction (AS/SVE)	AS injects air into LNAPL body to volatilize LNAPL constituents, and vapors are vacuum extracted. AS or SVE can also be used individually if conditions are appropriate (LNAPL phase-change remediation).	Proven implementable, treats residual LNAPL, better suited for more volatile LNAPLs but also enhances biodegradation of heavier-end hydrocarbons, some vapor recovery / treatment already in place	Does not treat effectively in low permeability soils, homogeneity, accessibility for closely spaced vertical wells, off-gas vapor management	C	U + S	HV, HS	Short to medium	High; proven technology, treats residual LNAPL, enhances biodegradation	Expensive; medium to large energy requirements	Access constraints; limited access to target area for drilling and conveyance lines if using vertical wells; access improves using horizontal approach, hydraulic containment and SVE required until remediation goals are met	Noise, vapor intrusion management, site access, temporary utilities	Retained
7	Bioslurping / enhanced fluid recovery (EFR)[4]	LNAPL is remediated via a combination of vacuum-enhanced recovery and bioventing processes (LNAPL mass recovery).	Proven implementable, residual LNAPL recovery, and vapor control	Timeframe, limited to mobile LNAPL, limited ROI, vapor and fluids treatment required	F, C	U + S	LV, LS, HV, HS	Very long	Low; limited to mobile LNAPL	Low cost; treatment and disposal of extracted groundwater at existing GWTS.	No concerns	Waste stream management	Retained
12	In situ chemical oxidation (ISCO)	ISCO involves injecting an oxidant (activated persulfate) to react with and destroy organic compounds. Treatment of LNAPL sites using ISCO focuses on treatment of the dissolved plume, soils, and LNAPL; oxidation reactions occur in the dissolved phase.	Timeframe, source removal, treats residual LNAPL	Rate-limited hydraulic control required, by-products, cost, vapor generation, rebound, accessibility for closely spaced vertical wells, or temporary injection probes	F, C	U + S	HV, HS	Very short to short	High; proven technology, treats residual LNAPL and dissolved phase	Expensive; oxidant costs, temporary injection points and/or installation of closely spaced wells	Access constraints; limited access to target area for drilling and conveyance lines if using vertical wells	Potential vapor intrusion/safety issues	Retained

Notes:

1 Applicable geology: F = clay to silt, C = sand to gravel

2 Applicable zone: U = unsaturated zone, S = saturated zone

3 LNAPL type: LV, LS = low volatility, low solubility, medium or heavy LNAPL (e.g., weathered gasoline, diesel, jet fuel, fuel oil, crude oil); HV, HS = high volatility, high solubility, light LNAPL with significant percentage of volatile or soluble constituents (e.g., gasoline, benzene)

4 This technology was technically eliminated in approximately 2006, however, this methodology would be essentially continued to remove residual LNAPL on a periodic basis.

FIGURES

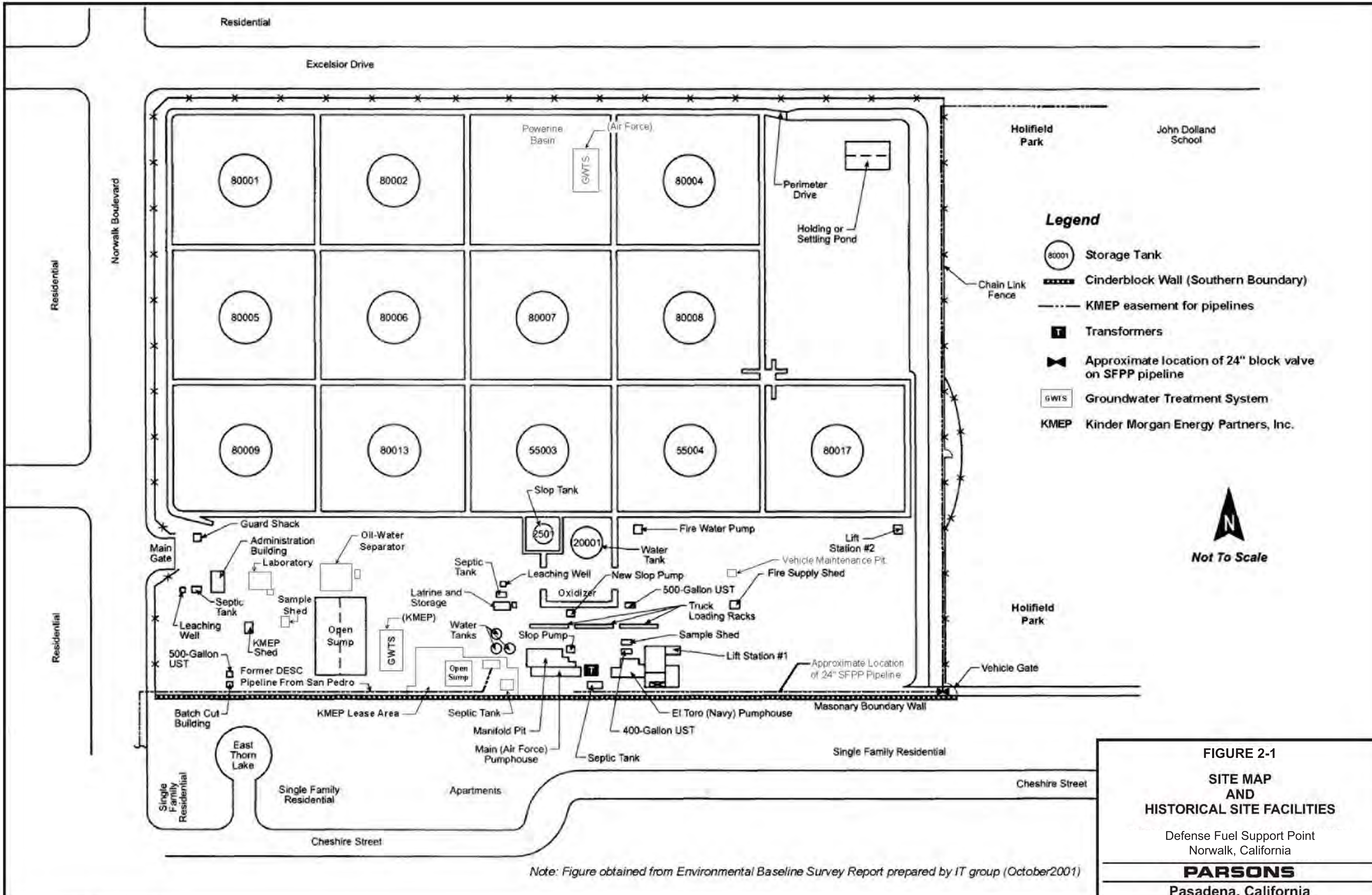
FIGURE 1-1

SITE
LOCATION MAP

Defense Fuel Support Point
Norwalk, California

PARSONS
Pasadena, California

K:\Depts\Dept48\DESC 07-2008 Contract\Norwalk\ACO-0010 Conceptual Site Model\Sept 2013 Complete CSM\Figures\Figure 1-1 Site Location Map.cdr



Note: *Figure obtained from Environmental Baseline Survey Report prepared by IT group (October2001)*

FIGURE 2-1

SITE MAP AND HISTORICAL SITE FACILITIES

Defense Fuel Support Point
Norwalk, California

PARSONS
Pasadena, California

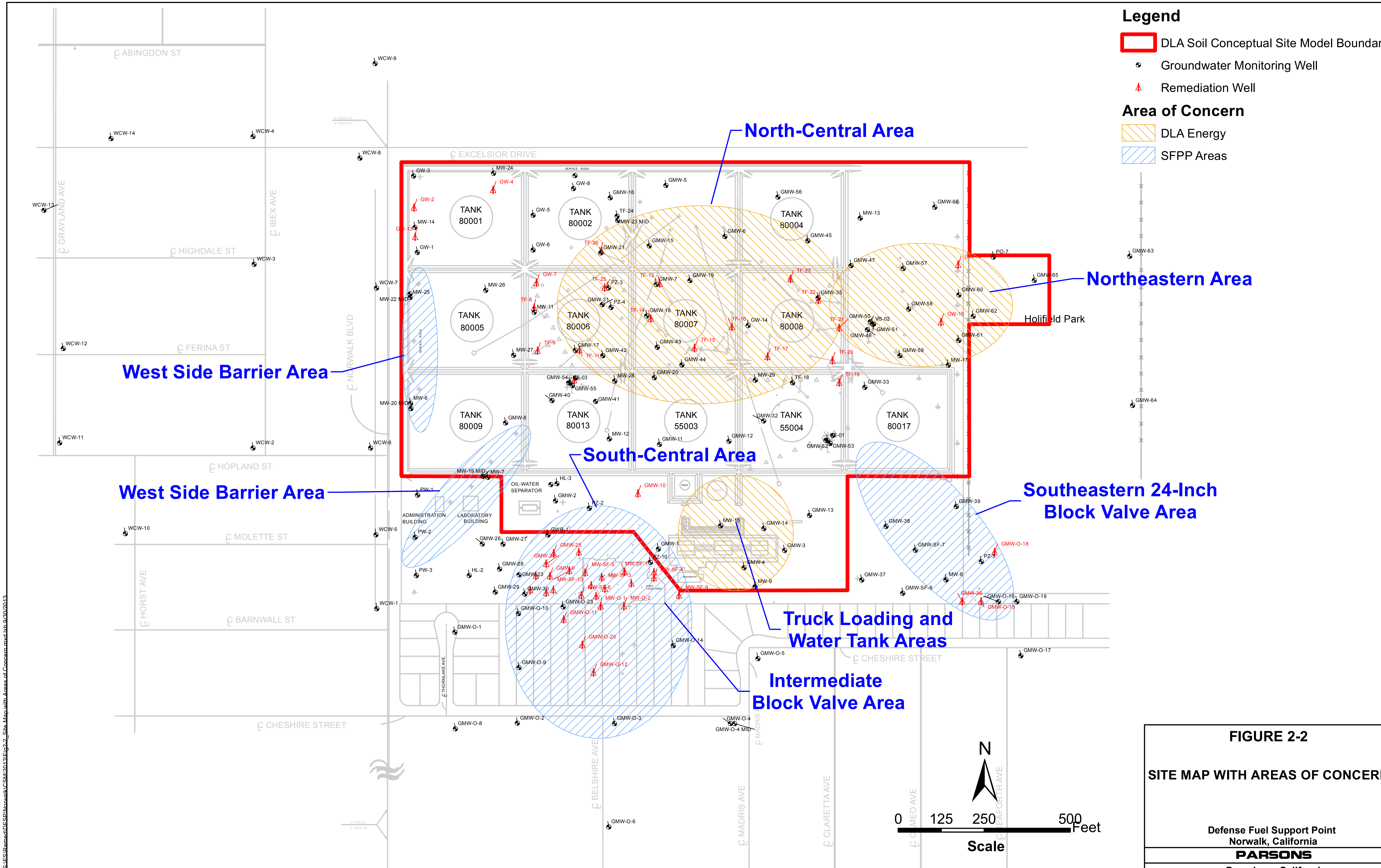


FIGURE 2-2

SITE MAP WITH AREAS OF CONCERN

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

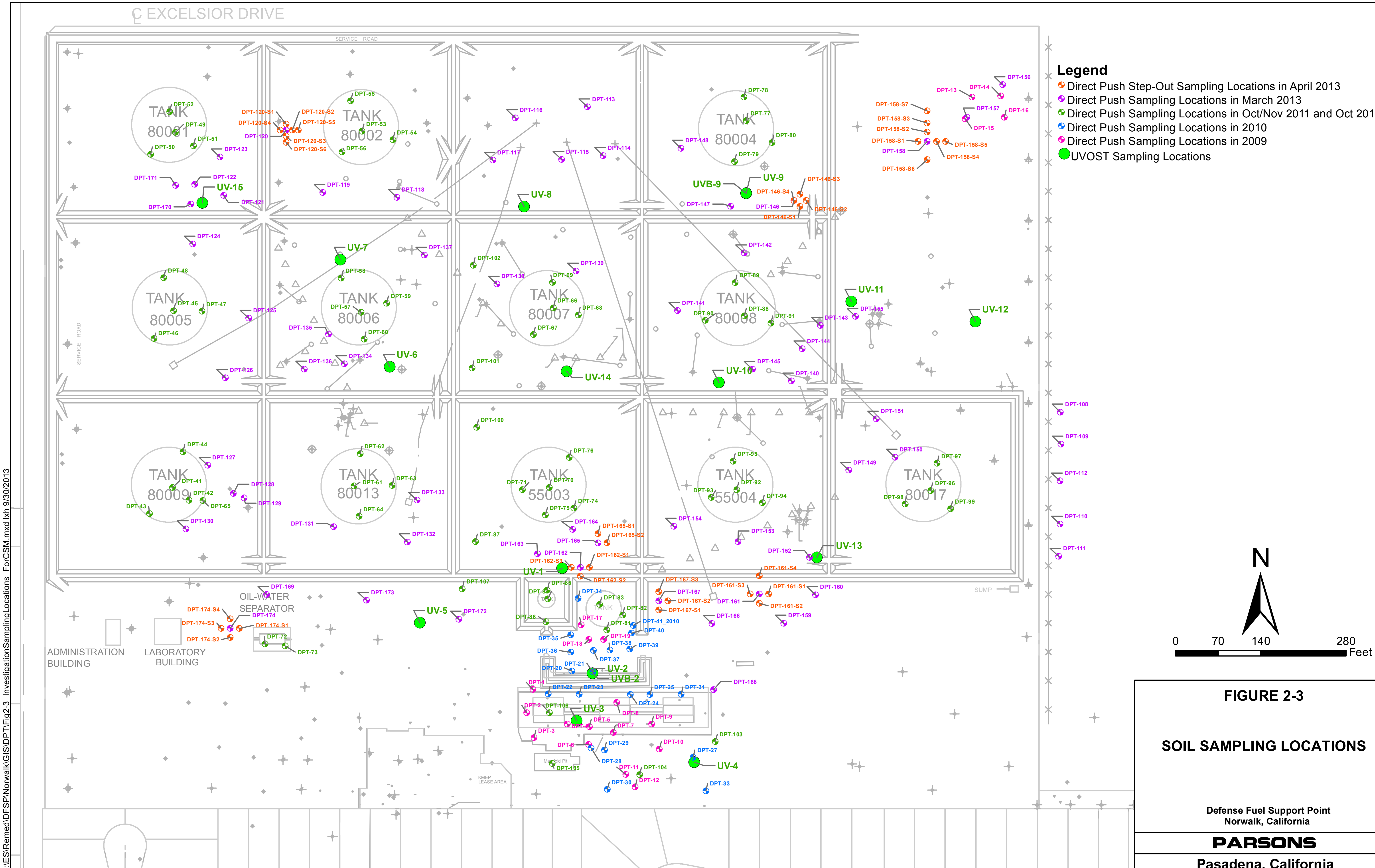


FIGURE 2-3

SOIL SAMPLING LOCATIONS

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

S:\ES\Remed\DFSP\Norwalk\GIS\DPT\Fig2-3_InvestigationSamplingLocations_ForCSM.mxd lxh 9/30/2013

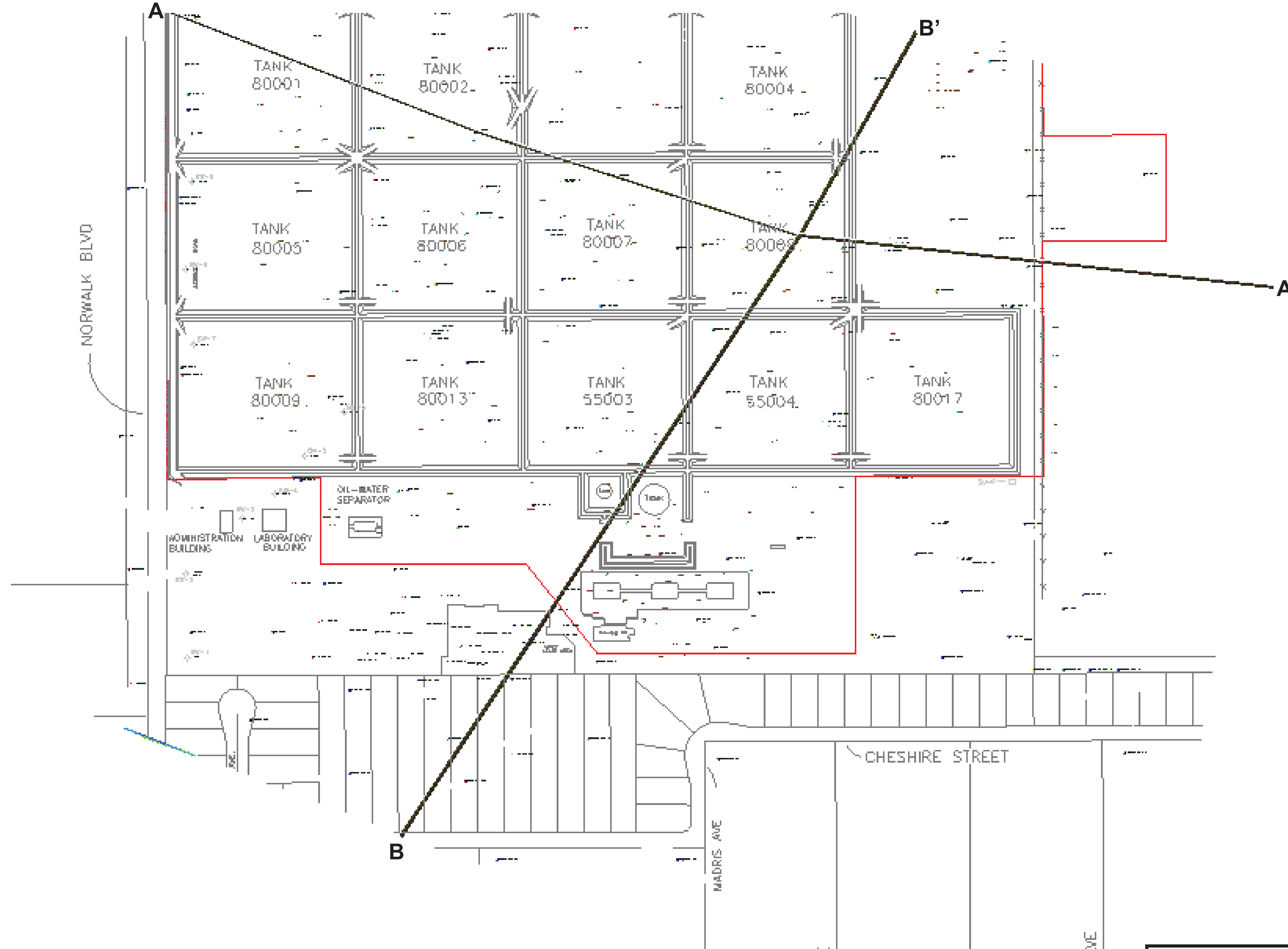


FIGURE 3-1

LOCATION OF GEOLOGIC CROSS-SECTIONS A-A' AND B-B'

Defense Fuel Support Point
Norwalk, California

PARSONS
Pasadena, California

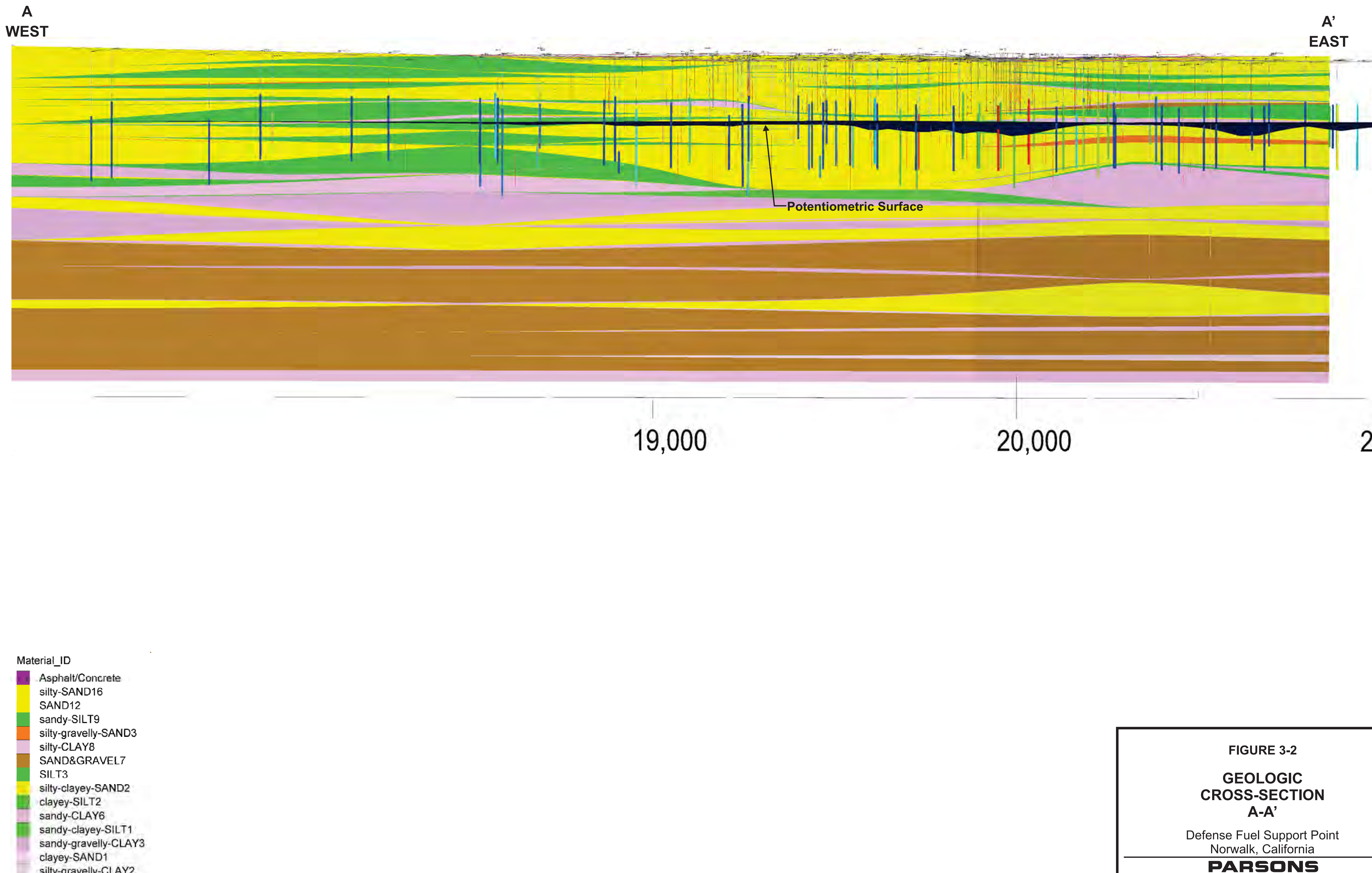


FIGURE 3-2

GEOLOGIC CROSS-SECTION A-A'

Defense Fuel Support Point
Norwalk, California

PARSONS
Pasadena, California

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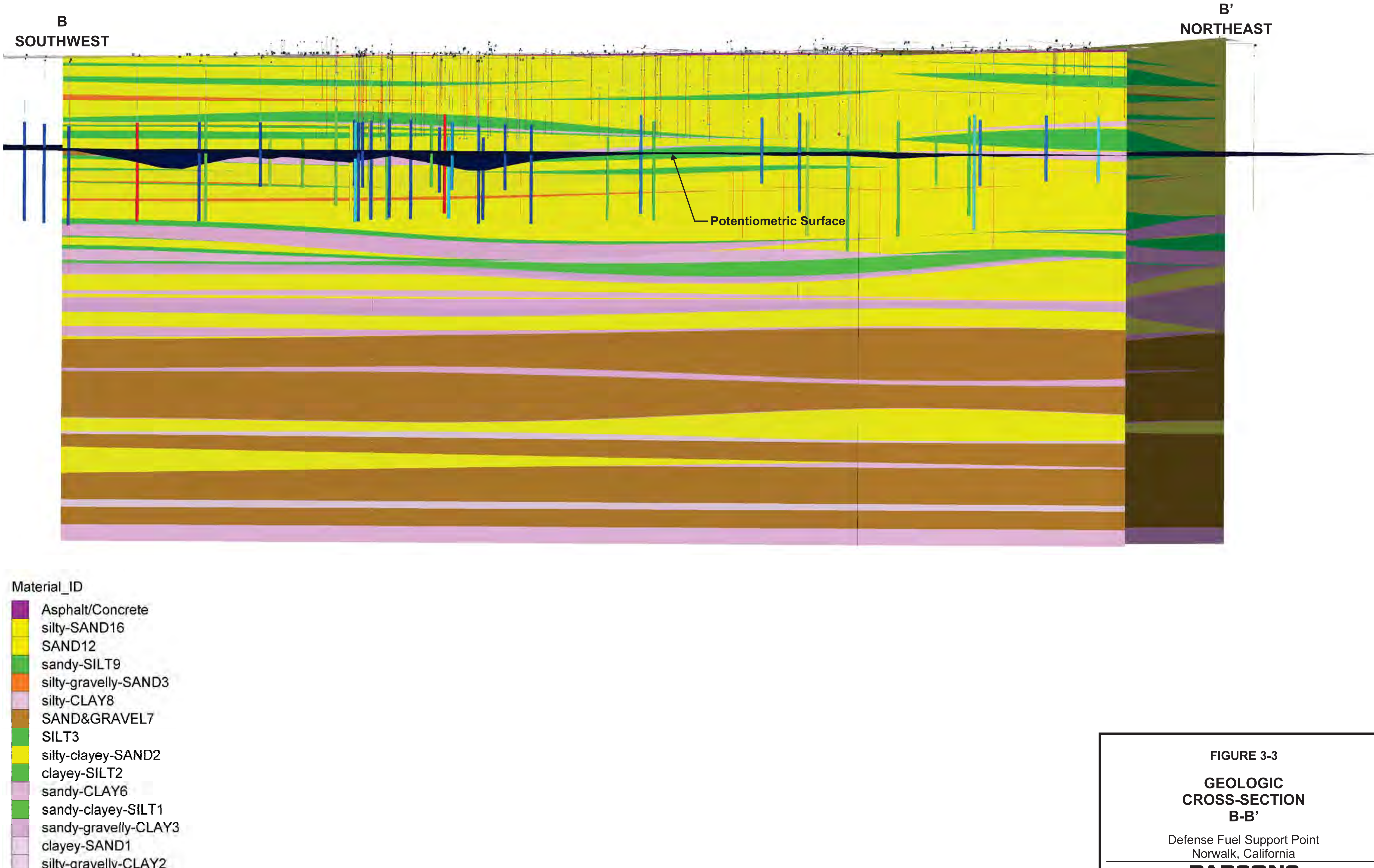

FIGURE 3-3

GEOLOGIC CROSS-SECTION B-B'

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

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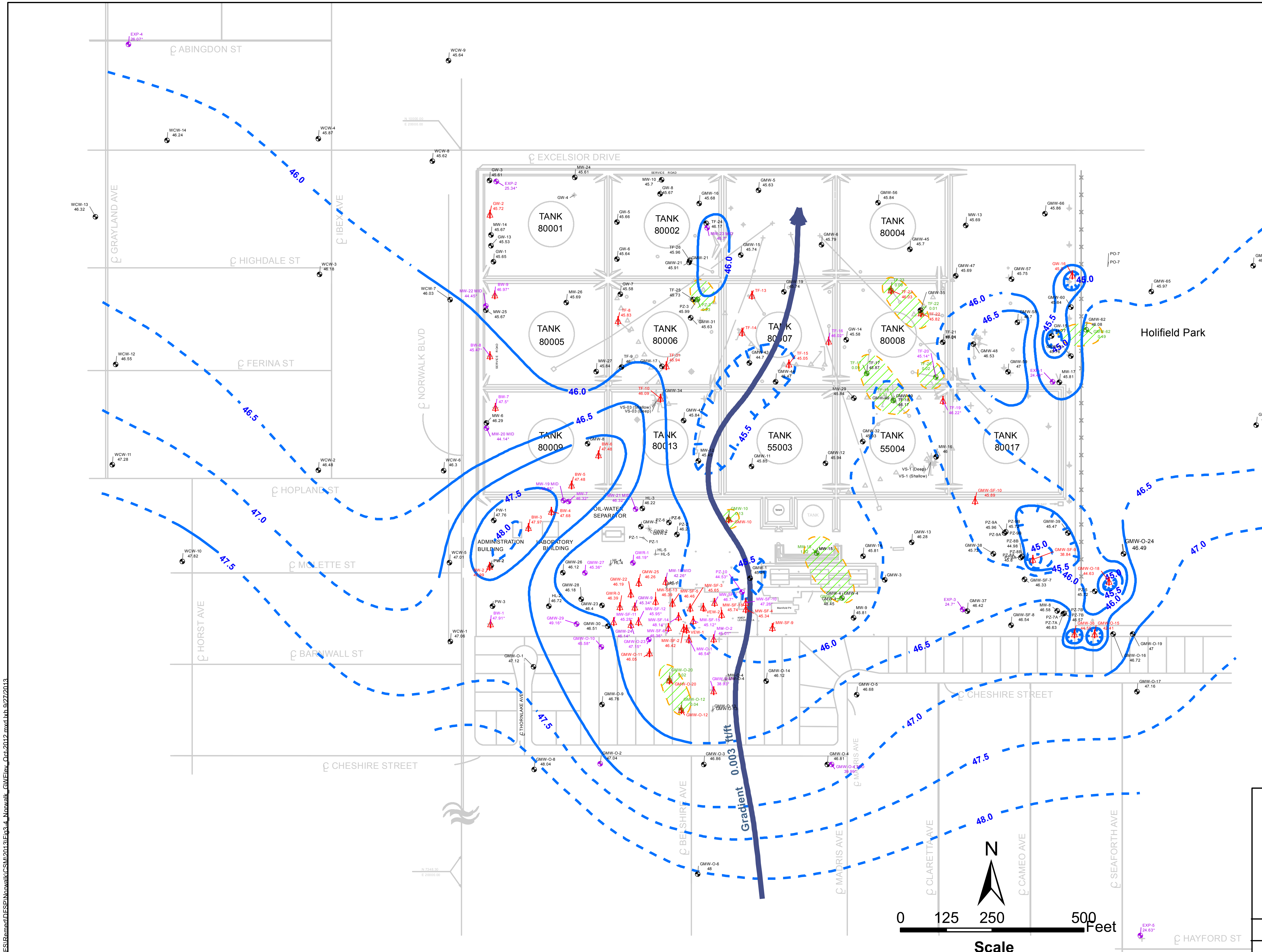


Legend

- GWElev_Oct_2012_GIS_MW_Symbol_GMW-35
- Extraction Well Used for Site Remediation
- Apparent Thickness of Free Product Measured (Feet)
- Groundwater Elevation Not Used in Contouring (See Note 2)
- Groundwater Elevation in Feet Above Mean Sea Level
- Generalized Flow Direction
- 52.5 Lines of Equal Groundwater Elevation Showing groundwater Elevation in Feet Above Mean Sea Level (Dashed where inferred)
- Estimated extent of measurable light nonaqueous phase hydrocarbons (LNAPL, free product) on groundwater; dashed where inferred.

Note:

1 Groundwater elevations shown at wells are based on data collected by Blaine Tech Services, Inc., CH2MHill, and Parsons in October 2012.

2 Wells screened in the Exposition Aquifer or near the bottom of the uppermost aquifer are not used in contouring. These individual local areas of mounding or drawdown are not depicted on the figure only data from wells with screened intervals of similar depth were used for this contour map. Wells not used in contours are marked with a purple asterisk (*).

SURVEY NOTES:

1. Base map prepared from data provided by Fluor Daniel GTI, Dulin & Boynton, and Geomatrix.
2. Except as noted below, well locations surveyed by Dulin & Boynton.
3. Locations of well HL-1, HL-3, and HL-4 based on field measurements by Fluor Daniel GTI and Woodward-Clyde.
4. Locations of wells BW-1 through BW-9 surveyed by Geomatrix based on reference to other wells surveyed by Dulin & Boynton.

FIGURE 3-4

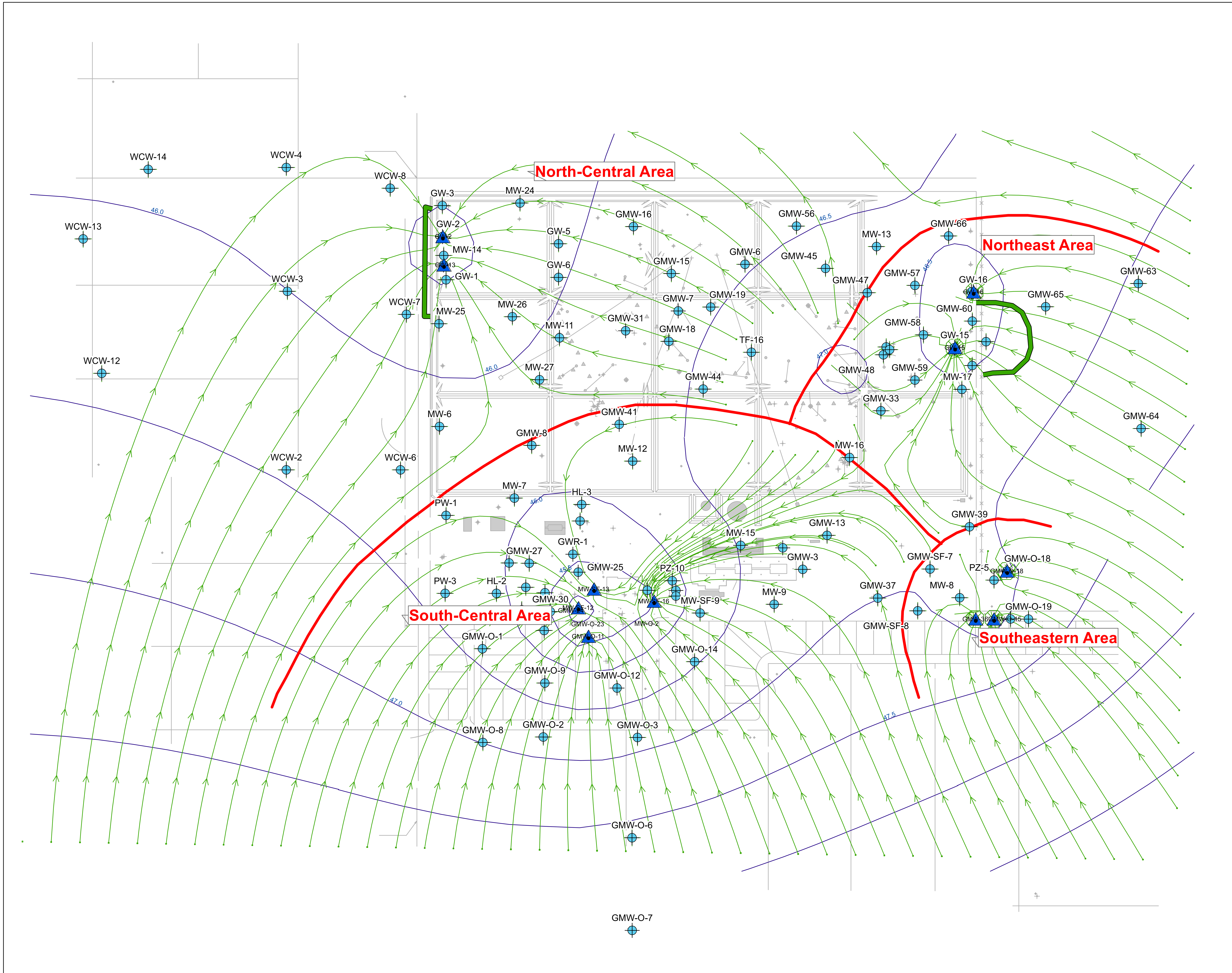
GROUNDWATER EQUIPOTENTIAL MAP AND FREE PRODUCT PLUMES UPPERMOST GROUNDWATER ZONE

OCTOBER 2012

Defense Fuel Support Point Norwalk, California

PARSONS

Pasadena, California



Legend

- PUMPING WELL
- WELL
- Capture Zone Boundaries
- SIMULATED GROUNDWATER FLOW PATH
- SIMULATED GROUNDWATER CONTOUR
- APPROXIMATE EXTENT OF TARGET CAPTURE ZONE RELATIVE TO SITE BOUNDARY

GROUNDWATER EXTRACTION RATES

NORTHWEST AREA
GW-2 = 3.4 gpm
GW-13 = 3.4 gpm

NORTHEAST AREA
GW-15 = 5.5 gpm
GW-16 = 2.2 gpm

SOUTHEAST AREA
GMW-36 = 2 gpm
GMW-O-15 = 3 gpm
GMW-O-18 = 1.5 gpm

SOUTH-CENTRAL AREA
MW-SF-12 = 5gpm
MW-SF-13 = 5 gpm
MW-SF-16 = 5 gpm
GMW-O-11 = 5 gpm

N W E S

0 70 140 280
Feet

FIGURE 3-5

SIMULATED FLOW MODEL RESULTS FOR CURRENT REMEDIATION SYSTEMS

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

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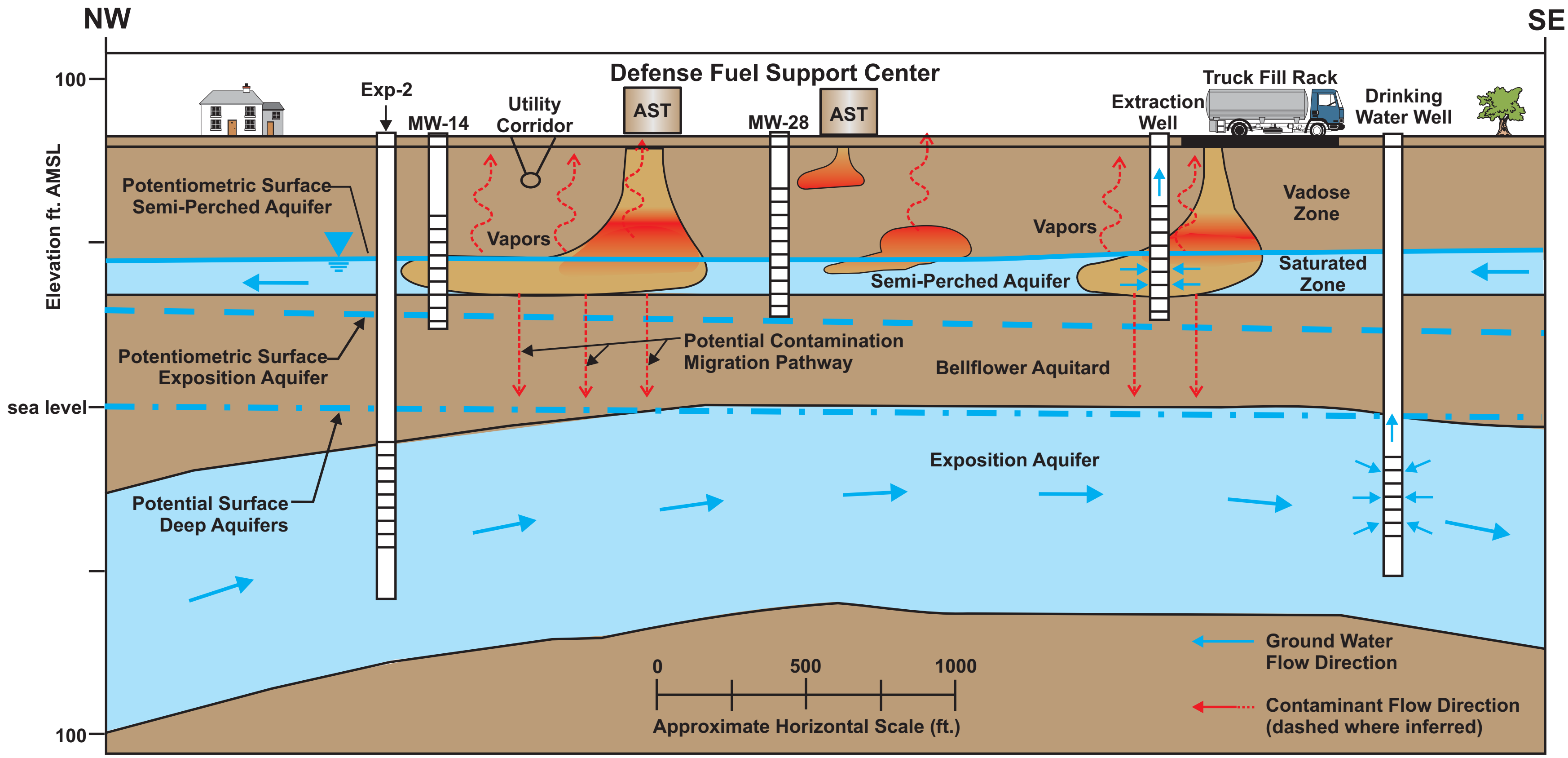

FIGURE 3-6

CONCEPTUAL SITE MODEL BLOCK DIAGRAM

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

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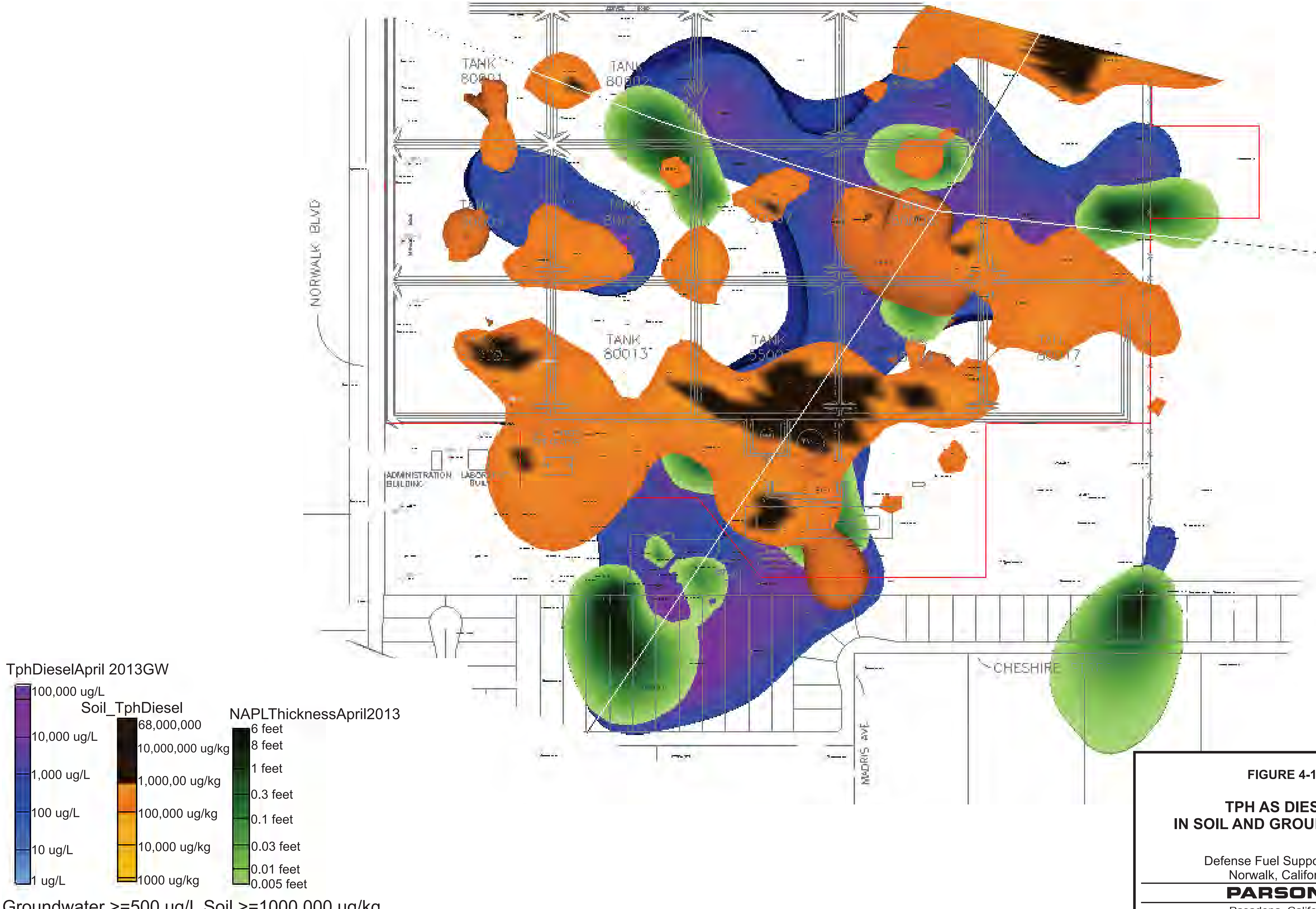

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FIGURE 4-1

TPH AS DIESEL
IN SOIL AND GROUNDWATER

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

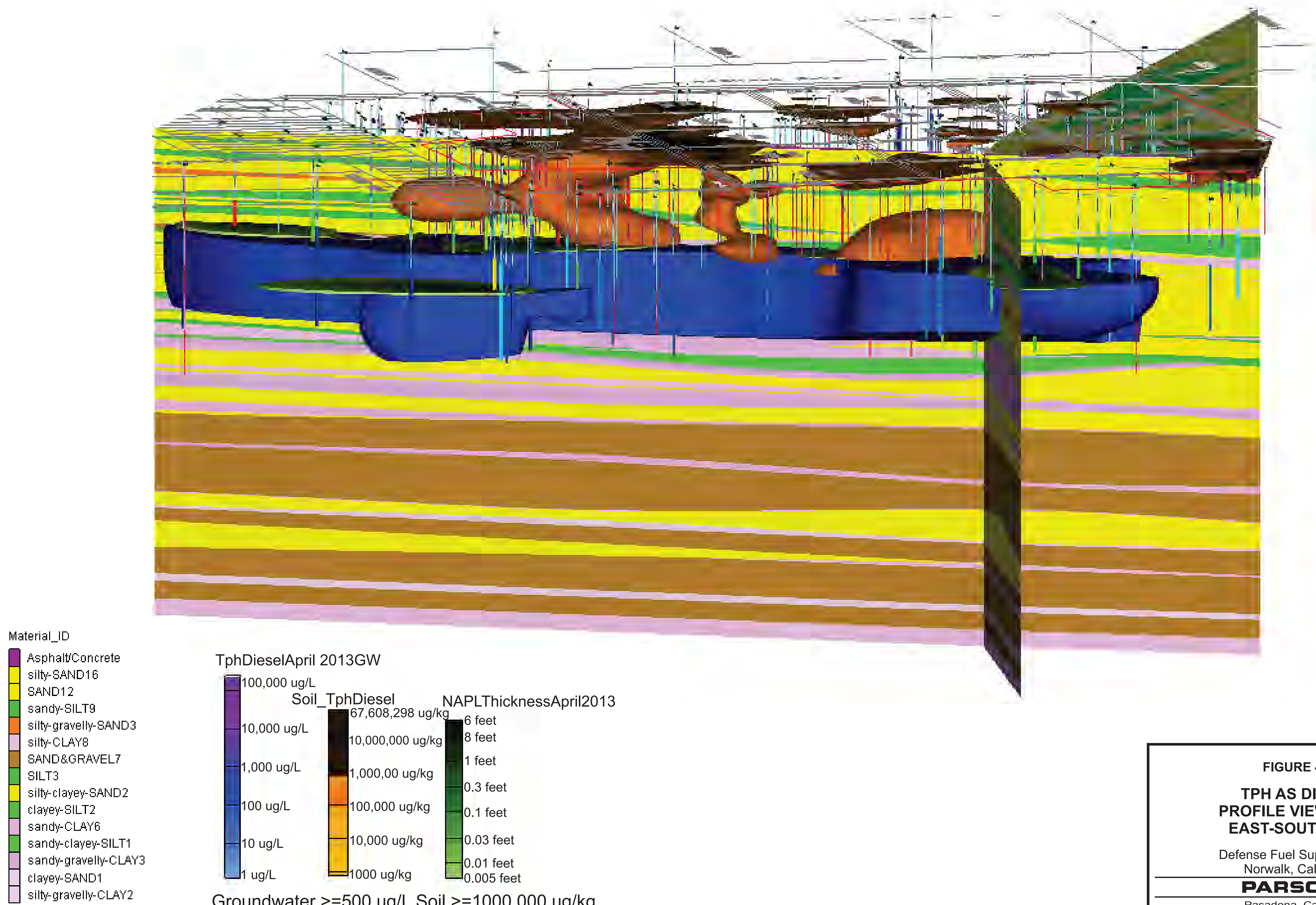


FIGURE 4-2

TPH AS DIESEL PROFILE VIEW FROM EAST-SOUTHEAST

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

draw\746687 CSM.cdr ma 09/24/13

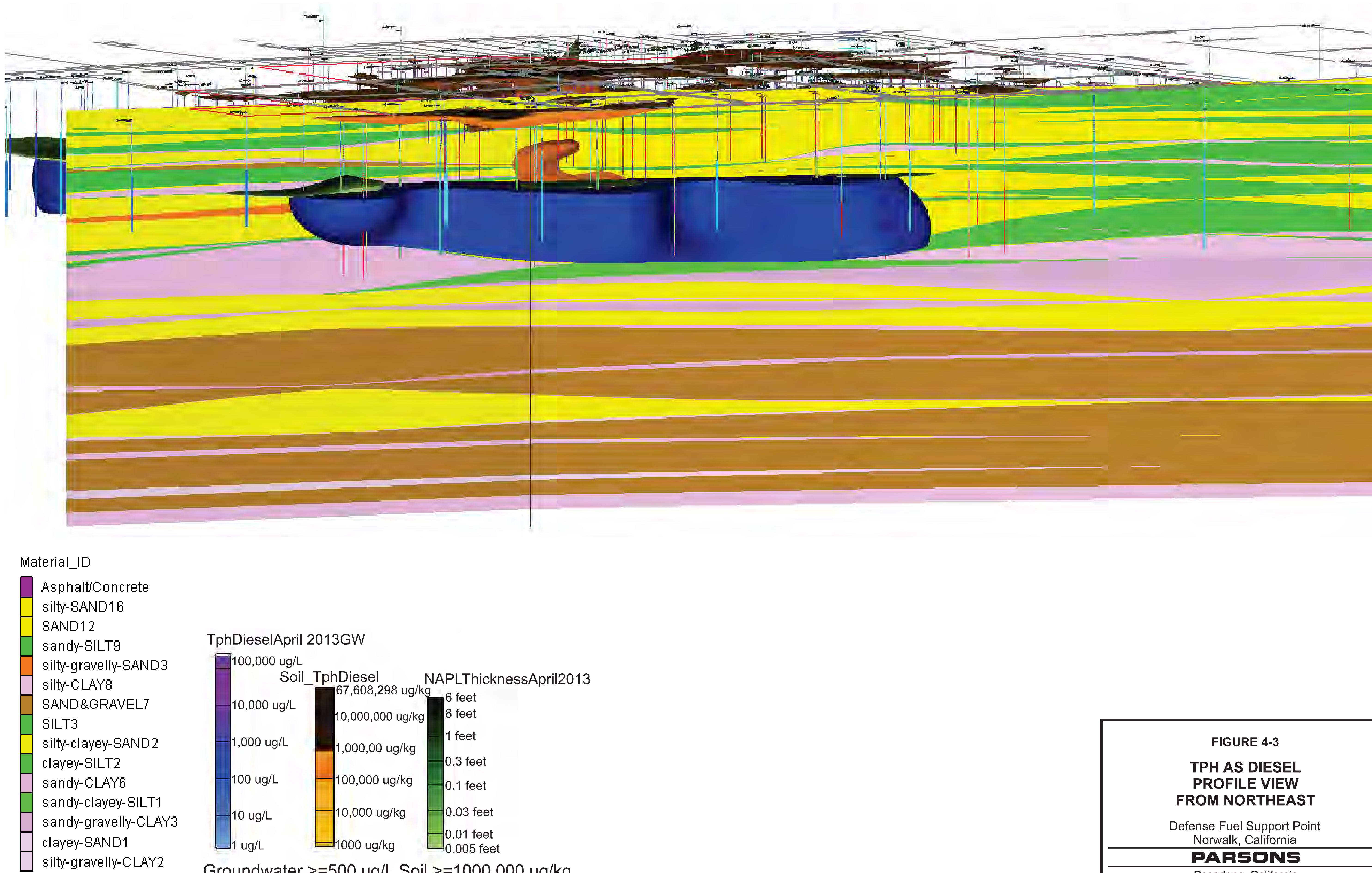


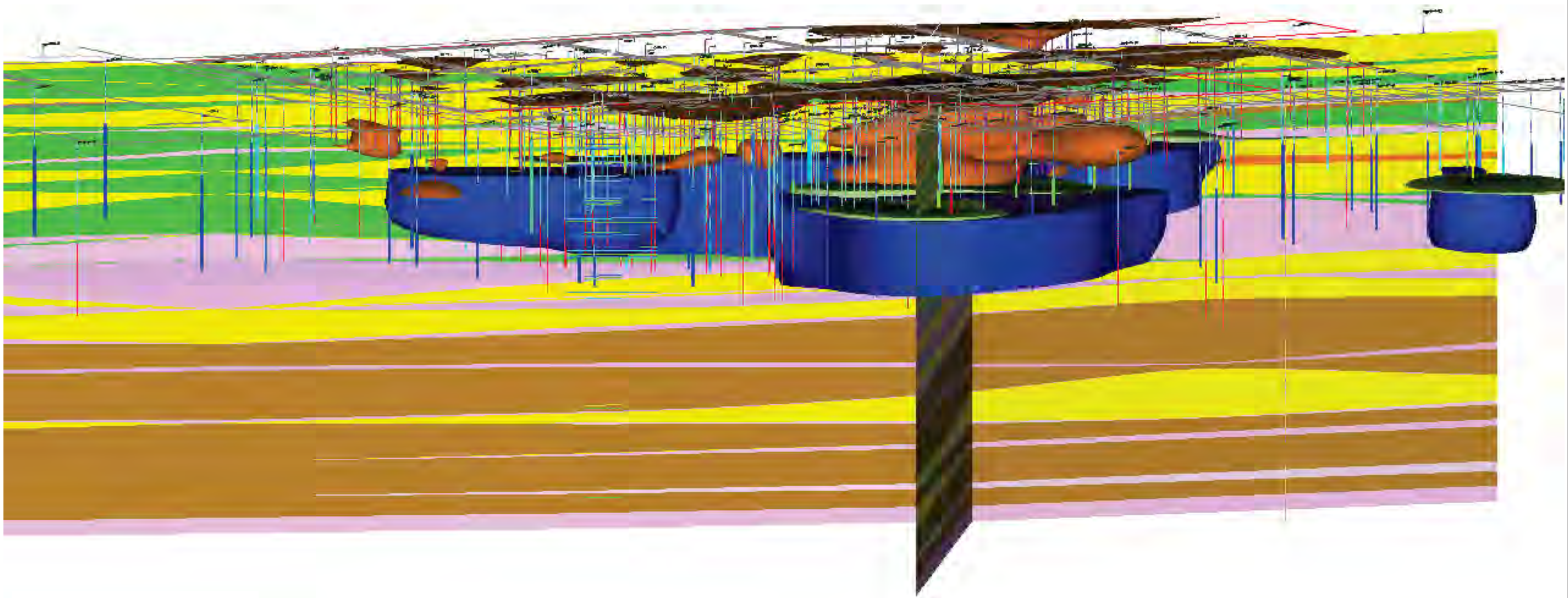
FIGURE 4-3

TPH AS DIESEL PROFILE VIEW FROM NORTHEAST

Defense Fuel Support Point
Norwalk, California

PARSONS
Pasadena, California

draw\746687 CSM.cdr ma 09/24/13



Material_ID

- Asphalt/Concrete
- silty-SAND16
- SAND12
- sandy-SILT9
- silty-gravelly-SAND3
- silty-CLAY8
- SAND&GRAVEL7
- SILT3
- silty-clayey-SAND2
- clayey-SILT2
- sandy-CLAY6
- sandy-clayey-SILT1
- sandy-gravelly-CLAY3
- clayey-SAND1
- silty-gravelly-CLAY2

TphDieselApril 2013GW

- 100,000 ug/L
- 10,000 ug/L
- 1,000 ug/L
- 100 ug/L
- 10 ug/L
- 1 ug/L

Soil_TphDiesel

- 67,608,298 ug/kg
- 10,000,000 ug/kg
- 1,000,00 ug/kg
- 100,000 ug/kg
- 10,000 ug/kg
- 1000 ug/kg

NAPLThicknessApril2013

- 6 feet
- 8 feet
- 1 feet
- 0.3 feet
- 0.1 feet
- 0.03 feet
- 0.01 feet
- 0.005 feet

Groundwater >=500 ug/L Soil >=1000,000,ug/kg

FIGURE 4-4

TPH AS DIESEL PROFILE VIEW FROM SOUTHWEST

Defense Fuel Support Point
Norwalk, California

PARSONS
Pasadena, California

draw\746687 CSM.cdr ma 09/24/13

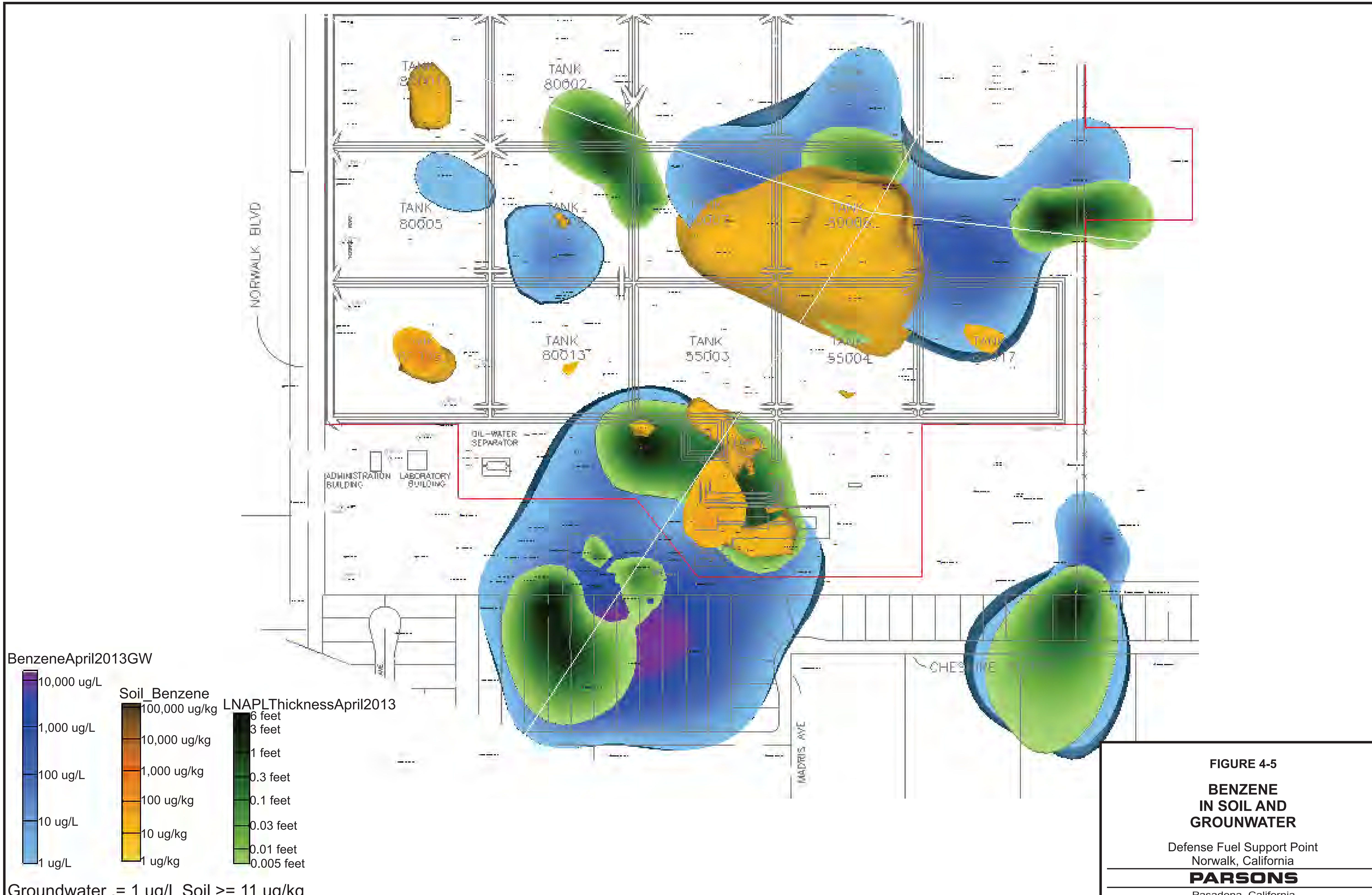


FIGURE 4-5

BENZENE IN SOIL AND GROUNWATER

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

draw\746687 CSM.cdr ma 09/24/13

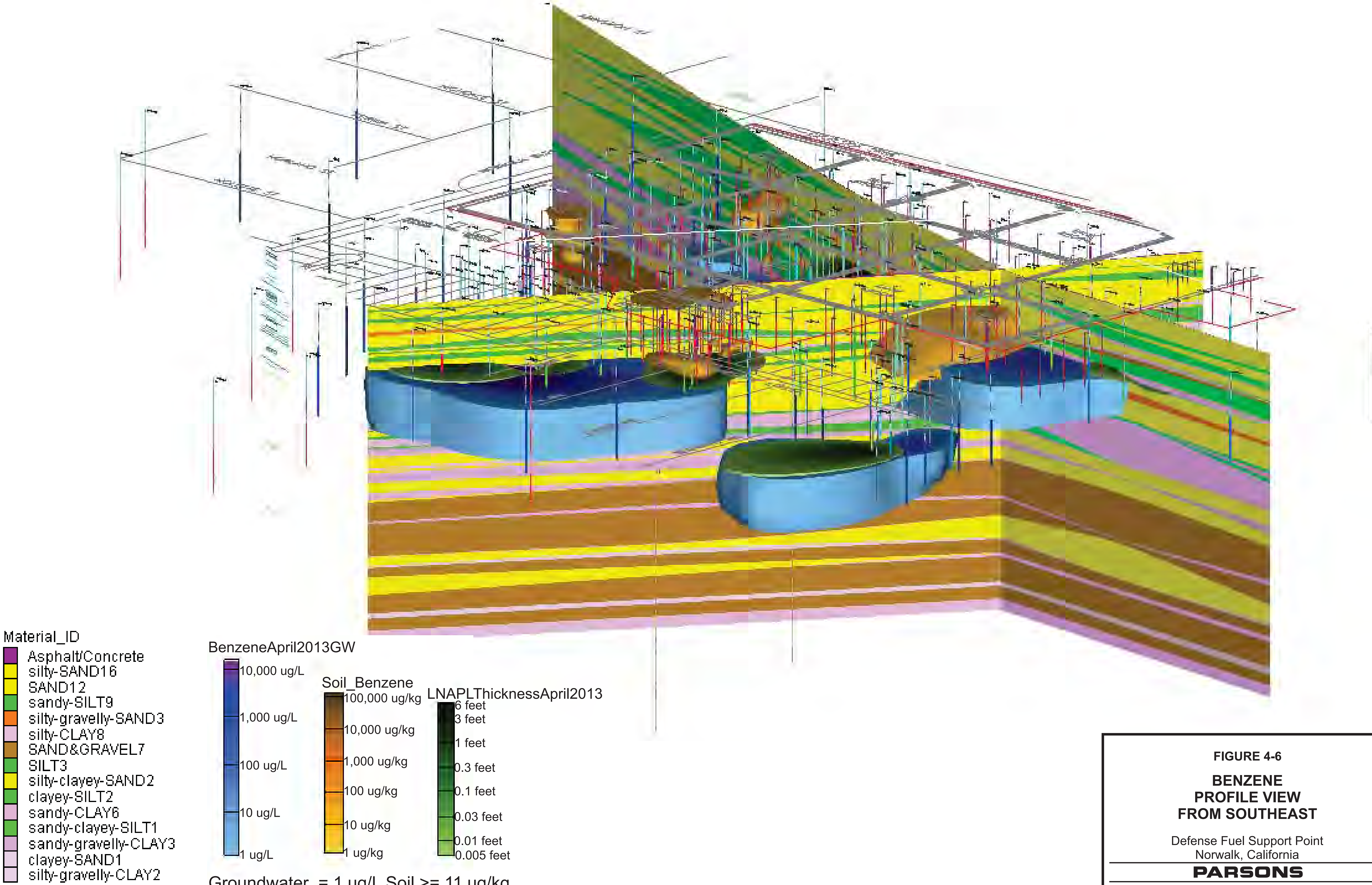


FIGURE 4-6

BENZENE PROFILE VIEW FROM SOUTHEAST

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

draw\746687 CSM.cdr ma 09/24/13

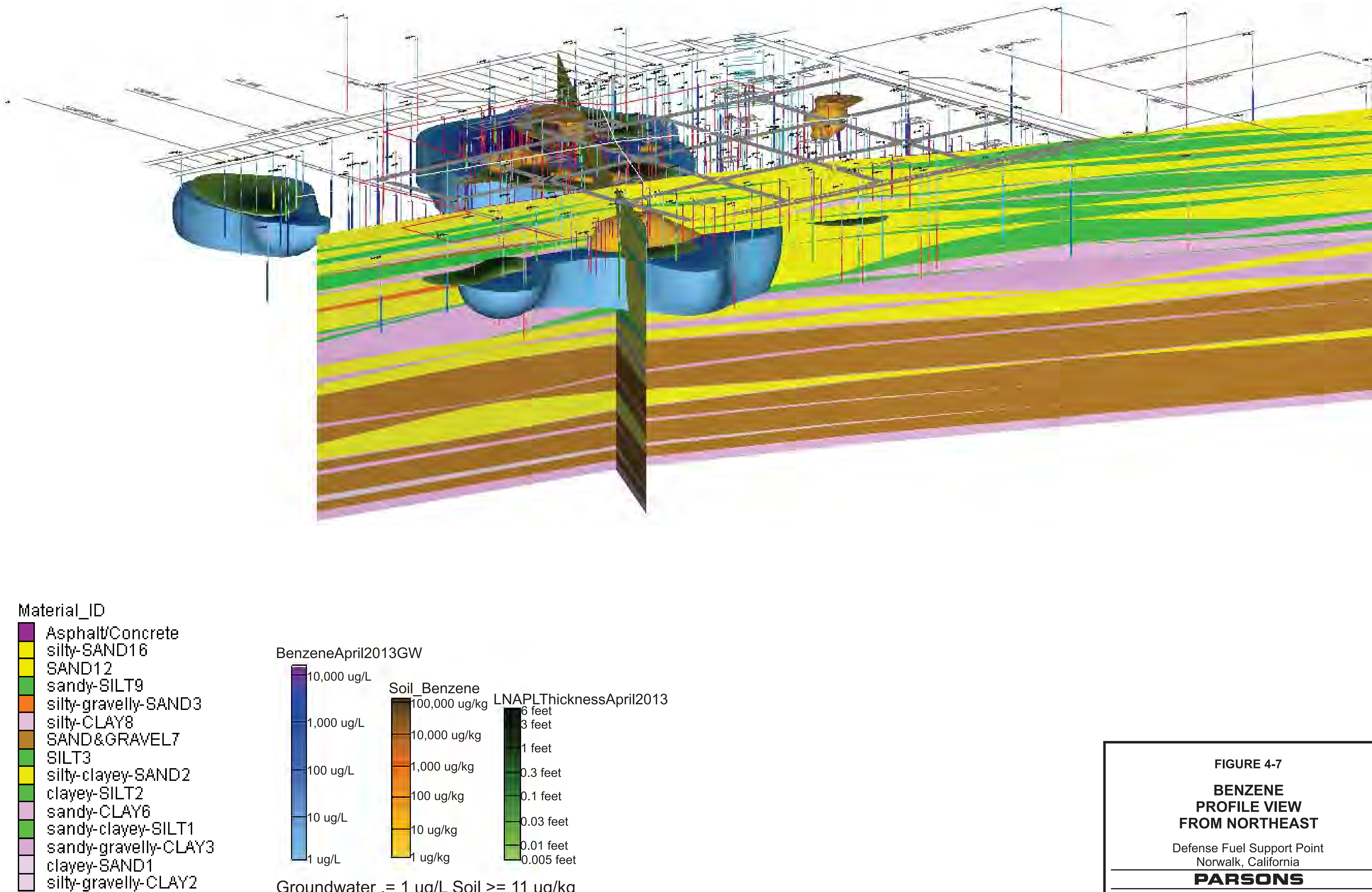


FIGURE 4-7

BENZENE PROFILE VIEW FROM NORTHEAST

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

draw\746687 CSM.cdr ma 09/24/13

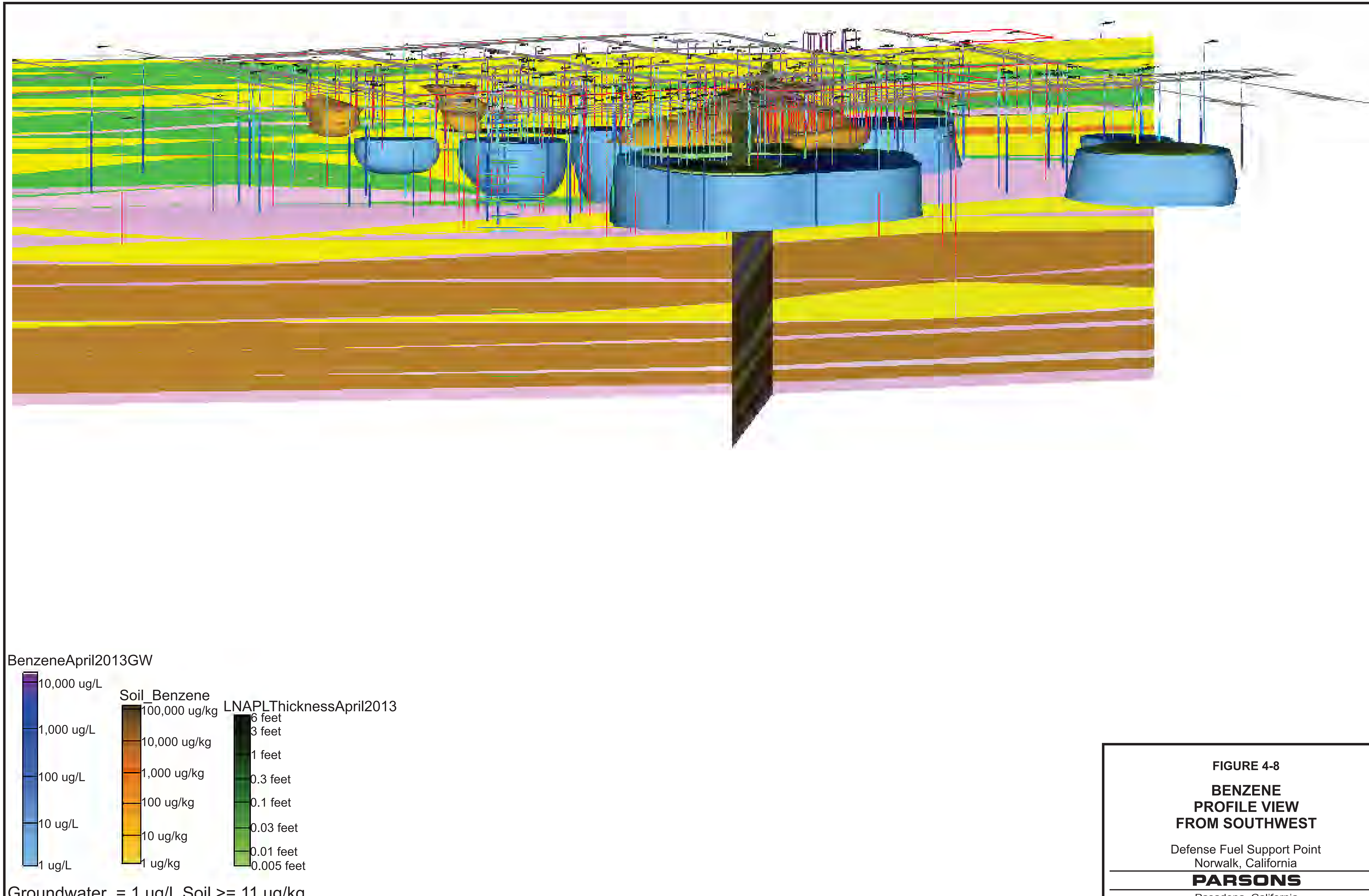


FIGURE 4-8

BENZENE PROFILE VIEW FROM SOUTHWEST

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

draw\746687 CSM.cdr ma 09/24/13

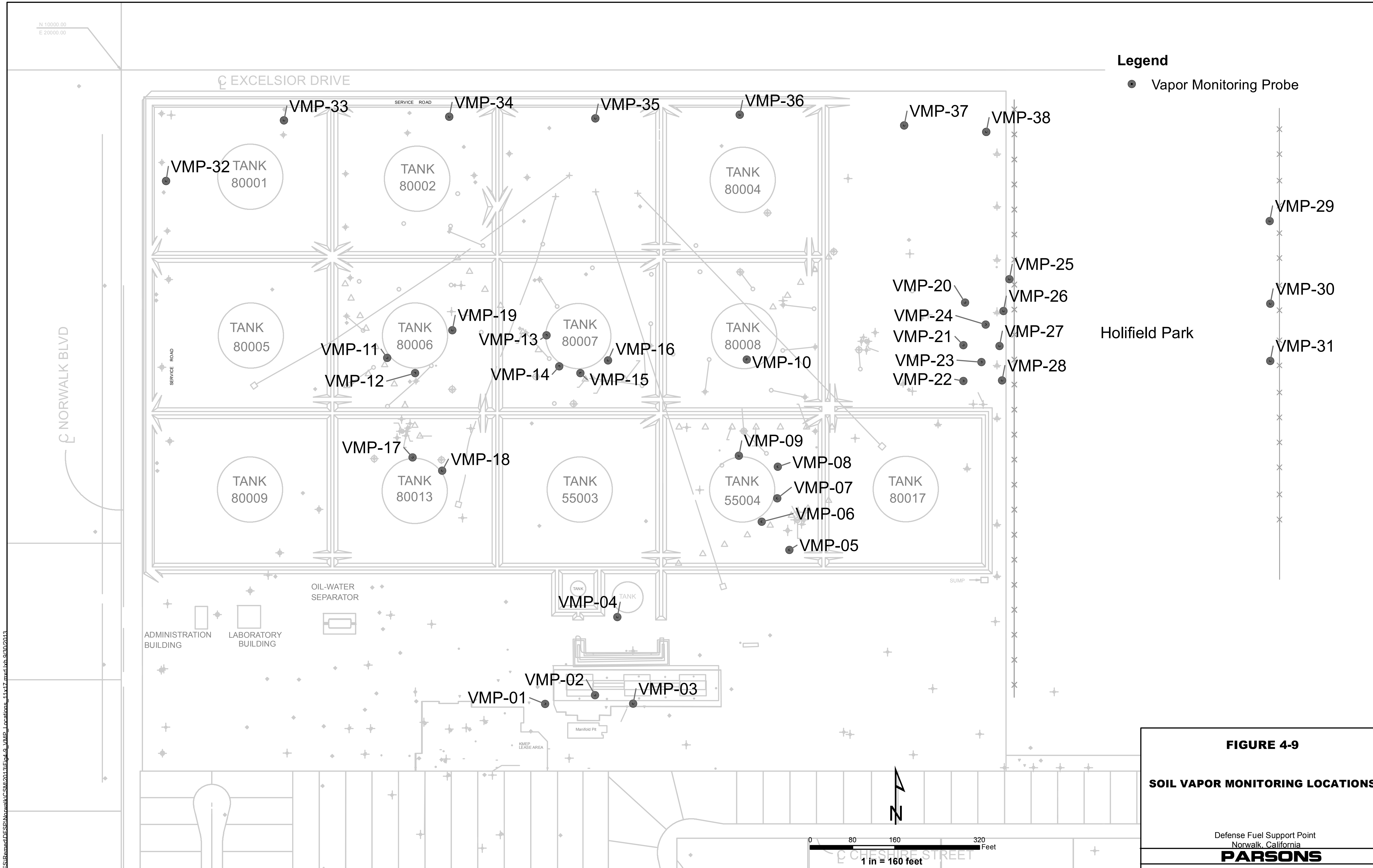


FIGURE 4-9

SOIL VAPOR MONITORING LOCATIONS

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

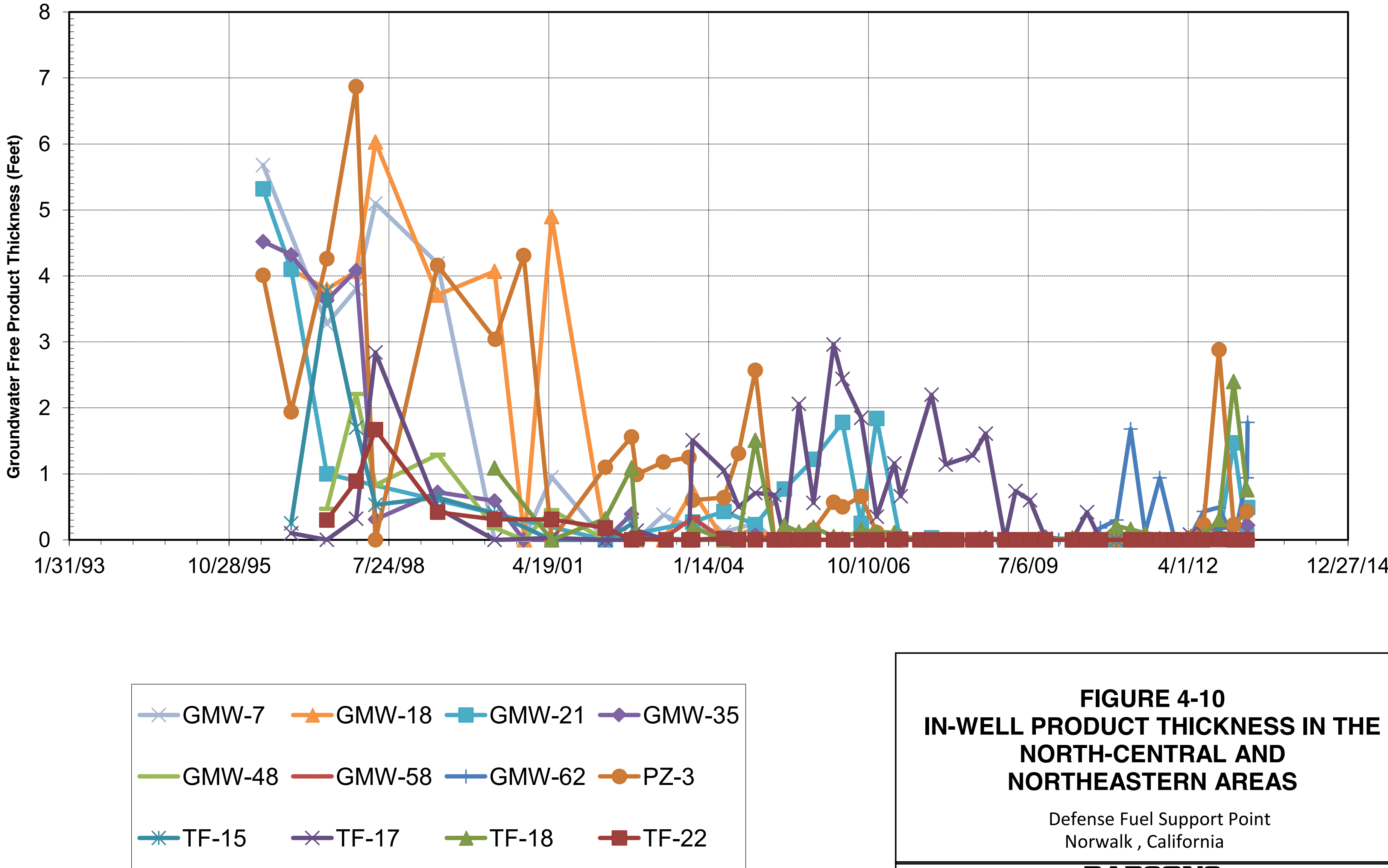


FIGURE 4-10
IN-WELL PRODUCT THICKNESS IN THE NORTH-CENTRAL AND NORTHEASTERN AREAS

Defense Fuel Support Point
Norwalk , California

PARSONS

Pasadena, California

S:\ESOL\DuPontSF\Database\Hydrograph\GMW-7.xls

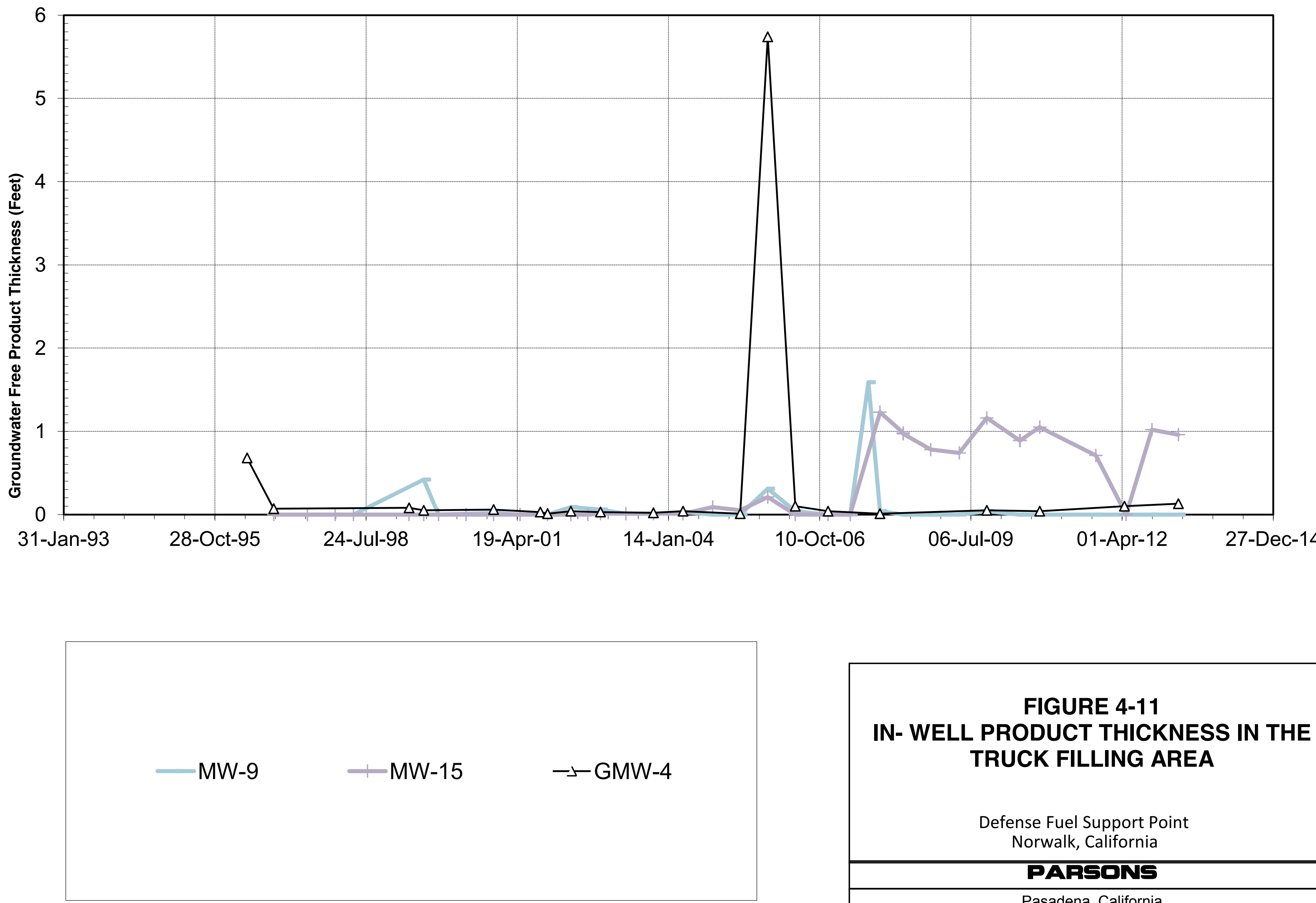


FIGURE 4-11
IN- WELL PRODUCT THICKNESS IN THE TRUCK FILLING AREA

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

S:\ESOL\DuPontSF\Database\Hydrograph\GMW-4.xls

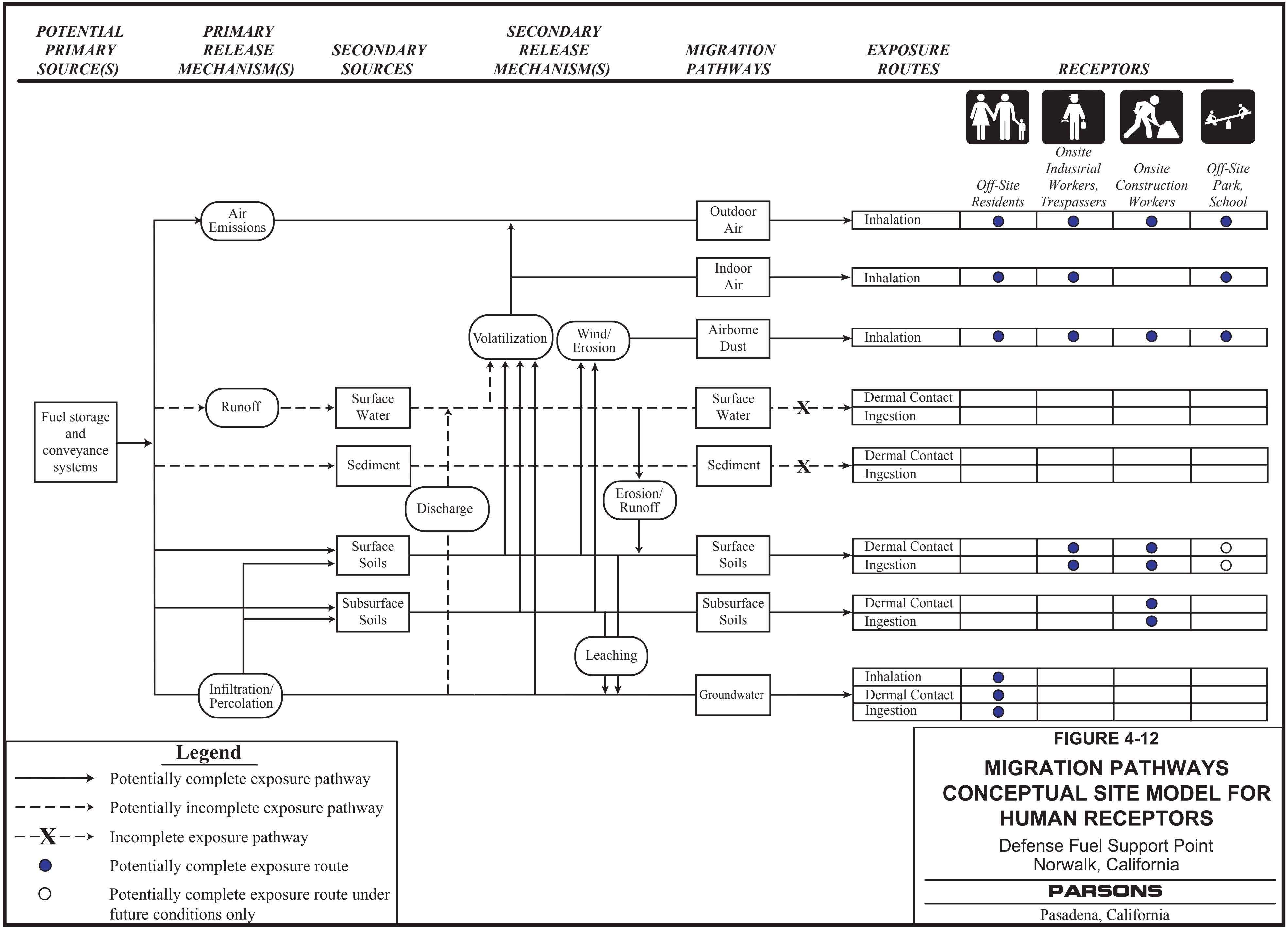


FIGURE 4-12

MIGRATION PATHWAYS CONCEPTUAL SITE MODEL FOR HUMAN RECEPTORS

Defense Fuel Support Point
Norwalk, California

PARSONS

Pasadena, California

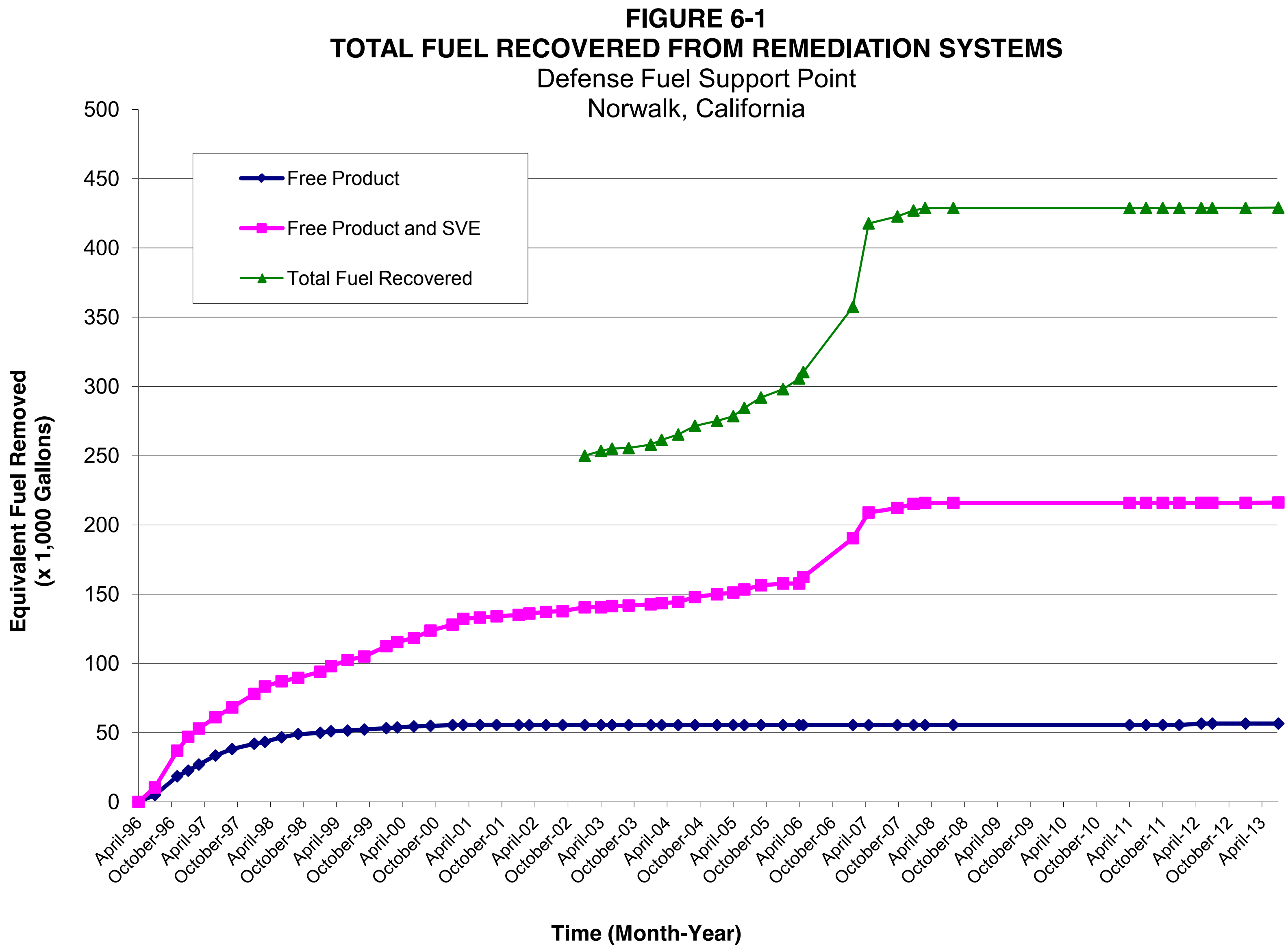
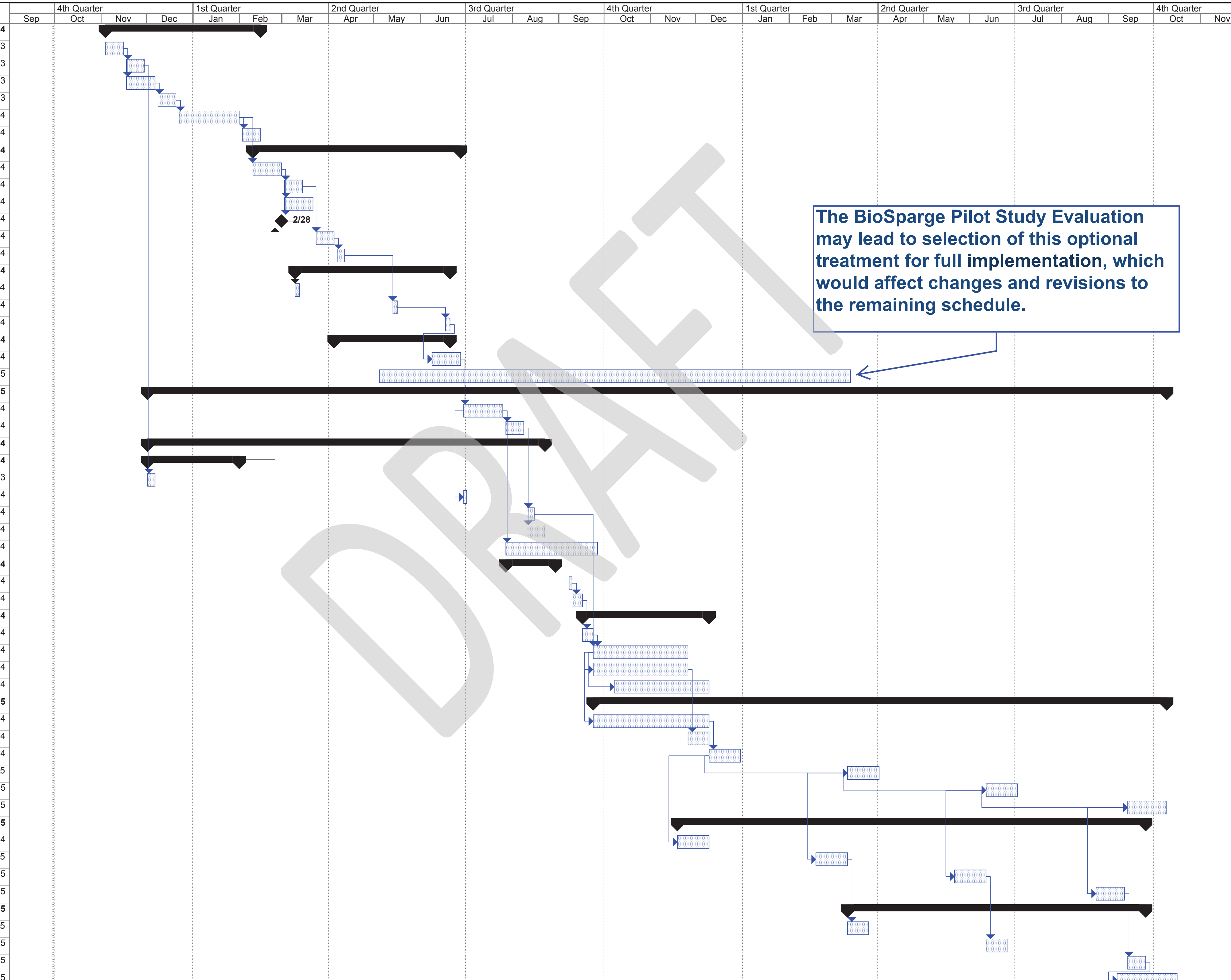


FIGURE 6-1
TOTAL FUEL RECOVERED FROM REMEDIATION SYSTEMS
Defense Fuel Support Point
Norwalk, California
Free Product
Free Product and SVE
Total Fuel Recovered
Equivalent Fuel Removed
(x 1,000 Gallons)
0
50
100
150
200
250
300
350
400
450
500
April-96
October-96
April-97
October-97
April-98
October-98
April-99
October-99
April-00
October-00
April-01
October-01
April-02
October-02
April-03
October-03
April-04
October-04
April-05
October-05
April-06
October-06
April-07
October-07
April-08
October-08
April-09
October-09
April-10
October-10
April-11
October-11
April-12
October-12
April-13
Time (Month-Year)

FIGURE 7-1.
REMEDIAL ACTION IMPLEMENTATION SCHEDULE
Defense Fuel Support Point, Norwalk, California

ID	Task Name	Duration	Start	Finish
1	**TREATABILITY STUDY**	**75 days**	**Mon 11/4/13**	**Fri 2/14/14**
2	Develop SOW and Work Plan	10 days	Mon 11/4/13	Fri 11/15/13
3	RWQCB Review and Approval	10 days	Mon 11/18/13	Fri 11/29/13
4	Procure Driller and Treatability Lab	15 days	Mon 11/18/13	Fri 12/6/13
5	Obtain Samples	10 days	Mon 12/9/13	Fri 12/20/13
6	Conduct In-Lab Treatability Study	30 days	Mon 12/23/13	Fri 1/31/14
7	Results Report and Design Parameters	10 days	Mon 2/3/14	Fri 2/14/14
8	**PILOT STUDY**	**100 days**	**Mon 2/10/14**	**Fri 6/27/14**
9	Develop Pilot Study Design and WP	15 days	Mon 2/10/14	Fri 2/28/14
10	RWQCB Review and Approval	10 days	Mon 3/3/14	Fri 3/14/14
11	Procure Inj Probe, Driller, and ISCO Subcontractors	15 days	Mon 3/3/14	Fri 3/21/14
12	Shutdown Internal SVE & GWE	0 days	Fri 2/28/14	Fri 2/28/14
13	Install Pilot Test System Support Equipment	10 days	Mon 3/24/14	Fri 4/4/14
14	Probe Injection of Activated Persulfate (12)	5 days	Mon 4/7/14	Fri 4/11/14
15	**Monitoring**	**75 days**	**Mon 3/10/14**	**Fri 6/20/14**
16	Conduct Baseline Monitoring	3 days	Mon 3/10/14	Wed 3/12/14
17	Step 1 Monitoring	3 days	Wed 5/14/14	Fri 5/16/14
18	Step 2 Monitoring	3 days	Wed 6/18/14	Fri 6/20/14
19	**PS Field Support & Maintenance Activities**	**55 days**	**Fri 4/4/14**	**Fri 6/20/14**
22	Results Report and Proposed Full-Scale Design Paraml	15 days	Mon 6/9/14	Fri 6/27/14
23	**EVALUATION OF KMP BIOSPARGE PILOT STUDY**	225 days	Mon 5/5/14	Fri 3/13/15
24	**EXCAVATION & IN-SITU OXIDATION REMEDY**	**485 days**	**Mon 12/2/13**	**Fri 10/9/15**
25	Develop Design and Execution Plan	20 days	Mon 6/30/14	Fri 7/25/14
26	RWQCB Review and Approval	10 days	Mon 7/28/14	Fri 8/8/14
27	**Permits**	**190 days**	**Mon 12/2/13**	**Fri 8/22/14**
28	**WDR Permit**	**45 days**	**Mon 12/2/13**	**Fri 1/31/14**
31	UIC Registration	5 days	Mon 12/2/13	Fri 12/6/13
32	Extend Stormwater NPDES Permit for Constr	2 days	Mon 6/30/14	Tue 7/1/14
33	SCAQMD 1166 Plan	5 days	Mon 8/11/14	Fri 8/15/14
34	SCAQMD PTO	10 days	Mon 8/11/14	Fri 8/22/14
35	Off-Site Access Agreement(s)	45 days	Mon 7/28/14	Fri 9/26/14
36	**Procurement**	**25 days**	**Mon 7/28/14**	**Fri 8/29/14**
39	Constructability and Excecution Review with Selected C	2 days	Mon 9/8/14	Tue 9/9/14
40	Revise and Finalize Design and Execution Plans	5 days	Wed 9/10/14	Tue 9/16/14
41	**Excavation**	**60 days**	**Wed 9/17/14**	**Tue 12/9/14**
42	Mobilze Equipment and Materials	5 days	Wed 9/17/14	Tue 9/23/14
43	Excavation and Off-site T&D	45 days	Wed 9/24/14	Tue 11/25/14
44	BIOX and Injection Probe Installation	45 days	Wed 9/24/14	Tue 11/25/14
45	Backfill Operations	45 days	Wed 10/8/14	Tue 12/9/14
46	**ISCO System Operation & Maintenance**	**273 days**	**Wed 9/24/14**	**Fri 10/9/15**
47	Remaining Injection Probe Installations	55 days	Wed 9/24/14	Tue 12/9/14
48	Injection System Installation and Startup	10 days	Wed 11/26/14	Tue 12/9/14
49	Injector Probe Dose #1	15 days	Wed 12/10/14	Tue 12/30/14
50	Injector Probe Dose #2	15 days	Thu 3/12/15	Wed 4/1/15
51	Injector Probe Dose #3 (if needed)	15 days	Fri 6/12/15	Thu 7/2/15
52	Equipment Demobilization	20 days	Mon 9/14/15	Fri 10/9/15
53	**Monitoring and Reporting**	**223 days**	**Wed 11/19/14**	**Fri 9/25/15**
54	Conduct Baseline Monitoring	15 days	Wed 11/19/14	Tue 12/9/14
55	Step 1 Monitoring	15 days	Thu 2/19/15	Wed 3/11/15
56	Step 2 Monitoring	15 days	Fri 5/22/15	Thu 6/11/15
57	Step 3 Monitoring	15 days	Mon 8/24/15	Fri 9/11/15
58	**Periodic Reports to Client and RWQCB**	**142 days**	**Thu 3/12/15**	**Fri 9/25/15**
59	Injection & Monitoring Results, Step 1	10 days	Thu 3/12/15	Wed 3/25/15
60	Injection & Monitoring Results, Step 2	10 days	Fri 6/12/15	Thu 6/25/15
61	Injection & Monitoring Results, Step 3	10 days	Mon 9/14/15	Fri 9/25/15
62	**PROJECT COMPLETION REPORT**	30 days	Mon 9/7/15	Fri 10/16/15



Project: CSM ISCO-Excavation Prelim
Date: Mon 9/30/13

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

APPENDIX A

LNAPL Transmissivity Calculation,

LNAPL Recovery Test Data, and

LNAPL Laboratory Reports

LNAPL Transmissivity Calculation

Well Designation:	GMW-62	
Date:	13-May-13	

Ground Surface Elev (ft msl)	0.0	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	0.0		0.05
Well Casing Radius, r_c (ft):	0.167	r_{e1}	
Well Radius, r_w (ft):	0.500		
LNAPL Specific Yield, S_Y:	0.175		
LNAPL Density Ratio, ρ_r:	0.780		
Top of Screen (ft bgs):	0.0		
Bottom of Screen (ft bgs):	0.0		
LNAPL Baildown Vol. (gal.):	15.0		
Effective Radius, r_{e3} (ft):	0.258	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.245		
Initial Casing LNAPL Vol. (gal.):	1.66		
Initial Filter LNAPL Vol. (gal.):	2.33		

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)
Initial Fluid Levels:	0	30.15	32.7	30.15	32.7	30.71			
Enter Test Data:	480.6	30.60	31.06	30.60	31.06	30.70	0.40		
	1566.0	30.59	31.46	30.59	31.46	30.78	0.39	1023.3	0.114
	4563.0	30.44	32.03	30.44	32.03	30.79	0.24	3064.5	0.072
	5838.0	30.41	32.21	30.41	32.21	30.81	0.21	5200.5	0.050
	10224.6	30.30	32.62	30.30	32.62	30.81	0.10	8031.3	0.036
	14543.4	30.28	32.77	30.28	32.77	30.83	0.08	12384.0	0.012
	16089.0	30.27	32.78	30.27	32.78	30.82	0.07	15316.2	0.004

APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

DFSP NORWALK

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P:\DFSP Norwalk\tech\PTest_capture_report\Figs_v2.ppt

Figure 1

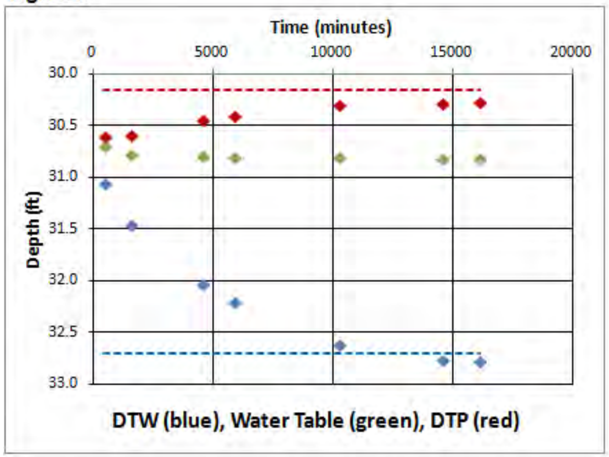
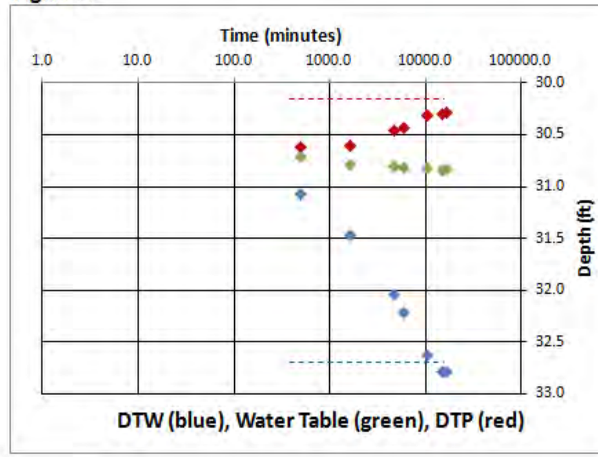


Figure 2



384.5	30.15
16089	30.15
384.5	32.7
16089	32.7

4022.3	#N/A
4022.3	#N/A

Figure 3

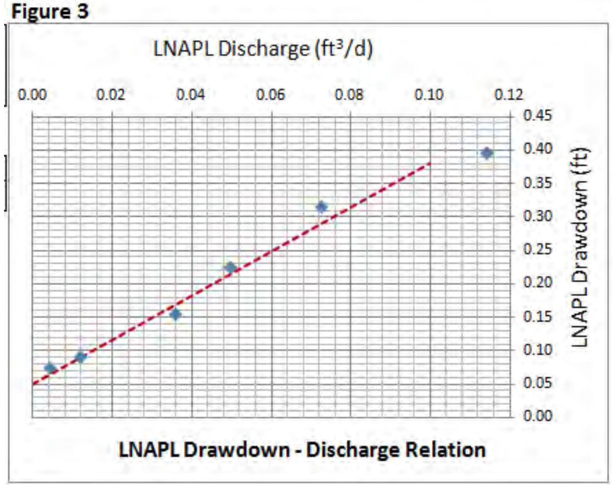
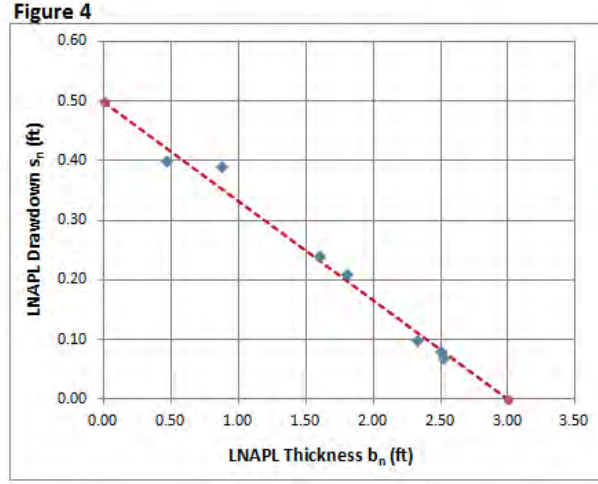


Figure 4



b_n	s_n
3	0
0	0.5

J-ratio	-0.167

APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

DFSP NORWALK

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Figure 5

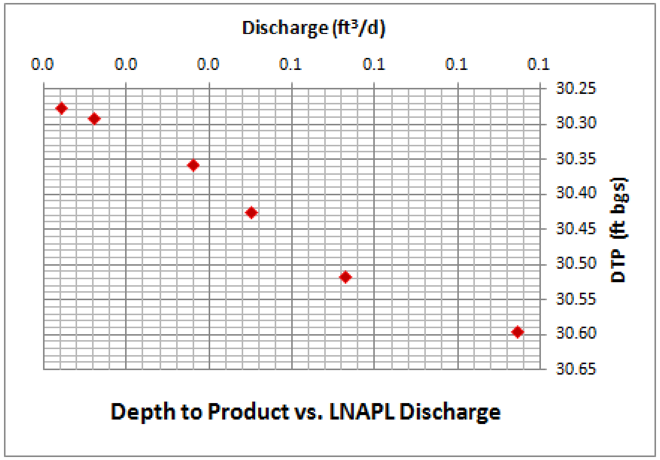


Figure 6

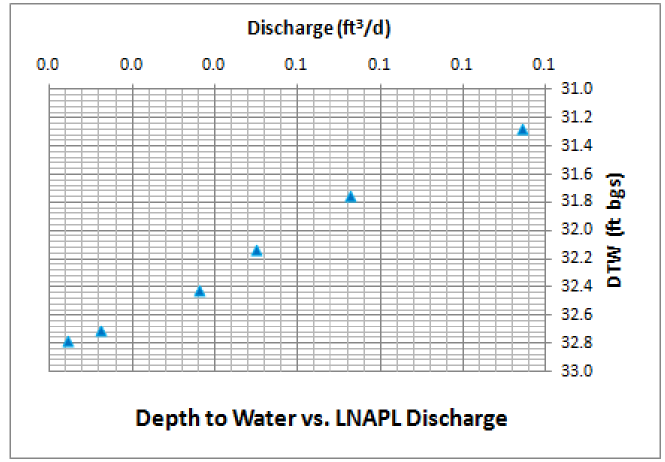


Figure 7

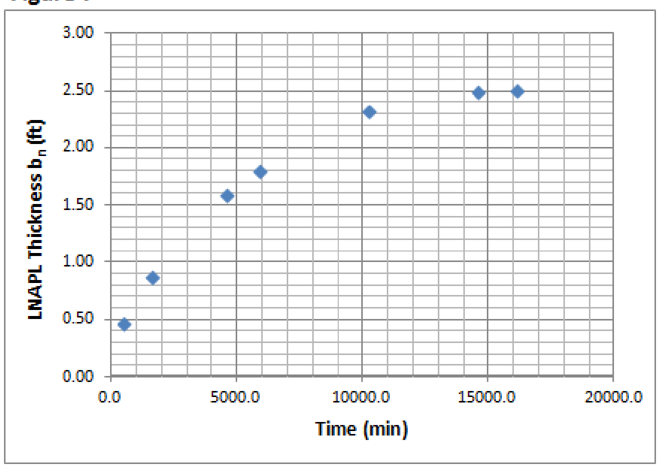
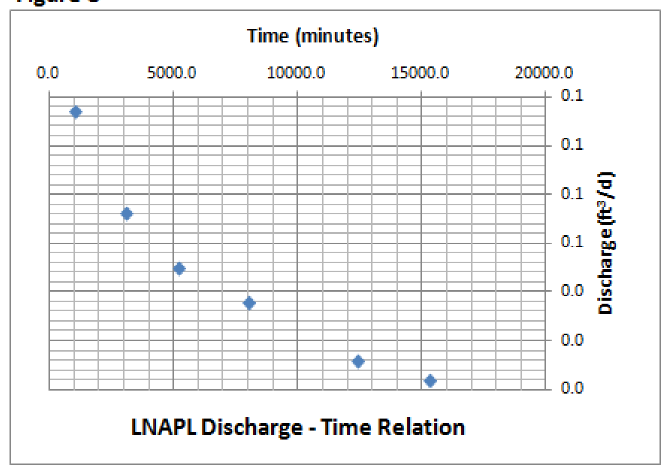


Figure 8



APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

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Figure 9

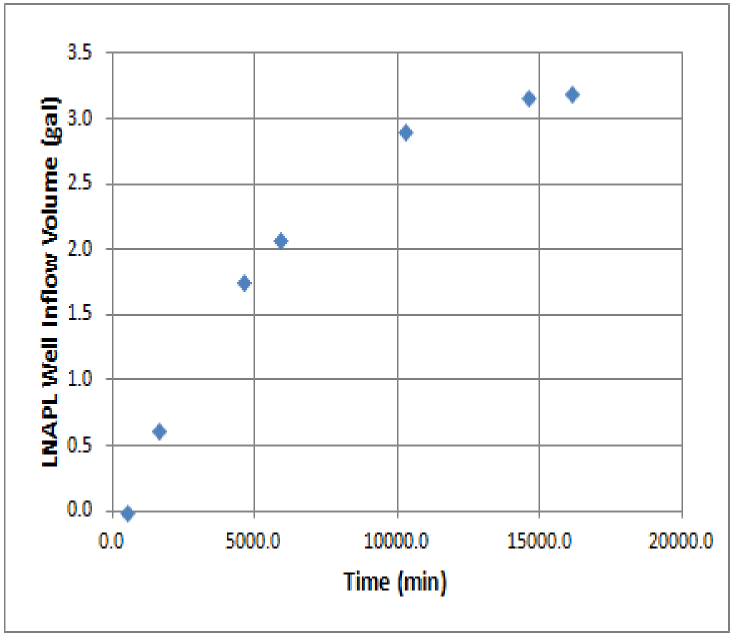
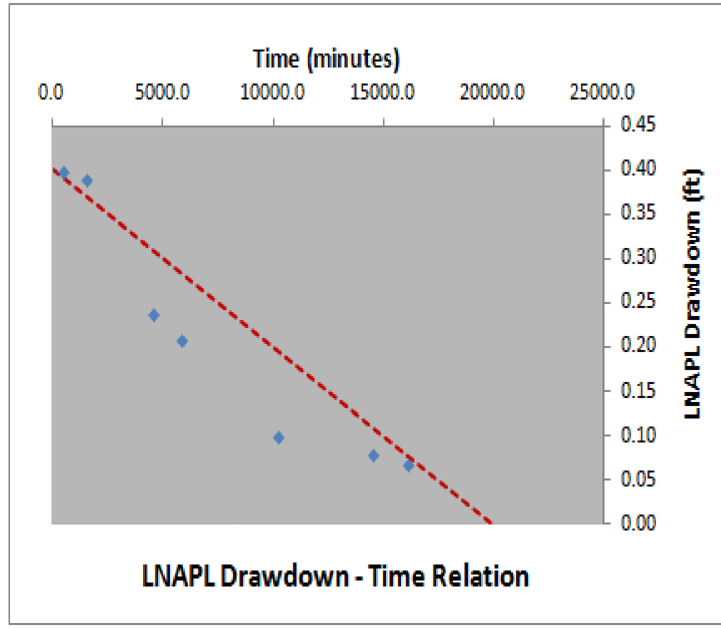


Figure 10



t (min)	s_n (ft)
0	0.4
20000	0

APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

DFSP NORWALK

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Generalized Bouwer and Rice (1976)

Well Designation:	GMW-62
Date:	13-May-13

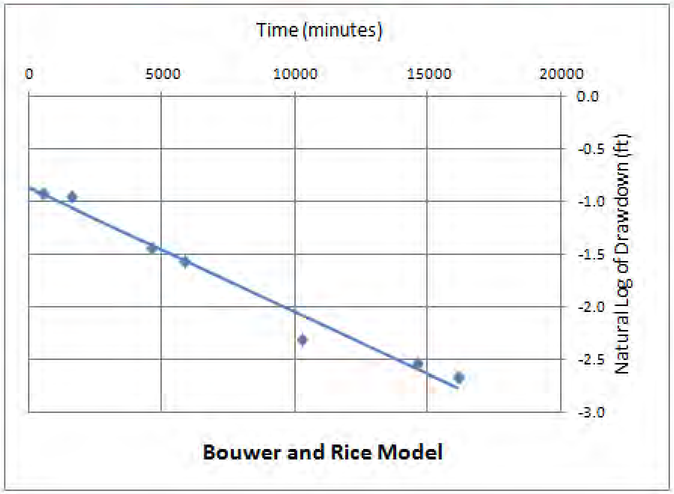
$$T_n = \frac{r_e^2 \ln(R/r_e) \ln(s_n(t_1)/s_n(t))}{2(-J)(t - t_1)}$$

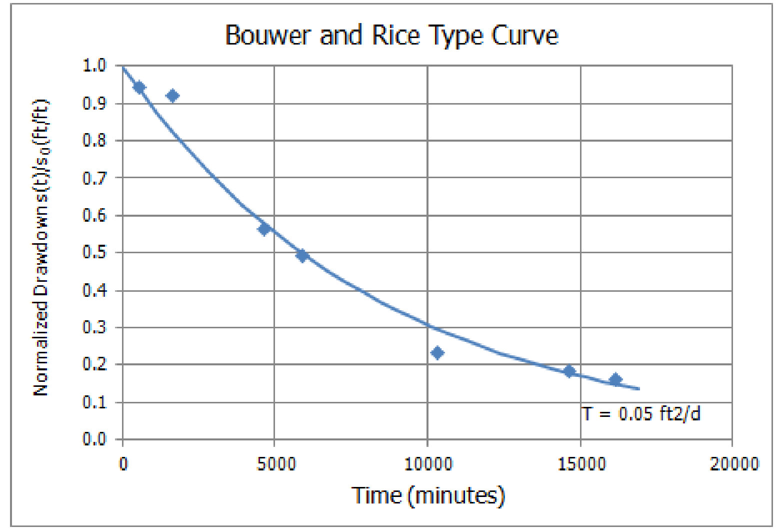
Enter early time cut-off for least-squares model fit

$Time_{cut}$	0	<- Enter or change value here

Model Results: T_n (ft^2/d) : 0.05648 +/- 0.004 ft^2/d

L_e/r_e	9.9
C	1.19
R/r_e	5.29
J-Ratio	-0.167
Coef. Of Variation	0.07





C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.

APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

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Cooper and Jacob (1946)

Well Designation:	GMW-62
Date:	13-May-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

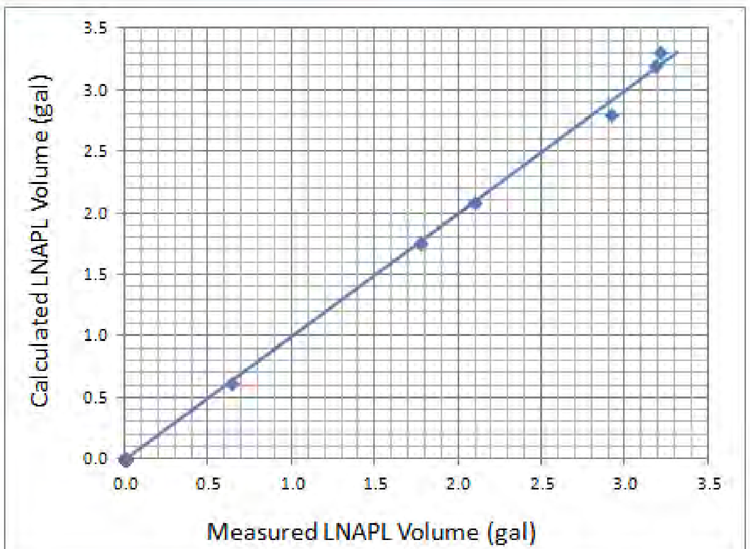
$Time_{cut}$ (min):	5	<- Enter or change values here
Time Adjustment (min):	5	

Trial S_n: d <-- Enter d for default or enter S_n value

Root-Mean-Square Error:	0.152	<-- Minimize this using "Solver"
	0.009	<-- Working S_n
Trial T_n (ft^2/d):	0.129	<-- By changing T_n through "Solver"

Add constraint $T_n > 0.00001$

Model Result: T_n (ft^2/d) = **0.13**



APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

DFSP NORWALK

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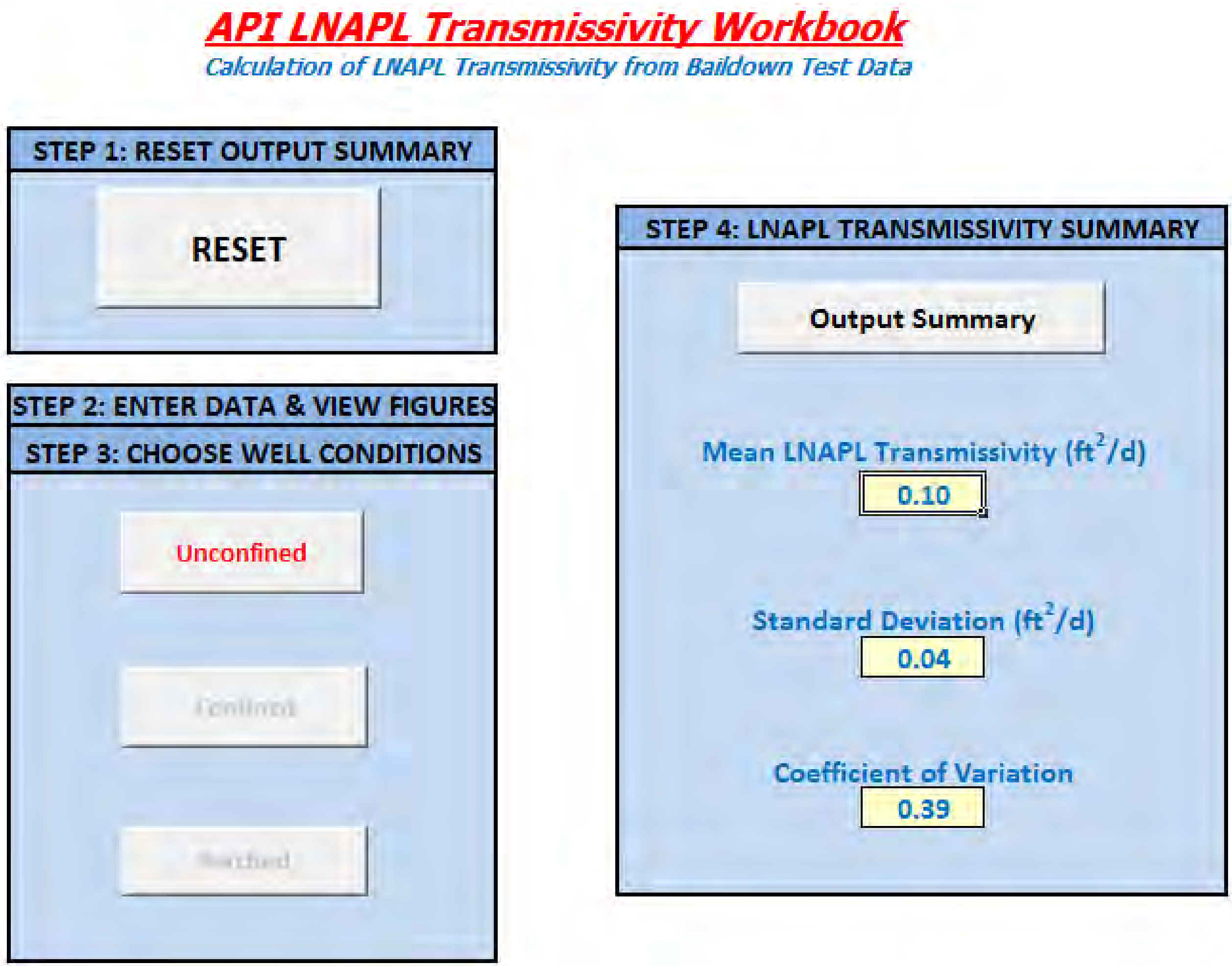

APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

DFSP NORWALK

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Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	GMW-62
Date:	13-May-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	0	<- Enter or change values here
Initial Drawdown s_n (ft):	0.5	

Trial S_n: d <-- Enter d for default

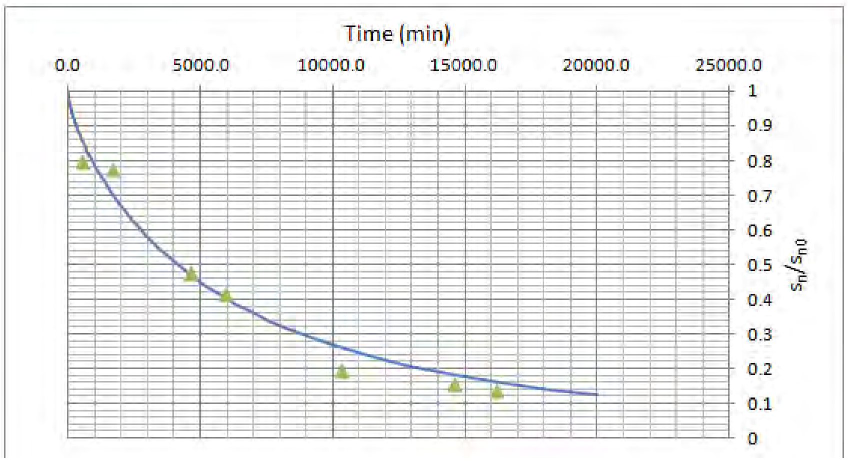
Root-Mean-Square Error: 0.118 <-- Minimize this using "Solver"

Trial T_n (ft^2/d): 0.123 <-- By changing T_n through "Solver"

0.009 <-- Working S_n Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.12**

T_{min}	3
T_{max}	20000



J-Ratio
-0.167

APPENDIX A
TRANSMISSIVITY CALCULATION WORKBOOK

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GMW-62 LNAPL Product Baildown Recovery Test Data

DFSP Norwalk
GMW-62 Baildown Test

Date	Time	Depth to Product (ft)	Depth to Water (ft)	Apparent Product Thickness (ft)	Casing Elevation (ft)	Ground water Elevation (ft)	Comments
07/11/10				0.00			3rd Qtr 2010
10/11/10				0.00			4th Qtr 2010
01/08/11	1609	0.00	29.03	0.00	76.34	47.31	
01/10/11		28.78	29.08	0.30	76.34	47.51	
02/18/11	1120	27.27	28.28	1.01	76.34	48.91	
04/07/11	1405	26.89	28.57	1.68	76.34	49.18	
05/18/11	1027	27.77	30.04	2.27	76.34	48.21	
05/25/11	1233	27.91	30.24	2.33	76.34	48.06	
06/29/11	1000	28.48	31.00	2.52	76.34	47.46	Measurements before pumping
06/29/11	1129	29.09	29.10	0.01	76.34	47.25	Measurements after pumping, removed 9 gallons free product, 10 gallons water
06/30/11	900	28.67	28.82	0.15	76.34	47.65	
07/07/11	1026	28.03	28.14	0.11	76.34	48.29	
07/27/11	1210	28.97	29.51	0.54	76.34	47.28	
08/02/11	1400	29.08	29.66	0.58	76.34	47.17	
08/12/11		29.17	29.97	0.80	76.34	47.04	
08/22/11	1330	29.08	29.92	0.84	76.34	47.13	
09/12/11	1330	28.23	29.06	0.83	76.34	47.98	
09/21/11	1345	29.21	30.16	0.95	76.34	46.98	
09/30/11	1230	29.06	29.96	0.90	76.34	47.14	
10/06/11	1002	28.45	29.39	0.94	76.34	47.74	
10/12/11	707	28.18	29.04	0.86	76.34	48.02	Measured by BTS
10/17/11	1045	29.42	30.43	1.01	76.34	46.76	Removed 1 L of product for testing
10/17/11	1100	29.74	30.41	0.67	76.34	46.49	After sample collection.
10/28/11	1405	29.55	30.27	0.72	76.34	46.67	
11/04/11	1340	29.11	29.78	0.67	76.34	47.12	
11/17/11	930	29.34	30.05	0.71	76.34	46.89	
12/02/11	1045	29.47	30.28	0.81	76.34	46.74	
12/14/11	800	29.86	30.78	0.92	76.34	46.33	Before bail down test. Removed 1 gallon of product and 2 gallons of water.
12/14/11	1541	29.97	30.01	0.04	76.34	46.36	6 Hours after product removal.
12/15/11	745	29.79	29.82	0.03	76.34	46.55	
12/19/11	1504	29.33	29.34	0.01	76.34	47.01	
12/23/11	915	30.08	30.20	0.12	76.34	46.24	
12/30/11	1030	29.75	29.80	0.05	76.34	46.58	
01/05/12	1124	29.10	29.13	0.03	76.34	47.24	
02/02/12	1200	30.01	30.16	0.15	76.34	46.31	
02/17/12	1000	30.07	30.22	0.15	76.34	46.25	
02/22/12	810	30.15	30.33	0.18	76.34	46.16	
02/28/12	1223	30.27	30.45	0.18	76.34	46.04	
03/07/12	743	30.25	30.43	0.18	76.34	46.06	
03/27/12	1304	29.50	29.58	0.08	76.34	46.83	
04/05/12	1500	30.25	30.42	0.17	76.34	46.06	

DFSP Norwalk
GMW-62 Baildown Test

Date	Time	Depth to Product (ft)	Depth to Water (ft)	Apparent Product Thickness (ft)	Casing Elevation (ft)	Ground water Elevation (ft)	Comments
04/12/12	808	29.58	29.68	0.10	76.34	46.74	
04/18/12	833	29.40	29.46	0.06	76.34	46.93	Measured by BTS
04/25/12	1150	30.01	30.08	0.07	76.34	46.32	
05/04/12	1117	30.36	30.51	0.15	76.34	45.96	
05/10/12	1005	30.23	30.37	0.14	76.34	46.09	
05/18/12	845	30.25	30.49	0.24	76.34	46.05	
05/23/12	930	30.22	30.52	0.30	76.34	46.07	
06/01/12	1100	30.32	30.63	0.31	76.34	45.97	
06/07/12	840	30.43	30.82	0.39	76.34	45.85	
06/12/12	1207	30.41	30.87	0.46	76.34	45.86	
06/19/12	1041	30.42	30.98	0.56	76.34	45.83	
06/27/12	1245	30.43	31.08	0.65	76.34	45.81	
07/06/12	1025	29.91	30.34	0.43	76.34	46.36	
07/09/12	1520	29.80	30.15	0.35	76.34	46.48	Measured by BTS
07/26/12	1030	30.58	31.31	0.73	76.34	45.64	
08/01/12	1344	30.57	31.40	0.83	76.34	45.64	
08/17/12	1045	30.62	31.74	1.12	76.34	45.54	
08/27/12	1414	30.58	31.80	1.22	76.34	45.56	FPR total removed = 5 gals (~2 gal was LNAPL)
08/27/12	1500	0.00	32.00	0.00	76.34	44.34	Gauged after FPR
09/12/12	1000	30.81	31.49	0.68	76.34	45.42	
09/18/12	1021	30.77	31.67	0.90	76.34	45.43	
09/24/12	1600	30.68	31.74	1.06	76.34	45.49	FPR total removed = 5 gals, (4 gals LNAPL)
10/02/12	1230	30.84	32.23	0.39	76.34	44.44	
10/25/12	1020	30.23	30.81	0.58	76.34	46.02	
11/01/12	1350	30.25	30.82	0.57	76.34	46.00	
11/09/12	905	30.26	30.83	0.57	76.34	45.99	
11/16/12	1430	30.25	30.83	0.58	76.34	46.00	
11/21/12	1150	30.67	31.33	0.66	76.34	45.56	
11/30/12	1445	30.77	31.32	0.55	76.34	45.48	
12/04/12	1000	30.59	31.95	1.36	76.34	45.53	
12/11/12	1200	30.61	32.36	1.75	76.34	45.45	
12/21/12	1300	30.50	32.40	1.90	76.34	45.54	
12/26/12	1450	30.57	32.97	2.40	76.34	45.39	
01/08/13	1430	29.96	32.78	2.82	76.34	45.93	FPR total removed = 9 gals (3 gals LNAPL)
01/11/13	817	30.62	30.62	0.00	76.34	45.72	
01/14/13	?	30.55	30.79	0.24	76.34	45.75	Measured by BTS?
01/17/13	1505	30.78	31.23	0.45	76.34	45.49	
01/25/13	1240	30.64	32.72	2.08	76.34	45.37	
01/29/13	1244	30.60	33.08	2.48	76.34	45.34	
02/04/13	1410	30.44	33.40	2.48	76.34	45.02	FPR total removed=3 gals (2 gals LNAPL)
02/12/13	1138	30.76	32.67	2.48	76.34	45.75	
02/19/13	1448	30.04	31.82	2.48	76.34	46.60	FPR total removed=3 gals (2 gals LNAPL)
02/26/13	958	30.18	31.62	1.44	76.34	45.93	

DFSP Norwalk
GMW-62 Baildown Test

Date	Time	Depth to Product (ft)	Depth to Water (ft)	Apparent Product Thickness (ft)	Casing Elevation (ft)	Ground water Elevation (ft)	Comments
03/04/13	1436	30.11	31.74	2.48	76.34	46.68	FPR total removed=5 gals (4 gals LNAPL)
03/11/13	1210	30.09	31.68	1.59	76.34	46.00	
03/25/13	1145	30.19	31.97	1.78	76.34	45.87	
04/01/13	1420	30.17	32.05	2.48	76.34	46.37	FPR total removed=6 gals (4 gals LNAPL)
04/01/13	1440	32.13	32.15	0.02	76.34	44.21	After purge
04/03/13	803	30.42	31.36	0.94	76.34	45.77	
04/08/13	?	30.35	32.13	1.78	76.34	45.71	Measured by BTS?
04/11/13	1256	30.56	32.42	1.86	76.34	45.48	
04/15/13	1517	30.46	33.48	3.02	76.34	45.40	FPR total removed=11 gals (10 gals LNAPL)
04/15/13	1545	32.75	32.75	0.00	76.34	43.59	After purge
04/19/13	1330	30.92	32.02	1.10	76.34	45.24	
04/24/13	1020	30.83	33.05	2.22	76.34	45.15	
05/02/13	1240	30.01	33.30	3.29	76.34	45.80	
05/07/13	1043	29.96	33.27	3.31	76.34	45.85	
2013 Product Baildown Recovery Test							
05/13/13	**525**	**29.98**	**33.29**	**3.31**	**76.34**	**45.83**	**Started bail down test. FPR total removed=25 gals (15 gals LNAPL)**
05/13/13	545	0.00	34.62	0.00	76.34	41.72	After purge
05/13/13	1346	30.60	31.06	0.46	76.34	45.67	
05/14/13	755	30.59	31.46	0.87	76.34	45.61	
05/15/13	739	30.52	31.48	0.96	76.34	45.67	
05/16/13	950	30.44	32.03	1.59	76.34	45.65	
05/17/13	715	30.41	32.21	1.80	76.34	45.64	
05/20/13	826	30.30	32.62	2.32	76.34	45.67	
05/21/13	1430	30.22	32.64	2.42	76.34	45.73	
05/22/13	810	30.23	32.70	2.47	76.34	45.71	
05/23/13	824	30.28	32.77	2.49	76.34	45.66	
05/24/13	1000	30.27	32.78	2.51	76.34	45.67	
05/28/13	755	30.20	32.71	2.51	76.34	45.74	
05/31/13	800	30.23	32.78	2.55	76.34	45.70	
06/03/13	837	30.24	32.81	2.57	76.34	45.69	
06/05/13	1035	30.24	32.81	2.57	76.34	45.69	
06/07/13	1228	30.17	32.75	2.58	76.34	45.76	

GMW-4

September 7, 2007 LNAPL Sample

Laboratory Report

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
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September 10, 2007

Shiow-Whei Chou, Project Manager
Geomatrix Consultants
510 Superior Avenue, Suite 200
Newport Beach, CA 92663

Dear Ms. Chou:

Included are the results from the testing of material submitted on September 10, 2007 from the DFSP Norwalk 1603.044, F&BI 709078 project. The product sample submitted for forensic evaluation arrived in good condition. Upon arrival, the sample GMW-4-090707 was placed in a refrigerator maintained at 4°C until removed for sample processing.

The sample GMW-4-090707 was diluted and analyzed using a gas chromatograph with a flame ionization detector (GC/FID). The data generated yielded information on the boiling range and general chemical composition of the material present. The GC/FID traces are enclosed. A GC/FID trace of a standard consisting of normal alkanes is also provided for reference purposes.

Please contact us if additional consultation is needed by our firm in the interpretation of the analytical results provided. We appreciate this opportunity to be of service to you and hope you will call if you should have any questions. We will hold your samples for 30 days before disposal unless directed otherwise.

Sincerely,

FRIEDMAN & BRUYA, INC.

Kurt Johnson
Chemist

Enclosures
NAA0910R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 09/10/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Extracted: 09/10/07
Date Analyzed: 09/10/07

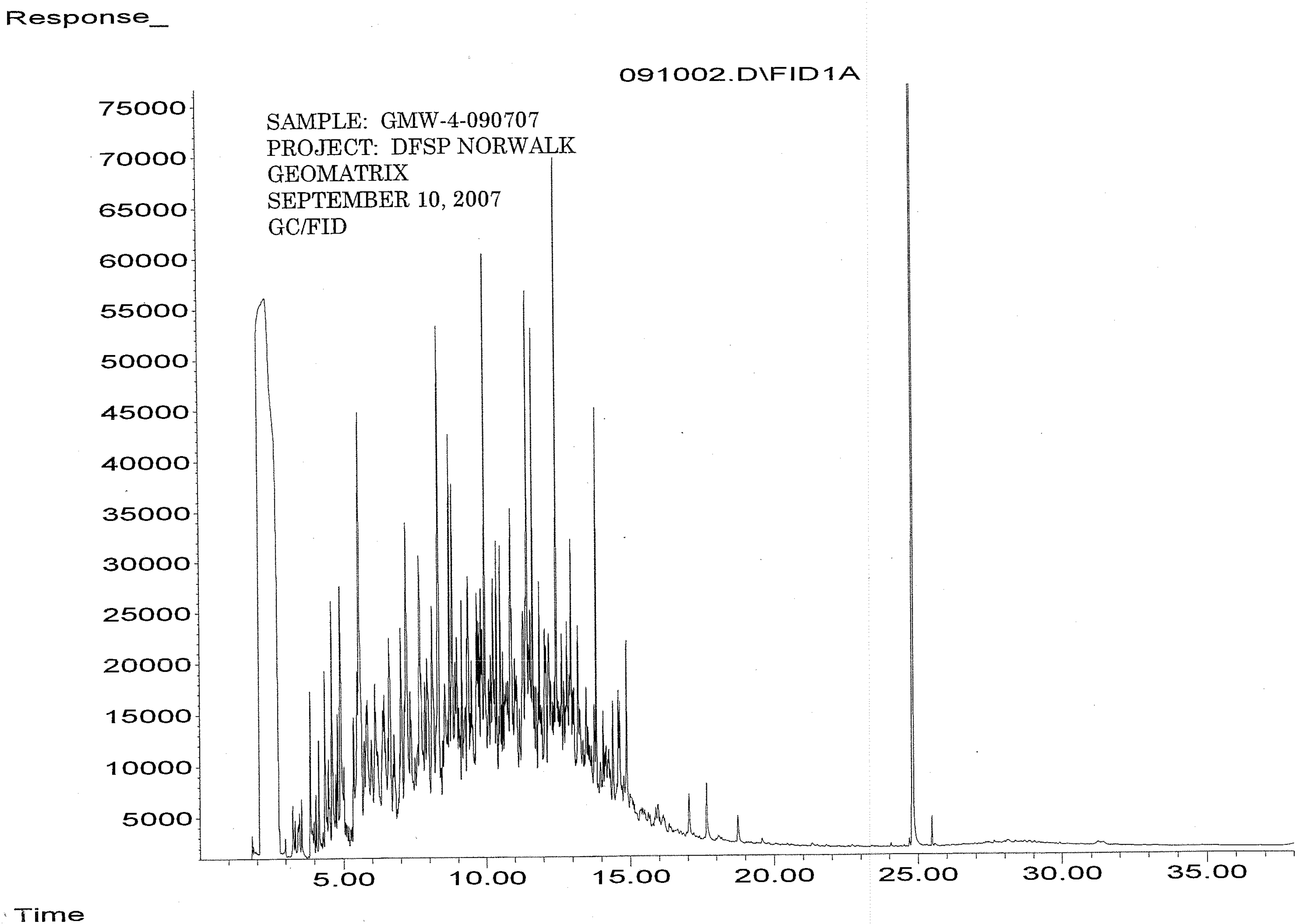
RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR FORENSIC EVALUATION BY CAPILLARY GAS CHROMATOGRAPHY USING A FLAME IONIZATION DETECTOR (FID)

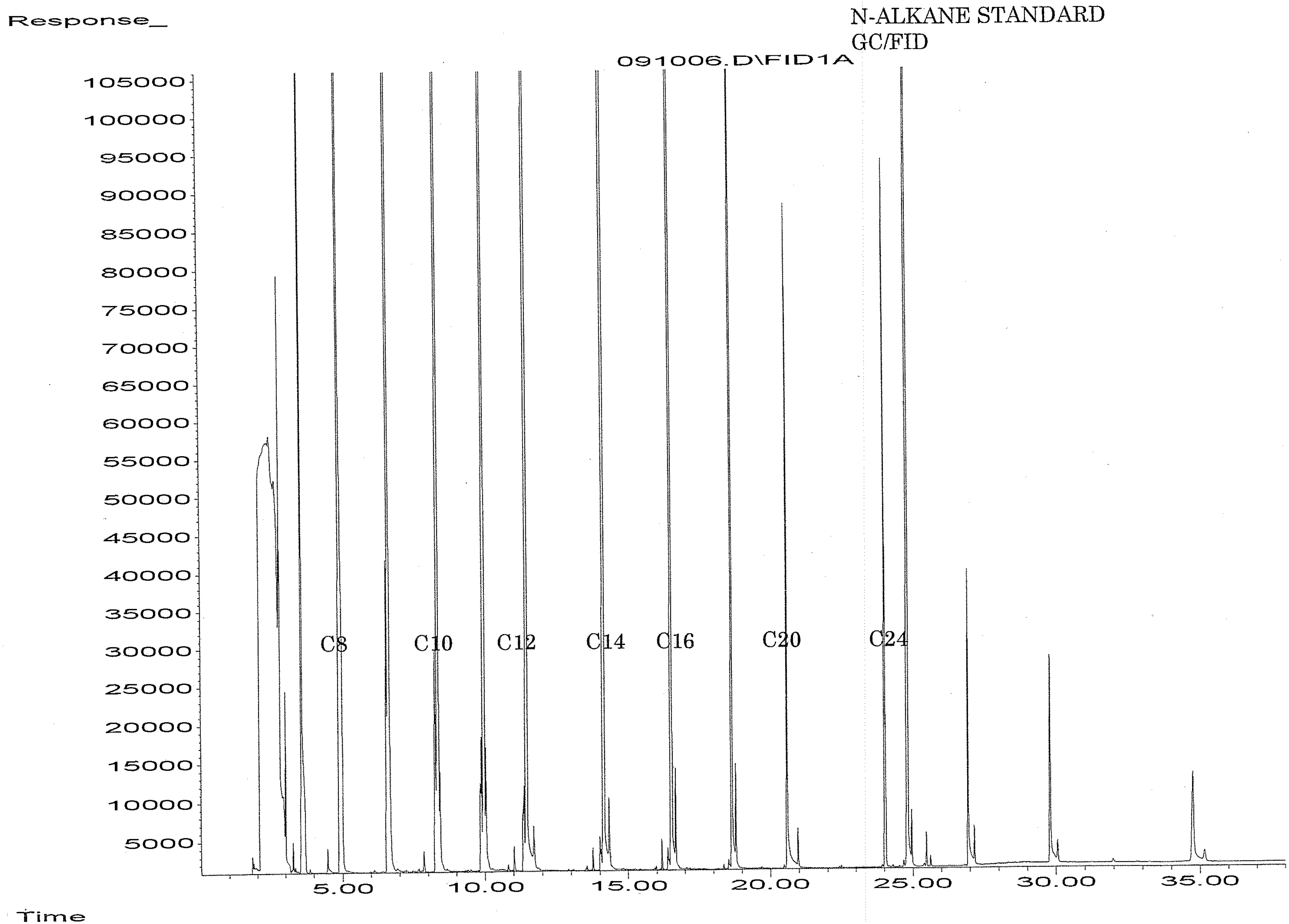
Sample ID	GC Characterization
GMW-4-090707	The GC trace using the flame ionization detector (FID) showed the presence of low and medium boiling compounds. The patterns displayed by these peaks are indicative of a low boiling petroleum distillate such as JP-4, or a mixture of gasoline, condensate, or JP-4 and a middle distillate such as kerosene, Jet A or JP-5.

The low boiling compounds appear as a ragged pattern of peaks eluting from n-C_7 to n-C_{17} showing a maximum near n-C_{10}. This correlates with a temperature range of approximately 100°C to 240 °C with a maximum near 170 °C. Peaks indicative of the most abundant aromatic compounds usually seen in gasoline are not present.

The medium boiling compounds appear as a regular pattern of peaks on top of a hump or unresolved complex mixture (UCM). This material elutes from n-C_8 to n-C_{18} showing a maximum near n-C_{13}. This correlates with a temperature range of approximately 130°C to 320 °C with a maximum near 240 °C. Within this range, the dominant peaks present are indicative of both normal alkanes and isoprenoids. The relative abundance of the normal alkanes and isoprenoids indicates that substantial biological degradation has not occurred to at least a portion of the fuel.

The large peak seen near 25 minutes on the GC/FID trace is pentacosane, added as a quality assurance check for this GC analysis.


Response_
091002.D\FID1A
SAMPLE: GMW-4-090707
PROJECT: DFSP NORWALK
GEOMATRIX
SEPTEMBER 10, 2007
GC/FID
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Time


N-ALKANE STANDARD
GC/FID
091006.D\FID1A
Response_
105000
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
C8
C10
C12
C14
C16
C20
C24
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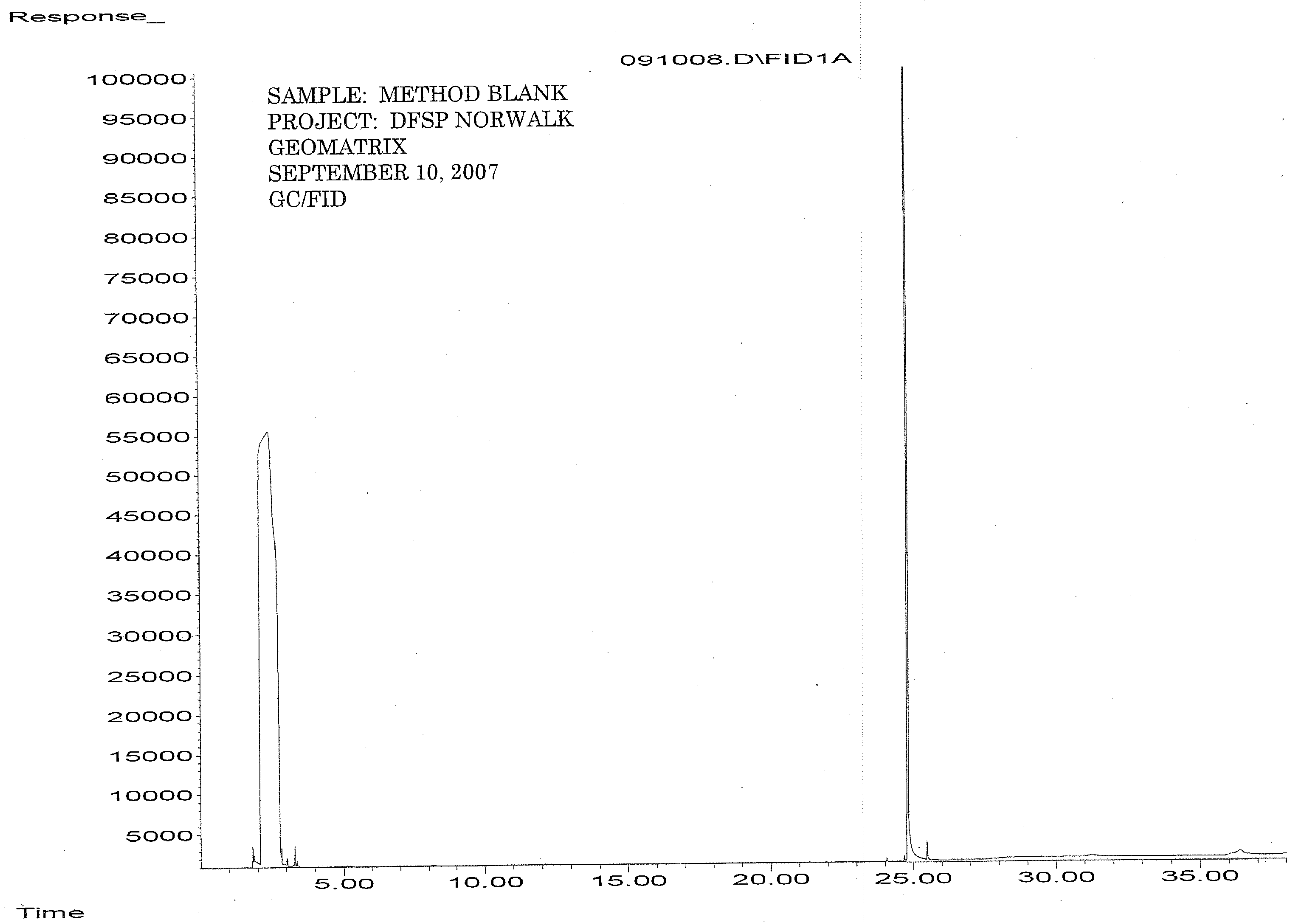
20.00
25.00
30.00
35.00
Time



Response_
091008.D\FID1A
SAMPLE: METHOD BLANK
PROJECT: DFSP NORWALK
GEOMATRIX
SEPTEMBER 10, 2007
GC/FID
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Time

CHAIN-OF-CUSTODY RECORD 709078 MP 09/10/07 NEW 11767 A02

PROJECT NAME: DFSP Norwalk			DATE: 9-7-07	PAGE 1 OF 1
PROJECT NUMBER: 1603.044	LABORATORY NAME:	CLIENT INFORMATION:	REPORTING REQUIREMENTS:	
RESULTS TO: Shiow-Whei Chou	LABORATORY ADDRESS:			
TURNAROUND TIME: 24 Hr				
SAMPLE SHIPMENT METHOD: Fedex	LABORATORY CONTACT:		GEOTRACKER REQUIRED YES NO	
	LABORATORY PHONE NUMBER:		SITE SPECIFIC GLOBAL ID NO.	

SAMPLERS (SIGNATURE): [signature]

ANALYSES

Lab ID	DATE	TIME	SAMPLE NUMBER	GC/FID		PIANO													CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
01 A-C	9-7-07	14:40	GMW-4-090707	X		X													40 mL VOA	O	–	–	–		3	

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	TOTAL NUMBER OF CONTAINERS: 3
SIGNATURE: [signature] PRINTED NAME: R. DOVE COMPANY: Geomatrix	9/7/07	1652	SIGNATURE: [signature] PRINTED NAME: Nhan Phan COMPANY: FeBI	9/10/07	09:30	SAMPLING COMMENTS:
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:			~~Sampl received at~~ 21 °C
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:			

510 Superior Avenue, Suite 200
Newport Beach, California 92663-3627
Tel 949.642.0245 Fax 949.642.4474
Geomatrix

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

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September 19, 2007

Shiow-Whei Chou, Project Manager
Geomatrix
510 Superior Avenue, Suite 200
Newport Beach, CA 92663

Dear Ms. Chou:

Included are the results from the testing of material submitted on September 10, 2007 from the DFSP Norwalk 1603.044, F&BI 709078 project. There are 6 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Kurt Johnson
Chemist

Enclosures
NAA0919R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 09/19/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Analyzed: 9/10/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709078-01
Client ID GMW-4-090707

Compound	Weight Percent
Propane	<0.01
Methanol	<0.01
Isobutane	<0.01
2-Methyl-1-propene	<0.01
Ethanol	<0.01
n-Butane	<0.01
t-2-Butene	<0.01
c-2-Butene	<0.01
Isopropanol	<0.01
3-Methyl-1-butene	<0.01
Isopentane	<0.01
tert-Butanol	<0.01
1-Pentene	<0.01
2-Methyl-1-butene	<0.01
n-Propanol	<0.01
n-Pentane	<0.01
t-2-Pentene	<0.01
c-2-Pentene	<0.01
2-Methyl-2-butene	<0.01
MTBE	<0.01
sec-Butanol	<0.01
4-Methyl-1-pentene	<0.01
Isobutanol	<0.01
2,3-Dimethylbutane	<0.01
Cyclopentane	<0.01
2-Methylpentane	<0.01
DIPE	<0.01
3-Methylpentane	<0.01
1-Hexene	<0.01
ETBE	<0.01
n-Hexane	<0.01

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 09/19/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Analyzed: 9/10/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709078-01
Client ID GMW-4-090707

Compound	Weight Percent
t-2-Hexene	<0.01
2-Methyl-1-pentene	<0.01
2-Methyl-2-pentene	<0.01
c-2-Hexene	<0.01
2,2-Dimethylpentane	<0.01
2,4-Dimethylpentane	<0.01
Methylcyclopentane	0.02
2,2,3-Trimethylbutane	<0.01
Benzene	<0.01
1-Methylcyclopentene	<0.01
TAME	<0.01
3,3-Dimethylpentane	<0.01
Cyclohexane	0.02
2-Methylhexane	0.02
2,3-Dimethylpentane	0.02
1,1-Dimethylcyclopentane	0.01
3-Methylhexane	0.04
c-1,3-Dimethylcyclopentane	0.03
3-Ethylpentane	0.01
Isooctane	0.02
t-1,2-Dimethylcyclopentane	0.06
1-Heptene	<0.01
n-Heptane	0.07
t-3-Heptene	<0.01
c-3-Heptene	<0.01
t-2-Heptene	<0.01
c-2-Heptene	<0.01
2,2-Dimethylhexane	<0.01
2,5-Dimethylhexane	0.02
Methylcyclohexane	0.24
2,4-Dimethylhexane	0.24
Ethylcyclopentane	0.04

Date of Report: 09/19/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Analyzed: 9/10/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709078-01
Client ID GMW-4-090707

Compound	Weight Percent
t-1,c-2,4-Trimethylcyclopentane	0.10
t-1,c-2,3-Trimethylcyclopentane	0.18
2,3,4-Trimethylpentane	0.02
Toluene	<0.01
2,3-Dimethylhexane	0.04
2-Methylheptane	0.25
3-Methylheptane	0.15
4-Methylheptane	0.07
3-Ethylhexane	0.03
1-Octene	<0.01
1,2,3-Trimethylcyclopentane	0.11
t-1,2-Dimethylcyclohexane	0.47
n-Octane	0.34
1-Ethyl-1-methylcyclopentane	0.09
c-2-Octene	<0.01
c-1,2-Dimethylcyclohexane	0.30
Isopropylcyclopentane	0.02
2,5-Dimethylheptane	0.10
3,5-Dimethylheptane	0.03
n-Propylcyclopentane	0.11
Ethylbenzene	0.12
2,3-Dimethylheptane	0.32
3,4-Dimethylheptane	0.03
2-Methyloctane	0.18
m-Xylene	0.03
p-Xylene	0.09
3-Methyloctane	0.32
1-Nonene	<0.01
3,3-Diethylpentane	<0.01
t-3-Nonene	<0.01
c3-Nonene	<0.01
o-Xylene	0.02

Date of Report: 09/19/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Analyzed: 9/10/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709078-01
Client ID GMW-4-090707

Compound	Weight Percent
n-Nonane	0.66
Isobutylcyclopentane	0.08
t-2-Nonene	<0.01
c-2-Nonene	<0.01
Isopropylbenzene	0.02
3,3-Dimethyloctane	0.03
n-Butylcyclopentane	0.14
n-Propylbenzene	0.14
2,3-Dimethyloctane	0.10
1-Methyl-3-ethylbenzene	0.02
1-Methyl-4-ethylbenzene	0.19
2-Methylnonane	0.18
3-Ethyloctane	0.19
3-Methylnonane	0.19
1,3,5-Trimethylbenzene	0.14
1-Methyl-2-ethylbenzene	0.28
1,2,4-Trimethylbenzene	0.37
tert-Butylbenzene	<0.01
n-Decane	0.67
Isobutylbenzene	0.11
Isopropylcyclohexane	<0.01
sec-Butylbenzene	0.18
1-Methyl-3-isopropylbenzene	0.16
Isobutylcyclohexane	<0.01
1-Methyl-4-isopropylbenzene	0.25
1,2,3-Trimethylbenzene	0.61
Indan	0.05
1-Methyl-3-n-propylbenzene	0.09
1-Methyl-4-n-propylbenzene	0.21
n-Butylbenzene	0.50
1,3-Dimethyl-5-ethylbenzene	0.32
1,2-Diethylbenzene	0.08

Date of Report: 09/19/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Analyzed: 9/10/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709078-01
Client ID GMW-4-090707

Compound	Weight Percent
1-Methyl-2-n-propylbenzene	0.26
1,4-Dimethyl-2-ethylbenzene	0.28
1,2-Dimethyl-4-ethylbenzene	0.41
1,3-Dimethyl-2-ethylbenzene	0.26
1,2-Dimethyl-3-ethylbenzene	0.28
n-Undecane	1.30
1,2,4,5-Tetramethylbenzene	0.24
2-Methylbutylbenzene	0.11
n-Pentylbenzene	0.10
Methylindan	0.19
1-tert-Butyl-3,5-dimethylbenzene	<0.01
1-tert-Butyl-4-ethylbenzene	<0.01
n-Dodecane	1.00
1,3,5-Triethylbenzene	<0.01
1,2,4-Triethylbenzene	<0.01
Naphthalene	0.39
n-Hexylbenzene	<0.01
2-Methylnaphthalene	0.99
n-Tridecane	0.63
1-Methylnaphthalene	0.67
n-Tetradecane	0.25
n-Pentadecane	0.11

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 09/19/07
Date Received: 09/10/07
Project: DFSP Norwalk 1603.044, F&BI 709078
Date Analyzed: 9/10/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709078-01
Client ID GMW-4-090707

PIANO SUMMARY	Weight Percent
Total Identified Compounds	17.84
Oxygenated Compounds	0.00
Hydrocarbon Compounds	17.84
Unidentified Compounds	82.16
Total	100

	Paraffins	Isoparaffins	Aromatics	Naphthenes	Olefins	Total
C3	<0.01					<0.01
C4	<0.01	<0.01			<0.01	<0.01
C5	<0.01	<0.01		<0.01	<0.01	<0.01
C6	<0.01	<0.01	<0.01	0.04	<0.01	0.04
C7	0.07	0.09	<0.01	0.38	<0.01	0.54
C8	0.34	0.83	0.25	1.39	<0.01	2.81
C9	0.66	0.98	1.83	0.22	<0.01	3.69
C10	0.67	0.69	4.23	<0.01		5.59
C11	1.30		1.87			3.17
C12	1.00		<0.01			1.00
C13	0.63					0.63
C14	0.25					0.25
C15	0.11					0.11
Total	5.05	2.60	8.17	2.02	<0.01	17.84

709078   MP 09/10/07   NEW 11767   A02

CHAIN-OF-CUSTODY RECORD

PROJECT NAME: DFSP Norwalk		DATE: 9-7-07	PAGE 1 OF 1
PROJECT NUMBER: 1603.044	LABORATORY NAME:	CLIENT INFORMATION:	REPORTING REQUIREMENTS:
RESULTS TO: Shiow-Whei Chou	LABORATORY ADDRESS:		
TURNAROUND TIME: 24 Hr			
SAMPLE SHIPMENT METHOD: Fedex	LABORATORY CONTACT:		GEOTRACKER REQUIRED YES NO
	LABORATORY PHONE NUMBER:		SITE SPECIFIC GLOBAL ID NO.

SAMPLERS (SIGNATURE): [signature]

ANALYSES

Lab ID	DATE	TIME	SAMPLE NUMBER	GC/FID		PIANO	CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
01 A-C	9-7-07	14:40	GMW-4-090707	X		X	40 mL VOA	O	—	—	—		3	

TOTAL NUMBER OF CONTAINERS: 3

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: [signature] PRINTED NAME: R. DOVE COMPANY: Geomatrix	9/7/07	1652	SIGNATURE: [signature] PRINTED NAME: Nhan Phan COMPANY: FeBI	9/10/07	09:30
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		

SAMPLING COMMENTS:

Sample received at 21 °C

510 Superior Avenue, Suite 200
Newport Beach, California 92663-3627
Tel 949.642.0245 Fax 949.642.4474

Geomatrix

MW-9

September 11, 2007 LNAPL Sample

Laboratory Report

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

September 13, 2007

Shiow-Whei Chou, Project Manager
Geomatrix Consultants
510 Superior Avenue, Suite 200
Newport Beach, CA 92663

Dear Ms. Chou:

Included are the results from the testing of material submitted on September 12, 2007 from the DFSP Norwalk 1603.044.0, F&BI 709117 project. The product sample submitted for forensic evaluation arrived in good condition. Upon arrival, the sample MW-9-091107 was placed in a refrigerator maintained at 4°C until removed for sample processing.

The sample MW-9-091107 was diluted and analyzed using a gas chromatograph with a flame ionization detector (GC/FID). The data generated yielded information on the boiling range and general chemical composition of the material present. The GC/FID traces are enclosed. A GC/FID trace of a standard consisting of normal alkanes is also provided for reference purposes.

Please contact us if additional consultation is needed by our firm in the interpretation of the analytical results provided. We appreciate this opportunity to be of service to you and hope you will call if you should have any questions. We will hold your samples for 30 days before disposal unless directed otherwise.

Sincerely,

FRIEDMAN & BRUYA, INC.

Kurt Johnson
Chemist

Enclosures
NAA0913R.DOC

Date of Report: 09/13/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Extracted: 09/12/07
Date Analyzed: 09/12/07

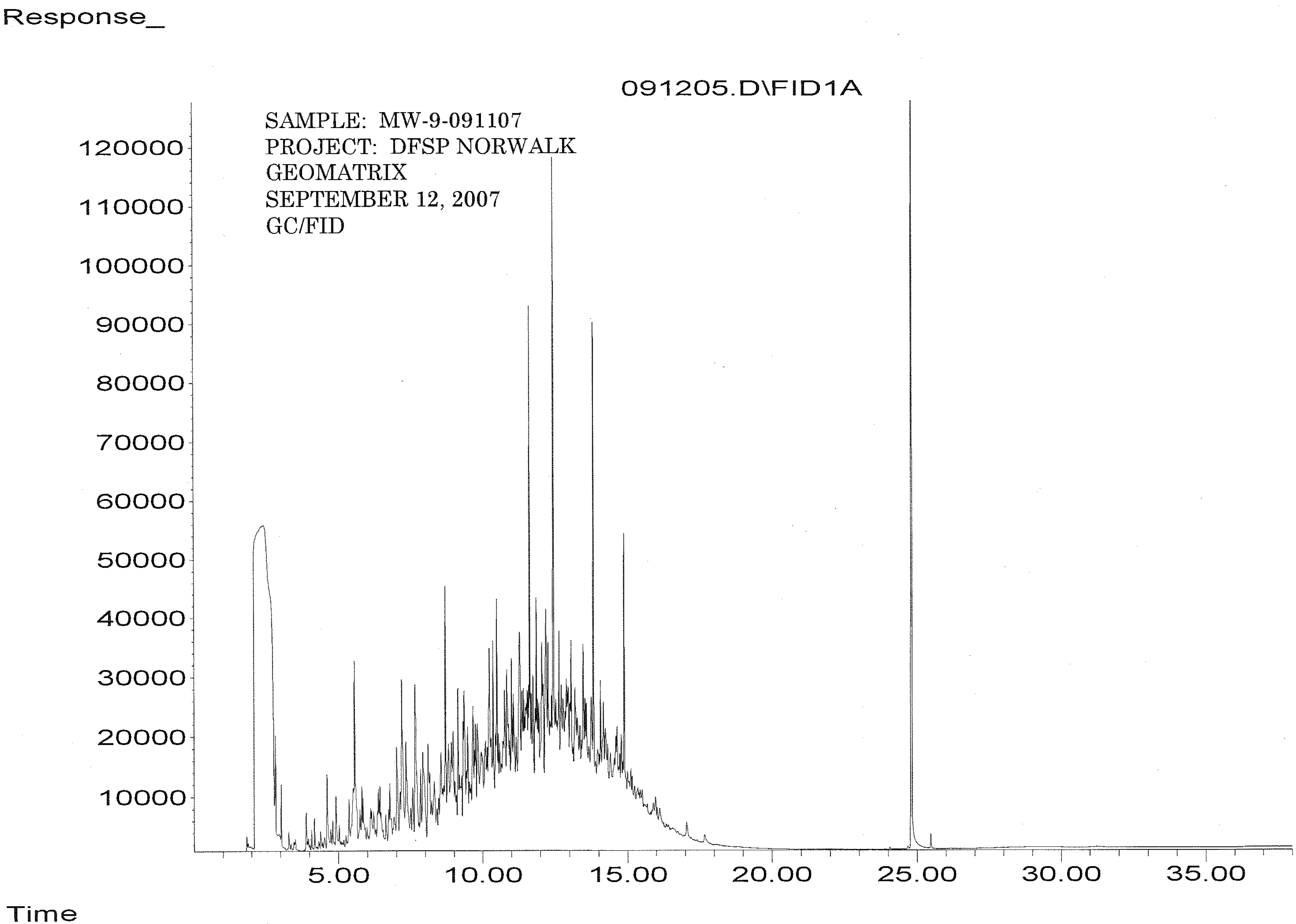
RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR FORENSIC EVALUATION BY CAPILLARY GAS CHROMATOGRAPHY USING A FLAME IONIZATION DETECTOR (FID)

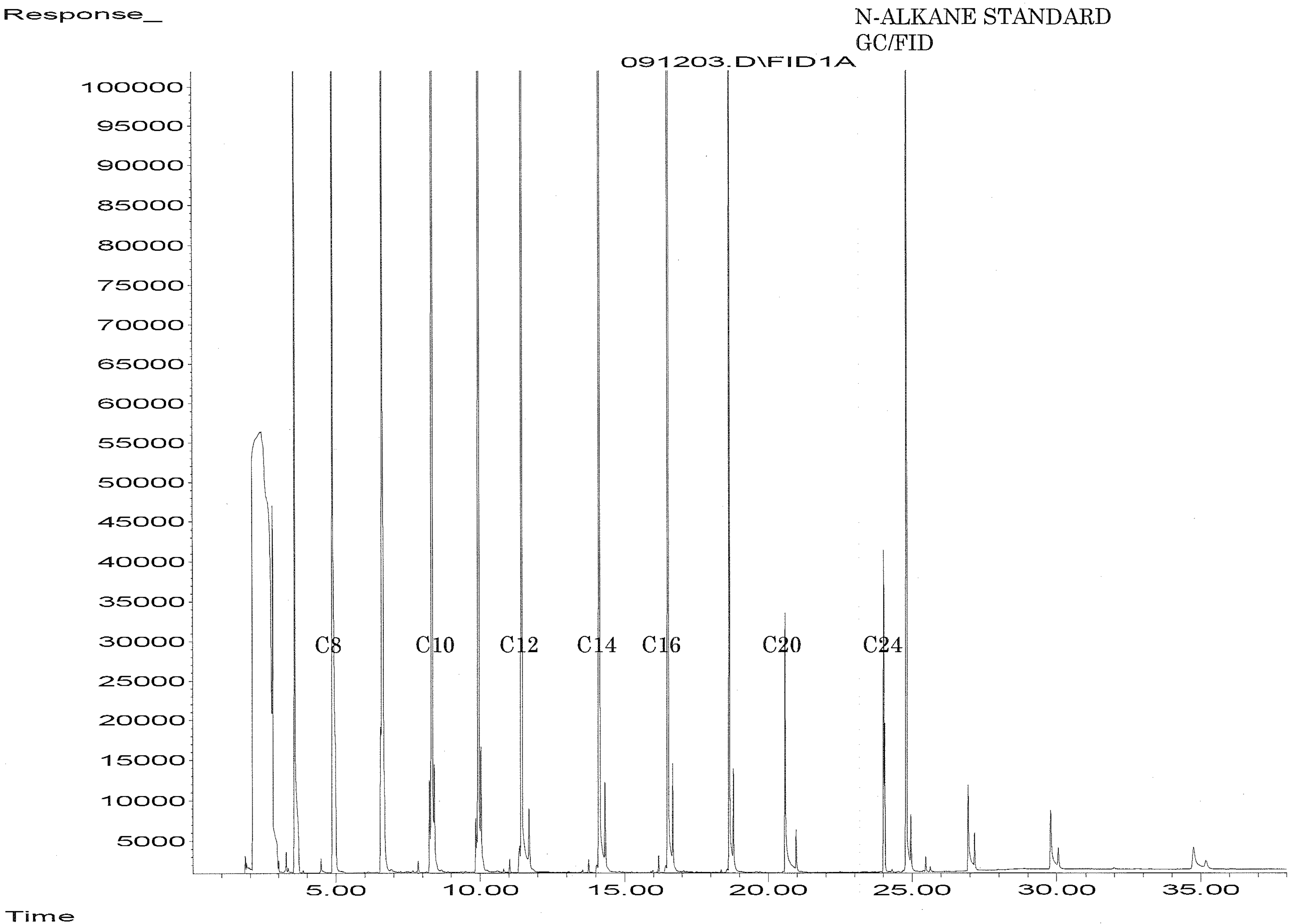
Sample ID	GC Characterization
MW-9-091107	The GC trace using the flame ionization detector (FID) showed the presence of low and medium boiling compounds. The patterns displayed by these peaks are indicative of a low boiling petroleum distillate such as JP-4, or a mixture of gasoline, condensate, or JP-4 and a middle distillate such as kerosene, Jet A or JP-5.

The low boiling compounds appear as a ragged pattern of peaks eluting from n-C_7 to n-C_{14} showing a maximum near n-C_{10}. This correlates with a temperature range of approximately 100°C to 250 °C with a maximum near 170 °C. Peaks indicative of the most abundant aromatic compounds usually seen in gasoline are not present.

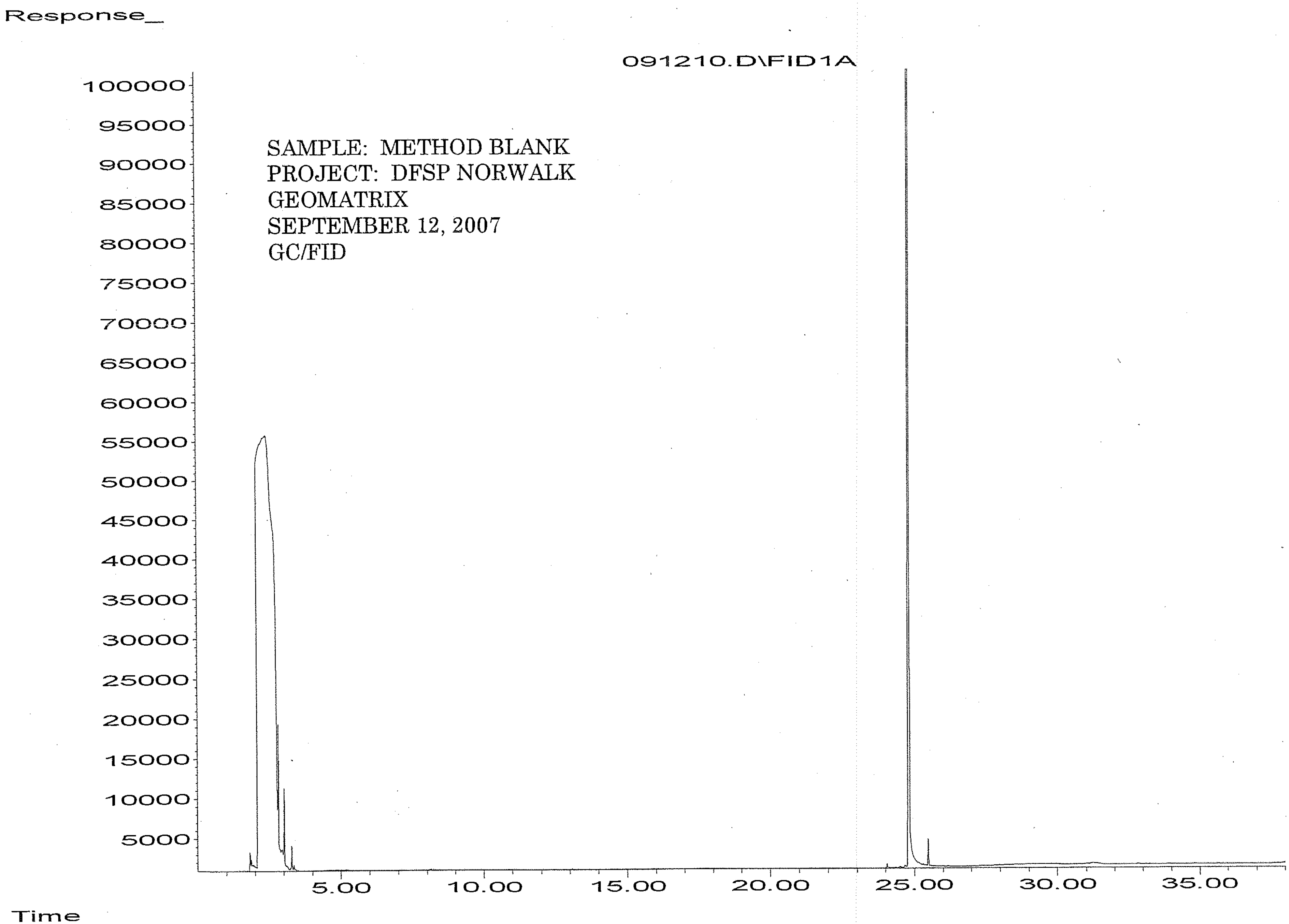
The medium boiling compounds appear as a regular pattern of peaks on top of a hump or unresolved complex mixture (UCM). This material elutes from n-C_8 to n-C_{17} showing a maximum near n-C_{13}. This correlates with a temperature range of approximately 130°C to 300 °C with a maximum near 240 °C. Within this range, the dominant peaks present are indicative of isoprenoids. A discernible pattern of peaks characteristic of the normal alkanes was not present. The abundance of isoprenoids in conjunctions with the apparent absence of normal alkanes indicates that the fuel present has undergone substantial biological degradation.

The large peak seen near 25 minutes on the GC/FID trace is pentacosane, added as a quality assurance check for this GC analysis.


Response_
091205.D\FID1A
SAMPLE: MW-9-091107
PROJECT: DFSP NORWALK
GEOMATRIX
SEPTEMBER 12, 2007
GC/FID
120000
110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Time



Response_
N-ALKANE STANDARD
GC/FID
091203.D\FID1A
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
C8
C10
C12
C14
C16
C20
C24
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Time



Response_
091210.D\FID1A
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
SAMPLE: METHOD BLANK
PROJECT: DFSP NORWALK
GEOMATRIX
SEPTEMBER 12, 2007
GC/FID
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Time

CHAIN-OF-CUSTODY RECORD 709117 MP 09-12-07 NEW 12029 A02

PROJECT NAME: DFSP NORWALK			DATE: 9.11.07	PAGE 1 OF 1
PROJECT NUMBER: 1603.044.0	LABORATORY NAME:	CLIENT INFORMATION:	REPORTING REQUIREMENTS:	
RESULTS TO: Shiow-Whei Chou	LABORATORY ADDRESS:			
TURNAROUND TIME: 24 hr (GC/FID)				
SAMPLE SHIPMENT METHOD: Fedex	LABORATORY CONTACT:		GEOTRACKER REQUIRED YES NO	
	LABORATORY PHONE NUMBER:		SITE SPECIFIC GLOBAL ID NO.	

SAMPLERS (SIGNATURE): [signature]

Lab ID	DATE	TIME	SAMPLE NUMBER	GC/FID	PIANO	CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
01 A-C	9.11.07	0940	MW-9-091107	✓	✓	40 mL VOAS	O		–			3	

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: [signature] PRINTED NAME: R. DOVE COMPANY: GMX	9/11/07		SIGNATURE: [signature] PRINTED NAME: Nhan Phan COMPANY: FeBI	9/12/07	15:00pm
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		

TOTAL NUMBER OF CONTAINERS: 3

SAMPLING COMMENTS:

Samples received at 23 °C

510 Superior Avenue, Suite 200
Newport Beach, California 92663-3627
Tel 949.642.0245 Fax 949.642.4474

Geomatrix

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

September 28, 2007

Shiow-Whei Chou, Project Manager
Geomatrix
510 Superior Avenue, Suite 200
Newport Beach, CA 92663

Dear Ms. Chou:

Included are the results from the testing of material submitted on September 12, 2007 from the DFSP Norwalk 1603.044.0, F&BI 709117 project. There are 6 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Kurt Johnson
Chemist

Enclosures
NAA0928R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 09/28/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Analyzed: 9/17/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709117-01
Client ID MW-9-091107

Compound	Weight Percent
Propane	<0.01
Methanol	<0.01
Isobutane	<0.01
2-Methyl-1-propene	<0.01
Ethanol	<0.01
n-Butane	<0.01
t-2-Butene	<0.01
c-2-Butene	<0.01
Isopropanol	<0.01
3-Methyl-1-butene	<0.01
Isopentane	<0.01
tert-Butanol	<0.01
1-Pentene	<0.01
2-Methyl-1-butene	<0.01
n-Propanol	<0.01
n-Pentane	<0.01
t-2-Pentene	<0.01
c-2-Pentene	<0.01
2-Methyl-2-butene	<0.01
MTBE	<0.01
sec-Butanol	<0.01
4-Methyl-1-pentene	<0.01
Isobutanol	<0.01
2,3-Dimethylbutane	<0.01
Cyclopentane	<0.01
2-Methylpentane	<0.01
DIPE	<0.01
3-Methylpentane	<0.01
1-Hexene	<0.01
ETBE	<0.01
n-Hexane	<0.01

Date of Report: 09/28/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Analyzed: 9/17/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709117-01
Client ID MW-9-091107

Compound	Weight Percent
t-2-Hexene	<0.01
2-Methyl-1-pentene	<0.01
2-Methyl-2-pentene	<0.01
c-2-Hexene	<0.01
2,2-Dimethylpentane	<0.01
2,4-Dimethylpentane	<0.01
Methylcyclopentane	<0.01
2,2,3-Trimethylbutane	<0.01
Benzene	<0.01
1-Methylcyclopentene	<0.01
TAME	<0.01
3,3-Dimethylpentane	<0.01
Cyclohexane	<0.01
2-Methylhexane	<0.01
2,3-Dimethylpentane	0.01
1,1-Dimethylcyclopentane	<0.01
3-Methylhexane	0.01
c-1,3-Dimethylcyclopentane	0.01
3-Ethylpentane	<0.01
Isooctane	<0.01
t-1,2-Dimethylcyclopentane	0.02
1-Heptene	<0.01
n-Heptane	<0.01
t-3-Heptene	<0.01
c-3-Heptene	<0.01
t-2-Heptene	<0.01
c-2-Heptene	<0.01
2,2-Dimethylhexane	<0.01
2,5-Dimethylhexane	0.01
Methylcyclohexane	0.08
2,4-Dimethylhexane	0.02
Ethylcyclopentane	0.01

Date of Report: 09/28/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Analyzed: 9/17/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709117-01
Client ID MW-9-091107

Compound	Weight Percent
t-1,c-2,4-Trimethylcyclopentane	0.05
t-1,c-2,3-Trimethylcyclopentane	0.07
2,3,4-Trimethylpentane	0.01
Toluene	<0.01
2,3-Dimethylhexane	0.03
2-Methylheptane	0.04
3-Methylheptane	0.02
4-Methylheptane	0.01
3-Ethylhexane	0.02
1-Octene	<0.01
1,2,3-Trimethylcyclopentane	0.04
t-1,2-Dimethylcyclohexane	0.24
n-Octane	<0.01
1-Ethyl-1-methylcyclopentane	0.02
c-2-Octene	<0.01
c-1,2-Dimethylcyclohexane	0.15
Isopropylcyclopentane	0.01
2,5-Dimethylheptane	0.07
3,5-Dimethylheptane	0.02
n-Propylcyclopentane	0.02
Ethylbenzene	<0.01
2,3-Dimethylheptane	0.11
3,4-Dimethylheptane	<0.01
2-Methyloctane	0.05
m-Xylene	<0.01
p-Xylene	0.02
3-Methyloctane	0.11
1-Nonene	<0.01
3,3-Diethylpentane	<0.01
t-3-Nonene	<0.01
c3-Nonene	<0.01
o-Xylene	<0.01

Date of Report: 09/28/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Analyzed: 9/17/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709117-01
Client ID MW-9-091107

Compound	Weight Percent
n-Nonane	<0.01
Isobutylcyclopentane	0.03
t-2-Nonene	<0.01
c-2-Nonene	<0.01
Isopropylbenzene	<0.01
3,3-Dimethyloctane	0.04
n-Butylcyclopentane	0.03
n-Propylbenzene	<0.01
2,3-Dimethyloctane	0.07
1-Methyl-3-ethylbenzene	<0.01
1-Methyl-4-ethylbenzene	<0.01
2-Methylnonane	0.06
3-Ethyloctane	0.12
3-Methylnonane	0.12
1,3,5-Trimethylbenzene	<0.01
1-Methyl-2-ethylbenzene	<0.01
1,2,4-Trimethylbenzene	0.03
tert-Butylbenzene	<0.01
n-Decane	<0.01
Isobutylbenzene	<0.01
Isopropylcyclohexane	<0.01
sec-Butylbenzene	<0.01
1-Methyl-3-isopropylbenzene	<0.01
Isobutylcyclohexane	<0.01
1-Methyl-4-isopropylbenzene	<0.01
1,2,3-Trimethylbenzene	<0.01
Indan	<0.01
1-Methyl-3-n-propylbenzene	0.02
1-Methyl-4-n-propylbenzene	0.02
n-Butylbenzene	<0.01
1,3-Dimethyl-5-ethylbenzene	<0.01
1,2-Diethylbenzene	<0.01

Date of Report: 09/28/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Analyzed: 9/17/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709117-01
Client ID MW-9-091107

Compound	Weight Percent
1-Methyl-2-n-propylbenzene	<0.01
1,4-Dimethyl-2-ethylbenzene	0.10
1,2-Dimethyl-4-ethylbenzene	0.14
1,3-Dimethyl-2-ethylbenzene	<0.01
1,2-Dimethyl-3-ethylbenzene	0.05
n-Undecane	<0.01
1,2,4,5-Tetramethylbenzene	0.14
2-Methylbutylbenzene	0.06
n-Pentylbenzene	<0.01
Methylindan	<0.01
1-tert-Butyl-3,5-dimethylbenzene	<0.01
1-tert-Butyl-4-ethylbenzene	<0.01
n-Dodecane	<0.01
1,3,5-Triethylbenzene	<0.01
1,2,4-Triethylbenzene	<0.01
Naphthalene	<0.01
n-Hexylbenzene	<0.01
2-Methylnaphthalene	0.10
n-Tridecane	<0.01
1-Methylnaphthalene	0.07
n-Tetradecane	<0.01
n-Pentadecane	<0.01

Date of Report: 09/28/07
Date Received: 09/12/07
Project: DFSP Norwalk 1603.044.0, F&BI 709117
Date Analyzed: 9/17/07

RESULTS FROM THE ANALYSIS OF THE PRODUCT SAMPLE FOR PARAFFINS, ISOPARAFFINS, OLEFINS, NAPHTHENES, AND AROMATICS
Results Reported as % by Weight

Laboratory ID 709117-01
Client ID MW-9-091107

PIANO SUMMARY	Weight Percent
Total Identified Compounds	2.52
Oxygenated Compounds	0.00
Hydrocarbon Compounds	2.52
Unidentified Compounds	97.48
Total	100

	Paraffins	Isoparaffins	Aromatics	Naphthenes	Olefins	Total
C3	<0.01					<0.01
C4	<0.01	<0.01			<0.01	<0.01
C5	<0.01	<0.01		<0.01	<0.01	<0.01
C6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
C7	<0.01	0.02	<0.01	0.12	<0.01	0.14
C8	<0.01	0.16	0.02	0.60	<0.01	0.77
C9	<0.01	0.37	0.03	0.06	<0.01	0.47
C10	<0.01	0.42	0.48	<0.01		0.90
C11	<0.01		0.24			0.24
C12	<0.01		<0.01			<0.01
C13	<0.01					<0.01
C14	<0.01					<0.01
C15	<0.01					<0.01
Total	<0.01	0.97	0.77	0.78	<0.01	2.52

CHAIN-OF-CUSTODY RECORD 709117 MP 09-12-07 NEW 12029 ADL

PROJECT NAME: DFSP NORWALK		DATE: 9.11.07	PAGE 1 OF 1
PROJECT NUMBER: 1603.044.0	LABORATORY NAME:	CLIENT INFORMATION:	REPORTING REQUIREMENTS:
RESULTS TO: Shiow-Whei Chou	LABORATORY ADDRESS:		
TURNAROUND TIME: 24 hr (GC/FID)			
SAMPLE SHIPMENT METHOD: Fedex	LABORATORY CONTACT:		GEOTRACKER REQUIRED YES NO
	LABORATORY PHONE NUMBER:		SITE SPECIFIC GLOBAL ID NO.

SAMPLERS (SIGNATURE): [signature]

Lab ID	DATE	TIME	SAMPLE NUMBER	GC/FID	PIANO	CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
01 A-C	9.11.07	0940	MW-9-091107	✓	✓	40 mL VOAS	O		—			3	

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: [signature] PRINTED NAME: R. DOVE COMPANY: GMX	9/11/07		SIGNATURE: [signature] PRINTED NAME: Nhan Phan COMPANY: FCBI	9/12/07	15:00pm
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		
SIGNATURE: PRINTED NAME:			SIGNATURE: PRINTED NAME: COMPANY:		

TOTAL NUMBER OF CONTAINERS: 3

SAMPLING COMMENTS:

Samples received at 23 °C

510 Superior Avenue, Suite 200
Newport Beach, California 92663-3627
Tel 949.642.0245 Fax 949.642.4474
Geomatrix

GMW-62

February 28, 2011; October 17, 2011; June 21, 2013 LNAPL Samples

Laboratory Reports

REPORT OF ANALYTICAL RESULTS

ZymaX FORENSICS

Client:	Mary Lucas Parsons 100 W Walnut Street Pasadena, CA. 91124	Lab Number: Collected: Received: Matrix:	42148-1 2/28/2011 3/2/2011 Product
Project: Project Number: Collected by:	GMW-62FP 747577 C. Zicker	Sample Description: GMW-62FP Analyzed: Method:	 3/21/2011 EPA 1624 GC/MS SIM

CONSTITUENT	PQL* mg/Kg	RESULT** mg/Kg
t-Amyl Methyl Ether (TAME)	100	ND
t-Butyl Alcohol (TBA)	10	ND
Diisopropyl Ether (DIPE)	100	ND
Ethanol	10	ND
Ethyl-t-Butyl Ether (ETBE)	50	ND
Methyl-t-Butyl Ether (MTBE)	50	ND
Percent Surrogate Recovery (MTBE-d3)		107

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.
J:Below PQL

Submitted by,
Zymax Forensics, a DPRA Company

Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD #9
42148-1.OXY.xls
STL

ZymaX FORENSICS

REPORT OF ANALYTICAL RESULTS

Client:	Mary Lucas Parsons 100 W Walnut Street Pasadena, CA. 91124

Lab Number:	42148
Collected:	2/28/2011
Received:	3/2/2011
Matrix:	Product

Project: GMW-62FP

Project Number: 747577
Collected by: C. Zicker

Sample Description: See Below

Analyzed: 3/22/2011
Method: GC/ECD

EDB and ORGANIC LEAD SPECIATION

LAB NUMBER	SAMPLE DESCRIPTION	EDB mg/L	TML mg/L	TMEL mg/L	DMDEL mg/L	MTEL mg/L	TEL mg/L	MMT mg/L
42148-1	GMW-62FP	<0.5	<5	<5	<5	<5	<5	<5
Detection Limit:		0.5	5.0	5.0	5.0	5.0	5.0	5.0
Method Blank:		<0.5	<5	<5	<5	<5	<5	<5

EDB: Ethylene Dibromide
TML: Tetramethyl Lead
TMEL: Trimethylethyl Lead
DMDEL: Dimethyldiethyl Lead
MTEL: Methyltriethyl Lead
TEL: Tetraethyl Lead
MMT: Methylcyclopentadienyl Manganese Tricarbonyl

Submitted by,
Zymax Forensics, A DPRA Company

Shan-Tan Lu, Ph.D.
Director of Forensic Geochemistry

42148e.xls
STL

QUALITY ASSURANCE REPORT

Client:	
	Parsons
	100 W Walnut Street
	Pasadena, CA. 91124

Lab Number:	42148
Analyzed:	3/22/2011
Method:	GC/ECD

QA DATA FOR EDB and TEL

ANALYTES	RF	RF_D	%D	ACCEPTANCE LIMIT %
EDB	0.684	0.68	0.50	± 15
TEL	0.038	0.033	13.50	± 15

EDB: Ethylene Dibromide
TEL: Tetraethyl Lead
RF = Mean response factor from 3 point calibration
RF_D= Daily calibration standard response factor
% D = % Difference
Calibration file: ORG07168.M / MMT07168.M

Submitted by,
Zymax Forensics, a DPRA Company

Shan-Tan Lu, Ph.D.
Director of Forensic Geochemistry

42148e.xls
STL

Calscience Environmental Laboratories, Inc.

☐ SoCal Laboratory
7440 Lincoln Way
Garden Grove, CA 92841-1427
(714) 895-5494

☐ NorCal Service Center
5063 Commercial Circle, Suite H
Concord, CA 94520-8577
(925) 689-9022

CHAIN OF CUSTODY RECORD

Date 2/28/2011

Page 1 of 1

LABORATORY CLIENT: Parsons

ADDRESS: 100 W. Walnut St.

CITY: Pasadena STATE: CA ZIP: 91124

TEL: 626-440-6032 E-MAIL: mary.lucas@parsons.com

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☑ STANDARD

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)
☐ RWQCB REPORTING FORMS ☐ COELT EDF ☐ ____________

SPECIAL INSTRUCTIONS:
✓ 3/17 AJ

CLIENT PROJECT NAME / NUMBER: DFSP Norwalk

P.O. NO.: 747577

PROJECT CONTACT: 747577

LAB USE ONLY: ☐☐-☐☐☐☐

SAMPLER(S): (PRINT) C. Zicker

COELT LOG CODE ☐☐☐☐

COOLER RECEIPT TEMP= ______ °C

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	FIELD POINT NAME (FOR COELT EDF)	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH (g)	TPH (d) or (C6-C36) or (C6-C44)	TPH (____)	BTEX / MTBE (8260B) or (____)	VOCs (8260B)	Oxygenates (8260B)	Encore Prep (5035)	SVOCs (8270C)	Pesticides (8081A)	PCBs (8082)	PNAs (8310) or (8270C)	T22 Metals (6010B/747X)	Cr(VI) [7196A or 7199 or 218.6]	VOCs (TO-14A) or (TO-15)	TPH (g) [TO-3]+	C3-C44 GC/FID	6 Fuel Oxys	EDB MMT Pb
42148-1	GMW-62 FP		2/28/2011	13:34	OT	2																X	✓	✓

Relinquished by: (Signature) [signature]	Received by: (Signature/Affiliation) Ryan Woon 3/3/11 11:30 am	Date: 3/2/2011	Time: 10:15
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

05/01/07 Revision

Q&Q Graphic 714-898-9702

ZymaX FORENSICS

3/7/2011

ZymaX ID	42148-1
Sample ID	GMW-62FP
Evaporation	
n-Pentane / n-Heptane	0.12
2-Methylpentane / 2-Methylheptane	0.46
Waterwashing	
Benzene / Cyclohexane	0.00
Toluene / Methylcyclohexane	0.01
Aromatics / Total Paraffins (n+iso+cyc)	0.37
Aromatics / Naphthenes	1.33
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	199.47
3-Methylhexane / n-Heptane	0.51
Methylcyclohexane / n-Heptane	1.77
Isoparaffins + Naphthenes / Paraffins	2.16
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.02
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	22.95
% Isoparaffinic	29.21
% Aromatic	26.89
% Naphthenic	20.28
% Olefinic	0.66

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Director of Forensic Geochemistry

ZymaX FORENSICS

3/7/2011

ZymaX ID		42148-1
Sample ID		GMW-62FP
		Relative Area %
1	Propane	0.00
2	Isobutane	0.03
3	Isobutene	0.00
4	Butane/Methanol	0.10
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	0.62
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	0.47
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.00
15	2,2-Dimethylbutane	0.10
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	0.30
18	2-Methylpentane	1.39
19	3-Methylpentane	1.14
20	Hexane	1.52
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	0.11
26	Methylcyclopentane	1.56
27	2,4-Dimethylpentane	0.24
28	Benzene	0.00
29	5-Methyl-1-hexene	0.09
30	Cyclohexane	1.21
31	2-Methylhexane/TAME	1.37
32	2,3-Dimethylpentane	0.77
33	3-Methylhexane	1.90
34A	1-trans-3-Dimethylcyclopentane	1.03
34B	1-cis-3-Dimethylcyclopentane	1.58
35	2,2,4-Trimethylpentane	0.11
I.S. #1	à,à,à-Trifluorotoluene	0.00

ZymaX FORENSICS

3/7/2011

ZymaX ID		42148-1
Sample ID		GMW-62FP
		Relative Area %
36	n-Heptane	3.74
37	Methylcyclohexane	6.65
38	2,5-Dimethylhexane	0.34
39	2,4-Dimethylhexane	0.48
40	2,3,4-Trimethylpentane	0.15
41	Toluene/2,3,3-Trimethylpentane	0.08
42	2,3-Dimethylhexane	0.93
43	2-Methylheptane	3.03
44	4-Methylheptane	0.88
45	3,4-Dimethylhexane	0.24
46A	3-Ethyl-3-methylpentane	1.70
46B	1,4-Dimethylcyclohexane	3.76
47	3-Methylheptane	0.05
48	2,2,5-Trimethylhexane	1.08
49	n-Octane	5.93
50	2,2-Dimethylheptane	0.07
51	2,4-Dimethylheptane	0.59
52	Ethylcyclohexane	4.49
53	2,6-Dimethylheptane	2.90
54	Ethylbenzene	1.87
55	m+p Xylenes	3.38
56	4-Methyloctane	1.09
57	2-Methyloctane	1.21
58	3-Ethylheptane	0.30
59	3-Methyloctane	2.08
60	o-Xylene	1.32
61	1-Nonene	0.46
62	n-Nonane	5.97
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.37
64	3,3,5-Trimethylheptane	0.46
65	2,4,5-Trimethylheptane	1.69
66	n-Propylbenzene	1.00
67	1-Methyl-3-ethylbenzene	1.09
68	1-Methyl-4-ethylbenzene	1.02
69	1,3,5-Trimethylbenzene	2.32
70	3,3,4-Trimethylheptane	1.83

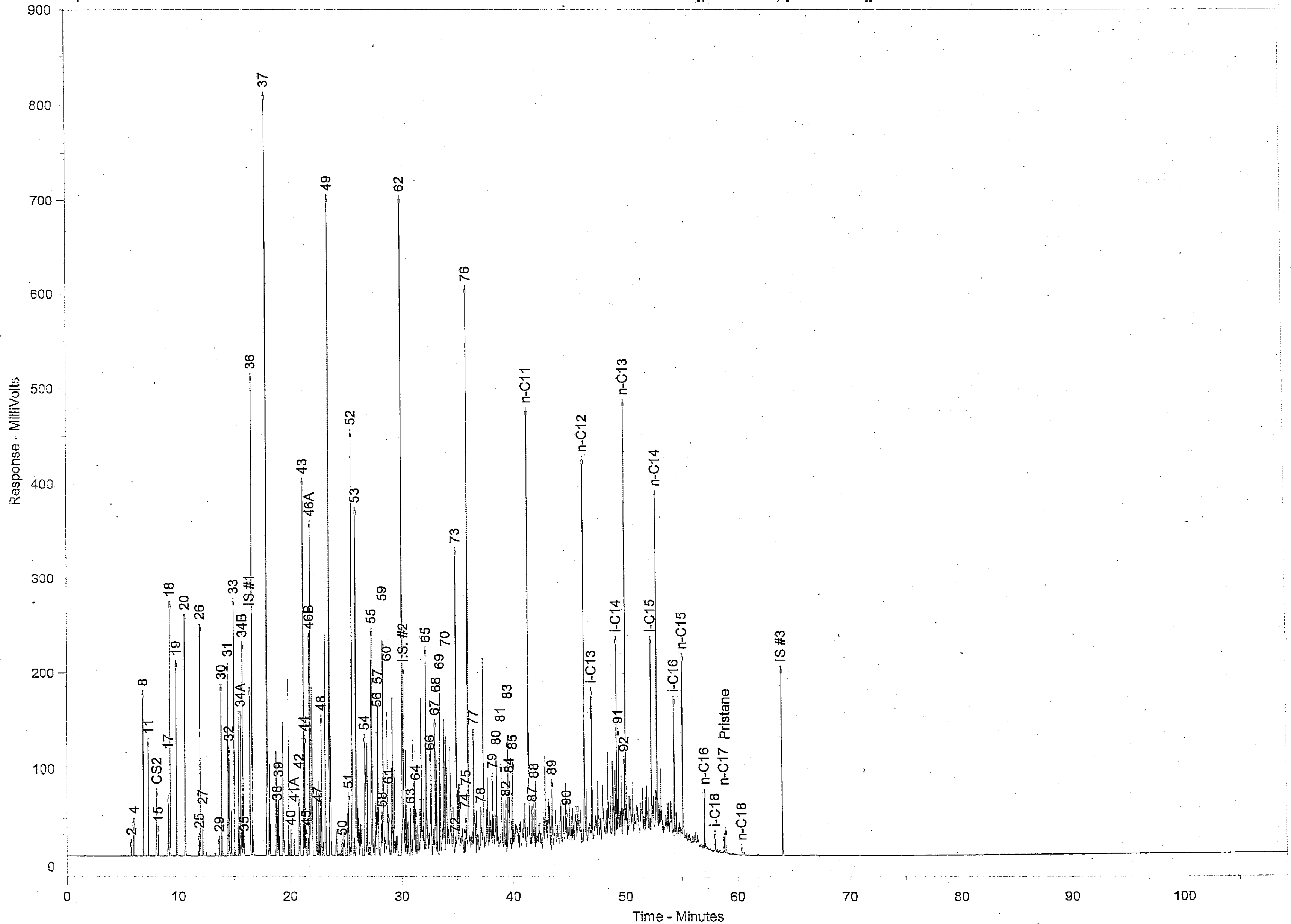
3/7/2011

ZymaX ID		42148-1
Sample ID		GMW-62FP
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.00
72	3-Methylnonane	0.14
73	1,2,4-Trimethylbenzene	2.64
74	Isobutylbenzene	0.24
75	sec-Butylbenzene	0.52
76	n-Decane	5.21
77	1,2,3-Trimethylbenzene	1.38
78	Indan	0.36
79	1,3-Diethylbenzene	1.03
80	1,4-Diethylbenzene	0.58
81	n-Butylbenzene	0.91
82	1,3-Dimethyl-5-ethylbenzene	0.44
83	1,4-Dimethyl-2-ethylbenzene	1.16
84	1,3-Dimethyl-4-ethylbenzene	0.77
85	1,2-Dimethyl-4-ethylbenzene	0.63
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	0.35
88	1,2,3,5-Tetramethylbenzene	0.53
89	1,2,3,4-Tetramethylbenzene	0.79
90	Naphthalene	0.36
91	2-Methyl-naphthalene	1.10
92	1-Methyl-naphthalene	0.68

Chrom Perfect Chromatogram Report

— C:\CPSpirit\2011\Mar11\030711\030711.0011.RAW

42148-1 [(GMW-62FP) [500+500cs2]] + IS F-011810-1



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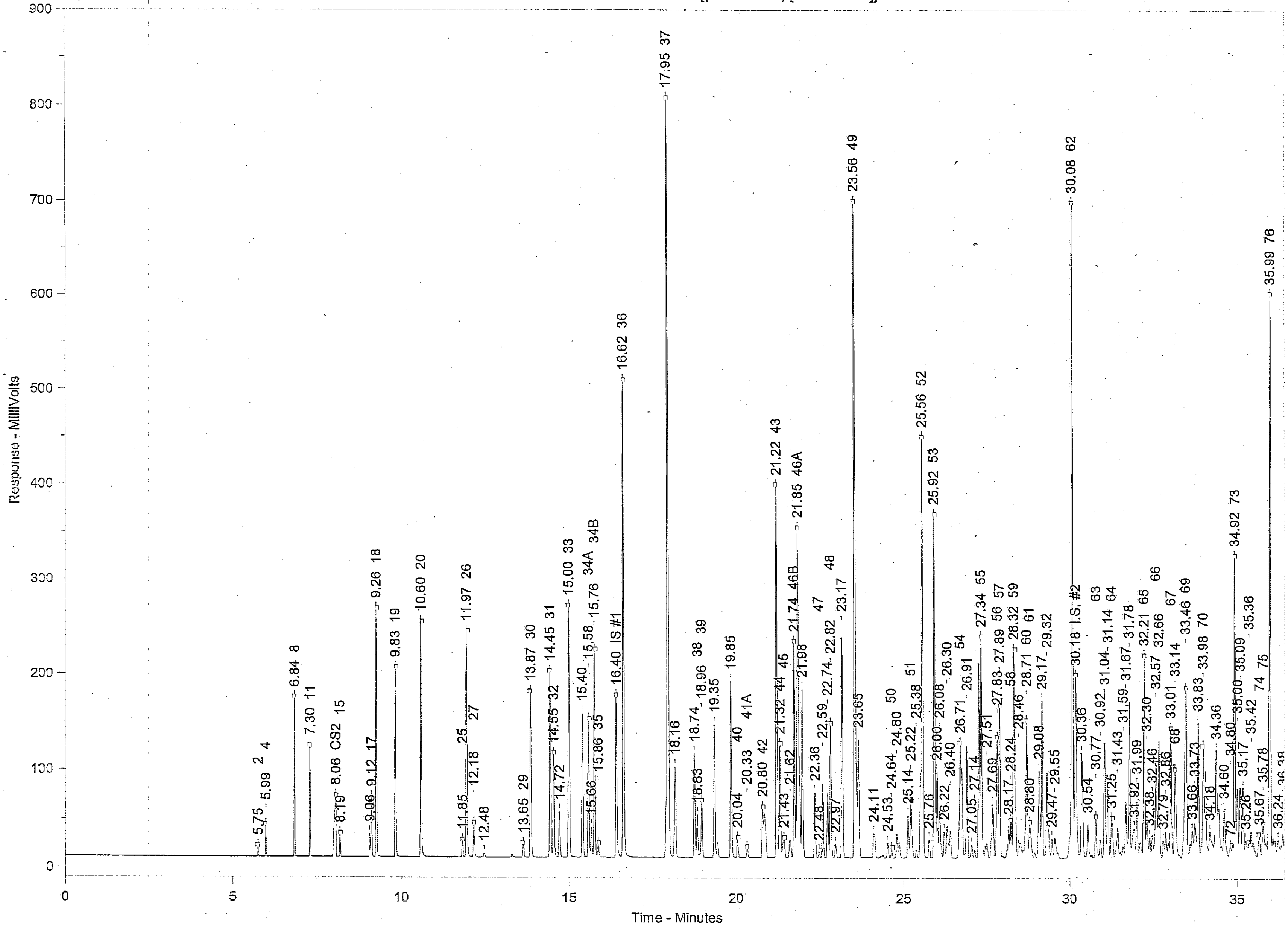
42148-1 [(GMW-62FP) [500+500cs2]] + IS F-011810-1



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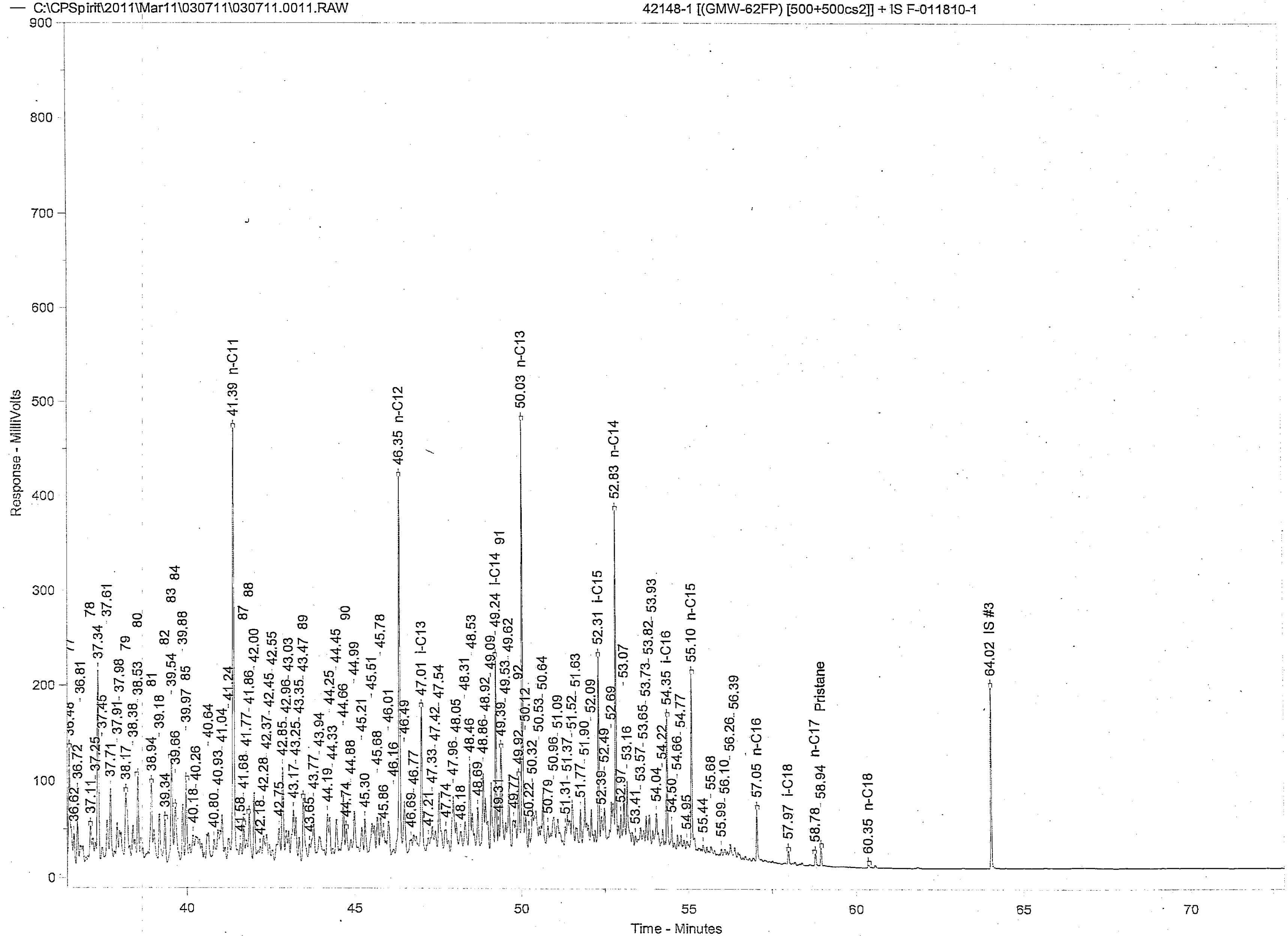

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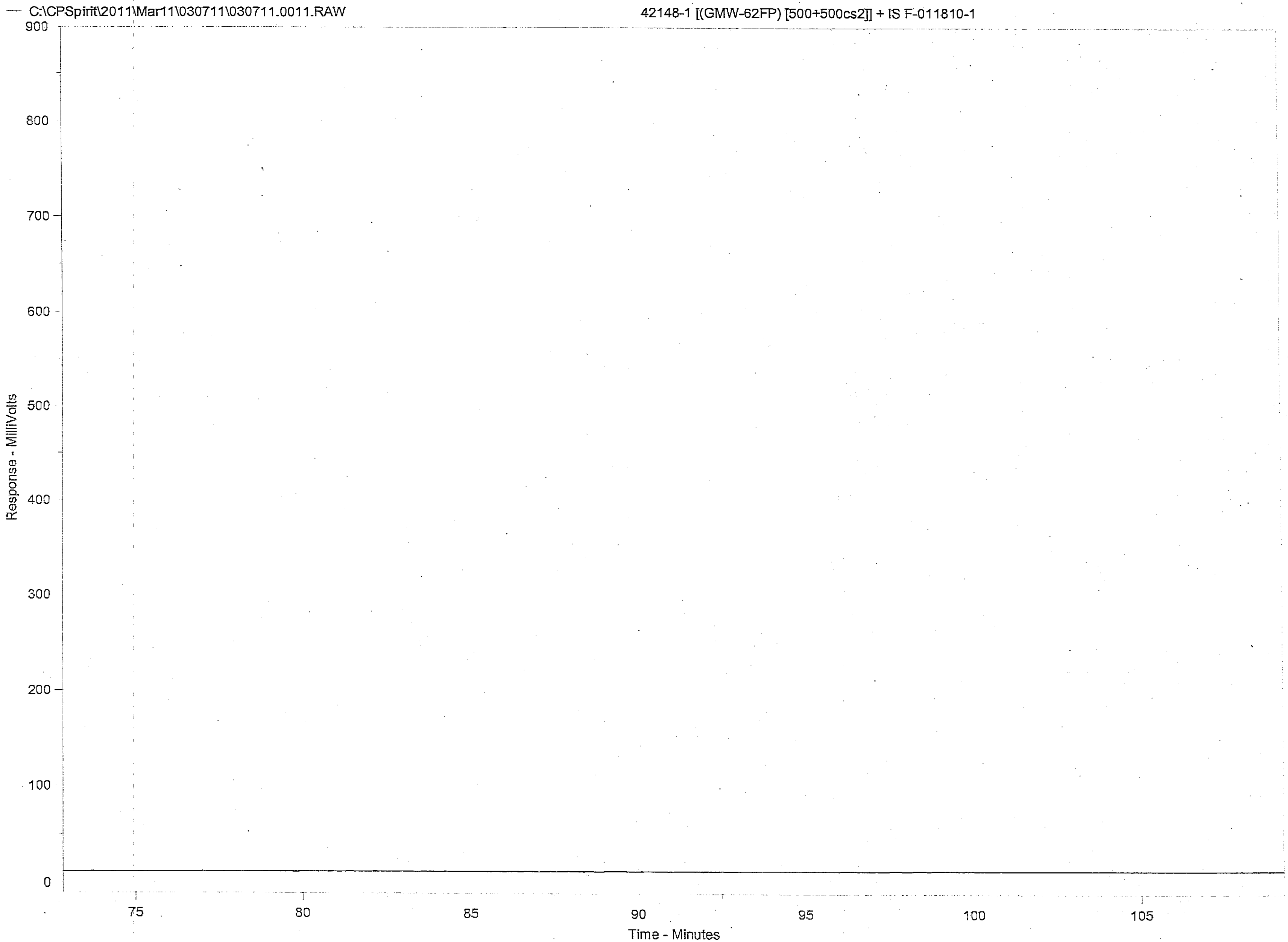
Chrom Perfect Chromatogram Report



Sample Name = **42148-1 [(GMW-62FP) [500+500cs2]] + IS F-011810-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

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Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\041610.cal

Date Taken (end) = 3/11/2011 12:21:11 AM
Method Version = 44
Calibration Version = 12

Peak Name	Ret. Time	Area %	Area
2	5.75	0.0143	9871.49
4	5.99	0.0502	34725.88
8	6.84	0.3053	211187.40
11	7.30	0.2287	158196.10
CS2	8.06	0.3200	221381.10
15	8.19	0.0496	34331.45
	9.06	0.0599	41464.37
17	9.12	0.1452	100460.80
18	9.26	0.6798	470302.00
19	9.83	0.5585	386427.90
20	10.60	0.7420	513330.00
25	11.85	0.0541	37418.82
26	11.97	0.7640	528599.10
27	12.18	0.1162	80398.93
	12.48	0.0147	10201.64
29	13.65	0.0463	32066.72
30	13.87	0.5909	408811.00
31	14.45	0.6691	462884.80
32	14.55	0.3785	261898.10
	14.72	0.1684	116476.50
33	15.00	0.9265	641002.30
	15.40	0.5287	365810.50
34A	15.58	0.5020	347326.90
	15.66	0.1122	77638.10
34B	15.76	0.7744	535750.20
35	15.86	0.0532	36812.54
IS #1	16.40	0.6255	432719.10
36	16.62	1.8309	1266678.00
37	17.95	3.2491	2247888.00
	18.16	0.3944	272879.20
	18.74	0.4044	279810.60
38	18.83	0.1679	116126.50
39	18.96	0.2325	160851.20
	19.35	0.5028	347857.80
	19.85	0.6924	479039.80
40	20.04	0.0739	51159.79
41A	20.33	0.0392	27089.61
42	20.80	0.4541	314158.50
43	21.22	1.4830	1026010.00
44	21.32	0.4300	297496.70
45	21.43	0.1179	81578.56
	21.62	0.1080	74745.36
46B	21.74	0.8333	576513.60
46A	21.85	1.8390	1272281.00
	21.98	0.6311	436620.30
	22.36	0.2597	179687.00
47	22.48	0.0237	16421.60
	22.59	0.2892	200114.40
	22.74	0.2568	177641.50
48	22.82	0.5267	364366.90
	22.97	0.0557	38526.20
	23.17	0.8864	613277.90
49	23.56	2.9006	2006755.00
	23.65	0.5111	353589.00
	24.11	0.1513	104690.60

Peak Name	Ret. Time	Area %	Area
	24.53	0.0595	41145.51
50	24.64	0.0342	23643.17
	24.80	0.0695	48100.03
	25.14	0.1710	118309.10
51	25.22	0.2899	200585.80
	25.38	0.0332	22948.51
52	25.56	2.1967	1519808.00
	25.76	0.0774	53515.10
53	25.92	1.4163	979865.20
	26.00	0.3520	243501.40
	26.08	0.2323	160732.00
	26.22	0.1058	73172.32
	26.30	0.1717	118762.50
	26.40	0.1167	80761.15
54	26.71	0.9123	631182.10
	26.91	0.4621	319668.70
	27.05	0.0650	44976.11
	27.14	0.0326	22521.31
55	27.34	1.6517	1142748.00
	27.51	0.0830	57422.07
	27.69	0.3342	231193.00
56	27.83	0.5348	370012.00
57	27.89	0.5898	408058.80
	28.17	0.1745	120748.60
58	28.24	0.1449	100260.30
59	28.32	1.0145	701857.90
	28.46	0.1537	106314.90
60	28.71	0.6450	446260.80
61	28.80	0.2242	155124.30
	29.08	0.4332	299717.50
	29.17	0.6597	456388.90
	29.32	0.4472	309419.80
	29.47	0.0856	59237.76
	29.55	0.1414	97832.09
62	30.08	2.9185	2019174.00
I.S. #2	30.18	0.9529	659232.70
	30.36	0.5280	365268.60
	30.54	0.1574	108925.50
63	30.77	0.1817	125706.20
	30.92	0.0881	60922.37
	31.04	0.5152	356451.20
	31.14	0.3345	231435.40
64	31.25	0.2256	156092.70
	31.43	0.2029	140358.40
	31.59	0.0579	40056.39
	31.67	0.2430	168124.20
	31.78	0.6740	466281.80
	31.92	0.2287	158202.70
	31.99	0.2450	169515.40
65	32.21	0.8282	572962.60
	32.30	0.1935	133877.20
	32.38	0.0882	60990.66
	32.46	0.1108	76644.84
66	32.57	0.4896	338709.60
	32.66	0.5753	398019.20
	32.79	0.0736	50888.14
	32.86	0.1190	82300.66
67	33.01	0.5338	369279.40
68	33.14	0.5007	346386.80
69	33.46	1.1334	784148.50
	33.66	0.2106	145681.40
	33.73	0.2001	138435.30
	33.83	0.5648	390724.60
70	33.98	0.8964	620167.40
	34.18	0.2293	158662.40
	34.36	0.8386	580165.20
	34.60	0.2678	185298.20

Peak Name	Ret. Time	Area %	Area
72	34.80	0.0680	47069.56
73	34.92	1.2883	891294.50
	35.00	0.2798	193569.60
	35.09	0.3169	219262.00
	35.17	0.3141	217291.70
	35.26	0.0893	61763.57
	35.36	0.0886	61270.69
	35.42	0.1914	132413.90
74	35.67	0.1168	80811.06
75	35.78	0.2543	175902.50
76	35.99	2.5496	1763923.00
	36.24	0.1180	81635.68
	36.38	0.1430	98943.30
77	36.48	0.6728	465455.90
	36.62	0.1284	88803.17
	36.72	0.1771	122552.10
	36.81	0.1816	125634.90
78	37.11	0.1746	120795.40
	37.25	0.0796	55098.56
	37.34	0.8538	590684.10
	37.45	0.0693	47935.06
	37.61	0.2133	147604.70
	37.71	0.3172	219475.50
	37.91	0.1526	105606.50
	37.98	0.2204	152486.00
79	38.17	0.5029	347945.30
	38.38	0.1792	124003.00
80	38.53	0.2844	196729.10
81	38.94	0.4431	306567.50
	39.18	0.2365	163592.40
82	39.34	0.2146	148465.10
83	39.54	0.5653	391099.50
84	39.66	0.3780	261549.00
	39.88	0.2189	151475.70
85	39.97	0.3065	212079.60
	40.18	0.0702	48541.53
	40.26	0.0666	46044.04
	40.64	0.2088	144448.00
	40.80	0.1274	88156.44
	40.93	0.1675	115897.20
	41.04	0.2109	145921.80
	41.24	0.1384	95776.03
n-C11	41.39	2.0345	1407568.00
	41.58	0.0901	62332.68
87	41.68	0.1688	116808.60
	41.77	0.1064	73588.70
88	41.86	0.2567	177631.50
	42.00	0.3003	207727.40
	42.18	0.0807	55841.32
	42.28	0.1610	111369.20
	42.37	0.1218	84290.90
	42.45	0.0755	52201.85
	42.55	0.0505	34967.48
	42.75	0.2809	194348.60
	42.85	0.4760	329298.10
	42.96	0.1549	107201.30
	43.03	0.1360	94108.63
	43.17	0.3825	264623.90
	43.25	0.1941	134312.60
	43.35	0.1051	72707.80
89	43.47	0.3886	268834.90
	43.65	0.0866	59944.33
	43.77	0.2963	204984.00
	43.94	0.3124	216109.20
	44.19	0.2342	162043.80
	44.25	0.1805	124855.60
	44.33	0.0532	36787.27

Peak Name	Ret. Time	Area %	Area
	44.45	0.2324	160766.90
	44.66	0.3515	243157.90
90	44.74	0.1759	121673.40
	44.88	0.1165	80575.97
	44.99	0.3533	244452.30
	45.21	0.1903	131630.20
	45.30	0.2021	139826.30
	45.51	0.2588	179049.70
	45.68	0.2217	153390.60
	45.78	0.2186	151229.30
	45.86	0.2009	139021.50
	46.01	0.2125	146983.50
	46.16	0.0354	24491.40
n-C12	46.35	1.6855	1166098.00
	46.49	0.3004	207842.80
	46.69	0.0527	36442.09
	46.77	0.0355	24536.62
i-C13	47.01	0.6076	420398.50
	47.21	0.0698	48323.38
	47.33	0.1418	98137.59
	47.42	0.0949	65673.34
	47.54	0.3375	233496.70
	47.74	0.1072	74195.03
	47.96	0.4071	281654.00
	48.05	0.1269	87762.02
	48.18	0.1516	104911.90
	48.31	0.1986	137417.90
	48.46	0.4211	291320.30
	48.53	0.2179	150744.90
	48.69	0.2004	138665.50
	48.86	0.4048	280079.60
	48.92	0.3382	233979.00
	49.09	0.3563	246526.60
i-C14	49.24	0.6893	476862.90
	49.31	0.0943	65265.00
91	49.39	0.5386	372628.80
	49.53	0.1749	120990.90
	49.62	0.2617	181058.10
	49.77	0.2862	197977.10
92	49.92	0.3303	228544.60
n-C13	50.03	1.4801	1024013.00
	50.12	0.1518	105048.80
	50.22	0.0489	33832.88
	50.32	0.0619	42843.77
	50.53	0.0304	21047.44
	50.64	0.1695	117244.20
	50.79	0.1005	69530.37
	50.96	0.1874	129655.00
	51.09	0.1831	126681.10
	51.31	0.0749	51801.85
	51.37	0.2597	179648.70
	51.52	0.2312	159965.20
	51.63	0.1159	80169.40
	51.77	0.1336	92414.60
	51.90	0.3929	271806.70
	52.09	0.1768	122295.40
i-C15	52.31	0.6158	426035.30
	52.39	0.1696	117339.40
	52.49	0.1828	126447.40
	52.69	0.4643	321213.70
n-C14	52.83	1.0357	716545.00
	52.97	0.1242	85926.50
	53.07	0.2493	172455.40
	53.16	0.3442	238140.80
	53.41	0.0506	35014.39
	53.57	0.1247	86244.59
	53.65	0.0866	59917.19

Peak Name	Ret. Time	Area %	Area
	53.73	0.1225	84753.62
	53.82	0.1548	107124.90
	53.93	0.0691	47805.71
	54.04	0.2249	155584.00
	54.22	0.0940	65031.77
i-C16	54.35	0.4467	309048.40
	54.50	0.0871	60281.70
	54.66	0.0582	40271.01
	54.77	0.0328	22707.27
	54.95	0.0355	24589.71
n-C15	55.10	0.4811	332867.50
	55.44	0.0255	17664.23
	55.68	0.0277	19161.99
	55.99	0.0224	15501.02
	56.10	0.0328	22709.17
	56.26	0.0601	41595.72
	56.39	0.0407	28148.57
n-C16	57.05	0.1806	124948.60
i-C18	57.97	0.0467	32276.44
n-C17	58.78	0.0506	34984.67
Pristane	58.94	0.0706	48861.33
n-C18	60.35	0.0172	11929.58
IS #3	64.02	0.5196	359471.20

Total Area = 6.918469E+07 Total Height = 2.252049E+07 Total Amount = 1

Calscience Environmental Laboratories, Inc.

☐ SoCal Laboratory
7440 Lincoln Way
Garden Grove, CA 92841-1427
(714) 895-5494

☐ NorCal Service Center
5063 Commercial Circle, Suite H
Concord, CA 94520-8577
(925) 689-9022

CHAIN OF CUSTODY RECORD

Date 2/28/2011

Page 1 of 1

LABORATORY CLIENT: Parsons

ADDRESS: 100 W. Walnut St.

CITY Pasadena STATE CA ZIP 91124

TEL: 626-440-6032 E-MAIL: mary.lucas@parsons.com

CLIENT PROJECT NAME / NUMBER: DFSP Norwalk

P.O. NO.: 747577

PROJECT CONTACT: 747577

LAB USE ONLY ☐☐-☐☐☐☐

SAMPLER(S): (PRINT) C. Zicker

COELT LOG CODE ☐☐☐☐

COOLER RECEIPT TEMP= °C

TURNAROUND TIME:
☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☑ STANDARD

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)
☐ RWQCB REPORTING FORMS ☐ COELT EDF ☐ ____

SPECIAL INSTRUCTIONS:

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	FIELD POINT NAME (FOR COELT EDF)	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH (g)	TPH (d) or (C6-C36) or (C6-C44)	TPH (____)	BTEX / MTBE (8260B) or (____)	VOCs (8260B)	Oxygenates (8260B)	Encore Prep (5035)	SVOCs (8270C)	Pesticides (8081A)	PCBs (8082)	PNAs (8310) or (8270C)	T22 Metals (6010B/747X)	Cr(VI) [7196A or 7199 or 218.6]	VOCs (TO-14A) or (TO-15)	TPH (g) [TO-3]+ ____	C3-C44 GC/FID		
42148-1	GMW-62 FP		2/28/2011	13:34	OT	2																X		

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Cindy Zicker	Ryan Woon 3/3/11 11:30 am	3/2/2011	10:15
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

05/01/07 Revision

Q&Q Graphic 714-898-9702

Calscience Environmental Laboratories, Inc.

CALSCIENCE

WORK ORDER NUMBER: 11-10-1170

The difference is service

AIR | SOIL | WATER | MARINE CHEMISTRY

Analytical Report For

Client: Parsons, Inc.

Client Project Name: DFSP - Norwalk

Attention: Mary Lucas
100 West Walnut Street
Pasadena, CA 91124-0002

Approved for release on 11/1/2011 by:
Ranjit Clarke
Project Manager

ResultLink ▸

Email your PM ▸

Calscience Environmental Laboratories certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analyses, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety. Note that the Chain-of-Custody Record and Sample Receipt Form are integral parts of this report.

Calscience Environmental Laboratories, Inc.

Contents

Client Project Name: DFSP - Norwalk
Work Order Number: 11-10-1170

1 Core Labs (Geotechnical Testing) - 11101170 4

2 Chain of Custody/Sample Receipt Form 7

Calscience Environmental Laboratories, Inc.

Subcontractor Analysis Report

Work Order # 11-10-1170

One or more samples in this Work Order have tests that were subcontracted. The subcontract report(s) follows.

For subcontracted tests, please reference the laboratory information noted below.

1 Core Laboratories - Bakersfield,CA ISO 9001:2000, CERT-0014993, ELAP CA # 1247
Geotechnical Testing

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Core Lab
RESERVOIR OPTIMIZATION

Petroleum Services Division
3437 Landco Dr.
Bakersfield, California 93308
Tel: 661-325-5657
Fax: 661-325-5808
www.corelab.com

November 1, 2011

Ranjit Clarke
Calscience Environmental Laboratories, Inc.
7440 Lincoln Way
Garden Grove, CA 92641-1432

Re: Physical Properties Analyses
Project: 11-09-1342
CL File No: 411068EN

Dear Ms. Gonsman:

Results of the viscosity and density determinations performed upon samples submitted from your Project # 11-10-1170 accompany this cover. This electronic version of the report will constitute the final report unless otherwise instructed.

Appropriate ASTM, EPA or API methodologies were used for this project and SOP's are available on request. The samples for this project are currently in storage and will be retained for thirty days past completion of testing at no charge. At the end of thirty days the sample will be disposed. You may contact me regarding continued storage, disposal or return of the sample.

We appreciate the opportunity to be of service to Calscience Environmental Laboratories, Inc. and trust these data will prove beneficial in the development of this project. Please do not hesitate to contact us (661-325-5657) if you have any questions regarding these results, or if we can be of any additional service.

Sincerely,
Core Laboratories

Jeffry L. Smith

Jeffry L. Smith
ARP Supervisor

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CLB Listed NYSE

VISCOSITY and DENSITY DATA

(METHODOLOGY: ASTM D445, ASTM D1481, API RP40)

PETROLEUM SERVICES

Calscience Environmental Laboratories, Inc

Core Lab File No: 411072EN

Lab Sample No.	Well or Sample ID	Matrix	Sample Source	Sample Date	Analysis Date	Temperature °F	Density g/cc	Viscosity	
								centistokes	centipoise
411072-1	11-10-1170	NAPL	N/A	10/17/11	10/26/11	80	0.7783	1.1240	0.8755
						100	0.7705	1.0546	0.8125
						120	0.7627	0.9294	0.7088

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Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1427
TEL: (714) 895-5494 . FAX: (714) 894-7501

TO: Core Labs

CHAIN OF CUSTODY RECORD

DATE: 10/17/11
PAGE: 1 OF 1

LABORATORY CLIENT: Calscience Environmental Laboratories, Inc.
ADDRESS: 7440 Lincoln Way
CITY: Garden Grove, CA 92841-1427
TEL: (714) 895-5494
E-MAIL: rclarke@calscience.com

CLIENT PROJECT NAME / NUMBER: 11-10-1170
P.O. NO.:
PROJECT CONTACT: Ranjit Clarke
QUOTE NO.:
SAMPLER(S): (PRINT)
LAB USE ONLY: 411072

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48HR ☐ 72 HR ☐ 5 DAYS ☒ Normal

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY): ☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS:
Viscosity: mulit-point analysis (3 temperatures).
80, 100 & 120 per R. Clarke 10/18/11 JJ

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	Density (ASTM D1481)	Viscosity (ASTM D445)
	GMW-62	10/17/11	10:45	L	2	X	X

Relinquished by: (Signature)	Received by / Affiliation: (Signature)	Date:	Time:
[signature] (CALSCIENCE)	GSO # 517633334	10/17/11	1500
	Jeff Smith / Core Lab / [signature]	10/18/11	11:00

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Calscience Environmental Laboratories, Inc.

☐ SoCal Laboratory
7440 Lincoln Way
Garden Grove, CA 92841-1427
(714) 895-5494

☐ NorCal Service Center
5063 Commercial Circle, Suite H
Concord, CA 94520-8577
(925) 689-9022

WO # / LAB USE ONLY: 11-10-1170

CHAIN OF CUSTODY RECORD

Date 10-17-11

Page 1 of 1

LABORATORY CLIENT: Parsons	CLIENT PROJECT NAME / NUMBER: DFSP-Norwalk
ADDRESS: 100 W. Walnut St	P.O. NO.: 747577
CITY: Pasadena STATE: CA ZIP:	PROJECT CONTACT: Mary Lucas
TEL: 626-440-6032 E-MAIL: mary.lucas@parsons.com	SAMPLER(S): (PRINT) Glenn Androsko

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ STANDARD

☐ COELT EDF | GLOBAL ID | LOG CODE

SPECIAL INSTRUCTIONS:

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	Unpreserved	Preserved	Field Filtered	TPH (g) or GRO	TPH (d) or DRO or (C6-C36) or (C6-C44)	TPH ( )	BTEX / MTBE (8260) or ( )	VOCs (8260)	Oxygenates (8260)	En Core / Terra Core Prep (5035)	SVOCs (8270)	Pesticides (8081)	PCBs (8082)	PNAs (8310) or (8270)	T22 Metals (6010/747X)	Cr(VI) [7196 or 7199 or 218.6]	Air - VOCs (TO-14A) or (TO-15)	Air - TPH (g) [TO-3]	Density ASTM D1481	Viscosity ASTM D445	
1	GMW-62	10-17-11	1045	oil	2	X																		X	X	

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Glenn Androsko	[signature] CEL	10-17-11	11:16
[signature]	[signature]	10/17/11	1217

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

06/01/10 Revision

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Calscience Environmental Laboratories, Inc.

WORK ORDER #: 11-10-1170

SAMPLE RECEIPT FORM

Cooler 1 **of** 1

CLIENT: PARSON **DATE:** 10/17/11

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen)

Temperature 1.6 °C + 0.5 °C (CF) = 2.1 °C ☑ Blank ☐ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: ________).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ **Received at ambient temperature, placed on ice for transport by Courier.**

Ambient Temperature: ☐ Air ☐ Filter **Initial:** VB

CUSTODY SEALS INTACT:

☐ Cooler	☐ ________	☐ No (Not Intact)	☑ Not Present	☐ N/A	Initial: VB
☐ Sample	☐ ________	☐ No (Not Intact)	☑ Not Present		Initial: PS

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☑	☐	☐
☐ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
pH / Res. Chlorine / Diss. Sulfide / Diss. Oxygen received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☐4ozCGJ ☐8ozCGJ ☐16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☐________

Water: ☐VOA ☐VOAh ☐VOAna₂ ☐125AGB ☐125AGBh ☐125AGBp ☐1AGB ☐1AGBna₂ ☐1AGBs ☐500AGB ☐500AGJ ☐500AGJs ☐250AGB ☐250CGB ☐250CGBs ☐1PB ☐1PBna ☐500PB ☐250PB ☐250PBn ☐125PB ☐125PBznna ☐100PJ ☐100PJna₂ ☐________ ☐________ ☐________

Air: ☐Tedlar® ☐Summa® **Other:** ☑ (soil) (2) SBAGS **Trip Blank Lot#:**________ **Labeled/Checked by:** PS

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** JbL

Preservative: **h:** HCL **n:** HNO_3 **na₂:** $Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **u:** Ultra-pure **znna:** $ZnAc_2$+NaOH **f:** Filtered **Scanned by:** JbL

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Calscience Environmental Laboratories, Inc.

CALSCIENCE

WORK ORDER NUMBER: 13-06-1485

The difference is service

AIR | SOIL | WATER | MARINE CHEMISTRY

Analytical Report For

Client: Parsons Government Services, Inc.

Client Project Name: DFSP - Norwalk

Attention: Mary Lucas
100 West Walnut Street
Pasadena, CA 91124-0002

Approved for release on 07/26/2013 by:
Ranjit Clarke
Project Manager

ResultLink ▸

Email your PM ▸

ACCREDITED IN ACCORDANCE WITH nelac

Calscience Environmental Laboratories, Inc. (Calscience) certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analyses, if any, is attached to this report. The results in this report are limited to the sample(s) tested and any reproduction thereof must be made in its entirety. The client or recipient of this report is specifically prohibited from making material changes to said report and, to the extent that such changes are made, Calscience is not responsible, legally or otherwise. The client or recipient agrees to indemnify Calscience for any defense to any litigation which may arise.

Calscience Environmental Laboratories, Inc.

Contents

Client Project Name: DFSP - Norwalk
Work Order Number: 13-06-1485

1 Work Order Narrative. 3

2 Chain of Custody/Sample Receipt Form. 4

3 Subcontract Narrative. 6

4 Core Labs (Geotechnical Testing) - 13061485. 7

Calscience Environmental Laboratories, Inc.

Work Order Narrative

Condition Upon Receipt:

Samples were received under Chain of Custody (COC) on 06/21/13. They were assigned to Work Order 13-06-1485.

Unless otherwise noted on the Sample Receiving forms all samples were received in good condition and within the recommended EPA temperature criteria for the methods noted on the COC. The COC and Sample Receiving Documents are integral elements of the analytical report and are presented at the back of the report.

Holding Times:

All samples were analyzed within prescribed holding times (HT) and/or in accordance with the Calscience Sample Acceptance Policy unless otherwise noted in the analytical report and/or comprehensive case narrative, if required.

Any parameter identified in 40CFR Part 136.3 Table II that is designated as "analyze immediately" with a holding time of <= 15 minutes (40CFR-136.3 Table II, footnote 4), is considered a "field" test and the reported results will be qualified as being received outside of the stated holding time unless received at the laboratory within 15 minutes of the collection time.

Quality Control:

All quality control parameters (QC) were within established control limits except where noted in the QC summary forms or described further within this report.

Additional Comments:

Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture. All QC results are always reported on a wet weight basis.

Subcontractor Information:

Unless otherwise noted below (or on the subcontract form), no samples were subcontracted.

Return to Contents

Calscience Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

[X] SoCal Laboratory
7440 Lincoln Way
Garden Grove, CA 92841-1427
(714) 895-5494

[ ] NorCal Service Center
5063 Commercial Circle, Suite H
Concord, CA 94520-8577
(925) 689-9022

WO # / LAB USE ONLY: 13-06-1485

Date: 6-21-13
Page 1 of 1

LABORATORY CLIENT: Parsons
ADDRESS: 100 W. Walnut St
CITY: Pasadena STATE: CA ZIP: 91124
TEL: 626-440-6032 E-MAIL: Mary.Lucas@Parsons.com

TURNAROUND TIME: [ ] SAME DAY [ ] 24 HR [ ] 48 HR [ ] 72 HR [X] STANDARD

[ ] COELT EDF GLOBAL ID: LOG CODE:

SPECIAL INSTRUCTIONS:

CLIENT PROJECT NAME / NUMBER: DFSP-Norwalk
P.O. NO.: 6687 ~~742576~~ 74 -05000
PROJECT CONTACT: Mary Lucas / Cindy Zicker
SAMPLER(S): (PRINT) Glenn Androsko

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	Unpreserved	Preserved	Field Filtered	TPH (g) or GRO	TPH (d) or DRO or (C6-C36) or (C6-C44)	TPH ( )	BTEX / MTBE (8260) or ( )	VOCs (8260)	Oxygenates (8260)	En Core / Terra Core Prep (5035)	SVOCs (8270)	Pesticides (8081)	PCBs (8082)	PNAs (8310) or (8270)	T22 Metals (6010/747X)	Cr(VI) [7196 or 7199 or 218.6]	Air - VOCs (TO-14A) or (TO-15)	Air - TPH (g) [TO-3]	Density	Viscosity	Interfacial Tension
1	GMW-62-LNAPL	6-21-13	1040	(liq)	2	2																		X	X	X

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Glenn Androsko	[signature] - CEL	6-21-13	~~1515~~ ~~1545~~ 1525 [initials] 6/21/13
[signature] - CEL	Dannyle CEL	6/21/13	1545

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06/01/10 Revision

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Calscience Environmental Laboratories, Inc.

WORK ORDER #: 13-06-1485

SAMPLE RECEIPT FORM

Cooler 1 of 1

CLIENT: Parsons

DATE: 06/21/13

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen except sediment/tissue)

Temperature 1.4 °C - 0.2 °C (CF) = 1.2 °C ☐ Blank ☑ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: ________).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ **Received at ambient temperature, placed on ice for transport by Courier.**

Ambient Temperature: ☐ Air ☐ Filter Initial: [initials]

CUSTODY SEALS INTACT:

☐ Cooler ☐ ________ ☐ No (Not Intact) ☑ Not Present ☐ N/A Initial: [initials]

☐ Sample ☐ ________ ☐ No (Not Intact) ☑ Not Present Initial: JD

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☑	☐	☐
☐ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
pH / Res. Chlorine / Diss. Sulfide / Diss. Oxygen received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	~~☑~~ 6/21/13	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☐4ozCGJ ☐8ozCGJ ☐16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☐________

Water: ☐VOA ☐VOAh ☐VOAna$_2$ ☐125AGB ☐125AGBh ☐125AGBp ☐1AGB ☐1AGBna$_2$ ☐1AGBs ☐500AGB ~~☑500AGJ~~ 6/21/13 JD ☐500AGJs ☐250AGB ☐250CGB ☐250CGBs ☐1PB ☐1PBna ☐500PB ☐250PB ☐250PBn ☐125PB ☐125PBznna ☐100PJ ☐100PJna$_2$ ☐________ ☐________ ☐________

Air: ☐Tedlar® ☐Canister **Other:** ☑ 500AGJ **Trip Blank Lot#:**________ **Labeled/Checked by:** JD

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** [initials]

Preservative: **h:** HCL **n:** HNO_3 **na$_2$:** $Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **u:** Ultra-pure **znna:** $ZnAc_2$+NaOH **f:** Filtered **Scanned by:** [initials]

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Calscience Environmental Laboratories, Inc.

Subcontractor Analysis Report

One or more samples in this work order have tests that were subcontracted. The subcontract report(s) follows.

For subcontracted tests, please reference the laboratory information noted below.

1. Core Laboratories - Bakersfield,CA ISO 9001:2000, CERT-0014993, ELAP CA # 1247
   Geotechnical Testing

Return to Contents

Petroleum Services Division
3437 Landco Dr.
Bakersfield, California 93308
Tel: 661-325-5657
Fax: 661-325-5808
www.corelab.com

July 26, 2013

Ranjit Clarke
Calscience Env. Laboratories, Inc.
7440 Lincoln Way
Garden Grove, CA 92841-1427

Subject: Fluid Properties Analyses
Project:13-06-1485
CL File No: 413045EN

Dear : Mr. Clarke:

The attached file presents the final viscosity,density and interfacial tension results for a LNAPL and water sample submitted from your Project #13-06-1485.

Appropriate ASTM, EPA or API methodologies were used for this project and SOP's are available on request.

Thank you for this opportunity to be of service to Calscience Env. Laboratories, Inc.. Please do not hesitate to contact us at (661-325-5657) if you have any questions regarding these results or if we can be of any additional service.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

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VISCOSITY and DENSITY DATA

(METHODOLOGY: ASTM D445, ASTM D1481, API RP40)

PETROLEUM SERVICES

Calscience Env. Laboratories, Inc.
Project Number: 13-06-1485

Core Lab File No: 413045EN

Lab Sample No.	Sample ID	Matrix	Sample Source	Sample Date	Temperature °F	Density g/cc	Viscosity	
							centistokes	centipoise
413045-1	GMW-62-LNAPL-1-A	LNAPL	N/A	6/21/13	80	0.7708	0.788	0.607
					120	0.7531	0.626	0.472
					140	0.7442	0.565	0.420

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INTERFACIAL / SURFACE TENSION DATA

(METHODOLOGY: DuNuoy Method - ASTM D971)

PETROLEUM SERVICES

Calscience Env. Laboratories, Inc.
Core Lab File No: 413045EN
Project Number: 13-06-1485
Sample Date: 6/26/13

Phase Pair		Temperature,	Interfacial Tension,
Sample ID / Phase	Sample ID / Phase	°F	Dynes/centimeter
GMW-62_Water	Air	60	73.2
GMW-62_LNAPL	Air	60	23.7
GMW-62_Water	GMW-62_LNAPL	60	24.3

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Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1427
TEL: (714) 895-5494 . FAX: (714) 894-7501

Return to Contents

TO: Core Labs

CHAIN OF CUSTODY RECORD

DATE: 06/24/13

PAGE: 1 OF 1

LABORATORY CLIENT: Calscience Environmental Laboratories, Inc.	CLIENT PROJECT NAME / NUMBER: 13-06-1485
ADDRESS: 7440 Lincoln Way	P.O. NO.:
CITY: Garden Grove, CA 92841-1427	PROJECT CONTACT: Ranjit Clarke
TEL: (714) 895-5494	QUOTE NO.:
E-MAIL: rclarke@calscience.com	SAMPLER(S): (PRINT)
	LAB USE ONLY

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48HR 72 HR ☐ 5 DAYS ☒ Normal

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY): ☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS:

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	LNAPL Physical Properties (Density, Viscosity, Interfacial Tension)
✓	GMW-62-LNAPL	06/21/13	10:40	L	2	X

4130645 EN

		Date	Time
Relinquished by: (Signature) [signature] (CALSCIENCE)	Received by / Affiliation: (Signature) GSO# 522119461	6/24/13	1600
Relinquished by: (Signature)	Received by / Affiliation: (Signature) Tracey Bishop	6/25/13	4:30 PM
Relinquished by: (Signature)	Received by / Affiliation: (Signature)		

Return to Contents

Calscience Environmental Laboratories, Inc.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1427
TEL: (714) 895-5494 . FAX: (714) 894-7501

TO: Core Labs

CHAIN OF CUSTODY RECORD

DATE: 06/27/13

PAGE: 1 OF 1

41304SEN

LABORATORY CLIENT: Calscience Environmental Laboratories, Inc.

ADDRESS: 7440 Lincoln Way

CITY: Garden Grove, CA 92841-1427

TEL: (714) 895-5494

E-MAIL: rclarke@calscience.com

CLIENT PROJECT NAME / NUMBER: 13-06-1766

P.O. NO.:

PROJECT CONTACT: Ranjit Clarke

QUOTE NO.:

SAMPLER(S): (PRINT)

LAB USE ONLY

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48HR 72 HR ☐ 5 DAYS ☒ Normal

SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY): ☐ RWQCB REPORTING ☐ ARCHIVE SAMPLES UNTIL ___/___/___

SPECIAL INSTRUCTIONS:

Additional sample for WO# 13-06-1485.
Please call Ranjit Clarke with any questions.

REQUESTED ANALYSIS

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	Matrix	#Cont	Interfacial Tension
	GMW-62-LNAPL	06/26/13	12:30	L	1	X

		Date:	Time:
Relinquished by: (Signature) [signature] (CALSCIENCE)	Received by / Affiliation: (Signature) GSO # 522194494	6/27/13	1610
Relinquished by: (Signature)	Received by / Affiliation: (Signature) Tracey Bishop	6-28-13	1:40 PM
Relinquished by: (Signature)	Received by / Affiliation: (Signature)		

APPENDIX B

RETERRO TREATABILITY STUDY RESULTS

DEFENSE LOGISTICS AGENCY SOIL SAMPLE TEST

MOBILE EDU TEST

July 23, 2014

1.0 Introduction

Reterro's R&D Mobile Evaporative Desorption Unit ("EDU"), is used to evaluate the feasibility of Evaporative Desorption Technology ("EDT") to remediate soils, drill cuttings, and other porous media. This report is intended to provide data demonstrating EDT Process remedial effectiveness. The following sections provide an overview of the EDT process and describe the treatability study performed for The Source Group, Inc., on total petroleum hydrocarbon ("TPH") impacted material from the Defense Logistics Agency ("DLA") site located in Norwalk, California.

2.0 Evaporative Desorption Technology Overview

Reterro's EDT is a remediation technique accomplished by placing excavated chemically-impacted soil including clay, silt, sand and gravel compositions, or other porous material combinations into Evaporative Desorption Units ("EDUs") fitted with vapor extraction lines coupled with a vacuum extraction system. The EDT process enables cost-effective and timely treatment of soils by removing a wide range of contaminants including volatile organic compounds ("VOCs"), halogenated VOCs ("HVOCs"), chlorinated VOCs ("CVOCs"), refined petroleum hydrocarbons, and crude oil.

EDT's ability to treat contaminated soil *ex-situ* to well below regulatory levels and reuse of the soil makes it a sustainable alternative to costly excavation and off-site disposal projects. EDT also avoids the diesel emissions and safety issues associated with offsite trucking.

The EDU is a thermally-insulated treatment chamber. Heated air is pulled through the soil bed via a vacuum system to evaporate and remove the contaminants. Depending on the type of contaminant constituents, the mobilized contaminants are either adsorbed on to a vapor-phase granular activated carbon bed, or destroyed by an oxidizer. The EDT treatment process is flameless which provides the effectiveness of thermal treatment without the permitting challenges associated with other technologies. EDT is not an incineration process. The chamber temperature of the EDU is maintained well below the formation temperature of NO_x and SO_x. Soil treatment time is determined based on site-specific parameters, and may be controlled by endpoint analysis using real time operational and emissions data. In general, treatment time for hydrocarbons, VOCs, HVOCs, and CVOCs is expected to range between 1 and 4 hours per EDU batch.

Following treatment, soil is emptied from the EDU in accordance with permit criteria from the local air quality management district. Treated soil is then spread out to cool and rehydrate which takes approximately 1 to 2 hours to complete. After treated soil has been cooled to ambient temperature and rehydrated, a post-treatment sample is collected for treatment verification.

3.0 Soil Sample Testing Overview

3.1 Samples

Two 55-gallon containers of soil were obtained from the DLA site in Norwalk, California. Soil from Container #1 was used for two treatability tests. The soil was comprised of mostly light gray fine sand with silt and clay. The physical character of the sample was relatively homogenous, with little to no rock, or hard clods of silt or clay within the sample containers. The material had a light hydrocarbon odor. Overall the material appeared dry.

Material in Drum # 1 as received from Norwalk

Material in soil box before treatment

3.2 Test Equipment

A Mobile EDU was used to test both runs of the DLA material. The system is configured with a Thermal Oxidizer to destroy contaminates desorbed during the EDT process. The system treats approximately 500 pounds of soil per batch. The Mobile EDU was designed to provide process results that are easily scaled to production quantities.

Reterro Mobile EDU with Thermal Oxidizer

3.3 Analysis

Samples were submitted for chemical analyses under chain-of-custody documentation to APEX Labs in Tigard, Oregon. The samples were analyzed for Diesel Range Organics ("DRO"), Oil Range Organics ("ORO"), and Gasoline Range Organics ("GRO") by EPA Method 8015B, Total VOCs by EPA Method 8260B, and PAHs by EPA Method 8270B. No inorganic analysis of the material was performed.

3.4 Process Steps

Two treatability tests and associated soil sampling were completed as follows.

1. For Run #1, 500 pounds of material was transferred to the soil box from Container #1. After visual inspection, a Pre-treatment sample was collected from the top of the soil box for analysis.

   Sample ID: 071014-1

2. Run #1 was processed, using normal treatment parameters. Post processing, two samples were obtained for lab analysis as follows:

   Sample ID: 071014-2, top of bed

   Sample ID: 071014-3, bottom of bed

3. New material from Container #1 was placed in the soil box and Run #2 commenced after a slight adjustment of process parameters. An additional Pre-treatment sample was collected for analysis.

   Sample ID: 071014-4

4. Run #2 was then processed under slightly modified conditions. Post processing, two samples were obtained for lab analysis as follows:

   Sample ID: 071014-5, top of bed

   Sample ID: 071014-6, bottom of bed

4.0 Experimental Results

Run #	Process Material Taken From	Location of post-treatment lab sample taken
#1	55 gal drum #1	Top and bottom of soil box
#2	55 gal drum #1	Top and bottom of soil box

Run #	Sample ID	Treatment	Sample Location in Bed	DRO mg/kg	ORO mg/kg	GRO mg/kg	TOTAL TPH mg/kg
Ref A	DP17	---	---	3,196	---	4,260	7,500
#1	071014-1	Pre	---	1,390	ND	205	1,595
	071014-2	Post	Top	ND	ND	ND	ND
	071014-3	Post	Bottom	46.6	ND	ND	46.6
#2	071014-4	Pre	---	1,360	ND	147	1,507
	071014-5	Post	Top	ND	ND	ND	ND
	071014-6	Post	Bottom	ND	ND	ND	ND

Note: 1. Due to the lack of significant PAHs concentration in the untreated soil, the results are omitted from this summary. A full copy of the final lab analysis report is available upon request.

Reference A: American Analytics Lab, report dated July 3, 2014, Re: DFSP Norwalk / 04-DLA-001 / A5331067 / 4F24012

5.0 Conclusions

The test results demonstrate the effectiveness of EDT with post processing results showing residual TPH concentrations at or near the laboratory detection limit. Analytical results for sample DP-17 were provided by the Source Group as representative of the material provided for testing. Of note, Reterro's pre-treatment soil sampling results were significantly lower (total TPH concentration of less than 1,600 mg/kg, as analyzed by Apex Labs) than the results for sample DP-17 (total TPH of 7,500 mg/kg). Some of this difference may be due to heterogeneity of chemical distribution in the soils. These differences will not impact treatability, but may require adjustment of treatment time based on normal processing parameters. Reterro considers these results to adequately demonstrate the treatability performance that can be expected in high volumes for material of a similar makeup and condition.

APPENDIX C

TREATABILITY RESULTS – F4 REMEDIATION

Appendix C –
F4 Remediation Treatability Results

C.1 Introduction

A field pilot test and treatabiity analysis of F4's biological treatment technology was conducted at DFSP Norwalk between June 24 and November 14, 2014. F4's ex-situ bioremediation technology combines a proprietary blend of non-pathogenic microbes and unique surfactants to mobilizes and degrade hydrocarbons and other organic compounds to carbon dioxide and water. The microbe and surfactant liquid solution, or Bioreclaim™ is applied to contaminated soil as the soil is processed through F4's custom designed Earth Cleaning Machine (ECM). The ECM can process approximately 2,500 tons of soil per day (volume can vary depending on soil and site conditions). The ECM soil processing and Bioreclaim™ application mechanics are engineered so that a one-time application permanently treats the soil to established cleanup requirements.

C.2 F4 Remediation Technology

F4's Bioreclaim™ solution contains a proprietary mixture microbes and surfactant. The microbes consist of the naturally occurring *Pseudomonas* bacteria. The particular strain of *Pseudomonas* has been selected for their affinity to utilize petroleum hydrocarbons as a carbon (food) source. The surfactant consists of a non-ionic alcohol ethoxelate surfactant solution and has been approved for use by the United States Environmental Protection Agency (see attached US EPA Technical Production Bulletin for Bio-Reclaim).

C.3 Project Objectives

As discussed above, the overall objective of the field scale pilot test would be to evaluate the efficacy of F4's Bioreclaim™ technology and treatment process to treat site COC (petroleum hydrocarbon) impacted soil at the Site. As discussed in the RAP, planned excavations will generate approximately 20,000 tons of soil for treatment during the first phase and a total of 100,000 tons of petroleum-containing soil during the entire project.

The cleanup requirements delineated in the Table on the following page have been developed for the DFSP Norwalk site.

Appendix C –

F4 Remediation Treatability Results

Soil Cleanup Goals

DFSP Norwalk Site, Norwalk California

	(feet below ground surface)					
Depth Below Ground Surface	**0.5**	**5**	**10**	**15**	**20**	**25**
Depth to Groundwater	**25.5**	**21**	**16**	**11**	**6**	**1**
Constituent	**Soil Cleanup Goal (mg/kg)**					
TPH as Gasoline (C4-C12)	500	500	100	100	100	100
TPH as JP-5 (C8-C17)	500	500	100	100	100	100
TPH as Diesel (C5-C25)	1,000	1,000	100	100	100	100
Benzene	0.015	0.013	0.012	0.013	0.011	0.012
Toluene	0.614	0.440	0.391	0.423	0.356	0.367
Ethylbenzene	2.07	1.44	1.19	1.33	1.07	1.10
Xylenes	5.55	3.77	3.09	3.47	2.76	2.84
1,1,2,2-Tetrachloroethane	0.0023	0.0020	0.0015	0.0012	0.0006	0.0002
1,1,2-Trichloroethane	0.0032	0.0029	0.0023	0.0020	0.0012	0.0008
1,2,3-Trichlorobenzene	0.0740	0.0634	0.0467	0.0356	0.0162	0.0034
1,2,3-Trichloropropane	8.74E-07	7.66E-07	5.87E-07	4.79E-07	2.56E-07	1.23E-07
1,2,4-Trimethylbenzene	2.10	1.80	1.34	1.03	0.478	0.120
1,2-Dibromo-3-chloropropane	2.50E-04	2.19E-04	1.68E-04	1.37E-04	7.31E-05	3.52E-05
1,2-Dibromoethane	3.05E-06	2.78E-06	2.27E-06	2.04E-06	1.30E-06	9.60E-07
1,2-Dichloroethane	1.06E-04	1.04E-04	9.37E-05	9.60E-05	7.29E-05	6.92E-05
1,3,5-Trimethylbenzene	2.06	1.77	1.31	1.01	0.470	0.118
2-Butanone	0.557	0.607	0.617	0.713	0.612	0.661
2-Chlorotoluene	0.558	0.481	0.358	0.278	0.132	0.039
2-Hexanone	0.0073	0.0072	0.0065	0.0066	0.0050	0.0047
4-Chlorotoluene	0.547	0.472	0.351	0.273	0.130	0.038
Acetone	0.994	1.17	1.28	1.57	1.42	1.60
Bromomethane	0.0015	0.0014	0.0013	0.0013	0.0010	0.0010
Carbon disulfide	0.049	0.046	0.039	0.038	0.026	0.023
Chlorobenzene	0.119	0.104	0.079	0.063	0.032	0.013
Chloroethane (Ethyl Chloride)	2.23	2.47	2.55	2.98	2.59	2.83
Chloroform	7.38E-05	6.82E-05	5.67E-05	5.25E-05	3.48E-05	2.75E-05
Dichlorodifluoromethane	0.984	0.868	0.672	0.559	0.309	0.167
Diisopropyl Ether (DIPE)	0.449	0.424	0.364	0.350	0.246	0.212
Isopropylbenzene	5.56	4.78	3.53	2.71	1.26	0.303
Methylene Chloride	7.78E-04	7.99E-04	7.61E-04	8.27E-04	6.69E-04	6.82E-04
Methyl-t-Butyl Ether (MTBE)	9.07E-04	9.10E-04	8.43E-04	8.89E-04	6.97E-04	6.86E-04
Naphthalene	0.270	0.231	0.170	0.130	0.059	0.012
n-Butylbenzene	3.97	3.40	2.50	1.91	0.867	0.179
n-Propylbenzene	2.18	1.87	1.39	1.06	0.489	0.114
p-Isopropyltoluene	2.82	2.42	1.79	1.37	0.636	0.154
sec-Butylbenzene	2.59	2.22	1.64	1.26	0.576	0.129
Styrene	0.463	0.399	0.296	0.229	0.108	0.030
Tert-Butyl Alcohol (TBA)	0.0010	0.0012	0.0013	0.0016	0.0014	0.0016
tert-Butylbenzene	2.07	1.78	1.32	1.01	0.465	0.110
Trichloroethene	0.0070	0.0061	0.0047	0.0038	0.0020	0.0009

Notes:
mg/kg = milligram per kilogram
NA = not applicable

Appendix C –
F4 Remediation Treatability Results

To accomplish the pilot test objectives, approximately 300 tons of soil were excavated and processed on June 24 and 25, 2014 to evaluate treatment effectiveness and develop costs for large scale treatment in accordance with the RAP. Periodic sampling was conducted to monitor the effectiveness of the treatment. The results of the effectiveness monitoring were compared to the cleanup objectives established for DFSP and a determination of the treatability of soils using F4's process was made.

A detailed discussion of field testing methodology, pilot test results and treatability follows.

C.4 Pre-Field Health and Safety Plan and Safety Meetings

A Site-specific Health and Safety Plan (HASP) covering the Site activities was prepared by SGI. The HASP was provided to all field personnel for review prior to initiating field activities. The objective of the HASP was to provide safe working conditions at the Site during the field activities conducted by consultants/contractors on behalf of DLA. The safety, organization, and procedures were established based on an analysis of potential hazards associated with the anticipated field activities, and personnel protection measures were selected in response to these risks.

C.5 Soil Relocation

As described in the RAP, the soil and groundwater AOC's are impacted with hydrocarbons mainly consisting of jet propellants 5 and 8 (JP-4 and JP-5), MTBE; and BTEX. In addition to soils contaminated by site fuel handling operations, an area of buried "oily sands" is present in the southwestern portion of the site.

On June 24 and 25, 2014, approximately 250 tons of impacted soil was excavated from the truck rack/water tank area and an additional 50 tons of the oily sludge soils (oily sand material referenced above) near the former oil/water separator for use in the pilot test. The soil was segregated by origin and placed into two temporary stockpiles located near the south-cental portion of the Site.

C.6 F4 Bioreclaim™ Application

As previously stated, F4's BioreclaimTM solution contains a proprietary mixture microbes and surfactant. On June 23, 2014, 24 hours prior to the scheduled application, the micobes were innoculated in a 250-gallon tote by mixing 8 kilograms of microbes in approximately in 250 gallons of water.

Appendix C –
F4 Remediation Treatability Results

On June 25, 2014, four, 250-gallon batches of Bioreclaim^{TM} solution were mixed for application on the previously excavated impacted soil. Each batch of Bioreclaim^{TM} solution included approximately 62 gallons of innoculated microbe mix to 250 gallons of water, and 0.7 % surfactant.

The Bioreclaim^{TM} solution was applied at the time the soil was being excavated and prior to being added to a temporary stockpile. The soil was immediately placed on and covered with plastic sheeting.

On July 22, 2014, approximately 300 tons of soil were removed from the site and transported to the TPS facility in Adelanto, California for treatment. Two small remaining piles (approximately 1 CY) of soil from the water tank/truck rack and the oil sand locations (stored on and covered with plastic sheeting) were left to allow further evaluation of the efficacy of the F4 bio treatment.

C.7 Pre-Treatment Sampling

To assess initial contaminant concentrations prior to initiation of the pilot test, soil samples were collected from the pilot study stockpiles. A minimum of one sample every 100 CY of treated soil was sampled from each stockpile. Samples were analyzed for TPH (C6-C44 hydrocarbon range) using EPA Method 8015 and VOCs including fuel oxygenates using EPA Method 8260B.

C.8 Progress Sampling

Progress samples were collected at approximately 3-4 week intervals following initiation of treatment to evaluate the effectiveness of the biotreatment process. Samples were collected from each of the stockpiles and submitted to the laboratory for separate analysis. Samples were collected at a randomly selected location from within the soil stockpile during each successive sampling event. Sampling was accomplished by digging down approximately 8-inches into the treated soil and collecting an undisturbed sample using a clean glass jar. Progress samples were analyzed for were analyzed for TPH (C6-C44 hydrocarbon range) using EPA Method 8015 and VOCs including fuel oxygenates using EPA Method 8260B.

C.9 Results

Laboratory analytical results for pretreatment and progress samples collected during the test are presented in the table below and grapically illustrated the subsequent graphs.

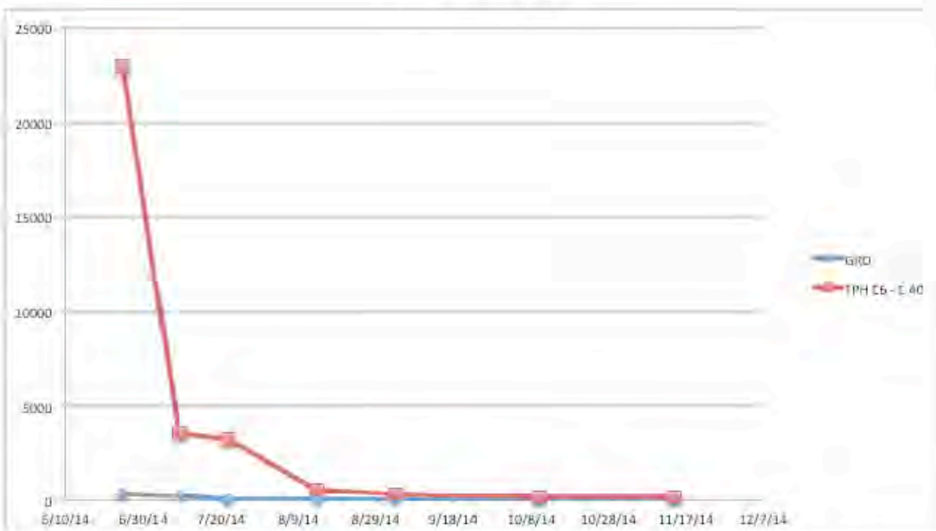
F4 Field Pilot Test Sampling and Analytical Results
DFSP Norwalk

Sample ID	Date Sampled	EPA 8015B GRO (C4 - C12) (mg/kg)	EPA 8015 MOD. TPH (C6-C40) (mg/kg)
DFSP Soil Cleanup Goals		**500/100**	**1,000/100**
"Typical" DFSP Soil			
SS-1-1*	06/25/14	250	19900
DP-17-F4-7-09-03	07/09/14	270	3600
Treated-3 yards-GS-1	07/22/14	57	3300
MAIN-PILE-8-14-2014	08/14/14	1.9	560
MAIN-PILE-9-3-2014	09/03/14	1.1	310
MAIN-PILE-10-10-2014	10/10/14	ND<0.5	160
MAIN-PILE-11-14-2014	11/14/14	<25	200
"Oily Sand" DFSP Soil			
OS-1-6/24/14	06/25/14	340	23000
SEP-F4-7-09	07/09/14	130	4100
Sep GS 7-22-2014-1	07/22/14	1	9700
SEP-1-8-14-2014	08/14/14	2.5	3700
SEP-1--9-3-2014	09/03/14	0.83	8500
SEP-1--10-10-2014	10/10/14	<0.5	1700
SEP-1--11-14-2014	11/14/14	<25	610
Legend:			
TPH: Total Petroleum Hydrocarbons			
GRO: Gasoline Range Organics			
mg/kg: Concentration in miilgrams per kilogram			
ND<0.47: Not Detected			
*Baseline Samples			
500/100: DFSP Soil Cleanup Goals < 10 feet bgs / > 10 feet bgs			

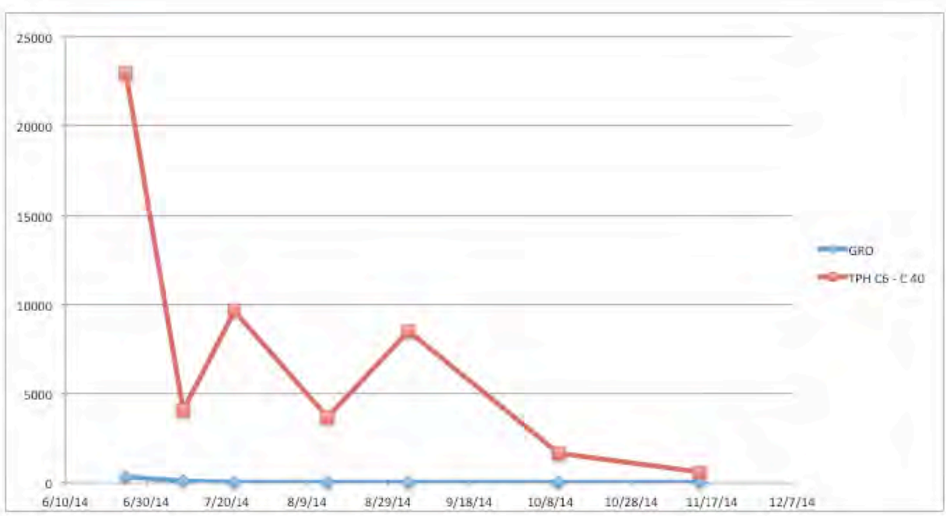
Appendix C –
F4 Remediation Treatability Results

F4 Field Pilot Test Sampling and Analytical Results
DFSP Norwalk

"Typical" DFSP Soil



"Oily Sand" DFSP Soil



Appendix C –
F4 Remediation Treatability Results

Based on the results of the test F4 makes the following comments and conclusions:

- Based on the laboratory analytical data, the application of Bioreclaim™ and subsequent biological treatment resulted on a 99+% decrease in concentrations of GRO and TPH (C6 to C40) over a 135 day treatment period for both the "Typical" and "Oily Sand" DFSP soils.
- The more stringent cleanup goal of 100 mg/kg GRO (soil > 10 feet below ground surface) was achieved within 30 days of treatment for both the "Typical" and "Oily Sand" DSSP soils.
- The less stringent cleanup goal of 1000 mg/kg for C6 to C40 TPH (soil <10 feet below ground surface) was achieved within 30 days of treatment for both the "Typical" Soil.
- The less stringent cleanup goal of 1000 mg/kg for C6 to C40 TPH (soil <10 feet below ground surface) was achieved within approximately 110 days of treatment for both the "Typical" and "Oily Sand" soils.
- The more stringent cleanup goal of 100 mg/kg for C6 to C40 TPH (soil > 10 feet below ground surface) has not been achieved as of the November 14, 2014 progress sampling event for both the "Typical" and Oily Sand" Soils. However based on the degradation trends it is anticipated that the more stringent cleanup objectives will be achieved within the next 30 to 45 days.
- Based on the latest results of the pilot test, F4's of Bioreclaim™ biological treatment process is capable of treating DFSP soils to at least the less stringent cleanup goals for TPH in 120 days or less and the most stringent cleanup goal for GRO in 60 days or less.
- Additional progress samples will be collected in December to confirm completion of treatment to all required cleanup goals.

Menu

SUMP SAFE BIO-RECLAIM

TECHNICAL PRODUCT BULLETIN: B-69
USEPA, OIL PROGRAM CENTER
LISTING DATE: OCTOBER 13, 2011
"SUMP SAFE BIO-RECLAIM"
EPA HAS NOT RECEIVED UPDATED CONTACT INFORMATION FOR THIS PRODUCT: 10/01/12

I. NAME, BRAND, OR TRADEMARK

SUMP SAFE BIO-RECLAIM
Type of Product: Bioremediation Agent (Biological Additive/Microbiological Culture)

II. NAME, ADDRESS, AND TELEPHONE NUMBER OF MANUFACTURER/CONTACT

Teamwork Distributing
P.O. BOX 2506
Stony Plain, Alberta
T7Z 1X1
Phone: (780) 968-5367 (Plant)
Mobile: (780) 238-2741
Fax: (780) 958-9070
E-mail: marlin@xplornet.com
E-mail: marlin@teamwrk.ca
(Mr. Marlin Rudolph)

III. NAME, ADDRESS, AND TELEPHONE NUMBER OF PRIMARY DISTRIBUTORS

PNE Corporation
55 International Way
Longview, WA 98632
Phone: (360) 423-2245
Fax: (360) 423-2272
E-mail: garyh@pnecorp.com
Website: www.pnecorp.com
(Mr. Gary Healea)

IV. SPECIAL HANDLING AND WORKER PRECAUTIONS FOR STORAGE AND FIELD APPLICATION

1. Flammability: Non-flammable (DOT: Non-hazardous)
2. Ventilation: No special requirements
3. Skin and eye contact; protective clothing; treatment in case of contact: No special equipment or clothing required, however goggles are recommended. If eye or skin irritation occurs, flush with plenty of fresh water.
4.a. Maximum storage temperature: 110°F maximum, must be used within 24 hours from constitution
4.b. Minimum storage temperature: 45°F
4.c. Optimum storage temperature range: 60°F to 90°F
4.d. Temperatures of phase separation and chemical changes: Stable

V. SHELF LIFE

The material must be used within 24-48 hours of constitution of the powdered bacteria portion in water. The dry material must be kept at -20°C and is stable for two years at this temperature. Once sent to the field, the material may be stored on ice for up to two weeks prior to constitution.

VI. RECOMMENDED APPLICATION PROCEDURE

1. Application Method: Product may be applied by the usual methods. For smaller spills a drum pump with sprayer may be used, mixing with fresh water typically. The concentrate is used at 25:1 dilution rate with water and is typically applied at a rate of 6 gallons per cubic meter of soil. It is important that the soil be broken up into small clumps (rototilling is acceptable) to ensure effective application. The soil is left and biodegradation is expected to complete in approximately 12 weeks. Analysis using approved sampling procedures is performed to confirm biodegradation.

For larger volume projects, any auger based soil homogenizer is employed to break up large clumps of soil, which are dug out from the contaminated area using a standard hoe. The broken up soil is taken up a conveyor and has the diluted concentrate (25:1) at a rate of 6 gallons per cubic meter of soil. Piles up to 20 feet high may be formed. The soil is left and biodegradation is expected to be complete in approximately 12-18 weeks. Analysis using approved sampling procedures is performed to confirm biodegradation. Proper safety rules must be employed to ensure that any holes dug out are not accessible to employees or unauthorized personnel.

For oil spills on open water, it is recommended that a 25:1 dilution of the product be applied via spraying. In this way, the bacteria can contact the floating oil and immediately begin to form a bio-film. The spray would also be applied on any soil contaminated on banks, etc. It is important to ensure complete coverage of the water/oily surface and soil during spray application. Degradation will be visible visually and can be confirmed by Fats, Oil and Grease (FOG) analysis.

For smaller, contained volumes of oily water (typically emulsified, white water), it is recommended that sufficient concentrate be added to the contaminated water such that it results in a 2.5% concentration of the concentrate in the contaminated water. Preferably, aeration can be performed, using even a small, fish tank aeration unit. Visual evidence of biodegradation should be apparent within one week or less and can be confirmed by FOG analysis.

2. Concentration/Application Rate: The concentrate is used at 25:1 dilution rate with water and is typically applied at a rate of 6 gallons per cubic meter of soil.

3. Conditions for Use: The product can be used in fresh or salt water and may be applied at temperatures between 40°F and 120°F. However, the product is most effective when applied at water temperatures between 70°F-90°F. Further, the product is effective on fresh spills or aged hydrocarbons. Note for preparation of the product to be applied while in the field: all components listed in the product are packaged as a complete unit and are applied as such. The microbial portion of the product is supplied in bags which are either drum (55 gallon) or pail (5 gallon) sizes. Fresh water, if available, is added to fill the bag (bags are placed in pails or open headed drums) to 55 gallon of 5 gallons respectively. Depending upon which of these are being constituted with water, a high-density polyethylene (HDPE) bottle with the appropriate quantity of surfactant is added into the container (bottles are labeled Bio-Reclaim Surfactant – Drum Size (or Pail Size)). In the same way, HDPE containers with appropriate amounts of sodium nitrite are added and are labeled Bio-Reclaim Salt – Drum Size (or Pail Size)).

VII. TOXICITY AND EFFECTIVENESS

a. Effectiveness:
Bioremediation Agent Effectiveness Test (40 CFR 300.900), Federal Register September 15, 1994:

Summary Data Table:

DAYS	PRODUCT 3 REPS/PROD	TOTAL MEAN ALKANES (ppm)	RED% 28 DAYS	TOTAL MEAN AROMATICS (ppm)	RED% 28 DAYS
	CONTROL	40,770	0	5,229	0
0	NUTRIENT	41,329	0	5,326	0
	PRODUCT	40,609	0	5,384	0
	CONTROL	37,530	0	4,824	0
7	NUTRIENT	21,788	0	4,634	0
	PRODUCT	38,354	0	5,298	0
	CONTROL	31,456	22.8	3,692	24.2
28	NUTRIENT	502	98.8	3,052	42.7
	PRODUCT	21,356	47.4	3,742	49.0

Results of Gravimetric Analysis:
Percentage (%) Decrease in Weight of Oil on Day 28
Control: 6.36%
Nutrient: 33.00%
Product: 3.00%

VIII. MICROBIOLOGICAL ANALYSIS

1. Listing of each component of the total formulation, other than microorganisms, by chemical name and percentage by weight: CONFIDENTIAL
2. Listing of all microorganisms by species and percentages of each species in the composition of the additive: CONFIDENTIAL
3. Optimum pH, temperature, and salinity ranges for use of the additive:
pH: 6-8
Temperature: 90°F
Salinity: Not applicable
3. Minimum and maximum pH, temperature, and salinity levels below or above which the effectiveness of the additive is reduced to half its optimum capacity:
pH: 4.8 – 9
Temperature: 59°F – 104°F
Salinity: Not applicable
4. Special nutrient requirements: A combination of 70 percent live active yeast mixed with 30 percent fine ground corn cob is used as a nutrient. In a 55 gallon drum of concentrate, approximately 1.1 kg of this mix will be found (relative to the 1.1 kg, the actual bacteria represent the negligible mass of several grams). There are no storage requirements for the nutrient portion of the formula; however, as they are in a homogenous mixture with the bacteria, they must be stored as described in Part V of this bulletin.
5. Test results regarding the determination of the presence of the following:
Salmonella: Negative
Fecal coliform: Negative
Shigella: Negative
Staphylococcus Coagulase positive: Negative
Beta hemolytic Streptococci: Negative

IX. PHYSICAL PROPERTIES

NA

X. ANALYSIS OF HEAVY METALS, CYANIDE, AND CHLORINATED HYDROCARBONS

NA

Last updated on August 26, 2014

APPENDIX D

SOIL MANAGEMENT PLAN

SOIL MANAGEMENT PLAN: TREATMENT CELL OPERATION AND SITE EXCAVATION

DEFENSE FUEL SUPPORT POINT NORWALK
15306 Norwalk Boulevard
Norwalk, California

04-NDLA-007

Prepared For:

Defense Logistics Agency - Energy
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For Submittal To:

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November 5, 2014

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Appendix C Department of Toxic Substance Control, 2001

LIST OF ACRONYMS

DLA Energy	Defense Logistics Agency - Energy
SGI	The Source Group, Inc.
WDR	Waste Discharge Requirement
MTBE	Methyl tertiary-Butyl Ether
TBA	Tertiary-Butyl alcohol
1,2-DCA	1,2-Dichloroethane
ft bgs	Feet Below Ground Surface
DPT	Direct Push Technology
LARWQCB	California Regional Water Quality Control Board, Los Angeles Region
SCP	Site Cleanup Program
SLIC	Spills, Leaks, Investigation and Cleanup
EPA	United States Environmental Protection Agency
F4	F4 Remediation, LLC
ECM	Earth Cleaning Machine
cu yd	Cubic Yard
SWPPP	Stormwater Pollution Prevention Plan
HASP	Health and Safety Plan
CFR	Code of Federal Regulations
HAZWOPER	Hazardous Waste Site Operations and Emergency Response Rule
SCAQMD	South Coast Air Quality Management District
VOCs	Volatile Organic Compounds
SVE	Soil Vapor Extraction
HDPE	High-density Polyethylene
PVC	Polyvinyl Chloride
GAC	Granular Activated Carbon
mil	Thousandths of an Inch
TPHg	Total Petroleum Hydrocarbons as Gasoline
TPHd	Total Petroleum Hydrocarbons as Diesel
1166 Plan	Site-specific Rule 1166 Contaminated Soil Mitigation Plan
ppmv	Parts per Million by Volume
UCL	Upper Confidence Limit
COC	Contaminant of Concern

BMP	Best Management Practice
PID	Photoionization Detector
PTO	Permit to Operate
OVA	Organic Vapor Analyzer
$\mu g/m^3$	Micrograms per Cubic Meter
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
SFPP	Santa Fe Pacific Pipelines Partners, L.P.
GWE	Groundwater Extraction
LNAPL	Light Non-Aqueous Phase Liquid
VES	Soil Vapor Extraction System
GWETS	Groundwater Extraction and Treatment System
NPDES	National Pollutant Discharge Elimination System
OM&M	Operations, Maintenance, and Monitoring
ELAP	Environmental Laboratory Accreditation Program
SM	Standard Method

1.0 INTRODUCTION

On behalf of our client, Defense Logistics Agency - Energy (DLA Energy), The Source Group, Inc. (SGI) is submitting this Land Treatment Operations Plan (Plan) for the temporary construction of designated bioremediation areas (treatment cells) at the former Defense Fuel Support Point (DFSP) Norwalk facility (site).

Parsons prepared a *Conceptual Site Model and Remedial Action Evaluation for Soil, Groundwater, and LNAPL* (CSM, Parsons, 2013). This report compiled extensive characterization data and evaluated remedial alternatives. The conceptual site model (CSM) described in Parson's document was subsequently approved by the Los Angeles Regional Water Quality Control Board (LARWQCB). Parson's originally proposed the excavation and off-site disposal of the upper 10 feet of petroleum contaminated soil present at the site. The RWQCB-approved site soil clean up goals are provided in Table 5-2 of the CSM.

However, upon further evaluation, deeper excavations and on-site treatment were evaluated and selected as a preferable remedy by DLA Energy. Therefore, on October 2, 2014, SGI, on behalf of DLA, submitted the required Form 200 and supporting information to apply for a Waste Discharge Requirement (WDR) under General WDR, Order No. 90-148; General Waste Discharge Requirements for Land Treatment of Petroleum Hydrocarbon Contaminated Soil in Los Angeles and Santa Clara River Basins. The WDR will be needed to allow excavated, petroleum containing soil to be treated on site using bioremediation techniques and then returned to the ground once confirmation soil analyses demonstrate that site cleanup goals have been met.

The site remedial strategy entails the excavation and on-site treatment of any soil containing chemicals of concern (COCs), principally petroleum hydrocarbons, that exceed defined site cleanup goals. The removal and treatment of the upper 10 feet of soil was designed to ready the property for eventual conveyance for use as recreational park land or for redevelopment as commercial property. As an extension of the excavation and on-site treatment of shallow contaminated soil, the DLA Energy has determined that it is beneficial to treat deeper contaminated soil. The removal and treatment of deeper contaminated soil will be done to promote the remediation of groundwater. The excavation of the deeper soil will be a component of a larger strategy for deep soil treatment that will include in-site treatment methods (such as vapor extraction, air sparging, and ISCO methods) and long-term monitored attenuation. Therefore, the excavation of deeper soils will be performed only in those areas that contain the highest concentrations of residual COCs (based both on excavation confirmation and historical soil analytical data.

In order for the areas of land to be utilized for land treatment, information delineating the construction, operation, maintenance, and monitoring of the treatment cells is imperative to ensure there are no unintended, adverse, environmental impact on soil of the treatment area or of other environmental media.

The current Plan serves two objectives. The first is to provide requisite information for the design, construction, operation and closure of areas used for soil treatment by means of bioremediation. The second objective of the Plan is to describe methods and means to be employed while completing the excavation and trenching planned for contaminated areas present at the Site.

1.1 Background

This site is located at 15306 Norwalk Boulevard, in Norwalk, California. Figure 1 is a site map.

The real property is owned by the Air Force and controlled through the offices of March Air Reserve Base. DLA Energy is responsible for environmental site restoration. The facility was formerly used to receive, store, and distribute military grade jet fuel. Active operations ceased in the 1990s and the tanks and above ground infrastructure were removed in 2012. As a result of fuel handling operations, soil and groundwater at the site have been contaminated with petroleum hydrocarbons. The primary chemicals of concern at the site include petroleum hydrocarbons (fuel products), benzene, methyl tertiary butyl ether (MTBE), tertiary butyl alcohol (TBA), and 1,2-dichloroethane (1,2-DCA).

In-situ remedies for soil have essentially been exhausted. The feasibility of excavation and onsite treatment was assessed and deemed the optimum remedy. Further, this remedy will substantially improve efforts to cleanup groundwater by removing source material from proximity of groundwater.

The purpose of temporarily establishing these treatment cells is for the remediation of soil from around the site. There are essentially 12 clusters of excavations planned for the site. Soil from depths of 0 to 25 feet below ground surface (feet bgs) will be excavated. Some contaminated soil within the excavations resides below clean overburden. For this reason soil will be actively managed to segregate potentially clean soil from impacted soil.

The setting of the site has conditions favorable to establishing areas for on-site treatment of soil. The site has manned security 24 hours a day and seven days a week and is completely fenced off. Further, because the historical use of the site was operating several above ground storage tanks, there are existing berms, originally constructed for secondary spill containment, which make for ideal protection against storm water impacts.

Site characterization has verified that chemicals of concern (COC) are limited to petroleum hydrocarbons and associated constituent chemicals (including benzene, toluene, ethylbenzene, and toluene) are present in the soil to be excavated and treated. Therefore, no treatment of hazardous wastes will be performed.

1.2 Specific Goal of the Excavation and Treatment Project

For the purposes of this plan shallow soil is defined as soil between 0 and 10 feet (ft) below ground surface (bgs). Soil between 10.5 ft bgs and 25 ft bgs is considered deep soil. The primary goal is to make the site suitable for transfer and development. To that end the objective is to excavate all impacted soil between 0 and 10 ft bgs and treat the soil on-site. Excavation of deeper soil serves a secondary objective to reduce source hydrocarbon contamination that is impacting groundwater.

Based on substantial characterization data, the excavation area and depth estimates are very conservative. Excavations which are planned for no greater than 10 ft bgs, should serve to remove all hydrocarbon impacted soil. However, in the event contamination appears to be deeper there is no requirement to excavate further. In the event it is decided to not excavate deeper and contamination still exists, a delineation layer of aggregate material will be placed in the bottom of the excavation between 10 ft bgs to 10.5 ft bgs. A field decision may be made to excavate deeper or expand the footprint. Conversely, because the footprints were bounded very conservatively, some excavations may not need to be as large as originally estimated.

1.3 Characterization of Waste to be Treated

Table 4-1, of CSM summarizes soil data acquired utilizing direct push technology (DPT) from 174 locations throughout the site. All waste to be treated is exclusively hydrocarbon-impacted soil and is considered non-hazardous.

In addition, site demolition activities to remove above ground storage tanks, concrete pads, an underground storage tank, an oil water separator and associated conveyance piping occurred in 2012. In February 2013, Parsons submitted a report *Concrete Demolition and Soil Confirmation Sampling Completion Report* (Parsons, 2013). 1856 tons of soil were disposed of and were profiled as non-hazardous.

1.4 Scope of Operation Plan

The LARWQCB is the State of California designated regulatory agency assigned to oversee all aspects of the remediation of the DSFP Norwalk site. This is done as part of the Site Cleanup Program (SCP), formerly the Spills, Leaks, Investigation and Cleanup (SLIC) program. The approval of use of land for the purpose of land treatment is administered through the LARWQCB Land Disposal Unit. The primary purpose of the plan is to specify how the site will be designed, constructed, operated, managed, and closed. The secondary purpose is to convey how soil will be screened (assumed clean versus contaminated) and the process to confirm soil is clean either without treatment or post treatment. Further, because the plan addresses segregation of assumed clean soil, management of that soil is also discussed.

1.5 Excavation and Treatment Overview

Figure two shows the site layout, the proposed excavations, the layout of one treatment cell and candidate staging locations for clean soil. This section describes the process and activities that will be performed on-site.

As shown on figure 2, excavation sites are identified as 0-5 ft bgs, 5-10 ft bgs, 10-15 ft bgs and 15-25 ft bgs. Surface release of COCs was very limited and occurred primarily from beneath above ground storage tanks from and from subsurface conveyance piping. As the majority of COC releases occurred in the subsurface, a substantial volume of soil to be handled during the site excavation activities will be clean overburden. As an example, if an area is identified with a 5-10 ft bgs excavation interval, potentially, 5 feet of clean over burden exists above the contaminated interval.

Excavations ranging from 0-5 ft bgs and 0-10 ft bgs will be conducted first. Once those excavations are completed, and provided field conditions, and technical aspects associated with the extent of contamination are not significantly different than originally characterized, the deeper excavations will commence. Because of this approach there will be multiple open excavations present at the site during the course of the project. These excavations will be secured, safety sloped, with plastic sheeting placed to control VOC emissions from exposed, contaminated soils.

Before soil can be placed in a biotreatment stockpile, it must be processed adding surfactant and bacteria to the soil. The bacteria and surfactant are proprietary material provided by F4 Remediation, Inc. (F4). See Appendix A. The liquid solution (Bio-Reclaim™) is an approved bioremediation agent on the United States Environmental Protection Agency's (EPA) National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The surfactant is a non-toxic, biodegradable solution designed to enhance air and water penetration, ensure desorption of hydrocarbons from the soil, and maximize nutrient and hydrocarbon assimilation by the microbes. F4 will amend the soil utilizing F4's custom designed Earth Cleaning Machine (ECM). The ECM can process 1,000 to 2,000 cubic yards (cu yd) per day. Soil to be processed will be placed in a staging area in close proximity to a treatment cell. An excavator will load soil into the ECM where the operator will apply the surfactant and the bacterial solution. The soil will then be transferred either by conveyor or heavy equipment for placement into the soil biotreatment stockpile.

Soil will remain in an engineered and monitored biotreatment stockpile until COCs are reduced to site clean-up goals. The estimated treatment time is on the order of 60 days to 90 days. The soil requires no additional treatment or manipulation after it is placed in the treatment stockpile.

In addition to soil undergoing the bioremediation treatment, soil segregated as clean will be staged in and around the excavation of origin. Figure 2, identifies candidate staging areas for clean soil. Clean soil will be managed carefully implementing Best Management Practices (BMPs) as prescribed by the Stormwater Pollution Prevention Plan (SWPPP).

All soil, other than soil removed and transported off site for disposal, is intended to be used on site to back-fill excavations.

2.0 HEALTH AND SAFETY PLAN

A site-specific health and safety plan (HASP) is in effect at this site. It was prepared in general conformance with the federal requirements of 29 Code of Federal Regulation (CFR) Title 8 Section 5192, Hazardous Waste Site Operations and Emergency Response Rule (HAZWOPER).

The HASP includes protocols for safe work practices throughout the operation of the treatment areas. All project team members who will be performing work on site will be responsible for reading and conforming to the HASP.

The RWQCB will be notified a minimum of 48 hours prior to the initiation of field activities.

3.0 CELL DESIGN AND CONSTRUCTION

The design and construction of the treatment cell areas incorporate requirements and permit conditions as specified by the South Coast Air Quality Management District (SCAQMD). The SCAQMD Rule 1166 provides conditions to be followed during the handling of volatile organic compound (VOC) contaminated soil. The SCAQMD has preliminarily approved a site-specific permits for both the excavation of VOC and on-site treatment of VOC containing soils. A copy of the two draft permits and monitoring provisions is included in Appendix B of this plan.

3.1 Cell/Treatment Stockpile Design

Figure 3 provides the fundamental design for a given soil treatment cell. A cell is simply the location of up to six stockpile rows. The rows within the historical tank basins are completely contained by berms originally constructed for secondary containment.

It is planned to use up to four basins for treatment cells, with a fifth cell designated as an alternate location for the treatment of additional soil. Initially, two basins will be prepared as treatment cells to receive soil. The first excavation event will occur and soil will be placed in the cells. When it has been adequately established that soil treatment is progressing as planned, two additional cells will be established. Each cell will contain up to approximately 10,000 cu yd. As a result, excavation events of 20,000 cu yd will be alternating with backfilling operations of the previous excavation event.

In the event more capacity is required, an adjoining basin would be constructed in identical fashion. SGI would notify the LARWQCB prior to constructing another cell or using a different location.

3.2 Baseline Sampling

There is no recognized surface contamination in the areas that are to be used for treatment cells. However, baseline sampling will be conducted and reported in the final report for comparison to sampling conducted after use of the treatment areas has concluded. Calibrated PID readings will be taken approximately every 20 feet along a treatment row area. If any location registers greater than 50 ppm, the location will be logged and a surface sample will be taken. Each designated row will have at least four, baseline, surface samples taken. Soil will be analyzed for TPH (speciated for carbon chain range) using EPA Method 8015.

3.3 Treatment Stockpile Construction

The area where a treatment row will be constructed will have the first six inches of soil removed and the soil placed into temporary stockpiles. High-density polyethylene (HDPE) liner material will then be laid in rows as shown in design figure 3. The temporarily stockpiled soil will then be used to cover the liner to protect the integrity of the liner and to ensure that the liner remains secured in place. The perimeter of the buried liner will be marked with wooden takes and caution tape.

After the liner material is in place it will be ready to receive soil. Soil that has been processed with surfactant and bacteria will be placed in the row in a series of lifts. At spacing of approximately 50 feet and at approximately two feet above grade, lateral piping (constructed of schedule 40 polyvinyl chloride (PVC) will be placed perpendicular to the long dimension of the pile stockpile. The lateral piping will be used to reduce the air pressure in the covered treatment piles to facilitate treatment (by inducing fresh, oxygen-rich air to seep into the piles) and to mitigate VOC emissions. Soil will be added until the stockpile is approximately 8 feet in height.

Each lateral pipe will be connected with a PVC ball valve to a main header and the header will, in turn, be connected to the on-site SVE system. The vapor extraction system consists of an electric motor and blower to extract soil vapors from the subsurface at a maximum rate of 1,500 cubic feet per minute. Subsurface extraction will limited during the course of the excavation so that the majority of the system capacity will be available for connection to the treatment piles. The extracted vapors will be conveyed to a knock-out tank that separates any entrained moisture from the soil vapors prior to entering the blower. Accumulated moisture in the knock-out tank will be transferred to and treated by the existing groundwater extraction and treatment system. The soil vapors will then treated through multiple granular activated carbon (GAC) vessels prior to be discharged to the atmosphere (the GAC vessels operated under conditions specified by a site-specific SCAQMD permit).

Soaker hoses will be placed on the stockpile to augment the moisture content of the soil, if necessary. Moisture will be maintained at 40 to 85% of field capacity. A tensiometer or equivalent monitoring device will be used to monitor moisture, and water will be added if the soil moisture falls below the optimum range.

Each pile will be covered with a 10 to 20 thousandths of an inch (mil) heavy duty plastic. Enough covering material to cover all piles at the production rates projected will be staged on site. The plastic sheeting will be overlapped, and seams and edges will be secured with sand bags, ropes, and/or sealants, as appropriate and needed.

Each cell and row will have a unique identity and each lot processed within a row will have a unique identity.

4.0 STOCKPILE MANAGEMENT

This section describes the segregation of soil, monitoring of soil treatment, monitoring of VOC emissions and dust, and management of stockpiles. This includes the verification and management of stockpiles of clean soil, the characterization of soil designated for treatment and soil designated for off-site disposal. In general, field observations (i.e. visual staining, strong odors, photo-ionization detector readings of greater than 50 parts per million) will serve as the first line of screening. During treatment soil will be monitored for progress toward achievement of cleanup goals. Assumed clean soil, and treated soil will undergo confirmation sampling with the methodology set forth in EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA SW-486). Soil will be analyzed for TPH (GRO and DRO) using EPA Method 8015 and VOCs using EPA Method 8260B. Once confirmation samples demonstrate that contaminant concentrations have been reduced to below site cleanup goals, the treated soil will be removed from the treatment cell and staged for backfilling on-site.

4.1 VOC-Containing Soil Stock Pile Operational Conditions

As a limitation of stockpile size, the site-specific Rule 1166 Contaminated Soil Mitigation Plan (1166 Plan) with Application Number 566483, specifies the following provisions:

1. Section I, General Requirements item 5: At no time shall the total quantity of VOC contaminated soil stockpiled not undergoing onsite treatment exceed 5,000 cubic yards;
2. Section III, Monitoring item 17: a VOC contaminated stockpile created for onsite storage only shall not contain more than 400 cubic yards of soil;
3. Section IV – Handling and Storage Item 18 D: Onsite treatment of soil which falls into the category of 50-1,000 parts per million by volume (ppmv) as hexane shall be initiated within 30 days; and
4. Section IV – Handling and Storage Item 19 A iii: Onsite treatment for the VOC contaminated soil for category (>1,000 ppmv) as hexane shall be initiated within 3 days of excavation.

4.2 Handling of Assumed Clean Soil

As previously described, field screening will be utilized to segregate assumed clean soil from contaminated soil. Assumed clean soil will be stockpiled proximal to the originating excavation in stockpiles not to exceed 2,000 cu yd. The stockpiles will be placed on plastic liners of 30-mil or greater. During construction, the piles will be lightly sprayed with water and covered with plastic sheeting of 10-mil or greater. Plastic sheeting will be secured with sandbags.

To verify that the stockpiled soil is clean, sixteen soil samples will be collected from each 2,000 cu yd clean soil stockpile. Data will be statistically analyzed to calculate the 95% upper confidence limit (UCL) for contaminants of concern (COCs) and compared to the predetermined cleanup goals

(See Table 2). If the UCL for the COCs meet or exceed site cleanup target concentrations, the soil pile will be deemed acceptable for reuse. As subsequent soil is deemed acceptable; stockpiles may be consolidated.

In the event a stockpile fails to meet the clean-up goal criteria, the stockpile will be routed to the designated soil preparation area where the soil will be augmented with surfactant and bacteria and then placed in a treatment pile.

Each stockpile originally field screened as assumed clean will be given a unique identification number which will be logged.

The structure of the number will be nine digits. The information of the digits is as follows:.

1. Digits 1 and 2: Excavation number (e.g. as excavation in a new area is begun it will be given a sequence number of 01, 02, 03, etc.);
2. Digits 3 and 4: Excavation interval (e.g. 05 signifies the soil was removed from the top five feet, approximately); 10 would signify soil was removed between 5 and 10 ft bgs
3. Digits 5, 6, and 7: Ordinal Date (e.g. day designation 1 through 365); and
4. Digits 8 and 9: Lot number (e.g. each stockpile within a given excavation area will be given a specific lot number).

Samples collected from the stockpile will be sequentially numbered 01 through 16. Acceptance sampling and evaluation is discussed in a later section.

Once a stockpile is covered and secured, the identification number will be clearly marked on the stockpile.

If analytical results indicate the stockpile is clean, the stockpile will be clearly marked as clean. If multiple clean stockpiles need to be consolidated due to space constraints or to facilitate field operations, the consolidation of stockpiles will be logged.

4.3 Handling of Assumed Contaminated Soil

Soil that is field screened and determined to be VOC containing, as defined by the SCAQMD (i.e. VOCs detected at a concentration greater than 50 ppmv when measured within 3 inches of the soil with a calibrated PID), will be directed to staging. Staging will consist of stockpiles no greater than 400 cu yd. Once a 400 cu yd stockpile is created, a composite sample of soil collected from 10 random locations on the stockpile will be taken. The sample number assigned will be a number that will be a combination of area, and sequence received. The purpose of the composite sample will be to pre-characterize the soil prior to treatment and placement in treatment cell. This baseline data will assist in estimating how long soil will need to be in a treatment pile.

The soil will then be treated with surfactant and bacteria. After treatment, the soil will be placed in a treatment row.

Stockpiles will be placed sequentially in the rows such that composite sample results can be traced to locations within the row. Soil designated for treatment will be added to a given row until the capacity of the row has been reached.

Once a row has been completed it will be given a designation number. The digits of the number are as follows:

1. Digit 1 represents the treatment cell: 1,2, 3 or 4.
2. Digit 2 represents the treatment row: 1, 2, 3 4, 5 or 6
3. Digit 3 represents the sequential number of the use of that row. A treatment row (location) will only be used to treat a few stockpile lots of soil.

Monitoring of the soil treatment progress and confirmation sampling will be discussed in subsequent sections.

4.4 Handling of Soil Not Suitable for On-site Treatment

It is anticipated that there will be a small percentage (approximately 1% to 2%) of the soil that will need to be disposed of by sending offsite. A field screening determination will be based on the appearance of excessive contamination, the presence of debris, and/or physical characteristics that will preclude processing the soil through the ECM. Once soil is designated as not practical or desirable for treatment; sampling will be done to provide the waste disposal facility the requisite profile for offsite disposal; this soil will be removed from the site within 30 days of generation and will be stored in accordance with SCQAMD Rule 1166 conditions.

4.5 Debris Management Procedures

Soil has the potential to adhere to subsurface debris, which has not been previously identified. Debris encountered during excavation activities may be impacted with former DFSP residuals; such has soil impacted with TPH. All effort should be taken to remove the soil from the debris, prior to disposal of the debris. It is anticipated that soil will be easily displaced from debris, and as a result will not require special handling. In cases where soil is not easily displaced from debris, the following decontamination activities may be implemented, pending the approval of DLA and/or its delegated Consultant:

1. A decontamination station consisting of plastic sheeting (10-mil or greater in thickness) shall be placed on the ground in the area where decontamination operations will be conducted. The plastic will be secured with sand bags or the equivalent such that wind or other environmental conditions will not lift the plastic off the ground, reducing the potential for creating a dust related hazard.

2. All impacted debris will be cleaned over the plastic sheeting by means of shovels and stiff-bristled brooms or brushes until they are fully cleaned. Upon completion of cleaning, any impacted debris will be placed in the appropriate container for proper disposal. If shovels/brooms cannot clean the impacted material off the debris, other means and methods may be used, including wire brushes.

Prior to loading of soil removed from debris, the plastic sheeting will be placed on the ground such that any spilled material will be prevented from contacting the ground surface. Upon completion of loading, the plastic sheeting will be folded and placed in the bin used for soil transport and disposal.

Personal Protective Equipment, such as disposable coveralls, will be removed and discarded in the decontamination areas. In order to decontaminate reusable items such as work boots, a two-stage decontamination process will be used. This process will include washing in a detergent solution with a stiff-bristled brush and rinsing with clean water. The rinseate water will be distributed over contaminated soil (to be exported) for dust control purposes.

4.6 Stockpile Monitoring and Maintenance

The combined goal of soil monitoring and acceptance sampling is to ensure treatment is working and that the soil will ultimately be suitable for reuse onsite. Air monitoring specific to treatment biopiles serves to meet compliance requirements as specified in the 1166 Plan with the objective of protecting human health and the environment. In addition, job site and perimeter air monitoring associated with fugitive dust serve to ensure appropriate dust control in order to protect the public and site workers. Stockpile maintenance is necessary to ensure the stockpile integrity is maintained, to maximize the treatment efficiency of the bacteria, and to ensure that BMPs are performing as designed.

4.6.1 Stockpile Monitoring

Progress samples will be collected at approximately 30-day intervals following initiation of treatment to evaluate the effectiveness of the biotreatment process. Samples will be collected at a rate of approximately one sample per 500 CY. Sampling locations will be determined by subdividing each batch into approximately equal grid cells. One sample will be collected at a randomly selected location from within each grid cell during each successive sampling event. Progress samples will be analyzed for TPH (speciated by carbon chain ranges) using EPA Method 8015B; monitoring the progress of TPH reduction will provide data as to the overall reduction in VOCs present in the soil.

Based on the combined data a decision to continue monitoring or to schedule acceptance sampling will be made.

4.6.2 Acceptance Sampling

Soil from each treatment stockpile will be characterized in accordance with the methodology as prescribed in Test Methods for Evaluating Solid Waste, Physical/Chemical methods, SW-846, U.S. Environmental Protection Agency (EPA SW-846). The number of soil samples will be based on the statistical requirements stated in EPA SW-486 (See Table 1). Soil will be analyzed for TPH (speciated by carbon chain ranges) using EPA Method 8015 and VOCs using EPA Method 8260B.

The typical pile is designed to hold approximately 1,700 cu yd. Accordingly, this amount of soil will require at least 27 samples to characterize the treated soil. The data set will be statistically analyzed to calculate the 95% Upper Confidence Level (UCL) for each COC. Provided all parameters are at or below the cleanup goals, the given lot will be deemed suitable for reuse.

The LARWQCB will be notified one week in advance that treatment pile acceptance sampling, to determine suitability for soil reuse, will be conducted. LARWQCB, at their discretion, may send a representative to witness sampling, collect soil samples or splits of soil samples, and/or review bio-treatment pile construction and maintenance records.

Samples will be taken at uniform intervals along the biopile and at depths of one to two feet. Interval spacing will be dependent upon final length of a treatment row. In general, samples will be taken on each of the ends of the biopile, and samples will be distributed evenly along both sides of the treatment stockpile.

Stockpiles that have been evaluated and deemed acceptable for reuse will be logged and SGI will inform the LARWQCB that the soil has met the acceptance criteria and will be used for backfill. The cleanup goals are variable with respect to depth. If soil analytical data indicates that the soil does not meet the most stringent cleanup goals, the soil will only be used at intervals where the soil meets the cleanup goals.

If sampling results indicate that the soil does not meet cleanup goals and is not suitable for reuse in its current state, the soil will remain under treatment and monitoring.

4.6.3 Air Monitoring

Air monitoring will be performed in accordance with the SCAQMD 1166 Plan and the SVE system Permit to Operate (PTO) G12863.

4.6.3.1 Stockpile Air Monitoring

During the excavation process, an organic vapor analyzer (OVA) such as RAE Systems Inc.'s MiniRAE 3000 PID, or equivalent, will be used to monitor VOCs. The PID will be calibrated by the manufacturer at least once every three months and calibration shall be verified using certified calibration gas at the beginning of each work day. If a calibration gas other than hexane is used, each measured reading shall be correlated to and expressed as hexane.

All monitoring shall be conducted at a distance no more than three inches above the soil surface. Initially, monitoring shall be conducted at a frequency of one reading every 15 minutes. Upon detection of VOCs greater than 50 ppmv, monitoring will be conducted at a frequency of one reading for every five cubic yards of soil excavated. Readings will be collected no later than three minutes after soil is excavated.

Written records will be maintained documenting calibrations and monitoring records. Upon detection of VOCs greater than 50 ppmv, the SCAQMD shall be notified per the 1166 Plan.

4.6.3.2 SVE Air Monitoring

Vapors will be extracted from the stockpiles via temporary soil vapor extraction piping constructed of scheduled 40 PVC as detailed in Section 3.1.1. Vapor concentrations will be measured utilizing a PID at the inlet and and outlet of each GAC vessel on a weekly basis. Vapor samples will be collected from the SVE system inlet and outlet and analyzed for VOCs by EPA Method 8015 and for benzene by EPA Method 8260B; the frequency of this sampling and analysis will be as described in the SVE system SCAQMD permit.

4.6.3.3 Fugitive Dust Control and Monitoring

To comply with SCAQMD rules and the HASP, dust control measures will be implemented during excavation activities. Dust control will be completed through the application of a water mist on drive roads, the working face of excavations, and on excavated soil. Potential dust and fugitive emission receptors include on-Site workers, Site personnel, oversight personnel, general public, pedestrians adjacent to the Site, and nearby workers and residents. A primary objective of these measures is to protect these potential receptors. The closest sensitive receptors are identified as the residents to the north, south, and west and Holifield Park users to the east, and Dolland Elementary School adjacent to Holifield Park to the east.

Dust monitoring will be conducted during excavation, processing of soil and construction of biopiles. Dust monitoring will consist of data collection of particulates using a Thermo Scientific pDR-1000AN (pDR-1000AN) particulate dust monitor (or equivalent). The dust monitoring data will be used to help evaluate when further engineering controls or modified work practices are needed to reduce airborne particulates. This may include the use of additional water application or modified work practices to reduce dust generation.

Dust levels at site perimeters will also be monitored during excavation and loading activities. If the monitoring data at the site perimeter indicates that dust levels are beyond the SCAQMD Rule 403 limit of 50 micrograms per cubic meter ($\mu g/m^3$) based on the difference between upwind and downwind measurements, then additional engineering control measures, listed above, will be implemented to reduce the dust level. In the event that stockpiles are left overnight, the exposed portion will be properly covered with plastic to reduce any dust emission.

The equipment to be used for excavation and treatment will be maintained properly so that exhaust emissions will be within acceptable standards. If necessary, the tires of trucks or equipment leaving the site will be washed in order to prevent tracking of soils or mud, which could increase fugitive dust levels outside the Site perimeter.

4.6.4 Stockpile Maintenance

Throughout the duration the soil is in a treatment row, the row will be visually inspected weekly in conjunction with weekly SWPPP inspections. As required by the SCAQMD permit, vapor and flow monitoring will be conducted. Damaged plastic will immediately be repaired and any exposed soil will be covered. Maintenance activities will be logged.

4.6.5 Waste Management

Waste such as decontamination water and oily waste from equipment maintenance will be placed in a United Nations-approved 55-gallon drums, labeled, and stored on site pending characterization for off-site disposal. Waste will be profiled in accordance with California Code of Regulations, Title 22, Division 4.5, Chapters 10 through 32, and Federal RCRA regulations. After analytical results have been received and evaluated, the drums will be transported off site under manifest to a permitted recycling/disposal facility.

5.0 TREATMENT CELL SITE CLEAN CLOSURE

It is not anticipated that biotreatment of soil will contaminate surface soil or subsurface soil because all of the treatment cell rows will be lined with HDPE. The soil placed on the HDPE will have been amended with bacteria and surfactant. However, those areas used for the land treatment of soil will be characterized after the treatment cells have been removed to provide a documented record of the underlying soil post-treatment. All areas used for treatment will be characterized. In addition, former tank containment basins that were not subject to excavations during the project will transected with trenches to a depth of 10 feet to document the remaining soil conditions.

5.1 Post Treatment Surface Sampling Beneath Each Treatment Row

After all treated soil has been removed from the liner, the liner will be inspected for any breaches. If the liner has been penetrated sampling will be conducted in proximity of the damage to determine if any contamination has occurred. The liner will then be removed to allow the underling soil to be inspected and tested. PID readings will be taken approximately every 50 feet along a treatment row area. Any locations registering greater than 50 ppm or greater will be logged and a surface sample will be taken. Any impacted soil will either be disposed of off site or, if a treatment cell is still active, the soil may be treated on site. A minimum of three surface soil samples will be collected along each former treatment row. The soil samples will be analyzed for TPH (speciated by carbon chain ranges) using EPA Method 8015 and VOCs using EPA Method 8260B.

5.2 Treatment Cell Reporting

A final report documenting the use and closure of the treatment cell areas will include the following:

1. Baseline sampling results and documentation,
2. Photo documentation of the installation of lining material,
3. Analytical data associated treatment row monitoring data and post-treatment sampling, and
4. Post characterization data of the cells used for treatment.

Provided the characterization of deconstructed treatment areas is adequate, SGI on behalf of DLA will request a determination of no further action (NFA) for each area used for soil treatment.

6.0 EXCAVATION SAMPLING AND REPORTING

This section provides additional information regarding the excavations (prior to backfilling) as well as exploratory trenching in areas that did not require excavation.

6.1 Excavation Confirmation Sampling

As figure 2 reflects there are essentially 12 clusters of excavations. As originally, stated the primary objective of this excavation and treatment effort is to clean the upper 10 feet of impacted soil. However, deeper soil excavation will be performed, but with different remedial objectives.

6.1.1 Confirmation Sampling of Shallow (< 10 Feet Deep) Excavations

Field screening with the PID will be used to help evaluate the extent of excavation. Excavation will continue to the full planned area and depth if PID readings are in excess of 50 ppm. If shallow soil contamination appears to occupy a larger area than originally estimated it will likely be deemed necessary for further excavation.

When it appears all contamination has been removed, confirmation samples of the sidewalls and bottoms will be collected from the excavation bucket. Sidewall sampling will be spaced apart at approximately 25 linear feet. Samples will be taken from the excavator bucket at depths of 2.5 feet and 7.5 feet below surface grade. Bottom samples will be collected at a frequency of one sample for every 800 square feet. Soil will be analyzed for TPH (speciated by carbon chain ranges) using EPA Method 8015 and VOCs using EPA Method 8260B.

6.1.2 Confirmation Sampling of Deep (> 10 Feet Deep) Excavations

The removal of deeper contaminated soil will be done to promote the remediation of groundwater. The excavation of the deeper soil will be a component of a larger strategy for deep soil treatment that will include in-site treatment methods (such as vapor extraction, air sparging, and ISCO methods) and long-term monitored attenuation. Therefore, the excavation of deeper soils will be performed only in those areas that contain the highest concentrations of residual COCs (based both on excavation confirmation sampling as described in Section 6.1.1. and historical soil analytical data. Due to funding limitations and permit limitations (the on-site soil treatment WDR prohibits the on-site treatment of greater than 100,000 cubic yards of soil), it is anticipated that no more than 40,000 cubic yards of soil will be generated from the deeper excavations.

After the deep excavations are completed, confirmation samples of the sidewalls and bottoms will be collected from the excavation bucket. Sidewall sampling will be spaced apart at approximately 25 linear feet. Samples will be taken from the excavator bucket at five-foot depth increments extending to the bottom of the excavation. Bottom samples will be collected at a frequency of one sample for every 800 square feet. Soil will be analyzed for TPH (speciated by carbon chain ranges) using EPA Method 8015 and VOCs using EPA Method 8260B.

6.2 Exploratory Trenching

Exploratory trenching to 10 feet bgs is planned in paths as shown in figure 2. This includes Treatment Cell #1 (Powerine Basin) and Treatment Cell #2 (location of tank 80004). The objective is to ensure the absence of soil contamination in areas that did not require excavation. As soil is being removed it will be field screened using a PID and will be inspected for stain and odor.

If contamination is not observed soil samples will be collected from the bucket of the excavator at approximate depths of 5 and 10 ft bgs and spaced at approximately 20-ft intervals. Depending on the location of utilities and existing remediation infrastructure, trenching may not be continuous for the planned paths.

In the event contaminated soil is observed a sample will be taken. The location and depth will be logged. Additional trenching will continue until all contaminated soil has been removed and routed for treatment on site or transported for disposal off-site.

Soil assumed clean will be stockpiled and sampled per EPA SW-486. Soil will be analyzed for TPH (GRO and DRO) using EPA Method 8015 and VOCs using EPA Method 8260B. If soil meets cleanup goal criteria it will be reused to backfill the trenches. Treatment Cell #1 will be the last area for trenching. If contaminated soil is found, that soil will be disposed of off site. Clean, back-fill material will be imported.

6.3 Clean Soil Import Criteria

In the event that excavated soil deemed appropriate for on-Site backfill re-use is insufficient to fill excavation cavities, import fill material may be necessary. The Department of Toxic Substance Control (DTSC) has defined procedures that must be used to minimize the possibility of introducing impacted soil onto a site that requires imported fill material. These procedures are defined in a Fact Sheet titled Information Advisory Clean Imported Fill Material, October 2001 (Appendix C). The fact sheet defines fill material sources; potential contaminants based on fill material sources, and recommended sampling requirements (type of analysis, frequency and risk criteria.). Prior to importing clean fill and backfilling, all imported fill must be evaluated per the clean imported fill material fact sheet and must meet the screening criteria defined in the advisory.

6.4 Discovery of Impacted Soil and Debris During remediation Activities

During excavation activities it is possible that affected soil and debris not previously characterized could be encountered. In the event of unexpected exposure of impacted soil, excavation-related activities in the area should be stopped immediately and the area should be covered with plastic sheeting and cordoned off until an evaluation of Site conditions can be made by a qualified environmental professional. DLA and/or its delegated Consultant should conduct no further work without verbal or written approval. The Contractor may be directed to segregate and temporarily store more heavily impacted material separately. When handling impacted material, the Contractor will be required to use appropriate PPE, as outline in the Contractor's HASP. If work in these areas is approved and below grade debris (i.e. man-made materials) is encountered, this debris must be decontaminated prior to off-Site transport and recycling/disposal or treatment prior to re-use on-Site.

6.5 Reporting

A letter report will be generated for each of the different excavation and trenching areas. The final size and depth as well as all supporting analytical data will be provided. SGI on behalf of DLA will request concurrence by letter response that the specified area is clean of contamination to the depth specified in the letter report.

Once all areas have been completed a final report will be generated summarizing excavation results for the entire site.

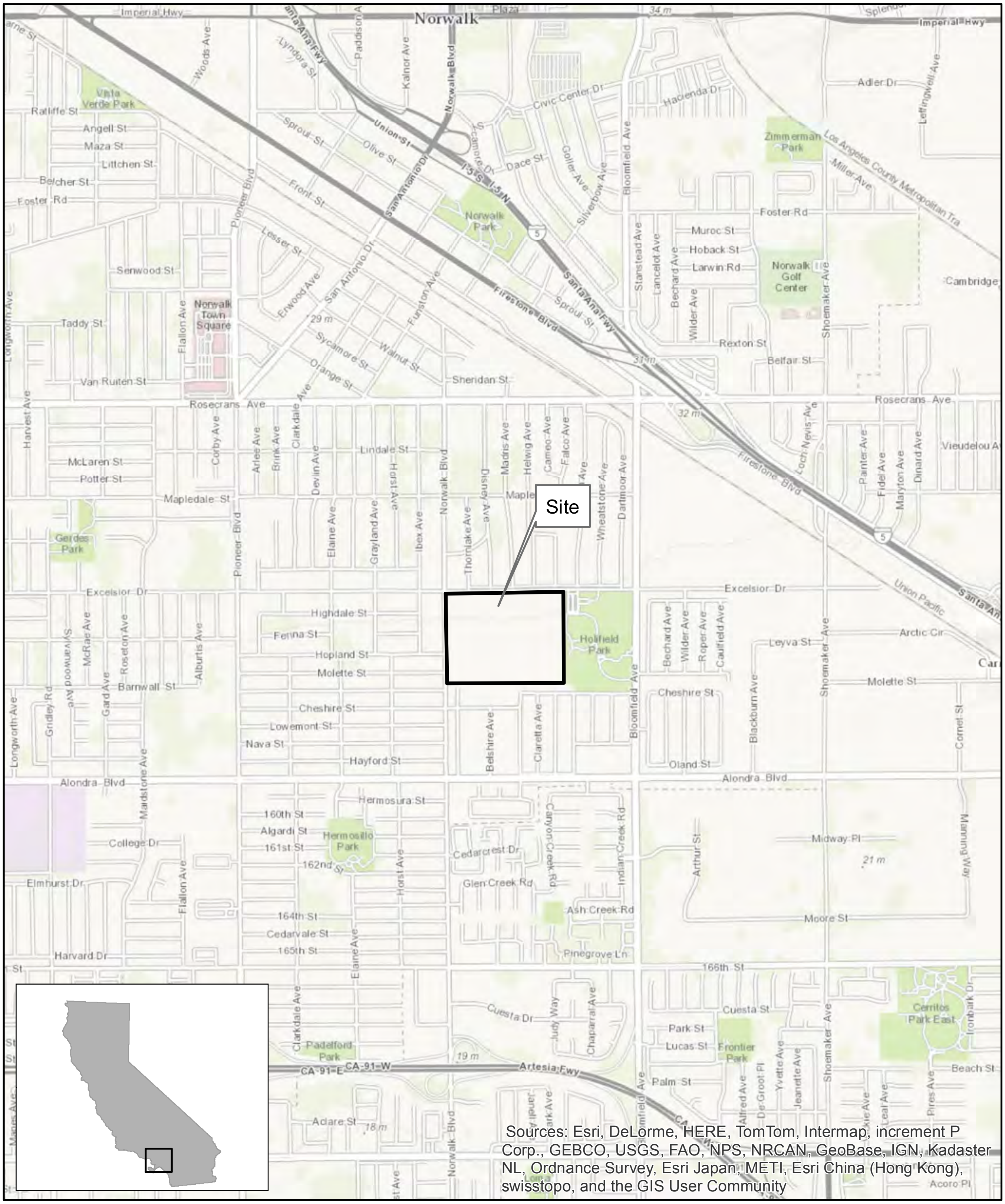
6.6 Schedule

Figure 4 provides a construction schedule. The schedule is dependent upon obtaining approved permits and plans.

7.0 LIMITATIONS

This document was prepared for the exclusive use of the Defense Logistics Agency - Energy (DLA Energy) and the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) for the express purpose of complying with a client or regulatory directive for environmental investigation or restoration. SGI and DLA Energy must approve any re-use of this work product in whole or in part for a different purpose or by others in writing. If any such unauthorized use occurs, it shall be at the user's sole risk without liability to SGI or DLA Energy. To the extent that this report is based on information provided to SGI by third parties, including DLA Energy, their direct contractors, previous workers, and other stakeholders, SGI cannot guarantee the completeness or accuracy of this information, even where efforts were made to verify third-party information. SGI has exercised professional judgment to collect and present findings and opinions of a scientific and technical nature. The opinions expressed are based on the conditions of the Site existing at the time of the field investigation, current regulatory requirements, and any specified assumptions. The presented findings and recommendations in this report are intended to be taken in their entirety to assist DLA Energy and LARWQCB personnel in applying their own professional judgment in making decisions related to the property. SGI cannot provide conclusions on environmental conditions outside the completed scope of work. SGI cannot guarantee that future conditions will not change and affect the validity of the presented conclusions and recommended work. No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, conclusions, and recommendations.

FIGURES



SOURCE: ESRI 7.5 MINUTE TOPOGRAPHIC MAP. http://resources.esri.com/arcgisonlineservices	PROJECT NO.: 04-NDLA-001	DATE: 5/28/2014	DR.BY: JK	APP.BY: PP	SCALE= 1:24,000 (0, 1,000, 2,000, 4,000 Feet)	N

SGI environmental
THE SOURCE GROUP, INC.
1962 FREEMAN AVENUE
SIGNAL HILL, CA 90755
(562) 597-1055

DEFENSE FUEL SUPPORT POINT NORWALK

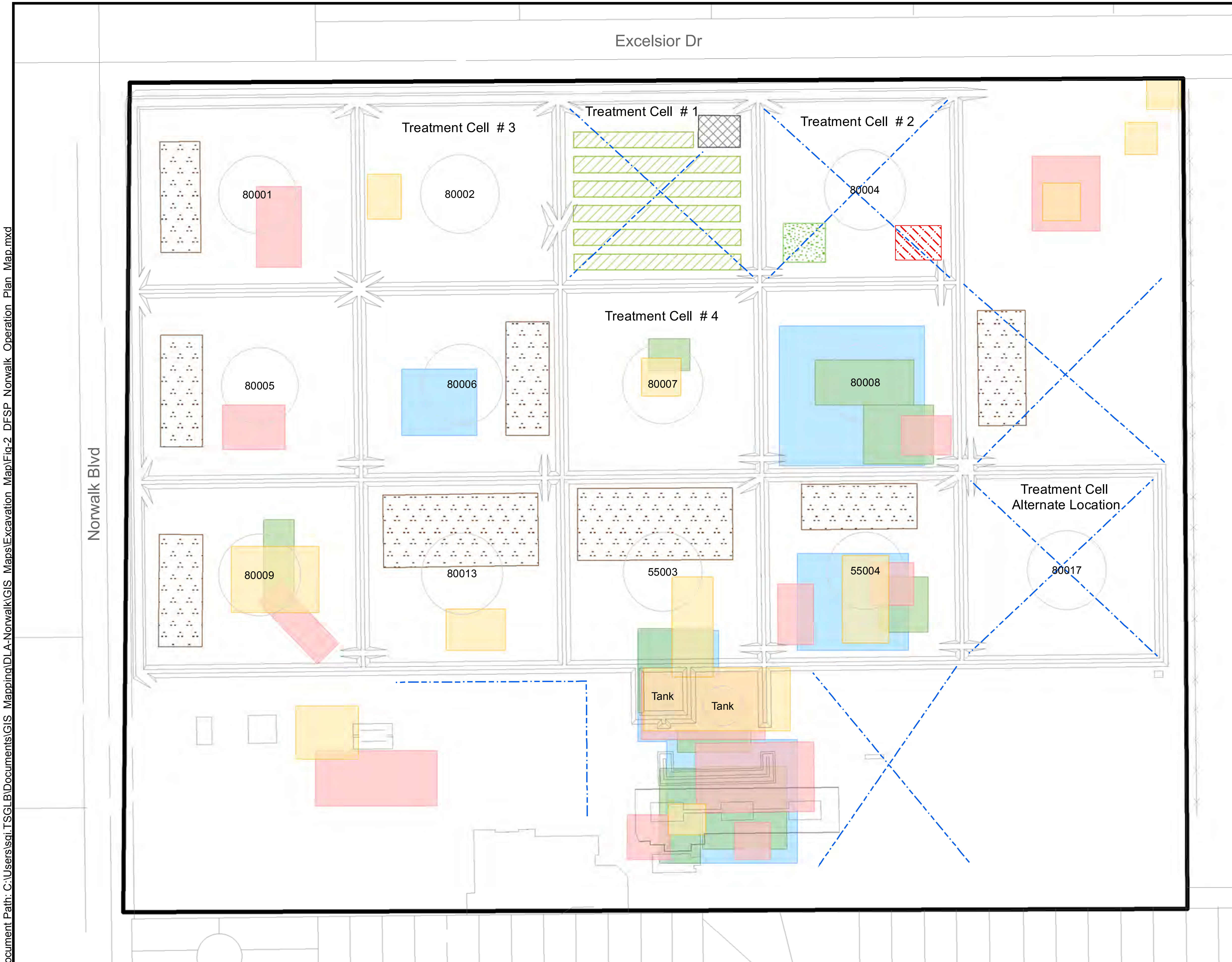
15306 NORWALK BOULEVARD
NORWALK, CALIFORNIA

SITE LOCATION MAP

FIGURE
1

Document Name: Fig-1 Norwalk Topo Site Location Map

Document Path: C:\Users\sgi.TSGLB\Documents\GIS_Mapping\DLA-Norwalk\GIS_Maps\Excavation_Map\Fig-2_DFSP_Norwalk_Operation_Plan_Map.mxd



Legend

- Former Above Ground Storage Tanks
- DFSP Norwalk Border
- Excavations 0-5ft bgs
- Excavation 5-10ft bgs
- Excavation 10-15ft bgs
- Excavation 15-25ft bgs
- Clean Soil Stockpile Staging Areas
- Treatment Cells
- Existing Soil Vapor Extraction System
- Treated Soil Staging Area for Placement in Treatment Cell (Excavation Event # 1)
- Contaminated Soil Staging Area Prior to Treatment (Excavation Event # 1)
- Exploratory Trenching

Notes:

1. Up to four treatment cells will be established.
2. Staging areas of contaminated soil and treated soil prior to placement in treatment cell will move throughout site as field conditions dictate.
3. Production rate ranges between 1,000 cubic yards and 2,000 cubic yards per day.
4. Bio-piles for only 1 of 4 cells shown.

N

0 75 150 300 Feet

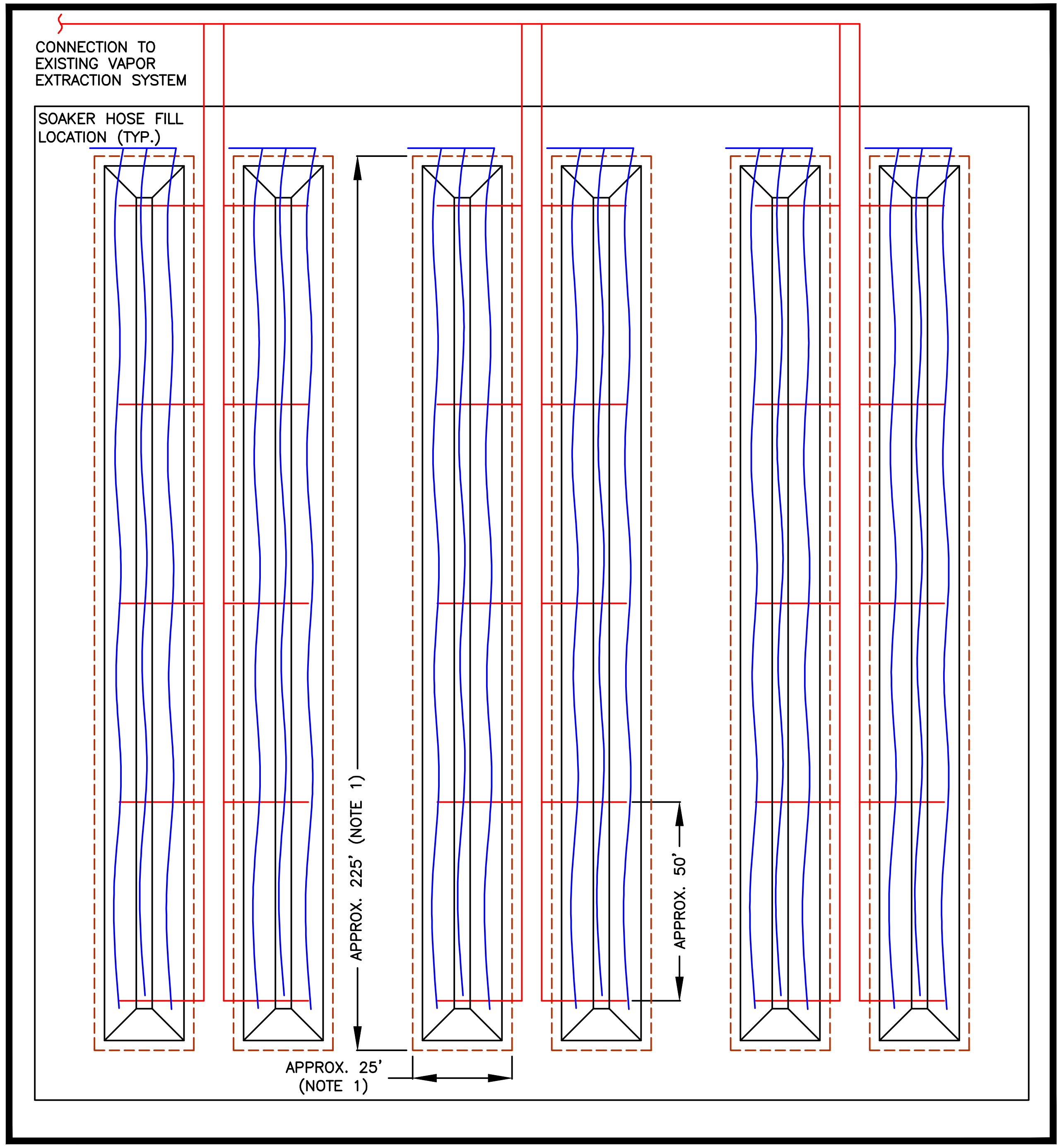
DFSP Norwalk
15306 Norwalk Boulevard
Norwalk, California

Project Number:	Date:	Drawn By:	Approved By:
04-NDLA-007	10/27/2014	A. Czuba	K. Wall

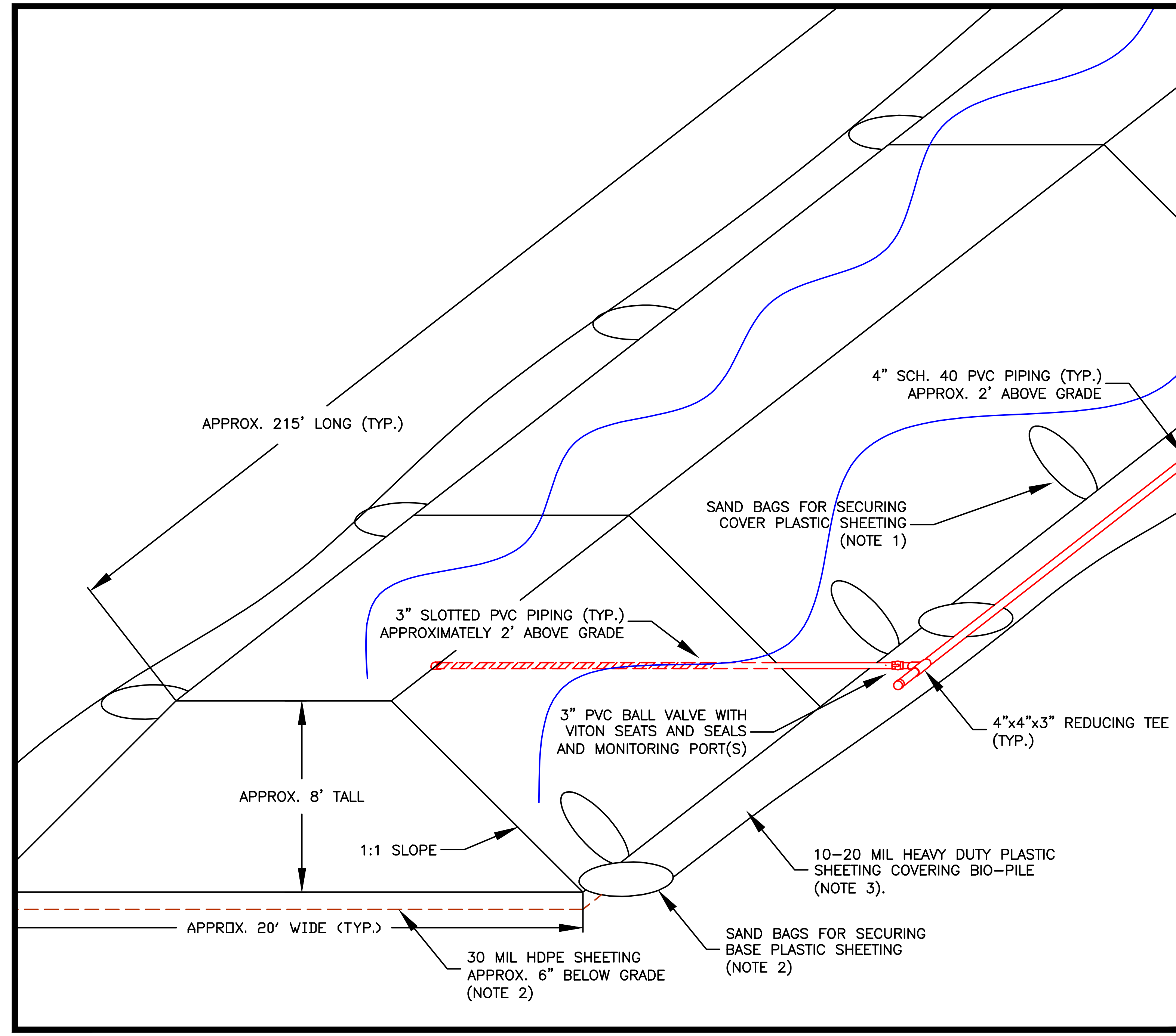
Operation Plan

SGI environmental THE SOURCE GROUP, INC.
1962 Freeman Avenue
Signal Hill, CA 90755
(562) 597-1055

Figure 2



PLAN VIEW
SINGLE BASIN BIO-PILE LAYOUT
TYPICAL
0 40 80
HORIZONTAL SCALE IN FEET



ISOMETRIC VIEW
BIO-PILE CONSTRUCTION DETAIL
TYPICAL - NOT ALL LATERALS SHOWN
0 6 12
HORIZONTAL SCALE IN FEET

LEGEND

- (red line) APPROXIMATE LOCATION OF PROPOSED VES CONVEYANCE PIPING (50' SPACING BETWEEN LATERALS)
- (blue line) APPROXIMATE LOCATION OF PROPOSED SOAKER HOSE
- (red dashed line) HDPE SHEETING BENEATH BIO-PILE

1. HIGH DENSITY POLYETHYLENE (HDPE) SHEETING FOOTPRINT IS APPROXIMATELY 225' X 25'.
2. 30 MIL HDPE TO BE PLACED BENEATH BIO-PILE APPROXIMATELY 6" BELOW GRADE (TO PROTECT LINER INTEGRITY DURING PILE CONSTRUCTION AND DESTRUCTION).
3. 10-20 MIL HEAVY DUTY PLASTIC SHEETING TO COVER BIO-PILE.

DFSP NORWALK
15306 NORWALK BLVD
NORWALK, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
04-NDLA-002	09/19/14	AD	NI

BIO-PILE DESIGN DETAILS

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1962 FREEMAN AVENUE
SIGNAL HILL, CA 90755

N

FIGURE
3

/Volumes/Data/DFSP Norwalk/DFSP Norwalk/04-NDLA-007/Bio-pile Design.dwg

ID	Task Name	Duration	Start	Finish
1	**Preparatory Tasks - Plan Development and Project Permitting**	**49 days**	**Mon 9/22/14**	**Thu 11/27/14**
2	Resource Assignment/Kick-off	1 day	Mon 9/29/14	Mon 9/29/14
3	**Select/Activate Sub-Contractors**	**5 days**	**Mon 9/29/14**	**Fri 10/3/14**
9	**SCAQMD 1166 Permit - Vapor monitoring**	**43 days**	**Mon 9/22/14**	**Wed 11/19/14**
10	Draft Permit	0 days	Mon 9/22/14	Mon 9/22/14
11	SCAQMD Review	40 days	Mon 9/22/14	Fri 11/14/14
12	Final Permit	3 days	Mon 11/17/14	Wed 11/19/14
13	**SCAQMD Modify Permit to Operate**	**43 days**	**Mon 9/22/14**	**Wed 11/19/14**
14	Draft Permit	0 days	Mon 9/22/14	Mon 9/22/14
15	SCAQMD Review	40 days	Mon 9/22/14	Fri 11/14/14
16	Final Permit	3 days	Mon 11/17/14	Wed 11/19/14
17	**LARWQCB WDR - Soil Reuse**	**44 days**	**Mon 9/22/14**	**Thu 11/20/14**
18	Draft Permit	20 days	Mon 9/22/14	Fri 10/17/14
19	LARWQCB Review	21 days	Mon 10/20/14	Mon 11/17/14
20	Final Permit	3 days	Tue 11/18/14	Thu 11/20/14
21	**LA County Public Works- Well Abandonment**	**15 days**	**Fri 11/7/14**	**Thu 11/27/14**
22	Prepare permits	5 days	Fri 11/7/14	Thu 11/13/14
23	LA County Review & Approval	7 days	Fri 11/14/14	Mon 11/24/14
24	Final Permit	3 days	Tue 11/25/14	Thu 11/27/14
25	**Storm Water Pollution Protection Plan (SWPPP) Update**	5 days	Mon 11/10/14	Fri 11/14/14
26	**City of Norwalk-Access Agreement**	**33 days**	**Wed 9/24/14**	**Fri 11/7/14**
27	Draft Agreement	20 days	Wed 9/24/14	Tue 10/21/14
28	City of Norwalk Review	10 days	Wed 10/22/14	Tue 11/4/14
29	Final Permit	3 days	Wed 11/5/14	Fri 11/7/14
30	**City of Norwalk-Excavation Plan**	**43 days**	**Wed 9/24/14**	**Fri 11/21/14**
31	Draft	30 days	Wed 9/24/14	Tue 11/4/14
32	City of Norwal Review	10 days	Wed 11/5/14	Tue 11/18/14
33	Final Permit	3 days	Wed 11/19/14	Fri 11/21/14
34	**Field Preparatory Tasks**	**20 days**	**Fri 11/21/14**	**Thu 12/18/14**
35	Mobilization	5 days	Fri 11/21/14	Thu 11/27/14
36	Geophystical Survey - Ultility clearance	5 days	Fri 11/28/14	Thu 12/4/14
37	Site Survey - excavation limits and infrastructure location	2 days	Fri 11/21/14	Mon 11/24/14
38	Well Removal	15 days	Fri 11/28/14	Thu 12/18/14
39	Treatment Cells 1&2 Set-Up	4 days	Fri 11/21/14	Wed 11/26/14
40	**Soil Excavation/Treatment and Fill**	**264 days**	**Thu 11/27/14**	**Tue 12/1/15**
41	**Excavation Event #1 (20,000 cy)**	**81 days**	**Thu 11/27/14**	**Thu 3/19/15**
42	Excavations 0'-5'	14 days	Thu 11/27/14	Tue 12/16/14
43	Stockpile Treatment	60 days	Wed 12/17/14	Tue 3/10/15
44	Prep Treatment Cells #3 and #4	3 days	Wed 12/17/14	Fri 12/19/14
45	Back-Fill	7 days	Wed 3/11/15	Thu 3/19/15
46	**Excavation Event #2 (20,000 cy)**	**85 days**	**Mon 12/22/14**	**Fri 4/17/15**
47	Excavations '0-5'/0'-10'	14 days	Mon 12/22/14	Thu 1/8/15

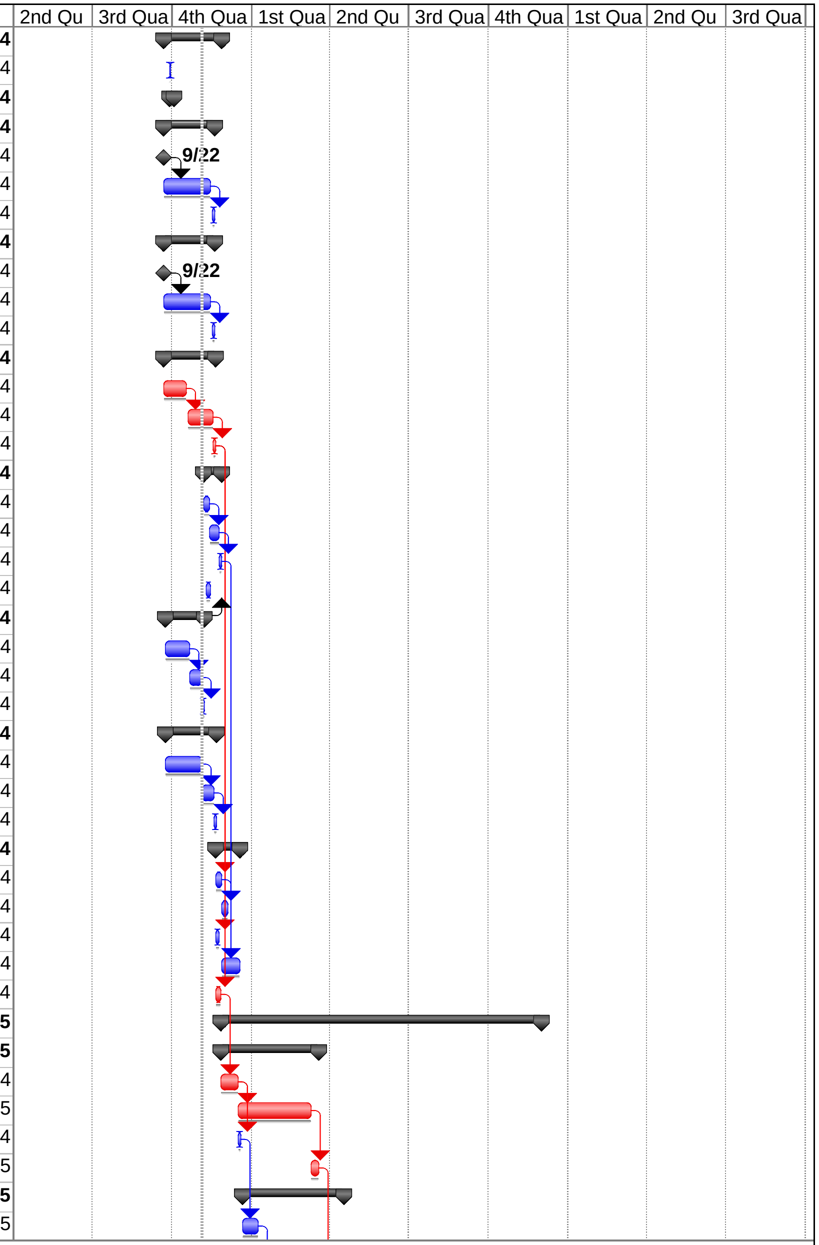

Figure 4 - Project Schedule
DSFP Norwalk ExcavationTreatment

Task	Rolled Up Task	External Tasks
Critical Task	Rolled Up Critical Task	Project Summary
Progress	Rolled Up Milestone	Group By Summary
Milestone	Rolled Up Progress	Deadline
Summary	Split	

ID	Task Name	Duration	Start	Finish
48	Stockpile Treatment	60 days	Fri 1/9/15	Thu 4/2/15
49	Back-Fill	7 days	Thu 4/9/15	Fri 4/17/15
50	**Excavation Event #3 (20,000 cy)**	**81 days**	**Fri 3/20/15**	**Fri 7/10/15**
51	Excavation 0'-10'	14 days	Fri 3/20/15	Wed 4/8/15
52	Stockpile Treatment	60 days	Thu 4/9/15	Wed 7/1/15
53	Back-Fill	7 days	Thu 7/2/15	Fri 7/10/15
54	**Excavation Event #4 (20,000 cy)**	**81 days**	**Mon 4/20/15**	**Mon 8/10/15**
55	Excavations 10'-15'	14 days	Mon 4/20/15	Thu 5/7/15
56	Stockpile Treatment	60 days	Fri 5/8/15	Thu 7/30/15
57	Back-Fill	7 days	Fri 7/31/15	Mon 8/10/15
58	**Excavation Event #5 (20,000 cy)**	**81 days**	**Mon 7/13/15**	**Mon 11/2/15**
59	Excavations 15'-25'	14 days	Mon 7/13/15	Thu 7/30/15
60	Stockpile Treatment	60 days	Fri 7/31/15	Thu 10/22/15
61	Back-Fill	7 days	Fri 10/23/15	Mon 11/2/15
62	**Excavation Event #6 (20,000 cy)**	**81 days**	**Tue 8/11/15**	**Tue 12/1/15**
63	Excavations 15'-25'	14 days	Tue 8/11/15	Fri 8/28/15
64	Stockpile Treatment	60 days	Mon 8/31/15	Fri 11/20/15
65	Back-Fill	7 days	Mon 11/23/15	Tue 12/1/15
66	**Exploratory Trenching**	**20 days**	**Tue 11/3/15**	**Mon 11/30/15**
67	Exploratory Trenching	20 days	Tue 11/3/15	Mon 11/30/15
68	**Cell Closures**	**26 days**	**Tue 11/3/15**	**Tue 12/8/15**
69	Cell 1 and 2	5 days	Tue 11/3/15	Mon 11/9/15
70	Cell 3 and 4	5 days	Wed 12/2/15	Tue 12/8/15
71	**Well Replacement**	**115 days**	**Tue 12/1/15**	**Mon 5/9/16**
72	**LA County Public Works- Well Replacement Permit**	**70 days**	**Tue 12/1/15**	**Mon 3/7/16**
73	Prepare application and well designs	30 days	Tue 12/1/15	Mon 1/11/16
74	LA County Review & Approval	30 days	Tue 1/12/16	Mon 2/22/16
75	Final Permits	10 days	Tue 2/23/16	Mon 3/7/16
76	**Install Wells**	45 days	Tue 3/8/16	Mon 5/9/16
77	Final Report	60 days	Tue 5/10/16	Mon 8/1/16

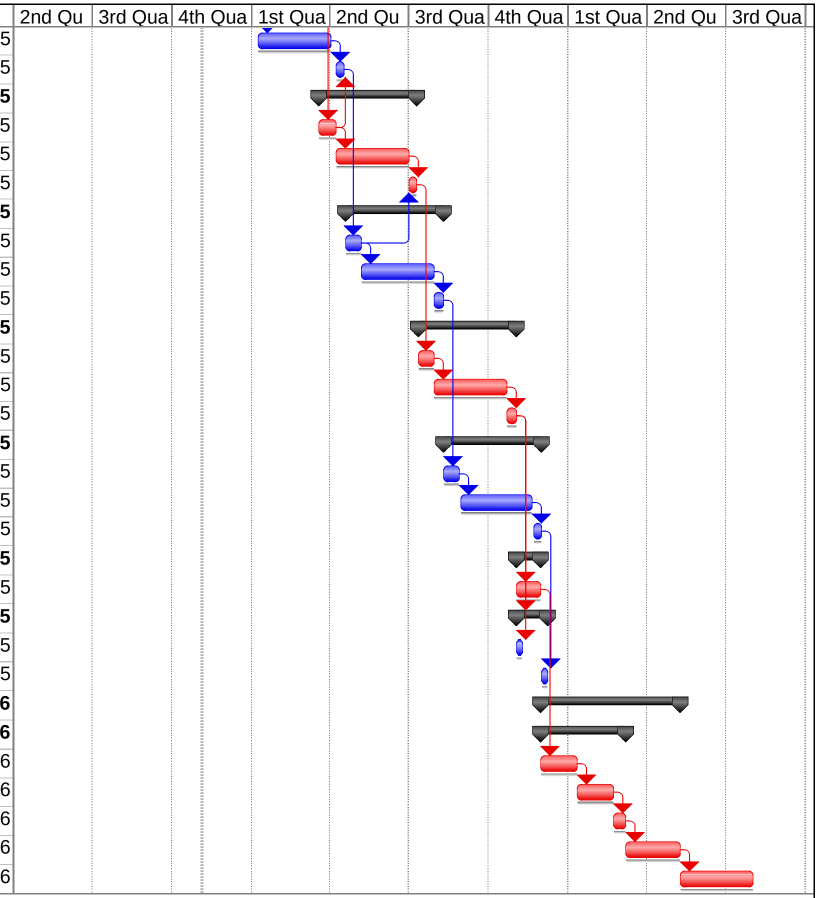

Figure 4 - Project Schedule
DSFP Norwalk ExcavationTreatment

Task		Rolled Up Task		External Tasks	
Critical Task		Rolled Up Critical Task		Project Summary	
Progress		Rolled Up Milestone		Group By Summary	
Milestone		Rolled Up Progress		Deadline	
Summary		Split			

TABLES

Table 1:

Protocol to Estimate the minimum number of samples: Test Methods for Evaluation Solid Waste, Physical/Chemical methods, SW-846, U.S. Environmental Protection Agency (EPA SW-846)

Stockpile Size Unit=cubic yards 9cy)	Sampling Frequency
<500	1 sample for every 25 cy (e.g., 20 samples for a 500 cy stockpile)
500 to < 1,000	20 samples plus 1 sample for every 100 cy in excess of the initial 500 cy (e.g., 25 samples for 1,0000 cy stockpile)
1,000 to 10,000	25 samples plus 1 sample for every 500 cy in excess of the initial 1,000(e.g., 43 samples for a 10,0000 cy stockpile)
>10,000	43 samples plus 1 for every 5,000 cy in excess of the initial 10,000 cy (e.g., 61 samples for a 100,000 cy stockpile)

TABLE 5-2
Soil Cleanup Goals
DFSP Norwalk Site, Norwalk California

	(feet below ground surface)					
Depth Below Ground Surface	**0.5**	**5**	**10**	**15**	**20**	**25**
Depth to Groundwater	**25.5**	**21**	**16**	**11**	**6**	**1**
Constituent	**Soil Cleanup Goal (mg/kg)**					
TPH as Gasoline (C4-C12)	500	500	100	100	100	100
TPH as JP-5 (C8-C17)	500	500	100	100	100	100
TPH as Diesel (C5-C25)	1,000	1,000	100	100	100	100
Benzene	0.015	0.013	0.012	0.013	0.011	0.012
Toluene	0.614	0.440	0.391	0.423	0.356	0.367
Ethylbenzene	2.07	1.44	1.19	1.33	1.07	1.10
Xylenes	5.55	3.77	3.09	3.47	2.76	2.84
1,1,2,2-Tetrachloroethane	0.0023	0.0020	0.0015	0.0012	0.0006	0.0002
1,1,2-Trichloroethane	0.0032	0.0029	0.0023	0.0020	0.0012	0.0008
1,2,3-Trichlorobenzene	0.0740	0.0634	0.0467	0.0356	0.0162	0.0034
1,2,3-Trichloropropane	8.74E-07	7.66E-07	5.87E-07	4.79E-07	2.56E-07	1.23E-07
1,2,4-Trimethylbenzene	2.10	1.80	1.34	1.03	0.478	0.120
1,2-Dibromo-3-chloropropane	2.50E-04	2.19E-04	1.68E-04	1.37E-04	7.31E-05	3.52E-05
1,2-Dibromoethane	3.05E-06	2.78E-06	2.27E-06	2.04E-06	1.30E-06	9.60E-07
1,2-Dichloroethane	1.06E-04	1.04E-04	9.37E-05	9.60E-05	7.29E-05	6.92E-05
1,3,5-Trimethylbenzene	2.06	1.77	1.31	1.01	0.470	0.118
2-Butanone	0.557	0.607	0.617	0.713	0.612	0.661
2-Chlorotoluene	0.558	0.481	0.358	0.278	0.132	0.039
2-Hexanone	0.0073	0.0072	0.0065	0.0066	0.0050	0.0047
4-Chlorotoluene	0.547	0.472	0.351	0.273	0.130	0.038
Acetone	0.994	1.17	1.28	1.57	1.42	1.60
Bromomethane	0.0015	0.0014	0.0013	0.0013	0.0010	0.0010
Carbon disulfide	0.049	0.046	0.039	0.038	0.026	0.023
Chlorobenzene	0.119	0.104	0.079	0.063	0.032	0.013
Chloroethane (Ethyl Chloride)	2.23	2.47	2.55	2.98	2.59	2.83
Chloroform	7.38E-05	6.82E-05	5.67E-05	5.25E-05	3.48E-05	2.75E-05
Dichlorodifluoromethane	0.984	0.868	0.672	0.559	0.309	0.167
Diisopropyl Ether (DIPE)	0.449	0.424	0.364	0.350	0.246	0.212
Isopropylbenzene	5.56	4.78	3.53	2.71	1.26	0.303
Methylene Chloride	7.78E-04	7.99E-04	7.61E-04	8.27E-04	6.69E-04	6.82E-04
Methyl-t-Butyl Ether (MTBE)	9.07E-04	9.10E-04	8.43E-04	8.89E-04	6.97E-04	6.86E-04
Naphthalene	0.270	0.231	0.170	0.130	0.059	0.012
n-Butylbenzene	3.97	3.40	2.50	1.91	0.867	0.179
n-Propylbenzene	2.18	1.87	1.39	1.06	0.489	0.114
p-Isopropyltoluene	2.82	2.42	1.79	1.37	0.636	0.154
sec-Butylbenzene	2.59	2.22	1.64	1.26	0.576	0.129
Styrene	0.463	0.399	0.296	0.229	0.108	0.030
Tert-Butyl Alcohol (TBA)	0.0010	0.0012	0.0013	0.0016	0.0014	0.0016
tert-Butylbenzene	2.07	1.78	1.32	1.01	0.465	0.110
Trichloroethene	0.0070	0.0061	0.0047	0.0038	0.0020	0.0009

Notes:

mg/kg = milligram per kilogram

NA = not applicable

APPENDICES

APPENDIX A

F4 REMEDIATION

F4 REMEDIATION

GREEN REMEDIATION TECHNOLOGY SPOTLIGHT

EPA Approved

F4 REMEDIATION'S EARTH CLEANING SYSTEM

A proven, cost-effective bioremediation system

for cleaning petroleum impacted soils and drill cuttings, production sumps and large scale oil spills.

A permanent solution **using a** ***ONE-time application*** **at a** ***fraction of the cost*** **of conventional methods.**

The Technology

- A proprietary blend of microbes, compounds and surfactant that degrades hydrocarbons and other organic compounds to CO_2 and H_2O
- A purpose-built Earth Cleaning Machine (ECM) that can process 2,500 tons of soil per day
- A permanent solution for the treatment of crude oil and sludges, light-end hydrocarbons and PAHs
- **One-time application**: no additional soil manipulation or aeration required
- Approved Bioremediation Agent on the EPA's National Oil and Hazardous Substances Pollution Contingency Plan (NCP). DNA-tested and pathogen free.
- Can be sprayed directly or processed by the ECM

How You Benefit

- Total hydrocarbon degradation from a one-time onsite application
- Substantial cost saving - no more costly transportation and tipping fees
- Elimination of landfill liability issues
- Safe and clean reusable soil. No backfill required.
- ***Remediation success within days or weeks rather than years AND at a fraction of the cost***

Our Clients

Canadian Natural

Apache

Plains All American Pipeline, L.P.

Spyglass Resources Corp.

Contacts

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Introduction

F4 Remediation's technology is the culmination of more than 25 years R&D into environmentally friendly alternatives to cleaners, acids and degreasers. Founded in 1988 by Marlin Rudolph, a former mechanic, the company began as a very successful manufacturing and distribution business servicing automotive and industrial markets with ready-to-use formulas and concentrates that were safer, healthier options without sacrificing efficiency. Products included multipurpose cleaners with superior penetration properties but no VOC's, *Nonylphenol Ethoxylates* or *Butoxyethanol*, and metal cleaners, brighteners, and concrete cleaners that use organic salts instead of traditional acids (like hydrofluoric). All products are 100% water-soluble, and classified as non-corrosive to skin (OSHA, DOT, WHMIS, and TDG), and therefore ideal for large-scale industrial projects with strict safety policies.

In 2003 Rudolph began researching the use of bacteria in cleaning applications specifically in relation to hydrocarbons and in 2007 he launched his own water-based biological parts washer as a replacement for solvent-based parts washers. The 30 gallon machines use a proprietary (recyclable) parts washing fluid, developed by Rudolph, containing trillions of non-pathogenic live bacteria that consume organic materials like oil and grease without any disposal issues. As long as the bacteria have parts to clean (and hydrocarbons to mineralize), the machines require virtually no maintenance other than a monthly top up of fluids. They are now being used by Canada's Department of National Defence and as far away as New Zealand.

In 2009, after several visits to an auto dealership in Vermilion, Alberta, an environmental consultant working for Canadian Natural Resources Limited (CNRL), one of the largest independent crude oil and natural gas producers in the world, wondered if Rudolph's technology would transfer to the oil field. Later that year, after considerable review and at the request of CNRL, Rudolph completed 12 test sites in a variety of different settings including clay soils, sandy soils, and muskeg (a swamp or bog frequently covered by a layer of sphagnum or other mosses) and F4 Environmental was born. Since then Rudolph has successfully completed 32 projects including the treatment of oil sumps, closed loop water systems, oil spills and grease traps as well as multiple soil remediation applications.

Rudolph's technology consists of a proprietary blend of biology (different strains of *Pseudomonas* bacteria and nutrients) and chemistry (surfactants and compounds) that can clean soil and water contaminated by Petroleum Hydrocarbons (PHCs). The name F4 comes from the CCME (Canadian Council of Ministers of the Environment)'s definition of Extremely Heavy Extractable Petroleum Hydrocarbons equivalent to C34-50 (see comparison below). F4 Environmental is so called because it can remediate everything from F4s to BTEX using a onetime application.

Hydrocarbon designation	Carbon chain length
F1 VOLATILE PHCs	C6-C10
F2 LIGHT EXTRACTABLE PHCs	C10-C16
F3 HEAVY EXTRACTABLE PHCs	C16-C34
F4 EXTREMELY HEAVY EXTRACTABLE	C34-C50

Rudolph has developed several bio remediation products including Bio Reclaim™, Bio Treat™ and Bio Surf™ all of which use the same ground-breaking bacteria used in his parts washers. In 2011 Bio-Aquatic Testing in Carrollton, Texas, a testing agency of the EPA, tested the efficacy of Bio Reclaim™ on ANS 521 Oil and determined that the product should be included on the EPA's National Oil and Hazardous Substances Pollution Contingency Plan (NCP) list of approved bio-remediation products.

F4 Environmental Inc. is ISN certified and has recently signed an exclusive licensing agreement with F4 Remediation LLC, a Californian company to market the technology and establish operations in the US. For the purposes of this document F4 Environmental and F4 Remediation are interchangeable and known collectively as F4.

F4 has been successful at degrading the following chemicals:

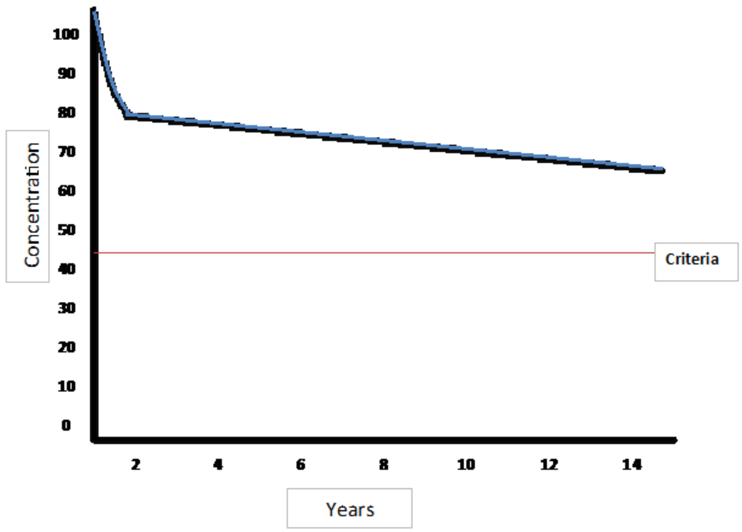
- Dichlorobenzene
- Dichlorotoluene
- Methyl Ethyl Ketone
- Methylene Chloride
- Napthalene
- Fluorine
- Benzene
- Toluene
- Ethylbenzene
- Xylene
- Crude oils/sludge
- Petroleum
- Isoprenoids
- Limonene
- Citronello
- Chlorinated Solvents
- Aliphatic Hydrocarbons
- Creosote

The Bacteria

Certain strains of bacteria have an extraordinary ability to mineralize PHCs by degrading them into water and a small amount of CO_2 Indigenous bacteria are usually of the *Bacillus* group which have an affinity for vegetable oils and animal fats but cannot assimilate mineral oil. This is in part because the *Bacillus* sporify when exposed to adverse environmental conditions such as highly contaminated soil.

When this occurs the *Bacillus* create a shell around themselves as a protective layer, and essentially go dormant until the surrounding area becomes safe for the spores to drop and the bacteria to resume their lifespan. A spore can stay like this, depending on circumstances and type of bacterium, for months and years, even centuries.

When sporification occurs degradation ceases before criteria is reached as represented by the typical hockey curve below:



Rudolph realized that in order to clean up F4 long chain hydrocarbon molecules (C34-C50 and above) he would need to use a different type of bacteria known as *Pseudomonas* that have a particular appetite for long chain hydrocarbons. *Pseudomonas* are different from *Bacillus* in that they cannot spore up, meaning they cannot protect themselves when exposed to high concentrations of contaminated soil and will continue to assimilate PHCs until there is no nothing left for them to eat.

Science has proven that *Pseudomonas* are successful at degrading mineral oil and petroleum grease quickly but are limited by having only a 20 minute lifespan making them virtually impossible to transport and remain active. To combat this issue, in conjunction with microbiologists in the US, Rudolph developed a patented process that allows *Pseudomonas* cultures to be transported in a live vegetative state. He also determined a methodology for maximizing their reproductive capabilities from 7 to 12 times in 20 minutes.

F4 uses multiple strains of *Pseudomonas* in its blend of microbes. The microbes are naturally occurring and were taken from oil spills and PHC contaminated soil and water. They are cultured in the US to Rudolph's specifications and each batch undergoes strict 48 hour quality control to insure they are pathogen free. Together with a proprietary surfactant (see below) and some "secret" all natural ingredients this combination makes F4's technology extremely effective.

The Surfactant

A surfactant by definition lowers the surface tension between two liquids or between a liquid and a solid. Part of F4's unique offering is that it has successfully married biology and chemistry by developing a surfactant that not only provides rapid penetration of a variety of different soils (with a remarkable ability to clean where agitation is restricted), but one that is also microbe friendly.

Rudolph's research team improved the surfactant used in his water-based parts washers to create a surfactant with an eco profile that is marine safe and yet works very well at distributing microbes. The end result is particularly effective at treating heavy oil and oilfield degreasing applications. Note: the product contains no phosphates or Alkyl Phenol Ethoxylates (APEs) and is VOC exempt.

The Process




In addition to developing a proprietary blend of microbes and surfactant F4 further distinguishes itself by offering its own Earth Cleaning Machine (ECM) which can be mobilized in less than ten minutes. Capable of processing up to 1500 M^3 of soil per day (assuming a 10 hour day with 8 hours spraying), this is a custom built machine and unique in the industry. After trying multiple aggregate and rock crushers, garbage shredders, roto tillers and a variety of augur based homogenizers, none of which worked fast enough or effectively, Rudolph used his earlier training to design and build his own machine, the 4^{th} generation of which is shown above. Note: the ECM is self contained and comes with its own conveyor.

For large volume projects, contaminated soil is dug out from the contaminated area using a standard hoe and then fed into the ECM where it is tumbled and sprayed with a solution of microbes and surfactant. This insures complete contact of the formula combination with the soil. The treated soil is taken up a conveyor and placed on a liner where it is piled into windrows 3-12 feet high. Analysis using approved sampling procedures is performed to confirm biodegradation (see case studies to follow).

The microbial portion of the product is supplied in 1kg bags. The bags must be kept at -20°C and are stable for two years at this temperature. Each 1kg of microbes is added to a 55 gallon drum of water together with some nutrients and proprietary compounds. The microbes inoculate for a 24 hour period and form a Concentrated Bioremediation Solution (CBS). The CBS is then further diluted with water prior to use in the field. The diluted CBS is sprayed through directional spray bars in the ECM which insure soil saturation and maximize penetration of the microbes.

For oil spills on open water, the CBS should be applied via spraying directly onto the surface. The spray should also be applied on any soil contaminated on banks, etc. Note the product can also be used in fresh or salt water and may be applied at temperatures between 40°F and 120°F.

Case Study 1

A Phase II Environmental Site Assessment (Phase II ESA) was completed on June 21, 2007 at a wellsite in High Prairie, Northern Alberta, Canada. The Phase II ESA identified a drilling sump in the southeast portion of the wellsite that exceeded allowable guideline limits for benzene, ethylbenzene, F2 hydrocarbons and F3 hydrocarbons. In July 2010 approximately 5000 M^3 of sump material was excavated and placed on a liner within the boundaries of the wellsite. A microbiological treatment was applied to ~750 M^3 of the sump material over a 1 week period beginning August 25, 2010. As part of the process, treated material was transferred and placed on a separate liner.

The following table shows the results of composite sampling of the sump material with respect to the concentrations of volatile and petroleum hydrocarbons. Sampling took place on July 30, September 22, and November 1, 2010 and in each case 10 composite samples were taken by an independent third party to protect chain of custody. A fourth sampling was completed on May 27, 2011 which showed that the concentration of all volatile and petroleum hydrocarbons were within allowable guideline limits. A final sampling was completed on July 7, 2011 that showed the concentration of all volatile and petroleum hydrocarbons remained within allowable guideline limits.

Hydrocarbon	Units	Sampling before Bio-Reclaim application **Aug 2010**	Composite sampling taken **Sept 2010**	Composite sampling taken **May 2011**	Alberta Environment Criteria
Benzene	mg/kg	0.08	<0.005	<0.005	0.046
Toluene	mg/kg	<0.05	<0.05	<0.05	0.52
Ethylbenzene	mg/kg	0.254	<0.015	<0.015	0.11
Xylenes	mg/kg	<0.1	<0.1	<0.05	15
F1	mg/kg	181	50	<10	210
F2	mg/kg	926	225	<10	150
F3	mg/kg	2180	816	132	1300
F4	mg/kg	1560	241	56	5600

Case Study 2

A Phase II ESA was completed in August 2007 at a drilling sump located north of Mayerthorpe in Alberta. The Phase II ESA indicated that the drilling waste disposal area did not meet the applicable remediation guidelines for Benzene, Toluene, Ethylbenzene, F2 hydrocarbons, and F3 hydrocarbons. Beginning on July 7, 2010 approx. 1750 M^3 of impacted soil was excavated and placed on a temporary lined containment area. In July 2011, a microbiological treatment was applied to the impacted soil. As part of the process, the impacted soil was relocated to a 30mm lined containment area. Environmental sampling on the treatment pile was conducted from September 2010 to August 2011 by a third party environmental service provider. All of the soil samples collected throughout the sampling program were submitted to AGAT Laboratories for hydrocarbon (BTEX / F1- F4) and available nutrient analysis.

Five composite soil samples were initially collected from the impacted soil on July 9, 2010 prior to the microbiological treatment being applied to provide a baseline for soils comparison. The first sampling conducted on the treatment pile was completed on September 1, 2010. Seven composite soil samples were collected from the treatment pile. The second sampling was completed on October 26, 2010. Fifteen composite soil samples were collected from the treatment pile. The third sampling was completed on June 2, 2011. Fifteen composite soil samples were collected from the treatment pile. The fourth sampling was completed on July 18, 2011. Fifteen composite soil samples were collected from the treatment pile. The final sampling took place on August 21, 2011. Fifteen composite soil samples were collected from the treatment pile. The soil samples analyzed for hydrocarbons during the environmental sampling program were compared to the Alberta Environment Tier 1 guidelines for fine grained surface soils under agricultural area land use (AENV 2010). Based on the results of the laboratory analysis from the environmental sampling to date, the impacted soil within the drilling waste disposal area treatment piles met the applicable remediation guidelines.

Hydrocarbon	Units	Sampling before Bio-Reclaim application **July 2010**	Composite sampling taken **Oct 2010**	Composite sampling taken **June 2011**	Alberta Environment Criteria
Benzene	mg/kg	0.30	0.020	<0.005	0.046
Toluene	mg/kg	0.53	0.12	<0.05	0.52
Ethylbenzene	mg/kg	3.36	0.05	<0.01	0.11
Xylenes	mg/kg	14.6	0.28	<0.05	15
F1	mg/kg	180	10	<10	210
F2	mg/kg	485	35	<10	150
F3	mg/kg	611	271	32	1300
F4	mg/kg	230	103	<10	5600

F4 REMEDIATION

Examples of F4 applied to surface water. The blue/black liquid in the photographs is crude oil.

APPENDIX B

SITE SPECIFIC 1166 MITIGATION PLAN

PLAN ISSUE DATE: **September 17, 2014**

COMPANY I.D. #: **177847**

MITIGATION PLAN #: **566483**

Company:	**Defense Fuel Support Point Norwalk** **c/o Defense Logistics Agency** **1962 Freeman Avenue, Signal Hill, CA 90755**
Site:	**15306 Norwalk Blvd.,** **Norwalk, CA 90650**
Attn:	**Everett Bole (Restoration Project Manager)**
Phone	**(703) 767-4520** **Fax – Not Given**

SITE SPECIFIC RULE 1166 CONTAMINATED SOIL MITIGATION PLAN

Reference is made to your Application **(A/N 566483)** for the excavation and handling of VOC-contaminated soil **at 15306 Norwalk Blvd., Norwalk, CA 90650.** In accordance with Rule 1166 (c), this plan is required prior to commencing excavation of any underground storage tank or transfer piping which has previously been used to store or transfer volatile organic compounds (VOC) and during the excavation, handling, or storage of VOC-contaminated soils.

The rights and privileges granted through the issuance of this plan are restricted exclusively to the plan holder to whom it was issued, and are non-transferable, even with the written or expressed consent of the plan holder listed above. No other excavation plan issued by the SCAQMD can be used at this site.

This plan has been approved under the provisions of Rule 1166 of the Rules and Regulations of the SCAQMD and is subject to the following conditions.

RULE 1166 CONDITIONS:

SECTION I – GENERAL REQUIREMENTS

1. THIS EXCAVATION PLAN SHALL EXPIRE **SEPTEMBER 16, 2016.**

2. A SIGNED COPY OF THIS PLAN SHALL BE PRESENT AT THE EXCAVATION SITE AT ALL TIMES AND SHALL BE MADE AVAILABLE TO SCAQMD PERSONNEL UPON REQUEST.

3. THIS PLAN IS NOT VALID FOR THE EXCAVATION OF VOC CONTAMINATED SOILS AT LANDFILLS OR SITES USED FOR DISPOSAL OF REFUSE OR OTHER TYPES OF WASTE.

4. THIS PLAN by itself DOES NOT ALLOW THE TREATMENT OF VOC-CONTAMINATED SOIL BY THERMAL, CHEMICAL, biological, OR MECHANICAL PROCESSES. ANY OF THE ABOVE TREATMENT PROCESSES REQUIRES A PERMIT TO OPERATE FROM THE SCAQMD which will be obtained prior to initiating treatment onsite.

5. THE TOTAL QUANTITY OF VOC CONTAMINATED SOIL EXCAVATED UNDER THIS PLAN SHALL NOT EXCEED 125**,000** CUBIC YARDS. AT NO TIME SHALL THE TOTAL QUANTITY OF VOC CONTAMINATED SOIL STOCKPILED not undergoing onsite treatment AT THIS SITE EXCEED 5**,000** CUBIC YARDS. Total Amount of soil undergoing various forms of treatment --------------------shall not exceed --------------------------

6. THE SCAQMD SHALL BE IMMEDIATELY NOTIFIED OF ANY COMPLAINTS RECEIVED AS A RESULT OF ACTIVITIES CONDUCTED UNDER THIS PLAN. SUCH NOTIFICATION SHALL INCLUDE THE NATURE OF THE COMPLAINT, NUMBER OF COMPLAINANTS, COMPLAINANT NAME, ADDRESS, PHONE NUMBER, ETC., AND THE ACTION TAKEN BY THE PLAN HOLDER TO MITIGATE THE SOURCE OF THE COMPLAINT.

7. DURING EACH STEP OF THE PROCESS UP TO AND INCLUDING THE REMOVAL, treatment, AND DISPOSAL PROCESS, ALL PRECAUTIONS AND MEASURES SHALL BE TAKEN TO MINIMIZE THE RELEASE OF VOC, ODOR AND DUST. THIS INCLUDES BUT IS NOT LIMITED TO:

   A) THE USE OF ADDITIONAL PLASTIC SHEETING OR SUPPRESSANTS ON EXPOSED SOIL SURFACES & WORK AREAS,
   B) MAINTAINING PAVED PUBLIC STREETS FREE OF SOIL DEPOSITS, AND
   C) OPERATING SUCH THAT VOC SOIL SHALL NOT BE SPREAD ON-SITE OR OFF-SITE; AND NOT PERFORMING ANY UNNECESSARY MOVEMENT OR AGITATION OF SOIL, INCLUDING THE RESHAPING OR RELOCATION OF STOCKPILES, THAT MAY CAUSE THE UNCONTROLLED EVAPORATION OF VOCs INTO THE ATMOSPHERE.

8. FOR THE PURPOSES OF RULE 1166 AND THIS PLAN, SOIL MEASURED PURSUANT TO RULE 1166 AS VOC CONTAMINATED SOIL, IS CONSIDERED AS VOC CONTAMINATED SOIL FROM THE TIME OF MEASUREMENT ONWARD, UNTIL THE SOIL IS TREATED PURSUANT TO AN APPROVED SCAQMD TREATMENT PROCESS.

SECTION II – PRIOR TO EXCAVATION

9.

A) AT LEAST 24 HOURS PRIOR TO COMMENCING EXCAVATION OR GRADING OF SOIL AT THE SITE, THE EXECUTIVE OFFICER OR DESIGNEE SHALL BE NOTIFIED OF THE EXCAVATION BY FAX USING A FORM APPROVED BY THE EXECUTIVE OFFICER WHICH IS FULLY COMPLETED AND INCLUDING, THE NAME OF THE COMPANY PERFORMING THE EXCAVATION, AND THE APPLICATION NUMBER LISTED ON THIS MITIGATION PLAN. THE NOTIFICATION SHALL BE MADE BY FAXING THE NOTIFICATION FORM AT (909) 396-3342. FAX NOTIFICATIONS WILL RECEIVE A REFERENCE NUMBER BY RETURN FAX OR CAN BE OBTAINED REFERENCING THE FAX NOTIFICATION BY PHONE TUESDAY THROUGH FRIDAY DURING BUSINESS HOURS AT 909 396-2326. THE REFERENCE NUMBER SHALL BE RETAINED AS PROOF OF COMPLIANCE WITH THIS REQUIREMENT.

REFERENCE NO: ------------------ NOTIFICATION DATE: --------------------

B) AT LEAST 24 HOURS PRIOR TO COMMENCING EXCAVATION OR GRADING OF SOIL AT THE SITE, ALL SENSITIVE RECEPTORS WITHIN 1,000 FEET FROM THE SITE SHALL BE NOTIFIED OF THE EXCAVATION BY LETTER USING A FORMAT APPROVED BY THE EXECUTIVE OFFICER WHICH INCLUDES THE NAME, ADDRESS AND PHONE NUMBER OF THE COMPANY PERFORMING THE EXCAVATION, THE DURATION OF THE EXCAVATION AND THE SCAQMD COMPLAINT HOTLINE NUMBER (909) 288-7664.

10. COMPLETE VERIFICATION INFORMATION IN CONDITION NO. 28 AND OBTAIN REQUIRED SIGNATURES, PRIOR TO COMMENCING EXCAVATION.

11. DURING THE EXCAVATION PROCESS, AN ORGANIC VAPOR ANALYZER (OVA) SHALL BE ON SITE AT ALL TIMES. THE OVA SHALL BE MAINTAINED IN GOOD WORKING ORDER AT ALL TIMES. AND SHALL BE CALIBRATED BY THE MANUFACTURER AT LEAST ONCE EVERY THREE MONTHS. THE CALIBRATION OF THE OVA SHALL BE VERIFIED USING CERTIFIED CALIBRATION GAS AT THE BEGINNING OF EACH WORKING DAY WITH THE PROCEDURES SPECIFIED BY THE MANUFACTURER. IF A CALIBRATION GAS OTHER THAN HEXANE IS USED, EACH MEASURED READING SHALL BE CORRELATED TO AND EXPRESSED AS HEXANE, USING EQUIVALENCY FACTORS PROVIDED BY THE MANUFACTURER. IN THE EVENT THAT INCONSISTENT OR ERRATIC READINGS ARE EXPERIENCED, OR THE OVA BECOMES OTHERWISE INOPERABLE, ALL EXCAVATION ACTIVITIES WILL CEASE UNTIL THE OVA IS REPAIRED OR REPLACED.

SECTION III – MONITORING

12. ALL MONITORING SHALL BE CONDUCTED AT A DISTANCE NO MORE THAN 3 INCHES ABOVE THE SOIL SURFACE USING AN OVA DESCRIBED IN CONDITION NO. 11 ABOVE. MONITORING SHALL BE INITIALLY CONDUCTED AT A MINIMUM FREQUENCY OF ONE READING EVERY FIFTEEN MINUTES. UPON DETECTION OF VOC CONTAMINATION, MONITORING SHALL BE CONDUCTED AT A MINIMUM RATE OF ONE READING FOR EVERY FIVE CUBIC YARDS EXCAVATED. ALL READINGS SHALL BE TAKEN NO LATER THEN THREE (3) MINUTES AFTER EACH LOAD OF SOIL IS EXCAVATED.

13. ALL MONITORING SHALL BE CONDUCTED BY TRAINED PERSONNEL WHO ARE PROFICIENT IN THE USE OF THE HYDROCARBON MONITOR SELECTED FOR USE AT THIS SITE.

14. WRITTEN RECORDS OF OVA MONITORING AND CALIBRATIONS REQUIRED ABOVE SHALL BE KEPT IN A FORMAT APPROVED BY THE SCAQMD. THE APPROVED FORMAT IS INCLUDED ON PAGE 11 OF THIS PLAN. THE CERTIFICATION ON ALL RECORDS SHALL BE SIGNED AND DATED ON THE DAY THE MEASUREMENTS ARE OBSERVED.

15. UPON DETECTION OF VOC CONTAMINATED SOIL (READINGS 50 PPM OR GREATER), THE EXECUTIVE OFFICER OR DESIGNEE SHALL BE NOTIFIED WITHIN 24 HOURS OF THE FIRST DETECTION OF VOC CONTAMINATION. THE NOTIFICATION SHALL BE MADE BY FAXING THE NOTIFICATION FORM TO (909) 396-3342 OR CALLING (909) 396-2326. A REFERENCE NUMBER WILL BE FAXED BACK OR WILL BE ISSUED WHEN THE PHONE NOTIFICATION IS RECEIVED. ALL PHONE NOTIFICATIONS SHALL BE FOLLOWED BY MAILING THE NOTIFICATION FORM TO THE DISTRICT POSTMARKED WITHIN 48 HOURS. THE REFERENCE NUMBER WILL BE RETAINED AS PROOF OF COMPLIANCE WITH THIS REQUIREMENT.

REFERENCE NO:--------------------- NOTIFICATION DATE:-----------------------------

SECTION IV –HANDLING & STORAGE

16. ALL VOC-CONTAMINATED SOIL BELOW 1000 PPM SHALL BE STOCKPILED, COVERED WITH PLASTIC SHEETING AND STORED SEPARATELY FROM NON-VOC-CONTAMINATED SOIL, OR STOCKPILED FOR ONSITE TREATMENT, OR IMMEDIATELY TRANSPORTED TO A TREATMENT FACILITY. CONTAMINATED SOIL ONCE EXCAVATED AND STOCKPILED WILL BE CONSIDERED CONTAMINATED AT ALL TIMES AND CANNOT BE BACKFILLED UNLESS TREATED TO LESS THAN 50 PPM LEVELS WITH PRIOR SCAQMD APPROVAL AND SCAQMD PERMITTED EQUIPMENT. WHENEVER THE SOIL STOCKPILES ARE UNDERGOING TREATMENT, STOCKPILES SHALL BE COVERED AS CONDTION NO. 18B AND WEEKLY INSPECTIONS SHALL BE COMPLETED AS PER THE GUIDANCE IN CONDITION NO. 22.

17. A VOC CONTAMINATED STOCKPILE created for onsite storage only SHALL NOT CONTAIN MORE THAN 400 CUBIC YARDS OF SOIL.

18. IF THE OVA MEASUREMENT SPECIFIED IN CONDITION NO. 12 IS GREATER THAN 50 PPMV, BUT LESS THAN 1000 PPMV,

A) THE AFFECTED WORK AREA AND LOAD OF SOIL SHALL BE SPRAYED WITH WATER AND/OR APPROVED VAPOR SUPPRESSANT.

B) CONTAMINATED SOIL IN STOCKPILES created for temporary storage SHALL BE COVERED WITH PLASTIC SHEETING WHICH OVERLAP A MINIMUM OF TWENTY FOUR INCHES AND ARE SECURED SO THAT NO PORTION OF THE CONTAMINATED SOIL IS EXPOSED TO THE ATMOSPHERE. IN THE COURSE OF HANDLING THE STOCKPILE, ONLY THE WORKING FACE OF THE STOCKPILE MAY BE UNCOVERED.

C) SOIL SHALL BE TRANSFERRED IN COVERED BINS/TRAILERS FOR TEMPORARY OFFSITE STORAGE BEFORE IT CAN BE TAKEN TO DISPOSAL FACILITY WITH IN 30 DAYS OF EXCAVATION.

D) Onsite treatment for the VOC contaminated soil which falls in the category of 50-1000 PPMV as hexane shall be initiated within -------------30 days of excavation.

19. IF THE SOIL OVA MEASUREMENT EQUALS OR IS GREATER THAN 1000 PPMV, NOTIFY THE DISTRICT IMMEDIATELY OR WITHIN ONE HOUR OF DETECTION, AND,

A) THE AFFECTED SOIL AND WORKING AREA SHALL BE IMMEDIATELY SPRAYED WITH WATER OR AN APPROVED VAPOR SUPPRESSANT, AND EITHER:

i) THE CONTAMINATED SOIL EXCAVATED SHALL BE IMMEDIATELY PLACED IN SCAQMD APPROVED SEALED CONTAINERS EQUIPPED WITH VAPOR TIGHT LIDS, OR,

ii) THE SOIL SHALL BE DIRECTLY LOADED IN TRUCKS, SPRAYED WITH ADDITIONAL WATER OR APPROVED VAPOR SUPPRESSANTS, COVERED, AND TRANSPORTED IMMEDIATELY OFF SITE TO AN APPROVED TREATMENT FACILITY, OR,

iii) Onsite treatment for the VOC contaminated soil for this category (>1000 PPMV as hexane) shall be initiated within -------------3 days of excavation, or,

B) HANDLED BY ALTERNATIVE STORAGE METHODS WITH PRIOR WRITTEN APPROVAL FROM THE SCAQMD.

C) Soil with contamination greater than 1,000 PPMV as hexane shall not be treated with biological methods.

20. DURING EXCAVATION, THE EXPOSED VOC CONTAMINATED SOIL SHALL BE RESTRICTED TO THE IMMEDIATE WORKING AREA OF THE STOCKPILE ONLY. ALL OTHER PORTIONS OF THE STOCKPILE SHALL BE COVERED WITH PLASTIC SHEETING, WITH SEAMS WHICH OVERLAP A MINIMUM OF TWENTY-FOUR (24)

INCHES AND ARE SECURED WITH DUCT TAPE. ALL EXPOSED VOC-CONTAMINATED SOIL SURFACES (WORK FACE) SHALL BE KEPT MOIST WITH WATER OR OTHER APPROVED SUPPRESSANTS AT ALL TIMES, AND SHALL BE RE-COVERED DURING PERIODS OF INACTIVITY LONGER THAN ONE (1) HOUR. AT THE END OF EACH WORKING DAY, ALL STOCKPILES SHALL BE COMPLETELY COVERED AND SECURELY ANCHORED TO PREVENT ANY EXPOSURE OF SOIL TO THE ATMOSPHERE.

21. ONCE COVERED WITH PLASTIC SHEETING, STOCKPILES SHALL REMAIN COVERED AND UNDISTURBED UNTIL REMOVED FROM THE SITE.

22. DAILY INSPECTIONS SHALL BE CONDUCTED OF ALL COVERED VOC-CONTAMINATED STOCKPILES TO ENSURE THE INTEGRITY OF THE PLASTIC COVER. SUCH INSPECTIONS SHALL INCLUDE A VISUAL INSPECTION OF ALL SEAMS AND PLASTIC COVER SURFACES. ANY HOLES, TEARS OR ANY OTHER POTENTIAL SOURCES OF FUGITIVE VOC EMISSIONS SHALL BE REPAIRED IMMEDIATELY. DAILY RECORDS SHALL BE MAINTAINED TO ENSURE COMPLIANCE WITH THIS CONDITION.

SECTION V –SOIL REMOVAL AND DISPOSAL

23. ALL VOC-CONTAMINATED SOIL SHALL BE REMOVED FROM THE SITE/OFFSITE STORAGE WITHIN THIRTY (30) DAYS OF ITS EXCAVATION or treatment shall be initiated with SCAQMD permitted system.

24. ALL VOC-CONTAMINATED SOIL REMOVED FROM THE SITE SHALL COMPLY WITH THE FOLLOWING:

    A) BE TRANSPORTED TO AN APPROVED TREATMENT/DISPOSAL FACILITY. IT SHALL BE THE RESPONSIBILITY OF THE PLAN HOLDER TO ENSURE THAT THE RECEIVING TREATMENT/DISPOSAL FACILITY HAS RECEIVED APPROVAL FROM THE APPROPRIATE ENVIRONMENTAL OVERSIGHT AGENCIES TO HANDLE AND TREAT VOC CONTAMINATED SOILS.

    B) WHEN LOADING IS COMPLETED AND DURING TRANSPORTATION, NO EXCAVATED MATERIAL SHALL EXTEND ABOVE THE SIDES OR REAR OF THE TRUCK OR TRAILER.

    C) PRIOR TO COVERING/TARPING, LOADED CONTAMINATED SOIL SHALL BE TREATED BY SPRAYING WITH WATER OR DUST SUPPRESSANTS.

    D) THE TRUCK OR TRAILER SHALL BE COMPLETELY COVERED/TARPED PRIOR TO LEAVING THE SITE TO PREVENT PARTICULATE EMISSIONS TO THE ATMOSPHERE.

E) THE EXTERIOR OF THE TRUCKS (INCLUDING THE TIRES) SHALL BE CLEANED OFF PRIOR TO THE TRUCKS LEAVING THE EXCAVATION SITE.

SECTION VI – RECORDS AND REPORTING

25. A WRITTEN REPORT SHALL BE GENERATED WHICH INCLUDES:

A) For the amount of soil treated onsite: type of treatment method used, duration of treatment each pile,

B) For the amount of soil treated offsite: THE FACILITY SELECTED TO TREAT THE VOC-CONTAMINATED SOIL, QUANTITY OF SOIL REMOVED FROM SITE, STATUS OF EXCAVATION PIT, AND ANY VOC CONTAMINATED SOIL REMAINING ON SITE.

C) A BRIEF SUMMARY INDICATING IF ADDITIONAL CLEAN UP EFFORTS ARE NECESSARY, THE ADDITIONAL QUANTITY OF VOC CONTAMINATED SOILS TO BE EXCAVATED AND THE PROJECTED SCHEDULE OF THE EXCAVATION.

26. RECORDS OF TREATMENT/DISPOSAL SHALL BE MAINTAINED FOR ALL VOC-CONTAMINATED SOIL excavated FROM THIS SITE. SUCH RECORDS SHALL BE CLEARLY LABELED "**SCAQMD RULE 1166-VOC CONTAMINATED SOIL"** AND SHALL INCLUDE THE IDENTIFICATION AND THE LOCATION OF, 1) THE GENERATOR, 2) TRANSPORTER AND 3) RECEIVING FACILITY. IN ADDITION, SUCH RECORDS SHALL BE SIGNED AND DATED BY EACH OF THE ABOVE PARTIES INDICATING RECEIPT OR RELINQUISHMENT OF THE VOC-CONTAMINATED SOIL AT THE TIME CUSTODY IS TRANSFERRED.

27. WITHIN FORTY (40) DAYS OF INITIAL DETECTION OF VOC-CONTAMINATION, THE WRITTEN RECORDS UNDER CONDITION NO. 22 AND WITHIN THIRTY (30) DAYS OF EXCAVATION PROJECT COMPLETION RECORDS UNDER CONDITION NOS. 14, 22, AND 25 SHALL BE SUBMITTED TO THE SCAQMD AT THE FOLLOWING ADDRESS.

SOUTH COAST AIR QUALITY MGMT DISTRICT
ENGINEERING & COMPLIANCE DIVISION.
RULE 1166 TOXICS AND WASTE MANAGEMENT SECTION
21865 COPLEY DR.
DIAMOND BAR, CA. 91765-4182

SECTION VII – SPECIAL CONDITIONS

A. TOTAL NUMBER OF ROUND TRIP TRUCK MILES DRIVEN (if excavated voc contaminated soil or hazardous material are taken offsite) PER DAY FROM THE DISPOSAL SITES IN THE SCAQMD BASIN SHALL NOT BE MORE THAN 2,800.

- APPLICANT SHALL RETAIN THE COPIES OF THE MANIFESTS GENERATED AT THE EXCAVATION SITE TO SHOW THE LOCATIONS WHERE THE EXCAVATED MATERIAL WAS TAKEN TO.

- WHILE CALCULATING THE MILES DRIVEN IN SCAQMD JURISDICTION, GUIDANCE TABLE SHOWN BELOW SHALL BE USED.

SITE NAME	ROUND TRIP DISTANCE IN SCAQMD BASIN	MAXIMUM NO. OF ROUND TRIPS PER DAY IF GOING TO ONLY ONE SITE (MENTIONED IN COLUMN ON THE LEFT)	
CLEAN HARBORS, MCKITTRICK, CA	80	35	TOTAL DISTANCE TRAVELLED IN SCAQMD BASIN NEEDS TO BE LESS THAN 2,800 MILES ON ANY GIVEN DAY.35
CHIQUITA CANYON LANDFILL, CASTAIC, CA	80	35	
US ECOLOGY, BEATTY, NV	120	23	
LA PAZ COUNTY LANDFILL, PARKER, AZ	380	7	
WASTE MANAGEMENT/TRS 1211 WEST GLADSTONE STREET AZUSA, CA 91702	44	64	
CHEMICAL WASTE MANAGEMENT 35251 OLD SKYLINE ROAD KETTLEMEN CITY, CA 93239	80	35	
SOIL SAFE, INC. 12328 HIBISCUS AVENUE ADELANTO, CA 92301	120	23	
SOUTH YUMA COUNTY LANDFILL 19536 S AVE #1E, YUMA, AZ	96 (via I-5 & I-8)	29	

B. EXCAVATED SOIL FROM THIS PROJECT SHALL ONLY BE STORED ONSITE AT LOCATION AS PER THE MAP ATTACHED WITH THIS PLAN. SOIL STORED ONSITE SHALL BE CLEARLY MARKED AND SEGREGATED FROM ANY OTHER SOILS STOCKPILED FROM OTHER PROJECTS.

C. ALL METAL CONTAMINATED EXCAVATED MATERIAL STOCKPILED SHALL BE KEPT SUFFICIENTLY DAMP TO PREVENT THE POSSIBLE RELEASE OF FUGITIVE EMISSIONS AND SHALL BE COVERED WITH APPROVED HEAVY-DUTY PLASTIC

SHEETING (VISQUEEN) AND ALSO COVERED AT THE END OF EACH WORKING DAY. PLASTIC SHEETING MUST BE SECURED.

D. ALL MATERIALS THAT ARE LISTED AS HAZARDOUS BY A FEDER**AL OR S**TATE AGENCY SHALL BE CONSIDERED "HAZARDOUS MATERIALS" FOR THE PURPOSE OF THIS PERMIT.

E. ALL HAZARDOUS EXCAVATED MATERIAL SHALL BE TRANSPORTED IN SUCH A MANNER AS TO PREVENT ANY EMISSIONS OF HAZARDOUS MATERIALS.

F. ALL HAZARDOUS MATERIALS SHALL BE TRANSPORTED IN CONTAINERS CLEARLY MANIFESTED AS TO THE TYPE OF MATERIAL CONTAINED AND WHAT PROCEDURES SHOULD BE FOLLOWED IN CASE OF ACCIDENTAL SPILLS.

G. EXCAVATED LIQUID HAZARDOUS MATERIALS WITH THE POTENTIAL TO CAUSE AIR EMISSIONS SHALL BE ENCAPSULATED OR ENCLOSED IN CONTAINERS WITH SEALED LIDS BEFORE LOADING INTO THE TRANSPORT VEHICLES.

28. THIS PLAN IS NOT VALID UNTIL ALL PARTIES HAVE REVIEWED AND SIGNED THE VERIFICATION STATEMENT BELOW.

Site Name	Type of Business	
Address	City	Zip
Responsible Party (Owner/Operator)		Phone
Address	City	Zip

I CERTIFY THAT I HAVE REVIEWED AND UNDERSTAND THE CONDITIONS CONTAINED WITHIN THIS PLAN. IN SIGNING BELOW, I ACKNOWLEDGE THAT UNDER THE PROVISIONS OF RULE 1166, I CAN BE HELD RESPONSIBLE FOR THE REQUIREMENTS SET FORTH IN THIS PLAN.

Responsible Party	Responsible Party Signature	Date Signed
General Contractor	General Contractor Signature	Date Signed
Excavation Contractor	Excavation Contractor Signature	Date Signed
Excavation Contractor	Excavation Contractor Signature	Date Signed
Environmental Consultant	Environmental Consultant Signature	Date Signed

DEFINITIONS

Excavation	Is the process of digging out and removing materials including any material necessary to that process such as the digging out and removal of asphalt or concrete necessary to expose, dig out and remove known VOC contaminated soil.
Organic Vapor Analyzer (OVA)	For the purposes of this plan, an OVA is an hydrocarbon monitor utilizing flame ionization, photo ionization or other analytical methods complying with 40 CFR PART 60 APPENDIX A, EPA METHOD 21 SECTION 3, "DETERMINATION OF VOLATILE ORGANIC COMPOUND LEAKS, MONITORING INSTRUMENT SPECIFICATIONS. The monitor shall be capable of being calibrated using hexane at a range of 0 parts per million by volume (PPMV) to 50 PPMV, and at a detection range of at least 30 PPMV to 1100 PPMV
Sensitive Receptor	A sensitive receptor is defined as: Schools (Kinder-garden through grade 12), licensed daycare centers, hospitals and convalescent homes.
Responsible Party	For the purposes of this plan, is the party financially responsible for initiating the excavation. This may include the property owner or the operator of the transfer, storage equipment. This excludes contractors working for the property owner or operator, and any other party that lacks the direct authority to immediately treat all VOC contaminated soils generated at the excavation site.
VOC Contaminated Soil	Is soil that registers a concentration of 50 PPM or greater of volatile organic compounds as measured before suppression materials have been applied and at a distance of no more than three inches from the surface of the excavated soil with an organic vapor analyzer calibrated with hexane.
Volatile Organic Compound (VOC)	Is any volatile compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and exempt compounds. Exempt compounds are as defined in Rule 102 – Definitions of Terms.

Once issued, this plan is subject to further review by the SCAQMD and may be revoked if excavation activities are found in violation of plan conditions or SCAQMD's Rules and Regulations. Failure to comply with one or more of the conditions contained within this plan constitutes a violation of Rules 221 and 1166.

Other governmental agencies may require approval before any excavation begins. It shall be the responsibility of the applicant to obtain that approval. The South Coast Air Quality Management District shall not be responsible or liable for any losses because of measures required or taken pursuant to the requirements of this approved 1166 Contaminated Soil Mitigation Plan.

If you have any questions concerning this plan, please call David Jones at (909) 396-2317.

Very truly yours,

David Jones
A.Q.A.C. Supervisor

Rule 1166 Soil Monitoring Records

ID No: 177847 Plan No: 566483	Facility/Site Information
Defense Fuel Support Point Norwalk **c/o Defense Logistics Agency** **1962 Freeman Avenue,** **Signal Hill, CA 90755**	**15306 Norwalk Blvd.,** **Norwalk, CA 90650**
Reference No(s).	

Monitor Information	Calibration Data	Monitoring Personnel	Excavation Summary (Upon completion of each page)	
Brand:	Gas:	Name:	Total Cubic Yds (This page)	
Model:	Date	Company:	Total Cubic Yds (To date)	
Type	By	Phone:	Removed from Site (To date)	

Time	VOC Concentration (PPMV) @ Excavated Load			Comment	Time	VOC Concentration (PPMV)@ Excavated Load			Comment
Every 15 min.	Reading	Hexane Factor	Adjusted Reading		Every 15 min.	Reading	Hexane Factor	Adjusted Reading	

I certify that the information contained in the above document is true and correct. I further certify that the above listed hydrocarbon monitor was operated in a manner consistent with the manufacturer's specifications and the conditions specified within this plan. In addition, I certify that the above readings represent the actual measurements I observed and recorded during the excavation process.

SIGNATURE:____ DATE:____________________

APPENDIX C

DTSC INFORMATION ADVISORY

October 2001

Information Advisory
Clean Imported Fill Material

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

It is DTSC's mission to restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality, by regulating hazardous waste, conducting and overseeing cleanups, and developing and promoting pollution prevention.

State of California

California Environmental Protection Agency

Executive Summary

This fact sheet has been prepared to ensure that inappropriate fill material is not introduced onto sensitive land use properties under the oversight of the DTSC or applicable regulatory authorities. Sensitive land use properties include those that contain facilities such as hospitals, homes, day care centers, and schools. This document only focuses on human health concerns and ecological issues are not addressed. It identifies those types of land use activities that may be appropriate when determining whether a site may be used as a fill material source area. It also provides guidelines for the appropriate types of analyses that should be performed relative to the former land use, and for the number of samples that should be collected and analyzed based on the estimated volume of fill material that will need to be used. The information provided in this fact sheet is not regulatory in nature, rather is to be used as a guide, and in most situations the final decision as to the acceptability of fill material for a sensitive land use property is made on a case-by-case basis by the appropriate regulatory agency.

Introduction

The use of imported fill material has recently come under scrutiny because of the instances where contaminated soil has been brought onto an otherwise clean site. However, there are currently no established standards in the statutes or regulations that address environmental requirements for imported fill material. Therefore, the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) has prepared this fact sheet to identify procedures that can be used to minimize the possibility of introducing contaminated soil onto a site that requires imported fill material. Such sites include those that are undergoing site remediation, corrective action, and closure activities overseen by DTSC or the appropriate regulatory agency. These procedures may also apply to construction projects that will result in sensitive land uses. The intent of this fact sheet is to protect people who live on or otherwise use a sensitive land use property. By using this fact sheet as a guide, the reader will minimize the chance of introducing fill material that may result in potential risk to human health or the environment at some future time.

Overview

Both natural and manmade fill materials are used for a variety of purposes. Fill material properties are commonly controlled to meet the necessary site specific engineering specifications. Because most sites requiring fill material are located in or near urban areas, the fill materials are often obtained from construction projects that generate an excess of soil, and from demolition debris (asphalt, broken concrete, etc.). However, materials from those types of sites may or may not be appropriate, depending on the proposed use of the fill, and the quality of the assessment and/or mitigation measures, if necessary. Therefore, unless material from construction projects can be demonstrated to be free of contamination and/or appropriate for the proposed use, the use of that material as fill should be avoided.

Selecting Fill Material

In general, the fill source area should be located in nonindustrial areas, and not from sites undergoing an environmental cleanup. Nonindustrial sites include those that were previously undeveloped, or used solely for residential or agricultural purposes. If the source is from an agricultural area, care should be taken to insure that the fill does not include former agricultural waste process byproducts such as manure or other decomposed organic material. Undesirable sources of fill material include industrial and/or commercial sites where hazardous ma-

Potential Contaminants Based on the Fill Source Area

Fill Source:	Target Compounds
Land near to an existing freeway	Lead (EPA methods 6010B or 7471A), PAHs (EPA method 8310)
Land near a mining area or rock quarry	Heavy Metals (EPA methods 6010B and 7471A), asbestos (polarized light microscopy), pH
Agricultural land	Pesticides (Organochlorine Pesticides: EPA method 8081A or 8080A; Organophosphorus Pesticides: EPA method 8141A; Chlorinated Herbicides: EPA method 8151A), heavy metals (EPA methods 6010B and 7471A)
Residential/acceptable commercial land	VOCs (EPA method 8021 or 8260B, as appropriate and combined with collection by EPA Method 5035), semi-VOCs (EPA method 8270C), TPH (modified EPA method 8015), PCBs (EPA method 8082 or 8080A), heavy metals including lead (EPA methods 6010B and 7471A), asbestos (OSHA Method ID-191)

**The recommended analyses should be performed in accordance with USEPA SW-846 methods (1996). Other possible analyses include Hexavalent Chromium: EPA method 7199*

Recommended Fill Material Sampling Schedule

Area of Individual Borrow Area	Sampling Requirements
2 acres or less	Minimum of 4 samples
2 to 4 acres	Minimum of 1 sample every 1/2 acre
4 to 10 acres	Minimum of 8 samples
Greater than 10 acres	Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile	Samples per Volume
Up to 1,000 cubic yards	1 sample per 250 cubic yards
1,000 to 5,000 cubic yards	4 samples for first 1000 cubic yards +1 sample per each additional 500 cubic yards
Greater than 5,000 cubic yards	12 samples for first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

terials were used, handled or stored as part of the business operations, or unpaved parking areas where petroleum hydrocarbons could have been spilled or leaked into the soil. Undesirable commercial sites include former gasoline service stations, retail strip malls that contained dry cleaners or photographic processing facilities, paint stores, auto repair and/or painting facilities. Undesirable industrial facilities include metal processing shops, manufacturing facilities, aerospace facilities, oil refineries, waste treatment plants, etc. Alternatives to using fill from construction sites include the use of fill material obtained from a commercial supplier of fill material or from soil pits in rural or suburban areas. However, care should be taken to ensure that those materials are also uncontaminated.

Documentation and Analysis

In order to minimize the potential of introducing contaminated fill material onto a site, it is necessary to verify through documentation that the fill source is appropriate and/or to have the fill material analyzed for potential contaminants based on the location and history of the source area. Fill documentation should include detailed information on the previous use of the land from where the fill is taken, whether an environmental site assessment was performed and its findings, and the results of any testing performed. It is recommended that any such documentation should be signed by an appropriately licensed (CA-registered) individual. If such documentation is not available or is inadequate, samples of the fill material should be chemically analyzed. Analysis of the fill material should be based on the source of the fill and knowledge of the prior land use.

Detectable amounts of compounds of concern within the fill material should be evaluated for risk in accordance with the DTSC Preliminary Endangerment Assessment (PEA) Guidance Manual. If metal analyses are performed, only those metals (CAM 17 / Title 22) to which risk levels have been assigned need to be evaluated. At present, the DTSC is working to establish California Screening Levels (CSL) to determine whether some compounds of concern pose a risk. Until such time as these CSL values are established, DTSC recommends that the DTSC PEA Guidance Manual or an equivalent process be referenced. This guidance may include the Regional Water Quality Control Board's (RWQCB) guidelines for reuse of non-hazardous petroleum hydrocarbon contaminated soil as applied to Total Petroleum Hydrocarbons (TPH) only. The RWQCB guidelines should not be used for volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCS). In addition, a standard laboratory data package, including a summary of the QA/QC (Quality Assurance/Quality Control) sample results should also accompany all analytical reports.

When possible, representative samples should be collected at the borrow area while the potential fill material is still in place, and analyzed prior to removal from the borrow area. In addition to performing the appropriate analyses of the fill material, an appropriate number of samples should also be determined based on the approximate volume or area of soil to be used as fill material. The table above can be used as a guide to determine the number of samples needed to adequately characterize the fill material when sampled at the borrow site.

Alternative Sampling

A Phase I or PEA may be conducted prior to sampling to determine whether the borrow area may have been impacted by previous activities on the property. After the property has been evaluated, any sampling that may be required can be determined during a meeting with DTSC or appropriate regulatory agency. However, if it is not possible to analyze the fill material at the borrow area or determine that it is appropriate for use via a Phase I or PEA, it is recommended that one (1) sample per truckload be collected and analyzed for all compounds of concern to ensure that the imported soil is uncontaminated and acceptable. (See chart on Potential Contaminants Based on the Fill Source Area for appropriate analyses). This sampling frequency may be modified upon consultation with the DTSC or appropriate regulatory agency if all of the fill material is derived from a common borrow area. However, fill material that is not characterized at the borrow area will need to be stockpiled either on or off-site until the analyses have been completed. In addition, should contaminants exceeding acceptance criteria be identified in the stockpiled fill material, that material will be deemed unacceptable and new fill material will need to be obtained, sampled and analyzed. Therefore, the DTSC recommends that all sampling and analyses should be completed prior to delivery to the site to ensure the soil is free of contamination, and to eliminate unnecessary transportation charges for unacceptable fill material.

Composite sampling for fill material characterization may or may not be appropriate, depending on quality and homogeneity of source/borrow area, and compounds of concern. Compositing samples for volatile and semivolatile constituents is not acceptable. Composite sampling for heavy metals, pesticides, herbicides or PAH's from unanalyzed stockpiled soil is also unacceptable, unless it is stockpiled at the borrow area and originates from the same source area. In addition, if samples are composited, they should be from the same soil layer, and not from different soil layers.

When very large volumes of fill material are anticipated, or when larger areas are being considered as borrow areas, the DTSC recommends that a Phase I or PEA be conducted on the area to ensure that the borrow area has not been impacted by previous activities on the property. After the property has been evaluated, any sampling that may be required can be determined during a meeting with the DTSC.

For further information, call Richard Coffman, Ph.D., R.G., at (818) 551-2175.

APPENDIX E

HEALTH AND SAFETY PLAN

SITE HEALTH AND SAFETY PLAN

Defense Fuel Support Point - Norwalk

15306 Norwalk Blvd.
Norwalk, CA 90650

04-NDLA-003

Prepared For:

Defense Logistics Agency – Energy
8725 John J. Kingman Road
Fort Belvoir, Virginia 22060-6222

Prepared By:

SGI environmental
THE SOURCE GROUP, INC.

1962 Freeman Avenue
Signal Hill, California, 90755

May 28, 2014

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HEALTH AND SAFETY PLAN REVIEW AND APPROVAL

Client:	Defense Logistics Agency - Energy	**Site Name:**	DFSP - Norwalk
Project:	Site Investigation	**Project Number:**	04-NDLA-003

Molly Black Plan Completed/Updated By	*Signature*	6/16/14 *Date*
Neil Irish Project Manager	*Signature*	6/17/2014 *Date*
Paul Parmentier Site Health and Safety Coordinator	*Signature*	6-19-2014 *Date*

This Site Health and Safety Plan (HASP) has been written for the use of The Source Group, Inc. (SGI), and its employees only. It may also be used as a guidance document by properly trained and experienced SGI subcontractors. However, SGI does not guarantee the health or safety of any person entering this Site. All subcontractors under contract with SGI will be required to follow the requirements in this Health and Safety document.

Due to the potential hazardous nature of this Site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards, which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this Site. The health and safety guidelines in this HASP were prepared specifically for this Site and should not be used on any other site without prior research by trained health and safety specialists.

SGI claims no responsibility for its use by others. The Site HASP is written for the specific site conditions, purposes, and personnel specified and must be amended if these conditions change. Changes to the requirements for health and safety guidelines must be approved by the SGI Health and Safety Coordinator.

PROJECT TELEPHONE NUMBERS

PROJECT TELEPHONE NUMBERS
Defense Fuel Support Point - Norwalk

LOCAL EMERGENCY TELEPHONE NUMBERS

CONTACT	NAME	TELEPHONE NO.
IN AN EMERGENCY CALL 911		
Fire	LA County Fire Department, Station 115	(562) 868-0411
Police	LA County Sheriff's Department, Norwalk Station	(562) 863-8711
Hospital	Coast Plaza Hospital	(562) 868-3751

PROJECT PERSONNEL TELEPHONE NUMBERS

PROJECT RESPONSIBILITY	NAME	TELEPHONE NO.
SGI Site Health & Safety Coordinator	Paul Parmentier The Source Group, Inc.	(562) 597-1055 ext 106 Mobile (714) 519-1218
SGI Project Manager and Managing Principal	Neil Irish The Source Group, Inc.	(562) 597-1055 ext 102 Mobile (562) 760-8659
Client Contact	Everett Bole Defense Logistics Agency - Energy	(703) 767-4520
SGI Health and Safety Director	Mark Labrenz, CHG The Source Group, Inc.	(805) 373-9063 ext. 203 Mobile (805) 432-5340

REGULATORY TELEPHONE NUMBERS:

AGENCY	NAME	TELEPHONE NO.
LARWQCB	Paul Cho	(213) 576- 6721

PROJECT TELEPHONE NUMBERS
Defense Fuel Support Point - Norwalk

IN THE EVENT OF DAMAGE TO AN UNDERGROUND UTILITY:

AGENCY	TELEPHONE NO.
If it is life threatening, clear the area and call:	911 and the utility owner
If it is NOT life threatening call:	utility owner
For utility owner emergency phone numbers contact USA and refer to the USA Ticket Number for the project	811

IN THE EVENT OF A HAZARDOUS WASTE SPILL/RELEASE,
<u>THE SGI PROJECT MANAGER</u> SHOULD CONTACT THE FOLLOWING:

AGENCY	TELEPHONE NO.
California Emergency Management Agency	(800) 852-7550

Refer to the Emergency Spill Response section of this HASP, for additional notification requirements and procedures.

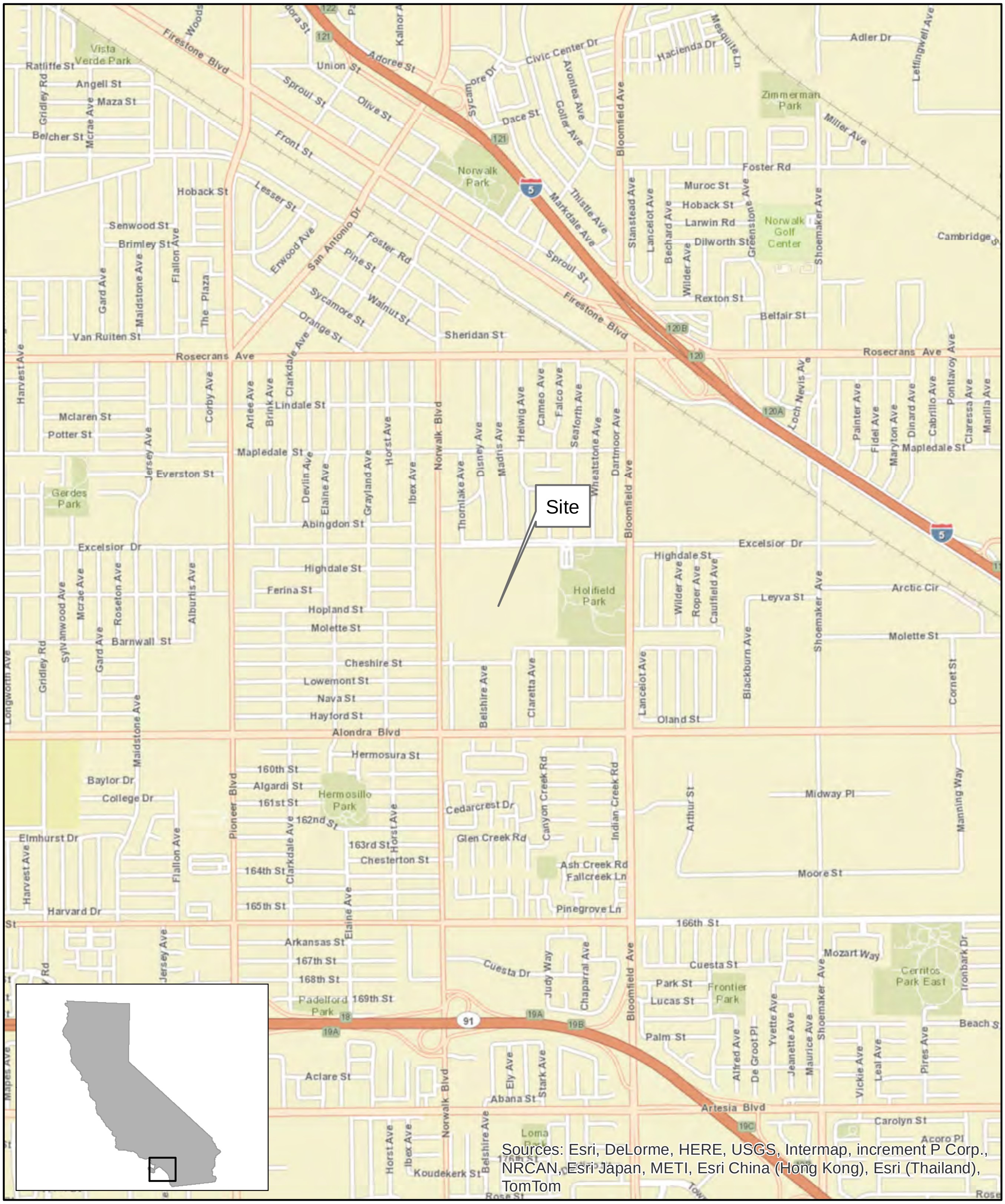
Additional Site-Specific Contacts:

Norwalk Security, Northstar Technology: 949-788-0738

Security Coordinating Personnel:

Diana Stevenson-Luna, Contracting Specialist, March ARB: 951- 655-2414

FIGURES



SOURCE: ESRI 7.5 MINUTE TOPOGRAPHIC MAP. http://resources.esri.com/arcgisonlineservices	PROJECT NO.:	DATE:	DR.BY:	APP.BY:	SCALE= 1:24,000
	04-NDLA-003	5/28/2014	JK	PP	0 875 1,750 3,500 Feet

N

SGI environmental THE SOURCE GROUP, INC.

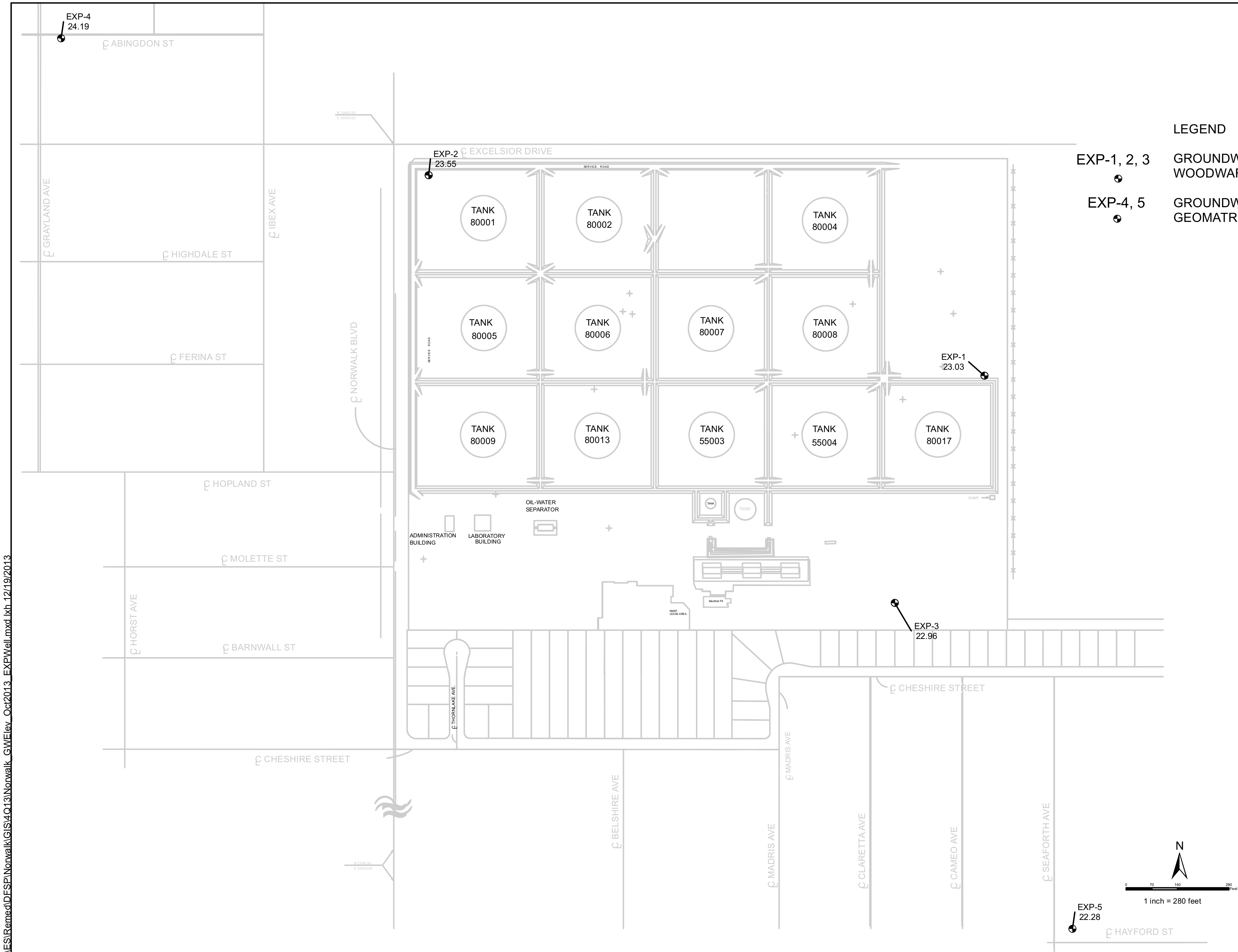
1962 FREEMAN AVENUE
SIGNAL HILL, CA 90755
(562) 597-1055

DEFENSE FUEL SUPPORT POINT NORWALK

15306 NORWALK BOULEVARD
NORWALK, CALIFORNIA

SITE LOCATION MAP

FIGURE
1



SITE PLAN

DEFENSE FUEL SUPPOR POINT NORWALK
15306 NORWALK BLVD.
NORWALK, CA 90650

THE SOURCE GROUP, INC.
1962 FREEMAN AVENUE
SIGNAL HILL, CA 90755
(562) 597-1055

FIGURE 2

SOURCE: PARSONS

S:\ES\Remed\DFSP\Norwalk\GIS\4Q13\Norwalk_GWElev_Oct2013_EXPWell.mxd lxh 12/19/2013

Figure 3 - Hospital Map

Coast Plaza Hospital
13100 Studebaker Road
Norwalk, CA 90650

(562) 868-3751

Google

Drive 2.7 miles, 6 min

Directions from 15306 Norwalk Blvd to Coast Plaza Hospital

○ 15306 Norwalk Blvd

Norwalk, CA 90650

1. Head **north** on **Norwalk Blvd** toward **Hopland St**

   0.9 mi

2. **Norwalk Blvd** turns slightly **left** and becomes **Foster Rd**

   1.6 mi

3. Turn **right** onto **Studebaker Rd**

   Destination will be on the right

   0.2 mi

◉ Coast Plaza Hospital

13100 Studebaker Road, Norwalk, CA 90650

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2014 Google

TABLES

Table 1
Potential Chemical Hazards
Total Petroleum Hydrocarbon Constituents

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm)		ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS
			TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)		
TPHg Gasoline	Motor fuel/spirits Natural gasoline Petrol	Clear liquid (may be light straw, light red, bronze) with a characteristic gasoline odor *(a complex mixture of volatile hydrocarbons)* Flashpoint = -35 degrees Fahrenheit UEL: 7.6% LEL: 1.4%	**300**	--	inh abs ing con	irritation to eyes, skin, mucous membrane; dermatitis; headache; nausea; fatigue; dizziness; blurred vision; slurred speech; mental confusion; convulsion; if aspirated, chemical pneumonitis and pulmonary edema
TPHd Diesel	Middle Distillate Fuel Oil	Straw colored to dyed red with characteristc petroleum odor Flashpoint = 125 degrees Fahrenheit UEL: 10% LEL: 0.3%	**15****	--	inh abs ing con	Irritation to eyes, skin, nose, and throat, aspiration hazard if swallowed; headache; nausea; fatigue; dizziness; drowsiness; weakness, exhaustion
TPHmo Motor Oil	Oil mist (mineral)	Dark brown to black thick, oily, liquid with strong, tar-like, naphthalene odor. Flashpoint = 150.8 degrees Fahrenheit UEL: 5% LEL: 1%	**5 mg/m^3**	--	inh abs ing con	Irritation to eyes, skin, and respiratory tract, CNS depressant, severe skin irriations or dermatitis, headache, nausea, weakness, dizziness, sleepiness, loss of coordination, loss of consciousness, pulmonary aspiration hazard
Benzene	Benzol Phenyl hydride	Colorless to light-yellow liquid with a sweet aromatic odor (odor threshold 3 - 5 ppm) *(a solid below 42 degrees Fahrenheit)* Flashpoint = 12 degrees Fahrenheit UEL: 7.8% LEL: 1.2%	**1**	**500**	inh abs ing con	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression
tert-Butyl alcohol	tBA 2-Methyl-2propanol Trimethyl carbinol	Colorless solid or liquid with a camphor-like odor Flashpoint = 52 degrees Fahrenheit UEL: 8.0% LEL: 2.4%	**100**	**1600**	inh ing con	Irritation eyes, skin, nose; throat; drowsiness; narcosis
Toluene	Methyl benzene Methyl benzol Phenyl methane Toluol	Colorless liquid with a sweet, pungent, benzene-like odor (odor threshold ~8 ppm) Flashpoint = 40 degrees Fahrenheit UEL: 7.1% LEL: 1.1%	**10**	**500**	inh abs ing con	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

Table 1
Potential Chemical Hazards
Total Petroleum Hydrocarbon Constituents

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm)		ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS
			TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)		
Ethylbenzene	Ethylbenzol Phenylethane	Colorless liquid with an aromatic odor Flashpoint = 55 degrees Fahrenheit UEL: 6.7% LEL: 0.8%	**100**	**800**	inh ing con	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma
Xylenes meta (40-65%) ortho (15-20%) para (<20%)	1,2-Dimethylbenzene xylol methyl toluene	Colorless liquid with an aromatic odor (odor threshold ~0.5 ppm) *(p-xylene a solid below 56 degrees Fahrenheit)* Flashpoint = 81-90 degrees Fahrenheit UEL: 6.7 - 7.0% LEL: 0.9 - 1.1%	**100**	**900**	inh abs ing con	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis
Methyl-tert Butyl Ether	MTBE	Liquid with an ether-like odor Flashpoint = -17 degrees Fahrenheit LEL: 1.6% LEL: 8.4%	**40**	**--**	inh abs ing con	Irritation to eyes, skin, mucous membrane

Notes: **Exposure limits are California OSHA values *(* unless noted otherwise). If California OSHA values were not available, then NIOSH RELs or ACGIH TLVs were listed.**
California OSHA Permissible Exposure Limit (CA PEL) - Legally required exposure limit.
* **NIOSH Recommended Exposure Limit (REL)** - Voluntary conservative exposure limit.
** **ACGIH Threshold Limit Value (TLV)** - Voluntary exposure limit (updated most frequently).

TWA = Time Weighted Average concentrations that must not be exceeded during any 8-hour workshift during a 40-hour workweek.
IDLH = Immediately Dangerous to Life or Health - a condition that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death, immediate or delayed permanent adverse health effects, or prevent escape from such an environment. EVERY EFFORT SHOULD BE MADE TO EXIT IMMEDIATELY!
Flashpoint = the temperature at which the liquid phase gives off enough vapor to flash when exposed to an external ignition source.
UEL = upper explosive (flammable) limit in air % by volume.
LEL = lower explosive (flammable) limit in air % by volume.
ppm = parts per million.

Table 1
Potential Chemical Hazards
Total Petroleum Hydrocarbon Constituents

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm)		ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS
			TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)		

Table 1
Potential Chemical Hazards
Volatile Organic Compounds

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm) TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)	ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS	TARGET ORGANS
Acetone	Dimethyl ketone Ketone propane 2-Propanone	Colorless liquid with a fragrant, mint-like odor. UEL: 12.8% LEL: 2.5%	**500**	**2,500**	inh ing con	Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eyes, skin, respiratory system, central nervous system
Benzene	Benzol Phenyl hydride	Colorless to light-yellow liquid with a sweet aromatic odor (odor threshold 3 - 5 ppm) *(a solid below 42 degrees Fahrenheit)* Flashpoint = 12 degrees Fahrenheit UEL: 7.8% LEL: 1.2%	**1**	**500**	inh abs ing con	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression	**CARCINOGEN** Eyes, skin, respiratory system, blood, central nervous system, bone marrow
Bromoform	Methyl tribromide Tribromomethane	Colorless to yellow liquid with a chloroform-like odor [Note: A solid below 47°F.] Noncombustible Liquid UEL: NA LEL: NA	**0.5**	**850**	inh abs ing con	Irritation eyes, skin, respiratory system; central nervous system depression; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys
2-Butanone	Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor. Flashpoint = 16 degrees Fahrenheit UEL(200°F): 11.4% LEL(200°F): 1.4%	**200**	**3,000**	inh ing con	Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eyes, skin, respiratory system, central nervous system
Carbon Disulfide	Carbon bisulfide	Colorless to faint-yellow liquid with a sweet ether-like odor. [Note: Reagent grades are foul smelling.] Flashpoint = -22 degrees Fahrenheit UEL: 50.0% LEL: 1.3%	**1**	**500**	inh abs ing con	Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	Central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system
Carbon Tetrachloride	Carbon chloride, Carbon tet, Freon® 10, Halon® 104, Tetrachloromethane	Colorless liquid with a characteristic ether-like odor. Noncombustible Liquid. UEL: NA LEL: NA	**2**	**200**	inh abs ing con	Irritation eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination	**CARCINOGEN** Central nervous system, eyes, lungs, liver, kidneys, skin

Table 1
Potential Chemical Hazards
Volatile Organic Compounds

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm)		ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS	TARGET ORGANS
			TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)			
Chlorobenzene	Benzene chloride Chlorobenzol MCB Monochlorobenzene Phenyl chloride	Colorless liquid with an almond-like odor. Flashpoint = 82 degrees Fahrenheit UEL: 9.6% LEL: 1.3%	**10**	**1,000**	inh ing con	Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eyes, skin, respiratory system, central nervous system, liver
Chloroform	Methane trichloride Trichloromethane	Colorless liquid with a pleasant odor. Noncombustible Liquid UEL: NA LEL: NA	**2**	**500**	inh abs ing con	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver	**CARCINOGEN** Liver, kidneys, heart, eyes, skin, central nervous system
Chloromethane	Methyl chloride Monochloromethane	Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations. Flammable Gas UEL: 17.4% LEL: 8.1%	**50**	**2,000**	inh con	Dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects	**CARCINOGEN** Central nervous system, liver, kidneys, reproductive system
Dibromochloromethane	Chlorodibromomethane	Colorless to yellow, heavy, nonflammable, liquids with a sweet odor	**--**		inh ing	Sleepiness	Central nervous system, liver, kidney
Dichlorodifluoromethane	Difluorodichloromethane Fluorocarbon 12 Freon® 12 Genetron® 12 Halon® 122 Propellant 12 Refrigerant 12	Colorless gas with an ether-like odor at extremely high concentrations. [Note: Shipped as a liquefied compressed gas.] Nonflammable Gas UEL: NA LEL: NA	**1000**	**15000**	inh con	Dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Cardiovascular system, peripheral nervous system
1,2-Dichlorobenzene	o-DCB ortho-Dichlorobenzene o-Dichlorobenzol	Colorless to pale-yellow liquid with a pleasant, aromatic odor. [herbicide] Flashpoint = 151 degrees Fahrenheit UEL: 9.2% LEL: 2.2%	**25**	**200**	inh abs ing con	Irritation eyes, nose; liver, kidney damage; skin blisters	Eyes, skin, respiratory system, liver, kidneys

Table 1
Potential Chemical Hazards
Volatile Organic Compounds

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm) TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)	ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS	TARGET ORGANS
1,4-Dichlorobenzene	p-DCB para-Dichlorobenzene Dichlorocide	Colorless or white crystalline solid with a mothball-like odor. [insecticide] Combustible Solid, but may take some effort to ignite. Flashpoint = 150 degrees Fahrenheit LEL: 2.5%	**10**	**150**	inh abs ing con	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury	**CARCINOGEN** Liver, respiratory system, eyes, kidneys, skin
1,1-Dichloroethane	Asymmetrical dichloroethane Ethylidene chloride 1,1-Ethylidene dichloride	Colorless, oily liquid with a chloroform-like odor. Flashpoint = 2 degrees Fahrenheit UEL: 11.4% LEL: 5.4%	**100**	**3,000**	inh ing con	Irritation skin; central nervous system depression; liver, kidney, lung damage	Skin, liver, kidneys, lungs, central nervous system
1,2-Dichloroethane	Ethylene dichloride Ethylene chloride Glycol dichloride	Colorless liquid with a pleasant, chloroform-like odor. Flashpoint = 56 degrees Fahrenheit UEL: 16% LEL: 6.2%	**1**	**50**	inh ing con abs	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage	**CARCINOGEN** Eyes, skin, kidneys, liver, central nervous system, cardiovascular system
1,1-Dichloroethene	1,1-DCE Vinylidene chloride 1,1-Dichloroethylene Vinylidene chloride Vinylidene dichloride	Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor. Flashpoint = -2 degrees Fahrenheit UEL: 15.5% LEL: 6.5%	**1**	**--**	inh abs ing con	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis	**CARCINOGEN** Eyes, skin, respiratory system, central nervous system, liver, kidneys
1,2-Dichloroethene	Acetylene dichloride cis-Acetylene dichloride trans-Acetylene dichloride sym-Dichloroethylene	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor. Flashpoint = 36-39 degrees Fahrenheit UEL: 12.8% LEL: 5.6%	**200**	**1,000**	inh ing con	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system
Ethylbenzene	Ethylbenzol Phenylethane	Colorless liquid with an aromatic odor Flashpoint = 55 degrees Fahrenheit UEL: 6.7% LEL: 0.8%	**100**	**800**	inh ing con	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system

Table 1
Potential Chemical Hazards
Volatile Organic Compounds

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm) TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)	ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS	TARGET ORGANS
Methylene Chloride	Dichloromethane Methylene dichloride	Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.] UEL: 23% LEL: 13%	**25**	**2,300**	inh con	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea	**CARCINOGEN** Eyes, skin, cardiovascular system, central nervous system
Methyl-tert Butyl Ether	MTBE	Liquid with an ether-like odor Flashpoint = -17 degrees Fahrenheit LEL: 1.6% LEL: 8.4%	**40**	**--**	inh abs ing con	Irritation to eyes, skin, mucous membrane	Central nervous system, skin, liver, kidneys, reproduction defects
Naphthalene	Naphthene mothballs tar camphor naphthalin white-tar	Colorless to brown solid with an odor of mothballs. Flashpoint = 174 degrees Fahrenheit UEL: 5.9% LEL: 0.9%	**0.01**	**250**	inh abs ing con	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system
Tetrachloroethene	Perchlorethylene Perchloroethylene Perk Tetrachlorethylene PCE	Colorless liquid with a mild, chloroform-like odor. UEL: NA LEL: NA	**25**	**150**	inh abs ing con	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage	**CARCINOGEN** Eyes, skin, respiratory system, liver, kidneys, central nervous system
Toluene	Methyl benzene Methyl benzol Phenyl methane Toluol	Colorless liquid with a sweet, pungent, benzene-like odor (odor threshold ~8 ppm) Flashpoint = 40 degrees Fahrenheit UEL: 7.1% LEL: 1.1%	**10**	**500**	inh abs ing con	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys
1,1,1-Trichloroethane	Chlorothene Methyl chloroform	Colorless liquid with a mild, chloroform-like odor.	**350**	**700**	inh ing con	Irritation eyes, skin; headache, lassitude (weakness, exhaustion) central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, central nervous system, cardiovascular system, liver
Trichloroethene	Trychloroethylene Ethylene trichloride TCE Trichloroethene Trilene	Clear colorless liquid with a sweet odor UEL(77°F): 10.5% LEL(77°F): 8%	**25**	**1,000**	inh abs ing con	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury	**CARCINOGEN** Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Table 1
Potential Chemical Hazards
Volatile Organic Compounds

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm)		ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS	TARGET ORGANS
			TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)			
Trichlorofluoroethane	Freon® 11 Monofluorotrichloromethane Refrigerant 11 fluorotrichloromethane trichloromonofluoromethane	Colorless to water-white, nearly odorless liquid or gas (above 75°F). Noncombustible Liquid Nonflammable Gas UEL: NA LEL: NA	**1000**	**2000**	inh ing con	Incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Skin, respiratory system, cardiovascular system
1,1,2-Trichloro-1,2,2-trifluoro-ethane	Chlorofluorocarbon-113, CFC-113, Freon® 113, Genetron® 113, Halocarbon 113, Refrigerant 113, TTE	Colorless to water-white liquid with an odor like carbon tetrachloride at high concentrations. [Note: A gas above 118°F.] Noncombustible Liquid at ordinary temperatures. UEL: NA LEL: NA	**1000**	**2000**	inh ing con	Irritation skin, throat, drowsiness, dermatitis; central nervous system depression; in animals: cardiac arrhythmias, narcosis	Skin, heart, central nervous system, cardiovascular system
1,2,4-Trimethylbenzene	Asymmetrical trimethylbenzene psi-Cumene Pseudocumene	Clear, colorless liquid with a distinctive, aromatic odor. Flashpoint = 112 degrees Fahrenheit UEL: 6.4% LEL: 0.9%	**25**	**--**	inh ing con	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, fatigue, dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system, blood
1,3,5-Trimethylbenzene	Mesitylene Symmetrical trimethylbenzene sym-Trimethylbenzene	Clear, colorless liquid with a distinctive, aromatic odor. Flashpoint = 122 degrees Fahrenheit	**25**	**--**	inh ing con	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system, blood
Vinyl Chloride	Chloroethene Chloroethylene Ethylene monochloride Monochloroethene Monochloroethylene VC	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. Flammable gas UEL: 33.0% LEL: 3.6%	**1**	**--**	inh con	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite	**CARCINOGEN** Liver, central nervous system, blood, respiratory system, lymphatic system

Table 1
Potential Chemical Hazards
Volatile Organic Compounds

CHEMICAL	SYNONYMS & TRADE NAMES	PROPERTIES	EXPOSURE LIMITS (ppm)		ROUTES OF EXPOSURE	SYMPTOMS / HEALTH EFFECTS	TARGET ORGANS
			TWA (8-hour workshift 40-hour week)	IDLH (exit immediately)			
Xylenes meta (40-65%) ortho (15-20%) para (<20%)	1,2-Dimethylbenzene xylol methyl toluene	Colorless liquid with an aromatic odor (odor threshold ~0.5 ppm) *(p-xylene a solid below 56 degrees Fahrenheit)* Flashpoint = 81-90 degrees Fahrenheit UEL: 6.7 - 7.0% LEL: 0.9 - 1.1%	**100**	**900**	inh abs ing con	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Notes: **Exposure limits are California OSHA values (unless noted otherwise). If California OSHA values were not available, then NIOSH RELs or ACGIH TLVs were listed.**
California OSHA Permissible Exposure Limit (CA PEL) - Legally required exposure limit.
* **NIOSH Recommended Exposure Limit (REL)** - Voluntary conservative exposure limit.
** **ACGIH Threshold Limit Value (TLV)** - Voluntary exposure limit (updated most frequently).

TWA = Time Weighted Average concentrations that must not be exceeded during any 8-hour workshift during a 40-hour workweek.
IDLH = Immediately Dangerous to Life or Health - a condition that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death, immediate or delayed permanent adverse health effects, or prevent escape from such an environment. EVERY EFFORT SHOULD BE MADE TO EXIT IMMEDIATELY!
Flashpoint = the temperature at which the liquid phase gives off enough vapor to flash when exposed to an external ignition source.
UEL = upper explosive (flammable) limit in air % by volume.
LEL = lower explosive (flammable) limit in air % by volume.
ppm = parts per million.
- - = no value available.

inh = inhalation
abs = absorption
ing = ingestion
con = skin and/or eye contact

Table 2
Action Levels for Air Quality Monitoring

- Monitor breathing zone continuously during the project while disturbing potentially contaminated soil (i.e., drilling, excavating, sampling etc.) and/or groundwater (i.e., sampling). **Monitor at least every 10 to 15 minutes in the breathing zone. Sample at the exclusion zone boundaries every 30 minutes.**
- The level for work stoppage indicated below is that concentration at which work on the job must stop. Determine why exposures have reached that concentration and how they can be reduced. Site evacuation is not necessary at this level. Implement engineering controls to reduce the concentration, then resume work.
- These values can be modified with particular knowledge of contaminants and site conditions. Contact Health and Safety Director, Mark Labrenz to discuss.

Chemical or Class of Chemicals	Monitoring Equipment	Breathing Zone Action Level	Required Action
Total VOCs (TPH gasoline sites)	PID, FID, OVM Photoionization Detector Flame ionization Detector Organic Vapor Meter	**Concentration > 20 ppm above background for 5 minutes**	**-Stop work.** -Notify Project Manager. -Evaluate engineering controls to reduce exposures (e.g., fans). -Evaluate PPE, work procedures, and engineering controls to reduce exposures.
Total VOCs (**NOT** TPH gasoline sites)	PID, FID, OVM Photoionization Detector Flame ionization Detector Organic Vapor Meter	**Concentration > 5 ppm above background for 5 minutes**	-Use colorimetric tube to monitor for specific VOCs with PEL<5ppm at 10-15 minute intervals (see below). -Evaluate work procedures. -Evaluate engineering controls to reduce exposures (e.g., fans).
VOCs, where Detectable<PEL<5ppm Potential Chemicals: 1. Benzene 2. Vinyl Chloride	Colorimetric Tube Chemical Detector Tube	Concentration > PEL Ceiling or STEL (see Table 2) 1. 1 ppm 2. 1 ppm	If detected, continue PID monitoring and -Monitor using colorimetric tubes for chemical at 5 minute intervals. If present in 3 consecutive readings, **-Stop work.** -Notify Project Manager. -Evaluate PPE, work procedures, and engineering controls to reduce exposures.

Table 2
Action Levels for Air Quality Monitoring

Chemical or Class of Chemicals	Monitoring Equipment	Breathing Zone Action Level	Required Action
Total VOCs (**NOT** TPH gasoline sites)	PID, FID, OVM Photoionization Detector Flame ionization Detector Organic Vapor Meter	**Concentration > 10 ppm above background for 5 minutes**	-Use colorimetric tube to monitor for specific VOCs with PEL<elevated PID reading at 10-15 minute intervals (see below). -Evaluate work procedures. -Evaluate engineering controls to reduce exposures (e.g., fans).
VOCs, where PEL>5ppm	Colorimetric Tube Chemical Detector Tube	Concentration > PEL (see Table 2)	If detected, continue PID monitoring and -Monitor using colorimetric tubes for chemical at 5 minute intervals. If present in 3 consecutive readings, **-Stop work.** -Notify Project Manager. -Evaluate PPE, work procedures, and engineering controls to reduce exposures.
		Concentration > PEL (Ceiling Level or STEL) (see Table 2)	**-Stop work.** -Notify Project Manager. -Evaluate PPE, work procedures, and engineering controls to reduce exposures.
Total VOCs	PID, FID, OVM Photoionization Detector Flame ionization Detector Organic Vapor Meter	**Concentration > 50 ppm above background for 5 minutes**	**-Stop work.** -Notify Project Manager. -Evaluate PPE, work procedures, and engineering controls to reduce exposures.
Combustible Atmosphere	Combustible Gas Indicator CGI	**Concentration > 10% of the LEL (lower combustible limit)**	**-Stop work.** -Notify Project Manager. -Evaluate PPE, work procedures, and engineering controls to reduce exposures.

1.0 INTRODUCTION

The Source Group, Inc. (SGI) has prepared this Site Health and Safety Plan (HASP; the "Plan") on behalf of Defense Logistics Agency – Energy (DLA Energy). This HASP addresses site safety issues associated with planned activities at the Defense Fuel Support Point (DFSP) - Norwalk located at 15306 Norwalk Blvd., Norwalk, CA 90650 (the Site, Figure 1). The Site activities are to be performed by SGI personnel and its subcontractors. In this HASP, the term "subcontractors" refers to subcontractors under contract with SGI. This Site HASP has been developed for the use of SGI personnel and its subcontractors, and is specific to the tasks being conducted by SGI.

1.1 Purpose

The primary purpose of this HASP is to provide SGI and subcontractor personnel with an understanding of the potential physical and chemical hazards that exist or may arise during Site activities. Additionally, the information contained herein will define the safety precautions necessary to respond to such hazards should they occur.

1.2 Objective

The primary objective is to ensure the well being of all field personnel and the community surrounding the Site. In order to accomplish this, project staff and approved subcontractors shall acknowledge and adhere to the policies and procedures established herein.

2.0 PROJECT PERSONNEL

SGI and subcontractor personnel will act in accordance with applicable federal, state, regional, and local regulations during all phases of the project. All subcontractor personnel working on the Site are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. At the time of job assignment, special training will be provided to Site personnel who may be exposed to unique or special hazards. The training and medical requirements and responsibilities for Site personnel are discussed below.

All subcontractor personnel assigned to this project shall have appropriate training and medical clearance. The subcontractor supervisor or manager is required to sign the Subcontractor Training and Medical Clearance Record Form (Appendix A). Subcontractor personnel without proper training and medical clearance will not be allowed to work on the Site.

2.1 SGI Key Personnel

Each person on the Site has responsibility for their own health and safety, as well as assisting others in carrying out the HASP. Any person observed to be in violation of the HASP should be assisted in complying with the HASP, or reported to the Site Health and Safety Coordinator. Any Site personnel may shut down field activities if there is a real or perceived immediate danger to life or health or the environment.

The implementation of health and safety protective measures at the Site will be an integrated effort among the SGI Project Manager, the appointed Site Health and Safety Coordinator, and the Health and Safety Director. The specific personnel that will fill these roles for this project are identified below.

Project Manager: .... Neil Irish

Site Health and Safety Coordinator:..... Paul Parmentier

Health and Safety Director: .... Mark Labrenz, CHG

2.1.1 Project Manager

The Project Manager is, by definition, the individual who has primary responsibility for ensuring health and safety compliance on this project. The Project Manager, therefore, is ultimately responsible for implementing the requirements of this HASP. Some of the Project Manager's specific responsibilities include:

- Ensuring all SGI employees training and medical clearances are confirmed.

- Ensuring that subcontractor personnel assigned to this project have appropriate training and medical clearance. The subcontractor supervisor or manager is required to sign the Subcontractor Training and Medical Clearance Record Form (Appendix A).
- Verifying all utility clearances.
- Maintaining regular communication with the Site Health and Safety Coordinator.

2.1.2 Site Health and Safety Coordinator

The Site Health and Safety Coordinator is responsible for enforcing the requirements of this HASP once Site work begins and has the authority to immediately correct all situations where noncompliance with this HASP is noted, including the immediate stoppage of work in cases where an immediate danger is perceived. Some of the Site Health and Safety Coordinator's specific responsibilities include:

- Ensuring that all Site personnel (SGI, subcontractor, visitor) have read and understand this HASP and have completed the HASP Acknowledgement and Agreement Form (Appendix B).
- Conducting a tailgate safety meeting (Appendix C) for all Site personnel (SGI, subcontractor, visitor), prior to performing work at the Site each day, apprising them of the contents of the HASP and potential site-specific hazards.
- Assuring that sufficient personal protective equipment (PPE), as required by this HASP, is available at the Site.
- Calibrating air monitoring instrumentation, performing air monitoring, and maintaining air monitoring logs, if required.
- Setting up and maintaining the personnel decontamination facility.
- Notifying the Project Manager of any noncompliance situations.
- Supervising and monitoring the safety performance of all personnel to ensure that required health and safety procedures are followed, and correcting any deficiencies.
- Conducting near miss and incident investigations and preparing appropriate reports (Appendix D).
- Initiating and supervising emergency response procedures.

2.1.3 Health and Safety Director

The Health and Safety Director is the individual responsible for the interpretation and modification of the HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the Project Manager or the Site Health and Safety Coordinator without the approval of the Health and Safety Director. Some of the Health and Safety Director's specific responsibilities include:

- Advising the Project Manager and Site Health and Safety Coordinator on matters relating to health and safety on this project.
- Coordinating field audits to monitor the effectiveness of this HASP and to assure compliance with it.
- Supporting the Project Manager as needed to evaluate site conditions and new information that might require modifications to the HASP.

2.2 Minimum Training, Respirator Fit-Testing, and Medical Surveillance Requirements for SGI Personnel and Subcontractors

The following certifications and testing represent the minimum requirements for SGI personnel and subcontractors involved in this field project:

- 40 hr. Hazardous Waste Operations Training (HAZWOPER) 29CFR1910.120.
- 8 hr. Annual HAZWOPER Refresher Training (current).
- 8 hr. Supervisor HAZWOPER Training for Site Health and Safety Coordinator.
- Annual Respirator Fit Testing.
- Annual Medical Clearance and Respirator Clearance by a physician.

2.3 Site Visitor

Occasionally, visitors may arrive at the Site during field activities. In general, most visitors can be accommodated by providing a viewing area in a safe location away from the active work zones and presenting a briefing conducted by the Site Health and Safety Coordinator. All visitors will sign into the Site. All visitors will read, understand, and sign the Health and Safety Acknowledgement and Agreement Form (Appendix B), acknowledging they have read and understand the HASP.

In some instances, visitors may require access to restricted zones of the Site. If a visitor desires access to the Site, the Site Health and Safety Coordinator will make arrangements for entry. The required level of PPE within the exclusion area will be strictly adhered to. Visitors must be escorted at all times. Visitors who cannot show proof of the required documentation of employee training and participation in a medical monitoring program as mandated by California Occupational Safety and Health Administration (CAL-OSHA) will not be allowed access to the exclusion areas. If respiratory protection is required, the visitor must furnish their own, and the respirator type must match the specifications detailed in this HASP.

If a workable, safe arrangement cannot be agreed upon, or if the activities or presence of the visitor have the potential to affect safety of personnel, subcontractors or Site activities, the Site Health and Safety Coordinator should immediately contact the Project Manager, who may decide to stop work activities immediately.

3.0 GENERAL HEALTH AND SAFETY PROCEDURES

The following items outline the general health and safety procedures to be followed:

- The minimum level of personal protective equipment (PPE) to be worn includes safety glasses, hard hat, shirt, long pants, and steel-toed boots. Other PPE may be required such as gloves, hearing protection or respirator. Refer to Section 4.2 for Task-Specific PPE.
- Underground Utility Clearance will be completed prior to beginning any work that may impact subsurface work.
- The Site Health and Safety Coordinator is responsible to ensure that the health and safety plan procedures are followed. Any subcontractor or other person subject to the plan will be dismissed for failure to comply.
- Daily tailgate safety meetings will be held by the Site Health and Safety Coordinator.
- All personnel who will be working in the contamination control zone will undergo an industrial hygiene baseline medical examination before commencing work. This requirement does not apply to individuals who have taken the examination during the last 12 months.
- The same personnel must be fitted and fully instructed on the use of respirators prior to starting work. Beards or other facial hair that interfere with respirator fit are prohibited for those individuals who may be required to use respiratory protection.
- Hearing protection in the form of disposable earplugs will be worn around heavy equipment, machinery, or when two individuals five feet or less apart need to shout to be heard.
- Potable water must always be available at the Site.
- Hands must be thoroughly washed upon leaving the work area and before eating, drinking, or other activities.
- If toilet facilities are not located within a 5-minute walk from the decontamination facilities, either provide a chemical toilet and hand washing facilities or have a vehicle available (not the emergency vehicle) for transport to nearby facilities.
- Establish Exclusion Zone, and set up Contamination Reduction Zone and Support Zone when upgrading to Level C.
- If necessary, provide dust control by spraying or misting soils with water or a surfactant/water solution. Ensure proper volume is used to avoid run-off.
- Perform regular air monitoring in working zone.
- Use ground fault circuit interrupters for plug-in electrical devices and extension cords.

- Be aware of tripping hazards with extension cords, tools, hoses, augers, etc.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer of materials is prohibited in the work areas.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, mud and other discolored surfaces; do not kneel on ground; do not lean, sit or place equipment on drums, containers, vehicles or the ground which are contaminated or being used to store or handle contaminated material. Try to remain upwind when collecting samples, venting wells, etc. It is important to avoid contact with chemicals.
- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel where the potential for adsorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician.
- Non-disposable safety gear and equipment should be cleaned before taken offsite. Equipment that comes in contact with contaminated soil or liquids will be cleaned and placed in designated areas or containers.
- SGI and subcontractor personnel shall be responsible for good housekeeping. The work area shall be kept clean as possible during the course of field activities. It is absolutely required that the area be left in a safe condition when leaving for the day as certain areas could be subject to traffic during the nights and weekends. All work areas will be provided with flashing barricades, fencing and/or other appropriate safety measures to prevent unauthorized entry.
- Before any machinery or electrical equipment is placed in use, it shall be inspected by a competent person to be in a safe operating condition. If the machinery or electrical device is not found to be in a safe operating condition or develops a problem, it shall be tagged "out of service", removed from the Site and not used until the problem(s) is/are corrected.
- Subcontractor personnel at the Site will abide by applicable safety standards for their associated work.
- Subcontractor personnel will perform daily inspections at the Site to insure compliance with this HASP.
- The number of individuals involved in the field operations should be kept to an appropriate level. Observers should stand a safe distance upwind of the project activities. No observers are allowed in these areas unless they are wearing OSHA/NIOSH approved hard hats, appropriate safety glasses and other protective equipment.

4.0 PROJECT HAZARD ANALYSIS

Chemical and physical hazards that may be encountered during site activities are outlined below according to each Task.

HAZARD	Task 1	Task 2	Task 3	Task 4	Task 5
	Groundwater Monitoring & Sampling	Soil Investigation	Soil Gas Investigation	Groundwater Well Drilling	LNAPL Removal
PPE REQUIRED	D	D	D	D	D
PHYSICAL HAZARDS	**APPLICABILITY**				
Biological (spiders, poison ivy, human fecal matter)	X	X	X	X	X
Confined space	N/A	N/A	N/A	N/A	N/A
Electrical	X	X	X	X	X
Equipment hazards: Geoprobe, Drilling, Excavation, Machinery	X	X	X	X	X
Exposure (heat or cold)	X	X	X	X	X
Fire / Explosion	X	X	X	X	X
Mechanical/Moving parts	X	X	X	X	X
Noise	X	X	X	X	X
Oxygen deficiency	X	X	X	X	X
Radiation (ionizing or non-ionizing)	X	X	X	X	X
Stored energy (i.e., pressurized pipe/lines)	X	X	X	X	X
Traffic	X	X	X	X	X
Utilities: overhead / underground	X	X	X	X	X
Work surfaces	X	X	X	X	X
Holes/Ditches	X	X	X	X	X
Steep grades	X	X	X	X	X
Slippery surfaces	X	X	X	X	X
Uneven terrain	X	X	X	X	X
Unstable surfaces	X	X	X	X	X
Elevated work surfaces	X	X	X	X	X
CHEMICAL HAZARDS	**HAZARD RATING**				
VOC-containing groundwater	X	X	X	X	X
VOC containing vapors	X	X	X	X	X
Compressor oil	X	X	X	X	X

HAZARD	Task 5 System O&M	Task 6 Excavation/ Disposal/ Backfill	Task 7 ISCO
PPE REQUIRED	D	D	D
PHYSICAL HAZARDS	**APPLICABILITY**		
Biological (spiders, poison ivy, human fecal matter)	X	X	X
Confined space	N/A	N/A	N/A
Electrical	X	X	X
Equipment hazards: Geoprobe, Drilling, Excavation, Machinery	X	X	X
Exposure (heat or cold)	X	X	X
Fire / Explosion	X	X	X
Mechanical/Moving parts	X	X	X
Noise	X	X	X
Oxygen deficiency	X	X	X
Radiation (ionizing or non-ionizing)	X	X	X
Stored energy (i.e., pressurized pipe/lines)	X	X	X
Traffic	X	X	X
Utilities: overhead / underground	X	X	X
Work surfaces	X	X	X
Holes/Ditches	X	X	X
Steep grades	X	X	X
Slippery surfaces	X	X	X
Uneven terrain	X	X	X
Unstable surfaces	X	X	X
Elevated work surfaces	X	X	X
CHEMICAL HAZARDS	**HAZARD RATING**		
VOC-containing groundwater	X	X	X
VOC containing vapors	X	X	X
Compressor oil	X	X	X

Innumerable tasks will be carried out during future Site activities. The potential for unknown hazards cannot be eliminated. Hazards can exist for all exposure routes; such as, inhalation, dermal contact, ingestion, and eye contact.

The identified and anticipated physical hazards listed above, which may be encountered during the Site activities are described in Appendix F. Prior to conducting any soil invasive site activities, SGI will make all attempts to identify existing underground utilities in the areas surrounding the activity. The Utility Clearance Log/Map is available in Appendix G.

The job safety analysis (JSA) presents a table that identifies job steps, PPE, potential hazards, and critical actions for tasks associated with a specific Site activity. Applicable JSAs are provided in Appendix E of this Site HASP. Potential PPE upgrade required for this job is listed in Section 4.2.

4.1 Chemical Hazards

Contaminants of concern at the Site are summarized in the following table.

Substance	Source of Sample	Maximum Sample Concentration (mg/kg / µg/L)
Total Petroleum Hydrocarbons	Soil	61,000 ppm
Benzene	Soil	570,000 ppb
Arsenic	Groundwater	25 mg/L
Total Petroleum Hydrocarbons as Gasoline	Groundwater	120,000 µg/L
Total Petroleum Hydrocarbons as Diesel	Groundwater	140,000 µg/L
Benzene	Groundwater	17,000 µg/L
1,2-Dichloroethane (DCA)	Groundwater	16 µg/L
MtBE	Groundwater	32,000 µg/L
Tertiary-Butyl Alcohol (TBA)	Groundwater	210,000 µg/L

Reference: *Parson's Second Semiannual 2013, Groundwater Monitoring Report, DFSP-Norwalk* dated February 14, 2014. **Free product was observed in 31 of the 166 wells measured during the second 2013 semiannual monitoring event**

Potential effects of any exposure are dependent on several factors; such as, toxicity of a chemical, exposure duration, concentration of chemical producing the exposure, general health of person exposed, and individual use of hazard reduction methods. The exposure limits, physical descriptions, and toxicological effects for contaminants of concern at the Site are presented in Table 2 at the beginning of this HASP.

4.2 Task-Specific Personnel Protective Equipment (PPE) Requirements

4.2.1 Level D

- Safety glasses, hard hat, disposable ear plugs, shirt, pants, and steel-toe boots. For contact with moist soil or liquid:
- Gloves: Latex or Nitrile Standard leather gloves if no direct contact with soil.

- Chemical resistant boots or boot covers: Chemical resistant boots if contacting liquids or moist soil.
- Dirt & Dust protection: Tyvek coveralls (optional).

4.2.2 Level C / Level D Modified

- Air-purifying Respirator (Half- or Full-Face): North full or half face or equivalent (Level C).
- Cartridges: Organic Vapors / Acid gas / HEPA.
- Gloves: Inner: Latex; Outer: Nitrile / Solvex / Gauntlet.
- Chemical resistant boots or boot covers: PVC boot covers.
- Dust & Dirt/Chemical resistant suit: Tyvek coveralls.
- Other: Hard hat and safety glasses/goggles, steel toed boots, hearing protection.

Maintenance and decontamination of respiratory protection is discussed in Sections 6.0 and 8.0, respectively.

4.2.3 Level B

Level B personal protection is required in the area where maximum respiratory protection (i.e., supplied air) is required; however, there is a low probability of dermal toxicity. The use of Level B is not anticipated at the Site.

4.2.4 Level A

Level A personal protection is required in the areas where maximum respiratory, skin, and eye protection are required. The use of Level A is not anticipated at the Site.

5.0 AIR MONITORING

Whenever work is performed that might generate gases, organic vapors, dusts, fumes, mists, or other airborne hazardous materials, air monitoring will be conducted. Breathing zone air monitoring will be conducted periodically throughout the day while work is being performed under above conditions, and results will be documented (see Appendix H). The following instruments may be used to monitor air quality:

- Photoionization Detector (PID) – It will be used to detect trace concentrations of certain organic gases and a few inorganic gases in the air. The PID detects mixtures of compounds simultaneously. PID readings do not measure concentrations of any individual compound when a mixture of compounds is present. The PID will serve as the primary instrument for personnel exposure monitoring.
- Colorimetric Tubes - Colorimetric tubes may be employed in the field to assess for the presence of individual VOCs. Colorimetric tube use will be determined on a project specific basis.
- Combustible Gas Indicator/Oxygen – During operations involving known combustible materials (e.g., free product) or operations conducted in an oxygen deficient environment (e.g., confined space), an approved Combustible Gas Indicator/Oxygen Meter and/or a four gas meter will be used to measure the concentration of flammable vapors and gases and oxygen in the air during field activities. Flammable gas concentrations are measured as percentages of the Lower Explosive Limit (LEL). Oxygen content is measured as a percentage of air.

All equipment should be calibrated and maintained in accordance with the Equipment Calibration and Maintenance table in Appendix H. Air monitoring performed as part of health and safety measurements should be logged on the Air Monitoring Log in Appendix H.

Table 2 presents the action levels for air quality monitoring. As data is collected, work procedures, engineering controls, and PPE will be evaluated.

6.0 MAINTENANCE AND CALIBRATION OF EQUIPMENT

6.1 Respiratory Protection

Respirators can be used to prevent dust and chemical exposure during Site activities. Respirators will be cleaned daily according to procedures described below. Cartridges will be replaced when conditions dictate or when breakthrough is detected while in use. Breakthrough for high efficiency particulate air (HEPA) cartridges will be determined by an increased resistance to breathing. All employees will be fit tested according to CCR Title 8 Section 5144 prior to working at the Site. The following checks will be performed daily, in addition to the above:

- Exhalation valve – pull off plastic cover and check valve for debris or for tears in the neoprene valve, which could cause leakage.
- Inhalation valves – screw off both cartridges and visually inspect neoprene valves for tears. Make sure that the inhalation valves and cartridge receptacle gaskets are in place.
- Make sure a protective lens cover is in place (full-face respirator).
- Make sure you have the proper HEPA cartridges including additional cartridges in the event breakthrough occurs with the initial pair.
- Make sure that the facepiece harness is not damaged. The serrated portion of the harness can fragment which will prevent proper face seal adjustment.
- Make sure the speaking diaphragm retainer ring is hand tight.

6.1.1 Respirator Leak Test

Test the respirator for leakage by using both the positive- and the negative-pressure method. Lightly place your palm over the exhalation valve cover. Exhale gently. The body of the respirator should bulge slightly outward from your face. If any leakage is detected around the face seal, readjust the head harness straps and repeat the test until there is no leakage. If leakage is detected other than in the face seal, the condition must be investigated and corrected before another test is made. The negative-pressure test must also be made. Lightly place your palms or some impervious material, like Saran Wrap® over the cartridges or filter holders. Inhale gently. The face-piece should collapse against the face. The respirator must pass these two tightness tests before the respirator is used. The respirator will not furnish protection unless all inhaled air is drawn through suitable cartridges or filters. Respirators will not provide protection in oxygen-deficient atmospheres.

6.1.2 Decontamination of Respirators

After respirator use, the following steps should be used to clean your respirator:

- Wash with mild soap and water solution or equivalent cleanser and brush gently. (This step will remove any soil/solid particulate matter that may have been collected on the respirator during field activities.)
- Rinse with distilled/de-ionized water, making sure the inhalation and exhalation valves are clean and unobstructed.
- Rinse with distilled/de-ionized water.
- Wipe with sanitizing solution. (This step will assure the sterility of the respirator.)
- Allow your respirator to air dry.
- Place the respirator inside a sealed bag or a clean area away from extreme heat, extreme cold, and dust.

6.2 Air Monitoring

Calibration and periodic maintenance will be required for air monitoring equipment. The methods and frequency for equipment calibration and maintenance are summarized in Appendix H.

7.0 SITE CONTROL MEASURES

7.1 Designation of Work Zones

Specific work zones are identified for projects where contaminated soils are exposed and may release their contaminants to the air, or come in contact with field personnel. To minimize the migration of contaminant from the Site to uncontaminated areas, the following three work zones will be set up:

- Zone 1 – Exclusion Zone
- Zone 2 – Contamination Reduction Zone
- Zone 3 – Support Zone

The Exclusion Zone is the area where contamination occurs or could occur. Initially, the Exclusion Zone should extend a distance of 25 feet from the edge of intrusive activity unless conditions at the Site warrant either a larger or smaller distance as determined by the Site Health and Safety Coordinator. All persons entering the Exclusion Zone must wear the applicable level of protection. It is anticipated that work zones will be established at each individual area of intrusive work rather than encompass the entire Site.

Between the Exclusion Zone and Support Zone is the Contamination Reduction Zone, which provides a transition between the contaminated and clean areas of the Site. The Contamination Reduction Zone will be located directly outside the Exclusion Zone. All personnel must decontaminate when leaving the Exclusion Zone. A Contamination Reduction Zone (decontamination area) will be established adjacent to each individual area of intrusive work.

The Support Zone is the area of the Site where significant exposure to contamination is not expected to occur during non-intrusive activities. The Support Zone is considered to be the “clean area” of the Site.

7.2 Confined Space Entry

Confined space entry is not anticipated as part of this scope of work. If needed in the future, confined space entry protocols will be described in an Appendix to this HASP and will require specific health and safety measures.

7.3 Emergency Exit

Evacuation routes will be discussed in the tailgate safety meeting. Based on the large size of the site, it is expected that during an emergency, field personnel will be able to re-locate on site at safe locations based on wind direction or physical hazards if access to the main access gate is limited.

In such cases, evacuate by the safest route available and decontaminate to the greatest extent possible.

8.0 DECONTAMINATION PROCEDURES

1. Personnel:
   - Wash face and hands with soap and water.
2. Sampling Apparatus:
   - Triple rinse in water; soapy water (Liquinox® or equivalent/tap water/de-ionized water.
3. Heavy Equipment (to be done by subcontractor):
   - Rinse with water, remove soil.
4. Level C Decontamination Stations (in order from the Exclusion Zone to Support Zone):
   - Wash and rinse outer garment, boots, and gloves;
   - Remove outer boots and gloves;
   - Change respirator cartridges (if returning to Exclusion Zone);
   - Remove inner gloves and outer garment;
   - Remove respirator; and
   - Clean hands and face.
5. The following equipment will be made available, or equivalent:
   - Emergency eyewash;
   - Soap/detergent solution and water rinse;
   - Soap gel or disposable wipes;
   - Disposable towels;
   - Plastic sheeting; and
   - Cleaning brushes and tubs.
6. Solid and liquid wastes:
   - Stored in properly labeled 55-gallon drums. Contaminated soil and groundwater will be disposed in accordance with the project specifications under the direction of the Project Manager.

9.0 EMERGENCY RESPONSE PLAN

The following sections describe the emergency response plan for safe and effective responses in the event of an emergency while performing Site activities.

9.1 Near Miss or Incident

If a near miss or incident occurs, take the following action:

- Notify the Site Health and Safety Coordinator immediately. The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting a Near Miss Report or Incident Report to the Health and Safety Director within 24 hours. Near Miss Report or Incident Report forms are available in Appendix D for use in the field at the time of the near miss or incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.

9.2 Injury or Illness

If an injury or illness occurs, take the following action:

- Summon for help. If emergency personnel (fire/ambulance) are necessary, call 911. If it makes sense to take an individual to the hospital, see Figure 3 for route to nearest hospital.
- Begin first aid for the person immediately. Use and complete the First Aid Assessment Form in Appendix D.
- Notify the Site Health and Safety Coordinator. The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting an Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. Incident Report forms are available in Appendix D for use in the field at the time of the incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.
- If a subcontractor employee is injured, the Subcontractor Supervisor or Manager will also complete their own injury/illness investigation and submit a copy of their report to SGI's Health and Safety Director as well.
- The Site Health and Safety Coordinator will assume charge during a medical emergency until more qualified emergency response personnel arrive at the Site.

In the event of a medical situation, NOT requiring an ambulance (i.e., minor lacerations, minor sprains, etc.):

- If necessary, transport the individual to the hospital for treatment; see Figure 3 for route to nearest hospital.

- A representative of SGI should always drive the injured employee to the hospital and remain at the facility until the employee is ready to be released. For subcontractor employees, a representative of the subcontractor should accompany the injured subcontractor employee to the hospital.

In the event of a medical situation, requiring an ambulance (i.e., severe head injuries, amputations, heart attacks, etc.):

- Call 911.
- Administer first aid until an ambulance arrives. Use and complete the First Aid Assessment Form in Appendix D.
- A representative of SGI should always accompany the injured employee to the hospital and remain at the facility until final diagnosis and other relevant information is obtained. For subcontractor employees, a representative of the subcontractor should accompany the injured subcontractor employee to the hospital.

In either situation, if the Site Health and Safety Coordinator leaves the Site to accompany an injured employee, arrangements must be made to have another SGI employee to act as the temporary Site Health and Safety Coordinator.

9.3 Local Emergency and Project Telephone Numbers

See Project Telephone Numbers at the beginning of this HASP. These numbers also include emergency response numbers.

9.4 Emergency Medical Treatment and First Aid Procedures

Emergency medical treatment or First Aid may be administered at the Site by the Site Health and Safety Coordinator or other personnel who have been certified in first aid. Use and complete the First Aid Assessment Form in Appendix D.

General emergency medical and first aid procedures are as follows:

- Assess the situation.
- Get medical assistance, if necessary and/or call 9-1-1.
- Attend to the injured person(s). Render first aid as needed; decontaminate affected personnel, if necessary.
- Do not move a seriously injured person unless it is necessary to protect them from further danger.
- Stay calm and lend a hand to others in need.

- Call an ambulance for transport to local hospital immediately if necessary.
- Evacuate other personnel at the Site to safe places until the Site Health and Safety Coordinator determines that it is safe for work to resume.
- The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting an Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. Incident Report forms are available in Appendix D for use in the field at the time of the incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.

9.5 Decontamination Procedures during an Emergency

Decontamination of an injured or exposed worker or during a Site emergency should be performed only if decontamination does not interfere with essential treatment or evacuation. If a worker has been injured or exposed and decontamination can be done, then wash, rinse, and/or cut off protective clothing and equipment.

If a worker has been injured or exposed and cannot be decontaminated, then perform the following tasks:

- Wrap the victim in blankets or towels to reduce contamination of other personnel;
- Alert emergency and offsite medical personnel to potential contamination; and
- Have the Site Health and Safety Coordinator or other personnel familiar with the incident and contaminants at the Site accompany the victim to the hospital. If possible, send a copy of the appropriate Material Safety Data Sheets (MSDSs) with the victim.

9.6 Directions to the Hospital from the Site

The route and directions to the nearest local hospital from the Site are illustrated in Figure 3.

9.7 Spill Control

To minimize the potential for spills, proper handling of chemicals and fluids is important. The primary risk for spills will come from accumulated knock-out water consisting of water entrained in the vapor stream, water condensed out of the vapor stream and investigative-derived waste consisting of water generated from the decontamination of equipment and purge water associated with field activities. Knock-out, purge and decontamination water will be stored onsite in 55-gallon drums, therefore proper drum handling practices is crucial in the prevention of accidental spills. To minimize the potential for spills to occur, workers will adhere to the hazard mitigator for drum handling and to the requirements of 8 CCR 5192(j). Drum hazard mitigators are as follows:

- Use only drums and containers that meet the appropriate DOT, OSHA, U.N. and EPA regulations;
- Be aware of the potential hazards of the contents of drums or containers before handling;
- Inspect the integrity of the drum or container before moving. Any drum or container lacking integrity shall be over-packed;
- Consider any unlabeled drum or container containing hazardous substance and leave alone until contents are properly identified and labeled;
- Organize site operations to minimize the amount of drum or container movement;
- Never stand on drums or containers;
- Know that bulging drums or containers are an indication of pressure build-up. Contact the Project Manager or Site Health and Safety Coordinator for guidance;
- Utilize drum/container handling equipment whenever possible. The equipment utilized should have a sufficiently rated load capacity, and should be able to operate smoothly on the available surface;
- Use proper lifting and moving techniques to prevent back injuries, if handling equipment is not available;
- Maintain a spill kit in the field vehicle or on-site including absorbent materials/pads for operations involving liquid drums;
- Wear leather gloves when handling drums or drum rings to avoid cuts or metal splinters. When liquid is present, nitrile gloves should be worn under the leather gloves;
- Have a clear view of the available pathway when moving drums. If needed, an additional person should be available to provide guidance;
- Set-up drum/container staging areas to safely identify and classify contents for proper shipment. Staging areas shall be provided with adequate ingress and egress routes;
- Label and identify drums and containers as to their contents when moved to the staging area, and;
- Utilize the Waste Tracking Inventory Form to document drums and other wastes stored on site.
- At least one ABC-type dry-chemical fire extinguisher and a first aid kit will be available onsite.
- Designate at least one vehicle for emergency use.

9.8 Emergency Spill Response

If a spill should occur, immediate measures will be taken to control spill runoff. Measures that may be taken include the use of absorbent pads or booms.

In the event of a release of hazardous materials, specific notification procedures should be followed. The remainder of this section provides important definitions and describes the notification procedures.

"Release" means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, unless permitted or authorized by a regulatory agency.

“Threatened release" means a condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment.

“Hazardous material” means any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or threatened hazard to human health and safety or to the environment, if released into the workplace or the environment.

In the event of a significant release or threatened release of hazardous materials, it must be reported IMMEDIATELY to the Project Manager or Principal-in-Charge. They will handle the appropriate reporting requirements. Be prepared to provide the Project Manager with the following information as State notification requirements for a spill or threatened release include:

- Identity of caller;
- Location, date and time of spill, release, or threatened release;
- Location of threatened or involved waterway or storm drains;
- Substance, quantity involved, and isotope if necessary;
- Chemical name (if known, it should be reported if chemical is extremely hazardous), and;
- Description of what happened.

The Project Manager should call the following:

- Client Contact for this Site
- California Emergency Management Agency (Cal EMA) 800-852-7550 Outside California call 916-845-8911
- If appropriate, 911 or Fire Department in the event of real or perceived immediate danger to life or health or the environment.

- If appropriate, California Highway Patrol for spills occurring on highways in the State of California

Upon receiving a report concerning a spill, unauthorized release, or other accidental release involving hazardous materials, the OES will immediately inform appropriate agencies.

Additional information on spill/release notification and reporting in California can be found on SGI's intranet at http:/www.intranet.thesourcegroup.net under "Safety Resources" or at the following website:
http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/Spill%20Notification%20Guide/$file/SpillNotif06.pdf.

APPENDIX A

SUBCONTRACTOR TRAINING AND MEDICAL CLEARANCE RECORD

SGI environmental THE SOURCE GROUP, INC.

SGI SUBCONTRACTOR TRAINING AND MEDICAL CLEARANCE RECORD

SGI Subcontractor: ____

Address: ____

Employees Assigned to Project: ____

____

I certify the above employees assigned to this project have received training, medical clearance, and respirator fit-testing according to the Health and Safety Plan and the Occupational Safety and Health Administration Standard on Hazardous Waste Operations and Emergency Response (29 CFR 1910.120). If any of these employees are injured, I will submit an incident report to the SGI Health and Safety Director within 24 hours.

Name: ____________________________ Signature: ________________________________

Title*: ____________________________ Date: ________________________________

*Subcontractor Supervisor or Manager only.

APPENDIX B

ACKNOWLEDGEMENT AND AGREEMENT FORM

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM
(SGI and SGI's subcontractor personnel must sign.)

I acknowledge I have reviewed a copy of the Site Health and Safety Plan for this project, understand it, and agree to comply with all of its provisions. I also understand I could be prohibited by the Site Health and Safety Coordinator or SGI personnel from working on this project for not complying with any aspect of this Site Health and Safety Plan:

Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date

APPENDIX C

TAILGATE SAFETY MEETING FORM

COMPLETE DAILY BEFORE FIELD OPERATIONS BEGIN

Date: ____________________ **Time:** ____________________ **Job Number:** 04-NDLA-003

Client: Defense Logistics Agency - Energy **Facility:** DFSP- Norwalk

Address: 15306 Norwalk Blvd., Norwalk, CA 90650

Specific Location: ____________________

Type of Work: ____________________

Special Equipment: ____________________

Chemicals Used: ____________________

MANDATORY SAFETY TOPICS:

❑	Emergency exit route and protocol	❑	Eye wash station locations	❑	Fire extinguisher locations
❑	First Aid, MSDS and PPE location	❑	Site safety plan review and location	❑	Public safety and fences

Protective Clothing Equipment: Level D

Chemical Hazards: TPH and benzene in soil. GRO, DRO, arsenic, benzene, and other VOCs in the groundwater.

Physical Hazards: Slips, trips, falls, uneven ground surface,

Emergency Procedures: CALL 911

Hospital / Clinic: Coast Plaza Hospital Phone: (562) 868-3751

Hospital Address 13100 Studebaker Road, Norwalk, CA 90650

Paramedic Name and Phone **911**

SITE SPECIFIC TOPICS:

❑	Manual lifting: strains / sprains	❑	Excavation / trenching	❑	Confined space entry
❑	Electrical hazards	❑	Noise Hazards	❑	Heat and cold stress
❑	Heavy Equipment / drill rigs	❑	Hot work permits	❑	Dust and vapor control
❑	Orderly site and housekeeping	❑	Portable tool safety and awareness	❑	Utility location
❑	Smoking in designated areas	❑	Decontamination procedures	❑	Stored energy
❑	Other:	❑	Other:	❑	Other:

Discussion/Comments/Follow-up Actions: ____________________

NAME	SIGNATURE	COMPANY

APPENDIX D

NEAR MISS AND INCIDENT REPORT FORMS

- **NEAR MISS REPORT FORM**
- **INCIDENT REPORT FORM**
- **FIRST AID ASSESSMENT FORM**

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NEAR MISS REPORT FORM

Date of Near Miss: ____________________

Employer (include SGI subcontractors)

Company Name: ____________________

Address: ____________________

City, State, Zip: ____________________

Project Name: ____________________

Project Number: ____________________

Employee (include SGI subcontractors)

First and Last Name: ____________________

Employment Status: ____________________

Near Miss Information

Where did near miss occur? (number, street, city, state, zip): ____________________

____

Other people affected in this event?: ____________________

Description of Near Miss (Explain exactly how and what happened): ____________________

____

____

____

Root Cause and Contributing Factors (Describe in Detail Why Near Miss Occurred)

1. ____________________

2. ____________________

Root Cause(s) Analysis (RCA) - Use proactively to avoid Near Misses.

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Uncontrollable.

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INCIDENT REPORT FORM

Date of Incident: ____________________

Time employee began work: ____________________

Time of event or exposure: ____________________

Incident Type

❑	Fatality	❑	Industrial Non-Recordable	❑	Spill/Leak	❑	General Liability
❑	Lost Workday (LW)	❑	Non-Industrial	❑	Product Integrity	❑	Criminal Activity
❑	LW Restricted Duty	❑	Off-the-Job Injury	❑	Equipment	❑	Notice of Violation
❑	OSHA Illness w/o LW	❑	Motor Vehicle Accident (MVA)	❑	Business Interruption	❑	First Aid
❑	Fire	❑		❑		❑	
❑		❑		❑		❑	

The investigation of the incident by the employee's supervisor or Site Health and Safety Coordinator must begin immediately. Human Resources and Corporate Health & Safety must be informed immediately and in no case longer than 24 hours after the incident. This report must be completed as soon as possible either on-line through SGI's intranet or by completing this hard copy. The hard copy must be reviewed and signed by the Principal and e-mailed or faxed to the Human Resources Manager, and Corporate Health and Safety, even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report to Human Resources within 24 hours of the initial exam and any subsequent exams.

Employer (include SGI subcontractors)

Company Name: ____________________

Address: ____________________

City, State, Zip: ____________________

Project Name: ____________________

Project Number: ____________________

Employee (include SGI subcontractors)

First and Last Name: ____________________

Home Address: ____________________

City, State, Zip: ____________________

Employment Status: ____________________

Date of Hire: ____________________

Injury or Illness Information

Where did incident occur? (number, street, city, state, zip): ________________________________

____

On Employer's premises: Yes or No: ____

Specific activity employee was engaged in when accident occurred: ______________________

____

All equipment, materials or chemicals employee was using when incident occurred (e.g., the machine employee struck against, the vapor inhaled or material swallowed, what employee was lifting, pulling, etc.): ____

____

Did employee lose at least one full shift's work?: ________________________________

Has employee returned to work?: ____

Date employer notified of incident: ______________________________________

To whom reported: ____

Other workers injured/made ill in this event?: ______________________________

Description of Incident: (Describe incident events fully. Tell exactly what and how it happened so that the incident could be recreated. Use back of form or extra paper if necessary):

____

____

____

Does this Accident involve a Motor Vehicle and a Professional Driver?: __________________

Does this incident involve a spill or a leak?: ________________________________

If so, material spilled and quantity: ______________________________________

Does this incident involve a third party?: ____________________________________

If so, name, address and phone number of third party: __________________________

Investigation Team Member Names and Job Titles: ______________________________

Reviewed by (Names and Job Titles): ______________________________________

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FIRST AID ASSESSMENT FORM

Date: ____________________

Victim's Name: ____

Company Name: ____

First Aid Responder's Name: ____

Vitals

TIME			
PULSE Normal: 60-100			
BREATHING Listen – Look			
BLOOD Fingernail color return test			
SKIN Temperature / Color			

Interview "P-Q-R-S-T"

Provoke (for example: what causes the pain? What makes it worse?): ____________________

____

Quality (sharp/dull/pressure): ____

Region / Radiates: ____

Severity (1 [low] to 10 [high]): ____________ Allergies: ____________________

Time (how long?): ____________________ Medical History: ____________________

What did victim last eat and when: ______________________________________

Head to Toe Check

Head (Skull, Ears, Eyes, Mouth): ______________________________________

Neck (Hand squeeze test – Foot press test): Stabilize neck immediately if test fails.

Chest: ____

Arms/Legs: ____

APPENDIX E

JOB SAFETY ANALYSIS

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Spill Prevention • Deploy dikes, berms and dams at storm drains or other such areas.	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required). •	1. Carrying heavy or bulky materials. 2. Body strains, sprains.	1a. Lift heavy objects using leg strength and proper posture 1b. Obtain assistance when lifting >50 lbs. - do not lift alone. 2a. Visually inspect work area for debris before leaving site - place in trash 2b. Uneven ground exists - maintain footing awareness
Spill Response • Using non-absorbent booms and squeegees, keep spilled solution from leaving jobsite through storm drains, ditches, etc. • Dike and dam released or spilled solution for recovery.	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; • APR with acid/gas cartridges	1. Carrying heavy or bulky materials. 2. Body strains, sprains. 3. Skin contact with solution.	1a. Lift heavy objects using leg strength and proper posture 1b. Obtain assistance when lifting >50 lbs. - do not lift alone 2a. Visually inspect work area for debris before leaving site - place in trash 2b. Uneven ground exists - maintain footing awareness 3a. Wear proper PPE to prevent contact with chemicals/solution while completing task. 3b. Use slow, deliberate movements to prevent excessive splashing/overspray or further contamination.
Spill Recovery • Recover dammed/diked material using vacuum after dilution. • Rinse spill/release area with clean water and recover liquid with vacuum. • Transfer recovered material from vacuum to 55 GAS drum for disposal or for re-injection.	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; • APR with acid/gas cartridges	1. Inhalation of vapor / mist generated with vacuum. 2. Splash of recovered material onto body/face.	1a. Wear proper PPE to prevent contact with chemicals/solution while completing task. 1b. If presence of mist is observed, don purified air respirator equipped with proper filter cartridges to mitigate inhalation of vapor/mist. 2a. Wear proper PPE to prevent contact with chemicals/solution while completing task. Hearing protection for excessive noise due to vacuum. 2b. Critical PPE includes use of chemical goggles and face shield.

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Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Re-injection • Re-inject recovered solution.	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; • APR with acid/gas cartridges	1. Chemical reaction. 2. Splash during transfer of recovered solution.	1a. Recovered solution must not be mixed with any other injection material. 1b. Screen out any debris from recovered solution. Manage waste as appropriate. 2a.Use chemical pump for transferring recovered solution to/from 55 GAL drums. Avoid transferring recovered material by hand (bucket).
Waste Handling • Containerize and label waste.	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; • APR with acid/gas cartridges	1. Contact with contaminated waste materials. 2. Fire, reaction with other incompatible materials.	1a. PPE must be worn during waste handling. 2a. Keep all wastes and waste containers separate from all other materials. 2b. Segregate chemically incompatible materials (e.g., acids versus bases, oxidants vs. organics, etc.). Have fire extinguisher ready. 2c. Do not transfer incompatible materials to staging or disposal area. 2d. Decontamination liquids must be recovered and disposed of properly.
Decontamination • Decontaminate tools and equipment • Decontaminate PPE before removal • Jobsite cleanup	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; • APR with acid/gas cartridges	1. Contact with contaminated tools, equipment, PPE, etc.	1a. PPE must be work during decontamination of equipment and tools used for spill response and recovery. 1b. Modified Level C PPE may be worn during jobsite cleanup and tear down provided tools and equipment has been decontaminated first. 1c. Worn PPE must be thoroughly rinsed with water before removing. 1d. At a minimum, discarded PPE must be removed and handled while wearing nitrile/latex gloves. 1e. Tools and equipment must be thoroughly rinsed with clean water.

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Trenching / Excavating	Steel toed shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that chemical exposure is possible, wear chemical resistant gloves, aprons, etc.	Backhoes, loaders, excavators, forklifts, etc. may cause physical harm. Contact with overhead and/or underground utilities can cause damage to property and physical harm.	● Stay clear of heavy equipment unless properly trained to operate. ● On-ground personnel should always be aware of your position with respect to the equipment's range to avoid being hit by the equipment. ● Operator should always be aware of surroundings, and must always keep ground personnel supporting the excavation work in sight. ● Operator must make sure that the equipment is in proper and safe working order. ● Reverse alarms should be checked for proper operation. Equipment with alarms not functioning must not be used until repaired. ● Check areas for overhead utilities and contact Underground Service Alert (USA) at least two full work days prior to digging. ● Equipment operators should maintain safe offsets from trench/excavation edges to avoid trench collapses and equipment from falling into the open pits.
Drilling	Steel toed shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that chemical exposure is possible, wear chemical resistant gloves, aprons, etc.	Drilling rig may cause physical harm. Contact with overhead and/or underground utilities can cause damage to property and physical harm.	● Stay clear of equipment unless properly trained to operate. ● Avoid non-drilling crew personnel from operating or assisting with the drilling operations. ● Be aware of your position with respect to the equipment's range to avoid being hit by the equipment. ● Operator should always be aware of surroundings, and not leave the equipment unattended. ● Operator must make sure that the equipment is in proper and safe working order. ● Emergency shut-off equipment and other integrated safety devices must be properly functioning
A safety meeting shall be held each day, even if there is only one person working on the project on any given day.			● Topics will always include the work scheduled for the day and restatement of the hazards and means to avoid them. Other topics may be extricated from the list included in the HASP. ● Use Daily Tailgate Safety Meeting Form for logging the topics discussed.

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions/Precautions
Mobilize with proper equipment/supplies.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves for the non-chemical aspects of work as necessary; Wear an air purifying respirator with combination organic vapor/P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or its equivalent).*	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	• Follow safe driving procedures. • Employ safe lifting procedures. • Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. • Review HASP and permit conditions. • Start project with Daily Health and Safety Briefing (**HASP Attachment 8**). • Develop a traffic guidance and control plan with the client and/or local agencies as applicable. Plan may include use of delineators, barrier tape, jersey barriers, snow fence, etc. *(Include in site-specific HASP).* • **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Guidance and Control configuration if a formally developed Traffic Guidance and Control Plan is not available.**
Set up necessary traffic control.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic guidance and control equipment placement.	• Use buddy system for placing traffic guidance and control equipment. • Reference traffic guidance and control plan section of HASP (may include specific requirements based on permits). (See site-specific HASP). • **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Guidance and Control configuration if a formally developed Traffic Guidance and Control Plan is not available.**
Perform material condition inspection of system, system compound, well vaults, all related equipment, etc.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle. Trip hazards. Accident when maneuvering around equipment. Chemical exposure. Electrical hazard.	• Use buddy system while inspecting equipment, system, material, etc. • Visually inspect all material associated with the site.
Unload and set up equipment.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle. Trip hazards. Accident when maneuvering equipment.	• Place equipment away from pump islands or other high traffic areas. • Visually inspect equipment (fire extinguisher on board/available on site, no damaged hoses or electrical lines, pressurized hoses secured with whip-checks or adequate substitute, all vapor and/or water hoses firmly connected, equipment grounded).

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions/Precautions
		Lifting hazard. Electrical hazard.	• Use proper lifting techniques.
Air sparge system O&M (accessing individual sparge casings for gauging or maintenance).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Stored Energy. Projectile hazard	• Confirm that the air sparge compressor is powered off and locked out. • Determine system status relative to stored energy (i.e. inspect pressure gauges and utilize pressure release valve assemblies). • If system is pressurized, release pressure from system in a controlled manner. • Remove air sparge well caps only after system pressure is confirmed to be abated.
Gauge water levels and product thickness (where applicable).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary. Wear chemical resistant suit as needed. Wear appropriate chemical resistant gloves as needed. Wear appropriate air purifying respirator with combination organic vapor/P-100 cartridges as needed. Wear appropriate hearing protection as needed.	Back strain. Inhalation or dermal exposure to chemical hazards. Repetitive motion. Traffic hazards.	• Maintain safe distance from the wellhead. • Employ safe lifting procedures. • Initiate air monitoring as outlined in the site-specific Health and Safety Plan, as necessary. • Have appropriate air purifying respirator with combination organic vapor/P-100 cartridges within 3-5 feet of work area, readily available. • Decontaminate equipment between each measurement. Decontamination will be accomplished by an Alconox wash, rinsed with tap water, and then rinsed with a distilled or de-ionized water rinse.
Commence remedial system monitoring (where applicable).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary. Wear chemical resistant suit as needed. Wear appropriate chemical resistant gloves. Wear appropriate air purifying respirator with combination organic vapor/P-100 cartridges as needed. Wear appropriate hearing protection as needed.	Explosion or fire. Trip hazards. Unauthorized release of contaminants. Exposure to contaminants (inhalation, dermal contact). Noise. Electrical hazards.	• Follow equipment-specific operation instructions. • Monitor treatment system vapor and oxygen concentrations if applicable. • Perform air monitoring as outlined in the site-specific Health and Safety Plan, as necessary. • Have appropriate air purifying respirator combination organic vapor/P-100 cartridges within 3 - 5 feet of work area, readily available. • Keep work area clean, minimizing slip, trip and fall hazards. • Monitor treatment system and collect data to ensure discharge is within permit parameters and capacity of any storage containers (concentrations and flow rates).
Collect samples in accordance with sampling plan, (where applicable).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather	Cross-contamination. Improper sample labeling or	• Label samples in accordance with sampling plan. • Keep samples stored in proper containers, at correct temperature, and

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Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions/Precautions
	gloves as necessary. Wear chemical resistant suit as needed. Wear appropriate chemical resistant gloves. Wear appropriate air purifying respirator with combination organic vapor/P-100 cartridges as needed. Wear appropriate hearing protection as needed.	storage. Exposure to site contaminants. Repetitive motion. Back Strain.	away from work area. Minimize splashing when collecting water samples. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan, as necessary. ● Have appropriate air purifying respirator with combination organic vapor/P-100 cartridges within 3-5 feet of work area, readily available. ● Decontaminate sampling equipment after collecting each sample. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums in a location determined by the O & M Technician and the Station Manager/Property Owner.
Perform Electrical/Mechanical maintenance.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary. Wear chemical resistant suit as needed. Wear appropriate electrical resistant gloves.	Slip, trip and fall hazards. Overhead hazards. Exposure to pressurized chemicals/air/gases. Chemical exposure. Vacuum and electrical hazards. Heat/cold stress.	● Use appropriate Lockout/Tagout precautions. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan, as necessary. ● Have appropriate air purifying respirator with combination organic vapor/P-100 cartridges within 3 - 5 feet of work area, readily available.
Perform routine maintenance. (e.g., Replace air filters and belts, change oil, etc.)	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary. Wear chemical resistant suit as needed. Wear appropriate electrical resistant gloves.	Slip, trip and fall hazards. Overhead hazards. Exposure to pressurized chemicals/air/gases. Chemical exposure. Vacuum and electrical hazards. Heat/cold stress.	● Use appropriate Lockout/Tagout precautions. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan, as necessary. ● Have appropriate air purifying respirator with combination organic vapor/P 100 cartridges within 3-5 feet of work area, readily available. ● Dispose of all drained oil, filters, etc., in an appropriate manner.
Store waste (water, carbon canisters, etc.) in accordance with site-specific	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather	Back strain. Traffic hazard.	● Use proper equipment to transport waste containers (pumps, drum dollies, etc.).

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions/Precautions
requirements	gloves as necessary. Wear chemical resistant suit as needed. Wear appropriate chemical resistant gloves.	Improper storage or disposal. If disposing through onsite treatment system, damage or injury from improper use of equipment	• Have proper storage containment and labeling available onsite. • Place materials in isolated location away from traffic and other site functions. • Label waste. • Coordinate proper disposal offsite (where applicable). • Review instructions for use of onsite treatment systems.
Clean site/demobilize	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Traffic hazard. Lifting hazards.	• Use buddy system as necessary to remove traffic guidance and control equipment. • Use proper lifting techniques. • Leave site clean of refuse and debris. • Notify station personnel of departure and location of any stored waste.
Package and deliver samples to lab		Bottle breakage. Back strain.	• Handle and pack bottles carefully (bubble wrap bags are helpful). • Use proper lifting techniques.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
NIGHT WORK: Night work is activity taking place between 1 hour before dusk and 1 hour after dawn. **Lighting Requirement**: All equipment must have a minimum of one headlight that will illuminate the area in front of the equipment at least 50 feet. There shall also be a minimum of one rear light illuminating the back of the equipment. Workers must have a minimum illumination of 10 foot-candles (107.6 lumens) when working within 25 feet of operating tractors, trucks, self□propelled or towed equipment. **Worker Health/Safety:** 1. Employees shall wear proper PPE including Class 2 high visibility garments to be easily seen. 2. Closely supervise new employees and provide all employees sufficient time to acclimatize to night work conditions. 3. All workers are required to be equipped with portable lights when sufficient lighting is not available to not only prevent worksite incidents but also ensure a system in place to prevent predatory night behavior. 4. Employees should not walk to and from worksite alone. 5. Employee break areas must be in a well-lit, accessible area. 6. Provide clean, cool, potable water to combat fatigue and dehydration. **Hazard Identification and Control:** Carefully review the worksite for potential hazards during day light hours and night time hours to determine the equipment required, safety procedures and protocol and specialized training needed. Inspect equipment and ensure it is working properly and that safety mechanisms are in place. Correct identifiable hazards during the day and document the correction.			
Clear drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Traffic hazards. Overhead and underground installations. Product releases. Property damage, and dealer inconvenience.	● Reference Utility Clearance Review form (**HASP Attachment 4**). ● Coordinate with Site Manger (or designee) to minimize potential conflicts. ● Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. ● Mark out the proposed borehole locations. ● Call underground utility locating service for public line location clearance and get list of utilities being contacted. If necessary, coordinate private line locator for private property. ● Develop a traffic control plan with the client and local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. *(Refer to section above).* **It is the responsibility of the SHSC to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Obtain sub-contractor equipment maintenance records prior to commencing work.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	● Verify and review maintenance records for equipment on site. ● Verify maintenance is current.
Mobilize with proper equipment/supplies for drilling.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves for the non-chemical aspects of work. Wear an air purifying respirator with	Vehicle accident. Lifting hazards. Delay or improper performance of work due to	● Start project with Daily Health and Safety Briefing (**Attachment 8**). ● Follow safe driving procedures. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or it's equivalent).*	improper equipment onsite.	labor, equipment and supplies. ● Review permit conditions.
Visually clear proposed drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Underground and overhead installations.	● Complete Pre-Mobilization section of Utility Clearance Review form (**HASP Attachment 4**) and adjust drilling locations as necessary.
Set up necessary traffic control. (See site-specific HASP)	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	● Use buddy system for placing traffic control. ● Implement traffic control plan such as setting out cones and tape defining safety area. ● Adhere to approved Traffic Control Plans when working in roadways. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Assist with set up of rig.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Vehicle accident during rig movement. Damage caused by rig while accessing set-up location. Contact with overhead installations. Soft terrain. Rig movement.	● Verify clear pathway to drilling location and clearance for raising mast. ● Provide as-needed hand signals and guidance to driver to place rig. ● Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). ● If necessary, use wooden blocks under jacks to spread load. ● Chock wheels.
Set up exclusion zone(s) and workstations (drilling and logging/sample collection).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Struck by vehicle during set up. Slip, trip and fall hazards.	● Implement exclusion zones. ● **It is the responsibility of the SHSO to annotate the Site Plan with the configuration of the exclusion zones.** ● Set up workstations with clear walking paths to and from rig.
Clear upper five feet of borehole location using post-hole digger or hand auger.	Don required PPE as appropriate for this step: steel toed and shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical	Back strain. Exposure to chemical hazards.	● Complete Pre-Drilling section of Utility Clearance Review form (**Attachment 4**) and adjust drilling locations as necessary. ● Stand upwind to avoid exposure whenever possible. ● Use the organic vapor monitor aggressively to track the airborne

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	aspects of work. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges if necessary. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek poly coated suit or its equivalent).*	Hitting an underground utility. Repetitive motion.	concentration of contaminants close to potential sources such as the core as it is being raised from the hole, the core is opened, etc. ● Initiate air quality monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Use proper lifting techniques and tools. Avoid twisting back during the operation. ● Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums onsite pending characterization and disposal. All drums require proper labeling.
Commence drilling borehole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed. Wear chemical resistant gloves if needed. Wear chemical resistant suit if needed.	Cross-contamination from previous hole. Back strain. Heat or cold stress. Eye injury. Noise. Exposure to chemical hazards. Hitting an underground utility. Slip, trip and fall hazards. Equipment failure	● Decontaminate sampling equipment after collecting each sample. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums onsite pending characterization and disposal. Decontaminate drilling equipment after each borehole. ● Use proper lifting techniques. ● Conduct air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Monitor drilling progress. ● Keep work area clear of tripping or slipping hazards. ● Perform periodic visual inspections of drill rig.
Collect samples in accordance with sampling plan.	Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Steel toed and shank shoes, hardhat, safety glasses	Cross-contamination. Improper labeling or storage.	● Conduct air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	with side shields, hearing protection, reflective safety vest, chemical resistant gloves and chemical resistant suit as needed.	Exposure to site contaminants.	P-100 cartridges within 3-5 feet of work area, readily available. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE ● Decontaminate sampling equipment between each sampling run. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a distilled rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums on site pending characterization and disposal. All drums require proper labeling. ● Label samples in accordance with sampling plan. Keep samples stored in proper containers, at correct temperature, and away from work area.
Cuttings will be picked up by shovel and placed directly in 55-gallon drums.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear chemical protective suit and/or appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Exposure to public. Traffic hazard or obstruction/inconvenience to station operation. Improper storage or disposal.	● Have proper storage containment and labeling available onsite. Place materials in isolated location away from traffic and other site functions. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Full drums will be staged onsite pending characterization and disposal. All drums require proper labeling.
Backfill borehole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work.	Improper grouting can lead to future vertical conduit for contaminant migration. Back strain. Slip, trip and fall hazards. Eye injury from splashing or release of pressurized grout.	● Mix grout to specification and completely fill the hole. ● Use proper lifting techniques. ● Keep work area clear of tripping hazards.
Supervisor/HSC must confirm all boreholes are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every borehole.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and	Traffic. Lifting hazards.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	leather gloves for the non-chemical aspects of work.		● Clearly mark/barricade any borings that need later topping off or curing. ● Notify site personnel of departure, final well locations and any cuttings/purge water left onsite. ● Use proper lifting techniques
Package and deliver samples to lab.		Bottle breakage. Back strain.	● Handle and pack bottle carefully (bubble wrap bags are helpful). Use proper lifting techniques.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Mobilize with proper equipment/supplies for the work objective.	Gather necessary PPE. Reflective vest, steel toed boots, hardhat, safety glasses with side shields, full body harness, shock absorbing lanyard(s), fall limiter(s), and leather gloves for the non-chemical aspects of work. Bring an air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed, Nitrile gloves or their equivalent, foam earplugs with an NRR of 33, Tyvek, poly coated chemical resistant suit or its equivalent, as needed.	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	• Follow safe driving procedures. • Employ safe lifting procedures. • Review permit conditions. • Review all JSA and ensure the risks have all been covered in the JSA(s). • Perform pre-job meeting with the Project Manager.
Perform Tailgate Safety Meeting	Wear reflective vest, steel toed boots, hardhat, safety glasses with side shields, and leather gloves.	One can potentially be struck by vehicle during safety meeting. Vehicle accident as a result of improper traffic control equipment placement.	• Start project with Daily Health and Safety Meeting**.** • Make sure sub-contractors are aware of their responsibilities for labor, equipment, and supplies. • Review permit conditions and HASP. • Complete ATW and other pertinent permits.
Assessment of the excavation(s)	Wear reflective vest, steel toed boots, hardhat, safety glasses with side shields, and leather gloves.	Explosion/fire. Slip, trip and fall hazards. Exposure to chemical hazards. Injury from heavy equipment. Soil collapse and fall injury.	• **DO NOT GO NEAR THE EXCAVATION UNTIL FULLY ASSESSED**. • Perform initial and periodic visual inspections of the excavation sides, base, and upper surface. See attached *Required Safety Practices.* • Items to note and consider. Does the excavation: **1)** have properly sloped, benched or shored sides (discuss with on-site OSHA Competent Person), **2)** have proper ventilation, **3)** have heavy equipment within 5 feet of the edge, **4)** have soil piled within 2 feet of the edge, **5)** have surface cracks, sidewall cracks, or sloughing, **6)** have free-standing water or have water entering the hole, **7)** have adequate entry/egress pathways (see OSHA and applicable state requirements). • Conduct air monitoring above excavation area as outlined in monitoring in accordance with site-specific HASP. • Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of working location, readily available.
Working near deep (>6 feet) excavations (SEE WORKING AT HEIGHTS JSA)	Reflective vest, steel toed boots, hardhat, safety glasses with side shields, full body harness, shock absorbing lanyard(s) or fall limiter(s), and leather gloves for the non-chemical aspects of work.	Explosion/fire. Slip, trip and fall hazards. Exposure to chemical hazards.	• Working near excavations greater than 6-feet deep with non-sloped walls should be avoided. • Assess alternatives to completing work. • Contact Mark Labrenz should no alternative to completing work be identified. • Maintain required excavation setbacks for workers and equipment and

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❶ Job Steps	**❷ Personal Protective Equipment**	**❸ Potential Hazard**	**❹ Critical Actions**
		Injury from heavy equipment. Soil collapse and fall injury.	monitor condition of sidewalls and surrounding ground conditions. • Keep work area clear of tripping or slipping hazards. • Have an OSHA Competent Person prepare an *Excavation Inspection Form/Permit to Work* prior to proceeding with the activities.
Working near deep (>20 feet) excavations (SEE WORKING AT HEIGHTS JSA)	Reflective vest, steel toed boots, hardhat, safety glasses with side shields, full body harness, shock absorbing lanyard(s) or fall limiter(s), and leather gloves for the non-chemical aspects of work..	Explosion/fire. Slip, trip and fall hazards. Exposure to chemical hazards. Injury from heavy equipment. Soil collapse and fall injury.	• Working near excavations greater than 20-feet deep with non-sloped walls should be avoided. • Assess alternatives to completing work. • Contact Mark Labrenz should no alternative to completing work be identified. • Have an OSHA Competent Person prepare an *Excavation Inspection Form/Permit to Work* prior to proceeding with the activities.
Entering an Excavation	ENTERING AN EXCAVATION IS NOT ALLOWED UNDER THIS JSA.	Explosion/fire. Slip, trip and fall hazards. Exposure to chemical hazards. Injury from heavy equipment. Soil collapse and fall injury.	• **ENTRANCE INTO AN EXCAVATION SHALL ONLY BE DONE AFTER MARK LABRENZ HAS GIVEN AUTHORITY TO ENTER.**

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clear probing locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Traffic hazards, overhead and underground installations, product releases, property damage, dealer inconvenience.	• Reference Utility Clearance Review form. • Coordinate with Site Manger (or designee) to minimize potential conflicts. • Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. • Mark out the proposed probing locations. • Call underground utility locating service for public line location clearance and get list of utilities being contacted. If necessary, coordinate private line locator for private property. • **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Obtain sub-contractor equipment maintenance records prior to commencing work.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	• Verify records in possession are for equipment on site. • Verify maintenance is current.
Mobilize with proper equipment/supplies for probing.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hard hat, safety glasses with side shields, ear plugs/muffs, leather gloves for the non-chemical aspects of work as necessary; Wear an air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North 7600 series full face respirator or its equivalent. Best brand nitrile gloves or their equivalent. Howard Leight Max foam earplugs with an NRR of 33 or their equivalent. Tyvek, poly coated chemical resistant suit or it's equivalent).*	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	• Start project with Daily Health and Safety Briefing Log. • Follow safe driving procedures. • Employ safe lifting procedures. • Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. • Review permit conditions.
Visually clear proposed probing locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Underground and overhead installations.	• Complete Pre-Mobilization section of Utility Clearance Review form and adjust probing locations as necessary.
Set up necessary traffic control. for detailed plan.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety	Struck by vehicle during placement. Vehicle accident	• Use buddy system for placing traffic control. Implement traffic control plan such as setting out cones and tape defining safety area.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	glasses with side shields, and leather gloves as necessary.	as a result of improper traffic control equipment placement.	● Adhere to approved Traffic Control Plans when working in roadways. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Assist with set up of rig.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, leather gloves as necessary.	Vehicle accident during rig movement. Damage caused by rig while accessing set-up location. Contact with overhead installations. Soft terrain. Rig movement.	● All staff should know where the kill switch is for the probing rig. ● Verify clear pathway to drilling location and clearance for raising mast. ● Provide as-needed hand signals and guidance to driver to place rig. ● Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition?). ● If necessary, use wooden blocks under jacks to spread load. Chock wheels.
Set up exclusion zone(s) and workstations (probing and logging/sample collection).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during set up. Slip trip and fall hazards.	● Implement exclusion zone set-up as appropriate for each probing location. ● Set up workstations with clear walking paths to and from rig. ● Use safety tape and cones. ● It is the responsibility of the SHSO to annotate the Site Plan with the exclusion zone configuration.
Clear upper five feet of probing location using small diameter hand auger.	Don required PPE as appropriate for this step: steel toed and shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, leather gloves for the non-chemical aspects of work as necessary. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges if necessary. (Use a North 7600 series full face respirator or its equivalent. Best brand nitrile gloves or their equivalent. Howard Leight Max foam earplugs with an NRR of 33 or their equivalent. Tyvek poly coated chemical resistant suit or it's equivalent).	Back strain, exposure to chemical hazards, hitting an underground utility, repetitive motion.	● Initiate air quality monitoring. ● Stand upwind to avoid exposure whenever possible. ● Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources such as the probe as it is being raised from the hole, the probe is opened, etc. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Use proper lifting techniques and tools. ● Complete the Pre-Drilling section of the Borehole Clearance Review form. ● Avoid twisting back during the operation; Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect wash/rinse water in 5 gallon buckets and transfer to 55-gallon drums and

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
			stage drums (state where drums will be staged).
Commence probing operation.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed.	Cross-contamination from previous hole. Back strain, heat or cold, eye injury, noise, exposure to chemical hazards, hitting an underground utility, slip, trip and fall hazards, equipment failure	● Avoid twisting back during the operation; Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect wash/rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums (state where drums are to be staged). ● Use proper lifting techniques. ● Monitor air quality. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Monitor probing progress. ● Keep work area clear of tripping or slipping hazards. ● Perform periodic visual inspections of probing rig.
Collect samples in accordance with sampling plan.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Cross-contamination. Back strain, inhalation or dermal exposure to chemical hazards, slip and fall. Improper labeling or storage, injury from broken sample bottle (cuts or acid burn).	● Perform air monitoring. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Decontaminate sampling equipment between each probe or sample. ● Use proper lifting techniques. ● Label samples in accordance with sampling plan. ● Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.
Excess soil will be picked up by shovel and placed directly in 55-gallon drums.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves.	Exposure to public. Traffic hazard or obstruction/inconvenience to station operation. Improper storage or disposal. Back strain.	● Have proper storage containment and labeling available onsite. ● Place materials in isolated location away from traffic and other site functions. Drums will be staged *(say where drums will be staged)(See next section for Waste Description.* ● Do not attempt to lift, push or move bins/drums without the proper tools and equipment.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Backfill probe hole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Improper grouting can lead to future vertical conduit for contaminant migration. Back strain, slip, trip and fall hazards, and eye injury from splashing or release of pressurized grout. Unauthorized backfilling causes extra work.	• Mix grout/cement to specification and completely fill the hole. • Use proper lifting techniques. • Keep work area clear of tripping hazards.
Supervisor/HSC must confirm all boreholes/probings are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	• Visually inspect each and every borehole/probings.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Traffic. Safety hazard left on site. Lifting hazards.	• Use buddy system as necessary to remove traffic control. • Leave site clean of refuse and debris. • Clearly mark/barricade any probings that need later topping off or curing. • Notify site personnel of departure, final well locations and any cuttings left onsite. • Use proper lifting techniques
Package and deliver samples to lab.		Bottle breakage, back strain.	• Handle and pack bottle carefully (bubble wrap bags are helpful). Use proper lifting techniques.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clear drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Traffic hazards. Overhead and underground installations. Product releases. Property damage Dealer inconvenience.	● Reference Utility Clearance Review form. ● Coordinate with Site Manger (or designee) to minimize potential conflicts. ● Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. ● Mark out the proposed borehole locations. ● Call underground utility locating service for public line location clearance and get list of utilities being contacted. If necessary, coordinate private line locator for private property. ● Develop a traffic control plan with the client and local agencies as applicable. Plan may include use of cones, delineators, barrier tape, jersey barriers, etc. *(Refer to site-specific HASP).* ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if a formally developed Traffic Control Plan is not available.**
Obtain sub-contractor equipment maintenance records prior to commencing work.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	● Verify records in possession are for equipment on site. ● Verify maintenance is current.
Mobilize with proper equipment/supplies for drilling.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hard hat, safety glasses with side shields, ear plugs/muffs, leather gloves for the non-chemical aspects of work as necessary; Wear an air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or its equivalent).*	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	● Start project with Daily Health and Safety Briefing. ● Follow safe driving procedures. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. ● Review permit conditions.
Visually clear proposed drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields,	Underground and overhead installations.	● Complete Pre-Mobilization section of Utility Clearance Review form and adjust drilling locations as necessary.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	and leather gloves as necessary.		
Set up necessary traffic control. See site-specific HASP for detailed plan.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	• Use buddy system for placing traffic control. Implement traffic control plan such as setting out delineators, snow fence and tape defining safety area. • Adhere to approved Traffic Control Plans when working in roadways. • **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if a formally developed Traffic Control Plan is not available.**
Assist with set up of rig.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Vehicle accident during rig movement. Damage caused by rig while accessing set-up location. Contact with overhead installations. Soft terrain. Rig movement.	• Rig mast must be down when moving/repositioning rig. • All staff should know where the kill switch is for the drilling rig. • Verify clear pathway to drilling location and clearance for raising mast. • Provide as-needed hand signals and guidance to driver to place rig. • Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). • If necessary, use wooden blocks under jacks to spread load. Chock wheels.
Set up exclusion zone(s) and workstations (drilling and logging/sample collection).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during set up. Slip, trip and fall hazards.	• Implement exclusion zone set-up. **It is the responsibility of the SHSO to annotate the Site Plan with the Exclusion Zone set up.** • Set up workstations with clear walking paths to and from rig. Use safety tape and delineators. • If utilizing Visqueen, (sheet plastic), for sampling area, completely secure Visqueen to the pavement, dirt, etc. with duct tape, delineators, etc. Do not use objects that are hard to notice or could become a trip hazard themselves.
Clear upper five feet of drilling location using post-hole digger or hand auger.	Don required PPE as appropriate for this step: steel toed and shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges if	Back strain. Exposure to chemical hazards. Hitting an underground utility. Repetitive motion.	• Initiate air quality monitoring as outlined in the site-specific Health and Safety Plan. • Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. • Stand upwind to avoid exposure whenever possible. • Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources such as the core as it is being raised from the hole, the core is opened, etc. • Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	necessary. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek poly coated suit or its equivalent).*		EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Use proper lifting techniques and tools. ● Complete the Pre-Drilling section of the Borehole Clearance Review form. ● Avoid twisting back during the operation; Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums onsite pending characterization and disposal.
Commence drilling operation.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed. Wear chemical resistant gloves if needed.	Cross-contamination from previous hole. Back strain. Heat or cold. Eye injury. Noise. Exposure to chemical hazards. Hitting an underground utility. Slips, trips and falls. Equipment failure.	● Decontaminate sampling after collecting a sample and decontaminate drilling equipment after each borehole. ● Use proper lifting techniques. ● Conduct air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of work area, readily available. ● Monitor drilling progress. ● Keep work area clear of tripping or slipping hazards. ● Perform periodic visual inspections of drill rig.
Collect samples in accordance with sampling plan.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed.	Cross-contamination, improper labeling or storage, exposure to site contaminants.	● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Decontaminate sampling equipment between each sampling run. Label samples in accordance with sampling plan. ● Keep samples stored in proper containers, at correct temperature, and away from work area. ● Conduct air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of work area, readily available.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Cuttings will be picked up by shovel and placed directly in 55-gallon drums.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Exposure to public. Traffic hazard or obstruction/inconvenience to station operation. Improper storage or disposal. Back strain.	• Have proper storage containment and labeling available onsite. Place materials in isolated location away from traffic and other site functions. *(See next section for Waste Description).* • Do not attempt to lift, push or move drums without the proper tools and equipment. • Conduct air monitoring as outlined in the site-specific Health and Safety Plan. • Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of work area, readily available.
Construct well.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Back strain. Eye injury. Slip, trip and fall hazards. Cross-contamination. Non-approved well construction.	• Use proper lifting techniques. • Keep pathways from well supplies to borehole clear of tripping hazards. • Make sure casing and other materials are clean before going into borehole. • Verify presence or other authorization by any required inspectors for well installation/grouting.
Cut pavement to set well vault.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. If you suspect that equipment is contaminated, wear chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Moving blade. Eye hazards. Exhaust from motor. Noise. Back strain. Particulate inhalation. Traffic hazards.	• Employ proper lifting techniques or mechanical assistance. • Keep work area clear of debris. • Maintain traffic control and face oncoming traffic. • Conduct air monitoring as outlined in the site-specific Health and Safety Plan. • Have appropriate respirator with combination organic vapor/HEPAP-100 cartridges within 3-5 feet of work area, readily available.
Install well vault and set in concrete.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical	Back strain. Eye injury. Skin exposure to concrete. Particulate inhalation.	• Use proper lifting technique and equipment to install well vault and in concrete preparation. • Complete well vault smooth to grade to eliminate trip hazard (if slightly elevated to prevent storm water intrusion, slope concrete skirt gradually). • Maintain traffic control and face oncoming traffic.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	resistant gloves. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Slip, trip and fall hazards. Traffic hazards.	● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available.
Develop well by hand bailing or vacuum truck	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Physical injury from mechanical failure vacuum truck. Trip hazard. Exposure to contaminants. Cross-contamination. Electric shock. Back strain.	● Make sure equipment is in good working order and pressurized hoses are whip-checked. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of work area, readily available. ● Keep work area orderly. ● Decontaminate all equipment going into well. ● Any generators must be equipped with GFCI circuit.
Gauge water levels and product thickness (where applicable) in wells.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear chemical resistant suit as needed.	Back strain. Inhalation or dermal exposure to chemical hazards. Repetitive motion.	● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location for quick access. ● Maintain safe distance from wellhead. ● Bend at knees, not at the waist.
Purge well(s) and collect purge water. Purging of the wells can be done by using one of two methods, by hand bailer or vacuum truck. If a hand bailer is used, collected water will be transferred to a 55-gallon drum.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. If you suspect that equipment is contaminated, wear chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear chemical resistant suit as needed.	Cross-contamination. Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Spilling contaminated water.	● Decontaminate purging equipment between each sampling location. Two methods of equipment decontamination will be used on this site. If disposable bailers are used, then they will be properly disposed of. If the bailers are reusable, then they will be washed in an Alconox wash, rinsed with tap water, then rinsed with de-ionized or distilled water. Decontamination water will be transferred to 55-gallon drums and staged onsite pending characterization and disposal. ● Use proper lifting techniques. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location, readily available.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
			● Keep work area clear of tripping or slipping hazards. ● Store purge water in 55-gallon drums and stage onsite pending characterization and disposal.
Collect groundwater samples in accordance with sampling plan.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA cartridges as needed.	Cross-contamination. Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Improper labeling or storage. Injury from broken sample bottle (cuts or acid burn).	● Decontaminate sampling equipment between each well (unless disposable). ● Use proper lifting techniques. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA cartridges within 3 - 5 feet of working location for quick access. ● Label samples in accordance with sampling plan. ● Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.
Dispose or store purge water (if any) onsite.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage or disposal.	● Use proper equipment to transport water (pumps, drum dollies, etc.). ● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location for quick access. ● Label storage containers properly, and locate in isolated area away from traffic and other site functions. ● Coordinate offsite disposal (where applicable). ● Do not attempt to lift, push or move drums without the proper tools or equipment.
Supervisor/HSC must confirm all boreholes are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every borehole.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Traffic. Safety hazard left on site. Lifting hazards.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Clearly mark/barricade any borings that need later topping off or curing. ● Notify site personnel of departure, final well locations and any cuttings/purge water left onsite. ● Use proper lifting techniques

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Package and deliver samples to lab.		Bottle breakage, back strain.	● Handle and pack bottle carefully (bubble wrap bags are helpful). Use proper lifting techniques.

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JSA 28: UTILITY LOCATING

March 30, 2010

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Mobilize with proper equipment/supplies for Utility Locating.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves. (*Foam earplugs with an NRR of 33).*	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	● Start project with Daily Health and Safety Briefing . ● Follow safe driving procedures. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. ● Review permit conditions.
Set up necessary traffic control. See site-specific HASP for detailed plan.	Wear reflective vest for traffic; steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs and leather gloves as necessary.	Potentially can be struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	● Use buddy system for placing traffic control. ● Create a traffic control plan to address traffic issues. Refer to Traffic Control Plan drawing in the site-specific HASP. ● Adhere to approved Traffic Control Plans when working in roadways. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Perform Utility Locating, marking utility locations with paint.	Wear reflective vest for traffic; steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs and leather gloves as necessary.	Potentially can be struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement. Muscle strains/sprains from lifting equipment.	● Adhere to approved traffic control plan ● Use proper lifting techniques.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work.	Traffic. Safety hazard left on site. Lifting hazards.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Clearly mark/barricade any borings that need later topping off or curing. ● Notify site personnel of departure, final well locations and any cuttings/purge water left onsite. ● Use proper lifting techniques

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Mobilize with proper equipment/supplies for sampling.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, leather gloves for the non-chemical aspects of work as necessary; Wear an air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or its equivalent).*	Vehicle accident. Lifting hazards. Delay or improper/unsafe performance of work due to improper equipment onsite. Cross-contamination of wells.	• Follow safe driving procedures. • Use proper lifting techniques. • Review work plan to determine equipment/supply needs. • Make sure all sampling/gauging equipment is decontaminated. • Bring ice for sample storage. • Develop a traffic control plan with the client and/or local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. *(Include in site-specific HASP).* • **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Set up necessary traffic control.	Wear reflective traffic vest, steel toed and shank shoes, hardhat (if required by job site).	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	• Use buddy system for placing traffic control. • Reference traffic control plan (See site-specific HASP). • **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Set up exclusion zone(s).	Wear reflective traffic vest, steel toed and shank shoes, hardhat (if required by job site).	Struck by vehicle. Slip and fall hazards to workers.	• Implement exclusion zone set-up instructions. • **It is the responsibility of the SHSO to annotate the site Plan with the Exclusion Zone configuration.** • Set up clear walking paths between workstations.
Gauge water levels and product thickness (where applicable) in wells.	Don required PPE as appropriate for this step: steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, leather gloves for the non-chemical aspects of work as necessary. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges as necessary.	Back strain. Inhalation or dermal exposure to chemical hazards. Repetitive motion.	• Initiate air quality monitoring in accordance with the site-specific Health and Safety Plan. • Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location, readily available. • Maintain safe distance from wellhead. • Use proper lifting techniques. • Decontaminate equipment between each measurement.
Purge well(s) and collect purge water. Purging of the wells can be done by	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and	Cross-contamination. Back strain.	• Decontaminate purging equipment between each sampling location. (Two methods of equipment decontamination can be used. If

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
using one of two methods, by hand bailer or vacuum truck. If a hand bailer is used, collected water will be transferred to a 55-gallon drums. If the vacuum truck is used there will be no collected water.	leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear appropriate air-purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear appropriate chemical resistant suit as needed.	Inhalation or dermal exposure to chemical hazards. Slip and fall. Spilling contaminated water.	disposable bailers are used, then they will be properly disposed of. If the bailers are reusable *then* they will be washed in an Alconox wash, rinsed with tap water, then rinsed with a de-ionized or distilled water rinse. Wash/rinse water will be transferred to 55-gallon drums and staged onsite pending characterization and disposal. ● Use proper lifting techniques. ● Perform air monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location, readily available. ● Keep work area clear of tripping or slipping hazards. ● Store purge water in 55-gallon drums. . Drums will be staged onsite pending characterization and disposal.
Collect samples in accordance with sampling plan.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear appropriate air-purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear appropriate chemical resistant suit as needed.	Cross-contamination. Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Improper labeling or storage. Injury from broken sample bottle (cuts or acid burn).	● Decontaminate sampling equipment between each sampling location. Two methods of equipment decontamination will be used on this site. If disposable bailers are used, then they will be properly disposed of. If the bailers are reusable *then* they will be washed in an Alconox wash, rinsed with tap water, then rinsed with a de-ionized or distilled water rinse. Decontamination water will be transferred to 55-gallon drums and staged onsite pending characterization and disposal. ● Use proper lifting techniques. ● Perform air monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location, readily available. ● Keep work area clear of tripping or slipping hazards. ● Store purge water in 55-gallon drums. Drums will be staged onsite pending characterization and disposal.
Dispose or store purge water (if any) onsite.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear appropriate air-purifying	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage	● Use proper equipment to transport water (pumps, drum dollies, etc.). ● Perform air monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 - 5 feet of working location, readily available. ● Label storage containers properly, and locate in isolated area away

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
	respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear appropriate chemical resistant suit as needed.	or disposal.	from traffic and other site functions. ● Coordinate offsite disposal (where applicable). ● Do not attempt to lift, push or move drums without the proper tools or equipment. ● Store purge water in 55-gallon drums. Drums will be staged onsite pending characterization and disposal.
Supervisor/HSC must confirm all monuments are closed.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every monument.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Traffic. Lifting hazard.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Notify station personnel of departure. ● Use proper lifting techniques or use mechanical assistance.
Package and deliver samples to lab.		Bottle breakage. Back strain.	● Handle and pack bottle carefully (bubble wrap bags are helpful). ● Use proper lifting techniques.
Supervisor/HSC must confirm all boreholes are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every borehole.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Mobilize with proper equipment/supplies for sampling.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, leather gloves for the non-chemical aspects of work as necessary; Wear an air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or its equivalent).*	Vehicle accident. Lifting hazards. Delay or improper/unsafe performance of work due to improper equipment onsite. Cross-contamination of wells.	● Follow safe driving procedures. ● Use proper lifting techniques. ● Review work plan to determine equipment/supply needs. ● Make sure all sampling/gauging equipment is decontaminated. ● Bring ice for sample storage. ● Develop a traffic control plan with the client and/or local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. *(Include in site-specific HASP).* ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Set up necessary traffic control.	Wear reflective traffic vest, steel toed and shank shoes, hardhat (if required by job site).	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	● Use buddy system for placing traffic control. ● Reference traffic control plan (See site-specific HASP). ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Set up exclusion zone(s).	Wear reflective traffic vest, steel toed and shank shoes, hardhat (if required by job site).	Struck by vehicle. Slip and fall hazards to workers.	● Implement exclusion zone set-up instructions. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Exclusion Zone configuration.** ● Set up clear walking paths between workstations.
Gauge water levels and product thickness (where applicable) in wells.	Don required PPE as appropriate for this step: steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, leather gloves for the non-chemical aspects of work as necessary. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges as necessary.	Back strain. Inhalation or dermal exposure to chemical hazards. Repetitive motion.	● Initiate air quality monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 – 5 feet of working location, readily available. ● Maintain safe distance from wellhead. ● Use proper lifting techniques. ● Decontaminate equipment between each measurement. Decontamination will be accomplished by an Alconox wash, rinsed with tap water, and then rinsed with distilled or de-ionized water rinse.
Perform LPH Removal. LPH Removal can be	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing	Cross-contamination.	● Decontaminate baling equipment between monitoring well location. Wash the PVC baler in an Alconox wash, rinsed with tap water, then rinsed with

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
accomplished by using one of two methods, (1) hand baling or vacuum truck.	protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear appropriate air-purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear appropriate chemical resistant suit as needed.	Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Spilling contaminated water.	a de-ionized or distilled water rinse. Wash/rinse water will be transferred to 55-gallon drums and staged onsite pending characterization and disposal. ● Use proper lifting techniques. ● Perform air monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 – 5 feet of working location, readily available. ● Keep work area clear of tripping or slipping hazards. ● Store baled LPH in 55-gallon drums. . Drums will be staged onsite pending characterization and disposal. Drums must be properly labeled. ●
Dispose or store any wastewater (if any) onsite.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear appropriate air-purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Wear appropriate chemical resistant suit as needed.	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage or disposal.	● Use proper equipment to transport water (pumps, drum dollies, etc.). ● Perform air monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3 – 5 feet of working location, readily available. ● Label storage containers properly, and locate in isolated area away from traffic and other site functions. ● Coordinate offsite disposal (where applicable). ● Do not attempt to lift, push or move drums without the proper tools or equipment. ● Store wastewater in 55-gallon drums. Drums will be staged onsite pending characterization and disposal. Drums must be properly labeled.
Supervisor/HSC must confirm all boreholes are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every borehole.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Traffic. Lifting hazard.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Notify station personnel of departure. ● Use proper lifting techniques or use mechanical assistance.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clear drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Traffic hazards. Overhead and underground installations. Product releases. Property damage.	● Reference Utility Clearance Log and Utility Clearance Map. ● Coordinate with Site Manger (or designee) to minimize potential conflicts. ● Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. ● Mark out the proposed borehole locations. ● Call underground utility locating service for public line location clearance and get list of utilities being contacted. If necessary, coordinate private line locator for private property. ● Develop a traffic control plan with the client and local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. *(Refer to site-specific HASP).* ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Obtain sub-contractor equipment maintenance records prior to commencing work.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	● Verify maintenance records in possession are for equipment on site. ● Verify maintenance is current.
Mobilize with proper equipment/supplies for drilling.		Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	● Start project with Daily Health and Safety Briefing. ● Follow safe driving procedures. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. ● Review permit conditions. ● Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves for the non-chemical aspects of work as necessary; Wear an appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North 7600 series full face respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33or their equivalent. Tyvek, poly coated chemical resistant suit or its equivalent).*
Visually clear proposed drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Underground and overhead installations.	● Complete Pre-Mobilization section of Utility Clearance Log and adjust drilling locations as necessary.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Set up necessary traffic control. See site-specific HASP for detailed plan.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	● Use buddy system for placing traffic control. Implement traffic control plan such as setting out cones and tape defining safety area. ● It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if a separate diagram is not available. ● Adhere to approved Traffic Control Plans (see site-specific HASP) when working in roadways. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Assist with set up of rig.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Vehicle accident during rig movement. Damage caused by rig while accessing set-up location. Contact with overhead installations. Soft terrain. Rig movement.	● All staff should know where the kill switch is for the drilling rig (incorporate into Daily Health and Safety Briefing). ● Verify clear pathway to drilling location and clearance for raising mast. ● Provide as-needed hand signals and guidance to driver to place rig. ● Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). ● If necessary, use wooden blocks under jacks to spread load. Chock wheels.
Set up exclusion zone(s) and workstations (Hydropunch/Geoprobe and logging/sample collection).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during set up. Slip/fall hazards.	● Implement exclusion zone set up. ● **It is the responsibility of the SHSO to annotate the Site Plan with the exclusion zone configuration.** ● Set up workstations with clear walking paths to and from rig. Use safety tape and cones.
Clear upper five feet of Hydropunch/Geoprobe location using post-hole digger or hand auger.	Don required PPE as appropriate for this step: steel toed and shank shoes, hard hat, safety glasses with side shields, hearing protection (foam earplugs with a NRR of 33 or their equivalent), reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges, if necessary. Wear Tyvek poly coated chemical resistant suit or its equivalent, if necessary.	Back strain. Exposure to chemical hazards. Hitting an underground utility. Repetitive motion.	● Stand upwind to avoid exposure whenever possible. ● Initiate air quality monitoring in accordance with the Site Specific Health and Safety Plan. ● Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources such as the core as it is being raised from the hole, the core is opened, etc. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Use proper lifting techniques and tools.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
			• Complete the Pre-Drilling section of the Borehole Clearance Review form. • Avoid twisting back during the operation. Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a second distilled or de-ionized water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums on site for future proper disposal.
Commence Geoprobe/Hydropunch operation.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed.	Cross contamination from previous borehole. Back strain. Heat or cold. Eye injury, noise. Exposure to chemical hazards. Hitting an underground utility. Trip and fall. Equipment failure.	• Decontaminate sampling equipment after collecting a sample. Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a second distilled or de-ionized water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums on site for future disposal. • Decontaminate Geoprobe/Hydropunch equipment after each evolution. • Use proper lifting techniques. • Monitor air quality in accordance with Site Specific Health and Safety Plan. • Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. • Monitor Geoprobe/Hydropunch progress. • Keep work area clear of tripping or slipping hazards. • Perform periodic visual inspections of Geoprobe/Hydropunch rig.
Collect samples in accordance with sampling plan.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Cross-contamination. Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Improper labeling or storage. Injury from broken sample bottle (cuts or acid burn).	• Perform air monitoring in accordance with the site-specific HASP. • Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. • Decontaminate sampling equipment between each well (unless disposable). If the equipment is reusable, then wash in an Alconox wash, rinsed with tap water, then rinsed with distilled or de-ionized water. Decontamination water will be transferred to 55-gallon drums and staged on site pending disposal. • Use proper lifting techniques. • Label samples in accordance with sampling plan. • Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.
Cuttings will be picked up by shovel and placed directly in 55-gallon	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and	Exposure to public. Traffic hazard or	• Have proper storage containment and labeling available onsite. • Place materials in isolated location away from traffic and other site

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
drums.	leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves.	obstruction/inconvenience to station operation. Improper storage or disposal. Back strain.	functions. *(See next section for Waste Description).* ● Use appropriate drum handling practices. Do not attempt to lift, push or move drums without the proper tools and equipment.
Backfill borehole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Back strain. Trip hazards. Eye injury from splashing or release of pressurized grout.	● Mix grout to specification and completely fill the hole. ● Use proper lifting techniques. ● Keep work area clear of tripping hazards.
Dispose or store purge water (if any) onsite.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage or disposal.	● Use appropriate drum handling practices. ● Use proper equipment to transport water (pumps, drum dollies, etc.). ● Monitor air quality in accordance with the Site Specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA cartridges within 3-5 feet of working location, readily available. ● Label storage containers properly, and locate in isolated area away from traffic and other site functions. ● Coordinate offsite disposal (where applicable). ● Do not attempt to lift, push or move drums without the proper tools or equipment.
Supervisor/HSC must confirm all boreholes are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every borehole.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Traffic. Lifting hazards.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Clearly mark/barricade any borings that need later topping off or curing. ● Notify site personnel of departure, final well locations and any cuttings/purge water left onsite. ● Use proper lifting techniques

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Package and deliver samples to lab.		Bottle breakage. Back strain.	● Handle and pack bottle carefully (bubble wrap bags are helpful). Use proper lifting techniques.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Typical work	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that chemical exposure is possible, wear chemical resistant gloves, aprons, etc.	Weather related incidents. Automobile accidents. Slips, trips and falls.	● Check weather reports daily. Project visits will not be performed during inclement weather. Sampling may be performed during light rain mist. Wear raincoats. ● Drive at speed limit or less as needed to keep safe distance from vehicle in front, avoid short stops.
Typical work.		Cold Stress.	● For temperatures below 40 ^{0}F, adequate insulating clothing must be worn. If the temperature is below 20 ^{0}F, workers will be allowed to enter a heated shelter at regular intervals. Warm, sweet drinks should be available. Coffee intake should be limited. ● No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress, such as heavy shivering, pain in fingers or toes, drowsiness or irritability. Onset of any of these signs are indications for immediate return to a heated shelter.
Typical work.		Heat Stress	● Discuss health effects and symptoms during daily production meetings. ● Drink water regularly, i.e., at least one cup every 20-30 minutes depending upon level of effort and PPE worn. ● Breaks should be taken in an area cooler than the work area. ● Monitor temperature and relative humidity using WBGT meter.
Typical work	High-top steel toed and shank shoes or rubber boots, light colored long sleeved shirt, long pants, and leather gloves.	Insect bites, (to include black-legged or deer ticks)	● Tuck pants into socks or boot tops to reduce or prevent insect exposure to the skin, or wear high rubber boots. ● Apply DEET to the skin and clothing to serve as a repellant, (for ticks) and insect repellant for other insects. ● Use Permethrin on clothing (Note: Permethrin kills insects (ticks) on contact and must be applied in advance to permit drying). ● Daily check for the presence of insects (ticks) and their immediate removal. (Note: This is of obvious importance, and especially noteworthy since infection with Lyme disease requires at least 36 hours of tick attachment).
No eating, drinking, or smoking on-site.		Ingestion of contaminants.	● Use proper personal hygiene practices. ● Use proper decontamination practices.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
No contact lenses on-site. No facial hair that would interfere with respirator fit.			• Exit Exclusion Zone and wash hands, face & neck before eating, drinking or smoking. • Utilize appropriate spectacle kit with the respirator in use. • Shave each morning before using respirator. Ensure that no facial hair interferes with respirator seal area.
A safety meeting shall be held each day, even if there is only one person working on the project on any given day.			• Topics will always include the work scheduled for the day and restatement of the hazards and means to avoid them. Other topics may be extricated from the list included in the HASP. • Use Daily Tailgate Safety Meeting for logging the topics discussed.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clear drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Traffic hazards. Overhead and underground installations. Product releases. Property damage. Dealer inconvenience.	● Reference Utility Clearance Review form. ● Coordinate with Site Manger (or designee) to minimize potential conflicts. ● Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. ● Mark out the proposed borehole locations. ● Call underground utility locating service for public line location clearance and get list of utilities being contacted. If necessary, coordinate private line locator for private property. ● Develop a traffic control plan with the client and local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. *(Refer to site-specific HASP).* ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if a “formally developed” Traffic Control Plan is not available.**
Obtain sub-contractor equipment maintenance records prior to commencing work.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	● Verify maintenance records in possession are for equipment on site. ● Verify maintenance is current.
Mobilize with proper equipment/supplies for drilling.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves for the non-chemical aspects of work as necessary; Wear an appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or its equivalent).*	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	● Start project with Daily Health and Safety Briefing. ● Follow safe driving procedures. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. ● Review permit conditions.
Visually clear proposed drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Underground and overhead installations.	● Complete Pre-Mobilization section of Utility Clearance Review form and adjust drilling locations as necessary.
Set up necessary traffic control. See site-specific	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety	Struck by vehicle during placement.	● Use buddy system for placing traffic control. Implement traffic control plan such as setting out cones and tape defining safety area.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
HASP for detailed plan.	glasses with side shields, and leather gloves as necessary.	Vehicle accident as a result of improper traffic control equipment placement.	● It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if a separate diagram is not available. ● Adhere to approved Traffic Control Plans (see site-specific HASP) when working in roadways. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if a "formally developed" Traffic Control Plan is not available.**
Assist with set up of rig.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Vehicle accident during rig movement. Damage caused by rig while accessing set-up location. Contact with overhead installations. Soft terrain. Rig movement.	● All staff should know where the kill switch is for the drilling rig (incorporate into Daily Health and Safety Briefing). ● Verify clear pathway to drilling location and clearance for raising mast. ● Provide as-needed hand signals and guidance to driver to place rig. ● Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). ● If necessary, use wooden blocks under jacks to spread load. Chock wheels.
Set up exclusion zone(s) and workstations (Hydropunch/Geoprobe and logging/sample collection).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during set up. Slip/fall hazards.	● Implement exclusion zone set up. ● **It is the responsibility of the SHSO to annotate the Site Plan with the exclusion zone configuration.** ● Set up workstations with clear walking paths to and from rig. Use safety tape and cones.
Clear upper five feet of Hydropunch/Geoprobe location using post-hole digger or hand auger.	Don required PPE as appropriate for this step: steel toed and shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges if necessary. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek poly coated chemical resistant suit or its equivalent).*	Back strain. Exposure to chemical hazards. Hitting an underground utility. Repetitive motion.	● Stand upwind to avoid exposure whenever possible. ● Initiate air quality monitoring in accordance with the site-specific Health and Safety Plan. ● Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources such as the core as it is being raised from the hole, the core is opened, etc. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Use proper lifting techniques and tools.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
			● Complete the Pre-Drilling section of the Borehole Clearance Review form. ● Avoid twisting back during the operation; Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a second distilled or de-ionized water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums at an agreed upon location between the Store Manager and SGI representative.
Commence Geoprobe/Hydropunch operation.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed.	Cross-contamination from previous hole. Back strain. Heat or cold. Eye injury. Noise. Exposure to chemical hazards. Hitting an underground utility. Trip and fall. Equipment failure	● Decontaminate sampling equipment after collecting a sample. Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a second distilled or de-ionized water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums at an agreed upon location between the Store Manager and SGI representative. ● Decontaminate Geoprobe/Hydropunch equipment after each evolution. Decontamination will be accomplished using a pressure washer and then air-dried. Decon water will be collected in 55-gallon drums and staged *at* an agreed upon location between the Store Manager and SGI representative. ● Use proper lifting techniques. ● Monitor air quality in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Monitor CPT/Geoprobe/Hydraulic Push progress. ● Keep work area clear of tripping or slipping hazards. ● Perform periodic visual inspections of CPT/Geoprobe/Hydraulic Push rig.
Collect samples in accordance with sampling plan.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Cross-contamination. Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Improper labeling or storage. Injury from broken sample	● Perform air monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Decontaminate sampling equipment between each well (unless disposable). If the equipment is reusable, then wash in an Alconox wash, rinsed with tap water, then rinsed with distilled or de-ionized water. Decontamination water will be transferred to 55-gallon drums and staged onsite for future characterization and disposal. All drums are to be properly labeled.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
		bottle (cuts or acid burn).	● Use proper lifting techniques. ● Label samples in accordance with sampling plan. ● Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.
Cuttings will be picked up by shovel and placed directly in 55-gallon drums.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that equipment is contaminated, wear chemical resistant gloves.	Exposure to public. Traffic hazard or obstruction/inconvenience to station operation. Improper storage or disposal. Back strain.	● Have proper storage containment and labeling available onsite. ● Place materials in isolated location away from traffic and other site functions. ● Use appropriate drum handling practices. Do not attempt to lift, push or move drums without the proper tools and equipment.
Backfill borehole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Back strain. Trip hazards. Eye injury from splashing or release of pressurized grout.	● Mix grout to specification and completely fill the hole. ● Use proper lifting techniques. ● Keep work area clear of tripping hazards.
Dispose or store purge water (if any) onsite.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and chemical resistant gloves as necessary. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage or disposal.	● Use appropriate drum handling practices. ● Use proper equipment to transport water (pumps, drum dollies, etc.). ● Monitor air quality in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA cartridges within 3-5 feet of working location, readily available. ● Label storage containers properly, and locate in isolated area away from traffic and other site functions. ● Coordinate offsite disposal (where applicable). ● Do not attempt to lift, push or move drums without the proper tools or equipment.
Supervisor/HSC must confirm all boreholes are		Possible injuries and damage to property due to stepping	● Visually inspect each and every borehole.

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❶ Job Steps	**❷ Personal Protective Equipment**	**❸ Potential Hazard**	**❹ Critical Actions**
closed, filled in and/or capped.		into or driving over the well.	
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary.	Traffic. Lifting hazards.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Clearly mark/barricade any borings that need later topping off or curing. ● Notify site personnel of departure, final well locations and any cuttings/purge water left onsite. ● Use proper lifting techniques
Package and deliver samples to lab.		Bottle breakage. Back strain.	● Handle and pack bottle carefully (bubble wrap bags are helpful). Use proper lifting techniques.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Obtain sub-contractor equipment maintenance records and/or personnel training records prior to commencing work, as appropriate.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	● Verify and review maintenance records in possession are for equipment on site. ● Review and verify subcontractor-training records prior to mobilizing to site. ● Verify maintenance is current.
Mobilize with proper equipment/supplies for cutting concrete and pavement.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves. Wear an appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed for dust. (Use *a North respirator or its equivalent. Foam earplugs with an NRR of 33. Tyvek chemical resistant suit or its equivalent).*	Traffic hazards. Vehicle accident. Lifting hazards. Delay or poor performance of work due to improper equipment on site.	● Develop a traffic control plan with the client/local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. Include drawings in the site-specific HASP. ● Follow safe driving procedures. ● Start project with Daily Health and Safety Briefing. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. ● Review permit conditions. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Set up traffic control, if necessary. See site-specific HASP for detailed plan.	Wear reflective vest for traffic; steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	● Use buddy system for placing traffic control. ● Implement traffic control plan such as setting out cones and tape defining safety area. This may entail oversight of traffic control subcontractor. ● Adhere to approved Traffic Control Plans when working in roadways. (See site-specific HASP). ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Perform concrete and/or pavement cutting.	Wear reflective vest for traffic, appropriate hearing protection, latex gloves, safety glasses with side shields, (or face shield), appropriate respirator with HEPA P-100 cartridges and Tyvek suit for nuisance dust.	Struck by vehicle during cutting. Noise from cutter. Eye injury from splatter, flying	● Adhere to approved Traffic Control Plans. (See site-specific HASP). ● Wear <u>ALL</u> appropriate PPE, safety glasses, hearing protection, etc. ● Employ safe lifting procedures. ● Collect, containerize, and solidify all cutting fluids.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
		debris. Inhalation of dust. Lifting hazard from cutter or concrete cut block. Skin irritation from dust, concrete, cement, or cutting fluids.	• Avoid skin contact with cement/cuttings. • See www.cement.org/basics/concretebasics_working.asp • If not properly solidified prior to or at the time of placing concrete cutting fluids into a drum, drum will likely require labeling and handling as a hazardous waste.
Supervisor/HSC must confirm all corings/cutouts are closed, filled in and/or capped.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Possible injuries and damage to property due to stepping into or driving over the cutout.	• Visually inspect each and every coring or cutout. • Ensure that any installed steel plates are properly anchored to prevent movement by car or heavy vehicle (truck/bus) traffic. • Ensure corners of plates are demarcated with safety paint, and signage/delineators, where applicable, to avoid tripping hazards to the extent possible. • If installed in traffic lanes, ensure plate installation and inspections are made per the encroachment permitting.
Clean site/demobilize	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves as necessary.	Traffic hazards. Lifting hazards.	• Leave site clean of refuse and debris. • Notify station personnel of departure. • Use proper lifting techniques. • Ensure drum is properly labeled (if cutting fluids are not pre-treated, waste is likely hazardous). • Ensure all rubble is placed in bin/dumpster or drum for final disposition. Profile material for proper disposal. If material is stained or contaminated, do not place in refuse dumpster. • Notify project manager/facility manager if any barricades are left over/around holes in areas of pedestrian or vehicle traffic. Photo-document such conditions as warranted.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clear drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Traffic hazards. Overhead and underground installations. Product releases. Property damage, and dealer inconvenience.	● Reference Utility Clearance Review form . ● Coordinate with Site Manger (or designee) to minimize potential conflicts. ● Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. ● Mark out the proposed borehole locations. ● Call underground utility locating service for public line location clearance and get list of utilities being contacted. If necessary, coordinate private line locator for private property. ● Develop a traffic control plan with the client and local agencies as applicable. Plan may include use of cones, barrier tape, jersey barriers, etc. *(Refer to section above).* **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Obtain sub-contractor equipment maintenance records prior to commencing work.		Improper equipment maintenance, which can cause equipment failure and possible personal injury.	● Verify and review maintenance records for equipment on site. ● Verify maintenance is current.
Mobilize with proper equipment/supplies for drilling.	Gather necessary PPE. Reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, ear plugs/muffs, and leather gloves for the non-chemical aspects of work. Wear an air purifying respirator with combination organic vapor/HEPA P-100 cartridges, and other PPE as needed. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek, poly coated chemical resistant suit or it's equivalent).*	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	● Start project with Daily Health and Safety Briefing. ● Follow safe driving procedures. ● Employ safe lifting procedures. ● Make sure sub-contractors are aware of their responsibilities for labor, equipment and supplies. ● Review permit conditions.
Visually clear proposed drilling locations.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Underground and overhead installations.	● Complete Pre-Mobilization section of Utility Clearance Review form and adjust drilling locations as necessary.
Set up necessary traffic control. (See site-specific HASP)	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather	Struck by vehicle during placement.	● Use buddy system for placing traffic control.

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	gloves.	Vehicle accident as a result of improper traffic control equipment placement.	● Implement traffic control plan such as setting out cones and tape defining safety area. ● Adhere to approved Traffic Control Plans when working in roadways. ● **It is the responsibility of the SHSO to annotate the Site Plan with the Traffic Control configuration if an Approved Traffic Control Plan is not available.**
Assist with set up of rig.	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Vehicle accident during rig movement. Damage caused by rig while accessing set-up location. Contact with overhead installations. Soft terrain. Rig movement.	● Verify clear pathway to drilling location and clearance for raising mast. ● Provide as-needed hand signals and guidance to driver to place rig. ● Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). ● If necessary, use wooden blocks under jacks to spread load. ● Chock wheels.
Set up exclusion zone(s) and workstations (drilling and logging/sample collection).	Wear reflective vest for traffic, steel toed and shank shoes, hardhat, safety glasses with side shields, and leather gloves.	Struck by vehicle during set up. Slip, trip and fall hazards.	● Implement exclusion zones. ● **It is the responsibility of the SHSO to annotate the Site Plan with the configuration of the exclusion zones.** ● Set up workstations with clear walking paths to and from rig.
Clear upper five feet of borehole location using post-hole digger or hand auger.	Don required PPE as appropriate for this step: steel toed and shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. Wear chemical resistant gloves during handling of soil. Wear an air-purifying respirator with combination organic vapor/HEPA P-100 cartridges if necessary. (*Use a North respirator or its equivalent. Best brand nitrile gloves or their equivalent. Foam earplugs with an NRR of 33. Tyvek poly coated suit or its equivalent).*	Back strain. Exposure to chemical hazards. Hitting an underground utility. Repetitive motion.	● Complete Pre-Drilling section of Utility Clearance Review form and adjust drilling locations as necessary. ● Stand upwind to avoid exposure whenever possible. ● Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources such as the core as it is being raised from the hole, the core is opened, etc. ● Initiate air quality monitoring in accordance with the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE. ● Use proper lifting techniques and tools. Avoid twisting back during

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
			the operation. ● Decontaminate equipment after use. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums onsite pending characterization and disposal. All drums require proper labeling.
Commence drilling borehole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges if needed. Wear chemical resistant gloves if needed. Wear chemical resistant suit if needed.	Cross-contamination from previous hole. Back strain. Heat or cold stress. Eye injury. Noise. Exposure to chemical hazards. Hitting an underground utility. Slip, trip and fall hazards. Equipment failure	● Decontaminate sampling equipment after collecting each sample. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a de-ionized or distilled water rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums onsite pending characterization and disposal. ● Decontaminate drilling equipment after each borehole. ● Use proper lifting techniques. ● Conduct air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Monitor drilling progress. ● Keep work area clear of tripping or slipping hazards. ● Perform periodic visual inspections of drill rig.
Collect samples in accordance with sampling plan.	Wear appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed. Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, chemical resistant gloves and chemical resistant suit as needed.	Cross-contamination. Improper labeling or storage. Exposure to site contaminants.	● Conduct air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Evaluate any soil samples inside a Ziploc bag at arm's length. DO NOT EVALUATE THE SAMPLE WITH THE BAG OPEN. THIS WILL AVOID UNNECESSARY EXPOSURE ● Decontaminate sampling equipment between each sampling run. Decontamination will be accomplished by an Alconox wash with tap water rinse followed by a distilled rinse. Collect rinse water in 5 gallon buckets and transfer to 55-gallon drums and stage drums on site pending characterization and disposal. All drums require proper labeling.

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❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
			● Label samples in accordance with sampling plan. Keep samples stored in proper containers, at correct temperature, and away from work area.
Cuttings will be picked up by shovel and placed directly in 55-gallon drums.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work. If you suspect that equipment is contaminated, wear chemical resistant gloves. Wear chemical protective suit and/or appropriate air purifying respirator with combination organic vapor/HEPA P-100 cartridges as needed.	Exposure to public. Traffic hazard or obstruction/inconvenience to station operation. Improper storage or disposal.	● Have proper storage containment and labeling available onsite. Place materials in isolated location away from traffic and other site functions. ● Perform air monitoring as outlined in the site-specific Health and Safety Plan. ● Have appropriate respirator with combination organic vapor/HEPA P-100 cartridges within 3-5 feet of work area, readily available. ● Full drums will be staged onsite pending characterization and disposal. All drums require proper labeling.
Backfill borehole.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work.	Improper grouting can lead to future vertical conduit for contaminant migration. Back strain. Slip, trip and fall hazards. Eye injury from splashing or release of pressurized grout.	● Mix grout to specification and completely fill the hole. ● Use proper lifting techniques. ● Keep work area clear of tripping hazards.
Supervisor/HSC must confirm all boreholes are closed, filled in and/or capped.		Possible injuries and damage to property due to stepping into or driving over the well.	● Visually inspect each and every borehole.
Clean site/demobilize.	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work.	Traffic. Lifting hazards.	● Use buddy system as necessary to remove traffic control. ● Leave site clean of refuse and debris. ● Clearly mark/barricade any borings that need later topping off or curing. ● Notify site personnel of departure, final well locations and any cuttings/purge water left onsite. ● Use proper lifting techniques
Package and deliver samples to lab.		Bottle breakage. Back strain.	● Handle and pack bottle carefully (bubble wrap bags are helpful). Use proper lifting techniques.

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clear Boring Locations: • Ensure boring locations have been cleared and marked by SGI and third-party locating company. • Check for overhead and subsurface utilities	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required).	1. Hitting subsurface and/or overhead utilities. 2. Electrocution 3. Explosion 4. Product release 5. Service interruptions 6. Property damage	1. – 6. Obtain USA ticket number (list subcontractor on ticket).
Project Setup and General Operations: • Set up material staging area. • Set up mixing truck. • Set up DPT vehicle. • Stage injection piping and hoses, connection fittings. • Review HASP	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required).	1. Slip/trip/fall 2. Field staff struck by mobile equipment, traffic 3. Strain from lifting 4. Pinch points	1a. Visually inspect work area for debris before start of work - place trash / debris in disposal. Keep work area neat as possible. 1b. Uneven ground exists - maintain footing awareness 1c. Everyone will conduct a 360-degree walk around to identify hazards 2a. Place vehicle adjacent to working area to shield body from traffic 2b. Place traffic cones around working area 2c. Wear high visibility traffic vest 2d. Attempt to work in high traffic areas in the early morning before peak traffic pattern. 3a. Lift heavy objects (buckets, water bottles, coolers, etc.) using leg strength and proper posture 3b. Obtain assistance when lifting >50 lbs. (such as generators) - do not lift alone 4a. Secure load to ensure it does not shift during transport 4b. Avoid placing hands/fingers beneath heavy objects (buckets, coolers, etc.) 4c. Wear leather gloves when handling equipment/supplies 4d. Watch hand position when opening/closing hinged lids/gates (i.e. tailgates, utility boxes, etc.)

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Set up additional and necessary traffic control: • Set up traffic signage • Set up traffic diversion cones.	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required).	1. Slip/trip/fall hazards to workers. 2. Field staff struck by mobile equipment, traffic.	1a. Visually inspect work area for debris before start of work - place trash / debris in disposal. Keep work area neat as possible. 1b. Uneven ground exists - maintain footing awareness 1c. Everyone will conduct a 360-degree walk around to identify hazards 2a. Place vehicle adjacent to working area to shield body from traffic 2b. Place traffic cones around working area 2c. Wear high visibility traffic vest 2d. Attempt to work in high traffic areas in the early morning before peak traffic pattern.
Set up exclusion zones(s) and workstations: • Set up temporary fencing around injection zone. • Set up decontamination stations • Set up access/egress control	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required).	1. Injury or exposure to public or other onsite personnel. 2. Slip/trip/fall hazards to workers	1a. Implement exclusion zone. Arrange safety fencing and barriers for both personal and vehicle safety if needed. 1b. Ensure that unauthorized personnel do not enter into exclusion zone. 1c. Personnel are not allowed in exclusion zone without PPE. 2a. Visually inspect work area for debris before start of work - place trash / debris in disposal. Keep work area neat as possible. 2b. Uneven ground exists - maintain footing awareness 2c. Everyone will conduct a 360-degree walk around to identify hazards
Spill Control: • Spill Prevention • Spill Response • Spill Recovery • Waste Handling • Decontamination	Refer to Spill Control JSA	1. Environmental Impact. 2. Operator exposure to spill materials in the work area 3. Operator exposure to released liquids from injection rig	1. – 3. Refer to Spill Control JSA

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Reagent Mixing: • Transfer of water from source to mixing tanks • Reagent transfer to mixing tanks. • Reagent/water mixing	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; • APR with acid/gas cartridges or Dust mask (NIOSH N-95) for dry reagent.	1. Loose, deteriorated hoses. 2. Potential energy – liquids under pressure. 3. Chemical Hazards	1a. Inspect all hoses and hose connections before beginning transfers and during transfers. 2a. Inspect all hoses and hose connections during transfers. 2b. Monitor pressures on transfer lines for over-pressure conditions. 3a. Don appropriate PPE 3b. Review MSDS
Install DPT points to pre-planned depth(s): • Movement of direct push rig • Clear work area • Safe use of rods/tips. • Rod separation • Safe use of hand tools	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required).	1. Noise 2. Fluids under pressure (hydraulic hose) 3. Field staff struck by mobile equipment, traffic. 4. Strain from lifting 5. Pinch points	1a. Hearing protection is required when working near an operating direct push drill rig. 2a. Inspect rig hydraulic hosing prior to work daily. 3a. Place vehicle adjacent to working area to shield body from traffic 3b. Wear high visibility traffic vest 3c. Attempt to work in high traffic areas in the early morning before peak traffic pattern. 4a. Lift heavy objects (buckets, water bottles, coolers, etc.) using leg strength and proper posture. 4b. Obtain assistance when lifting >50 lbs. (such as generators) - do not lift alone. 5a. Wear leather gloves when working with tools and supplies and opening/closing valves 5b. Be aware of hand placement when assembling/separating rods, opening/closing tool boxes, truck compartments, etc.

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Inject mixed reagent into DPT points: • Connect hoses from mixing truck to injection rig. • Connect hoses from injection rig to injection point(s). • Transfer of mixed reagents from mixing truck to direct push injection point(s). • Monitor flow rate, total volume, injection pressure(s).	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; APR with acid/gas cartridges	1. Potential energy – liquids under pressure 2. Surfacing of reagent 3. Chemical splash 4. Accidental Release to environment	1a. Check all hoses and connections prior to beginning injection. 1b. Verify that all appropriate valves are open prior to beginning injection. 1c. Stop injection if pressure is in excess of pre-determined safety condition for piping components. 2a. Continually monitor injection wells, monitoring wells, and surrounding areas. 3a. Personnel are not allowed in exclusion zone without PPE. 4a. Refer to Spill Control JSA.
Decontaminate tools and injection rig: • Wash hand tools • Wash injection tools • Decontaminatesampling equipment • Decontaminate injection rig • Decontaminate mixing truck.	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; APR with acid/gas cartridges	1. Worker exposure to chemicals 2. Corrosion of equipment 3. Possible incompatible chemicals for next injection event.	1a. Hands will be rinsed with water periodically and before eating or drinking. 1b. Eating, drinking and tobacco use are not allowed in the exclusion zone. 2a. Injection unit equipment and accessories shall be maintained in good working condition free of excessive grease and oil. 3a. Decontamination during injection shall include fresh water flush of all lines, tanks, and mixing equipment and shall occur after each day of injection while rig is on-site.
Empty Container and Recovered Injection Fluids Management: • Manage reagent bags (solid), drums (solids/liquids), and totes (liquids). • Segregate and dispose of residual material.	Modified Level C PPE: • Level D; • Tychem™ w/ hood; • Chemical Resistant Boot covers; • Goggles and face shield; • Nitrile gloves and chemical resistant over-gloves; APR with acid/gas cartridges	1. Mixing incompatible chemicals 2. Chemicals contacting combustible material, causing a fire	1a.Keep wastes segregated at all times. 1b. All ISCO solution containers shall be emptied to the greatest extent practical. 2a. Unused chemical or recovered reagent fluids will be containerized. 2b. Arrange for prompt waste management with client.

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Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, and lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Clean Site / Demobilize: • Tear down material staging area. • Tear down mixing truck, DPT vehicle. • Tear down injection piping and hoses, connection fittings. • General site trash / debris cleanup.	Level D PPE: • Hard hat, steel toed boots, safety glasses (Mandatory); and • Gloves, hearing protection, traffic vest (As Required).	1. Traffic 2. Slip/trip/fall 3. Nuisance or safety hazards left on-site.	1a. Place vehicle adjacent to working area to shield body from traffic 1b. Place traffic cones around working area 1c. Wear high visibility traffic vest 1d. Attempt to work in high traffic areas in the early morning before peak traffic pattern. 2a. Visually inspect work area for debris before start of work - place trash / debris in disposal. Keep work area neat as possible. 2b. Uneven ground exists - maintain footing awareness 2c. Everyone will conduct a 360-degree walk around to identify trip hazards 3a. Leave site clean of refuse and debris. 3b. Clearly mark and/or barricade any borings that may need later closure, topping off or curing.

APPENDIX F

GENERAL PHYSICAL HAZARD ANALYSIS

GENERAL PHYSICAL HAZARD ANALYSIS

The following general physical hazards are described in this Appendix.

- Machinery / Heavy Equipment
- Heat Stress (Summer Only)
- Cold Stress (Winter Only)
- Lightning
- Oxygen Hazards
- Flammable Atmosphere Hazards
- Hot Work in Hazardous Location
- Electrical Safety
- Utilities
- Noise
- Falls, Trips, Slipping
- Biological Hazards
- Stored Energy (pressurized pipes, etc.)

Machinery / Heavy Equipment

The following general procedures should be followed when operating near heavy equipment (drill rig, backhoe, excavator, wheel loader, crane, etc.) and performing associated activities.

- Only staff necessary to operate the equipment shall remain in its proximity. Site workers shall not remain near working equipment longer than necessary.
- Hearing protection will be worn when noise levels are above 85 decibels, and in the absence of noise measurements, protection will be worn while operating or within a 10 foot vicinity of equipment, and when understanding speech is difficult at 5 feet.
- All site personnel will wear ANSI-approved hardhats, safety glasses or goggles, and steel-toed/steel-shank boots and traffic vests.
- The equipment operator and associated field crew must discuss proposed operations in advance and document on the tailgate safety meeting form.
- Site workers shall be cognizant of equipment movement around them at all times.

Heat Stress (Summer Only)

Heat stress is the combination of both environmental and physical work factors that contribute to the total heat load imposed on the body. The Site Health and Safety Coordinator will observe field personnel for signs indicative of heat illness. Personnel experiencing heat strain symptoms will be required to immediately take action to reduce their stress. The following measures will be used to help reduce the effects of heat stress or to prevent the heat stress from occurring:

- Acclimation to the heat through short work periods, followed by longer periods of work can reduce heat stress.
- Limit the intake of diuretics (coffee, soda, etc.) and include electrolyte replacement drinks (Gatorade) if there is excessive sweating.
- Identify a shaded, cool rest area.
- Rotate personnel and alternate their job functions as needed.
- Ensure that personnel consume enough water to replace the amount of moisture lost through perspiration. Most workers exposed to hot conditions drink less fluid than they need. Workers should consume at least 50 ounces of fluid in small amounts at regular intervals during an 8-hour workday. This amount may be much larger depending upon the individual.
- Allow for frequent rest periods in the shade when temperatures exceed 80 degrees F. Each person will take their pulse at rest. At breaks, the pulse should be less than 110 beats per minute after one minute. Before returning to work, the pulse should be no more than 10 beats greater than the resting pulse. If necessary, a specific work/rest schedule will be established by the Site Health and Safety Coordinator.
- Work should stop if any of the following symptoms occur: muscle spasm and/or pain in the limbs or abdomen (heat cramps); weak pulse, heavy sweating, dizziness, and/or fatigue (heat exhaustion); or rapid pulse, no sweating, nausea, dizziness, and/or confusion (heat stroke). Provide First Aid immediately.
- Use sunscreen on unprotected skin to protect against ultraviolet exposure as necessary.
- Schedule the most strenuous activities during cooler periods, such as during the early morning hours or early evening hours.

Persons exhibiting symptoms of heat exhaustion (i.e., pale/clammy skin, dizziness, nausea, cramps) will be removed from the work area, given cool fluids to drink, and observed during the recovery period. Persons exhibiting symptoms of heat stroke (i.e. hot/dry skin, mental confusion, or unconsciousness) will be immediately cooled down and taken to the nearest hospital. Any of the following symptoms could indicate a serious heat stress problem: dizziness, rapid heart rate, nausea, cramps, breathing problems, weakness, or diarrhea.

Cold Stress (Winter Only)

When the body is unable to warm itself, cold related stress may result. Four factors contribute to cold stress: cold air temperatures, high velocity air movement, dampness of the air, and contact with cold water or surfaces. A cold environment forces the body to work harder to maintain its temperature. Protective Clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, silk and most synthetics, on the other hand, retain their insulation even when wet.

Plan for work in cold weather and take the following measures to help reduce the effects of cold stress or to prevent the cold stress from occurring:

- Wear at least three layers of clothing; an inner layer of wool, silk or synthetic to wick moisture away from the body, a middle layer of wool or synthetic to provide insulation, and an outer wind and rain protection layer that allows some ventilation to prevent overheating.
- Wear a hat or hood if appropriate. Up to 40% of body heat can be lost when the head is left exposed.
- Keep a change of dry clothing available in case work clothes become wet.
- Take frequent breaks and consume warm, high calorie food such as pasta to maintain energy reserves.
- Avoid fatigue since energy is needed to keep muscles warm.
- If possible, heavy work should be scheduled during the warmer parts of the day.
- Try to work in pairs to keep an eye on each other and watch for signs of cold stress.

Signs of cold stress include heavy shivering, pain in the fingers or toes, drowsiness or irritability. Do not underestimate the wetting effects of perspiration. Oftentimes wicking and venting of the body's sweat and heat are more important than protecting from rain or snow.

Personnel experiencing cold stress symptoms shall immediately take action to reduce their stress including moving to a warm area and staying active. Remove wet clothes and replace with dry clothes or blankets, cover the head. To promote metabolism and assist in raising internal core temperature drink a warm (not hot) sugary drink. Avoid drinks with caffeine. For more severe cases do all the above, plus contact emergency medical personnel (Call 911 for an ambulance), cover all extremities completely, place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin. Arms and legs should be warmed last. In cases of severe hypothermia treat the worker very gently and do not apply external heat to re-warm. Hospital treatment is required.

Lightning

Lightning can occur as dry lightning or heat lightning when certain meteorological conditions exist. Little warning may be provided and thus any operations, especially those including electrical work or elevated metallic structures (i.e. drill rig, crane), should be suspended if possible. Weather forecasts should be monitored in advance of field work, and additional precautions should be made when such conditions are reported in the region.

Lightning seeks the easiest route (not necessarily the shortest) between positive and negative regions within a cloud or between positive charges on the ground and negative charges in the cloud. The human body offers a path of least resistance. The hazard of lightning occurs in two ways, either as a direct hit or as a ground current.

The following measures will be used during lightning storms:

- Seek shelter inside a building.
- Select fiberglass or plastic hard hats rather than those of metal construction.
- Don't work on fences, electrical lines, pipelines, or structural steel fabrication.
- Don't use metal objects like fishing rods, soil augers, well- logging equipment, etc., that are in contact with the ground.
- Automobiles provide a safe shelter because the metal body creates a pathway for the lightning around the body. Avoid contact with metal objects in the car where your body could become a pathway.
- Lightning tends to strike the highest electrically conductive object in the area such as peaks, ridges, towers, trees, isolated sheds (especially with metal roof or siding), wire fences, etc. Seek lower elevation as in valleys or canyons.
- Avoid streams and lakes. If in a low area, be cautious of flash floods and sloughing off of earthen or rock materials from above.
- Sit on some insulating material if possible, such as coiled rope, a wooden pack board, a folded sleeping bag, a wool shirt, etc.
- A crouched position, sitting on your feet with the knees drawn up and feet close together, seems best to minimize the distance spanned by your contact points. Avoid any position with a hand, shoulder, or head touching a surface.
- Never use any radio or extend any antenna on a portable set if a lightning storm is within one mile.
- SUSPEND ACTIVITIES for 30 minutes after the last observed lightning or thunder.

Lightning strike injuries may include the following:

- The passage of electricity through the body can either burn tissues or only cause muscle spasms or contractions.
- Vital nerve centers may be blocked causing the heart or breathing to stop. **Immediate revival should be attempted using appropriate artificial respiration and cardiac massage (CPR) techniques. Be assured, however, that a lightning shock victim can be touched without any risk of shock to you.**

Oxygen Hazards

Oxygen deficiency is defined by O_2 levels below 19.5% by volume. Oxygen deficiency can be caused by combustion (cutting torches), decomposition of organic matter, and oxidation of metals from rusting, inerting with nitrogen gas. This can also happen from oxygen or air displacement due to the presence of a different gas (CO2, CO, etc.).

Oxygen enrichment when O_2 levels exceed 23.5% creates an extreme fire hazard. Flammable materials such as clothing and hair will burn very rapidly in an oxygen-enriched atmosphere. High oxygen levels could occur from leaking or unattended oxygen lines or cylinders.

If the risk from oxygen enrichment is high, such as in a confined space or a poorly ventilated room, the use of oxygen monitoring equipment is advisable. Good ventilation will reduce the risk of oxygen enrichment. If oxygen enrichment is suspected, the oxygen supply should be turned off. Cigarettes and open flames should be extinguished. The area should be well ventilated and the source of the leak identified and repaired. It is possible that oxygen may contaminate any clothing in the area. If this is suspected, the clothing should preferably be removed and taken outside for airing and ventilating.

Flammable Atmosphere Hazards

For a fire or explosion to occur, fuel, oxygen, a source of ignition, and mixing must be present. The specific mixture of fuel and oxygen that will ignite or explode varies with the specific combustible gas. In all cases, this critical point is defined as the range between the lower explosive limit (LEL) and the upper explosive limit (UEL).

Lower explosive limit levels will be continuously monitored during operations involving all known combustible materials. A portable combustible gas LEL meter will be utilized with an audible alarm set to alert at 10% of the LEL. This 10% LEL level will allow workers adequate time to discontinue work, retreat and reevaluate the work hazard. Additional ventilation and/or purging with inert gas may be required. SGI policy is that no work is allowed whenever LEL levels are above 10%.

Hot Work in Hazardous Location

Potential ignition sources include electrical sparks, open flame. Work activities that necessitate the use of a flame, generate a spark or otherwise create an elevated temperature, which could ignite combustible or flammable materials or atmospheres, are considered hot work. Some of the activities which could potentially create an ignition source include welding, metal cutting, grinding, or pneumatic chipping. Prior to hot work being performed, the location will be assessed for hazards by the subcontractor. SGIs Health and Safety Coordinator will be notified of all hot work activities. Areas where heat or spark may ignite the atmosphere or surrounding materials are considered a hazardous location, and a hot work permit will be required prior to performing the operation.

Electrical Safety

All electrical work will be performed in accordance with the National Fire Protection Association, National Electrical Safety Code, and OSHA Standards. Extension cords will be the three-wire type for grounded tools, and will be protected from damage. All extension cords will be protected by ground fault circuit interrupters. Only approved electrical cords will be utilized. Only receptacle and attachment plugs of the approved concealed-contact type are allowed.

Utilities

Prior to conducting any soil invasive site activities, SGI will make all attempts to identify existing underground utilities in the areas surrounding the activity, including but not limited to air knifing, hand augering, and geophysical clearance. Appropriate local utility companies will be contacted by notifying Dig Alert at least 48 hours in advance of digging, to clear area of proposed excavation areas for potential underground utilities. To avoid any contact with aboveground utilities, site activities will be conducted at distances greater than 20 feet from aboveground utilities. The Utility Clearance Log and Utility Clearance Map are available in this Appendix G.

Noise

If noise levels exceed 85 decibels in an 8-hour work day, personal protective equipment (e.g., ear plugs) will be provided and used to reduce noise levels.

Falls, Trips, Slipping

The areas surrounding the remedial action activities may consist of uneven surfaces. All site personnel will wear skid-proof boots. Any known potential fall/trip/slip hazards will be discussed in the tailgate safety meetings. All field personnel will be equipped with approved skid-proof boots.

Traffic

All site personnel should be aware of surrounding traffic and always exercise caution with crossing roadways and driveways. If work is conducted in the roadway, always use caution cones or barriers to protect your work area. When work is to be performed in or around the ground in high traffic areas, such as well vaults near dispenser islands, the buddy system is to be utilized to direct traffic and ensure safety.

Biological Hazards

All site personnel will wear long-sleeve shirts and pants, gloves, ANSI-approved hardhats, safety glasses or goggles, and steel-toed/steel-shank boots to avoid contact with biological hazards. Any person suffering from insect or animal bites should be treated immediately and taken to the nearest hospital, if necessary.

Lifting

All site personnel shall ensure proper lifting techniques when handling objects on site. Important practices include to plan ahead before lifting, lifting close to your body, keep feet shoulder width apart, bend your knees and keep your back straight, tighten your stomach muscles, lift with your legs, get help on objects that are heavy or awkward in shape and wear a belt or back support.

- Never bend your back to pick something up.
- Hold the object close to your body.
- You are a much more stable lifter if you're not reaching for an object.
- Don't twist or bend.
- Face in the direction you are walking. If you need to turn, stop, turn in small steps, and then continue walking.
- Keep your eyes up when walking and look slightly upwards to help maintain a better position of the spine.

APPENDIX G

UTILITY CLEARANCE LOG/MAP

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UTILITY CLEARANCE LOG

Date: ____________________

"One-call" confirmation number and date contacted: ____________________

"One-call" expiration date: ____________________

Subcontractor locating firm and invoice number: ____________________

Facility contact person & telephone number: ____________________

Facility drawings reviewed: ____________________

Verbal/written sign-off of clearance by facility contact: ____________________

Pressurized lines/shut-off valves identified: ____________________

Underground utilities/lines identified: ____________________

____

Underground utilities/lines marked on-site by: ____________________

Overhead utilities/lines identified: ____________________

Overhead utilities identified on-site by: ____________________

Clearance Contact:

____________________	____________________	____________________
Name (SGI employee only)	Signature	Date

Clearance Reviewed by:

____________________	____________________	____________________
Name (SGI Project Manager)	Signature	Date

UTILITY CLEARANCE MAP

(As per the *Utility Clearance for Drilling Memorandum* completed before the event.)

APPENDIX H

AIR MONITORING TABLE/LOGS

- **MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE TABLE**
- **AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG**
- **AIR MONITORING LOG**

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MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE TABLE

Equipment	Type/Model	Field Calibration Method	Field Calibration Frequency	Field Maintenance Method	Field Maintenance Frequency
Photoionization Detector (PID)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Flameionization Detector (FID)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Organic Vapor Meter (OVM)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Chemical Detector Tube (colorimetric)		___ Check expiration date ___ Other (please specify):	___ Before each use ___ Before day of sampling ___ Other (please specify):	___ All parts included and working ___ Other (please specify):	___ Before day of sampling ___ Other (please specify): ___
Combustible Gas Meter (LEL)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Multiparameter Meter		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Other (please specify)		___ Buffer solutions ___ Span gas ___ Zero gas Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling Other (please specify):

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AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Date	Equipment Type/Model	Serial No.	Battery Check OK?	Zero Adjust OK?	Calibration Gas (PPM)	Reading (PPM)	Leak Check (Colorimetric Tube Pump)	Performed By	Comments

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AIR MONITORING LOG*

Date	Time	Location	Source/Area/ Breathing Zone	Equipment Type/Model	Concentration/Units	Sampled By

*Notify the Health & Safety Coordinator or Project Manager immediately if a PEL, TLV, or other limit is exceeded.
On-line Reference: http://www.cdc.gov/niosh/npg Centers for Disease Control "*NIOSH Pocket Guide to Chemical Hazards*"

Notes:
IDLH – Immediately Dangerous to Life or Health
PEL – Permissive Exposure Limits
TLV – Threshold Limit Value
TWA – Time Weighted Average