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April 11, 2007

Mr. Steven Plunkett
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: Texaco Gasoline Service Station (Formerly Freedom ARCO Station)
Site Address: 15101 Freedom Avenue, San Leandro, California
STID 4473/RO0000473

Dear Mr. Plunkett:

SOMA's "Workplan for Monitoring Well Installation, Soil Gas Survey and Remediation Feasibility Study" for the subject property has been uploaded to the State's GeoTracker database and Alameda County's FTP site for your review.

Thank you for your time in reviewing our report. Please do not hesitate to call me at (925) 734-6400, if you have questions or comments.

Sincerely,

Mansour Sepehr, Ph.D.,PE
Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
MANSOUR SEPEHR
No. C042928
Exp. 3-31-08
CIVIL
STATE OF CALIFORNIA

cc: Mr. Mohammad Pazdel w/report enclosure

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Workplan for Monitoring Well Installation, Soil Gas Survey and Remediation Feasibility Study

Texaco Gasoline Service Station
15101 Freedom Avenue
San Leandro, California
Fuel Leak Case No. RO0000473

Project 2550

April 16, 2007

Prepared for

Mr. Mohammad Pazdel
1770 Pistacia Court
Fairfield, California 94533

Prepared by

SOMA Environmental Engineering, Inc.
6620 Owens Drive, Suite A
Pleasanton, California

CERTIFICATION

SOMA Environmental Engineering, Inc. submits this workplan on behalf of Mr. Mohammad Pazdel, the owner of the property located at 15101 Freedom Avenue, San Leandro, California. This workplan has been prepared pursuant to the request of the Alameda County Health Care Services – Environmental Health Services for a workplan as specified in their correspondence dated March 14, 2007.

Mansour Sepehr, Ph.D., P.E.
Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

SOMA Environmental Engineering, Inc. (SOMA) has prepared this workplan for conducting the following work at 15101 Freedom Avenue, San Leandro, California (the Site):

- Installing groundwater monitoring wells in the Second Water-Bearing Zone (WBZ)
- Locating and sampling two off-site irrigation wells
- Conducting a soil gas survey
- Conducting remediation feasibility studies

This workplan was requested by the Alameda County Health Care Services – Environmental Health Services (ACHCS) in their correspondence of March 14, 2007 to Mr. Mohammad Pazdel, the owner of the Site.

1.1 Site Location and Description

The Site is located at the foot of the San Leandro Hills, along the west side of San Leandro Valley, at 15101 Freedom Avenue, San Leandro, California (Figure 1). The Site is bound on the north by Freedom Avenue, on the east by Fairmont Avenue, on the south by residential properties and on the west by 151st Avenue. It currently operates as a Valero gasoline service station with mini-mart, and retails Texaco-branded gasoline and diesel fuel. No automotive repair facility is on the Site. The Site has three canopied product dispenser islands and three underground storage tanks (USTs): one 6,000-gallon diesel UST, one 8,000-gallon gasoline UST, and one 10,000-gallon gasoline UST. Figure 2 illustrates the features on the Site.

Since the 1960s, the Site has been operated as a gasoline service station. In May 1985, the present owner purchased the station facilities on the Site, and in 1992 purchased the property. The Site operated as Freedom ARCO Station from 1985 to 1997, until the present owner sold the station facilities on the Site.

1.2 Environmental Assessment Background

In May 1999, three 10,000-gallon USTs, approximately 250 feet of product piping, and six product dispensers were removed from the Site (Geo-Logic, 1999). A total of 21 soil samples were collected for laboratory analyses from the removal areas, including seven soil samples collected from the east and west sides of the UST removal excavation, at depths ranging from 12 to 14 feet below ground surface (bgs), and 14 soil samples collected from beneath the fuel dispensers and product delivery piping ranging in depth from 2.5 to 3.5 feet bgs.

The samples were analyzed for the following: total petroleum hydrocarbons as gasoline (TPH-g); benzene, toluene, ethylbenzene, xylenes (BTEX); and methyl tertiary-butyl ether (MtBE). The results of the laboratory analyses indicated the need for additional removal of soil from the product piping areas and the UST removal excavation. Concentrations of TPH-g, BTEX and MtBE in the soil samples collected from the UST removal excavation were elevated relative to those samples collected from the product piping and dispenser areas, where concentrations were relatively low. Following the overexcavation activities, three soil samples were collected for laboratory analyses from the enlarged UST removal excavation ranging in depth from 16.5 to 24.5 feet bgs, and one sample was collected from the product delivery piping at 5 feet bgs. The laboratory analyses detected elevated concentrations in the soil samples collected at 24.5 feet bgs from the UST removal excavation relative to those samples collected at 16.5 and 19.5 feet bgs. Low concentrations were detected in the soil sample collected from the product delivery piping.

In July 1999, one 20,000-gallon gasoline UST, one 8,000-gallon gasoline UST, and one 6,000-gallon diesel UST were installed at the Site (Geo-Logic, 1999).

On January 3, 2000, the ACHCS notified the owner of the property, Mr. Pazdel, of an unauthorized release that had occurred during the removal of the old USTs in May 1999. The ACHCS requested that a preliminary site assessment (PSA) be conducted on the Site.

On July 5, 2001, a soil and groundwater investigation was conducted at the Site to delineate the extent of soil and groundwater impact discovered during the removal of the USTs, product delivery piping and product dispensers in May 1999 (CSS Environmental Services, 2001). Five soil borings, SB-1 thru SB-5, were advanced on the Site using direct-push methods. The locations of the borings are illustrated in Figure 2. The soil borings were advanced to a maximum depth of 31 feet bgs. Groundwater was encountered in the soil borings at depths ranging from 29 to 30 feet bgs, and stabilized at depths ranging from 17 to 20 feet bgs. A total of 10 soil samples were collected from the soil borings for laboratory analyses of TPH-g, BTEX and MtBE. The analytical results revealed elevated concentrations between 19 and 25.5 feet bgs. Maximum concentrations of TPH-g and BTEX in the soil samples collected were 470,000 micrograms per kilogram (µg/kg), 2,600 µg/kg, 16,000 µg/kg, 12,000 µg/kg, and 73,000 µg/kg, respectively. MtBE was not detected in any of the soil samples. Grab groundwater samples were collected from each boring for laboratory analyses of TPH-g, BTEX and MtBE. The maximum concentrations of TPH-g and benzene in the groundwater samples collected from the soil borings were 83,000 micrograms per liter (µg/l) and 19,000 µg/l, respectively. MtBE was detected in four of the five grab groundwater samples. The maximum MtBE concentration was 87,000 µg/l.

In April 2002, five groundwater monitoring wells (MW-1 thru MW-5) were installed on the Site to a total depth of 30 feet bgs, and competed with well screens installed between 15 and 30 feet bgs. The locations of the wells are illustrated on Figure 2. The wells were installed to evaluate the groundwater flow gradient and the extent of dissolved-phase fuel hydrocarbons in the groundwater beneath the Site (SOMA, 2002). Groundwater was first encountered at depths ranging from approximately 25 to 29 feet bgs, and stabilized at depths ranging from 21 to 23 feet bgs. Five soil samples were collected from the soil borings for laboratory analyses of TPH-g, BTEX and MtBE. The analytical results revealed elevated concentrations of TPH-g and BTEX between 21 and 26 feet bgs, coincident with the depth at which groundwater was first encountered in the boreholes. Concentrations of MtBE were not detected in the soil samples. Groundwater samples were initially collected from each monitoring well during the Second Quarter 2002 (May 2002) for laboratory analyses of TPH-g, BTEX and MtBE (SOMA, 2002a). The maximum concentrations of TPH-g, benzene and MtBE in the groundwater samples collected from the monitoring wells were 44,000 µg/l, 6,000 µg/l and 12,000 µg/l, respectively. The groundwater gradient was determined to flow south across the Site. Due to the presence of elevated levels of dissolved-phase hydrocarbons in the furthest downgradient monitoring well, off-site migration was apparent.

Between August and October 2003, a soil and groundwater investigation was conducted to evaluate the off-site extent of the dissolved-phase hydrocarbon migration with groundwater (SOMA, 2003). The investigation included a sensitive receptor survey to locate water supply wells and/or water bodies within a 2,000-foot radius of the Site, and a conduit study to identify underground utilities adjacent to the Site beneath Freedom Avenue, Fairmont Drive and 153rd Avenue. Six soil borings (TWB-1 thru TWB-6) were advanced to depths ranging from 30 to 44 feet bgs, at locations ranging from 125 to 750 feet hydraulically downgradient from the Site. Figure 3 illustrates the locations of the off-site soil borings. A total of 14 soil samples were collected from the soil borings at depths ranging from 16 to 39 feet bgs for laboratory analyses of TPH-g, BTEX, MtBE and 1,2-DCE. The analytical results revealed soil impact off-site to a maximum distance of 265 feet hydraulically downgradient of the Site, and at depths ranging from 18 to 31.5 feet bgs. Elevated concentrations were detected at depths ranging from 21.5 to 24.5 feet bgs, approximately 125 feet hydraulically downgradient from the Site. Concentrations of benzene, MtBE and 1,2 DCE were not detected in the soil samples. Grab groundwater samples were collected from each boring for laboratory analyses of TPH-g, BTEX, MtBE and 1,2-dichloroethane (1,2-DCA). The maximum concentrations of TPH-g and benzene were 410,000 µg/l and 2,200 µg/l, respectively, detected in a grab groundwater sample collected from a soil boring located 125 feet hydraulically downgradient of the Site. The maximum concentration of MtBE was 34 µg/l, detected in a grab groundwater sample collected from a soil boring located 265 feet hydraulically downgradient of the Site. The investigation resulted in the preliminary identification of two water-bearing zones beneath the Site and proximity. The sensitive receptor survey identified 10 wells within 2,000 feet of the Site. Three are located hydraulically downgradient of the Site: one irrigation well and two wells of unknown use. The remaining wells are either hydraulically upgradient or crossgradient of the Site. No water body was identified within a 0.5-mile distance from the Site. The conduit study revealed two sewer lines beneath Fairmont Drive and 153rd Avenue; it was determined that neither was submerged by groundwater.

In September 2004, an additional soil and groundwater investigation was conducted to further evaluate the extent of dissolved-phase hydrocarbon migration with groundwater off the Site (SOMA 2004). Four groundwater monitoring wells (MW-6 thru MW-9) were installed at locations downgradient from the Site. The locations of the monitoring wells are illustrated on Figure 3. The four wells were installed to total depths ranging from 21 to 33 feet bgs, and completed with well screens ranging from 4 to 15 feet long installed at the base of each well. Groundwater was first encountered at depths ranging from approximately 15 to 20 feet bgs, and stabilized at depths ranging from 12 to 17 feet bgs. Four soil samples were collected from one of the four monitoring well boreholes. Soil samples were not collected from the other well boreholes because of extensive and unexpected lateral lithologic changes encountered between the well boreholes during drilling, necessitating continuous coring that precluded collecting soil samples for laboratory analyses. The soil samples were analyzed for TPH-g and BTEX; neither was detected.

During this investigation, an attempt was made to collect a groundwater sample from an irrigation well hydraulically downgradient from the Site, identified by the sensitive receptor survey conducted between August and October 2003. The irrigation well was found to have been unused for some time and, subsequently, no groundwater sample could be collected from the irrigation well.

An attempt was made to locate another well of unknown use hydraulically downgradient from the Site, also identified by the sensitive receptor survey. This well could not be located despite efforts at canvassing the surrounding residential neighborhood with written requests for information. Based on the results of this investigation and the previous investigation conducted between August and October 2003, one water-bearing zone was identified to consist of discontinuous water-bearing layers and stringers separated by discontinuous clay lenses of varying thickness. Additionally, a preferential flow pathway study was proposed consisting of a possible buried stream channel trending north to south beneath the eastern portion of the Site, and extending off-site to the south, beneath the intersection of 153rd Avenue, Fairmont Drive and Liberty Avenue, which is hydraulically downgradient from the Site.

On November 21, 2005, the ACHCS requested that the owner of the property submit a workplan for a soil and water investigation by January 21, 2006. On December 28, 2005, a workplan was submitted to the ACHCS (SOMA, 2005)

proposing the installation of eight cone penetrometer test (CPT), membrane interface probe (MIP) borings to refine hydrogeologic conditions using CPT technology on and off the Site. The purpose of this investigation was to define the horizontal and vertical extent of the soil and groundwater impact on and off the Site using MIP technology, and to collect soil and groundwater samples for laboratory analyses to support the MIP findings.
Based on a telephone conversation between SOMA and the ACHCS, on March 3, 2006, an addendum to SOMA's December 2005 workplan was prepared and submitted to the ACHCS. The workplan provided further clarification for advancing the CPT/MIP as requested by the ACHCS.

On April 10, 2006, SOMA oversaw the drilling of the CPT/MIP boreholes, compliant with SOMA's approved workplan. Fisch Environmental (Fisch), SOMA's subcontractor, used a Geoprobe 6600 to drill the CPT/MIP boreholes. Because of unforeseen subsurface drilling conditions, and the fact that Fisch's drilling rig was not strong enough to drill through the hard subsurface materials, the drilling depth could not be advanced beyond 35 feet bgs in any of the CPT/MIP locations, despite three days' effort. During this operation, a representative of the ACHCS was present at the Site. On April 26, using a hollow stem auger, a CPT calibration borehole was drilled to 47 feet bgs. The location of the boring (HSA) is illustrated in Figure 4. Because the CPT/MIP boreholes could not be advanced to the targeted depths, SOMA negotiated with Fisch and it was decided that Gregg Drilling would perform the CPT/MIP drilling boreholes at a later date, and Fisch's compensation would be appropriately reduced.

In a letter dated May 29, 2006, the ACHCS reduced the number of the on-site CPT/MIP borings from six to five, altered the locations of some of the CPT/MIP borings, adjusted the depths at which the groundwater samples would be collected, and requested the development of a site conceptual model (SCM) and corrective action plan (CAP) for the Site along with an interim remediation and migration control evaluation. The ACHCS establish November 30, 2006 as the investigative report submittal date.

On September 7, 2006, SOMA resumed the field investigation. To characterize the Site's lithology and hydrogeology, and to evaluate the lateral and vertical distribution of the soil and groundwater impact both on and off the Site, SOMA supervised the advancement of eight CPT/MIP borings using a 25-ton CPT rig provided by Gregg Drilling. The locations of the borings, CPT/MIP-1 through CPT/MIP-8, are illustrated in Figure 4. The MIP portion of the study was performed by Fisch utilizing an MIP probe attached to Gregg Drilling's CPT probe. After completion of the CPT/MIP program, eight borings were advanced using direct-push drilling methods, in the immediate proximity of the CPT/MIP borings. These borings were advanced to collect soil and groundwater samples for laboratory analyses to support the MIP findings.

The results of the investigation were presented by SOMA in a report titled "Additional Soil and Groundwater Investigation Report and Initial Conceptual Site Model, Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California," dated November 27, 2006. The report also included an interim remediation and migration control evaluation.

In summary, the report described two main water-bearing zones designated as the First and Second water-bearing zones (WBZs). Both WBZs appear to be laterally continuous across the Site and hydraulically downgradient of the Site, and are separated by a laterally continuous aquitard. Moderately weathered fuel hydrocarbons are adsorbed to the soil or dissolved in the groundwater within the First and Second WBZs. The source area in the First WBZ appears to be situated in proximity to the location of the former USTs and the existing fuel dispensers in both the north and southeast portions of the Site. A source area for the Second WBZ is indeterminate based on the limited data for the Second WBZ generated by the investigation. The Site is located in an area of primarily residential properties with a commercial property located east of the Site. The population/receptors exposed to the fuel hydrocarbons in the soil and groundwater of the First WBZ on and off the Site include current and future on-site workers and current off-site commercial workers and residents. The sources are the fuel hydrocarbons adsorbed to the soil profile of the First WBZ and the dissolved-phase hydrocarbons in the groundwater of the First WBZ. The exposure pathways for on-site receptors are inhalation of volatile emissions from the impacted soil and groundwater of the First WBZ. The only exposure pathway for the off-site residents appears to be the incidental ingestion of groundwater from the First and Second WBZs. The soil interim remediation alternatives evaluated included soil excavation, soil vapor extraction (SVE), and multi-phase extraction (MPE). Groundwater interim remediation alternatives included groundwater extraction, ozone sparging and hydrogen peroxide injection.

The ACHCS responded to SOMA's November 27, 2006 report with correspondence dated March 14, 2007, in which the ACHCS directed that a workplan be prepared to address ACHCS comments in that correspondence and SOMA's recommendations in the report.

Quarterly groundwater monitoring/sampling has been regularly conducted at the Site since Second Quarter 2002. Currently there are nine groundwater monitoring wells at the Site, six on-site and three off-site.

2.0 SITE HYDROGEOLOGY

The Site is located in the San Leandro Valley at an elevation of approximately 54 feet above mean sea level with a moderate topographic gradient toward the south. The San Leandro Valley is within the San Francisco Bay – Santa Clara Valley depression, a northwest-to-southeast trending basin bounded on the east and west by mountains. The basin is characterized by Quaternary alluvium, chiefly fan and terrace deposits that are generally several hundred feet thick and flat lying.

There is no water body within a half-mile radius of the Site. The nearest water body, Estudillo Canal, is located about 0.6 miles southwest of the Site. The next closest water body is San Leandro Creek, located approximately 1.5 miles south of the Site. The Site is approximately four miles north of San Francisco Bay. East of the Site are the northwest-trending Hayward Fault Zone, the San Leandro Hills, and an assemblage of ultramafic metamorphic and volcanic rocks (California Division of Mines and Geology, 1990).

The United States Geological Survey (USGS) mapped the Site on Late Pleistocene age (10,000 to 70,000 years old) alluvium consisting of irregularly interbedded clay, silt, sand and gravel. Due to the age of this alluvium, these stream-deposited sediments are typically more consolidated than alluvial deposits of Holocene age. In developed urban areas such as the Bay Area, earthwork construction often involves the emplacement of artificial fill derived from nearby cuts or quarries. Artificial fill is emplaced over native earth materials to provide level building pads and base rock for roadways.

The Site is located in the East Bay Groundwater Basin of the San Francisco Bay hydrologic study area. Water-bearing formations include the Santa Clara Formation of Plio-Pleistocene age and late Pleistocene, and recent sediments that have been grouped as Late Quaternary alluvium. Non–water-bearing units underlie the water-bearing formations and are exposed along the surface in the Diablo Range east of the Site and Coyote Hills, near Newark, which is south of the Site.

The CPT/MIP program conducted by SOMA in September 2006 identified two main WBZs within the depths explored by the CPT. These zones are designated as the First and Second WBZs. Based on the CPT data, both WBZs appear to be laterally continuous across the Site, and are separated by a laterally continuous aquitard.

From approximately 12 to 22 feet bgs, the First WBZ occurs as an approximate 10- to 15-foot-thick interbedded sequence of sand, silty sand to sandy silt, cemented sand, and silt to clayey silt. The groundwater monitoring well network in the on- and off-site areas is completed within the First WBZ. There are nine groundwater monitoring wells at the Site, six on-site and three off-site, that are being monitored quarterly. Groundwater elevations measured in the wells over the period of record for quarterly groundwater monitoring (Second Quarter 2002 to Third Quarter 2006) reflect potentiometric head in the First WBZ, with the groundwater flow gradient in the First WBZ predominately toward the south/southwest.

From approximately 32 to 50 feet bgs, the Second WBZ occurs as an approximate 5- to at least 35-foot-thick interbedded sequence of the same lithologic type as seen in the First WBZ. None of the nine groundwater monitoring wells is completed in the Second WBZ. During grab groundwater sampling activities in September 2006, after setting the discrete water sampler, groundwater elevations rose immediately above the top of the sampler and into the hollow push rods. This implies that groundwater in the Second WBZ reflects potentiometric pressure. Therefore, the Second WBZ can also be considered a confined aquifer. Because no groundwater monitoring wells are screened in the Second WBZ, the groundwater monitoring flow direction and degree of impact of the Second WBZ is not known.

The First and Second WBZs are separated by a 5- to 25-foot-thick, laterally continuous, unsaturated layer of clay, clayey silt, and silt. This unit is referred to as an aquitard.

3.0 SCOPE OF WORK

SOMA's recommendations in the November 27, 2006 report titled "Additional Soil and Groundwater Investigation Report and Initial Conceptual Site Model" included the following:

- A soil vapor study should be conducted to evaluate the potential of vapor intrusion into residences that abut the Site to the south and southwest.

- Because the groundwater monitoring wells in the Second WBZ are not completed, differences in groundwater elevations, vertical flow gradients between the First and Second WBZs, and the distribution of dissolved-phase hydrocarbons in the groundwater in the Second WBZ cannot be determined. Groundwater monitoring wells should be completed with well screens installed within the Second WBZ.

- Soil and groundwater analytical data for the Second WBZ are limited. A source area for the Second WBZ is indeterminate based on the data generated by this investigation. Additional soil and groundwater assessments targeting the Second WBZ should be conducted to further define the extent of soil and groundwater impact in the Second WBZ, as well as determine the source area for the Second WBZ.

- No remediation feasibility studies, including appropriate pilot tests, have been conducted at the Site or in areas off the Site. Conducting feasibility studies and pilot tests are needed to determine the most appropriate, technically effective, and cost-effective interim remedial alternative to remediate the soil and groundwater in the source area of the First WBZ, and to control migration of dissolved-phase hydrocarbons in the groundwater within the First WBZ emanating from the Site to areas off the

Site. The pilot testing should include, at minimum, aquifer pump testing, MPE pilot testing, and ozone injection permeability testing.

- Another attempt should be made to collect a groundwater sample from the irrigation well located hydraulically downgradient of the Site at 1573 153rd Street. Likewise, another attempt should be made to locate the well of unknown use located hydraulically downgradient of the Site on Oriole Avenue. Once this well is located, a groundwater sample should be collected from it.

The ACHCS responded to SOMA's report and recommendations with correspondence dated March 14, 2007, directing that a workplan be prepared to address the following:

- Perform a soil gas investigation near the southeastern boundary of the Site to evaluate potential vapor intrusion pathways for adjacent residential land use.
- Perform pilot testing for MPE and ozone sparging
- Install groundwater monitoring wells in the Second WBZ
- Locate and sample two off-site irrigation wells located hydraulically downgradient of the Site.

To comply with the March 14, 2007 directives of the ACHCS, SOMA proposes to conduct the following work:

1) Prepare a Health and Safety Plan
2) Install groundwater monitoring wells in Second WBZ
3) Locate and sample two off-site irrigation wells
4) Conduct soil gas survey
5) Conduct remediation feasibility studies

3.1 Task 1 – Prepare Health and Safety Plan

As required by the Occupational Safety and Health Administration (OSHA) Standard "Hazardous Waste Operations and Emergency Response" guidelines (29 CFR 1910.120), and by the California Occupational Safety and Health Administration (Cal/OSHA) "Hazardous Waste Operations and Emergency Response" guidelines (CCR Title 8, Section 5192), SOMA will prepare a site-specific Health and Safety Plan (HASP). The HASP will be reviewed by field staff and contractors before beginning field operations, and will be in the possession of SOMA personnel while conducting work activities at the Site. The HASP will be updated as needed if field activities are modified, or if potential hazards not originally addressed in the HASP are identified.

3.2 Task 2 - Install Groundwater Monitoring Wells in Second WBZ

SOMA proposes installing three groundwater monitoring wells in the Second WBZ at the locations illustrated on Figure 5 (MW-1D, MW-3D and MW-4D). All three proposed well locations are situated on the Site. The proposed locations are in close proximity to existing groundwater monitoring wells that are screened only in the upper portion of the First WBZ. This will allow vertical flow gradients between the First and Second WBZs to be determined, as well as groundwater elevations, groundwater flow direction, gradient, and dissolved-phase hydrocarbon concentrations in the Second WBZ. The proposed monitoring wells will be incorporated into the ongoing quarterly monitoring program for the Site.

3.2.1 Permit Acquisition

Before initiating field assessment activities, SOMA will obtain the necessary well drilling permit from the Alameda County Public Works Agency to install the three groundwater monitoring wells on the Site.

3.2.2 Subsurface Utility Clearance

SOMA will notify Underground Service Alert (USA) to clear the drilling areas of underground utilities. Following USA clearance, SOMA will retain a private utility locator to survey the proposed drilling areas and locate any additional subsurface conduits. Immediately prior to the onset of drilling activities, each well boring will be hand-augered to a depth of 5 feet bgs.

3.2.3 Well Drilling/Construction/Completion/Development

The proposed groundwater monitoring wells will be drilled, constructed and completed using hollow-stem auger methods and techniques. The soils encountered will be evaluated for possible sample collection and laboratory analyses based on odors, visual observations and photoionization detector (PID) measurements, and described on a borehole log in accordance with the United Soil Classification System. The wells will be constructed with 2-inch-diameter, Schedule 40 PVC blank casing and well screened with 0.020-inch slotting. The monitoring wells will be completed using a 10-inch conductor casing that will extend down to the top of the well screen for each well to eliminate cross-contamination between the First and Second WBZs. Filter pack material will consist of No. 3 Monterey sand. Table 1 lists the completion details for the proposed groundwater monitoring wells. The proposed monitoring well completion details are based on the results of SOMA's September 2006 additional soil and groundwater investigation. The actual well depths and screen intervals will be selected based on field observations. The wells will be completed at existing grade with traffic-rated vaults.

The wells will be developed by surging and bailing in accordance with standard regulatory protocol. A California state-licensed land surveyor will survey the wells to determine latitude, longitude, and top of casing elevation relative to the California State Coordinate System Zone II (NAVD 88). The well survey data and an updated site map will be uploaded to the GeoTracker system.

Following the installation, development, and survey control of the wells, groundwater elevations will be measured, and groundwater samples will be collected for laboratory analyses in accordance with standard regulatory protocol, during the next quarterly monitoring/sampling event.

A description of general field procedures is included in Appendix A

3.2.4 Soil Sample Laboratory Analyses

Representative soil samples, if any, will be submitted to a California state-certified environmental laboratory for analyses. The samples will be analyzed for the following:

- TPH-g
- BTEX
- Fuel oxygenates, additives and lead scavengers including MtBE, tertiary-butyl alcohol (TBA), ethyl tertiary-butyl ether (ETBE), diisopropyl ether (DIPE), tertiary-amyl methyl ether (TAME), 1,2-dichloroethane (1,2-DCA), 1,2-dibromomethane (EDB) and ethanol.

All analyses will be conducted using US EPA Method 8260B.

3.2.5 Investigative Derived Waste Collection, Storage and Disposal

Soil cuttings and waste water generated during well installation activities will be temporarily stored on the Site in a secure area in DOT-rated 55-gallon steel drums pending characterization, profiling, and transportation to an approved disposal/recycling facility. Each drum will be labeled with the Site's address, contents, date of accumulation, and contact phone number.

3.3 Task 3 – Locate and Sample Two Off-site Irrigation Wells

SOMA conducted a sensitive receptor survey in September and October 2003 (SOMA, 2003) that included locating water supply wells within a 2,000-foot radius of the Site. Well location information was obtained from the California Department of Water Resources (DWR).

Based on DWR records, only 10 wells were located within 2,000 feet of the Site. Three of the wells are located hydraulically downgradient of the Site; there are one irrigation well and two wells of unknown use. The results of the sensitive receptor survey indicated that the off-site groundwater plume could impact two private wells (SOMA, 2004). One of the wells was reportedly located at 1575 153rd Street, and the other at an unidentified address along Oriole Avenue.

In September 2004, an attempt was made to collect groundwater samples from these two wells. No residence for 1575 153rd Street was found. However, the owner of the residence at 1573 153rd Street indicated that there is a non-operational well on his property. The owner stated that water from this well was previously used only for irrigation since potable water for the residence is provided by the local utilities. An attempt was made to collect a water sample from the well by running the well pump for several hours. However, no groundwater was produced. An attempt was then made to unbolt the well cap. However, it was noted that preexisting cracks in the casing were exhibiting signs of stress resulting from this procedure. Removal of the cap was terminated to avoid damaging the well casing and no groundwater sample was collected from the well (SOMA, 2004).

Because the well survey findings did not indicate a specific address for the private well installed along Oriole Avenue, written notification was distributed to all residents on the potentially affected avenue. However, none of the contacted homeowners responded to the notification (SOMA, 2004).

3.3.1 Oriole Avenue Door-to-Door Survey

SOMA will conduct a door-to-door survey of residences along Oriole Avenue in an attempt to locate the private well on this street as identified by the DWR. The door-to-door survey will be conducted in person, during which the occupant/property owner will be interviewed using a Public Health Assessment questionnaire. An example of the questionnaire is included in Appendix B. An attempt will be made to personally meet with every occupant/property owner on Oriole Avenue. In the event there is no response to the door-to-door survey, the Public Health Assessment questionnaire will be mailed to the property owner, identified using the Alameda County Assessor's Office, for response.

If the well is located, SOMA will seek permission from the property owner to evaluate the condition of the well to determine if a groundwater sample can be collected, and will collect a groundwater sample from the well if feasible. The groundwater sample would be collected by one of the following: 1) using the existing pump in the well, if so equipped, to purge the well, allow the well to recover and collect a groundwater sample using the well pump, or 2) if no pump is in the well, gaining access to the inside of the well casing and utilizing a bailer to collect a grab groundwater sample. The diameter of the well, groundwater level and well total depth would be measured.

3.3.2 Sample Well at 1573 153rd Street

SOMA will personally meet with the owner of the parcel at 1573 153rd Street to request permission to evaluate the condition of the former irrigation well, to determine the approach for collecting a groundwater sample from the well. If the well pump is still in the well and operable as in 2004, SOMA will operate the pump to purge the well, allow the well to recover, and collect a groundwater sample using the well pump. If the well pump is in the well but not operable, SOMA will disconnect electrical power to the pump, carefully remove the well cap, remove the pump if possible, and use a bailer to collect a grab groundwater sample from the well. If no pump is present, SOMA will carefully remove the well cap and use a bailer to collect a grab groundwater sample from the well. The diameter of the well, groundwater level and well total depth would be measured.

3.3.3 Groundwater Sample Laboratory Analyses

Collected groundwater samples will be submitted to a California state-certified environmental laboratory for analyses. The samples will be analyzed for the following:

- TPH-g
- BTEX
- Fuel oxygenates, additives and lead scavengers including MtBE, TBA, ETBE, DIPE, TAME, 1,2-DCA, EDB, and ethanol.

All analyses will be conducted using US EPA Method 8260B.

3.4 Task 4 – Conduct Soil Gas Survey

SOMA's SCM (SOMA 2006) inferred impacted soil and groundwater in the First WBZ extending beneath residential properties abutting the Site to the southwest. SOMA will conduct a soil gas survey to evaluate potential soil vapor intrusion pathways for the adjacent residents. SOMA proposes three locations, illustrated in Figure 6, to advance soil vapor-sampling probes to implement the soil gas survey. The probes would be advanced to a depth of 5 feet bgs.

3.4.1 Methodology

Soil vapor samples are collected by temporarily inserting a 1-inch-diameter steel drilling rod equipped with a steel drop-off tip. The probe is hydraulically driven into the asphalted subsurface using direct-push technology. Once the probe has reached the designated sampling depth of 5 feet bgs, a ¼-inch diameter Teflon flow sampling tube is inserted down the center of the probe and threaded into the sampling port at the end of the rod. The sampling tube is then capped with a vapor tight valve and the probe is retracted 6 inches and allowed to equilibrate for approximately 20 to 30 minutes.

Hydrated bentonite is placed around the top opening of the drill rod and on the ground surface surrounding the drill rod to inhibit surface air migration down the center or outer portion of the drill rod. A pre- and post-sample vacuum reading is recorded for each Summa Canister (pre-evacuated steel canister that is connected to the surface end of the sample tubing) sample. A 200-milliliter/minute (ml/min) flow regulator with a built-in vacuum gauge is connected to the downhole side of the tee fitting. A particulate filter is also installed on the downhole side of the regulator. A vacuum test (mechanical leak check) is then performed for 10 minutes to test the connections between the Summa Canister and vapor tight valve. A leak detector compound (isopropyl alcohol) is placed around the borehole subsurface, top of the probe rod, and at the vapor tight valve. The vapor tight valve and purge canister valve are then opened to purge three volumes of air from the sample tubing and borehole sample interval. In addition to purging the calculated volume, a visual inspection of the vacuum gauge will also be noted to ensure adequate flow.

After three tubing volumes have been purged, the vapor tight valve and the purge canister valve will be closed. The vapor tight valve and sample canister valve are closed until after the sample canister gauge indicates that approximately 5 inches mercury of vacuum remains in the canister, approximately 20 percent of the presample vacuum.

In addition, the field parameter calculations during the soil vapor sample collection will be noted as follows:

> The effective volume of ¼-inch diameter Teflon tubing is approximately 2.41 ml/ft; the average vapor flow rate through the sampling tube is 200 ml/min. The total length of the Teflon tubing is approximately 10 feet.

3.4.2 Soil Vapor Sample Laboratory Analyses

Soil vapor samples will be analyzed for the following constituents using EPA Method TO-3:

- TPH-g

In addition, the following constituents will be analyzed using EPA Method TO-15:

- BTEX
- MtBE
- Gasoline oxygenates, consisting of TBA, DIPE, ETBE, and TAME

3.5 Task 5 – Conduct Remediation Feasibility Studies

No remediation feasibility studies, including appropriate pilot tests, have been conducted at the Site or in areas off the Site. Feasibility studies and pilot tests are necessary to determine the most appropriate, technically effective, and cost-effective interim remedial alternative to remediate the soil and groundwater in the source area of the First WBZ.

SOMA previously evaluated several soil and groundwater interim remedial alternatives (SOMA 2006). The soil interim remediation alternatives evaluated included soil excavation, soil vapor extraction, and MPE. Groundwater interim remediation alternatives included groundwater extraction, ozone sparging and hydrogen peroxide injection. Based on SOMA's evaluation, the ACHCS directed that MPE and ozone sparging pilot testing be conducted to determine feasibility and applicability of these two alternatives to remediate soil and groundwater impact in the First WBZ.

3.5.1 MPE

The purpose of MPE pilot test is to determine the feasibility of dewatering the Smear Zone and removing light nonaqueous phase liquids (LNAPL) using vacuum-enhanced volatilization. Smear Zone dewatering is critical to MPE success. Pilot testing is required to determine the degree of steady-state dewatering necessary to expose the Smear Zone, air/water yields necessary to achieve steady-state drawdown, and volatile organic compound mass removal rates.

MPE systems have two primary configurations; dual-phase extraction (DPE) and two-phase extraction (TPE). DPE utilizes separate mechanical systems for pumping groundwater and extracting soil vapor from the Smear Zone. TPE utilizes a single vacuum pump to extract both groundwater and soil vapor through small diameter drop tube (stinger) piping inserted in the well. The most cost-effective MPE configuration is determined by aquifer permeability and the corresponding yield of both air and water. DPE is appropriate for sites exhibiting higher permeability and larger well yields, at groundwater extraction rates greater than 2 gpm, and casing vacuums between 4 and 6 inches of mercury. When aquifer yield is lower than these values, TPE is typically more cost effective.

3.5.1.1 Smear Zone

The lateral extent of soil impact in the First WBZ is situated beneath the northwest, central, and southeast portions of the Site, in the area of the UST cluster and product dispensers in the north and southeast portions of the Site. The lateral extent off the Site is inferred to continue south/southeast beneath the northeast corner of the residential area south of the Site, and continuing further southeast and east beneath the intersection of Fairmont Avenue, 152nd Avenue and Liberty Street.

Because depth to groundwater in the First WBZ has ranged from approximately 17 to 23 feet bgs, the majority of the soil impact is below groundwater elevations in the First WBZ.

SOMA's review of the boring logs for soil borings and groundwater monitoring wells installed at the Site between 2001 and 2002, as well as the MIP logs generated during the September 2006 additional soil and groundwater investigation (SOMA, 2006), indicates the presence of a hydrocarbon Smear Zone below the capillary fringe of the First WBZ. A Smear Zone is developed as mobile light fuel hydrocarbons (LNAPL) released to the water table spread aaalaterally as a non-wetting phase in soils below the water table, and are distributed vertically through the upper aquifer during seasonal water table fluctuations. As smearing continues, the LNAPL becomes trapped as discontinuous ganglia within soil pores of the upper aquifer. Thus, the Smear Zone is an area of intimate contact between LNAPL and groundwater, representing a long-term source for dissolved-phase hydrocarbons in groundwater. The Smear Zone in the First WBZ is identified as gray to gray-green staining of soils at and below the capillary fringe, accompanied by moderate to strong hydrocarbon odor, and elevated PID readings on the MIP logs. The thickness of the Smear Zone ranges from 3 feet to 12 feet. The thicker accumulations were identified in groundwater monitoring wells MW-1 (5 feet), MW-3 (10 feet), MW-4 (6 feet), MW-5 (5 feet), soil boring SB-4 (6 feet), CTP/MIP-2 (12 feet), CPT/MIP-5 (8 feet), and CPT/MIP-3 (6 feet), all of which are located in proximity to or hydraulically downgradient of the fuel dispensers and UST cluster (Figure 7).

Table 2 lists the soil borings, groundwater monitoring wells, and CPT/MIP borings where the Smear Zone was identified in the boring logs, or inferred from the MIP data, and tabulates the thickness of the Smear Zone. The lateral extent and thickness of the Smear Zone at the Site are illustrated on Figure 7.

3.5.1.2 Methodology

Due to the potential that the Smear Zone is actively leaching dissolved-phase hydrocarbons to groundwater in the First WBZ, SOMA proposes to conduct MPE pilot testing to determine the feasibility of remediating the Smear Zone using MPE methods and techniques. SOMA will conduct the MPE pilot test in the north, northeast, southcentral and southeast portions of the Site, where thicker accumulations of Smear Zone were identified in groundwater monitoring well MW-1 and soil boring SB-4, groundwater monitoring well MW-3 and CPT/MIP-3, groundwater monitoring well MW-4 and CPT/MIP-5 plus CPT/MIP-2, and groundwater monitoring well MW-5.

3.5.1.3 Equipment

A self-contained mobile treatment system (MTS) owned and operated by SOMA will be used to conduct a MPE pilot test. The MTS is equipped with electrical generator, air compressors, liquid ring vacuum pump rated at 25 horsepower and 428 standard cubic feet per minute (scfm), electrical/pneumatic submersible pumps, air/water separator vessel, discharge hoses and traffic-rated hose ramps, downhole stingers, and a thermal/catalytic oxidizer for vapor treatment. The oxidizer operates under a valid various-locations permit issued by the Bay Area Quality Management District (BAAQMD).

3.5.1.4 BAAQMD Notification

In accordance with the conditions of the various-locations BAAQMD permit for the MTS, SOMA will notify the BAAQMD of the location, date and duration of the pilot test, and the vapor treatment to be utilized.

3.5.1.5 Conduct MPE Pilot Tests

SOMA proposes conducting four independent MPE pilot tests using monitoring wells MW-1, MW-3, MW-4 and MW-5. For each pilot test, one of the four wells will be the designated extraction well, with the remaining three wells utilized to monitor groundwater elevations in the First WBZ and vacuum generated by the pilot test. Each well is completed with 4-inch diameter well screen and casing to a depth of 30 feet bgs. A 15-foot well screen extends from 15 feet bgs to total depth in each well, thereby completely exposing the Smear Zone as well as the impacted vadose zone above. The designated extraction well and monitoring wells are illustrated on Figure 8.

MPE pilot testing should continue long enough to define steady-state dewatering rather than within an arbitrary time frame. The typical time frame to approach steady-state dewatering varies, but is usually less than 72 hours. Therefore, each of the four pilot tests will not exceed 72 hours in duration. The pilot test will terminate when soil vapor extraction concentrations begin to decrease after steady-state dewatering is achieved. Extracted groundwater will be stored on the Site in a closed-top 21,000-gallon-capacity Baker Tank, sampled and profiled, and transported off-site for disposal. Extracted soil vapor will be treated by the oxidizer onboard the MTS.

Vacuum measurements will be collected at the well casing, the stinger, and the manifold. Groundwater-level measurements will also be collected with an interface probe and drop tube installed the monitoring wells to total depth. The frequency of measurements will be hourly for the first 8 hours and every 3 hours thereafter until the end of the test. Extracted soil vapor concentrations will be continuously measured with a PID.

Samples of extracted soil vapor will be collected in Tedlar bags, on achievement of steady-state drawdown, every 24 hours thereafter until the end of the pilot test, and at the end of the pilot test. A sample will also be obtained from the oxidizer stack at the end of the final pilot test to demonstrate compliance with BAAQMD various-locations permit conditions.

The data collected during the pilot tests will be analyzed and used to determine the flowing parameters:

- The air/water flow rate necessary to achieve steady-state dewatering in MW-1, MW-3, MW-4 and MW-5
- Mass removal rates achieved at each well.

If initial mass removal rates are greater than 25 pounds/day/well, and cumulative recoveries are sustained, there is a good chance for significant post-remediation concentration reduction, and MPE is likely to be feasible.

In addition, the data collected during the pilot test will be analyzed and used to determine vacuum radius of influence (ROI). The ROI determined will be used to establish extraction well spacing for MPE in the Smear Zone.

3.5.1.6 Extracted Soil Vapor Sample Analyses

The extracted soil vapor samples collected in Tedlar bags will be analyzed for the following constituents using EPA Method TO-3:

- TPH-g

In addition, the following constituents will be analyzed using EPA Method TO-15:

- BTEX
- MtBE
- Gasoline oxygenates, consisting of TBA, DIPE, ETBE, and TAME

3.5.2 Ozone Sparging

The introduction of ozone through several ozone sparge points directly destroys dissolved petroleum hydrocarbons and MtBE and stimulates in situ aerobic biodegradation of dissolved-phase petroleum hydrocarbons, by increasing subsurface oxygen concentrations. Though concentrations may initially increase owing to the desorption of petroleum hydrocarbons from soil caused by the aggressive mechanical scrubbing action of the ozone microbubbles, ozone sparging can facilitate subsequent rapid degradation of the dissolved-phase petroleum hydrocarbon plume beneath the Site. However, ozone sparging does present a potential explosion hazard, particularly if conducted in close proximity of the USTs, because of the microbubble scrubbing action resulting in the deterioration of the UST sidewalls and the exothermic reaction resulting from generation of the hydroxyl radical from the injected ozone. Because ozone sparging at the Site would need to be conducted in proximity to the existing USTs, there is a potential explosion hazard.

Ozone sparging would be an effective migration control measure, particularly if the sparging is implemented hydraulically downgradient from the source area of the First WBZ and away from the existing USTs on the Site. In addition, the introduction of ozone through sparge points will stimulate in situ aerobic biodegradation of organic contaminants by increasing subsurface oxygen concentrations. Hydrocarbon concentrations may increase initially, owing to desorption of the petroleum hydrocarbon and fuel oxygenate constituents from soil caused by the aggressive mechanical scrubbing action of the ozone microbubbles. However, subsequent to this potential initial increase, dissolved-phase hydrocarbon concentrations will decrease as formed hydroxyl free radicals destroy dissolved hydrocarbons in groundwater and enhanced biodegradation occurs. Enhanced dissolved oxygen in groundwater will migrate down the hydraulic gradient of the First WBZ with groundwater to stimulate in situ biodegradation of dissolved-phase hydrocarbons in areas off the Site to the south and southwest that are impacted, specifically in the vicinity of monitoring wells MW-6 and MW-7, where moderate to low concentrations of TPH-g and MtBE have been detected during quarterly groundwater sampling events.

3.5.2.1 Impact to Groundwater in First WBZ

Over the period of record for quarterly monitoring and sampling at the Site, the detection of dissolved-phase hydrocarbons in the First WBZ, including TPH-g, BTEX, MtBE, TBA, ETBE and TAME, has been limited to groundwater samples collected from groundwater monitoring wells MW-1 thru MW-5 located on the Site and groundwater monitoring wells MW-6 thru MW-7 located off the Site. Concentrations of TPH-d have also been detected in the First WBZ, but are limited to the grab groundwater samples collected from the First WBZ during the September 2006 CPT/MIP investigation (SOMA 2006). Elevated concentrations occur in groundwater monitoring well MW-3 relative to the remaining wells where dissolved-phase hydrocarbons have been detected. In general, dissolved-phase hydrocarbon concentrations are elevated in groundwater monitoring wells on the Site (MW-1 thru MW-5) relative to those groundwater monitoring wells off the Site (MW-6 and MW-7).

3.5.2.2 Methodology

To evaluate the injection rate of ozone into the subsurface and the use of ozone sparging to actively remediate groundwater in the First WBZ, SOMA will conduct a series of in situ soil permeability tests utilizing existing groundwater monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-6 and MW-7. Figure 9 illustrates the locations of the wells.

The purpose of the pilot testing is to determine the permeability of the sediments with respect to air just above the saturated zone in the vicinity of these wells. SOMA will utilize a test kit developed by Piper Environmental Group, Castroville, California. The test kit includes a compressor, hoses, and a pressure regulator for adjusting the flow to the wellhead.

To evaluate the permeability of the sediments with respect to air, compressed air will be applied to each wellhead. While compressed air is applied inside the well, the pressure head and air flow rate through the well screen into the formation will be recorded in scfh (standard cubic feet per hour). The sediments are considered permeable if the flow rate through the well screen reaches 180 scfh (3 scfm). Depth to groundwater in the test well will be measured prior to and after each test.

3.5.2.3 Estimation of Ozone Requirement

To estimate the total mass of dissolved-phase hydrocarbons in the First WBZ, the following formula will be used:

$$\text{Estimated Hydrocarbon Mass} = (A)(B)(\Phi)(C_a)$$

Where:

A = treatment area volume in the First WBZ
B = average saturated thickness of the First WBZ,
Φ = average soil porosity of the First WBZ
C_a = average dissolved-phase hydrocarbon concentration in groundwater

To estimate the destruction rate of dissolved-phase hydrocarbons in the First WBZ, the following formula will be used:

$$\text{Estimated Hydrocarbon Destruction Rate} = (D)(E)$$

Where:

D = Amount of ozone produced per day at an assumed injection rate
E = hydrocarbon/ozone destruction ratio (1.0 g hydrocarbon/3.5 grams ozone).

The estimated treatment time is calculated by the following formula:

$$T_t = \text{Estimated Hydrocarbon Mass/Estimated Hydrocarbon Destruction Rate}$$

Where T_t is the treatment time.

4.0 REPORT

A report of the monitoring well installation, soil gas survey and remediation feasibility study will include the following:

- A description of the drilling, construction, completion and development activities to install the three groundwater monitoring wells in the Second WBZ;

- A discussion of the field conditions observed during the well installation activities, including boring logs describing soil types encountered, sample intervals, and PID vapor readings, as well as groundwater elevations and vertical flow gradients measured

- Laboratory analytical results of soil samples collected from the groundwater monitoring well borings

- A description of the effort to locate and activities undertaken to sample two offsite irrigation wells

- A description of the soil gas survey conducted including laboratory analytical results obtained

- A description of the MPE pilot test, procedures and field equipment used, duration of test, parameters measured, results of monitored field parameters and chemical analyses of samples collected during the pilot test

- A description of the ozone sparging pilot test, procedures and field equipment used, duration of test, parameters measured, results of monitored field parameters and estimation of ozone requirement

- A discussion and summary of SOMA's findings related to the feasibility of using MPE technology to effectively remediate the Smear Zone in the First WBZ, and ozone sparging to remediate dissolved-phase hydrocarbons in the First WBZ on and off the Site

- An update of the SCM for the Site

5.0 SCHEDULE

Based on SOMA's review of groundwater elevations measured in groundwater monitoring wells completed in the First WBZ over the period of record for quarterly groundwater monitoring at the Site, the lowest groundwater elevations occur during the third and fourth quarters. SOMA recommends that the MPE pilot testing occur within this same time frame to take advantage of low groundwater elevations.

The Workplan will be implemented upon receiving written authorization from the ACHCS, and cost preapproval from the State Water Resources Control Board Underground Storage Tank Cleanup Fund Program. SOMA anticipates that the proposed work will be completed in 12 weeks following receipt of necessary approvals, authorizations, and permits. Field activities will be scheduled according to the availability of the necessary equipment and field personnel. The report and updated SCM would be submitted within 45 days of completing the remediation feasibility studies.

6.0 REFERENCES

Geo-Logic, Geotechnical and Environmental Consulting Services, June 11, 1999 “Report of Soil Sampling During Tank Removal and Station Upgrade.”

CSS Environmental Services, Inc. August 15, 2001 “Preliminary Site Assessment for the Property Located at 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., June 5, 2002. “Monitoring Well Installation Report, Texaco Service Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., July 14, 2002a. “Second Quarter 2002 Groundwater Monitoring Report, Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., November 5, 2003. “Off-Site Soil and Groundwater Investigation, Former Texaco Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., October 25, 2004. “Off-Site Groundwater Monitoring Well Installation Report, Former Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., December 27, 2005. “Workplan to Conduct Additional Soil and Groundwater Investigation at the Former Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., November 27, 2006. “Additional Soil and Groundwater Investigation Report and Initial Site Conceptual Model, Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

California Regional Water Quality Control Board, San Francisco Bay Region, July 2003, “Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater”

TABLES

TABLE 1

WELL COMPLETION DETAILS

Texaco Gasoline Service Station
15101 Freedom Avenue
San Leandro, California

Well	Boring Diameter (inches)	Well Diameter (inches)	Total Depth (feet bgs)	10-inch Diameter Conductor Casing Interval (feet bgs)	Blank Casing Interval (feet bgs)	Well Screen Interval (feet bgs)	Filter Pack Interval (feet bgs)	Bentonite Seal Interval (feet bgs)	Cement Grout Interval (feet bgs)
GROUNDWATER MONITORING WELLS									
MW-1D	12	--	45	0 to 45	--	--	--	--	45 to 0
	8	2	60	--	0 to 45	45 to 60	60 to 43	43 to 40	40 to 0
MW-2D	12	--	45	0 to 45	--	--	--	--	45 to 0
	8	2	60	--	0 to 45	45 to 60	60 to 43	43 to 40	40 to 0
MW-3D	12	--	40	0 to 40	--	--	--	--	40 to 0
	8	2	60	--	0 to 40	40 to 60	60 to 38	38 to 35	35 to 0

Notes:
bgs - Below ground surface

TABLE 2

SMEAR ZONE IDENTIFICATION AND THICKNESS - FIRST WBZ

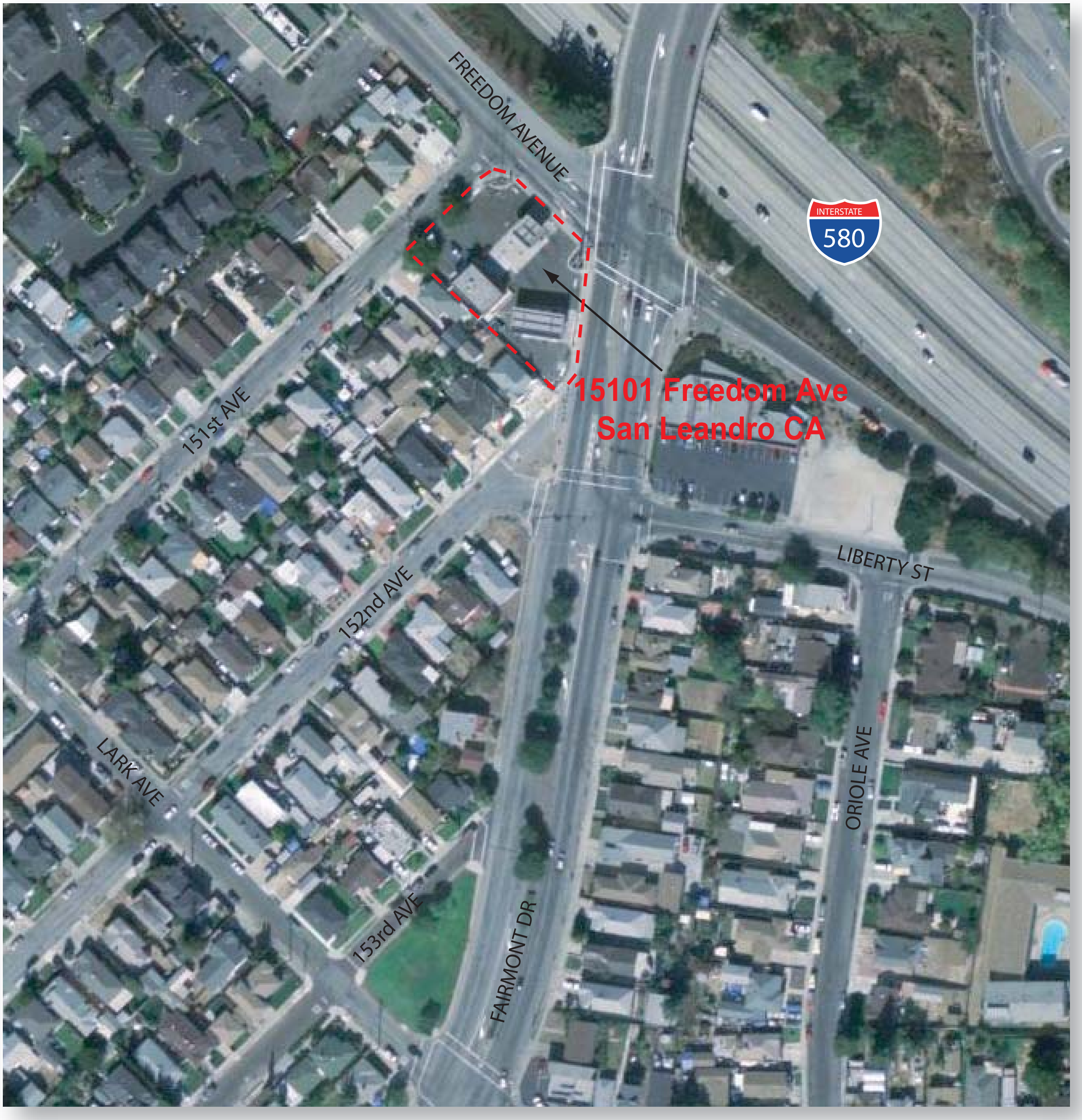
Texaco Gasoline Service Station
15101 Freedom Avenue
San Leandro, California

SOIL BORING OR MONITORING WELL	TOTAL DEPTH (feet bgs)	DEPTH TO TOP OF SMEAR ZONE (feet bgs)	DEPTH TO BOTTOM OF SMEAR ZONE (feet bgs)	SMEAR ZONE THICKNESS (feet)
SB-1	31	28	30	2
SB-2	31	24	27	3
SB-3	36	Boring Drilled in UST Backfill (0'-24') - No log 26'-36'		
SB-4	31	25	31	6
SB-5	31	25	29	4
MW-1	30	25	30	5
MW-2	31	No Evidence of Smear Zone Observed in Well Boring		
MW-3	30	20	30	10
MW-4	30	24	30	6
MW-5	30	20	25	5
CPT/MIP-1	63	26	30	4
CPT/MIP-2	50	22	32	10
CPT/MIP-3	67	26	32	6
CPT/MIP-4	48	24	26	2
CPT/MIP-5	47	22	30	8

Notes:

bgs - Below ground surface

FIGURES



N

approximate scale in feet

0 150 300

Figure 1: Site vicinity map.

SOMA ENVIRONMENTAL ENGINEERING, INC.

approximate scale in feet
0 40 80

Figure 2: Locations of USTs, Fuel Dispensers, Soil Borings, and Groundwater Monitoring Wells On the Site

SOMA ENVIRONMENTAL ENGINEERING, INC.

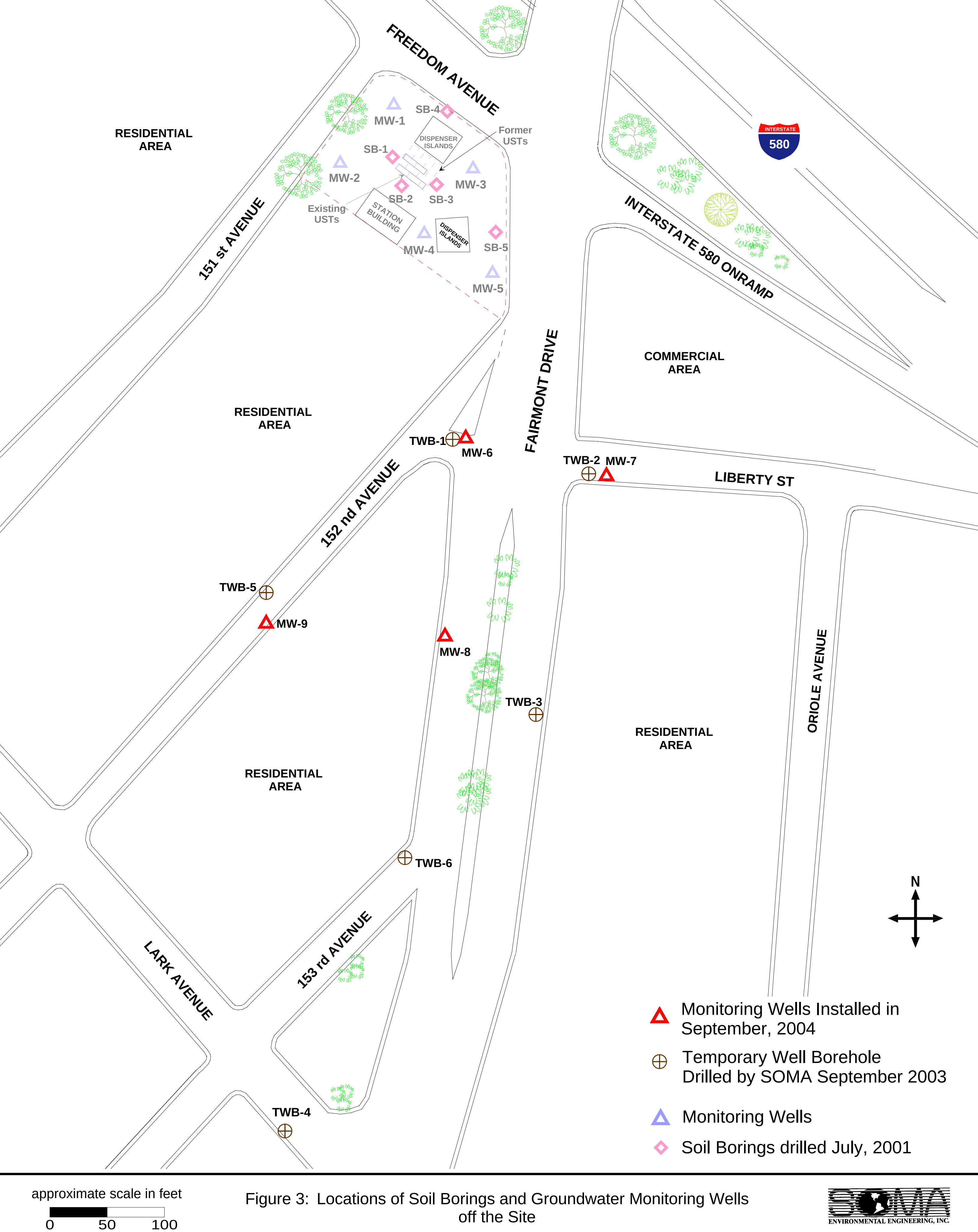
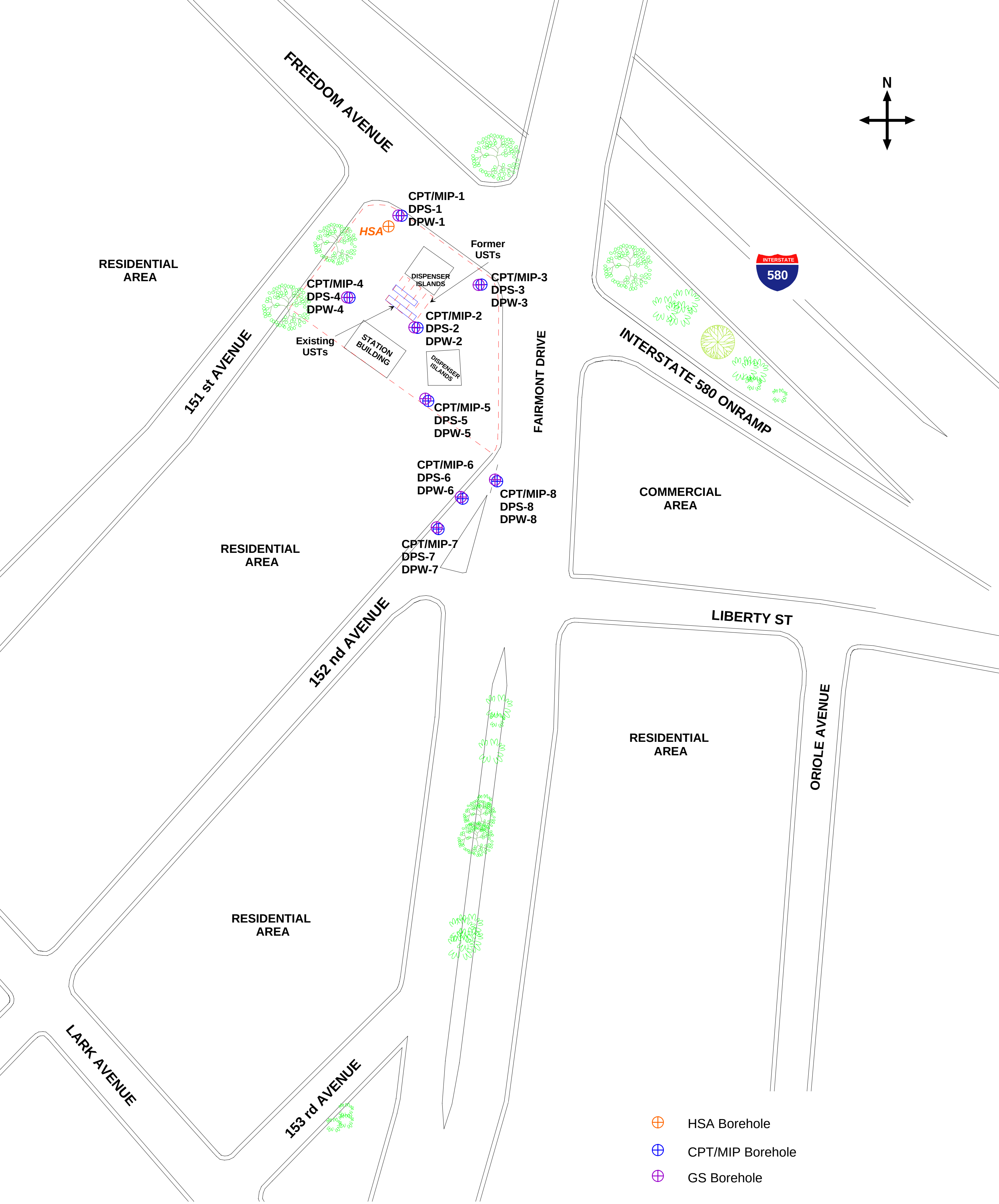


Figure 3: Locations of Soil Borings and Groundwater Monitoring Wells off the Site

SOMA ENVIRONMENTAL ENGINEERING, INC.



approximate scale in feet

0 50 100

Figure 4: Locations of CPT/MIP and Soil/Groundwater Sample Borings

SOMA ENVIRONMENTAL ENGINEERING, INC.

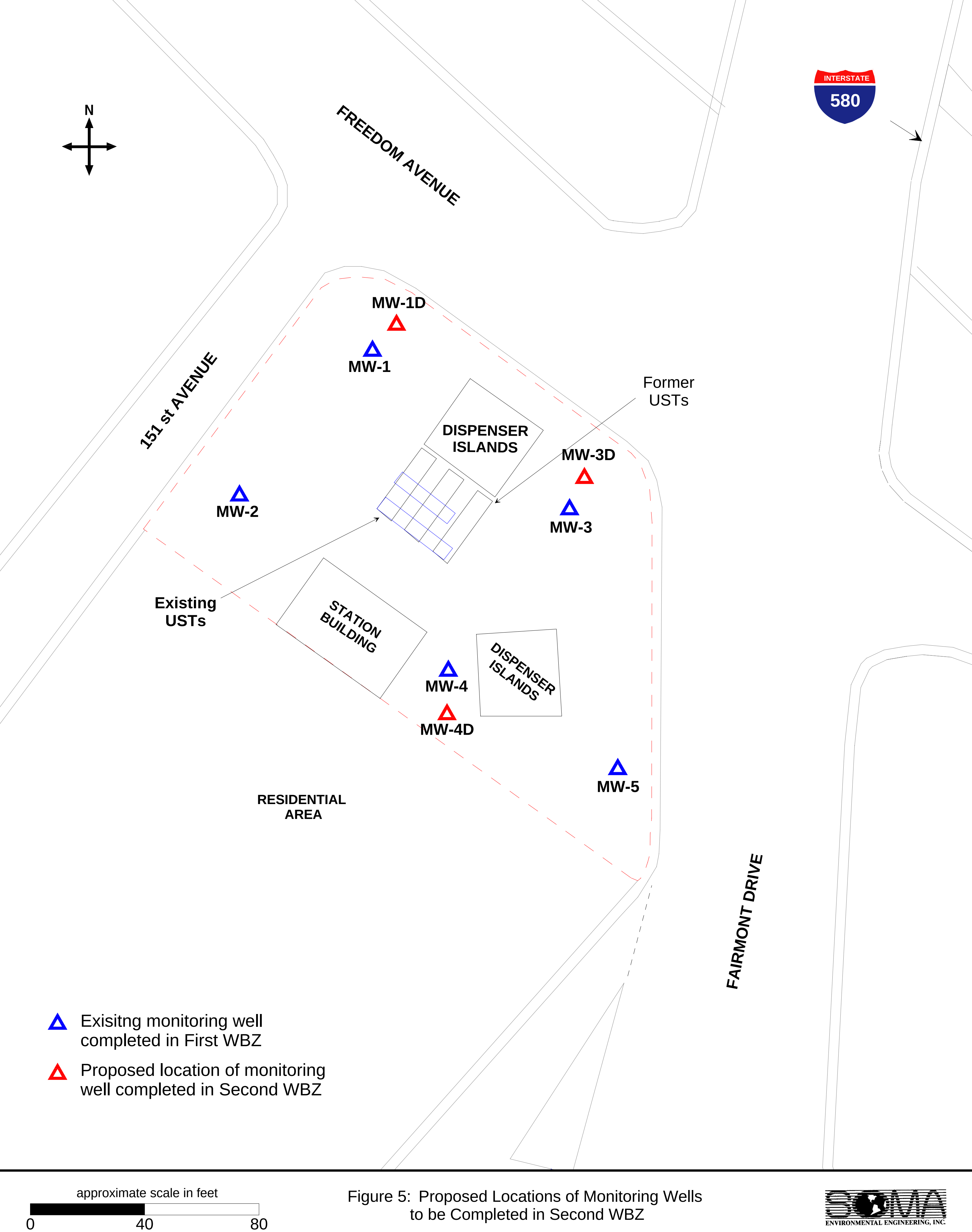


Figure 5: Proposed Locations of Monitoring Wells
to be Completed in Second WBZ

SOMA ENVIRONMENTAL ENGINEERING, INC.

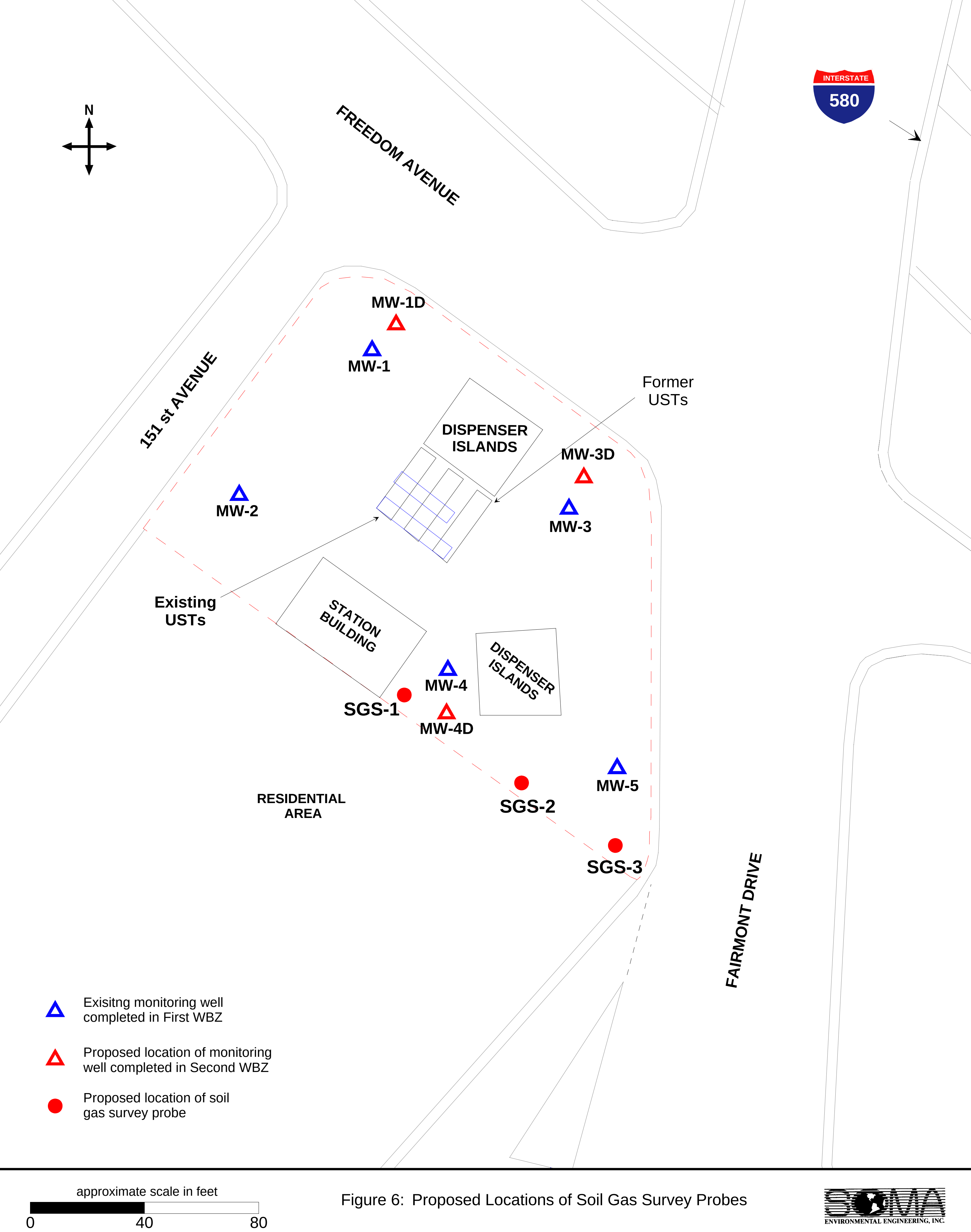
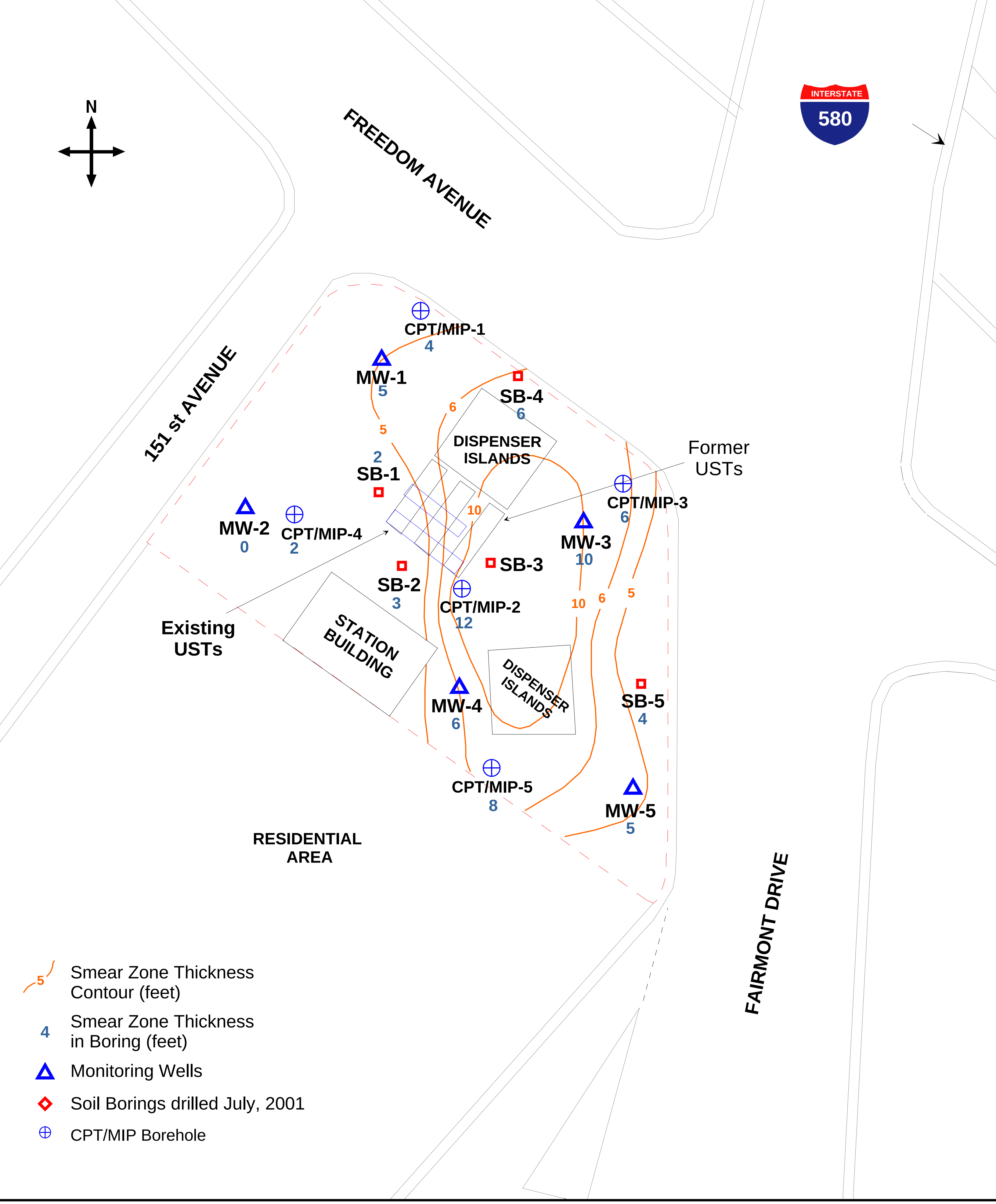


Figure 6: Proposed Locations of Soil Gas Survey Probes

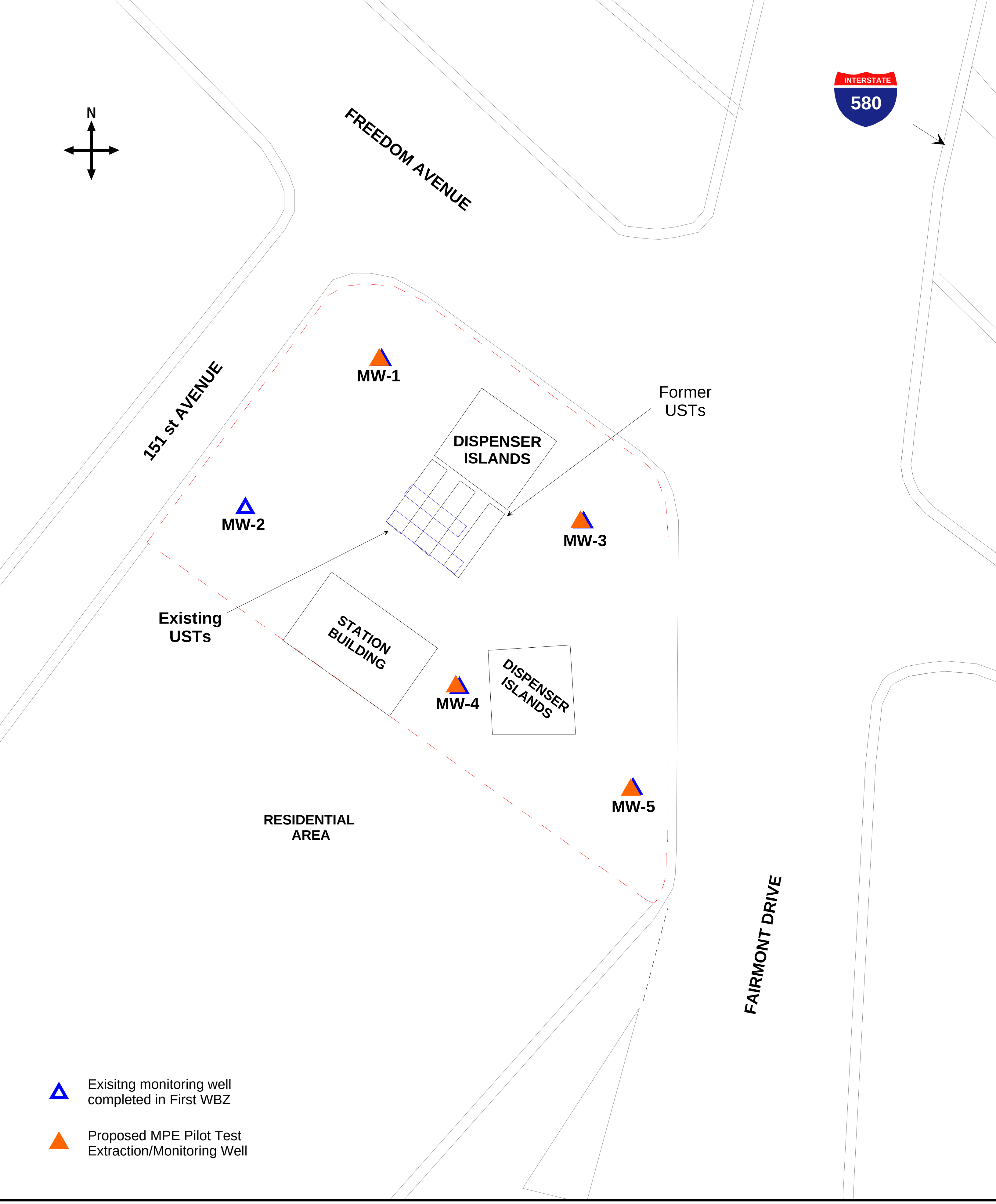


approximate scale in feet

0 40 80

Figure 7: Lateral Extent of Smear Zone in First WBZ

ENVIRONMENTAL ENGINEERING, INC.



approximate scale in feet

0 40 80

Figure 8: Proposed MPE Pilot Test Extraction Wells

ENVIRONMENTAL ENGINEERING, INC.

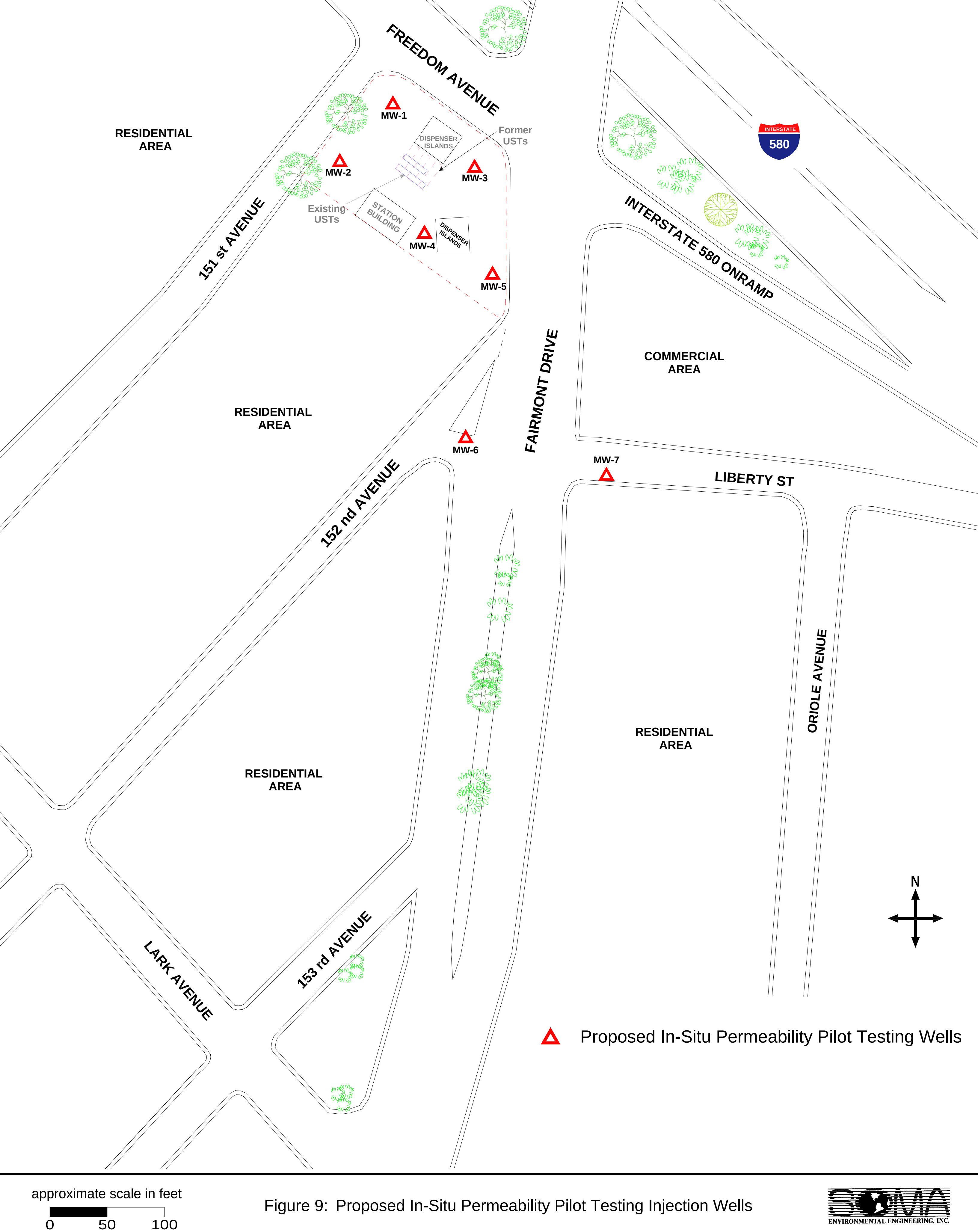


Figure 9: Proposed In-Situ Permeability Pilot Testing Injection Wells

SOMA ENVIRONMENTAL ENGINEERING, INC.

APPENDIX A
Field Procedures

FIELD AND LABORATORY PROCEDURES

Direct-Push, Hydraulic Push (Geoprobe) Drilling and Soil Sampling

Soil borings are advanced using direct-push large bore techniques. Soil sampling is performed using a Large Bore (LB) sampler containing a removable polybutyrate liner. Soil samples are collected at five feet depth intervals to total depth at each boring location. The sampler is driven over the sampling interval by hydraulic ram. The sampler is then retrieved and the liner exposed to extrude the sampled soil. The soil is screened with a Photo-Ionization Detector (PID), and examined and described in accordance with the Unified Soil Classification System. The portion of the liner to be submitted for laboratory analysis is then trimmed to an approximate 6-inch length, covered at both ends with Teflon tape, sealed at both ends with polyethylene end caps, labeled, logged on a chain-of-custody form, and placed in an ice chest containing ice, and kept at 4^0C for transport to the analytical laboratory for analyses.

Alternatively, precleaned push rods (typically one to two inches in diameter) are advanced using a hydraulic push type rig for the purpose of collecting samples and evaluating subsurface conditions. Upon arriving at the designated sampling point, the pointed push tip is retracted to expose the sampler lined with brass, stainless steel or plastic sample tubes. The sampler is pushed, or driven using a hydraulic hammer, into underlying soil approximately 12 to 18 inches to fill the sample tubes. Once the sample is collected, the rods and sampler are retracted and the sample tubes are removed from the sampler head. The sampler head is then cleaned, filled with clean sample tubes, inserted into the borehole and advanced to the next sampling point where the sample collection process is repeated. The soil is screened with a Photo-Ionization Detector (PID), and examined and described in accordance with the Unified Soil Classification System. The portion of the liner to be submitted for laboratory analysis is then trimmed to an approximate 6-inch length, covered at both ends with Teflon tape, sealed at both ends with polyethylene end caps, labeled, logged on a chain-of-custody form, and placed in an ice chest containing ice, and kept at 4^0C for transport to the analytical laboratory for analyses.

Upon completion of drilling and sampling, the rods are retracted, and the resulting borehole is filled with concrete, bentonite grout, hydrated bentonite chips or pellets as required by the regulatory agency. Cement is tremied into place as the push rods are removed. In areas where the borehole penetrates asphalt or concrete, the borehole is capped with an equivalent thickness of asphalt or concrete patch to match finish grade.

Groundwater Sampling

Groundwater samples are collected at each boring location using a Screen Point 15 (SP15) groundwater sampler. Once the sampler is set the screen sleeve was pulled back exposing a five-foot length of slotted PVC screen.

Groundwater samples are collected using a small diameter stainless steel or disposable bailer and transferred to laboratory supplied and preserved glass containers with Teflon lined lids at the base of the bailer, via a Teflon check valve and nipple. Each sample container is completely filled allowing no headspace following placement of the Teflon-lined lid. Following transference, each sample container is labeled, logged on a Chain-Of-Custody form, and placed in an ice chest to be kept at 4^{0}C during transport to the analytical laboratory. Prior to initial collection and between borings, the stainless steel bailer is field decontaminated to avoid cross-contaminating the collected groundwater samples.

During the sampling process a physical description of observed soil characteristics (i.e. moisture content, consistency, odor, color, etc.), drilling difficulty, and soil type as a function of depth are described on boring logs in accordance with the Unified Soil Classification System (USCS).

No soil cuttings are generated during drilling as the underlying soils are displaced by the push rods. However, hand auger cuttings generated in the upper five feet during the initial utility clearance may be compacted in the upper portion of the hole immediately under the asphalt cap.

Groundwater Monitoring Well Drilling and Soil Sampling

Groundwater monitoring well and soil sampling/exploratory borings are drilled using Hollow-Stem Auger (HSA) drilling equipment. Soil samples from borings are collected at five-foot intervals using a modified California split spoon sampler fitted with three 1-1/2 inch by 6-inch brass or stainless steel liners. Soil samples are collected by advancing the borehole to the desired sampling increment (five-foot intervals) and lowering the modified California sampler through the hollow-stem auger string to the bottom of the borehole. The sampler is then advanced 18-inches ahead of the auger string using a 140-pound hammer. The sampler is then removed from the borehole and hollow-stem auger string and broken down into its component parts. The first, or tip, liner is retrieved for possible laboratory analyses. The collected sample is then labeled, logged on a Chain-Of-Custody form, and placed in an ice chest containing ice, and kept at 4^{0}C for transport to the analytical laboratory for analyses. The second liner is screened for the presence of fuel hydrocarbon concentrations using a photo-ionization detector (PID). The contents of the second and third liner are extruded and examined to prepare a soil lithologic log for each boring in accordance with the Unified Soil

Classification System, and to inspect the soil for visual evidence of fuel hydrocarbons including staining, discoloration or odors.

Soil cuttings generated during drilling are placed in 55-gallon capacity DOT rated steel drums, labeled, and stored on the Site pending transport for offsite treatment/disposal. Each drum is labeled with date of accumulation, station address, contents, owner, and a contact phone number.

Drill bits, drill stem, drive casing and other tools used in well borehole drilling and soil sampling are thoroughly steam cleaned before initial use and between use at each subsequent well borehole location. The modified California sampling tube and stainless steel liners are washed in clear water, washed in a mixture of Liquinox and clear water, rinsed in clear water, rinsed in distilled water, rinsed in deionized water, and allowed to air dry prior to their initial use, and prior to subsequent use downhole. Water produced during equipment decontamination is contained in 55-gallon capacity DOT rated steel drums, labeled, and stored on the Site pending transport for offsite treatment/disposal. Each drum is labeled with date of accumulation, station address, contents, owner, and a contact phone number.

Groundwater Monitoring Well Installation

In each well boring, when the desired borehole depth is reached, blank casing, screen, filter pack, and bentonite seal are installed inside the HSA auger string. During the installation of well construction materials, the HSA auger string is removed in sequence, leaving the completed monitoring well installation in the borehole. A bentonite/cement grout slurry was then tremied into place to ground surface.

Materials used for constructing each monitoring well include 2 to 4-inch diameter interior/exterior flush threaded NSF approved rigid PVC Schedule 40 well casing and well screen. Well screen perforations are precision machine slotted. Screen slot sizes are 0.02-inch (20 slot) to maximize development of the monitoring well, expedite purging of the well prior to sampling, and lower groundwater entrance velocities thereby minimizing volatilization of groundwater quality samples collected from the monitoring well. The well screen is positioned to provide at least 5 feet of screen length above and below the elevation at which saturated conditions are encountered in the boring during drilling, so as to adequately compensate for any annual fluctuations in the groundwater surface, thereby allowing accurate determination of groundwater elevations at any time of the year, and provide representative groundwater samples. All screen/casing strings are threaded together. The use of solvent glues is not allowed to assemble the screen/casing strings. Filter pack material utilized is clean, rounded, water-worn material, and is installed in the annular space adjacent to the well screen, to a distance of at least 2-feet above the top of the well screen section. Within the annular space above the filter pack material, a minimum 2-foot thick hydrated bentonite chip seal is placed. The remaining portion of the annular space is sealed with a slurry equivalent to a 10.3 sack mix (188 pounds of sand and 94 pounds of cement per 7 gallons of water) to ground surface. To protect the monitoring wells from accidental damage or tampering, a traffic rated minimum 12-inch diameter utility box with an internal steel protective cover and locking cap is placed over each monitoring wellhead set in concrete and resting flush with existing grade.

All well screen/casing strings are thoroughly steam cleaned prior to insertion in each well borehole. All well construction materials (filter pack, bentonite and cement) are stockpiled away from drilling and sampling activities on polyethylene sheeting and covered to prevent contamination. Each well is completed utilizing rigid NSF approved PVC casing and screen.

Groundwater Monitoring Well Development

Groundwater monitoring wells are developed by mechanically surging the screened portion of each well with a vented surge block, followed by bailing the well to remove material entering the well through the well screen in response to surging operations. Development operations continue until pH, conductivity and temperature readings stabilize to within 10 percent of the previous two readings, or 10 borehole volumes of groundwater have been removed from the well. Temperature, pH and conductivity were measured using a hand-held field meter. The meter was calibrated prior to daily use in accordance with the manufacture's specifications.

Water produced during well development activities is contained in 55-gallon capacity DOT rated steel drums and securely stored on the Site pending transport for offsite treatment/disposal. Each drum is labeled with date of accumulation, street address, contents of the drum, owner, and a contact phone number.

Groundwater Monitoring Well Purging and Sampling

Prior to purging, the monitoring well is evaluated for the presence of LNAPL using an electrical interface probe. Groundwater surface elevation in the monitoring well is then measured. Measurements are made using an electrical water level meter graduated in tenths of inches. The elevations are measured at the top of casing of each well. The top of casing of each well is referenced to the site-specific benchmark.

Each well is then purged of stagnant groundwater prior to sampling utilizing a 2-inch electrical submersible pump to assure the collection of representative samples of groundwater for analyses. Purging continues until pH, conductivity and temperature readings stabilize to within 10 percent of the previous two readings, or 5 borehole volumes of groundwater have been removed from the well. Temperature, pH and conductivity are measured using a hand-held field meter. The meter is calibrated prior to daily use in accordance with the manufacture's specifications. Water produced well purging is contained in 55-gallon capacity DOT rated steel drums and securely stored on the Site pending transport for offsite treatment/disposal. Each drum is labeled with date of accumulation, street address, contents of the drum, owner, and a contact phone number.

Following purging, groundwater samples from each well are collected utilizing a 1-inch diameter by 5-foot long unused, disposable, polyethylene point-source bailer. Groundwater samples are transferred to laboratory supplied and preserved glass containers with Teflon lined lids at the base of the bailer, via a Teflon check valve and nipple. Each sample container was completely filled allowing no headspace following placement of the Teflon-lined lid. Following transference, each sample container was labeled, logged on a Chain-Of-Custody form, and placed in an ice chest to be kept at $4^{0}C$ during transport to the analytical laboratory.

Prior to initial use and between subsequent purging events the submersible pump used for well purging is field decontaminated by submerging the pump in a mixture of Liquinox and clear water and pumping approximately 15 gallons of the mixture through the pump and the discharge line. Discharge is contained in a 55-gallon capacity DOT rated steel drum and securely stored on the Site pending transport for offsite treatment/disposal. The drum is labeled with date of accumulation, street address, contents of the drum, owner, and a contact phone number. The pump is then removed and rinsed in clear water, rinsed in distilled water, rinsed in deionized water, and allowed to air dry. The outer casing of the discharge line is washed in clear water, washed in a mixture of Liquinox and clear water, rinsed in clear water, rinsed in distilled water, rinsed in deionized water, and allowed to air dry. At each monitoring well, a clean, unused bailer line was utilized to lower and raise the sampling bailer.

APPENDIX B
Public Health Assessment Questionnaire

PUBLIC HEALTH ASSESSMENT

DATE

SUBJECT: POTENTIAL FUEL CONTAMINATION IN THE VICINITY OF A FORMER GASOLINE SERVICE STATION LOCATED AT 15101 FREEDOM AVENUE, SAN LEANDRO, CALIFORNIA

Dear Resident:

Alameda County Health Care Services – Environmental Health Services staff have requested a list of receptors that could potentially be affected by fuel released from an existing service station located at 15101 Freedom Avenue in San Leandro, California. The attached map shows the location of the service station in relation to your property. Also attached is a questionnaire. Please only complete Section A if you do not have a well, basement, or a groundwater pumping sump. It is permissible to write "unknown" if you simply do not know.

The results of this assessment will be used to determine whether the water in your well or sump should be tested for fuel compounds. The testing would be free of charge and performed at your convenience. You will also receive a copy of the laboratory testing report.

Please return your responses in the enclosed self-addressed stamped envelope as soon as possible. A second questionnaire will be mailed to your attention if we do not receive a response within two weeks. Again, please participate for your protection. Additionally, we welcome any comments you may have. Please contact Steven Plunkett of the Alameda County Health Care Services – Environmental Health Services at 510-383-1767 or the undersigned at 925-734-6400, if you have any questions or concerns regarding this questionnaire.

Sincerely,

Matthew H. Spielmann

Matthew H. Spielmann
Senior Project Geologist

Enclosures

SECTION A

Your name: ____

Your address: ____

Your telephone number: ____

Do you own or rent this property? ____

If you rent this property, please provide the owner's information:

Owner's name: ____

Owner's address: ____

Owner's telephone number: _________________________

Is the property used for commercial or residential purposes? ___________________

Is the property occupied by a multi-family complex (e.g. apartment building)? _________

Is there a well on the property? ________________

Is there a basement on the property? _____________

Is there a sump on the property that pumps groundwater? _____________

SECTION B (complete if a well exists at the subject site)

Number of wells: ________ Well Diameter(s): ______________________________

Well Depth(s): _______________________ Pump Depth(s): ____________________

Material used for the well casing: ____

Date(s) the well(s) were installed: ____

How frequently are the well(s) used? ______________________________________

What is the well water used for? ____

SECTION C (complete if you have a sump which pumps groundwater)

Frequency of use: ______________________

Approximate gallons of water pumped from the sump each day: _____________________

Where is the sump water discharged? ____

Additional Comments (if any):

____
____
____
____
____
____