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November 15, 2008

ADDITIONAL INFORMATION REPORT

20957 Baker Road
Castro Valley, California 94546
ACEH Leak Case RO 2739

AEI Project No. 273928

Prepared For

Nat and Darlene Piazza
7613 peppertree Road
Dublin, CA 94568

Prepared By

AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94597

AEI

CERTIFICATION STATEMENT
ADDITIONAL INFORMATION REPORT

November 15, 2008

209057 Baker Road
Castro Valley, California 94568

I DECLARE, UNDER PENALTY OF PERJURY, THAT THE INFORMATION AND/OR RECOMMENDATIONS CONTAINED IN THE ATTACHED DOCUMENT OR REPORT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

Natale Piazza
NATALE PIAZZA

11-18-08
DATE

Darlene J. Piazza
DARLENE J. PIAZZA

11/18/08
DATE

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1.0 INTRODUCTION

AEI Consultants (AEI) has prepared this report on behalf of Mr. and Mrs. Nat Piazza (client), owners of the above referenced property. AEI has been retained by the client to provide environmental engineering and consulting services associated with a release from two previously removed underground storage tank (USTs) on the property. This Additional Information Report was prepared in response to a request from the Alameda County Environmental Health Department (ACEH) for a clarification of the current conditions at the subject site.

2.0 SITE DESCRIPTION

The subject property (hereafter referred to as the "site" or "property") is located at 20957 Baker Road in Castro Valley, California (Figure 1: Site Location Map). The site is located in a mixed residential and commercial/light-industrial area of Castro Valley. The site is approximately 81 feet by 300 feet in area and is currently undeveloped and not in use. The site is partially covered with asphalt surfacing and concrete slabs with the remainder of the site graveled. The site occupies the southern two thirds of the fenced in area.

Baker Road makes up the east boundary of the site with residential property to the east of the road. Rutledge Road bounds the property to the west with commercial and residential property west of the road. The property is bounded to the north by a partially vacant lot. The parcel to the north is split by a fence, with the southern half of the adjacent lot appearing to be part of the subject site. Two residential buildings are located in the northeast quadrant of is adjacent lot. To the south, the east half of the property is by an apartment complex and on the west half bounded to the south by a plumbing contractor. The locations of these buildings relative to the subject site and locations of the former UST are shown on Figure 2, "Site Map".

3.0 BACKGROUND

3.1 Geotechnical Investigation

In 1986 Merrill, Seeley, Mullen, Sandefur, Inc. performed a geotechnical exploration and engineering study for design of proposed construction at the subject site. Nine (9) soil borings (GT-1 through GT-9) were drilled at to the top of bedrock. The investigation described a surface layer of gravelly clay fill one (1) to two (2) feet thick. The native soil was described as very stiff to hard dark brown to black, silty clay. At depths of three (3) to four (4) feet bgs the color changed to grayish brown. Silt and sand was encountered under the silty clay in Borings GT-4 through GT-8. Bedrock was encountered at depths ranging from six (6) below the ground surface (bgs) in boring GT-1 to 13 feet bgs in GT-9. Groundwater was encountered at depths ranging from nine (9) to twelve (12) feet bgs in borings GT-2, GT-4, through GT-6, GT-8 and GT-9. No groundwater was encountered in boring GT-1, GT-3, and GT-7. A copy of the "*Geotechnical Exploration and Engineering Study Report* " is attached in Appendix A.

3.2 Tank Removal

On April 21, 2004, AEI removed two 1,000-gallon USTs from the site (Figure 2). The removal was performed under permit from the ACEH. Robert Weston, Inspector for the ACEH, observed the tank removal.

Two soil samples were collected from underneath each UST and analyzed for Total Petroleum Hydrocarbons as gasoline (TPH-g), benzene, toluene, ethylbenzene, xylenes (BTEX) and Methyl tertiary butyl ether (MTBE) by EPA Method 8021B/8015Cm. Total Petroleum Hydrocarbons as diesel (TPH-d) was analyzed by EPA Method 8015C and total lead by EPA Method 7010.

Hydrocarbons were reported in all the soil samples analyzed. TPH-g was reported at concentrations ranging from 160 milligrams per kilogram (mg/kg) (T1W-EB8') to 1,400 mg/kg (T2W-EB8'). TPH-d was reported at concentrations ranging from 1,400 mg/kg (T2E-EB8') to 10,000 mg/kg (T1E-EB8'). Total xylenes were reported in two samples at 8.4 mg/kg (T2W-E8') and 0.25 mg/kg (T2E-EB8'). No benzene, toluene or ethylbenzene were reported in any of the soil samples. Total lead was reported at concentrations ranging from 6.1 mg/kg (T1W-E8') to 24 mg/kg (stockpile sample STKP1-4).

The following notes were attached to the gasoline results of all four soil samples collected in the tank excavation:

- g) strongly aged gasoline or diesel range compounds are significant
- m) no recognizable pattern

The following notes were attached to the diesel results of the soil samples collected in the tank excavation:

- c) aged diesel ? is significant – T1STKP1-4
- d) diesel range compounds are significant no recognizable pattern- T2E-EB8', T2W-EB8', and T2STKP1-4

The results of hydrocarbon analyses of soil samples collected during tank removal are included in Table 1. Copies of the analytical reports were included in "*Underground Storage Tank removal Final Report*", which attached in Appendix B.

Under instruction from Robert Weston, ACEH inspector, no over excavation or cleaning of the excavation was done. The excavation was lined with plastic sheeting and backfilled with base rock.

The tanks, which had been unused for over 15 years were reported to still contain a small amount of fuel and sludge. The tanks were reported to be intact with no obvious leaks, this is consistent with the fuel remaining in the tanks and suggests that the release at the site was from over filling or piping/dispenser leaks. This combined with the absence of MTBE and minimal presence of VOCs and the notes on the analytical reports referencing aged gasoline, aged diesel, and no recognizable pattern indicates that the releases are old enough to have undergone significant degradation and likely occurred prior to the late 1980s when the tanks ceased to be in operation.

3.3 Preliminary Site Investigation

AEI performed a preliminary site investigation at the property on May 18, 2005. Eight (8) soil borings (SB-1 through SB-8) were advanced to depths ranging from 14 to 18 feet below ground surface (bgs) using a Geoprobe® Model 5410 direct-push drilling rig. The locations of the soil borings are shown on Figure 2, Site Map.

No detectable concentrations of TPH-g, TPH-d, TPH-mo, MTBE or BTEX, were reported in any of the soil samples from depths of 7.5 to 11 feet bgs at or above detection limits of 1.0 mg/kg, 1.0 mg/kg, 5.0 mg/kg, 0.05 mg/kg, and 0.005 mg/kg, respectively. The results of the soil analyses are summarized in Table 1 (Soil Analytical Data) and shown on Figure 3 (Soil Analytical Data).

TPH-g was reported in the groundwater sample from soil boring SB-2 (SB-2W) at concentration of 7,300 micrograms per liter (µg/L). No TPH-g was reported in groundwater samples from any other borings at or above the detection limit of 50 µg/L. The analytical report carries the note "m) no recognizable pattern". This degradation of the normal gasoline chromatograph pattern is indicative of old, biologically degraded hydrocarbons.

Maximum TPH-d was reported at a concentration of 23,000 µg/L in the in the groundwater sample from boring SB-2 (SB-2W). LNAPL was observed both in the field and by the laboratory in this groundwater sample. TPH-d was reported in the other seven borings at concentrations ranging from ND<50 µg/L (SB-7) to 670 µg/L (SB-5). The diesel analytical report carries the note "m) diesel range compounds are significant; no recognizable pattern". This degradation of the normal diesel chromatograph pattern is indicative of old, biologically degraded hydrocarbons.

No TPH-mo was reported in groundwater samples from borings SB-3, SB-4 and SB-7 at or above a detection limit of 250 µg/L. TPH-mo was reported in groundwater samples from borings SB-1, SB-2, SB-5, SB-6 and SB-8 at concentrations ranging from 300 µg/L (SB-6) to 1400 µg/L (SB-1 and SB-5).

No MTBE was reported in the groundwater samples from any of the borings at or above a detection limit of 5.0 µg/L.

The results of the groundwater analyses are summarized in Table 2 (Groundwater Analytical Data - Soil Borings and Paired Monitoring Wells) and shown on Figure 4 (Groundwater Analyses - 5/18/05 & 10/18/07). A copy of the "*Preliminary Site Investigation Report*" is attached in Appendix C.

3.4 Monitoring Well Installation

On October 12, 2007 AEI installed five (5) 2-inch nominal diameter groundwater monitoring wells, one on each side of the former tank hold (MW-1, MW-2), one through the center of the backfill (IN-1) and two down gradient of the former tank hold (MW-3, MW-4). The details of well construction are summarized in Table 3 (Well Construction Details).

Two soil samples from borings MW-1 through MW-3 and three soil samples from wells MW-4 and IN-1 were analyzed for TPH-g and MBTEX by EPA Method 8015/8021B and TPH-d, TPH-mo, and TPH-bo by method 8015C.

Analysis of soil sampled reported TPH-d in well IN-1 at concentrations of 4.0 mg/kg, 5.1 mg/kg, and ND<1.0 in samples collected at depths of 8.5 feet bgs, 10 feet bgs, and 12 feet bgs, respectively. No TPH-g, TPH-mo, BTEX or MTBE was reported in soil samples from well IN-1.

No TPH-g, TPH-d, TPH-mo, TPH-bo, BTEX or MTBE was reported in any of the soil samples analyzed from wells MW-1 through MW-4 at or above standard reporting limits.

The wells were initially developed on October 15, 2007. Depth to water at the time the wells were developed ranged from 11.00 feet bgs (IN-1) to 14.57 feet bgs (MW-4). On October 18, 2007, at the time of the initial sampling event, the depth to groundwater ranged from 10.89 feet bgs (IN-1) to 14.92 feet bgs (MW-4). Depth to groundwater in the wells on November 6, 2007 ranged from 8.00 feet bgs (MW-4) to 11.37 feet bgs (MW-2). The depth to water in well MW-4 was anomalously low when the wells were installed and at the three times depth to water was measured in October 2007.

Depth to groundwater on November 6, 2007 ranged from 11.20 feet bgs (MW-3, IN-1) to 8.00 feet bgs (MW-4). The direction of groundwater flow at the time of measurement was to the south-southeast with a groundwater gradient of 0.002 ft/ft. A historical summary of groundwater elevations can be found on Table 4.

Groundwater samples from the October 18, 2007 groundwater monitoring event were analyzed for TPH-g, MBTEX by EPA Method SW8021B/8015Cm and Total petroleum Hydrocarbons as Bunker oil (TPH-bo – C10+), TPH-d (C10-23) and TPH-mo (C18+) by EPA Method SW8015C.

No TPH-g, BTEX or MTBE were present at or above standard reporting limits in any of the groundwater samples.

No TPH-bo, TPH-d, or TPH-mo, were reported in samples from wells MW-2 through MW-4 and IN-1 at or above detection limits of 100 µg/L, 50 µg/L, and 250 µg/L, respectively. TPH-bo (C10+, middle - heavy residual fuel), TPH-d (C10 - 23, middle residual fuel), and TPH-mo (C18+ heavy residual fuel were reported in the water sample from well MW-1 at concentrations of 56 µg/L, 140 µg/L, and ND<250 µg/L, respectively. The difference between concentrations reported for TPH-bo (C10+) and TPH-d suggest a TPH-mo concentration around 86 µg/L.

The initial groundwater monitoring wells indicate a significant decrease in dissolved hydrocarbon concentrations in the groundwater between soil boring grab sample (May 18, 2005) and the initial sampling of monitoring wells (October 18, 2007) had occurred. No hydrocarbons were reported in any groundwater samples since the January 14, 2008 monitoring event. A historical summary of groundwater analyses can be found on Tables 3 and 5. A complete copy of the "*Well Installation Report*" is attached in Appendix D.

During the first groundwater monitoring event, the soil vapors present in the vadose zone of impacted wells were measured using a RKI Eagle gas analyzer. The Eagle measures Total Volatile Hydrocarbons (TVH), oxygen (O_2), carbon dioxide CO_2), and methane concentrations (CH_4). The purpose of the sampling was determine if significant volatile hydrocarbons were present in the vadose zone and whether sufficient oxygen is present in the vadose zone to sustain biodegradation.

Vapor samples were collected from the vadose zone in each of the five wells on site. No TVH was detected in any of the wells, this is consistent with the results of soil and groundwater analyses which reported little or no light range hydrocarbons. O_2 content ranged from ambient conditions, 20.8% in MW-1, to slightly depressed, 7.9% in MW-3, 15.9% in MW-2, and 12.4 % in IN-1. CO_2 content ranged from near normal, 0.4% in MW-1 to slightly elevated in MW-3 (7.3%) and IN-1 (5.0%). The vapor survey field data is summarized of Table 6.

Normal air composition is approximately 20.9% O_2 and 0.1% carbon dioxide. O_2 concentrations of <5% are considered to be O_2 limited. With an O_2 concentrations ranging from 7.9% to 20.8% the site is not O_2 limited and would be expected to sustain an active biomass if hydrocarbons were present. The depressed concentrations of O_2 and elevated concentrations of CO_2 in the soil gas is consistent with relatively low levels of biodegradation of natural organic material, in the soil such as the black clay seen in soil borings at depth of approximately 1 to 4 feet bgs.

4.0 GEOLOGY AND HYDROLOGY

The site is located at approximately 160 feet above mean sea level (msl). The site is relatively flat and the local topography slopes very gently to south-southwest toward an unnamed stream (Figure 1). During periods of rain, surface drainage on the bulk of the site is to the southwest then onto the storm drains along Rutledge Road (Figure 4). Some of the surface flow is across the tank excavation site, which likely recharges the gravel backfill with oxygenated water.

The lithology observed in the borings drilled to date typically consists of 0.5 to 2 feet of gravelly clay – clayey gravel (Fill). This is underlain by relatively impermeable, organic rich, black silty clay to a depth of 3 to 4 feet bgs. The black clay is underlain by dark yellowish brown oxidized clayey silt which grades into sand at depths ranging of 6 to 9 feet bgs. The yellowish brown to reddish gray silty, gravelly sand is present to the top of the bedrock at depths of 13 to 17 feet bgs (Figure 5). These sands are greenish gray in boring SB-2 and MW-2, which are the only reduced sediments observed below the shallow black clay. In several borings saprolitic clay (claystone weathered in place.) is present between the sandy sediments and the claystone bedrock.

The relationships of the sediments that underlie the site are shown on Figure 10 (Cross sections A-A' and B-B') in the 2007 Well installation Report that is attached in Appendix D. Copies of the boring/well logs are included in their respective reports in Appendices C and D. A detailed cross section across the tank pit is attached as Figure 8.

May 2005 Groundwater was encountered in soil borings at depths of D to 11 feet bgs. On October 12, 2007 groundwater was encountered at depths ranging from 13.3 feet bgs in well IN-1 to 15.5

feet bgs in well MW-1. This indicates that during at least part of the dry season, groundwater is not present above the top of the bedrock (Figure 6). The overall northward slope to the bedrock surface under the former USTs, and the local bedrock low in the area of SB-2 combined with the common eastward component to the groundwater gradient (Table 4a) would have resulted in hydrocarbon migration toward boring SB-2 and MW-2 where the historically the highest concentrations of hydrocarbons were present in the groundwater.

Between October 12, 2007 and 8/20/2008, the groundwater flow direction ranged from southwest to east with highly variable gradients (Table 5). The groundwater surface has a strong southerly component but commonly forms an arching surface centered on well IN-1 with gradients toward both the southwest and east. This high coincides with the subcrop ridge on the bedrock surface. The coincidence of the high in the groundwater surface with the high on the bedrock surface suggests the possibility that the two are related. Groundwater within the underlying low permeability sediments is typically through interconnected fracture system. If the subcrop ridge is related to fracture system it is possibly that the local groundwater is being re-charged with water entering the fracture system in the adjacent hill.

Although most of the site is unpaved, the shallow black clay is relatively impermeable and rain water puddles and runs across the site including across the backfilled excavation. It is probably that whenever sufficient rainfall occurs to produce runoff across the site the gravel fill would likely become charged with rainwater. This water could percolate downward producing a localized high. However, a comparison of nearby rainfall records does not show any correlation between rainfall and the direction of the groundwater gradient at the site

The nearest surface water body to the site is a small, unnamed creek, located approximately 500 feet southwest of the site that drains into San Lorenzo Creek.

5.0 SUMMARY OF ENVIRONMENTAL CONDITIONS

Analysis of soil samples collected from beneath the two previously removed 1000-gallon fuel USTs in 2004 reported maximum TPH-g and TPH-d concentrations of 1,400 mg/kg and 10,000 mg/kg, respectively from a depth of 8.0 bgs. Despite the significant concentrations of TPH-g and TPH-d, no benzene, toluene, or ethylbenzene were reported is the soil analyses. Low concentrations of xylenes were reported in two samples. The absence of significant amounts of VOCs in the soil samples with significant hydrocarbons is indicative of an old degraded release.

Analysis of soil samples collected during the 2005 "*Preliminary Site Investigation*" reported no TPH-g, TPH-d, TPH-mo or MBTEX, however obviously reduced greenish gray sand was observed below the top groundwater in boring SB-2. Field screening reported 175 ppmv from this interval. Field screening found no other soil samples with significant concentrations of volatile organic vapors. Reduced sediments were not encountered in any other soil borings. Based on the data from the 2004 UST removal and 2005 preliminary Site Investigation data, impacted soil appeared to be limited to an area less than 10 feet by 30 feet, essentially the footprint of the previous tank hold and in the bedrock low around boring SB-2.

Significant concentrations of TPH-g, TPH-d, and TPH-mo were reported in the groundwater only at the East End of the tank pit in boring SB-2. No BTEX was reported in water samples from boring SB-1, and SB-3 through SB-8. Relatively low concentrations of toluene and xylenes were reported in the water sample from SB-2. No benzene or ethylbenzene were reported present in SB-2. Low levels of TPH-d and TPH-mo were reported with TPH-mo consistently higher than TPH-mo. This combined with the absence of VOCs and gasoline fractions is indicative of an old, degraded hydrocarbon release.

The distribution of hydrocarbons in the groundwater away from the source at this site is directly related to their weight, the reverse of the pattern that is expected. In a mixed weight lightweight hydrocarbons exhibit the greatest dispersion and heavier weight hydrocarbons such as motor oil disperse shorter distances. TPH-mo exhibits the widest areal distribution, followed by TPH-d, then by TPH-g, which was reported only in boring SB-2. Such distributions typically are indicative of old collapsing hydrocarbon plumes where biodegradation is reducing the lighter fractions faster that the heavier oil range compounds. This picture of an old collapsing groundwater plume is consistent with the nature and age of the release as described in section 3.1 above. This interpretation is supported by laboratory notes attached to the gasoline and diesel results for the 2005 groundwater sample from boring SB-2. The gasoline analytical report carries the note “m) no recognizable pattern”. The diesel analytical report carries the note “m) diesel range compounds are significant; no recognizable pattern”. Both notes are indicative of old biologically degraded hydrocarbons.

AEI installed five (5) monitoring wells in October of 2007. Analysis of soil samples collected during the installation of monitoring wells MW-1 through MW4 drilled adjacent to the former tank hold and IN-1 which was drilled through the backfilled excavation reported no hydrocarbons above standard reporting limits. Four quarters of groundwater monitoring have reported no hydrocarbons present except for the first quarter in Well MW-1 where diesel and oil range hydrocarbons were reported below RWQCB ESLs. Based on this data the site meets the established RWQCB standard for closure.

6.0 TECHNICAL COMMENTS TO 3RD QTR 2008 MONITORING REPORT

6.1 Comment #1. Evaluation of Soil and Groundwater Conditions

6.1.1 Condition of Soil Remaining Beneath the Tank Pit

The ACEH Technical Comment #1 states, “However, ACEH notes that TPHg and TPHd detected during the tank removal remain in the soil beneath the former tank pit.” AEI response is that the following data collected during the 2007 installation of the monitoring well clearly shows that no significant hydrocarbons were present beneath or adjacent to the former tank pit at the time well IN-1 was installed. This view is supported by the following arguments.

- Well IN-1 was sampled across the base of the backfill. The native sediment in contact with the backfill consisted of an approximately 1-inch thick layer of odorless olive yellow sand. This was underlain by oxidized dark yellowish brown sand with no odors. The oxidized color of the sediments is indicative of an oxygen rich environment and is not compatible with the presence of hydrocarbons. The removal of oxygen from the environment by the bio-mass which degrades hydrocarbons reduces the red and yellow iron compounds in the soil to the greenish or bluish gray iron pigments associated with hydrocarbon contamination in the soil.

- The location of IN-1 was midway between tank excavation samples T1E-EB8' (2,400 mg/kg TPH-g, 10,000 mg/kg TPH-d) and T2W-EB8' (1,400 mg/kg TPH-g, 2,400 mg/kg TPH-d). The soil sample from 8.5 feet bgs was collected from essentially the same interval as the pit samples, see Figure 2, Site Map and Figure 9, Cross Section – Analytical Data. The oxidized nature of the soil encountered in IN-1 indicate that no significant amount of hydrocarbon degrading biomass and no hydrocarbon are present under the center of the tank pit where highest concentrations had been reported 3 ½ years earlier.

- Analysis sample IN-1-8.5 that was collected midway between and six (6) inches below and IN-1-10 from 2 feet below tank pit samples T1E-EB8' and T2W-EB8' reported residual TPH-d concentrations of 4.0 and 5.1, respectively. These minimal concentrations indicate that significant concentrations of hydrocarbons are no longer present where the previous highest concentrations were reported.

- AEI measured the soil gases present in well IN-1 on October 18, 2007 and July 12, 2008. No hydrocarbons were measured in the soil gas which would be expected if hydrocarbons were present in the vadose zone near the well. CO_2 concentrations were elevated and the O_2 concentration depressed but not sufficiently ($<5\%$ O_2) to indicate a significant biomass grading hydrocarbons. The relative concentrations of oxygen and carbon dioxide in IN-1 are consistent background levels in the other wells on the site where no hydrocarbons have been reported in the soil.

- Four quarters of groundwater monitoring have reported no detectable hydrocarbons in well IN-1. On January 14, 2008, the groundwater level in well IN-1 was at 8.39 feet bgs, at the same depth that the hydrocarbon contamination was reported in 2004 samples, T1E-EB8' and T2W-EB8'. If significant hydrocarbon contamination remained beneath the tank pit it would have been in contact with the groundwater and which would have been shown by the presence of hydrocarbons in the ground water samples.

Taken together this data is clear evidence that the previously reported hydrocarbons are no longer present. The obvious conclusion is that natural attenuation processes have reduced during the 3 ½ years between when the tanks were removed and well IN-1 were installed.

6.1.2 Disagreement between SB-2 and MW-2 groundwater analytical data

The ACEH Technical Comment #1 also states, "In addition, groundwater analytical data from soil boring SB-2 disagree with groundwater analytical data from well MW-2." AEI does not understand how groundwater data collected from a soil boring in 2005 and monitoring well analytical data collected from a period 2 ½ to 3 ½ years later constitutes a problem. Hydrocarbons degradation is a natural process/phenomenon inherent to almost all fuel hydrocarbon release. Furthermore, hydrocarbons have been show by many studies to degrade rapidly in aerobic environments. The monitoring data from between October 2007 and August 2008 consistently shows no hydrocarbons present. This is consistent with the hydrocarbon contamination reported in 2004 not being present in the soil as discussed above. Analysis of the greenish gray sand in MW-2 at depths of 11.5 and 13.5 feet reported no petroleum hydrocarbons, which is consistent with the most recent groundwater samples.

AEI believes that given the monumental amount of literature documenting the near universal nature of degradation of hydrocarbons in shallow oxygenated environments that the data presented in the previous reports and above should be sufficient. However in light of the ACEH request for additional supporting arguments supporting the biodegradation the additional discussion below is offered to support AEI's view that the available data is consistent with degradation of the previously reported hydrocarbons by natural attenuation processes.

All available data from the sites has been included in previous reports. The available data is from the tank removal, the initial investigation in 2005 (1 year later) and the installation of wells in 2008 (3 years later) followed by a year of groundwater monitoring data. The soil data from 2005 showed no soil impact outside of the immediate area of the tank pit. Soil data from the installation of IN-1 found only traces concentrations of TPH-d beneath the tank pit. No data is available showing a progression of decreasing concentrations.

No groundwater data is available from the tank removal, but given the concentrations reported in the soil beneath the tank pit and the presence of free product in boring SB-2 in 2005, it is likely that free product was present in the groundwater beneath the tank pit in 2005. Analysis of the 2005 soil boring groundwater samples reported TPH-g only at the West end of the tank pit (SB-2, 7,300 µg/L) and the highest concentration of TPH-d (23,000 µg/L) in the same boring. BTEX was either not reported except for toluene and xylenes, which were reported in SB-2 at a minimal concentration. TPH-mo range hydrocarbons had the widest areal distribution with TPH-mo concentrations in boring SB-1, SB-8 and SB-6 higher than TPH-g concentrations.

Some of the common mechanisms for natural attenuation are:

- Physical reduction of the hydrocarbon concentration through vadose zone dispersion, the loss of volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylenes (BTEX) to the vadose zone and ultimately to the atmosphere.
- Physical reduction of the hydrocarbon concentration by dissolution into the groundwater and dispersion along with groundwater movement. The distance of dispersion

- Physical reduction of the hydrocarbon concentration by non-aqueous phase dispersion along with groundwater movement.

- Chemical (weathering – abiotic degradation) degradation.

- Biological destruction by biomass activity, both aerobic and anaerobic.

Active natural attenuation of hydrocarbons is evidenced by the following:

- Analysis of soil samples collected at the site in 2004 reported xylene in two of the tank removal samples. No benzene, toluene or ethyl benzene was reported. This indicates that dispersion due to volatilization was reducing the concentrations of the lighter hydrocarbon fractions in the impacted soil and groundwater.

- Despite the significant concentrations of TPH-g and TPH-d reported in the 2005 water sample from soil boring SB-2; only low concentrations of toluene and xylenes and no benzene or ethylbenzene was reported. This also is indicative of dispersion by volatilization was reducing the concentrations of the lighter hydrocarbon fractions in the groundwater.

- Active dispersion through non-aqueous phases is demonstrated by the presence of diesel range LNAPL observed in the field and by the laboratory in the water sample from boring SB-2.

- Dissolved phase dispersion is demonstrated by the presence of low concentrations of TPH-d and TPH-mo up gradient in boring SB-1 and down gradient in boring SB-8 and SB-6.

- The distribution of hydrocarbons in the groundwater away from the source at this site is directly related to their weight, the reverse of the pattern that is expected. In a mixed weight lightweight hydrocarbons exhibit the greatest dispersion and heavier weight hydrocarbons such as motor oil disperse shorter distances. TPH-mo exhibits the widest areal distribution, followed by TPH-d, then by TPH-g, which was reported only in boring SB-2. Such distributions typically are indicative of old collapsing hydrocarbon plumes where biodegradation is reducing the lighter fractions faster that the heavier oil range compounds. This picture of an old collapsing groundwater plume is consistent with the nature and age of the release as described in section 3.1 above. This interpretation is supported by laboratory notes attached to the gasoline and diesel results for the 2005 groundwater sample from boring SB-2. The gasoline analytical report carries the note “m) no recognizable pattern”. The diesel analytical report carries the note “m) diesel range compounds are significant; no recognizable pattern”. Both notes are indicative of old biologically degraded hydrocarbons.

Natural attenuation by both dispersion and biodegradation would also have been enhanced at the site in the following ways:

- Depth to water in well IN-1 located approximately midway between tank samples T1E-EB8' and T2W-EB8' has ranged from 8.39 to 11.39 feet bgs. This indicates that the clayey silty sand underlying the tank excavation lies within the capillary fringe/smear zone. Much of the year, the impacted sand in the capillary fringe was a moist substrate with sufficient oxygen content much of the year to sustain high levels of bioactivity. Oxygen percentages in vapor samples from the monitoring wells confirm that oxygen levels in the vadose zone were high enough to support active biodegradation

- The surface of the site is underlain by relatively impermeable black clay that limits infiltration during periods of heavy rain. As a result, during periods of rain, surface runoff flows down slope toward the southwest as shown on Figure 11. During installation of the monitoring wells in 2007, water was draining across the tank pit area. During these periods the backfilled tank pit can be expected to act as a conduit for oxygenated. Water accumulating in the backfill will flow downward toward the saturated zone creating a mounding effect followed by lateral flow in all directions as show in Figure 12. This water movement will have the effect of enhancing lateral transport and dispersion of hydrocarbons. The oxygenated water will increase the biomass in impacted soil and accelerate the rate of biodegradation.

As discussed above the lack of volatile hydrocarbons and wider distribution of heavy less mobile oil range hydrocarbons relative to lighter more mobile hydrocarbons indicate that the hydrocarbons present in the soil and groundwater at the tank pit area represent a old release which has undergone significant collapse. An old release such as this would contain an abundant and diverse bio-mass well suited to biodegradation to the particular hydrocarbons present. Data from soil samples and groundwater monitoring show the impacted intervals to be well-oxygenated and suitable sites for rapid biodegradation. The combination removal of the USTs, the influx of oxygen and water through the gravel backfill and/or recharge from the underlying bedrock and significant range of fluctuation in groundwater levels have created an oxygen rich environment beneath the tank pit. This resulted in rapid biodegradation of the residual hydrocarbons seen during the tank removal in 2004.

The available literature discussing thousands of sites indicates that biodegradation of hydrocarbons is and accepted and proven natural attenuation pathway. As the data presented demonstrates the impacted soil is permeable and oxygenated. As such it is an excellent environment for development of biomass with resultant reasonably rapid rates of hydrocarbon degradation. AEI believes that natural attenuation by biologic action is sufficient to explain “where the hydrocarbons went”. AEI believes the discussions above adequately demonstrated that natural attenuation processes are active on the site and are sufficient to explain the reduction of concentrations of hydrocarbons see in a two and a half year period in the area of boring SB-2 and MW-2.

6.2 Comment #2. Soil Vapor Sampling of Monitoring Wells

The ACEH questions the use of analysis of soil vapor from groundwater monitoring wells. The January 2003 "Active Soil Gas Investigation Advisory" (ASGI) referenced by the ACEH was prepared to provide guidance on how to collected soil vapor samples to meet the strict data quality objectives required for the evaluation of vapor intrusion potential and risk to the public health, and does not necessarily apply, much less even mention, the subject of collecting soil gas samples for the evaluation of bioventing feasibility and natural attenuation potential. Natural attenuation potential, not vapor intrusion, was the focus of the sampling techniques used at this site.

While nested soil gas probes with discrete screens will provide a better lateral and vertical profile of the TVH, CH4, O2, and CO2 distribution in the subsurface, almost any monitoring well with a section of screen exposed to the vadose zone and capillary fringe can be used with this soil gas sampling technique. When properly collected, soil gas samples from monitoring wells can represent the average chemistry of many cubic feet of soil as compared to a discrete soil or soil gas sample.

The use of soil gas surveys for bioventing feasibility and natural attenuation potential dates back to the mid to late 1980s when many of the original techniques used today were developed. Evidence of biodegradation resulting from the injection of air was reported by the Texas Research Institute in laboratory experiments for the American Petroleum Institute as early as 1980 (TRI, 1980 and 1984). The first field scale demonstration of bioventing was completed by Jack van Eyk for Shell research in 1982 (van Eyk and Vreeken, 1986 as reported in Downey et al., 2004).

Beginning in 1988 and 1992, the United State Air Force Center for Environmental Excellence (AFCEE), currently know as the Air Force Center for Engineering and the Environment, embarked on a large scale bioventing demonstration project, dubbed the "Bioventing Initiative" to evaluate the effectiveness of aerating soils to enhance aerobic biodegradation. AFCEE performed soil gas surveys, soil sampling, and installed pilot-scale bioventing system at over 145 sites at 56 Air Force installations located throughout the United States, including Alaska and Hawaii. The methodology for collecting soil gas samples to evaluate bioventing feasibility and natural attenuation potential and in situ oxygen utilization and biodegradation rates was further refined and AFCEE published the initial version of the "Test Plan and Technical Protocol For A Field Treatability Test for Bioventing" (Hinchee, et al., 1992). This document was written to standardize bioventing testing methods, including the use of soil gas surveys.

In 1994, AFCEE published "Addendum One to the Test Plan and Technical Protocol for a Field Treatability Test for Bioventing, Using Soil Gas Surveys to Determine Bioventing Feasibility and Natural Attenuation Potential" supplemental on how soil gas surveys can be used as an indicator of subsurface hydrocarbon contamination and natural attenuation in the vadose zone.

Soil gas sampling techniques were further refined but remained basically the same for the next 10 years. In 2004, AFCEE published "Procedures for Conducting Bioventing Pilot Tests and Long-Term Monitoring of Bioventing Systems" to replace the 1992 protocols to provide environmental engineers and scientists with an updated approach for conducting bioventing pilot tests and for monitoring the long-term progress of bioventing systems, including soil gas sampling (Downey et al., 2004). Please refer to Appendix E for more information on soil gas investigation methods.

The results of the two vapor sampling events reported volatile organic concentrations to be less than 1 ppmv, the equipment detection limit. This demonstrates the absence of significant concentrations of hydrocarbons in the subsurface. The absence of methane and high concentrations of carbon dioxide combined with moderate concentrations of oxygen remaining are indicative of the absence of hydrocarbon degrading active biomass.

6.3 Comment #3. Site Residential Redevelopment

ACEH Technical Comment # 3 states, "ACEH has determined that residual soil contamination (TPHg 1,400 ppm, TPHd 10,000 ppm) in the source area exceed residential environmental screening levels (Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater, San Francisco Bay regional Water Quality Board, California EPA ESLs, November 2007.) More importantly, no evaluation has been submitted by you to very that the site meets residential cleanup standards for all media (soil, groundwater, soil vapor) and that residual contamination in the source area will not pose a risk to human health or the environment."

The determination that ACEH finding that residual contamination of 1,400 ppm TPH-g, 10,000 ppm TPH-d remains in the source area is completely at odds with the results with recent soil and groundwater sampling. The residual concentrations referenced were collected in April 2004. Analysis of more recent soil samples collected from well IN-1 in October 2008 reported TPH-g concentration as non-detectable at a detection limit of 1.0 mg/kg and TPH-d at concentrations of 4.0 mg/kg and 5.1 mg/kg. As noted in section 5.3 above, these samples were collected immediately under the center of the tank pit between two the samples that were the source of the results referenced by the ACEH. The ACEH for reasons not explained has chosen to ignore the more recent data, which was collected under more controlled conditions, with an AEI professional geologist and the ACEH case manager on site.

With regard to the request for an evaluation to demonstrate that the ESLs for soil groundwater and soil vapor have been met, AEI presents the discussion below of the data collected at the subject site:

6.3.1 Groundwater

Four quarters of groundwater monitoring have reported TPH-g and TPH-d at concentrations below the residential environmental screening levels where groundwater has drinking water potential (Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater, San Francisco Bay regional Water Quality Board, California EPA ESLs, May 2008, Table F-1a) of 100 μg/L. This clearly demonstrates that the residential groundwater standard has been met.

One of the wells, MW-2 is a twin to soil boring SB-2 where the maximum concentrations of hydrocarbons were reported in 2005. Well IN-1 is located in the center of the tank pit midway between the locations of soil borings reporting the maximum concentrations of TPH-g and TPH-d. Two of the three remaining soil boring are co-located with soil borings where low concentrations of hydrocarbons were reported in 2005. This groundwater data demonstrates that no detectable concentrations of hydrocarbons are currently present at the site, hence no potential risk to human health or the environment exists relative to the groundwater.

6.3.2 Soil

Analysis of soil samples IN-1-8.5, IN-1-8.5, IN-1-10, and IN-1-12 collected in October 2008 from well IN-1 located midway between within soil samples T1E-EB8' and T2W-EB8' collected 3 ½ years earlier during the UST removal. Analysis of these 2007 soil samples, which were collected within several feet laterally of the samples from October 2007, reported no hydrocarbons except for TPH-d which was reported act concentrations of 4.0 and 5.1 in IN-1-8.5, IN-1-8.5, respectively. These concentrations are well below the residential ESL where groundwater has drinking water potential of 83 mg/kg (Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater, San Francisco Bay regional Water Quality Board, California EPA ESLs, May 2008, Tables B-1 and C-1). Depth to water in well IN-1 on January 14, 2008 was at a depth of 8.39 feet bgs. At this depth the water table would have been in contact with the soil horizon sampled during the UST removal in 2004. If, as the ACEH has implied, the soil samples collected in 2008 at depths of 8.5 and 11.5 feet bgs are not representative of the current soil conditions and that significantly hydrocarbon impacted soil remains beneath the tank pit, the groundwater collected at that time from a well penetrating that soil interval would contain detectable hydrocarbons. The lack of detectable hydrocarbons in the January 14, 2008 sample from IN-1 supports AEI's contention that natural biodegradation has reduced the concentrations of hydrocarbons to well below current residential ESLs.

6.3.3 Soil Vapor Concentrations.

No soil vapor sampling has been done at the subject site with the aim to evaluate potential for vapor intrusion. No detectable hydrocarbons are present in the groundwater. No BTEX has been reported in any groundwater sample except for SB-2 in 2004, which also contained significant concentrations of TPH-g. Vapor sampling of the monitoring wells which was designed to evaluate bio-mass activity reported no VOCs at a instrument detection limit of 1 ppmv. Although the well vapor samples were collected according to different protocols than the January 2003 "Active Soil Gas Investigation Advisory" (ASGI) referenced by the ACEH, the <1 ppmv concentration reported for VOCs is below the RWQCB ESL for TPH of 10,000 mg/m^3 (Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater, San Francisco Bay regional Water Quality Board, California EPA ESLs, May 2008, Table E-2) and is consistent with the other data from the site indicating that no significant hydrocarbons are currently present at the subject site

7.0 SUMMARY

AEI believes that data discussed above clearly demonstrates hydrocarbons identified at the time of the 2004 tank removal the site was an old already significantly degraded release. Further that the same natural attenuation processes have reduced soil impact to minimal levels and groundwater impact to non-detectable concentrations. The residual hydrocarbons identified are approximately 2% of the applicable soil ESL and do not pose a risk to human health or the environment.

AEI requests that the site be granted closure. Please contact either of the undersigned at (925) 944-2899, if you have any questions or need any additional information.

Sincerely,
AEI Consultants

Richard J. Bradford
Project Engineer

Robert F. Flory, PG
Project Manager

PROFESSIONAL GEOLOGIST
ROBERT F. FLORY
No. 5825
10/31/10
STATE OF CALIFORNIA

8.0 REFERENCED DOCUMENTS

1. AEI Consultants, 2004, “Underground Storage Tank Removal Final Report”, May 19, 2004, prepared by AEI Consultants, Walnut Creek, CA, May 19, 2004,
2. AEI Consultants, 2005, “Preliminary Site Investigation Report”, June 7, 2005, prepared by AEI Consultants, Walnut Creek, CA, November 29, 2007
3. AEI Consultants 2007, “Well Installation Report”, prepared by AEI Consultants, Walnut Creek, CA, November 29, 2007
4. Downey, D.C. and Hall, J.F., 1994 “Addendum One to the Test Plan and Technical Protocol for a Field Treatability Test for Bioventing, Using Soil Gas Surveys to Determine Bioventing Feasibility and Natural Attenuation Potential”, Prepared for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, TX, February 1994
5. Downey, D.C., Miller, R.N., and Dragoo, T., 2004. “Procedures for Conducting Bioventing Pilot Tests and Long-Term Monitoring of Bioventing Systems”, Prepared for the United States Air Force Center for Environmental Excellence by Parsons, Inc, Denver, Colorado.
6. Hinchee, R.E., Ong, S.K., Miller, R.N., et al., 1992. “Test Plan and Technical Protocol for a Field Treatability Test for Bioventing”, Prepared for United States Air Force Center for Environmental Excellence by the Battelle, Columbus, Ohio.
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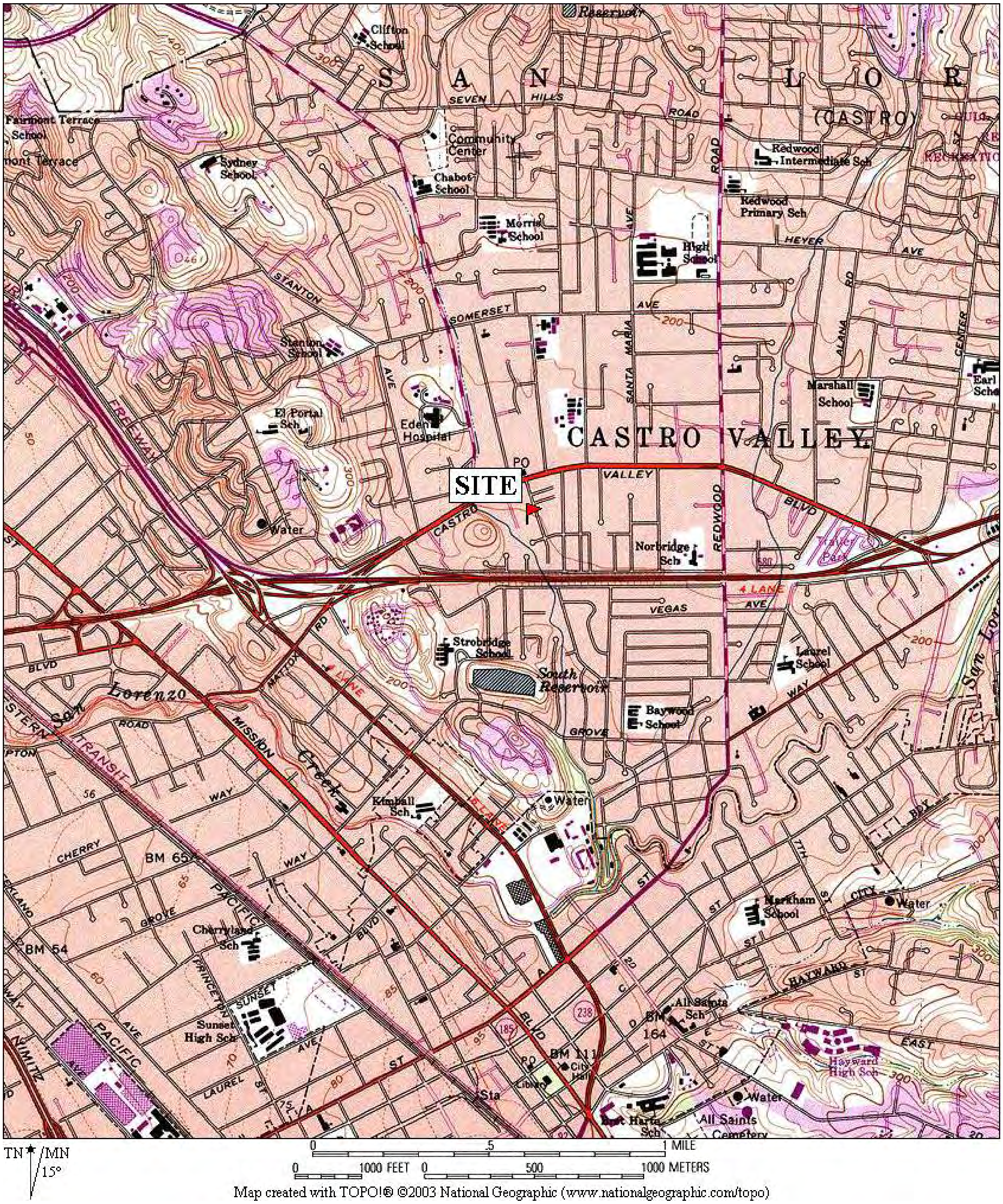
8. Texas Research Institute, 1980. “Laboratory Scale Gasoline Spill and Venting Experiment”, Conducted for the American Petroleum Institute, Interim Report No. 7743-5:JST, Washington, DC.
9. Texas Research Institute, 1984, “Forced Venting to Remove Gasoline Vapor from a Large-Scale Model Aquifer”, Conducted for the American Petroleum Institute, Final Report No. 82101-F:TAV, Washington, DC.

Distribution:

File

Nat Piazza, 7613 Pepper Tree Road, Dublin, California, 94568-3343	2 copies
Steven Plunkett, Alameda County Environmental Health Services	electronic
Geotracker	electronic

FIGURES



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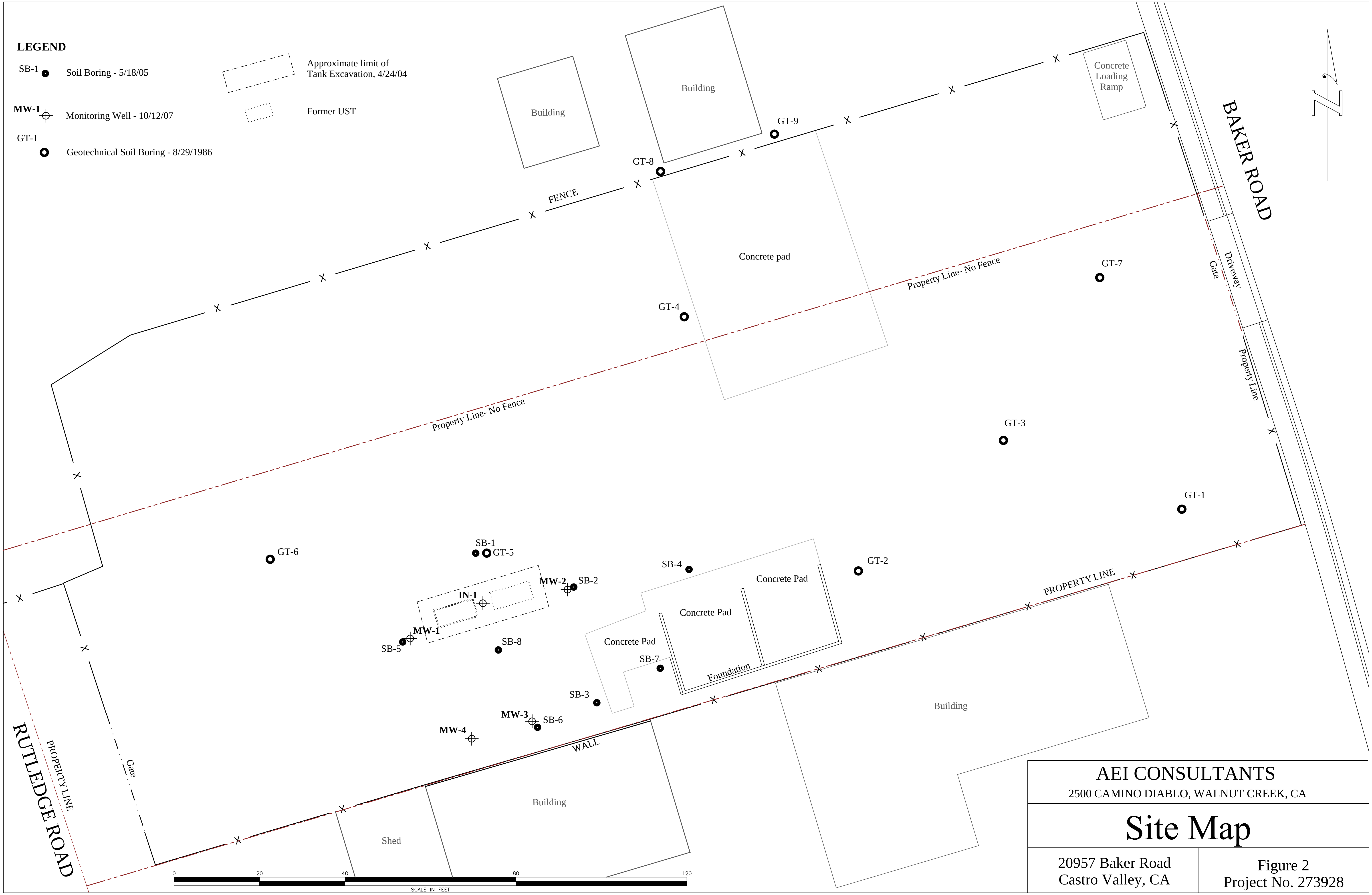
SITE LOCATION MAP

20957 BAKER ROAD
CASTRO VALLEY, CALIFORNIA

FIGURE 1
PROJECT NO. 273928



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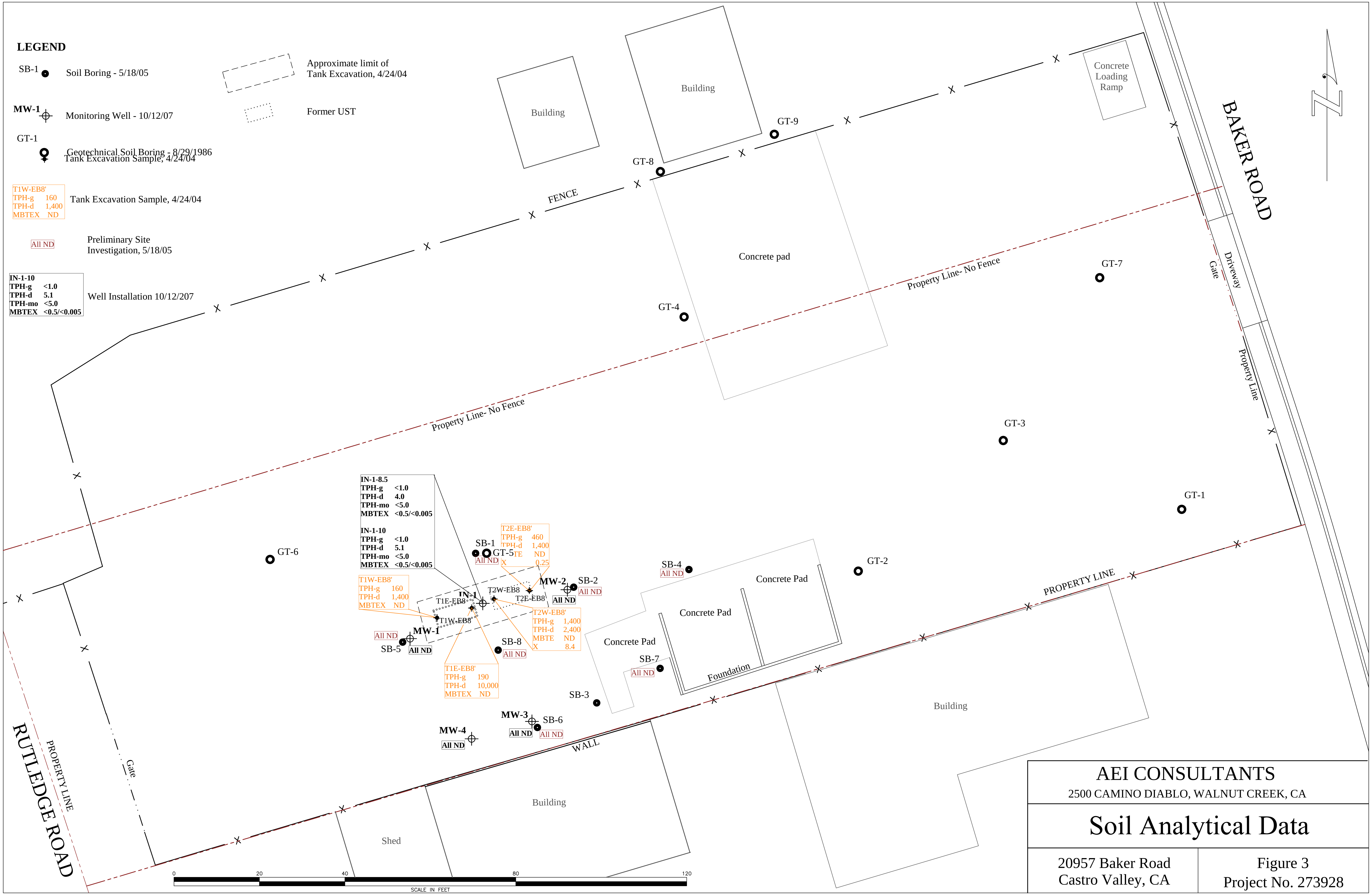
2500 CAMINO DIABLO, WALNUT CREEK, CA

Site Map

20957 Baker Road
Castro Valley, CA

Figure 2
Project No. 273928



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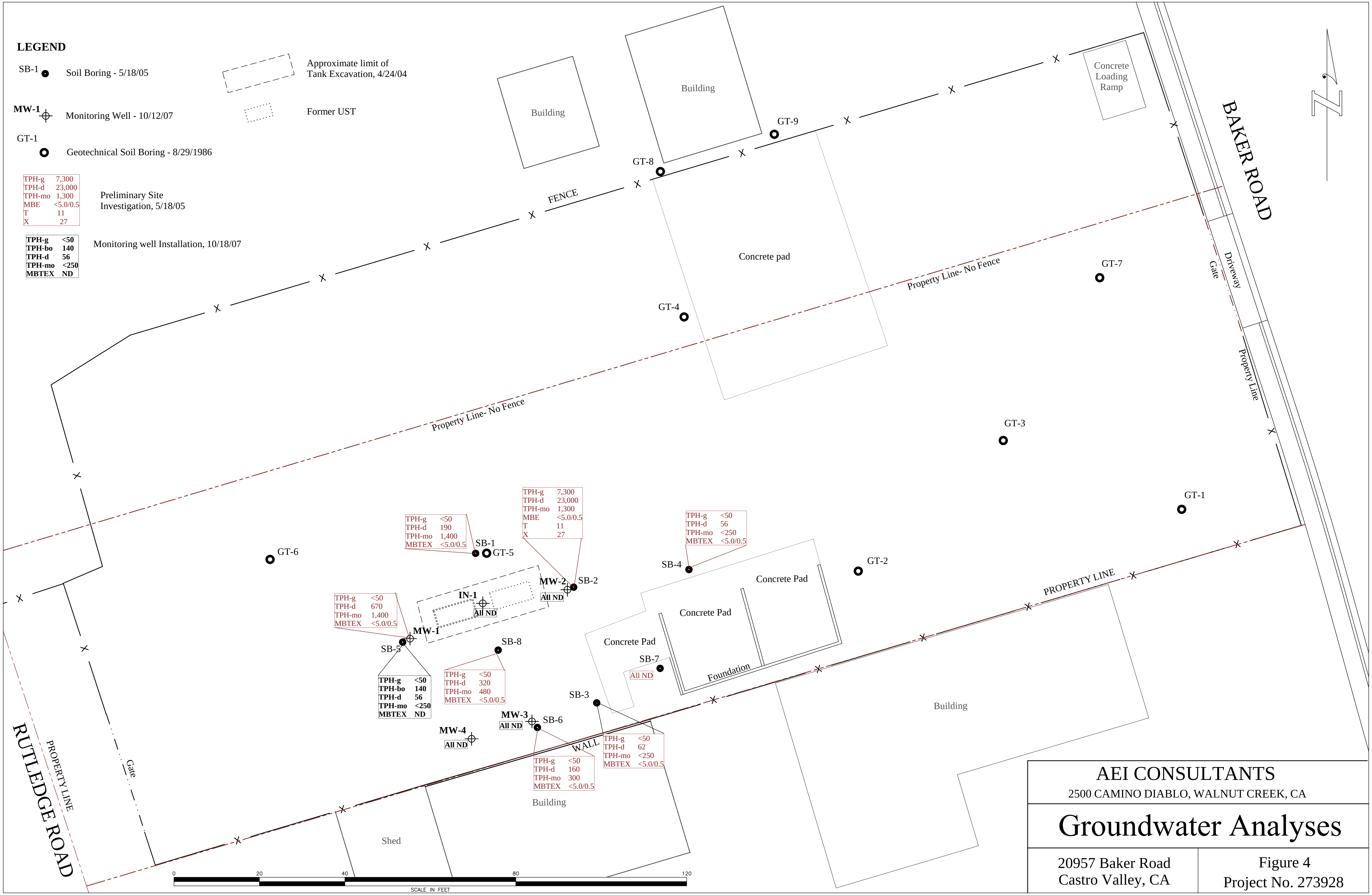
2500 CAMINO DIABLO, WALNUT CREEK, CA

Soil Analytical Data

20957 Baker Road
Castro Valley, CA

Figure 3
Project No. 273928



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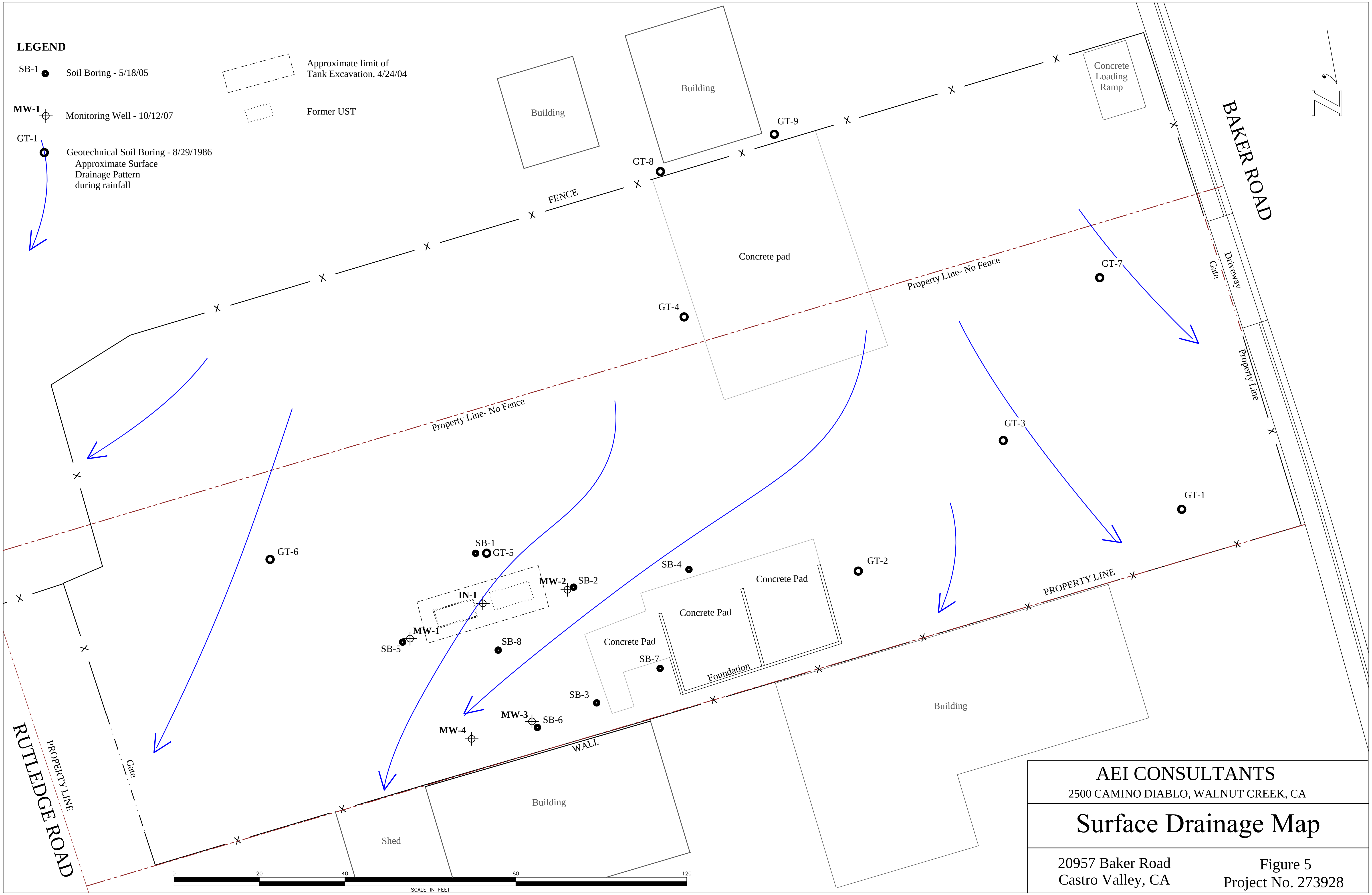
2500 CAMINO DIABLO, WALNUT CREEK, CA

Groundwater Analyses

20957 Baker Road Castro Valley, CA	Figure 4 Project No. 273928



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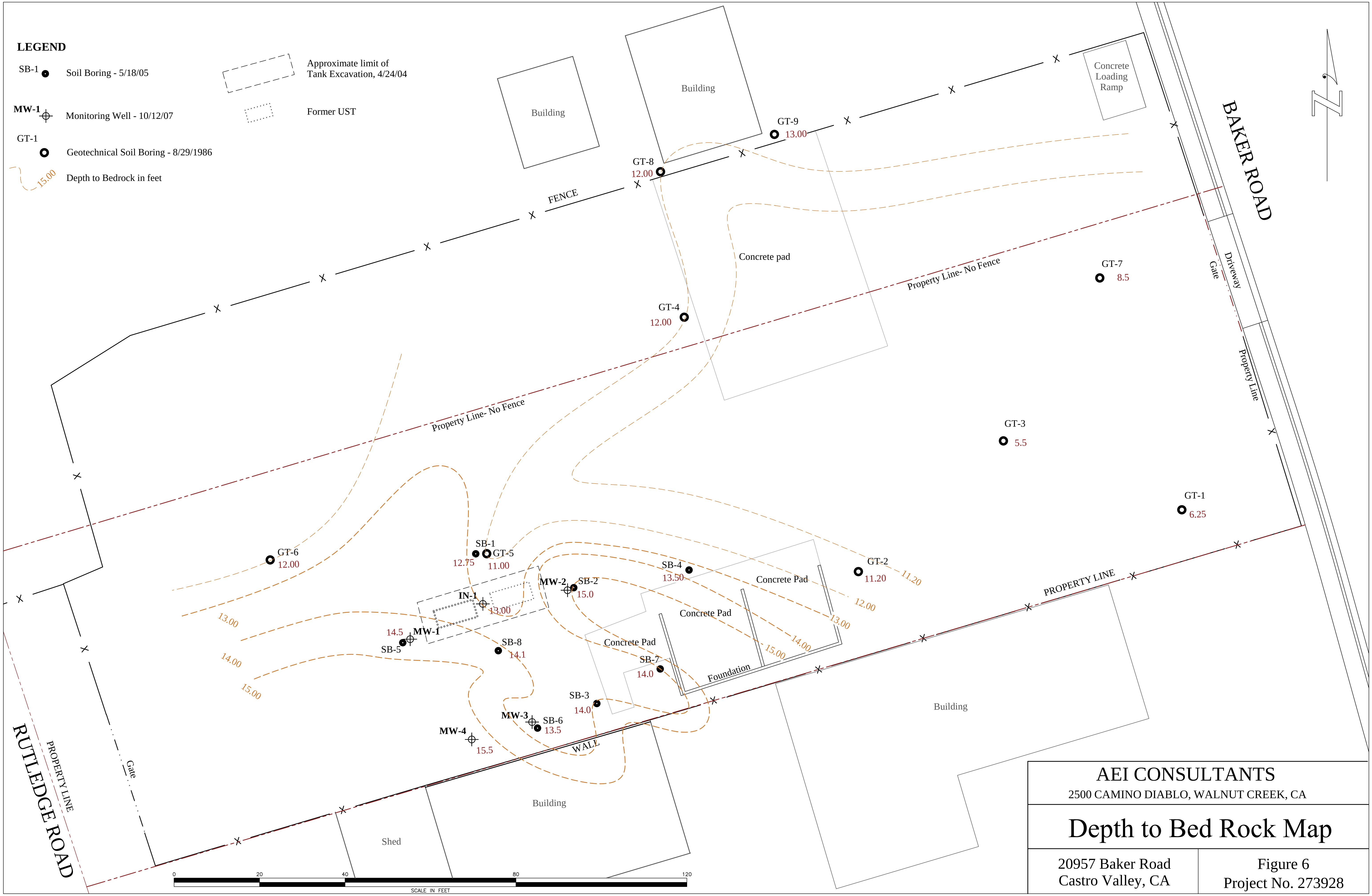
2500 CAMINO DIABLO, WALNUT CREEK, CA

Surface Drainage Map

20957 Baker Road
Castro Valley, CA

Figure 5
Project No. 273928



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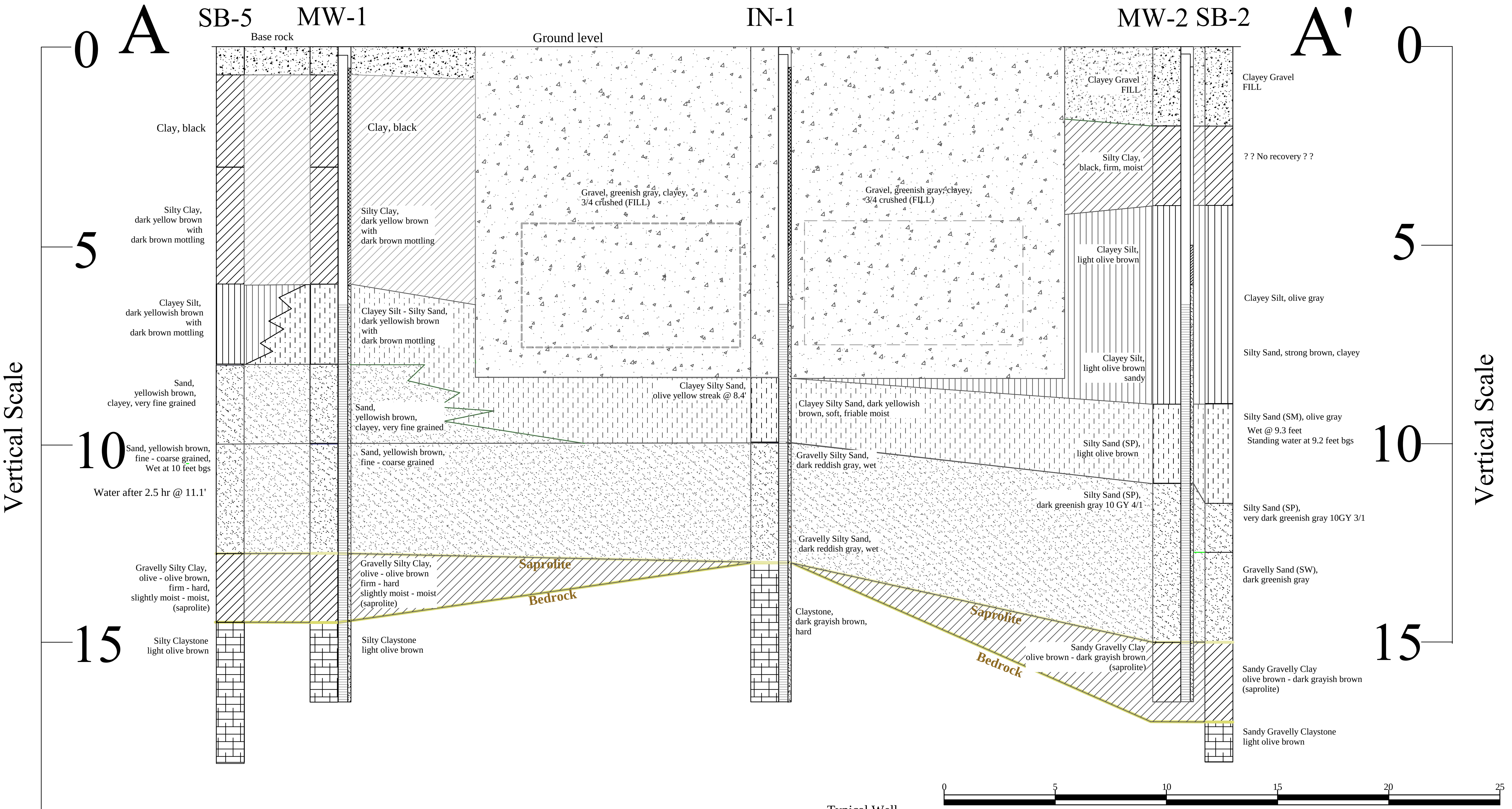
2500 CAMINO DIABLO, WALNUT CREEK, CA

Depth to Bed Rock Map

20957 Baker Road
Castro Valley, CA

Figure 6
Project No. 273928



KEY

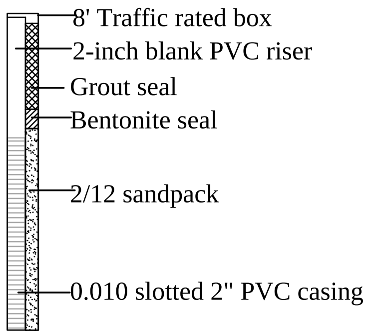
▨ Clay

▥ Silt

▦ Silty Sand

░ Sand

▤ Gravel



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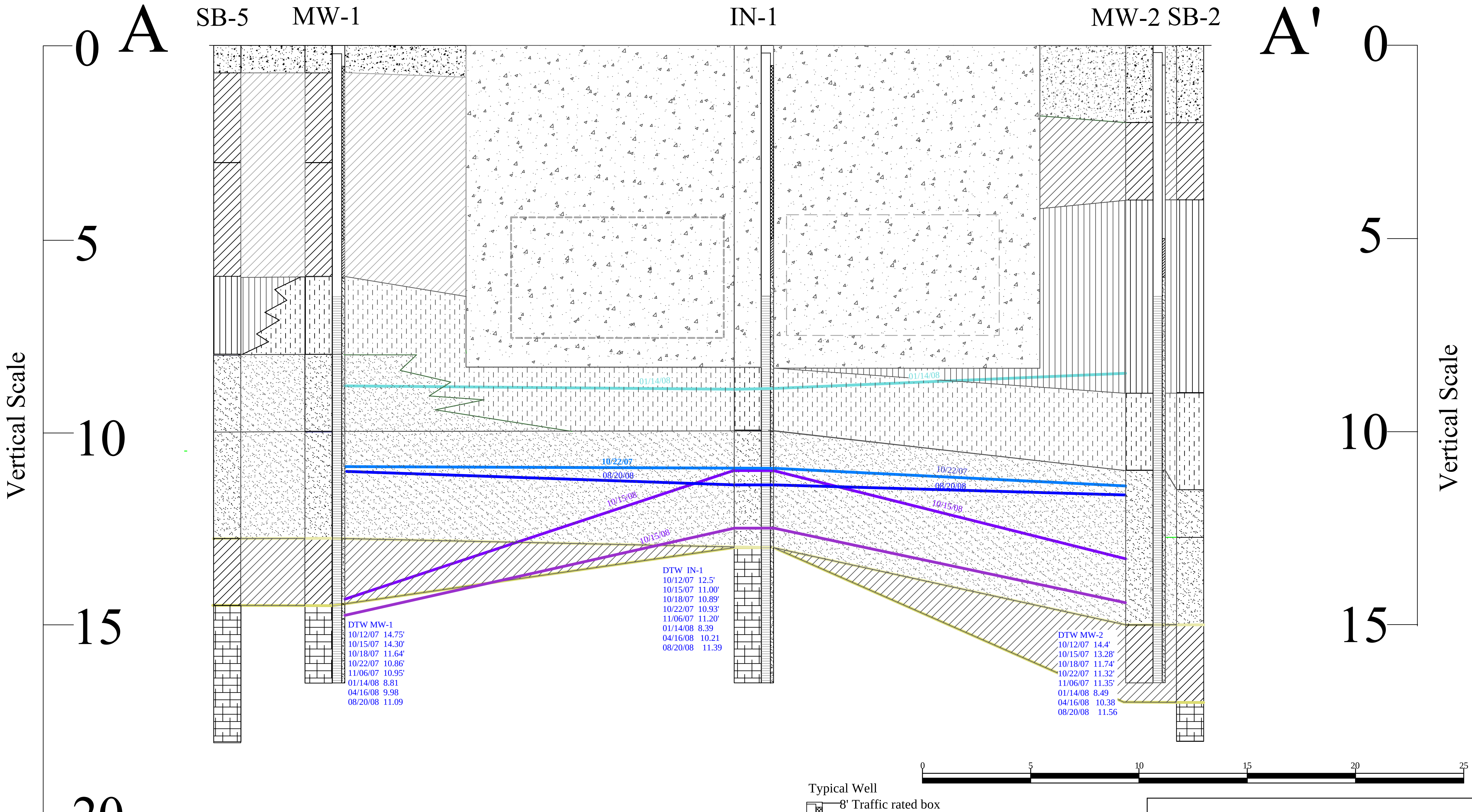
2500 CAMINO DIABLO, WALNUT CREEK, CA

Cross Section - Lithology

Piazza
20957 Baker Road
Castro Valley, California

FIGURE 7
Project No. 273928



DTW MW-1
10/12/07 14.75'
10/15/07 14.30'
10/18/07 11.64'
10/22/07 10.86'
11/06/07 10.95'
01/14/08 8.81
04/16/08 9.98
08/20/08 11.09

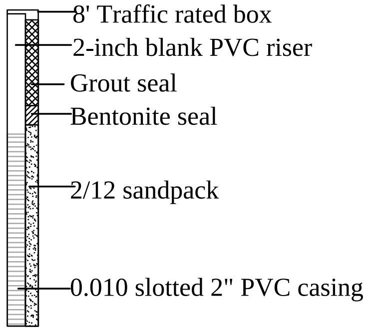
DTW IN-1
10/12/07 12.5'
10/15/07 11.00'
10/18/07 10.89'
10/22/07 10.93'
11/06/07 11.20'
01/14/08 8.39
04/16/08 10.21
08/20/08 11.39

DTW MW-2
10/12/07 14.4'
10/15/07 13.28'
10/18/07 11.74'
10/22/07 11.32'
11/06/07 11.35'
01/14/08 8.49
04/16/08 10.38
08/20/08 11.56

KEY

- ▨ Clay
- ▥ Silt
- ▦ Silty Sand
- ▩ Sand
- ▩ Gravel

Typical Well



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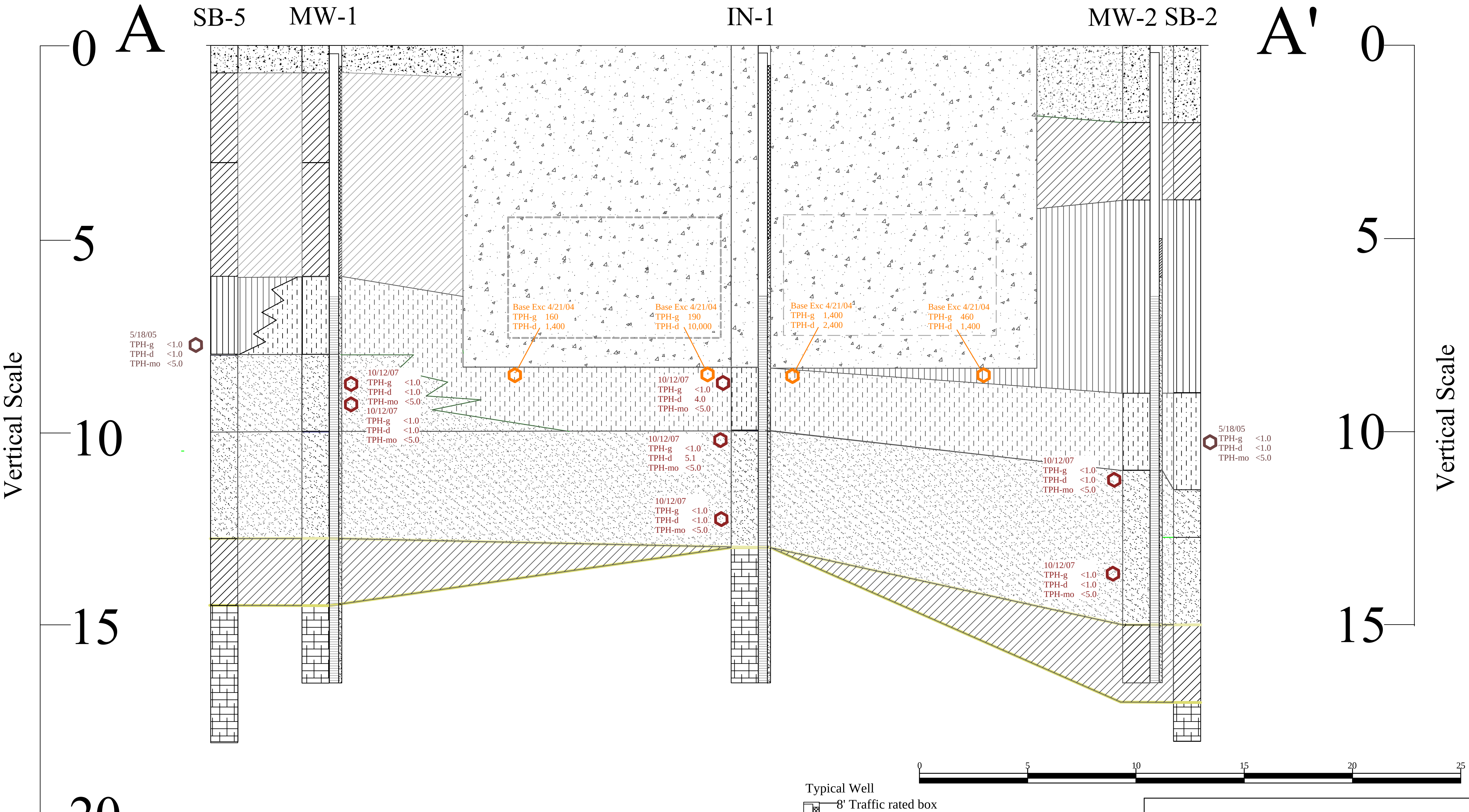
2500 CAMINO DIABLO, WALNUT CREEK, CA

Cross Section - Depth to Water

Piazza
20957 Baker Road
Castro Valley, California

FIGURE 8
Project No. 273928



KEY

▨ Clay

▥ Silt

▦ Silty Sand

░ Sand

▒ Gravel

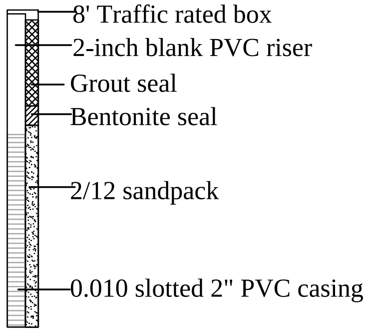
Base Exc 4/21/04
TPH-g 190
TPH-d 10,000

Tank Removal Sample
4/21/04 - mg/kg

TPH-g ND<1.0
TPH-d 4.0
TPH-mo ND<5.0

Soil analytical
5/18/05 & 10/12/07
mg/kg

Typical Well



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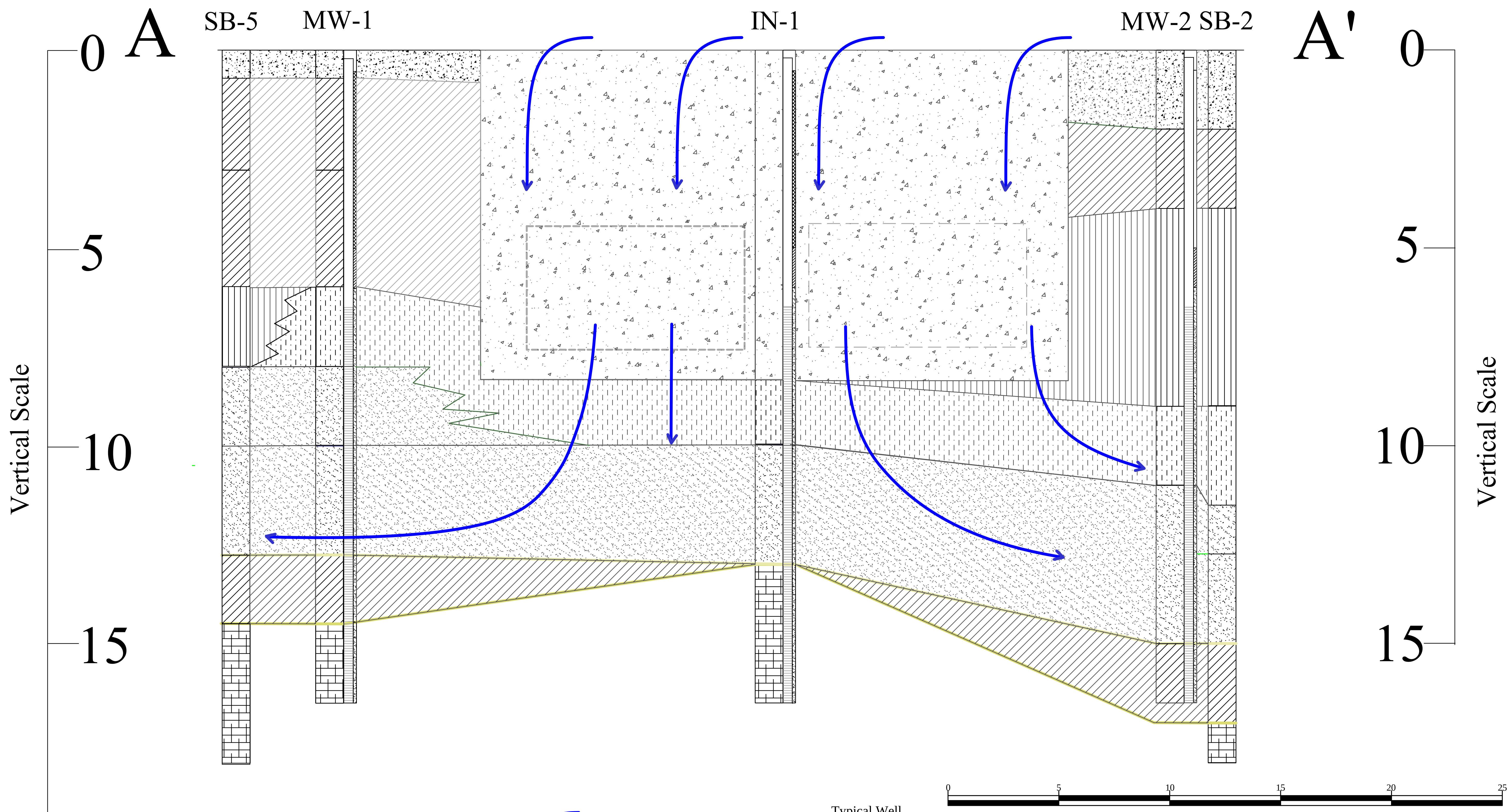
2500 CAMINO DIABLO, WALNUT CREEK, CA

Cross Section - Analytical Data

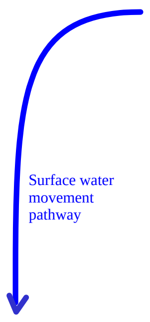
Piazza
20957 Baker Road
Castro Valley, California

FIGURE 9
Project No. 273928

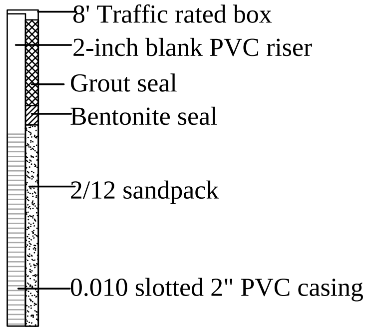


KEY

- ▨ Clay
- ▥ Silt
- Silty Sand
- Sand
- Gravel



Typical Well



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2500 CAMINO DIABLO, WALNUT CREEK, CA

Cross Section - Rainwater Infiltration pathways

Piazza
20957 Baker Road
Castro Valley, California

FIGURE 10
Project No. 273928

TABLES

Table 1 Soil Analytical Data

Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID		TPH-g	TPH-d	TPH-mo	MTBE	Benzene	Toluene	Ethyl benzene	Xylenes
		mg/kg							
		8015 C			8021 B				
Tank Removal									
T1W-EB8'	4/21/2004	**160**	**4,900**	----	<0.50	<0.05	<0.05	<0.05	<0.05
T1E-EB8'	4/21/2004	**190**	**10,000**	----	<1.7	<0.17	<0.17	<0.17	**8.4**
T2W-EB8'	4/21/2004	**1,400**	**2,400**	----	<10	<1.0	<1.0	<1.0	<1.0
T2E-EB8'	4/21/2004	**460**	**1,400**	----	<0.50	<0.05	<0.05	<0.05	0.25
Phase II Site Investigation									
SB1-11.5	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB2-10	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB3-7.5	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB4-7.5	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB5-7.5	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB6-7.5	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB7-8	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB8-7.5	5/18/2005	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
Well Installation									
IN-1-8.5	10/12/2008	<1.0	**4.0**	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
IN-1-10	10/12/2008	<1.0	**5.1**	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
IN-1-12	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-1-8.5	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-1-9	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-2-11.5	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-2-13.5	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-3-11	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-3-13	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-4-11	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-4-12	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-4-16	10/12/2008	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
ESL <9 ft DW		83	83	370	0.25	0.044	0.29	2.3	2.3
ESL <9 ft NDW		83	83	2500	0.25	0.044	0.29	2.3	2.3

Notes:

Values in Bold above reporting limit **Values in Bold Orange are above ESL**

ESL <9 ft DW = Shallow soil groundwater having potential for drinking water use

ESL <9 ft NDW = Shallow soil groundwater with no potential for drinking water use

Table 2 Groundwater Analytical Data - Soil Borings and Paired Monitoring Wells
Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID	**Date**	**Depth to Water** feet	**TPH-g C6-C12** µg/L	**TPH-d C10-C23**	**TPH-mo C18+** µg/L	**TPH-bo C10+**	**MTBE** µg/L	**Benzene** µg/L	**Toluene** µg/L	**Ethyl-benzene** µg/L	**Xylenes** µg/L
			EPA Method 8015				*EPA Method 8021B*				
SB-1 W	5/18/2005	8.75	<50	**190**	**1,400**	----	<5.0	<0.5	<0.5	<0.5	<0.5
IN-1	10/18/07	10.89	<50	<50	ND<250	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	1/14/2008	8.39	<50	<50	----	<250	<5.0	<0.5	<0.5	<0.5	<0.5
	04/16/08	10.21	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	08/20/08	11.39	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
SB-2 W	5/18/2005	9.20	**7,300**	**23,000**	**1,300**	----	<5.0	<0.5	11	ND<5.0	27
MW-2	10/18/07	11.74	<50	<50	ND<250	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	1/14/2008	8.49	<50	<50	----	<250	<5.0	<0.5	<0.5	<0.5	<0.5
	04/16/08	10.38	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	08/20/08	11.56	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
SB3-W	5/18/2005	8.56	<50	**62**	ND<250	----	<5.0	<0.5	<0.5	<0.5	<0.5
MW-3	10/18/07	11.10	<50	<50	ND<250	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	1/14/2008	8.41	<50	<50	----	<250	<5.0	<0.5	<0.5	<0.5	<0.5
	04/16/08	10.19	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	08/20/08	11.38	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
SB4-W	5/18/2005	9.60	<50	56	ND<250	----	<5.0	<0.5	<0.5	<0.5	<0.5
SB5-W	5/18/2005	11.60	<50	**670**	**1,400**	----	<5.0	<0.5	<0.5	<0.5	<0.5
MW-1	10/18/07	11.64	<50	56	ND<250 (86)	140	<5.0	<0.5	<0.5	<0.5	<0.5
	1/14/2008	8.81	<50	<50	----	<250	<5.0	<0.5	<0.5	<0.5	<0.5
	04/16/08	8.98	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
	08/20/08	11.09	<50	<50	----	<100	<5.0	<0.5	<0.5	<0.5	<0.5
SB6-W	5/18/2005	8.62	<50	**160**	**300**	----	<5.0	<0.5	<0.5	<0.5	<0.5
MW-3	10/18/07	11.10	<50	<50	ND<250	<100	<5.0	<0.5	<0.5	<0.5	<0.5
SB7-W	5/18/2005	8.56	ND<50	ND<50	ND<250	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB8-W	5/18/2005	8.70	ND<50	**320**	**480**	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
RWQCB ESLs**			100	100	100	----	5.0	1.0	40	30	20

Notes

Soil boring data from 2005 is paired with twin 2007 groundwater monitoring well data for comparison purposes.

BOLD = Current groundwater data

TPH-g = total petroleum hydrocarbons as gasoline

TPH-d = total petroleum hydrocarbons as diesel

TPH-mo = total petroleum hydrocarbons as motor oil

MTBE = methyl tert-butyl ether

µg/L = micrograms per liter (parts per billion)

ft amsl = feet above mean sea level

ND = Not reported at or above the indicated method detection limit

** = RWQCB ESLs November 2007, TABLE F-1a. Groundwater Screening levels, Groundwater is a current or potential drinking water resource

Table 3: Well Construction Details

Piazza, 20957 Baker Road, Castro Valley, CA

Well ID	Date Installed (feet)	Top of casing (feet)	Top of Well Box (feet)	Depth To Water 08/20/08 (feet)	Casing Material	Boring Total Depth (feet)	Well Total Depth (feet)	Borehole Diameter (inches)	Casing Diameter (inches)	Screened Interval (feet)	Slot Size (inches)	Filter Pack Interval (feet)	Filter Pack Sand (feet)	Bentonite Interval (feet)	Grout Interval (feet)
IN-1	10/12/07	160.12	159.85	11.39	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-5.5	.05-5.0
MW-1	10/12/07	159.84	159.62	11.09	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0
MW-2	10/12/07	160.30	160.00	11.56	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0
MW-3	10/12/07	160.04	159.79	11.38	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0
MW-4	10/12/07	159.95	159.69	11.42	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0

Table 4 Groundwater Elevation Data
Piazza, 20957 Baker Road, Castro Valley, CA

Well ID	Date	Well Elevation (ft amsl)	Depth to Water (ft)	Groundwater Elevation (ft amsl)	Elevation Change (ft)
IN-1	10/15/07	159.85	11.00	148.85	----
	10/18/07	159.85	10.89	148.96	0.11
	10/22/2007*	159.85	10.93	148.92	-0.04
	11/06/07	159.85	11.20	148.65	-0.27
	01/14/08	159.85	8.39	151.46	2.81
	04/16/08	159.85	10.21	149.64	-1.82
	08/20/08	**159.85**	**11.39**	**148.46**	**-1.18**
MW-1	10/15/07	159.62	14.30	145.32	----
	10/18/07	159.62	11.64	147.98	2.66
	10/22/07	159.62	10.86	148.76	0.78
	11/06/07	159.62	10.95	148.67	-0.09
	01/14/08	159.62	8.81	150.81	2.14
	04/16/08	159.62	9.98	149.64	-1.17
	08/20/08	**159.62**	**11.09**	**148.53**	**-1.11**
MW-2	10/15/07	160.00	13.28	146.72	----
	10/18/07	160.00	11.74	148.26	1.54
	10/22/07	160.00	11.32	148.68	0.42
	11/06/07	160.00	11.35	148.65	-0.03
	01/14/08	160.00	8.49	151.51	2.86
	04/16/08	160.00	10.38	149.62	-1.89
	08/20/08	**160.00**	**11.56**	**148.44**	**-1.18**
MW-3	10/15/07	159.79	11.01	148.78	----
	10/18/07	159.79	11.10	148.69	-0.09
	10/22/07	159.79	10.95	148.84	0.15
	11/06/07	159.79	11.20	148.59	-0.25
	01/14/08	159.79	8.41	151.38	2.79
	04/16/08	159.79	10.19	149.60	-1.78
	08/20/08	**159.79**	**11.38**	**148.41**	**-1.19**
MW-4	10/15/07	159.69	14.57	145.12	----
	10/18/07	159.69	14.92	144.77	-0.35
	10/22/07	159.69	14.65	145.04	0.27
	10/22/07 Well loaded with fresh water- surged for 15 minutes- water level dropping slowly @ 4.0 feet bgs				
	11/06/07	159.69	8.00	151.69	6.65
	01/14/08	159.69	8.77	150.92	-0.77
	04/16/08	159.69	9.94	149.75	-1.17
	08/20/08	**159.69**	**11.42**	**148.27**	**-1.48**

Depth to water measured from the top of well casing
ft amsl = feet above mean sea level

Table 5 Flow Direction and Hydraulic Gradient Summary
Piazza, 20957 Baker Road, Castro Valley, CA

Event	Date	Average Water Table Elevation (ft amsl)	Water Table Elevation Change (ft)	Hydraulic Gradient Flow Direction (ft/ft)
Develop wells	10/15/07	147.42	----	WSW to SSE to East
1	10/18/07	148.47	1.06	East to SE
Re-develop well MW-4	10/22/07	148.80	0.33	WSW to SSE to East
----	11/06/07	148.64	-0.16	0.002/SSE
2	01/14/08	151.22	2.58	0.010-0.029/SW
3	04/16/08	149.65	-1.57	0.004/SSE
4	08/20/08	148.42	-1.23	SSW to SE to East

Notes

Table 6 Groundwater Analytical Data
Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID	**Date**	**Depth to Water** feet	**TPH-g C6-C12** µg/L	**TPH-d C10-C23** µg/L	**TPH-mo C18+** µg/L	**TPH-bo C10+**	**MTBE** µg/L	**Benzene** µg/L	**Toluene** µg/L	**Ethyl-benzene** µg/L	**Xylenes** µg/L
			EPA Method 8015				*EPA Method 8021B*				
IN-1	10/18/07	10.89	ND<50	ND<50	ND<250	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	1/14/2008	8.39	ND<50	ND<50	----	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	04/16/08	10.21	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	08/20/08	11.39	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-1	10/18/07	11.64	ND<50	**56**	ND<250	**140**	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	1/14/2008	8.81	ND<50	ND<50	----	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	04/16/08	8.98	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	08/20/08	11.09	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-2	10/18/07	11.74	ND<50	ND<50	ND<250	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	1/14/2008	8.49	ND<50	ND<50	----	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	04/16/08	10.38	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	08/20/08	11.56	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-3	10/18/07	11.10	ND<50	ND<50	ND<250	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	1/14/2008	8.41	ND<50	ND<50	----	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	04/16/08	10.19	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	08/20/08	11.38	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-4	10/18/07	14.82	ND<50	ND<50	ND<250	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	1/14/2008	8.77	ND<50	ND<50	----	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	04/16/08	9.94	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	08/20/08	11.42	ND<50	ND<50	----	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
ESLs Residential			100	100	100	----	5.0	1.0	40	30	20
ESLs Commercial Industrial			210	210	210	----	1800	46	130	43	100

Notes

Bold concetration above detection limit

TPH-g = total petroleum hydrocarbons as gasoline

TPH-d = total petroleum hydrocarbons as diesel

TPH-mo = total petroleum hydrocarbons as motor oil

TPH-bo = total petroleum hydrocarbons as bunker oil

MTBE = methyl tert-butyl ether

µg/L = micrograms per liter (parts per billion)

ft amsl = feet above mean sea level

ND = Not reported at or above the indicated method detection limit

** = RWQCB ESLs November 2007, TABLE F-1a. Groundwater Screening levels, Groundwater is a current or potential drinking water resource

Table 7 **Soil Vapor Data - RKI Eagle Gas Detector**

Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID	**Date**	**Vacuum**	**TVH**	**Methane**	**Oxygen**	**Carbon Dioxide**
			ppmv	**Percent (%)**		
MW-1	10/18/2007	11.64	0.0	0.0	20.8	0.4
	7/12/2008	----	0.0	0.0	9.8	8.8
MW-2	10/18/2007	11.74	0.0	0.0	15.9	2.9
	7/12/2008	----	0.0	0.0	10.5	7.7
MW-3	10/18/2007	11.1	0.0	0.0	7.9	7.3
	7/12/2008	----	0.0	0.0	10.5	7.7
MW-4	10/18/2007	14.92	0.0	0.0	19.0	1.3
	7/12/2008	----	0.0	0.0	11.3	6.0
IN-1	10/18/2007	10.89	0.0	0.0	12.4	5.0
	7/12/2008	----	0.0	0.0	9.2	9.4

TVH - Total Volatile Hydrocarbons 7?

APPENDIX A

Geotechnical Exploration and Engineering Study Report

GEOTECHNICAL EXPLORATION
AND ENGINEERING STUDY
PROPOSED BAKER ROAD APARTMENTS
CASTRO VALLEY, CALIFORNIA

Ms

MERRILL, SEELEY,
MULLEN, SANDEFUR, INC.

Mr. Peter Shutts, Architect
699 Peters Avenue, Suite A
Pleasanton, California 94566

December 3, 1986
Project 86204

Dear Mr. Shutts,

We are pleased to submit this report which transmits the results of our geotechnical exploration and engineering study for design of the proposed apartments on Baker Road in Castro Valley, California. Our study was conducted in accordance with our proposal dated August 20, 1986.

This report presents our opinions regarding foundations, support of slab-on-grade floors, pavements, earthwork, and other geotechnical aspects of site development. The report also includes the results of our field exploration and laboratory testing programs which serve as the basis for our conclusions and recommendations.

We trust that the information presented herein is clear, concise and responsive to the project needs. Should you have any questions regarding our report, please contact our office. We would be pleased to review our findings and recommendations with you or the local review agencies.

Sincerely yours,
MERRILL, SEELEY, MULLEN, SANDEFUR, INC.

Michael J. Merrill

Michael J. Merrill
Principal Engineer

Thomas J. O'Brien

Thomas J. O'Brien
Senior Staff Engineer

MJM/TJO:ste

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GEOTECHNICAL EXPLORATION
AND ENGINEERING STUDY
PROPOSED BAKER ROAD APARTMENTS
CASTRO VALLEY, CALIFORNIA

INTRODUCTION

This report presents the results of our geotechnical exploration and engineering study performed in conjunction with design of the proposed apartments on Baker Road in Castro Valley, California. The scope of work for this study included a site reconnaissance, subsurface exploration, laboratory testing, engineering analyses of field and laboratory data, formulation of opinions and recommendations regarding foundtion design, support of concrete slabs-on-grade, earthwork, and other geotechnical aspects of site development, and preparation of an engineering report.

Specifically, our scope of work for this project included the following:

- Review readily available information regarding the general geologic and subsurface conditions in the vicinity of the project site;
- Review previous geotechnical studies conducted in the vicinity of the project site;
- Perform a geologic reconnaissance of the site;
- Explore the subsurface conditions at the site by drilling nine (9) exploratory borings;
- Perform laboratory tests on selected representative samples to evaluate the engineering properties of subsurface materials encountered at the site;
- Provide design recommendations regarding types and depths of foundations and design bearing pressures for the proposed apartment complex;
- Provide recommendations concerning support of concrete slab-on-grade floors;
- Provide recommendations for support of pavements;
- Provide recommendations regarding earthwork at the site;
- Render an opinion regarding the potential effects of groundwater and settlement on the proposed apartments;

- Render an opinion regarding the potential effects of geologic hazards;
- Prepare an engineering report summarizing our field exploration and laboratory testing, as well as our opinions and recommendations.

PROJECT DESCRIPTION

The project site is located between Rutledge Road (a private road) and Baker Road, approximately 200 feet southeast of Castro Valley Boulevard, in Castro Valley. The project site is relatively level. Existing structures on the subject property include several wood-frame residential dwellings.

It is our understanding that the approximate southern two-thirds of the project property will be developed, resulting in demolition of some of the existing structures. Present plans call for construction of an apartment complex and a parking area (Hardison, Komatsu, Ivelich & Tucker, 1986). It is our understanding that the proposed apartment complex will be of wood-frame construction with concrete slab-on-grade floors throughout the ground floor. The apartment building will be three stories in height, and will be constructed at or near existing grade. It is also our understanding that areas adjacent to the structure will be paved with asphaltic concrete for parking and access.

No specific information regarding structural loadings is presently available; however, we anticipate that loads will be moderate based on the proposed type of construction. We also anticipate that earthwork at the site will be limited to the excavation and filling necessary to achieve the desired pavement subgrades and building pad grades.

FIELD EXPLORATION AND LABORATORY TESTING

Nine (9) exploratory borings were drilled for this study on August 29, 1986, at the approximate locations shown on the Site Plan and Boring Location Map, Figure 2. A brief summary of subsurface conditions encountered in the exploratory borings is presented in the "Subsurface Conditions" section of this report. More detailed descriptions of subsurface conditions encountered are presented in the Logs of Borings, pages A-4 through A-12.

Representative samples of subsurface materials were recovered from the borings and taken to our laboratory for further examination and testing. The laboratory test results are presented on pages A-4 through A-14. Details regarding the drilling and sampling program and the laboratory testing program are presented on pages A-1, A-2 and A-3.

A geologic reconnaissance of the site was conducted to evaluate the site for evidence of unstable and erosion prone areas. These items are addressed in greater detail in a subsequent report section.

SITE DESCRIPTION

General

The site of the proposed apartment complex is located between Baker and Rutledge Roads, south of Castro Valley Boulevard, in Castro Valley, California. The location of the site relative to local roads and landmarks is presented on the Site Location Map, Figure 1.

The site is relatively level and partially covered with asphaltic concrete paving and portland cement concrete slabs. Existing structures on the subject property include several wood-frame residences and wood and chain-link fences.

Site Geology

Geologic mapping of the site vicinity (Dibblee, 1980) indicates that the site is underlain by alluvial deposits. A trace of the inactive East Chabot fault has also been located in the immediate vicinity of the project site.

The native soils underlying the project site have been mapped as Clear Lake Clay (Welch, 1981). This soil is a very deep, poorly drained soil formed in alluvium. Engineering characteristics of this soil include relatively low strength, low permeability and a high shrink-swell potential.

The project site lies approximately 0.8 miles northeast of the Hayward fault (CDMG, 1982), seven (7) miles southwest of the Calaveras fault, and twenty (20) miles northeast of the San Andreas fault (Jennings, 1975), all of which are considered active by the State Geologist. However, the project site lies outside any Alquist-Priolo Special Studies Zones placed alongside active faults. There is no evidence to indicate that active faults exist closer to the site.

Subsurface Conditions

The subsurface conditions encountered in our exploratory program can generally be described as a thin layer of fill underlain by native soils which, in turn, are underlain by weathered bedrock. The fill is a stiff, moist, brown, gravelly clay one (1) to two (2) feet thick.

The native soils generally consist of a very stiff to hard, dark brown to black, silty clay of medium to high plasticity. The color changed to a grey-brown at depths of approximately three (3) to four (4) feet. In Borings 4 through 8, we encountered silts and sands with varying amounts of clay underlying the aforementioned silty clay.

The bedrock underlying the native soils generally consists of plastic to weak, weathered claystone and shale. The depth to bedrock varied from five and one-half (5½) to twelve (12) feet and generally increased in the north and west directions.

Free groundwater was encountered in Borings 2, 4, 5, 6, 8 and 9 (beneath roughly the east and north portions of the site) at depths of nine (9) to eleven (11) feet. Free groundwater was not encountered in our other exploratory borings.

A more comprehensive description of subsurface conditions encountered in our exploratory borings is presented in the Logs of Borings, pages A-4 through A-12.

CONCLUSIONS

General

It is our opinion, based on the results of our study, that the proposed apartment complex can be developed as planned, provided that the recommendations presented in this report are implemented.

The native soils encountered in our exploration program are relatively uniform and exhibit moderately high strengths and low compressibilities. The native soils below the surficial soils vary in density and are of high plasticity. These soils have a high potential for expansion and could cause cracking and heaving of floor slabs and pavements if used for their direct support. Therefore, recommendations are presented herein to support slab-on-grade floors on a section of select engineered fill. It is also recommended that the existing fill in the area of the building pad be removed.

Groundwater

As previously mentioned, free groundwater was encountered in six (6) of the nine (9) exploratory borings at depths of nine (9) to eleven (11) feet. Also, available subsurface information from the site area indicates that this is a reasonable representation of the groundwater table and does not suggest that a significant rise in the groundwater level is likely. Therefore, it is our opinion that groundwater at the site should have little, if any, effect on construction or performance of the project as proposed.

Land Slippage and Erosion

As discussed previously, a geologic reconnaissance of the site was conducted to search for indications of instability or erosion prone areas. No evidence of instability was noted during the geologic reconnaissance or during our field exploration, primarily because the site is relatively level. Therefore, it is our opinion that the potential for damage due to land slippage is low.

No evidence of erosion was noted during our field exploration or geologic reconnaissance. In addition, the subsurface materials appear to have a low to moderate potential for erosion. Therefore, it is our opinion that the potential for damage due to erosion should be low, provided that the recommendations presented in this report are implemented.

Settlements

The native subsurface materials encountered at the project site exhibit low compressibilities, moderately high strengths, and the anticipated loads from the proposed building are relatively moderate. Therefore, it is our opinion that settlement of the proposed structure should be minimal, provided that the recommendations presented herein are implemented.

Expansive Soils

The native soils encountered at the project site exhibit a moderate to high potential for expansion. These soils can exert significant uplift pressures on shallow foundation elements and on pavements if their moisture content changes. This can result in differential heaving or settlement and damage to structures and pavements. Therefore, it is recommended in subsequent report sections that foundations and slab-on-grade floors be supported on sections of select engineered fill. It is our opinion that the potential for damage due to the expansive soils can be mitigated if the recommendations presented herein are implemented.

Seismic Considerations

Seismic Shaking - The site is not located in an Alquist-Priolo Special Studies Zone; however, it is in an area of potential seismic activity. As will most sites in the Bay area, the subject property will be subjected to strong seismic shaking in the event of a large magnitude earthquake occurring on any of the active faults in the region. Therefore, the proposed structure should be designed for strong seismic ground motions.

Potential for Liquefaction - Soil liquefaction is a phenomenon in which loose, fine-grained, cohesionless soils (sands) located below the groundwater table experience a temporary but essentially total loss of shear strength due to reversing cyclic shear stresses caused by seismic shaking.

Cohesionless soils were encountered in some of our exploratory borings drilled for this study. These sands varied in grain size and were generally dense and contained some silt and clay binder. In addition, they appear to be located at or immediately below the groundwater table. Therefore, it is our opinion that the potential for liquefaction of the subsurface materials encountered in our exploratory borings is low.

RECOMMENDATIONS

General

The subsurface soils at the site generally exhibit moderate to high strengths; therefore, it is recommended that the proposed apartments be supported on spread footing foundations. The native soils also exhibit a high expansion potential; therefore, it is recommended that foundation elements and slab-on-grade floors be supported on a section of select engineered fill. Recommendations regarding pavements are also presented herein. It is also recommended that our firm be retained to review all plans for the apartment complex to check for general compliance with the intent of the recommendations presented herein.

Earthwork

Monitoring of Earthwork - It is recommended that all earthwork associated with this project be performed under the direct, full-time observation of a representative of our firm and in accordance with the recommendations contained in this section and in Appendix B, "Guide Specifications for Earthwork."

Surface Preparation - Prior to commencing earthwork operations, all areas to receive fill should be stripped to remove all surface vegetation, organic-laden topsoil, existing concrete slabs, existing pavement, or debris. These materials should be removed from the site; however, surface vegetation and topsoil can be stockpiled for re-use later in planting areas. These materials should not be re-used for engineered fill.

After stripping has been completed, excavation for the recommended sections of select engineered fill beneath spread footings and floor slabs should be made. Details regarding the recommended sections of select fill are presented in subsequent report sections.

Any loose, badly cracked or weak surficial soils encountered during stripping or at the bottoms of excavations should be removed. When surface preparation has been completed, all exposed soils should be scarified to a depth of at least six (6) inches, brought to a water content one (1) to three (3) percent above the laboratory optimum, and compacted to the requirements of engineered fill.

Fill Placement and Re-Use of On-Site Material - All fill should be compacted to a minimum degree of compaction of 92 percent based on California Test Method 216-F. Fill material should be spread in uniform lifts not exceeding eight (8) inches in uncompacted thickness. The material should be brought to a water content at or near the laboratory optimum and should be mixed thoroughly before compaction to achieve a uniform distribution of moisture. After the surface preparation is completed, the mass filling should commence immediately and proceed until the site is to grade.

On-site materials, if free from organic materials, debris, or other deleterious substances, can be used as general engineered fill. However, on-site materials do not meet the requirement of select fill, which is recommended beneath footings and floor slabs. All material imported to the site for use as fill should be select material as defined in the attached "Guide Specifications for Earthwork."

Utility Trench Backfill - It is recommended that all utility trench backfill be placed in accordance with the compaction requirements and procedures for engineered fill, with the additional recommendations presented in this section and with Appendix B, "Guide Specifications for Earthwork."

Foundations

It is recommended that the proposed apartments be supported on isolated spread footings under columns and on continuous footings under walls. Footings should be underlain by a minimum of twenty-four (24) inches of select engineered fill. It is recommended that interior and exterior footings be embedded a minimum of twenty-four (24) inches below the lowest adjacent finished grade. Continuous wall footings should have a minimum width of eighteen (18) inches; isolated spread footings should have a minimum width of twenty-four (24) inches. Design bearing pressures for footings designed and constructed as recommended herein should not exceed 3,000 psf due to dead loads, 4,000 psf due to dead plus live loads, and 5,000 psf due to all loads, including wind and seismic forces. All select engineered fill beneath footings should be compacted to a minimum degree of compaction of 92 percent.

Resistance to Sliding

Resistance to sliding for the proposed structure can be developed by friction acting on bottoms of spread footings and by passive pressure acting on the faces of spread footings. A coefficient of friction of 0.4 can be used for design, as well as an equivalent fluid weight of 300 pcf, assuming that the footings are poured neat against compacted soil.

Slab-On-Grade Floors

It is our understanding that the floors of the proposed apartments will be of the slab-on-grade type. As discussed in a previous report section, the surficial soils are highly expansive and could cause heaving of floor slabs if used for their direct support. Therefore, it is recommended that the building floor slabs be supported on a minimum thickness of eighteen (18) inches of select engineered fill.

All fill beneath floor slabs should be compacted to a minimum degree of compaction of 92 percent. Concrete slabs should be designed and constructed in accordance with standard engineering recommendations such as those provided by the American Concrete Institute.

It is recommended that a capillary break consisting of four inches of rounded or subangular gravel be placed beneath the floor slab and covered by a moisture-vapor barrier to minimize dampness on the finished slab surface. A two-inch-thick layer of sand is usually placed over the membrane to aid in protecting it from damage during slab construction. Guide specifications for gravel beneath floor slabs are presented in Appendix C. The capillary break should not be considered part of the eighteen (18) inches of select engineered fill recommended above.

Pavements

It is our understanding that pavements will be constructed of asphaltic concrete. We expect that traffic loadings for the apartment complex are likely to range from passenger car parking to occasional garbage truck loading. Based on our past experience, we have provided preliminary pavement sections for three (3) proposed pavement uses. This standard design consists of asphaltic concrete (AC), class 2 aggregate base (AB), and compacted native subgrade (CSG). It is recommended that all baserock and the top six (6) inches of subgrade beneath pavements be compacted to a minimum degree of compaction of 95 percent; it is also recommended that the moisture content of the compacted subgrade be one (1) to three (3) percent above the laboratory optimum.

Based on an assumed R-value of 10, the following pavement sections are recommended:

Proposed Use	Estimated TI	AC (in.)	AB (in.)	CS (in.)
Auto Parking	4	2½	8	6
Access Aisles	5	2½	10½	6
Garbage Truck Loading	-	12	0	6

It is recommended that final parking lot striping include markings designating the area to be used for garbage truck loading (the area with the thickest section of asphaltic concrete pavement).

Surface Drainage and Erosion Control

Good surface drainage is essential to intercept and control surface water runoff and to minimize soil erosion and subsurface infiltration. Ground surfaces should slope away from the structure at a gradient of at least two (2) percent. Care should be taken to grade areas to control and collect surface water runoff. In addition, roof downspouts should be connected to closed collector pipes which outlet into the storm water system.

LIMITATIONS

The recommendations presented in this report are made for a specific development. The opinions and recommendations presented herein have been formulated in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made or should be inferred. If the proposed construction will differ from that planned at the present time, our firm should be notified so that supplementary recommendations can be made. The recommendations contained in this report should be implemented in their entirety unless modifications have been provided by our firm in writing. The recommendations should not be considered applicable if only a portion of the recommendations are implemented.

Our firm should be retained to provide a representative to observe all earthwork on a full-time basis, to verify that the subsurface conditions encountered in the field are as were anticipated in development of these recommendations and to check for general compliance with the intent of these recommendations. The recommendations presented herein should not be considered applicable if our firm has not been retained to observe subsurface conditions encountered in the field during construction, to make supplemental recommendations as appropriate, and to observe construction procedures employed. The opinions and recommendations presented in this report are based in part upon the data obtained from the exploratory borings. The nature and extent of variations between the borings may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

If the contractor encounters subsurface conditions at the site that (a) are materially different from those indicated in this report, or (b) could not have been reasonably anticipated as inherent in this type work, the contractor shall immediately notify the owner verbally and in writing within 24 hours.

The contents of this report are not warranted to present information in the degree of detail that may be required or considered necessary by contractors for competent preparation of bids, or for planning of their construction operations for troublefree, efficient, profitable, or successful performance of their work. Merrill, Seeley, Mullen, Sandefur, Inc. has no objection to bidders or contractors evaluating the information presented in this report to bid, plan and perform their construction operations. Their evaluation of this information should be based on their expertise of the various construction operations.

This report is issued with the understanding that it is the responsibility of the owner to insure that all recommendations contained herein are carried out in the field. It is also the responsibility of the owner to see that the recommendations are called to the attention of the appropriate parties, such as the contractor, the subcontractor, and the municipality or other government organizations that may have jurisdiction. It is the responsibility of the owner to inform Merrill, Seeley, Mullen, Sandefur, Inc., of the intent to commence earthwork operations at least 48 hours prior to their start. Lastly, it is the responsibility of the owner to inform Merrill, Seeley, Mullen, Sandefur, Inc., of the intent to implement any of the recomendations presented in this report and/or to perform any further work on the project.

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATION

Nine (9) exploratory borings were drilled for this study at the locations shown on the Site Plan and Boring Location Map, Figure 2. The drilling was done on August 29, 1986, under the supervision of Mr. Barry Butler. The borings were advanced using a 4½-inch-diameter auger. Drive samples were obtained using samplers described on page A-3. The sampler used was driven 18 inches into the soil by a 140-pound hammer free falling 30 inches. The number of blows required to penetrate the last 12 inches or a fraction thereof is shown on the Logs of Borings. When the sampler was withdrawn from the hole, the samples were carefully removed, sealed to minimize moisture loss and returned to our laboratory. Classifications, made in the field from auger cuttings and drive samples, were verified in the laboratory after further examination and testing of the samples.

Conditions between boring locations may vary considerably and it should not be expected that they will be precisely represented by any one of the borings. Soil deposition processes and topographic forming processes are such that soil and rock types and conditions may change in small vertical intervals and short horizontal distances. Stratification lines, as indicated on the Boring Logs, represent approximate changes in soil and rock composition, moisture and color as approximated by field personnel logging the drilling operation and by the engineer in the laboratory from sample recovery data and by observation of the samples. Actual depths to changes in the field may differ from those indicated on the logs, or transitions may occur in a gradual manner and may not be sharply defined by a readily obvious line of demarcation.

Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors at the time water levels were observed.

The location of borings were approximately determined by tape measurement. Elevations of borings were approximately determined by interpolation between contours shown on the topographic and boundary survey of the subject property (Archer, 1986). The location and elevation of the borings should be considered accurate only to the degree implied by the method used.

LABORATORY TESTING

The water content, dry density, and unconfined compressive strength were determined for selected samples to evaluate the strength and compressibility characteristics of the soils. The results of these tests, together with the resistance to penetration of the sampler, are shown at the corresponding sample locations on the Logs of Borings.

Plasticity characteristics of the surficial soils were determined for two (2) samples of fill and native soils by performing Liquid Limit and Plastic Limit tests in accordance with ASTM test methods D423 and D424. The results of these tests are presented on page A-13.

A mechanical grain-size analysis was performed on one (1) sample of the native soils. The portion of the sample retained in a No. 200 sieve (U.S. Standard) was analyzed according to ASTM test method D-422. The results of this test are presented on page A-14.

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. SAMPLE

Project Number: 86204

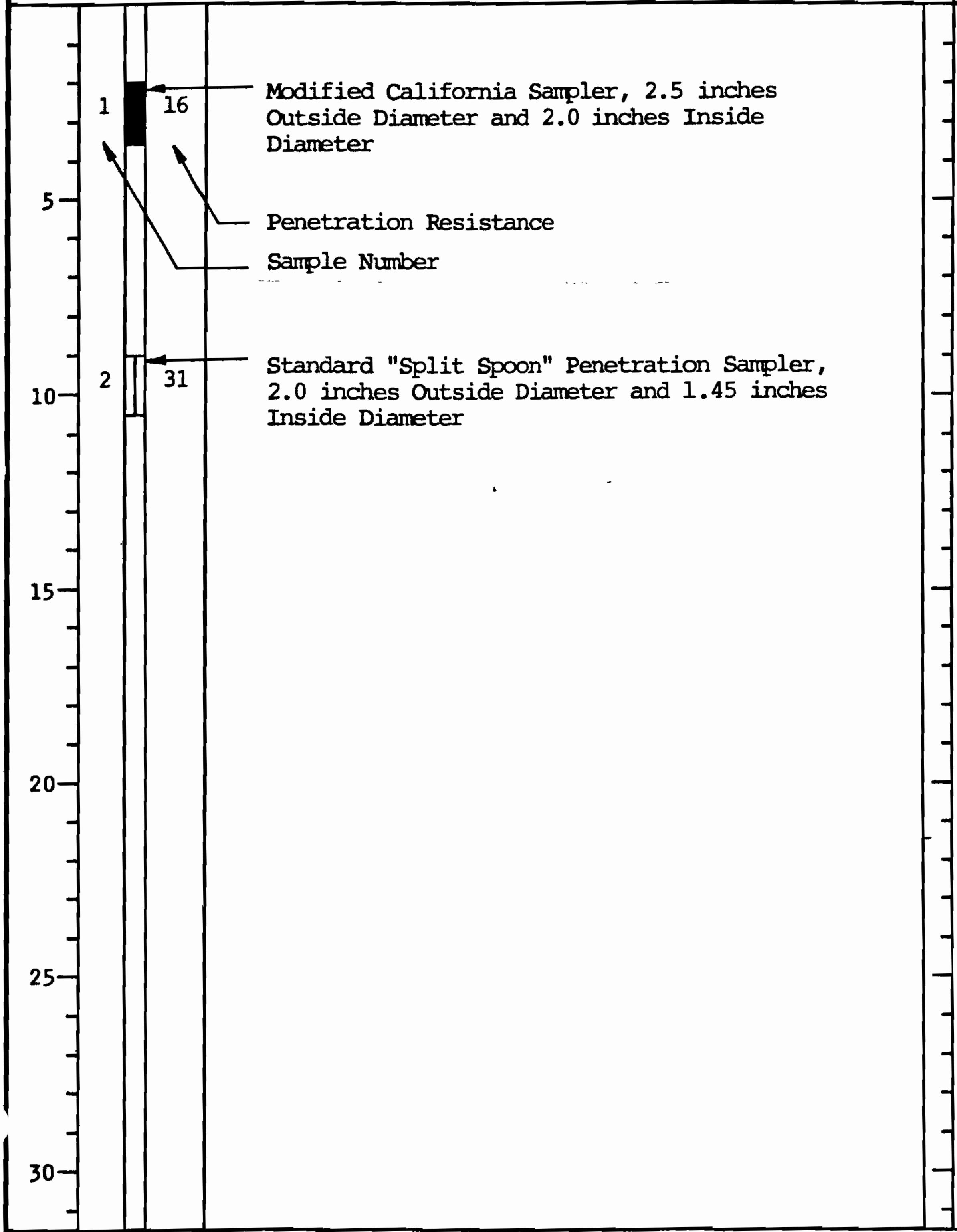
Date Drilled: ___

Type of Boring: ___

Hammer Weight: ---

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf

Surface Elevation: ---



Modified California Sampler, 2.5 inches Outside Diameter and 2.0 inches Inside Diameter

Penetration Resistance

Sample Number

Standard "Split Spoon" Penetration Sampler, 2.0 inches Outside Diameter and 1.45 inches Inside Diameter

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 1

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Surface Elevation: 158.0 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
			GRAVELLY CLAY (CL) FILL stiff, moist, brown			
	1	16		21	101	5430
			SILTY CLAY (CL) very stiff, moist, dark brown to black with traces of coarse sands and weathered light brown sandstone deposits			
	2	10		20	101	5000
5						
	3	47	WEATHERED CLAYSTONE plastic, light brown	24	99	6590
10	4	30* 2"	light grey-brown	--	---	-----
15	5	50* 1"		--	---	-----
			Bottom of boring at 15'-1". No groundwater encountered at time of drilling. *Blow count during seating of sampler.			
20						
25						
30						

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 2

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Surface Elevation: 157.7 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
	1	19	GRAVELLY CLAY (CL) FILL very stiff, moist, mottled orange-brown with silts, sands, and angular rock fragments	12	112	6660
	2	13		16	111	5680
			SILTY CLAY (CL) very stiff, moist, brown with traces of fine sands and orange-brown sandstone deposits			
5	3	15		16	112	5030
			orange-brown with fine gravels and coarse sands			
	4	21		11	123	2100
10			∇**			
			WEATHERED CLAYSTONE plastic, orange-brown			
	5	30* 3"		—	---	-----
15			Bottom of boring at 13'-3". *Blow count during seating of sampler. **Groundwater at 10'-0" at time of drilling.			
20						
25						
30						

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 3

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Surface Elevation: 158.2 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	LABORATORY TESTS Dry Density, pcf	LABORATORY TESTS Unconfined Compressive Strength, psf
			A.C. pavement approximately 6 inches thick			
	1	17	GRAVELLY CLAY (CL) FILL very stiff, moist, mottled brown	20	101	9850
	2	20	SILTY CLAY (CL) hard, moist, dark brown to black with traces of sands	14	119	13,210
5	3	30/4"	↓ grey-brown with some coarse sands	13	120	6010
	4	37*/6"	WEATHERED CLAYSTONE plastic, brown, indurated	--	---	-----
10			Bottom of boring at 9'-0". No groundwater at time of drilling. *Blow count during seating of sampler.			
15						
20						
25						
30						

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 4

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Surface Elevation: 157.9 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
	1	12	GRAVELLY CLAY (CL) FILL stiff, moist, mottled brown with rock fragments	13	104	-----
	2	12	SILTY CLAY (CL) hard, moist, dark brown to black with traces of sands	15	111	10,530
5	3	16		14	117	12,820
			CLAYEY SILT (ML) hard, moist, brown with some fine sands			
	4	17	CLAYEY SAND (SC-SW) medium dense, moist, brown with varying amounts of silt and clay	17	109	1340
10			wet ***▽ **▽			
	5	26		—	---	-----
	6	39	WEATHERED SHALE plastic, brown	—	---	-----
15	7	20/3"	grey with fine sands stronger with depth	—	---	-----
20	8	50*/2"		—	---	-----
25						
30						

Bottom of boring at 20'-2".
*Blow count during seating of sampler.
**Groundwater at 11'-6" at time of drilling.
***Groundwater at 10'-3" on September 2, 1986.

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 5

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
			Surface Elevation: 157.3 ft.			
			A.C. pavement and aggregate baserock			
	1	18	SILTY CLAY (CH) hard, moist, black	24	101	8180
5			mottled brown-grey			
	2	14		--	---	-----
			SILTY CLAY (CL) stiff, moist, light brown, silt content increasing with depth			
	3	12		--	---	-----
10			SANDY SILT-SILTY SAND (ML-SM) ** stiff, moist, light brown-orange brown with very find sands			
	4	30*/1"		--	---	-----
			WEATHERED SHALE weak, brown			
15			Bottom of boring at 11'-1".			
20						
25						
30						

*Blow count during seating of sampler.
**Groundwater at 11'-0" at time of drilling.

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 6

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Surface Elevation: 156.8 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content, %	LABORATORY TESTS: Dry Density, pcf	LABORATORY TESTS: Unconfined Compressive Strength, psf
			A.C. pavement			
	1	16	GRAVELLY CLAY (CL) FILL stiff, moist, mottled brown	23	97	6520
			SILTY CLAY (CH) very stiff, moist, black			
5	2	13	mottled brown-grey with traces of sands	17	111	6370
			increasing silt content			
	3	21	SILTY SAND (SM) *▽ dense, moist, mottled orange-brown	--	---	-----
10						
	4	20/5"	WEATHERED SHALE weak, grey with clay seams	--	---	-----
			Bottom of boring at 12'-11". *Groundwater at 9'-6" at time of drilling.			
15						
20						
25						
30						

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 7

Project Number: 86204

Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: 140 lbs.

Surface Elevation: 158.1 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content, %	LABORATORY TESTS: Dry Density, pcf	LABORATORY TESTS: Unconfined Compressive Strength, psf
	1	11	GRAVELLY CLAY (CL) FILL stiff, moist, mottled brown	12	113	17,050
	2	11	SILTY CLAY (CL) very stiff to hard, moist, dark brown with scattered organics and fine sands	15	113	6700
5						
	3	15	increasing silt content	--	---	-----
	4	46	SANDY SILT-SILTY SAND (ML-SM) hard, moist, mottled dark brown	--	---	-----
10			WEATHERED SHALE weak, light brown			
15						
20						
25						
30						

Bottom of boring at 10'-0".
No groundwater encountered at time of drilling.

Project: Baker Road Apartments Castro Valley, California	# Log of Boring No. 8
Project Number: 86204 **Date Drilled:** August 29, 1986	**Type of Boring:** 4½ inch Auger **Hammer Weight:** ----

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	 Dry Density, pcf	 Unconfined Compressive Strength, psf
			Surface Elevation: 158.0 ft.			
			GRAVELLY CLAY (CL) FILL stiff, moist, mottled brown			
			SILTY CLAY (CL) very stiff, moist, dark brown			
5			mottled brown			
			SILTY SAND (SM) * ▽ dense, wet, mottled brown			
10						
			WEATHERED CLAYSTONE weak, brown			
15			Bottom of boring at 13'-0". *Groundwater at 9'-0" at time of drilling.			
20						
25						
30						

Project: Baker Road Apartments
Castro Valley, California

Log of Boring No. 9

Project Number: 86204

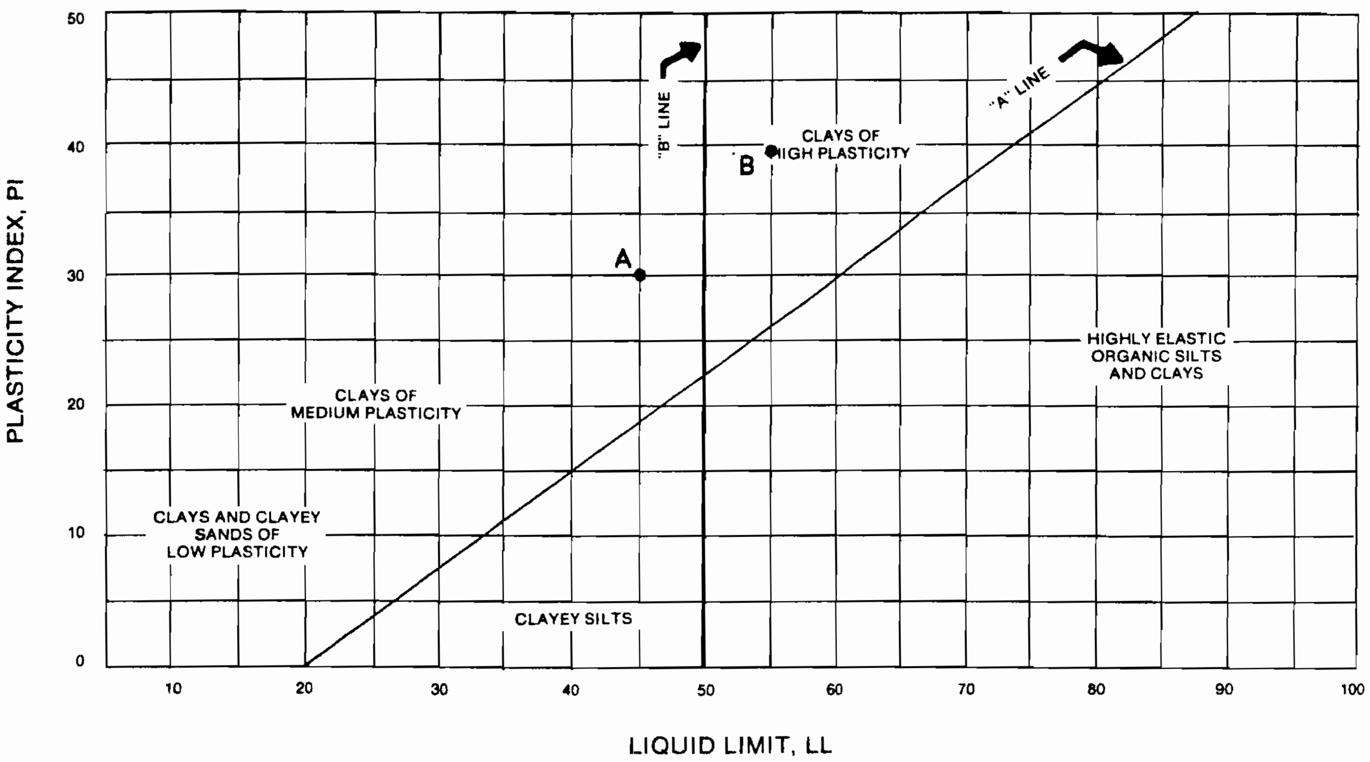
Date Drilled: August 29, 1986

Type of Boring: 4½ inch Auger

Hammer Weight: ----

Surface Elevation: 158.0 ft.

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
			GRAVELLY CLAY (CL) FILL stiff, moist, brown			
			SILTY CLAY (CL) very stiff, moist, dark brown			
5			mottled brown			
			GRAVELLY CLAY (CL) very stiff, moist			
10						
15			Bottom of boring at 13'-0". No groundwater encountered at time of drilling. Weathered claystone encountered at bottom of boring.			
20						
25						
30						

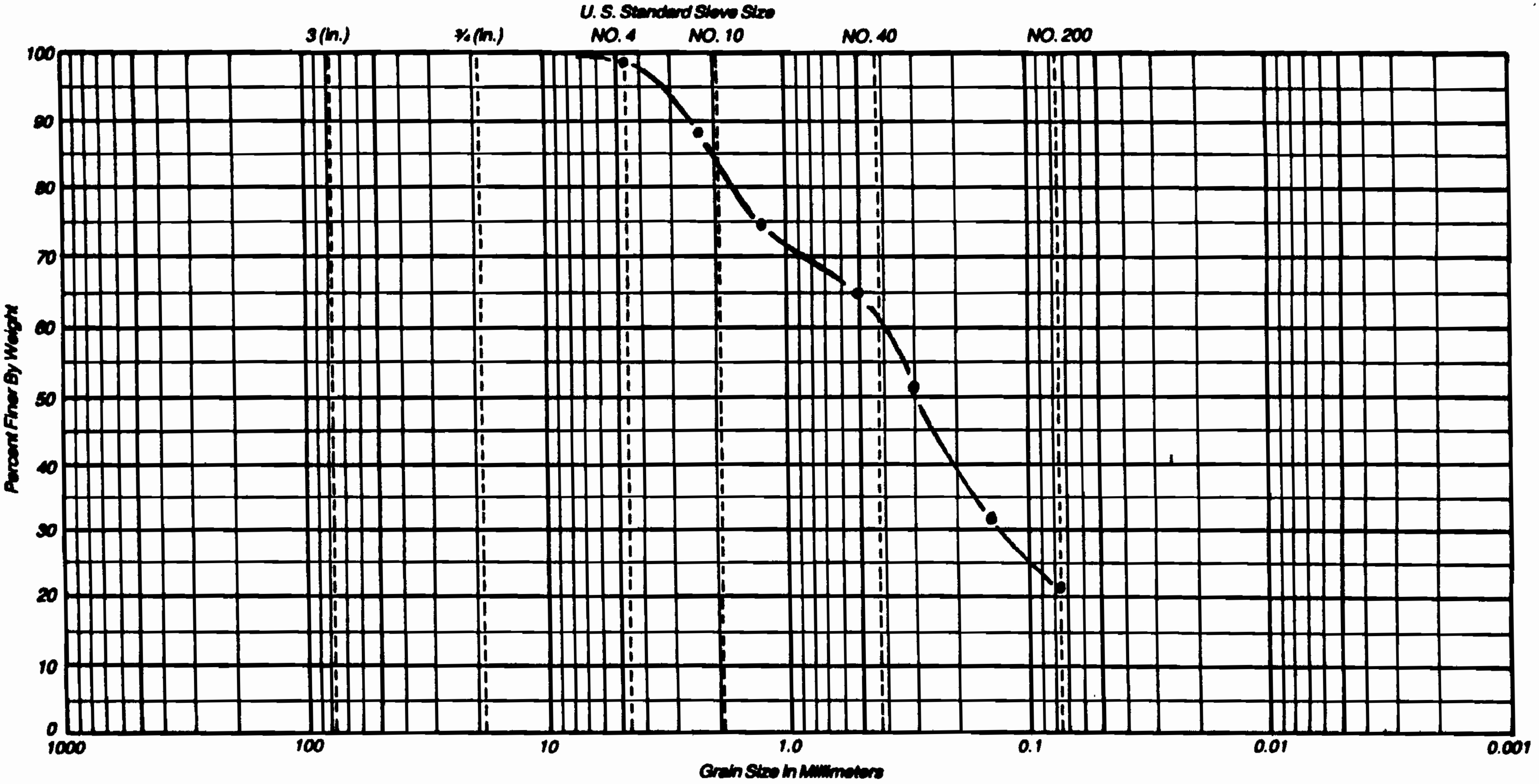


CLASSIFICATION TEST RESULTS

SAMPLE IDENTIFICATION			ATTERBERG LIMITS			GRAIN SIZES — % DRY WEIGHT			
LETTER DESIG'N	SAMPLE NO.	DEPTH, FT.	LIQUID LIMIT	PLASTICITY INDEX	PLASTIC LIMIT	SAND	SILT	CLAY	COLLOIDAL
A	1—2	4.0	45	30	15				
B	Bulk 1	<5.0	55	39	16				

PLASTICITY CLASSIFICATION TEST RESULTS

GRADATION CURVES



	COBBLES	GRAVEL		SAND			SILT	CLAY
		Coarse	Fine	Coarse	Medium	Fine		

Boring No.	Sample No.	Depth		Gradation						Plasticity			Water Content (%)
		from (ft.)	to (ft.)	Agg (%)	C.S. (%)	M.S. (%)	F.S. (%)	Silt (%)	Clay (%)	LL (%)	PL (%)	PI (%)	
4	5	11.5	12.0	1	15	23	39						SW

Boring No.	Sample No.	Depth		Gradation						Plasticity			Water Content (%)
		from (ft.)	to (ft.)	Agg (%)	C.S. (%)	M.S. (%)	F.S. (%)	Silt (%)	Clay (%)	LL (%)	PL (%)	PI (%)	

PROJECT 86204

APPENDIX B

GUIDE SPECIFICATIONS FOR EARTHWORK

1. GENERAL CONDITIONS

1.1 Definition of Terms

(A) FILL...all soil or rock material placed to raise the natural grade of the site or to backfill excavations.

(B) ON-SITE MATERIAL...that which is obtained from the required excavation on the site.

(C) IMPORT MATERIAL...that which is hauled in from offsite borrow areas.

(D) ENGINEERED FILL...fill upon which the Geotechnical Engineer has made tests and observations to enable him to issue a written statement that in his opinion the fill has been placed and compacted in accordance with the specification requirements.

(E) SELECT MATERIAL...an on-site or imported soil or rock material meeting the requirements set forth in Section 3.2.

(F) MATERIALS MANUAL...State of California, Business and Transportation Agency, Department of Transportation, latest revision.

(G) PERCENT COMPACTION...the ratio, expressed as a percentage, of the dry density of the fill material as compacted in the field to the maximum dry density of the same material determined by California Test Method 216-F. Field densities shall be determined in accordance with ASTM D-1556 or ASTM D-2922-71.

1.2 Duties of the Geotechnical Engineer

The Geotechnical Engineer shall be the Owner's representative to observe the grading operations both during preparation of the site and the compaction of any engineered fill. He shall make visits to the site to familiarize himself generally with the progress and quality of the work. He shall make field observations and tests to enable him to form an opinion and advise the Owner regarding the site preparation, the acceptability of the fill material, and the extent to which the percent compaction of the fill, as placed, meets the specification requirements. He shall recommend that any fill that does not meet the specification requirements be removed and/or recompacted until the requirements are satisfied. He shall not be responsible for checking the grades during construction or final grades. Nothing in this section relieves the contractor of his responsibility under the contract to place all earthwork in accordance with the recommendations and the plans and specifications.

1.3 Subsurface Conditions

A geotechnical investigation has been performed for this site. A contractor shall familiarize himself with the subsurface conditions at the site, whether covered in the report or not, and shall thoroughly understand all recommendations associated with grading.

2. SITE PREPARATION

2.1 Stripping

The site shall be stripped and cleared of all vegetation, debris, concrete slabs, pavement, and organic-laden topsoil. The stripped material shall be hauled from the site unless approval is given to stockpile the material for re-use later as topsoil in future landscape areas. This material shall not be used for engineered fill. Any existing foundations, tanks and utilities encountered during grading shall be removed from the site.

2.2 Excavation

After stripping, the site shall be excavated to the required grades to remove the existing fill. Sub-excavations shall be made as recommended by the Geotechnical Engineer. Existing subsurface soils shall be excavated sufficiently to allow for a minimum thickness of twenty-four (24) inches of fill beneath footings and eighteen (18) inches beneath concrete slabs-on-grade. The bottoms of the excavations shall extend beyond the plan area of the building a distance equal to the depth of the excavation beneath the structure. All excavations shall be carefully made true to the grades and elevations shown on the plans.

The excavated surfaces shall be properly graded to provide good drainage during construction and prevent ponding of water. Earthwork is most expediently accomplished using large, heavy equipment, unimpeded by obstacles. Therefore the entire area should be excavated to the recommended depths at the same time to permit uniform preparation of the subgrade and placement of engineered fill in a uniform, continuous operation.

2.3 Preparation for Filling

All excavations made during the stripping and clearing operations that are below finish grade shall be cleaned of all loose soil and debris and backfilled with engineered fill.

After stripping, all areas to support structures, including pavements, shall be prepared further by removing any loose, weak or badly cracked surficial soils. The depths of these excavations shall be determined by the Geotechnical Engineer.

Once the specified stripping and excavation are complete, the exposed surface and excavation bottom should be scarified a minimum depth of six inches and recompacted to the requirements of engineered fill. If the exposed surface or bottom of the excavation is soft and unstable, and required compaction cannot be achieved, the bottom should be stabilized. Stabilization possibly could be accomplished by additional excavation, use of fabric and replacement with clean dry soil or well-graded rock with sufficient fines to be cohesive, or by use of coarse gravel if approved by the Geotechnical Engineer.

Before placing fill, the Contractor shall obtain the Geotechnical Engineer's approval of the site preparation in the areas to be filled. The excavated materials then can be re-placed as fill if they meet the requirements for fill.

3. MATERIALS USED FOR FILL

3.1 General Requirements for Fill Materials

All fill materials and the re-use of on-site material must be approved by the Geotechnical Engineer. The material shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances. The fill material shall not contain rocks or lumps over 6 inches in greatest dimension and not more than 15 percent larger than 3 inches.

Materials from the site, if free from organic or other deleterious substances, can be re-used for general engineered fill.

3.2 Requirements for Select Fill Material

In addition to the requirements of Section 3.1, above, select material shall have a Plasticity Index (PI) less than 15 percent and an R-value greater than 25. All import material shall meet the requirements of select fill.

Materials from the site do not appear to meet the requirements for re-use as select fill and should not be used for direct support of concrete footings or slabs-on-grade.

4. PLACING AND COMPACTING FILL MATERIAL

All fill material shall be compacted as specified below or by other methods, if approved by the Geotechnical Engineer, so as to produce a minimum percent of compaction of 92 percent with the exception of subgrades beneath pavements, which should be compacted to a minimum degree of compaction of 95 percent. Fill material should be spread in uniform lifts not exceeding eight inches in uncompacted thickness. Fill material shall be brought to a water content that will permit proper compaction by either: aerating the material if it is too wet; or spraying the material with water if it is too dry. Each lift shall be thoroughly mixed before compaction to ensure a uniform distribution of water content. The moisture content predominantly fine grained fill materials (silts and clays) shall be at or near the optimum moisture content, or slightly less, in order to maintain stability in the fill mass beneath the compacting equipment. Predominantly coarse grained materials (sands and gravels), which are not as sensitive to moisture content with regard to stability, shall not become saturated to the point that a pumping condition occurs. On-site material that is identified by the Geotechnical Engineer in the field as potentially expansive, shall be compacted at a moisture content of at least 3 percent above optimum. The minimum moisture content shall be determined by the Geotechnical Engineer. The grading shall commence immediately after the surface preparation phase and shall proceed in a continuous operation until the site is brought to grade.

5. TREATMENT AFTER COMPLETION OF GRADING

After grading is completed and the Geotechnical Engineer has finished his observation of the work, no further excavation or filling shall be done except with the approval of and under the observation of the Geotechnical Engineer.

It shall be the responsibility of the Grading Contractor to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

6. UTILITY TRENCH BACKFILL

It is recommended that all utility trench backfill be placed in accordance with the compaction requirements and procedures for engineered fill and the additional recommendations presented in this section.

The pipes should first be bedded in accordance with standard practice or as required by the County of Alameda or the particular utility. From 12 inches above the pipe to finish grade, the backfill should be placed in thin lifts and compacted using approved compaction equipment to the minimum degree of compaction specified above. The bedding materials, one foot over the pipes, should be compacted to a minimum of 85 percent compaction. Care should be taken to prevent damage to pipes during the compaction process. Jetting of backfill should not be permitted. The backfill material should consist of a soil material free of organic matter or any other deleterious substances, and should not contain rocks over four inches in greatest dimension or soil lumps greater than two inches in size. Clay soils used for backfill material should meet the moisture requirements for engineered fill. Sand is not recommended for backfill within 18 inches of finish grade.

Prior to the placement of underground utilities, the trench should be examined for subsurface seepage. If seepage is encountered, our firm should be consulted so that recommendations for subsurface drainage can be made. Trenches containing free water should be de-watered prior to backfilling.

It is recommended that trench backfill for major utilities, such as storm sewers, sanitary sewers and water service lines be observed by our firm where such lines are located within the building area, beneath pavements and in close proximity to footings. These particular underground utilities can be identified more fully after utility plans are finalized.

APPENDIX C

GUIDE SPECIFICATIONS FOR GRAVEL BENEATH FLOOR SLABS

A. DESCRIPTION

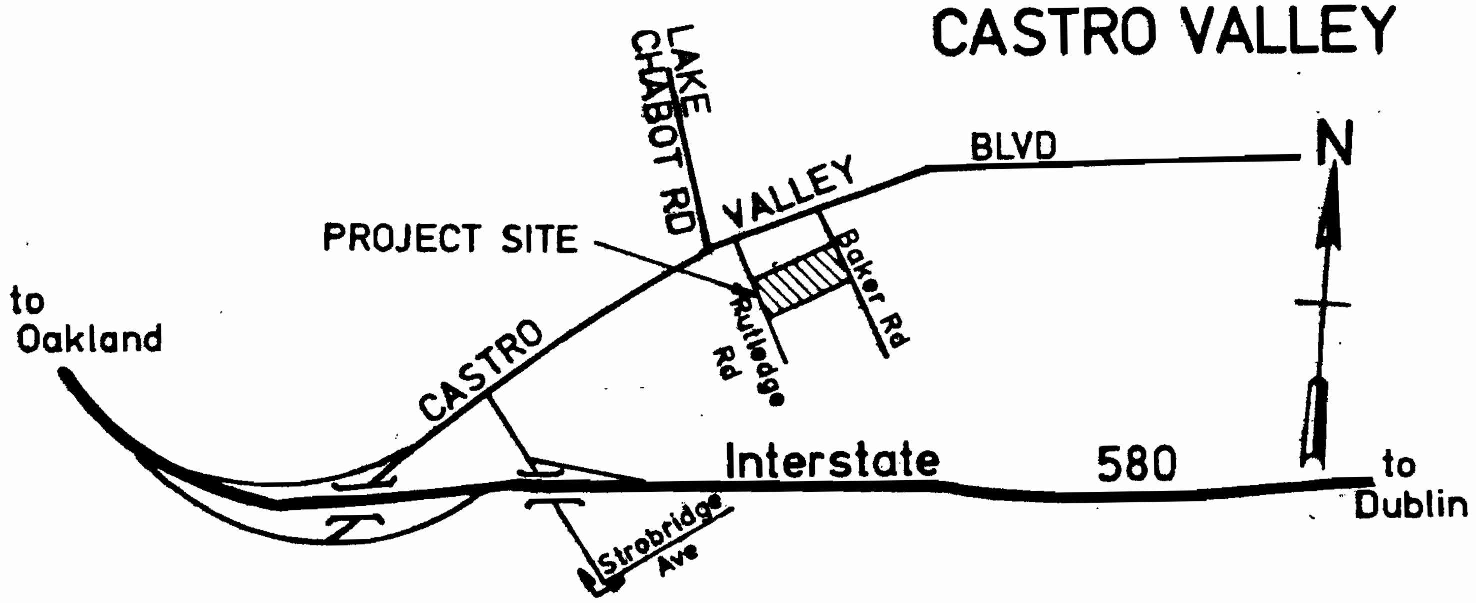
Graded gravel for use beneath floor slabs shall consist of mineral aggregate placed in accordance with the recommendations of this report and in conformity with the dimensions shown on the plans.

The mineral aggregate for use beneath floor slabs shall consist of broken stone, crushed or uncrushed gravel, clean quarry waste, or a combination thereof. The aggregate shall be free from adobe, vegetable matter, loam, volcanic tuff, and other deleterious substances. It shall be of such quality that the absorption of water in a saturated surface dry condition does not exceed 3 percent of the oven dry weight of the sample.

B. GRADATION

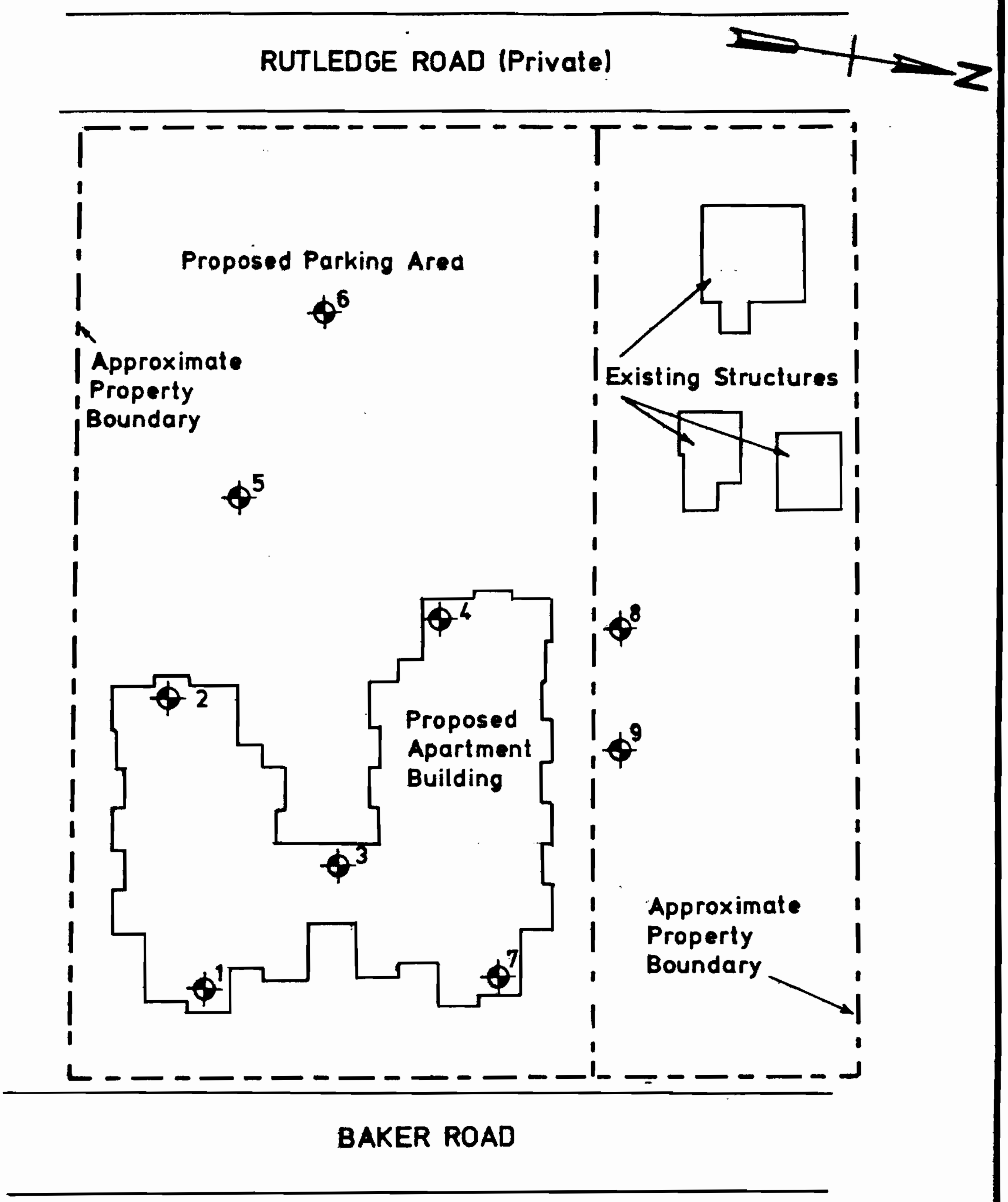
The mineral aggregate shall be of such size that the percentage composition by dry weight as determined by laboratory sieves (U.S. Series) will conform to the following gradation:

Sieve Size	Percentage Passing Sieve
1"	100
3/4"	90 - 100
No. 4	0 - 10



SITE LOCATION MAP

Scale: None	Project: 86204
	Figure 1



LEGEND

⊕ Approximate Location of Exploratory Borings

SITE PLAN AND BORING LOCATION MAP

Project: 86204

Scale: None

Figure 2

REFERENCES

Archer, R., 1986, Topographic and Boundary Survey of a Portion of Lots 11 and 12, Baker Vista Tract, Alameda County, California, dated February, 1986 (Job 1224), scale 1 in. = 20 ft.

CDMG, 1982, State of California Special Studies Zones, Hayward Quadrangle, Alameda and Contra Costa Counties, California: California Division of Mines and Geology, scale 1:24,000.

Dibblee, T.W., Jr., 1980, Preliminary Geologic Map of the Hayward Quadrangle, Alameda and Contra Costa Counties, California: U.S. Geological Survey Open-File Report 80-540, scale 1:24,000.

Hardison, Komatsu, Ivelich & Tucker, 1986, Site Plan, Baker Road Apartments, 20957 Baker Road, Castro Valley, California, scale 1 in. = 20 ft.

Jennings, C.W. (compiler), 1975, Fault Map of California: California Division of Mines and Geology, scale 1:750,,000.

Welch, L.E., 1981, Soil Survey of Alameda County, California, Western Part: U.S. Department of Agriculture, map sheet 4, scale 1:24,000.

APPENDIX B

Underground Storage Tank Removal Final Report

May 19, 2004

UNDERGROUND STORAGE TANK REMOVAL FINAL REPORT

20957 Baker Road
Castro Valley, California

Project No. 8131

Prepared For

Mr. Nat Piazza
7613 Peppertree Rd.
Dublin, CA 94568

Prepared By

AEI Consultants
2500 Camino Diablo, Suite 200
Walnut Creek, CA 94597
(800) 801-3224

AEI

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LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

AEI Consultants (AEI) has prepared this final report to document the underground storage tank closure activities performed at 20957 Baker Road in Castro Valley, California (Figure 1: Site Location Map). One (1) 1,000-gallon gasoline underground storage tank (UST) and one (1) 1,000-gallon diesel underground storage tank (UST) were removed. For the tank locations refer to Figure 2: Site Plan.

AEI was contracted to obtain all necessary permits, excavate to expose the tank, remove and dispose of residual liquids, remove and dispose the tank, perform soil sampling and analysis, backfill and resurface the excavation.

2.0 PERMITS

The Alameda County Departments of Fire Prevention and Environmental Health issued permits on February 25, 2004. Inspector Robert Weston was assigned to represent the Alameda County Environmental Health Department, and observed the tank closure activities at the site. The excavation areas were marked and the property representative was notified of the specific time plan.

Copies of the permit and notification documents are located in Appendix A: Permits and Notification Documents.

3.0 MOBILIZATION, EXCAVATION AND REMOVAL

On April 21, 2004, the AEI field staff was briefed and the Site Health and Safety Plan reviewed prior to the initiation of work. The Site Health and Safety Plan is located in Appendix B. Ground cover was broken and the soil above the tank was excavated. Upon exposure, it was determined that the tanks were 1,000 gallons in size, not the originally estimated 500 gallons. Two stockpiles of the excavated soil were created adjacent to the excavation (Figure 2: Site Plan and Figure 3: Sample Location Plan).

Excel Environmental Services, Inc. removed 245 gallons of waste liquid from the tanks prior to removal. Dry ice was introduced into the tank until the Lower Explosive Limit (LEL) and oxygen content reached acceptable levels.

The tanks were removed on April 21, 2004, and visually inspected prior to loading for transport. Minor rust and corrosion were observed on the surface of the tanks.

The tanks were loaded onto an Ecology Control Industries' (ECI) truck and transported under non-hazardous waste manifest to the ECI disposal facility at 255 Parr Boulevard in Richmond, California, where the tank was triple rinsed, cut, and scrapped.

Soil samples were collected prior to backfilling. The excavation was lined with Visqueen, then backfilled with stockpiled soil and clean import material to replace the volume of the tanks.

The non-hazardous waste manifests for the waste liquid and tank are located in Appendix C: Transport and Disposal Documents.

4.0 SAMPLING AND ANALYSES

All samples were collected under the direction of Inspector Weston of the Alameda County Environmental Health Department. A total of six (6) soil samples were collected from the tank removal activities. Four samples were collected eight feet below ground surface (bgs) beneath each end of both tanks. Eight (8) discrete soil samples were collected from the stockpile, and were composited into two samples (T1STKP 1-4 and T2STKP 1-4) for analysis. Please refer to Figure 3: Sample Location Plan for the sample locations.

Groundwater was not encountered during the removal activities.

All soil samples were collected in brass tubes that were driven into the soil until completely full, then sealed with Teflon tape and plastic caps. The secured sample tubes were immediately placed into a cooler with ice. Chain of Custody documentation was initiated. The cooler and samples were brought to McCampbell Analytical, Inc. (State Certification #1644) of Pacheco, California on April 21, 2004, for analysis.

The samples were analyzed for Total Petroleum Hydrocarbons as gasoline (EPA 8015), Total Petroleum Hydrocarbons as diesel (EPA 8015), Total Lead (EPA Method 6010/200), methyl-tert-butyl ether (MTBE), benzene, toluene, ethyl-benzene, and xylenes (BTEX) (EPA Method 602/8020) and Oxygenated Volitle Organics (EPA 8260B). The analytical results are summarized in the following table(s):

TABLE 1 - Soil Sample Analyses for Excavation 1

	T1W-EB8'	T2W-EB8'	T1E-EB8'	T2E-EB8'	T1 STKP1-4	T2 STKP1-4
TPH-GASOLINE (mg/kg)	160	1,400	190	460	ND	ND
TPH-DIESEL (mg/kg)	4,900	2,400	10,000	1,400	77	2.1
MTBE (mg/kg)	ND<0.50	ND<10	ND<1.7	ND<0.50	ND	ND
BENZENE (mg/kg)	ND<0.05	ND<1.0	ND<0.17	ND<0.05	ND	ND
TOLUENE (mg/kg)	ND<0.05	ND<1.0	ND<0.17	ND<0.05	ND	ND
ETHYL BENZENE (mg/kg)	ND<0.05	ND<1.0	ND<0.17	ND<0.05	ND	ND
TOTAL XYLENES (mg/kg)	ND<0.05	8.4	ND<0.17	0.25	ND	ND
TOTAL LEAD (mg/kg)	6.1	17	6.1	18	24	22

mg/kg = milligrams per kilogram (ppm)

Copies of all analytical results and Chain of Custody documentation are located in Appendix D: Analytical Documentation.

5.0 SUMMARY AND CONCLUSIONS

On April 21, 2004, one (1) 1,000-gallon gasoline underground storage tank (UST) and one (1) 1,000-gallon diesel underground storage tank (UST) were removed from the property located at 20957 Baker Road in Castro Valley, California. Prior to removal, 245 gallons of waste liquid were removed, transported and disposed off-site. The tank was transported under non-hazardous waste manifest to the Ecology Control Industries' disposal facility in Richmond, California where the tank was cleaned and disposed of as scrap metal.

A total of six (6) soil samples were collected during the tank removal activities. Concentrations of TPH-g (ranging from 160 to 1,400 mg/kg) and TPH-d (ranging from 1,400 to 10,000 mg/kg) present in the four samples taken along the excavation bottom were above the general action levels, and indicated that an unauthorized release occurred from the USTs. Petroleum hydrocarbons were also detected in the stockpile at significantly lesser concentrations. This case has since been passed on from the Alameda County Environmental Health Department to the San Francisco Bay Regional Water Quality Control Board. It is likely that the San Francisco Bay Regional Water Quality Control Board will require further investigation to determine the extent of the contamination.

6.0 REPORT LIMITATIONS AND SIGNATURES

This report presents a summary of work completed by AEI Consultants, including observations and descriptions of site conditions encountered. Where appropriate, it includes analytical results for samples taken during the course of the work. The number and location of samples are chosen to provide required information, but it cannot be assumed that they are representative of areas not sampled. All conclusions and/or recommendations are based on these analyses and observations, and the governing regulations. Conclusions beyond those stated and reported herein should not be inferred from this document.

All services were performed in accordance with generally accepted practices, in the environmental engineering and construction field, which existed at the time and location of the work.

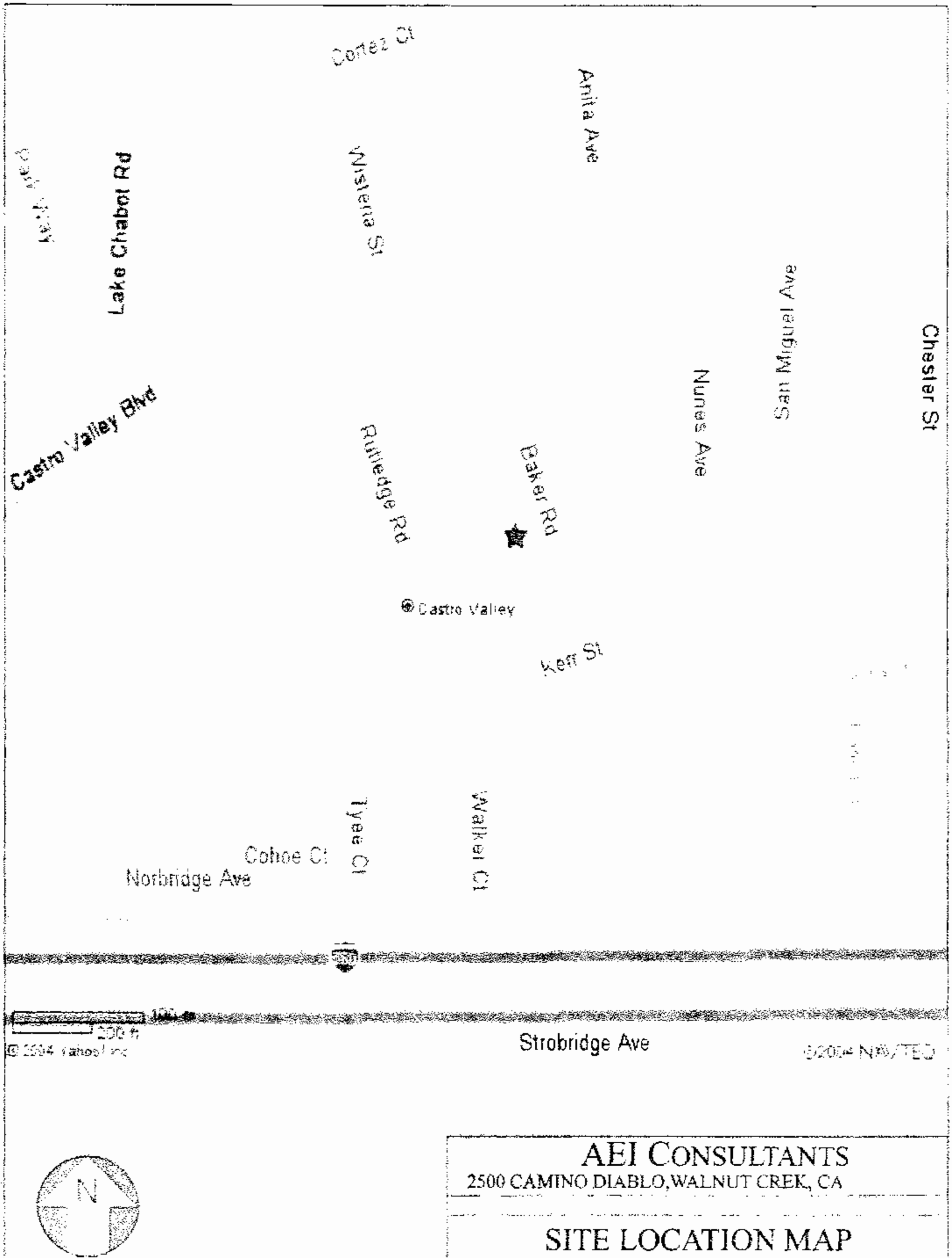
AEI Consultants

for

Peter Hoversen
Project Manager

Robert Flory
R.G., Senior Project Geologist

Registered Geologist
Robert F. Flory
No. 5825
10/3/06
State of California



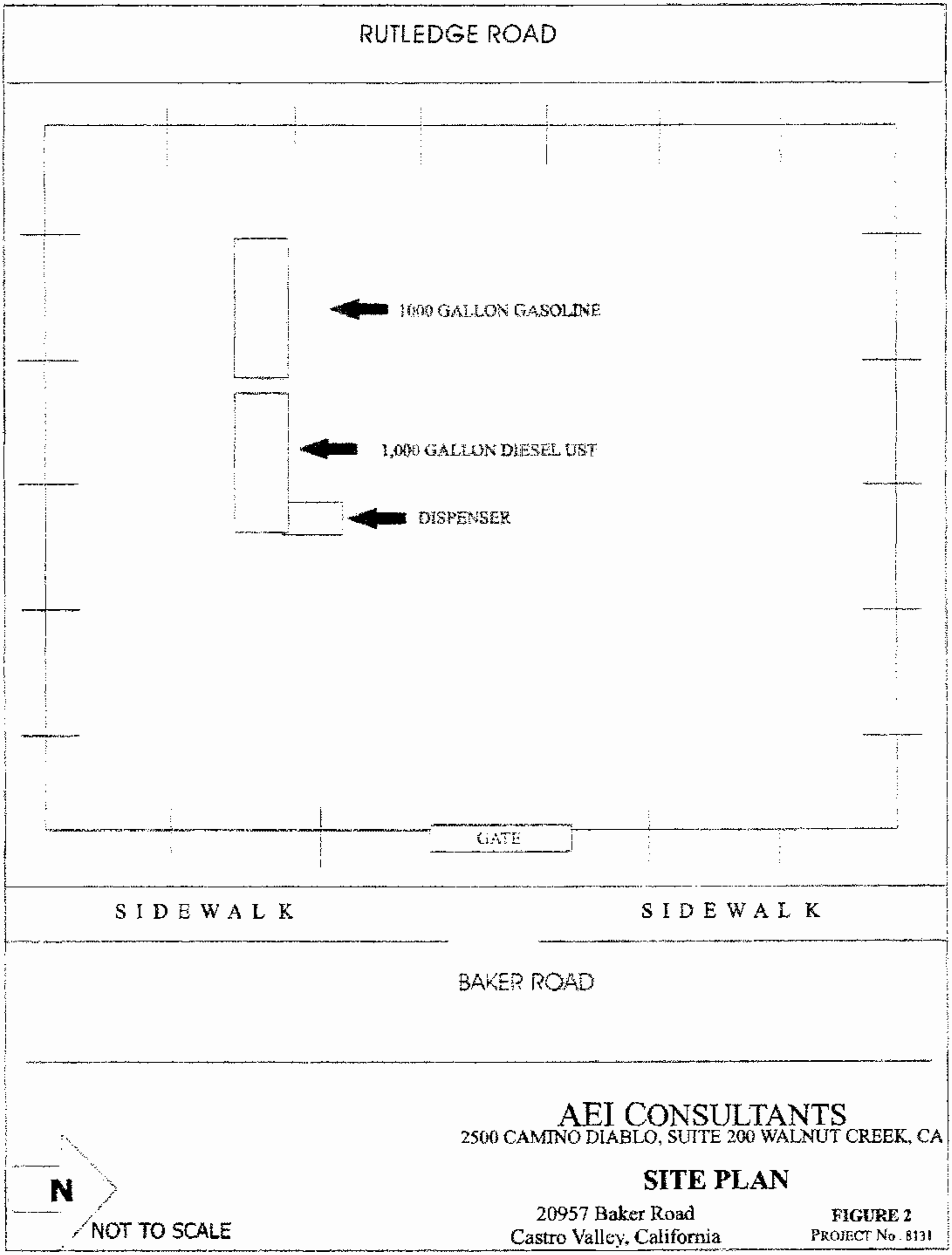
AEI CONSULTANTS

2500 CAMINO DIABLO, WALNUT CREEK, CA

SITE LOCATION MAP

20957 BAKER ROAD
CASTRO VALLEY, CALIFORNIA

FIGURE 1

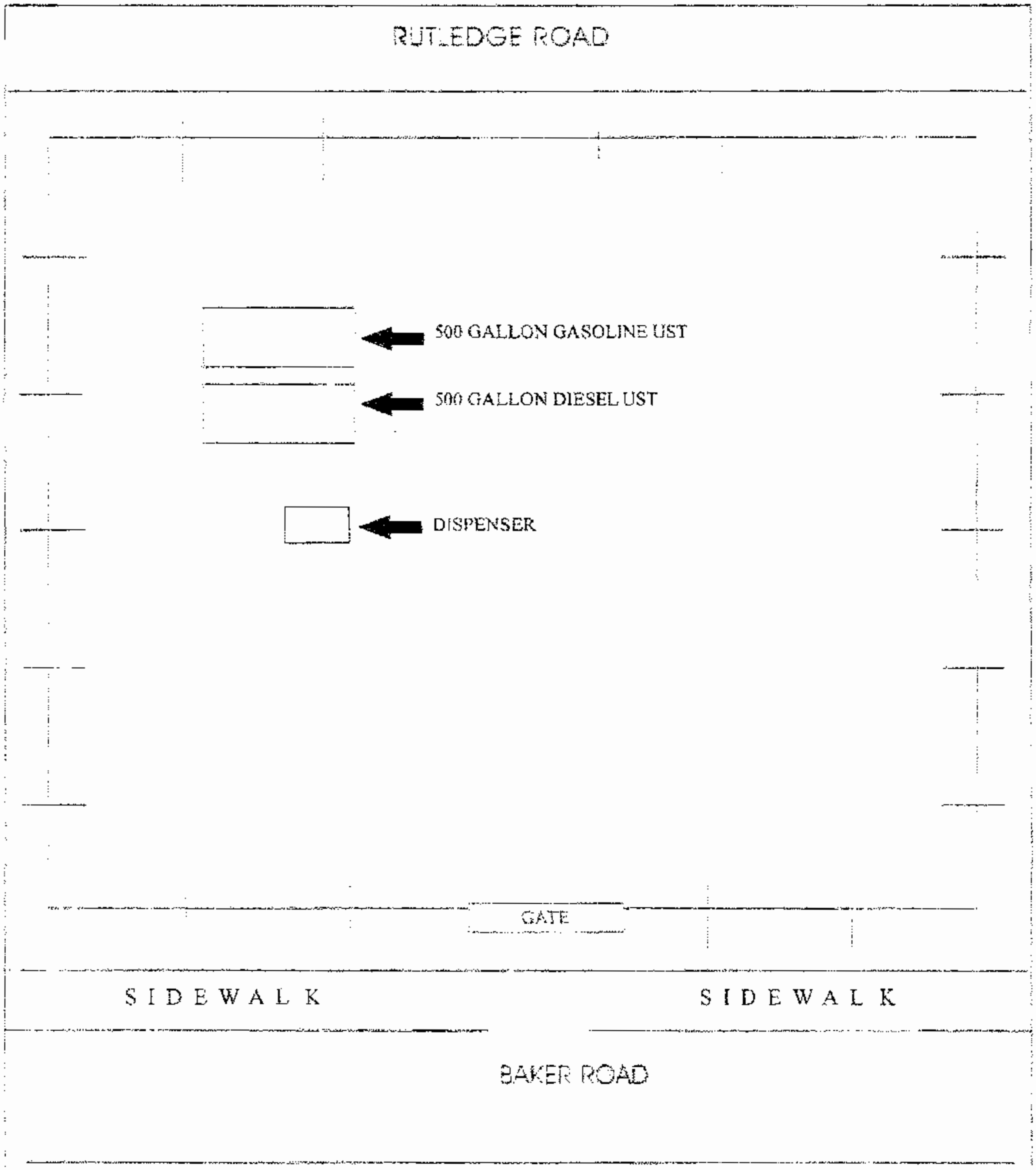


AEI CONSULTANTS
2500 CAMINO DIABLO, SUITE 200 WALNUT CREEK, CA

SITE PLAN

20957 Baker Road
Castro Valley, California

FIGURE 2
PROJECT No. 8131



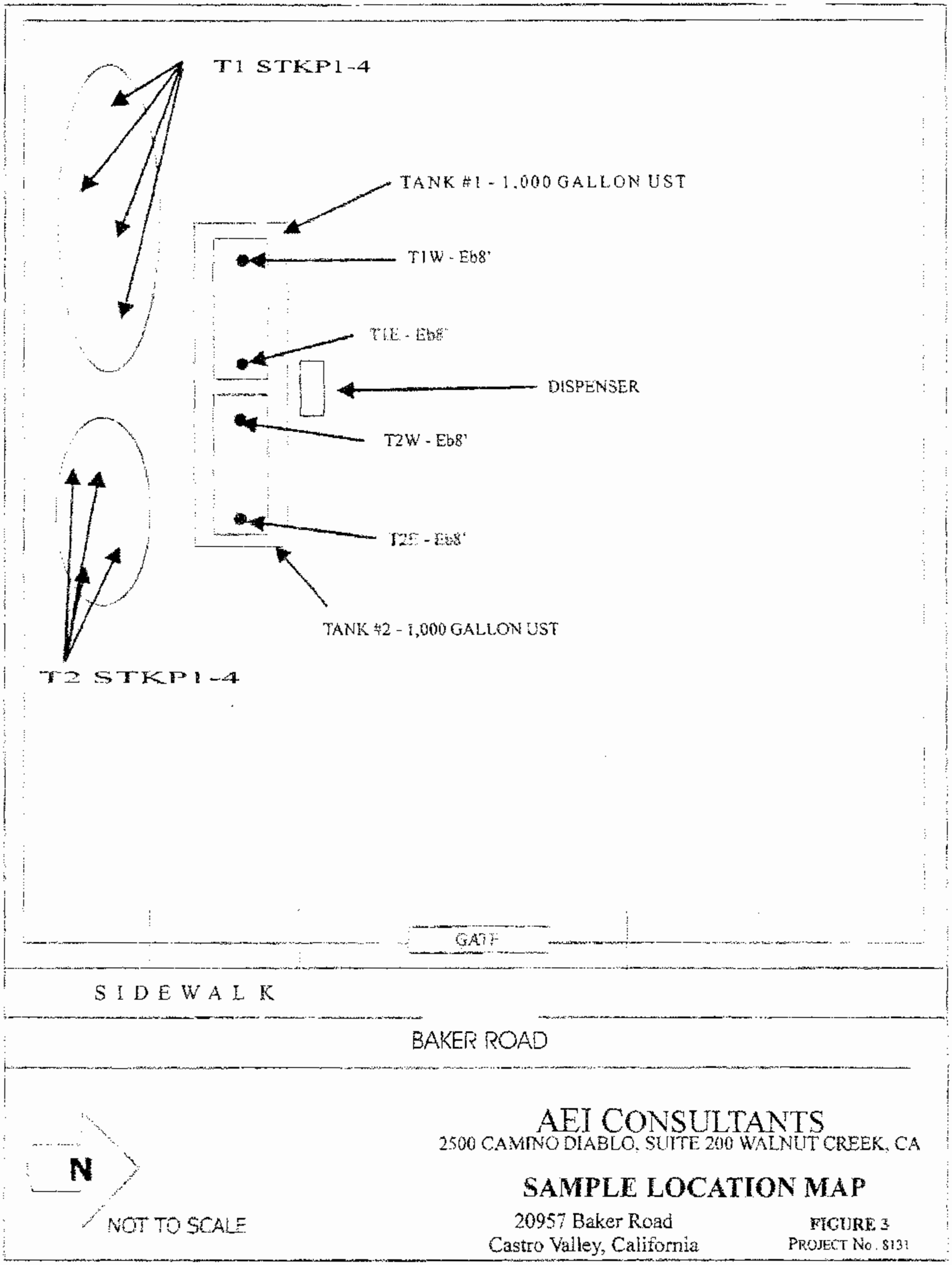
AEI CONSULTANTS
2500 CAMINO DIABLO, SUITE 200 WALNUT CREEK, CA

N
NOT TO SCALE

SITE PLAN

20957 Baker Road
Castro Valley, California

FIGURE 2
PROJECT No. 8131



AEI CONSULTANTS
2500 CAMINO DIABLO, SUITE 200 WALNUT CREEK, CA

SAMPLE LOCATION MAP

20957 Baker Road
Castro Valley, California

FIGURE 3
PROJECT No. 8131

ALAMEDA COUNTY
DEPARTMENT OF ENVIRONMENTAL HEALTH
1131 HARBOR BAY PARKWAY
ALAMEDA, CA 94502-6577
PHONE (510) 567-6700

ACCEPTED

Underground Storage Tank Closure Permit Application
Alameda County Division of Hazardous Materials
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

These closure/removal plans have been received and found to be acceptable and essentially meet the requirements of State and Local Hazardous Materials Laws. Changes to your closure plans indicated by this Department are to assure compliance with State and local laws. The project proposed herein is now released for issuance of any required building permits for construction/demolition.

One copy of the accepted plans must be on the job and available to all contractors and craftsmen involved with the removal.

Any changes or alterations of these plans and specifications must be submitted to this Department and to the Fire and Building Inspection Departments to determine if such changes meet the requirements of State and local laws. Notify this Department at least 72 hours prior to the following required inspections:

✓ Removal of Tank(s) and Piping
✓ Sampling
✓ Final Inspection

Issuance of a) permit to operate, b) permanent site closure, is dependent on compliance with accepted plans and all applicable laws and regulations.

THERE IS A FINANCIAL PENALTY FOR NOT OBTAINING THESE INSPECTIONS.

Contact Specialist:

Robert Weston

Accepted February 25, 2004
Note: Site Safety Plan required to be on site

UNDERGROUND STORAGE TANK CLOSURE PLAN

***** Complete closure plan according to instructions *****

1. Name of Business ______
   Business Owner or Contact Person **(PRINT)** Mr. Nat Piazza
2. Site Address 20957 Baker Road
   City, State Castro Valley, CA Zip 94546 Phone ______
3. Mailing Address 7613 Peppertree Rd.
   City, State Dublin, Ca Zip 94568 Phone 925-828-1577
4. Property Owner Mr. Nat Piazza
   Business Name (if applicable) ______
   Address 7613 Peppertree Rd
   City, State Dublin CA Zip 94568 Phone 925-~~888~~-1577
5. Generator name under which tank will be manifested
   Mr. NAT PIAZZA
   EPA I.D. No. under which tank(s) will be manifested C A C 0 0 2 5 7 4 5 2 0

02-19-2004

Rev 09/17/03 RW
N:\LOP-CUPA-TEAMS\CUPA\UST

SR0005716

6. Contractor AEI Consultants

Address 2500 Camino Diablo, Suite 200

City, State Walnut Creek Zip 94597 Phone 925-283-6000

License Type A/HAZ ID# 654919

7. Consultant (if applicable) Same as Contractor

Address

City, State Zip Phone

8. Main Contact Person for Investigation (if applicable)

Name PETER HOVERSEN Title PROJECT MANAGER

Company AEI CONSULTANTS

Phone 925 283-6000

9. Number of underground tanks being closed with this plan 2

Length of piping being removed under this plan UNKNOWN

Total number underground tanks at this facility (**confirmed with owner or operator) 2

10. State Registered Hazardous Waste Transporters/Facilities (See Instructions).

a) Product/Residual Sludge/Rinsate Transporter

Name Excel Environmental EPA I.D. No. CAL 000170148

Hauler License No. 3662 License Exp. Date

Address 1141 Catalina Drive

City, State Livermore, CA Zip 94550

b) Product/Residual Sludge/Rinsate Disposal Site

Name Alviso Independent Oil EPA I.D. No. CAL 00161743

Address 5002 Archer St.

City, State Alviso, CA Zip 95002

c) Tank and Piping Transporter

Name Ecology Control Industries EPA I.D. No. CAD009466392

Hauler License No. 1533 License Exp. Date ________

Address 255 Parr Blvd.

City, State Richmond, CA Zip 94801

d) Tank and Piping Disposal Site

Name Same as Tank Transporter EPA I.D. No. ________

Address ________

City, State ________ Zip ________

11. Sample Collector

Name Peter Hoversen

Company AEI Consultants

Address 2500 Camino Diablo, Suite 200

City, State Walnut Creek, CA Zip 94597 Phone 925 283-6000

12. Laboratory

Name McCampbell Analytical

Company ________

Address 110 2nd Avenue South #D7

City, State Pacheco, CA Zip 94553

State Certification No. 1644

13. Have tank(s) or piping leaked in the past? Yes [ ] No [ ] Unknown [X]

If yes, describe: ________

14. Describe method(s) to be used for rendering tank(s) inert:

DRY ICE

Before tank(s) are pumped out and inerted, all associated piping must be flushed back into the tank(s). All accessible piping must then be removed. Inaccessible piping must be permanently plugged using grout.

The Bay Area Air Quality Management District, (415) 771-6000, along with local Fire and Building Departments, must also be contacted for tank removal permits. Fire departments typically require the use of a combustible gas indicator to verity tank inertness. **It is the contractor's responsibility to have a functional combustible gas indicator on-site to verity that the tank(s) is inerted.**

15. Tank History and Sampling Information ***(**See Instructions**)***

Tank			
Capacity (gallons)	Use History include date last used (estimated)	Material to be sampled (tank contents, soil, groundwater)	Location and Depth of Sample(s)
500	UNKNOWN	soil	2 feet beneath the bottom of each tank

One soil sample must be collected for every 20 linear feet of underground piping that is removed. A groundwater sample must be collected if any groundwater is present in the excavation.

Excavated/Stockpiled Soil	
Stockpiled Soil Volume (estimated)	Sampling Plan
	4 point composite sample

Stockpiled soil must be placed on bermed plastic and must be completely covered by plastic sheeting.

Will the excavated soil be returned to the excavation immediately after tank removal? ☐ yes ☐ no ☒ unknown

If yes, explain reasoning ____________________

____

If unknown at this point in time, please be aware that **excavated soil may not be returned to the excavation without <u>prior</u> approval from this office. This means that the contractor, consultant, or responsible party must communicate with the Specialist IN ADVANCE of backfilling activities.**

RECOMMENDED MINIMUM VERIFICATION ANALYSES FOR UNDERGROUND TANK LEAKS

For Use by Unidocs Member Agencies or where approved by your Local Jurisdiction

TABLE #2

REVISED 1 MARCH 1999

HYDROCARBON LEAK	**SOIL ANALYSIS** (SW-846 METHOD)		**WATER ANALYSIS** (Water/Waste Water Method)	
Gasoline (Leaded and Unleaded)	TPHG	8015M or 8260	TPHG	8015M or 524.2/624 (8260)
	BTEX	8260	BTEX	524.2/624 (8260)
	EDB and EDC	8260	EDB and EDC	524.2/624 (8260)
	MTBE, TAME, ETBE, DIPE, and TBA by 8260 for soil and 524.2/624 (8260) for water			
	TOTAL LEAD	AA	TOTAL LEAD	AA
		-- Optional --		
	Organic Lead	DHS-LUFT	Organic Lead	DHS-LUFT
Unknown Fuel	TPHG	8015M or 8260	TPHG	8015M or 524.2/624 (8260)
	TPHD	8015M or 8260	TPHD	8015M or 524.2/624 (8260)
	BTEX	8260	BTEX	524.2/624 (8260)
	EDB and EDC	8260	EDB and EDC	524.2/624 (8260)
	MTBE, TAME, ETBE, DIPE, and TBA by 8260 for soil and 524.2/624 (8260) for water			
	TOTAL LEAD	AA	TOTAL LEAD	AA
		-- Optional --		
	Organic Lead	DHS-LUFT	Organic Lead	DHS-LUFT
Diesel, Jet Fuel, Kerosene, and Fuel/Heating Oil	TPHD	8015M or 8260	TPHD	8015M or 524.2/624 (8260)
	BTEX	8260	BTEX	524.2/624 (8260)
	EDB and EDC	8260	EDB and EDC	524.2/624 (8260)
	MTBE, TAME, ETBE, DIPE, and TBA by 8260 for soil and 524.2-624 (8260) for water			
Chlorinated Solvents	CL HC	8260	CL HC	524.2/624 (8260)
	BTEX	8060 or 8021	BTEX	524.2/624 (8260) or 524.2/602 (8021)
Non-chlorinated Solvents	TPHD	8015M or 8260	TPHD	8015M or 524.2/624 (8260)
	BTEX	8060 or 8021	BTEX	524.2/624 (8260) or 524.2/602 (8021)
Waste, Used, or Unknown Oil	TPHG	8015M or 8260	TPHG	8015M or 524.2/624 (8260)
	TPHD	8015M or 8260	TPHD	8015M or 524.2/624 (8260)
	O&G	9070	O&G	418.1
	BTEX	8260	BTEX	524.2/624 (8260)
	CL HC	8260	CL HC	524.2/624 (8260)
	EDB and EDC	8260	EDB and EDC	524.2/624 (8260)
	MTBE, TAME, ETBE, DIPE, and TBA by 8260 for soil and 524.2/624 (8260) for water			
	METALS (Cd, Cr, Pb, Ni, Zn) by ICAP or AA for soil and water			
	PCB*, PCP*, PNA, CREOSOTE by 8270 for soil and 524/625 (8270) for water			
	* If found, analyze for dibenzofurans (PCBs) or dioxins (PCP)			

NOTES:

1. 8021 replaces old methods 8020 and 8010
2. 8260 replaces old method 8240
3. Reference: Table B-1 in Appendix B of "Expedited Site Assessment Tools for Underground Storage Tank Sites: A Guide for Regulators" (EPA 510-B-97-001)

16. Chemical methods and associated detection limits to be used for analyzing sample(s):

The Tri-Regional Board recommended minimum verification analyses and practical quantitation reporting limits shall be followed.

See Table 2, Recommended Minimum Verification Analyses for Underground Tank Leaks.

Contaminant Sought	EPA or Other Sample Preparation Method Number	EPA or Other Analysis Method Number	Method Detection Limit
TPH (g)			1.0 mg/kg
TPH (d)			1.0 mg/kg
BTEX			5.0 mg/kg
MTBE			5.0 mg/kg
Total lead			

17. Submit Site Health and Safety Plan (See Instructions)

18. Submit Worker's Compensation Certificate copy

Name of Insurer State Compensation Insurance Fund

19. Submit Plot Plan *****(See Instructions)*****

20. Enclose Deposit (See Instructions)

21. **Report all leaks or contamination to this office within 5 days of discovery.** The written report shall be made on an Underground Storage Tank Unauthorized Leak/Contamination Site Report (URL) form.

22. **Submit a closure report to this office within 60 days of the tank removal. The closure report must contain all information listed in item 22 of the instructions.**

23. Submit State (Underground Storage Tank Permit Application) Forms A and B (one-B form for each UST to be removed) (mark box 8 for "tank removed" in the upper right hand corner).

I declare that to the best of my knowledge and belief that the statements and information provided above are correct and true.

I understand that information, in addition to that provided above, may be needed in order to obtain approval from the Environmental Protection Division and that no work is to begin on this project until this plan has been approved.

I understand that any changes in design, materials, or equipment will void this plan if prior approval is not obtained.

I understand that all work performed during this project will be done in compliance with all applicable OSHA (Occupational Safety and Health Administration) requirements concerning personnel health and safety. I understand that site and worker safety are solely the responsibility of the property owner or his agent and that this responsibility is not shared nor assumed by the County of Alameda.

Once I have received my stamped, accepted closure plan, I will contact the project Hazardous Materials Specialist at least three working days in advance of site work to schedule the required inspections.

CONTRACTOR INFORMATION

Name of Business AEI Consultants

Name of Individual PETER HOVERSEN

Signature Date 2/18/04

☒ PROPERTY OWNER OR ☐ MOST RECENT TANK OPERATOR (Check one)

Name of Business

Name of Individual Mr. Nat Piazza

Signature Agent for Owner Date

UNIFIED PROGRAM CONSOLIDATED FORM

TANKS

UNDERGROUND STORAGE TANKS - FACILITY

(one page per site) Page 1 of 1

TYPE OF ACTION (Check one item only)
☐ 1. NEW SITE PERMIT
☐ 3. RENEWAL PERMIT
☐ 4 AMENDED PERMIT
☐ 5.CHANGE OF INFORMATION specify change local use only ______________
☐ 6.TEMPORARY SITE CLOSURE
☐ 7.PERMANENTLY CLOSED SITE
☑ 8. TANK REMOVED
400

I. FACILITY / SITE INFORMATION

BUSINESS NAME (Same as FACILITY NAME or DBA – Doing Business As) 3: 20957 Baker Road, Castro Valley CA

FACILITY ID#:

NEAREST CROSS STREET 401: Castro Valley Blvd.

BUSINESS TYPE: ☐ 1. GAS STATION ☐ 3. FARM ☑ 5. COMMERCIAL ☐ 2. DISTRIBUTOR ☐ 4. PROCESSOR ☐ 6. OTHER 403

FACILITY OWNER TYPE: ☐ 1. CORPORATION ☒ 2. INDIVIDUAL ☐ 3 PARTNERSHIP ☐ 4. LOCAL AGENCY/DISTRICT* ☐ 5. COUNTY AGENCY* ☐ 6 STATE AGENCY* ☐ 7. FEDERAL AGENCY* 402

TOTAL NUMBER OF TANKS REMAINING AT SITE: 0 404

Is facility on Indian Reservation or trustlands? ☐ Yes ☒ No 405

*If owner of UST is a public agency: name of supervisor of division, section or office which operates the UST (This is the contact person for the tank records.) 406

II. PROPERTY OWNER INFORMATION

PROPERTY OWNER NAME 407: Mr. Nat Piazza

PHONE 408: 925 828-1577

MAILING OR STREET ADDRESS 409: 7613 Peppertree Rd.

CITY 410: Dublin

STATE 411: CA

ZIP CODE 412: 94568

PROPERTY OWNER TYPE: ☐ 1. CORPORATION ☒ 2. INDIVIDUAL ☐ 3. PARTNERSHIP ☐ 4. LOCAL AGENCY / DISTRICT ☐ 5. COUNTY AGENCY ☐ 6. STATE AGENCY ☐ 7. FEDERAL AGENCY 413

III. TANK OWNER INFORMATION

TANK OWNER NAME 414: SAME AS PROPERTY OWNER

PHONE 415:

MAILING OR STREET ADDRESS 416:

CITY 417:

STATE 418:

ZIP CODE 419:

TANK OWNER TYPE: ☐ 1. CORPORATION ☒ 2. INDIVIDUAL ☐ 3. PARTNERSHIP ☐ 4. LOCAL AGENCY / DISTRICT ☐ 5. COUNTY AGENCY ☐ 6. STATE AGENCY ☐ 7. FEDERAL AGENCY 420

IV. BOARD OF EQUALIZATION UST STORAGE FEE ACCOUNT NUMBER

TY (TK) HQ 44- Call (916) 322-9669 if questions arise 421

V. PETROLEUM UST FINANCIAL RESPONSIBILITY

INDICATE METHOD(s):
☐ 1. SELF-INSURED
☐ 2. GUARANTEE
☐ 3. INSURANCE
☐ 4. SURETY BOND
☐ 5. LETTER OF CREDIT
☐ 6. EXEMPTION
☐ 7. STATE FUND
☐ 8. STATE FUND & CFO LETTER
☐ 9. STATE FUND & CD
☐ 10. LOCAL GOVT MECHANISM
☐ 99. OTHER:
422

VI. LEGAL NOTIFICATION AND MAILING ADDRESS

Check one box to indicate which address should be used for legal notifications and mailing. Legal notifications and mailings will be sent to the tank owner unless box 1 or 2 is checked. ☐ 1. FACILITY ☐ 2. PROPERTY OWNER ☐ 3. TANK OWNER 423

VII. APPLICANT SIGNATURE

Certification: I certify that the information provided herein is true and accurate to the best of my knowledge.

SIGNATURE OF APPLICANT: Agent for Owner

DATE 424: 2/18/04

PHONE 425: 925 283 6000

NAME OF APPLICANT (print) 426: PETER HOVOKSEN - AEI

TITLE OF APPLICANT 427: PROJECT MANAGER

STATE UST FACILITY NUMBER (For local use only) 428:

1998 UPGRADE CERTIFICATE NUMBER (For local use only) 429:

UNIFIED PROGRAM CONSOLIDATED FORM

TANKS

UNDERGROUND STORAGE TANKS – TANK PAGE 1

(two pages per tank)

Page 1 of 2

TYPE OF ACTION (Check one item only) ☐ 1 NEW SITE PERMIT ☐ 3 RENEWAL PERMIT ☐ 4 AMENDED PERMIT ☐ 5 CHANGE OF INFORMATION ☐ 6 TEMPORARY SITE CLOSURE ☐ 7 PERMANENTLY CLOSED ON SITE ☒ 8 TANK REMOVED 430

(Specify reason – for local use only) (Specify reason – for local use only)

BUSINESS NAME (Same as FACILITY NAME or DBA – Doing Business As) 20957 BAKER RD. Castro Valley CA 3

FACILITY ID 1

LOCATION WITHIN SITE (Optional) 431

I. TANK DESCRIPTION (A scaled plot plan with the location of the UST system including buildings and landmarks shall be submitted to the local agency.)

TANK ID # 432 1

TANK MANUFACTURER 433 UNKNOWN

COMPARTMENTALIZED TANK ☐ Yes ☒ No 434 If "Yes", complete one page for each compartment.

DATE INSTALLED (YEAR/MO) 435 UNKNOWN

TANK CAPACITY IN GALLONS 436 500

NUMBER OF COMPARTMENTS 437 N/A

ADDITIONAL DESCRIPTION (For local use only) 438

II. TANK CONTENTS

TANK USE 439
☒ 1. MOTOR VEHICLE FUEL (If marked complete Petroleum Type)
☐ 2. NON-FUEL PETROLEUM
☐ 3. CHEMICAL PRODUCT
☐ 4. HAZARDOUS WASTE (Includes Used Oil)
☐ 95. UNKNOWN

PETROLEUM TYPE 440
☒ 1a. REGULAR UNLEADED ☐ 1b. PREMIUM UNLEADED ☐ 1c. MIDGRADE UNLEADED
☐ 2. LEADED ☐ 3. DIESEL ☐ 4. GASOHOL
☐ 5. JET FUEL ☐ 6. AVIATION FUEL ☐ 99. OTHER

COMMON NAME (from Hazardous Materials Inventory page) 441 Gasoline

CAS# (from Hazardous Materials Inventory page) 442

III. TANK CONSTRUCTION

TYPE OF TANK (Check one item only) ☒ 1. SINGLE WALL ☐ 2. DOUBLE WALL ☐ 3. SINGLE WALL WITH EXTERIOR MEMBRANE LINER ☐ 4. SIGNLE WALL IN VAULT ☐ 5. SINGLE WALL WITH INTERNAL BLADDER SYSTEM ☐ 95. UNKNOWN ☐ 99. OTHER 443

TANK MATERIAL – primary tank (Check one item only) ☐ 1. BARE STEEL ☐ 2. STAINLESS STEEL ☐ 3. FIBERGLASS / PLASTIC ☐ 4. STEEL CLAD W/FIBERGLASS REINFORCED PLASTIC (FRP) ☐ 5 CONCRETE ☐ 8. FRP COMPTIBLE W/100% METHANOL ☒ 95. UNKNOWN ☐ 99. OTHER 444

TANK MATERIAL – secondary tank (Check one item only) ☐ 1. BARE STEEL ☐ 2. STAINLESS STEEL ☐ 3. FIBERGLASS / PLASTIC ☐ 4. STEEL CLAD W/FIBERGLASS REINFORCED PLASTIC (FRP) ☐ 5. CONCRETE ☐ 5. CONCRETE ☐ 8. FRP COMPTIBLE W/100% METHANOL ☐ 10. COATED STEEL ☒ 95. UNKNOWN ☐ 99 OTHER 445

TANK INTERIOR LINING OR COATING (Check one item only) ☐ 1. RUBBER LINED ☐ 2 ALKYD LINING ☐ 3. EPOXY LINING ☐ 4 PHENOLIC LINING ☐ 5. GLASS LINING ☐ 6 UNLINED ☒ 95. UNKNOWN ☐ 99 OTHER 446

DATE INSTALLED 447 (For local use only)

OTHER CORROSION PROTECTION IF APPLICABLE (Check one item only) ☐ 1 MANUFACTURED CATHODIC PROTECTION ☐ 2 SACRIFICIAL ANODE ☐ 3 FIBERGLASS REINFORCED PLASTIC ☐ 4 IMPRESSED CURRENT ☒ 95 UNKNOWN ☐ 99 OTHER 448

DATE INSTALLED 449 (For local use only)

SPILL AND OVERFILL (Check all that apply) YEAR INSTALLED 450 TYPE (local use only) 451
☐ 1 SPILL CONTAINMENT
☐ 2 DROP TUBE
☐ 3 STRIKER PLATE

OVERFILL PROTECTION EQUIPMENT: YEAR INSTALLED 452
☐ 1 ALARM ☐ 2 BALL FLOAT ☐ 3 FILL TUBE SHUT OFF VALVE ☒ 4 EXEMPT

IV. TANK LEAK DETECTION (A description of the monitoring program shall be submitted to the local agency.)

IF SINGLE WALL TANK (Check all that apply) 453
☐ 1 VISUAL (EXPOSED PORTION ONLY)
☐ 2 AUTOMATIC TANK GAUGING (ATG)
☐ 3 CONTINUOUS ATG
☐ 4 STATISTICAL INVENTORY RECONCILIATION (SIR) BIENNIAL TANK TESTING
☒ 5 MANUAL TANK GAUGING (MTG)
☐ 6 VADOSE ZONE
☐ 7 GROUNDWATER
☐ 8 TANK TESTING
☐ 99 OTHER

IF DOUBLE WALL TANK OR TANK WITH BLADDER (Check one item only) 454
☐ 1 VISUAL (SINGLE WALL IN VAULT ONLY)
☐ 2 CONTINUOUS INTERSTITIAL MONITORING
☐ 3 MANUAL MONITORING

IV. TANK CLOSURE INFORMATION / PERMANENT CLOSURE IN PLACE

ESTIMATED DATE LAST USED (YR/MO/DAY) 455 UNKNOWN

ESTIMATED QUANTITY OF SUBSTANCE REMAINING 456 UNKNOWN gallons

TANK FILLED WITH INERT MATERIAL? 457 ☐ Yes ☐ No

UNIFIED PROGRAM CONSOLIDATED FORM

TANKS

UNDERGROUND STORAGE TANKS – TANK PAGE 2

VI. PIPING CONSTRUCTION (Check all that apply)

Page 2 of 2

UNDERGROUND PIPING

SYSTEM TYPE ☐ 1. PRESSURE ☐ 2. SUCTION ☐ 3. GRAVITY 458

CONSTRUCTION ☐ 1. SINGLE WALL ☐ 3. LINED TRENCH ☐ 99. OTHER 460

MANUFACTURER ☐ 2. DOUBLE WALL ☒ 95. UNKNOWN

MANUFACTURER 461

☐ 1. BARE STEEL
☐ 2. STAINLESS STEEL
☐ 3. PLASTIC COMPATIBLE W/ CONTENTS
☐ 4. FIBERGLASS
☐ 5. STEEL W/COATING
☐ 6. FRP COMPATIBLE W/100% METHANOL
☐ 7. GALVANIZED STEEL
☐ 8. FLEXIBLE (HDPE)
☐ 9. CATHODIC PROTECTION 464
☒ Unknown
☐ 99. Other

ABOVEGROUND PIPING

☐ 1. PRESSURE ☐ 2. SUCTION ☐ 3. GRAVITY 459

☐ 1. SINGLE WALL ☒ 95. UNKNOWN 462

☐ 2. DOUBLE WALL ☐ 99. OTHER

MANUFACTURER 463

☐ 1. BARE STEEL
☐ 2. STAINLESS STEEL
☐ 3. PLASTIC COMPATIBLE W/ CONTENTS
☐ 4. FIBERGLASS
☐ 5. STEEL W/COATING
☐ 6. FRP COMPATIBLE W/100% METHANOL
☐ 7. GALVANIZED STEEL
☐ 8. FLEXIBLE (HDPE) ☐ 99. OTHER
☐ 9. CATHODIC PROTECTION
☒ 95. UNKNOWN 465

VII. PIPING LEAK DETECTION (Check all that apply) (A description of the monitoring program shall be submitted to the local agency.)

UNDERGROUND PIPING

SINGLE WALL PIPING 466

PRESSURIZED PIPING (Check all that apply):

☐ 1. ELECTRONIC LINE LEAK DETECTOR 3.0 GPH TEST WITH AUTO PUMP SHUT OFF FOR LEAK, SYSTEM FAILURE, AND SYSTEM DISCONNECTION + AUDIBLE AND VISUAL ALARMS.

☐ 2. MONTHLY 0.2 GPH TEST

☐ 3. ANNUAL INTEGRITY TEST (0.1GPH)

CONVENTIONAL SUCTION SYSTEMS

☐ 5. DAILY VISUAL MONITORING OF PUMPING SYSTEM + TRIENNIAL PIPING INTEGRITY TEST (0.1 GPH)

SAFE SUCTION SYSTEMS (NO VALUES IN BELOW GROUNDPIPING):

☐ 7. SELF MONITORING

GRAVITY FLOW

☐ 9. BIENNIAL INTEGRITY TEST (0.1 GPH)

SECONDARILY CONTAINED PIPING

PRESSURIZED PIPING (Check all that apply):

10. CONTINUOUS TURBINE SUMP SENSOR WITH AUDIBLE AND VISUAL ALARMS AND (Check one)
    - ☐ a. AUTO PUMP SHUT OFF WHEN A LEAK OCCURS
    - ☐ b. AUTO PUMP SHUT OFF FOR LEAKS, SYSTEM FAILURE AND SYSTEM DISCONNECTION
    - ☐ c. NO AUTO PUMP SHUT OFF

☐ 11. AUTOMATIC LINE LEAK DETECTOR (3.0 GPH TEST) WITH FLOW SHUT OFF OR RESTRICTION

☐ 12. ANNUAL INTEGRITY TEST (0.1 GPH)

SUCTION/GRAVITY SYSTEM

☐ 13. CONTINUOUS SUMP SENSOR + AUDIBLE AND VISUAL ALARMS

EMERGENCY GENERATORS ONLY (Check all that apply)

☐ 14. CONTINUOUS SUMP SENSOR WITHOUT AUTO PUMP SHUT OFF + AUDIBLE AND VISUAL ALARMS

☐ 15. AUTOMATIC LINE LEAK DETECTOR (3.0 GPH TEST) WITHOUT FLOW SHUT OFF OR RESTRICTION

☐ 16. ANNUAL INTEGRITY TEST (0.1 GPH)

☐ 17. DAILY VISUAL CHECK

ABOVEGROUND PIPING

SINGLE WALL PIPING 467

PRESSURIZED PIPING (Check all that apply):

☐ 1. ELECTRONIC LINE LEAK DETECTOR 3.0 GPH TEST WITH AUTO PUMP SHUT OFF FOR LEAK, SYSTEM FAILURE, AND SYSTEM DISCONNECTION + AUDIBLE AND VISUAL ALARMS.

☐ 2. MONTHLY 0.2 GPH TEST

☐ 3. ANNUAL INTEGRITY TEST (0.1GPH)

☐ 4. DAILY VISUAL CHECK

CONVENTIONAL SUCTION SYSTEMS (Check all that apply)

☐ 5. DAILY VISUAL MONITORING OF PIPING AND PUMPING SYSTEM

☐ 6. TRIENNIAL INTEGRITY TEST (0.1 GPH)

SAFE SUCTION SYSTEMS (NO VALVES IN BELOW GROUND PIPING):

☐ 7. SELF MONITORING

GRAVITY FLOW (Check all that apply):

☐ 8. DAILY VISUAL MONITORING

☐ 9. BIENNIAL INTEGRITY TEST (0.1 GPH)

SECONDARILY CONTAINED PIPING

PRESSURIZED PIPING (Check all that apply):

10. CONTINUOUS TURBINE SUMP SENSOR WITH AUDIBLE AND VISUAL ALARMS AND (Check one)
    - ☐ a. AUTO PUMP SHUT OFF WHEN A LEAK OCCURS
    - ☐ b. AUTO PUMP SHUT OFF FOR LEAKS, SYSTEM FAILURE AND SYSTEM DISCONNECTION
    - ☐ c. NO AUTO PUMP SHUT OFF

☐ 11. AUTOMATIC LEAK DETECTOR

☐ 12. ANNUAL INTEGRITY TEST (0.1 GPH)

SUCTION/GRAVITY SYSTEM

☐ 13. CONTINUOUS SUMP SENSOR + AUDIBLE AND VISUAL ALARMS

EMERGENCY GENERATORS ONLY (Check all that apply)

☐ 14. CONTINUOUS SUMP SENSOR WITHOUT AUTO PUMP SHUT OFF + AUDIBLE AND VISUAL ALARMS

☐ 15. AUTOMATIC LINE LEAK DETECTOR (3.0 GPH TEST)

☐ 16. ANNUAL INTEGRITY TEST (0.1 GPH)

☐ 17. DAILY VISUAL CHECK

VIII. DISPENSER CONTAINMENT

DISPENSER CONTAINMENT

DATE INSTALLED 468

☐ 1. FLOAT MECHANISM THAT SHUTS OFF SHEAR VALVE

☐ 2. CONTINUOUS DISPENSER PAN SENSOR + AUDIBLE AND VISUAL ALARMS

☐ 3. CONTINUOUS DISPENSER PAN SENSOR WITH AUTO SHUT OFF FOR DISPENSER + AUDIBLE AND VISUAL ALARMS

☐ 4. DAILY VISUAL CHECK

☐ 5. TRENCH LINER / MONITORING

☒ 6. NONE 469

IX. OWNER/OPERATOR SIGNATURE

I certify that the information provided herein is true and accurate to the best of my knowledge.

SIGNATURE OF OWNER/OPERATOR Agent for Owner

DATE 2/18/04 470

NAME OF OWNER/OPERATOR (print) PETER HOVERSON – AEI 471

TITLE OF OWNER/OPERATOR PROJECT MANAGER 472

Permit Number (For local use only) 473

Permit Approved (For local use only) 474

Permit Expiration Date (For local use only) 475

UNIFIED PROGRAM CONSOLIDATED FORM

TANKS

UNDERGROUND STORAGE TANKS – TANK PAGE 1

(two pages per tank)

Page 1 of 2

TYPE OF ACTION (Check one item only)
☐ 1 NEW SITE PERMIT
☐ 3 RENEWAL PERMIT
☐ 4 AMENDED PERMIT ______ (Specify reason – for local use only)
☐ 5 CHANGE OF INFORMATION ______ (Specify reason – for local use only)
☐ 6 TEMPORARY SITE CLOSURE
☐ 7 PERMANENTLY CLOSED ON SITE
☒ 8 TANK REMOVED
430

BUSINESS NAME (Same as FACILITY NAME or DBA – Doing Business As) 1: 20957 BAKER RD. Castro Valley CA

FACILITY ID:

LOCATION WITHIN SITE (Optional) 431:

I. TANK DESCRIPTION (A scaled plot plan with the location of the UST system including buildings and landmarks shall be submitted to the local agency.)

TANK ID # 432:

TANK MANUFACTURER 433: UNKNOWN

COMPARTMENTALIZED TANK ☐ Yes ☒ No 434
If "Yes", complete one page for each compartment.

DATE INSTALLED (YEAR/MO) 435: UNKNOWN

TANK CAPACITY IN GALLONS 436: 500

NUMBER OF COMPARTMENTS 437: N/A

ADDITIONAL DESCRIPTION (For local use only) 438:

II. TANK CONTENTS

TANK USE 439
☒ 1 MOTOR VEHICLE FUEL
(If marked complete Petroleum Type)
☒ 2. NON-FUEL PETROLEUM
☐ 3. CHEMICAL PRODUCT
☐ 4. HAZARDOUS WASTE
(Includes Used Oil)
☐ 95. UNKNOWN

PETROLEUM TYPE 440
☐ 1a. REGULAR UNLEADED
☐ 1b. PREMIUM UNLEADED
☐ 1c. MIDGRADE UNLEADED
☐ 2. LEADED
☒ 3. DIESEL
☐ 4. GASOHOL
☐ 5. JET FUEL
☐ 6 AVIATION FUEL
☐ 99. OTHER

COMMON NAME (from Hazardous Materials Inventory page) 441:

CAS# (from Hazardous Materials Inventory page) 442:

III. TANK CONSTRUCTION

TYPE OF TANK (Check one item only) 443
☒ 1. SINGLE WALL
☐ 2. DOUBLE WALL
☐ 3. SINGLE WALL WITH EXTERIOR MEMBRANE LINER
☐ 4. SIGNLE WALL IN VAULT
☐ 5. SINGLE WALL WITH INTERNAL BLADDER SYSTEM
☐ 95. UNKNOWN
☐ 99 OTHER

TANK MATERIAL – primary tank (Check one item only) 444
☐ 1. BARE STEEL
☐ 2. STAINLESS STEEL
☐ 3. FIBERGLASS / PLASTIC
☐ 4. STEEL CLAD W/FIBERGLASS REINFORCED PLASTIC (FRP)
☐ 5. CONCRETE
☐ 8. FRP COMPTIBLE W/100% METHANOL
☒ 95 UNKNOWN
☐ 99. OTHER

TANK MATERIAL – secondary tank (Check one item only) 445
☐ 1. BARE STEEL
☐ 2. STAINLESS STEEL
☐ 3. FIBERGLASS / PLASTIC
☐ 4. STEEL CLAD W/FIBERGLASS REINFORCED PLASTIC (FRP)
☐ 5. CONCRETE
☐ 5. CONCRETE
☐ 8. FRP COMPTIBLE W/100% METHANOL
☐ 10. COATED STEEL
☒ 95. UNKNOWN
☐ 99. OTHER

TANK INTERIOR LINING OR COATING (Check one item only) 446
☐ 1. RUBBER LINED
☐ 2 ALKYD LINING
☐ 3. EPOXY LINING
☐ 4 PHENOLIC LINING
☐ 5. GLASS LINING
☐ 6 UNLINED
☒ 95. UNKNOWN
☐ 99 OTHER

DATE INSTALLED 447: ______ (For local use only)

OTHER CORROSION PROTECTION IF APPLICABLE (Check one item only) 448
☐ 1 MANUFACTURED CATHODIC PROTECTION
☐ 2 SACRIFICIAL ANODE
☐ 3 FIBERGLASS REINFORCED PLASTIC
☐ 4 IMPRESSED CURRENT
☒ 95 UNKNOWN
☐ 99 OTHER

DATE INSTALLED 449: ______ (For local use only)

SPILL AND OVERFILL (Check all that apply) YEAR INSTALLED 450 TYPE (local use only) 451
☐ 1 SPILL CONTAINMENT
☐ 2 DROP TUBE
☐ 3 STRIKER PLATE

OVERFILL PROTECTION EQUIPMENT: YEAR INSTALLED 452
☐ 1 ALARM
☐ 2 BALL FLOAT
☐ 3 FILL TUBE SHUT OFF VALVE
☒ 4 EXEMPT

IV. TANK LEAK DETECTION (A description of the monitoring program shall be submitted to the local agency.)

IF SINGLE WALL TANK (Check all that apply) 453
☐ 1 VISUAL (EXPOSED PORTION ONLY)
☐ 2 AUTOMATIC TANK GAUGING (ATG)
☐ 3 CONTINUOUS ATG
☐ 4 STATISTICAL INVENTORY RECONCILIATION (SIR) BIENNIAL TANK TESTING
☒ 5 MANUAL TANK GAUGING (MTG)
☐ 6 VADOSE ZONE
☐ 7 GROUNDWATER
☐ 8 TANK TESTING
☐ 99 OTHER

IF DOUBLE WALL TANK OR TANK WITH BLADDER (Check one item only) 454
☐ 1 VISUAL (SINGLE WALL IN VAULT ONLY)
☐ 2 CONTINUOUS INTERSTITIAL MONITORING
☐ 3 MANUAL MONITORING

IV. TANK CLOSURE INFORMATION / PERMANENT CLOSURE IN PLACE

ESTIMATED DATE LAST USED (YR/MO/DAY) 455: UNKNOWN

ESTIMATED QUANTITY OF SUBSTANCE REMAINING 456: UNKNOWN gallons

TANK FILLED WITH INERT MATERIAL? 457 ☐ Yes ☐ No

UNIFIED PROGRAM CONSOLIDATED FORM

TANKS

UNDERGROUND STORAGE TANKS – TANK PAGE 2

Page 2 of 2

VI. PIPING CONSTRUCTION (Check all that apply)

UNDERGROUND PIPING

SYSTEM TYPE ☐ 1. PRESSURE ☐ 2. SUCTION ☐ 3. GRAVITY 458

CONSTRUCTION ☐ 1. SINGLE WALL ☐ 3. LINED TRENCH ☐ 99. OTHER 460

MANUFACTURER ☐ 2 DOUBLE WALL ☒ 95. UNKNOWN

MANUFACTURER 461

☐ 1. BARE STEEL ☐ 6. FRP COMPATIBLE w/100% METHANOL

☐ 2. STAINLESS STEEL ☐ 7. GALVANIZED STEEL ☒ Unknown

☐ 3. PLASTIC COMPATIBLE W/ CONTENTS ☐ 99. Other

☐ 4. FIBERGLASS ☐ 8 FLEXIBLE (HDPE)

☐ 5. STEEL W/COATING ☐ 9. CATHODIC PROTECTION 464

ABOVEGROUND PIPING

☐ 1. PRESSURE ☐ 2. SUCTION ☐ 3. GRAVITY 459

☐ 1. SINGLE WALL ☒ 95. UNKNOWN 462

☐ 2. DOUBLE WALL ☐ 99. OTHER

MANUFACTURER 463

☐ 1. BARE STEEL ☐ 6. FRP COMPATIBLE W/100% METHANOL

☐ 2. STAINLESS STEEL ☐ 7. GALVANIZED STEEL

☐ 3. PLASTIC COMPATIBLE W/ CONTENTS ☐ 8. FLEXIBLE (HDPE) ☐ 99. OTHER

☐ 4. FIBERGLASS ☐ 9. CATHODIC PROTECTION

☐ 5 STEEL W/COATING ☒ 95. UNKNOWN 465

VII. PIPING LEAK DETECTION (Check all that apply) (A description of the monitoring program shall be submitted to the local agency.)

UNDERGROUND PIPING

SINGLE WALL PIPING 466

PRESSURIZED PIPING (Check all that apply):

☐ 1. ELECTRONIC LINE LEAK DETECTOR 3.0 GPH TEST WITH AUTO PUMP SHUT OFF FOR LEAK, SYSTEM FAILURE, AND SYSTEM DISCONNECTION + AUDIBLE AND VISUAL ALARMS.

☐ 2. MONTHLY 0.2 GPH TEST

☐ 3. ANNUAL INTEGRITY TEST (0.1GPH)

CONVENTIONAL SUCTION SYSTEMS

☐ 5. DAILY VISUAL MONITORING OF PUMPING SYSTEM + TRIENNIAL PIPING INTEGRITY TEST (0.1 GPH)

SAFE SUCTION SYSTEMS (NO VALUES IN BELOW GROUNDPIPING):

☐ 7. SELF MONITORING

GRAVITY FLOW

☐ 9. BIENNIAL INTEGRITY TEST (0.1 GPH)

SECONDARILY CONTAINED PIPING

PRESSURIZED PIPING (Check all that apply):

10. CONTINUOUS TURBINE SUMP SENSOR WITH AUDIBLE AND VISUAL ALARMS AND (Check one)
    - ☐ a. AUTO PUMP SHUT OFF WHEN A LEAK OCCURS
    - ☐ b. AUTO PUMP SHUT OFF FOR LEAKS, SYSTEM FAILURE AND SYSTEM DISCONNECTION
    - ☐ c. NO AUTO PUMP SHUT OFF

☐ 11. AUTOMATIC LINE LEAK DETECTOR (3.0 GPH TEST) WITH FLOW SHUT OFF OR RESTRICTION

☐ 12. ANNUAL INTEGRITY TEST (0.1 GPH)

SUCTION/GRAVITY SYSTEM

☐ 13. CONTINUOUS SUMP SENSOR + AUDIBLE AND VISUAL ALARMS

EMERGENCY GENERATORS ONLY (Check all that apply)

☐ 14. CONTINUOUS SUMP SENSOR WITHOUT AUTO PUMP SHUT OFF + AUDIBLE AND VISUAL ALARMS

☐ 15. AUTOMATIC LINE LEAK DETECTOR (3.0 GPH TEST) WITHOUT FLOW SHUT OFF OR RESTRICTION

☐ 16. ANNUAL INTEGRITY TEST (0.1 GPH)

☐ 17. DAILY VISUAL CHECK

ABOVEGROUND PIPING

SINGLE WALL PIPING 467

PRESSURIZED PIPING (Check all that apply)

☐ 1. ELECTRONIC LINE LEAK DETECTOR 3.0 GPH TEST WITH AUTO PUMP SHUT OFF FOR LEAK, SYSTEM FAILURE, AND SYSTEM DISCONNECTION + AUDIBLE AND VISUAL ALARMS.

☐ 2. MONTHLY 0.2 GPH TEST

☐ 3. ANNUAL INTEGRITY TEST (0.1GPH)

☐ 4. DAILY VISUAL CHECK

CONVENTIONAL SUCTION SYSTEMS (Check all that apply)

☐ 5. DAILY VISUAL MONITORING OF PIPING AND PUMPING SYSTEM

☐ 6. TRIENNIAL INTEGRITY TEST (0.1 GPH)

SAFE SUCTION SYSTEMS (NO VALVES IN BELOW GROUND PIPING):

☐ 7. SELF MONITORING

GRAVITY FLOW (Check all that apply):

☐ 8. DAILY VISUAL MONITORING

☐ 9. BIENNIAL INTEGRITY TEST (0.1 GPH)

SECONDARILY CONTAINED PIPING

PRESSURIZED PIPING (Check all that apply):

10. CONTINUOUS TURBINE SUMP SENSOR WITH AUDIBLE AND VISUAL ALARMS AND (Check one)
    - ☐ a. AUTO PUMP SHUT OFF WHEN A LEAK OCCURS
    - ☐ b. AUTO PUMP SHUT OFF FOR LEAKS, SYSTEM FAILURE AND SYSTEM DISCONNECTION
    - ☐ c. NO AUTO PUMP SHUT OFF

☐ 11. AUTOMATIC LEAK DETECTOR

☐ 12. ANNUAL INTEGRITY TEST (0.1 GPH)

SUCTION/GRAVITY SYSTEM

☐ 13. CONTINUOUS SUMP SENSOR + AUDIBLE AND VISUAL ALARMS

EMERGENCY GENERATORS ONLY (Check all that apply)

☐ 14. CONTINUOUS SUMP SENSOR WITHOUT AUTO PUMP SHUT OFF + AUDIBLE AND VISUAL ALARMS

☐ 15. AUTOMATIC LINE LEAK DETECTOR (3.0 GPH TEST)

☐ 16. ANNUAL INTEGRITY TEST (0.1 GPH)

☐ 17. DAILY VISUAL CHECK

VIII. DISPENSER CONTAINMENT

DISPENSER CONTAINMENT

DATE INSTALLED 468

☐ 1. FLOAT MECHANISM THAT SHUTS OFF SHEAR VALVE

☐ 2. CONTINUOUS DISPENSER PAN SENSOR + AUDIBLE AND VISUAL ALARMS

☐ 3. CONTINUOUS DISPENSER PAN SENSOR WITH AUTO SHUT OFF FOR DISPENSER + AUDIBLE AND VISUAL ALARMS

☐ 4. DAILY VISUAL CHECK

☐ 5. TRENCH LINER / MONITORING

☒ 6. NONE 469

IX. OWNER/OPERATOR SIGNATURE

I certify that the information provided herein is true and accurate to the best of my knowledge.

SIGNATURE OF OWNER/OPERATOR: Agent for Owner

DATE: 2/18/04 470

NAME OF OWNER/OPERATOR (print): PETER HOVERSEN – AEI 471

TITLE OF OWNER/OPERATOR: PROJECT MANAGER 472

Permit Number (For local use only) 473

Permit Approved (For local use only) 474

Permit Expiration Date (For local use only) 475

HEALTH AND SAFETY PLAN

Prepared for:

Undergournd Storage Tank Removal
at
20957 Baker Road
Castro Valley, California 94546

D. HAZARD EVALUATION

Potential chemical hazards include skin and eye contact or inhalation exposure to potentially toxic concentrations of hydrocarbon vapors. The potential toxic compounds that may exist at the site are listed below with descriptions of specific health effects of each. The list includes the primary potential toxic constituents that may be found at sites which previously handled petroleum hydrocarbons, including home heating diesel fuel.

1. Benzene
   a. Colorless to light yellow, flammable liquid with an aromatic odor.
   b. Toxic hazard by **inhalation, adsorption, ingestion** and **skin and/or eye contact.**
   c. Exposure may irritate eyes, nose and respiratory system and may cause acute restlessness, convulsions, nausea, or depression. Benzene is carcinogenic.*
   d. Permissible exposure level (PEL) for a time weighted average (TWA) over an eight hour period is 1.0 ppm.

2. Toluene
   a. Colorless liquid with a sweet, pungent, benzene like odor.
   b. Toxic hazard by **inhalation, adsorption, ingestion** and **skin and/or eye contact.**
   c. Exposure may cause fatigue, weakness, confusion, euphoria, dizziness, headaches, dilated pupils, lacrimation, nervousness, insomnia, paresthesia, and dermatitis.
   d. Permissible exposure level for a time weighted average over an eight hour period is 100 ppm.

3. Xylene
   a. Colorless liquid with an aromatic odor.
   b. Toxic hazard by **inhalation, adsorption, ingestion** and **skin and/or eye contact.**
   c. Exposure may irritate eyes nose and throat and may cause dizziness, excitement, drowsiness, incoordination, corneal vacuolization, anorexia, nausea, vomiting, and dermatitis.
   d. Permissible exposure level for a time weighted average over an eight hour period is 100 ppm.

4. Ethylbenzene
   a. Colorless liquid with an aromatic odor.
   b. Toxic hazard by **inhalation, ingestion**, and **skin and/or eye contact.** Ethylbenzene is carcinogenic.*
   c. Exposure may irritate eyes and mucous membrane and may cause headaches, dermatitis, narcosis and loss of consciousness.
   d. Permissible exposure level for a time weighted average over an eight hour period is 100 ppm.

*** Known to the State of California to cause cancer.**

Dusty Roy has been designated to coordinate access control and security on site. All work will strictly follow OSHA guidelines. A safe perimeter has been established at a three feet radius surrounding the site. These boundaries are identified by yellow caution tape and orange safety cones. Personnel shall maintain the maximum distance from the pit while performing their duties. No one shall enter an excavation pit that is greater than five feet in depth unless the excavation is shored or sloped and no one shall climb on the stockpiled material except to cover it with plastic. Additional hazards on site include heavy equipment and overhead lifting equipment. Heavy equipment used for performing the tank removal project may include a backhoe, an excavator, or a crane for lifting the tank out of the excavation. Only 40 hour trained personnel will operate equipment or perform any duty associated with this project. A hard hat and steel toed boots are mandatory for all personnel associated with the tank removal.

A FIRST AID KIT AND A 40 POUND BC FIRE EXTINGUISHER WILL BE AVAILABLE ON SITE.
EMERGENCY SERVICES ARE AVAILABLE BY DIALING 911 ON THE TELEPHONE LOCATED IN THE SITE MANAGER'S VEHICLE. THIS VEHICLE WILL BE ON SITE AT ALL TIMES.

E. PERSONAL PROTECTIVE CLOTHING

Based on evaluation of potential hazards, level "D" protective clothing has been designated as the appropriate protection for this project. The level of protective clothing will be upgraded if the organic vapor levels in the operator's breathing zone exceeds 5 ppm above background levels continuously for more than five minutes, or if any single reading exceeds 25 ppm. If this occurs then level C protection will be used. If the organic concentration in the operator's breathing zone exceeds 200 ppm for 5 minutes and/or the organic vapor concentration two feet above the excavation exceeds 1,000 ppm or 10% of the lower explosive limit, then the equipment will be shut down and the site evacuated. If organic vapor concentrations exceed 200 ppm and work continues then level B protection will be required.

"EPA Standard Operating Safety Guidelines" defines the levels of protective clothing as follows:

LEVEL A:
Fully encapsulating suit / SCBA / Hard hat / Steel toe boots / Safety gloves.

LEVEL B:
Splash resistant suit / SCBA / Hard Hat / Steel toe boots / Safety gloves.

LEVEL C:
Half face respirator / Hard hat / Safety glasses / Steel toe boots / Coveralls / Gloves.

LEVEL D:

H. READ AND SIGN

The work party was briefed on the contents of this plan on ___ ____________ at 8:00 am. All site personnel have read the above plan and are familiar with its provisions.

NAME:	SIGNATURE:	COMPANY NAME:

ECI ///
Ecology Control Industries
A FULL SERVICE ENVIRONMENTAL COMPANY

TRANSPORTATION SERVICE ORDER

SERVICE ORDER # 260667

52T1157 DATE: 4-21-04

CUSTOMER

Name: All Environmental Job Location: Castro Valley CA

Address (BILLING): City: Zip:

Ordered by: T[illegible] #56 Company: P.O. #:

DRIVER

Name (PRINT): K Clark Signed: Kevin S Clark

Truck #: ~~[illegible]~~ 12038 Trailer #: — Size/Type: ~~24~~ F550

SERVICES

Services performed: TKO 2 X 500 GALLON TANKS TO ECI FOR DISPOSAL

TIME

MANIFEST #: DISPOSAL #:

23422835

# #

#Loads: Qty:

BBL: Gal: Tons: Yards:

Start 10:20 [✓ AM] PM Stop: AM PM

MEALS: Start AM PM Stop: AM PM

Other Time: Add/Deduct

Gross Time: Hrs.

Less: Hrs.

Total: Hrs.

SITE

Time In: 11:30 AM Time In: Time In: Stop Miles:

Start Miles: 72924

Time Out 2:00 PM Time Out Time Out Miles Driven:

DESCRIPTION

	QTY.	U.O.M.	RATE	EXT.		QTY.	U.O.M.	RATE	EXT.
Vacuum Truck					Disposal				
End Dump					Washout				
Roll-off					Roper Pump				
Flat Bed					Bin Liner				
Tank Mover					Surcharge				
Driver Relief									
Subsistence									

Authorized & Approved by: Title: Tr. Mgr.

TOTAL CHARGES: $

If invoice is not paid within 30 days, interest shall commence accruing at 1.5% per month. Should suit be commenced to collect any portion of this invoice, Ecology Control Industries shall be entitled to any costs deemed reasonable by the court, including attorney fees.

Original: Accounting *Yellow: Accounting* *Pink: Customer* *Gold: Driver* TSO-1

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. [illegible] Manifest Document No. [illegible]
2. Page 1 of [illegible]

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number 21026720

3. Generator's Name and Mailing Address [illegible] Pizza
[illegible]
[illegible] Co.

4. Generator's Phone ( ) [illegible]

B. State Generator's ID

5. Transporter 1 Company Name [illegible]
6. US EPA ID Number [illegible]

C. State Transporter's ID [Reserved.]

D. Transporter's Phone [illegible]

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address [illegible]
[illegible]
[illegible]
10. US EPA ID Number [illegible]

G. State Facility's ID

H. Facility's Phone [illegible]

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non RCRA Hazardous Waste Liquid [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	State [illegible] EPA/Other [illegible]
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above
a.
b.
c.
d.

15. Special Handling Instructions and Additional Information
Emergency Phone [illegible] ERG [illegible]
[illegible]

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name CRAIG BA[illegible]
Signature
Month [illegible] Day [illegible] Year [illegible]

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name [illegible]
Signature
Month [illegible] Day [illegible] Year [illegible]

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

GENERATOR

TRANSPORTER

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name
Signature
Month Day Year

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Yellow: GENERATOR RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CAC002574520 Manifest Document No. 22835
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address Nat Pizza 7613 Peppertree Rd. Dublin CA 94568
A. State Manifest Document Number 23422835
4. Generator's Phone (925) 828-1577
B. State Generator's ID
5. Transporter 1 Company Name Ecology Control Industries
6. US EPA ID Number [illegible]
C. State Transporter's ID [Reserved.]
D. Transporter's Phone 510-235-1393
7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved.]
F. Transporter's Phone
9. Designated Facility Name and Site Address
Ecology Control Industries
255 PARR BLVD.
RICHMOND CA 94801
10. US EPA ID Number [illegible]
G. State Facility's ID
H. Facility's Phone 510-235-1393

GENERATOR

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. NON RCRA HAZARDOUS WASTE SOLID (EMPTY STORAGE TANK) And Associated Piping	002	TP	02000	P	State EPA/Other
b.					State NONE EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
QTY 2 EMPTYSTORAGE TANK # 31559 31560
TANKS HAVE BEEN INERTED WITH 15 LBS DRY ICE PER 1000 GALLONS CAPACITY

K. Handling Codes for Wastes Listed Above
a.
b.
c.
d.

15. Special Handling Instructions and Additional Information JN: 527 1157
24 hour Emergency contact: Peter Hoversen
Wear proper protective equipment while handling. Weights or volumes are approximate.
24 hour emergancy number: (925) 283-6000 SITE ADDRESS: 20957 Baker Rd Castro Valley CA 94546

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name PETER HOVERSEN
Signature
Month 04 Day 21 Year 04

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Kevin E. Clark
Signature Kevin E. Clark
Month 04 Day 21 Year 04

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name
Signature
Month Day Year

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Yellow: GENERATOR RETAINS

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

All Environmental, Inc. 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #8131; Baker R.D	Date Sampled: 04/21/04
		Date Received: 04/21/04
	Client Contact: Peter Hoverson	Date Reported: 04/28/04
	Client P.O.:	Date Completed: 04/27/04

WorkOrder: 0404313

April 28, 2004

Dear Peter:

Enclosed within are:

1) The results of the **6** analyzed samples from your project **#8131; Baker R.D,**
2) A QC report for the above samples,
3) A copy of the chain of custody, and
4) An invoice for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits. If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Yours truly,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

0404313

McCAMPBELL ANALYTICAL INC.
110 2nd AVENUE SOUTH, #D7
PACHECO, CA 94553-5560
Telephone: (925) 798-1620 Fax: (925) 798-1622

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

EDF Required? ☐ Yes ☐ No

Report To: Peter HOVERSEN
Bill To:
Company: AEI Consultants
2500 Camino Diablo, Suite 200
Walnut Creek, CA 94597
E-Mail:
Tele: (925) 944-2899
Fax: (925) 944-2895
Project #: 8131
Project Name: BAKER RD.
Project Location: CASTRO VALLEY
Sampler Signature:

SAMPLE ID (Field Point Name)	LOCATION	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED Ice	METHOD PRESERVED HCl	METHOD PRESERVED HNO_3	METHOD PRESERVED Other	BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (5520 E&F/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 601 / 8010	BTEX ONLY (EPA 602 / 8020)	EPA 608 / 8080	EPA 608 / 8080 PCB's ONLY	EPA 624 / 8240 / 8260	EPA 625 / 8270	PAH's / PNA's by EPA 625 / 8270 / 8310	CAM-17 Metals	LUFT 5 Metals	Lead (7240/7421/239.2/6010) AA	RCI	5 Fuel oxy (8260)	Pb. Scav (EDB, EDC) 8260	Other	Other	Comments
T1W-EB8'		4/21		1	BRASS		X				X				X	X												X		X	X			
T2W-EB8'				1			X				X				X	X												X		X	X			
T1E-EB8'				1			X				X				X	X												X		X	X			
T2E-EB8'				1			X				X				X	X												X		X	X			
~~[illegible]~~				~~[illegible]~~			~~X~~																											
T1STKP1-4				4			X				X				X	X												X		X	X			
T2STKP1-4		↓		4			X				X				X	X												X		X	X			

Relinquished By:	Date: 4/21/04	Time: 4:50pm	Received By:
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t° /
GOOD CONDITION /
HEAD SPACE ABSENT
DECHLORINATED IN LAB
PRESERVATION /
APPROPRIATE CONTAINERS /
PERSERVED IN LAB

	VOAS	O&G	METALS	OTHER
PRESERVATION				

All Environmental, Inc. 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #8131; Baker R.D	Date Sampled: 04/21/04
		Date Received: 04/21/04
	Client Contact: Peter Hoverson	Date Extracted 04/21/04
	Client P.O.:	Date Analyzed: 04/22/04-04/23/04

Oxygenated Volatile Organics + EDB and 1,2-DCA by P&T and GC/MS*

Extraction Method: Analytical Method: SW8260B Work Order: 0404313

Lab ID	0404313-001A	0404313-002A	0404313-003A	0404313-004A	Reporting Limit for DF =1	
Client ID	T1W-EB8'	T2W-EB8'	T1E-EB8'	T2E-EB8'		
Matrix	S	S	S	S		
DF	200	200	40	200	S	W
Compound	**Concentration**				μg/Kg	ug/L
tert-Amyl methyl ether (TAME)	ND<1000	ND<1000	ND<200	ND<1000	5.0	NA
t-Butyl alcohol (TBA)	ND<5000	ND<5000	ND<1000	ND<5000	25	NA
1,2-Dibromoethane (EDB)	ND<1000	ND<1000	ND<200	ND<1000	5.0	NA
1,2-Dichloroethane (1,2-DCA)	ND<1000	ND<1000	ND<200	ND<1000	5.0	NA
Diisopropyl ether (DIPE)	ND<1000	ND<1000	ND<200	ND<1000	5.0	NA
Ethyl tert-butyl ether (ETBE)	ND<1000	ND<1000	ND<200	ND<1000	5.0	NA
Methyl-t-butyl ether (MTBE)	ND<1000	ND<1000	ND<200	ND<1000	5.0	NA
Surrogate Recoveries (%)						
%SS:	118	115	109	114		
Comments	j	j	j	j		

* water and vapor samples and all TCLP & SPLP extracts are reported in μg/L, soil/sludge/solid samples in μg/kg, wipe samples in μg/wipe, product/oil/non-aqueous liquid samples in mg/L.

ND means not detected above the reporting limit; N/A means analyte not applicable to this analysis.

surrogate diluted out of range or surrogate coelutes with another peak.

h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) sample diluted due to high organic content.

DHS ELAP Certification 1644

AR Angela Rydelius, Lab Manager

All Environmental, Inc. 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #8131; Baker R.D	Date Sampled: 04/21/04 Date Received: 04/21/04
	Client Contact: Peter Hoverson	Date Extracted 04/21/04
	Client P.O.:	Date Analyzed: 04/22/04-04/23/04

Oxygenated Volatile Organics + EDB and 1,2-DCA by P&T and GC/MS*

Extraction Method: Analytical Method: SW8260B Work Order: 0404313

Lab ID	0404313-005A	0404313-006A			Reporting Limit for DF =1	
Client ID	T1STKP1-4	T2STKP1-4				
Matrix	S	S				
DF	1	1			S	W
Compound	**Concentration**				µg/Kg	ug/L
tert-Amyl methyl ether (TAME)	ND	ND			5.0	NA
t-Butyl alcohol (TBA)	ND	ND			25	NA
1,2-Dibromoethane (EDB)	ND	ND			5.0	NA
1,2-Dichloroethane (1,2-DCA)	ND	ND			5.0	NA
Diisopropyl ether (DIPE)	ND	ND			5.0	NA
Ethyl tert-butyl ether (ETBE)	ND	ND			5.0	NA
Methyl-t-butyl ether (MTBE)	ND	ND			5.0	NA
Surrogate Recoveries (%)						
%SS:	109	103				
Comments						

* water and vapor samples and all TCLP & SPLP extracts are reported in µg/L, soil/sludge/solid samples in µg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples in mg/L.

ND means not detected above the reporting limit; N/A means analyte not applicable to this analysis.

surrogate diluted out of range or surrogate coelutes with another peak.

h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) sample diluted due to high organic content.

DHS ELAP Certification 1644

AR Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.

"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

All Environmental, Inc. 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #8131; Baker R.D	Date Sampled: 04/21/04
		Date Received: 04/21/04
	Client Contact: Peter Hoverson	Date Extracted 04/21/04
	Client P.O.:	Date Analyzed: 04/22/04-04/24/04

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE*

Extraction method: Analytical methods: SW8021B/8015Cm Work Order: 0404313

Lab ID	Client ID	Matrix	TPH(g)	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	DF	% SS
001A	T1W-EB8'	S	160,g,m	ND<0.50	ND<0.050	ND<0.050	ND<0.050	ND<0.050	10	84
002A	T2W-EB8'	S	1400,g,m	ND<10	ND<1.0	ND<1.0	ND<1.0	8.4	200	107
003A	T1E-EB8'	S	190,g,m	ND<1.7	ND<0.17	ND<0.17	ND<0.17	ND<0.17	33	90
004A	T2E-EB8'	S	460,g,m	ND<0.50	ND<0.050	ND<0.050	ND<0.050	0.25	10	85
005A	T1STKP1-4	S	ND	ND	ND	ND	ND	ND	1	82
006A	T2STKP1-4	S	ND	ND	ND	ND	ND	ND	1	85

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	NA	NA	NA	NA	NA	NA	1	ug/L
	S	1.0	0.05	0.005	0.005	0.005	0.005	1	mg/Kg

* water and vapor samples and all TCLP & SPLP extracts are reported in µg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples in mg/L.

cluttered chromatogram; sample peak coelutes with surrogate peak.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (stoddard solvent / mineral spirit?); f) one to a few isolated non-target peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) reporting limit raised due to high MTBE content; k) TPH pattern that does not appear to be derived from gasoline (aviation gas). m) no recognizable pattern.

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc. "When Quality Counts"	1534 Willow Pass Road, Pittsburg, CA 94565-1701 Web: www.mccampbell.com E-mail: main@mccampbell.com Telephone: 877-252-9262 Fax: 925-252-9269

All Environmental, Inc. 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #8131; Baker R.D	Date Sampled: 04/21/04 Date Received: 04/21/04
	Client Contact: Peter Hoverson	Date Extracted 04/21/04
	Client P.O.:	Date Analyzed: 04/22/04

Lead by Graphite Furnace Atomic Absorption*

Extraction method: Analytical methods: SW7010 Work Order: 0404313

Lab ID	Client ID	Matrix	Extraction Type	Lead	DF	% SS
0404313-001A	T1W-EB8'	S	TTLC	6.1	1	N/A
0404313-002A	T2W-EB8'	S	TTLC	17	2	N/A
0404313-003A	T1E-EB8'	S	TTLC	6.1	1	N/A
0404313-004A	T2E-EB8'	S	TTLC	18	2	N/A
0404313-005A	T1STKP1-4	S	TTLC	24	4	N/A
0404313-006A	T2STKP1-4	S	TTLC	22	2	N/A

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	S	TTLC	0	mg/Kg

*water/product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate recovery outside of acceptance range due to matrix interference; & means surrogate diluted out of acceptance range; ND means not detected above the reporting limit; N/A means not applicable to this sample or instrument.

Analytical Methods: EPA 6010C/200.7 for all elements except: 200.9 (water/liquid- Sb, As, Pb, Se, Tl); 245.1 (Hg); 7010 (sludge/soil/solid/oil/product/wipe/filter - As, Se, Tl); 7471B (Hg).

i) liquid sample that contains greater than ~1 vol. % sediment; this sediment is extracted with the liquid, in accordance with EPA methodologies and can significantly effect reported metal concentrations; j) reporting limit raised due to insufficient sample amount; k) results are reported by dry weight; y) estimated values due to low surrogate recovery; z) reporting limit raised due to matrix interference.

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

All Environmental, Inc. 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #8131; Baker R.D	Date Sampled: 04/21/04 Date Received: 04/21/04
	Client Contact: Peter Hoverson	Date Extracted 04/21/04
	Client P.O.:	Date Analyzed 04/22/04-04/23/04

Diesel Range (C10-C23) Extractable Hydrocarbons as Diesel*

Extraction method: Analytical methods: SW8015C Work Order: 0404313

Lab ID	Client ID	Matrix	TPH(d)	DF	% SS
0404313-001A	T1W-EB8'	S	4900,a	100	90
0404313-002A	T2W-EB8'	S	2400,d,b	50	116
0404313-003A	T1E-EB8'	S	10,000,a	100	102
0404313-004A	T2E-EB8'	S	1400,d,b	20	109
0404313-005A	T1STKP1-4	S	77,c,g	5	94
0404313-006A	T2STKP1-4	S	2.1,g,b	1	102

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	NA	NA
	S	1.0	mg/Kg

* water samples are reported in µg/L, wipe samples in µg/wipe, soil/solid/sludge samples in mg/kg, product/oil/non-aqueous liquid samples in mg/L, and all DISTLC / STLC / SPLP / TCLP extracts are reported in µg/L.

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel is significant; d) gasoline range compounds are significant; e) unknown medium boiling point pattern that does not appear to be derived from diesel; f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; k) kerosene/kerosene range; l) bunker oil; m) fuel oil; n) stoddard solvent/mineral spirit.

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

QC SUMMARY REPORT FOR SW8260B

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder: 0404313

EPA Method: SW8260B **Extraction:** **BatchID: 11216** **Spiked Sample ID: 0404356-002A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	µg/Kg	µg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
tert-Amyl methyl ether (TAME)	ND	50	99.6	101	1.49	94.3	95.1	0.896	70 - 130	70 - 130
t-Butyl alcohol (TBA)	ND	250	99.1	96.8	2.37	111	116	4.50	70 - 130	70 - 130
1,2-Dibromoethane (EDB)	ND	50	108	105	2.92	102	104	1.95	70 - 130	70 - 130
1,2-Dichloroethane (1,2-DCA)	ND	50	114	111	2.27	110	112	2.20	70 - 130	70 - 130
Diisopropyl ether (DIPE)	ND	50	102	103	0.733	95.1	95.7	0.597	70 - 130	70 - 130
Ethyl tert-butyl ether (ETBE)	ND	50	104	102	1.43	102	102	0	70 - 130	70 - 130
Methyl-t-butyl ether (MTBE)	ND	50	106	108	1.59	99.7	101	1.18	70 - 130	70 - 130
%SS1:	90	50	100	96.1	4.16	103	103	0	70 - 130	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 11216 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
0404313-001A	04/21/04	04/21/04	04/22/04 3:20 PM	0404313-002A	04/21/04	04/21/04	04/22/04 4:04 PM
0404313-003A	04/21/04	04/21/04	04/23/04 5:04 PM	0404313-004A	04/21/04	04/21/04	04/22/04 2:37 PM
0404313-005A	04/21/04	04/21/04	04/22/04 5:31 PM	0404313-006A	04/21/04	04/21/04	04/22/04 6:14 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

* MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder: 0404313

EPA Method: SW8021B/8015Cm **Extraction:** **BatchID: 11209** **Spiked Sample ID: 0404306-017A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
TPH(btex)£	ND	0.60	101	102	0.861	101	102	1.59	70 - 130	70 - 130
MTBE	ND	0.10	96.7	99.7	3.01	95.3	95	0.353	70 - 130	70 - 130
Benzene	ND	0.10	99.8	107	6.82	99	101	1.72	70 - 130	70 - 130
Toluene	ND	0.10	84.9	90.8	6.68	84.3	85.1	0.947	70 - 130	70 - 130
Ethylbenzene	ND	0.10	105	109	4.07	104	105	1.01	70 - 130	70 - 130
Xylenes	ND	0.30	95.7	100	4.43	95.3	95.7	0.349	70 - 130	70 - 130
%SS:	88	0.10	98.2	106	7.64	93.2	96.4	3.38	70 - 130	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 11209 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
0404313-001A	04/21/04	04/21/04	04/24/04 4:06 AM	0404313-002A	04/21/04	04/21/04	04/22/04 3:26 PM
0404313-003A	04/21/04	04/21/04	04/23/04 6:42 AM	0404313-004A	04/21/04	04/21/04	04/22/04 10:22 PM
0404313-005A	04/21/04	04/21/04	04/23/04 6:13 PM	0404313-006A	04/21/04	04/21/04	04/22/04 2:03 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

* MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte

QC SUMMARY REPORT FOR SW7010

W.O. Sample Matrix: Solid QC Matrix: Solid WorkOrder: 0404313

EPA Method: SW7010 **Extraction:** **BatchID: 11082** **Spiked Sample ID: 0404313-006A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
Lead	N/A	5	N/A	N/A	N/A	98.3	100	1.66	N/A	80 - 120

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 11082 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
0404313-001A	04/21/04	04/21/04	04/22/04 5:59 PM	0404313-002A	04/21/04	04/21/04	04/22/04 6:05 PM
0404313-003A	04/21/04	04/21/04	04/22/04 6:12 PM	0404313-004A	04/21/04	04/21/04	04/22/04 6:19 PM
0404313-005A	04/21/04	04/21/04	04/22/04 6:28 PM	0404313-006A	04/21/04	04/21/04	04/22/04 6:35 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

* Acceptance Criteria for MS / MSD is between 70% and 130%. MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder: 0404313

EPA Method: SW8015C **Extraction:** **BatchID: 11215** **Spiked Sample ID: 0404315-001A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
TPH(d)	1.3	150	105	103	1.39	108	110	1.70	70 - 130	70 - 130
%SS:	92	50	104	102	1.16	97.5	99	1.55	70 - 130	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 11215 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
0404313-001A	04/21/04	04/21/04	04/22/04 7:43 PM	0404313-002A	04/21/04	04/21/04	04/22/04 9:07 PM
0404313-003A	04/21/04	04/21/04	04/23/04 4:37 PM	0404313-004A	04/21/04	04/21/04	04/22/04 6:27 PM
0404313-005A	04/21/04	04/21/04	04/23/04 7:29 PM	0404313-006A	04/21/04	04/21/04	04/22/04 8:44 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

* MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

APPENDIX C

Preliminary Site Investigation Report

June 7, 2005

PRELIMINARY SITE INVESTIGATION REPORT

20957 Baker Road
Castro Valley, California 94546

Project No. 10509

Prepared For

Nat Piazza
7613 Peppertree Road
Dublin, CA 94568

Prepared By

AEI Consultants
2500 Camino Diablo, Suite 100
Walnut Creek, CA 94597
(925) 944-2899

AEI

2500 Camino Diablo, Suite 100, Walnut Creek, CA 94597
Phone: (925) 944-2899 Fax: (925) 944-2895

June 7, 2005

Nat Piazza
7613 Peppertree Road
Dublin, CA 94568

Subject: **Phase II Subsurface Investigation**
20957 Baker Road
Castro Valley, California 94546
Project No. 10509

Dear Mr. Piazza:

The following letter report describes the activities and results of the subsurface investigation performed by AEI Consultants at the above referenced property (Figure 1: Site Location Map). The scope of work for this investigation was designed to determine the extent of soil contamination and its impact on groundwater resulting from the hydrocarbon release from the former USTs.

I Background

The subject property (hereafter referred to as the "site" or "property") is located at 20957 Baker Road in Castro Valley, California (Figure 1: Site Location Map). The site is located in a mixed residential and commercial/light-industrial area of Castro Valley. The site is approximately 160 by 300 feet and is undeveloped. The site is partial covered with asphalt surfacing and concrete slabs utilized for parking.

On April 21, 2004, AEI removed two 1,000-gallon tanks under from the site. The removal was performed under permit from the Alameda County Environmental Health Services (ACEHS). The tank removal was observed by Robert Weston, Inspector, ACEHS. Two soil samples were collected from underneath each UST and analyzed for Total Petroleum Hydrocarbons as gasoline (TPH-g), Benzene, toluene, ethylbenzene, xylenes (BTEX) and Methyl tert- butyl ether (MTBE) by EPA Method 8021B/8015Cm. Fuel oxygenates and 1,2-Dibromoethane (EDB) and 1,2 Dichloroethane (1,2-DCA) were analyzed by EPA Method 8260. Total Petroleum Hydrocarbons as diesel (TPH-d) was analyzed by EPA Method 8015C and total lead by EPA method 7010. Hydrocarbons were detected in all the soil samples, TPH-g at concentrations ranging from 160 milligrams per kilogram (mg/kg) in sample T1W-EB8' to 1,400 mg/kg in sample T2W-EB8' and TPH-d at concentrations ranging from 1,400 mg/kg (T2E-EB8') to 10,000 mg/kg (T1E-EB8'). Total xylenes were reported in two soil samples at 8.4 mg/Kg (T2W-E8') and at 0.25 mg/kg (T2E-EB8'). No fuel oxygenates, EDB, or DCA were detected in the samples. Total lead was reported at concentrations ranging from 6.1 mg/kg to 24 mg/kg (stockpile sample STKP1-4).

AEI prepared a Preliminary Site Assessment workplan, which was approved by Don Hwang, Hazardous Materials Specialist with the ACEHS in a letter dated April 8, 2005.

II Investigative Efforts

AEI performed the subsurface investigation at the property on May 18, 2005. Prior to mobilization, AEI applied for a subsurface drilling permit from the Alameda County Public Works Agency (ACPWA). Underground Service Alert (USA) was notified more than two business days prior to the drilling to allow local utilities to be marked. Notification of the drilling schedule was made to the county. No county inspector made an appearance at the site.

Eight (8) soil borings (SB-1 through SB-8) were advanced to depths ranging from 14 to 18 ft. below ground surface (bgs). The locations of the soil borings are shown on Figure 2.

Soil Sample Collection

The temporary borings were advanced with a Geoprobe® model 5410 direct-push drilling rig by Vironex, a licensed California drilling contractor (C57 – 705927).

A continuous core was cut from the surface to the top of bedrock. The cores were cut using an approximately 2” outer diameter sampling tube, which held in 1.75-inch diameter acrylic liners 4-feet in length. At least one sediment sample was retained for possible chemical analysis. An adjacent sample was placed in a 1-quart zipper locking plastic bad and used for field screening. The samples were screened using a Mini-Rae photo ionization detector (PID). The tip of the PID was inserted into the 1-quart bag through a small diameter hole poked into the bag. The PID readings were recorded on the boring logs. The borings were logged by an AEI Professional Geologist using the Unified Soil Classification System (USCS). Copies of the boring logs, including depth of samples collected are included in Appendix B.

The soil samples retained for possible chemical analysis were sealed with Teflon film and plastic end-caps. Each sample was labeled with at minimum, company name and project number, unique sample identifier, sampler’s name, time and date of collection. The samples were placed in individual zipper locking bags and placed in a cooler with wet ice, pending transportation to the laboratory. The remainder of each core was examined and described by the AEI geologist. The descriptions of the cores are included on the boring logs that are included in Appendix A.

Groundwater Sample Collection

Groundwater samples were collected from each of the eight soil borings. A new unused, ¾-inch PVC casing was placed in each boring to facilitate collection of the water samples. The casing consisted of 5-feet of 0.010-inch slotted casing and sufficient blank casing to rise above the ground surface. The water samples were collected using ¼-inch polyethylene tubing with a check valve on the bottom. Water samples were collected directly into one 1-liter amber bottle and three 40-milliliter (ml) volatile organic analysis vials (VOAs). The water samples from each boring, except SB-5, were collected immediately after the borings were drilled. Boring SB-5 contained no water at the time it was drilled. After twenty minutes, a small amount of water had collected and after 2.5 hours, sufficient water had accumulated in the boring to fill three VOAs and partially fill a 1-liter amber.

Each sample was labeled with at minimum, company name and project number, unique sample identifier, sampler's name, time and date of collection. The samples were placed in individual zipper locking bags and placed in a cooler with water ice, pending transportation to the laboratory.

Boring Destruction

Following sample collection, each boring was sealed to the surface with neat cement emplaced through a treamie pipe in accordance with Alameda County Public Works Agency and State of California guidelines.

Laboratory Analysis

On May 19, 2005, the soil and groundwater samples were transported to McCampbell Analytical Inc. (Department of Health Services Certification #1644) under chain of custody protocol. One soil and one groundwater sample from each boring were selected for chemical analysis. The results of soil and groundwater analyses are shown on Tables 1 and Table 2. Chain of custody documents and copies of the analytical reports are included in Appendix C

The selected soil samples were analyzed for TPH-g, MTBE, and BTEX by methods SW 8015Cm/8021B. Analysis was also performed for TPH-d and Total Petroleum Hydrocarbons as motor oil (TPH-mo) by EPA method 8015C.

Groundwater samples were analyzed for TPH-g, MTBE, BTEX by methods SW 8015 Cm/8021B. Analysis was also performed for TPH-d, TPH-mo by EPA method 8015C.

III Findings

Soil Analyses

No detectable concentrations of TPH-g, TPH-d, TPH-mo, MTBE or BTEX, were reported in any of the soil samples above detection limits of 1.0 mg/kg, 1.0 mg/kg, 5.0 mg/kg, 0.05 mg/kg and 0.005 mg/kg respectively.

Groundwater Analyses

TPH-g was reported in groundwater sample from boring SB-2 (SB2-W) at a concentration of 7,300 micrograms per liter (µg/L). No TPH-g was reported in any other borings at or above a detection limit of 50 µg/L. Toluene and xylenes were reported at concentrations of 11 µg/L and

27 µg/L respectively in SB-2. No other BTEX compounds were reported in groundwater samples from any of the other borings at or above detection limits.

No TPH-d was reported in borings SB-7 at or above a detection limit of 50 µg/L. TPH-d was reported in the other seven borings at concentrations ranging from 56 µg/L (SB-4) to 23,000 µg/L (SB-2).

No TPH-mo was reported in groundwater samples from borings SB-3, SB-4 and SB-7 at or above a detection limit of 250 µg/L. TPH-mo was reported in groundwater samples from borings SB-1, SB-2, SB-5, SB-6 and SB-8 at concentrations ranging from 300 µg/L (SB-6) to1400 µg/L (SB-1 and SB-5).

No MTBE was reported by EPA Method 8021B in groundwater samples from any of the eight soil borings at or above a detection limit of 0.05 µg/L.

The results of the groundwater analyses are summarized in Table 2 (Groundwater Sample Analytical Data) and shown on Figures 3 through 6. Copies of the laboratory reports are attached as Appendix B.

VI Recommendations

AEI recommends the following action:

- Install four groundwater monitoring wells, one 4-inch diameter well at the location of boring SB-2 and three 2-inch diameter wells as shown on Figure 7.
- Upon approval of the above, prepare a workplan if required, followed by installation of the wells.
- Monitor the wells for a period of one year, at which time a remedial action plan should be prepared, if necessary

VII Report Limitation

This report presents a summary of work completed by AEI Consultants. The completed work includes observations and descriptions of site conditions encountered. Where appropriate, it includes analytical results for samples taken during the course of the work. The number and location of samples are chosen to provide the required information, but it cannot be assumed that they are representative of areas not sampled. All conclusions and/or recommendations are based on these analyses and observations, and the governing regulations. Conclusions beyond those stated and reported herein should not be inferred from this document.

These services were performed in accordance with generally accepted practices, in the environmental engineering field, which existed at the time and location of the work.

If you have any questions regarding our investigation, please do not hesitate to contact Peter McIntyre or Robert Flory at (925) 944-2899.

Sincerely,
AEI Consultants

Robert F. Flory, P.G.
Senior Project Geologist

PROFESSIONAL GEOLOGIST
ROBERT F. FLORY
No. 5825
STATE OF CALIFORNIA

Peter J. McIntyre, P.G.
Program Manager

Figures

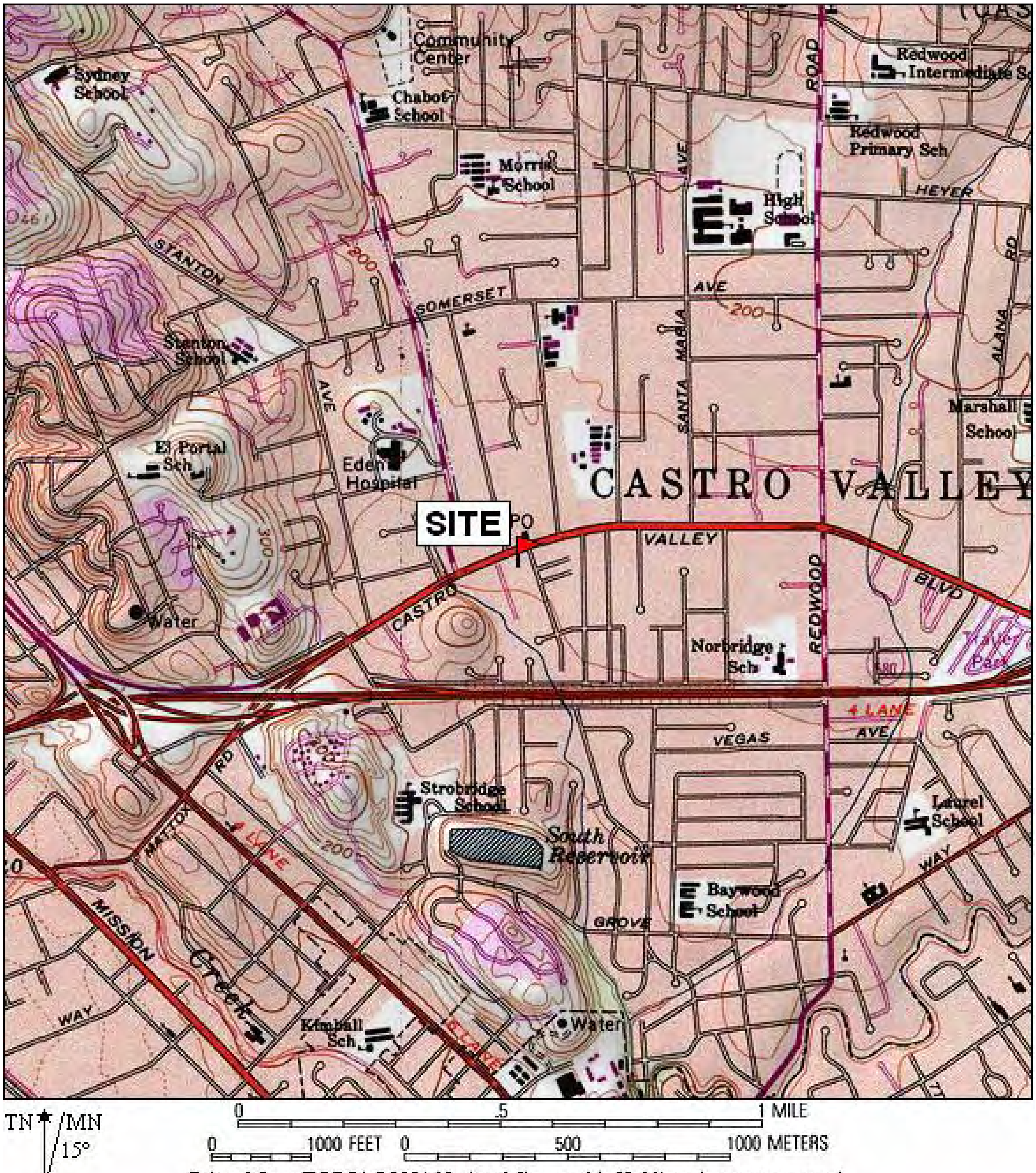
Figure 1: Site Location Map
Figure 2: Site Plan
Figure 3: Boring location Plan
Figure 4: Groundwater Analytical Results
Figure 5: TPH-d Isopleths
Figure 6: TPH-mo Isopleths
Figure 7: Proposed Well Locations

Tables

Table 1: Soil Sample Analytical Data
Table 2: Groundwater Sample Analytical Data

Appendix A *Boring Logs*
Appendix B *Laboratory Analyses*

FIGURES



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AEI CONSULTANTS

SITE LOCATION MAP

20957 BAKER ROAD CASTRO VALLEY, CALIFORNIA	**FIGURE 1** PROJECT NO. 10509

○ GT-1 Geotechnical Boring - 1986

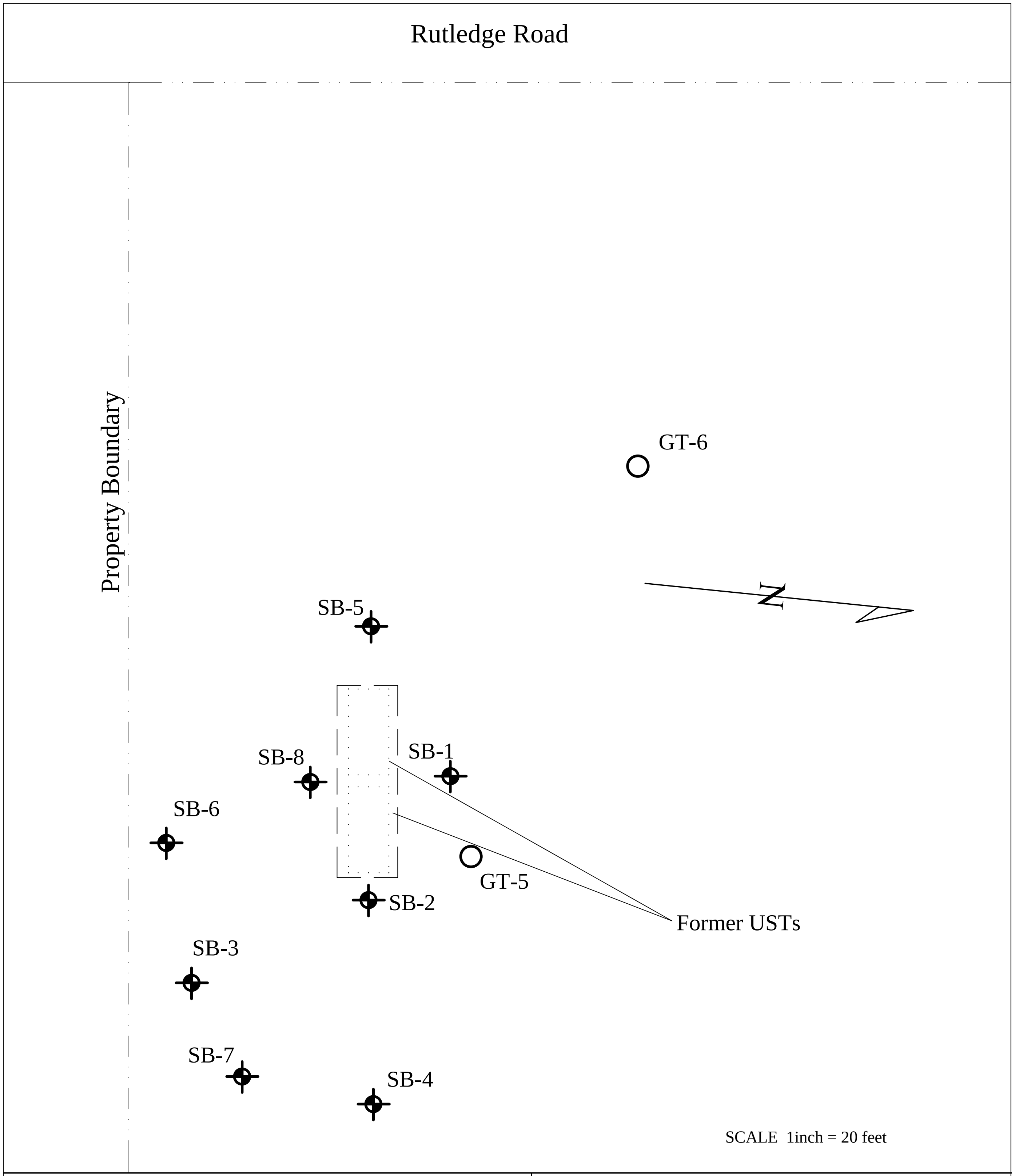
⊕ SB-1 Soil Borings - 5/18/2005

SCALE 1inch = 50 feet

AEI CONSULTANTS
2500 CAMINO DIABLO, SUITE 100 WALNUT CREEK, CA

SITE MAP

20957 BAKER ROAD CASTRO VALLEY, CA	FIGURE 2 Project No. 10509



○ GT-1 Geotechnical Boring - 1986

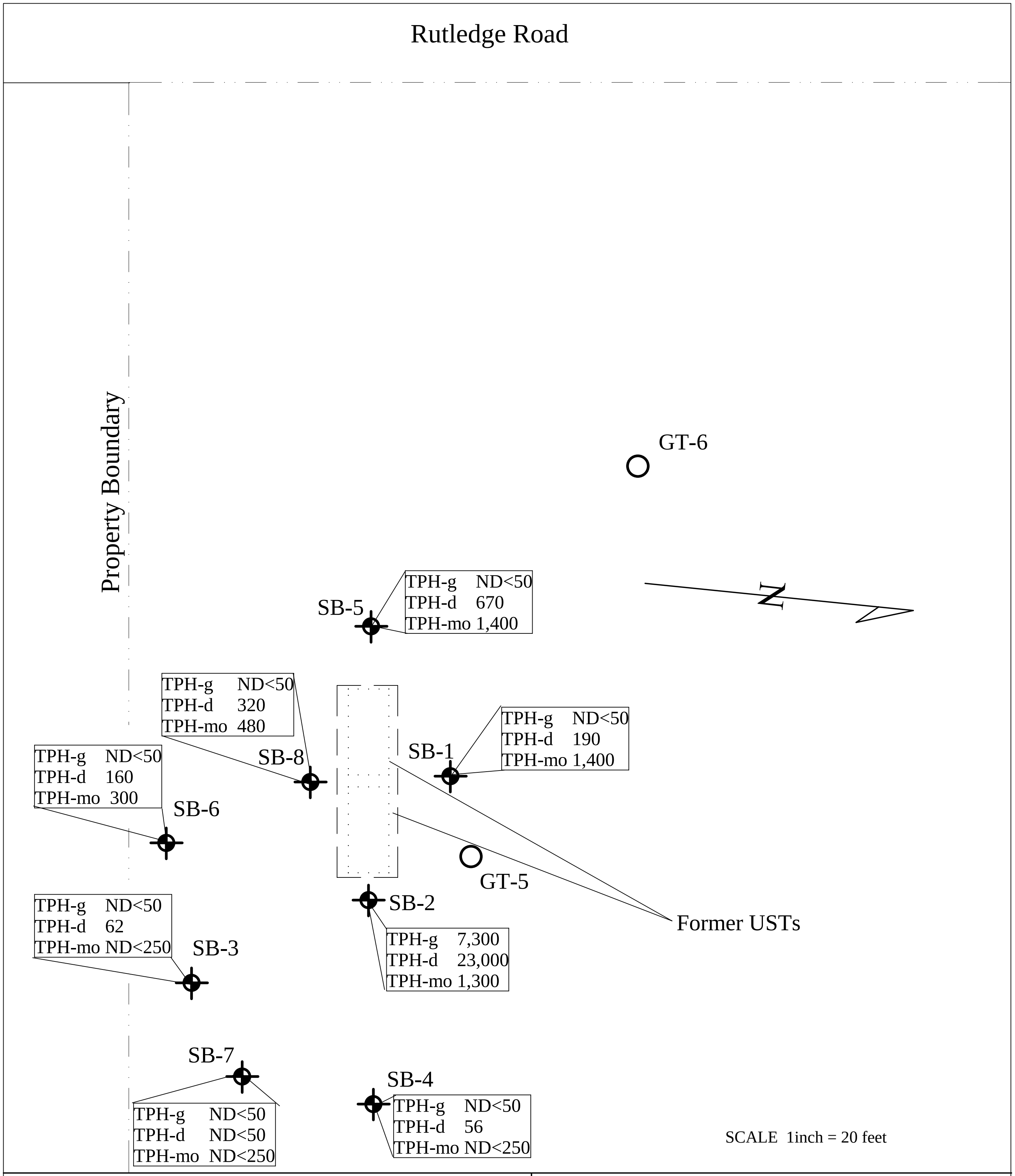
⊕ SB-1 Soil Borings - 5/18/05

AEI CONSULTANTS
2500 CAMINO DIABLO, SUITE 100 WALNUT CREEK, CA

BORING LOCATION PLAN

20957 BAKER ROAD
CASTRO VALLEY, CA

FIGURE 3
Project No. 10509



○ GT-1 Geotechnical Boring - 1986

⊕ SB-1 Soil Borings - 5/18/05

TPH-g	7,300
TPH-d	23,000
TPH-mo	1,300

Units µg/L

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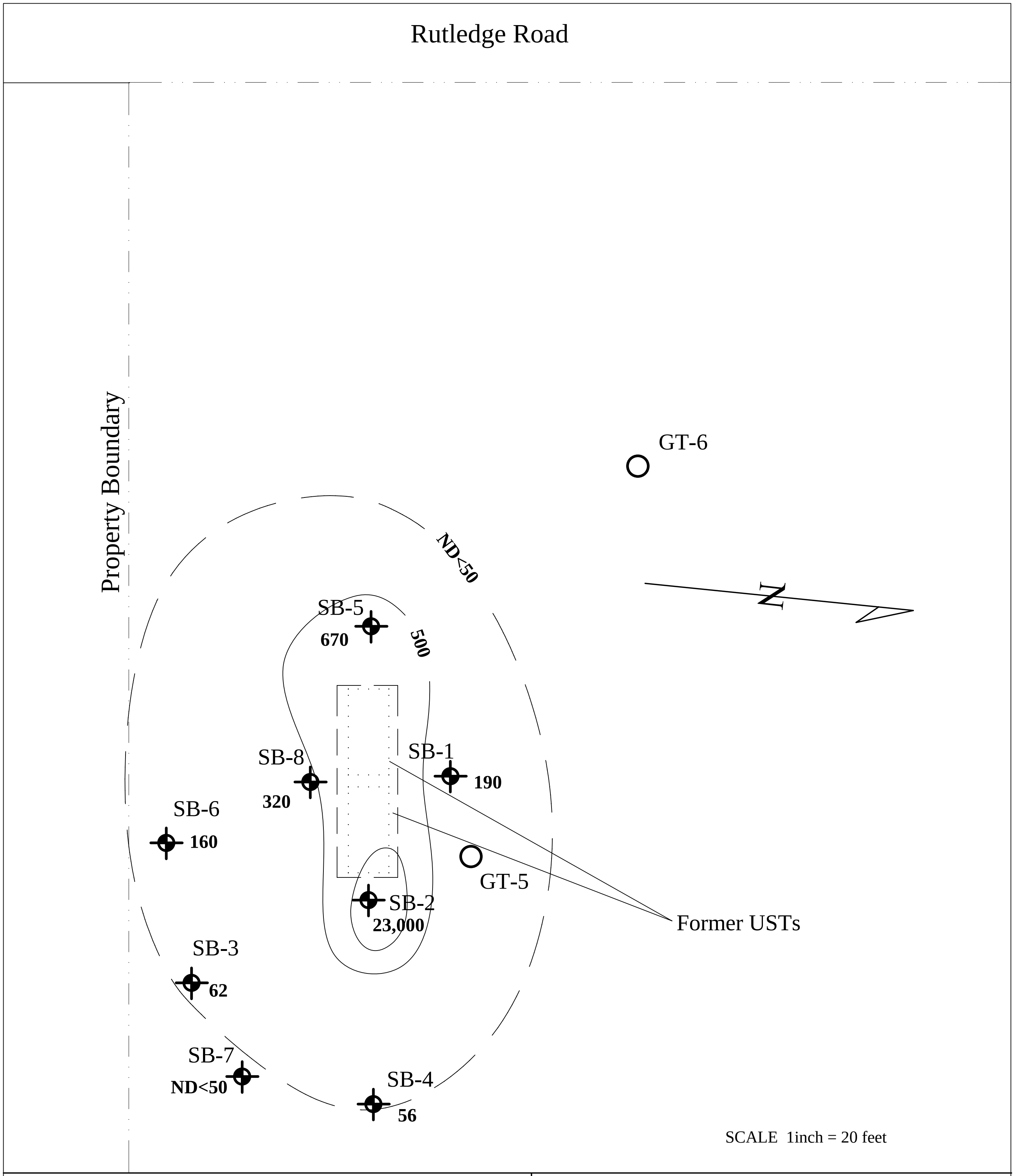
GROUNDWATER ANALYTICAL RESULTS (5/18/05)

20957 BAKER ROAD
CASTRO VALLEY, CA

FIGURE 4
Project No. 10509



○ GT-1 Geotechnical Boring - 1986

⊕ SB-1 Soil Borings - 5/18/05

62 Units µg/L

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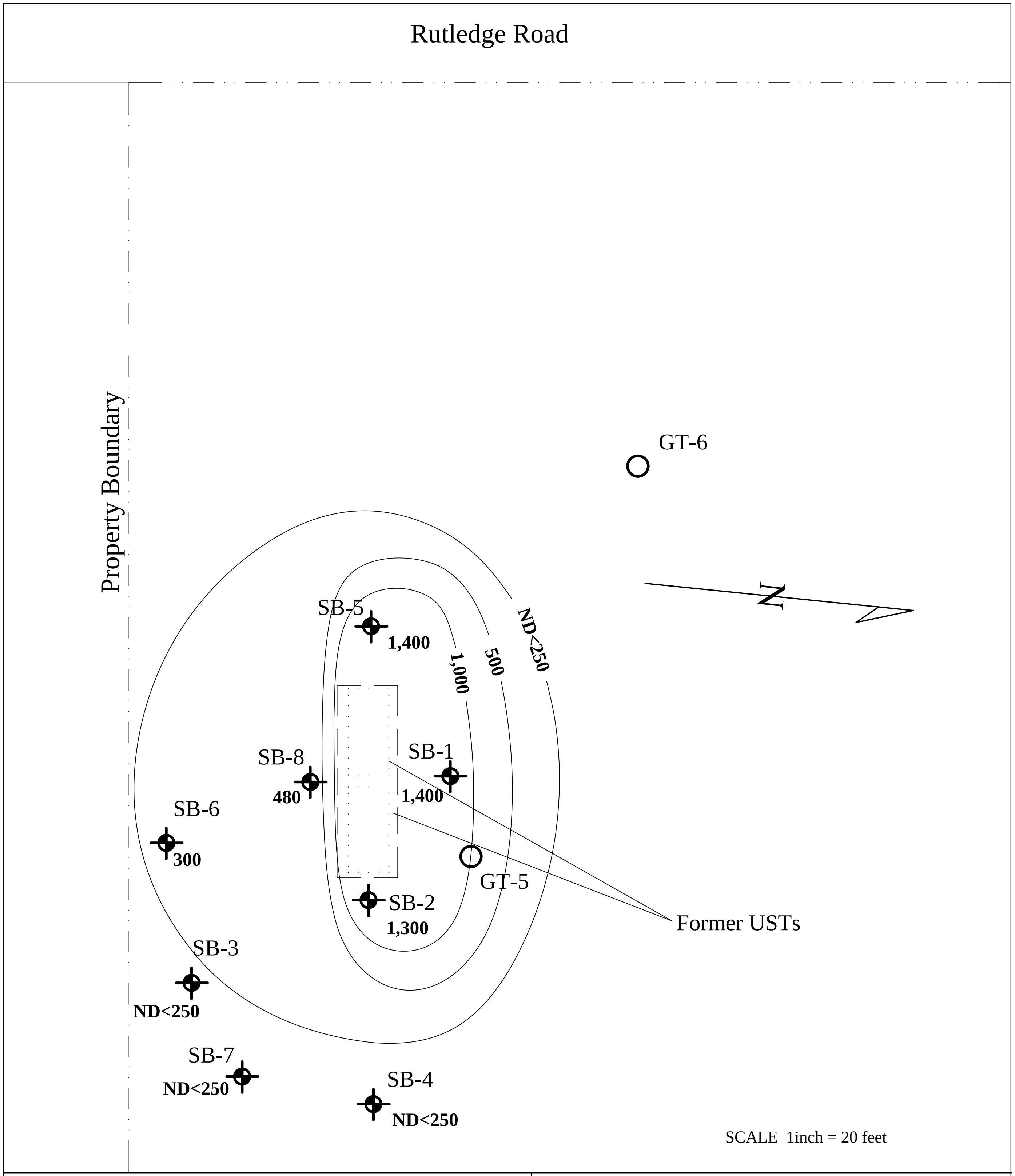
TPH-d Isopleths

20957 BAKER ROAD
CASTRO VALLEY, CA

FIGURE 5
Project No. 10509



○ GT-1 Geotechnical Boring - 1986

⊕ SB-1 Soil Borings - 5/18/05

1,300 Units µg/L

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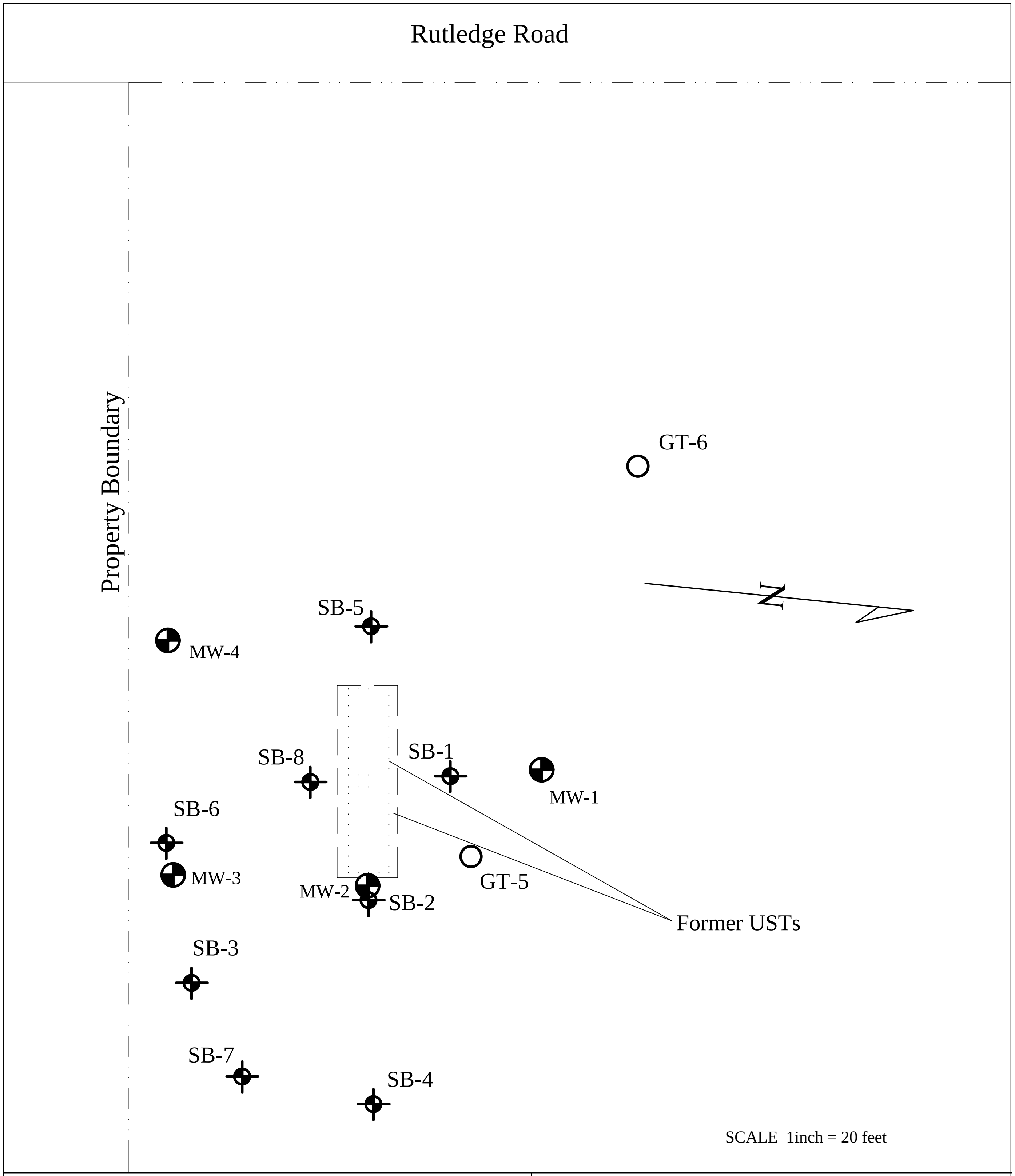
TPH-mo Isopleths

20957 BAKER ROAD
CASTRO VALLEY, CA

FIGURE 6
Project No. 10509



○	GT-1	Geotechnical Boring - 1986
⊕	SB-1	Soil Borings - 5/18/05
●	MW-1	Proposed wells

AEI CONSULTANTS
2500 CAMINO DIABLO, SUITE 100 WALNUT CREEK, CA

PROPOSED WELL LOCATIONS

20957 BAKER ROAD
CASTRO VALLEY, CA

FIGURE 7
Project No. 10509

TABLES

Table 1, Soil Sample Analytical Data, 20957 Baker Road, Castro Valley, California

Sample ID	**TPH-g** mg/kg	**TPH-d** mg/kg	**TPH-mo** mg/kg	**MTBE** mg/kg	**Benzene** mg/kg	**Toluene** mg/kg	**E'benzene** mg/kg	**Xylenes** mg/kg
	EPA method 8015			*EPA method 8021B*				
SB1-11.5	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB2-10	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB3-7.5	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB4-7.5	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB5-7.5	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB6-7.5	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB7-8	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB8-7.5	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005

Notes

TPH-g = total petroleum hydrocarbons as gasoline
TPH-d = total petroleum hydrocarbons as diesel
TPH-mo = total petroleum hydrocarbons as motor oil
MTBE = methyl tert-butyl ether
mg/kg = micrograms per liter (parts per billion)

Table 2, Groundwater Sample Analytical Data, 20957 Baker Road, Castro Valley, California

Sample ID	**TPH-g** µg/l	**TPH-d** µg/l	**TPH-mo** µg/l	**MTBE** µg/l	**Benzene** µg/l	**Toluene** µg/l	**E'benzene** µg/l	**Xylenes** µg/l
	EPA method 8015			*EPA method 8021B*				
SB-1 W	ND<50	190[1,2]	1400	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB-2 W	7,300[3, 4]	23,000[1,2,4,5]	1300	ND<50	ND<5.0	11	ND<5.0	27
SB3-W	ND<50	62	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB4-W	ND<50	56[2]	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB5-W	ND<50	670[1,2]	1400	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB6-W	ND<50	160[1,2]	300	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB7-W	ND<50	ND<50	ND<250	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB8-W	ND<50	320[1,2]	480	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5

Notes
1 - oil range compounds are significant
2 = diesel range compounds are significant, no recognizablr pattern
3 = no recognizable pattern
4 = lighter than water immiscible sheen/product is present
5 = gasoline rage compounds are significant

TPH-g = total petroleum hydrocarbons as gasoline
TPH-d = total petroleum hydrocarbons as diesel
TPH-mo = total petroleum hydrocarbons as motor oil
MTBE = methyl tert-butyl ether
µg/l = micrograms per liter (parts per billion)

APPENDIX A

Boring Logs

Project: Piazza

Project Location: 20957 Baker Road, Castro Valley, CA

Project Number: 10509

Log of Boring SB-1

Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type	Total Depth of Borehole **14 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **8.75 feet ATD**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			Asphalt		Asphalt 2", base rock 4"		
				CL		Clay, black 10YR 2/1, firm, stiff, moist		
		☒	SB1-3.5	CL		Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2	0.3	
	5			CL-ML		Sandy silty Clay - Clayey Sand Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling		
				SM		Silty Sand, yellowish brown 10YR 4/6, very fine grained, slightly clayey, firm - moderately firm, friable, very moist		
		☒	SB1-7.5				0.5	
						becoming wet @ 9 feet (ATD) ▽		
	10							
		☒	SB1-11.5	SP		Sand, strong brown 7.5 4/6, soft, loose, wet	0.9	Boring sealed to surface with neat cement grout.
				GC		Clayey Gravel, olive - olive brown 5y 4/4 - 2.5 4/4, firm, moist - (saprolite)		
				Claystone		Sandy Silty Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated		
						Bottom of Boring at 14 feet bgs		
	15							
	20							

Figure

AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 10509

Log of Boring SB-2

Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type **2 inch**	Total Depth of Borehole **18 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **9.2 feet ATD**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			GC		Clayey Gravel, black - dark yellow brown 10YR 2/1 - 3/4, firm, dry (FILL?)		
						No recovery		
		☒	SB2-3.5				0.1	
				ML		Clayey Silt, olive gray 5Y 5/2, moderately firm, moist		
	5							
						becoming sandy downward		
		☒	SB2-7.5				0.3	
				SM		Silty Sand, olive gray 5Y 5/2, clayey, moderately firm, moist wet @ 9.3 (ATD) ▽		
	10							
		☒	SB2-11.5	SP		Silty Sand, dark gray green 10GY 3/1, clayey, moderately firm,	175	
		☒	SB2-13	SW		Gravelly Sand, dark greenish gray 10GY 4/1, firm, wet	85	Boring sealed to surface with neat cement grout
	15			CL		Sandy Gravelly Clay, olive brown - dark grayish brown 2.5Y 4/4 - 4/2, firm, slightly moist (saprolite)		
				Claystone		Sandy Gravelly Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated		
						Bottom of Boring at 18 feet bgs		
	20							

Figure

AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

X:\PROJECTS\CHARACTERIZATION & REMEDIATION\CHARACTERIZATION\10509 PH II (Piazza) Castro Valley\Prelim Inv\Borings 1-8.bgs [DP Boring 20.tpl]

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 10509

Log of Boring SB-3

Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type **2 inch**	Total Depth of Borehole **16 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **8.56 feet ATD**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			Asphalt		Asphalt 2", base rock 4"		
				CL		Clay, black 10YR 2/1, firm, stiff, moist		
	5	⊠	SB3-3.5	CL		Silty Clay, dark yellowish brown 10YR3/4 with some very dark brown 10YR 2/2 mottling, firm, slightly moist	0.5	
		⊠	SB3-7.5	CL-ML		Clayey Silt - Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling	1.0	
	10	⊠	SB3-11.5	SM		Silty Sand, strong brown 7.5 YR 5/6, firm, moist becoming wet @ 10.0 (ATD) ▽	1.2	
				SP		Clayey Sand, yellowish brown 10YR 4/6, moderately firn - moderately soft, wet		
				Claystone		Sandy Silty Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated, slightly moist		Borings sealed to surface with neat cement grout
	15					No recovery		
	20					Bottom of Boring at 16 feet bgs		

Figure

AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

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Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 10509

Log of Boring SB-4

Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type **2 inch**	Total Depth of Borehole **13.5 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **9.6 feet ATD**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			Asphalt	■	Asphalt 2", base rock 4"		
				CL	▨	Clay, black 10YR 2/1, firm, stiff, moist		
		☒	SB4-3.5				1.0	
	5			CL-ML	▨	Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2 Sandy Silty Clay - Clayey Sandy Silt, dark yellowish brown 10YR 3/4 - 4/6 mottled,		
				CL-ML	▨	Silty Clay - Clayey Silt, yellowish brown 10YR 4/6, moderately firm, moist		
		☒	SB4-7.5				0.3	
						becoming wet @ 9 feet (ATD) ∇		
	10			CL	▨	Sandy Clay grading downward to Clayey Sand, dark yellowish brown - 10YR 6/6, firm, moist		
				SC	▨	Clayey Sand, brownish yellow - light yellowish brown 10YR 6/6 - 6/4, firm - moderately firm, very moist		
		☒	SB4-11.5				0.5	
		☒	SB4-12				0.5	Boring sealed to surface with neat cement grout
				SC	▨	Clayey Sand, light olive brown 2.5Y 5/6 - strong brown 7.5 YR 5/8 mottling, moderately firm, wet		
						Refusal at 13.5 feet		
	15							
	20							

Figure

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ENVIRONMENTAL & CIVIL ENGINEERING

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Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 10509

Log of Boring SB-5

Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type **2 inch**	Total Depth of Borehole **18 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **Dry feet ATD, 11.1 feet after 2.5 hrs**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			Asphalt	■	Asphalt 2", base rock 4"		
				CL	▨	Clay, black 10YR 2/1, firm, stiff, moist		
				CL	▨	Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2		
		☒	SB5-3.5				0.1	
	5							
				CL-ML	▨	Clayey Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling, firm,slighly moist		
		☒	SB5-7.5				0.1	
				SM	⁝	Sand, yellowish brown 10YR 4/6, very fine grained, clayey, firm - moderately firm, friable, very moist		
	10			SP	⁘	Sand, yellowish brown 10YR 4/6, very fine grained - coarse grained, firm, wet ? (after 2.5 hrs) ▼		
		☒	SB5-11.5				0.3	
				CL	▨	Gravelly Clay - Silty Clay, olive - olive brown 5y 4/4 - 2.5 4/4, firm - hard, slightly moist - (saprolite)		
		☒	SB5-14	Claystone	▤	Silty Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated	1.0	Boring sealed to surface wit neat cement grout
	15							
						Bottom of Boring at 18 feet bgs		
	20							

Figure

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ENVIRONMENTAL & CIVIL ENGINEERING

Project: Piazza **Project Location: 20957 Baker Road, Castro Valley, CA** **Project Number: 10509**	**Log of Boring SB-6** Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type **2 inch**	Total Depth of Borehole **14 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **8.62 feet ATD**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			Asphalt	■	Asphalt 2", clayey gravelly FILL		
				CL	▨	Clay, black 10YR 2/1, soft, moist		
		☒	SB6-3.5	CL	▨	Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2	1.0	
	5			CL-ML	▨	Sandy Silty Clay - Clayey Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling, firm, moist		
				SM	▥	Silty Sand, yellowish brown 10YR 4/6, very fine grained, slightly clayey, firm - moderately firm, friable, very moist - wet		
		☒	SB6-7.5				0.8	
						becoming wet @ 9 feet (ATD) ▽		
	10							
		☒	SB6-10.5				1.1	
				SP	∴	Sand, strong brown 7.5 YR 5/8 with yellowish brown 10YR 5/4, moderately soft - soft, wet		
		☒	SB6-10.5				0.9	Boring sealed to surface with neat cement grout
				GC-CL	▨	Clayey Gravel - Gravelly Clay, olive gray - olive 4/2 - 5/3, firm, moist, (saprolite)		
						Bottom of Boring at 14 feet bgs		
	15							
	20							

Figure

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ENVIRONMENTAL & CIVIL ENGINEERING

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Project: Piazza **Project Location: 20957 Baker Road, Castro Valley, CA** **Project Number: 10509**	# Log of Boring SB-7 Sheet 1 of 1

Date(s) Drilled **May 18, 2005**	Logged By **Robert F. Flory**	Checked By **Adrian Angel**
Drilling Method **Geoprobe**	Drill Bit Size/Type **2 inch**	Total Depth of Borehole **16 feet bgs**
Drill Rig Type **Geoprobe 5410**	Drilling Contractor **EnProb**	Approximate Surface Elevation
Groundwater Level and Date Measured **8.56 feet ATD**	Sampling Method(s) **Tube**	Permit #
Borehole Backfill **Cement Slurry**	Location	

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			Asphalt		Asphalt 2", base rock 4"		
				CL		Clay, black 10YR 2/1, firm, stiff, moist		
		☒	SB7-3.5	CL		Silty Clay, dark yellowish brown 10YR3/4 with some very dark brown 10YR 2/2 mottling, firm, slightly moist	0.1	
	5	☒	SB7-7.5	CL-ML		Clayey Silt - Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling	0.4	
	10			SM		Silty Sand, strong brown 7.5 YR 5/6, firm, moist becoming wet @ 10.0 (ATD) ▽		
		☒	SB7-13.5	SP		Clayey Sand, yellowish brown 10YR 4/6, moderately firn - moderately soft, wet	1.1	Boring sealed to surface with neat cement grout
	15			Claystone		Sandy Silty Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated, slightly moist		
		☒	SB7-11.5			No recovery	0.6	
	20					Bottom of Boring at 16 feet bgs		

Figure

X:\PROJECTS\CHARACTERIZATION & REMEDIATION\CHARACTERIZATION\10509 PH II (Piazza) Castro Valley\Prelim Inv\Borings 1-8.bgs [DP Boring 20.tpl]

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ENVIRONMENTAL & CIVIL ENGINEERING

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 10509

Log of Boring SB-8

Sheet 1 of 1

Date(s) Drilled	**May 18, 2005**	Logged By	**Robert F. Flory**	Checked By	**Adrian Angel**
Drilling Method	**Geoprobe**	Drill Bit Size/Type	**2 inch**	Total Depth of Borehole	**15 feet bgs**
Drill Rig Type	**Geoprobe 5410**	Drilling Contractor	**EnProb**	Approximate Surface Elevation	
Groundwater Level and Date Measured	**8.7 feet ATD**	Sampling Method(s)	**Tube**	Permit #	
Borehole Backfill	**Cement Slurry**	Location			

Elevation, feet	Depth, feet	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
	0			GC		Base rock		
				CL		Sandy Silty Clay, reddish brown 5YR 5/4 - yellowish brown 10YR 5/6, mottled, firm slightly moist		
				CL		Clay, black 10YR 2/1, firm, moderately firm, moist		
	5		SB8-3.5	CL		Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2	0.2	
				CL-ML		Sandy silty Clay - Clayey Sand Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling		
		☒	SB8-7.5	Sandstone		Silty Sand, yellowish brown 10YR 4/6, very fine grained, slightly clayey, firm - moderately firm, friable, very moist Moisture content increasing downward (ATD) ▽ becoming wet @ 9 feet	1.1	
	10	☒	SB8-11.5	SP		Sand, strong brown 7.5 4/6, soft - moderately soft, wet	0.1	
		☒	SB8-13	SP		Sand, strong brown 7.5 4/6 - yellowish brown 10YR 5/6 mottled, locally clayey, moderately soft - moderately firm, wet	2.3	Boring sealed with neat cement grout
				Claystone		Sandy Silty Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated		
	15					Bottom of Boring at 15 feet bgs		
	20							

Figure

X:\PROJECTS\CHARACTERIZATION & REMEDIATION\CHARACTERIZATION\273928 WI (Piazza) Castro Valley - (RFF)\10509 PH II (Piazza) Castro Valley\Prelim Inv\Borings 1-8.bgs [DP Boring 20.tpl]

APPENDIX B

Laboratory Analyses
With
Chain of Custody Documentation

McCampbell Analytical, Inc.

110 2nd Avenue South, #D7, Pacheco, CA 94553-5560
Telephone : 925-798-1620 Fax : 925-798-1622
Website: www.mccampbell.com E-mail: main@mccampbell.com

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #10509; Piazza	Date Sampled: 05/18/05
		Date Received: 05/19/05
	Client Contact: Robert Flory	Date Reported: 05/24/05
	Client P.O.:	Date Completed: 05/24/05

WorkOrder: 0505282

May 24, 2005

Dear Robert:

Enclosed are:

1). the results of 9 analyzed samples from your **#10509; Piazza project,**

2). a QC report for the above samples

3). a copy of the chain of custody, and

4). a bill for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits. If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Yours truly,

Angela Rydelius, Lab Manager

aeL 1/2

AEI Consultants
2500 Camino Diablo, Suite 100
Walnut Creek, CA 9459
Telephone: (925) 944-2899 Fax: (925) 944-2895

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☑ 5 DAY

EDF Required? Coelt (Normal) No Write On (DW) No

Report To: Robert Flory **Bill To:**
Company: AEI Consultants AEI Consultants
2500 Camino Diablo, Suite 100
Walnut Creek, CA 94597 **E-Mail:** rflory@aeiconsultants.com
Tele: (925) 944-2899 ext. 122 **Fax:** (925) 944-2895
Project #: 10509 **Project Name:** Piazza
Project Location: Castro Valley
Sampler Signature:

SAMPLE ID (Field Point Name)	LOCATION	SAMPLING		# Containers	Type Containers	MATRIX					METHOD PRESERVED				Analysis Request															Other				Comments
		Date	Time			Water	Soil	Air	Sludge	Other	Ice	HCl	HNO_3	Other	BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPH Multi-range diesel/motor oil (8015)	Total Petroleum Oil & Grease (5520 E&F/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 601 / 8010 (basic list)	BTEX ONLY (By EPA 602 / 8020)	EPA 8010 - basic list (by 8260)	EPA 608 / 8010 PCB's ONLY	EPA 624 / 8240 / 8260	EPA 625 / 8270	PAH's / PNA's by EPA 625 / 8270 / 8310	CAM-17 Metals	LUFT 5 Metals	Lead (7240/7421/239.2/6010) Toatal lead	RCI	TPH multi-range EPA 8015	LEAD - Total	LEAD - STLC		
SB1-3.5		5-18-05	0800																															EDF
SB1-7.5			0802																															
SB1-11.5			0805												X	X																		
SB2-7.5			0900																															
SB2-10			0905												X	X																		
SB2-13			0910																															
SB3-7.5			0950												X	X																		
SB3-11.5			0956																															
SB4-3.5			1045																															
SB4-7.5			1050												X	X																		
SB4-11.5			1054																															
SB4-12			1105																															

Relinquished By:	Date: 5/19/05	Time: 1110	Received By:
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t° ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT______
DECHLORINATED IN LAB______

	VOAS	O&G	METALS	OTHER
PRESERVATION				

APPROPRIATE CONTAINERS ✓
PERSERVED IN LAB______

aev 0505282

2/2

AEI Consultants
2500 Camino Diablo, Suite 100
Walnut Creek, CA 9459
Telephone: (925) 944-2899 Fax: (925) 944-2895

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

[✓ EDF Required?] Coelt (Normal) No Write On (DW) No

Report To: Robert Flory
Bill To: AEI Consultants
Company: AEI Consultants
2500 Camino Diablo, Suite 100
Walnut Creek, CA 94597
E-Mail: rflory@aeiconsultants.com
Tele: (925) 944-2899 ext. 122
Fax: (925) 944-2895
Project #: 10509
Project Name: Piazza
Project Location: Castro Valley
Sampler Signature:

SAMPLE ID (Field Point Name)	LOCATION	SAMPLING		# Containers	Type Containers	MATRIX					METHOD PRESERVED				Analysis Request															Other				Comments
		Date	Time			Water	Soil	Air	Sludge	Other	Ice	HCl	HNO_3	Other	BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPH Multi-range diesel/motor oil (8015)	Total Petroleum Oil & Grease (5520 E&F/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 601 / 8010 (basic list)	BTEX ONLY (By EPA 602 / 8020)	EPA 8010 - basic list (by 8260)	EPA 608 / 8010 PCB's ONLY	EPA 624 / 8240 / 8260	EPA 625 / 8270	PAH's / PNA's by EPA 625 / 8270 / 8310	CAM-17 Metals	LUFT 5 Metals	Lead (7240/7421/239.2/6010) Total lead	RCI	TPH multi-range EPA 8015	LEAD - Total	LEAD - STLC		PDF
SB5-7.5		5-18-05	1130	4	2x5										X	X																		
SB5-11.5			1135																															
SB6-7.5			1220												X	X																		
SB6-10.5			1230																															
SB7-8			1315												X	X																		
SB7-11.5			1320																															
SB8-7.5			1410												X	X																		
SB8-10.5			1416																															

Relinquished By:	Date:	Time:	Received By:
	5/19/05	1110	
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t° ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ______
DECHLORINATED IN LAB ______

	VOAS	O&G	METALS	OTHER
PRESERVATION				

APPROPRIATE CONTAINERS ✓
PERSERVED IN LAB ______

McCampbell Analytical, Inc.

110 Second Avenue South, #D7
Pacheco, CA 94553-5560
(925) 798-1620

CHAIN-OF-CUSTODY RECORD

WorkOrder: 0505282 **ClientID: AEL**

Report to:

Robert Flory
AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

TEL: (925) 283-6000
FAX: (925) 283-6121
ProjectNo: #10509; Piazza
PO:

Bill to:

Diane
All Environmental, Inc.
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

Requested TAT: **5 days**

Date Received: **05/19/2005**
Date Printed: **06/03/2005**

					Requested Tests (See legend below)														
Sample ID	**ClientSampID**	**Matrix**	**Collection Date**	**Hold**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
0505282-001	SB1-3.5	Soil	05/18/2005	☐		A													
0505282-003	SB1-11.5	Soil	05/18/2005	☐	A		A												
0505282-005	SB2-10	Soil	05/18/2005	☐	A		A												
0505282-007	SB3-7.5	Soil	05/18/2005	☐	A		A												
0505282-010	SB4-7.5	Soil	05/18/2005	☐	A		A												
0505282-013	SB5-7.5	Soil	05/18/2005	☐	A		A												
0505282-015	SB6-7.5	Soil	05/18/2005	☐	A		A												
0505282-017	SB7-8	Soil	05/18/2005	☐	A		A												
0505282-019	SB8-7.5	Soil	05/18/2005	☐	A		A												

Test Legend:

1	**G-MBTEX_S**	**2**	**PREDF REPORT**	**3**	**TPH(DMO)_S**	**4**		**5**	
6		**7**		**8**		**9**		**10**	
11		**12**		**13**		**14**		**15**	

Prepared by: Melissa Valles

Comments:

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #10509; Piazza	Date Sampled: 05/18/05 Date Received: 05/19/05
	Client Contact: Robert Flory	Date Extracted: 05/19/05
	Client P.O.:	Date Analyzed: 05/20/05

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE*

Extraction method: SW5030B Analytical methods: SW8021B/8015Cm Work Order: 0505282

Lab ID	Client ID	Matrix	TPH(g)	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	DF	% SS
003A	SB1-11.5	S	ND	ND	ND	ND	ND	ND	1	94
005A	SB2-10	S	ND	ND	ND	ND	ND	ND	1	99
007A	SB3-7.5	S	ND	ND	ND	ND	ND	ND	1	92
010A	SB4-7.5	S	ND	ND	ND	ND	ND	ND	1	90
013A	SB5-7.5	S	ND	ND	ND	ND	ND	ND	1	95
015A	SB6-7.5	S	ND	ND	ND	ND	ND	ND	1	100
017A	SB7-8	S	ND	ND	ND	ND	ND	ND	1	105
019A	SB8-7.5	S	ND	ND	ND	ND	ND	ND	1	99

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	NA	NA	NA	NA	NA	NA	1	ug/L
	S	1.0	0.05	0.005	0.005	0.005	0.005	1	mg/Kg

* water and vapor samples and all TCLP & SPLP extracts are reported in µg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples in mg/L.

cluttered chromatogram; sample peak coelutes with surrogate peak.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (stoddard solvent / mineral spirit?); f) one to a few isolated non-target peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) reporting limit raised due to high MTBE content; k) TPH pattern that does not appear to be derived from gasoline (aviation gas). m) no recognizable pattern; n) TPH(g) range non-target isolated peaks subtracted out of the TPH(g) concentration at the client's request.

DHS Certification No. 1644 _______Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #10509; Piazza	Date Sampled: 05/18/05 Date Received: 05/19/05
	Client Contact: Robert Flory	Date Extracted: 05/19/05
	Client P.O.:	Date Analyzed: 05/20/05

Diesel (C10-23) and Oil (C18+) Range Extractable Hydrocarbons as Diesel and Motor Oil*

Extraction method: SW3550C Analytical methods: SW8015C Work Order: 0505282

Lab ID	Client ID	Matrix	TPH(d)	TPH(mo)	DF	% SS
0505282-003A	SB1-11.5	S	ND	ND	1	116
0505282-005A	SB2-10	S	ND	ND	1	110
0505282-007A	SB3-7.5	S	ND	ND	1	102
0505282-010A	SB4-7.5	S	ND	ND	1	113
0505282-013A	SB5-7.5	S	ND	ND	1	106
0505282-015A	SB6-7.5	S	ND	ND	1	94
0505282-017A	SB7-8	S	ND	ND	1	110
0505282-019A	SB8-7.5	S	ND	ND	1	106

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	NA	NA	ug/L
	S	1.0	5.0	mg/Kg

* water samples are reported in µg/L, wipe samples in µg/wipe, soil/solid/sludge samples in mg/kg, product/oil/non-aqueous liquid samples in mg/L, and all DISTLC / STLC / SPLP / TCLP extracts are reported in µg/L.

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel? is significant); d) gasoline range compounds are significant; e) unknown medium boiling point pattern that does not appear to be derived from diesel (asphalt?); f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; k) kerosene/kerosene range; l) bunker oil; m) fuel oil; n) stoddard solvent/mineral spirit.

DHS Certification No. 1644 _______Angela Rydelius, Lab Manager

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Soil   QC Matrix: Soil   WorkOrder: 0505282

EPA Method: SW8021B/8015Cm   Extraction: SW5030B   BatchID: 16289   Spiked Sample ID: 0505280-034A

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
TPH(btex)£	ND	0.60	95.9	93.2	2.82	98.6	92.2	6.76	70 - 130	70 - 130
MTBE	ND	0.10	93.3	87.3	6.66	91.3	94.8	3.74	70 - 130	70 - 130
Benzene	ND	0.10	106	102	3.48	103	110	5.98	70 - 130	70 - 130
Toluene	ND	0.10	83.7	84.4	0.844	85.7	88.9	3.69	70 - 130	70 - 130
Ethylbenzene	ND	0.10	100	98.7	1.74	102	106	3.67	70 - 130	70 - 130
Xylenes	ND	0.30	90.7	87	4.13	91.7	91	0.730	70 - 130	70 - 130
%SS:	109	0.10	108	112	3.64	105	108	2.82	70 - 130	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 16289 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0505282-003A	5/18/05 8:05 AM	5/19/05	5/20/05 8:49 AM	0505282-005A	5/18/05 9:05 AM	5/19/05	5/20/05 9:19 AM
0505282-007A	5/18/05 9:50 AM	5/19/05	5/20/05 10:19 AM	0505282-010A	5/18/05 10:50 AM	5/19/05	5/20/05 10:48 AM
0505282-013A	5/18/05 11:30 AM	5/19/05	5/20/05 11:18 AM	0505282-015A	5/18/05 12:20 PM	5/19/05	5/20/05 11:48 AM
0505282-017A	5/18/05 1:15 PM	5/19/05	5/20/05 7:19 AM	0505282-019A	5/18/05 2:10 PM	5/19/05	5/20/05 7:52 AM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder: 0505282

EPA Method: SW8015C **Extraction: SW3550C** **BatchID: 16282** **Spiked Sample ID: 0505282-019A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
TPH(d)	ND	20	81.1	81.8	0.826	98.8	100	1.18	70 - 130	70 - 130
%SS:	106	50	89	91	1.19	106	107	1.32	70 - 130	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 16282 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0505282-003A	5/18/05 8:05 AM	5/19/05	5/20/05 2:50 PM	0505282-005A	5/18/05 9:05 AM	5/19/05	5/20/05 2:50 PM
0505282-007A	5/18/05 9:50 AM	5/19/05	5/20/05 8:42 PM	0505282-010A	5/18/05 10:50 AM	5/19/05	5/20/05 7:36 PM
0505282-013A	5/18/05 11:30 AM	5/19/05	5/20/05 5:24 PM	0505282-015A	5/18/05 12:20 PM	5/19/05	5/20/05 6:30 PM
0505282-017A	5/18/05 1:15 PM	5/19/05	5/20/05 4:13 PM	0505282-019A	5/18/05 2:10 PM	5/19/05	5/20/05 4:13 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS Certification No. 1644 _______QA/QC Officer

McCampbell Analytical, Inc.

110 2nd Avenue South, #D7, Pacheco, CA 94553-5560
Telephone : 925-798-1620 Fax : 925-798-1622
Website: www.mccampbell.com E-mail: main@mccampbell.com

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #10509; Piazza	Date Sampled: 05/18/05
		Date Received: 05/19/05
	Client Contact: Robert Flory	Date Reported: 05/26/05
	Client P.O.:	Date Completed: 05/26/05

WorkOrder: 0505283

May 26, 2005

Dear Robert:

Enclosed are:

1). the results of **8** analyzed samples from your **#10509; Piazza project,**

2). a QC report for the above samples

3). a copy of the chain of custody, and

4). a bill for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits. If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Yours truly,

Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #10509; Piazza	Date Sampled: 05/18/05
		Date Received: 05/19/05
	Client Contact: Robert Flory	Date Extracted: 05/20/05
	Client P.O.:	Date Analyzed: 05/20/05

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE*

Extraction method: SW5030B Analytical methods: SW8021B/8015Cm Work Order: 0505283

Lab ID	Client ID	Matrix	TPH(g)	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	DF	% SS
001A	SB1-W	W	ND,i	ND	ND	ND	ND	ND	1	96
002A	SB2-W	W	7300,m,h,i	ND<50	ND<5.0	11	ND<5.0	27	10	100
003A	SB3-W	W	ND,i	ND	ND	ND	ND	ND	1	92
004A	SB4-W	W	ND,i	ND	ND	ND	ND	ND	1	97
005A	SB5-W	W	ND,i	ND	ND	ND	ND	ND	1	96
006A	SB6-W	W	ND,i	ND	ND	ND	ND	ND	1	100
007A	SB7-W	W	ND,i	ND	ND	ND	ND	ND	1	95
008A	SB8-W	W	ND,i	ND	ND	ND	ND	ND	1	96

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	50	5.0	0.5	0.5	0.5	0.5	1	μg/L
	S	NA	NA	NA	NA	NA	NA	1	mg/Kg

* water and vapor samples and all TCLP & SPLP extracts are reported in ug/L, soil/sludge/solid samples in mg/kg, wipe samples in μg/wipe, product/oil/non-aqueous liquid samples in mg/L.

cluttered chromatogram; sample peak coelutes with surrogate peak.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (stoddard solvent / mineral spirit?); f) one to a few isolated non-target peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) reporting limit raised due to high MTBE content; k) TPH pattern that does not appear to be derived from gasoline (aviation gas). m) no recognizable pattern; n) TPH(g) range non-target isolated peaks subtracted out of the TPH(g) concentration at the client's request.

DHS Certification No. 1644

Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #10509; Piazza	Date Sampled: 05/18/05
		Date Received: 05/19/05
	Client Contact: Robert Flory	Date Extracted: 05/19/05
	Client P.O.:	Date Analyzed: 05/20/05-05/24/05

Diesel (C10-23) and Oil (C18+) Range Extractable Hydrocarbons as Diesel and Motor Oil*

Extraction method: SW3510C Analytical methods: SW8015C Work Order: 0505283

Lab ID	Client ID	Matrix	TPH(d)	TPH(mo)	DF	% SS
0505283-001B	SB1-W	W	190,g,b,i	1400	1	105
0505283-002B	SB2-W	W	23,000,d,b,g,h,i	1300	1	102
0505283-003B	SB3-W	W	62,i	ND	1	102
0505283-004B	SB4-W	W	56,b,i	ND	1	106
0505283-005B	SB5-W	W	670,g,b,i	1400	1	113
0505283-006B	SB6-W	W	160,g,b,i	300	1	111
0505283-007B	SB7-W	W	ND,i	ND	1	105
0505283-008B	SB8-W	W	320,g,b,i	480	1	115

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	50	250	μg/L
	S	NA	NA	mg/Kg

* water samples are reported in μg/L, wipe samples in μg/wipe, soil/solid/sludge samples in mg/kg, product/oil/non-aqueous liquid samples in mg/L, and all DISTLC / STLC / SPLP / TCLP extracts are reported in μg/L.

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel? is significant); d) gasoline range compounds are significant; e) unknown medium boiling point pattern that does not appear to be derived from diesel; f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; k) kerosene/kerosene range; l) bunker oil; m) fuel oil; n) stoddard solvent/mineral spirit.

DHS Certification No. 1644

AC for Angela Rydelius, Lab Manager

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Water　　QC Matrix: Water　　WorkOrder: 0505283

EPA Method: SW8015C　**Extraction: SW3510C**　**BatchID: 16279**　**Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
TPH(d)	N/A	1000	N/A	N/A	N/A	99.4	98.9	0.467	N/A	70 - 130
%SS:	N/A	2500	N/A	N/A	N/A	108	107	0.752	N/A	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 16279 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0505283-001B	5/18/05 8:30 AM	5/19/05	5/24/05 12:41 AM	0505283-002B	5/18/05 9:30 AM	5/19/05	5/23/05 10:20 PM
0505283-003B	5/18/05 10:20 AM	5/19/05	5/24/05 9:55 AM	0505283-004B	5/18/05 11:00 AM	5/19/05	5/23/05 11:31 PM
0505283-005B	5/18/05 3:00 PM	5/19/05	5/24/05 7:35 AM	0505283-006B	5/18/05 12:50 PM	5/19/05	5/20/05 1:44 PM
0505283-007B	5/18/05 1:45 PM	5/19/05	5/24/05 12:30 PM	0505283-008B	5/18/05 2:30 PM	5/19/05	5/24/05 6:26 AM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Water QC Matrix: Water WorkOrder: 0505283

EPA Method: SW8021B/8015Cm **Extraction: SW5030B** **BatchID: 16281** **Spiked Sample ID: 0505283-006A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)	
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	LCS / LCSD
TPH(btex)£	ND	60	92.3	93.9	1.70	94.4	93.3	1.21	70 - 130	70 - 130
MTBE	ND	10	82	82.4	0.505	91	88.7	2.60	70 - 130	70 - 130
Benzene	ND	10	103	105	1.62	93.2	98.2	5.16	70 - 130	70 - 130
Toluene	ND	10	104	110	5.50	101	102	1.11	70 - 130	70 - 130
Ethylbenzene	ND	10	105	102	2.77	99	101	1.67	70 - 130	70 - 130
Xylenes	ND	30	91.3	90.7	0.733	86.3	90.3	4.53	70 - 130	70 - 130
%SS:	100	10	109	112	2.42	100	103	2.46	70 - 130	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 16281 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0505283-001A	5/18/05 8:30 AM	5/20/05	5/20/05 1:48 AM	0505283-002A	5/18/05 9:30 AM	5/20/05	5/20/05 10:06 PM
0505283-003A	5/18/05 10:20 AM	5/20/05	5/20/05 3:59 AM	0505283-004A	5/18/05 11:00 AM	5/20/05	5/20/05 7:14 AM
0505283-005A	5/18/05 3:00 PM	5/20/05	5/20/05 9:24 AM	0505283-006A	5/18/05 12:50 PM	5/20/05	5/20/05 7:46 AM
0505283-007A	5/18/05 1:45 PM	5/20/05	5/20/05 8:51 AM	0505283-008A	5/18/05 2:30 PM	5/20/05	5/20/05 9:57 AM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

N/A = not applicable or not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS Certification No. 1644

QA/QC Officer

ae 0505283

AEI Consultants
2500 Camino Diablo, Suite 100
Walnut Creek, CA 9459
Telephone: (925) 944-2899 Fax: (925) 944-2895

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

EDF Required? Coelt (Normal) No Write On (DW) No

Report To: Robert Flory	Bill To:
Company: AEI Consultants	AEI Consultants
2500 Camino Diablo, Suite 100	
Walnut Creek, CA 94597	E-Mail: rflory@aeiconsultants.com
Tele: (925) 944-2899 ext. 122	Fax: (925) 944-2895
Project #: 10509	Project Name: Piazza
Project Location: Castro Valley	
Sampler Signature:	

Comments: PDF

	SAMPLE ID (Field Point Name)	LOCATION	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	Soil	Air	Sludge	Other	METHOD PRESERVED Ice	HCl	HNO_3	Other	BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPH Multi-range diesel/motor oil (8015)	Total Petroleum Oil & Grease (5520 E&F/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 601 / 8010 (basic list)	BTEX ONLY (By EPA 602 / 8020)	EPA 8010 - basic list (by 8260)	EPA 608 / 8010 PCB's ONLY	EPA 624 / 8240 / 8260	EPA 625 / 8270	PAH's / PNA's by EPA 625 / 8270 / 8310	CAM-17 Metals	LUFT 5 Metals	Lead (7240/7421/239.2/6010) Toatal lead	RCI	Other: TPH multi-range EPA 8015	LEAD - Total	LEAD - STLC		Comments
+2	SB1-W		5-18-05	0830	4	3VOA 1AMB										X	X																		
+10	SB2-W			0930												X	X																		
+20	SB3-W			1020												X	X																		
+10	SB4-W			1100												X	X																		
+40	SB5-W			1500												X	X																		
+10	SB6-W			1250												X	X																		
+30	SB7-W			1345												X	X																		
+10	SB8-W			1430												X	X																		

Relinquished By:	Date: 5/19/05	Time: 110	Received By:
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t° ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ✓
DECHLORINATED IN LAB____

	VOAS	O&G	METALS	OTHER
PRESERVATION	✓			

APPROPRIATE CONTAINERS ✓
PERSERVED IN LAB____

McCampbell Analytical, Inc.
110 Second Avenue South, #D7
Pacheco, CA 94553-5560
(925) 798-1620

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: 0505283 **ClientID: AEL**

Report to:
Robert Flory
AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

TEL: (925) 283-6000
FAX: (925) 283-6121
ProjectNo: #10509; Piazza
PO:

Bill to:
Diane
All Environmental, Inc.
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

Requested TAT: 5 days
Date Received: 05/19/2005
Date Printed: 05/19/2005

Sample ID	ClientSampID	Matrix	Collection Date	Hold	Requested Tests (See legend below) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0505283-001	SB1-W	Water	5/18/05 8:30:00 AM	☐	A	A	B												
0505283-002	SB2-W	Water	5/18/05 9:30:00 AM	☐	A		B												
0505283-003	SB3-W	Water	5/18/05 10:20:00	☐	A		B												
0505283-004	SB4-W	Water	5/18/05 11:00:00	☐	A		B												
0505283-005	SB5-W	Water	5/18/05 3:00:00 PM	☐	A		B												
0505283-006	SB6-W	Water	5/18/05 12:50:00	☐	A		B												
0505283-007	SB7-W	Water	5/18/05 1:45:00 PM	☐	A		B												
0505283-008	SB8-W	Water	5/18/05 2:30:00 PM	☐	A		B												

Test Legend:

1	G-MBTEX_W	2	PREDF REPORT	3	TPH(DMO)_W	4		5	
6		7		8		9		10	
11		12		13		14		15	

Prepared by: Melissa Valles

Comments:

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

APPENDIX D

Well Installation Report

November 29, 2007

WELL INSTALLATION REPORT

20957 Baker Road
Castro Valley, California 94546
ACHCS Leak Case RO 2739

AEI Project No. 273928

Prepared For

Nat and Darlene Piazza
7613 peppertree Road
Dublin, CA 94568

Prepared By

AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94597

AEI

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1.0 INTRODUCTION

AEI Consultants (AEI) has prepared this report on behalf of Mr. and Mrs. Nat Piazza (client), owners of the above referenced property. AEI has been retained by the client to provide environmental engineering and consulting services associated with a release from two previously removed underground storage tank (USTs) on the property. This investigation was carried out in response to a request from the Alameda County Environmental Health Services (ACEHS) for a soil and groundwater investigation. The purpose of the investigation was to determine the lateral and vertical extent of impact to the soil and groundwater that resulted from the hydrocarbon release. AEI has prepared this report to summarize the activities and results of the investigation.

2.0 SITE DESCRIPTION

The subject property (hereafter referred to as the “site” or “property”) is located at 20957 Baker Road in Castro Valley, California (Figure 1: Site Location Map). The site is located in a mixed residential and commercial/light-industrial area of Castro Valley. The site is approximately 81 feet by 300 feet in area and is currently undeveloped and not in use. The site is partially covered with asphalt surfacing and concrete slabs with the remainder of the site graveled. The site occupies the southern two thirds of the fenced in area.

Baker Road makes up the east boundary of the site with residential property to the east of the road. Rutledge Road bounds the property to the west with commercial and residential property west of the road. The property is bounded to the north by a partially vacant lot. The parcel to the north is split by a fence, with the southern half of the adjacent lot appearing to be part of the subject site. Two residential buildings are located in the northeast quadrant of is adjacent lot. To the south, the east half of the property is by an apartment complex and on the west half bounded to the south by a plumbing contractor. The locations of these buildings relative to the subject site and locations of the former UST are shown on Figure 2, “Site Map”.

3.0 BACKGROUND

3.1 Tank Removal

On April 21, 2004, AEI removed two 1,000-gallon USTs from the site (Figure 2). The removal was performed under permit from the ACEHS. Robert Weston, Inspector for the ACEHS, observed the tank removal. Two soil samples were collected from underneath each UST and analyzed for Total Petroleum Hydrocarbons as gasoline (TPH-g), benzene, toluene, ethylbenzene, xylenes (BTEX) and Methyl tertiary butyl ether (MTBE) by EPA Method 8021B/8015Cm. Total Petroleum Hydrocarbons as diesel (TPH-d) was analyzed by EPA Method 8015C and total lead by EPA method 7010.

Hydrocarbons were reported in all the soil samples analyzed. TPH-g was reported at concentrations ranging from 160 milligrams per kilogram (mg/kg) (T1W-EB8’) to 1,400 mg/kg

(T2W-EB8’). TPH-d was reported at concentrations ranging from 1,400 mg/kg (T2E-EB8’) to 10,000 mg/kg (T1E-EB8’). Total xylenes were reported in two samples at 8.4 mg/kg (T2W-E8’) and 0.25 mg/kg (T2E-EB8’). Benzene and ethylbenzene were reported as not detected. Total lead was reported at concentrations ranging from 6.1 mg/kg (T1W-E8’) to 24 mg/kg (stockpile sample STKP1-4). The results of hydrocarbon analyses of soil samples collected from the tank removal are included in Table 1.

3.2 Preliminary Site Investigation

AEI performed a Preliminary investigation at the property on May 18, 2005. Eight (8) soil borings (SB-1 through SB-8) were advanced to depths ranging from 14 ft. to 18 ft. below ground surface (bgs) using a Geoprobe® Model 5410 direct-push drilling rig. The locations of the soil borings are shown on Figure 2, Site Map.

No detectable concentrations of TPH-g, TPH-d, TPH-mo, MTBE or BTEX, were reported in any of the soil samples from depths of 7.5 to 11 feet bgs at or above detection limits of 1.0 mg/kg, 1.0 mg/kg, 5.0 mg/kg, 0.05 mg/kg, and 0.005 mg/kg, respectively.

TPH-g was reported in the groundwater sample from soil boring SB-2 (SB-2W) at concentration of 7,300 micrograms per liter (µg/L). No TPH-g was reported in groundwater samples from any other borings at or above the detection limit of 50 µg/L.

The maximum concentration of TPH-d was reported at a concentration of 23,000 µg/L in the in the groundwater sample from boring SB-2 (SB-2W). LNAPL was observed both in the field and by the laboratory in this groundwater sample. TPH-d was reported in the other seven borings at concentrations ranging from ND<50 µg/L (SB-7) to 670 µg/L (SB-5).

No TPH-mo was reported in groundwater samples from borings SB-3, SB-4 and SB-7 at or above a detection limit of 250 µg/L. TPH-mo was reported in groundwater samples from borings SB-1, SB-2, SB-5, SB-6 and SB-8 at concentrations ranging from 300 µg/L (SB-6) to 1400 µg/L (SB-1 and SB-5).

No MTBE was reported in the groundwater samples from any of the borings at or above a detection limit of 5.0 µg/L.

The results of the groundwater analyses are summarized in Table 2 (Groundwater Sample Analytical Data) and shown on Figure 4, “Soil Boring Groundwater Samples”.

4.0 GEOLOGY AND HYDROLOGY

The site is located at approximately 160 feet above mean sea level (msl). The site is relatively flat and the local topography slopes very gently to south-southwest toward an unnamed stream (Figure 1). During periods of rain, surface drainage on the bulk of the site is to the southwest then onto the storm drains along Rutledge Road.

The lithology observed in the borings drilled to date typically consists of 1 to 2 feet of gravelly clay – clayey gravel (Fill). The surface fill is underlain by silty clay, which becomes clayey silt downward to a depth of 6 to 8 feet bgs. This silt and clay unit is underlain by silty and gravelly sands to the top of the bedrock at depths of 13 to 17 feet bgs (Figure 9). In several borings saprolitic clay is present between the sandy sediments and the claystone bedrock.

Groundwater, where present, was encountered at depths of 9 to 11 feet bgs in May 2005. On October 12, 2007 groundwater was encountered at depths ranging from 13.3 feet bgs in well IN-1 to 15.5 feet bgs in well MW-1. This indicates that during at least part of the dry season, groundwater is not present above the top of the bedrock. The overall northward slope to the bedrock surface under the former USTs and the local bedrock low in the area of SB-2 could have resulted in hydrocarbon migration up or across the normal groundwater gradient at times if the groundwater level is below the top of the bedrock. The relationships of the sediments that underlie the site are shown on Figure 10 (Cross sections A-A' and B-B'). Copies of the boring/well logs are included in Appendix B, Boring/Well Logs

Between October 12 and November 6, 2007, the groundwater flow direction ranged from southwest to southeast with highly variable gradients (Table 3, Figures 4 through 7). The high variability is believed to be the result of the low groundwater level and scattered light rainfall during this period.

The nearest surface water body to the site is a small unnamed creek, located approximately 500 feet southwest of the site that drains into San Lorenzo Creek.

5.0 PRE-INVESTIGATION ENVIRONMENTAL CONCERNS

Analysis of soil samples collected from beneath the two previously removed 1000-gallon fuel USTs in 2004 reported maximum TPH-g and TPH-d concentrations of 1,400 mg/kg and 10,000 mg/kg, respectively from a depth of 8.0 bgs.

Analysis of soil samples collected during the 2005 Preliminary Site Investigation reported no detectable concentrations of TPH or MBTEX, however obviously impacted greenish gray sand was observed below the top groundwater in boring SB-2. Field screening of sample SB-2-11.5 reported organic vapors at a concentration of 175 ppmv. Based on the data from the 2004 UST removal and 2005 preliminary Site Investigation data, impacted soil appeared to be limited to an area approximately 10 feet by 40 feet, essentially the footprint of the previous tank hold and in the bedrock low around boring SB-2.

Analysis of groundwater samples collected from soil borings in 2005, reported concentrations of TPH-g exceeding the detection limit of 50 µg/L only in SB-2. In SB-2 TPH-g was reported at a concentration of 7,300 µg/L. The reported concentrations of BTEX exceeded the detection limit of 0.5 µg/L only in SB-2 where toluene and total xylenes were reported at concentrations of 11 µg/L and 27 µg/L, respectively.

TPH-d was reported at concentrations up to 23,000 µg/L (SB-2). TPH-mo was reported at concentrations of up to 1,400 µg/L (SB-1 and SB-5). The results of the groundwater analyses are summarized on Figure 3.

6.0 SCOPE OF WORK

The scope of work for this investigation consisted of the following:

- Install four (4) 2-inch diameter groundwater monitoring wells, one on each side of the former tank hold and two down gradient of the former tank hold.
- Install one (1) 2-inch diameter injection through the center of the former tank hold.
- Prepare a report summarizing well installation and development activities

7.0 MONITORING WELL INSTALLATION

Prior to the initiation of field activities well construction permits W2007-0964 to W2007-0968 were obtained from Alameda County Department of Public Works (DPW), the work area was marked, and Underground Service Alert (USA North) was notified more than 2 working days prior to the initiation of drilling activities. A copy of the drilling permit is attached in Appendix A. H E W Drilling, California C-57 license number 604987, installed the wells on October 12, 2007.

7.1 Well Installation and Construction

Four (4) two-inch diameter groundwater monitoring wells (MW-1 through MW-4) and two-inch diameter injection well IN-1 were installed onsite with a CME-75 drilling rig the locations shown on Figure 2. Wells MW-1 and MW-2 were located west and east ends of the UST excavation, respectively. Wells MW-3 and MW-4 were located down gradient of the UST excavation. Injection well IN-1 was installed in the center of the UST excavation.

The soil borings were advanced to a depth of 16.5 feet bgs using a CME 75 drilling rig with nominal 8 ¼-inch diameter continuous flight, hollow stem augers. Soil samples were typically collected at depths of 5, 8, 10, and 12 feet bgs with an 18-inch long modified California split-spoon sampler. Samples were also collected at a depth of 15 feet bgs in wells MW-2 and MW-4. No sample was collected at a depth of 5 feet bgs in well IN-1. In well IN-1 soil sampling began at a depth of 8 feet bgs, just above the base of UST excavation. Selected soil samples were retained for possible laboratory analysis. The sample sleeves were sealed with Teflon tape, plastic caps, and labeled with a unique identifier. The samples were then placed in a cooler filled with water ice, and transported under appropriate chain-of-custody documentation for analysis to McCampbell Analytical Inc., (DOHS Certification Number 1644) of Pittsburg, California. Selected soil samples were analyzed for TPH-g, TPH-d, TPH-mo, and TPH bunker oil (TPH-bo) by EPA method 8015, benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX), and MTBE by EPA method 8021B. Soil samples were described by an AEI staff geologist and logged using the Unified Soil Classification System. Selected samples were field screened using a photo ionization detector (PID)

The wells were constructed at a total depth of 16.5 feet bgs with 10 feet of 0.020-inch factory slotted, 2-inch diameter schedule 40 PVC screen. The annular space around the slotted casing was filled with #2/16 Monterey sand to a depth approximately 6.0 feet bgs. Approximately 1 foot of 3/8-inch bentonite chip was placed on top of the sand and hydrated with clean water. The balance of the boring was then sealed with neat cement grout. A flush mount well box was cemented at the surface. The details of well construction are summarized in Table 4, *Well Construction Details.*

7.2 Soil Analyses

Two soil samples from borings MW-1 through MW-3 and three soil samples from wells MW-4 and IN-1 were analyzed for TPH-g and MBTEX by EPA Method 8015/8021B and TPH-d, TPH-mo, and TPH-bo by method 8015C. In addition one sample from well MW-2 and one sample from well IN-1 were analyzed for Hexavalent chromium by Alkaline Digestion and IC-UV Analysis, CAM 17/CCR Metals by ICP/MS, chemical oxygen demand (COD) by method SM5220D, and pH by method SW9045C. Three samples were forwarded to a geotechnical laboratory for sieve analysis.

7.3 Soil Analytical Results

No TPH-g, TPH-d, TPH-mo, TPH-bo, BTEX or MTBE was reported in any of the soil samples analyzed from wells MW-1 through MW-4. No TPH-g, TPH-mo, BTEX or MTBE was reported in soil samples from well IN-1. TPH-d was reported concentrations of 4.0 mg/kg, 5.1 mg/kg, and ND<1.0 at depths of 8.5 feet bgs, 10 feet bgs, and 12 feet bgs, respectively. The results of soil analyses for hydrocarbons and MBTEX are summarized in Table 2, *Soil Analytical Data*. COD was reported at 2,400 mg/kg and 1,800 mg/kg in samples IN-1-8.5 and MW-2-11.5, respectively. pH was reported as 7.37 at 24.1 degrees Celsius and 5.82 at 23.8 degrees Celsius in samples IN-1-8.5 and MW-2-11.5, respectively. The results of Cam 17 metal analysis in samples IN-1-8.5 and MW-2-11.5 were all reported within normal background ranges. Hexavalent chromium was reported as below the detection limit in both samples. The results of COD, pH, and metal analyses are summarized on Table 5, *Soil Analytical Data-Metals and Miscellaneous Analyses*. Laboratory results and chain of custody documents are included in Appendix D.

7.4 Groundwater Monitoring Well Development

The wells were initially developed on October 15, 2007. The wells were developed by a combination of over pumping, and surging. Depth to water at the time the wells were developed ranged from 11.00 feet bgs (IN-1) to 14.57 (MW-4).

On October 18, 2007, at the time of the initial sampling event, the depth to groundwater ranged from 10.89 (IN-1) feet bgs to 14.92 feet bgs (MW-4). On October 22, 2007, monitoring well MW-4 was re-developed by loading the well with water (Safeway's house brand drinking water) and surged for 15 minutes. Depth to water in the wells was on November 6, 2007 ranged from 8.00 feet bgs (MW-4) to 11.37 bgs (MW-2) feet bgs. Depth to water in well MW-4 was anomalously low when the wells were installed and at the three times depth to water was measured in October. The anomalously high water level on November 6, 2006 suggests that the permeability development in the well is insufficiently developed for use of the well as a monitoring well. Depth to water measurements are summarized in Table 3, *Groundwater Elevation Data*.

7.5 Groundwater Sampling

The initial groundwater monitoring event occurred on November 18, 2007. Prior to sampling the wells, the well caps were all removed and the wells were allowed to equilibrate with the atmosphere for at least 15 minutes. The depth to water was then measured in each well to ± 0.01 foot using an electronic depth to water meter. Each well purged using a peristaltic pump with ¼-inch polyethylene drop tube. The wells were low flow (12) or micro-purged at a rate of approximately 0.5-liter per minute. During well purging temperature, pH, specific conductivity, dissolved oxygen, and oxidation-reduction potential (ORP) was measured at one-minute intervals. The wells were purged until the three successive readings are within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for ORP, and ± 10% for temperature between three consecutive measurements or until the well dewatered. Visual estimates of turbidity were noted during the purging of the wells.

Once the groundwater parameters stabilized water samples were collected from each well using the peristaltic pump. Water samples were collected into containers with appropriate preservatives to each analysis. Samples for volatile analytes were collected into 40 milliliter (mL) hydrochloric acid preserved volatile organic analysis (VOA) vials, with zero headspace (no air bubbles). Samples to be analyzed for CAM 17 and Hexavalent Chromium were filtered in the field. Samples were entered of an appropriate chain-of-custody and placed in a cooler on water ice under chain of custody protocols to McCampbell Analytical, Inc. of Pittsburg, California (Department of Health Services Certification #1644).

Groundwater samples were analyzed for TPH-g, MBTEX by method SW8021B/8015Cm and Total petroleum Hydrocarbons as Bunker oil (TPH-bo – C10+), TPH-d (C10-23) and TPH0mo (C18+) by method SW8015C. Two groundwater samples, MW-2 and MW-3, were analyzed for Cam 17 metals and Hexachrome by ICP MS and IC respectively.

7.6 Field Results

No sheen or free product was encountered during monitoring activities. No petroleum odors were noted in the groundwater purged from any well prior to sample collection.

Copies of the Field Data Sheets are attached in Appendix C. Groundwater elevation data is summarized in Table 3.

Depth to groundwater was measured prior to well development, prior to sampling, at the time of the redevelopment of MW-4 on November 6, 2007. The groundwater elevation contours and groundwater flow direction are shown in Figures 4 through 7. Significant variability is observed in the contours on the top of the groundwater. This is probably related to variable recharge from fractures in the underlying bedrock following the early part of the wet season and the irregularity of the shallow bedrock surface. This variability is expected to decrease as groundwater levels rise and groundwater flow stabilizes as the wet season progresses.

Groundwater elevations at the time of the current monitoring event ranged from 144.77 feet bgs (MW-4) to 148.96 feet bgs (IN-1). The direction of the groundwater flow at the time of measurement was variable ranging from the southeast to east southeast. The calculated apparent groundwater gradient ranged from 0.015 to 0.026 ft/ft.

Groundwater elevations on November 6, 2007 ranged from 148.59 (MW-3) to 151.69 feet bgs (MW-4) to 148.96 feet bgs (IN-1). The direction of groundwater flow at the time of measurement was to the south southeast with a groundwater gradient of 0.002 ft/ft.

7.7 Groundwater Analytical Results

No TPH-g, BTEX or MTBE were reported at or above standard reporting limits in any of the groundwater samples. No TPH-bo, TPH-d, or TPH-mo, were reported in samples from wells MW-2 through MW-4 and IN-1 at or above detection limits of 100 µg/L, 50 µg/L, and 250 µg/L, respectively. TPH-bo (C10+, middle - heavy residual fuel), TPH-d (C10 - 23, middle residual fuel), and TPH-mo (C28+ heavy residual fuel were reported in the water sample from well MW-1 at concentrations of 56 µg/L, 140 µg/L, and ND<250 µg/L, respectively. The difference between concentrations reported for TPH-bo and TPH-d indicate that the heavy residual concentration is approximately 86 µg/L. All metal analyses were reported within normal background ranges. A summary of groundwater analytical data is presented in Tables 2 and 6. Laboratory results and chain of custody documents are included in Appendix C.

8.0 WELL ELEVATION SURVEY

The location and elevation of each newly installed well was surveyed by Morrow Surveying of West Sacramento, California, a California licensed land surveyor. As required, survey data was obtained utilizing global positioning system (GPS) technology, and was reported at a level of precision and in a format acceptable for submission to the California GeoTracker database. A copy of the site survey is attached as Appendix G.

9.0 WELL VAPOR SURVEY

During the first groundwater monitoring event the soil vapors present in the vadose zone of impacted wells were measured using a RKI Eagle gas analyzer. The Eagle measures hydrocarbon, oxygen, carbon dioxide, and methane concentrations. The relative presence of these gases can be used as an estimate of the amount and type of biodegradation taking place in the subsurface.

Vapor samples were collected from the vadose zone in each of the five wells on site. Eagle gas detector contains multiple detectors that measure Total Hydrocarbons, methane, oxygen, and carbon dioxide. No hydrocarbons were detected in any of the wells, this is consistent with the results of soil and groundwater analyses which reported little or no light hydrocarbons. Oxygen content ranged from near normal, 20.8% in MW-1, to slightly depressed, 7.9% in MW-3, 15.9% in MW-2, and 12.4 % in IN-1. Carbon dioxide content ranged from near normal, 0.4% in MW-1 to significantly elevated in MW-3 (7.3%) and IN-1 (5.0%). The vapor survey field data is found on the Field data sheets and attached in Appendix C and is summarized of Table 7.

Normal air composition is approximately 20.9% Oxygen and 0.03% carbon dioxide. The depressed concentrations of oxygen and elevated concentrations of carbon dioxide in the soil gas is consistent with relatively low levels of biodegradation and low levels of residual hydrocarbons.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of field screening, soil and groundwater analysis from this investigation, the hydrocarbons observed in soil at the base of the tank excavation in 2004 and in the groundwater from soil borings in 2005 has been reduced by natural attenuation processes over the last three years. No TPH-g, MBTE, or TPH-mo was identified by this investigation in the soil or groundwater. TPH-d was reported in the soil of only one well, IN-1, in soil underlying the UST excavation at trace concentrations. The current investigation found TPH-bo, TPH-d, or TPH-mo in wells MW-2 through IN-1 at or above standard reporting limits. In well MW-1, TPH-mo was reported as ND<250. TPH-bo and TPH-d were reported at concentrations of 140 µg/L and 56 µg/L, respectively. Subtracting the reported concentration of TPH-d (C10-23), from the concentration of TPH-bo (C10+) gives an approximate concentration of residual fuels of 84 µg/L. These concentrations are below the Regional Water Quality control boards November 2007 ESLs (Table F-1a)

No remedial action is warranted as it appears that the site is essentially clean and is a candidate to site closure.

AEI recommends continued groundwater monitoring on a quarterly basis. The next quarterly monitoring event is tentatively scheduled for mid January 2008. If the results of groundwater analysis at that time are consistent with the currently reported results, AEI will submit a formally request site closure at that time.

AEI requests your comments and approval to proceed with this project. Please contact either of the undersigned at (925) 944-2899, if you have any questions or need any additional information.

Sincerely,
AEI Consultants

PROFESSIONAL GEOLOGIST
ROBERT F. FLORY
No. 5825
10/31/08
STATE OF CALIFORNIA

Robert F. Flory, PG
Project Manager

11.0 REFERENCED DOCUMENTS

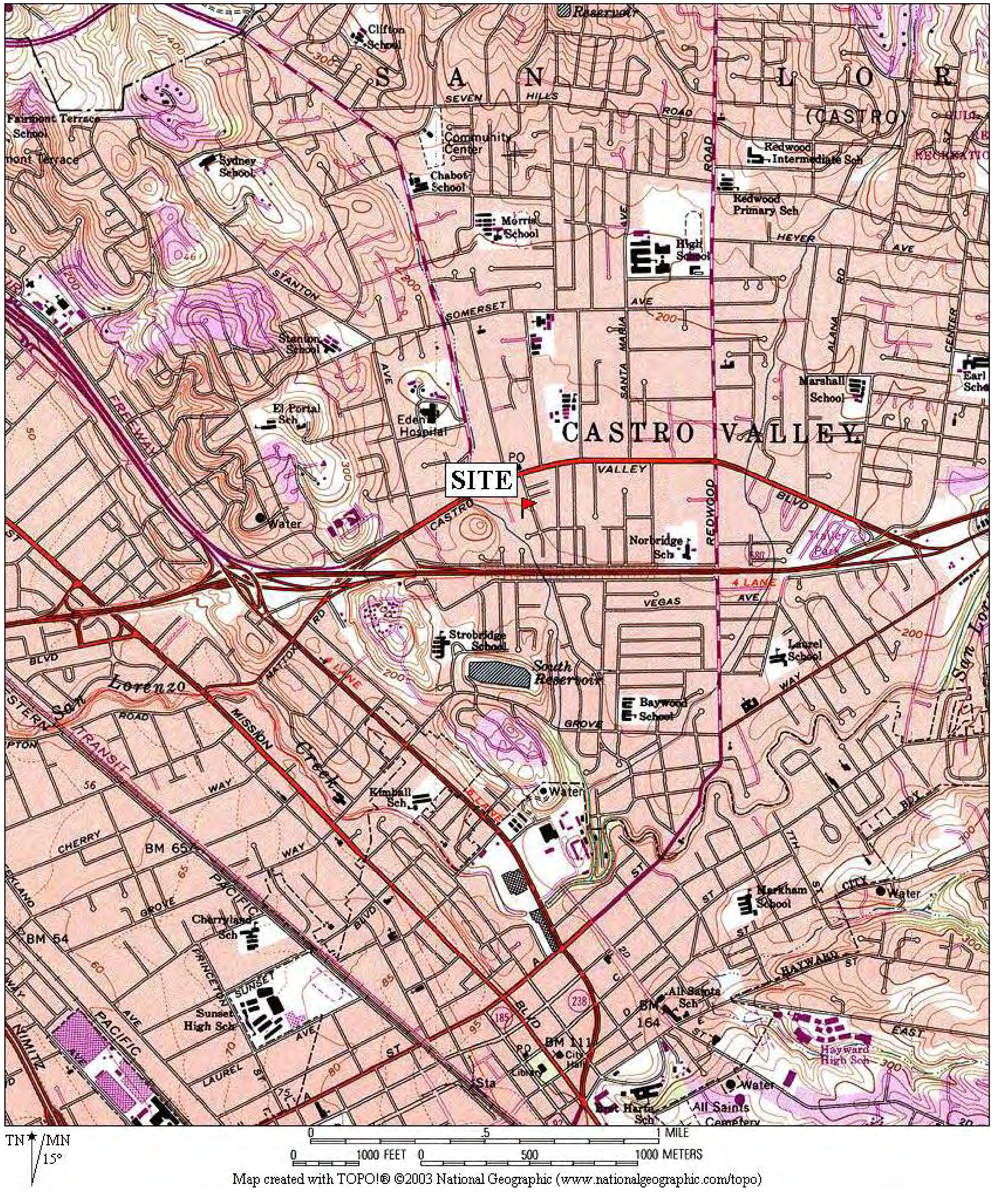
1. *Geotechnical Exploration and Engineering Study, Proposed Baker Road Apartments*, December 3, 1986, prepared by JMK Environmental Solutions, Inc.
2. *Underground Storage Tank removal Final Report*, May 19, 2004, prepared by AEI Consultants
3. *Workplan for Soil and Groundwater Investigation and Interim Source Removal*, September 20, 2007, prepared by AEI Consultants

Distribution:

File

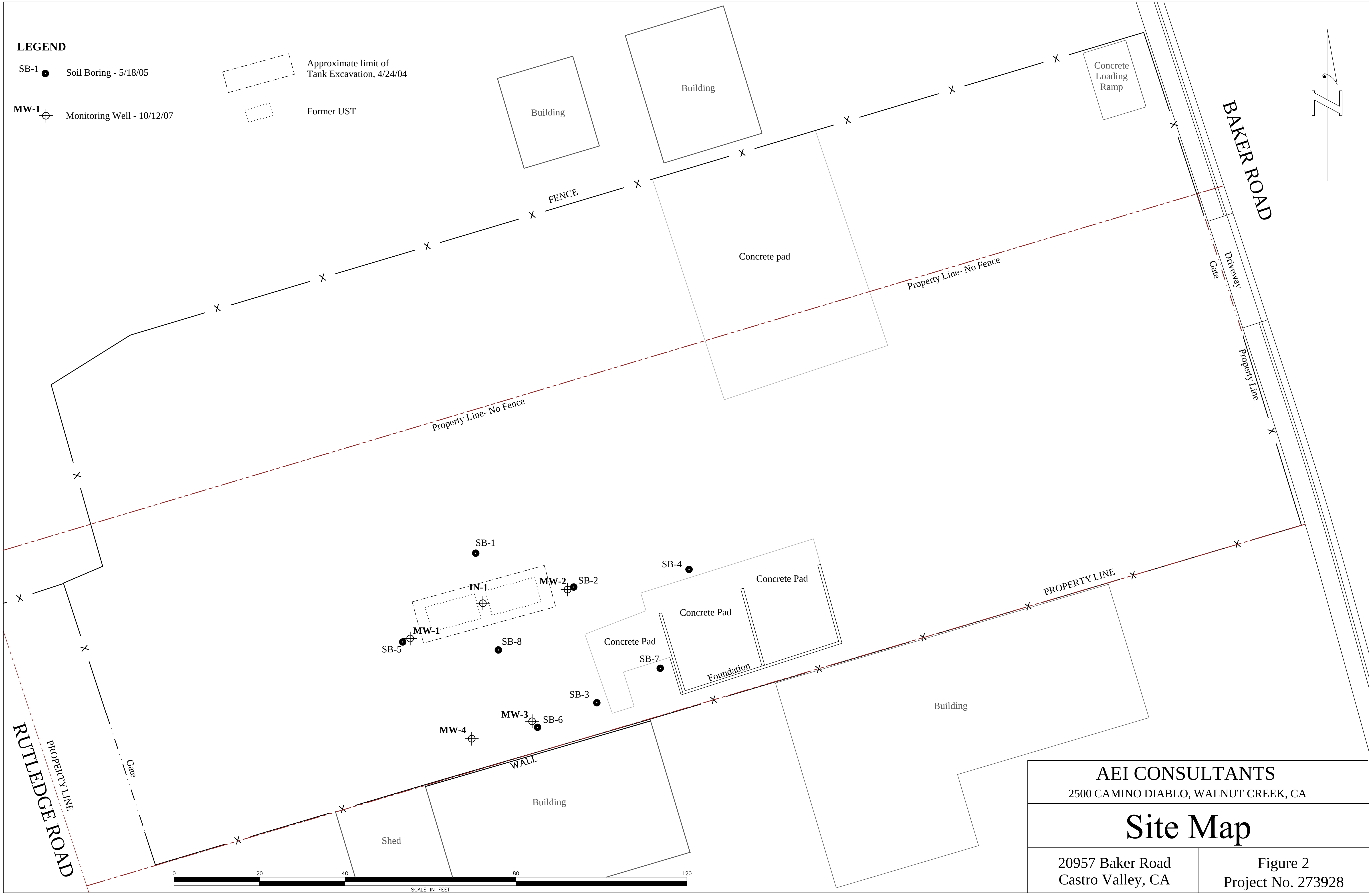
Nat Piazza, 7613 Pepper Tree Road, Dublin, California, 94568-3343	2 copies
Steven Plunkett, Alameda County Environmental Health Services	electronic
Geotracker	electronic

FIGURES



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

AEI CONSULTANTS	
SITE LOCATION MAP	
20957 BAKER ROAD CASTRO VALLEY, CALIFORNIA	**FIGURE 1** PROJECT NO. 273928



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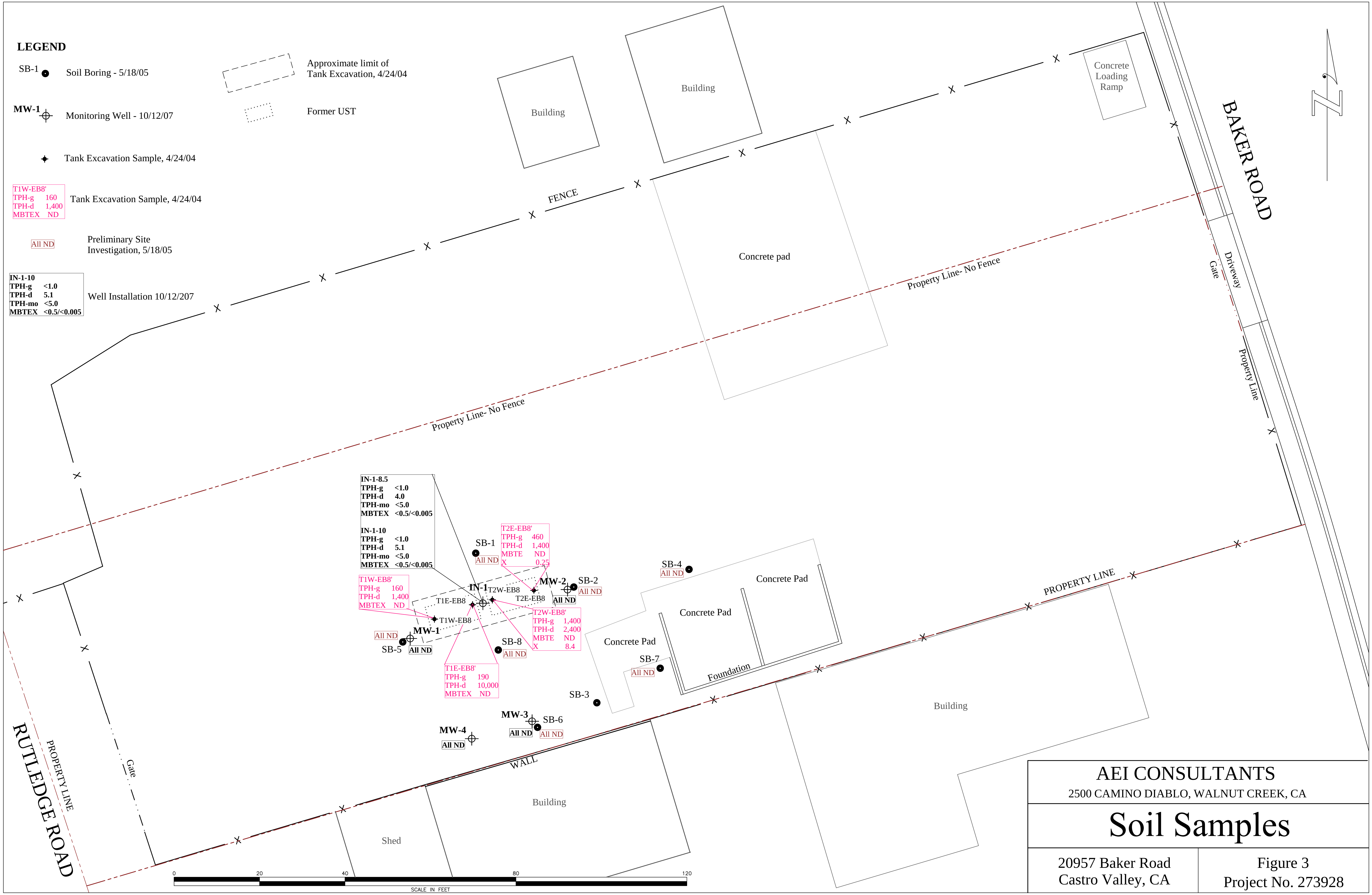
2500 CAMINO DIABLO, WALNUT CREEK, CA

Site Map

20957 Baker Road
Castro Valley, CA

Figure 2
Project No. 273928



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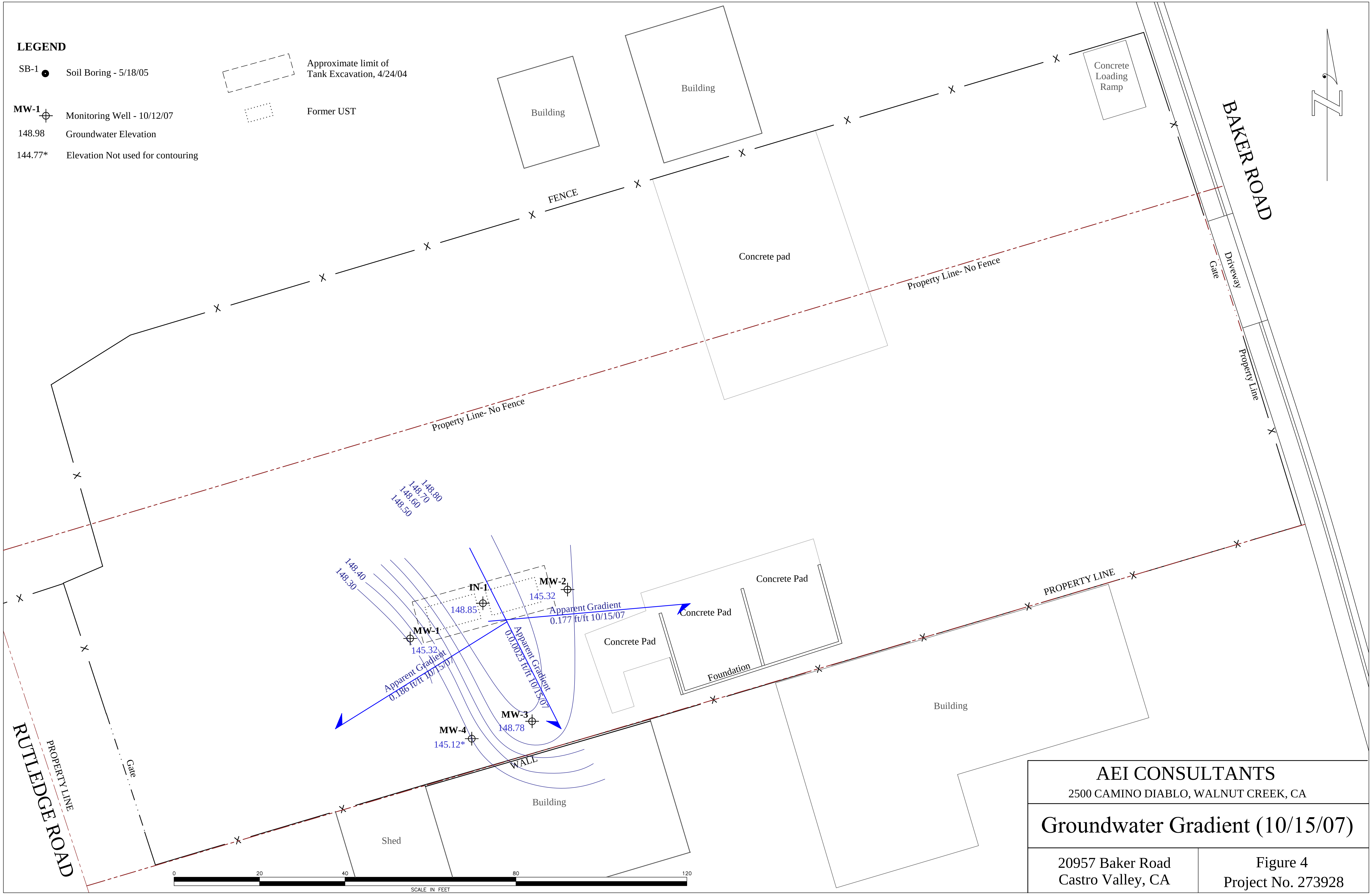
Soil Samples

20957 Baker Road
Castro Valley, CA

Figure 3
Project No. 273928



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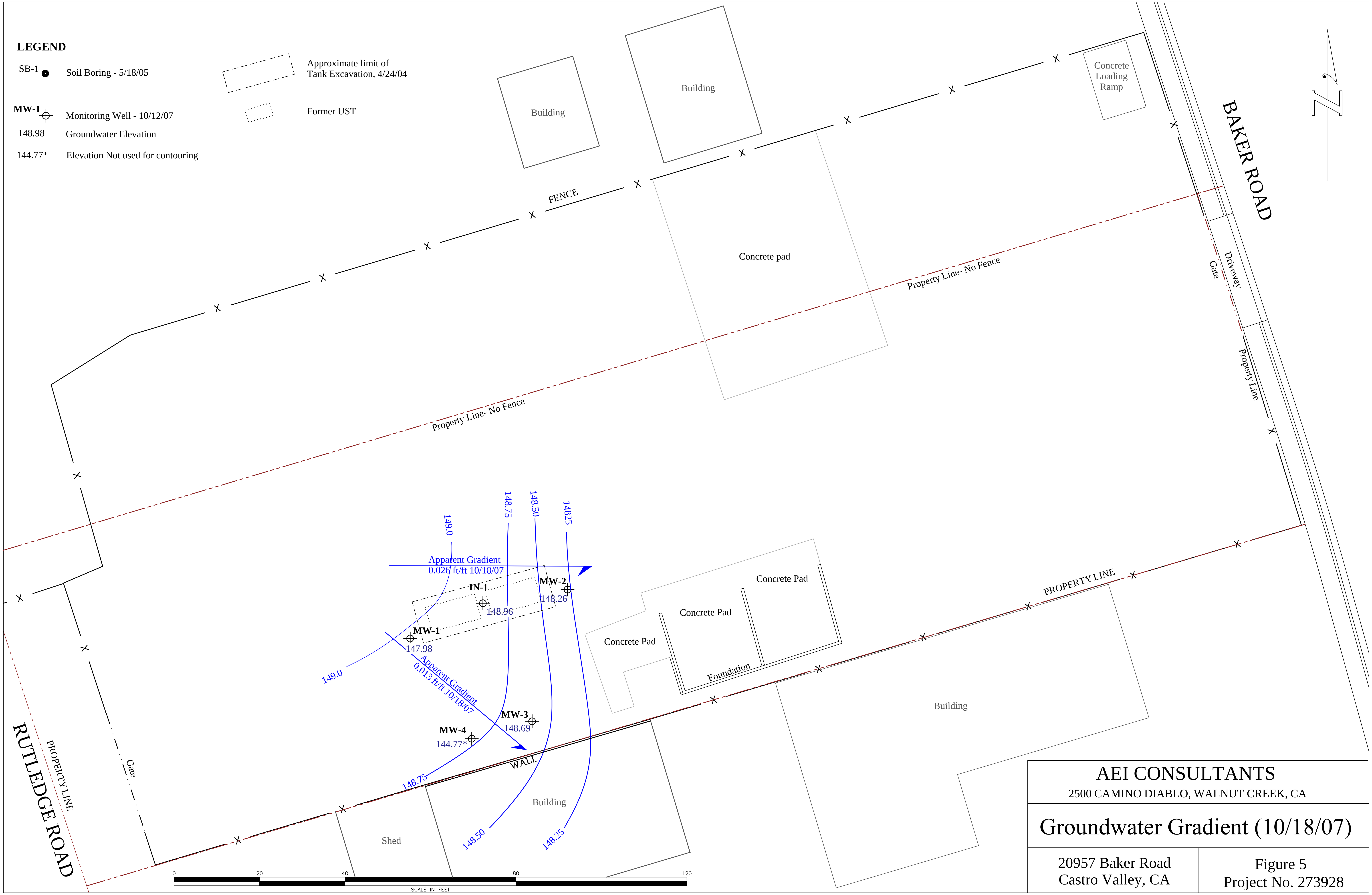
Groundwater Gradient (10/15/07)

20957 Baker Road Castro Valley, CA	Figure 4 Project No. 273928



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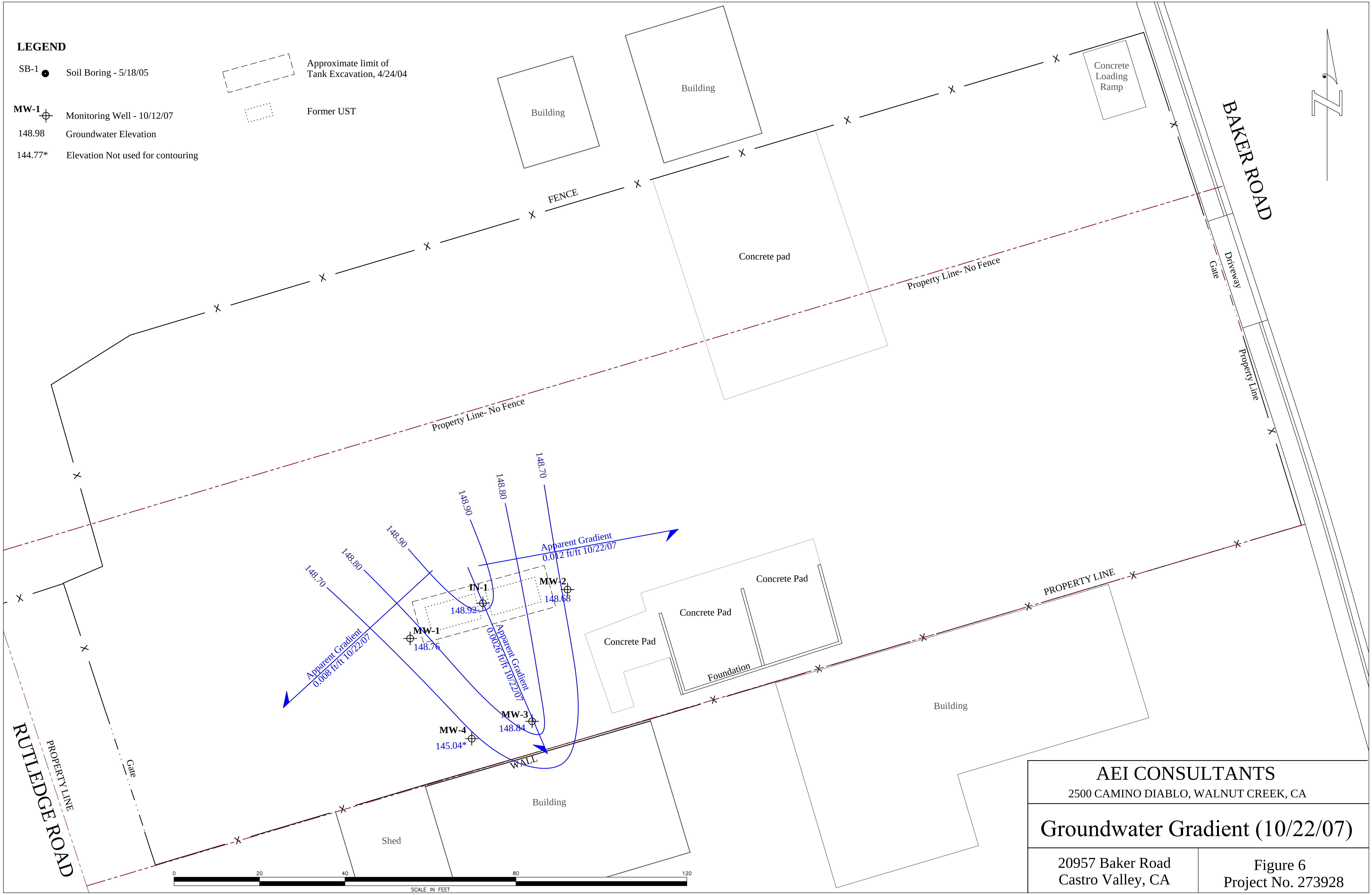
Groundwater Gradient (10/18/07)

20957 Baker Road
Castro Valley, CA

Figure 5
Project No. 273928



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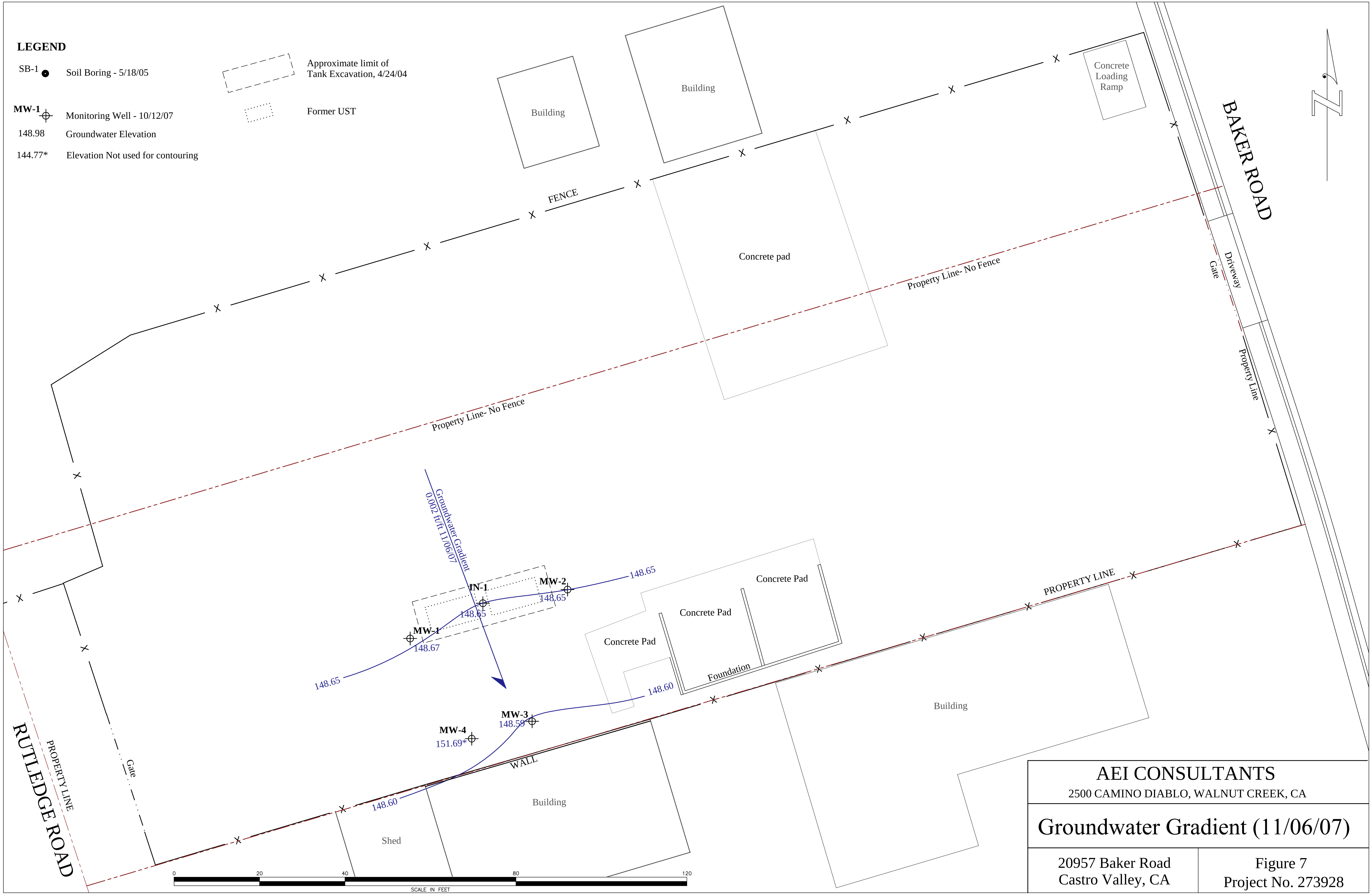
Groundwater Gradient (10/22/07)

20957 Baker Road
Castro Valley, CA

Figure 6
Project No. 273928



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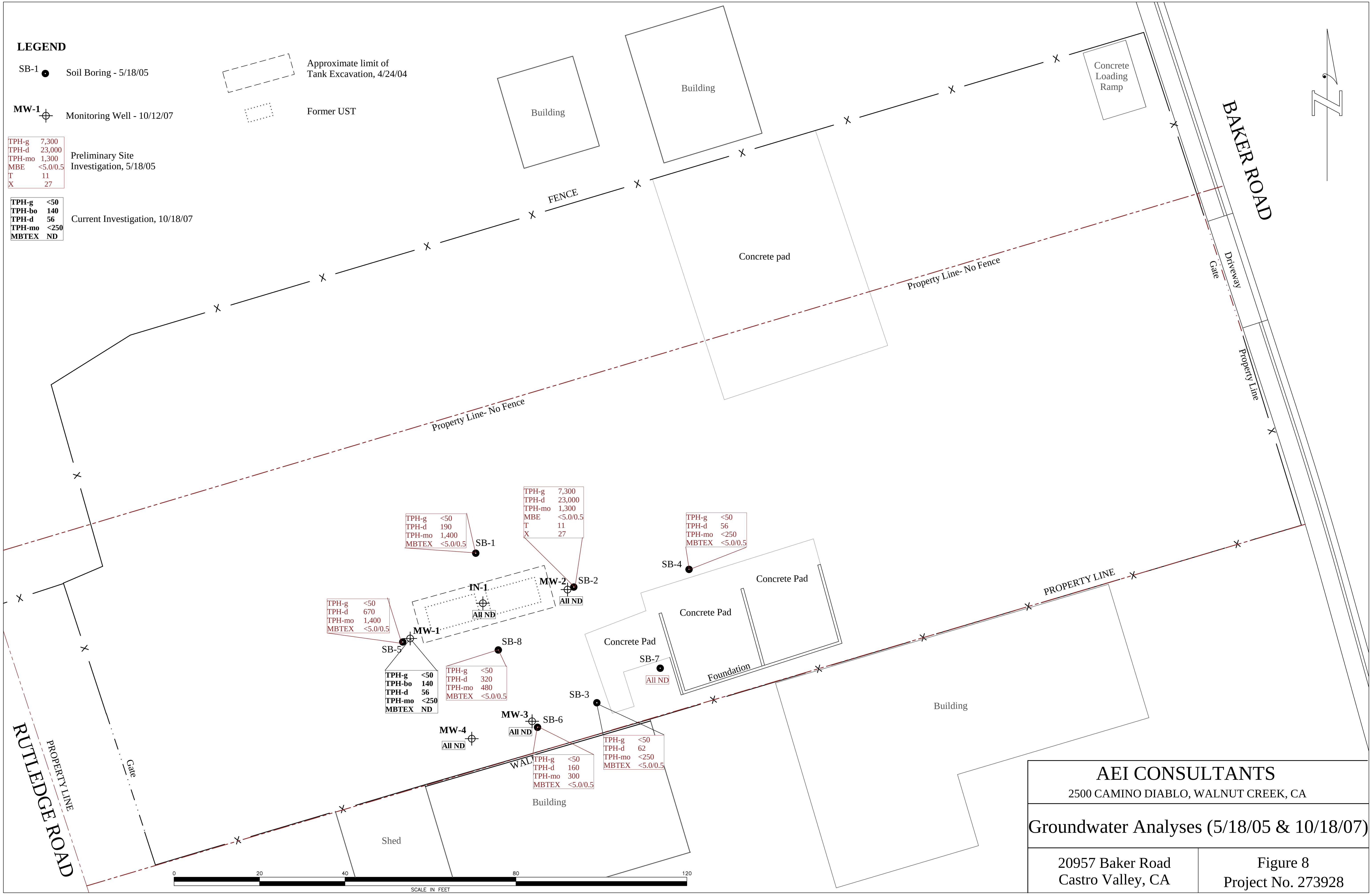
Groundwater Gradient (11/06/07)

20957 Baker Road
Castro Valley, CA

Figure 7
Project No. 273928



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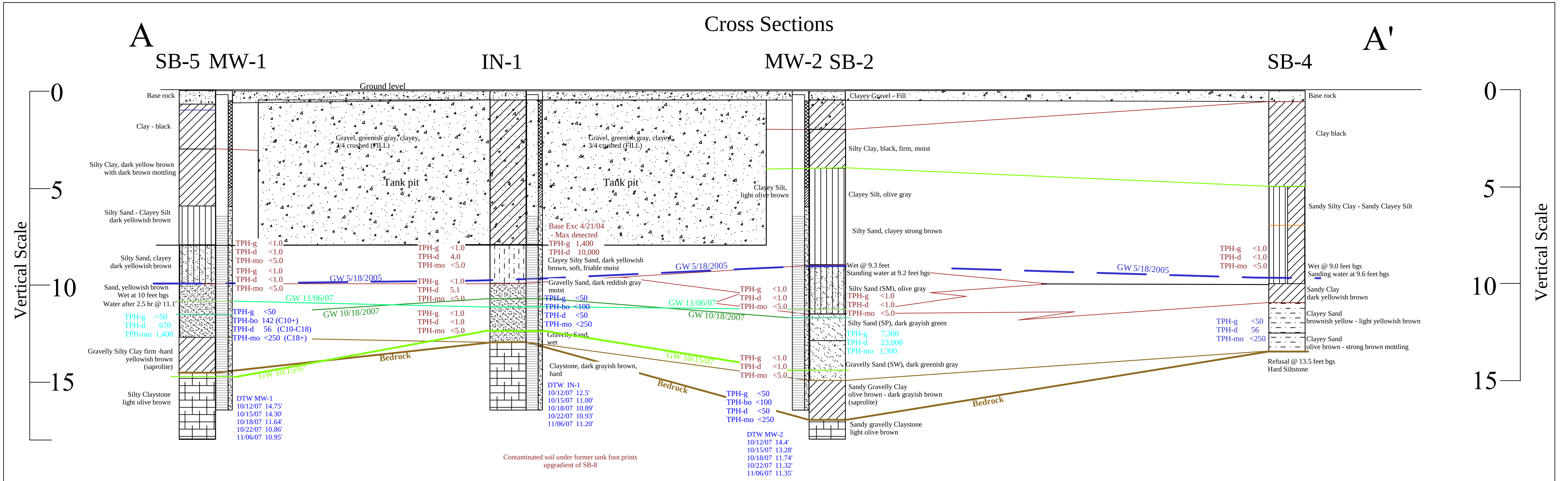
2500 CAMINO DIABLO, WALNUT CREEK, CA

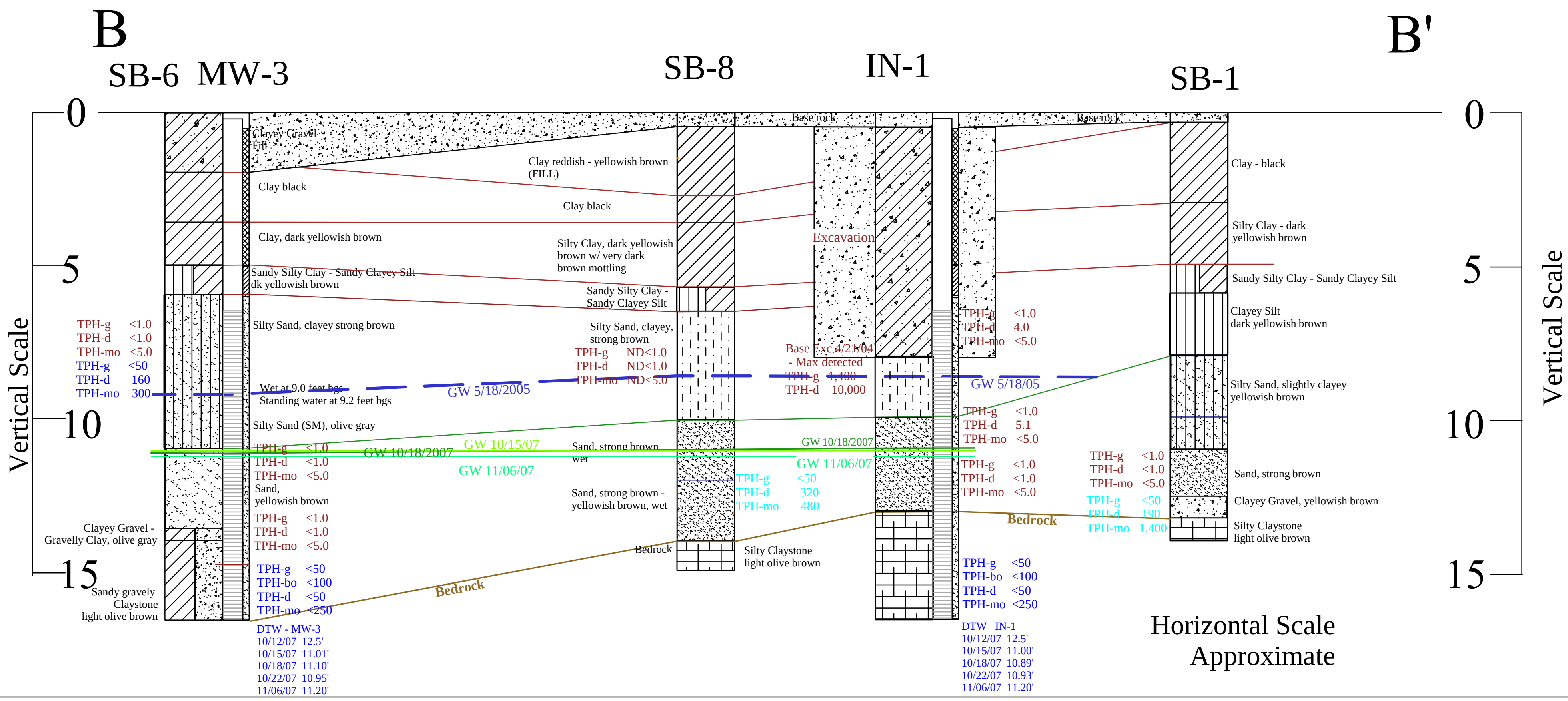
Groundwater Analyses (5/18/05 & 10/18/07)

20957 Baker Road
Castro Valley, CA

Figure 8
Project No. 273928

Cross Sections





Horizontal Scale
Approximate

KEY

- ▨ Clay
- ▨ Sandy Clay
- ▥ Silt
- ▨ Silty Sand
- ▨ Clayey Sand
- ▨ Sand
- ▨ Gravel

TPH-g ND<1.0
TPH-d 4.0
TPH-mo ND<5.0
Soil analytical mg/kg

TPH-g <50
TPH-bo <100
TPH-d <50
TPH-mo <250
Groundwater analyticals 10/18/07 in ug/L

TPH-g <50
TPH-bo <100
TPH-d <50
TPH-mo <250
Groundwater analyticals 5/18/05 in ug/L

Typical Well
- 2-inch blank riser
- 10 ft. slotted casing

Drafted 12/8/05 by RFF
Rev 10/29/07

AEI CONSULTANTS
2500 CAMINO DIABLO, WALNUT CREEK, CA

Cross Sections A-A' and B - B'

Piazza
20957 Baker Road
Castro Valley, California

FIGURE 9

Project No. 273928

TABLES

Table 1 Soil Analytical Data
Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID	Date	TPH-g	TPH-d	TPH-mo	MTBE	Benzene	Toluene	Ethyl benzene	Xylenes
		mg/kg							
		8015 C			8021 B				
IN-1-8.5	10/12/2007	<1.0	4.0 [1]	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
IN-1-10	10/12/2007	<1.0	5.1 [1]	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
IN-1-12	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-1-8.5	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-1-9	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-2-11.5	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-2-13.5	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-3-11	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-3-13	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-4-11	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-4-12	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
MW-4-16	10/12/2007	<1.0	<1.0	<5.0	<0.05	<0.005	<0.005	<0.005	<0.005
SB1-11.5	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB2-10	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB3-7.5	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB4-7.5	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB5-7.5	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB6-7.5	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB7-8	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
SB8-7.5	5/18/2005	ND<1.0	ND<1.0	ND<5.0	ND<0.05	ND<0.005	ND<0.005	ND<0.005	ND<0.005
T1W-EB8'	4/21/2004	160	4,900	----	ND<0.50	ND<0.05	ND<0.05	ND<0.05	ND<0.05
T1E-EB8'	4/21/2004	190	10,000	----	ND<1.7	ND<0.17	ND<0.17	ND<0.17	8.4
T2W-EB8'	4/21/2004	1,400	2,400	----	ND<10	ND<1.0	ND<1.0	ND<1.0	ND<1.0
T2E-EB8'	4/21/2004	460	1,400	----	ND<0.50	ND<0.05	ND<0.05	ND<0.05	0.25

Notes:

1 - Aged diesel ? is significant

Lead in excavation samples 6.1 mg/kg to 18 mg/kg, stockpile 22 mg/kg to 24 kmg/kg

Table 2 Groundwater Analytical Data

Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID	Date	Depth to Water feet	TPH-g C6-C12 µg/L	TPH-d C10-C23	TPH-mo C18+ µg/L	TPH-bo C10+	MTBE µg/L	Benzene µg/L	Toluene µg/L	Ethyl-benzene µg/L	Xylenes µg/L
			EPA Method 8015				*EPA Method 8021B*				
IN-1	**10/18/07**	**10.89**	**ND<50**	**ND<50**	**ND<250**	**ND<100**	**ND<5.0**	**ND<0.5**	**ND<0.5**	**ND<0.5**	**ND<0.5**
SB-1 W	5/18/2005	8.75	ND<50	190 [1,2]	1,400		ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-1	**10/18/07**	**11.64**	**ND<50**	**56**	**ND<250 (86) [6]**	**140 [2]**	**ND<5.0**	**ND<0.5**	**ND<0.5**	**ND<0.5**	**ND<0.5**
SB5-W	5/18/2005	11.60	ND<50	670 [1,2]	1,400	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-2	**10/18/07**	**11.74**	**ND<50**	**ND<50**	**ND<250**	**ND<100**	**ND<5.0**	**ND<0.5**	**ND<0.5**	**ND<0.5**	**ND<0.5**
SB-2 W	5/18/2005	9.20	7,300 [3, 4]	23,000 [1,2,4,5]	1,300	----	ND<50	ND<5.0	11	ND<5.0	**27**
MW-3	**10/18/07**	**11.10**	**ND<50**	**ND<50**	**ND<250**	**ND<100**	**ND<5.0**	**ND<0.5**	**ND<0.5**	**ND<0.5**	**ND<0.5**
SB6-W	5/18/2005	8.62	ND<50	160 [1,2]	300	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-4	**10/18/07**	**14.92**	**ND<50**	**ND<50**	**ND<250**	**ND<100**	**ND<5.0**	**ND<0.5**	**ND<0.5**	**ND<0.5**	**ND<0.5**
SB-1 W	5/18/2005	8.75	ND<50	190 [1,2]	1,400	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB-2 W	5/18/2005	9.20	7,300 [3, 4]	23,000 [1,2,4,5]	1,300	----	ND<50	ND<5.0	11	ND<5.0	**27**
SB3-W	5/18/2005	8.56	ND<50	62	ND<250	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB4-W	5/18/2005	9.60	ND<50	56 [2]	ND<250	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB5-W	5/18/2005	11.60	ND<50	670 [1,2]	1,400	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB6-W	5/18/2005	8.62	ND<50	160 [1,2]	300	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB7-W	5/18/2005	8.56	ND<50	ND<50	ND<250	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
SB8-W	5/18/2005	8.70	ND<50	320 [1,2]	480	----	ND<5.0	ND<0.5	ND<0.5	ND<0.5	ND<0.5
RWQCB ESLs**			100	100	100	----	5.0	1.0	40	30	20

Notes

Soil boring data from 2005 is paired with twin 2007 groundwater monitoring well data for comparison purposes.

BOLD = Current groundwater data

TPH-g = total petroleum hydrocarbons as gasoline

TPH-d = total petroleum hydrocarbons as diesel

TPH-mo = total petroleum hydrocarbons as motor oil

MTBE = methyl tert-butyl ether

µg/L = micrograms per liter (parts per billion)

ft amsl = feet above mean sea level

ND = Not reported at or above the indicated method detection limit

** = RWQCB ESLs November 2007, TABLE F-1a. Groundwater Screening levels, Groundwater is a current or potential drinking water resource

1 - oil range compounds are significant

2 = diesel range compounds are significant, no recognizable pattern

3 = no recognizable pattern

4 = lighter than water immiscible sheen/product is present

5 = gasoline range compounds are significant

6 = value in parenthesis is approximate "residual fuel", C10+ value minus TPH-d value

Table 3 Groundwater Elevation Data
Piazza, 20957 Baker Road, Castro Valley, CA

Well ID	Date	Well Elevation (ft amsl)	Depth to Water (ft)	Groundwater Elevation (ft amsl)	Elevation Change (ft)
IN-1	10/15/07	159.85	11.00	148.85	----
	10/18/07	159.85	10.89	148.96	0.11
	10/22/2007*	159.85	10.93	148.92	-0.04
	11/06/07	**159.85**	**11.20**	**148.65**	**-0.27**
MW-1	10/15/07	159.62	14.30	145.32	----
	10/18/07	159.62	11.64	147.98	2.66
	10/22/07	159.62	10.86	148.76	0.78
	11/06/07	**159.62**	**10.95**	**148.67**	**-0.09**
MW-2	10/15/07	160.00	13.28	146.72	----
	10/18/07	160.00	11.74	148.26	1.54
	10/22/07	160.00	11.32	148.68	0.42
	11/06/07	**160.00**	**11.35**	**148.65**	**-0.03**
MW-3	10/15/07	159.79	11.01	148.78	----
	10/18/07	159.79	11.10	148.69	-0.09
	10/22/07	159.79	10.95	148.84	0.15
	11/06/07	**159.79**	**11.20**	**148.59**	**-0.25**
MW-4	10/15/07	159.69	14.57	145.12	----
	10/18/07	159.69	14.92	144.77	-0.35
	10/22/07	159.69	14.65	145.04	0.27
	10/22/07 Well loaded with fresh water- surged for 15 minutes- water level dropping slowly @ 4.0 feet bgs				
	11/06/07	**159.69**	**8.00**	**151.69**	**6.65**

Depth to water measured from the top of well casing
ft amsl = feet above mean sea level

Table 3a Groundwater Elevation and Gradient
Piazza, 20957 Baker Road, Castro Valley, CA

Event	**Date**	**Average Water Table Elevation (ft amsl)**	**Water Table Elevation Change (ft)**	**Hydraulic Gradient Flow Direction (ft/ft)**
Develop wells	10/15/07	147.42	----	variable
1	**10/18/07**	**148.47**	**1.06**	**variable**
Develop well MW-4	10/22/07	148.80	0.33	variable
----	**11/06/07**	**148.64**	**-0.16**	**0.002/SSE**

Notes

* = average groundwater elevation of wells, IN-1, MW-1 through MW-3, Well MW-4 has no apparent permeability below 8 feet bgs.

Table 4: Well Construction Details

Piazza, 20957 Baker Road, Castro Valley, CA

Well ID	**Date Installed** (feet)	**Top of casing** (feet)	**Top of Well Box** (feet)	**Depth To Water 10/18/07** (feet)	**Casing Material**	**Total Depth Boring** (feet)	**Total Depth Well** (feet)	**Borehole Diameter** (inches)	**Casing Diameter** (inches)	**Screened Interval** (feet)	**Slot Size** (inches)	**Filter Pack Interval** (feet)	**Filter Pack Sand** (feet)	**Bentonite Interval** (feet)	**Grout Interval** (feet)
IN-1	10/12/07	160.12	159.85	140.87	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-5.5	.05-5.0
MW-1	10/12/07	159.84	159.62	11.64	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0
MW-2	10/12/07	160.30	160.00	11.74	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0
MW-3	10/12/07	160.04	159.79	11.1	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0
MW-4	10/12/07	159.95	159.69	14.92	PVC	16.5	16.5	8 1/4	2.0	6.5-16.5	0.020	6.0-16.5	2/12	5.0-6.5	.05-5.0

Table 5 Soil Analytical Data - Metals and Misc.

Piazza, 20957 Baker Road, Castro Valley, CA

Analyte	Sample ID	
	IN-1-8.5 mg/kg	MW-2-11.5 mg/kg
Antimony	0.51	0.60
Arsenic	4.4	5.3
Barium	73	80
Beryllium	<0.5	<0.5
Cadmium	<0.25	<0.25
Chromium (Total)	22	22
Chromium VI	<0.8	<0.2
Cobalt	4.3	11
Copper	11	14
Lead	4	7.4
Mercury	<0.05	<0.012
Molybdenum	<0.5	<0.5
Nickel	18	27
Selenium	<0.5	<0.5
Silver	<0.5	<0.5
Thallium	<0.5	<0.5
Vanadium	26	34
Zinc	26	39
COD	2400	1800
pH	7.37 @24.1 C	5.86 @ 23.8 C

Sampled 10/12/07
mg/kg = micrograms per kilogram

Table 6

Groundwater Analytical Data - Metals
Piazza, 20957 Baker Road, Castro Valley, CA

Analyte	Sample ID	
	MW-2 µg/L	MW-3 µg/L
Antimony	0.72	<0.5
Arsenic	2.3	0.82
Barium	300	360
Beryllium	<0.5	<0.5
Cadmium	<0.25	<0.25
Chromium (Total)	0.57	0.55
Chromium VI	<0.2	<0.2
Cobalt	<0.2	<0.5
Copper	2.00	1.3
Lead	<0.5	<0.5
Mercury	0.017	<0.012
Molybdenum	4.7	0.70
Nickel	1.6	2.0
Selenium	1.9	1.4
Silver	<0.19	<0.19
Thallium	<0.5	<0.5
Vanadium	2.1	1.3
Zinc	180	190

Sampled 10/18/07

µg/L = micrograms per kilogram

Table 7

Soil Vapor Data
Piazza, 20957 Baker Road, Castro Valley, CA

Sample ID	Date	DTW	Hydrocarbons	Methane	Oxygen	Carbon Dioxide
			Percent (%) *RKI Eagle Gas Detector*			
MW-1	10/18/2007	11.64	0.0	0.0	20.8	0.4
MW-2	10/18/2007	11.74	0.0	0.0	15.9	2.9
MW-3	10/18/2007	11.1	0.0	0.0	7.9	7.3
MW-4	10/18/2007	14.92	0.0	0.0	19.0	1.3
IN-1	10/18/2007	10.89	0.0	0.0	12.4	5.0

APPENDIX A

Well Permits

Alameda County Public Works Agency - Water Resources Well Permit

399 Elmhurst Street
Hayward, CA 94544-1395
Telephone: (510)670-6633 Fax:(510)782-1939

Application Approved on: 08/31/2007 By jamesy

Permit Numbers: W2007-0964 to W2007-0968
Permits Valid from 10/05/2007 to 10/09/2007

Application Id: 1188588659887
Site Location: 20957 Baker Road
Project Start Date: 09/11/2007
Extension Start Date: 10/05/2007
Extension Count: 1

City of Project Site: Castro Valley
Completion Date: 09/11/2007
Extension End Date: 10/09/2007
Extended By: vickyh1

Applicant: AEI Consultants - Robert Flory
2500 Camino Diablo, Walnut Creek, CA 94597
Phone: 925-944-2899
Property Owner: Nat Piazza
7613 Peppertree Road, Dublin, CA 94568
Phone: 925-828-1577
Client: ** same as Property Owner **
Contact: Robert Flory
Phone: 925-944-2899
Cell: 925-457-7517

Receipt Number: WR2007-0389
Payer Name : Peter J McIntyre

Total Due: $1500.00
Total Amount Paid: $1500.00
Paid By: VISA **PAID IN FULL**

Works Requesting Permits:

Well Construction-Monitoring-Monitoring - 5 Wells
Driller: HEW Drilling - Lic #: 384167 - Method: hstem

Work Total: $1500.00

Specifications

Permit #	Issued Date	Expire Date	Owner Well Id	Hole Diam.	Casing Diam.	Seal Depth	Max. Depth
W2007-0964	08/31/2007	12/10/2007	MW-1	8.25 in.	2.00 in.	7.00 ft	20.00 ft
W2007-0965	08/31/2007	12/10/2007	MW-2	8.25 in.	2.00 in.	7.00 ft	20.00 ft
W2007-0966	08/31/2007	12/10/2007	MW-3	8.25 in.	2.00 in.	7.00 ft	20.00 ft
W2007-0967	08/31/2007	12/10/2007	MW-4	8.25 in.	2.00 in.	7.00 ft	20.00 ft
W2007-0968	08/31/2007	12/10/2007	MW-5	8.25 in.	2.00 in.	7.00 ft	20.00 ft

Specific Work Permit Conditions

1. Permittee shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend and save the Alameda County Public Works Agency, its officers, agents, and employees free and harmless from any and all expense, cost, liability in connection with or resulting from the exercise of this Permit including, but not limited to, properly damage, personal injury and wrongful death.

2. Permitte, permittee's contractors, consultants or agents shall be responsible to assure that all material or waters generated during drilling, boring destruction, and/or other activities associated with this Permit will be safely handled, properly managed, and disposed of according to all applicable federal, state, and local statutes regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where work is being completed.

3. Prior to any drilling activities, it shall be the applicant's responsibility to contact and coordinate an Underground Service Alert (USA), obtain encroachment permit(s), excavation permit(s) or any other permits or agreements required

for that Federal, State, County or City, and follow all City or County Ordinances. No work shall begin until all the permits and requirements have been approved or obtained. It shall also be the applicants responsibilities to provide to the Cities or to Alameda County an Traffic Safety Plan for any lane closures or detours planned. No work shall begin until all the permits and requirements have been approved or obtained.

4. Compliance with the well-sealing specifications shall not exempt the well-sealing contractor from complying with appropriate State reporting-requirements related to well construction or destruction (Sections 13750 through 13755 (Division 7, Chapter 10, Article 3) of the California Water Code). Contractor must complete State DWR Form 188 and mail original to the Alameda County Public Works Agency, Water Resources Section, within 60 days. Including permit number and site map.

5. Applicant shall contact Vicky Hamlin for an inspection time at 510-670-5443 or email to vickyh@acpwa.org at least five (5) working days prior to starting, once the permit has been approved. Confirm the scheduled date(s) at least 24 hours prior to drilling.

6. Wells shall have a Christy box or similar structure with a locking cap or cover. Well(s) shall be kept locked at all times. Well(s) that become damaged by traffic or construction shall be repaired in a timely manner or destroyed immediately (through permit process). No well(s) shall be left in a manner to act as a conduit at any time.

7. Minimum surface seal thickness is two inches of cement grout placed by tremie

8. Minimum seal (Neat Cement seal) depth for monitoring wells is 5 feet below ground surface(BGS) or the maximum depth practicable or 20 feet.

9. Copy of approved drilling permit must be on site at all times. Failure to present or show proof of the approved permit application on site shall result in a fine of $500.00.

Scheduling Work/Inspections:

Alameda County Public Works Agency (ACPWA), Water Resources Section requires scheduling and inspection of permitted work. All drilling activities must be scheduled in advance. Availability of inspections will vary from week to week and will come on a first come, first served bases. To ensure inspection availability on your desired or driller scheduled date, the following procedures are required:

Please contact **James Yoo at 510-670-6633** to schedule the inspection date and time (You must have drilling permit approved prior to scheduling).

Schedule the work as far in advance as possible (at least 5 days in advance); and confirm the scheduled drilling date(s) at least 24 hours prior to drilling.

Once the work has been scheduled, an ACPWA Inspector will coordinate the inspection requirements as well as how the Inspector can be reached if they are not at the site when Inspection is required. Expect for special circumstances given, all work will require the inspection to be conducted during the working hours of 8:30am to 2:30pm., Monday to Friday, excluding holidays.

Request for Permit Extension:

Permits are only valid from the start date to the completion date as stated on the drilling permit application and Conditions of Approval. To request an extension of a drilling permit application, applicants must request in writing prior to the completion date as set forth in the Conditions of Approval of the drilling permit application. Please send fax or email to Water Resources Section, Fax 510-782-1939 or email at wells@acpwa.org. There are no additional fees for permit extensions or for re-scheduling inspection dates. You may not extend your drilling permit dates beyond 90 days from the approval date of the permit application. **NO refunds** shall be given back after 90 days and the permit shall be deemed voided.

Cancel a Drilling Permit:

Applicants may cancel a drilling permit only in writing by mail, fax or email to Water Resources Section, Fax 510-782-1939 or email at wells@acpwa.org. If you do not cancel your drilling permit application before the drilling completion date or notify in writing within 90 days, Alameda County Public Works Agency, Water Resources Section may void the permit and No refunds may be given back.

Refunds/Service Charge:

A service charge of $25.00 dollars for the first check returned and $35.00 dollars for each subsequent check returned.

Applicants who cancel a drilling permit application **before** we issue the approved permit(s), will receive a **FULL** refund (at any amount) and will be mailed back within two weeks.

Applicants who cancel a drilling permit application **after** a permit has been issued will then be charged a service fee of $50.00 (fifty Dollars).

To collect the remaining funds will be determined by the amount of the refund to be refunded (see process below).

Board of Supervisors Minute Order, File No. 9763, dated January 9, 1996, gives blanket authority to the Auditor-Controller to process claims, from all County departments for the refund of fees which do not exceed $500 (Five Hundred Dollars)(with the exception of the County Clerk whose limit is $1,500).

Refunds over the amounts must be authorized by the Board of Supervisors Minute Order, File No. 9763 require specific approval by the Board of Supervisors. The forms to request for refunds under $500.00 (Five Hundred Dollars) are available at this office or any County Offices. If the amount is exceeded, a Board letter and Minute Order must accompany the claim. Applicant shall fill out the request form and the County Fiscal department will process the request.

Enforcement

Penalty. Any person who does any work for which a permit is required by this chapter and who fails to obtain a permit shall be guilty of a misdemeanor punishable by fine not exceeding Five Hundred Dollars ($500.00) or by imprisonment not exceeding six months, or by both such fine and imprisonment, and such person shall be deemed guilty of a separate offense for each and every day or portion thereof during which any such

APPENDIX B

Boring/Well Logs

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 273928

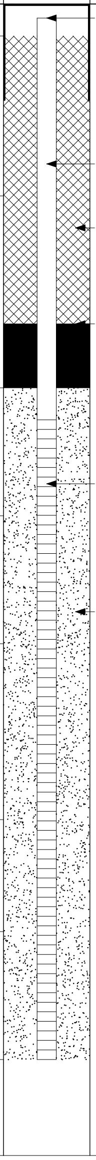
Log of Boring MW-1

Sheet 1 of 1

Date(s) Drilled **October 12, 2007**	Logged By **Leah Levine-Goldberg**	Checked By **Robert F. Flory, PG**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 1/4 inch**	Total Depth of Borehole **16.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **HEW Drilling**	Surface Elevation **159.84 feet MSL**
Groundwater Level and Date Measured **14.75 feet ATD**	Sampling Method(s) **ModCal**	Permit # **W2007-0964**
Borehole Backfill **Well Completion**	Location	

Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm
0				Asphalt		Asphalt 2", base rock 4"	
				CL		Clay, black 10YR 2/1, firm, stiff, moist	
				CL		Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2	
5	■	MW-1-5	5/7/7				<1
				SM-ML		Clayey Silt - Silty Sand, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling, firm,slighly moist	
	■	MW-1-8	4/6/7	SM		Sand, yellowish brown 10YR 4/6, very fine grained, clayey, firm - moderately firm, friable, very moist	<1
10	■	MW-1-10	5/7/10	SP		Sand, yellowish brown 10YR 4/6, very fine grained - coarse grained, firm, wet ?	<1
	■	MW-1-12	5/10/13				<1
				CL		Gravelly Clay - Silty Clay, olive - olive brown 5y 4/4 - 2.5 4/4, firm - hard, slightly moist - (saprolite)	
15				Claystone		Silty Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated (ATD) ▽	

Well Log



REMARKS AND OTHER TESTS

TOC 159.62 ft

MW-1 is a twin to boring 5 (SB-5)

Blank 2" diameter schedule 40 PVC

Neat cement grout

3/8" bentonite pellets

X:\PROJECTS\CHARACTERIZATION & REMEDIATION\CHARACTERIZATION\273928 WI (Piazza) Castro Valley - (RFF)\Investigation\Graphics\Wells MW-1 IN-1.bgs [augerwell 20.tpl]

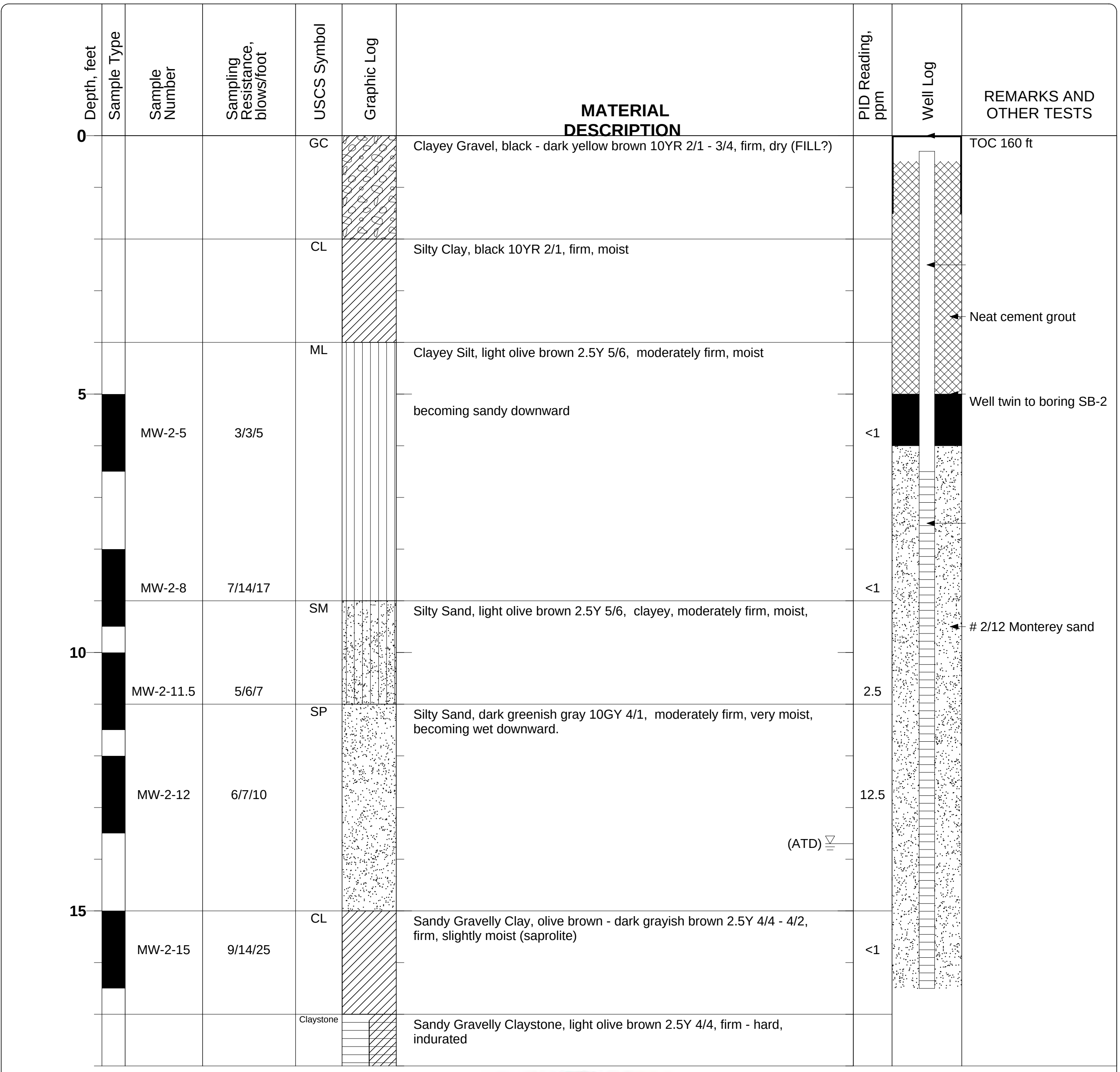
AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 273928

Log of Boring MW-2

Sheet 1 of 1

Date(s) Drilled **October 12, 2007**	Logged By **Leah Levine-Goldberg**	Checked By **Robert F. Flory, PG**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 1/4 inch**	Total Depth of Borehole **18 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **HEW DRILLING**	Surface Elevation **160.3 feet**
Groundwater Level and Date Measured **13.7 feet ATD**	Sampling Method(s) **ModCal**	Permit # **W2007-0965**
Borehole Backfill **Well Completion**	Location	



Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	USCS Symbol	MATERIAL DESCRIPTION	PID Reading, ppm	REMARKS AND OTHER TESTS
0				GC	Clayey Gravel, black - dark yellow brown 10YR 2/1 - 3/4, firm, dry (FILL?)		TOC 160 ft
				CL	Silty Clay, black 10YR 2/1, firm, moist		Neat cement grout
				ML	Clayey Silt, light olive brown 2.5Y 5/6, moderately firm, moist		
5	■	MW-2-5	3/3/5		becoming sandy downward	<1	Well twin to boring SB-2
	■	MW-2-8	7/14/17			<1	
				SM	Silty Sand, light olive brown 2.5Y 5/6, clayey, moderately firm, moist,		# 2/12 Monterey sand
10	■	MW-2-11.5	5/6/7			2.5	
				SP	Silty Sand, dark greenish gray 10GY 4/1, moderately firm, very moist, becoming wet downward.		
	■	MW-2-12	6/7/10			12.5	
					(ATD) ▽		
15	■	MW-2-15	9/14/25	CL	Sandy Gravelly Clay, olive brown - dark grayish brown 2.5Y 4/4 - 4/2, firm, slightly moist (saprolite)	<1	
				Claystone	Sandy Gravelly Claystone, light olive brown 2.5Y 4/4, firm - hard, indurated		

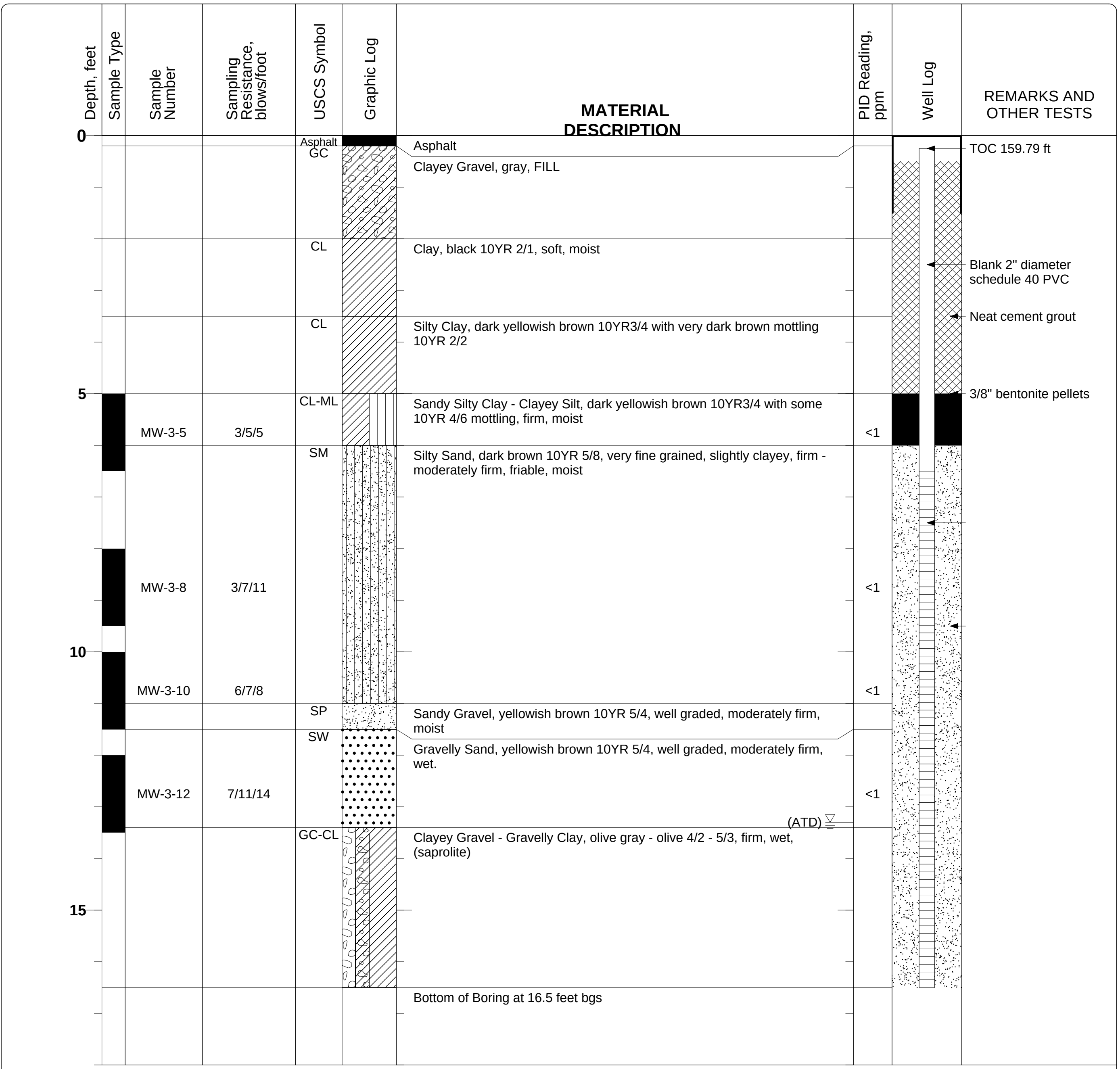
AEI
CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 273928

Log of Boring MW-3

Sheet 1 of 1

Date(s) Drilled **October 12, 2007**	Logged By **Leah Levine-Goldberg**	Checked By **Robert F. Flory, PG**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 1/4 inch**	Total Depth of Borehole **16.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **HEW Drilling**	Surface Elevation **160.04 feet MSL**
Groundwater Level and Date Measured **13.3 feet ATD**	Sampling Method(s) **ModCal**	Permit # **W2007-0966**
Borehole Backfill **Well Completion**	Location	



Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	Well Log	REMARKS AND OTHER TESTS
0				Asphalt		Asphalt			
				GC		Clayey Gravel, gray, FILL			TOC 159.79 ft
				CL		Clay, black 10YR 2/1, soft, moist			Blank 2" diameter schedule 40 PVC
				CL		Silty Clay, dark yellowish brown 10YR3/4 with very dark brown mottling 10YR 2/2			Neat cement grout
5		MW-3-5	3/5/5	CL-ML		Sandy Silty Clay - Clayey Silt, dark yellowish brown 10YR3/4 with some 10YR 4/6 mottling, firm, moist	<1		3/8" bentonite pellets
				SM		Silty Sand, dark brown 10YR 5/8, very fine grained, slightly clayey, firm - moderately firm, friable, moist			
		MW-3-8	3/7/11				<1		
10		MW-3-10	6/7/8				<1		
				SP		Sandy Gravel, yellowish brown 10YR 5/4, well graded, moderately firm, moist			
		MW-3-12	7/11/14	SW		Gravelly Sand, yellowish brown 10YR 5/4, well graded, moderately firm, wet.	<1		
						(ATD) ▽			
				GC-CL		Clayey Gravel - Gravelly Clay, olive gray - olive 4/2 - 5/3, firm, wet, (saprolite)			
15									
						Bottom of Boring at 16.5 feet bgs			

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AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

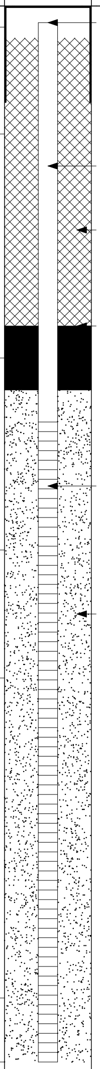
Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 273928

Log of Boring MW-4

Sheet 1 of 1

Date(s) Drilled **October 12, 2007**	Logged By **Leah Levine-Goldberg**	Checked By **Robert F. Flory, P.G**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 1/4 inch**	Total Depth of Borehole **16.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **HEW Drilling**	Surface Elevation **159.95 feet MSL**
Groundwater Level and Date Measured **15.4 feet ATD**	Sampling Method(s) **ModCal**	Permit # **W2007-0967**
Borehole Backfill **Well Completion**	Location	

Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	PID Reading, ppm	Well Log	REMARKS AND OTHER TESTS
0				Asphalt					TOC 159.69 ft
				GC		Clayey Gravel, gray, FILL			
				CL		Clay, Black 10YR 2/1			Blank 2" diameter schedule 40 PVC Neat cement grout
5									
		MW-4-6	5/8/9	CL		Sandy Silty Clay, dark brown, 10YR 3/6, moist , firm	<1		
		MW-4-8	5/7/10	SC		Clayey Silty Sand, dark olive brown - light olive brown 2.5Y 3/3 - 5/6, moderately firm, moist	<1		
10									
		MW-4-11	3/8/11	CL		Gravelly Clay, light brownish gray, weathered claystone with green siltstone clasts, firm, moist	<1		
		MW-4-12	6/8/12				<1		
15						(ATD) ▽			
		MW-4-16	5/7/10	Claystone		Silty Claystone, grayish brown 2.5Y 5/2, saprolitic with purplish black clasts, firm, moist	<1		
						Bottom of Boring at 16.5 feet bgs			



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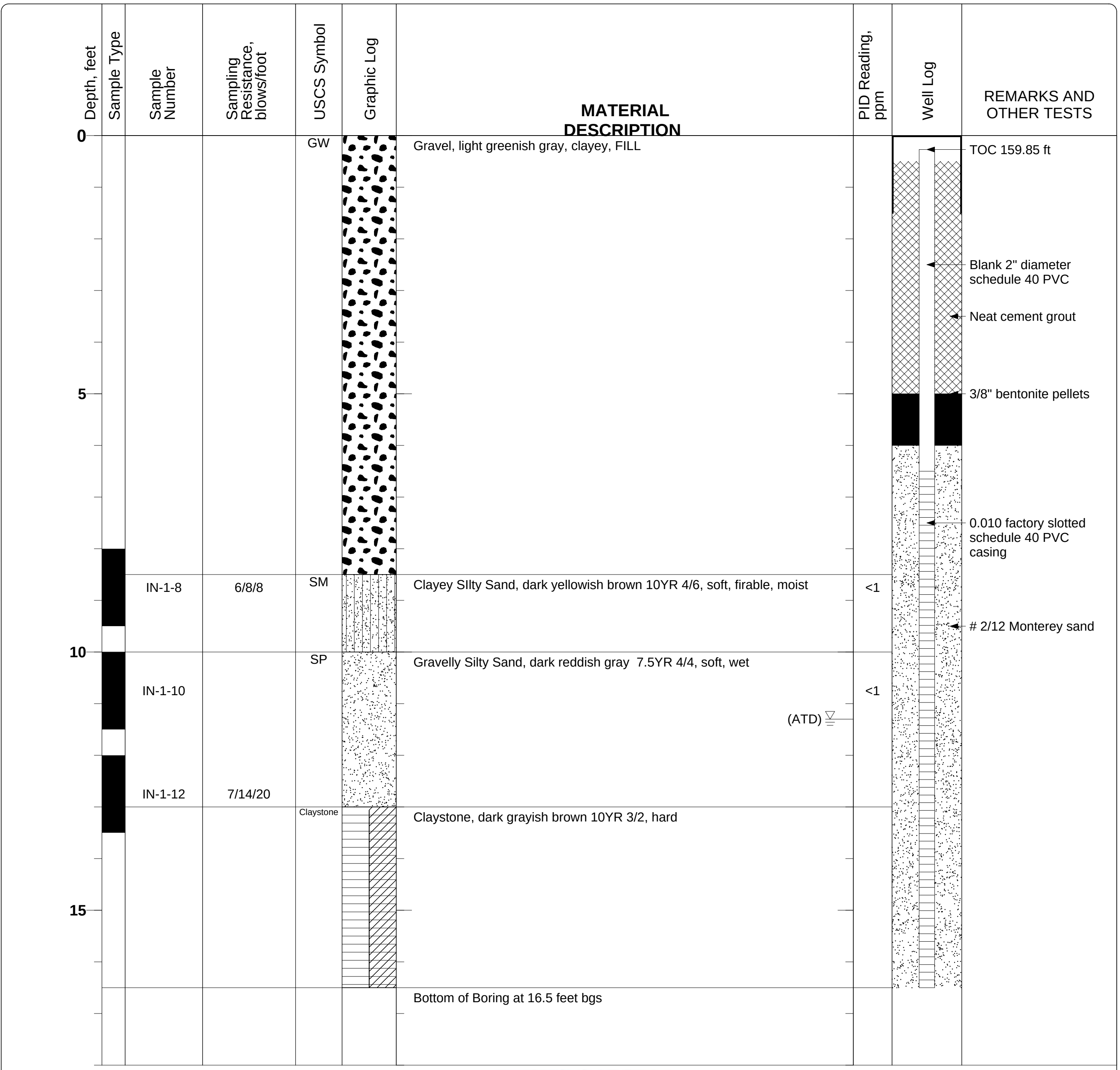
AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

Project: Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Project Number: 273928

Log of Boring IN-1

Sheet 1 of 1

Date(s) Drilled **October 12, 2007**	Logged By **Leah Levine-Goldberg**	Checked By **Robert F. Flory, P.G**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 1/4 inch**	Total Depth of Borehole **16.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **HEW Drilling**	Surface Elevation **160.12 feet MSL**
Groundwater Level and Date Measured **11.3 feet ATD**	Sampling Method(s) **ModCal**	Permit # **W2007-0968**
Borehole Backfill **Well Completion**	Location	



Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	USCS Symbol	MATERIAL DESCRIPTION	PID Reading, ppm
0				GW	Gravel, light greenish gray, clayey, FILL	
8.5	■	IN-1-8	6/8/8	SM	Clayey SIlty Sand, dark yellowish brown 10YR 4/6, soft, firable, moist	<1
10	■	IN-1-10		SP	Gravelly Silty Sand, dark reddish gray 7.5YR 4/4, soft, wet (ATD) ▽	<1
12	■	IN-1-12	7/14/20			
13				Claystone	Claystone, dark grayish brown 10YR 3/2, hard	
16.5					Bottom of Boring at 16.5 feet bgs	

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AEI CONSULTANTS
ENVIRONMENTAL & CIVIL ENGINEERING

APPENDIX C

Groundwater Monitoring Well
Field Sampling Forms

AEI CONSULTANTS
GROUNDWATER MONITORING WELL FIELD SAMPLING FORM

Monitoring Well Number: **MW-1**

Project Name:	Nat Piazza	Date of Sampling:	10/18/2007
Job Number:	273928	Name of Sampler:	R. Bartlett
Project Address:	20957 Baker Road, Castro valley, California		

MONITORING WELL DATA

Well Casing Diameter (2"/4"/6")	2		
Wellhead Condition	OK ▼		
Elevation of Top of Casing (feet above msl)	159.84		
Depth of Well	16.50		
Depth to Water (from top of casing)	11.64		
Water Elevation (feet above msl)	148.20		
Well Volumes Purged	Micropurged		
Actual Volume Purged (liters)	2.0		
Appearance of Purge Water	Clear		
Free Product Present?	No	Thickness (ft):	----

GROUNDWATER SAMPLES

Number of Samples/Container Size: 3 - 40 ml VOA, 1 1-liter Amber, 2 - 500 ml Poly

Time	Vol Removed (liter)	Temperature (deg C)	pH	Conductivity (µS/cm)	DO (mg/L)	ORP (meV)	Comments
11.49	0.5	22.03	7.40	2340	6.03	28.3	
11.53	1.0	22.38	7.35	2170	6.30	28.4	
11.56	1.5	22.52	7.34	2134	6.44	26.9	
11.58	2.0	22.60	7.34	2095	6.59	26.8	
Eagle readings	**HC**	**CH4**	**O2**	**CO2**			
	0.0	0.0	20.8	0.4			

COMMENTS (i.e., sample odor, well recharge time & percent, etc.)

Purge water clear with no odor

AEI CONSULTANTS

GROUNDWATER MONITORING WELL FIELD SAMPLING FORM

Monitoring Well Number: **MW-2**

Project Name:	Nat Piazza	Date of Sampling:	10/18/2007
Job Number:	273928	Name of Sampler:	R. Bartlett
Project Address:	20957 Baker Road, Castro valley, California		

MONITORING WELL DATA

Well Casing Diameter (2"/4"/6")	2		
Wellhead Condition	OK		
Elevation of Top of Casing (feet above msl)	160.30		
Depth of Well	16.50		
Depth to Water (from top of casing)	1174.00		
Water Elevation (feet above msl)	-1013.70		
Well Volumes Purged	Micropurged		
Actual Volume Purged (liters)	2.0		
Appearance of Purge Water	Clear		
Free Product Present?	No	Thickness (ft):	----

GROUNDWATER SAMPLES

Number of Samples/Container Size	3 - 40 ml VOA, 1 1-liter Amber

Time	Vol Removed (liter)	Temperature (deg C)	pH	Conductivity (μS/cm)	DO (mg/L)	ORP (meV)	Comments
1153	0.5	23.14	7.48	1488	5.09	51.6	
1156	1.0	22.83	7.33	1765	4.71	54.6	
1159	1.5	22.81	7.30	2133	4.74	54.3	
1202	2.0	22.77	7.32	2190	4.87	53.7	
Eagle readings	**HC**	**CH4**	**O2**	**CO2**			
	0.0	0.0	15.9	2.9			

COMMENTS (i.e., sample odor, well recharge time & percent, etc.)

Purge water clear with no odor

AEI CONSULTANTS
GROUNDWATER MONITORING WELL FIELD SAMPLING FORM

Monitoring Well Number: **MW-3**

Project Name:	Nat Piazza	Date of Sampling:	10/18/2007
Job Number:	273928	Name of Sampler:	R. Bartlett
Project Address:	20957 Baker Road, Castro valley, California		

MONITORING WELL DATA

Well Casing Diameter (2”/4”/6”)	2		
Wellhead Condition	OK ▼		
Elevation of Top of Casing (feet above msl)	160.04		
Depth of Well	16.50		
Depth to Water (from top of casing)	11.10		
Water Elevation (feet above msl)	148.94		
Well Volumes Purged	Micropurged		
Actual Volume Purged (liters)	2.0		
Appearance of Purge Water	Clear		
Free Product Present?	No	Thickness (ft):	----

GROUNDWATER SAMPLES

Number of Samples/Container Size: 3 - 40 ml VOA, 1 1-liter Amber, 2 - 500 ml Poly

Time	Vol Removed (liter)	Temperature (deg C)	pH	Conductivity (μS/cm)	DO (mg/L)	ORP (meV)	Comments
1051	0.5	20.34	6.72	829	3.31	109.7	
1053	1.0	20.72	6.85	805	2.83	89.4	
1055	1.5	20.87	6.88	783	2.92	86.2	
1057	2.0	20.98	6.89	740	3.13	83.1	
Eagle readings	**HC**	**CH4**	**O2**	**CO2**			
	0.0	0.0	7.9	7.3			

COMMENTS (i.e., sample odor, well recharge time & percent, etc.)

Purge water clear with no odor

AEI CONSULTANTS

GROUNDWATER MONITORING WELL FIELD SAMPLING FORM

Monitoring Well Number: **MW-4**

Project Name:	Nat Piazza	Date of Sampling:	10/18/2007
Job Number:	273928	Name of Sampler:	R. Bartlett
Project Address:	20957 Baker Road, Castro valley, California		

MONITORING WELL DATA

Well Casing Diameter (2”/4”/6”)	2		
Wellhead Condition	OK ▼		
Elevation of Top of Casing (feet above msl)	159.95		
Depth of Well	16.50		
Depth to Water (from top of casing)	14.92		
Water Elevation (feet above msl)	145.03		
Well Volumes Purged	Micropurged		
Actual Volume Purged (liters)	2.0		
Appearance of Purge Water	Clear		
Free Product Present?	No	Thickness (ft):	----

GROUNDWATER SAMPLES

Number of Samples/Container Size: 3 - 40 ml VOA, 1 1-liter Amber, 2 - 500 ml Poly

Time	Vol Removed (liter)	Temperature (deg C)	pH	Conductivity (µS/cm)	DO (mg/L)	ORP (meV)	Comments
1126	0.5	19.67	7.09	2709	5.10	85.8	
1128	1.0	20.02	7.24	2246	5.70	50.0	
1130	1.5	20.24	7.33	1721	6.87	47.6	
1132	2.0	20.30	7.30	1936	6.65	46.4	
Eagle readings	**HC**	**CH4**	**O2**	**CO2**			
	0.0	0.0	19.0	1.3			

COMMENTS (i.e., sample odor, well recharge time & percent, etc.)

Well went dry @ 11:32, sampled A 11:36

Purge water clear with no odor

AEI CONSULTANTS
GROUNDWATER MONITORING WELL FIELD SAMPLING FORM

Monitoring Well Number: **IN-1**

Project Name:	Nat Piazza	Date of Sampling:	10/18/2007
Job Number:	273928	Name of Sampler:	R. Bartlett
Project Address:	20957 Baker Road, Castro valley, California		

MONITORING WELL DATA

Well Casing Diameter (2”/4”/6”)	2		
Wellhead Condition	OK ▼		
Elevation of Top of Casing (feet above msl)	160.12		
Depth of Well	16.50		
Depth to Water (from top of casing)	10.89		
Water Elevation (feet above msl)	149.23		
Well Volumes Purged	Micropurged		
Actual Volume Purged (liters)	2.0		
Appearance of Purge Water	Clear		
Free Product Present?	No	Thickness (ft):	----

GROUNDWATER SAMPLES

Number of Samples/Container Size: 3 - 40 ml VOA, 1 1-liter Amber, 2 - 500 ml Poly

Time	Vol Removed (liter)	Temperature (deg C)	pH	Conductivity (µS/cm)	DO (mg/L)	ORP (meV)	Comments
1221	0.5	22.80	7.54	856	2.47	50.9	
1223	0.1	22.82	7.11	793	2.33	55.8	
1225	0.5	22.67	7.02	792	2.28	57.4	
1228	0.2	22.73	6.88	731	2.47	61.5	
Eagle readings	**HC**	**CH4**	**O2**	**CO2**			
	0.0	0.0	12.4	5.0			

COMMENTS (i.e., sample odor, well recharge time & percent, etc.)

Purge water clear with no odor, becoming brown & purging dry @ 2 liters.

APPENDIX D

Laboratory Analyses
With
Chain of Custody Documentation

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/12/07 Date Received: 10/15/07
	Client Contact: Robert Flory	Date Reported: 10/22/07
	Client P.O.:	Date Completed: 10/22/07

WorkOrder: 0710502

October 22, 2007

Dear Robert:

Enclosed are:

1). the results of **12** analyzed samples from your **#273928; Piazza project,**

2). a QC report for the above samples

3). a copy of the chain of custody, and

4). a bill for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits. If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Best regards,

Angela Rydelius, Lab Manager

0710502 1/2

McCampbell Analytical, Inc.
1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Telephone: (925) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☒ PDF ☒ Excel ☐ Write On (DW) ☐

Report To: Robert Flory/Leah Goldberg **Bill To:** Same
Company: AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94597 **E-Mail:** rflory@aeiconsultants.com
Tel: (925) 944-2899, extension 122 **Fax:** (925) 944-2895
Project #: 273928 **Project Name:** Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Sampler Signature: Leah Levine-Goldberg

SAMPLE ID	Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED Ice	METHOD PRESERVED HCl	METHOD PRESERVED HNO$_3$	METHOD PRESERVED Other
MW3-5	MW3	10/12/07	8:50											
mw3-9			8:55											
mw3-11			9:00											
mw3-13			9:10											
mw4-6			10:00											
mw4-11			10:10											
mw4-12			10:15											
mw4-16			10:25											
MW1-6			11:00											
mw1-8.5			11:05											
MW1-9			11:05											
mw1-11			11:10											
mw1-12			11:15											
		↓												

Analysis Request

SAMPLE ID	BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPH Multirange (8015) (TPH-d & TPH-mo)	Total Petroleum Oil & Grease (5520 E&F/B&F)	Total Petroleum Hydrocarbons (418.1)	HVOCs EPA 8260 (8010 list)	BTEX ONLY (EPA 602 / 8020)	Pesticides EPA 608 / 8080	PCBs EPA 608 / 8080	EPA 624 / 8260 (9) Oxygenates & scavengers	EPA 625 / 8270	PAH's / PNA's by EPA 625 / 8270 / 8310	CAM-17 Metals	LUFT 5 Metals	Lead (7240/7421/239.2/6010)		Other: Chromium VI				Comments
MW3-5	~~X~~	~~X~~	hold	LLG								~~X~~	LG							Filter Samples for Metals Analysis: Yes / No
mw3-9	hold																			
mw3-11	X	X																		
mw3-13	X	X																		
mw4-6	hold																			
mw4-11	X	X																		
mw4-12	X	X																		
mw4-16	hold																			
MW1-6	hold																			
mw1-8.5	X	X																		
MW1-9	X	X																		
mw1-11	hold																			
mw1-12	hold																			

Relinquished By:	Date:	Time:	Received By:
Leah Levine-Goldberg	10/14/07	2:35	
	10/15/07	5:00	K. Burke

ICE/t° 7.8
GOOD CONDITION_____
HEAD SPACE ABSENT_____
DECHLORINATED IN LAB_____

	VOAS	O&G	METALS	OTHER
PRESERVATION				

APPROPRIATE CONTAINERS_____
PERSERVED IN LAB_____

2/2

McCampbell Analytical, Inc.
1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Telephone: (925) 252-9262 **Fax: (925) 252-9269**

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☒ **PDF** ☒ **Excel** ☐ **Write On (DW)** ☐

Report To: Robert Flory/Leah Goldberg **Bill To:** Same
Company: AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94597 **E-Mail:** rflory@aeiconsultants.com
Tel: (925) 944-2899, extension 122 **Fax:** (925) 944-2895
Project #: 273928 **Project Name:** Piazza
Project Location: 20957 Baker Road, Castro Valley, CA
Sampler Signature: Leah Levine-Goldberg

Comments
Filter Samples for Metals Analysis:
Yes / No

SAMPLE ID	Field Point Name	SAMPLING		# Containers	Type Containers	MATRIX					METHOD PRESERVED				Analysis Request															Other			
		Date	Time			Water	Soil	Air	Sludge	Other	Ice	HCl	HNO_3	Other	BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPH Multirange (8015) (TPH-d & TPH-mo)	Total Petroleum Oil & Grease (5520 E&F/B&F)	Total Petroleum Hydrocarbons (418.1)	HVOCs EPA 8260 (8010 list)	BTEX ONLY (EPA 602 / 8020)	Pesticides EPA 608 / 8080	PCBs EPA 608 / 8080	EPA 624 / 8260 (9) Oxygenates & scavengers	EPA 625 / 8270	PAH's / PNA's by EPA 625 / 8270 / 8310	CAM-17 Metals	LUFT 5 Metals	Lead (7240/7421/239.2/6010)		Chromium VI	SIVE Analysis		
IN-1-8.5		10/12/07	12:00												X	X										X				X	X		
IN-1-10			12:05												X	X																	
IN-1-12			12:10												hold																		
mw2-8			13:20												hold																		
mw2-11.5			13:25												X	X										X				X	X		
mw2-13.5			13:30												X	X															X		
mw2-16.5			13:35												hold																		

Relinquished By:	Date:	Time:	Received By:
Leah Levine-Goldberg	10/14/07	2:35	
	10/15/07	5:00	K. Burks

ICE/t° 7.8
GOOD CONDITION_____
HEAD SPACE ABSENT_____
DECHLORINATED IN LAB_____

	VOAS	O&G	METALS	OTHER
PRESERVATION				

APPROPRIATE CONTAINERS_____
PERSERVED IN LAB_____

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: 0710502 **ClientID: AEL**

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Report to:
Robert Flory
AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

Email: rflory@aeiconsultants.com
TEL: (925) 283-6000 FAX: (925) 944-2895
ProjectNo: #273928; Piazza
PO:

Bill to:
Denise Mockel
AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597
dmockel@aeiconsultants.com

Requested TAT: **5 days**

Date Received: **10/15/2007**
Date Printed: **10/17/2007**

Sample ID	ClientSampID	Matrix	Collection Date	Hold	Requested Tests (See legend below)											
					1	2	3	4	5	6	7	8	9	10	11	12
0710502-003	MW3-11	Soil	10/12/2007	☐			A	A	A							
0710502-004	MW3-13	Soil	10/12/2007	☐			A		A							
0710502-006	MW4-11	Soil	10/12/2007	☐			A		A							
0710502-007	MW4-12	Soil	10/12/2007	☐			A		A							
0710502-008	MW4-16	Soil	10/12/2007	☐			A		A							
0710502-010	MW1-8.5	Soil	10/12/2007	☐			A		A							
0710502-011	MW1-9	Soil	10/12/2007	☐			A		A							
0710502-014	IN-1-8.5	Soil	10/12/2007	☐	A	A	A		A							
0710502-015	IN-1-10	Soil	10/12/2007	☐			A		A							
0710502-016	IN-1-12	Soil	10/12/2007	☐			A		A							
0710502-018	MW2-11.5	Soil	10/12/2007	☐	A	A	A		A							
0710502-019	MW2-13.5	Soil	10/12/2007	☐			A		A							

Test Legend:

1	218_6m_S
2	CAM17MS_S
3	G-MBTEX_S
4	PREDF REPORT
5	TPH(DMO)_S
6	
7	
8	
9	
10	
11	
12	

The following SampIDs: 014A, 018A contain testgroup.

Prepared by: Ana Venegas

Comments: Joanne no longer with AEI; invoices to dmockel@aeiconsultants.com

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Sample Receipt Checklist

Client Name: **AEI Consultants**

Date and Time Received: **10/15/07 4:31:29 PM**

Project Name: **#273928; Piazza**

Checklist completed and reviewed by: Ana Venegas

WorkOrder N°: **0710502** Matrix Soil

Carrier: Client Drop-In

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Sample IDs noted by Client on COC?	Yes ☑	No ☐	
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐	
Sampler's name noted on COC?	Yes ☑	No ☐	

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp: 7.8°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
TTLC Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑

Client contacted: Date contacted: Contacted by:

Comments:

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

Client Project ID: #273928; Piazza

Client Contact: Robert Flory

Client P.O.:

Date Sampled: 10/12/07

Date Received: 10/15/07

Date Extracted: 10/17/07

Date Analyzed 10/17/07

TTLC Hexachrome by Alkaline Digestion and IC-UV Analysis*

Analytical Method: E218.6m

Work Order: 0710502

Lab ID	Client ID	Matrix	Hexachrome	DF
0710502-014A	IN-1-8.5	S	ND	1
0710502-018A	MW2-11.5	S	ND	1

Reporting Limit for DF = 1; ND means not detected at or above the reporting limit	W	NA	
	S	0.8 mg/Kg	

* All samples are reported in mg/kg unless otherwise requested. All samples and QC were cleaned up prior to analysis.

j) reporting limit raised due to matrix interference; k) reporting limit raised due to insufficient sample amount.

DHS ELAP Certification N° 1644

Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/12/07
		Date Received: 10/15/07
	Client Contact: Robert Flory	Date Extracted: 10/15/07
	Client P.O.:	Date Analyzed 10/16/07

CAM / CCR 17 Metals*

Lab ID	0710502-014A	0710502-018A			Reporting Limit for DF =1; ND means not detected above the reporting limit	
Client ID	IN-1-8.5	MW2-11.5				
Matrix	S	S			S	W
Extraction Type	TOTAL	TOTAL			mg/Kg	mg/L

ICP-MS Metals, Concentration*

Analytical Method: 6020A Extraction Method: SW3050B Work Order: 0710502

Dilution Factor	1	1			1	1
Antimony	0.51	0.60			0.5	NA
Arsenic	4.4	5.3			0.5	NA
Barium	73	80			5.0	NA
Beryllium	ND	ND			0.5	NA
Cadmium	ND	ND			0.25	NA
Chromium	22	22			0.5	NA
Cobalt	4.3	11			0.5	NA
Copper	11	14			0.5	NA
Lead	4.0	7.4			0.5	NA
Mercury	ND	ND			0.05	NA
Molybdenum	ND	ND			0.5	NA
Nickel	18	27			0.5	NA
Selenium	ND	ND			0.5	NA
Silver	ND	ND			0.5	NA
Thallium	ND	ND			0.5	NA
Vanadium	26	34			0.5	NA
Zinc	26	39			5.0	NA
%SS:	97	96				
Comments						

*water samples are reported in µg/L, product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate diluted out of range; ND means not detected above the reporting limit; N/A means not applicable to this sample or instrument.

TOTAL = acid digestion.

WET = Waste Extraction Test (STLC).

DI WET = Waste Extraction Test using de-ionized water.

i) aqueous sample containing greater than ~1 vol. % sediment; for DISSOLVED metals, this sample has been preserved prior to filtration; for TOTAL^ metals, a representative sediment-water mixture was digested; j) reporting limit raised due to insufficient sample amount; J) analyte detected below quantitation limits; k) reporting limit raised due to matrix interference; m) estimated value due to low/high surrrogate recovery, caused by matrix interference; n) results are reported on a dry weight basis; p) see attached narrative.

DHS ELAP Certification N° 1644 Angela Rydelius, Lab Manager

AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

Client Project ID: #273928; Piazza

Client Contact: Robert Flory

Client P.O.:

Date Sampled: 10/12/07
Date Received: 10/15/07
Date Extracted: 10/22/07
Date Analyzed 10/22/07

Chemical Oxygen Demand (COD)*

Analytical Method: SM5220D

Work Order: 0710502

Lab ID	Client ID	Matrix	COD	DF
0710502-014A	IN-1-8.5	S	2400	1
0710502-018A	MW2-11.5	S	1800	1

Reporting Limit for DF = 1; ND means not detected at or above the reporting limit	W	NA	
	S	250 mg/Kg	

*water/product/oil/non-aqueous liquid samples and all TCLP/STLC/DISTLC/SPLP extracts are reported in mg/L; soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

DHS ELAP Certification N° 1644

Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/12/07
		Date Received: 10/15/07
	Client Contact: Robert Flory	Date Extracted: 10/15/07-10/17/07
	Client P.O.:	Date Analyzed 10/16/07-10/18/07

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE*

Extraction method SW5030B Analytical methods SW8021B/8015Cm Work Order: 0710502

Lab ID	Client ID	Matrix	TPH(g)	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	DF	% SS
003A	MW3-11	S	ND	ND	ND	ND	ND	ND	1	84
004A	MW3-13	S	ND	ND	ND	ND	ND	ND	1	78
006A	MW4-11	S	ND	ND	ND	ND	ND	ND	1	80
007A	MW4-12	S	ND	ND	ND	ND	ND	ND	1	79
008A	MW4-16	S	ND	ND	ND	ND	ND	ND	1	74
010A	MW1-8.5	S	ND	ND	ND	ND	ND	ND	1	91
011A	MW1-9	S	ND	ND	ND	ND	ND	ND	1	75
014A	IN-1-8.5	S	ND	ND	ND	ND	ND	ND	1	82
015A	IN-1-10	S	ND	ND	ND	ND	ND	ND	1	80
016A	IN-1-12	S	ND	ND	ND	ND	ND	ND	1	83
018A	MW2-11.5	S	ND	ND	ND	ND	ND	ND	1	82
019A	MW2-13.5	S	ND	ND	ND	ND	ND	ND	1	85

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	NA	NA	NA	NA	NA	NA	1	ug/L
	S	1.0	0.05	0.005	0.005	0.005	0.005	1	mg/Kg

* water and vapor samples and all TCLP & SPLP extracts are reported in µg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples in mg/L.

cluttered chromatogram; sample peak coelutes with surrogate peak.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (stoddard solvent / mineral spirit?); f) one to a few isolated non-target peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) reporting limit raised due to high organic / MTBE content; k) TPH pattern that does not appear to be derived from gasoline (aviation gas). m) no recognizable pattern; n) TPH(g) value derived using a client specified carbon range; o) results are reported on a dry weight basis; p) see attached narrative.

DHS ELAP Certification N° 1644

_______ Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/12/07 Date Received: 10/15/07
	Client Contact: Robert Flory	Date Extracted: 10/17/07
	Client P.O.:	Date Analyzed 10/17/07

pH*

Analytical Method: SW9045C

Work Order: 0710502

Lab ID	Client ID	Matrix	pH
0710502-014A	IN-1-8.5	S	7.37 @ 24.1°C
0710502-018A	MW2-11.5	S	5.86 @ 23.8°C

Method Accuracy and Reporting Units	W	NA
	S	±0.05, pH units @ °C

DHS ELAP Certification N° 1644

Angela Rydelius, Lab Manager

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AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/12/07
		Date Received: 10/15/07
	Client Contact: Robert Flory	Date Extracted: 10/15/07-10/17/07
	Client P.O.:	Date Analyzed 10/16/07-10/18/07

Diesel (C10-23) and Oil (C18+) Range Extractable Hydrocarbons as Diesel and Motor Oil*

Extraction method: SW3550C Analytical methods: SW8015C Work Order: 0710502

Lab ID	Client ID	Matrix	TPH(d)	TPH(mo)	DF	% SS
0710502-003A	MW3-11	S	ND	ND	1	90
0710502-004A	MW3-13	S	ND	ND	1	91
0710502-006A	MW4-11	S	ND	ND	1	92
0710502-007A	MW4-12	S	ND	ND	1	88
0710502-008A	MW4-16	S	ND	ND	1	99
0710502-010A	MW1-8.5	S	ND	ND	1	93
0710502-011A	MW1-9	S	ND	ND	1	91
0710502-014A	IN-1-8.5	S	4.0,c	ND	1	82
0710502-015A	IN-1-10	S	5.1,c	ND	1	88
0710502-016A	IN-1-12	S	ND	ND	1	101
0710502-018A	MW2-11.5	S	ND	ND	1	91
0710502-019A	MW2-13.5	S	ND	ND	1	93

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	NA	NA	ug/L
	S	1.0	5.0	mg/Kg

* water samples are reported in µg/L, wipe samples in µg/wipe, soil/solid/sludge samples in mg/kg, product/oil/non-aqueous liquid samples in mg/L, and all DISTLC / STLC / SPLP / TCLP extracts are reported in µg/L.

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel? is significant); d) gasoline range compounds are significant; e) unknown medium boiling point pattern that does not appear to be derived from diesel (asphalt?); f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; k) kerosene/kerosene range/jet fuel; l) bunker oil; m) fuel oil; n) stoddard solvent/mineral spirit; o) mineral oil; p) see attached narrative.

DHS ELAP Certification N° 1644

Angela Rydelius, Lab Manager

QC SUMMARY REPORT FOR E218.6m

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method E218.6m **Extraction SW3060A** **BatchID: 31407** **Spiked Sample ID: 0710502-014a**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Hexachrome	ND	40	99	104	5.21	108	108	0	80 - 120	20	90 - 110	10

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31407 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-014A	10/12/07 12:00 PM	10/17/07	10/17/07 8:23 PM	0710502-018A	10/12/07 1:25 PM	10/17/07	10/17/07 8:42 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QC SUMMARY REPORT FOR 6020A

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method 6020A **Extraction SW3050B** **BatchID: 31308** **Spiked Sample ID 0710447-014A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	Spiked	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	mg/Kg	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Antimony	ND	50	114	105	8.18	10	106	106	0	70 - 130	20	80 - 120	20
Arsenic	7.3	50	115	105	7.71	10	98.3	95	3.42	70 - 130	20	80 - 120	20
Barium	250	500	120	106	8.61	100	93.1	92.8	0.376	70 - 130	20	80 - 120	20
Beryllium	ND	50	100	93.9	6.44	10	97.6	97.6	0	70 - 130	20	80 - 120	20
Cadmium	ND	50	112	103	8.48	10	97.9	97.5	0.409	70 - 130	20	80 - 120	20
Chromium	35	50	105	94.4	6.15	10	93.2	92.4	0.787	70 - 130	20	80 - 120	20
Cobalt	10	50	106	98.1	6.23	10	99.9	99.6	0.271	70 - 130	20	80 - 120	20
Copper	22	50	113	103	6.44	10	97.9	96.9	0.996	70 - 130	20	80 - 120	20
Lead	7.6	50	113	104	7.39	10	94.1	93.2	0.940	70 - 130	20	80 - 120	20
Mercury	ND	1.25	106	100	5.85	0.25	86.3	90	4.13	70 - 130	20	80 - 120	20
Molybdenum	0.59	50	110	102	7.23	10	87.3	89.2	2.09	70 - 130	20	80 - 120	20
Nickel	33	50	116	105	6.41	10	96.6	95.1	1.61	70 - 130	20	80 - 120	20
Selenium	ND	50	117	110	5.85	10	98.5	101	2.17	70 - 130	20	80 - 120	20
Silver	ND	50	113	105	7.37	10	98.1	97.8	0.388	70 - 130	20	80 - 120	20
Thallium	ND	50	109	102	6.65	10	91.8	91.3	0.513	70 - 130	20	80 - 120	20
Vanadium	55	50	109	94.7	6.80	10	92.7	91.8	0.998	70 - 130	20	80 - 120	20
Zinc	56	500	112	103	7.61	100	110	109	0.641	70 - 130	20	80 - 120	20
%SS:	109	250	118	108	8.65	250	128	116	9.75	70 - 130	20	70 - 130	20

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 31308 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-014A	10/12/07 12:00 PM	10/15/07	10/16/07 10:49 PM	0710502-018A	10/12/07 1:25 PM	10/15/07	10/16/07 10:56 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte

DHS ELAP Certification N° 1644

QA/QC Officer

QC SUMMARY REPORT FOR SM5220D

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SM5220D **Extraction SM5220D** **BatchID: 31406** **Spiked Sample ID: 0710502-014A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
COD	2400	10000	95.5	97.8	1.98	98.4	101	2.40	80 - 120	20	90 - 110	20

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31406 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-014A	10/12/07 12:00 PM	10/22/07	10/22/07 4:36 PM	0710502-018A	10/12/07 1:25 PM	10/22/07	10/22/07 4:42 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QA/QC Officer

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8021B/8015Cm **Extraction SW5030B** **BatchID: 31310** **Spiked Sample ID: 0710453-020A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(btex£)	ND	0.60	92.1	90.4	1.93	104	114	8.57	70 - 130	30	70 - 130	30
MTBE	ND	0.10	82.7	85.8	3.79	103	82	22.4	70 - 130	30	70 - 130	30
Benzene	ND	0.10	84.2	90.1	6.79	112	92.9	18.5	70 - 130	30	70 - 130	30
Toluene	ND	0.10	77.2	82	5.67	108	93.8	14.1	70 - 130	30	70 - 130	30
Ethylbenzene	ND	0.10	90.3	94.5	4.60	115	109	5.29	70 - 130	30	70 - 130	30
Xylenes	ND	0.30	86.3	90.7	4.90	117	107	8.96	70 - 130	30	70 - 130	30
%SS:	89	0.10	81	85	4.83	106	92	14.4	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31310 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-003A	10/12/07 9:00 AM	10/15/07	10/16/07 9:10 PM	0710502-004A	10/12/07 9:10 AM	10/15/07	10/16/07 10:52 PM
0710502-006A	10/12/07 10:10 AM	10/15/07	10/16/07 10:43 AM	0710502-007A	10/12/07 10:15 AM	10/15/07	10/16/07 10:13 AM
0710502-010A	10/12/07 11:05 AM	10/15/07	10/17/07 1:09 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8021B/8015Cm **Extraction SW5030B** **BatchID: 31341** **Spiked Sample ID: 0710502-019A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(btex)£	ND	0.60	113	101	11.5	106	107	0.997	70 - 130	30	70 - 130	30
MTBE	ND	0.10	81	73.1	10.3	81.2	79.5	2.01	70 - 130	30	70 - 130	30
Benzene	ND	0.10	92.2	90.5	1.84	96.3	97.4	1.16	70 - 130	30	70 - 130	30
Toluene	ND	0.10	90.6	87	3.88	94.1	95.4	1.34	70 - 130	30	70 - 130	30
Ethylbenzene	ND	0.10	96.1	97	1.01	101	103	1.72	70 - 130	30	70 - 130	30
Xylenes	ND	0.30	91.3	91.3	0	96	96.3	0.347	70 - 130	30	70 - 130	30
%SS:	85	0.10	77	78	0.685	81	82	1.44	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31341 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-011A	10/12/07 11:05 AM	10/15/07	10/16/07 11:14 AM	0710502-014A	10/12/07 12:00 PM	10/15/07	10/17/07 1:43 AM
0710502-015A	10/12/07 12:05 PM	10/15/07	10/16/07 7:39 AM	0710502-018A	10/12/07 1:25 PM	10/15/07	10/16/07 7:06 AM
0710502-019A	10/12/07 1:30 PM	10/15/07	10/16/07 8:12 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

DHS ELAP Certification N° 1644

QA/QC Officer

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8021B/8015Cm Extraction SW5030B BatchID: 31358 Spiked Sample ID: 0710502-016A

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(btex)£	ND	0.60	108	102	6.16	101	97.7	3.34	70 - 130	30	70 - 130	30
MTBE	ND	0.10	102	114	11.5	110	118	6.60	70 - 130	30	70 - 130	30
Benzene	ND	0.10	94.6	95.1	0.496	96.5	92.8	3.94	70 - 130	30	70 - 130	30
Toluene	ND	0.10	105	106	1.16	107	102	4.46	70 - 130	30	70 - 130	30
Ethylbenzene	ND	0.10	103	104	0.578	105	100	4.76	70 - 130	30	70 - 130	30
Xylenes	ND	0.30	113	113	0	120	110	8.70	70 - 130	30	70 - 130	30
%SS:	83	0.10	97	111	14.1	85	92	8.02	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31358 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-016A	10/12/07 12:10 PM	10/16/07	10/17/07 11:00 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

DHS ELAP Certification N° 1644

QA/QC Officer

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8021B/8015Cm **Extraction SW5030B** **BatchID: 31381** **Spiked Sample ID: 0710502-008A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(btex)£	ND	0.60	104	102	2.53	110	113	3.10	70 - 130	30	70 - 130	30
MTBE	ND	0.10	101	100	0.430	102	108	5.65	70 - 130	30	70 - 130	30
Benzene	ND	0.10	95.3	98.1	2.92	104	102	2.25	70 - 130	30	70 - 130	30
Toluene	ND	0.10	92	94.6	2.73	98.3	95.3	3.14	70 - 130	30	70 - 130	30
Ethylbenzene	ND	0.10	102	103	1.37	109	105	3.54	70 - 130	30	70 - 130	30
Xylenes	ND	0.30	96.7	100	3.39	103	103	0	70 - 130	30	70 - 130	30
%SS:	74	0.10	90	91	1.53	96	93	2.75	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31381 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-008A	10/12/07 10:25 AM	10/17/07	10/18/07 1:33 PM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

QC SUMMARY REPORT FOR WET CHEMISTRY TESTS

Test Method: pH **Matrix: S** **WorkOrder: 0710502**

Method Name: SW9045C	Units ±, pH units @ °C	BatchID: 31344

SampleID	Sample	DF	Dup / Ser. Dil.	DF	RD	Acceptance Criteria
0710502-014A	7.37 @ 24.1°C	1	7.37 @ 24.1°C	1	0	±0.05
0710502-018A	5.86 @ 23.8°C	1	5.85 @ 23.9°C	1	0.01	±0.05

BATCH 31344 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-014A	10/12/07 12:00 PM	10/17/07	10/17/07 6:50 PM	0710502-018A	10/12/07 1:25 PM	10/17/07	10/17/07 7:00 PM

Dup = Duplicate; Ser. Dil. = Serial Dilution; MS = Matrix Spike; RD = Relative Difference; RPD = Relative Percent Deviation.

RD = Absolute Value {Sample - Duplicate}; RPD = 100 * (Sample - Duplicate) / [(Sample + Duplicate) / 2].

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8015C **Extraction SW3550C** **BatchID: 31312** **Spiked Sample ID: 0710453-020A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(d)	ND	20	113	114	0.471	116	113	2.71	70 - 130	30	70 - 130	30
%SS:	105	50	105	105	0	106	103	2.69	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31312 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-003A	10/12/07 9:00 AM	10/15/07	10/16/07 9:13 PM	0710502-004A	10/12/07 9:10 AM	10/15/07	10/18/07 6:46 AM
0710502-006A	10/12/07 10:10 AM	10/15/07	10/16/07 6:52 PM	0710502-007A	10/12/07 10:15 AM	10/15/07	10/17/07 6:33 AM
0710502-010A	10/12/07 11:05 AM	10/15/07	10/16/07 8:03 PM	0710502-011A	10/12/07 11:05 AM	10/15/07	10/16/07 9:13 PM
0710502-014A	10/12/07 12:00 PM	10/15/07	10/17/07 3:03 AM	0710502-015A	10/12/07 12:05 PM	10/15/07	10/17/07 4:12 AM
0710502-018A	10/12/07 1:25 PM	10/15/07	10/18/07 7:56 AM	0710502-019A	10/12/07 1:30 PM	10/15/07	10/18/07 10:16 AM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS ELAP Certification N° 1644

_______ QA/QC Officer

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8015C **Extraction SW3550C** **BatchID: 31347** **Spiked Sample ID: 0710517-004A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(d)	920	20	NR	NR	NR	121	121	0	70 - 130	30	70 - 130	30
%SS:	93	50	95	95	0	115	116	1.03	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31347 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-016A	10/12/07 12:10 PM	10/16/07	10/18/07 6:03 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Soil QC Matrix: Soil WorkOrder 0710502

EPA Method SW8015C **Extraction SW3550C** **BatchID: 31402** **Spiked Sample ID: 0710597-037A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(d)	1.4	20	107	108	0.843	119	110	7.17	70 - 130	30	70 - 130	30
%SS:	98	50	74	76	3.18	100	79	23.4	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31402 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710502-008A	10/12/07 10:25 AM	10/17/07	10/18/07 3:16 PM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/08/07-10/18/07 Date Received: 10/18/07
	Client Contact: Robert Flory	Date Reported: 10/25/07
	Client P.O.:	Date Completed: 10/25/07

WorkOrder: 0710655

October 25, 2007

Dear Robert:

Enclosed are:

1). the results of **5** analyzed samples from your **#273928; Piazza project,**

2). a QC report for the above samples

3). a copy of the chain of custody, and

4). a bill for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits. If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Best regards,

Angela Rydelius, Lab Manager

0710655

McCAMPBELL ANALYTICAL, INC.

1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (877) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☒ PDF ☒ Excel ☐ Write On (DW) ☐

☐ Check if sample is effluent and "J" flag is required

Report To: Bob Flory Bill To: SAME
Company: AEI Consultants
2500 Camino Diablo
Walnut Creek, CA
E-Mail: rflory@aeiconsultants.com
Tele: (925) 944-2899
Fax: (925) 944-2895
Project #: 273928
Project Name: Piazza
Project Location: 20957 Baker Rd, Castro Valley, CA
Sampler Signature:

	SAMPLE ID	LOCATION/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED ICE	METHOD PRESERVED HCL	METHOD PRESERVED HNO_3	METHOD PRESERVED Other
(+)	MW-1		10/18	11:05	4		X					X	X		
✓	MW-2		10/18	12:15	6		X					X	X		X
✓	MW-3		10/18	10:05	6		X					X	X		X
+	MW-4		10/18	1:35	4		X					X	X		
	~~[illegible]~~		10/18	11:30	4		X					X	X		
+	IN-1						~~X~~					~~X~~	~~X~~		

SAMPLE ID	BTEX & TPH as Gas (602 / 8021 + 8015) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 502.2 / 601 / 8010 / 8021 (HVOCs)	MTBE / BTEX ONLY (EPA 602 / 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ONLY; Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Lead (200.7 / 200.8 / 6010 / 6020)	Other: Hexavalent Chromium (218.6)	Other	Other	Comments: Filter Samples for Metals analysis: Yes / No
MW-1	X	X																		
MW-2	X	X												X			X			Filtered in field
MW-3	X	X												X			X			Filtered in field
MW-4	X	X																		
~~[illegible]~~	X	X																		
IN-1																				

Relinquished By:	Date: 10/18	Time: 4:00pm	Received By: K. BURKS
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t° 9.2
GOOD CONDITION______
HEAD SPACE ABSENT______
DECHLORINATED IN LAB______
APPROPRIATE CONTAINERS______
PRESERVED IN LAB______

COMMENTS:
* MW-4. TPH-d 2 micro extraction.

	VOAS	O&G	METALS	OTHER
PRESERVATION			pH<2	

McCampbell Analytical, Inc.

1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: **0710655** **ClientID:** **AEL**

☑ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty

Report to:
Robert Flory
AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597

Email: rflory@aeiconsultants.com
TEL: (925) 283-6000 FAX: (925) 283-6121
ProjectNo: #273928; Piazza
PO:

Bill to:
Denise Mockel
AEI Consultants
2500 Camino Diablo, Ste. #200
Walnut Creek, CA 94597
dmockel@aeiconsultants.com

Requested TAT: **5 days**

Date Received: **10/18/2007**
Date Printed: **10/18/2007**

					Requested Tests (See legend below)											
Sample ID	**ClientSampID**	**Matrix**	**Collection Date**	**Hold**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0710655-001	MW-1	Water	10/18/07 11:05:00	☐			B		B	A						
0710655-002	MW-2	Water	10/18/07 12:15:00	☐	D	C	B	C		A						
0710655-003	MW-3	Water	10/18/07 10:05:00	☐	D	C	B	C		A						
0710655-004	MW-4	Water	10/18/07 1:35:00	☐			B			A						
0710655-005	IN-1	Water	10/8/07 11:30:00	☐			B			A						

Test Legend:

1	218_6_W
2	CAM17MS_DISS
3	G-MBTEX_W
4	PRDISSOLVED
5	PREDF REPORT
6	TPH(D)_W
7	
8	
9	
10	
11	
12	

Prepared by: Ana Venegas

Comments: Joanne no longer with AEI; invoices to dmockel@aeiconsultants.com

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Sample Receipt Checklist

Client Name: **AEI Consultants**

Date and Time Received: **10/18/07 5:40:28 PM**

Project Name: **#273928; Piazza**

Checklist completed and reviewed by: Ana Venegas

WorkOrder N°: **0710655** Matrix Water

Carrier: Client Drop-In

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp:	9.2°C	NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☑	No ☐	No VOA vials submitted ☐
Sample labels checked for correct preservation?	Yes ☑	No ☐	
TTLC Metal - pH acceptable upon receipt (pH<2)?	Yes ☑	No ☐	NA ☐

Client contacted:

Date contacted:

Contacted by:

Comments:

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/18/07 Date Received: 10/18/07
	Client Contact: Robert Flory	Date Extracted: 10/18/07
	Client P.O.:	Date Analyzed: 10/18/07

Hexachrome by IC*

Analytical Method: E218.6 Work Order: 0710655

Lab ID	Client ID	Matrix	Hexachrome	DF
0710655-002D	MW-2	W	ND	1
0710655-003D	MW-3	W	ND	1

Reporting Limit for DF = 1; ND means not detected at or above the reporting limit	W	0.2 µg/L	
	S	NA	

* water samples are reported in µg/L.

N/A means surrogate not applicable to this analysis; # surrogate diluted out of range or surrogate coelutes with another peak.

h) a lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) sample diluted due to matrix interference; p) see attached narrative.

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/18/07
		Date Received: 10/18/07
	Client Contact: Robert Flory	Date Extracted: 10/18/07
	Client P.O.:	Date Analyzed 10/19/07-10/23/07

CAM / CCR 17 Metals*

ICP-MS Metals, Concentration*

Analytical Method: E200.8 Extraction Method: E200.8 Work Order: 0710655

Lab ID	0710655-002C	0710655-003C			Reporting Limit for DF =1; ND means not detected above the reporting limit	
Client ID	MW-2	MW-3				
Matrix	W	W			S	W
Extraction Type	DISS.	DISS.			mg/kg	µg/L
Dilution Factor	1	1			1	1
Antimony	0.72	ND			NA	0.5
Arsenic	2.3	0.82			NA	0.5
Barium	300	360			NA	5.0
Beryllium	ND	ND			NA	0.5
Cadmium	ND	ND			NA	0.25
Chromium	0.57	0.55			NA	0.5
Cobalt	ND	ND			NA	0.5
Copper	2.0	1.3			NA	0.5
Lead	ND	ND			NA	0.5
Mercury	0.017	ND			NA	0.012
Molybdenum	4.7	0.70			NA	0.5
Nickel	1.6	2.0			NA	0.5
Selenium	1.9	1.4			NA	0.5
Silver	ND	ND			NA	0.19
Thallium	ND	ND			NA	0.5
Vanadium	2.1	1.3			NA	0.5
Zinc	180	190			NA	5.0
%SS:	N/A	N/A				
Comments						

*water samples are reported in µg/L, product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate diluted out of range; ND means not detected above the reporting limit; N/A means not applicable to this sample or instrument.

TOTAL = acid digestion.

WET = Waste Extraction Test (STLC).

DI WET = Waste Extraction Test using de-ionized water.

i) aqueous sample containing greater than ~1 vol. % sediment; for DISSOLVED metals, this sample has been preserved prior to filtration; for TOTAL^ metals, a representative sediment-water mixture was digested; j) reporting limit raised due to insufficient sample amount; k) reporting limit raised due to matrix interference; m) estimated value due to low/high surrrogate recovery, caused by matrix interference; n) results are reported on a dry weight basis; p) see attached narrative.

DHS ELAP Certification N° 1644

Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/08/07-10/18/07 Date Received: 10/18/07
	Client Contact: Robert Flory	Date Extracted: 10/19/07
	Client P.O.:	Date Analyzed: 10/19/07

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE*

Extraction method: SW5030B Analytical methods: SW8021B/8015Cm Work Order: 0710655

Lab ID	Client ID	Matrix	TPH(g)	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	DF	% SS
001B	MW-1	W	ND	ND	ND	ND	ND	ND	1	103
002B	MW-2	W	ND	ND	ND	ND	ND	ND	1	103
003B	MW-3	W	ND	ND	ND	ND	ND	ND	1	102
004B	MW-4	W	ND	ND	ND	ND	ND	ND	1	110
005B	IN-1	W	ND	ND	ND	ND	ND	ND	1	123

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	50	5.0	0.5	0.5	0.5	0.5	1	µg/L
	S	NA	NA	NA	NA	NA	NA	1	mg/Kg

* water and vapor samples and all TCLP & SPLP extracts are reported in ug/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples in mg/L.

cluttered chromatogram; sample peak coelutes with surrogate peak.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (stoddard solvent / mineral spirit?); f) one to a few isolated non-target peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; j) reporting limit raised due to high MTBE content; k) TPH pattern that does not appear to be derived from gasoline (aviation gas). m) no recognizable pattern; n) TPH(g) range non-target isolated peaks subtracted out of the TPH(g) concentration at the client's request; p) see attached narrative.

DHS ELAP Certification N° 1644

AR Angela Rydelius, Lab Manager

AEI Consultants 2500 Camino Diablo, Ste. #200 Walnut Creek, CA 94597	Client Project ID: #273928; Piazza	Date Sampled: 10/08/07-10/18/07 Date Received: 10/18/07
	Client Contact: Robert Flory	Date Extracted: 10/18/07
	Client P.O.:	Date Analyzed 10/19/07-10/24/07

Bunker Oil (C10+), Diesel (C10-C23) & Motor Oil Range (C18+) Extractable Hydrocarbons as Bunker Oil, Diesel & Motor Oil*

Extraction method: SW3510C Analytical methods: SW8015C Work Order: 0710655

Lab ID	Client ID	Matrix	TPH(bo)	TPH(d)	TPH(mo)	DF	% SS
001A	MW-1	W	140,b	56	ND	1	94
002A	MW-2	W	ND	ND	ND	1	112
003A	MW-3	W	ND	ND	ND	1	112
004A	MW-4	W	ND	ND	ND	1	113
005A	IN-1	W	ND	ND	ND	1	88

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	100	50	250	µg/L
	S	NA	NA	NA	mg/Kg

* water samples are reported in µg/L, wipe samples in µg/wipe, soil/solid/sludge samples in mg/kg, product/oil/non-aqueous liquid samples in mg/L, and all DISTLC / STLC / SPLP / TCLP extracts are reported in µg/L.

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel? is significant); d) gasoline range compounds are significant; e) unknown medium boiling point pattern that does not appear to be derived from diesel; f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen/product is present; i) liquid sample that contains greater than ~1 vol. % sediment; k) kerosene/kerosene range/jet fuel range; l) bunker oil; m) fuel oil; n) stoddard solvent/mineral spirit.

DHS ELAP Certification N° 1644

Angela Rydelius, Lab Manager

QC SUMMARY REPORT FOR E218.6

W.O. Sample Matrix: Water QC Matrix: Water WorkOrder 0710655

EPA Method E218.6 **Extraction E218.6** **BatchID: 31430** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Hexachrome	N/A	25	N/A	N/A	N/A	94.2	93.8	0.426	N/A	N/A	90 - 110	10

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31430 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710655-002D	10/18/07 12:15 PM	10/18/07	10/18/07 8:47 PM	0710655-003D	10/18/07 10:05 AM	10/18/07	10/18/07 8:28 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

QC SUMMARY REPORT FOR SW8021B/8015Cm

W.O. Sample Matrix: Water QC Matrix: Water WorkOrder 0710655

EPA Method SW8021B/8015Cm Extraction SW5030B BatchID: 31425 Spiked Sample ID: 0710655-004B

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(btex)£	ND	60	79.1	80	1.25	91.7	101	10.1	70 - 130	30	70 - 130	30
MTBE	ND	10	97	104	7.04	105	101	3.80	70 - 130	30	70 - 130	30
Benzene	ND	10	101	106	4.42	86.5	94.2	8.47	70 - 130	30	70 - 130	30
Toluene	ND	10	100	105	4.64	97.3	106	8.27	70 - 130	30	70 - 130	30
Ethylbenzene	ND	10	101	105	4.16	95.3	102	6.96	70 - 130	30	70 - 130	30
Xylenes	ND	30	93.5	95.1	1.74	107	113	6.06	70 - 130	30	70 - 130	30
%SS:	110	10	107	107	0	83	88	5.27	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31425 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710655-001B	10/18/07 11:05 AM	10/19/07	10/19/07 8:28 AM	0710655-002B	10/18/07 12:15 PM	10/19/07	10/19/07 7:58 AM
0710655-003B	10/18/07 10:05 AM	10/19/07	10/19/07 7:27 AM	0710655-004B	10/18/07 1:35 PM	10/19/07	10/19/07 6:57 AM
0710655-005B	10/08/07 11:30 AM	10/19/07	10/19/07 6:26 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

£ TPH(btex) = sum of BTEX areas from the FID.

cluttered chromatogram; sample peak coelutes with surrogate peak.

QC SUMMARY REPORT FOR E200.8

W.O. Sample Matrix: Water QC Matrix: Water WorkOrder 0710655

EPA Method E200.8 **Extraction E200.8** **BatchID: 31427** **Spiked Sample ID: 0710657-001A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Antimony	0.55	10	98.9	99.9	0.953	108	107	0.834	70 - 130	20	80 - 120	20
Arsenic	37	10	116	116	0	100	99.1	1.18	70 - 130	20	80 - 120	20
Barium	33	100	99.6	99.8	0.151	101	100	0.596	70 - 130	20	80 - 120	20
Beryllium	ND	10	85.1	86	1.12	102	101	1.18	70 - 130	20	80 - 120	20
Cadmium	ND	10	94	93.5	0.499	102	101	0.891	70 - 130	20	80 - 120	20
Chromium	12	10	89.3	90.9	0.747	96.2	96.7	0.550	70 - 130	20	80 - 120	20
Cobalt	1.4	10	83	84	1.01	104	105	0.383	70 - 130	20	80 - 120	20
Copper	130	10	NR	NR	NR	94.2	93.9	0.255	70 - 130	20	80 - 120	20
Lead	6.1	10	100	101	0.124	100	102	1.51	70 - 130	20	80 - 120	20
Mercury	0.057	0.25	88.8	88.1	0.647	86.6	87.2	0.736	70 - 130	20	80 - 120	20
Molybdenum	66	10	116	118	0.284	97.3	96.2	1.18	70 - 130	20	80 - 120	20
Nickel	8.7	10	103	118	7.58	98.4	101	2.48	70 - 130	20	80 - 120	20
Selenium	26	10	111	115	0.987	103	103	0	70 - 130	20	80 - 120	20
Silver	ND	10	90.6	91.1	0.619	103	102	0.974	70 - 130	20	80 - 120	20
Thallium	ND	10	94.3	94.8	0.518	94.2	95	0.772	70 - 130	20	80 - 120	20
Vanadium	20	10	96.1	97.2	0.372	99.3	98.2	1.06	70 - 130	20	80 - 120	20
Zinc	210	100	99.7	98.8	0.288	102	104	1.74	70 - 130	20	80 - 120	20
%SS:	105	750	108	109	0.676	105	103	2.07	70 - 130	20	70 - 130	20

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31427 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710655-002C	10/18/07 12:15 PM	10/18/07	10/19/07 1:15 AM	0710655-002C	10/18/07 12:15 PM	10/18/07	10/23/07 2:37 PM
0710655-003C	10/18/07 10:05 AM	10/18/07	10/19/07 1:23 AM	0710655-003C	10/18/07 10:05 AM	10/18/07	10/23/07 7:26 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS ELAP Certification N° 1644

QA/QC Officer

QC SUMMARY REPORT FOR SW8015C

W.O. Sample Matrix: Water QC Matrix: Water WorkOrder 0710655

EPA Method SW8015C **Extraction SW3510C** **BatchID: 31428** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
TPH(d)	N/A	1000	N/A	N/A	N/A	111	112	1.39	N/A	N/A	70 - 130	30
%SS:	N/A	2500	N/A	N/A	N/A	73	80	9.22	N/A	N/A	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:

NONE

BATCH 31428 SUMMARY

Sample ID	Date Sampled	Date Extracted	Date Analyzed	Sample ID	Date Sampled	Date Extracted	Date Analyzed
0710655-001A	10/18/07 11:05 AM	10/18/07	10/22/07 8:31 PM	0710655-002A	10/18/07 12:15 PM	10/18/07	10/19/07 11:43 PM
0710655-003A	10/18/07 10:05 AM	10/18/07	10/20/07 12:50 AM	0710655-004A	10/18/07 1:35 PM	10/18/07	10/20/07 1:57 AM
0710655-005A	10/08/07 11:30 AM	10/18/07	10/24/07 3:05 PM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

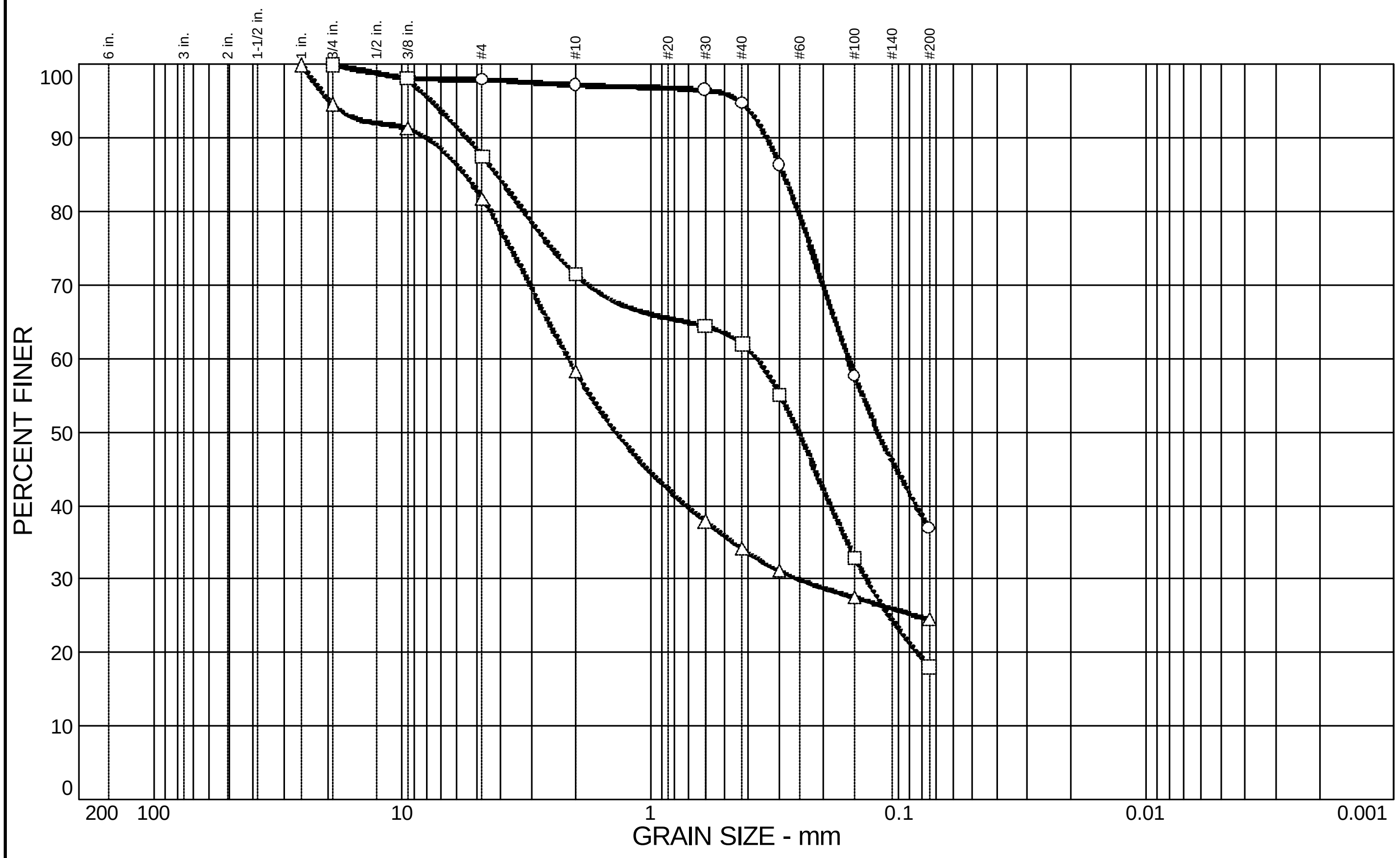
DHS ELAP Certification N° 1644

_______ QA/QC Officer

APPENDIX E

Sieve Analyses

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		2.1	61.0	36.9					
□		12.5	69.5	18.0					
△		18.3	57.2	24.5					

SIEVE inches size	PERCENT FINER ○	□	△
1			100.0
3/4	100.0	100.0	94.6
3/8	98.2	98.1	91.3
	GRAIN SIZE		
D_{60}	0.159	0.373	2.14
D_{30}		0.135	0.253
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	97.9	87.5	81.7
#10	97.2	71.5	58.2
#30	96.5	64.4	37.9
#40	94.7	62.0	34.1
#50	86.3	55.1	31.1
#100	57.6	32.9	27.5
#200	36.9	18.0	24.5

SOIL DESCRIPTION

○ Reddish Brown Silty SAND

□ Olive Silty SAND

△ Brown Clayey SAND w/ Gravel

REMARKS:

○

□

△

○ Source: IN-1-8.5 Sample No.: 0710502-014A
□ Source: MW2-11.5 Sample No.: 0710502-018A
△ Source: MW2-13.5 Sample No.: 0710502-019A

COOPER TESTING LABORATORY

Client: McCampbell Analytical, Inc.
Project: Piazza - 273928

Project No.: 385-034 Figure

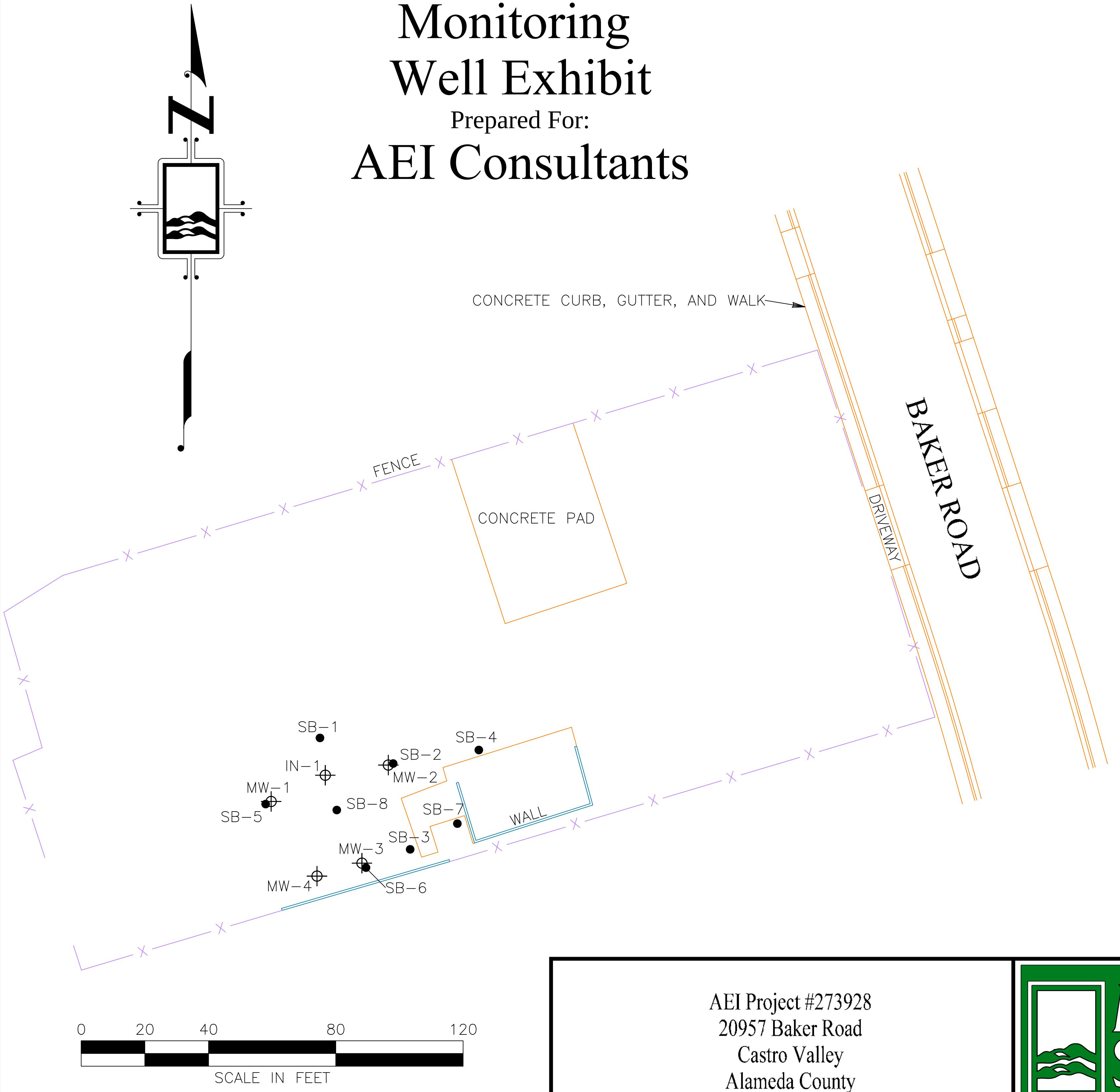
APPENDIX F

Well Elevation Survey Data

Monitoring Well Exhibit

Prepared For:

AEI Consultants



DESCRIPTION	NORTHING	EASTING	ELEV (PVC)	ELEV (BOX)	ELEV (GND)
IN-1	2078970.9	6103272.5	159.85	160.12	
MW-1	2078962.6	6103255.5	159.62	159.84	
MW-2	2078974.1	6103292.3	160.00	160.30	
MW-3	2078943.2	6103284.0	159.79	160.04	
MW-4	2078939.2	6103269.9	159.69	159.95	
SB-1	2078982.6	6103270.8			160.0
SB-2	2078974.5	6103293.9			
SB-3	2078947.6	6103299.2			159.8
SB-4	2078978.8	6103320.8			160.3
SB-5	2078961.8	6103253.8			159.6
SB-6	2078941.8	6103285.3			159.9
SB-7	2078955.7	6103314.0			160.1
SB-8	2078959.9	6103276.1			160.1

DESCRIPTION	LATITUDE	LONGITUDE
IN-1	37.6938001	-122.0843653
MW-1	37.6937767	-122.0844236
MW-2	37.6938098	-122.0842970
MW-3	37.6937248	-122.0843239
MW-4	37.6937129	-122.0843724
SB-1	37.6938322	-122.0843717
SB-2	37.6938131	-122.0843220
SB-3	37.6937374	-122.0842718
SB-4	37.6938242	-122.0841990
SB-5	37.6937744	-122.0844295
SB-6	37.6937210	-122.0843194
SB-7	37.6937603	-122.0842210
SB-8	37.6937703	-122.0843522

BASIS OF COORDINATES AND ELEVATIONS:

COORDINATES ARE CALIFORNIA STATE PLANE ZONE 3 COORDINATES FROM GPS OBSERVATIONS USING UNIVERSITY OF CALIFORNIA BAY AREA DEFORMATION CORS STATION OBSERVATION FILES AND BASED ON THE CALIFORNIA SPATIAL REFERENCE CENTER DATUM, REFERENCE EPOCH 2000.35.

COORDINATE DATUM IS NAD 83(CORS).

DATUM ELLIPSOID IS GRS80.

REFERENCE GEOID IS GEOID99.

CORS STATIONS USED WERE TIBB AND SUTB.

VERTICAL DATUM IS NAVD 88 FROM GPS OBSERVATIONS.

AEI Project #273928
20957 Baker Road
Castro Valley
Alameda County
California

Morrow
Surveying
LAND SURVEYORS

1450 Harbor Blvd. Ste. D
West Sacramento
California 95691
(916) 372-8124
paulg@morrowsurveying.com

Date: 11-16-07
Scale: 1" = 40'
Sheet 1 of 1
Revised: 11-20-07
Field Book: MW-37
Dwg. No. 0116-038 PG

APPENDIX E

Selected Soil Gas Investigation References

IN SITU BIOVENTING: PILOT TESTING RESULTS IN DEEP SOILS IN THE SOUTHWESTERN UNITED STATES

John W. Ratz, Russell A. Frishmuth, Brian R. Blicker,
John F. Hall, and Douglas C. Downey
Parsons Engineering Science, Inc.
Denver, Colorado

ABSTRACT

In situ bioventing, or low flow rate soil ventilation for the enhanced aerobic biodegradation of petroleum hydrocarbon contaminants, has been shown to be a cost-effective remedial alternative for vadose zone soils. The success of the technology relies on the ability of indigenous soil microorganisms to utilize hydrocarbon contaminants as a primary growth substrate. The rate of hydrocarbon biodegradation at a given site depends on a variety of factors, including the concentration of soil microorganisms present. Soil microbial populations are typically elevated in shallow soils due to an abundance of naturally occurring substrates and nutrients, but may be limited at greater depths due to a lack of these constituents. Therefore, the effectiveness of *in situ* bioventing is questionable in contaminated soil zones that extend far below the ground surface (bgs). Also, because the soil microbial population relies on soil moisture to sustain hydrocarbon degradation, the viability of bioventing is questionable in arid climates, where the soil moisture content is suspected to be minimal.

Parsons Engineering Science, Inc. (Parsons ES) has conducted bioventing pilot tests at 6 U.S. Air Force sites in Arizona, Nevada, New Mexico, and Utah, where petroleum hydrocarbon contamination had been transported to maximum depths ranging from 65 to 220 feet bgs. Test results demonstrated that bioventing can be a viable remedial alternative in deep soils in arid regions. Petroleum biodegradation was shown to be occurring at significant rates at 3 of the 6 subject sites. Average oxygen consumption rates ranged from 4.6 to 12.8 percent per day during initial *in situ* respiration testing at these 3 sites. At 5 of the 6 sites, average soil total Kjeldahl nitrogen (TKN) concentrations ranged from 50 to 150 milligrams per kilogram (mg/kg), generally indicating that significant bacterial populations may exist in deep soils at these sites, and that enough nitrogen was present to support aerobic hydrocarbon biodegradation. At Site 35, located at Davis-Monthan Air Force Base (AFB) in Arizona, the average TKN concentration in soil was 16 mg/kg and the average oxygen consumption rate was 0.22 percent per day, demonstrating that the lack of a significant microbial population may contribute to the low hydrocarbon biodegradation rates estimated at this site. During these initial pilot tests, soil moisture was found to be present in adequate amounts at all subject sites to support aerobic petroleum hydrocarbon biodegradation. Extended bioventing pilot testing is currently being conducted at these 6 sites to determine the long-term impact of bioventing on site contaminant concentrations.

TECHNOLOGY OVERVIEW

Releases of petroleum hydrocarbons into soil often require remedial action to protect public health and the environment. Because petroleum-contaminated soil is generally not classified as a hazardous waste under the Resource Conservation and Recovery Act (RCRA), excavation and placement of these soils in approved landfills has frequently been the most expedient remedial option. However, soil excavation and disposal can become prohibitively expensive or physically infeasible if large volumes of contaminated soil must be removed, or if contamination extends to more than a few feet bgs. Also, the risk of becoming a potentially responsible party in future landfill remediation has made the excavation and disposal option much less attractive.

Many sites with surface soil contamination can be remediated by excavating soils and treating them aboveground using thermal, chemical/physical, or biological processes. However, soil excavation is impractical at many sites due to the depth of contamination or the presence of surface features such as roads, railways, or buildings. Also, aboveground systems are often impractical and expensive due to surface space limitations and labor-intensive system operation and maintenance, respectively.

In situ remedial technologies based on the movement of air through contaminated media are proving to be cost-effective alternatives to landfill disposal or *ex situ* treatment. Soil vapor extraction (SVE), for example, has been extensively used to physically remove volatile hydrocarbons from soils. However, SVE systems often require costly off-gas treatment such as incineration or granular activated carbon adsorption, and they are not designed to remediate sites contaminated with less volatile petroleum hydrocarbons such as those found in diesel fuel, kerosene, Stoddard® solvent, and jet fuel.

In situ bioventing is an innovative, cost-effective technology for the remediation of soils contaminated with petroleum hydrocarbons, regardless of the volatility of the contaminants. Bioventing can be described as *in situ* soil ventilation with the primary objective of supplying oxygen to subsurface soils to stimulate the aerobic biodegradation of fuel residuals by indigenous soil microbes. Although most soil microbial populations can biodegrade fuels under either aerobic or anaerobic conditions, petroleum biodegradation is typically at least an order of magnitude faster under aerobic conditions. Given an enhanced oxygen supply, indigenous soil microorganisms can biodegrade fuel residuals more quickly than they could under anaerobic conditions that are typically encountered in petroleum-contaminated soil. In addition to an enhanced oxygen supply, soil bacteria also require moisture and a variety of nutrients to sustain hydrocarbon biodegradation. These nutrients, which include nitrogen, phosphorus, sulfur, and metals such as calcium and iron, are used by bacteria to synthesize new biomass and to manufacture enzymes. At some sites, concentrations of nitrogen or phosphorous may be low enough to limit the growth of the native microbial population. Other nutrients normally are present at adequate concentrations to support microbial growth. Although the time required for site cleanup is longer using bioventing instead of traditional methods such as excavation and landfarming, cost for site closure using bioventing is typically at least an order of magnitude lower than that of implementing these traditional approaches.

Researchers at the Texas Research Institute (1984) and Chevron (Ely and Heffner, 1988) have observed or utilized enhanced petroleum hydrocarbon biodegradation through the use of soil ventilation, and U.S. Air Force field tests using *in situ* bioventing have documented this technique of stimulating aerobic biodegradation of fuel residuals. As a part of previous U.S. Air Force testing efforts, a full-scale soil ventilation project to remediate a 27,000-gallon jet fuel spill at a site in Utah has been completed. During this 18-month project, jet fuel residuals in soils were reduced from an average total petroleum hydrocarbon (TPH) concentration of approximately 900 milligrams per kilogram (mg/kg) to less than 10 mg/kg (Hinchee and Miller, 1991). Monitoring of extracted soil gas indicated that volatilization accounted for 60 percent of the contaminant removal, and biodegradation accounted for the remaining 40 percent.

A conceptual layout of an *in situ* bioventing system is illustrated in Figure 1. Although bioventing systems use essentially the same equipment as SVE systems, there are two primary differences between the technologies. First, bioventing systems operate at much lower flow rates

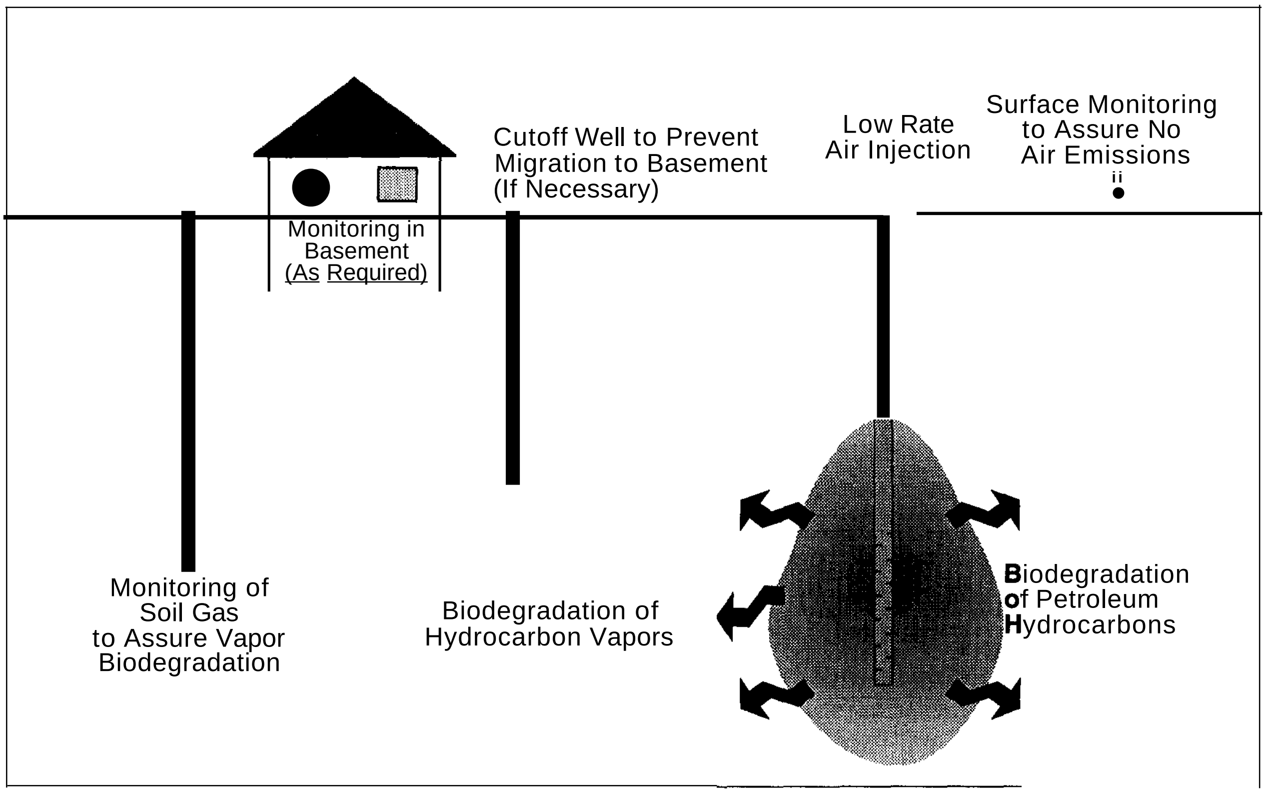


Figure 1. Conceptual layout of *in situ* bioventing.

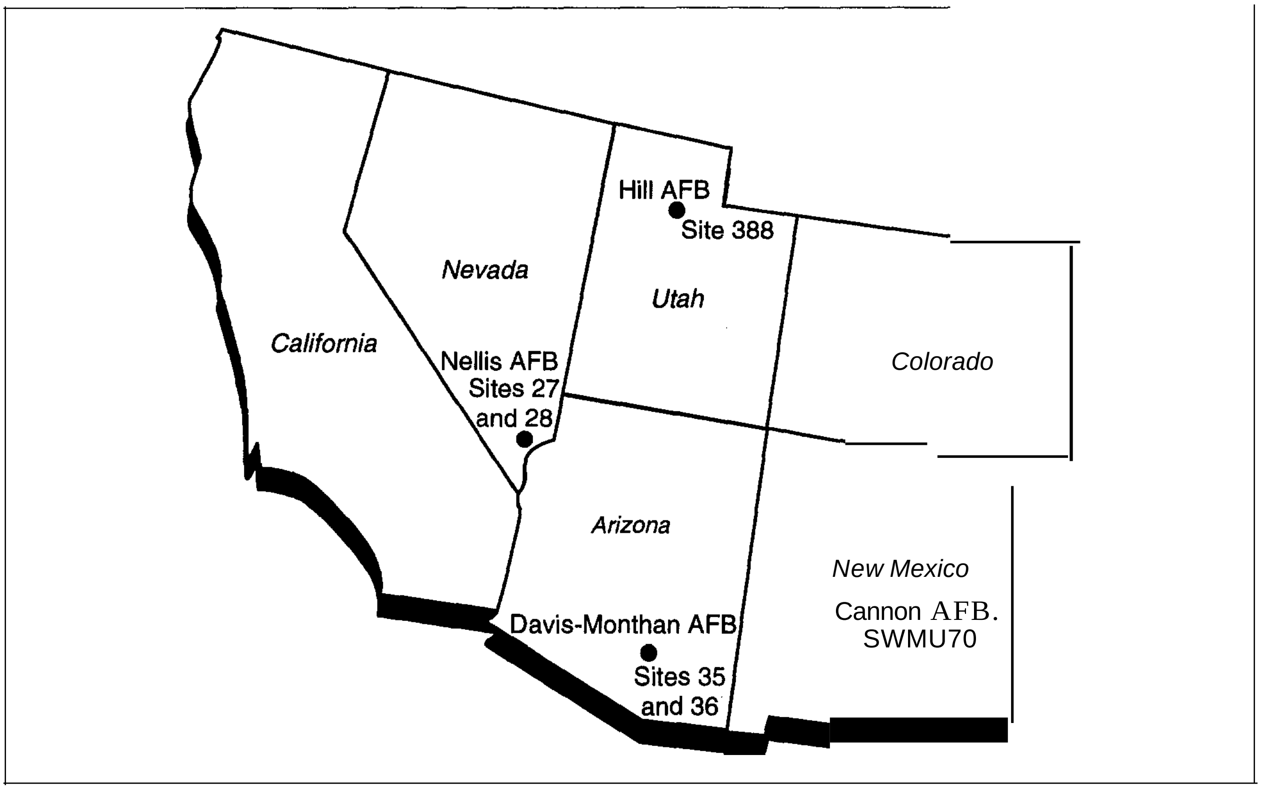


Figure 2. Site locations.

than SVE systems to minimize the volatilization of contaminants while still providing oxygen to contaminated soil. Bioventing systems operate at 0.5 to 1 soil pore volume exchange per day, while SVE systems exchange 5 to 10 soil pore volumes per day to maximize volatilization. Secondly, bioventing systems can operate in either an air injection mode or a soil gas extraction mode, whereas SVE systems are limited to high flow rate soil gas extraction for the control of volatile organic compound (VOC) emissions. Because of these basic differences, *in situ* bioventing is much less expensive than SVE. Treatment of extracted soil gas is avoided or minimized using *in situ* bioventing, which is significant because off-gas treatment systems can amount to more than half of the project cost associated with the design, installation, and operation of SVE systems (Reisinger et al., 1994). Point-source air permitting can be avoided by using injection systems in locations where air emissions are a concern. However, air quality monitoring is normally required during injection system startup to demonstrate that VOCs are not being transported into the breathing zone or into areas where vapors could accumulate, such as basements (Figure 1). To avoid this situation, injection systems are typically used only for hydrocarbon contaminants that are not highly volatile.

BIOVENTING PILOT TESTING

In April 1992, Parsons ES was retained by the Air Force Center for Environmental Excellence (AFCEE) to conduct bioventing pilot tests at over 130 petroleum-contaminated sites on Air Force bases throughout the United States. The objective of this ongoing research project is to assess the successes and limitations of this innovative technology in remediating a wide variety of hydrocarbon contaminants in varying soil types and climatic conditions. Six of these sites were located in the southwestern United States (Figure 2), and had soil contamination to depths ranging from 65 to 220 feet bgs. These six sites were of particular interest due to the depths to which contamination extended, and because they were located in arid regions.

The feasibility of *in situ* bioventing can be questioned in deep soils, where native microbial populations may be too sparse to biodegrade petroleum hydrocarbons at significant rates. Typically, microbial concentrations decrease with depth in the soil profile due to the lack of metabolizable carbon and nutrients at greater depths. In one study, sediments in an aquifer contained 10 times less biomass than neighboring surface sediments (Alexander, 1977). Organic carbon reaches the subsurface via the percolation of recharge water through the soil column. Since the microflora at higher levels within the soil column have initial contact with the percolating water, they can metabolize the carbon compounds, leaving little to no degradable carbon when the percolating water reaches greater depths. Because little carbon is available at these greater depths, microbial concentrations can be sparse. TKN can be used as a general indicator of the magnitude of the bacterial population present in soils. The TKN value indicates the concentration of organic nitrogen, nitrate, and nitrite present in a sample. Much of the organic nitrogen may originate from cell mass. Low TKN concentrations, generally below 25 mg/kg, indicate that little nitrogen or cell mass is present in soil. Higher TKN concentrations indicate the presence of nitrate, nitrite, and organic nitrogen, and may also indicate the presence of a significant bacterial population.

An additional concern at these six study sites is that, due to the climatic conditions, soils may not contain adequate levels of moisture to sustain *in situ* biodegradation. A column test using soils from the full-scale bioventing site in Utah showed increasing fuel biodegradation as soil moisture was increased from 6 to 18 percent by weight (Hinchee and Arthur, 1990). Soil moisture contents of less than 3 to 4 percent by weight may limit the growth of the bacterial population and their ability to biodegrade petroleum hydrocarbons.

PILOT TESTING PROCEDURES

Pilot testing was performed in accordance with the *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Hinchee et al., 1992). The primary objectives of each test were to assess the potential for supplying oxygen throughout contaminated soil zones, to determine if indigenous soil microbes were capable of biodegrading hydrocarbon residuals, and if so, to quantify the rate at which indigenous microbes can biodegrade fuel when stimulated by oxygen-rich soil gas.

Site Characterization and Well Installation

At each pilot testing site, a drilling and sampling program was conducted to characterize the prevailing hydrogeologic conditions and the contaminant distribution in the subsurface. A minimum of four boreholes were drilled at each pilot testing site to facilitate this subsurface investigation. A minimum of three soil samples were collected from each site and submitted to an analytical laboratory for a variety of chemical and physical analyses, including TPH; benzene, toluene, ethylbenzene, and total xylenes (BTEX); soil moisture content, and total Kjeldahl nitrogen (TKN).

A vent well (VW) for the injection of air into the subsurface, and at least three multiple-depth vapor monitoring points (MPs), for soil gas sampling, were constructed in the boreholes drilled at each site. The VWs were constructed using 4-inch-diameter, Schedule 40 polyvinyl chloride (PVC) casing and 0.04-inch slotted screen. At Site 35 and Site 388, VWs that had been installed during previous site investigations were used for the pilot test. Typically, three MPs were installed at each pilot testing site, and at least three screens were installed at discrete depths at each MP. Thermocouples were installed at one MP at each site to measure soil temperature. Additionally, background points were installed in uncontaminated soil at many of these sites to characterize background soil and soil gas conditions.

Initial Soil Gas Characterization

After the installation of the VW and MPs, initial soil gas conditions were characterized. The objective of the initial soil gas characterization was to measure the initial concentrations of total volatile hydrocarbons (TVH) in the soil gas, and to determine if aerobic fuel biodegradation was occurring in contaminated soils. Because oxygen is a primary electron acceptor in microbial degradation pathways, the uptake of oxygen in soil is a quantifiable indicator of hydrocarbon biodegradation. Also, the production of carbon dioxide in soil gas indicates that petroleum hydrocarbons are being completely mineralized. Typically, petroleum-contaminated soils will be oxygen depleted (i.e., anaerobic or containing no more than 3 percent oxygen) and will contain elevated concentrations of carbon dioxide, sometimes as high as 15 percent. To ascertain that oxygen consumption and carbon dioxide production are caused by the degradation of petroleum hydrocarbons rather than that of naturally occurring soil organic matter, soil gas conditions are also characterized at background MPs in uncontaminated soil. If oxygen levels are elevated in the background MPs relative to those in contaminated soil, it can be established that oxygen in contaminated soils is being utilized specifically for the consumption of petroleum hydrocarbons.

In Situ Respiration Testing

In situ respiration testing was performed at each site to quantify the rates of aerobic petroleum hydrocarbon biodegradation. As soil bacteria consume fuel, they utilize oxygen and produce carbon dioxide. Prior field research has shown that oxygen consumption rates can be used to accurately estimate the rates of hydrocarbon biodegradation (Miller and Hinchee, 1990; Hinchee and Miller, 1991). Although carbon dioxide should provide an equivalent estimate of fuel biodegradation, natural consumption and production of carbon dioxide in the soil carbonate cycle often mask carbon dioxide production associated with bacterial respiration. Complete biological mineralization of fuel hydrocarbons (e.g., n-decane) can be described by the expression:

$$C_{10}H_{22} + 15.5O_2 \rightarrow 10CO_2 + 11H_2O$$

Using an equivalent ratio based on mass, approximately 3.5 grams of oxygen is required to mineralize 1 gram of fuel hydrocarbons to carbon dioxide and water. Based on the 3.5:1 ratio, oxygen utilization rates observed during respiration testing, and estimated air-filled porosity values for the subject soils, hydrocarbon biodegradation rates can be calculated.

In situ respiration tests were conducted at each subject site by injecting air admixed with helium, an inert tracer gas, into contaminated soils, and monitoring the rates of oxygen consumption and helium diffusion after injection ceased. Helium is an inert, highly diffusive, nonbiodegradable gas, and it can be used as a conservative tracer to determine if leakage is occurring or if oxygen diffusion is responsible for a portion of the oxygen lost during respiration testing. Hydrocarbon biodegradation rates were estimated for each testing point after oxygen consumption rates had been calculated.

Soil Formation Permeability Testing

The primary objective of *in situ* bioventing is to supply oxygen uniformly throughout contaminated soil zones. Therefore, soil formation permeability tests were conducted at each site to determine if oxygen could be delivered throughout contaminated soil zones. This is a critical test because site soils must be permeable to air flow for *in situ* bioventing to be feasible. Previous permeability testing conducted at other sites has demonstrated that oxygen can be distributed even in fine-grained soils, with clay contents as high as 80 percent (Downey et al., 1992). At each site, air was injected into the VW, while changes in soil gas composition were observed at surrounding MPs. Pressure response was also measured at the MPs using differential pressure gauges. A radius of oxygen influence was estimated for each site.

Extended Pilot Testing

After the completion of each initial bioventing pilot test, which consisted of the site characterization through the soil formation permeability test, pilot-scale bioventing systems were installed at each site for continuous operation over a 12-month extended testing phase to determine the long-term influences of bioventing. An *in situ* respiration test was performed at each site after 6 months of pilot system operation to verify that long-term hydrocarbon biodegradation was occurring. To date, the only subject pilot-scale system that has operated for a full year is the system installed at Site 388 at Hill AFB. At the end of the 12-month extended testing phase at Site 388, a final *in situ* respiration test was performed and soil and soil gas samples were collected to determine the actual degree of cleanup that had been achieved. This final investigation program will be performed in the near future at the remainder of the study sites where long-term oxygen utilization has been documented during 6-month respiration testing.

SITE DESCRIPTIONS

Site 27

Site 27 is a former fuel storage yard at Nellis AFB in Las Vegas, Nevada. Four 20,000-gallon underground storage tanks (USTs) were removed from the site in 1989 after a leak was discovered in one of the tanks. While active, the tanks contained heating oil and waste petroleum, oil, and lubricants (POL). BTEX compounds and heavier heating oil-related hydrocarbons are the primary contaminants at the site. Soil samples collected during the removal of the tanks had TPH concentrations of up to 14,000 mg/kg. Groundwater is encountered at approximately 70 feet bgs throughout the area, and the soils consist of alluvial deposits of silt, clay, and fine sand with isolated lenses of caliche. The released hydrocarbons have migrated through the unsaturated soil column to groundwater, and up to 8 feet of free product has been found in groundwater monitoring wells in the vicinity.

Site 28

Site 28 at Nellis AFB is an active fuel loading facility adjacent to the flightline. Two 2,000-gallon JP-4 jet fuel spills were reported in the area in 1967 and 1982. Each spill was contained within an unlined diked area and allowed to evaporate and percolate into the ground. Soil samples collected at the site had TPH concentrations of up to 24,000 mg/kg. Groundwater is encountered at approximately 65 feet bgs at Site 28. Soils are very similar to those encountered at Site 27, consisting of alluvial deposits of silt, clay, and fine sand with isolated lenses of caliche. Up to 5 feet of free product has been found in groundwater monitoring wells at Site 28.

Site 35

Site 35, a fuel pumphouse, is located in the west-central part of Davis-Monthan AFB in Tucson, Arizona. The site is currently used for the storage and transfer of JP-4 jet fuel. In 1985, a leak was discovered in a 6-inch product line approximately 8 feet bgs. The leak was repaired and a site investigation ensued. Contaminated soils were encountered, and soil samples collected during the construction of monitoring wells in the area had TPH concentrations as high as 320,000 mg/kg. The groundwater surface is approximately 300 feet bgs at the site. Soils consist of interbedded sand, gravel, silt, and clay layers. Groundwater at the site has been only slightly impacted by the hydrocarbon release.

Site 36

Site 36 is a base fuel station located at Davis-Monthan AFB. Contamination at the site resulted from a past leak in a UST and fuel dispenser. The tank and dispenser have been taken out of service; however, the site still operates as a fuel station. Primary contaminants at the site include BTEX compounds and other gasoline-related hydrocarbons. Soil samples collected from borings in the area had TPH concentrations of up to 4,900 mg/kg. Groundwater is encountered at approximate 300 feet bgs at the site and soils consist of interbedded sand, gravel, silt, and clay layers. Groundwater at the site has not been impacted.

Site 388

Site 388 is the site of a former 2,300-gallon underground waste fuel vault at Hill AFB in Ogden, Utah. The vault, formerly containing waste JP-4 jet fuel, was permanently removed from service in December 1987. Hydrocarbon-contaminated soil was discovered during the removal of the vault. Fuel residuals have migrated downward to a depth greater than 100 feet bgs, and laterally at least 130 feet to the south-southwest. Soil sample analyses have yielded TPH concentrations of up to 16,800 mg/kg. Groundwater at the site is encountered at approximately 150 feet bgs and has not been significantly impacted by the petroleum hydrocarbon release. Soil at the site generally consists of silty sands with thin layers of sandy gravels that extend to below the water table.

SWMU70

Solid Waste Management Unit (SWMU) 70, the site of an oil/water separator, is located at Cannon'AFB in Clovis, New Mexico. The separator was used to recover petroleum products from wastewater generated from lP-4 fuel truck maintenance. Water from the separator was discharged into a leach well. Free product is also suspected to have discharged into the leach well in the past. Soil samples collected from borings in the area had maximum TPH concentrations of 26,500 mg/kg. Groundwater at the site is encountered at approximately 270 feet bgs and has not been impacted. Soils at the site consist of silts and clays from the ground surface to approximately 17 feet bgs. Sands with silt and clay were encountered from 17 feet bgs to approximately 32 feet bgs. Below 32 feet bgs, are slightly silty fine-to medium-grained sands with discontinuous cemented sandstone extending to 65 feet bgs. Below this depth, sands with layers of caliche were encountered to a total drilling depth of 120 feet bgs.

PILOT TESTING RESULTS

Site Characterization

Table 1 summarizes the significant parameters measured during the initial site characterization effort in hydrocarbon-contaminated soil at each of the subject sites. The number in parentheses to the right of each value indicates the number of sampling points that were utilized. The average TKN concentration in soil at Site 35 was estimated at 16 mg/kg, indicating that the concentration of the microbial population could be limited at the site, and that very little nitrogen was present for use by the microbial population. TKN concentrations in 5 of the 7 soil samples collected at Site 35 were below the detection limit of the method, and so the TKN concentrations in most regions of contaminated soil at Site 35 are substantially less than 16 mg/kg. Bacterial plate counts from deep soils at Site 35 were very low, confirming that the bacterial population was limited (Montgomery Watson, 1993). Colony forming units were present at concentrations of less than 100 per gram in 12 of 17 samples that were analyzed. Average soil TKN concentrations at the remaining 5 subject sites ranged from 50 to 150 mg/kg. Soil TKN concentrations observed at over 60 bioventing sites nationwide ranged from less than 50 mg/kg to over 700 mg/kg (Miller et aI., 1993), with an average TKN concentration of approximately 240 mg/kg. Thus, the TKN values at all six of the subject sites are low compared to the average of those measured at sites nationwide.

The average soil moisture content at the subject sites ranged from 7.2 to 24.1 percent by weight. The soil moisture content values observed over the 60-site nationwide study ranged from less than 5 percent by weight to over 25 percent by weight, with an average soil moisture content of approximately 14.6 percent (Miller et aI., 1993). The soil moisture content at the subject sites does not appear to differ significantly from the range of those observed nationwide. Despite the climatic conditions, a sufficient amount of soil moisture is present at these sites to support aerobic hydrocarbon biodegradation. Soil temperatures ranged from 16.3 to 25.2 degrees centigrade, which is within the range of temperatures observed previously at successful bioventing sites.

Initial Soil Gas Characterization

Biological petroleum degradation was shown to be occurring in soils at all six sites. Initial oxygen levels were depleted (Table 2), and carbon dioxide and TVH concentrations were elevated in soil gas samples collected from petroleum-contaminated soils. Oxygen levels ranged from 0 to 2.9 percent in contaminated soils at all of the subject sites with the exception of Site 35, where oxygen was present at concentrations ranging from 0.8 to 17.5 percent. Although long-term biological activity was occurring in some soil zones at Site 35, biological activity in other areas was not occurring at rates high enough to deplete oxygen levels in the soil gas. Soil gas from deep uncontaminated soils at Cannon AFB, Nellis AFB, and Davis-Monthan AFB was oxygen-rich and contained low concentrations of TVH, demonstrating that oxygen depletion in petroleum-contaminated soil was due to the degradation of the petroleum rather than of naturally occurring soil organic matter.

Site	Maximum Depth, feet bgs	Average TKN Concentration, *mg/kg*	Average Soil Moisture Content, percent by weight	Average Soil Temperature, degrees C
27	80	97 (3)	14.0 (4)	20.8 (1)
28	65	100 (4)	24.1 (4)	23.2 (1)
35	220	16 (7)	10.9 (7)	23.6 (3)
36	100	50 (3)	7.2 (3)	25.2 (1)
388	120	58 (1)	10.0 (5)	16.3 (2)
SWMU 70	120	150 (4)	12.2 (3)	18.2 (2)

Table 1. Results of initial site characterization.

Site	Average Initial Soil Gas TVH Concentration, ppmv	Initial Oxygen Content in Contaminated Soils, percent	Average Oxygen Uptake Rate, percent per day	Estimated Hydrocarbon Biodegradation Rate, *mg/kg/year*
27	81,700 (3)	0.5 to 2.9	1.8 (4)	40 to 150
28	72,000 (3)	0 to 2.2	4.6 (4)	70 to 1,220
35	46,100 (13)	0.8 to 17.5	0.22 (6)	10 to 50
36	39,700 (3)	0.7 to 2.8	1.9 (4)	100 to 520
388	26,300 (3)	0	10.2 (4)	710 to 8,400
SWMU 70	13,450 (2)	0	12.8 (5)	390 to 1,100

Table 2. Biological oxygen and hydrocarbon consumption in contaminated soils.

In Situ Respiration Testing

Table 2 summarizes the results of *in situ* respiration testing at the sites. Low oxygen uptake rates ranging from 0.22 to 1.9 percent per day were observed at Site 27, Site 35 and Site 36. Tests performed at Site 28, Site 388, and SWMU 70 resulted in relatively rapid average oxygen uptake rates of 4.6, 10.2 and 12.8 percent per day, respectively. In the compilation of bioventing data from 60 sites nationwide, respiration rates ranged from less than 1 percent oxygen per day to over 30 percent oxygen per day, with an approximate average of 11 percent oxygen per day (Miller et al, 1993).

At each pilot testing site, petroleum biodegradation rates were estimated using MP-specific oxygen utilization rates, estimated air-filled porosities, and a conservative ratio of 3.5 mg of oxygen consumed for every mg of fuel biodegraded. The ranges of biological hydrocarbon consumption estimated at each site are summarized in Table 2. Petroleum biodegradation rates of over 1,000 milligrams of fuel per kilogram of soil per year (mg/kg/yr) were estimated at MPs at Site 28, Site 388, and SWMU 70. At these rates, most volumes of contaminated soil could be brought down to traditional TPH-based action levels within approximately 5 to 10 years of full-scale bioventing. Treatment times required to remediate soil to risk-based BTEX action levels are expected to be substantially less. Fuel biodegradation rates ranging from 10 to 520 mg/kg/yr were estimated at Site 27, Site 35, and Site 36. Taking Site 35 as a worst-case scenario, 300 years of bioventing at petroleum biodegradation rates of 10 mg/kg/yr would theoretically be required to remediate soils with TPH concentrations of 3,000 mg/kg. Obviously, bioventing is not expected to be a successful remedial technology in such scenarios.

Soil Formation Permeability Testing

Soil formation permeability tests were conducted by injecting air into a central VW for approximately 20 hours, at air injection flow rates ranging from 7 standard cubic feet per minute (scfm) to 73 scfm. Average injection pressures ranged from 7 inches of water to 3.0 pounds per square inch (psi).

Oxygen was easily delivered throughout petroleum-contaminated soils in the pilot test zones at these sites. Based on measured pressure response, which is an indicator of long-term oxygen transport, it is anticipated that the radii of influence for long-term bioventing systems at these site will range from 35 to 65 feet.

Extended Pilot Testing

Six-month respiration testing at the sites generally showed decreases in the oxygen consumption rates. This can be attributed to a number of causes, including the selective consumption of easily degraded compounds during initial months of testing, soil dessication in soils near the injection VWs, and diffusion effects. At Site 35 and 36, *in situ* respiration testing completed at the end of 9 months of system operation indicated that oxygen consumption had almost entirely ceased. The Air Force has funded nutrient addition experiments to observe the effects of moisture and nutrient supplementation on long-term oxygen consumption rates at these two sites.

Of the 6 subject sites to date, the 12-month extended pilot test has been completed only at Site 388 at Hill AFB. The average oxygen consumption rate observed during 12-month respiration testing was 9.4 percent oxygen per day, compared with the 10.2 percent per day average obtained during initial testing (Table 2). These results indicate that long-term oxygen consumption rates were not decreasing substantially over time, and that significant rates of fuel biodegradation could likely be sustained over a long period of time. Figure 3 illustrates the impact of bioventing on the benzene and TVH concentrations in soil gas at Site 388. Significant benzene and TVH

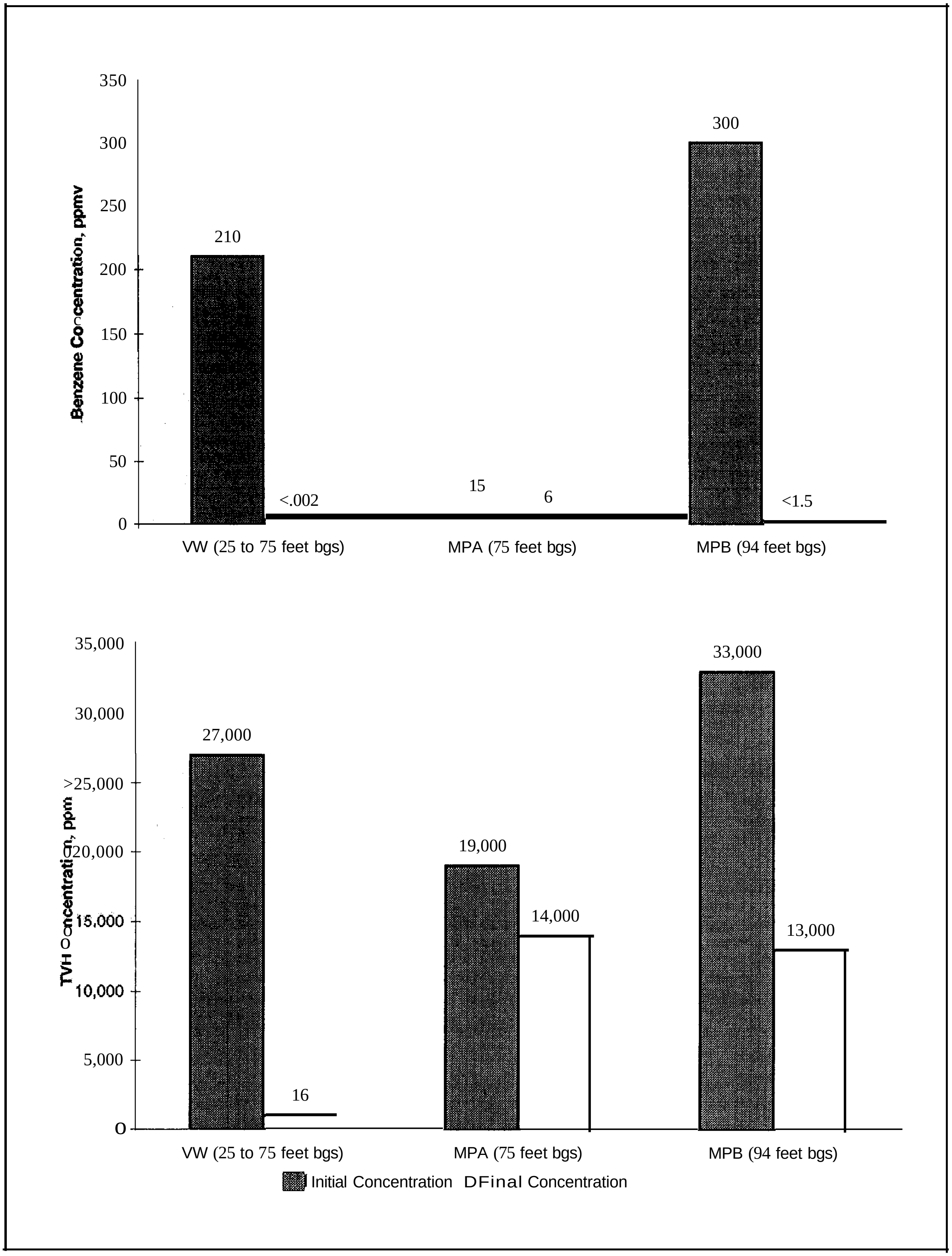


Figure 3. Changes in benzene and TVH concentrations in soil gas after one year of bioventing at Site 388.

reductions were realized at all three sampling points. Because TVH and BTEX compounds still remain in the soil gas at significant concentrations at Site 388, Hill AFB personnel continue to operate the system. The smallest decrease in the illustrated contaminant concentrations occurred at the 75-feet bgs interval at MPA, where the TVH concentration dropped by 5,000 parts per million, volume per volume (ppmv) during one year of pilot-scale treatment. These results suggest that TVH concentrations could be attenuated to the method detection limit over a 4-year period of *in situ* bioventing, assuming that the rate of decrease for the TVH concentration remains constant.

Similar sampling efforts will be completed at the end of 12 months of bioventing at the remaining subject sites except for Site 35 and Site 36 due to the lack of oxygen utilization at these sites. With the exception of Site 27, Site 35, and Site 36, the extended pilot-scale systems installed at these sites may set the stage for future full-scale remediation efforts.

CONCLUSIONS

These pilot tests demonstrated that, in many cases, bacteria in deep soils are capable of aerobically degrading petroleum hydrocarbons *in situ.* Bioventing is expected to be a viable remedial alternative at at least three of the subject sites. Soil TKN concentrations are useful as an indirect indicator of the magnitude of the bacterial population present in contaminated soils. Sites with low TKN values, such as Site 35, are likely to contain limited bacterial populations, and bioventing may not be a suitable remedial option at such sites. Soil gas characterization and *in situ* respiration testing have been shown to be cost-effective methods for determining if petroleum hydrocarbon biodegradation is occurring, and if rates are high enough to for *in situ* bioventing to be a feasible remedial option.

The moisture content appears to be high enough in deep soils at these arid sites to support bacterial fuel degradation. However, long-term air injection may dessicate soils near the VW, especially in arid climates where relative humidity is extremely low. Future research regarding moisture addition into the injected air stream may help define whether moisture amendment is required to sustain high rates of biological fuel degradation near the injection VW at any given site.

Finally, the importance of bioventing pilot testing has been highlighted by this effort. The effectiveness of bioventing depends on a wide variety of site-specific parameters and cannot be determined by simply reviewing existing site investigation information. The feasibility of bioventing as a remedial technology can only be determined through site-specific pilot testing.

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IN SITU RESPIRATION TESTING: A FIELD TREATABILITY TEST FOR BIOVENTING

Jeffrey A. Kittel and Robert E. Hinchee, Ph.D.[1], Colonel Ross Miller, Ph.D.[2], Captain Catherine Vogel[3], and Ron Hoeppel[4].

1 - BATTELLE, Columbus, Ohio.
2 - AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE, Brooks AFB, Texas.
3 - AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY, Tyndall AFB, Florida.
4 - NAVAL CIVIL ENGINEERING LABORATORY, Port Hueneme, California.

ABSTRACT

Bioventing is the process of aerating subsurface soils to stimulate in situ biological activity and promote bioremediation. Bioventing differs from soil venting in remedial approach. Soil venting is designed and operated to maximize the volatilization of low-molecular-weight compounds, with some biodegradation occurring. In contrast, bioventing is designed to maximize biodegradation of aerobically biodegradable compounds, regardless of their molecular weight, with some volatilization occurring. Bioventing is gaining wide acceptance as a remediation alternative at petroleum-contaminated sites. However, site variability usually requires that a short term treatability test be conducted in situ at potential sites to determine the applicability of bioventing.

Battelle has worked with the U.S. Air Force and the U.S. Navy to develop a simple and inexpensive field test to evaluate bioventing potential at petroleum-contaminated sites. This test has been used to evaluate the applicability of bioventing at over 50 sites.

The in situ respiration test consists of injecting air and an inert tracer gas (helium) over a 24-hour period to aerate soils at an oxygen-deficient, petroleum-contaminated site. Soil vapor samples are collected to determine oxygen utilization rates and carbon dioxide production rates. The stoichiometric relationship for the oxidation of hexane is used to calculate the biodegradation rate. The tracer gas is monitored to estimate the effect of diffusion on changes in soil-gas concentrations.

The purpose of this paper is to describe the field procedures used to conduct this simple test and to present an overview of the results from tests conducted at over 50 Air Force and Navy petroleum-contaminated sites.

IN SITU RESPIRATION TESTING: A FIELD TREATABILITY TEST FOR BIOVENTING

Bioventing is the process of aerating subsurface soils to stimulate in situ biological activity and promote bioremediation. Although it is related to the process of soil venting (a.k.a. soil vacuum extraction, soil gas extraction, and in situ soil stripping), its primary objectives are different. Soil venting is designed and operated to maximize the volatilization of low-molecular-weight compounds, with some biodegradation occurring. In contrast, bioventing is designed to maximize biodegradation of aerobically biodegradable compounds, regardless of their molecular weight, with some volatilization occurring. The major difference between these technologies is that the objective of soil venting is volatilization, and the objective of bioventing is biodegradation. Although both technologies involve the venting of air through the subsurface, the differences in objectives result in different design and operation of the remedial systems.

Petroleum distillate hydrocarbons such as JP-4 jet fuel generally are biodegradable if the naturally occurring microorganisms that acclimate to the fuels as a carbon source are provided an adequate supply of oxygen and basic nutrients (Atlas, 1986). Field data to date indicate that site nutrients usually are sufficient to support natural biodegradation (Dupont et al., 1991; Miller et al.,1991). However, the biodegradation process can quickly become oxygen-limited because oxygen concentrations in the soil depend on natural oxygen diffusion rates (Ostendorf and Kambell, 1989). As a result, natural biodegradation frequently is too slow to prevent the spread of contamination, and sites may require remediation to protect sensitive aquifers. Acceleration or enhancement of the natural biodegradation process through forced aeration via bioventing may prove to be the most cost-effective remediation for hydrocarbon-contaminated sites.

Laboratory-scale respirometry tests can be performed to evaluate microbial activity in site soil samples. However, site variables may be difficult to anticipate and duplicate in the lab. On-site testing is the most effective way to evaluate the potential of bioventing for remediating contaminants at a particular site. An effective in situ respiration test has been developed to assess the potential for enhancing natural in situ biodegradation via bioventing.

TEST PROCEDURE

The four phases of the in situ respiration test are (1) site evaluation and selection via soil gas survey, (2) soil-gas monitoring point installation for conduct of the respiration test, (3) test setup and monitoring, and (4) data reduction and biodegradation calculations.

Soil Gas Survey

The first step in evaluating the application of bioventing to a contaminated site usually is a soil gas survey. Soil gas from the contaminated site is analyzed for concentrations of CO_2, O_2, and hydrocarbons.

If depth to contamination is less than 20 ft, soil gas sampling usually can be conducted using hand-driven, small-diameter (~⅝-inch OD) stainless steel probes with a slotted well point assembly. At deeper sites, hydraulically driven probes can be used. It can be useful also to analyze soil gas from existing site wells. With driven probes, it is useful to collect samples at incremental depths to develop the soil-gas profile. While it is usually helpful to use soil-gas-survey techniques to investigate an entire site, a much smaller area can be surveyed to select locations for conducting an in situ respiration test.

There are numerous instruments commercially available for on-site soil-gas analysis. The instruments used by the authors are Gastech Model 3252OX for O_2 and CO_2 and Gastech Trace-Techtor^{TM} for total hydrocarbons, but other similar equipment could be used. The main criterion for determining that a site is suitable for bioventing is that the microbial activity at the site is oxygen-limited. Under such conditions, the O_2 level will be low (usually 0% to 2%), CO_2 will be high (typically 5% to 20%, depending on soil type), and the hydrocarbon content will be high (> 10,000 ppm depending on contaminant).

An uncontaminated site also must be selected for use as an experimental control to monitor background respiration of natural organic matter and inorganic sources of CO_2. Typical O_2 and CO_2 levels at an uncontaminated site are 15% to 20% and 1% to 5%, respectively. The hydrocarbon content in the soil gas of a contaminated site is generally below 100 ppm.

Prior to sampling, soil-gas probes are purged with a sample pump. To determine adequate purging time, soil-gas concentrations are monitored until the concentrations stabilize. When shallow soil-gas samples are collected, air withdrawal should be kept to a minimum to reduce the chance of sample bias from leakage from the atmosphere. Figure 1 shows a typical setup for monitoring soil gas.

The result of the soil gas survey should be the identification of three or four locations in the contaminated zone and one location in the background area at which soil-gas monitoring points can be installed for use in the in situ respiration test.

Installation of Soil-Gas Monitoring Points

As with the soil-gas survey, it is possible to conduct the in situ respiration test using hand-driven probes. However, with such probes, a great deal of leakage to the surface can occur during the extended monitoring of the respiration test. This phenomenon is true particularly at sites with permeable soils and shallow depth to groundwater. At all sites, it is best to install multilevel soil-gas monitoring points in borings augered by hand or with a portable drill rig. The constructed monitoring points will be useful for future monitoring at the test site.

Various construction materials can be used for the monitoring points. The basic construction should consist of multiple screened intervals with sand packs separated with hydrated bentonite or grouted plugs. It is useful to install thermocouples for soil temperature monitoring during the respiration test. A typical monitoring point construction diagram is shown in Figure 2. Each probe interval consists of ¼-inch o.d. nylon tubing with a 6-inch filter screen packed with course gravel at the base and a "quick-disconnect" fitting at the surface. A 1- to 2-ft silica sand filter pack should be placed across the screened interval and be followed with a 2-ft-thick wetted bentonite pellet or grout plug. At the surface, the monitoring points can be finished in a flush-mount manhole or monument box.

In Situ Respiration Test

The in situ respiration test is conducted using three or four screened intervals of the installed monitoring points and a background monitoring point. The results from this test will indicate whether in situ microbial activity is occurring and whether it is O_2-limited.

Test Implementation

Air with 1% to 2% helium is injected into the contaminated and background monitoring points. Following injection, the change of O_2, CO_2, total hydrocarbon, and helium in the soil gas is measured over time. Helium is used as an inert tracer gas to assess the extent of diffusion of soil gases within the aerated zone. The background monitoring point will be used to monitor natural degradation of organic matter in the soil. A schematic of the apparatus to be used in the in situ respiration test is presented in Figure 3.

The O_2, CO_2, and total hydrocarbon levels are measured at the monitoring points before air injection to establish baseline concentrations. Normally, air is injected into the ground for 20 to 24 hours at rates ranging from 60 to 100 cubic ft per hour (cfh). This duration of aeration is assumed sufficient to satisfy any chemical oxygen demand at the site (Hinchee et al., 1992). The blowers typically used are diaphragm compressors Model 4Z024 from Grainger (or equivalent) with a nominal capacity of 100 cfh at 10 psi. The helium used as a tracer should be at least 99% pure; such is available from most welding supply stores. The flow rate of helium is adjusted to 0.6 to 1.0 cfh to obtain about 1% to 2% in the final air mixture which is injected into the contaminated and background areas. Helium in the soil gas is measured with a Marks Helium Detector Model 9821 (or equivalent) with a minimum sensitivity of 0.01%.

After air and helium injection is terminated, the soil gas is sampled and analyzed for O_2, CO_2, helium, and total hydrocarbons. Soil gas is extracted from the contaminated area with a soil-gas sampling pump system similar to that shown in Figure 4. Typically, measurement of the soil gas is conducted at 2, 4, 6, and 8 hours and then every 4 to 12 hours, depending on the rate at which the oxygen is utilized. If oxygen uptake is rapid, more frequent monitoring is required. If it is slower, less frequent readings are acceptable.

At shallow monitoring points, there is a risk of pulling in atmospheric air in the process of purging and sampling. Excessive purging and sampling may result in erroneous readings.

There is no benefit in over sampling, and care should be taken to minimize the volume of air extraction while sampling shallow points. In these cases, a low-flow extraction pump of about 2 to 4 cfh is used. Field judgment is required at each site to determine the sampling frequency. Table 1 provides a summary of the various parameters that will be measured and their frequency.

The in situ respiration test is terminated when the oxygen level is about 5%, or after 5 days of sampling. The temperature of the soil before air injection and after the in situ respiration test is recorded.

Data Interpretation

Data from the in situ respiration test is plotted to develop O_2 utilization rates and CO_2 production rates. Biodegradation rates can be calculated based on O_2 utilization and/or CO_2 production rates. O_2 utilization rate is the preferred measure of biodegradation because fewer variables affect O_2 concentration in the soil than CO_2 concentration. CO_2 produced due to biodegradation may be bound in the soils as observed by Hinchee et al. (1991) at a site with high-alkalinity soils in Fallon, Nevada. In addition, not all carbon from the degraded molecule is converted directly to CO_2; some carbon will reside in hydrocarbon degradation intermediates and some will be converted to biomass via mineralization (Hinchee et al., 1991).

Oxygen Utilization

Oxygen utilization rates are determined from the data obtained during the bioventing tests. The rates are calculated as the percent change in O_2 over time. Table 2 contains the two sets of sample data illustrated in Figure 4. The O_2 utilization rate is determined as the slope of the O_2% vs. time line. A zero-order respiration rate as seen in the Fallon NAS data is typical of most sites. However, a fairly rapid change in oxygen levels may be seen as in the data from Kenai, Alaska; for these data, the oxygen utilization rate was obtained from the initial linear portion of the respiration curve.

To estimate biodegradation rates of hydrocarbon from the oxygen utilization rates, a stoichiometric relationship for the oxidation of the hydrocarbon is used. Hexane is used as the representative hydrocarbon, and the stoichiometric relationship used to determine degradation rates is:

$$C_6H_{14} + 9.5\ O_2 \rightarrow 6CO_2 + 7H_2O$$

Based on the utilization rates (percent change of oxygen per day), the biodegradation rate in terms of mg of hexane-equivalent per kg of soil per day is estimated using the following equation.

$$K_B = -K_o\ A\ D_o\ C/100 \qquad (1)$$

where:

K_B = biodegradation rate (mg/kg day)
K_o = oxygen utilization rate (percent per day)
A = volume of air/kg of soil (l/kg)
D_o = density of oxygen gas (mg/l)
C = mass ratio of hydrocarbon to oxygen required for mineralization.

Using several assumptions, values for A, D_o, and C can be calculated and substituted into equation 1. Assumptions used for these calculations are:

- Porosity of 0.3 (the air-filled porosity; in any given soil varies with moisture content in any given soil)
- Soil bulk density of 1,440 kg/m^3
- D_o oxygen density of 1,330 mg/l (varies with temperature, altitude, and atmospheric pressure)
- C, hydrocarbon-to-oxygen ratio of 1/3.5 from the above equation for hexane.

Based on the above assumed porosity and bulk density, the term A, volume of air/mg of soil, becomes 300/1,440 = 0.21. The resulting equation is:

$$K_B = -(K_o)(0.21)(1330)(1/3.5)/100 = 0.8\,K_o \qquad (2)$$

The 0.8 conversion factor was used by Hinchee et al. (1991) in calculating biodegradation rates of hydrocarbons. Another way to estimate biodegradation rates is based on CO_2 generation rates, but as discussed above CO_2 production rates are less reliable than O_2 utilization rates.

Helium Monitoring

Figures 5 and 6 show typical helium data for two test wells. The helium concentration at monitoring point S1 (Figure 5) at Tinker AFB started at 1.5% and after 108 hours had dropped to 1.1%, a fractional loss of ~0.25. In contrast, for Kenai K3 (Figure 6), the change in helium was rapid (a fractional drop of about 0.8 in 7 hours), indicating that there was possible short-circuiting at this monitoring point. This suggested that the data from this monitoring point were unreliable, and the data therefore were not used in calculating degradation rates.

As a rough estimate, diffusion of gas molecules is inversely proportional to the square root of the molecular weight of the gas (Hinchee et al., 1992). Based on the molecular weights of 4 and 32 g mol for helium and oxygen, respectively, helium diffuses about 2.8 times faster than oxygen. This translates into a fractional oxygen loss of ~0.095 for S1 of Tinker

AFB, a minimal loss. The data from this monitoring point were used in the calculation rates. As a guide, data from tests where fractional helium loss is 0.4 or less over 100 hours, or an equivalent fractional oxygen loss of 0.15, are acceptable.

RESULTS

The in situ respiration test has been applied to over 100 hydrocarbon-contaminated sites to date. The test has proven to be an effective positive indicator of the potential of bioventing to enhance natural in situ biodegradation. Table 3 presents the results of in situ respiration tests at representative hydrocarbon-contaminated sites.

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Table 1. Parameters to be Measured for the In Situ Respiration Tests

Parameter/Media	Suggested Method	Suggested Frequency	Instrument Sensitivity (Accuracy)
Carbon dioxide/soil gas	Infrared adsorption method. GasTech Model 32520X (0 to 5% and 0 to 25% carbon dioxide) or equivalent	Initial soil gas sample before pumping air, immediately after pump shut off, every 2 hours for the first 8 hours, and then every 8 to 10 hours	±0.2%
Oxygen/soil gas	Electrochemical cell method, GasTech Model 32520X (0 to 21% oxygen) or equivalent	Same as above	±0.5%
Total hydrocarbons (THC)/soil gas	GasTech hydrocarbon detector or similar field instrumentation	Initial soil gas sample before pumping air, then same as above if practical	±1 ppm
Helium	Marks Helium Detector Model 9821 or equivalent	Same as for carbon dioxide	±0.01%
Pressure	Pressure gauge (0 to 30 psia)	During air injection	0.5 psia
Flow rate/air	Flowmeter	Reading taken during air injection	±5 cfh

Table 2. Sample Data Set for Two In Situ Respiration Tests

Fallon NAS Nevada (Test Well A2)			Kenai, Alaska (Test Well K1)			
Time (Hours)	O_2(%)	CO_2(%)	Time (Hours)	O_2(%)	CO_2(%)	Helium
-23.5	0.05	20.4	-22.0	3.0	17.5	-
0	20.9	0.05	0	20.9	0.05	1.8
2.5	20.3	0.08	7.0	11.0	2.7	1.4
5.25	19.8	0.10	12.25	4.8	4.6	1.4
8.75	18.7	0.13	19.50	3.5	6.0	1.3
13.25	18.1	0.16	26.25	1.8	6.5	1.0
22.75	15.3	0.14	46.00	2.0	7.0	0.9
27.0	15.2	0.22				
32.5	13.8	0.14				
37.0	12.9	0.23				
46.0	11.2	0.22				
49.5	10.6	0.16				

Table 3. Biodegradation Rates for Selected Sites (Leeson et. al., 1993)

		Biodegradation Rate	
Location	**Site**	**Based on O_2 Utilization (mg/kg/day)**	**Based on CO_2 Production (mg/kg/day)**
Keesler AFB	SWMU 66	14 ± 12	2.5 ± 1.3
	AOG A	1.8 ± 0.87	0.59 ± 0.28
	Background	0.24	0.16
Newark AFB	Facility 27	4.9 ± 2.2	0.88 ± 0.31
	Facility 89	0.4 ± 0.14	0.16 ± 0.13
Robins AFB	UST 173	0.56 ± 0.15	0.45 ± 0.18
	SS10	3.5 ± 2.6	0.37 ± 0.20
Tinker AFB	Site 1	1.2 ± 0.41	NA

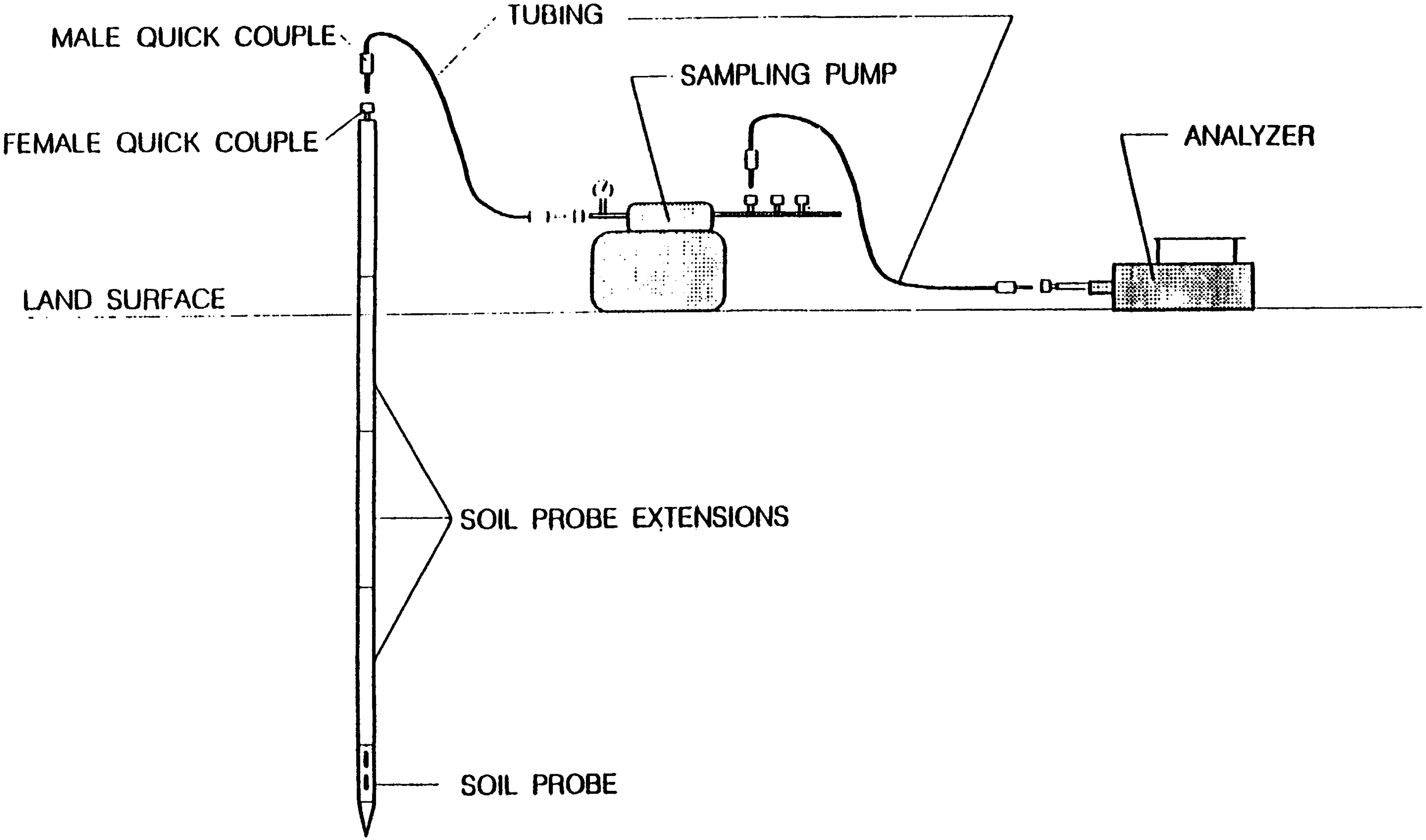

Figure 1. Schematic Diagram of Soil Gas Sampling Setup.

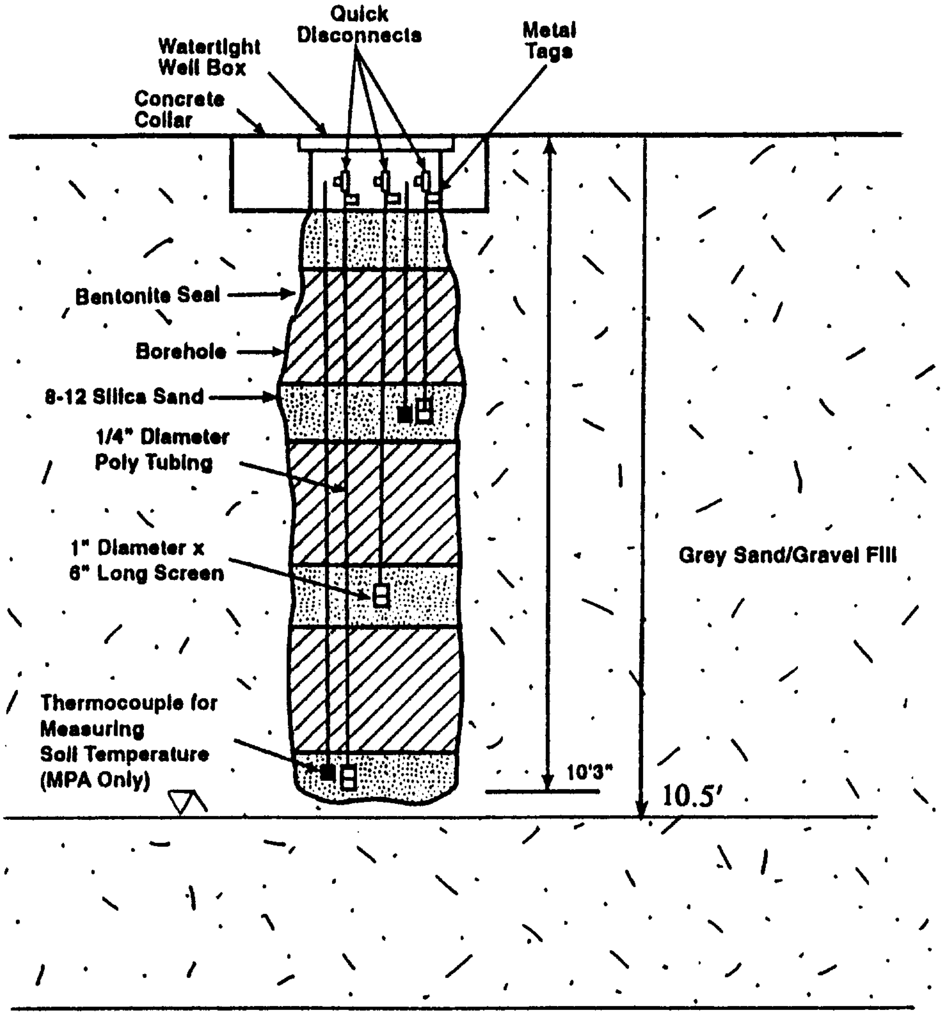

Figure 2. Diagram of Typical Soil Gas Monitoring Point Construction.

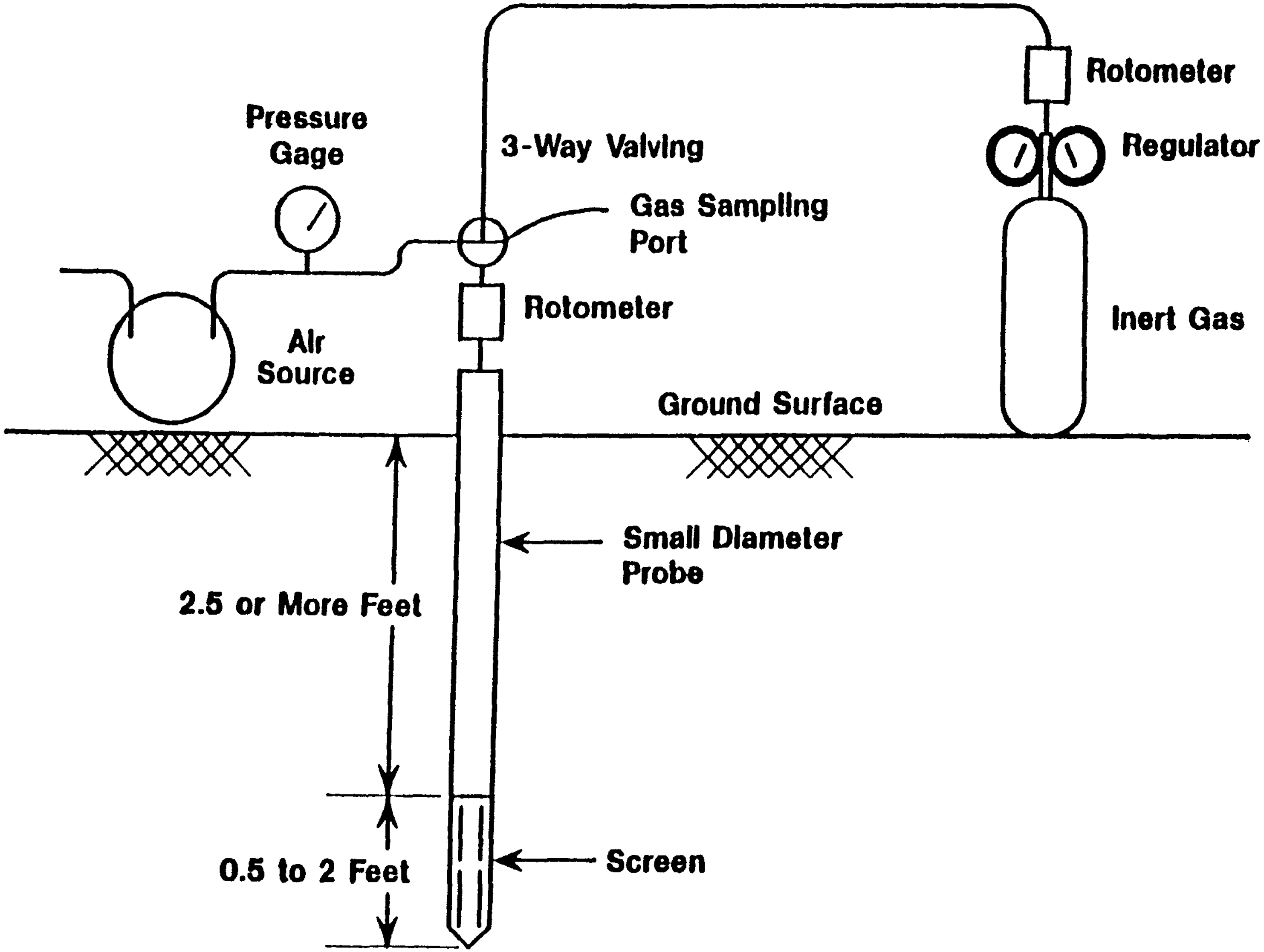

Figure 3. Schematic Diagram of In Situ Respiration Test Equipment.

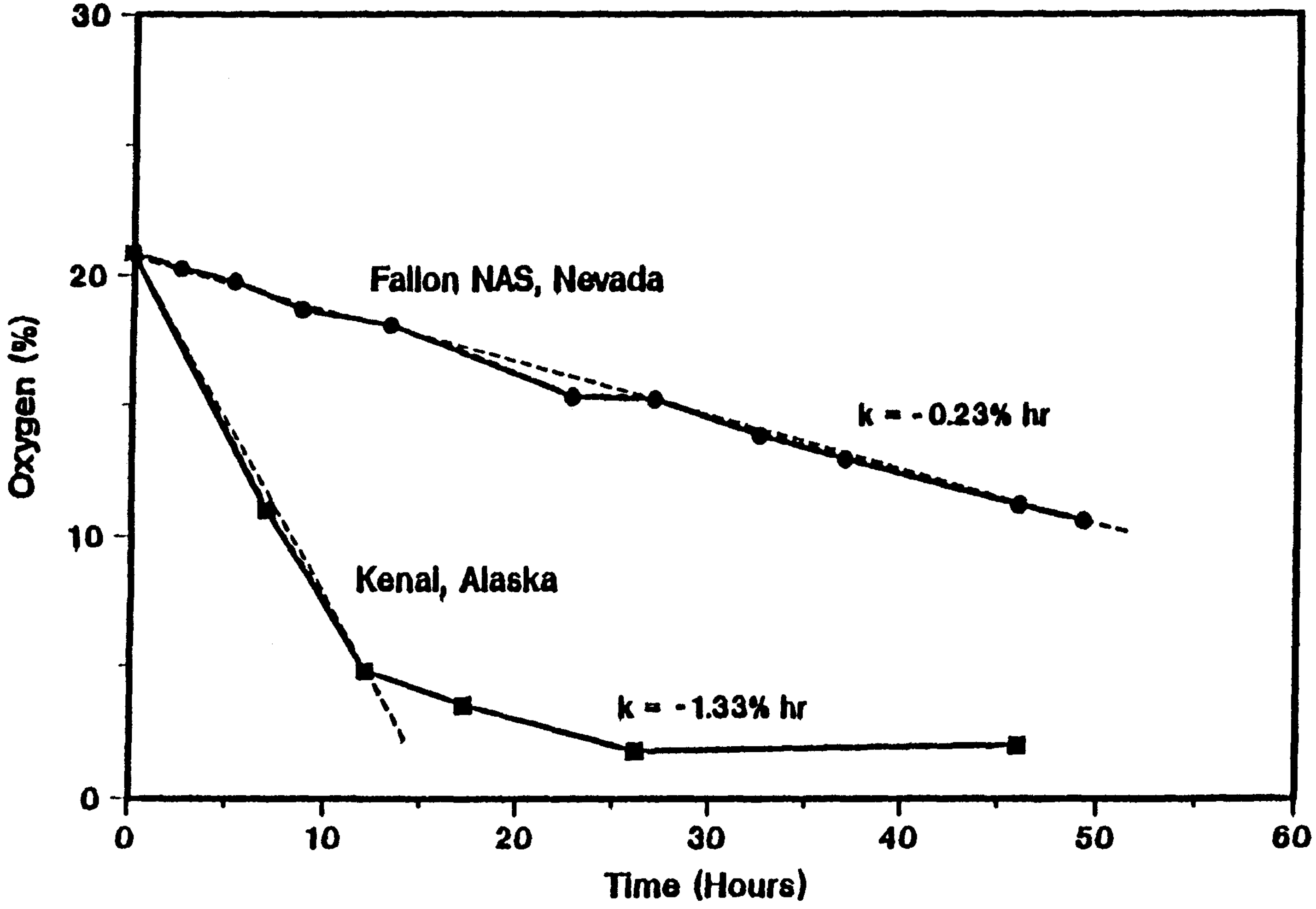

Figure 4. In Situ Respiration Test Results for Two Bioventing Test Sites: Fallon NAS, Nevada and Kenai, Alaska.

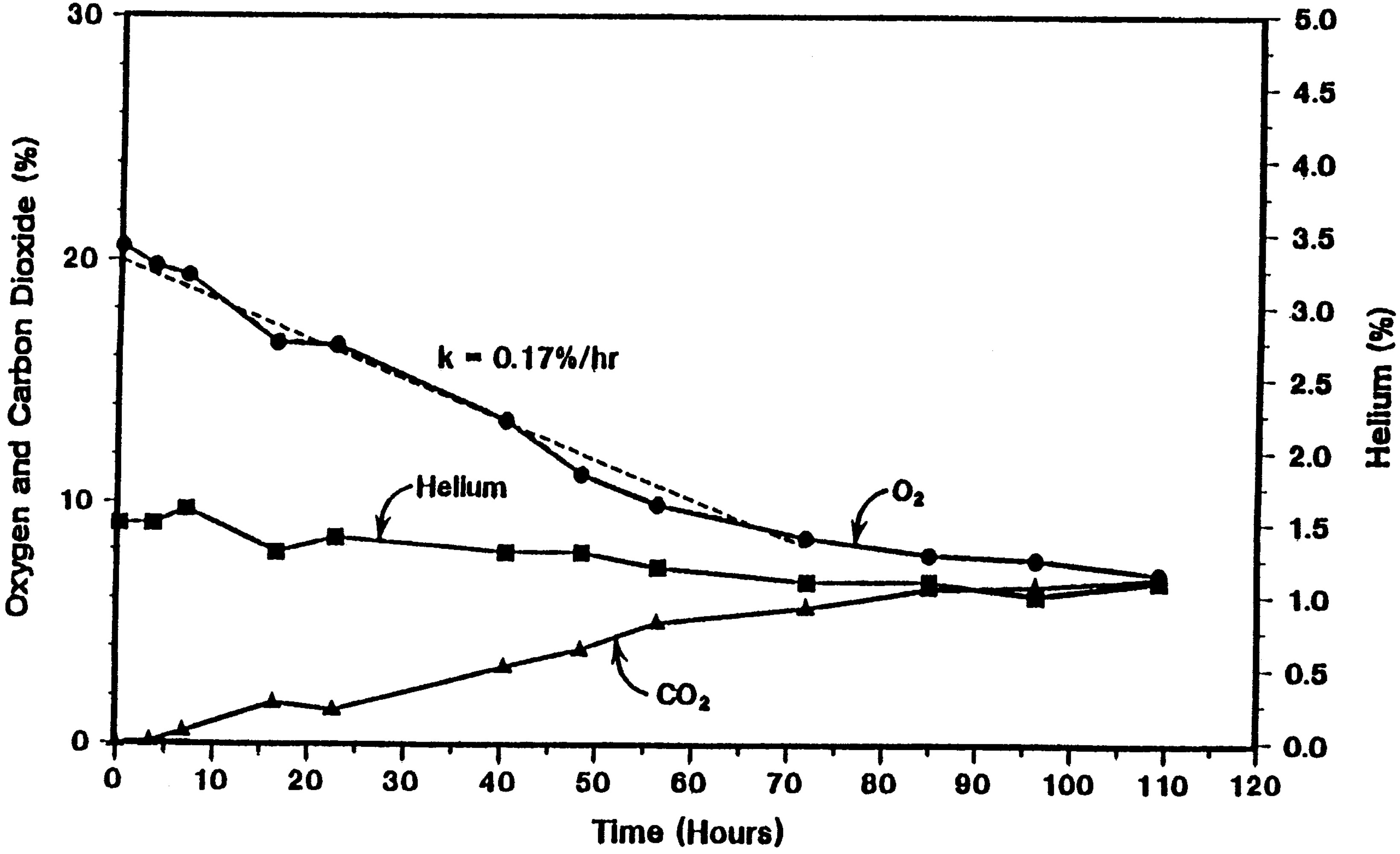

Figure 5. In Situ Respiration Test Results for Monitoring Point S1, Tinker AFB, Oklahoma.

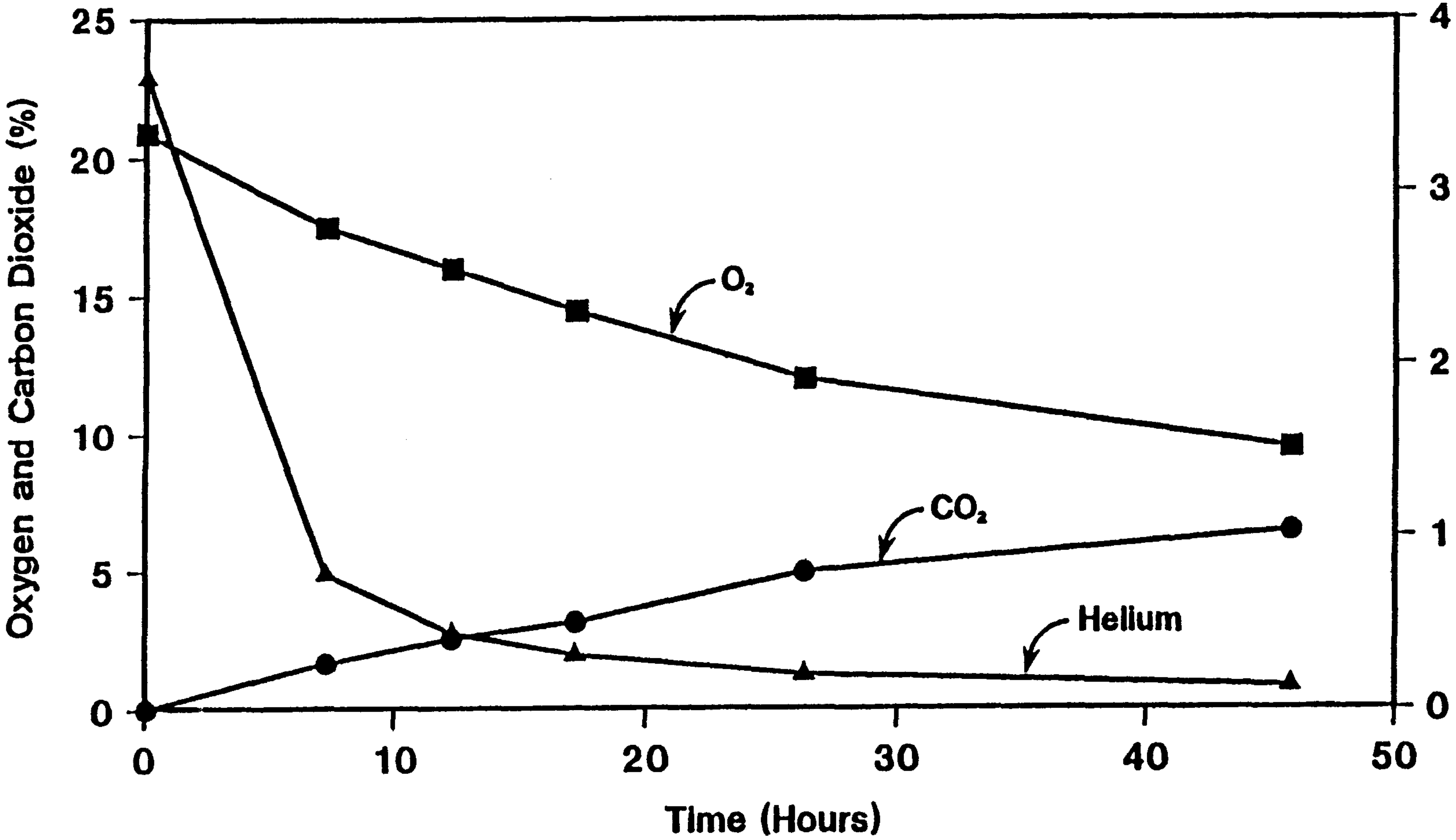

Figure 6. In Situ Respiration Test Results for Monitoring Point K3, Kenai, Alaska.

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UNITED STATES OF AMERICA

ADDENDUM ONE TO TEST PLAN AND TECHNICAL PROTOCOL FOR A FIELD TREATABILITY TEST FOR BIOVENTING-

USING SOIL GAS SURVEYS TO DETERMINE BIOVENTING FEASIBILITY AND NATURAL ATTENUATION POTENTIAL

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USING SOIL GAS SURVEYS TO DETERMINE BIOVENTING FEASIBILITY AND NATURAL ATTENUATION POTENTIAL

by

D.C. Downey and J.F. Hall

Engineering-Science, Inc.

Denver, Colorado

for

U.S. Air Force

Center for Environmental Excellence

Brooks Air Force Base, Texas

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1.0 BACKGROUND

1.1 Overview

The objective of this addendum is to provide the reader with a working knowledge of how soil gas can be used as an indicator of subsurface hydrocarbon contamination and how bioventing feasibility can be determined using soil gas monitoring techniques. This addendum expands on soil gas discussions in the *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Hinchee et al., 1992), or “Bioventing Protocol”, and is intended to supplement that primary document. This addendum has been organized into five sections including this background section. Section 2.0 describes the mechanical aspects of soil gas monitoring, the use of soil gas probes, and construction of more permanent monitoring points. Section 3.0 explains how soil gas data are interpreted to indicate bioventing feasibility, and Section 4.0 describes how soil gas data can be used to design pilot- or full-scale bioventing systems. Section 5.0 list the references cited in this addendum.

1.2 Soil Gas Chemistry

The chemical composition of soil gas can vary considerably from atmospheric composition as a result of biological and mineral reactions in the soil. Although numerous compounds and elements may be present in soil gas as a result of specific soil and bedrock geochemistry, three indicators are of particular interest in the bioventing context: oxygen, carbon dioxide, and. hydrocarbon vapors. The soil gas concentrations of these indicators in relation to atmospheric air and uncontaminated background soils can provide valuable information on the ongoing natural biodegradation of hydrocarbon contaminants and the potential for bioventing to enhance the rate of natural biodegradation.

As described in the Bioventing Protocol, oxygen serves as a primary electron acceptor for soil microorganisms employed in the degradation of both refined and natural hydrocarbons. Following a hydrocarbon spill, soil microorganisms begin to use available soil gas oxygen. As the population of fuel-degrading microorganisms increases, the supply of soil gas oxygen is often depleted, creating an anaerobic volume of contaminated soil. Under anaerobic conditions, fuel biodegradation generally proceeds at significantly slower rates. In some cases, aerobic biodegradation will continue because the diffusion or advection of oxygen into soils from the atmosphere exceeds biological oxygen utilization rates. Under these circumstances the site is naturally aerated, and the hydrocarbons will be naturally attenuated over time.

Carbon dioxide is produced as a by-product of the complete biodegradation of natural or refined hydrocarbons, and can also be produced or buffered by the soil carbonate cycle (Ong et al., 1991). Carbon dioxide levels in soil gas are generally elevated in fuel-contaminated soils when compared to levels in clean background soils. However, due to the buffering capacity of alkaline soils, the relationship between contaminant biodegradation and carbon dioxide production is not always a reliable indicator. In acidic soils, such as exist at Tyndall Air Force Base (AFB), Florida, carbon dioxide production was directly proportional to oxygen utilization (Miller and Hinchee, IWO).

Volatile hydrocarbons found in soil gas can also provide valuable information on the extent and magnitude of subsurface contamination. Fuels such as gasoline, which contain a significant fraction Of C_6 and lighter compounds, are easily detected using soil gas monitoring techniques. Heavier fuels, such as diesel, contain fewer volatiles and are more difficult to locate based on volatile hydrocarbon monitoring. Methane is frequently produced as a by-product of anaerobic biodegradation and, like oxygen depletion, can also be used to locate the most contaminated soils at a site. Extensive literature is available on soil gas survey techniques for using volatile hydrocarbons as indicators of contamination (Rivett and Cherry, 1991). Section 3.0 explains how soil gas hydrocarbons can be used to better delineate potential bioventing sites.

1.3 Advantages and Limitations

The use of soil gas to determine bioventing feasibility and bioventing progress has several economic and technical advantages over more traditional drilling and soil sampling techniques. In shallow (<20 feet), predominantly sand soils, the labor and equipment cost for a two-person soil gas survey team is approximately one-third the cost of a three-person conventional drilling and sampling team. Many new hydraulically driven, multi-purpose probes can be used for soil gas sampling, as well as for collecting soil and groundwater samples at depth. These probes can be advanced as quickly as conventional augers and do not produce drill cuttings which require expensive analysis and disposal.

An additional advantage of soil gas sampling is that a properly collected gas sample can represent the average chemistry of several cubic feet of soil as compared to a discrete soil sample, which can only describe a few cubic inches of the subsurface. This advantage is of particular importance in risk-based remediation projects where the degree of benzene removal can most accurately be determined by using multiple soil gas sampling locations.

Soil gas techniques have several limitations which must be acknowledged if this approach is to be properly applied. Soil gas monitoring is often impossible in very moist soils and particularly in fined-grained units. Attempts to gather soil gas samples from low permeability soils often result in the leakage of atmospheric air into the sampling system and inaccurate sampling results.

Although hydraulically driven probes such as cone penetrormeters are extending the depth of application, deep contamination and contamination in tight or cobble soils can best be assessed by using standard drilling techniques to install permanent soil gas monitoring points.

Once installed, the spatial orientation of soil gas points in relation to actual fuel-contaminated soil can provide false-positive or false-negative readings, particularly when volatile hydrocarbons are the only analyte. Soil heterogeneities such as clay layers can prevent migration of volatiles from deeper contaminated intervals to shallow soil gas points. Conversely, volatile hydrocarbons can diffuse great distances through very permeable soils, creating volatile soil contamination far from the source area. Because degradation of volatile hydrocarbons exerts a significant oxygen demand in subsurface soils, bioventing wells may be mistakenly sited in soils which actually contain very little adsorbed or free-phase hydrocarbons.

2.0 SOIL GAS INVESTIGATION METHODS

2.1 Introduction

This section describes the test equipment and methods that are required to conduct field soil gas surveys, to monitor soil gas for bioventing systems, and to install temporary and permanent soil gas monitoring points. The procedures and equipment described in this section are intended as guidelines. Because of widely varying site conditions, site specific applications will be required. In some states, soil gas surveys and permanent monitoring points must comply with well installation regulations.

2.2 Soil Gas Surveys

Whenever possible, soil gas surveys should be conducted at potential bioventing sites prior to locating the pilot test vent well(s) and monitoring points. The objective of the soil gas survey is to determine the areal extent and, in the case of shallow contamination, the vertical extent of soil contamination. These data are used to locate the vent well and soil gas monitoring points (MPs), and to determine the optimum depths of screened intervals. Additionally, the survey is used to determine if bioventing is required based on whether or not anaerobic soil gas conditions exist. If sufficient oxygen (0_2) is naturally available and distributed throughout the subsurface, bioventing may not be required to enhance fuel biodegradation rates.

2.2.1 Location of Soil Gas Points

The soil gas survey points should be arranged in a grid pattern centered on the known or suspected contaminated area. The soil gas probes are positioned at each grid intersection, and the survey begins near the center of the grid and progress outward to the limits of significant detectable soil contamination. In many cases, soil gas measurements should be taken at a number of depths at each location to determine the vertical distribution of contamination and oxygen supply. At shallow sites, a soil gas sampling grid should be completed with samples collected from multiple depths if the contaminated interval exceeds 3 feet or if contamination is suspected in different soil types.

2.2.2 Soil Gas Probes and Installation Techniques

Soil gas sampling is conducted using small-diameter [approximately 5/8- to 1 inch outside-diameter (OD)] steel probes. The typical probe consists of a drive point with a retractable, perforated tip that is threaded onto a series of drive rod extensions (Figure 2.1).

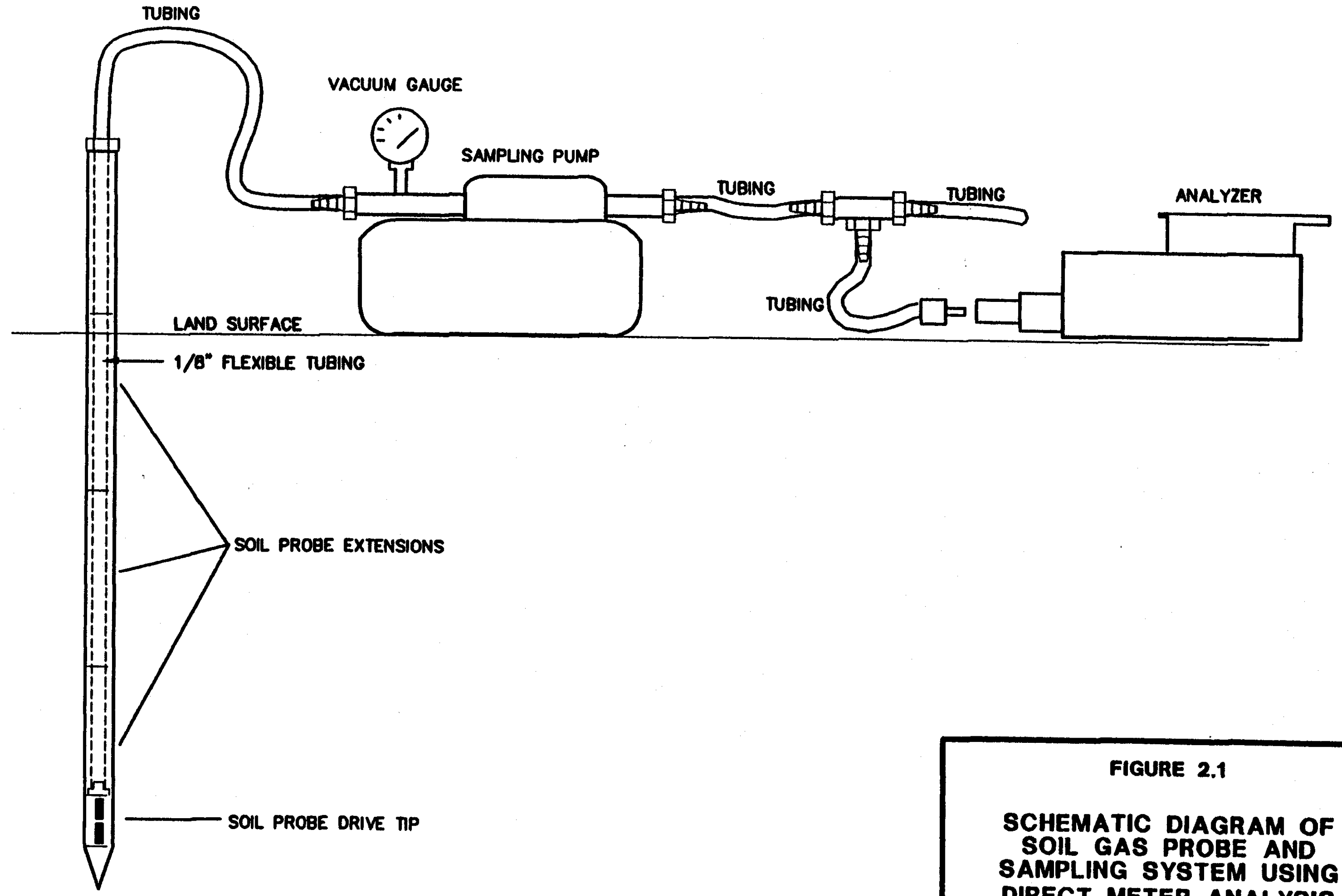

FIGURE 2.1

SCHEMATIC DIAGRAM OF SOIL GAS PROBE AND SAMPLING SYSTEM USING DIRECT METER ANALYSIS

The soil probe is fitted with a replaceable stainless steel screen to prevent fine-grained soils from clogging the perforations. Before use, 1/8-inch-diameter flexible tubing is connected to the soil probe and passed through the center of the drive rods. The 1/8-inch tubing, which is used to collect soil gas samples, extends from the soil probe to the purge pump or sampling device at the surface. This probe design greatly reduces the chance of vacuum leaks and is a standard feature on AMS® or equivalent soil gas sampling systems.

The method of probe installation will be dictated by ' soil conditions and depth of contamination. A digging permit from the host Air Force base and utility clearances from the local utility companies should be obtained prior to probe installation. Temporary probes are installed using either a hand-driven electric hammer or a hydraulic ram. The maximum depth for hammer-driven probes is typically 10 to 15 feet, depending on soil texture. Hydraulic rams are capable of driving the probes over 30 feet in a variety of soil conditions.

At sites with deeper contamination, where soil texture precludes the use of a hammer or hydraulic ram or where a permanent monitoring, system is required, permanent soil gas MPs may be installed using either a portable or truck-mounted drill rig. Permanent MPs are discussed in the following section.

2.3 Permanent Monitoring Points

Permanent, multi-depth soil gas MPs are typically used for monitoring pressure and soil gas near the vent well in pilot or full-scale bioventing systems. MPs are generally installed at a minimum of three locations near the vent well. The total number of monitoring locations and depth intervals will vary depending on site conditions. The location and installation of MPs are briefly described in this section. Additional discussion related to these topics is included in Section 4.0 of the Bioventing Protocol.

2.3.1 Location of Monitoring Points

To the extent possible, the MPs should be located in heavily contaminated soil. The MPs are generally installed in a straight line, with the radial distances from the vent well determined based on soil type and depth of contamination. Typical MP spacings for different site conditions are listed in Table 4.1 of the Bioventing Protocol.

2.3.2 Monitoring Point Construction

A typical multi-depth soil gas MP is shown in Figure 2.2. Soil gas should be monitored at discrete depths determined based on the soil stratigraphy and the contamination profile at each site. At deeper sites, permanent MPs should be completed at 10-foot intervals

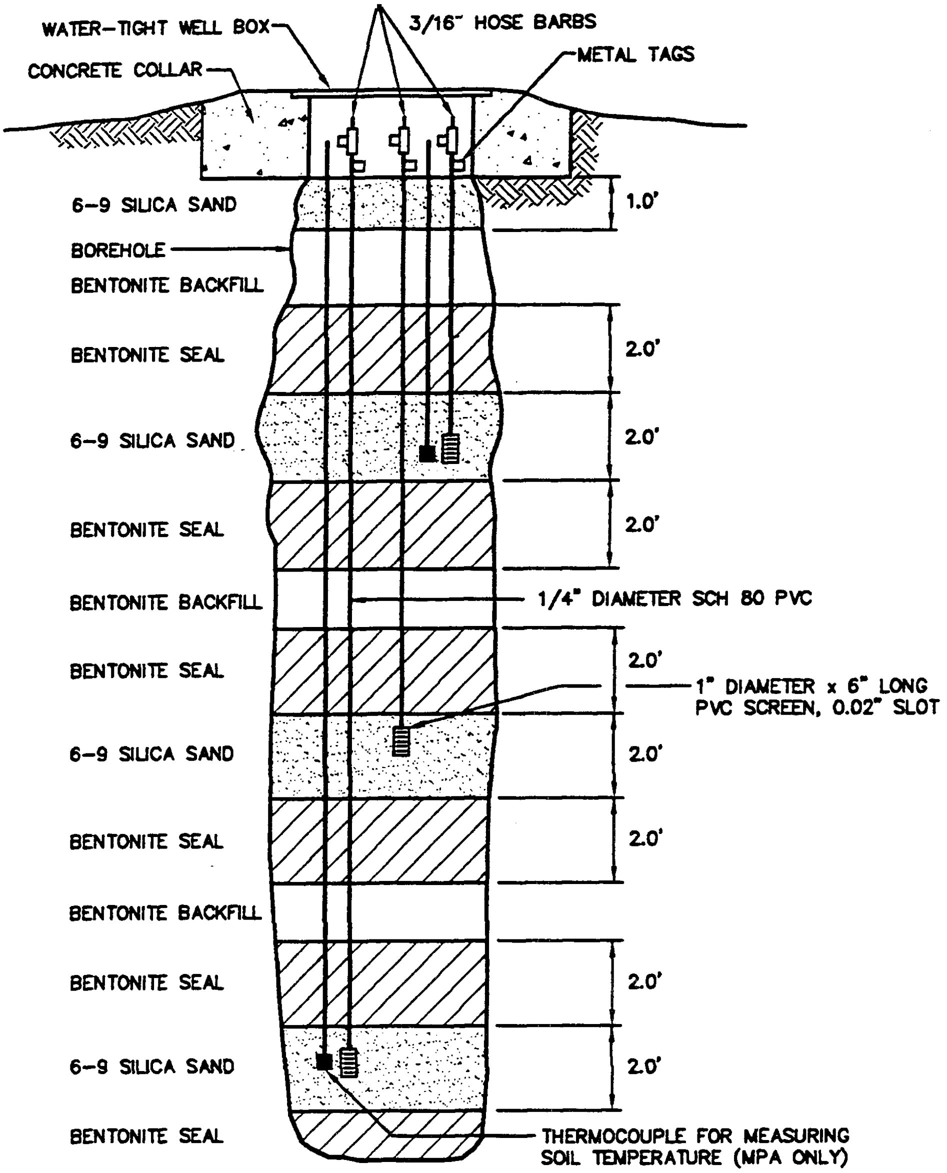

FIGURE 2.2

TYPICAL MONITORING POINT CONSTRUCTION DETAIL

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or in the middle of strata where oxygen transfer will be most limited by lower soil gas permeability. Soil temperature can be monitored using either J- or K-type thermocouples installed at the same depths as the deepest and shallowest vapor probes. Depending on soil conditions, MPs should be constructed either through hollow-stern augers or, in cohesive soils, in the open borehole.

Each MP can be constructed with multiple vapor probes placed within sand intervals and separated by bentonite seals. Vapor probes, constructed of 6-inch-long sections of 1-inch-diameter polyvinyl chloride (PVC) well screen, are placed within a 2-foot-thick layer of coarse-grained silica sand. One-quarter-inch-diameter PVC risers extend from each vapor probe to the surface. The annular spaces between the MP sand intervals are sealed with bentonite to isolate the monitoring intervals. The top of each riser is fitted with a ball valve and hose barb, and labeled to indicate the MP location and vapor probe depth. Additional details on MP construction is presented in Section 4.0 of the Bioventing Protocol.

2.4 Field Instrumentation and Measurements

Sections 2.4.1 through 2.4.4 discuss the equipment used for soil gas measurements. Additional discussion of this topic is included in Section 4.5 of the Bioventing Protocol.

2.4.1 Oxygen and Carbon Dioxide

Gaseous concentrations of carbon dioxide (CO_2) and 0_2 can be analyzed using an $0_2/CO_2$ analyzer. The analyzer will generally have an internal battery-powered sampling pump and range settings of 0 to 25 percent for both 0_2 and $C0_2$. Prior to taking measurements, the analyzer should be checked for battery charge level and should be calibrated daily using atmospheric concentrations of 0_2 and $C0_2$ (20.9 and 0.05 percent, respectively) and a gas standard containing 0.0 percent 0_2 and 5.0 percent $C0_2$.

2.4.2 Volatile Hydrocarbon Concentration

Total volatile hydrocarbon (TVH) concentrations can be analyzed using a variety of hydrocarbon analyzers. The analyzer must be capable of measuring hydrocarbon concentrations in the range of I to 10,000 parts per million, volume per volume (ppmv) and be capable of distinguishing between methane and non-methane hydrocarbons. Although flame ionization detectors are the most accurate instruments for fuel hydrocarbons, platinum catalyst detectors are also acceptable and are easier to use in the field. Photoionization detectors are not recommended for the high levels of volatile hydrocarbons found at many sites. Prior to taking measurements, the battery charge level should be checked and the analyzer should be calibrated against a hexane calibration gas to ensure proper operation.

The analyzer should also have a selector switch to change the response to eliminate the contribution of methane gas to the TVH readings. Methane gas is a common constituent of anaerobic soil gas and is generated by degrading manmade or natural hydrocarbons. Methane is commonly produced in swampy areas or in fill areas containing organic material. If the methane is not excluded from the TVH measurement, TVH results may indicate erroneously high levels of petroleum hydrocarbon contamination in the soil. . The methane content can also be estimated by placing a large carbon trap in front of the hydrocarbon analyzer. Heavier hydrocarbons will be retained by the carbon while methane passes through to the detector.

2.4.3 Sampling Pumps

Electric sampling pumps are used both to purge and collect samples from MPs and soil gas probes. The pumps should be either oilless rotary-vane or diaphragm pumps capable of delivering approximately 1 cubic foot per minute (cfm) of air at a maximum vacuum of 270 inches of water. The pumps have oilless filters to eliminate particulates from the air stream.

2.4.4 Differential Vacuum Gauges

Differential vacuum gauges are used to monitor the vacuum in the sampling point during purging and to estimate the permeability of soil to air flow. Typical vacuum ranges of the gauges are 0 to 50 and 0 to 250 inches of water for sites with sandy and clayey soils, respectively.

2.5 Soil Gas Sampling Procedures

The following soil gas sampling methods are recommended for extracting and analyzing soil gas samples from either temporary soil gas probes or permanent MPs. Proper sampling procedures will ensure that representative soil gas samples are collected from the subsurface.

2.5.1 Purging

Purging the soil gas probe or MP is a prerequisite for obtaining representative soil gas samples. A typical purging system (Figure 2. 1) will consists of a 1-cfm sampling pump, a vacuum gauge, and an O_2/CO_2 meter. The vacuum side of the pump is connected to the soil gas probe or MP. A vacuum gauge is attached to a tee in the vacuum side of the system to monitor the vacuum produced during purging, and the O_2/ CO_2 analyzer is connected to a tee in the outlet tubing to monitor O_2/CO_2 concentrations in the extracted soil gas. The magnitude of vacuum measured during purging is inversely proportional to soil permeability and will determine the method of sample collection.

After the purging system is attached to the soil gas probe or MP, the valve or hose clamp is opened and the pump is turned on. Purging is continued until O_2 and CO_2 concentrations stabilize, indicating that purging is complete. Before turning off the pump, the hose clamp or MP valve is closed to prevent fresh air from being drawn into the soil gas probe or MP.

2.5.2 Soil Gas Sampling - High-Permeability Soils

Sampling methods for high-permeability soils (sand and silt) should be followed if the vacuum measured during purging is less than 10 inches of water. Soil gas sampling and analysis is performed using the same equipment used for purging, minus the vacuum gauge. After opening the sampling point valve or hose clamp, the sampling pump is turned on, and the extracted soil gas is analyzed for stable $0_2/CO_2$ and TVH concentrations.

2.5.3 Soil Gas Sampling - Low-permeability Soils

A different sampling procedure should be followed to collect soil gas samples from low-permeability soils. The higher vacuums required for sampling increase the risk of vacuum leaks introducing fresh air and diluting the soil gas sample.

After purging the sampling point, a soil gas sample is collected in a Tedlar® bag prior to analysis. The evacuated Tedlar® bag should be placed inside a desiccator modified for soil gas sample collection. The desiccator is then connected to the sampling point via a hose barb that passes through the desiccator wall. The desiccator is then closed, sealed, and connected to the pump inlet with flexible tubing. The sampling system is shown in Figure 2.3. To collect the sample, the MP valve is opened, the pump is turned on, and the pressure relief port on the desiccator is sealed using either a valve or -the sampler's finger. The partial vacuum within the desiccator created by the pump will draw soil gas into the Tedlar® bag. When the Tedlar® bag is nearly filled the sampling point valve or hose clamp is closed, and the pump is turned off. The desiccator is then opened, the Tedlar® bag valve is closed, and the bag is removed from the desiccator. The soil gas sample is then analyzed by attaching the O_2/CO_2 and TVH analyzers directly to the Tedlar® bag.

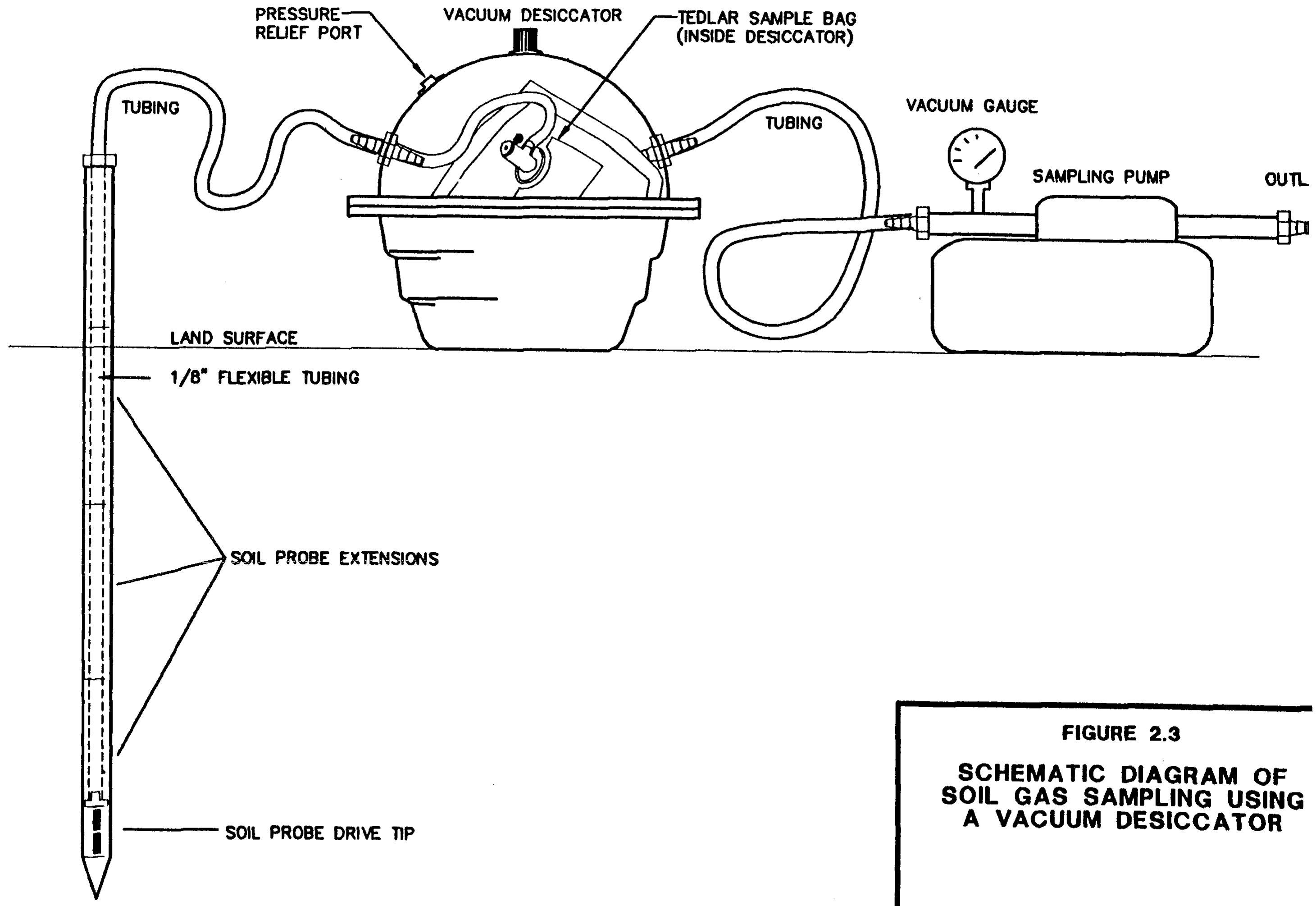

FIGURE 2.3

SCHEMATIC DIAGRAM OF SOIL GAS SAMPLING USING A VACUUM DESICCATOR

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2.5.4 Troubleshooting Common Problems

Most problems encountered during soil gas sampling and purging can be divided into three categories: 1) difficulty extracting soil gas from the sampling point, 2) water being drawn from the sampling point, and 3) high oxygen readings in areas of known soil contamination. Some of the more common problems and solutions are discussed in this section.

Difficulty extracting soil gas from a sampling point is typically caused by low-permeability (clayey and/or nearly saturated) soils. Collecting soil gas samples from low-permeability soils is facilitated by allowing the vacuum in the sampling point to equilibrate after purging and allowing additional time for the Tedlar® bag to fill with soil gas during sampling. After purging, the valve or hose clamp at the sampling point is closed until the vacuum in the point, induced by purging, equilibrates with the atmospheric pressure. Sampling is then performed as described in Section 2.5.3, but the vacuum should be applied to the desiccator for an extended period of time to collect a sufficient volume of soil gas for analysis.

Difficulty extracting soil gas from a soil gas probe can also be caused by the screen being fouled by fine-grained soil or heavy petroleum residuals. The probe should be removed from the soil, and the screen should be either cleaned or replaced if visibly fouled.

Water being drawn from the sampling point by the purge pump may be the result either of the point being installed in the saturated zone or, in the case of permanent MPs, the filter pack-being saturated with water during construction. In the former case, a temporary probe can be pulled up to a shallower depth above the saturated zone and resampled. With a permanent MP installed within the saturated zone, sampling must be delayed until either the water table drops because of seasonal variations or the water table is artificially depressed by a dewatering operation.

If the screened interval in a permanent MP is installed above the saturated zone but the filter pack was saturated with water during construction, sampling may still be possible if the water is pumped from the MP. This method will only work if the screened interval is at a depth of less than approximately 22 feet, which is the practical limit of suction lift.

High soil gas 0_2 readings in areas of known soil contamination may indicate a leak in the sampling or purging system. The potential for leakage, and the resulting dilution of the sample with atmospheric air, is higher in low-permeability soils where higher vacuums are required for purging and sampling. If a leak is suspected, all connections in the sampling system and the seal around the MP or soil gas probe should be inspected for leaks. Seals around a soil gas probe or MP can be checked for leaks by inspecting for air bubbles while injecting air with a sampling pump after adding water around the probe or MP. Any observed or suspected leaks should be corrected by tightening connections, repositioning the soil gas probe, or attempting to repair the MP seal.

3.0 **INTERPETATION OF SOIL GAS DATA**

The purpose of gathering soil gas data during bioventing investigations is to locate those areas which are most in need of additional 0_2 to enhance fuel biodegradation. If a pilot test is to be completed, the area of lowest 0_2 concentrations should first be determined. For full-scale applications, it is useful to determine the entire areal extend and depth of soils which exhibit an 0_2 deficit (for practical purposes less than 5 percent 0_2). Finally, soil gas data is useful for determining which sites are naturally aerated and therefore do not require mechanical bioventing systems. The following soil gas data sets were collected from six actual candidate sites. The first two sites are typical of anaerobic site conditions which definitely warrant the testing and design of mechanical bioventing systems. The next four sites show how soil gas surveys can be used to determine that remaining contaminants could naturally biodegrade without engineered bioventing enhancements.

3. 1 Candidate Site 1

Site Location/History: Fire Training Area (FTA-2) at Patrick AFB, FL. The site had been used as a fire training facility for 22 years, and soils are visibly contaminated with JP-4 jet fuel and waste oils.

Soil Type(s): Sandy soil with shell fragments. Groundwater is approximately 4feet below the surface.

Soil Gas Survey: A soil gas survey was conducted at the nine locations shown in Figure 3. 1. An attempt was made to sample soil gas at two depths. Soil gas results am presented in Table 3 1

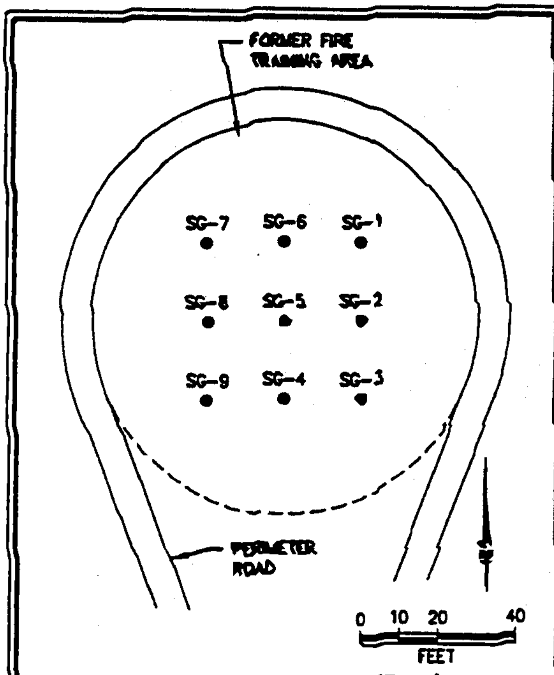

Figure 3.1 Fire Training Area (FTA-2) Patrick AFB, FL

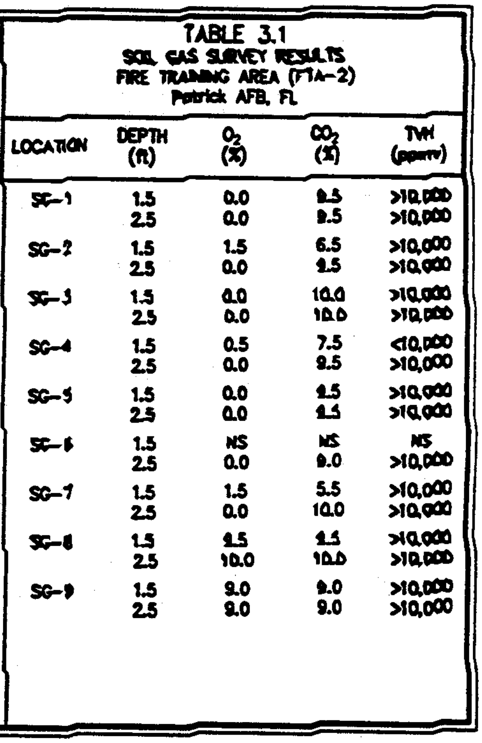

TABLE 3.1
SOIL GAS SURVEY RESULTS
FIRE TRAINING AREA (FTA-2)
Patrick AFB, FL

LOCATION	DEPTH (ft)	O_2 (%)	CO_2 (%)	TVH (ppmv)
SG-1	1.5	0.0	9.5	>10,000
	2.5	0.0	9.5	>10,000
SG-2	1.5	1.5	6.5	>10,000
	2.5	0.0	9.5	>10,000
SG-3	1.5	0.0	10.0	>10,000
	2.5	0.0	10.0	>10,000
SG-4	1.5	0.5	7.5	<10,000
	2.5	0.0	9.5	>10,000
SG-5	1.5	0.0	9.5	>10,000
	2.5	0.0	9.5	>10,000
SG-6	1.5	NS	NS	NS
	2.5	0.0	9.0	>10,000
SG-7	1.5	1.5	5.5	>10,000
	2.5	0.0	10.0	>10,000
SG-8	1.5	9.5	9.5	>10,000
	2.5	10.0	10.0	>10,000
SG-9	1.5	9.0	9.0	>10,000
	2.5	9.0	9.0	>10,000

Interpretation: High TVH levels remain in these soils, indicating that remaining fuels are not highly weathered and contamination is widespread within the bermed area. 0_2 at both the 1.5-foot and 2.5 sampling depths was completely depleted, indicating that natural diffusion is not meeting the biological oxygen demand of fuel-degrading microorganisms. $C0_2$ concentrations are also elevated, indicating that this primary biodegradation by-product is also being produced. This is in sharp contrast to background soil gas concentrations in these soils which are at near-atmospheric levels. This site is an excellent candidate for engineered bioventing.

3.2 Candidate Site 2

Site Location/History: JP-4 spill, Site Area S-4, Kelly AFB, TX. Free product has been recovered in this area, and a rising and falling water table has smeared contamination over a 6- to 8-foot interval.

Soil Type(s): Predominantly gravelly clay, with groundwater at approximately 13 feet below the surface.

Soil Gas Survey: Soil sample samples were collected from multi-depth MPs and an air-injection vent well, as shown in Figure 3.2. Soil gas was sampled from three depths at each MP. Soil gas results are presented in Table 3.2.

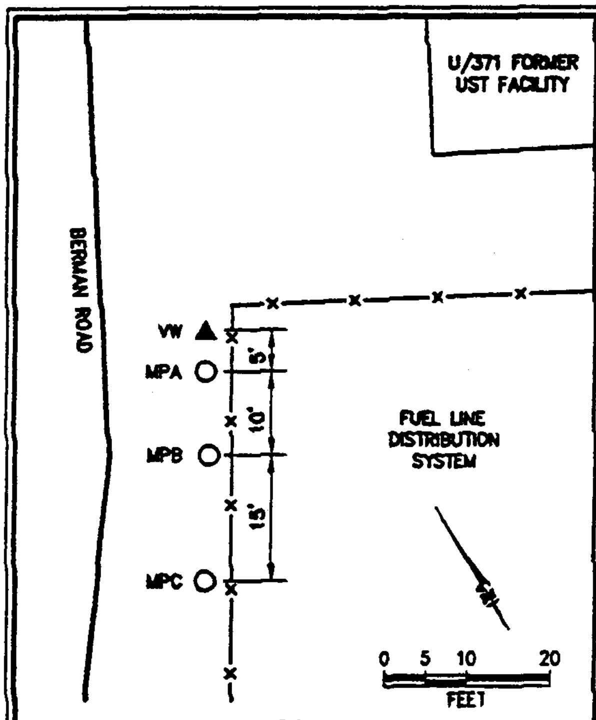

Figure 3.2 Site S-4
Kelly AFB, TX

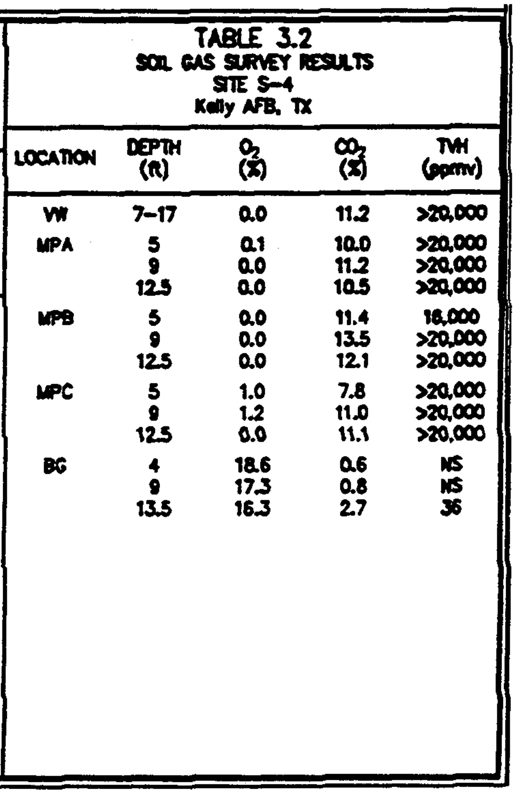

TABLE 3.2
SOIL GAS SURVEY RESULTS
SITE S-4
Kelly AFB, TX

LOCATION	DEPTH (ft)	O_2 (%)	CO_2 (%)	TVH (ppmv)
VW	7-17	0.0	11.2	>20,000
MPA	5	0.1	10.0	>20,000
	9	0.0	11.2	>20,000
	12.5	0.0	10.5	>20,000
MPB	5	0.0	11.4	16,000
	9	0.0	13.5	>20,000
	12.5	0.0	12.1	>20,000
MPC	5	1.0	7.8	>20,000
	9	1.2	11.0	>20,000
	12.5	0.0	11.1	>20,000
BG	4	18.6	0.6	NS
	9	17.3	0.8	NS
	13.5	16.3	2.7	36

Interpretation: High TVH levels remain in these soils, indicating that remaining fuels are not highly weathered and contamination is widespread within the test area. 0_2 levels at most sampling locations and depths were completely depleted, indicating that natural diffusion is not meeting the biological 0_2 demand of fuel degrading microorganisms. $C0_2$ concentrations are also elevated, indicating that this primary biodegradation by-product is also being produced. This is in sharp contrast to background soil gas concentrations in these soils, which are at near-atmospheric levels. This site is an excellent candidate for engineered bioventing.

3.3 Candidate Site 3

Site Location/History: Building 1813 Underground Storage Tank Leak, Hanscom AFB, MA. Tank containing diesel fuel had leaked. Tank was removed, but an unknown quantity of fuel-contaminated soil remains at the site.

Soil Type(s): Sandy soil to groundwater, which occurs at 8 to 9 feet.

Soil Gas Survey: A soil gas survey was conducted at the seven locations shown in Figure 3.3 and at multiple depths. Soil gas results are presented in Table 3.3.

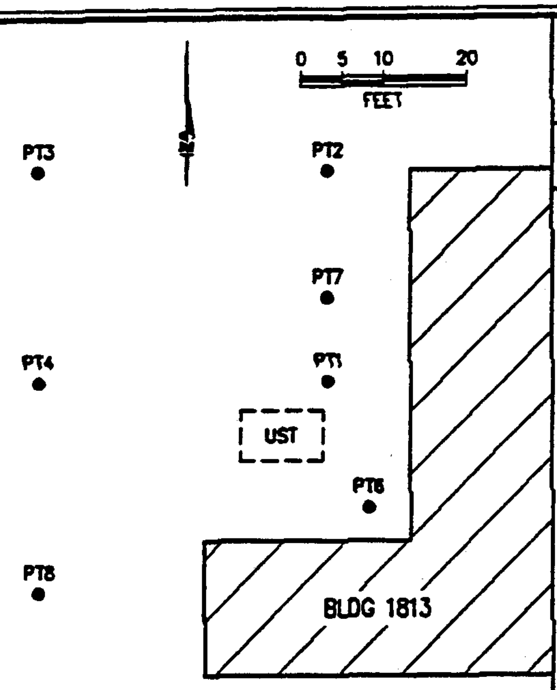

Figure 3.3 Building 1813 UST
Hanscom AFB, MA

TABLE 3.3
SOIL GAS SURVEY RESULTS
BUILDING 1813 UST
Hanscom AFB, MA

LOCATION	DEPTH (ft)	O_2 (%)	CO_2 (%)	TVH (ppmv)
PT1	3	20.5	0.8	62
PT2	3	20.5	1.0	60
	6	20.6	0.5	42
PT3	3	19.0	2.0	80
	6	19.0	2.0	78
PT4	3	19.2	2.2	80
	6	19.0	2.4	93
PT6	3	20.5	0.8	46
	6	20.5	0.8	44
PT7	3	20.0	0.5	82
	6	19.8	1.5	61
	7	19.0	1.0	70
PT8	6	19.5	1.5	60
	8	20.5	0.5	48

Interpretation: Low levels of TVH indicate that little diesel-contaminated soil remains at the site or that residual fuels are highly weathered. Near-atmospheric O_2 levels at all depths indicate that remaining hydrocarbons are being biodegraded with oxygen supplied by natural diffusion. CO_2 was found at levels above the atmospheric concentration of 0.03 percent, indicating some biological respiration was occurring. Higher CO_2 levels and slightly depressed O_2 levels at PT3 and PT4 indicate remaining fuel is probably located in this area of the site. Natural aeration appears to be providing sufficient O_2 for biodegradation of remaining fuel residuals.

3.4 Candidate Site 4

Site Location/History: Fire Training Area (FTA-l), Patrick AFB, FL. Site was thought to have been used as a fire training area. Suspected contaminants are JP-4 and waste oils. Some surface staining is evident.

Soil Type: Sand and shell fragments. Groundwater is located approximately 3 feet below the surface.

Soil Gas Survey: A soil gas survey consisting of a nine-point grid was completed within the berm, as shown in Figure 3.4. All points were sampled at a depth of 2 feet. Results of the survey are provided in Table 3.4

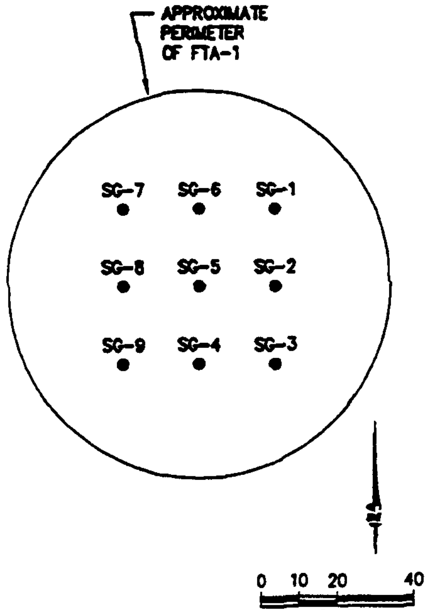

Figure 3.4 Fire Training Area (FTA-1) Patrick AFB, FL

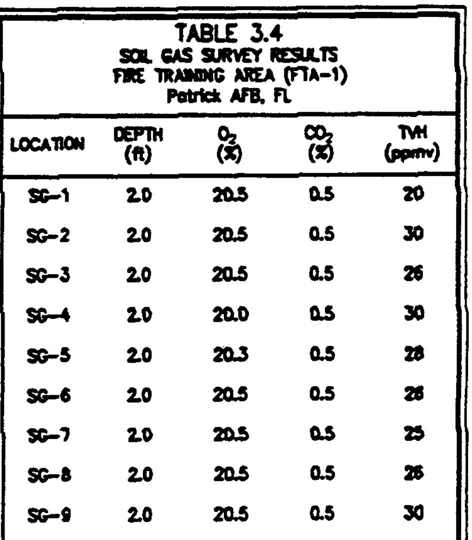

TABLE 3.4
SOIL GAS SURVEY RESULTS
FIRE TRAINING AREA (FTA-1)
Patrick AFB, FL

LOCATION	DEPTH (ft)	O_2 (%)	CO_2 (%)	TVH (ppmv)
SG-1	2.0	20.5	0.5	20
SG-2	2.0	20.5	0.5	30
SG-3	2.0	20.5	0.5	26
SG-4	2.0	20.0	0.5	30
SG-5	2.0	20.3	0.5	28
SG-6	2.0	20.5	0.5	26
SG-7	2.0	20.5	0.5	25
SG-8	2.0	20.5	0.5	26
SG-9	2.0	20.5	0.5	30

Interpretation: Very low concentrations TVH were detected in the soil gas at this site. Both 0_2 and $C0_2$ were at near-atmospheric levels. This site contains only small quantities of surface contamination which are being biodegraded before they impact groundwater.

3.5 Candidate Site 5

Site Location/History: Aquasystem Site, Westover AFB, MA. . Removal of USTs at this site revealed soil contamination. An unknown quantity of mixed fuels contamination remains in the soil.

Soil Type: Predominantly sand, with groundwater at approximately 13 feet below the surface.

Soil Gas Survey: A soil gas survey consisting of a 12-point grid was completed in and downgradient of the former tank pit, as shown in Figure 3.5. All points were sampled at multiple depths. Results of the survey are provided in Table 3.5

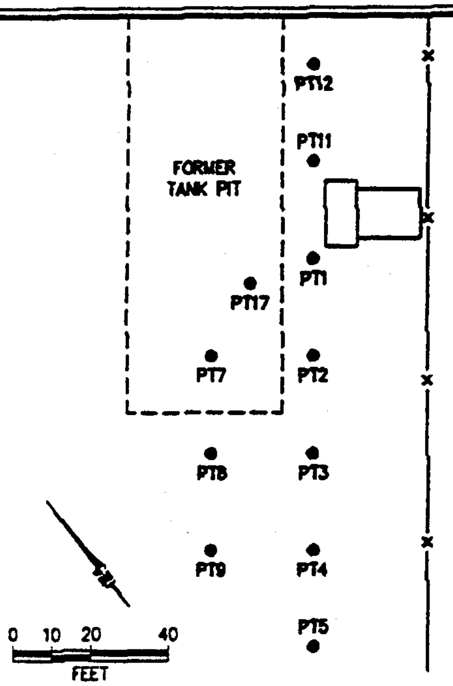

Figure 3.5 Aquasystem Site
. Westover AFB, MA

TABLE 3.5
SOIL GAS SURVEY RESULTS
AQUASYSTEM SITE
Westover AFB, MA

LOCATION	DEPTH (ft)	O_2 (%)	CO_2 (%)	TVH (ppmv)
PT1	3	16	3.2	80
	6	12.5	5	80
PT2	3	15.5	4.3	72
	6	13	6	74
PT3	3	18	2.6	74
	6	12	6.2	84
PT4	3	16	4	86
	6	11.5	6	80
PT5	3	14.8	4	76
	6	11	5.2	72
PT7	3	14	7	105
	6	8.5	8.5	69
PT8	3	12	5.5	75
	6	11	6.5	78
PT9	3	11.5	6	90
	6	11	6.2	78
PT11	3	16	3.5	84
	6	15	4	94
PT12	3	18.5	2.5	80
	6	15.5	4.2	91
	9	15	4.8	90
	12	13	5.6	92
PT16	6	17	2	94
	7.5	13	3.5	80
PT17	6	11.8	6.5	92
	9	11	8.5	96
	12	9	8	100

Interpretation: Low levels Of TVH were detected in the soil gas at this site. O_2 levels were significantly depleted below atmospheric concentrations in soils near PT7 and PTI 7, and generally decreased with depth. However the 8 to 9 percent of 0_2 available in this area is more than sufficient to sustain in situ biodegradation.. $C0_2$ ranged from 2 to 8.5 percent and generally increased with depth. The available data suggest that significant natural biodegradation is occurring at the site. It is possible that more 0_2-depleted soil exists in the capillary fringe, and that engineered bioventing could accelerate biodegradation if this anaerobic zone exists. The decision to biovent this site should be based on other factors, such as the impact and potential risk that soil contamination poses to groundwater.

3.6 Candidate Site 6

Site Location/History: Oil/water separator leak (CCPOL-1) located near a diesel transfer station at Cape Canaveral APS, FL.

Soil Type(s): Sandy soil with shell fragments. Groundwater is approximately 6 feet below the surface.

Soil Gas Survey: A soil gas survey was conducted at the eight locations shown in Figure 3.6. An attempt was made to sample soil gas at two depths. Soil gas results are presented in Table 3.6.

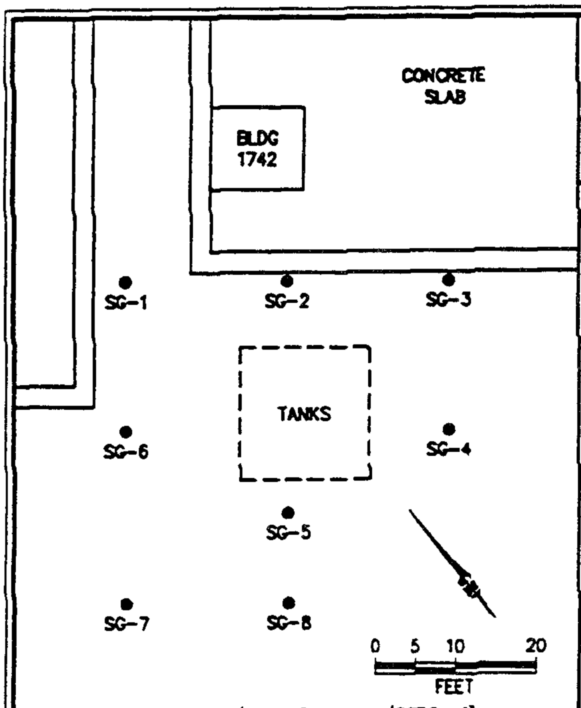

Figure 3.6 Oil/Water Separator (CCPOL-1)
Cape Canaveral AFS, FL

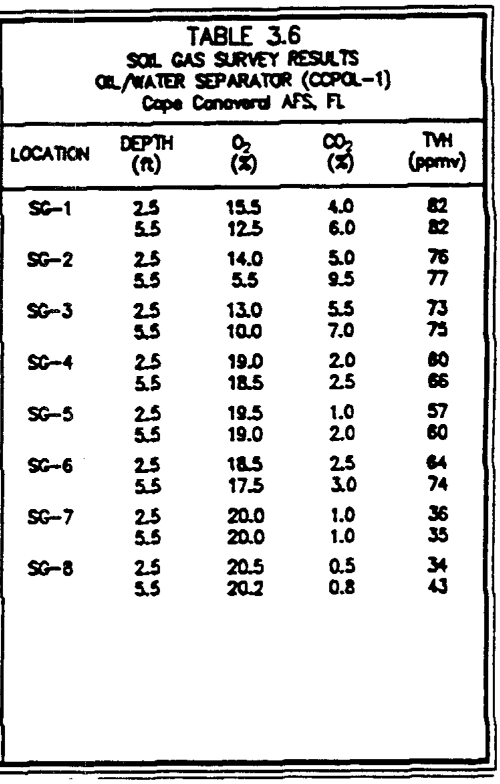

TABLE 3.6
SOIL GAS SURVEY RESULTS
OIL/WATER SEPARATOR (CCPOL-1)
Cape Canaveral AFS, FL

LOCATION	DEPTH (ft)	O_2 (%)	CO_2 (%)	TVH (ppmv)
SG-1	2.5	15.5	4.0	82
	5.5	12.5	6.0	82
SG-2	2.5	14.0	5.0	76
	5.5	5.5	9.5	77
SG-3	2.5	13.0	5.5	73
	5.5	10.0	7.0	75
SG-4	2.5	19.0	2.0	60
	5.5	18.5	2.5	66
SG-5	2.5	19.5	1.0	57
	5.5	19.0	2.0	60
SG-6	2.5	18.5	2.5	64
	5.5	17.5	3.0	74
SG-7	2.5	20.0	1.0	36
	5.5	20.0	1.0	35
SG-8	2.5	20.5	0.5	34
	5.5	20.2	0.8	43

Interpretation: Low levels of TVH indicate that little diesel-contaminated soil remains at the site or it is highly weathered. 0_2 levels were significantly depleted near SG-2, and generally decreased with depth in points near the oil/water separator. $C0_2$ levels are elevated in areas with low 0_2, indicating that in situ biodegradation is proceeding in the vicinity of the oil/water separator. It is possible that more 0_2-depleted soil exists in the capillary fringe, and that engineered bioventing could accelerate biodegradation, if this anaerobic zone exists. The decision to biovent this site should be based on other factors, such as the impact and potential risk that soil contamination poses to groundwater. One additional note: it is possible that if the oil/water separator was connected to a sanitary line, the biological oxygen demand could be the result of leaking sewage. An analysis of soil gas for BTEX compounds could help to determine if the 0_2 demand is fuel related.

4.0 USING SOIL GAS DATA FOR BIOVENTING DESIGN

In the absence of very complete, multi-depth soil sampling data, a soil gas survey is essential for the efficient placement of air injection vent wells and permanent soil gas MPs. At sites with deep contamination, more expensive exploratory drilling is required to determine the center and areal extent of contamination.

4.1 Air Injection Well Design

In most cases, the optimum location for an air injection well is at the center of contaminant mass, with a screened interval extending over the depth interval of soil contamination. The center of contaminant mass can generally be located by completing a soil gas survey grid, as shown in Section 3.0, and locating the volume of soil with the lowest 0_2 concentrations and highest levels of volatile hydrocarbons. At sites with shallow groundwater, this often corresponds with the capillary fringe where past or present free-phase product has accumulated. At deeper sites, the highest levels of contamination are often found on top of a low-permeability layer in the vicinity of the suspected spill source. The screened interval of the air injection well should be limited to a depth interval with 0_2 levels of less than 5 percent. This will focus air flow through the soils with the greatest 0_2 demand, and reduce the volume of air injection. One important exception to this design is when the center of contamination is beneath or adjacent a building or underground utility corridor. If high levels of TVH (> 1,000 ppmv) are found in soil gas, air injection can result in undesirable vapor migration into these structures. Under these circumstances, short-term soil vapor extraction may be required to reduce initial high volatile hydrocarbon concentrations.

4.2 Permanent Monitoring Point Design

Permanent soil gas MPs have two primary functions in bioventing applications: measuring the rate of 0_2 utilization to determine approximate rates of biodegradation, and monitoring the pressure and movement of soil gases in the treatment area. Because the rate of 0_2 utilization is most accurately measured in the most anaerobic soil volume, data from the soil gas survey can be used to place several soil gas points in the most 0_2-depleted soil volume.

For bioventing pilot tests it is also important to locate at least one multi-depth soil gas point at the outer limit of contamination or outer limit of expected 0_2 influence from the single air injection well. In a properly completed soil gas grid, the outer limit of contamination can often be estimated both by a noticeable reduction in TVH concentrations and an increase in 0_2 levels. The depth interval of perimeter MPs should be the same as MPs located in contaminated soils to monitor oxygen influence at critical depths.

4.3 Summary

Data on soil gas concentrations of 0_2, $C0_2$, and TVH can provide valuable insight into the extent of subsurface contamination and the potential for in situ bioventing. The procedures outline in this addendum are intended to assist in the collection and interpretation of soil gas information, with the ultimate goal of promoting a more cost effective approach to fuel-contaminated soil remediation.

5.0 **REFERENCES**

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