SCS ENGINEERS

SUBSURFACE ASSESSMENT

Assessor's Parcel Number (APN)
045-5302-010-05
555 98th Avenue
Oakland, California

Presented to:
Alameda County
Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 93705
90034

Prepared for:
AMCAL Multi-Housing, Inc.
4545 North West Avenue, Suite 118
Fresno, California 93705

Presented by:
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April 24, 2008
Project Number: 01205501.17

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Mr. Jerry Wickham, PG 3766, CEG 1177, CHG 297
Senior Hazardous Materials Specialist
Alameda County Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

cc: Mr. Leo Puig
AMCAL Multi-Housing, Inc.
4545 North West Avenue, Suite 118
Fresno, California 93705

Subject: Subsurface Assessment (Soil, Groundwater, and Soil Vapor Sampling, and Human Health Risk Assessment)

Site: Assessor's Parcel Number (APN) 045-5302-010-05
555 98th Avenue
Oakland, California

Dear Mr. Wickham:

SCS Engineers (SCS) is please to present this report (Report) on behalf of AMCAL Multi-Housing, Inc. (Client) in connection with Subsurface Assessment activities conducted at the Site including soil, groundwater, and soil vapor sampling, and human health risk assessment.

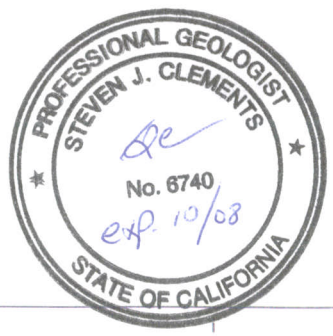
We greatly appreciate your timely review of this Report. If we can be of further assistance, or if you have any questions, please contact one of the undersigned at (858) 571-5500.

Sincerely,

Steve Clements, P.G. 6740
Project Geologist
SCS ENGINEERS

Ryan T. Marcos
Project Manager
SCS ENGINEERS

Daniel E. Johnson
Vice President
SCS ENGINEERS



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1.0 BACKGROUND

The Site consists of approximately 1.6 acres of vacant land in Oakland, California. Information obtained from previous assessment activities at the Site (referenced below) indicate that the Site was occupied by a gasoline service station from the early 1950s to circa 1995. A leaking underground storage tank (LUST) case is associated with the Site. However, the LUST case has a "case closed" status.

AMCAL Multi-Housing, Inc. (AMCAL) proposes to redevelop the Site for residential use. SCS understands that the proposed development will consist of multi-family residences constructed over concrete slab-on-grade foundations. It was reported that, with the possible exception of minor excavation for utilities, no soil will be excavated or exported from the Site during development.

2.0 REGULATORY AGENCY LIAISON

SCS has completed the following assessment and subsurface assessment reports in connection with the Site:

- *Phase I Environmental Site Assessment, Assessor's Parcel Number (APN) 045-5302-010-05, 555, 591, 594, and 599 98th Avenue, Oakland, California*, which was dated November 8, 2006.

- *Additional Site Investigation Activities, 555 98th Avenue, Oakland, California*, which was dated June 19, 2007.

- *Letter Report to Alameda County Department of Environmental Health, Assessor's Parcel Number (APN) 045-5302-010-05, 555 98th Avenue, Oakland, California*, which was dated October 11, 2006.

- *Technical Comments – Response to Alameda County Health Care Service Letter dated February 29, 2008, Assessor's Parcel Number (APN) 045-5302-010-05, 555 98th Avenue, Oakland, California*, which was dated March 17, 2008.

Based on a review of the above-referenced reports, Alameda County Environmental Health Services (ACEHS) issued a letter entitled, *SLIC Case RO0002958 and Geotracker Global ID SLT19701216, AMCAL Multi-Housing Development, 555 98th Avenue, Oakland, CA 94603*, which was dated March 19, 2008. This letter provided the following technical comments:

- "During tank removal activities in December 1993, soil contamination was detected in the area of the former fuel underground storage tanks (USTs) located northeast of the former service station building. Soil samples collected from the base of the UST excavation (12 feet bgs) on December 7, 1993 contained total petroleum hydrocarbons as gasoline (TPHg) at concentrations ranging from 230 to 12,000 milligrams per kilogram (mg/kg) and benzene at concentrations ranging from 0.8 to 11 mg/kg. Soil removed from the tank excavation was stockpiled on site and sampled on January 22, 1996. Based on

the results of the stockpile soil sampling, the stockpiled soil was used as backfill for the former UST excavation. However, there does not appear to be any documentation of soil treatment prior to reuse as excavation backfill. The proposed development includes plans for residential units on ground level in the area of the former USTs. Two soil vapor samples were collected in the general area of the former USTs as part of a soil vapor investigation conducted on May 31, 2007. Soil vapor sample SV5, which appears to have been collected within the footprint of the former service station building, did not contain detectable concentrations of volatile organic compounds (VOCs). Soil vapor sample SV3, which was collected immediately south of the former fuel dispensers, also did not contain detectable concentrations of VOCs. Although these soil vapor samples did not detect VOCs in the general area of the USTs, these sampling locations do not appear to be sufficiently close to the former USTs to evaluate potential vapor intrusion to residential units located directly above the former USTs. In addition, the reporting limit for VOC analysis of soil vapor samples SV3 and SV5 was 0.1 micrograms per liter (µg/L), which is equivalent to 100 micrograms per cubic meter (µg/m3). The Environmental Screening Level (San Francisco Bay Regional Water Quality Control Board, November 2007) for potential vapor intrusion from soil vapor to indoor air is 84 µg/m3 for residential land use. Therefore, the reporting limit exceeds the Environmental Screening Level for residential land use. We request that you further evaluate the potential for vapor intrusion to indoor air in the area of the former USTs. Additional soil vapor sampling in the area of the former USTs is acceptable. We also request that you extend a minimum of one soil boring in the area of the former USTs to assess the residual soil and groundwater contamination left in place below the tank backfill material."

Based on the above-referenced ACEHS technical comment in connection with the previous laboratory detection limits, SCS contacted the analytical laboratory (TEG Northern California, Inc. [TEG]) to assess the potential for lowering the reporting limits on the previous soil vapor sample data. TEG confirmed that this was possible and in a letter dated March 25, 2008, TEG indicated the following:

- "TEG reviewed the chromatograms and analytical quantitation reports, generated from the above referenced project, for the presence of benzene. No benzene was detected in any of the soil vapor samples analyzed at or above the reporting limit of 0.080 µg/L of vapor."

Based on the above-referenced ACEHS letter and a March 26, 2008 meeting with ACEHS, SCS, the Client, the representative of the City of Oakland and the City of Oakland Fire Department, SCS prepared the following workplan:

- *Workplan for Soil Vapor Sampling, Human Health Risk Assessment, Soil Sampling, and Groundwater Sampling (Workplan), Assessor's Parcel Number (APN) 045-5302-010-05, 555 98th Avenue, Oakland, California*, which was dated April 4, 2008.

Based on a review of the above-referenced workplan, the ACEHS issued a letter entitled, *SLIC Case RO0002958 and Geotracker Global ID SLT19701216, AMCAL Multi-Housing Development, 555 98th Avenue, Oakland, CA 94603*, which was dated April 8, 2008. This letter provided the following technical comments:

- "In the single soil boring proposed, we request that soil samples be collected continuously from ground surface to the bottom of the boring soil sampling for logging and screening purposes. Field screening is to be conducted by a qualified field geologist using visual observations, odor, and measurements using a field photoionization detector (PID) fitted with an appropriate lamp and calibrated for the chemicals of concern. Soil samples are to be extracted from the continuous cores at intervals and placed in sealed jars or plastic bags for measurement and recording of VOC concentrations in the headspace using the PID. Soil samples are to be collected for laboratory analysis from any zones where visible staining, odor, or elevated PID readings are observed. If no visible staining, odor, or elevated PID readings are observed, the collection of soil samples at the proposed fixed intervals of 3, 5, and 7 feet bgs is acceptable. In addition to the proposed laboratory analyses for volatile organic compounds (VOCs) using EPA Method 8260B, we also request that the soil samples be analyzed for total petroleum hydrocarbons as gasoline using EPA Method 8260B or 8015. Please present the results in the Site Investigation Report requested below."

- "In addition to the proposed laboratory analyses for VOCs using EPA Method 8260B, we request that the groundwater sample also be analyzed for total petroleum hydrocarbons as gasoline using EPA Method 8260B or 8015. Please present the results in the Site Investigation Report requested below."

- "The Work Plan proposes collection of soil vapor samples at two locations within the estimated location of the former USTs and one location within an area that may be a mis-plotted location for the former USTs. Due to the approximate and possible inaccurate nature of former site plans, we request that you use known points of reference such as the former building pad and former monitoring well STMW-1 to help locate the proposed soil vapor samples. We recommend reviewing a historical aerial photograph that shows the former service station building and/or USTs to help locate the soil vapor sampling locations. We understand that soil vapor sampling is planned for Friday, April 11, 2008. ACEH plans to have a representative visit the site during the proposed sampling. If the location of the former UST excavation area is uncertain, ACEH may request additional soil vapor sampling locations. Please present the results in the Site Investigation Report requested below."

The following scope of services includes Subsurface Assessment activities designed to address the above-referenced ACEHS requests.

3.0 OBJECTIVES

The objectives of the scope of services described in this Report were to:

- Assess the possible presence and concentrations of total petroleum hydrocarbons as gasoline (TPHg) and VOCs in the soil and groundwater in the interpreted area of the former USTs excavation at the Site.

- Assess the possible presence and concentrations of VOCs in the soil vapor in the interpreted area of the former USTs excavation at the Site.

- Assess the likelihood that Significant[1] human health risk exists at the Site as a result of vapor phase migration of VOCs.

4.0 SCOPE OF SERVICES

4.1 PREPARATION FOR FIELD WORK

4.1.1 Site Health and Safety Plan

A Site health and safety plan (Plan) was required for the work conducted at the Site by workers within the "exclusion zone" pursuant to the regulations in 29 Code of Federal Regulations (CFR) Part 1910.120 and Title 8 California Code of Regulations (CCR) Section 5192. A Plan was prepared which outlined the potential chemical and physical hazards that might be encountered during the drilling and sampling activities. The appropriate personal protective equipment and emergency response procedures for the Site-specific chemical and physical hazards were detailed in the Plan. All field personnel involved with the field work were required to read and sign the document in order to encourage proper health and safety practices.

4.1.2 Utility Search and Markout

Prior to drilling, SCS contacted Underground Service Alert (USA) and contracted with a private underground utility search company (Cruz Brothers Locators) to attempt to locate subsurface utilities and improvements at the Site to minimize the likelihood of drilling into an underground utility. USA issued ticket number 125297 for the utility notification request.

4.1.3 Boring Permits

As required by the Alameda County Department of Public Works (ACDPW), a boring permit application was prepared and submitted to the ACDPW with the proper fees. The permit application was reviewed by an appropriate licensed professional. On April 2, 2008, ACDPW approved the application and issued Boring Permit Number: W2008-0157.

4.1.4 Project Management, Subcontractor Management, and Scheduling

Prior to mobilizing for fieldwork, SCS notified the Client and the ACEHS and scheduled the subcontractors including the private utility locator (Cruz Brothers Locators), the drilling company (TEG), and the mobile laboratory (TEG).

1 The U.S. Environmental Protection Agency (EPA) uses one excess death in 1,000,000 as the maximum acceptable risk. California's Proposition 65 uses one excess cancer death in 100,000 as the risk level above which public notification is required. For the purposes of this assessment, significant is defined as one in 1,000,000 excess lifetime cancer risk.

4.2 FIELD ACTIVITIES

4.2.1 Soil and Groundwater Sampling

On April 11, 2008, a direct push drilling rig was used to advance one boring to a depth of 20 feet below current grade to assess the possible presence of TPHg and VOCs in the shallow soil and groundwater beneath the Site (in connection with possible residual concentrations of TPHg and VOCs in the USTs excavation backfill material, soil beneath the USTs excavation, and groundwater beneath the USTs excavation as they relate to human health risk from vapor intrusion). The boring location at the interpreted area of the former USTs excavation was determined based on a review of the following (please note that the following sources are included as an appendix to this Report):

- A figure labeled *Figure 2* in a report entitled, *Soil Sampling Below Removed Underground Storage Tanks*, prepared by Soil Tech Engineering, Inc. and dated 1994.
- A figure labeled *Figure 2* in a report entitled, *Remedial Excavation Activities and Soil Sampling*, prepared by Soil Tech Engineering, Inc. and dated 1996.
- A figure labeled *Figure 2* prepared by Alpha Geo Services (report name and date not provided).
- A figure labeled *Site Plan* in a report entitled, *Limited Phase I Environmental Site Assessment*, prepared by Gettler-Ryan, Inc. and dated August 28, 1997.
- Figures labeled *Site Map, Potentiometric Map, Soil Concentration Map, and Groundwater Concentration Map*, in a report entitled, Well Installation and Soil Boring Report, prepared by Gettler-Ryan, Inc. and dated October 9, 1997.
- A figure labeled *Site Plan* in a report entitled, *Groundwater Monitoring and Sampling*, Gettler-Ryan, Inc. and dated October 21, 1997.
- A historical aerial photograph provided by Environmental Data Resources, Inc. dated 1965.

Soil sampling depth locations within the soil boring were selected based on field screening techniques conducted by SCS personnel. Field screening techniques included visual observations (e.g., soil staining), odor (e.g., petroleum hydrocarbon odor), and measurement using a field photoionization detector (PID) (MiniRAE 2000), fitted with an appropriate lamp (10.6 eV), and calibrated for the chemicals of concern using isobutylene. If there were no obvious indications of petroleum hydrocarbon-bearing soil, soil sample depths were chosen to provide vertical coverage of the soil column (i.e., excavation fill soil and soil beneath excavation). The following sample depths were selected:

- 4, 7, and 8.5 feet below current grade – field screening techniques indicated no soil staining, odor, or PID readings.

- 11.5 feet below current grade – field screening indicated soil staining, petroleum hydrocarbon odor, and PID readings.

- 18.5 feet below current grade – groundwater was encountered and sampled.

It should be noted that the above-referenced sample depths are in feet below current grade. Based on observations during subsurface assessment activities, it appeared that additional soil had been placed in the vicinity of the soil boring location, approximately 2.5 feet in thickness. Therefore, it is interpreted that the above-referenced sample depths are approximately 1.5, 4.5, 6, 9, and 16 feet below the former grade when the Site was developed as a gasoline service station.

As indicated in the Background section above, there was some uncertainly as to the location of the former USTs excavation area. However, it is our professional opinion that the soil boring was placed at the former USTs excavation area. This opinion is based on the following:

- A review of the above-referenced figures, documents, and aerial photograph depicting the former gasoline service station, former USTs, and/or former USTs excavation area.

- Observations of soil types during soil sampling activities (i.e., based on observations, the soil at 4, 7, and 8.5 feet below current grade appeared to be consistent with typical UST backfill material, and the soil at 11.5 feet below current grade appeared to consist of clayey soil reportedly consistent with native soil beneath the Site).

- Field screening techniques conducted at the Site (i.e., no obvious indications of staining, odors, or PID reading were associated with soils at 4, 7, and 8.5 feet below current grade, and indications of staining, odors, and PID readings were associated with the soil at 11.5 feet below grade). This data is consistent with previous assessment and subsurface assessment activities indicating that the UST backfill material contained no detectable concentrations of constituents of concern (CoCs); however, residual concentrations of CoCs were present in soil beneath the USTs excavation.

Continuous soil cores were obtained by hydraulically hammering a 2.25-inch diameter, four-foot long, stainless steel hollow drive rods containing acetate sample sleeves. Upon retrieval, the acetate sleeve containing the soil core was removed from the hollow drive rod and inspected. Six inch long sections were cut from the four-foot long core at desired sample depths. Immediately following soil sample collection, both ends of the cut acetate sleeve section were covered with Teflon™ sheets, capped with plastic end caps, and taped with polyethylene tape. A label noting the date of collection, sample number, depth, and project number was affixed to each collected sample. The remainder of each core was used for soil logging purposes in accordance with the Unified Soil Classification System and field screening. Soil samples were driven into acetate tubes and the ends of the sample tubes were covered with Teflon™ sheeting, and tightly closed with end caps.

A shallow groundwater grab sample was collected from the boring using a temporary PVC casing and four foot long section of well screen with 0.010 inch factory cut screen slots. After the completion of soil and groundwater sampling activities, the direct push boring was backfilled

with appropriate backfill materials as required by the ACDPW. No soil cuttings were generated during the drilling operations at the Site.

Sampling equipment was cleaned prior to each sampling event to minimize the likelihood of cross-contamination and to minimize the potential for a false positive in the soil samples analyzed.

The sample tubes (soil) and glass containers (groundwater) were labeled and submitted to a State-accredited laboratory for analysis. Chain-of-custody procedures were implemented for sample tracking. A written analytical report was provided by the laboratory upon completion of the sample testing.

4.2.2 Soil and Groundwater Sampling Laboratory Analysis

To assess the possible presence of TPHg and VOCs in the shallow soil and groundwater in the interpreted area of the former USTs excavation at the Site, four soil samples and one groundwater sample were analyzed for TPHg and VOCs in general accordance with EPA Method 8260B. The laboratory reporting limits for VOCs (associated with carcinogenic analytes associated with gasoline [e.g., benzene, ethyl benzene, MTBE, etc.]) were set less than their respective Environmental Screening Level (ESL) values.

4.2.3 Soil Vapor Sampling

On April 11, 2008, a direct push drilling rig used to advance five borings at the Site, to depths of 7.5 feet below current grade, to assess the potential for soil vapor to contain VOCs at the interpreted locations of two possible former USTs excavations.[2] The soil vapor probes were constructed of 1.5 inch outside diameter steel and equipped with a hardened drop-off steel tip. Small diameter inert tubing (e.g., Nylaflow) was inserted through the center of the rod and threaded into a gas tight fitting just above the tip. Once advanced to a depth of 7.5 feet below current grade, the probe was retracted slightly to expose the vapor sampling port.

Soil vapor sampling procedures were conducted in general accordance with the California Department of Toxic Substances Control (DTSC) guidelines.

The probe rod was sealed at the surface with granular and hydrated bentonite for a minimum of 20 minutes before sampling. Soil vapor was withdrawn from the end of the inert tubing that runs from the sampling tip to the surface using a 20 cubic centimeter syringe.

At the first vapor sampling location (SV-1) at step purge volume test was conducted to evaluate the most appropriate purge volume. Purging is conducted to remove ambient air from the

2 SCS was provided two figures from the ACEHS indicating two possible locations of the former USTs excavation. As reported by the ACEHS, the location depicted to the northeast of the former gasoline service station building is the interpreted correct excavation location and the location depicted to the west of the former gasoline service station building is the interpreted misplotted excavation location. As indicated in the text of this Report, this interpretation was supported by observations and field screening techniques.

sampling system and to ensure that the collected soil vapor samples represents conditions in the soil. The purge test at location SV-1 consisted of one, three, and seven purge volumes. Three purge volumes were used for all subsequent sampling locations and depths. A sample of in-situ soil vapor was then withdrawn and immediately transferred to the mobile laboratory within minutes of collection.

A can containing compressed 1,1-diflouroethane (Dust Off) was expelled over each sampling system during sample collection. The presence of 1,1-diflouroethane in the analytical results is used to indicate potential leaks in the sampling system. 1,1-diflouroethane was not detected in any of the samples.

Chain-of-custody procedures were implemented for sample tracking. A written analytical report was provided by the laboratory upon the completion of the sample analysis.

As appropriate, soil vapor sampling equipment was cleaned or changed out between soil vapor probes to minimize the likelihood of cross-contamination of the soil vapor probe holes and to minimize the potential for a false positive in the soil vapor samples analyzed. The soil vapor probe holes will be backfilled with appropriate backfill materials as required by the ACDPW.

4.2.4 Soil Vapor Sampling Laboratory Analysis

The soil vapor samples were analyzed on-Site by a State-accredited mobile laboratory. Samples were analyzed for VOCs in general accordance with EPA Method 8260B. The laboratory reporting limits for VOCs (associated with carcinogenic analytes associated with gasoline [e.g., benzene, ethyl benzene, MTBE, etc.]) were set less than their respective ESL values.

5.0 GEOLOGY AND HYDROGEOLOGY

5.1.1 Topography

Based on a review of a topographic map entitled, *United States Geological Survey (USGS) 7.5 Minute Topographic Map, San Leandro Quadrangle, Alameda County, California, 1993*, the Site is interpreted to be at an elevation of approximately 20 feet above mean sea level (MSL). The Site vicinity is relatively flat with a slight downward slope to the east towards San Leandro Bay and the San Francisco Bay.

5.1.2 Soil Survey

As indicated above, SCS advanced one boring within the interpreted former USTs excavation area. SCS interpreted artificial fill from the surface to a depth of approximately 10 feet below current grade at this location. Based on this interpretation, SCS was unable to determine the shallow soil type within the Site vicinity. Therefore, SCS has used other sources to describe the shallow soil within the Site vicinity. Based on a review of the *U.S. Department of Agriculture's Soil Conservation Service Soil Survey*, the soil in the general Site vicinity is classified as clay and silty clay from the surface to approximately 5 feet below grade. SCS observed gray to brown clay with silt from approximately 10 to 18.5 feet below current grade. Between 18.5 feet below current grade and the depth of the boring, 20 feet below current grade, SCS observed well graded

sand. In addition, a review of assessment and subsurface assessment reports prepared by Gettler-Ryan, Inc. indicated that the clayey soil is underlain by sandy zone consisting of sand and clayey sand at approximately 22 feet below the previous grade.

5.1.3 Geology

Based on a review of a geologic map published by the California Geological Survey, the Site vicinity is interpreted to be in the Coast Ranges province, that trend northwest subparallel to the San Andreas Fault. The Site is also interpreted to be in the San Francisco Bay Hydrologic Region, Santa Clara Valley Groundwater Basin and the East Bay Plain Subbasin, according to the Department of Resources Groundwater Bulletin (California DWR, 2004, *California's Groundwater Bulletin 118, Santa Clara Valley Groundwater Basin East Bay Plain Subbasin Update*). The East Bay Subbasin is composed of unconsolidated sediments of Quaternary age, including deposits from the early Pleistocene Santa Clara Formation, the late Pleistocene Alameda Formation, the early Holocene Temescal Formation, and Artificial Fill. The Formations are described having lake and flood plain deposits.

5.1.4 Water Quality Survey

As indicated above, the Site is interpreted to be located in the Santa Clara Valley Groundwater Basin and the East Bay Subbasin. According to the San Francisco Regional Water Quality Control Board (SFBRWQCB) (SFBRWQCB, 1999, *East Bay Plain Groundwater Basins Beneficial Use Evaluation Report – Alameda and Contra Costa Counties, CA*), groundwater within this hydrologic subbasin has been designated as having potential or existing beneficial uses for municipal, agricultural, and industrial purposes.

5.1.5 Hydrogeology

A review of assessment and subsurface assessment activities conducted at the Site by Gettler-Ryan, Inc. indicated that groundwater was encountered between 7 and 10 feet below grade during 1995 and 1997 groundwater sampling events. Groundwater flow direction was reported to be to the north. SCS encountered groundwater at approximately 18.5 feet below current grade during the Subsurface Assessment activities described in this Report.

6.0 FINDINGS

6.1 SOIL SAMPLING LABORATORY RESULTS

As indicated above, four soil samples from one boring (SS-1) were collected at the interpreted former USTs excavation area. Soil samples were analyzed for TPHg and VOCs in accordance with EPA Method 8260B. Laboratory analysis indicated that soil samples collected at 4, 7, and 8.5 feet below current grade contained no detectable concentrations of TPHg or VOCs above the laboratory detection limits. Laboratory analysis indicated that the soil sample collected at 11.5 feet below current grade contained detectable concentrations of TPHg and VOCs as follows: TPHg (39 mg/kg), isopropylbenzene (0.18 mg/kg), n-propylbenzene (0.62 mg/kg), tert-butylbenzene (0.064 mg/kg), sec-butylbenzene (0.31 mg/kg), p-isopropyltoluene (0.10 mg/kg),

n-butylbenzene (0.550 mg/kg), and naphthalene (0.045 mg/kg). The boring locations are shown on Figure 1 and the laboratory analytical results are included in an appendix to this Report.

6.2 GROUNDWATER SAMPLING LABORATORY RESULTS

As indicated above, one groundwater sample from one boring (SS-1) was collected at the interpreted former USTs excavation area. The groundwater sample was collected at a depth of approximately 18.5 feet below current grade. The groundwater sample was analyzed for TPHg and VOCs in accordance with EPA Method 8260B. Laboratory analysis indicated that the groundwater sample contained detectable concentrations of TPHg and VOCs as follows: TPHg (1,200 µg/L), m,p-xylene (2.0 µg/L), isopropylbenzene (5.9 µg/L), n-propylbenzene (20 µg/L), 1,3,5-trimethylbenzene (44 µg/L), tert-butylbenzene (1.1 µg/L), 1,2,4-trimethylbenzene (160 µg/L), sec-butylbenzene (5.0 µg/L), p-isopropyltoluene (3.3 µg/L), and naphthalene (8.0 µg/L). The boring locations are shown on Figure 1 and the laboratory analytical results are included in an appendix to this Report.

6.3 SOIL VAPOR SAMPLING

As indicated above, five soil vapor samples from five borings (SV-1 to SV-5) were collected at the interpreted former USTs excavation areas. The soil vapor samples were collected at depths of 7.5 feet below current grade and were analyzed for VOCs in general accordance with EPA Method 8260B. Laboratory analysis indicated that four of the five soil vapor samples contained concentrations of tetrachloroethene ranging in concentration from 0.13 to 0.21 µg/L of vapor (µg/Lv). No additional volatile organic compounds were detected in the soil vapor samples. The boring locations are shown on Figure 1 and the laboratory analytical results are included in an appendix to this Report.

7.0 DISCUSSION

7.1 ENVIRONMENTAL SCREENING LEVELS

The concentrations of TPHg and VOCs in soil, groundwater, and soil vapor samples collected at the Site were compared to Environmental Screening Levels (ESLs) as indicated in a document entitled, *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater*, which was prepared by the California Regional Water Quality Control Board and dated November 2007. The above-referenced document indicates the following:

- "The ESLs are considered to be conservative. Under most circumstances, and within the limitations described, the presence of a chemical in soil, soil gas, or groundwater at concentrations below the corresponding ESL can be assumed to not pose a significant, long-term (chronic) threat to human health and the environment."

- "The presence of a chemical at concentrations in excess of an ESL does not necessarily indicate that adverse impacts to human health or the environment are occurring; this simply indicates that a potential for adverse risk may exist and that additional evaluation is warranted."

7.2 RESIDUAL CONSTITUENTS OF CONCERN IN SOIL

7.2.1 Comparison to ESLs

As indicated above, four soil samples were collected at the interpreted area of the former USTs excavation to assess the possible presence of TPHg and VOCs in connection with human health risk from vapor intrusion. The above-referenced ESL document indicates the following in connection with soil screening levels for potential vapor intrusion concerns:

- "Soil screening levels for evaluating vapor intrusion concerns are no longer provided. This is due to concerns associated with contaminant loss during sampling, which would lead to an under-prediction of contaminant mass, as well as concerns associated with the ability of the soil versions of the EPA Johnson and Ettinger models to accurately predict indoor air concentrations based on soil VOC measurements. DTSC no longer supports use of the finite-source version of the model (which uses bulk soil concentrations as the source term), and has removed it from its web site."

The above-referenced ESL document does not provide soil ESL concentrations related to potential vapor intrusion concerns. However, as discussed above and below, SCS collected various soil vapor samples at the interpreted area of the former USTs excavation, which were compared to ESL values and the Department of Toxic Substance Control (DTSC) health risk models.

It should be noted that the above-referenced ESL document does provide ESLs for soil as it relates to potential groundwater impacts (*Table C, Environmental Screening Levels [ESLs], Deep Soils [>3m bgs], Groundwater is a Current or Potential Source of Drinking Water*), which are compared to the concentrations of CoCs in the soil at the Site (please note that there are no ESL values for the other VOCs detected in the soil at the Site):

Constituent	Site Concentration (mg/kg)	ESL Concentration (mg/kg)
Naphthalene	0.045	3.4
TPHg	39	83

Notes:
TPHg: Total petroleum hydrocarbons as gasoline
mg/kg: Milligrams per kilogram
ESL: Environmental Screening Level

As indicated in the table above, the CoCs detected in the soil at the Site do not exceed their ESL concentrations.

7.2.2 Comparison to Historical Data

As indicated in the Regulatory Liaison section above, SCS previously prepared a report for the Site entitled, *Letter Report to Alameda County Department of Environmental Health, Assessor's Parcel Number (APN) 045-5302-010-05, 555 98th Avenue, Oakland, California*, which was dated October 11, 2006. This report provided concentrations of residual CoCs in soil at the Site

in connection with the former gasoline service station operations. The following table compares historical and current CoC concentrations at the Site:

	TPHg (mg/kg)	Benzene (mg/kg)	MTBE (mg/kg)
Pre-Closure (1995-1996)	Up to 46	Up to 0.044	NA
Post-Closure (1997)	Up to 22	ND	Up to 0.03
Current (2008)	39	ND	ND

Notes:
MTBE: Methyl-butyl ether
TPHg: Total petroleum hydrocarbons as gasoline
mg/kg: Milligrams per kilogram
NA: Not analyzed
ND: None detected above the laboratory detection limit

As indicated in the table above, the concentrations of TPHg in soil at the Site from current subsurface assessment activities are in the range of TPHg concentrations previous reported for the Site. In addition, concentrations of benzene and methyl-butyl ether (MTBE) were previously detected in the soil at the Site, however, they were not detected in current soil sampling activities.

7.3 RESIDUAL CONSTITUENTS OF CONCERN IN GROUNDWATER

7.3.1 Comparison to ESLs

As indicated above, one groundwater sample was collected at the interpreted area of the former USTs excavation to assess the possible presence of TPHg and VOCs in connection with human health risk from vapor intrusion. The following table compares the concentrations of CoCs in the groundwater at the Site and their respective ESLs (*Table E-1, Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns [Volatile Chemicals Only]*) (please note that there are no ESL values for the other VOCs detected in the groundwater at the Site):

Constituent	Site Concentration (µg/L)	ESL Concentration (µg/L)
m,p-Xylene	2.0	160,000
Naphthalene	8.0	3,200
TPHg	1,200	10

Notes:
TPHg: Total petroleum hydrocarbons as gasoline
µg/L: Micrograms per liter
ESL: Environmental Screening Level

As indicated in the table above, reported concentrations of m,p-xylene and naphthalene at the Site do not exceed their respective ESL values. However, the concentration of TPHg exceeds its ESL value. The above-referenced ESL document indicates the following in connection with groundwater concentrations which exceed ESL values:

- "For areas where groundwater screening levels for vapor intrusion concerns are approached or exceeded or sites where significant releases to the vadose-zone have occurred, collect shallow soil gas samples immediately beneath or adjacent to building and compare results to soil-gas screening levels."

As discussed above and below, SCS collected various soil vapor samples at the interpreted area of the former USTs excavation, which were compared to ESL values and DTSC health risk models.

7.3.2 Comparison to Historical Data

As indicated in the Regulatory Liaison section above, SCS previously prepared a report for the Site entitled, *Letter Report to Alameda County Department of Environmental Health, Assessor's Parcel Number (APN) 045-5302-010-05, 555 98th Avenue, Oakland, California*, which was dated October 11, 2006. This report provided concentrations of residual CoCs in groundwater at the Site in connection with the former gasoline service station operations. The following table compares historical and current CoC concentrations at the Site:

	TPHg (µg/L)	Benzene (µg/L)	MTBE (µg/L)
Pre-Closure (1995-1996)	Up to 1,300	Up to 5.9	NA
Post-Closure (1997)	Up to 330	Up to 9.3	Up to 3.9
Current (2008)	1,200	ND	ND

Notes:
MTBE: Methyl-butyl ether
TPHg: Total petroleum hydrocarbons as gasoline
µg/L: Micrograms per liter
NA: Not analyzed
ND: None detected above the laboratory detection limit

As indicated in the table above, the concentration of TPHg in groundwater at the Site from current subsurface assessment activities is in the range of TPHg concentrations previous reported for the Site. In addition, concentrations of benzene and methyl-butyl ether (MTBE) were previously detected in the groundwater at the Site; however, were not detected in current soil sampling activities.

7.4 RESIDUAL CONSTITUENTS OF CONCERN IN SOIL VAPOR

7.4.1 Comparison to ESLs

As indicated above, five soil vapor samples were collected at the interpreted area of the former USTs excavation to assess the possible presence of VOCs in connection with human health risk from vapor intrusion. The following table compares the concentrations of the CoC (tetrachloroethene) in the soil vapor at the Site and the ESL (*Table E, Environmental Screening Levels [ESLs], Indoor Air and Soil Gas [Vapor Intrusion Concerns]*):

Constituent	Site Concentration (µg/Lv)	ESL Concentration (µg/Lv)
Tetrachloroethene	0.21	0.41

Notes:
TPHg: Total petroleum hydrocarbons as gasoline
µg/Lv: Micrograms per liter of vapor
ESL: Environmental Screening Level

As indicated in the table above, the highest reported concentration of tetrachloroethene at the Site does not exceed the respective ESL value.

7.4.2 Human Health Risk Assessment

As indicated above, tetrachloroethene was the only VOC detected in the soil vapor in the interpreted area of the former USTs excavation. To evaluate the risk from migration of tetrachloroethene vapors, SCS conducted a human health risk assessment for the Site in connection with the proposed residential land use. The soil vapor sample with the highest tetrachloroethene concentration was used in the analysis. The risk from migration of tetrachloroethene vapors has been evaluated, as described below, by using the DTSC Indoor Air Guidance Unclassified Soil Screening Model (DTSC/HERD, last updated November 1, 2003).

Carcinogenic and non-carcinogenic health risks were calculated. The model inputs and outputs are presented in the following table:

HRA using default values for commercial exposure					
Sample ID	Sample Date	Contaminant of Concern	Model Input Concentration	Excess Cancer Risk	Hazard Index
SV-4	4/11/08	Tetrachloroethene	0.21 µg/L	3.3E-08	3.8E-04

Notes:
µg/l – micrograms per liter

The chemical abstract service number (CAS Number), the soil gas concentration, the depth where each soil gas sample was collected, and the vadose zone soil type were input into the model, but all other parameters were left at residential land use default values.

As indicated in the table above, the calculated health risk at the Site does not exceed the DTSC criterion of one-in-one-million (1.00×10^{-6}) Excess Cancer Risk. In addition, a hazard index of one (significant non-carcinogenic risk criterion) was not exceeded in this analytical model output. The data entry sheet, chemical property sheet, intermediate calculations sheet, and result sheet for the models are included in the appendix of this Report.

8.0 CONCLUSIONS

Based on the information provided above and our experience, it is our professional opinion that there is a very low likelihood that a Significant human health risk exists at the Site in connection with residual concentrations of constituents of concern (CoCs) in the soil, groundwater, and soil vapor beneath the Site (in connection with the former gasoline service station) and the proposed Site land use for residential purposes for the following reasons:

8.1 PREVIOUS SOIL VAPOR SURVEY AND HEALTH RISK ASSESSMENT ACTIVITIES

- A previous soil vapor survey (consisting of 12 soil vapor points) conducted at the Site detected only low concentrations of methylene chloride and toluene in the soil vapor beneath the Site.

- Reported concentrations of volatile organic compounds (VOCs) in the soil vapor beneath the Site were less that Environmental Screening Levels (ESLs) as established by the San Francisco Bay Regional Water Quality Control Board.

- A human health risk assessment using the results of the soil vapor survey and conducted in general accordance with California Department of Toxic Substances Control (DTSC) guidelines for residential Site land use indicated that there is a very low likelihood that a Significant human health risk exists at the Site in connection with vapor intrusion into the proposed Site buildings.

- The laboratory was able to adjust the reporting limits for benzene associated with the previous soil vapor survey and reported that no concentrations of benzene were detected above the reduced laboratory detection limit (discussed in the Regulatory Liaison section above).

8.2 CURRENT SUBSURFACE ASSESSMENT ACTIVITIES

- Concentrations of constituents of concern (CoCs) detected in soil samples beneath the Site are below their respective ESL values.

- With the exception of total petroleum hydrocarbons as gasoline (TPHg), concentrations CoCs detected in the groundwater beneath the Site are below their respective ESL values. Concentrations of TPHg in groundwater exceeds its respective ESL value; however, soil vapor sampling was conducted (as recommended in the above-reference ESL document when groundwater concentrations exceed ESL values), which is described below.

- Concentrations of CoCs in soil vapor beneath the Site do not exceed their respective ESL values.

- A human health risk assessment, conducted in accordance with DTSC guidelines for residential Site land use indicated that there is a very low likelihood that a Significant human health risk exists at the Site in connection with vapor intrusion into the proposed Site buildings.

9.0 RECOMMENDATION

Based on the information described in this report and the conclusions presented above, we recommend that the Alameda County Health Care Services (ACEHS) concur with our professional opinion that there is a very low likelihood that a Significant human health risk exists at the Site in connection with residual concentrations of CoCs in soil, groundwater, and soil vapor beneath the Site (from the historical Site land use as a gasoline service station) and the proposed residential Site development plans.

REPORT USAGE AND FUTURE SITE CONDITIONS

This Report is intended for the sole usage of the Client and the parties designated by SCS. Use of this Report is subject to the provisions of the fully executed Contract between the Client and SCS. Any third party usage of this Report shall be subject to the provisions of the Contract and any unauthorized misuse of or reliance upon the Report shall be without risk or liability to SCS.

The conclusions of this Report are judged to be relevant at the time the work described in this Report was conducted. Future conditions may differ and this Report should not be relied upon to represent future Site conditions unless a qualified consultant familiar with the practice of subsurface assessment activities in Alameda County is consulted to assess the necessity of updating this Report.

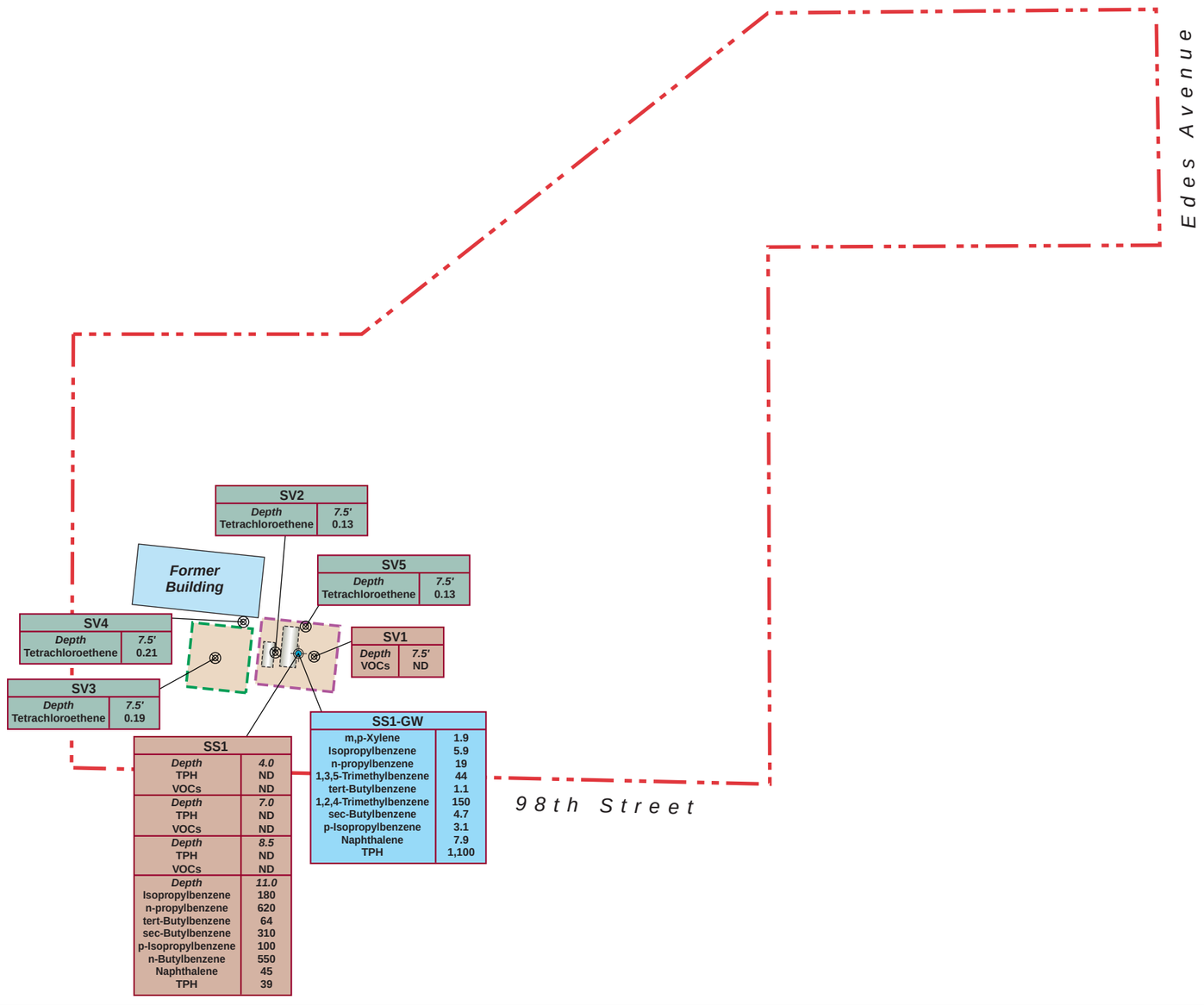
Although this Subsurface Assessment has attempted to assess the likelihood that the Site has been impacted by a hazardous material/waste release, potential sources of impact may have escaped detection for reasons which include, but are not limited to: 1) our reliance on inadequate or inaccurate information rightfully provided to us by third parties, such as public agencies and other outside sources; 2) the limited scope of this Assessment; and 3) the presence of undetected, unknown, or unreported environmental releases.

LIKELIHOOD STATEMENTS

Statements of "likelihood" have been made in this Report. Likelihood statements are based on professional judgments of SCS. The term "likelihood," as used herein, pertains to the probability of a match between the prediction for an event and its actual occurrence. The likelihood statement assigns a measure for a "degree of belief" for the match between the prediction for the event and the actual occurrence of the event.

The likelihood statements in this Report are made qualitatively (expressed in words). The qualitative terms can be approximately related to quantitative percentages. The term "low likelihood" is used by SCS to approximate a range of 10 to 20 percent; the term "moderate likelihood" refers to an approximate range of 40 to 60 percent; and the term "high likelihood" refers to an approximate range of 80 to 90 percent.

SAMPLE LOCATION MAP



EXPLANATION

- Approximate Site boundary
- Interpreted location of former underground storage tanks (UST)
- Soil vapor sample locations
- Soil and groundwater boring location
- Interpreted "correct" location of UST excavation (Soil Tech Engineering, 1996)
- Interpreted "misplotted" location of UST excavation (Soil Tech Engineering, 1994)

SV5	
Depth	*7.5'*
Tetrachloroethene	0.13

Soil vapor samples with depth in feet below current grade, analyzed for volatile organic compounds (VOCs) in general accordance with EPA Method 8260B (compounds not listed were not detected). Results reported in micrograms per liter of vapor (µg/Lv). ND indicates not detected above the laboratory detection limit.

SS1	
Depth	*4.0*
TPH	ND
VOCs	ND
Depth	*7.0*
TPH	ND
VOCs	ND
Depth	*8.5*
TPH	ND
VOCs	ND
Depth	*11.0*
Isopropylbenzene	180
n-propylbenzene	620
tert-Butylbenzene	64
sec-Butylbenzene	310
p-Isopropylbenzene	100
n-Butylbenzene	550
Naphthalene	45
TPH	39

Soil samples with depth in feet below current grade, analyzed for total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) in general accordance with EPA Method 8260B. VOC concentrations are reported in micrograms per kilogram (µg/kg) and TPH concentrations are reported in milligrams per kilogram (mg/kg). ND indicates not detected above the laboratory detection limit.

SS1-GW	
m,p-Xylene	1.9
Isopropylbenzene	5.9
n-propylbenzene	19
1,3,5-Trimethylbenzene	44
tert-Butylbenzene	1.1
1,2,4-Trimethylbenzene	150
sec-Butylbenzene	4.7
p-Isopropylbenzene	3.1
Naphthalene	7.9
TPH	1,100

Groundwater sample analyzed for total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) in general accordance with EPA Method 8260B (compounds not listed were not detected). Results reported in micrograms per liter (µg/L).

0 25 50 75

Approximate Graphic Scale in Feet

North

Disclaimer: This figure is based on available data. Actual conditions may differ. All locations and dimensions are approximate.

SCS ENGINEERS
Environmental Consultants
8799 Balboa Avenue, Suite 290
San Diego, California 92123

SAMPLE LOCATION MAP

AMCAL Multi-Housing, Inc.
555 98th Avenue
Oakland, California

Project No.: 01205501.17

Figure 1

Date Drafted: 4/23/08

TEG LETTER

25 March 2008

Mr. Steve Clements
SCS Engineers
6601 Koll Center Parkway, Suite 140
Pleasanton, CA 94566

SUBJECT: DATA REPORT - SCS Engineers Project # 01207042.00
555 98th Street, Oakland, California

TEG Project # 70531F

Mr. Clements:

TEG reviewed the chromatograms and analytical quantitation reports, generated from the above referenced project, for the presence of benzene.

No benzene was detected in any of the soil vapor samples analyzed at or above the reporting limit of 0.080 µg/L of vapor

Sincerely,

Mark Jerpbak
Director, TEG-Northern California

BORING PERMIT

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: 04/02/2008 By jamesy

Permit Numbers: W2008-0157
Permits Valid from 04/11/2008 to 04/11/2008

Application Id: 1206986119863
City of Project Site: Oakland
Site Location: 555 98th Street
Oakland, CA
Project Start Date: 04/11/2008
Completion Date: 04/11/2008
Requested Inspection: 04/11/2008
Scheduled Inspection: 04/11/2008 at 2:00 PM (Contact your inspector, Vicky Hamlin at (510) 670-5443, to confirm.)

Applicant: SCS Engineers - Ted Sison
6601 Koll Center Parkway, Suite 140, Pleasanton, CA 94566
Phone: 925-426-0080

Property Owner: Leo Freedom Fund, Inc c/o Leo Puig
2082 Michelson Drive, Suite 100, Irvine, CA 92612
Phone: 559-351-3424

Client: ** same as Property Owner **

	Total Due:	$200.00
Receipt Number: WR2008-0098	**Total Amount Paid:**	$200.00
Payer Name : Joe Miller	Paid By: VISA	**PAID IN FULL**

Works Requesting Permits:

Borehole(s) for Investigation-Contamination Study - 4 Boreholes
Driller: TEG - Lic #: 706568 - Method: DP

Work Total: $200.00

Specifications

Permit Number	Issued Dt	Expire Dt	# Boreholes	Hole Diam	Max Depth
W2008-0157	04/02/2008	07/10/2008	4	2.50 in.	16.00 ft

Specific Work Permit Conditions

1. Backfill bore hole by tremie with cement grout or cement grout/sand mixture. Upper two-three feet replaced in kind or with compacted cuttings. All cuttings remaining or unused shall be containerized and hauled off site. The containers shall be clearly labeled to the ownership of the container and labeled hazardous or non-hazardous.

2. Boreholes shall not be left open for a period of more than 24 hours. All boreholes left open more than 24 hours will need approval from Alameda County Public Works Agency, Water Resources Section. All boreholes shall be backfilled according to permit destruction requirements and all concrete material and asphalt material shall be to Caltrans Spec or County/City Codes. No borehole(s) shall be left in a manner to act as a conduit at any time.

3. 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.

4. 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.

Alameda County Public Works Agency - Water Resources Well Permit

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. 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.

7. Permit is valid only for the purpose specified herein. No changes in construction procedures, as described on this permit application. Boreholes shall not be converted to monitoring wells, without a permit application process.

HISTORICAL RESOUCES

File No. 10-93-570-ST

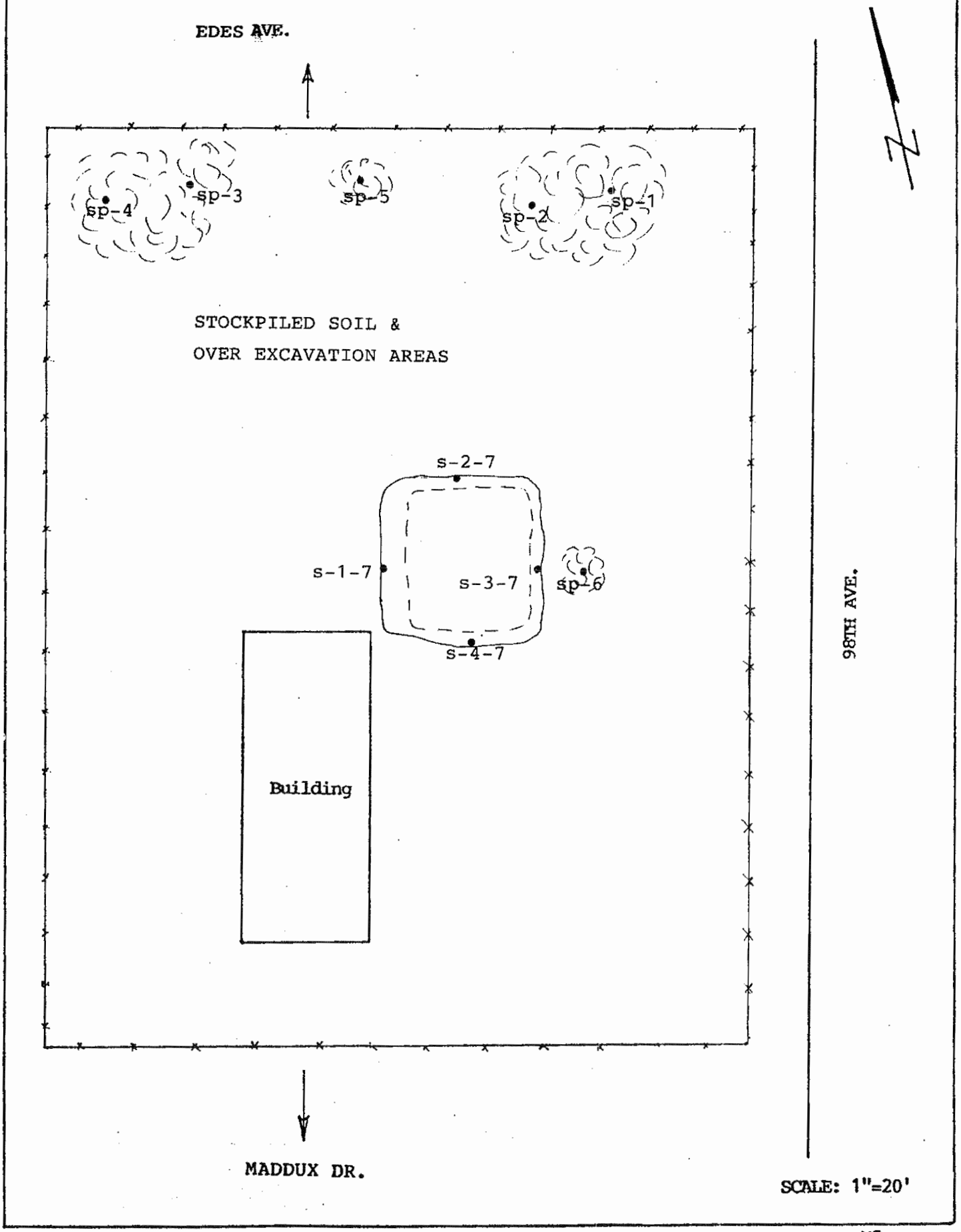


Figure 2

SOIL TECH ENGINEERING, INC.

M2

File No. 10-93-570-ST

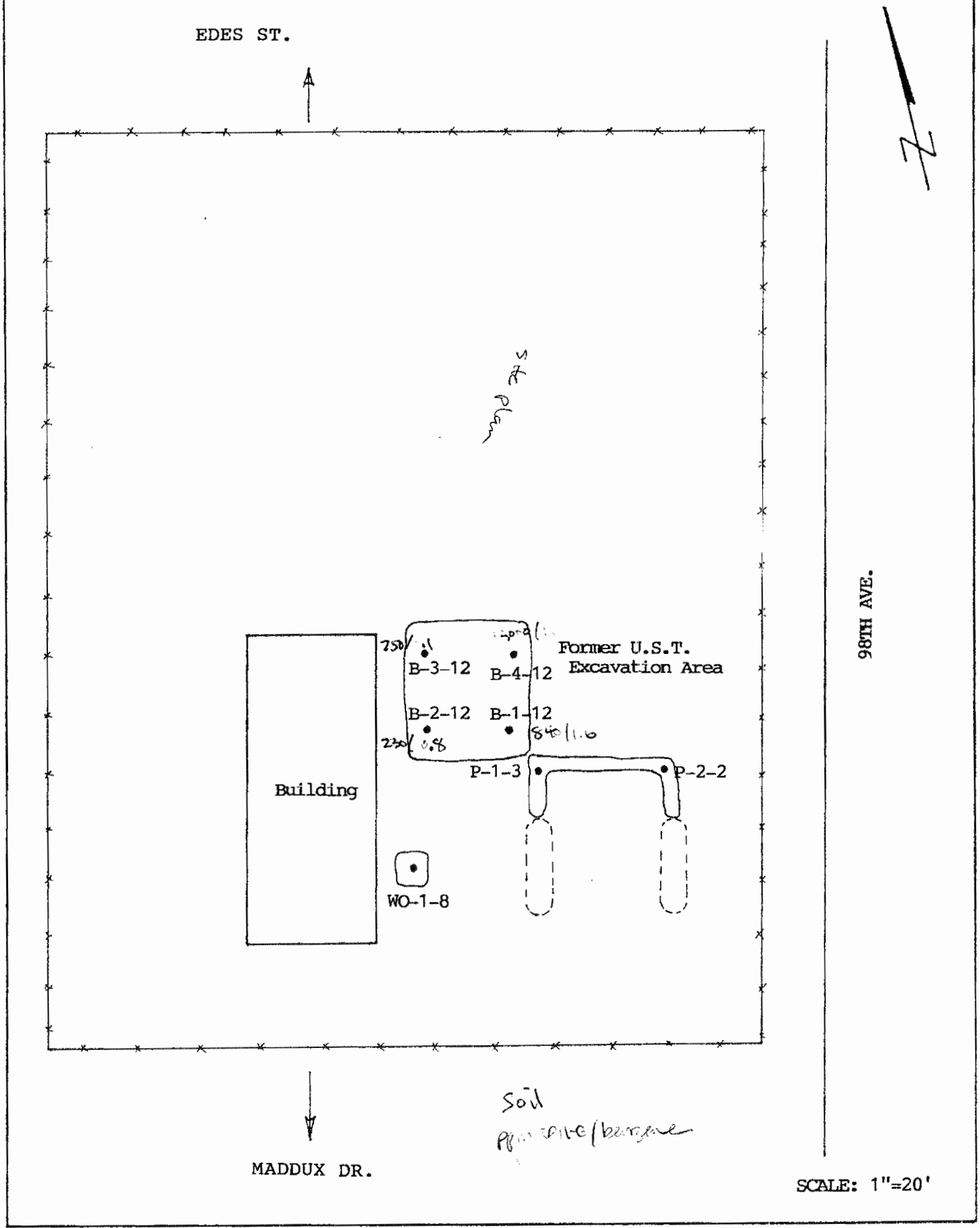


Figure 2

SOIL TECH ENGINEERING, INC.

M2

File No. TR108

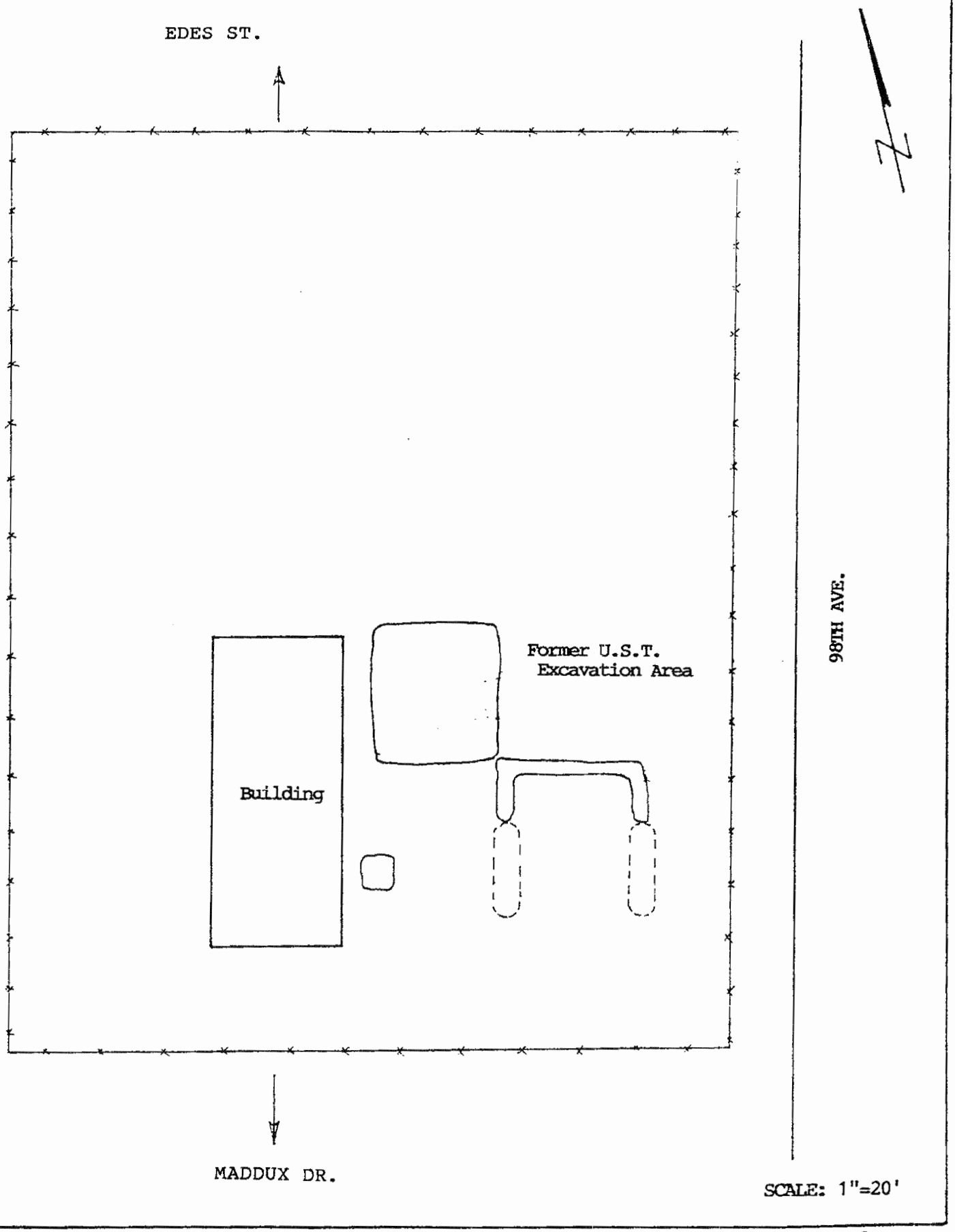
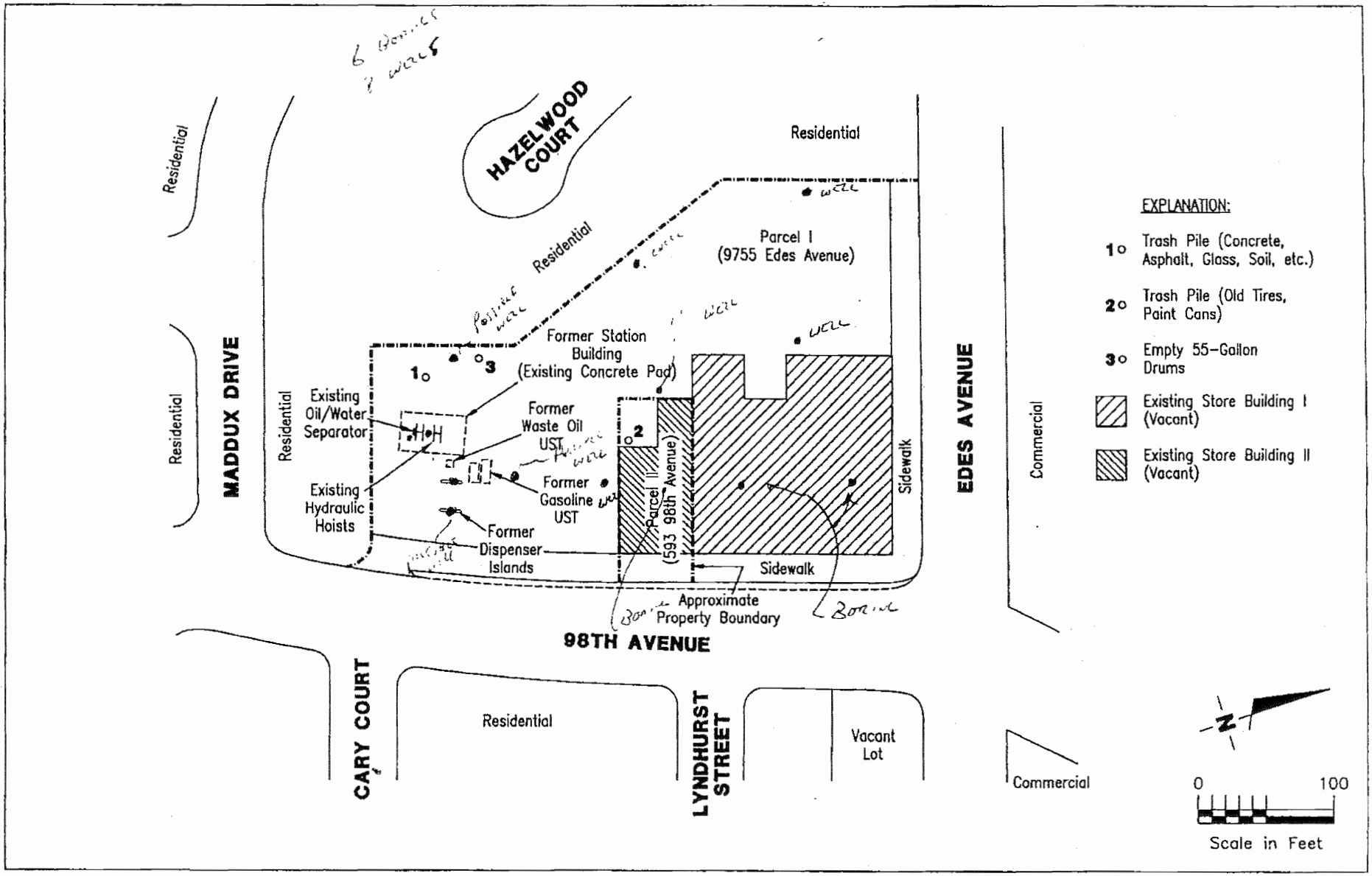


Figure 2

ALPHA GEO SERVICES

M2



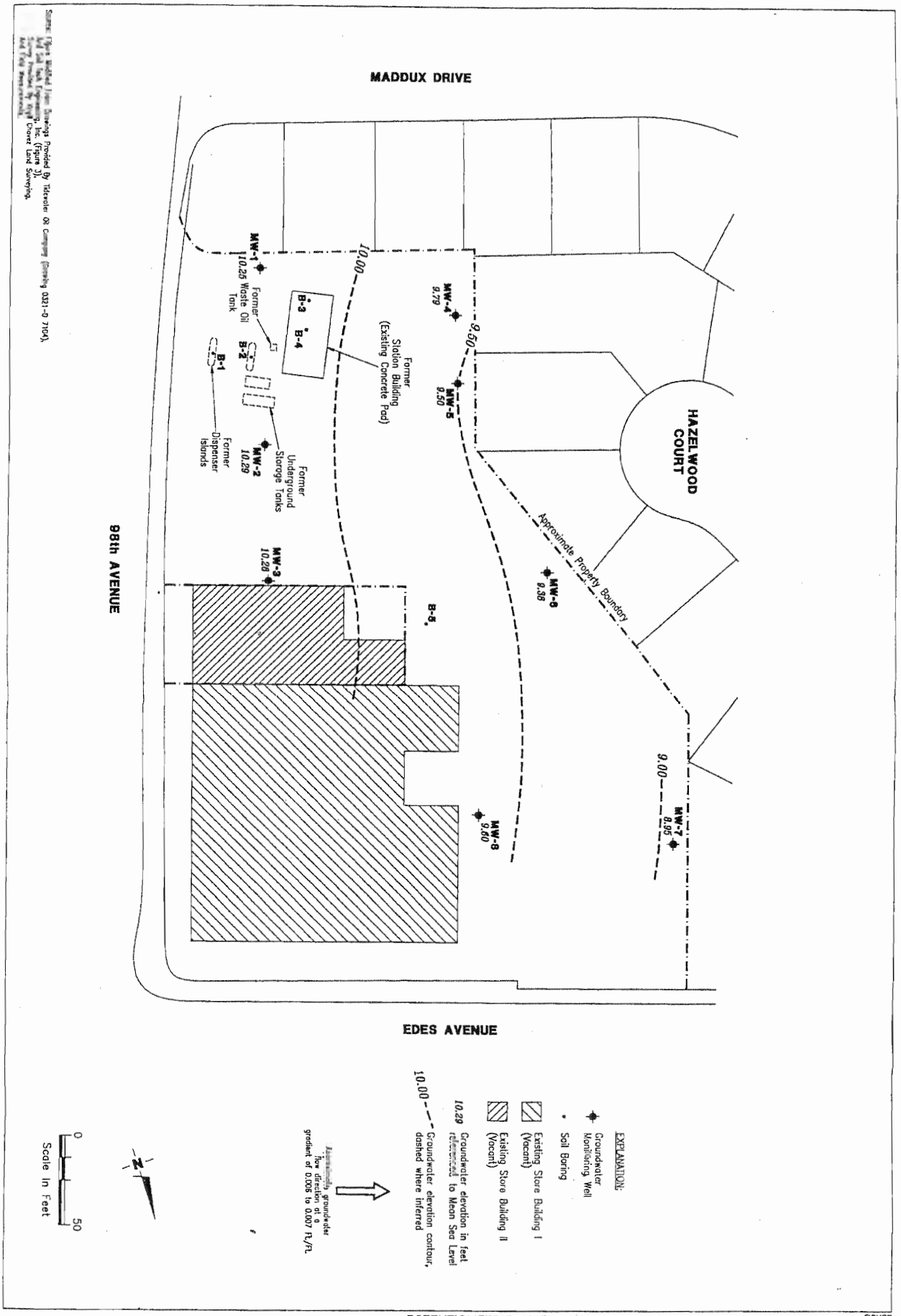
Gettler - Ryan Inc.

6747 Sierra Ct., Suite J
Dublin, CA 94568
(510) 551-7555

SITE PLAN
Freedom Fund Foundation Property
9755 Edes Avenue/593 98th Avenue
Oakland, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
6409		08/97	



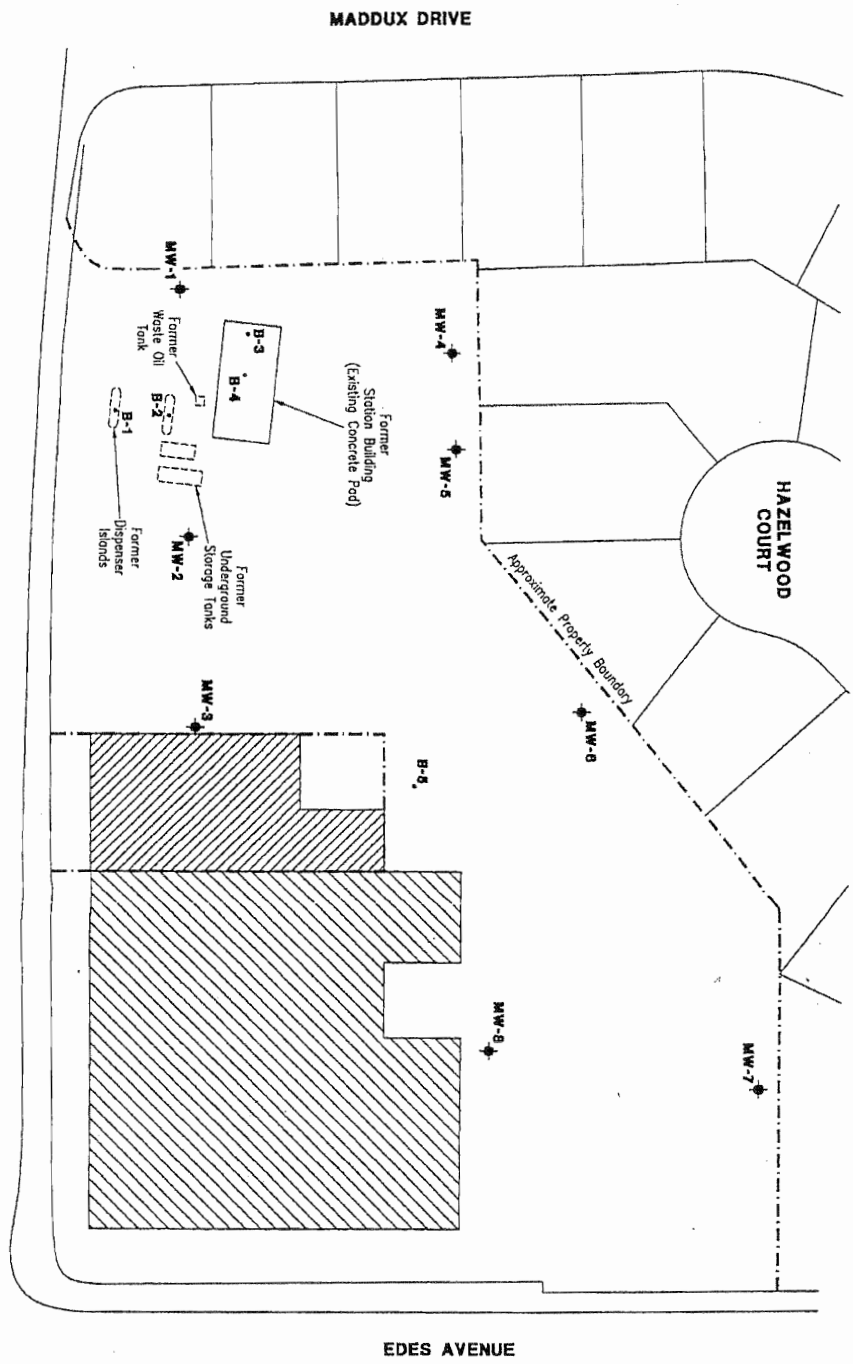
SOURCE: Plant Modified From Drawings Provided By Interstate Oil Company (Drawing 0321-D 7104), And Topographic Survey (Figure 3) Prepared By Kier & Wright Civil Engineers & Surveyors, And Field Measurements.

Gettler - Ryan Inc.
6747 Sierra Ct., Suite J (510) 551-7555
Dublin, CA 94568

POTENTIOMETRIC MAP
Freedom Fund Inc.
9755 Edes Avenue/593 98th Avenue
Oakland, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
6409		October 6, 1997	



Source: Figure Modified From Drawings Provided By Tidewater Oil Company (Drawing 0321-D 7104), And Soil Tech Engineering, Inc. (Figure 3). Survey Provided By Virgil Chavez Land Surveying, And Field Measurements.

Gettler - Ryan Inc.

6747 Sierra Ct., Suite J (510) 551-7555
Dublin, CA 94568

SITE MAP
Freedom Fund Inc.
9755 Edes Avenue/593 98th Avenue
Oakland, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
6409		10/97	


INQUIRY #: 1750477.5
YEAR: 1965
= 333'
N

LABORATORY RESULTS

AND CHAIN-OF-CUSTODY DOCUMENTATION

TEG Project #80411D

SCS Engineers Project # 01207042.00
555 98th Avenue, Oakland, California

EPA Method 8260B Analyses of SOIL VAPOR in ug/L of Vapor

SAMPLE NUMBER:	RL	Probe Blank	SV-1	SV-1	SV-1	SV-2	SV-3	SV-3 dup	SV-4	SV-5
SAMPLE DEPTH (feet):			7.5	7.5	7.5	7.5	7.5	7.5	8.5	7.5
PURGE VOLUME:			1	3	7	3	3	3	3	3
COLLECTION DATE:		4/11/08	4/11/08	4/11/08	4/11/08	4/11/08	4/11/08	4/11/08	4/11/08	4/11/08
COLLECTION TIME:		09:21	09:44	10:08	10:30	11:00	11:20	12:35	11:38	12:04
DILUTION FACTOR:		1	1	1	1	1	1	1	1	1
Dichlorodifluoromethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chloromethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Vinyl Chloride	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Bromomethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Methylene Chloride	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Methyl-t-butyl ether (MtBE)	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chloroform	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Bromochloromethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzene	0.080	nd	nd	nd	nd	nd	nd	nd	nd	nd
Trichloroethene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloropropane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Bromodichloromethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dibromomethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Toluene	0.20	nd	nd	nd	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Tetrachloroethene	0.10	nd	nd	nd	nd	0.13	0.19	0.18	0.21	0.13
Dibromochloromethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chlorobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ethylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
m,p-Xylene	0.20	nd	nd	nd	nd	nd	nd	nd	nd	nd
o-Xylene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Styrene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Bromoform	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Isopropylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
n-propylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Bromobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
n-Butylbenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Naphthalene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	0.10	nd	nd	nd	nd	nd	nd	nd	nd	nd
TPH (gasoline range)	10	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,1 Diflouroethane (leak check)	10	nd	nd	nd	nd	nd	nd	nd	nd	nd
Surrogate Recovery (DBFM)		105%	106%	108%	107%	105%	104%	104%	105%	107%
Surrogate Recovery (1,2-DCA-d4)		113%	115%	123%	123%	114%	111%	114%	114%	115%
Surrogate Recovery (Toluene-d8)		100%	102%	103%	104%	101%	102%	101%	102%	102%
Surrogate Recovery (1,4-BFB)		100%	99%	103%	103%	100%	100%	99%	99%	100%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Jon Edmondson

11350 Monier Park Place, Rancho Cordova, CA 95742 Phone: (916) 853-8010 Fax: (916) 853-8020

TEG Project #80411D

CALIBRATION DATA - Calibration Check Compounds

	Vinyl Cl	1,1 DCE	Cl-Form	1,2 DCP	Toluene	Ethylbenzene
Midpoint	100	100	100	100	100	100
Continuing Calibration - Midpoint						
4/11/08	104.0	98.1	104.2	110.3	97.6	107.8
	104.0%	98.1%	104.2%	110.3%	97.6%	107.8%

TEG Project #80411D

SCS Engineers Project # 01207042.00
555 98th Avenue, Oakland, California

EPA Method 8260B Analyses of WATER in ug/L

SAMPLE NUMBER:		Blank	SS-1GW	SS-1GW dup
COLLECTION DATE:			04/11/08	04/11/08
ANALYSIS DATE:		04/11/08	04/11/08	04/11/08
DILUTION FACTOR:			1	1
	RL			
Dichlorodifluoromethane	1.0	nd	nd	nd
Chloromethane	1.0	nd	nd	nd
Vinyl Chloride	1.0	nd	nd	nd
Bromomethane	1.0	nd	nd	nd
Chloroethane	1.0	nd	nd	nd
Trichlorofluoromethane	1.0	nd	nd	nd
1,1-Dichloroethene	1.0	nd	nd	nd
Methylene Chloride	1.0	nd	nd	nd
Methyl-t-butyl ether (MTBE)	1.0	nd	nd	nd
trans-1,2-Dichloroethene	1.0	nd	nd	nd
1,1-Dichloroethane	1.0	nd	nd	nd
2,2-Dichloropropane	1.0	nd	nd	nd
cis-1,2-Dichloroethene	1.0	nd	nd	nd
Chloroform	1.0	nd	nd	nd
Bromochloromethane	1.0	nd	nd	nd
1,1,1-Trichloroethane	1.0	nd	nd	nd
1,1-Dichloropropene	1.0	nd	nd	nd
Carbon Tetrachloride	1.0	nd	nd	nd
1,2-Dichloroethane	1.0	nd	nd	nd
Benzene	1.0	nd	nd	nd
Trichloroethene	1.0	nd	nd	nd
1,2-Dichloropropane	1.0	nd	nd	nd
Bromodichloromethane	1.0	nd	nd	nd
Dibromomethane	1.0	nd	nd	nd
cis-1,3-Dichloropropene	1.0	nd	nd	nd
Toluene	1.0	nd	nd	nd
trans-1,3-Dichloropropene	1.0	nd	nd	nd
1,1,2-Trichloroethane	1.0	nd	nd	nd
1,2-Dibromoethane	1.0	nd	nd	nd
1,3-Dichloropropane	1.0	nd	nd	nd
Tetrachloroethene	1.0	nd	nd	nd
Dibromochloromethane	1.0	nd	nd	nd
Chlorobenzene	1.0	nd	nd	nd
Ethylbenzene	1.0	nd	nd	nd
1,1,1,2-Tetrachloroethane	1.0	nd	nd	nd
m,p-Xylene	1.0	nd	2.0	1.9
o-Xylene	1.0	nd	nd	nd
Styrene	1.0	nd	nd	nd
Bromoform	1.0	nd	nd	nd
Isopropylbenzene	1.0	nd	5.9	5.9
1,1,2,2-Tetrachloroethane	1.0	nd	nd	nd
1,2,3-Trichloropropane	1.0	nd	nd	nd
n-propylbenzene	1.0	nd	20	19
Bromobenzene	1.0	nd	nd	nd
1,3,5-Trimethylbenzene	1.0	nd	44	44
2-Chlorotoluene	1.0	nd	nd	nd
4-Chlorotoluene	1.0	nd	nd	nd
tert-Butylbenzene	1.0	nd	1.1	1.1
1,2,4-Trimethylbenzene	1.0	nd	160	150
sec-Butylbenzene	1.0	nd	5.0	4.7
p-Isopropyltoluene	1.0	nd	3.3	3.1
1,3-Dichlorobenzene	1.0	nd	nd	nd
1,4-Dichlorobenzene	1.0	nd	nd	nd
n-Butylbenzene	1.0	nd	nd	nd
1,2-Dichlorobenzene	1.0	nd	nd	nd
1,2-Dibromo-3-chloropropane	1.0	nd	nd	nd
1,2,4-Trichlorobenzene	1.0	nd	nd	nd
Hexachlorobutadiene	1.0	nd	nd	nd
Naphthalene	1.0	nd	8.0	7.9
1,2,3-Trichlorobenzene	1.0	nd	nd	nd
TPH-gasoline range (C5-C11)	50	nd	1200	1100
Surrogate Recovery (DBFM)		104%	103%	103%
Surrogate Recovery (1,2-DCA-d4)		110%	111%	116%
Surrogate Recovery (Toluene-d8)		101%	103%	102%
Surrogate Recovery (1,4-BFB)		100%	102%	101%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Jon Edmondson

11350 Monier Park Place, Rancho Cordova, CA 95742 Phone: (916) 853-8010 Fax: (916) 853-8020

TEG Project #80411D

SCS Engineers Project # 01207042.00
555 98th Avenue, Oakland, California

EPA Method 8260B Analyses of SOIL in ug/Kg (mg/kg for TPH-Gasoline)

SAMPLE NUMBER:		Blank	SS-1,4	SS-1,4 dup	SS-1,7	SS-1,8.5	SS-1,11.5
COLLECTION DATE:			04/11/08	04/11/08	04/11/08	04/11/08	04/11/08
ANALYSIS DATE:		04/14/08	04/14/08	04/14/08	04/14/08	04/14/08	04/14/08
DILUTION FACTOR:		1	1	1	1	1	5
	RL						
Dichlorodifluoromethane	5.0	nd	nd	nd	nd	nd	nd
Chloromethane	5.0	nd	nd	nd	nd	nd	nd
Vinyl Chloride	5.0	nd	nd	nd	nd	nd	nd
Bromomethane	5.0	nd	nd	nd	nd	nd	nd
Chloroethane	5.0	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Methylene Chloride	5.0	nd	nd	nd	nd	nd	nd
Methyl-t-butyl ether (MTBE)	5.0	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Chloroform	5.0	nd	nd	nd	nd	nd	nd
Bromochloromethane	5.0	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
Benzene	5.0	nd	nd	nd	nd	nd	nd
Trichloroethene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Bromodichloromethane	5.0	nd	nd	nd	nd	nd	nd
Dibromomethane	5.0	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Toluene	5.0	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Tetrachloroethene	5.0	nd	nd	nd	nd	nd	nd
Dibromochloromethane	5.0	nd	nd	nd	nd	nd	nd
Chlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Ethylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
m,p-Xylene	5.0	nd	nd	nd	nd	nd	nd
o-Xylene	5.0	nd	nd	nd	nd	nd	nd
Styrene	5.0	nd	nd	nd	nd	nd	nd
Bromoform	5.0	nd	nd	nd	nd	nd	nd
Isopropylbenzene	5.0	nd	nd	nd	nd	nd	180
1,1,2,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	5.0	nd	nd	nd	nd	nd	nd
n-propylbenzene	5.0	nd	nd	nd	nd	nd	620
Bromobenzene	5.0	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	5.0	nd	nd	nd	nd	nd	64
1,2,4-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	5.0	nd	nd	nd	nd	nd	310
p-Isopropyltoluene	5.0	nd	nd	nd	nd	nd	100
1,3-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
n-Butylbenzene	5.0	nd	nd	nd	nd	nd	550
1,2-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	5.0	nd	nd	nd	nd	nd	nd
Naphthalene	5.0	nd	nd	nd	nd	nd	45
1,2,3-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
TPH-gasoline range (C5-C11)	1.0	nd	nd	nd	nd	nd	39
Surrogate Recovery (DBFM)		91%	136%	157%	118%	104%	98%
Surrogate Recovery (1,2-DCA-d4)		85%	134%	144%	108%	96%	92%
Surrogate Recovery (Toluene-d8)		97%	144%	157%	117%	109%	114%
Surrogate Recovery (1,4-BFB)		95%	147%	170%	107%	109%	96%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Jon Edmondson

11350 Monier Park Place, Rancho Cordova, CA 95742 Phone: (916) 853-8010 Fax: (916) 853-8020

TEG Northern California, Inc.

Chain of Custody Record

Page: 1 of 1

11350 Monier Park Place
Rancho Cordova, CA 95742
Ph: 916.853.8010
Fax: 916.853.8020

Project Manager: S. Clements E-Mail: sclements@scsenv.com

Client: SCS Engineers TEG Project #: 80411D Client Project #: 01207092.00

Address: 6601 Koll Center Pkwy Suite 140 Location: 555 98th Ave Oakland CA

Pleasanton CA 94566 Collector: [illegible] Date of Collection: 4-11-08

Phone: 925-426-0888 Fax: 925-426-0707

Sample Designation	Depth	Date / Time	Sample Matrix	Container Type	EPA 8260B (Full List)	EPA 8260B (DTSC List)	EPA 8260B (BTEX & MTBE)	5 Oxygenates (8260B)	5 Oxygenates, BTEX (8260B)	TPH gasoline (8260B)	TPH 8015mod (gas)	TPH 8015mod (diesel)	TPH 8015mod (motor oil)	MTBE by 8260B	Field Notes	# of containers
SS-1, 4	4	4-11-08	Soil	Sleeve	X				X			X			~~Lookout~~ JZ	1
SS-1, 7	7	↓	↓	↓	X				X			X				1
SS-1, 8.5	8.5				X				X			X				1
SS-1, 11.5	11.5				X				X			X				4
SS-1 (GW)	19		H2O	4 VOAs	X				X			X				
END																

Relinquished by:	Date / Time	Received by	Date / Time
Soil	4-11-08 / 12:17		4-11-08 12:18
Relinquished by:	Date / Time	Received by	Date / Time
WATER	4-11-08 / 12:45		4-11-08 12:46
Relinquished by	Date / Time	Received by	Date / Time

Sample Receipt:

Good Condition?	Y
Cold?	NA
Seals Intact?	NA
Total Number of Containers	8

Remarks: Placed in Refridgerator upon Receipt. JZ

Distribution: White - Lab, Yellow - File, Pink - Originator

Sample disposal Instructions: __ Return to client __ Pickup

BORING LOG

SCS ENGINEERS

BORING LOG

6601 Koll Center Parkway, Suite 140
Pleasanton, California 94568

BORING NUMBER: SS-1

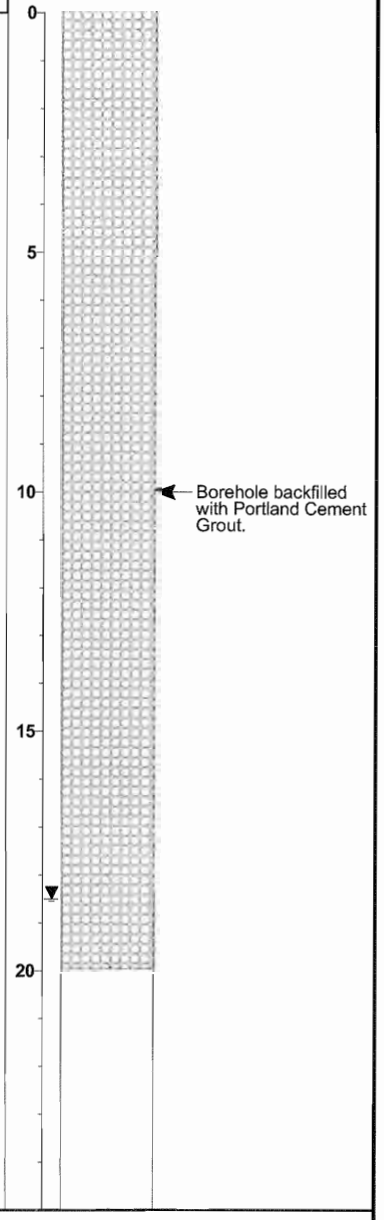
Amcal Site
555 98th Street
Oakland, CA

JOB NUMBER: 01205501.17 Task 3

REMARKS:
Ground surface at SS-1 covered with grassy weeds and appears approximately 2.5 feet higher than original grade when compared to surrounding grade.

Depth (meters)	Depth (feet)	Sample Location	Sample Number	Blow Counts	OVM (ppm)	USCS Soil Class.	Graphic Log	Description
0	0							No Recovery: Appears to be artificial fill.
1			SS-1 4		ND	CL		Poor Recovery: Silty clay, few fine to coarse sands, brown to very dark brown, dry, no odor.
	5							
2			SS-1 7		ND			Poor Recovery: Quarry fines, very little clay, brown/gray, slightly moist, no odor.
			SS-1 8.5		ND	CL		Clay, little silt, low plasticity, brown, moist, no odor.
3	10							
			SS-1 11.5		53	CL		Clay, little silt, color changes from brown to gray @ 11' and has a moderate hydrocarbon odor.
4								
	15							Clay, little silt, color changes from gray to brown @ 14' with no hydrocarbon odor.
5								
6	20					SW		Well graded sand, very little clay, few sub-rounded fine gravels, wet, no odor.
7								
	25							

Completion Detail



Drilling Company: **TEG**
Drilling Method: **Direct Push**
Logged By: **T. Sison**
Sampling Method: **Continuous Core/ Acetate Sleeve**

Date Started: **4/11/08**
Date Ended: **4/11/08**
Boring Diameter: **2.5 inch**

Depth to Water: **18.5 ft**
Total Depth: **20.0 ft**

STANDARD_LOG AMCAL OAKLAND.GPJ STD_LOG.GDT 4/21/08

ENVIRONMENTAL SCREENING LEVEL TABLES

Table C. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater IS a Current or Potential Source of Drinking Water

Chemical	[1]Deep Soil		[3]Groundwater (ug/L)
	[2]Residential Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)	
Acenaphthene	1.6E+01	1.6E+01	2.0E+01
Acenaphthylene	8.9E+01	8.9E+01	2.1E+02
Acetone	2.1E+00	2.1E+00	6.3E+03
Aldrin	1.5E+00	1.5E+00	2.0E-03
Anthracene	8.5E+01	8.5E+01	2.2E+01
Antimony	2.8E+02	2.8E+02	6.0E+00
Arsenic	1.4E+01	1.4E+01	5.0E+01
Barium	2.5E+03	2.6E+03	1.0E+03
Benzene	4.4E-02	4.4E-02	1.0E+00
Benzo(a)anthracene	1.2E+01	1.2E+01	2.9E-02
Benzo(b)fluoranthene	1.5E+01	1.5E+01	2.9E-02
Benzo(k)fluoranthene	2.7E+00	2.7E+00	2.9E-02
Benzo(g,h,i)perylene	3.5E+01	3.5E+01	1.3E-01
Benzo(a)pyrene	1.5E+00	1.5E+00	2.0E-01
Beryllium	9.8E+01	9.8E+01	4.0E+00
1,1-Biphenyl	6.5E-01	6.5E-01	5.0E-01
Bis(2-chloroethyl) ether	4.0E-04	4.0E-04	3.2E-02
Bis(2-chloroisopropyl) ether	1.5E-04	1.5E-04	1.4E-02
Bis(2-ethylhexyl) phthalate	7.8E+02	7.8E+02	4.0E+00
Boron	4.6E+04	4.6E+04	1.0E+03
Bromodichloromethane	1.9E+00	1.9E+00	1.0E+02
Bromoform (Tribromomethane)	2.2E+00	2.2E+00	1.0E+02
Bromomethane	3.9E-01	3.9E-01	9.8E+00
Cadmium	3.9E+01	3.9E+01	5.0E+00
Carbon tetrachloride	1.1E-01	1.1E-01	5.0E-01
Chlordane	1.5E+01	1.5E+01	1.0E-01
p-Chloroaniline	3.0E-01	3.0E-01	2.8E+01
Chlorobenzene	3.0E+00	3.0E+00	5.0E+01
Chloroethane	8.5E-01	8.5E-01	1.2E+01
Chloroform	2.1E+00	2.1E+00	7.0E+01
Chloromethane	6.4E+00	6.4E+00	4.1E+01
2-Chlorophenol	1.2E-02	1.2E-02	1.8E-01
Chromium (total)	2.5E+03	5.0E+03	5.0E+01
Chromium III	2.5E+03	5.0E+03	5.0E+04
Chromium VI	5.3E-01	5.3E-01	2.1E+01
Chrysene	5.3E+01	5.3E+01	8.0E-01
Cobalt	9.4E+01	9.4E+01	1.4E+02
Copper	2.5E+03	5.0E+03	1.0E+03
Cyanide	5.4E-01	5.4E-01	1.5E+02
Dibenz(a,h)anthracene	2.4E+00	2.4E+00	4.8E-03
Dibromochloromethane	8.3E+00	8.3E+00	1.0E+02
1,2-dibromo-3-chloropropane	4.5E-03	4.5E-03	2.0E-01
1,2-Dibromoethane	3.3E-04	3.3E-04	5.0E-02
1,2-Dichlorobenzene	1.1E+00	1.1E+00	1.0E+01

Table C. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater IS a Current or Potential Source of Drinking Water

	[1]Deep Soil		
Chemical	[2]Residential Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)	[3]Groundwater (ug/L)
1,3-Dichlorobenzene	2.4E+01	2.4E+01	2.1E+02
1,4-Dichlorobenzene	5.9E-01	5.9E-01	5.0E+00
3,3-Dichlorobenzidine	7.7E-03	7.7E-03	2.9E-02
Dichlorodiphenyldichloroethane (DDD)	1.1E+02	1.1E+02	1.5E-01
Dichlorodiphenyldichloroethene (DDE)	7.6E+01	7.6E+01	1.0E-01
Dichlorodiphenyltrichloroethane (DDT)	4.3E+00	4.3E+00	1.0E-01
1,1-Dichloroethane	2.0E-01	2.0E-01	5.0E+00
1,2-Dichloroethane	4.5E-03	4.5E-03	5.0E-01
1,1-Dichloroethene	1.0E+00	1.0E+00	6.0E+00
cis-1,2-Dichloroethene	1.9E-01	1.9E-01	6.0E+00
trans-1,2-Dichloroethene	6.7E-01	6.7E-01	1.0E+01
2,4-Dichlorophenol	3.0E-01	3.0E-01	3.0E-01
1,2-Dichloropropane	1.2E-01	1.2E-01	5.0E+00
1,3-Dichloropropene	5.9E-02	5.9E-02	5.0E-01
Dieldrin	2.7E-03	2.7E-03	2.2E-03
Diethyl phthalate	1.3E+02	1.3E+02	5.6E+03
Dimethyl phthalate	1.0E+03	1.2E+03	5.0E+04
2,4-Dimethylphenol	6.7E-01	6.7E-01	1.0E+02
2,4-Dinitrophenol	4.0E-01	4.0E-01	1.4E+02
2,4-Dinitrotoluene	3.9E-04	3.9E-04	5.1E-02
1,4-Dioxane	1.8E-03	1.8E-03	3.0E+00
Dioxin (2,3,7,8-TCDD)	2.4E-04	2.4E-04	3.0E-05
Endosulfan	2.2E+01	2.2E+01	4.2E+01
Endrin	5.6E-01	5.6E-01	2.0E+00
Ethylbenzene	3.3E+00	3.3E+00	3.0E+01
Fluoranthene	8.4E+02	8.4E+02	1.3E+02
Fluorene	6.4E+02	6.4E+02	2.8E+02
Heptachlor	3.7E-02	3.7E-02	1.0E-02
Heptachlor epoxide	3.8E-02	3.8E-02	1.0E-02
Hexachlorobenzene	1.2E+01	1.2E+01	1.0E+00
Hexachlorobutadiene	2.2E+00	2.2E+00	4.5E-01
γ-Hexachlorocyclohexane (Lindane)	1.2E-01	1.2E-01	2.0E-01
Hexachloroethane	3.0E+00	3.0E+00	9.0E-01
Indeno(1,2,3-c,d)pyrene	1.3E+01	1.3E+01	4.8E-02
Lead	7.5E+02	7.5E+02	1.5E+01
Mercury (elemental)	3.3E+01	3.3E+01	2.0E+00
Methoxychlor	2.6E+02	2.6E+02	2.0E+01
Methylene chloride	7.7E-02	7.7E-02	5.0E+00
Methyl ethyl ketone	3.9E+00	3.9E+00	4.2E+03
Methyl isobutyl ketone	2.8E+00	2.8E+00	1.2E+02
Methyl mercury	4.1E+01	4.1E+01	7.0E-01
2-Methylnaphthalene	1.2E+00	1.2E+00	1.0E+01
tert-Butyl methyl ether	2.3E-02	2.3E-02	5.0E+00
Molybdenum	2.5E+03	3.6E+03	3.5E+01

Table C. Environmental Screening Levels (ESLs)
Deep Soils (>3m bgs)
Groundwater IS a Current or Potential Source of Drinking Water

Chemical	[1]Deep Soil		[3]Groundwater (ug/L)
	[2]Residential Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)	
Naphthalene	3.4E+00	3.4E+00	1.7E+01
Nickel	2.6E+02	2.6E+02	1.0E+02
Pentachlorophenol	9.9E+01	9.9E+01	1.0E+00
Perchlorate	5.0E+02	5.0E+02	6.0E+00
Phenanthrene	4.9E+02	4.9E+02	2.1E+02
Phenol	7.6E-02	7.6E-02	5.0E+00
Polychlorinated biphenyls (PCBs)	3.4E+00	3.4E+00	5.0E-01
Pyrene	1.0E+03	1.2E+03	6.8E+01
Selenium	2.5E+03	3.6E+03	5.0E+01
Silver	2.5E+03	3.6E+03	3.5E+01
Styrene	1.5E+00	1.5E+00	1.0E+01
tert-Butyl alcohol			
1,1,1,2-Tetrachloroethane	2.4E-02	2.4E-02	1.3E+00
1,1,2,2-Tetrachloroethane	1.8E-02	1.8E-02	1.0E+00
Tetrachloroethene	7.0E-01	7.0E-01	5.0E+00
Thallium	5.7E+01	5.7E+01	2.0E+00
Toluene	2.9E+00	2.9E+00	4.0E+01
Toxaphene	6.4E+00	6.4E+00	3.0E+00
TPH (gasolines)	8.3E+01	8.3E+01	1.0E+02
TPH (middle distillates)	8.3E+01	8.3E+01	1.0E+02
TPH (residual fuels)	5.0E+03	5.0E+03	1.0E+02
1,2,4-Trichlorobenzene	1.5E+00	1.5E+00	5.0E+00
1,1,1-Trichloroethane	2.5E+01	2.5E+01	2.0E+02
1,1,2-Trichloroethane	7.0E-02	7.0E-02	5.0E+00
Trichloroethene	4.6E-01	4.6E-01	5.0E+00
2,4,5-Trichlorophenol	3.2E+00	3.2E+00	2.0E+02
2,4,6-Trichlorophenol	2.3E-01	2.3E-01	7.0E-01
Vanadium	7.1E+02	7.1E+02	1.5E+01
Vinyl chloride	8.5E-02	8.5E-02	5.0E-01
Xylenes	2.3E+00	2.3E+00	2.0E+01
Zinc	2.5E+03	5.0E+03	5.0E+03

Notes:

1. Deep soils defined as soils greater than 3 meters (approximately 10 feet) below ground surface.
2. Category "Residential Land Use" generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.)
3. Assumes potential discharge of groundwater into a freshwater, marine or estuary surface water system.

Soil ESLs intended to address human health, groundwater protection and nuisance concerns under a construction/trench worker exposure scenario and noted land-use scenarios. **Soil gas data should be collected for additional evaluation of potential indoor-air impacts at sites with significant areas of VOC-contaminated soil.**

Groundwater ESLs intended to be address drinking water, surface water, indoor-air and nuisance concerns. **Use in conjunction with soil gas screening levels to more closely evaluate potential impacts to indoor-air if groundwater screening levels for this concern approached or exceeded.**

Aquatic habitat goals for bioaccumulation concerns not considered in selection of groundwater goals.

Soil and water ESLs for ethanol based on gross contamination concerns (see Appendix 1, Chapter 5 and related tables).

TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

Table E-1. Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (volatile chemicals only)

Chemical	Physical State		Residential Land Use (µg/L)	Commercial/Industrial Land Use (µg/L)
Acenaphthene	V	S	4.2E+03	4.2E+03
Acenaphthylene	V	S	(Use soil gas)	(Use soil gas)
Acetone	V	L	5.3E+07	1.5E+08
Aldrin	NV	S		
Anthracene	V	S	4.3E+01	4.3E+01
Antimony	NV	S		
Arsenic	NV	S		
Barium	NV	S		
Benzene	V	L	5.4E+02	1.8E+03
Benzo(a)anthracene	NV	S		
Benzo(b)fluoranthene	NV	S		
Benzo(k)fluoranthene	NV	S		
Benzo(g,h,i)perylene	NV	S		
Benzo(a)pyrene	NV	S		
Beryllium	NV	S		
1,1-Biphenyl	V	S	(Use soil gas)	(Use soil gas)
Bis(2-chloroethyl) ether	V	L	6.5E+01	2.2E+02
Bis(2-chloroisopropyl) ether	V	L	(Use soil gas)	(Use soil gas)
Bis(2-ethylhexyl) phthalate	NV	S		
Boron	NV	S		
Bromodichloromethane	V	L	1.7E+02	5.6E+02
Bromoform (Tribromomethane)	NV	S		
Bromomethane	V	G	5.8E+02	1.6E+03
Cadmium	NV	S		
Carbon tetrachloride	V	L	9.3E+00	3.1E+01
Chlordane	NV	S		
p-Chloroaniline	NV	S		
Chlorobenzene	V	L	1.3E+04	3.7E+04
Chloroethane	V	G	8.2E+02	2.7E+03
Chloroform	V	L	3.3E+02	1.1E+03
Chloromethane	V	G	4.1E+01	1.4E+02
2-Chlorophenol	V	L	5.3E+03	1.5E+04
Chromium (total)	NV	S		
Chromium III	NV	S		
Chromium VI	NV	S		
Chrysene	NV	S	(Use soil gas)	(Use soil gas)
Cobalt	NV	S		
Copper	NV	S		
Cyanide	NV	S	(Use soil gas)	(Use soil gas)
Dibenz(a,h)anthracene	NV	S		
Dibromochloromethane	V	S	1.7E+02	5.7E+02
1,2-dibromo-3-chloropropane	V	L	(Use soil gas)	(Use soil gas)
1,2-Dibromoethane	V	S	1.5E+02	5.1E+02
1,2-Dichlorobenzene	V	L	7.7E+04	1.6E+05
1,3-Dichlorobenzene	V	L	(Use soil gas)	(Use soil gas)
1,4-Dichlorobenzene	V	S	3.4E+02	1.1E+03
3,3-Dichlorobenzidine	NV	S		
Dichlorodiphenyldichloroethane (DDD)	NV	S		
Dichlorodiphenyldichloroethene (DDE)	NV	S		
Dichlorodiphenyltrichloroethane (DDT)	NV	S		
1,1-Dichloroethane	V	L	1.0E+03	3.4E+03
1,2-Dichloroethane	V	L	2.0E+02	6.9E+02

Table E-1. Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (volatile chemicals only)

Chemical	Physical State		Residential Land Use (µg/L)	Commercial/Industrial Land Use (µg/L)
1,1-Dichloroethene	V	L	6.3E+03	1.8E+04
cis-1,2-Dichloroethene	V	L	6.2E+03	1.7E+04
trans-1,2-Dichloroethene	V	L	6.7E+03	1.9E+04
2,4-Dichlorophenol	NV	S		
1,2-Dichloropropane	V	L	2.8E+02	9.3E+02
1,3-Dichloropropene	V	L	5.3E+01	1.8E+02
Dieldrin	NV	S		
Diethyl phthalate	NV	S		
Dimethyl phthalate	NV	S		
2,4-Dimethylphenol	V	S	2.5E+06	7.1E+06
2,4-Dinitrophenol	NV	S		
2,4-Dinitrotoluene	NV	S		
1,4-Dioxane	NV	L		
Dioxin (2,3,7,8-TCDD)	NV	S		
Endosulfan	NV	S		
Endrin	NV	S		
Ethylbenzene	V	L	1.7E+05	1.7E+05
Fluoranthene	NV	S		
Fluorene	V	S	1.9E+03	1.9E+03
Heptachlor	NV	S		
Heptachlor epoxide	NV	S		
Hexachlorobenzene	NV	S		
Hexachlorobutadiene	NV	S		
γ-Hexachlorocyclohexane (Lindane)	NV	S		
Hexachloroethane	NV	S		
Indeno(1,2,3-c,d)pyrene	NV	S		
Lead	NV	S		
Mercury (elemental)	V	S	(Use soil gas)	(Use soil gas)
Methoxychlor	NV	S		
Methylene chloride	V	L	2.4E+03	8.1E+03
Methyl ethyl ketone	V	L	2.4E+07	6.8E+07
Methyl isobutyl ketone	V	L	3.0E+06	8.4E+06
Methyl mercury	NV	S		
2-Methylnaphthalene	V	S	2.6E+04	2.6E+04
tert-Butyl methyl ether	V	L	2.4E+04	8.0E+04
Molybdenum	NV	S		
Naphthalene	V	S	3.2E+03	1.1E+04
Nickel	NV	S		
Pentachlorophenol	NV	S		
Perchlorate	NV	S		
Phenanthrene	V	S	(Use soil gas)	(Use soil gas)
Phenol	NV	S		
Polychlorinated biphenyls (PCBs)	NV	S		
Pyrene	V	S	1.4E+02	1.4E+02
Selenium	NV	S		
Silver	NV	S		
Styrene	V	L	3.1E+05	3.1E+05
tert-Butyl alcohol			(Use soil gas)	(Use soil gas)
1,1,1,2-Tetrachloroethane	V	L	(Use soil gas)	(Use soil gas)
1,1,2,2-Tetrachloroethane	V	L	1.9E+02	6.4E+02
Tetrachloroethene	V	L	1.2E+02	4.2E+02
Thallium	NV	S		

Table E-1. Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (volatile chemicals only)

Chemical	Physical State		Residential Land Use (µg/L)	Commercial/Industrial Land Use (µg/L)
Toluene	V	L	3.8E+05	5.3E+05
Toxaphene	NV	S		
TPH (gasolines)	V	L	(Use soil gas)	(Use soil gas)
TPH (middle distillates)	V	L	(Use soil gas)	(Use soil gas)
TPH (residual fuels)	NV	L/S		
1,2,4-Trichlorobenzene	V	L	2.5E+03	7.1E+03
1,1,1-Trichloroethane	V	L	1.3E+05	3.6E+05
1,1,2-Trichloroethane	V	L	3.5E+02	1.2E+03
Trichloroethene	V	L	5.3E+02	1.8E+03
2,4,5-Trichlorophenol	V	S	8.3E+05	1.2E+06
2,4,6-Trichlorophenol	NV	S		
Vanadium	NV	S		
Vinyl chloride	V	G	3.8E+00	1.3E+01
Xylenes	V	L	1.6E+05	1.6E+05
Zinc	NV	S		

Notes:

1. "Residential" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

2. High permeability soil model: One meter dry sandy soil (92% sand, 5% silt, 3% clay) over one meter moist clayey loam (33% sand, 34% silt, 33% clay).

Screening levels calculated using spreadhseet provided with *User's Guide for the Johnson and Ettinger Indoor Air model (1991) for Subsurface Vapor*

Intrusion Into Buildings (USEPA 2003). Assumed vadose-zone thickness/depth to groundwater three meters. See Appendix 1 text for model details.

Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S -id, L - liquid, G - gas).

Chemical considered to be "volatile" if Henry's Law constant (atm m3/mole) >0.00001 and molecular weight <200.

Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004).

Target cancer risk = 1E-06, Target Hazard Quotient = 0.2

Table E. Environmental Screening Levels (ESLs)
Indoor Air and Soil Gas
(Vapor Intrusion Concerns)

	Indoor Air Screening Levels		[2]Shallow Soil Gas Screening Levels	
Chemical	[1]Residential Land Use ($\mu g/m^3$)	Commercial/ Industrial Land Use Only ($\mu g/m^3$)	[1]Residential Land Use ($\mu g/m^3$)	Commercial/ Industrial Land Use Only ($\mu g/m^3$)
Acenaphthene	4.4E+01	6.1E+01	4.4E+04	1.2E+05
Acenaphthylene	2.2E+01	3.1E+01	2.2E+04	6.1E+04
Acetone	6.6E+02	9.2E+02	6.6E+05	1.8E+06
Aldrin				
Anthracene	2.2E+02	3.1E+02	2.2E+05	6.1E+05
Antimony				
Arsenic				
Barium				
Benzene	8.4E-02	1.4E-01	8.4E+01	2.8E+02
Benzo(a)anthracene				
Benzo(b)fluoranthene				
Benzo(k)fluoranthene				
Benzo(g,h,i)perylene				
Benzo(a)pyrene				
Beryllium				
1,1-Biphenyl				
Bis(2-chloroethyl) ether	7.4E-03	1.2E-02	7.4E+00	2.5E+01
Bis(2-chloroisopropyl) ether	3.4E-03	5.8E-03	3.4E+00	1.2E+01
Bis(2-ethylhexyl) phthalate				
Boron				
Bromodichloromethane	1.4E-01	2.3E-01	1.4E+02	4.6E+02
Bromoform (Tribromomethane)				
Bromomethane	1.0E+00	1.5E+00	1.0E+03	2.9E+03
Cadmium				
Carbon tetrachloride	1.9E-02	3.1E-02	1.9E+01	6.3E+01
Chlordane				
p-Chloroaniline				
Chlorobenzene	2.1E+02	2.9E+02	2.1E+05	5.8E+05
Chloroethane	2.1E+01	2.9E+01	2.1E+04	5.8E+04
Chloroform	4.6E-01	7.7E-01	4.6E+02	1.5E+03
Chloromethane	1.9E+01	2.6E+01	1.9E+04	5.3E+04
2-Chlorophenol	3.7E+00	5.1E+00	3.7E+03	1.0E+04
Chromium (total)				
Chromium III				
Chromium VI				
Chrysene				
Cobalt				
Copper				
Cyanide	1.5E+01	2.0E+01	1.5E+04	4.1E+04
Dibenz(a,h)anthracene				
Dibromochloromethane				
1,2-dibromo-3-chloropropane	1.3E-03	2.2E-03	1.3E+00	4.3E+00
1,2-Dibromoethane	4.1E-03	6.8E-03	4.1E+00	1.4E+01
1,2-Dichlorobenzene	4.2E+01	5.8E+01	4.2E+04	1.2E+05

Table E. Environmental Screening Levels (ESLs)
Indoor Air and Soil Gas
(Vapor Intrusion Concerns)

	Indoor Air Screening Levels		[2]Shallow Soil Gas Screening Levels	
Chemical	[1]Residential Land Use ($\mu g/m^3$)	Commercial/ Industrial Land Use Only ($\mu g/m^3$)	[1]Residential Land Use ($\mu g/m^3$)	Commercial/ Industrial Land Use Only ($\mu g/m^3$)
1,3-Dichlorobenzene	2.2E+01	3.1E+01	2.2E+04	6.1E+04
1,4-Dichlorobenzene	2.2E-01	3.7E-01	2.2E+02	7.4E+02
3,3-Dichlorobenzidine				
Dichlorodiphenyldichloroethane (DDD)				
Dichlorodiphenyldichloroethene (DDE)				
Dichlorodiphenyltrichloroethane (DDT)				
1,1-Dichloroethane	1.5E+00	2.6E+00	1.5E+03	5.1E+03
1,2-Dichloroethane	9.4E-02	1.6E-01	9.4E+01	3.1E+02
1,1-Dichloroethene	4.9E-02	8.2E-02	4.9E+01	1.6E+02
cis-1,2-Dichloroethene	7.3E+00	1.0E+01	7.3E+03	2.0E+04
trans-1,2-Dichloroethene	1.5E+01	2.0E+01	1.5E+04	4.1E+04
2,4-Dichlorophenol				
1,2-Dichloropropane	2.4E-01	4.1E-01	2.4E+02	8.2E+02
1,3-Dichloropropene	1.5E-01	2.6E-01	1.5E+02	5.1E+02
Dieldrin				
Diethyl phthalate				
Dimethyl phthalate				
2,4-Dimethylphenol				
2,4-Dinitrophenol				
2,4-Dinitrotoluene				
1,4-Dioxane				
Dioxin (2,3,7,8-TCDD)				
Endosulfan				
Endrin				
Ethylbenzene	2.1E+02	2.9E+02	2.1E+05	5.8E+05
Fluoranthene				
Fluorene	2.9E+01	4.1E+01	2.9E+04	8.2E+04
Heptachlor				
Heptachlor epoxide				
Hexachlorobenzene				
Hexachlorobutadiene				
γ-Hexachlorocyclohexane (Lindane)				
Hexachloroethane				
Indeno(1,2,3-c,d)pyrene				
Lead				
Mercury (elemental)	1.9E-02	2.6E-02	1.9E+01	5.3E+01
Methoxychlor				
Methylene chloride	5.2E+00	8.7E+00	5.2E+03	1.7E+04
Methyl ethyl ketone	1.0E+03	1.5E+03	1.0E+06	2.9E+06
Methyl isobutyl ketone	6.3E+02	8.8E+02	6.3E+05	1.8E+06
Methyl mercury				
2-Methylnaphthalene				
tert-Butyl methyl ether	9.4E+00	1.6E+01	9.4E+03	3.1E+04
Molybdenum				

Table E. Environmental Screening Levels (ESLs)
Indoor Air and Soil Gas
(Vapor Intrusion Concerns)

	Indoor Air Screening Levels		[2]Shallow Soil Gas Screening Levels	
Chemical	[1]Residential Land Use ($\mu g/m^3$)	Commercial/ Industrial Land Use Only ($\mu g/m^3$)	[1]Residential Land Use ($\mu g/m^3$)	Commercial/ Industrial Land Use Only ($\mu g/m^3$)
Naphthalene	7.2E-02	1.2E-01	7.2E+01	2.4E+02
Nickel				
Pentachlorophenol				
Perchlorate				
Phenanthrene	2.2E+01	3.1E+01	2.2E+04	6.1E+04
Phenol				
Polychlorinated biphenyls (PCBs)				
Pyrene	2.2E+01	3.1E+01	2.2E+04	6.1E+04
Selenium				
Silver				
Styrene	1.9E+02	2.6E+02	1.9E+05	5.3E+05
tert-Butyl alcohol				
1,1,1,2-Tetrachloroethane	3.2E-01	5.4E-01	3.2E+02	1.1E+03
1,1,2,2-Tetrachloroethane	4.2E-02	7.0E-02	4.2E+01	1.4E+02
Tetrachloroethene	4.1E-01	6.9E-01	4.1E+02	1.4E+03
Thallium				
Toluene	6.3E+01	8.8E+01	6.3E+04	1.8E+05
Toxaphene				
TPH (gasolines)	1.0E+01	1.4E+01	1.0E+04	2.9E+04
TPH (middle distillates)	1.0E+01	1.4E+01	1.0E+04	2.9E+04
TPH (residual fuels)				
1,2,4-Trichlorobenzene	8.3E-01	1.2E+00	8.3E+02	2.3E+03
1,1,1-Trichloroethane	4.6E+02	6.4E+02	4.6E+05	1.3E+06
1,1,2-Trichloroethane	1.5E-01	2.6E-01	1.5E+02	5.1E+02
Trichloroethene	1.2E+00	2.0E+00	1.2E+03	4.1E+03
2,4,5-Trichlorophenol	7.3E+01	1.0E+02	7.3E+04	2.0E+05
2,4,6-Trichlorophenol				
Vanadium				
Vinyl chloride	3.1E-02	5.2E-02	3.1E+01	1.0E+02
Xylenes	2.1E+01	2.9E+01	2.1E+04	5.8E+04
Zinc				

Notes:

1. Category "Residential Land Use" generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.)
2. Soil Gas: Screening levels based on soil gas data collected less than 1.5 meters (five feet) below a building foundation or the ground surface. Intended for evaluation of potential indoor-air impacts.

Soil gas data should be collected and evaluated at all sites with significant areas of VOC-impacted soil. Screening levels also apply to areas over of impacted groundwater.

TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.).

HUMAN HEALTH RISK CALCULATIONS

SG-SCREEN
PA Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	2.10E+02			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	228.6	24	CL		

MORE ↓

ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, $\rho_b{}^A$ (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, $\theta_w{}^V$ (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
CL	1.43	0.459	0.215	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	5.9E-06	3.5E-02	165.83

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
213.6	0.244	0.358	1.29E-09	0.787	1.02E-09	4,000	2.10E+02	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	9,410	1.74E-02	7.14E-01	1.80E-04	3.12E-03	213.6

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	2.10E+02	1.25	1.79E+00	3.12E-03	5.00E+03	3.15E+00	6.55E-05	1.38E-02

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
5.9E-06	3.5E-02

END

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.3E-08	3.8E-04

MESSAGE SUMMARY BELOW:

END