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RECEIVED
2:16 pm, Jun 29, 2007
Alameda County
Environmental Health

June 28, 2007 Our Ref.: 053-7020

Alameda County Environmental Health Services
Environmental Protection
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Attention: Ms. Donna Drogos

RE: REVISED SOURCE ZONE REMEDIATION PLAN ADDENDUM, FUEL LEAK CASE NO. RO0000278, DESERT PETROLEUM, 2008 1ST STREET, LIVERMORE, CALIFORNIA

Dear Ms. Drogos:

Golder Associates Inc. (Golder) has prepared this revised addendum to our Source Zone Remediation Plan[1] on behalf of Valley Gas (Formerly B&C Minimart) for the Desert Petroleum (DP) site at 2008 1st Street, Livermore, California. The first addendum was prepared in response to and as requested by Alameda County Environmental Health Services (ACEHS) in a letter dated March 26, 2007.[2] This revision has been prepared in response to and as requested in a meeting between ACEHS, Mr. Balaji Angle, and representatives of Golder and a follow-up letter from ACEHS.[3] Pertinent excerpts from these ACEHS letters are included in Attachment A. Golder's responses to ACEHS's comments/requests are in the following sections. The comments from each of the ACEHS letters are included as applicable with the letter date in parentheses. The sections have been organized to correspond to the latest ACEHS letter (May 25, 2007).

TECHNICAL COMMENTS

1) Remediation Objectives and Cleanup Levels

ACEH did not concur with the cleanup levels nor the exclusion of source zone remediation on the Desert Petroleum site in the remediation plan proposal. The addendum needs to include your discussion of your plan to expand the system to address source zone cleanup on both the Groth and Desert Petroleum sites (e.g., following pilot test evaluation) and to establish clean up levels and goals for contaminants at the sites. (Reference: directive letter dated March 26, 2007, Technical Comments A.1. and A.7.) (May 25, 2007)

As described below (response to comment 2.d.), Golder proposes expanding the pilot test at the Desert Petroleum (DP) site. Depending on the results of the pilot test, the remediation approach may include additional ozone/air sparging wells on the DP site and/or the installation of SVE wells. These additional wells may be installed between the underground storage tanks (USTs) and the pump

[1] Golder Associates Inc., *Source Zone Remediation Plan*, August 11, 2006.

[2] Alameda County Environmental Health Services, Letter to Mr. Balaji Angle, et al, March 26, 2007.

[3] Alameda County Environmental Health Services, Letter to Mr. Balaji Angle, et al, May 25, 2007.

islands or on the east side of the pump islands (Figure 1). On the Groth Brothers property, Golder will evaluate the installation of separate equipment to avoid trenching beneath the street and the installation of additional ozone/air sparging wells consistent with the results of the pilot test. The installation of additional ozone/air sparging wells on the Groth Brothers site will be dependent on coordination with the upcoming development and access constraints.

The Source Zone Remediation Plan was prepared to address the chemicals present beneath the Groth property that might pose an unacceptable risk to future residents in buildings on that site. This was established as a short term remedial goal on the basis of the impending residential development at the Groth Brothers site. Before or concurrent with the preparation of a corrective action plan (CAP) the responsible parties will perform a complete evaluation of appropriate cleanup levels (active remediation) and cleanup goals (water quality objectives) considering the chemicals of concern (COCs), relevant receptors, and potential changing conditions (water level fluctuations, installation of water supply wells, etc.). This evaluation will also include an estimate of the time to reach the cleanup goals.

2) Technical Comments in March 26, 2007 Letter to be Addressed

a) Technical Comment A.10. – Depth to Water

The remediation plan states that depth to water has varied from 18 to 37-feet bgs since 1995. More correctly depth to water has varied from 17' bgs in 1997 to 69 feet bgs in 1992, and the first reported release at the site occurred in 1988. It is unclear why pre-1995 water levels are excluded. Please address this comment in the work plan addendum requested below. (March 26, 2007)

Golder did not rely on depths to water within any historical time frame to determine the target depths for the source zone remediation plan but relied on information gathered during the source zone investigation. During Golder's source zone investigation[4] the membrane interface probe (MIP) boring locations that exhibited the strongest responses with the photo-ionization detector (PID) and flame-ionization detector (FID) were MIP-3, MIP-8, MIP-13, and MIP-14. Based on confirmation soil analytical data, it appears that borings MIP-8, MIP-13, and MIP-14 are located within the source zone of adsorbed gasoline, potentially non-aqueous phase liquid (NAPL) in soil (saturated soil). Golder estimated that the source zone extends from the tank pit to the northwest under the Groth Brothers showroom and is approximately 250 feet long, 30 to 120 feet wide and generally confined to the lower coarse grained unit with the majority of the impacted sediment located at depths from 36 to 48 feet below ground surface (bgs). These area and depth ranges as described in the source zone investigation report are the targets of the planned source zone remediation.

b) Technical Comment A.11.a – COCs

The remediation plan focuses only on treating benzene and NAPL near the water table (assumed current) and affecting cleanup for the Groth Property (see also Technical Comment A.1. regarding target cleanup zones). No other known COCs were discussed. For example, although MTBE is also a primary contaminant of concern contributing to a long-term groundwater problem, it is not mentioned in the source zone cleanup plan. Additionally, PCE

[4] Golder Associates Inc., *Field Investigation for Source Zone Remediation*, June 6, 2006.

(see attached) has been detected in both the MIP and monitoring wells associated with your site (see attachment) and your treatment approach must consider this contaminant also. Your source zone remediation plan is required to address all known COCs at the site. (March 26, 2007)

Please include all COCS at the site. COCs include target compounds (petroleum related compounds) for remediation and secondary COCs (e.g., solvents) from unknown sources that are within the treatment area. (May 25, 2007)

Golder identified the COCs associated with the DP site in its risk assessment.[5] Tetrachloroethene also known as perchloroethene (PCE) has also been found in the groundwater beneath the DP site at concentrations up to an estimated 47 micrograms per liter (ug/L).[6]

The Source Zone Remediation Plan was prepared to address the chemicals present beneath the Groth property (and the source of those chemicals) that might pose an unacceptable risk to future residents in buildings on that site. The current land use around the DP site is commercial; however, as part of a redevelopment effort being conducted by the City of Livermore, The Groth Brothers site is to be redeveloped as mixed high-density residential with integrated retail stores. The proposed redevelopment was the driver for an accelerated evaluation of potential vapor risk at the Groth Brothers site and remedial action (as necessary). The source zone investigation,[7] risk assessment,[8] and source zone remediation plan were prepared at the request of the City of Livermore.[9]

In the conclusions of the risk assessment, Golder recommended remedial actions targeting dissolved benzene, with a cleanup goal of 418 microgram per liter (ug/L), and mitigating the non-aqueous phase liquid (NAPL) source area. Therefore, benzene and NAPL were the "chemicals of concern" (COCs). These remedial targets were the basis for the remedial action objectives described in the Source Zone Remediation Plan. The preferred alternative, in situ chemical oxidation (ISCO) using ozone, is a non-selective oxidation method. In an oxidizer-strength ranking of nine common oxidants ozone is behind only hydroxyl radical and sulfate radical.[10] Therefore, ozone is a powerful oxidizer and will create a non-selective oxidizing environment that will treat the organic chemicals present in the groundwater and soil. Even though other organic chemicals (MTBE and PCE) present in the groundwater are not short term remedial targets, these chemicals should also be oxidized in the presence of ozone[11] and are included in the monitoring plan described in this document.

c) Technical Comment A.11.b - By-Products

Please include an evaluation of all anticipated reaction byproducts for all COCs and those potentially produced by the treatment method. (March 26, 2007)

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[5] Golder Associates Inc., *Screening Vapor Intrusion Risk Assessment*, May 31, 2006.

[6] Alameda County Environmental Health Services, Letter to Mr. Balaji Angle, et al, March 26, 2007.

[7] Golder Associates Inc., *Field Investigation for Source Zone Remediation*, June 6, 2006.

[8] Golder Associates Inc., *Screening Vapor Intrusion Risk Assessment*, May 31, 2006.

[9] City of Livermore, Letter to Mr. Balaji Angle, August 5, 2005.

[10] Interstate Technology & Regulatory Council (ITRC), *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, Second Edition, January 2005, Page 2.

[11] Interstate Technology & Regulatory Council (ITRC), *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, Second Edition, January 2005, Table 1-6, Page 17.

Please provide additional information for this comment. Evaluation of anticipated reaction by-products for all COCs includes identification of the specific compounds and plans for analysis. (May 25, 2007)

As stated in the Source Zone Remediation Plan, to confirm the effectiveness of ozone as an oxidant and to assess whether ozone sparging will generate chemical species that are deleterious to groundwater quality, bench-scale testing will be performed using representative aquifer materials and groundwater. The aquifer materials and groundwater for the bench-scale testing will be collected during the installation of the sparge wells. The formation of by-products will be evaluated as part of the bench test.

Theoretically potential by products of the oxidation of PCE and the COCs include the following species:

Chemical	Theoretically Potential By-products	Analytical Method
PCE	Tetrachloroethene epoxide	None available (unstable)
	Mono-, di-, and tri-chloroacetal isomers	Non-standard analyses (note 1)
	Phosgene	None available (unstable)
	Mono-, di-, and tri-chloroacetic acid isomers	EPA Method 552.2
	Chlorinated ethanediols	Non-standard analyses (note 2)
	Chlorohydroxyacetal isomers	Non-standard analyses (note 1)
Aliphatic Hydrocarbons	Acetate	Non-standard analyses (note 1)
	Butyrate	Non-standard analyses (note 1)
	Formate	Non-standard analyses (note 1)
	Propionate	Non-standard analyses (note 1)
BTEX	Carboxylic acids	Non-standard analyses (note 1)
Oxygenates	TBA (tertiary butyl alcohol)	EPA 8260B
	TBF (tertiary butyl formate)	EPA 8260B
	Formate	Non-standard analyses (note 1)
	Acetate	Non-standard analyses (note 1)
	Formaldehyde	EPA Method 8315A

Notes:

1) Non-standard analyses require setup fee and establishing methods based on EPA 300.1. Potential for establishing method depends on availability of standards.

2) Non-standard analyses require setup fee and establishing methods based on high performance liquid chromatography.

According to the Interstate Technology & Regulatory Council (ITRC)[12], "(with ozone sparging) The contaminants are treated in situ, converted to innocuous and/or naturally occurring compounds (e.g., H_2O, CO_2, O_2, halide ions)."

If this revised work plan addendum is approved by the ACEHS without comment(s) to the contrary, Golder will perform the laboratory analyses for the by-products listed above, for which there exists standard, established laboratory protocol, in at least one of the samples collected at the completion of the bench study as described in the source zone remediation plan. Golder will also analyze one pilot test groundwater sample for these same parameters, see below. Other potential by products of ozone sparging that are typically included in ozone sparging bench and pilot studies and plans for analysis are discussed in the source zone remediation plan.

d) Technical Comment A.11.c. and A.11.d. – Monitoring Well Network for Pilot Test and Pilot Test Frequency

***Monitoring Network for Pilot Test** - The proposed network of wells to monitor the effectiveness of the pilot test is insufficient. Monitoring in the down-gradient direction is not proposed. A sampling and monitoring program to monitor oxidant dispersion and treatment effectiveness in three dimensions is an essential component for evaluation of your pilot test. We recommend that you install additional monitoring points to meet these criteria. Please include an explanation of your rationale for locating additional monitoring points and your monitoring frequencies. Include your plan for monitoring to differentiate between displacement of contaminated water and actual mass destruction. (March 26, 2007)*

***Pilot Test Frequency** - Please specify the time frames for your pilot test, how long before rebound is anticipated, timeframes to evaluate displacement, the basis for estimating these timeframes, proposed frequencies for different monitoring activities, etc. (March 26, 2007)*

Options for design and location of an additional short screened monitoring network (small diameter direct push, CMT, etc.) capable of collecting data to evaluate the effectiveness of the treatment system was discussed during the meeting. Please finalize your proposal for this network. Include your rationale for the network design and specify the data to be collected to evaluate treatment system effectiveness, differentiate plume displacement verses mass destruction etc. Include graphics for well location and design. (May 25, 2007)

In addition to the three originally proposed dual-completion ozone/air sparging (SP) wells, Golder proposes installing two additional SP wells on the DP site and one SP well on the Groth Brothers property, SP-1 (A, B) through SP-6 (A, B) (Figure 1). These SP wells will be constructed consistent with the SP wells proposed in the source zone remediation work plan and as shown in Figure 2. Golder also proposes installing an additional single-completion SP well next to SP-6 (SP-6C) that will be screened at approximately 52.5 to 54 feet bgs as shown in Figure 3. The screen depths of the sparging wells are shown on cross section D-D' from the investigation report on Figure 4.

During the pilot test, Golder will sparge ozone into SP-1 (A, B) and use the other SP wells for monitoring. This will provide four, dual-completion monitoring points surrounding the active sparge well including one dual-completion well in the upgradient direction. In this orientation, dual

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[12] Interstate Technology & Regulatory Council (ITRC), *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater,* Second Edition, January 2005, Page 15.

completion monitoring wells will be located approximately 8, 12, 16, and 22 feet from the active sparge well. This orientation will provide resolution of the vertical and horizontal radius of influence (DO, ORP, helium) and perturbation of the groundwater elevations surrounding the sparging well. The down gradient wells, SP-6 (A, B, and C) will provide horizontal and vertical monitoring of the sparging effects including displacement versus mass destruction.

During the later stages of the pilot test, the on- or near-site SP wells will provide monitoring of the oxidant dispersion, dissolved oxygen enhancement into the groundwater migrating beneath and past the DP site, and COC destruction versus potential displacement. SP-6 will provide down gradient monitoring of the effects of ozone sparging including COC and non-COC chemical concentrations, dissolved oxygen, and oxidation reduction potential. The pilot test plan and timing is discussed further below and in Attachment B.

To assess remaining vadose zone source areas at the DP site and provide increased pilot test vapor monitoring, Golder proposes installing a soil vapor extraction well (SVE-1) to the south of the underground storage tanks as shown on Figure 1. This location is near the soil sample (T1S) collected during the UST removal in 1996 that contained 8,500 milligrams per kilogram of TPHg referenced in the ACEHS's March 26, 2007 letter (Technical Comment A.1.). The proposed construction of the SVE well is shown on Figure 5. During baseline testing, vapor sampling will be performed as described below at MW-6 and SVE-1.

To evaluate displacement of impacted groundwater, Golder will monitor the inactive sparge wells (SP-2 through SP-5) once every two weeks during sparging (time enough for groundwater to migrate approximately 10 feet under normal gradient; see rationale in the following comment/response). If field monitoring of DO and/or ORP indicates the presence of ozone, the ozone injection will be discontinued for one day before samples are collected so that ozone present in the samples does not interfere with the results. The half-life of ozone in water is typically 30 minutes,[13] therefore, the ozone present at the monitoring locations should dissipate within one day. In this manner, Golder will collect data to evaluate temporal and spatial trends. Golder will also monitor the down gradient ozone sparge/monitoring wells SP-6 (A, B, C) monthly for indications of displacement (see rationale in the following comment/response). Concentration increases in one or more of the monitoring locations will indicate whether impacted groundwater has been displaced.[14]

Please note however, that during ISCO, it is typical that dissolved concentrations increase near the oxidant injection point due to localized agitation of the groundwater, dissolution of NAPL, and/or oxidation of soil adsorption sites (oxidation of soil organic matter). Therefore, concentrations in groundwater near the location of injection may show increases that are not specifically related to displacement. Golder will also evaluate the average concentrations in the inactive sparge wells surrounding SP-1 to provide an indication of the mass of COCs before, during, and after the pilot test. Even if a single monitoring location indicates a concentration increase, but the average concentrations decline, overall, the treatment has reduced COC mass. Again, this assessment will also be confirmed by monitoring down gradient wells SP-6 (A, B, C).

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[13] Interstate Technology & Regulatory Council (ITRC), *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, Second Edition, January 2005, Page 14.

[14] Interstate Technology & Regulatory Council (ITRC), *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, Second Edition, January 2005, Page 56.

Golder will also reduce the potential for displacement by pulsing the operation of the sparge points; operation will likely involve alternating sparging into the upper and lower screens of SP-1 in a programmed sequence. This programming sequence will be evaluated during the initial few days of the pilot test and will be modified as indicated by ongoing monitoring.

Golder has accordingly revised the plan for the pilot test that was included in the source zone remediation plan. The revised pilot test plan is included in Attachment B.

e) Technical Comment A.11.d. –Pilot Test Frequency

Please include information supporting your rationale for estimating time frames to evaluate rebound displacement, system effectiveness, etc. (May 25, 2007)

The Source Zone Remediation Plan included performing the pilot test for one to two months and Golder will recommend whether or not to operate for the second month based on the results of performance monitoring and whether the ozone sparge system has operated as planned. The pilot testing time frames may also be modified by the results of the bench study. As described above, Golder plans to focus the pilot test by sparging into SP-1 (A, B) only during the initial stages of the pilot test (first month). If the sparge results do not provide sufficient trends or the results are inadequate for evaluating full scale operating parameters, Golder will recommend operating for a longer period in an attempt to resolve the inadequacies with more data. If there are operational problems with the ozone sparging equipment such that continuous planned operation has not consistently occurred, Golder will recommend operating for a longer time period to collect data during periods of consistent operation.

Golder recommends sampling the down gradient wells, SP-6 (A, B, and C) and MW-5 monthly following the start of the pilot test for a period of at least 6 months. This frequency is based on the assumed groundwater velocity and a factor of safety in case the sparging increases the groundwater velocity. As described in the site conceptual model,[15] the shallow groundwater beneath and down gradient of the DP site flows at a rate of approximately 280 feet per year. This corresponds to approximately 5.4 feet per week. Under its normal gradient, the groundwater will flow from SP-1 to the area around SP-6 in approximately 18 weeks or around 4.5 months (18 weeks x 5.4 feet per week = 97 feet).

When the pilot test is completed, Golder recommends allowing the subsurface to equilibrate for three weeks before collecting samples to evaluate rebound. In full-scale remediation situations, rebound monitoring should typically be performed at least 3 months after the cessation of injections.[16] However, considering the groundwater velocity as discussed above and assuming a radius of influence of 15 feet, the groundwater will move 15 feet in approximately 3 weeks. During rebound testing, Golder will monitor groundwater parameters such as dissolved oxygen and oxidation reduction potential. If these parameters are higher than the baseline values, Golder will evaluate whether or not the subsurface has re-equilibrated and consider extending the rebound period and re-sampling. If rebound has already occurred, extending the rebound period will be unnecessary. The data acquired during the pilot test is influenced by many factors and Golder will evaluate the data and make recommendations on a case-by-case basis. In addition, the routine monitoring will continue and

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[15] RO#0000278 B&C_ Desert Petroleum SCM_2.0 Final.doc.

[16] Interstate Technology & Regulatory Council (ITRC), *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, Second Edition, January 2005, Page 56.

this data will also be evaluated over time and assessed for impacts due to the ozone sparging pilot test and expanded remediation.

f) Technical Comment A.11.e. – Well Construction

Golder proposes the installation of nested wells for their treatment system. Nested wells are not acceptable at contaminated sites due to the difficulties in ensuring reliable seals between sampling zones. Poor seals can result in leakage between zones and are therefore not allowed. We request that you consider an alternative design for these wells. (March 26, 2007)

Include graphics that demonstrate how the nested injection wells will be constructed to maintain separation of multiple casings ensuring reliable seals between sampling zones. (May 25, 2007)

Golder proposed nested ozone sparging wells for this pilot test for the following reasons:

- The target zone is sufficiently thick that if a sparge well was constructed over the entire length, the higher hydrostatic pressure at depth would force the sparge gas through the upper portion of the screen and no treatment would be accomplished in the lower part of the target zone. Therefore, installing two shorter sparge wells at different depths will provide more efficient distribution of the sparge gas.

- Installing separate sparge wells approximately 3 to 5 feet apart would require twice as many penetrations of the road surface within the City of Livermore easement and more trenching and resurfacing to connect the sparge conveyance lines.

- The sparge wells are not going to be installed across an aquitard or zone of lower permeability material such that cross-contamination may be encouraged. The geologic materials across the entire length of the target sparge zone are consistent and described as coarse-grained material.[17]

- The sparge wells will be installed using stainless steel centralizers and a spacer to maintain the sparge wells and casing materials in positions away from the boring sidewalls and each other within the seal materials to improve the seal between the two sparge points. Golder proposes to install a 3.5-foot thick bentonite seal between the two sparge points.

The nested sparge well construction diagram showing the spacer and centralizers proposed by Golder to ensure adequate seal is shown on Figure 2.

g) Technical Comment A.11.f. – Utility Survey

The utility survey portion of your conduit study has not been completed, as noted in SCM 1.1 and the risk assessment. The presence of deep utilities and a potential petroleum pipeline are reported to be in the vicinity of your site and the Groth site and could act as a preferential

[17] Golder Associates Inc., *Field Investigation for Source Zone Remediation*, June 6, 2006.

pathway for contamination, oxidant and/or byproducts of the reaction. We request that you complete your evaluation of this data gap for your pilot test proposal. (March 26, 2007)

Report results of: conduit study, review of Mill Springs case file, data from recent Groth Bros. investigation. Schedule date to review documents at ACEH offices. (May 25, 2007)

Golder acquired a utility map for the site vicinity and this is included in Attachment C. Golder reviewed ACEHS files on June 5, 2007. The information gathered during this file review is also included in Attachment C.

CLOSING

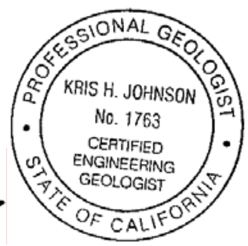
This material and data in this report were prepared under the supervision and direction of the undersigned. This report was prepared consistent with current and generally accepted geologic and environmental Consulting principles and practices that are within the limitation provided.

If you have any questions or comments, please call Kris Johnson at 650-386-3828 or Mark Naugle at 916-786-2424.

Sincerely,

GOLDER ASSOCIATES INC.

Mark H. Naugle, P.E.
Senior Engineer



Kris H. Johnson, C.E.G. 1763
Senior Consultant

<u>Figures</u>:

Figure 1	Site Plan
Figure 2	Ozone/air Sparge Well Schematic
Figure 3	Deep Ozone/air Sparge Well Schematic
Figure 4	Geologic Cross Section D-D' (With Sparge Well Screen Locations; from Source Zone Investigation, Golder Associates Inc., June 6, 2006)
Figure 5	Soil Vapor Extraction Well Schematic

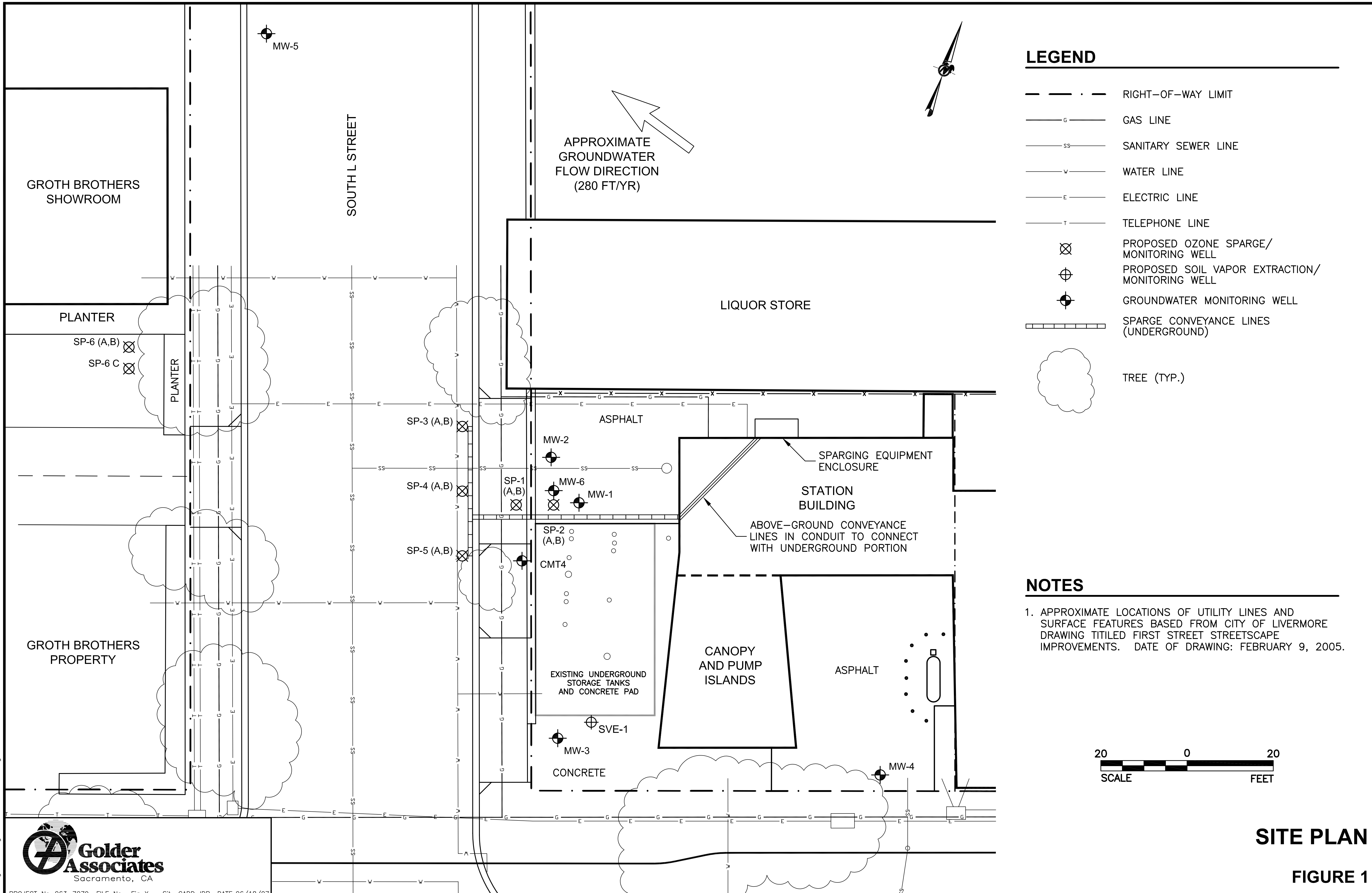
<u>Attachments</u>:

Attachment A	March 26, 2007 and May 25, 2007 Letters from Alameda County Environmental Health Services (Pertinent Excerpts)
Attachment B	Pilot Test Plan
Attachment C	City of Livermore Utility Map and Other ACEHS File Review Information

Distribution:

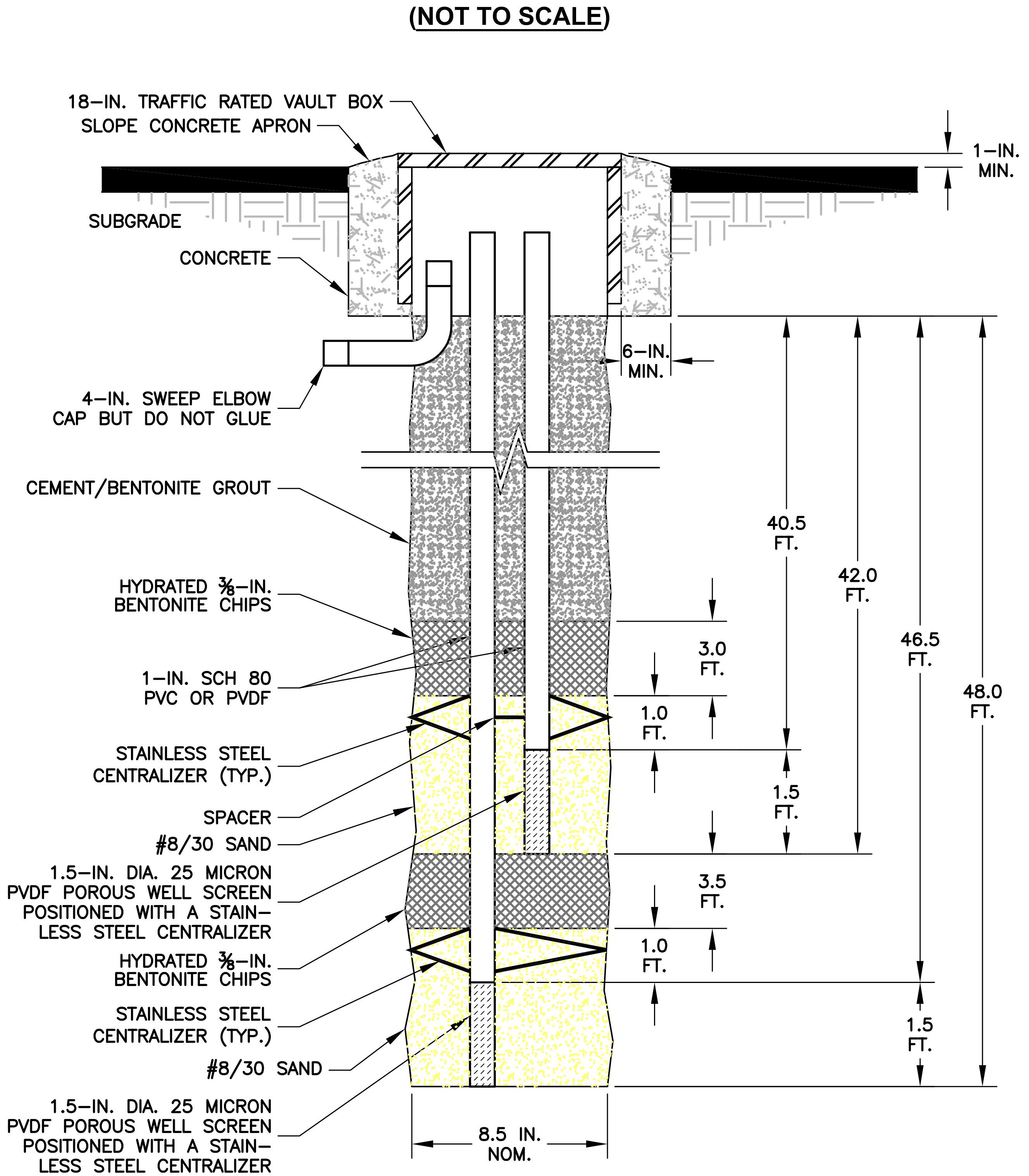
(1) Copy – Mr. Balaji Angle (hardcopy)
(1) Copy – Ms. Donna Drogos (electronic upload)
(1) Copy – GeoTracker Database (submitted electronically)
(1) Copy – Mr. Michael Veiluva (electronic)
(1) Copy – Mr. Glenn Young (electronic)
(1) Copy – Ms. Leah Goldberg (electronic)
(1) Copy – Golder Associates Inc.

FIGURES



SITE PLAN

FIGURE 1



LEGEND

IN.	INCH
FT	FEET
MIN.	MINMUM
NOM.	NOMINAL
PVDF	POLYVINYLIDENE FLUORIDE (KYNAR ®)

OZONE/AIR SPARGE WELL SCHEMATIC

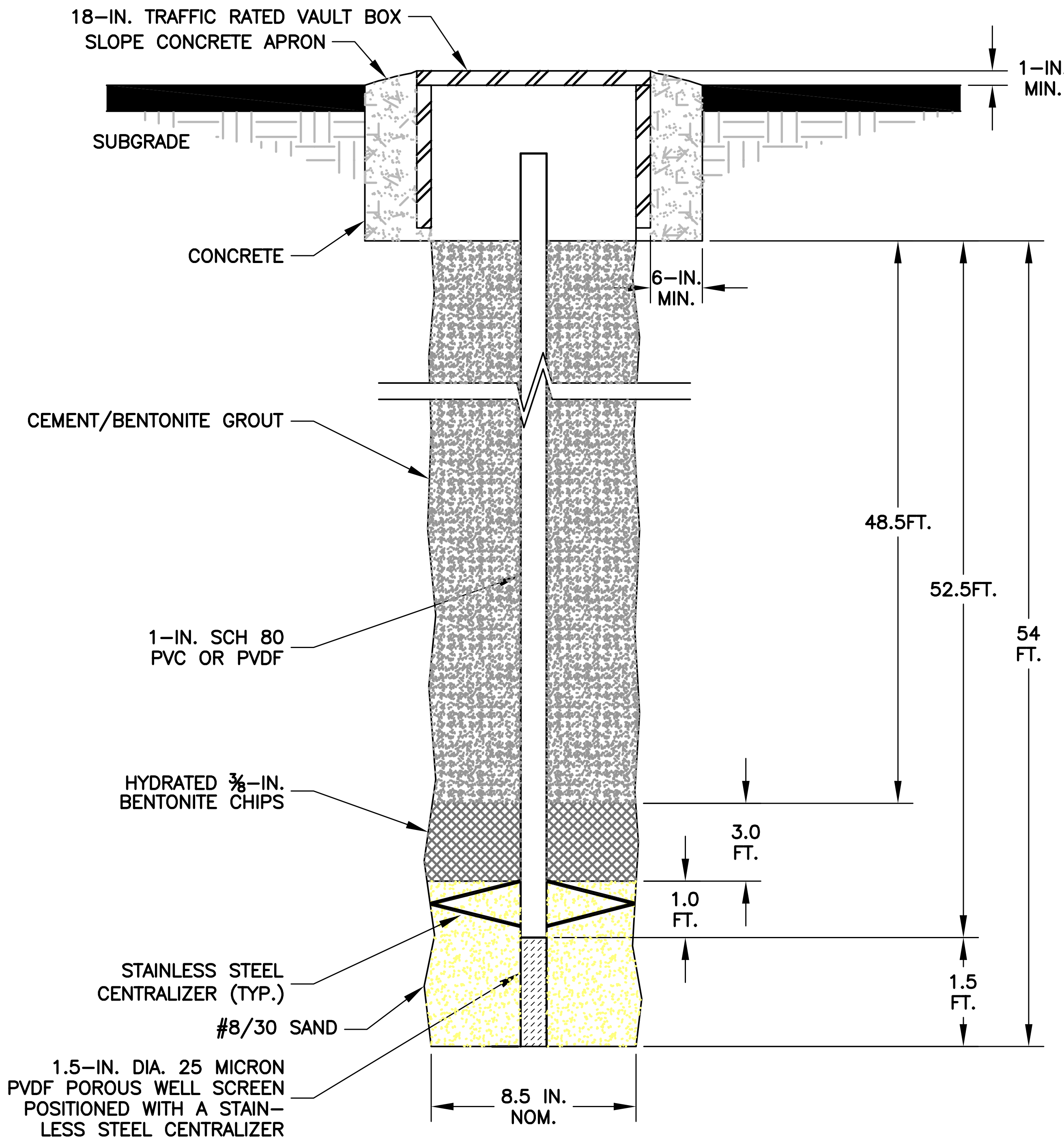
Golder Associates
Sacramento, CA

FIGURE 2

PROJECT No. 053–7020 FILE No. Fig 4 – Air CADD JDR DATE 08/10/06

Drawing file: Fig 2 – Air Sparge Well.dwg Jun 27, 2007 – 11:49am

(NOT TO SCALE)



LEGEND

IN.	INCH
FT	FEET
MIN.	MINMUM
NOM.	NOMINAL
PVDF	POLYVINYLIDENE FLUORIDE (KYNAR ®)

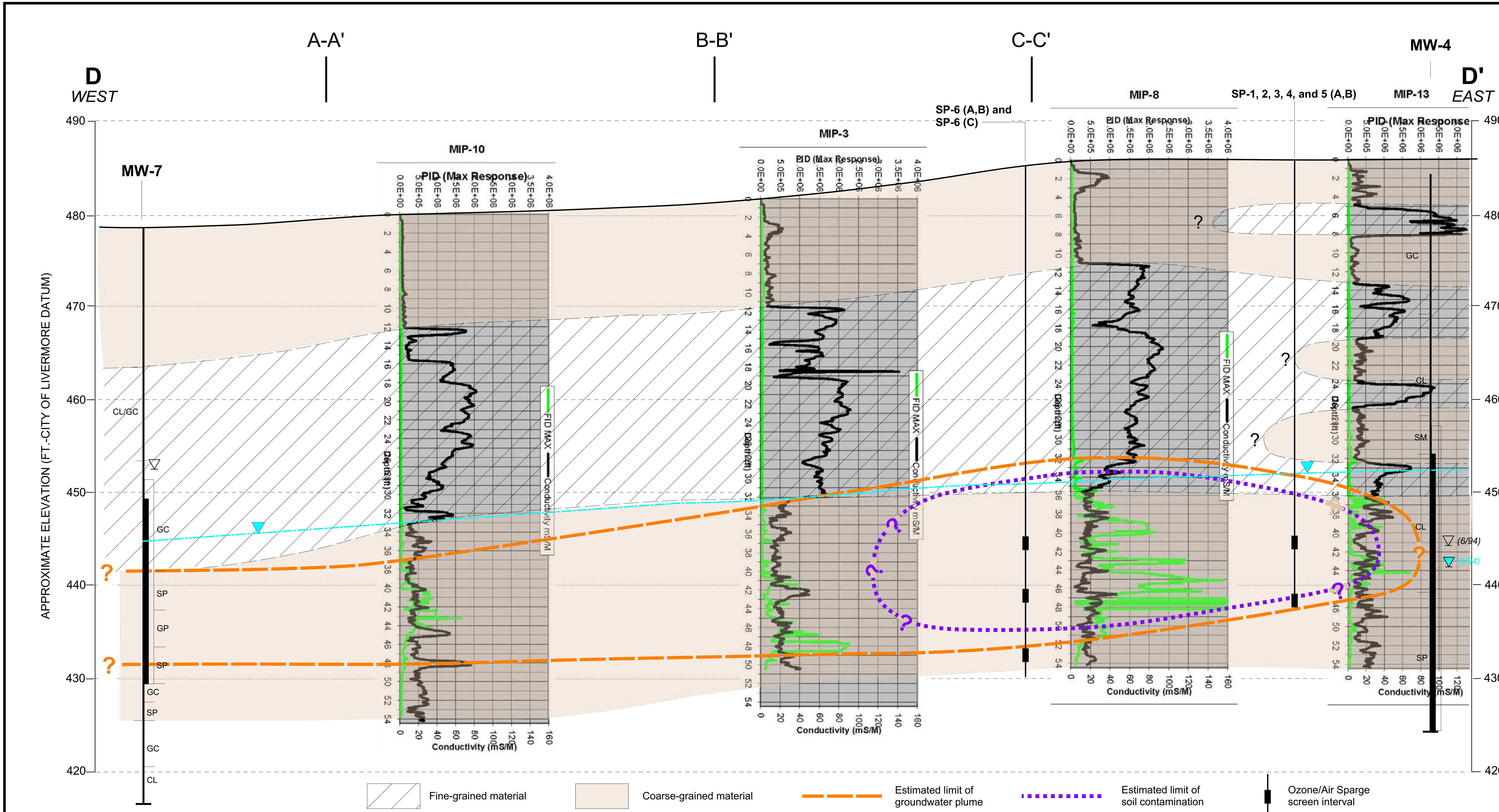
DEEP OZONE/AIR SPARGE WELL SCHEMATIC

Golder Associates
Sacramento, CA

FIGURE 3

PROJECT No. 053–7020 FILE No.Fig 3 – Deep CADD JDR DATE 06/26/07

Drawing file: Fig 3 – Deep Air Sparge Well.dwg Jun 27, 2007 – 11:50am



Golder Associates

SCALE: 0 50 100 150 FEET

(V.E.= 5X)

CORRECTIVE ACTION INVESTIGATION
B & C GAS MINI MART/VALLEY GAS
LIVERMORE, CALIFORNIA

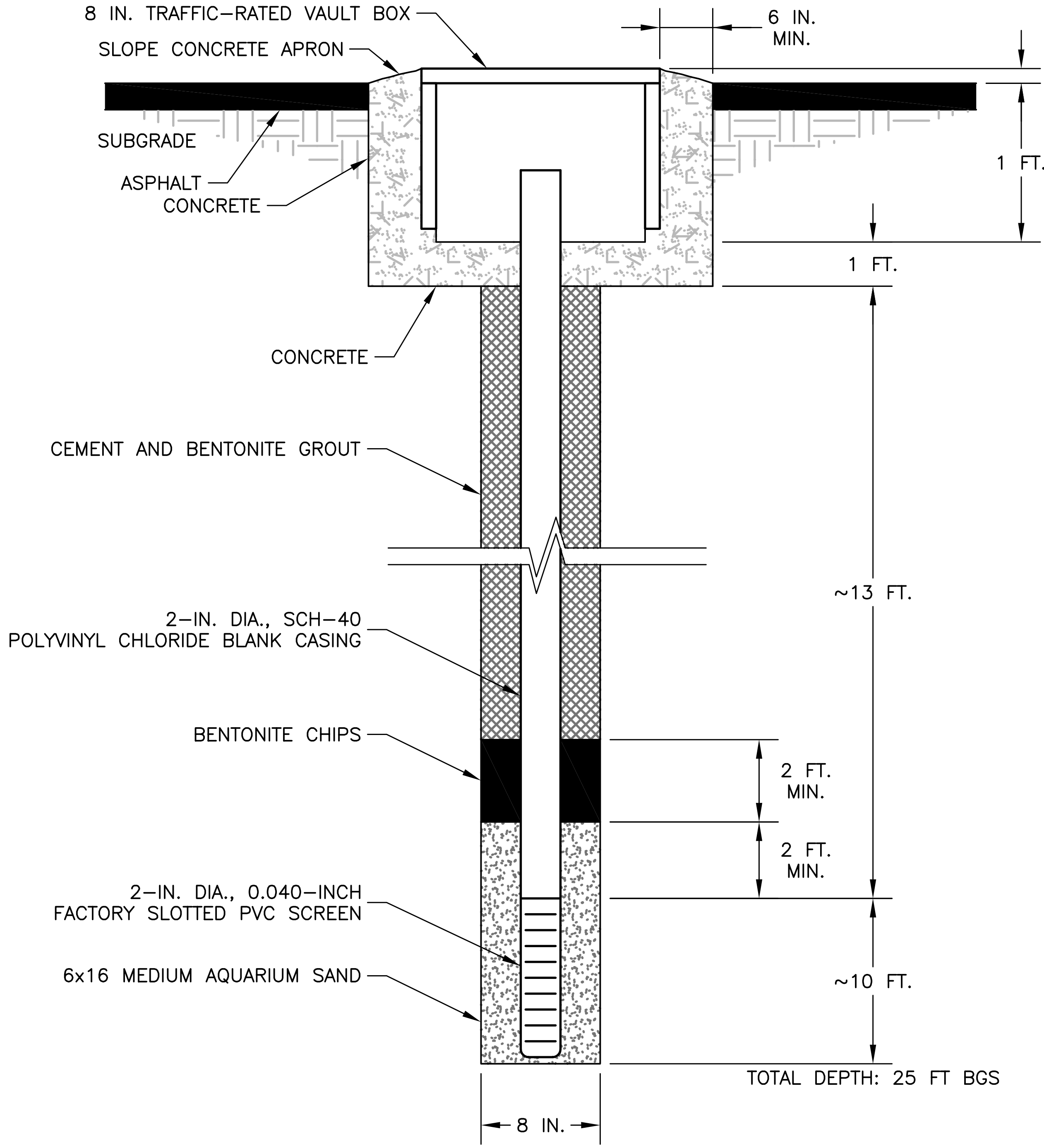
GEOLOGIC CROSS SECTION D-D'

FIGURE
4

PROJECT NO.
053-7020

G:\053-7020\FIGURES\XSEC DD w_ AIR SPARGE.DSF 6/26/07

SOIL VAPOR EXTRACTION WELL SCHEMATIC
(TYPICAL)



LEGEND

IN	INCH
FT	FEET
MIN.	MINIMUM
NOM.	NOMINAL
DIA.	DIAMETER

Drawing file: Fig 5 - SVE Well.dwg Jun 27, 2007 - 11:51am

Golder Associates
Sacramento, CA

PROJECT No. 053-7020 FILE No. Fig 5 - SVE CADD JDR DATE 06/26/07

SOIL VAPOR EXTRACTION WELL SCHEMATIC

FIGURE 5

ATTACHMENT A

March 26, 2007 and May 25, 2007 Letters from Alameda County Environmental Health Services (Pertinent Excerpts)

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

March 26, 2007

Mr. Balaji Angle
B&C Gas Mini Mart
2008 1ST Street
Livermore, CA 94550

Mr. John Rutherford
Desert Petroleum
PO Box 1601
Oxnard, CA 93032

Dear Messrs. Angle and Rutherford:

Subject: Fuel Leak Case No. RO0000278, Desert Petroleum, 2008 1ST Street, Livermore, CA

ACEH staff has reviewed the "Field Investigation for Source Zone Remediation" (field investigation), dated June 6, 2006, the "Soil Vapor Intrusion Risk Assessment" (risk assessment), dated May 31, 2006, the "Source Zone Remediation Plan" (remediation plan), dated August 11, 2006, the "Fourth Quarter 2006 Groundwater Monitoring Report," dated January 16, 2007, and previous monitoring reports, all prepared by Golder Associates (Golder).

The above referenced reports provide data for source area characterization and soil gas sampling performed both on the subject site and off-site on the Groth property. Also, a soil vapor risk evaluation was performed for the Groth site. We note however, that a significant portion of additional work also requested in ACEH's letters dated July 5, 2005, and February 24, 2006, to address data gaps in the SCM and complete the evaluation of dissolved contaminant plumes, specifically for MTBE, has not been performed. Further, specific work directives by ACEH pertaining to monitoring of the dissolved plume, evaluation of alternative valid hypotheses for the migration of dissolved contaminants from your site, and evaluation of the risk of the contaminant plumes to the drinking water basin have been largely ignored in your reports.

Compliance with the City of Livermore's Polanco Act related work that pertains specifically to the residential redevelopment of the Groth property is required of you. However, not in lieu of the work required of you to address the contamination you caused to the regional drinking water aquifer and to your site. You are required to complete the work requested in this letter and ACEH's previous letters referenced above. Further failure on your part to perform the work required of you and submit the reports as specified below, will result in initiation of enforcement actions on your case; specifically, ACEH will request the SWRCB remove your site from the USTCF eligibility list.

This letter provides comments on your recently submitted reports and incorporates the items you have failed to address in ACEH's last two directive letters. In general, ACEH does not concur with the groundwater cleanup level proposed in the risk evaluation due to the data gaps present in the risk assessment, elimination of relevant exposure pathways, and failure to address all COCs. However, we are prepared to concur with Golder's recommendation for a pilot test although specific requirements for monitoring and evaluating the pilot test of your system are required.

We request that you address the following technical comments, perform the proposed work, and send us the technical reports requested below.

TECHNICAL COMMENTS (SECTION A)

1. **Vertical Extent of Source Area Contamination** – Source area sampling, in the field investigation report, included locations on the Desert Petroleum site and off-site on the Groth property to define the lateral and vertical extent of contamination. Golder's field investigation report states that "the zone of contamination is generally confined to the lower coarse grained unit with the majority of the impacted sediment from 36 to 48 feet bgs," and recommends NAPL source mitigation be focused on shallow NAPL near the water table. The water table during this phase of work was 26 feet bgs. As the depth to groundwater has historically varied from 17' bgs in 1997 to 69 feet bgs in 1992, it is unclear why the current depth to water is the target depth for remedial efforts.

We note that soil sampling from this and previous work identified significant residual soil contamination that was left in place on the Desert site during UST removal (TPHG: 8500 ppm, benzene: 61 ppm, and MTBE 96 ppm) and was detected during monitoring well installation, at depths as shallow as 14 feet bgs. Data from the Groth site indicates a deeper source area for which the recommended remediation depth appears to address. Therefore the remedial efforts appear to target the Groth property while potentially leaving significant shallow and deep residual source in place on the Desert site which could be an ongoing source of contamination to groundwater and on-site soil gas.

A source area of significant vertical extent exist on both the B&C and the Groth properties and the remediation approach cannot selectively address cleanup depths (2006 water levels) nor focus on one property (Groth). Please provide a proposal and rationale for specifying target cleanup zones for both properties in the work plan addendum and SCM 2.0 requested below.

2. **Multiple Hypotheses for Contaminant Transport**

Golder's field investigation, risk assessment, and quarterly reports state that the "Concentrations of MTBE and BTEX have been declining throughout the plume sine 1995. Declining concentrations appear to be due to natural attenuation based on positive chemical indicators of natural attenuation and the shrinking dimensions of the BTEX plume."

We note that Golder has not supported their conclusionary statement regarding MTBE natural attenuation. ACEH has commented on Golder's statements regarding natural attenuation of MTBE; requested that you collect evidence to demonstrate your hypothesis for natural attenuation for MTBE; provided a valid alternative hypothesis for the apparent "declining" concentrations of dissolved phase MTBE i.e., detached plume; and asked for specific data collection to evaluate this hypothesis. ACEH's comments were provided to you as stated in Sections B.1. and C.3 below. To date, you have not performed this work, significant data gaps exist in SCM 1.1, and ACEH's requests have not been addressed in SCM 2.0 as previously requested of you. Golder's conclusions cannot be supported without having addressed these data gaps. As previously stated we do not concur with Golder's conclusions.

ACEH has reviewed the data from this site in detail and maintains there is sufficient evidence at this site to suggest that the MTBE plume may have detached from the source. This is a valid hypothesis for the dissolved phase MTBE contamination at your site and it is required to be determine cleanup levels need to consider all locations of contamination. Report the results of your evaluation in the CAP requested below.

Overall soil gas sampling was limited to a one time event at during the rainy season (high water table) and we concur with the recommendation that permanent soil gas sampling probes be installed and monitored. Also, we request that soil gas sampling from permanent monitoring point, port 1 of CMT-4, when it is dry, be incorporated during monitoring events. Include your proposal for locations of permanent soil gas sampling probes in SCM 2.0 below.

6. **Benzene Plume Length** – The risk assessment erroneously states that the benzene plume has been limited to 600 – 800' feet. The benzene plume has historically extended to at least 1,400 feet d/g.

7. **Contaminants of Concern (COCs) and Receptors** – The risk assessment back calculated a groundwater cleanup level for benzene of 418 ppb to address indoor air concerns on the Groth property. A risk evaluation for potential vapor intrusion at the Desert site was not performed. Cleanup levels for the drinking water basin were specifically excluded from the risk assessment. Also, cleanup levels were not evaluated for all COCs at the site, including MTBE.

Further, the effect of increasing or decreasing groundwater elevations on the risk posed by residual contamination was not evaluated. Any evaluation of risk must consider the threat posed by the residual pollution under changing conditions (e.g. increasing and decreasing groundwater levels, new supply well installed nearby, etc.) for as long as the residual pollution (adsorbed and dissolved) remains in place in the environment. The threat posed by the residual source must be evaluated under all conditions, and reasonable use or occurrence scenarios cannot be excluded.

ACEH therefore, cannot concur with cleanup levels proposed in Golder's risk assessment which "Recommends that NAPL source mitigation be implemented, focused on shallow NAPL near the water table. ... Alternate approach may be to rely on soil vapor measurements for development of remediation goals (i.e., as opposed to groundwater).

To be a complete risk evaluation used to develop a CAP, all COCs and all receptors need to be evaluated; the threat posed by the residual pollution under changing conditions for as long as the residual pollution remains in place in the environment evaluated; cleanup levels (active remediation) and cleanup goals (water quality objectives) determined; and the time it will take to reach cleanup levels and goals calculated.

As such the risk evaluation for source remediation is incomplete and cannot be approved. ACEH notes that the tasks previously required of you as part of your SCM 2.0 need to be completed before your consultant can undertake this risk evaluation. Also, the additional information obtained from the pilot scale test will assist in developing a remediation strategy. Please address these items in your risk evaluation as part of the CAP requested below.

8. **Groundwater Ingestion** – Golder's risk assessment states that "The ingestion of groundwater used for drinking water is not considered to be of concern based on water use in the area of the site, which is limited to municipal water supply, and absence of known drinking water wells near to the site." The subject site is located above the municipal drinking water aquifer which supplies drinking water to the City of Livermore. Dissolved plumes from your site are in the immediate vicinity of active municipal supply well CWS-8 and appear to be migrating into an area for which you have not yet performed a well survey (as previously required of you in SCM 2.0).

Thus, this pathway cannot be eliminated from your risk assessment. Please address this data gap in SCM 2.0 and this pathway in your risk evaluation as part of the CAP requested below.

9. **Preferential Pathways** – Golder's risk assessment states that vapor migration along utility corridors was not specifically evaluated. This is a data gap in your SCM that you were requested to evaluate and have not. Free product, reported as fresh gasoline, was detected 900-feet downgradient of your site in MS-MW1. Deep utilities and a potential petroleum pipeline, (associated with previous land use at the Mill Spring Apartments) are reported to be in the vicinity of your site and the Groth site, and could act as a preferential pathway for contamination to move from your site, to the Groth site, and to Mill Springs Apartments, and/or other locations. This is a key data gap that could affect your analysis of risk to the Groth site. Please address this data gap in SCM 2.0 and this pathway in your risk evaluation as part of the CAP requested below.

10. **Depth to water** – The remediation plan states that depth to water has varied from 18 to 37-feet bgs since 1995. More correctly depth to water has varied from 17' bgs in 1997 to 69 feet bgs in 1992, and the first reported release at the site occurred in 1988. It is unclear why pre-1995 water levels are excluded. Please address this comment in the work plan addendum requested below.

11. **Remediation Pilot Test** – We concur with your remediation plan's proposal to evaluate the use of in-situ chemical oxidation (ISCO) with ozone as a pilot test. However, we request that you submit an amended plan for this work, by the date specified below, that addresses the following comments:

a. **COCs** - The remediation plan focuses only on treating benzene and NAPL near the water table (assumed current) and affecting cleanup for the Groth Property (see also Technical Comment A.1. regarding target cleanup zones). No other known COCs were discussed. For example, although MTBE is also a primary contaminant of concern contributing to a long-term groundwater problem, it is not mentioned in the source zone cleanup plan. Additionally, PCE (see attached) has been detected in both the MIP and monitoring wells associated with your site (see attachment) and your treatment approach must consider this contaminant also. Your source zone remediation plan is required to address all known COCs at the site.

b. **By-Products** – Please include an evaluation of all anticipated reaction by-products for all COCs and those potentially produced by the treatment method.

c. **Monitoring Network for Pilot Test** – The proposed network of wells to monitor the effectiveness of the pilot test is insufficient. Monitoring in the down-gradient direction is not proposed. A sampling and monitoring program to monitor oxidant dispersion and treatment effectiveness in three dimensions is an essential component for evaluation of your pilot test. We recommend that you install additional monitoring points to meet these criteria. Please include an explanation of your rationale for locating additional monitoring points and your monitoring frequencies. Include your plan for monitoring to differentiate between displacement of contaminated water and actual mass destruction.

d. **Pilot Test Frequency** – Please specify the time frames for your pilot test, how long before rebound is anticipated, timeframes to evaluate displacement, the basis for estimating these timeframes, proposed frequencies for different monitoring activities, etc.

e. **Well Construction** – Golder proposes the installation of nested wells for their treatment system. Nested wells are not acceptable at contaminated sites due to the difficulties in ensuring reliable seals between sampling zones. Poor seals can result in leakage between zones and are therefore not allowed. We request that you consider an alternative design for these wells.

f. **Utility Survey** – The utility survey portion of your conduit study has not been completed, as noted in SCM 1.1 and the risk assessment. The presence of deep utilities and a potential petroleum pipeline are reported to be in the vicinity of your site and the Groth site and could act as a preferential pathway for contamination, oxidant and/or by-products of the reaction. We request that you complete your evaluation of this data gap for your pilot test proposal.

12. **Vertical Gradient** - Anomalous data regarding vertical gradient in well pairs MW-11, MW-12, D-1, and D-2 has consistently been reported in the quarterly reports. We request that these anomalies be analyzed and the rationale for their occurrence be provided in SCM 2.0. Please include hydrographs and head profiles for these wells, your depth discrete wells (CMT), supply wells, etc., and an analysis of these graphs and other data to support your evaluation.

13. **SCM Data Needs** - Include <u>all</u> soil & groundwater analytical results and sample location maps, boring logs, and cross-sections in the SCM 2.0 requested below. This request encompasses data and maps from UST removal and/or closure through site investigation activities.

14. **Corrective Action Plan** – The purpose of the CAP is to use the information obtained during investigation activities to propose cost-effective final cleanup objectives for the entire contaminant plume and remedial alternatives for soil and groundwater that will adequately protect human health and safety, the environment, eliminate nuisance conditions, and protect water resources.

We require that you prepare a CAP for the final cleanup of contamination (MTBE, benzene, other petroleum products, and associated blending compounds and additives) in soil and groundwater caused by the unauthorized releases at your site. The CAP shall detail at least three technically and economically feasible methods, besides the no action, MNA, and natural attenuation alternatives, to restore and protect beneficial uses of water and to meet the cleanup objectives for each contaminant established in the CAP. The evaluation is to include cost estimates for each alternative and the timeframes to reach remediation objectives.

The CAP is to include a risk evaluation that: considers all COCs and all receptors; evaluates the threat posed by the residual pollution under changing conditions (e.g. increasing and decreasing groundwater levels, new supply well installed nearby, etc.) for as long as the residual pollution (adsorbed and dissolved) remains in place in the environment; determines cleanup levels (active remediation) and cleanup goals (water quality objectives); and calculates the likelihood of reaching cleanup objectives and the time it will take to reach cleanup levels and goals.

The CAP must propose a monitoring network capable of monitoring the effectiveness of on-going remediation (process monitoring). Note that this will likely require monitoring points in addition to your current network. The CAP must also propose verification sampling and monitoring (soil and groundwater) to confirm completion of corrective actions and evaluate CAP implementation effectiveness. Please submit your CAP by the date below.

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

May 25, 2007

Mr. Balaji Angle
B&C Gas Mini Mart
2008 1ST Street
Livermore, CA 94550

Mr. John Rutherford
Desert Petroleum
3781 Telegraph Rd
Ventura, CA 93003-3420

Dear Messrs. Angle and Rutherford:

Subject: Fuel Leak Case No. RO0000278, Desert Petroleum, 2008 1ST Street, Livermore, CA

This letter is to follow-up the meeting on May 24, 2007, attended by you, your consultant Golder Associates Inc. (Golder), and representatives of Alameda County Environmental Health (ACEH) at the ACEH offices. The meeting was held to discuss the deficiencies in the rejected submittal entitled "Source Zone Remediation Plan Addendum," dated April 27, 2007, prepared by Golder. Listed below is a summary of the items discussed and work to respond to agency directives for the site and for the remediation plan addendum.

TECHNICAL COMMENTS

1) **Remediation Objectives and Cleanup Levels** – ACEH did not concur with the cleanup levels nor the exclusion of source zone remediation on the Desert Petroleum site in the remediation plan proposal. The addendum needs to include your discussion of your plan to expand the system to address source zone cleanup on both the Groth and Desert Petroleum sites (e.g., following pilot test evaluation) and to establish cleanup levels and goals for contaminants at the sites. (Reference: directive letter dated March 26, 2007, Technical Comments A.1. and A.7.).

2) **Technical Comments in March 26, 2007, directive letter to be addressed –**

   a) **Technical Comment A.10.** – Please address this comment in the remediation plan addendum.

   b) **Technical Comment A.11.a.** – Please include all COCs at the site. COCs include target compounds (petroleum related compounds) for remediation and secondary COCs (e.g., solvents) from unknown sources that are within the treatment area.

   c) **Technical Comment A.11.b.** – Please provide additional information for this comment. Evaluation of anticipated reaction by-products for all COCs, includes identification of the specific compounds and plans for analysis.

   d) **Technical Comment A.11.c. and A.11.d.**– Options for design and location of an additional short screened monitoring network (small diameter direct push, CMT, etc.) capable of collecting data to evaluate the effectiveness of the treatment system was discussed during the meeting. Please finalize your proposal for this network. Include your rationale for the network design and specify the data to be collected to evaluate treatment system effectiveness, differentiate plume displacement verses mass destruction, etc. Include graphics for well location and design.

e) **Technical Comment A.11.d.** – Please include information supporting your rationale for estimating timeframes to evaluate rebound, displacement, system effectiveness, etc.

f) **Technical Comment A.11.e.** – Include graphics that demonstrate how the nested injection wells will be constructed to maintain separation of multiple casings ensuring reliable seals between sampling zones.

g) **Technical Comment A.11.f.** – Report results of: conduit study, review of Mill Springs case file, data from recent Groth Bros. investigation. Schedule date to review documents at ACEH offices.

3) **SCM** – Complete SCM 2.0. Schedule review/pickup of data analysis and documents related to detached plume.

4) **Monitoring Well Purging** – Monitoring wells are currently being purged of limited casing volumes (e.g., one volume in long screen wells) prior to being sampled. Purging is not following the standard protocol for ensuring that formation water is being sampled at the site. Please evaluate the sampling protocol for all monitoring wells at this site. Propose an appropriate sample collection protocol for this site and provide the technical rationale to support your proposal.

5) **Schedule** – Golder expressed concern that the pilot test reporting schedule did not allot enough time for treatment system permitting and installation. Please submit your proposal for a detailed schedule for system installation and system evaluation reporting. Also, include your timeframes for completing the specified items above.

TECHNICAL REPORT REQUEST

Please submit technical reports electronically to ACEH (Attention: Ms. Donna L. Drogos), according to the schedule below and as established for the project under the Polanco Act.

- **May 30, 2007** – Proposed Schedule

These reports are being requested pursuant to Section 25296.10 of the California Health and Safety Code. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

ELECTRONIC SUBMITTAL OF REPORTS

The Alameda County Environmental Cleanup Oversight Programs (LOP and SLIC) require submission of all reports in electronic form to the county's ftp site. Paper copies of reports will no longer be accepted. The electronic copy replaces the paper copy and will be used for all public information requests, regulatory review, and compliance/enforcement activities. Instructions for submission of electronic documents to the Alameda County Environmental Cleanup Oversight

ATTACHMENT B

Pilot Test Plan

OZONE PILOT TEST/INTERIM REMEDIATION

The primary goal of the pilot test is to confirm the effectiveness of utilizing ozone sparging to treat petroleum hydrocarbons in groundwater near the source area. If the pilot test proves successful, the data will be used to formulate the design basis for full scale implementation. The pilot test will be performed to evaluate the following:

- The gas entry pressure of the course-grained unit within the source zone;
- The potential radius of influence (ROI);
- The relationship between pressure and flow rate (and ROI) during sparging;
- The extent that petroleum hydrocarbons are off-gasing to the vadose zone;
- The contaminant removal rates from groundwater versus potential displacement; and,
- The extent that oxidation by-products accumulate (in conjunction with the bench study).

A. System Components

The primary components anticipated for the sparging pilot test include:

- Power supply;
- Dual completion ozone/air sparge wells
- Ozone sparging equipment package to include:
    - oxygen enriched inlet air,
    - programmable operation with actuated valves and manifold;
    - capability to produce up to 2 pounds per day ozone;
    - capability of 2 standard cubic feet per minute (SCFM);
    - capability of up to 20 pounds per square inch (psi).
- Pressure gauges on injection and monitoring wells
- Helium delivery system with flow meter, pressure gauge/regulator.
- Helium detector;
- Oxygen/carbon dioxide/lower explosive limit meter;
- Ozone detector (optional);
- Miscellaneous soil vapor and groundwater sampling equipment; and
- Photo-ionization detector (PID).

B. Baseline Sampling

Prior to starting the pilot test, a sampling pump will be used to obtain baseline vapor samples for field screening of:

- VOCs;
- ozone (optional);
- helium;
- carbon dioxide; and,
- oxygen.

Vapor samples will be collected from monitoring well MW-6 and SVE-1 using a drop tube (1/8 to 1/4-inch diameter tubing) inserted through a sealed well cap and lowered to around 20 feet bgs to assess these parameters in the vadose zone in the pilot test area. Vapor samples will also be collected from each sparge well surrounding SP-1 (SP-2 (A, B) through SP-5 (A, B)) using a drop tube (1/8 to

1/4-inch diameter tubing) inserted through a vented well cap and located within one foot of the water table to assess headspace concentrations in equilibrium with the groundwater (these screens are submerged).

Groundwater samples will be collected from the sparge wells surrounding SP-1 (SP-2 (A, B) through SP-5 (A, B)) and from SP-6 (A, B, and C) consistent with the procedures included in Appendix C of the source zone remediation plan. During groundwater sampling the following field parameters will be collected:

- Depth to water; and,
- Dissolved oxygen (DO), oxidation reduction potential (ORP), electrical conductivity (EC), and pH.

Groundwater samples will be collected for chemical analysis using disposable polyethylene bailers, peristaltic pumps (low flow method), or inertial pumps (low flow method). Groundwater samples will be analyzed for:

- VOCs by US EPA Method 8260B;
- Total petroleum hydrocarbons as gasoline (TPHg) by US EPA Method 8015 or 8260B
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) by US EPA Method 8260B; and,
- Fuel oxygenates by US EPA Method 8260B; and
- Bromide, bromate, chromium, and hexachrome by US EPA Methods 300.1, 200.8 and E218.6.

Other parameters may be added based on the results of the bench scale study. One well may also be analyzed for COC ozonation by-products.

C. Testing Procedures

Golder proposes to conduct two types of performance tests including:

- Variable pressure/flow rate tests for estimating sparge cycle durations, gas injection system equipment requirements, and potential sparge radius of influence.
- Constant-rate tests for evaluating ozone area of influence and contaminant removal effectiveness.

The variable pressure/flow rate tests will be conducted first to evaluate the gas entry pressure and determine the time required to generate the maximum effective zone of sparging (maximum DO and ORP). These results will be used to plan the injection timing and flow rates for the constant-rate test. The constant-rate test will be conducted following the variable pressure/flow rate test to evaluate the area of influence and efficiency of contaminant removal from groundwater and effects on soil vapor petroleum hydrocarbon concentrations. Testing will be performed on SP-1 (A, B). The constant-rate test will be performed as interim remediation over a period of approximately one month.

Variable Pressure/Flow Rate Test

The variable/pressure/flow rate test is primarily assessing the physical phenomena involved with ozone or air sparging including the migration of the gas bubbles and pressure and flow relationships. This testing will also provide an indication of the mass transfer rate of ozone into the groundwater and whether COCs are volatilized into the vadose zone prior to oxidation. Depending on the rate that bubbles or dissolved gases reach the monitoring points, this part of the test will take two or more days to complete.

The initial testing will be performed by injecting ambient air into the shallow (SP-1A) and deep (SP-1B) sparge points separately. During the variable pressure/flow rate test, the shallow sparge point will be tested first since it will disturb less groundwater than the deeper sparge point and the time required for re-stabilization after the test will be less for the shallow sparge point. The deeper sparge point (SP-1B) will be tested after the water level in SP-1A is within 10% of its baseline measurement (water column height).

The variable pressure/flow rate test will consist of applying air pressure to a sparge point and recording the resulting air flow. The air flow will be zero until the break-out pressure is reached. Groundwater is pushed out of the sparge point until the hydrostatic pressure (height of the water column) is equalized. The pressure will continue to increase until the air-entry pressure is overcome. The air-entry pressure is the pressure necessary to push the air out of the porous sparge screen, through the filter pack, and into the aquifer materials. The sum of the hydrostatic pressure and the air-entry pressure is the break-out pressure.

Once air begins to flow, pressure and flow rates will be increased incrementally and recorded. Helium tracer gas will be added to the injected air to aid in assessing the radius of influence (ROI) at each pressure/flow. The pressure will be increased to a maximum of 25 to 50% above the break-out pressure (and within the limitations of the pilot test equipment). During this testing the following parameters will be monitored in the surrounding wells (SP-2 (A, B) through SP-5 (A, B)):

- Vapor monitoring as described in Section B;
- Depth to water;
- Dissolved oxygen, ORP, EC, and pH

Vapor monitoring will also be performed in SVE-1 and MW-6. Monitoring will be performed in the wells closest to the active sparge point initially and then be moved outward as the parameters are influenced by sparging. Typical monitoring frequencies will range from 5 minutes to 1 hour depending on the rate the parameters are changing.

Following the air injection tests, ozone will be injected into the shallow and deep sparge points separately. As the flow rates are increased, soil vapor and groundwater headspace will be monitored to assess whether or not ozone is reducing the VOCs in the off gas in comparison to the air-only test (if possible, the ozone concentration may also be adjusted). Oxygen is a byproduct of the ozonation reaction as well as the breakdown of ozone. During this testing, the oxygen levels in the vadose zone, groundwater headspace, and groundwater (along with ORP) will be monitored to indicate the optimum mass loading for the ozone. Mass loading is the combination of the concentration of ozone and the flow rate. Theoretically, the optimum ozone application rate is that which provides the most ozone to the subsurface (within the sparge point and equipment capabilities) without causing excess volatilization of un-oxidized VOCs, migration of ozone or oxygen (above atmospheric levels) through the subsurface, or displacement of groundwater. Typically the same parameters will be monitored in the surrounding SP wells and SVE-1 and MW-6 as described above.

This data will be used to develop a relationship between pressure, flow, and ROI necessary for full-scale system design and selection of operating parameters for the remainder of the pilot test and interim remediation.

<u>Constant–Rate Injection Test Procedures</u>

Based on the data acquired during the variable pressure/flow rate testing, ozone will be injected at the assumed optimal flow rates and monitoring will be performed to assess the effectiveness of ozone sparging. The optimal flow rate will be the flow rate that maximizes the injection of ozone with minimal liberation of petroleum hydrocarbons to the vadose zone (within system operating limitations). The pilot test system will be programmed for continuous operation at the deep and shallow sparge points (SP-1A and SP-1B) and modified as monitoring data is evaluated. Continuous operation will likely involve rotating from point to point in a programmed sequence with “resting” periods in between.

Soil vapor monitoring will be performed as described in Section B within 2 to 3 days after continuous operation commences and at least weekly thereafter. Groundwater sampling will be performed as described in Section B once every two weeks after continuous operation commences. The frequency of future monitoring will depend on the results of this data and the results of the bench study.

D. Rebound Testing

After approximately one month of operation, the system will be shut down for approximately three weeks. At the beginning and at the end of this stabilization period, soil vapor and groundwater monitoring will be performed as described in Section B to assess rebound. Additionally, one sample from SP-3A will be analyzed for the following oxidation by-products:

- Mono-, di-, and tri-chloroacetic acid isomers by EPA Method 552.2;
- TBA (tertiary butyl alcohol) and TBF (tertiary butyl formate) by EPA 8260B; and,
- Formaldehyde by EPA Method 8315A

Rebound can be caused by migration from higher-concentration areas, desorption from saturated soils, or solubilization of NAPL. The occurrence and magnitude of rebound can indicate the potential time to remediate, whether or not sufficient ozone is being applied, and whether augmentation such as the addition of peroxide should be conducted. Note: it is normal for in situ chemical oxidation (ISCO) to cause temporary increases in dissolved-phase concentrations as organic carbon in the soil is oxidized causing a reduction in the adsorptive capacity of the soil and the adsorbed mass is desorbed by the physical agitation of sparging. The presence of NAPL within the area of ozone sparging will also cause temporary increases in dissolved-phase concentrations due to agitation and changes in the equilibrium conditions in the subsurface.

PILOT TEST DATA ANALYSIS AND REPORTING

VOC removal rates will be calculated for the detected constituents utilizing the field and laboratory data for VOC concentrations from the monitoring wells. The data will be presented in terms of VOC removal percentages. The changes in VOC concentrations over time will be reviewed together in order to establish a general rate of decline towards clean-up goals. This data will serve as a baseline for estimating the duration of full-scale ozone treatment (with consideration of rebound). Monitoring for secondary chemical effects of injection will be performed as indicated by the bench study.

Wellhead vapor measurements will be summarized in tables and graphs of concentrations versus time. In addition, the ratio of the ozone to helium tracer gas will be calculated at each well over time to determine the breakthrough periods for both gases (ozone may not be measured). Helium breakthrough time will be used along with gas injection rates to estimate the volume of aquifer contacted by the injected gases. The changes in vadose zone vapor concentrations will be used to asses the relative effects of volatilization versus oxidation.

A report will be prepared to summarize the results of the sparge well installation, bench study, and pilot test. The report will be prepared after the rebound check; approximately 1 to 2 months after the start of the test. The technical report will include design basis and remedial implementation plan for ozone/air sparging in the source zone.

ATTACHMENT C

City of Livermore Utility Map and Other ACEHS File Review Information

GENERAL NOTES:

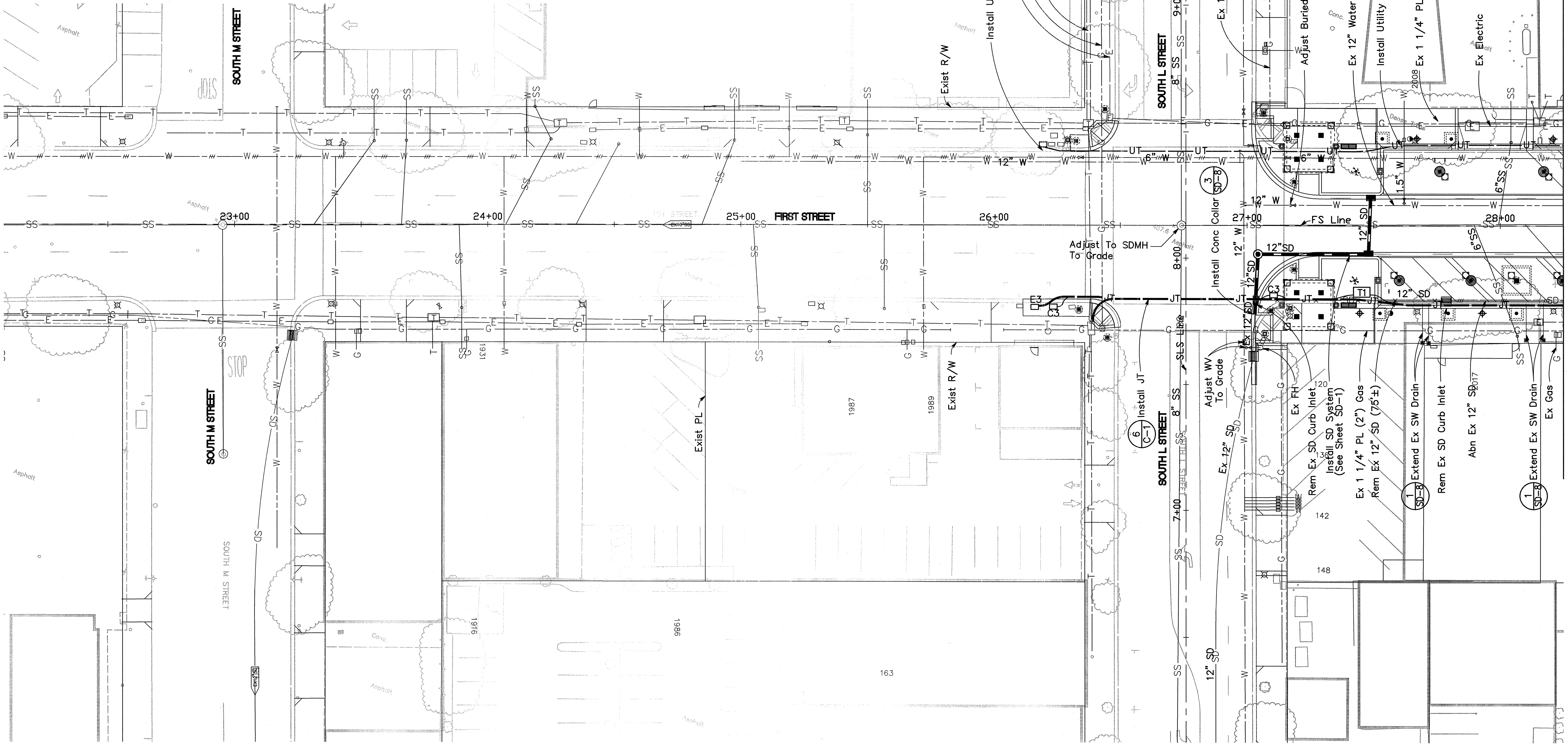
1. CONTRACTOR SHALL SCHEDULE CONSTRUCTION OPERATIONS SO THAT UTILITIES ARE KEPT IN SERVICE AT ALL TIMES.
2. LOCATION OF UTILITY FACILITIES SHOWN ON THESE PLANS WERE OBTAINED FROM OWNERS RECORDS, CITY AND STATE MAPS. CONTRACTOR IS RESPONSIBLE TO FILED VERIFY LOCATIONS AND DEPTHS OF ALL UTILITIES PRIOR TO BEGINNING OF WORK.
3. SEE DEMOLITION PLANS FOR REMOVAL OF EXISTING UTILITIES.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING UTILITY BOX ADJUSTMENTS WITH APPROPRIATE UTILITY AGENCIES.
5. SANITARY SEWER LATERAL INCLUDE CLEANOUT. REFER TO CITY STANDARD DETAIL S-5A.

EXIST FACILITIES LEGEND:

——SS——	SANITARY SEWER
——SD——SD——	STORM DRAIN
——W——W——	WATER
——T——	TELEPHONE
——G——	GAS
——E——	ELECTRIC
—///— UTILITY —///—	ABANDONED UTILITY
▭	WATER METER, ELECTRICAL OR TELEPHONE JUNCTION BOX
○	MANHOLE
⋈	WATER VALVE
⍝	FIRE HYDRANT
▬	STORM DRAIN CURB INLET

NEW FACILITIES LEGEND:

——SS——	SANITARY SEWER
━━━	STORM DRAIN (SEE STORM DRAIN SHEETS)
——JT——	UTILITY JOINT TRENCH (SEE ELECTRICAL SHEETS)
——UT——	UTILITY TRENCH (SEE ELECTRICAL SHEETS)
—///— UTILITY —///—	UTILITY TO BE ABANDONED
—×— UTILITY —×—	UTILITY TO BE REMOVED
◉	STORM DRAIN MANHOLE
▲	FIRE HYDRANT
■	STORM DRAIN CURB INLET
●	SANITARY SEWER MANHOLE
•	SANITARY SEWER CLEAN OUT



Roberto Escobar 2/9/05	APPROVED BY / DATE
DESIGNED BY: RE/TW/PB	
DRAWN BY: RE/FY	
CHECKED BY: RE/TW/PB	

REGISTERED PROFESSIONAL ENGINEER — ROBERTO J. ESCOBAR — No. C58461 — Exp. 12-31-06 — CIVIL — STATE OF CALIFORNIA

NO.	DATE	BY	REVISIONS
1			

CITY OF LIVERMORE
COMMUNITY DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION
City Project No. 200321

FIRST STREET STREETSCAPE IMPROVEMENTS
Phase I - L Street to Maple Street
UTILITY

U-1
Sheet 26 Of 106
Scale: 1"=20'

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

aqua resources inc.

2030 Addison Street, Suite 500 • Berkeley, California 94704 • 415 540-6954

September 12, 1988 87157.5

Barnett-Range Corporation
P.O. Box 8189
Stockton, CA 95208-1489

Attention: Mr. Larry Malcolm, Project Manager

Subject: Interim Report
Environmental Engineering Services Summary
Mill Springs Park Apartments (Formerly Livermore Superblock)
Railroad Avenue between South P and South L Streets
Livermore, California

EXECUTIVE SUMMARY

Aqua Resources Inc. (ARI) has provided environmental consultation and engineering services in order to evaluate environmental concerns at the proposed Mill Springs Park Apartment Site. The site is located on Railroad Avenue, between South L and South P Streets, in Livermore, California. The site was known formerly as the Livermore Superblock. Environmental services provided by ARI included a limited historical review of site usage, three subsurface investigations, and collection and review of chemical analyses during soil removal.

Information obtained during the historical review indicated that the site previously contained railway trackage including a main railway line that ran generally east-west through the center of the site and several spur tracks off the main line. The railway trackage was removed during the mid 1970's; adjacent buildings were also removed during that time. Interviews with people familiar with the site indicated that the site was used for coal and sugar beet stockpiling, a cattle stockyard, and a furniture store while the rail lines were in operation. Those interviewed knew of no other activities on the site.

Based on the limited site history and on the fact that old railroad right of ways are usually suspect for transient leakage from bulk carriers and diesel engines, ARI recommended that a subsurface investigation be performed. A preliminary subsurface investigation was performed, followed by two additional subsurface investigations. The two additional subsurface investigations were performed to better quantify the nature of potential contaminants and to define their horizontal and vertical limits.

Results of the investigations indicated that the only contaminants present were lead, over a limited area of the site, and soils containing asphaltic material over other portions of the site. Furthermore, the contaminants also appeared to be limited to the surface soils to depths generally between about 1 foot up to about 5 feet. However, because of the shallow depth of the contaminants, groundwater contamination was not considered likely. Likewise, because of the shallow depth of the contaminants, removal of contaminated soils was judged to be the most economical method of remediation. In addition, from discussion with the California Department of Health Services (CDHS), the Department does not consider asphaltic materials to be hazardous. The asphaltic character of these materials was determined by tests performed by Construction Materials Testing.

Based on the data obtained from the subsurface investigations, four areas (Areas A, B, C, and D) were designated for removal. Removal was performed by IT Corporation using a mechanical excavator. Excavated soils containing lead were placed in a sealable container for disposal to a Class I facility. Soil containing asphaltic and oily materials was stockpiled on site until disposal requirements were determined. Composite samples of the soils were obtained during removal to assist in determining disposal requirements.

Subsurface conditions encountered during the removal were generally as anticipated except in a portion of Area B where several abandoned underground oil lines and an underground concrete structure were encountered. The oil lines were observed not to be connected to any existing or past underground storage facilities. Deeper removal was required in localized areas due to leakage from the oil lines. The localized leakage appeared to have resulted from corrosion of the oil lines.

Results of the chemical analyses indicate that the oil is fuel oil and that the fuel oil does not contain any PCB's. Likewise, based on observations made during removal and chemical analyses, some additional removal may be necessary from portions of the existing excavation base in Area B, and in the southwest portion of Area B, where additional lead containing soils were encountered.

Prior to performing additional removal, ARI recommends that additional subsurface exploration work be performed to determine the vertical extent of oil contamination at the three locations observed in Area B and to determine the horizontal and vertical extent of lead contamination also in Area B. We also recommend that the existing underground concrete structure be removed.

Based on this and the solubility tests determined from the prior TTLC and STLC for sample A-3 (STLC of 9.9 mg/kg), no further removal was considered necessary. However, the additional removal was performed as a precaution. Subsequent additional testing of the soil samples from this removed material indicated STLC limits in excess of the allowable ones which justified the decision for the removal.

4.3 Area B

Area B was excavated between August 10 and August 16, 1988. The actual excavation limits were generally within the planned excavation limits. The width of the excavation was highly variable depending on observed conditions and ranged from 18 feet wide up to about 69 feet wide and had a finished length of about 317 feet. The excavation depth was also highly variable ranging from about 2.5 feet up to 13 feet deep. Most of the excavated areas extended only to 3 feet; however, deeper removal was required in 3 areas where contamination was observed to extend to deeper depths. The volume of material excavated from Area B is estimated to be about 2390 cubic yards. A composite sample of the excavated materials was obtained generally at 100 cubic yard intervals during removal.

Numerous buried structures were encountered within the excavated limits for Area B. These structures are described briefly below and their locations shown approximately on the Excavation Plan, Plate 1. The structures encountered included three (6-inch to 8-inch diameter) steel pipes running generally east-west. Two of these lines turn and run south under an existing paved area, while the third line terminates about 25 feet east of the east excavation limit. All three lines were observed to contain a viscous oil substance thought to be Fuel Oil. The lines were observed to be highly corroded with numerous corrosion holes through the pipe sidewalls. Visible soil contamination was observed along portions of the pipe alignments as the pipes were removed from the excavation. Two additional steel lines were observed; however, one appeared to be an abandoned gravity drain line while the other appeared to be an abandoned water line.

Two steel barrels and one wooden barrel were also encountered. The barrels could have been used as sumps; however, no lines were observed entering or leaving the barrel structures. The soil surrounding the wooden sump was observed to be heavily contaminated: visible contamination was still present in a test pit excavated to a depth of about 13 feet at this location. No visible contamination was noted around the two steel barrels, although observation of barrel interiors suggested they may have contained oil at one time. The barrels appeared visually to be significantly intact with few visible corrosion holes.

A concrete structure was encountered under the existing paved area. The structure is about 30 feet square in plan dimension, and appears to extend to a depth of about 5 feet below the perimeter side wall. The interior of the structure is sloped. The perimeter wall is generally about .5 to 1 foot below the existing pavement grade. The structure appeared to have been backfilled with wood debris, sand, and gravel. The structure may have contained oil at one time as the concrete was stained but it did not have it now. The upper 2 to 3 feet of backfill did not appear visually to be contaminated; this material was removed and stockpiled. The remaining backfill material was left in place because of potential contamination and presence of free water in the bottom of the structure.

The western limits of the Area B excavation were adjusted based on field observation because the asphaltic material was no longer visible. Several test pits were excavated further west, but the asphaltic material was not observed. Further excavation of Area B was discontinued. However, at one test pit location southeast of Area A, a second area of suspected lead contamination was encountered. Chemical analyses confirmed the lead contamination.

4.4 Area C

Area C was excavated to the limits shown on the plan. The excavation was about 50 feet long, 30 feet wide, and extended to a depth of about 2.5 feet. Excavation to the designed 3 foot depth was judged unnecessary based on test pits excavated to this depth within the excavation limits. The volume of material excavated from this area is estimated to be about 167 cubic yards.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Our conclusions based on review of field observations and results of chemical analyses to date are:

1. Excavation for Area A appears to have removed soil having lead concentrations exceeding regulatory allowable limits. However, the second suspect area may require removal.

2. Conditions encountered in Area B were significantly different from the anticipated conditions. Visible fuel oil contamination resulting from leaks from the corroded steel lines required deeper removal than originally anticipated at selected locations.

3. Contamination in Area B does not appear to extend beyond the existing horizontal excavation limits except at isolated locations based on visual examination of sidewalls and TPH test results. Portions of existing excavation base in Area B may require additional removal.

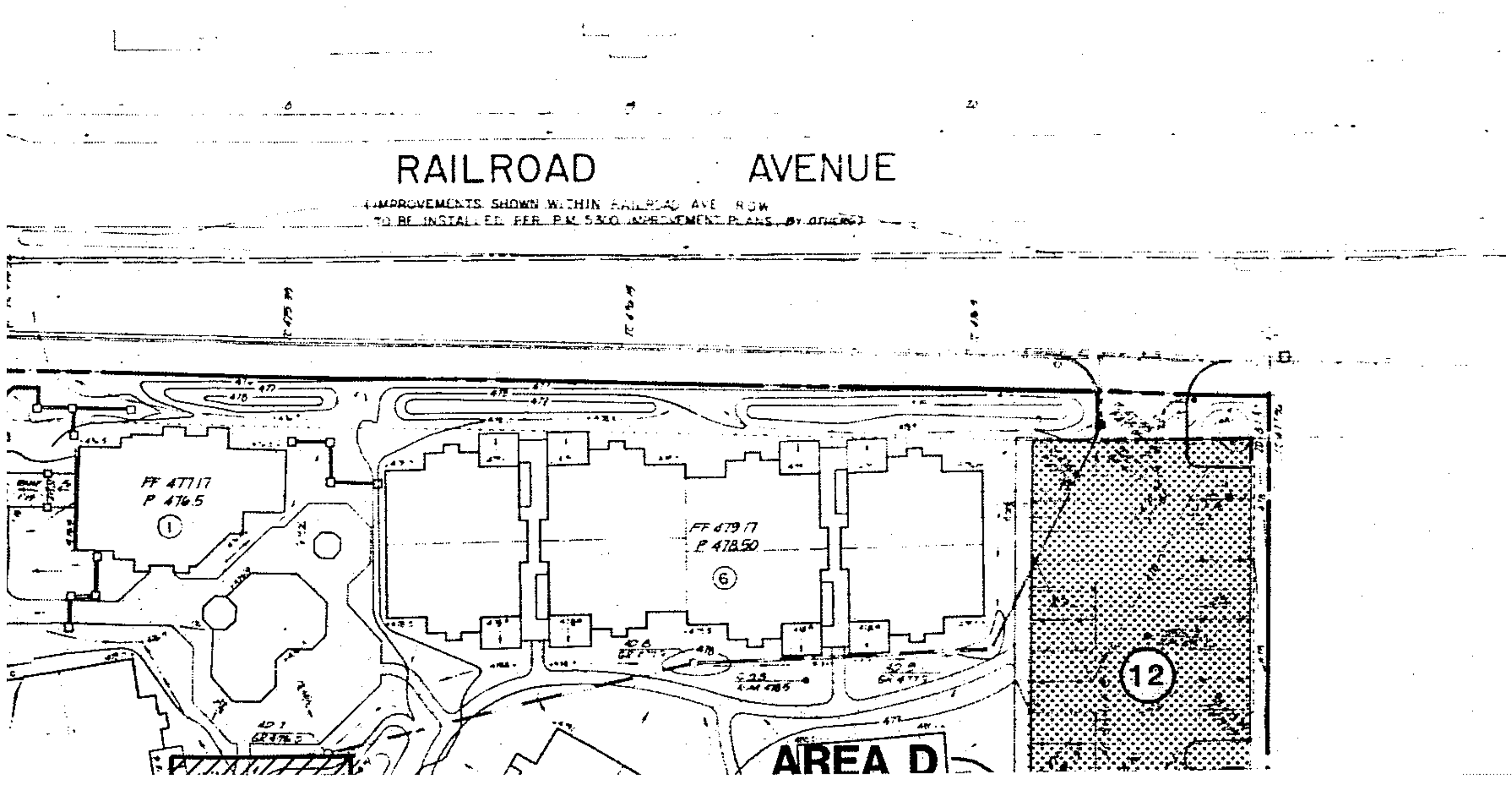
4. Contamination in Areas C and D does not appear to extend beyond the existing horizontal and vertical excavation limits based on visual examination of the excavation sidewalls and based on TPH test results.

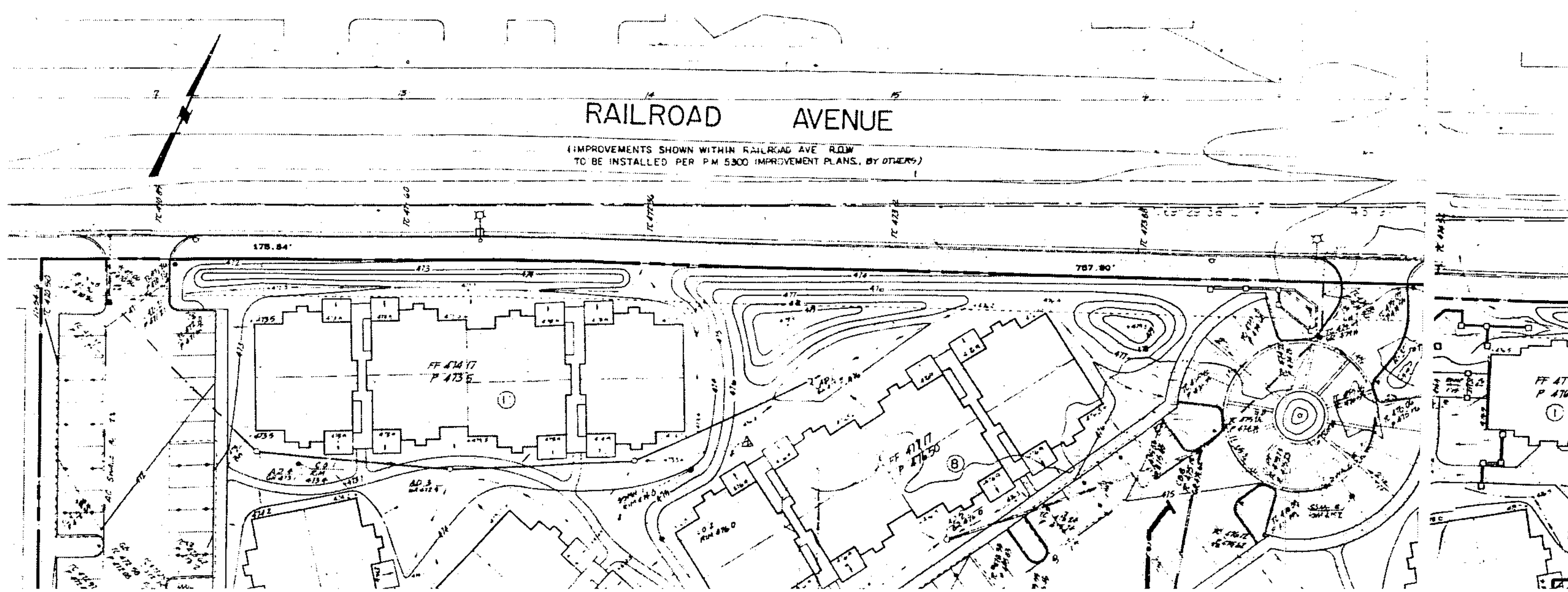
5. The oil observed in the buried pipes is a fuel oil based on results of Gas Chromatographic typing techniques and does not to contain PCB's.

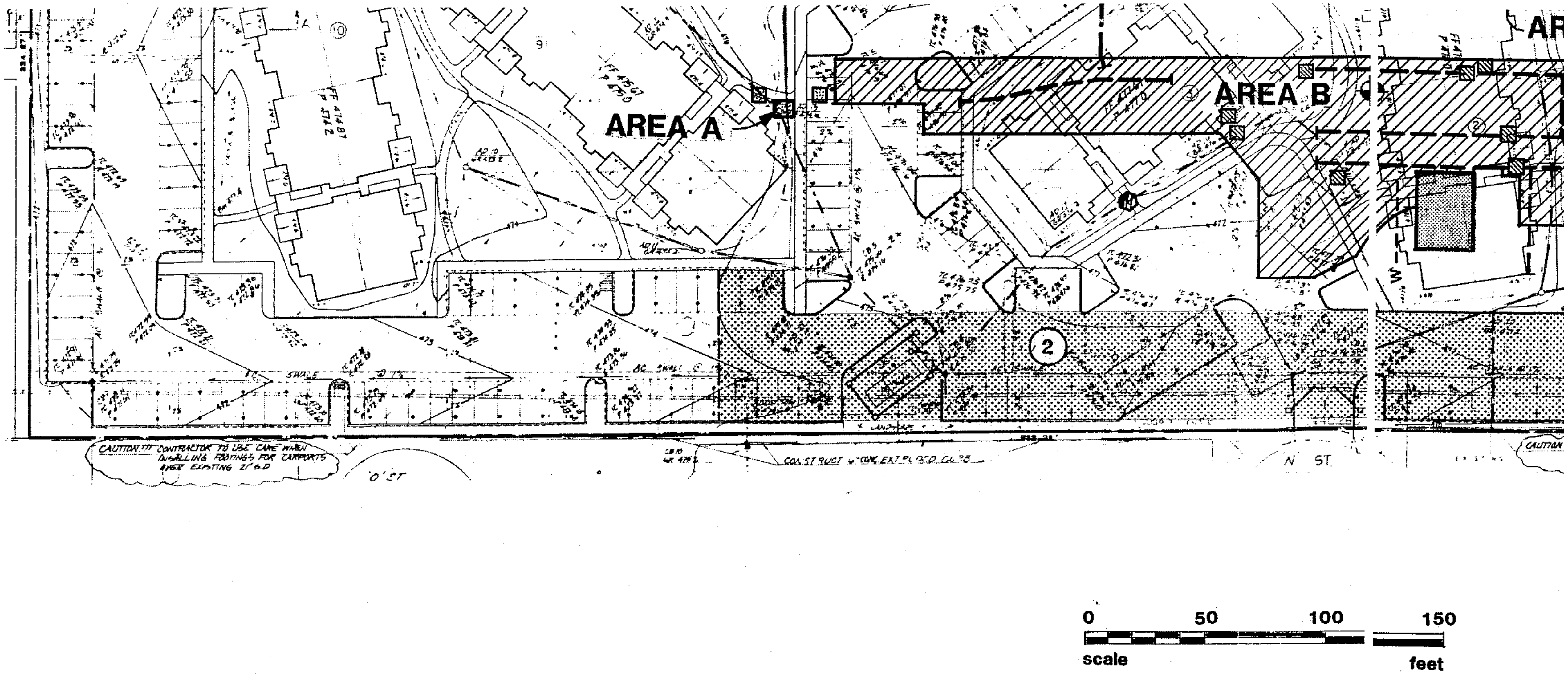
6. TPH concentration from composite samples of the stockpiled material indicate the materials should be acceptable to a Class III disposal facility.

Based on these conclusions we recommend the following:

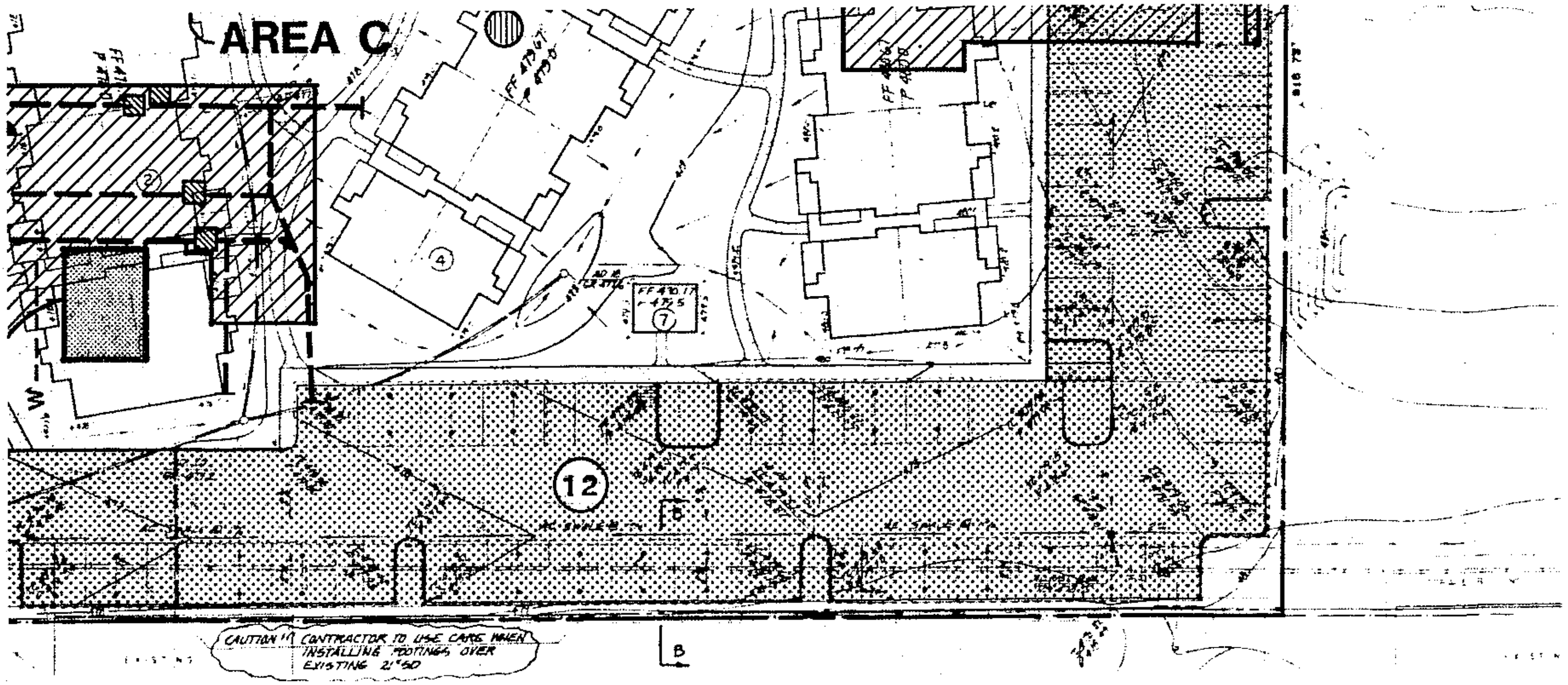
1. Perform additional field sampling and analyses to determine the


RAILROAD AVENUE
(IMPROVEMENTS SHOWN WITHIN RAILROAD AVE. R.O.W.
TO BE INSTALLED PER P.M. 5300 IMPROVEMENT PLANS, BY OTHERS)
FF 477.17
P 476.5
1
FF 479.17
P 478.50
6
12
AREA D


RAILROAD AVENUE
(IMPROVEMENTS SHOWN WITHIN RAILROAD AVE. R.O.W.
TO BE INSTALLED PER P.M. 5300 IMPROVEMENT PLANS, BY OTHERS)
178.84'
757.90'



OR BARNETT RANGE, BY BABBITT CIVIL ENGINEERING, INC.,
1988, AT A SCALE OF 1"=50'



LEGEND

— — —	Property Line
(hatched)	Phase I Excavation Limits (approximate)
(cross-hatched square)	Phase II Removal of Oil Contaminated Soil
(dotted, circled 2)	Location of Oil Contaminated Soil Reused as Subbase in Pavement Area. Number in Circle Indicates Thickness of Subbase Placed, in Inches
(stippled)	Limits for Soil Contaminated with Lead Removed to Class I Landfill
├— — — —┤	Fuel Oil Line (removed)
├—·—·—┤	Drain Line
W — — —	Existing Water Line
(shaded box)	Concrete Structure (removed)
(circle)	Tank No. 1
(hexagon)	Tanks No. 2, 3 & 4
(crosshair)	Location of Monitoring Well (Proposed)

150
feet

MAPS

AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA

MILL SPRINGS PARK APARTMENTS
Livermore Superblock

FINAL EXCAVATION LOCATION PLAN

JOB NO. 87157.5	SHEET NO. 1 OF 1
	DATE February 1989

PLATE 2