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1:59 pm, Mar 21, 2008

Alameda County
Environmental Health

March 4, 2008

Mr. Jerry Wickham, PG, CEG, CHG
Alameda County Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

RE: Cardanal Partners, LLC
632-638 2nd Street
(aka "626 2nd Street")
Oakland, California 94607
Clearwater Group Project # GB001H

Dear Mr. Wickham,

As the legally authorized representatives of the above-referenced project location, we have reviewed the *Soil and Groundwater Investigation Workplan* prepared by our consultant of record, Clearwater Group. We declare, under penalty of perjury, that the information and/or recommendations contained in this report are true and correct to the best of our knowledge.

Sincerely,

Mr. Daniel Altwarg
Cardanal Partners

CLEARWATER

GROUP

Environmental Services

SOIL AND GROUNDWATER INVESTIGATION WORKPLAN

Cardanal Partners, LLC
632–638 2nd Street
(aka "626 2nd Street")
Oakland, California 94607

APN 001-125-001

Prepared by:

CLEARWATER GROUP

Prepared for:

Cardanal Partners, LLC
c/o Bartlett, Leader-Picone & Young, LLP
2201 Broadway, Suite 803
Oakland, CA 94612

and

PG&E
77 Beale St., Room 2439C
San Francisco, CA 94105

March 7, 2008

CLEARWATER
GROUP
Environmental Services

TABLE OF CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

Clearwater Group (Clearwater) has prepared this *Soil and Groundwater Investigation Workplan* for the property located at 632-638 2nd Street, aka "626 2nd Street," Oakland, California (*Subject Property*) (**Figure 1**). The workplan proposes Cardanal Partners, LLC's and PG&E's response to a December 4, 2007, Alameda County Environmental Health Services (ACEH) letter (see **Appendix A**) prepared in response to Clearwater's June 21, 2007, *Underground Storage Tank Closure-in-Place Report*.

All site investigation work will be performed according to State Water Resources Control Board (SWRCB) Resolution No. 68-16 and the Tri-Regional Guidelines set forth by the Regional Water Quality Control Board (RWQCB), April 2004.

2 SITE DESCRIPTION AND HISTORY

The *Subject Property* constitutes a large portion of a city block southwest of State Highway 880 and three blocks west of Jack London Square (**Figure 2**). It is bounded by Martin Luther King Jr. Way (formerly Grove Street) to the west-northwest, Second Street to the west-southwest, Third Street to the east-northeast, and a parking area to the east-southeast (**Figure 3**).

The property is zoned M-30 (general industry) and is included in the Estuary Planning Area of the 1999 City of Oakland Estuary Policy Plan (Plan). The Plan includes objectives and policies to plan an enhanced future of the area of Oakland between Adeline Street, the Nimitz Freeway, 66th Avenue, and the Oakland Estuary shoreline.

3 RECENT ENVIRONMENTAL INVESTIGATION

An underground storage tank (UST) closure-in-place application for five out-of-service USTs (I, II, III, IV, and V) was permitted on June 26, 2006, by the City of Oakland Fire Department (OFD). The closure-in-place was completed in two events over three days from May 1 to May 2, 2007, and May 25, 2007. On May 1 to May 2, 2007, USTs I, II, III, and IV were triple rinsed, pumped out, and filled with concrete. See **Figure 3** for tank locations.

Following the pumping and cleaning of UST V on May 1, on May 2, a creosote/water liquid mix was observed to have partially filled that UST. Therefore, the OFD staff requested that Clearwater determine the source of the creosote and postpone the closure of UST V. Clearwater staff monitored the creosote level in UST V over a 2-week period following the May 2 cleaning event and determined that the volume of creosote had not increased in that period. The most logical hypothesis is that the creosote was draining into the UST from an abandoned delivery line. On May 25, 2007, Clearwater staff and Clearwater Environmental Management remobilized to the *Subject Property* to triple rinse (steam clean) UST V again and pump out the contents with a vacuum truck. After this pumping and cleaning event, no creosote was observed coming into the UST. The UST was subsequently filled with concrete.

Before the tanks were filled with concrete, twelve borings were driven around the USTs to collect soil and groundwater samples. The boring locations are shown in **Figure 3**. Borings T2-A, T3-B, T4-C, and T5-C were bored on an angle of 30° from vertical to obtain soil samples from under the USTs. Total depth varied from 10.0′ bgs to 16.5′ bgs. Only five of the twelve borings (T1-B, T2-A, T3-B, T4-C, and T5-C) contained enough groundwater to sample: T1-B (at 10′ bgs), which was a straight boring, and then all the slant borings (T2-A [15 bgs], T3-B [12 bgs], T4-C [15 bgs], and T5-C [16.5 bgs]).

The soil sample analytical results indicated that there is no contamination from TPH-d, TPH-g, BTEX, or semivolatile organic compounds (SVOCs) in the soil samples above the San Francisco Bay Regional Water Quality Control Board's Environmental Screening Level (ESL) for commercial land where groundwater is not a source of drinking water.

The groundwater samples obtained from borings T4-C and T5-C show slightly elevated TPH-d concentrations. However, these concentrations are below the ESL. The groundwater samples taken from borings T1-B, T2-A, and T3-B contained high concentrations (that exceed the ESLs) of TPH-d, TPH-g, and BTEX. Boring T1-B had the highest reported concentration of TPH-d, TPH-g, ethylbenzene, and total xylenes, at <40,000 μg/L, 35,000 μg/L, 1,800 μg/L, and 4,500 μg/L, respectively. T3-B had the highest reported benzene concentration of all the samples, at 360 μg/L.

In summary, the analytical results provide no evidence that USTs IV and V have leaked. However, there is evidence that UST systems I through III have leaked petroleum hydrocarbons and BTEX compounds into the surrounding groundwater. The soil and groundwater analytical results are shown in **Figures 4** and **5**, respectively.

4 SCOPE OF PROPOSED WORK

In their letter of December 4, 2007, ACEH staff requested a work plan to delineate the horizontal and vertical extent of fuel hydrocarbons in the soil and groundwater. ACEH requested that Clearwater conduct soil borings to obtain soil and groundwater samples as the first phase of investigation to delineate the hydrocarbon plume in the soil and groundwater.

Clearwater proposes to conduct this investigation in two phases. The initial phase will be to determine the lateral extents of the plume. The most efficient way to delineate the lateral extent of dissolved hydrocarbon contaminants is to conduct a Gore-Sorber® passive soil gas survey (Gore-Sorber® Survey). Clearwater is proposing module locations on a grid based on the results of the soil and groundwater analytical results obtained during the tank closure. Gore-Sorber® surveys are used as a screening tool to find the location of the approximate zero contamination line.

The second phase of the investigation will be conducted following a review of the Gore-Sorber® survey results. This second phase will include soil borings conducted at locations where Gore-Sorber results indicated low concentrations of TPH-g and BTEX. Soil and groundwater analytical results from these soil borings will be used to delineate the extent of the dissolved-phase plume. The soil and groundwater analytical from the second phase will corroborate the Gore survey results.

This scope of proposed work, as outlined above, will be implemented in the following steps. The details of these steps follow in **Sections 5** through **8** below.

This work plan will address the following tasks:

- Investigation permitting, field preparation, Health & Safety Plan (HSP), and utility locating and clearance;
- Performance of a Gore-Sorber Screening Survey using 23 modules; analysis of the Gore-Sorber modules, and report;
- Drilling soil borings to obtain soil and groundwater samples to delineate the hydrocarbon plume; disposal of investigation-derived waste; preparation of the subsequent investigation report; and
- Production of plans for future activities moving toward the goal of site closure.

5 PERMITTING / FIELD PREPARATION

All work will be pre-approved by ACEH staff prior to initiation.

5.1 Permitting

Permits for the Gore-Sorber survey and the boring installations will be obtained from the Alameda County Public Works Agency (ACPWA) preparatory to initiation of the field activities. Encroachment and excavation permits to drill soil borings near the sidewalk at the *Subject Property* and in 2nd Street will be obtained from the City of Oakland, Building and Public Works Departments. A traffic control plan will be submitted to the City of Oakland, Public Works Department in order to close the street one lane at a time and close the sidewalk for the work.

5.2 Health and Safety Plan

The May 2007 site-specific Health and Safety Plan (HSP) will be updated to cover the activities proposed in this phase of work. Traffic control will also be discussed in the HSP. The HSP will be signed by the Clearwater project manager and the Clearwater

Health & Safety officer before it is released to the field staff. All field staff will review and sign the HSP before the field activities begin.

5.3 Utility Locating

The perimeter of the site investigation area will be clearly marked with white paint (dashes and box corners), and Underground Service Alert (USA) will be notified 13 days prior to the event to have those utility companies with underground utilities in the area mark their utilities and clear the proposed boring locations. Before any soil borings are driven, a private utility locator service will be engaged to pre-screen, using GPR (ground penetrating radar), each proposed boring location and confirm the current utility (sewer and storm laterals) locations and also search for unmarked buried utilities. The locator service will use utility locating instruments, such as pipe and cable locators and metal detectors.

6 GORE-SORBER SURVEY

In order to establish the extent and distribution of potential TPH-g, TPH-d, and BTEX contamination in the soil and groundwater, Clearwater proposes that a Gore-Sorber® Survey be undertaken as a screening tool. Twenty three (23) Gore-Sorber® modules are proposed to be installed along the sidewalks and in the pavement on 2nd Street (**Figure 6**). The proposed locations of these modules were determined by the building location, the need to minimize holes in the new sidewalk, unless absolutely necessary, and the trend of the presumed groundwater flow direction which is presumed to generally flow toward the bay (Oakland Inner Harbor Channel).

6.1 Gore-Sorber® Procedure

The Gore-Sorber® modules contain various polymeric and carbonaceous adsorbents within a sheath of Gore-Tex® material. The sorbents are designed to retain volatile and semivolatile organic compounds. Each module is installed in a shallow, hand-driven soil boring at a depth of approximately 30 inches bgs and capped with a cork, per Gore recommended procedures. See **Appendix B** for Statement of Procedures for Gore-Sorber® surveys. Organic vapors released from petroleum hydrocarbons and solvents in the soil and groundwater are adsorbed within the modules during the 14-day exposure period.

To maximize the soil gas survey results, the modules are placed so that the maximum spacing between modules is equal to or less than 3 times the average depth to water (@ 8 feet bgs; so 24′ maximum spacing). The locations proposed are at 15-foot centers. After a 14-day exposure period, the modules are removed from the boreholes, the hole is filled with bentonite pellets, and the surface is patched to match the surrounding material.

6.2 Analysis of Gore-Sorber® Modules

The modules are placed immediately back into the lab-provided inert glass sample containers they came in, which are then capped and sealed. The module retrieval time and date are noted on the Chain-of-Custody document, which accompanies the samples. The samples are labeled and shipped under chain-of-custody procedures, via FedEx, to Gore for analysis. The modules are analyzed by Gore using a modified version of EPA Method 8260 (volatile organics).

The Gore-Sorber® results are used for screening purposes and are presented in micrograms (μg). There is no currently accepted method of directly correlating the Gore-Sorber® results with the soil or groundwater sample analytical results. (Subsequent grab soil and groundwater samples will be used to corroborate the data.)

6.3 Additional Gore-Sorber® Survey

If the results of the initial Gore-Sorber® survey reports high levels of TPH-g, TPH-d, or BTEX contamination at the outer limits of the survey area, subsequent rounds of Gore-Sorber® module placements can be deployed, with the concurrence of ACEH staff, to further delineate the lateral extents of the plume.

6.4 Gore-Sorber® Report

Following the Gore-Sorber® survey, a report detailing these activities will be prepared. The report will include all analytical results and color maps showing concentrations of the contaminants at each of the Gore-Sorber® sampling points. This report will recommend soil boring locations for the second phase of the investigation.

7 CONFIRMATION SOIL BORINGS

Once the lateral extents of the plume have been defined by the Gore-Sorber® survey, soil borings will be proposed on the edge of the plume to confirm the Gore-Sorber® findings. At each soil boring location a soil sample will be collected from the vadose zone, and a groundwater sample will be collected from the saturated zone. In addition, if the leading edge of the plume can be determined from the Gore survey map, several depth discrete groundwater samples will be collected to determine the vertical extent of the hydrocarbon plume. Soil boring and sampling will be conducted according to Clearwater's sampling procedures (**Appendix C**).

7.1 Disposal of Investigation-Derived Waste

Efforts will be made to minimize the quantity of soil discarded. Soil cuttings will be placed in labeled 55-gallon steel drums and temporarily stored onsite, pending receipt of the soil disposal characterization sample results. The drummed soil will be disposed of at a permitted landfill, after receipt of the sample results.

8 REPORT PREPARATION

Following the soil borings, a report detailing these activities will be prepared. The soil boring investigation report will include boring logs, soil and groundwater sampling depths, soil and groundwater analytical results, soil cutting disposal manifests, and site photographs. The second investigation report will also include Clearwater's recommendations as to appropriate remediation techniques and the next phase of work required to move the site toward closure.

9 SCHEDULE

Task	Description	Start Date	Estimated End Date	Duration
1	Work plan approval by Local Oversight Agency	3/07/08	4/04/08	30
2	Use comments to amend proposed work	4/04/08	4/18/08	14
3	Budget preparation and client approval	4/18/08	5/02/08	14
4	ACPWA Permit application, city encroachment and excavation acquisition submittal and approval. Engage driller, USA notification, Gore module acquisition/HSP update	5/02/08	6/11/08	40
5	Gore-Sorber® Deployment	6/11/08	6/12/08	2
6	Gore-Sorber® in ground	6/12/08	6/26/08	14
7	Gore-Sorber® analysis and report preparation	6/27/08	7/17/08	21
8	Request agency approval for next phase based on results	7/17/08	8/19/08	30
9	Client and PG&E approval/budget	8/19/08	9/03/08	15
10	Permitting (same as 4 above)	9/03/08	10/13/08	40
11	Soil borings @ 6′ to 15′ bgs after GPR screening	10/14/08	10/14/08	1
12	Analytical Received and Report Preparation	10/14/08	12/4/08	45

LICENSED PROFESSIONALS

All projects are directed by in-house licensed professionals. These professionals, including geologists or engineers, shall be guided by the highest standards of ethics, honesty, integrity, fairness, personal honor, and professional conduct. To the fullest extent possible, the licensed professional seeks to protect the public health and welfare and property in carrying out professional duties. In the course of normal business, recommendations by the in-house professional may include the use of equipment, services or products in which the Clearwater has an interest. Therefore, Clearwater is making full disclosure of potential or perceived conflicts of interest to all parties.

CERTIFICATION

This report was prepared by and under the supervision of a State of California Professional Geologist at the Clearwater Group. All statements, conclusions, and recommendations are based solely upon field observations by Clearwater Group or previous consultants.

Information and interpretation presented herein are for the sole use of the client and regulatory agency. A third party should not rely upon the information and interpretation contained in this document. The service performed by the Clearwater Group has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the area of the site. No other warranty, expressed or implied, is made.

Sincerely,
Clearwater Group

Erik Lervaag
Senior Engineer/Project Manager

James A. Jacobs, P.G. #4815, C.H.G. #88
Chief Hydrogeologist

PROFESSIONAL GEOLOGIST
JAMES ALAN JACOBS
NO. 88
CERTIFIED HYDROGEOLOGIST
STATE OF CALIFORNIA

CLEARWATER GROUP
Environmental Services

DISTRIBUTION

Jerry Wickham, PG, CEG, CHG
Alameda County Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

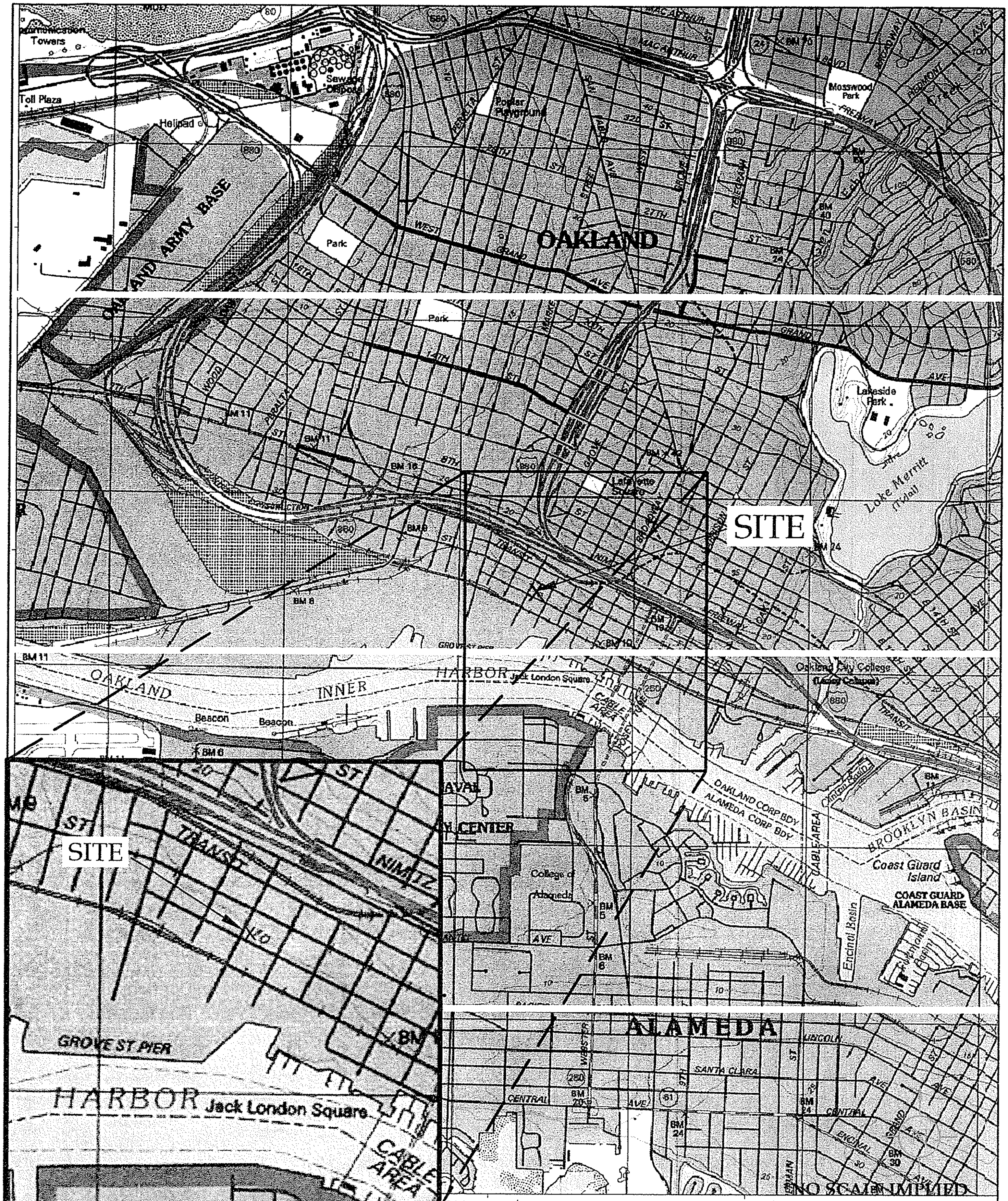
Mr. Daniel Altwarg
Cardanal Partners, LLC
c/o Bartlett, Leader-Picone & Young, LLP
2201 Broadway, Suite 803
Oakland, CA 94612

Mr. Richard Arnold, et al.
Gamma Investments
301 Jefferson Street
Oakland, CA 94607

Ms. Betty Brunswick
PG&E
77 Beale Street, Room 2439C
San Francisco, CA 94105

Mr. Ray Garnica
United California Bank
601 South Figueroa
Los Angeles, CA 90017-5704

FIGURES

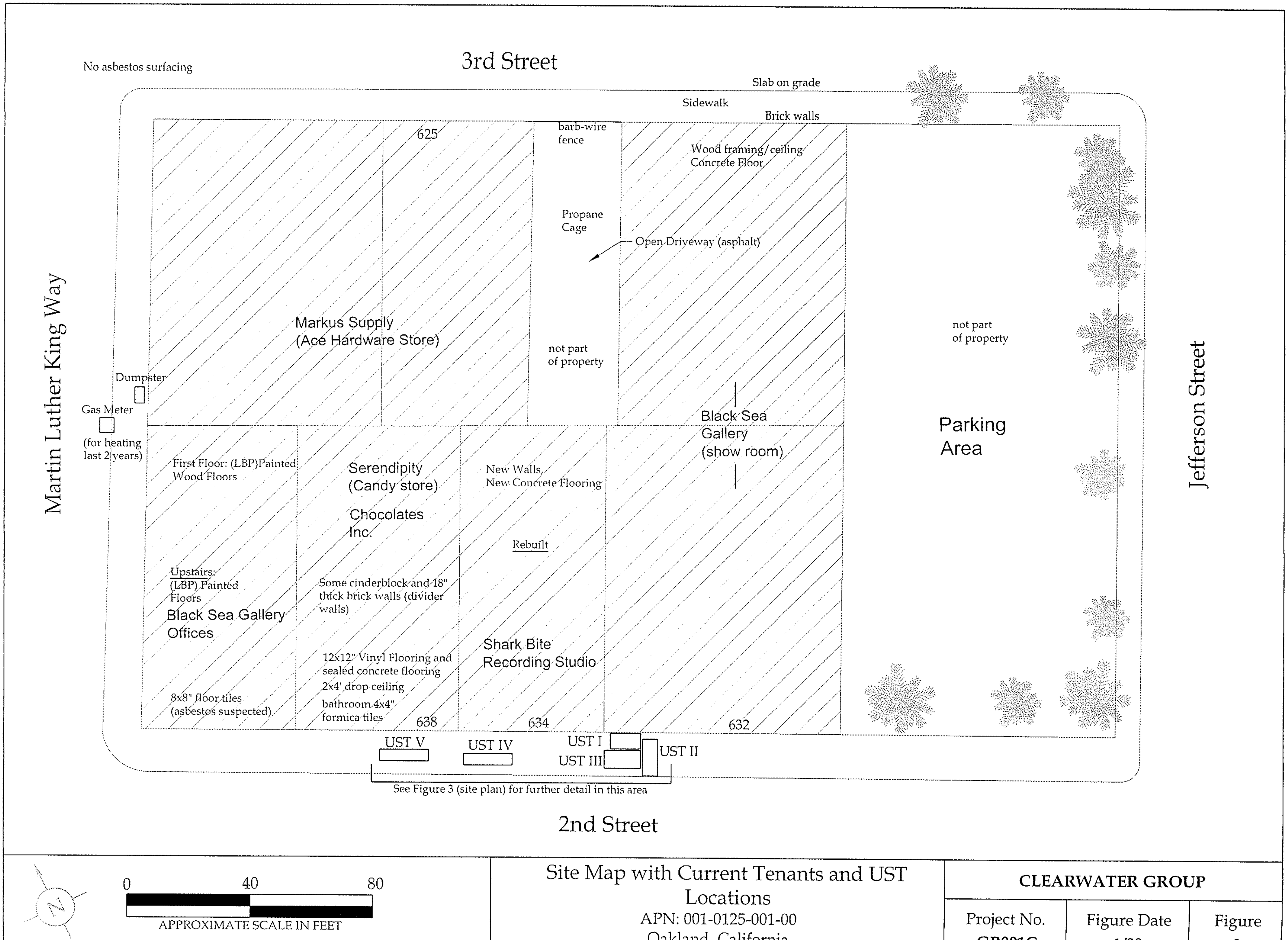


SITE LOCATION MAP

Cardanal Partners, LLC
APN 001-125-001, Oakland, California

CLEARWATER GROUP

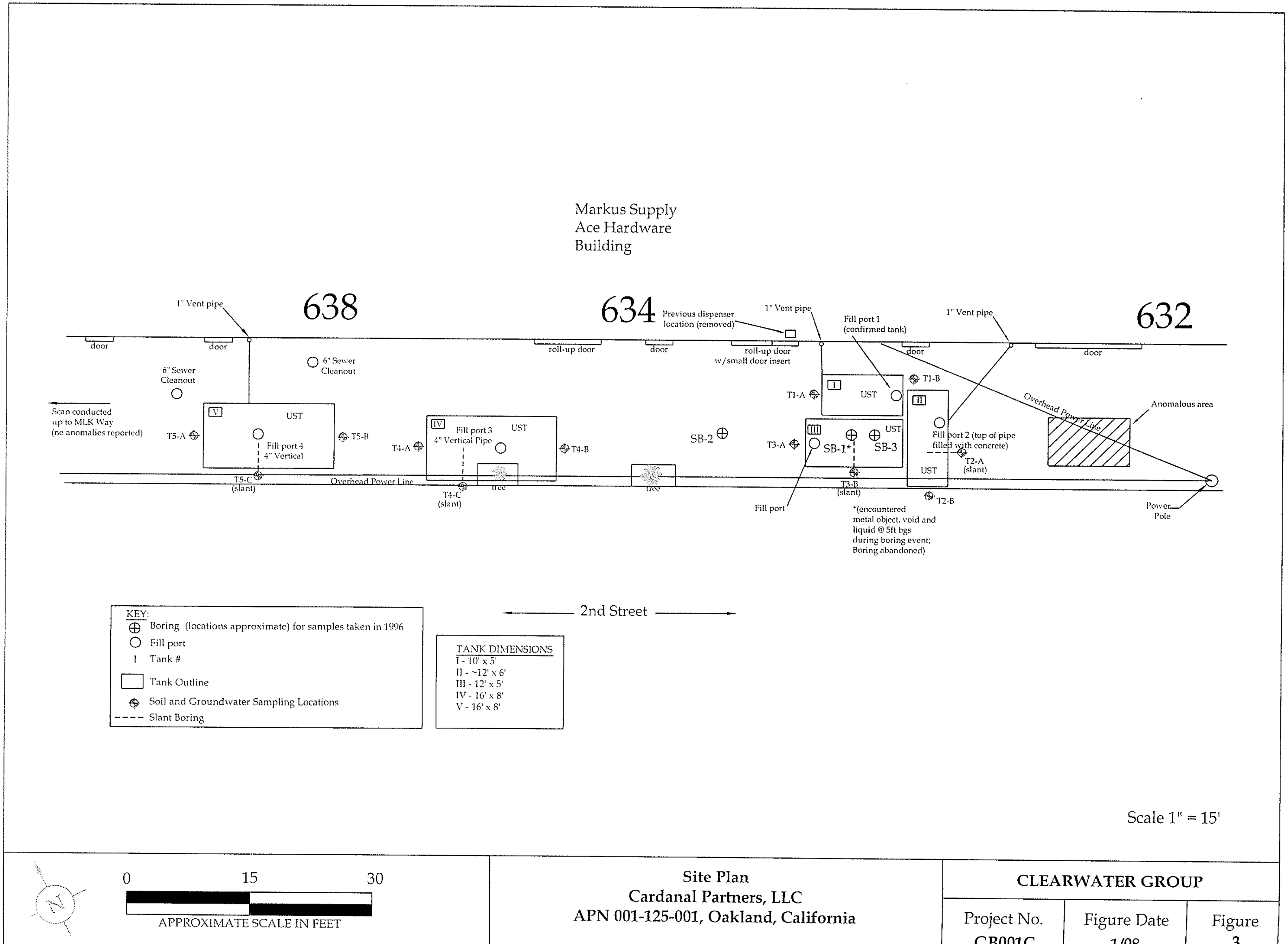
Project No.	Figure Date	Figure
GB001C	2/07	1



Site Map with Current Tenants and UST Locations
APN: 001-0125-001-00
Oakland, California

CLEARWATER GROUP

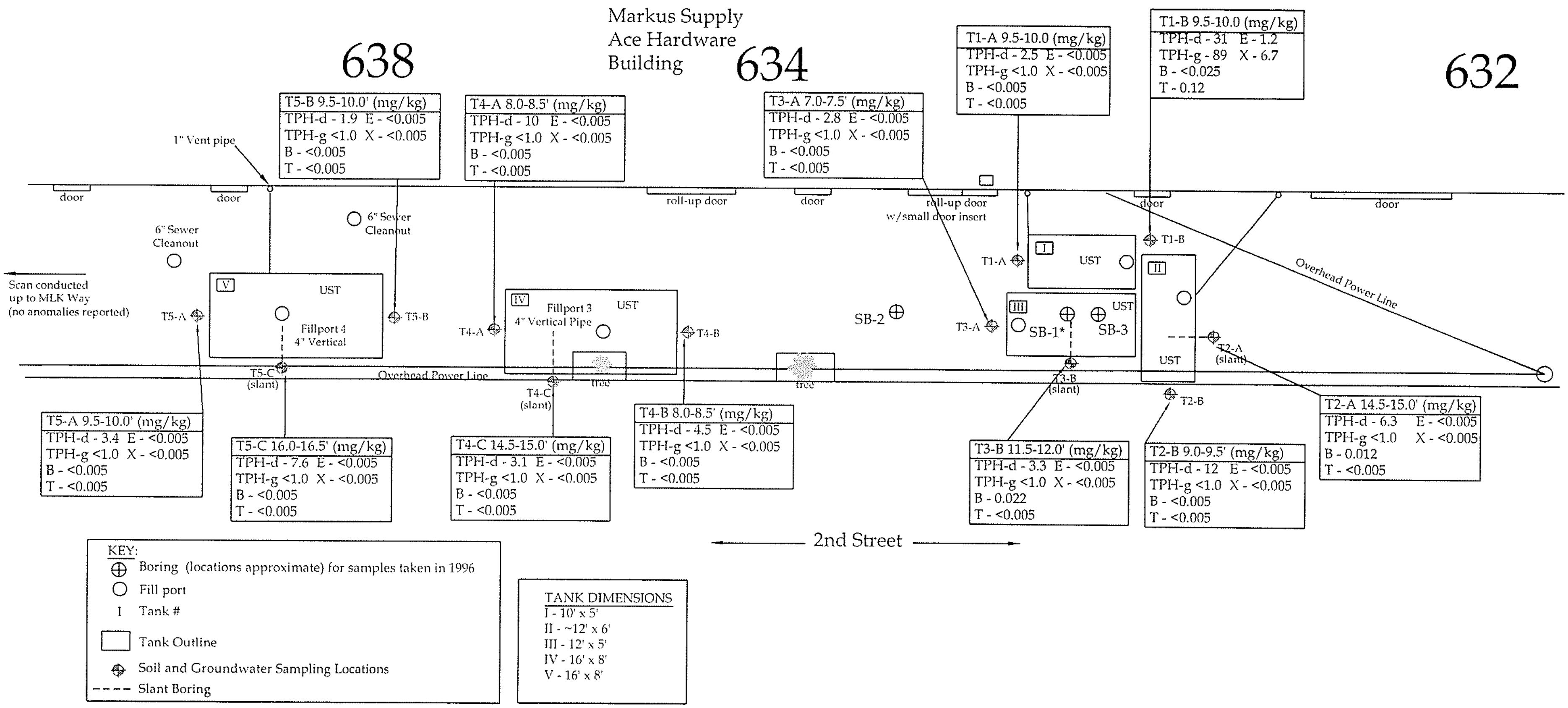
Project No.	Figure Date	Figure
GB001C	1/08	2



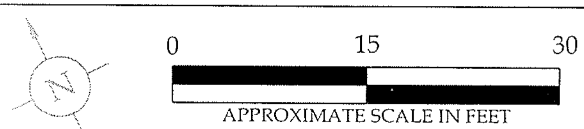
Site Plan
Cardanal Partners, LLC
APN 001-125-001, Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
GB001C	1/08	3



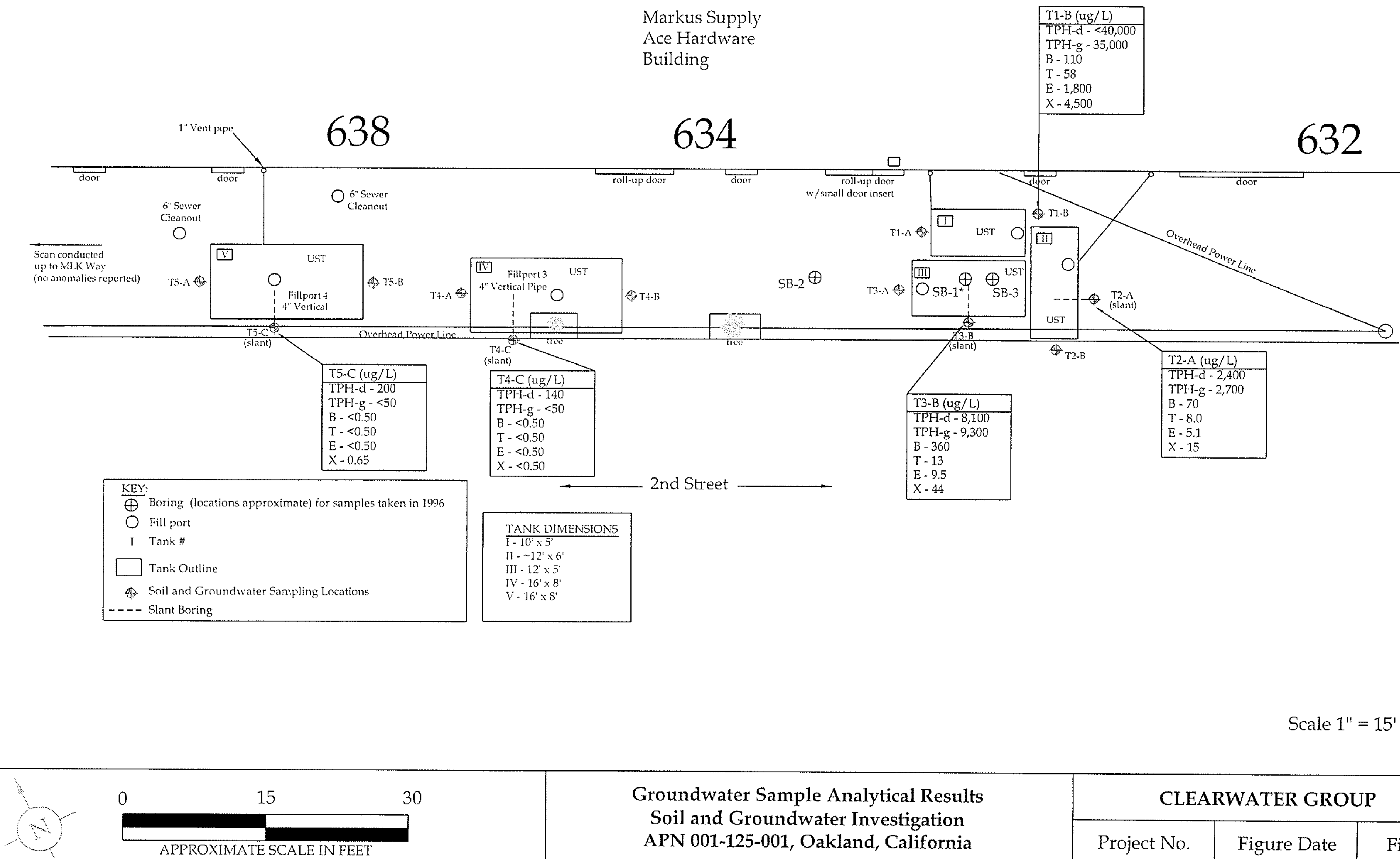
Scale 1" = 15'



Soil Sample Analytical Results
Soil and Groundwater Investigation
APN 001-125-001, Oakland, California

CLEARWATER GROUP

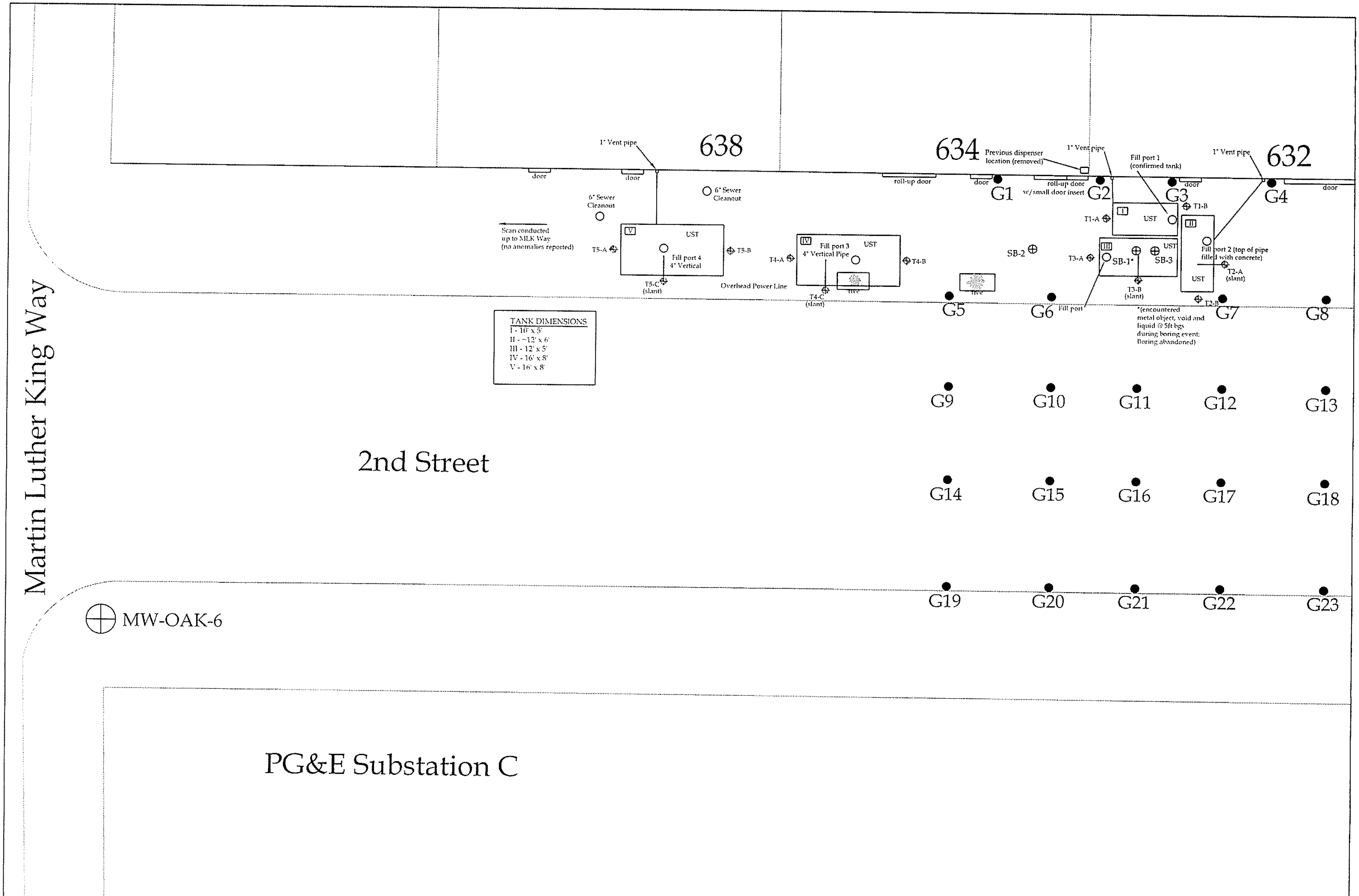
Project No.	Figure Date	Figure
GB001C	1/08	4

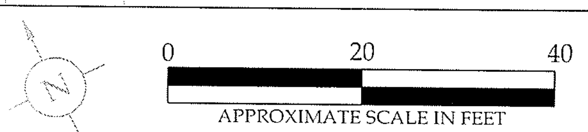


Groundwater Sample Analytical Results
Soil and Groundwater Investigation
APN 001-125-001, Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
GB001C	1/08	5





Proposed Gore-Sorber Locations

Cardanal Partners, LLC
626 2nd Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
GB001H	3/08	6

APPENDICES

APPENDIX A

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

December 4, 2007

Mr. Daniel Altwarg
Cardanal Properties, LLC
C/o Bartlett, Leader-Picone & Young, LLP
2201 Broadway, Suite 803
Oakland, CA 94612

Ms. Betty Brunswick
PG&E
77 Beal Street, Room 2439C
San Francisco, CA 94105

Mr. Richard Arnold, et al
Gamma Investments
301 Jefferson Street
Oakland, CA 94607

Mr. Ray Garnica
United California Bank
601 South Figueroa
Los Angeles, CA 90017-5704

Subject: Fuel Leak Case No. RO0002949 and Geotracker Global ID T0619758441, Markus Supply Hardware, 632-638 2nd Street, Oakland, CA 94607

Dear Mr. Altwarg, Ms. Brunswick, Mr. Arnold, and Mr. Garnica:

Alameda County Environmental Health (ACEH) staff has reviewed the case file for the above-referenced site, including the most recent report entitled, "Underground Storage Tank Closure-in-Place Report," dated June 21, 2007, prepared on your behalf by Clearwater Group. The report summarizes the results from cleaning and closure of five USTs at the above referenced site. The five USTs were closed-in-place beneath the sidewalk on 2nd Street by filling with concrete in May 2007.

In February 2007, 12 soil borings were advanced in the immediate vicinity of the five USTs to collect soil and groundwater samples. Total petroleum hydrocarbons as gasoline (TPHg) were detected in 1 of the 12 soil borings at a concentration of 89 milligrams per kilogram. Groundwater samples from five of the soil borings contained TPHg at concentrations up to 35,000 micrograms per liter (µg/L), benzene at concentrations up to 360 µg/L, ethylbenzene at concentrations up to 1,800 µg/L, and total xylenes at concentrations up to 4,500 µg/L. The horizontal and vertical extent of fuel hydrocarbons in soil and groundwater has not been defined. Therefore, we request that you submit a **Work Plan for site assessment by February 22, 2008.**

We recommend that your investigation incorporate expedited site assessment techniques. Expedited site assessment tools and methods are a scientifically valid and cost-effective approach to fully define the three-dimensional extent of groundwater contamination. Technical protocol for expedited site assessments are provided in the U.S. Environmental Protection Agency's "Expedited Site Assessment tools for Underground Storage Tanks: A Guide for Regulators," (EPA 510-B-97-001), dated March 1997. Therefore, we recommend that you utilize direct push technology to collect soil samples and depth-discrete groundwater samples prior to the installation of groundwater monitoring wells. Sampling locations should be located to assess the extent of soil and groundwater contamination. Other options for additional investigation may be appropriate to define contamination at your site.

TECHNICAL REPORT REQUEST

Please submit technical reports to Alameda County Environmental Health (Attention: Jerry Wickham), according to the following schedule:

- **February 22, 2008** – Work Plan

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 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 Program ftp site are provided on the attached "Electronic Report Upload (ftp) Instructions." Please do not submit reports as attachments to electronic mail.

Submission of reports to the Alameda County ftp site is an addition to existing requirements for electronic submittal of information to the State Water Resources Control Board (SWRCB) Geotracker website. Submission of reports to the Geotracker website does not fulfill the requirement to submit documents to the Alameda County ftp site. In September 2004, the SWRCB adopted regulations that require electronic submittal of information for groundwater cleanup programs. For several years, responsible parties for cleanup of leaks from underground storage tanks (USTs) have been required to submit groundwater analytical data, surveyed locations of monitor wells, and other data to the Geotracker database over the Internet. Beginning July 1, 2005, electronic submittal of a complete copy of all necessary reports was required in Geotracker (in PDF format). Please visit the SWRCB website for more information on these requirements (http://www.swrcb.ca.gov/ust/cleanup/electronic_reporting).

PERJURY STATEMENT

All work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party that states, at a minimum, the following: "I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge." This letter must be signed by an officer or legally authorized representative of your company. Please include a cover letter satisfying these requirements with all future reports and technical documents submitted for this fuel leak case.

PROFESSIONAL CERTIFICATION & CONCLUSIONS/RECOMMENDATIONS

The California Business and Professions Code (Sections 6735, 6835, and 7835.1) requires that work plans and technical or implementation reports containing geologic or engineering evaluations and/or judgments be performed under the direction of an appropriately registered or certified professional. For your submittal to be considered a valid technical report, you are to present site specific data, data interpretations, and recommendations prepared by an appropriately licensed professional and include the professional registration stamp, signature, and statement of professional certification. Please ensure all that all technical reports submitted for this fuel leak case meet this requirement.

UNDERGROUND STORAGE TANK CLEANUP FUND

Please note that delays in investigation, later reports, or enforcement actions may result in your becoming ineligible to receive grant money from the state's Underground Storage Tank Cleanup Fund (Senate Bill 2004) to reimburse you for the cost of cleanup.

AGENCY OVERSIGHT

If it appears as though significant delays are occurring or reports are not submitted as requested, we will consider referring your case to the Regional Board or other appropriate agency, including the County District Attorney, for possible enforcement actions. California Health and Safety Code, Section 25299.76 authorizes enforcement including administrative action or monetary penalties of up to $10,000 per day for each day of violation.

If you have any questions, please call me at (510) 567-6791 or send me an electronic mail message at jerry.wickham@acgov.org.

Sincerely,

Jerry Wickham

Jerry Wickham, California PG 3766, CEG 1177, and CHG 297
Hazardous Materials Specialist

Enclosure: ACEH Electronic Report Upload (ftp) Instructions

cc: Mr. Matthew Ryder-Smith, Clearwater Group, 229 Tewksbury Avenue, Point Richmond, CA 94801

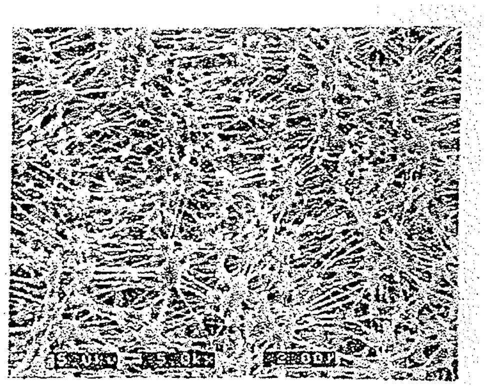
Donna Drogos, ACEH
Jerry Wickham, ACEH
File

APPENDIX B

STATEMENT OF PROCEDURES
Environmental Bio-Systems, Inc.

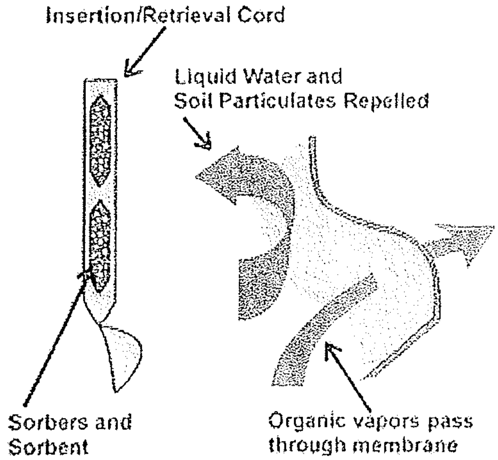
PASSIVE GORE-SORBER® SOIL GAS SURVEY

The GORE-SORBER® Module is a patented, passive soil gas sampler, is used to evaluate soil gas for contaminant source identification in environmental projects. The temporary survey process involves planting a dozen or more Gore-sorber modules in a sampling grid designed to meet the project objectives.

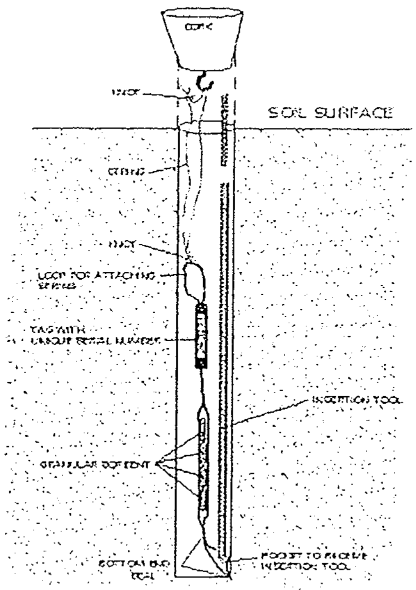


The module is constructed entirely of GORE-TEX® membrane. This membrane is an expanded polytetrafluoroethylene (ePTFE) which is a chemically inert, microporous (vapor permeable), and hydrophobic (waterproof). Much of the node and fibril structure is void space available for vapor transfer. Pore spaces are designed to be orders of magnitude smaller than a liquid drop of water.

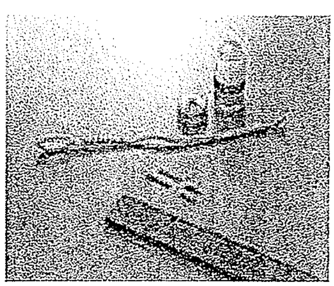
The module is constructed of a hollow ePTFE insertion/retrieval cord that contains smaller ePTFE tubes (sorbers). The sorbers contain various polymeric and carbonaceous adsorbents selected for their affinity to a wide variety of volatile and semi-volatile organic compounds, while minimizing the uptake of water vapor.



STATEMENT OF PROCEDURES
Environmental Bio-Systems, Inc.



The membrane facilitates vapor transfer across the entire surface area while providing strength for retrieval from the subsurface. Organic vapors present in the soil gas migrate unimpeded through the membrane to the adsorbent housed in the sorbers. This design prevents soil particles and liquid water from impacting sample integrity.



The module itself is approximately one foot in length and contains enough sorbers for two samples. This allows for duplicate analyses, if required, or a back up analyses in the event of an instrument malfunction. Additional sorbers can be placed in the module if a greater number of samples are required. Each module is stored in individual containers and is uniquely numbered and tracked throughout the project.

STATEMENT OF PROCEDURES

Environmental Bio-Systems, Inc.

Trip Blanks

Additional modules are provided with each project to document impact to the modules during transit, storage and installation/retrieval away from Gore's facility. Trip blanks are identical to the field-installed modules. The client selects which modules are to be trip blanks and leaves them unopened during all phases of the passive soil gas survey.

Module Installation for GORE-SORBER® Screening Surveys

In general, the installation and retrieval of the modules is simple. A narrow diameter hole (three-quarter inch) is drilled into the subsurface to a maximum depth of three feet, the recommended depth for soil gas sampling in environmental sampling applications (1, 2). The hole can be created using hand tools such as a slide hammer and tile probe, a Geoprobe-type or similar direct push probe rig or a rotary hammer drill with a 36-inch carbide-tipped drill bit attached. Once the hole is created, a length of cord is tied to the loop end of the module, and a cork is tied to the surface end of the cord. A stainless steel insertion rod (supplied by Gore) is placed in the pocket at the opposite end of the module, and the unit is inserted down the hole. The insertion rod is removed and the cork tamped flush into the ground at the surface. The site map is marked with the location of the module and its serial number, and the Chain of Custody undated. Global positioning systems (GPS) are now being used to record actual coordinate information in the field.

Following the recommended exposure period, each module is retrieved, the cord and cork discarded properly and the module is returned to its respective container. The serial number and location are verified, and the modules are returned to Gore's laboratory for analysis. The Chain of Custody is updated and returned with the modules.

DETAILS OF THE MODULE INSTALLATION

To facilitate the installation of the modules, it is recommended that the cord and corks be prepared prior to going to the field. For the installation of each module, cut a piece of the supplied polypropylene cord to a length of approximately 7.0 feet or 2.25 meters. Tie the ends of the cord together using a non-slip knot (square knot is suggested - see below). This loop should be long enough to allow for an installation of three feet (one meter) into the subsurface. Pass the looped cord through the eyelet in the cork and pull it back through itself. This will attach the cord to the cork. Wrap the remainder of the cord around the cork and secure the cord/cork combination with a rubber band. The cork and cord are now ready to attach to the module after the pilot hole is created at the installation location.

STATEMENT OF PROCEDURES
Environmental Bio-Systems, Inc.

Square knot instructions (see Figure 1)

1. Take an end of the cord in each hand.
2. Pass the left-hand cord over the right-hand cord and wrap it around the right-hand cord.
3. Take the cord end that is now in your right hand, place it over the cord end in your left hand and wrap it around that cord.
4. Pull the cord carefully to tighten the knot.

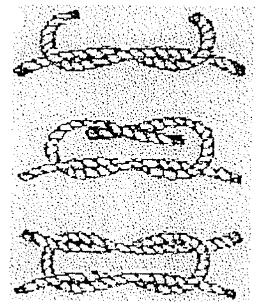


Figure 1.Square Knot

- Always obtain utility clearance before digging or probing.
- We do not recommend installation of modules within 15 feet of monitoring wells, utility trenches or other conduits, which may act as a preferential pathway for soil vapor migration.
- Drive/drill narrow pilot hole at desired pre-marked location. In sandy soils, occasionally the pilot hole will collapse after the drill or tile probe is removed. Adding deionized water to the sandy soil will temporarily compact the soil and keep the hole open for module insertion.
- Wearing clean surgical gloves, remove module from numbered container and re-seal the jar (this numbered container should correspond to the numbered module ID tag - please verify this).
- Attach the cord and cork to the module by passing the looped cord through the loop on the module and pull the cord/cork back through itself.
- Place insertion rod into the pre-cut pocket at the base of the module and lower it into the hole. If you encounter resistance remove the module and ream the hole and re-insert the module.
- Once deployed to the desired depth, press the insertion rod against the side of the hole and twist slightly to release the module. Remove the rod and push any excess cord into the pilot hole and plug it with the cork. (See Figure 2 for schematic of completed module installation.)
- Indicate the module number, date and time of installation and any pertinent comments on the installation/retrieval log. Write the module serial number on the site map adjacent to the appropriate map location.
- To minimize sample location errors, it is preferable to record the GORE-SORBER Module location on the field map. However, if another sample numbering system is used, information relating the sample number system to the GORE-SORBER Module serial numbers must be provided either on the Installation and Retrieval Log, or in a separate table.

- Clean the tile probes or drill bits and the insertion rod prior to use at the next location. Replace the surgical gloves as necessary before handling any modules.
- Following module installation, the modules selected as trip blanks should be kept in the sample box provided and stored as described above in "STORAGE" until sample retrieval.

DETAILS OF THE MODULE RETRIEVAL

- Following the module exposure period (usually 10 - 14 days) identify and check each module location in the field using the site map.
- Remove the cork with a penknife or corkscrew. Grasp the cord and pull the module from the ground; verify the module ID number. Cut off and discard the cork and cord. Place the entire module in its labeled container and tightly secure the lid.
- Use caution when screwing down the lid on the sample jars. Be sure the seal is tight and that no part of module or any dirt/ debris is pinched in the jar threads. Over-tightening may cause breakage.
- Replace the sample container in the box. Where possible, please attempt to keep modules in numbered sequence to expedite sample check-in and processing.
- Complete the module retrieval date/time on the installation/retrieval log.
- Do not use Styrofoam "peanuts" as packing material. Bubble packing is acceptable. Water ice can be added if desired, but cooling in general is not necessary. If shipping with ice, please take precautions to keep boxes dry (perhaps shipping in a cooler).
- Return the samples with insertion rod and paperwork (preferably by overnight courier) to:

Screening Modules Laboratory
W.L. Gore & Associates, Inc.
100 Chesapeake Blvd.
Elkton, MD 21921
Phone: (410) 392-7600

Attn: NOTIFY LAB IMMEDIATELY UPON DELIVERY!!

IMPORTANT: Samples should not be shipped for weekend or holiday delivery at GORE.

Module Installation for the GORE-SORBER® Exploration Surveys

Installation and retrieval of the module in this application is similar to the screening surveys. However, these surveys tend to be carried out in remote locations over large areas necessitating portable hand tools. A narrow diameter hole (1 cm) is created to depths of 24 inches (60cm) below grade by hammering a narrow steel tool, such as a long screwdriver, into the ground.

After the pilot hole is completed, modules are tied to a section of cord and inserted into the completed hole using the stainless steel insertion rod. The cord is secured at the surface by collapsing the hole. The location is marked on a map and location coordinates are secured where possible with a GPS having file download capabilities.

Module retrieval requires that field personnel locate the retrieval cord and manually pull the module from each location. The cord is separated from the module and discarded properly. The exposed modules are resealed in their respective containers and returned to Gore for analysis. The appropriate paperwork including the Chain of Custody is returned with the modules. Additional installation and retreival information can be found by clicking here.

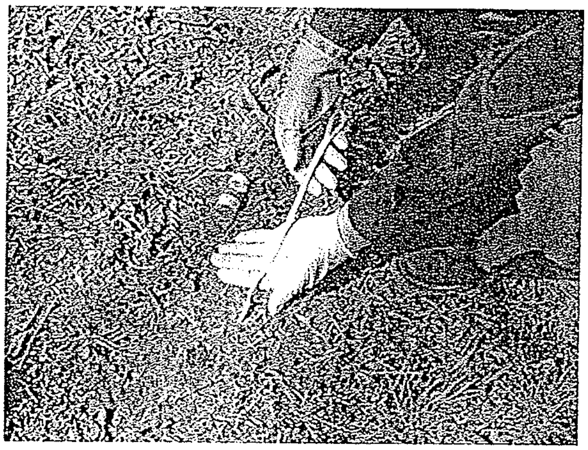
Creating the Installation Hole

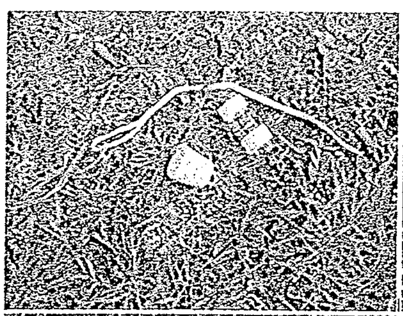
Narrow diameter, uncased installation holes are easily prepared using a slide hammer and long tile probe (left), a rotary hammer drill with a long carbide tipped bit (typically used to create the installation hole through impermeable layers such as asphalt; middle), or with a handheld hammer and steel rod (right).

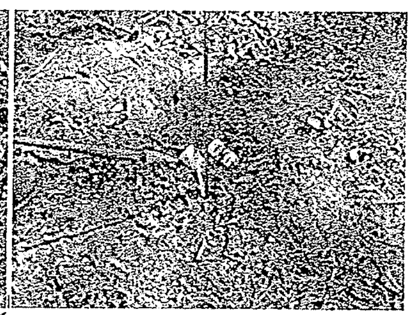
Installing a Module

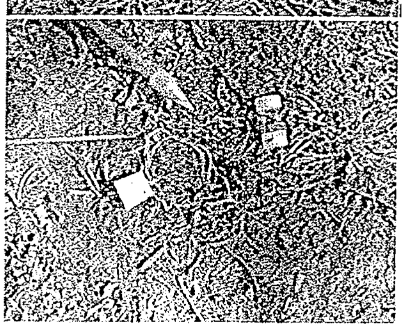
The photo at left illustrates a module, its container, and a length of string tied to the loop of the module. String is cut to the appropriate length in the field and attached to each module loop during the installation process. The insertion rod is placed in the pocket at the opposite end of the module, and a cork it tied to the string. The entire unit is slid down into the installation hole (middle photo). The insertion rod is pulled out of the hole, decontaminated, and is ready for use at the next sample location. A quick twist of the rod while in the hole, or placing the unit against the side of the hole while pulling the rod out of the ground, will cause the module to slip off of the insertion rod and remain at the required installation depth. The installation hole is plugged with a cork at the surface. The field map and installation notes are updated.

FIELD PHOTOS: Using the Gore-Sorber Modules









STATEMENT OF PROCEDURES
Environmental Bio-Systems, Inc.

String, an insertion rod, and corks (as needed) are supplied by Gore.
NOTE: For the exploration surveys, corks are not required to seal the installation hole. The cord is secured at the surface by collapsing the hole.

INTERPRETATION

Soil Gas Data Interpretation

In general, the detection of VOCs and SVOCs in field-exposed modules indicates that potential sources (i.e. soil adsorbed-, dissolved- and separate-phase organics) of the detected compound(s) may exist in proximity to the module location. The module will adsorb migrating gases present in the adjacent media (soil or water). The processes that govern the movement of gases in the subsurface are complex, involving interactions between the soil, soil moisture, pore gasses, ground water, natural and human made barriers, and the volatile contaminant. Chemical and microbiological processes can further influence the presence of soil gases, by reacting with or metabolizing these compounds.

Vapor pressure, water solubility, molecular weight, and the Henry's Law partitioning coefficient, are important chemical parameters to consider when interpreting soil gas data. The Henry's Law coefficient reflects a compound's behavior when partitioned into air and water, which aids in understanding an organic chemical's likely state in the subsurface. An understanding of the site geology (geologic structure, geochemistry), hydrogeolology and operational history are also important when interpreting the distribution of soil gases.

A strong relative correlation is often observed between the soil gas mass levels and the compound concentrations in the subsurface.

Contour Maps

Graphic presentation of the data extracted from GORE-SORBER® Modules is normally presented by overlaying the contamination patterns detected during analysis onto CAD maps supplied by the customer. Either minimum surface curvature or kriging models are employed. Standard "B-sized" (11" x 17") color contour plots are included with each project, however up to "E-size" (24" x 36") plots are available, if requested. The site plan base map(s) provided by the customer must include a scaled drawing with relevant site features, and a layer containing the sample locations and module serial numbers for the survey.

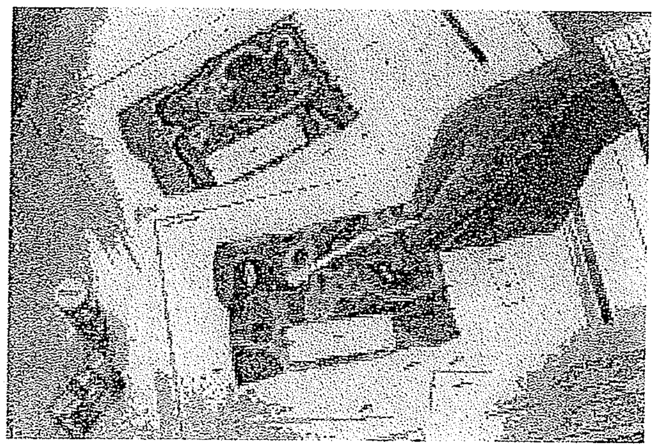
Tentatively Identified Compounds (TICs)

Some of the modules may contain non-target analytes (compounds not on GORE's target list). GORE can provide tentative identification of prominent non-target compound peaks

(TICs). These compounds can include non-target soil gas analytes, and contaminants introduced during sample transport and installation/retrieval activities.

Final Reporting

The results of the GORE-SORBER® Screening Survey will be summarized in a brief report, which will include the chain of custody, analytical data summary table, sample chromatograms, and color contour maps. A laboratory analytical data deliverables package incorporating results of samples, standards and blanks, and mass spectra compared to standards for all detects can be provided as an option.



References:

1 – Field Sampling Procedures Manual, ed. J.R. Schoenleber and P.S. Morton, New Jersey Department of Environmental Protection and Energy, 364pp., 1992

2 – Devitt, D. A., Evans, R.B., Jury, W. A., and Starks, T.H., Soil Gas Sensing for Detection and Mapping of Volatile Organics, National Groundwater Association, Dublin, OH

NOTES: This statement of procedures was compiled from materials provided by Gore. http://www.gore.com/surveys/

APPENDIX C

CLEARWATER GROUP

Direct-Push Drilling Investigation Procedures

The direct-push method of drilling soil borings has several advantages over hollow-stem auger drilling. The direct-push method produces no drill cuttings and is capable of 150 to 200 feet of soil boring or well installation work per day. Direct-push drilling can be used for soil gas surveys, soil sampling, groundwater sampling, and installation of small-diameter monitoring well and remediation system components such as air sparge points. The equipment required to perform direct-push work is varied, ranging from a roto-hammer and operator to a pickup truck-mounted rig capable of substantial static downward force combined with percussive force. This method allows subsurface investigation work to be performed in areas inaccessible to conventional drill rigs such as basements, beneath canopies, or below power lines. Direct-push equipment is ideal at sites with unconsolidated soil or overburden, and for sampling depths less than 30 feet. This method is not appropriate for boring through bedrock or gravelly soils.

Permitting and Site Preparation

Prior to direct-push drilling, Clearwater Group will obtain all necessary permits and locate all underground and above-ground utilities through Underground Service Alert and a thorough site inspection. All drilling equipment will be inspected daily and will be maintained in safe operating condition. All down-hole drilling equipment will be cleaned prior to arriving on-site. Working components of the rig near the borehole, as well as casing and sampling equipment, will be thoroughly decontaminated between each boring location by either steam cleaning or washing with an Alconox® solution. All drilling and sampling methods will be consistent with ASTM Method D-1452-80 and county, state, and federal regulations.

Boring Installation and Soil Sampling

Direct-push drilling uses a 1.5-inch outer barrel with an inner rod held in place during pushing. Soil samples are collected by penetrating to the desired depth, retracting the inner rod, and attaching a soil sampler. The sampler is then thrust beyond the outer barrel into native soil. Soil samples are recovered in brass, stainless steel, or acetate sample tubes held inside the sampler.

Soil removed from the upper tube section is used for lithologic descriptions, according to the Unified Soil Classification System. If organic vapors will be analyzed in the field, a portion of each soil sample will be placed in a plastic zip-lock bag. The bag will be sealed and warmed for approximately 10 minutes to allow soil vapors to be released from the sample and diffused into the head space of the bag. The bag is then pierced with the probe of a calibrated organic vapor detector and the detector readings recorded with the lithologic descriptions on the soil boring log. Soil samples selected for laboratory analysis will be covered on both ends with Teflon™ tape and plastic end caps. The samples will then be labeled, recorded on a chain-of-custody document, stored on ice in a cooler, and transported to a state-certified analytical laboratory.

Temporary Well Installation and Groundwater Sampling

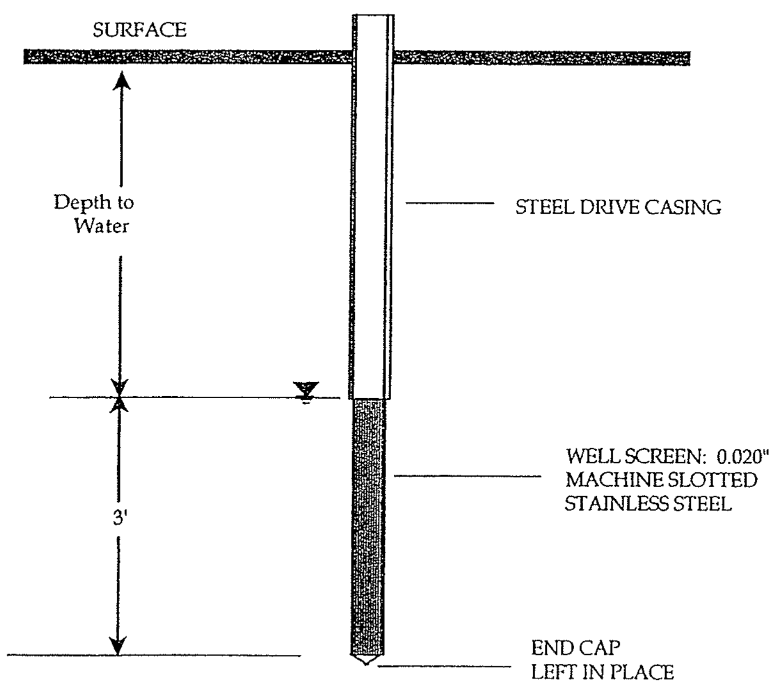


Figure 1

Grab Groundwater Sample Collection

Groundwater samples are collected by removing the inner rod and attaching a 4-foot stainless steel screen with a drive point at the end (**Figure 1**). The screen and rod are then inserted inside the outer barrel and driven to the desired depth, where the outer rod is retracted to expose the screen. If enough water for sampling is not produced through the stainless well screen, a 1-inch PVC screen can be installed in the boring and the outer rod retracted to leave a temporary well point for collecting groundwater samples, water level, or other parameters.

Monitoring Well Installation and Development

Permanent small-diameter monitoring wells are installed by driving a 2-inch diameter outer barrel and inner rod as described above. Upon reaching the desired depth, the system is removed, and 1-inch outside diameter (OD) (1/2-inch inside diameter [ID]) pre-packed PVC piping is installed. The well plug is created using granular bentonite. The well seal is constructed of cement and sealed at the surface with a conventional "Christy® Box" or similar vault. Monitoring wells are developed by surging the well with a small-diameter bailer and removing approximately 10 casing volumes of water, until the water is clear.

Groundwater Sample Collection and Water Level Measurement from Monitoring Wells

Before groundwater is collected from the wells, the water levels are measured in all wells using an electronic water-level gauge. Monitoring wells are prepared for sampling by purging three or more well volumes of water. Water is removed using small-diameter bailers, a peristaltic pump, or by manually pumping using tubing with a check valve at the bottom. During removal of each well volume of water, the temperature, pH, and conductivity are measured and recorded on the field sampling form. Successive well volumes are removed until the parameters have stabilized or the well has gone dry. Prior to sampling, the well is allowed to recover to within 90% of the stabilized water levels. The groundwater samples[1] are collected using small-diameter bailers.

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[1] Small-diameter wells often produce small sample quantities and are appropriate for analysis of volatile and aromatic compounds and dissolved metals analysis using VOA vials. Obtaining liter-size samples can be difficult and time consuming. Monitoring wells installed by the direct-push method are most effective at sites where the subsurface soils are more coarse than silt, gasoline components are the key contaminants of concern, and water levels are not more than 25 feet below ground surface.

The samples are decanted into laboratory-supplied containers, labeled, recorded on a chain-of-custody document, stored on ice in a cooler, and transported to a certified analytical laboratory for analysis.