GROWTH
ENVIRONMENTAL SERVICES, INC.
('FORMERLY CEC/WRA')

SAN FRANCISCO DISTRICT
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February 15, 1995

REF: 477-1852.WP

Mr. Barney M. Chan
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, CA 94502
(510) 567-6700

1.0

SUBJECT: Work Plan for Phase II Site Characterization of Groundwater at Motor Partners, 1234 40th Avenue, Oakland, CA

Dear Mr. Chan:

Growth Environmental Services, Inc. (GROWTH) is pleased to submit the enclosed Work Plan and Site Safety Plan for the Phase II Site Characterization of the above referenced site. The State of California Underground Storage Tank Cleanup Fund (USTCF) requires that, when possible, work plans be submitted for activities according to their funding groupings. Therefore, the workplan for this project has been rewritten to include all tasks that may be required to complete the Phase II Site Characterization.

All past correspondences and reports concerning the subject property have been reviewed for this resubmittal. The tasks described in the attached workplan should include all tasks the USTCF requires for the Phase II Site Characterization. It is recognized, however, that all proposed work will be subject to your requirements and/or approval.

Please call if you have any questions or comments regarding this resubmittal. We look forward to working with you on this project.

Sincerely,
Growth Environmental Services, Inc.

Gary Rogers, Ph.D.
Project Manager

Stanley L. Klemetson, Ph.D., P.E.
Director of Engineering & RMO

REGISTERED PROFESSIONAL ENGINEER
STANLEY LOUIS KLEMETSON
No. 40087
Exp. ______
CIVIL
STATE OF CALIFORNIA

Enclosures
cc: Mr. Bill Owens, Motor Partners

WORK PLAN FOR
PHASE II SITE CHARACTERIZATION
OF GROUNDWATER
AT
1234 40TH
AVENUE OAKLAND, CALIFORNIA

PREPARED FOR

Mr. Bill Owens
Motor Partners
2221 Olympic Boulevard
Walnut Creek, CA 94595
(510) 935-3840

SUBMITTED TO

Mr. Barney M. Chan
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, CA 94502
(510) 567-6700

PREPARED BY

Growth Environmental Services, Inc.
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GROWTH PROJECT NO. 477-1852

February 15, 1995

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INTRODUCTION

Site Location and Description

The subject property located at 1234 40th Avenue in Oakland, California (Figure 1). Bay Area Rapid Transit (BART) tracks are located approximately 500 feet west of the site, and San Leandro Bay is less than one mile to the southwest.

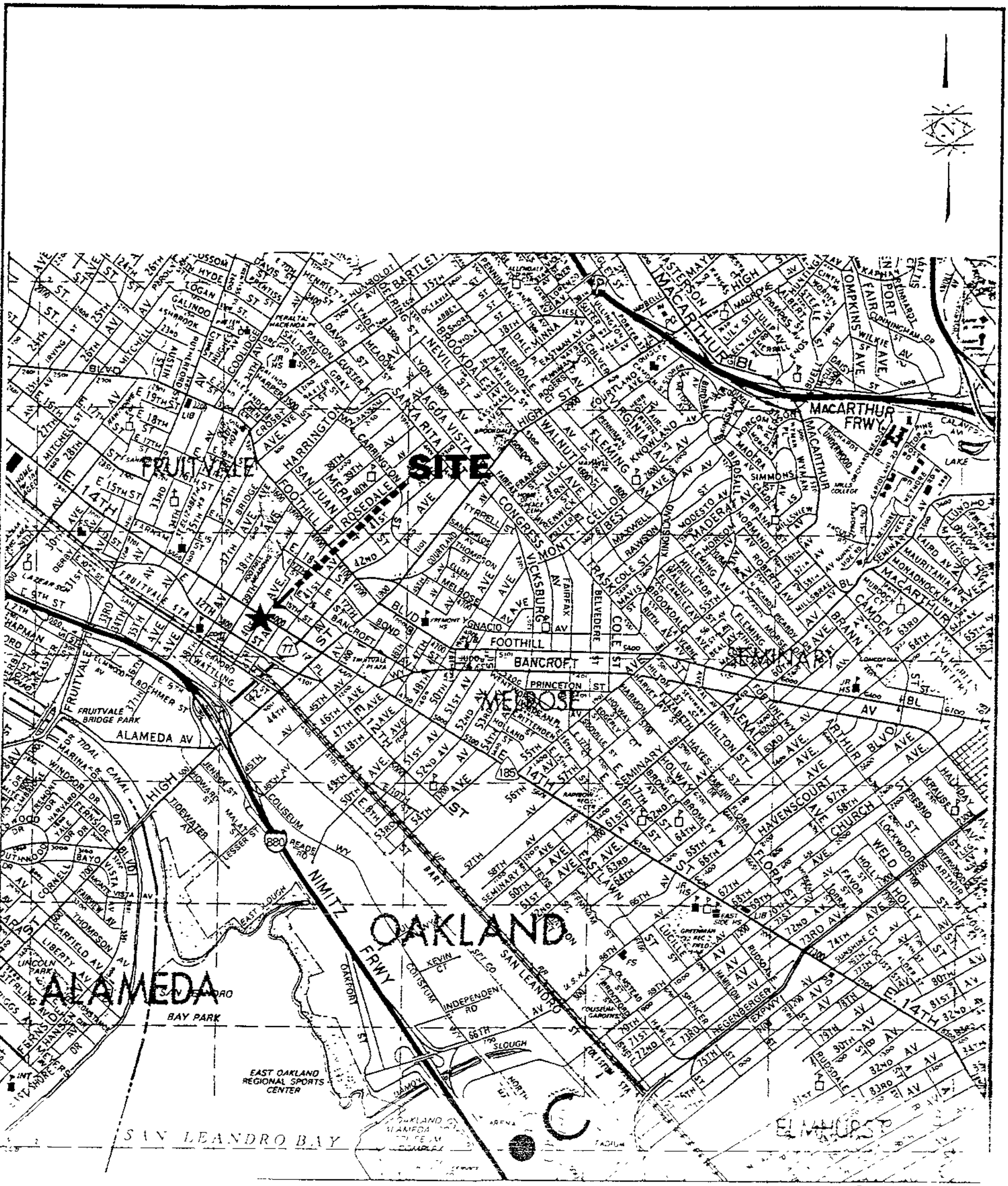
Site History and Use

Motor Partners used the site in the past for automobile repair shops. Much of the building is now vacant or used as storage. Two underground fuel storage tanks were maintained outside of the 1234 40th Avenue building. A 1,000-gallon gasoline tank and a 500-gallon waste oil tank were located below the sidewalk (Figure 2).

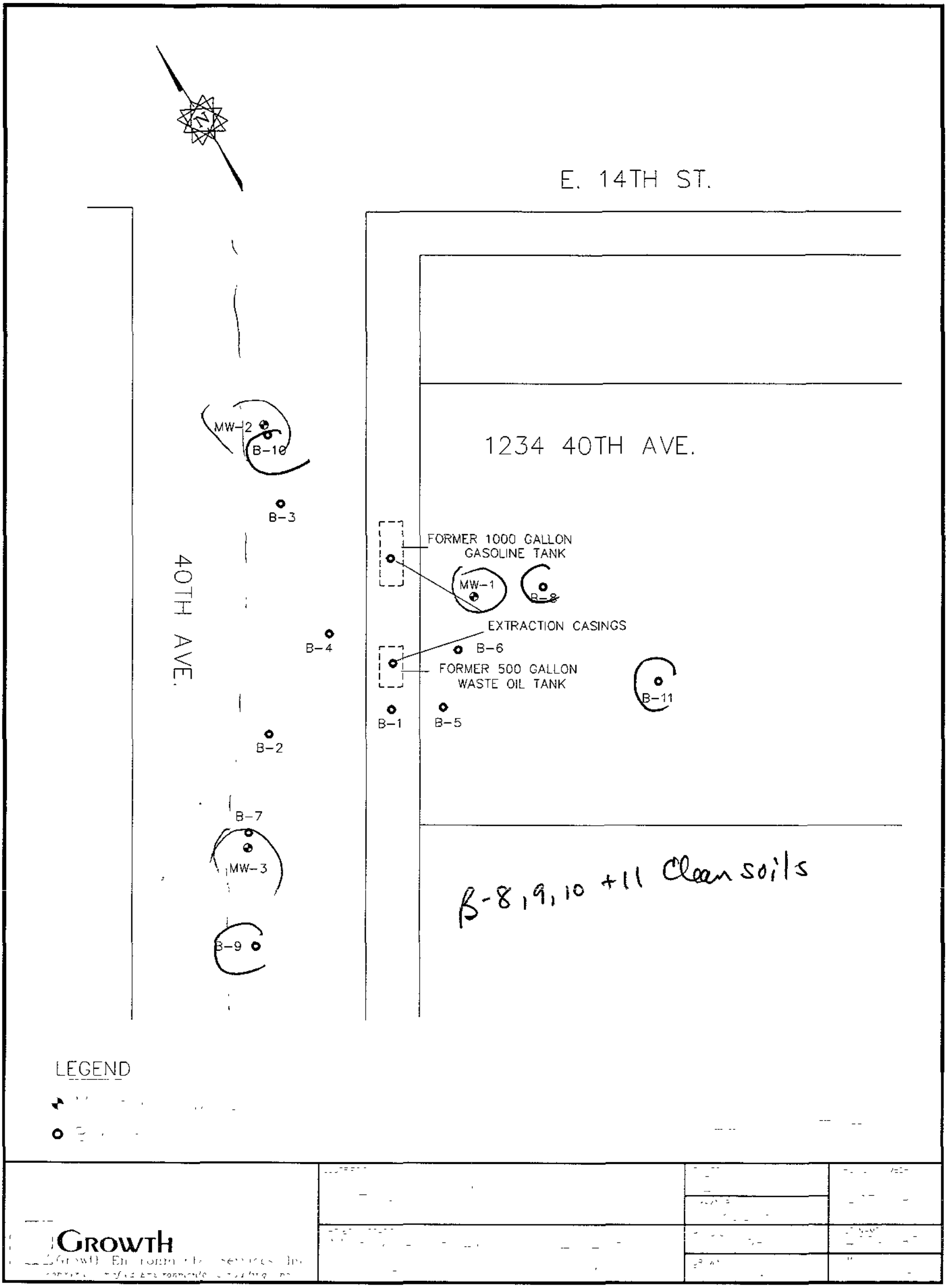
Previous Subsurface Investigations

On October 12, 1990, SEMCO Inc., of Modesto California removed a 1,000-gallon underground gasoline tank and a 500-gallon underground waste oil tank from the subject property. Total petroleum hydrocarbons in the gasoline range (TPH-G) located in soil below the gasoline tank were as high as 1,600 ppm. TPH-G and TPH-D (diesel) concentrations in soil under the waste oil tank were 570 ppm and 650 ppm, respectively. There was no record of groundwater in the excavations. Both excavations were backfilled to grade with original spoils.

In January 1994, SEMCO re-excavated the area to remove petroleum impacted soil and backfill. Groundwater was encountered. During the course of overexcavation, it was noted that contamination extended beneath the building and into the street. Utilities and the presence of the building prevented further excavation. Samples were collected from the sidewalls of each excavation. Extraction well casings (4" diameter, 13' length) were installed in the center of each excavation. Clean imported rock was used to backfill the two excavations. Christy boxes housed the top of the two extraction casings, and the sidewalk was resurfaced. Levels of TPH-G in soil from the former waste oil tank area ranged from 100 to 700 ppm. Levels of TPH-G in soil from the former gasoline tank area ranged from 150 to 1,200 ppm. Contaminated soil from the excavation was stockpiled off-site for remediation.


SITE
FRUITVALE
MELROSE
SEMINARY
OAKLAND
ALAMEDA
ELMHURST
MACARTHUR FRWY
NIMITZ FRWY
FRUITVALE BRIDGE PARK
BAY PARK
EAST OAKLAND REGIONAL SPORTS CENTER
SAN LEANDRO BAY

GROWTH


E. 14TH ST.
1234 40TH AVE.
40TH AVE.
MW-2
B-10
B-3
FORMER 1000 GALLON GASOLINE TANK
MW-1
B-8
EXTRACTION CASINGS
B-4
B-6
FORMER 500 GALLON WASTE OIL TANK
B-11
B-1
B-5
B-2
B-7
MW-3
B-9
B-8, 9, 10 + 11 Clean soils
LEGEND
Growth

SUMMARY OF PHASE I SITE INVESTIGATION

In September 1994, GROWTH submitted a report on the Phase I Site Investigation performed at the property. Between May 17 and June 2, 1994, eleven borings were drilled, and three monitoring wells were installed to define the extents of contamination. Soil and groundwater samples were collected from each boring and the first quarterly sampling event was conducted on the monitoring wells.

Almost every boring location revealed the presence of petroleum contamination in soil and groundwater at the site (See analytical results presented in Tables 1 and 2). High concentrations of soil contamination (up to 2,700 ppm TPH-D, 1,100 TPH-G, and 9,300 Oil and Grease) were found under the western side of the building and under 40th Avenue. Samples collected on 40th Avenue at the periphery of the study area had low, but detectable amounts of contaminants. Sample B-11, the most interior sample collected from under the building, had 520 ppm TPH-D and 30 ppm TPH-G.

All groundwater samples collected from the soil borings had detectable levels of petroleum products. The contaminants appeared to be concentrated in the immediate tank area, and directly west, under 40th Avenue. Sample B-1-W-1 had the highest concentrations of TPH-D and Motor Oil at 16,000 ppb and 16,000 ppb, respectively. TPH-G was detected at levels up to 64,000 ppb in sample B-6-W-3. Detectable levels of BTEX were found in groundwater from all soil borings, with a maximum of 13,000 ppb xylenes in sample B-6-W-3.

Lateral extents of the contaminant plume under the building and across 40th Avenue could not be determined from this study. Across 40th Avenue is another business that is currently conducting a separate investigation of the contamination. The farthest interior sample from 40th Avenue (B-11) had 520 ppm TPH-D, and 30 ppm TPH-G.

Two quarterly monitoring well sampling events have been conducted at the site (June 17, 1994, and December 7, 1994). Contamination was found in all three wells at the site, with a maximum of 17 ppm TPH-G found in MW-1 (Table 3). Results of the latest sampling event showed concentrations of TPH-D ranging between ND (none detected) to 1.7 ppm, and benzene was as high as 0.38 ppm. Refer to Figure 3 for a site plan showing groundwater flow direction calculated from the quarterly sampling data.

Table 1. Soil Sample Results for Motor Partners, 1234 40th Ave., Oakland, CA

Sample #	Date	TPH-D (mg/kg)	Motor Oil (mg/kg)	TPH-G (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	EB (mg/kg)	Xylene (mg/kg)
B-1-2 @ 9'	5/17/94	260	ND	850	0.55	0.63	0.42	3.6
B-2-2 @ 9.5'	6/1/94	1000	NA	1900	ND	5.0	36	29
B-3-1 @ 6'	5/17/94	ND	ND	910	ND	0.026	0.049	0.092
B-4-1 @ 3'	6/1/94	ND	NA	ND	ND	ND	ND	ND
B-4-2 @ 7.5'	6/1/94	44	NA	83	0.087	0.20	0.21	0.46
B-4-3 @ 11'	6/1/94	450	NA	1000	5.6	8.4	15	71
B-5-2 @ 12'	5/17/94	2700	9300	1100	15	3.7	13	24
B-6-1 @ 9.5'	5/17/94	140	ND	260	0.49	0.53	3.9	13
B-7-1 @ 6'	6/1/94	ND	NA	3.0	0.01	ND	ND	0.019
B-7-2 @ 10.5'	6/1/94	280	NA	1100	0.38	1.9	3.4	5.9
B-8-1 @ 6'	6/1/94	ND	NA	ND	ND	ND	ND	ND
B-8-2 @ 11'	6/1/94	ND	NA	ND	ND	ND	ND	ND
B-9-1 @ 6'	6/2/94	ND	NA	ND	ND	ND	ND	0.008
B-9-2 @ 11'	6/2/94	ND	NA	1.8	ND	ND	ND	0.01
B-10-1 @ 4'	6/2/94	ND	NA	ND	ND	ND	ND	ND
B-10-2 @ 9'	6/2/94	ND	NA	2.3	ND	ND	0.007	0.01
B-11-1 @ 4.5'	6/2/94	ND	NA	ND	ND	ND	ND	ND
B-11-2 @ 9.5'	6/2/94	520	NA	30	ND	ND	ND	0.073

NOTES:

ND = None Detected
NA = Not Analyzed

Table 2. Water Sample Results for Motor Partners, 1234 40th Ave., Oakland, CA

Sample #	Date	TPH-D (ug/kg)	Motor Oil (ug/kg)	TPH-G (ug/kg)	Benzene (ug/kg)	Toluene (ug/kg)	EB (ug/kg)	Xylene (ug/kg)
B-1-W-1	5/17/94	16,000	16,000	16,000	210	46	150	190
B-2-W	6/1/94	7000	NA	8100	220	34	220	60
B-3-W-4	5/17/94	620	ND	910	5.3	2.5	3.0	5.0
B-4-W	6/1/94	4900	NA	38,000	3200	1800	2000	7100
B-5-W-2	5/17/94	2100	7400	3700	370	25	180	160
B-6-W-3	5/17/94	8600	430	64,000	2900	5200	3800	13,000
B-7-W	6/1/94	4500	NA	12,000	380	36	520	170
B-8-W	6/1/94	470	NA	570	6.8	3.2	1.7	5.7
B-9-W	6/2/94	ND	NA	160	2.8	0.62	ND	0.61
B-10-W	6/2/94	1700	NA	6100	28	29	14	62
B-11-W	6/2/94	94	NA	750	6.8	3.2	1.7	5.7

NOTES:

ND = None Detected
NA = Not Analyzed

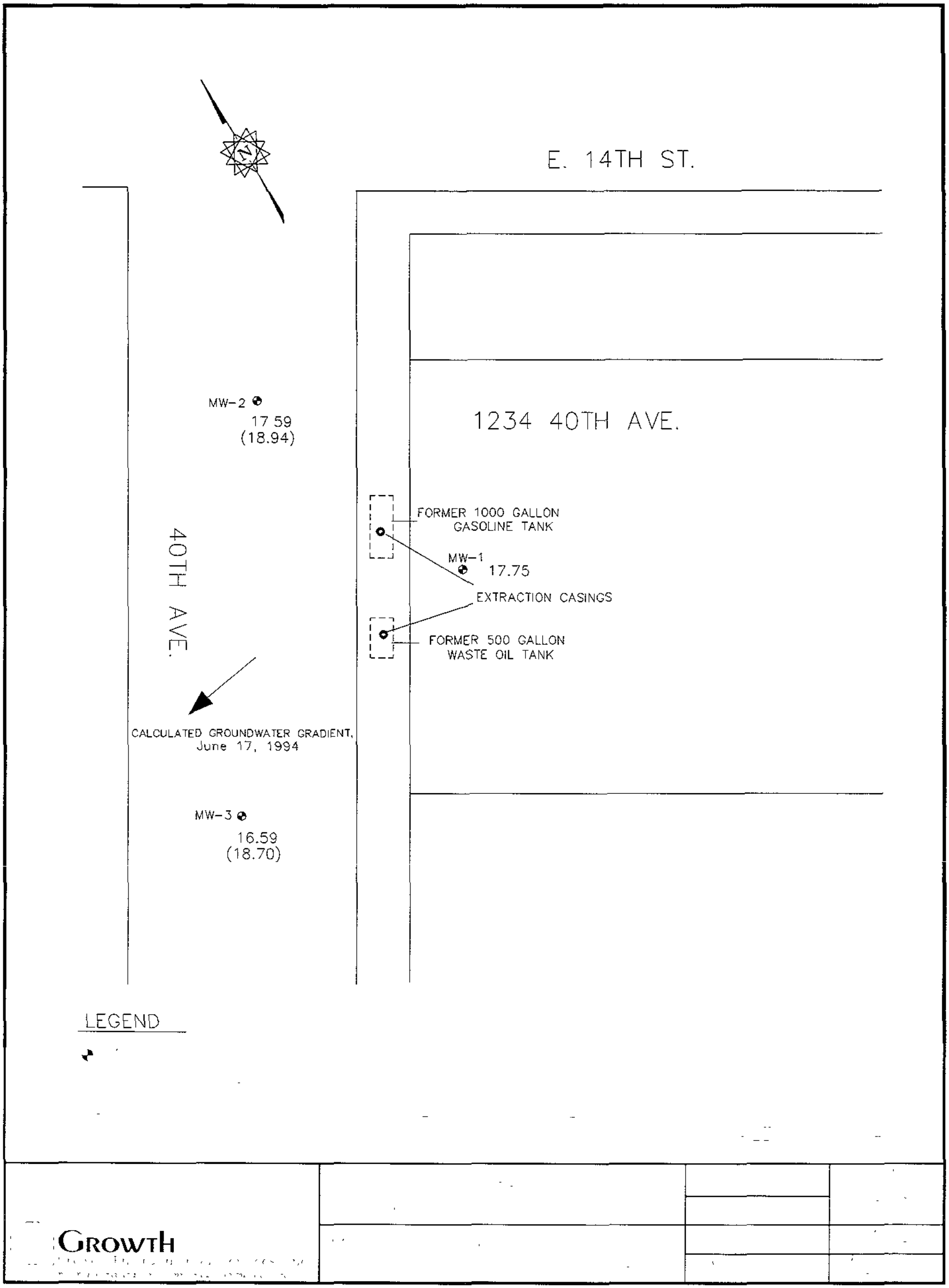
TABLE 3

Groundwater Monitoring Well Results
1234 40th Avenue, Oakland, CA

Sample Number	Sample Date	TPH-D (ppb)	TPH-G (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylene (ppb)
MW-1	06-17-94	2400	17,000	1200	220	1000	2600
MW-2	06-17-94	370	990	ND	1.3	2.3	4.4
MW-2	**12-07-94**	**ND**	**170**	**2.1**	**0.70**	**0.60**	**1.7**
MW-3	06-17-94	2200	9500	330	40	100	74
MW-3	**12-07-94**	**1700**	**7500**	**380**	**42**	**130**	**72**
*CA Dept. of Health Services primary maximum contaminant level for drinking water.		None Listed	None Listed	1.0	1000	680	1750

* Marshack, J.B., 1989, A Compilation of Water Quality Goals, Staff Report of the California Regional Water Quality Control Board, Central Valley Region, 15 p.

ND = Not Detected



N
E. 14TH ST.
40TH AVE.
1234 40TH AVE.
MW-2
17 59
(18.94)
FORMER 1000 GALLON
GASOLINE TANK
MW-1
17.75
EXTRACTION CASINGS
FORMER 500 GALLON
WASTE OIL TANK
CALCULATED GROUNDWATER GRADIENT,
June 17, 1994
MW-3
16.59
(18.70)
LEGEND
GROWTH

PROJECT DESCRIPTION

In November 1994, it was decided a workplan for the Motor Partners project should be resubmitted which includes all possible work necessary to complete the Phase II Characterization. The resubmittal of this workplan is an attempt to comply with the State of California Underground Storage Tank Cleanup Fund (USTCF) requirements. It should be noted that the proposed tasks may prove to be more extensive than required, or may need to be expanded. The actual work required will be subject to regulatory agency direction and approval.

GEOLOGY AND HYDROGEOLOGY

GEOLOGY

The site is located on the East Bay Plain approximately 1.0 mile west of the Oakland Hills, 1.0 mile east of the San Francisco Bay, and 0.5 miles north of San Leandro Bay. The property is bounded on the northeast by 14th Avenue.

The site rests on Quaternary deposits of various composition and physical properties. The predominant formation is the Temescal Formation consisting of contemporaneous alluvial units of different origin, lithology, and physical properties. The material ranges from irregularly bedded clay, silt, sand and gravel to lenses of clay, silt, sand and gravel with Claremont Chert.

The Hayward Fault is approximately 1.5 miles east of the site and is an active historic fault. The Hayward Fault is the only active fault in the Oakland East Quadrangle.

HYDROGEOLOGY

The site is located within the East Bay Plain which makes up the groundwater reservoir in the area. Water bearing capacity varies within the area due to the juxtaposed positions of the various types of soils and strata encountered underneath the East Bay Plain.

In general, the water bearing capacities of the Younger Alluvium range from moderately permeable to low permeable soils. Below the Younger Alluvium at a depth of approximately 70 feet lies the Older Alluvium, which yields large to small quantities of well water.

References

Radbruch, Dorothy, H., Areal and Engineering Geology of the Oakland East Quadrangle. California. Map GQ-769, 1969.

PHASE II SITE CHARACTERIZATION

The proposed work includes: 1) Project Management, 2) Preparation of Work Plan for all Phase II Site Characterization Work, 3) Determine Extent of Groundwater and Soil Contamination, 4) Preparation of Interim Report, 5) Monitoring Well Installations, 6) Quarterly Monitoring Well Sampling, 7) Pneumatic Pump Test, 8) Groundwater Pump Test, and 9) Preparation of Final Report and Corrective Action Plan. A detailed description of each task is provided below.

The following is a discussion of the activities to be completed for the Phase II Site Characterization. All of the tasks are subject to regulatory agency review and approval.

Task 1. Project Development/Project Planning

These are generally additional regulatory agency and client reporting meetings that are outside the scope of specific tasks. Also compliance with USTCF invoicing and reporting requirements add additional time to the following tasks. These items will be invoiced and justified as they occur.

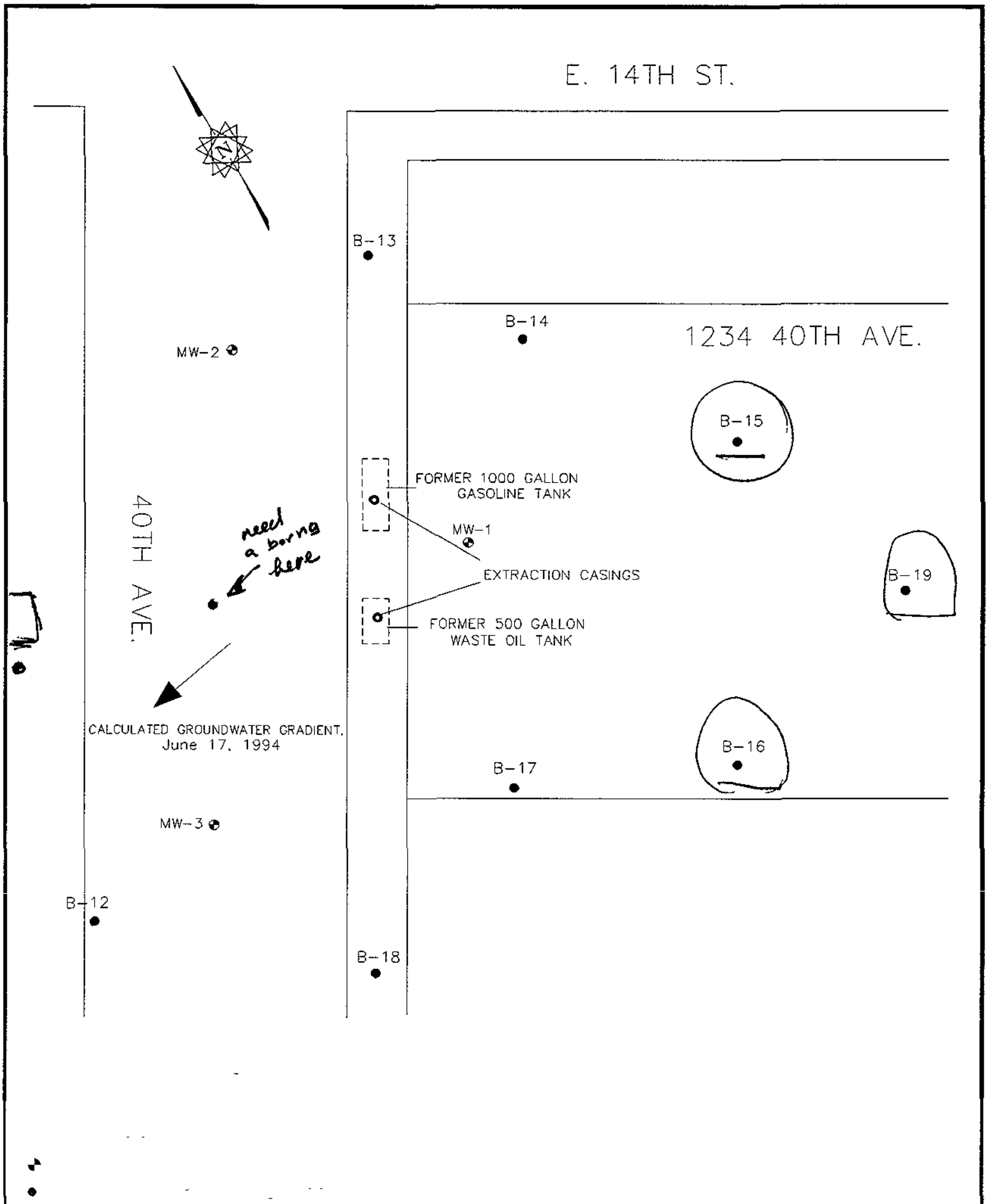
Task 2. Work plan for Phase II Site Characterization of Groundwater

The work plan and site safety plan summarizes planned activities for completion of site characterization. It will include a brief summary of available data and will be a revised plan which complies with USTCF requirements.

Task 3. Determination of Extent of Soil and Groundwater Contamination

The primary purpose of this task is to determine the lateral extent of groundwater contamination. However, soil samples will also be collected. A total of eight soil borings to groundwater will be advanced on the subject property, the sidewalk and 40th Avenue. It is anticipated that water samples will be obtained at depths of less than 10 feet using a Screen Point Ground Water Sampler driven by a truck mounted GeoProbe System hydraulic probing machine. Soil samples will be collected with the GeoProbe sampling tool. Data collected from groundwater sampling will be used to determine the extent of the contaminant plume. The need for additional monitoring wells will be determined on the basis of this data. See proposed sampling locations in Figure 4.

Groundwater samples will be analyzed for TPH-G (EPA Modified Method 8015 and Method 5030), TPH-D (EPA Modified Method 8015 and Method 3550) and BTEX (EPA Method 8020 and Method 5030). Soil samples from the area of the former hydraulic lifts will be analyzed for TPH-G, TPH-D, BTEX and oil & grease (O & G, EPA method 418.1). A few soil samples (no more than three) will also be analyzed for lead (EPA 6010). Water samples at the hydraulic lifts will be analyzed for TPH-G, TPH-D. BTEX and O & G. where?


E. 14TH ST.
N
B-13
B-14
1234 40TH AVE.
MW-2
B-15
FORMER 1000 GALLON GASOLINE TANK
40TH AVE.
need a boring here
MW-1
EXTRACTION CASINGS
B-19
FORMER 500 GALLON WASTE OIL TANK
CALCULATED GROUNDWATER GRADIENT, June 17, 1994
B-16
B-17
MW-3
B-12
B-18

GROWTH

Task 4. Interim Report

The data collected from the soil and groundwater sampling will be evaluated to determine the extent of the contaminant plume. The need for additional monitoring wells and their location will be determined.

Task 5. Monitoring Well Installations

If necessary, three additional 2" monitoring wells will be installed to a depth of approximately 25 feet or 15 feet below groundwater surface. The wells will be installed outside of the contaminant plume to monitor possible migration during site remediation efforts. The wells will be developed, purged, and sampled. The monitoring well installation report will be a section of the final report. Soil porosity will be determined to assist with analysis of a future groundwater pumping test. Soil and groundwater samples will be analyzed for TPH-G (EPA Modified Method 8015 and Method 5030), TPH-D (EPA Modified Method 8015 and Method 3550) and BTEX (EPA Method 8020 and Method 5030). Wells will be surveyed to a city benchmark MSL and to other wells. The hydraulic gradient will be determined.

Additional soil samples will be collected during monitoring well installations for evaluation of biological parameters. The data will determine the viability of the microbial population and nutrients required for contaminant degradation (See Task 7 below). This will aid in evaluating the feasibility of bioremediation.

Task 6. Quarterly Monitoring Well Sampling

It is assumed that one quarter of monitoring well sampling will be required before the Phase III/IV work is sent out for bid and started. After monitoring wells proposed in Task 4 are installed, all six wells on-site will be sampled at the end of the next quarter. The wells will be sounded and a new hydraulic gradient will be calculated. The data will be presented in the final report.

Task 7. Air Sparge Test

If safe to do so, an air sparge test will be performed using existing wells and newly installed pressure sampling points. If existing wells are not adequate for the air sparge test, another well will be installed on-site for that purpose. The test will be utilized to evaluate the potential for air sparging as a valid method for groundwater remediation. An additional well will also be installed for soil vapor extraction, which will recover volatiles created by the air sparging procedure.

Task 8. Groundwater Pump Test

A groundwater pump test will be conducted at the site to determine the hydraulic properties of the affected aquifer. The test will be conducted to determine the saturated zone, hydraulic conductivity, transmissivity, drawdown, soil permeability, yield, and groundwater flow characteristics. This data will be utilized in the design of the remediation system. The data will be presented in the final report.

Task 9. Final Report and Corrective Action Plan

A risk assessment model may be used to used to evaluate the site. This assessment will provide a scientifically defensible "risk based" approach to help meet regulatory requirements and to determine appropriate clean-up levels needed for the site. A computer model may be used to aid in determining remediation needs, assess pathways of exposure, assess human health risk, determine the fate and transport of contaminants, and evaluate uncertainty in risk estimates. Included in this assessment are: hazard identification, exposure assessment, dose-response assessment, and risk characterization.

Utilizing the data collected from the site characterization, at least three remediation alternatives will be evaluated to determine the most feasible approach for achieving required site clean-up levels in a time and cost effective manner. This information will then be used in development of the Corrective Action Plan.

A final report will be prepared that summarizes all of the previously collected soil and groundwater data and recommendations. The Corrective Action Plan (CAP) will present a conceptual design of the remedial alternative that is recommended from the feasibility analysis. The conceptual design presentation will discuss the major equipment and drawings necessary for approval and construction as well as design testing needs. The CAP will be completed and submitted to the regulatory agency within the current regulatory guidelines. The CAP can be used as documentation for the bid process for Phases III and IV (Remediation, Monitoring, and Closure) of this project.

Notifications

The following notifications will take place before beginning work:

1. Work Plan will be submitted to Alameda County Department of Environmental Health. Drilling permits will also be obtained from Alameda County.

2. Sites for soil borings will be marked with white paint and Underground Service Alert, (800) 227-2600, will be notified at least one week prior to commencement of work.

3. Barney Chan, of the Alameda County Department of Environmental Health, (510) 567-6700, will be notified at least 48 hours prior to commencement of site work.

4. Mr. Bill Owens, Motor Partners, (510) 935-3840, will be notified at least 48 hours prior to commencement of site work.

APPENDIX A

SOIL SAMPLING IN GEOPROBE BOREHOLES

U.S. Environmental Protection Agency standards serve as the foundation for all field sampling operations. EPA SW 846 is the primary publication from which procedures are derived. While some aspects of field and laboratory work may be delegated to the California Department of Health Services, the California Water Resources Control Board, and the San Francisco Bay Regional Water Quality Control Board establish the general and specific criteria for sampling.

SAMPLE INTERVALS

Samples will be taken at five-foot intervals, distinct lithologic changes, and the capillary fringe zone. Selected samples will be properly retained for chemical analysis.

COLLECTION DEVICES

Samples will be collected using a 1-inch-I.D. by 24-inch long piston-type soil sampler capable of recovering a discrete sample inside of a removable liner. The driving equipment is a GeoProbe *(GeoProbe is a registered trademark of Kejr Engineering, Inc., Salina, Kansas).* The unit is vehicle-mounted, hydraulically-powered, soil probing machine that utilizes status force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core, soil gas, or ground-water samples. The sampler and ? will be decontaminated before and after each use by steam cleaning, or a tri-sodium phosphate solution wash, and triple tap water or deionized water rinses.

PRESERVATION AND HANDLING

Sample tubes will be labeled, sealed at each end with Teflon sheeting and PVC end caps, and stored in an ice chest with ice. Samples will be delivered under chain of custody to a State-certified laboratory.

SOILS CLASSIFICATION

Soils exposed at the ends of each brass tube will be examined by a geologist for obvious signs of contamination and classified according to the Unified Soil Classification System. These observations will be recorded in the boring logs.

Selection of samples for laboratory analysis will be based primarily on headspace readings and position within the boring, although some discretion by the site geologist or engineer will be required. In general, samples with headspace readings over 50 ppm or that have visual or olfactory indications of contamination will be submitted for analysis. One sample will also be selected from one to two intervals below the apparent lower limit of contamination to obtain a "zero line" value. In addition, the sample closest to the depth of the storage tank invert (i.e. 12-13 feet) will be submitted for analysis. If the water table is above the tank invert, the sample closest to the water table will be selected. If the water table is below the tank invert, a sample from the capillary fringe zone above the water table will be collected and analyzed.

SAMPLE LABELING AND CHAIN OF CUSTODY

Samples selected for analysis will be labeled with self-adhesive, pre-printed labels with the sample number. This number will also be recorded the sampler's field notebook along with the project number, sample location, depth, and the date and time collected. The same information will be recorded on the chain of custody.

DOCUMENTATION

A diagram for each boring will be completed by the geologist and submitted to the project manager when the work has been completed. In addition, the details of drilling and field measurements will be summarized as daily entries in a field notebook or data sheets which will be submitted to the project manager when the work has been completed.

DRILLING EQUIPMENT DECONTAMINATION PROCEDURES

The sampler will be decontaminated before and after each use by steam cleaning or washing in a tri-sodium phosphate, followed by tap water. Only clean water from a municipal supply will be used for decontamination of drilling equipment.

All rinseate used in the decontamination process will be stored on site in steel DOT approved drums. Drums will be labeled as to contents, suspected contaminants, date container filled, expected removal date, company name, contact and phone number, sealed and left on-site for subsequent disposal pending analytical results.

APPENDIX B

WATER SAMPLING IN GEOPROBE BOREHOLES

OBJECTIVE

The objective of this procedure is to drive a sealed stainless steel screen to depth, open the screen, and obtain a water sample via a tubing system to the surface. In general this method is classified as a grab sample; however, it is a relatively undisturbed sample since the screen is located in a closed borehole.

EQUIPMENT

The assembled Screen Point Sampler is 1.0-inch O.D. x 36-inch overall length. This sampler has a 19-inch screen encased in a perforated stainless steel sleeve. The device is also useful for measurement of piezometric levels.

The driving equipment is a GeoProbe *(GeoProbe is a registered trademark of Kejr Engineering, Inc., Salina, Kansas).* The unit is vehicle-mounted, hydraulically-powered, soil probing machine that utilizes status force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core, soil gas, or ground-water samples.

SAMPLER OPERATION

The assembled Screen Point Sampler is threaded onto the leading edge of a GeoProbe probe rod and driven into the subsurface using a GeoProbe machine. Additional probe rods are connected in succession to advance the sampler to depth. When the desired sampling depth is reached, the sampler is pulled up about 2 feet to disengage the expendable drive point and creates an open borehole from which to sample. The inner core, which consists of a stainless steel wire screen inside of a perforated stainless steel sleeve, is then pushed out into the borehole and water is allowed to enter the sampler and connected probe rods.

SAMPLE COLLECTION

In common practice, ground water samples are recovered by pumping or bailing of water collected in the open probe rods. Alternatively, tubing from the surface may be connected directly to the sampler screen and samples are recovered using a peristaltic pump or vacuum source. The pore size of the sampler screen is 0.0057 inches (0.145 mm). The sampler will collect relatively clean water samples in a short time period due to its large surface area.

Sample vials and bottles will be filled to overflowing and sealed so that no air is trapped in the vial or bottle. Once filled, samples shall be inverted and tapped to test for air bubbles. Samples will be contained in vial and bottles approved by the US EPA and the RWQCB, San Francisco Bay Region. Some analyses may require separate sample containers in accordance with EPA methods described in 40 CFR Part 136 and SW-846.

Water samples intended for volatile hydrocarbon analysis will be contained in 40 ml VOA vials prepared according to EPA SW 849 and capped with Teflon-lined septa caps. Samples intended for EPA 602 analysis will contain a small amount of preservative (HCl). Samples intended for EPA 601 and EPA 624 GCMS procedures will not be preserved. Water samples intended for low level diesel analysis will be stored in dark glass 1-liter bottles to reduce degradation by sunlight. Antimicrobial preservative (HCl) may be added to the sample if a prolonged holding time is expected prior to analysis.

Sample containers will be labelled with self-adhesive, pre-printed tags. Labels will contain the sample number in waterproof ink. The sample number will be listed in the sampler's field notebook, along with the time the sample was taken, sample location, and all other appropriate sample information.

All purged water will be stored on site in steel DOT approved drums. Drums will be labeled as to contents, suspected contaminants, date container filled, expected removal date, company name; contact and phone number, sealed and left on-site for subsequent disposal pending analytical results.

DOCUMENTATION

Sampling information will be recorded in ink in a bound notebook with consecutively number pages. Pages will not be removed for any reason. Alternatively, specially formatted field data sheets may be used to record the information collected during water quality sampling. Errata may be marked out with a single line, and initials of person making the change. The log book and data sheets will be placed in the project file when sampling is completed.

FIELD EQUIPMENT DECONTAMINATION PROCEDURES

The sampler and other equipment will be decontaminated before and after each use by steam cleaning, or a tri-sodium phosphate solution wash, and triple tap water or deionized water rinses.

All rinseate used in the decontamination process will be stored on site in steel DOT approved drums. Drums will be labeled as to contents, suspected contaminants, date container filled, expected removal date, company name, contact and phone number, sealed and left on-site for subsequent disposal pending analytical results.

APPENDIX C

DRILLING FOR WELL CONSTRUCTION

GENERAL PRACTICES

Each monitoring well will be designed to register the potentiometric surface, facilitate soil sampling, and permit water sampling. GROWTH's standard procedures for well installation and soil/water sampling meet or exceed guidelines set by California EPA, California Regional Water Quality Control Boards, and local regulator agencies. Drilling, construction, and completion of all exploratory borings and monitoring wells will be in conformance with procedures in this manual.

DRILLING PROCEDURES

Monitoring wells will be drilled with a hollow-stem, continuous-flight auger. All boring and logging will be overseen by a geologist with special attention given to the avoidance of cross contaminating underlying aquifers. The following procedures used by GROWTH geologists prevent pollution of clean aquifers underlying contaminated zones:

1. Drilling will cease if five feet of impermeable material is encountered. It will be assumed that any significant, saturated, impermeable layer, such as a clay layer, is an aquitard separating the shallow and deep aquifers and should not be penetrated.

2. Drilling will be terminated 10-15 feet below any perched or unconfined water table.

3. Drilling will be terminated at 60 feet below ground surface if groundwater is not encountered. This is above nearly all deep aquifers currently supplying groundwater in the Bay Area.

The drill rig operator and the GROWTH geologist will discuss significant changes in material penetrated by the drill, changes in drilling conditions, hydraulic pressure, and drilling action. The GROWTH geologist will be present during the drilling of exploratory borings and will observe and record changes by time and depth and evaluate the relative moisture and content of the samples and note water producing zones. This record will be used later to prepare a detailed lithologic log. Lithologic descriptions will include soil or rock type, color, grain, size, texture, hardness, degree of induration, carbonate content, presence of fossils and other materials (gypsum, hydrocarbons) and other pertinent information. A copy of the logs will be retained in the field file at the project site.

SOIL CUTTINGS

Soil cuttings generated during drilling will be placed on and covered by polyethylene sheeting. Soils will remain on-site for subsequent disposal pending analytical results. Soil cuttings will be the responsibility of the owner/generator, although GROWTH may arrange for disposal.

SOIL SAMPLING IN BOREHOLES

U.S. Environmental Protection Agency standards serve as the foundation for all field sampling operations performed by GROWTH. EPA SW 846 is the primary publication from which procedures are derived. While some aspects of field and laboratory work may be delegated to the California Department of Health Services, the California Water Resources Control Board, the San Francisco Bay Regional Water Quality Control Board, and the San Mateo County Environmental Health Services Division establish the general and specific criteria for sampling.

SAMPLE INTERVALS

Samples will be taken at five-foot intervals, distinct lithologic changes, and the capillary fringe zone. Selected samples will be properly retained for chemical analysis.

Collection Devices. Samples will be collected using a 2- or 2.5-inch-I.D. modified California split spoon sampler containing three, six-inch-long brass tubes. The sampler and will be decontaminated before and after each use by steam cleaning, or a tri-sodium phosphate solution wash, and triple tap water or deionized water rinses. The sampler will be driven ahead of the augers using a 140 pound drop hammer. The average blow counts required to drive the sampler the last 12 inches will be recorded on the boring logs.

Preservation and Handling. Sample tubes will be labeled, sealed at each end with Teflon sheeting and PVC end caps, and stored in an ice chest with ice. Samples will be delivered under chain of custody to a State-certified laboratory.

Soils Classification. Soils exposed at the ends of each brass tube will be examined by a geologist for obvious signs of contamination and classified according to the Unified Soil Classification System. These observations will be recorded in the boring logs.

Selection of samples for laboratory analysis will be based primarily on headspace readings and position within the boring, although some discretion by the site geologist or engineer will be required. In general, samples with headspace readings over 50 ppm or that have visual or olfactory indications of contamination will be submitted for analysis. One sample will also be selected from one to two intervals below the apparent lower limit of contamination to obtain a "zero line" value. In addition, the sample closest to the depth of the storage tank invert (i.e. 12-13 feet) will be submitted for analysis. If the water table is above the tank invert, the sample closest to the water table will be selected. If the water table is below the tank invert, a sample from the capillary fringe zone above the water table will be collected and analyzed.

Sample Labeling and Chain of Custody. Samples selected for analysis will be labeled with self-adhesive, pre-printed labels with the sample number. This number will also be recorded the sampler's field notebook along with the project number, sample location, depth, and the date and time collected. The same information will be recorded on the chain of custody.

Documentation, A well construction diagram for each monitoring well will be completed by the geologist and submitted to the project manager when the work has been completed. In addition, the details of well installation, construction, development, and field measurements of water quality parameters will be summarized as daily entries in a field notebook or data sheets which will be submitted to the project manager when the work has been completed.

DRILLING EQUIPMENT DECONTAMINATION PROCEDURES

The sampler will be decontaminated before and after each use by steam cleaning or washing in a tri-sodium phosphate, followed by tap water. Only clean water from a municipal supply will be used for decontamination of drilling equipment.

All rinseate used in the decontamination process will be stored on site in steel DOT approved drums. Drums will be labeled as to contents, suspected contaminants, date container filled, expected removal date, company name, contact and phone number, sealed and left on-site for subsequent disposal pending analytical results.

SCREEN AND CASING

The monitoring well assembly will consist of new, schedule 40 PVC casing from the bottom of the boring to ground surface. Casing will be steam cleaned before installation.

From the base of the well to approximately five feet above the ground water surface, casing will consist of perforated casing (well screen); the remainder of the well will be solid PVC casing. Perforated casing (well screen) will be factory slotted. Screen sizes are not intended to provide optimum flow to provide hydraulic connection between the borehole and the monitoring well. The perforation size is selected to retain 70 to 90% of the filter pack material. A slot size of 0.020 inches will be used.

Upon completion of drilling, well casing will be assembled and lowered to the bottom of the boring. Casing will be connected with dry threads or slip joints, because using glue to connect casing sections could cause false analytical interpretations of water quality. The bottom of the casing will be approximately flush with the bottom of the boring and will be capped with a threaded PVC cap or plug. Using the lithologic log for control, the GROWTH geologist will specify the exact depths of screened intervals so that the well screen is approximately opposite the water-bearing zone to be monitored.

Where possible, the casing will extend six inches above the ground surface. When monitoring wells are placed in traffic areas where they cannot extend above the surface, pre-cast concrete or cast iron boxes and covers will be installed.

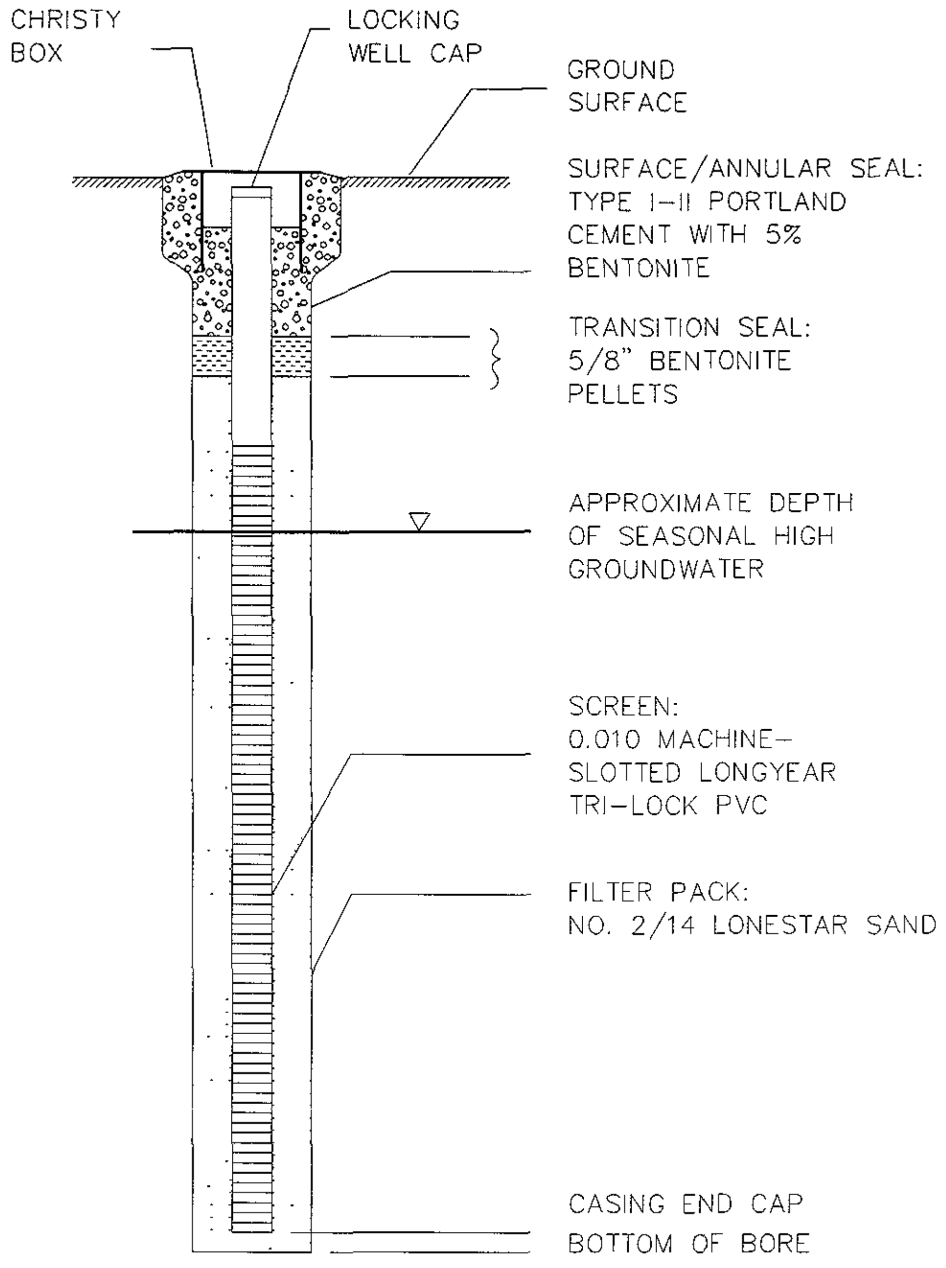
FILTER PACK

After the monitoring well assembly has been lowered to the specified depth, filter pack will be placed in the annular space between the well casing and borehole from the bottom of the well to approximately two feet above the top of the well screen. The depth to the top of the filter pack will be verified using the tremie pipe or a weighted steel tape. Filter pack will be at least 95% silica sand. Sand will be hard, durable, well rounded, spherical grains that have been washed until free of dust and contamination. A filter pack of #3 Lonestar sand will be used.

ASTM recommends the following guidelines for screen slot and filter pack selection based on the anticipated strata:

Anticipated Soil Type	Recommended Well Screen Slot Size (in)	Recommended Filter Pack Material (U S. sieve sizes)
Sand & Gravel	0.030	20 to 4
Silt & Sand	0.020	30 to 8
Clay & Silt	0.010	50 to 16

Reference: Development Methods for Water Wells: An Anthology, NWWA Water Well Journal, June 1988.


CHRISTY BOX
LOCKING WELL CAP
GROUND SURFACE
SURFACE/ANNULAR SEAL: TYPE I-II PORTLAND CEMENT WITH 5% BENTONITE
TRANSITION SEAL: 5/8" BENTONITE PELLETS
APPROXIMATE DEPTH OF SEASONAL HIGH GROUNDWATER
SCREEN: 0.010 MACHINE-SLOTTED LONGYEAR TRI-LOCK PVC
FILTER PACK: NO. 2/14 LONESTAR SAND
CASING END CAP
BOTTOM OF BORE

GROWTH		5	

A layer of bentonite chips or pellets approximately one foot thick will be placed above the filter pack and charged with water. The depth to the top of the bentonite pellets layer will be verified using the tremie pipe or a weighted steel tape.

A cement-bentonite grout mixture will be tremied into the annular space from the bentonite seal to the top of the well. The grout material will be a mixture of Portland Type I/II cement (94 lb) to five gallons of clean water or a sand-cement slurry with a minimum of 11 sacks of Portland Type I/II cement per cubic yard. Only clean water from a municipal supply shall be used to prepare the grout.

CAPPING WELLS

After emplacing the grout, a steel or pre-cast concrete well vault (or valve box) will be completed below ground surface. A metal tag containing well number and construction data will be permanently attached to the well vault. A steel well cover clearly marked "monitoring well" will be bolted to the vault. A suitable watertight, locking well cap will be fitted to the riser casing to prevent the entry of surface runoff or foreign matter.

WELL DEVELOPMENT

When well installation is complete, the well will be developed by purging, and/or bailing, and/or pumping to remove fines from the formation and filter pack. Well development will not begin until the grout has set a minimum of 48 hours. Well development generally restores natural hydraulic properties to the adjacent soils and improves hydraulic properties near the borehole so the water flows more freely in the well.

At the least, pumping should continue until water in casing storage has been removed. There are at least two common methods for determining that water in casing storage has been removed and water is flowing freely from the aquifer: (1) Monitor water level while pumping. When the pumping water level has "stabilized," it is likely that little or no water from casing storage is being pumped. (2) Monitor the temperature, pH, conductivity, and turbidity of the water while pumping. When these parameters "stabilize," it is probable that little or no water from casing storage is being pumped and most of the water is coming from the aquifer. When these parameters "stabilize" purging may begin.

GROWTH will use the latter method. During development, pH, specific conductance, and temperature of the return water from the water pump will be measured. Well development will proceed until these field-measured water quality parameters have stabilized and the water is, in the judgment of the geologist, at its greatest possible clarity.

Temperature, pH, specific conductance, and turbidity meters will be calibrated per manufacturers guidelines. Temperature will be measured with a good grade mercury-filled Centigrade thermometer, bimetallic-element thermometer, or electronic thermistor. The pH measurements will be made as soon as possible after collection of the sample preferably within a few minutes.

Conductivity will be measured by dipping the conductivity probe in the water source or sample. The probe must be immersed above the vent. The temperature of the sample will be used to calculate specific conductance from the conductivity measurement. Conductivity will be reported in units of micromhos per centimeter (μmho/cm) at 25° C.

Turbidity will be measured by placing a vial of development/purge water into a turbidity meter for measurement. The instrument will be calibrated to read in a range between 1 and 400 Nephelometric turbidity units (NTUs). This is a measure of the amount of light scattered at right angles to the path of light passing through the water. The greater the NTU reading, the greater the amount of light scattered by particles in the water, therefore, the greater the turbidity.

APPENDIX D

WATER SAMPLING IN WELLS AND BOREHOLES

GENERAL CONSIDERATIONS

In general, the composition of water within the well casing and in close proximity to the well is not representative of groundwater quality. This may be due to contamination by drilling fluids or drilling equipment or to disparities between the oxidation-reduction potential in the well and the redox potential in the aquifer. To obtain a representative sample of groundwater, therefore, the well should be pumped or bailed until the well is thoroughly flushed of standing water and contains fresh water from the aquifer. One common procedure is to pump or bail the well until a minimum of three bore volumes (or alternatively, 10 well volumes) have been removed.

At the least, pumping should continue until water in casing storage has been removed. There are at least two common methods for determining that water in casing storage has been removed and water is flowing freely from the aquifer: (1) Monitor water level while pumping. When the pumping water level has "stabilized," it is likely that little or no water from casing storage is being pumped. (2) Monitor the temperature, pH, conductivity, and turbidity of the water while pumping. When these parameters "stabilize," it is probable that little or no water from casing storage is being pumped and most of the water is coming from the aquifer.

WELL PURGING

Purging and sampling will not begin for at least 48 hours following well construction. Static water level will be measured prior to purging using an electronic sounder. All water-level measurements will be recorded to the nearest 0.01 foot with respect to casing elevation.

A minimum of three bore volumes will generally be purged from the well prior to sampling. The well will be allowed to return to 80 percent of the original water level before sampling.

Temperature, pH, specific conductance, and turbidity will be measured for each bore volume pumped. Purging will continue until these field-measured water quality parameters have stabilized and the water is, in the judgment of the geologist, representative of water in the aquifer. Data obtained from field water quality measurements will be recorded in the field log book or data sheets. A separate aliquot of groundwater collected from the purge water outlet stream will be used for field measurements; samples intended for laboratory analysis will not be used.

Temperature, pH, specific conductance, and turbidity meters will be calibrated per manufacturers guidelines.

Temperature will be measured with a good grade mercury-filled Centigrade thermometer, bimetallic-element thermometer, or electronic thermistor.

Acidity/alkalinity (pH) will be measured by dipping the conductivity probe in the water source or sample; pH will be measured as soon as possible after collection of the sample, preferably within a few minutes.

Conductivity will be measured by dipping the conductivity probe in the water source or sample. The temperature of the sample will be used to calculate specific conductance from the conductivity measurement. Measurements shall be reported in units of micromhos per centimeter at 25 degrees Centigrade.

Turbidity will be measured using a vial of development/purge water and a turbidity meter. The instrument will be calibrated to read between 1 and 400 Nephelometric turbidity units (NTUs). This is a measure of the amount of light scattered at right angles to the path of light passing through the water. The greater the NTU reading, the greater the amount of light scattered by particles in the water, therefore, the greater the turbidity.

SAMPLE COLLECTION

Wells and borings will be sampled using a new, clean, disposable Teflon bailer attached to new, clean string. Sample vials and bottles will be filled to overflowing and sealed so that no air is trapped in the vial or bottle. Once filled, samples shall be inverted and tapped to test for air bubbles. Samples will be contained in vial and bottles approved by the US EPA and the RWQCB, San Francisco Bay Region. Some analyses may require separate sample containers in accordance with EPA methods described in 40 CFR Part 136 and SW-846.

Water samples intended for volatile hydrocarbon analysis will be contained in 40 ml VOA vials prepared according to EPA SW 849 and capped with Teflon-lined septa caps. Samples intended for EPA 602 analysis will contain a small amount of preservative (HCl). Samples intended for EPA 601 and EPA 624 GCMS procedures will not be preserved. Water samples intended for low level diesel analysis will be stored in dark glass 1-liter bottles to reduce degradation by sunlight. Antimicrobial preservative (HCl) may be added to the sample if a prolonged holding time is expected prior to analysis.

Sample containers will be labelled with self-adhesive, pre-printed tags. Labels will contain the sample number in waterproof ink. The sample number will be listed in the sampler's field notebook, along with the time the sample was taken, sample location, and all other appropriate sample information.

All purged water will be stored on site in steel DOT approved drums. Drums will be labeled as to contents, suspected contaminants, date container filled, expected removal date, company name, contact and phone number, sealed and left on-site for subsequent disposal pending analytical results.

DOCUMENTATION

Sampling information will be recorded in ink in a bound notebook with consecutively number pages. Pages will not be removed for any reason. Alternatively, specially formatted field data sheets may be used to record the information collected during water quality sampling. Errata may be marked out with a single line, and initials of person making the change. The log book and data sheets will be placed in the project file when sampling is completed.

FIELD EQUIPMENT DECONTAMINATION PROCEDURES

Bailers and string will be properly disposed of off site. All other sampling equipment, such as buckets and stands, will be decontaminated after each use by washing in a tri-sodium phosphate solution, followed by triple rinsing with tap water.

All rinseate used in the decontamination process will be stored on site in steel DOT approved drums. Drums will be labeled as to contents, suspected contaminants, date container filled, expected removal date, company name, contact and phone number, sealed and left on-site for subsequent disposal pending analytical results.

APPENDIX E

PNEUMATIC PUMP TEST METHOD

OBJECTIVE

A Pneumatic Pump Test (PPT) will be conducted to evaluate the soil air permeability and other parameters. This information will be used to determine the feasibility of an In-situ Soil Vapor Extraction (SVE) System. – probably not applicable due to contamination at capillary fringe.

SCOPE OF WORK

One soil vapor extraction well and three pressure and soil gas probes will be emplaced to a depth not to exceed 20 feet. The PPT will be connected and run for day. A report will be prepared to recommend whether or not an SVE system can be installed as an effective method for site remediation.

PROCEDURES

The first step in a Soil Vapor Extraction (SVE) Project is to conduct the Pneumatic Pump Test (PPT). One of the most critical factors used to determine SVE design is the vapor flow rate that can be induced at a particular site. The vapor flow rate is directly dependent upon the air permeability with the applied vacuum. The soil's permeability to air flow demonstrates how easily vapor flows through the soil and will be one of the two most important parameters for design and success of SVE.

Soil air permeability is evaluated by conducting a pilot test called the Pneumatic Pump Test (PPT). Information gained from a PPT will be vital in determining site specific design considerations for the vapor extraction system, the vapor treatment system, obtaining the air permits to operate the system, and for preparing the Work Plans for regulatory approval.

Work Plan and Air Permit for the Pneumatic Pump Test. Prior to the start of the PPT, a Work Plan will be prepared which meets the requirements of the local regulatory agencies to perform this test. The Work Plan will include the following:

- Description of the activities occurring on the site.
- Description of well installation methodologies.
- Sampling methodologies.
- Testing methodologies.
- Health and Safety Plan.
- Air Permit Application

Installation of Test Well. As part of the PPT, one vapor extraction well and three vapor probes will be installed. The extraction well will ultimately be integrated into the final system. Soil samples will be collected and analyzed during the well installation and analyzed for their chemical and physical parameters. This will add to existing information on the site.

GROWTH will then install the system of vapor probes using hollow 1 inch hardened steel probes driven to various depths using an electric or pneumatic ram. The location and depth of the probe will be selected so that the influence of the vacuum system over various distances and through various geological lithologies can be evaluated.

Mobile Test Unit Connection. Once the vapor extraction well and the vacuum probes are installed, the mobile test unit can be connected. The test unit consists of a series of the air pumps, filters, and scrubbers.

Each of the vacuum wells is fitted with a customized well head assembly to allow for the application of vacuum and vapor extraction. The test unit is connected to the vapor extraction well by a system of manifolds and valves. Air from the vapor extraction well is transferred to the intake of the test unit through the system of piping, manifolds and valves. In the test unit, the air is first past through a trap to remove moisture to prevent fouling of the other parts of the test unit. The air then goes through a filter to remove any entrained soil particles. Next, the air passes through the 350 cfm air pump which is driven by a propane powered engine. Prior to exhausting the air, it is passed through a activated charcoal scrubber to remove any contamination.

Pneumatic Pump Test. After the well is installed and the test unit is connected to it, the Pneumatic Pump Test (PPT) can be performed. The purpose of the PPT is to:

- Evaluate the flow versus vacuum relationship for each vent well (vapor extraction well) region.
- Measure the radii of influence.
- Determine the propagation of induced vacuum as a function of applied vacuum.
- Evaluate the soil air permeability.
- Determine the concentrations of contaminants in the extracted vapor.

To start the test, the unit is turned on and allowed to run for several minutes so that the flow of air in the soil will stabilize. Several vacuum tests will be conducted at each well head and in combination with the other well. The vacuum is increased incrementally for each test. During a given test, vacuum measurements are made every 20 minutes at each of the three monitoring probes and flow measurements are made at the vapor extraction well.

In addition to measuring the vacuum and air flows, the exhaust air from the vapor extraction well will be sampled and analyzed for its chemical constituents. In-field measurements for oxygen, carbon dioxide, hydrocarbons, etc. will be made. Grab samples of the air will also be collected in Tedlar bags for laboratory analysis. The grab samples will be analyzed for some of the solvents found during the previous characterization work performed at this site.

Analyze Data. The main objective of this task is to analyze the data collected from the previous tasks. One important piece of information is the calculation of the radius of influence or the zone in which vapor flow is induced. This information is obtained by fitting radial pressure distribution data from the PPT to the steady-state radial pressure distribution equation.

Other important information is the steady state concentration of the chemical constituents in the air stream vs. flow rates.

Equipment Selection and Construction Estimates. From the analysis of the data, the equipment for the vapor extraction system can be selected. The radius of influence vs. static pressure or flow will dictate well placement and spacing, and specifications for the blowers. The concentration of vapor vs. flow rate or static pressure will also dictate blower specifications and will determine the correct and most cost effective air treatment system.

The selection of off gas treatment system depends upon:

- The nature of the contaminants.
- The concentration of the contaminants.
- Flow rate.
- Moisture content of the vapor.

APPENDIX F

GROUNDWATER PUMP TEST METHODS

GROUNDWATER PUMP TEST

The groundwater pumping test will be conducted to determine the hydraulic characteristics of the aquifer. The yield and drawdown will be recorded to measure the capacity of the well by pumping at a given rate and recording the drawdown with time.

Before testing, decisions will be made on locating the pumping well and observation wells. In addition, each of the wells should be just large enough to allow accurate and rapid measurement of the water levels. Small diameter wells are best since large wells may cause a time lag in drawdown changes.

For unconfined aquifers, the observation wells will be placed within 100 to 300 feet from the pumped well. Screens for the observation wells should be installed about the same depth as screens in the production well.

Pre-Test. Prior to conducting the Pump Test, some preliminary information must be collected. The following data is needed to properly set-up the Pump Test. This information will be obtained by conducting a pre-test.

1) Measure the static water levels just before the test is started.

2) Determine the maximum anticipated drawdown.

3) Determine the volume of water delivered from the production well at varied pumping rates.

Analysis of this data will be required to determine whether or not the observation wells are located properly so that they exhibit sufficient drawdown.

Pump Test. The actual pumping test will not be started until the water level in the aquifer has returned to the pre-test static level.

An electronic sounder will be used to measure the depth to water in each of the wells. All of the wells do not need to be sampled at the same time, but watches will be synchronized so that time is referenced accurately to the time pumping was started. The top of the well casing is used as the reference point for depth measurements. Drawdown readings in the wells should be taken at recommended intervals (see Table F-1 and Table F-2). The pumping rate should be recorded accurately at times throughout the test.

Barometric pressure and tidal changes will be recorded during the pump test. In addition, any weather changes during the test will also be reported.

The accuracy of drawdown data collected during the pumping test will depend on the following;

1) Maintaining a constant yield throughout the test.

2) Measuring the drawdown carefully in the pumping well and at least two properly placed observation wells.

3 Taking drawdown readings in appropriate time intervals.

4) Determining how changes in pressure, stream levels, and tidal fluctuations affect the drawdown.

5) Comparing recovery data with drawdown data taken during the pumping portion of the test.

6) Continuing the test for at least 24 hours for confined aquifer and 72 hours for an unconfined aquifer.

Data Analysis. The determination of accurate transmissivity values from the pumping tests will depend on how well the test is conducted and also on the interpretation of results. The nature of the aquifer must be understood in order to make sense of the data.

The procedure for calculating the hydraulic conductivity of the well and the well efficiency will include the following steps;

1) Graph the time-drawdown data (semi-log plot of drawdown versus time).

2) Calculate drawdown Δs from slope of drawdown line of best fit.

3) At a particular time, note the drawdown in an observation well.

4) Plot (on a distance-drawdown graph) the drawdown for the observation well at the proper distance from the pumping well.

5) Complete the drawdown curve by using a slope of 2 times Δs so that the value of Δs in the distance drawdown graph is twice the value of Δs in the time drawdown graph.

6) Extend the slope of the data to the radius of the well.

Table F-1. Recommended Time Intervals For Drawdown Measurement in Production Well

Time Since Start of Pumping (min)	Time Intervals Between Measurements (min)
0 - 10	0.5 - 1
10 - 15	1
15 - 60	5
60 - 300	30
300 - 1440	60
1440 - End of Test	480

Table F-2. Recommended Time Intervals For Drawdown Measurement in Observation Wells

Time Since Start of Pumping (min)	Time Intervals Between Measurements (min)
0 - 60	2
60 - 120	5
120 - 240	10
240 - 360	30
360 - 1440	60
1440 - End of Test	480

APPENDIX G

Site Specific Health and Safety Plan for Motor Partners 1234 40th Avenue, Oakland, California

I. PROJECT PLAN

Objectives and Project Description

Growth Environmental Services, Inc., (GROWTH) has prepared this Health and Safety Plan for Motor Partners prior to drilling and installing monitoring wells at the 1234 40th Avenue, Oakland, California site. The following emergency response plan will be implemented prior to beginning site work to handle on-site emergencies. The first priority in all emergency incidents will be to minimize adverse health risks to workers.

Field Activities

Site work will include site characterization, soil borings and installation of three 25-ft. monitoring wells.

Personnel Requirements

Field geologist, engineer, and drillers.

Key Personnel and Owner Representative

Project Assignment	Name/Agency	Telephone
Field Geologist	Chris Wong, GROWTH	(707) 745-0171
Project Manager & Assistant Site Safety Officer	Gary Rogers, GROWTH	(707) 745-0171
Quality Assurance Officer	Stanley L. Klemetson, GROWTH	(707) 745-0171
Site Safety Officer	Michael T. Noble, GROWTH	(707)745-0171
Owner Representative	Bill Owens Motor Partners	(510) 935-3840

II. JOB HAZARD ANALYSES

Threshold Limit Values for Anticipated Chemical Substances

Substance	OSHA PEL	ACGIH TLV	NIOSH REL
Benzene	10 ppm	10 ppm	0.1 ppm
Toluene	200	100	100
Xylene	100	100	-

Toxicological Hazards of Wastes

Human exposure to benzene concentrations in excess of 150 ppm may cause headache, weariness, and loss of appetite. Vapors at high concentrations may cause smarting of the eyes and dermatitis.

Physical Hazards Associated with Site Activities

- Slip, trip and fall hazards
- Hazards due to falling or swinging objects and heavy equipment
- Excessive noise

III. SITE CHARACTERIZATION

A. Site Information

Location	Motor Partners 1234 40th Avenue Oakland, CA 94621
Topography	Flat and gently sloping to the east
Accessibility	There are no access problems.
Pathways for Hazardous Substance Dispersion	Gasoline may volatilize slightly from contaminated soil
Anticipated Weather Conditions	Mild weather
Past and Present Use of Site	Presently used as an automotive repair facility, now vacant buildings

B. Description of Wastes On Site

Location	Soils underlying sidewalk and building.
Physical State of Wastes	Adsorbed in soil matrix
Range of Concentrations Found to Date	Soil samples below the 1,000-gallon tank contained 1,600 ppm TPH-G. Soils below the 500-gallon tank contained 570 ppm TPH-G.

IV. PERSONAL PROTECTIVE EQUIPMENT

Level of Protection Level D

Respiratory Protection Half mask dual cartridge respirator with organic vapor cartridges; will only be required if airborne concentrations are above action levels.

Protective Clothing

- Hard hat (required)
- Work boots (required)
- Safety Glasses (optional)
- Hearing Protection (optional)
- Protective gloves (optional)

Action Levels and Work Requirements Don respirators if organics in the breathing zone exceed a constant 30 ppm

V. EXPOSURE MONITORING PLAN

Frequency and Type of Monitoring Air should be monitored every 30 minutes using an organic vapor meter while excavating and sampling in contaminated areas.

Methodology Monitor downwind in the breathing zone.

VI. DECONTAMINATION PROCEDURES

For PPE Leave the work area and remove clothing, respirator last. All non-reusable clothing will be disposed of in garbage containers.

VII. PROTECTION OF GENERAL PUBLIC

Procedures The contractor will redirect pedestrian traffic around the work area using temporary fencing, or barricades and warning ribbon. The temporary pedestrian walkway will also be protected from automobile traffic using barricades and warning ribbon. Any excavation left open over night will be enclosed with fencing.

Only authorized personnel will be permitted within 10 ft. of heavy equipment.

VIII. EMERGENCY RESPONSE

Command and Control

The on-site GROWTH representative will be responsible for health and safety issues related to sampling and drilling.

Directions to Hospital

See area map for route to Booth Memorial Hospital, Oakland, California

Emergency Procedures for Personnel Injured or Exposed in the Work Zone

1. Assist the injured or exposed worker out of the sampling area.

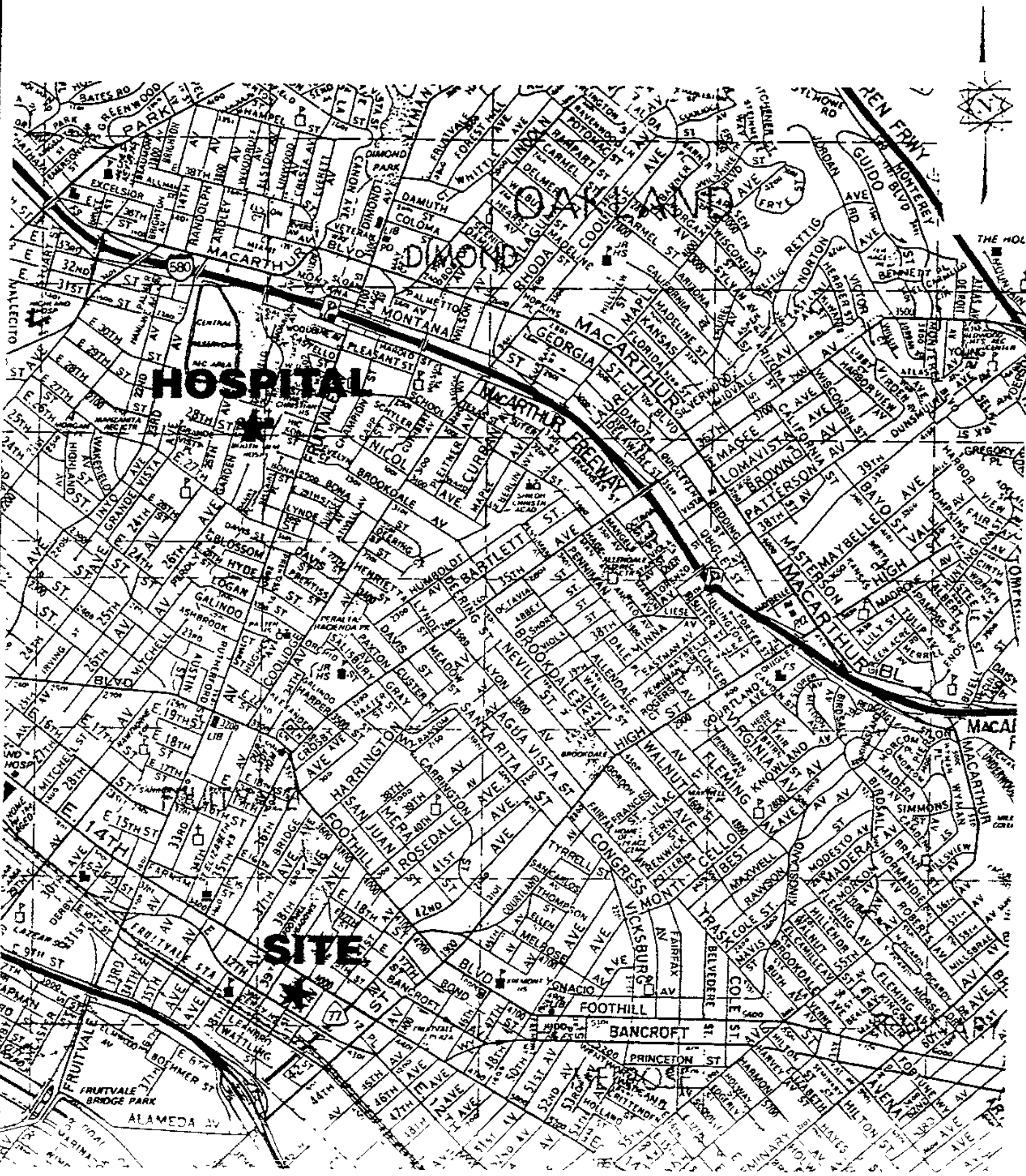
2. Call for medical help.

3. Administer CPR/first aid as needed.

4. If possible, carefully remove the victim's PPE and begin decontamination procedures.

Emergency Agencies with Telephone Numbers

Emergency Service	Name/Agency	Telephone
Ambulance	Oakland Fire Dept.	911
Hospital	Booth Memorial Hospital 2794 Garden Street Oakland, CA	(510) 535-5088
Police	Oakland	911
Fire Department	Oakland	911
Public Health	Barney Chan Department of Environmental Health	(510) 271-4530
Project Manager	Gary Rogers	(707) 745-0171
Emergency Spills	CalEPA	(415) 974-8131
Worker Health and Safety	OSHA	(800) 648-1003
CHEMTREC	CHEMTREC	(800) 424-9300
Utilities	Underground Service Alert	(800) 227-2600


HOSPITAL
SITE
OAKLAND
DIMOND
MACARTHUR FREEWAY
MACARTHUR BLVD
FOOTHILL
BANCROFT
PRINCETON ST
FRUITVALE BRIDGE PARK
ALAMEDA AV
WARREN FRWY
580
77

GROWTH