STREAMBORN

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Casimiro and Josephine Damele
3750 Victor Avenue
Oakland CA 94619

15 September 1997

Project No. P214

STID 812

Workplan
Investigation of Gasoline-Contaminated Soil and Groundwater
4401 Market Street
Oakland CA

Dear Mr. and Ms. Damele:

The attached workplan describes proposed soil and groundwater investigation activities associated with releases from former underground gasoline tanks at the subject property. This workplan has been prepared pursuant to Streamborn's 4 August 1997 proposal.

If you have any questions or comments, please call.

Sincerely,
STREAMBORN

K.B. Alexander

Kenneth B. Alexander, RG, CH
Certified Hydrogeologist

Attachment

cc: Amy Leech/Alameda County Environmental Health Services, Alameda, CA

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Workplan
Soil and Groundwater Investigation
4401 Market Street
Oakland CA

Prepared For
Casimiro and Josephine Damele
Oakland CA

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INTRODUCTION

This workplan describes proposed soil and groundwater investigation activities associated with releases from former underground gasoline tanks at 4401 Market Street, Oakland CA (Figure 1). Planned activities include: (1) collection and analysis of soil and groundwater samples using direct-push techniques, and (2) preparation of an ASTM Risk-Based Corrective Action (RBCA) Tier 1 Evaluation.

BACKGROUND

A chronology of activities associated with the former underground gasoline tanks is summarized in Table 1.

The subject property is a former gasoline station. W. A. Craig reported that the structure on the property was constructed in 1943 and used as a gasoline station until the 1970's. Four underground gasoline tanks (one 1,000-gallon tank and three 500-gallon tanks) were located on the southeast corner of the property near the intersection of Market Street and 44th Street (Figure 2).

On 22 June 1990, the tanks were removed by Environmental Bio-Systems, Inc. of Hayward CA (EBS 1990). Contaminated soil was discovered within the tank excavation (Table 2). Benzene, toluene, ethylbenzene, and xylenes (BTEX) were also detected in the soil samples (Table 2). Soil excavated during the tank removal was placed back into the excavation.

On 6 September 1990, W. A. Craig excavated 2 trenches to a depth of approximately 5 feet in the vicinity of the former dispenser island. Contaminated soil was observed but no laboratory analyses were performed. Soil excavated during trenching was placed back into the trenches.

In October 1994, W. A. Craig drilled 7 borings, 3 of which were completed as monitoring wells (MW-1, MW-2, and MW-3). Free product, presumably gasoline, was observed in one of the borings (SB-2) at the southwest corner of the property (Figure 2). TPH-gasoline was detected in soil samples collected from 3 of the borings (SB-2, SB-4, and MW-2) (Table 3). Monitoring well completion data is summarized in Table 4.

Eight rounds of groundwater monitoring have been performed at the property periodically since November 1994. Analytical results of well sampling are summarized in Table 5. TPH-gasoline and BTEX have been detected in samples from well MW-2 during each monitoring event (Table 5). The depth to groundwater in the 3 monitoring wells has been measured between approximately 12 to 16 feet. The groundwater gradient direction has varied between southeast and southwest.

In letters dated 4 December 1996 and 7 March 1997, Alameda County Environmental Health Services (ACDEH 1996, 1997) requested the following:

- Investigate the extent of contaminated soil in the vicinity of the former gasoline dispenser island.
- Investigate the extent of contaminated soil and groundwater in the vicinity of boring SB-2, where free product was reportedly observed in 1994.
- Evaluate the lateral and vertical extent of groundwater contamination.

APPROACH

Our proposed approach to soil and groundwater investigation at the subject property includes the following:

- We will evaluate the groundwater gradient direction in the vicinity of the property by reviewing site-specific historic data.
- We will collect soil and groundwater samples using direct-push technology such as HydroPunch, Enviro-core, or GeoProbe. These techniques are cost-efficient, fast, and produce little or no soil cuttings compared to borings drilled with hollow-stem augers.
- We will collect soil and groundwater samples in the vicinity of (1) the former dispenser island and trenches, (2) boring SB-2, where free product has been observed, and (3) the intersection of 44th and Market Streets, in the presumed downgradient direction from the property. We will also collect a soil sample from a presumed uncontaminated location. This sample will be analyzed for various parameters to determine "background" conditions.
- Two soil samples will be analyzed from each boring: (1) at a depth of ±12 feet coincident with the highest historical water level elevation and (2) at a depth coincident with the water table. An additional sample will be analyzed from a depth of ±7-feet in the 2 borings in the vicinity of the former dispenser island and trenches. One groundwater sample will be analyzed from each boring. If contamination is observed during advancement of the borings, additional samples may be analyzed.
- Soil and groundwater samples will be analyzed for TPH-gasoline, MTBE, and BTEX using either a mobile laboratory or 24-hour turnaround time at a stationary laboratory. This will allow us to use the analytical results to identify optimal placement of the downgradient sampling locations and delineate the extent of soil and groundwater contamination. Sampling will continue in a downgradient direction until the extent of contamination is delineated.
- After obtaining the soil and groundwater analytical data, we will perform a ASTM Risk-Based Corrective Action (RBCA) Tier 1 Evaluation.
- The results of the soil and groundwater sampling and the RBCA Tier 1 Evaluation will be summarized in a report.

SCOPE OF WORK

We will obtain drilling and encroachment permits from Alameda County Environmental Health Services and the City of Berkeley. We will retain an underground utility locator service to search for buried utilities at each proposed sampling location. We will also notify Underground Service Alert (USA) to check the vicinity of the proposed sampling locations for underground utilities. As appropriate, we will have concrete or asphalt cored at the proposed sampling locations.

Soil Sampling and Analysis

At least 8 borings will be advanced to a depth of ±5-feet below groundwater using direct-push technology such as HydroPunch, Enviro-core, or GeoProbe. Groundwater is anticipated at a depth of ±15-feet; the total depth of the borings is anticipated to be between ±18- and 22-feet.

The proposed sample locations are depicted on Figure 2 and are summarized below:

- Two borings in the vicinity of the former dispenser island and trenches.
- One boring in the vicinity of boring SB-2, where free product has been observed.
- At least 5 borings in the vicinity of 44th and Market Streets, downgradient from the property. Sampling will continue in a downgradient direction until the extent of contamination is delineated.

The exact locations of the downgradient borings will be finalized after evaluation of the groundwater gradient direction. The rationale for the proposed sampling locations is summarized in Table 6.

Soil samples will be collected continuously or 5-foot intervals or at detectable lithologic changes, whichever is more frequent. Soil samples will be classified in the field in accordance to ASTM Standard 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Samples will be screened in the field using an organic vapor monitor. Soil sampling will be performed in accordance with our Standard Operating Procedure 29 - Soil Sampling Using Direct Push Techniques (Appendix A).

Soil samples selected for chemical analysis will be analyzed for TPH-gasoline, MTBE, and BTEX (modified EPA Method 8015 and EPA Method 8020) using either a mobile laboratory or 24-hour turnaround time at a stationary laboratory. Three soil samples will be collected for analysis from each boring in the vicinity of the former dispenser island and trenches: (1) at a depth of ±7-feet, (2) at a depth of ±12-feet (coincident with the highest historical water level elevation), and (3) at a depth coincident with the water table (anticipated to be ±15-feet).

For the downgradient locations and the location near boring SB-2, soil samples will be collected at depths of ±12- and ±15-feet. If field observations indicate the presence of soil contamination, then additional samples may be collected from the contaminated horizon. If encountered, free product thickness will be measured.

One soil sample will be collected from a presumed uncontaminated location. In addition, to being analyzed for TPH-gasoline, MTBE, and BTEX, this sample will also be analyzed for (1) bulk density, moisture content, and porosity (ASTM Method 2937), and (2) fraction of organic carbon (ASTM Method D-2974).

Soil sampling and testing requirements are described in Table 7.

Grab Groundwater Sampling and Analysis

Grab groundwater samples will be collected from each boring, except for the upgradient boring near well MW-3. Groundwater sampling will be performed in accordance with our Standard Operating Procedure 23: Grab Groundwater Sampling Using Direct Push Techniques (Appendix A). Due to reportedly slow groundwater recharge into the existing monitoring wells, temporary, narrow-diameter wells may have to be left in place overnight to allow time for groundwater to enter each boring. At boring B-7, a temporary well, screened across the water table, will be left in the ground overnight to check for the presence of free product.

Groundwater samples will be analyzed for TPH-gasoline, MTBE, and BTEX using either a mobile laboratory or 24-hour turnaround time at a stationary laboratory.

Groundwater sampling and testing requirements are summarized in Table 8.

Investigation-Derived Waste

Soil and groundwater investigation activities will generate decontamination wastewater. Decontamination wastewater will be containerized in individual, labeled, steel 55-gallon DOT 17H drums pending receipt of analytical results. These drums will be staged at 4401 Market Street. A sample of the decontamination wastewater will be collected and analyzed for TPH-gasoline, MTBE, and BTEX.

Water represented by analytical results where chemicals were not detected may be treated as inert. Inert water may be discharged to a sanitary sewer subject to local regulations.

Non-inert water requires specific interpretation with respect to current regulations. Accordingly, non-inert water will be examined on a case by case basis to determine testing, treatment, and disposal requirements.

Risk-Based Corrective Action (RBCA) Tier 1 Evaluation

After obtaining the soil and groundwater analytical data, we will perform a ASTM Risk-Based Corrective Action (RBCA) Tier 1 Evaluation. Site-specific parameters for depth to groundwater and soil properties will be used. In addition, a well survey of nearby drinking water and monitoring wells will be completed.

Reporting

The results of the soil and groundwater sampling and the RBCA Tier 1 Evaluation will be summarized in a report. The report will document details of the soil and grab groundwater sampling, analytical results, disposition of investigation-derived waste, and interpretation of results.

QUALITY ASSURANCE/QUALITY CONTROL

Specific quality control procedures for sample collection and field testing are discussed in the standard operating procedures (Appendix A).

Quality Control Samples

The laboratory will include laboratory blank, laboratory replicate, and laboratory spike quality control samples during soil and groundwater analysis. Field quality control samples will not be collected or analyzed.

Field Meter Quality Control Procedures

Meters for measurement of field parameters (pH, specific conductance, temperature, and dissolved oxygen) will be calibrated daily. Calibration standards should generally approximate or span the anticipated range of measurements. Recalibration may be appropriate if unusual measurements are noticed.

The field organic vapor monitor (used for site safety and to screen soil samples) will be calibrated using a standard gas prior to the beginning of each field day. Recalibration may be appropriate if unusual measurements are noticed.

HEALTH AND SAFETY

The Site Safety Plan in Appendix B presents the procedures to be followed to protect the safety of workers during planned field work at the subject property. Physical and chemical hazards, such as working around equipment and exposure to chemicals, are addressed. Work is planned in a previously investigated area, with existing data suggesting minimal chemical hazards. Although the proposed investigation does not necessarily require adherence to safety protocols for hazardous waste sites, the procedures in the Site Safety Plan are intended to comply with the pertinent sections of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

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Table 1

Environmental Chronology
4401 Market Street, Oakland CA

Date	Activities Performed By	Description
Unknown	Unknown	• Four underground gasoline tanks (one 1,000-gallon and three 500-gallon tanks) were installed. • W.A. Craig (1997b) reported that the structure at the property was constructed in 1943 and used as a gasoline station until the 1970's.
22 June 1990	Environmental Bio-Systems, Inc.	• The 4 underground gasoline tanks, dispenser island, and associated piping were removed. • Soil samples were collected below the tanks and from the excavated soil. Soil samples were analyzed for TPH-gasoline and BTEX. Soil excavated during the tank removal was placed back into the excavation.
6 September 1990	W.A. Craig, Inc.	• Two trenches were excavated to a depth of approximately 5 feet in the vicinity of the former dispenser island. • Contaminated soil was observed but no laboratory analyses were performed. Soil excavated during trenching was placed back into the trenches.
October 1994	W.A. Craig, Inc.	• Seven borings were drilled, 3 of which were completed as monitoring wells (MW-1, MW-2, and MW-3). • Free product, presumably gasoline, was observed in one of the borings (SB-2) at the southwest corner of the property. • Soil samples were analyzed for TPH-gasoline and BTEX.
8 November 1994	W.A. Craig, Inc.	• Groundwater samples were collected from the 3 monitoring wells and analyzed for TPH-gasoline and BTEX.
Between 14 February 1995 and 12 June 1997	W.A. Craig, Inc.	• Eight rounds of groundwater monitoring were performed. • The depth to groundwater was measured in the 3 monitoring wells during each round of monitoring. • Groundwater samples were collected from the 3 monitoring wells and analyzed for TPH-gasoline and BTEX during each round of monitoring.

General Notes

(a) TPH = total petroleum hydrocarbons.

(b) BTEX = benzene, toluene, ethylbenzene, and xylenes.

(c) MTBE = methyl *tert*-butyl ether.

Table 2

Analytical Results of Soil Sampling during Tank Removal
4401 Market Street, Oakland CA

Location	Sample Date	Sample Type	Sample Identi-fication	Depth (feet)	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Xylenes (mg/kg)
±2-feet below invert at center of Tank A	22 June 1990	Grab (liner)	#S6	±8.5	730	5	24	26	140
±2-feet below invert at center of Tank B	22 June 1990	Grab (liner)	#S2	±8.5	360	0.99	12	9.5	53
±2-feet below invert at center of Tank C	22 June 1990	Grab (liner)	#S3	±7.5	160	1.2	2.5	2.8	13
±2-feet below invert at non-fill end of Tank D	22 June 1990	Grab (liner)	#S4	±8	210	3.3	9.4	7.6	32
±2-feet below invert at fill end of Tank D	22 June 1990	Grab (liner)	#S5	±8	870	3.2	24	20	110
±8.5-feet below inverts and midway between Tanks A & B at fill end	22 June 1990	Grab (liner)	#S8	±15	260	3.7	14	7.1	33
Stockpile of soil excavated during removal of Tanks A & B	22 June 1990	Comp-osite (liners)	#S1A-D	Not reported	38	0.22	0.37	0.38	1.1
Stockpile of soil excavated during removal of Tanks C & D	22 June 1990	Comp-osite (liners)	#S7A-D	Not reported	130	0.9	1.3	1.8	13

General Notes

(a) Analytical data from Environmental Bio-Systems, Inc. (1990).

(b) TPH = total petroleum hydrocarbons.

(c) Samples were collected by Environmental Bio-Systems, Inc. (Hayward CA). Samples were analyzed by Anametrix, Inc. (San Jose CA).

(d) Tanks A, B, and C were 500-gallon, underground, gasoline tanks. Tank D was a 1,000-gallon, underground, gasoline tank. The former locations of the tanks are shown on Figure 2.

Table 3

Analytical Results of Soil Sampling during Drilling
4401 Market Street, Oakland CA

Boring or Well Number	Sample Date	Sample Identification	Depth (feet)	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Xylenes (mg/kg)
SB-1	27 October 1994	3365 SB1-10	10 to 10.5	<1	<0.005	<0.005	<0.005	<0.005
	27 October 1994	3365 SB1-15	15 to 15.5	72	<0.01	0.13	0.21	0.18
	27 October 1994	3365 SB1-20	20 to 20.5	<1	<0.005	<0.005	<0.005	<0.005
SB-2	27 October 1994	3365 SB2-10.5	10 to 10.5	40	0.079	0.034	0.43	4.7
	27 October 1994	3365 SB2-15	15 to 15.5	19	0.46	0.041	0.31	4.2
	27 October 1994	3365 SB2-20.5	20 to 20.5	5.7	0.006	<0.005	0.010	0.079
SB-3	27 October 1994	3365 SB3-10	10 to 10.5	<1	<0.005	<0.005	<0.005	<0.005
	27 October 1994	3365 SB3-15	15 to 15.5	<1	<0.005	<0.005	<0.005	<0.005
	27 October 1994	3365 SB3-19.5	19.5 to 20	<1	<0.005	<0.005	<0.005	<0.005
SB-4	28 October 1994	3365 SB4-10	10 to 10.5	<1	<0.005	0.005	0.006	0.016
	28 October 1994	3365 SB4-15	15 to 15.5	220	<0.01	0.60	0.46	0.93
	28 October 1994	3365 SB4-19.5	19.5 to 20	<1	<0.005	<0.005	<0.005	<0.005
MW-1	27 October 1994	3365 MW1-10	10 to 10.5	<1	<0.005	<0.005	<0.005	<0.005
	27 October 1994	3365 MW1-15	15 to 15.5	<1	<0.005	<0.005	0.005	<0.005
	27 October 1994	3365 MW1-20	20 to 20.5	<1	<0.005	<0.005	<0.005	<0.005
MW-2	28 October 1994	3365 MW2-10	10 to 10.5	<1	<0.005	<0.005	<0.005	<0.005
	28 October 1994	3365 MW2-15	15 to 15.5	97	1.5	1.4	2.3	12
	28 October 1994	3365 MW2-20	20 to 20.5	2.0	<0.005	0.009	0.016	0.062
MW-3	28 October 1994	3365 MW3-10	10 to 10.5	1.1	<0.005	0.006	<0.005	0.010
	28 October 1994	3365 MW3-15	15 to 15.5	<1	<0.005	<0.005	<0.005	<0.005
	28 October 1994	3365 MW3-20	20 to 20.5	<1	<0.005	<0.005	<0.005	<0.005

General Notes

(a) Analytical data from W.A. Craig (1995).

(b) < denotes less than laboratory reporting limit (shaded cells).

(c) TPH = total petroleum hydrocarbons.

(d) Samples were collected by W.A. Craig, Inc. (Napa CA). Samples were analyzed by McCampbell Analytical, Inc. (Pacheco CA).

Table 4

Monitoring Well Completion Data
4401 Market Street, Oakland CA

Well No.	Date of Installation	Installed By	Installation Method	Measuring Point Description	Measuring Point Elevation	Approximate Ground Surface Elevation	Approximate Seal Depth (feet)	Total Boring Depth (feet)	Total Casing Length (feet)	Casing Diameter (inches)	Boring Diameter (inches)	Screened Casing Interval (feet)		Blank Casing Interval (feet)		Screen Specifications
												Depth	Elevation	Depth	Elevation	
MW-1	27 Oct 94	W.A. Craig	Hollow-Stem Auger	North Side, Top of PVC Casing	71.12	72.1	19	25.5	25.5	2	8	±20 to ±25.5	46.5 to 52	0 to ±20	52 to 72	PVC, perforation size unknown
MW-2	28 Oct 94	W.A. Craig	Hollow-Stem Auger	North Side, Top of PVC Casing	70.62	71.9	19	27.5	25	2	8	±20 to ±25	47 to 52	0 to ±20	52 to 72	PVC, perforation size unknown
MW-3	28 Oct 94	W.A. Craig	Hollow-Stem Auger	North Side, Top of PVC Casing	71.79	72.9	19	27.5	25	2	8	±20 to ±25	48 to 53	0 to ±20	53 to 73	PVC, perforation size unknown

General Notes

(a) Elevations referenced to mean sea level, U.S.G.S. datum.

(b) Depths measured relative to ground surface.

(c) W.A. Craig = W.A. Craig, Inc., Napa CA.

Table 5

Analytical Results of Well Sampling
4401 Market Street, Oakland CA

Well Number	Sample Date	Sampled By	TPH-Gasoline (µg/L)	MTBE (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)
MW-1	8 November 1994	W.A. Craig	54	-	<0.5	<0.5	<0.5	1.2
	14 February 1995	W.A. Craig	71	-	<0.5	<0.5	<0.5	0.97
	7 June 1995	W.A. Craig	540	-	0.6	<0.5	1.7	1.3
	29 August 1995	W.A. Craig	440	-	<0.5	<0.5	1.3	1.1
	8 December 1995	W.A. Craig	<50	-	<0.5	<0.5	<0.5	<0.5
	7 March 1996	W.A. Craig	77	44	<0.5	<0.5	<0.5	<0.5
	19 June 1996	W.A. Craig	500	84	<0.5	<0.5	0.85	0.36
	20 December 1996	W.A. Craig	<50	28	<0.5	<0.5	<0.5	<0.5
	12 June 1997	W.A. Craig	190	12	<0.5	<0.5	<0.5	<0.5
MW-2	8 November 1994	W.A. Craig	20,000	-	1,400	960	980	4,600
	14 February 1995	W.A. Craig	8,600	-	380	210	410	2,000
	7 June 1995	W.A. Craig	6,200	-	500	78	270	1,200
	29 August 1995	W.A. Craig	4,100	-	330	61	210	980
	8 December 1995	W.A. Craig	9,400	-	360	190	440	2,000
	7 March 1996	W.A. Craig	12,000	18	790	170	440	2,000
	19 June 1996	W.A. Craig	9,000	ND	520	82	350	1,500
	20 December 1996	W.A. Craig	13,000	<16	830	180	410	2,200
	12 June 1997	W.A. Craig	5,100	<36	320	32	190	880
MW-3	8 November 1994	W.A. Craig	<50	-	0.71	0.84	1.2	5.8
	14 February 1995	W.A. Craig	<50	-	<0.5	<0.5	<0.5	<0.5
	7 June 1995	W.A. Craig	<50	-	<0.5	<0.5	<0.5	1.6
	29 August 1995	W.A. Craig	<50	-	<0.5	<0.5	<0.5	<0.5
	8 December 1995	W.A. Craig	<50	-	<0.5	<0.5	<0.5	<0.5
	7 March 1996	W.A. Craig	<50	<5	<0.5	<0.5	<0.5	<0.5
	19 June 1996	W.A. Craig	<50	<5	<0.5	<0.5	<0.5	<0.5
	20 December 1996	W.A. Craig	<50	<5	<0.5	<0.5	<0.5	<0.5
	12 June 1997	W.A. Craig	<50	<5	<0.5	<0.5	<0.5	<0.5

General Notes

(a) Analytical data from W.A. Craig (1997d).

(b) < denotes less than laboratory reporting limit (shaded cells).

(c) ND = not detected (shaded cells).

(d) TPH = total petroleum hydrocarbons.

(e) MTBE = methyl *tert*-butyl ether.

(f) W.A. Craig = W.A. Craig, Inc. (Napa CA).

Table 6

Rationale for Proposed Sampling Locations
4401 Market Street
Oakland CA

Hole Number	Location	Depths of Soil Samples	Grab Groundwater Sample Collected?	Rationale
B-5, B-6	On property near former dispenser island	±7-feet ±12-feet ±15-feet	Yes	• Evaluate vertical extent of contamination in vicinity of former dispenser island. • Confirm level of contamination observed when trenches were excavated in 1990.
B-7	On property near former boring SB-2	±12-feet ±15-feet	Yes	• Evaluate level of contamination. • Confirm presence of free product reportedly observed in 1994. If present, measure thickness of free product.
B-8, B-9, B-10, B-11, B-12	44th Street and/or Market Street	±12-feet ±15-feet	Yes	• Evaluate downgradient extent of contamination.
others (if needed)	44th Street and/or Market Street depending on initial analytical results	±12-feet ±15-feet	Yes	• Evaluate downgradient extent of contamination.

General Note

(a) The sample depth of ±12-feet was selected because it is coincident with the highest historical water level elevation measured at the property. The sample depth of ±15-feet is the expected depth to groundwater.

(b) A soil sample will also be collected from 1 of the downgradient borings and analyzed for various parameters to determine "background" conditions.

Table 7

Soil Sampling and Testing Requirements
4401 Market Street
Oakland CA

Item	Requirement
Number of Borings	At least eight.
Depth	Advance all borings to ±5-feet below the groundwater table, which is anticipated at a depth of ±15-feet.
Sampling Interval and Sample Type	Collect discrete (grab) samples at selected intervals based on the type of direct-push technology used; typically at 3-foot centers or detectable changes in strata, whichever is more frequent. Collect additional samples if elevated organic vapor readings and/or contamination are observed.
Sampler	Direct push sampler with liners.
Liners	Brass or stainless steel. Size dependent on the type of direct-push technology used.
Rods, Sampler, and Liner Decontamination	Steam clean rods between borings. Wash drive sampler between samples. Wash with soap, rinse with tap water, rinse with distilled water.
Field Observations and Measurements	Screen samples with field organic vapor monitor. Note staining or odor. Visually classify samples according to ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
Samples Retained for Physical Testing	One soil sample will be collected from a downgradient boring. This sample will be analyzed for bulk density, moisture content, porosity, and fraction of organic carbon to determine "background" conditions.
Samples Retained for Chemical Testing	For borings B-5 and B-6, retain samples from depths of ±7-, ±12-, and ±15-feet. For all other borings, retain samples from depths of ±12-, and ±15-feet. Analyze soil samples for TPH-gasoline, MTBE, and BTEX. If field observations indicate the presence of soil contamination, additional soil samples may be analyzed.
Sample Handling for Chemical Testing	Cap liner with Teflon sheet, plastic cap, and duct tape (do not use electrical tape). Label liner, place in ziplock bag, and store on ice in cooler until delivery to the laboratory. Log chemical samples on chain-of-custody form and maintain sample security.
Quality Control Samples for Chemical Testing	None.
Grout	Grout boreholes with 1 sack (94-pounds) cement for 5-gallons water.

General Notes

(a) TPH = total petroleum hydrocarbons.

(b) MTBE = methyl *tert*-butyl ether.

(c) BTEX = benzene, toluene, ethylbenzene, and xylenes.

Table 8

Groundwater Sampling and Testing Requirements
4401 Market Street
Oakland CA

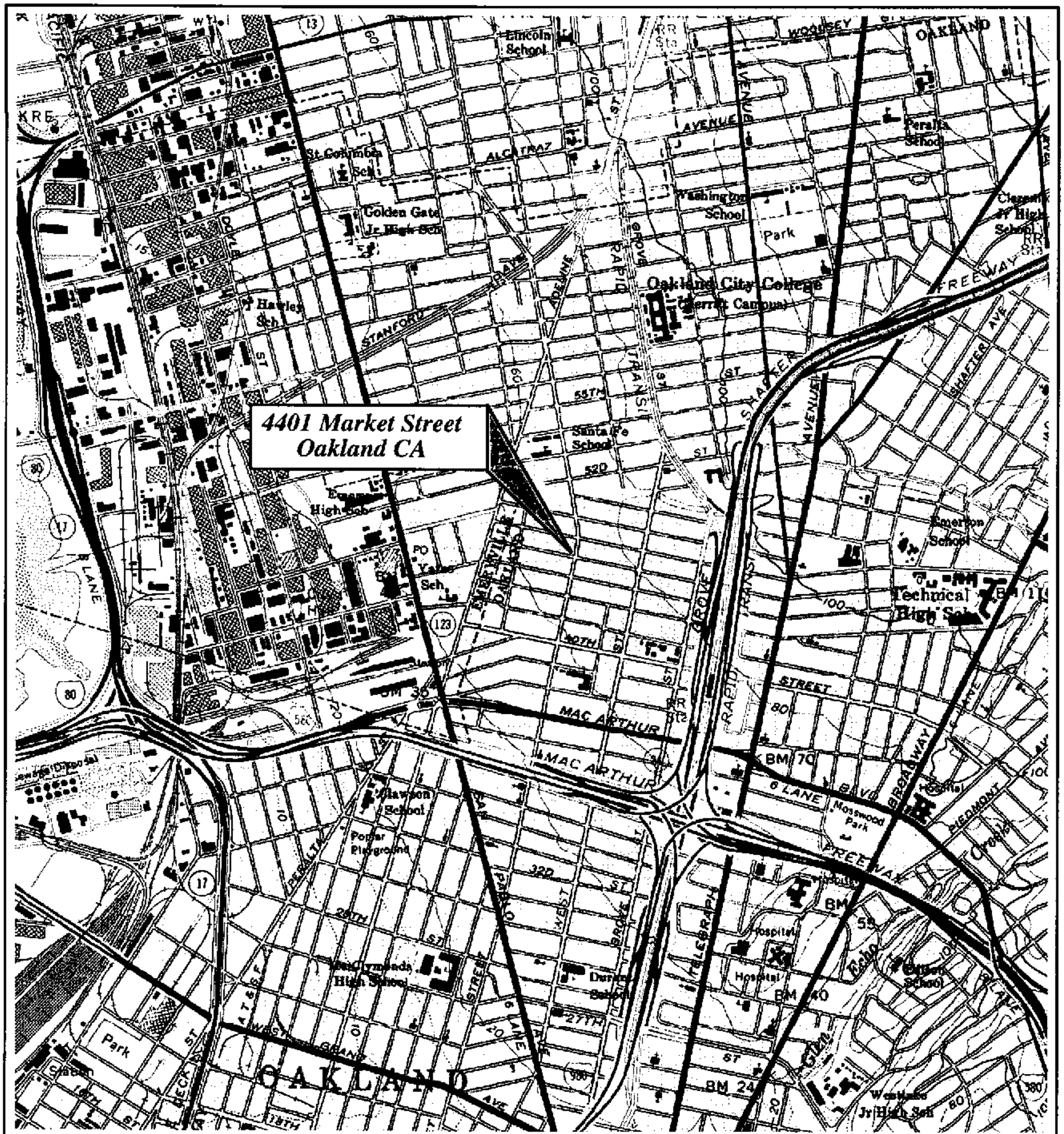
Item	Requirement
Sampling Frequency	Every boring.
Sampler	Type of direct-push technology to be determined.
Sampler Decontamination	Wash with Alconox or Liquinox soap, rinse with tap water, rinse with distilled water.
Sample Collection	Push sampler to drill rod and lower to the desired sampling depth (typically several feet below water table). Depending on the type of sampler, either (1) open the sampling tool, allow the tool's sample container to fill, and bring the groundwater sample to the ground surface inside the tool, or (2) open the sampling tool to expose a temporary well screen, allow the temporary well to fill with water, and use a small-diameter bailer to collect the groundwater sample. If groundwater does not enter the sampling tool within 30 minutes, install temporary, narrow-diameter well and leave in the ground overnight. At boring B-7, a temporary well, screened across the water table, will be left in the ground overnight to check for the presence of free product.
Observations During Sampling	Observe color and odor of the groundwater sample.
Laboratory Analytical Parameters	Analyze samples for TPH-gasoline, MBTE and BTEX.
Sample Containers	Three 40-milliliter glass vials with hydrochloric acid as a preservative.
Sample Handling and Preservation	Verify no headspace. Label containers, place in ziplock bags, store on ice in cooler, enter onto chain-of-custody, maintain sample custody until sent to laboratory.
Field Quality Control Samples	None.

General Notes

(a) TPH-gasoline = total petroleum hydrocarbons as gasoline.

(b) MTBE = methyl *tert*-butyl ether.

(c) BTEX = benzene, toluene, ethylbenzene, and xylenes.



0 0.5 1.0

Approximate Scale in Miles

0 5,000

Approximate Scale in Feet

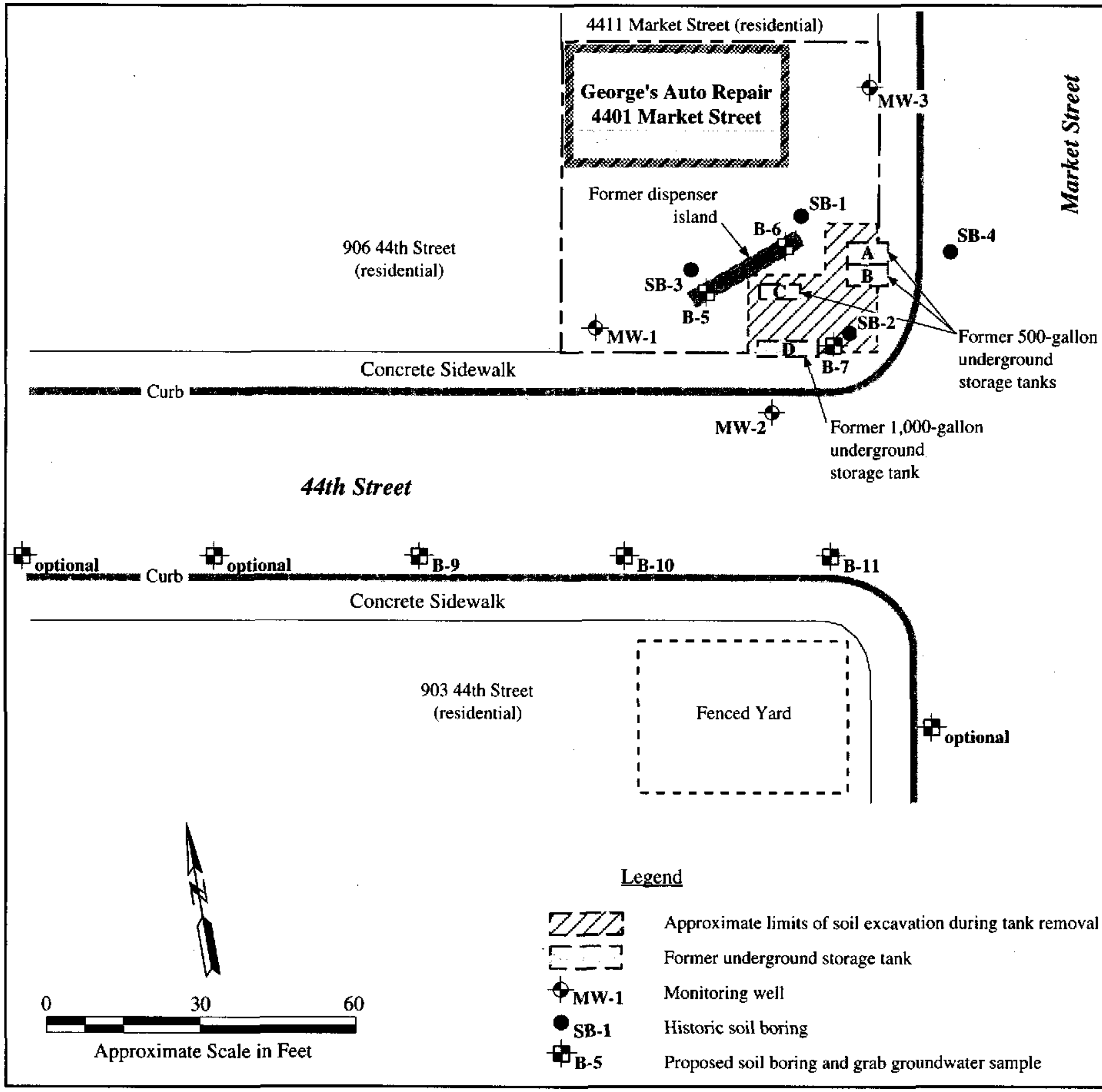
N

Basemap: U.S. Geological Survey, 7.5 Minute Topographic Quadrangle, Oakland West CA, 1959 (Photorevised 1980).

Figure 1

Location Map

4401 Market Street
Oakland CA



Note: Basemap from W.A. Craig (1997b). Locations of former underground tanks and limits of excavation from W.A. Craig (1994).

Figure 2

Site Map with Proposed Sampling Locations

4401 Market Street Oakland CA

STREAMBORN

APPENDIX A

Standard Operating Procedures

STANDARD OPERATING PROCEDURE (SOP) 23
GRAB GROUNDWATER SAMPLING USING DIRECT PUSH TECHNIQUES

1.0 INTRODUCTION AND SUMMARY

This SOP describes methods for collecting grab groundwater samples in conjunction with field investigations using "Direct-Push" (DP) techniques.

DP techniques, such as Geoprobe® and cone penetrometer testing (CPT), utilize small-diameter probes which are pushed or driven into the ground to the desired sampling depth. Groundwater sampling tools, such as the HydroPunch®, BAT® sampler, or Push-In PVC Piezometer (PIPP®), with outside diameters of 1.5- to 2-inches, are attached to the ends of the probes and are used to collect grab groundwater samples by either of the following methods:

- Method 1: Opening the sampling tool, allowing the tool's sample container to fill, and bringing the groundwater sample to the ground surface inside the tool.
- Method 2: Opening the sampling tool to expose a temporary well screen, allowing the temporary well to fill with water, and using a small-diameter bailer to collect the groundwater sample.

This SOP describes grab groundwater sampling using Method 2.

The procedures for grab groundwater sampling generally consist of initial decontamination of equipment, insertion of the DP probe to the desired depth, opening the groundwater sampling tool, allowing the temporary well to fill with water, collecting the sample without purging using a bailer, transferring the groundwater sample into appropriate containers, and recovering the sampling tool. Following sampling, the remaining borehole will typically be grouted. Grouting procedures are not covered in this SOP.

2.0 EQUIPMENT AND MATERIALS

- Equipment to make a borehole and/or push the sampling tool to the desired depth. Methods include DP rig or CPT rig.
- Groundwater Sampling Tool. The tool type, material of construction, outside diameter, and length of well screen be noted.
- Laboratory-cleaned sample containers of proper type and size for the analytical parameters (refer to Table 1).
- Reagent-grade chemicals for sample preservation, as required for the analytical parameters (refer to Table 1).
- Sample labels and chain-of-custody forms.
- Ziploc plastic bags of size to accommodate sample containers.
- Cooler with ice (do not use blue ice).
- Field organic vapor monitor. The make, model, and calibration information of the field organic vapor monitor (including compound and concentration of calibration gas) should be noted.

- Equipment and materials necessary to decontaminate the DP equipment and groundwater sampling tool. Equipment may include, buckets, bristle brushes, and low-residue organic-free soap (such as Alconox or Liquinox)
- Equipment to capture decontamination wastewater such as 55-gallon steel drums.
- Distilled water.

As specified in the Site Safety Plan, additional decontamination equipment and materials may be needed.

3.0 TYPICAL PROCEDURES

The following typical procedures are intended to cover the majority of grab groundwater sampling conditions wherein the sampling tool is inserted and opened at the desired depth. Deviations from the following procedures may be expected and should be noted.

1. Decontaminate the downhole equipment (push rods, probe tips, and groundwater sampling tool). Assemble the temporary well screen inside the groundwater sampling tool.
2. Push the groundwater sampling tool to the bottom of the desired sampling interval. Record the depth.
3. When the final depth has been reached, raise the push rods. This will open the groundwater sampling tool, expose the temporary well screen, and allow groundwater to enter. In low-permeability sediments, the groundwater sampling tool should be opened as much as possible, typically 4- or 5-feet depending on the type of sampler and the length of the temporary well screen. Record the interval that the sampler is open.
4. Use a small-diameter (typically 3/4-inch) Teflon bailer to collect the groundwater sample. Collect the first-gatherer water, without purging. Transfer the sample into appropriate sample containers. Label containers and place in ziploc bags on ice inside cooler. Enter samples on chain-of-custody form.
5. After collecting the sample, remove the push rods and temporary well screen. The probe tip (±2-inch diameter, made of stainless steel) will remain in-place.
6. If desired, additional groundwater samples may be collected from permeable zone(s) below the initial sample. Repeat steps 2 through 6.
7. Decontaminate the downhole equipment between boreholes. Decontaminate all equipment prior to leaving the site.
8. Containerize decontamination wastewaters in steel drums. Affix labels to the drums identifying date, description of contents, generator name, and generator address.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Optional quality control samples may be collected, including: field blanks to check for field-induced cross-contamination, travel/trip blanks to check for non-field induced cross-contamination, and replicates.

5.0 DOCUMENTATION

Observations, measurements, and other documentation of grab groundwater sampling should be recorded on the following:

- Field Notebook or Drilling Log
- Chain-of-Custody

Documentation should include any deviations from this SOP, as well as documentation of the containerization and disposition of investigation-derived waste.

6.0 DECONTAMINATION

Prior to entering the site, the DP rig and appurtenant items (push rod, probe tips, sampling tools, temporary well screen, etc.) should be decontaminated by steam cleaning or pressure washing. Between each borehole, appurtenant items that contacted downhole soil/water should be decontaminated by steam cleaning or pressure washing. Prior to leaving the site, the DP rig and appurtenant items should be decontaminated by steam cleaning and pressure washing. Decontamination water should be captured and containerized.

Prior to each sample, the groundwater sampling tool and other equipment or materials that may directly contact the sample should be decontaminated. Decontamination for these items should consist of a soap wash (Alconox, Liquinox, or other organic free - low residue soap), followed by a tap water rinse, followed by a distilled water rinse. Wastewater from the soap wash should be captured and containerized. Wastewater from the tap water and distilled water rinses may be discharged to the ground surface or a sanitary sewer.

7.0 INVESTIGATION-DERIVED WASTE

Wastes resulting from the activities of this SOP may include decontamination wastewater, excess sample water, and miscellaneous waste (paper, plastic, gloves, jars, etc.) Unless otherwise prohibited by the Site Safety Plan, miscellaneous waste should be disposed of as municipal waste.

Decontamination wastewater for each borehole should be placed in individual steel drums with waste labels affixed. Wastewaters from multiple boreholes may be combined.

8.0 SAFETY

Normal and special safety precautions are described in the Site Safety plan. Physical hazards typically prevail because the DP rig contains exposed hydraulic equipment and because push rods consist of heavy material with sharp edges.

Chemical hazards are typically discovered upon raising the push rods and exposing the sampling tool. Opportune monitoring for volatile chemicals may be conducted at these times. Splash protection and direct contact protection are also essential measures to minimize the potential for chemical exposure.

Table 1

Sampling and Preservation for Groundwater Samples

Parameter	Analytical Method	Container	Preservation	Maximum Holding Time
Purgeable Halocarbons by GC	EPA 8010	Three 40-ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	14 days after collection
Purgeable Aromatics by GC	EPA 8020	Three 40-ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	14 days after collection
Organochlorine Pesticides and PCB's	EPA 8080	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Organophosphorus Pesticides	EPA 8140	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Chlorinated Herbicides (Phenoxy Herbicides)	EPA 8150	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Volatile Organic Compounds by GC/MS	EPA 8240	Three 40-ml glass vials	Cool to 4 degrees Celsius	14 days after collection
Semi-Volatile Organic Compounds by GC/MS (Base/Neutral/Acid Extractable Organics)	EPA 8270	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP)	EPA 504	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Total Petroleum Hydrocarbons Gasoline/BTEX/MTBE	Extract by EPA 5030, analyze by EPA 8015	Three 40-ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	Extract 7 days after collection Analyze 7 days after extraction
Total Petroleum Hydrocarbons Diesel, Kerosene, or Motor Oil	Extract by EPA 3510, analyze by EPA 8015	One 1-liter amber glass	HCl to pH<2, cool to 4 degrees Celsius	Extract 7 days after collection Analyze 7 days after extraction
Oil & Grease	SM 503	One 1-liter glass with aluminum foil-lined cap	H_2SO_4 to pH<2, cool to 4 degrees Celsius	28 days after collection
Total Metals	EPA 7000 Series	One 1/2 liter poly	HNO_3 to pH<2, cool to 4 degrees Celsius	6 months after collection (28 days for mercury)
Dissolved Metals	EPA 7000 Series	One 1/2 liter poly	HNO_3 to pH<2, cool to 4 degrees Celsius	6 months after collection (28 days for mercury)
General Minerals	Various	Two 1-liter poly	Cool to 4 degrees Celsius	7 days after collection

STANDARD OPERATING PROCEDURE (SOP) 29
SOIL SAMPLING USING DIRECT-PUSH TECHNIQUES

1.0 INTRODUCTION AND SUMMARY

This SOP describes methods for collecting soil samples in conjunction with field investigations using "Direct-Push" (DP) techniques. DP techniques, such as Enviro-Core® and cone penetrometer testing (CPT), utilize small-diameter probes which are pushed, driven, or vibrated into the ground to the desired sampling depth. As the DP probes are being advanced, soil samples may be collected using stainless steel liners or clear plastic tubes. Soil samples may be collected continuously or at designated intervals. The soil sampling techniques described in this SOP are generally suitable for chemical characterization and physical classification tests. However, because of the narrow diameter of the DP probe, the resulting soil samples should generally be considered "disturbed" with respect to physical structure and may not be suitable for measuring sensitive physical parameters, such as strength and compressibility.

The DP techniques described in this SOP generally produce a borehole with: (1) a diameter of approximately 1.5- to 2.5-inches corresponding to the outside diameter of the DP probe, and (2) limited capability for cross-contamination between subsurface strata as the DP probe passes from contaminated strata to uncontaminated underlying strata. However, should conditions require strict measures to help prevent cross-contamination or maintain the integrity of an aquitard, consideration should be given to augmenting the procedures of this SOP, for example, by using pre-drilled and grouted isolation casing.

The procedures for soil sampling using DP techniques generally consist of initial decontamination, advancement of the DP probe, recovering the core sampler, logging and packaging of the soil samples, decontamination of the core sampler (for chemical characterization samples), and continued sampling until the total depth of the borehole is reached. Withdrawal of the DP probe upon reaching the total depth requires completion of the borehole by grouting.

2.0 EQUIPMENT AND MATERIALS

- Equipment to make a borehole and/or push the DP probe to the desired depth. Methods include DP rig or CPT rig.
- Core sampler. The sampler type, material of construction, outside diameter, and length should be noted. Sampler lengths are typically 3- to 5-feet.
- Liners may or may not be required depending on the type of DP technique. The liner type, material of construction, outside diameter, and length should be noted.
- Plastic end caps of appropriate diameter for liner type.
- Teflon sheets, approximate 6-mil thickness, precut to a diameter or width of the liner diameter plus approximately 1 inch.
- 1/2-pint widemouth glass jars, laboratory cleaned.
- Kimwipes, certified clean silica sand, or deionized water (for blank sample preparation).
- Duct tape.

- Sample labels, boring log forms, chain-of-custody forms, hazardous waste labels, and daily report forms.
- Ziploc plastic bags of size to accommodate a liner.
- Stainless steel spatula and knife.
- Cooler with ice (do not use blue ice).
- Field organic vapor monitor. The make, model, and calibration information of the field organic vapor monitor (including compound and concentration of calibration gas) should be noted.
- Equipment and materials necessary to decontaminate the DP equipment and groundwater sampling tool. Equipment may include, buckets, bristle brushes, and low-residue organic-free soap (such as Alconox or Liquinox)
- Equipment to capture decontamination wastewater such as 55-gallon, steel drums.
- Distilled water.

As specified in the Site Safety Plan, additional safety and personnel decontamination equipment and materials may be needed.

3.0 TYPICAL PROCEDURES

The following typical procedures are intended to cover the majority of soil sampling conditions using DP techniques. However, normal field practice requires re-evaluation of these procedures and implementation of alternate procedures upon encountering unusual or unexpected subsurface conditions. Deviations from the following procedures may be expected and should be noted.

1. Decontaminate the downhole equipment (push rods, DP probe tips, and core sampler).
2. Investigate the location of the proposed boreholes for buried utilities and obstructions. At least 48 hours before drilling, contact known or suspected utility services individually or collectively through services such as "USA" and "Underground Alert". As appropriate, retain private buried utility location services or geophysical investigation services to search for buried utilities and obstructions. Also as appropriate, pothole suspect utility locations prior to drilling or relocate boreholes. During initial advancement of each borehole, use post-hole diggers to break the ground surface and cautiously explore the first 1- to 2-feet for buried utilities. Continue boring with DP probe and exercise caution by having the operator pay particular attention to the "feel" of the probe. The suspected presence of an obstruction, buried pipeline or cable, utility trench backfill, or similar may be cause for suspension of drilling, subject to further investigation.
3. Advance the DP probe to the desired sampling depth. Samples should be taken at intervals of 5-feet or less in homogeneous strata and at detectable changes of strata. For continuous sampling, the core sampler will be advanced 3- to 5-feet depending on the DP technique. Note depth interval, subsurface conditions, and operator's comments on the boring log.

4. Retrieve the core sampler. Remove the liner from the core sampler for purposes of chemical characterization and/or physical parameter testing. Observe soil at each end of liner(s) for purposes of completing sample description. Place Teflon sheet at each end of liner, cover with plastic caps, and tape plastic caps with duct tape (do not use electrical tape) to further minimize potential loss of moisture or volatile compounds. Label liner(s) and place in ziploc bag on ice inside cooler. Enter samples on chain-of-custody form.

5. If headspace screening to be performed, place subsample of soil in a ziploc plastic bag. After allowing the soil in the bag to equilibrate for 5 minutes, screen for organic vapors with the field organic vapor monitor by inserting the probe into the bag. Record depth interval, observed sample reading, and ambient (background) reading on the boring log.

6. Visually classify soil sample in approximate accordance with ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Descriptions should include moisture content, color, textural information, group symbol, group name, and odor. Optional descriptions, especially if classification is performed with protective gloves, include particle angularity and shape, clast composition, plasticity, dilatancy, dry strength, toughness, and reaction with HCl. Add notes pertaining to geologic structure of sample, as appropriate. Record depth interval, visual classification, and other notes to the boring log.

7. Repeat steps 3 through 6 until total depth of borehole is reached.

8. Complete the boring by backfilling with grout. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, grout may consist of:

   - neat cement grout, using 1 sack (94 pounds dry weight) of Type I/II Portland cement to 5 gallons of water, or

   - cement-bentonite grout using the same basic formula but substituting approximately 5% powdered bentonite for part of the cement.

   Local requirements may require inspection of grout seal placement by the regulating authority.

9. Decontaminate the downhole equipment between boreholes. Decontaminate all equipment prior to leaving the site.

10. Containerize decontamination wastewater in steel drums. Affix labels to the drums identifying date, description of contents, generator name, and generator address.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Optional quality control samples may be collected, including: field blanks to check for field-induced cross-contamination, travel/trip blanks to check for non-field induced cross-contamination, and replicates.

The comparability of the field visual classification may be checked by conducting laboratory classification tests.

5.0 DOCUMENTATION

Observations, measurements, and other documentation of grab groundwater sampling should be recorded on the following:

- Field Notebook or Drilling Log
- Chain-of-Custody

Documentation should include any deviations from this SOP, as well as documentation of the containerization and disposition of investigation-derived waste.

6.0 DECONTAMINATION

Prior to entering the site, the DP rig and appurtenant items (push rod, probe tips, sampling tools, etc.) should be decontaminated by steam cleaning or pressure washing. Between each borehole, appurtenant items that contacted downhole soil/water should be decontaminated by steam cleaning or pressure washing. Prior to leaving the site, the DP rig and appurtenant items should be decontaminated by steam cleaning and pressure washing. Decontamination water should be captured and containerized.

Prior to each sample, the core sampler and other equipment or materials that may directly contact the sample should be decontaminated. Decontamination for these items should consist of a soap wash (Alconox, Liquinox, or other organic free - low residue soap), followed by a tap water rinse, followed by a distilled water rinse. Wastewater from the soap wash should be captured and containerized. Wastewater from the tap water and distilled water rinses may be discharged to the ground surface or a sanitary sewer.

7.0 INVESTIGATION-DERIVED WASTE

Wastes resulting from the activities of this SOP may include excess soil sample, decontamination wastewater, and miscellaneous waste (paper, plastic, gloves, jars, aluminum foil, site safety disposable, etc.) Unless otherwise prohibited by the Site Safety Plan, miscellaneous waste should be disposed of as municipal waste.

Excess soil sample should be placed in individual steel drums or 5-gallon plastic buckets with waste labels affixed. Decontamination wastewater for each borehole should be placed in individual steel drums with waste labels affixed. Wastewaters from multiple boreholes may be combined.

8.0 SAFETY

Normal and special safety precautions are described in the Site Safety plan. Physical hazards typically prevail because the DP rig contains exposed hydraulic equipment and because push rods consist of heavy material with sharp edges.

Chemical hazards are typically discovered upon raising the push rods and exposing the sampling tool. Opportune monitoring for volatile chemicals may be conducted at these times. Splash protection and direct contact protection are also essential measures to minimize the potential for chemical exposure.

9.0 REFERENCES

American Society for Testing and Materials, 1989. 1989 Annual Book of ASTM Standards, Section 4 - Construction, Volume 4.08 - Soil and Rock, Building Stones; Geotextiles. ASTM, Philadelphia, PA. 1989.

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U.S. Environmental Protection Agency, 1989b. Soil Sampling Quality Assurance User's Guide - Second Edition. National Technical Information Service, PB 89-189 864/AS, Springfield, VA. 1989.

APPENDIX B

Site Safety Plan

Site Safety Plan
Soil and Groundwater Investigation
4401 Market Street
Oakland CA

Anticipated Field Work The anticipated field work includes soil and grab groundwater sampling.

Chemical Hazard Evaluation Gasoline constituents, which have been detected in soil and groundwater during previous investigations at the property, are summarized in Table 1.

Physical Hazard Evaluation Physical hazards which may be encountered include: heavy machinery, heavy lifting, slip-trip-fall, loud noise, and heat exposure.

Health and Safety Responsibilities This site safety plan will be implemented by the site safety officer under the supervision of the project manager and in coordination with an appropriate client representative. Safety personnel and their responsibilities are presented in Table 2.

Work Zone A work zone will be established around the area of work. The work zone is an area of sufficient size to allow safe completion of the work while maintaining control of access to the work area. The work zone will be restricted by requesting people not directly involved in the work to stay out of the immediate work area, and/or by restricting access by other suitable means, such as with a work fence, traffic cones, or barricades.

No smoking, chewing of tobacco or gum, eating, or drinking will be allowed in the work zone.

Personal Protective Equipment Field work will begin in modified Level-D personal protection (Table 3). If air monitoring results of the work zone exceed the action levels specified below, then personal protective equipment will be upgraded to modified Level-C (Table 3).

Monitoring Visual monitoring should be routinely conducted by the workers. Workers should evaluate themselves and co-workers for signs of fatigue as the work progresses. Work breaks should be taken as reasonably required to maintain safety and efficiency.

The breathing zone in the work area will be monitored using a field organic vapor monitor (Thermo Environmental Instruments Model 580B, 10.0 eV photoionization detector, calibrated to 100 ppm v/v isobutylene).

If continual readings greater than 5 ppm above background are detected in the breathing zone, personal protection should be upgraded to modified Level-C from modified Level-D. 5 ppm was selected using the exposure criteria in Table 1.

If continual readings greater than 50 ppm above background are recorded in the breathing zone, work should stop. Work should be resumed after consultation with the project manager and possibly the client, and may include additional safety precautions.

Emergency Procedures. These procedures are designed to allow rapid treatment of workers for injuries or exposure to hazardous substances occurring on the worksite. A secondary purpose of these procedures is to allow documentation of emergencies.

Emergency information is summarized in Table 4. The location of the nearest hospital is shown on Figure 1.

If required, first aid will be provided for injured workers.

The site safety officer will be notified immediately of an emergency. It is the site safety officer's responsibility to document the emergency and report it to the project manager and client in a timely manner.

Decontamination Decontamination refers to removal of potential chemical contamination from worker's clothing and from health and safety monitoring equipment. In many instances, removal and thorough cleaning of work clothing is adequate for worker decontamination. However, if skin contact with chemical-containing material occurs during field work, the affected area will be washed thoroughly with soap and water.

Monitoring equipment should be kept clean by wiping as required with a paper towel or other suitable material.

Health and Safety Wastes Wastes generated by health and safety practices include disposable protective equipment such as gloves, tyvek-coveralls, and boot covers, as well as used paper towels. These items may be disposed of with normal municipal refuse.

Liquid wastes from washing may be disposed of in the sanitary sewer.

Table 1

Chemical Hazard Evaluation
4401 Market Street
Oakland CA

Chemical	Maximum Measured in Soil (mg/kg)	Maximum Measured in Groundwater (µg/L)	Odor Threshold (ppm v/v)	Lower Explosive Limit (ppm v/v)	Permissible Exposure Limit (ppm v/v)	Time Weighted Average (ppm v/v)	Immediately Dangerous to Life and Health (ppm v/v)
Total Petroleum Hydrocarbons as Gasoline	870	20,000	NA	14,000	300	300	NA
MTBE	not measured	84	NA	NA	NA	NA	NA
Benzene	5	1,400	12	13,000	1	10	2,000
Toluene	24	960	2.9	13,000	100	100	2,000
Ethylbenzene	20	980	2.3	10,000	100	100	2,000
Xylenes	110	4,600	1.1	10,000	100	100	10,000

General Notes

(a) Exposure criteria from: (1) American Conference of Governmental Industrial Hygienists, *1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices,* (2) National Institute for Occupational Safety and Health, *Pocket Guide to Chemical Hazards*, 1985, (3) American Conference of Governmental Industrial Hygienists, *Guide to Occupational Exposure Values,* Undated (circa 1990), (4) Amoore, J. E. and Hautala, E., *Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution*, Journal of Applied Toxicology, Volume 3, Number 6, 1983, and (5) *Material Safety Data Sheet, Chevron Unleaded Gasoline*, Chevron Environmental Health Center, Richmond CA, 12 September 1991.

(b) NA = no applicable value listed in cited references.

(c) < denotes less than detection limit.

Table 2

Safety Personnel and Responsibilities
4401 Market Street
Oakland CA

Personnel	Responsibilities
Project Manager (Kenneth B. Alexander)	Development and overall implementation of Site Safety Plan, provide properly trained onsite personnel to complete the work, coordination of safety issues with client.
Site Safety Officer (Kenneth B. Alexander)	Onsite implementation of Site Safety Plan, coordination and documentation of field safety procedures, communication of safety issues to project manager, delineate work zone, atmospheric monitoring, review site safety procedures with subcontractors, contact Underground Service Alert, clear underground utilities, maintain adequate supply of safety equipment onsite for Streamborn personnel.
Subcontractor's Site Safety Officer (to be determined)	Understand and obtain subcontracting crews' compliance with Site Safety Plan, maintain onsite supply of safety equipment for subcontractor's personnel, relay safety concerns to Site Safety Officer.

Table 3

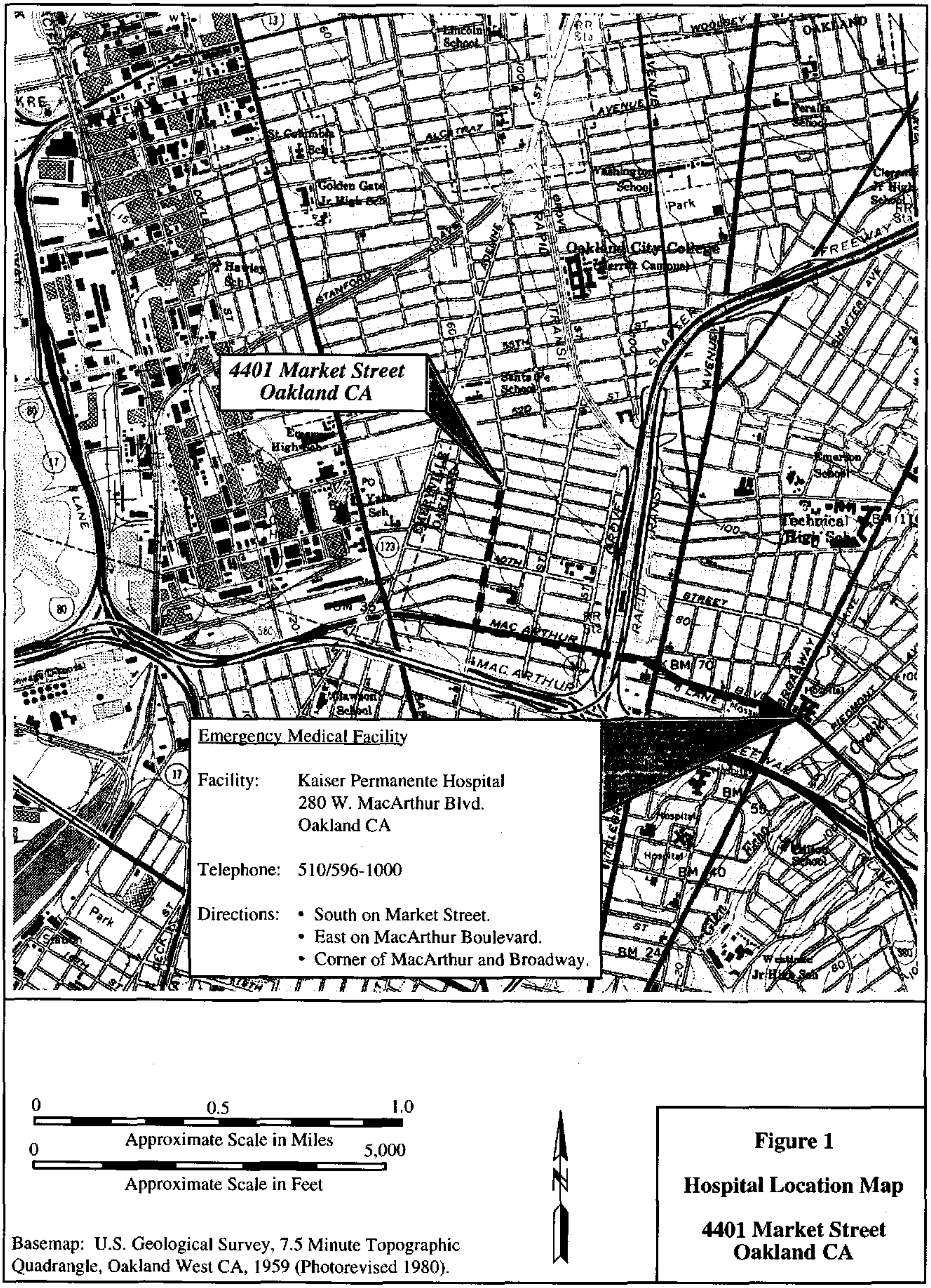
Personnel Protective and Monitoring Equipment
4401 Market Street
Oakland CA

Item	Requirement
Modified Level-D Personal Protective Equipment	Hardhat, dedicated work clothing (cotton coveralls or tyveks), water repellent steel-toed boots, work gloves, latex gloves (as appropriate), nitrile gloves (as appropriate), first aid kit, fire extinguisher, warning tape, optional eye and hearing protection.
Modified Level-C Personal Protective Equipment	Add Half-face respirator with OV-HEPA cartridges and mandatory tyveks to modified Level-D protective equipment. Change respirator cartridges upon detection of breakthrough (by smell), increase in breathing resistance, or daily (whichever is more frequent).
Atmospheric Monitoring	Field organic vapor monitor capable of detecting organic vapor concentrations of 1 ppm (v/v). Field organic vapor monitor to be calibrated to known reference gas daily. Action levels (measurement in the breathing zone of work area): >5 ppm for 10 minutes: upgrade to modified Level C >50 ppm for 10 minutes: stop work, consult with project manager
Visual Monitoring	Evaluate yourself and co-workers for signs of fatigue and visual signs of distress (that may be caused by physical labor and possible chemical exposure).

Table 4

Emergency Information
4401 Market Street
Oakland CA

Emergency Service or Contact	Telephone	Address and Directions
Hospital	510/596-1000	• Kaiser Permanente Hospital 280 W. MacArthur Boulevard Oakland CA • From property, go south on Market Street. • Turn left on MacArthur Boulevard. • Hospital is on the left after crossing Broadway. • See Figure 1 for the route.
Ambulance	911	
Fire Department	911	
Police Department	911	
Onsite Telephone	none	
Site Safety Officer	Kenneth B. Alexander 510/528-4234 (work) 510/649-1937 (home) 510/541-8410 (mobile)	
Project Manager	Kenneth B. Alexander 510/528-4234 (work) 510/649-1937 (home) 510/541-8410 (mobile)	
Property Owner (or Representative)	Casimiro and Josie Damele 510/531-0778	
Subcontractors	To be determined	



Basemap: U.S. Geological Survey, 7.5 Minute Topographic Quadrangle, Oakland West CA, 1959 (Photorevised 1980).

Figure 1

Hospital Location Map

4401 Market Street
Oakland CA