BLYMYER
ENGINEERS, INC.

RO314

September 17, 2003
BEI Job No. 203004

Mr. Amir Gholami
Alameda County Health Care Services Agency
Environmental Protection Division
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Alameda County
SEP 19 2003
Environmental Health

Subject: **Workplan for Geoprobe® Investigation**
Former Fiesta Beverage Facility
966 89th Avenue
Oakland, California
ACHCSA Site # RO0000314

Dear Mr. Gholami:

On behalf of the Fiesta Beverage Company, Blymyer Engineers, Inc. is pleased to forward this workplan to conduct a Geoprobe® investigation at the subject site (Figures 1 and 2). As you are aware, a review of the groundwater analytical data collected prior to and after the application of a 7% solution of hydrogen peroxide (March 2001) suggest that a rebound of contaminant concentrations in groundwater is underway (See Tables I, II, and III). If this assumption is correct, the data appear to indicate that the peroxide application did suppress groundwater concentrations for awhile; however, it also appears to indicate that the residual contaminant concentrations in soil are an adequate source for the continued degradation of vicinity groundwater. It is likely that the extent of soil removal from the UST basins at the time of the removal of the USTs (August 1990) and at the time of overexcavation (January 1991) was laterally limited due to the immediate proximity of the buildings to the southeast (See Tables IIB and IV). The proposed Geoprobe® investigation will be conducted in the site vicinity in an attempt to determine the location of the residual soil contamination, and to help determine the lateral extent of impacted groundwater. This will help target the residual contamination for corrective actions, and will also help in determining the most appropriate method of achieving the goal of regulatory closure. Once a better understanding of the location and lateral extent of contamination is known, further testing may be required to determine the most effective manner of targeting the residual contamination, should a risk-based closure not be appropriate.

Scope of Work

Task 1 Generate workplan for installation of approximately nine Geoprobe® bores

Blymyer Engineers will generate this workplan for submittal to the Alameda County Health Care Service Agency (ACHCSA). The workplan will be in conformance with San Francisco Bay Region Water Quality Control Board's (RWQCB) guidelines, and will describe the proposed subsurface investigation including the proposed Geoprobe® bore locations, as well as the soil and groundwater analytical parameters to be used in the investigation. Only upon approval of the workplan will Blymyer Engineers proceed with the work.

Task 2 Install approximately nine Geoprobe® bores

Nine Geoprobe® soil bores are proposed for the approximate locations indicated in Figure 2. These locations have been selected in order to help determine the extent of contaminated soil that may require remediation.

- **Secure all required permits**

  Upon authorization to proceed, a drilling permit will be obtained from Alameda County Public Works, and an excavation permit will be obtained from the city of Oakland.

- **Generate a site-specific health and safety plan**

  A health and safety plan will be generated in order to outline potentially hazardous work conditions and contingencies for an emergency.

- **Locate utilities**

  Offsite utilities will be marked for location by Underground Service Alert (USA). Additionally, proposed bore locations will be marked for clearance by a private utility location service. Site utility laterals, as well as utility corridors that pass through the site will also be located at this time per the standing request of the ACHCSA.

- **Drill approximately nine Geoprobe® soil bores**

  A Geoprobe® rig will be scheduled to drill for one full day. It is estimated that nine bores can be installed during that time period. The Geoprobe® bores will be installed as generally depicted in Figure 2, or otherwise modified. The Geoprobe® soil bores will be hydraulically pushed to a depth of approximately 15 to 20 feet below grade surface (bgs). A continuous soil core will be collected from each bore. All soil samples will be collected in accordance with standard operating procedures. The soil bores will be converted to temporary wells and grab groundwater samples will be collected. The soil bores will be backfilled with cement grout upon removal of the temporary well casing.

- **Field screen and collect soil samples for laboratory analysis**

  At a minimum of 5-foot intervals selected soil samples will be collected from the soil cores for field screening using a photoionization detector (PID) and for lithologic description. All soil samples will be collected in accordance with the enclosed Blymyer Engineers' *Standard Operating Procedure No. 4, Soil and Grab Groundwater Sampling Using Hydraulically-Driven Sampling Equipment* (Appendix A).

The soil sample displaying the highest PID reading or the soil sample from the groundwater interface will be collected for laboratory analysis. Up to one additional sample will be collected from selected bores (an estimated 14 samples will be submitted in total). The soil samples will be analyzed for Total Petroleum Hydrocarbons (TPH) as gasoline by modified EPA Method 8015; and for benzene, toluene, ethylbenzene, total xylenes, (BTEX) and methyl tert-butyl ether (MTBE) by EPA Method 8021. The soil sample with the highest concentration of MTBE will be resubmitted for confirmation of the detection of MTBE and for other fuel oxygenates using EPA Method 8260. Two soil samples will be selected for analysis of total lead by EPA Method 6010. The soil samples will be submitted to a California-certified laboratory on a standard 5-day turnaround. The laboratory report will also be requested to be delivered in the EDF format for uploading to the state GeoTracker website.

- **Collect grab groundwater samples for laboratory analysis**

Grab groundwater samples will be collected from the temporary wells and will be submitted to a California-certified laboratory for analysis of TPH as gasoline by modified EPA Method 8015 and BTEX and MTBE by EPA Method 8021. MTBE will be confirmed on a one time basis with EPA Method 8260 should it be detected by Method 8021. The laboratory report will also be requested to be delivered in the EDF format for uploading to the state GeoTracker website.

- **Soil and decontamination water handling**

Due to the volume of soil that is anticipated to be generated, all soil cuttings will be stored in a Department of Transportation (DOT)-approved 55-gallon drum for later disposal by the owner. All decontamination water will also be stored on-site in a DOT-approved 55-gallon drum for later disposal by the owner.

Task 3 Generate letter report

A letter report will be prepared for submission to the ACHCSA which will document all work performed and will include summaries of data, detailed soil bore logs, and conclusions and recommendations for further work.

Should you have any questions about this workplan, please call Mark Detterman at (510) 521-3773.

Sincerely,

Blymyer Engineers, Inc.

By: _____
Mark B. Detterman, C.E.G.
Senior Geologist

MARK E. DETTERMAN
No. 1723
CERTIFIED ENGINEERING GEOLOGIST
Ex. 9/05

By: _____
Michael S. Lewis
Vice President, Technical Services

Attachments:

	Table I:	Summary of Groundwater Elevation Measurements
	Table II:	Summary of Groundwater Sample Hydrocarbon Analytical Results
	Table IIB:	Summary of Miscellaneous Groundwater Sample Hydrocarbon Analytical Results
	Table III:	Summary of Groundwater Sample Fuel Oxygenate Analytical Results
	Table IV:	Summary of Soil Sample Hydrocarbon Analytical Results
	Figure 1:	Site Location Map
	Figure 2:	Site Plan and Groundwater Gradient, June 23, 2003
	Appendix A:	Blymyer Engineers' *Standard Operating Procedure No. 4, Soil and Grab Groundwater Sampling Using Hydraulically-Driven Sampling Equipment*

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Table I, Summary of Groundwater Elevation Measurements BEI Job No. 203004, Fiesta Beverage 966 89th Avenue, Oakland, California				
Well ID	Date	TOC Elevation (feet)	Depth to Water (feet)	Groundwater Surface Elevation (feet)
MW-1	8/6/93	18.72	8.96	9.76
	1/12/96		8.55	10.17
	4/16/96		7.65	11.07
	7/15/96		8.76	9.96
	10/16/96		9.04	9.68
	12/15/98		8.38	10.34
	1/18/01		8.49	10.23
	4/25/01		8.24	10.48
	3/17/03*		8.08	10.64
	6/23/03		8.63	10.09
MW-2	8/6/93	18.44	8.68	9.76
	1/12/96		8.24	10.20
	4/16/96		7.41	11.03
	7/15/96		8.45	9.99
	10/16/96		8.73	9.71
	12/15/98		8.05	10.39
	1/18/01		8.24	10.20
	4/25/01		7.88	10.56
	3/17/03*		7.08	11.36
	6/23/03		8.90	9.54

Table I, Summary of Groundwater Elevation Measurements BEI Job No. 203004, Fiesta Beverage 966 89th Avenue, Oakland, California				
Well ID	Date	TOC Elevation (feet)	Depth to Water (feet)	Groundwater Surface Elevation (feet)
MW-3	8/6/93	19.01	9.07	9.94
	1/12/96		8.65	10.36
	4/16/96		7.82	11.19
	7/15/96		8.88	10.13
	10/16/96		9.16	9.85
	12/15/98		8.45	10.56
	1/18/01		8.57	10.44
	4/25/01		8.29	10.72
	3/17/03*		8.50	10.51
	6/23/03		9.05	9.96

Notes: TOC = Top of casing
* = Initial data set collected under direction of Blymyer Engineers, Inc.
NM = Not measured

Elevations in feet above mean sea level

Table II, Summary of Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Date	Modified EPA Method 8015 (μg/L)	EPA Method 8020 or 8021B (μg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MW-1	8/6/93	17,000	7.1	8.4	9.2	53	NA
	1/12/96	12,000	1,900	840	370	1,100	NA
	4/16/96	3,500	700	55	100	180	NA
	7/15/96	11,000	2,300	450	350	910	NA
	10/16/96	21,000	4,200	2,200	650	2,600	NA
	12/15/98	10,000	1,800	520	270	1,100	<350
	1/18/01	11,000 [a]	2,000	320	320	1,100	<120
	4/25/01	2,100 [a, c]	270	46	59	130	<5.0
	3/17/03*	2,200 [a]	260	19	36	54	NA [d]
	6/23/03	6,100 [a]	930	53	99	200	NA
MW-2	8/6/93	2,700	1.3	1.7	2.0	8.1	NA
	1/12/96	2,700	600	310	94	220	NA
	4/16/96	190	39	11	10	14	NA
	7/15/96	700	160	33	34	48	NA
	10/16/96	190	48	8.2	10	13	NA
	12/15/98	200	62	17	4.9	14	4.4 [b]
	1/18/01	300 [a]	74	26	7.3	21	7.3
	4/25/01	<50 [c]	4.5	2.2	0.57	1.9	<5.0
	3/17/03*	78 [a]	26	3.3	1.5	3.5	NA [d]
	6/23/03	160 [a]	51	1.6	1.2	1.8	NA
MW-3	8/6/93	5,200	2.1	2.9	3.6	17	NA
	1/12/96	4,500	280	180	120	470	NA
	4/16/96	5,400	370	340	160	580	NA
	7/15/96	1,800	200	220	66	250	NA
	10/16/96	2,000	340	140	100	300	NA
	12/15/98	1,400	200	39	72	150	<22

Table II, Summary of Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 or 8021B (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MW-3 (cont.)	1/18/01	**1,800** [a]	**240**	**41**	**86**	**120**	<10
	4/25/01	**8,300** [a, c]	**300**	**330**	**200**	**1,100**	<20
	3/17/03*	**2,100** [a]	**240**	**78**	**10**	**280**	NA [d]
	6/23/03	<50	**2.5**	**0.60**	**0.69**	**1.4**	NA
MCL		N/A	1.0	150	700	1,750	13
City of Oakland RBSL; Commercial / Industrial Land Use; Clayey Silt Default; Groundwater a Potential Source of Drinking Water; (Groundwater Ingestion)		N/A	1.0	150	700	1,000	20
RWQCB RBSL Commercial / Industrial Land Use; Groundwater Not a Potential Source of Drinking Water		500	46	130	290	13	1,800

Notes:
- µg/L = Micrograms per liter
- TPH = Total Petroleum Hydrocarbons
- MTBE = Methyl *tert*-butyl ether
- NA = Not analyzed
- <x = Less than the analytical detection limit (x)
- EPA = Environmental Protection Agency
- N/A = Not applicable
- MCL = Maximum Contaminant Level
- >Sol. = Greater than the solubility of pure product in water
- RWQCB = Regional Water Quality Control Board
- RBSL = Risk Based Screening Level
- [a] = Laboratory note indicates the unmodified or weakly modified gasoline is significant.
- [b] = Confirmed with EPA Method 8260.
- [c] = Groundwater samples for MW-1 and MW-3 suspected to have been switched (mismarked) in field. First collection of groundwater samples after application of Hydrogen Peroxide on March 7, 2001.
- [d] = Analysis conducted by EPA Method 8260. See Table III.
- * = Initial data set collected under direction of Blymyer Engineers, Inc.

Bold results indicate detectable analyte concentrations.
Shaded results indicate analyte concentrations above the MCL.

Table IIB, Summary of Miscellaneous Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
W1*	1/15/91	**25,000**	**3,100**	**2,900**	**380**	**2,800**	NA
W2*	1/15/91	**36,000**	**3,700**	**4,300**	**840**	**4,900**	NA
B-1	11/30/99	**850** [a, b]	**0.94**	**3.0**	**0.70**	**5.7**	<5.0
B-2	11/30/99	**3,200** [a, c]	**94**	**210**	**79**	**370**	<10
B-3	11/30/99	**90** [b]	<0.5	<0.5	<0.5	**0.52**	<5.0
B-4	11/30/99	<50	<0.5	<0.5	<0.5	<0.5	<5.0
RWQCB RBSL Commercial / Industrial Land Use; Groundwater Not a Potential Source of Drinking Water		500	46	290	130	13	1,800

Notes:
- µg/L = Micrograms per liter
- TPH = Total Petroleum Hydrocarbons
- MTBE = Methyl *tert*-butyl ether
- NA = Not analyzed
- <x = Less than the analytical detection limit (x)
- EPA = Environmental Protection Agency
- * = Pit water collected at a depth of 14 feet below grade surface.
- [a] = Laboratory note indicates that heavier gasoline range compounds are significant (aged gasoline?).
- [b] = Laboratory note indicates no recognizable pattern.
- [c] = Laboratory note indicates unmodified or weakly modified gasoline is significant.

Bold results indicate detectable analyte concentrations.
Shaded results indicate analyte concentrations above the RWQCB RBSL value.

Table III, Summary of Groundwater Sample Fuel Oxygenate Analytical Results
BEI Job No. 203004, Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Date	EPA Method 8260B				
		DIPE (μg/L)	ETBE (μg/L)	MTBE (μg/L)	TAME (μg/L)	TBA (μg/L)
MW-1	3/17/03	<0.50	<0.50	**10**	**8.3**	<5.0
	6/23/03	<2.5	<2.5	**8.0**	**6.4**	<25
MW-2	3/17/03	<0.50	<0.50	**13**	**2.1**	**6.0**
	6/23/03	<0.50	<0.50	**11**	**4.5**	<5.0
MW-3	3/17/03	<0.50	<0.50	**10**	**4.3**	**8.6**
	6/23/03	<0.50	<0.50	**5.6**	**2.6**	<5.0

Notes: DIPE = Di-isopropyl ether
ETBE = Ethyl *tert*-Butyl ether
MTBE = Methyl *tert*-butyl ether
TAME = *tert*-Amyl methyl ether
TBE = *tert*-Butyl alcohol
(μg/L) = Milligrams per liter

Table IV, Summary of Soil Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Depth (ft)	Date	Modified EPA Method 8015 (mg/Kg)	EPA Method 8020 (mg/Kg)				
			TPH as Gas	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
1	9*	8/24/90	**350**	**3.5**	**15**	**4.5**	**28**	NA
2	9*	8/24/90	**4,900**	**59**	**260**	**100**	**500**	NA
3	9*	8/24/90	**780**	**13**	**41**	**13**	**67**	NA
4	9*	8/24/90	**810**	**16**	**52**	**17**	**87**	NA
Composite 1 5A - 5D	N/A	8/24/90	**1,000**	**0.16**	**1.8**	**0.57**	**22**	NA
Composite 2 6A - 6D	N/A	8/24/90	**10**	**0.0071**	**0.032**	**0.037**	**1.1**	NA
Composite 3 7A - 7D	N/A	8/24/90	**440**	**0.10**	**0.59**	**1.7**	**13**	NA
S1	14**	1/15/91	<0.5	<0.005	**0.0068**	<0.005	**0.0077**	NA
S2	14**	1/15/91	**2.2**	**0.081**	**0.013**	<0.005	**0.0092**	NA
MW-1	6.0	6/24/93	**43**	**0.900**	**0.710**	**0.700**	**3.80**	NA
MW-1	11.0	6/24/93	**60**	**2.80**	**2.30**	**3.50**	**10**	NA
MW-2	6.0	6/24/93	**260**	**7.9**	**30**	**6.30**	**49**	NA
MW-2	11.0	6/24/93	**11**	**0.097**	**0.340**	**0.440**	**1.60**	NA

Table IV, Summary of Soil Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Depth (ft)	Date	Modified EPA Method 8015 (mg/Kg)	EPA Method 8020 (mg/Kg)				
			TPH as Gas	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MW-3	6.0	6/24/93	**5.0**	**0.150**	**0.160**	**0.180**	**0.480**	NA
MW-3	11.0	6/24/93	**22**	**0.290**	**2.20**	**0.290**	**5.60**	NA
RWQCB RBSL Commercial / Industrial Land Use; **Surface Soil**; Groundwater Not a Potential Source of Drinking Water			400	0.39	8.4	24	1.0	1.0

Notes:
- ft = feet
- mg/Kg = Milligrams per kilogram
- TPH = Total Petroleum Hydrocarbons
- MTBE = Methyl *tert*-butyl ether
- NA = Not analyzed
- <x = Less than the analytical detection limit (x)
- EPA = Environmental Protection Agency
- * = Assumed to be bottom samples.
- ** = Bottom samples (per Tank Protect Engineering *Preliminary Site Assessment Report*, dated December 15, 1993).
- [a] = Laboratory note indicates the result is a hydrocarbon within the diesel range but that it appears to be the less volatile constituents of gasoline.
- [b] = Also detected "High Point Hydrocarbons" calculated as oil at 300 mg/kg, and Oil and Grease at 80 mg/kg.

Bold results indicate detectable analyte concentrations.
Shaded results indicate analyte concentrations above the RWQCB RBSL value.

UNITED STATES GEOLOGICAL SURVEY 7.5' QUADS. "OAKLAND EAST, CA & SAN LEANDRO, CA", BOTH PHOTOREVISED 1981.

BLYMYER ENGINEERS, INC.

BEI JOB NO. 203004

DATE 3-19-03

0 1000 2000

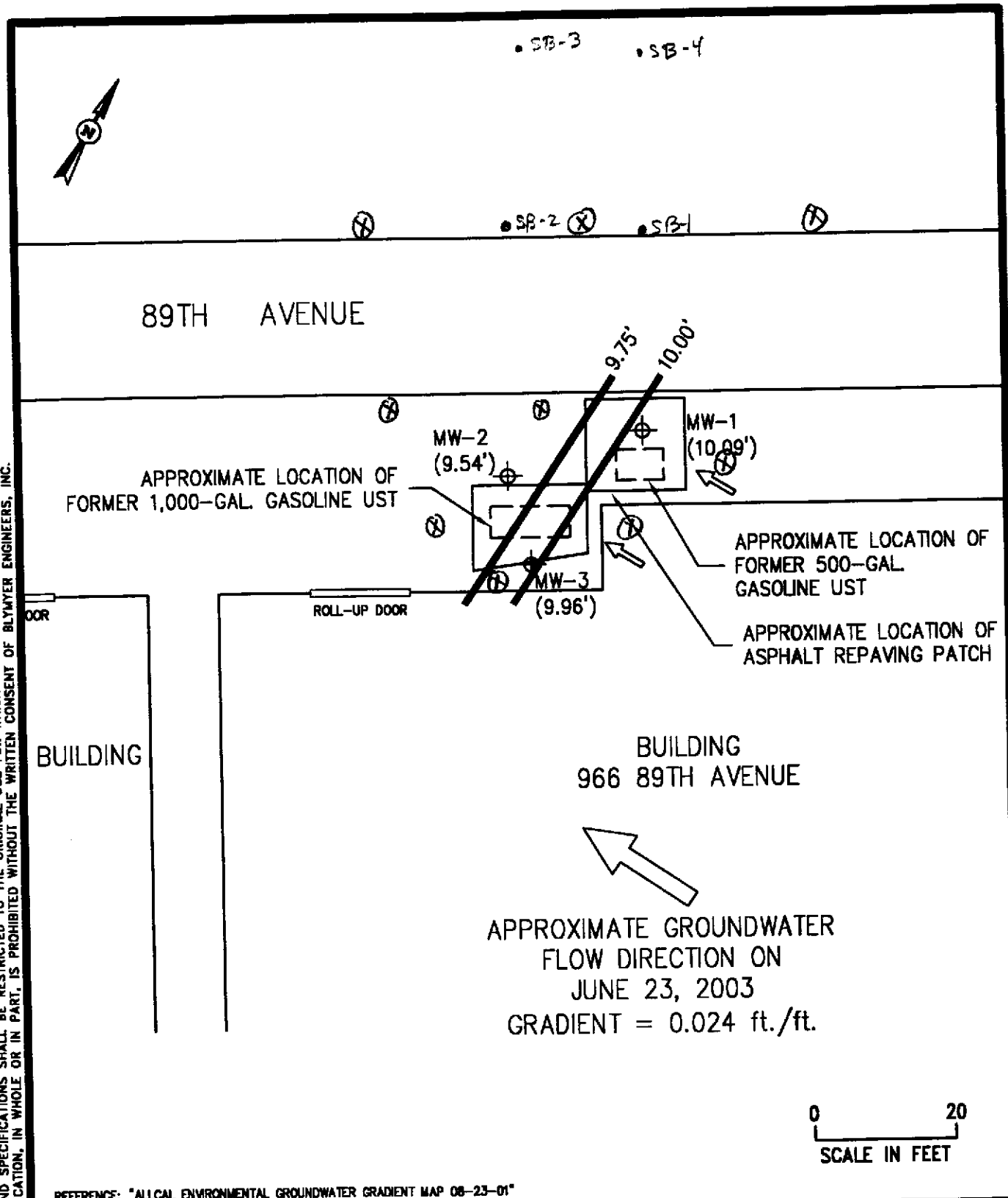
SCALE IN FEET

N

SITE LOCATION MAP

FORMER FIESTA BEVERAGE
966 89TH AVE.
OAKLAND, CA

FIGURE 1



REFERENCE: "ALLCAL ENVIRONMENTAL GROUNDWATER GRADIENT MAP 08-23-01"

BLYMYER ENGINEERS, INC.

BEI JOB NO.	DATE
203004	7-8-03

LEGEND

UST UNDERGROUND STORAGE TANK

GROUNDWATER MONITORING WELL

GROUNDWATER FLOW DIRECTION

⊗ PROPOSED SOIL BORE LOCATION

• PREVIOUS SOIL BORE LOCATION

SITE PLAN & GROUNDWATER GRADIENT MAP
JUNE 23, 2003
FORMER FIESTA BEVERAGE
966 89TH AVE.
OAKLAND, CA

FIGURE 2

BLYMYER
ENGINEERS, INC.

Standard Operating Procedure No. 4

Soil and Grab Groundwater Sampling Using Hydraulically-Driven Sampling Equipment

Revision No. 1

Approved By:

Michael Lewis
Quality Assurance/Quality Control Officer
Blymyer Engineers, Inc.

9/1/94
Date

Table of Contents

Attachments:

Boring and Well Construction Log
Drum Inventory Sheet

1.0 Introduction and Summary

This Standard Operating Procedure (SOP) describes methods for drilling with the use of hydraulically-driven equipment, soil sampling with the use of split-spoon samplers, and grab groundwater sampling through an open borehole. Drilling activities covered by this SOP are conducted to obtain soil and grab groundwater samples. Soil samples may be obtained to log subsurface materials, to collect samples for chemical characterization, or to collect samples for physical parameter characterization.

The soil sampling techniques described in this SOP are generally suitable for chemical characterization and physical classification tests; because a driven split-spoon sampler is employed, 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 techniques described in this SOP generally produce a borehole with a diameter corresponding to the outside diameter of the drill rods, a relatively small annulus of remolded soil surrounding the outside diameter of the drill rods, and limited capability for cross-contamination between subsurface strata as the leading drill rods pass 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 hydraulically-driven soil sampling generally consist of initial decontamination, advancement of the drill rods, driving and recovery of the split-spoon sampler, logging and packaging of the soil samples, decontamination of the split-spoon and continued driving and sampling until the total depth of the borehole is reached. Withdrawal of the drill rods upon reaching the total depth requires completion of the borehole by grouting or other measures.

2.0 Equipment and Materials

- Drill rods and drive-weight assembly (hydraulic hammer or vibrator) for driving the drill rods and split-spoon sampler.

- Split-spoon sampler should conform to ASTM D 1586-Standard Method for Penetration Test and Split-Barrel Sampling of Soils, except: (1) split-spoon should be fitted with liners for collection of chemical characterization samples, and (2) allowable split-spoon diameters include nominal 1.5-inch inside diameter by nominal 2-inch outside diameter (Standard Penetration Test split-spoon), nominal 2-inch inside diameter by nominal

2.5-inch outside diameter (California Modified split-spoon), or nominal 2-1/2-inch inside diameter by nominal 3-inch outside diameter (Dames & Moore split-spoon). The split-spoon type and length of the split barrel portion of the sampler should be noted on the Boring and Well Construction Log (copy attached), as should the use of a sample catcher if employed.

- Liners should be 3- to 6-inch length, fitted with plastic end caps, brass or stainless steel, with a nominal diameter corresponding to that of the inside diameter of the split-spoon sampler. The Boring and Well Construction Log should note whether brass or stainless steel liners were used.

- Teflon® sheets, approximate 6-mil thickness, precut to a diameter or width of the liner diameter plus approximately 1 inch.

- Plastic end caps.

- Adhesiveless silicone tape.

- Disposable polyethylene bailer.

- Type I/Type II Portland cement.

- Groundwater sample containers (laboratory provided only).

- Kimwipes®, certified clean silica sand, or deionized water (for blank sample preparation).

- Sample labels, Boring and Well Construction Logs, chain-of-custody forms, drum labels, Drum Inventory Sheet (copy attached), and field notebook.

- Ziploc® plastic bags of size to accommodate a liner.

- Stainless steel spatula and knife.

- Cooler with ice or dry ice (do not use blue ice) and packing material.

- Field organic vapor monitor. The make, model, and calibration information for the field organic vapor monitor (including compound and concentration of calibration gas) should be noted in the field notebook.

- Pressure washer or steam cleaner.
- Large trough (such as a water tank for cattle), plastic-lined pit, or equivalent for decontamination of drill rod and end plug.
- Buckets and bristle brushes for decontamination of liners, split-spoon sampler, and other small gear.
- Low-residue, organic-free soap such as Liquinox® or Alconox®.
- Distilled water.
- Heavy plastic sheeting such as Visqueen.
- 55-gallon, open-top, DOT-approved, 17H drums
- 5-gallon open-top DOT-approved pails, if required.

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 hydraulic drilling and sampling conditions. 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 typical procedures may be expected and should be noted on the Boring and Well Construction Log.

1. Investigate location of the proposed boreholes for buried utilities and obstructions. At least 48 hours before drilling, contact known or suspected utility services individually or through collective services such as "Underground Service Alert."

2. Decontaminate drill rods, split-spoon sampler, and other drilling equipment immediately prior to mobilization to the site.

3. Calibrate field organic vapor monitor equipment in accordance with the manufacturer's specifications. Note performance of the calibration in the geologist's field notebook.

4. Conduct "tail-gate" meeting and secure the work area in accordance with the Site Safety Plan.

5. Core concrete, if required.

6. Using hand-augering device, hand auger to a depth of 5 feet, if feasible, to clear underground utilities and structures not located by a utility service or on drawings. As appropriate, retain private buried utility location services or geophysical investigation services to search for buried utilities and obstructions. During initial advancement of each borehole, drill cautiously and have the driller pay particular attention to the "feel" of drilling conditions. 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.

7. Advance drill rods, or nested drill rods, to the desired sampling depth using hydraulic hammer or vibrator. Note depth interval, augering conditions, and driller's comments on Boring and Well Construction Log. Samples should be collected at intervals of 5 feet or less in homogeneous strata and at detectable changes of strata.

The sampling procedure varies depending on whether the drill rods are nesting-type. With nesting-type drill rods, the inner and outer drill rods are driven simultaneously. As they are driven, soil is forced into the lined inner drill rod. The outer drill rod is left in place and the inner drill rod is relined with sample sleeves and replaced for the next sampling segment. Where nesting-type drill rods are not used, a split-spoon sampler is used. The following sampling procedures cover sampling with a split-spoon sampler:

8. Remove drill rod and note presence of water mark on drill rod, if any. Also, monitor the top of hollow drill rods using field organic vapor monitor, as appropriate.

9. Decontaminate split-spoon sampler, liners, spatulas and knives, and other equipment that may directly contact the chemical characterization sample. Fit the split-spoon sampler with liners and attach to drill rod.

10. Lower split-spoon sampler until sampler is resting on soil. If more than 6 inches of slough exists inside the borehole, consider the conditions unsuitable and re-advance the drill rods and sampler to a new sampling depth.

11. Drive and recover split-spoon sampler. Record depth interval and sample recovery on Boring and Well Construction Log. Monitor the recovered split-spoon sampler with the field organic vapor monitor, as appropriate.

12. Remove either bottom-most or second-from-bottom liner (or both) from split-spoon sampler for purposes of chemical characterization and 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 adhesiveless silicone tape (do not use electrical or duct tape) to further minimize potential loss of moisture or volatile compounds. Label liner(s) and place in Ziploc® bag on ice or dry ice inside cooler.

13. Extrude soil from remaining liner(s) and subsample representative 1-inch cube (approximate dimensions). Place subsample in Ziploc® bag and seal. Allow bag to equilibrate at ambient conditions for approximately 5 minutes and screen for organic vapors by inserting the probe of the field organic vapor monitor into the bag. Record depth interval, observed sample reading, and ambient (background) reading on the Boring and Well Construction Log. Discard bag and sample after use in the solid waste stockpile.

14. Classify soil sample in approximate accordance with ASTM D 2488-Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and in accordance with the Unified Soil Classification System (USCS). Description 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 on geologic structure of sample, as appropriate. Record depth interval, field organic vapor monitor reading, USCS classification, and other notes on the Boring and Well Construction Log.

15. Repeat steps 7 through 14 until total depth of borehole is reached.

16. If a grab groundwater sample is to be collected, slowly lower bailer through the open borehole to minimize agitation and aeration of the sampled water. Transfer the grab groundwater sample into sample container(s). Label sample container(s), place packing materials around containers, and place on ice inside cooler.

17. After drill rods are removed, complete borehole according to the requirements specified elsewhere or by abandonment in accordance with section 8.0.

18. Decontaminate drill rods between boreholes and after finishing last borehole prior to drill rig leaving site.

19. Change decontamination solutions and clean decontamination trough, buckets, and brushes between boreholes.

20. Containerize decontamination liquids in 17H steel drums. Affix completed "Caution - Analysis Pending" labels to the drums.

21. Store any excess soil sample on and cover with heavy plastic sheeting. If required by local regulations or due to site constraints, store excess soil sample in 5-gallon pails. Affix completed "Caution - Analysis Pending" labels to drums.

22. Complete Drum Inventory Sheet.

23. Complete pertinent portion of the chain-of-custody form and enter descriptions of field work performed in the field notebook.

4.0 Quality Assurance and Quality Control (QA/QC)

Optional quality control sampling consists of sequential replicates, collected at an approximate frequency of one sequential replicate for every 10 collected soil samples. Sequential replicates are collected by packaging two adjacent liners of soil from a selected split-spoon drive. Each sample is labeled according to normal requirements. The replicate samples obtained in such a manner are suitable for assessing the reproducibility of both chemical and physical parameters. Interpretations of data reproducibility should recognize the potential for significant changes in soil type, even over 6-inch intervals. Accordingly, sequential replicates do not supply the same information as normally encountered in duplicate or split samples. Duplicate or split samples are better represented by the laboratory performing replicate analyses on adjacent subsamples of soil from the same liner.

Optional quality control samples may be collected to check for cross-contamination using field blanks. Field blanks may be prepared by (1) wipe sampling decontaminated liners and split-spoon with Kimwipes®, (2) pouring clean silica sand into a decontaminated split-spoon sampler that has been fitted with liners, or (3) pouring deionized water over the decontaminated liners and split-spoon sampler and collecting the water that contacts the sampling implements for aqueous analysis. Field blanks may be prepared at the discretion of the field staff given reasonable doubt regarding the efficacy of the decontamination procedures.

The comparability of the field soil classification may be checked by conducting laboratory classification tests. Requests for laboratory testing verification of the field classification should be left to the discretion of the field staff.

Field decisions that may also affect the quality of collected data include the frequency of sampling and the thoroughness of documentation. Subject to reasonable limitations of budget and schedule, the completeness, comparability, and representativeness of data obtained using this SOP will be enhanced by decreasing the sampling interval (including collecting continuous samples with depth) and increasing the level of detail for sample classification and description of drilling conditions. More frequent sampling and more detailed documentation may be appropriate in zones of chemical concentration or in areas of critical geology (for example, zones of changing strata or cross-correlation of confining strata).

As required, rinse or wipe samples may be collected from the sampling equipment before the initial sampling is conducted to establish a baseline level of contamination present on the sampling equipment. Rinse or wipe samples may also be collected at intervals of decontamination wash and rinse events or after the final decontamination wash and rinse event.

5.0 Documentation

Observations, measurements, and other documentation of the drilling and soil sampling effort should be recorded on the following:

- Sample label
- Boring and Well Construction Log
- Field notebook
- Chain-of-custody form
- Drum Inventory Sheet

Documentation should include any deviations from this SOP, notations of unusual or unexpected conditions, and documentation of the containerization and disposal of investigation-derived waste. Information to be documented on the sample label and Boring and Well Construction Log is listed below.

5.1 Sample Label

- Project name and project number
- Borehole number
- Sample depth interval (feet below ground surface), record the depth interval using notation similar to "19.2-19.7;" generally do not record just one depth "19.2" because of uncertainty regarding the location such depth corresponds to (midpoint, top, etc.)
- Sample date and sample time
- Name of on-site geologist
- Optional designation of orientation of sample within the subsurface, for example, an arrow with "up" or "top" designated

5.2 Boring Log

- Project name, project number, and name of on-site geologist
- Borehole number
- Description of borehole location, including taped or paced measurements to noticeable topographic features (a location sketch should be considered)
- Date and time drilling started and completed
- Name of drilling company and name of drilling supervisor, optional names and responsibilities of driller's helpers
- Name of manufacturer and model number of sampling rig
- Type and size of sampler, optional description of the size of drill rod
- USCS classification
- Sampling interval and total depth of borehole

- Depth at which groundwater was first encountered with the notation "initial" and any other noted changes in groundwater movement or stabilized water level
- Field organic vapor monitor readings
- Method of boring completion
- Other notations and recordings described previously in section 2.0, Equipment and Materials, and section 3.0, Typical Procedures

6.0 Decontamination

Prior to entering the site, the sampling rig and appurtenant items (drill rods, split-spoon sampler, shovels, troughs and buckets, driller's stand, etc.) should be decontaminated by steam cleaning or pressure washing. Between each borehole, appurtenant items that contacted downhole soil (essentially all appurtenant items including drill rod, split-spoon sampler, shovels, troughs, and buckets, etc.) should be decontaminated by steam cleaning or pressure washing. The sampling rig should be steam cleaned or pressured washed as a final decontamination event. On-site decontamination should be conducted within the confines of a trough or lined pit to temporarily contain the wastewater. Between each borehole and prior to demobilization, the trough or lined pit should be decontaminated by steam cleaning or pressure washing. If a rack or other support is used to suspend appurtenant items over the trough or lined pit during decontamination, only the rack or other support needs to be decontaminated between boreholes.

Prior to collection of each sample, the split-spoon sampler, liners, sample catcher, spatulas and knives, 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 clean water rinse. If testing for metals, a final rinse of deionized water should be conducted. Wastewater should be temporarily contained.

Between each borehole, buckets and brushes should be decontaminated by steam cleaning or pressure washing. Before installation of each borehole is begun, fresh decontamination solutions should be prepared. Decontaminated equipment should be kept off of the ground surface. Cleaned equipment should be placed on top of plastic sheeting, which is replaced after completion of each borehole, or on storage racks.

More rigorous decontamination procedures may be employed if necessary to meet sampling or QA/QC requirements.

7.0 Investigation-Derived Waste

Wastes resulting from the activities of this SOP may include excess soil samples, decontamination liquids, and miscellaneous waste (paper, plastic, gloves, bags, etc.).

Solid waste from each borehole should be placed on and covered with heavy plastic sheeting or containerized in DOT-approved 5-gallon pails. Solids from multiple boreholes may be combined within a single stockpile if field observations (presence or absence of chemical staining and field organic vapor monitoring) indicate the solids are similarly uncontaminated or similarly contaminated. Given sufficient space and reasonable doubt, separate stockpiles should be used for solid waste from each borehole.

Decontamination liquids for each borehole should be placed in individual 17H steel drums with completed "Caution - Analysis Pending" labels affixed. Liquids from multiple boreholes may be combined, subject to the same limitations as solids.

8.0 Borehole Abandonment

Each borehole should be completely filled with neat cement (5.5 gallons of water in proportion to one 94-pound bag of Type I/Type II Portland cement, ASTM C-150) from the bottom of the bore to grade surface. Water used to hydrate cement should be free of contaminants and organic material. Bentonite may be added to reduce shrinkage and improve fluidity. Add 3 to 5 pounds of bentonite with 6.5 gallons of water and one 94-pound bag of Type I/Type II Portland cement. The water and bentonite should be mixed first before adding the cement. The borehole should be filled from the bottom first to grade surface. A tremie pipe should be used in small diameter boreholes or in formations prone to bridging or collapse. The tremie pipe should be lifted as the cement grout is poured, but should never be lifted above the surface of the neat cement. In boreholes deeper than 50 feet, the neat cement may need to be applied with pressure.

9.0 References

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BORING & WELL CONSTRUCTION LOG:

Job No.:
Client:
Site:

Date Drilled:
Sample Container:

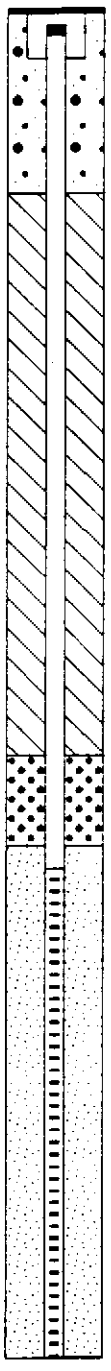
Driller:
Drilling Contractor:
Logged By:
Drilling Equipment:
Bore Diameter:
Total Depth: Ft.

Well Completion Depth: '
Component Size/Type — Depths in Feet: From — To

Surface Completion:
Blank Casing:
Slotted Casing:
Filter Pack:
Seal:
Annular Seal:
Surface Seal:
Bottom Seal:

Initial Water Level: ▽
Stabilized water level: ▼

Depth (ft)	Blows/6 In.	P.I.D. (ppm)	Samples	DESCRIPTION	Unified Soil Classification	Graphic Log	Water Depth
0							
5							
10							
15							
20							
25							
30							



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BLYMYER ENGINEERS DRUM INVENTORY FORM

Number of Drums	Date Generated	Person on-site when generated	Soil or Groundwater	Contents (Cuttings, Purge Water, Development Water, Decon Water, PPE)	% Full	Bore or Monitoring Well ID	Do Lab Results Exist for Contents?

[illegible]

Date Client Informed? _____ All drums labeled? _____