STREAMBORN
415/528-4234
Fax 528-2613

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Report
Additional Soil and Groundwater Investigation
2801 MacArthur Boulevard
Oakland CA

Cali France

Prepared For:
A.P.A. Fund Limited
Oakland CA

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS W. LOVELL
No. 31914
CIVIL
STATE OF CALIFORNIA

Expires 12/31/92

Prepared By:
STREAMBORN
Berkeley CA

Project No. P26

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Mail: P.O. Box 9504, Berkeley CA 94709-0504
Office: 900 SantaFe Avenue, Albany CA 94706

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INTRODUCTION

This report summarizes the results of drilling, soil sampling and testing, well and piezometer construction, and groundwater monitoring at 2801 MacArthur Boulevard, Oakland CA, Figure 1.

BACKGROUND

The subject property was operated as a service station for numerous years. In May 1989, three underground gasoline tanks were removed from a single (common) excavation at the subject property and verification soil samples were collected and analyzed. On 12 June 1989, drilling, soil sampling, and subsequent sample analysis was performed for one location (B1) in vicinity of the former gasoline tanks excavation. On 3 July 1989, a waste oil tank and associated petroleum-contaminated soil were removed and verification soil samples were collected and subsequently analyzed. Eight additional soil borings (B2 through B9) were conducted at the subject facility on 13-14 July 1989 and 25, 28, and 30 August 1989. Excavation and boring locations are shown on Figure 2. Verification soil sampling results from beneath the tanks and piping, as well as results from B1 through B9, are summarized in Appendix H. The aforementioned work was performed by Riedel Environmental Services and documented in reports dated: 9 June 1989, 20 June 1989, and 14 December 1989.

The soil sampling and analysis work performed by Riedel documented that some areas of the property contain residual concentrations of petroleum hydrocarbons and associated chemicals. The Alameda County Department of Environmental Health, which is charged with local administration of the San Francisco Bay Regional Water Quality Control Board's underground storage tank program, requested further investigation of soil and groundwater contamination and, if necessary, remediation. The Alameda County Department of Environmental Health request was contained in a letter dated 8 March 1990.

We prepared a workplan, dated 30 August 1990, addressing the Alameda County Department of Environmental Health's request for further investigation. The workplan proposed installation of two piezometers and one monitoring well. Workplan comments were provided verbally on 24 September 1990 by Larry Seto of the Alameda County Department of Environmental Health. At the request of Mr. Seto, the workplan was modified to add two soil borings (B10 and B11 - shown on Figure 2) plus more soil analyses. These modifications were documented in our letter to Mr. Seto dated 5 October 1990. Mr. Seto subsequently approved the modified workplan on the condition that oil & grease analyses be added to selected borings. Mr. Seto's approval was documented in his 19 October 1990 correspondence.

The work reported herein was performed according to the requirements of the modified and approved workplan. As will be described subsequently, additional investigations (not mandated by the workplan) were undertaken and are documented in this report. These additional investigations were performed to gain a more accurate understanding of the hydrogeology at the property.

SCOPE OF WORK

Our scope of work included:

- Drilling, soil sampling, and analysis at 7 boring locations. Two phases of drilling were performed: (1) P1, P2, M1, B10, and B11 were installed during the first phase while (2) P3 and M2 were installed during the second phase.

- Completion of 3 borings as piezometers (P1, P2, and P3). Completion of 2 borings as wells (M1 and M2). Grouting the remaining 2 borings (B10 and B11).
- Surveying borehole, piezometer, and well elevations; measuring water levels; and calculating the direction of the groundwater gradient.
- Development of P1, P2, M1, and M2. P3, which has only supplied water level data, was not developed because hydraulic response was considered adequate for water level measurements.
- Interface probe measurement to determine if a measurable thickness of free product was present in P1, P2, and M1 - free product was not detected. Because interface probe measurement did not detect free product at the property and because free product is not otherwise suspected in P3 and M2, interface probe measurements were not repeated after installation of P3 and M2.
- Groundwater sampling and analysis from P2 and M2.
- Containerization of investigation-derived waste.
- Permitting of the borings, piezometers, and monitoring wells (permits are included in Appendix F).

CHRONOLOGY

Table 1 presents a chronology of our field work.

As approved by the Alameda County Department of Environmental Health, 2 borings, then 2 piezometers, and subsequently 1 monitoring well were to be installed. The well was to be located 10 feet downgradient of the former gasoline tanks excavation. During project planning and at the time of field work, the direction of groundwater gradient was unknown; however, based on regional topography, a southwesterly gradient was anticipated. By surveying the ground surface elevation at each drilling location, leaving the boreholes open overnight, periodically measuring water levels, and calculating the direction of groundwater gradient, we anticipated that the gradient could be determined in the field and the planned single well could be accurately located in the desired position. We were optimistic that this could be accomplished with a single mobilization of drilling equipment.

As the data show, water level readings did not necessarily stabilize within hours or even days of drilling. This is attributable to the generally fine-grained (clayey, relatively impermeable) character of the soil at the property. Accordingly, the originally-anticipated well was installed using available (not stabilized) water level data and was not correctly positioned downgradient of the former gasoline tanks excavation. A second phase of drilling was then performed to gather the necessary hydrogeologic data and install a second well in the requisite location.

RESULTS OF INVESTIGATION

Drilling, Soil Sampling, and Analysis

Drilling was performed at 7 locations, to depths ranging from 45 to 60 feet below existing ground surface. Five of the borings (B10, B11, P1, P2, and M1) were drilled during the first phase of drilling (October 1990) while the remaining two borings (P3 and M2) were drilled during the second phase of drilling (March and April 1991). The borings were typically sampled at 5-foot intervals during drilling. Boring locations are shown on Figure 2. Boring logs are presented in Appendix A.

Drilling and soil sampling were performed in accordance with Standard Operating Procedure (SOP) 1A - Hollow-Stem Auger Drilling and Split-Spoon Soil Sampling (Appendix C). Soil samples were screened using a field organic vapor monitor (Thermo Environmental Instruments Model 580B, 10.0 eV photoionization detector, calibrated to 100 ppm v/v isobutylene). From each split-spoon drive, the lowermost or middle liner was retained for potential chemical analysis - depending on which liner yielded the highest organic vapor monitor reading. The retained soil samples were labeled, capped with Teflon sheets and plastic endcaps, logged on chain of custody form (Appendix D), placed on ice in a cooler, and delivered to the laboratory within 1 day of collection.

Of the several samples retained from each boring, four soil samples were typically analyzed. The 2 samples with the highest organic vapor readings were selected for laboratory analysis, as well as the bordering two samples with lower organic vapor readings (1 shallower and 1 deeper than the high-reading samples). An exception is location P3, where laboratory analyses were only performed on the two soil samples showing elevated readings. The laboratory analytical program, in combination with the field screening results, helped to define the vertical extent of contamination in each boring.

Four soil samples each from B10, B11, M1, and P2, were analyzed for total petroleum hydrocarbons as gasoline (TPH-gasoline); benzene, toluene, ethylbenzene, and xylenes; and oil & grease. Four soil samples from P1, two soil samples from P3, and five soil samples from M2, were analyzed for TPH-gasoline, and benzene, toluene, ethylbenzene, and xylenes. The soil samples from P1, P3, and M2 were not analyzed for oil & grease because these borings were not proximal to the former waste oil tank. In addition, field observations did not reveal visible oil & grease in these soil samples.

Results of soil analyses are presented in Table 2 and Figures 3 and 4. Laboratory analytical methods are summarized in Table 3, and laboratory reports are presented in Appendix B.

Oil & grease was not detected in the samples. Concentrations of all parameters measured in boring B10 were below detection limits. Otherwise, the samples with detectable concentrations of measured parameters are discussed below.

With few exceptions, concentrations of benzene, toluene, ethylbenzene, and xylenes were near or below detection limits. Each of the exceptions were also associated with elevated TPH-gasoline measurements; the three samples showing concentrations of benzene, toluene, ethylbenzene, and xylenes above 1 mg/kg - showed concentrations of TPH-gasoline above 230 mg/kg (Table 2). Accordingly, TPH-gasoline concentrations serve as an indicator of soil contamination. The historic soil data (Appendix H) also support use of TPH-gasoline as an indicator parameter for soil contamination.

The borings that we drilled showed detectable to elevated (above 100 mg/kg) concentrations of TPH-gasoline at depths between 26 and 42 feet, bounded above and below by samples with TPH-gasoline concentrations <10 mg/kg (generally nondetect). This zone of soil contamination is approximately coincident with the groundwater table.

<u>Completion of Borings as Piezometers and Wells</u>

B10 and B11 were backfilled with cement-bentonite grout (±5% powdered bentonite). M1, M2, P1, P2, and P3 were completed as 2-inch monitoring wells and piezometers in accordance with

SOP 2A - Completion of Borings as Wells (Appendix C). Completion schematics are provided in Appendix A and completion data are presented in Table 5.

Borings M1 and M2 were completed in anticipation of their use as groundwater sampling wells. Accordingly, the base of the filter-pack rests on native soil and the top of the filter-pack is separated from the grouted interval with a bentonite seal. P3 was completed in an identical manner.

P1 and P2 were completed in anticipation of use as piezometers and, because the borings were originally drilled relatively deep, the bottom portion was grouted back prior to piezometer construction. The grouting was performed to reduce the length of filter-pack/screen and to provide for easier (eventual) abandonment. The filter-pack for P1 and P2 was placed on top of the grouted portion. As will be subsequently described, we elected to sample groundwater from piezometer P2. Because the filter-pack and grout are in contact, the P2 groundwater sample showed elevated pH and specific conductance (Tables 6 and 7).

Well/Piezometer Development

M1, M2, P1, and P2 were developed to help obtain reliable measurement of groundwater levels and/or render the piezometers/wells ready for groundwater sampling (not all were sampled). Development consisted of bailing and surging in accordance with SOP 3A - Well Development (Appendix C). Surging was accomplished by rapidly raising and lowering a bailer through the water column in each well/piezometer. Approximately 3 standing volumes were removed from each well/piezometer during development, except where recharge into the well/piezometer was slow. Observations made during development are summarized in Table 6 and documented in Appendix E.

During development, a petroleum sheen and odor were observed in P1, P2, and M2. However, interface probe measurements (discussed below) did not reveal detectable floating product.

During development and subsequent sampling, approximately 15 degrees difference in temperature was measured between groundwater in P2 and M2 (Tables 6 and 7). Different ambient air temperatures during development and sampling may have resulted in biased temperature measurement or the data may reflect different groundwater temperatures. Additional monitoring should be performed before drawing a conclusion.

Interface Probe Measurement

On 2 November 1990, a Solinst Model 121 oil/water interface probe was used to determine if detectable free product was present in M1, P1, and P2. The interface probe provided a manufacturer-cited sensitivity of 0.05-inches. Product was not detected with the probe. On the basis of this measurement, interface probe measurements were not re-attempted after P3 and M2 were installed.

Surveying

Boring, piezometer, and well elevations were surveyed relative to an assumed site-specific datum (Temporary Bench Mark #1, top of concrete, western edge of the northernmost pump island, assumed Elevation = 1,000.00 feet, Figure 2).

Initially, ground surface elevations at B10, B11, P1, and P2 were surveyed on 19 October 1990. A survey of casing and ground surface elevations at M1, P1, P2 was performed on 24 October 1990; at P3 on 29 March 1991; and at M2 on 30 April 1991.

Survey field notes are contained in Appendix G. Elevation data are summarized in Tables 4 and 5 and on the boring logs and completion schematics in Appendix A.

Our elevation data should not be confused with the topographic elevation data contained on the basemap for the property (basemap used in Figures 2, 3, 4, and 5). Two different datums were used. At the time of our survey work, we did not know of the existence of the basemap and its elevation data.

Monitoring of Groundwater Elevations

Water levels were periodically monitored in the wells and piezometers, as well as in the soil borings while open. Water level measurements and observations are summarized in Table 4. Not all the reported measurements correspond to stabilized groundwater elevation data. A representative set of stabilized measurements (7 May 1991) are plotted on Figure 5.

Observations made during monitoring in P2 and M2 included a petroleum odor and a slightly "greasy" coating on the water level probe. As cited previously, interface probe measurements failed to detect free product in P2.

Analyses of groundwater elevation data since March 1991 produce a consistent interpretation of the direction and magnitude of groundwater gradient. The five most recent episodes of water level measurements (recorded from 18 March 1991 through 7 May 1991) indicate the direction of groundwater gradient to be south-southeast, with a gradient magnitude of approximately 0.09 (9%).

Prior to March 1991, different combinations of data (a combination being 3 piezometers/wells - otherwise known as a 3-point interpretation) indicated different groundwater gradients - even for data collected on the same date. The apparent discrepancy in the groundwater elevation data may be attributable to the slow-recharging nature of selected piezometers and wells - resulting in unstabilized water levels. The slow recharge may be attributable to the generally fine-grained (clayey, relatively impermeable) nature of the saturated zone soil intercepted in selected piezometers and wells. The slow recharge may also indicate that saturated coarse-grained (sandy, relatively permeable) layers have limited interconnection.

When assimilated with the difference in groundwater temperature measured between P2 and M2, the apparent discrepancy in the groundwater elevation data may also indicate the presence of isolated groundwater zones. A further explanation accepts the data as representative, indicating unstable and varying groundwater gradients. Even another hypothesis incorporates a vertical gradient within the saturated zone.

Despite the validity of alternative interpretations, our judgement indicates the saturated zone beneath the property is continuous and under the influence of a consistent water table and gradient. The magnitude and direction of the groundwater gradient may change seasonally, but this has yet to be measured. We also believe that, while groundwater may be recovered from coarse-grained strata intercepted by selected piezometers/wells, saturated coarse-grained zones beneath the property have limited inter-connectivity. Accordingly, groundwater movement beneath the property is primarily controlled by the overall fine-grained nature of soil within the upper portion of the saturated zone.

Groundwater Sampling and Analysis

Groundwater sampling and analysis was performed in M2 and P2. Sampling was performed in accordance with SOP 4A: Well Purging and Sampling (Appendix C). Groundwater purging and sampling data are summarized in Table 7, chain-of-custody forms are contained in Appendix D, and sampling logs are presented in Appendix E.

On 6 November 1990, P2 was purged and sampled. The sample was analyzed for TPH-gasoline, and benzene, toluene, ethylbenzene, and xylenes. Elevated pH (12.6) and specific conductance (13,650 μmho/cm^2) were measured in groundwater from P2 during collection of the groundwater sample. The elevated pH and specific conductance resulted from direct contact of the filter-pack with the cement-bentonite grout (used to seal the borehole below the screened interval - P2 was originally constructed as a piezometer).

On 7 May 1991, M2 was purged and sampled. The sample was subsequently analyzed for TPH-gasoline, and benzene, toluene, ethylbenzene, and xylenes.

Results of the groundwater analyses are summarized in Table 8, analytical methods are summarized in Table 3, and laboratory reports are included in Appendix B.

Groundwater analytical results from P2 and M2 show elevated concentrations of benzene (4,700 μg/L and 1,300 μg/L, respectively) and TPH-gasoline (33,000 μg/L and 16,000 μg/L, respectively). Concentrations of toluene, ethylbenzene, and xylenes were also above detection limits, albeit at concentrations below those measured for benzene and TPH-gasoline.

The benzene concentrations exceed the EPA Maximum Contaminant Level for drinking water. Maximum Contaminant Levels have not been established for TPH-gasoline. Concentrations of the remaining analytes were below promulgated Maximum Contaminant Levels. It has not been determined whether groundwater beneath the subject property has a maximum beneficial use as drinking water. Such a determination is required before applying drinking water standards.

Investigation-Derived Waste

Soil cuttings and excess soil samples were placed in steel drums. Purge and development water was also containerized in steel drums. The drums were marked according to waste type, boring of origin, affixed with hazardous waste labels, and stored on the property.

INTERPRETATIONS AND CONCLUSIONS

Figures 6 and 7 present stratigraphic cross-sections across the property (the cross-section locations are shown on Figure 2). These cross-sections were constructed using data from our borings. As depicted on the cross-sections, soils at the property include mixtures and layers of clay, silt, silty- and clayey-sand, silty- and clayey-gravel, sand, and gravel. The sand and gravel deposits, which can potentially transmit groundwater more readily, appear to be discontinuous across the property. Accordingly, although there exist saturated sand and gravel strata beneath the property, groundwater movement is likely limited by fine-grained strata which envelope the more-permeable coarse-grained lenses.

Groundwater occurs at a depth of approximately 25 feet at the upgradient boundary of the property and approximately 40 feet near the downgradient boundary of the property. The occurrence of groundwater and the groundwater table appear to be continuous across the property. This conclusion is corroborated by the consistency of gradient interpretations using the various combinations of water level data since March 1991. The observed slow recharge of groundwater within selected wells supports our belief that coarse-grained strata beneath the property have limited inter-connectivity.

The direction of groundwater gradient is south-southeast. The magnitude of the gradient is approximately 0.09.

The results of this investigation indicate the presence of a zone of soil with elevated concentrations of TPH-gasoline located in the central portion of the property. This zone of soil contamination is found at a depth of approximately 30 to 35 feet. This depth is approximately coincident with the groundwater table.

To the north, east, and south, the lateral limits of this gasoline-contaminated soil zone are defined using data from the 16 borings/piezometers/wells The westerly limits of soil contamination are not as well defined.

Using the data depicted in Figure 3, our judgement indicates the primary source of contamination to be releases from the former gasoline tanks, former waste oil tank, and associated piping and pump islands. Releases from these potential sources would have migrated vertically in the unsaturated zone, with limited horizontal spreading. Upon reaching the groundwater table, the released hydrocarbons would have spread horizontally (as a floating layer on the water table) with bias in the direction of groundwater gradient. Selected soil concentration data from the western portion of the property may also suggest as-yet unidentified onsite or offsite contamination sources.

The groundwater sampling results to date indicate the presence of dissolved gasoline and associated compounds (benzene, toluene, ethylbenzene, and xylenes). Two wells have been sampled once and the reproducibility of the data have not been established.

RECOMMENDATIONS

According to the approved workplan, M2 is scheduled for 3 more quarterly sampling and analysis events. We recommend these be conducted.

To assess the downgradient extent of groundwater contamination, we recommend sampling of P1. Although slated to function as a piezometer, the construction of P1 will allow collection of groundwater samples. The grout is in contact with the filter-pack in P1 and elevated pH and specific conductance should be expected. The standing water column in P1 is also relatively small. Despite these limitations, we believe sampling of P1 will provide useful information.

To assess whether contaminated water is entering the property, we recommend sampling of P3. Unlike P1 which was constructed with the filter-pack in contact with grout, P3 was constructed without an underlying grouted interval (identically to the monitoring wells) and groundwater samples from P3 should prove valid.

Our recommended groundwater monitoring data should be collected and analyzed before additional investigation is undertaken.

Table 1

Chronology of Field Work

Date	Field Activity
18 October 1990	Drilling and soil sampling of borings B10 and B11. Measurement of water levels.
19 October 1990	Drilling and soil sampling of P1. Partial drilling and soil sampling of P2. Completion of P1 as a piezometer. Surveying of ground surface at B10, B11, P1, and P2. Measurement of water levels.
20 October 1990	Complete drilling and soil sampling of P2. Partial completion of P2 as a piezometer. Drilling, soil sampling, and partial completion of M1 as a monitoring well. Measurement of water levels.
21 October 1990	Completion of M1 and P2. Grouting of B10 and B11. Measurement of water levels.
25 October 1990	Surveying of measuring points for M1, P1, and P2. Measurement of water levels.
26 October 1990	Measurement of water levels. Bailing of P1, P2, and M1 to allow recovery and verification of water levels.
2 November 1990	Measurement of water levels. Monitoring for floating product at P1, P2, and M1 using an interface probe (no product detected).
6 November 1990	Development and sampling of P2.
16 November 1990	Measurement of water levels.
23 November 1990	Measurement of water levels.
28 November 1990	Measurement of water levels.
5 December 1990	Measurement of water levels.
18 March 1991	Drilling, soil sampling, and completion of P3 as a piezometer. Measurement of water levels.
29 March 1991	Measurement of water levels.
3 April 1991	Measurement of water levels.
9 April 1991	Measurement of water levels.
16 April 1991	Measurement of water levels.
18 April 1991	Drilling, soil sampling, and completion of M2 as a monitoring well. Measurement of water levels.
30 April 1991	Development of M2. Measurement of water levels.
7 May 1991	Purging and sampling of M2. Measurement of water levels.

Table 2

Results of Soil Analyses

Sample Location	Sample Designation	Sample Date	Sample Type	Sample Depth (feet)	Total Petroleum Hydrocarbons As Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Oil & Grease (mg/kg)	Field Screening (ppm v/v)
B10	B10, 15.5-16	18 October 1990	Grab (liner)	15.5-16	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
B10	B10, 21-21.5	18 October 1990	Grab (liner)	21-21.5	<2.5	<0.005	<0.005	<0.005	<0.005	<10	1-47
B10	B10, 30.5-31	18 October 1990	Grab (liner)	30.5-31	<2.5	<0.005	<0.005	<0.005	<0.005	<10	4.5-31
B10	B10, 45.5-46	18 October 1990	Grab (liner)	45.5-46	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
B11	B11, 21-21.5	18 October 1990	Grab (liner)	21-21.5	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
B11	B11, 31-31.5	18 October 1990	Grab (liner)	31-31.5	230	0.15	0.47	0.88	1.60	<10	420-430
B11	B11, 36-36.5	18 October 1990	Grab (liner)	36-36.5	<2.5	<0.005	<0.005	<0.005	<0.005	<10	12-225
B11	B11, 46-46.5	18 October 1990	Grab (liner)	46-46.5	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
P1	P1, 25.5-26	19 October 1990	Grab (liner)	25.5-26	<2.5	<0.005	<0.005	<0.005	<0.005	NM	<1
P1	P1, 35-35.5	19 October 1990	Grab (liner)	35-35.5	7.4	0.011	<0.005	<0.005	<0.005	NM	48-50
P1	P1, 40.5-41	19 October 1990	Grab (liner)	40.5-41	<2.5	<0.005	<0.005	<0.005	<0.005	NM	133
P1	P1, 49.7-50.3	19 October 1990	Grab (liner)	49.7-50.3	<2.5	<0.005	<0.005	<0.005	<0.005	NM	1-39
P2	P2, 20.5-21	19 October 1990	Grab (liner)	20.5-21	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
P2	P2, 30-30.5	19 October 1990	Grab (liner)	30-30.5	20	0.018	<0.005	<0.005	0.013	<10	276-296
P2	P2, 35.5-36	19 October 1990	Grab (liner)	35.5-36	95	0.21	0.20	0.14	0.33	<10	328-422
P2	P2, 55.5-56	19 October 1990	Grab (liner)	55.5-56	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
P3	P3, 35.5-36	18 March 1991	Grab (liner)	35.5-36	990	5.8	24	11	20	NM	69-132
P3	P3, 40.5-41	18 March 1991	Grab (liner)	40.5-41	<1	<0.005	<0.005	<0.005	<0.005	NM	<1
M1	M1, 20.5-21	20 October 1990	Grab (liner)	20.5-21	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
M1	M1, 25.5-26	20 October 1990	Grab (liner)	25.5-26	<2.5	<0.005	<0.005	<0.005	<0.005	<10	2
M1	M1, 35.5-36	20 October 1990	Grab (liner)	35.5-36	82	<0.005	0.019	0.028	0.026	<10	86-294
M1	M1, 45.5-46	20 October 1990	Grab (liner)	45.5-46	<2.5	<0.005	<0.005	<0.005	<0.005	<10	<1
M2	M2, 26-26.5	18 April 1991	Grab (liner)	26-26.5	1.3	0.32	<0.005	0.04	0.036	NM	18-19
M2	M2, 31-31.5	18 April 1991	Grab (liner)	31-31.5	490	<0.005	0.41	3.4	7.5	NM	95-138
M2	M2, 36-36.5	18 April 1991	Grab (liner)	36-36.5	33	<0.005	0.072	0.099	0.094	NM	135-151
M2	M2, 41-41.5	18 April 1991	Grab (liner)	41-41.5	25	0.17	0.079	0.13	0.12	NM	112-116
M2	M2, 46-46.5	18 April 1991	Grab (liner)	46-46.5	<1	<0.005	<0.005	<0.005	<0.005	NM	<1

General Notes

(a) < denotes parameter below detection limits

(b) NM = not measured

(c) Laboratory analyses by Chromalab, San Ramon CA

(d) Field screening results represent measurements obtained from the ends of the liner retained for testing. Where only one measurement is cited in the table, either one measurement was performed or both measurements were identical. Field screening was performed with a Thermo Environmental Instruments, Model 580B, 10.0 eV photoionization detector, calibrated to 100 ppm v/v isobutylene.

Table 3

Laboratory Analytical Methods

Matrix	Sample Type	Analyte	Method	Method Summary	Equipment	Typical Detection Limits
Soil	Grab (liner)	Total Petroleum Hydrocarbons as Gasoline	Extraction by EPA Method 5030, analysis by GCFID	Purge and trap followed by injection of purged vapor into gas chromatograph equipped with flame ionization detector.	Tekmar model 700 purge and trap device. Varian model 3700 gas chromatograph. Varian Vista model 6000 flame ionization detector.	2.5 mg/kg
		Benzene, Toluene, Xylenes, and Ethylbenzene	EPA Method 8020	Purge and trap followed by direct injection of purged vapor into gas chromatograph equipped with photo ionization detector. Dilution with methanol as required.	Tekmar model 700 purge and trap device. Varian model 3700 gas chromatograph. Tracor model 700 photoionization detector.	0.005 mg/kg
		Oil & Grease	SM 5520 D & F	Weigh sample, extract with Freon, boil extract and weigh residue.	Mettler balance	10 mg/kg
Groundwater	Grab (bailer equipped with bottom emptying device)	Total Petroleum Hydrocarbons as Gasoline	Extraction by EPA Method 5030, analysis by GCFID	Purge and trap followed by injection of purged vapor into gas chromatograph equipped with flame ionization detector.	Tekmar model 700 purge and trap device. Varian model 3700 gas chromatograph. Varian Vista model 6000 flame ionization detector.	50 µg/l
		Benzene, Toluene, Xylenes, and Ethylbenzene	EPA Method 602	Purge and trap followed by direct injection of purged vapor into gas chromatograph equipped with photo ionization detector. Dilution with methanol as required.	Tekmar model 700 purge and trap device. Varian model 3700 gas chromatograph. Tracor model 700 photoionization detector	0.5 µg/l

General Notes

(a) Laboratory analyses by Chromalab, San Ramon CA

Table 4

Groundwater Elevation Measurements

Location	B10		B11		M1		M2		P1		P2		P3	
Measuring Point	Ground Surface-N Side, Elevation 998.6		Ground Surface-N Side, Elevation 997.8		Top of PVC Casing-N Side, Elevation 1,000.0 (Ground Surface-N Side, Elevation 1,000.3)		Top of PVC Casing-N Side, Elevation 999.6 (Ground Surface-N Side, Elevation 999.9)		Top of PVC Casing-N Side, Elevation 999.6 (Ground Surface-N Side, Elevation 999.8)		Top of PVC Casing-N Side, Elevation 997.8 (Ground Surface-N Side, Elevation 998.1)		Top of PVC Casing-N Side, Elevation 999.1 (Ground Surface-N Side, Elevation 999.3)	
	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation
Intercepted Interval	0.0 to 50.0	948.6 to 998.6	0.0 to 51.5	946.3 to 997.8	32.5 to 45.9	954.4 to 967.8	35 to 45	954.9 to 964.9	27.5 to 38.8	961.0 to 972.3	33 to 43	955.1 to 965.1	35 to 45	964.3 to 954.3
18 October 1990 (18:45 hrs)	45.6	953	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
19 October 1990 (10:00 hrs)	37.8	960.8	32.0	965.8	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
19 October 1990 (13:20 hrs)	37.2	961.4	31.6	966.2	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
20 October 1990 (8:00 hrs)	35.0	963.8	32.2	965.6	NM	NM	NM	NM	38.0 (1)	961.8 (1)	NM	NM	NM	NM
21 October 1990 (9:00 hrs)	34.5	964.1	32.4	965.4	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
24 October 1990	NM	NM	NM	NM	36.1	963.9	NM	NM	37.9	961.7	41.1	956.7	NM	NM
25 October 1990	NM	NM	NM	NM	36.1	963.9	NM	NM	38.0	961.6	40.6	957.2	NM	NM
2 November 1990 (2)	NM	NM	NM	NM	36.4	963.6	NM	NM	38.4	961.2	38.4	959.4	NM	NM
6 November 1990	NM	NM	NM	NM	36.8	963.2	NM	NM	38.7	960.9	37.0	960.8	NM	NM
16 November 1990	NM	NM	NM	NM	36.8	963.2	NM	NM	38.3	961.3	37.4	960.4	NM	NM
23 November 1990	NM	NM	NM	NM	36.9	963.1	NM	NM	38.1	961.5	35.9	961.9	NM	NM
28 November 1990	NM	NM	NM	NM	37.0	963.0	NM	NM	38.3	961.3	35.4 (3)	962.4 (3)	NM	NM
5 December 1990	NM	NM	NM	NM	37.2	962.8	NM	NM	38.2	961.4	35.0 (3)	962.8 (3)	NM	NM
18 March 1991	NM	NM	NM	NM	35.8	964.2	NM	NM	37.8	961.8	31.4 (3)	966.4 (3)	NM	NM
29 March 1991	NM	NM	NM	NM	32.4	967.6	NM	NM	36.9	962.7	28.2 (3)	969.6 (3)	24.7	974.4
3 April 1991	NM	NM	NM	NM	31.9	968.1	NM	NM	36.8	962.8	26.8 (3)	971.0 (3)	25.1	974.0
9 April 1991	NM	NM	NM	NM	31.6	968.4	NM	NM	36.9	962.7	26.5 (3)	971.3 (3)	25.9	973.2
16 April 1991	NM	NM	NM	NM	31.2	968.8	NM	NM	36.7	962.9	26.5 (3)	971.3 (3)	26.2	972.9
18 April 1991	NM	NM	NM	NM	31.1	968.9	NM	NM	36.8	962.8	26.5 (3)	971.3 (3)	26.2	972.9
30 April 1991	NM	NM	NM	NM	31.1	968.9	31.1 (3)	968.5 (3)	36.3	963.3	26.7 (3)	971.1 (3)	26.8	972.3
7 May 1991	NM	NM	NM	NM	31.2	968.8	31.3 (3)	968.3 (3)	36.2	963.4	27.0 (3)	970.8 (3)	27.4	971.7

General Notes

(a) Measurements in units of feet

(b) Elevations relative to site specific datum - Temporary Bench Mark No. 1, top of concrete at west corner of northernmost pump island, assumed elevation = 1,000.00 feet

(c) NM = not measured

(d) For borings B10 and B11, water level depths measured relative to ground surface. The remaining water level depths measured relative to casing, except as footnoted.

Footnotes

(1) Measured relative to ground surface prior to surveying of PVC casing

(2) An interface probe was used to discern whether free product was present - free product was not detected with the probe

(3) A petroleum odor and/or coating was observed on the water level probe

Table 5

Piezometer and Well Completion Data

No.	Date of Installation	Installed By	Installation Method	Measuring Point Description	Measuring Point Elevation (feet)	Ground Surface Elevation (feet)	Sealed Depths (feet)	Total Boring Depth (feet)	Total Casing Length (feet)	Casing Diameter (inches)	Typical Static Groundwater (feet)		Filter Pack Interval (feet)		Screened Casing Interval (feet)		Blank Casing Interval (feet)		Screen Material
											Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	
M1	20-21 October 1990	Geo Drill Exploration	Hollow Stem Auger	Top PVC Casing, N Side	1,000.0	1,000.3	32.5 to Surface	45.9	44.2	2	37.3	963	32.5 to 45.9	954.4 to 967.8	44.5 to 34.5	955.8 to 965.8	34.5 to 0.3	965.8 to 1,000.0	SCH 40 PVC 0.010-inch slots
M2	18 April 1991	Bayland Drilling	Hollow Stem Auger	Top PVC Casing, N Side	999.6	999.9	32.8 to Surface	45.0	44.5	2	31.3	968.3	32.8 to 45.0	954.9 to 967.1	44.8 to 34.8	955.1 to 965.1	34.8 to 0.3	965.1 to 999.6	SCH 40 PVC 0.010-inch slots
P1	19 October 1990	Geo Drill Exploration	Hollow Stem Auger	Top PVC Casing, N Side	999.6	999.8	50 to 38.8 and 27.5 to Surface	50	38.7	2	38.2	961.6	27.5 to 38.8	961.0 to 972.3	38.9 to 28.9	960.9 to 970.9	28.9 to 0.2	970.9 to 999.8	SCH 40 PVC 0.010-inch slots
P2	20-21 October 1990	Geo Drill Exploration	Hollow Stem Auger	Top PVC Casing, N Side	997.8	998.1	60 to 42.2 and 29 to Surface	61	42.2	2	35.3	962.8	29.0 to 42.4	955.7 to 969.1	42.5 to 32.5	955.6 to 965.6	32.5 to 0.3	965.6 to 998.1	SCH 40 PVC 0.010-inch slots
P3	18 March 1991	Bayland Drilling	Hollow Stem Auger	Top PVC Casing, N Side	999.1	999.3	32.8 to Surface	45.0	44.6	2	27.4	971.7	32.8 to 45.0	954.3 to 966.5	44.8 to 34.8	954.5 to 964.5	34.8 to 0.2	964.5 to 999.1	SCH 40 PVC 0.010-inch slots

General Notes

(b) Elevations relative to site specific datum - Temporary Bench Mark No. 1, top of concrete at west corner of northernmost pump island, assumed elevation = 1,000.00 feet

(b) Depths measured relative to ground surface

Table 6

Well and Piezometer Development Information

Location	Development Method	Prior to Development								After Development								
		Static Depth to Water (feet)	Total Depth (feet)	Date	Time	Specific Conductance (µmhos/cm^2 at field temperature)	pH	Temperature (degrees Fahrenheit)	Water Description	Static Depth to Water (feet)	Total Depth (feet)	Date	Time	Approximate Volume Removed (gallons)	Specific Conductance (µmhos/cm^2 at field temperature)	pH	Temperature (degrees Fahrenheit)	Water Description
M1	Surge and Bail	36.4	44.5	25 October 1990	18:30	NM	NM	NM	Translucent to opaque, brown	39.2	NM	25 October 1990	20:10	4	NM	NM	NM	Translucent, brown
M2	Surge and Bail	31.1	45.0	30 April 1991	13:30	2,710	8.05	75.9	Clear, light brown, petroleum odor	31.9	NM	30 April 1991	14:30	11	2,620	7.35	75.0	Cloudy, light brown, silty, petroleum odor
M2 (development prior to sampling)	Surge and Bail	31.3	44.9	7 May 1991	12:20	2,360	7.2	78.4	Clear, light brown, petroleum odor	NM	NM	7 May 1991	13:30	5	2,820	7.27	78.4	Slightly cloudy, colorless, petroleum odor
P1	Surge and Bail	38.2	38.9	25 October 1990	19:00	NM	NM	NM	Opaque, brown, slight petroleum odor	38.4	NM	25 October 1990	20:10	1	NM	NM	NM	Translucent to opaque, brown, slight petroleum odor
P2	Surge and Bail	40.9	42.2	25 October 1990	19:30	NM	NM	NM	Opaque, brown, petroleum sheen and odor	41.9	NM	25 October 1990	20:10	2.5	NM	NM	NM	Translucent to opaque, brown, petroleum sheen and odor
P2 (development prior to sampling)	Surge and Bail	37.3	42.2	6 November 1990	8:15	8,750	12.28	60.1	Cloudy, light brown, petroleum sheen and odor	41.1	43	6 November 1990	9:40	2.9	13,650	12.61	61 5	Clear, light brown, petroleum sheen and odor

General Notes

(a) Depths measured relative to ground surface

(b) NM = not measured

Table 7

Groundwater Purging and Sampling Information

Location	Sample Designation	Sample Date	Sample Time	Type of Sample	Specific Conductance (µmho/cm² at field temperature)	pH	Temperature (degrees F)	Purge Method	Purge Duration (minutes)	Volume Purged (gallons)	Static Casing Volumes Removed	Comments
P2	P2	6 November 1990	9:40	Grab (bailer)	13,650	12.6	61.5	Bailer	85	2.9	±3	Well was dewatered twice during purging and allowed to recover to approximately 75% of the original standing water height prior to sample collection
M2	M2	7 May 1991	13:30	Grab (bailer)	2,820	7.3	78.4	Bailer	70	5.0	±2.3	

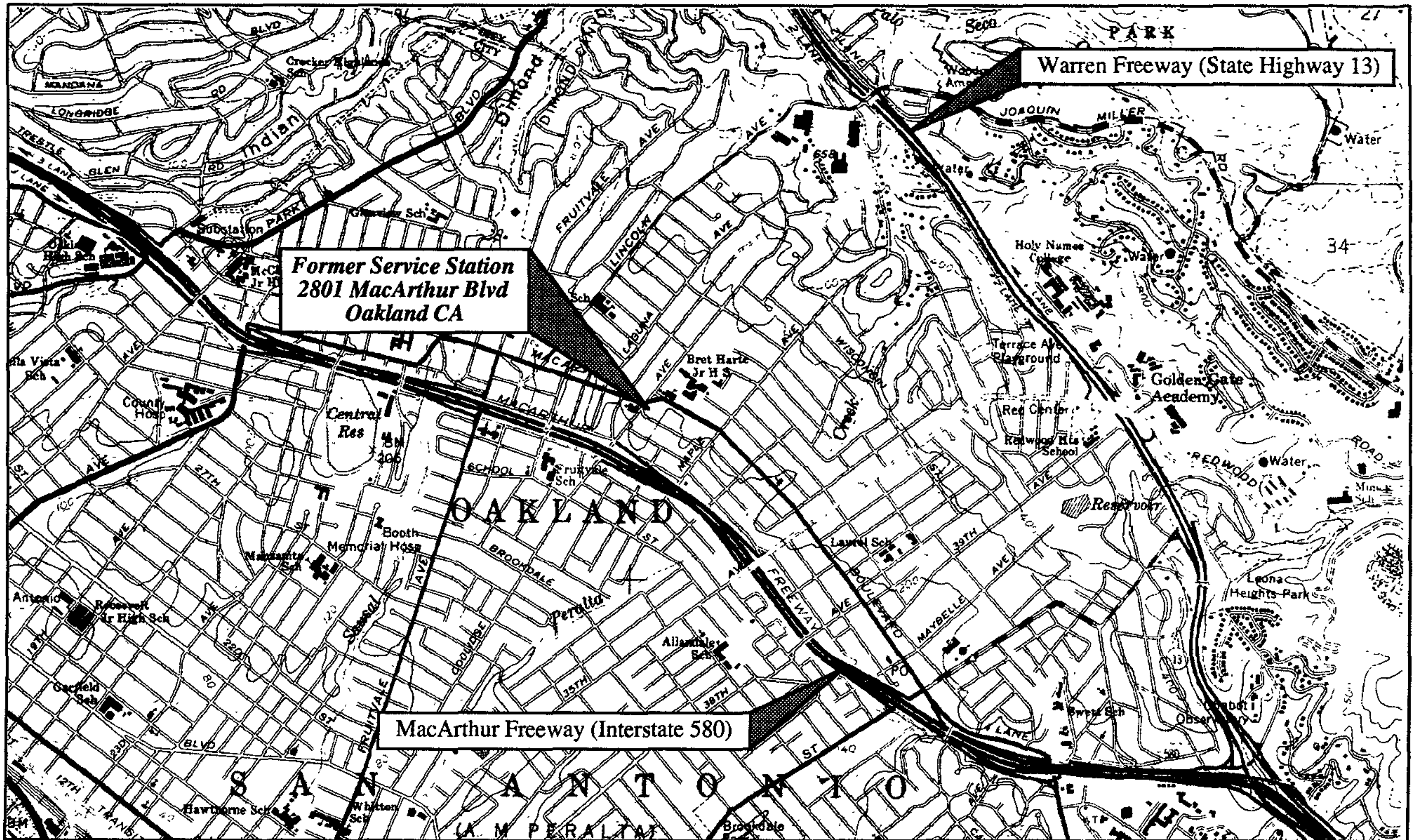
Table 8

Results of Groundwater Analyses

Sample Location	Sample Designation	Sample Date	Sample Collection Method	Total Petroleum Hydrocarbons As Gasoline (µg/l)	Benzene (µg/l)	Toluene (µg/l)	Ethyl-benzene (µg/l)	Xylenes (µg/l)	Comments
P2	P2	6 November 1990	Purge and Sample with Bailer	33,000	4,700	2,100	380	630	Elevated specific conductance and pH were measured during sampling. These elevated measurements reflect the effect of grout seal abutting the base of the filter-pack.
M2	M2-GW1	7 May 1991	Purge and Sample with Bailer	16,000	1,300	950	170	890	
EPA Maximum Contaminant Level				Not Promulgated	5	2,000	700	10,000	Drinking water criteria based on health risks, available control and treatment technologies, and cost

General Note

(a) Laboratory analyses by Chromalab, San Ramon CA



Basemap Reference: U.S. Geological Survey, 7.5 Minute Topographic Quadrangle, Oakland East CA, 1959 (photorevised 1980)

0 0.5 1.0

Approximate Scale in Miles

0 5,000

Approximate Scale in Feet

N

Figure 1

Location Map

2801 MacArthur Boulevard
Oakland CA

STREAMBORN

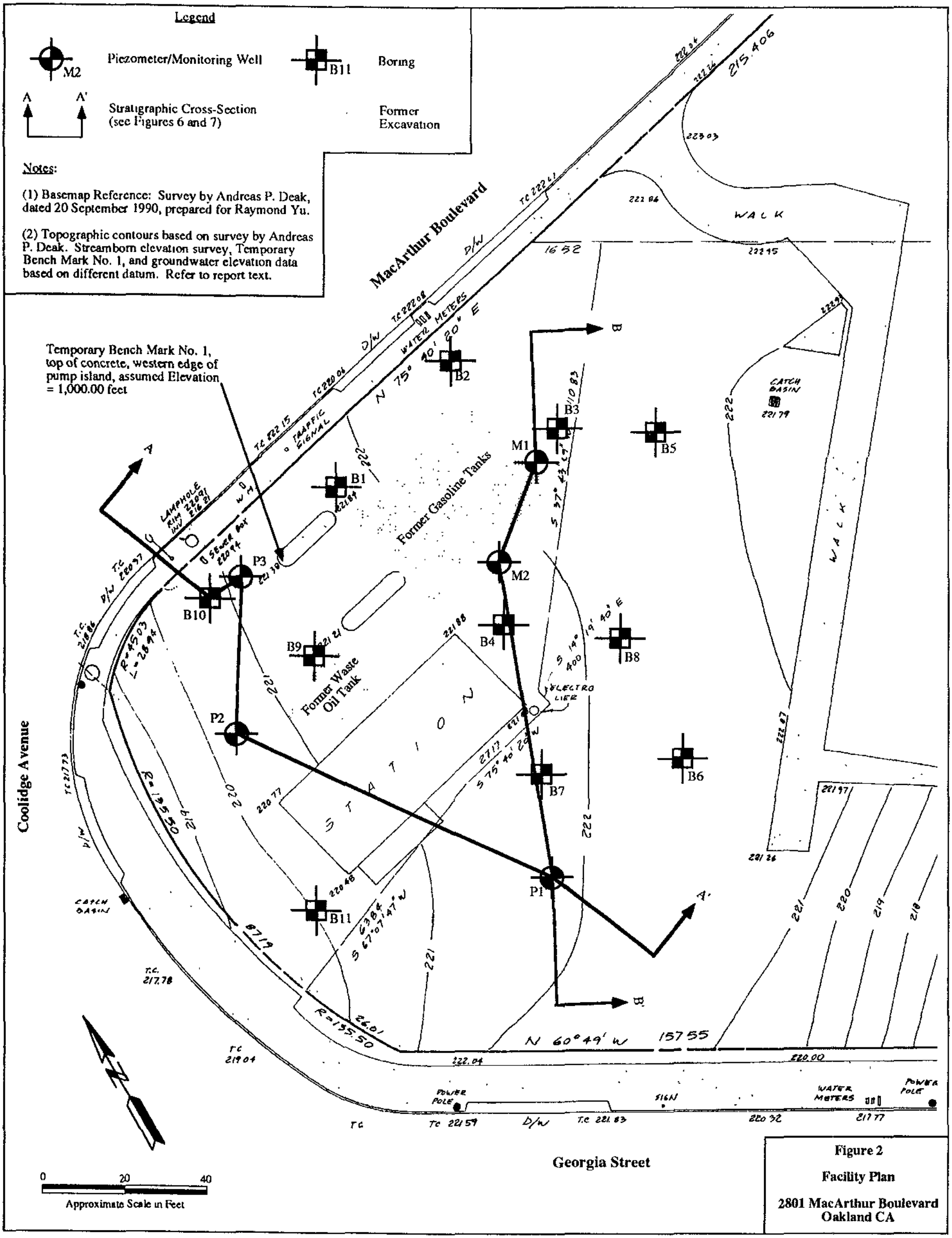


Figure 2

Facility Plan

2801 MacArthur Boulevard
Oakland CA

STREAMBORN

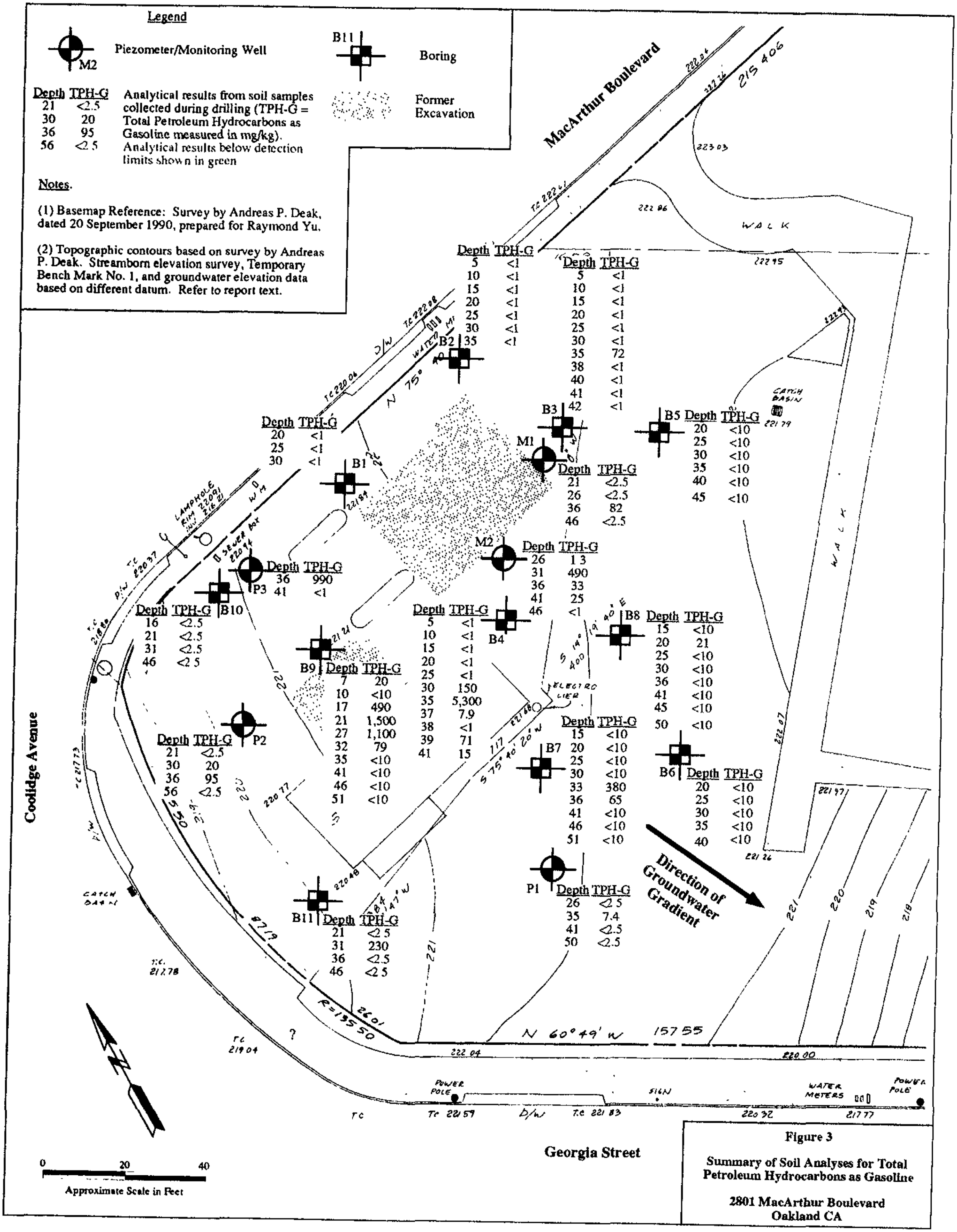


Figure 3

Summary of Soil Analyses for Total Petroleum Hydrocarbons as Gasoline

2801 MacArthur Boulevard
Oakland CA

STREAMBORN

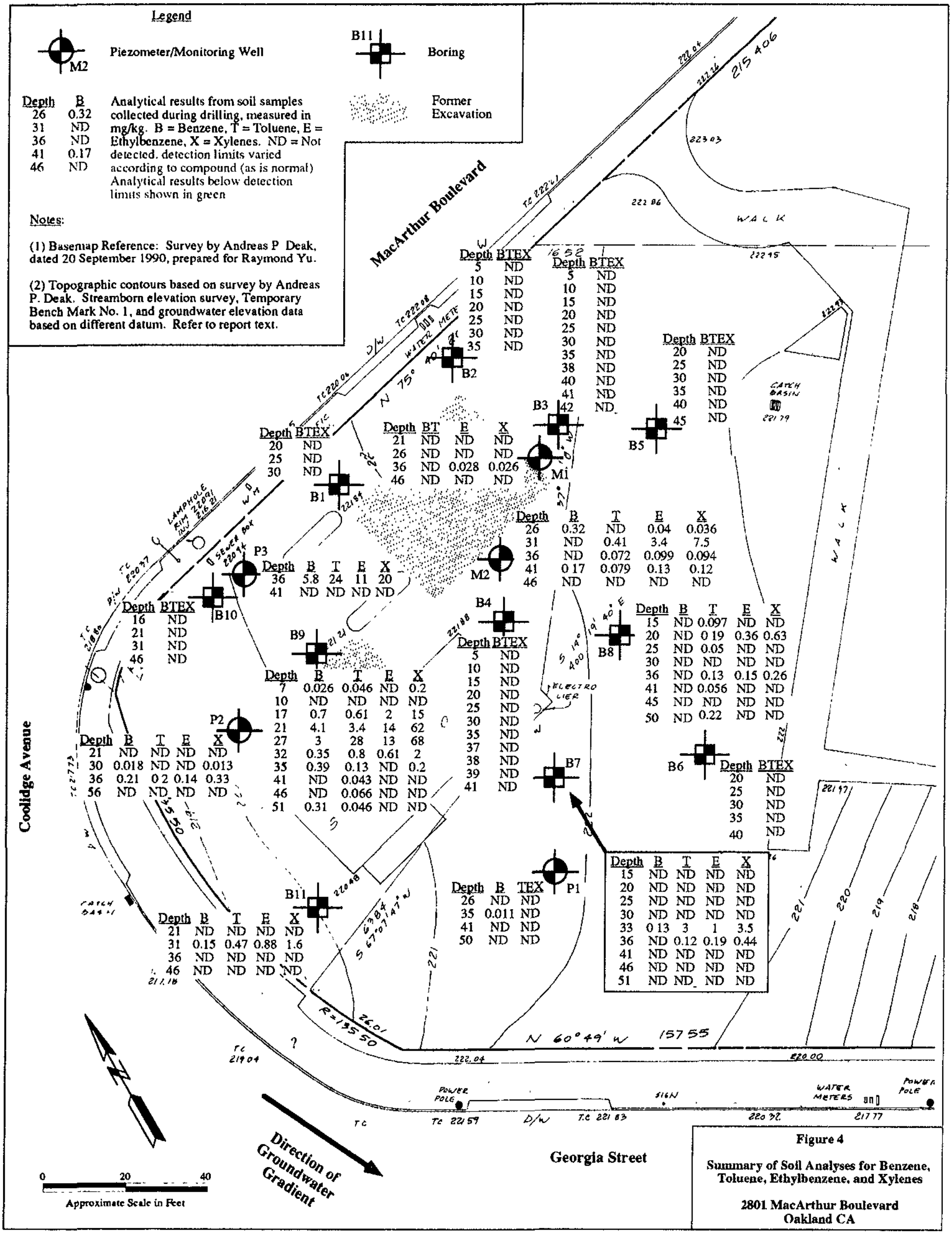


Figure 4

Summary of Soil Analyses for Benzene, Toluene, Ethylbenzene, and Xylenes

2801 MacArthur Boulevard
Oakland CA

STREAMBORN

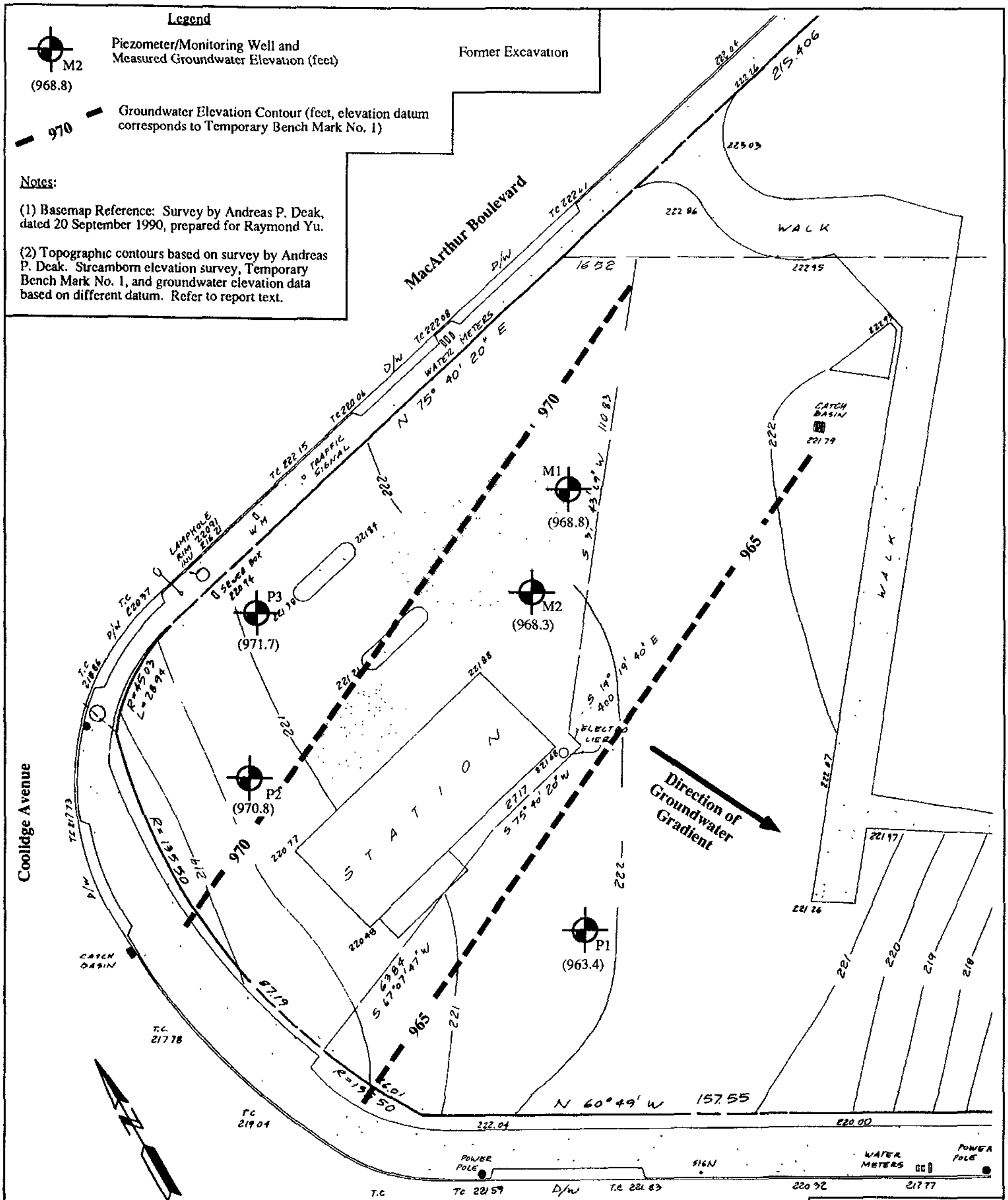
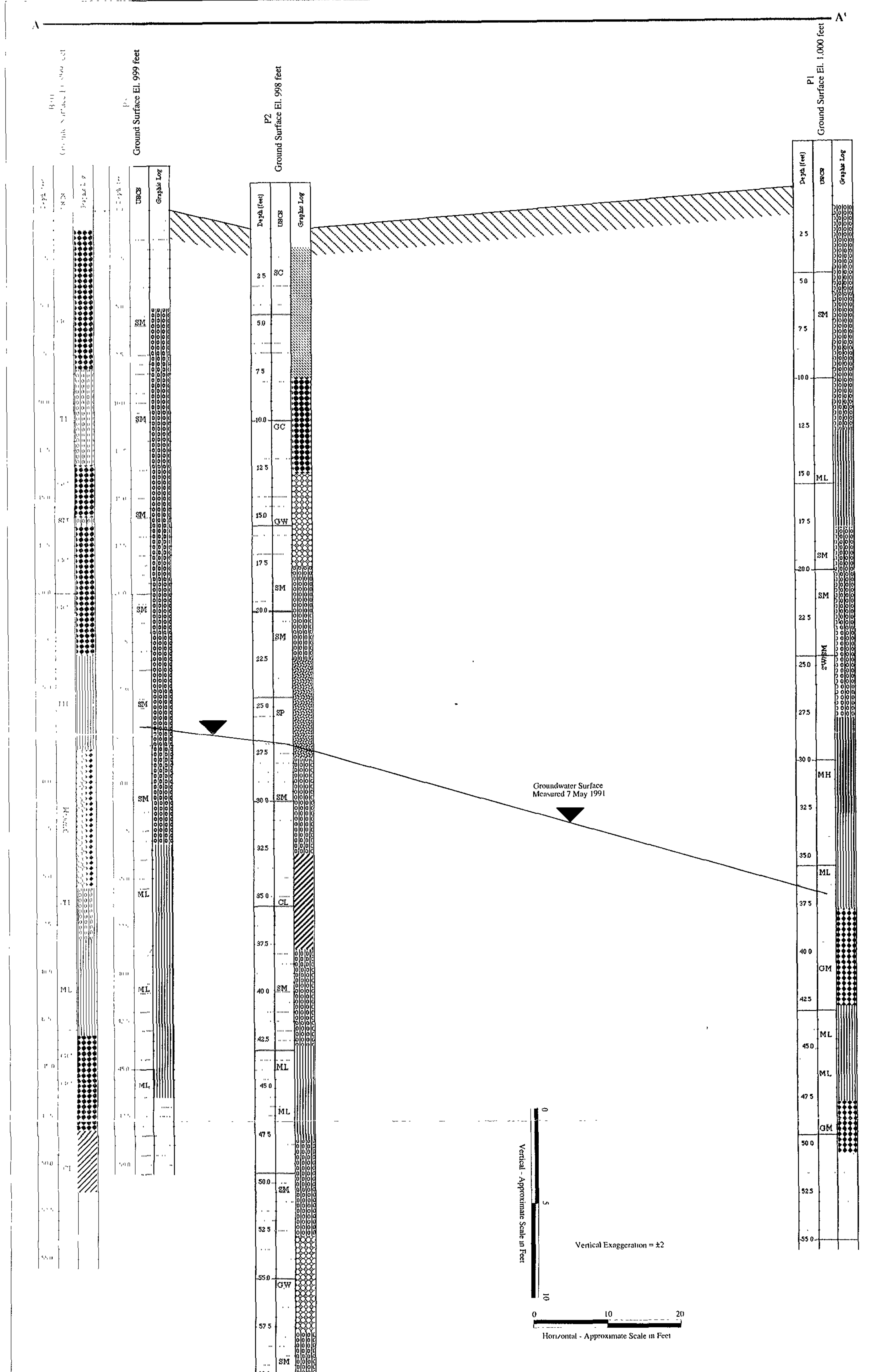


Figure 5

Groundwater Elevations (7 May 1991)

2801 MacArthur Boulevard Oakland CA



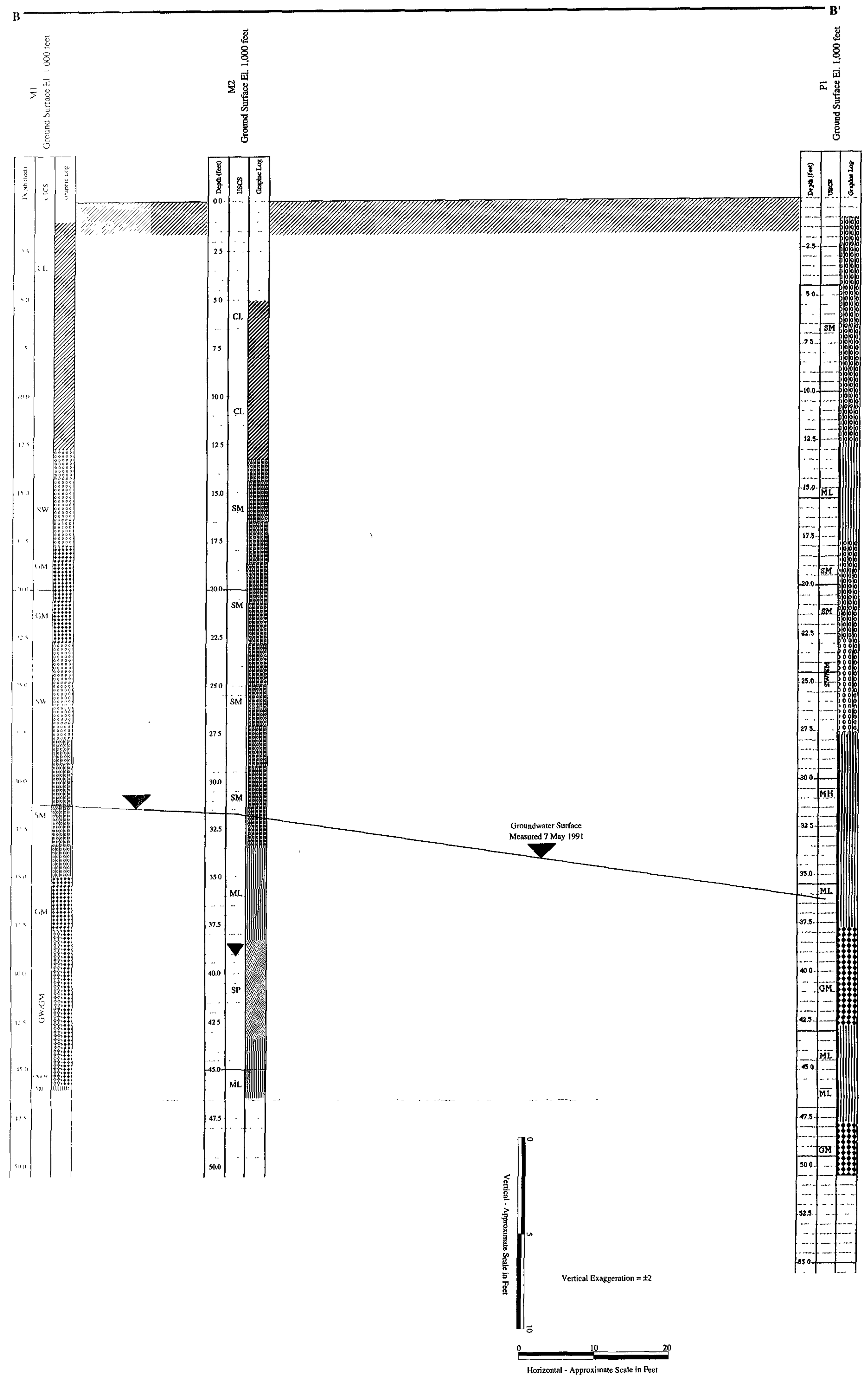
Note:

(1) Elevations on this cross-section corresponds to Streamborn elevation survey, which is based on Temporary Bench Mark No 1. Topographic contours on Figures 2-5 correspond to survey by Andreas P Deak which is based on a different datum. Refer to report text.

Figure 6

Cross-Section A-A'

2801 MacArthur Boulevard
Oakland CA



Note:

(1) Elevations on this cross-section corresponds to Streamborn elevation survey, which is based on Temporary Bench Mark No 1. Topographic contours on Figures 2-5 correspond to survey by Andreas P.

Figure 7

Cross-Section B-B'

2801 MacArthur Boulevard

APPENDIX A

Boring Logs and Completion Diagrams

BORING LOG LEGEND AND NOTES

Soil Classification

Soils were classified in the field in approximate accordance with ASTM D 2488-84 (Standarc Practice for Description and Identification of Soils, Visual-Manual Procedure). Textural classifications represent the opinion of the field geologist or field engineer regarding the character of encountered materials. Laboratory classification tests were not performed to verify the field classifications. In general, mixtures of soil types and gradual transitions between soil types may more accurately represent the subsurface materials, instead of the distinct divisions depicted on the logs.

Textural Classification

CL: Sandy Clay,

MH: Inorganic Silt

ML: Sandy Silt

SM: Silty Sand

SW: Well-graded Sand

SC: Clayey Sand

SP: Poorly-graded Sand

GC: Clayey Gravel

GM: Silty Gravel

GW: Well-graded gravel, Well graded Gravel with Sand

— — — Approximate location of gradational transition or inferred contact between soil types

——— Approximate location of observed soil transition

Sample Symbol

Sample from this depth interval retained in brass liner and shipped to the laboratory for possible testing

General Notes

(a) NR indicates information not recorded

(b) Soil samples were collected by driving a 2-inch ID by 18 inch long split-spoon using a 140-pound weight

(c) Percentages of textural classes (sand, gravel, etc.) cited on logs are approximate

(d) Graphic log symbols are extrapolated beyond sample boundaries

(e) OVM (ppm) = Measurement by field organic vapor monitor in ppm volume/volume. Measurements performed using Thermo Environmental Instruments Model 580B OVM, 10.0 eV photoionization detector, calibrated to 100 ppm v/v isobutylene. Measurements performed by screening the ends of the freshly retrieved liners

(f) Depths measured from ground surface

Boring Log for B10 (page 1 of 3)

Project	Soil and Groundwater Investigation Former Gasoline Station Oakland CA	Address	2801 MacArthur Boulevard Oakland CA 94602
Location	North of easternmost canopy support adjacent to sidewalk along MacArthur Boulevard	Project No.	P12A
Elevation	Ground surface = 998.6 feet (surveyed)	Logged By	Greg Reller, Streamborn, Berkeley
Start	9:00, 18 October 1990	Finish	13:30, 18 October 1990
Completion	Sealed with cement grout containing ±5% bentonite powder	Driller	Geo Drill Exploration, Berkeley CA
Drill Method/Rig	±4-inch ID by ±8-inch OD hollow-stem auger/Mobile B61	Total Depth	±51.5 feet
Sampling	±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.	Groundwater	±34.5 feet below ground surface (measured in uncased hole open for 2 days after drilling)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
					Asphalt concrete pavement and aggregate base to ±1-foot depth	
2.5						
5.0				7	Clayey Gravel, clasts (metamorphic and igneous) are deeply weathered	NR
	GC			12	and difficult to distinguish from matrix, dry, red-brown, matrix is firm,	<1
				14	matrix also contains medium subangular sand	NR
7.5						
10.0				10	Silty Sand, ±75% very fine to coarse subangular to subrounded sand	<1
	SM			15	bound in silt matrix, firm, dry, red-brown, sand is mostly serpentinite	NR
				21	and phyllite, matrix is slightly plastic	NR
12.5						
	GC					
15.0				19	Clayey Gravel (as above)	
				43		<1
	SM			25	Silty Sand (as above)	NR
					Clayey Gravel, clasts (metamorphic and igneous) are deeply weathered	NR
17.5					and difficult to distinguish from matrix, dry, red-brown, matrix is	
					firm, matrix also contains medium subangular sand, soil fractures	
	GC				around large clasts, clasts are mantled with black oxide	
20.0						

Boring Log for B10 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
	GC		X	24 32 50	Clayey Gravel, mostly chert clasts, moist, red-brown with greenish mottling, matrix is firm, matrix also contains medium subangular sand, gasoline odor	1 47 3
22.5						
25.0	ML		X	15 27 33	Sandy Silt, ±25% very fine to fine sand, ±10% medium to coarse subround sand, trace of pea-gravel (chert), gray-green with rust-orange mottling, faint gasoline odor, black organic material in lower 3-inches occurs in lensoid clasts	18 22 12
27.5						
30.0	GW/GM		X	20 31 50/4"	Well-graded Gravel with Silt and Sand, abundant coarse subangular to subrounded pebbles bound in silty sand matrix (very fine sand containing ±35% silt), moist, matrix is firm, rust-orange to red-brown with dendritic greenish zones	31 4.5 <1
32.5						
35.0				19	Well-graded Gravel with Silt and Sand (as above)	<1
	SM		X	26 34	Silty Sand, moist, hard, trace of subangular to subrounded pea-gravel, red-brown with rust orange mottling associated with black organic clasts, hackly fracture	6 2
37.5						
40.0	ML		X	27 37 42	Sandy Silt, ±30% very fine to fine sand, ±15% black subrounded coal fragments, dry, hard, red-brown with sparse pale green mottling, slight gasoline odor in lower 6-inches	2 2 <1
42.5						
	GC				Refer to next page	
45.0						

Boring Log for B10 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
	GC		X	23	Clayey Gravel, fine to coarse subround to round gravel (chert, shale,	<1
				58	and serpentine) bound in hard sandy clay matrix, ±5% coal clasts,	<1
				54	moist, red-brown	<1
47.5						
50.0	CL		X	20	Sandy Clay, ±10% sand and fine gravel, moist, hard, red-brown, clasts	<1
				31	coated with black oxide mineral, subvertical blocky fracture with shiny	<1
				47	surfaces	<1
52.5					Total depth of boring = 51.5 feet	
					Groundwater not observed during drilling	
55.0						
57.5						
60.0						
62.5						
65.0						
67.5						
70.0						

Boring Log for B11 (page 1 of 3)

Project	Soil and Groundwater Investigation Former Gasoline Station Oakland CA	Address	2801 MacArthur Boulevard Oakland CA 94602
Location	North of building	Project No.	P12A
Elevation	Ground surface = 997.8 feet (surveyed)	Logged By	Greg Reller, Streamborn, Berkeley
Start	15:30, 18 October 1990	Finish	19:30, 18 October 1990
Completion	Sealed with cement grout containing ±5% bentonite powder	Driller	Geo Drill Exploration, Berkeley CA
Drill Method/Rig	±4-inch ID by ±8-inch OD hollow-stem auger/Mobile B61	Total Depth	±51.5 feet
Sampling	±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.	Groundwater	32.4 feet below ground surface (measured in uncased hole open for 2 days after drilling)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
					Asphalt concrete pavement and aggregate base to ±1-foot depth	
2.5						
5.0				5	Gravelly Clay, ±10% subangular to subrounded medium sand to	<1
				12	medium gravel bound in clay matrix, dry, hard, red-brown, shiny	<1
			X	17	subvertical fractures	NR
7.5	CL					
10.0				7	Sandy Clay, ±30% fine sand, trace medium subangular gravel, ±10%	<1
			X	17	coal clasts, moist, hard, red-brown, hackly fracture	<1
				27		NR
12.5						
15.0				9	Sandy Clay, as above, sand increases to base and soil is clayey sand at	<1
				17	base, pale greenish mottling	<1
			X	24		6
	GC				Clayey Gravel (similar to gravelly clay described above), ±70% subround to round pea gravel	
17.5						
	CL				Refer to next page	
20.0						

Boring Log for B11 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
				17	Sandy Clay, ±20% medium to coarse subangular sand, trace subangular	<1
			X	32	to subrounded pea-gravel, ±10% coal chips, moist, hard, red brown,	<1
				53	poor subvertical fracture	NR
22.5						
	CL					
25.0						
				13	Sandy Clay, ±20% very fine sand, red-brown with gray-green mottling	150
			X	23	along subvertical anastomozing fractures, black oxide mineral along	150
			X	35	fractures, gasoline odor from drive shoe	60
27.5						
30.0						
				32	Well graded Sand with Gravel, medium to coarse subangular sand and	320
	SW		X	34	subangular to subround pea gravel, moist, red-brown with pale green	430
			X	34	mottling, cross and horizontally stratified, sharp contacts between	420
					strata, strong gasoline odor	
32.5						
35.0						
				32	No Recovery	
	GM			33	Silty Gravel, fines to Silty Sand, at base, moist, hard, Red-brown,	225
			X	34	sparse rust orange mottling, trace of black (coal?) clasts	12
37.5						
					Hard drilling from 38 to 40 feet	
	SC					
40.0						
				22	Clayey Sand, 50% very fine to fine sand, ±10% medium to coarse	<1
				39	subangular sand, ±30% clay matrix, dry, hard, red-brown, ±10% black	<1
			X	65	(coal?) clasts	2
42.5						
					Refer to Next Page	
45.0						

Boring Log for B11 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
				22	Clayey Sand, as above, less black clasts, coarse subangular chert gravel	<1
	SC			35		<1
			⊠	49		<1
47.5						
	CL					
50.0				22	Sandy Clay, ±30% subangular to angular medium to coarse sand, trace	<1
				46	fine subangular pebbles, moist, hard, red-brown, plastic	<1
			⊠	81		<1
52.5					Total depth of boring = 51.5 feet	
					Groundwater not observed during drilling	
55.0						
57.5						
60.0						
62.5						
65.0						
67.5						
70.0						

Boring Log for P1 (page 1 of 3)

Project	Soil and Groundwater Investigation Former Gasoline Station Oakland CA	Address	2801 MacArthur Boulevard Oakland CA 94602
Location	±40 feet west of building	Project No.	P12
Elevation	Ground surface = 999.8 feet (surveyed)	Logged By	Greg Reller, Streamborn, Berkeley
Start	8:00, 19 October 1990	Finish	16:30, 19 October 1990
Completion	Piezometer with traffic-rated utility box at ground surface	Driller	Geo Drill Exploration, Berkeley CA
Drill Method/Rig	±4-inch ID by ±8-inch OD hollow-stem augers/Mobile B61	Total Depth	±50.5 feet
Sampling	±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.	Groundwater	±38 feet below ground surface (stabilized measurement after casing installed)

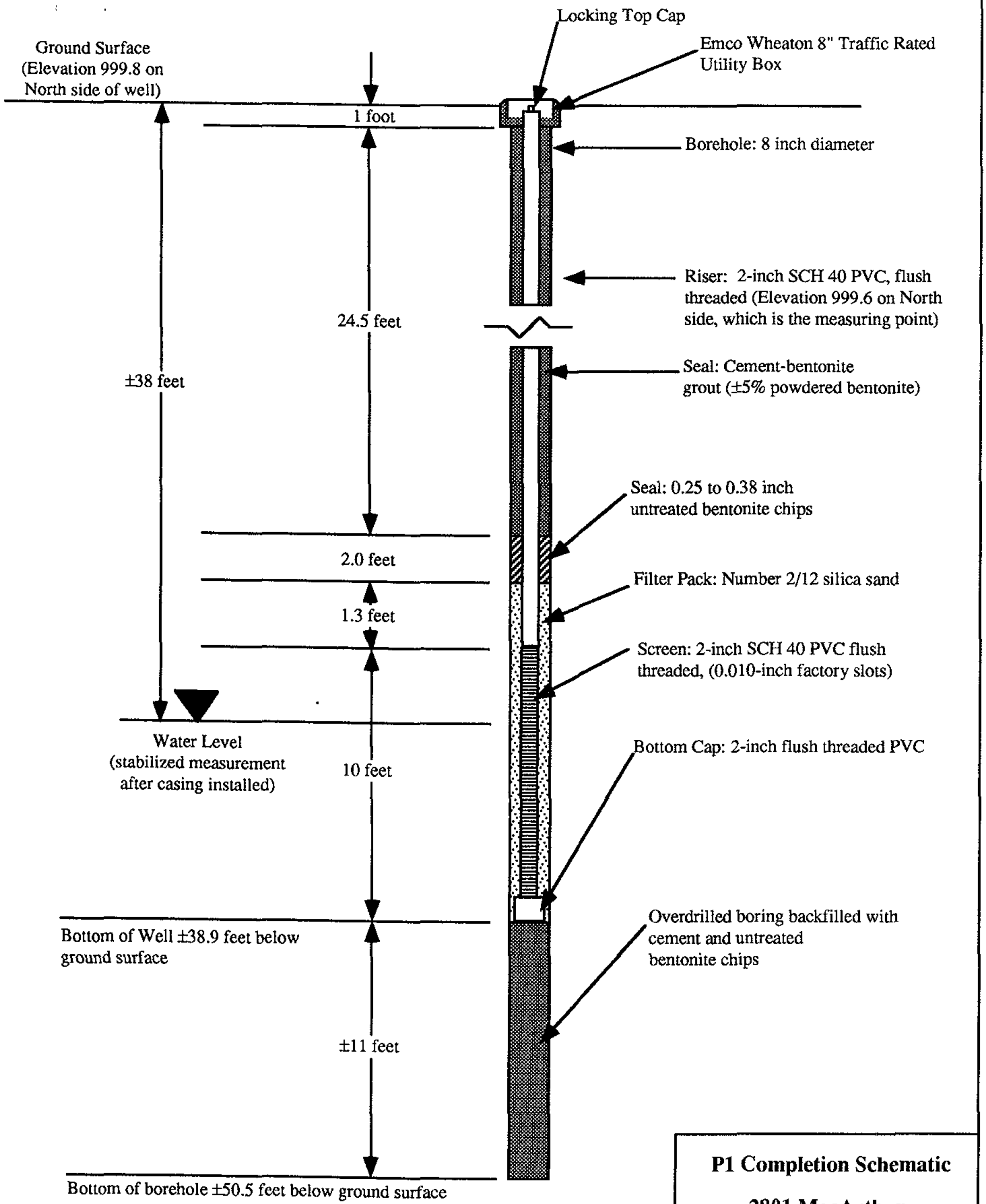
Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
					Asphalt concrete pavement and aggregate base to ±1-foot depth	
2.5						
5.0	SM			6	Slough	<1
			X	11	Silty Sand, ±70% fine to medium subangular sand, ±5% coarse	<1
				21	subround sand, bound in silt matrix (not plastic) moist, hard, red-brown, rootlet surrounded by gray-green mottling at ±5.2 feet	<1
7.5						
10.0				8	Silty Sand, as above, with medium to coarse subangular sand, ± 10%	<1
			X	15	fine subangular gravel, dendritic black rootlets, subvertical fracture	<1
				27	with black oxide coating	NR
12.5						
15.0	ML			9	Sandy Silt, ±25% fine to medium subangular to subrounded sand,	<1
			X	16	±10%black (coal?) clasts, slightly plastic, moist, hard, red-brown,	<1
				18	sparse pale green mottling, trace rootlets-associated with mottling	NR
17.5						
	SM				Refer to next page	
20.0				13		<1

Boring Log for P1 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
				22	Silty Sand, ±70% fine to coarse angular to subangular sand bound in	<1
			X	31	silt, trace fine subangular gravel, non-plastic fines, dry, red-brown,	NR
	SM				±5% black (coal?) clasts	
22.5						
	SW/SM					
25.0				14	Well graded Sand with Silt and Gravel, ±50% medium subangular sand	<1
				26	with abundant medium to coarse subangular gravel (metamorphic and	<1
			X	33	volcanic), dry, hard, red-brown, clasts are weathered and partially	NR
					decomposed, soil is bound with silt or clay matrix, trace of pale green	
					mottling	
27.5						
30.0				11	Silt, ±5% very fine sand, moist, hard, gray-green, rust-orange mot-	1
			X	18	tling, poor anastomozing subvertical fracture	<1
	MH			30		<1
32.5						
35.0				12	Sandy Silt, ±15% fine to coarse subangular sand (mostly quartz),	48
			X	24	moist, hard, red-brown, gray-green mottling along fractures and rootlet	50
	ML			32	tubes, gasoline odor	4
37.5						
40.0				14	Silty Gravel, subround to round fine to medium gravel (chert and	27
				31	volcanic) bound in sandy silt matrix, moist hard red-brown with green-	133
	GM		X	46	ish mottling, slight gasoline odor	NR
42.5						
					Refer to next Page	
	ML					
45.0				11		<1

Boring Log for P1 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
	ML		X	28 37	Sandy Silt, ±25% medium to coarse subangular sand, ±5% black (coal?) clasts, trace round medium gravel, dry, hard, red-brown, poor blocky fracture with shiny surfaces	<1
47.5						
	GM					
50.0			X	39 64/4.5"	Silty Gravel, subround medium gravel (volcanic and metamorphic) in sandy silt matrix, wet, soft, red brown	39
					Total depth of boring = ±50.5 feet Groundwater not observed during drilling	
52.5						
55.0						
57.5						
60.0						
62.5						
65.0						
67.5						
70.0						



P1 Completion Schematic

2801 MacArthur
Oakland CA

Boring Log for P2 (page 1 of 3)

Project	*Soil and Groundwater Investigation* Former Gasoline Station Oakland CA
Address	2801 MacArthur Boulevard Oakland CA 94602
Location	±40 feet west of building
Project No.	P12
Elevation	Ground surface = 998.1 feet (surveyed)
Logged By	Greg Reller, Streamborn, Berkeley
Start	16:00, 19 October 1990
Finish	14:00, 21 October 1990
Completion	Piezometer with traffic-rated utility box at ground surface
Driller	Geo Drill Exploration, Berkeley CA
Drill Method/Rig	±4-inch ID by ±8-inch OD hollow-stem augers/Mobile B61
Total Depth	±61 feet
Sampling	±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.
Groundwater	±35 feet below ground surface (stabilized measurement after casing installed)

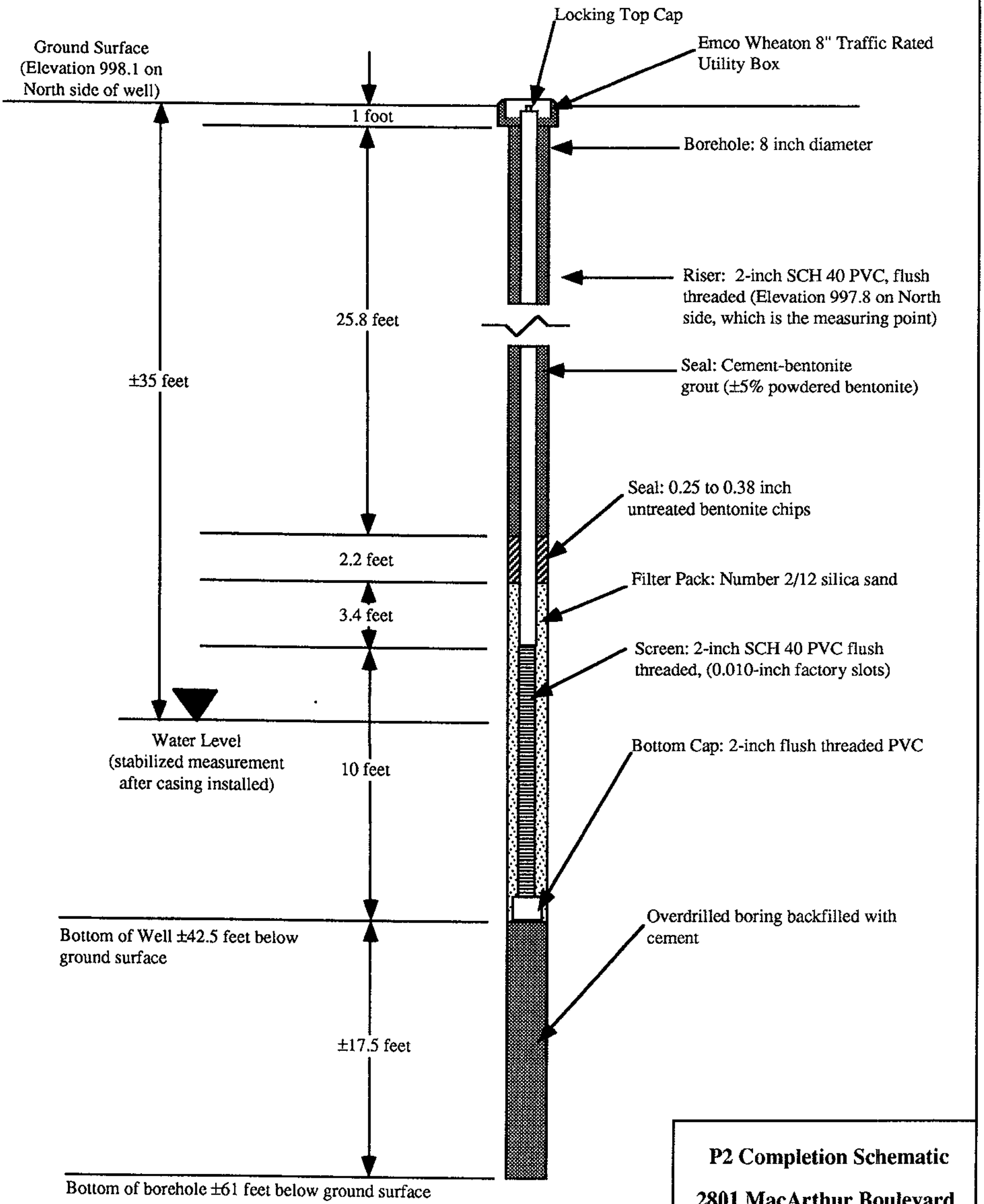
Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
					Asphalt concrete pavement and aggregate base to ±1 foot depth	
2.5	SC					
5.0				6	Clayey Sand, ±65% fine to coarse, subangular to subround sand bound	<1
			X	15	in silt matrix, ± 5% black (coal?) clasts, dry, hard, red-brown, trace	<1
				19	fine subangular pebbles	NR
7.5						
10.0				11	Clayey Gravel, fine to medium subangular to subrounded gravel bound	<1
	GC			18	in sandy clay matrix, ±5% black (coal?) clasts, moist, hard, red-brown	<1
			X	24		<1
12.5						
15.0				11	Sandy Gravel, as above, less gravel, better rounding, matrix is sand	<1
	GW		X	14	with trace of fines	<1
				23		<1
17.5						
	SM				Refer to next page	
20.0				12		NR

Boring Log for P2 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
	SM		X	19	Silty Sand, ±70% fine to medium subangular to subrounded sand, trace coarse subangular volcanic gravel, dry, hard, red-brown, clasts are bound in silt/clay matrix (matrix not plastic)	<1
				25		<1
22.5					Hard drilling at 22.5 feet	
25.0	SP		X	12	Sand, 95% fine sand, ±5% fines, moist, Gray-green with rust orange mottling, slight gasoline odor, coarsens to medium to coarse sand at 26 feet	9
				16		2
				27		3
27.5						
30.0	SM		X	NR	Silty Sand, very fine sand with abundant silt, Greenish with rust orange mottling around black (coal?) clasts, coarse silty gravel at base	276
						296
						230
32.5						
35.0	CL		X	11	Sandy Clay, ±20% very fine sand, moist, hard, plastic, red-brown and grayish green mottled, dendritic black rootlet molds, gasoline odor	228
				20		328
				22		422
37.5						
40.0	SM		X	11	Silty Sand, ±70% very fine to fine sand, trace coarse sand, hard, dry, red brown, greenish mottling around black (coal?) clasts	26
				40		16
				60		1
42.5						
	ML					
45.0				13		<1

Boring Log for P2 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
				25	Gravelly Silt, trace fine to coarse subangular gravel (volcanic and	32
				41	metamorphic), trace black (coal?) clasts, dry, hard, red-brown	2
	ML					
47.5						
50.0					Silty Sand, ±80% fine sand with silt matrix, trace fine subround gravel	4
	SM			NR	and black (coal?) clasts, dry, hard, red-brown	3
						2
52.5						
55.0				27	Gravel with Sand, fine to coarse subangular to subrounded gravel	1
	GW			42	(volcanic and metamorphic) bound in silty sand matrix, dry, firm, red-	<1
				53	brown,	NR
57.5						
	SM					
60.0				14	Silty Sand, ±10% silt, moist, firm, red-brown, drive shoe contained a	1
				34	thin gravelly sand layer with sharp boundaries, silty sand had pale	NR
				61	green motttling	<1
					Total depth of boring = 61 feet	
62.5					Groundwater not observed during drilling	
65.0						
67.5						
70.0						



P2 Completion Schematic

**2801 MacArthur Boulevard
Oakland CA**

Boring Log for P3 (page 1 of 3)

Project	Soil and Groundwater Investigation Former Gasoline Station Oakland CA	Address	2801 MacArthur Blvd. Oakland CA 94602
Location	Immediately west of canopy extending from service station building	Project No.	P26
Elevation	Ground surface = 999.3 feet (surveyed)	Logged By	Mark Buscheck, STREAMBORN, Berkeley
Start	8:00, 18 March 1991	Finish	13:00, 18 March 1991
Completion	Monitoring well with traffic-rated utility box at ground surface	Driller	Bayland Drilling, Menlo Park CA
Drill Method/Rig	±4-inch ID by ±8-inch OD hollow-stem auger/Mobile CME55	Drilled Depth	±45 feet
Sampling	±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.	Groundwater	±39 feet below ground surface (measurement on 18 March 1991, after casing installed)

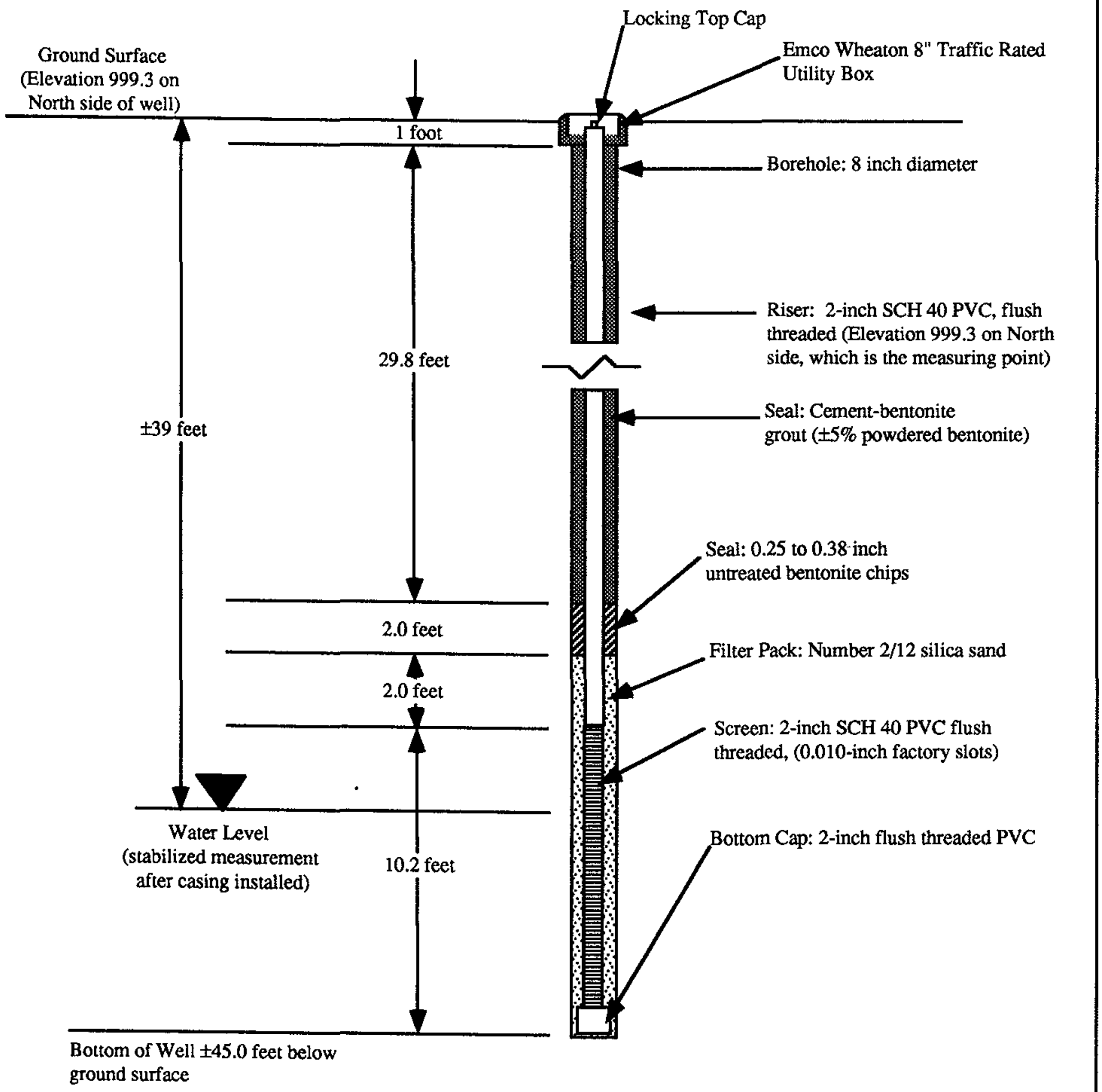
Depth (feet)	USCS	Graphic Log	Sample	Blows per 6 inches	Recovery (inches)	Soil Description, Observations, and Comments	OVM (ppm)
0.0						Asphalt concrete pavement and aggregate base to ±1-foot depth	
2.5							
5.0	SM			5 7 14	6 6 6	Silt with sand, ±85% silt, light brown to red hard, moist (>10% of silt in fine dark clasts), ±15% fine to coarse subangular to subrounded sand, light brown	<1 <1 <1
7.5							
10.0	SM			4 9 16	6 6 6	Sand with silt and gravel, ±70% fine to coarse subangular to subrounded sand, light brown to red, moist (±5% of sand in dark coarse clasts), ±15% brown silt, ±15% poorly-graded subangular to subrounded gravel, grey, hard	<1 <1 <1
12.5							
15.0	SM			3 9 19	6 6 6	Sand with silt and gravel (as above) Hard drilling observed at ±15 feet	<1 <1 <1
17.5							
20.0							

Boring Log for P3 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows per 6 inches	Recovery (inches)	Soil Description, Observations, and Comments	OVM (ppm)
20.0	SM			9 15 24	6 6 1	Sand with gravel and silt, ±65% medium to coarse subangular to subrounded sand, light brown to red, moist , ±20% poorly graded, subangular to subrounded gravel, grey, hard, ±15% light brown silt; <5% clay in silt matrix	<1 <1 <1
22.5							
25.0	SM			8 12 18	6 6 6	Sand with silt, ±85% fine sand, light brown with grey and olive green mottling, moist, ±15% light brown silt, <5% clay within sand and silt matrix	<1 <1 <1
27.5							
30.0	SM			9 12 18	6 6 6	Sand with silt, ±80% fine to medium subrounded sand, light brown with grey and olive green mottling, moist, ±15% light brown silt, ±5% subangular hard gravel	<1 <1 <1
32.5							
35.0	ML		X	9 12 20	6 6 6	Silt with sand, ±70% silt, light brown to red with grey and olive green mottling, moist, ±20% fine to coarse subangular to subrounded sand, light brown, ±10% clay, slight petroleum odor observed	132 69 18
37.5							
	▼					Groundwater measurement on 18 March 1991, after casing installed	
40.0	ML		X	9 12 22	6 6 6	Silt with sand, ±75% silt, light brown to red with grey and olive green mottling, moist, ±15% fine brown sand, ±10% clay, within silt matrix <5% black sand clasts (<0.25-inch diameter)	<1 <1 <1
42.5							
45.0							

Boring Log for P3 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows per 6 inches	Recovery (inches)	Soil Description, Observations, and Comments	OVM (ppm)
45.0	ML			15 16 19	6 6 6	Silt with sand and gravel, ±70% silt, light brown to red with grey and olive green mottling, moist, ±15% fine to medium subrounded sand, ±15% subrounded to rounded hard gravel, <10% clay, <5% of silt matrix contains dark medium sand clasts	<1 <1 <1
47.5						Boring drilled to ±45 feet	
50.0							
52.5							
55.0							
57.5							
60.0							
62.5							
65.0							
67.5							
70.0							



P3 Completion Schematic

2801 MacArthur Blvd.
Oakland CA

Boring Log for M1 (page 1 of 3)

Project	Soil and Groundwater Investigation Former Gasoline Station Oakland CA	Address	2801 MacArthur Boulevard Oakland CA 94602
Location	Immediately south of former gasoline tanks	Project No.	P12
Elevation	Ground surface = 1,000.3 feet (surveyed)	Logged By	Greg Reller, Streamborn, Berkeley
Start	11:00, 20 October 1990	Finish	10:30, 21 October 1990
Completion	2-inch monitoring well with traffic-rated utility box at ground surface	Driller	Geo Drill Exploration, Berkeley CA
Drill Method/Rig	±4-inch ID by ±8-inch OD hollow-stem auger/Mobile B61	Total Depth	±46 feet
Sampling	±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.	Groundwater	±37 feet below ground surface (stabilized measurement after casing installed)

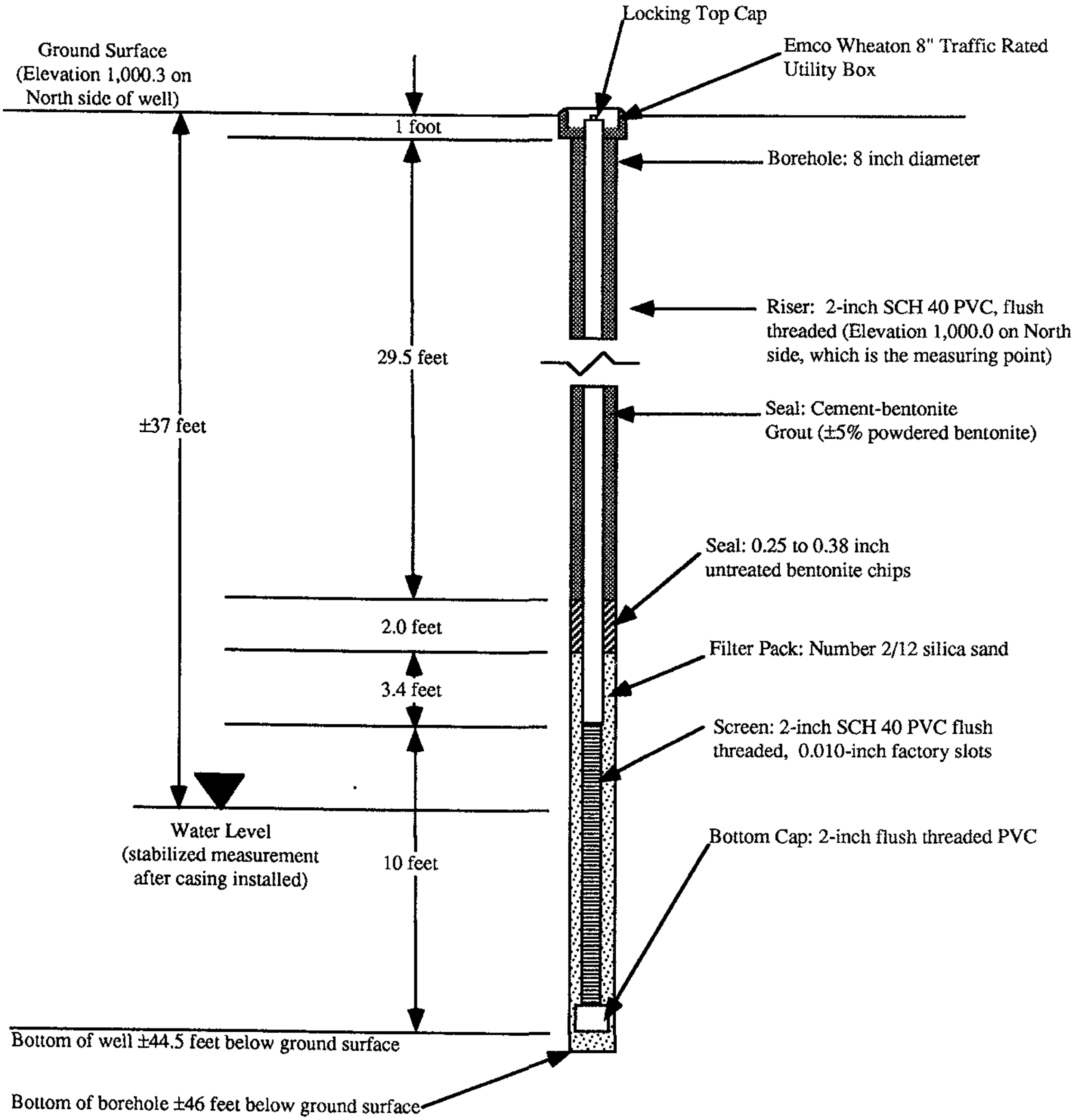
Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
					Asphalt concrete pavement and aggregate base to ±1-foot depth	
2.5	CL					
5.0			X	6 10 13	Sandy Clay, ±30% subround coarse sand and fine gravel in clay matrix, moist, hard, red-brown, black oxide mineral around some clasts	<1 <1 NR
7.5						
10.0			X	5 11 17	Sandy Clay, as above, ±30% medium to coarse subangular sand, poor blocky fracture, subhorizontal and subvertical zones of black oxide mineral	2 <1 NR
12.5						
15.0	SW		X	9 17 25	Sand, ±95% fine to very coarse subangular to subrounded sand with a trace of medium subangular gravel, ±5% silt, dry, red-brown, slightly cohesive, coarsens downward	<1 1 NR
17.5	GM				Refer to next page	
20.0				11		<1

Boring Log for M1 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
	GM			21	Silty Gravel, fine to coarse subangular gravel (volcanic and	
			X	23	metamorphic), slightly bound by silt matrix, dry, firm, brown	<1
						NR
22.5						
25.0	SW			12	Gravelly Sand, ±75% medium to coarse subangular to subrounded sand,	<1
				18	±15% silt, ±10% medium subround gravel, moist, brown, pale green	2
			X	29	mottling along poorly developed fractures, trace of black oxide mineral	NR
27.5						
30.0	SM			21	Silty Sand, ±15% silt, moist, firm, pale green with red brown mottling,	211
			X	26	strong gasoline odor, trace black (coal?) clasts,	55
				29		33
32.5						
35.0				20	Silty Sand (as above) ±25% silt	
	GM		X	25	Silty Gravel, fine to coarse subangular to subround gravel bound in	10
			X	35	sandy silt matrix, moist, greenish, red-brown mottling, strong	86
					gasoline odor	294
37.5						
40.0	GW/GM			7	Well graded Gravel with Silt and Sand, medium to coarse subround to	15
				22	subangular gravel (serpentinite, volcanic, and sedimentary) in silty sand	27
			X	31	matrix, moist, pale green, slight gasoline odor	NR
42.5						
					Refer to next page	
45.0				25		1

Boring Log for M1 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows/6-inches	Soil Description, Observations, and Comments	OVM (ppm)
	GW/GM			41	Well graded Gravel with Sand and Silt (as above), wet, deeply weathered (clasts are soft)	<1
				40		
	ML				Drive Shoe contains Sandy silt, ±25% medium to coarse subangular sand bound in silt, moist (no water yielded upon pounding with hammer) hard, pale green	NR
47.5						
					Total depth of boring = 46 feet	
50.0					Groundwater encountered at ±44.5 feet during drilling	
52.5						
55.0						
57.5						
60.0						
62.5						
65.0						
67.5						
70.0						



M1 Completion Schematic

2801 MacArthur Boulevard
Oakland CA

Boring Log for M2 (page 1 of 3)

Project: Soil and Groundwater Investigation
Former Gasoline Station
Oakland CA

Address: 2801 MacArthur Blvd.
Oakland CA 94602

Location: Immediately southwest of former gasoline tank location

Project No.: P26

Elevation: Ground surface = 999.9 feet (surveyed)

Logged By: Mark Buscheck, STREAMBORN, Berkeley

Start: 8:00, 18 April 1991

Finish: 13:00, 18 April 1991

Completion: Monitoring well with traffic-rated utility box at ground surface

Driller: Bayland Drilling, Menlo Park CA

Drill Method/Rig: ±4-inch ID by ±8-inch OD hollow-stem auger/Mobile CME55

Drilled Depth: ±45 feet

Sampling: ±2-inch ID by ±2-1/2-inch OD driven split-spoon fitted with 2-inch diameter by 6-inch long brass liners. Samples collected by driving spoon ahead of auger bit.

Groundwater: ±39 feet below ground surface (measurement on 18 April 1991, after casing installed)

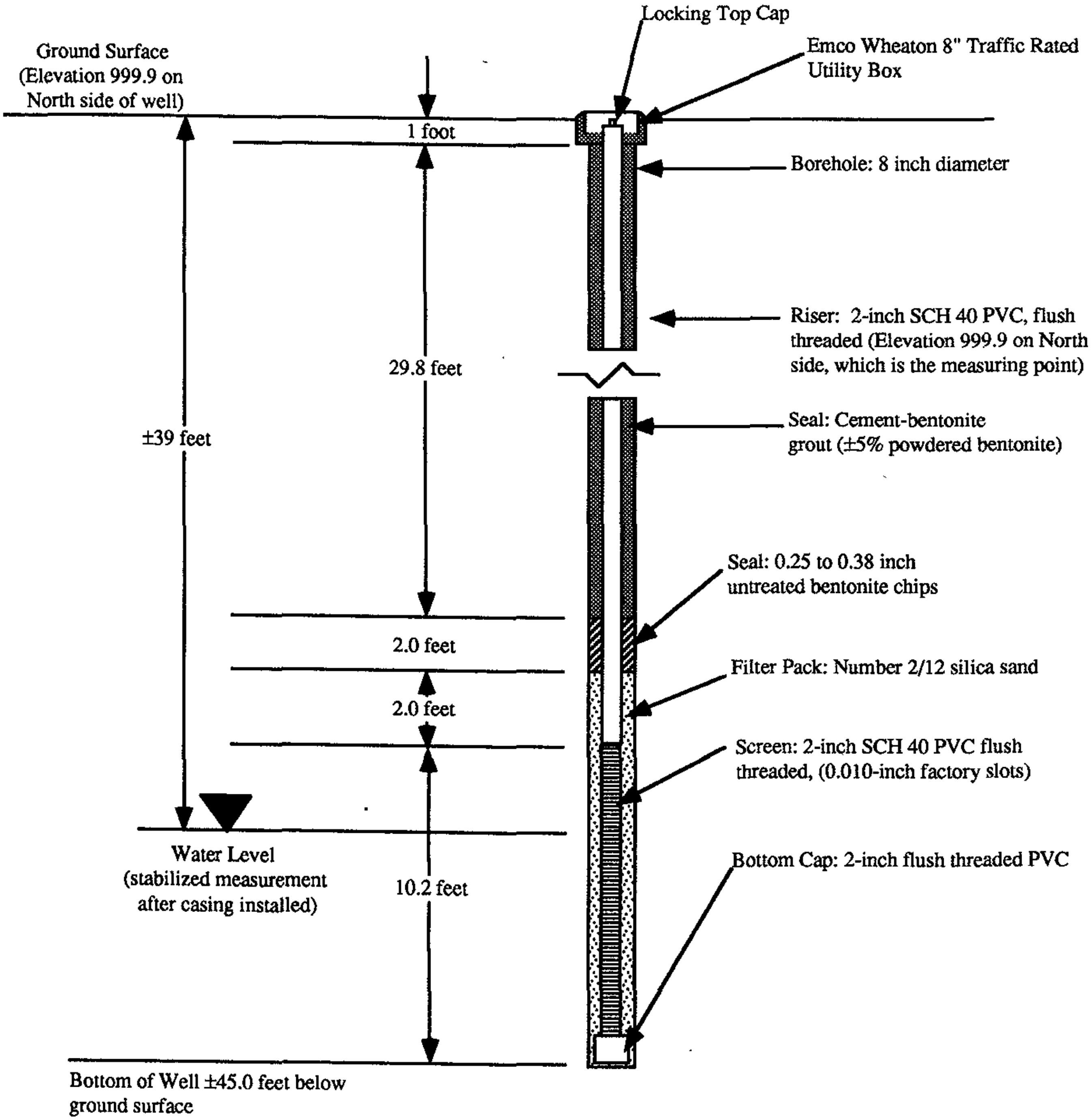
Depth (feet)	USCS	Graphic Log	Sample	Blows per 6 inches	Recovery (inches)	Soil Description, Observations, and Comments	OVM (ppm)
0.0						Asphalt concrete pavement and aggregate base to ±1-foot depth	
2.5							
5.0	CL			3 5 9	6 6 6	Clay with silt and sand, ±60% lean clay, reddish-brown, cohesive, moist, ±20% medium to coarse subangular to subrounded brown sand, 20% brown silt, some black silt clasts within clay matrix	<1 <1 <1
7.5							
10.0	CL			6 13 17	6 6 6	Clay with silt and sand, as above	<1 <1 <1
12.5							
15.0	SM			6 9 17	6 6 6	Sand with silt, ±70% medium to fine subangular to subrounded sand, light brown, slightly stiff, moist, ±15% light brown silt, 10% subangular to subrounded poorly-graded hard gravel, <5% black silt clasts within sand matrix	<1 <1 <1
17.5							
20.0							

Boring Log for M2 (page 2 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows per 6 inches	Recovery (inches)	Soil Description, Observations, and Comments	OVM (ppm)
20.0	SM			9 25 28	6 6 6	Sand with silt, ±25% fine to medium subangular to subrounded sand, moist, light brown with red and yellow mottling, loose to medium dense, ±15% light brown silt, ±5% subangular hard brown chert gravel, ±5% clay	<1 <1 <1
22.5						Hard drilling (gravel) at ±22 feet	
						Petroleum odor observed from borehole at ±24 feet	
25.0	SM			10 10 17	6 6 6	Sand with silt, ±75% fine to medium subangular to subrounded sand, light to medium brown with pale green and grey mottling, moist, loose to medium dense, ±15% brown silt, ±10% poorly-graded grey hard gravel, pale green and grey mottling appears on poorly developed fracture planes, observe moderate petroleum odor	21 19 18
27.5						Continued hard drilling at 28 feet	
30.0	SM			16 22 41	6 6 6	Sand with silt and gravel, ±65% medium to coarse subangular to subrounded sand, light brown with pale green-gray mottling, moist, medium dense, ±20% brown silt, ±15% poorly-graded subangular grey and brown hard gravel, green-gray mottling appears on poorly developed fracture planes, observe slight petroleum odor from liners and borehole	232 95 138
32.5							
35.0	ML			6 9 17	6 6 6	Silt with sand, ±65% loose silt, light brown with grey-green mottling, moist, ±25% medium to fine subangular to subrounded light brown sand, ±10% clay, observe moderate petroleum odor from liners and borehole	131 135 151
37.5							
	▼					Groundwater measurement on 18 April 1991, after casing installed	
40.0	SP			9 11 17	6 6 6	Sand with gravel, ±65% medium subangular to subrounded sand, light brown with red, green, and grey mottling, moist, loose, ±25% poorly-graded subangular grey hard gravel, ±10% brown silt, observe moderate petroleum odor from liners and borehole	136 112 116
42.5						Observe water and mud on augers at ±40 feet	
45.0							

Boring Log for M2 (page 3 of 3)

Depth (feet)	USCS	Graphic Log	Sample	Blows per 6 inches	Recovery (inches)	Soil Description, Observations, and Comments	OVM (ppm)
45.0	ML			9	6	Silt with sand, ±75% silt, moist, light brown with olive green mottling,	<1
				16	6	loose to medium dense, ±25% fine sand, light brown, very moist	<1
				32	6		<1
						Boring drilled to ±45 feet	



M2 Completion Schematic

2801 MacArthur Blvd.
Oakland CA

APPENDIX B

Laboratory Reports

CHROMALAB, INC.

Analytical Laboratory
Specializing in GC-GC/MS

- Environmental Analysis
- Hazardous Waste (#E694)
- Drinking Water (#955)
- Waste Water
- Consultation

October 26, 1990 ChromaLab File No.: 1090143

STREAMBORN ENGINEERING, INC.

Attn: Greg Reller

RE: Twelve soil samples for Gasoline/BTEX and Oil & Grease analyses

Project Number: P12
Date Sampled: Oct. 18, 1990 Date Submitted: Oct. 19, 1990
Date Extracted: Oct. 22-26,1990 Date Analyzed: Oct. 22-26,1990

RESULTS:

Sample No.	Gasoline (mg/Kg)	Benzene (µg/Kg)	Toluene (µg/Kg)	Ethyl Benzene (µg/Kg)	Total Xylenes (µg/Kg)	Oil & Grease (mg/Kg)
B10, 15.5-16'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B10, 21-21.5'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B10, 30.5-31'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B10, 45.5'-46'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B11, 21-21.5'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B11, 31-31.5'	230	150	470	880	1600	N.D.
B11, 36-36.5'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B11, 46-46.5'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
P1, 25.5-26'	N.D.	N.D.	N.D.	N.D.	N.D.	----
P1, 35-35.5'	7.4	11	N.D.	N.D.	N.D.	----
P1, 40.5-41'	N.D.	N.D.	N.D.	N.D.	N.D.	----
P1, 49.7-50.3'	N.D.	N.D.	N.D.	N.D.	N.D.	----
BLANK	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
SPIKE RECOVERY	96.4%	86.1%	92.5%	94.4%	93.5%	----
DUP SPIKED RECOVERY	92.5%	90.3%	107.9%	102.5%	89.1%	----
DETECTION LIMIT	2.5	5	5	5	5	10
METHOD OF ANALYSIS	5030/ 8015	8020	8020	8020	8020	503 D&E

CHROMALAB, INC.

David Duong
Senior Chemist

Eric Tam (by DD)
Eric Tam
Laboratory Director

2239 Omega Road, #1 • San Ramon, California 94583
415/831-1788 • Facsimile 415/831-8798
Federal ID #68-0140157

CHROMALAB, INC.

Analytical Laboratory
Specializing in GC-GC/MS

- Environmental Analysis
- Hazardous Waste (#E694)
- Drinking Water (#955)
- Waste Water
- Consultation

October 29, 1990 ChromaLab File No.: 1090157

STREAMBORN ENGINEERING, INC.

Attn: Greg Reller

RE: Eight soil samples for Gasoline/BTEX and Oil & Grease analyses

Project Number: P12
Date Sampled: Oct. 20, 1990 Date Submitted: Oct. 22, 1990
Date Extracted: Oct. 23-29,1990 DAte Analyzed: Oct. 23-29,1990

RESULTS:

Sample No.	Gasoline (mg/Kg)	Benzene (µg/Kg)	Toluene (µg/Kg)	Ethyl Benzene (µg/Kg)	Total Xylenes (µg/Kg)	Oil & Grease (mg/Kg)
M1, 20.5-21'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
M1, 25.5-26'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
M1, 35.5-36'	82	N.D.	19	28	26	N.D.
M1, 45.5-46'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
P2, 20.5-21'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
P2, ~~30.5-31'~~ 30-30.5	20	18	N.D.	N.D.	13	N.D.
P2, 35.5-36'	95	210	200	140	330	N.D.
P2, 55.5-56'	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
BLANK	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
SPIKED RECOVERY	93.8%	105.5%	98.6%	91.0%	93.0%	----
DUP SPIKED RECOVERY	96.4%	86.1%	92.5%	94.4%	93.5%	----
DETECTION LIMIT	2.5	5	5	5	5	10
METHOD OF ANALYSIS	5030/ 8015	8020	8020	8020	8020	503 D&E

CHROMALAB, INC.

David Duong
Senior Chemist

Eric Tam
Laboratory Director

2239 Omega Road, #1 • San Ramon, California 94583
415/831-1788 • Facsimile 415/831-8798
Federal ID #68-0140157

CHROMALAB, INC.

Analytical Laboratory
Specializing in GC-GC/MS

- Environmental Analysis
- Hazardous Waste (#E694)
- Drinking Water (#955)
- Waste Water
- Consultation

November 14, 1990

ChromaLab File No.: 1190026

STREAMBORN ENGINEERS, INC.

Attn: Greg Reller

RE: One water sample for Gasoline/BTEX analysis

Project Number: P12
Date Sampled: Nov. 6, 1990
Date Submitted: Nov. 6, 1990
Date Extracted: Nov. 9-12, 1990
Date Analyzed: Nov. 9-12, 1990

RESULTS:

Sample No.	Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl Benzene (µg/L)	Total Xylenes (µg/L)
P2	33000	4700	2100	380	630
BLANK	N.D.	N.D.	N.D.	N.D.	N.D.
SPIKED RECOVERY	90.3%	84.6%	87.1%	84.9%	82.7%
DETECTION LIMIT	50	0.5	0.5	0.5	0.5
METHOD OF ANALYSIS	5030/ 8015	602	602	602	602

CHROMALAB, INC.

David Duong
Senior Chemist

Eric Tam (by DD)
Eric Tam
Laboratory Director

2239 Omega Road, #1 • San Ramon, California 94583
415/831-1788 • Facsimile 415/831-8798
Federal ID #68-0140157

CHROMALAB, INC.

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- Environmental Analysis
- Hazardous Waste (#E694)
- Drinking Water (#955)
- Waste Water
- Consultation

March 29, 1991 ChromaLab File No.: 0391101

STREAMBORN ENGINEERING

Attn: Mark Buscheck

RE: Two soil samples for Gasoline/BTEX analysis

Project Name: CALIFRANCE
Project Number: P26
Date Sampled: March 18, 1991 Date Submitted: March 20, 1991
Date Extracted: March 28, 1991 Date Analyzed: March 28, 1991

RESULTS:

Sample No.	Gasoline (mg/Kg)	Benzene (µg/Kg)	Toluene (µg/Kg)	Ethyl Benzene (µg/Kg)	Total Xylenes (µg/Kg)
P3 35.5-36.0	990	5800	24000	11000	20000
P3 40.5-41.0	N.D.	N.D.	N.D.	N.D.	N.D.
BLANK	N.D.	N.D.	N.D.	N.D.	N.D.
SPIKE RECOVERY	115.8%	86.2%	88.3%	85.1%	87.1%
DUP SPIKE RECOVERY	103.1%	90.1%	89.2%	87.7%	88.1%
DETECTION LIMIT	1.0	5.0	5.0	5.0	5.0
METHOF OF ANALYSIS	5030/ 8015	8020	8020	8020	8020

ChromaLab, Inc.

David Duong
Chief Chemist

Eric Tam
Laboratory Director

2239 Omega Road, #1 • San Ramon, California 94583
415/831-1788 • Facsimile 415/831-8798
Federal ID #68-0140157

CHROMALAB, INC.

Analytical Laboratory (E694)

5 DAYS TURNAROUND

May 6, 1991 ChromaLab File No.: 0491131

STREAMBORN ENGINEERS, INC.

Attn: Mark Buscheck

RE: Five soil samples for Gasoline/BTEX analysis

Project Name: A.P.A. FUND LIMITED (CALIFRANCE CORP.)
Project Number: P26 (Califrance Add-Ons)
Date Sampled: April 18, 1991 Date Submitted: April 23, 1991
Date Extracted: April 30, 1991 Date Analyzed: April 30, 1991

RESULTS:

Sample No.	Gasoline (mg/Kg)	Benzene (µg/Kg)	Toluene (µg/Kg)	Ethyl Benzene (µg/Kg)	Total Xylenes (µg/Kg)
M2, 26.0-26.5'	1.3	320	N.D.	40	36
M2, 31.0-31.5'	490	N.D.	410	3400	7500
M2, 36.0-36.5'	33	N.D.	72	99	94
M2, 41.0-41.5'	25	170	79	130	120
M2, 46.0-46.5'	N.D.	N.D.	N.D.	N.D.	N.D.
BLANK	N.D.	N.D.	N.D.	N.D.	N.D.
SPIKE RECOVERY	100.4%	104.3%	105.0%	102.0%	103.9%
DUP SPIKE RECOVERY	85.7%	86.4%	92.2%	90.8%	90.6%
DETECTION LIMIT	1.0	5.0	5.0	5.0	5.0
METHOF OF ANALYSIS	5030/ 8015	8020	8020	8020	8020

ChromaLab, Inc.

David Duong
Chief Chemist

Eric Tam
Laboratory Director

2239 Omega Road, #1 • San Ramon, California 94583
415/831-1788 • Facsimile 415/831-8798
Federal ID #68-0140157

CHROMALAB, INC.

Analytical Laboratory (E694)

5 DAYS TURNAROUND

May 14, 1991

ChromaLab File # 0591051

Streamborn Engineering

Attn: Noah Heller

Re: One water sample for BTEX and Gasoline analysis

Project Name: Califrance Corp.
Date Sampled: May 7, 1991
Date Analyzed: May 14, 1991

Project No.: P26
Date Submitted: May 7, 1991

Results:

Sample No.	Gasoline (μg/l)	Benzene (μg/l)	Toluene (μg/l)	Ethyl Benzene (μg/l)	Total Xylenes (μg/l)
M2-GW1	16000	1300	950	170	890
METHOD BLANK	N.D.	N.D.	N.D.	N.D.	N.D.
SPIKE RECOVERY	100.7%	107.8%	103.9%	102.3%	99.5%
DETECTION LIMIT	50	0.5	0.5	0.5	0.5
METHOD #	5030/8015	602	602	602	602

ChromaLab, Inc.

David Duong
Chief Chemist

Eric Tam
Laboratory Director

2239 Omega Road, #1 • San Ramon, California 94583
415/831-1788 • Facsimile 415/831-8798
Federal ID #68-0140157

APPENDIX C

Standard Operating Procedures

STANDARD OPERATING PROCEDURE (SOP) 1A
HOLLOW-STEM AUGER DRILLING AND SPLIT-SPOON SOIL SAMPLING

1.0 INTRODUCTION AND SUMMARY

This SOP describes methods for drilling with the use of hollow-stem augers and soil sampling with the use of spilt-spoon samplers. Drilling activities covered by this SOP may be conducted to obtain soil samples or to create a borehole within which a well may be constructed. 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 augering techniques described in this SOP generally produce a borehole with a diameter corresponding to the outside diameter of the auger flights, a relatively small annulus of remoulded soil surrounding the outside diameter of the auger flights, and limited capability for cross-contamination between subsurface strata as the leading flights of the augers 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 hollow-stem auger drilling and split-spoon soil sampling generally consist of initial decontamination, advancement of the augers, driving and recovery of the split-spoon sampler, logging and packaging of the soil samples, decontamination of the split-spoon, and continued augering and sampling until the total depth of the borehole is reached. Withdrawal of the augers upon reaching the total depth requires completion of the borehole by grouting, by constructing a well, or other measures; borehole completion is not covered in this SOP.

2.0 EQUIPMENT AND MATERIALS

- Drill rig, drill rods, hollow-stem augers, and drive-weight assembly (for driving the split-spoon sampler) should conform to ASTM D 1586 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils, except: (1) hollow-stem augers may exceed 6.5 inches inside diameter as may be necessary for installing 4-inch diameter well casing, (2) hollow-stem augers should have a center bit assembly (end plug), (3) alternative drive-weight assemblies or downhole hammers are acceptable as long as the type, weight, and equivalent free fall are noted on the boring log.
- 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 sample, and (2) allowable split-spoon diameters include nominal 1-1/2-inch inside diameter by nominal 2-inch outside diameter (Standard Penetration Test split-spoon), nominal 2-inch inside diameter by nominal 2-1/2-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 log, 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 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
- 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 or dry 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 on the boring log.
- Aluminum foil, and rubber bands
- Pressure washer or steam cleaner
- Large trough (such as a water tank for cattle), plastic-lined pit, or equivalent for decontamination of hollow-stem augers, 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 Liqui-nox or Alconox
- Distilled water
- Steel, 55-gallon, open-top drums conforming to the requirements of DOT 17H

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 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 log.

1 Decontaminate drill rig, drill rods, hollow-stem augers, split-spoon sampler and other drilling equipment immediately prior to mobilization to the site.

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 through collective 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, drill cautiously and have the driller pay particular attention to the "feel" of the hollow-stem auger. 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 hollow-stem auger, fitted with end plug, to the desired sampling depth. Note depth interval, augering conditions, and driller's comments on boring log. Samples should be taken at intervals of 5 feet or less in homogeneous strata and at detectable changes of strata.

4 Remove drill rod and end plug from the hollow stem and note presence of water mark on drill rod, if any. If below the groundwater table in clean sand, allow water level in hollow-stem to equilibrate prior to removing end plug and remove plug slowly so as to minimize suction at the base of the plug. Also, monitor top of hollow-stem using field organic vapor monitor, as appropriate.

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

6 Lower split-spoon sampler through hollow-stem of auger until sampler is resting on soil. Note discrepancy between elevation of tip of sampler and leading edge of augers, if any. If more than 6-inches of slough exists inside the hollow-stem augers, consider the conditions unsuitable and re-advance the hollow-stem augers and end plug to a new sampling depth.

7 Drive and recover the split-spoon according to the requirements of ASTM D 1586 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils. Record depth interval, hammer blows for each 6-inches, and sample recovery on boring log. Monitor the recovered split-spoon with the field organic vapor monitor, as appropriate.

8 Remove either bottom-most or second-from-bottom liner (or both) from split-spoon 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 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 or dry ice inside cooler.

9 Extrude soil from remaining liner(s) and subsample representative 1-inch cube (approximate dimensions). Place subsample in widemouth glass jar, cover jar with aluminum foil and seal foil to jar with rubber band. Allow jar to equilibrate at ambient conditions for approximately 5 minutes and screen for organic vapors by inserting the probe of the field organic vapor monitor through the aluminum foil. Record depth interval, observed sample reading, and ambient (background) reading on the boring log. Glass jars may be reused by discarding the soil subsample and wiping any residue from the jar using a paper towel.

10 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 on geologic structure of sample, as appropriate. Record depth interval, visual classification, and other notes to the boring log.

11 Repeat steps 3 through 10 until total depth of borehole is reached.

12 Complete borehole according to the requirements specified elsewhere.

13 Decontaminate hollow-stem augers, drill rod, and end plug between boreholes and after finishing last borehole prior to drill rig leaving site.

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

15 Containerize soil cuttings, excess soil sample, and decontamination wastewaters in steel drums. Affix hazardous waste labels to the drums.

16 Complete pertinent portion of the chain-of-custody form and daily activity report.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality control sampling consists of sequential replicates, collected at an approximate frequency of 1 sequential replicate for every 10 natural 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 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) swipe 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 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 visual 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).

5.0 DOCUMENTATION

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

- Daily Report
- Field Notebook
- Boring Log
- Sample Label
- Chain-of-Custody

Documentation should include any deviations from this SOP, notations of unusual or unexpected conditions, and documentation of the containerization and disposition/disposal of investigation-derived waste. Specific instructions for selected forms are provided below.

5.1 Sample Label

- Project name and project number
- Boring or well 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
- Sampler
- Optional designation of orientation of sample within the subsurface, for example, an arrow with "up" or "top" designated

5.2 Boring Log

- Project name and project number
- Boring number
- Description of boring location, including taped or paced measurements to noticeable topographic features (a location sketch should be considered)
- Date and time drilling started and completed
- Drilling company and name of drilling supervisor, optional names and responsibilities of drillers helpers
- Manufacturer and model number of drill rig
- Inside diameter of the hollow stem and outside diameter of the auger flights of the hollow-stem augers, optional description of type of bit on end plug and leading edge of auger, optional description of the size of drill rod
- Depth at which groundwater was first encountered with the notation "during drilling"
- Method of borehole completion
- Other notations and recordings described previously in 2. EQUIPMENT AND MATERIALS and 3. TYPICAL PROCEDURES

6.0 DECONTAMINATION

Prior to entering the site, the drill rig and appurtenant items (drill rod, hollow-stem augers, end plug, split-spoon sampler, shovels, troughs and buckets, drillers 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, hollow-stem augers, end plug, split spoon sampler, shovels, troughs and buckets, etc.) should be decontaminated by steam cleaning or pressure washing. Prior to leaving the site, the drill rig and appurtenant items should be decontaminated by steam cleaning and pressure washing. Onsite 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 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 tap water rinse, followed by a distilled water rinse. Wastewater from the soap wash should be temporarily contained. Wastewater from the tap water and distilled water rinses may be discharged to the ground surface or a sanitary sewer.

Between each borehole, buckets and brushes should be decontaminated by steam cleaning or pressure washing. Before each borehole, fresh decontamination solutions should be prepared.

7.0 INVESTIGATION-DERIVED WASTE

Wastes resulting from the activities of this SOP may include soil cuttings, excess soil sample, decontamination wastewaters, and miscellaneous waste (paper, plastic, gloves, jars, aluminum foil, etc.) Unless otherwise prohibited by the Site Safety Plan, miscellaneous waste should be double-bagged in plastic garbage bags and disposed of as municipal waste.

Soil cuttings and excess soil sample from each borehole should be placed in individual steel drums with hazardous waste labels affixed. Solids from multiple boreholes may be combined within a single drum 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 drums and reasonable doubt, separate drums should be used for each borehole.

Decontamination wastewaters for each borehole should be placed in individual steel drums with hazardous waste labels affixed. Wastewaters from multiple boreholes may be combined, subject to the same limitations as solids.

8.0 SAFETY

Normal and special safety precautions are described in the Site Safety plan. The Site Safety plan should be reviewed periodically during drilling to keep mindful of important safety measures. Physical hazards typically prevail because the drill rig contains exposed rotating and hammering equipment and because drill rod and augers are heavy material with sharp edges.

Chemical hazards are typically discovered upon withdrawal of the end plug or withdrawal of the soil-filled split-spoon sampler from the hollow-stem auger, as well as removal of the soil-filled liners from the split-barrel. 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.

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

U.S. Environmental Protection Agency, 1989a. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, OSWER Directive 9355.0-14. USEPA, Office of Emergency and Remedial Response, Washington, DC. December 1989.

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.

STANDARD OPERATING PROCEDURE (SOP) 2A
COMPLETION OF BORINGS AS WELLS

1.0 INTRODUCTION AND SUMMARY

This SOP describes methods for installation of a monitoring well within an existing borehole. The well construction techniques discussed in this SOP are generally suitable for construction of wells screened in one groundwater zone which will be used for water quality sampling and/or observations of groundwater elevation (piezometers). Typically, 2- or 4-inch diameter wells, with total depths less than 80 feet will be installed using this SOP. Large diameter or deep wells may require modification of the methods described herein. Discussion of specific well casing and screen material is beyond the scope of this SOP, and well casing and screen material should be selected on a site specific basis. The permitting activities of this SOP apply in California and different permits are needed in other locations.

The procedures for construction of wells generally consist of well permitting, well design, decontamination of well casing and screen, simultaneous assembly and lowering of casing and screen into the borehole, placement of the filter-pack around the screen, installation of a bentonite seal above the filter pack, sealing of the remaining annular space with grout, and surface completion. The procedures described below are intended to conform to practices outlined in Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells (Aller, et al., 1989); A Compendium of Superfund Field Operations Methods (U. S. EPA, 1989); and California Well Standards (Final Draft), (California Department of Water Resources, 1990) .

2.0 EQUIPMENT AND MATERIALS

- Pressure washer or steam cleaner
- Grout mixing equipment
- Tap water
- Hand tools (pipe wrenches, chain wrenches, pipe vise, shovels, rubber mallet, etc.)
- Tape measure long enough to reach the bottom of the boring
- Well casing, screen, and end caps
- Centralizers (if required)
- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- Filter pack material (typically clean sand of specified gradation)
- Bentonite pellets (or powder) for seal above filter pack, unaltered sodium bentonite
- Cement for grout
- Locking hasp
- Protective surface casing
- Well construction log and daily report forms

- Calculator

Site specific conditions may require other specialized equipment, thus great care should be taken to anticipate conditions reasonably expected to occur during well installation.

3.0 TYPICAL PROCEDURES

The following procedures apply to most well installations. However, normal field practice requires re-evaluation and modification of these procedures upon encountering unexpected situations during well construction. Deviations from the following procedures are to be expected and should be documented.

1 Determine local jurisdiction charged with regulation of wells and apply for required local permits. Local jurisdictions may include county, water district, or city. Determine special design considerations (such as minimum length of grout seal) and inspection requirements (such as witnessing the placement of the grout seal). Also file notice of intent to construct well with the California Department of Water Resources using its standardized form.

2 Well design begins with the conception of the specific purpose for the well, and should include consideration of the specific analytes of interest, anticipated subsurface conditions at the intended well location, and the soil conditions encountered during drilling and recorded on the boring log.

   Design considerations discussed in this SOP are limited to portions of the well subject to modification by information gathered during drilling. Such information includes depth to groundwater, thickness of water bearing strata, and grain size distribution of the water bearing strata. Conceptual well designs should be modified as required in the field to prevent connection of naturally separate groundwater zones, to allow an adequate surface seal to be installed, and to maximize the chance for detection of the contaminants of concern. Modifications of conceptual designs should be discussed with the project supervisor prior to implementation whenever possible.

3 Prior to installation in the borehole, well casing and screen should be decontaminated and inspected to help minimize cross-contamination which may affect subsequent water quality samples.

   Decontamination should comprise steam cleaning, pressure washing, or equivalent, with tap water rinse. If oil or grease contamination is suspect, decontamination should also include a soap wash and tap water rinse. This procedure should be applied to both the outside and the inside of well casing and screen immediately before assembly and well installation.

4 Assembly of the well screen and blank casing is accomplished simultaneously with insertion into the boring. Initially, a bottom plug is attached to the bottom of the screen and the screen is lowered into the boring. The next length of casing (screen or blank depending on the specific well design) is attached and the process is repeated until the well extends from the ground surface to the bottom of the boring. Various types of mechanical clamps are used to prevent dropping of the well screen into the well during assembly. It is useful to leave surplus blank casing extending above grade at this point to facilitate subsequent construction activities.

Measure the length of well screen and blank casing inserted into the boring and record the quantities on the well construction log. The total length of well screen and casing should be confirmed by taping.

5 Install the filter pack by pouring filter pack material into the annulus between the casing and borehole. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, install filter pack from (1) an elevation approximately 6 inches beneath the elevation of the bottom cap of the well casing to (2) approximately 2 feet above the top of the screened interval.

If augers or drill casing remain in the ground during well construction, the annulus between the well material and the casing may be used as a tremie If the well is constructed in an open borehole, then the filter pack should be placed using a tremie pipe. The filter pack should be poured slowly into the borehole and the depth to the top of the filter pack should be "tagged" periodically with a tape. Adequate time should be allowed for the sand to settle through standing water prior to tagging or the tape may be lost by burial. Tagging is time consuming, however it provides reasonable checks of filter pack bridging during installation.

If augers or other temporary casing are being used as a tremie, they should be withdrawn as the filter pack is placed. During placement, the elevation of the tip of the augers/temporary casing should be kept slightly above the top of the filter pack. Minimizing the separation between the top of the filter pack and tip of the augers/temporary casing during filter pack placement will help prevent inclusions of formation material or slough within the filter pack. However, if the tip of the augers/temporary casing is not kept above the top of the filter pack and the filter pack is allowed to settle within the augers/temporary casing, a filter pack bridge may occur and the well casing may become "locked" inside the augers/temporary casing.

The quantity of filter pack material required to fill the annulus should be calculated. The quantity of filter pack material actually installed in the well should be measured and compared to the calculated quantity. Both quantities should be recorded on the well construction log.

6 The bentonite seal is installed by pouring bentonite pellets or slurried bentonite powder onto the top of the filter pack. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, the bentonite seal should extend approximately two feet above the top of the filter pack. The quantity and type of bentonite used should be recorded on the well construction log. The top of the bentonite seal should be measured by taping. If bentonite pellets are used and the seal exists above the groundwater table, water should be poured on top of the pellets after their installation and the pellets should be allowed to hydrate for approximately 10 minutes before proceeding with installation of the overlying grout seal.

7 The grout seal should be tremied into the well to prevent inclusions of formation material or slough in the annular seal. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, grout seal may consist of (1) neat cement grout, using 1 sack (94 pounds dry weight) of Type I/II Portland cement to 5 gallons of water, or (2) 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.

If augers or temporary casing remain in the borehole during grouting, the level of the grout should be kept above the tip of the augers or casing to help prevent inclusions of formation material in the grout seal.

The volume of the grout actually used should be recorded on the well construction log and compared to the calculated annular volume of the sealed interval. Any discrepancies should be noted on the well construction log.

8 Complete the surface of the well by installing a protective surface casing and locking mechanism around the top of the well casing. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, the protective casing should be anchored approximately 3 feet into the grout annulus.

9 The completed well should be protected from disturbance while bentonite seal hydrates and grout cures. Further well activities, such as development or sampling, should be withheld for a period of 3 to 7 days to allow these materials to obtain an initial set.

10 Complete and file form DWR 188 plus reports or forms required by local agencies.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance checks for well completion include comparison of theoretical versus actual volumes of filter pack, bentonite seal, and grout seal. Discrepancies that indicate actual "take" was less than theoretical may indicate inclusions of formation material or slough within the annulus. Specific attention to such discrepancies is necessary if the bentonite seal and grout seal are needed to separate contaminated from uncontaminated zones that may be penetrated by the well.

Other quality assurance details include accurate measurement and documentation of the lengths and types of materials used to complete the well.

5.0 DOCUMENTATION

Observations, measurements, and other documentation of the well completion effort should be recorded on the following:

- Daily Report
- Field Notebook
- Well Completion Log
- DWR 188

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

6.0 DECONTAMINATION

Materials used for filter pack, bentonite seal, and grout seal should be new at the beginning of each project. Typically, damaged or partially-used containers of material that are brought onsite by drillers or other material suppliers should not be used for well completion. If there is sufficient question regarding contamination of materials, obtain representative samples for later laboratory testing.

Well casing and screen should be decontaminated immediately prior to insertion within the borehole. Casing and screen with oil or grease staining may be rejected or decontaminated by washing with soap, rinsing with tap water, and then steam cleaning, pressure washing or equivalent. New and visually clean casing and screen should be decontaminated by steam cleaning, pressure washing, or equivalent.

If augers or temporary casing are removed during well construction, these materials should be decontaminated by steam cleaning, pressure washing, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Wastewater from casing and screen decontamination may be discharged to the ground surface near the well subject to the landowner's permission. Otherwise, these wastewaters may be discharged to the sanitary sewer.

Borehole fluids displaced during well completion, excess grout, and decontamination wastes from the cleaning of augers or temporary casing should be placed in steel drums. The drums should be labeled with a hazardous waste label indicating the generator's name and accumulation date. The drums should also be labeled with a description of contents and well number from which the wastes originated.

8.0 SAFETY

Primary chemical hazards during well completion are associated with dermal exposure to borehole fluids that may be displaced during completion. Primary protection against dermal exposure includes splash protection and gloves.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

U.S. Environmental Protection Agency, 1989. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, OSWER Directive 9355.0-14. USEPA, Office of Emergency and Remedial Response, Washington, DC. December 1989.

STANDARD OPERATING PROCEDURE (SOP) 3A

WELL DEVELOPMENT

1.0 INTRODUCTION AND SUMMARY

This SOP describes procedures to develop wells that have been properly installed. Typically, fine soil particles are entrained within the filter pack and adjacent formation during well installation. The well development procedures described herein are intended to help remove the fine soil particles, resulting in enhanced hydraulic response of the well and increased representativeness of water quality samples collected from the well.

Typically, this SOP will be used to develop 2- or 4-inch diameter monitoring wells and occasionally larger diameter monitoring or pumping wells; all screened within a single groundwater zone. The procedures described herein should be modified for domestic wells. The procedures described herein may also need modification if product is observed in the well.

Well development activities generally include decontaminating the downhole equipment, repetitive combinations of surging/swabing and overpumping/bailing, measurement and observation of well yield, turbidity, and field parameters, and containerizing the development wastewater. Development is typically conducted until (1) no further improvement in well response and turbidity is observed, or (2) a reasonable time has been devoted to development.

2.0 EQUIPMENT AND MATERIALS

- Pressure washer or steam cleaner
- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- Tap water
- Steel, 55-gallon, open-top drums conforming to the requirements of DOT 17H
- 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 documented.
- Glass beaker, ±250 milliliter for measurement of field parameters. A similar flow-through cell may also be used.
- Water level meter
- pH, temperature, and specific conductivity instruments, including pH and specific conductivity standards approximating or spanning the natural groundwater parameters.
- Vented surge block or swab of appropriate diameter for the screened interval of the well casing.
- Bailing and/or overpumping equipment consisting of one or a combination of the following:

  Bailer: Steel or PVC. Dedicated or new bailer rope. Generally as large a diameter as will fit down well.

Surface Centrifugal Pump: Limited to water lift of approximately 20 feet. Dedicated or new flexible plastic suction hose. Foot valve and flow control valve optional.

Air-Lift Pump: Dual-casing assembly with eductor casing (outer casing) to extend at least 2 feet beyond inner casing. Foot valve should be provided at the bottom of the eductor casing to prevent release of aerated water into the well when the air lift pump is turned off. Air from compressor should be dual-filtered to remove oil.

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

3.0 TYPICAL PROCEDURES

The following procedures are intended to cover the majority of well development conditions. However, normal field practice requires re-evaluation of these procedures upon encountering unusual or unexpected conditions such as observation of free product, measuring elevated pH in the development water, or observing dramatic increases in turbidity as development progresses. Deviations from the following procedures may be expected and should be documented.

1. Development should generally be initiated after the well sealing materials (grout) have obtained an initial cure. Typically, development may begin 3 to 7 days after well completion.
2. Remove top cap and perform field organic vapor monitoring of well casing.
3. Measure static water level and total depth of well. Compare total depth to well completion diagram. Calculate volume of standing water in casing.
4. Decontaminate downhole equipment (see section DECONTAMINATION in this SOP).
5. Begin bailing or overpumping using as high an evacuation rate as possible. Record the following at the beginning of development and during each bail/overpump cycle:
   - Volume removed and time
   - pH, temperature, and specific conductance
   - Turbidity (clarity and color)
   - Approximate drawdown and well yield
   - Whether well was bailed/pumped dry
   - Other observations (such as presence of product) as appropriate

   Bail/overpump until at least one casing volume of standing water has been removed. Continue bailing/overpumping if the removed water remains very turbid, indicating removal of fines from the screened interval. Terminate bailing/overpumping upon improvement of clarity.
6. Surge/swab the well to loosen fines from the screened interval. Position vented surge block several feet above the screened interval and surge/swab with upward motion. Lower the surge/swab several feet and repeat, keep surging/swabing progressively lower intervals until the bottom of the screened interval is reached. For each interval, surge/swab for several minutes or as indicated by field experimentation.

7. Repeat items 5 and 6 until evacuated water at the end of the bailing/overpumping cycle is low or non-turbid, field parameters are representative of natural groundwater conditions, and well yield has stabilized at a value representative of the intercepted groundwater zone. Terminate development after a reasonable period of time even if these conditions are not observed. Unless otherwise specified in the Workplan, Quality Assurance Project Plan, or Sampling Plan, 4 hours may typically be taken as a reasonable time effort.

8. Terminate development by bailing or overpumping for an extended period of time to remove fines that have been loosened by the last cycle of surging/swabing. Record final observations.

9. Containerize development water and decontamination wastewater in steel drum(s). Label drum(s) with hazardous waste label, description of contents, and well number from which waste originated.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Meters for measurement of field parameters should be calibrated at least once per day. Calibration standards should generally approximate or span natural groundwater characteristics. Recalibration may be appropriate if unusual measurements are noticed. Calibration activities should be documented on the instrument calibration log.

Quantitative turbidity measurements may be taken with a turbidity meter (both field and laboratory versions are available). If qualitative descriptions of turbidity are used, these terms (very-, moderate-, low-turbidity) may be further defined on the development log. Representative samples may also be collected and returned to the laboratory for measurement with a turbidity meter.

Because well development is typically the first activity of a newly completed well and because the activity is fairly vigorous, the following precautions may be appropriate:

- If product is observed but not anticipated within the groundwater zone intercepted by a well, and the well penetrated a contaminated overlying groundwater zone, well development may be interrupted subject to further consideration or study. Faulty well sealing may result in migration of product from overlying to underlying groundwater zones, which is exacerbated during development.
- If elevated pH is observed but not anticipated, and the well is being developed soon after completion, well development may be interrupted subject to further consideration or study. Elevated pH may originate from grout that has not yet cured, or from grout contamination of the filter pack.
- If turbidity increases dramatically after surging/swabing and does not return to previously observed levels, the cause may be a broken well casing, broken screen, or dislodged end cap, which allows soil to enter the casing unretarded by the filter pack. Probing the well may disclose a break or faulty joint. Consider interrupting well development if this condition is suspected.

5.0 DOCUMENTATION

The well completion schematic should be taken into the field to serve as reference information. Observations, measurements, and other documentation of the development effort should be recorded on the following:

- Daily Report
- Field Notebook
- Instrument Calibration Log
- Well Development Log

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

6.0 DECONTAMINATION

Prior to entering the site, well development equipment should be decontaminated by steam cleaning, pressure washing, or equivalent.

Prior to development of each well, down-well equipment should be decontaminated by steam cleaning or pressure washing, washing with soap, and rinsing with tap water, or equivalent.

Prior to leaving the site, equipment should be steam cleaned, pressure washed, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Development water and decontamination wastewater should be containerized in steel drums. Drums should be labeled with hazardous waste labels, including: generator's name and accumulation date. The drums should also be labeled with a description of contents and well number of waste origination. Waste from different wells may be combined in single drums, but chemically-affected and clean wastes should not be mixed.

8.0 SAFETY

Primary chemical hazards during well development are associated with dermal exposure. Primary protection against dermal exposure includes splash protection and gloves. Air-lift pumping may also exacerbate the release of volatile organic compounds from groundwater to air, thus increasing the risk of exposure; frequent monitoring with the field organic vapor monitor may be employed to mitigate this risk.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

U.S. Environmental Protection Agency, 1989. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, OSWER Directive 9355.0-14. USEPA, Office of Emergency and Remedial Response, Washington, DC. December 1989.

STANDARD OPERATING PROCEDURE (SOP) 4A
WELL PURGING AND SAMPLING

1.0 INTRODUCTION AND SUMMARY

This SOP describes procedures to purge and sample wells that have been properly installed and developed. Typically, this SOP will be used for sampling monitoring wells with 2- or 4-inch diameter casing. The sampling described herein is appropriate for a variety of groundwater analyses, including: total and dissolved metals, volatile and semi-volatile organic compounds, and general minerals. For newly installed and developed well, the purging and sampling described in this SOP is typically performed at least 7 days after well development to allow ambient groundwater conditions to re-establish in the vicinity of the well.

The procedures described in this SOP should be modified for domestic wells or wells with dedicated sampling equipment. The procedures should also be modified if product is observed in the well.

Typical well sampling and purging activities include decontaminating the purging and sampling equipment, purging the stagnant water from the well casing and filter pack by pumping or bailing, measuring field parameters and evacuated volume of groundwater during purging, terminating the purging process when field parameters stabilize, collecting groundwater samples by pumping or bailing, and labeling and preserving the collected samples.

2.0 EQUIPMENT AND MATERIALS

- Pressure washer or steam cleaner
- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- If sampling is to be performed for metals, dilute (10%) reagent-grade nitric acid for decontamination
- Tap water
- Distilled water
- Deionized water for cross-contamination blanks
- Cooler with ice (do not use blue ice or dry ice)
- Ziplock bags of size to accommodate sample containers
- Steel, 55-gallon, open-top drums, DOT 17H
- 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 documented.
- Laboratory-cleaned 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)
- If dissolved metals analyses are required, 45-micron cellulose acetate filters and filtering device. Alternate filter type and size (cellulose nitrate,

Teflon, or glass-fiber pre-filters) may be required as specified in the Quality Assurance Project Plan or Sampling Plan. The make, type, and size of filter, including disposable filters, should be documented.

- Glass beaker, ±250 milliliter for measurement of field parameters. A similar flow-through cell may also be used.
- Water level meter
- pH, temperature, and specific conductivity instruments, including pH and specific conductivity standards approximating or spanning the natural groundwater parameters. As specified in the Quality Assurance Project Plan or Sampling Plan, oxidation-reduction potential (ORP) or dissolved oxygen meters may also be required.
- Purging equipment consisting of one of the following:

  Bailer: Steel, PVC, Teflon, or stainless steel. Dedicated or new bailer rope.

  Bladder Pump: Plastic or Teflon bladder. 4-inch or 6-inch diameter by ±4-foot long decontamination chambers.

  Submersible Electric Pump: Normally used where relatively large quantities of purge water are expected from wells with quick recharge. Pump should have flow control valve and foot valve. 6-inch diameter by ±4-foot long decontamination chambers.

  Surface Centrifugal Pump: Limited to water lift of approximately 20 feet. Dedicated or new flexible plastic suction hose. Foot valve. Flow control valve.
- Sampling device consisting of one of the following:

  Bailer: Teflon or stainless steel. Dedicated or new bailer rope. If samples are collected for volatile organic compound analysis, bailer should also be fitted with bottom-emptying device.

  Bladder Pump: Teflon bladder. Dedicated or new Teflon or Tygon tubing for sample discharge line. 4-inch or 6-inch diameter by ±4-foot long decontamination chambers.

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

3.0 TYPICAL PROCEDURES

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

1. Remove top cap and perform field organic vapor monitoring of well casing
2. Measure static water level and total depth and compare to historic measurements. Remeasure if discrepancies are noted with historic data. Document observations of product, if appropriate. Calculate volume of standing water in casing.

3. Decontaminate purging and sampling equipment (see section DECONTAMINATION in this SOP)

4. Begin purging and if possible, adjust purge rate to expose as little of the screened interval as possible (subject to reasonable time constraints). Record the following observations at the beginning of purge, periodically during purge, and during sampling:

   - Purge volume and time
   - pH, temperature, and specific conductivity
   - Turbidity (clarity and color)
   - Approximate drawdown and well yield during purge
   - Whether well was purged dry
   - Other observations (such as presence of product) as appropriate

5. Terminate purging when one of the following conditions is observed:

   Quick Recharge Wells: Well shows stabilized field parameters and at least 3 casing volumes of standing water have been removed - ready for sampling. If field parameters have not stabilized after removal of 5 casing volumes of standing water, terminate purging anyway. Wells should be allowed to recover to at least 1/2 the original standing water depth prior to sampling.

   Slow Recharge Wells: Wells that are initially purged dry, and do not recover to 1/2 the original standing water depth within 4 hours, should be purged dry again and then sampled when sufficient recovery has occurred to submerge the sampling bailer or pump. Generally, 3 feet of recovery may be considered sufficient recovery for normal bailer or pump submergence.

6. If recharge has submerged the entire screened interval, sample from mid-depth of screened interval. Otherwise, sample from mid-depth of water column at time of sampling.

7. If dissolved metals analyses are to be performed, filter sample. Also if dissolved metals analyses are to be performed and the sample is moderately turbid or very turbid, collect companion filtered and unfiltered samples.

8. For parameters other than dissolved metals, do not filter sample. Fill sample containers directly and preserve according to the requirements of Table 1. Containers should generally filled to capacity. 40 milliliter glass vials should be filled from the bottom using a sample discharge tube (bottom-emptying device for bailer or discharge tube of bladder pump). 40 milliliter vials should not have headspace.

9. Label sample containers, place in ziplock bag, and place on ice in cooler.

10. Log samples onto chain-of-custody form and maintain sample custody until shipped to laboratory.

11. Containerize purge water, excess sample, and decontamination wastewater in steel drum(s). Label drum(s) with hazardous waste label, contents, and well number from which waste originated.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality control samples should consist of the following:

- Duplicate samples at a frequency of 1 per 10 natural samples
- Cross-contamination blank (also known as a sampler rinsate blank) at a frequency of 1 per 10 natural samples. Cross-contamination blanks are prepared by passing deionized water over and through decontaminated sampling equipment (including sample filter if used).
- If analyses require collection of samples in 40 milliliter vials, travel blanks should also be included at a frequency of 1 per day of sampling.
- Optional quality control samples include standard reference materials and natural matrix spikes.

Meters for measurement of field parameters should be calibrated at least once per day. Calibration standards should generally approximate or span natural groundwater characteristics. Recalibration may be appropriate if unusual measurements are noticed. Calibration activities should be documented on the instrument calibration log.

5.0 DOCUMENTATION

The following information should be collected prior to sampling and taken into the field for reference:

- Well completion schematic
- Summary of historic water level, total depth, and field parameter measurements

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

- Daily Report
- Field Notebook
- Instrument Calibration Log
- Well Purge and Sample Log
- Chain-of-Custody

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

6.0 DECONTAMINATION

Prior to entering the site, purging and sampling equipment should be decontaminated by steam cleaning, pressure washing, or equivalent.

Prior to sampling each well, down-well equipment and equipment that will contact the sample (except sample containers) should be decontaminated according to the following procedure:

- Steam clean or pressure wash (optional unless oily contamination covers equipment)
- Wash with soap

- Rinse with tap water
- Double rinse with distilled water

If metals are included in the analytical parameters, the decontamination procedures should include:

- Steam clean or pressure wash (optional unless oily contamination covers equipment)
- Wash with soap
- Rinse with tap water
- Rinse with dilute nitric acid (skip for pumps containing metal parts)
- Rinse with tap water
- Double rinse with distilled water

Suction or discharge hoses from purge pumps need external decontamination only. Purge or sampling pumps should be decontaminated by filling the decontamination chamber with the aforementioned solutions and pumping the solutions from the chamber to the waste drum.

Prior to leaving the site, purging and sampling equipment should be steam cleaned, pressure washed, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Purge water, excess sample, and decontamination wastewater should be containerized in steel drums. Drums should be labeled with hazardous waste labels, including: Generator's name and accumulation date. Wastes from different wells may be combined, but wastes that are anticipated to contain chemical should not be mixed with waste that are not thought to be contaminated.

8.0 SAFETY

Primary chemical hazards during well purging and sampling are associated with dermal exposure. Acids used for decontamination and sample preservation may also present chemical hazards. Primary protection against dermal exposure includes splash protection and gloves. Special chemical hazards may be associated with the presence of product, if discovered during sampling. Water quality samples are not generally considered representative in the presence of product. Accordingly, it may be appropriate to abandon sampling efforts if product is discovered.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

U.S. Environmental Protection Agency, 1989a. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, OSWER Directive 9355.0-14. USEPA, Office of Emergency and Remedial Response, Washington, DC. December 1989.

U.S. Environmental Protection Agency, 1989b. USEPA Method Study #39, Method 504, 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) in Water, Pb 89-119 580/AS. National Technical Information Service, Springfield VA. 1989.

Table 1

Sampling and Preservation for Groundwater Samples

Parameter	Analytical Method	Container	Preservation	Maximum Holding Time
Purgeable Halocarbons by GC	EPA 8010	Two 40 ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	14 days after collection
Purgeable Aromatics by GC	EPA 8020	Two 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	Two 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 as Deisel	Extract by EPA 3550 and analyze by GCFID	Two 40-ml glass vials	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	HNO3 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	HNO3 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

APPENDIX D

Chain-of-Custody Forms

1090143

Chain of Custody

Client: STREAMBORN   Sampler: G. RELLER

Project Number: P/2   Date Sampled: 18 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH-G	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
B10 6-6.5	S	X								ARCHIVE	
B10 10.5-11	S	X								ARCHIVE	
B10 15.5-16	S	X		✓	✓	✓				ANALYZE	
B10 21-21.5	S	X		✓	✓	✓				ANALYZE	
B10 25.5-26	S	X								ARCHIVE	
B10 30.5-31	S	X		✓	✓	✓				ANALYZE	

Relinquished By: Gregory J Reller Date: 19 OCT 90 Time: 13:15
Received By: Tom Donovan Date: 10-19-90 Time: 1:15
Relinquished By: ____ Date: ____ Time: ____
Received By: Tom Donovan Date: 10-19-90 Time: 5:00
Relinquished By: ____ Date: ____ Time: ____
Received By: ____ Date: ____ Time: ____
Relinquished By: ____ Date: ____ Time: ____
Received By: ____ Date: ____ Time: ____

1090143

Chain of Custody

Client: STREAMBORN Sampler: G. RELLER

Project Number: P12 Date Sampled: 18 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH-G	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
B10 36-36.5	S	X								ARCHIVE	
B10 40.5-41	S	X								ARCHIVE	
B10 45.5-46	S	X		✓	✓	✓				ANALYZE	
B10 51-51.5	S	X								ARCHIVE	
B11 6-6.5	S	X								ARCHIVE	
B11 10.5-11	S	X								ARCHIVE	

Relinquished By: Gregory J Reller Date: 19 OCT 90 Time: 13:15
Received By: Tara Donovan Date: 10-19-90 Time: 1:15
Relinquished By: ____ Date: ____ Time: ____
Received By: Tara Donovan Date: 10-19-90 Time: 5:00
Relinquished By: ____ Date: ____ Time: ____
Received By: ____ Date: ____ Time: ____
Relinquished By: ____ Date: ____ Time: ____
Received By: ____ Date: ____ Time: ____

Chain of Custody

Client: STREAMBORN

Sampler: G. RELLER

CHROMALAB FILE # 1090143

Project Number: 812

Date Sampled: 18OCT90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH-G	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
B-11 16.9-16.4	S	X								ARCHIVE	
B-11 21-21.5	S	X		✓	✓	✓				ANALYZE	
B-11 26-26.5 B-11 25.5-26	S	X								ARCHIVE BOTH	
B-11 30.5-31 B-11 31-31.5	S	X		✓ ✓	✓ ✓	✓ ✓				~~ANALYZE BOTH~~ HOLD ANALYZE	
B-11 36-36.5	S	X		✓	✓	✓				ANALYZE	
B-11 41.-41.5	S	X								ARCHIVE	

Relinquished By: Gregory J Reller Date: 19OCT90 Time: 13:15

Received By: Tom Donovan Date: 10-19-90 Time: 1:15

Relinquished By: Date: Time:

Received By: Tom Donovan Date: 10-19-90 Time: 5:00

Relinquished By: Date: Time:

Received By: Date: Time:

Relinquished By: Date: Time:

Received By: Date: Time:

1090143

Chain of Custody

Client: STREAMBORN
Sampler: G. RELLER

Project Number: P12
Date Sampled: 18 OCT 90 / 19 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	BTXE	TPH-G	O&G				Sampler Comments & Instructions	Laboratory Comments
B-11 46-46.5	S	X		✓	✓	✓				ANALYZE	
B-11 51-51.5	S	X								ARCHIVE	
P1 5.5-6	S	X								ARCHIVE	
P1 10.5-11	S	X								ARCHIVE	
P1 15.5-16 ~~20.5-21~~	S	X								ARCHIVE	
P1 20.5-21	S	X								ARCHIVE	

Relinquished By: Gregory J Reller Date: 19 OCT 90 Time: 13:15
Received By: Tara Donovan Date: 10-19-90 Time: 1:15
Relinquished By: Date: Time:
Received By: Tara Donovan Date: 10-19-90 Time: 5:00
Relinquished By: Date: Time:
Received By: Date: Time:
Relinquished By: Date: Time:
Received By: Date: Time:

1090143

Chain of Custody

Client: STREAMBORN

Sampler: G. Reller

Project Number: P12

Date Sampled: 19 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH-GASOLINE					Sampler Comments & Instructions	Laboratory Comments
P1 25.5-26				✓	✓					ANALYZE	
P-1 30-30.5										ARCHIVE	
P1 35-35.5				✓	✓					ANALYZE	
P1 40.5-41				✓	✓					ANALYZE	
P1 45.5-46										ARCHIVE	
P1 49.7-50.3				✓	✓					ANALYZE	

Relinquished By: Gregory J. Reller Date: 19 OCT 90 Time: 13:15

Received By: Tara Donovan Date: 10-19-90 Time: 1:15

Relinquished By: Date: Time:

Received By: Tara Donovan Date: 10-19-90 Time: 5:00

Relinquished By: Date: Time:

Received By: Date: Time:

Relinquished By: Date: Time:

Received By: Date: Time:

Chain of Custody

Client: STREAMBORN
Sampler: GJR

Project Number: 712
Date Sampled: 20 OCT 90

CHROMALAB FILE # 1090157

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH-GASOLINE	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
A1 5.5-6	S	X								ARCHIVE	
10-10.5	S	X								ARCHIVE	
15.5-16	S	X								ARCHIVE	
20.5-21	S	X		X	X	X				ANALYZE	
25.5-26	S	X		X	X	X				ANALYZE	
30-30.5	S	X								ARCHIVE	

Relinquished By: Gregory J. Rulle Date: 21 OCT 90 Time: 1530
Received By: ______ Date: ______ Time: ______
Relinquished By: ______ Date: ______ Time: ______
Received By: ______ Date: ______ Time: ______
Relinquished By: ______ Date: ______ Time: ______
Received By: ______ Date: ______ Time: ______
Relinquished By: ______ Date: ______ Time: ______
Received By: ______ Date: ______ Time: ______

Chain of Custody

Client: STREAMBORN Sampler: GJR

Project Number: P12 Date Sampled: 20 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH - GASOLINE	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
M1 35-35.5	S	X								ARCHIVE ~~ANALYZE IN~~	
M1 35.5-36	S	X		X	X	X				~~35.5-36 IN~~ ANALYZE	
M1 40.5-41	S	X								ARCHIVE	
M1 45.5~~46~~	S	X		X	X	X				ANALYZE	
R1	W	X		X	X	X				ANALYZE	Hold } PER GREG RELLER
R2	W	X		+	X	X				ANALYZE	Hold }
P2 5.5-6	S	X								ARCHIVE	

Relinquished By: Gregory D Reller Date: 21 OCT 90 Time: 11:30

Received By: ___ Date: ___ Time: ___

Relinquished By: ___ Date: ___ Time: ___

Received By: ___ Date: ___ Time: ___

Relinquished By: ___ Date: ___ Time: ___

Received By: ___ Date: ___ Time: ___

Relinquished By: ___ Date: ___ Time: ___

Received By: ___ Date: ___ Time: ___

Chain of Custody

Client: STREAMBORN
Sampler: GJR
Project Number: P12
Date Sampled: 20 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH GASOLINE	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
P2 10.5-11	S	X								ARCHIVE	
P2 15-15.5	S	X								ARCHIVE	
P2 20.5-21	S	X		X	X	X				ANALYZE	
P2 25-25.5	S	X								ARCHIVE	
P2 ~~30.5-31~~ 30-30.5	S	X		X	X	X				ANALYZE	
P2 35.5-36	S	X		X	X	X				ANALYZE	

Relinquished By: Gregory [signature] Date: 21 OCT 90 Time: 11:30
Received By: ______ Date: ______ Time: ______
Relinquished By: ______ Date: ______ Time: ______
Received By: ______ Date: ______ Time: ______
Relinquished By: ______ Date: ______ Time: ______
Received By: ______ Date: ______ Time: ______
Relinquished By: ______ Date: ______ Time: ______
Received By: ______ Date: ______ Time: ______

Chain of Custody

Client: STREAMBORN

Sampler: GJR

Project Number: P12

Date Sampled: 20 OCT 90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH GASOLINE	Analysis: O&G				Sampler Comments & Instructions	Laboratory Comments
P2 40-40.5	S	X								ARCHIVE	
P2 45.5-46	S	X								ARCHIVE	
P2 50-50.5	S	X								ARCHIVE	
P2 55.5-56	S	X		X	X	X				ANALYZE	
P2 60.5-61	S	X									

Relinquished By: Gregory J Scell Date: 21 OCT 90 Time: 11:30
Received By: Date: Time:
Relinquished By: Date: Time:
Received By: Date: Time:
Relinquished By: Date: Time:
Received By: Date: Time:
Relinquished By: Date: Time:
Received By: Date: Time:

Chain of Custody

Client: STREAMBORN

Sampler: M. BUSCHECK

CHROMALAB FILE # 1190026

Project Number: P.12

Date Sampled: 11-6-90

Sample Identification	Matrix (S, V, Gw)	Grab	Composite	Analysis: BTXE	Analysis: TPH GASOLINE					Sampler Comments & Instructions	Laboratory Comments
P2	GW	X		X	X					pH ≐ 12 AT TIME OF SAMPLE COLLECTION (GSR)	

Relinquished By: [signature] Date: 11-6-90 Time: 10:25 AM

Received By: Gregory J. Rell Date: 6 NOV. 90 Time: 10:25 AM

Relinquished By: Gregory J. Rell Date: 6 NOV 90 Time: 2:30 P.M.

Received By: Tara Donovan Date: 11-6-90 Time: 2:30 P.M.

Relinquished By: Date: Time:

Received By: Tara Donovan Date: 11-6-90 Time: 4:45

Relinquished By: Date: Time:

Received By: Date: Time:

Chain of Custody

Client Califrance
Project Number P26

Sampler Mark Buscheck
Date Sampled 18 March 1991

CHROMALAB FILE # 391101
1857

Sample Identification	Sample Date/Time	Matrix(S, V, Gw)	Grab	Composite	Analysis: TPH-Gasoline	Analysis: BTX&E					Sampler Comments & Instructions	Laboratory Comments
P3 35.5-36.0	18 March 10:55	Soil	✓		✓	✓					10 Day Turnaround	
P3 40.5-41.0	18 March 11:20	Soil	✓		✓	✓					10 Day Turnaround	

Relinquished By: [signature] Date: 20 March '91 Time: 14:15
Received By: T. Donovan Date: 3-20-91 Time: 2:15
Relinquished By:____ Date:____ Time:____
Received By:____ Date:____ Time:____
Relinquished By:____ Date:____ Time:____
Received By:____ Date:____ Time:____
Relinquished By:____ Date:____ Time:____
Received By: LAB T. Donovan Date: 3-20-91 Time: 6:00

STREAMBORN
P.O. Box 9504
Berkeley CA 94709

Chain of Custody

CHROMALAB FILE # 491131

2088

Client: A.P.A. Fund Limited (Califrance Corp.)
Project Number: P26 (Califrance Add-ons)

Sampler: Mark Buscheck
Date Sampled: 18 April 1991

Sample Identification	Sample Date/Time	Matrix(S, V, Gw)	Grab	Composite	Analysis: TPH-Gasoline	BTE&X				Sampler Comments & Instructions	Laboratory Comments
M2 21.0-21.5	18 April 1991 10:00	Soil	X							Archive until further advised	
M2 26.0-26.5	18 April 1991 10:15	Soil	X							Archive until further advised	
M2 31.0-31.5	18 April 1991 10:30	Soil	X							Archive until further advised	
M2 36.0-36.5	18 April 1991 10:45	Soil	X							Archive until further advised	
M2 41.0-41.5	18 April 1991 11:00	Soil	X							Archive until further advised	
M2 46.0-46.5	18 April 1991 11:15	Soil	X							Archive until further advised	

Relinquished By: MARK BUSCHECK [signature] Date: 19 APRIL 1991 Time: 12:08
Received By: T. Donovan Date: 4-19-91 Time: 12:08
Relinquished By:___ Date:___ Time:___
Received By:___ Date:___ Time:___
Relinquished By:___ Date:___ Time:___
Received By:___ Date:___ Time:___
Relinquished By:___ Date:___ Time:___
Received By: LAB T Donovan Date: 4-19-91 Time: 5:30

STREAMBORN
P.O. Box 9504
Berkeley CA 94709

Chain of Custody

Client: A.P.A. Fund Ltd. c/o Califrance Corp.
Project Number: P26

Sampler: Noah Heller
Date Sampled: 7 May 1991

CHROMALAB FILE # 591051
2250

Sample Identification	Sample Date/Time	Matrix(S, V, Gw)	Grab	Composite	Analysis: TPH-Gasoline	BTXE	TPH-Diesel	Oil & Grease			Sampler Comments & Instructions	Laboratory Comments
M2-GW1	7May'91 1330	GW	X		X	X					Preserved HCL 6 40-ml Vials	
TB-1	7 May'91 14:00										Trip Blank Archive	

Relinquished By: Noah R. Heller Date: 5-7-91 Time: 3:45 P.M.
Received By: T. Donovan Date: 5-7-91 Time: 3:45 p.m.
Relinquished By:______ Date:______ Time:______
Received By:______ Date:______ Time:______
Relinquished By:______ Date:______ Time:______
Received By:______ Date:______ Time:______
Relinquished By:______ Date:______ Time:______
Received By: T. Donovan Date: 5-7-91 Time: 5:15

STREAMBORN
P.O. Box 9504
Berkeley CA 94709-0504
415/528-4234
Fax 528-2613

APPENDIX E

Groundwater Monitoring Logs

T2 Califrance
MW3 6 Nov. 1990

GROUNDWATER MONITORING WELL SAMPLING LOG

Client: Califrance

Sampler Name: M Buscheck

Site Name: 2801 MacArthur Blvd.

Sampling Method: Bailer - Teflon

Well Number: P2

Well Elevation:

Sampling Date: 6 November 1990

Depth to Water: ± 37

Well Diameter: 2"

Bottom of Well: ± 43

Condition of Well: Good

Notes - Thick White Coating Present On Inside Wall Of Casing (At Surface); 6 GW Samples Relinquished To G. Keller At 10:25 AM 6 November 1990

Start Time: 8:15 Completion Time: 9:35

Type of Samples Collected: Groundwater (6) / Notes: Calibrated Water Quality Meter At Start, Check Meter With Buffer Solution At Conclusion - All Readings Accurate, Distilled H_2O Measured Conductivity At 5,250; DTW At Conclusion = 39.8' (9:50), Well Bailed Dry Twice

Calculation of Standing Well Volume:

Total Depth of Well - Depth to Water x Volume per Foot of Well Casing = Standing Well Volume
(0.163 Gal/Ft for 2 inch well)
(0.653 Gal/Ft for 4 inch well)
(1.47 Gal/Ft for 6 inch well)

43 - 37 x 0.163 = 0.978 Gallons

Purging:	pH	SC	T	Comments:
Initial Volume	12.29	8,750	60.1	Water Light Brown Slightly Cloudy 8:15
1 Gallons	12.40	9,200	61.6	±1 Casing Volume Removed 8:20
1.5 Gallons	12.50	11,350	61.8	Waited ± 20 Minutes For Recharge 8:40
2 Gallons	12.67	13,760	61.6	± 2 Casing Volumes Removed Less Cloudy 8:50
2.5 Gallons	12.61	13,690	61.5	Water More Clear, Less Cloudy 9:00
2.7 Gallons	12.64	13,650	61.6	Waited ± 25 Minutes For Recharge 9:25
3.1 Gallons	12.62	13,640	61.6	PVC Chips Floating In Bailer 9:30
3.4 Gallons	12.62	13,650	61.5	Water Very Light Brown & Clear, Sampled
Gallons				At 9:40, Slight Oily Sheen On Water
Gallons	± 3 Casing Volumes Removed			Surface In Wastewater Bucket

P26 CALIFRANCE
ADD-ONS

GROUNDWATER MONITORING WELL SAMPLING LOG

Client: CALAFRANCE

Sampler Name: N. Heller

Site Name: C

Sampling Method: Bailer

Well Number: M2

Well Elevation:

Sampling Date: 4-30-91

Depth to Water : 31.15

Well Diameter: 2"

Bottom of Well: 45.0

Condition of Well: Good Petroleum odor from well inside, see water

Start Time: 13:30 Completion Time: 14:30

Type of Samples Collected: None

Calculation of Standing Well Volume:

Total Depth of Well - Depth to Water x Volume per Foot of Well Casing = Standing Well Volume
(0.163 Gal/Ft for 2 inch well)
(0.653 Gal/Ft for 4 inch well)
(1.47 Gal/Ft for 6 inch well)

45.0 - 31.15 x .163 = 2.2 Gallons

Purging:	pH	SC	T	Comments:
Initial Volume Pulls	8.05	2710	75.9	clear - hydro-odor
2.2 Gallons 9	7.60	3180	75.6	whitish cloudy
4.4 Gallons 18	7.38	3040	75.0	brownish cloudy - slight hydro odor
6.6 Gallons 27	7.36	2970	75.0	
8.8 Gallons 36	7.37	2680	75.1	
11 Gallons 45	7.35	2620	75.0	sandy light brown silty
Gallons				mucky
Gallons				
Gallons				
Gallons				

GROUNDWATER MONITORING WELL SAMPLING LOG

Client: [illegible]

Sampler Name: N. Hedley

Site Name: [illegible]

Sampling Method: Bailer

Well Number: MW-2

Well Elevation:

Sampling Date: 5-7-91

Depth to Water: 31.29

Well Diameter: 2"

Bottom of Well: 44.85

Condition of Well: Good, Petroleum odor ~~and~~ observed from well and purge water

Start Time: 12:20

Completion Time: 12:50

Type of Samples Collected: TPH-G & BTEX
3 40-ml vials each

Calculation of Standing Well Volume:

Total Depth of Well - Depth to Water x Volume per Foot of Well Casing = Standing Well Volume
(0.163 Gal/Ft for 2 inch well)
(0.653 Gal/Ft for 4 inch well)
(1.47 Gal/Ft for 6 inch well)

44.85 - 31.29 x 0.163 = 2.21 Gallons

Purging:	pH	SC	T	Comments:
Initial Volume	7.2	2360	74.6	Clear, sl. odor
2.5 Gallons	7.27	2720	75.8	~~[illegible]~~ cloudy to clear
5.0 Gallons	7.27	1800	78.4	slightly cloudy, no odor
___ Gallons				Hydrocarbon odor
___ Gallons				
___ Gallons				
___ Gallons				
___ Gallons				
___ Gallons				
___ Gallons				

APPENDIX F

Permits

STREAMBORN

415/528-4234
Fax 528-2613

Craig A. Mayfield
Water Resources Engineer III
Alameda County Flood Control and
Water Conservation District, Zone 7
5997 Parkside Drive
Pleasanton CA 94566

31 December 1990

Project No. P12

Permit Number 90623
Well, Piezometer, and Soil Boring Completion Information
2801 MacArthur Boulevard
Oakland CA

Dear Mr. Mayfield:

Attached are the logs for borings B10 and B11 plus the logs and completion schematics for piezometers P1 and P2 and monitoring well M1. Also attached are figures showing the pertinent locations. The borings, piezometers, and well were installed under permit number 90623. If you require additional information please call.

Sincerely,

STREAMBORN

Don W Covell FOR

Gregory J. Reller
Geologist

Attachments

Mail: P.O. Box 9504, Berkeley CA 94709-0504 Office: 900 SanteFe Avenue, Albany CA 94706

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94566 • (415) 484-2600

16 October 1990

Streamborn
P.O. Box 9504
Berkeley, CA 94709-0504

Gentlemen:

Enclosed is Groundwater Protection Ordinance permit 90623 for a monitoring well construction project at 2801 MacArthur Boulevard in Oakland for APA Fund Limited.

Please note that permit condition A-2 requires that a well construction report be submitted after completion of the work. The report should include drilling and completion logs, location sketch, and permit number.

If you have any questions, please contact Todd Wendler or Craig Mayfield at 484-2600.

Very truly yours,

Jim Dixon
General Manager

By Craig A. Mayfield
Craig A. Mayfield
Water Resources Engineer III

TW:mm
Enc.

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94566 • (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 2801 MacArthur Blvd.
Oakland CA

CLIENT
Name APA FUND LIMITED c/o CALIFRANCE CORP.
Address 1904 Franklin St. Phone 452-4711
City Oakland Zip 94612

APPLICANT
Name Greg Keller
Streamborn
Address P.O. Box 9504 Phone 528-4234
City Berkeley Zip 94709-0504

TYPE OF PROJECT
Well Construction
- Cathodic Protection ___
- [Wat]er Supply ___
- [M]onitoring X

Geotechnical Investigation
- General ___
- Contamination X
- Well Destruction ___

PROPOSED WATER SUPPLY WELL USE
Domestic ___ Industrial ___ Other ___
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger X
Cable ___ Other ___

DRILLER'S LICENSE NO. 521617

WELL PROJECTS
- Drill Hole Diameter 8 in. Maximum
- Casing Diameter 2 in. Depth 50 ft.
- Surface Seal Depth 25 ft. Number 1 WELL
  2 PIEZOMETERS

GEOTECHNICAL PROJECTS
- Number of Borings 2 Maximum
- Hole Diameter 8 in. Depth 40 ft.

ESTIMATED STARTING DATE 19 OCTOBER 90
ESTIMATED COMPLETION DATE 20 OCTOBER 90

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE Gregory J. Keller Date ___

FOR OFFICE USE

PERMIT NUMBER 90623
LOCATION NUMBER ___

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A.) GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.

(B.) WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

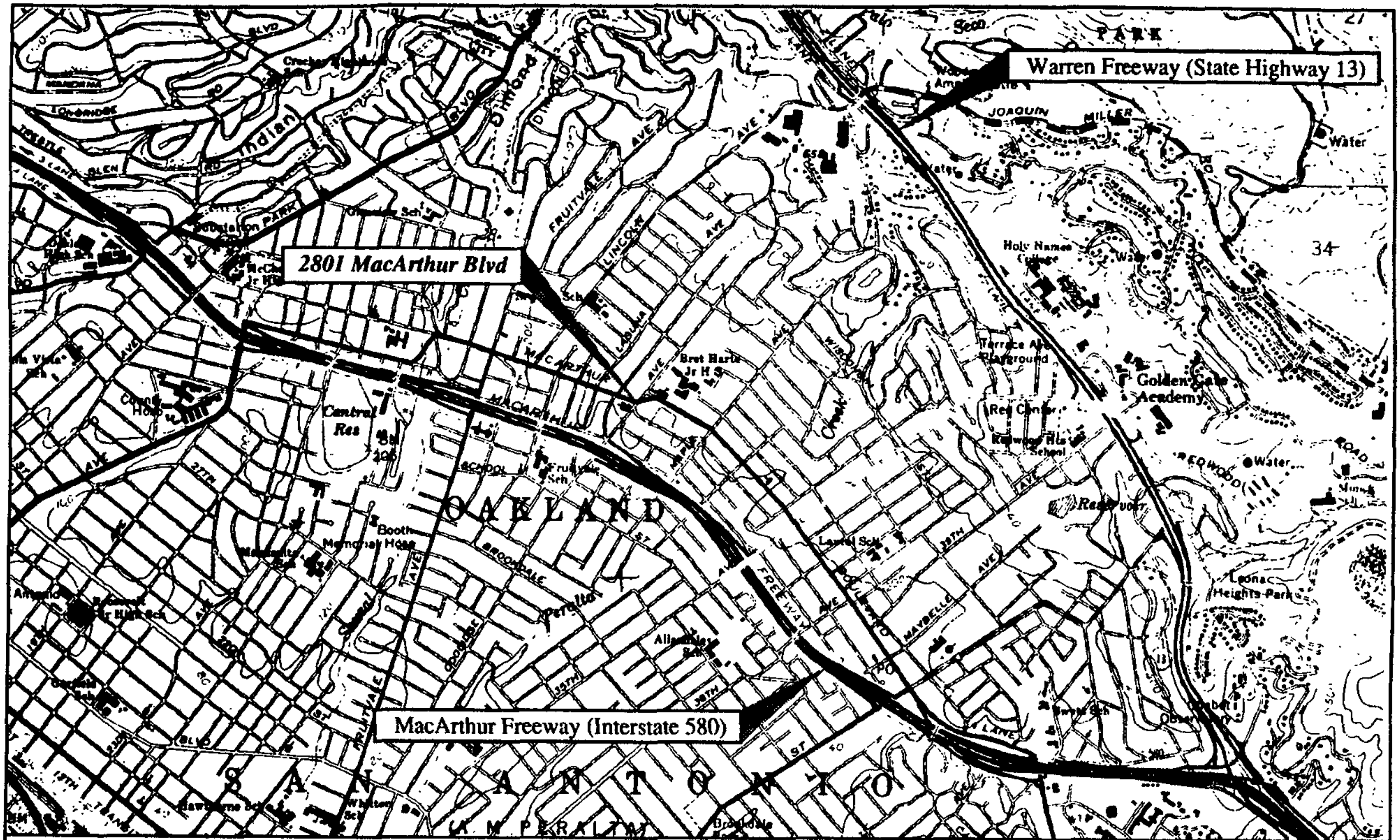
(C.) GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

D. CATHODIC. Fill hole above anode zone with concrete placed by tremie.

E. WELL DESTRUCTION. See attached.

Approved [signature] Date 12 Oct 90
Todd N. Wendler

121989



Basemap Reference: U.S. Geological Survey, 7.5 Minute Topographic Quadrangle, Oakland East CA, 1959 photorevised 1980

0 0.5 1.0
Approximate Scale in Miles

0 5,000
Approximate Scale in Feet

Figure 1

Location Map

2801 MacArthur Boulevard
Oakland CA

STREAMBORN

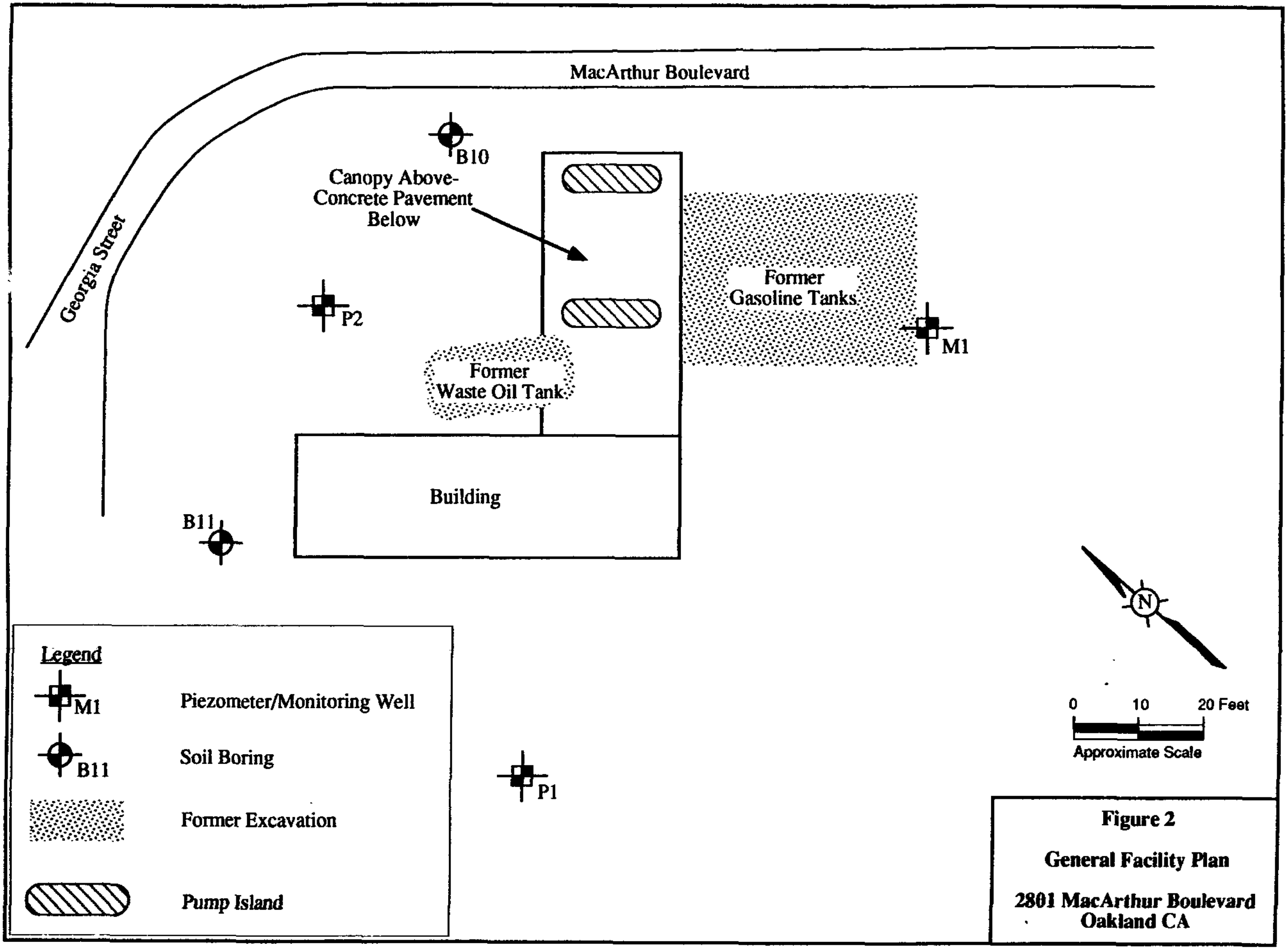


Figure 2

General Facility Plan

2801 MacArthur Boulevard
Oakland CA

STREAMBORN

Boring Logs, Completion Diagrams, and Boring Log Legend are Contained in Appendix A

STREAMBORN

415/528-4234
Fax 528-2613

J. Killingstad
Chief Water Resources Engineering
Alameda County Flood Control and
Water Conservation District, Zone 7
5997 Parkside Drive
Pleasanton CA 94588

28 May 1991

Project No. P26

Permit Number 91144
Well and Piezometer Completion Information
2801 MacArthur Boulevard
Oakland CA

Dear Mr. Killingstad:

Attached are the logs and completion schematics for piezometer P3 and monitoring well M2. Also attached are figures showing the pertinent locations. The piezometer and well were installed under permit number 91144. If you require additional information please call.

Sincerely,

STREAMBORN

Mark W. Buscheck
Geologist

Enclosures (DWR 188, Figure 1, Figure 2, Boring Log Legend and Notes, Boring Log for P3, P3 Completion Schematic, Boring Log for M2, Completion Schematic for M2)

cc: Department of Water Resources, Central District

Mail: P.O. Box 9504, Berkeley CA 94709-0504 Office: 900 SanteFe Avenue, Albany CA 94706

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94588 • (415) 484-2600

19 March 1991

Streamborn Consulting Services
P.O. Box 9504
Berkeley, CA 94709-0504

Gentlemen:

Enclosed is Groundwater Protection Ordinance permit 91144 for a monitoring well construction project at 2801 MacArthur Boulevard in Oakland for APA Fund Limited.

Please note that permit condition A-2 requires that a well construction report be submitted after completion of the work. The report should include drilling and completion logs, location sketch, and permit number.

If you have any questions, please contact Wyman Hong or Craig Mayfield at 484-2600.

Very truly yours,

J. Killingstad, Chief
Water Resources Engineering

WH:mm
Enc.

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94566 • (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 2801 MacArthur Blvd
Oakland CA
At Intersection Of Coolidge & MacArthur

CLIENT
Name APA Fund Limited c/o California Corporation
Address 1904 Franklin St. Phone 415 452-4711
City Oakland Zip 94612

APPLICANT
Name Mark Buscheck
Streamborn
Address P.O. Box 9504 Phone 415 528-4234
City Berkeley Zip 94709-0504

TYPE OF PROJECT
Well Construction
- Cathodic Protection ___
- Water Supply ___
- Monitoring X

Geotechnical Investigation
- General ___
- Contamination ___
- Well Destruction ___

PROPOSED WATER SUPPLY WELL USE
Domestic ___ Industrial ___ Other ___
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger X
Cable ___ Other ___

DRILLER'S LICENSE NO. C57 374152

WELL PROJECTS
Drill Hole Diameter ±8 in. Maximum
Casing Diameter ±2 in. Depth ±45 ft.
Surface Seal Depth ±32 ft. Number 2

GEOTECHNICAL PROJECTS
Number of Borings ___ Maximum
Hole Diameter ___ in. Depth ___ ft.

ESTIMATED STARTING DATE 18 March 1991
ESTIMATED COMPLETION DATE 15 April 1991

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] Date 14 March '91

FOR OFFICE USE

PERMIT NUMBER 91144
LOCATION NUMBER ___

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A.) GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.

(B.) WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

D. CATHODIC. Fill hole above anode zone with concrete placed by tremie.

E. WELL DESTRUCTION. See attached.

Approved [signature] Wyman Hong Date 14 Mar 91

121989

Basemap Reference: U.S. Geological Survey, 7.5 Minute Topographic Quadrangle, Oakland East CA, 1959 (photorevised 1980)

0 0.5 1.0
Approximate Scale in Miles

0 5,000
Approximate Scale in Feet

N

Figure 1

Location Map

2801 MacArthur Boulevard
Oakland CA

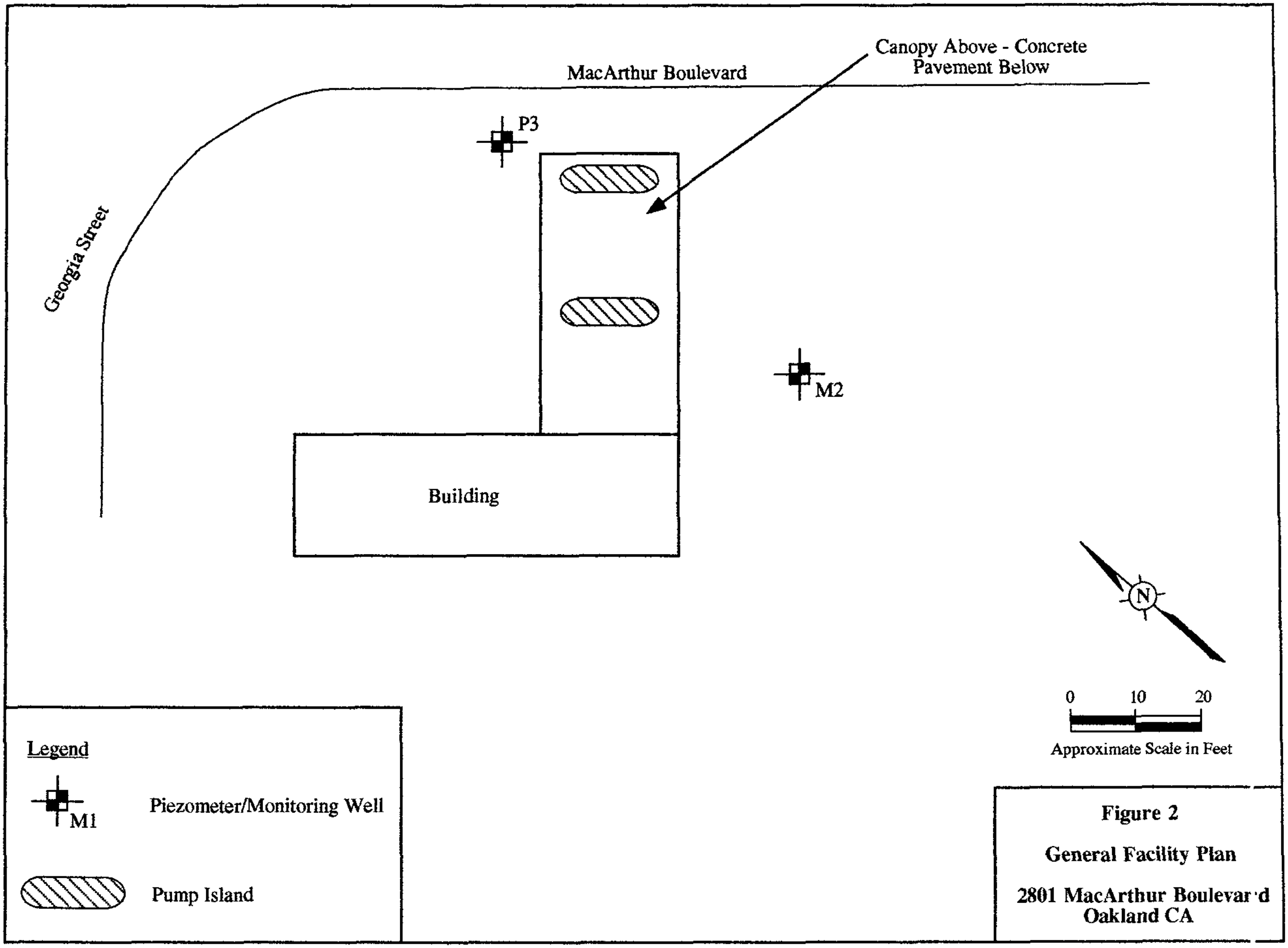


Figure 2

General Facility Plan

2801 MacArthur Boulevard
Oakland CA

APPENDIX G

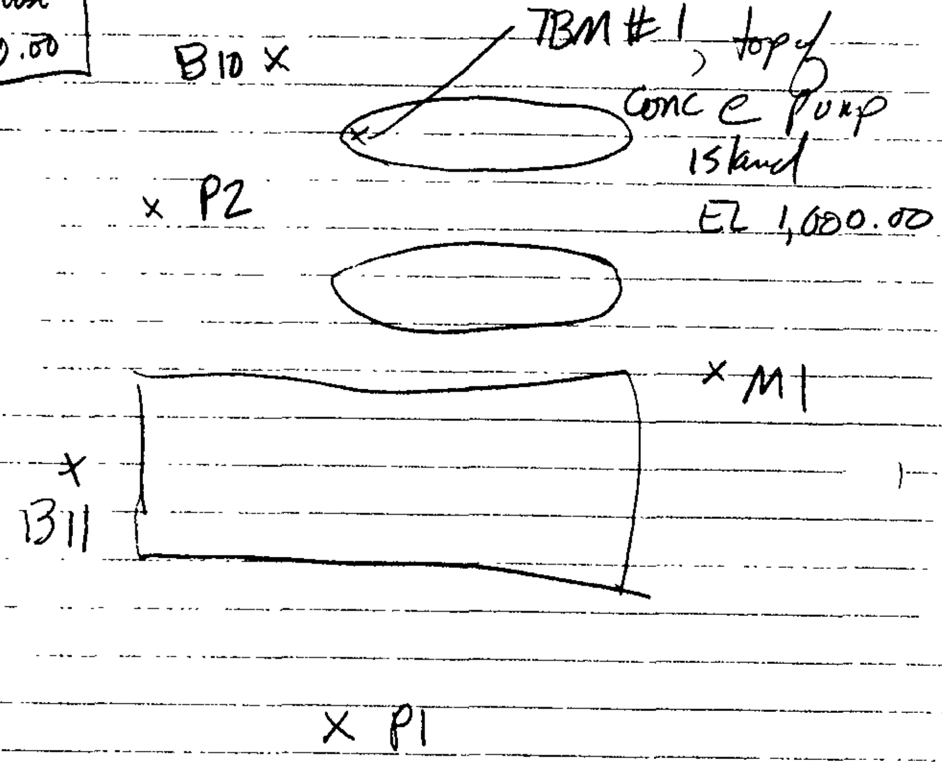
Survey Notes

19 Oct 90 DWL & MB Sun, Warm, Calm

Point	Elev	BS	HI	FS
TBM #1	1,000.00	2.08	1,002.08	
B10	998.63			3.45
P2	997.93			4.15
B11	997.81			4.27
P1	999.84			2.24
TBM #1	1,000.00	5.29	1,005.29	
M1	999.53			5.76

Close 0.00

Close 0.00



ALL GROUND SHOTS N-SIDE

3:00 PM
DWL & MWB

24 OCT
P-12

		ELEV	BS	HI	FS
TBM #1		1,000.00	5.32		
P2	TOC-N	997.78			7.54
	GS-N				7.26
M1	TOC-N	999.98			5.34
	GS-N				5.06
P1	TOC-N	999.59			5.73
	GS-N				5.48
Close			5.32 ✓		

P26 Californie Add. Obs
29 March 1991
16' 20
Close & Warm
MWB & DWL

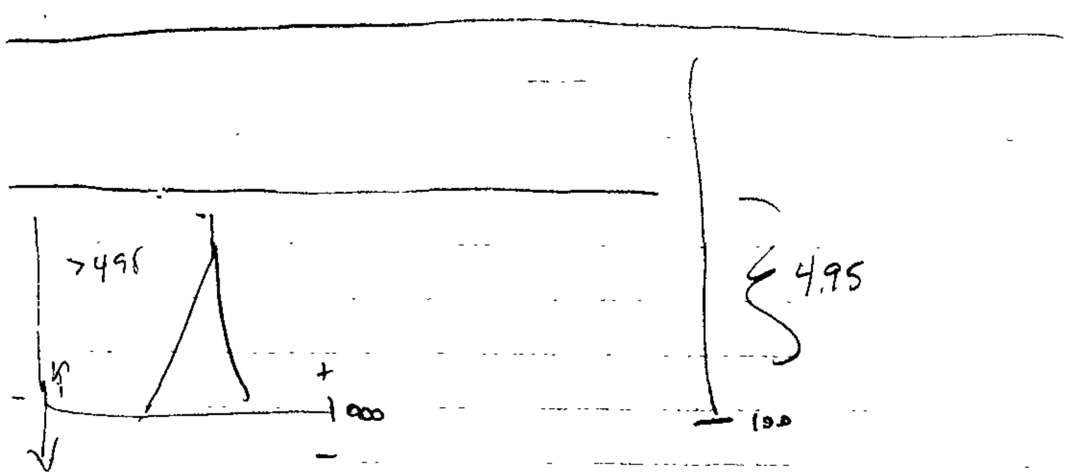
Level Survey P3

	Elevation	B.S.	H.I	F.S.
TBM #1	1,000	3.32		
P3 TOC-N	999.06			4.26
GS-N	999.27			4.05
T Box-N	999.30			4.02
P2 TOC N	997.77			5.55
T Box N	998.13			5.19
Close		3.32		

Overcast & Cool
11:00 PM
30 April 1991
P26

MWB / NRH

	Elev	BS	HI	FS
TBM#	1,000.00	4.95		
M1 Top Of Casing-N	999.98			4.97
Top Of Box-N	1000.27			4.68
Ground Surface-N	1000.26			4.69
M2 Top Of Casing-N	999.57			5.38
Top Of Box-N	999.90			5.05
Ground Surface-N	999.88			5.07
Close		4.95		



APPENDIX H

Historic Sampling Results

Table 1

Soil Results from Verification Samples Collected During Tank and Piping Removal

Sample Designation	Sample Location	Depth (feet)	Sample Date	Sample Type	Lead (mg/kg)	Total Petroleum Hydrocarbons (mg/kg)			Nonhalogenated Volatile Aromatic Organic Compounds (mg/kg)				Oil & Grease (mg/kg)		Purgeable Halocarbons (mg/kg)
						Gasoline	Diesel	Motor Oil	Benzene	Toluene	Ethyl-benzene	Xylenes	Non-Polar	Total	
1771-A	7,500-gallon Unleaded Gasoline Tank	11	5/7/89	Grab	NM	<10	NM	NM	0.005	<0.003	<0.003	<0.003	NM	NM	NM
1771-B	7,500-gallon Unleaded Gasoline Tank	11	5/7/89	Grab	NM	<10	NM	NM	0.011	0.008	<0.003	0.007	NM	NM	NM
1772-A	3,500-gallon Unleaded Gasoline Tank	11	5/7/89	Grab	NM	<10	NM	NM	0.004	<0.003	<0.003	0.010	NM	NM	NM
1772-B	3,500-gallon Unleaded Gasoline Tank	11	5/7/89	Grab	NM	<10	NM	NM	0.021	0.012	0.003	0.014	NM	NM	NM
1773-A	3,500-gallon Leaded Gasoline Tank	11	5/7/89	Grab	11	480	NM	NM	0.120	1.200	0.910	5.200	NM	NM	NM
1773-B	3,500-gallon Leaded Gasoline Tank	11	5/7/89	Grab	10	<10	NM	NM	<0.003	<0.003	<0.003	<0.003	NM	NM	NM
Waste Oil Vt	1,000-gallon Waste Oil Tank	NA	7/3/89	Grab	NM	27	<10	<10	<0.0025	<0.0025	<0.003	<0.003	<100	<50	<0.002 to <0.050
73	Waste Oil Piping	NA	8/30/89	Grab	NM	<10	NM	NM	<0.025	0.310	0.088	0.180	NM	NM	NM
74	Waste Oil Piping	NA	8/30/89	Grab	NM	<10	NM	NM	<0.025	0.160	<0.075	0.130	NM	NM	NM
75	Waste Oil Piping	NA	8/30/89	Grab	NM	<10	NM	NM	<0.025	0.053	<0.075	<0.075	NM	NM	NM
76	Waste Oil Piping	NA	8/31/89	Grab	NM	180	NM	NM	<0.025	0.420	0.660	1.800	NM	NM	NM

General Notes

(a) NM indicates parameter not analyzed

(b) < indicates parameter below detection limit

(c) NA indicates information not available

Table 2
Soil Results from Borings

Sample Location	Sample Designation	Sample Depth (feet)	Sample Date	Sample Type	Total Petroleum Hydrocarbons (mg/kg) as Gasoline	as Diesel	as Motor Oil	Nonhalogenated Volatile Aromatic Organic Compounds (mg/kg) Benzene	Toluene	Ethylbenzene	Xylenes
B1	B1-20	20.0-20.5	6/12/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B1	B1-25	25.0-25.5	6/12/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B1	B1-30	30.0-30.5	6/12/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-5.0	5.0-5.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-10.0	10.0-10.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-15.0	15.0-15.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-20.0	20.0-20.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-25.0	25.0-25.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-30.0	30.0-30.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B2	B-2-35.0	35.0-35.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-5.0	5.0-5.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-10.0	10.0-10.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-15.0	15.0-15.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-20.0	20.0-20.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-25.0	25.0-25.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-30.0	30.0-30.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-35.0	35.0-35.5	7/14/89	SS-Liner	72	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-38.0	38.0-38.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-39.5	39.5-40.0	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-41.0	41.0-41.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B3	B-3-42.0	42.0-42.5	7/13/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1

See notes on last page

Table 2 (continued)

Sample Location	Sample Designation	Sample Depth (feet)	Sample Date	Sample Type	Total Petroleum Hydrocarbons (mg/kg)			Nonhalogenated Volatile Aromatic Organic Compounds (mg/kg)			
					as Gasoline	as Diesel	as Motor Oil	Benzene	Toluene	Ethylbenzene	Xylenes
B4	B-4-5.0	5.0-5.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-10.0	10.0-10.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-15.0	15.0-15.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-20.0	20.0-20.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-25.0	25.0-25.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-30.0	30.0-30.5	7/14/89	SS-Liner	150	NM	NM	<0.25	<0.5	<0.5	<0.5
B4	B-4-35.0	35.0-35.5	7/14/89	SS-Liner	5,300	NM	NM	<5.0	<10.0	<10.0	<10.0
B4	B-4-36.5	36.5-37.0	7/14/89	SS-Liner	7.9	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-38.0	38.0-38.5	7/14/89	SS-Liner	<1.0	NM	NM	<0.05	<0.1	<0.1	<0.1
B4	B-4-39.0	39.0-39.5	7/14/89	SS-Liner	71	NM	NM	<0.25	<0.5	<0.5	<0.5
B4	B-4-40.5	40.5-41.0	7/14/89	SS-Liner	15	NM	NM	<0.05	<0.1	<0.1	<0.1
B5	B-5-20	20.0-20.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B5	B-5-25	25.0-25.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B5	B-5-30	30.0-30.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B5	B-5-35	35.0-35.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B5	B-5-40	40.0-40.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B5	B-5-45	45.0-45.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B6	B-6-20	20.0-20.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B6	B-6-25	25.0-25.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B6	B-6-30	30.0-30.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B6	B-6-35	35.0-35.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B6	B-6-40	40.0-40.5	8/24/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075

See notes on last page

Table 2 (continued)

Sample Location	Sample Designation	Sample Depth (feet)	Sample Date	Sample Type	Total Petroleum Hydrocarbons (mg/kg)			Nonhalogenated Volatile Aromatic Organic Compounds (mg/kg)			
					as Gasoline	as Diesel	as Motor Oil	Benzene	Toluene	Ethylbenzene	Xylenes
B7	B-7-15	15.0-15.5	8/25/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B7	B-7-20	20.0-20.5	8/25/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B7	B-7-25	25.0-25.5	8/25/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B7	B-7-30	30.0-30.5	8/25/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B7	B-7-33	33.0-33.5	8/25/89	SS-Liner	380	NM	NM	0.130	3.00	1.00	3.50
B7	B-7-36	36.0-36.5	8/25/89	SS-Liner	65	NM	NM	<0.025	0.120	0.190	0.440
B7	B-7-41	41.0-41.5	8/25/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B7	B-7-45.5	45.5-46.0	8/25/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B7	B-7-51.0	51.0-51.5	8/28/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B8	B-8-15	15.0-15.5	8/28/89	SS-Liner	<10	NM	NM	<0.025	0.097	<0.075	<0.075
B8	B-8-20	20.0-20.5	8/28/89	SS-Liner	21	NM	NM	<0.025	0.190	0.360	0.630
B8	B-8-25	25.0-25.5	8/28/89	SS-Liner	<10	NM	NM	<0.025	0.050	<0.075	<0.075
B8	B-8-30	30.0-30.5	8/28/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B8	B-8-35.5	35.5-36.0	8/28/89	SS-Liner	<10	NM	NM	<0.025	0.130	0.150	0.260
B8	B-8-40.5	40.5-41.0	8/28/89	SS-Liner	<10	NM	NM	<0.025	0.056	<0.075	<0.075
B8	B-8-45	45.0-45.5	8/28/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B8	B-8-50	50.0-50.5	8/28/89	SS-Liner	<10	NM	NM	<0.025	0.220	<0.075	<0.075
B9	B-9-6.5	6.5-7.0	8/28/89	SS-Liner	20	NM	NM	0.026	0.046	<0.075	0.200
B9	B-9-9.5	9.5-10.0	8/30/89	SS-Liner	<10	NM	NM	<0.025	<0.025	<0.075	<0.075
B9	B-9-16.5	16.5-17.0	8/30/89	SS-Liner	490	NM	NM	0.700	0.610	2.000	15.000
B9	B-9-21.0	21.0-21.5	8/30/89	SS-Liner	1,500	NM	NM	4.1	3.4	14.0	62.0
B9	B-9-26.5	26.5-27.0	8/30/89	SS-Liner	1,100	NM	NM	3.0	28.0	13.0	68.0

See notes on last page

Table 2 (continued)

Sample Location	Sample Designation	Sample Depth (feet)	Sample Date	Sample Type	Total Petroleum Hydrocarbons (mg/kg)			Nonhalogenated Volatile Aromatic Organic Compounds (mg/kg)			
					as Gasoline	as Diesel	as Motor Oil	Benzene	Toluene	Ethylbenzene	Xylenes
B9	B-9-31.5	31.5-32.0	8/30/89	SS-Liner	79	NM	NM	0.350	0.800	0.610	2.0
B9	B-9-35.0	35.0-35.5	8/30/89	SS-Liner	<10	NM	NM	0.390	0.130	<0.075	0.200
B9	B-9-40.5	40.5-41.0	8/30/89	SS-Liner	<10	NM	NM	<0.025	0.043	<0.075	<0.075
B9	B-9-45.5	45.5-46.0	8/30/89	SS-Liner	<10	NM	NM	<0.025	0.066	<0.075	<0.075
B9	B-9-51.0	51.0-51.5	8/30/89	SS-Liner	<10	NM	NM	0.310	0.046	<0.075	<0.075

General Notes

(a) NM indicates parameter not measured

(b) < indicates parameter below detection limits

(c) SS-Liner indicates sample collected using split-spoon sampler fitted with liners

See notes on last page