CytoCulture
INTERNATIONAL INC.
Biotechnology Research, Scale-Up and Marketing

June 15, 1988

Mr. Lowell Miller
Senior Hazardous Materials Specialist
ALAMEDA COUNTY DEPARTMENT OF
ENVIRONMENTAL HEALTH
80 Swan Way
Oakland, CA 94621

Dear Mr. Miller:

As per our conversation today, I have enclosed our updated Progress Reports on the in situ bioremediation project for diesel-contaminated soil and groundwater at the former P.I.E. Nationwide truck terminal in Emeryville. At this point, we have just completed the investigatory work which we have performed in collaboration with the Department of Health Services Office of Alternative Technology Policy in Sacramento.

Greg Zentner and Mike Chee at the RWQCB have been kept informed of the progress at this site and suggested that I send you the enclosed **Phase II Report on the Hydrogeology and Site Characterization Studies** completed by our subcontracting geologists at Alton Geoscience. This report includes an overview of the bioreclamation program and updated recommendations by CytoCulture for proceeding with the Phase III recovery of free diesel product and treatment of contaminated groundwater as originally outlined in the Operational Plan we submitted to the DHS on December 18, 1987. A copy of this Operational Plan and an abbreviated copy of the original proposal are also enclosed for your reading.

I look forward to discussing the Phase II Report with you in the near future as we finalize our plans for the "pump and treat" phase of the clean-up at this site under the NPDES permit variance letter issued by the Regional Water Quality Control Board to P.I.E. Nationwide on November 25, 1986 (copy attached).

Thank you.

Sincerely,

Randall J. von Wedel

Randall J. von Wedel, Ph.D.
Project Director

cc: Chris Falbo, Blymyer & Sons Engineers for P.I.E. Nationwide

Report on Additional Site Characterization Studies at P.I.E. Nationwide Property, 5500 Eastshore Freeway, Emeryville, California.

Prepared for:

Cyto Culture International, Inc.
1208 Fourth Avenue,
San Francisco, California
94122

April 28, 1988

by:

Alton Geoscience
16510 Aston Street
Irvine, California
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Table of Contents

Figures

1. Index Map
2. Site Plan Showing Location of Monitoring Wells
3. Cross Section A-A'
4. Cross Section B-B'
5. Cross Section C-C'
6. Site Plan Showing Estimated Extent of Adsorbed-Phase Plume
7. Site Plan Showing Estimated Extent of Free Product Plume
8. Site Plan Showing Estimated Extent of Dissolved-Phase Plume

Tables

1. Laboratory Results of Soil Samples Analyzed for Total Petroleum Hydrocarbons Using Modified EPA Method 8015.
2. Results of Laboratory Analyses of Ground Water Samples Using EPA Method 8015.
3. Results of Laboratory Analyses of Ground Water Samples Collected From Monitoring Wells MW-13 and MW-14 Using EPA Method 602.

Appendices

A. Boring Logs, Well Construction Details
B. Soil Sample Official Laboratory Reports and Chain of Custody Records.
C. Monitoring Data, Approximate Times of High and Low Tides for the Emeryville, California Area Between March 10 and March 15, 1988
D. Water Sample Official Laboratory Report and Chain of Custody Record.

Introduction

Overview of Program

In previous site characterization and geotechnical studies performed by Alton Geoscience and others, it was determined that hydrocarbon-affected soil and ground water existed beneath the site. Please refer to the Alton Geoscience report dated November 3, 1987, for a review of pertinent background information and details of previous work.

Objectives

The objectives of this study are to determine the extent and concentrations of hydrocarbons in the soil and ground water and to determine the potential impact, if any, these hydrocarbons may have on utilized ground water and any receiving surface waters.

Site Description

This former trucking facility is located between the Eastshore Freeway and Shellmound Street in Emeryville, California (Please refer to Figure 1, Index Map, and Figure 2, Site Plan). Light and heavy industrial businesses are located north, east, and south of the site. The Eastshore Freeway is located to the west. The site is presently undergoing construction of a retail shopping mall.

Background Review

Geographic Setting

The site is located along the eastern edge of San Francisco Bay at an elevation of approximately 6 feet above mean sea level (N.G.V.D.-1929). San Pablo Ridge is located to the east and northeast. The San Leandro Hills are present to the east and southeast.

The topography is relatively flat near the site, with low rolling hills dominating the surrounding landscape to the east. The topography at the site slopes gently down toward the west.

The San Francisco Bay is located approximately one tenth of a mile west of the site.

Regional Geology

The site is underlain by unconsolidated materials consisting of artificial fill, bay mud, salt marsh deposits, and alluvial fan deposits of the Temescal Formation.

The Hayward Fault is located approximately 5 miles east of the site.

Regional Hydrogeology

First ground water occurs at a depth of approximately [illegible]. According to the Regional Water Quality Control Board, San Francisco Bay Region, ground water flow in the region is generally toward San Francisco Bay.

It has been reported that tidally induced fluctuations of 2 to 3 feet in ground water levels were observed in former monitoring wells at the site.

Ground Water Quality

The quality of ground water beneath the site is expected to be poor. An Alameda County Department of Public Works representative stated during a telephone conversation that intrusion of high-salinity water occurs at a depth of 70 feet in the City of Alameda, approximately 5 miles south of the site. The California Department of Water Resources (1975) reported that sea-water intrusion in Alameda and Santa Clara Counties is being managed by recharge programs.

Local Well Data

There are no wells within one mile of the site which utilize ground water. According to the Alameda County Department of Public Works, three monitoring wells are located within one mile of the site (Please See Figure 1). One monitoring well is located approximately 0.6 miles southeast of the site and has a total depth of 19 feet. Another monitoring well is located approximately 0.6 miles east of the site and has a total depth of 22 feet. Information regarding the perforated intervals was not available for these wells. The third monitoring well is situated approximately 0.3 miles east of the site. This well has a total depth of 32 feet and is perforated in the interval from 9 to 28 feet. Information regarding sanitary seals was not available for any of these wells.

Subsurface Investigations

Soil Borings

Between March 7 and March 11, 1988, eighteen borings, B-5 (MW-1) through B-22 (MW-18), were drilled at the site to depths of 11.5 to 17.0 feet. Borings B-12 (MW-8) through B-14 (MW-10) are located off site to the east and Borings B-20 (MW-16) through B-22 (MW-18) are located off site to the south. Please refer to the Site Plan in Figure 2 for the boring locations.

Borings B-5 (MW-1), B-6 (MW-2), B-7 (MW-3), B-8 (MW-4), B-11 (MW-7), and B-19 (MW-15) were drilled using ten-inch diameter, hollow-stem augers. The remaining borings were drilled using eight-inch diameter, hollow-stem augers. Soil samples were collected using a standard-penetration sampler fitted with stainless-steel sample-tube inserts. The augers were steam cleaned and the sampler and sample-tube inserts were washed with a solution of sodium tripolyphosphate and rinsed with water prior to each use. Borings B-5 (MW-1), B-8 (MW-4), and B-19 (MW-15) were sampled continuously to provide adequate stratigraphic control. Borings B-6 (MW-2), B-7 (MW-3), B-9 (MW-5), B-11 (MW-7), B-18 (MW-14), and B-20 (MW-16) were sampled at a 2.5-foot interval. The remaining borings were sampled at a 4-foot interval.

Soil Description

The Boring Logs, included in Appendix A, present a field description of the soil samples in accordance with the Unified Soil Classification System.

In general, the soils present within the borings consisted of two types, artificial fill and native soil. The artificial fill is composed mostly of loose to dense, moderate yellowish brown and dusky yellowish green, silty sands with lesser amounts of fine-grained sands, and gravelly sands. Three different facies were observed in the native soil. A bay mud facies underlies the fill material and is composed mostly of soft to very soft, black organic silty clays and silts with lighter black organic silty sands, fine-grained sands, and gravelly sands. Underlying the bay mud in the western portion of the site are dark gray to olive gray silty clays, fine- to coarse-grained sands, and gravelly sands. Mottled light brown and light olive gray silty clays underlie the bay mud in the eastern portion of the site.

The fill material and bay mud are thicker in the west and gradually thin eastward. Please refer to the geologic cross sections in Figures 3, 4, and 5 for graphical representations of the subsurface stratigraphy.

A strong diesel odor was detected in the samples and a sheen of free product was present on the sampler during the drilling of Borings B-7 (MW-3), B-8 (MW-4), B-11 (MW-7), and B-19 (MW-15).

Analyses of Soil Samples

Representative soil samples were analyzed for total petroleum hydrocarbons with distinction between the gasoline and diesel ranges using Modified EPA Method 8015. The results of the laboratory analyses are presented in Table 1. The Official Laboratory Reports and Chain of Custody Records are included in Appendix B. Please refer to Figure 6 for the estimated extent of the adsorbed-phase plume.

TABLE 1. Laboratory Results of Soil Samples Analyzed for Total Petroleum Hydrocarbons Using Modified EPA Method 8015.

Boring	Depth (feet)	Total Petroleum Hydrocarbon (ppm)	Hydrocarbon Range
B-5 (MW-1)	5.5	30	Diesel
B-6 (MW-2)	---	-----	----
B-7 (MW-3)	8.0	[redacted]	Diesel
B-8 (MW-4)	8.5	[redacted]	Diesel
B-9 (MW-5)	5.0	10	Diesel
B-10 (MW-6)	5.5	ND<10	----
B-11 (MW-7)	7.0	[redacted]	Diesel
B-12 (MW-8)	5.5	ND<10	----
B-13 (MW-9)	5.5	20	Diesel
B-14 (MW-10)	5.5	ND<10	----
B-15 (MW-11)	4.5	ND<10	----
B-16 (MW-12)	5.5	90	Diesel
B-17 (MW-13)	5.5	[redacted]	Diesel
B-18 (MW-14)	7.5	[redacted]	Diesel
B-19 (MW-15)	7.0	[redacted]	Diesel
B-20 (MW-16)	5.5	15	Diesel
B-21 (MW-17)	9.5	240	Diesel
B-22 (MW-18)	5.5	10	Diesel

ND = Not Detected, ppm = Parts Per Million

Monitoring Well Installation

Monitoring Wells MW-1 through MW-18 were installed in Borings B-5 through B-22, respectively. Monitoring Wells MW-1 (B-5), MW-2 (B-6), MW-3 (B-7), MW-4 (B-8), MW-7 (B-11), and MW-15 (B-19) were constructed using 4-inch diameter PVC casing. The remaining wells were constructed using 2-inch diameter PVC casing. Please refer to the Well Construction Details included in Appendix A.

Fluid Level Monitoring

Fluid levels and product thicknesses were monitored between March 10 and March 15, 1988, at various times in relation to the tidal cycle. The monitoring data and list of approximate times of high and low tides for the Emeryville area are presented in Appendix C. Monitoring data indicate that the tidally influenced depth to ground water ranges from approximately 3.2 to 9.5 feet. Monitoring Well MW-7 (B-11) was monitored at approximately 0810 hours on March 10, 1988, and 1.32 feet of free product was detected. A low tide occurred at approximately 1000 hours. Monitoring Well MW-7 (B-11) was monitored again on March 15, 1988, at 0817 hours and 0.02 feet of free product was detected. A high tide occurred on March 15, 1988, at approximately 0847 hours. Please refer to Figure 7 for the estimated extent of the free product plume.

Ground Water Sampling and Analyses

Between March 10 and March 14, 1988, the monitoring wells were monitored, developed, and sampled. The wells were developed by removing a minimum of four standing well volumes of water. The water was pumped from each well with an air-diaphragm pump into fifty-five gallon drums which were stored at the site. Ground water samples were collected using a clean Teflon bailer and immediately transferred to zero-headspace glass bottles, packed in ice, and transported to a State-Certified laboratory. Monitoring Well MW-7 (B-11) was not sampled due to the presence of free product on the ground water. Monitoring Well MW-11 (B-15) remained dry after one well volume of water was removed and therefore was also not sampled.

Ground water samples were analyzed for total petroleum hydrocarbons (TPHC) with distinction between the gasoline and diesel ranges in accordance with Modified EPA Method 8015. Ground water samples from Monitoring Wells MW-13 (B-17) and MW-14 (B-18) were also analyzed for benzene, toluene,

xylenes, and ethylbenzene (BTXE) using EPA Method 602. The Official Laboratory Report and Chain of Custody Record are included in Appendix D. Tables 2 and 3 present the results of the laboratory analyses of the ground water samples. Please refer to Figure 8 for the estimated extent of the dissolved-phase plume.

The water sample collected from Monitoring Well MW-9 (B-13) was also analyzed for specific conductance. A value of 1260 umhos/cm was determined using EPA Method 120.1. The total dissolved solids (TDS) in a water sample can be estimated by multiplying the specific conductance value by 0.65. This indicates that the sample from Monitoring Well MW-9 (B-13) contained 819 parts per million (ppm) TDS.

TABLE 2. Results of Laboratory Analyses of Ground Water Samples Using Modified EPA Method 8015.

Well Number	Diesel-Range TPHC (ppm)
MW-1 (B-5)	ND<1
MW-2 (B-6)	0.05
MW-3 (B-7)	0.15
MW-4 (B-8)	1.2
MW-5 (B-9)	ND<1
MW-6 (B-10)	ND<0.05
MW-7 (B-11)	-----
MW-8 (B-12)	ND<0.05
MW-9 (B-13)	ND<1
MW-10 (B-14)	ND<1
MW-11 (B-15)	-----
MW-12 (B-16)	0.05
MW-13 (B-17)	1.7
MW-14 (B-18)	ND<1
MW-15 (B-19)	1.8
MW-16 (B-20)	ND<0.05
MW-17 (B-21)	ND<0.05
MW-18 (B-22)	ND<0.05

Notes: ppm = Parts Per Million, TPHC = Total Petroleum Hydrocarbons, ND = Not Detected, ----- = Not Analyzed.

TABLE 3. Results of Laboratory Analyses of Ground Water Samples Collected From Monitoring Wells MW-13 and MW-14 Using EPA Method 602.

Well Number	Benzene (ppm)	Toluene (ppm)	Xylenes (ppm)	Ethyl-benzene (ppm)
MW-13	ND<0.0005	ND<0.0005	ND<0.0005	ND<0.0005
MW-14	ND<0.0005	ND<0.0005	ND<0.0005	ND<0.0005

Notes: ppm = Parts Per Million, ND = Not Detected,

Findings

Twelve on-site and six off-site monitoring wells were installed to depths of 11.5 to 17.0 feet below grade between March 7 and March 11, 1988.

Two basic soil types were encountered during drilling. Artificial fill, composed mostly of silty sands with lesser amounts of fine-grained and gravelly sands, is present to depths of approximately 6 to 10 feet. The artificial fill is underlain by native soils of three facies: 1) Bay mud composed mostly of black organic silty clays and silts with lesser amounts of lighter black organic silty sands, fine-grained sands and gravelly sands, 2) Dark gray to olive gray silty clays, fine- to coarse-grained sands, and gravelly sands that underlie the bay mud in the western portion of the site, and 3) Mottled light brown and light olive gray silty clays that underlie the bay mud in the eastern portion of the site. The fill and bay mud thicken toward the west.

Elevated levels of diesel-range total petroleum hydrocarbons (TPHC) were detected in soil samples collected during drilling of Borings B-7 (MW-3), B-8 (MW-4), B-9 (MW-5), B-17 (MW-13), B-18 (MW-14), B-19 (MW-15), and B-21 (MW-17). Hydrocarbon concentrations in samples from these borings range from 240 ppm in Boring B-21 (MW-17) to 17,000 ppm in Boring B-7 (MW-3). Samples analyzed from the other borings contained TPHC concentrations less than 100 ppm.

Free product is present in Monitoring Well MW-7 (B-11), located near the western edge of the site. A product thickness of 1.32 feet was detected during low tide on March 10, 1988. A thickness of 0.02 feet was detected on March 15, 1988, during high tide. Free product was not detected in any other monitoring well.

Dissolved-phase diesel-range total petroleum hydrocarbons were detected in water samples from Monitoring Wells MW-2, MW-3, MW-4, MW-12, MW-13, and MW-15 (0.05, 0.15, 1.2, 0.05, 1.7, and 1.8 ppm, respectively). Dissolved-phase hydrocarbons were not detected in samples from any other well. Laboratory analyses of ground water samples from Monitoring Wells MW-13 and MW-14 did not detect any volatile aromatic hydrocarbons (BTXE).

Conclusions

Based on the initial fluid-level monitoring data, the free product plume appears to be well defined to the north, east, and south of Monitoring Well MW-7 (B-11), but extends an unknown distance toward the west.

Low-level dissolved-phase hydrocarbons appear to be localized along the southern and western property margins. The western margin of the plume is currently undefined. The findings of this study do, however, indicate that the dissolved-phase plume is of limited lateral extent and exhibits low concentrations of total petroleum hydrocarbons immediately to the north, east, and south of the free product plume. The findings also indicate a lack of volatile aromatic hydrocarbons immediately to the north and south of the free product plume. These observations are consistent with the low-solubility characteristics of diesel-range hydrocarbons.

Diesel-range hydrocarbons detected in soil samples collected during drilling indicate that the adsorbed-phase plume is present in the southwestern portion of the site. The plume appears to extend slightly off site to the south and an undetermined distance off site to the west. The presence of adsorbed-phase hydrocarbons (240 ppm) detected in the soil sample analyzed from Boring B-21 (MW-17), located on the property south of the site, appears to be anomalous. It is unlikely that hydrocarbons from the source area at the site could have migrated to the location of Boring B-21 (MW-17) without affecting the soil around Boring B-22. The reason for this anomaly is not yet known. ?

Recommendations

Alton Geoscience recommends that an extraction trench be excavated along the western margin of the property to remove free product from the subsurface and inhibit westward migration of product in the area of Monitoring Well MW-7. Alton Geoscience further recommends that one bioreactor be installed at the southwestern corner of the site to treat the

water recovered from this trench. The effluent should be tested and disposed of in accordance with the sanitary sewer discharge permit.

Based on the elevated hydrocarbon concentrations in the soils, the presence of product observed during excavation of Borings B-7, B-8, B-11, B-18, and B-19 (MW-3, MW-4, MW-7, MW-14, and MW-15, respectively), and the free product accumulation in Monitoring Well MW-7, it is possible that free product may occur cyclically in the monitoring wells in this area. In addition, free product accumulation in Monitoring Well MW-7 has been shown to vary significantly with tidally influenced changes in the monitoring well water elevation. Therefore, Alton Geoscience recommends that fluid levels be monitored in all wells for at least one tidal cycle to ensure adequate definition of the free product plume and to better define the hydrodynamics of the site. If free product is detected, the extent of the plume should be re-evaluated and the need for an additional trench along the southern property margin should be considered.

Alton Geoscience appreciates the opportunity to provide technical services for Cyto Culture International, Inc. Please call if you have any question regarding this project.

Respectfully submitted,

ALTON GEOSCIENCE

Terrence A. Fox
Project Geologist

Jeffery W. Wiegand C.E.G. 331
Vice President

TAF/REL/JWW

References

California's Ground Water, 1975, Department of Water Resources, Bulletin Number 18.

County of Alameda, Department of Public Works, 1987, Personnel Communication.

Regional Water Quality Control Board, San Francisco Bay Region, 1987, Personnel Communication.

LEGEND

● Well Locations

SOURCE:
United States Geological Survey
7.5 minute Topographic Map
Oakland West Quadrangle

FIGURE 1: INDEX MAP

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

ALTON GEOSCIENCE
16510 ASTON ST
IRVINE, CA 92714

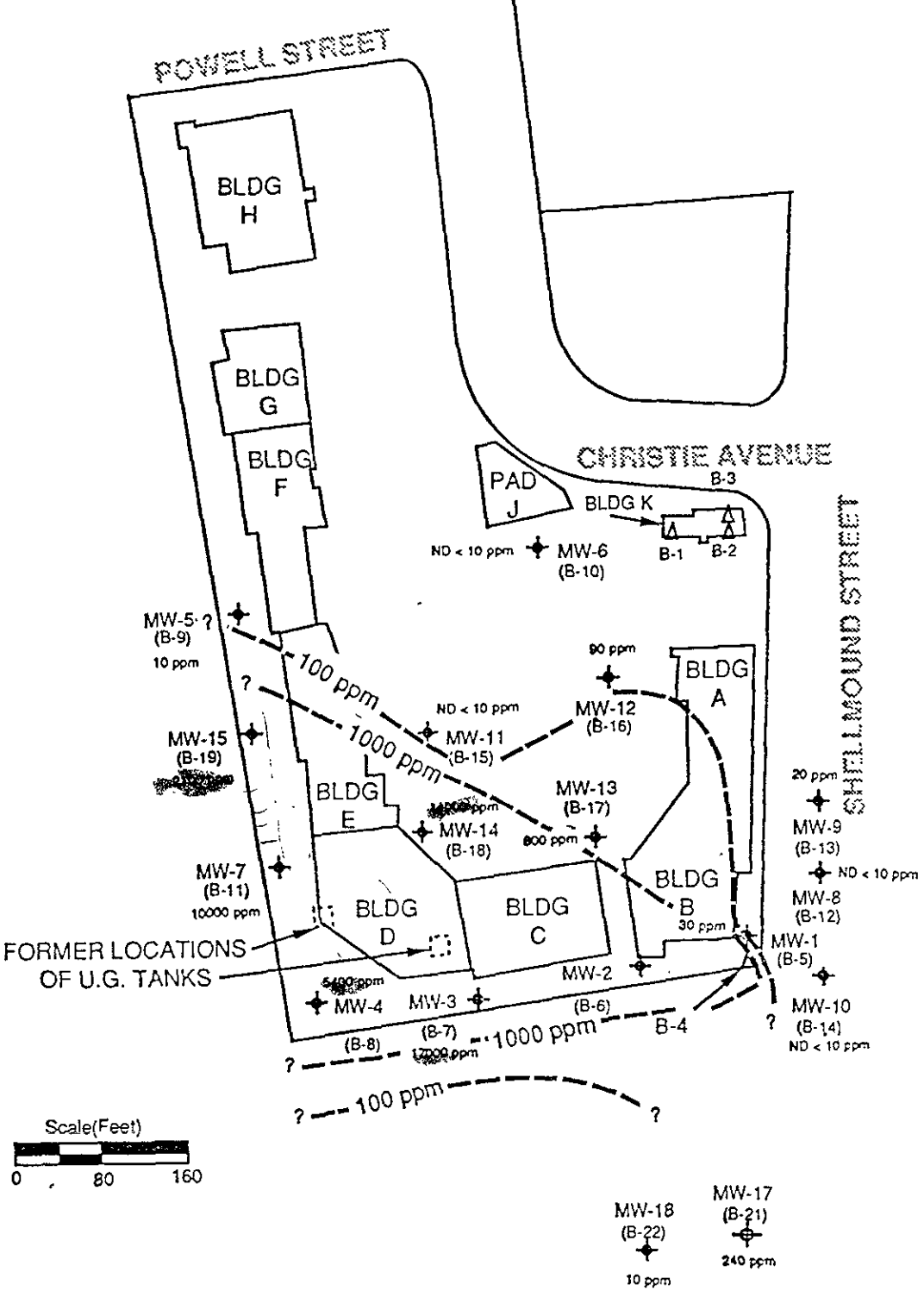

FIGURE 6: SITE PLAN SHOWING ESTIMATED EXTENT OF ADSORBED-PHASE PLUME

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

LEGEND

- Monitoring Well Location
- Concentration Contour Line
- Boring Location

NOTE Contour lines are interpreted based on analysis of soil samples collected on 10-7-87 between 3-10-88 and 3-11-88

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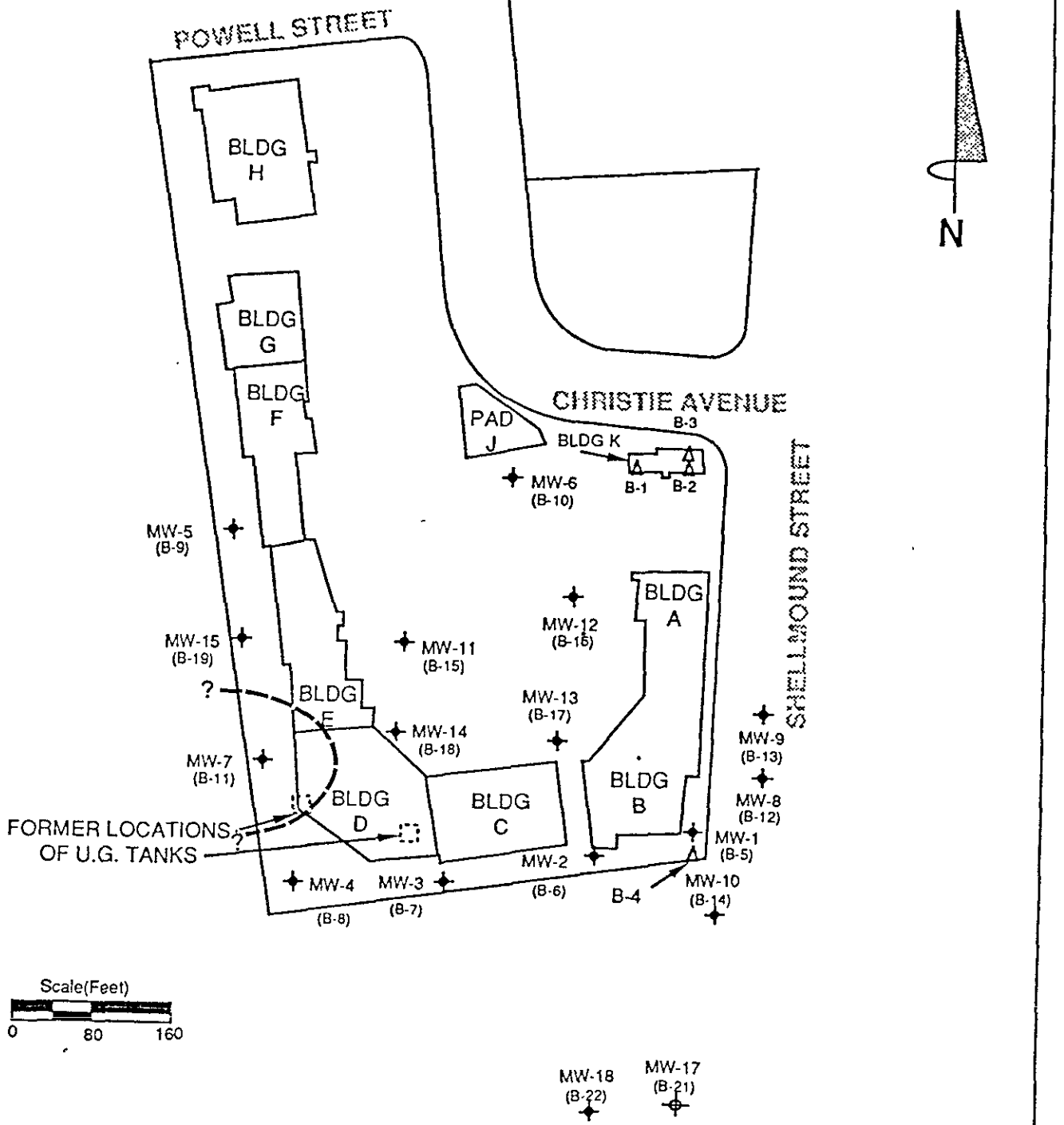
16510 ASTON ST
IRVINE, CA 92714



LEGEND

- ⌖ Monitoring Well Location
- — — Estimated Extent Of Free Product Plume
- Δ Boring Location

FIGURE 7: SITE PLAN SHOWING ESTIMATED EXTENT OF FREE PRODUCT PLUME
P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

NOTE Estimated extent is interpreted based on monitoring data collected between 3-10 88 and 3-15 88

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16510 ASTON ST.
IRVINE, CA 92714

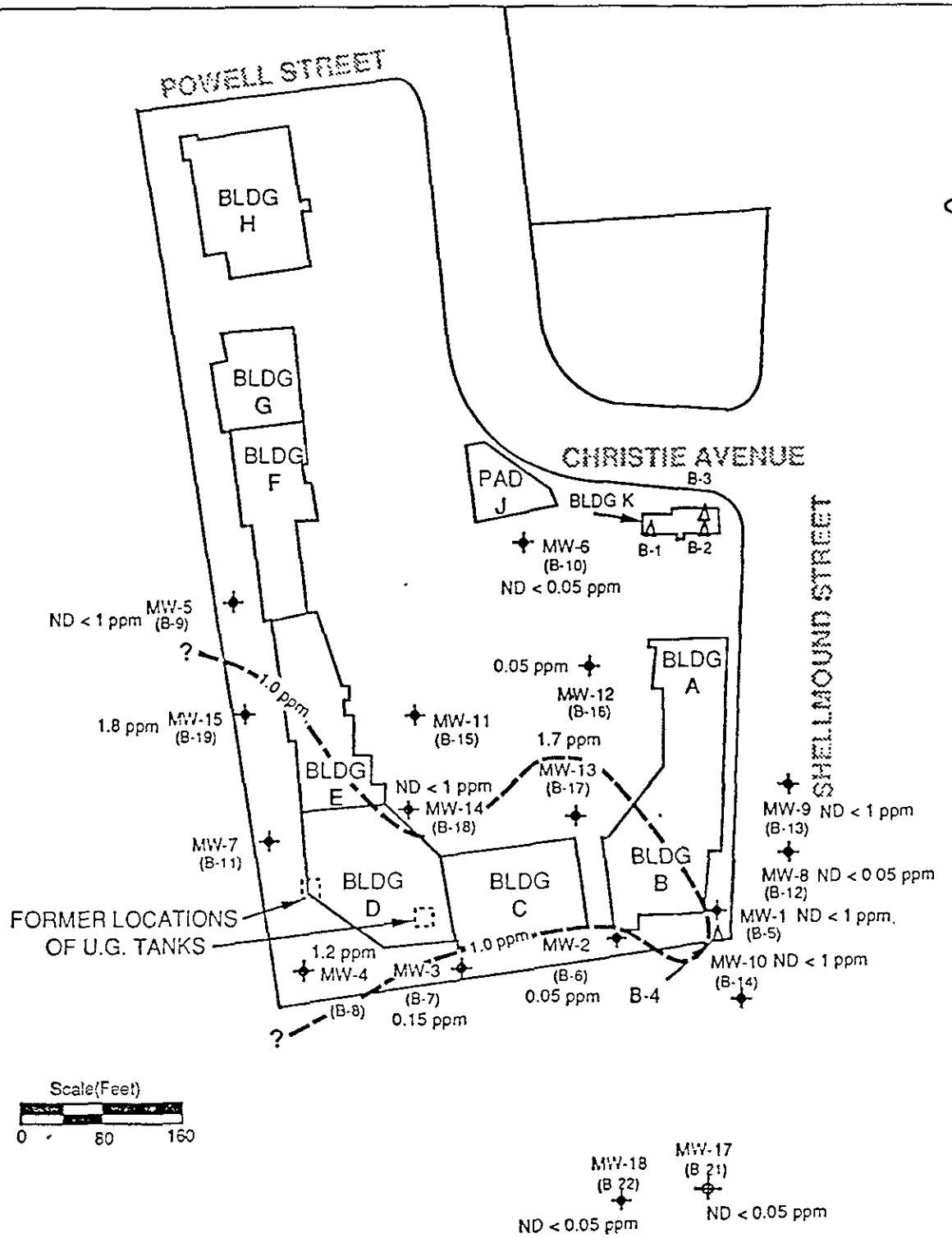

FIGURE 8: SITE PLAN SHOWING ESTIMATED EXTENT OF DISSOLVED-PHASE PLUME

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

NOTE Contour lines are interpreted based on analysis of ground water samples collected between 3-10-88 and 3-15-88

LEGEND

- Monitoring Well Location
- Concentration Contour Line
- Boring Location

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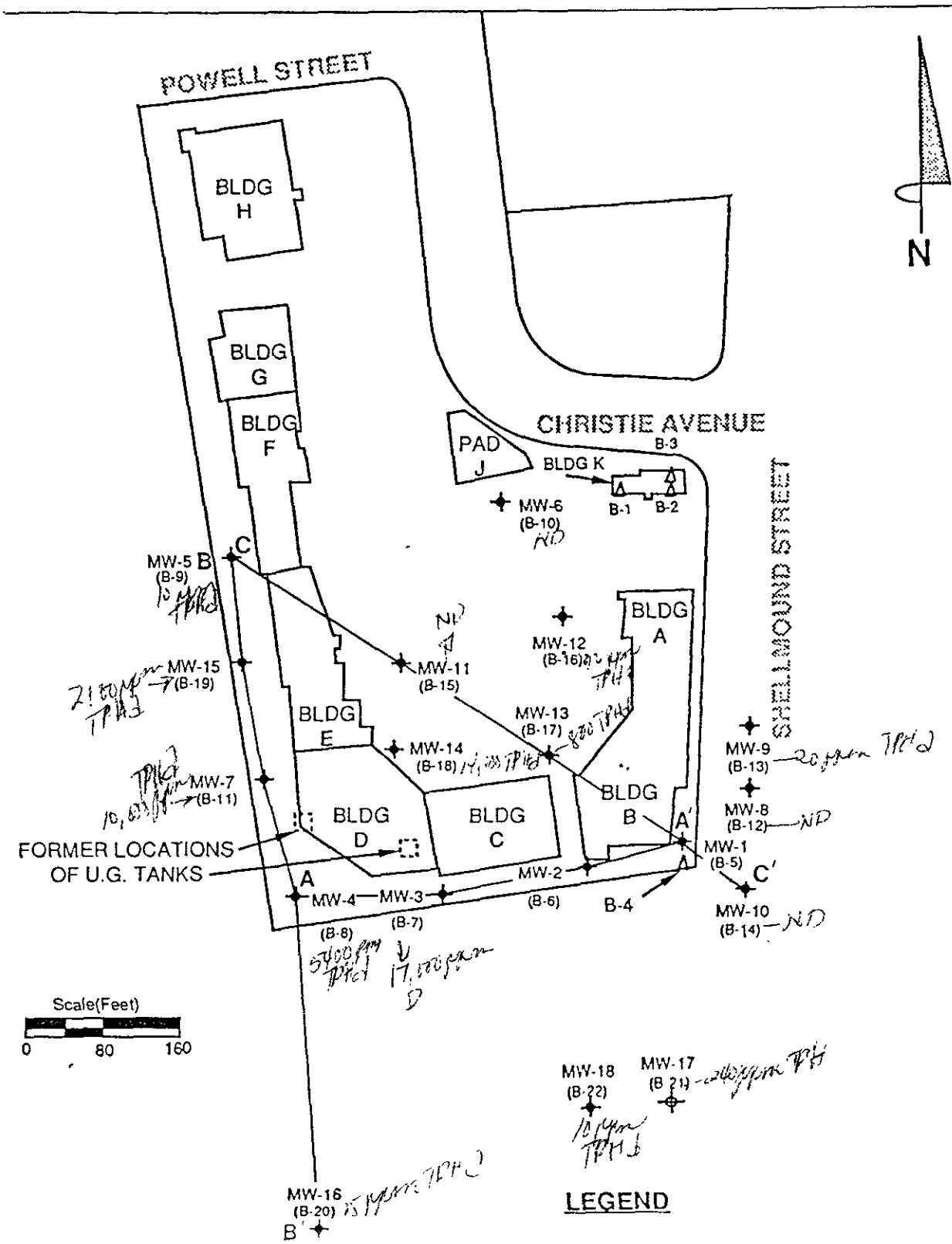
16510 ASTON ST
IRVINE, CA 92714



LEGEND

- ✦ Monitoring Well Location
- Δ Boring Location
- A—A′ Cross-Section Line

FIGURE 2: SITE PLAN SHOWING LOCATION OF MONITORING WELLS

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

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16510 ASTON ST.
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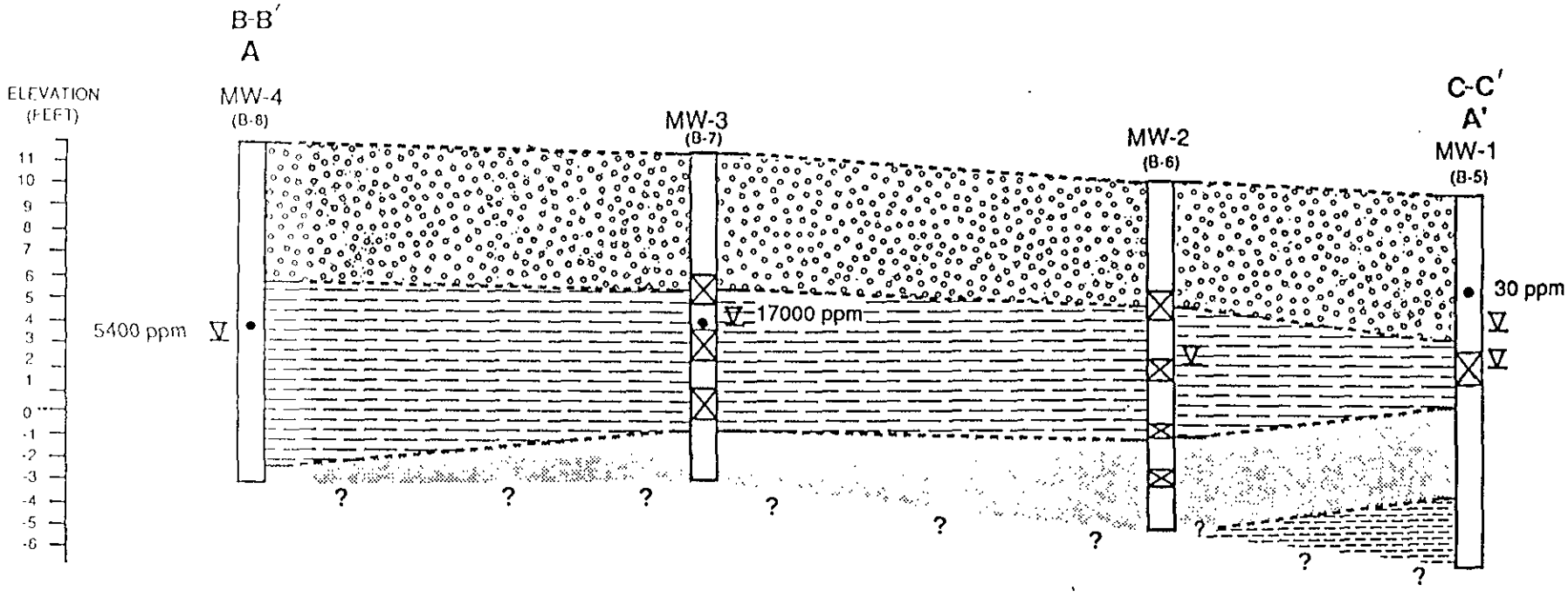

FIGURE 3: **CROSS SECTION A-A'**
SHOWING SUBSURFACE
STRATIGRAPHY

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

NOTE Fluid levels are tidally influenced.
See Appendix C for fluid level monitoring data.

Scale(Feet)
0 50 100

LEGEND

- Artificial Fill
- Black Bay Mud Sediments
- Olive Gray / Dusky Green Sands, Silts, and Clays
- Light Brown and Light Olive Gray Silty and Sandy Clays
- Fluid Level Measurement
- 30 ppm • Sample Location
- No Sample

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16510 ASTON ST.
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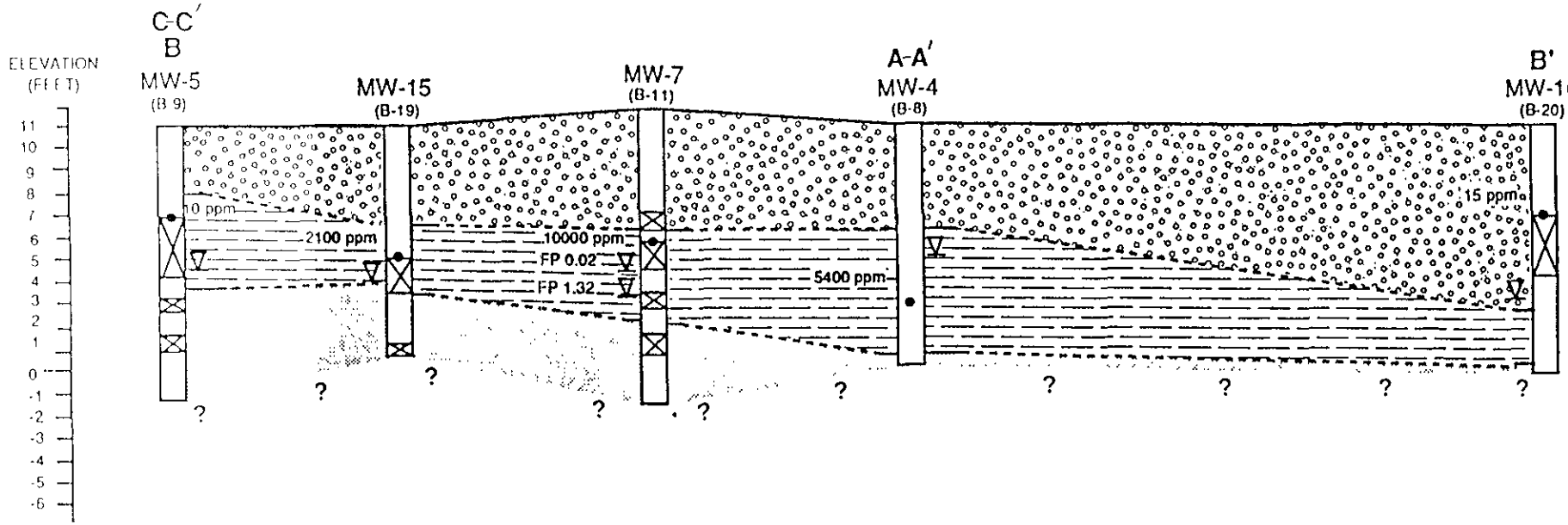

FIGURE 4: CROSS SECTION B-B' SHOWING SUBSURFACE STRATIGRAPHY

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

NOTE Fluid levels are tidally influenced.
See Appendix C for fluid level monitoring data.

Scale(Feet)
0 50 100

LEGEND

- Artificial Fill
- Black Bay Mud Sediments
- Olive Gray / Dusky Green Sands, Silts, and Clays
- Fluid Level Measurement
- Sample Location
- 5400 ppm
- No Sample

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16510 ASTON ST.
IRVINE, CA 92714

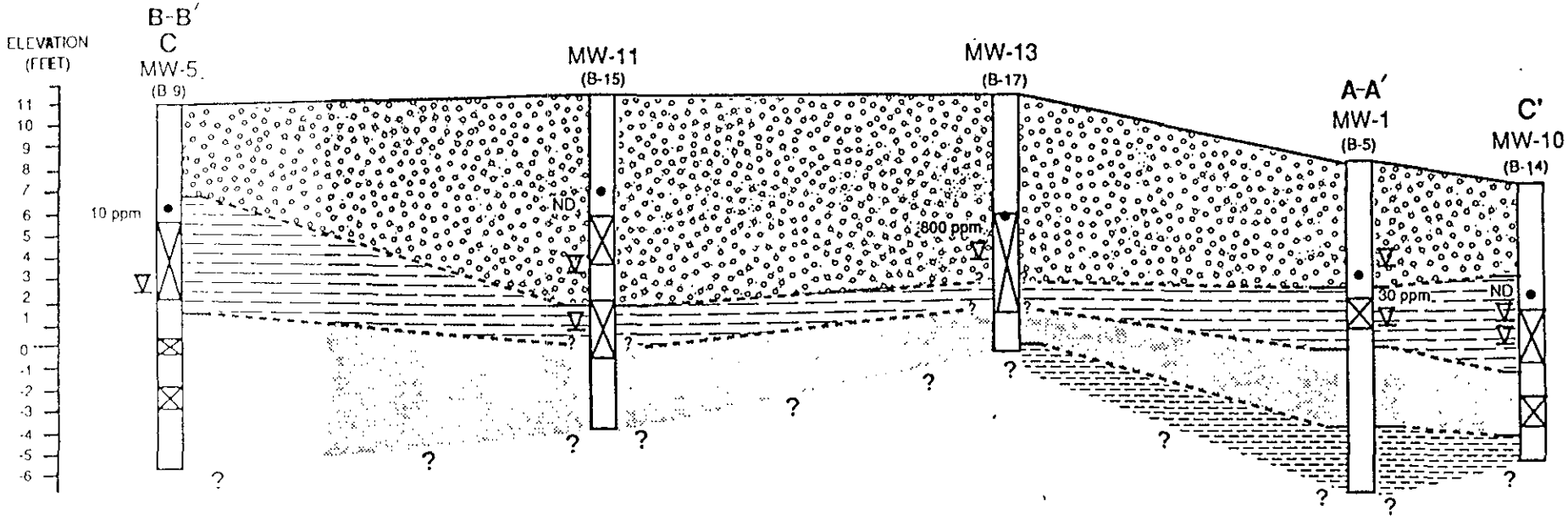

FIGURE 5: CROSS SECTION C-C' SHOWING SUBSURFACE STRATIGRAPHY

P.I.E. Nationwide
5500 Eastshore Freeway
Emeryville, California

NOTE Fluid levels are tidally influenced.
See Appendix C for fluid level monitoring data.

Scale(Feet)
0 50 100

LEGEND

- Artificial Fill
- Black Bay Mud Sediments
- Olive Gray / Dusky Green Sands, Silts, and Clays
- Light Brown and Light Olive Gray Silty and Sandy Clays
- Fluid Level Measurement
- 5400 ppm • Sample Location
- No Sample

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