HYDRO
ENVIRONMENTAL
TECHNOLOGIES, INC.

PROBLEM ASSESSMENT REPORT

BP Oil Company Service Station No. 11104
1716 Webster Street
Alameda, California

Prepared for:

BP OIL COMPANY
16400 Southcenter Parkway, Suite 301
Tukwila, WA 98188

Prepared by:

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.
2363 Mariner Square Drive, Suite 243
Alameda, CA 94501
HETI Job No. 9-038

June 10, 1993

BP OIL

BP Oil Company
16400 Southcenter Parkway, Suite 301
Tukwila, Washington 98188
(206) 575-4077

June 23, 1993

Ms. Juliet Shin
Alameda County Dept. of Environmental Health - Haz. Mat. Division
80 Swan Way, Room 200,
Oakland, CA 94621

RE: BP OIL FACILITY #11104
1716 Webster Street
Oakland, CA

Dear Ms. Shin:

Attached please find our **PROBLEM ASSESSMENT REPORT** for the above referenced facility.

Please call me at (206) 394-5243 with questions regarding this submission.

Respectfully,

Scott T. Hooton
Environmental Resources Management

STH:jc ERM11104

cc: Mr. Rich Hiett, Regional Water Quality Control Board - San Francisco Bay Region, 2101 Webster Street, Suite 500, Oakland, CA 94621

Mr. Markus Niebanck, Hydro-Environmental Technologies, Inc. 2363 Mariner Square Drive, Suite 243, Alameda, CA

Nr, Robert Merriken, Mobil Oil Corp, 3225 Gallows Road, Fairfax, VA 22037

Site file

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

TABLE OF CONTENTS

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

APPENDICES

A HETI Protocols

B Health and Safety Plan

C Boring Log Legend
Boring Logs/Well Construction Diagrams: MW-1, MW-2 and MW-3
Well Installation Permits

D Site Survey Data
Ground Water Gauging Data Sheet
Field Data Sheets

E Chains-of-Custody
Laboratory Report: Sequoia Analytical - soil
Laboratory Report: Sequoia Analytical - water

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to present the results of Hydro-Environmental Technologies, Inc.'s (HETI's) cumulative investigative work to evaluate the presence of hydrocarbons in the subsurface at BP Oil Company (BP) service station No. 11104, located at 1716 Webster Street in Alameda, California (Figure 1).

This report describes the results of off-site monitoring well installation, and collection and analysis of soil and ground water samples. A description of field activities is presented in chronological order, followed by a presentation and discussion of the results of each of the activities. A summary of cumulative investigative efforts is presented at the end of this report.

1.2 Background

In September 1990, BP retained Kaprealian Engineering, Inc. (KEI) to supervise the removal of product delivery lines and the dispenser islands. KEI collected soil samples from the side walls of the excavation and one ground water sample from the excavation. Laboratory analysis of the samples indicated that petroleum hydrocarbons were present in the subsurface soils and ground water.

At the request of the Alameda County Department of Environmental Health (ACDEH), KEI supervised additional excavation of soil in the vicinity of the dispenser islands. The extent of the adsorbed hydrocarbons in subsurface soils was not completely delineated by additional excavation and soil sampling. Details of dispenser/line removal and soil sampling are presented in KEI's report dated October 16, 1990.

In June 1992, BP retained HETI to install three monitoring wells on-site (MW-1, MW-2, MW-3) to determine the lateral extent of hydrocarbons in subsurface soils and ground water, and the direction of ground water flow. Gasoline hydrocarbons were detected in soil and ground water samples collected from MW-1. Soil and ground water samples collected from MW-2, and MW-3 did not contain gasoline hydrocarbons in concentrations exceeding the method detection limit. Ground water was encountered in unconfined conditions at a depth of approximately 5 feet below grade and was calculated to move toward the north - northeast. Detailed results of the installation of these wells was presented in HETI's Phase I Report dated August 21, 1992.

Unleaded gasoline (regular, plus and super) is the only fuel presently stored and dispensed at the site. Used oil is also stored on-site, until transported for off-site disposal.

Following completion of the first phase of investigation, BP retained HETI to further evaluate the lateral extent of hydrocarbons in soils and ground water beneath the site. Activities performed by HETI during this phase of investigation are described in this report and include the installation, development and survey of two off-site monitoring wells, and the collection of soil and ground water samples for laboratory analysis.

An active Chevron station is located north of the BP station, across Buena Vista Avenue. File review at the Regional Water Quality Control Board by HETI personnel revealed that the Chevron station is an open leaking underground fuel tank case. Diesel and gasoline hydrocarbons have affected the ground water primarily in the vicinity of the Chevron tank complex and dispenser islands. According to Chevron quarterly monitoring reports, neither diesel nor gasoline hydrocarbons have historically been detected in concentrations exceeding the method detection limit in water samples collected from the well (B-6) located on the southernmost portion of Chevron's property (Figure 2). Because water samples collected from well B-6 do not contain detectable levels of dissolved hydrocarbons and the shallow depth to ground water in the vicinity of the site (5 feet below grade), it is unlikely that the hydrocarbons have affected subsurface soils near well B-6; however, analytical results for soil samples collected from that boring were not available to HETI. This data will be used later in Section 3.0 as a delineating point for dissolved plume associated with the BP station.

2.0 FIELD ACTIVITIES

2.1 Soil Boring Installation and Soil Sampling

HETI held a safety briefing on-site with Bayland Drilling personnel prior to the start of drilling on March 3, and March 31, 1993. At the end of the briefing, all personnel reviewed and signed the Field Crew Health and Safety Plan (Appendix B). Well installation permits were obtained from the Alameda County Flood Control and Water Conservation District - Zone 7 prior to drilling (Appendix C).

Bayland Drilling of Menlo Park, California used a CME 55 drill rig, equipped with 8.75-inch outside diameter hollow-stem augers, to drill two off-site soil borings, designated MW-4 and MW-5, in locations shown on the Site Plan (Figure 2). A 2.5-inch outside diameter California-modified split-spoon sampler, lined with brass

tubes, was used to a collect soil sample from each borehole at a depth of five feet below grade. The brass tubes containing the soil samples were covered with teflon tape and plastic end caps, labeled, documented on a chain-of-custody, and placed in a cooler for transport to the analytical laboratory.

Soil samples collected from both borings were analyzed for total low to medium boiling point petroleum hydrocarbons (TPHg) and benzene, toluene, ethylbenzene, and total xylenes (BTEX) by EPA Methods 8015 (DHS-modified) and 8020. Soil sample analysis was performed by Pace, Inc., a state DHS-certified laboratory, located in Novato, California.

Portions of each soil sample were also retained for visual description by a HETI geologist, using the Unified Soil Classification System, and for volatile headspace analysis using an Organic Vapor Meter 580B (OVM). Complete soil sample descriptions and OVM readings are presented on the Boring Logs (Appendix C). Soil cuttings generated during drilling were stored on-site in labeled 55-gallon drums and await disposition.

All drilling and soil sampling was performed according to HETI protocol (Appendix A) and consistent with ACDEH and Regional Water Quality Control Board (RWQCB) recommended guidelines and procedures.

2.2 Monitoring Well Installation, Development and Survey

HETI installed a monitoring well in boring MW-4 on March 3, 1993 and in boring MW-5 on March 31, 1993. The monitoring wells were designated the same as the respective borings. Well locations are shown on the Site Plan (Figure 2).

All wells were constructed of two-inch diameter polyvinyl chloride (PVC), flush joint threaded well materials without the use of solvents. **Well screen was extended from the bottom of each borehole, 15 feet below grade, to 5 feet below grade.** Solid well casing was coupled to the screen and extended to the surface. The annular space around each well screen was filled with a clean, uniform sand to one foot above the screened interval, and a one-foot thick seal of hydrated bentonite was placed above the sand pack. The annular space remaining around each well casing was filled to the surface with grout, and a traffic-rated road box was cemented in place, flush with existing grade. Monitoring well construction details are presented on the Boring Logs (Appendix C).

After installation, each well was developed by a combination of surging and bailing. The wells were developed in order to remove fine-grained sediments from the sandpack, and to increase the hydraulic connection with the aquifer. Following

development, the location and elevation of the top-of-casing of each well was surveyed relative to an existing benchmark, corrected for mean sea level (accurate to ±0.01 feet). Survey data is presented on the Field Data Sheets (Appendix D).

2.3 Ground Water Gauging, Sampling and Analysis

On April 1, 1993, HETI personnel gauged all existing monitoring wells for depth to water and thickness of any separate-phase petroleum with an interface probe (accurate to ±0.01 feet). No separate-phase petroleum was detected in any of the wells. Wells MW-4 and MW-5 were sampled on March 5, 1993 and April 1, 1993, respectively. Prior to sampling, each well was purged until temperature, pH, and conductivity of the purge water had stabilized and/or until the well had gone dry. Purge water was stored on-site in labeled 55-gallon drums, and awaits final disposition. Well purging information is presented on the Field Data Sheets (Appendix D).

Following recovery of water levels in the wells to at least 70% of their original levels, a ground water sample was collected from each well and transferred to sample containers supplied by the analytical laboratory. Sample containers were then labeled, documented on a chain-of-custody, and stored in a cooler for transport to the analytical laboratory. All sampling was conducted in accordance with HETI protocol, and consistent with ACDEH and RWQCB guidelines.

Ground water samples were analyzed for TPHg and BTEX compounds by EPA Methods 8015 (DHS-modified) and 8020. Water sample analysis was performed by Pace, Inc.

3.0 RESULTS AND DISCUSSION

3.1 Site Stratigraphy

Sediments encountered during the drilling of borings MW-4 and MW-5 consisted of asphalt and fill for the first foot, underlain predominantly by silty sand to 15 feet below grade, the maximum depth explored in both borings. Soil types encountered in these borings correlate well with those previously encountered in borings MW-1, MW-2, and MW-3. Ground water was initially encountered in unconfined conditions and stabilized at a depth of approximately 5 feet below grade in both borings. The depth to the bottom of this uppermost water bearing zone has not been determined.

3.2 Soil Sample Analytical Results

Neither TPHg nor BTEX compounds were detected in concentrations exceeding the method detection limit in soil samples collected from borings MW-4 and MW-5. This analytical data, in addition to that gathered previously from borings MW-1, MW-2, MW-3, and chevron well B-6 indicates that extent of hydrocarbons in subsurface soils has been delineated, and does not extend beyond the locations of wells MW-2, MW-3, MW-4, MW-5, and Chevron well B-6.

Cumulative soil sample analytical results are summarized in Table 1. Copies of the laboratory reports and chains-of custody are included in Appendix E.

3.3 Ground Water Gauging and Analytical Results

After well installation and development, all wells were gauged for depth to water on April 1, 1993. Depth to ground water in each of the wells ranged from approximately 4.5 to 5.3 feet below grade. The depth to water measurements and wellhead elevation data were used to calculate ground water elevation contours. These contours are shown on the Ground Water Elevation Contour Map (Figure 3). Ground water flow is toward the north at a gradient of 0.009 ft/ft (0.9%). The direction of ground water flow beneath the site has has historically ranged from north to north-northeast at gradients ranging from 0.5 to 0.9%.

Neither TPHg nor BTEX compounds were detected in concentrations exceeding the method detection limit in the water samples collected from MW-4 and MW-5. According to quarterly monitoring reports for the Chevron station across Buena Vista Avenue, these compounds have not been historically detected in concentrations exceeding the method detection limit in ground water samples collected from well B-6. Additionally, these compounds were not detected previously in water samples collected from wells M-2 and MW-3. This indicates that the extent of the dissolved hydrocarbon plume has been delineated and does not extend beyond the locations of wells MW-2, MW-3, MW-4, MW-5 and Chevron well B-6.

Cumulative ground water elevations and analytical results are summarized in Table 2, and are represented graphically on the TPHg and Benzene Isoconcentration Maps, respectively (Figures 4 and 5). Copies of the laboratory analytical reports and chains-of-custody are included in Appendix E.

4.0 SUMMARY AND CONCLUSIONS

A summary of cumulative investigative results and conclusions are presented below:

1. Three on- and two off-site monitoring wells have been installed at the site during the period between July 1992 to April 1993.

2. The site is underlain predominantly by silty sand to a depth of 17 feet below grade, the maximum depth explored. Ground water is present beneath the site in unconfined conditions at a depth of approximately 5 feet below grade.

3. Direction of ground water flow beneath the site has has historically ranged from north to north-northeast at gradients ranging from 0.5 to 0.9%.

4. The extent of hydrocarbons in subsurface soils has been delineated and does not extend beyond the locations of wells MW-2, MW-3, MW-4, and MW-5. The hydrocarbons in subsurface soils are centered in the vicinity of the underground gasoline storage tanks to the north of the dispenser islands.

5. The extent of the dissolved hydrocarbon plume has been delineated and does not extend beyond the locations of wells MW-2, MW-3, MW-4, MW-5, and Chevron well B-6. The dissolved plume is centered in the vicinity of the underground gasoline storage tank complex.

5.0 CERTIFICATION

This report was prepared under the supervision of a registered geologist. All statements, conclusions and recommendations are based solely upon field observations and sample analyses performed by a state-certified laboratory related to work performed by Hydro-Environmental Technologies, Inc.

It is possible that variations in soil or ground water conditions exist beyond the points explored in this investigation. Also, site conditions are subject to change at some time in the future due to variations in rainfall, temperature, regional water usage, or other factors.

The service performed by Hydro-Environmental Technologies, Inc. has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the area of the site. No other warranty, expressed or implied, is made.

Hydro-Environmental Technologies, Inc. includes in this report chemical analytical data from a state-certified laboratory. These analyses are performed according to procedures suggested by the U.S. EPA and the State of California. Hydro-Environmental Technologies, Inc. is not responsible for laboratory errors in procedure or result reporting.

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

Prepared by:

Frances H. Maroni
Project Engineer

Reviewed by:

REGISTERED GEOLOGIST
MARKUS B. NIEBANCK
#5607
STATE OF CALIFORNIA

Markus B. Niebanck, R.G.
Western Regional Manager

Table 1
Summary of Soil Sample Analytical Results
BP Oil Station No. 11104
1716 Webster Street, Alameda, CA

Boring No.	Date	Sample depth (feet)	TOG (ppm)	TPHd (ppm)	TPHg (ppm)	B (ppm)	T (ppm)	E (ppm)	X (ppm)	HVO (ppm)	Cd (ppm)	Cr (ppm)	Pb (ppm)	Ni (ppm)	Zn (ppm)
MW-1	7/8/92	6	–	–	3200	ND<0.5	2	8.1	3.9	–	–	–	–	–	–
MW-2	7/8/92	6	–	–	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005	–	–	–	–	–	–
MW-3	7/8/92	6	ND<10	ND<1.0	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005	ND<0.005	2	25	4.2	22	29
MW-4	3/4/93	5	–	–	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005	–	–	–	–	–	–
MW-5	3/31/93	4.5	–	–	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005	–	–	–	–	–	–

Notes:

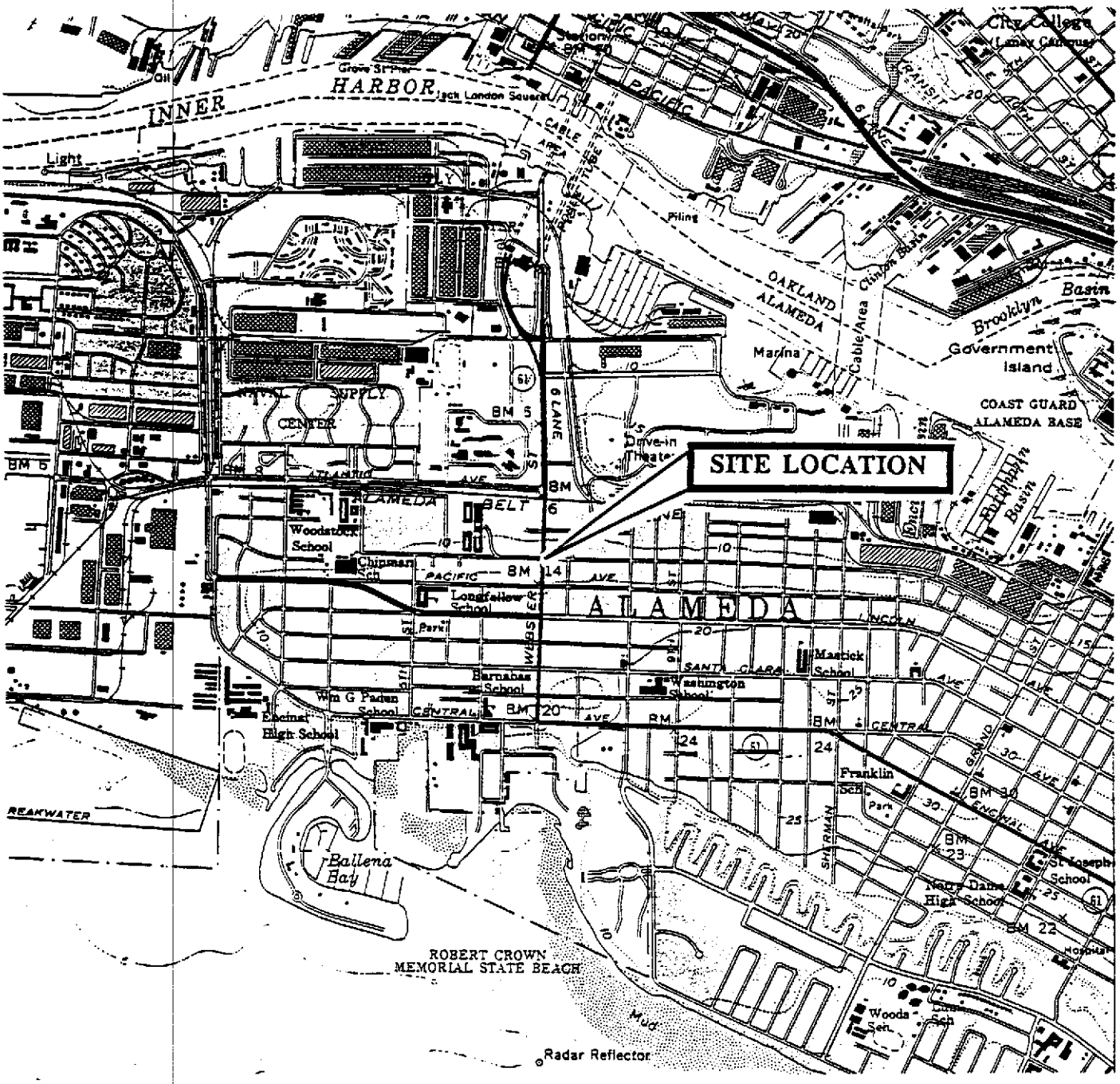
TOG = Total oil and grease by Standard Method 5520 E&F
TPHd = Total high boiling point petroleum hydrocarbons by EPA Method 8015
TPHg = Total low to medium boiling point petroleum hydrocarbons by EPA Method 8015
BTEX = Benzene, toluene, ethylbenzene and total xylenes by EPA Method 8020
HVO = Halogenated volatile organics by EPA Method 8010
Cd = Cadmium by EPA Method 6010
Cr = Chromium by EPA Method 6010
Pb = Lead by EPA Method 6010
Ni = Nickel by EPA Method 6010
Zn = Zinc by EPA SW-846 Method 7950
ND = Not detected in concentrations exceeding the indicated method detection limit
– = Not tested

Table 2
Summary of Ground Water Elevations and Ground Water Analytical Results
BP Oil Station No. 11104
1716 Webster Street
Alameda, California

MW-No.	Date	TOC (feet)	DTW (feet)	GW Elev. (feet)	TPHg (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	Cd (ppb)	Cr (ppb)	Ni (ppb)	Pb (ppb)	Zn (ppb)
MW-1	7/21/92	8.51	5.91	2.60	34,000	7,000	1,700	2,500	6,900	–	–	–	–	–
	10/20/92	8.51	6.66	1.85	–	–	–	–	–	–	–	–	–	–
	3/5/93	8.51	4.56	3.95	–	–	–	–	–	–	–	–	–	–
	4/1/93	8.51	4.57	3.94	–	–	–	–	–	–	–	–	–	–
MW-2	7/21/92	9.41	6.44	2.97	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	–	–	–	–	–
	10/20/92	9.41	7.39	2.02	–	–	–	–	–	–	–	–	–	–
	3/5/93	9.41	4.91	4.50	–	–	–	–	–	–	–	–	–	–
	4/1/93	9.41	4.92	4.49	–	–	–	–	–	–	–	–	–	–
MW-3	7/21/92	9.91	7.07	2.84	ND<50	0.95	ND<0.5	ND<0.5	ND<0.5	ND<1	ND<10	ND<10	ND<10	10
	10/20/92	9.91	8.06	1.85	–	–	–	–	–	–	–	–	–	–
	3/5/93	9.91	5.16	4.75	–	–	–	–	–	–	–	–	–	–
	4/1/93	9.91	5.25	4.66	–	–	–	–	–	–	–	–	–	–
MW-4	3/5/93	8.33	4.81	3.52	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	–	–	–	–	–
	4/1/93	8.33	4.80	3.53	–	–	–	–	–	–	–	–	–	–
MW-5	4/1/93	8.17	4.77	3.40	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	–	–	–	–	–
B-6*	9/20/91	–	–	–	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	–	–	–	–	–
	2/12/92	–	–	–	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	–	–	–	–	–
	5/18/92	–	–	–	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	–	–	–	–	–

Notes:

TOC = Top of north side of casing - surveyed relative to USGS Mon. (7.68' MSL) located at NW corner of Webster and Buena Vista
DTW = Depth to water
GW Elev. = Ground water elevation
TPHg = Total low to medium boiling point petroleum hydrocarbons analyzed by EPA Method 8015
BTEX = Benzene, Toluene, Ethylbenzene, and total Xylenes analyzed by EPA Method 8020
ND = Not detected above the laboratory method detection limit
– = Not tested or not available
* = Well B-6 ground water sample analytical results taken from Chevron quarterly monitoring report dated 7/8/92



Source:
USGS 7.5' Quadrangle
Oakland, East

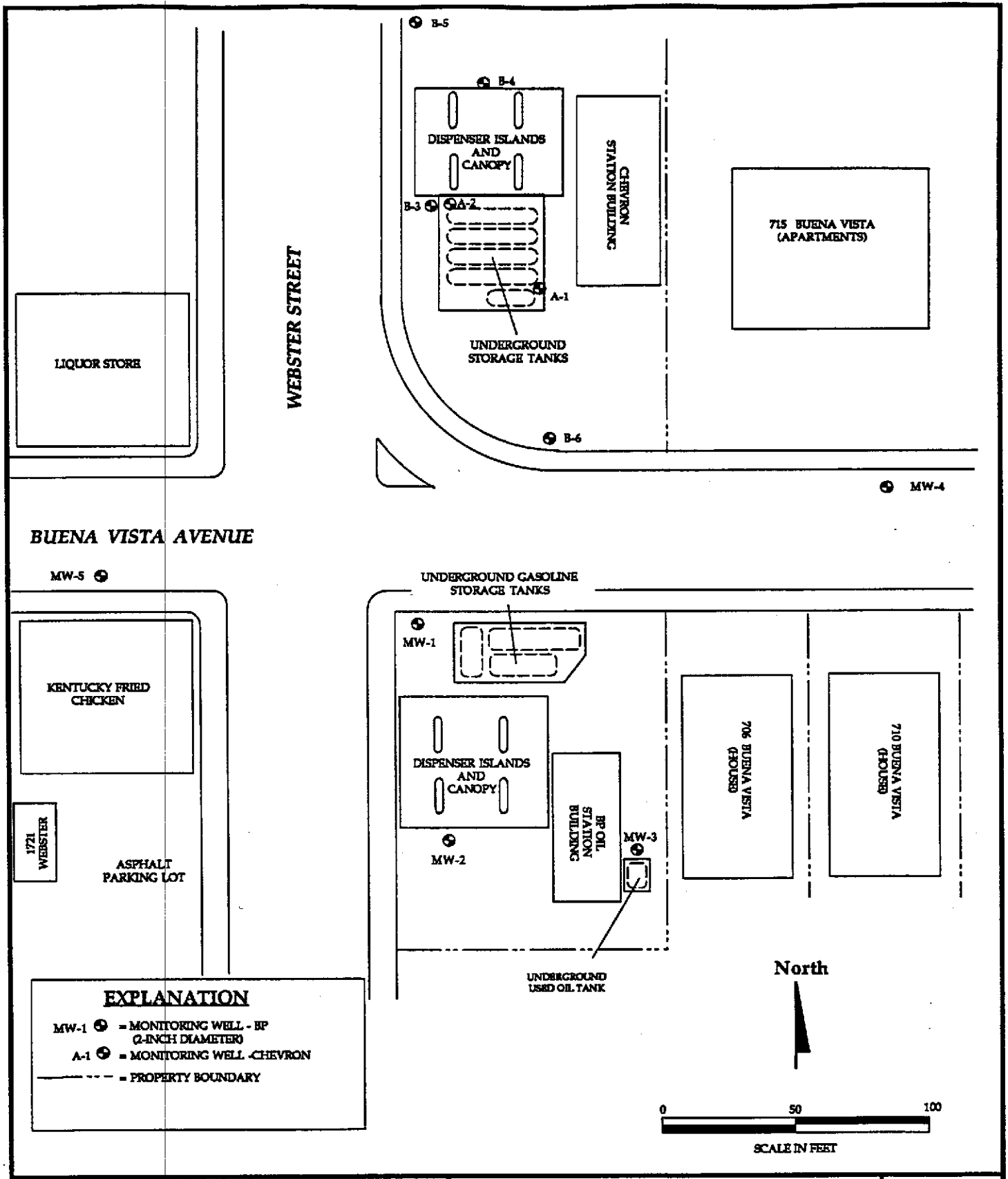
SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

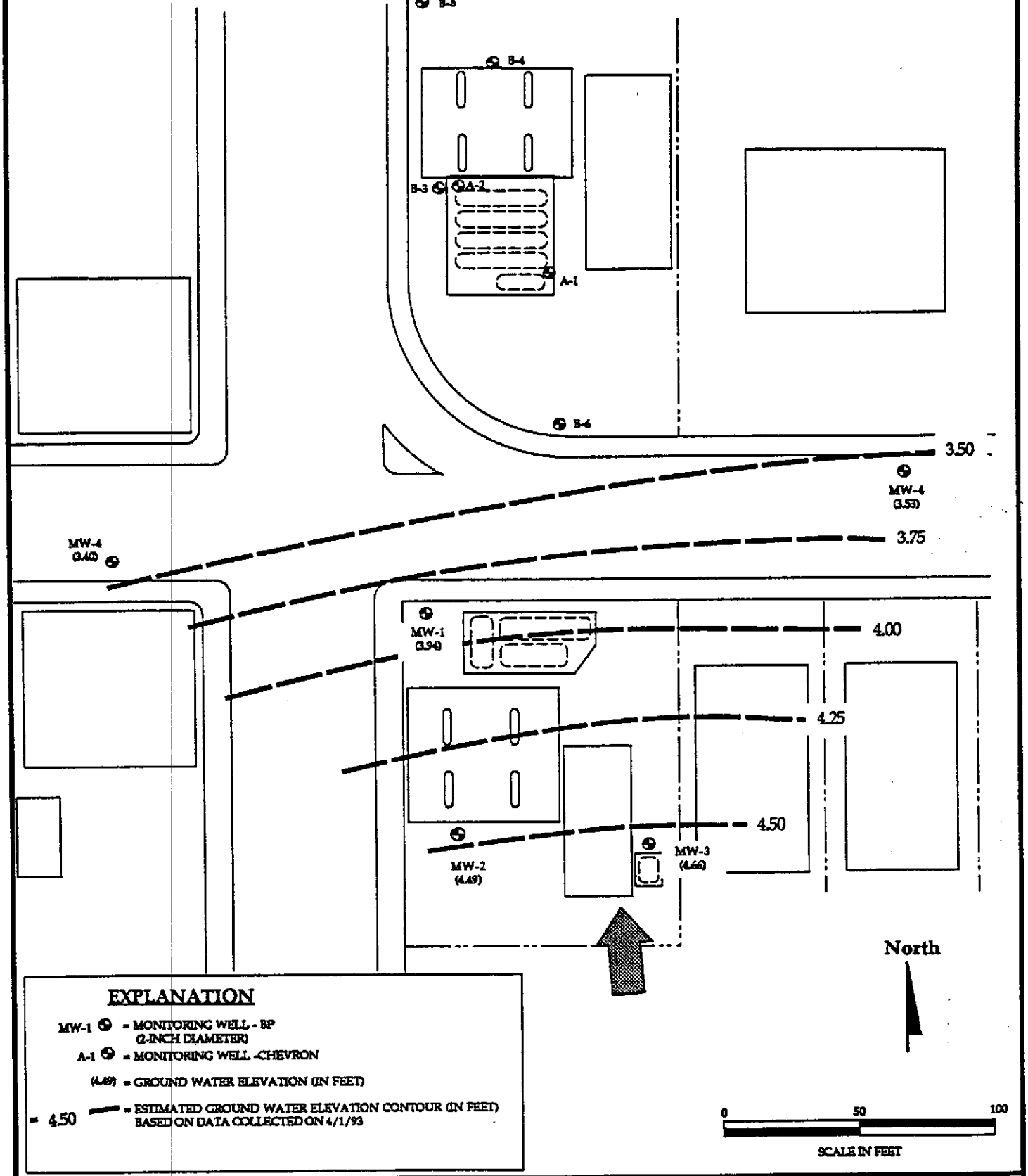
HYDR◆ ENVIR◆NMENTAL TECHN◆LOGIES, INC.	SITE LOCATION MAP BP Oil Facility No. 11104 1716 Webster Street Alameda, California	Job No. 9-038 Figure 1



HYDR◆
ENVIR◆NMENTAL
TECHN◆LOGIES, INC.

SITE PLAN
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

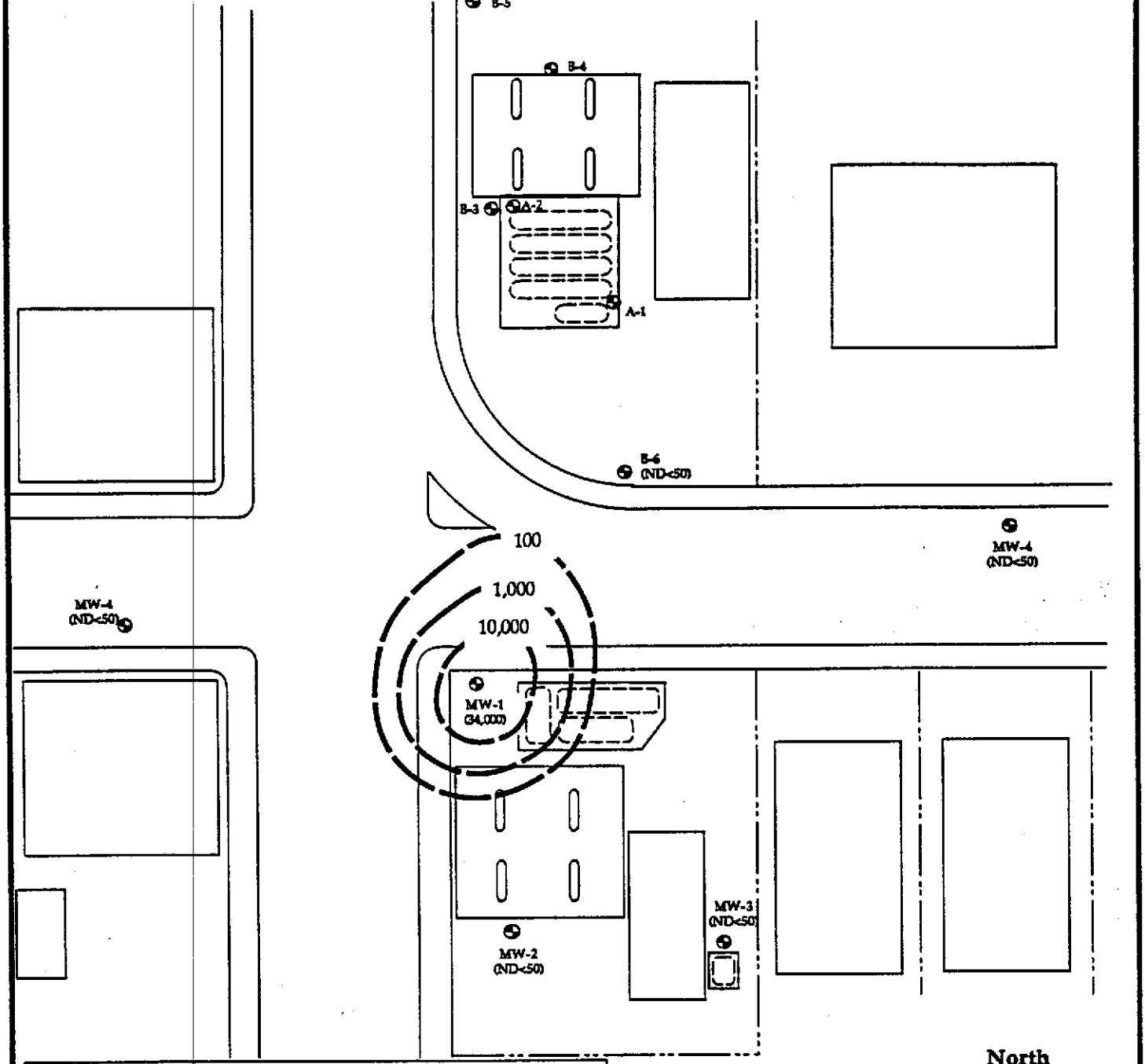
Job No.
9-038
Figure
2



HYDR♦
ENVIR♦NMENTAL
TECHN♦LOGIES, INC.

GROUND WATER ELEVATION
CONTOUR MAP
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

Job No.
9-038
Figure
3



EXPLANATION

MW-1 = MONITORING WELL - BP (2-INCH DIAMETER)

A-1 = MONITORING WELL - CHEVRON

(34,000) = CONCENTRATION OF DISSOLVED TPHg IN GROUND WATER SAMPLE - IN PPB

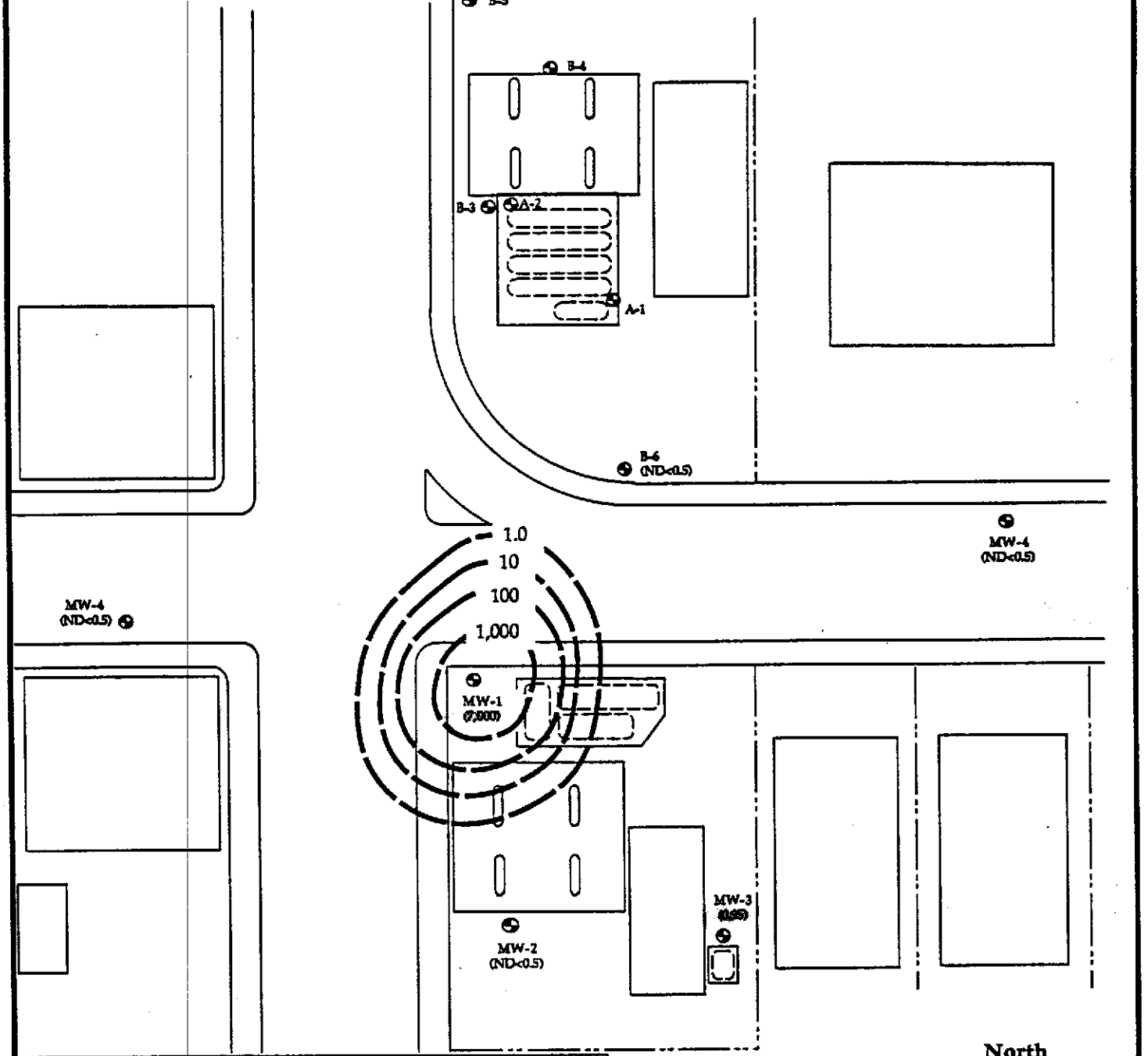
100 = ESTIMATED EXTENT OF DESIGNATED CONCENTRATION OF TPHg DISSOLVED IN GROUND WATER - IN PPB

NOTE: BASED ON DATA COLLECTED FROM MW-1, MW-2, AND MW-3 ON 7/21/92, FROM MW-4 ON 3/5/93, FROM MW-5 ON 4/1/93, AND FROM B-6 ON 5/18/92

HYDROENVIRONMENTAL TECHNOLOGIES, INC.

TPHg ISOCONCENTRATION MAP
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

Job No. 9-038
Figure 4



EXPLANATION

MW-1 = MONITORING WELL - BP (2-INCH DIAMETER)

A-1 = MONITORING WELL - CHEVRON

7,000 = CONCENTRATION OF DISSOLVED BENZENE IN GROUND WATER SAMPLE - IN PPB

100 = ESTIMATED EXTENT OF DESIGNATED CONCENTRATION OF BENZENE DISSOLVED IN GROUND WATER - IN PPB

NOTE: BASED ON DATA COLLECTED FROM MW-1, MW-2, AND MW-3 ON 7/21/92, FROM MW-4 ON 3/5/93, FROM MW-5 ON 4/1/93, AND FROM B-6 ON 5/18/92

HYDROENVIRONMENTAL TECHNOLOGIES, INC.

BENZENE ISOCONCENTRATION MAP
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

Job No. 9-038
Figure 5

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.
CALIFORNIA

DRILLING
WELL CONSTRUCTION
AND
SAMPLING PROTOCOLS

November 1992

DRILLING, WELL CONSTRUCTION, AND SAMPLING PROTOCOLS

Drilling Protocol

Prior to any drilling activities, Hydro-Environmental Technologies, Inc. (HETI) will verify that necessary drilling permits have been secured.

Prior to drilling, underground and above ground utilities will be located using Underground Service Alert (USA) and site reconnaissance. To the extent possible, drilling will be conducted so that disruptions of normal business activities at the project site are minimized. HETI shall obtain and review available public data on subsurface geology and, if warranted, the location of wells within a quarter mile of the project site will be identified. Drilling equipment will be inspected for suitability and integrity prior to performing work.

Subsurface investigations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons or other contaminants which may be present in soils and groundwater. Drilling methods will be selected to optimize field data requirements and to be compatible with known or suspected subsurface geologic conditions.

Shallow soil borings will be drilled dry using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum of 3-inches nominal outside diameter (O.D.) for borings not to be completed as wells. The auger size will be a minimum of 8-inches nominal O.D. for borings to be completed as wells. No drilling fluids will be used during this drilling method. All augers and drill rods will initially be thoroughly steam cleaned before arriving on-site, to prevent the introduction of contaminants from off-site, and augers and drill rods which are used will be steam cleaned between borings away from boring locations. Working components of the drilling rig (subs, collars and all parts of the rig chassis near the borehole) will also be steam cleaned. Cleaned augers, rods and other tools, if required, will be stored and covered when not in use. Decontamination of drilling equipment will consist of steam cleaning, and/or trisodium phosphate wash. Cleaning operations will be observed and supervised by a representative of HETI. The drilling rig will also be inspected by a representative of HETI to ensure that no fluids (hydraulic or lubricant) are leaking from the equipment.

Soil Sampling Protocol

Soil samples are typically collected at 5-foot intervals, from the ground surface to the total depth of the boring, with a California Modified split-spoon sampler driven 18 to 24 inches ahead of the lead auger by a 140-pound hammer falling a minimum of 30 inches. The sampler will be lined with clean brass or stainless steel tubes. The number of blows necessary to drive the sampler will be recorded on the boring log and well construction diagram (Plate A-1) to help evaluate the consistency of the materials encountered. Additional soil samples may be collected based on significant lithologic changes and/or potential chemical content. All equipment that contacts soil samples will be thoroughly cleaned prior to arrival at the project site and between each individual sample collection point on-site. New and used split-spoon samplers will be steam cleaned or washed with a trisodium phosphate or Alconox solution, rinsed with tap water, air dried or wiped dry with a clean towel. Soil removed from the top two liners (typically each 4 to 6 inches in length) and the end cone will be used for visual logging purposes and disposed with cuttings produced during the drilling operations. The bottom liner, if suitable, will be preserved for laboratory analysis. Soil samples from each sampling interval will be lithologically described, consistent with the Unified Soil Classification System, by a HETI geologist. The exact depth of all borings to the nearest 1/2-

foot will be determined in the field. Exploratory boring logs shall be prepared under the direction of a Registered Geologist or Professional Engineer.

Head-space analysis will be performed in the field to check for the presence of volatile organic compounds. Head-space analysis will be performed using an organic vapor meter (either flame-ionization or photo-ionization). The method used will be consistent with the method described by Fitzgerald (1989). Organic vapor concentrations will be recorded on the HETI Soil Boring Log (Figure 1). The selection of soil samples for chemical analysis are typically based on the following criteria:

a. Soil discoloration
b. Soil odors
c. Visual confirmation of chemical in soil
d. Depth with respect to underground tanks
e. Depth with respect to groundwater
f. Organic vapor meter reading

The soil sampler and liners will be cleaned with a trisodium-phosphate or Alconox solution, rinsed with clean tap water and air dried or wiped dry with a clean towel prior to each sampling event. Soil samples (full liners) selected for chemical analyses will be covered with aluminum foil or teflon tape and the ends will be sealed with plastic end caps. The end caps will then be taped to ensure a more secure seal. The samples will then be labeled and entered onto a Chain-of-Custody document, and placed in a cooler on blue ice (hard shell) for transport to a state certified analytical laboratory.

Where copper and zinc contamination are the subject of the investigation, stainless steel liners will be used in lieu of brass liners. Stainless steel liners will also be used when the client, additional sampling protocol or regulatory agencies require.

Soil borings will be backfilled (sealed) to the ground surface using either a neat cement or cement-bentonite grout mixture in accordance with appropriate local regulations.

Pending the outcome of the results of the laboratory analyses, excess drill cuttings will remain on-site and, when deemed necessary, covered with a plastic tarp or drummed. Confirmed uncontaminated soils may be appropriately disposed of on-site by the client. Soils found to contain concentrations of contaminants above applicable local or state limits will be placed in appropriately labeled 55-gallon D.O.T. drums or in a hazardous materials drop bin and left on-site for proper disposal by the client. At the clients request, HETI will act as the client's agent by assisting in the disposal of the contained material. In no case will HETI personel sign a Hazardous Waste Manifest.

Well Construction

Monitoring wells shall be installed using a truck-mounted hollow-stem auger drilling rig or an air or mud-rotary drilling rig. Typically, the hollow stem rig will be used for the installation of wells up to 100 feet deep, if subsurface conditions prove favorable. Wells greater than 100 feet in depth will typically be drilled using air or mud-rotary equipment. Mud-rotary equipment will typically be used when alternate methods have failed or proven ineffective.

Monitoring well casing and screen shall be constructed of a minimum of Schedule 40, flush joint, threaded, polyvinylchloride (PVC) pipe. The well screen will be factory mill-slotted. The screen length shall be determined in the field and shall be placed with the intent of setting the screened interval adjacent to the aquifer material. The screen length shall also be set with the intent of placing the top of the screened interval a minimum of 2 feet above the static water

level. All screens and casings used will be in a contaminant-free condition when placed in the ground. No thread lubrication shall be used, other than teflon tape or distilled water, during the connection of individual lengths of screened and solid well casing. Screen shall not be placed in a borehole that creates hydraulic interconnection of two or more distinctly separate aquifer units. Screen slot size will be chosen to be compatible with the encountered aquifer materials. The screen slot size will be chosen to retain a high percentage of the filter pack or natural formation. The remainder of the well casing, above the screened interval, shall be of solid riser casing. A sand pack shall be placed in the remaining anular space surrounding the well casing to a minimum of 1 foot above the screened interval. Sand pack shall not be placed such that it interconnects two or more distinctly separate aquifer units. Sand pack shall be chosen to be compatible with both the aquifer materials and the screen slot size. Sand pack shall consist of clean, washed, kiln dried silica sand. A minimum 1-foot thick bentonite pellet or bentonite slurry seal shall be placed above the sand pack. All bentonite shall be hydrated by either formation water or steam-distilled water. The remaining annular space above the bentonite seal shall be grouted with a neat cement or bentonite-neat cement mixture and shall be placed from the top of the bentonite pellet seal to within 6 inches of the top of the well. If used, the bentonite content of the mixture shall not exceed 5 percent by weight. Sand pack, bentonite, and cement seal levels will be confirmed during construction by measuring the remaining anular space with a calibrated weighted tape. If shallow water table conditions prevail, the screen interval will be placed such that the screen height above the static water level is reduced and a maximum possible surface seal can be achieved. A field boring log and well construction diagram (Plate A-1) shall be prepared by a representative of HETI for each well completed. Monitoring and extraction wells shall be constructed with Class-A cement/bentonite grout or bentonite pellets tremied into position as a base for the well casing if necessary. The well casing will be set within the aquifer according to the proposed function of the well and the chemistry of the potential contaminants.

In the event a monitoring well is required to be installed in an aquifer unit underlying an existing, shallower aquifer, the well will be completed in the lower aquifer such that only water from the lower aquifer is drawn into the well. The upper aquifer will be sealed by installing a steel conductor casing which extends to the base of the shallow aquifer. The steel casing will be tremied into position with an annular neat cement or cement-bentonite grout seal placed between the outside wall of the casing and the wall of the borehole. The cement grout will be allowed a minimum of 72 hours to set prior to advancing the boring beyond the sealed conductor casing and into the next aquifer. After 72 hours, the boring will be advanced below the seal and completed as a well as described above but within the steel conductor casing.

The tops of all well casings will be sealed and placed in a vandal resistant, traffic rated box to prevent entry of surface contamination, unauthorized entry and tampering.

Monitoring wells will be surveyed to obtain north-end casing elevations to the nearest $\pm$ 0.01 foot. Water level measurements will be recorded with an interface probe to the nearest $\pm$ 0.01 foot and referenced to either a project datum or mean sea level (MSL). A project site datum is typically chosen such that it will remain in the event the project site undergoes a physical change as a result of construction or other cultural disturbance. Where required, the wells will be surveyed by a licensed land surveyor relative to the nearest bench mark and relative to mean sea level. Typically, the establishment of a known, on-site reference by a licensed survey, is enough to allow for the remaining well top elevations to be determined using a survey level and rod. Unless directed otherwise by local regulatory agencies, the well top elevations will be established in this manner.

Well Development

After installation, all monitoring wells shall be developed to remove fine grained sediments from the well and to stabilize sand, gravel and disturbed aquifer materials in the annular area around the screened interval. Well development will be accomplished by air-lift pump, suction-lift pump, submersible pump, bladder pump, surge block, bailer or any combination of the above. All well development equipment will be decontaminated prior to development using a steam cleaner and/or trisodium-phosphate solution wash, clean water rinse, and steam distilled water rinse. Well development will continue until each well is relatively free of turbidity. The adequacy of well development will be assessed by a HETI geologist. Where appropriate, indicator parameters (pH, specific conductance, temperature, and turbidity) will be monitored during well development. Field instrument calibrations will be performed prior to use according to manufacturers specifications.

Well Head Completion and Site Clean-up

Monitoring wells shall be completed below grade unless special conditions exist that require above grade design. Monitoring well casing (including the well locking seal and cap) will be completed approximately two inches below the vandal resistant traffic rated road box cover. Except in areas where snow plows might be used, the road box cover shall be completed approximately one inch above the existing grade surface to allow for precipitation runoff. All concrete work, both inside and outside the road box, shall be completed with a smooth finish.

Above ground completions will be set inside a 2 to 3 foot tall locking steel protective casing. If traffic conditions dictate, three 4-inch diameter steel pipes will be set in concrete in a triangular pattern to act as bumper posts. The posts will be set 2 feet deep and will be filled with concrete. A four foot square, 3-inch thick concrete pad which slopes away from the well will be set around each well. Both the protective steel well casing and the bumper posts will be painted yellow.

The project site shall be left as clean as possible. All soils and excess concrete produced from each monitoring well will be placed in appropriate areas to be disposed as previously described. All monitoring well locations will either be broomed or washed down such that staining of the existing surface cover is minimized.

GROUNDWATER SAMPLING AND ANALYSIS

Quality Assurance/Quality Control Objectives

The sampling and analysis procedures employed by HETI for groundwater sampling and monitoring follow specific Quality Assurance/Quality Control (QA/QC) guidelines. Quality Assurance (QA) objectives have been established by HETI to develop and implement procedures for obtaining field data and evaluating water quality in an accurate, precise and complete manner so that sampling procedures and field measurements provide information that is comparable and representative of the actual field conditions. Quality Control (QC) is maintained by HETI by using specific field protocols and requiring the analytical laboratory to perform internal and external QC checks. It is the goal of HETI to provide data that are accurate, precise, complete, comparable, and representative. The definitions for accuracy, precision, completeness, comparability, and representativeness are as follows:

1. Accuracy - the degree of agreement of a measurement with an accepted reference or true value.

2. Precision - a measure of agreement among individual measurements under similar conditions. Usually expressed in terms of standard deviation.

3. Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals.

4. Comparability - the confidence with which one data set can be compared with another.

5. Representativeness - the degree to which a sample or group of samples reflect the characteristics of a media at a given sampling point. Also includes the degree to which a sampling point represents the actual parameter variations which are under study.

As part of the HETI QA/QC program, applicable federal, state and local reference documents are to be followed. The procedures outlined in these regulations, manuals, handbooks, guidance documents and journals are incorporated into the HETI sampling procedures to assure that: (1) groundwater samples are properly collected, (2) groundwater samples are identified, preserved, and transported in a manner such that they are representative of field conditions, and (3) chemical analyses of samples are accurate and reproducible.

GUIDANCE AND REFERENCE DOCUMENTS USED TO COLLECT GROUNDWATER SAMPLES

U.S.E.P.A. - 339/9-51-002	NEIC Manual for Groundwater/ Subsurface Investigation at Hazardous Waste Sites
U.S.E.P.A. - 503/SW611	Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities (August, 1977)
U.S.E.P.A. - 600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
U.S.E.P.A. - 600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)
U.S.E.P.A. - SW-846#, 3rd Edition	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (November, 1986) and latter additions
40 CFR 136.3e Table II	Required Containers, Preservation Techniques, and Holding Times
Resources Conservation and Recovery Act (OSWER 9950.1)	Groundwater Monitoring Technical Enforcement Guidance Document (September, 1986)
California Regional Water Quality Control Board (Central Valley Region)	A Compilation of Water Quality Goals (September, 1988); Updates (October, 1988)
California Regional Water Quality Control Board (North Coast, San Francisco Bay, and Central Valley)	Regional Board Staff Recommendations for Initial Evaluations and Investigation of Underground Tanks: Tri-Regional Recommendations (June, 1988)
California Regional Water Quality Control Board (Central Valley Region)	Memorandum: Disposal, Treatment, and Refuse of Soils Contaminated with Petroleum Fractions (August, 1986)
State of California Department of Health Services	Hazardous Waste Testing Laboratory Certification List (March, 1987)
State of California Water Resources Board	Leaking Underground Fuel Tank Control (LUFT) Field Manual (May, 1988), and LUFT Field Manual Revision (April, 1989)

State of California Water Resources 85), Control Board	Title 23 (Register #85.#33-8-17- Subchapter 16: Underground Tank Regulations; Article 3, Sections 2632 and 2634; Article 4, Section 2647 (October, 1986)
Santa Clara Valley Water District	Guidelines for Investigating Fuel Leaks (March, 1989)
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)
Alameda County Water District	Groundwater Protection Program Guidelines for Groundwater and Soil Investigations at Leaking Underground Fuel Tank Sites (most recent revision)
American Public Health Association	Standard Methods for the Examination of Water and Wastewaters, 16th Edition
Analytical Chemistry (journal)	Principles of Environmental Analysis Volume 55, pages 2212-18,December, 1983
American Petroleum Institute Environmental Affairs Dept., June, 1983	Groundwater Monitoring & Sample Bias
The Bay Area Air Quality Management District	Regulation 8 - Rule 40 & Rule 48

Because groundwater samples collected by HETI are analyzed in the parts per billion (ppb) range for many analytes, care is exercised to prevent contamination of samples. When volatile or semivolatile organic compounds are included for analysis, HETI sampling crew members will adhere to the following precautions in the field:

1. A new pair of clean, disposable, latex (or comparable material) gloves are to be worn for each well to be sampled.

2. When possible, samples will first be collected from wells known or suspected to contain the fewest contaminants, followed by wells in increasing order of degree of contamination.

3. All sample bottles and equipment are to be kept away from fuels and solvents. When possible, gasoline (used in generators and water pumps) is to be shipped to the project site in separate compartments of the same vehicle or in a separate vehicle as that in which sample bottles are shipped.

4. Sampling bailers are to be composed of polyethylene (when dedicated to the well), Teflon or stainless steel. Other materials, such as acrylic, may contain phthalate esters which can interfere with gas chromatography (GC) analyses. Well purging may be performed with PVC bailers.

5. Volatile organic groundwater samples are collected so that air passage through the sample does not occur or is minimal (to prevent volatiles from being stripped from the samples). Sample bottles are filled by slowly running the sample down the side of the bottle until there is a positive convex meniscus over the neck of the bottle. The Teflon side of the septum (in cap) is positioned against the meniscus and the cap is screwed on tightly. The sample is then inverted and lightly tapped while the sampler inspects the contents of the bottle for an air bubble. The absence of an air bubble indicates a successful seal. If a bubble is evident, the cap is removed and more water is added to the sample. The inspection procedure is repeated and if bubbles persist, the vial is discarded in a container designated for used and broken vials and bottles and the sample filling procedure is repeated with another vial.

6. Extra vials shall be available for use in the event of dropped bottles and/or caps. Any bottle which has come in contact with the ground shall be considered contaminated and shall not be used. When replacing septa, or if septa become inverted, care shall be taken to assure that the Teflon seal faces the interior of the bottle.

7. All preservatives shall be provided by the contract analytical laboratory.

Laboratory and field handling procedures of samples may be monitored by including QC samples for analysis with sample lots from a project site. QC samples may include any combination of the following:

1. Trip Blank - Used for purgable organic compounds only; QC samples shall be collected in 40 milliliter (ml) sample vials filled in the analytical laboratory with organic free water. Trip blanks should be sent to the project site, and travel with the samples from the project site. Trip blanks are <u>not</u> opened, and are returned from the project site with the samples from the project site for analysis.

2 Field Blank - Prepared in the field using steam-distilled water. Field blank QC samples shall accompany project site samples to the laboratory and shall be analyzed for the same chemical parameters as those samples taken from the project site.

3. Equipment Blank - Equipment Blank QC samples shall be prepared in the field using field equipment rinsate between two different wells after the equipment has been washed and rinsed. The equipment blank will consist of deionized water retained in the sampling equipment. These QC samples will only be taken when a dedicated bailer is not used for sampling.

4. Duplicates - Duplicate QC samples shall be collected "second samples" from a selected well and project site. Duplicates shall be collected as either split samples or second-run samples (i.e. later date) from the same well.

The number and types of QC samples shall be determined by HETI on a site-specific basis.

GROUNDWATER SAMPLE COLLECTION

This section describes the routine procedures followed by HETI while collecting groundwater samples for chemical analysis. These procedures include decontamination, water level measurements, well purging, physical parameter measurements, sample collection, sample preservation, and sample handling. Critical sampling objectives for HETI are to:

1. Collect groundwater samples which are representative of the sampled matrix.

2. Maintain sample integrity from the time of sample collection to delivery to the analytical laboratory.

Sample analyses, methods, containers, preservation, and holding times are presented in Table A-1.

Decontamination Procedures

All physical parameter measuring and sampling equipment shall be decontaminated prior to measurement and sample collection using a trisodium phosphate or Alconox solution wash, followed by two separate rinses in tap water, followed by one rinse in steam-distilled water. Any sampling equipment surfaces or parts that might absorb specific contaminants, such as plastic pump valves, impellers, etc., are to be cleaned in the same manner.

Sample bottles, bottle caps, and septa used for sampling volatile organics are thoroughly pre-cleaned in either the laboratory or the factory. All appropriate measures shall be taken to assure continued sterility of the containers issued by the contract laboratory prior to usage at the project site.

During field sampling, equipment which has been placed in a well shall be decontaminated by washing with a trisodium-phosphate or Alconox solution followed by two rinses in tap water and one rinse in steam-distilled water.

Water Level Measurements

Prior to purging and sampling any wells, the static-water level shall be measured by use of an electronic sounder and/or calibrated portable oil-water interface probe. Both static water level and separate phase product thickness shall be measured and noted to the nearest $\pm$0.01 foot. Interface probe results shall be confirmed by sampling the top of the water column with a clear bailer and measuring any floating product thickness to the nearest $\pm$0.01 foot with an engineers scale tape. In all cases a clear bailer sample will be taken from each well to check for color, sheen and undetected floating product. If floating product of any measureable thickness is observed, no sampling will be performed for that well. If visible product sheen is observed, sampling shall proceed under normal protocols.

The line used to lower the bailer shall be discarded after each use to preclude the possibility of cross contamination. Field observations (e.g., well integrity, product odor, turbidity, water color, odors, etc.) shall be recorded on the HETI Purge/Sample Sheet (Plate A-2). Before and after the use of the electric sounder, interface probe, non-dedicated bailer, or any other down well equipment, each will be decontaminated by washing in a trisodium phosphate or Alconox solution, followed by a double rinse with tap water, followed by a rinse with steam-distilled water.

Well Purging

Before sampling commences, well casing storage water and interstitial water in the artificial sand pack shall be purged from the well using: (1) a positive displacement bladder pump constructed of inert non-wetting Teflon and stainless steel; (2) a pneumatic-airlift pumping system; (3) a centrifugal pumping system; or (4) a PVC, Teflon or stainless steel bailer. Methods of purging will be assessed based on the well size, location, depth, accessibility, and known chemical conditions. Individual well purge volumes are calculated from the casing volumes. In general, a minimum of 3 to 5 casing volumes will be purged. Wells which dewater or demonstrate slow recharge capacities (i.e., low yield wells which only recover to 70 percent of initial water column height after 1 hour) during purging activities may be sampled after fewer than 3 to 5 purging cycles. If a low yield well is to be sampled, sampling shall not take place until at least 70 percent of the previously measured water column has been replaced by recharge. Monitoring wells shall be purged according to the protocol flowchart presented in Plate A-3. Water removed from the wells will either be disposed or stored in 55-gallon DOT drums for future disposal according to proceedures outlined for contaminated soil cuttings in the Soil Sampling Protocol section above. Where appropriate, physical parameters (pH, specific conductance, and temperature) will be monitored by HETI field crew during well purging operations. If necessary, purging may continue until all three physical parameters have stabilized. Stability shall be defined as a change of less than 0.2 pH units, less than 10 percent in micro mhos, and less than 1.0 degree Centigrade. The pH meters shall be read to the nearest $\pm$ 0.1 pH units. Specific conductance meters shall be read to the nearest $\pm$ 10 micro-mhos per centimeter. Both types of meters shall be calibrated daily to manufacturer's specifications. Temperature shall be read to the nearest $\pm$ 0.1 degree centigrade. Field data collected while developing, purging and sampling the wells will be entered onto the HETI Purge/Sample Sheet (Plate A-2). Copies of the Purge/Sample Sheets will be reviewed for accuracy and completeness for each well sampled.

DOCUMENTATION

Sample Container Labels

Each sample container shall be labeled immediately after the sample is collected and sealed. The label shall include:

- Company Name (HETI)
- Source (i.e., well number or code)
- Sampler's identification
- Project number
- Date and time of collection
- Type of preservation (if any) used

Field Sampling Data Sheets

In the field, the HETI sampling crew will record the following information on the Purge/Sample Sheet (Plate A-2) for each well sampled:

- Project number
- Client
- Location
- Source (i.e., well number or code)
- Time and date of development, purging and sampling
- Well accessibility and integrity
- Pertinent well data (e.g., total depth, product thickness, static water level)
- Physical parameters when appropriate (e.g., specific conductance, pH, temperature) - may be more than one reading
- Gallons and well casing volumes purged

Chain-of-Custody

A chain-of-custody record shall be completed and will accompany every shipment of samples to the analytical laboratory in order to establish documentation tracing sample possession from the time of collection until delivery to the laboratory. The record will contain the following information:

- Sample or station number or code (ID)
- Signature of the collector, sampler, or recorder
- Date and time of collection
- Place of collection (project address and name of business)
- Sample type (soil or water)
- Type of analysis requested
- Signatures of persons involved in chain of possession (in chronological order)
- Dates and times of individual possession (inclusive)
- Laboratory comments regarding the sample receptacle conditions

Samples will always be accompanied by a Chain-of-Custody record. When transferring the samples, the individuals relinquishing and receiving the samples will sign, date and note the time on the Chain-of-Custody record.

Sample Collection, Handling, Storage and Transport

All water samples will be collected in an order such that those parameters most sensitive to volatilization will be sampled first. A general order of collection for some common groundwater parameters is as follows:

- Volatile Organic Compounds (VOC's)
- Total Organic Halogens (TOH)
- Total Organic Carbon (TOC)
- Extractable Organics
- Total Metals
- Dissolved Metals
- Phenols
- Sulfate and Chloride
- Nitrate and Ammonia
- Turbidity

All samples from the same well shall be collected immediately after purging or when the well recovers to 70 percent of the original water column height. All samples from one sampling set from a single well should be collected on the same day.

All chemical sample handling and storage will be conducted under the direction of HETI's consulting analytical chemist. All laboratory chemical testing will be accomplished by a state approved analytical laboratory.

All water samples will be held at 4°C by packing them in a water-tight container inside an ice chest and covering with hard shelled "blue ice™". In no event shall the time between sample collection and delivery to the contract laboratory be greater than 72 hours. Preservatives will not be added to any sample by the sampling crew, unless instructed by the consulting analytical chemist. If added in the field, preservatives shall be supplied by the contract analytical laboratory. No one will open the samples other than laboratory personnel who will perform the specified chemical analyses.

If it is necessary for samples or sample ice chests to leave the immediate control of the sampling crew prior to delivery to the laboratory or laboratory courier, such as shipment by a common carrier (e.g., UPS™), a custody seal will be placed on each sample container and/or sample chest. Custody seals will be placed to ensure that the samples have not been tampered with during shipment and will contain the samplers signature, the date and time the seal was emplaced.

TABLE A-1

SAMPLE ANALYSIS METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Parameter	Analytical Method	Reporting Units	Container*	Preservation†	Maximum Holding Time
Total Petroleum Hydrocarbons (low to med. b.p. i.e. gasoline)	EPA 8015 (DHS modified)	ppb ug/l	40ml glass vial, Teflon lined septum	4°C HCl to pH<2**	14 days
Benzene Toluene Ethylbenzene Xylenes (BTEX)	EPA 8020	ppb ug/l	40ml glass vial, Teflon lined septum	4°C HCl to pH<2**	7 days(w/o preservative) 14 days (w/preservative)
Oil & Grease	SM 503A&E	ppb ug/l	1L glass jar, Teflon lined cap	4°C H2SO4 to pH<2	28 days
Total Petroleum Hydrocarbons (high. b.p. i.e. diesel)	EPA 8015 (DHS modified)	ppb ug/l	1L glass jar, Teflon lined cap	4°C	14 days
Halogenated Volatile Organics (chlorinated solvents)	EPA 8010	ppb ug/l	40ml glass vial, Teflon lined septum	4°C	14 days
Non-Chlorinated Solvents	EPA 8020	ppb ug/l	as above	4°C	14 days
Volatile Organics (GC/MS)	EPA 8240	ppb ug/l	as above	4°C	14 days
Semi-Volatile Organics (GC/MS)	EPA 8270	ppb ug/l	as above	4°C	14 days
Metals	ICP-EPA 200.7 or A.A.EPA-	ppb ug/l	100 ml	4°C HNO3 to pH<2	6 months

* Containers listed are for water - soil containers are to be brass or stainless steel tubes with plastic end caps.

† Applies only to liquid samples.

** May vary depending on lab requirements.

SITE/LOCATION		BEGUN	BORING DIAMETER	ANGLE/BEARING	BORING NO
DRILLING CONTRACTOR		COMPLETED	FIRST ENCOUNTERED WATER DEPTH		
OPERATOR		LOGGED BY	STATIC WATER DEPTH/DATE		
DRILL MAKE & MODEL		SAMPLING METHOD			BOTTOM OF BORING
WELL MATERIAL	SLOT SIZE FILTER PACK	BORING SEAL			WELL NO.

BLOWS/ FOOT	FIELD HEAD-SPACE*	DEPTH	SAMPLE	WATER LEVEL	WELL CONSTR.	GRAPHIC LOG	MATERIAL CLASSIFICATION & PHYSICAL DESCRIPTION
		1					
		2					
		3					
		4					
		5					
		6					
		7					
		8					
		9					
		10					
		11					
		12					
		13					
		14					
		15					
		16					
		17					
		18					
		19					
		20					
		21					
		22					
		23					
		24					
		25					
		26					
		27					
		28					
	*PID (ppm)	29					
		30					

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

DATE:

APPROVED BY:

SOIL BORING LOG MW-4
AND
WELL CONSTRUCTION MW-4

PLATE
A-1

JOB NO.

PURGED/SAMPLED BY: _____ DATE: _____

GAUGING DATA:

Depth to bottom: _____ ft.

Depth to water: _____ ft.

Saturated Thickness: _____ ft.

Conversion	
diam.	gals/ft.
2 in.	x 0.16
4 in.	x 0.65
6 in.	x 1.44

Well casing volume _____ gallons

volumes to purge x _____ vols.

*Total volume to purge = _____ gallons

* unless chemical parameters stabilize earlier

PURGING DATA:

Purge method: PVC bailer/ Submersible pump/ Suction lift pump/ _____
(circle one)

Time	Volume (gallons)	Temp. (°F)	Conductivity (mS/cm)	pH

Color: _____ Turbidity: _____

Recharge: _____ SPP _____ ft.

SAMPLING DATA:

Sampling method: Dedicated bailer / _____

Sample for: (circle)

TPHg/BTEX	METALS	TOG	8010	
TPHd	O-Pb	TEL	8020	
TPH mo	Total Pb	EDB	8240	
601	602	Nitrates	8260	8270

Other: _____

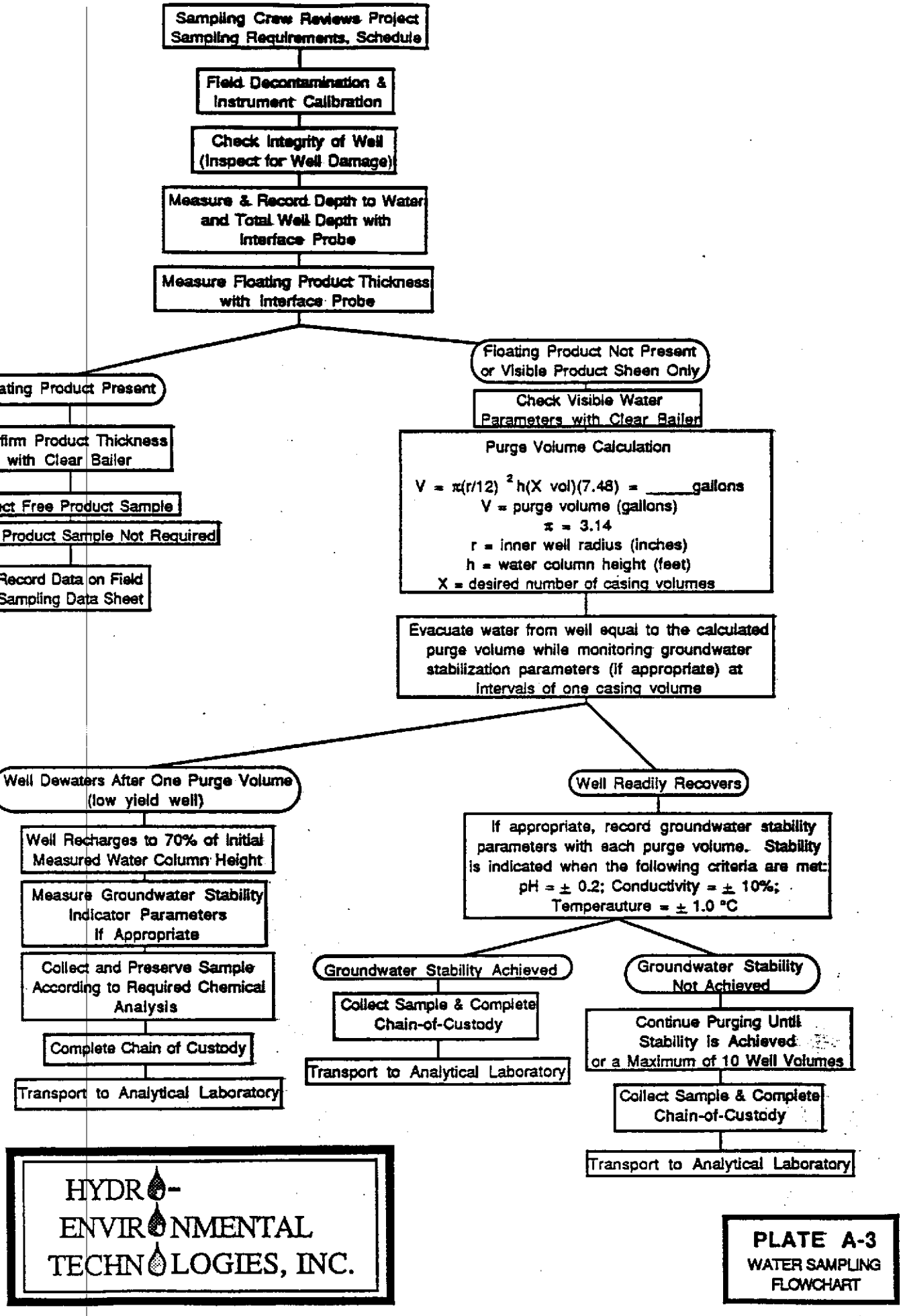
HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

MONITORING WELL PURGE/SAMPLE SHEET

WELL # _____

LOCATION _____

PLATE A-2



HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

PLATE A-3
WATER SAMPLING FLOWCHART

HYDRO-
ENVIRONMENTAL
TECHNOLOGIES, INC.

- 9-038

HEALTH AND SAFETY PLAN
FOR
DRILLING AND SAMPLING ACTIVITIES

AT
BP OIL STATION NO. 11104
1716 WEBSTER STREET
ALAMEDA, CALIFORNIA

PREPARED BY

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.
2363 MARINER SQUARE DRIVE
ALAMEDA, CALIFORNIA

JULY 1992

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

TABLE OF CONTENTS

FIGURES:

1.0 IMPORTANT LOCATIONS AND TELEPHONE NUMBERS

- ALAMEDA HOSPITAL
  2070 Clinton Av., Alameda, CA

  Go southeast on Buena Vista Av., turn right on Willow St., turn right on Clinton Av., hospital is immediately on the left (refer to Figure 2).

  Telephone (510) 523-4357

- Police Department - 911
  Fire Department - 911

2.0 SITE DESCRIPTION

Company Name:	BP Oil Company, Tukwila, WA
Site Location:	1716 Webster Street, Alameda, CA (Figure 1)
Property Owner:	BP Oil Company Cleveland, OH
Contact Person:	Tony Ramirez (510) 521-2684 Hydro-Environmental Technologies, Inc. (HETI)
Hazards:	Traffic, noise, hydrocarbon exposure and utilities (obstructoin) during the process of drilling, excavating and construction of facilities

3.0 SCOPE OF SERVICES

- Work planned at this site includes installing ~~three~~ two monitoring wells to a total depth of 17 feet below grade and water sample collection from the wells.

4.0 ONSITE ORGANIZATION

Site Safety Officer:	Brian Gwinn
Field Leader:	Brian Gwinn
Contractor Representative:	Bayland Drilling 811 Hamilton Avenue Menlo Park, CA 94025 License # C57-347152

5.0 ON-SITE CONTROL

Mr. Ramirez (geologist) will monitor all field activities. A safe work zone has been established for drilling activities. Monitoring of ambient hydrocarbon vapor concentrations will be conducted by HETI. Traffic safety devices will be utilized as needed.

6.0 HAZARD EVALUATION

6.1 Chemical Hazard

According to laboratory analysis of soil samples collected from this site previously, the possible contaminants to be encountered during drilling are petroleum hydrocarbons as gasoline, benzene, toluene, ethylbenzene, and xylene.

Inhalation and skin absorption present the main exposure hazards. Based on laboratory analysis of the soil, we do not anticipate the potential levels of exposure will exceed permissible exposure limits (PEL) or threshold limit value (TLV) limits set by the Occupational Safety and Health Administration (OSHA).

Following are short descriptions of each contaminant suspected of being present on-site:

- *Gasoline*

  Gasoline is a clear, aromatic, volatile liquid. It is a mixture of aliphatic hydrocarbons and has:

  - Flash point = 50°F
  - Lower exposure limit = =1.3%
  - TLV in the air = 300 ppm
  - OSHA 8-hour time weighted average (TWA) PEL = 300 ppm
  - OSHA short-term exposure limit (STEL) 15 minute = 500 ppm

- *Benzene*

  This is a carcinogenic (cancer causing) substance. Benzene is a common constituent of gasoline and other petroleum product materials. It is a clear, colorless liquid and has:

  - Flash point = 12°F
  - TLV = 1 ppm
  - OSHA PEL = 1 ppm
  - STEL (15 minute) = 5 ppm

- *Ethylbenzene*

  - Flash point = 59°F
  - OSHA 8-hour TWA = 100 ppm
  - OSHA STEL = 125 ppm

- *Toluene*

  This material is a flammable, colorless liquid and has:

  - Flash point = 40°F
  - TLV in the air = 100 ppm
  - STEL = 150 ppm
  - OSHA PEL (8-hour TWA) = 100 ppm
  - OSHA STEL = 150 ppm

- *Xylene*

  This clear liquid has:

  - Flash point = 100°F
  - TLV in the air = 100 ppm
  - OSHA PEL (8-hour TWA) = 100 ppm
  - OSHA STEL = 150 ppm

6.2 Physical Hazards

Because the anticipated work is to be performed as a "normal" working day, all aspects of safety concerning drilling will be adhered to; Safety requirements such as but not limited to:

Driller will examine all wires/cables daily
Drilling equipment will be maintained in safe operating condition
Drilling equipment will meet state safety requirements
Driller will block/chock rig as required
All personnel and visitors in the work area will have completed 40 hours of OSHA training or have current 8 hours of a refresher course

The main physical hazards during construction are:

- Dust
- Noise
- Vehicular traffic
- Bodily injury due to equiptment operation
- Strain: lifting, slipping, tripping, falling, or moving equipment
- Underground utility lines

All personnel in the work area will know the location of:
-first aid kit
-fire extinguisher
-telephone

7.0 REQUIRED PROTECTION

At a minimum, Level D of protection will be worn in the work zone. That is, field personnel and visitors are required to wear the following clothing and equipment:

- Hard hat (ANSI Z89.1)
- Safety glasses (ANSI Z87.0)
- Safety shoes (steel toe) (ANSI Z41.0)
- Gloves (nitrile)
- Hearing protection

8.0 AIR MONITORING

An Organic Vapor Meter Model 580B (OVM) will be used to monitor the air space within a 2 foot radius of the auger bit, downwind and upwind of the drill rig at a height of 5 feet every hour. If hydrocarbon odors within this area become detectable with the OVM at a concentration of 10 parts per million (ppm) of total organic compounds, the personnel assigned to the project will upgrade their personal protection with half face respirators with organic vapor cartridges.

No hand to mouth transfer is to occur within the work zone. Workers are required to wash hands and face with soap thoroughly after work or before meals.

This plan was prepared by Brian Gwinn
Brian Gwinn - Project Manager

I have read and understand this document and will abide by the provisions herein:

(1) Henry Hutchens Date: 3-4-93

(2) John D Ahn Date: 3.4.93

(3) Ron S Date: 3-4-93

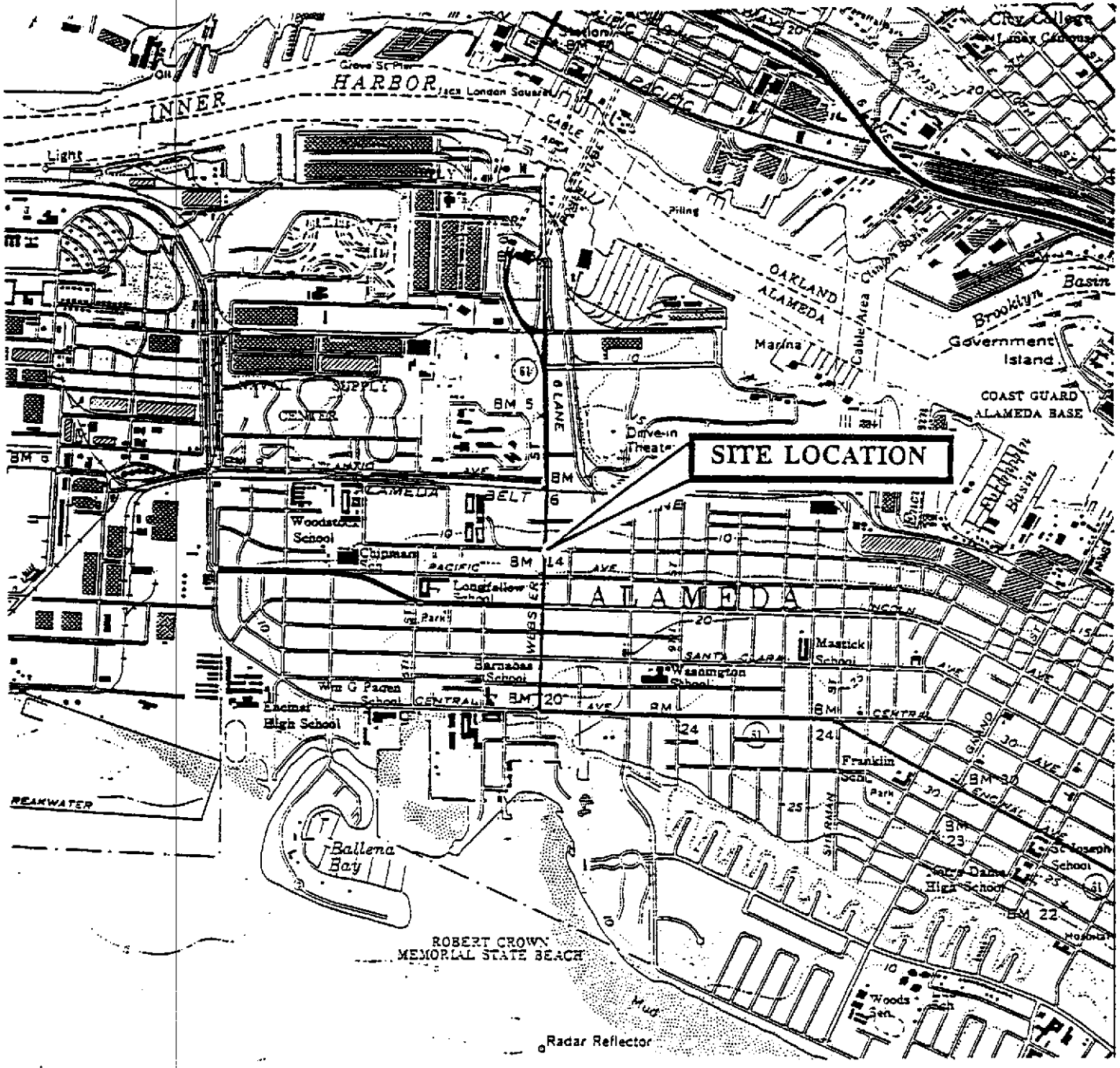
(4) B C Date: 3/26/93

(5) Michael R Lehzen Date: 3/31/93

(6) _____ Date: _____

(7) _____ Date: _____

(8) _____ Date: _____



North

Source:
USGS 7.5' Quadrangle
Oakland, East

SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

HYDRO ENVIRO MENTAL TECHNO LOGIES, INC.

SITE LOCATION MAP
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

Job No.
9-038
Figure
1

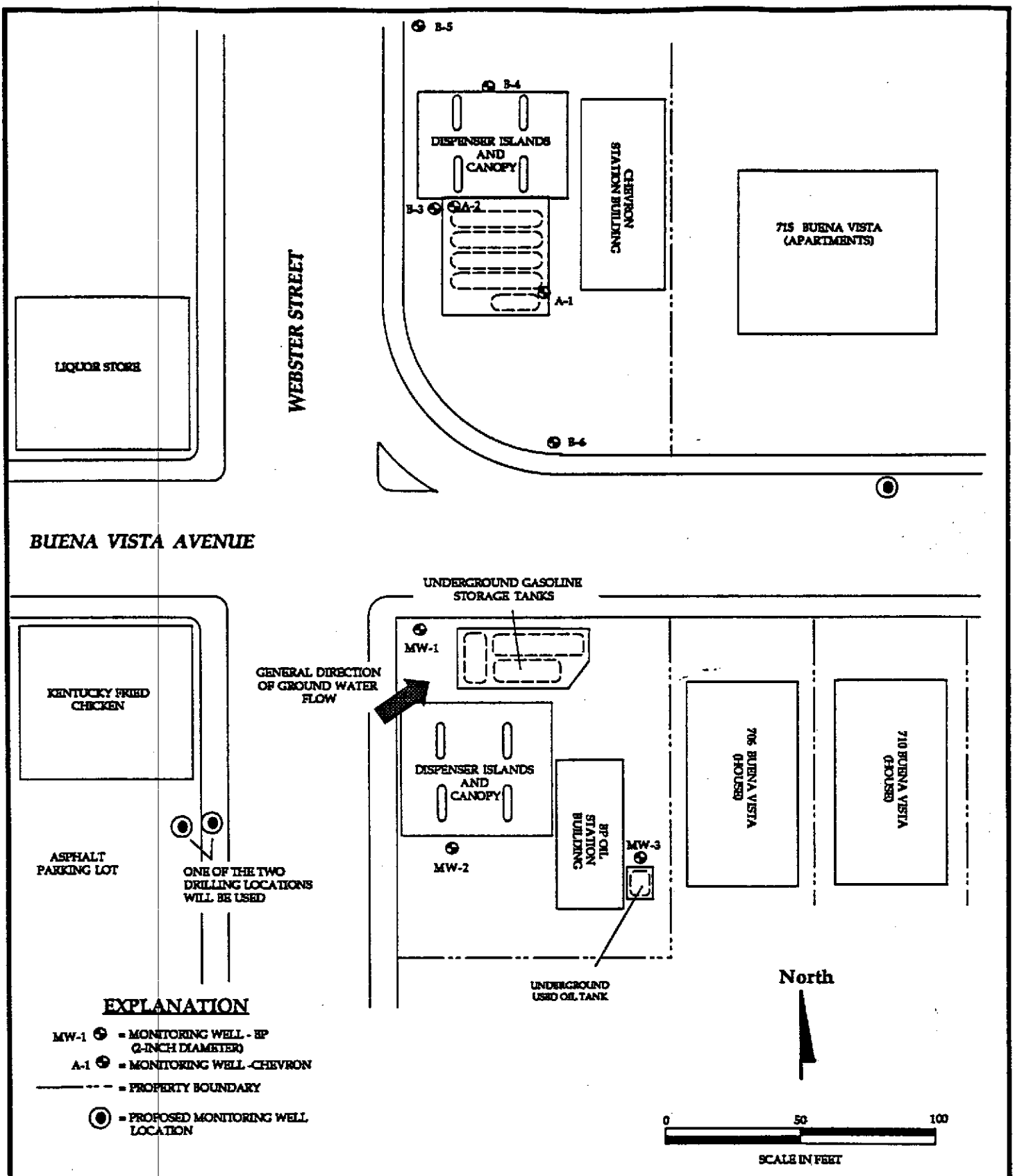
North

Source:
USGS 7.5' Quadrangle
Oakland, East and West

HYDRO ENVIRO MENTAL TECHNO LOGIES, INC.

HOSPITAL LOCATION MAP
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

Job No.
9-038
Figure
2



HYDR◆
ENVIR◆MENTAL
TECHN◆LOGIES, INC.

SITE PLAN
BP Oil Facility No. 11104
1716 Webster Street
Alameda, California

Job No.
9-038
Figure
3

UNIFIED SOIL CLASSIFICATION SYSTEM - VISUAL CLASSIFICATION OF SOILS
(ASTM D-2488)

MAJOR DIVISIONS		GROUP SYMBOL	GROUP NAME	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravel Well-graded gravel with sand	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravel Poorly-graded gravel with sand	Poorly-graded gravels or gravel sand mixture, little or no fines.
		GM	Silty gravel Silty gravel with sand	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravel Clayey gravel with sand	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sand Well-graded sand with gravel	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sand Poorly-graded sand with gravel	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sand Silty sand with gravel	Silty sands, sand-silt mixtures.
		SC	Clayey sand Clayey sand with gravel	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS	ML	Silt; Silt with sand; Silt with gravel Sandy silt; Sandy silt with gravel Gravelly silt; Gravelly silt with sand	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Lean clay; Lean clay with sand; Lean clay with gravel Sandy lean clay; Sandy lean clay with gravel Gravelly lean clay; Gravelly lean clay with sand	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	ELASTIC SILTS AND CLAYS	MH	Elastic silt; Elastic silt with sand; Elastic silt with gravel Sandy elastic silt; Sandy elastic silt with gravel Gravelly elastic silt; Gravelly elastic silt with sand	Inorganic silts, micaceous or diatamaceous fine sandy or silty soils, elastic silts.
		CH	Fat clay; Fat clay with sand; Fat clay with gravel Sandy fat clay; Sandy fat clay with gravel Gravelly fat clay; Gravelly fat clay with sand	Inorganic clays of high plasticity, fat clays.
HIGHLY ORGANIC SOILS		OL/OH	Organic soil; Organic soil with sand; Organic soil with gravel Sandy organic soil; Sandy organic soil with gravel Gravelly organic soil; Gravelly organic soil with sand	Organic silts and organic silt-clays of low plasticity. Organic clays of medium to high plasticity.
		Pt	Peat	Peat and other highly organic soils.

NOTE: Blow count represents the number of blows of a 140-lb hammer falling 30 inches per blow required to drive a sampler through the last 12 inches of an 18-inch penetration.

No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

Retained for Analysis } Sample Interval

S = Sampler sank into medium under the weight of the hammer (no blow count)
P = Sampler was pushed into medium by drilling rig (no blow count)
NR = No Recovery

SANDS & GRAVELS	BLOWS/FT
VERY LOOSE	0 - 5
LOOSE	5 - 12
MED. DENSE	12 - 37
DENSE	37 - 62
VERY DENSE	OVER 62

SILTS & CLAYS	BLOWS/FT
SOFT	0 - 5
FIRM	5 - 10
STIFF	10 - 20
VERY STIFF	20 - 40
HARD	OVER 40

Approximate stabilized water level

Approximate first encountered water level

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

BORING LOG LEGEND

APPENDIX C

PLATE C-1

SITE/LOCATION	BEGUN	BORING DIAMETER	ANGLE/BEARING	BORING NO
1716 Webster Street, Alameda, CA	3/4/93	8 Inches	90 Degrees	MW-4
DRILLING CONTRACTOR	**COMPLETED**	**FIRST ENCOUNTERED WATER DEPTH**		
Bayland Drilling	3/4/93	7 Feet		
OPERATOR	**LOGGED BY**	**STATIC WATER DEPTH/DATE**		
John Atno	H. Hurkmans	4.81 Feet - 3/5/93		
DRILL MAKE & MODEL	**SAMPLING METHOD**			**BOTTOM OF BORING**
CME 55	California modified split spoon			15 Feet
WELL MATERIAL	**SLOT SIZE**	**FILTER PACK**	**WELL SEAL**	**WELL NO.**
2" SCH 40 PVC	0.010"	#2/12	Neat cement over bentonite	MW-4

BLOWS/FOOT	FIELD HEAD-SPACE *	DEPTH	SAMPLE	WATER LEVEL	WELL CONSTR.	GRAPHIC LOG	MATERIAL CLASSIFICATION & PHYSICAL DESCRIPTION
		1					ASPHALT
5	105	5		▼			Silty SAND (SM), tan, loose, moist, poorly graded, fine grained, sub-angular, 20% silt content.
		7		▽			
		10					At 10 feet; as above, wet
		15					At 15 feet; as above, wet
	*PID (ppm)	30					

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

DATE:

APPROVED BY:

SOIL BORING LOG AND WELL CONSTRUCTION MW-4

BP Oil Station No. 11104
1716 Webster Street
Alameda, CA

PLATE
C-2

JOB NO.
9-038

SITE/LOCATION	BEGUN	BORING DIAMETER	ANGLE/BEARING	BORING NO
1716 Webster Street, Alameda, CA	3/31/93	8 Inches	90 Degrees	MW-5
DRILLING CONTRACTOR	**COMPLETED**	**FIRST ENCOUNTERED WATER DEPTH**		
Bayland Drilling	3/31/93	6.5 Feet		
OPERATOR	**LOGGED BY**	**STATIC WATER DEPTH/DATE**		
John Atno	B. Gwinn	4.77 Feet - 4/1/93		
DRILL MAKE & MODEL	**SAMPLING METHOD**			**BOTTOM OF BORING**
CME 55	California modified split spoon			15 Feet
WELL MATERIAL	**SLOT SIZE**	**FILTER PACK**	**WELL SEAL**	**WELL NO.**
2" SCH 40 PVC	0.010"	#2/12	Neat cement over bentonite	MW-5

BLOWS/FOOT	FIELD HEAD-SPACE *	DEPTH	SAMPLE	WATER LEVEL	WELL CONSTR.	GRAPHIC LOG	MATERIAL CLASSIFICATION & PHYSICAL DESCRIPTION
		1					ASPHALT (6-inches thick)
P	0	5	■	▼			Silty SAND (SM), tan, loose, moist, poorly graded, fine grained, sub-rounded, 15-20% silt content.
		6		▽			
		10					At 10 feet; as above, wet, silt content increases to 30%.
		15					At 15 feet; as above, wet.
	*PID (ppm)	30					

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

DATE:

APPROVED BY:

SOIL BORING LOG AND WELL CONSTRUCTION MW-5

BP Oil Station No. 11104
1716 Webster Street
Alameda, CA

PLATE C-3

JOB NO. 9-038

ZONE 7 WATER AGENCY

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94588 VOICE (510) 484-2600
FAX (510) 462-3914

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 1716 Webster St.
Alameda, CA 94501

CLIENT
Name BP Oil Company
Address 16408 Southcenter Pkwy Phone 206-394-5246
City Tukwila, WA Zip 98188

APPLICANT
Name Hydro-Environmental Technologies, Inc.
2363 Mariner Square Dr. #248
Address Phone 510-521-2684
City Alameda, CA Zip 94501

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	___	General	___
Water Supply	___	Contamination	___
Monitoring	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. C57-374157

WELL PROJECTS
Drill Hole Diameter 8 in. Maximum
Casing Diameter 2 in. Depth 15 ft.
Surface Seal Depth 4 ft. Number 2

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

ESTIMATED STARTING DATE MAR 20 '93
ESTIMATED COMPLETION DATE APR 10 '93

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

APPLICANT'S SIGNATURE [signature] Date 12/30/92

FOR OFFICE USE

PERMIT NUMBER 93072
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 Wyman Hong Date 18 Feb 93

3:992

CITY OF ALAMEDA
CENTRAL PERMIT OFFICE
2263 SANTA CLARA AVE., ROOM 204
ALAMEDA, CA 94501
415-522-4100

APPLICATION FOR PERMIT TO EXCAVATE IN THE RIGHT-OF-WAY OF THE CITY OF ALAMEDA

_____ SERVICE NUMBER DATE 12/30/92 19____

Application is hereby made for a permit to excavate on the north (shoulder) side of Buena Vista Ave St. 120 feet east of the center line of Webster St.

House No. 1716 Webster St. Owner BP Oil Company

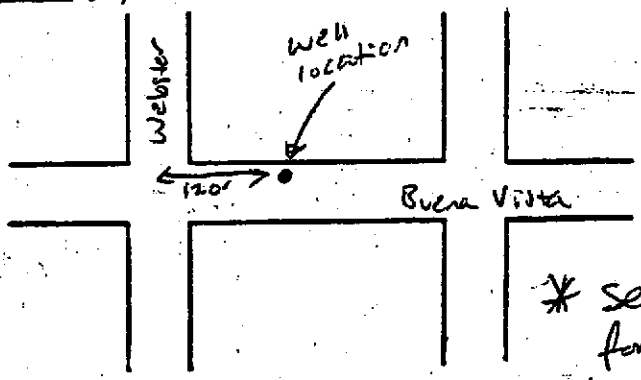
For the purpose of Installation of one two-inch diameter PVC ground water monitoring well (see attached diagram for construction detail)

Name of Applicant Hydro-Environmental Technologies Address 2367 Mariner Sq. Dr. #243 Alameda, CA 94501

Phone 510-521-2684

☐ VERBAL APPROVAL
Date
By
Reasons:

RECEIVED
DEC 30 1992



* see attached site plan for detail

Diagram of Proposed Work

FOR OFFICE USE ONLY

This permit to be Inspected by ☑ ENGINEERING DIVISION ☐ MAINTENANCE DIVISION

☑ ALL STRIPING, PAINTED GRAPHICS AND PAVEMENT MARKERS DAMAGED OR DESTROYED BY STREET EXCAVATION WORK ARE TO BE RESTORED BY THE PERMITEE.

☑ ALL CONSTRUCTION WITHIN THE PUBLIC RIGHT OF WAY MUST HAVE BARRICADES WITH FLASHERS FOR NIGHT TIME PROTECTION.

☑ ALL WORK INVOLVED IS TO BE DONE IN ACCORDANCE WITH STANDARD CITY OF ALAMEDA SPECIFICATIONS AND CITY OF ALAMEDA PRACTICES ALL TO THE SATISFACTION OF THE CITY ENGINEER. INSPECTION CHARGES SHALL BE PAID TO THE CITY MONTHLY. ACCEPTANCE OF THIS PERMIT CONSTITUTES ACCEPTANCE OF THE CONDITIONS INCLUDED.

X Brian [signature] SIGNATURE 12/30/92 DATE

☐ CONCRETE PERMIT REQUIRED

☐ NO OPEN TRENCH CUTTING

☐ STATE PERMIT REQUIRED

☐ SPECIAL CONDITIONS PLACE WELL OUT OF MAIN DRIVING LANE

RECEIVED DATE 12-30-92 SIGNED [signature]

APPROVAL DATE 12/31/92 SIGNED [signature]

ISSUED DATE 1-5-93 SIGNED S. Colvin

PERMIT # 92-0142

WHITE: APPLICANT'S COPY YELLOW: CENTRAL PERMIT OFFICE COPY PINK: INSPECTION COPY

Permits

CITY OF ALAMEDA
CENTRAL PERMIT OFFICE
2263 SANTA CLARA AVE., ROOM 204
ALAMEDA, CA 94501

415-522-4100

APPLICATION FOR PERMIT TO EXCAVATE IN THE RIGHT-OF-WAY OF THE CITY OF ALAMEDA

C SERVICE NUMBER

DATE 3/17/93 19

Application is hereby made for a permit to excavate on the South (shoulder) side of Buena Vista ~~St.~~ Ave. 50 feet West of centerline of Webster St.

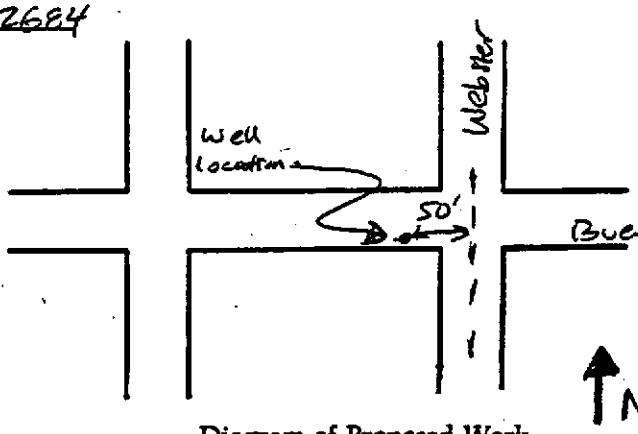
House No. 1716 Webster St. Owner BP Oil Company

For the purpose of Installation of one two-inch diameter PVC ground water monitoring well. (See attached diagram for well construction

Name of Applicant Hydro-Environmental Tech. Address 2363 Mariner Sq. Dr. #243 Alameda, CA 94501

Phone 510-521-2684

☐ VERBAL APPROVAL
Date _____
By _____
Reasons: _____



* See attached site plan for detail

Diagram of Proposed Work

FOR OFFICE USE ONLY

This permit to be Inspected by ☑ ENGINEERING DIVISION ☐ MAINTENANCE DIVISION

☑ ALL STRIPING, PAINTED GRAPHICS AND PAVEMENT MARKERS DAMAGED OR DESTROYED BY STREET EXCAVATION WORK ARE TO BE RESTORED BY THE PERMITEE.

☐ ALL CONSTRUCTION WITHIN THE PUBLIC RIGHT OF WAY MUST HAVE BARRICADES WITH FLASHERS FOR NIGHT TIME PROTECTION.

☑ ALL WORK INVOLVED IS TO BE DONE IN ACCORDANCE WITH STANDARD CITY OF ALAMEDA SPECIFICATIONS AND CITY OF ALAMEDA PRACTICES ALL TO THE SATISFACTION OF THE CITY ENGINEER. INSPECTION CHARGES SHALL BE PAID TO THE CITY MONTHLY. ACCEPTANCE OF THIS PERMIT CONSTITUTES ACCEPTANCE OF THE CONDITIONS INCLUDED.

SIGNATURE 3/17/93 DATE

☐ CONCRETE PERMIT REQUIRED

☐ NO OPEN TRENCH CUTTING

CLEAR SIGNATURE DATE

☐ STATE PERMIT REQUIRED

☐ SPECIAL CONDITIONS _____

RECEIVED DATE 3/17/93 SIGNED D. Colwin

APPROVAL DATE 3/18/93 SIGNED _____

ISSUED DATE 3-22-93 SIGNED _____

PERMIT # 93-0017

RECEIVED FEB 19 1993

Permits

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94588 • (510) 484-2600

18 February 1993

Hydro-Environmental Technologies, Inc.
2363 Mariner Square Drive, #243
Alameda, CA 94501

Gentlemen:

Enclosed is drilling permit 93072 for a monitoring well construction project at 1716 Webster Street in Alameda for BP Oil Company.

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 me at 484-2600.

Very truly yours,

Craig A. Mayfield

Craig A. Mayfield
Water Resources Engineer III

WH:mm
Enc.

Well Casing Elevation Survey Data Sheet
BP Oil Station No. 11104
1716 Webster Street
Alameda, CA

Well No.	Backshot	HI	Foreshot	TOC
BM	6.29	13.97		
MW-1		13.97	5.46	8.51
MW-2		13.97	4.56	9.41
MW-3		13.97	4.06	9.91
MW-4		13.97	5.64	8.33
MW-5		13.97	5.80	8.17
BM	6.29	CLOSURE		

Notes:

BM = Benchmark - USGS Monument on northwest corner of Webster and Buena Vista - 7.68 feet above MSL
Backshot = Backshot to benchmark in feet
HI = Height of instrument in feet (= backshot + BM = 13.97 feet)
Foreshot = Foreshot to north side of top of well casing in feet
TOC = Top well casing on north side in feet

PURGED/SAMPLED BY: BG DATE: 3/5/93

GAUGING DATA:

Depth to bottom: 14.50 ft.

Depth to water: 4.81 ft.

Saturated Thickness: 9.69 ft.

Conversion	
diam.	gals/ft.
2 in.	x 0.16
4 in.	x 0.65
6 in.	x 1.44

Well casing volume 1.55 gallons

volumes to purge x 10 vols.

*Total volume to purge = 15.5 gallons

* unless chemical parameters stabilize earlier

PURGING DATA:

Purge method: PVC bailer/ Submersible pump/ Suction lift pump/ _____
(circle one)

Time	Volume (gallons)	Temp. (°F)	Conductivity (mS/cm)	pH
11:25	0	—	—	—
	2	62.3	8.98	8.92
	4	65.1	10.02	8.50
	6	62.4	9.96	8.51
	8	65.1	9.98	8.32
↓	10	64.6	10.07	8.18
11:45	12	65.1	10.01	8.07

Near dry

Color: Tan Turbidity: Moderate

Recharge: Poor SPP Ø ft.

SAMPLING DATA:

Sampling method: Dedicated bailer

Sample for: (circle)

TPHg/BTEX	METALS	TOG	8010
TPHd	O-Pb	TEL	8020
TPH mo	Total Pb	EDB	8240
601	602	Nitrates	8260 8270

Other: _____

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

MONITORING WELL PURGE/SAMPLE SHEET

WELL # MW-4

LOCATION BP # 11104

JOB NO. 9-038

PURGED/SAMPLED BY: HH / BG DATE: 7-1-93

GAUGING DATA:

Depth to bottom: 14.50 ft.

Depth to water: 4.77 ft.

Saturated Thickness: 9.73 ft.

Conversion	
diam.	gals/ft.
(2 in.)	x 0.16
4 in.	x 0.65
6 in.	x 1.44

Well casing volume 1.56 gallons

volumes to purge x 10 vols.

*Total volume to purge = 15.6 gallons

* unless chemical parameters stabilize earlier

PURGING DATA:

Purge method: (PVC bailer) Submersible pump/ Suction lift pump/ _____
(circle one)

Time	Volume (gallons)	Temp. (°F)	Conductivity (mS/cm)	pH
9:15	0	—	—	—
↓	5	58.9	9.99	10.09
9:25	10	58.5	9.99	9.79

dry

Color: Tan Turbidity: Moderate

Recharge: Poor SPP Ø ft.

SAMPLING DATA:

Sampling method: (Dedicated bailer) / _____

Sample for: (circle)

(TPHg/BTEX) METALS TOG 8010

TPHd O-Pb TEL 8020

TPH mo Total Pb EDB 8240

601 602 Nitrates 8260 8270

Other: _____

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

MONITORING WELL PURGE/SAMPLE SHEET

WELL # MW-5

LOCATION BP Webster St.

JOB NO. 9-038

pace
INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

RECEIVED MAR 16 1993

March 15, 1993

Mr. Brian Gwinn
Hydro-Environmental Tech.,Inc.
2363 Mariner Square Dr., Suite 243
Alameda, CA 94501

RE: PACE Project No. 430304.524
Client Reference: BP Station # 11104

Dear Mr. Gwinn:

Enclosed is the report of laboratory analyses for samples received March 04, 1993.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Caron E. Sontag

Caron E. Sontag
Project Manager

Enclosures

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Hydro-Environmental Tech.,Inc.
2363 Mariner Square Dr., Suite 243
Alameda, CA 94501

March 15, 1993
PACE Project Number: 430304524

Attn: Mr. Brian Gwinn

Client Reference: BP Station # 11104

PACE Sample Number:			70 0020700	
Date Collected:			03/04/93	
Date Received:			03/04/93	
			MW-4-5'	
Parameter	Units	MDL		DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE FUELS AND AROMATICS				
TOTAL FUEL HYDROCARBONS, (LIGHT):			-	03/11/93
Purgeable Fuels, as Gasoline (EPA 8015M)	ug/kg wet	1000	ND	03/11/93
PURGEABLE AROMATICS (BTXE BY EPA 8020M):			-	03/11/93
Benzene	ug/kg wet	5.0	ND	03/11/93
Toluene	ug/kg wet	5.0	ND	03/11/93
Ethylbenzene	ug/kg wet	5.0	ND	03/11/93
Xylenes, Total	ug/kg wet	5.0	ND	03/11/93

These data have been reviewed and are approved for release.

Darrell Cain

Darrell C. Cain
Regional Director

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

Client Reference: BP Station # 11104

MDL Method Detection Limit
ND Not detected at or above the MDL.

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

Mr. Brian Gwinn
Page 3

QUALITY CONTROL DATA

March 15, 1993
PACE Project Number: 430304524

Client Reference: BP Station # 11104

PURGEABLE FUELS AND AROMATICS
Batch: 70 19261
Samples: 70 0020700

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TOTAL FUEL HYDROCARBONS, (LIGHT):			-
Purgeable Fuels, as Gasoline (EPA 8015M	ug/kg wet	200	ND
PURGEABLE AROMATICS (BTXE BY EPA 8020M)			-
Benzene	ug/kg wet	1.0	ND
Toluene	ug/kg wet	1.0	ND
Ethylbenzene	ug/kg wet	1.0	ND
Xylenes, Total	ug/kg wet	1.0	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Purgeable Fuels, as Gasoline (EPA 8015M	ug/kg wet	200	1000	105%	103%	1%
Benzene	ug/kg wet	1.0	40.0	97%	94%	3%
Toluene	ug/kg wet	1.0	40.0	92%	89%	3%
Ethylbenzene	ug/kg wet	1.0	40.0	92%	87%	5%
Xylenes, Total	ug/kg wet	1.0	120	93%	90%	3%

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Mr. Brian Gwinn
Page 4

FOOTNOTES
for page 3

March 15, 1993
PACE Project Number: 430304524

Client Reference: BP Station # 11104

MDL Method Detection Limit
ND Not detected at or above the MDL.
RPD Relative Percent Difference

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WPA204524

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33305 First Way South, Federal Way, WA 98003
CHAIN OF CUSTODY

☒ Novato, CA, 11 Digital Drive, 94949
Phone: (415) 883-6100 Fax: (415) 883-2673

Consultant's Name: Hydro-Environmental Tech. Inc. Page 1 of

Address: 2363 Mariner Square Dr. #243, Alameda, CA

Project Contact: Brian Gwinn | Consultant Project #: 9-038 | Phone #: 510 521-2684 Fax #: (510) 521-5

Sampled by (print): Henry Hartmans | Sampler's Signature: Henry Hartmans

Shipment Method: 1gb courier | B.P. Site Location #: 11104 | B.P. Site Location: Webster St. Ala

TAT: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☒ Standard (10 day)

ANALYSIS REQUIRED

Sample Condition as Receiv
Temperature ° C: ____
Cooler #: ____
Inbound Seal Yes No
Outbound Seal Yes No

Sample Description	Collection Date/Time	Matrix Soil/Water	Prsv	# of Cont	PACE Sample #	TPH/GAS/BTEX EPA 8015/8020	TPH/Diesel EPA 8015	Oil & Grease SM 5520	HVOC 8010	COMMENTS
MW-4-9'	3-4-93	soil	—	1	2070.0	X	X → Delete (*)			

Relinquished by/Affiliation	Date	Time	Accepted by/Affiliation	Date	Time
Henry Hartmans HETI	3-4-93	11:45	HETI	3/4/93	11:45
HETI	3/4/93	12:00		3/4	1200
	3/4	1511		3/4	18:11

Additional Comments:
(*) DELETED DIESEL PER CES/CLIENT - cc 3/5

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REPORT OF LABORATORY ANALYSIS

RECEIVED MAR 1 8 1993

March 17, 1993

Mr. Brian Gwinn
Hydro-Environmental Tech.,Inc.
2363 Mariner Square Dr., Suite 243
Alameda, CA 94501

RE: PACE Project No. 430308.502
Client Reference: BP Station # 11104

Dear Mr. Gwinn:

Enclosed is the report of laboratory analyses for samples received March 08, 1993.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Caron E. Sontag

Caron E. Sontag
Project Manager

Enclosures

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Novato, CA 94949
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REPORT OF LABORATORY ANALYSIS

Hydro-Environmental Tech.,Inc.
2363 Mariner Square Dr., Suite 243
Alameda, CA 94501

March 17, 1993
PACE Project Number: 430308502

Attn: Mr. Brian Gwinn

Client Reference: BP Station # 11104

PACE Sample Number:			70 0023149	
Date Collected:			03/05/93	
Date Received:			03/08/93	
Client Sample ID:			MW-4	
Parameter	Units	MDL		DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE FUELS AND AROMATICS				
TOTAL FUEL HYDROCARBONS, (LIGHT):			-	03/11/93
Purgeable Fuels, as Gasoline (EPA 8015M)	ug/L	50	ND	03/11/93
PURGEABLE AROMATICS (BTXE BY EPA 8020M):			-	03/11/93
Benzene	ug/L	0.5	ND	03/11/93
Toluene	ug/L	0.5	ND	03/11/93
Ethylbenzene	ug/L	0.5	ND	03/11/93
Xylenes, Total	ug/L	0.5	ND	03/11/93

These data have been reviewed and are approved for release.

Darrell C. Cain
Regional Director

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

Mr. Brian Gwinn
Page 2

FOOTNOTES
for page 1

March 17, 1993
PACE Project Number: 430308502

Client Reference: BP Station # 11104

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Mr. Brian Gwinn
Page 3

QUALITY CONTROL DATA

March 17, 1993
PACE Project Number: 430308502

Client Reference: BP Station # 11104

PURGEABLE FUELS AND AROMATICS
Batch: 70 19380
Samples: 70 0023149

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TOTAL FUEL HYDROCARBONS, (LIGHT):			-
Purgeable Fuels, as Gasoline (EPA 8015M	ug/L	50	ND
PURGEABLE AROMATICS (BTXE BY EPA 8020M)			-
Benzene	ug/L	0.5	ND
Toluene	ug/L	0.5	ND
Ethylbenzene	ug/L	0.5	ND
Xylenes, Total	ug/L	0.5	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Purgeable Fuels, as Gasoline (EPA 8015M	ug/L	50	1000	99%	103%	3%
Benzene	ug/L	0.5	40.0	102%	100%	1%
Toluene	ug/L	0.5	40.0	101%	99%	2%
Ethylbenzene	ug/L	0.5	40.0	103%	101%	1%
Xylenes, Total	ug/L	0.5	120	104%	101%	2%

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Mr. Brian Gwinn
Page 4

FOOTNOTES
for page 3

March 17, 1993
PACE Project Number: 430308502

Client Reference: BP Station # 11104

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

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4303B.502

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☐ Huntington Beach, CA, 5702 Bolsa Avenue, 92649
Phone: (714) 892-2565 Fax: (714) 890-4032

Consultant's Name: Hydro-Environmental Tech. | Consultant Project #: 9-038 | Page 1 o

Address: 2363 Mariner Sq. Dr. #243

Project Contact: B. Gwinn | Phone #: 510-521-2664 Fax #: 510-521-5078 | Consultant Work Order #: F83671

Sampled by (print): Brian Gwinn | Sampler's Signature: BG | B.P. Site Location #: 11104

Shipment Method: Pace Courier | Airbill #: | Shipment Date: 3/5/93 | B.P. Site Location: 1716 Webster St., Alameda, CA

TAT: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☒ Standard (10 day)

ANALYSIS REQUIRED

Sample Condition as Re
Temperature ° C: ____
Cooler #: ____
Inbound Seal Yes N
Outbound Seal Yes N

Sample Description	Collection Date/Time	Matrix Soil/Water	Prsv	# of Cont	PACE Sample #	TPH/GAS/BTEX EPA 8015/8020	TPH/Diesel EPA 8015	TRPH EPA 418.1	HVOC 8010									COMMENTS
MW-4	3/5/93 11 am	H_2O	HCl	3	2314.9	X												
5/2																		

Relinquished by/Affiliation	Date	Time	Accepted by/Affiliation	Date	Time
HETT	3/8/93	2:12 PM	Donald Johnson Pace	3-8-93	1415
Donald Johnson Pace	3-8-93	1635	J. Dyp/Pace	3/9/93	1635

Additional Comments:

Gold-general Consultant Field Staff

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

9-078
Analytical

April 15, 1993

Mr. Brian Gwinn
Hydro-Environmental Tech.,Inc.
2363 Mariner Square Dr., Suite 243
Alameda, CA 94501

RE: PACE Project No. 430402.513
Client Reference: BP Station # 11104

Dear Mr. Gwinn:

Enclosed is the report of laboratory analyses for samples received April 02, 1993.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Caron E. Sontag

Caron E. Sontag
Project Manager

Enclosures

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FAX: 415-883-2673

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REPORT OF LABORATORY ANALYSIS

Hydro-Environmental Tech.,Inc.
2363 Mariner Square Dr., Suite 243
Alameda, CA 94501

April 15, 1993
PACE Project Number: 430402513

Attn: Mr. Brian Gwinn

Client Reference: BP Station # 11104

PACE Sample Number:			70 0041511	
Date Collected:			04/01/93	
Date Received:			04/02/93	
Client Sample ID:			MW-5	
Parameter	Units	MDL		DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE FUELS AND AROMATICS				
TOTAL FUEL HYDROCARBONS, (LIGHT):			-	04/13/93
Purgeable Fuels, as Gasoline (EPA 8015M)	ug/L	50	ND	04/13/93
PURGEABLE AROMATICS (BTXE BY EPA 8020M):			-	04/13/93
Benzene	ug/L	0.5	ND	04/13/93
Toluene	ug/L	0.5	ND	04/13/93
Ethylbenzene	ug/L	0.5	ND	04/13/93
Xylenes, Total	ug/L	0.5	ND	04/13/93

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Mr. Brian Gwinn
Page 2

April 15, 1993
PACE Project Number: 430402513

Client Reference: BP Station # 11104

PACE Sample Number:			70 0041503	
Date Collected:			03/31/93	
Date Received:			04/02/93	
Client Sample ID:			MW-5-4.5'	
Parameter	Units	MDL		DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE FUELS AND AROMATICS				
TOTAL FUEL HYDROCARBONS, (LIGHT):			-	04/13/93
Purgeable Fuels, as Gasoline (EPA 8015M)	ug/kg wet	1000	ND	04/13/93
PURGEABLE AROMATICS (BTXE BY EPA 8020M):			-	04/13/93
Benzene	ug/kg wet	5.0	ND	04/13/93
Toluene	ug/kg wet	5.0	ND	04/13/93
Ethylbenzene	ug/kg wet	5.0	ND	04/13/93
Xylenes, Total	ug/kg wet	5.0	ND	04/13/93

These data have been reviewed and are approved for release.

Darrell C. Cain
Regional Director

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FAX: 415-883-2673

Mr. Brian Gwinn
Page 3

FOOTNOTES
for pages 1 through 2

April 15, 1993
PACE Project Number: 430402513

Client Reference: BP Station # 11104

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Mr. Brian Gwinn
Page 4

QUALITY CONTROL DATA

April 15, 1993
PACE Project Number: 430402513

Client Reference: BP Station # 11104

PURGEABLE FUELS AND AROMATICS
Batch: 70 20258
Samples: 70 0041503

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TOTAL FUEL HYDROCARBONS, (LIGHT):			-
Purgeable Fuels, as Gasoline (EPA 8015M	ug/kg wet	200	ND
PURGEABLE AROMATICS (BTXE BY EPA 8020M)			-
Benzene	ug/kg wet	1.0	ND
Toluene	ug/kg wet	1.0	ND
Ethylbenzene	ug/kg wet	1.0	ND
Xylenes, Total	ug/kg wet	1.0	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Purgeable Fuels, as Gasoline (EPA 8015M	ug/kg wet	200	1000	96%	92%	4%
Benzene	ug/kg wet	1.0	40.0	94%	97%	3%
Toluene	ug/kg wet	1.0	40.0	106%	109%	2%
Ethylbenzene	ug/kg wet	1.0	40.0	103%	107%	3%
Xylenes, Total	ug/kg wet	1.0	120	106%	109%	2%

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Mr. Brian Gwinn
Page 5

QUALITY CONTROL DATA

April 15, 1993
PACE Project Number: 430402513

Client Reference: BP Station # 11104

PURGEABLE FUELS AND AROMATICS
Batch: 70 20259
Samples: 70 0041511

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TOTAL FUEL HYDROCARBONS, (LIGHT):			-
Purgeable Fuels, as Gasoline (EPA 8015M	ug/L	50	ND
PURGEABLE AROMATICS (BTXE BY EPA 8020M)			-
Benzene	ug/L	0.5	ND
Toluene	ug/L	0.5	ND
Ethylbenzene	ug/L	0.5	ND
Xylenes, Total	ug/L	0.5	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Purgeable Fuels, as Gasoline (EPA 8015M	ug/L	50	1000	88%	86%	2%
Benzene	ug/L	0.5	40.0	100%	103%	2%
Toluene	ug/L	0.5	40.0	96%	97%	1%
Ethylbenzene	ug/L	0.5	40.0	101%	102%	0%
Xylenes, Total	ug/L	0.5	120	102%	103%	0%

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Mr. Brian Gwinn
Page 6

FOOTNOTES
for pages 4 through 5

April 15, 1993
PACE Project Number: 430402513

Client Reference: BP Station # 11104

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

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Page 1 of 1

Consultant's Name: Hydro-Environmental Tech. | Consultant Project #: 9-038.1

Address: 2363 Mariner Sq. Dr. #243, Alameda, CA 94501

Project Contact: B. Gorman | Phone #: 510-521-2684 Fax #: 510-521-5078 | Consultant Work Order #: P036744

Sampled by (print): Brian Gorman | Sampler's Signature: | B.P. Site Location #: BP #11104

Shipment Method: PACE | Airbill #: | Shipment Date: | B.P. Site Location: 1716 Webster St., Alameda, CA

TAT: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☒ Standard (10 day)

ANALYSIS REQUIRED

Sample Condition as Received
Temperature ° C: ____
Cooler #: ____
Inbound Seal Yes No
Outbound Seal Yes No

Sample Description	Collection Date/Time	Matrix Soil/Water	Prsv	# of Cont	PACE Sample #	TPH/GAS/BTEX EPA 8015/8020	TPH/Diesel EPA 8015	TRPH EPA 418.1	HVOC 8010									COMMENTS
MW-5-4.5'	3/31/93	SOIL	—	1	4150.3	X												
MW-5	4/1/93	H_2O	HCl	3	51.1	X												
0/1.5, 14/3																		

Relinquished by/Affiliation	Date	Time	Accepted by/Affiliation	Date	Time
(FOR BRIAN)	4/2	1130	Pace	4/2	1130
- Pace	4/2	1705	Pace	4/2	1705

Additional Comments:

White - Original Yellow - B.P. Oil Pink - Lab Goldenrod - Consultant Field Staff