10/19/89

TEXACO REFINING AND MARKETING INC.
100 CUTTING BOULEVARD
RICHMOND, CA 94804

October 16, 1989

Ms. Dyan Whyte
Regional Water
Quality Control Board
1111 Jackson Street, Room 6000
Oakland, CA 94607

94610

10/89

Dear Ms. Whyte:

Enclosed is a copy of our Environmental Assessment Report dated September 22, 1989 for our former Texaco service station located at 500 Grand Avenue in Oakland, California. 94610

Please call me at (415) 236-1770 if you have any questions.

Very truly yours,

R.R. ZIELINSKI
Field Environmental
Supervisor

RRZ:rw

Enclosure

cc: Mr. Rafat Shahid
Alameda County
Environmental Health Department
80 Swan Way, Room 200
Oakland, CA 94621

A Report Prepared for

Texaco Refining and Marketing Inc.
100 Cutting Boulevard
Richmond, California 94804

ENVIRONMENTAL ASSESSMENT REPORT
FORMER TEXACO STATION NO. 6248800235
500 GRAND AVENUE
OAKLAND, CALIFORNIA

HLA Job No. 2251,081.03

by

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September 22, 1989

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I INTRODUCTION

This report presents the results of an environmental assessment by Harding Lawson Associates (HLA) at a former Texaco service station (No. 6248800235) at 500 Grand Avenue, Oakland, California (Plate 1). The purpose of our assessment was to evaluate possible effects of gasoline hydrocarbons on the subsurface soils and shallow ground water at the site. This station is now an Exxon service station.

II PREVIOUS INVESTIGATION

In May 1988, Texaco Refining and Marketing Inc., retained HLA to conduct a Sensitive Receptor Survey (SRS) for the Texaco station at 500 Grand Avenue, Oakland, California. The purpose of the survey was to provide the following site-specific information:

- Proximity of wells for:
  - public water supply
  - private water supply
  - observation or monitoring
- Proximity of subways, basements, and schools
- Proximity of surface-water bodies
- Type of local water supply
- Local aquifer classification
- Site and area maps

Results of the SRS are presented on a fact sheet in Appendix A.

In June 1988, following the SRS, Texaco Refining and Marketing Inc. requested that HLA proceed with a limited subsurface investigation to evaluate whether petroleum hydrocarbons had affected the shallow soil or ground water. The subsurface investigation included the following tasks:

1. Drill, develop and sample four 2-inch-diameter, shallow ground-water monitoring wells (MW-8A, MW-8B, MW-8C, and MW-8D)
2. Survey wells and gauge water levels

3. Determine the direction of ground-water flow

4. Analyze one ground-water sample from each monitoring well for benzene, toluene, ethylbenzene, and total xylenes (BTEX).

The results of this investigation (documented in a report issued to Texaco on July 20, 1988) showed that the ground water in some of the wells contained detectable concentrations of petroleum hydrocarbons, as follows:

Well	Benzene	Toluene	Ethylbenzene	Xylenes
	(parts per billion)			
MW-8C	5.3	3.5	2.6	13
MW-8A	ND	1.5	ND	6.6
MW-8B	ND	ND	ND	ND
MW-8D	(did not produce enough water for sampling)			

ND = Below detection limits

Soil boring logs and well completion details are in Appendix A.

III LOCATION AND TOPOGRAPHY

The former Texaco (now Exxon) service station is approximately 200 feet north of the eastern end of Lake Merritt in Oakland California (Plate 2). The surrounding area contains commercial/retail businesses and single- and multi-family residential units.

The elevation of the site is approximately 20 feet above mean sea level (MSL). The topography of the surrounding area consists of gently rolling hills that slope toward Lake Merritt. The area is fully developed, and surface water runoff is intercepted by the municipal storm sewer system.

IV REGIONAL GEOLOGY

The shallow sand, silt, and clay soil mixtures at the site most likely belong to the Temescal formation, which consists of young alluvial material. This formation is commonly found between 5 and 60 feet below the ground surface. The Temescal formation is underlain by the Alameda formation, which is mainly composed of continental and marine sediments and which may extend as deep as 1,050 feet (Radbruch, 1957). Site-specific geology is discussed in Section VII, "Subsurface Conditions".

V REGIONAL HYDROGEOLOGY

From a hydrogeologic point of view, the site is in the Merritt Sand subarea (Hickenbottom, 1988). The top of this sand is thought to have been encountered during drilling at a depth of approximately 20 feet. The Merritt Sand formation is a loose, well-sorted, medium- to fine-grained sand and silt, with lenses of sandy clay and clay. Water in this formation is generally unconfined. While the formation can produce enough water for domestic use, the water is recommended only for non-potable uses.

The regional direction of ground-water flow is westward. Recharge occurs primarily from rainwater infiltration, seepage from streams, leaking sewers, and excess irrigation water runoff.

VI FIELD INVESTIGATION

The field investigation for HLA's assessment included the following tasks:

- Soil-gas survey
- Drilling and sampling soil borings
- Installing, developing, and sampling ground-water monitoring wells.

A. Soil-gas Survey

A soil-gas survey involves sampling and analyzing gas from the pore spaces of unsaturated soils (the vadose zone). This reconnaissance tool helps measure the distribution of organic chemicals in soil and ground water. Because many petroleum hydrocarbons exhibit significant vapor pressures they can migrate through the soil via vapor-phase permeation and transport. If they reach the water table and travel with ground water, vapors can emanate into overlying soil. Thus, measuring concentrations of organic compounds in soil gas can give some indication of their presence in soil or ground water.

Because of complex interactions* between organic compounds and subsurface materials, it is seldom possible to estimate, from soil-gas data alone, actual concentrations of such compounds in soil or ground water. However, a soil-gas survey can be an excellent screening tool.

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* These interactions are a function of soil particle size and mineralogy, natural soil organic content, soil moisture, temperature, lithology, and heterogeneity.

On September 21 and 28, 1988, under the supervision of HLA, a soil-gas survey was conducted by Tracer Research Corporation (TRC) to assess the near-surface distribution of petroleum hydrocarbons on and immediately adjacent to the site. Soil-gas sampling locations are shown on Plate 3. TRC's standard sample collection and analysis methods, described in Appendix B, were used. Using gas chromatography, each soil-gas sample was analyzed in the field for: total petroleum hydrocarbons (TPH) and BTEX.

B. Soil Sampling

HLA explored subsurface conditions on the site and in areas immediately downgradient of the site by drilling and sampling a series of borings and monitoring wells over a six-month period. In October 1988, four on-site borings (B-1 through B-4) were drilled and sampled. A fifth boring (MW-8E) was drilled and converted to a monitoring well. On the basis of the results of chemical analyses performed on the soil and water samples collected during this work, one additional on-site boring (B-5) was drilled, and two off-site monitoring wells (MW-8F and MW-8G) were installed in March 1989. Locations of borings B-1 through B-5 and MW-8E, MW-8F, and MW-8G are shown on the Site Plan (Plate 4). Lithologic logs are presented on Plates 5 through 11.

Borings were advanced using truck-mounted, 8-inch-diameter, hollow-stem auger drilling equipment. Undisturbed soil samples were collected using a 2.5-inch inside diameter (ID) Sprague and

Henwood (S&H) split-barrel sampler lined with three 6-inch-long brass tubes. Drilling was performed under the direction of an HLA field geologist, who logged the borings in accordance with the Unified Soil Classification System (USCS) described on Plate 12. Soil samples were screened in the field with a photoionization detector (PID). PID readings, which indicate relative concentrations of volatile organic compounds (VOCs) in soil, are presented on the logs. All drill cuttings were placed in 55-gallon drums approved by the Department of Transportation (DOT) for subsequent disposal. Sampling equipment was washed with a phosphate-free detergent solution and rinsed with clean water between usages. All drilling equipment was cleaned using a high-pressure, hot-water wash before and after each boring. B-1 through B-5 were grouted to their full depths upon completion of sampling.

C. Monitoring Well Construction

Monitoring wells MW-8E, MW-8F, and MW-8G were installed between October 1988 and May 1989 under permits issued by the Alameda County Flood Control and Water Conservation District, Zone 7, and the Oakland Department of Public Works. As illustrated on Plates 13 to 15, each monitoring well was constructed of steam-cleaned, 4-inch-diameter, Schedule 80, flush-threaded PVC casing and screen. The annular space between casing and borehole wall was filled with No. 3 Monterey sand to approximately two feet above the top of the screen. A bentonite

seal was placed above the sand pack, and the remainder of the annulus was filled with cement/bentonite grout to just below the ground surface. The top of each well was completed slightly below ground surface and covered by a water-tight traffic box (EMCO Wheaton A-721) that came slightly above grade. Finally, each well was equipped with a water-tight cap (OPW 634-TTM) to minimize intrusion of surface water.

D. Water Quality Sampling

The following table summarizes well development and sampling dates for all wells, including those installed during HLA's previous investigation.

Well	Date Developed	Date Sampled		
MW-8A	06/88	06/88	10/88	--
MW-8B	06/88	06/88	10/88	--
MW-8C	06/88	06/88	10/88	--
MW-8E	10/88	--	10/88	--
MW-8F	04/89	--	--	04/89
MW-8G	04/89	--	--	04/89

Wells were developed using a clean PVC bailer. Development was considered complete when at least two casing volumes were removed from each well; the water appeared clear; and temperature, pH, and conductivity of discharge water had stabilized. All excess fluids produced during development were placed in 55-gallon metal drums for subsequent disposal.

Each well was checked for the presence of free product prior to sampling. Ground-water samples were collected from each well with a clean stainless steel bailer and decanted into 40-milliliter (ml) volatile organic analysis (VOA) vials. The vials were immediately sealed, labeled, and stored in an insulated container with ice. All samples were transported under chain-of-custody to ChemWest Analytical Laboratories, Inc., in Sacramento, California for analysis. Between wells, sampling equipment was washed with a phosphate-free detergent solution and rinsed in clean tap and distilled water.

Appropriate quality assurance and quality control (QA/QC) measures were employed during the field investigation. HLA maintains an internal QA/QC program that includes provisions for avoiding cross-contamination during site investigation and procedures for decontamination, sample handling and preservation, and chain-of-custody.

VII SUBSURFACE CONDITIONS

A. Geologic Profile

All borings were drilled in paved areas of the site. As shown on the geologic cross-section (Plate 16), subsurface soils generally consist of a 4- to 13-foot-thick layer of moist clay, underlain by a 2- to 4-foot layer of clayey sand. Below the clayey sand is a layer of hard, white clay at least 4 feet thick and then a saturated sand layer at approximately 20 feet beneath the surface. Ground water was initially encountered between 13 and 16 feet below grade.

Some hydrocarbon vapors were noted in soil from borings located along the southern property boundary (B-1, B-3, B-4, and MW-8E). Slight gasoline odors were also noted in, MW-8E after its completion as a monitoring well. Soil samples with the highest PID readings from each boring were submitted for chemical analysis. Laboratory results are discussed in Section VIII of this report.

B. Ground Water

Table 1, below, summarizes all water-level data collected to date. Review of this data indicates that the depth to the water table varies seasonally. This is a common characteristic of shallow water tables.

Table 1. Summary of Water-level Data

Well	Top of Casing Elevation* (feet)	Depth to Ground Water (feet) 07/14/88	10/21/88	05/10/89
MW-8A	99.72	2.92	3.32	4.72
MW-8B	101.11	1.91	1.04	0.33
MW-8C	98.41	7.43	7.46	8.13
MW-8E	99.38	--	5.02	3.12
MW-8F	97.94	--	--	9.41
MW-8G	97.24	--	--	10.27

* HLA site datum.

The predominant direction of ground-water flow, as inferred from the calculated hydraulic gradient direction, is to the south (Plate 17), with a calculated gradient of 0.1 feet per foot. The relative rate of ground-water movement is discussed in Section IX of this report.

VIII DISCUSSION OF RESULTS

A. Results of Soil Gas Sampling

Soil gas samples were collected from the locations shown on Plate 3 and analyzed for their concentrations of TPH and BTEX. The TPH concentrations are indicated on Plate 3 adjacent to the sample location. These results indicate the presence of hydrocarbon vapors in the following areas:

- Along Euclid Avenue (Probes 4 and 5)
- Along Grand Avenue (Probes 12, 13, 15, and 16)
- Adjacent to the underground tanks (OB-1 through OB-4).

The presence of these vapors suggest an on-site source that is described in subsections D and E. The results also indicate that the only area of off-site migration appears to be into Grand Avenue.

B. Results of Soil Sampling

Soil samples collected from each boring were analyzed for the following constituents:

- BTEX (EPA Test Method 8020)
- TPH as gasoline (LUFT Field Manual).

Laboratory reports are presented in Appendix C. On the basis of stabilized water levels recorded October 21, 1988, soil samples from B-1, B-3, B-4, and MW-8D collected shallower than 7 feet can be classified as vadose material.

Laboratory results of chemical analyses on soil are presented in Table 2. Results of analyses on soil samples from B-1, B-3, B-4, and MW-8D indicate the presence of gasoline hydrocarbons in vadose zone soils between depths of 1 and 7 feet in two areas: near the underground gasoline storage tanks and in the vicinity of the southernmost pump island.

In the immediate vicinity of the underground tanks, concentrations of TPH as gasoline varied from 10 to 510 milligrams per kilogram (mg/kg) in vadose soil samples collected from B-1, B-4, and MW-8D. Downgradient of the pump islands, TPH concentrations in the vadose soil sample from B-3 was 520 mg/kg.

Table 2. Results of Chemical Tests on Soil Samples (reported as mg/kg [ppm])

Boring/ Well Number	Depth (feet)	TPH (gasoline)	Benzene	Toluene	Ethyl-benzene	Xylenes
B-1	6.5	12	<0.05	<0.1	<0.2	<0.1
B-3	4.0	520	<1	<2	<4	5
B-4	3.5	510	<0.5	1	3.5	13
B-5	5.5	<10	<0.05	<0.1	<0.2	<0.1
B-5	10.5	<10	<0.05	<0.1	<0.2	<0.1
B-5	16	<10	<0.05	<0.1	<0.2	<0.1
MW-8D	1.3	10	<0.05	0.40	<0.20	0.50
MW-8E	5.5	750	0.82	6.5	5.5	26
MW-8F	11	<10	<0.5	<0.1	<0.2	<0.1
MW-8G	6	<10	<0.5	<0.1	<0.2	<0.1

C. Water Quality Results

Ground-water samples collected from each well after development and purging were analyzed for BTEX (EPA Test Method 602). Laboratory results are presented in Appendix D.

Ground-water samples were collected using the procedures described in Section VI. Results of chemical analyses, summarized in Table 3, indicate that on-site wells MW-8A and MW-8C, and off-site wells MW-8F and MW-8G all had water with BTEX concentrations below analytical detection limits. Only water from MW-8E, an on-site well adjacent to the southernmost pump island, and MW-8B, adjacent to the northern pump island, had detectable BTEX concentrations.

Table 3. Results of Chemical Tests on Ground-water Samples (reported as ug/L [ppb])

Monitoring Well	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes
MW-8A	10/28/88	<0.5	<1	<2	<1
MW-8B	10/21/88	<0.5	<1	<2	3.1
MW-8C	10/21/88	<0.5	<1	<2	<1
MW-8E	10/25/88	1,400	510	2.9	420
MW-8F	04/14/89	<0.5	<1	<2	<1
MW-8G	04/14/89	<0.5	<1	<2	<1

D. Possible Sources - Causes

There are at least three possible scenarios by which gasoline hydrocarbons may have been introduced into subsurface materials at this site. They are:

- Tank overfilling and surface spillage
- Tank leaks
- Line leaks.

The lack of free product, together with the relatively low BTEX concentrations detected in the ground water, provide no evidence of active leaks; gasoline constituents detected were probably introduced into the subsurface materials in the past. Integrity testing of the tanks and lines performed in late 1988, prior to transfer of the station to Exxon, indicated no leaks. These test results also support our conclusion that there are no active leaks. The most likely causes of hydrocarbons in the soil and ground water appear to be periodic overfilling of tanks, surface spillage, and/or past leaks in lines.

E. Possible Sources - Locations

As shown on Plates 18 and 19, gasoline constituents were detected in vadose zone soils in the vicinity of the underground tanks and the southernmost pump island, and in the ground water immediately downgradient and upgradient of the pump islands. Soil-gas survey results (Plate 3) also indicate the presence of hydrocarbons in most of these locations, as well as along the downgradient property boundary and along Euclid Avenue.

Gasoline introduced into subsurface materials from tank overfilling and/or surface spillage could account for the presence of hydrocarbons near the tanks and the southernmost pump island. In addition, surface spillage or any past leak in lines associated with either of the pump islands could also account for the presence of hydrocarbons in these areas.

There are no identifiable sources located along Euclid Avenue to account for the fuel hydrocarbons detected in the soil gas in this area. Possible sources of these hydrocarbons are the lines associated with the pump islands and/or surface spillage. Potential migration mechanisms that could explain the presence of these hydrocarbons are discussed in the next section.

F. Possible Soil and Ground-water Migration Pathways

There are five possible mechanisms that can account for the gasoline constituents that have been detected in on-site vadose zone soils and ground water. The first is vertical migration into the soils of small to moderate quantities of fuel constituents from overfilling a tank, from surface spillage or from a line leak. A small or moderate quantity of gasoline would penetrate only a portion of the vadose zone. This type of mechanism would explain the presence of fuel constituents in the vadose soils immediately around the underground tanks and the pump island.

The second and third mechanisms for migration involve the introduction of fuel constituents into the ground water. If a

sufficiently large quantity of gasoline was leaked or spilled, the fuel constituents would continue to distribute themselves downward through the entire thickness of the vadose zone until the water table was encountered. Even if fuel only partially migrated through the vadose zone, constituents could become entrained in the ground water through the seasonal fluctuation of the water table. Once introduced into the ground water, fuel constituents would be transported downgradient with its flow.

The fourth and fifth mechanisms of transport apply to vadose zone soils not immediately adjacent to a hydrocarbon source. As they are transported by ground water, fuel constituents can migrate into previously uncontaminated vadose zone soils via upward wicking of contaminated ground water through capillary rise. Volatilized fuel hydrocarbons can also be transported through vadose soils above the water table to areas up-, down- or cross-gradient of the source.

IX HYDRAULIC CONDUCTIVITY TESTING

The hydraulic conductivity of shallow saturated soils was estimated from the results of tests using two monitoring wells located on the downgradient side of the site. Two single-well slug tests were performed using monitoring wells MW-8C and MW-8E. At the time of the slug tests, the equilibrium water levels in the wells were 8.95 and 3.65 feet below the top of casing in each well, respectively. The water levels were compared to the stratigraphic log of the wells to classify any aquifer materials adjacent to the screen in the saturated zone as hydraulically confined or unconfined. The clayey sand in MW-8E was initially considered to be confined, but the slug test response did not follow that expected of a confined aquifer. It appears that the saturated soils in MW-8E are unconfined. A centrifugal suction pump was used to rapidly remove a volume (slug) of water from the wells. Table 4 summarizes the conditions of the slug tests at this site.

Table 4. Slug Test Conditions

Well Number	Test Type	Pump Type	Approximate Slug Volume (gallons)	Initial Water Level (feet)	Classification of Stratum
MW-8C	Withdrawal	Suction	1	8.95	Unconfined
MW-8E	Withdrawal	Suction	5	3.65	Unconfined

A pressure transducer, placed near the bottom of the wells, was used to measure the water level recoveries following the slug withdrawals. The output of the transducer was interpreted and recorded by a data logger for subsequent analysis. The method of slug test analysis is discussed in Appendix E.

The slug-test recovery hydrographs are shown in Plates 20 and 21 for tests in MW-8C and MW-8E, respectively. Table 5 lists the hydraulic conductivity estimates derived from the tests. The materials tested are relatively impermeable. Ground water would be expected to move relatively slowly through them.

Table 5. Slug Test Results

Well Number	Lithology of Tested Soils	Thickness of Tested Soils (feet)	Estimated Hydraulic Conductivity of Tested Soils (feet/day)
MW-8C	Silty Clay	13	0.03
MW-8E	Sandy Clay, clayey sand	11.5	0.02

X SUMMARY OF FINDINGS

Conclusions and observations include the following:

1. Shallow subsurface soils consist of moist clays underlain by a thin sandy layer, above a hard low permeability white clay.

2. The direction of ground-water flow is primarily southward toward Lake Merritt.

3. BTEX and TPH as gasoline have been detected in shallow subsurface soils along the southern property boundary. Possible sources of soil contamination include:

   - overfilling of underground gasoline storage tanks, surface spillage, or leaks from former fuel lines

   - adsorption of gasoline constituents onto soil particles from contaminated ground water

4. BTEX components in concentrations of note have been detected in water from one on-site, downgradient monitoring well, MW-8E. This well is located adjacent to the southernmost pump island. Possible sources for the gasoline constituents are:

   - past leaks in the fuel lines or surface spillage associated with the pump island

   - Overfilling of gasoline storage tanks

   - Leakage from previously used gasoline storage tanks.

5. Upgradient shallow soils and ground water contain only very small concentrations of BTEX if any are present at all.

6. Downgradient, off-site soils and ground water in the vicinity of MW-8F and MW-8G, contain no detectable concentrations of BTEX.

7. The lack of free product, together with the relatively low BTEX concentrations detected in ground water, indicate that no active product leaks presently exist.

8. The hydraulic conductivity of shallow saturated clay beneath the site is estimated to be about 0.02 feet per day. Ground water would be expected to move slowly through this clay.

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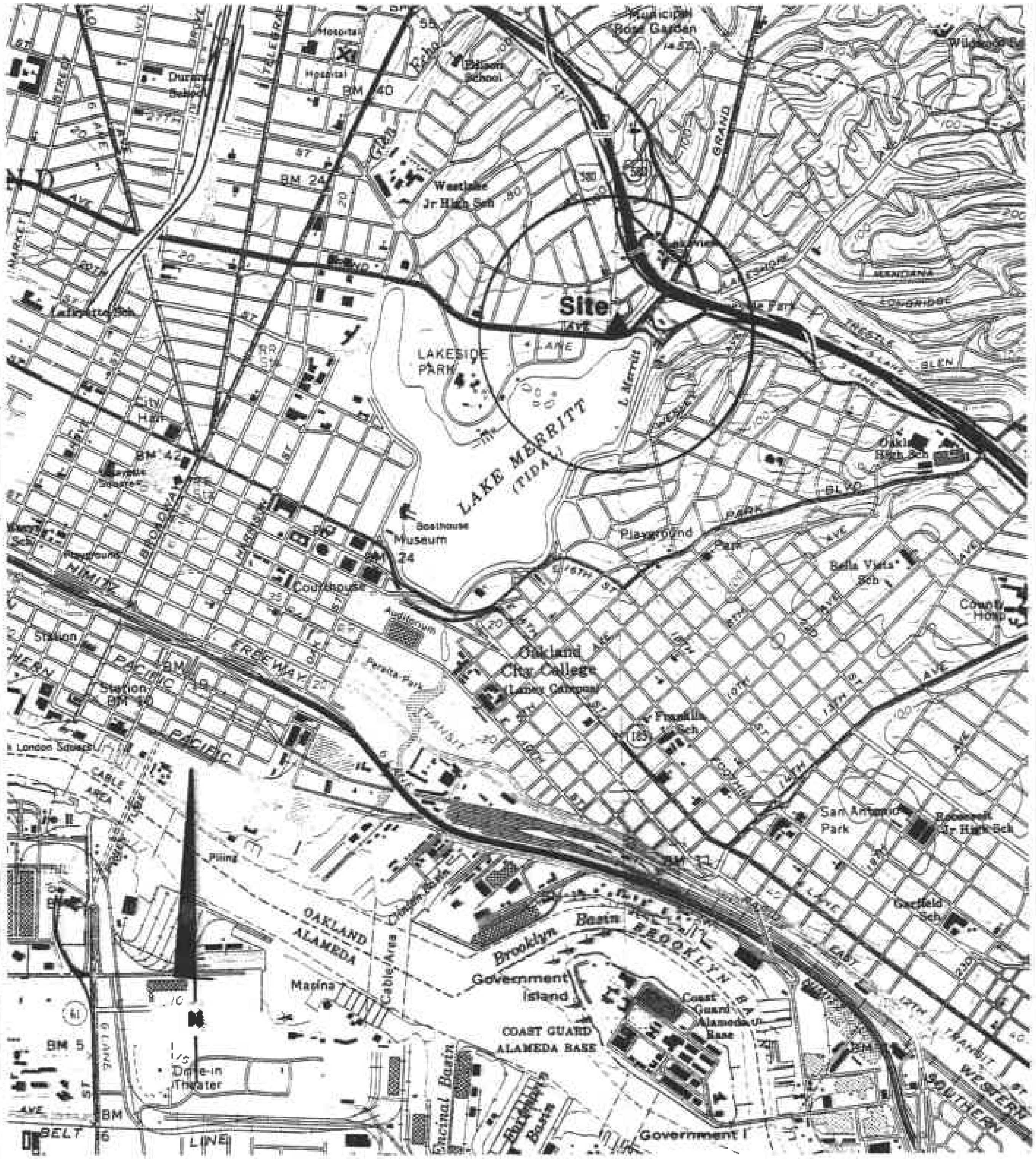
100649



Ref: USGS, 7.5 Minute Topographic Map, Oakland West, California, Photo revised 1980.

0 2000 4000
SCALE IN FEET

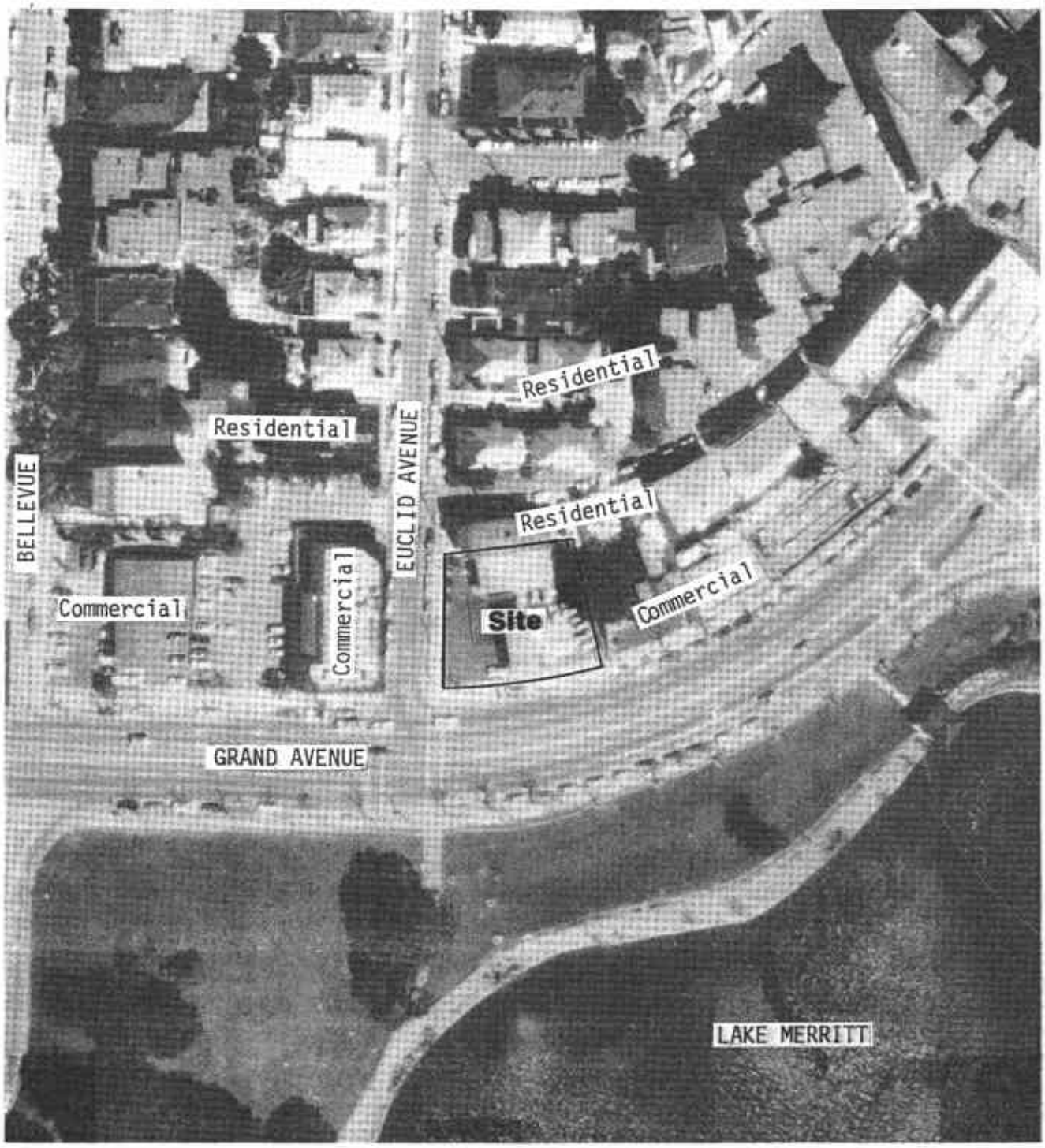
Harding Lawson Associates
Engineers and Geoscientists

Regional Map
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	AK	5/89		

105649

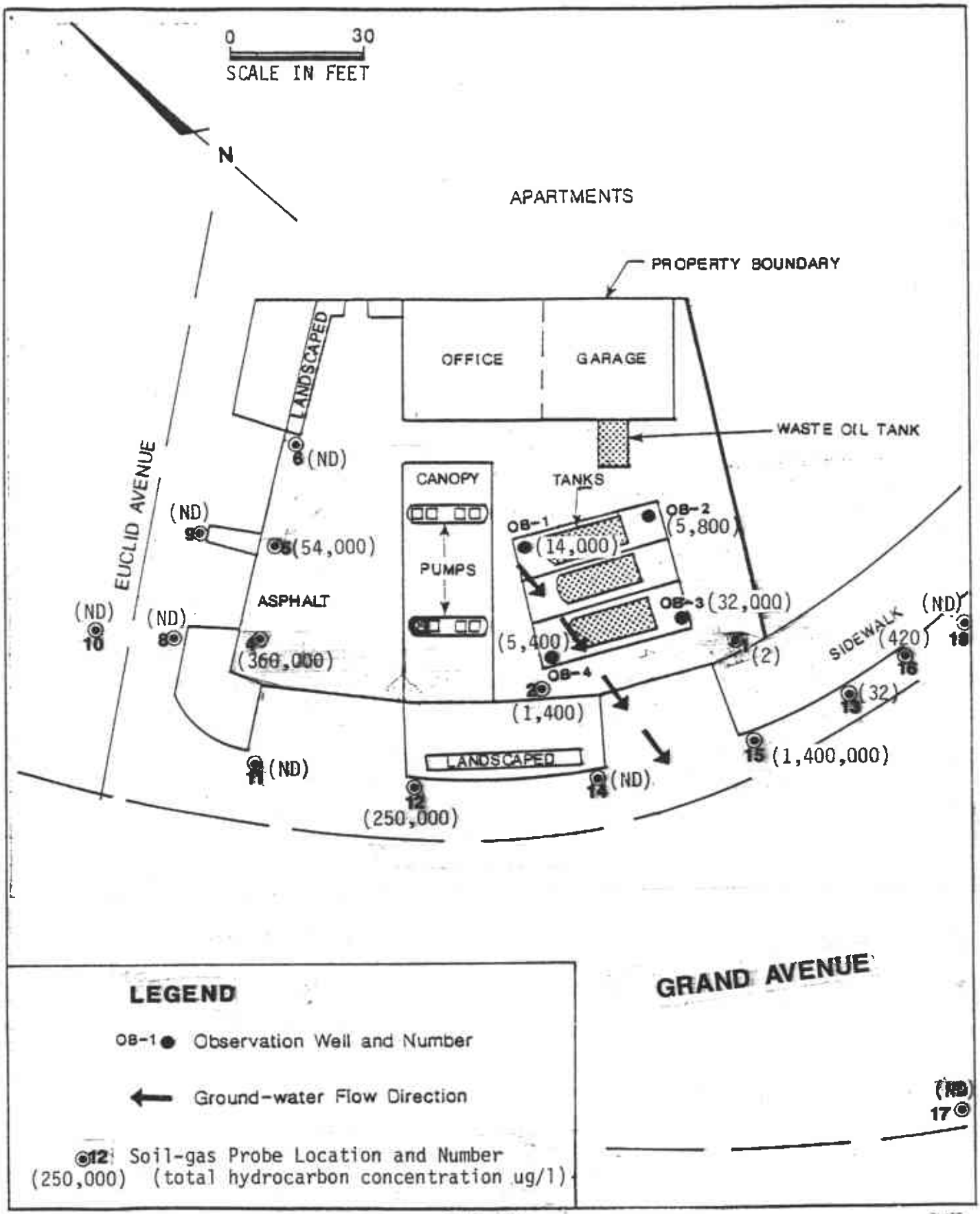


Harding Lawson Associates
Engineers and Geoscientists

Aerial Photograph/Vicinity Map
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
KH	2251,081.03	STV	6/89		



LEGEND

OB-1 ● Observation Well and Number

← Ground-water Flow Direction

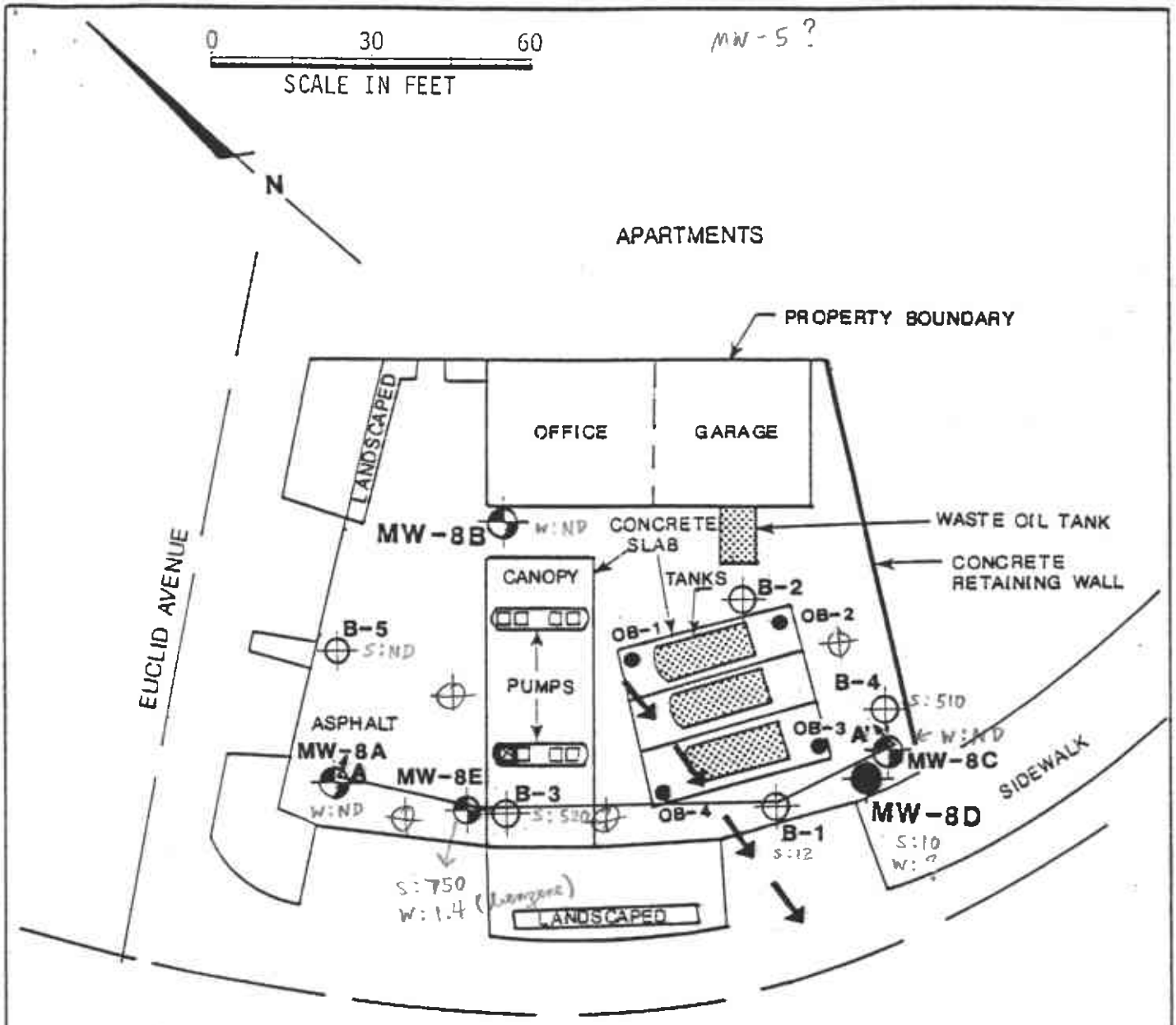
12 Soil-gas Probe Location and Number
(250,000) (total hydrocarbon concentration ug/l)

Harding Lawson Associates
Engineers and Geoscientists

Soil-Gas Probe Locations
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **3**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	AK	5/89		



Harding Lawson Associates
Engineers and Geoscientists

Site Plan
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	AR	5/89		

Equipment Hollow Stem Auger

Elevation 99.5*** Date 10/10/88

Laboratory Tests	Blows/foot *	TIP (ppm**)	Depth (ft)	Sample	
			0		ASPHALT
					GREEN-GRAY SILTY CLAY W/FINE SAND (CL) moist
	35	6			No odor
		20			BROWN CLAYEY SAND (SC) moist
		1	5		
	29	1			More clay
		300			Less clay
	43	250			HARD WHITE CLAY W/GRAVEL (CL) dry
	63	5			BROWN CLAYEY SILT W/SMALL PIECES LIMESTONE (CL) dry
		6	10		
					BROWN CLAYEY SAND (SC) moist
		ND			
	30	ND			
		ND			GRAY-BROWN CLAY W/SOME SAND (CL)
	50	ND	15		wet
					Water level (10/10/88)
	26	—			Bottom of boring at 17.5 feet
			20		
			25		
			30		
			35		
			40		

* S&H Sampler Blow Counts Converted to SPT Blow Counts

** Parts Per Million

***HLA Project Datum

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring B-1

Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **5**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJO	11/88		

Equipment Hollow Stem Auger

Elevation 100 Date 10/10/88

Laboratory Tests	Blows/foot	TIP(ppm)	Depth (ft)	Sample	
			0		ASPHALT CONCRETE
					Water level (10/10/88)
	3.4	ND	5		GRAVEL W/TRACE SAND (GP) saturated
	2.1	ND			WHITE SILTY CLAY (CL) very stiff, dry
			10		Bottom of boring at 8.0 feet
			15		
			20		
			25		
			30		
			35		
			40		

HLA **Harding Lawson Associates**
Engineers, Geologists & Geophysicists

Log of Boring B-2
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE 6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJD	11/88		

Equipment Hollow Stem Auger

Elevation 99.5 Date 10/10/88

Laboratory Tests	Blows/foot	TIP (ppm)	Depth (ft)	Sample	
			0		ASPHALT
					BROWN CLAY W/SAND (CL) stiff, moist
	26	270			
		5	5		
	43	150 10 15			BROWN SANDY SILT (ML) stiff, dry
	28	ND ND	10		BROWN CLAY W/FINE SAND (CL) moist
					WHITE CLAY (CL) very hard, dry
	55	ND			BROWN CLAY (CL) soft, moist
			15		WHITE CLAY (CL) hard, dry
	39				Bottom of boring at 16.5 feet
			20		
			25		
			30		
			35		
			40		

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring B-3
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **7**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SDO	11/88		

Equipment Hollow Stem Auger

Elevation 98.6 Date 10/10/88

Laboratory Tests	Blows/foot	TIP (ppm)	Depth (ft)	Sample
			0	
		1200		
	29	250		
			5	
		3		
	68	2		
	45	—		
			10	
	—	—		
			15	
			20	
			25	
			30	
			35	
			40	

ASPHALT

BROWN-GRAY CLAY (CL) stiff, moist, hydrocarbon odor

BROWN MEDIUM COARSE SAND (SC) wet, hydrocarbon odor

WHITE CLAY (CL) hard, dry, no odor

BROWN CLAYEY SILT (CL) stiff, dry

Water level (10/10/88)

BROWN CLAYEY SILT W SAND (CL) stiff, wet

Bottom of boring at 16.0 feet

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring B-4
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **8**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJD	11/88		

LOG OF BORING B-5

Equipment Hollow Stem Auger

Elevation 100 Date 3/2/89

Blows/foot	HNu (ppm)	Depth (ft)	Sample
		0	
20	0	5	
26	0	10	
65	0	15	
		20	
		25	
		30	
		35	
		40	

Asphalt

Baserock

MOTTLED GRAY BROWN LEAN CLAY WITH SAND (CL), medium stiff, moist

MOTTLED LIGHT BROWN LEAN CLAY WITH SAND (CL), very stiff, moist

MOTTLED LIGHT BROWN CLAYEY SAND (SM), very dense, moist, calcified cementation

Bottom of boring at 16.5 feet

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring B-5
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE 9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJO	5/89		

Equipment Hollow Stem Auger

Elevation 99.5 Date 10/11/88

Laboratory Tests	Blows/foot	TIP (ppm)	Well Screen Interval	Depth (ft)	Sample	
				0		ASPHALT
						GRAY-BROWN CLAY (CL) stiff, moist, very strong hydrocarbon odor
	30	250 250	Water Level 5/10/89	5		
	20	ND ND		10		BROWN SANDY CLAY (CL) stiff, moist
						TAN CLAYEY SAND (SC) very soft, wet
	63	—		15		DARK GRAY CLAY W/SOME SAND (CL) soft, moist
						WHITE CLAY (CL) hard, dry
	35	—		20		BROWN CLAYEY SAND (SC) stiff, saturated
						Bottom of boring at 20.0 feet
				25		
				30		
				35		
				40		

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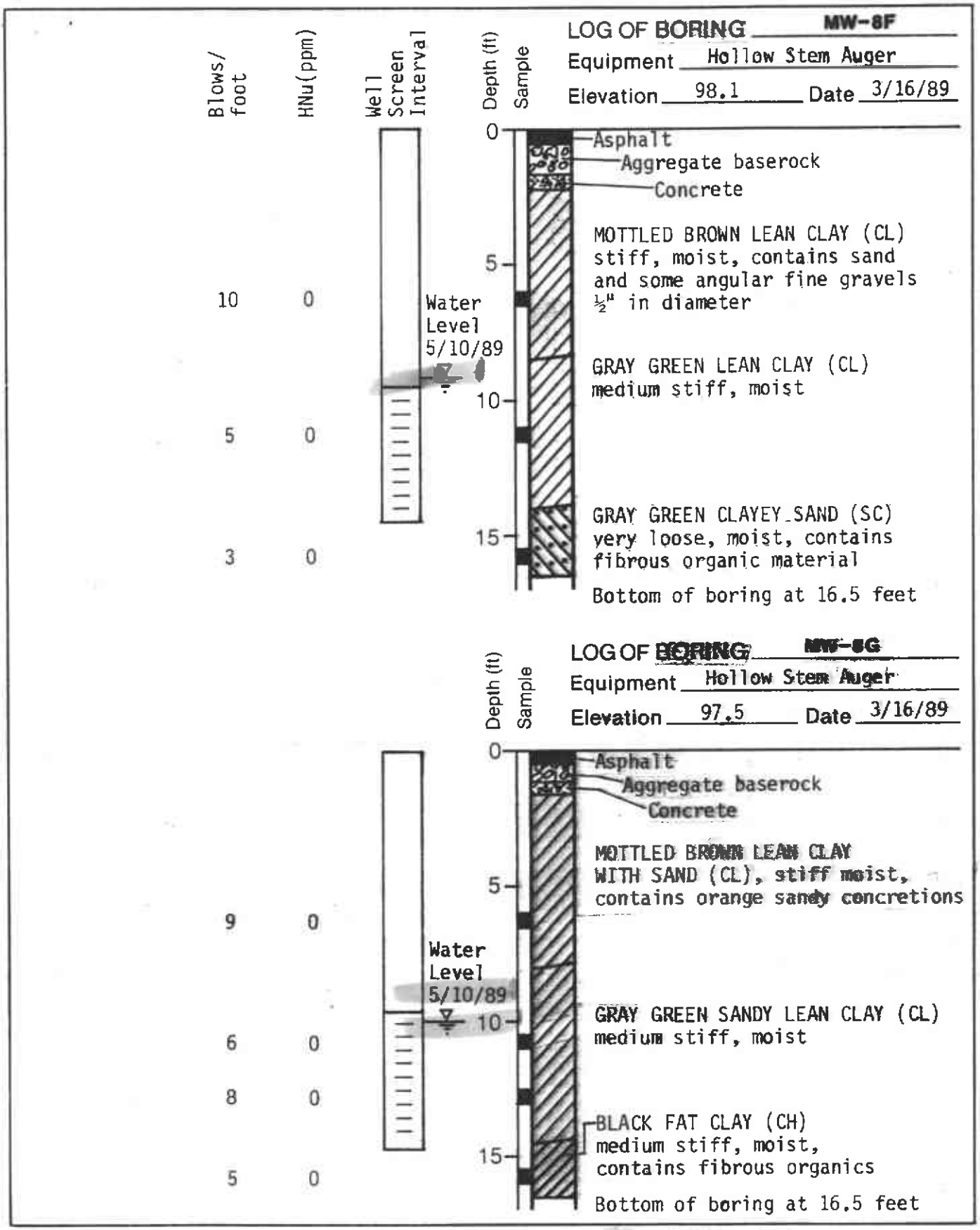
Engineers, Geologists & Geophysicists

Log of Monitoring Well MW-8E
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **10**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03		11/88		



HLA **Harding Lawson Associates**
Engineers, Geologists & Geophysicists

Log of Boring MW-8F and MW-8G
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **11**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SAO	5/89		

6196

MAJOR DIVISIONS					TYPICAL NAMES
COARSE–GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP		POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC		CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP		POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE–GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL		ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC SILTS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION – ASTM D2487-85

Perm	—	Permeability
Consol	—	Consolidation
LL	—	Liquid Limit (%)
PI	—	Plastic Index (%)
G_s	—	Specific Gravity
MA	—	Particle Size Analysis
■	—	"Undisturbed" Sample
☒	—	Bulk or Classification Sample

Shear Strength (psf) ↓		Confining Pressure ↓		
TxUU (FM) or (S)	3200	(2600)	—	Unconsolidated Undrained Triaxial Shear (field moisture or saturated)
TxCU (P)	3200	(2600)	—	Consolidated Undrained Triaxial Shear (with or without pore pressure measurement)
TxCD	3200	(2600)	—	Consolidated Drained Triaxial Shear
SSCU (P)	3200	(2600)	—	Simple Shear Consolidated Undrained (with or without pore pressure measurement)
SSCD	3200	(2600)	—	Simple Shear Consolidated Drained
DSCD	2700	(2000)	—	Consolidated Drained Direct Shear
UC	470		—	Unconfined Compression
LVS	700		—	Laboratory Vane Shear

KEY TO TEST DATA

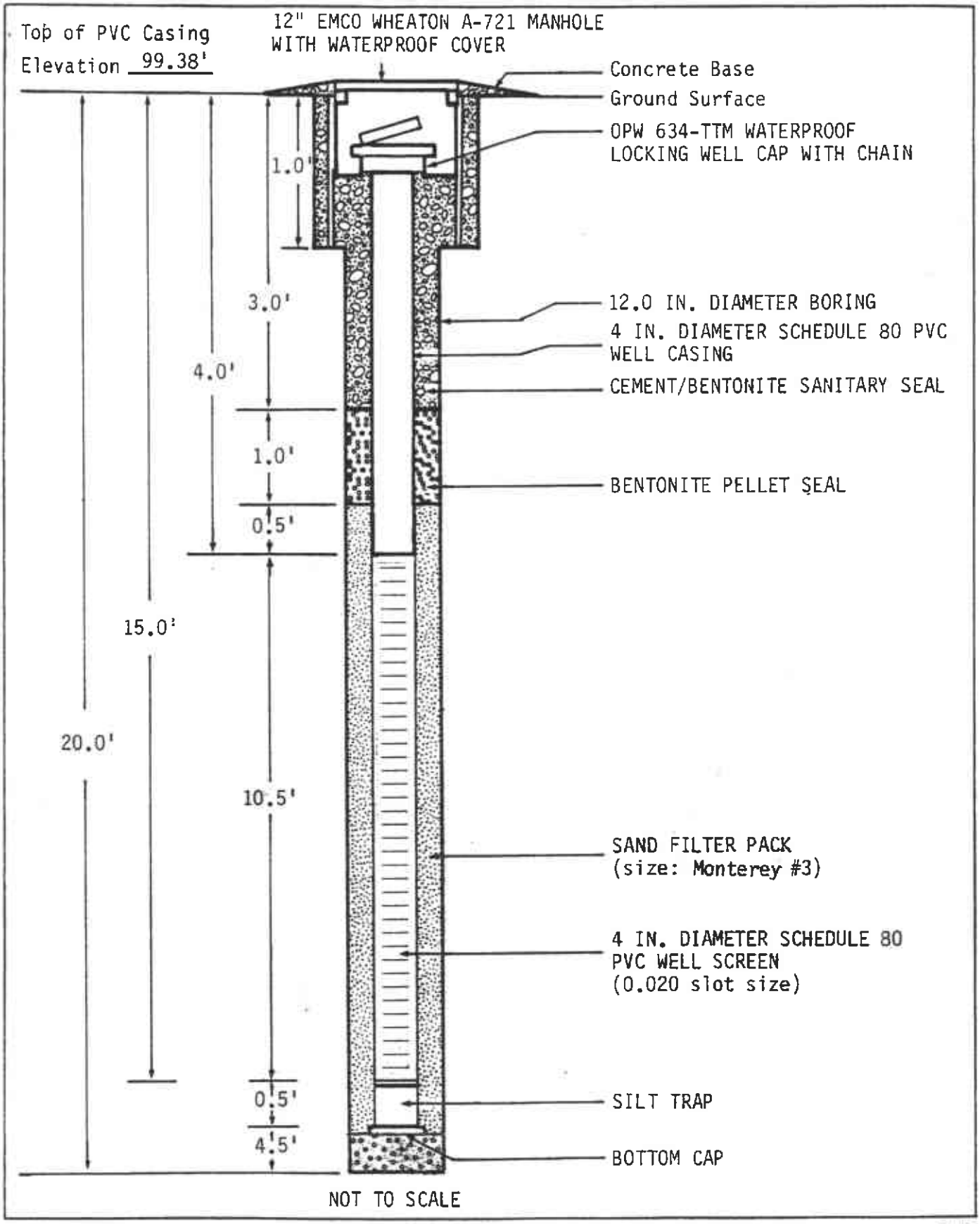
Harding Lawson Associates
Engineers and Geoscientists

Soil Classification and Test Data Key
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **12**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SS	5/89		

105848



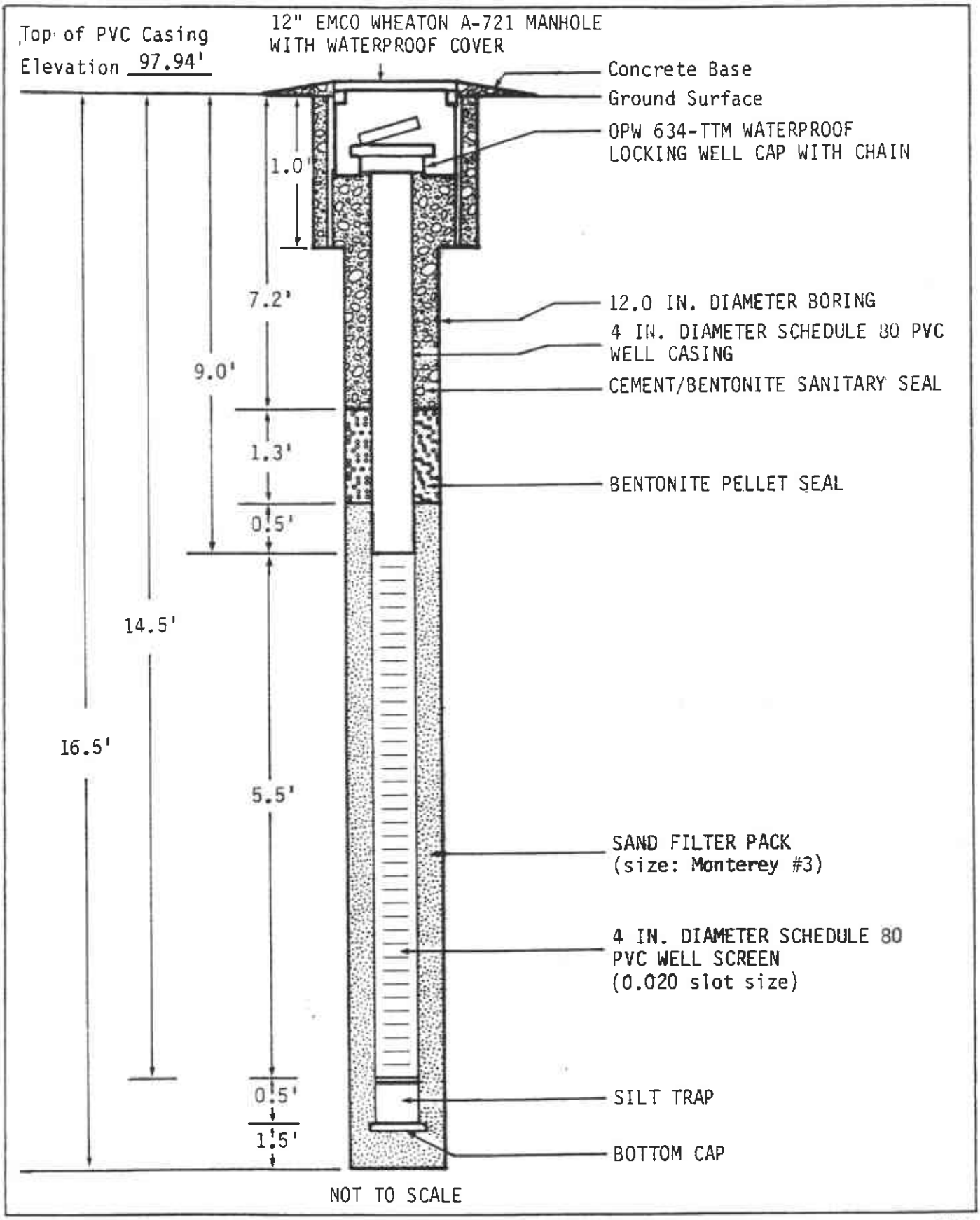
Harding Lawson Associates
Engineers and Geoscientists

Well Construction Diagram MW-8E
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
13

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJP	12/88		

106649



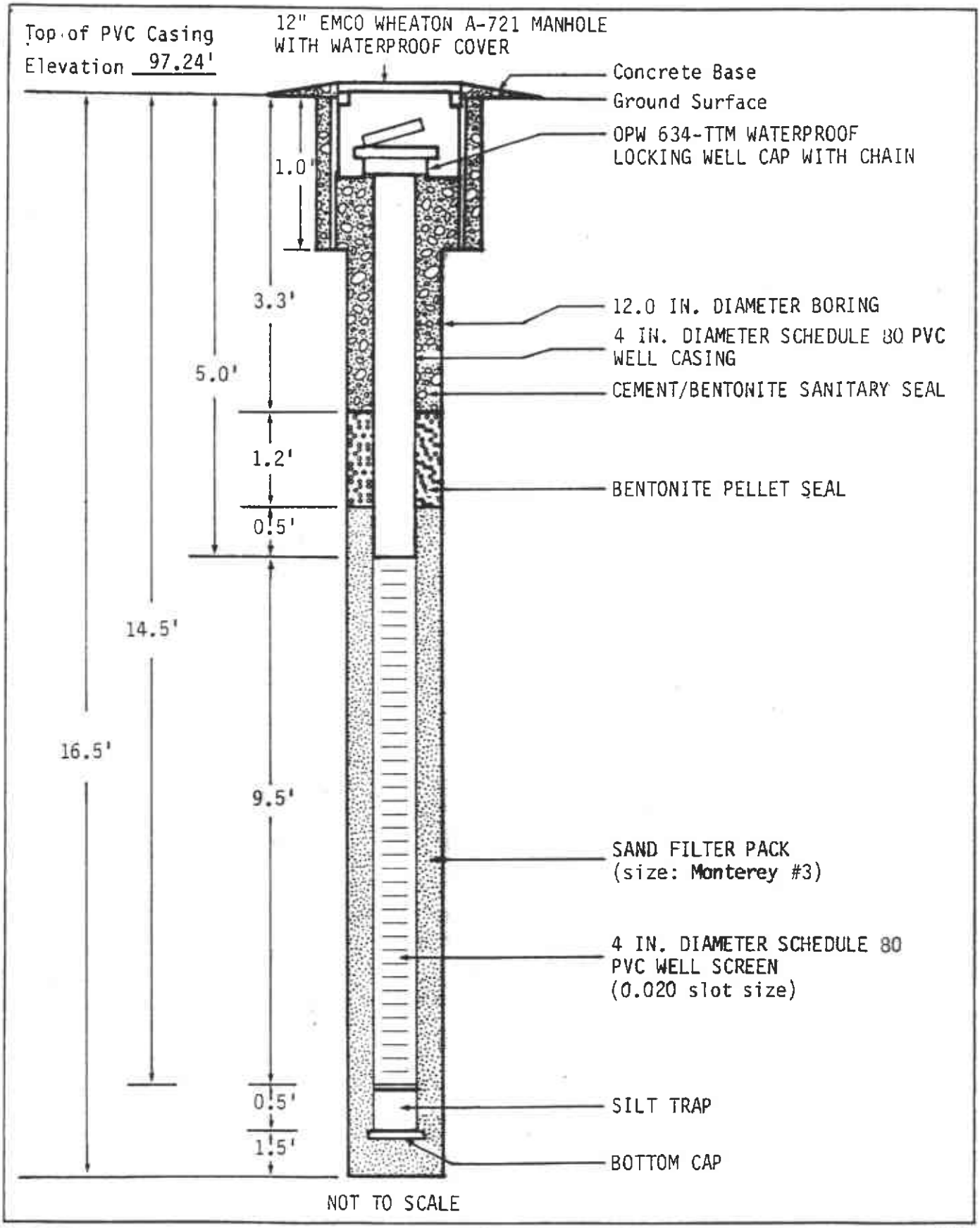
Harding Lawson Associates
Engineers and Geoscientists

Well Construction Diagram – MW-8F
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **14**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJD	5/89		

105649



Harding Lawson Associates
Engineers and Geoscientists

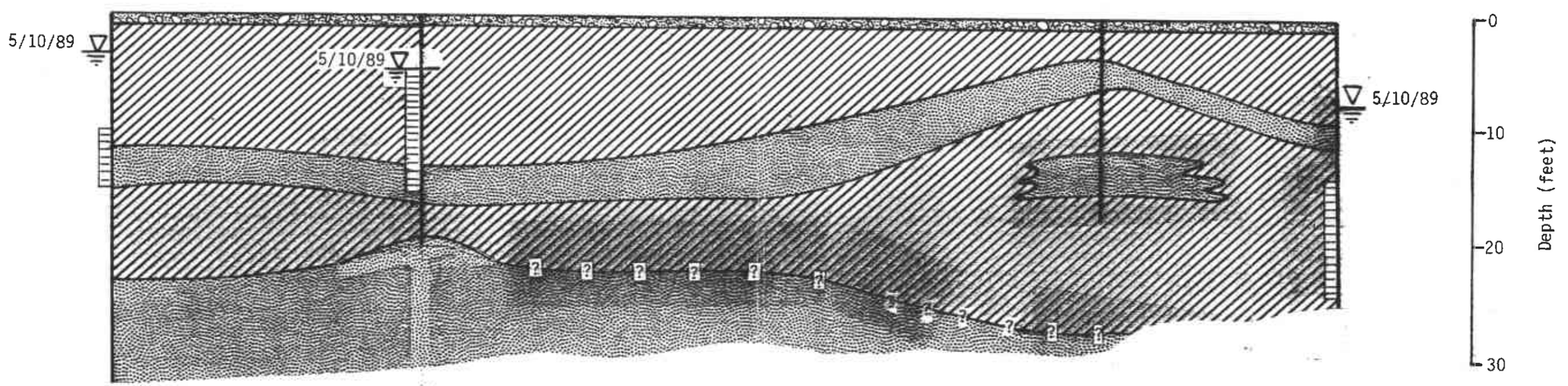
Well Construction Diagram – MW-8G
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **15**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	SJO	5/89		

A
WEST

A'
EAST



Horizontal Scale

0 10 20

SCALE IN FEET

LEGEND

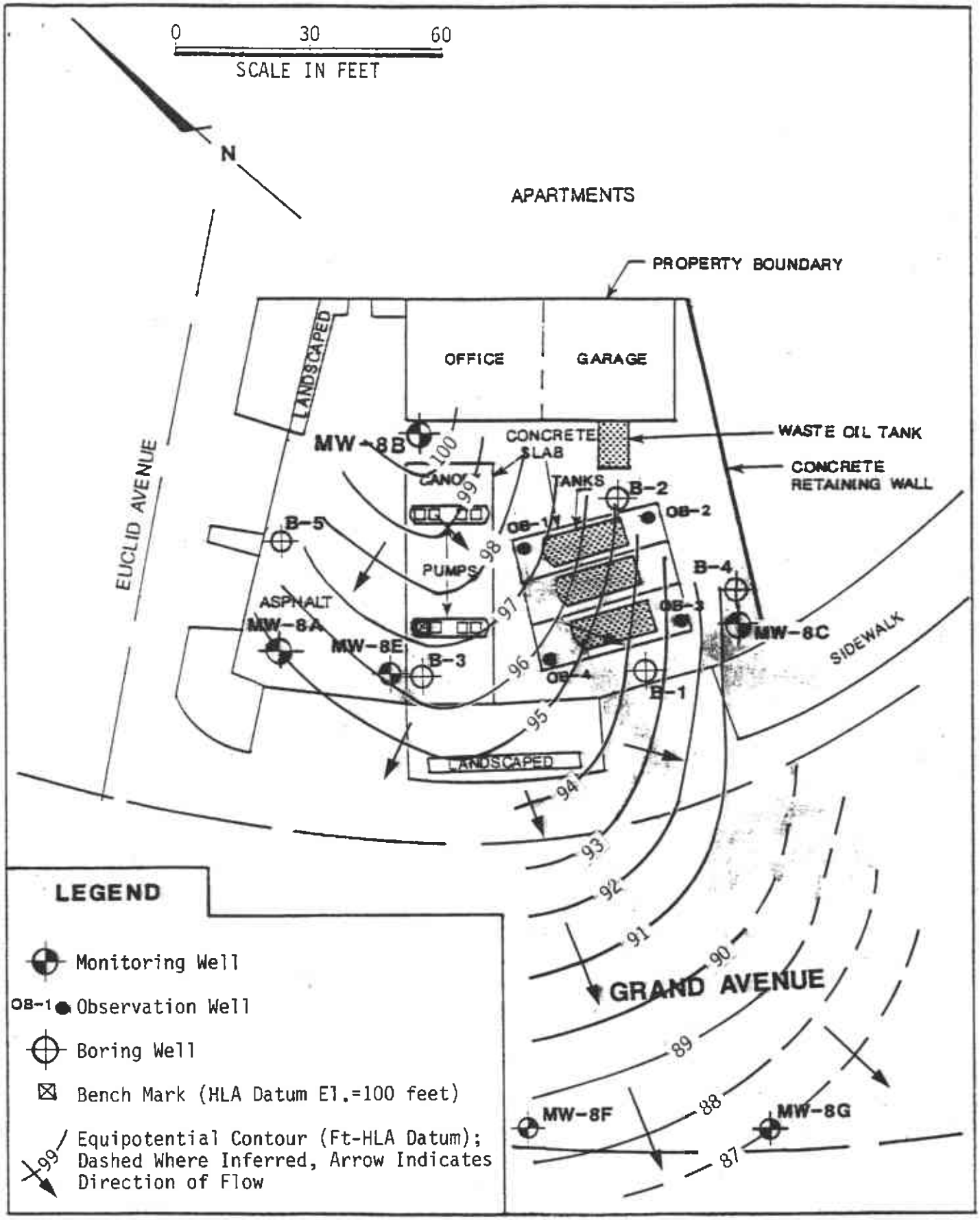
- Asphalt/Sub Base
- Clay
- Clayey Sand
- Screened interval and 5/89 stabilized water level

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

East-West Geologic Cross Section
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE **16**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
KH	2251,081.03	SJD	6/89		

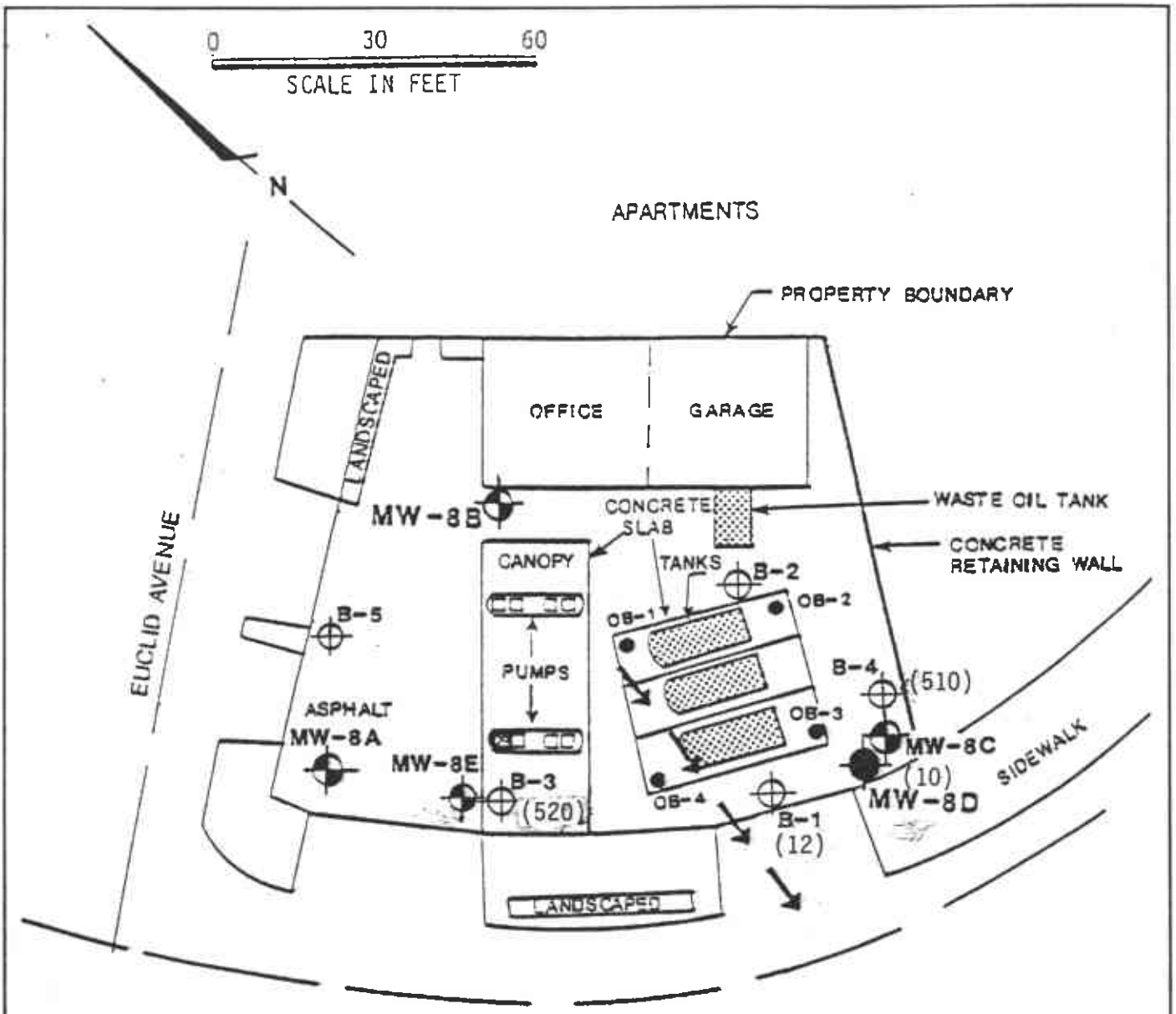


Harding Lawson Associates
Engineers and Geoscientists

Phreatic Surface – May 1989
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
17

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,081.03	AK	5/89		

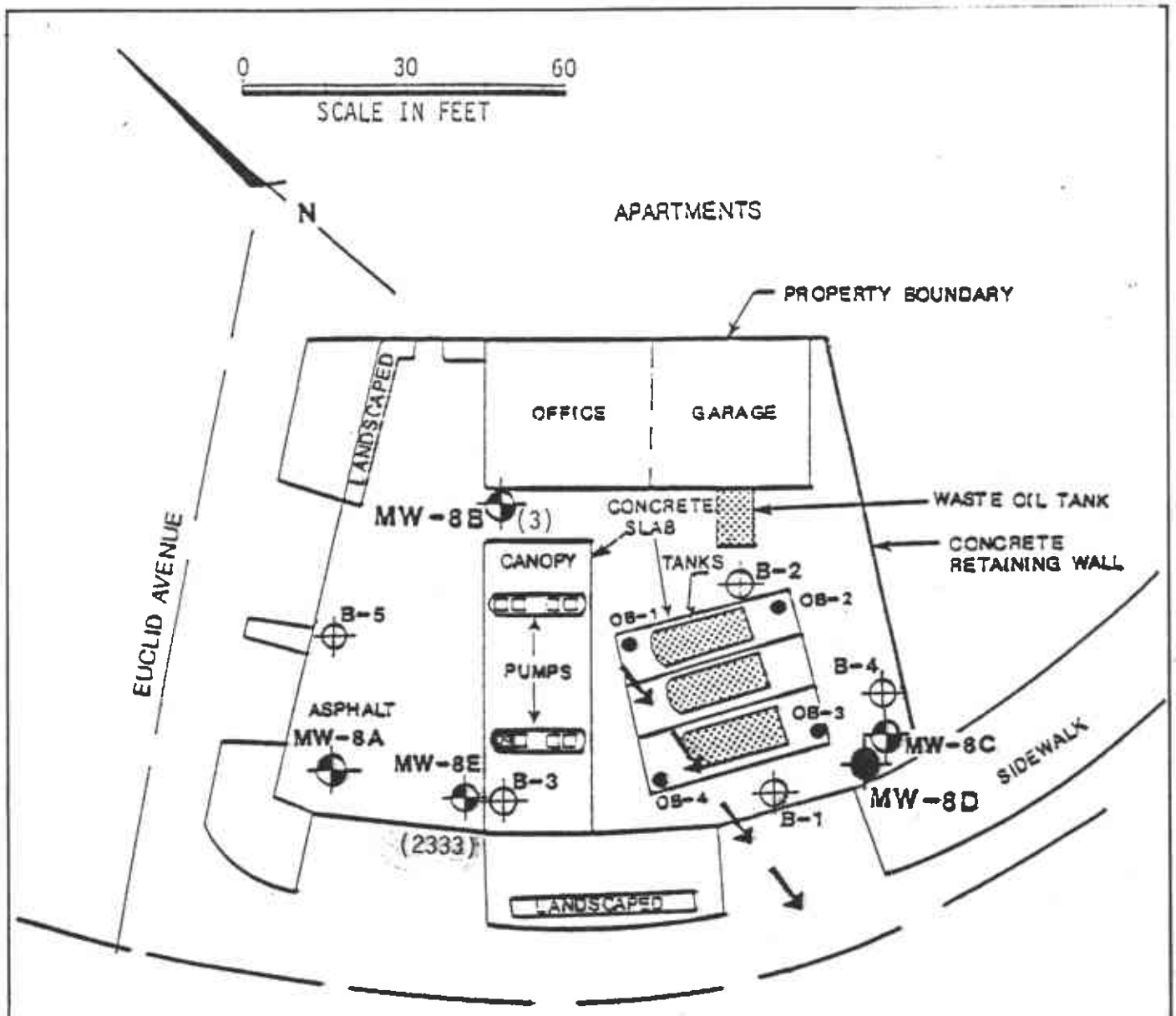


Harding Lawson Associates
Engineering and Environmental Services

Distribution of Hydrocarbons in Vadose Soils Between 3.5 and 6.5 Feet Below Grade
500 Grand Avenue
Oakland, California

PLATE **18**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
KH	2251,081.03	SJD	7/89	

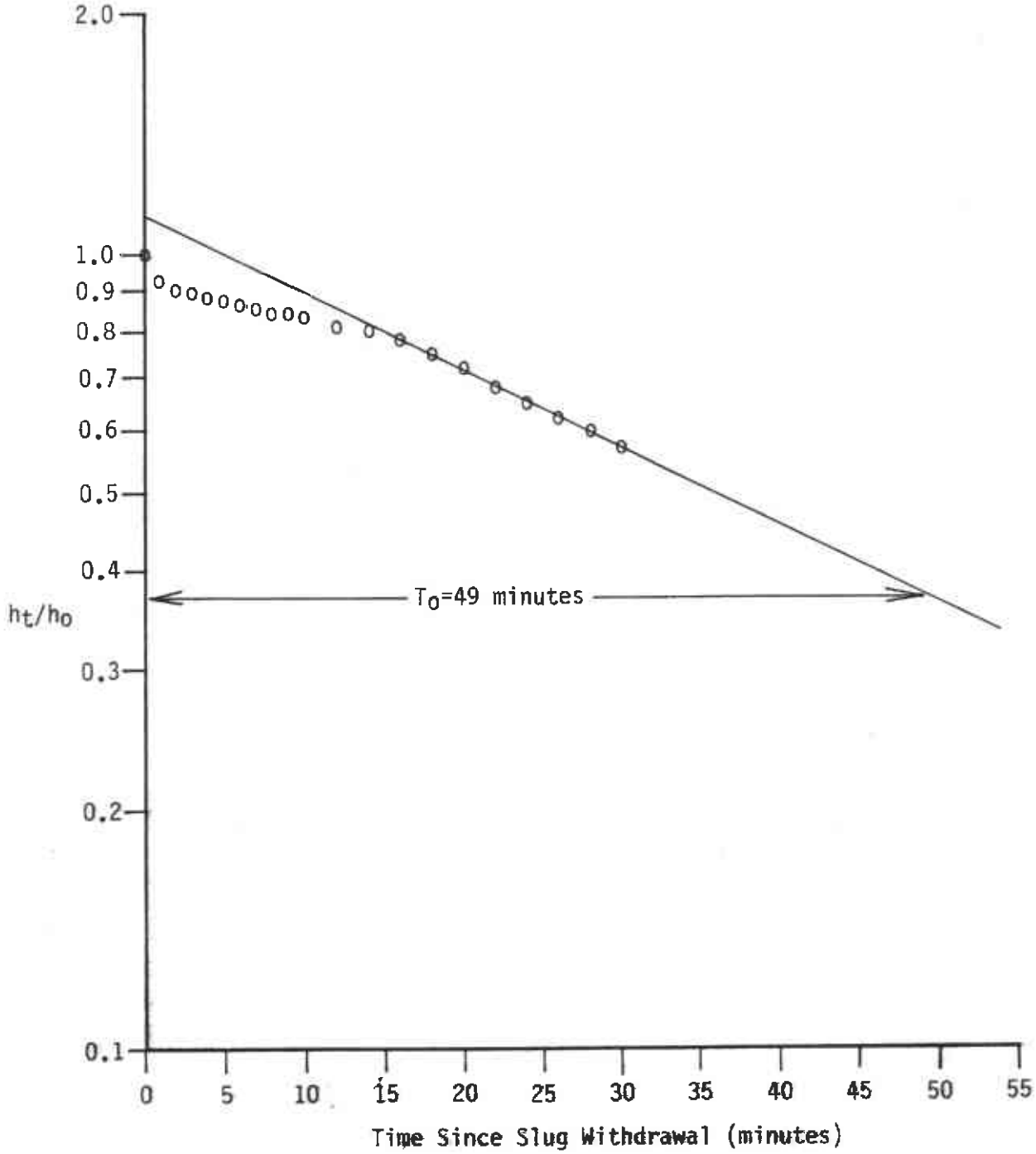


Harding Lawson Associates
Engineering and Environmental Services

Distribution of Hydrocarbons in the Ground-water
500 Grand Avenue
Oakland, California

PLATE **19**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
KH	2251,081.03	SJD	7/89	

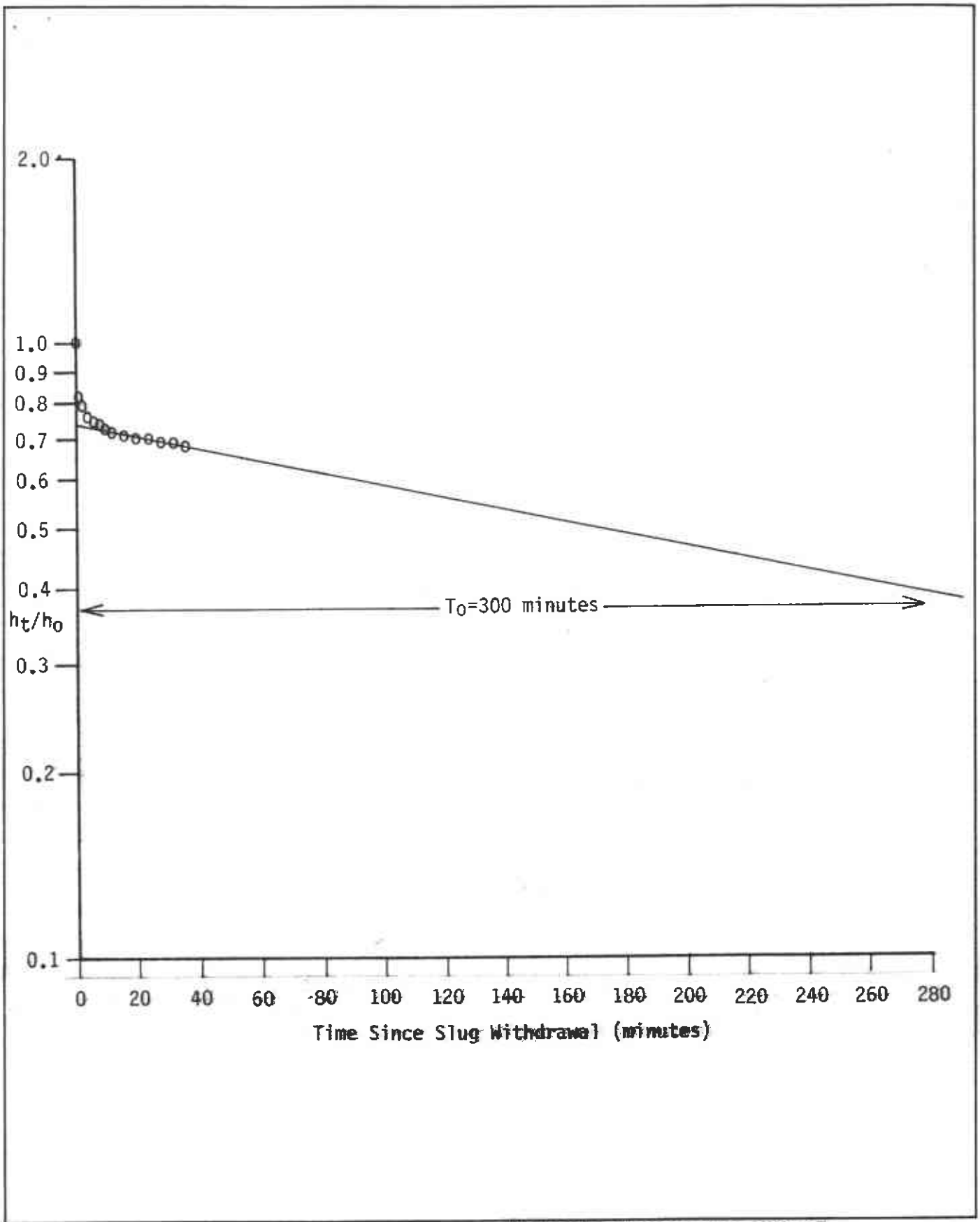


Harding Lawson Associates
Engineering and
Environmental Services

Water Level Recovery MW-8C
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
20

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
YC	2251,081.03	SJD	8/89	



Harding Lawson Associates
Engineering and
Environmental Services

Water Level Recovery MW-8E
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
21

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
YC	2251,081.03	SSO	8/89	

APPENDIX A

Plates from Previous Reports

Attachment A to Environmental Testing Procedures

SENSITIVE RECEPTORS - SITE INVESTIGATION AND RISK ASSESSMENT

Location #: 62488000235
Address: 500 Grand Avenue
City/State: Oakland CA
County: Alameda

I Provide answers to the following questions to the extent reasonably known:

A. Is there a public water supply well within 2500'? (Y/N) No
If Yes, distance (FT) _____

B. Is there a private water supply well within 1000'? (Y/N) No
If Yes, distance (FT) _____

C. Is there a subway within 1000'? (Y/N) No
If Yes, distance (FT) _____

D. Is there a basement within 500'? (Y/N) Yes
If Yes, distance (FT) 250

E. Is there a school within 1000'? (Y/N) No
If Yes, distance (FT) _____

F. Is there a surface body of water within 500'? (Y/N) Yes
(i.e., lake, river, ocean) If Yes, distance (FT) 200

II Describe type of local water supply:

Public X
- Suppliers' Name East Bay Mud
- Suppliers' Source Mokelumne Aqueduc
- Distance to Site 30 miles NE

Private _____

III Aquifer Classification, if available:

Class I - Special Ground Waters _____
- Irreplaceable Drinking Water Source
- Ecologically Vital
Class II - Current and Potential Drinking Water Sources X
Class III - Not Potential Source of Drinking Water _____

IV Describe observation wells, if any:

Number 4
Free Product (Y/N) Yes

V Provide a site diagram or a local/topographic (USGS) map of the area.

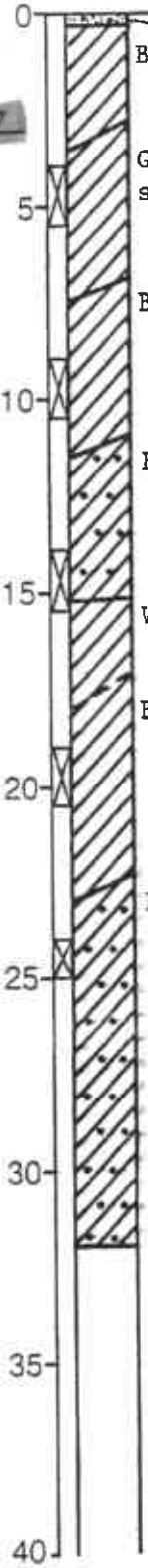
VI Report should consist of this fact sheet, the site or area map, and a cover letter.

VII Signature of Preparer: _____ Date: 5/24/88

Equipment 8-inch Hollow Stem Auger

Elevation **100 feet Date 6/6/88

Laboratory Tests	Blows/foot	PID* Reading (ppm)	Depth (ft)	Sample
		120	0	
	19	130 70	5	
	27	30	10	
	30	5 5	15	
	55	5	20	
	30/6"	5	25	
			30	
			35	
			40	



asphaltic pavement

BLACK SILTY CLAY (CL) trace sand
stiff, moist, [redacted]

GREENISH GRAY SILTY CLAY with sand (CL)
stiff, moist, slight petroleum [redacted]

BROWN SILTY CLAY (CL)
very stiff, moist

BROWN CLAYEY SAND (SC)
dense, wet

WHITE SILTY CLAY (CL)
hard, moist

BROWN SILTY CLAY with sand (CL)
hard, moist

BROWN CLAYEY SAND (SC)
very dense, saturated

the lithology between 15 and 32 feet is inferred from a boring 5-feet to the west of well MW-8A

bottom of boring 32 feet

stabilized water level at 3 feet on 6/14/88

*PID = photo ionization detector, HNU PI 101
ppm = parts per million

**Reference Elevation (arbitrary datum)

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring MW-8A
Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

PLATE 3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251.054.04	[redacted]	7/88		

Equipment 8-inch Hollow Stem Auger

Elevation ***101.5 feet Date 6/7/88

Laboratory Tests	** Blows/foot	PID * Reading (ppm)	Depth (ft)	Sample
		30	0	
	17/6"		5	
	28	0	10	
	27/6"	10	15	
	15		20	
			25	
			30	
			35	
			40	

asphaltic pavement

GREENISH GRAY SILTY CLAY (CH)
stiff, moist

water seep

GRAYISH BROWN SILTY CLAY (CL)
hard, moist

WHITE SILTY CLAY trace sand (CL)
very stiff, moist

BROWN CLAYEY SAND (SC)
very dense, moist

BROWN MOTTLED GRAY SILTY CLAY (CL)
very stiff, moist

bottom of boring 20 feet

stabilized water level at [redacted] feet on 6/14/88

*PID = photo ionization detector,
HNU PI 101
ppm = parts per million

**S&H Sampler blow counts converted to SPT blow counts.

***Reference Elevation
(arbitrary datum)

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Boring MW-8B

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

PLATE 4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251,054.04	JO	7/88		

Equipment 8-inch Hollow Stem Auger

Elevation ***98.7 feet Date 6/7/88

Laboratory Tests	Blows/foot	PID * Reading (ppm)	Depth (ft)	Sample
			0	
	**21	100		
			5	
	**22	50		
			10	
	32	50		
			15	
	26	40		
			20	
	27	10	25	
			30	
			35	
			40	

aspnaltic pavement

GRAYISH BROWN CLAYEY SAND (SC)
dense, moist

GRAY GRAVELLY SAND (SW)
dense, saturated

GRAYISH BROWN CLAYEY SAND (SC)
dense, moist

GRAYISH BROWN SILTY CLAY
trace sand (CL)
very stiff, moist

BROWN SILTY CLAY (CL)
hard, moist

BROWN CLAYEY SAND (SC)
dense, moist

BROWN MOTTLED GRAY SILTY CLAY (CL)
moist, hard, with 1 to 2 inches
brown sand lenses (SP)

BROWN SILTY CLAY (CL)
very stiff, moist

GRAY SILTY CLAY (CH)
very stiff, dry, intermixed
with WHITE SILTY CLAY (CL)
very stiff, dry

bottom of boring 24.5 feet

stabilized water level at
7.5 feet on 6/14/88

*PID = photo ionization detector
HNU PI 101
ppm = parts per million

**S&H Sampler blow counts converted
to SPT blow counts

***Reference Elevation
(arbitrary datum)

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Boring MW-8C

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

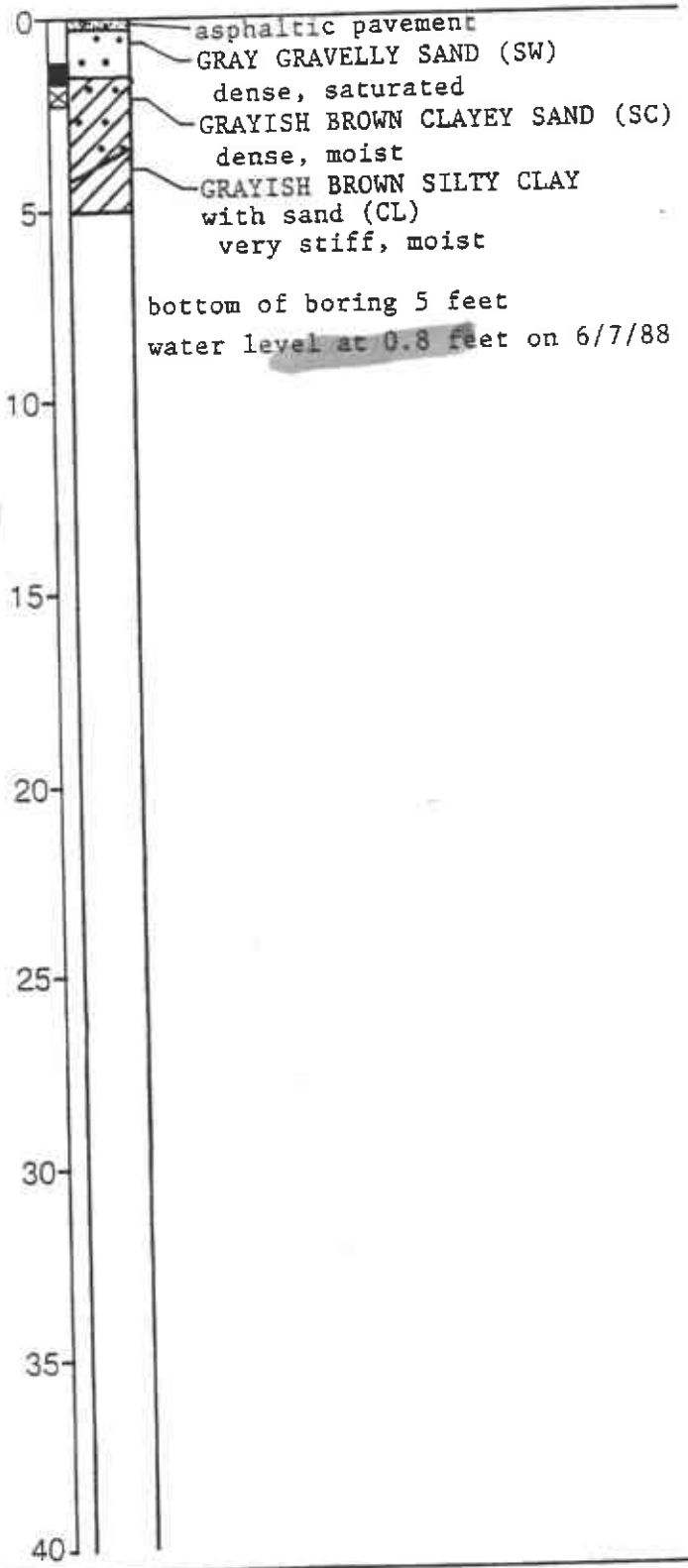
PLATE 5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251,054.04	[illegible]	7/88		

Equipment 8-inch Hollow Stem Auger

Elevation ***98± feet Date 6/7/88

Laboratory Tests	** Blows/foot	PID * Reading (ppm)	Depth (ft)	Sample
	21	170	0	



■ Sample kept for testing

*PID = photo ionization detector
HNU PI 101
ppm = parts per million

**S&H Sampler blow counts converted to SPT blow counts.

*** Reference Elevation
(arbitrary datum)

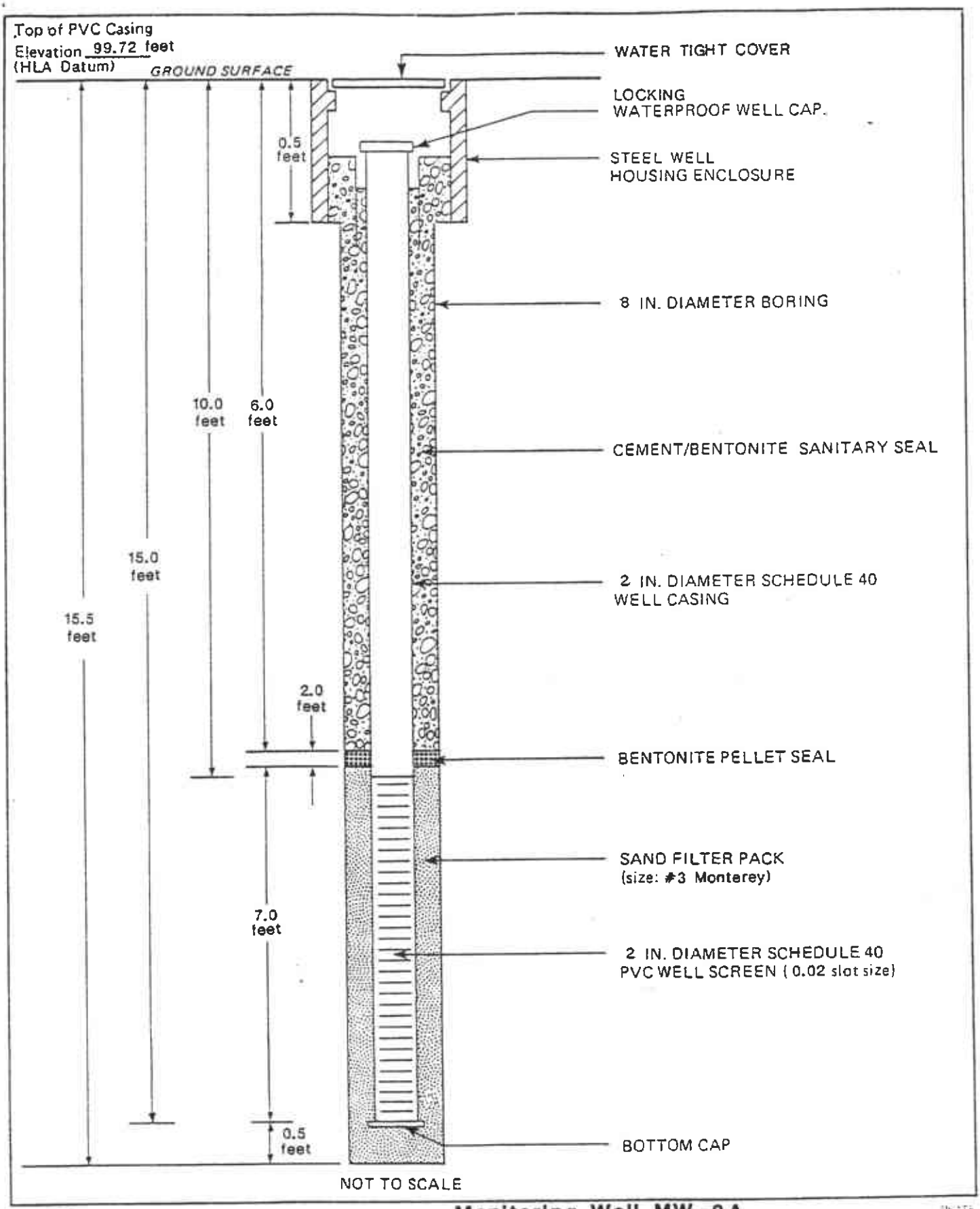
Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Boring MW-8D

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

PLATE 6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251.054.04	AO	7/88		



Harding Lawson Associates
Engineers, Geologists
& Geophysicists

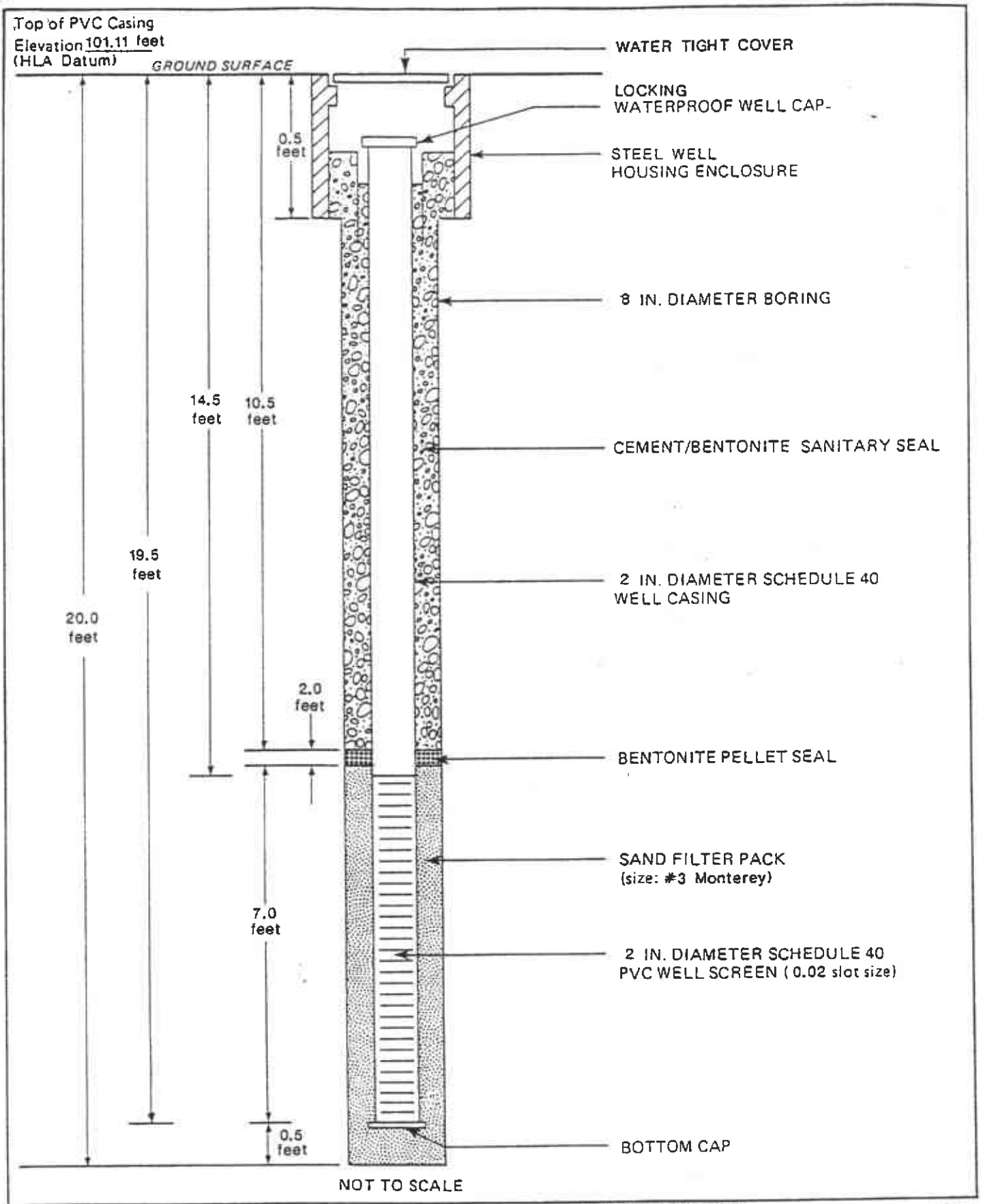
Monitoring Well MW-8A Completion Detail

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

PLATE
8

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251.054.04	AO	7/88		

FORM GW3



Harding Lawson Associates
Engineers, Geologists
& Geophysicists

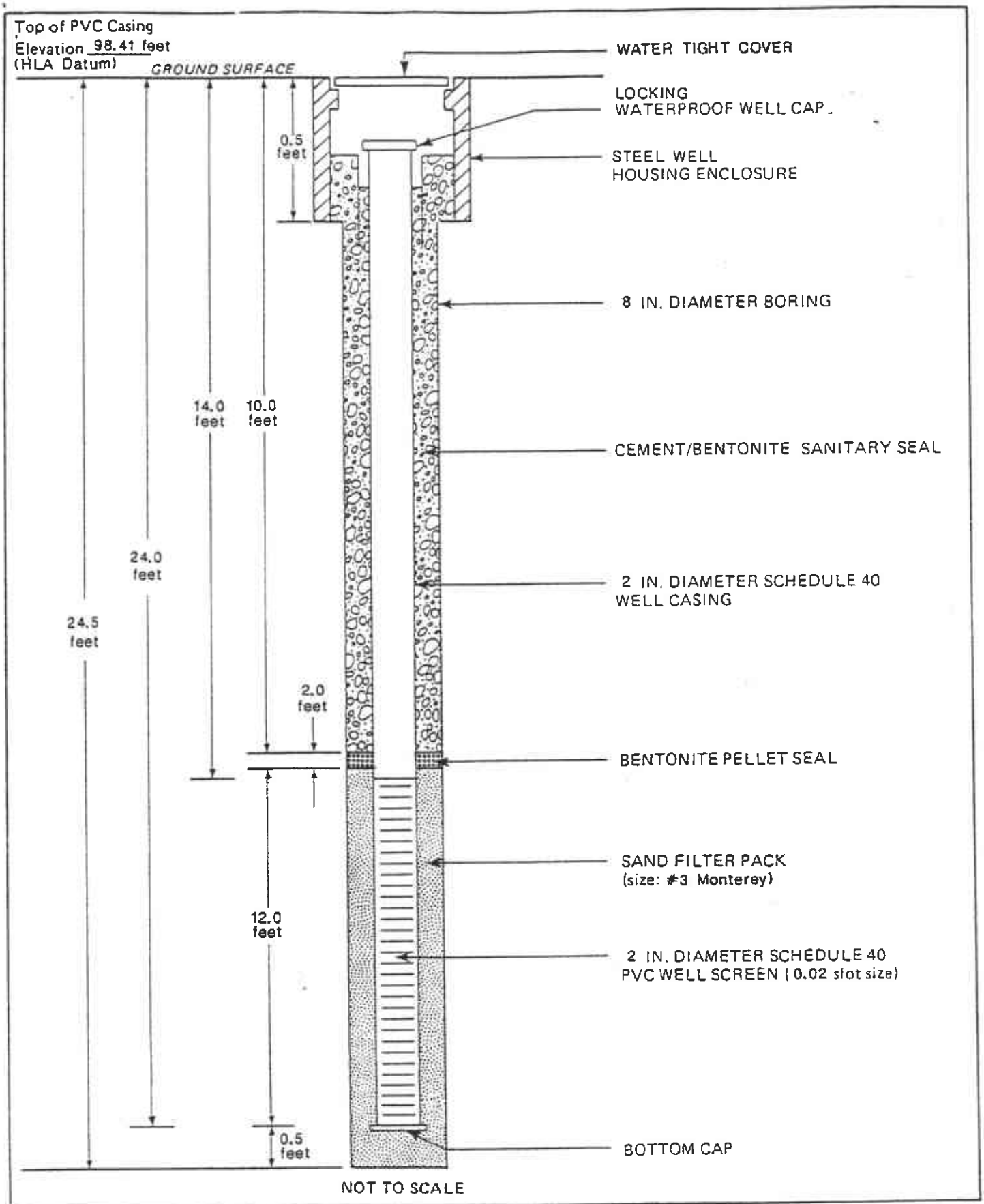
Monitoring Well MW-8B Completion Detail

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

PLATE
9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251,054.04	AO	7/88		

FORM GW3



Harding Lawson Associates
Engineers, Geologists
& Geophysicists

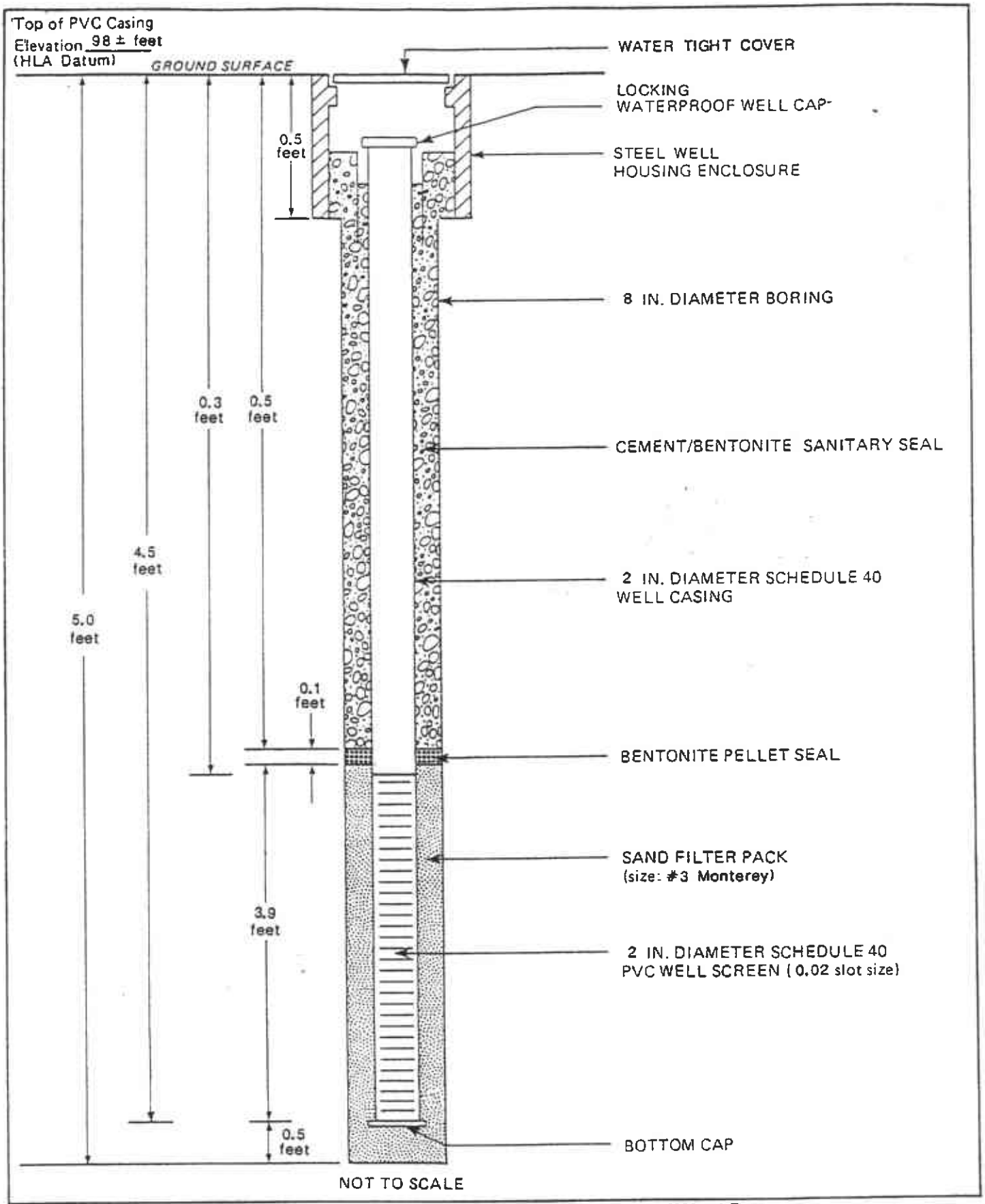
Monitoring Well MW-8C Completion Detail

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

10

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251.054.04	JO	7/88		

FORM GW3



Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Monitoring Well MW-8D Completion Detail

Texaco Station - 62488000235
500 Grand Avenue
Oakland, California

PLATE
11

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	2251,054.04	JO	7/88		

FORM GW3

APPENDIX B

Soil-gas Survey Methodology

Tracer Research Corporation

SHALLOW SOIL GAS/GROUNDWATER INVESTIGATION AT THE TEXACO SERVVICE STATIONS NORTHERN CALIFORNIA

SEPTEMBER/DECEMBER 1988

PREPARED FOR:

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520

SUBMITTED BY:

Martin D. Faverolu
Tracer Research Corporation

TABLE OF CONTENTS

INTRODUCTION

Several shallow soil gas/groundwater investigations were performed by Tracer Research Corporation (TRC) at the following Texaco gas station sites in the Northern California:

2225 Telegraph Ave., Oakland, CA
2200 E. Twelfth St., Oakland, CA
500 Grand Ave., Oakland, CA
495 El Camino Real, San Carlos, CA
800 El Camino Real, San Bruno, CA
196 Main St., Half Moon Bay, CA
595 Munras St., Monterey, CA
1550 Fremont St., Seaside, CA
334 San Antonio Rd., Mountain View, CA
975 Stierlin Rd., Mountain View, CA
5153 Redwood Hwy., Petaluma, CA

The investigation was conducted between September 19 and December 6, 1988 under contract to Harding Lawson Associates. The purpose of the investigation was to determine the possible presence of volatile petroleum compounds (VOCs) in the subsurface as part of environmental site assessments.

For this survey, a total of 139 soil gas and 12 groundwater samples were collected and analyzed in the field. The samples were analyzed for the following compounds:

benzene
toluene
ethyl benzene
xylenes
total hydrocarbons

The compounds in this suite were chosen because of their extensive use at the sites and their suspected presence in the subsurface.

SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Soil gas contaminant investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing [redacted] low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large data base. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical field van which was equipped with one gas chromatograph and two Spectra Physics SP4270 computing integrators. In addition, the van has two built-in gasoline powered generators which provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

SAMPLING PROCEDURES

Sampling probes consist of 7-foot lengths of 3/4 inch diameter hollow steel pipe which are fitted with detachable drive points. Soil gas samples were collected after driving the steel probe to a depth between 2 and 15 feet into the ground. The above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. To adequately purge the volume of air within the probe, 5 to 10 liters of gas were evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate injections) in volumes ranging from 1 µL to 2 mL, depending on the VOC concentration at any particular location.

Groundwater samples were collected by driving a hollow steel probe to a depth between 5 and 12 into the ground or by direct sampling of an observation or monitoring well. A length of polyethylene tubing was inserted to the bottom of the probe. The

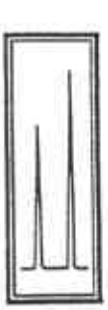
tubing was attached to a peristaltic pump. Approximately 40 mL of water was collected in bottles with teflon lined septum caps so as to exclude air. Any sediment collected with the groundwater was allowed to settle. The water was subsampled (duplicate injections) in volumes ranging from 1 µL to 10 µL.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph equipped with a flame ionization detector (FID) was used for the soil gas analyses. The FID was used to analyze for benzene, toluene, ethyl benzene, xylenes and total hydrocarbons. Xylenes are reported as the total of the three xylene isomers and total hydrocarbons are approximately C4-C9 aliphatic, alicyclic and aromatic compounds. Nitrogen was used as the carrier gas.

Detection limits for the compounds of interest are a function of the injection volume as well as the detector sensitivity for individual compounds. Thus, the detection limit varies with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest must be kept within the linear range of the analytical equipment. If any compound has a high concentration, it is necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may cause decreased detection limits for other compounds in the analyses. For example, during this investigation, a few of the soil gas samples had high concentrations of benzene, toluene and xylenes. To bring the peak for these compounds within linear range, it was necessary to make small injections. This had the effect of decreasing the detection limits for ethyl benzene in these samples.

The detection limits range down to 0.08 µg/L for compounds such as benzene and toluene depending on the conditions of the



measurement, in particular, the sample size. If any component being analyzed is not detected, the detection limit for that compound in that analysis is given as a "less than" value (e.g. <0.08 µg/L). Detection limits obtained from GC analyses are calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples.

- Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.

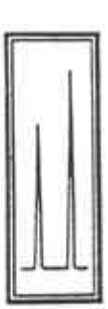
- Probe adaptors (steel reducer and tubing) are used once during the course of the day and cleaned at the end of each working day by baking in the GC oven. The tubing is replaced periodically as needed during the job to insure cleanliness and good fit.

- Silicone tubing (connecting the adaptor to the vacuum pump) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.

- Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas (nitrogen) and baked out between probe samplings.

- Septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.

- Analytical instruments are calibrated each day by the use of chemical standards prepared in water by serial dilution from commercially available pure chemicals. Calibration checks are also run after approximately every five soil gas sampling locations.

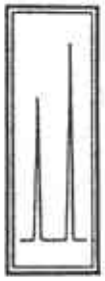


- 2 cc subsampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.

- Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to a concurrently sampled air analysis.

- All sampling and 2 cc subsampling syringes are decontaminated each day and no such equipment is reused before being decontaminated. Microliter size subsampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.

- Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A negative pressure (vacuum) of 2 in. Hg less than the maximum capacity of the pump (evacuation rate >0.02 cfm) usually indicates that a reliable gas sample cannot be obtained because the soil has a very low air permeability.



APPENDIX A: CONDENSED DATA

HARDING LAWSON ASSOCIATES/GRAND AVENUE/OAKLAND, CALIFORNIA

Sample	Depth	Date	Benzene (ug/l)	Toluene (ug/l)	Ethyl Benzene (ug/l)	Xylenes (ug/l)	Total Hydroc. (ug/l)
Air		09/21	<0.8	<0.8	<0.9	<0.9	<0.8
SG-01	3'	09/21	<0.8	<0.8	<0.9	<0.9	<0.8
SG-01	6'	09/21	0.4	0.4	<0.2	0.4	2
SG-02	3'	09/21	320	280	120	23	1,400
SG-04	4'	09/21	86,000	40,000	26,000	3,300	360,000
SG-05	2'	09/21	42,000	8,600	86	86	54,000
SG-06	4'	09/21	<0.8	<0.8	<0.9	<0.9	<0.8
OB-1		09/21	7,700	1,400	260	<9	14,000
OB-2		09/21	5,600	320	180	<9	5,800
OB-3		09/21	5,600	3,000	120	<9	32,000
OB-4		09/21	3,600	780	61	<9	5,400
Air		09/21	<0.8	<0.8	<0.9	<0.9	<0.8

Tracer Research Corporation

Notations:
I interference with adjacent peaks
NA not analyzed

Analyzed by K. Tolman

Checked by R. Sheldrake

Proofed by L. Kaplanian

HARDING LAWSON ASSOCIATES/GRAND AVENUE/OAKLAND, CALIFORNIA

Sample	Depth	Date	Benzene (ug/l)	Toluene (ug/l)	Ethyl Benzene (ug/l)	Xylenes (ug/l)	Total Hydroc. (ug/l)
Air		09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-08	5'	09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-09	4'	09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-10	4'	09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-11	3.5'	09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-12	4'	09/28	38,000	16,000	180	170	250,000
SG-13	3'	09/28	<0.4	<0.4	<0.5	<0.4	32
SG-14	4'	09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-15	3'	09/28	300,000	90,000	27,000	22,000	1,400,000
SG-16	4'	09/28	120	63	14	14	420
SG-17	4'	09/28	<0.4	<0.4	<0.5	<0.4	<0.4
SG-18	4'	09/28	<8	<7	<9	<9	<8

Notations:
I interference with adjacent peaks
NA not analyzed

Analyzed by K. Tolman

Checked by R. Sheldrake

Proofed by L. Kaplander

Tracer Research Corporation

WELL LOG
KEY TO ABBREVIATIONS

Drilling Method

HSA - Hollow stem auger
CFA - Continous flight auger
Air - Reverse air circulation

Gravel Pack

CA - Coarse aquarium sand

Sampling Method

Cal. Mod. - California modified split-spoon sampler (2" inner diameter) driven 18" by a 140-pound hammer having a 30" drop. Where penetration resistance is designated "P", sampler was instead pushed by drill rig.
Disturbed - Sample taken from drill-return materials as they surfaced.
Shelby - Shelby Tube thin-walled sampler (3" diameter), where sampler is pushed by drill-rig.

Moisture Content

Dry - Dry
Dp - Damp
Mst - Moist
Wt - Wet
Sat - Saturated

Sorting

PS - Poorly sorted
MS - Moderately sorted
WS - Well sorted

Plasticity

L - Low
M - Moderate
H - High

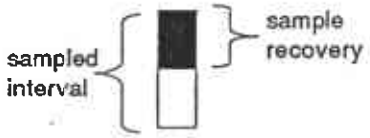
H-NU (ppm)

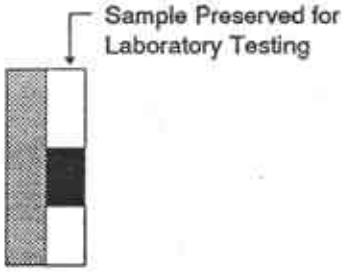
ND - No detection

Symbols

▽ - First encountered ground water

▼ - Static ground water level





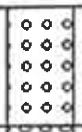
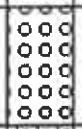
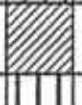
Density (Blows/Foot - Cal Mod Sampler)

Sands and gravels		Silts and Clays	
0 - 5	- Very Loose	0 - 2	- Very Soft
5 - 13	- Loose	2 - 4	- Soft
13 - 38	- Medium dense	4 - 9	- Firm
38 - 63	- Dense	9 - 17	- Stiff
over 63	- Very dense	17 - 37	- Very Stiff
		37 - 72	- Hard
		over 72	- Very Hard

GRAIN - SIZE SCALE

GRADE LIMITS U.S. Standard inch	sieve size		GRADE NAME
12.0			Boulders
3.0	3.0 in.		Cobbles
0.19	No. 4		Gravels
0.08	No. 10	coarse	
	No. 40	medium	Sand
	No. 200	fine	
			Silt
			Clay Size

PACIFIC ENVIRONMENTAL GROUP, INC.

Primary Divisions			Group Symbol	Graphic	Typical Names
COARSE GRAINED SOILS more than half is larger than #200 sieve	GRAVELS half of coarse fraction larger than #4 sieve	CLEAN GRAVELS (less than 5% fines)	GW		Well graded gravels, gravel-sand mixtures; little or no fines
			GP		Poorly graded gravels or gravel-sand mixtures; little or no fines
		GRAVEL WITH FINES	GM		Silty gravels, gravel-sand-silt mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS half of coarse fraction smaller than #4 sieve	CLEAN SANDS (less than 5% fines)	SW		Well graded sands, gravelly sands, little or no fines
			SP		Poorly graded sands or gravelly sands; little or no fines
		SANDS WITH FINES	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS more than half is smaller than #200 sieve	SILTS AND CLAYS liquid limit less than 50%		ML		Inorganic silts and very fine sand, rock flour, silty or clayey fine sands or clayey silts, with slight plasticity
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL		Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS liquid limit more than 50%		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt		Peat and other highly organic soils

PACIFIC ENVIRONMENTAL GROUP, INC.

Unified Soil Classification System

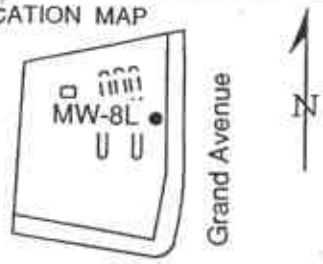
ATTACHMENT B
SAMPLING AND LABORATORY PROCEDURES

The sampling procedure consisted of first measuring the water level in each well with an electronic water-level indicator, and checking each well for the presence of separate-phase hydrocarbons using a clear Teflon bailer or an oil-water interface probe. The wells were then purged of approximately four casing volumes of water (or until dry) using a bailer or centrifugal pump, during which time temperature, pH, and electrical conductivity were monitored to indicate that a representative sample was obtained. After purging, the water levels in the wells were allowed to restabilize. Groundwater samples were then collected using a Teflon bailer, placed into appropriate EPA-approved containers, labeled, logged onto chain-of-custody documents, and transported on ice to the laboratory.

Water removed from the wells during the sampling event was placed in a 500-gallon water transportation trailer. Upon completion of the work on site, the purge water contained within the trailer was transported to Gibson Oil and Refining Company, Inc., Redwood City facility and injected into the treatment system.

Groundwater samples collected from site monitoring wells were analyzed for the presence of total petroleum hydrocarbons calculated as gasoline (TPH-g) by EPA Methods 8015 (modified) and 5030, and for benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) by EPA Method 8020. The TPH-g and BTEX samples were examined using the purge and trap technique, with final detection by gas chromatography. Samples were also analyzed for total petroleum hydrocarbons calculated for diesel using EPA Methods 8015 and 3510, with final detection by gas chromatography; or by EPA Method 3550 with gravimetric determination by standard Method 5520. All analyses were performed by a state-certified laboratory.

LOCATION MAP



NORTHING EASTING ELEVATION

PACIFIC ENVIRONMENTAL GROUP, INC.

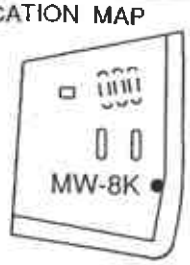
WELL NO. MW-8L
PAGE 1 OF 1

PROJECT NO. 340-34.20
LOGGED BY: L.D.
DRILLER: WEST HAZMAT
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: #3 SAND

CLIENT: TEXACO
DATE DRILLED: 5-18-93
LOCATION: 500 Grand Avenue, Oakland
HOLE DIAMETER: 8"
HOLE DEPTH: 19.5'
WELL DIAMETER: 2"
WELL DEPTH: 18'
CASING STICKUP: NA

WELL COMPLETION	MOISTURE CONTENT	PID	PENETRATION (BLOWS/FT)	DEPTH (FEET)	RECOVERY / SAMPLE INTERVAL	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
#3 SAND, NEAT CEMENT, BENTONITE				2			GC	CLAYEY GRAVEL - FILL: dark gray; 30-40% clay; 10-15% sand; fine to coarse gravel; angular; medium dense; faint product odor.
	Sat	100	24	6			CL	SANDY CLAY: olive brown; low plasticity; some silt; 15-25% fine to coarse sand; medium dense; faint product odor.
	Mst	20	50	10			SM	SILTY SAND: dark yellowish brown; some clay; 15-20% silt; fine sand; dense; no product odor.
	Mst	2	41	16				@15': as above; no product odor.
	Mst	0	49	18			CL	SANDY CLAY: light olive brown; iron oxide and manganese oxide; medium dense; no product odor.
				20				BOTTOM OF BORING AT 19.5'
				22				
				24				
				26				
				28				
				30				
				32				
				34				
				36				
				38				
				40				
				42				
				44				

LOCATION MAP



NORTHING EASTING ELEVATION

PACIFIC ENVIRONMENTAL GROUP, INC.

WELL NO. MW-8K
PAGE 1 OF 1

PROJECT NO. 340-34.20
LOGGED BY: L.D.
DRILLER: WEST HAZMAT
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: #3 SAND

CLIENT: TEXACO
DATE DRILLED: 5-18-93
LOCATION: 500 Grand Avenue, Oakland
HOLE DIAMETER: 8"
HOLE DEPTH: 19.5'
WELL DIAMETER: 2"
WELL DEPTH: 18'
CASING STICKUP: NA

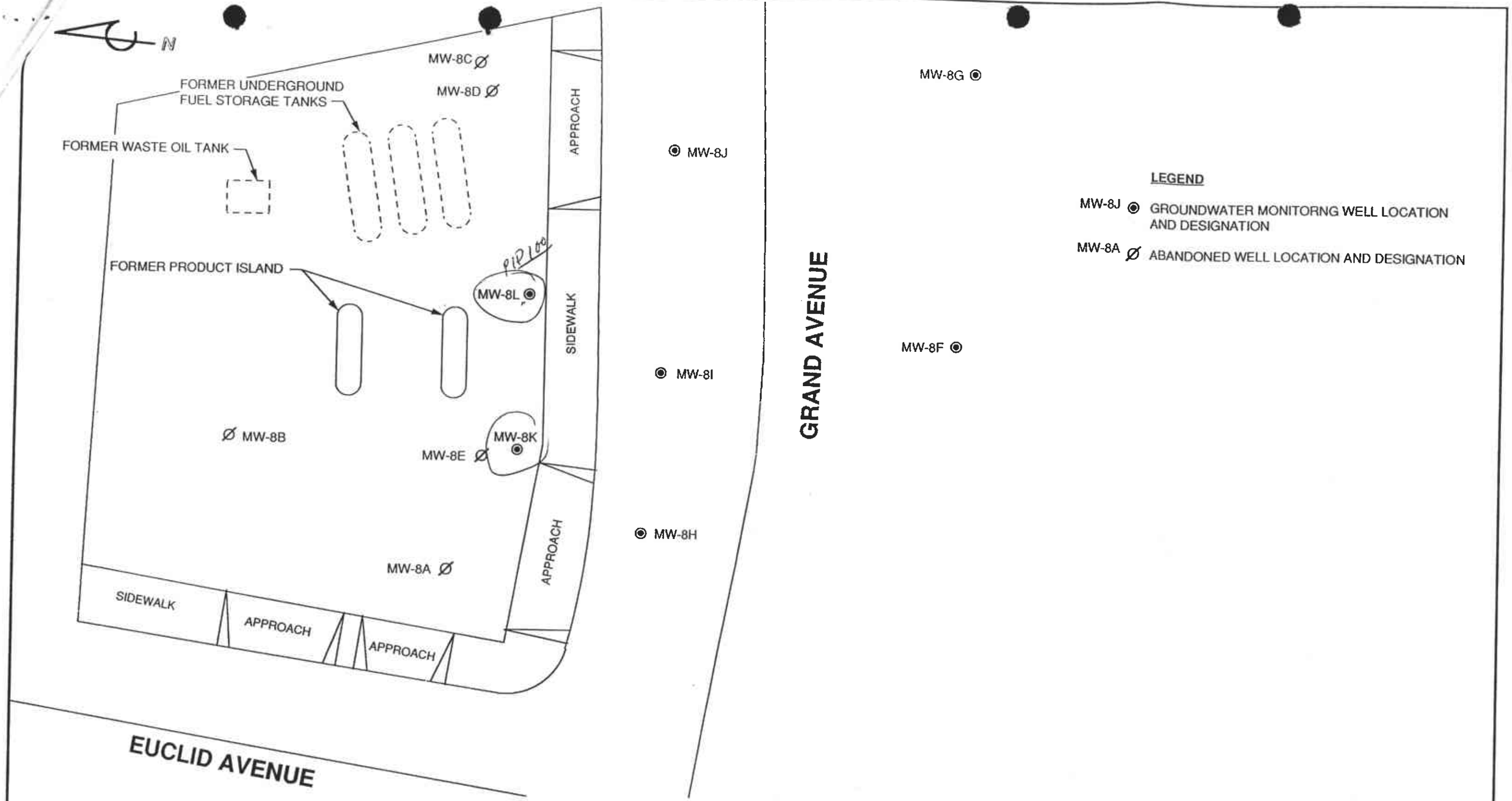
WELL COMPLETION	MOISTURE CONTENT	PID	PENETRATION (BLOWS/FT)	DEPTH (FEET)	RECOVERY SAMPLE INTERVAL	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
NEAT CEMENT, BENTONITE, #3 SAND				0			GC	CLAYEY GRAVEL - FILL: dark gray; 30-40% clay; 10-15% sand; fine to coarse gravel; angular; no product odor.
	Sat	6	7	6				@15': as above; fill; loose; no product odor.
	Mst	3	27	10			CL	SANDY CLAY: olive brown; low plasticity; some silt; 15-25% fine to coarse sand; medium dense; no product odor.
	Mst	12	60	14			CL	GRAVELLY CLAY: brown; low plasticity; 25-35% coarse sand to gravel; dense; no product odor.
	Sat	2	32	18			SM	SILTY SAND: (1/4" found in the shoe of sampler); dark yellowish brown; some clay; 15-20% silt; fine sand; medium dense; no product odor.
				20				BOTTOM OF BORING AT 19.5'
				22				
				24				
				26				
				28				
				30				
				32				
				34				
				36				
				38				
				40				
				42				
				44				

ATTACHMENT B
SAMPLING AND LABORATORY PROCEDURES

The sampling procedure consisted of first measuring the water level in each well with an electronic water-level indicator, and checking each well for the presence of separate-phase hydrocarbons using a clear Teflon bailer or an oil-water interface probe. The wells were then purged of approximately four casing volumes of water (or until dry) using a bailer or centrifugal pump, during which time temperature, pH, and electrical conductivity were monitored to indicate that a representative sample was obtained. After purging, the water levels in the wells were allowed to restabilize. Groundwater samples were then collected using a Teflon bailer, placed into appropriate EPA-approved containers, labeled, logged onto chain-of-custody documents, and transported on ice to the laboratory.

Water removed from the wells during the sampling event was placed in a 500-gallon water transportation trailer. Upon completion of the work on site, the purge water contained within the trailer was transported to Gibson Oil and Refining Company, Inc., Redwood City facility and injected into the treatment system.

Groundwater samples collected from site monitoring wells were analyzed for the presence of total petroleum hydrocarbons calculated as gasoline (TPH-g) by EPA Methods 8015 (modified) and 5030, and for benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) by EPA Method 8020. The TPH-g and BTEX samples were examined using the purge and trap technique, with final detection by gas chromatography. Samples were also analyzed for total petroleum hydrocarbons calculated for diesel using EPA Methods 8015 and 3510, with final detection by gas chromatography; or by EPA Method 3550 with gravimetric determination by standard Method 5520. All analyses were performed by a state-certified laboratory.



PACIFIC ENVIRONMENTAL GROUP, INC.

SCALE
0 20 40 FEET

FORMER TEXACO STATION
500 Grand Avenue at Euclid Avenue
Oakland, California

SITE MAP

FIGURE
1
PROJECT:
340-34.20

APPENDIX C

Soil Analyses - Laboratory Reports

CHEMWEST
ANALYTICAL LABORATORIES, INC.

October 27, 1988

Harding Lawson
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 2425

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analyses you requested: Total Petroleum Hydrocarbons, Purgeable (gasoline) - DHS Method, LUFT Field Manual; and BTEX - EPA Method 602.

Four soil samples for Project 500 Grand-Texaco, Project Number 2251,081.03 were received October 12, 1988 in good condition. Results of the analyses along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Jill B. Henes, Ph.D.
Vice President of Technical Services

and

Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

ANALYTICAL METHODOLOGY

BTEX (Benzene, Toluene, Ethyl Benzene, and Xylenes) by Purge & Trap and GC-PID

WATER - Method 602 or 8020

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Photoionization Detector (PID). A packed column is used to separate the compounds.

SOIL - Method 8020

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

ANALYTICAL METHODOLOGY

Total Petroleum Hydrocarbons by Purge & Trap and GC-FID

WATER - DHS Method - Luft Field Manual

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Flame Ionization Detector (FID). A packed column is used to separate the compounds.

SOIL - DHS Method - Luft Field Manual

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: B-1
Date Analyzed: 10/16/88
Date Extracted: 10/14/88

CHEMWEST I.D.: 2425-1
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.05
Toluene	BRL	0.1
Ethyl Benzene	BRL	0.2
Total-Xylenes (1)	BRL	0.1
Total Petroleum Hydrocarbon (Purgeable)	12	10

Surrogate	% Recovery	Acceptance Window
ortho-Chlorotoluene	77%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: B-3
Date Analyzed: 10/24/88
Date Extracted: 10/14/88

CHEMWEST I.D.: 2425-2
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	1
Toluene	BRL	2
Ethyl Benzene	BRL	4
Total-Xylenes (1)	5	2
Total Petroleum Hydrocarbon (Purgeable)	520	200

Surrogate	% Recovery	Acceptance Window
ortho-Chlorotoluene	87%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: B-4
Date Analyzed: 10/16/88
Date Extracted: 10/14/88

CHEMWEST I.D.: 2425-3
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.5
Toluene	1	1
Ethyl Benzene	3.5	2
Total-Xylenes (1)	13	1
Total Petroleum Hydrocarbon (Purgeable)	510	97

Surrogate	% Recovery	Acceptance Window
ortho-Chlorotoluene	97%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: MW-5
Date Analyzed: 10/24/88
Date Extracted: 10/14/88

CHEMWEST I.D.: 2425-4
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	0.82	0.5
Toluene	6.5	2
Ethyl Benzene	5.5	4
Total-Xylenes (1)	26	2
Total Petroleum Hydrocarbon (Purgeable)	750	200

Surrogate	% Recovery	Acceptance Window
ortho-Chlorotoluene	93%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

2425

CHEM WEST ANALYTICAL LABORATORIES, INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No.
Date Rec'd. 10/12/83 18:15
Compl. Date
Section: KIRK POCAN

CLIENT: Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Project Name: 500 Grand - TEXACO
Project No. 2251,081.03
P.O. NO.
Contact Randy Stone / Andrea Karoff
Phone (415) 687-9660

ANALYSIS: Four soil samples rec'd under chain of custody in 6" Brass Core Tubes (4) to be analyzed for BTEX, TPH - GAS. 7 Day T/A

	SAMPLE I.D.	DEPTH	DATE	ANALYSIS	MATRIX	CONTAINER
2425-1	B-1	6.5' To 7.0'	10/10/83	BTEX, TPH-GAS	Soil	1-6" Core Tube
-2	B-3	4.0' To 4.5'	"	" "	"	1- " "
-3	B-4	3.5' To 4.0'	"	" "	"	1- " "
-4	MW-5	5.5' To 6.0'	10/11/83	" "	"	1- " "

F-1
BM's
BILL McBENGE

Chem West Courier

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: CHEM-WEST

Samplers: A. KAROFF

Job Number: 2251,081.03

Name/Location: 500 GRAND - TEXACO

Project Manager: ANDREA KAROFF

Recorder: A. Karoff (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	Ice	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED: EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene/E	Total Petrol. Hydrocarb. GAS
			X					1			B-1	88	10	10		6½-7'						X	X
4	4		X					1			B-3	88	10	10		4-4½'						X	X
4	4		X					1			B-4	88	10	10		3½-4'						X	X
4	4		X					1			MW-5	88	10	11		5½-6'						X	X
4	4		X					1			B-2	88	10	10		Reject							

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) A. Karoff	RECEIVED BY: (Signature)	DATE/TIME 10/12/88 1430
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME 10/14/88 1815
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) DATE/TIME	RECEIVED FOR LAB BY: (Signature) BILL McBENGE	DATE/TIME 10/14/88 18:15
METHOD OF SHIPMENT ChemWest Courier		

Laboratory Copy White — Project Office Copy Yellow — Field or Office Copy Pink

6533

CHEMWEST
ANALYTICAL LABORATORIES, INC.

March 13, 1989

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 3406

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analyses you requested: Total Petroleum Hydrocarbons, Purgeable (gasoline) - DHS Method, LUFT Field Manual; and BTEX - EPA Method 8020.

Four soil samples for Project Texaco #8; 500 Grand, Project Number 2251,081.03 were received March 3, 1989 in good condition. Results of the analyses, along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Robert T. Hart
Data Control Manager

and Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

ANALYTICAL METHODOLOGY

BTEX (Benzene, Toluene, Ethyl Benzene, and Xylenes) by Purge & Trap and GC-PID

WATER - Method 602 or 8020

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Photoionization Detector (PID). A packed column is used to separate the compounds.

SOIL - Method 8020

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

ANALYTICAL METHODOLOGY

Total Petroleum Hydrocarbons by Purge & Trap and GC-FID

WATER - DHS Method - Luft Field Manual

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Flame Ionization Detector (FID). A packed column is used to separate the compounds.

SOIL - DHS Method - Luft Field Manual

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: B-5-1
Date Extracted: 03/06/89
Date Analyzed : 03/09/89

CHEMWEST I.D.: 3406-1
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.05
Toluene	BRL	0.1
Ethyl Benzene	BRL	0.2
Total-Xylenes (1)	BRL	0.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	10

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	91%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: [signature]

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: B-5-2
Date Extracted: 03/06/89
Date Analyzed : 03/09/89

CHEMWEST I.D.: 3406-2
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.05
Toluene	BRL	0.1
Ethyl Benzene	BRL	0.2
Total-Xylenes (1)	BRL	0.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	10

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	91%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: JP

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: B-5-3
Date Extracted: 03/06/89
Date Analyzed : 03/09/89

CHEMWEST I.D.: 3406-3
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.05
Toluene	BRL	0.1
Ethyl Benzene	BRL	0.2
Total-Xylenes (1)	BRL	0.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	10

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	99%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: [signature]

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: DS-8-1
Date Extracted: 03/06/89
Date Analyzed : 03/09/89

CHEMWEST I.D.: 3406-4
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	0.28	0.05
Toluene	0.4	0.1
Ethyl Benzene	0.4	0.2
Total-Xylenes (1)	1.8	0.1
Total Petroleum Hydrocarbon (Purgeable)	35	10

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	*	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

*: High due to matrix interference.

Approved by: _____

REV2.9.88

CHEM WEST ANALYTICAL LABORATORIES INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 3406
Date Rec'd. 3/3/89 @ 1755
Compl. Date
Section Kirk Doan

CLIENT: Harding Lawson Assoc.
1355 Willow Way, Suite 104
Concord, CA 94520

Project Name Exxco #8 ; 500 Hand
Project No. 22510810 03
P.O. NO.
Contact Randy Stern
Phone (415) 687-9600

ANALYSIS: Four soil samples recd under chain of custody in 6" metal core tubes (4) to be analyzed for BTEX and TPH-Gas.

* Seven day turnaround !!! RUSH

	Sampled	Date	Analysis	Matrix	Containers
3406-1	B-5-1	3/2/89	as above	soil	1-6" tube
-2	B-5-2				
-3	B-5-3				
-4	DS-8-1				

RI
MICHELLE TOLIVER

CHEM WEST COURIER

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: CHEM WEST

Samplers: GLENN S. YOUNG

Job Number: 2251.08.03

Name/Location: TEXACO #8, 500 GRAND

Project Manager: A A KAROFF

Recorder: *(Signature Required)*

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	ICE	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED: EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb.	As	Pb
4			X					X	B	5	1					SAMPLE BEING IN GOOD CONDITION					X	X	X	X	X
4			X					X	B	5	2										X	X	X	X	X
4			X					X	B	5	3										X	X	X	X	X
4			X					X	DS	5	1										X	X	X	X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)* GARY BLASE	DATE/TIME 3-3-89 | 1240
RELINQUISHED BY: *(Signature)* GARY BLASE	RECEIVED BY: *(Signature)*	DATE/TIME 3-3-89 | 1755
RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)*	DATE/TIME
RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)*	DATE/TIME
DISPATCHED BY: *(Signature)* DATE/TIME	RECEIVED FOR LAB BY: *(Signature)* MICHELLE TOLIVER	DATE/TIME 3/3 | 1700
METHOD OF SHIPMENT: CHEM WEST COURIER		

6533

Laboratory Copy White — Project Office Copy Yellow — Field or Office Copy Pink

CHEMWEST
ANALYTICAL LABORATORIES, INC.

April 3, 1989

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 3486

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analyses you requested: Total Petroleum Hydrocarbons, Purgeable (gasoline) - DHS Method, LUFT Field Maanual; and BTEX - EPA Method 8020.

Four soil samples for Project Texaco #8, Project Number 2251,08.03 were received March 17, 1989 in good condition. Results of the analyses, along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Robert T. Hart
Data Control Manager

and Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: MW8CS-F
Date Extracted: 03/21/89
Date Analyzed : 03/22/89

CHEMWEST I.D.: 3486-1
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.05
Toluene	0.1	0.1
Ethyl Benzene	BRL	0.2
Total-Xylenes (1)	BRL	0.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	10

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	80%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: MW8CS-G
Date Extracted: Ø3/21/89
Date Analyzed : Ø3/22/89

CHEMWEST I.D.: 3486-2
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	Ø.Ø5
Toluene	BRL	Ø.1
Ethyl Benzene	BRL	Ø.2
Total-Xylenes (1)	BRL	Ø.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	1Ø

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	1Ø3%	5Ø-15Ø%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: KP

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: MW8-F
Date Extracted: Ø3/21/89
Date Analyzed : Ø3/22/89

CHEMWEST I.D.: 3486-3
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	Ø.Ø5
Toluene	BRL	Ø.1
Ethyl Benzene	BRL	Ø.2
Total-Xylenes (1)	BRL	Ø.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	1Ø

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	89%	5Ø-15Ø%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: KP

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES
AND TOTAL PETROLEUM HYDROCARBONS - PURGEABLE

Client I.D.: MW8G
Date Extracted: 03/21/89
Date Analyzed : 03/22/89

CHEMWEST I.D.: 3486-4
Matrix : Soil

Compound	Amount Detected (mg/Kg)	RL (mg/Kg)
Benzene	BRL	0.05
Toluene	BRL	0.1
Ethyl Benzene	BRL	0.2
Total-Xylenes (1)	BRL	0.1
Total Petroleum Hydrocarbon (Purgeable)	BRL	10

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	105%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: YH

REV2.9.88

CHEM WEST ANALYTICAL LABORATORIES, INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 3486
Date Rec'd. 3/17/89 @ 1705
Compl. Date
Section K. Pocan

CLIENT: Harding Lawson Assoc.
1355 Willow Way, Suite 109
Concord, CA 94520

Project Name: Texaco #8
Project No. 2251, 08.03
P.O. NO.
Contact: Brandy Stone
Phone (415) 687-9660

ANALYSIS: Four soil samples rec'd under chain of custody in 6" metal core tubes (4) to be analyzed for BTEX/TPH.

* 7-Day Turnaround !!!

	Sample Id	Date	analysis	Matrix	container
3486-1	HW8-F comp.	3/16	BTEX/TPH	Soil	1-6" tube
-2	HW8-G comp	3/18	↓	↓	↓
-3	HW8F-11.0'	3/16	↓	↓	↓
-4	HW8-G 6.0	3/16	↓	↓	↓

RI
H.A. Michelle Oliver
~~O.A.C.~~

CHEM WEST COURIER

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: Chem West

Samplers: Herb Steffe

Job Number: 2251,081.03

Name/Location: Texaco #6

Project Manager: Andrea Kerroff

Recorder: Herb Steffe
(Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES
SJ			X					M	W	8 CS-F	89	03	16		Composite
SO			X					M	W	8 CS-G					Composite
SO			X					M	W	8 F					Depth- 11-11½'
SO			X					M	W	8 G					Depth- 6-6½'
															7 day turnaround

ANALYSIS REQUESTED	EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene (E	Total Petrol. Hydrocarb. Gas
						X	X
						X	X
						X	X
						X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) Herb Steffe	RECEIVED BY: (Signature) Gary Braga GARY BRAGA	DATE/TIME 3-17-89 1400
RELINQUISHED BY: (Signature) Gary Braga GARY BRAGA	RECEIVED BY: (Signature)	DATE/TIME 3-17-89 1705
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) DATE/TIME	RECEIVED FOR LAB BY: (Signature) Michelle Shuer	DATE/TIME 3/17 1705

METHOD OF SHIPMENT CHEM WEST COURIER

Laboratory Copy White | Project Office Copy Yellow | Field or Office Copy Pink

6533

APPENDIX D

Water Analyses - Laboratory Reports

CHEMWEST
ANALYTICAL LABORATORIES, INC.

November 3, 1988

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 2509

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analysis you requested: BTEX - EPA Method 602.

Two water samples for Project Texaco #8; 500 Grand, Project Number 2251,081.03 were received October 24, 1988 in good condition. Results of the analysis, along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Jill B. Henes, Ph.D.
Vice President of Technical Services

and

Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

ANALYTICAL METHODOLOGY

BTEX (Benzene, Toluene, Ethyl Benzene, and Xylenes) by Purge & Trap and GC-PID

WATER - Method 602 or 8020

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Photoionization Detector (PID). A packed column is used to separate the compounds.

SOIL - Method 8020

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES

Client I.D.: MW-8B-1&2
Date Analyzed: 10/28/88

CHEMWEST I.D.: 2509-1
Matrix : Water

Compound	Amount Detected (ug/L)	RL (ug/L)
Benzene	BRL	0.5
Toluene	BRL	1
Ethyl Benzene	BRL	2
Total-Xylenes (1)	3.1	1

Surrogate	% Recovery	Acceptance Window
ortho-Chlorotoluene	73%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: JBH

REV2.9.88

CHEM WEST ANALYTICAL LABORATORIES, INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

2509

Order No.
Date Rec'd. 10/24/88@1825
Compl. Date
Section H. Pacan

CLIENT: Harding Lawson Assoc.
1365 Willow Way Suite 109
Concord, CA 94520

Project Name: 2251,081.03
Project No. Texaco #8; 500 Grand
P.O. NO.
Contact
Phone (415) 687-9100

ANALYSIS: Two water samples rec'd under chain of custody in 40ml VOA Vials (4) to be analyzed for BTEX.

* Seven day turnaround !!!

	Sampled	Date	Time	analysis	matrix	container
2509-1	MW-8B-1&2	10/21	1403	BTEX	water	2-40ml VOA
-2	MW-8C-1&2	"	1139	"	"	2- " "

GC
M.T. MICHELLE TOUVER

Chem Dept Courier

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: CHEM WEST.

Samplers: GLENN S. YOUNG
DAVID RAY HASE

Job Number: 2251.001.03

Name/Location: TEXACO #8, 500 GRAND

Project Manager: AA KAROOT

Recorder: _____ (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	HCL	SAMPLE NUMBER OR LAB NUMBER: Yr Wk Seq	DATE: Yr Mo Dy Time	STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED: EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene (BTX)	Total Petrol. Hydrocarb.
23	X							X	MW-8B-1	881021 1403							X	
23	X							X	MW-8B-2	1403	Air Bubble						X	
23	X							X	MW-8C-1	1109							X	
23	X							X	MW-8C-2	1139							X	

LAB NUMBER: Yr Wk Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature) Thomas S. Smith	DATE/TIME 10/24/88 1305
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME 10/24/88 1825
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) DATE/TIME	RECEIVED FOR LAB BY: (Signature) MICHELLE TOLIVER KA	DATE/TIME 10/24 1825
METHOD OF SHIPMENT: Chem West Courier		

Laboratory Copy Project Office Copy Field or Office Copy

6533

CHEMWEST
ANALYTICAL LABORATORIES, INC.

November 7, 1988

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 2562

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analysis you requested: BTEX - EPA Method 602.

One water sample for Project Texaco Assessment-Station #8, Project Number 02251,081.03 was received October 31, 1988 in good condition. Results of the analysis, along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Jill B. Henes, Ph.D.
Vice President of Technical Services

and

Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

ANALYTICAL METHODOLOGY

BTEX (Benzene, Toluene, Ethyl Benzene, and Xylenes) by Purge & Trap and GC-PID

WATER - Method 602 or 8020

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Photoionization Detector (PID). A packed column is used to separate the compounds.

SOIL - Method 8020

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

CHEM WEST ANALYTICAL LABORATORIES, INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 2562
Date Rec'd. 10/31/88@1600
Compl. Date
Section H. Pacan

CLIENT: Harding Lawson Assoc.
~~1365 Willow St~~ 11/1/88
1355 Willow Way Suite 109
Concord, CA 94520

Project Name: Texaco Assessment ~~Dst~~ #8
Project No. 02251, 081.03
P.O. NO.
Contact
Phone (415) 687-9600

ANALYSIS: One water sample rec'd under chain of custody in 40ml VOA vials (2) to be analyzed for BTEX.

* Note: Seven Day Turnaround !!!

Sample ID	Date	Time	analysis	Matrix	container
2562	MW-8A&2	10/28	1510	BTEX	water	2-40ml VOA

GC
M.T. MICHELLE TOLIVER

Chem West courier

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: Chem West

Samplers: David R. Hose
Glenn S. Young

Job Number: 02251, 081.03
Name/Location: Texaco Assessment - Station #8
Project Manager: A. Karoff
Recorder: David R. Hose (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	VOA (2)	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED: EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb.
2 3	X							X	1	W	8 A	8	8	1 0	2 8	1 5 1 0	Note that containers read: MW-8A-1 & MW-8A-2					X	

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						SAMPLES REC'D IN GOOD CONDITION M.T.

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) David R. Hose	RECEIVED BY: (Signature)	DATE/TIME 10/31/85 1315
RELINQUISHED BY: (Signature) Thomas A. Wright	RECEIVED BY: (Signature)	DATE/TIME 10/31/85 1630
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature)	DATE/TIME	RECEIVED FOR LAB BY: (Signature) Michelle Allen — DATE/TIME 10/31 1620
METHOD OF SHIPMENT	Chemwest Courier	

Laboratory Copy White — Project Office Copy Yellow — Field or Office Copy Pink

6533

CHEMWEST
ANALYTICAL LABORATORIES, INC.

November 9, 1988

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 2534

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analysis you requested: BTEX - EPA Method 602.

One water sample for Project Texaco #8; Grand, Project Number 2251,081.03 were received October 25, 1988 in good condition. Results of the analysis, along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Jill B. Henes, Ph.D.
Vice President of Technical Services

and

Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

600W North Market Boulevard • Sacramento, CA 95834 • Phone (916) 923-0840 • FAX (916) 923-1938

A Subsidiary of CompuChem Corporation

ANALYTICAL METHODOLOGY

BTEX (Benzene, Toluene, Ethyl Benzene, and Xylenes) by Purge & Trap and GC-PID

WATER - Method 602 or 8020

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Photoionization Detector (PID). A packed column is used to separate the compounds.

SOIL - Method 8020

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES

Client I.D.: MW-8E-1&2
Date Analyzed: 11/02/88

CHEMWEST I.D.: 2534
Matrix : Water

Compound	Amount Detected (ug/L)	RL (ug/L)
Benzene	1400	25
Toluene	510	50
Ethyl Benzene	2.9	100
Total-Xylenes (1)	420	50

Surrogate	% Recovery	Acceptance Window
ortho-Chlorotoluene	108%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

REV2.9.88

CHEM WEST ANALYTICAL LABORATORIES,INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 2534
Date Rec'd. 10/26/88@
Compl. Date
Section Kink. prom

CLIENT: Harding Lawson Assoc.
1355 Willow Way Suite 109
Concord, CA 94520

Project Name: 2251, 081.03
Project No. Texaco #8; Grand
P.O. NO.
Contact
Phone (415) 687-9660

ANALYSIS: One water sample rec'd under chain of custody in 40ml VOA vials (2) to be analyzed for BTEX

* Seven day turnaround !!!

Sample Id	Date	Time	analysis	matrix	container
25314 HW-8E-1&2	10/25	10:52	BTEX	water	2-40ml VOAs

GC
M.T. MICHELLE TOLIVER

Chem West Courier

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: CHEMWEST

Samplers: DAVID R. HOSE
GLENN S. YOUNG

Job Number: 2251, 08103

Name/Location: TEXACO #8, OAKLAND

Project Manager: AA IK

Recorder: _____ (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	HCL	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES
1	X							X	H	N	- 8 E - 1	88	10	25	1052	
2	X							X	H	N	- 8 E - 2	88	10	25	1052	

ANALYSIS REQUESTED	EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene (E)	Total Petrol. Hydrocarb.
						X	
						X	

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature) Dirk Knowlton	DATE/TIME 10-25-88 11:40
RELINQUISHED BY: (Signature) Dirk Knowlton	RECEIVED BY: (Signature)	DATE/TIME 10/26/88 1245
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME 10/26/88 1905
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) DATE/TIME	RECEIVED FOR LAB BY: (Signature) Michelle Miller	DATE/TIME 10/26 1905
METHOD OF SHIPMENT: ChemWest Courier		

6533

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CHEMWEST
ANALYTICAL LABORATORIES, INC.

April 20, 1989

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Attention: Mr. Randy Stone

Subject: Report of Data - Case Number 3679

Dear Mr. Stone:

The technical staff at CHEMWEST is pleased to provide our report for the analysis you requested: BTEX - EPA Method 602.

Two water samples for Project Texaco #8 Oakland, Project Number 2251,081.03 were received April 17, 1989 in good condition. Results of the analysis, along with the analytical methodology and appropriate reporting limits, are presented on the following pages.

Thank you for choosing CHEMWEST Laboratories. Should you have questions concerning this data report or the analytical methods employed, please do not hesitate to contact Toni Weeks, our Technical Service Representative, or your project manager. We hope that you will consider CHEMWEST Laboratories for your future analytical support and service requirements.

Sincerely,

Robert T. Hart
Data Control Manager

and Kirk Pocan
Project Manager

KP:bw

cc: Joel Bird, President
File

600W North Market Boulevard • Sacramento, CA 95834 • Phone (916) 923-0840 • FAX (916) 923-1938

A Subsidiary of CompuChem Corporation

ANALYTICAL METHODOLOGY

BTEX (Benzene, Toluene, Ethyl Benzene, and Xylenes) by Purge & Trap and GC-PID

WATER - Method 602 or 8020

A 5 ml sample volume, or 5 ml of a suitable dilution, is purged on a suitable purge and trap system with helium. The purged sample is analyzed on a Gas Chromatograph equipped with a Photoionization Detector (PID). A packed column is used to separate the compounds.

SOIL - Method 8020

A 10 gram, or other appropriate aliquot of soil, is weighed into a clean VOA vial. Soils received in brass core tubes are sampled by discarding 2-5 centimeters of soil from each end of the tubes (this is done to reduce the possibility of analyzing a portion of soil that has been exposed to sampling technique contamination). Equal aliquots of soil are then removed from each end of the tube and combined in the VOA vial. Soil in jars or bags is aliquoted using a similar technique, which discards exposed sample surfaces. A 10 ml, or other appropriate volume of methanol, is added to the soil and the soil is shaken with the solvent. 100 ul of the extract, or a reduced aliquot or volume of a suitable dilution, is injected into 5 ml of laboratory blank water and analyzed by the same technique used for water samples.

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES

Client I.D.: MW-8F
Date Analyzed: 04/18/89

CHEMWEST I.D.: 3679-1
Matrix : Water

Compound	Amount Detected (ug/L)	RL (ug/L)
Benzene	BRL	0.5
Toluene	BRL	1
Ethyl Benzene	BRL	2
Total-Xylenes (1)	BRL	1

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	91%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

REV2.9.88

CHEMWEST ANALYTICAL LABORATORIES
BENZENE, TOLUENE, ETHYL BENZENE, XYLENES

Client I.D.: MW-8G
Date Analyzed: 04/18/89

CHEMWEST I.D.: 3679-2
Matrix : Water

Compound	Amount Detected (ug/L)	RL (ug/L)
Benzene	BRL	0.5
Toluene	BRL	1
Ethyl Benzene	BRL	2
Total-Xylenes (1)	BRL	1

Surrogate	% Recovery	Acceptance Window
Bromofluorobenzene	92%	50-150%

BRL: Below Reporting Limit.
RL: Reporting Limit.

(1): Total of P-, M-, and O- Xylenes.

Approved by: _____

REV2.9.88

CHEM WEST ANALYTICAL LABORATORIES,INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 3679
Date Rec'd. 4/17/89 18:00
Compl. Date
Section Kirk Pocan

CLIENT: Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520

Project Name: TEXACO #8 OAKLAND
Project No. 2251,081.03
P.O. NO.
Contact Randy Stone / Andrea Karcz
Phone (415) 687-9660

ANALYSIS: Two water samples recid under chain of custody in 40ml voa vials ins duplicate (4) to be analyzed for BTEX. Seven Day Turn Around Chain of Custody does not agree. See C of C

RUSH

	SAMPLE I.D	DATE	ANALYSIS	MATRIX	CONTAINERS
3679-1	MW-8F	4/6/89	BTEX	Water	2-40ml voa vials
-2	MW-8G	"	"	"	2- " " "

GC
BMc
BILL McBENCE

CHEM WEST COURIER

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, California 94520
415/687-9660
Telecopy: 415/687-9673

CHAIN OF CUSTODY FORM

Lab: Chem West

Samplers: Herb Stoffle

Job Number: 2251.081.03

Name/Location: Texaco #8 Oakland

Project Manager: Andrea Karoff

Recorder: _____ (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	HCl	VOA's	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES	EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petroleum Hydrocarbons (TPH)
2	X							X	X	M	W	8 F	8	9	0	4	1	4						X	X
2	X							X	X	M	W	8 G												X	X

7 day Turnaround
1 - acid w/ bubbles

Date on C of C does not agree with dates on samples
Dates on samples 4/6 - C of C 4/14
BMS

ANALYSIS REQUESTED

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) Herb Stoffle	RECEIVED BY: (Signature) Gary Biase GARY BIASE	DATE/TIME 4/17/89 1510
RELINQUISHED BY: (Signature) Gary Biase GARY BIASE	RECEIVED BY: (Signature)	DATE/TIME 4/17/89 1800
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature)	DATE/TIME	RECEIVED FOR LAB BY: (Signature) Bill McBENGE	DATE/TIME 4/18/89 10:00

METHOD OF SHIPMENT: CHEM WEST COURIER

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6533

APPENDIX E

Method of Slug Test Analysis

The slug tests in monitoring wells MW-8C and MW-8E were analyzed according to the method of Hvorslev (1951). The ratio h_t/h_o is graphed on the logarithmic scale of semilogarithmic graph paper as a function of time since slug withdrawal. Here h_o is the vertical distance between the initial water level in the well immediately after slug withdrawal, and the equilibrium water level (hydraulic head) in the tested aquifer. h_t is that vertical distance at some time after slug withdrawal.

Hydraulic conductivity is calculated from

$$K = \frac{r^2 \ln (L/R)}{2 L T_o} ,$$

where r is the well casing radius, R is the well screen radius, L is the height of the portion of the well through which water enters, and T_o is the basic time lag. The value of T_o is measured directly from the water-level recovery hydrograph at $h_t/h_o = 0.37$.

DISTRIBUTION

3 copies: Texaco Refining and Marketing Inc.
100 Cutting Boulevard
Richmond, California 94804

Attention: Mr. R. R. Zielinski

AAK/RS/ly 030953P/R22

QUALITY CONTROL REVIEWER

Stephen J. Osborne
Principal Engineer