A Report Prepared for

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

QUARTERLY TECHNICAL REPORT
FOURTH QUARTER OF 1989
FORMER TEXACO STATION
2225 TELEGRAPH AVENUE
OAKLAND, CALIFORNIA

1/29/90

HLA Job No. 2251,111.03

by

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INTRODUCTION

This quarterly technical report (QTR) presents the results of site investigation and remediation activities conducted by Harding Lawson Associates (HLA) at a service station site formerly owned by Texaco Refining and Marketing Inc. The station, at 2225 Telegraph Avenue, Oakland, California (see Plate 1), is currently owned and operated by Exxon Company U.S.A. This QTR summarizes HLA's work at the site, ongoing since June 1988, and presents results of the recent quarter's work.

SITE DESCRIPTION

The site is on the southwest corner of the intersection of Telegraph and West Grand Avenues (Plate 2). The surrounding area contains commercial/retail businesses, including a Chevron service station immediately across Telegraph Avenue and a Beacon service station northeast of the site. Adjacent to the site on the south is the First Baptist Church of Oakland. There is an apartment building, currently occupied, immediately west of the site.

Surface elevation at the site is approximately 20 feet above mean sea level. The land surface slopes gently southeast, toward Lake Merritt and the Oakland/Alameda Inner Harbor, an area of tidal flats that has been filled. This area has been extensively developed, and surface water runoff is mainly controlled by the municipal storm sewer system.

Structures at the service station include a building, three fuel pump islands, one underground waste oil tank, and three underground fuel storage tanks. Leaded and unleaded gasoline are dispensed from these tanks; automotive repair services are also provided.

HYDROGEOLOGIC SETTING

The East Bay Plain has been divided into seven ground-water subareas, defined by the California Department of Water Resources (DWR) on the basis of areal differences (i.e., faults and other geologic conditions). This site lies within the Oakland Upland and Alluvial Plain subarea. Most ground water used in the East Bay Plain is for irrigation or industrial, rather than domestic, purposes. The majority of domestic water is supplied by the East Bay Municipal Utility District (EBMUD).

The ground-water reservoir is made up of the Alameda and Temescal Formations, along with the Merritt Sand; these have an aggregate thickness of more than 1,100 feet. According to maps for the area, surface materials at the site are from the Temescal Formation, an alluvial fan deposit. Approximately 1,000 feet west of the site is an outcrop of the Merritt Sand. Direction of regional ground-water flow is west-southwest, toward San Francisco Bay.

Subsurface materials at the site, down to the maximum depth explored of 20 feet, generally consist of stiff, silty clay (CL),

underlain by a dense layer of silty sand that ranges from 3 to 8 feet in thickness. According to slug test results, the hydraulic conductivity of the shallow, saturated sand aquifer beneath the site ranges from 1.2 to 5.9 feet per day (Table 1). Ground water is currently encountered at approximately 13 feet below grade (Table 2).

The tops of well casings were surveyed to a temporary datum located at the western end of the dispenser island nearest West Grand Avenue, with an assumed elevation of 100.0 feet (HLA datum, see Plate 3). Well monitoring and survey data are presented in Table 1. The estimated direction of ground-water flow is to the southwest, with a gradient of 0.005 foot per foot, as shown on the Ground-water Surface Map, Plate 4.

SUMMARY OF PREVIOUS WORK

Previous Investigation

Since May 1988, HLA has investigated soil and ground-water conditions at this site. To date, the investigation has been performed in three sequential phases, and results were presented in the following reports:

1.	Sensitive Receptor Study	May 24, 1988
2.	Subsurface Investigation	July 20, 1988
3.	Environmental Assessment	June 22, 1989
4.	Ground-water Remediation Plan	November 30, 1989

Soil-gas Survey

In September 1988, a soil-gas survey was conducted to help evaluate the lateral extent of petroleum hydrocarbons. Soil-gas probes were driven at seven locations on site and in streets near the site (Plate 3).

Soil-gas testing is conducted using a mobile van. A hollow steel probe is driven 6 to 10 feet into the ground, and a vacuum pump is attached to its above-ground end. Immediately upon extraction, soil-gas and/or water samples are analyzed with a portable gas chromatograph for concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH).

At this site, detectable concentrations of petroleum products in soil-gas samples were limited to probe locations SG-3 and SG-4 (Plate 3). Both SG-3 and SG-4 were placed along the edge of Telegraph Avenue, which lies over underground sewer and storm drain lines. The chromatography produced by analysis of the soil-gas samples resembled patterns associated with paint or varnish more than those of gasoline. Results of the soil-gas survey are summarized in Table 3.

Soil Borings

HLA explored subsurface conditions on and off site by drilling and sampling 16 soil borings between June 1988 and August 1989. Boring locations are shown on Plate 3. Because of restricted subsurface access on Telegraph and West Grand Avenues, no off-site exploration was conducted north or east of the site.

These restrictions were imposed by the City of Oakland and the Bay Area Rapid Transit (BART), whose tunnel is in this area (see Plate 2).

Borings were advanced using truck-mounted, hollow-stem auger drilling equipment. Sampling was conducted with a 2.5-inch-diameter (I.D.), Sprague and Henwood (S&H), split-barrel sampler lined with three 6-inch-long, stainless steel tubes. Drilling was performed under the direction of an HLA field geologist, who logged the borings.

Soil samples were screened in the field for volatile organic vapors. Selected samples were preserved and transported under chain-of-custody protocol to ChemWest Analytical Laboratories, Inc. (ChemWest), in Sacramento, California. They were analyzed for levels of BTEX and TPH as gasoline (see Table 4).

Water Quality Sampling

Nine of the borings were completed as monitoring wells (MW-6A through MW-6I). Within two weeks after installation, each of the monitoring wells was developed, water from these was sampled, and they were surveyed by an HLA technician. Water from all monitoring wells is resampled periodically, using the following procedures.

Each monitoring well is purged of at least three well volumes. A ground-water sample is then collected with a clean, stainless steel bailer and decanted into laboratory-prepared, 40 milliliter, volatile organic analysis (VOA) vials. The vials are

immediately sealed, labeled, and placed in a cooler with ice; transported under chain-of-custody protocol to ChemWest; and analyzed for BTEX content. Results are presented in Table 5.

Aquifer Hydraulic Testing

Hydraulic conductivity was estimated from the results of three single-well slug tests, using monitoring wells MW-6H, MW-6D, and MW-6E. A volume (slug) of water was injected into MW-6D and pumped from MW-6E and MW-6H. A pressure transducer, placed near the bottom of the wells, measured the rate of water level recovery. The output of the transducer was recorded by a data logger for subsequent analysis. The most permeable stratum adjacent to the well screen in the saturated zone was classified as hydraulically confined or unconfined by comparing the water level in the well to its stratigraphic log. Slug test results are presented in Table 1.

WORK PERFORMED DURING THE FOURTH QUARTER OF 1989

HLA performed the following activities during the fourth quarter of 1989:

1. Prepared and issued a Ground-water Remediation work plan to Texaco Refining and Marketing Inc.
2. Applied to EBMUD for a waste water discharge permit
3. Evaluated remedial options to reduce costs associated with proposed ground-water treatment system
4. Measured water levels in all monitoring wells.

Remediation Plan

A ground-water remediation plan was issued to Texaco Refining and Marketing Inc., on November 30, 1989. The plan outlined a proposal to extract ground water using three on-site recovery wells, treat the extracted water through contact with granular-activated carbon, and discharge the clean, treated water into the Oakland sanitary sewer system.

Discharge Permit

An application to discharge treated ground water to the Oakland sanitary sewer system was made to EBMUD on December 8, 1989. Review of the application is anticipated to take approximately two months.

Ground-water Levels

Water levels recorded on October 3, 1989, are presented in Table 2; these were used to prepare the Ground-Water Surface Map, Plate 4.

DISCUSSION OF RESULTS

Vadose-Zone Soil Condition

No significant concentrations of petroleum hydrocarbons have been found in vadose-zone soils. BTEX constituents and TPH in excess of 100 parts per million (ppm) have been detected exclusively in soils at 12 to 13.5 feet below the ground surface (Table 4); this depth is within the zone of fluctuation of the ground-water table.

Ground-water Conditions

No free product has been observed in any of the monitoring wells. As shown on Plate 5, hydrocarbons dissolved in the ground water are generally limited to the vicinity of the tanks and pump islands, extending southwest.

Water from five on-site wells near the tanks and pump islands contains detectable levels of TPH as gasoline. As of September 1989, the lateral limits of the plume are delineated by MW-6G, MW-6A, MW-6F, and MW-6I; samples from these wells show no detectable hydrocarbons (detection limit for TPH = <50 parts per billion [ppb]). Upgradient plume definition is incomplete because of restricted subsurface access imposed by the City of Oakland and BART.

Hydrocarbon contaminants may be migrating to the site from an upgradient source. In water from upgradient well MW-6B, combined concentrations of BTEX have increased from 7 to 298 ppb (samplings of October 20, 1988, and September 7, 1989, respectively). Water samples from every monitoring well besides MW-6B and downgradient well MW-6E have exhibited a reduction in BTEX over the same time period.

Source of Dissolved Hydrocarbons

Our results to date suggest that gasoline handling operations on site have produced the BTEX components found in ground water both on and off site. Tank system integrity testing in 1988 showed that the fuel storage and dispensing systems were tight. A spill containment system, with filters and flushing

mechanisms, is currently in place. It is therefore likely that the fuel hydrocarbons encountered have resulted either from surface spillage, overfilling during product delivery prior to installation of the spill containment system, or line or tank leakage that occurred before the current storage and dispensing systems were installed.

Remedial Options

Several remedial options are being investigated to minimize costs associated with the proposed water treatment system. The current proposal uses activated carbon as the primary treatment system; it may be cost-effective to install a biological reactor upstream of the carbon treatment system to minimize carbon utilization. Evaluation of catalytic oxidation and air stripping indicates that capital cost associated with those systems will exceed the cost of regenerating activated carbon.

LIST OF TABLES

LIST OF ILLUSTRATIONS

Table 1. Slug Test Results

Well Number	Most Permeable Stratum Adjacent to Well Screen			
	Lithology	Classification	Thickness (feet)	Estimated Hydraulic Conductivity (feet/day)
MW-6D	sand	confined	2	5.9
MW-6E	sand, fine-grained	confined	2.5	1.2
MW-6H	sand, medium-grained	unconfined	6	4.8

Table 2. Well Monitoring and Survey Data

Well No.	Top of Casing Elevation* (feet)	Depth to Ground Water** (feet)	Ground-Water Surface Elevation+ (feet)
MW-6A	98.99	13.77	85.22
MW-6B	98.81	13.01	85.80
MW-6C	99.89	14.41	85.48
MW-6D	98.78	13.53	85.25
MW-6E	98.99	13.84	85.15
MW-6F	99.91	14.73	85.18
MW-6G	99.16	12.39	86.77
MW-6H	97.93	12.39	85.54
MW-6I	97.60	12.82	84.78

Notes:

* Elevation relative to HLA temporary benchmark located at the western end of the dispenser island nearest West Grand Avenue, with an arbitrary elevation of 100.0 feet (see Plate 3).

** Depth to ground water on October 3, 1989.

\+ Ground-water surface elevation = top of casing elevation - depth to water.

Table 3. Results of Soil-gas Survey
Conducted on September 19, 1988

Concentrations in micrograms per liter (μg/L)

Sample	Depth (feet)	Benzene	Ethyl-benzene	Toluene	Xylenes	Total Petroleum Hydrocarbons
Air	N/A	<0.7	<0.8	<0.8	<0.8	<0.7
SG-01	--	--	--	--	--	--
SG-02	5.0	<0.7	<0.8	<0.8	<0.8	<0.7
SG-03	12.0	10	4	<0.8	2,800	6,100
SG-04	13.0	<0.7	<0.8	<0.8	140	780
WS-05*	12.0	<75	<76	<77	<77	<75
SG-06	13.0	<0.7	<0.8	<0.8	<0.8	<0.7
SG-07	--	--	--	--	--	--
Air	N/A	<0.7	<0.8	<0.8	<0.8	<0.7

-- - Not able to obtain sample
N/A - Not applicable
Air - Ambient air sample
* - WS-05 was a sample of ground water

Table 4. Results of Soil Chemical Analyses
Concentrations in milligrams per kilogram (mg/kg)

Sample Number	Depth (feet)	Benzene [1]	Ethyl-benzene [2]	Toluene [3]	Xylenes [3]	TPH as Gasoline [4]
B-1	8.0	0.05	ND	ND	ND	ND
B-1	13.0	ND (5)	10 (10)	16 (10)	41 (10)	2,000 (1,000)
B-2	7.0	ND	ND	ND	ND	ND
B-2	13.5	ND	ND	ND	ND	ND
B-3	7.0	0.06	ND	ND	ND	ND
B-3	13.5	40 (25)	84 (50)	390 (50)	370 (50)	11,000 (5,000)
B-4	13.5	ND	ND	ND	ND	ND
B-5	5.5	ND	ND	ND	ND	ND
B-5	9.5	ND	ND	ND	ND	ND
B-5	12.5	ND	ND	ND	ND	ND
B-6	6.0	ND	ND	ND	ND	ND
B-6	9.5	ND	ND	ND	ND	ND
B-6	12.0	40 (5)	40 (20)	110 (10)	450 (10)	3,000 (1,000)
B-7	6.0	0.64	0.4	0.9	3.4	24
B-7	9.5	0.5	ND	0.7	1.0	ND
B-7	12.0	20 (5)	20 (20)	72 (10)	190 (10)	1,400 (1,000)
MW-6E	13.0	ND	ND	ND	ND	ND
MW-6F	13.0	ND	ND	ND	ND	ND
MW-6G	13.5	ND	ND	ND	ND	5.2
MW-6H	13.5	11 (0.5)	8.8 (2)	3.2 (1)	19 (1)	1,000 (495)
MW-6I	13.5	ND	ND	ND	ND	ND

ND = Not detected.

1 Detection limit 0.05 mg/kg except as noted in parentheses.
2 Detection limit 0.2 mg/kg except as noted in parentheses.
3 Detection limit 0.1 mg/kg except as noted in parentheses.
4 Detection limit 10 mg/kg except as noted in parentheses.

Table 5. Results of Ground-water Chemical Analyses
Concentrations in micrograms per liter (µg/L)

EPA TEST METHOD 602

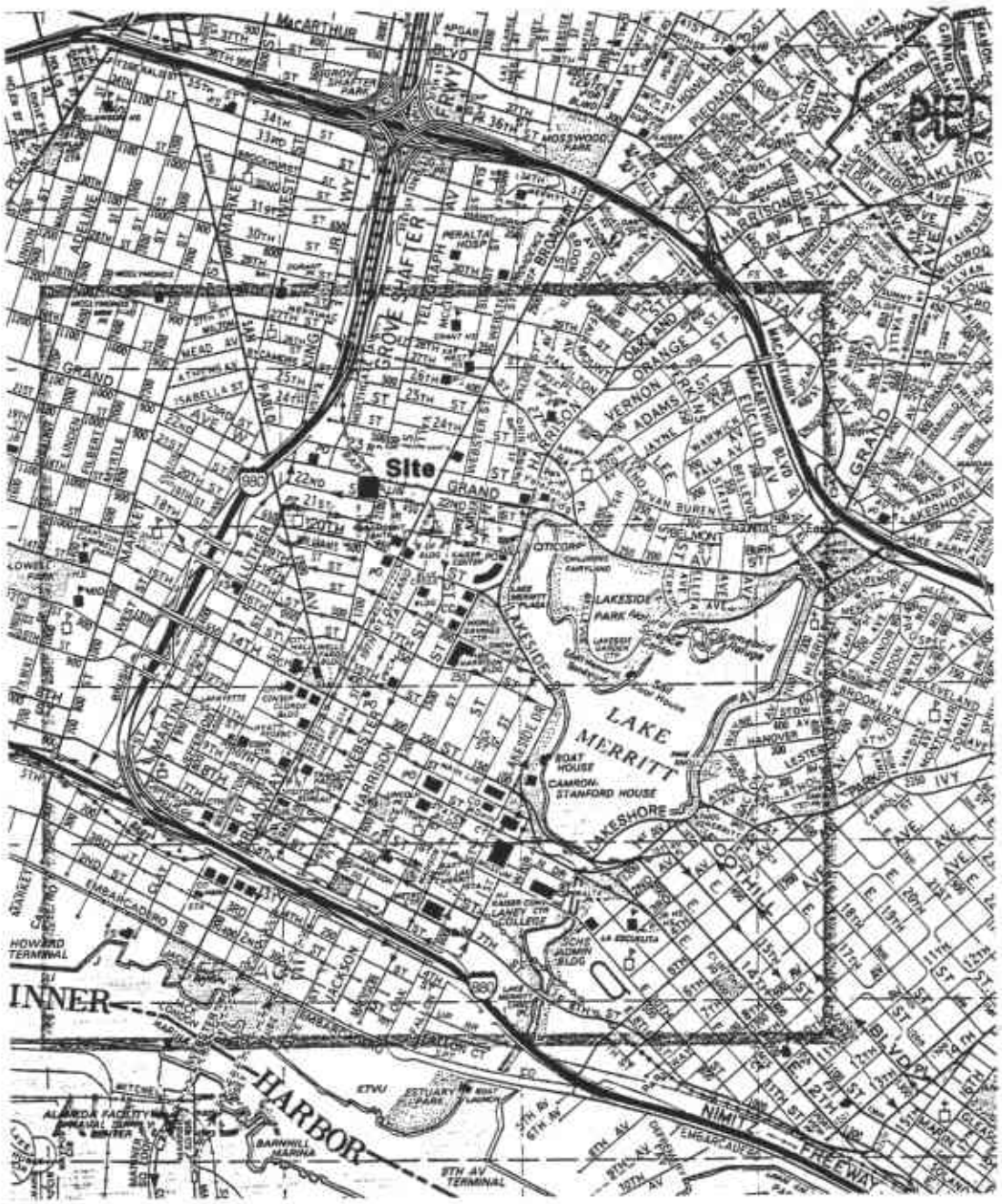
Well Number	Date Sampled	Benzene[1]	Ethylbenzene[2]	Toluene[3]	Xylenes[3]	TPH[4] (as gasoline)
MW-6A	06/24/88	ND	ND	ND	ND	-
MW-6A	10/20/88	1	ND	ND	ND	
MW-6A	09/07/89	2	ND	ND	ND	ND
MW-6B	06/24/88	ND	ND	ND	5	-
MW-6B	10/20/88	4	ND	3	ND	-
MW-6B	09/07/89	70 (2.5)	60 (3)	8 (3)	160 (4)	2,700 (25)
MW-6C	06/24/88	7,400	170	7	2,300	-
MW-6C	10/20/88	9,500 (50)	170 (2)	65 (100)	850 (1)	-
MW-6C	09/07/89	7,900 (25)	350 (25)	430 (25)	1,100 (38)	18,000 (2,500)
MW-6D	07/11/88	220 (5)	ND (20)	27 (10)	ND (10)	-
MW-6D	10/20/88	710 (5)	22 (20)	74 (10)	110 (10)	-
MW-6D	09/07/89	600 (12.5)	58 (13)	26 (13)	31 (19)	2,200 (1,250)
MW-6E	10/20/88	1	ND	ND	3	
MW-6E	09/07/89	3	ND	ND	ND	220
MW-6F	10/25/88	ND	ND	ND	2	
MW-6F	09/07/89	ND	ND	ND	ND	ND
MW-6G	12/07/88	ND	ND	ND	ND	-
MW-6G	09/07/89	ND	ND	ND	ND	ND
MW-6H	12/07/88	1,200 (25)	110 (20)	320 (10)	220 (10)	-
MW-6H	09/07/89	480 (10)	16 (10)	ND (10)	ND (15)	660 (500)
MW-6I	12/07/88	ND	ND	ND	ND	-
MW-6I	09/07/89	ND	ND	ND	ND	ND

ND = Not detected.

Detection limits given in parentheses, where applicable. If not:

1. Detection limit = 0.5
2. Detection limit = 2
3. Detection limit = 1
4. Detection limit = 50

105849



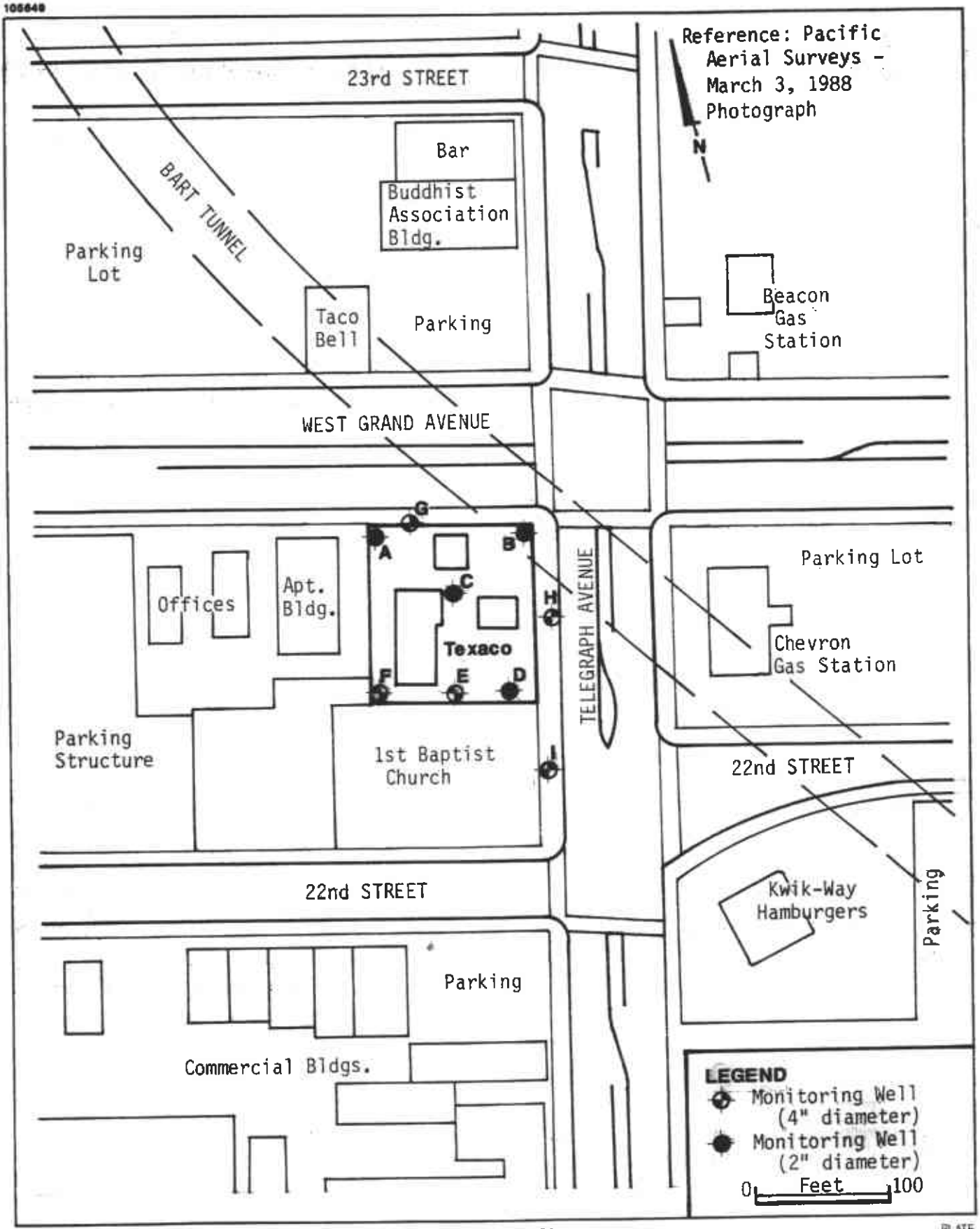
Harding Lawson Associates
Engineers and Geoscientists

Site Location Map
Former Texaco Service Station
2225 Telegraph Avenue
Oakland, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,111.03		2/89		

105648



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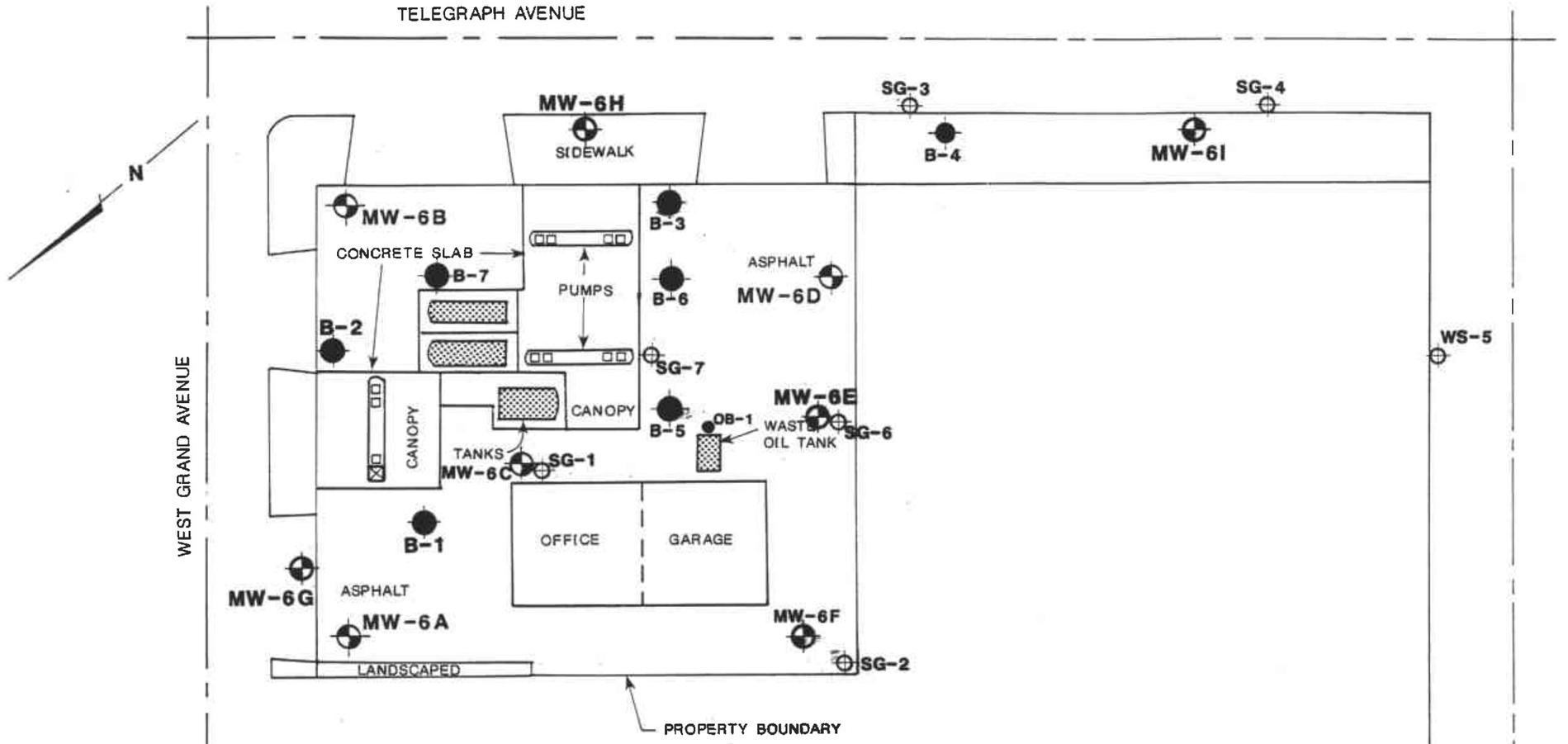
Vicinity Plan
Former Texaco Service Station
2225 Telegraph Avenue
Oakland, California

PLATE **2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,111.03		12/88		



EXPLANATION

MW-6A — Monitoring Well Location and Number

OB-1 — Observation Well Location and Number

B-2 — Boring Locations

SG-1 — Soil-Gas Probe Location

30 60

SCALE IN FEET

⊠ Bench Mark (HLA Datum El. = 100 feet)

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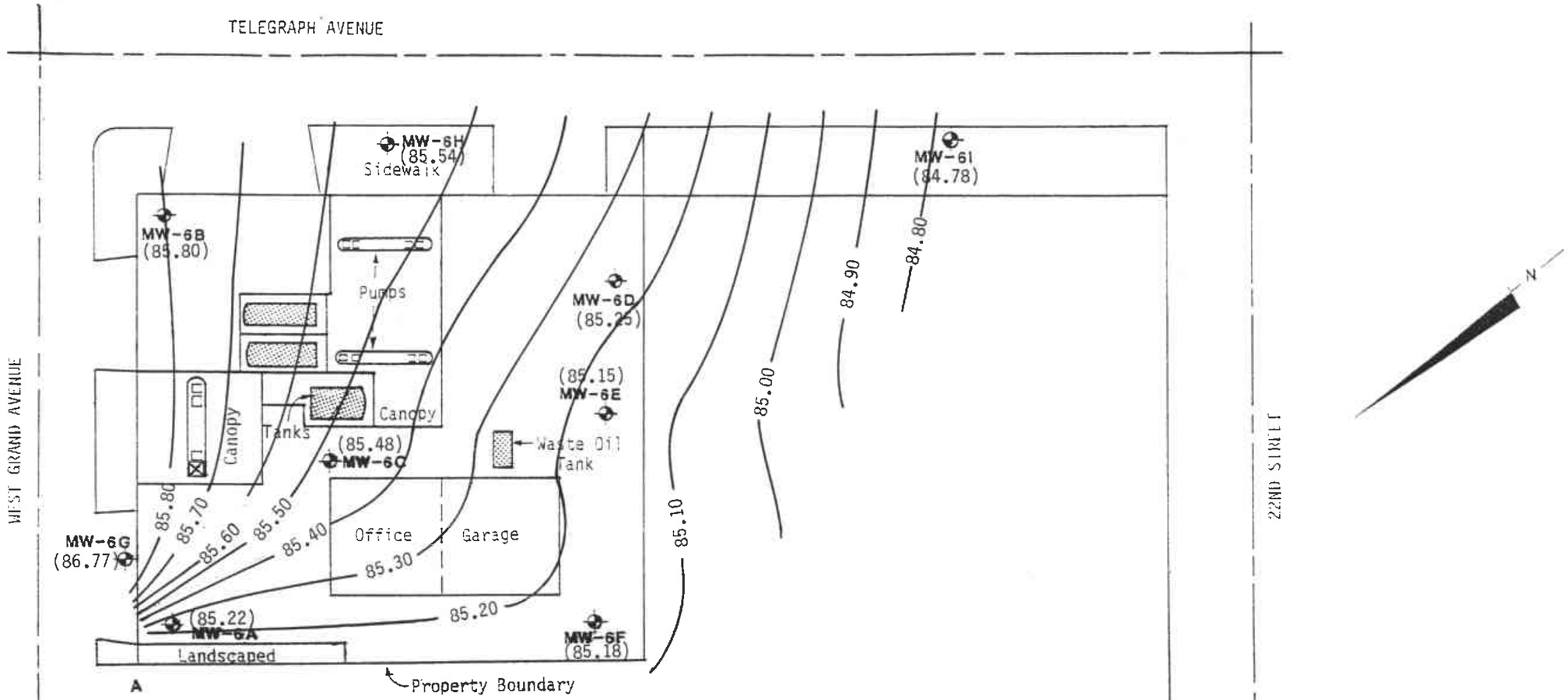
Site Plan
Former Texaco Service Station
2225 Telegraph Avenue
Oakland, California

PLATE 3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,111.03		2/89		



LEGEND

MW-6J (85.69) — Monitoring Well Location and Ground-water Surface Elevation on October 4, 1989

Bench Mark (HLA Datum El.= 100 feet)

0 30 60

SCALE IN FEET

109463

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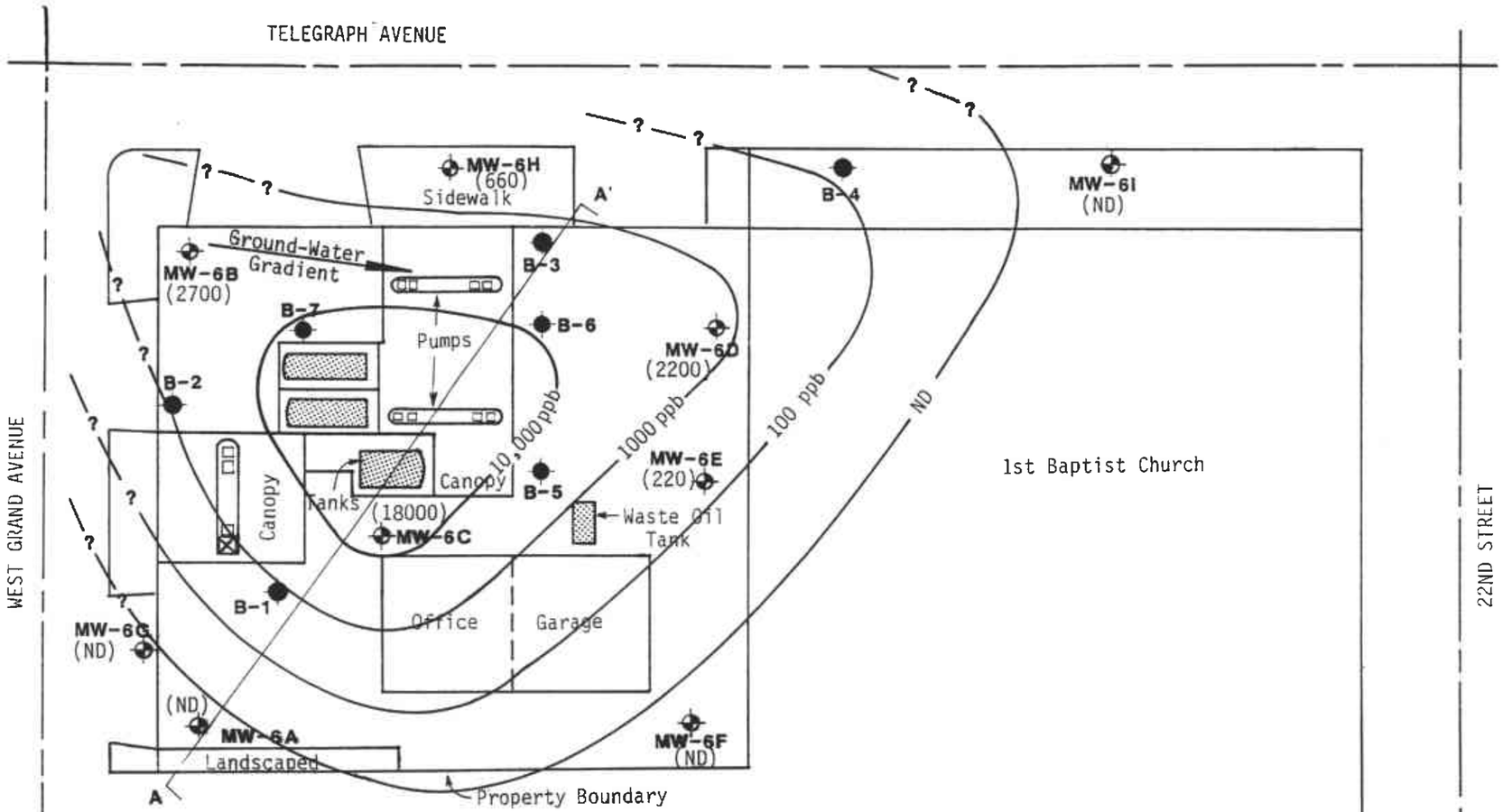
Ground-Water Surface Map
Former Texaco Service Station
2225 Telegraph Avenue
Oakland, California

PLATE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
KH	2251,111.03		9/89		



Explanation

B-1 ● Boring Location

MW-6J ⊕ Monitoring Well Location

⊠ Bench Mark (HLA Datum El.= 100 feet)

(2700) Total Petroleum Hydrocarbon (TPH) Concentration on September 7, 1989

——— Contour of Constant TPH Concentration

ND = Not Detectable (<50 ppb)

0 30 60

SCALE IN FEET

109463

HLA Harding Lawson Associates Engineers and Geoscientists	**Distribution of Hydrocarbons in Ground Water** Former Texaco Service Station 2225 Telegraph Avenue Oakland, California				PLATE **5**
DRAWN KH	JOB NUMBER 2251,111.03	APPROVED	DATE 9/89	REVISED	DATE

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