A Report Prepared for

City of Oakland
Redevelopment Agency
One City Hall Plaza
Oakland, California 94612

WORK PLAN
GASOLINE LEAK INVESTIGATION
CHINATOWN REDEVELOPMENT PROJECT AREA
OAKLAND, CALIFORNIA

HLA Job No. 9382,011.01

11th & Webster

by

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I INTRODUCTION

This document presents the work plan developed by Harding Lawson Associates (HLA) to address soil and ground-water contamination associated with leakage from underground fuel storage tanks at 11th and Webster streets in the Chinatown Redevelopment Project Area of Oakland, California (Plate 1). The purpose of this work plan is to summarize the results of previous investigations, present an interim soil remediation program for source control, and propose an additional ground-water investigation to aid in evaluating the magnitude of ground-water contamination at the site.

II PREVIOUS INVESTIGATIONS

Four underground storage tanks were located under the sidewalk along the northeastern edge of a now-vacant lot bounded by 11th, 10th, Webster and Franklin streets (Plate 2). The lot is part of the Chinatown Redevelopment Project Area, and a portion of it is slated for construction of an underground parking facility and high-rise office complex. Construction is scheduled to begin in late 1987 or early 1988.

The four underground storage tanks were removed in April 1987. During tank removal, HLA collected soil samples and observed the excavation activities. Concentrations of total petroleum hydrocarbons (TPH) measured in soil samples collected below the tanks ranged from 3,200 to 11,000 parts per million (ppm). On the basis of our observations and test results, HLA concluded that significant leakage or spillage of hydrocarbons into the surrounding soils had occurred and recommended that a ground-water monitoring well be installed to evaluate the

impact of the leakage on water quality and that a test boring be drilled in the tank excavation to evaluate the vertical distribution of hydrocarbons.

The second phase of the site investigation was conducted in late May 1987. Two test borings were drilled and sampled. Boring 1, located south of the former tank location, was completed as a ground-water monitoring well (MW-1). Boring 2 (B-2), drilled to ground water, was located within the tank excavation area. The locations of Boring B-2 and Monitoring Well MW-1 are shown on Plate 2. Soil samples were collected from both borings to evaluate the vertical extent of soil contamination. One ground-water sample was collected from MW-1 and analyzed for TPH, for benzene, toluene, and xylenes (BTX), and for organohalides using EPA Test Method 601. The analytical results from these samples and data from a later investigation are shown in Tables 1 and 2. Elevated concentrations of TPH and BTX were detected in the ground water sample and in the soil samples from Boring B-2. From these results, HLA again concluded that significant leakage had occurred from one or more of the former tanks at this site. We recommended that a Leak Report be filed with the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB), and that further ground-water investigations be conducted.

Test borings drilled by HLA and others show that geologic conditions at this site are conducive to contaminant migration. Logs for MW-1, B-2, and other borings (Appendix A) show that the upper unit comprises approximately 40 feet of medium to poorly-sorted sand with a small percentage of fines. A locally continuous clay unit is found approximately 40 feet below the ground surface. Depth to ground water is 22 to 24 feet and the hydraulic gradient is unknown but assumed to be toward the south.

The third phase of the site investigation was initiated in August 1987. The goal of this phase was to confirm the ground-water data collected in the previous investigation, to prepare a preliminary assessment of the extent of hydrocarbon migration, and to begin an evaluation of technologies suitable for source control. During this phase, HLA resampled MW-1, conducted soil gas mapping as a reconnaissance tool for ground-water plume identification, and drilled six additional soil borings near the former tank site.

Analytical data from the resampling of MW-1 (Table 2) confirmed the high BTX and TPH concentrations, but GC/MS analysis ruled out contamination by other volatile organic compounds. The most significant levels are those for benzene which ranged from 4,900 parts per billion (ppb) in the sample collected in May to 11,000 ppb in the August sample.

The use of soil gas mapping for plume identification was inconclusive at this site. Therefore, six additional borings, B-3 through B-8, were drilled near the former tank location to evaluate soil and ground-water contamination. The locations of these borings and the soil gas probes are shown on Plate 2. Boring logs are included in Appendix A. Soil samples from near the water table and a ground-water sample were collected from each soil boring and analyzed for BTX and TPH. Analytical results are presented in Tables 1 and 2. The water samples were taken from within the hollow-stem auger to field screen ground water conditions. Results of these analyses can only be used for order of magnitude estimates of chemical concentrations present. The TPH and BTX levels analyzed in the resampling of MW-1 and for water samples taken from Borings B-3 through B-8 are shown on Plate 3. As shown on this plate, the highest levels of ground-water contamination are found near the former tank location and in the assumed

downgradient direction near Boring B-6. However, benzene concentrations exceeding the RWQCB action level of 0.7 ppb were found at the furthest boring, B-8.

As a result of the data developed in this phase of the investigation, HLA recommended that additional ground-water monitoring wells be installed to assess hydrogeologic conditions at the site, and that monitoring and sampling be conducted to further evaluate the vertical and horizontal extent of contamination. In addition, HLA recommended that an interim soil remediation program be initiated as a source control measure. Boring T-1, shown on Plate 2, was drilled to assess the feasibility of using large-diameter augers to excavate contaminated soil in and around the former tank location. The proposed ground-water investigation and the interim soil remediation program are outlined in the following sections.

III PROPOSED INTERIM SOIL REMEDIATION PROGRAM

The interim remedial measure for soil contamination proposed for this site is based on the "Guidelines for Addressing Fuel Leaks" issued by the RWQCB. Soil that contains TPH at concentrations greater than 1,000 ppm will be excavated and aerated on site. HLA investigations to date have identified approximately 600 cubic yards of soil that should be removed and aerated. An additional 800 cubic yards of "clean" soil above the contaminated soil will also have to be removed during the excavation. The area of soil removal, approximately 1,100 square feet, is shown on Plate 4. Soil will be excavated to a minimum depth of approximately 25 feet and possibly to 30 feet depending on field conditions. Prior to implementing this program, a permit from the Bay Area Air Quality Management District (BAAQMD) will be obtained and the Alameda County

Department of Health Services will be informed of the work to be performed at the site. All soil removed from the excavation will be placed on Visqueen, bermed to prevent runoff, covered with plastic, and enclosed behind a locked chain-link fence. A detailed outline of the soil remediation program is provided in Appendix B.

IV PROPOSED GROUND-WATER INVESTIGATION

To aid in defining the extent of ground-water contamination at this site, HLA proposes to install four additional ground-water monitoring wells (MW-2 through MW-5). The locations selected for these wells (Plate 5) will be partially compatible with the proposed building construction; only two of the five monitoring wells would be destroyed during construction activities. As shown on Plate 5, MW-2 is projected as an upgradient well, MW-3 and MW-4 would attempt to define the gradient at the site and provide lateral plume definition, and MW-5 would provide information on the downgradient extent of contaminant migration.

The four new wells will be constructed of 4-inch diameter Schedule 40 PVC with complete screening of the saturated thickness of the aquifer. The well screen will extend a minimum two feet above the top of the water table. Screen slot size will be selected on the basis of grain size analysis of aquifer material. The wells will be installed using hollow-stem augers and all borings will be logged by an HLA geologist or engineer. A soil sample will be collected at the water table in each new boring and analyzed for TPH and BTX.

Upon completion of well installation and development, the wells will be surveyed and water levels measured so the hydraulic gradient may be calculated. Each of the five wells will be sampled twice to provide confirmation of results; the

interval between sampling rounds will be one week. Standard sampling protocols will be followed. Samples will be analyzed for TPH calibrated to gasoline and BTX using EPA Test Method 602. Additional water samples from MW-1, MW-2, and one other downgradient well will be tested for lead. These metals tests will aid in evaluating if concentrations of lead from stored fuel products are present that could be a potential risk to human health or the environment. Quality control samples including blanks and duplicates will also be collected to aid in data validation.

The estimated hydraulic conductivity for the uppermost aquifer, based on an examination of boring logs and literature on the geology of the area, ranges from 1 to 10^{-3} centimeters per second (cm/sec). Projected well yields from an aquifer test at this site indicate that an unmanageable amount of contaminated ground water would need to be stored for future treatment. Therefore, a series of slug tests will be conducted to provide order of magnitude estimates of hydraulic parameters. Constant head and falling head tests will be conducted for Wells MW-3, MW-4, and MW-5. Data collected from several tests rather than only one or two should provide adequate information for estimating hydraulic parameters related to contaminant transport and potential remedial measures for this site.

V SCHEDULE

HLA proposes that the above activities be initiated as soon as possible. If excavation for the interim soil remediation program is initiated within two weeks, remediation should be completed by the time the development construction begins in early 1988. The ground-water investigation should be initiated within the same

time frame since redevelopment construction would destroy the existing monitoring well. Additionally, the hydraulic data collected in this investigation can aid in the design of an interim ground-water remediation program that could be combined with future construction activities.

Upon completion of the tasks outlined in this work plan, a report will be produced. This report will include a summary of the field programs, all data including boring logs, well completion diagrams, and analytical results, the interpretation of these data and recommendations. This report will be submitted to the City of Oakland within 60 days of notice to proceed. A summary of the implemented interim soil remediation program and all appurtenant data will be submitted in a separate report at the completion of the aeration.

TABLES

Table 1. Laboratory Results of Chemical Analyses of Soil Samples[1]

Boring No.	Sample Depth (feet)	Date Sampled	Total Petroleum Hydrocarbons (as gasoline)	Benzene	Ethyl-Benzene	Toluene	Xylenes
B1	20.0 - 20.5	5/26/87	430	12	NA[2]	ND[3]	ND
B2	15.0 - 15.5	5/26/87	3,700,000	9,800	NA	22,000	74,000
B2	20.0 - 20.5	5/26/87	2,400,000	1,600	NA	5,500	42,000
B2	25.0 - 25.5	5/26/87	16,000,000	48,000	NA	110,000	190,000
B3	15.5 - 16.0	10/9/87	ND	0.5	ND	0.6	ND
B3	20.5 - 21.0	10/9/87	ND	0.5	ND	ND	ND
B3	25.5 - 26.0	10/9/87	2,000,000	5,800	14,600	13,400	50,000
B3	30.0 - 30.5	10/9/87	2,500,000	14,000	21,000	10,000	47,100
B3	35.5 - 36.0	10/9/87	31,000	350	350	450	850
B4	15.5 - 16.0	10/9/87	ND	ND	ND	ND	ND
B4	20.5 - 21.0	10/9/87	ND	ND	ND	3.0	ND
B4	25.5 - 26.0	10/9/87	120.0	11.7	1.0	ND	24.3
B4	30.0 - 30.5	10/9/87	1,400.0	740.0	556.0	61.8	606.0
B4	35.5 - 36.0	10/9/87	860.0	525.0	29.5	14.0	198.0
B5	20.5 - 21.0	10/9/87	ND	ND	ND	0.5	ND
B5	25.5 - 26.0	10/9/87	2,800,000	8,300	28,000	10,000	197,000
B5	30.0 - 30.5	10/9/87	29,000	21	270	100	880
B5	35.5 - 36.0	10/9/87	470,000	13,047	1,232	492	6,594
B6	21.0 - 21.5	10/8/87	ND	ND	ND	ND	ND
B6	30.0 - 30.5	10/8/87	870,000	4,800	5,600	6,000	24,900
B7	25.5 - 26.0	10/8/87	1,100	4.9	1.9	0.7	3.4
B8	20.5 - 21.0	10/8/87	ND	ND	ND	ND	ND
B8	35.5 - 36.0	10/8/87	330.0	1.4	1.0	18.7	4.5

1 Concentrations in parts per billion
2 Not analyzed
3 Not detected

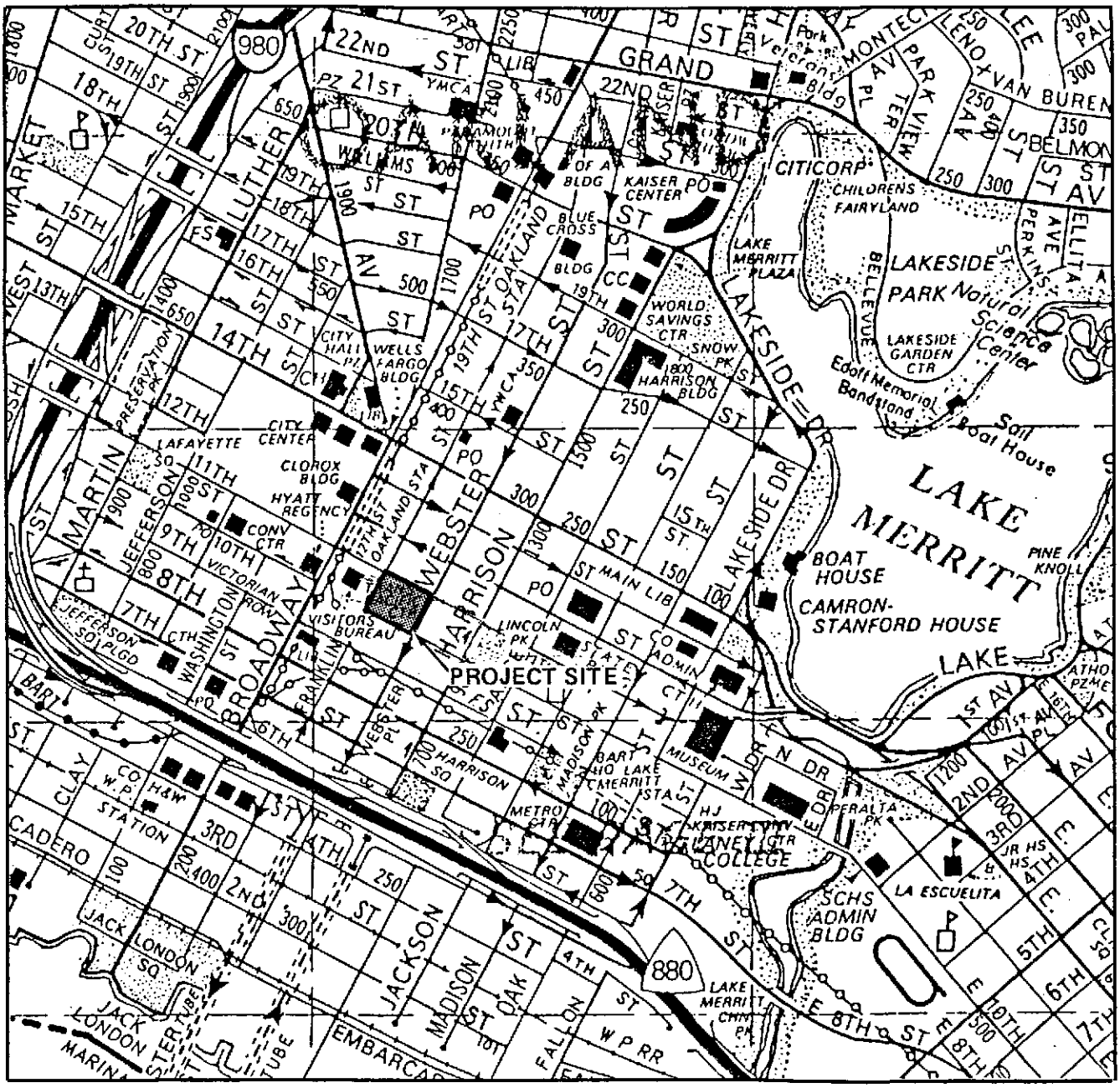
Table 2. Laboratory Results of Chemical Analyses of Ground-Water Samples[1]

Boring No.	Date Sampled	Total Petroleum Hydrocarbons (as gasoline)	Benzene	Ethyl-Benzene	Toluene	Xylenes	Other Purgeable Priority Pollutants
MW-1	5/28/87	66,000	4,900	ND[2]	6,800	6,100	--[3]
MW-1	8/28/87	72,000	11,000	ND	6,100	6,000	ND
B3	10/9/87	77,100	9,725	1,350	5,375	6,050	NA[4]
B4	10/9/87	28,500	6,935	580	188	663	NA
B5	10/9/87	57,800	3,465	1,315	2,655	4,480	NA
B6	10/8/87	138,040	11,025	1,675	6,275	12,150	NA
B7	10/8/87	29,440	3,365	418	108	623	NA
B8	10/8/87	3,900	34.5	35.0	41.5	219	NA

1 Concentrations in parts per billion
2 Not detected
3 Detectable concentrations were found for chlorobenzene, 1,2-Dichloroethane, 1,2-Dichloropropane ethylene dibromide, trichloroethene, and 1,1,2-trichloroethane.
4 Not analyzed

ILLUSTRATIONS

105649

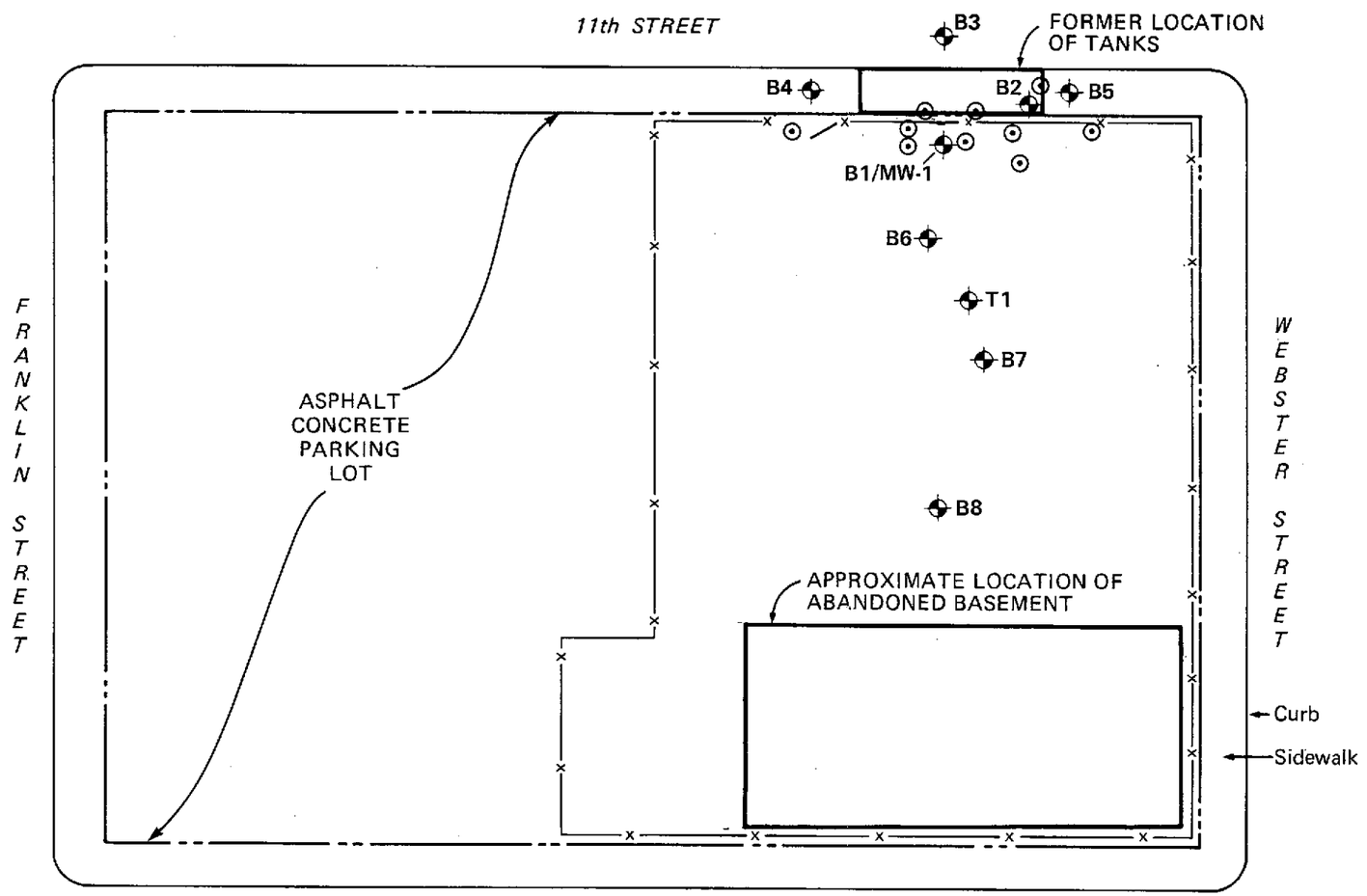


Harding Lawson Associates
Engineers and Geoscientists

Site Location Map
Oakland Chinatown
Oakland, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CSN	9382,008.01		11/87		



EXPLANATION

- Boring or Monitoring Well Location
- Soil Gas Probe Location
- x——x Fence
- ——— Property Line

N

0 40 80

SCALE IN FEET

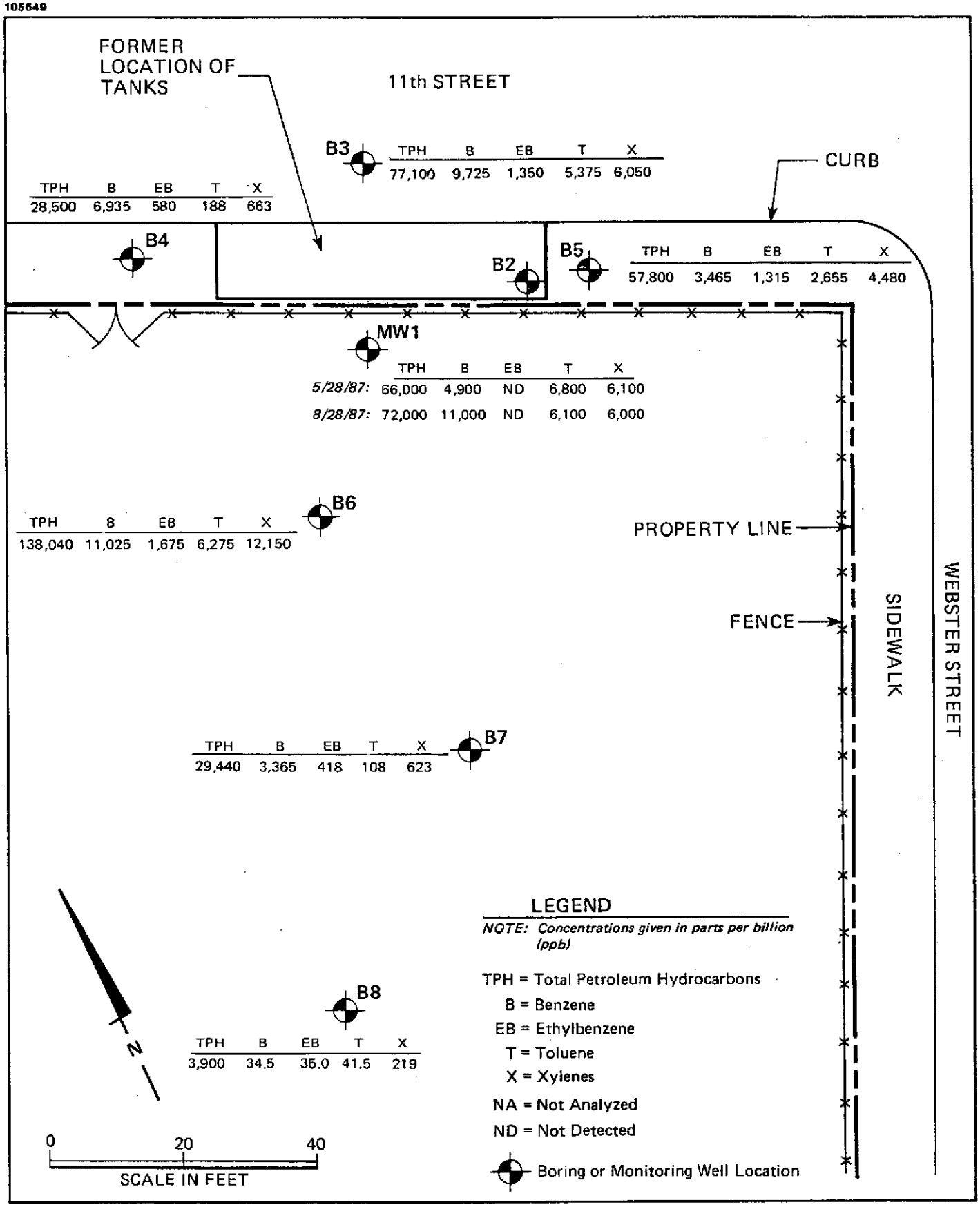
Harding Lawson Associates
Engineers, Geologists & Geophysicists

Site Plan, Previous Investigations
Oakland Chinatown Tanks
Oakland, California

PLATE **2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CSN	9382,008.01		11/87		

105649



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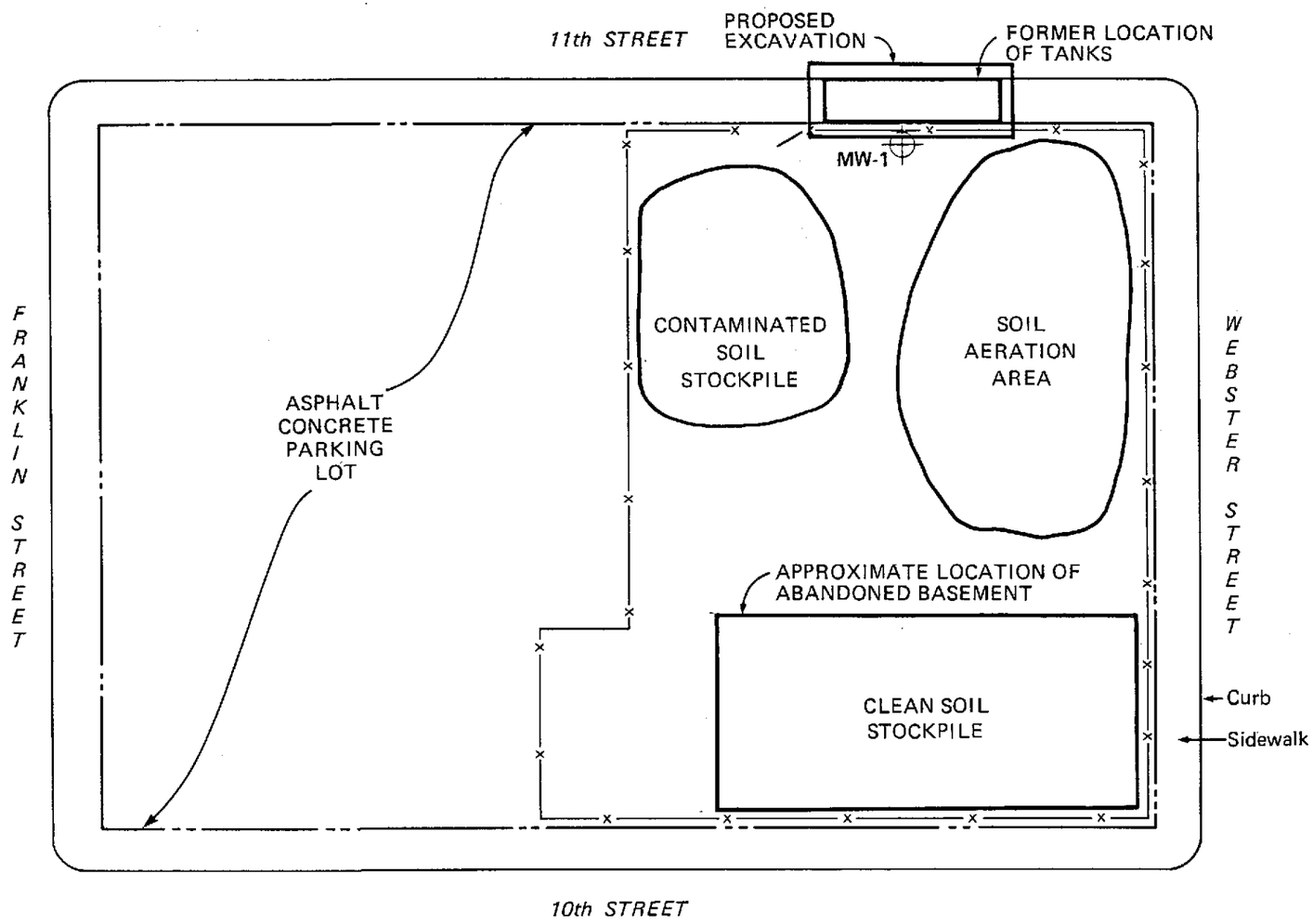
Groundwater Chemistry Distribution Map
Oakland Chinatown Tanks
Oakland, California

PLATE **3**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		



EXPLANATION

- Existing Monitoring Well Location
- Fence
- Property Line

N

0 40 80

SCALE IN FEET

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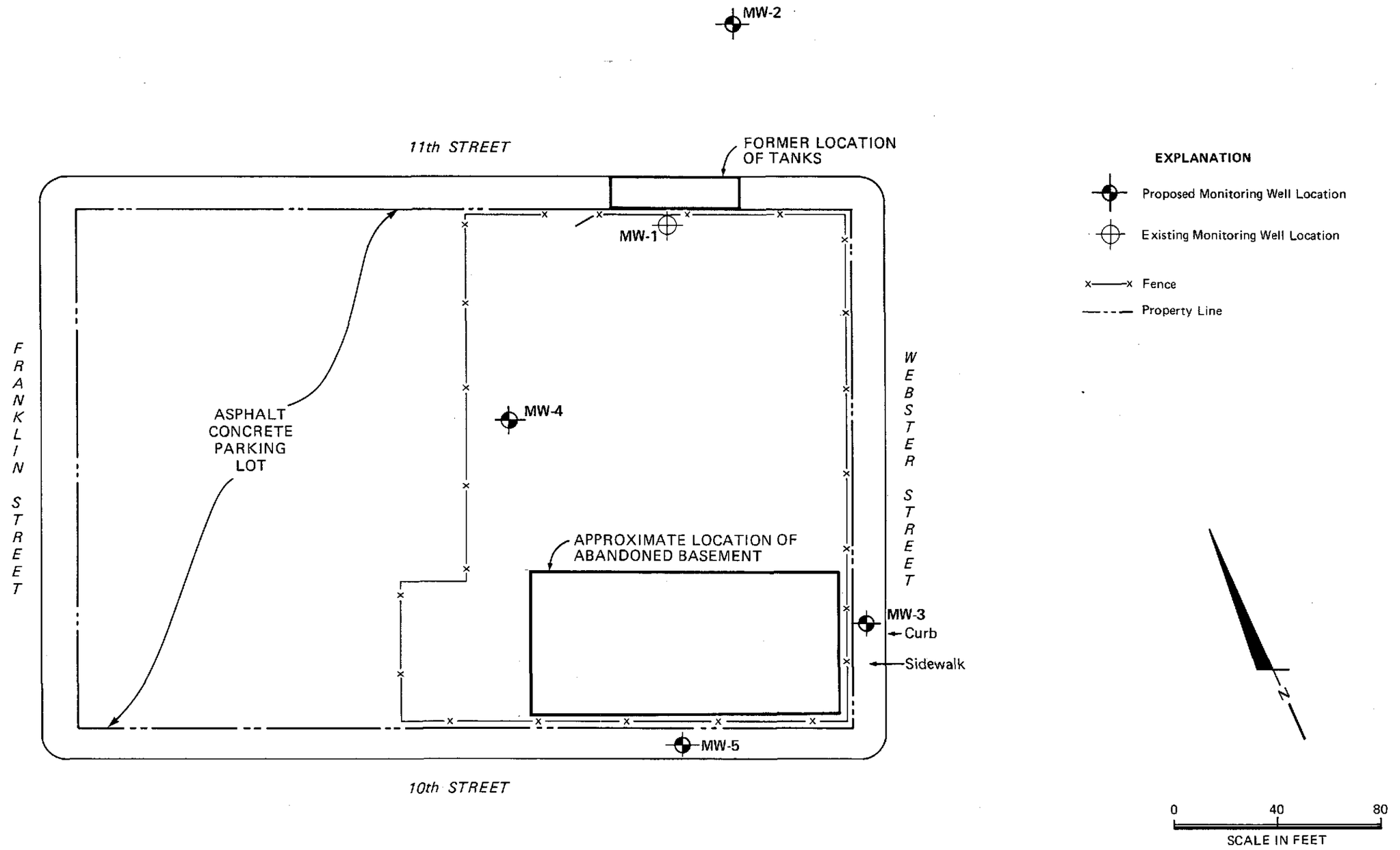
Site Plan, Interim Soil Remediation Program
Oakland Chinatown
Oakland, California

PLATE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CSN	9382,008.01		11/87		



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Site Plan - Groundwater Investigation
Oakland Chinatown Tanks
Oakland, California

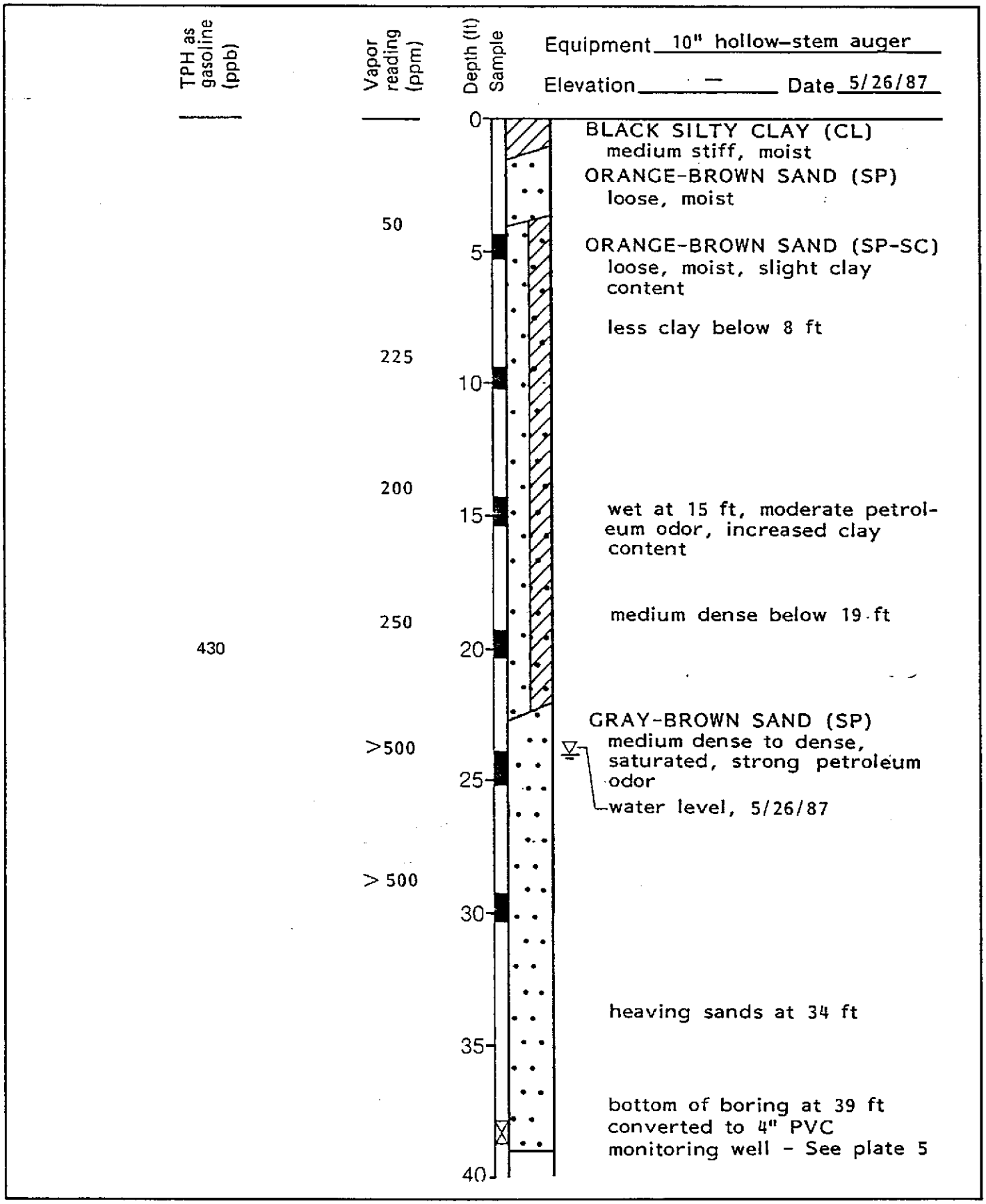
PLATE **5**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CSN	9382,008.01		11/87		

Appendix A

BORING LOGS AND WELL COMPLETION DIAGRAM FROM PREVIOUS INVESTIGATIONS

105649



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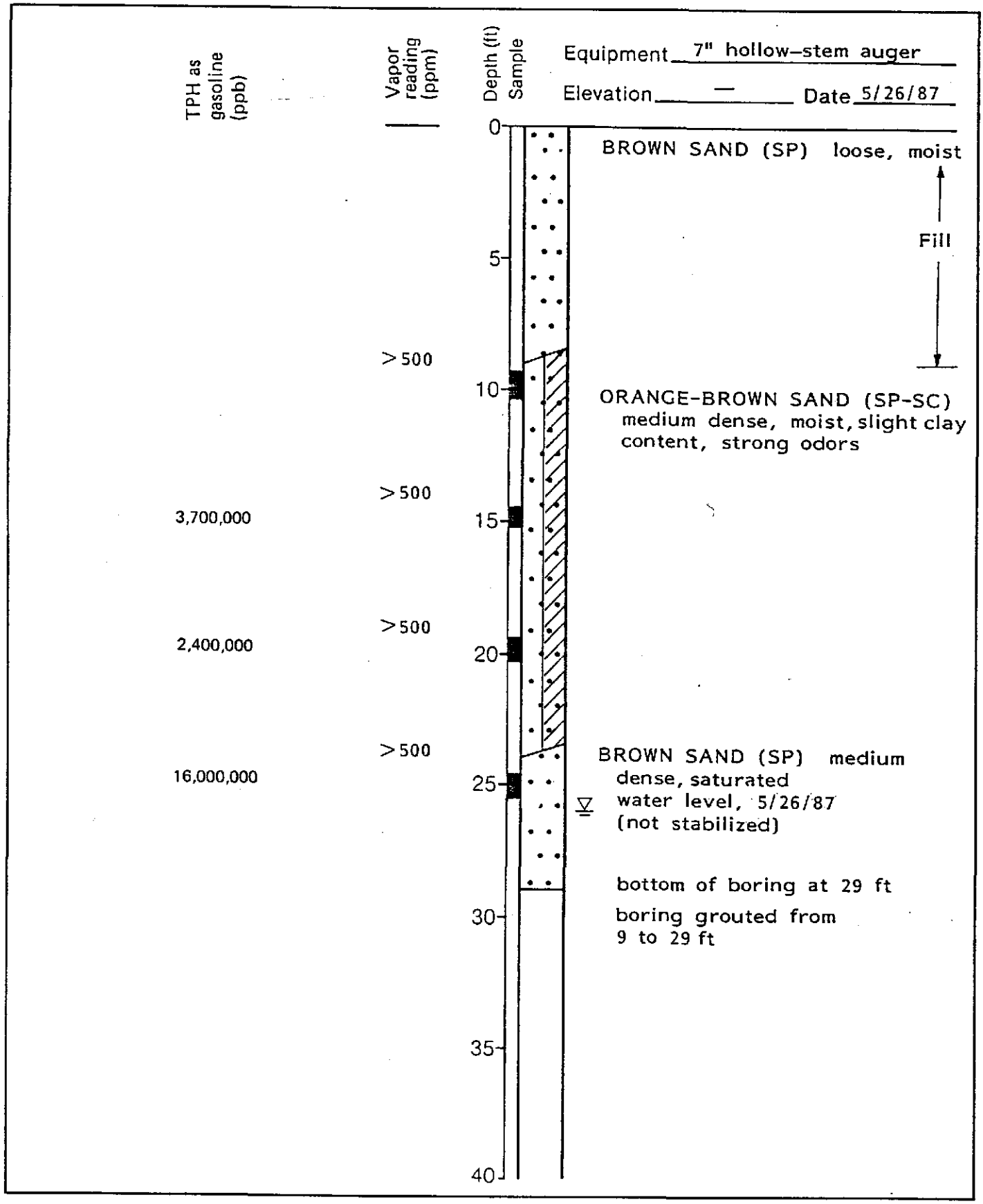
Log of Monitoring Well MW-1
Oakland Chinatown Tanks
Oakland, California

PLATE
A-1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9382,008.01		11/87		

105649



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Log of Boring 2
Oakland Chinatown Tanks
Oakland, California

PLATE
A-2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9382,008.01		11/87		

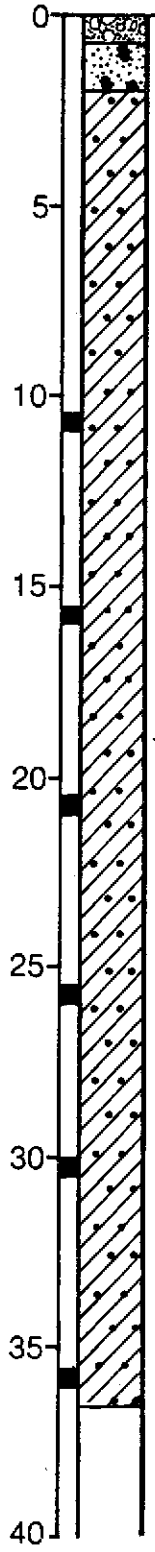
4286

TPH as gasoline (ppb)	Vapor Reading (ppm)
ND	75
ND	80
2,000,000	>500
2,500,000	>500
31,000	200

Depth (ft) Sample

Equipment 8" Hollow Stem Auger

Elevation — Date 10/9/87



ASPHALT CONCRETE

BROWN GRAVEL WITH SAND (GP) baserock

BROWN CLAYEY SAND (SC)
medium dense to dense

▽ water level at 1400, 10/9/87

bottom of boring at 36.5 ft

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Log of Boring B-3
Oakland Chinatown Tanks
Oakland, California

PLATE
A-3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

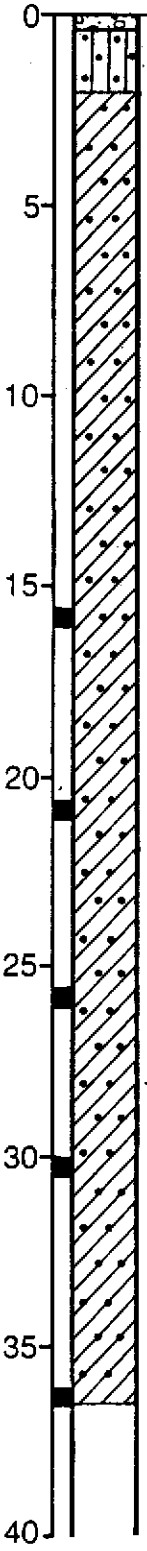
4286

TPH as gasoline (ppb)	Vapor Reading (ppm)
ND	90
ND	90
120	125
1,400	
860	

Depth (ft) Sample

Equipment 8" Hollow Stem Auger

Elevation — Date 10/9/87



CONCRETE

DARK BROWN SILTY SAND (SM)

BROWN CLAYEY SAND (SC)
medium dense to dense, moist to wet

▽ water level at 1745, 10/9/87

bottom of boring at 36.5 ft

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Engineers and Geoscientists

Log of Boring B-4
Oakland Chinatown Tanks
Oakland, California

PLATE
A-4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

4286

Equipment 8" Hollow Stem Auger

Elevation ____ Date 10/9/87

TPH as gasoline (ppb)	Vapor Reading (ppm)	Depth (ft) Sample	
		0	CONCRETE SIDEWALK BROWN SAND WITH CLAY (SC) dense to very dense
		5	
		10	
			increase in clay content at 13.0 ft
		15	
			decrease in clay content at 19.0 ft
ND	60	20	
			▽ water level at 1000, 10/9/87
2,800,000	>500	25	
29,000	>500	30	
470,000		35	
			bottom of boring at 36.5 ft
		40	

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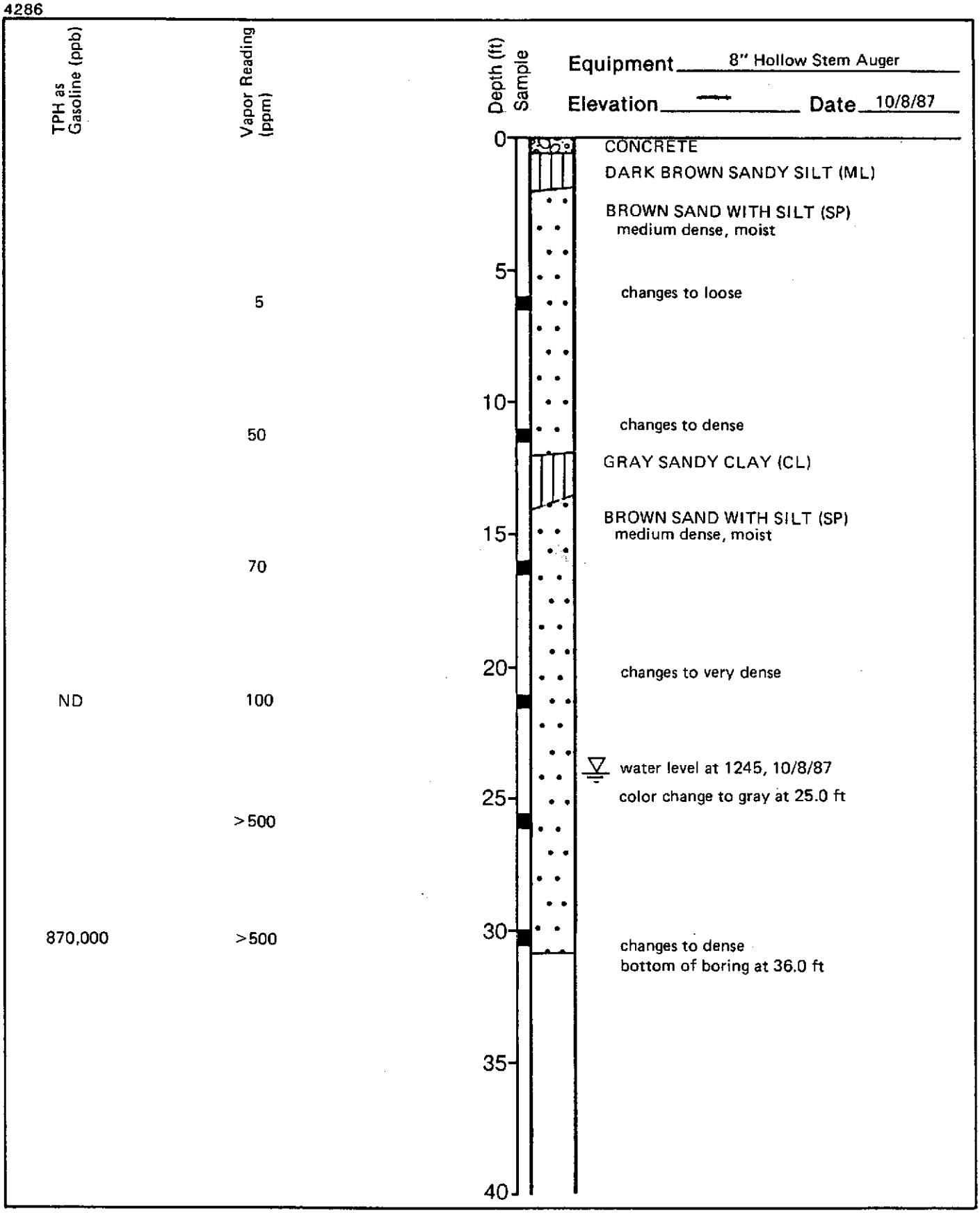
Log of Boring B-5
Oakland Chinatown Tanks
Oakland, California

PLATE
A-5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

4286



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Log of Boring B-6
Oakland Chinatown Tanks
Oakland, California

PLATE
A-6

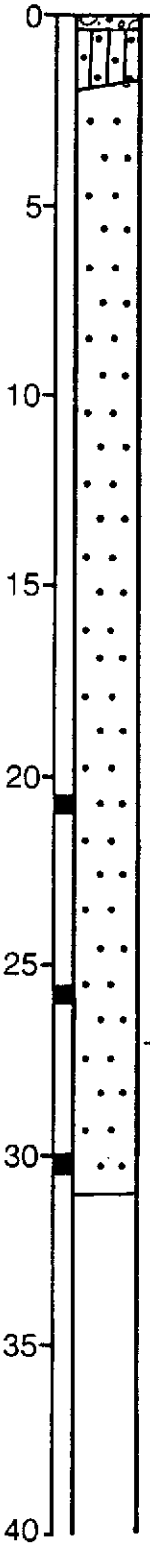
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

4286

TPH as Gasoline (ppb)	Vapor Reading (ppm)	Depth (ft)	Sample

Equipment 8" Hollow Stem Auger

Elevation — Date 10/8/87



CONCRETE

DARK BROWN SILTY SAND (SM)

BROWN SAND WITH CLAY (SP)
dense to very dense, moist to wet

50

1,100

slight odor

water level at 1900, 10/8/87

slight odor
saturated

bottom of boring at 31.0 ft

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Log of Boring B-7
Oakland Chinatown Tanks
Oakland, California

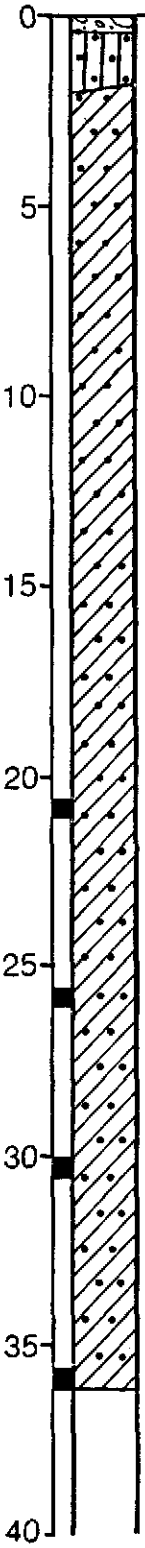
PLATE
A-7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

4286

Equipment 8" Hollow Stem Auger

Elevation _____ Date 10/8/87



TPH as Gasoline (ppb)	Vapor Reading (ppm)	Depth (ft) Sample	
		0	CONCRETE
			DARK BROWN SILTY SAND (SM)
			BROWN SAND WITH CLAY (SC)
		5	
		10	
		15	
		20	
ND	50		very dense
			changes to mottled gray-brown at 23.0 ft
		25	
			changes to medium dense
	90		
			▽ water level at 1615, 10/8/87
		30	
	60		changes to very dense
		35	
330			changes to dense, bottom of boring at 30.8 ft
		40	

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Engineers and Geoscientists

Log of Boring B-8
Oakland Chinatown Tanks
Oakland, California

PLATE
A-8

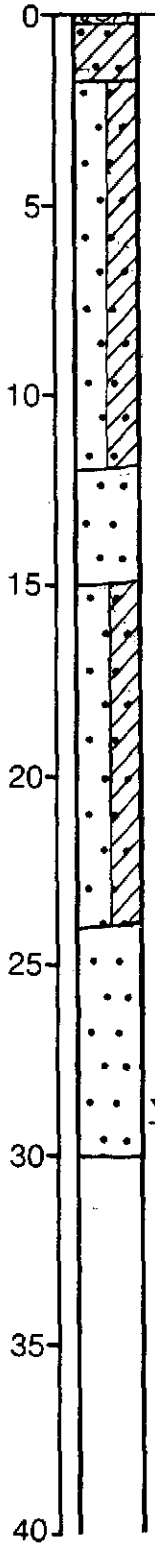
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

4286

Depth (ft) Sample

Equipment: Texoma 700, 30" Continuous Flight Auger

Elevation: — Date: 9/25/87



CONCRETE

BROWN CLAYEY SAND (SC) medium dense, moist, brick fragments, wood fragments, fill

GRAY CLAYEY SAND WITH GRAVEL (SC) medium dense, medium gravel, wood fragments, fill

RED-BROWN POORLY GRADED SAND WITH CLAY (SP-SC) medium dense, medium sand

RED-BROWN POORLY GRADED SAND WITH CLAY (SP-SC) medium dense, moist, no odor

GRAY POORLY GRADED SAND (SP) medium dense, moist, solvent-like odor

strong petroleum odor at 27.0 ft

▽ water level at 1030, and rising

▽ water level at 0950, and rising

bottom of boring at 30.0 ft

boring backfilled with cuttings

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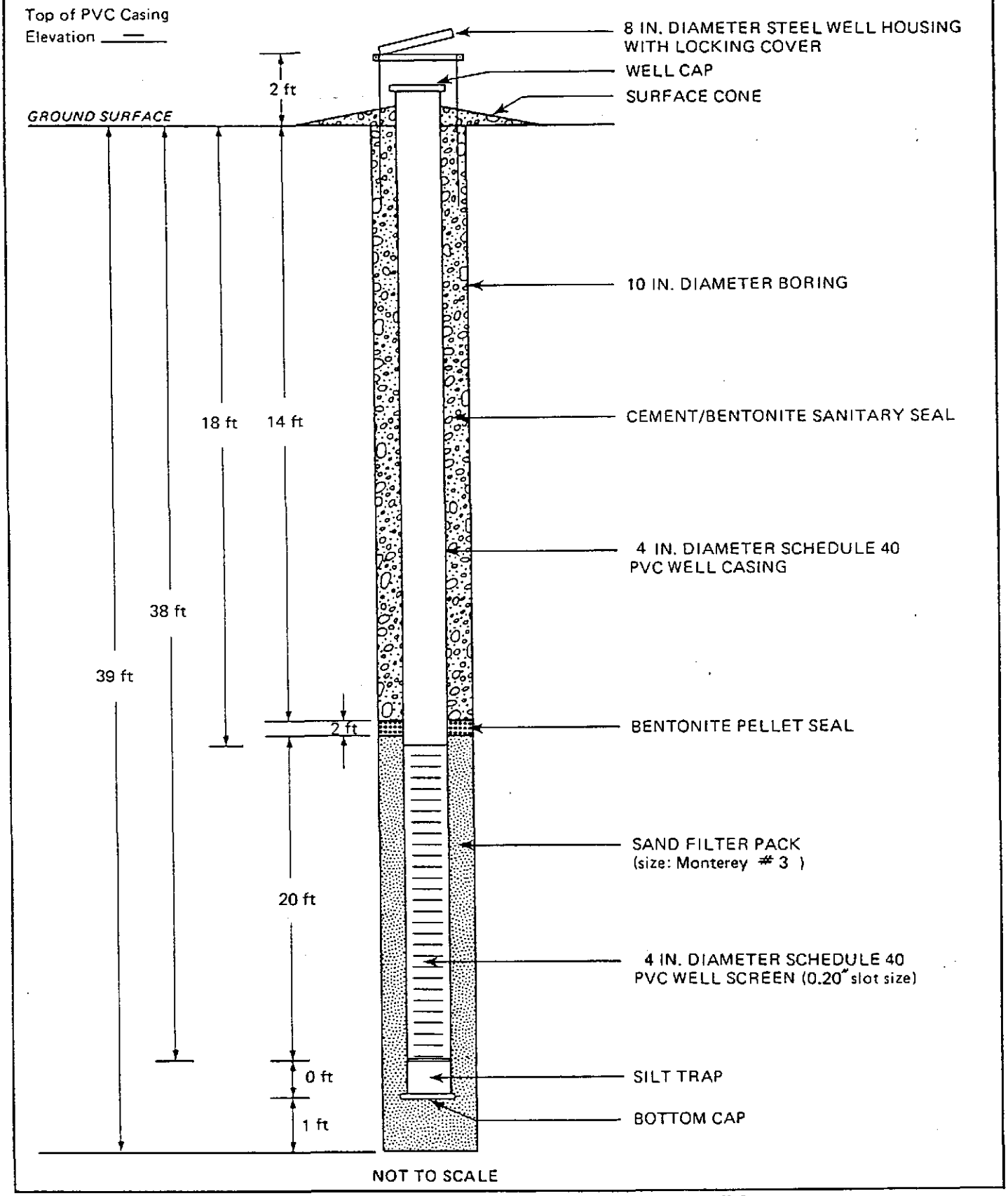
Engineers and Geoscientists

Log of Boring T-1
Oakland Chinatown Tanks
Oakland, California

PLATE
A-9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JAS	09382,008.01		10/87		

0159



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Well Construction Detail for Monitoring Well 1
Oakland Chinatown Tanks
Oakland, California

PLATE
A-10

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9382,005.02		6/87		

FORM GW1

Appendix B

INTERIM SOIL REMEDIATION PROGRAM: SOIL AERATION PLAN

APPENDIX B

EXCAVATION AND AERATION WORK PLAN

Extent of Excavation

- Based on laboratory results, excavation will extend laterally to approximately 5 feet beyond the original tank excavation, as underground utility lines permit, and extend vertically to a maximum depth of approximately 25-30 to 35 feet.

- However, conditions encountered during excavation activities may modify these dimensions. An organic vapor analyzer (OVA) will be utilized to aid in determining the extent of the excavation.

Preparation

- Clear aeration area of all weeds, cobblestones, sandpiles, and other debris.

- Check for underground utilities in area of excavation.

- Remove street lights, curbs, sidewalks, and asphalt in area to be excavated.

- Temporarily remove a portion of the fencing along 11th Street because of the lateral extent of the excavation.

- Install temporary fencing around excavation area such that entire site remains fenced.

- Designate three areas for stockpiling excavated soil; locations will be accessible to heavy equipment. The following areas are recommended:

  - "Clean" soil (<50 ppm TPH): at City's option, stockpile in pit located in southern portion of site;

  - Contaminated soil (>50 ppm TPH): stockpile along western fence line and extend into center of site, as needed;

  - Aerating soil: spread along eastern fence line and extend into center of site, as needed.

  Excavated soil will be screened with an OVA and placed in the appropriate stockpile as determined by the OVA reading.

- Construct berms around aerating and contaminated stockpiles to prevent runoff and line stockpile sites with Visqueen.

- Inform Bay Area Air Quality Management District (BAAQMD) in accordance with Regulation 8, Rule 40, 24-hours prior to start of excavation, spreading, and aeration of contaminated soils and supply the following information:

  - Estimated quantity of soil to be excavated (1400 yd^3)
  - Estimated quantity of soil to be aerated (600 yd^3)
  - Chemical composition of organic compounds (gasoline)
  - Estimated average degree of contamination (2000 - 3000 ppm of gasoline)
  - Description of basis from which these estimates were derived (i.e., analytical laboratory tests on soil samples)

Soil Excavation and Aeration

- Control vehicle traffic on 11th Street as required by City of Oakland.

- Secure site at the end of each day of excavation activities in accordance with City of Oakland traffic safety/construction regulations,

- In accordance with BAAQMD regulations, cover and secure contaminated pile with a tarpaulin to restrict uncontrolled emission of toxic vapors.

- Aerate soil in accordance with the following schedule based on BAAQMD regulations for TPH:

  - 15 cubic yards of contaminated soil to initiate aeration on Day 1
  - 15 cubic yards of contaminated soil added daily to aeration pile
  - Approximately 40 cycles of 15-cubic-yard daily additions will be needed to aerate soil

- Follow the procedures below for daily soil aeration:

  - Remove cover from contaminated pile.
  - Remove approximately 15 cubic yards of soil from contaminated pile and add to a new section of aeration pile.
  - Spread soil in 1-foot thick lift.
  - In a representative number of locations, use portable OVA to estimate level of contamination and record readings.
  - Re-cover contaminated pile with tarpaulin and secure.
  - Turn soil daily to hasten aeration process.
  - When OVA indicates <50 ppm, collect representative quantity of confirmation composite samples and analyze for TPH (in gasoline range).
  - When laboratory results indicate <100 ppm TPH (in gasoline range), remove that portion of soil and place in "clean" pile.
  - Lock gate at end of each day.
  - Monitor organic vapors with OVA in surrounding off-site area as a precautionary measure and record results.
  - Continue aeration until all excavated soil has TPH levels below 100 ppm.

Report

- At completion of soil excavation and aeration program, summarize all field and analytical laboratory results in a report submitted to the City of Oakland.

DISTRIBUTION

GASOLINE LEAK INVESTIGATION WORK PLAN
CHINATOWN REDEVELOPMENT PROJECT AREA
OAKLAND, CALIFORNIA

November 10, 1987

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