

ENVIRONMENTAL  
PROTECTION

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**GROUNDWATER MONITORING REPORT  
APRIL 1996**

**Northwest Area  
Marina Village  
Alameda, California**

**Prepared for**

**Alameda Marina Village Associates  
1150 Marina Village Parkway  
Alameda, California**

**September 1996  
Project No. 1736.14**

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**Geomatrix Consultants**

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San Francisco, CA 94111  
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13 September 1996  
Project 1736

Ms. Juliet Shin  
Alameda County Health Care Services Agency  
Divisions of Hazardous Materials  
Department of Environmental Health  
1131 Harbor Bay Parkway  
Alameda, California 94502

Subject: Groundwater Monitoring Report  
April 1996  
Northwest Area  
Marina Village Development  
Alameda, California

Dear Ms. Shin:

On behalf of Alameda Marina Village Associates (AMVA), Geomatrix Consultants, Inc. (Geomatrix), is submitting the subject report. Based on the data presented in this report, we recommend discontinuation of groundwater monitoring at the site, and consideration of the site for closure according to Regional Water Quality Control Board Guidelines for Low Risk Groundwater cases. We look forward to discussing site closure and discontinuation of monitoring with you at our 18 September 1996 meeting.

Sincerely,

GEOMATRIX CONSULTANTS

A handwritten signature in cursive script that reads "Yvonne G. Pierce".

Yvonne G. Pierce, R.G.  
Senior Geologist

A handwritten signature in cursive script that reads "Elizabeth A. Nixon".

Elizabeth A. Nixon, P.E.  
Senior Engineer

YGP/EAN:mdg  
K:\WPDOCS\1736\GMRI-LTR.DOC (WORD)

Enclosure

cc: Rahn Verhaeghe, AMVA  
**Geomatrix Consultants, Inc.**  
Engineers, Geologists, and Environmental Scientists

ENVIRONMENTAL  
PROTECTION  
26 SEP 16 AM 9:31



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**Geomatrix Consultants**

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**GROUNDWATER MONITORING REPORT**  
**APRIL 1996**  
**Northwest Area**  
**Marina Village**  
**Alameda, California**

## **1.0 INTRODUCTION AND OBJECTIVES**

This report presents a summary of groundwater monitoring activities conducted by Geomatrix Consultants, Inc. (Geomatrix) on behalf of the Alameda Marina Village Associates (AMVA) at the Northwest Area of Marina Village in Alameda, California (Figure 1). The work was performed in response to the 6 April 1995 letter from the Alameda County Health Care Services Agency (ACHCSA) to the AMVA requesting additional soil and groundwater investigations at the site. Work was conducted in accordance with the 13 June 1995 work plan prepared by Geomatrix, which was approved by ACHCSA in a 22 June 1995 letter to AMVA.

The objective of this sampling event was to confirm the results of the July 1995 monitoring event, including: (1) the possible presence of separate-phase hydrocarbons in wells at the site; (2) the distribution of possible dissolved petroleum hydrocarbons and their constituents, benzene, toluene, ethylbenzene, and xylenes (BTEX) in groundwater at the site; and (3) the direction of the hydraulic gradient at the site. These data were subsequently used as a basis for recommendations regarding the discontinuation of monitoring and the development of a management program for closure of the site.

## **2.0 BACKGROUND**

The site currently consists of undeveloped areas and paved parking lots. The site is bounded to the east by Oakland Inner Harbor and boat docks, to the west by Marina Village Parkway, to the south by four former shipways that currently are developed as office space, and to the north by an adjacent property owned by Barnhill Construction Company (Figure 2). A sheet-pile wall extends from the shipways westward and northward along the boat docks as shown on Figure 2.

The historical direction of the hydraulic gradient at the site generally has been toward Oakland Inner Harbor, and may be influenced by the presence of the sheet-pile wall and tidal fluctuations.

The extent of petroleum hydrocarbons in soil at the site and surrounding areas was characterized during previous investigations performed by Levine•Fricke (1988, 1989, 1990) and Geomatrix (1992). Based on the results of these investigations, medium- and high-boiling petroleum hydrocarbons (crude oil, waste oil, diesel oil and fuel) were detected in shallow soil at concentrations greater than 500 parts per million (ppm) beneath approximately 2.5 acres of the site. Residual separate-phase high-boiling petroleum hydrocarbons, characterized as degraded crude oil, were observed in the soil beneath an area of approximately 1.3 acres adjacent to the northwest property boundary. The vertical extent of petroleum hydrocarbons in soil has been limited by the occurrence of estuarine clay sediments, locally referred to as San Francisco Bay Mud. The Bay Mud occurs at shallow depths (ranging from approximately 4 to 15 feet) below the ground surface at the site. The source of petroleum hydrocarbons in soil at the site likely was a combination of shipbuilding activities at and in the vicinity of the site that date back to the first half of this century, and historical off-site sources to the northwest of Marina Village. Other chemicals that have been detected in soil include lead, which was detected in two samples at concentrations of 130 and 520 milligrams per kilogram (mg/kg), and toluene, concentrations up to 0.7 mg/kg.

Since 1987, ten shallow groundwater monitoring wells have been installed at the Northwest Area (Figure 2). Well construction details for these wells are summarized in Table 1. From 1988 to 1990, concentrations of medium and high boiling petroleum hydrocarbons detected in groundwater were either in the range of several milligrams per liter (mg/l) or were not detected in groundwater samples from wells located at the site downgradient perimeter (wells WC-3, LF-6, LF-7, LF-11, LF-12, LF-13 and GMW-2). Separate-phase product or petroleum sheen were observed in two of the wells, LF-8 and LF-9, located near the northwest property boundary. A sheen was also observed in groundwater from well LF-10, which is located approximately upgradient from the Northwest Area. TPH concentrations measured in Well LF-10 in 1990 were 17 mg/l. Very low concentrations of dissolved petroleum hydrocarbon constituents benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected in groundwater samples from wells

LF-7, LF-9, and LF-13 during one sampling round in 1990. During a subsequent sampling event (July 1995), total petroleum hydrocarbons as diesel (TPHd), total petroleum hydrocarbons as motor oil (TPHmo), and BTEX were not detected in groundwater samples collected except for low concentrations of TPHd (0.07 mg/l) in the sample from well LF-10.

In 1993 a 10,000 cubic yard soil stockpile was placed in the vicinity of monitoring well LF-9, rendering this well inaccessible for sampling. As discussed in our previous groundwater monitoring report dated December 1995, data that would be obtained from this well would not provide additional information regarding site characterization or the potential for migration of petroleum hydrocarbons towards Oakland Inner Harbor that is not already available.

### 3.0 SEPARATE-PHASE PRODUCT AND WATER-LEVEL MEASUREMENTS

The presence of separate-phase petroleum hydrocarbons was measured to the nearest 0.01 foot on 15 April 1996 using a Flexidip oil-water interface probe. Water levels were measured on 15 April 1996 using an electric well sounder. Measurement equipment was washed with a detergent-water solution and rinsed with deionized water before each measurement was taken. Separate-phase product and water-level measurements are summarized in Table 2; field records for these measurements are included in Appendix A.

Approximately 2 inches of separate-phase product previously characterized as degraded crude oil was measured on top of the water column in well LF-8. Separate-phase product was not measured nor seen observed in the other wells tested. Water-level elevations across the site ranged from -1.3 feet at well LF-13 to -5.26 feet at well WC-3 (relative to City of Alameda datum). The horizontal hydraulic gradient direction at the site, although generally to the southeast toward Oakland Inner Harbor, appears to be locally variable, with gradient directions ranging from southeast in the northwestern portion to south in the southeastern portion. The potentiometric surface map for 15 April 1996 is shown on Figure 3. This variable gradient direction is consistent with measurements taken since monitoring was initiated in 1988. It is believed that the

observed variability is a result of tidal influence and the presence of the sheet-pile wall that is aligned along the shoreline.

#### **4.0 GROUNDWATER SAMPLING**

Before sample collection, the wells were purged with a diaphragm pump or disposable bailer until a minimum of four casing volumes were removed and water quality parameters stabilized. The purge water was collected in 55-gallon drums and stored temporarily on site pending analysis. Groundwater samples were collected using disposable polyethylene bailers from monitoring wells LF-6, LF-7, LF-10, LF-11, LF-12, LF-13, WC-3, and GMW-2 on 15 April 1996. No sample was collected from well LF-8 due to the presence of separate-phase product in the well. Field records for sampling are included in Appendix A.

Samples to be analyzed for extractable petroleum hydrocarbons and lead were transferred to 1-liter amber bottles, and samples to be analyzed for BTEX were transferred to 40-milliliter volatile organic analysis vials. Immediately after collection, samples were placed in an ice-chilled cooler and transported under Geomatrix chain-of-custody procedures to Friedman and Bruya, Inc., of Seattle, Washington, a California-certified laboratory.

#### **5.0 LABORATORY ANALYTICAL PROGRAM AND RESULTS**

The analytical program consisted of analyzing samples from eight wells by modified EPA Method 8015 for TPHd and TPHmo. Samples from wells LF-7 and LF-13 additionally were analyzed according to EPA Method 8020 for BTEX. As requested by the ACHCSA in a 2 May 1996 meeting, samples from wells LF-11 and LF-12 were analyzed for total lead by EPA Method 6010 to evaluate the possible presence of lead in groundwater downgradient of the area, where low concentrations of lead historically had been detected in shallow soil. One equipment blank (identified as sample EBNT-41596) and one blind field duplicate from well LF-10 (identified as sample LF-14) were collected and analyzed for TPHd and TPHmo for quality control purposes. Additionally, one equipment blank (identified as sample EBNT-41596) and



one blind field duplicate from well LF-7 (identified as sample LF-15) were collected and analyzed for BTEX for quality control purposes.

Samples for TPHd and TPHmo analysis were filtered by the laboratory prior to extraction with a 0.7-micron glass filter to remove nondissolved petroleum hydrocarbons associated with particulates in the sample media that possibly can cause interference with the analysis. In addition, to remove polar biogenic materials from the samples, a silica gel cleanup procedure was used in the preparation of the sample extract.

Groundwater analytical results for samples collected to date from the monitoring wells are summarized in Table 3. Analytical results from this latest sampling event are presented on Figure 4. Analytical laboratory reports and chain-of-custody documentation for the samples collected during this sampling event are presented in Appendix B.

No lead, TPHd, or TPHmo were detected in the groundwater samples. BTEX was not detected in any samples except in one set of samples from well LF-7 (0.7 micrograms per liter ( $\mu\text{g}/\text{l}$ ) of benzene and 0.7  $\mu\text{g}/\text{l}$  of toluene). BTEX was not detected in duplicate samples from this well. Similar low concentrations of benzene and toluene historically have occurred sporadically in some of the wells, and may be due to the proximity of the adjacent boat dock and Oakland Inner Harbor.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on data obtained during this groundwater monitoring event, we conclude the following:

- The hydraulic gradient at the site generally appears to be to the east towards Oakland Inner Harbor. Local variability in the gradient may be a result of tidal influence and the presence of a shoreline sheet-pile wall.
- No lead was detected in groundwater samples collected.
- No TPHd or TPHmo were detected in groundwater samples collected.

- Residual separate-phase crude oil was measured in well LF-8 and historically observed in well LF-9 along the northern property boundary; however, TPHd and TPHmo have not been detected in samples collected in 1995 and 1996 from wells LF-13, LF-7, LF-12, and LF-6 located downgradient of wells LF-8 and LF-9.
- Benzene (0.7 µg/l) and toluene (0.7 µg/l) were detected in one of the samples (but not the duplicate sample) from well LF-7. No BTEX was detected in the sample from LF-13.
- Based on the data, groundwater at the perimeter of the Northwest Area does not contain dissolved petroleum hydrocarbons or significant concentrations of BTEX. The data collected since 1988 indicate that residual petroleum hydrocarbons in soil beneath the Northwest Area are not a continuing source of petroleum hydrocarbons to groundwater. Therefore, the potential for migration of these constituents toward Oakland Inner Harbor is very low.

Based on these conclusions, we recommend discontinuation of groundwater monitoring at the site. Sufficient data have been collected to establish site conditions and to provide the basis for supporting a recommendation for site closure under the California Regional Water Quality Control Board (RWQCB) Guidelines for Low Risk Groundwater Case Closure.

## 7.0 REFERENCES

- Geomatrix Consultants, Inc., 1992, Soil and Groundwater Quality Investigation, Shipways Project, Marina Village Development, Alameda, California, prepared for Alameda Real Estate Investments, July.
- Geomatrix Consultants, Inc., 1995, Groundwater Monitoring Report, Lots 1 and 2 (Northwest Area), Marina Village, Alameda, California, prepared for Alameda Marina Village Associates, December
- Levine•Fricke, 1988, Investigations of Northwest Area Marina Village, Alameda, California, 6 October.
- Levine•Fricke, 1989, Continued Soil and Groundwater Investigation of Parcel 5, Implementation of a Groundwater Monitoring Program and Proposed Remedial Measures in the Northwest Study Area, Marina Village, Alameda, California, 26 June.
- Levine•Fricke, 1990, Results of Third Round of Groundwater Sampling, Northwest Area, Marina Village, Alameda, California, 13 April.

TABLE 1

## WELL CONSTRUCTION DETAILS

 Northwest Area  
 Marina Village  
 Alameda, California

Well Number	Date Constructed	Well Depth (feet below grade)	Screened Interval (feet below grade)	Measuring Point Elevation <sup>1</sup> (feet)
LF-6	3/88	15	5-15	3.30
LF-7	3/88	15	5-15	4.56
LF-8	3/88	15	5-15	4.84
LF-9	3/88	15	5-15	NA <sup>2</sup>
LF-10	3/88	15	5-15	3.95
LF-11	3/89	15	5-15	5.09
LF-12	3/89	15	5-15	7.19
LF-13	3/89	13	3-13	2.95
WC-3	1987	14	7-14	3.84
GMW-2	3/16/92	13.5	3-13	3.5

## Notes:

<sup>1</sup> Top of well casings were surveyed on 10 July 1995 by Luk, Milani & Associates of Walnut Creek, California, relative to an established City of Alameda datum.

<sup>2</sup> Well LF-9 not accessible for surveying.

TABLE 2

WATER-LEVEL MEASUREMENTS

Northwest Area  
Marina Village  
Alameda, California

Well Number	Date Water Level Measured	Measuring Point (MP) Elevation <sup>1</sup>	Depth to Water Below MP <sup>2</sup> (feet)	Water-Level Elevation <sup>1</sup>	Separate Phase Product Thickness <sup>3</sup> (feet)
LF-6	4/15/96	3.3	5.74	-2.44	0
LF-7	4/15/96	4.56	7.11	-2.55	0
LF-8	4/15/96	4.84	7.08 <sup>4</sup>	NA <sup>5</sup>	0.16
LF-10	4/15/96	3.95	7.52	-3.57	0
LF-11	4/15/96	5.09	8.13	-3.04	0
LF-12	4/15/96	7.19	10.50	-3.31	0
LF-13	4/15/96	2.95	4.25	-1.3	0
WC-3	4/15/96	3.84	9.10	-5.26	0
GMW-2	4/15/96	3.5	6.86	-3.36	0

Notes:

- <sup>1</sup> Top of well casings were surveyed on 10 July 1995 by Luk, Milani & Associates of Walnut Creek, California, relative to an established City of Alameda datum.
- <sup>2</sup> Water levels were measured with an electric sounder.
- <sup>3</sup> Thickness of separate-phase product measured with a Flexidip oil-water interface probe.
- <sup>4</sup> Measurement is approximate.
- <sup>5</sup> Water-level elevation not calculated due to the presence of separate-phase product.

**TABLE 3**

**HISTORICAL GROUNDWATER ANALYTICAL RESULTS<sup>1</sup>**

Northwest Area  
Marina Village  
Alameda, California

Concentrations in milligrams per liter (mg/l)

Well Number	Date Sampled	TPHd <sup>2</sup>	TPHmo <sup>3</sup>	Benzene	Toluene	Ethylbenzene	Xylenes	Total Lead	Petroleum Product <sup>4</sup> Thickness (inches)
LF-6	3/29/88	<0.05	<0.05	<0.004	<0.006	<0.007	NA	NA	
	3/28/89	<0.3	<0.5	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3	<0.5	NA	NA	NA	NA	NA	
	1/1/90	NA	NA	NA	NA	NA	NA	NA	
	7/12/95	<0.05	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	NA	NA	NA	NA	NA	
LF-7	3/29/88	<0.05	<0.05	<0.004	<0.006	<0.007	NA	NA	
	3/28/89	<0.3	1.8	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3	<0.5	NA	NA	NA	NA	NA	
	1/31/90	<0.3	3.3	<0.0005	0.003	0.001	0.007	NA	
	7/13/95	<0.05	<0.2	<0.0005	<0.0005	<0.0005	<0.002	NA	
	4/15/96	<0.05	<0.25	0.0007/<0.0005	0.0007/<0.0005	<0.0005/<0.0005	<0.0005/<0.0005	NA	
LF-8	3/29/88	62.0	NQ	<0.004	<0.006	<0.007	NA	NA	<0.1
	3/28/89	NA	NA	<0.003	<0.003	<0.003	<0.010	NA	Approx. 2
	8/3/89	NA	NA	NA	NA	NA	NA	NA	Approx. 5
	1/31/90	NA	NA	NA	NA	NA	NA	NA	Approx. 7
	7/11/95	NA	NA	NA	NA	NA	NA	NA	Approx. 6
	4/15/96	NA	NA	NA	NA	NA	NA	NA	Approx. 2
LF-9	3/29/88	54.0	NQ	<0.004	<0.006	0.007	NA	NA	
	3/28/89	12.0	6.0	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	79.0	67.0	NA	NA	NA	NA	NA	
	1/31/90	15.0/12.0	17.0/15.0	0.003/0.003	<0.0005/<0.0005	0.007/0.006	0.014/0.012	NA	

TABLE 3

HISTORICAL GROUNDWATER ANALYTICAL RESULTS<sup>1</sup>

Well Number	Date Sampled	TPHd <sup>2</sup>	TPHmo <sup>3</sup>	Benzene	Toluene	Ethylbenzene	Xylenes	Total Lead	Petroleum Product <sup>4</sup> Thickness (inches)
LF-10	3/29/88	43.0	NQ	<0.004	<0.006	<0.007	NA	NA	
	3/28/89	<0.2	7.8	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3/<0.3	8.3/7.6	NA/NA	NA/NA	NA/NA	NA/NA	NA	
	1/31/90	<0.3	17.0	<0.0005	<0.0005	<0.0005	<0.002	NA	
	7/14/95	0.06/0.06	<0.2/<0.2	NA/NA	NA/NA	NA/NA	NA/NA	NA	
	7/14/95 (filtered)	0.07	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	NA	NA	NA	NA	NA	
LF-11	3/28/89	<0.3	1.0	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3	0.9	NA	NA	NA	NA	NA	
	1/31/90	<0.3	1.2	<0.0005	<0.0005	<0.0005	<0.002	NA	
	7/12/95	<0.05	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	NA	NA	NA	NA	<0.005	
LF-12	3/28/89	<0.3	1.1	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3	2.0	NA	NA	NA	NA	NA	
	1/31/90	<0.3	1.4	<0.0005	<0.0005	<0.0005	<0.002	NA	
	7/13/95	<0.05	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	NA	NA	NA	NA	<0.005	
LF-13	3/28/89	<0.3	4.4	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3	3.0	NA	NA	NA	NA	NA	
	1/31/90	<0.3	6.1	0.004	0.001	<0.0005	<0.002	NA	
	7/14/95	NR	NR	<0.0005	<0.0005	<0.0005	<0.002	NA	
	7/14/95	<0.05	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	<0.0005	<0.0005	<0.0005	<0.0005	NA	

TABLE 3

HISTORICAL GROUNDWATER ANALYTICAL RESULTS<sup>1</sup>

Well Number	Date Sampled	TPHd <sup>2</sup>	TPHmo <sup>3</sup>	Benzene	Toluene	Ethylbenzene	Xylenes	Total Lead	Petroleum Product <sup>4</sup> Thickness (inches)
WC-3	3/31/88	<0.05	<0.05	<0.004	<0.006	<0.007	NA	NA	
	3/28/89	<0.3	3.2	<0.0005	<0.0005	<0.0005	<0.002	NA	
	8/3/89	<0.3	1.0	NA	NA	NA	NA	NA	
	1/31/90	<0.3	5.7	<0.0005	<0.0005	<0.0005	<0.002	NA	
	7/14/95	<0.05	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	NA	NA	MA	NA	NA	
GMW-2	4/29/92	0.2	0.4	NA	NA	NA	NA	NA	
	7/12/95	<0.05	<0.2	NA	NA	NA	NA	NA	
	4/15/96	<0.05	<0.25	NA	NA	NA	NA	NA	

Notes:

/ Indicates duplicate sample.

<sup>1</sup> Samples analyzed for total petroleum hydrocarbons as diesel and motor oil by EPA Method 8015, and for benzene, toluene, ethylbenzene, and xylenes by EPA Method 602. In 1995, silica gel cleanup was performed prior to all 8015 analyses, and samples from wells LF-10, LF-13, and WC-3 were filtered prior to analysis. In 1996, all samples were filtered and a silica gel cleanup was performed prior to 8015 analysis.

<sup>2</sup> TPHd = total petroleum hydrocarbons as diesel.

<sup>3</sup> TPHmo = total petroleum hydrocarbons as motor oil.

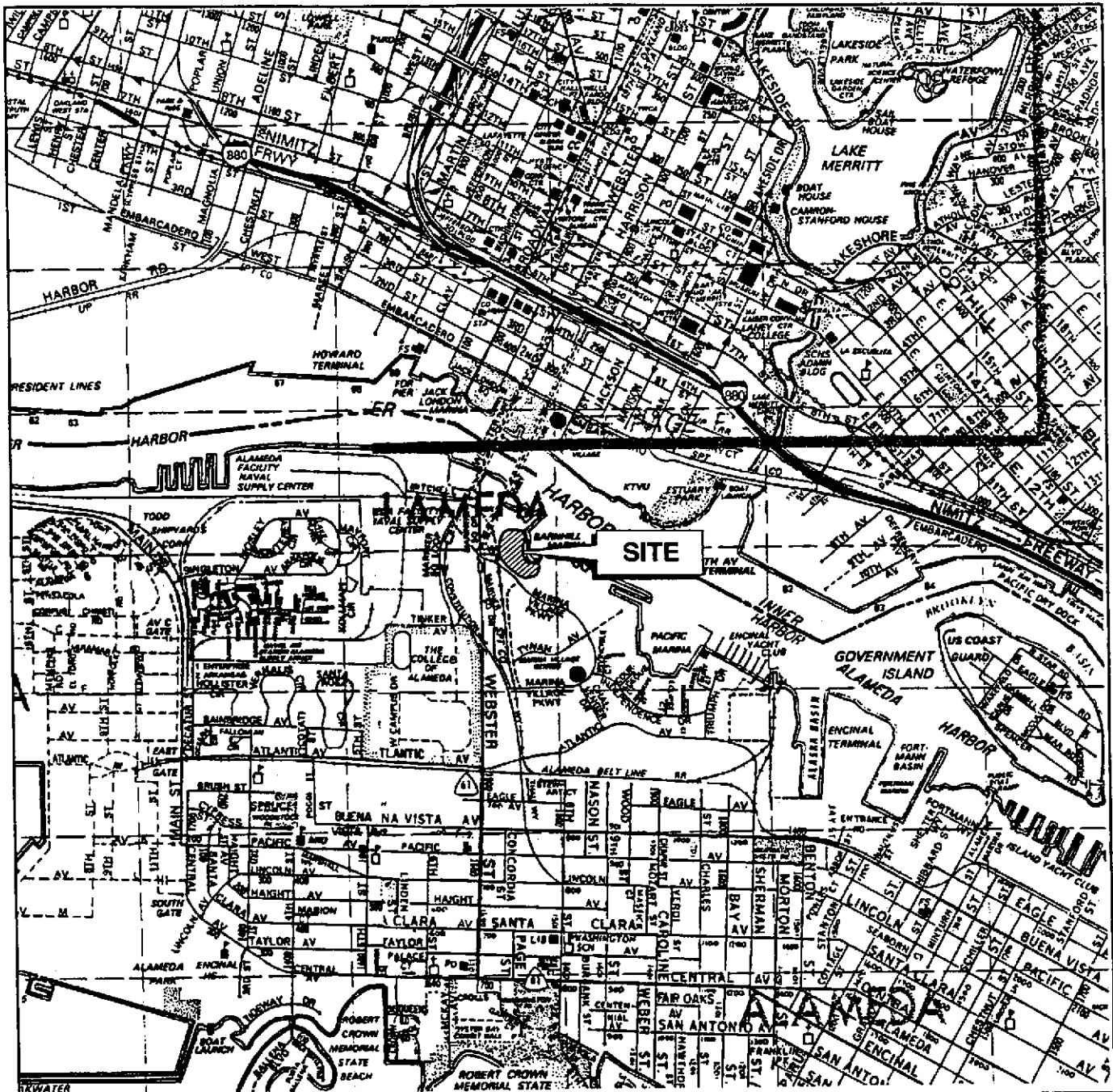
<sup>4</sup> Product characterized as crude oil.

NQ Indicates extractable TPH detected in samples was not quantified against motor oil standard.

NA Indicates not analyzed.

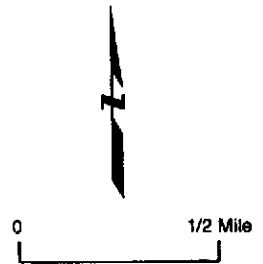
NR Not reported due to insufficient silica gel cleanup on the sample.





Map Source: The Thomas Guide, Alameda County Street Guide and Directory, 1993

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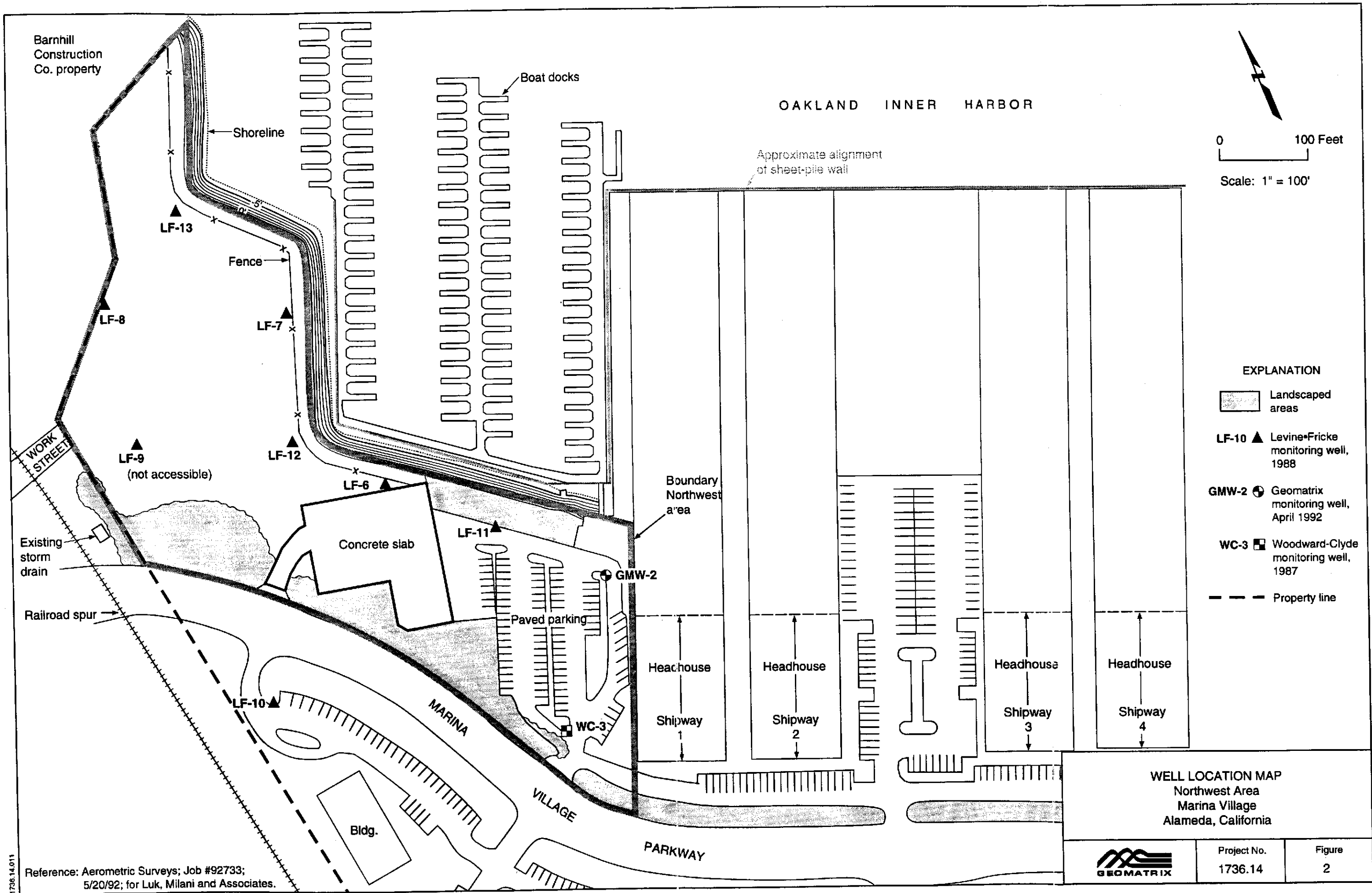
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**SITE LOCATION MAP**  
 Marina Village  
 Alameda, California

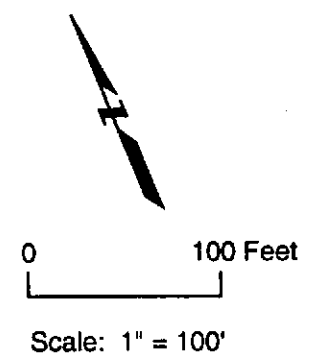
Figure  
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






Barnhill  
Construction  
Co. property

OAKLAND INNER HARBOR



EXPLANATION

-  Landscaped areas
- LF-10**  Levine-Fricke monitoring well, 1988
- GMW-2**  Geomatrix monitoring well, April 1992
- WC-3**  Woodward-Clyde monitoring well, 1987
-  Property line

WELL LOCATION MAP  
Northwest Area  
Marina Village  
Alameda, California

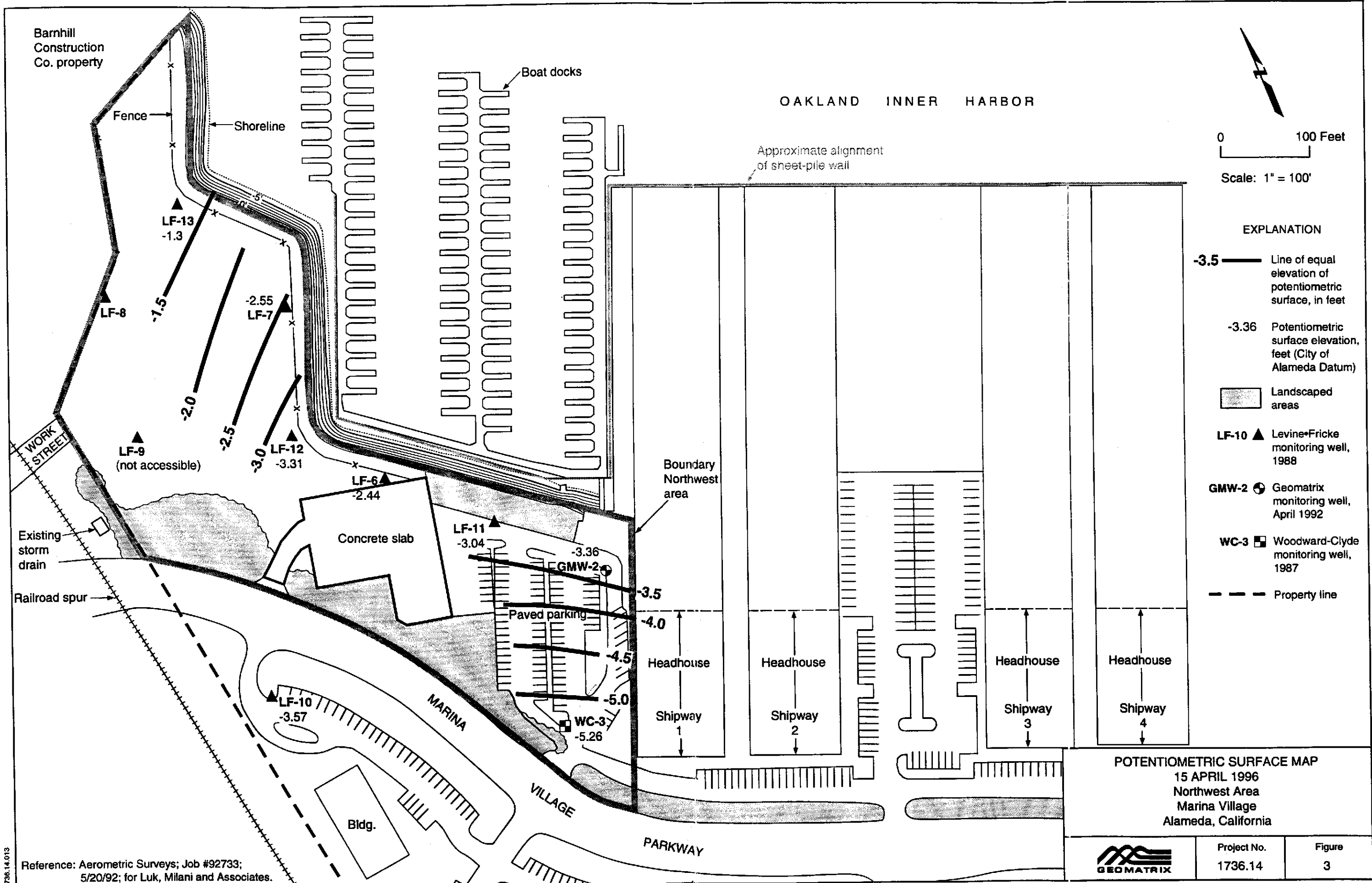


Project No.  
1736.14

Figure  
2

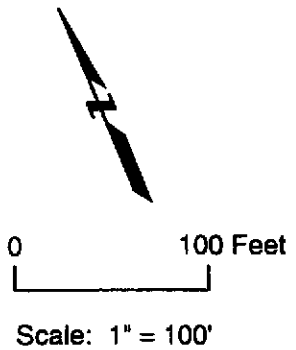
Reference: Aerometric Surveys; Job #92733;  
5/20/92; for Luk, Milani and Associates.

1736.14.011



Barnhill  
Construction  
Co. property

OAKLAND INNER HARBOR



EXPLANATION

- 3.5 ——— Line of equal elevation of potentiometric surface, in feet
- 3.36 Potentiometric surface elevation, feet (City of Alameda Datum)
- Landscaped areas
- LF-10 ▲ Levine-Fricke monitoring well, 1988
- GMW-2 ⊕ Geomatrix monitoring well, April 1992
- WC-3 □ Woodward-Clyde monitoring well, 1987
- - - Property line

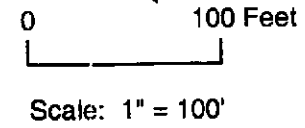
Reference: Aerometric Surveys; Job #92733;  
5/20/92; for Luk, Milani and Associates.

<b>POTENTIOMETRIC SURFACE MAP</b> 15 APRIL 1996 Northwest Area Marina Village Alameda, California		
	Project No. 1736.14	Figure 3

1736.14.013

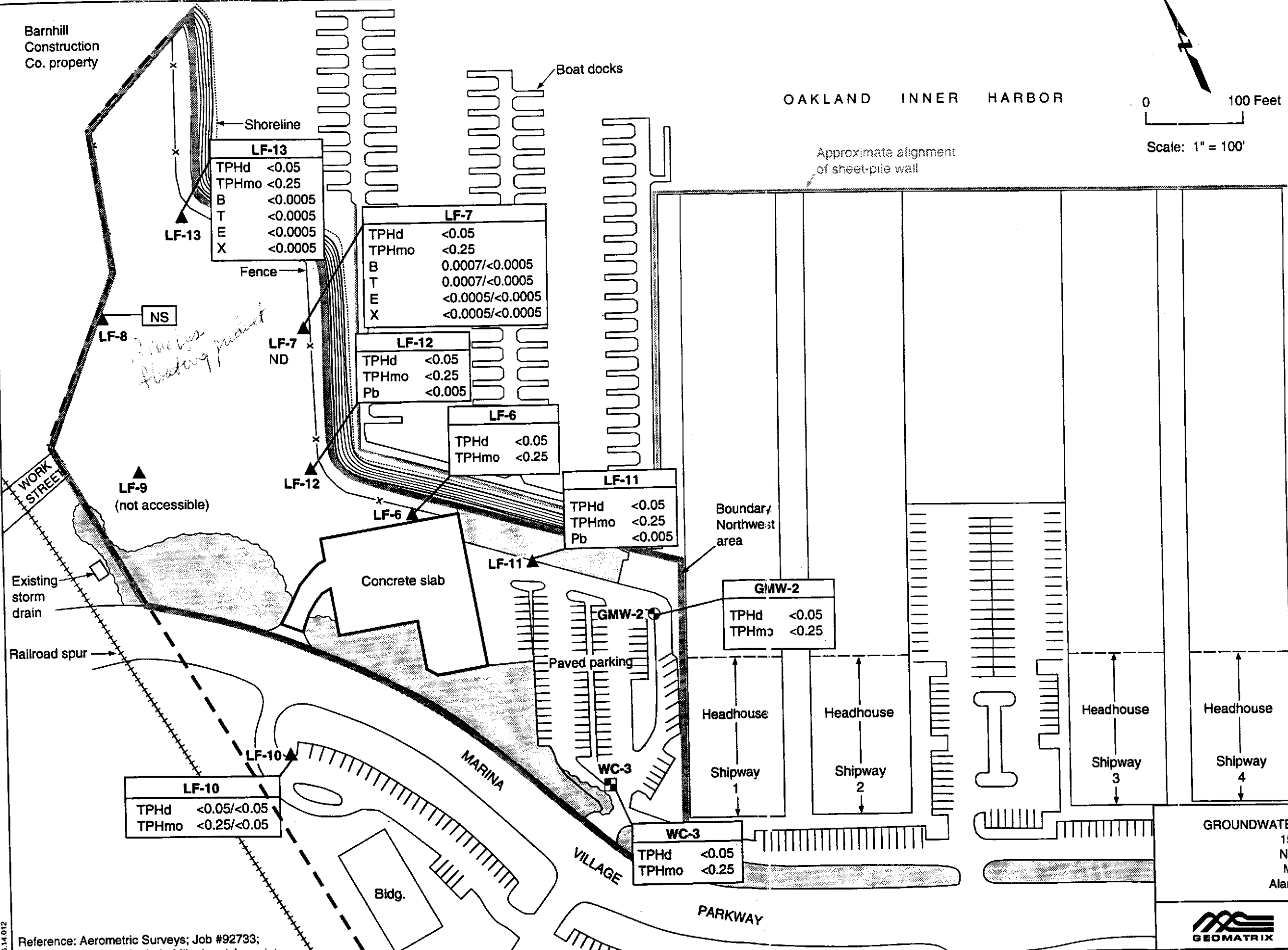
Barnhill  
Construction  
Co. property

OAKLAND INNER HARBOR



EXPLANATION

- Landscaped areas
- LF-10** ▲ Levine-Fricke monitoring well, 1988
- GMW-2** ● Geomatrix monitoring well, April 1992
- WC-3** ■ Woodward-Clyde monitoring well, 1987
- Property line
- <0.25 = Not detected above reporting limit
- NS = Not sampled due to presence of separate-phase petroleum in well
- TPHd = Total petroleum hydrocarbons as diesel
- TPHmo = Total petroleum hydrocarbons as motor oil
- B = Benzene  
T = Toluene  
E = Ethylbenzene  
X = Xylene  
Pb = Lead
- 15.0 = Concentrations in milligrams per liter (mg/l). Duplicate analyses also are shown



**LF-13**

TPHd	<0.05
TPHmo	<0.25
B	<0.0005
T	<0.0005
E	<0.0005
X	<0.0005

**LF-7**

TPHd	<0.05
TPHmo	<0.25
B	0.0007/<0.0005
T	0.0007/<0.0005
E	<0.0005/<0.0005
X	<0.0005/<0.0005

**LF-12**

TPHd	<0.05
TPHmo	<0.25
Pb	<0.005

**LF-6**

TPHd	<0.05
TPHmo	<0.25

**LF-11**

TPHd	<0.05
TPHmo	<0.25
Pb	<0.005

**GMW-2**

TPHd	<0.05
TPHmo	<0.25

**LF-10**

TPHd	<0.05/<0.05
TPHmo	<0.25/<0.05

**WC-3**

TPHd	<0.05
TPHmo	<0.25

GROUNDWATER ANALYTICAL RESULTS  
15 APRIL 1996  
Northwest Area  
Marina Village  
Alameda, California



Project No. 1736.14  
Figure 4

Reference: Aerometric Surveys; Job #92733; 5/20/92; for Luk, Milani and Associates.

1736.14.012

**APPENDIX A**

**WATER LEVEL AND MONITORING  
WELL SAMPLING RECORD FIELD SHEETS**























**APPENDIX B**

**ANALYTICAL LABORATORY REPORTS  
AND CHAIN-OF-CUSTODY DOCUMENTATION**



FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman  
James E. Bruya, Ph.D.  
(206) 285-8282

3012 16th Avenue West  
Seattle, WA 98119-2029  
FAX: (206) 283-5044

April 22, 1996

Yvonne Pierce, Project Manager  
Geomatrix Consultants, Inc.  
100 Pine Street, Suite 1000  
San Francisco, CA 94111-5112


Dear Ms. Pierce:

Enclosed are the results from the testing of material submitted on April 17, 1996 from your 1736.14 project.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.



Beth Albertson  
Chemist

keh  
Enclosures  
GMC0422R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: April 22, 1996

Date Received: April 17, 1996

Project: 1736.14

Date Samples Extracted: April 17, 1996

RESULTS FROM THE ANALYSIS OF WATER SAMPLES  
FOR BENZENE, TOLUENE, ETHYLBENZENE AND THE XYLENES  
USING METHOD 8020

Samples Processed Using Method 5030

Results Reported as  $\mu\text{g/L}$  (ppb)

<u>Sample ID</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl- benzene</u>	<u>Total Xylenes</u>	<u>Surrogate % Recovery</u>
LF-7	0.7	0.7	<0.5	<0.5	94
LF-13	<0.5	<0.5	<0.5	<0.5	95
LF-15 Duplicate LF-7	<0.5	<0.5	<0.5	<0.5	93
EBNT-41596	<0.5	0.6	<0.5	0.5	95
Method Blank	<0.5	<0.5	<0.5	<0.5	98

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: April 22, 1996

Date Received: April 17, 1996

Project: 1736.14

QUALITY ASSURANCE RESULTS  
FOR THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE,  
ETHYLBENZENE, AND THE XYLENES  
USING EPA METHOD 8020

Laboratory Code: 67978 (Duplicate)

Analyte:	Reporting Units	Sample Result	Duplicate Result	Relative Percent Difference	Acceptance Criteria
Benzene	ug/L (ppb)	<0.5	<0.5	nm	0-20
Toluene	ug/L (ppb)	<0.5	<0.5	nm	0-20
Ethylbenzene	ug/L (ppb)	<0.5	<0.5	nm	0-20
Xylenes	ug/L (ppb)	<0.5	<0.5	nm	0-20

Laboratory Code: 67979 (Matrix Spike)

Analyte:	Reporting Units	Spike Level	Sample Result	% Recovery MS	Acceptance Criteria
Benzene	ug/L (ppb)	100	<0.5	98	87-106
Toluene	ug/L (ppb)	100	<0.5	100	74-109
Ethylbenzene	ug/L (ppb)	100	<0.5	100	72-111
Xylenes	ug/L (ppb)	300	<0.5	102	66-114

Laboratory Code: Spike Blank

Analyte:	Reporting Units	Spike Level	% Recovery		Acceptance Criteria	Relative Percent Difference
			MS	MSD		
Benzene	ug/L (ppb)	100	103	102	79-113	1
Toluene	ug/L (ppb)	100	105	104	77-117	1
Ethylbenzene	ug/L (ppb)	100	106	104	77-121	2
Xylenes	ug/L (ppb)	300	106	105	79-123	1

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: April 22, 1996

Date Received: April 17, 1996

Project: 1736.14

Date Samples Extracted: April 17, 1996

RESULTS FROM THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL PETROLEUM HYDROCARBONS AS  
DIESEL RANGE AND MOTOR OIL RANGE ORGANICS  
BY GC/FID (Modified 8015)

Samples Processed Using Method 3510  
Results Reported as  $\mu\text{g/L}$  (ppb)

<u>Sample ID</u>	<u>Diesel</u>	<u>Motor Oil</u>	<u>Surrogate</u> (% Recovery)
LF-6	<50	<250	99
LF-7	<50	<250	86
LF-10	<50	<250	108
LF-11	<50	<250	92
LF-12	<50	<250	110
LF-13	<50	<250	90
LF-14 Duplicate LF-10	<50	<250	91
WC-3	<50	<250	103
GMW-2	<50	<250	106
EBNT-41596	<50	<250	94
Method Blank	<50	<250	103

**FRIEDMAN & BRUYA, INC.**

**ENVIRONMENTAL CHEMISTS**

Date of Report: April 22, 1996

Date Received: April 17, 1996

Project: 1736.14

**QUALITY ASSURANCE RESULTS  
FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM  
HYDROCARBONS AS DIESEL RANGE AND MOTOR OIL RANGE ORGANICS  
BY GC/FID (Modified 8015)**

Laboratory Code: 68028 (Duplicate)

<u>Analyte:</u>	<u>Reporting Units</u>	<u>Sample Result</u>	<u>Duplicate Result</u>	<u>Relative Percent Difference</u>	<u>Acceptance Criteria</u>
Diesel	ug/L (ppb)	<50	<50	nm	0-20
Motor Oil	ug/L (ppb)	<250	<250	nm	0-20

Laboratory Code: 68030 (Matrix Spike)

<u>Analyte:</u>	<u>Reporting Units</u>	<u>Spike Level</u>	<u>Sample Result</u>	<u>% Recovery MS</u>	<u>Acceptance Criteria</u>
Diesel	ug/L (ppb)	2500	<50	94	55-145

Laboratory Code: Spike Blank

<u>Analyte:</u>	<u>Reporting Units</u>	<u>Spike Level</u>	<u>% Recovery</u>		<u>Acceptance Criteria</u>	<u>Relative Percent Difference</u>
			<u>MS</u>	<u>MSD</u>		
Diesel	ug/L (ppb)	2500	89	89	55-145	0

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: June 26, 1996  
Date Received: April 17, 1996  
Project: 1736.14  
Date Samples Extracted: June 19, 1996  
Date Extracts Analyzed: June 20, 1996

RESULTS FROM THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL LEAD BY  
INDUCTIVELY COUPLED PLASMA (ICP)  
(METHOD 6010)  
Results Reported as  $\mu\text{g/L}$  (ppb)

<u>Sample ID</u>	<u>Lead</u>
LF-11	<5
LF-12	<5
Method Blank	<5

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: June 26, 1996

Date Received: April 17, 1996

Project: 1736.14

QUALITY ASSURANCE RESULTS  
FROM THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL LEAD BY  
INDUCTIVELY COUPLED PLASMA (ICP)  
(METHOD 6010)

Laboratory Code: 69749 (Duplicate)

<u>Analyte:</u>	<u>Reporting Units</u>	<u>Sample Result</u>	<u>Duplicate Result</u>	<u>Relative Percent Difference</u>	<u>Acceptance Criteria</u>
Lead	ug/L (ppb)	<5	<5	nm	0-20

Laboratory Code: Spike Blank

<u>Analyte:</u>	<u>Reporting Units</u>	<u>Spike Level</u>	<u>% Recovery</u>		<u>Acceptance Criteria</u>	<u>Relative Percent Difference</u>
			<u>MS</u>	<u>MSD</u>		
Lead	ug/L (ppb)	500	108	106	80-120	2

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

