Versar INC.

GROUNDWATER MONITORING REPORT - MAY 3, 1995
FORMER PACIFIC DRY DOCK AND REPAIR COMPANY YARD I
OAKLAND, CALIFORNIA

Prepared for:

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Versar Project No. 2722-117

August 31, 1995

PROJECT SUMMARY

On May 3, 1995, Versar, Inc. (Versar) conducted the eighth round of groundwater monitoring and sampling at the former Pacific Dry Dock and Repair Company Yard I facility located at 1441 Embarcadero in Oakland, California.

Groundwater monitoring is being conducted as part of the site investigation activities. Each sampling event includes: (1) measurement of groundwater levels from all five monitoring wells; (2) collection and analysis of groundwater samples for total petroleum hydrocarbons as gasoline, total petroleum hydrocarbons as diesel, benzene, toluene, ethylbenzene, and xylenes from monitoring wells MW-1 and MW-3; (3) calculation of the hydraulic gradient; and (4) production of a report summarizing the results of the sampling event. Mr. Philip Hoffmeister, Geologist, prepared this report under the guidance of Mr. Lawrence Kleinecke, Senior Geohydrologist.

The following conclusions summarize the investigation:

- On May 3, 1995, the calculated groundwater gradient was 0.018 feet/foot just south of east. The data used to calculate this gradient were collected during an outgoing tide.
- Total petroleum hydrocarbons as diesel, benzene, and toluene were detected in a sample collected from groundwater monitoring well MW1.

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1.0 INTRODUCTION

Versar, Inc. (Versar) has been retained by Crowley Marine Services, Inc. (Crowley) to conduct environmental investigations, including a program of groundwater monitoring, at the former Pacific Dry Dock and Repair Company Yard I Facility (The Site), located at 1441 Embarcadero in Oakland, California. This groundwater monitoring report describes the procedures and findings of the eighth round of monitoring and groundwater sampling, which was conducted on May 3, 1995. This investigation is being conducted in accordance with the regulations and policies of the San Francisco Bay Regional Water Quality Control Board and the Alameda County Health Care Services Agency.

The site occupies approximately two acres and is bounded by the Embarcadero to the north, the Oakland Inner Harbor to the south, an undeveloped lot to the east, and a boat repair yard to the west. The Site has been unoccupied since January 1994.

Currently, a machine shop with covered storage occupies the south-central section and a sheet metal bulkhead abuts the southern edge of the Site. Four aboveground diesel storage tanks occupy the southwest corner of the Site. Other structures, including an office building, a machine shed, an aboveground waste oil tank, and assorted sheds and storage buildings were demolished recently and removed. Figures 1 and 2 show the Site location and Site layout, respectively.

During the second, third, and fourth rounds of groundwater sampling, Versar collected additional filtered duplicate groundwater samples from monitoring wells MW1 and MW3. These additional samples were filtered in the field using a 0.45 micrometer filter and submitted for laboratory analysis of TPH-D. Laboratory analytical results of the filtered duplicate samples generally indicated a lower concentration of TPH-D compared to the unfiltered samples. These results indicate that the concentrations of TPH-D detected in unfiltered samples are higher due to contaminant adsorption to soil particles in the groundwater samples.

Concentrations of total dissolved solids (TDS) in the groundwater samples collected from the Site regularly exceed 3,000 milligrams per liter, the baseline above which the water quality

control plan published by the Regional Water Quality Control Board - San Francisco Bay Region considers water not suitable for beneficial uses. The groundwater elevation is consistently higher at the west end of the site.

1.1 Site Geology and Geohydrology

The Site is located in the Coast Ranges geomorphic province between the Hayward Fault (to the east) and the San Andreas Fault (to the west). The underlying bedrock consists of Mesozoic volcanic and metavolcanic rocks similar to those found throughout the Coast Ranges. Overlying the bedrock are Quaternary marine and nonmarine alluvial sediments consisting of clays and silts.

The Site is nearly level at an elevation ranging from five to ten feet above lower low-tide datum (National Geodetic Vertical Datum of 1929). Versar's investigation has characterized the shallow soils beneath the Site as sand, silt, and clay fill material extending from the surface to the bay muds. The fill material contains wood and brick fragments. The bay muds consist of silty clays, clays with shell fragments, and thin layers of sands or gravels. These layers are often saturated with groundwater.

During the May 3, 1995 sampling event, Versar measured the depth to groundwater between 3.01 and 8.90 feet below ground surface (bgs), during an outgoing tide. Calculations indicate a groundwater gradient of 0.018 feet per foot (ft/ft) just south of east. The impact of tidal fluctuations on gradient calculations has not yet been determined. Figure 3 shows the groundwater contours and flow direction calculated from the eighth sampling round. A hydrograph of the groundwater elevations in the monitoring wells from all seven groundwater monitoring events is included as Figure 4. The groundwater contours and flow direction calculated from previous sampling events are depicted in Appendix A.

1.2 Site History

Since 1935, the Site has been used as a dry dock facility. In the past, while repairing and refurbishing seagoing vessels, Crowley used products containing regulated materials and generated various regulated and nonregulated wastes. These products and waste materials include waste sand-blasting materials, oil-based paints, solvents, acids, caustic agents, waste oils, motor fuels, and the waste generated during the use of these products.

During December 1989 and January 1990, Versar conducted a site assessment of the Site. The Site assessment (Versar, 1990) identified an underground storage tank (UST) reported to contain unleaded gasoline. The UST was reportedly out of service.

In September 1991, Versar supervised the removal of the UST (Versar, 1991). Soil and groundwater samples collected from the excavation following the removal were found to contain total petroleum hydrocarbons as gasoline (TPH-G); total petroleum hydrocarbons as diesel (TPH-D); total oil and grease (TOG); benzene, toluene, ethylbenzene, and xylenes (BTEX); and organic lead.

During October 1991 and January 1992, Versar collected a series of soil and groundwater samples from the Site (Versar, May 1992). The results of this investigation identified four areas of soil containing identifiable concentrations of TPH-G, TPH-D, TOG, and BTEX.

On June 23 and 24, 1993, five 2-inch-diameter groundwater monitoring wells were installed to a depth of 13 to 14 feet bgs at the Site (Versar, November 7, 1993). During drilling activities, soil samples collected from boreholes MW1, MW2, and MW4 were submitted for laboratory analysis and concentrations of TPH-D, BTEX, and TOG were identified. Analysis of soil samples collected from borehole MW3 identified concentrations of TPH-D and toluene. The sample collected from borehole MW5 contained only toluene.

Metals were detected in two soil samples (MW1-5.5 and MW3-5.5). Metals detected were arsenic, barium, beryllium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc. However, none of the detected metals exceeded their respective regulatory limits.

On June 25, 1993, Versar developed each monitoring well by removing a minimum of five well volumes of groundwater, or until dry. On July 1, 1993, each well was purged and sampled in the first of a series of monitoring and sampling events. The groundwater samples were analyzed for TPH-D, TPH-G, TOG, and BTEX. Additionally, the groundwater sample collected from MW3 was analyzed for semivolatile organic compounds and volatile organic compounds.

Versar conducted the second round of groundwater monitoring and sampling at the Site on October 14, 1993. The samples were analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. On December 8, 1993, a peristaltic pump and groundwater sampling filter were used to collect duplicate samples from monitoring wells MW1 and MW3. The analytical results of filtered groundwater samples collected from these wells showed up to a tenfold decrease in the concentration of TPH-D when compared to unfiltered samples. These results indicate that some of the TPH-D contamination detected previously in monitoring wells MW1 and MW3 was due to the adsorption of TPH-D to soil particles.

Versar conducted the third round of monitoring and sampling at the Site on January 17 and 18, 1994. The groundwater samples were again analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. Petroleum hydrocarbon constituents were detected in monitoring wells MW1 and MW3.

Versar conducted the fourth round of monitoring and sampling at the Site on March 30, 1994. The groundwater samples were analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. Petroleum hydrocarbon constituents were detected in monitoring well MW1. In addition, toluene was detected in the other four monitoring wells.

Versar conducted the fifth round of monitoring and sampling at the Site on July 15, 1994. The groundwater samples were analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. Petroleum hydrocarbon constituents were detected in monitoring well MW1. In addition, toluene was detected in the other four monitoring wells. Due to the extremely low concentrations of analytes, when detected, in monitoring wells MW2, MW4, and MW5 however, it was decided that only MW1 and MW3 would be sampled in the sixth groundwater

monitoring event. The Alameda County Department of Health Services (ACHS) agreed to Crowley's proposal to reduce the number of wells to be sampled.

Versar conducted the sixth round of monitoring and sampling at the Site on October 19, 1994. The groundwater samples were analyzed for TPH-D, TPH-G, and BTEX. Petroleum hydrocarbon constituents were detected in monitoring well MW1. Monitoring well MW3 did not contain any petroleum hydrocarbons at or above the method reporting limit.

Versar conducted the seventh round of monitoring and sampling at the Site on February 2, 1995. The groundwater samples were analyzed for TPH-D, TPH-G, and BTEX. Groundwater samples from MW1 and MW3 did not contain concentrations of TPH-D at or above the method reporting limits. The groundwater sample from MW3 contained 100 micrograms per liter (µg/l) of TPH-G. Laboratory analytical results also identified benzene and toluene in monitoring well MW3, at concentrations of 38 µg/l and 0.55 µg/l, respectively. The groundwater sample from MW1 did not contain concentrations of TPH-G at or above the method reporting limits. Further discussions with the analytical laboratory determined that the TPH-G reported in sample MW-3 consisted primarily of benzene, which was also measured as TPH-G. Because the benzene occurs as part of the TPH-G chromatograph, the benzene was reported both as benzene and as TPH-G. The difference in reported concentrations is due to different algorithms being applied to determine concentrations from the chromatograph peaks. A letter from the laboratory discussing the analytical result was included within Appendix D of the seventh quarterly report.

1.3 Groundwater Monitoring Program

The primary purpose of this program is to maintain regularly scheduled groundwater monitoring at the Site. The general objectives of this eighth sampling event were to:

- measure groundwater levels in monitoring wells MW1, MW2, MW3, MW4, and MW5 and determine the local hydraulic gradient;
- purge and collect groundwater samples from monitoring wells MW1, and MW3;

- submit the groundwater samples to a certified laboratory for analysis for TPH-G, TPH-D, and BTEX; and
- prepare this groundwater monitoring report.

3.0 LABORATORY ANALYTICAL RESULTS

During this sampling event, Versar submitted two groundwater samples for laboratory analysis for TPH-G, TPH-D, and BTEX. Analysis for TPH-G and TPH-D was performed following the California Department of Health Services method. Analysis for BTEX was performed following the modified EPA Method 8020. The analytical results are summarized in Figure 5. A copy of the laboratory analytical report and chain-of-custody record from the sampling event is included as Appendix D.

The laboratory reported that the groundwater samples collected on May 3, 1995, from monitoring wells MW1 and MW3 did not contain concentrations of TPH-G at or above the method reporting limits. The groundwater sample from MW1 contained 78 micrograms per liter (µg/L) of TPH-D. Laboratory analytical results also identified benzene and toluene in monitoring well MW1, at concentrations of 1.6 µg/L and 0.58 µg/L, respectively. The groundwater sample from MW3 did not contain concentrations of TPH-D or BTEX at or above the method reporting limits.

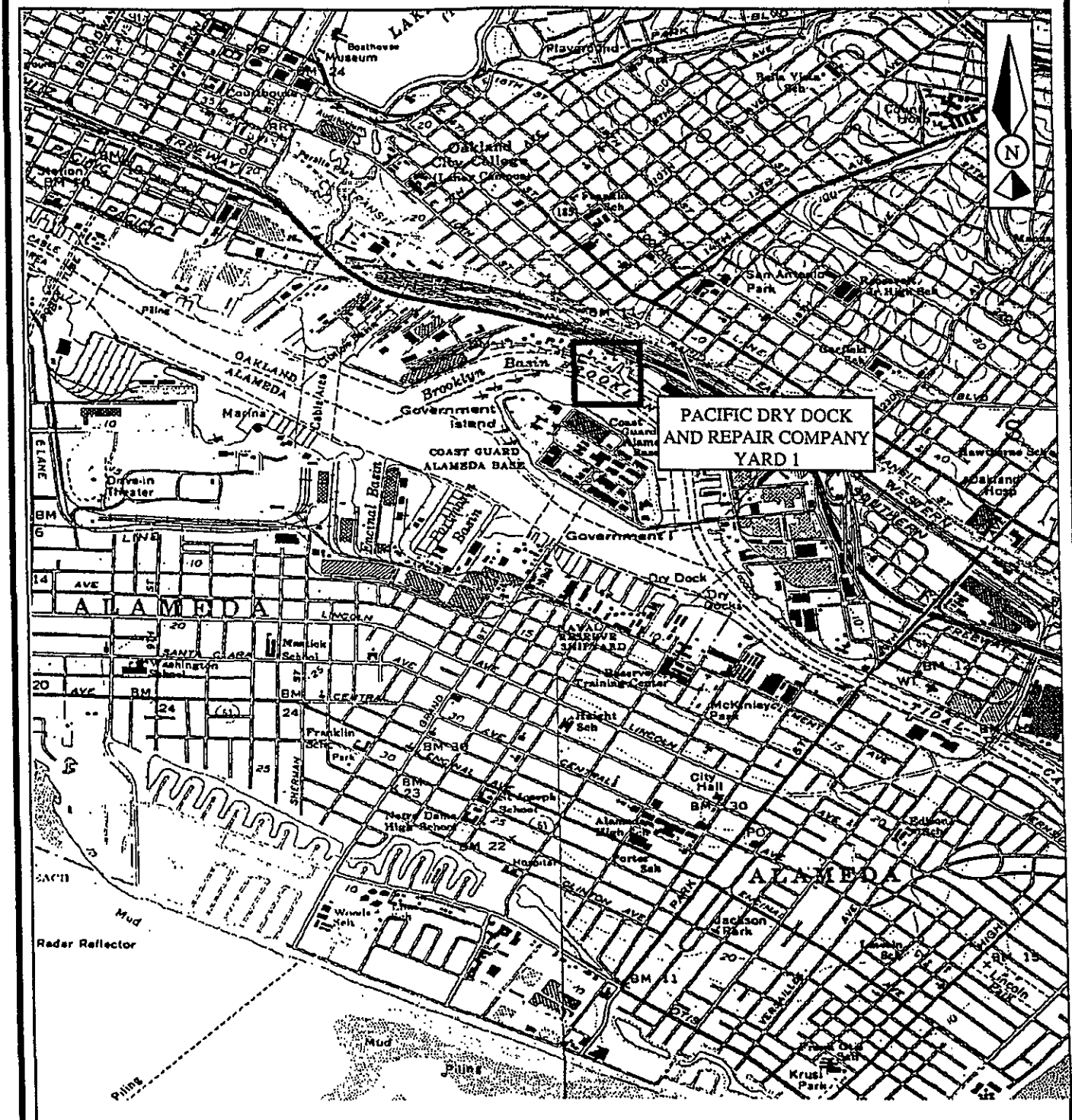
Laboratory analytical results for groundwater samples from May 3, 1995, are summarized in Table 2. Results of laboratory analysis for TPH-D in the filtered duplicate samples from MW1 and MW3 from previous sampling events are summarized in Table 3. The historical chemical data is summarized in Table 4.

4.0 FUTURE ACTIVITIES

This is the eighth round of the sampling activities for the two monitoring wells MW1 and MW3 at the Site. The next sampling event is scheduled for August 1995.

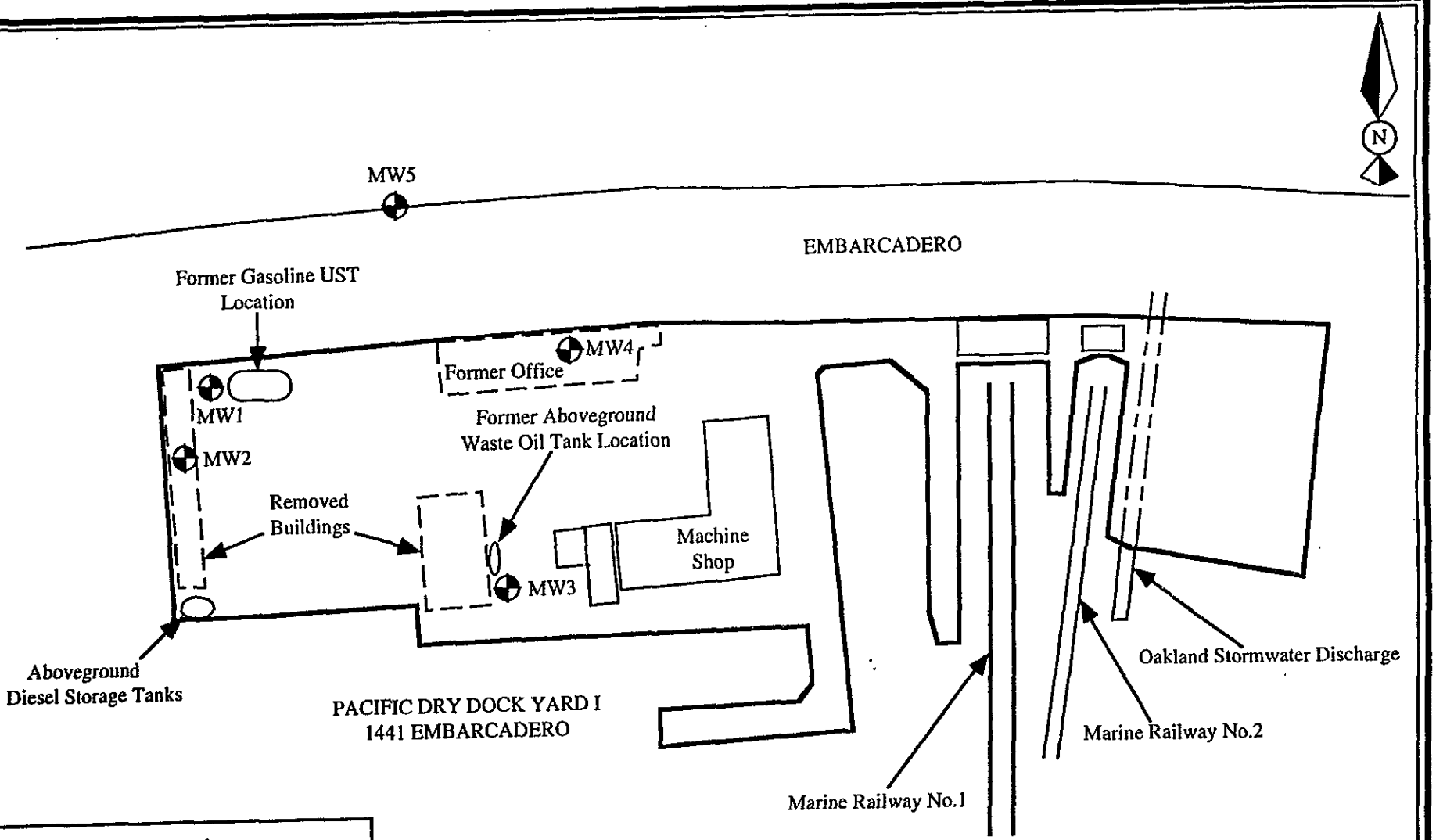
5.0 REFERENCES

Versar, Inc. Fair Oaks, California. November 7, 1993, Well Installation, Pacific Dry Dock and Repair Yard I, Western Section, Oakland, California.



SOURCE: USGS TOPO 1959

Scale (miles) 0 0.25 0.50	Site Location Pacific Dry Dock and Repair Company Yard I Oakland, California	Figure 1
Project No. 2722-117		Versar, Inc.



Scale (feet)

0 50 100

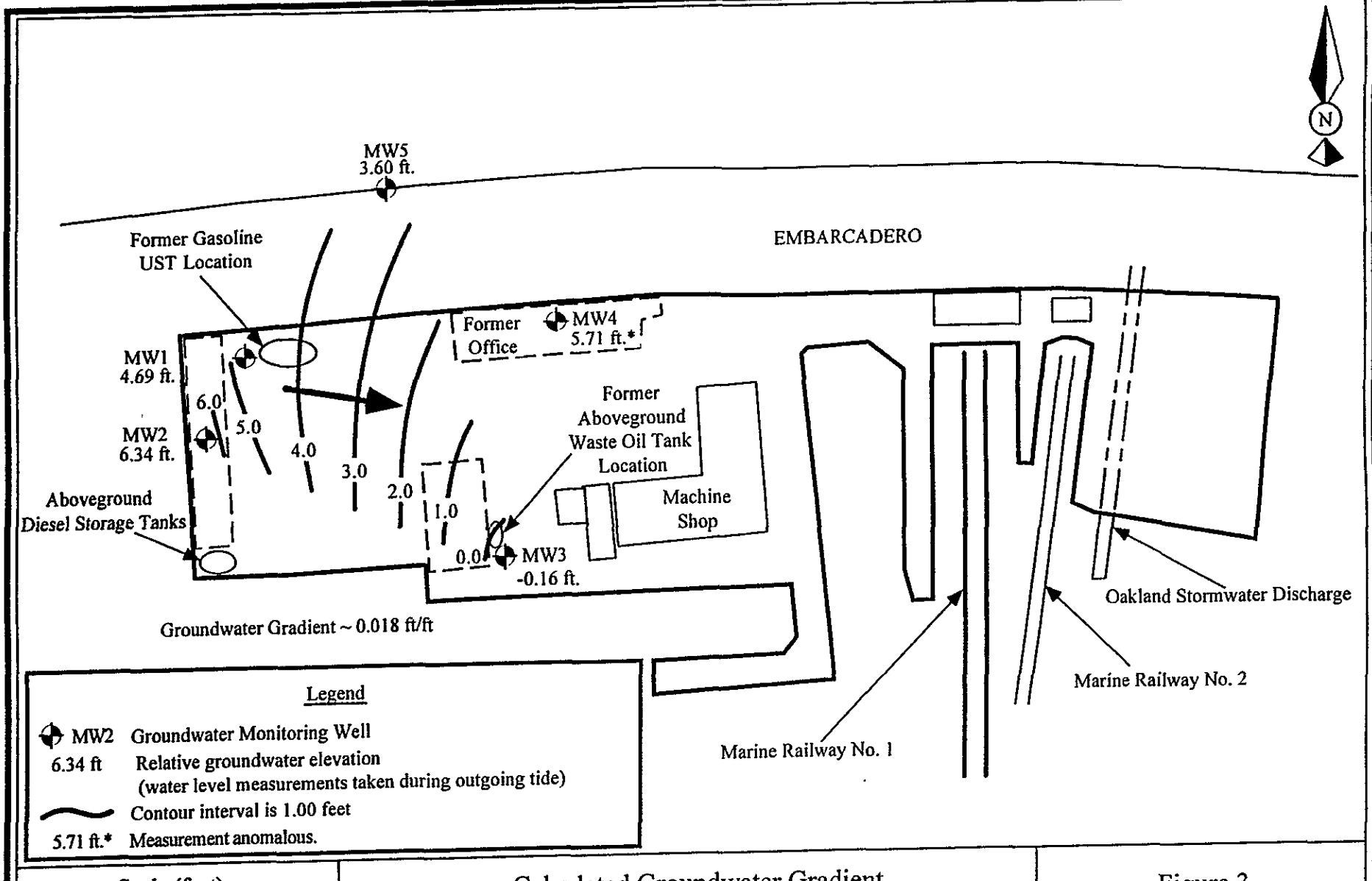
Project No. 2722-117

Site Layout

Pacific Dry Dock and Repair Company Yard I
Oakland, California

Figure 2

Versar, Inc.



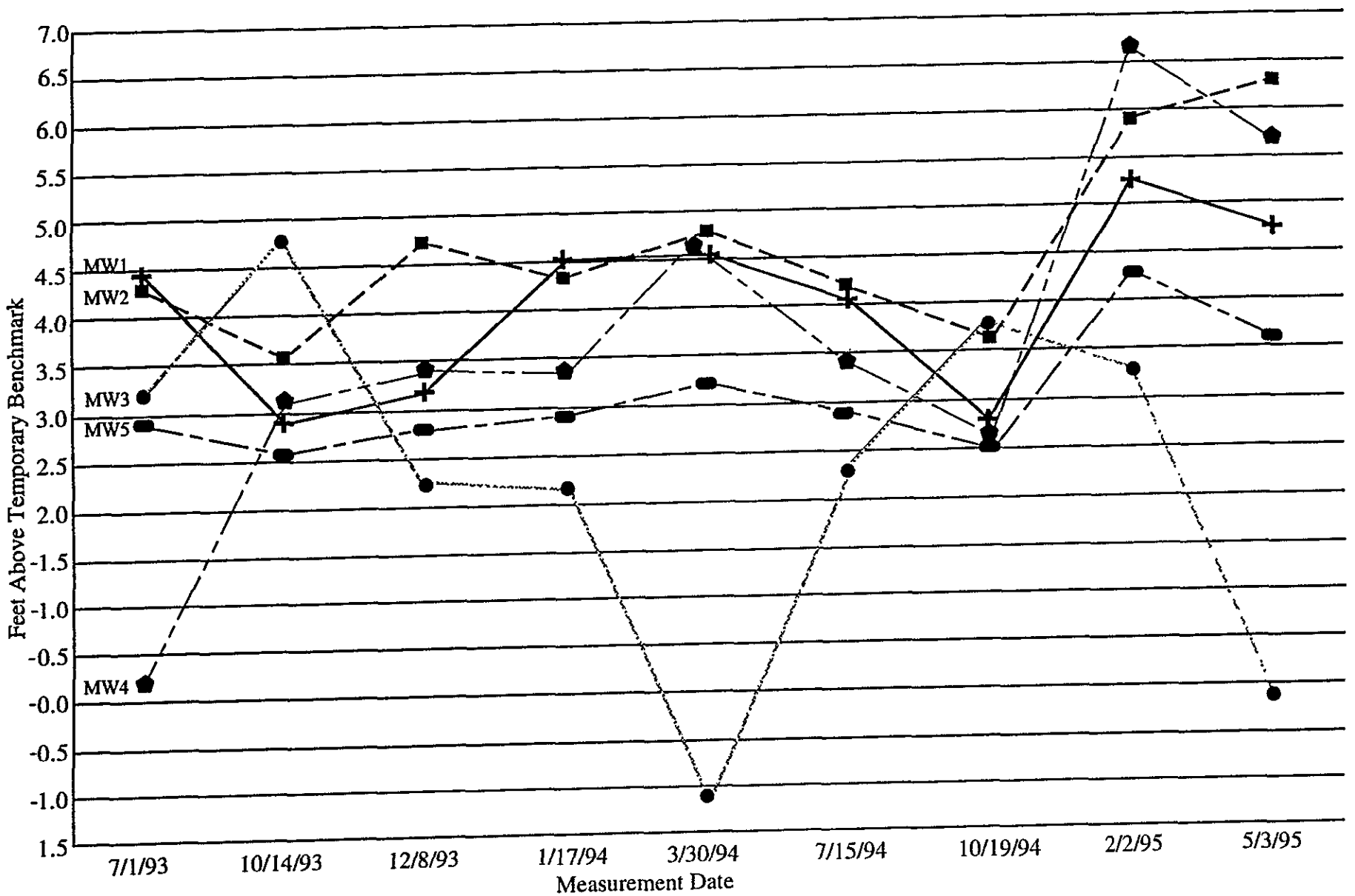
Project No. 2722-117

Calculated Groundwater Gradient
May 3, 1995

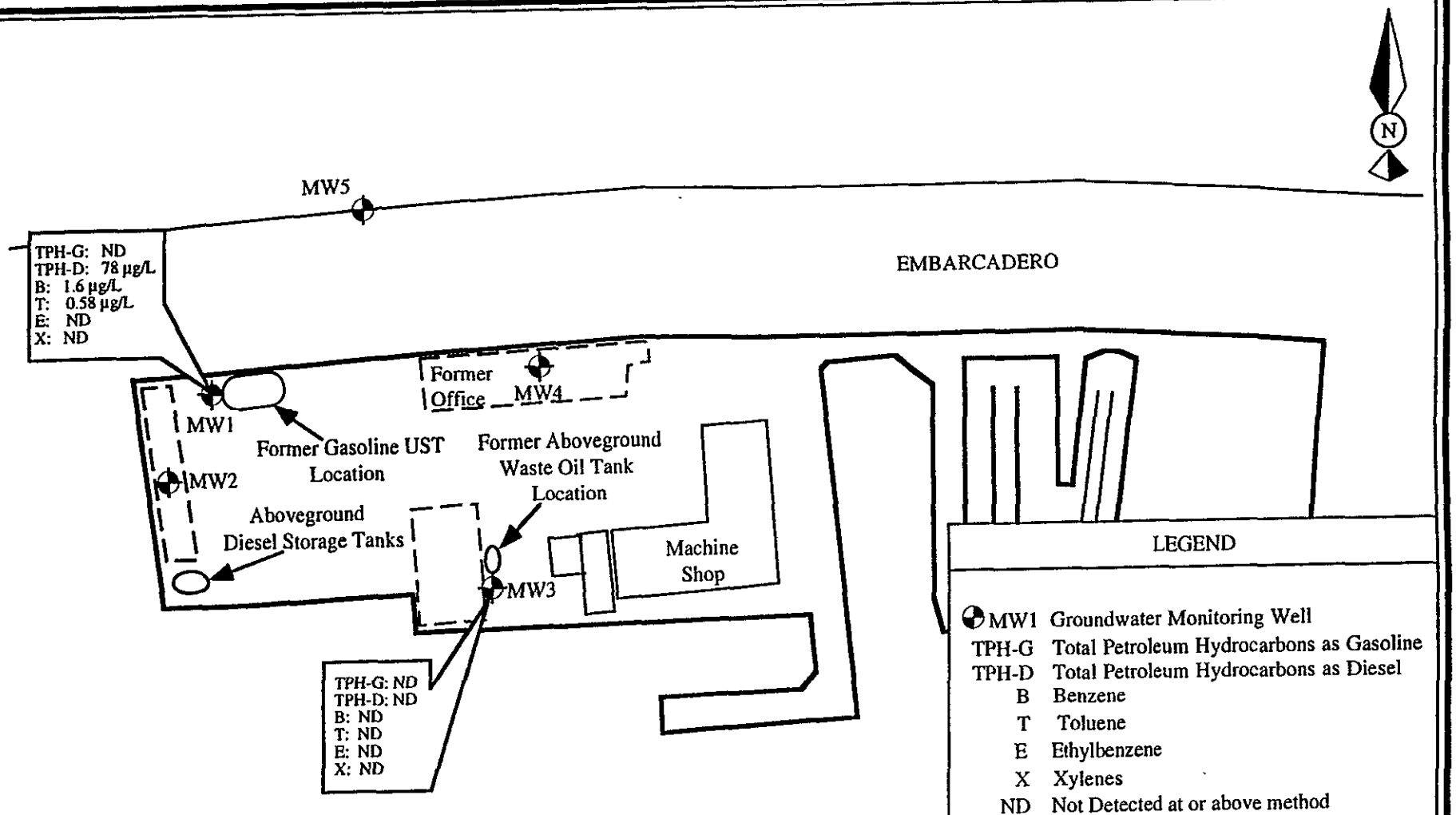
Pacific Dry Dock and Repair Company Yard I
Oakland, California

Figure 3

Versar, Inc.



Not to Scale	Groundwater Measurements July 1, 1993 through May 3, 1995 Pacific Dry Dock and Repair Company Yard I Oakland, California	Figure 4
Project No. 2722-117		Versar, Inc.



Scale (feet)

0 50 100

Project No. 2722-117

Laboratory Analytical Results for Groundwater Samples Collected on May 3, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

Figure 5

Versar, Inc.

TABLE 1

GROUNDWATER MONITORING REPORT
MONITORING WELL GROUNDWATER LEVELS

May 3, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

	MW1	MW2	MW3	MW4	MW5	Hydraulic Gradient (feet/foot)
Reference Casing Elevation (feet)	9.45	9.34	8.76	9.55	9.51	
July 1, 1993						
Depth to Groundwater (High Tide)[1]	5.01	4.94	5.54	9.33	6.56	
Groundwater Elevation	4.44	4.40	3.22	1.22	2.95	0.017 ft/ft to the east
October 14, 1993						
Depth to Groundwater (High Tide)[1]	6.54	5.74	3.98	6.45	6.92	
Groundwater Elevation	2.91	3.60	4.78	3.10	2.59	0.013 ft/ft to the north
December 8, 1993						
Depth to Groundwater (Low Tide)[2]	6.28	4.55	6.50	6.02	6.71	
Groundwater Elevation	3.17	4.79	2.26	3.53	2.80	0.016 ft/ft to the east
January 17, 1994						
Depth to Groundwater (High Tide)[1]	4.93	4.90	6.60	6.05	6.60	
Groundwater Elevation	4.52	4.44	2.16	3.50	2.91	0.013 ft/ft to the southeast
March 30, 1994						
Depth to Groundwater (Low Tide)[2]	4.87	4.51	9.81	4.91	6.35	
Groundwater Elevation	4.58	4.83	-1.05	4.65	3.16	0.030 ft/ft to the southeast

[1] Depth-to-groundwater measurements were taken during high tide and are expressed in feet below top of casing.
[2] Depth-to-groundwater measurements were taken during low tide and are expressed in feet below top of casing.

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GROUNDWATER MONITORING REPORT
MONITORING WELL GROUNDWATER LEVELS

May 3, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

	MW1	MW2	MW3	MW4	MW5	Hydraulic Gradient (feet/foot)
July 15, 1994						
Depth to Groundwater (Outgoing Tide)[3]	5.31	5.16	8.76	9.55	9.51	
Groundwater Elevation	4.14	4.18	1.81	3.49	2.95	0.013 ft/ft to the southeast
October 19, 1994						
Depth to Groundwater (Incoming Tide)[4]	6.67	5.72	5.00	6.89	7.00	
Groundwater Elevation	2.78	3.62	3.76	2.66	2.51	0.007 ft/ft to the northeast
Reference Casing Elevation (feet) February 17, 1995	9.45	9.35	8.74	9.50	9.51	
February 2, 1995						
Depth to Groundwater (Incoming Tide)[4]	4.24	3.43	6.06	2.92	5.15	0.017 ft/ft
Groundwater Elevation	5.21	5.92	2.68	6.58	4.36	to the southeast
May 3, 1995						
Depth to Groundwater (Outgoing Tide)	4.76	3.01	8.90	3.79	5.91	0.018 ft/ft
Groundwater Elevation	4.69	6.34	-0.16	5.71	3.60	south of east

[1] Depth-to-groundwater measurements were taken during high tide and are expressed in feet below top of casing.
[2] Depth-to-groundwater measurements were taken during low tide and are expressed in feet below top of casing.
[3] Depth-to-groundwater measurements were taken on an outgoing tide and are expressed in feet below top of casing.
[4] Depth-to-groundwater measurements were taken on an incoming tide and are expressed in feet below top of casing.

TABLE 2

GROUNDWATER MONITORING REPORT
LABORATORY ANALYTICAL RESULTS FOR GROUNDWATER

May 3, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G (µg/L)[1]	TPH-D (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS (µg/L)	Salinity
MW1	5/3/95	ND[2]	78	1.6	0.58	ND	ND	NA	NA[3]
MW3	5/3/95	ND	ND	ND	ND	ND	ND	NA	NA

[1] µg/L = micrograms per liter
[2] ND = Not Detected at or above method reporting limits.
[3] NA = Not Analyzed

TABLE 3

GROUNDWATER MONITORING REPORT
LABORATORY ANALYTICAL RESULTS FOR TPH-D IN FILTERED DUPLICATE SAMPLES
FROM MONITORING WELLS MW1 AND MW3

May 3, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	Total Petroleum Hydrocarbons as Diesel (µg/L)[1]
MW1	10/14/93	63
	1/18/94	60
	3/30/94	110
MW1 (Filtered Duplicate)	12/8/93	57
	1/18/94	150
	3/30/94	ND[2]
MW3	10/14/93	840
	1/18/94	64
	3/30/94	ND
MW3 (Filtered Duplicate)	12/8/93	89
	1/18/94	91
	3/30/94	ND

[1] µg/L = micrograms per liter
[2] ND = Not Detected at or above method reporting limits.

TABLE 4

GROUNDWATER SAMPLING AND ANALYSIS PROGRAM
HISTORICAL TREND OF CHEMICAL DATA FOR GROUNDWATER

May 3, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G (µg/L)[1]	TPH-D (µg/L)	Total Oil and Grease (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS (µg/L)	Salinity
MW1	7/1/93	ND[2]	ND	ND	ND	ND	ND	ND	NA[3]	NA
	1014/93	ND	63	NA	ND	ND	ND	ND	8,800,000	8.7
	1/18/94	ND	60	NA	NA	1.0	1.4	1.5	1,200,000	1.0
	3/30/94	ND	110	NA	2.5	1.7	0.56	1.9	NA	0.97
	7/15/94	ND	60	ND	ND	ND	ND	ND	NA	NA
	10/19/94	ND	830	NA	ND	ND	ND	ND	NA	NA
	2/2/95	ND	ND	NA	ND	ND	ND	ND	NA	NA
	5/3/95	ND	78	NA	1.6	0.58	ND	ND	NA	NA
MW2	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	ND	NA	ND	ND	ND	ND	12,000,000	11
	1/18/94	ND	ND	NA	ND	ND	ND	ND	570,000	0.46
	3/30/94	ND	ND	ND	ND	2.2	ND	ND	NA	0.29
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA
MW3	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	840	NA	ND	ND	ND	ND	31,000,000	29
	1/18/94	ND	64	NA	ND	ND	ND	ND	28,000,000	27
	3/30/94	ND	ND	NA	ND	0.90	ND	ND	NA	21
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/19/94	ND	ND	NA	ND	ND	ND	ND	NA	NA
	2/2/95	100	ND	NA	38	0.55	ND	ND	NA	NA
	5/3/95	ND	ND	NA	ND	ND	ND	ND	NA	NA

[1] µg/L = micrograms per liter
[2] ND = Not Detected at or above method reporting limits.
[3] NA = Not Analyzed

TABLE 4 (Continued)

GROUNDWATER SAMPLING AND ANALYSIS PROGRAM
HISTORICAL TREND OF CHEMICAL DATA FOR GROUNDWATER

May 3, 1995

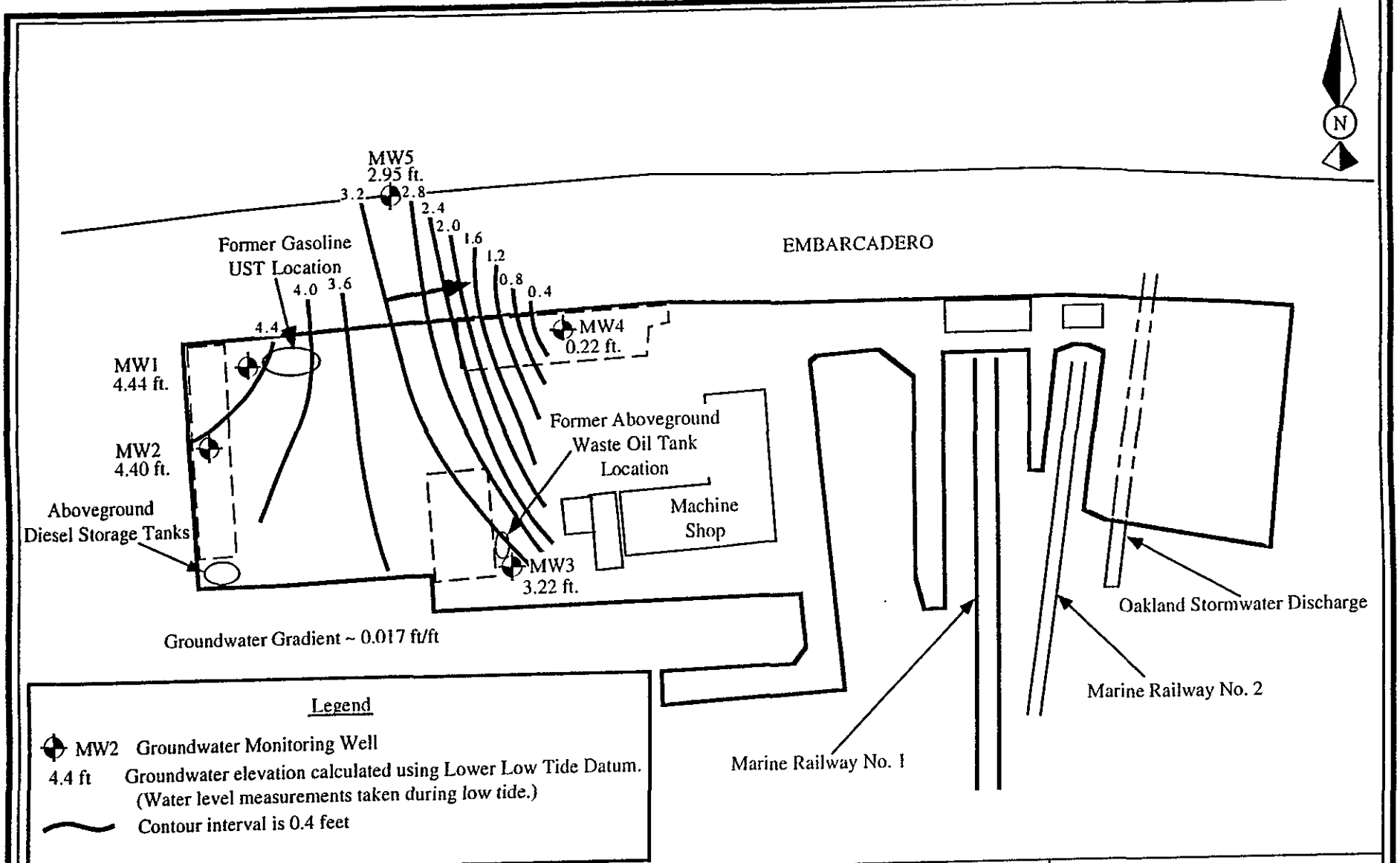
Pacific Dry Dock and Repair Company Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G (µg/L)[1]	TPH-D (µg/L)	Total Oil and Grease (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS (µg/L)	Salinity
MW4	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	ND	NA	ND	ND	ND	ND	3,600,000	3.4
	1/18/94	ND	ND	NA	ND	ND	ND	ND	3,100,000	2.6
	3/30/94	ND	ND	NA	ND	1.5	ND	1.5	NA	0.1
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA
MW5	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	ND	NA	ND	ND	ND	ND	2,000,000	2.0
	1/18/94	ND	ND	NA	ND	ND	ND	ND	2,200,000	2.1
	3/30/94	ND	ND	ND	ND	0.87	ND	ND	NA	1.6
	7/15/94	ND	ND	ND	ND	ND	ND	NA	NA	

[1] µg/L = micrograms per liter
[2] ND = Not Detected at or above method reporting limits.
[3] NA = Not Analyzed

APPENDIX A

Groundwater Contour Maps from Previous Groundwater Monitoring Events

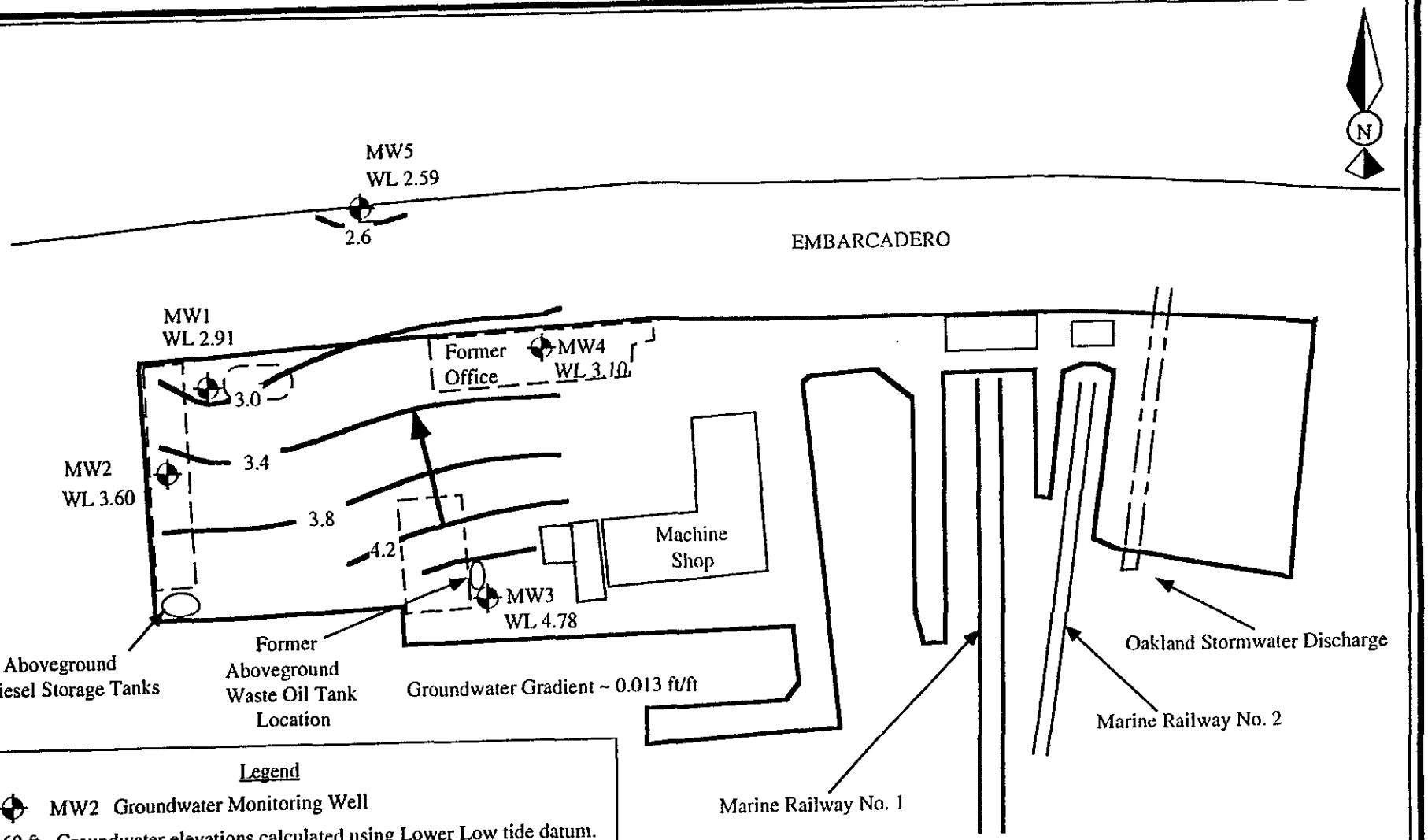


Project No. 2722-017

Calculated Groundwater Gradient
July 1, 1993
Pacific Dry Dock Yard I
Oakland, California

Figure 1

Versar, Inc.



Scale (feet)

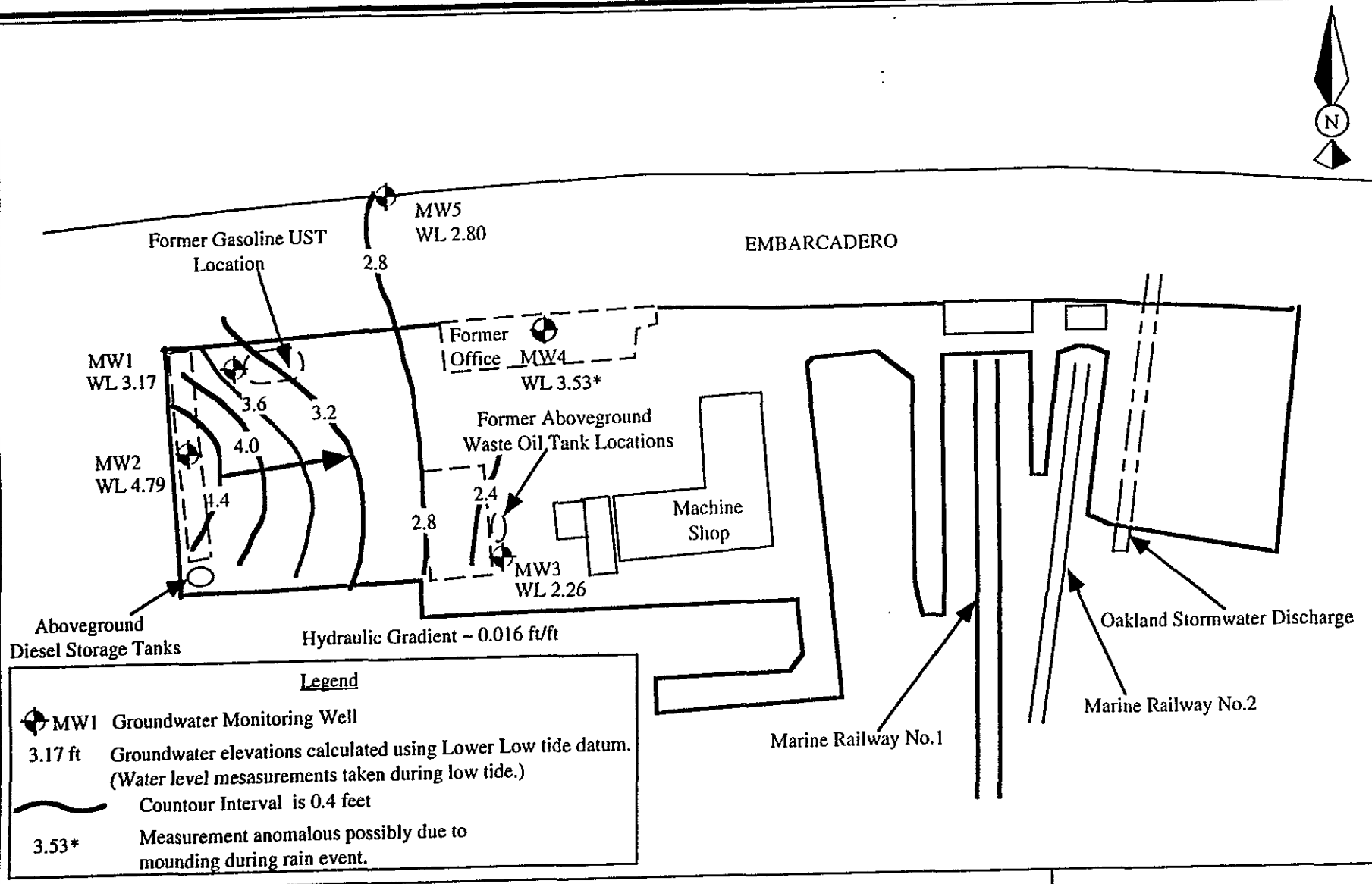
0 50 100

Project No. 2722-017

Calculated Groundwater Gradient
October 14, 1993
Pacific Dry Dock Yard I
Oakland, California

Figure 2

Versar, Inc.



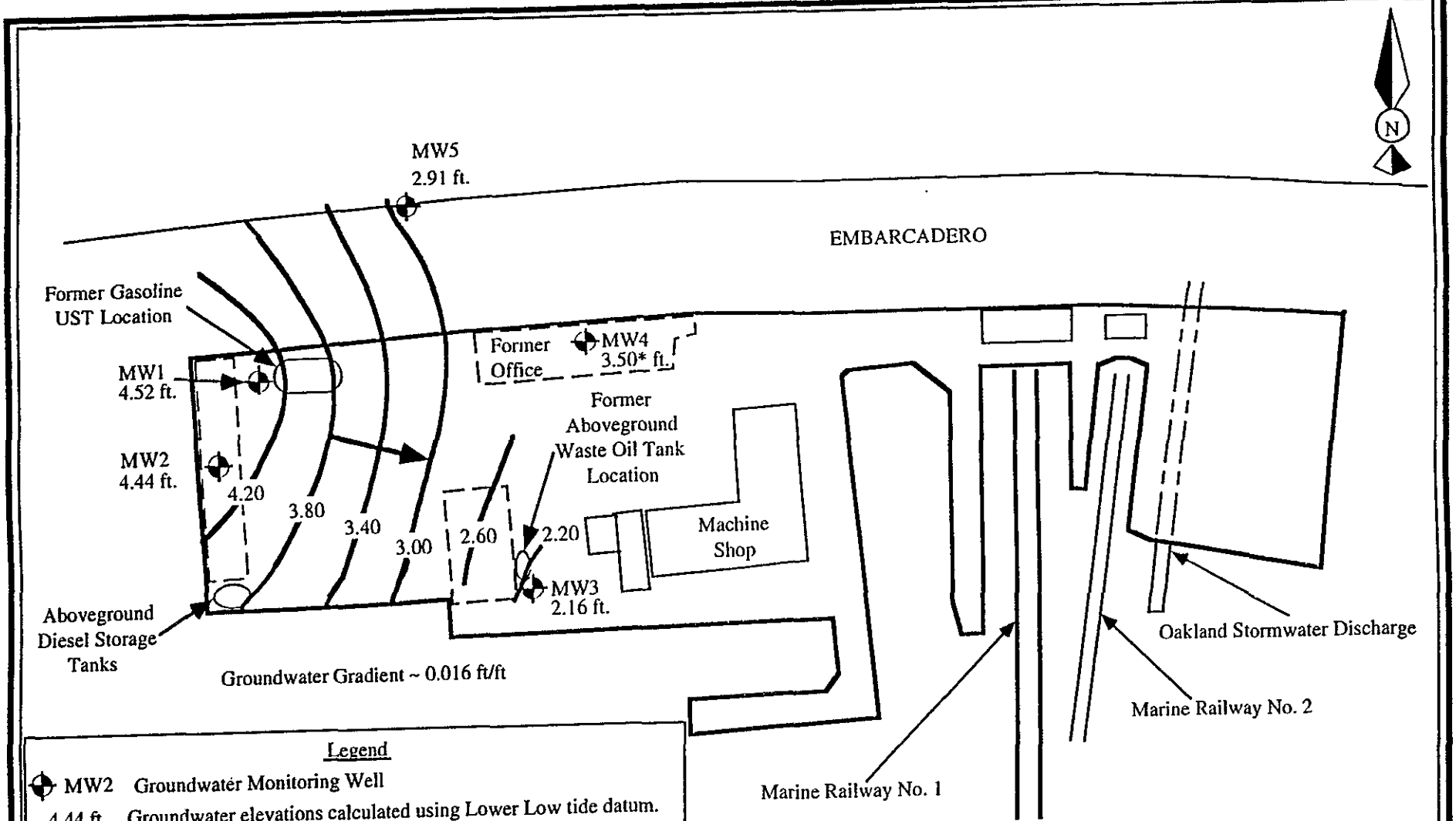
Calculated Groundwater Gradient
December 8, 1993

Figure 3

Project No. 2722-017

Pacific Dry Dock Yard I
Oakland, California

Versar, Inc.



Legend

MW2 Groundwater Monitoring Well

4.44 ft. Groundwater elevations calculated using Lower Low tide datum. (Water level measurements taken during high tide.)

Contour interval is 0.40 feet

3.50* ft. Measurement anomalous due to mounding during rain event.

Scale (feet)

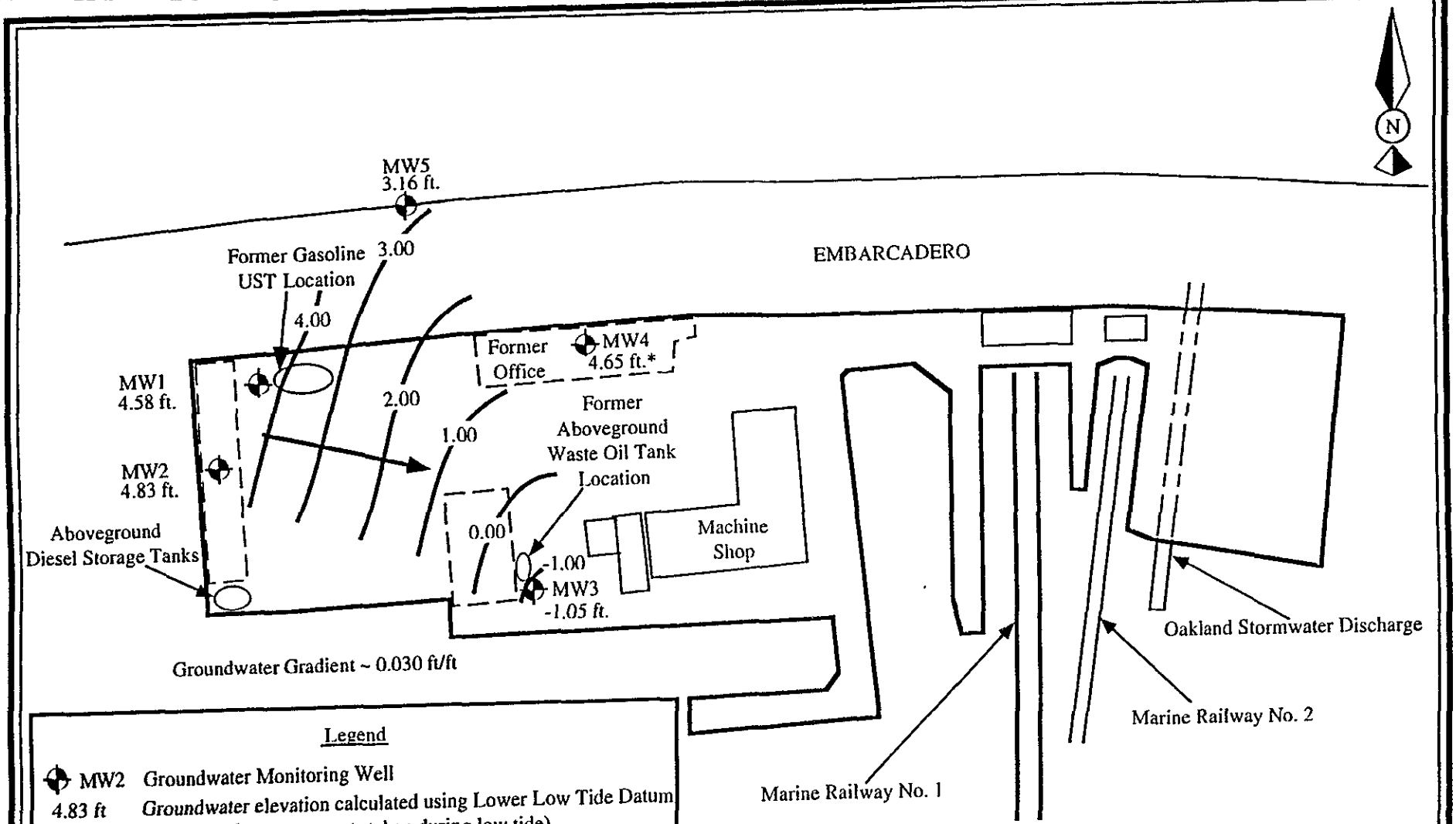
0 50 100

Project No. 2722-017

Calculated Groundwater Gradient
January 17, 1994
Pacific Dry Dock Yard I
Oakland, California

Figure 4

Versar, Inc.

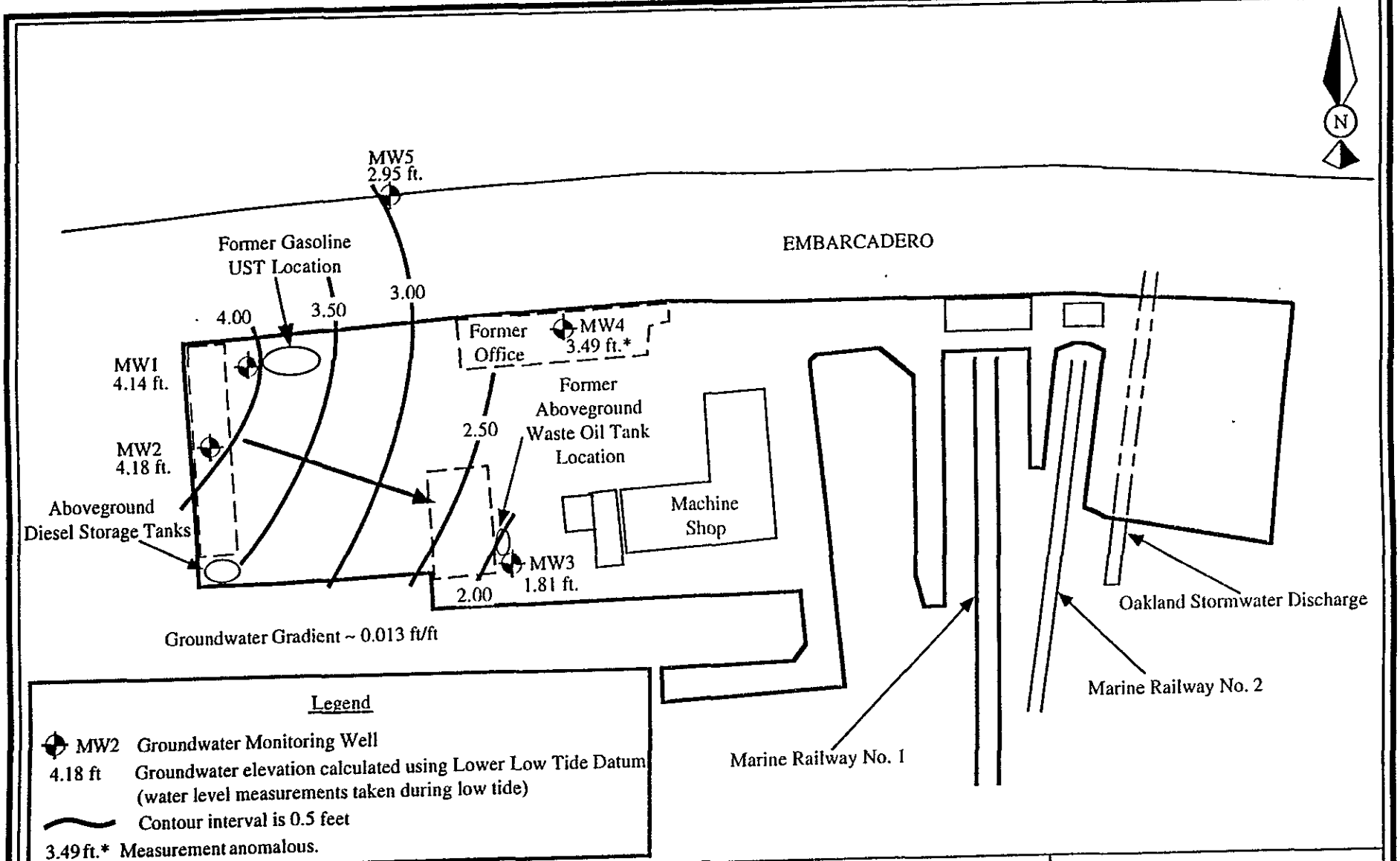


Project No. 2722-017

Calculated Groundwater Gradient
March 30, 1994
Pacific Dry Dock Yard I
Oakland, California

Figure 5

Versar, Inc.

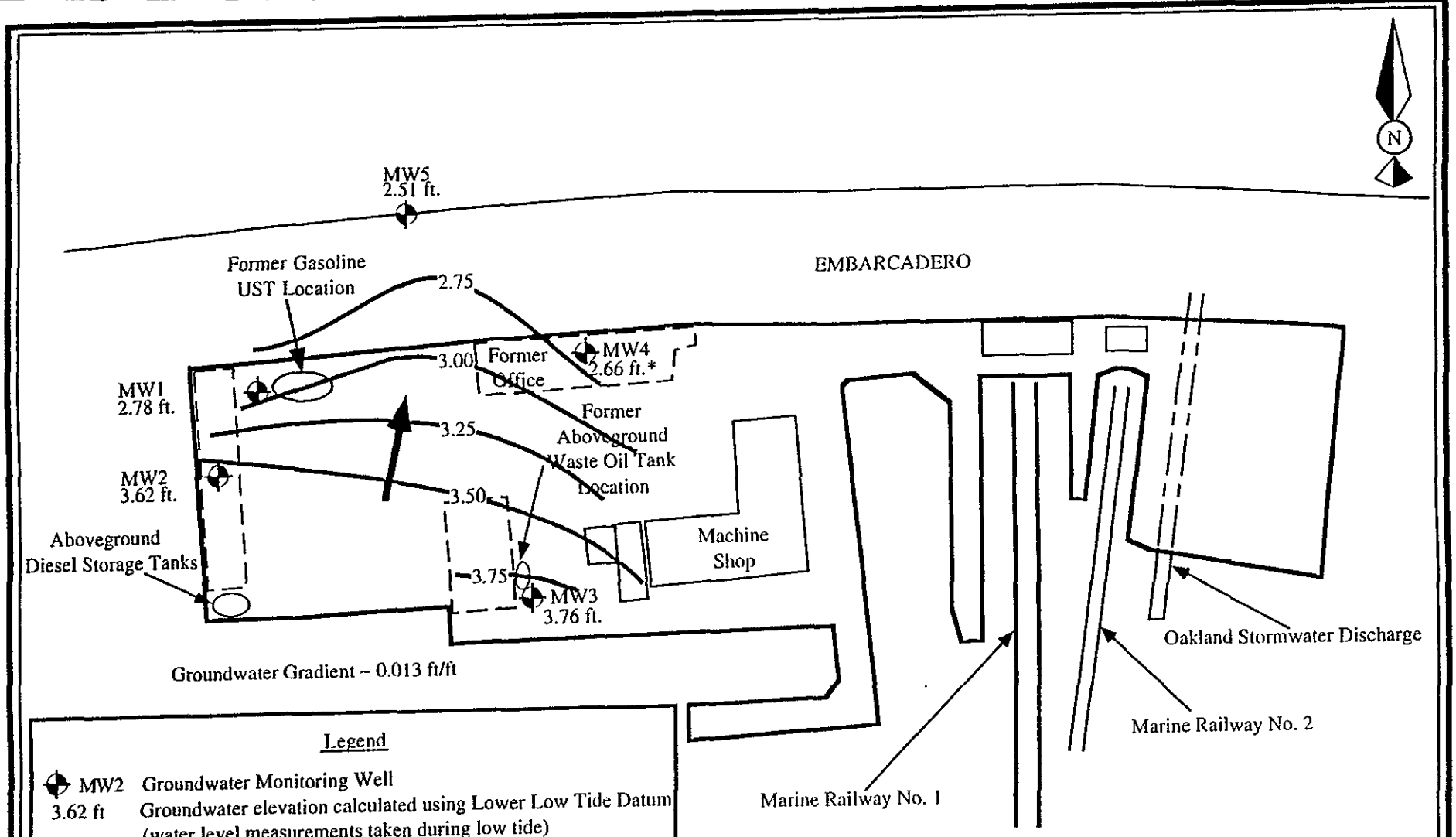


Project No. 2722-017

Calculated Groundwater Gradient
July 15, 1994
Pacific Dry Dock Yard I
Oakland, California

Figure 6

Versar, Inc.

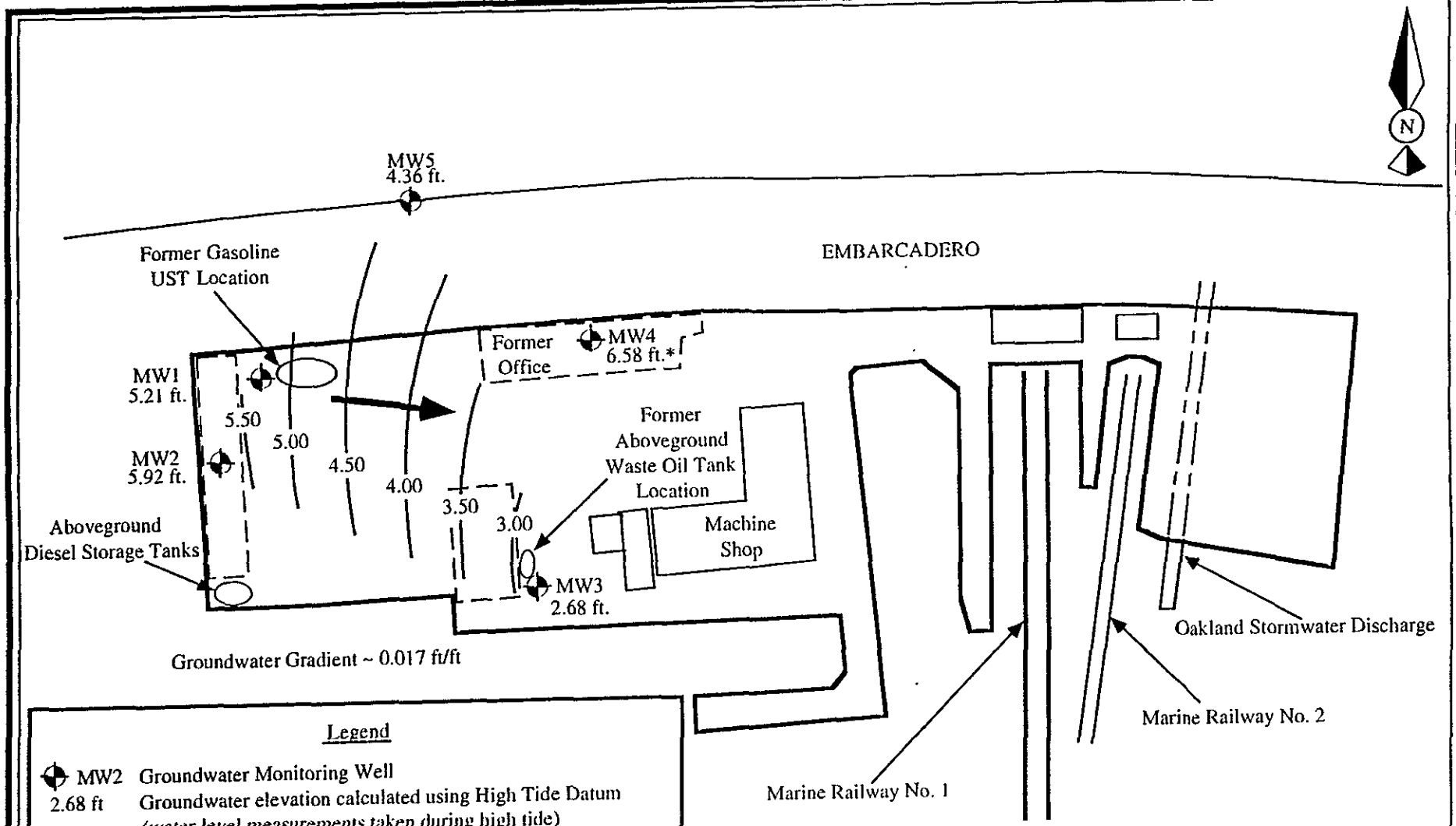


Project No. 2722-017

Calculated Groundwater Gradient
October 19, 1994
Pacific Dry Dock Yard I
Oakland, California

Figure 7

Versar, Inc.



Project No. 2722-117

Calculated Groundwater Gradient
February 2, 1995

Pacific Dry Dock and Repair Company Yard I
Oakland, California

Figure 8

Versar, Inc.

APPENDIX B

Groundwater Monitoring and Sampling Procedures

1.0 SAMPLING AND DECONTAMINATION PROCEDURES

The decontamination procedures for non-dedicated field equipment and well development/purging equipment are given below. These procedures are followed during all field activities.

1. Non-dedicated well development, purging, and sampling equipment is carefully pre-cleaned prior to each use, as follows:

   a. Carefully brush off any loose foreign debris with a soft bristle brush.

   b. Rinse the equipment thoroughly in clean water.

   c. Wash the equipment in a non-phosphate detergent bath.

   d. Rinse thoroughly in clean water.

   e. Rinse with pesticide-grade hexane (if deemed necessary).

   f. Rinse thoroughly with deionized water.

   g. Air dry in a dust-free environment.

   h. Store in sterile plastic bags or other suitable cover until use.

2. Clean disposable gloves are worn by all field personnel when handling decontaminated equipment.

2.0 COLLECTION OF SAMPLES

2.1 Groundwater Sampling

Groundwater samples were collected for laboratory analysis using the procedures given below.

1. Open the well and measure the organic vapor concentration with a flame ionization detector (FID) or photoionization dectector (PID).

2. Measure the water levels (if any) in the well using a decontaminated measuring device. All measurements must be made to the nearest 0.01 foot, and measured relative to the top of the casing. Record the depth of the water in the field notebook.

3. Inspect the disposal bailer to ensure that the bottom valve assembly is working correctly.

4. Begin purging the well by inserting a bailer into the PVC monitoring well casing and carefully lower it into the well. Take care to avoid agitating and aerating the fluid column in the well.

5. Slowly withdraw the bailer and transfer the water samples to a sampling containers.

6. Measure the temperature, pH, conductivity, and turbidity. Record these and all subsequent measurements in the field notebook.

7. Continue purging the well (a minimum of three well volumes) until the temperature, pH, conductivity, and turbidity have stabilized, or the well is dry.

8. When the water has recovered to 80 percent of the original level, carefully lower a new disposable bailer into the well and recover groundwater samples.

9. Fill the appropriate sample containers by releasing water from the bailer via the bottom emptying device with a minimum of agitation. The most volatile parameters are collected first, proceeding to the least volatile parameters.

10. Place the purge water in a DOT-approved 55-gallon drums.

3.0 ANALYSIS OF SAMPLES

Samples are submitted to a California state-certified laboratory for analysis.

4.0 SAMPLE HANDLING

4.1 Sample Containers, Preservation, and Holding Times

All samples are collected, placed in containers, preserved, and analyzed within the time constraints with applicable local, provincial, and federal procedures. All sample containers are precleaned in accordance with prescribed EPA methods. A non-adhesive tape is placed

around all sample container lids to prevent leaks and to prevent unauthorized tampering with individual samples following collection and prior to the time of analysis.

4.2 Sample Tracking and Management

All samples are tracked using a standard chain-of-custody form. The chain of custody record includes the following information:

1. Sample number
2. Signature of collector
3. Date and time of collection
4. Sample collection location
5. Sample type
6. Signature of persons involved in the chain-of-possession
7. Inclusive dates of possession
8. Analytical parameters
9. Pertinent field observations

The custody record is completed using waterproof ink. Corrections are made by drawing a line through, initialing the error, and then entering the correct information.

Custody of the samples begins at the time of sample collection and are maintained by the sampling team supervisor until samples are relinquished for shipment to the laboratory, or until samples are hand-delivered to the designated laboratory sample custodian. Partial sample sets being accumulated for hand-delivery to the laboratory are stored in coolers with chain-of-custody records affixed.

Each sample shipment is accompanied by a chain-of-custody record identifying its contents. The original record accompanies the shipment and the copy is retained by the sampling team leader. The original (the top copy) is enclosed in a plastic zip-lock bag and secured to the inside of the cooler lid with tape.

APPENDIX C

Monitoring Well Purge Table Sheets

MONITORING WELL PURGE TABLE

Project Number: 2722-017	**Site Name:** Pacific Dry Dock and Repair Company Yard I
Well Number: MW1	**Date(s) Purged:** 5/3/95
OVA - Ambient: 0 ppm	**Purge Method:** Dedicated bailer
OVA - Vault: 1 ppm	**Purge Rate:** 0.5 gallons/min
OVA - Casing: 240 ppm	**Date & Time Sampled:** 5/3/95 (1500)
Water Level - Initial: 4.76 feet	**Purged & Sampled By:** P. Cox and V. Elarth
Water Level - Final: 5.00 feet	**Sampling Method:** Dedicated bailer
Well Depth: 14.24 feet	**Free Product:** None
Well Diameter: 2 inches	**Sheen:** None
Well Casing Volume: 1.5 gallons	**Odor:** Mod. petroleum hydrocarbons

Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
1115	0.25	66.3	7.32	601	Clear
1116	1	66.1	7.24	551	
1117	1	66.0	6.83	559	
1119	2.0 .	65.9	6.25	739	
1119	2.5	66.1	6.19	750	
1120	3.0	65.5	5.99	968	
1121	3.5	65.4	5.58	1,972	
1122	4.0	65.7	5.57	2,870	
1123	4.5	65.7	5.66	3,400	
1125	5.0	65.8	5.75	4,080	
1300	Sample	69.6	9.99*	564	Clear

Field Notes: * Equipment malfunction

MONITORING WELL PURGE TABLE

Project Number: 2722-017	**Site Name:** Pacific Dry Dock and Repair Company Yard I
Well Number: MW3	**Date(s) Purged:** 5/3/95
OVA - Ambient: 0 ppm	**Purge Method:** Dedicated bailer
OVA - Vault: 0 m	**Purge Rate:** 0.5 gallons/min
OVA - Casing: 3 ppm	**Date & Time Sampled:** 5/3/95 (1110)
Water Level - Initial: 8.90 feet	**Purged & Sampled By:** P. Cox and V. Elarth
Water Level - Final: 9.03 feet	**Sampling Method:** Dedicated bailer
Well Depth: 14.95 feet	**Free Product:** None
Well Diameter: 2 inches	**Sheen:** None
Well Casing Volume: .97 gallons	**Odor:** mod. sulfur

Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
1054	0.25	64.8	6.12	5,650	Low
1055	0.50	63.8	6.04	5,100	Moderate
1056	0.75	63.4	6.18	4,960	Moderate
1056	1.0	63.2	6.01	4,920	Moderate
1057	1.25	63.2	6.05	4,760	Moderate
1057	1.5	63.6	6.05	4,790	Moderate
1058	1.75	63.4	6.04	4,780	Moderate
1058	2.0	63.6	6.04	4,760	Moderate
1059	2.25	63.5	5.98	4,780	Moderate
1059	2.5	63.6	6.05	4,760	Moderate
1100	2.25	63.6	6.01	4,890	Low
1100	3.0	63.6	6.02	4,760	Low
1110	Sample	63.8	6.13	5,030	Low

Field Notes:

APPENDIX D

Laboratory Analytical Results and Chain-of-Custody Records for
Groundwater Samples Collected During May 3, 1995
Eighth Groundwater Sampling Event

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545
Telephone (510) 783-6960
Facsimile (510) 783-1512

COPY

TAL

May 19, 1995

Mr. Lawrence Kleinecke
Versar, Inc.
7844 Madison Avenue, Suite 167
Fair Oaks, California 95628

Dear Mr. Kleinecke:

Trace Analysis Laboratory received two water samples on May 3, 1995 for your Project No. 2722-117, Crowley Yard 1, QM+S (our custody log number 5476).

These samples were analyzed for Total Petroleum Hydrocarbons as Diesel, Gasoline, Benzene, Toluene, Ethylbenzene, and Xylenes. Our analytical report and the completed chain of custody form are enclosed for your review.

Trace Analysis Laboratory is certified under the California Environmental Laboratory Accreditation Program. Our certification number is 1199.

If you should have any questions or require additional information, please call me.

Sincerely yours,

Scott T. Ferriman
Project Specialist

Enclosures

Trace Analysis Laboratory, Inc.

LOG NUMBER: 5476
DATE SAMPLED: 05/03/95
DATE RECEIVED: 05/03/95
DATE ANALYZED: 05/11/95 and 05/15/95
DATE REPORTED: 05/19/95
PAGE: Two

Sample Type: Water

Method and Constituent:	Units	MW-1 Concentration	MW-1 Reporting Limit	MW-3 Concentration	MW-3 Reporting Limit	Method Blank Concentration	Method Blank Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	ND	50	ND	50	ND	50
Modified EPA Method 8020 for:							
Benzene	ug/l	1.6	0.50	ND	0.50	ND	0.50
Toluene	ug/l	0.58	0.50	ND	0.50	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Xylenes	ug/l	ND	1.5	ND	1.5	ND	1.5

QC Summary:

Recovery: 91, 102
RPD: 6.6, 1.3

Concentrations reported as ND were not detected at or above the reporting limit.

Louis W. DuPuis
Quality Assurance/Quality Control Manager

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545
Telephone (510) 783-6960
Facsimile (510) 783-1512

TAL

LOG NUMBER: 5476
DATE SAMPLED: 05/03/95
DATE RECEIVED: 05/03/95
DATE EXTRACTED: 05/11/95
DATE ANALYZED: 05/13/95
DATE REPORTED: 05/19/95

CUSTOMER: Versar, Inc.

REQUESTER: Lawrence Kleinecke

PROJECT: No. 2722-117, Crowley Yard 1, QM+S

Sample Type: Water

Method and Constituent:	Units	MW-1 Concentration	MW-1 Reporting Limit	MW-3 Concentration	MW-3 Reporting Limit	Method Blank Concentration	Method Blank Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Diesel	ug/l	78	50	ND	50	ND	50

QC Summary:

% Recovery: 111
% RPD: 0.3

Concentrations reported as ND were not detected at or above the reporting limit.

Versar INC. 5476 CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
2722-117	Crowley Vol. I QM&S

SAMPLERS: (Signature) Philip M. Cox (Printed) Philip M. Cox

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH D	Gas/BTEX	REMARKS
MW1	5/3/95	1590		X	Monitoring Well 1	3	X	X	Water
MW3	↓	1110		X	Monitoring Well 3	3	X	X	↓

PARAMETERS

INDUSTRIAL HYGIENE SAMPLE Y X

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Philip M. Cox	5/4/95 1510				
(Printed) Philip M. Cox		(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) Scott T. Ferriman	Date / Time 5/5/95 1510	Remarks 15 Day TAT	
(Printed)		(Printed) Scott T. Ferriman			

Distribution: Original Plus One Accompanies Shipment (white and yellow). Copy to Coordinator Field Files (pink). p/u water, 12 x 2 VOAs HCl each

TRACE ANALYSIS 5107831512 17:05 05/19/95 004

CROWLEY MARINE SERVICES, INC.

October 4, 1995

Mr. Thomas Peacock
Hazardous Materials Division
Department of Environmental Health
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway
Alameda, CA 94502

Reference: **Pacific Dry Dock and Repair Company Yard I**

Dear Mr. Peacock:

Enclosed, for your review, please find a ground water monitoring report for the Crowley Marine Services' facility referenced above, located at 1441 Embarcadero in Oakland. I apologize for the lateness in delivering this report to your office. All future reports will be delivered to your office within 45 days, where possible, from the sampling date.

If you have any questions or comments regarding this matter please contact me at (206) 443-8042.

Sincerely,

Stephen Wilson
Manager, Environmental Compliance

Enclosure

cc: PDD I Correspondence w/o enclosure
Beth Hamilton w/o enclosure
Michael Sellens w/o enclosure

Post Office Box 2287, Seattle, Washington 98111-2287 - (206) 443-8100 - Telex 6838207 - Fax (206) 443-8072
Pier 41 (Red & White Fleet), San Francisco, California 94133 - (415) 546-2800 - Fax (415) 546-2623 (Admin & Sales)
Pier 1, Berth 47-49, Long Beach, California 90802-1098 - (310) 491-4700 - Telex 650447 - Fax (310) 491-4790
4300 B Street, Suite 507, Anchorage, Alaska 99503-5997 - (907) 563-1114 - Telex 6732564 - Fax (907) 762-3330
Pier 54, San Francisco, California 94107 - (415) 546-2684 - Fax (415) 546-2606 (Admin)
Post Office Box 2110, Jacksonville, Florida 32203-2100 - (904) 727-2200 - Telex 4611037 - Fax (904) 727-2401