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Woodward-Clyde Consultants

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July 10, 1989

PHASE III ENVIRONMENTAL EXPLORATION
187 NORTH L STREET
LIVERMORE, CALIFORNIA

Prepared for

City of Livermore
Redevelopment Agency
1052 South Livermore Avenue
Livermore, California 94550

July, 1989

Prepared by

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7/11/89

ALAMEDA COUNTY
DEPT. OF ENVIRONMENTAL HEALTH
HAZARDOUS MATERIALS

July 10, 1989
8810220A

City of Livermore
Redevelopment Agency
1052 South Livermore Avenue
Livermore, California 94550

Attention: Ms. Karen Majors

Subject: Phase III Environmental Exploration
187 North L Street
Livermore, California

Ladies and Gentlemen:

We are pleased to present the following report which describes the results of exploration of soil and groundwater at the site. The laboratory analyses of soil show that petroleum contamination occurs in soil near the former underground petroleum product storage tanks below a depth of 15 feet. Petroleum contamination was also detected in groundwater from three monitoring wells installed at the site.

We are available to meet with the City and with representatives of the Alameda County Department of Environmental Health to discuss the findings. Please call if you have any questions or would like to set a time or date for a meeting.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

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187 NORTH L STREET
LIVERMORE, CALIFORNIA

1.0 INTRODUCTION

1.1 Background

Petroleum product contamination was previously detected in soil at this site during Phase II site exploration. Gasoline contamination was detected in soil samples to depths of up to 25 feet, and diesel fuel was detected in soil samples at a depth of 15 feet, in several exploratory borings located in the vicinity of former underground storage tanks, reported removed in 1972. In order to explore for evidence of groundwater contamination, three groundwater monitoring wells were installed at the site during this Phase III study. In addition two soil borings were drilled to explore for shallow soil contamination at locations on the site not previously explored. The locations of the Phase II and III exploratory borings and wells are shown in Figure 1.

1.2 Purpose and Scope

The purpose of this study is to provide the City of Livermore Redevelopment Agency with an assessment of the potential impact of petroleum contamination at this site on their planned redevelopment of this property, as part of the Railroad Avenue Project. This report provides soil and groundwater contamination data for submittal to the Alameda County Health Care Services Agency for their review and comments. The Alameda County Health Care Services Agency, Department of Environmental Health, is the regulatory agency that will decide whether or not remedial actions are needed, and will review and approve any remedial action plan.

Three groundwater monitoring wells were installed at the site to explore the depth to groundwater, the groundwater flow direction and gradient, and evidence of petroleum contamination in the groundwater. The wells were drilled to depths of about 50 feet. Soil samples were collected during drilling of the wells and from drilling of two additional, supplemental soil borings. Soil samples and groundwater samples were tested in a state certified analytical laboratory for the presence of total petroleum products, as gasoline and diesel, and for benzene, toluene, ethylbenzene, and xylenes, which are gasoline constituents. Records of water wells within about 1/2 mile of the site were reviewed to evaluate the usage of groundwater in the site vicinity. The results of these tasks are presented in this report along with an assessment of potential impacts of contamination and supporting data, such as logs of borings and laboratory test results.

2.0 PREVIOUS STUDIES

Woodward-Clyde Consultants presented the results of soil exploration and laboratory tests of soil samples in a report dated April 7, 1989 (see references). The locations of the five soil borings drilled during that study are shown in Figure 1. The most significant petroleum contamination was detected in Boring B-1 at depths of 20 and 25 feet, where 170 parts per million (ppm) and 220 ppm total petroleum hydrocarbons (TPH), as gasoline, were detected. Several parts per million of TPH as diesel, as well as benzene, toluene, ethylbenzene, and xylenes (BTEX) were also detected in soil samples from that boring. One soil sample from boring B-1 contained 3.5 ppm 2-methylnaphthalene, 3.4 ppm 2-naphthalene, and 0.3 ppm phenol. Low concentrations of gasoline and diesel, generally in the range of 1 to 8 ppm, were detected in soil samples from borings B-2, B-3, and B-5. No TPH as diesel or gasoline, or BTEX was detected in soil from boring B-4. It was concluded that the soil contamination was probably the result of a leak from one of the former fuel tanks or from a waste oil tank at the site. It

was recommended that several groundwater monitoring wells be installed to explore for possible groundwater contamination. Only recently (July 6, 1989) has another contaminant source been reported. As discussed later in this report, Mr. Tony Sullins reports that more than 600 gallons of gasoline was poured down a vapor monitoring well near the existing 1,000 gallon underground fuel storage tank on the site.

3.0 FIELD PROCEDURES

3.1 Monitoring Wells

Monitoring well W-1 was drilled at the approximate location of the former 6,000 gallon fuel tank (Figure 1). Wells W-2 and W-3 were located just west of the Arrow Rentals property boundary, as shown in Figure 1. The wells were drilled with a truck-mounted drill rig, equipped with 8-inch diameter, hollow-stem, continuous flight augers. The log of each well, prepared by a WCC geologist, is presented in Appendix A.

Before drilling each boring the augers and sampling rods were steam cleaned. The sampler was cleaned between sampling intervals with Alconox detergent and then triple rinsed. The cuttings generated from the drilling were placed in 55 gallon drums and stored on site.

Soil samples were collected at five-foot depth intervals with a two-inch I.D. modified California sampler, lowered through the augers. The sampler was driven a maximum of 18 inches, using a 140 pound hammer with a 30-inch drop. The number of blows required to advance the sampler the final 12 inches of each drive ("blow count") are shown on the logs. The soil samples were retained in four, four-inch long, two-inch diameter, brass liners within the sampler. The brass liners were identified as A to D from the bottom to the top. The liners retained for laboratory analysis ("A" samples) are identified on the logs (Appendix A). Those samples were covered on both ends with teflon sheeting and sealed with plastic end

caps. The samples were labeled, placed in a plastic "zip-lock" bag, and transported on ice to the analytical laboratory using chain-of-custody procedures.

The second of the four soil samples ("B" samples) was used to perform head-space analyses in the field for volatile organic compounds. The test procedure involved emptying the contents of the brass liner into a "zip-lock" bag, sealing the bag, and placing the bag in a warm area for 20 to 30 minutes, then inserting the organic vapor analyzer (OVA) instrument probe into the bag. This technique provides a means for approximate field evaluations of relative hydrocarbon concentrations in the soil. The total organic vapor is measured in parts per million (ppm-OVA units) with the organic vapor analyzer. The results of these field tests are shown on the logs (Appendix A). The remaining liners were used to describe the soil using the Unified Soil Classification System. The descriptions are shown on the logs.

Monitoring wells were constructed by placing two-inch diameter Schedule 40 PVC well casing through the augers. A ten foot long, 0.010 inch, screened section, with an end cap, was placed at the bottom of the well. Solid PVC casing extends to the surface, where a slip cap and a locking cover were installed. No. 2/12 Monterey Sand was placed in the annulus around the screened section to a level about five feet above the screened section. About two feet of bentonite pellets were placed above the sand as seal. Water was added to hydrate the bentonite pellets prior to placing a bentonite/cement grout from the top of the bentonite pellets to the surface.

A protective vault box was used to complete Well W-1 at the surface, metal above ground locking covers were installed at Wells W-2 and W-3. The wells were developed on May 31, 1989 by bailing ten casing volumes of water from Wells W-1 and W-3 and 3.9 casing volumes from Well W-2 which was very slow to recharge. A sheen was noted on the water while developing Well W-1.

Groundwater was sampled from the monitoring wells on June 2, 1989. Immediately before sampling, the wells were purged by bailing 3.8 casing volumes from Well W-1, 2.5 casing volumes from Well W-2, and 4.5 casing volumes from Well W-3. Temperature, pH and specific conductance were monitored and generally stabilized, except for pH in Well W-3 which appeared to be from instrument error.

The depth to groundwater was measured in each of the three wells. The relative elevation of the tops of casing in the wells were measured by Bissel and Karn Engineers on June 27, 1989. The results of the elevation survey are presented on Figure 2. The relative elevations of groundwater in the wells, as measured on June 2, 1989, are summarized in Table 1. For the purpose of measuring the relative elevations of the top of each well casing a temporary bench mark elevation of 100 feet was assumed. Available topographic maps show the elevation of the site to be about 460 feet.

3.2 Soil Borings

Soil borings B-7 and B-8 were drilled at the location of a former 1,500 gallon tank and the former pump island, using the hollow stem augers, as described above. The borings were drilled to depths of about ten feet. Soil samples were collected using the same procedures as described above. Soil cuttings were placed in 55 gallon drums which were stored on site. The complete borings were filled with bentonite/cement grout. Logs of the borings are attached in Appendix A.

4.0 SITE HYDROGEOLOGY

The geologic units encountered in the three wells at the site consist of interbedded silty and clayey gravels to depths of between 35 to 38 feet. One unit in this upper zone appears to extend laterally through each of the three wells. This unit, a silty gravel layer two to nine feet

thick, occurs at a depth of about 14 feet. Other discontinuous silty gravel units occur in this upper zone. Clayey gravels form the bulk of the upper zone and also extend through all three wells.

Another unit, a medium brown to grey silty clay (CH), about four to nine feet thick, extends through each of the three borings at a depth of about 38 feet. The first groundwater is encountered immediately beneath this clay layer, in a clayey to silty gravel (GC-GW) about six feet thick. In wells W-1 and W-3 a clayey gravel (GC) to a silty clay (CL) underlies the shallow water-bearing stratum. The water bearing zone in well W-2 is less well defined and is somewhat gradational with the underlying clayey strata.

The shallow groundwater appears to be confined in well W-1, where it was encountered at a depth of about 50 feet and then, when measured after 7 days, rose to a depth of 43 feet, about 6 feet above the base of the overlying silty clay layer. Groundwater was encountered at depths of about 45 feet in both wells W-2 and W-3, but, when measured after 7 days, rose to depths of about 44 feet, which is below the overlying silty clay layer.

The measured relative groundwater elevations in wells W-1, W-2 and W-3, shown in Table 1, were used to calculate the shallow groundwater flow direction and gradient, as shown in Figure 2. The shallow groundwater gradient is towards the northwest (from well W-1 towards well W-3).

5.0 LABORATORY ANALYSES

5.1 Laboratory Soil Analyses

Soil samples from the wells and borings were tested in the laboratory for total petroleum hydrocarbons (TPH) as gasoline, and benzene, toluene, ethylbenzene and xylene (BTEX) using EPA method 8015 and 8020. Selected soil samples were tested for TPH as diesel and BTEX using EPA method 8015

and 8020. One groundwater sample from each well was tested for TPH as gasoline, and as diesel, and BTEX using EPA methods 8015 and 8020. The chemical results for soils are summarized in Table 2 and the chemical results for water are summarized in Table 3. The Sequoia Analytical Laboratory analytical report for soils and groundwater is presented in Appendix B.

No gasoline or BTEX were detected in soil from 5 and 10 foot depths in borings B-7 and B-8. Boring B-7 was located at the south end of the former pump island, and B-8 was drilled at the location of one of the former 1500 gallon underground tanks. The test results are shown in Table 2.

No gasoline or BTEX were detected in soil from well W-1 at the 5 and 10 foot depths. The zone of soil contaminated with gasoline begins at a depth of 15 feet in well W-1 and extends to the bottom of the well, at 55 feet. TPH as gasoline was detected at 15 feet in W-1, at 1,200 parts per million (ppm), with no detection of benzene, 21 ppm toluene, 20 ppm ethylbenzene, and 130 ppm xylenes. The maximum concentration of TPH as gasoline in W-1 was detected at 16,000 ppm at 40 feet, just above the water level. Benzene was detected at 220 ppm, toluene at 1100 ppm, ethylbenzene at 340 ppm, and xylenes at 1500 ppm, in soil at 40 feet in W-1. These concentrations decreased to 120 ppm TPH, 3.2 ppm benzene, 10 ppm toluene, 2.7 ppm ethylbenzene, and 13 ppm xylenes in soil at 55 feet in W-1. TPH as diesel was detected at 380 ppm at 20 feet, and 1500 ppm at 40 feet in W-1.

No benzene, ethylbenzene, or xylenes were detected in any of the soil samples from well W-2, to a depth of 50 feet. Only one soil sample contained detectable gasoline, a sample at 5 feet contained 1.2 ppm TPH as gasoline. Toluene was detected at 0.14 ppm in soil at 5 feet, and 0.10 ppm in soil at 10 feet in W-2. One soil sample from a depth of 45 feet was tested for TPH as diesel with a result of no detection.

No gasoline (TPH as gasoline) or BTEX were detected in soil samples from a depth of 5 feet to a depth of 45 feet in well W-3. No diesel (TPH as diesel) was detected in the soil sample tested at a depth of 40 feet in W-3. The only detection of petroleum products was in the soil sample from the bottom of the well at 50 feet, with TPH as diesel at 12 ppm, benzene at 0.06 ppm, and no detection of toluene, ethylbenzene, or xylenes.

5.2 Laboratory Groundwater Analysis

The highest concentrations of petroleum products in groundwater were detected in water from well W-1. TPH as gasoline was detected at 210,000 parts per billion (ppb), and as diesel at 300,000 ppb (see Table 3). Benzene was detected at 29,000 ppb, with toluene at 30,000 ppb, ethylbenzene at 5,400 ppb, and xylenes at 24,000 ppb.

No diesel was detected in groundwater from well W-2. TPH as gasoline was detected at 360 ppb in water from W-2. Benzene was detected at 6.7 ppb, toluene at 2.1 ppb, ethylbenzene at 0.47 ppb, and xylenes at 1.3 ppb in water from W-2.

Groundwater from well W-3 contained 2,200 ppb diesel(TPH) and 11,000 ppb gasoline (TPH). Benzene was detected at 290 ppb, toluene at 120 ppb, ethylbenzene at 150 ppb, and xylenes at 140 ppb in water from W-3, as shown in Table 3.

6.0 REGIONAL HYDROGEOLOGY

Geologic cross sections of the Livermore Valley in the Department of Water Resources Bulletin 118-2 (1974) shows the site is underlain by Tertiary aged Livermore Gravels up to 600 feet deep. About 100 feet of Quaternary Alluvial Fan deposits overly the Livermore Gravels in the site vicinity. The Livermore gravels consist of massive beds of rounded gravel cemented by a sandy clay matrix. The Alluvial Fan deposits consist of

semi-consolidated deposits of clay, silt, sand and gravel in a matrix of clayey sand.

The site is located in the Mocho Subbasin, which is a division of the Livermore Valley Groundwater Basin. Groundwater ranges from unconfined in near-surface zones to confined in the deeper zones. A map by Zone 7 of the Alameda County Flood Control and Water Conservation District (1989) shows the elevation of shallow groundwater at 425 feet, or about 35 feet below the ground surface. A deeper groundwater level is shown at an elevation of about 390 feet, or about 70 feet below the surface. The flow directions for both the shallow and deeper aquifers is towards the northwest, as shown in Figure 3. The nearest well shown screened in the shallow aquifer is about 2,000 feet to the northwest (Figure 3). The nearest downgradient well screened in the lower aquifer is shown on that map as located 2,000 feet west of the site (Figure 3).

Groundwater is pumped from deeper aquifers for domestic use by the California Water Company in wells located about 5 miles west of the site (Figure 3). Groundwater contours show wells producing from deeper aquifers to the northwest and southeast have depressed the potentiometric surface in the lower aquifer.

7.0 WELL SURVEY

A water well survey of wells within about a half mile of the site was conducted using records provided by the Alameda County Flood Control and Water Conservation District, Zone 7, as shown on Figure 4 and summarized on Table 4. There are four water supply wells listed on Table 4 as 1, 3, 8 and 9 with screened intervals that range from 120 feet to 455 feet deep, through deep aquifers. A series of 50 to 60 foot deep monitoring wells (10, 11, and 12) are located between the site and Water Supply Wells 8 and 9. Water Supply Wells 8 and 9 are located down groundwater gradient from the site. The other two Water Supply Wells near the site, Wells 1 and 3,

are located cross-gradient from the site. The other wells shown on Figure 4 and described in Table 4 are monitoring or cathodic protection wells. The monitoring wells are all screened at depths in the range from about 25 feet to about 70 feet.

8.0 CONTAMINANT DISTRIBUTION AND SOURCES

New information provided by Tony Sullins of Arrow Rentals, on July 6, 1989, indicates that a gasoline distributor poured more than 600 gallons of gasoline down a vapor monitoring well that extends into the tank backfill at the location of the existing 1,000 gallon tank, located on the southeast corner of the site. Mr. Sullins estimates that this incident occurred 3 to 4 years ago. Boring B-5, located next to this tank, was drilled and chemical analyses were performed on soil samples to a depth of 25 feet below ground surface during our Phase II study. Gasoline was detected at less than 2 ppm TPH and BTEX was not detected. Presuming that information concerning this reported spill is correct, some of the gasoline may still be ponded in the tank backfill, or it may have migrated downward in a vertical path away from our previous Boring B-5. The possible vertical and lateral distribution of petroleum contamination in soil around this tank is unknown. If the reported spill can be confirmed by another source, such as the petroleum delivery company, then it appears that this spill might also have contributed to the petroleum contamination found in groundwater at the site.

The location and depth of petroleum contamination at the site indicates that one, or more, of the former underground fuel storage tanks leaked prior to their removal, in 1972 or 1984. Three 1500 gallon tanks were reportedly removed in 1972. Well W-1 is located adjacent to the 6,000- and 4,000-gallon underground fuel storage tanks reportedly removed in 1984. The detected soil contaminants include diesel and gasoline, found at highest concentrations near the groundwater level in well W-1. Concentrations of up to 16,000 ppm gasoline and 1500 ppm diesel were detected at a depth of 40 feet in soil in well W-1. Lower concentrations

of gasoline (TPH up to 220 ppm) were detected below 20 feet in borings B-2 and B-3. No gasoline or diesel or BTEX were detected in soil samples from above 15 feet in borings B-7 and B-8. The zone of soil contamination appears to be located in the immediate vicinity of the former tanks, and to generally be greatest at or just above the water table. The zone of soil contamination just above the water table might extend some distance laterally away from the former tanks. As seen in Table 2, soil contamination falls off sharply from the 40-foot sample taken near the groundwater table, to 55 feet, the total depth of the boring.

No floating product was found on the groundwater in wells W-2 and W-3. A visible sheen was observed on the surface of the groundwater sample from well W-1. The highest concentrations of petroleum products in groundwater were detected in water from well W-1. The petroleum contaminants appear to be concentrated in the shallow aquifer found at a depth of about 43 feet below grade in well W-1. The detected concentrations of 300,000 ppb diesel and 210,000 ppb gasoline, and 29,000 ppb benzene, 30,000 ppb toluene, 5,400 ppb ethylbenzene, and 24,000 ppb xylene in the water sample from well W-1 may be higher than the actual dissolved phase because the sample contained a slight sheen of petroleum product. The concentration of gasoline and detected BTEX in groundwater is significantly lower in water from well W-2, that is approximately cross-gradient from the leak site. No sheen was observed and no diesel was detected in water from well W-2, and the gasoline concentration was nearly three orders of magnitude less (360 ppb TPH) than in water from well W-1. BTEX concentrations were also orders of magnitude less in water from well W-1 (B=6.7 ppb, T=2.1 ppb, E=0.47 ppb, and X=1.3 ppb).

Well W-3 is located about 150 feet in the general downgradient direction from well W-1. No sheen was observed on the surface of water from well W-3, and the detected gasoline, diesel, and BTEX concentrations were also one to two orders of magnitude less than in water from W-1, near the leak. Water from W-3 contained 2,200 ppb diesel, 11,000 ppb gasoline,

290 ppb benzene, 120 ppb toluene, 150 ppb ethylbenzene, and 140 ppb xylenes. These laboratory test results indicate that the plume of shallow groundwater containing petroleum extends from the source near W-1 to at least 150 feet generally downgradient at well W-3.

The BTEX concentrations in water from well W-1 greatly exceed state and Federal Maximum Contamination Levels and State Action Levels as shown on Table 3. However, only benzene exceeds the MCL in water from wells W-2 and W-3 (6.7 ppb and 290 ppb benzene detected, respectively).

The data does not provide an evaluation of the downgradient limit of the shallow groundwater contaminant plume. However, considering the orders-of-magnitude decrease in BTEX concentrations in water in the 150-foot distance from well W-1 to well W-3, it is anticipated that the BTEX concentrations would be further decreased, or perhaps below detectable concentrations several hundred feet downgradient of well W-1.

9.0 SUMMARY

- Soils presented below the site consist of interbedded silty and clayey gravels from surface to 35 to 38 feet below grade. An approximately 4 to 9-foot-thick layer of silty clay extends through each of the borings and is laterally continuous at a depth of about 38 feet below grade. These sediments are part of the Alluvial Fan deposits which consist of semi-consolidated deposits of clay, silt, sand and gravel. The clay layers in these deposits help provide separation between the upper shallow aquifer, which is contaminated on site and the lower aquifer, which is used by the off-site water supply wells.

- First groundwater was encountered at a depth of about 43 feet below ground surface, beneath the clay layer found at about 38

feet. The groundwater flow direction in this shallow aquifer is towards the northwest, from well W-1 generally towards well W-3.

- No gasoline or BTEX was detected in soil samples from borings B-7 and B-8 at 5- and 10-foot depths, the total depth of these borings. No gasoline or BTEX was detected in soil samples from well W-1, located near the former 4,000 and 6,000 gallon underground storage tanks, at 5- and 10-foot depths. However, TPH as gasoline and BTEX were detected in all of the other soil samples in this well, from 15 feet, at 5-foot intervals, to 55 feet below ground surface. The greatest concentrations of gasoline and BTEX in soil samples from this well were detected just above the water table, at a depth of 40 feet below grade. The concentrations measured at that depth were 16,000 ppm gasoline, 220 ppm benzene, 1,100 ppm toluene, 340 ppm ethylbenzene and 1,500 ppm xylenes. Diesel was also detected at 1,500 ppm TPH at 40 feet.

  Well W-3 is located about 150 feet generally downgradient from the former underground tanks and well W-1. Gasoline and BTEX were detected at just above the detection limit in soils from the 5-foot depth in well W-2, and at 12 ppm TPH as gasoline and 0.06 ppm benzene at the 50-foot depth in well W-3. No gasoline, diesel, or BTEX were detected in the rest of the soil samples from wells W-2 or W-3, taken at 5-foot depth intervals from 5 feet to 50 feet below ground surface.

  Gasoline may have leaked from one or more of the former tanks into the bottom of the tank backfill at about 13 feet below grade, and then down to the shallow aquifer at these locations. Thus, soils are generally free from detectable petroleum contamination from surface grade to between 10 and 15 feet below grade.

- About 600 gallons of gasoline is reported to have been pumped into a vapor monitoring well near the existing 1,000 gallon storage tank. If confirmed, that spill would also be a source of petroleum contamination at the site.

- Gasoline, diesel, and BTEX were detected in groundwater samples from each of the wells, W-1, W-2, and W-3. The greatest concentrations were detected in well W-1 at 300,000 µg/l TPH diesel, 210,000 µg/l TPH gasoline, 29,000 µg/l benzene, 30,000 µg/l toluene, 5,400 µg/l ethylbenzene, and 24,000 µg/l xylenes. The concentrations of gasoline, diesel and BTEX drop off sharply in the down groundwater gradient direction, from well W-1 to well W-3. The concentration of gasoline constituents in water samples from well W-3 is, however, still above state and federal drinking water standards (MCLs and Action Levels). Water from well W-2, located generally cross-gradient from well W-1, also had benzene in concentrations above the drinking water standard. The sharp, one to several orders-of-magnitude drop in detected contaminant concentrations, in water samples from well W-1 to wells W-2 and W-3, suggests that gasoline contaminants may not extend far off-site,in the down-gradient direction, beyond the location of well W-3.

- Based on information provided by the Department of Water Resources, four water supply wells are located approximately two thousand feet in an approximate down-gradient direction, from the site. These wells have screened intervals in deeper aquifers that range from 120 feet to 455 feet below grade.

- Since the concentration of petroleum hydrocarbon contamination drops off sharply over several hundred feet at the site, at the site, contaminants detected in soils and groundwater on site have a low potential for impacting the water supply wells located 2,000 feet from the site.

10.0 RECOMMENDATIONS

We recommend that this report be submitted to the Alameda County Health Care Services Agency, Department of Environmental Health for their review and comment. Based upon the findings, it is likely that the County will, as a minimum, require installation of several additional monitoring wells to define the downgradient limit of the groundwater contaminant plume, the depth of groundwater contamination, and upgradient groundwater quality. The downgradient wells may need to be located off-site, beyond the north property line, where no groundwater data is available.

If the groundwater contamination is of limited extent off-site, as is suggested by this data, it is possible that groundwater remediation will not be required, and that the monitoring wells can be used for continued monitoring at the site. Future groundwater monitoring should also include analyses of groundwater for lead, 2-methylnaphthalene, 2-naphthalene, and phenol.

The presence of petroleum contamination in soil, in the vicinity of well W-1, below a depth of 15 feet, should not preclude development of the Arrow Rentals property as part of the planned redevelopment of the Railroad Avenue Site. However, some limitations should be considered for the type of development over, and in the immediate vicinity of, the former underground tanks. Paved parking or a driveway would be the most suitable use for the area immediately above the former tanks. Grading should be of limited depth in the former tank area. Utility trenches should be planned to avoid the former underground tank area. The locations of buildings should also be planned to avoid the former underground tank area. While shallow petroleum soil contamination appears to only be found in the vicinity of the former tanks, as a precaution for possible accumulation of petroleum vapors, buildings in the area of the groundwater contaminant plume might be constructed with soil vapor protection beneath the floor or slabs-on-grade.

Prior to development, we recommend that the existing underground gasoline tank, near boring B-5, be removed in accordance with State and County requirements. Prior to removal, the tank should be tested for integrity. If the report of pouring gasoline into the vapor monitoring well is correct, soil contamination is expected. If petroleum contamination is found in the tank backfill and underlying soil, the contaminated soils should be excavated and either removed to an approved waste site or be treated on site by aeration, if on-site treatment is feasible and is approved by the regulatory agencies. The excavation should be backfilled with clean soil.

Table 1. ELEVATIONS OF MEASURING POINTS AND ELEVATION OF GROUNDWATER, 187 NORTH L STREET, LIVERMORE, CALIFORNIA

Well Number	Measuring Point Elevation (Project Datum, feet)	Depth to Groundwater (feet)	Elevation (feet) June 2, 1989
W-1	99.22	43.16	56.06
W-2	99.07	44.24	54.83
W-3	98.03	44.50	53.53

Note: Assumed temporary benchmark elevation 100 feet.

Should be determined
to determine new location
new well
depth of existing wells before exact
location

all new wells by located depth method
location

slug test to determine

to determine
proper
location

Table 2. SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS FOR MONITORING WELLS W-1, W-2 AND W-3 AND BORINGS B-7 AND B-8, 187 NORTH L STREET, LIVERMORE, CALIFORNIA

Well/ Boring Number	Sample Depth	High Boiling Point Hydrocarbons (Diesel) (ppm)	Low Boiling Point Hydrocarbons (Gasoline) (ppm)	Benzene (ppm)	Toluene (ppm)	Ethylbenzene (ppm)	Xylenes (ppm)
W-1	5'	NR	ND	ND	ND	ND	ND
	10'	NR	ND	ND	ND	ND	ND
	15'	NR	1,200	ND	21	20	130
	20'	380	350	2.5	14	6.3	30
	25'	NR	490	3.5	24	9.4	46
	30'	NR	~~160~~	1.0	7.9	3.6	18
	35'	NR	370	2.4	20	8.2	40
	40'	1,500	16,000	220	1,100	340	1,500
	45'	NR	~~1,600~~	30	120	34	160
	50'	NR	2,500	28	200	59	270
	55'	NR	120	3.2	10	2.7	13
W-2	5'	NR	1.2	ND	0.14	ND	ND
	10'	NR	ND	ND	0.1	ND	ND
	15'	NR	ND	ND	0.1	ND	ND
	20'	NR	ND	ND	ND	ND	ND
	25'	NR	ND	ND	ND	ND	ND
	30'	NR	ND	ND	ND	ND	ND
	35'	NR	ND	ND	ND	ND	ND
	40'	NR	ND	ND	ND	ND	ND
	45'	ND	ND	ND	ND	ND	ND
	50'	NR	ND	ND	ND	ND	ND
W-3	5'	NR	ND	ND	ND	ND	ND
	10'	NR	ND	ND	ND	ND	ND
	15'	NR	ND	ND	ND	ND	ND
	20'	NR	ND	ND	ND	ND	ND
	25'	NR	ND	ND	ND	ND	ND
	30'	NR	ND	ND	ND	ND	ND
	35'	NR	ND	ND	ND	ND	ND
	40'	ND	ND	ND	ND	ND	ND
	45'	NR	ND	ND	ND	ND	ND
	50'	NR	12	0.06	ND	ND	ND

Table 2. SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS FOR WELLS W-1, W-2 AND W-3 AND BORINGS B-7 AND B-8, 187 NORTH L STREET, LIVERMORE, CALIFORNIA

Well/ Boring Number	Sample Depth	High Boiling Point Hydrocarbons (Diesel) (ppm)	Low Boiling Point Hydrocarbons (Gasoline) (ppm)	Benzene (ppm)	Toluene (ppm)	Ethylbenzene (ppm)	Xylenes (ppm)
B-7	5'	ND	ND	ND	ND	ND	ND
	10'	NR	ND	ND	ND	ND	ND
B-8	5'	NR	ND	ND	ND	ND	ND
	10'	ND	ND	ND	ND	ND	ND
Detection Limits:		1.0	1.0	0.05	0.1	0.1	0.1

ND = Not Detected
NR = Analysis Not Run

Table 3. SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS, NOVEMBER 1988, 187 NORTH L STREET, LIVERMORE, CALIFORNIA

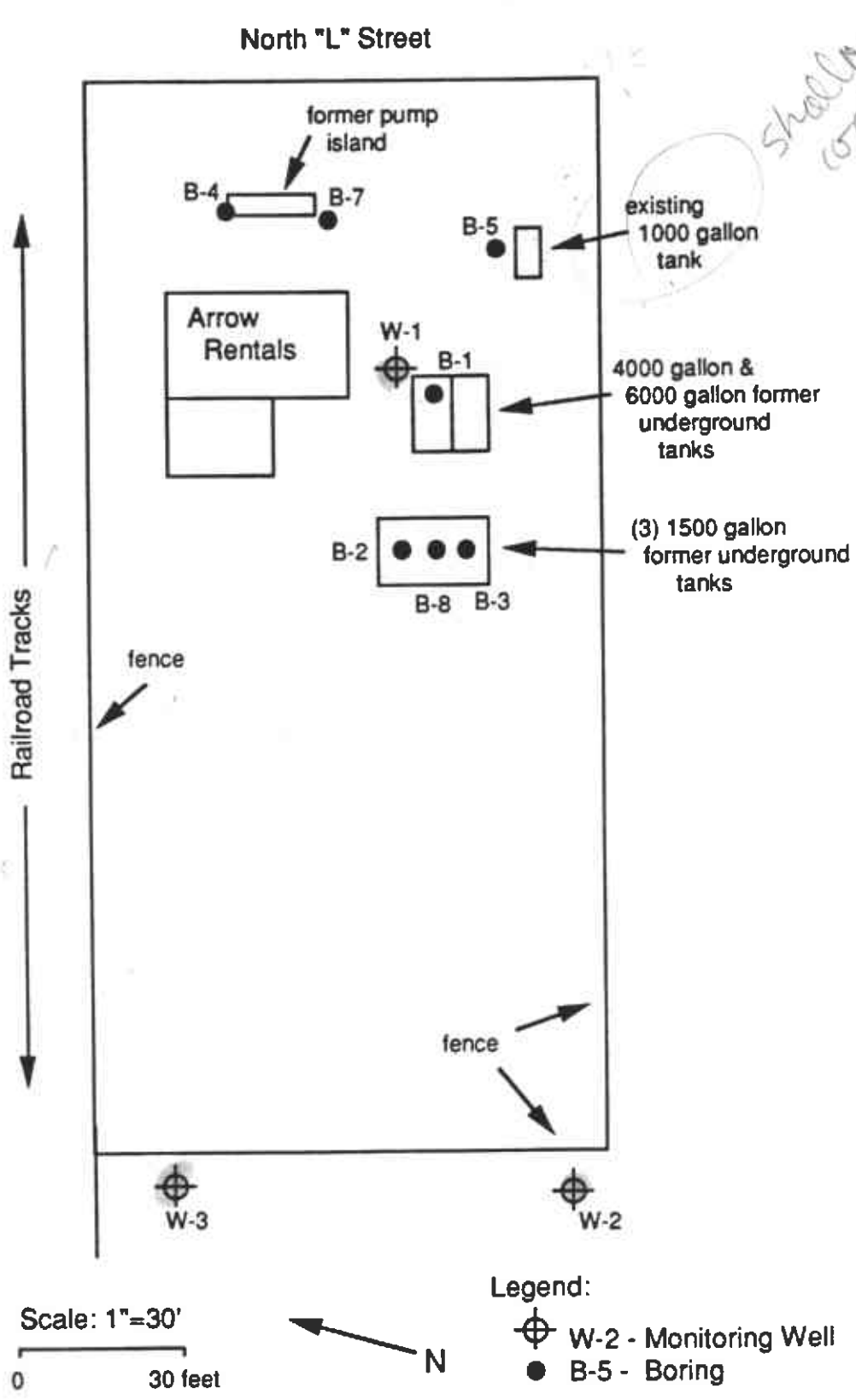
	Micrograms per Liter (µg/L)					
Well Number	High Boiling Point Hydrocarbon (Diesel)	Low Boiling Point Hydrocarbon (Gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes
W-1	300,000	210,000	29,000	30,000	5,400	24,000
W-2	ND	360	6.7	2.1	0.47	1.3
W-3	2,200	11,000	290	120	150	140
Detection Limits:	50.0	30.0	0.3	0.3	0.3	0.3
State or Federal Drinking Water Limits (MCLS)	--	--	1.0	2,000	680	1750
State Drinking Water Action Levels	--	--	0.7	100	680	620

ND = Not Detected

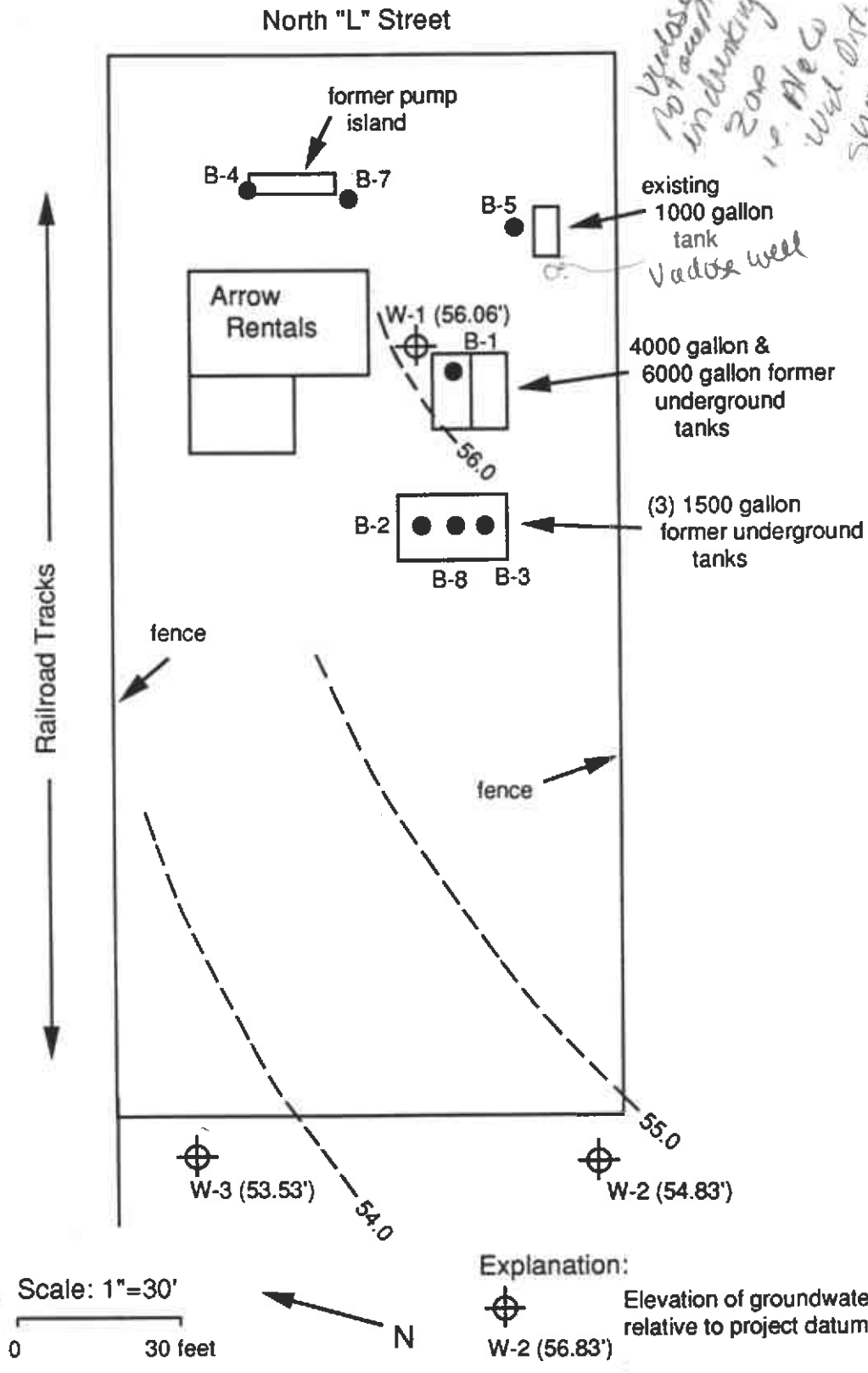
Table 4. WELL SURVEY, 187 NORTH L STREET, LIVERMORE, CALIFORNIA

Well Number	Well Identification	Location	Depth of Well	Screened Interval	Use
1	3S/2E-8G2	Elm Street and North "N" Street	465'	120'-455'	Water Supply
2	3S/2E-8G2	Locust Street and North "L" Street	120'	N.I.	Cathodic Protection
3	3S/2E-8H1	Elm Street and North Livermore Avenue	625'	N.I.	Water Supply
4	3S/2E-8H2	Junction Avenue and North "K" Street	46'	N.I.	Monitoring
5	3S/2E-8J3	394 N. Livermore Avenue	130.5'	N.I.	Abandoned
6	3S/2E-8K1	Chestnut Street and North "N" Street	120'	N.I.	Cathodic Protection
7	3S/2E-8K2	Walnut Street and North "P" Street	75'	64'-69'	Monitoring
8	3S/2E-8P1	1493 Olivina Avenue	273'	122'-263'	Water Supply
9	3S/2E-8P2	Railroad Avenue between Stanley Boulevard and North "P" Street	420'	280'-412'	Water Supply
10	3S/2E-8P3	Railroad Avenue and North "P" Street	55'	25'-55'	Monitoring
11	3S/2E-8Q1	Railroad Avenue and North "P" Street	53'	25'-53'	Monitoring
12	3S/2E-8Q2	Railroad Avenue and North "P" Street	60'	30'-60'	Monitoring
13	3S/2E-8R1	2008 1st Street	77'	27'-77'	Monitoring
14	3S/2E-9P2	Maple Street and 2nd Street	120'	N.I.	Cathodic Protection
15	3S/2E-9P3	367 McLeod Street	88.2'	N.I.	Abandoned

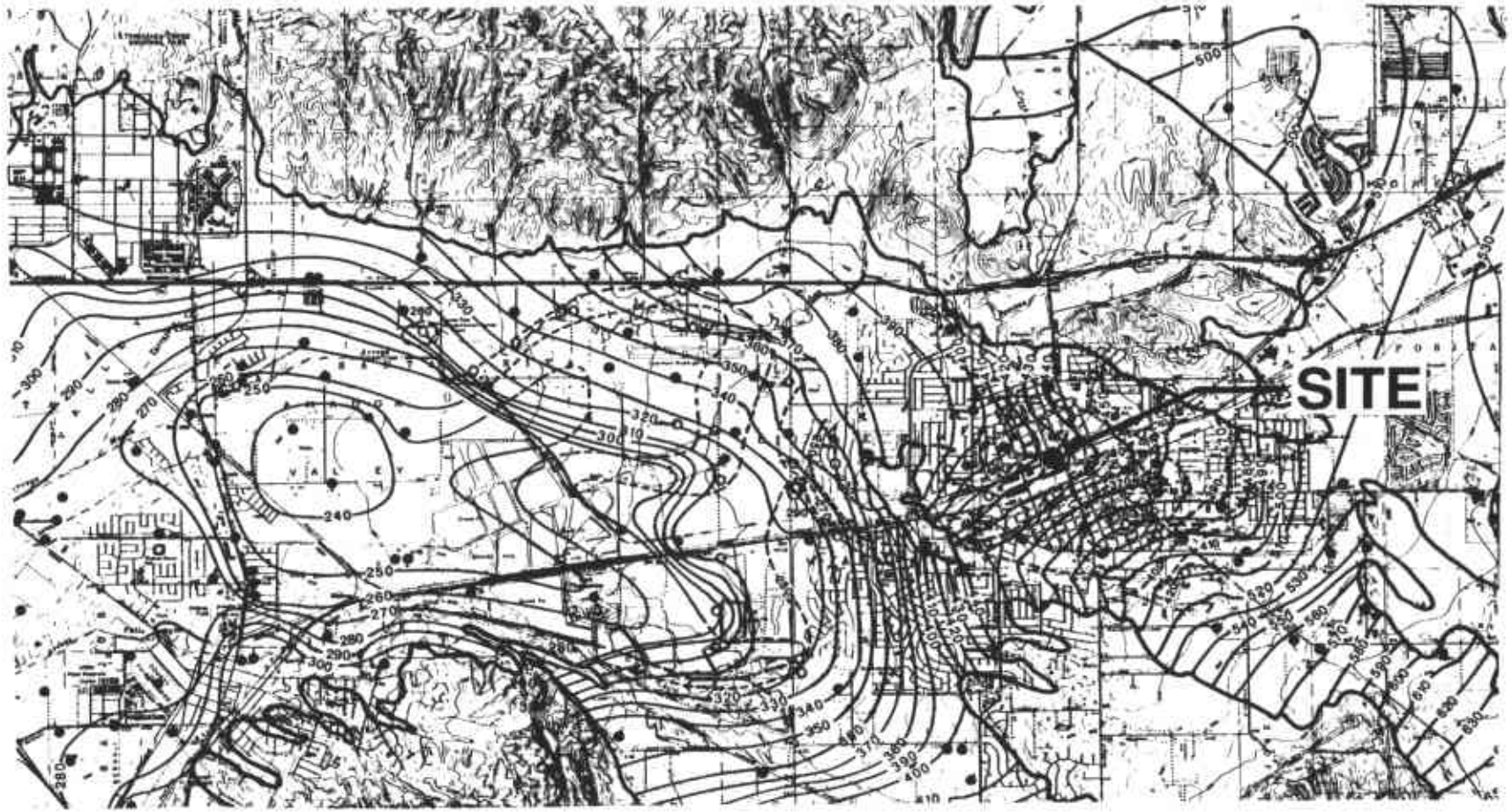
N.I. = No Information



Project No. 8810220A	Railroad Ave. Property	Location of Borings and Monitoring Wells, 187 North L Street, Livermore, California	Figure 1
Woodward-Clyde Consultants			



Project No. 8810220A	Railroad Ave. Property	Site Groundwater Gradient Map, 187 North L Street, Livermore, California	Figure 2
Woodward-Clyde Consultants			



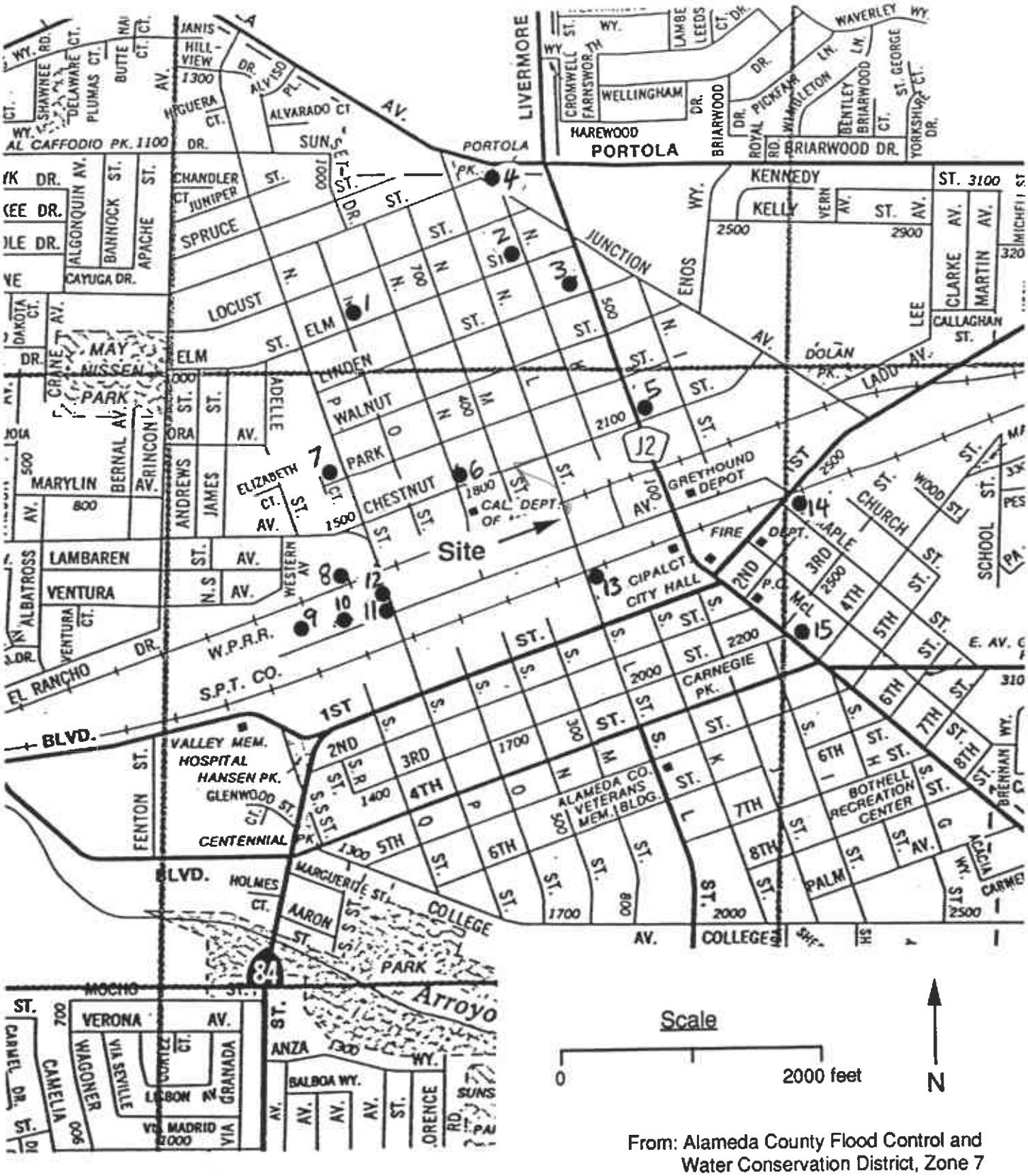
EXPLANATION

- RECENT ALLUVIUM BOUNDARY
- −350− WATER LEVEL OF AQUIFER
- --250-- WATER LEVEL OF UNDERLYING AQUIFER
- ● WELL
- ○ WELL IN LOWER AQUIFER

3000 0 3000 6000
SCALE FEET

N

Project No. 8810220A	Railroad Ave. Property	Regional Water Level Contours and Well Locations, Fall 1988, 187 North L Street, Livermore, California	Figure 3
Woodward-Clyde Consultants			



From: Alameda County Flood Control and Water Conservation District, Zone 7

Project No. 8810220A	Railroad Ave. Property	Well Survey Locations Within About a Half Mile of the Site, 187 North L Street, Livermore, California	Figure 4
Woodward-Clyde Consultants			

APPENDIX A

WCC LOGS OF WELL W-1, W-2 AND W-3 AND BORINGS B-7 AND B-8

Woodward-Clyde Consultants

PROJECT NAME Livermore NO. 8810220A

BORING LOCATION	Livermore W-1			ELEVATION AND DATUM	
DRILLING AGENCY	Datum Exploration	DRILLER	Dennis Vernon	DATE STARTED / DATE FINISHED	May 26, 1989
DRILLING EQUIPMENT	CME 75			COMPLETION DEPTH	56.5'
DRILLING METHOD	8" Hollowstem Augers	DRILL BIT		NO. OF SAMPLES: DIST.	NA
SIZE AND TYPE OF CASING	2" Schedule 40 PVC			WATER LEVEL: FIRST	50'
TYPE OF PERFORATION	0.010" Slotted PVC	FROM	45.5 TO 55.5 FT.	LOGGED BY:	E. Gonzalez
SIZE AND TYPE OF PACK	#2/12 Monterey Type Sand	FROM	41.5 TO 55.5 FT.	CHECKED BY:	N. Gorczyca
TYPE OF SEAL NO. 1	3/8" Bentonite Pellets	FROM	39 TO 41.5 FT.		
TYPE OF SEAL NO. 2	Cement Grout	FROM	1 TO 39 FT.		

DEPTH (feet)	DESCRIPTION	GRAPHIC LOG: Piezometer Installation	Water Content	DEPTH (feet)	SAMPLES: Drive Number	Sample Number	Recov. (Feet)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
	CONCRETE								christy box
	SILTY GRAVEL (GM): grey (fill)								
	CLAYEY GRAVEL (GC)								
	- very dark brown with granules (0.25-0.5" diameter),moist,very loose, plastic clay			5	1	1-A		2 2 5C	- OVA = 1.2 ppm
10	- medium dense			10	2	2-A		18 19 18	- OVA = 7.0 ppm
	SILTY GRAVEL (GM)								
15	- light grey to greenish grey, medium dense; gravel may be decomposed serpentine bedrock; angular and fragmented			15	3	3-A		17 33 37	- OVA = 0 ppm
20	- mottled green-grey, yellowish green, grey and brown; moist			20	4	4-A		17 18 22	-OVA > 1000 ppm gasoline odor
	- cuttings become more clayey								
25	- SILTY to CLAYEY GRAVEL (GM/GC) - greenish grey to tan; gravels range in size from coarse sand to fine gravel, moist			25	5	5-A		16 27 33	- OVA > 1000 ppm slight gasoline ' odor
30	- cuttings become more clayey			30	6	6-A		16 31 38	- OVA > 1000 ppm slight gasoline ' odor
35				35					

Woodward-Clyde Consultants

PROJECT NAME Livermore NO. 8810220A

DEPTH (feet)	DESCRIPTION	GRAPHIC LOG: Piezometer Installation	Water Content	Piezometer Data	SAMPLES: Drive Number	Sample Number	Recov. (feet)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
35	CLAYEY GRAVEL (GC) - mottled greenish grey; brown and tan, fine gravel			35	7	7-A		12 20 27	- OVA > 1000 ppm slight gasoline odor
40	SILTY CLAY (CH) - medium brown, trace fine sand to very fine gravel, firm, plastic, very moist			40	8	8-A		5 10 13	- OVA > 1000 ppm gasoline odor
45				45	9	9-A		5 6 8	- OVA > 1000 ppm gasoline odor
50	CLAYEY GRAVEL (GC) - greyish brown to yellowish brown; fine gravel in clayey matrix; medium dense		ATD	50	10	10-A		19 36 28	- OVA > 1000 ppm trace gasoline odor
55	SANDY CLAY (SC) - medium brown CLAY (CL) - medium brown silty clay, firm, slight plasticity			55	11	11-A		2 9 16	- OVA > 1000 ppm gasoline odor
60	Bottom of Boring at 56.5'			60					
65				65					
70				70					
75				75					
80				80					

FIELD LOG OF BORING NO. W-1 SHEET 2 OF 2

Woodward-Clyde Consultants

PROJECT NAME Livermore NO. 8810220A

BORING LOCATION	Livermore [illegible]2	ELEVATION AND DATUM	
DRILLING AGENCY	Datum Exploration	DRILLER Dennis Vernon	DATE STARTED May 24, 1989 / DATE FINISHED May 26, 1989
DRILLING EQUIPMENT	CME 75	COMPLETION DEPTH 49'	SAMPLER 2" Modified California Type
DRILLING METHOD	8" Hollowstem Augers	DRILL BIT	NO. OF SAMPLES DIST. NA / UNDIST. 9
SIZE AND TYPE OF CASING	2" PVC	WATER LEVEL FIRST 49?	COMPL. NA / 24 HRS. NA
TYPE OF PERFORATION	0.010" Slotted PVC	FROM 39 TO 49 FL.	LOGGED BY: E. Gonzalez
SIZE AND TYPE OF PACK	#2/12 Monterey Type Sand	FROM 36 TO 49 FL.	CHECKED BY: N. Gorczyca
TYPE OF SEAL NO. 1	3/8" Bentonite Pellets	FROM 22.5 TO 36 FL.	
TYPE OF SEAL NO. 2	Cement-Bentonite Grout	FROM 0 TO 32.5	

DEPTH (feet)	DESCRIPTION	GRAPHIC LOG / Piezometer Installation	Water Content	DEPTH (feet)	SAMPLES: Drive Number	Sample Number	Recov. (Feet)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
	SILTY CLAY (CL) - dark brown, with gravel, dry								- background OVA = 0.2 ppm
	SILTY GRAVEL (GM) - dark brown, with silty clay and gravel (0.5-2" diameter); loose to medium dense, dry			5	1	1-A		25 / 14 / 10	- OVA = 5.6 ppm
10				10	2	2-A		40 / 24 / 28	- OVA = 6.2 ppm
	GRAVEL (GP) - dark grey								
15	SILTY GRAVEL (GM): grey, with some orange-brown clay and light grey gravel, medium dense			15	3	3-A		25 / 32 / 41	- OVA = 6.9 ppm
	CLAYEY GRAVEL (GC) - medium grey with fine gravel (0.125-0.25" diameter), medium dense			20	4	4-A		17 / 20 / 36	- OVA = 7.6 ppm
25	GRAVELLY CLAY (CL) to CLAYEY GRAVEL (GC) - yellowish brown to tan			25	5	5-A		10 / 14 / 39	- OVA = 12 ppm
	- cuttings become more gravelly								
30	CLAYEY GRAVEL (GC) - yellowish grey to brown with some orange-brown areas; fine gravel (0.125 - 0.5" diameter), loose, clay moist and plastic			30	6	6-A		4 / 12 / 15	- OVA = 9.2 ppm
35				35					

Woodward-Clyde Consultants

PROJECT NAME: Livermore NO. 8810220A

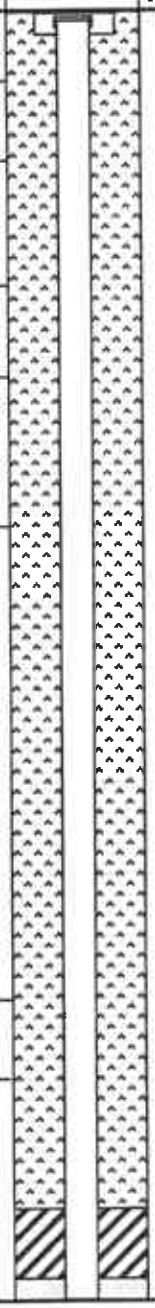
DEPTH (feet)	DESCRIPTION	GRAPHIC LOG: Piezometer Installation	Water Content	Piezometer Data	SAMPLES: Drive Number	Sample Number	Recov. (feet.)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
35				35	7	7-A		16 37 25/0"	- OVA =24 ppm
									- slow, hard drilling 38-42'
	SANDY CLAY (CL) - grey								- no sample @ 40'
40	- clayey gravel ?			40	8	8-A		50/4" NO NO	- OVA =8.8 ppm
	CLAYEY GRAVEL and CLAYEY SAND (GC/SC) - greyish brown; gravel to 0.125" diameter, medium dense								
45				45	9	9-A		28 28 25/2"	- OVA = 18 ppm
									- hard drilling 45-50'
50			ATD	50	10	10-A		NC 10 25/2"	- OVA = 9.8 ppm
	Bottom of Boring 51.5'								- Note: sand and pellets emplaced 5/24/89; grout seal emplaced 5/26/89
55				55					
60				60					
65				65					
70				70					
75				75					
80				80					

FIELD LOG OF BORING NO. W-2 SHEET 2 OF 2

Woodward-Clyde Consultants

PROJECT NAME Livermore NO. 8810220A

BORING LOCATION	Livermore [redacted]	ELEVATION AND DATUM	
DRILLING AGENCY	Datum Exploration	DRILLER Dennis Vernon	DATE STARTED May 25, 1989 / DATE FINISHED May 26, 1989
DRILLING EQUIPMENT	CME 75	COMPLETION DEPTH 48'	SAMPLER 2" Modified California Type
DRILLING METHOD	8" Hollowstem Augers	DRILL BIT	NO. OF SAMPLES DIST. NA / UNDIST. 10
SIZE AND TYPE OF CASING	2" Schedule 40 PVC	WATER LEVEL FIRST 45'	COMPL. NA / 24 HRS. NA
TYPE OF PERFORATION	0.010" Slotted PVC	FROM 38 TO 48 FL	LOGGED BY: E. Gonzalez
SIZE AND TYPE OF PACK	#2/12 Monterey Type Sand	FROM 34.5 TO 48 FL	CHECKED BY: N. Gorczyca
TYPE OF SEAL NO. 1	3/8" Bentonite Pellets	FROM 32.5 TO 34.5 FL	
TYPE OF SEAL NO. 2	Cement-Bentonite Grout	FROM 0 TO 32.5 FL	

DEPTH (feet)	DESCRIPTION	GRAPHIC LOG / Piezometer Installation	Water Content	DEPTH (feet)	SAMPLES: Drive Number	Sample Number	Recov. (Feet)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
	CLAYEY to SILTY GRAVEL (GC) - medium brown, dry								-Note: sample OVA readings are head-space measurements
	GRAVEL (GP) - subrounded pebbles (0.5-2" diameter)								
5	CLAYEY GRAVEL (GC) - greyish brown, silty, loose, dry			5	1	1-A		15 12 17	- OVA = 3.0 ppm
	GRAVEL (GP) - subrounded pebbles (0.125-2" diameter)								
10	CLAYEY GRAVEL (GC) - greyish brown, slightly moist, moderately pebble size 1/16-1/2" diameter, fractured clayey matrix, loose to medium dense			10	2	2-A		7 18 19	- OVA = 3.6 ppm
15	SILTY to CLAYEY GRAVEL (GM / GC) - greyish brown, some tan to brown clay; coarse sand and granules (up to 0.5" diameter), moist to very moist, clay slightly plastic, medium dense			15	3	3-A		20 27 28	- OVA = 4.4 ppm
20	-brown clay matrix with some silt, medium dense			20	4	4-A		20 33 37	- OVA = 8.8 ppm
25	- yellowish grey to greyish brown			25	5	5-A		22 37 48	- OVA = 7.6 ppm
	GRAVEL (GP) - contains subrounded pebbles (0.125-2" diameter)								
30	CLAYEY GRAVEL (GC) - pebbles in brown to greyish brown clay matrix; stiff, plastic, moist			30	6	6-A		17 27 30	- OVA = 22 ppm
35				35					

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PROJECT NAME Livermore NO. 8810220A

DEPTH (feet)	DESCRIPTION	GRAPHIC LOG: Piezometer Installation	Water Content	Piezometer Data	SAMPLES: Drive Number	Sample Number	Recov. (feet.)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
35	CLAY (CH) - mottled medium brown, yellowish to dark yellowish brown with grey zones; firm, moist, plastic				7	7-A		7 7 11	- OVA = 48 ppm
40					8	8-A		7 4 3	-OVA = 23 ppm
45	SILTY GRAVEL (GM) - medium brown to grey matrix; wet; gravel to 0.5" diameter , medium dense		ATD		9	9-A		13 26 38	- OVA = 64 ppm
50	SILTY COARSE SAND (SM) to GRAVEL (GW) - medium grey, gravel has some silt and sand, wet CLAYEY GRAVEL (GC) - greenish brown, with green clay matrix; gravel to 0.25" diameter, medium dense				10	10-C		17 32 29	- OVA = 54 ppm
55	Bottom of Boring 51.5'								
60									
65									
70									
75									
80									

FIELD LOG OF BORING NO. W-3 SHEET 2 OF 2

Woodward-Clyde Consultants

PROJECT NAME Livermore NO. 8810220A

BORING LOCATION	Livermore B-7			ELEVATION AND DATUM	
DRILLING AGENCY	Datum Exploration	DRILLER	Dennis Vernon	DATE STARTED / DATE FINISHED	May 25, 1989
DRILLING EQUIPMENT	CME 75			COMPLETION DEPTH	10'
DRILLING METHOD	8" Hollowstem Augers	DRILL BIT		NO. OF SAMPLES / DIST.	1
SIZE AND TYPE OF CASING	NA			WATER LEVEL / FIRST	NA
TYPE OF PERFORATION	NA	FROM	TO FT.	LOGGED BY:	E. Gonzalez
SIZE AND TYPE OF PACK	NA	FROM	TO FT.	CHECKED BY:	N. Gorczyca
TYPE OF SEAL	NO. 1 Cement - Bentonite Grout	FROM 0	TO 10 FT.		
	NO. 2 NA	FROM	TO FT.		

SAMPLER 2" Modified California Type

UNDIST. NA

COMPL. NA 24 HRS. NA

DEPTH (feet)	DESCRIPTION	Water Content	DEPTH (feet)	SAMPLES: Drive Number	Sample Number	Recov. (Feet)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
	Asaphaltic Concrete							Background - OVA = 0.2 ppm
	SILTY CLAY (CL) dark brown, fill							
	CLAYEY GRAVEL (GC) brownish gray, dry, medium dense, pebbles (0.125 - 1" diameter)			1	1-A		14, 27, 16	OVA = 52 ppm
5	GRAVEL (GP) gray, subrounded pebbles (0.5 - 2" diameter), dry, medium dense		5					
	SILTY GRAVEL (GM) medium brown, dry, medium dense, 1 large (2" diameter) pebble			2	2-A		23, 25, 19	no recovery
10	Bottom of Boring - 11.5'		10					
15			15					
20			20					
25			25					
30			30					
35			35					

FIELD LOG OF BORING NO. B-7 SHEET 1 OF 1

Woodward-Clyde Consultants

PROJECT NAME Livermore NO. 8810220A

BORING LOCATION	Livermore B-8			ELEVATION AND DATUM	
DRILLING AGENCY	Datum Exploration	DRILLER	Dennis Vernon	DATE STARTED / DATE FINISHED	May 25, 1989
DRILLING EQUIPMENT	CME 75			COMPLETION DEPTH	10'
DRILLING METHOD	8" Hollowstem Augers	DRILL BIT		NO. OF SAMPLES / DIST.	2
SIZE AND TYPE OF CASING	NA			WATER LEVEL / FIRST	NA
TYPE OF PERFORATION	NA	FROM	TO FT.	LOGGED BY:	CHECKED BY:
SIZE AND TYPE OF PACK	NA	FROM	TO FT.	E. Gonzalez	N. Gorczyca
TYPE OF SEAL	NO. 1 Cement - Bentonite Grout	FROM 0	TO 10 FT.		
	NO. 2 NA	FROM	TO FT.		

DEPTH (feet)	DESCRIPTION	Water Content	DEPTH (feet)	SAMPLES: Drive Number	Sample Number	Recov. (Feet)	Blow Counts	REMARKS (Drill Rate, Fluid Loss, Odor, etc.)
	Asaphaltic Concrete							Background - OVA = 0.2 ppm
	SILTY GRAVEL (GM) medium gray, fill							
	SILTY CLAY (CL) very dark brown, contains pebbles, dry, soft			1	1-A		8 13 9	OVA = 7.9 ppm
	cuttings contain CLAYEY GRAVEL (GC), dry							
5	GRAVEL (GP) medium brown, little silt / varies from coarse sand to granule-sized gravel, some small (0.25") pebbles, moderately dense, slightly moist		5					
10	SILTY GRAVEL (GM) medium brown, with gravel up to 0.5" diameter, dry, medium to very dense		10	2	2-A		NC 17 36/0"	OVA = 10 ppm
	Bottom of Boring - 11.5'							
15			15					
20			20					
25			25					
30			30					
35			35					

SAMPLE CLASSIFICATION CHART

MOISTURE CONTENT

DRY	- LITTLE/NO PERCEPTIBLE MOISTURE
DAMP	- SOME PERCEPTIBLE MOISTURE, NOT COMPACTABLE
MOIST	- COMPACTABLE
WET	- ABOVE COMPACTABLE RANGE
SATURATED	- PORES, VOIDS FILLED WITH WATER
▼	- WATER TABLE (AT TIME OF DRILLING)

SORTING ($So = P_{75}/P_{25}$)

	So
EXTREMELY WELL	1.0-1.1
VERY WELL	1.1-1.2
WELL	1.2-1.4
MODERATELY	1.4-2.0
POORLY	2.0-2.7
VERY POORLY	2.7-5.0

SOIL CONSISTANCY

SILT, SAND and GRAVEL	BLOWS/FT 2 1/2 in. O.D. SAMPLER	CLAY	BLOWS/FT 2 1/2 in. O.D. SAMPLER	THUMB PENETRATION
Very loose	< 6	Very Soft	< 3	Very easily - inches
Loose	6 - 16	Soft	3 - 6	Easily - inches
Medium Dense	16 - 47	Medium (firm)	6 - 13	Moderate effort - inches
Dense	47 - 78	Stiff	13 - 23	Indented easily
Very Dense	> 78	Very Stiff	23 - 47	Indented by nail
		Hard	> 47	Difficult by nail

SOIL BORING AND WELL CONSTRUCTION LEGEND


MODIFIED CALIFORNIA SAMPLE RECOVERY


WATER LEVEL OBSERVED IN BORING


STATIC WATER LEVEL MEASURED IN WELL


BLANK CASING


SCREENED CASING


CEMENT GROUT


BENTONITE


SAND PACK

NOTE: BLOW COUNT (BLOWS/FT) REPRESENTS THE NUMBER OF BLOWS OF A 140 - POUND HAMMER FALLING 30 INCHES PER BLOW REQUIRED TO DRIVE A SAMPLER THROUGH THE LAST 12 INCHES OF AN 18 - INCH PENETRATION

NOTE: THE LINE SEPARATING STRATA ON THE LOGS REPRESENTS APPROXIMATE BOUNDARIES ONLY. THE ACTUAL TRANSITION MAY BE GRADUAL. NO WARRANTY IS PROVIDED AS TO THE CONTINUITY OF SOIL STRATA BETWEEN BORINGS. LOGS REPRESENT THE SOIL SECTION OBSERVED AT THE BORING LOCATION ON THE DATE OF DRILLING ONLY.

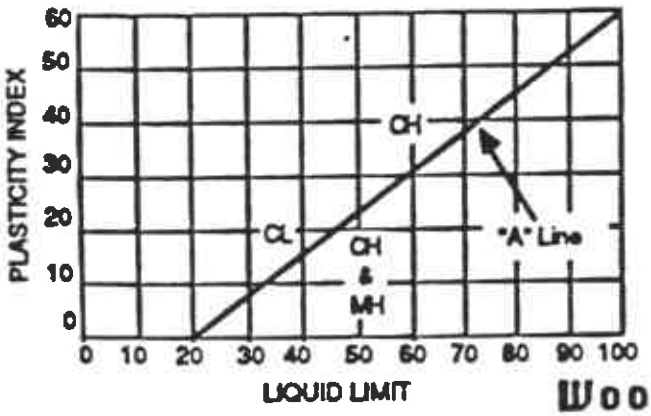
Woodward-Clyde Consultants

SAMPLE CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION SCHEME				
MAJOR DIVISIONS		SYMBOLS	GRAPHIC COLUMN	TYPICAL NAMES
COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size)	GW		Well-graded gravels and gravel-sand mixtures, little or no fines
		GP		Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM		Silty gravels, gravel-sand-silt mixtures
		GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction < no. 4 sieve size)	SW		Well-graded sands or gravelly sands, little or no fines
		SP		Poorly-graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand-silt mixtures
		SC		Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils

CLASSIFICATION MODIFIERS	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
± MODIFIERS	

PLASTICITY CHART



GRAIN SIZE CLASSIFICATION		
CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
coarse (c)	3" to 3/4"	76.2 to 19.1
fine (f)	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse (c)	No. 4 to No. 10	4.76 to 2.00
medium (m)	No. 10 to No. 40	2.00 to 0.420
fine (f)	No. 40 to No 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

Woodward-Clyde Consultants

APPENDIX B

SOIL AND GROUNDWATER LABORATORY ANALYSIS RESULTS, AND CHAIN-OF-CUSTODY RECORD

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Client Project ID:	#88-10220A-8000, RR Ave., Livermore	Sampled:	May 24, 1989
500 12th St., Suite 100	Matrix Descript:	Soil	Received:	May 30, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Jun 6, 1989
Attention: Helen Nuckolls	First Sample #:	905-3351	Reported:	Jun 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
905-3351	W-2A (5')	1.2	N.D.	0.14	N.D.	N.D.
905-3352	W-2B (10')	N.D.	N.D.	0.1	N.D.	N.D.
905-3353	W-2C (15')	N.D.	N.D.	0.1	N.D.	N.D.
905-3354	W-2D (20')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3355	W-2E (25')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3356	W-2F (30')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3357	W-2G (35')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3358	W-2I (45')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3359	W-2J (50')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3360	W-3A (5')	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.05**	**0.1**	**0.1**	**0.1**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Client Project ID:	#88-10220A-8000, RR Ave., Livermore	Sampled:	May 24, 1989
500 12th St., Suite 100	Matrix Descript:	Soil	Received:	May 30, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Jun 6, 1989
Attention: Helen Nuckolls	First Sample #:	905-3361	Reported:	Jun 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
905-3361	W-3B (10')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3362	W-3C (15')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3363	W-3D (20')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3364	W-3E (25')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3365	W-3F (30')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3366	W-3G (35')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3367	W-3H (40')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3368	W-3I (45')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3369	W-3 (50')	12	0.06	N.D.	N.D.	N.D.
905-3370	B-7A (5')	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.05**	**0.1**	**0.1**	**0.1**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

9053351.WOO <2>

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Woodward-Clyde Consultants	Matrix Descript:	#88010220A-8000, RR Ave., Livermore	Sampled:	May 24, 1989
500 12th St., Suite 100	Matrix Descript:	Soil	Received:	May 30, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 5030/8015/8020	Analyzed:	6/6-6/7/89
Attention: Helen Nuckolls	First Sample #:	905-3371	Reported:	Jun 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
905-3371	B-7B (10')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3372	B-8A (5')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3373	B-8B (10')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3374	W-1A (5')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3375	W-1B (10')	N.D.	N.D.	N.D.	N.D.	N.D.
905-3376	W-1C (15')	1,200	N.D.	21	20	130
905-3377	W-1D (20')	350	2.5	14	6.3	30
905-3378	W-1E (25')	490	3.5	24	9.4	46
905-3379	W-1F (30')	160	1.0	7.9	3.6	18
905-3380	W-1G (35')	370	2.4	20	8.2	40
Detection Limits:		**1.0**	**0.05**	**0.1**	**0.1**	**0.1**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

9053351.WOO <3>

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680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Matrix Descript:	#88010220A-8000, RR Ave., Livermore	Sampled:	May 24, 1989
500 12th St., Suite 100	Matrix Descript:	Soil	Received:	May 30, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 5030/8015/8020	Analyzed:	6/6-6/7/89
Attention: Helen Nuckolls	First Sample #:	905-3381	Reported:	Jun 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
905-3381	W-1H (40')	16,000	220	1,100	340	1,500
905-3382	W-1I (45')	1,600	30	120	34	160
905-3383	W-1J (50')	2,500	28	200	59	270
905-3384	W-1K (55')	120	3.2	10	2.7	13
Detection Limits:		**1.0**	**0.05**	**0.1**	**0.1**	**0.1**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

9053351.WOO <4>

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Woodward-Clyde Consultants	Client Project ID:	#88-10220A-8000, RR Ave., Livermore	Sampled:	May 24, 1989
500 12th St., Suite 100	Matrix Descript:	Soil	Received:	May 30, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 3550/8015	Analyzed:	Jun 7, 1989
Attention: Helen Nuckolls	First Sample #:	905-3357	Reported:	Jun 15, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
905-3357	W-2I (45')	N.D.
905-3367	W-3H (40')	N.D.
905-3370	B-7A (5')	N.D.
905-3373	B-8B (10')	N.D.
905-3377	W-1D (20')	380
905-3381	W-1H (40')	1,500

Detection Limits:	**1.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Laboratory Director

9053351.WOO <5>

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Helen Nuckolls

Client Project ID: #88-10220A-8000, RR Ave., Livermore

QC Sample Group: 9053351-84

Reported: Jun 15, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	Ethyl Benzene

Method:	EPA 8020
Analyst:	A. Miraftab
Reporting Units:	ppm
Date Analyzed:	Jun 6, 1989
QC Sample #:	905-3351

Sample Conc.:	0.0
Spike Conc. Added:	0.20
Conc. Matrix Spike:	0.16
Matrix Spike % Recovery:	80.0
Conc. Matrix Spike Dup.:	0.17
Matrix Spike Duplicate % Recovery:	85.0
Relative % Difference:	6.1

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Laboratory Director

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

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Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Helen Nuckolls

Client Project ID: #88-10220A-8000

QC Sample Group: 9053369-84

Reported: Jun 15, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	Ethyl Benzene	TPH-Diesel
Method:	EPA 8020	EPA 8015
Analyst:	A. Miraftab	J. McKee
Reporting Units:	ppm	ppm
Date Analyzed:	Jun 7, 1989	Jun 7, 1989
QC Sample #:	905-3372	Matrix blank
Sample Conc.:	0.0	N.D.
Spike Conc. Added:	0.20	16.2
Conc. Matrix Spike:	0.18	16.2
Matrix Spike % Recovery:	90.0	100.0
Conc. Matrix Spike Dup.:	0.18	13.8
Matrix Spike Duplicate % Recovery:	90.0	85.0
Relative % Difference:	0.0	16.0

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Laboratory Director

% Recovery:	$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}}$	x 100
Relative % Difference:	$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}}$	x 100

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680 Chesapeake Drive • Redwood City, CA 94063
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Woodward-Clyde Consultants	Client Project ID:	#8810220A	Sampled:	Jun 2, 1989
500 12th St., Suite 100	Matrix Descript:	Water	Received:	Jun 2, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 3510/8015	Analyzed:	Jun 12, 1989
Attention: Helen Nuckolls	First Sample #:	906-0359	Reported:	Jun 16, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons µg/L (ppb)
906-0359	RR Ave-W1B	300,000
906-0361	RR Ave-W2B	N.D.
906-0363	RR Ave-W-3B	2,200

Detection Limits:	**50.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Arthur G. Burton
Laboratory Director

9060359.WOO <1>

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants	Client Project ID:	#8810220A	Sampled: Jun 2, 1989
500 12th St., Suite 100	Matrix Descript:	Water	Received: Jun 2, 1989
Oakland, CA 94607-4041	Analysis Method:	EPA 5030/8015/8020	Analyzed: Jun 12, 1989
Attention: Helen Nuckolls	First Sample #:	906-0358 A-B	Reported: Jun 16, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
9060358 A-B	W1A1 & W1A2	210,000	29,000	30,000	5,400	24,000
9060360 A-B	W2A1 & W2A2	360	6.7	2.1	0.47	1.3
9060362 A-B	W3A1 & W3A2	11,000	290	120	150	140
Detection Limits:		**30.0**	**0.3**	**0.3**	**0.3**	**0.3**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Arthur G. Burton
Laboratory Director

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(415) 364-9600 • FAX (415) 364-9233

Woodward-Clyde Consultants
500 12th St., Suite 100
Oakland, CA 94607-4041
Attention: Helen Nuckolls

Client Project ID: #8810220A

QC Sample Group: 9060359-63

Reported: Jun 16, 1989

QUALITY CONTROL DATA REPORT

ANALYTE	TPH-Diesel	Ethyl Benzene
Method:	EPA 8015	EPA 8020
Analyst:	J. McKee	C. Camba
Reporting Units:	ppb	ppb
Date Analyzed:	Jun 12, 1989	Jun 12, 1989
QC Sample #:	Matrix blank	9061162
Sample Conc.:	N.D.	N.D.
Spike Conc. Added:	324.0	1.5
Conc. Matrix Spike:	363.0	1.5
Matrix Spike % Recovery:	112.0	100.0
Conc. Matrix Spike Dup.:	275.0	1.4
Matrix Spike Duplicate % Recovery:	85.0	93.0
Relative % Difference:	28.0	7.0

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Laboratory Director

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

Woodward-Clyde Consultants
One Walnut Creek Center, 100 Pringle Avenue
Walnut Creek, CA 94596 (415) 945-3000

Chain of Custody Record

RR Ave. – Livermore 5/24/89

PROJECT NO. 88-10220A – 8,000

SAMPLERS: (Signature) [signature]

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 626	EPA Method 608		EPA Method 8015 gas*	" " diesel*			NUMBER OF CONTAINERS	REMARKS (Sample preservation, handling procedures, etc.)
5/24	1030	W-2 A (5ft)							X				1	
↓	1042	W-2 B (10ft)							X				1	Containers: 4-inch brass liner
	1102	W-2 C (15ft)							X				1	Medium: soil
	1118	W-2 D (20ft)							X				1	
	1136	W-2 E (25ft)							X				1	For questions please call
	1200	W-2 F (30ft)							X				1	Helen Nuckolls or
	1224	W-2 G (35ft)							X	X			1	Al Ridley
														(415) 893-3600
	1412	W-2 I (45ft)							X				1	
↓	1540	W-2 J (50ft)							X				1	

INSTRUCTIONS

1. Analyze all samples using EPA Method 8015-8020 for gasoline (TPH: low to medium-gasoline / BTEX)
2. Analyze W-2G (35ft) using EPA Method 8015 (TPH- high: diesel)

Well W-2
5/24/89
Total samples: 9
Total analyses: 10

TOTAL NUMBER OF CONTAINERS: 9

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Siganture)	DATE/TIME	RECEIVED BY: (Signature)
[signature]	5/.. 1452	[signature]			

METHOD OF SHIPMENT	SHIPPED BY	COURIER:	RECEIVED FOR LAB BY	DATE/TIME

Woodward-Clyde Consultants One Walnut Creek Center, 100 Pringle Avenue Walnut Creek, CA 94596 (415) 945-3000	**Chain of Custody Record** RR Ave - Livermore 5/25/89

PROJECT NO. 88-10220A-8,000

SAMPLERS: (Signature) [signature]

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608		EPA Method 8015-gas*	" " " diesel				NUMBER OF CONTAINERS
5/25	0833	W-3 A (5 ft)							X					1
↓	0853	W-3 B (10 ft)							X					1
	0906	W-3 C (15 ft)							X					1
	0920	W-3 D (20 ft)							X					1
	0938	W-3 E (25 ft)							X					1
	1010	W-3 F (30 ft)							X					1
	1032	W-3 G (35 ft)							X					1
	1050	W-3 H (40 ft)							X	X				1
	1107	W-3 I (45 ft)							X					1
	1130	W-3 J (50 ft)							X					1
5/25	1546	B-7 A (5 ft)							X	X				1
5/25	1611	B-7 B (10 ft) *							X					1*
5/25	1707	B-8 A (5 ft)							X					1
5/25	1719	B-8 B (10 ft)							X	X				1

TOTAL NUMBER OF CONTAINERS: 14

REMARKS (Sample preservation, handling procedures, etc.)

Container: 4-inch brass liner
Material: soil

For questions please call:
Helen Nuckolls or Al Ridley
(415) 893-3600

INSTRUCTIONS

1. Analyze all samples using EPA Method 8015-8020 for gasoline (TPH low to medium gasoline/BTEX)
2. Analyze: W-3 H (40 ft)
   B-7 A (5 ft)
   B-8 B (10 ft)
   using EPA Method 8015 for TPH-high-diesel

* Partial sample. Please analyze if possible. If insufficient for analysis please call. Do not grind rocks.

Boring B-7
Boring B-8
Well W-3
5/25/89
Total samples: 14
Total analyses: 17

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Siganture)	DATE/TIME	RECEIVED BY: (Signature)
[signature]	5/25 [illegible]	[signature]			

METHOD OF SHIPMENT: | SHIPPED BY (Signature) | COURIER (Signature) | RECEIVED FOR LAB BY: (Signature) | DATE/TIME

Woodward-Clyde Consultants

One Walnut Creek Center, 100 Pringle Avenue
Walnut Creek, CA 94596 (415) 945-3000

Chain of Custody Record

RR Ave - Livermore 5/26/89

PROJECT NO.: 88-10220A - 8000

SAMPLERS: (Signature)

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	EPA Method 8015 - gas	" - diesel					NUMBER OF CONTAINERS
5/26	0836	W-1 A (5ft)						X						1
	0846	W-1 B (10ft)						X						1
	0856	W-1 C (15ft)						X						1
	0911	W-1 D (20ft)						X	X					1
	0923	W-1 E (25ft)						X						1
	0935	W-1 F (30ft)						X						1
	0957	W-1 G (35ft)						X						1
	1016	W-1 H (40ft)						X	X					1
	1029	W-1 I (45ft)						X						1
	1040	W-1 J (50ft)						X						1
	1057	W-1 K (55ft)						X						1

TOTAL NUMBER OF CONTAINERS: 11

REMARKS (Sample preservation, handling procedures, etc.)

Containers: 4-inch brass liners

Medium: Soil

For questions please call:
Helen Nuckolls or
Al Ridley
(415) 893-3600

INSTRUCTIONS

1. Analyze all samples using EPA Method 8015-8020 for gasoline (TPH- low to medium: gasoline/BTEX)

2. Analyze W-1 D (20ft)
W-1 H (40ft)
using EPA Method 8015
(TPH - high: diesel)

Well W-1
5/26/89
Total samples: 11
Total analyses: 13

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
	5/26 1842				

METHOD OF SHIPMENT	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME

Woodward-Clyde Consultants

500 12th Street, Suite 100, Oakland, CA 94607-4041
(415) 893-3600

Chain of Custody Record

PROJECT NO. 88/0220A

SAMPLERS: (Signature) [signature]

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	EPA 5015 gasoline/BTXE	EPA 5015 diesel				Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
6-2	0930	W-3A1 + W3A2						X					2	Samples kept in ice cooler
6-2	0930	W3B							X				1	
6-2	1000	W-2A1 + W2A2						X					2	For questions call:
6-2	1000	W2B							X				1	Helen Nuckolls or Al Ridley (415) 893-3600
6-2	1145	W1A1 + W1A2						X					2	
6-2	1145	W1B							X				1	

Remarks (continued): Analyses: VOA's: EPA 5015 gasoline/BTXE; amber: EPA 5015 diesel; Medium: water

Total analyses 6
Total containers 9

TOTAL NUMBER OF CONTAINERS: 9

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
[signature]	6-2 1145				

METHOD OF SHIPMENT:	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME
CCX Courier		[signature] CCX		