gettler — ryan inc.
general contractors

April 14, 1989

Mr. Steven R. Ritchie
Regional Water Quality Control Board
San Francisco Bay Region
1111 Jackson Street, Room 6040
Oakland, California 94607

Reference: Shell Service Station
3790 Hopyard Road
Pleasanton, California

Gentlemen:

As requested by Ms. Diane Lundquist of Shell Oil Company, Gettler-Ryan Inc. is forwarding the Quarterly Summary Report (Shell Oil Company's CALWATER program) for the above referenced location. The summary reports cover the first quarter of 1989 (January - March, 1989). The quarterly technical report for this location was issued by Woodward-Clyde Consultants on January 18, 1989. A report discussing the installation of two additional ground-water monitoring wells on February 24, 1989 is pending.

Please do not hesitate to call should you have any questions or comments.

Sincerely,

John P. Werfal
Project Manager

JPW/ns

enclosure

cc: Ms. Diane Lundquist, Shell Oil Company
Mr. Rick Mueller, Pleasanton Fire Department
Mr. Rafat Shahid, Alameda County Environmental Health

1992 national avenue • hayward, california 94545-1787 • 783-7500

gettler — ryan inc.
general contractors

April 14, 1989

Mr. Steven R. Ritchie
Regional Water Quality Control Board
San Francisco Bay Region
1111 Jackson Street, Room 6040
Oakland, California 94607

Reference: Shell Service Station
3790 Hopyard Road
Pleasanton, California

Gentlemen:

As requested by Ms. Diane Lundquist of Shell Oil Company, Gettler-Ryan Inc. is forwarding the Quarterly Summary Report (Shell Oil Company's CALWATER program) for the above referenced location. The summary reports cover the first quarter of 1989 (January - March, 1989). The quarterly technical report for this location was issued by Woodward-Clyde Consultants on January 18, 1989. A report discussing the installation of two additional ground-water monitoring wells on February 24, 1989 is pending.

Please do not hesitate to call should you have any questions or comments.

Sincerely,

John P. Werfal
Project Manager

JPW/ns

enclosure

cc: Ms. Diane Lundquist, Shell Oil Company
Mr. Rick Mueller, Pleasanton Fire Department
Mr. Rafat Shahid, Alameda County Environmental Health

SHELL OIL CORPORATION
QUARTERLY REPORT TO THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
County of ALAMEDA Date of Report: 04/14/89

Site ID: 204613804 1801 SANTA RITA ROAD City of PLEASANTON

Actions in past three months: GROUNDWATER SAMPLES WERE COLLECTED FROM ALL PROJECT WELLS ON MARCH 11, 1989. THE RESULTS OF THE QUARTERLY SAMPLING ARE PRESENTED IN A REPORT ISSUED BY GEOSTRATEGIES INC. ON APRIL 14, 1989.

Actions planned for next three months: CONTINUE QUARTERLY GROUNDWATER SAMPLING.

Soil contamination defined? Yes Soil clean-up in progress? No
Free product plume defined? Yes Free product clean-up in progress? No
Dis'ld const'nt plume defined? Yes Dis'ld const'nt clean-up in progress? No
Contractor: GETTLER-RYAN INC.

Site ID: 204613805 3790 HOPYARD ROAD City of PLEASANTON

Actions in past three months: A REPORT DISCUSSING THE INSTALLATION OF TWO GROUNDWATER MONITORING WELLS WAS ISSUED BY WOODWARD-CLYDE CONSULTANTS ON JANUARY 18, 1989. TWO ADDITIONAL GROUNDWATER MONITORING WELLS WERE INSTALLED ON FEBRUARY 24, 1989.

Actions planned for next three months: A REPORT DOCUMENTING THE FEBRUARY 24, 1989 WELL INSTALLATION IS PENDING. FUTURE SCOPES OF WORK AT THE SITE WILL BE DESCRIBED IN A SITE WORK PLAN TO BE PREPARED BY GEOSTRATEGIES INC.

Soil contamination defined? No Soil clean-up in progress? No
Free product plume defined? Yes Free product clean-up in progress? No
Dis'ld const'nt plume defined? No Dis'ld const'nt clean-up in progress? No
Contractor: GETTLER-RYAN INC.

Site ID: 204685210 15272 WASHINGTON City of SAN LEANDRO

Actions in past three months: A REPORT DISCUSSING THE INSTALLATION OF SEVEN GROUNDWATER MONITORING WELLS WAS ISSUED BY WOODWARD-CLYDE CONSULTANTS ON APRIL 7, 1989.

Actions planned for next three months: ADDITIONAL GROUNDWATER MONITORING WELLS WILL BE INSTALLED TO EVALUATE THE EXTENT OF CONTAMINATION.

Soil contamination defined? No Soil clean-up in progress? No
Free product plume defined? Yes Free product clean-up in progress? No
Dis'ld const'nt plume defined? No Dis'ld const'nt clean-up in progress? No
Contractor: GETTLER-RYAN INC.

8820011POS CON-1

Woodward-Clyde Consultants

1/89

ENVIRONMENTAL ASSESSMENT REPORT
SHELL SERVICE STATION
3790 HOPYARD ROAD
PLEASANTON, CALIFORNIA

Prepared for

Gettler-Ryan Inc.
1992 National Avenue
Hayward, CA 94545

January 18, 1989

Prepared by

Woodward-Clyde Consultants
500 12th Street, Suite 100
Oakland, CA 94607-4014

Oakland City Center
500 12th Street
Suite 100
Oakland, CA 94607-4014
(415) 893-3600

Woodward-Clyde Consultants

January 18, 1989
8820011A-0066

Gettler-Ryan Inc.
1992 National Avenue
Hayward, Ca 94545-1787

Attention: Mr. Jeff Ryan

Subject: **Environmental Assessment Report**
Shell Service Station
Hopyard Road at West Las Positas Blvd.
Pleasanton, California

Enclosed is a report summarizing the results of Woodward-Clyde Consultants' environmental assessment of shallow soils and shallow groundwater at the Shell Service Station located at Hopyard and West Las Positas Boulevard in Pleasanton, California.

Two monitoring wells, S-6 and S-7, were installed east (S-6) and southeast (S-7) of the study site adjacent to the median strip on Hopyard Road to explore the shallow soils and groundwater for evidence of petroleum products. Monitoring wells S-1 through S-5 were previously installed at the site in 1987 and 1988 by Pacific Environmental Group, Inc. The shallow native soils encountered at this site consist of a dark, organic silty soil overlying dark gray clay. The clay was encountered in all soil samples collected below the first soil sampling interval from 4.0 to 5.5 feet below grade. Concentrations of organic vapor less than 6 ppm were detected in soil samples from monitoring well S-6 except for a value of 130 ppm from the soil sample from 19 to 20.5 feet below grade. No organic vapors or petroleum product odors were detected in soil samples collected from monitoring well S-7.

The environmental laboratory detected gasoline concentrations of less than 10 ppm in soil samples from 14 to 15.5 and 19 to 20.5 feet below grade from monitoring well S-6. Benzene was not detected above detection limits in the soil samples from 9 to 10.5 and 19 to 20.5 feet below grade and ethyl benzene was detected at detection limits in the soil sample from 19 to 20.5 feet below grade from monitoring well S-6. There were no positive laboratory detections of gasoline or BTEX in the soil samples from monitoring well S-7.

Laboratory chemical analyses of groundwater detected gasoline and benzene in samples from monitoring wells S-2, S-4, S-5, and S-6. No gasoline was detected in groundwater monitoring wells S-3 and S-7. No benzene was detected in groundwater from monitoring well S-3 and the benzene concentration was near detection limits in monitoring well S-7.

The calculated top of liquid contour orientations using data provided by Gettler-Ryan Inc. indicates a general south to southeast flow direction toward Arroyo Mocho Canal. Numerical solutions were found where the Arroyo Mocho Canal effectively drained the shallow groundwater from the study site. Under the simulated conditions, shallow groundwater from the site drained into the Arroyo Mocho Canal.

We appreciate the opportunity to provide consulting services on this project. Please call if we can be of additional assistance.

Sincerely,

WOODWARD-CLYDE CONSULTANTS

Robert G. Aaserude, RCE C040152
Senior Project Engineer

O. Glenn Heyman
Senior Staff Geologist

8820011POS/CON
MSB:cd

TABLE OF CONTENTS

APPENDICES

A EMCON ASSOCIATES, 1986, LETTER REPORT ON SHELL SERVICE STATION, WEST LAS POSITAS BLVD. AND HOPYARD ROAD, PLEASANTON, CALIFORNIA, 2P.

PACIFIC ENVIRONMENTAL GROUP, INC., 1987, LETTER REPORT ON SHELL SERVICE STATION, AT W. LAS POSITAS, PLEASANTON, CALIFORNIA, DECEMBER 4, 1987, 5P.

PACIFIC ENVIRONMENTAL GROUP, INC., 1988, LETTER REPORT ON SHELL SERVICE STATION, AT W. LAS POSITAS, PLEASANTON, CALIFORNIA, MARCH 10, 1988, 8P.

BLAINE TECH SERVICES, INC., 1988, LETTER REPORT ON GROUNDWATER WELL SAMPLING, OCTOBER 13, 1988, 6P.

B LOGS OF MONITORING WELLS S-6 AND S-7. EXPLANATION OF TERMS USED FOR SOIL DESCRIPTION AND LEGEND OF BORING LOG SYMBOLS. IT LABORATORY ANALYTICAL SOIL ANALYSES. WCC CHAIN-OF-CUSTODY-FORMS.

C DOCUMENTATION OF GROUNDWATER FLOW MODEL

LIST OF TABLES

Table

LIST OF FIGURES

Figure

ENVIRONMENTAL ASSESSMENT REPORT
SHELL SERVICE STATION
3790 HOPYARD ROAD
PLEASANTON, CALIFORNIA

1.0
INTRODUCTION

1.1 BACKGROUND

The following report summarizes the results of Woodward-Clyde Consultants' (WCC) environmental assessment of shallow soils at the Shell Service Station located at the southwest corner of Hopyard Road and West Las Positas Boulevard in Pleasanton, California (Figure 1). The site had been previously investigated by Emcon Associates (Emcon, 1986) and Pacific Environmental Group (PEG, 1987 and 1988) and their respective reports show evidence of petroleum products in both shallow soils and shallow groundwater.

This investigation was conducted under WCC's January 13, 1988 agreement with Gettler-Ryan Inc. acting as agent for Shell Oil Company. In October 1988, Gettler-Ryan requested WCC to provide a geologist to log soils, collect soil samples for laboratory analysis, observe monitoring well construction, review laboratory data, and prepare a report assessing the environmental condition of the shallow soils at the site.

1.2 PURPOSE

The purpose of this investigation was to additionally explore the shallow soils and shallow groundwater adjacent to the service station for evidence of petroleum products. The work included the advancement of two soil borings and conversion of these borings in to monitoring wells S-6 and

S-7 (Figure 2). The well locations and completion depths were specified by Gettler-Ryan Inc.

1.3 SCOPE

To complete the current task, two soil borings were drilled and converted to monitoring wells S-6 and S-7 adjacent to the median on Hopyard Road at locations and to depths specified by Gettler-Ryan Inc. (Figure 2). While drilling, a WCC geologist collected soil samples from each boring, measured the volatile organic vapor content of the samples using an HNu photoionization detector, prepared a log for each boring showing materials encountered using the Unified Soil Classification System, and observed the monitoring well construction. Chemical analyses of selected soil and groundwater samples were conducted by IT Corporation at their California Department of Health Services (DHS) certified environmental laboratory in San Jose, California. The samples were analyzed for benzene, toluene, ethyl benzene, xylenes (BTEX), and low boiling hydrocarbons (gasoline). The results of WCC's field investigation and the laboratory analyses are summarized below.

1.4 SITE DESCRIPTION

The site is located at 3790 Hopyard Road at the southwest intersection of Hopyard Road and Las Positas Boulevard in Pleasanton, California. The site is bordered on all sides by commercial property. The service station was in operation at the time of the field investigation.

Structures existing at the time of this investigation include a service station building, two service islands, an underground fuel storage tank complex, two monitoring wells in the former tank backfill, and four monitoring wells (S-2, S-3, S-4, and S-5) in the underlying water bearing zone. (Monitoring well S-1 was destroyed when the new tank complex was constructed in August 1988, oral communication from Gettler-Ryan Inc. in

November 1988). The Arroyo Mocho Canal is located approximately 265 feet south of the site.

1.5 PREVIOUS INVESTIGATIONS

Three previous phases of investigation have been completed at the referenced location. Emcon Associates (1986) completed a letter report on the results of the Phase I soil investigation in 1986. The purpose of their work was to examine soil conditions adjacent to the underground product storage tanks located at the site. Five exploratory borings S-A through S-E were advanced during this phase of work. Soil boring S-C was converted to a 2-inch-diameter temporary monitoring well scheduled to be destroyed with the replacement of the then existing underground storage tanks. Gasoline concentrations as high as 5,100 ppm were found in soils from boring S-C. Emcon's report documenting this work is included in Appendix A of this report.

Pacific Environmental Group, Inc. (1987) conducted a Phase II investigation in 1987. The purpose of their work was to document: (1) the soil conditions beneath the tank complex and adjacent to the product lines, and (2) groundwater conditions at the site. Groundwater monitoring wells S-1 and S-2 and tank-backfill interface monitoring wells ST-1 and ST-2 were installed in the Phase II work. Soil and groundwater samples from monitoring wells S-1 and S-2 were sampled and analyzed for petroleum products and lead. Gasoline, BTEX, and lead were detected in the soils and gasoline and BTEX were detected in groundwater by laboratory analyses at this time. PEG's report is included in Appendix A of this report.

Pacific Environmental Group, Inc. later conducted a Phase III investigation in 1988. The purpose of this work was to: (1) further define the extent of the dissolved hydrocarbon plume previously identified at the site, and (2) investigate the possibility that the Arroyo Mocho Canal acts as a hydraulic barrier between the site and the water-supply wells located

southeast of the site. To conduct this work, PEG: (1) identified the location and construction information of water-supply wells within a 1/2-mile radius of the site, (2) installed groundwater monitoring wells S-3, S-4, and S-5, and (3) surveyed the canal in order to determine the elevations of water encountered in the canal bottom. The PEG report is included in Appendix A of this report.

2.0
HYDROGEOLOGY

The site is located in the Livermore Valley groundwater basin, a 170-square mile basin drained by Arroyo de la Laguna (California Department of Water Resources, 1975). The Livermore Valley groundwater basin, at the northwestern end of the Diablo Range, is nearly coincident with the Livermore Valley.

Locally, the surface soils consist of the Clear Lake clay, a dark gray, very deep soil that occurs in large bodies in nearly level basins (Welch, et al., 1961). Welch reports that the soil is slowly permeable and when it is dry and deeply cracked, the Clear Lake clay absorbs water readily. The surface soils are underlain by Holocene medium-grained alluvium generally consisting of well-bedded, unconsolidated, moderately-sorted, moderately-permeable fine sand, silt and clayey silt with occasional thin beds of coarse sand (Helley, et al., 1979).

The local groundwater flow direction is to the south-southeast toward Arroyo Mocho Canal based on water-level data collected in a previous investigation (PEG, 1988). The Arroyo Mocho Canal, approximately 265 feet south of the study site, is an unlined drain and was mapped by Welch (1961) as an intermittent stream. Since 1961 the Arroyo Mocho Canal has been deepened from about 6 feet to about 14 feet below grade and is now reported to be perennial. Recharge of shallow groundwater is by surface infiltration from rainfall near the site and in the hills to the west, where coarser-grained soils are found at the surface.

3.0
FIELD PROCEDURES

3.1 SOIL BORINGS

Two soil borings were drilled and converted into monitoring wells S-6 and S-7 on October 4, 1988 at locations selected by Gettler-Ryan Inc (Figure 2). The borings were advanced to a depth of 35.5 feet below grade. The borings were drilled with 8-inch diameter, hollow stem, continuous flight augers powered by a CME-75 truck-mounted drill rig. A WCC geologist observed the drilling and prepared a log for each boring. WCC's boring logs are attached in Appendix B.

3.2 SOIL SAMPLING

Soil samples were collected at five-foot intervals by advancing a modified California Sampler through the hollow stem of the augers. The sampler was either pushed into the undisturbed soil using the hydraulic system on the rig, or driven a maximum of 18 inches using a 140-pound hammer with a 30-inch drop. The hydraulic pressure, in pounds per square inch (psi), or number of blows required to drive or push the sampler are shown on the well logs (Appendix B).

The soil samples were retained in four, four-inch long, two-inch diameter brass liners within the sampler. The brass liners were labeled A through D from bottom to top. Soil sample A was retained for laboratory analysis by covering both ends of the liner with teflon sheeting and sealing with plastic end caps and electrical tape. The sample was then labeled, and selected samples were later transported on ice to the laboratory using chain-of-custody documentation.

Soil sample B was used to perform a head-space analysis in the field for volatile organic compounds. The test procedure involved emptying the contents of the brass liner into a clear glass jar and sealing the jar with aluminum foil secured under a ring-type threaded lid. The jar was placed in a warm area for twenty to thirty minutes. The foil was pierced and the head-space within the jar was tested for total organic vapor, measured in parts per million (HNu units), with an HNu photoionization detector. The HNu photoionization detector was calibrated at the start of the day to 81 ppm using benzene calibration gas. The results of these tests appear on the boring logs and in Table 1.

Soil samples C and D (from the modified California Sampler) were described by a WCC geologist using the Unified Soil Classification System. The descriptions are shown on the boring logs presented in Appendix B.

3.3 MONITORING WELL CONSTRUCTION

Following completion of the two soil borings, a monitoring well was constructed in each borehole. To complete this task, three-inch diameter, schedule 40, flush threaded, PVC well casing with a threaded-type cap on the bottom, was placed down the hollow stem of the augers. In monitoring wells S-6 and S-7, the casing consisted of a section of 0.020-inch slotted screen 25 feet long placed from 35 to 10 feet below grade. Number 2/12 Lonestar sand was poured into the annulus between the borehole wall and the well casing. The sand pack was installed from the bottom of the well to a depth of about 8 feet below grade, which was about 2 feet above the top of the slotted casing. The well was then sealed by pouring approximately 1.5 feet of bentonite pellets on top of the sand pack and adding concrete from the top of the bentonite pellets to the surface. A locking lid was then placed over the well, and a traffic-rated vault box was placed over the locking lid.

4.0
RESULTS

4.1 SOIL DESCRIPTION

As shown on the logs in Appendix B, the native soils encountered below the site consist predominantly of clay (CL). The first occurrence of groundwater is not clear because there was no direct evidence of saturated material at the time of drilling. Previous investigators (PEG, 1987 and 1988) reported the first occurrence of groundwater between 14 to 15 feet below grade and damp to moist soil samples to a depth of 25.5 feet below grade, grading to moist to wet from 29 to 30.5 feet below grade. The soil samples from monitoring wells S-6 and S-7 had similar descriptions of moisture as reported by PEG for monitoring wells S-1 through S-5, however, the first occurrence of groundwater in monitoring wells S-6 and S-7 was not recorded.

4.2 FIELD HEAD-SPACE ANALYSIS

As shown in Table 1 and on the boring logs in Appendix B, concentrations of organic vapor less than or equal to 130 ppm were detected in the soil samples from monitoring well S-6. Organic vapor concentrations were generally less than 6 ppm, except for the soil sample from 19 to 20.5 feet below grade where organic vapors were detected at 130 ppm. Product odor was detected in the soil sample from 19 to 20.5 feet below grade from monitoring well S-6. No organic vapors or petroleum product odors were detected in soil samples collected from monitoring well S-7.

4.3 LABORATORY SOIL ANALYSIS

Soil samples were selected by Gettler-Ryan Inc. to be analyzed by the IT Corporation's certified environmental laboratory for benzene, toluene, ethyl benzene, xylenes (BTEX) and low boiling hydrocarbons (calculated as gasoline). The soil samples selected for chemical analysis from each soil boring are marked with an asterisk on WCC's boring logs. The analyses were made by using EPA Test Methods 8015, 8020 and 5030. The analytical results are summarized in Table 2. IT Corporation's analytical report and chain-of-custody documents are provided in Appendix B.

IT's laboratory reports that gasoline is present in soil samples from 14 to 15.5 and 19 to 20.5 feet below grade from monitoring well S-6 at concentrations of less than 10 ppm. Benzene was reported present at concentrations up to 0.05 ppm in the soil samples from 9 to 10.5 and 19 to 20.5 feet below grade. Ethyl benzene was also reported present at detection limits (0.1 ppm) in the soil sample obtained from 19 to 20.5 feet. There were no positive laboratory detections of gasoline or BTEX in the soil samples from monitoring well S-7.

4.4 LABORATORY GROUNDWATER ANALYSES

Groundwater samples were collected on October 13, 1988 from monitoring wells S-2 through S-7 by Blaine Tech Services under the direction of Gettler-Ryan Inc. A copy of the Blaine Tech Services report is attached to Appendix A of this report. The samples were analyzed by IT Corporation's environmental laboratory for low boiling hydrocarbons (gasoline) and benzene, toluene, ethyl benzene, and xylenes (BTEX) using EPA Test Methods 8015, 8020, and 5030. The analytical results are summarized in Table 3. The IT Corporation analytical report is included in Appendix B and the analytical results are summarized in Table 3.

IT Corporation reports that low boiling hydrocarbons as gasoline and/or BTEX are present in monitoring wells S-2, S-4, S-5, S-6, and S-7. The groundwater samples from monitoring wells S-2, S-4, and S-5 had reported dissolved gasoline concentrations ranging from 0.53 to 0.56 milligrams per liter (mg/l) and the groundwater sample from monitoring well S-6 had a reported concentration of 1.1 mg/l. Benzene concentrations ranged from 0.11 mg/l in groundwater from monitoring well S-2 to 0.0006 mg/l from monitoring well S-7. Toluene concentrations were near or below detection limits except for the groundwater sample from monitoring well S-5, where the concentration was reported as 0.020 mg/l. Ethyl Benzene concentrations ranged from 0.045 mg/l in groundwater from monitoring well S-2 to below detection limits in monitoring wells S-3 and S-7. Xylene concentrations ranged from 0.036 mg/l in groundwater from monitoring well S-4 to below detection limits in monitoring wells S-3 and S-7. Gasoline and benzene concentrations are plotted in Figure 2.

4.5 GROUNDWATER FLOW DIRECTION

Gettler-Ryan Inc. surveyed the elevations of monitoring wells S-2 through S-7 to a project datum and measured the depth to top of liquid in each monitoring well on October 18, 1988. These reported top of casing elevations and depths to top of liquid-levels are summarized in Table 4. Based on these data, a liquid elevation contour map was prepared and is shown in Figure 3. The liquid-level contours were generated using SDS Software (Design Professionals Management Systems, 1985). The calculated contour orientation indicates a general south to southeast flow direction toward Arroyo Mocho Canal. This direction is consistent with the slope direction local topography and drainage.

A steady-state, cross-sectional groundwater flow model (Appendix C) was developed to determine if the Arroyo Mocho Canal prevents the flow of shallow groundwaters from the study site toward the water-supply wells located to the south. The flow model was needed because the change in

water-levels from the site to the canal represented a significant dewatering of the upper water-bearing unit.

Calibration of the steady-state, cross-sectional groundwater flow model was achieved by matching simulated water-levels to data collected by PEG (1988). The numerical simulation assumed that the Arroyo Mocho Canal is perennial. Numerical solutions were found where the Arroyo Mocho Canal effectively drained the shallow groundwaters from the study site. Under the simulated conditions, shallow groundwater drained into the Arroyo Mocho Canal. These conditions, however, need to be verified by additional field testing. A description of the model and the results of a simulation are shown in Appendix C.

5.0
SUMMARY

The results of this study are summarized as follows:

- The shallow native soils encountered at this site consist of a dark, organic silty soil overlying a dark gray clay. The clay was encountered in all soil samples collected below the first soil sampling interval of 4.0 to 5.5 feet below grade.

- Concentrations of organic vapor less than 6 ppm were detected in soil samples from monitoring well S-6, except for a value of 130 ppm from the soil sample from 10 to 20.5 feet below grade. No organic vapors or petroleum product odors were detected in soil samples collected from monitoring well S-7.

- The environmental laboratory detected low concentrations of gasoline (less than 10 ppm) in soil samples from 14 to 15.5 and 19 to 20.5 feet below grade from monitoring well S-6. Benzene was not detected above the detection limits in the soil samples from 9 to 10.5 and 19 to 20.5 feet below grade and ethyl benzene was detected at detection limits in the soil sample from 19 to 20.5 feet below grade from monitoring well S-6. There were no positive laboratory detections of gasoline or BTEX in the soil samples from monitoring well S-7.

- Laboratory chemical analyses of groundwater detected gasoline and benzene in samples from S-2, S-4, S-5, and S-6. Gasoline was not detected in groundwater monitoring wells S-3 and S-7. Benzene was

not detected in groundwater from monitoring well S-3 and the benzene concentration was near the detection limit in monitoring well S-7.

- Groundwater has a calculated south-southeast flow direction toward the Arroyo Mocho Canal. Numerical solutions were found where the Arroyo Mocho Canal effectively drained the shallow groundwaters from the study site. Under the simulated conditions, shallow groundwater from the site drained into the Arroyo Mocho Canal. However, the simulated boundary conditions need to be verified by additional field observations.

6.0
LIMITATIONS

This study was performed under contract and within the scope outlined by Gettler-Ryan Inc. The scope of the field investigation was limited to exploration of shallow soils for evidence of petroleum product contamination. The possible presence or absence of any other type of contamination at the site is not addressed in this study. The boring logs indicate the approximate soil conditions encountered at the time and locations where the borings were made, and may not represent conditions at other times and locations.

BIBLIOGRAPHY

California Department of Water Resources, 1966, Livermore and Sunol Valley - An Evaluation of Ground Water Resources: Bulletin No. 118-2, Appendix A: Geology, August 1966.

California Department of Water Resources, 1975, California's Ground Water, Bulletin 118-80, 73 p.

Emcon Associates, 1986, Letter Report on Shell Service Station, Hopyard Road and Las Positas Boulevard, Pleasanton, California, 2 p.

Helley, E.J., La Joie, K.R., Spangle, W.E., and Blair, M.L., 1979, Flatland Deposits of the San Francisco Bay Region, California, U.S. Geological Survey Professional Paper 943, 88p.

McDonald, M.G., And A.W. Harbaugh, 1984, A Modular Three-dimensional Finite Difference Groundwater Flow Model, U.S. Geological Survey, 528 p.

Pacific Environmental Group, Inc., 1987, Letter Report on Shell Service Station, Hopyard Road and Las Positas Boulevard, Pleasanton, California, 5 p.

Pacific Environmental Group, Inc., 1988, Letter Report on Shell Service Station, Hopyard Road and Las Positas Boulevard, Pleasanton, California, 8 p.

Welch, E., Huff, R.E., Dierking, R.A., Cook, T.D., Bates, L.A., and Andrews, W.F., 1986, Soil Survey of the Alameda Area, California, United States Department of Agriculture, Soil Conservation Service, Series 1961, No. 41, 95 p.

Table 1. ORGANIC VAPOR CONCENTRATIONS AS MEASURED WITH AN HNu PHOTOIONIZATION DETECTOR IN SOIL SAMPLES FROM MONITORING WELLS S-6 AND S-7, SHELL SERVICE STATION, 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA

Well Number	Sample Number	Depth (feet)	Maximum HNu Reading (ppm - HNu Units)
S-6	1B	4-5.5	0.5
	2B	9-10.5	5.5
	3B	14-15.5	6.0
	4B	19-20.5	130.0
	5B	24-25.5	4.0
	6B	29-30.5	4.5
	7B	34-35.5	1.5
S-7	1B	4-5.5	0.0
	2B	9-10.5	0.0
	3B	14-15.5	0.0
	4B	19-20.5	0.0
	5B	24-25.5	0.0
	6B	29-30.5	0.0
	7B	34-35.5	0.0

Table 2. SUMMARY OF SOIL SAMPLE LABORATORY ANALYSES, SHELL SERVICE STATION, 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA

Well Number	Sample Depth	Parts per million (ppm) - Dry Soil Basis: Low Boiling Hydrocarbons (Gasoline)	Benzene	Toluene	Ethyl Benzene	Xylene
S-6	2A, 9-10.5	nd	0.05	nd	nd	nd
	3A, 14-15.5	9.	nd	nd	nd	nd
	4A, 19-20.5	6.	0.05	nd	0.1	nd
	5A, 24-25.5	nd	nd	nd	nd	nd
S-7	2A, 9-10.5	nd	nd	nd	nd	nd
	3A, 14-15.5	nd	nd	nd	nd	nd
	4A, 19-20.5	nd	nd	nd	nd	nd
	Detection Limit	5.	0.05	0.1	0.1	0.3

nd = none detected

Table 3. SUMMARY OF GROUNDWATER LABORATORY ANALYSES, SHELL SERVICE STATION, 3790 HOPYARD ROAD,PLEASANTON, CALIFORNIA

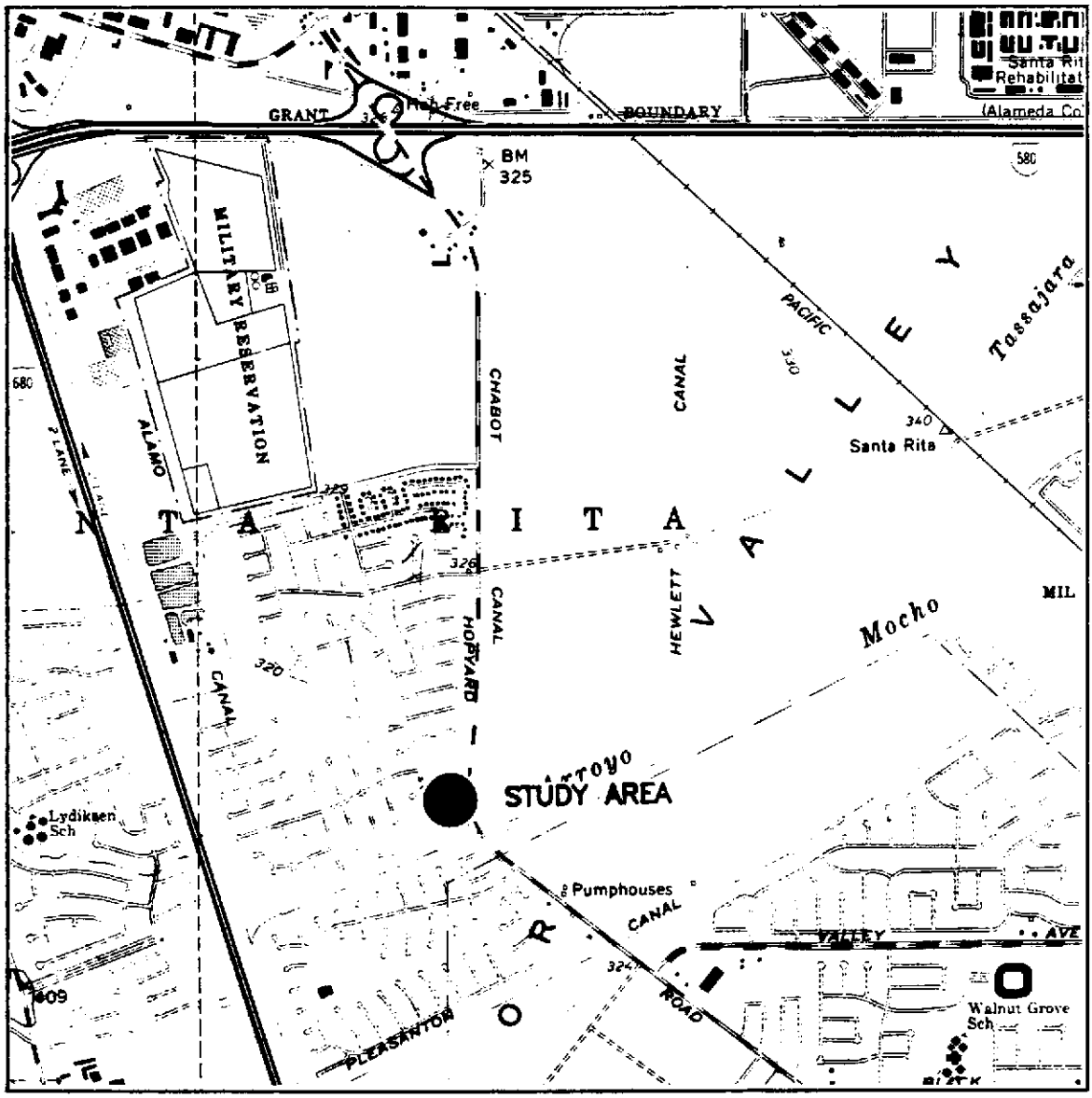
Well Number	Low Boiling Hydrocarbons (Gasoline)	Milligrams per Liter			
		Benzene	Toluene	Ethyl Benzene	Xylenes
S-2	0.55	0.11	0.001	0.045	0.015
Detection Limit	0.05	0.002	0.001	0.001	0.003
S-3	nd	nd	nd	nd	nd
Detection Limit	0.05	0.0005	0.001	0.001	0.003
S-4	0.53	0.024	0.001	0.025	0.016
Detection Limit	0.05	0.0005	0.001	0.001	0.003
S-5	0.56	0.066	0.020	0.018	0.036
Detection Limit	0.05	0.001	0.001	0.001	0.003
S-6	1.1	0.013	0.001	0.042	0.033
Detection Limit	0.2	0.0005	0.001	0.001	0.003
S-7	nd	0.0006	0.001	nd	nd
Detection Limit	0.05	0.0005	0.001	0.001	0.003

nd = none detected

Table 4. SUMMARY OF MONITORING WELL LIQUID ELEVATIONS MEASURED ON OCTOBER 10, 1988, SHELL SERVICE STATION, 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA

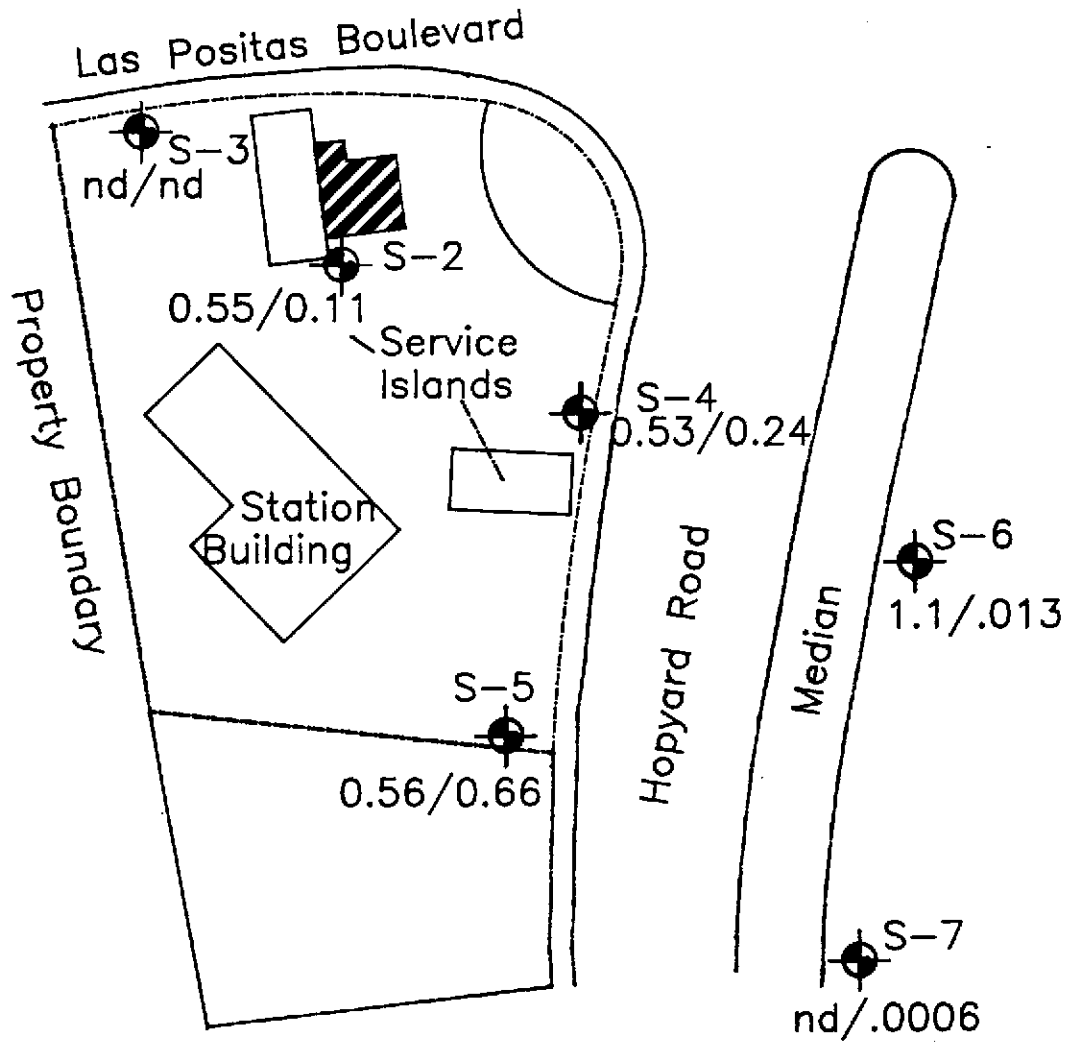
Monitoring Well	S-2	S-3	S-4	S-5	S-6	S-7
Surveyed* Top of Casing (feet)	100.66	99.12	99.75	101.18	98.99	100.05
Measured Top of Liquid (feet)	13.88	11.96	13.07	15.59	13.37	15.96
Top of Liquid (feet)	86.78	87.16	86.68	85.59	85.62	84.09
Thickness of Product (feet)	0.	0.	0.	0.	0.	0.

* Surveyed to Project Datum



● LOCATION OF STUDY AREA

Project No. 8820011A	Gettler-Ryan Inc.	LOCATION OF SHELL SERVICE STATION AT 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA	Figure 1
	Woodward-Clyde Consultants		



LEGEND

Former Tank Complex

S-5 / 0.56/0.66 — Monitoring Well Location and Gasoline over Benzene Concentration in Groundwater, Milligrams per Liter

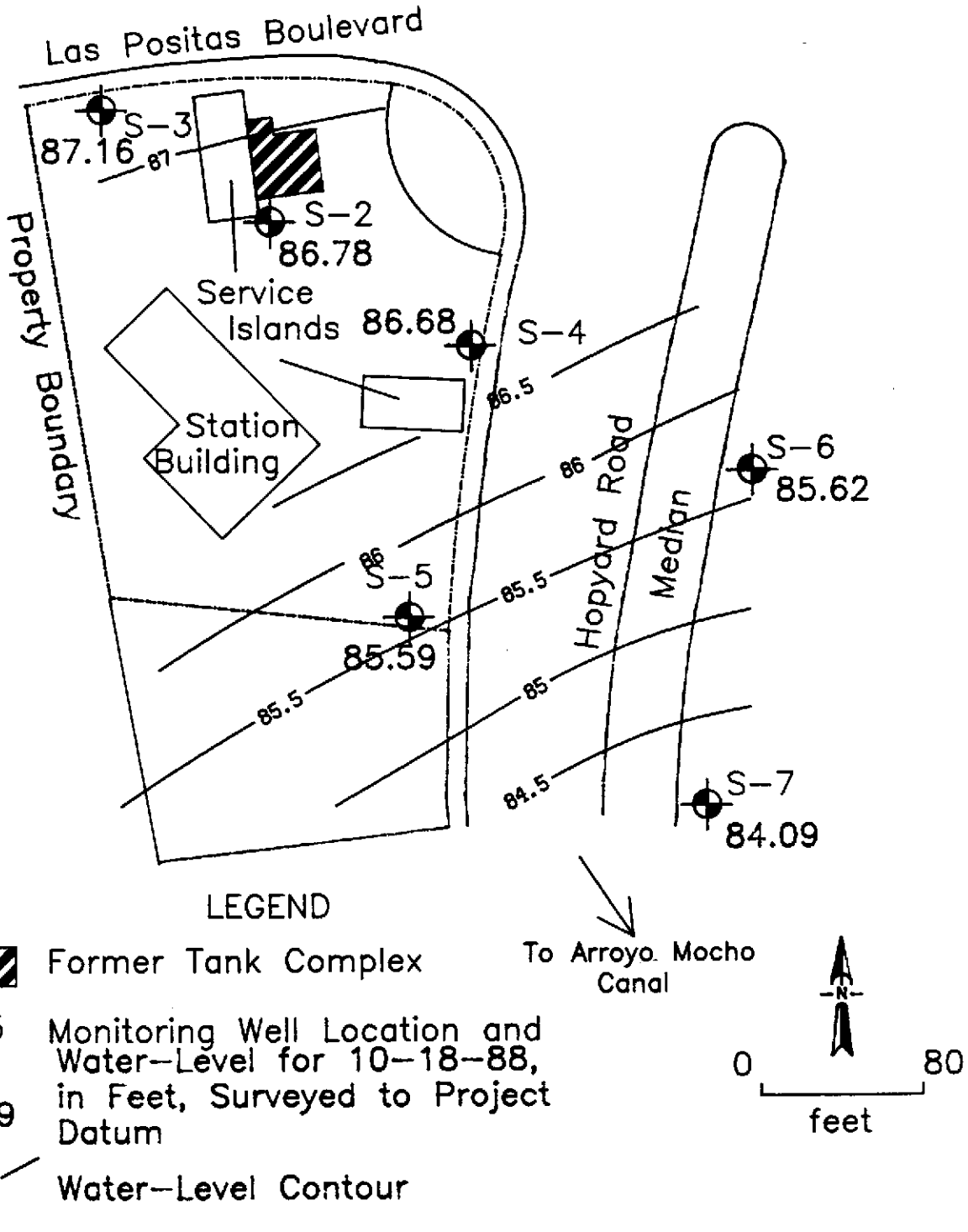
nd — none detected

N

0 80

feet

Project No. 8820011A	Gettler–Ryan	SITE PLAN SHOWING MONITORING WELL LOCATIONS AND GASOLINE AND BENZENE CONCENTRATION IN GROUNDWATER, SHELL SERVICE STATION, 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA	Figure 2
Woodward–Clyde Consultants			



Project No. 8820011A	Gettler-Ryan	WATER-LEVEL CONTOURS FOR OCTOBER 18, 1988, SHELL SERVICE STATION, 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA	Figure 3
Woodward-Clyde Consultants			

APPENDIX A

EMCON ASSOCIATES, 1986, LETTER REPORT

PACIFIC ENVIRONMENTAL GROUP, INC., 1987, LETTER REPORT

PACIFIC ENVIRONMENTAL GROUP, INC., 1988, LETTER REPORT

BLAINE TECH SERVICES, INC., 1988, LETTER REPORT ON GROUNDWATER WELL SAMPLING, OCTOBER 13, 1988, 6P.

EMCON
ASSOCIATES
Consultants in Wastes
Management and
Environmental Control

March 21, 1986
Project 800-02.01

Gettler-Ryan, Incorporated
1992 National Avenue
Hayward, California 94545

Attention: Mr. Jeffrey M. Ryan

Re: Shell Service Station,
Shell, West Las Positas
Blvd. and Hopyard Rd.,
Pleasanton, California

Gentlemen:

This letter presents the results of a soil investigation conducted by EMCON Associates at the Shell service station located at the corner of West Las Positas Boulevard and Hopyard Road in Pleasanton, California. The purpose of this investigation was to examine subsurface soil conditions adjacent to the underground product storage tanks located at the site. It is EMCON's understanding that the existing subsurface tanks at the site are scheduled to be replaced, and that information contained in this report will be used to document hydrocarbon levels for soil disposal.

FIELD INVESTIGATION PROCEDURES

Five exploratory borings (S-A through S-E), were drilled at the locations selected by Gettler-Ryan, as shown on the attached Figure 1. The borings were drilled using continuous-flight solid-stem and hollow-stem auger drilling equipment, and were logged by an EMCON geologist. Soil samples for logging were obtained from auger-return materials and by advancing a California modified split-spoon sampler into undisturbed soil beyond the tip of the auger. Soil samples for chemical analysis were sealed in glass containers, packed on ice, and delivered directly to an independent laboratory as authorized by Gettler-Ryan. Complete laboratory results accompany this report.

Upon completion, Borings S-A, S-B, S-D and S-E were backfilled with soil cuttings and concrete to the ground surface as detailed on the attached Exploratory Boring Logs. Boring S-C was converted to a 2-inch-diameter temporary monitoring well which will be destroyed during future tank replacement. Well construction details for the temporary monitoring well are included with the Exploratory Boring Log.

FINDINGS

Boring S-A was placed adjacent to the subsurface waste oil tank. Borings S-B through S-E were placed within the subsurface gasoline storage tank complex. Subsurface conditions explored during drilling ranged from 13 feet for Borings S-B through S-E to 20 feet for Boring S-A.

Soil Boring S-A encountered silty clay to the total depth explored of 20 feet. Borings S-B, S-C and S-E encountered sand and clayey sand fill materials to depths of 8 to 11 feet, underlain by clay to the total depth explored of 13 feet. Boring S-D encountered sand fill to the total depth explored of 13 feet. Ground water was first encountered in all borings at a depth of 9 feet.

Soils from Boring S-A contained no noticeable product odor. Product odor was noted in soils from Borings S-B through S-E between the depths of 4 to 11-1/2 feet.

Temporary Well S-C was field checked for the presence of free-floating product with a clear acrylic bailer on January 31, 1986. A 1/16-inch film of a free-floating product was observed in the well.

Soil collected from the depth interval of 7 to 8-1/2 feet (approximately even with the base of the waste oil tank) in Boring S-A was analyzed for the presence of waste oil. No waste oil was detected.

Selected individual soil samples from Borings S-B through S-E were analyzed for gasoline and BTX (benzene, toluene, xylenes) compounds, as well as total lead and organic lead. The results of the the gasoline, total and organic lead analyses are presented in the attached Table 1.

If you have any questions regarding the contents of this report, please do not hesitate to call.

Very truly yours,

EMCON Associates

Howard H. Koltermann
Staff Geologist

Susan M. Willhite
Senior Project Geologist
CEG 1272

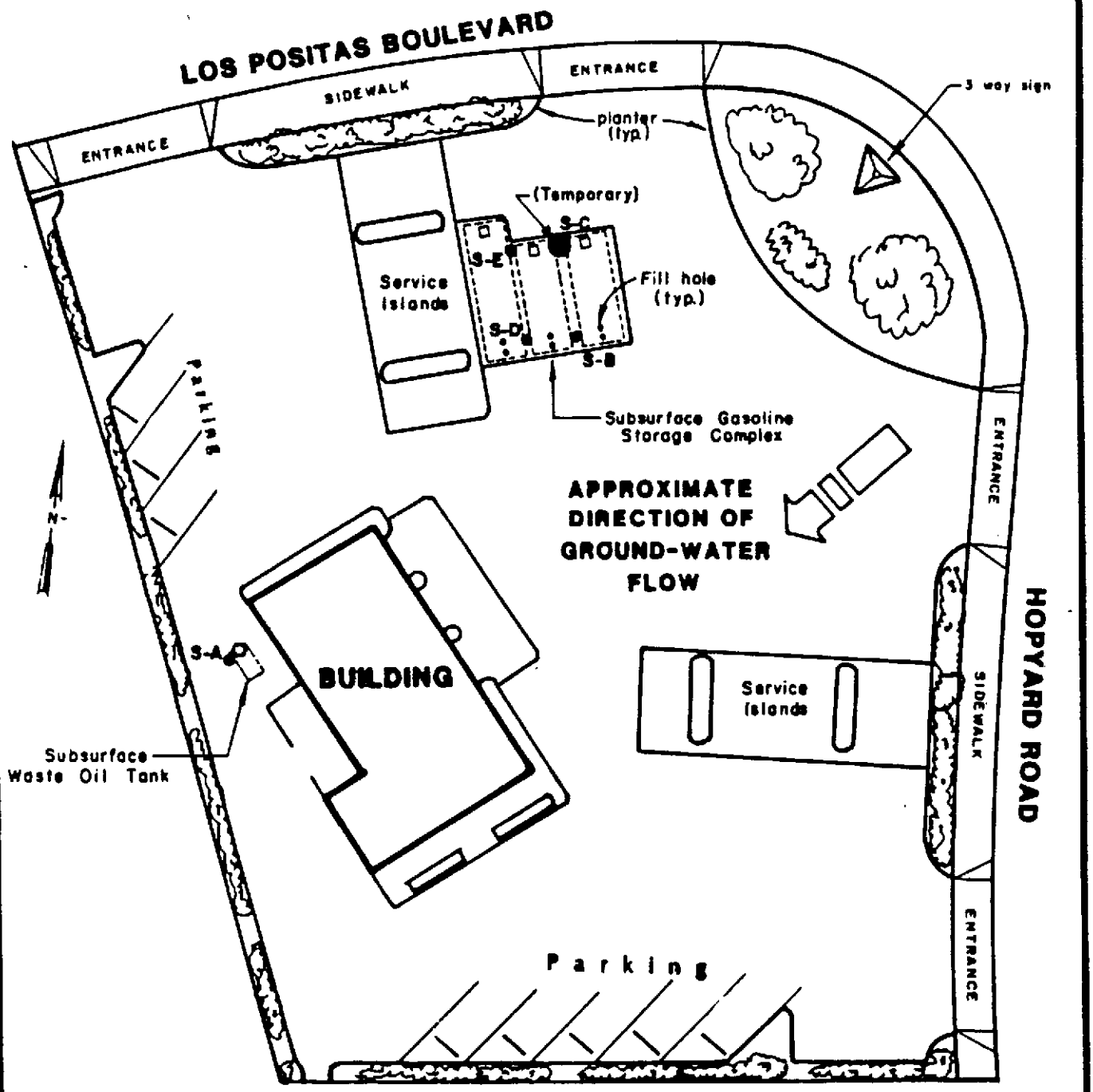
HHK/SMW:jdb
Enclosure

Table 1

LABORATORY RESULTS OF THE SOILS ANALYSES

Boring	Depth Interval (in feet)	Gasoline	Total Lead	Organic Lead
S-B	4 to 5-1/2	30	9.0	<0.1
	8 to 9-1/2	74	11.0	<0.1
	11-1/2 to 13	79	9.0	<0.1
S-C	4 to 5-1/2	2	4.9	<0.1
	7 to 8-1/2	5,100	6.8	0.2
	11-1/2 to 13	420	9.1	<0.1
S-D	4 to 5-1/2	2	4.2	<0.1
	7 to 8-1/2	10	5.2	<0.1
	11-1/2 to 13	110	7.3	<0.1
S-E	4 to 5-1/2	nd	5.1	<0.1
	7 to 8-1/2	6	9.2	<0.1
	11-1/2 to 13	6	9.1	<0.1

Concentrations in milligrams per kilogram or parts per million (ppm).
nd = none detected



EMCON Associates
San Jose, California

GETTLER-RYAN, INC.
SUBSURFACE HYDROGEOLOGIC INVESTIGATION
SHELL STATION, HOPYARD RD. AND LOS POSITAS BLVD.
PLEASANTON, CALIFORNIA

SITE PLAN

FIGURE 1

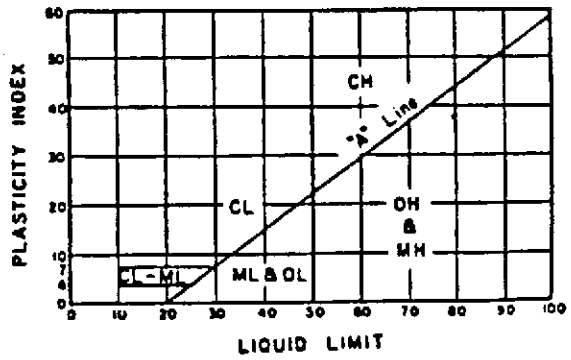
PROJECT NO. 800-02.01

MAJOR DIVISIONS		SYMBOLS	TYPICAL SOIL DESCRIPTIONS
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 or 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 CHART
(Unified Soil Classification System)

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	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART



PLASTICITY CHART

METHOD OF SOIL CLASSIFICATION

EMCON ASSOCIATES

PLATE

NOTES:

Logs of Exploratory Borings

2.5 YR, 6/2 — Denotes color as field checked to Munsell Soil Color Charts (1975 Edition)

 Denotes undisturbed sample taken in 2-inch split-spoon sampler.

 Denotes disturbed sample (bag sample).

▽ Denotes first observation of groundwater.

▼ Denotes static ground-water level.

Penetration — Sample drive hammer weight = 140 pounds, drop = 30 inches. Blows required to drive sampler 1 foot are indicated on logs.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 800-02.01 BORING NO. S-A

PROJECT NAME Gettler-Ryan, Shell, W. Las Positas Ave. and Hopyard Rd., Pleasanton PAGE 1 OF 1

BY JDB DATE 1/22/86 SURFACE ELEV. 320±

TORVANE (TSF)	POCKET PENETROMETER (TSF)	PENETRATION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
				0		CL	ASPHALT and GRAVEL - FILL.
							CLAY; very dark grayish brown (2.5Y, 3/2); 5-10% fine to coarse sand; slightly silty; stiff; very moist; no product odor.
				5			@4': dark gray (5Y, 4/1); 10-15% fine to coarse gravel; very stiff; moist; slight product odor.
	2.5	21	▽		1		@7': very stiff; moist to wet; no product odor.
				10			
	3.0	24		15	2		@14': wet; no product odor.
	1.25	16			3		@18½': stiff; wet; no product odor.
				20			BOTTOM OF BORING AT 20 FEET.

REMARKS Drilled by 5-inch solid-stem auger; samples collected with 2-inch California modified split-spoon sampler. Borehole backfilled with soil cuttings to ½ foot; concrete to surface.

EMCON ASSOCIATES

PLATE A

LOG OF EXPLORATORY BORING

PROJECT NUMBER 800-02.01 BORING NO. S-B

PROJECT NAME Gettler-Ryan, Shell, W. Las Positas Ave. and Hopyard Rd., Pleasanton PAGE 1 OF 1

BY JDB DATE 1/22/86 SURFACE ELEV. 320±

TORVANE (TSF)	POCKET PENETROMETER (TSF)	PENETRATION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
				0			CONCRETE and GRAVEL - FILL.
					SW		SAND - FILL; dark olive gray (5Y, 3/2); fine to coarse grained; dense; moist.
					SC		CLAYEY SAND - FILL; gray (5Y, 5/1); 15-25% fines; fine to coarse sand; 20-30% fine to medium gravel; moist; very slight gasoline odor.
	1.75	16	▽	5	1		
					CL		CLAY; dark gray (5Y, 4/1); slightly silty; stiff; moist to wet; no gasoline odor.
				10	2		
	1.0	10			3		@11½': stiff; wet; no gasoline odor
							@13': no gasoline odor.
							BOTTOM OF BORING AT 13 FEET.
				15			
				20			

REMARKS Drilled by 8-inch continuous-flight, hollow-stem auger; samples collected with 2-inch California modified split-spoon sampler. Borehole backfilled with soil cuttings to ½ foot; concrete to surface.

EMKON ASSOCIATES

PLATE B

LOG OF EXPLORATORY BORING

PROJECT NUMBER 800-02.01

BORING NO. S-C

PROJECT NAME Gettler-Ryan, Shell, W. Las Positas Ave. and Hopyard Rd., Pleasanton

PAGE 1 OF 1

BY JDB DATE 1/22/86

SURFACE ELEV. 320±

TORVANE (TSF)	POCKET PENETROMETER (TSF)	PENETRATION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
				0			CONCRETE and GRAVEL - FILL.
						SW	SAND - FILL; dark gray (5Y, 4/1); fine to coarse sand; 20-30% coarse gravel; loose; moist; no gasoline odor.
		9		5	1		
					2		@7': medium dense; wet; strong gasoline odor.
		12	▽	10			
					3	CL	CLAY; dark gray (5Y, 4/1); slightly silty; stiff; wet; no gasoline odor.
	2.0	7					BOTTOM OF BORING AT 13 FEET.
				15			
				20			

REMARKS Drilled by 8-inch continuous-flight, hollow-stem auger; samples collected with 2-inch California modified split-spoon sampler. Borehole converted to a temporary monitoring well with the installation of 2-inch PVC screens from 12½ feet to the surface; well backfilled with sand cuttings to ½-foot, concrete to the surface.

EMCON ASSOCIATES

PLATE C

LOG OF EXPLORATORY BORING

PROJECT NUMBER 800-02.01 BORING NO. S-D

PROJECT NAME Gettler-Ryan, Shell, W. Las Positas Ave. and Hopyard Rd., Pleasanton PAGE 1 OF 1

BY JDB DATE 1/23/86 SURFACE ELEV. 320±

TORVANE (TSF)	POCKET PENETROMETER (TSF)	PENETRATION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
				0			CONCRETE and GRAVEL - FILL.
						SW	SAND - FILL; dark gray (5Y, 4/1); fine-to coarse-grained; loose; moist; no gasoline odor.
		8		5	1		
					2		@7': moderate gasoline odor.
		14	▽				@9': medium dense; wet; moderate gasoline odor.
				10	3		@11½': slight gasoline odor.
							BOTTOM OF BORING AT 13 FEET.
				15			
				20			

REMARKS Drilled by 5-inch continuous-flight, hollow-stem auger; samples collected with 2-inch California modified split-spoon sampler; Borehole backfilled with soil cuttings to ½ foot; concrete to surface.

EMCON ASSOCIATES

PLATE D

LOG OF EXPLORATORY BORING

PROJECT NUMBER 800-02.01 BORING NO. S-E

PROJECT NAME Gettler-Ryan, Shell, W. Las Positas Ave. and Hopyard Rd., Pleasanton PAGE 1 OF 1

BY JDB DATE 1/23/86 SURFACE ELEV. 320±

TORVANE (TSF)	POCKET PENETROMETER (TSF)	PENETRATION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
				0			CONCRETE and GRAVEL - FILL.
						SW	SAND - FILL; dark gray (5Y, 4/1); fine to coarse sand; 10-20% fine to coarse gravel; loose; moist; no gasoline odor.
				5	1		
					2		@7': slight gasoline odor.
		6	▽			CL	CLAY; dark gray (5Y, 4/1); slightly silty; stiff; wet; no gasoline odor.
				10			
					3		@11½': no gasoline odor.
	1.5	12					BOTTOM OF BORING AT 13 FEET.
				15			
				20			

REMARKS Drilled by 5-inch continuous-flight, hollow-stem auger; samples collected with 2-inch California modified split-spoon sampler. Borehole backfilled with soil cuttings to ½ foot; concrete to surface.

EMCON ASSOCIATES

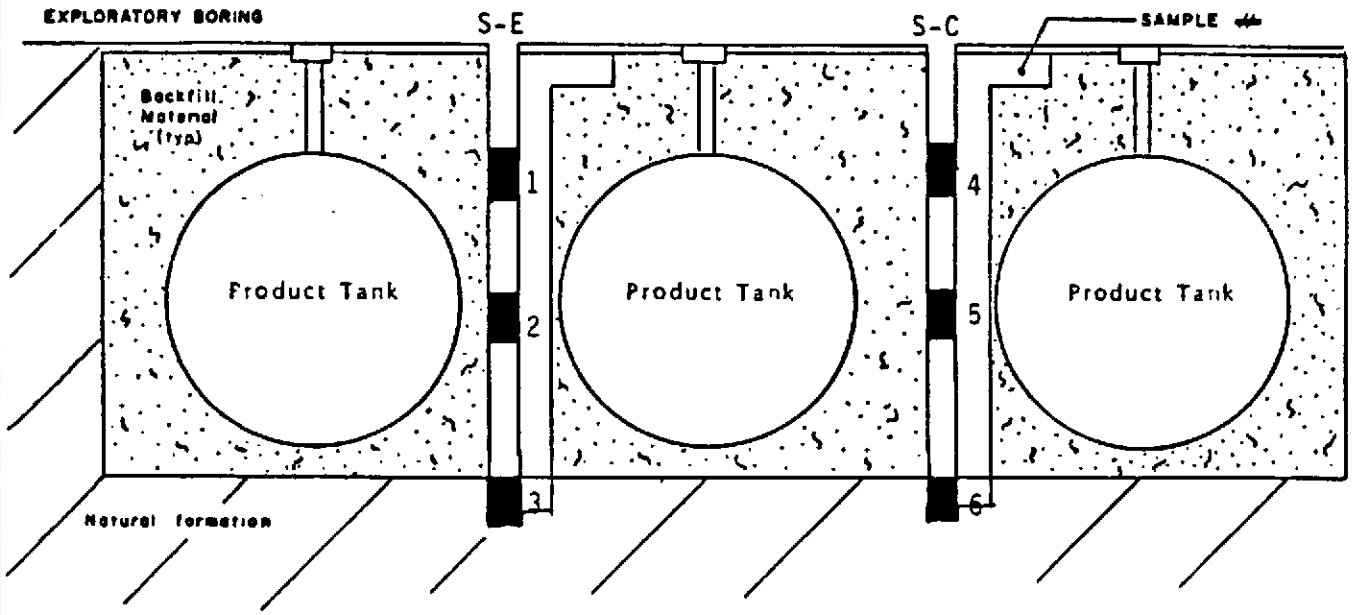
PLATE E

GETTLER-RYAN,

GENERALIZED PROFILE OF SUBSURFACE TANK COMPLEX AND GASOLINE CONCENTRATIONS WITHIN BACKFILL MATERIAL

PROJECT NUMBER 800-02.01
PROJECT NAME Shell, Hopyard Rd. and Las Positas Blvd.
NUMBER OF TANKS IN COMPLEX 3

MAPVIEW DIMENSIONS 30 x 30 Feet
APPROXIMATE DEPTH 12 Feet



not to scale

SAMPLE #	BORING	DEPTH INTERVAL	GASOLINE CONCENTRATIONS (parts per million)
1	S-E	4 to 5½	nd
2	S-E	7 to 8½	6
3	S-E	11½ to 13	6
4	S-C	4 to 5½	2
5	S-C	7 to 8½	5,100
6	S-C	11½ to 13	420

nd = none detected

PACIFIC
ENVIRONMENTAL
GROUP, INC.

December 4, 1987
Project No. 101-08.01

Gettler-Ryan Inc.
1992 National Avenue
Hayward, CA 94545

Attn: Mr. Jeff Ryan

Re: Shell Service Station
Hopyard Road at W. Los Positas
Pleasanton, California

Gentlemen:

This letter presents the results of a soil and groundwater investigation conducted at the Shell Oil Company service station located at Hopyard Road and West Los Positas Boulevard in Pleasanton, California (See Figure 1). The purposes of the investigation were to: 1) document soil conditions beneath the tank complex and adjacent to the product lines and 2) document groundwater conditions at the site. The scope of this investigation included installation of two tank-backfill interface monitoring wells, two groundwater monitoring wells, and sampling and analysis of the two groundwater monitoring wells.

SITE INVESTIGATION

Procedures

The two interface wells (ST-1 and ST-2) and the two groundwater monitoring wells (S-1 and S-2) were installed on October 28, 1987. The interface wells were installed in-between the product storage tanks at the site. The groundwater monitoring wells were installed adjacent to product and vent lines. The well locations are shown on Figure 1.

The borings for the monitoring wells and the interface wells were drilled using eight-inch diameter hollow-stem auger drilling equipment and were logged by a PACIFIC geologist using the Unified Soil Classification System. Boring logs are attached to this report. Soil samples collected for logging and analysis from the monitoring well borings were collected at five-foot intervals by advancing a California-modified split-spoon sampler with brass liners into undisturbed soil beyond the tip of the auger.

The sampler was driven a maximum of 18 inches, using a 140-pound hammer with a 30-inch drop. Soil samples for logging of the interface wells were taken from auger returns while drilling in the tank backfill. At the fill-native soil interface, an undisturbed sample was collected with a California-modified split spoon sampler in the manner described above.

The soil samples collected were used to perform a head-space analysis in the field for volatile organic compounds. The test procedure involved measuring approximately 30 grams from an undisturbed soil sample, placing this sub-sample in a clean glass jar, and sealing the jar with aluminum foil secured under a ring-type threaded lid. The jar was placed in a warm water bath (75 to 90 degrees F) for approximately twenty minutes. Then the foil was pierced and the head-space within the jar was tested for total organic vapor, measured in parts per million, with a TIP photo-ionization detector. The results of these tests appear on the boring logs.

The borings for the monitoring wells were advanced approximately 20 feet into the water-bearing zone. After the drilling, monitoring wells were constructed using 3-inch diameter, Schedule 40 PVC casing and 0.020-inch factory-slotted screen. The screen was placed through the entire saturated section, extending approximately 10 feet above the static water level. Graded sand pack was placed in the annular space across the screened interval, and it extended approximately one foot above the screen. A bentonite and concrete seal extends from the sand pack to the ground surface. The borings for the interface wells were advanced 18 inches into the native soil beneath the tank backfill. After drilling, interface wells were constructed with 3-inch diameter, Schedule 40 PVC casing and 0.020-inch factory-slotted screen. The screen was placed from 13.5 feet to 4.5 feet in depth. Pea gravel was backfilled around the casing, and a one-foot bentonite and/or concrete seal extended to the surface. A locking cap and protective vault box were installed by Gettler-Ryan on the top of each well.

The two groundwater monitoring wells (S-1 and S-2) were sampled by PACIFIC on November 6, 1987. The procedure consisted of first measuring the water level in each well, and checking each well for the presence of floating petroleum product using a clear teflon bailer. Floating product was not detected in either of the wells. The wells were then purged of approximately four casing volumes using

a submersible pump. After purging the wells were allowed to partially restabilize and samples were collected using a teflon bailer. The samples were placed into the appropriate EPA-approved containers, labeled, logged onto chain-of-custody documents, and transported on ice to the laboratory for analysis. The groundwater samples were analyzed for low boiling hydrocarbons (gasoline) and benzene, toluene, and xylene isomers (BTX).

Soil samples collected from Borings ST-1 and ST-2 at the depth interval of 13 to 14.5 feet, along with soil samples collected from Borings S-1 and S-2 at the depth intervals of 14 to 15.5 feet, 19 to 20.5 feet, and 33.5 to 35 feet were analyzed for the presence of gasoline, BTX compounds, and total lead. Certified Analytical Reports which summarized analytical methods for the soil and groundwater samples are attached to this letter.

Subsurface Conditions

Subsurface conditions encountered during installation of Wells S-1 and S-2 consisted primarily of clay to the total depth explored of 35 feet. Soils encountered during installation of Wells ST-1 and ST-2 consisted of gravelly sand and clayey sand fill to a depth of 13 feet, underlain by clay to the total depth explored of 14.5 feet. Product odor was noted in all four borings to depths of approximately 14-1/2 to 15 feet.

Groundwater was encountered and stabilized at a depth of approximately 15 feet in Borings S-1 and S-2. Based on regional topography and the proximity of the site to local drainages, the groundwater flow at the site appears to be to the west-southwest.

Field Results

TIP readings ranged from 2.0 parts per million (ppm) to 1789 ppm. Most of the relatively high TIP readings recorded during headspace analysis were noted in soil samples obtained at or just below the water table, from the depths of 15 to 20 feet. TIP results did not correlate well with the analytical results, probably due to moisture content and/or the abundance of naturally occurring organic matter in the soil.

Analytical Results

Gasoline concentrations ranged from none detected in Borings S-1 and S-2 at the 33.5 to 35 foot depth interval to 57 ppm from Boring S-1 at 14 to 15.5 feet in depth.

Soil samples taken from the native soil directly beneath the tank complex in Borings ST-1 and ST-2 contained 13 ppm and 23 ppm gasoline, respectively. Lead concentrations ranged from 4.2 ppm to 7.1 ppm for all samples analyzed.

Laboratory analysis of groundwater samples revealed dissolved gasoline concentrations for Wells S-1 and S-2 of 920 parts per billion (ppb) and 16,000 ppb, respectively. Groundwater and soil analytical results are presented on the attached Table 1, as well as on the attached Certified Analytical Reports.

SUMMARY OF FINDINGS

- The project site is underlain by primarily clayey deposits.
- Groundwater beneath the site occurs at an approximate depth of 15 feet. The regional groundwater flow direction appears to be west-southwesterly, based on surface topography and drainage patterns in the area.
- Gasoline concentrations in soil samples analyzed ranged from none detected for samples taken approximately 20 feet below water to 57 ppm for samples taken at static water level. Lead concentrations for soil samples ranged from 4.2 ppm to 7.1 ppm.
- Groundwater collected from Wells S-1 and S-2 contained 920 ppb and 16,000 ppb dissolved gasoline, respectively.

If you have any questions regarding the contents of this report, please call.

Sincerely,

PACIFIC ENVIRONMENTAL GROUP, INC.

Susan Willhite
Senior Geologist
CEG 1272

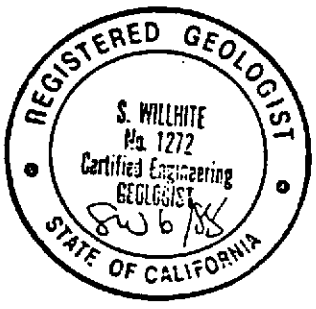


TABLE 1

Summary of Analytical Results

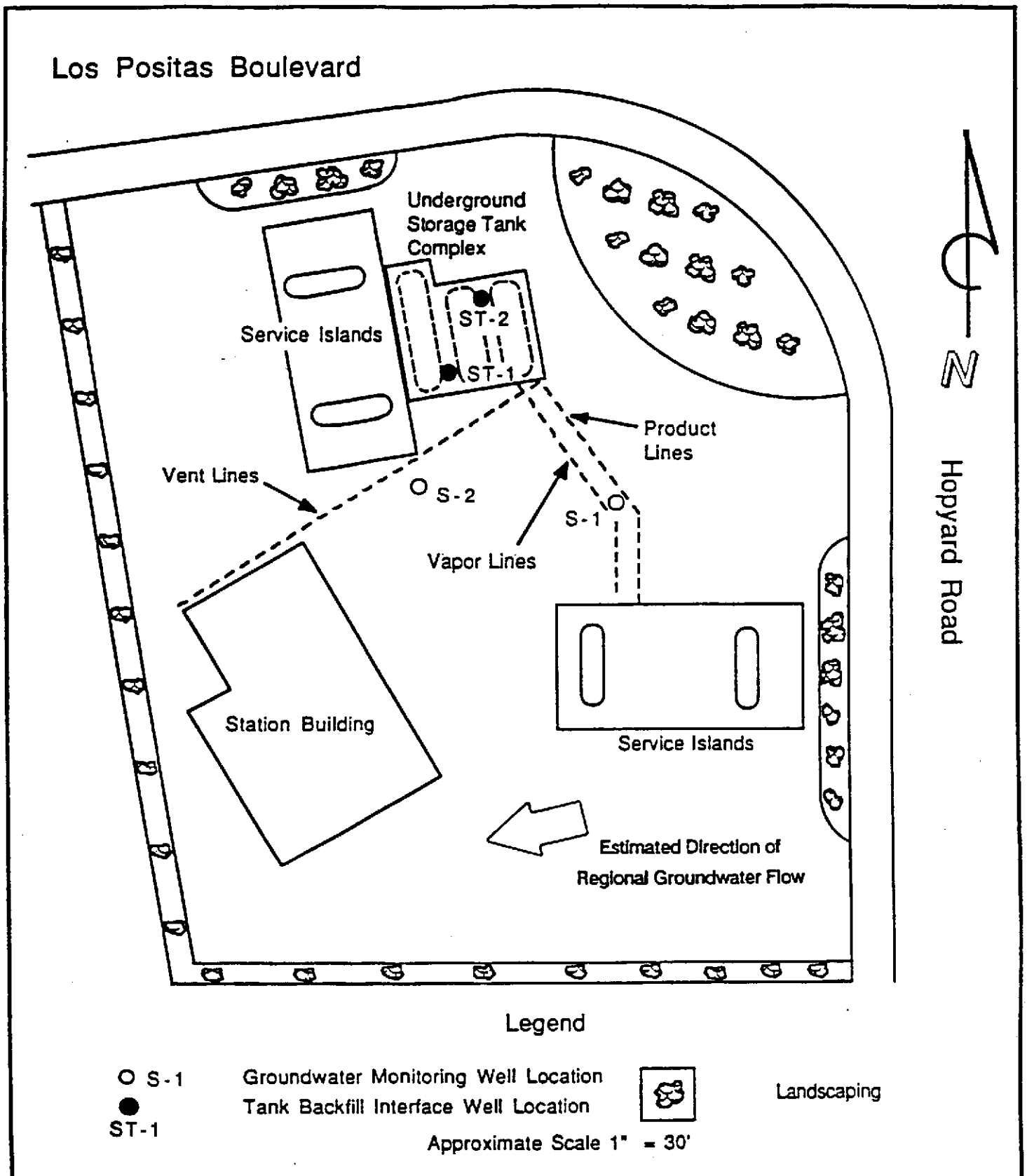
Soil Samples

Boring	Depth (feet)	Gasoline (ppm)	Benzene (ppm)	Toluene (ppm)	Xylenes (ppm)	Lead (ppm)
ST-1	13.0-14.5	13	2.7	0.3	1.4	4.2
ST-2	13.0-14.5	23	0.22	0.7	4.3	4.6
S-1	14.0-15.5	57	5.3	0.3	6.8	7.0
	19.0-20.5	9	0.43	0.1	0.8	6.4
	33.5-35.0	nd	nd	nd	nd	4.2
S-2	14.0-15.5	53	6.7	0.1	8	5.4
	19.0-20.5	5	0.07	nd	0.4	7.1
	33.5-35.0	nd	nd	nd	nd	5.4
Detection Limits		5	0.05	0.1	0.4	

Groundwater Samples (Sample Date: 11/6/87)

Well	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Xylenes (ppb)
S-1	920	230	nd	150
S-2	16,000	870	nd*	2,700
Detection Limits	50	1	1 100*	1

Notes: nd - not detected
ppb - parts per billion
ppm - parts per million



PACIFIC ENVIRONMENTAL GROUP INC.	Shell Service Station Hopyard Road and West Las Positas Boulevard Pleasanton, California SITE MAP	FIGURE: 1 PROJECT: 101-08.01

UNIFIED SOIL CLASSIFICATION SYSTEM

PRIMARY DIVISIONS			GROUP SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS more than half is larger than #200 sieve	GRAVELS half of coarse fraction larger than #4 sieve	CLEAN GRAVELS (less than 5% fines)	GW	Well graded gravels, gravel-sand mixtures; little or no fines
			GP	Poorly graded gravels or gravel-sand mixtures; little or no fines
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS half of coarse fraction smaller than # 4 sieve	CLEAN SANDS (less than 5% fines)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS more than half is smaller than #200 sieve	SILTS AND CLAYS liquid limit less than 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 AND CLAYS liquid limit more than 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 silts
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils

WELL LOG
KEY TO ABBREVIATIONS

Drilling Method
- HSA - Hollow stem auger
- CFA - Continuous flight auger
- Air - Reverse air circulation

Gravel Pack
- CA - Coarse aquarium sand

Sampling Method
- Cal. Mod. - California modified split-spoon sampler (2" inner diameter) driven 18" by a 140-pound hammer having a 30" drop. Where penetration resistance is designated "P", sampler was instead pushed by drill rig.
- Disturbed - Sample taken from drill-return materials as they surfaced.
- n/a - Not applicable

Moisture Content
- Dr - Dry
- Dp - Damp
- Mst - Moist
- Wt - Wet
- Sat - Saturated

Sorting
- PS - Poorly sorted
- MS - Moderately sorted
- WS - Well sorted

Plasticity
- L - Low
- M - Moderate
- H - High

H-NU (ppm)
- ND - No detection

Density

Sands and gravels	Silts and clays
VL - Very loose	VS - Very soft
L - Loose	Sft - Soft
MD - Medium dense	MSt - Medium Stiff
D - Dense	Stf - Stiff
VD - Very dense	VSt - Very stiff
	Hd - Hard

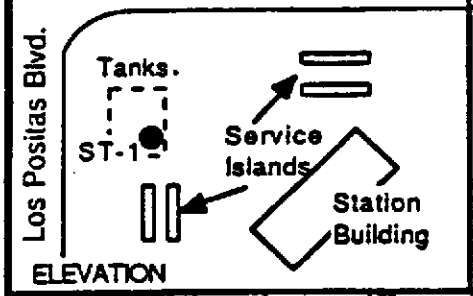
Symbols
- ▽ - First encountered ground water
- ▼ - Static ground water level

GRAIN-SIZE SCALE

GRADE LIMITS inches	GRADE LIMITS U.S. Standard sieve size	GRADE NAME
12.0		Boulders
3.0	3.0 in.	Cobbles
0.19	No. 4	Gravel
	coarse	
0.08	No. 10	
	medium	Sand
	No. 40	
	fine	
	No. 200	
		Silt
		Clay Size

PACIFIC ENVIRONMENTAL GROUP, INC.

LOCATION MAP Hopyard Rd.



PACIFIC ENVIRONMENTAL GROUP, INC.

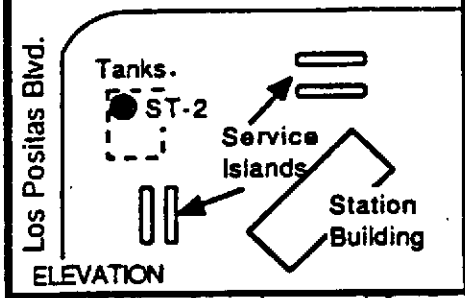
WELL / BORING NO. ST-1
PAGE 1 OF 1

PROJECT NO. 101-08.01
LOGGED BY: E.L.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL. MOD.
CASING TYPE: SHC. #40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G-R/SHELL
DATE DRILLED: 10/28/87
LOCATION: Hopyard & Los Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 14.5'
WELL DEPTH: 14.5'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	TIP	PENETRATION RESISTANCE (BLOW/FT)	DEPTH (feet)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
Concrete Over Bentonite / Pea Gravel				0				CONCRETE FILL
				2			SW	SAND FILL; gray; 5-10% fines; fine to coarse grained; 20-30% fine gravel; no product odor.
	Dp			4	X			
				6				
				8				
	Dp			10	X			@ 10'; as above; 5-10% fine gravel; strong product odor; product sheen in sample.
				12				
	Mst	120	5	14			CL	CLAY; black; moderate plasticity; trace organics; rootlets; soft; faint product odor.
				16				BOTTOM OF BORING AT 14.5 FEET
				18				
				20				
				22				
				24				
				26				
				28				
				30				
				32				
				34				
				36				
				38				
				40				
				42				
				44				

LOCATION MAP Hopyard Rd.



PACIFIC ENVIRONMENTAL GROUP, INC.

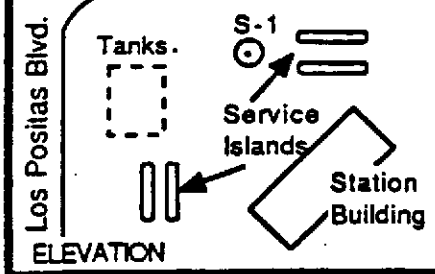
WELL / BORING NO. ST-2
PAGE 1 OF 1

PROJECT NO. 101-08.01
LOGGED BY: E.L.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL. MOD.
CASING TYPE: SHC. #40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G-R/SHELL
DATE DRILLED: 10/28/87
LOCATION: Hopyard & Los Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 14.5'
WELL DEPTH: 14.5'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	TIP	PENETRATION RESISTANCE (BLOW/FT)	DEPTH (feet)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
Concrete Seal / Pea Gravel	Mst			2, 4	⊠		SC	CONCRETE & FILL CLAYEY SAND FILL; gray; 15-20% low plasticity fines; fine to coarse grained; 10-20% fine gravel; faint product odor.
	Mst			6, 8, 10	⊠			@ 10'; as above; faint product odor.
	Mst	1789	7	12, 14	■		CL	CLAY; black mottled gray; moderate plasticity; 5-10% organics; faint hydrogen sulfide odor; rootlets; medium stiff; faint product odor.
				16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44				BOTTOM OF BORING AT 14.5 FEET

LOCATION MAP Hopyard Rd.

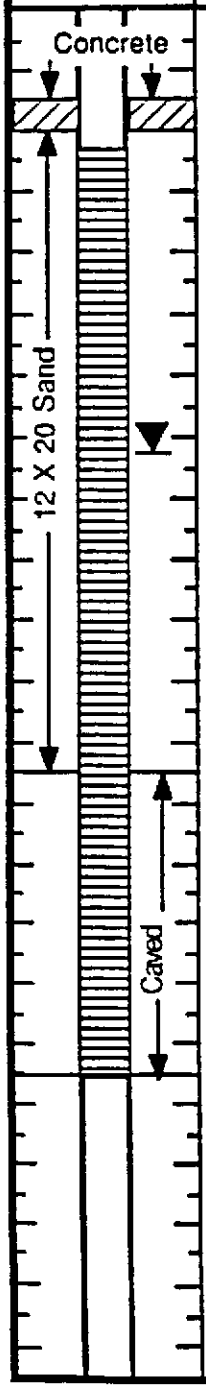


PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / BORING NO. S-1
PAGE 1 OF 1

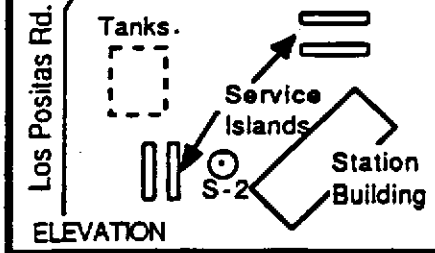
PROJECT NO. 101-08.01
LOGGED BY: E.L.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL. MOD.
CASING TYPE: SHC. #40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G-R/SHELL
DATE DRILLED: 10/28/87
LOCATION: Hopyard & Los Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 35'
WELL DEPTH: 35'
WELL DIAMETER: 3"



MOISTURE CONTENT	TIP	PENETRATION RESISTANCE (BLOW/FT)	DEPTH (feet)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
			0				ASPHALT & BASEROCK FILL
			2			CL	CLAY; gray; trace silt; moderate plasticity; 5-10% fine sand; trace medium sand to fine gravel; faint product odor.
Dp	31.5	P	4				@ 5'; as above; thin (1") interbed of fine sand; gravel saturated with black product; strong product odor.
			6				
			8			CH	CLAY; black; high plasticity; trace fine sand; very stiff; faint product odor.
Dp	85.0	27	10				
			12				
			14			CL	CLAY; black; moderate plasticity; trace silt; 5-10% organics; hydrogen sulfide odor; rootlets; medium stiff; faint product odor.
Dp	454	6	16				
			18				
Wt	597	9	20				@ 19'; as above; stiff; no product odor.
			22				
			24				@ 24'; as above; occasional 1"-2" thick peaty clay interbeds; hydrogen sulfide odor; stiff; no product odor.
Wt	2.0	9	26				
			28				
			30				@ 29'; as above; peat absent; stiff; no product odor.
Wt	64.5	11	32				
			34				@ 33.5'; as above; trace fine to medium sand; 5-10% coarse sand to fine gravel; stiff; no product odor.
Wt	4.0	9	36				BOTTOM OF BORING AT 35 FEET
			38				
			40				
			42				
			44				

LOCATION MAP Hopyard Rd.



PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / BORING NO. S-2
PAGE 1 OF 1

PROJECT NO. 101-08.01
LOGGED BY: E.L.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL. MOD.
CASING TYPE: SHC. #40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G-R/SHELL
DATE DRILLED: 10/28/87
LOCATION: Hopyard & Los Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 35'
WELL DEPTH: 35'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	TIP	PENETRATION RESISTANCE (BLOW/FT)	DEPTH (feet)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
Concrete; Bentonite; 12 X 20 Sand; Caved				2				ASPHALT & BASEROCK FILL
	Dp	4.5	P	4			CL	CLAY; gray; moderate plasticity; silty; trace fine to coarse sand; faint product odor. @3.5'; as above; 5-10% coarse sand to fine gravel; moderate product odor.
	Dp	83.5	11	10			CH	CLAY; gray; high plasticity; trace coarse gravel; rootholes; stiff; faint product odor.
	Dp	314	6	14			CL	CLAY; gray; moderate plasticity; trace fine sand; roots; occasional peaty interbeds; 5-15% organics; hydrogen sulfide odor; medium stiff; faint product odor.
	Wt	333	3	20				@ 19'; as above; soft; no product odor.
	Wt	20.5	7	24				@ 24'; as above; peat absent; medium stiff; no product odor.
	Wt	5.5	10	30				@29'; as above; no product odor.
	Wt	11.5	12	34			CH	CLAY; gray; high plasticity; trace silt; stiff; no product odor.
				36				BOTTOM OF BORING AT 35 FEET
				38				
				40				
				42				
				44				

INTERNATIONAL TECHNOLOGY CORPORATION

Pacific Environmental Group, Inc.
1601 Civic Center Drive
Suite 202
Santa Clara, CA 95050

November 23, 1987

ATTN: John Adams

Following are the results of analyses on the samples described below.

Project Number:	101-08.01
Lab Numbers:	S7-11-033-01 thru S7-11-033-08
Number of Samples:	8
Sample Type:	soil
Date Received:	11/3/87
Analyses Requested:	Low Boiling Hydrocarbons, Total Lead

The method of analysis for low boiling hydrocarbons is taken from E.P.A. Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photo-ionization detector.

The result for total low boiling hydrocarbons is calculated as gasoline and include benzene, toluene, ethyl benzene and xylenes.

Results of the analyses for total lead performed by the IT Cerritos Laboratory are attached. The sample identifications are as follows:

IT Santa Clara Laboratory Number	Sample Identification
S7-11-033-01	ST-1, 13-14.5'
S7-11-033-02	ST-2, 13-14.5'
S7-11-033-03	S-1, 14-15.5'
S7-11-033-04	S-1, 19-20.5'
S7-11-033-05	S-1, 33.5-35'
S7-11-033-06	S-2, 14-15.5'
S7-11-033-07	S-2, 19-20.5'
S7-11-033-08	S-2, 33.5-35'

Fred Rouse

FR/ksr

1 Page Following - Table of Results

IT/Santa Clara to
Pacific Environmental Group, Inc.
ATTN: John Adams

November 23, 1987

Summary of Results

Project Number: 101-08.01

Lab Number	Sample Identification	Parts per Million - (Dry Soil Basis) Low Boiling Hydrocarbons (Gasoline)	Benzene	Toluene	Ethyl benzene and xylenes
S7-11-033-01	ST-1, 13-14.5'	13.	2.7	0.3	1.4
S7-11-033-02	ST-2, 13-14.5'	23.	0.22	0.7	4.3
S7-11-033-03	S-1, 14-15.5'	57.	5.3	0.3	6.8
S7-11-033-04	S-1, 19-20.5'	9.	0.43	0.1	0.8
S7-11-033-05	S-1, 33.5-35'	nd	nd	nd	nd
S7-11-033-06	S-2, 14-15.5'	53.	6.7	0.1	8.
S7-11-033-07	S-2, 19-20.5'	5.	0.07	nd	0.4
S7-11-033-08	S-2, 33.5-35'	nd	nd	nd	nd
Detection Limit		5.	0.05	0.1	0.4

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

17605 Fabrica Way • Cerritos, California 90701 • 213-921-9831 / 714-523-9200

CERTIFICATE OF ANALYSIS

Prepared for: IT Corporation
397 Mathew Street
Santa Clara, CA 95050

Attn: Sample Administration

Date: November 19, 1987

Date Received: November 7, 1987 P.O. Number 189993/4631-67 (PEG) Job Number 43658/sls

Eight (8) soil samples

The samples were digested with acid. Lead was analyzed by flame atomic absorption spectroscopy. The results are listed below.

	Milligrams Per Kilogram
Sample ID	Lead
S7-11-033-01A	4.2
S7-11-033-02A	4.6
S7-11-033-03A	7.0
S7-11-033-04A	6.4
S7-11-033-05A	4.2
S7-11-033-06A	5.4
S7-11-033-07A	7.1
S7-11-033-08A	5.4

I certify that this report truly represents the finding of work performed by me or under my direct supervision.

Hung-Dwan Lee
Chemist

Reviewed and Approved

Ken Faust
Technical Director

INTERNATIONAL TECHNOLOGY CORPORATION

Pacific Environmental Group, Inc.
1601 Civic Center Drive
Suite 202
Santa Clara, CA 95050

November 30, 1987

ATTN: John Adams

Following are the results of analyses on the samples described below.

Project Number:	101-08.01, Hopyard & Las Politas
Lab Numbers:	S7-11-069-01 and S7-11-069-02
Number of Samples:	2
Sample Type:	Water
Date Received:	11/6/87
Analyses Requested:	Low Boiling Hydrocarbons

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector.

The result for total low boiling hydrocarbons is calculated as gasoline and include benzene, toluene, ethyl benzene and xylenes.

Summary of Results

ND = None Detected

		Micrograms per Liter			
Lab Number	Sample Identification	Low Boiling Hyrocarbons (Gasoline)	Benzene	Toluene	Ethyl benzene and xylenes
S7-11-069-01	S-1	920.	230.	ND	150.
S7-11-069-02	S-2	16,000.	870.	ND*	2,700.
Detection Limit				5. 100.*	

Fred Rouse

FR/gg

11

PACIFIC
ENVIRONMENTAL
GROUP INC.

March 10, 1988
Project No. 101-08.02

Gettler-Ryan Inc.
1992 National Avenue
Hayward, CA 94545

Attn: Mr. Jeff Ryan

Re: Shell Service Station
Hopyard Rd. at W. Las Positas Blvd.
Pleasanton, California

Gentlemen:

This letter presents the results of a groundwater investigation conducted by Pacific Environmental Group, Inc. (PACIFIC) at the Shell Oil Company service station located at Hopyard Road and West Las Positas Boulevard in Pleasanton, California (see Figure 1). The purpose of the investigation was to further define the extent of the dissolved hydrocarbon plume previously identified at the site. Additionally, PACIFIC performed work to determine whether the Arroyo Mocho Canal appears to act as a hydraulic barrier between the site and water-supply wells located southeast of the site. The scope of this investigation included installation of three additional groundwater monitoring wells, chemical analysis of selected soil samples, groundwater sampling and analysis of all site wells, and a review of construction information and flow conditions of the Arroyo Mocho Canal.

BACKGROUND

In October, 1987 PACIFIC performed a soil and groundwater investigation at the site. The investigation included installation of two groundwater monitoring wells (S-1 and S-2) and two tank backfill interface wells (ST-1 and ST-2) at the site, at the locations shown on Figure 2. Dissolved gasoline was detected in groundwater samples obtained from Wells S-1 and S-2 on November 6, 1987 at concentrations of 920 parts per billion (ppb) and 16,000 ppb, respectively. The findings of that investigation were presented in a letter report dated December 4, 1987.

SITE INVESTIGATION

Procedures

A total of three additional groundwater monitoring wells (S-3, S-4 and S-5) were installed on January 26, 1988. The new wells were installed in an attempt to further define the extent of dissolved product at the site. The well locations are shown on Figure 2.

The borings for the monitoring wells were drilled using eight-inch diameter hollow-stem auger drilling equipment and were logged by a PACIFIC geologist using the Unified Soil Classification System. Boring logs are attached to this report. Soil samples for logging and chemical analysis were collected at five-foot intervals by advancing a California-modified split-spoon sampler with brass liners into undisturbed soil beyond the tip of the auger. The sampler was driven a maximum of 18 inches, using a 140-pound hammer with a 30-inch drop. Soil samples for chemical analysis were retained in brass liners, sealed in glass jars, chilled, and transported to the laboratory with appropriate chain-of-custody documentation.

The soil samples collected were used to perform a head-space analysis in the field for volatile organic compounds. The test procedure involved measuring approximately 30 grams from an undisturbed soil sample, placing this sub-sample in a clean glass jar, and sealing the jar with aluminum foil secured under a ring-type threaded lid. The jar was placed in a warm water bath (75 to 90 degrees F) for approximately twenty minutes. Then the foil was pierced and the head-space within the jar was tested for total organic vapor, measured in parts per million, with an H-NU photo-ionization detector. The results of these tests, in parts per million (ppm), appear on the boring logs.

Each boring was advanced approximately 20 feet into the water-bearing zone. After the drilling, monitoring wells were constructed using 3-inch diameter, Schedule 40 PVC casing and 0.020-inch factory-slotted screen. The screen was placed through the entire saturated section, extending approximately 7 to 10 feet above the static water level. Graded sand pack was placed in the annular space across the screened interval, and it extends approximately 1 to 1-1/2 feet above the screen. A bentonite and concrete seal

extends from the sand pack to the ground surface. A locking cap and protective vault box were installed by Gettler-Ryan Inc. on the top of each well. All site wells were surveyed by a licensed surveyor relative to mean sea level datum.

All site monitoring wells (S-1 through S-5) were sampled by Blaine Tech Services on February 14, 1988. The procedure consisted of first measuring the water level in each well, and checking each well for the presence of floating petroleum product using a clear acrylic bailer. No floating product was detected at the site, so groundwater samples were collected from all wells. The wells were purged of approximately four casing volumes of water using a submersible pump constructed of stainless steel and Teflon materials. Groundwater samples were then collected directly from the pump discharge into the appropriate EPA-approved containers. The sample bottles were labeled, logged onto chain-of-custody documents, and transported on ice to the laboratory for analysis.

The soil and groundwater samples were analyzed for low-boiling hydrocarbons (gasoline) and benzene, toluene, and xylene isomers (BTX). The analyses were performed by the purge-and-trap technique with final detection by gas chromatography using a flame-ionization detector as well as a photo-ionization detector. Certified analytical reports are attached to this letter.

Subsurface Conditions

Soils encountered beneath the site consisted of clay to the total depth explored of 36 feet. Groundwater was first detected at an approximate depth of 14 feet, and stabilized at depths ranging from approximately 12-1/2 to 15-1/2 feet.

No product odor was noted in soil samples collected from Boring S-3. Moderate product odor was noted in soil samples collected from Boring S-4 at 19 feet in depth, and moderate to strong odor was observed in Boring S-5 between 14 and 25-1/2 feet. The results of the H-NU analyses generally supported these observations. Total organic vapor concentrations range from 20 to 254 ppm in Borings S-4 and S-5 between the depths of 9 and 30 feet, with the highest organic vapor levels detected at 20 feet in each of these borings. All other samples collected contained headspace concentrations of 8 ppm or less.

The groundwater flow direction on site, based on water levels collected by PACIFIC on February 16, 1988, is to the south-southeast at an approximate gradient of 0.008. This

flow direction is consistent with regional trends, as reported by the Alameda County Flood Control and Water Conservation District (ACFCD).

Soil and Groundwater Analytical Results

Soil samples collected at the 19- to 20-1/2-foot depth interval in Borings S-3, S-4 and S-5 were submitted to the laboratory for analysis. Gasoline was detected in soil from Borings S-4 and S-5 at 41 parts per million (ppm) and 4,700 ppm, respectively. No gasoline was detected in the soil sample from S-3.

Laboratory analysis of groundwater samples collected on February 14, 1988 revealed dissolved gasoline concentrations ranging from none detected in Well S-3 to 5,100 ppb in Well S-4. The highest concentrations, ranging from 1,800 to 5,100 ppb, were detected in Wells S-1, S-2 and S-4, located near (and downgradient of) the underground storage tank complex. Well S-5, located at the downgradient property boundary, contained 1,000 ppb gasoline. Soil and groundwater analytical results are tabulated on Table 1, and are summarized on the attached certified analytical reports. In addition, gasoline concentrations are plotted on Figure 2.

Well Survey

PACIFIC conducted a well survey in order to identify the location and construction information of any water-supply wells within 1/2-mile of the site. Information obtained from the ACFCD indicates that there are five water-supply wells located within a 1/2-mile radius of the site (see Figure 1). These wells are located to the southeast (downgradient, as measured in the shallow aquifer) of the service station. Wells 1, 2 and 5 belong to ACFCD and are part of a municipal well field, Well 4 belongs to the City of Pleasanton, and the owner of Well 3 is unknown. Wells 1 and 2 are actively used for water supply, Well 4 was inactivated by the City due to the detection of dissolved gasoline in site Wells S-1 and S-2 during PACIFIC's October, 1987 investigation, and Well 5 has not yet had a pump installed. The operational status of Well 3 is unknown. Well depths range from 233 to 750 feet. No information was available regarding the perforated interval or seal depth of the wells. Available well information is presented on Table 2.

Arroyo Mocho Canal

The Arroyo Mocho Canal is located approximately 265 feet south of the site (see Figure 3), and flows to the east. According to Jerry Killingstad of the ACFCD, the Arroyo

Mocho is an improved canal, which has probably been diverted somewhat from its original drainage path. The canal is unlined, and occurrence of water is seasonal.

PACIFIC had the canal surveyed in order to determine the elevations of the groundwater encountered beneath the site and of the canal bottom. The elevation of the base of the canal directly south of the site is 301.6 feet, approximately 12-1/2 feet below the elevation of the groundwater table beneath the site. The water surface elevation in the canal was approximately 302.2 feet on March 4, 1988. A cross-section showing the relationship of the canal to site geology and groundwater conditions is shown on Figure 4. Based on this cross-section, the Arroyo Mocho Canal may act to provide hydraulic separation between the site and the municipal well field. Water levels in the canal and in site wells need to be monitored through the year to evaluate whether this situation is perennial or seasonal.

SUMMARY OF FINDINGS

- The project site is underlain by clay deposits to the total depth explored of 36 feet.

- Groundwater beneath the site occurs at an approximate depth of 14 feet, and flows to the south-southeast at an approximate gradient of 0.008.

- Gasoline concentrations of not-detected, 41 ppm and 4,700 ppm were found in soils from the depth interval of 19 to 20-1/2 feet in Borings S-3, S-4 and S-5, respectively.

- The highest levels of dissolved gasoline (ranging from 1,800 ppb to 5,100 ppb) were found to occur in Wells S-1, S-2 and S-4, located near (and downgradient of) the underground storage tank complex. Well S-5, located on the downgradient property boundary contained 1,000 ppb gasoline.

- There are five water-supply wells located within 1/2-mile downgradient of the site. Two of the wells are active municipal water-supply wells. The minimum well depth is 233 feet. No other construction information was available for these wells.

- The elevation of the water surface at the base of the Arroyo Mocho Canal is approximately 12 feet lower than the surface of the water table beneath the site, suggesting that the canal may act to provide hydraulic separation between the site and the municipal wells. However, this condition needs further evaluation.

If you have any questions regarding the contents of this report, please call.

Sincerely,

PACIFIC ENVIRONMENTAL GROUP, INC.

Erin Garner
Project Geologist

Susan Willhite
Senior Geologist
CEG 1272

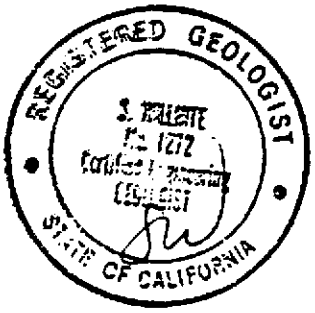


TABLE 2

SUMMARY OF WELL SURVEY DATA

Water-Producing Wells
Within 1/2-Mile Radius of the Site

Map Symbol	Well Number	Well Depth(ft)	Year Drilled	Usage	Status
1	3S1E18A1	389	1986	Municipal	Active
2	3S1E18A2	233	1970	Municipal	Active
3	3S1E18A4	750	1967	?	?
4	3S1E18A5	454	1977	Municipal	Inactive (temp.)
5	3S1E18A6	510	1987	Municipal	No pump yet

TABLE 1

Summary of Analytical Results

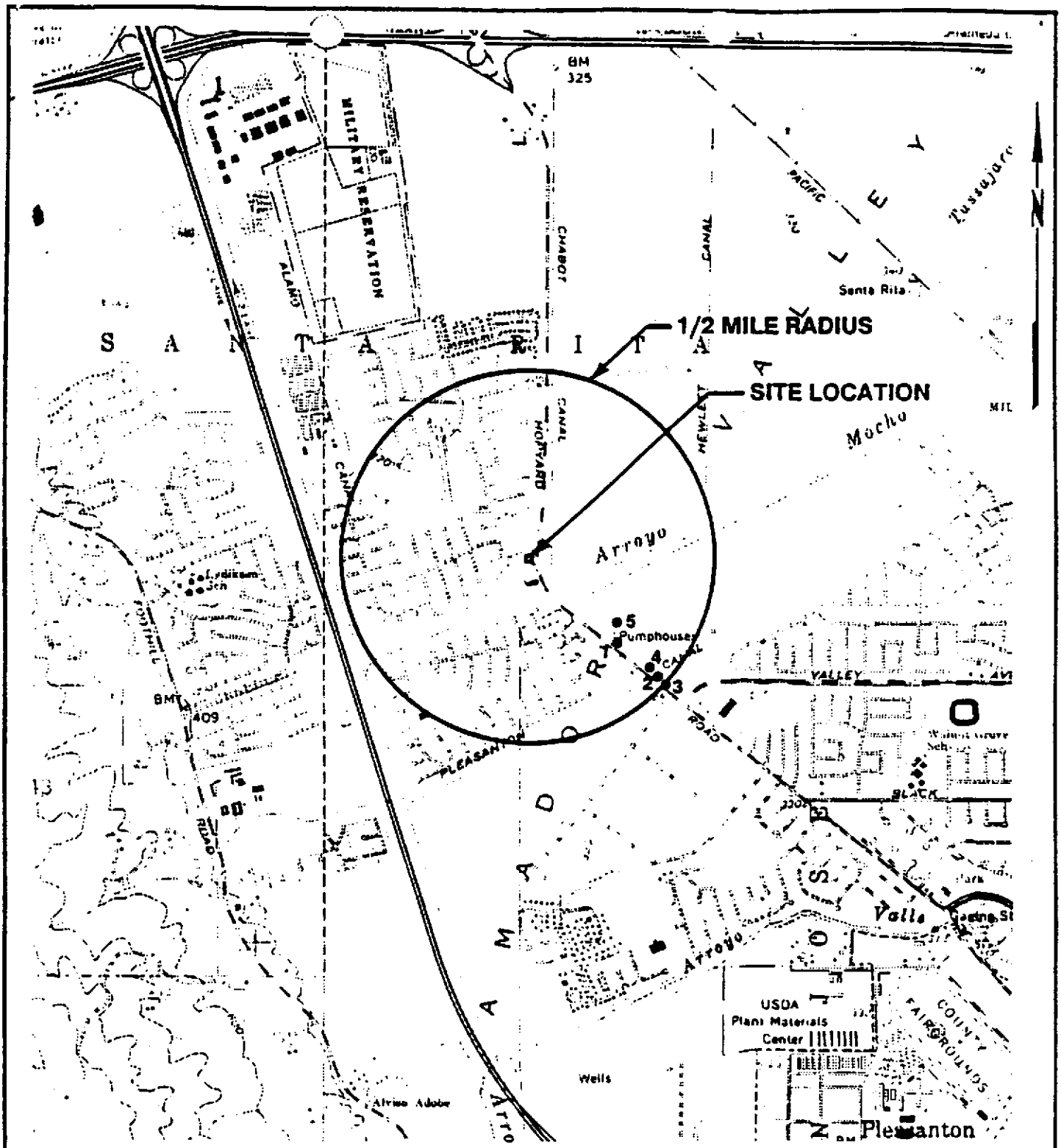
Soil Samples

Boring	Depth (feet)	Gasoline (ppm)	Benzene (ppm)	Toluene (ppm)	Xylenes (ppm)
S-3	19 to 20-1/2	nd	nd	nd	nd
S-4	19 to 20-1/2	41	6.2	nd	5.9
S-5	19 to 20-1/2	4700	50	170	900
Detection Limits		5	0.05	0.1	0.4

Groundwater Samples (Sample Date: 02/14/88)

Well	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Xylenes (ppb)
S-1	3,500	1,300	<40	500
S-2	1,800	440	<10	140
S-3	nd	nd	nd	nd
S-4	5,100	160	8	730
S-5	1,000	40	86	180
Detection Limits	50	0.5	1	4

Notes: nd - not detected
ppb - parts per billion
ppm - parts per million



LEGEND

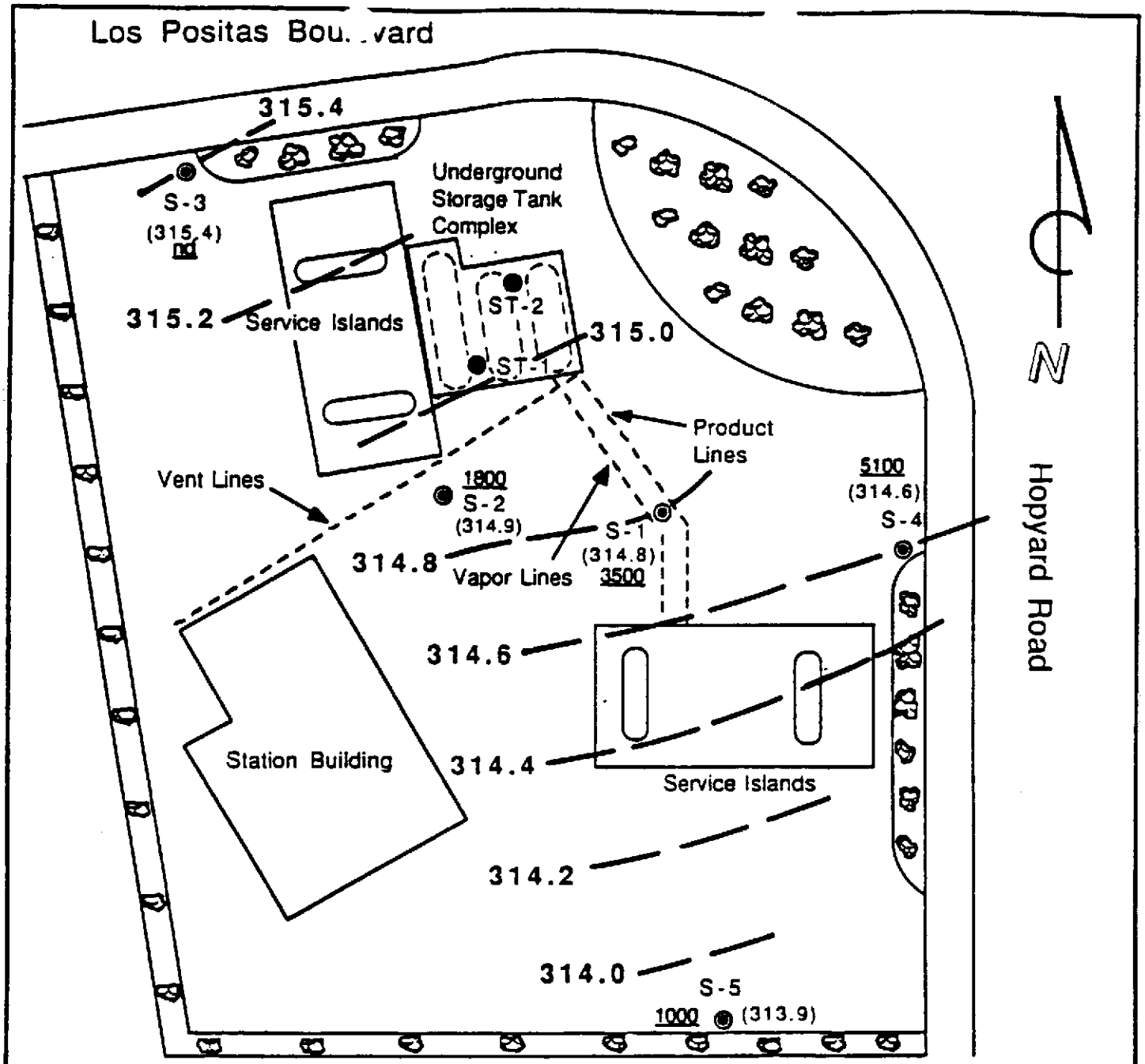
- Water-supply well location

APPROXIMATE SCALE: 1" = 2000'

Base Map From USGS Topographic Map

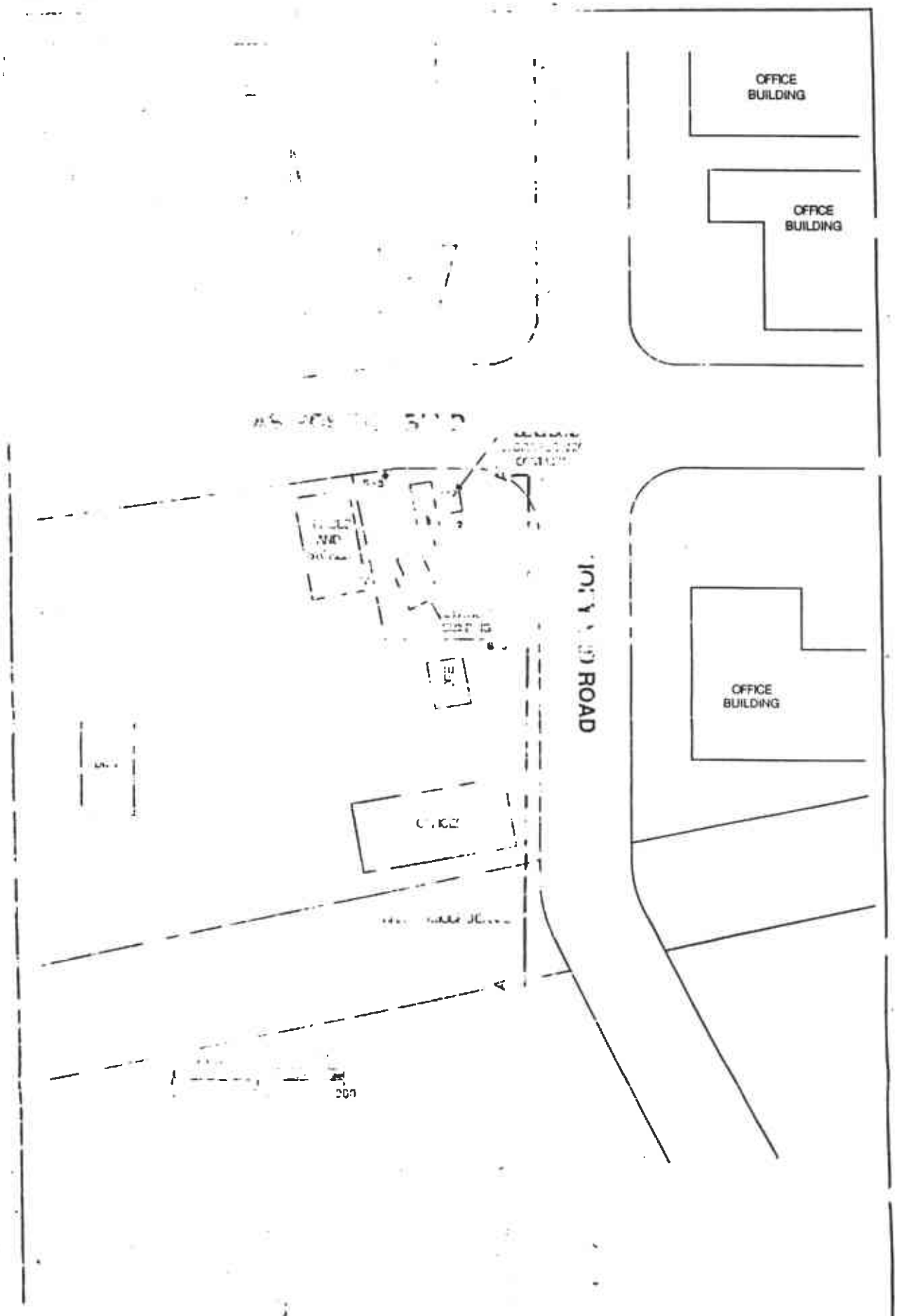
PACIFIC ENVIRONMENTAL GROUP INC.	**SHELL SERVICE STATION** Hopyard Road and West Las Positas Boulevard Pleasanton, California	FIGURE: 1 PROJECT: 101-08.02
	SITE LOCATION MAP	

SAN JOSE BLUEPRINT CO
PRINTED ON 10/00/94-10



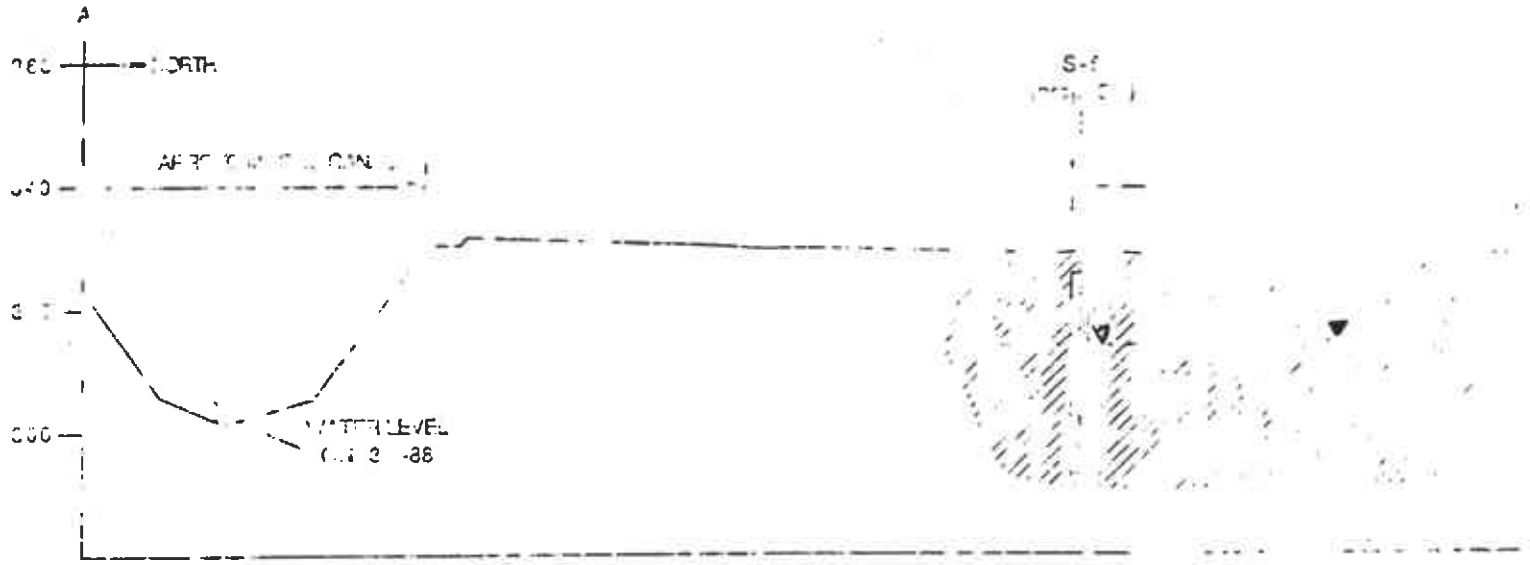
PACIFIC ENVIRONMENTAL GROUP INC.	**SHELL SERVICE STATION** Hopyard Road and West Las Positas Boulevard Pleasanton, California **SITE MAP**	FIGURE: **2** PROJECT: 101-08.02

SAN JOSE BLUEPRINT CO
PRINTED ON 1000H-10



SHELL SERVICE STATION
Las Positas Boulevard
California
SITE MAP

FIGURE:
3
PROJECT:
101-08.02



LEGEND

GROUNDWATER MONITORING WELL

SCREENED INTERVAL

GRAVEL PACK

WATER LEVEL (2/14/68)

CLAY DEPOSITS (CL, CH)

NOTE: REFER TO FIGURE 3 FOR CROSS-SECTION LOCATION.

HORIZONTAL SCALE

0 50 100

REVISIONS | DRAWN BY | DATE/NUMBER

PACIFIC ENVIRONMENTAL GROUP, INC.

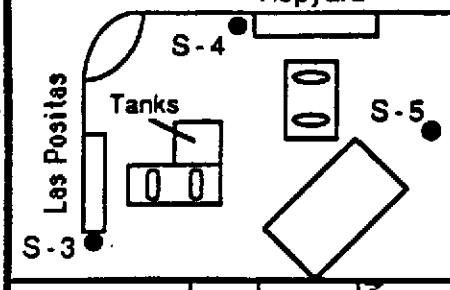
SHELL SERVICE STATION
Hopyard Road and West Las Positas Boulevard
Pleasanton, California

CROSS-SECTION A-A'

FIGURE: 4

PROJECT: 101-08.02

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / S-3
BORING NO.
PAGE 1 OF 1

PROJECT NO. 101-08.02
LOGGED BY: C.P.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G.R. Shell
DATE DRILLED: 1-26-88
LOCATION: Hopyard & Las Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 36'
WELL DEPTH: 36'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
CONCRETE				2			CL	ASPHALT & BASEROCK - FILL CLAY; dark olive gray; moderate plasticity; trace coarse sand; roots; firm; no product odor.
BENTONITE	Dp	0.6	PUSH	4				
				6				
				8				
	Dp	3.0	13	10				@9'; as above; ; stiff; no product odor.
				12				
	Dp	2.0	4	14				@14'; as above; medium olive gray; rootholes; soft; no product odor.
				16				
12 X 20 SAND				18				
	Mst	0.0	5	20			CH	CLAY; mottled olive and gray; high plasticity; trace-5% organics; soft; no product odor.
				22				
	Mst	4.0	7	24				@24'; as above; mottled olive gray and black; trace organics; iron oxide staining; firm; no product odor.
				26				
				28				
	Mst	0.3	10	30			CL	CLAY; low plasticity; mottled olive and gray; 10-15% coarse sand; stiff; no product odor.
				32				
	Mst	0.0	11	34				@34'; as above; olive; trace organics; no sand; no product odor.
				36				BOTTOM OF BORING AT 36'
				38				
				40				
				42				
				44				

WELL LOG
KEY TO ABBREVIATIONS

Drilling Method

HSA - Hollow stem auger
CFA - Continuous flight auger
Air - Reverse air circulation

Gravel Pack

CA - Coarse aquarium sand

Sampling Method

Cal. Mod. - California modified split-spoon sampler (2" inner diameter) driven 18" by a 140-pound hammer having a 30" drop. Where penetration resistance is designated "P," sampler was instead pushed by drill rig.
Disturbed - Sample taken from drill-return materials as they surfaced.
n/a - Not applicable.

Moisture Content

Dr - Dry
Dp - Damp
Mst - Moist
Wt - Wet
Sat - Saturated

Sorting

PS - Poorly sorted
MS - Moderately sorted
WS - Well sorted

Plasticity

L - Low
M - Moderate
H - High

H-NU (ppm)

ND - No detection

Symbols

▽ - First encountered ground water

▼ - Static ground water level

Density

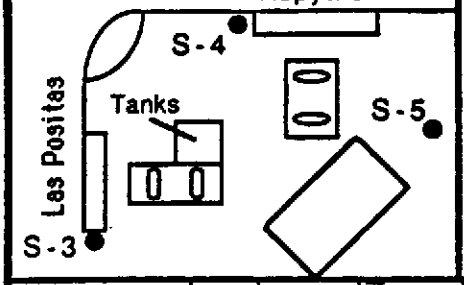
Sands and gravels		Silts and clays	
0 - 4	- Very Loose	0 - 2	- Very Soft
5 - 10	- Loose	3 - 4	- Soft
11 - 30	- Medium dense	5 - 8	- Firm
31 - 50	- Dense	9 - 16	- Stiff
over 50	- Very dense	17 - 32	- Very stiff
		over 32	- Hard

GRAIN-SIZE SCALE

GRADE LIMITS U.S. Standard inches	sieve size	GRADE NAME
12.0		Boulders
3.0	3.0 in.	Cobbles
0.19	No. 4	Gravel
	coarse	
0.08	No. 10	
	medium	Sand
	No. 40	
	fine	
	No. 200	
		Silt
		Clay Size

PACIFIC ENVIRONMENTAL GROUP, INC.

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

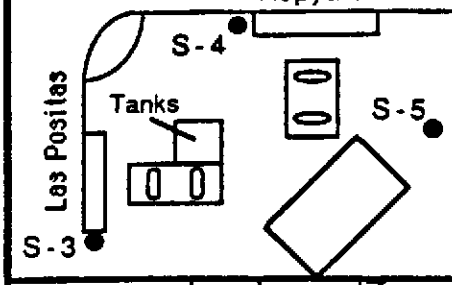
WELL / S-4
BORING NO.
PAGE 1 OF 1

PROJECT NO. 101-08.02
LOGGED BY: C.P.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G.R. Shell
DATE DRILLED: 1-26-88
LOCATION: Hopyard & Las Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 36'
WELL DEPTH: 36'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
CONCRETE								ASPHALT, GRAVEL, & BRICK.
				2			CL	CLAY; olive gray; low plasticity; trace coarse sand; trace organics; trace coarse gravel; firm; no product odor.
	Dp	12.2	PUSH	4				
BENTONITE				6				
				8				
	Dp	20	14	10				@9'; as above; moderate plasticity; no gravel; stiff; no product odor.
				12				
	Dp	78	5	14				@14'; as above; mottled medium brown and olive; low plasticity; trace medium sand; iron oxide staining; charcoal; roots; low plasticity; firm; no product odor; peat lens @14 1/2'.
12 X 20 SAND				16				
				18				
	Dp	188	8	20				@19'; as above; mottled green & olive; 5-10% silt; rootholes; firm; moderate product odor.
				22				
	Mst	110	12	24				@24'; as above; black; moderate plasticity; stiff; no product odor.
				26				
				28				
	Mst	22	14	30			CH	CLAY; dark gray; trace fine gravel; trace fine sand; no product odor.
				32				
				34				@34'; as above; olive; high plasticity; rootholes; trace organics; stiff; no prodcut odor.
	Mst	2.2	10	36				BOTTOM OF BORING AT 36'
				38				
				40				
				42				
				44				

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / S-5
BORING NO.
PAGE 1 OF 1

PROJECT NO. 101-08.02
LOGGED BY: C.P.
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020
GRAVEL PACK: 12 X 20 SAND

CLIENT: G.R. Shell
DATE DRILLED: 1-26-88
LOCATION: Hopyard & Las Positas
HOLE DIAMETER: 8"
HOLE DEPTH: 36'
WELL DEPTH: 35 1/2'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
CONCRETE								ASPHALT & BASEROCK/GRAVEL
				2			CL	CLAY; dark olive gray; 10-15% fine gravel; medium plasticity; trace organics; trace medium sand; firm; no product odor.
	Dp	5.9	PUSH	4				
BENTONITE				6				
				8				
	Dp	42	14	10				@9'; as above; dark olive silty; no gravel; trace medium to coarse sand; clay sheared through center of sampler; stiff; faint product odor.
				12				
				14				
	Dp	35	8	16			CH	CLAY; dark bluish gray; medium to high plasticity; trace coarse sand; peaty; 10-15% organics; stiff; moderate product odor (oil).
12 X 20 SAND				18				
	Dp	254	9	20			CL	CLAY; medium brownish gray; moderate plasticity; trace-5% organics; iron oxide staining; rootholes; stiff; visible product sheen; strong product odor.
				22				
				24				@24'; as above; mottled gray and olive brown; firm; moderate product odor.
	Dp	50	7	26				
				28				
	Dp	58	8	30				@29'; as above; dark olive; trace organics; trace medium sand; firm; faint product odor.
				32				@30.5; silt lens.
CAYED								
	Dp	8.0	10	34				@34'; as above; medium olive gray; firm; thin lens of silty clay; no product odor.
				36				BOTTOM OF BORING AT 36'
				38				
				40				
				42				
				44				

BLAINE
TECH SERVICES INC.

1370 TULLY RD., SUITE 505
SAN JOSE, CA 95122
(408) 995-5535

October 19, 1988

Gettler Ryan
1992 National Ave.
Hayward, CA 94545

Attention: John Werfal

GETTLER/RYAN PROJECT: 83122

SITE:
SHELL STATION
3790 HOPYARD ROAD
PLEASANTON, CALIFORNIA

GROUNDWATER WELL SAMPLING:
OCTOBER 13, 1988

GROUNDWATER WELL SAMPLING REPORT 88287-T-1

This report deals with the groundwater well sampling performed by our firm in response to your request. Data collected in the course of our work at the site is presented in the TABLE OF WELL MONITORING DATA. This data was collected during our inspection, well evacuation, and sample collection. Measurements include the total depth of the well and depth to water. These measurements are taken from grade at the well head, which is defined by placing a straight edge across the open enclosure or utility box in which the monitoring well is situated. Water surfaces are further inspected for the presence of a petroleum sheen or free product zone. A series of electrical conductivity, pH, and temperature readings are obtained during well evacuation and at the time of sample collection. Recharge performance can be evaluated by comparing the anticipated five case volume evacuation gallonage with the volume which could actually be purged.

TABLE OF WELL MONITORING DATA

Well I.D.	S-2	S-3	S-4
Date Sampled	10/13/88	10/13/88	10/13/88
Well Diameter (in.)	3	3	3
Total Well Depth (ft.)	33.0	34.5	34.5
Depth To Water (ft.)	13.97	11.96	13.13
Free Product (in.)	NONE	NONE	NONE
Reason If Not Sampled	--	--	--
"Ideal" 5 Case Vol. (gal.)	35.2	41.7	39.5
Did Well Dewater?	YES @ 24 gals.	NO	YES @ 20 gals.
Gallons Evacuated	26.0	43.0	24.0
Purging Device	MIDDLEBURG	MIDDLEBURG	MIDDLEBURG
Sampling Device	MIDDLEBURG	MIDDLEBURG	MIDDLEBURG
Time	12:26 12:38 12:58	13:08 13:33 13:45	11:39 11:50 12:07
Temperature (Fahrenheit)	66.1 67.3 65.7	66.5 67.0 67.1	66.0 67.3 65.7
pH	7.6 7.6 7.4	7.6 7.8 7.8	7.4 7.5 7.5
Conductivity (micromhos/cm)	3700 3600 3800	4100 3500 3200	3700 3300 3800
BTS Chain of Custody	88287-T-1	88287-T-1	88287-T-1
BTS Sample I.D.	S-2 LIQUID	S-3 LIQUID	S-4 LIQUID
DHS HNTL Laboratory	IT CORPORATION	IT CORPORATION	IT CORPORATION
Laboratory Sample I.D.	S8-10-126-01	S8-10-126-02	S8-10-126-03
Analysis To Detect	THC (GAS) & BTXE	THC (GAS) & BTXE	THC (GAS) & BTXE

TABLE OF WELL MONITORING DATA

Well I.D.	S-5			S-6			S-7	
Date Sampled	10/13/88			10/13/88			10/13/88	
Well Diameter (in.)	3			3			3	
Total Well Depth	34.0			30.5			34.5	
Depth To Water (ft.)	15.76			13.55			16.13	
Free Product (in.)	NONE			NONE			NONE	
Reason If Not Sampled	--			--			--	
"Ideal" 5 Case Vol. (gal.)	34.0			31.5			34.0	
Did Well Dewater?	NO			YES @ 20 gals.			NO	
Gallons Evacuated	36.0			24.5			34.0	
Purging Device	MIDDLEBURG			MIDDLEBURG			MIDDLEBURG	
Sampling Device	MIDDLEBURG			MIDDLEBURG			MIDDLEBURG	
Time	10:50	11:12	11:24	10:12	10:25	10:36	09:26	09:40	09:56
Temperature (Fahrenheit)	65.2	65.0	64.8	66.0	66.2	65.7	65.5	65.4	65.0
pH	8.0	7.7	7.8	7.6	7.5	7.8	7.0	7.0	7.3
Conductivity (micromhos/cm)	1700	1800	1800	3200	2700	2750	4500	3600	3700
BTS Chain of Custody	88287-T-1			88287-T-1			88287-T-1		
BTS Sample I.D.	S-5 LIQUID			S-6 LIQUID			S-7 LIQUID		
DHS EMTL Laboratory	IT CORPORATION			IT CORPORATION			IT CORPORATION		
Laboratory Sample I.D.	88-10-126-04			88-10-126-05			88-10-126-06		
Analysis To Detect	THC (GAS) & BTXE			THC (GAS) & BTXE			THC (GAS) & BTXE		

SAMPLING

Samples were obtained by standardized sampling procedures that follow an evacuation and sample collection protocol which conforms with State and Regional Water Quality Control Board standards and specifically adheres to EPA requirements for apparatus, sample containers and sample handling as specified in publication SW 846.

Included in the scope of work are routine measurements and investigative procedures which are intended to determine if the wells are suitable for evacuation and sampling. These include measurement of the total depth of the well; the depth to water (groundwater or free product zone), and the thickness of any free product zone (FPZ) encountered. The presence of a significant free product zone may interfere with efforts to collect a water sample that accurately reflects the condition of groundwater lying below the FPZ. This interference is caused by adhesion of petroleum to any device being lowered through the FPZ and the likelihood that minute globules of petroleum may break free of the sampling device and be included in the sample. Accordingly, evaluation of analytical results from wells containing any amount of free petroleum should take into account the possibility that positive results have been skewed higher by such an inclusion. The decision to sample or not sample such wells is left to the discretion of our field personnel at the site and the client's consultant who establishes sampling guidelines based on the need for current information on groundwater conditions at the site.

SAMPLING EQUIPMENT AND MECHANICS

If equipment is not specifically selected by the client, the apparatus for well evacuation and sample collection is selected by our field personnel based on an evaluation of the field conditions.

Four types of devices are commonly available for employment:

- Bailers
- High Volume Suction Pumps
- Electric Submersible Pumps
- USGS/Middleburg positive displacement sampling pumps

USGS/Middleburg pumps were selected for the samples collected at your site.

USGS/MIDDLEBURG POSITIVE DISPLACEMENT SAMPLING PUMPS

USGS/Middleburg positive displacement sampling pumps are EPA approved pumps appropriate for use in wells down to two inches in diameter and depths up to several hundred feet. The pump contains a flexible Teflon bladder which is alternately allowed to fill with well water and then collapsed. Actuation of the pump is accomplished with compressed air supplied by a single hose to one side of the Teflon membrane. Water on the other side of the membrane is squeezed out of the pump and up a Teflon conductor pipe to the surface. Evacuation and sampling are accomplished as a continuum. The rate of water

removal is relatively slow and loss of volatiles almost non-existent. There is only positive pressure on the water being sampled and there is no impeller cavitation or suction. The pumps can be placed at any location within the well, can draw water from the very bottom of the well case, and are virtually immune to the erosive effects of silt or lack of water which destroy other types of pumps.

Disadvantages associated with Middleburg pumps include their high cost, low flow rate, temperamental operation, and cleaning requirements which are both elaborate and time consuming.

SAMPLING METHODOLOGY

Our standard evacuation protocol calls for the removal of five case volumes of water. This is safely above accepted minimum evacuation levels and usually more than sufficient to insure the sampling of fresh formation water in all but truly oversized borings. However, this level of evacuation may not be obtainable from wells installed in certain formations. Rather than initiate a lengthy study of the well's recovery characteristics, incur the cost of a return visit, or otherwise second guess the professional responsible for the evaluation of the well's performance, our field personnel deal with non-recovering wells in the following manner: The volume of water removed prior to dewatering is noted for comparison to the five case volume standard. The well is allowed to recover during an interval of time which is reported in the table on page two. A sample is then drawn from the water that has recovered in the well case. When large diameter well cases are being evacuated, the pH, EC, and temperature parameters are carefully noted for the first indication of stabilization signifying that fresh formation water is entering and being removed from the well. This is typically after 3 case volumes of water have been evacuated.

The pumps and their associated lines and hoses are thoroughly cleaned between use in different monitoring wells. This has proven to be a far more effective safeguard against cross contamination than reliance on estimations of probable contamination.

SAMPLE HANDLING PROCEDURES

Sample material is collected in specially prepared containers appropriate to the type of analyses intended. These containers are supplied to us by the certified laboratory performing the analyses. Sample material to be analyzed for gasoline and its dissolved constituents is contained in 40 ml volatile organic analysis (VOA) vials prepared with hydrochloric acid preservative. Sample material to be analyzed for lead is contained in 250 ml VOA bottles with a nitric acid preservative. Sample material to be analyzed for diesel and other high boiling compounds is contained in 1 liter bottles without preservatives. Volatile organic analysis containers are filled and then sealed without headspace. All samples are promptly placed in an ice chest containing pre-frozen blocks of an ice substitute for transport to the laboratory under our standard chain of custody.

CHAIN OF CUSTODY

The chain of custody form requires time, date, and signature entries by the person releasing the samples and corresponding time, date, and signature entries by the person accepting custody of the samples. These notations are required at each transmittal.

HAZARDOUS MATERIALS TESTING LABORATORY

The samples obtained at this site were transported to the IT Corporation Santa Clara Valley Laboratory, which is located at 2055 Junction Avenue, San Jose, California. This laboratory has been assigned a California Department of Health Services certification as a Hazardous Materials Testing Laboratory. Their certification number is 137.

CERTIFIED ANALYTICAL REPORT

On completion of the requested analytical procedures, the laboratory issued their results in the form of a certified analytical report which is included as an attachment at the close of this report.

Please call if we can be of any further assistance.

Richard C. Blaine

RCB/rfs

attachments: chain of custody
certified analytical report

BLAINE TECH SERVICES INC.

1370 TULLY ROAD, SUITE 505
SAN JOSE, CA 95122
(408) 995-5535

CHAIN OF CUSTODY # 88787 T1

SITE SPECIFICATION Chettler Ryan #83122
Shell Station
3790 Hopyard Rd.
Pleasanton, Ca

( ) Bill BLAINE TECH SERVICES, Inc.
(X) Bill Jerry Mitchell

SPECIAL INSTRUCTIONS
58-10-126

SAMPLE I.D.	QUANTITY	TYPE	OK	ANALYSIS TO DETECT	STATUS	RESULTS	LAB NUMBER
S-2	3	L		TPH(GAS) BTXE	1wk	10/20	cool/OK
S-3							
S-4							
S-5							
S-6							
S-7							

Field sampling was performed by Thomas W Peeples

Sampling was completed at 12:00 AM/PM 10-13-1988

RELEASE OF SAMPLES FROM (name,time,date) ——>>>>> INTO THE CUSTODY OF (name,time,date)

from [illegible] @ 4:55 AM/PM 10/13-88 -> to [illegible] @ 4:55 AM/PM 10/13-88

from [illegible] @ 16:23 AM/PM 10/13-88 -> to [illegible] @ 16:23 AM/PM 10/13-88

from _____ @ ___:___ AM/PM _____-88 -> to _____ @ ___:___ AM/PM _____-88

The laboratory designated to perform these analyses is: IT/SCV DHS #HTL # 137
NOTE: Procedures and detection limits must confrom to RWQCB Region II specifications.
Please include chain of custody number and site specification on reports and invoices.

INTERNATIONAL TECHNOLOGY CORPORATION

Gettler-Ryan
1992 National Avenue
Hayward, CA 94545

October 27, 1988

ATTN: John Werfal

Following are the results of analyses on the samples described below.

Project:	G-R #83122/BTS #88287T1, Shell, 3790 Hopyard, Pleasanton
Lab Numbers:	S8-10-126-01 thru S8-10-126-06
Number of Samples:	6
Sample Type:	Water
Date Received:	10/13/88
Analyses Requested:	Low Boiling Hydrocarbons

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline and includes benzene, toluene, ethyl benzene and xylenes.

The E.P.A.'s method for aromatic hydrocarbons (method 602) specifies that the sample be preserved by acidification to pH2 or less as well as refrigeration of the volatile organics analysis containers. The samples listed below had pHs above 2.

IT Santa Clara Valley Lab Laboratory Number	Sample Identification
S8-10-126-05	S-6
S8-10-126-06	S-7

Fred Rouse

FR/tjh

1 Page Following - Table of Results

cc: Rich Blaine, Blaine Tech Services

IT Santa Clara Valley Lab to Gettler-Ryan
ATTN: John Werfal

October 27, 1988
Page 1 of 1

Project: G-R #83122/BTS #88287T1, Shell,
3790 Hopyard, Pleasanton

ND = None Detected

Summary of Results - Milligrams per Liter

Lab Number	Sample Identification	Low Boiling Hydrocarbons (calculated as gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes
S8-10-126-01	S-2	0.55	0.11	0.001	0.045	0.015
Detection Limit		0.05	0.002	0.001	0.001	0.003
S8-10-126-02	S-3	ND	ND	ND	ND	ND
Detection Limit		0.05	0.0005	0.001	0.001	0.003
S8-10-126-03	S-4	0.53	0.024	0.001	0.025	0.016
Detection Limit		0.05	0.0005	0.001	0.001	0.003
S8-10-126-04	S-5	0.56	0.066	0.020	0.018	0.036
Detection Limit		0.05	0.001	0.001	0.001	0.003
S8-10-126-05	S-6	1.1	0.013	0.001	0.042	0.033
Detection Limit		0.2	0.0005	0.001	0.001	0.003
S8-10-126-06	S-7	ND	0.0006	0.001	ND	ND
Detection Limit		0.05	0.0005	0.001	0.001	0.003

APPENDIX B

Log of Monitoring Wells S-6 and S-3. Explanation of Terms Used for Soil Description and Legend of Boring Log Symbols. IT Laboratory Analytical Soil and Groundwater Analyses. WCC Chain-of-Custody-Forms.

Woodward-Clyde Consultants

PROJECT NAME GETTLER-RYAN NO. 8820011A

MONITORING WELL LOCATION	Los Positas and Hopyard, Pleasanton, CA (S-6)							ELEVATION AND DATUM	
DRILLING AGENCY	Bay Land Drilling Co.	DRILLER	Kurt					DATE STARTED / DATE FINISHED	10/4/88
DRILLING EQUIPMENT	Truck mounted CME - 75							COMPLETION DEPTH	35'
DRILLING METHOD	8" Hollow stem augers	DRILL BIT						NO. OF SAMPLES	DIST. 7
SIZE AND TYPE OF CASING	3" PVC Threaded	FROM	35	TO	0	FT.		WATER LEVEL	FIRST
TYPE OF PERFORATION	0.020" Slot	FROM	35	TO	10	FT.		LOGGED BY:	K. Stevens
SIZE AND TYPE OF PACK	2/12 Lonestar Sand	FROM	35	TO	8	FT.		CHECKED BY:	M. Borkowski
TYPE OF SEAL NO. 1	Bentonite	FROM	8	TO	6.5	FT.			
TYPE OF SEAL NO. 2	Concrete	FROM	6.5	TO	0	FT.			

Depth (feet)	Samples	Blows	MATERIAL DESCRIPTION		USCS	Well Construction
			Asphalt and Gravel Base		SM	
5	1	pushed @ 250 psi	SILTY SAND silty sand with some gravel, loose, poorly sorted, dry	H Nu = 0.5 ppm No Hydrocarbon odor	CL	
10	2	3 4 7	CLAY dark gray clay, trace silt, very stiff, plastic	H Nu = 5.5 ppm No Hydrocarbon odor	CL	
15	3"	2 2 5	dark gray with trace gravel, very stiff, plastic, dry to damp	H Nu = 6 ppm No Hydrocarbon odor	CL	
20	4"	2 3 6	dark gray with layer fine silt, medium stiff, damp	H Nu = 130 ppm Hydrocarbon odor	CL	
25	5"	2 3 7	mottled brown, black, gray clay with occasional gravel, stiff, plastic, damp	H Nu = 4 ppm No Hydrocarbon odor	CL	
30	6	4 4 6	dark gray clay, very stiff, plastic	H Nu = 4.5 ppm No Hydrocarbon odor	CL	
			GRAVEL layer coarse gravel and some coarse sand, poorly sorted, wet		GP	
35						

PROJECT NAME GETTLER-RYAN NO. 8820011A

Depth (feet)	Samples	Blows	MATERIAL DESCRIPTION	USCS	Well Construction
35	7	4 5 7	CLAY dark gray clay with trace gravel, soft, plastic, wet H Nu = 1.5 ppm No Hydrocarbon odor	CL	
			Total Depth = 35.5 feet * = Lab Sample		
40					
45					
50					
55					
60					
65					
70					
75					
80					

LOG OF MONITORING WELL NO. S-6 SHEET 2 OF 2

PROJECT NAME GETTLER-RYAN NO. 8820011A

Depth (feet)	Samples	Blows	MATERIAL DESCRIPTION	USCS	Well Construction
35	7		dark green clay with trace gravel, soft, plastic, moist to wet PID = 0 ppm No Hydrocarbon odor	CL	
			Total Depth = 35.5 feet * = Lab Sample		

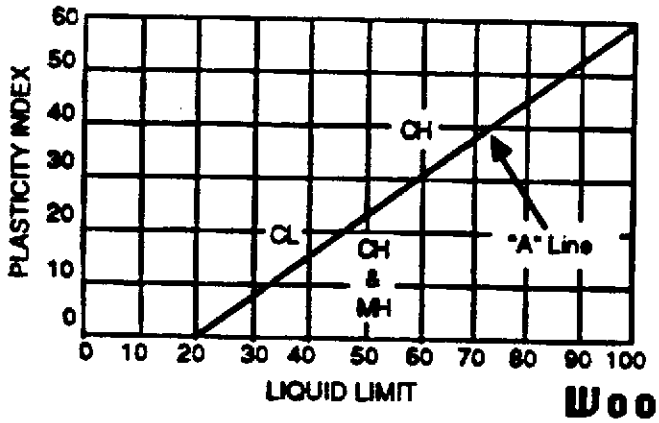
LOG OF MONITORING WELL NO. S-7 SHEET 2 OF 2

SAMPLE CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION SHCEME				
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

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

SAND OR GRAVEL	BLOWS/FT	SILT OR CLAY	BLOWS/FT	THUMB PENETRATION
Very loose	< 5	Very Soft	< 3	Very easily - inches
Loose	5 - 15	Soft	3 - 5	Easily - inches
Medium Dense	16 - 40	Medium (firm)	6 - 10	Moderate effort - inches
Dense	41 - 65	Stiff	11 - 20	Indented easily
Very Dense	> 65	Very Stiff	21 - 40	Indented by nail
		Hard	> 40	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

INTERNATIONAL TECHNOLOGY CORPORATION

Gettler-Ryan
1992 National Avenue
Hayward, CA 94545

October 26, 1988

ATTN: John Werfal

Following are the results of analyses on the samples described below.

Project:	G-R #9685/WCC #8820011A, Shell, Hopyard & Las Positas, Pleasanton
Lab Numbers:	S8-10-106-01 thru S8-10-106-03
Number of Samples:	3
Sample Type:	Soil
Date Received:	10/11/88
Analyses Requested:	Low Boiling Hydrocarbons

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline and includes benzene, toluene, ethyl benzene and xylenes.

Summary of Results

ND = None Detected

Parts per Million - (Dry Soil Basis)

Lab Number	Sample Identification	Low Boiling Hydrocarbons (calculated as gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes
S8-10-106-01	C-7/3A 14-15.5	ND	ND	ND	ND	ND
S8-10-106-02	C-7/2A 9-10.5	ND	ND	ND	ND	ND
S8-10-106-03	C-8/2A 9-10.5	ND	0.05	ND	ND	ND
Detection Limit		5.	0.05	0.1	0.1	0.3

Fred Rouse

FR/tjh

Santa Clara Valley Laboratory
2055 Junction Avenue • San Jose, California 95131 • 408-943-1540

INTERNATIONAL TECHNOLOGY CORPORATION

October 19, 1988

Gettler-Ryan
1992 National Avenue
Hayward, CA 94545

ATTN: John Werfal

Following are the results of analyses on the samples described below.

Project:	G-R #9685/WCC #8820011A, Shell, Hopyard & Las Positas, Pleasanton
Lab Numbers:	S8-10-075-01 thru S8-10-075-04
Number of Samples:	4
Sample Type:	Soil
Date Received:	10/5/88
Analyses Requested:	Low Boiling Hydrocarbons

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline and includes benzene, toluene, ethyl benzene and xylenes.

Summary of Results

ND = None Detected

Parts per Million - (Dry Soil Basis)

Lab Number	Sample Identification	Low Boiling Hydrocarbons (calculated as gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes
S8-10-075-01	S-7/4A 19.0-20.5	ND	ND	ND	ND	ND
S8-10-075-02	S-6/3A 14.0-15.5	9.	ND	ND	ND	ND
S8-10-075-03	S-6/4A 19-20.5	6.	0.05	ND	0.1	ND
S8-10-075-04	S-6/5A 24-25.5	ND	ND	ND	ND	ND
Detection Limit		5.	0.05	0.1	0.1	0.3

Fred Rouse

FR/tjh

Santa Clara Valley Laboratory
2055 Junction Avenue • San Jose, California 95131 • 408-943-1540

INTERNATIONAL
TECHNOLOGY
CORPORATION

October 27, 1988

Gettler-Ryan
1992 National Avenue
Hayward, CA 94545

ATTN: John Werfal

Following are the results of analyses on the samples described below.

Project:	G-R #83122/BTS #88287T1, Shell, 3790 Hopyard, Pleasanton
Lab Numbers:	S8-10-126-01 thru S8-10-126-06
Number of Samples:	6
Sample Type:	Water
Date Received:	10/13/88
Analyses Requested:	Low Boiling Hydrocarbons

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline and includes benzene, toluene, ethyl benzene and xylenes.

The E.P.A.'s method for aromatic hydrocarbons (method 602) specifies that the sample be preserved by acidification to pH2 or less as well as refrigeration of the volatile organics analysis containers. The samples listed below had pHs above 2.

IT Santa Clara Valley Lab Laboratory Number	Sample Identification
S8-10-126-05	S-6
S8-10-126-06	S-7

Fred Rouse

FR/tjh

1 Page Following - Table of Results

cc: Rich Blaine, Blaine Tech Services

IT Santa Clara Valley Lab to Gettler-Ryan
ATTN: John Werfal

October 27, 1988
Page 1 of 1

Project: G-R #83122/BTS #88287T1, Shell,
3790 Hopyard, Pleasanton

ND = None Detected

Summary of Results - Milligrams per Liter

Lab Number	Sample Identification	Low Boiling Hydrocarbons (calculated as gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes
S8-10-126-01	S-2	0.55	0.11	0.001	0.045	0.015
Detection Limit		0.05	0.002	0.001	0.001	0.003
S8-10-126-02	S-3	ND	ND	ND	ND	ND
Detection Limit		0.05	0.0005	0.001	0.001	0.003
S8-10-126-03	S-4	0.53	0.024	0.001	0.025	0.016
Detection Limit		0.05	0.0005	0.001	0.001	0.003
S8-10-126-04	S-5	0.56	0.066	0.020	0.018	0.036
Detection Limit		0.05	0.001	0.001	0.001	0.003
S8-10-126-05	S-6	1.1	0.013	0.001	0.042	0.033
Detection Limit		0.2	0.0005	0.001	0.001	0.003
S8-10-126-06	S-7	ND	0.0006	0.001	ND	ND
Detection Limit		0.05	0.0005	0.001	0.001	0.003

Woodward-Clyde Consultants

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

Chain of Custody Record

PROJECT NO.: 88200111A

SAMPLERS: (Signature)

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	BTEX	Low Boiling hydrocarbons as gasoline			Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
10/4		SB-7/4A						✓	✓			1	Normal 10 working Day turn around
		GR# 9685/Shell											
		Los Positas & Hopyard											
		Pleasanton CA											
		19.0 - 20.5											
10/4		SB-8/3A						✓	✓			1	
		GR# 9685/Shell											
		Los Positas & Hopyard											
		Pleasanton											
		14.0 - 15.5											
10/4		SB-4/4A						✓	✓			1	
		GR# 9685/Shell											
		Los Positas & Hopyard											
		Pleasanton											
		2.0 - 2.5											
10/4		SB-8/5A											
		GR# 9685/Shell						✓	✓			1	
		Los Positas & Hopyard											
		Pleasanton											
		24 - 25.5											

TOTAL NUMBER OF CONTAINERS: 4

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
K. [signature]	10 5	[signature]			

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

Woodward-Clyde Consultants

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

Chain of Custody Record

PROJECT NO. 882001I A

SAMPLERS: (Signature) [signature]

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	BTEX	Low boiling hydrocarbons gasoline			Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
10/4		C-7/3A						1	1			1	NORMAL TAT
		SR# 9685/Shell											
		Las Positas & Hopyard											
		Pleasanton											
		14-15.5											
10/4		C-7/2A						1	1			1	
		SR# 9685/Shell											
		Las Positas & Hopyard											
		Pleasanton											
		9-10.5											
10/4		C-4/2A						1	1			1	
		SR# 9685/Shell											
		Las Positas & Hopyard											
		Pleasanton											
		9-10.5											

TOTAL NUMBER OF CONTAINERS: 3

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
[signature]	10 / 6				

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

APPENDIX C

NUMERICAL MODELING

This appendix describes the application of a quasi-three-dimensional fluid flow model to simulate groundwater flow in the vicinity of the study site and the Arroyo Mocho Canal (Figure C-1). The principal objective of the model application was to evaluate whether the Arroyo Mocho Canal acts as a drain to shallow groundwaters, thus preventing the south-southeastward migration of shallow groundwaters to water wells south of the site.

In order to accomplish this, a numerical model was calibrated to groundwater data collected by the Pacific Environmental Group (1988). For the model simulation, it was assumed that the upper water-bearing zone was uniform throughout the modeled area. Application of analytical solutions from groundwater hydraulics to the data collected by PEG was considered. However, due to the change in saturated thickness of the shallow aquifer between the site and Arroyo Mocho Canal, the use of analytical solutions was deemed unsuitable. Therefore, a steady-state, finite-difference, cross-sectional flow model was utilized.

Model Discretization

A quasi-three-dimensional finite-difference fluid flow model developed by McDonald and Harbaugh (1984) was used to simulate the groundwater flow pattern in the vicinity of the study site and the Arroyo Mocho Canal. This model utilizes an approach developed by Bredehoeft and Pinder (1970). The code solves the two-dimensional fluid flow equation governing flow in each of several layers. Linkage between the layers is incorporated through transport of fluid between the adjoining layers. The model requires that

the area to be modeled be divided into finite-difference blocks (cells). For a given set of water-bearing zone properties and boundary conditions, the model simulates the hydraulic head changes with the modeled domain.

The size of the modeled area was chosen to minimize boundary effects on the solution. The modeled area (Figure C-2) is one foot wide, approximately 576 feet long (from the middle of Arroyo Mocho Canal perpendicular to groundwater contours to monitoring well S-2), and 17 feet thick (the observed saturated thickness of the water-bearing zone beneath the site). The grid spacing was 1 foot wide, 32 feet long, and 1 foot thick. The upper layer was defined as the top of groundwater in monitoring well S-2. The bottom of the modeled cross-section was the bottom of the monitoring wells at the study site. The model grid is shown schematically in Figure C-2.

Boundary Conditions

Boundary conditions were determined by the known physical characteristics of the site. The four types of boundaries used were (1) specified hydraulic head at the approximate location of monitoring well S-2 as reported by PEG (1988), (2) the bottom of Arroyo Mocho Canal was about 12.5 feet below the water-level at the study site as reported by PEG (1988), (3) the canal acted as a perennial drain with an approximate water-level 12 feet below the water-level in monitoring well S-2 as reported by PEG (1988), and (4) the uppermost seven layers above the drain were inactive model nodes to simulate the canal. At the specified hydraulic head boundary, the hydraulic head is maintained at the specified value throughout the simulation. The bottom of the Arroyo Mocho Canal was treated as a drain with a constant head boundary.

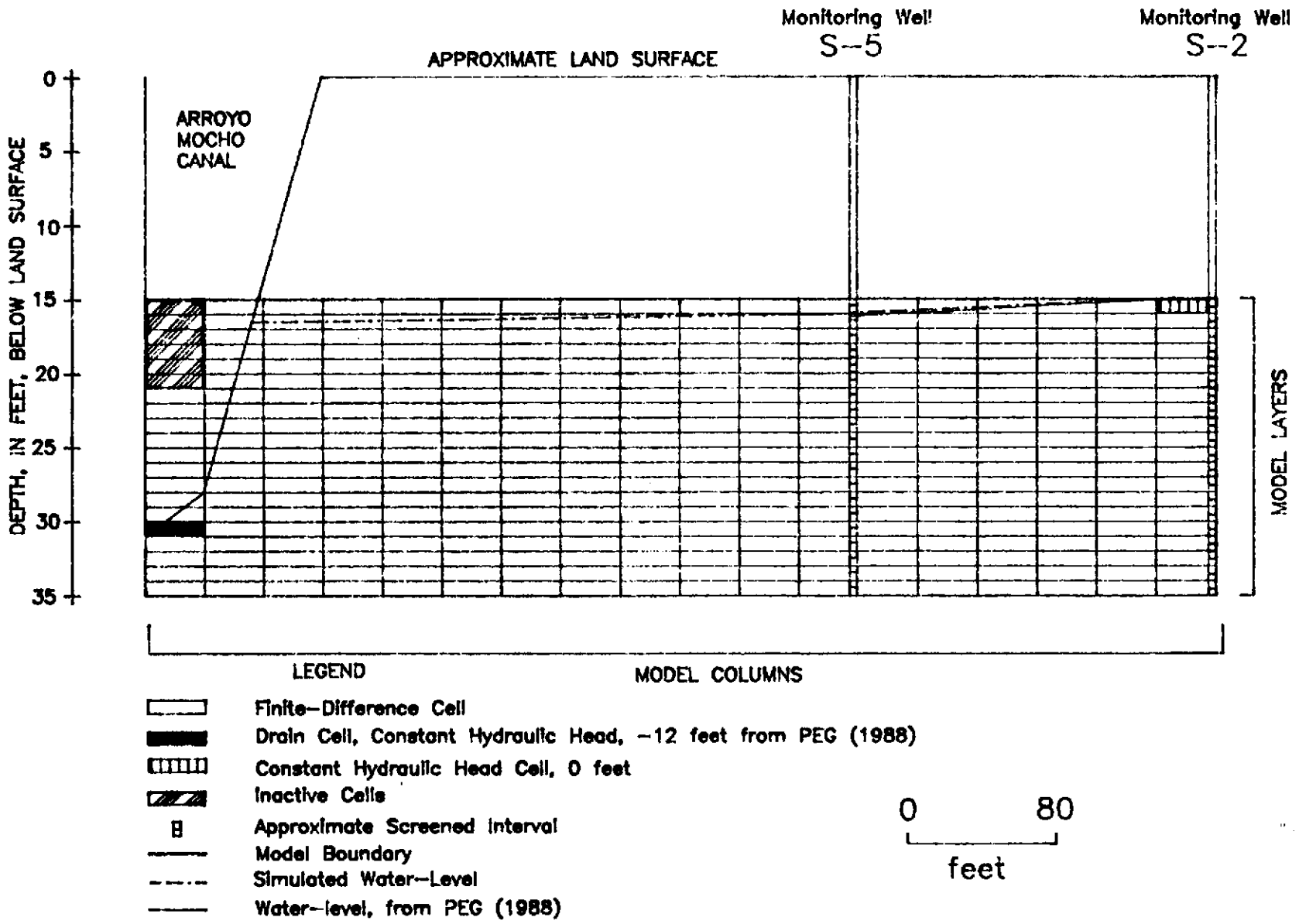
Calibration

During development of the steady-state model, the ratio of vertical to horizontal hydraulic conductivity was adjusted until a good fit to the reported gradient was simulated by the model. Hydraulic conductivity

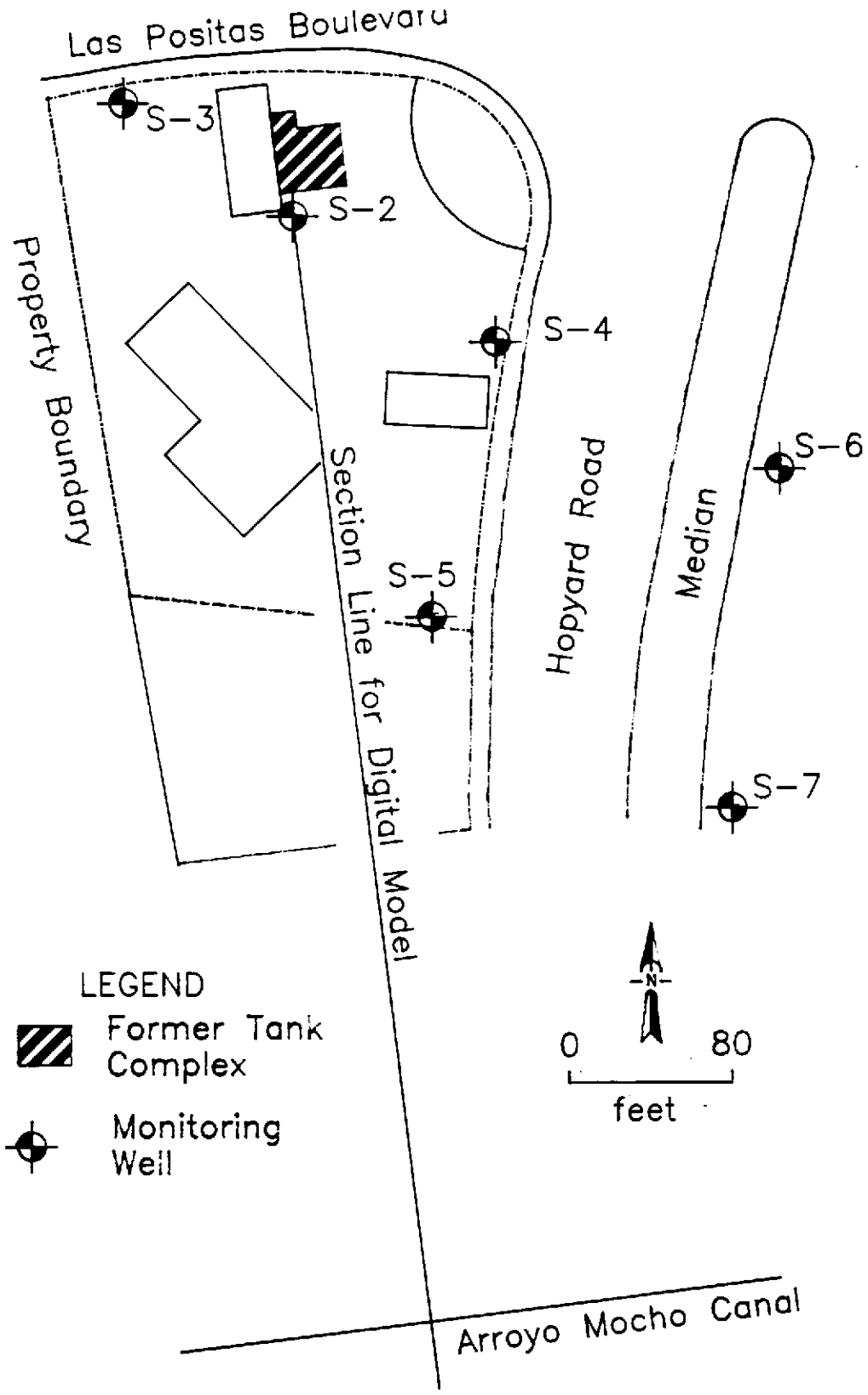
values could not be calculated because discharge data from the water-bearing zone to the canal was unknown. The calibrated water-level gradient projected from the site to Arroyo Mocho Canal is shown in Figure C-2.

Conclusion

The results of the model simulation suggest that the Arroyo Mocho Canal may drain shallow groundwaters and prevent the south-southeastward migration of shallow fluids from the study site (as long as there is water flowing in the canal).



Project No. 8820011A	Gettler--Ryan	SCHEMATIC DIAGRAM SHOWING FINITE--DIFFERENCE GRID ON SECTION LINE FOR DIGITAL MODEL WITH SIMULATED AND REPORTED WATER--LEVELS, SHELL SERVICE STATION 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA	Figure C2
Woodward--Clyde Consultants			



Project No. 8820011A	Gettler–Ryan	EXTENDED SITE MAP SHOWING SECTION LINE FOR THE DIGITAL MODEL FROM ARROYO MOCHO CANAL TO MONITORING WELL S–2, SHELL SERVICE STATION, 3790 HOPYARD ROAD, PLEASANTON, CALIFORNIA	Figure C1
Woodward–Clyde Consultants			