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**Supplemental Report of
Geoenvironmental Services
Subsurface Contamination Study
Unocal Service Station 5353
Seattle, Washington**

July 7, 1992

**For
Unocal**

July 7, 1992

Geotechnical,
Geoenvironmental and
Geologic Services

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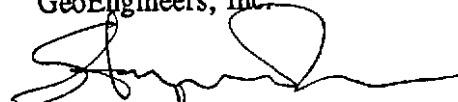
Attention: Mr. Gary Gunderson

We are submitting five copies of our "Supplemental Report of Geoenvironmental Services" for Unocal Service Station 5353 in Seattle, Washington. Mr. Gary Gunderson of Unocal verbally authorized our services on October 1, 1991. Contractual terms for our services are described in blanket contract number B1982F.

Several other reports summarizing other aspects of this project are currently being completed. These include reports summarizing Phase I ESA (environmental site assessment) research, operation and monitoring of the VES (vapor extraction system) on Unocal property since January 1991, operation and monitoring of the interim VES on city of Seattle property since January 1992, and air monitoring on city of Seattle property since October 1991. We anticipate that drafts of these reports will be available by September 1, 1992.

We appreciate the opportunity to be of continued service to Unocal. Please call if you have questions regarding this report.

Yours very truly,
GeoEngineers, Inc.



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**SUPPLEMENTAL REPORT OF GEOENVIRONMENTAL SERVICES
SUBSURFACE CONTAMINATION STUDY
UNOCAL SERVICE STATION 5353
SEATTLE, WASHINGTON
FOR
UNOCAL**

INTRODUCTION

This report presents the results of our subsurface petroleum contamination study at the site of Unocal Service Station 5353. The property owned by Unocal consists of the southern half of the city block bounded by Mercer Street to the south, Westlake Avenue to the west, Valley Street to the north and Terry Avenue to the east. The Unocal property consists of Unocal Service Station 5353 (600 Westlake Avenue North) and an adjacent Denny's restaurant (601 Terry Avenue North) to the east. The northern half of the city block described above is owned by the city of Seattle. The United States Public Land Survey system description for the site is the SE $\frac{1}{4}$ of the NE $\frac{1}{4}$ and the NE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 30, Township 25 North, Range 4 East. The Ecology (Washington State Department of Ecology) UST (underground storage tank) Site Number is 008463. The site location is shown relative to surrounding physical features in Figure 1. The site location and the immediate vicinity are shown in Figure 2.

Unocal Service Station 5353 is the site of an 80,000 gallon release of leaded premium gasoline that occurred in 1980. Previous investigations at the site defined the limits of the resulting free product plume and monitored free product recovery operations. GeoEngineers conducted additional subsurface explorations between October 1991 and February 1992 to define the approximate extent and concentrations of residual petroleum contamination in soil and ground water in the vicinity of the site.

HISTORICAL BACKGROUND

GeoEngineers conducted a phase I ESA (environmental site assessment) for the site in 1992. The results of the ESA will be presented in a separate report in the near future. A summary of the historical information gathered during our ESA is presented in the following sections.

AREA HISTORY

The site is located about 500 feet south of the present southern shoreline of Lake Union. The original shoreline of Lake Union extended south of the present alignment of Mercer Street, and south of the Unocal site. In the late 1800s, the south end of Lake Union was developed predominantly with lumber mills and related facilities. The mills were typically built on piles over the water to facilitate transportation of raw logs to the mills. Sawdust and wood waste generated by the mills were dumped in the lake, leaving thick deposits of wood debris. The southern lake shore was extended northward by the accumulations of wood waste and other fill

materials. As the lake shore was extended northward, the mills shifted their locations northward to remain over the water. By 1905 the south shore of Lake Union was along the present alignment of Valley Street. By 1912, the shoreline was extended further north, approximately to its present position.

The land use in the area of the site between the late 1800s and the present was primarily commercial, light industrial and heavy industrial. A service station owned by Shell Oil was located at the southwest corner of the intersection between Westlake Avenue and Valley Street approximately between 1948 and 1958. A service station owned by Unocal was located at southeast corner of the intersection between Westlake Avenue and Valley Street approximately between 1938 and 1965. A service station presently owned by Texaco is located at the northwest corner of the intersection between Mercer Street and Boren Avenue, about 1½ blocks east of the Unocal site. The Texaco station is the site of documented soil and ground water contamination.

SITE HISTORY

The location of the present site was covered by Lake Union before the south shore of the lake was extended northward in the late 1800s. In 1893, the site was occupied by the Brace and Hergert Mill Company. Century Brewing Company and Horluck Creameries Inc. occupied the site from some time between 1917 and 1935 until 1965. Unocal leased the site from 1965 until 1968, and has owned the site since 1968. The western half of the site has been occupied by and operated as a service station since 1965, and the eastern half of the site has been occupied by a Denny's restaurant since 1968.

The original Unocal service station at the site was constructed in 1965. The configuration of the station at that time included three service bays with two hydraulic hoists, one 280-gallon steel waste oil UST, one 550-gallon steel heating oil UST, two 10,000-gallon steel gasoline USTs and steel product lines to four service islands. In 1966 a fourth service bay was added to the station building. The 280-gallon steel waste oil UST was replaced with a 550-gallon UST sometime between 1966 and 1977. An additional 8,000-gallon steel gasoline UST was installed in 1977. The 1980 site layout is shown in Figure 3. In mid-1980 the steel gasoline USTs were replaced with four 10,000-gallon fiberglass gasoline USTs, and the steel product lines were replaced with fiberglass product lines. The steel heating oil and waste oil USTs were relocated in 1980. In 1985, the two western service islands were extended southward and additional product dispensers were installed. The present configuration of the station includes four service bays with three single post hydraulic hoists and one dual post hydraulic hoist, one 550-gallon steel heating oil UST, one 550-gallon steel waste oil UST, four 10,000-gallon fiberglass gasoline USTs, and associated fiberglass product lines. The current site layout is shown in Figure 4.

ASSESSMENT AND CLEANUP HISTORY

In May 1980 Unocal employees detected a gasoline leak at Service Station 5353. Based on inventory records, Unocal estimated that as much as 80,000 gallons of leaded premium gasoline had been released during the four month period prior to detection of the leak. The gasoline USTs and product lines were immediately removed and replaced with fiberglass tanks and lines. Observations made during the 1980 tank removal activities indicated that the gasoline had leaked from a product line near the western service islands. The apparent location of the product line leak is shown in Figure 5.

A total of 25 monitoring wells were drilled and installed in 1980 to assess the extent of free product floating on the ground water surface beneath the site. The approximate locations of these monitoring wells are shown in Figure 6. An extensive free product plume was encountered, extending beneath the Unocal site, north to Valley Street, west into Westlake Avenue and south into Mercer Street. The approximate maximum limits of the free product plume, based on data gathered from the 25 monitoring wells completed in 1980, are shown in Figure 6.

In June 1980 a free product recovery system was installed at the site. The subsurface portion of the free product recovery system consisted of several rock-filled trenches and excavations, with recovery points consisting of 4-foot-diameter perforated CMP (corrugated metal pipe). The subsurface portion of the free product recovery system is shown in Figure 7. The recovery system was operated from June 1980 until October 1982. A total of approximately 41,900 gallons of gasoline were recovered during this period.

In June 1988 a subsurface VES (vapor extraction system) was installed at the site. The subsurface portion of the free product recovery system was used as the collection portion of the VES. The purpose of the VES was to reduce concentrations of combustible vapors beneath the site. The VES operated continuously from June 1988 to January 1991. Concentrations of combustible vapors recovered by the VES declined significantly during the period between June 1988 and January 1991. The VES has been operated intermittently from January 1991 to the present. GeoEngineers estimates that approximately 4,450 gallons of liquid gasoline (approximately 184,110 cubic feet of gasoline vapor) and approximately 133,000 cubic feet of methane have been removed by the subsurface VES through January 1992.

SCOPE

The 1980 investigation at the site was directed toward evaluating the limits of the plume of free product present beneath the site and in the immediate area. In July 1991 Unocal requested that GeoEngineers perform a subsurface contamination study to evaluate the extent of petroleum-related soil and ground water contamination in the vicinity of the site. In our "Work Plan, Supplemental Subsurface Contamination Study" dated August 13, 1991, GeoEngineers outlined a scope of services for this purpose. The scope of services completed for this phase of the project is as follows.

1. Monitor the drilling of 18 soil borings at the approximate locations shown in Figure 8 using hollow-stem auger drilling equipment.
2. Obtain soil samples from the borings at 2½-foot intervals and conduct field screening for potential contamination on each soil sample using visual, water sheen and headspace vapor screening methods. These methods are described in Appendix A.
3. Test one or more soil samples from each boring for gasoline by Ecology Method WTPH-G and for BETX (benzene, ethylbenzene, toluene and xylenes) by EPA Method 8020. Selected soil samples were also analyzed for fuel hydrocarbons (gasoline-range and diesel-range) by modified EPA Method 8015, and for total lead by EPA Method 6010.
4. Monitor the installation of a 4-inch-diameter PVC monitoring well casing with a flush-grade, lockable surface monument in boring MW-35.
5. Monitor the installation of a 2-inch-diameter PVC monitoring well casing with flush-grade, lockable surface monuments in each of the remaining borings.
6. Develop the well screens by hand bailing.
7. Determine the monitor well casing elevations to an accuracy of 0.01 foot using a laser level.
8. Measure the depth to ground water in each well in order to determine water table elevations and ground water flow direction.
9. Measure the thickness of free (floating) product in the new monitoring wells, where free product is present.
10. Measure combustible vapor concentrations in the monitoring well casings using a Bacharach TLV Sniffer calibrated to hexane.
11. Obtain ground water samples from each new monitoring well for laboratory analysis of fuel hydrocarbons by modified EPA Method 8015, BETX by EPA Method 8020 and dissolved lead by EPA Method 7421.
12. Evaluate the field and laboratory data with regard to existing regulatory concerns.

GeoEngineers proposed completing 20 borings for this assessment in our August 13, 1991 work plan. Borings at the final two locations, directly north and south of the Denny's restaurant building, have not yet been completed and await property access agreements.

SITE CONDITIONS

GENERAL

Unocal Service Station 5353 is located on the western portion of the property currently owned by Unocal. A Denny's restaurant is located on the eastern portion of the site. The Unocal property measures about 240 feet by 180 feet in plan dimensions.

The service station is currently active. We understand that Unocal has no immediate plans for closing the station. The current facility includes the service station building, four service bays with hydraulic hoists, four service islands, two canopies, one 550-gallon steel waste oil UST, one 550-gallon steel heating oil UST, four 10,000-gallon fiberglass gasoline USTs and fiberglass product lines (Figure 4).

SURFACE TOPOGRAPHY

The general topography in the area surrounding the site slopes gently downward toward Lake Union. The site is relatively flat with an approximate ground surface elevation of 20 feet above mean sea level (USGS datum). The ground surface of the eastern half of the city property located immediately north of the Unocal site is approximately 8 feet to 10 feet lower than the grade of the surrounding area. This local low point collects surface runoff from a large area. The runoff is collected in a sump located on the city property and pumped to a storm drain located on the Unocal site. The Unocal property and the city property are separated by a concrete retaining wall.

SUBSURFACE SOIL CONDITIONS

Subsurface soil conditions beneath the site and in its general vicinity were explored by drilling 18 soil borings (MW-32A through MW-49) at the approximate locations shown in Figure 8. The 18 borings were completed to depths ranging between 21.5 feet and 29.0 feet. The boring logs for borings MW-1 through MW-6, MW-11 through MW-20, MW-22 through MW-25, MW-27 and MW-29 through MW-32 (Figure 6), completed during the 1980 study, were reviewed to supplement the borings drilled for this study. Details of the field exploration program and the boring logs for this study are presented in Appendix A.

Most of the borings completed for this study encountered thin, discontinuous zones of mixed fill materials consisting of clean sand, sand with silt, silty sand, silty gravel, and silt. Borings MW-36, MW-48 and MW-49, all located north of the site, encountered a relatively continuous thickness of silty sand. Boring MW-44, located northwest of the site, encountered a continuous section of silt. Occasional wood chips were observed in soil samples obtained from most of the borings. On-site borings MW-45 and MW-47, and off-site borings MW-39 and MW-41, encountered zones of sawdust or wood chips ranging from several feet to greater than 10 feet in thickness. Borings MW-18 through MW-20, and MW-29, MW-30, MW-31, completed during the 1980 study, also encountered zones of sawdust or wood chips.

Borings MW-29 and MW-31, completed during the 1980 study, were drilled to depths of 70 feet and 65 feet, respectively. Native sand with varying amounts of gravel and discontinuous silt lenses were encountered in these borings beginning at depths of 37 feet and 33 feet, respectively. The native sand extended to the base of the borings in both MW-29 and MW-31.

GROUND WATER CONDITIONS

Ground water conditions at the site were explored by constructing a 2-inch-diameter monitoring well in 17 of the borings, and a 4-inch-diameter monitoring well in one of the borings (MW-35).

GeoEngineers measured depths to ground water in monitoring wells MW-32A through MW-47 on November 4 and 5, 1991. The depths to ground water were measured in monitoring wells MW-32A through MW-49 on June 22 and 23, 1992. The depths to ground water in November 1991 ranged from 8.54 feet to 13.36 feet below grade. The depths to ground water in June 1992 ranged from 7.24 feet to 11.75 feet below grade, excluding monitoring well MW-49 (which is located 8 feet to 10 feet lower than the other monitoring wells). The general direction of ground water flow in both November 1991 and June 1992 was toward the northeast, although considerable variation in flow direction occurs in localized areas. Ground water elevations and ground water elevation contours, based on survey data and water levels measured in November 1991 and June 1992, are shown in Figure 9 and Figure 10, respectively.

SUBSURFACE CONTAMINATION

The presence of petroleum-related subsurface soil and ground water contamination at the site was evaluated by: (1) field screening soil samples obtained from the supplemental borings, (2) selecting soil samples for laboratory analysis based on field screening results, (3) testing the selected soil samples for gasoline-related compounds, (4) measuring the airspace in each monitoring well casing for the presence of combustible vapors, (5) measuring the thickness of free product, if present, in the monitoring wells, (6) obtaining ground water samples from each monitoring well, and (7) testing the ground water samples for gasoline-related compounds.

Field screening procedures are described in Appendix A. Field screening results are summarized in Table 1 and shown on the boring logs in Appendix A. The subsurface soil analytical data are summarized in Table 1. Ground water analytical data and combustible vapor concentrations are summarized in Table 2. The laboratory reports for the soil and ground water samples, and an analysis of laboratory QA/QC (quality assurance/quality control) are included in Appendix B.

Field Screening Results

Field screening results indicating the presence of gasoline-related contamination (moderate to high combustible vapor concentrations and moderate to heavy sheens) were observed in soil samples obtained from 12.5 feet and 15.0 feet in MW-32A; 12.5 feet in MW-33; 2.5 feet, 5.0 feet, 7.5 feet and 10.0 feet in MW-34; 10.0 feet, 12.5 feet and 15.0 feet in MW-35; and from 2.5 feet, 5.0 feet, 7.5 feet and 10.0 feet in MW-45. Field screening results indicating the presence of oil-related contamination (low to moderate combustible vapors and moderate to heavy sheens) were observed in soil samples obtained from 3.0 feet, 8.0 feet, 10.5 feet, 13.0 feet, 15.5 feet and 18.0 feet in MW-49. Soil samples obtained from zones with sawdust in soil,

especially in borings MW-35, MW-38, MW-39, MW-41, MW-42 and MW-43, typically had moderate concentrations of combustible vapors and slight to no sheens. Field screening results in soil samples obtained from borings MW-36, MW-37, MW-38, MW-39, MW-40, MW-41, MW-42, MW-43, MW-44, MW-46, MW-47 and MW-48 did not suggest the presence of petroleum-related soil contamination.

Soil Analytical Data

A total of 35 soil samples obtained from the 18 borings were selected for chemical analysis. The samples were selected to characterize zones of potential petroleum-related soil contamination tentatively identified by field screening. In the borings where field screening did not indicate the presence of petroleum-related soil contamination, samples were selected from zones where soil contamination was most likely, usually from near the ground water table. All of the selected soil samples were analyzed for the presence of BETX by EPA Method 8020 and gasoline-range hydrocarbons by Ecology Method WTPH-G, except samples MW-41-7 and MW-47-3. These two samples were analyzed for the presence of fuel hydrocarbons (gasoline-range and diesel-range) by modified EPA Method 8015. Samples MW-33-3, MW-34-5, MW-36-3, MW-39-5, MW-40-4, MW-43-4, MW-44-5, MW-45-3, MW-49-1 and MW-49-3 were analyzed for fuel hydrocarbons in addition to BETX and WTPH-G. The fuel hydrocarbons test was used when sample location or field screening results indicated the possible presence of a petroleum product other than gasoline. The fuel hydrocarbons test was also used where field screening indicated moderate concentrations of combustible vapors where wood was present in the samples. Samples MW-32-5, MW-32-7, MW-33-3, MW-34-5, MW-34-7, MW-35-5, MW-36-3, MW-38-3, MW-39-5, MW-40-4, MW-42-5, MW-43-4, MW-45-3 and MW-45-6 were also analyzed for total lead by EPA Method 6010. The soil analytical data are summarized in Table 1.

Benzene, ethylbenzene, toluene and/or xylenes were detected at concentrations greater than the soil cleanup levels (MTCA Method A soil cleanup levels) in soil samples MW-32-5, obtained from a depth of 12.5 feet; MW-34-5, obtained from a depth of 12.5 feet; MW-37-5, obtained from a depth of 15.0 feet; MW-45-3, obtained from a depth of 7.5 feet; MW-45-5, obtained from a depth of 15.0 feet; MW-49-3, obtained from a depth of 15.5 feet (the ground surface in the area of boring MW-49 is 8 feet to 10 feet below the ground surface in the areas of the other borings); and MW-49-6, obtained from a depth of 23.0 feet. Benzene was detected at concentrations approaching but not exceeding the soil cleanup levels in samples MW-32-7 (0.33 mg/kg [milligrams per kilogram]), obtained from a depth of 22.5 feet; MW-34-6 (0.28 mg/kg), obtained from a depth of 20.0 feet; and MW-42-5 (0.20 mg/kg), obtained from a depth of 15.0 feet. Benzene, ethylbenzene, toluene and/or xylenes either were not detected or were detected at concentrations significantly less than the soil cleanup levels in the remaining soil samples tested.

Gasoline-range hydrocarbons were detected by the WTPH-G test at concentrations exceeding the soil cleanup level in soil samples MW-32-5; MW-34-5; MW-34-6; MW-45-3; MW-49-1, obtained from a depth of 3.0 feet; MW-49-3; and MW-49-6. Gasoline-range

hydrocarbons were detected at concentrations approaching but not exceeding the soil cleanup level in samples MW-33-3 (60 mg/kg), obtained from a depth of 12.5 feet; and MW-37-5 (80 mg/kg). Gasoline-range hydrocarbons either were not detected or were detected at concentrations significantly less than the soil cleanup levels in the remaining soil samples tested.

Gasoline-range hydrocarbons were detected by the fuel hydrocarbons test at concentrations exceeding the soil cleanup levels in soil sample MW-34-5. Gasoline- and diesel-range hydrocarbons were detected at concentrations exceeding the soil cleanup levels in soil samples MW-45-3 and MW-49-3. Gasoline- and diesel-range hydrocarbons were detected at concentrations approaching but not exceeding the soil cleanup levels in soil sample MW-49-1. Examination of the chromatograms provided by the fuel hydrocarbons test indicated that the contaminant present in soil samples MW-34-5 and MW-45-3 was weathered gasoline and possibly another unidentified gasoline-range product, and that the contaminant present in soil samples MW-49-1 and MW-49-3 was a combination of gasoline, possibly another unidentified gasoline-range product, and heavy oil. Gasoline- and diesel-range hydrocarbons were not detected in the remaining samples tested.

Total lead was detected at concentrations exceeding the soil cleanup level in soil samples MW-36-3 and MW-45-3. The concentration of total lead detected in sample MW-36-3 (3,900 mg/kg) was much greater than the soil cleanup level. Hydrocarbons were not detected in sample MW-36-3. Total lead either was not detected or was detected at concentrations significantly less than the soil cleanup level in the remaining samples tested.

Combustible Vapors Measurements

Combustible vapor concentrations in the monitoring well casings were measured on November 15, 1991 with a Bacharach TLV Sniffer calibrated to hexane. The VES had not been operating for two weeks prior to these measurements. Combustible vapors were not measured in MW-35, MW-48 and MW-49. Combustible vapors were measured in MW-32A, MW-36 through MW-40, MW-42, MW-43 and MW-45 through MW-47 at concentrations greater than 10,000 ppm (parts per million). Combustible vapors were measured in MW-33, MW-34, MW-41 and MW-44 at concentrations of 2,200 ppm, 520 ppm, 7,000 ppm and 3,800 ppm respectively. The combustible vapor concentration measurements are summarized in Table 2.

Free Product Measurements

Small amounts of free product were detected in monitoring wells MW-35 (0.02 feet) and MW-45 (0.01 feet). The product was dark brown, relatively nonviscous and had a gasoline-like odor.

Ground Water Analytical Data

Ground water samples were obtained from MW-32A through MW-47 on November 4 and November 5, 1991, and from MW-48 and MW-49 on January 29, 1992. The ground water samples were analyzed for BETX by EPA Method 8020, fuel hydrocarbons (gasoline-range and

diesel-range) by modified EPA Method 8015 and dissolved lead by EPA Method 7421. The samples analyzed for dissolved lead were filtered in the field. The ground water analytical data are summarized in Table 2.

Benzene, ethylbenzene, toluene and xylenes were detected at concentrations exceeding the ground water cleanup levels (MTCA Method A ground water cleanup levels) in the ground water samples obtained from monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-37, MW-45, MW-48 and MW-49. Benzene only was detected at concentrations exceeding the ground water cleanup level in the ground water samples obtained from monitoring wells MW-36, MW-40, MW-41, MW-42, MW-43 and MW-47. BETX either was not detected or was detected at concentrations significantly less than the ground water cleanup levels in the ground water samples obtained from the remaining monitoring wells.

Gasoline-range hydrocarbons were detected at concentrations equal to or greater than the ground water cleanup level in the ground water samples obtained from monitoring wells MW-32A through MW-37, MW-45, MW-48 and MW-49. Diesel-range hydrocarbons were detected at concentrations exceeding the ground water cleanup level in the ground water samples obtained from MW-45, MW-48 and MW-49. Examination of the chromatograms provided by the fuel hydrocarbons analysis indicated that the contaminant present in the ground water samples is weathered gasoline. Gasoline- and diesel-range hydrocarbons were not detected in the ground water samples obtained from the remaining monitoring wells.

Dissolved lead was detected at concentrations equal to or exceeding the ground water cleanup level in the ground water samples obtained from monitoring wells MW-32A, MW-34, MW-45 and MW-46. Dissolved lead was detected at a concentration approaching but not exceeding the ground water cleanup level in the ground water sample obtained from MW-33 (0.045 mg/l [milligrams per liter]). Dissolved lead was not detected in the ground water samples obtained from the remaining monitoring wells.

CONCLUSIONS

The results of this study indicate the presence of subsurface petroleum-related contamination in the soil and ground water beneath most of the Unocal site. Trace amounts of free product were observed in on-site wells MW-35 and MW-45, and occasionally observed in monitoring wells MW-2 and MW-19, completed during the 1980 study. High concentrations of combustible vapors are present in the casings of on-site and off-site monitoring wells. The soil contamination extends off site southward beneath Mercer Street, northward beneath the city property to the north of the site, and possibly westward beneath Westlake Avenue. The ground water contamination extends off site in all directions.

Very small amounts of a gasoline-like free product were measured in monitoring wells MW-35 and MW-45 in November 1991. During routine monitoring of the VES operating at the site, small amounts of free product are occasionally measured in monitoring wells MW-2 and

MW-19, completed during the 1980 study. Free product has not been observed during the routine VES monitoring of MW-3, located between MW-35 and MW-45. MW-3 also was completed during the 1980 study.

Small remnants of the original free product plume appear to be present on site and off site. Wells MW-2, MW-35 and MW-45 are located immediately adjacent to the concrete retaining wall between the Unocal property and the city property. This retaining wall may be acting as a hydraulic barrier behind which the remaining free product accumulates.

High to very high concentrations of combustible vapors were detected in all of the monitoring wells completed for this study except MW-34. Chemical analysis of vapor samples performed during routine VES monitoring has indicated that the combustible vapors present in the monitoring wells completed for the 1980 study are composed predominantly of methane, although significant concentrations of volatile hydrocarbons are also present (Table A-3, Progress Report Number 2, January 3, 1991). The origin of the methane present in the vicinity of the site could be either the anaerobic decomposition of hydrocarbons in the subsurface or the anaerobic decomposition of other organic materials such as wood waste. Subsurface deposits of wood waste were encountered in several borings completed for both this study and the 1980 study. GeoEngineers is presently conducting analyses to establish the origin of the methane present in the monitoring well casings using carbon dating, and other techniques. If the analyses are successful, we expect to establish the origin of the methane by the end of July 1992.

Field screening and analytical testing of soil samples obtained from the borings completed for this study indicate the presence of petroleum-related soil contamination in borings MW-32A, MW-33, MW-34, MW-35 and MW-45, located in the northern and western portions of the Unocal site, in boring MW-37 located in Mercer Street, and in boring MW-49 located near the center of the city property to the north of the Unocal site. The contaminated soil encountered in borings MW-32A, MW-33, MW-35 and MW-37 appears to be located in a 5-foot to 10-foot-thick zone centered near the ground water table at approximately 10 feet below grade. In boring MW-34, located within several feet of the 1980 product line leak, soil contamination was present from the surface to a depth of about 20 feet. In boring MW-45, located near the property line between the Unocal property and the city property, soil contamination was present from the surface to a depth of about 15 feet. In boring MW-49, located near the center of the city property, soil contamination was present from the surface to a depth of about 23 feet, or possibly deeper. The contaminants detected in soil samples obtained from borings MW-32A, MW-33, MW-34, MW-35, MW-37 and MW-45 were BETX and gasoline-range compounds. BETX and gasoline-range compounds were also present in the soil samples obtained from boring MW-49, located on the city property, but the predominant contaminant in this boring was an unidentified heavy hydrocarbon resembling motor oil. This contaminant was not detected in the borings on the Unocal site, and may originate from a source other than the Unocal service station.

Lead was detected at a concentration exceeding the soil cleanup level in the soil sample obtained from a depth of 7.5 feet in MW-45. This lead may be related to activities at the Unocal service station. Lead was detected at a very high concentration in the soil sample obtained from

a depth of 7.5 feet in MW-36. Boring MW-36 is located more than 180 feet from the site and no petroleum contamination was detected in this sample. In our opinion, the lead detected in the soil sample obtained from MW-36 is not related to activities at the Unocal service station. Field screening and analytical testing of soil samples obtained from the borings completed for this study do not indicate the presence of petroleum-related soil contamination at concentrations approaching or exceeding the soil cleanup levels in borings MW-40 and MW-41 (located south of the site), in borings MW-39, MW-43 and MW-44 (located west of the site), in borings MW-36, MW-47 and MW-48 (located east of the site), or in borings MW-38 and MW-46 (located northeast of the site).

The approximate areal limits of petroleum-contaminated soil based on field screening and analytical testing of soil samples obtained from the borings completed for this study are shown in Figure 11.

Analytical testing of ground water samples obtained from the monitoring wells completed for this study indicate the presence of gasoline-related ground water contamination at concentrations exceeding the ground water cleanup level in monitoring wells MW-32A, MW-33, MW-34, MW-35 and MW-45 (located on the Unocal site), in monitoring well MW-37 (located upgradient of the site in Mercer Street), in monitoring well MW-49 (located downgradient of the site on city property), and in monitoring wells MW-36 and MW-48 (located downgradient of the site in Terry Avenue). Benzene, ethylbenzene, toluene and/or xylenes were detected at concentrations exceeding the ground water cleanup levels in the monitoring wells listed above. Benzene only was detected at concentrations exceeding the ground water cleanup level in monitoring wells MW-42 and MW-43 (located crossgradient of the site in Westlake Avenue), in monitoring well MW-40 (located upgradient of the site in Mercer Street), in monitoring well MW-47 (located crossgradient of the site in Terry Avenue), and in monitoring well MW-41 (located upgradient of the site in Westlake Avenue). In our opinion, because monitoring well MW-41 is located about 390 feet upgradient of the Unocal site, the benzene detected in the ground water sample obtained from MW-41 probably originates from a source other than the Unocal site.

Dissolved lead was detected at concentrations approaching or exceeding the ground water cleanup level in monitoring wells MW-32A, MW-34, MW-45 and MW-46. In our opinion, the dissolved lead detected in monitoring wells MW-32A, MW-34 and MW-45 may be related to activities at the Unocal service station, but the dissolved lead detected in monitoring well MW-46 is not.

Analytical testing of ground water samples obtained from the monitoring wells completed for this study do not indicate the presence of petroleum-related ground water contamination in monitoring wells MW-39 and MW-44 (located crossgradient of the site in Mercer Street and Westlake Avenue), or in monitoring wells MW-38 and MW-46 (located downgradient of the site in Terry Avenue).

The limits of the plume of ground water contaminated with gasoline and/or BETX is not defined to the east, northwest or south of the Unocal site. The estimated areal limits of the gasoline-contaminated ground water and the BETX-contaminated ground water based on the ground water samples obtained from monitoring wells completed for this study are shown in Figure 12.

PRELIMINARY RECOMMENDATIONS

GeoEngineers recommends installing passive free product recovery devices in monitoring wells MW-35, MW-45 and 1980 well MW-2. The operation of these devices should be monitored regularly.

We recommend that operation of the VES located at the Unocal site be continued to reduce the concentrations of gasoline vapors beneath the Unocal site and the adjacent properties.

When the necessary access agreements have been obtained, GeoEngineers recommends completing the final two monitoring wells as proposed in our August 13 work plan. These proposed monitoring well locations are shown in Figure 12.

We recommend that water levels and free product be measured in all the wells twice per year, and that ground water samples be obtained from selected monitoring wells completed for this study. The ground water samples should be tested for the presence of BETX by EPA Method 8020, dissolved lead by EPA Method 7421, and gasoline-range hydrocarbons by Ecology Method WTPH-G. In addition, ground water samples obtained from monitoring wells where BETX concentrations are less than the ground water cleanup levels and gasoline-range hydrocarbon concentrations are less than 1 mg/l should be tested for diesel-range hydrocarbons by Ecology Method WTPH-D, and for heavier hydrocarbons by Ecology Method WTPH-418.1 Modified. The WTPH testing methods are as specified in Appendix L of Ecology's document "Guidance for Remediation of Releases from Underground Storage Tanks."

Based on the results of the ground water sampling discussed above, GeoEngineers recommends evaluating the need for completing additional monitoring wells east, northwest and south of the site. These monitoring wells would further establish the limits of the plume of contaminated ground water in the vicinity of the site. Possible additional monitoring well locations are shown in Figure 12. One or more of these additional monitoring wells may be installed in the future depending on results of the next round of ground water sampling. The exact locations of any additional monitoring wells will depend on locations of underground and overhead utilities, and securing the necessary access agreements.

GeoEngineers will make recommendations for soil and ground water remediation at the site after the final monitoring wells have been constructed and one complete round of ground water samples has been obtained and tested.

LIMITATIONS

We have prepared this report for use by Unocal. This report may be made available to prospective buyers of the property, to the city of Seattle, and to regulatory agencies. This report is not intended for use by others and the information contained herein is not applicable to other sites.

Our interpretations of subsurface conditions are based on data from widely-spaced borings at the site. It is always possible that areas with contamination may exist in areas of the site that were not explored by drilling.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this study was initiated. No other conditions, express or implied, should be understood.



Please call if you have questions concerning this report.

Respectfully submitted,

GeoEngineers, Inc.

Norman L. Puri
Environmental Engineer

A handwritten signature in black ink, appearing to read "Stephen C. Perrigo".

Stephen C. Perrigo
Principal

NLP:SCP:cms
Document ID: 0161013R.SP

TABLE 1 (Page 1 of 2)
SUMMARY OF SUBSURFACE SOIL CHEMISTRY DATA

Sample Number	Date Sampled	Depth of Sample (feet)	Field Screening Results ¹		BETX ² (mg/kg)				WTPH-G ³ (mg/kg)	Fuel Hydrocarbons ⁴ (mg/kg)		Total Lead ⁵ (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X		Gasoline-Range	Diesel-Range	
MW-32-5	10/21/91	12.5	6,000	HS	41	110	300	600	4,500	-	-	26
MW-32-7	10/21/91	22.5	<100	SS	0.33	0.40	1.1	2.3	18	-	-	29
MW-33-3	10/21/91	12.5	840	MS	<0.025	0.27	0.098	1.3	60	<5	<5	2.0
MW-33-5	10/21/91	17.5	120	SS	<0.025	<0.025	<0.025	0.10	<5	-	-	-
MW-33-7	10/21/91	22.5	540	NS	<0.025	<0.025	<0.025	<0.025	<5	-	-	-
MW-34-5	10/22/91	12.5	>10,000	HS	9.0	51	4.4	290	2,600	340	100	8.2
MW-34-6	10/22/91	20.0	100	NS	0.28	1.2	2.3	7.5	170	-	-	-
MW-34-7	10/22/91	22.5	400	SS	<0.025	<0.025	<0.025	<0.025	<5	-	-	<2.3
MW-35-5	10/22/91	12.5	1,800	MS	0.045	<0.025	0.032	0.065	<5	-	-	3.4
MW-35-10	10/22/91	25.0	1,200	SS	<0.025	<0.025	0.055	0.11	<5	-	-	-
MW-36-3	10/23/91	7.5	<100	SS	<0.025	<0.025	<0.025	0.025	<5	<5	<5	3,900
MW-37-5	10/24/91	15.0	600	SS	1.5	8.9	16	42	80	-	-	-
MW-37-6	10/24/91	17.5	<100	SS	0.11	0.42	1.3	2.8	7	-	-	-
MW-38-3	10/24/91	7.5	720	SS	<0.025	<0.025	<0.025	<0.025	<5	-	-	130
MW-38-8	10/24/91	20.0	1,100	NS	<0.025	<0.025	<0.025	<0.025	<5	-	-	-
MW-39-5	10/25/91	12.5	3,000	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	<5	3.0
MW-39-6	10/25/91	15.0	2,600	NS	<0.076	<0.076	<0.076	<0.076	<5	-	-	-
MW-40-4	10/25/91	10.0	540	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	<5	2.0
MW-40-5	10/25/91	15.0	2,000	SS	<0.093	<0.093	<0.093	<0.093	13	-	-	-
MW-41-3	10/28/91	7.5	<100	NS	<0.040	<0.040	<0.040	<0.040	<5	-	-	-
MW-41-7	10/28/91	17.5	2,000	NS	-	-	-	-	-	<5	<5	-
MW-42-5	10/28/91	15.0	680	SS	0.20	<0.025	<0.025	<0.025	<5	-	-	2.1
MW-42-9	10/28/91	25.0	1,200	SS	<0.025	<0.025	<0.025	<0.025	<5	-	-	-
MTC A Method A Soil Cleanup Level					0.5	20	40	20	100	100	200	250

TABLE 1 (Page 2 of 2)

Sample Number	Date Sampled	Depth of Sample (feet)	Field Screening Results ¹		BETX ² (mg/kg)				WTPH-G ³ (mg/kg)	Fuel Hydrocarbons ⁴ (mg/kg)		Total Lead ⁵ (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X		Gasoline-Range	Diesel-Range	
MW-43-4	10/29/91	10.0	1,600	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	<5	2.6
MW-43-7	10/29/91	17.5	100	NS	<0.069	<0.069	<0.069	<0.069	<5	-	-	-
MW-44-5	10/29/91	12.5	200	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	<5	-
MW-45-3	10/29/91	7.5	>10,000	HS	6.1	63	56	370	1,900	1,900	2,200	980
MW-45-5	10/29/91	15.0	400	NS	1.8	2.6	3.5	15	24	-	-	-
MW-45-6	10/29/91	20.0	100	NS	<0.025	<0.025	<0.025	<0.025	<5	-	-	<2.1
MW-46-3	10/30/91	10.0	1,400	SS	<0.025	<0.025	<0.025	<0.025	<5	-	-	-
MW-47-3	10/30/91	7.5	1,400	SS	-	-	-	-	-	<5	<5	-
MW-48-4	01/27/92	10.5	160	NS	0.15	<0.025	<0.025	0.053	<5	-	-	-
MW-49-1	01/27/92	3.0	<100	MS	0.14	<0.025	<0.025	0.049	180	71	130	-
MW-49-3	01/27/92	15.5	100	HS	1.2	3.3	0.39	15	190	140	340	-
MW-49-6	01/27/92	23.0	2,000	NS	1.8	4.5	0.44	19	120	-	-	-
MTC A Method A Soil Cleanup Level					0.5	20	40	20	100	100	200	250

Notes:

¹Field screening methods are described in Appendix A. NS = no sheen, SS = slight sheen, MS = moderate sheen, HS = heavy sheen.

²B = benzene, E = ethylbenzene, T = toluene, X = xylenes by EPA Method 8020.

³WTPH-G = gasoline as specified by Ecology in "Guidance for Remediation of Releases From Underground Storage Tanks."

⁴By modified EPA Method 8015.

⁵By EPA Method 7420.

ppm = parts per million

mg/kg = milligrams per kilogram

TABLE 2 (Page 1 of 2)
SUMMARY OF GROUND WATER CHEMISTRY DATA

Monitor Well Number	Date Sampled	BETX ¹ (µg/l)				Fuel Hydrocarbons ² (mg/l)		Dissolved Lead ³ (µg/l)	Combustible Vapor Concentration ⁴ (ppm)
		B	E	T	X	Gasoline-Range	Diesel-Range		
MW-32A	11/04/91	10,000	2,000	10,000	10,000	52	<1	0.009	>10,000
MW-33	11/04/91	550	240	490	1,300	11	<1	0.0045	2,200
MW-34	11/04/91	23,000	2,600	18,000	14,000	40	<1	0.010	520
MW-35	11/04/91	440	610	2,600	4,300	24	<1	<0.0030	-
MW-36	11/05/91	24	<0.5	0.9	1.0	1	<1	<0.0030	>10,000
MW-37	11/05/91	810	470	2,400	3,300	21	<1	<0.0030	>10,000
MW-38	11/05/91	<0.5	<0.5	0.6	0.5	<1	<1	<0.0030	>10,000
MW-39	11/05/91	0.8	<0.5	0.9	<0.5	<1	<1	<0.0030	>10,000
MW-40	11/05/91	5.8	0.5	0.7	0.8	<1	<1	<0.0030	>10,000
MW-41	11/05/91	67	<0.5	<0.5	<0.5	<1	<1	<0.0030	7,000
MW-42	11/05/91	180	0.8	2.9	4.7	<1	<1	<0.0030	>10,000
MW-43	11/05/91	86	0.6	3.4	2.7	<1	<1	<0.0030	>10,000
MW-44	11/05/91	<0.5	<0.5	<0.5	<0.5	<1	<1	<0.0030	3,800
MW-45	11/04/91	500	370	1,000	2,300	17	2	0.005	>10,000
MW-46	11/05/91	<0.5	<0.5	0.6	1.2	<1	<1	0.006	>10,000
MW-47	11/05/91	5.2	<0.5	0.5	<0.5	<1	<1	<0.0030	>10,000
MW-48	01/29/92	430	180	330	600	4	2	<0.0030	-
MW-49	01/29/92	550	720	54	3,200	22	3	<0.0030	-
MTCA Method A Ground Water Cleanup Level		5	30	40	20	Note ⁵	Note ⁵	0.005	

TABLE 2 (Page 2 of 2)

Notes:

¹B = benzene, E = ethylbenzene, T = toluene, X = xylenes by EPA Method 8020.

²By modified EPA Method 8015.

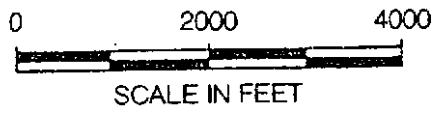
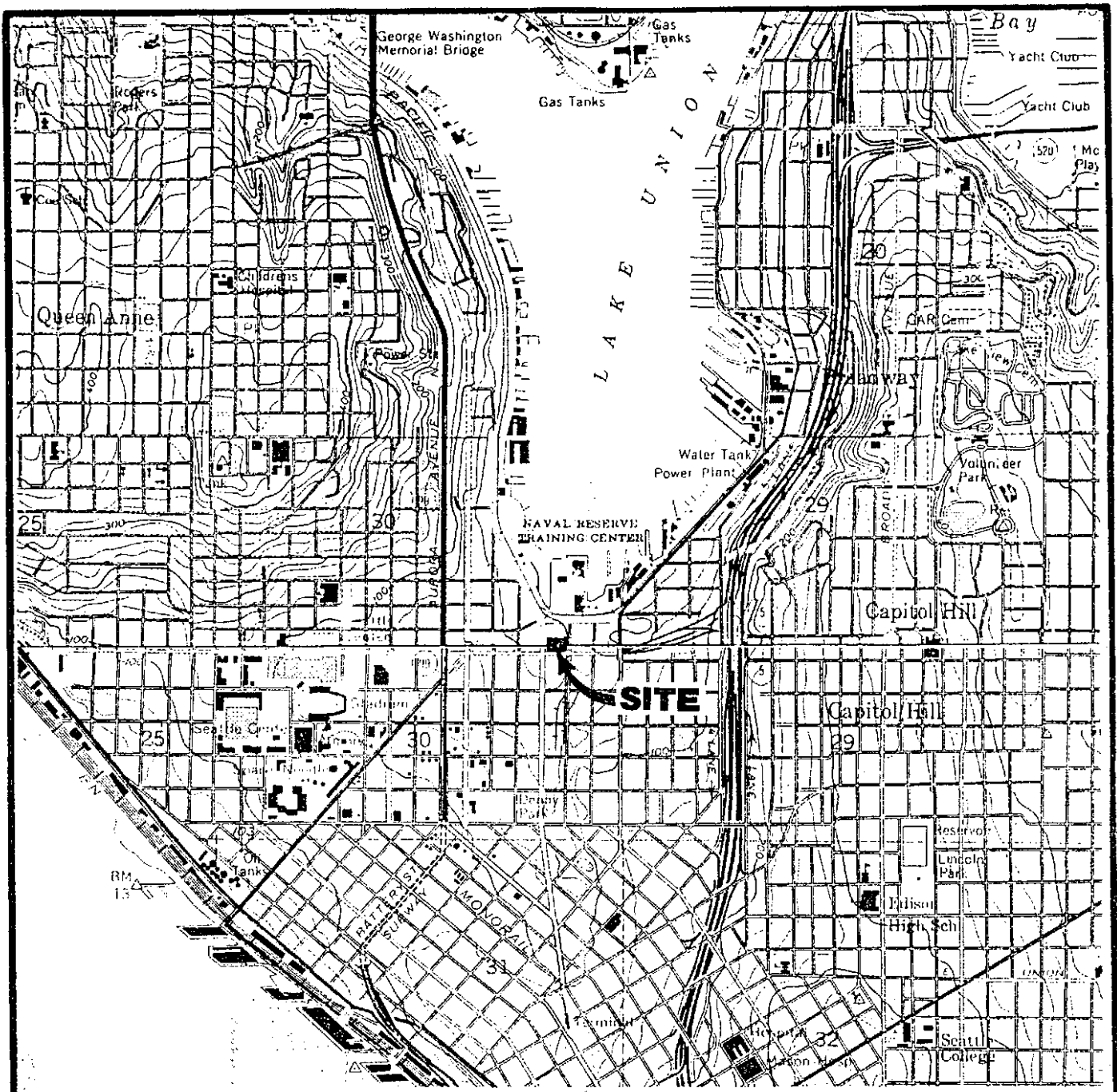
³By EPA Method 7421.

⁴Measured with a Bacharach TLV Sniffer and a Tygon tube connected to the well head with a slip cap.

⁵Petroleum hydrocarbons in ground water are not regulated on the basis of separate components. The MTCA Method A ground water cleanup level for the total of gasoline-range, diesel-range and heavier hydrocarbons is 1 mg/l.

$\mu\text{g/l}$ = micrograms per liter; mg/l = milligrams per liter; ppm = parts per million; "-" = not tested.

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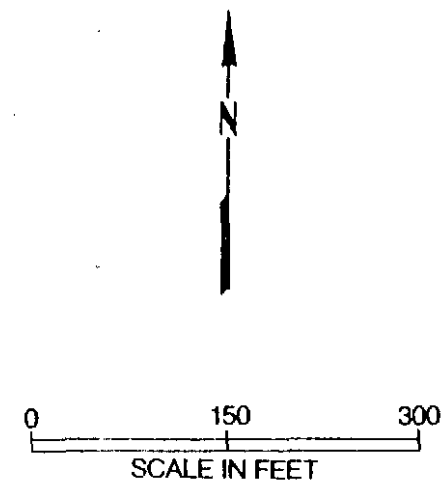
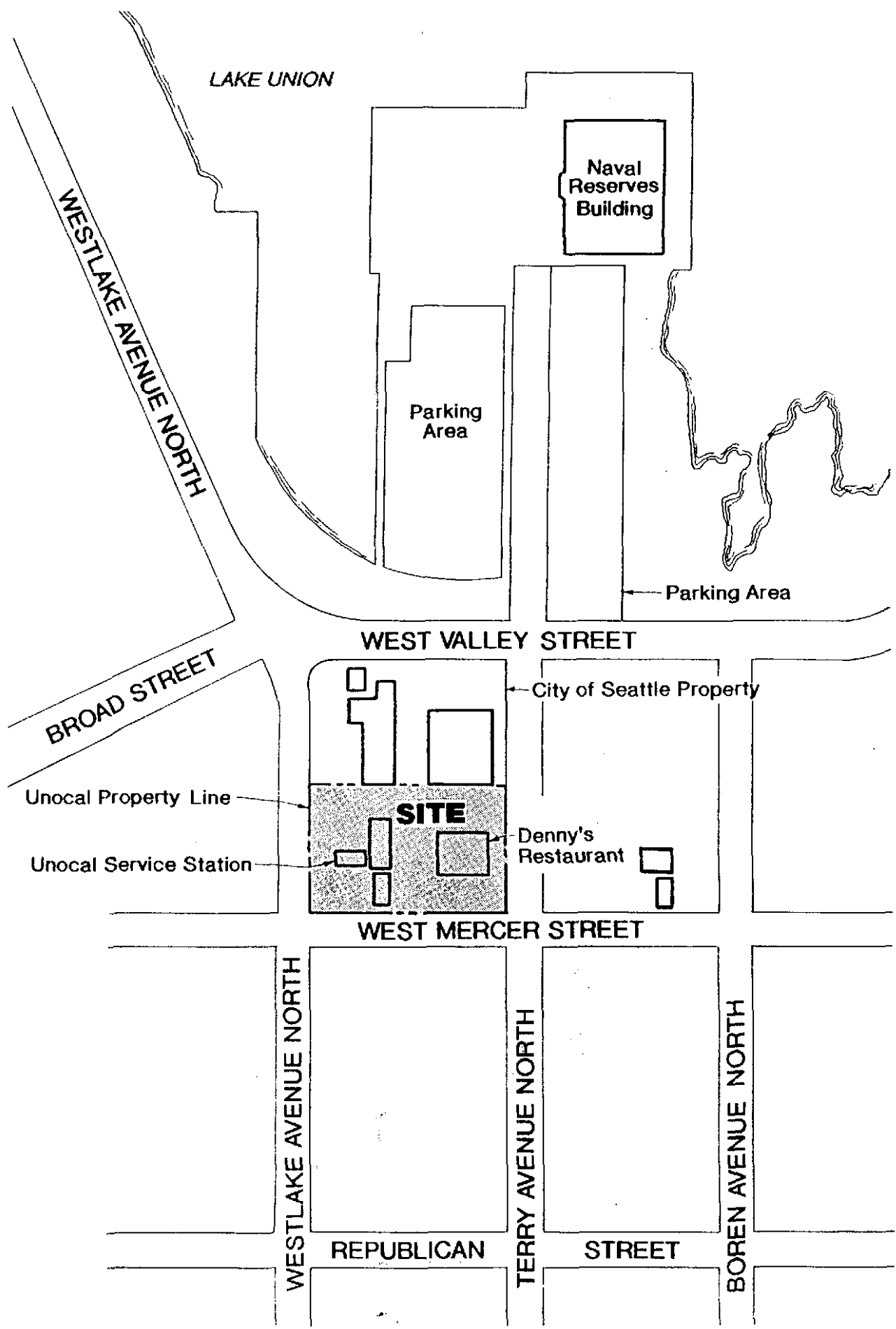


REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAPS "SEATTLE NORTH, WASH.,"
PHOTOREVISED 1968 AND "SEATTLE SOUTH, WASH.," PHOTOREVISED 1973.



VICINITY MAP

FIGURE 1



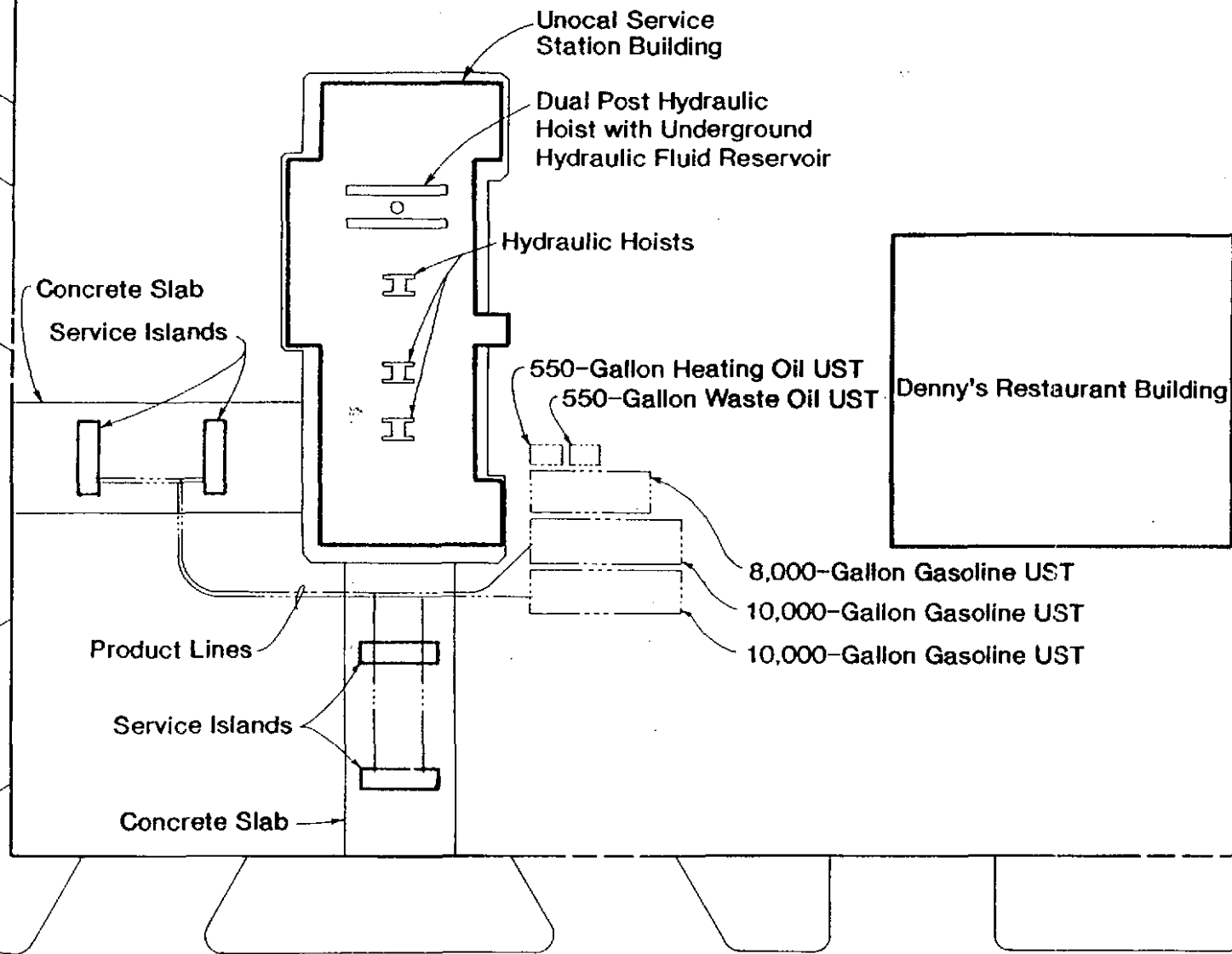
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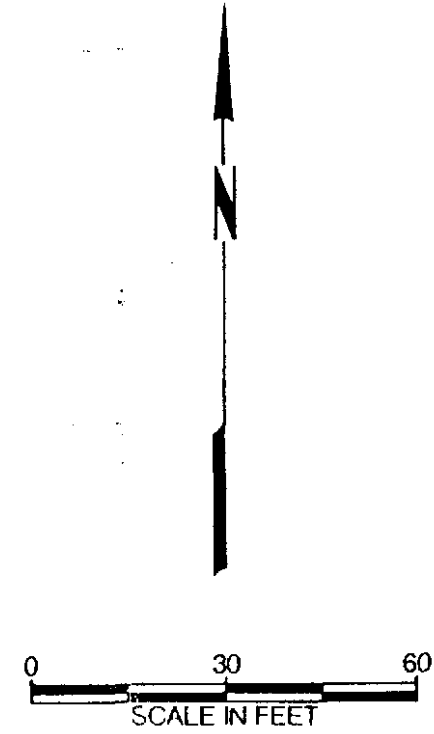
	SITE AND IMMEDIATE VICINITY
	FIGURE 2

WESTLAKE AVENUE NORTH

Property Line



MERCER STREET



EXPLANATION:

UST UNDERGROUND STORAGE TANK

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0161 013 R69 NLP BDH 12.6.91(B)

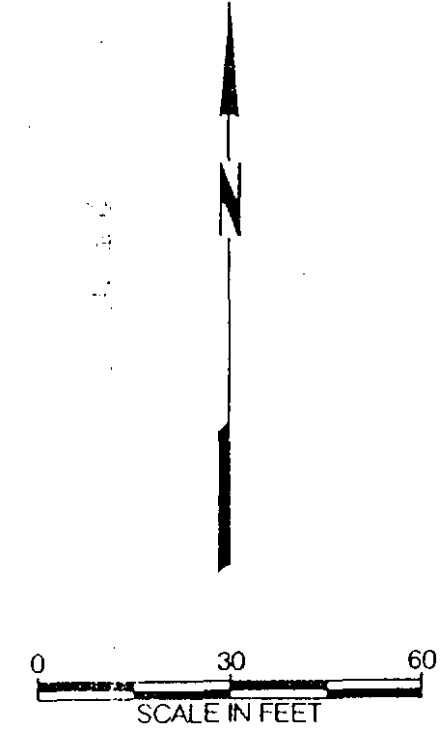
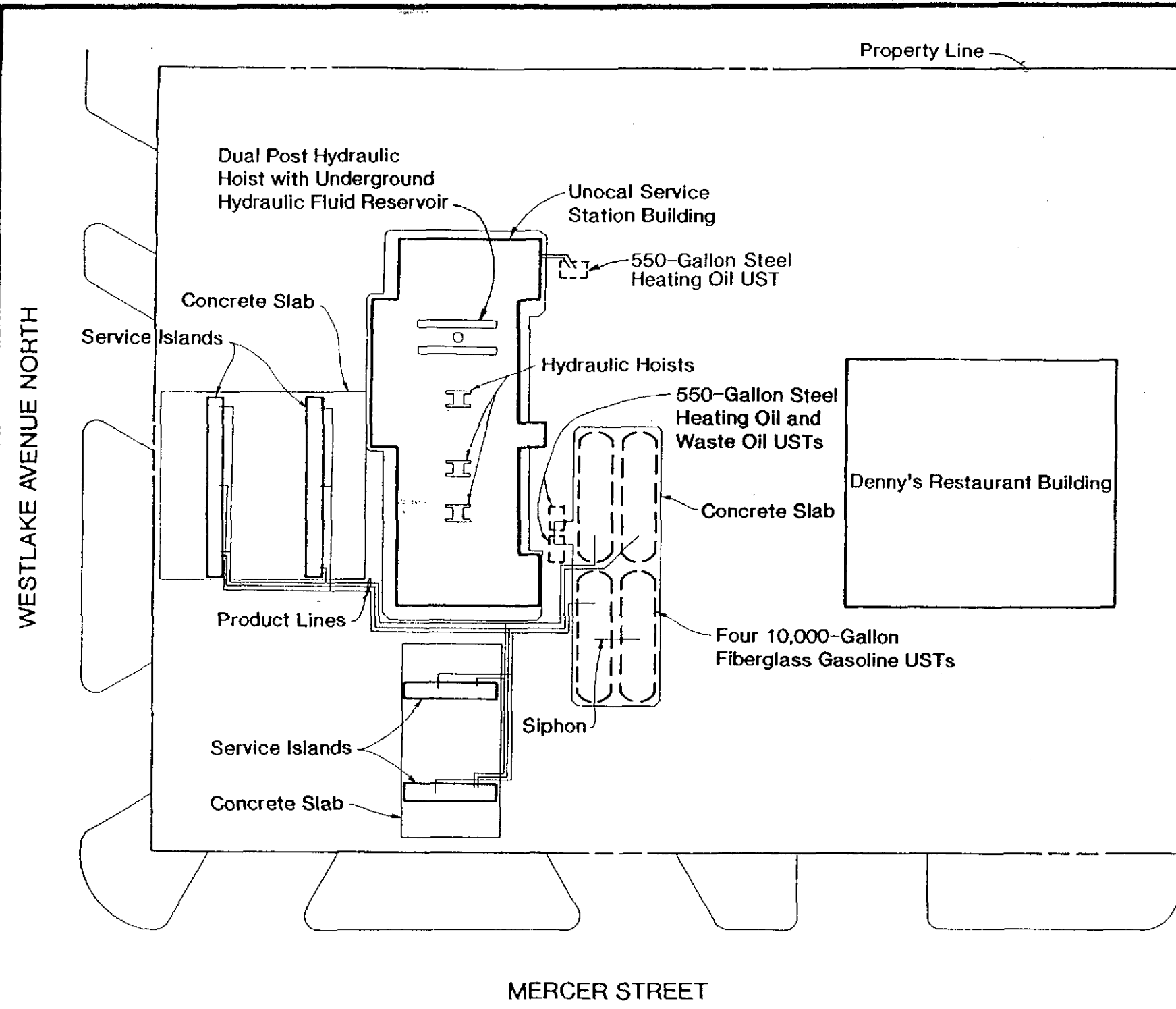
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SERVICE STATION FACILITIES
1980

FIGURE 3

0161 015 123 MLP 507 12 9 91.3



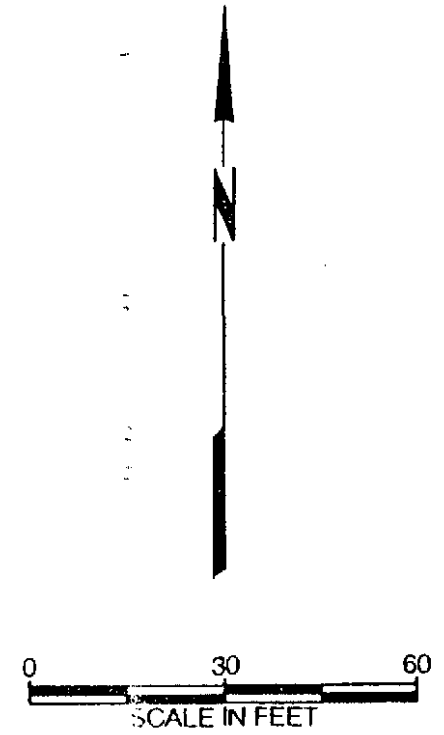
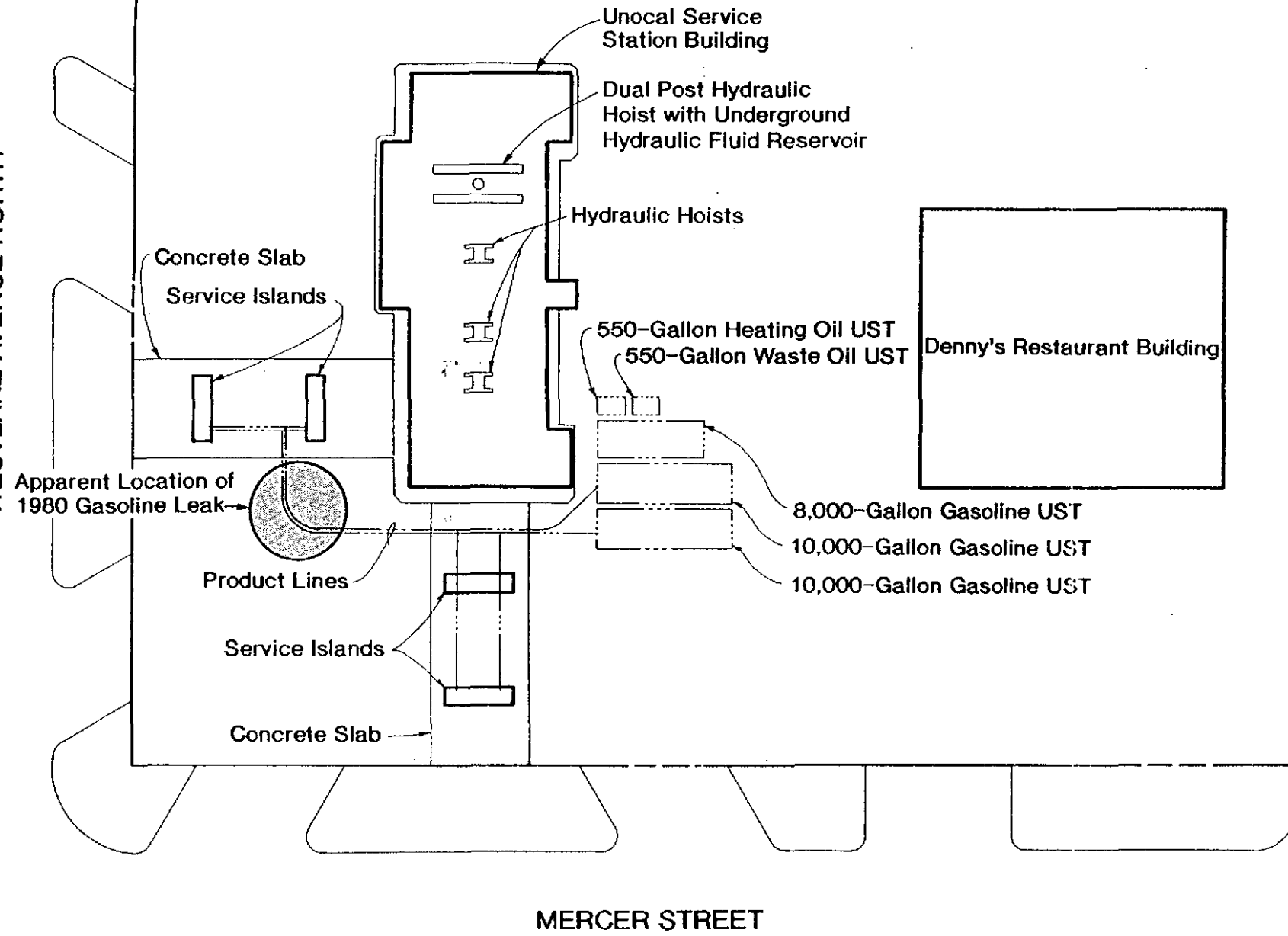
EXPLANATION:
 UST - UNDERGROUND STORAGE TANK

REFERENCE: DRAWINGS ENTITLED "GENERAL ARRANGEMENT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE WASHINGTON," DATED 03/05/65; AND "TANK & PIPELINE REPLACEMENT PROJECT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE, WASHINGTON," DATED 06/18/80, BOTH BY UNION OIL COMPANY OF CALIFORNIA.

	SERVICE STATION FACILITIES 1981 TO PRESENT
	FIGURE 4

WESTLAKE AVENUE NORTH

Property Line



EXPLANATION:

UST UNDERGROUND STORAGE TANK

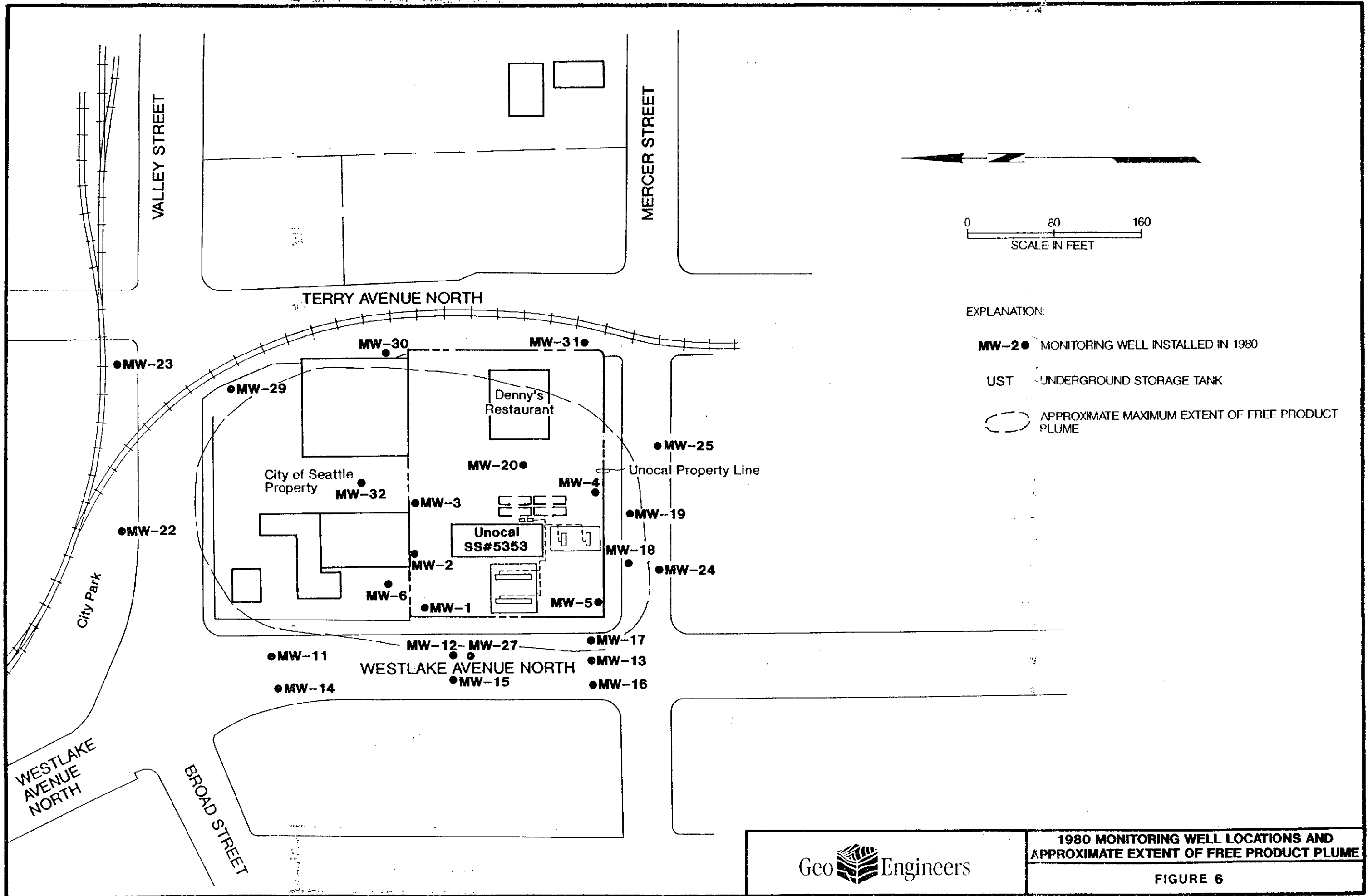
0161 013 RGS NLP BDH 12 6 91(5)

REFERENCE: DRAWING ENTITLED "GENERAL ARRANGEMENT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE, WASHINGTON," BY UNION OIL COMPANY OF CALIFORNIA, DATED 03/05/65.



APPARENT LOCATION OF 1980 GASOLINE LEAK

FIGURE 5



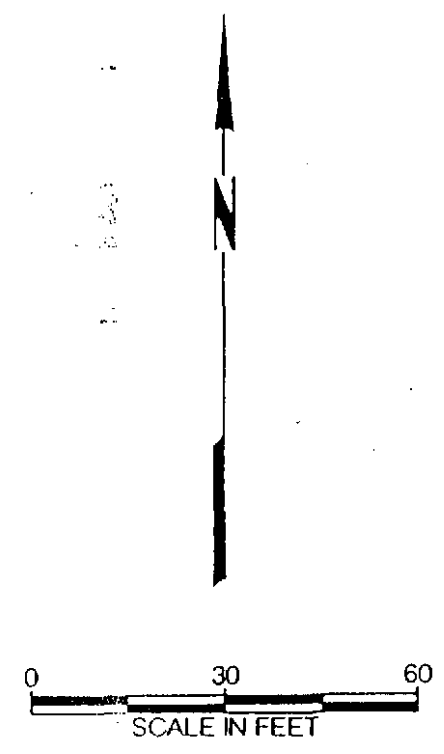
WESTLAKE AVENUE NORTH

Property Line

Unocal Service Station Building

Denny's Restaurant Building

MERCER STREET



EXPLANATION:



Note: Product recovery piping is not shown.

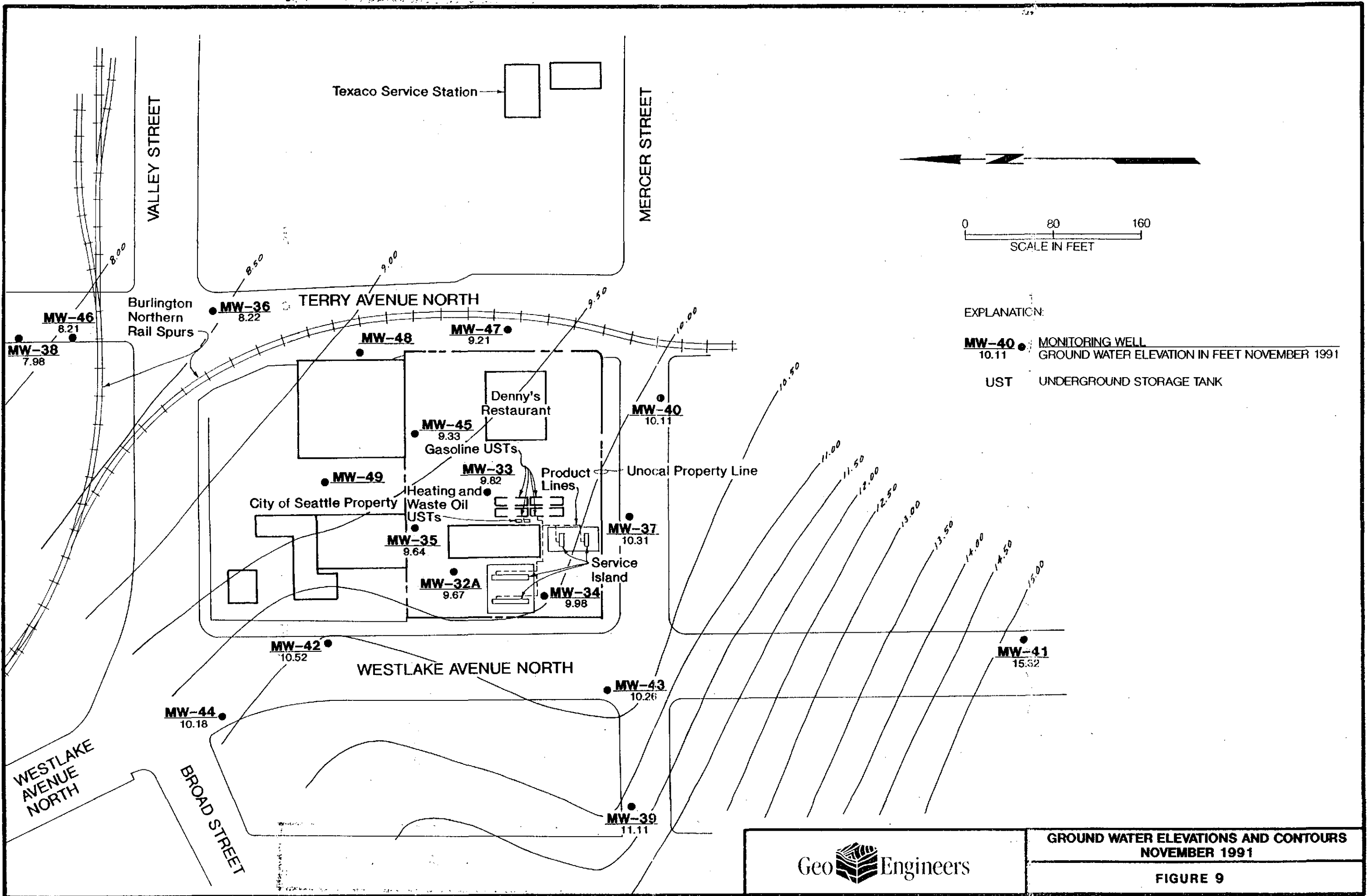
REV. 12/1/83 7-6-92
D/G: D/S R/S N/P B/DH 12 9 1 3

REFERENCE: DRAWINGS ENTITLED "GENERAL ARRANGEMENT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE WASHINGTON," DATED 03/05/65; AND "TANK & PIPELINE REPLACEMENT PROJECT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE, WASHINGTON," DATED 06/18/80, BOTH BY UNION OIL COMPANY OF CALIFORNIA.

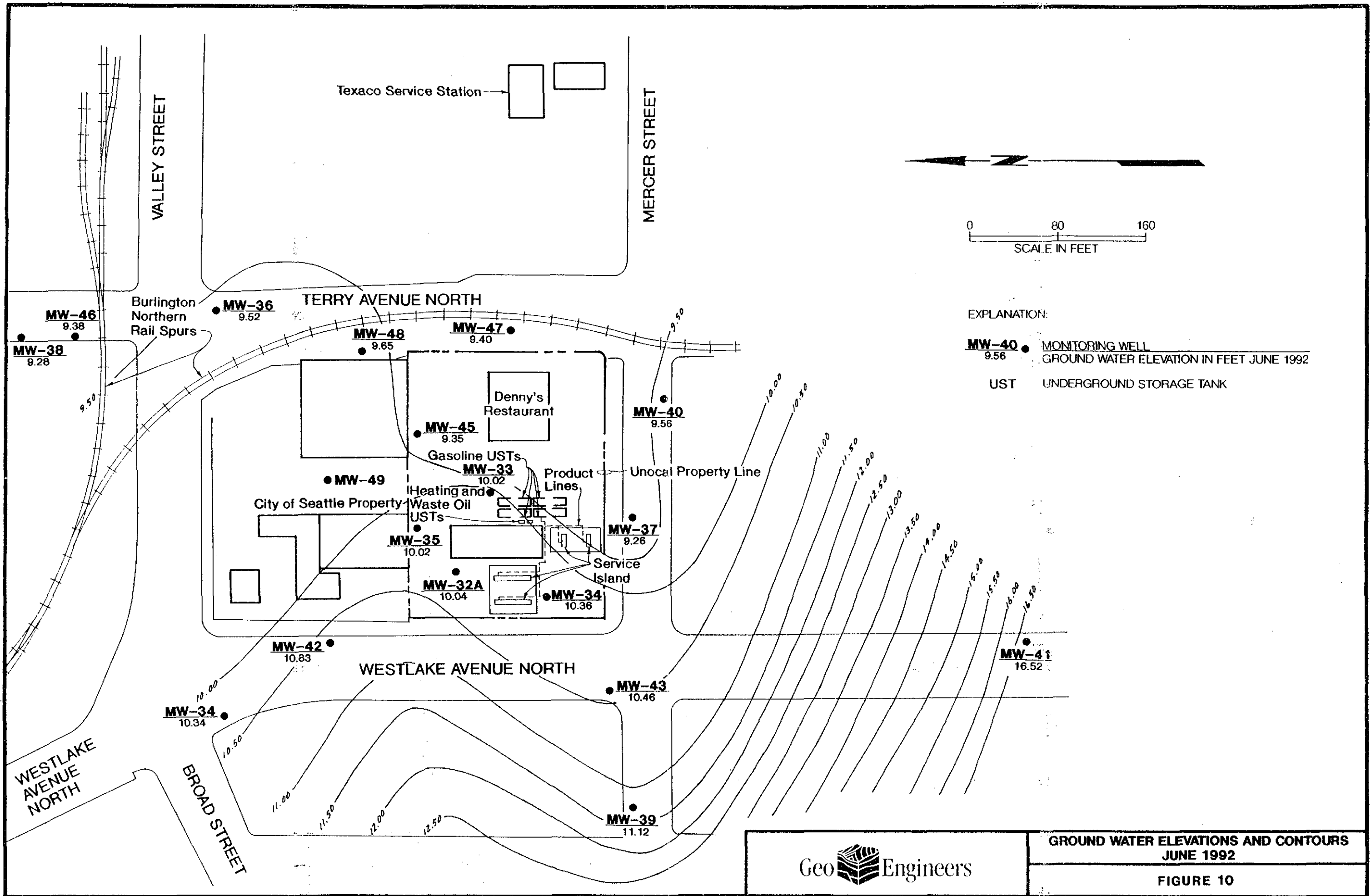


1980 FREE PRODUCT RECOVERY SYSTEM CONFIGURATION

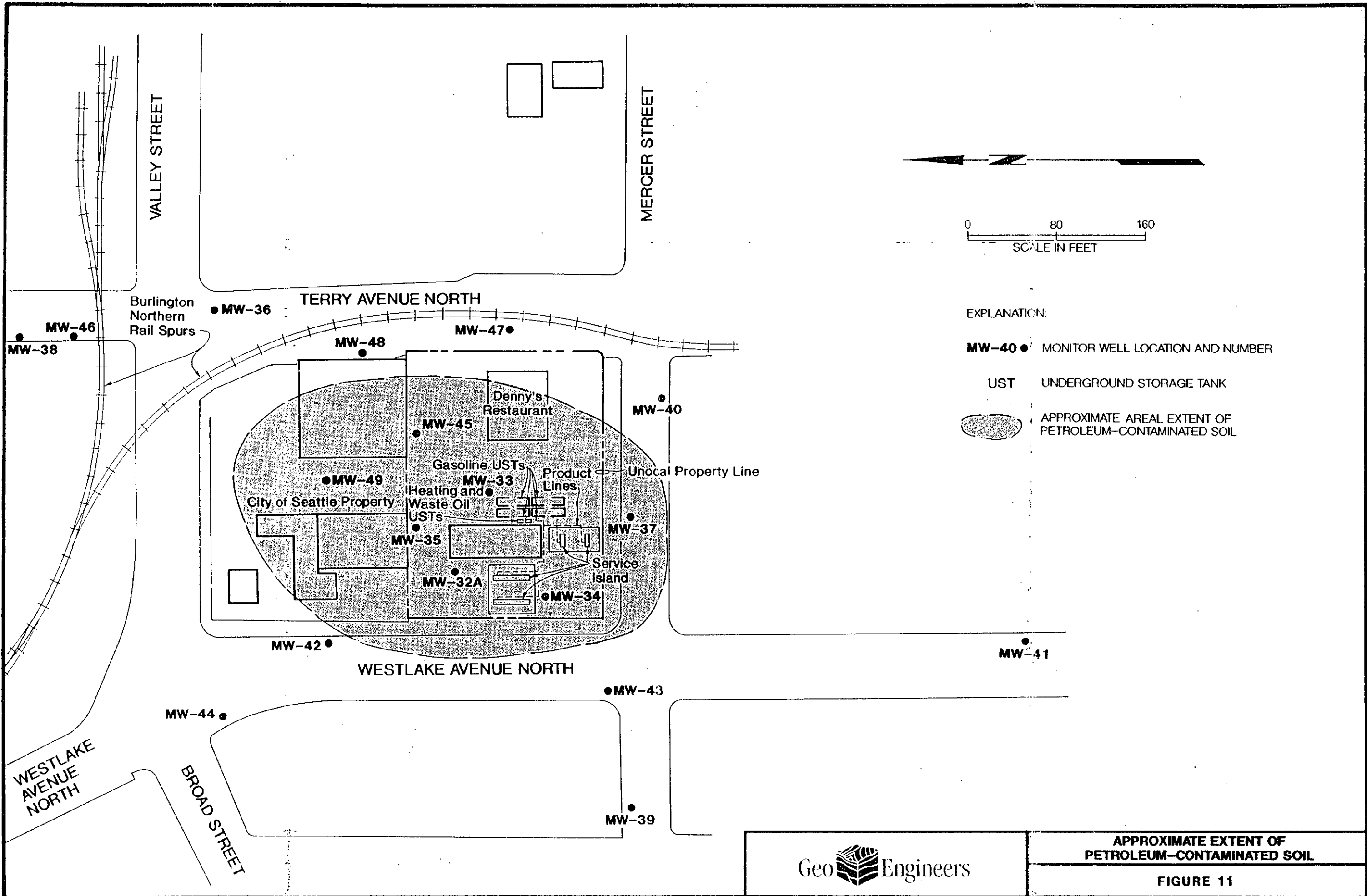
FIGURE 7

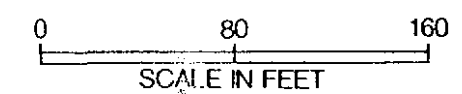
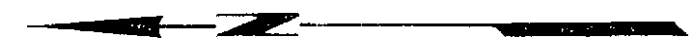
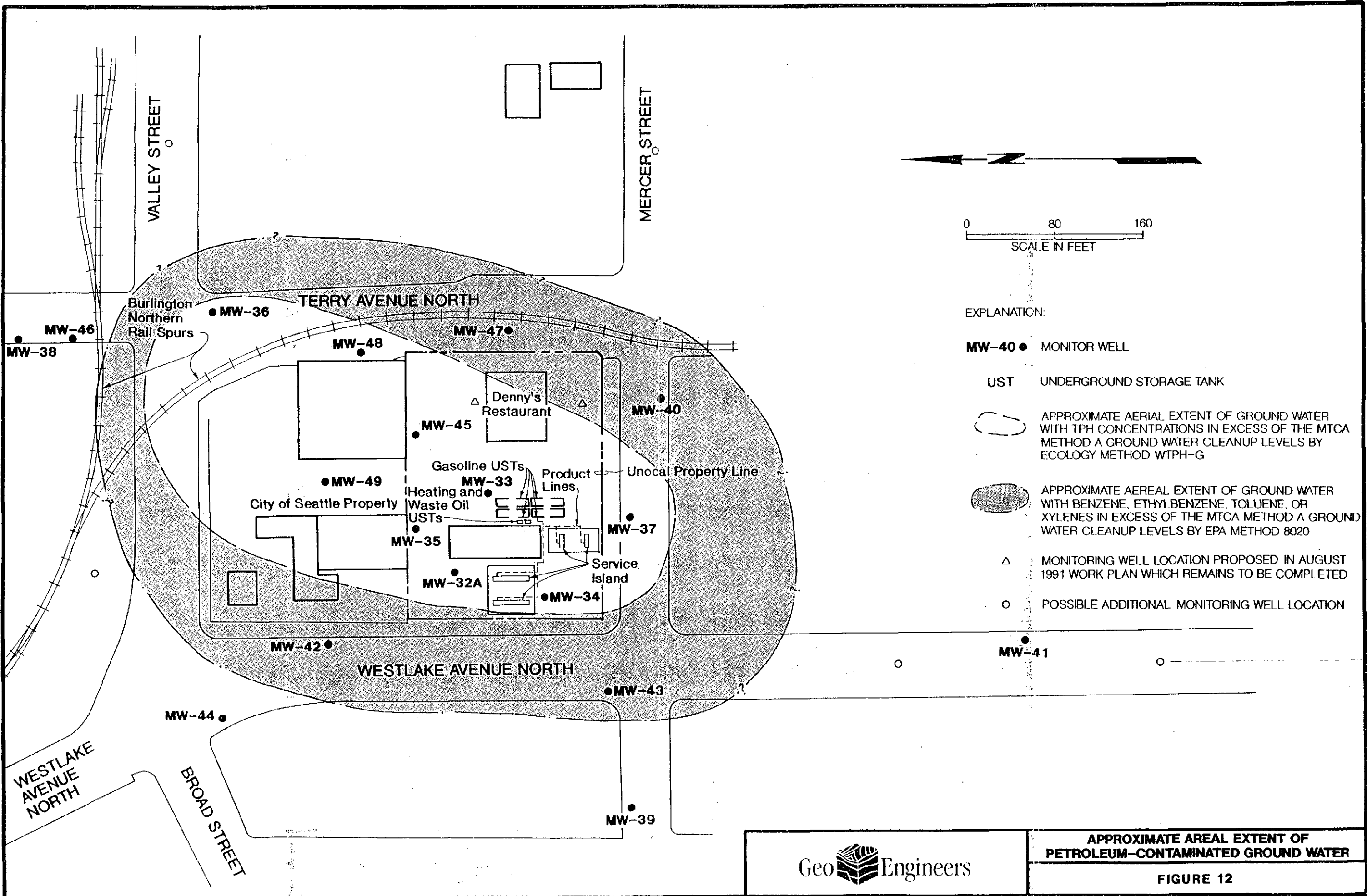


11/27/91 REV. 6/23/92
 11/27/91 REV. 6/23/92



11/27/91 REV. 5-25-92





EXPLANATION:

- MW-40 ● MONITOR WELL
- UST UNDERGROUND STORAGE TANK
- APPROXIMATE AERIAL EXTENT OF GROUND WATER WITH TPH CONCENTRATIONS IN EXCESS OF THE MTCA METHOD A GROUND WATER CLEANUP LEVELS BY ECOLOGY METHOD WTPH-G
- APPROXIMATE AERIAL EXTENT OF GROUND WATER WITH BENZENE, ETHYL BENZENE, TOLUENE, OR XYLENES IN EXCESS OF THE MTCA METHOD A GROUND WATER CLEANUP LEVELS BY EPA METHOD 8020
- △ MONITORING WELL LOCATION PROPOSED IN AUGUST 1991 WORK PLAN WHICH REMAINS TO BE COMPLETED
- POSSIBLE ADDITIONAL MONITORING WELL LOCATION

Geo Engineers

APPROXIMATE AERIAL EXTENT OF
PETROLEUM-CONTAMINATED GROUND WATER

FIGURE 12

REV. 6/25/92

APPENDIX A

APPENDIX A

FIELD EXPLORATIONS

DRILLING AND SOIL SAMPLING PROGRAM

Drilling Program

Subsurface conditions at the site were explored by drilling 18 supplemental borings (MW-32A through MW-49) using hollow-stem auger drilling methods. Approximate locations of the borings are shown in Figure 8. The borings were drilled from October 21, 1991 through January 27, 1992. The borings were drilled to total depths ranging from 20 feet to 27.5 feet below the ground surface, using drilling equipment owned and operated by Geoboring, Inc.

GeoEngineers representatives examined and classified the soils encountered, and prepared a detailed log of each boring. Soils encountered were classified visually in general accordance with ASTM D-2488-83, which is described in Figure A-1. An explanation of the boring log symbols is presented in Figure A-2. The boring logs are given in Figures A-3 through A-20.

Soil samples were obtained from the hollow-stem auger borings using an 18-inch-long split-barrel Dames & Moore sampler (2.4-inch-ID) containing two 3-inch and one 4-inch brass sleeves. The sampler was driven 18 inches by a 300-pound weight falling a vertical distance of approximately 30 inches. The number of blows needed to advance the sampler the final 12 inches or other indicated distances is indicated to the left of each corresponding sample notation on the boring logs.

Soil Sampling Program

Discrete soil samples were obtained, when possible, from each boring at 2.5-foot intervals. At least one soil sample was selected from each boring for chemical analysis of petroleum-related compounds. Samples that were tested are denoted in our boring logs with a "CA." The two 3-inch sleeves (or one if sample recovery was poor) were immediately removed from the sampler, sealed with teflon tape and plastic end caps, labeled and placed in plastic self-locking sample bags. The samples were immediately placed in cold transport containers with appropriate chain-of-custody documentation and delivered to the analytical laboratory. The contents of the 4-inch sleeve were used for field screening and descriptive logging.

Field Screening Procedures

A GeoEngineers representative conducted field screening on soil samples obtained from the exploratory borings. Field screening results are used as a general guideline to delineate areas of potential petroleum-related contamination in soils. In addition, screening results are used to aid in the selection of soil samples for chemical analysis. The field screening methods employed included (1) visual examination, (2) sheen testing and (3) headspace vapor testing using a TLV (Bacharach TLV Sniffer). The results of headspace and sheen screening are included in Table 1 and Figures A-3 through A-20.

Visual screening consisted of inspecting the soil for the presence of stains indicative of petroleum-related contamination. Visual screening is generally more effective in detecting the presence of heavier petroleum hydrocarbons such as motor oil or when hydrocarbon concentrations are high. Sheen screening and headspace vapor screening are more sensitive methods which have been effective in detecting contamination at concentrations less than regulatory cleanup guidelines.

Sheen testing involves placing soil in water and observing the water surface for signs of a sheen. Sheen classifications are as follows:

- | | |
|---------------------|--|
| No Sheen (NS) | No visible sheen on the water surface. |
| Slight Sheen (SS) | Light colorless sheen, spread is irregular, not rapid; film dissipates rapidly. |
| Moderate Sheen (MS) | Light to heavy film, may have some color or iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on water surface. |
| Heavy Sheen (HS) | Heavy colorful film with iridescence; spread is rapid, and sheen flows off the sample; entire water surface may be covered with sheen. |

Headspace vapor screening involves placing a soil sample in a plastic sample bag. The sample bag is sealed and shaken to expose the soil to the air trapped in the bag. The probe of a TLV is inserted into the bag, then the instrument measures the concentration of combustible vapors within the sample bag headspace. The TLV measures concentrations in ppm (parts per million) and is calibrated to hexane. The TLV is designed to measure combustible vapors at concentrations ranging between 100 ppm and 10,000 ppm.

Field screening results are site-specific. The results vary with temperature, soil type, type of contaminant and soil moisture content.

Decontamination Procedures

The drilling equipment was cleaned with a hot-water pressure washer prior to drilling each boring. All soil sampling equipment was cleaned between sampling attempts with a detergent solution and a trisodium phosphate solution followed by a potable water rinse and a distilled water rinse. All water generated during decontamination was contained in 55-gallon drums and remain at the site of Unocal Service Station 5353. The above decontamination procedure has proved to be adequate on other sites.

Soil Cuttings

Soil cuttings generated by the drilling were placed in 55-gallon drums. The drums were removed to former Unocal Service Station 6947 for storage.

MONITORING WELL CONSTRUCTION

Two-inch-diameter, Schedule 40 PVC (polyvinyl chloride) casing was installed in the borings at the completion of drilling. The lower portion of the PVC casing consists of machine-slotted (0.020-inch slot width) well screen, allowing entry of water, floating hydrocarbons and hydrocarbon vapors into the well casings. Medium sand was placed in the borehole annulus surrounding the slotted portion of the wells. The well casings are protected within flush-grade, locking surface monuments. Monitoring well construction details are included in Figures A-3 through A-20.

The monitoring well screens were developed by removing water from the wells with a stainless steel bailer. A minimum of five well casing volumes were removed from each well. The water generated during development was placed in 55-gallon drums and remains at the site of Unocal Service Station 5353.

We determined the elevations of the well casings and ground elevations to the nearest 0.01 foot using a laser level on June 22 and 23, 1992. The survey was referenced to the City of Seattle Datum. Elevations referenced to this datum are included in the monitoring well boring logs.

GROUND WATER SAMPLING PROGRAM

GeoEngineers collected ground water samples from monitoring wells MW-32A through MW-47 on November 4 and 5, 1991 and from monitoring wells MW-48 and MW-49 on January 28, 1992. The water samples were collected with disposable polyethylene bailers after a minimum of three well casing volumes were removed from each well casing. The water samples were transferred to 40 ml septum vials, 250 ml glass bottles and 500 ml plastic bottles in the field and were kept cool during transport to the laboratory. The water samples obtained for BETX analysis had hydrochloric acid added as a preservative. The water samples obtained for dissolved lead analysis sulfuric acid added as a preservative and were filtered through a 0.5 micron filter before being transferred to the sample bottle. Chain-of-custody procedures were used to transport the water samples to the laboratory.

The temperature, pH and electrical conductivity of ground water which was bailed from the monitoring wells was measured with a Hydac pH/temperature/conductivity meter periodically as it was bailed. The meter was calibrated against standard pH and conductivity solutions each day. Each well was bailed until the temperature, pH and conductivity stabilized to within 1 degree Fahrenheit, 0.1 pH units and 50 μ mhos, respectively, for three consecutive measurements. Each well was sampled after the temperature, pH and conductivity of the purge water had stabilized as described above.

GROUND WATER ELEVATIONS

The depth to ground water relative to the monitoring well casing rims was measured in monitoring wells MW-32A through MW-47 on November 4 and 5, 1991, and in monitoring wells MW-32A through MW-49 on June 22 and 23, 1992. The measurements were made using a water/product interface probe. The interface probe was cleaned with a TSP solution wash and distilled water rinse prior to use at each well.

COMBUSTIBLE VAPOR CONCENTRATIONS

Combustible vapor concentrations were measured in each monitoring well on November 15, 1991. Vapor concentrations were measured with a Bacharach TLV Sniffer using a slip cap. The lower threshold of significance in this application is 400 ppm. The vapor concentration data are presented in Table 2.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 60% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY	
		OH	ORGANIC CLAY, ORGANIC SILT	
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

- Field classification is based on visual examination of soil in general accordance with ASTM D2488-84.
- Soil classification using laboratory tests is based on ASTM D2487-85.
- Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

- Dry - Absence of moisture, dusty, dry to the touch
- Moist - Damp, but no visible water
- Wet - Visible free water or saturated, usually soil is obtained from below water table

LABORATORY TESTS:

CA Chemical Analysis

FIELD SCREENING TESTS:

Headspace vapor concentration data given in parts per million

Sheen classification system:

NS No Visible Sheen

SS Slight Sheen

MS Moderate Sheen

HS Heavy Sheen

NT Not Tested

SOIL GRAPH:



SM Soil Group Symbol
(See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

▽ Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 300-pound hammer falling 30 inches.

22 ■

Location of relatively undisturbed sample

12 ☒

Location of disturbed sample

17 □

Location of sampling attempt with no recovery

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using 140-pound hammer falling 30 inches.

10 ■

Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

26 □

Location of SPT sampling attempt with no recovery

☐

Location of grab sample

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.

2. Soil classification system is summarized in Figure A-1.

GEI 121-90

MONITORING WELL NO. MW-32A

WELL SCHEMATIC

Casing Elevation (ft.): 20.70
 Casing Stickup (ft.): -0.28

Vapor
 Conc. (ppm)
 Sheen

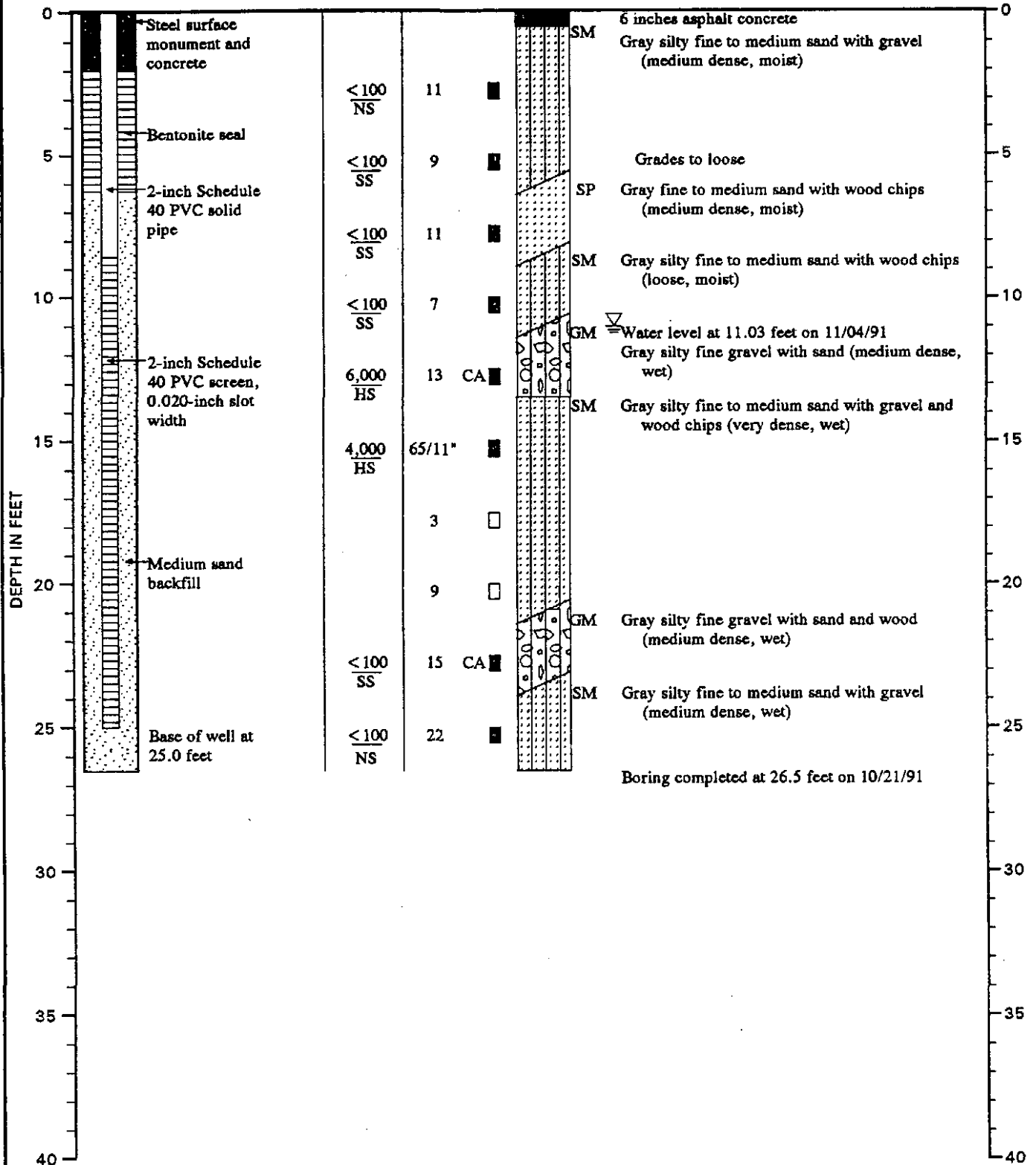
Blow
 Count

Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 20.98



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-33

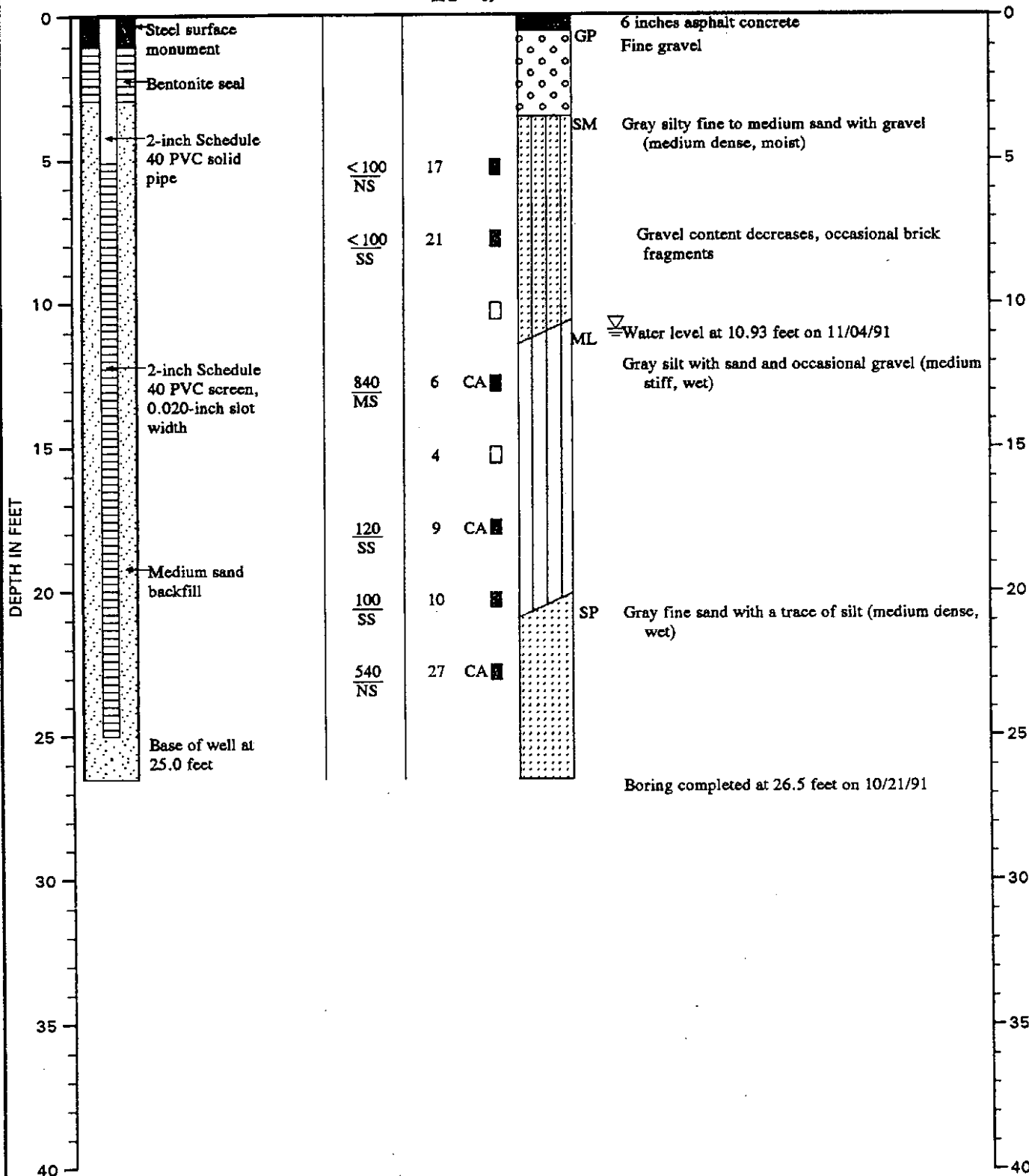
WELL SCHEMATIC

Casing Elevation (ft.): 20.75
 Casing Stickup (ft.): -0.14

Vapor
 Conc. (ppm)
 Sheen

DESCRIPTION

Surface Elevation (ft.): 20.89



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-34

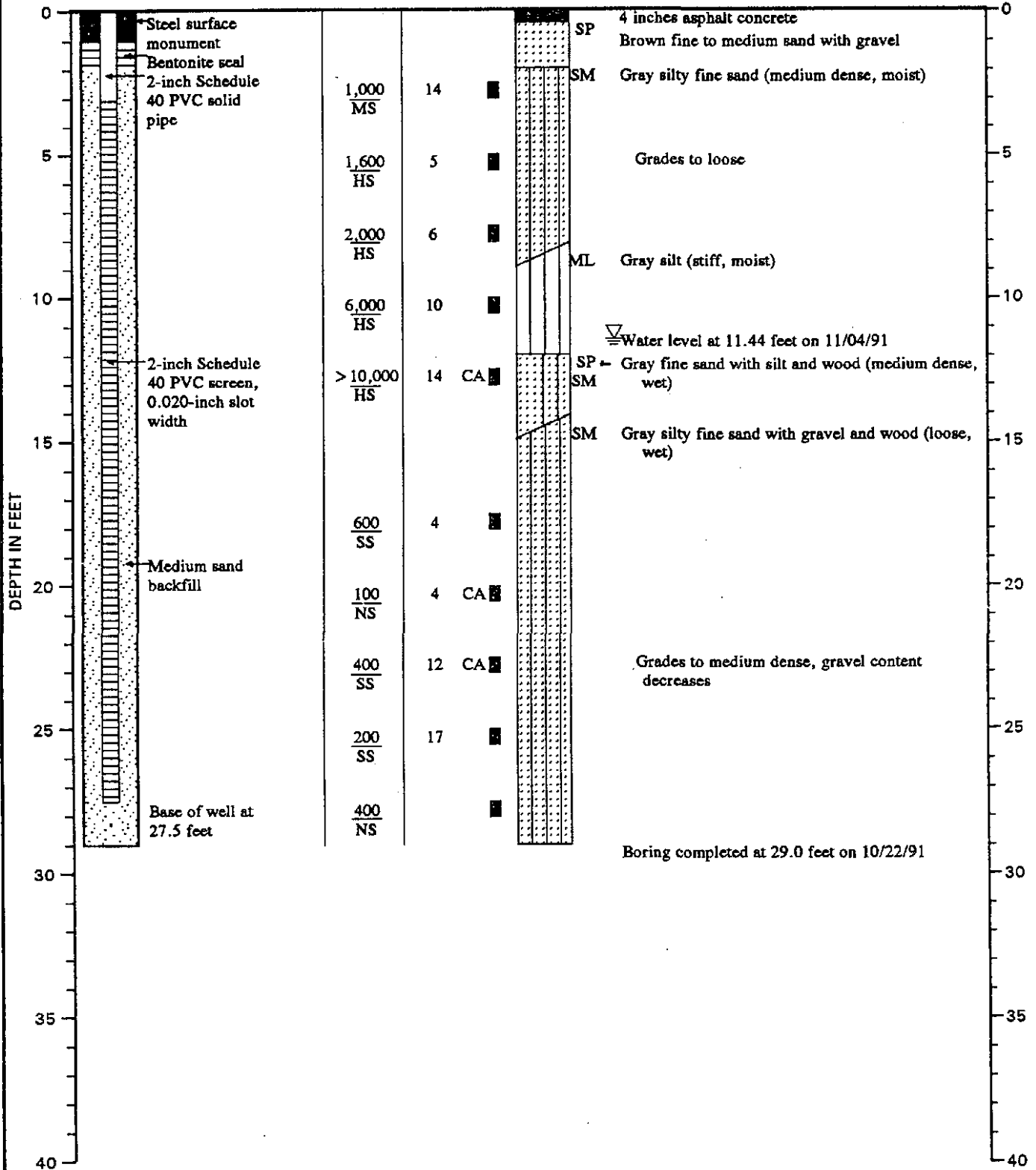
WELL SCHEMATIC

Casing Elevation (ft.): 21.42
 Casing Stickup (ft.): -0.28

Vapor
 Conc. (ppm)
 Sheen

DESCRIPTION

Surface Elevation (ft.): 21.70



Note: See Figure A-2 for explanation of symbols



LOG OF MONITORING WELL

FIGURE A-5

:WAP:LJB:DAC:CBK:CMS 6/24/92

0161-013-R69

MONITORING WELL NO. MW-35

WELL SCHEMATIC

Casing Elevation (ft.): 20.10
 Casing Stickup (ft.): -0.17

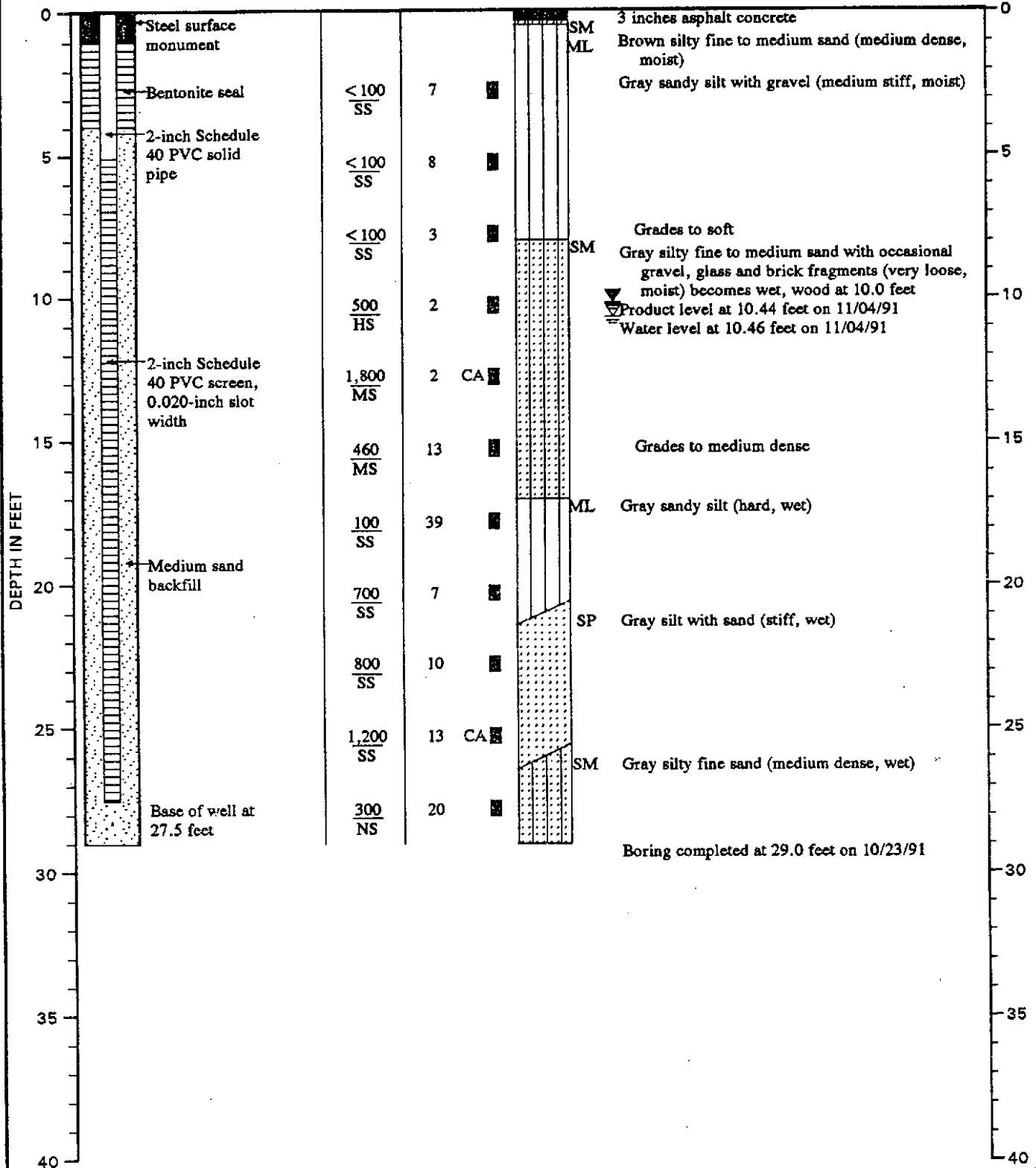
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 20.27



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-36

WELL SCHEMATIC

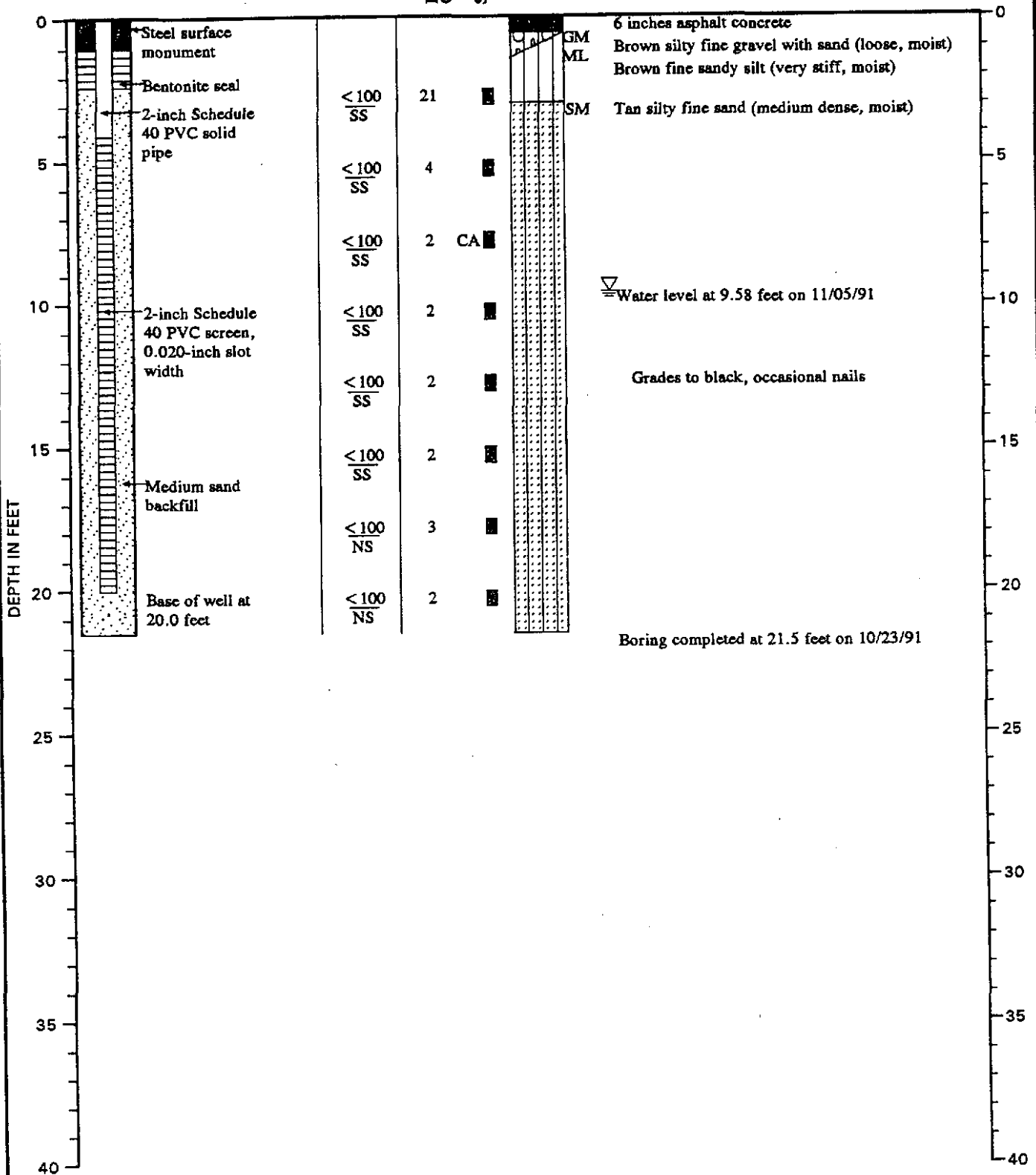
Casing Elevation (ft.): 17.80
 Casing Stickup (ft.): -0.24

Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples
 Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 18.04



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-37

WELL SCHEMATIC

Casing Elevation (ft.): 21.01
 Casing Stickup (ft.): -0.17

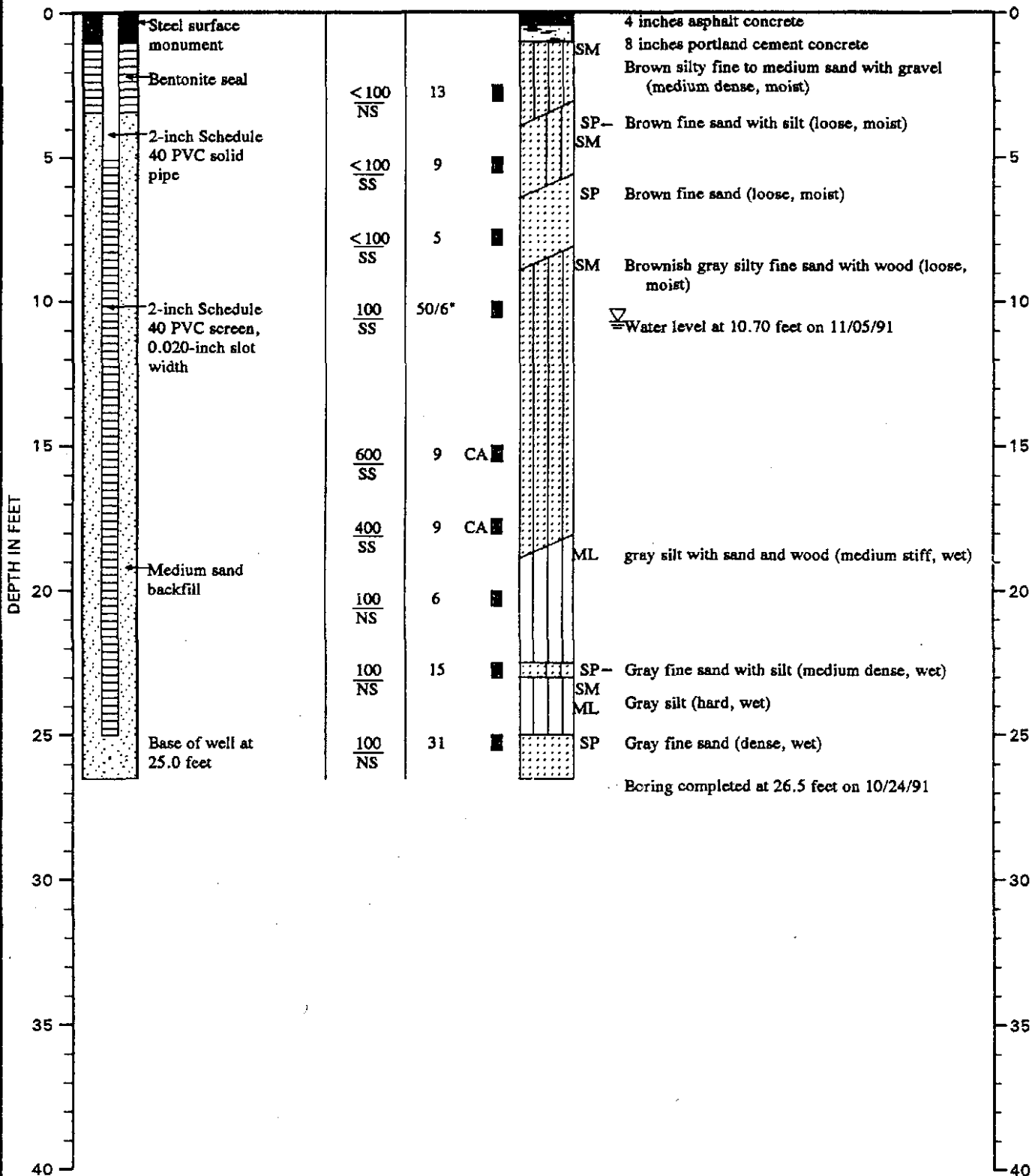
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 21.18



Note: See Figure A-2 for explanation of symbols



LOG OF MONITORING WELL

FIGURE A-8

:WAP:LB:DAC:CBK:CMS 6/24/92

0161-013-R69

MONITORING WELL NO. MW-38

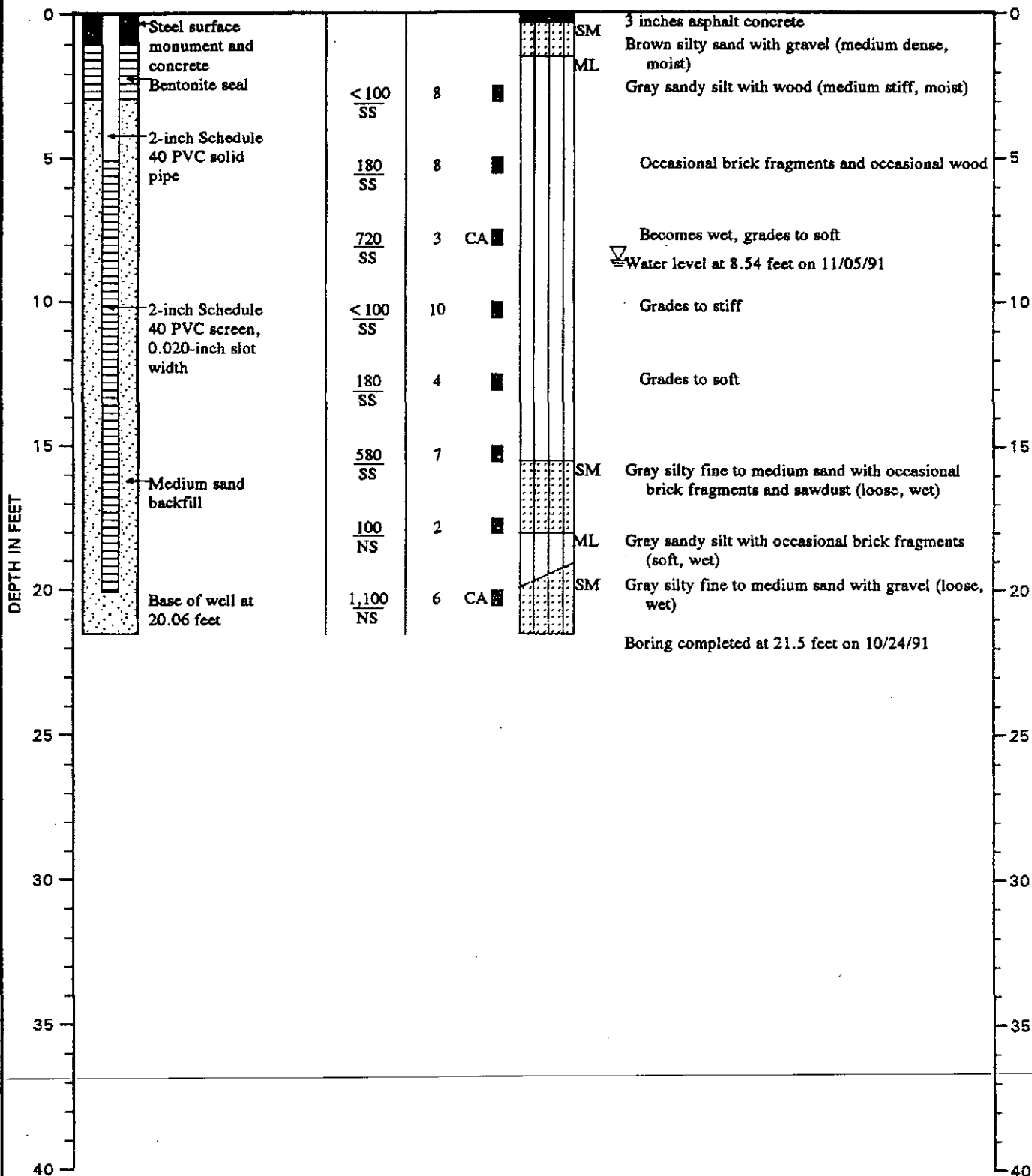
WELL SCHEMATIC

Casing Elevation (ft.): 16.52
 Casing Stickup (ft.): -0.31

Vapor
 Conc.(ppm)
 Sheen

DESCRIPTION

Surface Elevation (ft.): 16.83



Note: See Figure A-2 for explanation of symbols



LOG OF MONITORING WELL

FIGURE A-9

:WAF:LJB:DAC:CBK:CMS 6/24/92

0161-013-R69

MONITORING WELL NO. MW-39

WELL SCHEMATIC

Casing Elevation (ft.): 24.47
 Casing Stickup (ft.): -0.38

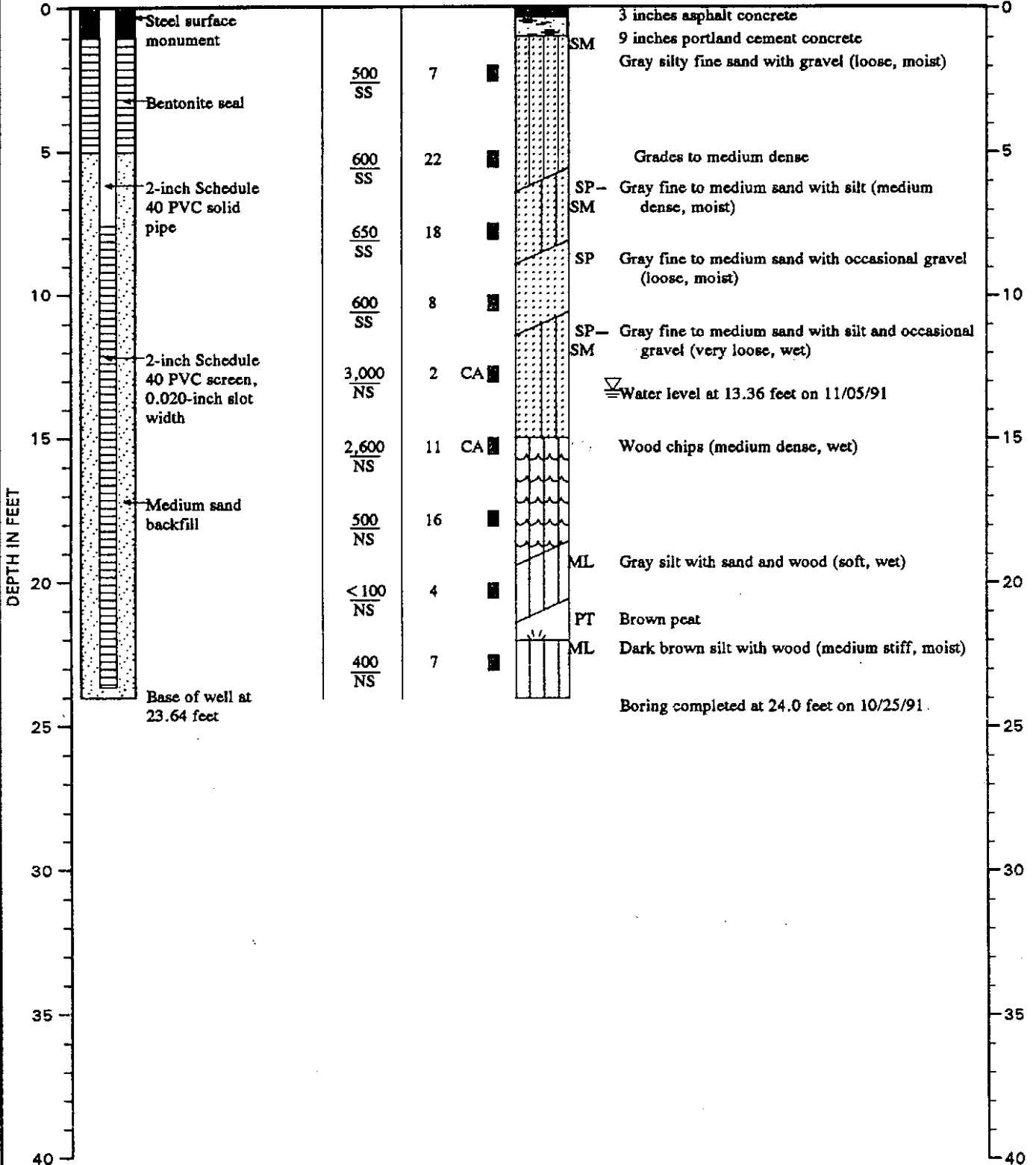
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 24.85



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-40

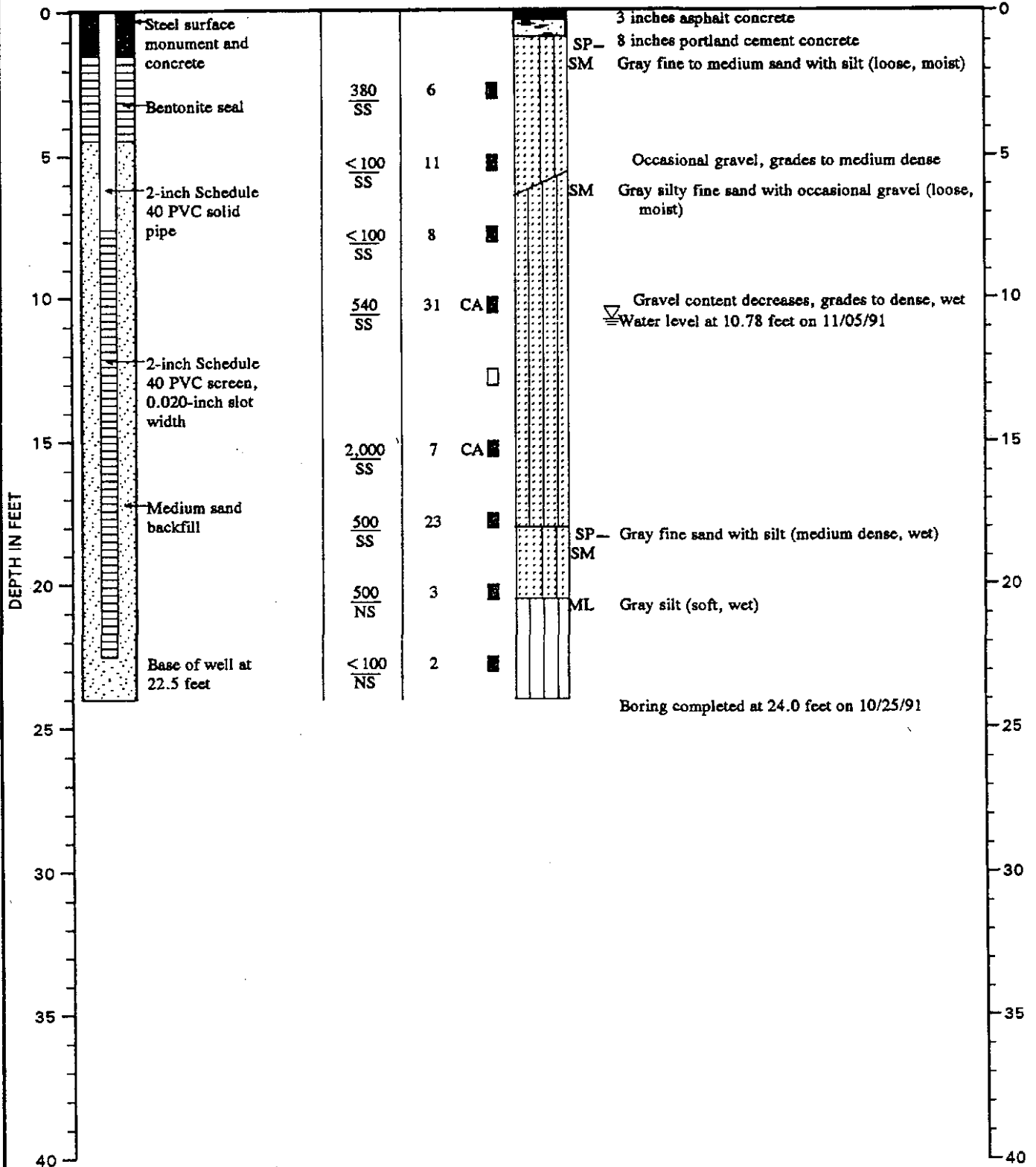
WELL SCHEMATIC

Casing Elevation (ft.): 20.89
 Casing Stickup (ft.): -0.23

Vapor
 Conc. (ppm)
 Sheen

DESCRIPTION

Surface Elevation (ft.): 21.12



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-41

WELL SCHEMATIC

Casing Elevation (ft.): 27.00
 Casing Stickup (ft.): -0.2

Vapor
 Conc. (ppm)
 Sheen

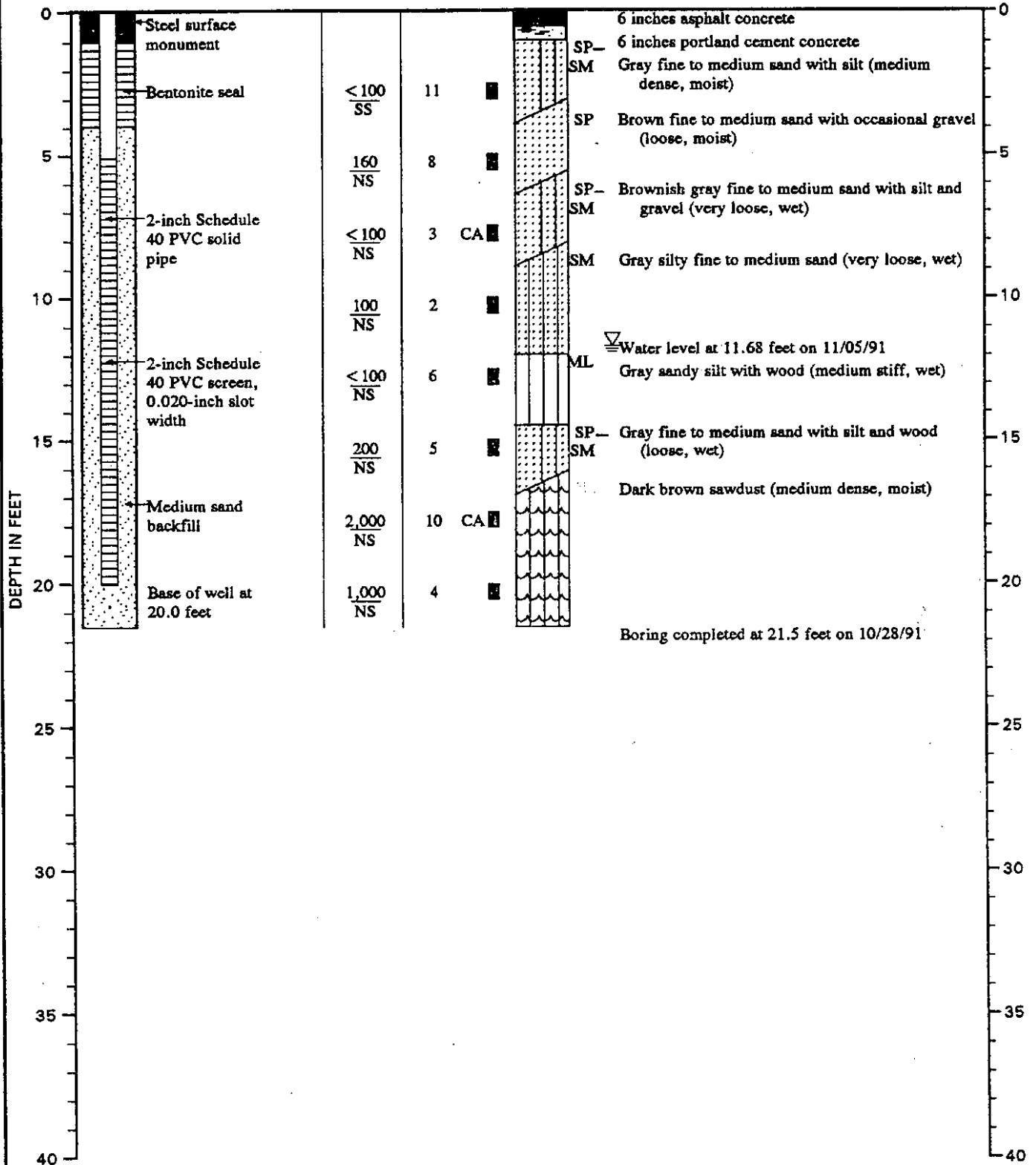
Blow
 Count

Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 27.20



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-42

WELL SCHEMATIC

Casing Elevation (ft.): 20.32
 Casing Stickup (ft.): -0.02

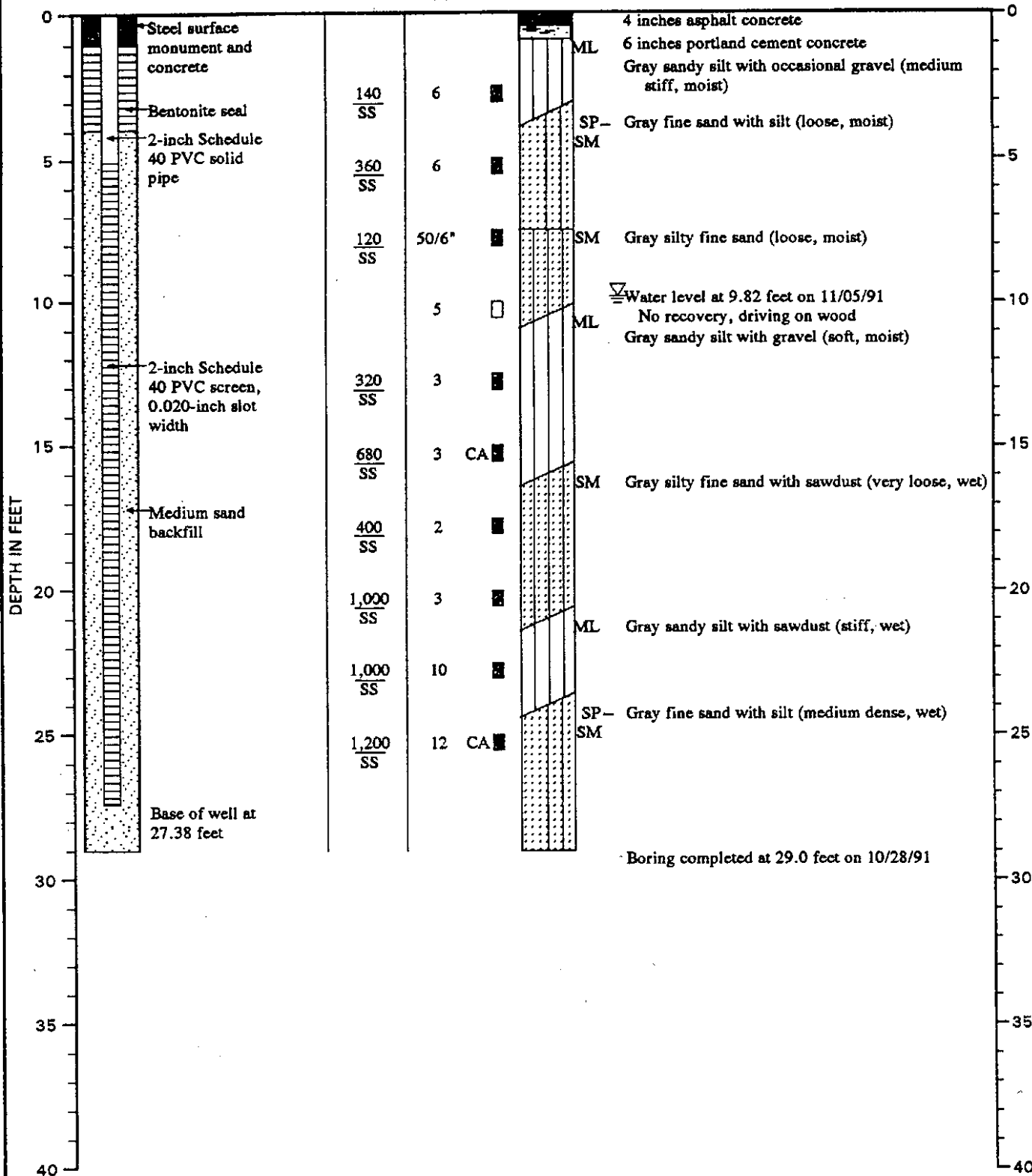
Vapor
 Conc.(ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 20.34



Note: See Figure A-2 for explanation of symbols



LOG OF MONITORING WELL

FIGURE A-13

:WAP:LJB:DAC:CBK:CMS 6/24/92

0161-013-R69

MONITORING WELL NO. MW-43

WELL SCHEMATIC

Casing Elevation (ft.): 21.04
 Casing Stickup (ft.): -0.25

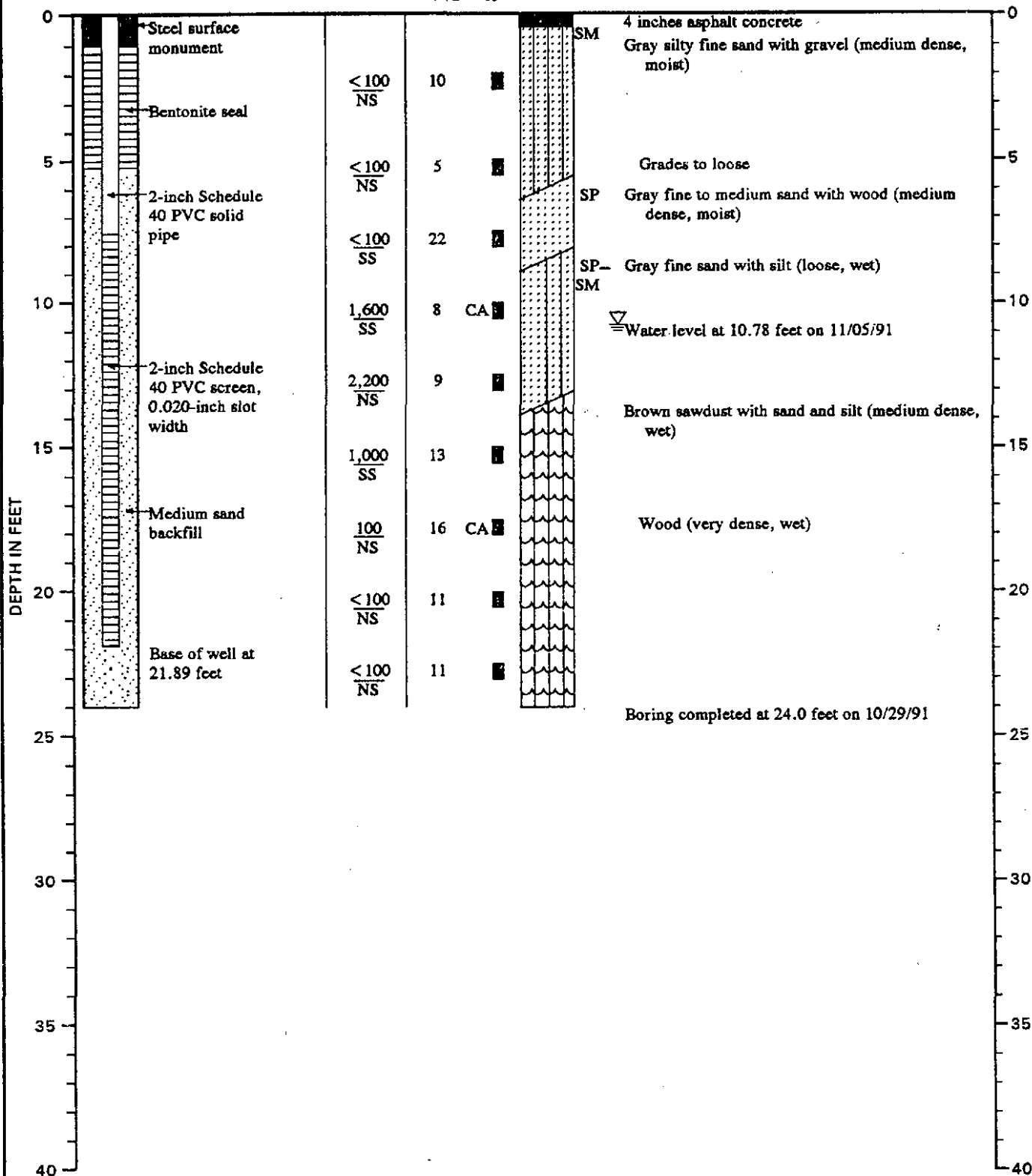
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 21.29



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-44

WELL SCHEMATIC

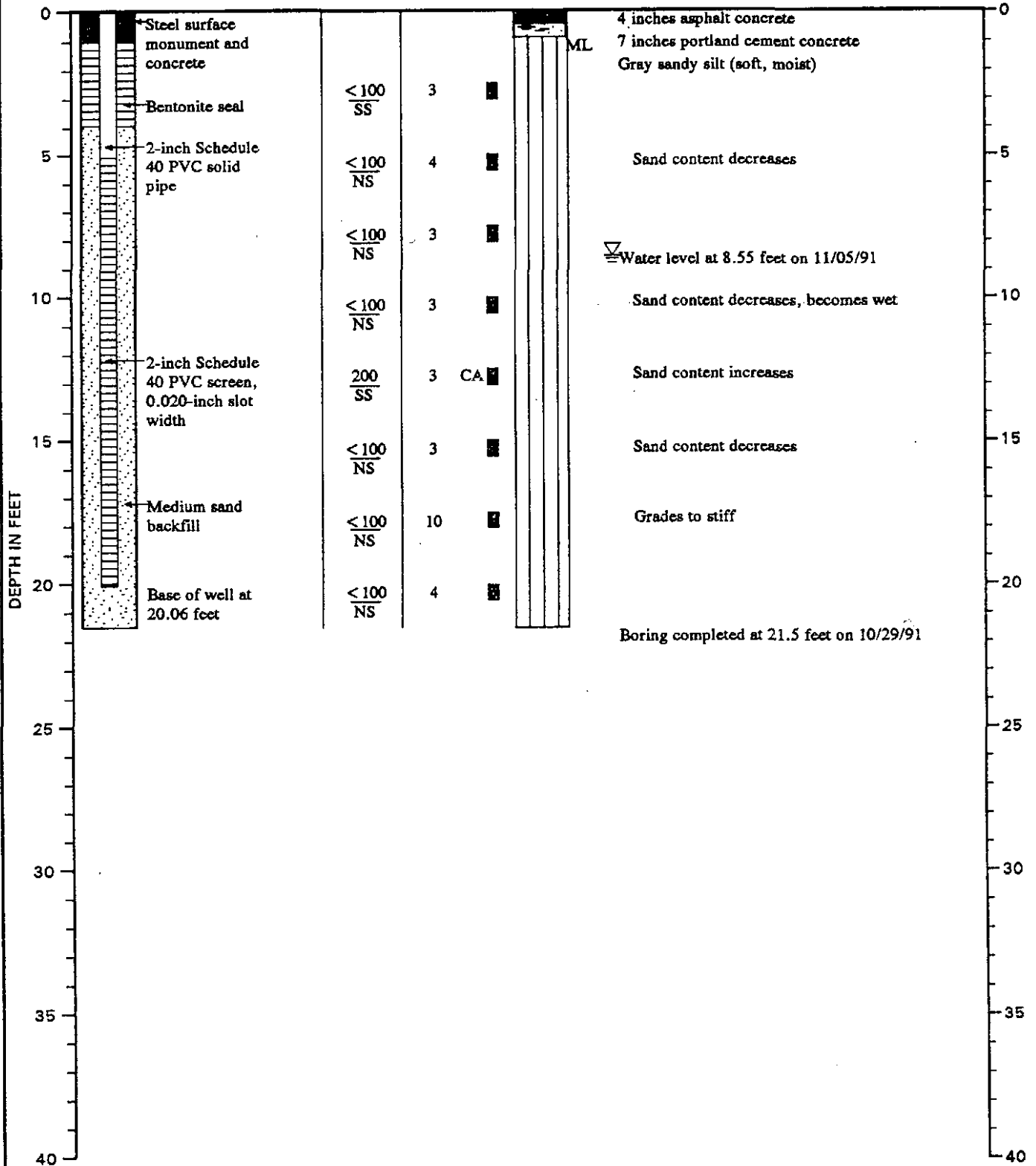
Casing Elevation (ft.): 18.73
 Casing Stickup (ft.): -0.17

Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples
 Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 18.92



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-45

WELL SCHEMATIC

Casing Elevation (ft.): 18.15
 Casing Stickup (ft.): -0.26

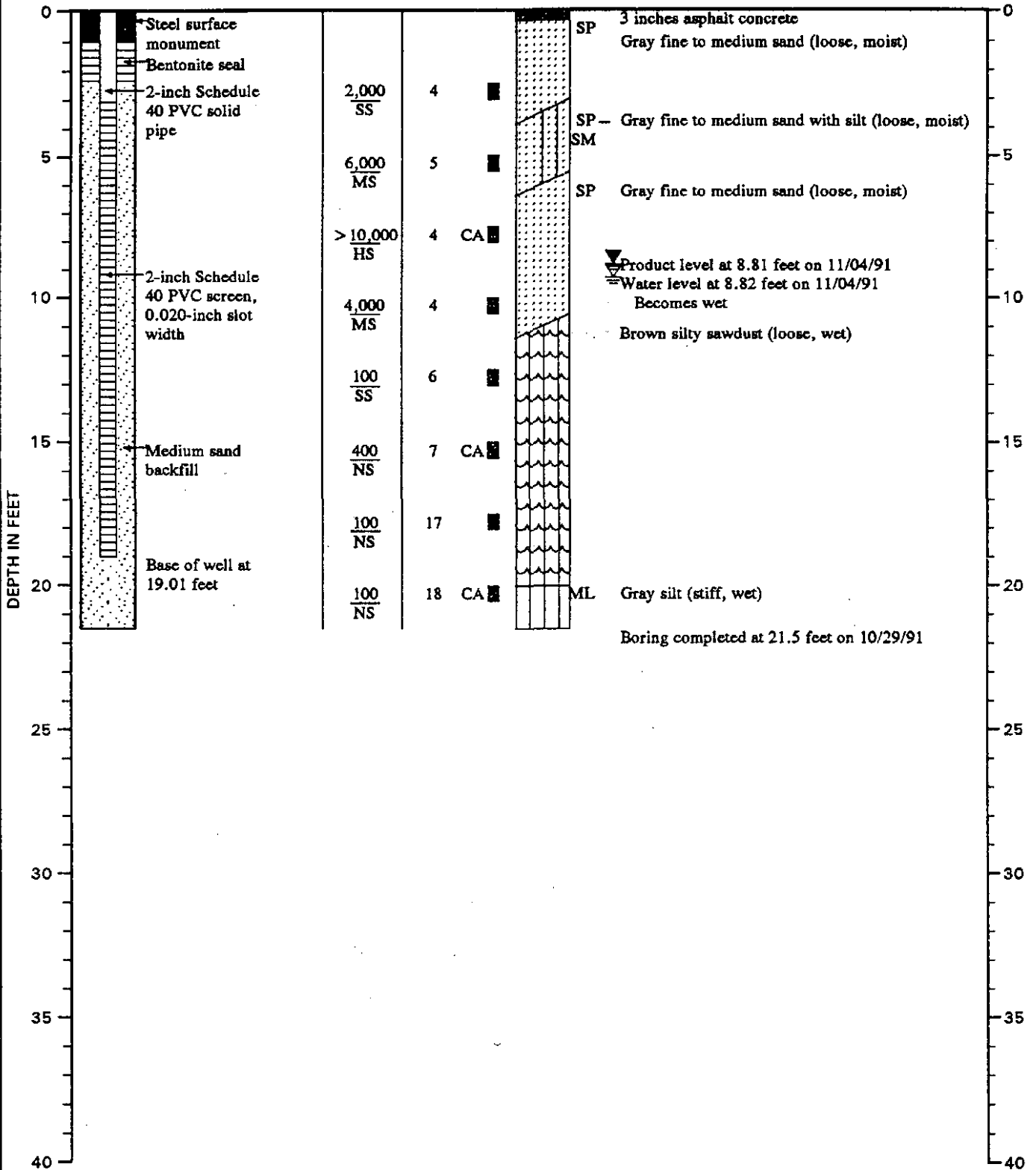
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 18.41



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-46

WELL SCHEMATIC

Casing Elevation (ft.): 16.91
 Casing Stickup (ft.): -0.40

Vapor
 Conc. (ppm)
 Sheen

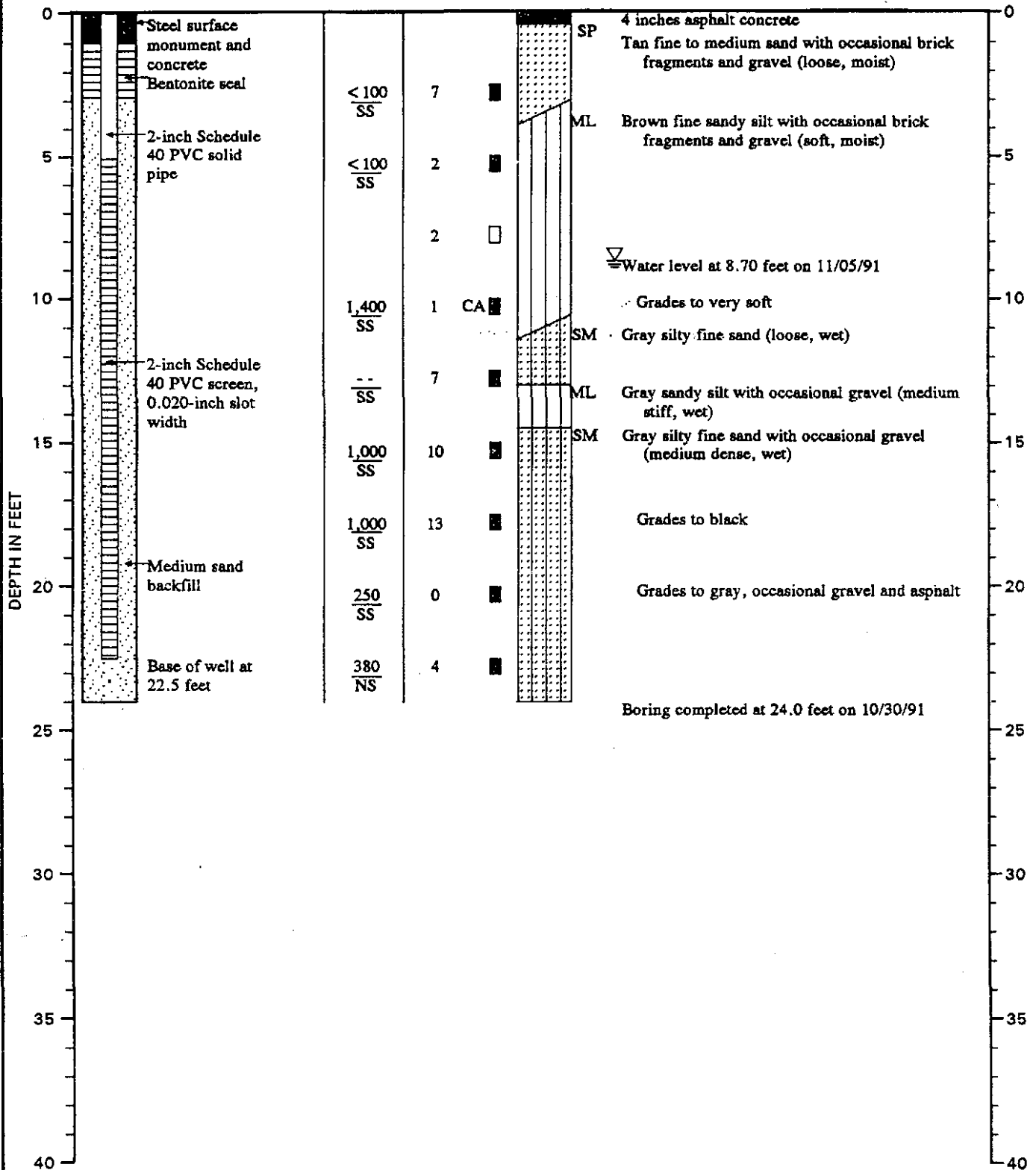
Blow
 Count

Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 17.31



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-47

WELL SCHEMATIC

Casing Elevation (ft.): 19.83
 Casing Stickup (ft.): -0.21

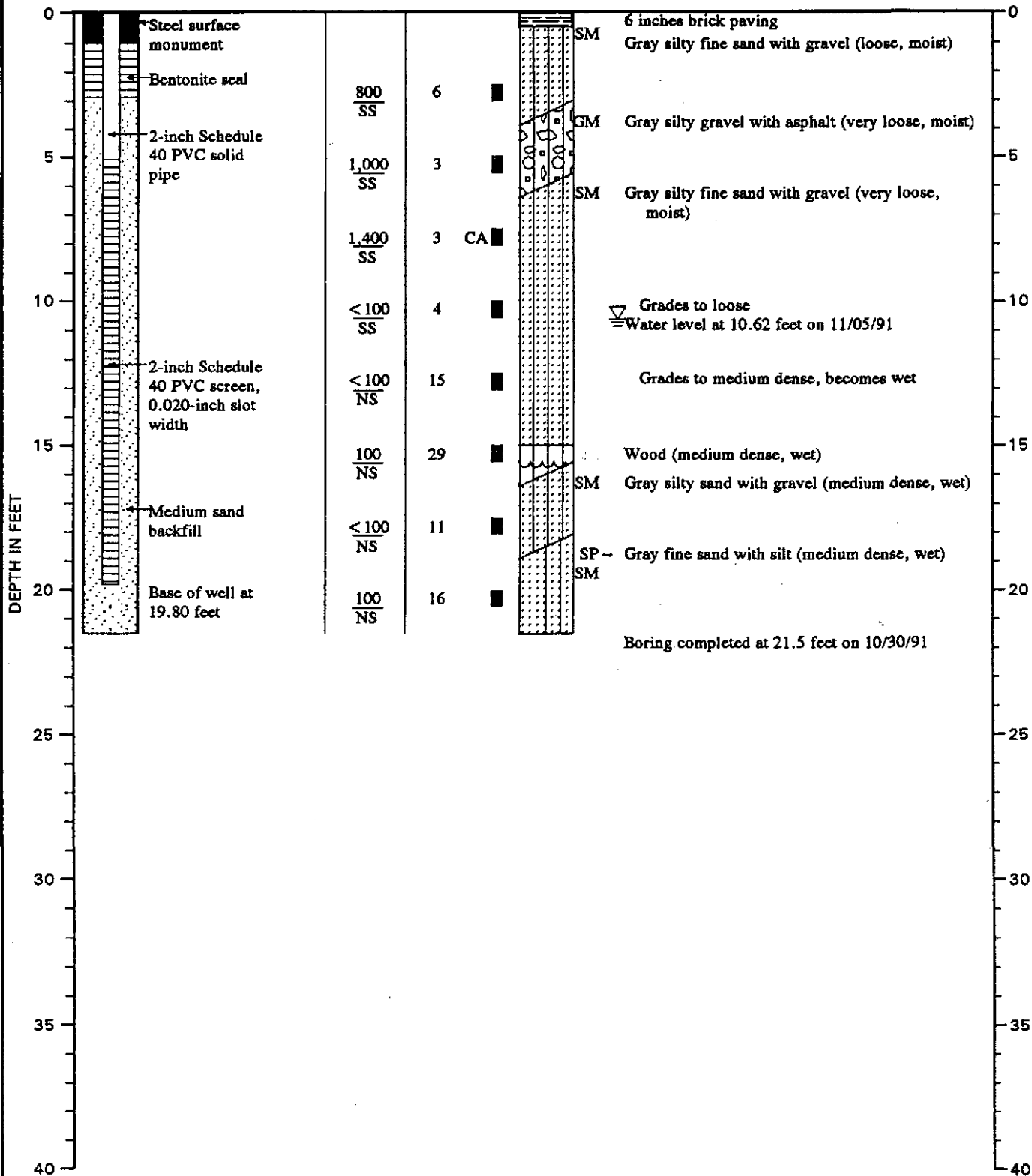
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 20.04



Note: See Figure A-2 for explanation of symbols



LOG OF MONITORING WELL

FIGURE A-18

:WAP:LJB:DAC:CBK:CMS 6/24/92

0181-013-R89

MONITORING WELL NO. MW-48

WELL SCHEMATIC

Casing Elevation (ft.): 18.49
 Casing Stickup (ft.): -0.19

Vapor
 Conc. (ppm)
 Sheen

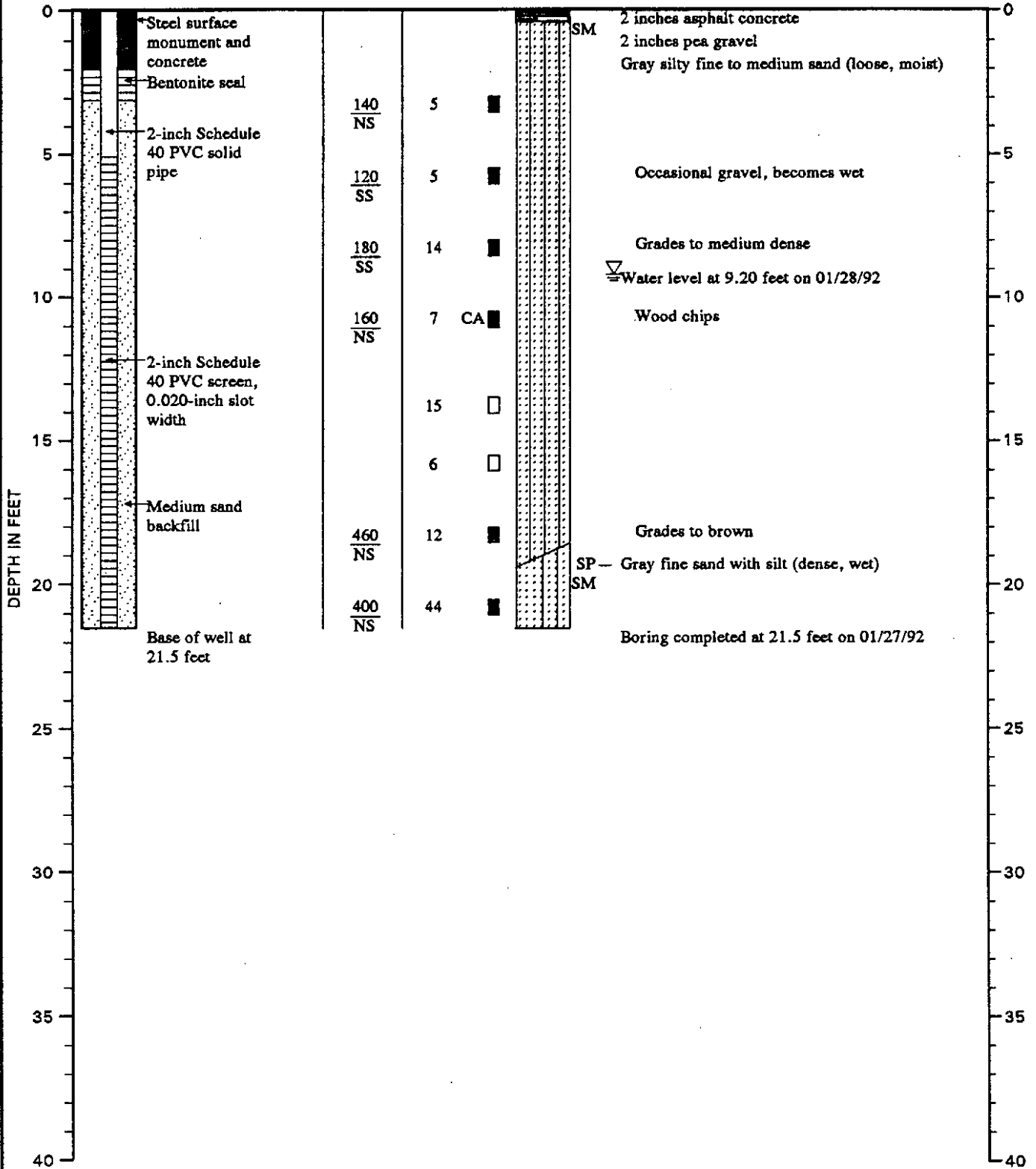
Blow
 Count

Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 18.68



Note: See Figure A-2 for explanation of symbols

MONITORING WELL NO. MW-49

WELL SCHEMATIC

Casing Elevation (ft.): 12.61
 Casing Stickup (ft.): -0.82

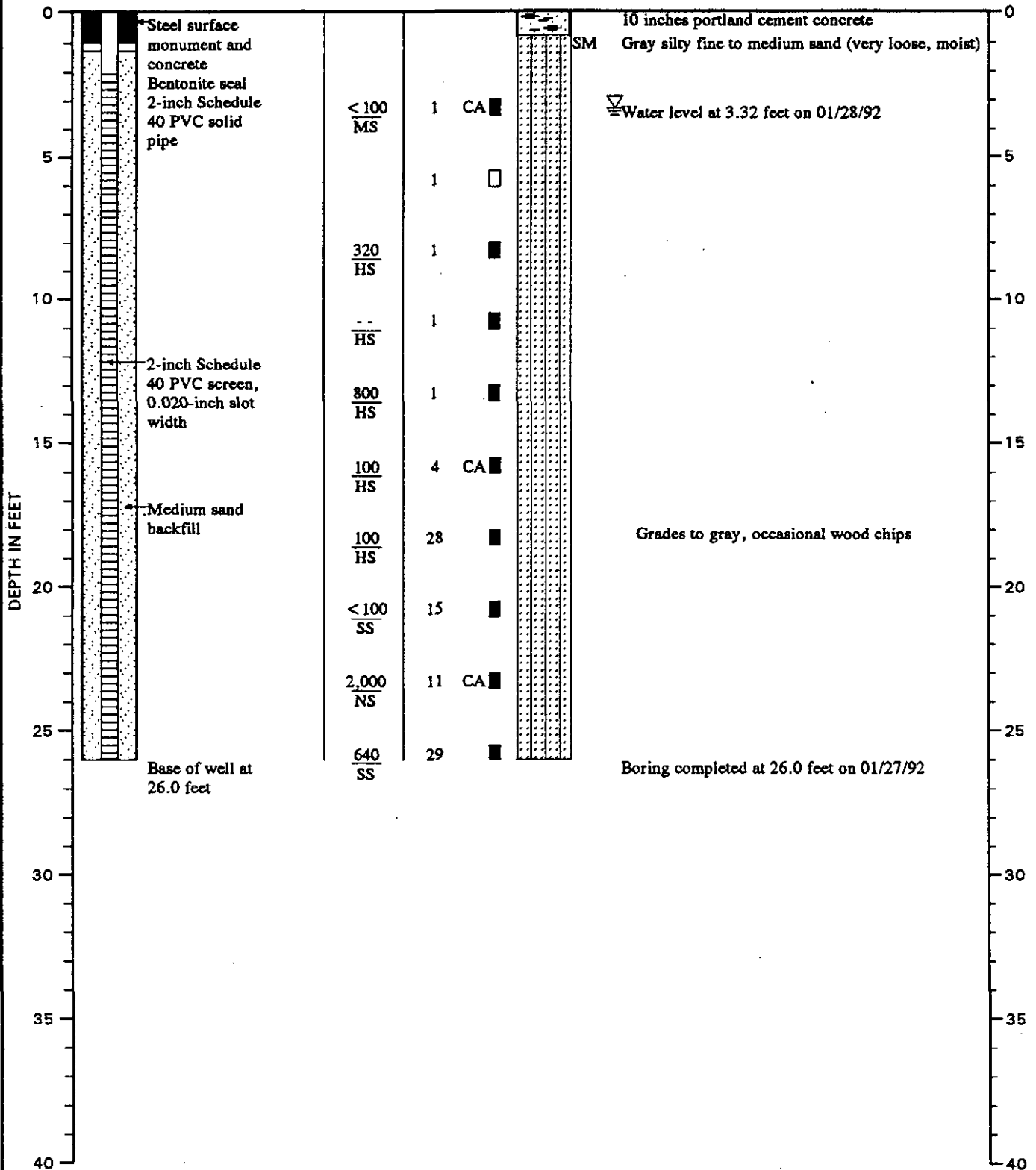
Vapor
 Conc. (ppm)
 Sheen

Blow
 Count
 Samples

Group
 Symbol

DESCRIPTION

Surface Elevation (ft.): 13.43



Note: See Figure A-2 for explanation of symbols



LOG OF MONITORING WELL

FIGURE A-20

:WAP:LJB:DAC:CBK:CMS 6/24/92

0161-013-R69

APPENDIX B

APPENDIX B

CHEMICAL ANALYTICAL PROGRAM

ANALYTICAL METHODS

Chain of Custody procedures were followed during transport of the water and soil samples to the analytical laboratory. The samples were held in cold storage pending extraction and/or analysis. Both the water and the soil samples were analyzed by ATI (Analytical Technologies Inc.) of Renton, Washington. A total of 37 soil samples and 18 water samples were analyzed using the following methods:

<u>Analyte</u>	<u>Technique/Equipment</u>	<u>Method</u>
BETX	Gas Chromatography/ Photo Ionization Detector	EPA 8020
Fuel Hydrocarbons	Gas Chromatography/ Flame Ionization Detector	EPA 8015
Total Petroleum Hydrocarbons Gasoline-Range	Gas Chromatography/ Flame Ionization Detector	Ecology WTPH-G
Lead	Inductively Coupled Argon Plasma Emission Spectrometry	EPA 6010
Lead	Atomic Absorption Graphite Furnace Detector	EPA 7421

The laboratory reports are included in this Appendix.

QUALITY CONTROL DATA REVIEW

Data Quality Goals

We reviewed ATI's analytical data for acceptability within laboratory-specific control limits, and for general compliance with mandated QC (Quality Control) procedures as described in EPA's SW-846. ATI uses a combination of surrogate percent recovery, matrix spike recovery and duplicate recovery to evaluate the validity of analytical results. ATI also uses data quality goals for individual chemicals or groups of chemicals based on long-term performance of the test methods.

Data Quality Review

Surrogates. Surrogates are added by ATI to all soil and water samples prior to extraction and analysis for all organic compounds to monitor sample handling procedures, matrix effects, and purging efficiency. The surrogate recoveries were within control limits except for sample MW-37-6, MW-39-5, MW-40-5, MW-45-5, and MW-49-6. The exceptions are listed below under the Data Quality Exceptions section.

Matrix Spike/Matrix Spike Duplicates (MS/MSD). Matrix spikes and matrix spike duplicates were analyzed as appropriate to monitor matrix effects. The MS/MSD recoveries and relative percent differences were within control limits.

Holding Times. All samples were extracted and analyzed within the recommended holding times except for MW-34-7 and MW-45-6.

Blanks. Laboratory blanks were prepared and analyzed for possible contaminants introduced during sample analysis. Contaminants were not detected in the blanks.

Data Quality Exceptions

The data quality exceptions and our evaluation of the exceptions are listed below. Some of the QC exceptions are noted by ATI in its laboratory reports which are included in this appendix.

<u>Samples</u>	<u>Date</u>	<u>Sample</u>	<u>Data Quality Exception</u>	<u>Evaluation of Exception</u>
<u>Affected</u>	<u>Sampled</u>	<u>Matrix</u>		
MW-37-6	10/24/91	Soil	Surrogates out of limits.	Analytical results indicate that the data outliers are due to matrix interference.
MW-39-5	10/25/91	Soil		
MW-40-5	10/25/91	Soil		
MW-45-5	10/29/91	Soil		
MW-49-6	01/29/92	Soil		

Summary

Some data quality exceptions were encountered in analyzing the samples for this project. The exceptions are outlined in the Data Quality Exceptions section above. Based on the overall QC data and our evaluation of the data quality exceptions, it is our opinion that the sample data are acceptable for use in this report with the restrictions noted above.



Analytical **Technologies, Inc.**

560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9110-340

November 27, 1991

GeoEngineers

DEC 02 1991

GeoEngineers, Inc.
8410 154th Ave N.E.
Redmond, WA 98052

Routing ALP
File

Attention : Norm Puri

Project Number : 0161-13-R69

Project Name : Unocal - SS-5353

On October 28, 1991, Analytical Technologies, Inc., received 13 soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Frederick W. Grothkopp
Laboratory Manager

FWG/hal/ew

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL - SS-5353

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9110-340-1	MW-32-5	10/21/91	SOIL
9110-340-2	MW-32-7	10/21/91	SOIL
9110-340-3	MW-33-3	10/21/91	SOIL
9110-340-4	MW-33-5	10/21/91	SOIL
9110-340-5	MW-33-7	10/21/91	SOIL
9110-340-6	MW-34-5	10/22/91	SOIL
9110-340-7	MW-34-6	10/22/91	SOIL
9110-340-8	MW-35-5	10/22/91	SOIL
9110-340-9	MW-36-3	10/23/91	SOIL
9110-340-10	MW-39-5	10/25/91	SOIL
9110-340-11	MW-39-6	10/25/91	SOIL
9110-340-12	MW-40-4	10/25/91	SOIL
9110-340-13	MW-40-5	10/25/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	13

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL - SS-5353

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
LEAD	ICAP	EPA 6010	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9110-340

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	96
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ATI I.D. # 9110-340

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	85
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ATI I.D. # 9110-340-1

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-32-5	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	41
ETHYLBENZENE	110
TOLUENE	300
TOTAL XYLENES	600

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	67
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ATI I.D. # 9110-340-2

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-32-7	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	0.33
ETHYLBENZENE	0.40
TOLUENE	1.1
TOTAL XYLENES	2.3

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	62
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ATI I.D. # 9110-340-3

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-33-3	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	0.27
TOLUENE	0.098
TOTAL XYLENES	1.3

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	64
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ATI I.D. # 9110-340-4

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-33-5	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	0.10

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	57
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ATI I.D. # 9110-340-5

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-33-7	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	65
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ATI I.D. # 9110-340-6

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-34-5	DATE ANALYZED	: 11/03/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	9.0
ETHYLBENZENE	51
TOLUENE	4.4
TOTAL XYLENES	290

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	85
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ATI I.D. # 9110-340-7

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-34-6	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	0.28
ETHYLBENZENE	1.2
TOLUENE	2.3
TOTAL XYLENES	7.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	61
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ATI I.D. # 9110-340-8

 VOLATILE ORGANIC ANALYSIS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-35-5	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	0.045
ETHYLBENZENE	<0.025
TOLUENE	0.032
TOTAL XYLENES	0.065

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	58
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ATI I.D. # 9110-340-9

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/23/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-36-3	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	61
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ATI I.D. # 9110-340-10

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-39-5	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

----- COMPOUND	RESULT -----
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	F
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F = Out of limits due to matrix interference.

ATI I.D. # 9110-340-11

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-39-6	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.076
ETHYLBENZENE	<0.076
TOLUENE	<0.076
TOTAL XYLENES	<0.076

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	64
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ATI I.D. # 9110-340-12

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-40-4	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	61
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ATI I.D. # 9110-340-13

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-40-5	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUND	RESULT
BENZENE	<0.093
ETHYLBENZENE	<0.093
TOLUENE	<0.093
TOTAL XYLENES	<0.093

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	F
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F = Out of limits due to matrix interference.

ATI I.D. # 9110-340

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL - SS-5353
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 10/29/91
DATE ANALYZED : 10/31/91
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.747	75	0.725	73	3
TOLUENE	<0.025	1.00	0.856	86	0.808	81	6
TOTAL XYLENES	<0.025	2.00	1.80	90	1.73	87	4

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-340

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL - SS-5353
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 11/04/91
DATE ANALYZED : 11/04/91
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.694	69	0.740	74	6
TOLUENE	<0.025	1.00	0.814	81	0.825	83	1
TOTAL XYLENES	<0.025	2.00	1.70	85	1.73	87	2

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$



ATI I.D. # 9110-340

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL

ATI I.D. # 9110-340

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/26/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/27/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL



ATI I.D. # 9110-340-3

 FUEL HYDROCARBON ANALYSIS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-33-3	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

 COMPOUND

 RESULT

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

ATI I.D. # 9110-340-6

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-34-5	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

340
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

100
C12 - C24
DIESEL



ATI I.D. # 9110-340-9

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/23/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-36-3	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

----- COMPOUND -----	RESULT -----
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
 FUEL HYDROCARBONS	 <5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

ATI I.D. # 9110-340-10

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 11/26/91
CLIENT I.D.	: MW-39-5	DATE ANALYZED	: 11/27/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

ATI I.D. # 9110-340-12

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL - SS-5353
 CLIENT I.D. : MW-40-4
 SAMPLE MATRIX : SOIL
 METHOD : 8015 (MODIFIED)

DATE SAMPLED : 10/25/91
 DATE RECEIVED : 10/28/91
 DATE EXTRACTED : 10/29/91
 DATE ANALYZED : 10/30/91
 UNITS : mg/Kg
 DILUTION FACTOR : 1

COMPOUNDRESULT

FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

<5
 C7 - C12
 GASOLINE

FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

<5
 C12 - C24
 DIESEL

ATI I.D. # 9110-340

FUEL HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : 9110-336-11
PROJECT # : 0161-13-R69	DATE EXTRACTED : 10/29/91
PROJECT NAME : UNOCAL - SS-5353	DATE ANALYZED : 10/30/91
METHOD : 8015 (MODIFIED)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
FUEL HYDROCARBONS (DIESEL)	<5.0	500	431	86	371	74	15

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-340

FUEL HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : 9110-340-10
PROJECT # : 0161-13-R69	DATE EXTRACTED : 11/26/91
PROJECT NAME : UNOCAL - SS-5353	DATE ANALYZED : 11/27/91
METHOD : 8015 (MODIFIED)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
FUEL HYDROCARBONS (DIESEL)	<25	500	565	113	590	118	4

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-340

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE



ATI I.D. # 9110-340-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-32-5	DATE ANALYZED	: 11/03/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 100

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

4,500
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-340-2

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-32-7	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS
-----FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING18
BENZENE TO NAPHTHALENE
GASOLINE



Analytical Technologies, Inc.

ATI I.D. # 9110-340-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-33-3	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS	60
HYDROCARBON RANGE	BENZENE TO NAPHTHALENE
HYDROCARBON QUANTITATION USING	GASOLINE



ATI I.D. # 9110-340-4

 TOTAL PETROLEUM HYDROCARBONS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-33-5	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

 COMPOUNDS

 RESULTS

 FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

 <5
 BENZENE TO NAPHTHALENE
 GASOLINE

ATI I.D. # 9110-340-5

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/21/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-33-7	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-340-6

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-34-5	DATE ANALYZED	: 11/03/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 100

COMPOUNDSRESULTS
-----FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING2,600
BENZENE TO NAPHTHALENE
GASOLINE



Analytical Technologies, Inc.

ATI I.D. # 9110-340-7

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-34-6	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

170
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-340-8

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-35-5	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-340-9

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/23/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-36-3	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-340-10

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-39-5	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE



ATI I.D. # 9110-340-11

 TOTAL PETROLEUM HYDROCARBONS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-39-6	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

 COMPOUNDS

RESULTS

 FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

 <5
 BENZENE TO NAPHTHALENE
 GASOLINE

ATI I.D. # 9110-340-12

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-40-4	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE



ATI I.D. # 9110-340-13

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/25/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/28/91
PROJECT NAME	: UNOCAL - SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-40-5	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

13
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-340

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9110-340-4
PROJECT #	: 0161-13-R69	DATE EXTRACTED	: 10/29/91
PROJECT NAME	: UNOCAL - SS-5353	DATE ANALYZED	: 11/01/91
EPA METHOD	: WTPH GASOLINE	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	<5.0	100	56.5	57	61.0	61	8

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$



Analytical Technologies, Inc.

ATI I.D. # 9110-340

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL - SS-5353

MATRIX : SOIL

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	11/05/91	11/06/91

ATI I.D. # 9110-340

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL - SS-5353

MATRIX : SOIL
UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9110-340-1	MW-32-5	26
9110-340-2	MW-32-7	29
9110-340-3	MW-33-3	2.0
9110-340-6	MW-34-5	8.2
9110-340-8	MW-35-5	3.4
9110-340-9	MW-36-3	3,900
9110-340-10	MW-39-5	3.0
9110-340-12	MW-40-4	2.0
REAGENT BLANK	-	<1.5



ATI I.D. # 9110-340

 METALS ANALYSIS
 QUALITY CONTROL DATA

 CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL - SS-5353

 MATRIX : SOIL
 UNITS : mg/Kg

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9110-340-12	2.0	2.2	10	241	287	83

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-340

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL - SS-5353

MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
MOISTURE	-	10/30/91



ATI I.D. # 9110-340

 GENERAL CHEMISTRY ANALYSIS
 DATA SUMMARY

 CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL - SS-5353

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9110-340-1	MW-32-5	21
9110-340-2	MW-32-7	36
9110-340-3	MW-33-3	11
9110-340-4	MW-33-5	18
9110-340-5	MW-33-7	15
9110-340-6	MW-34-5	20
9110-340-7	MW-34-6	18
9110-340-8	MW-35-5	15
9110-340-9	MW-36-3	22
9110-340-10	MW-39-5	12
9110-340-11	MW-39-6	67
9110-340-12	MW-40-4	15
9110-340-13	MW-40-5	73

ATI I.D. # 9110-340

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL - SS-5353

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9110-340-12	15	14	7	N/A	N/A	N/A

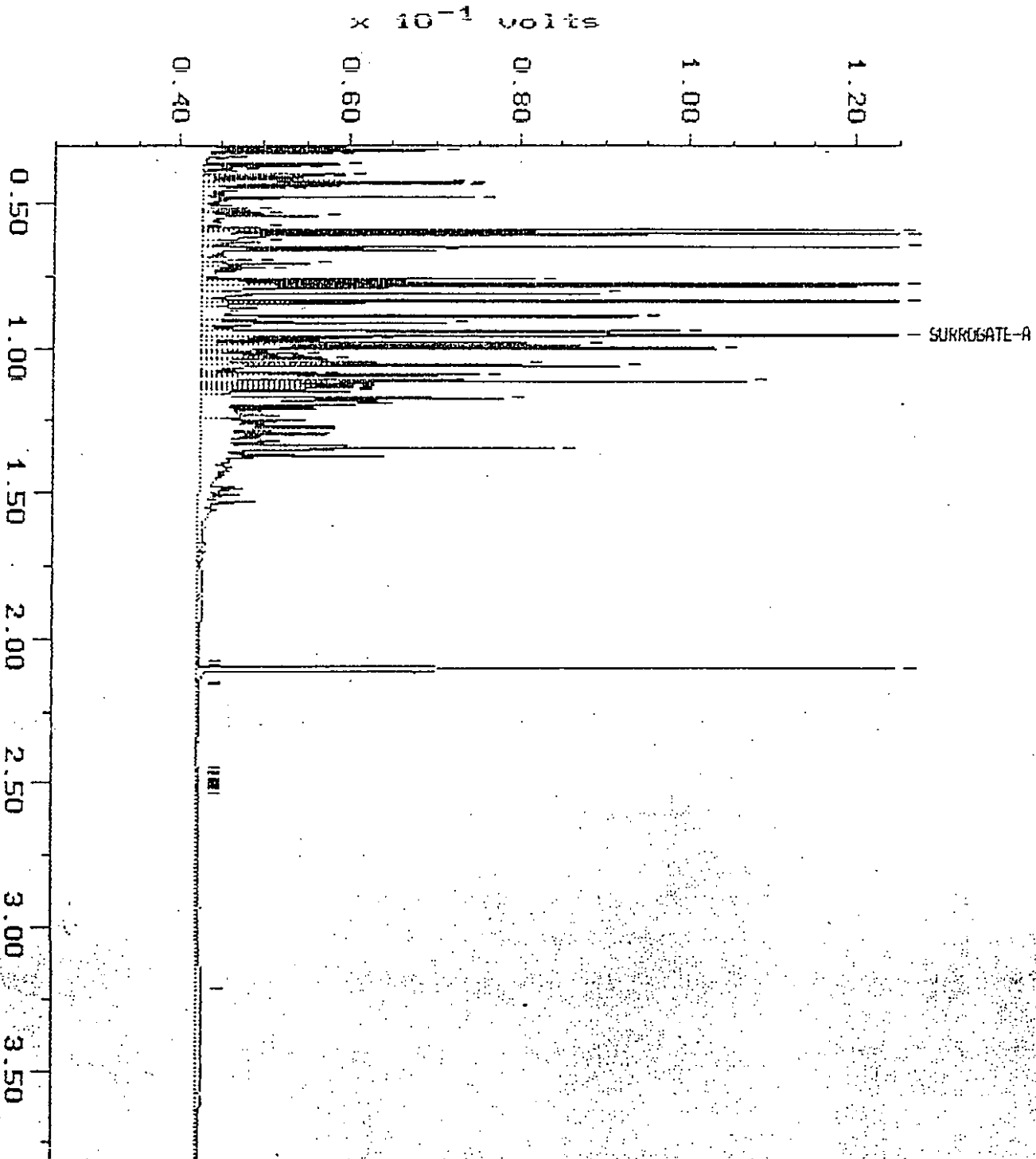
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

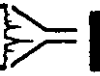
$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9110-340-6
Acquired: 30-OCT-91 23:52
Inj Vol: 1.00

Channel: BERT
Method: L:\BRI2\MAX\DATA\BERT\FUEL1030

Filename: 1030BE05
Operator: PEA





Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody LABORATORY NUMBER: 011-240

DATE 10/29/94 PAGE 1 OF 2

ANALYSIS REQUEST

PROJECT MANAGER: Nancy P.
 COMPANY: GET
 ADDRESS: _____
 PHONE: 861-6000 SAMPLED BY: WAP/LWB
 ATTI Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	8080 Pesticide (4)	8240 ZH-EXT	8270	8150 Herbicides (2)	Metals (8)	TOTP ONLY	WTPH - G	Total Pb 7420	NUMBER OF CONTAINERS		
MW-32-5	10/21/91		Soil	-1	X																													
MW-32-7	10/21/91			-2	X																													
MW-32-3	10/21/91			-3	X																													
MW-32-5	10/21/91			-4	X																													
MW-33-7	10/21/91			-5	X																													
MW-34-5	10/21/91			-6	X																													
MW-34-6	10/21/91			-7	X																													
MW-35-5	10/21/91			-8	X																													
MW-36-3	10/22/91			-9	X																													
MW-39-5	10/25/91			-10	X																													
MW-39-6	10/25/91			-11	X																													
MW-40-4	10/25/91			-12	X																													

PROJECT INFORMATION
 PROJECT NUMBER: 161-13-269
 PROJECT NAME: Unocal 55-5353
 PURCHASE ORDER NUMBER: _____
 ONGOING PROJECT? YES NO

SAMPLE RECEIPT
 TOTAL NUMBER OF CONTAINERS: 12
 COC SEALS/INTACT? Y/N/V/A: _____
 RECEIVED GOOD COND./COLD: Y
 RECEIVED VIA: Truck

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS
 TAT: (NORMAL) 2WKS (RUSH) 24HR 48HRS 72HRS 1WK

SPECIAL INSTRUCTIONS:
Bill to Cary Gunderson, Unocal

RELINQUISHED BY:
 1. Signature: [Signature] Time: _____
 Printed Name: Norman L. P. Date: 10/25/91
 Company: GET

RELINQUISHED BY:
 2. Signature: _____ Time: _____
 Printed Name: _____ Date: _____
 Company: _____

RELINQUISHED BY:
 3. Signature: _____ Time: _____
 Printed Name: _____ Date: _____
 Company: _____

RECEIVED BY:
 1. Signature: [Signature] Time: _____
 Printed Name: QUENA SERRA Date: 10/25/91
 Company: ATI

RECEIVED BY:
 2. Signature: _____ Time: _____
 Printed Name: _____ Date: _____
 Company: _____

RECEIVED BY:
 3. Signature: _____ Time: _____
 Printed Name: _____ Date: _____
 Company: _____

Chain of Custody LABORATORY NUMBER: 0110-340

DATE: 1/28/91 PAGE 2 OF 2

PROJECT MANAGER: <u>Norman Paci</u>		COMPANY: <u>GET</u>		ADDRESS: _____	
PHONE: <u>861-6000</u>		SAMPLED BY: <u>WAP/LIB</u>		SAMPLE DISPOSAL INSTRUCTIONS	
<input checked="" type="checkbox"/> AT1 Disposal @ \$5.00 each		<input type="checkbox"/> Return			
SAMPLE ID	DATE	TIME	MATRIX	LAB ID	
<u>MW-90-5</u>	<u>1/25/91</u>		<u>GLL</u>	<u>-13</u>	
					8010 Halogenated Volatiles
					8020 Aromatic Volatiles
				X	8020 BETX ONLY
					8240 GCMS Volatiles
					8270 GCMS BNA
					8310 HPLC PNA
					8080 Pesticides & PCB's
					8080 PCB's ONLY
					8140 Phosphate Pesticides
					8150 Herbicides
					WDOE PAH/HH (WAC 173)
					418.1 (TPH)
					413.2 Grease & Oil
					8015 (Modified)
					TOC 9050
					TOX 9020
					% Moisture
					EP TOX Metals (8) EP EXT
					Priority Pollutant Metals (13)
					8080 Pesticide (4)
					8240 ZH-EXT
					8270
					8150 Herbicides (2)
					Metals (8)
				X	WTPH-G
					NUMBER OF CONTAINERS
					1

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJECT NUMBER: <u>161-13-269</u>	TOTAL NUMBER OF CONTAINERS: <u>1</u>	REINQUISHED BY: <u>1</u>	REINQUISHED BY: <u>2</u>
PROJECT NAME: <u>16001 55-5353</u>	COG SEAL/INTACT? <u>Y/N/A</u>	Signature: _____	Signature: _____
PURCHASE ORDER NUMBER: _____	RECEIVED GOOD COND/COLD: <u>Y</u>	Printed Name: _____	Printed Name: _____
ONGOING PROJECT? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	RECEIVED VIA: <u>Container</u>	Date: <u>1/28/91</u>	Date: _____
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS			
TAT: (NORMAL) <input type="checkbox"/> 2WKS (RUSH) <input type="checkbox"/> 24HR <input type="checkbox"/> 48 HRS <input type="checkbox"/> 72 HRS <input checked="" type="checkbox"/> 1WK	RECEIVED BY: _____	Signature: _____	Signature: _____
GREATER THAN 24 HR. NOTICE? YES <input type="checkbox"/> NO <input type="checkbox"/> (LAB USE ONLY)	RECEIVED BY: _____	Printed Name: _____	Printed Name: _____
SPECIAL INSTRUCTIONS:	Signature: _____	Date: _____	Date: _____
	Signature: _____	Date: _____	Date: _____
	Signature: _____	Date: _____	Date: _____
	Signature: _____	Date: _____	Date: _____



ATI I.D. # 9110-344

November 21, 1991

GeoEngineers

GeoEngineers, Inc.
8410 154th Ave. N.E.
Redmond, WA 98052

NOV 21 1991

Routing *NLP*
File

Attention : Norm Puri

Project Number : 0161-13-R69

Project Name : Unocal SS-5353

On October 29, 1991, Analytical Technologies, Inc., received seven soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Frederick W. Grothkopp
Laboratory Manager

FWG/hal/elf

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL SS-5353

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9110-344-1	MW-35-10	10/22/91	SOIL
9110-344-2	MW-37-5	10/24/91	SOIL
9110-344-3	MW-38-3	10/24/91	SOIL
9110-344-4	MW-38-8	10/24/91	SOIL
9110-344-5	MW-35-11	10/22/91	SOIL
9110-344-6	MW-37-6	10/24/91	SOIL
9110-344-7	MW-38-4	10/24/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	7

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9110-344

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL SS-5353

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
LEAD	ICAP	EPA 6010	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9110-344

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/29/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	83
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ATI I.D. # 9110-344

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/30/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	107
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ATI I.D. # 9110-344

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/31/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/31/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	113
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ATI I.D. # 9110-344-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-35-10	DATE ANALYZED	: 10/29/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	0.055
TOTAL XYLENES	0.11

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	58
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-37-5	DATE ANALYZED	: 10/29/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	1.5
ETHYLBENZENE	8.9
TOLUENE	16 D
TOTAL XYLENES	42 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	58
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D = Value from a ten fold diluted analysis.

ATI I.D. # 9110-344-3

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-38-3	DATE ANALYZED	: 10/29/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	59
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ATI I.D. # 9110-344-4

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/30/91
CLIENT I.D.	: MW-38-8	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	61
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ATI I.D. # 9110-344-6

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-37-6	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	0.11
ETHYLBENZENE	0.42
TOLUENE	1.3
TOTAL XYLENES	2.8

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	F
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F = Out of limits due to matrix interference.

ATI I.D. # 9110-344

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : 9110-369-3
PROJECT # : 0161-13-R69	DATE EXTRACTED : 10/30/91
PROJECT NAME : UNOCAL SS-5353	DATE ANALYZED : 10/30/91
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.680	68	0.726	73	7
TOLUENE	<0.025	1.00	0.688	69	0.758	76	10
TOTAL XYLENES	<0.025	2.00	1.45	73	1.59	80	9

$$\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-344

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 0161-13-R69	DATE EXTRACTED : 10/29/91
PROJECT NAME : UNOCAL SS-5353	DATE ANALYZED : 10/29/91
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.910	91	0.909	91	0
TOLUENE	<0.025	1.00	0.936	94	0.967	97	3
TOTAL XYLENES	<0.025	2.00	1.85	93	1.90	95	3

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATTI I.D. # 9110-344

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 0161-13-R69	DATE EXTRACTED : 10/31/91
PROJECT NAME : UNOCAL SS-5353	DATE ANALYZED : 10/31/91
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.807	81	0.771	77	5
TOLUENE	<0.025	1.00	0.841	84	0.890	89	6
TOTAL XYLENES	<0.025	2.00	1.82	91	1.85	93	2

$$\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-344

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/29/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: TPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-344-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-35-10	DATE ANALYZED	: 10/29/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: TPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-344-2

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-37-5	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: TPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

80
BENZENE TO NAPHTHALENE
GASOLINE



ATI I.D. # 9110-344-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-38-3	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: TPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-344-4

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-38-8	DATE ANALYZED	: 10/30/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: TPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE



ATI I.D. # 9110-344-6

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/24/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 10/29/91
PROJECT NAME	: UNOCAL SS-5353	DATE EXTRACTED	: 10/29/91
CLIENT I.D.	: MW-37-6	DATE ANALYZED	: 11/01/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: TPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

7
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9110-344

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 0161-13-R69	DATE EXTRACTED : 10/29/91
PROJECT NAME : UNOCAL SS-5353	DATE ANALYZED : 10/29/91
EPA METHOD : TPH GASOLINE	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	<5.0	100	104	104	107	107	3

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-344

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL SS-5353

MATRIX : SOIL

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	11/05/91	11/06/91

ATI I.D. # 9110-344

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL SS-5353

MATRIX : SOIL

UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9110-344-3	MW-38-3	130
REAGENT BLANK	-	<1.5

ATI I.D. # 9110-344

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL SS-5353

MATRIX : SOIL
UNITS : mg/Kg

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9110-340-12	2.0	2.2	10	241	287	83

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

ATI I.D. # 9110-344

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL SS-5353

MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
MOISTURE	-	10/30/91
MOISTURE (SAMPLE -6)	-	11/04/91

ATI I.D. # 9110-344

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL SS-5353

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9110-344-1	MW-35-10	16
9110-344-2	MW-37-5	79
9110-344-3	MW-38-3	22
9110-344-4	MW-38-8	11
9110-344-6	MW-37-6	67

ATI I.D. # 9110-344

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL SS-5353

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9110-344-3	22	21	5	N/A	N/A	N/A
MOISTURE	9111-005-26	9.1	11	19	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Chain of Custody LABORATORY NUMBER: 2110-344

DATE 10/24/91 PAGE 1 OF 2

ANALYSIS REQUEST

PROJECT MANAGER: Norm Puri
 COMPANY: GEI
 ADDRESS: _____
 PHONE: 261-6000
 SAMPLED BY: WAP/LAB
 SAMPLE DISPOSAL INSTRUCTIONS
 ATT Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010	8020	8020	8240	8270	8310	8080	8080	8140	8150	WDOE	418.1	413.2	8015	TOC	TOX	%	EP TOX	Priority	8080	8240	8270	8150	Metals	TCAP ONLY	WTPH-6	Total Pb	7420	NUMBER OF CONTAINERS	
MW-35-10	10/22/91		Soil	-1			X																											
MW-37-5	10/24/91			2			X																											
MW-38-3	10/24/91			3			X																											
MW-38-8	10/24/91			4			X																											

PROJECT INFORMATION

PROJECT NUMBER: 61-13-269
 PROJECT NAME: Uveral SS-5353
 PURCHASE ORDER NUMBER: _____
 ONGOING PROJECT? YES NO

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS: 4
 COC SEALS/INTACT? Y/NNA
 RECEIVED GOOD COND./COLD
 RECEIVED VIA: AIRCARR

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) 2WKS (RUSH) 24HR 48 HRS 72 HRS 1 WK
 GREATER THAN 24 HR. NOTICE? YES NO (LAB USE ONLY)

SPECIAL INSTRUCTIONS:
 Bill to Gary Gundersen, Uveral
 Fax results to Norm Puri ASAP.
 LOOK TAT ONLY

RELINQUISHED BY: 1. Signature: [Signature] Time: 1:00 PM Date: 10/24/91 Company: GEI
 RECEIVED BY: 1. Signature: [Signature] Time: 1:00 PM Date: 10/24/91 Company: GEI

RELINQUISHED BY: 2. Signature: [Signature] Time: _____ Date: _____ Company: _____
 RECEIVED BY: 2. Signature: [Signature] Time: _____ Date: _____ Company: _____

RELINQUISHED BY: 3. Signature: [Signature] Time: _____ Date: _____ Company: _____
 RECEIVED BY: 3. Signature: [Signature] Time: _____ Date: _____ Company: _____

Chain of Custody LABORATORY NUMBER: 9110-314

DATE 12/29/91 PAGE 1 of 1

PROJECT MANAGER: Norm Per
 COMPANY: GET
 ADDRESS: _____
 PHONE: 861-1220 SAMPLED BY: WAP/LLS

SAMPLE DISPOSAL INSTRUCTIONS
 ATT Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	ANALYSIS REQUEST
MW-35-11	10/22/91		Sol	5	8010 Halogenated Volatiles
MW-37-6	10/24/91		L	6	8020 Aromatic Volatiles
MW-38-4	10/29/91		L	7	8020 BETX ONLY
					8240 GCMS Volatiles
					8270 GCMS BNA
					8310 HPLC PNA
					8080 Pesticides & PCB's
					8080 PCB's ONLY
					8140 Phosphate Pesticides
					8150 Herbicides
					WDOE PAH/H (WAC 173)
					418.1 (TPH)
					413.2 Grease & Oil
					8015 (Modified)
					TOC 9060
					TOX 9020
					% Moisture
					EP TOX Metals (8) EP EXT
					Priority Pollutant Metals (13)
					8080 Pesticide (4)
					8240 ZH-EXT
					8270
					8150 Herbicides (2)
					Metals (8)
					TOX ONLY
					EXTRACT FOR WTPH-G/BETX held pending further instructions
					NUMBER OF CONTAINERS

PROJECT INFORMATION

PROJECT NUMBER: 161-13-B69 TOTAL NUMBER OF CONTAINERS: 7

PROJECT NAME: Unsat SS-5353 COC SEALS/INTACT? Y/N/A: Y/Y

PURCHASE ORDER NUMBER: _____ RECEIVED GOOD COND./COLD: Y/Y

ONGOING PROJECT? YES NO RECEIVED VIA: QUICK

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) 2WKS (RUSH) 24HR 48HRS 72HRS 1WK

GREATER THAN 24 HR. NOTICE? YES NO (LAB USE ONLY)

SPECIAL INSTRUCTIONS:
 Whether or not these samples are run is contingent on the results of samples MW-35-11, MW-37-5, MW-38-3 and MW-38-8. Please extend and hold.

RELINQUISHED BY: 1. Signature: _____ Time: _____ Date: 1/20/92

Printed Name: _____ Company: Norm Per

RECEIVED BY: 1. Signature: Norm Per Time: _____ Date: _____

Company: GET

RELINQUISHED BY: 2. Signature: _____ Time: _____ Date: _____

Printed Name: _____ Company: _____

RECEIVED BY: 2. Signature: _____ Time: _____ Date: _____

Company: _____

RELINQUISHED BY: 3. Signature: _____ Time: _____ Date: _____

Printed Name: _____ Company: _____

RECEIVED BY: 3. Signature: _____ Time: _____ Date: _____

Company: _____



ATI I.D. # 9111-021

November 15, 1991

GeoEngineers

NOV 19 1991

GeoEngineers, Inc.
8410 154th Ave N.E.
Redmond, WA 98052

Routing *NLP*
File

Attention : Norm Puri

Project Number : 161-13-R69

Project Name : Unocal Westlake & Mercer

On November 1, 1991, Analytical Technologies, Inc., received 11 soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Frederick W. Grothkopp
Laboratory Manager

FWG/hal/ew

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-R69
 PROJECT NAME : UNOCAL WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9111-021-1	MW-41-3	10/28/91	SOIL
9111-021-2	MW-41-7	10/28/91	SOIL
9111-021-3	MW-42-5	10/28/91	SOIL
9111-021-4	MW-42-9	10/28/91	SOIL
9111-021-5	MW-43-4	10/29/91	SOIL
9111-021-6	MW-43-7	10/29/91	SOIL
9111-021-7	MW-44-5	10/29/91	SOIL
9111-021-8	MW-45-3	10/29/91	SOIL
9111-021-9	MW-45-5	10/29/91	SOIL
9111-021-10	MW-46-3	10/30/91	SOIL
9111-021-11	MW-47-3	10/30/91	SOIL

=====

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	11

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-R69
 PROJECT NAME : UNOCAL WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
LEAD	ICAP	EPA 6010	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9111-021

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	85
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ATI I.D. # 9111-021

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/06/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
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BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	74
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ATI I.D. # 9111-021-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/06/91
CLIENT I.D.	: MW-41-3	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.040
ETHYLBENZENE	<0.040
TOLUENE	<0.040
TOTAL XYLENES	<0.040

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	71
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ATI I.D. # 9111-021-3

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/06/91
CLIENT I.D.	: MW-42-5	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDSRESULTS

BENZENE	0.20
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	63
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ATI I.D. # 9111-021-4

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-42-9	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	61
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ATI I.D. # 9111-021-5

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-43-4	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	60
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ATI I.D. # 9111-021-6

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-43-7	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.069
ETHYLBENZENE	<0.069
TOLUENE	<0.069
TOTAL XYLENES	<0.069

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	58
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ATI I.D. # 9111-021-7

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-44-5	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	60
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ATI I.D. # 9111-021-8

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-45-3	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 50
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	6.1
ETHYLBENZENE	63
TOLUENE	56
TOTAL XYLENES	370

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	72
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ATI I.D. # 9111-021-9

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/06/91
CLIENT I.D.	: MW-45-5	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	1.8
ETHYLBENZENE	2.6
TOLUENE	3.5
TOTAL XYLENES	15

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	F
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F = Out of limits due to matrix interference.

ATI I.D. # 9111-021-10

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/30/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-46-3	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	62
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ATI I.D. # 9111-021

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 161-13-R69	DATE EXTRACTED : 11/04/91
PROJECT NAME : UNOCAL WESTLAKE & MERCER	DATE ANALYZED : 11/04/91
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.694	69	0.740	74	6
TOLUENE	<0.025	1.00	0.814	81	0.825	83	1
TOTAL XYLENES	<0.025	2.00	1.70	85	1.73	87	2

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-021

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 161-13-R69	DATE EXTRACTED : 11/06/91
PROJECT NAME : UNOCAL WESTLAKE & MERCER	DATE ANALYZED : 11/06/91
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.798	80	0.797	80	0
TOLUENE	<0.025	1.00	0.890	89	0.845	85	5
TOTAL XYLENES	<0.025	2.00	1.73	87	1.70	85	2

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-021

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/01/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL

ATI I.D. # 9111-021

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL



ATI I.D. # 9111-021-2

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-41-7	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

42 *
C12 - C24
DIESEL

* Sample chromatogram indicates a petroleum hydrocarbon-like contamination heavier than diesel.

ATI I.D. # 9111-021-5

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-43-4	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL

ATI I.D. # 9111-021-7

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-44-5	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL



ATI I.D. # 9111-021-8

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-45-3	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 5

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

2,200
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

300 *
C12 - C24
DIESEL

* Sample chromatogram indicates a gasoline-like contamination and a contamination heavier than diesel.



Analytical Technologies, Inc.

ATI I.D. # 9111-021-11

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/30/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/01/91
CLIENT I.D.	: MW-47-3	DATE ANALYZED	: 11/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
C12 - C24
DIESEL

ATI I.D. # 9111-021

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9110-378-8
PROJECT #	: 161-13-R69	DATE EXTRACTED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE ANALYZED	: 11/02/91
EPA METHOD	: 8015 (MODIFIED)	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (DIESEL)	<5.0	500	499	100	502	100	1

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-021

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9111-010-1
PROJECT #	: 161-13-R69	DATE EXTRACTED	: 11/04/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE ANALYZED	: 11/04/91
EPA METHOD	: 8015 (MODIFIED)	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (DIESEL)	120	500	585	93	553	87	6

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-021

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS
-----FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-41-3	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-42-5	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS
-----FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021-4

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/28/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-42-9	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021-5

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-43-4	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE



Analytical Technologies, Inc.

ATI I.D. # 9111-021-6

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-43-7	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021-7

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-44-5	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE



Analytical Technologies, Inc.

ATI I.D. # 9111-021-8

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-45-3	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 50

COMPOUNDS

RESULTS

FUEL HYDROCARBONS	1,900
HYDROCARBON RANGE	BENZENE TO NAPHTHALENE
HYDROCARBON QUANTITATION USING	GASOLINE

ATI I.D. # 9111-021-9

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-45-5	DATE ANALYZED	: 11/06/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

24
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021-10

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/30/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/01/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE EXTRACTED	: 11/04/91
CLIENT I.D.	: MW-46-3	DATE ANALYZED	: 11/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-021

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9111-021-10
PROJECT #	: 161-13-R69	DATE EXTRACTED	: 11/04/91
PROJECT NAME	: UNOCAL WESTLAKE & MERCER	DATE ANALYZED	: 11/05/91
EPA METHOD	: WTPH GASOLINE	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	<5.0	100	72.7	73	66.4	66	9

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|\text{Spike Result} - \text{Duplicate Result}|}{\text{Average Result}} \times 100$$



ATI I.D. # 9111-021

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL WESTLAKE & MERCER

MATRIX : SOIL

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	11/05/91	11/06/91

ATI I.D. # 9111-021

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL WESTLAKE & MERCER UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9111-021-3	MW-42-5	2.1
9111-021-5	MW-43-4	2.6
9111-021-8	MW-45-3	980
REAGENT BLANK	-	<1.5

ATI I.D. # 9111-021

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL WESTLAKE & MERCER

MATRIX : SOIL
UNITS : mg/Kg

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9110-340-12	2.0	2.2	10	241	287	83

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-021

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL WESTLAKE & MERCER

MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
MOISTURE	-	11/06/91

ATI I.D. # 9111-021

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL WESTLAKE & MERCER

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9111-021-1	MW-41-3	37
9111-021-3	MW-42-5	17
9111-021-4	MW-42-9	17
9111-021-5	MW-43-4	17
9111-021-6	MW-43-7	64
9111-021-7	MW-44-5	24
9111-021-8	MW-45-3	14
9111-021-9	MW-45-5	82
9111-021-10	MW-46-3	22

ATI I.D. # 9111-021

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL WESTLAKE & MERCER

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9111-021-8	14	14	0	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

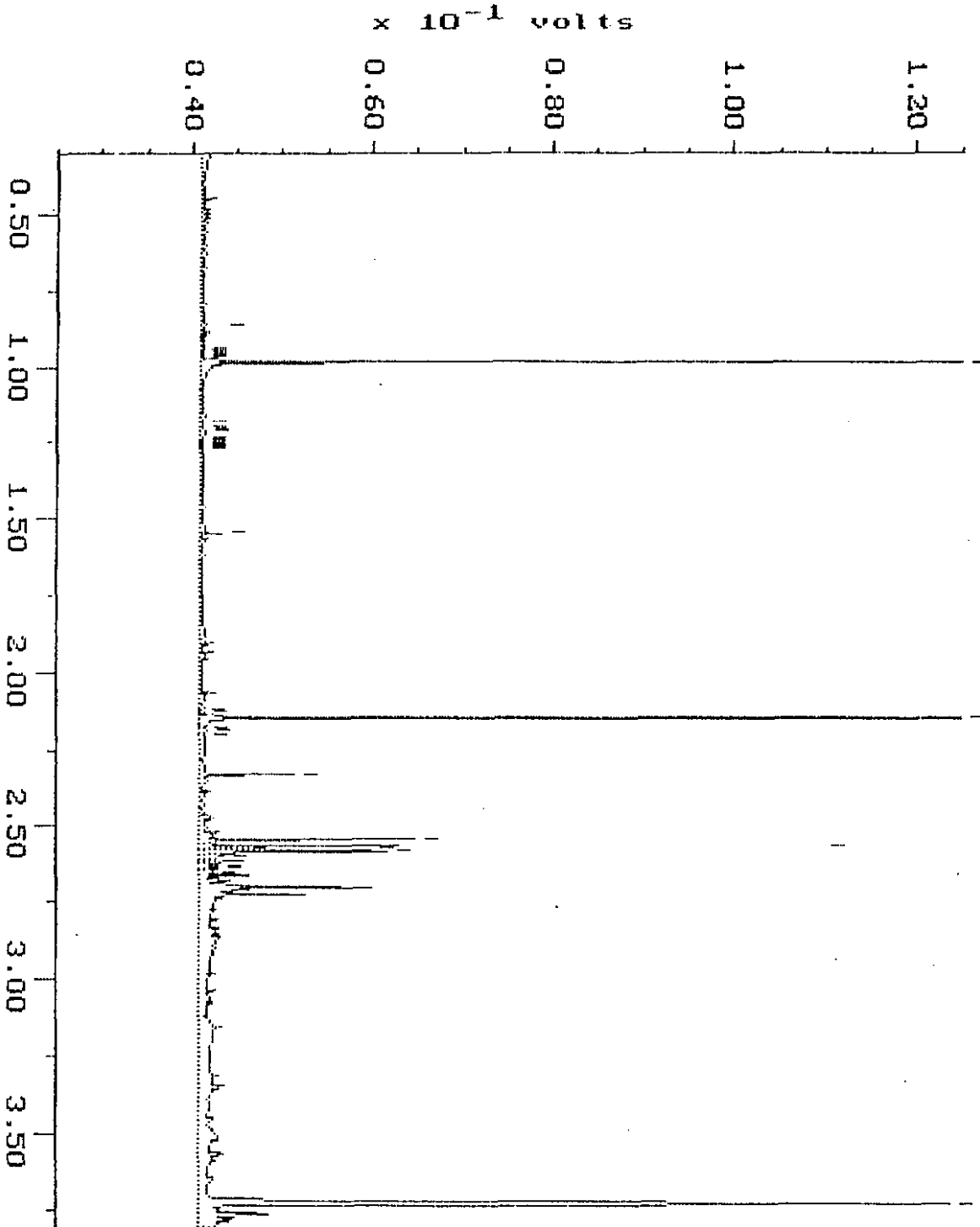
$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

8015

Sample: 9111-021-2
Acquired: 05-NOV-91 10:50
Inj Vol: 1.00

Channel: ERNIE
Method: L:\BRO2\MAXDATA\ERNIE\FUEL1103

Filename: 1103ER28
Operator:

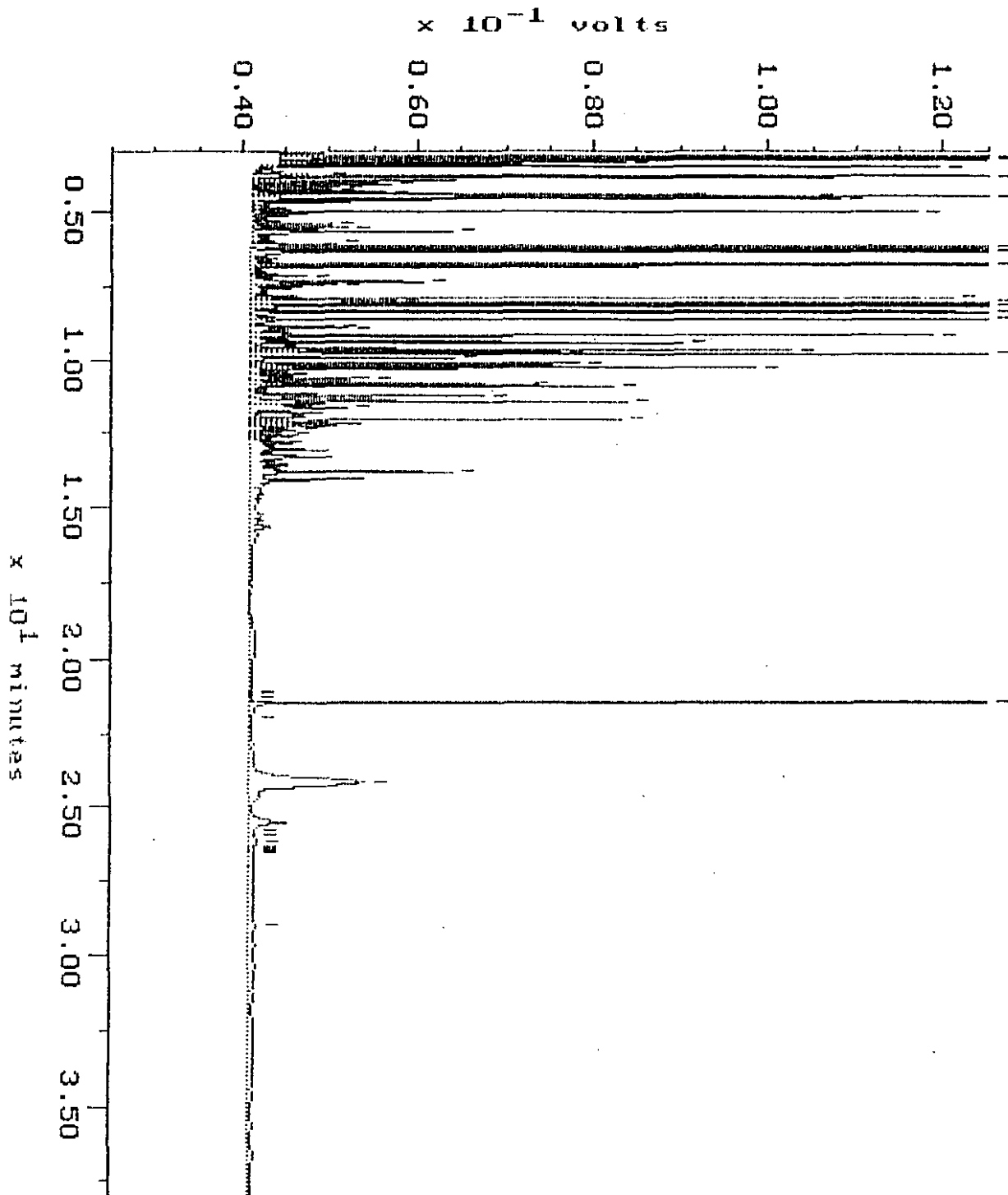


8015

Sample: 9111-021-8 D1L
Acquired: 05-NOV-91 11:36
Dilution: 1 : 5.000

Channel: ERNIE
Method: L:\BRD2\MAXDATA\ERNIE\FUEL1103
Inj Vol: 1.00

Filename: 1103ER29
Operator:





Analytical Technologies, Inc.

560 Neches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody LABORATORY NUMBER: 911-021

DATE 11/19/91 PAGE 1 OF 2

PROJECT MANAGER: Norman Perry
 COMPANY: GTR Engineers Inc.
 ADDRESS: 8410 15th Ave. NE
Redmond WA 98052
 PHONE: 861-6000 SAMPLED BY: WHP
 SAMPLE DISPOSAL INSTRUCTIONS
 Return
 All Disposal @ \$5.00 each

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-41-3	10/28/91		Soil	-1
MW-41-7	10/28/91			2
MW-42-5	10/28/91			3
MW-42-9	10/28/91			4
MW-43-4	10/29/91			5
MW-43-7	10/29/91			6
MW-44-5	10/29/91			7
MW-45-3	10/29/91			8
MW-45-5	10/29/91			9
MW-46-3	10/30/91			10
MW-47-3	10/30/91			11

ANALYSIS REQUEST	
8010	Halogenated Volatiles
8020	Aromatic Volatiles
8020	BETX ONLY
8240	GCMS Volatiles
8270	GCMS BNA
8310	HPLC PNA
8080	Pesticides & PCB's
8080	PCB's ONLY
8140	Phosphate Pesticides
8150	Herbicides
WDOE PAH/HH (WAC 173)	
418.1	(TPH)
413.2	Grease & Oil
8015	(Modified)
TOC	9060
TOX	9020
%	Moisture
EP TOX Metals (8)	EP EXT
Priority Pollutant Metals (13)	
8080	Pesticide (4)
8240	ZH-EXT
8270	
8150	Herbicides (2)
Metals (8)	
TPH-G	
Pb by EPA 7420	
NUMBER OF CONTAINERS	

PROJECT INFORMATION

PROJECT NUMBER: 161-13-1269 TOTAL NUMBER OF CONTAINERS: 11

PROJECT NAME: Unacid Meltblow Fiber COC SEALS/INTACT? Y/N

PURCHASE ORDER NUMBER: _____ RECEIVED GOOD COND/COOL Y/N

ONGOING PROJECT? YES NO RECEIVED VIA: QUICK

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) 2WKS (RUSH) 24HR 48HRS 72HRS 1WK

GREATER THAN 24 HR NOTICE? YES NO (LAB USE ONLY)

SPECIAL INSTRUCTIONS: 24 hr. turnaround on MW-47-3

RELINQUISHED BY: 1.		RELINQUISHED BY: 2.		RELINQUISHED BY: 3.	
Signature:	Date:	Signature:	Date:	Signature:	Date:
<u>[Signature]</u>	<u>11/30</u>	<u>[Signature]</u>		<u>[Signature]</u>	
Company: <u>SET</u>		Company: _____		Company: _____	

RECEIVED BY: 1.		RECEIVED BY: 2.		RECEIVED BY: (LAB) 3.	
Signature:	Date:	Signature:	Date:	Signature:	Date:
<u>[Signature]</u>	<u>11/19/91</u>	<u>[Signature]</u>		<u>[Signature]</u>	
Printed Name: <u>Norman Perry</u>	Date: <u>11/19/91</u>	Printed Name: _____	Date: _____	Printed Name: _____	Date: _____
Company: <u>ATG</u>		Company: _____		Company: <u>Analytical Technologies, Inc.</u>	



ATI I.D. # 9111-068

GeoEngineers

November 22, 1991

NOV 25 1991

GeoEngineers, Inc.
8410 154th Ave N.E.
Redmond, WA 98052

Routing *NLP*
File

Attention : Norm Puri

Project Number : 161-13-R69

Project Name : Unocal/Westlake & Mercer

On November 6, 1991, Analytical Technologies, Inc., received 16 water samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Frederick W. Grothkopp
Laboratory Manager

FWG/hal/elf

ATI I.D. # 9111-068

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-R69
 PROJECT NAME : UNOCAL/WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9111-068-1	MW-32A	11/04/91	WATER
9111-068-2	MW-33	11/04/91	WATER
9111-068-3	MW-34	11/04/91	WATER
9111-068-4	MW-35	11/04/91	WATER
9111-068-5	MW-36	11/05/91	WATER
9111-068-6	MW-37	11/05/91	WATER
9111-068-7	MW-38	11/05/91	WATER
9111-068-8	MW-39	11/05/91	WATER
9111-068-9	MW-40	11/05/91	WATER
9111-068-10	MW-41	11/05/91	WATER
9111-068-11	MW-42	11/05/91	WATER
9111-068-12	MW-43	11/05/91	WATER
9111-068-13	MW-44	11/05/91	WATER
9111-068-14	MW-45	11/04/91	WATER
9111-068-15	MW-46	11/05/91	WATER
9111-068-16	MW-47	11/05/91	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	16

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9111-068

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-R69
 PROJECT NAME : UNOCAL/WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
LEAD	AA/GF	EPA 7421	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9111-068

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

-----	-----
COMPOUNDS	RESULTS
-----	-----
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	103
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ATI I.D. # 9111-068

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	95
--------------------	----

ATI I.D. # 9111-068

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/11/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
-----------	---------

BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	92
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ATI I.D. # 9111-068-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-32A	DATE ANALYZED	: 11/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 500

COMPOUNDS	RESULTS
BENZENE	10,000
ETHYLBENZENE	2,000
TOLUENE	10,000
TOTAL XYLENES	10,000

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	105
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ATI I.D. # 9111-068-2

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-33	DATE ANALYZED	: 11/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100

COMPOUNDSRESULTS

BENZENE	550
ETHYLBENZENE	240
TOLUENE	490
TOTAL XYLENES	1,300

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	98
--------------------	----

ATI I.D. # 9111-068-3

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-34	DATE ANALYZED	: 11/11/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 500

----- COMPOUNDS -----	RESULTS -----
BENZENE	23,000
ETHYLBENZENE	2,600
TOLUENE	18,000
TOTAL XYLENES	14,000

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	94
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ATI I.D. # 9111-068-4

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-35	DATE ANALYZED	: 11/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 500

COMPOUNDSRESULTS

BENZENE	440
ETHYLBENZENE	610
TOLUENE	2,600
TOTAL XYLENES	4,300

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	101
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ATTI I.D. # 9111-068-5

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-36	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

BENZENE	24
ETHYLBENZENE	<0.5
TOLUENE	0.9
TOTAL XYLENES	1.0

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	101
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ATI I.D. # 9111-068-6

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-37	DATE ANALYZED	: 11/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100

COMPOUNDSRESULTS

BENZENE	810
ETHYLBENZENE	470
TOLUENE	2,400
TOTAL XYLENES	3,300

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	98
--------------------	----

ATI I.D. # 9111-068-7

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-38	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	0.6
TOTAL XYLENES	0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	106
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-39	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

BENZENE	0.8
ETHYLBENZENE	<0.5
TOLUENE	0.9
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	101
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-40	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS RESULTS

BENZENE	5.8
ETHYLBENZENE	0.5
TOLUENE	0.7
TOTAL XYLENES	0.8

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	105
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-41	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

BENZENE	67
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	100
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-42	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

BENZENE	180	D
ETHYLBENZENE	0.8	
TOLUENE	2.9	
TOTAL XYLENES	4.7	

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	100
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D = Value from a ten fold diluted analysis.

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-43	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	86
ETHYLBENZENE	0.6
TOLUENE	3.4
TOTAL XYLENES	2.7

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	97
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-44	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	99
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-45	DATE ANALYZED	: 11/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100

COMPOUNDS

RESULTS

BENZENE	500
ETHYLBENZENE	370
TOLUENE	1,000
TOTAL XYLENES	2,300

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	101
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-46	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	0.6
TOTAL XYLENES	1.2

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	104
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VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-47	DATE ANALYZED	: 11/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS

RESULTS

BENZENE	5.2
ETHYLBENZENE	<0.5
TOLUENE	0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	100
--------------------	-----

VOLATILE ORGANIC COMPOUNDS
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9111-068-16
PROJECT #	: 161-13-R69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE ANALYZED	: 11/09/91
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	5.23	20.0	24.5	96	23.8	93	3
TOLUENE	0.530	20.0	18.8	91	18.2	88	3
TOTAL XYLENES	<0.5	40.0	37.3	93	36.7	92	2

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/07/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-32A	DATE ANALYZED	: 11/07/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	52 C7 - C12 GASOLINE
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	<1 C12 - C24 DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-33	DATE ANALYZED	: 11/07/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	11 C7 - C12 GASOLINE
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	<1 C12 - C24 DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-34	DATE ANALYZED	: 11/07/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

40
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C12 - C24
DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-35	DATE ANALYZED	: 11/07/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	24
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-36	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

1
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C12 - C24
DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-37	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	21
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL



FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-38	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C12 - C24
DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-39	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-40	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C12 - C24
DIESEL



ATI I.D. # 9111-068-10

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-41	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-42	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-43	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C7 - C12
GASOLINE

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<1
C12 - C24
DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-44	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	<1 C7 - C12 GASOLINE
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	<1 C12 - C24 DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/04/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-45	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	17
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	2
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-46	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	<1 C7 - C12 GASOLINE
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	<1 C12 - C24 DIESEL

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 11/05/91
PROJECT #	: 161-13-R69	DATE RECEIVED	: 11/06/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE EXTRACTED	: 11/07/91
CLIENT I.D.	: MW-47	DATE ANALYZED	: 11/08/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND

RESULT

FUEL HYDROCARBONS <1
HYDROCARBON RANGE C7 - C12
HYDROCARBON QUANTITATION USING GASOLINE

FUEL HYDROCARBONS <1
HYDROCARBON RANGE C12 - C24
HYDROCARBON QUANTITATION USING DIESEL

FUEL HYDROCARBON ANALYSIS
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9111-068-1
PROJECT #	: 161-13-R69	DATE EXTRACTED	: 11/07/91
PROJECT NAME	: UNOCAL/WESTLAKE & MERCER	DATE ANALYZED	: 11/07/91
METHOD	: 8015 (MODIFIED)	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	51.6	50	97.3	91	98.1	93	1

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL/WESTLAKE & MERCER

MATRIX : WATER

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	11/15/91	11/17/91

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 161-13-R69
PROJECT NAME : UNOCAL/WESTLAKE & MERCER UNITS : mg/L

ATI I.D. #	CLIENT I.D.	LEAD
9111-068-1	MW-32A	0.009
9111-068-2	MW-33	0.0045
9111-068-3	MW-34	0.010
9111-068-4	MW-35	<0.0030
9111-068-5	MW-36	<0.0030
9111-068-6	MW-37	<0.0030
9111-068-7	MW-38	<0.0030
9111-068-8	MW-39	<0.0030
9111-068-9	MW-40	<0.0030
9111-068-10	MW-41	<0.0030
9111-068-11	MW-42	<0.0030
9111-068-12	MW-43	<0.0030
9111-068-13	MW-44	<0.0030
9111-068-14	MW-45	0.005
9111-068-15	MW-46	0.006
9111-068-16	MW-47	<0.0030
REAGENT BLANK	-	<0.0030

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
 PROJECT # : 161-13-R69
 PROJECT NAME : UNOCAL/WESTLAKE & MERCER UNITS : mg/L

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9111-068-10	<0.0030	<0.0030	NC	0.019	0.025	76
LEAD	9111-068-16	<0.0030	<0.0030	NC	0.022	0.025	88

NC = Not Calculable.

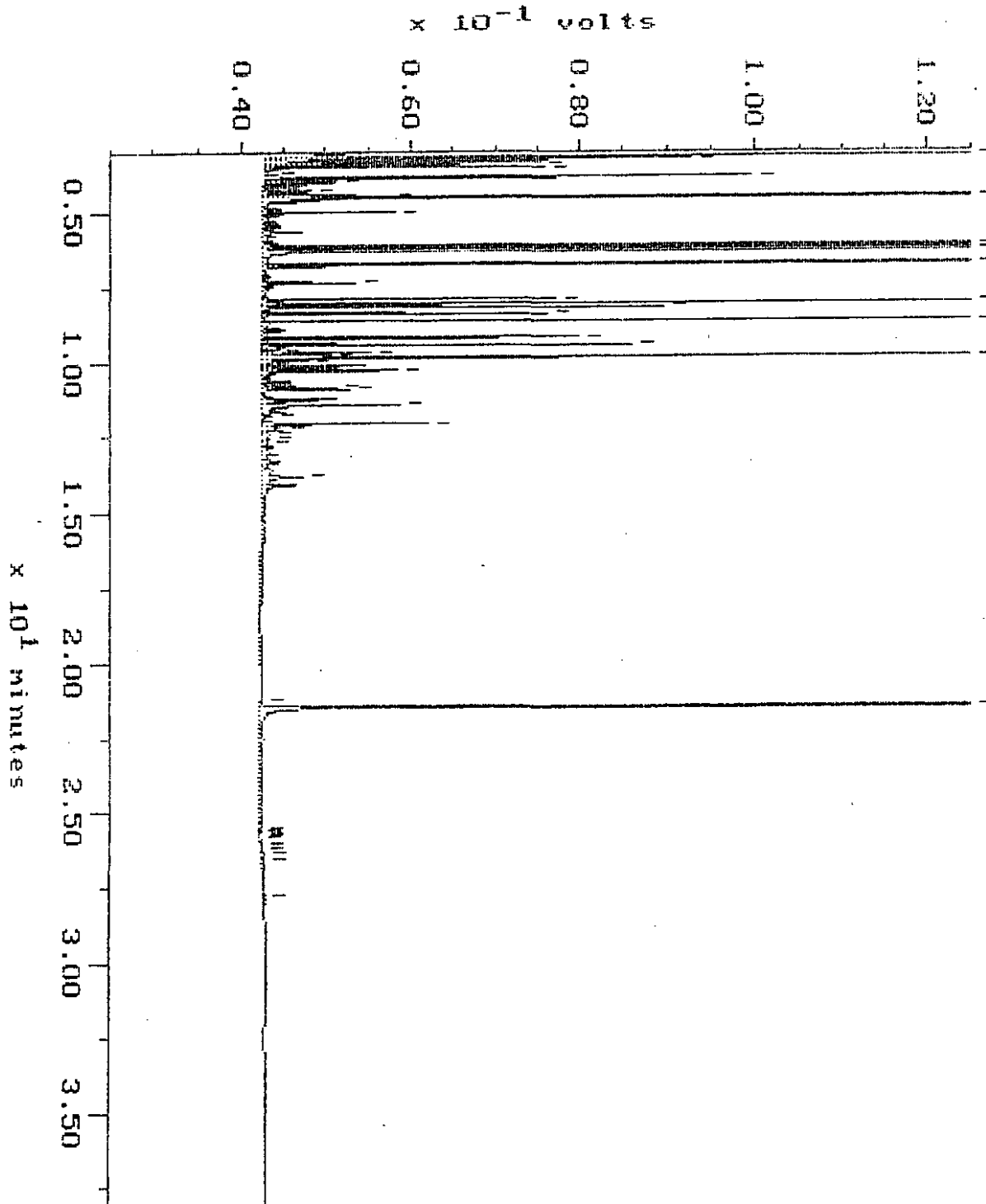
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9111-068-1
Acquired: 07-NOV-91 18:43
Inj Vol: 1.00

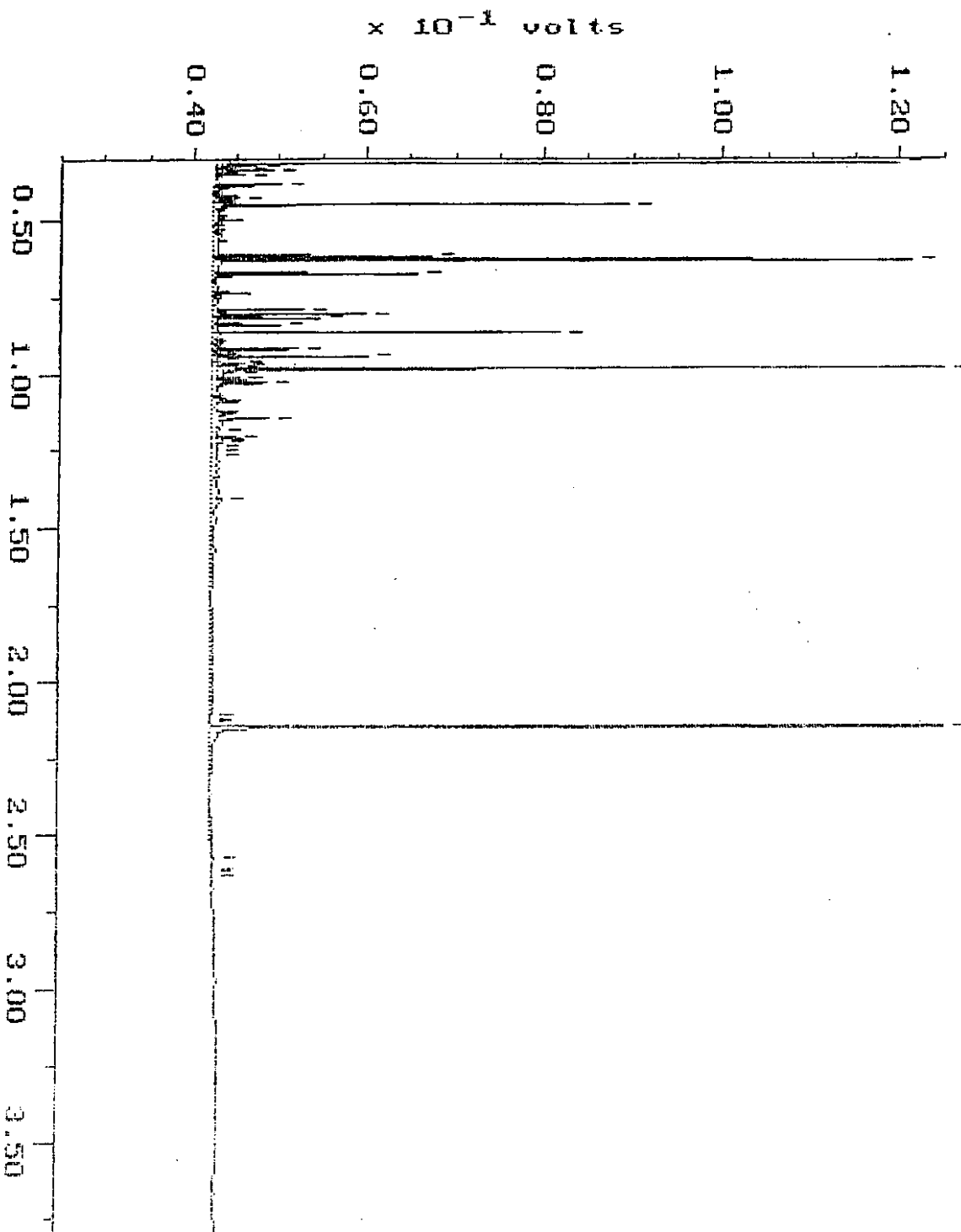
Channel: ERNIE
Method: L:\BRD2\MAXDATA\ERNIE\FUEL1107

Filename: 1107ER04
Operator:



Sample: 9111-058-2 Channel: ERNIE
Acquired: 07-NOV-91 21:50 Method: L:\BRO2\MAXDATA\ERNIE\FUEL1107
Inj Vol: 1.00

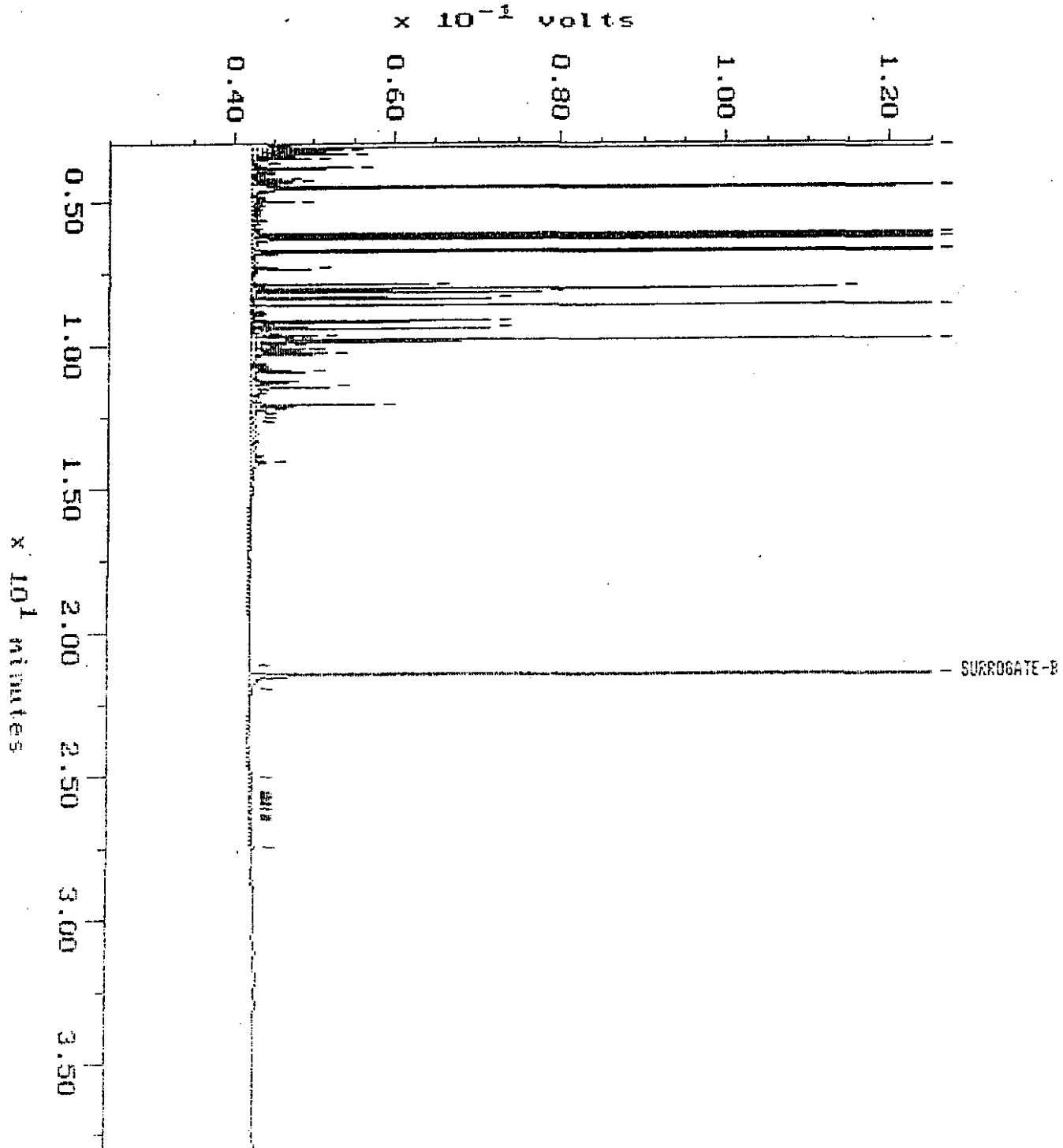
Filename: 1107ER08
Operator:



Sample: 9111-068-3
Acquired: 07-NOV-91 22:36
Inj Vol: 1.00

Channel: ERNIE
Method: L:\BRO2\MAXDATA\ERNIE\FUEL1107

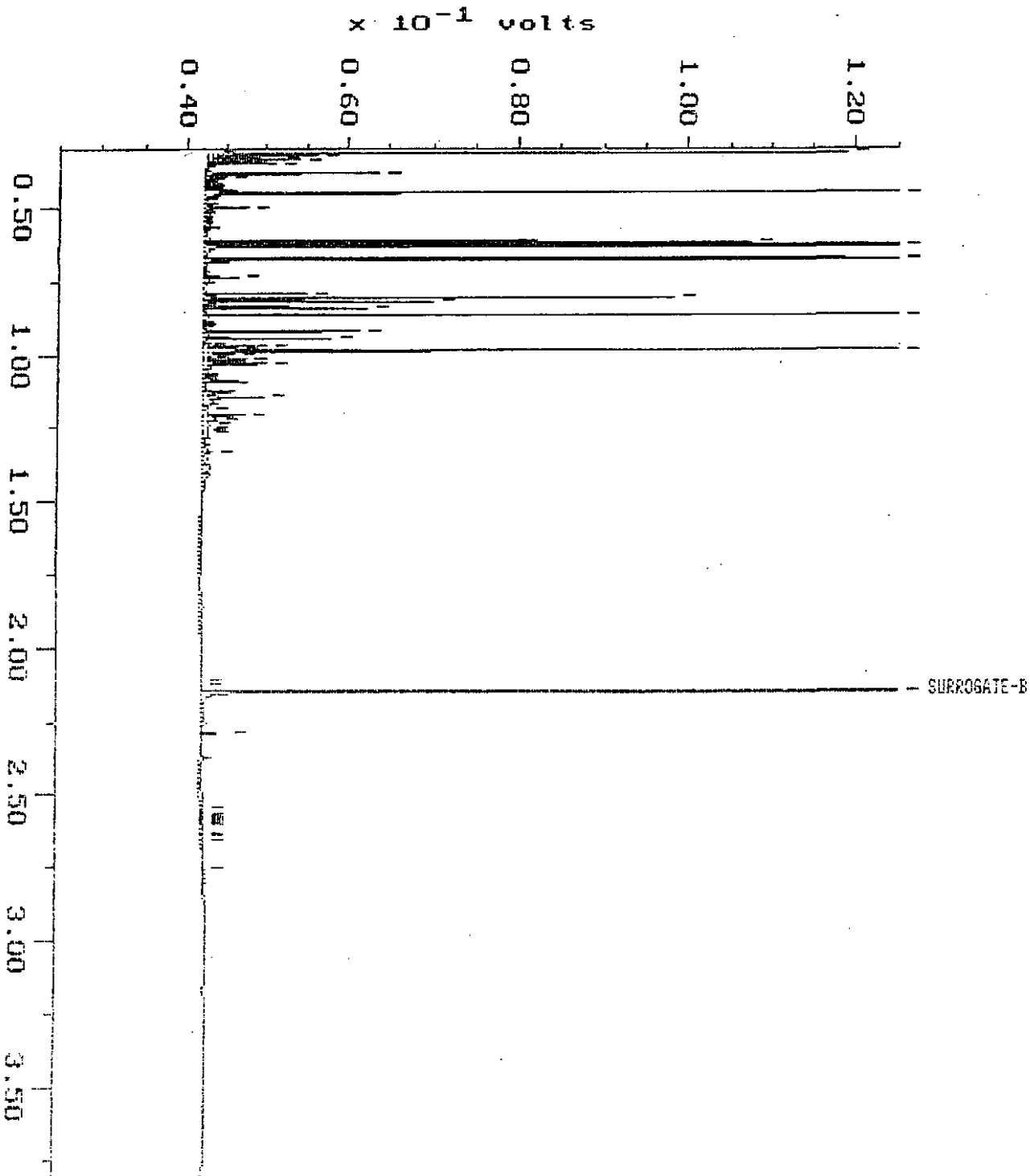
Filename: 1107ER09
Operator:



Sample: 9111-068-4
Acquired: 07-NOV-91 23:23
Inj Vol: 1.00

Channel: ERNIE
Method: L:\BRO2\MAXDATA\ERNIE\FUEL1107

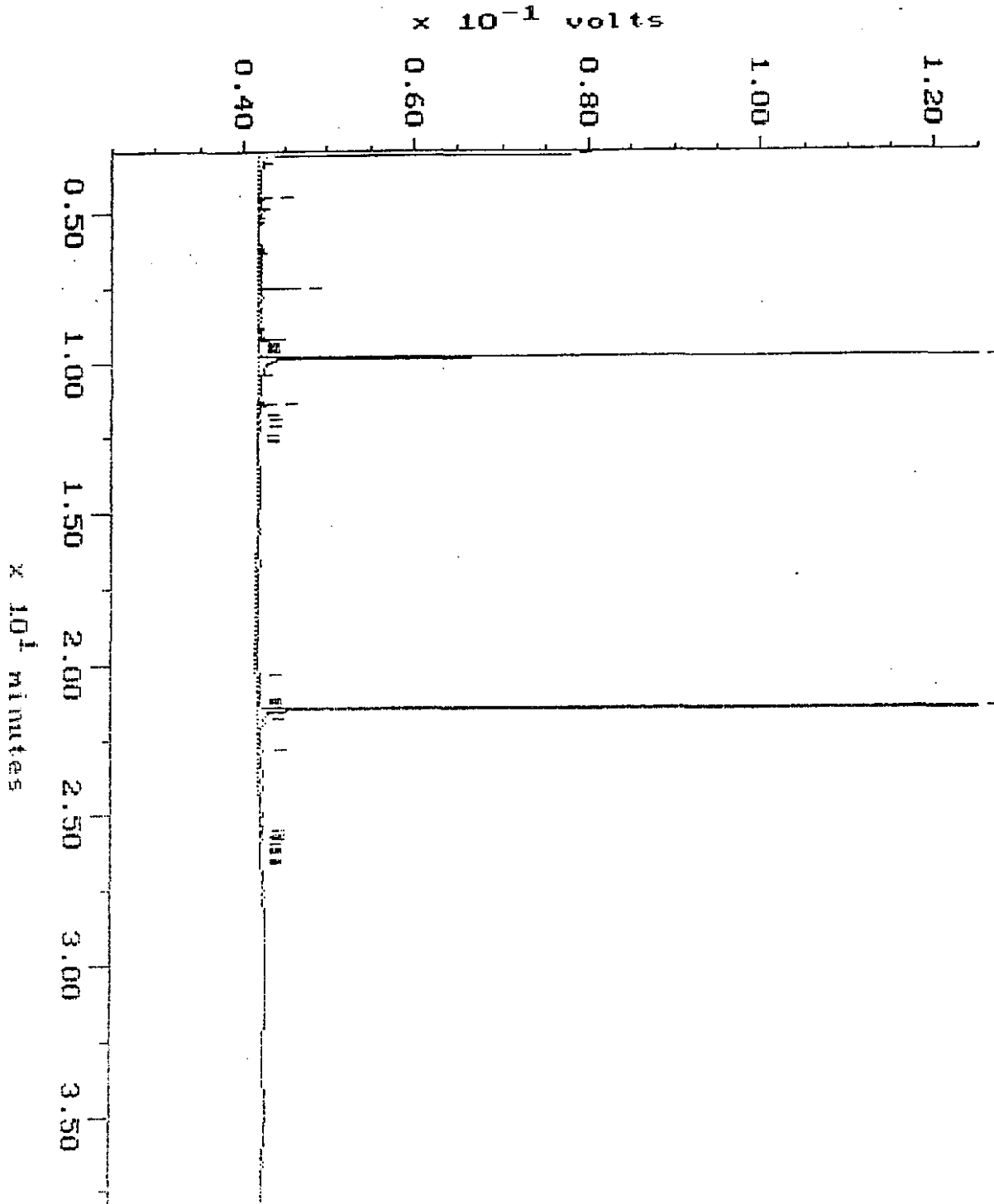
File name: 1107ER10
Operator:



Sample: 9111-068-5
Acquired: 08-NOV-91 0:09
Inj Vol: 1.00

Channel: ERNIE
Method: L:\BRO2\MAXDATA\ERNIE\FUEL1107

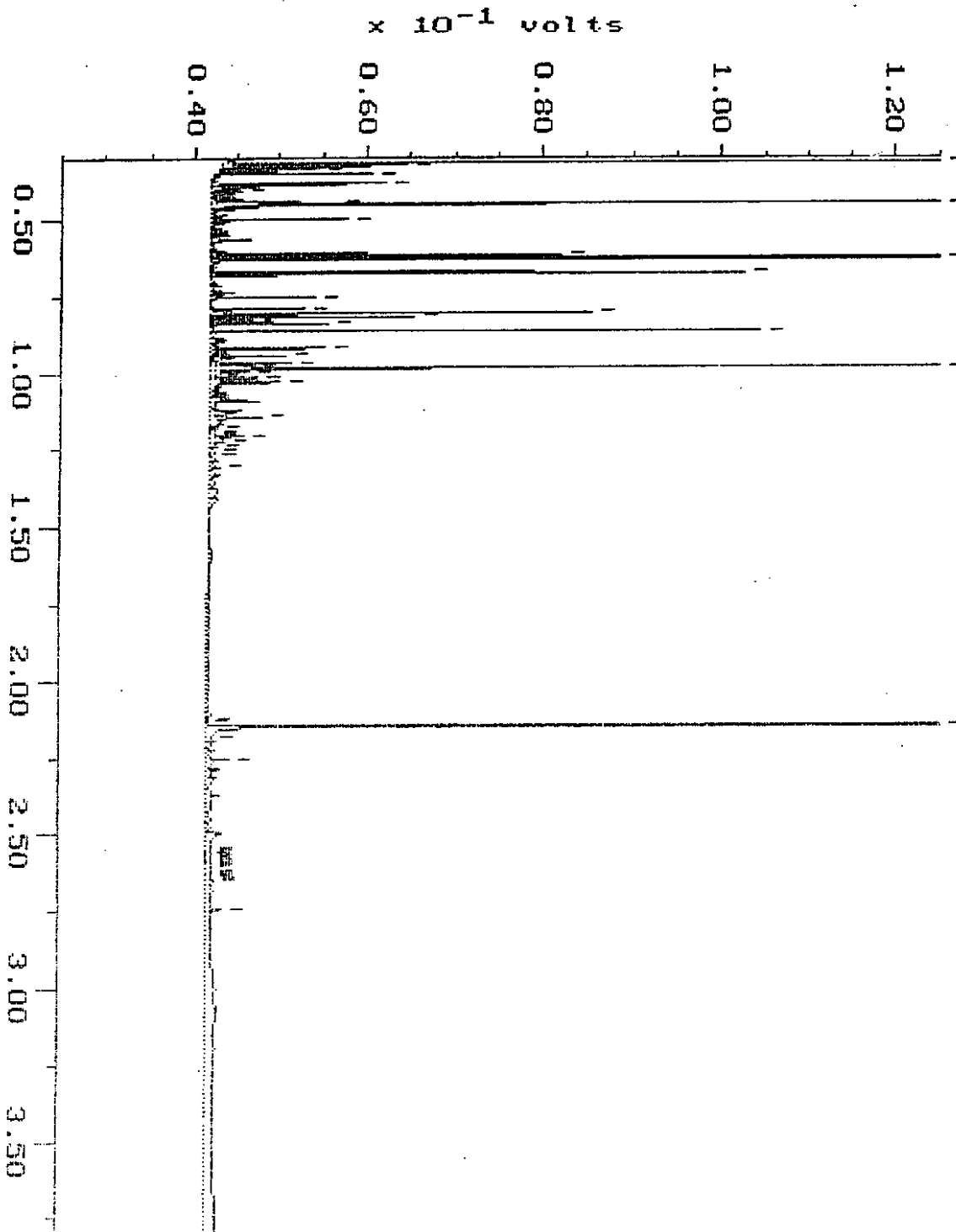
Filename: 1107ER11
Operator:



Sample: 9111-068-6
Acquired: 08-NOV-91 0:56
Inj Vol: 1.00

Channel: ERNIE
Method: L:\BRO2\MAXDATA\ERNIE\FUEL1107

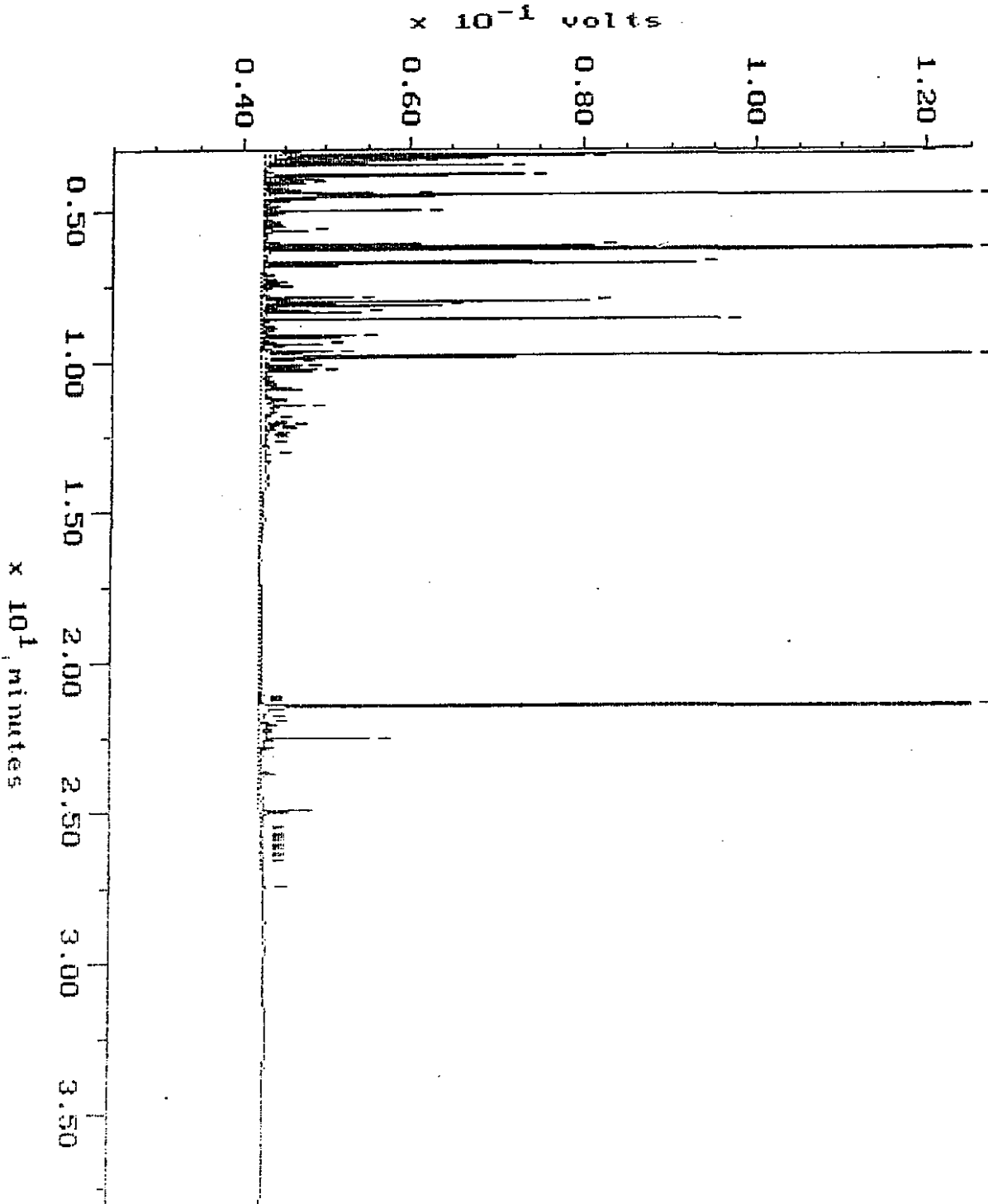
Filename: 1107ER12
Operator:



Sample: 9111-06S-14
Acquired: 08-NOV-91 8:41
Inj Vol: 1.00

Channel: ERNIE
Method: L:\BRO2\MAY\DATA\ERNIE\FUEL1107

Filename: 1107ER22
Operator:



Chain of Custody LABORATORY NUMBER: 9111-068

DATE 11/6/91 PAGE 1 OF 1

PROJECT MANAGER: Norm Perry
 COMPANY: Green Engineers
 ADDRESS: 8410 154th Ave NE
Redmond WA 98052
 PHONE: 861-6000 SAMPLED BY: Bill White
 SAMPLE DISPOSAL INSTRUCTIONS
 ATT Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010	8020	8020	8240	8270	8310	8080	8080	8140	8150	WDOE PAH/HH (WAC 173)	418.1	413.2	8015	TOC	TOX	%	EP TOX	Priority	8080	8240	8270	8150	Metals	Disposal	NUMBER OF CONTAINERS	
MW-32A	11/4/91	1035	WATER	1			X																							4	
MW-33		1100		2			X																								
MW-34		1120		3			X																								
MW-35		1205		4			X																								
MW-36	11/5/91	1430		5			X																								
MW-37		1010		6			X																								
MW-38		1530		7			X																								
MW-39		0930		8			X																								
MW-40		1040		9			X																								
MW-41		700		10			X																								
MW-42		1330		11			X																								
MW-43		100		12			X																								

PROJECT INFORMATION: PROJECT NUMBER: 61-13-1265 SAMPLE RECEIPT TOTAL NUMBER OF CONTAINERS: 48
 PROJECT NAME: Unord water sample COC SEALS/INTACT? Y
 PURCHASE ORDER NUMBER: RECEIVED GOOD COND/COLD? Y
 ONGOING PROJECT? YES NO RECEIVED VIA: Caravan
 PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS
 TAT: (NORMAL) 2WKS (RUSH) 24HR 48HRS 72HRS 1WK
 GREATER THAN 24HR NOTICE? YES NO (LAB USE ONLY)
 SPECIAL INSTRUCTIONS: Unord SS #5353

RELINQUISHED BY: 1. Signature: [Signature] Time: 0900 Date: 11/6/91 Company: ATI
 RECEIVED BY: 1. Signature: [Signature] Time: 1200 Date: 11/6/91 Company: ATI
 RELINQUISHED BY: 2. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]
 RECEIVED BY: 2. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]
 RELINQUISHED BY: 3. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]
 RECEIVED BY: 3. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]

Chain of Custody LABORATORY NUMBER: 9111-068

PROJECT MANAGER: Noel Bui
 COMPANY: GeoEngineers
 ADDRESS: 8410 154th Ave NE
Redmond WA 98052
 PHONE: 861-6000 SAMPLED BY: Will Park
 SAMPLE DISPOSAL INSTRUCTIONS
 ATI Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TOTAL ONLY				NUMBER OF CONTAINERS						
MW-44	11/17/91	1130	WATER	13			X	X										X															4	
MW-45	11/14/91	1145		14			X											X																4
MW-46	11/5/91	1500		15			X											X															4	
MW-47	11/5/91	1400		16			X											X															4	

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS:
 TAT: (NORMAL) 2WKS (RUSH) 24HR 48 HRS 72 HRS 1 WK
 GREATER THAN 24 HR. NOTICE? YES NO (LAB USE ONLY)

PROJECT INFORMATION	SAMPLE RECEIPT	RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
PROJECT NUMBER: <u>61-13-R65</u>	TOTAL NUMBER OF CONTAINERS: <u>16</u>	Signature: <u>Will Park</u> Time: <u>0900</u>	Signature:	Signature:
PROJECT NAME: <u>Ward Wash/1st Ave</u>	COC SEALS/INTACT? <u>Y/N/A</u>	Printed Name: <u>Will Park</u> Date: <u>11/6/91</u>	Printed Name:	Printed Name:
PURCHASE ORDER NUMBER:	RECEIVED GOOD COND./COLD	Company: <u>ATI</u>	Company:	Company:
ONGOING PROJECT? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	RECEIVED VIA: <u>Carrier</u>	RECEIVED BY: 1. Signature: <u>Will Park</u> Time: <u>1200</u>	RECEIVED BY: 2. Signature:	RECEIVED BY: (LAB) 3. Signature:
SPECIAL INSTRUCTIONS:		Printed Name: <u>Will Park</u> Date: <u>11/6/91</u>	Printed Name:	Printed Name:
		Company: <u>ATI-WA</u>	Company:	Analytical Technologies, Inc.



ATI I.D. # 9111-105

GeoEngineers

December 5, 1991

DEC 05 1991

Routing

File

WLP

GeoEngineers, Inc.
8410 154th Ave N.E.
Redmond, WA 98052

Attention : Norm Puri

Project Number : 0161-13-R69

Project Name : Unocal-Westlake & Mercer

On November 8, 1991, Analytical Technologies, Inc., received two soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Frederick W. Grothkopp
Laboratory Manager

FWG/hal/ew

ATI I.D. # 9111-105

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL-WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9111-105-1	MW-34-7	10/22/91	SOIL
9111-105-2	MW-45-6	10/29/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL-WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
LEAD	ICAP	EPA 6010	R
MOISTURE	GRAVIMETRIC	CLP SOW ILMO1.0	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9111-105

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE EXTRACTED	: 11/13/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/13/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	97
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ATI I.D. # 9111-105-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 11/08/91 *
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE EXTRACTED	: 11/12/91
CLIENT I.D.	: MW-34-7	DATE ANALYZED	: 11/13/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	70
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* Please note that the sample was received past the recommended 14 day holding time.

ATI I.D. # 9111-105-2

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 11/08/91
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE EXTRACTED	: 11/12/91
CLIENT I.D.	: MW-45-6	DATE ANALYZED	: 11/13/91 *
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	71
--------------------	----

* Please note that the sample was analyzed past the recommended 14 day holding time.

ATI I.D. # 9111-105

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 0161-13-R69	DATE EXTRACTED : 11/12/91
PROJECT NAME : UNOCAL-WESTLAKE & MERCER	DATE ANALYZED : 11/13/91
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.725	73	0.734	73	1
TOLUENE	<0.025	1.00	0.847	85	0.865	87	2
TOTAL XYLENES	<0.025	2.00	1.75	88	1.76	88	1

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-105

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-13-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE EXTRACTED	: 11/08/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 11/12/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDRESULT
-----FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-105-1

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/22/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 11/08/91 *
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE EXTRACTED	: 11/08/91
CLIENT I.D.	: MW-34-7	DATE ANALYZED	: 11/12/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	BENZENE TO NAPHTHALENE
HYDROCARBON QUANTITATION USING	GASOLINE

* Please note that the sample was received past the recommended 14 day holding time.

ATI I.D. # 9111-105-2

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/29/91
PROJECT #	: 0161-13-R69	DATE RECEIVED	: 11/08/91
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE EXTRACTED	: 11/08/91
CLIENT I.D.	: MW-45-6	DATE ANALYZED	: 11/12/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WTPH GASOLINE	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
BENZENE TO NAPHTHALENE
GASOLINE

ATI I.D. # 9111-105

FUEL HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: 0161-13-R69	DATE EXTRACTED	: 11/08/91
PROJECT NAME	: UNOCAL-WESTLAKE & MERCER	DATE ANALYZED	: 11/12/91
METHOD	: WTPH GASOLINE	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	<5.0	100	99.7	100	97.0	97	3

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9111-105

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL-WESTLAKE & MERCER

MATRIX : SOIL

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	11/25/91	11/26/91



Analytical Technologies, Inc.

ATI I.D. # 9111-105

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL-WESTLAKE & MERCER

MATRIX : SOIL
 UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9111-105-1	MW-34-7	<2.3
9111-105-2	MW-45-6	<2.1
REAGENT BLANK	-	<1.5

ATI I.D. # 9111-105

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL-WESTLAKE & MERCER

MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
MOISTURE	-	11/11/91

ATI I.D. # 9111-105

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-13-R69
 PROJECT NAME : UNOCAL-WESTLAKE & MERCER

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9111-105-1	MW-34-7	16
9111-105-2	MW-45-6	17

ATI I.D. # 9111-105

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-13-R69
PROJECT NAME : UNOCAL-WESTLAKE & MERCER

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9111-105-1	16	15	6	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Chain of Custody LABORATORY NUMBER: 9111-105

DATE 11/8/91 PAGE 1 OF 1

ANALYSIS REQUEST

PROJECT MANAGER: Norm Puri
 COMPANY: GeoEngineers
 ADDRESS: 8410 154th Ave NE
Redmond WA 98052
 PHONE: 861-6200 SAMPLED BY: Will Pirk
 AT1 Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-34-2	10-22		Soil	-1
MW-45-6	10-21			-2

ANALYSIS REQUEST	8010	8020	8020	8240	8270	8310	8080	8080	8140	8150	WDOE	418.1	413.2	8015	TOC	TOX	%	EP TOX	Priority	8080	8240	8270	8150	Metals	NUMBER OF CONTAINERS	
Halogenated Volatiles											PAH/HH (WAC 173)	(TPH)	Grease & Oil	(Modified)	9060	9020	Moisture	(8) EP EXT	(13)	Pesticide (4)	ZH-EXT		Herbicides (2)	(8)		
Aromatic Volatiles																										
BETX ONLY																										
GCMS Volatiles																										
GCMS BNA																										
HPLC PNA																										
Pesticides & PCB's																										
PCB's ONLY																										
Phosphate Pesticides																										
Herbicides																										
WDOE PAH/HH (WAC 173)																										
(TPH)																										
Grease & Oil																										
(Modified)																										
TOC 9060																										
TOX 9020																										
% Moisture																										
(8) EP EXT																										
Priority Pollutant Metals (13)																										
8080 Pesticide (4)																										
8240 ZH-EXT																										
8270																										
8150 Herbicides (2)																										
Metals (8)																										
WTPH-G																										
Total Pb by 7420																										

PROJECT INFORMATION	SAMPLE RECEIPT	RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
PROJECT NUMBER: <u>16-13-0269</u>	TOTAL NUMBER OF CONTAINERS: <u>3</u>	Signature: <u>[Signature]</u> Time: <u>1545</u>	Signature: _____ Time: _____	Signature: _____ Time: _____
PROJECT NAME: <u>Unseal Well at Lake Washington</u>	COC SEALS/INTACT? <u>Y/N/A</u>	Printed Name: <u>William Pirk</u> Date: <u>11/8/91</u>	Printed Name: _____ Date: _____	Printed Name: _____ Date: _____
PURCHASE ORDER NUMBER: _____	RECEIVED GOOD COND./COLD	Company: <u>ATI</u>	Company: _____	Company: _____
ONGOING PROJECT? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	RECEIVED VIA: <u>Carrier</u>	RECEIVED BY: _____ Time: _____	RECEIVED BY: _____ Time: _____	RECEIVED BY: _____ Time: _____
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS				
TAT: (NORMAL) <input checked="" type="checkbox"/> 2WKS (RUSH) <input type="checkbox"/> 24HR <input type="checkbox"/> 48HRS <input type="checkbox"/> 72HRS <input checked="" type="checkbox"/> 1WK	GREATER THAN 24 HR. NOTICE? YES <input type="checkbox"/> NO <input type="checkbox"/> (LAB USE ONLY)	Signature: <u>[Signature]</u> Time: <u>17:46</u>	Signature: _____ Time: _____	Signature: _____ Time: _____
SPECIAL INSTRUCTIONS: <u>P5 ON NORMAN 2 WKTAT</u>				
Printed Name: <u>Handreck</u> Date: <u>11/8/91</u>	Printed Name: _____ Date: _____	Printed Name: _____ Date: _____	Printed Name: _____ Date: _____	Printed Name: _____ Date: _____
Company: <u>ATI</u>	Company: _____	Company: _____	Company: _____	Company: <u>Analytical Technologies, Inc.</u>



ATI I.D. # 9201-239

February 13, 1992

GeoEngineers

FEB 14 1992

GeoEngineers, Inc.
8410 154th Ave. N.E.
Redmond, WA 98052

Routing *NLP*
File

Attention : Norm Puri

Project Number : 161-013-R4

Project Name : Unocal

On January 29, 1992, Analytical Technologies, Inc., received four soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Frederick W. Grothkopp
Laboratory Manager

FWG/hal/rmn

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R4
 PROJECT NAME : UNOCAL

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9201-239-1	MW-48-4	01/29/92	SOIL
9201-239-2	MW-49-1	01/29/92	SOIL
9201-239-3	MW-49-3	01/29/92	SOIL
9201-239-4	MW-49-6	01/29/92	SOIL

 ----- TOTALS -----

MATRIX	# SAMPLES
SOIL	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9201-239

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R4
 PROJECT NAME : UNOCAL

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9201-239

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R4
PROJECT NAME : UNOCAL

CASE NARRATIVE: BETX

These samples were extracted for a BETX analysis on January 29, 1992. Sample 9201-239-4 (MW-49-6), was originally analyzed on January 31, 1992, with the surrogate recovery falling below established control limits. This sample was reanalyzed on February 1, 1992; again the surrogate failed low.

The sample was re-extracted on February, 3, 1992, with the sample jar for 9201-239-4 (MW-49-6) containing headspace. The re-extracted sample was analyzed on February 7, 1992. The surrogate was within acceptable limits, both sets of results are included.

ATI I.D. # 9201-239

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/31/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

-----	-----
COMPOUNDS	RESULTS
-----	-----
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	96
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ATI I.D. # 9201-239

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 02/03/92
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 02/03/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

-----	-----
COMPOUNDS	RESULTS
-----	-----
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	94
--------------------	----

ATI I.D. # 9201-239-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-48-4	DATE ANALYZED	: 02/01/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDSRESULTS

BENZENE	0.15
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	0.053

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	67
--------------------	----

ATI I.D. # 9201-239-2

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-1	DATE ANALYZED	: 02/01/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDSRESULTS

BENZENE	0.14
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	0.049

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	64
--------------------	----

ATI I.D. # 9201-239-3

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-3	DATE ANALYZED	: 02/01/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

-----	-----
COMPOUNDS	RESULTS
-----	-----
BENZENE	1.2
ETHYLBENZENE	3.3
TOLUENE	0.39
TOTAL XYLENES	15 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	67
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D = Value from a 10 fold diluted analysis.

ATI I.D. # 9201-239-4

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-6	DATE ANALYZED	: 02/01/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUNDS	RESULTS
BENZENE	1.8
ETHYLBENZENE	4.5
TOLUENE	0.44
TOTAL XYLENES	19 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	51 H
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D = Value from a 10 fold diluted analysis.

H = Out of limits.

ATI I.D. # 9201-239-4 RE

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 02/03/92
CLIENT I.D.	: MW-49-6	DATE ANALYZED	: 02/07/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT			

COMPOUNDS	RESULTS
BENZENE	0.48
ETHYLBENZENE	0.25
TOLUENE	0.14
TOTAL XYLENES	1.4

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	59
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VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 161-013-R4	DATE EXTRACTED : 01/29/92
PROJECT NAME : UNOCAL	DATE ANALYZED : 01/31/92
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.866	87	0.741	74	16
TOLUENE	<0.025	1.00	0.985	99	0.839	84	16
TOTAL XYLENES	<0.025	2.00	2.03	102	1.70	85	18

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 161-013-R4	DATE EXTRACTED : 02/03/92
PROJECT NAME : UNOCAL	DATE ANALYZED : 02/03/92
EPA METHOD : 8020 (BETX)	UNITS : mg/Kg
SAMPLE MATRIX : SOIL	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.911	91	0.902	90	1
TOLUENE	<0.025	1.00	0.929	93	0.931	93	0
TOTAL XYLENES	<0.025	2.00	1.79	90	1.87	94	4

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9201-239

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/29/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

-----	-----
COMPOUND	RESULT
-----	-----

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE

FUEL HYDROCARBONS	<25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

SURROGATE PERCENT RECOVERIES

O-TERPHENYL	111
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ATI I.D. # 9201-239-2

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-1	DATE ANALYZED	: 02/03/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

----- COMPOUND -----	RESULT -----
FUEL HYDROCARBONS	71
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	130 *
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

SURROGATE PERCENT RECOVERIES

O-TERPHENYL	91
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* Chromatogram indicates petroleum hydrocarbons heavier than diesel.



ATI I.D. # 9201-239-3

 FUEL HYDROCARBON ANALYSIS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-3	DATE ANALYZED	: 01/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	140
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	340 *
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

SURROGATE PERCENT RECOVERIES

O-TERPHENYL	118
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* Chromatogram indicates petroleum hydrocarbons heavier than diesel.

ATI I.D. # 9201-239

FUEL HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9201-222-13
PROJECT #	: 161-013-R4	DATE EXTRACTED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE ANALYZED	: 01/29/92
METHOD	: 8015 (MODIFIED)	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
FUEL HYDROCARBONS (DIESEL)	429	500	862	87	932	101	8

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$



ATI I.D. # 9201-239

FUEL HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: 161-013-R4	DATE EXTRACTED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE ANALYZED	: 01/29/92
METHOD	: 8015 (MODIFIED)	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
FUEL HYDROCARBONS (DIESEL)	<25	500	422	84	462	92	9

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9201-239

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R4
PROJECT NAME : UNOCAL

CASE NARRATIVE: TOTAL PETROLEUM HYDROCARBONS

These four samples were extracted for a WA DOE TPH-G analysis on January 29, 1992. Sample 9201-239-4 (MW-49-6) was originally analyzed on January 30, 1992, with the surrogate recovery falling below established control limits. This sample was reanalyzed on February 4, 1992; again the surrogate failed low.

The sample was re-extracted and analyzed on February 4, 1992. The sample jar for 9201-239-4 (MW-49-6) contained headspace with approximately 9 grams of soil. The result for the re-extracted sample passed for surrogate recovery. Both sets of results are included.

ATI I.D. # 9201-239

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

COMPOUNDS

RESULTS

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE	85
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ATI I.D. # 9201-239

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 02/04/92
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 02/04/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

COMPOUNDS

RESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

<5
TOLUENE TO DODECANE
GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE

91



ATI I.D. # 9201-239-1

 TOTAL PETROLEUM HYDROCARBONS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 02/04/92
CLIENT I.D.	: MW-48-4	DATE ANALYZED	: 02/04/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

 COMPOUNDS

 RESULTS

 FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

 <5
 TOLUENE TO DODECANE
 GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE

96

ATI I.D. # 9201-239-2

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-1	DATE ANALYZED	: 01/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

----- COMPOUNDS -----	RESULTS -----
FUEL HYDROCARBONS	180
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE	52
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ATI I.D. # 9201-239-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-3	DATE ANALYZED	: 02/04/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

COMPOUNDSRESULTS

FUEL HYDROCARBONS
HYDROCARBON RANGE
HYDROCARBON QUANTITATION USING

190
TOLUENE TO DODECANE
GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE

53

ATI I.D. # 9201-239-4

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/29/92
CLIENT I.D.	: MW-49-6	DATE ANALYZED	: 01/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

COMPOUNDSRESULTS

FUEL HYDROCARBONS	120
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE	34 H
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H = Out of limits.



ATI I.D. # 9201-239-4 RE

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R4	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 02/04/92
CLIENT I.D.	: MW-49-6	DATE ANALYZED	: 02/04/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

COMPOUNDS

RESULTS

FUEL HYDROCARBONS	36
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERIES

TRIFLUOROTOLUENE	75
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ATI I.D. # 9201-239

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: 161-013-R4	DATE EXTRACTED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE ANALYZED	: 01/30/92
METHOD	: WA DOE WTPH-G	UNITS	: mg/Kg
SAMPLE MATRIX	: WATER		

RESULTS ARE CORRECTED FOR THE MOISTURE CONTENT

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP.	DUP.	RPD
					SPIKED SAMPLE	% REC.	
PETROLEUM HYDROCARBONS (GASOLINE)	<5.0	2.00	104	104	102	102	2

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$



ATI I.D. # 9201-239

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R4
PROJECT NAME : UNOCAL

MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
MOISTURE	-	01/30/92

ATI I.D. # 9201-239

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARYCLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R4
PROJECT NAME : UNOCAL

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9201-239-1	MW-48-4	14
9201-239-2	MW-49-1	14
9201-239-3	MW-49-3	27
9201-239-4	MW-49-6	55



Analytical Technologies, Inc.

ATI I.D. # 9201-239

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R4
PROJECT NAME : UNOCAL

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9201-245-2	10	9.8	2	N/A	N/A	N/A

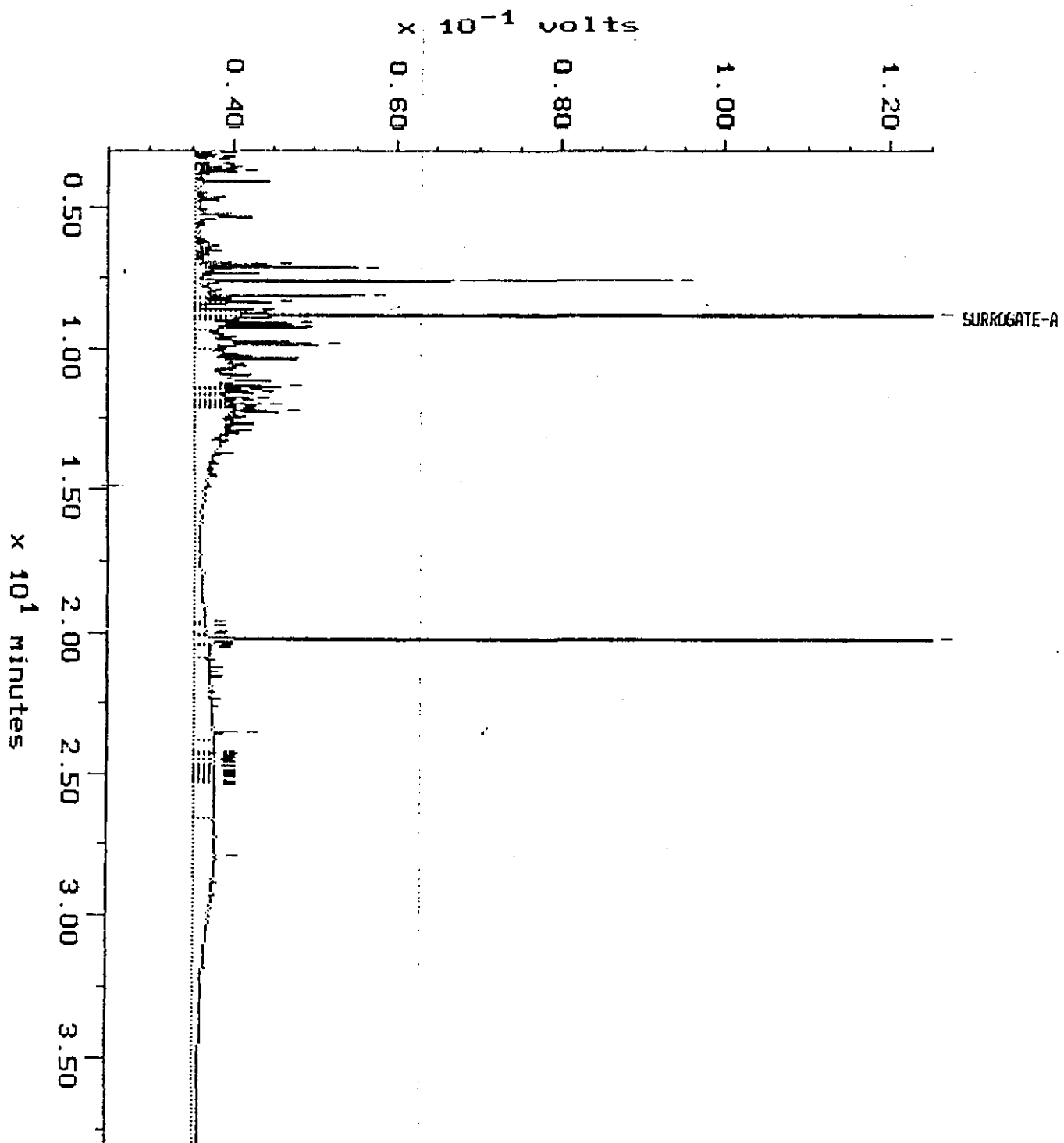
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9201-239-2
Acquired: 03-FEB-92 22:00
Inj Vol: 1.00

Channel: DEMITRI
Method: M:\BRO2\MAXDATA\SERGE-D\FUEL0203

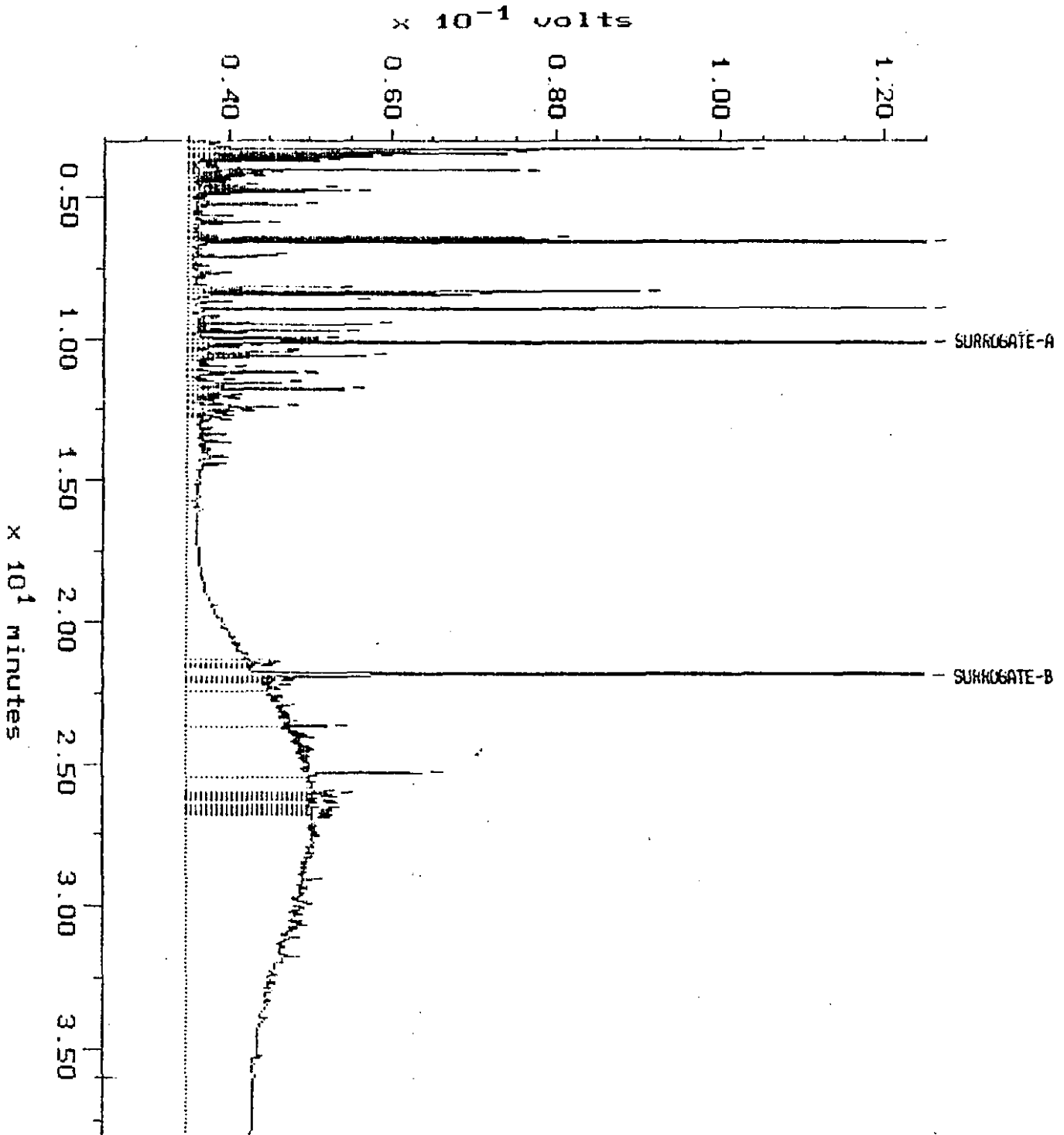
Filename: 0203SD15
Operator: ACE



Sample: 9201-239-3
Acquired: 30-JAN-92 3:45
Inj Vol: 1.00

Channel: CLARENCE
Method: M:\BRJ2\MAXDATA\SERGE-C\FUEL0129

Filename: 0129SC16
Operator: BRJ



Chain of Custody LABORATORY NUMBER: 9811-239

DATE _____ PAGE ____ OF ____

PROJECT MANAGER: Norm Ruri		COMPANY: GEL		ADDRESS: 8110 15111 th St Redmond WA 98052		PHONE: 861-6600		SAMPLED BY: CBK DAC																					
SAMPLE DISPOSAL INSTRUCTIONS																													
<input checked="" type="checkbox"/> ATT Disposal @ \$5.00 each					<input type="checkbox"/> Return																								
SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010	8020	8020	8240	8270	8310	8080	8080	8140	8150	WDOE PAHHH (WAC 173)	418.1	413.2	8015	TOC	TOX	%	EP TOX	Priority	8080	8240	8270	8150	Metals	NUMBER OF CONTAINERS
MW-48-4	1/29/92		Soil	-1			X											X											1
MW-49-1				2														X											1
MW-49-3				3														X											1
MW-49-6				4														X											1
PROJECT INFORMATION					SAMPLE RECEIPT					ANALYSIS REQUEST																			
PROJECT NUMBER: 161-013-R4					TOTAL NUMBER OF CONTAINERS: 4					8010 Halogenated Volatiles																			
PROJECT NAME: Unocal					COC SEALS/INTACT? Y/N/A: NY					8020 Aromatic Volatiles																			
PURCHASE ORDER NUMBER:					RECEIVED GOOD COND./COLD: NY					8020 BETX ONLY																			
ONGOING PROJECT? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>					RECEIVED VIA: COURIER					8240 GCMS Volatiles																			
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS										8270 GCMS BNA																			
TAT: (NORMAL) <input checked="" type="checkbox"/> 2WKS (RUSH) <input type="checkbox"/> 2HR <input type="checkbox"/> 48 HRS <input type="checkbox"/> 72 HRS <input type="checkbox"/> 1 WK					GREATER THAN 24 HR. NOTICE? YES <input type="checkbox"/> NO <input type="checkbox"/> (LAB USE ONLY)					8310 HPLC PNA																			
SPECIAL INSTRUCTIONS: FAX RESULTS TO NORM RURI 55 # 5353										8080 Pesticides & PCB's																			
RELINQUISHED BY: 1. Signature: Chris Kimmel Time: 0830					RELINQUISHED BY: 2. Signature: Time: 0830					8080 PCB's ONLY																			
Signature: [Signature] Time: 11:00					Signature: [Signature] Time: 2					8140 Phosphate Pesticides																			
Printed Name: Chris Kimmel Date: 1/28/92					Printed Name: Date: 1/28/92					8150 Herbicides																			
Company: GEL					Company: [Blank]					WDOE PAHHH (WAC 173)																			
RECEIVED BY: 1. Signature: [Signature] Time: 1					RECEIVED BY: 2. Signature: [Signature] Time: 2					418.1 (TPH)																			
Signature: [Signature] Time: 11:00					Signature: [Signature] Time: 2					413.2 Grease & Oil																			
Printed Name: [Signature] Date: 1/28/92					Printed Name: [Signature] Date: 1/28/92					8015 (Modified)																			
Company: GEL					Company: [Blank]					TOC 9060																			
RECEIVED BY: 3. Signature: [Signature] Time: 3					RECEIVED BY: (LAB) Signature: [Signature] Time: 3					TOX 9020																			
Signature: [Signature] Time: 3					Signature: [Signature] Time: 3					% Moisture																			
Printed Name: [Signature] Date: 1/28/92					Printed Name: [Signature] Date: 1/28/92					EP TOX Metals (8) EP EXT																			
Company: GEL					Company: [Blank]					Priority Pollutant Metals (13)																			
RELINQUISHED BY: 3. Signature: [Signature] Time: 3					RELINQUISHED BY: 3. Signature: [Signature] Time: 3					8080 Pesticide (4)																			
Signature: [Signature] Time: 3					Signature: [Signature] Time: 3					8240 ZH-EXT																			
Printed Name: [Signature] Date: 1/28/92					Printed Name: [Signature] Date: 1/28/92					8270																			
Company: GEL					Company: [Blank]					8150 Herbicides (2)																			
RECEIVED BY: (LAB) Signature: [Signature] Time: 3					RECEIVED BY: (LAB) Signature: [Signature] Time: 3					Metals (8)																			
Signature: [Signature] Time: 3					Signature: [Signature] Time: 3					WTPH-6																			
Printed Name: [Signature] Date: 1/28/92					Printed Name: [Signature] Date: 1/28/92					NUMBER OF CONTAINERS																			
Company: GEL					Company: [Blank]																								



Analytical **Technologies, Inc.**

560 Naches Avenue, S.W., Suite 101, Renton, WA 98055. (206) 228-8335

ATI I.D. # 9201-241

February 7, 1992

GeoEngineers

FEB 10 1992

GeoEngineers, Inc.
8410 154th Ave. N.E.
Redmond, WA 98052

Routing

File

Attention : Norm Puri

Project Number : 161-013-R69

Project Name : Unocal

On January 29, 1992, Analytical Technologies, Inc., received two water samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Laboratory Manager

FWG/hal/rmn

ATI I.D. # 9201-241

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9201-241-1	MW-48	01/29/92	WATER
9201-241-2	MW-49	01/29/92	WATER

=====

----- TOTALS -----

MATRIX	# SAMPLES
WATER	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9201-241

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
LEAD	AA/GF	EPA 7421	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9201-241

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/31/92
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	103
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ATI I.D. # 9201-241

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 02/01/92
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	99
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ATI I.D. # 9201-241-1

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R69	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-48	DATE ANALYZED	: 02/01/92
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 50

COMPOUND	RESULT
BENZENE	430
ETHYLBENZENE	180
TOLUENE	330
TOTAL XYLENES	600

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	99
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ATI I.D. # 9201-241-2

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R69	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-49	DATE ANALYZED	: 01/31/92
SAMPLE MATRIX	: WATER	UNITS	: ug/L
BPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

----- COMPOUND -----	RESULT -----
BENZENE	550 D
ETHYLBENZENE	720 D
TOLUENE	54
TOTAL XYLENES	3,200 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	106
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D = Value from a 50 fold diluted analysis.

ATI I.D. # 9201-241

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9201-248-1
PROJECT #	: 161-013-R69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL	DATE ANALYZED	: 01/31/92
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.6	98	18.6	93	5
TOLUENE	<0.5	20.0	19.8	99	18.9	95	5
TOTAL XYLENES	<0.5	40.0	39.4	99	37.7	94	4

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9201-241

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL
 CLIENT I.D. : REAGENT BLANK
 SAMPLE MATRIX : WATER
 METHOD : 8015 (MODIFIED)

DATE SAMPLED : N/A
 DATE RECEIVED : N/A
 DATE EXTRACTED : 01/30/92
 DATE ANALYZED : 01/30/92
 UNITS : mg/L
 DILUTION FACTOR : 1

 COMPOUNDS

RESULTS

FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

<1
 C7 - C12
 GASOLINE

FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

<1
 C12 - C24
 DIESEL

SURROGATE PERCENT RECOVERIES

O-TERPHENYL

108

ATI I.D. # 9201-241-1

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL
 CLIENT I.D. : MW-48
 SAMPLE MATRIX : WATER
 METHOD : 8015 (MODIFIED)

DATE SAMPLED : 01/29/92
 DATE RECEIVED : 01/29/92
 DATE EXTRACTED : 01/30/92
 DATE ANALYZED : 01/31/92
 UNITS : mg/L
 DILUTION FACTOR : 1

 COMPOUNDS

RESULTS

FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

4
 C7 - C12
 GASOLINE

FUEL HYDROCARBONS
 HYDROCARBON RANGE
 HYDROCARBON QUANTITATION USING

2
 C12 - C24
 DIESEL

SURROGATE PERCENT RECOVERIES

O-TERPHENYL

113

ATI I.D. # 9201-241-2

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/29/92
PROJECT #	: 161-013-R69	DATE RECEIVED	: 01/29/92
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 01/30/92
CLIENT I.D.	: MW-49	DATE ANALYZED	: 01/31/92
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

FUEL HYDROCARBONS	22
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE

FUEL HYDROCARBONS	3	*
HYDROCARBON RANGE	C12 - C24	
HYDROCARBON QUANTITATION USING	DIESEL	

SURROGATE PERCENT RECOVERIES

O-TERPHENYL	110
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* Chromatogram indicates petroleum hydrocarbons indicative of gasoline.

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9201-251-2
PROJECT #	: 161-013-R69	DATE EXTRACTED	: 01/30/92
PROJECT NAME	: UNOCAL	DATE ANALYZED	: 01/30/92
EPA METHOD	: 8015 (MODIFIED)	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	<1.0	50.0	50.4	101	50.3	101	0

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 161-013-R69	DATE EXTRACTED : 01/30/92
PROJECT NAME : UNOCAL	DATE ANALYZED : 01/30/92
EPA METHOD : 8015 (MODIFIED)	UNITS : mg/L
SAMPLE MATRIX : WATER	

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS (GASOLINE)	<1.0	50.0	48.3	97	41.9	84	14

$$\% \text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9201-241

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R69
PROJECT NAME : UNOCAL

MATRIX : WATER

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	01/30/92	01/31/92



ATI I.D. # 9201-241

METALS ANALYSIS
DATA SUMMARYCLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R69
PROJECT NAME : UNOCAL

MATRIX : WATER

UNITS : mg/L

ATI I.D. #	CLIENT I.D.	LEAD
9201-241-1	MW-48	<0.0030
9201-241-2	MW-49	<0.0030
REAGENT BLANK	-	<0.0030

ATI I.D. # 9201-241

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-013-R69
PROJECT NAME : UNOCAL

MATRIX : WATER

UNITS : mg/L

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9201-241-2	<0.0030	<0.0030	NC	0.0235	0.0250	94
LEAD	BLANK SPIKE	<0.0030	N/A	N/A	0.0224	0.0250	90

NC = Not Calculable.

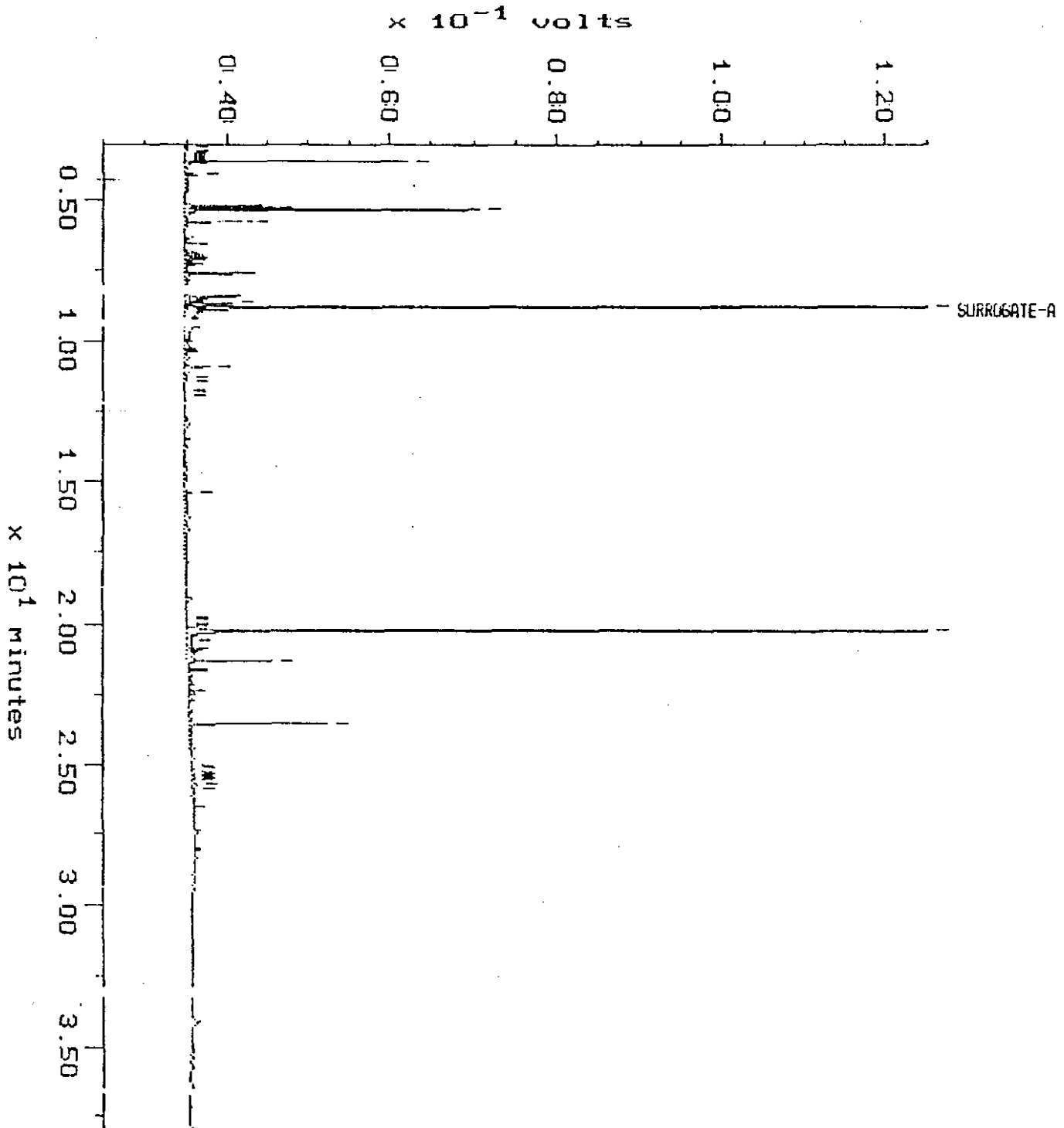
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9201-241-1
Acquired: 31-JAN-92 1:28
Inj Vol: 1.00

Channel: DEMITRI
Method: M:\8R02\MAXDATA\SERGE-D\FUEL0130

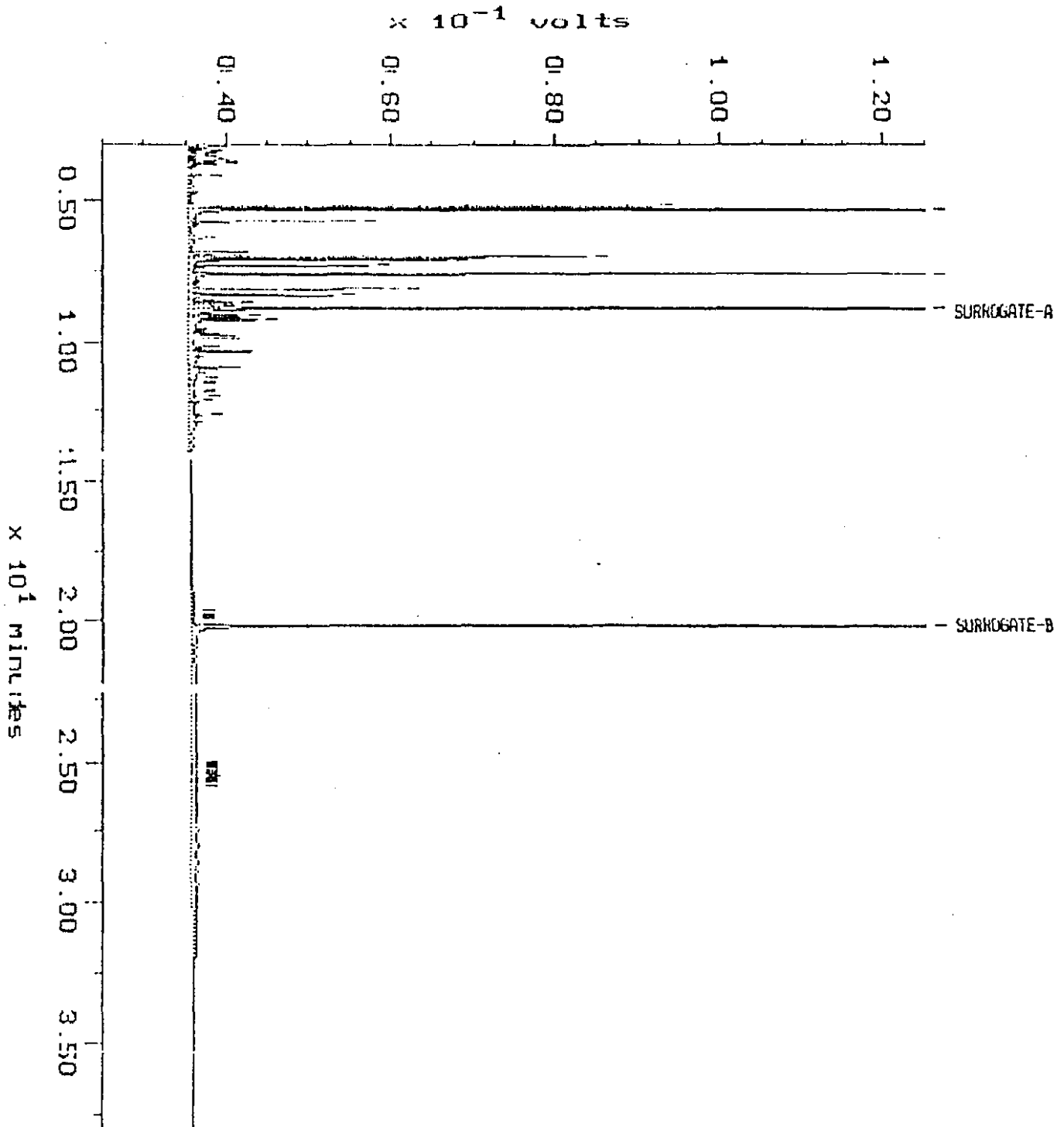
Filename: 0130SD12
Operator: ACE



Sample: 9501-241-2
Acquired: 31-JAN-92 2:08
Inj Vol: 1.00

Channel: DEMITRI
Method: M:\8RD2\MAXDATA\SERGE-D\FUEL0130

Filename: 0130S013
Operator: ACE



PROJECT MANAGER: Norm Puri

COMPANY: Geotengineers

ADDRESS: 8110 154th St
Redmond, WA 98052

PHONE: 811-6000 SAMPLED BY: CBK

SAMPLE DISPOSAL INSTRUCTIONS: ATT Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	ANALYSIS REQUEST	TOX ONLY	NUMBER OF CONTAINERS
MW-18	1/29/92	0930	H ₂ O	1	8010 Halogenated Volatiles 8020 Aromatic Volatiles 8020 BETX ONLY 8240 GCMS Volatiles 8270 GCMS BNA 8310 HPLC PNA 8080 Pesticides & PCB's 8080 PCB's ONLY 8140 Phosphate Pesticides 8150 Herbicides WDOE PAH/HH (WAC 173) 418.1 (TPH) 413.2 Grease & Oil 8015 (Modified) TOC 9060 TOX 9020 % Moisture EP TOX Metals (8) EP EXT Priority Pollutant Metals (13) 8080 Pesticide (4) 8240 ZH-EXT 8270 8150 Herbicides (2) Metals (8) 742 Pb DISSOLVED METALS	X	4
MW-49 UNPRESERVED	1/29/92	1000	H ₂ O	2		X	4

PROJECT INFORMATION

PROJECT NUMBER: 1101-013-RB9

PROJECT NAME: Uvaca

PURCHASE ORDER NUMBER:

ONGOING PROJECT? YES NO

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS: 6

COG SEAL/INTACT? Y/N/A: N/A

RECEIVED GOOD COND/COLD: 4/4

RECEIVED VIA: Hand Del.

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) 2WKS (RUSH) 24HR 48HRS 72HRS 1WK

GREATER THAN 24 HR. NOTICE? YES NO (LAB USE ONLY)

SPECIAL INSTRUCTIONS: * MW-49 BETX BOTTLES ARE NOT PRESERVED

SS # 5353

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

RELINQUISHED BY: 1. Signature: [Signature] Time: 12:00 Date: 1/29/92 Company: GEI

RELINQUISHED BY: 2. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]

RELINQUISHED BY: 3. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]

RECEIVED BY: 1. Signature: [Signature] Time: 1:00 Date: 1/29/92 Company: GEI

RECEIVED BY: 2. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]

RECEIVED BY: (LAB) 3. Signature: [Signature] Time: [Time] Date: [Date] Company: [Company]