2030 Addison Street, Suite 500, Berkeley, California 94704

September 29, 1995

Alameda County Health Agency
Department of Environmental Health
Hazardous Materials Division
1131 Harbor Bay Parkway, Room 250
Alameda, California 94502

687157.08
File: Report

Attention: Ms. Eva Chu

Subject: **Transmittal of Interim LNAPL Assessment and Groundwater Characterization Investigation Report, Mill Springs Park Apartments, 1809 Railroad Avenue, Livermore, California**

Dear Eva:

Telephone
510.540.6954
Facsimile
510.540.7496

This letter transmits two copies of EARTH TECH's (The Earth Technology Corporation) interim LNAPL Assessment and Groundwater Characterization Report for the Mill Springs Park Apartment site in Livermore, California. The investigation was performed in conformance with EARTH TECH's June 30, 1995 Workplan as amended in correspondence dated July 27, 1995.

The report includes an assessment of the possible sources of the light non-aqueous phase liquid (LNAPL) detected in monitoring well MW-1. The report also presents the results of LNAPL measurements, groundwater level surveys and chemical analyses performed on groundwater samples obtained as part of the investigation. Conclusions are given based on interpretation of the data, and recommendations are made regarding the need for further characterization of the groundwater plume.

If you have any questions, please contact the undersigned.

Very truly yours,

EARTH TECH

Mark M. Milani, P.E.
Project Manager

MM:mm

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INTERIM REPORT
LNAPL ASSESSMENT AND
GROUNDWATER CHARACTERIZATION EVALUATION
(VOLUME I - REPORT)

Mill Springs Park Apartments
1809 Railroad Avenue
Livermore, California

Submitted to:

WINGFIELD VENTURE FUND
131 East Maple Street
Hinsdale, Illinois 60521

Prepared by:

EARTH TECH
2030 Addison Street, Suite 500
Berkeley, CA 94704

September 29, 1995
Project Nº. 687157.08

INTERIM REPORT
LNAPL ASSESSMENT AND
GROUNDWATER CHARACTERIZATION EVALUATION

Mill Springs Park Apartments
Livermore, California

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1.0 INTRODUCTION

1.1 PROJECT LOCATION AND DESCRIPTION

This interim report presents the results of a floating product (LNAPL) assessment and groundwater characterization evaluation performed by EARTH TECH (The Earth Technology Corporation) at the Mill Springs Park Apartments site (MSP) in Livermore, California. The investigation was performed for the Wingfield Venture Fund (WVF), owner of the property. The MSP project site is located at 1809 Railroad Avenue, between South L and South P Streets, in Livermore, California. The site is shown in relation to the city of Livermore on the Vicinity Map, Figure 1.

The site is relatively level and occupies approximately 6½ acres. The site has been graded and has been developed with residential apartments. Additional site improvements include asphalt concrete paved roadways, parking areas and landscape improvements. The current usage and key features of the site are shown on the Site Plan, Figure 2.

1.2 PREVIOUS INVESTIGATION AND REMEDIAL ACTION SUMMARY

EARTH TECH (as Aqua Resources Inc.) previously provided environmental consultation and engineering services during the Phase I and Phase II (Final) Site Remediation and Closure for the Mill Springs Park Apartment site. Results of Phase I site remediation were presented in a report dated September 12, 1988; the final site remediation (Phase II) was documented in a report dated March 14, 1989. Site remediation included the physical removal of lead impacted soils from Area A and petroleum impacted soils from Areas B, C and D. These areas, where soil removal was conducted, are shown on the Final Remediation Area Location Plan, Figure 3.

As part of regulatory approval of the final site remediation, the Alameda County Health Care Agency, Department of Environmental Health (ACHA-DEH) requested that a groundwater monitoring plan be implemented at MSP. EARTH TECH prepared and implemented a groundwater monitoring program for the site. As part of the groundwater monitoring program, EARTH TECH performed a groundwater study of the Mill Springs Park site, and presented the results in a report dated March 3, 1989. Based on the results of this study, one groundwater monitoring well (MW-1) was installed. The monitoring well location is shown on Figure 2. The groundwater monitoring program was conducted from September 1989 through May 1993.

No LNAPL was observed during this groundwater monitoring program and the only petroleum hydrocarbon compound detected in the groundwater samples was benzene. The results of the groundwater monitoring program were presented in a report dated September 14, 1993. This report along with a request for formal site closure was forwarded to the ACHA-DEH and the Regional Water Quality Control Board (RWQCB). Final site closure was granted by the Regional Water Quality Control Board in December 1993.

In February 1995, EARTH TECH obtained Drilling Permit No. 95045 from the Alameda County Flood Control and Water Conservation District (ACFCWCD), Zone 7 to close the monitoring well. However, when the monitoring well was opened at the time well closure was performed, a hydrocarbon odor was detected. A light non-aqueous phase liquid (LNAPL) was detected when the depth to groundwater was measured using an electronic interface probe. The LNAPL thickness was determined to be between ¼ to ½ inch. The well closure operation was immediately suspended after the LNAPL was encountered. Following discovery of the LNAPL, The ACHA-DEH and the ACFCWCD were notified of the presence of the LNAPL.

In order to identify the source of the LNAPL and evaluate the horizontal extent of the LNAPL and dissolved petroleum hydrocarbons on the MSP site, EARTH TECH prepared a Workplan that was submitted to ACHA-DEH on June 30, 1995. The Workplan was approved by ACHA-DEH in correspondence dated July 7, 1995. EARTH TECH amended the original Workplan in correspondence dated July 27, 1995.

EARTH TECH's Workplan was developed specifically to augment additional characterization to be performed by Desert Petroleum Inc. (DP). In addition, the Workplan was submitted with the intent of establishing a coordinated program for the gathering, disseminating and reviewing of all necessary and pertinent information needed to develop an effective and efficient course of action between the ACHA-DEH, MSP and Desert Petroleum Inc. for the remediation of the MSP site and others impacted by this contamination.

1.3 SCOPE OF LNAPL ASSESSMENT AND GROUNDWATER CHARACTERIZATION INVESTIGATION

The scope of services for the LNAPL Assessment and Groundwater Characterization Investigation performed by EARTH TECH included the following:

- Prepare a site specific Health and Safety Plan (HASP) in conformance with the Occupational Safety and Health Administration (OSHA) requirements [29 CFR 1910.120(j)].
- Prepare a Workplan for review and approval by ACHA-DEH and obtain necessary drilling permits from the ACFCWCD, Zone 7.
- Perform an initial site reconnaissance and utility clearance survey to clear proposed boring locations.
- Perform a subsurface investigation at 11 locations (H-1 to H-11) to collect soil and grab groundwater samples.
- Obtain depth-to-water measurements in all grab groundwater sampling locations and monitoring wells and LNAPL thickness measurements where floating product is found.
- Purge and sample monitoring well MW-1 at MSP and monitoring well G-1 located at Groth Brothers Oldsmobile.
- Submit soil and groundwater samples to a State-certified analytical laboratory for analyses for total petroleum hydrocarbons (TPH) as gasoline (TVH), diesel (TEHd), fuel oil (TEHfo) and for Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) and Methyl

Tertiary Butyl Ester (MTBE). Selected soil and groundwater samples would also be analyzed for other volatile organic compounds

- Perform necessary field and laboratory QA/QC checks to validate the analytical data.

- Evaluate the data obtained from the chemical analyses to identify the possible sources of the LNAPL (both onsite and offsite), estimate the lateral extent of floating product, estimate the groundwater impact from dissolved petroleum hydrocarbons, and evaluate the need for floating product removal and/or groundwater remediation.

- Prepare a report summarizing the observed site conditions and data obtained from the investigation including conclusions and recommendations regarding the need for LNAPL removal and/or groundwater remediation and the need for additional monitoring wells.

In conjunction with this investigation, EARTH TECH prepared a separate Workplan to perform air monitoring at the Mill Springs Park Apartment site in Livermore California. This Workplan was prepared in response to the ACHA-DEH's request that air monitoring be performed at the subject site. This request was presented at a meeting held on Thursday, May 11, 1995 at ACHA-DEH's office. The air monitoring Workplan was submitted in correspondence dated June 9, 1995.

The purpose of the air monitoring was to evaluate if fugitive emissions were migrating from the LNAPL floating on groundwater detected at a depth of about 30 feet below ground surface (bgs) in monitoring well MW-1. Fugitive emissions from the LNAPL, characterized as gasoline - a complex mixture of petroleum hydrocarbons, could migrate through the non-saturated (vadose zone) soils in a vapor phase state and possibly enter enclosed spaces (i.e. below grade utility vaults, building envelopes, etc.). This could lead to possible exposure via inhalation. In addition, soil vapor containing gasoline could possibly enter enclosed spaces that are not ventilated, resulting in a potential explosive condition or fire hazard due to accumulation of soil vapor containing gasoline. Data collected from the air monitoring program was used to evaluate the potential for exposure from inhalation and for physical hazards (fire/explosion). The results of the air monitoring program were presented in correspondence dated September 26, 1995. A copy of this report is presented in Appendix D.

1.4 REPORT ORGANIZATION

The LNAPL and groundwater characterization report is organized into five sections labeled 1.0 through 5.0. Section numbers and main headings are:

- 1.0 Introduction
- 2.0 Regional Geology and Hydrogeology
- 3.0 Investigation Summary
- 4.0 Nature and Extent of Contamination
- 5.0 Conclusions and Recommendations
- 6.0 Limitations

Section 2.0 gives a brief description of the regional and site geology and hydrogeology. Section 3.0 summarizes the field investigation including soil and groundwater sampling performed during this investigation. The nature and extent of groundwater impact are summarized in Section 4.0. Section 5.0 presents conclusions developed from the assessment and recommendations regarding the need for LNAPL removal or groundwater remediation at the MSP site. Section 6.0 presents investigation limitations.

References are listed in Section 7.0. Figures and Tables referenced in the report are presented at the end of the report.

Supporting information is presented in four (4) Appendices. Appendix A includes the project Health and Safety Plan. Boring Logs are presented in Appendix B. Appendix C contains copies of the Certified Analytical Reports and Chain of Custody Record Sheets. Appendix D includes other information and supporting documentation referenced in report.

2.0 GEOLOGY AND HYDROGEOLOGY

Subsurface and geologic data for the MSP site presented in this report were obtained from both previous and current investigations performed by EARTH TECH. The MSP site is located within the Alameda County Flood Control and Water Conservation District, Zone 7. This agency was contacted regarding available groundwater data. In addition, the Department of Water Resources Bulletin (DWRB) No. 118-2, "Evaluation of Groundwater Resources: Livermore and Sunol Valleys", June, 1974 was reviewed. Subsurface and geologic data were used as observed.

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

The Mill Springs Park Apartment site is located within the Livermore Valley groundwater basin. As presented in the DWRB, the Livermore Valley groundwater basin is comprised of numerous groundwater subbasins. The subject site is located within the Mocho subbasin, particularly the Mocho II province which comprises the western portion of the Mocho subbasin.

Groundwater movement in the Livermore Valley generally follows the dip of the topographic surface towards the longitudinal axis of the valley. Groundwater then flows along the longitudinal axis generally in a western direction towards the Bernal subbasin. The regional groundwater flow can be interpreted from the groundwater elevation contour maps prepared by ACFCWCD, Zone 7. Copies of these contour maps for the years 1989 to 1995 are presented in Appendix D. It should be noted that although the general flow direction corresponds closely with the longitudinal axis of the valley, operation of the gravel extraction pits located within the valley does have a significant impact on both the local and regional groundwater flow regimes. However, the gravel extraction pits do not seem to have a significant impact on groundwater flow in the vicinity of the Mill Springs Park Apartment site.

Groundwater flow occurs in multiple water-bearing units. The principal water bearing units include an upper, unconfined aquifer overlying a series of semi-confined aquifers of the Valley Fill materials (recent alluvium). These units in turn are underlain by a multilayer, confined aquifer system of the Livermore Formation.

Both vertical and horizontal groundwater flow restrictions occur in the aquifer system. Faults, lithologic variations and permeability variations affect horizontal groundwater movement, particularly in the Valley Fill materials. Faults primarily control the hydraulic continuity between individual subbasins. Vertical groundwater movement is often restricted due to internal stratification of the aquifer materials. Vertical movement between the Valley Fill and Livermore Formation appears to be limited to areas where the Livermore Formation is in direct contact with overlying stream channel deposits (along the Arroyo Valle and Arroyo Mocho stream channels), and to some extent where existing wells penetrate both aquifers.

The Mocho subbasin is the largest subbasin in the Livermore Valley groundwater basin, and also is one of the most important. The principle streams draining the Mocho subbasin include the Arroyo Seco and the Arroyo Mocho. The Mocho subbasin is bounded to the east by the Tesla Fault, to the west by the central zone of the Livermore Fault, to the north by the Tassajara Formation and to the south by non water bearing marine rocks.

As mentioned earlier, the Mocho subbasin has been divided into two provinces: Mocho I (eastern) and Mocho II (western). The subject site is located within the Mocho II province; consequently, only the Mocho II province will be discussed. In addition, the DWRB states that the near surface materials in both provinces appear to lack lateral hydraulic continuity.

The Valley Fill materials in the Mocho II province consist of sand, gravel and cemented gravel separated by interbeds of silt and clay. The Valley Fill reportedly extends to depths of about 30 feet along the Arroyo Mocho to over 150 feet along the longitudinal axis of the valley. The underlying Livermore Formation consists of sandy gravel and cemented gravel. Individual aquifers are generally separated by aquitards consisting of silty clay and clayey gravel.

The Alameda County Flood Control and Water Conservation District, Zone 7 monitors numerous wells within the Mocho subbasin as well as other subbasins for both water level and water quality. From their monitoring program, Zone 7 has also prepared water level contour maps. Although the water levels have varied, the hydraulic gradient appears to have been relatively consistent, with groundwater flowing to the northwest on a local basis.

2.2 SITE GEOLOGY

The site is located near the eastern boundary of the Coast Ranges geologic province at the northern terminus of the Diablo Range. The soils underlying the site and vicinity consist of alluvial deposits which vary from fine silty sands to gravels. Local clay interbeds can also occur.

Site geology and soil lithology were interpreted from a previous groundwater study conducted by EARTH TECH in 1989 and the additional soil borings performed as part of the this investigation.

During installation of the monitoring well (MW-1) at the site, sandy clay gravel fill was encountered from the ground surface to a depth of about five feet below ground surface (bgs). The fill is underlain to the depth explored (about 62 feet) with native soils consisting of interbedded clayey sand, gravelly sand, silty sand, sandy gravel, and silty clay. Detailed subsurface conditions encountered in the boring are presented on the attached boring logs, Appendix B.

As part of the current investigation, EARTH TECH drilled eleven additional borings to depths ranging from 35 to 40 feet bgs. Limited fill was observed in borings with the exception of borings H-8, H-10 and H-11. The fill thickness was interpreted to be about 3 to 5 feet in these borings. Detailed subsurface conditions encountered in each boring are presented on the attached boring logs (Appendix B).

The lithology is interpreted on three cross sections, AA-AA', BB-BB' and CC-CC'. The cross sections are shown on Figures 4, 5 and 6 respectively. Section AA-AA' is approximately parallel to the groundwater gradient, while cross sections BB-BB' and CC-CC' are approximately perpendicular to the groundwater gradient. Native soils encountered under the fill, where observed, consisted of interbedded or interfingered clayey sand, gravelly sand, silty sand, sandy gravel, and silty clay. The individual units do not appear to be laterally continuous over significant horizontal distances. Based on the field observations, facies changes between lithologic units at the site are common.

2.3 SITE GROUNDWATER DEPTH, FLOW AND HYDRAULIC GRADIENT

EARTH TECH has monitored groundwater levels at the site as part of a previous groundwater monitoring program. Groundwater level data from monitoring well MW-1 is tabulated in Table 2 and presented graphically on the monitoring well hydrograph in Figure 7. The data indicate that there has been a seasonal rise in groundwater level during the winter and spring months (about November to June) and a fall in groundwater level during the summer and autumn months (July to October) except during 1991 when increased groundwater extraction occurred.

In March 1995, LNAPL was detected in the monitoring well (MW-1) at the time the well was to be closed.

As part of this investigation, groundwater level surveys were conducted between August 16 and September 21, 1995 to collect data for estimating groundwater gradient and groundwater flow directions. Results of these surveys are discussed in Section 3.2.1.

3.0 INVESTIGATION SUMMARY

3.1 KEY PROJECT OBJECTIVES

The primary objectives of this investigation were to:

- Obtain sufficient data to demonstrate that the LNAPL was not originating from the MSP site
- Obtain sufficient data to identify potential offsite sources of the LNAPL if the data demonstrate that an onsite source is not present
- Obtain sufficient data to characterize the lateral extent of the LNAPL and estimate the lateral extent of the dissolved petroleum hydrocarbons
- Obtain data to estimate the direction and gradient of groundwater flow

The first objective was evaluated by an extensive soil sampling and analysis program. Potential offsite sources were evaluated by file searches conducted by EARTH TECH personnel at the ACHA-DEH. The last three objectives were achieved by groundwater level surveys and a comprehensive groundwater sampling program. Quality Assurance and Quality Control objectives were achieved by implementing the field program in conformance with standard EARTH TECH Field Procedures and laboratory QA/QC procedures.

To achieve the above objectives, the LNAPL Assessment and Groundwater Characterization program performed by EARTH TECH at the Mill Springs Park (MSP) site included six tasks: Permitting/Utility Clearance, LNAPL Characterization, Groundwater Sampling, Soil Sampling and Waste Management/Site Restoration. Each of these tasks are described briefly below.

3.2 PERMITTING AND UTILITY CLEARANCE

EARTH TECH obtained necessary drilling permits from ACFCWCD-Zone 7 prior to drilling and will submit necessary reports to Zone 7 for permit compliance and closeout. An encroachment permit was also obtained from the City of Livermore, Public Works Department for borings located within the existing easement along the southern portion of the MSP site.

EARTH TECH contacted Underground Service Alert (USA) to have utility owners field locate known utilities at the MSP site and clear proposed boring locations. Areas that were unable to be cleared by USA were cleared using a private utility locating service.

On August 3, 1995, a site reconnaissance was conducted to visually assess the general condition of site, and locate and clear proposed boring locations of underground utilities. Utility clearance was performed by downUnder Technologies.

3.3 FIELD INVESTIGATION

The investigation consisted of drilling soil borings, collecting soil samples during drilling, installing temporary piezometers in the completed boreholes, performing field surveys to measure LNAPL thickness and depth to groundwater, collecting groundwater samples and managing investigation derived waste (IDW). Prior to performing the investigation, a site specific health and safety plan was prepared. A copy of the health and safety plan is presented in Appendix A.

3.3.1 Piezometer Installation

To estimate the horizontal extent of LNAPL and LNAPL thickness on the MSP site, EARTH TECH drilled eleven (11) soil borings (H-1 to H-11) on the MSP site. The boring locations are identified on the Site Plan, Figure 2. The borings were drilled by Bay Area Exploration (C-57 License No. 522125) using a CME 55 drill rig equipped with a 6-inch hollow stem auger. The boring depths ranged from 35 feet bgs up to 40 feet bgs.

A temporary piezometer was installed in each boring so that depth to groundwater and grab groundwater samples could be collected. The piezometers were constructed with 2-inch diameter, schedule 40 PVC casing. The lower 10 feet of casing was slotted (0.010 inch slot size). The piezometers were installed so that the screen interval extended above the free groundwater interface a minimum of two feet. A temporary surface seal was installed to minimize the potential for surface infiltration into the piezometers.

At the conclusion of the investigation, the temporary well points were removed and the borings were grouted using a Portland Type I-II cement and bentonite grout mixture.

3.3.2 Soil Sampling

To evaluate the MSP site as a possible source of the LNAPL, soil samples were collected from all soil borings within the unsaturated soil zone and field screened using a organic vapor analyzer equipped with a photoionization detector (OVM-PID). The borings were logged in the field by a registered geologist and a boring log was prepared for each boring. The completed boring logs are presented in Appendix B.

The soil samples were collected generally at five foot intervals and at changes in lithology. The soil samples were collected using a modified split barrel drive sampler (2-5/8 inch outer diameter and 2 inch inner diameter). The sampler has the capacity for obtaining an 18-inch sample using three six-inch long stainless steel liners. The sampler was driven using a 140 pound hammer having a drop of about 30-inches. Blow counts were recorded (at 6-inch intervals) for each sample drive.

Soil samples were collected at five-foot intervals during the drilling of each well. Sample intervals were staggered between boring locations. The soil exposed in the ends of each tube was quickly noted, and then the ends were sealed with teflon tape and new snug-fitting plastic caps. The sample tube was labeled with the sample number, depth, date, and project name. A second sample taken from each five-foot interval was used for lithologic logging purposes. Samples submitted for chemical analyses are summarized on Table 1, Soil Sample Analytical Summary Table.

Prior to each sample interval, the disassembled sampler and the sample liners were washed in a solution of Alconox in water. Each piece was triple rinsed, with the final rinse being distilled water. The soil samples were placed in a chilled ice chest as they were collected. Selected soil samples were submitted for chemical analyses; remaining samples were held pending results of the chemical analyses.

3.3.3 LNAPL Thickness Measurements

Well surveys were conducted by EARTH TECH between August 16 and September 21, 1995 by an EARTH TECH field engineer. During each survey, an interface probe was used to collect data on floating product (LNAPL) thickness and depth to groundwater. The data are tabulated in Table 2, Product Thickness and Groundwater Elevation Table. The eleven piezometers and the existing monitoring well are identified as H-1 through H-11 and MW-1, respectively. The locations of the piezometers and the monitoring well are shown on the Site Plan, Figure 2.

Floating product (LNAPL) thickness, depth to groundwater and total casing depth were determined using a combined electric interface and groundwater depth probe. The thickness of floating product was first determined followed by the depth to groundwater and total casing depth. The measurements were recorded to the nearest 0.01 foot; all measurements were made relative to the top of casing.

No measurable floating product layer was encountered using an oil/water interface probe in any of the well points, except in H-7 during the first survey. No measurable floating product layer was encountered in monitoring well MW-1 during the initial surveys. However, LNAPL was present in monitoring well MW-1 at the time the temporary well points were closed on September 21, 1995. An LNAPL sample was collected during this investigation from monitoring well MW-1 to perform a "fingerprint" analysis so that the chromatograms could be compared with the LNAPL sample obtained from MW-1 in March 1995.

3.3.4 Site Groundwater Depth, Flow and Hydraulic Gradient

Groundwater level surveys were performed as part of the investigation. The groundwater survey included surveying the eleven temporary piezometers locations and the monitoring wells on the MSP and Groth sites to a common datum for both elevation and horizontal location. The surveying was performed by a licensed land surveyor.

The procedures used in determining depth to groundwater were described in section 3.3.3. Groundwater has been identified at depths of between 26 feet and 30 feet bgs during this investigation. The groundwater appears to be contained in a shallow unconfined aquifer. The source of the groundwater in the aquifer appears to be from surface infiltration and local recharge.

Potentiometric surface maps developed by the Alameda County Flood Control and Water Conservation District have shown that the groundwater flow is generally west to northwest in the vicinity of the MSP site. Copies of the potentiometric surface maps are included in Appendix D.

Based on the groundwater depth data obtained during this investigation, groundwater level contour maps were developed for each survey interval, and are shown on Figures 8 through 11. The direction of groundwater flow is to generally to the west with an estimated average gradient of 0.015 foot/foot. The direction and gradient appear to be relatively consistent over the four survey intervals and with direction and gradient of groundwater flow reported by others.

3.4 GROUNDWATER SAMPLING

Following the depth to groundwater and floating product thickness measurements, grab groundwater samples were collected from each well point using a bailer. A new, disposable bailer was used for each grab groundwater sample point to reduce the potential for cross contamination. In addition, monitoring well MW-1 on the MSP site and G-1 on the Groth site were purged to enable groundwater sampling. The depth to groundwater and total casing depth measurements were used to estimate purge volumes for each monitoring well. Monitoring well purging and groundwater sampling activities were conducted by an EARTH TECH field engineer using standard EARTH TECH Field Procedures.

The monitoring wells were purged using a submersible pump. The pump was decontaminated between wells in conformance with EARTH TECH Field Procedures. The standard purge volume of three casing volumes was obtained from both wells.

Following purging, the monitoring wells were allowed to recover to at least 80 percent of the original water column height so that a representative groundwater sample could be collected. Groundwater samples were collected using 1½ inch diameter disposable polyvinyl chloride (PVC) bailers. Groundwater samples submitted for chemical analyses are summarized on Table 3, Groundwater Sample Analytical Summary Table.

3.5 CHEMICAL ANALYSES

The soil and groundwater samples were collected, handled and shipped in conformance with EARTH TECH Field Procedures to a state Certified laboratory (Curtis & Tompkins, LTD.). All the soil samples submitted were analyzed for total petroleum hydrocarbons against gasoline, diesel and fuel oil standards (TVH, TEH), and for Benzene, Toluene, Ethylbenzene and Xylenes (BTXE) and for MTBE. TVH and TEH (diesel and fuel oil) were determined using modified EPA Method 8015 (LUFT) and BTXE and MTBE compounds were analyzed using EPA Method 8020. In addition, selected soil samples were analyzed for chlorinated hydrocarbons by EPA Method 8010.

All the groundwater samples submitted were also analyzed for total petroleum hydrocarbons against both gasoline, diesel and fuel oil standards (TVH and TEH), and for Benzene, Toluene, Ethylbenzene and Xylenes (BTXE) and for MTBE. TVH and TEH were determined using modified EPA Method 8015 (LUFT) and BTXE and MTBE compounds were analyzed using EPA Method 8020. In addition, selected groundwater samples were analyzed for chlorinated hydrocarbons by EPA Method 8010.

The soil and groundwater samples submitted and specific analyses performed and analytical results are summarized on Tables 4 and 5. Groundwater samples for diesel were collected in 1-liter glass bottles. Groundwater samples for gasoline and volatile organic compound (BTXE, MTBE and chlorinated hydrocarbons) analyses were collected in 40-ml glass VOAs equipped with a teflon septum. VOAs were visually inspected to ensure that no airspace or air bubbles remained in the sample container.

The soil and groundwater samples were individually labeled, and stored in an insulated cooler with ice. All samples collected were transported to the laboratory either by EARTH TECH or by a Curtis and Tompkins courier under chain-of-custody record. The chain-of-custody record was signed and kept with the cooler during transport. A temperature blank and trip blank were also contained in the cooler.

The analytical results for TVH, TEHd, TEHfo, BTXE and MTBE analyses are shown in Table 4 for soil analytical results and Table 5 for groundwater analytical results. No EPA 8010 analytes were detected

above the 0.5 μg/L method detection limit for soil and groundwater samples collected at the MSP site. Laboratory reports and chain-of-custody documentation are included in Appendix B.

For QA/QC purposes, field duplicates were be collected so that relative percent difference (RPDs) value can be calculated.

3.6 WASTE MANAGEMENT

Drill cuttings were placed in a 20 cubic yard, lined and covered bin provided by a licensed waste disposal contractor (All Chemical Disposal). Purge water and decontamination fluids were contained in DOT approved 17H (open head style) drums. All drums were labelled with contents and accumulation start date.

Soil borings were backfilled with cement grout in conformance with Zone 7 requirements.

Representative samples were collected from the soil cuttings and fluids for waste characterization. Soil cuttings were transported to BFI's Vasco Road Landfill for disposal. Disposal of purge water is pending.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section summarizes the nature and extent of groundwater contamination defined during this investigation. Based on the data from this investigations, EARTH TECH has developed estimates of the extent of groundwater impact from releases of gasoline. The nature and extent of this impact is discussed further below.

4.1 LNAPL Fingerprinting and Source Investigation

As part of the investigation, EARTH TECH performed a detailed reconnaissance of the vicinity to identify potential sources of the LNAPL. Sites considered to be possible sources of the LNAPL are listed below by site name and address:

- Unocal Station, 1771 First Street FG, SIR, permit · 2 USTs
- Beacon Station, 1619 First Street 3 UST permitted, (YES)
- Tri-Valley Tune-up, 1737 First Street no permit, no monitoring, no known leaks
- B & C Gas Mini-mart (formerly Desert Petroleum), 2008 First Street, Livermore permitted / under review
- Groth Brothers Oldsmobile, 78 L Street, Livermore

EARTH TECH conducted a review of available files at the ACHA-DEH for the above sites on September 26, 1995. Data obtained from this file review is currently being reviewed and will be reported in the final report.

In addition, due to previous unauthorized release reports filed by the B & C mini-mart at the ACHA-DEH and that an apparent UST failure may have occurred and the increased LNAPL thickness observed in monitoring well MW-1, samples of gasoline products dispensed at the B & C mini-mart were obtained for "fingerprint" analysis. The product samples were submitted to Curtis & Tompkins under chain of custody by EARTH TECH personnel. The "fingerprints" obtained from these analyses were compared against the "fingerprint" of the LNAPL sample obtained from monitoring well MW-1. A comparison of the three fingerprints was performed by Curtis & Tompkins, and their assessment was presented in a letter dated September 29, 1995. A copy of this letter is presented in Appendix D.

4.2 INTERPRETATION OF SOIL ANALYTICAL RESULTS

Based on the data presented in Table 5, no petroleum hydrocarbons were detected in soil samples located in the unsaturated zone collected during this investigation. Selected soil samples located at the groundwater interface had detectable concentrations of gasoline.

4.3 INTERPRETATION OF GROUNDWATER ANALYTICAL RESULTS

Based on the data presented in Table 5, total petroleum hydrocarbons as gasoline and BTXE and MTBE compounds have been detected in at least 8 of the 13 locations (11 well points and two monitoring wells) sampled during this investigation. The concentration of gasoline (TVH) in the groundwater, where detected, exceeded the 50 μg/L action level presented in the Tri-Regional Guidelines for Investigating Leaking Underground Fuel Tanks by the Regional Water Quality Control Board (RWQCB). At selected locations, the TVH concentration was considered to be significant (H-6, H-7, H-8 and MW-1).

In addition, the concentrations of benzene, toluene, xylene and ethylbenzene (BTXE) compounds in the groundwater also exceeded applicable Maximum Contaminant Limits (MCLs) for drinking water in up to 6 of the 13 locations sampled. Significant concentrations of MTBE were also detected at numerous sample locations.

No fuel oil was detected in any of the groundwater samples collected during this investigation.

4.4 ESTIMATE OF GROUNDWATER IMPACT

Groundwater contamination appears to be limited to the eastern portion of the MSP site. Iso-concentration contour maps for TVH were developed using a computer contouring program. No contour maps for LNAPL occurrence could be prepared since LNAPL was only detected in monitoring well MW-1 on a consistent basis.

The contouring was performed using the TVH data presented in Table 5. Where TVH was not detected above the method detection limit (mdl), a value of one half the mdl (½ mdl) was used for those sample locations. An iso-contour plot of the TVH (gasoline) data is presented on Figure 12. The estimated limits of groundwater impact from gasoline are shown on Figure 13.

The iso-concentration contours indicate that the TVH groundwater plume is flowing to the west. This is consistent with the potentiometric surface map generated from the groundwater elevation data. The downgradient edge of the plume could not be determined since the groundwater samples from H-7 and H-8 contained significant TVH concentrations.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Conclusions developed during the LNAPL assessment and groundwater characterization investigation are presented below.

- The results of soil analyses indicate that the MSP site is not a source of the LNAPL detected in MW-1 since no petroleum hydrocarbons were detected in the soil samples collected from the unsaturated zone. Based on this EARTH TECH concludes that the LNAPL has originated from an offsite source.

- While the results of a detailed file review are pending, the hydrogeologic and analytical data obtained from this investigation limit the potential source of the LNAPL to two sites: B & C Mini-mart (2008 First Street) and Groth Brothers Oldsmobile (78 L street). Of these two sources, the B&C Mini-mart has at least two unauthorized releases of gasoline. The Groth site has a history of USTs on the property; however, the USTs have either been removed or abandoned in-place. In addition, comparison of the LNAPL fingerprint from monitoring well MW-1 with fingerprints of petroleum products (gasoline) dispensed at the B & C mini-mart shows numerous similarities.

- No significant thickness of LNAPL was detected during this investigation. However, LNAPL was detected in selected well points and in well MW-1. The largest accumulation of LNAPL was detected in MW-1. In addition, an increased LNAPL thickness was observed in the monitoring well MW-1 during this investigation.

- Groundwater underlying the MSP site has been impacted from releases of gasoline and dissolved gasoline constituents (BTXE and MTBE). The groundwater impact appears to be limited to the eastern portion of the site.

- Groundwater contamination appears to extend beyond the MSP property boundary based on the results of H-7 and H-8. The extent of this contamination beyond the MSP property could not be determined.

5.2 RECOMMENDATIONS

Based on the above conclusions, EARTH TECH recommends that following:

- Since the LNAPL and groundwater contamination appears to originate from an offsite source, EARTH TECH recommends that the final site closure granted by the RWQCB remain in place and that MSP not be required to perform any further site characterization or periodic groundwater monitoring.

- The closure of monitoring well MW-1 should be completed and if further monitoring wells need to be installed, they should be installed by the responsible party causing the offsite contamination that has migrated onto the MSP property by subsurface transport..

- ACHA-DEH should issue a letter to MSP stating that final site closure status has not changed and that MSP will not be held responsible for further monitoring or remediation of impacted groundwater underlying the site. ACHA-DEH should also obtain similar concurrence from the RWQCB regarding monitoring and remediation.

- ACHA-DEH should require that a detailed subsurface investigation be performed at the site located at 2008 First street to determine if this is the source of the LNAPL.

6.0 LIMITATIONS

Our investigation was performed in substantial conformance with the approved scope of services. Soil and groundwater data utilized were used as reported. Chemical analyses were performed by others not under direct supervision by EARTH TECH. The conclusions and recommendations contained herein represent professional opinions prepared consistent with the standards of care and diligence normally practiced by environmental consultants of a similar nature in the same locale. No other warranty, expressed or implied, is made.

OTHER CONSIDERATIONS

Data and findings developed from this investigation will be made available to all interested parties so that an informed decision can be made jointly by all parties.

7.0 REFERENCES

Aqua Resources, 1988, *Interim Report - Environmental Engineering Services Summary during Phase I Remediation*; Mill Springs Park Apartments, Livermore. California.

Aqua Resources, 1988, *Final Closure Workplan - Phase II Remediation*; Mill Springs Park Apartments, Livermore. California.

Aqua Resources, 1989, *Final Remediation and Site Closure Report - Phase II Remediation*; Mill Springs Park Apartments, Livermore. California.

Aqua Resources, 1989, *Final Remediation and Site Closure Report - Phase II Remediation*; Mill Springs Park Apartments, Livermore. California.

EARTH TECH, 1993, *Final Groundwater Monitoring Program Report and Request for Final Site Closure*; Mill Springs Park Apartments, Livermore. California.

California Regional Water Quality Control Board, 1993, *UST Case Clsoure for Mill Springs Apartments;* Mill Springs Park Apartments, Livermore. California.

EARTH TECH, 1995, *Notice of Floating Product during Abandonment of Monitoring Well*; Mill Springs Park Apartments, Livermore. California.

EARTH TECH, 1995, *LNAPL Assessment Report*; Mill Springs Park Apartments, Livermore. California.

EARTH TECH, 1995, *Air Monitoring Workplan*; Mill Springs Park Apartments, Livermore. California.

EARTH TECH, 1995, *Workplan to Support Coordinated Approach to LNAPL Characterization*; Mill Springs Park Apartments, Livermore. California.

Table 1
Soil Sample and Analysis Summary Table

Sample ID	Sampling Depth (ft)	Gasoline (TVH) EPA 8015 (LUFT) mg/kg	Diesel (TEH) EPA 8015 (LUFT) mg/kg	Fuel Oil (TEH) EPA 8015 (LUFT) mg/kg	BTEX & MTBE EPA 8020/8240 ug/kg	Other VOCs EPA 8010 ug/kg
MSP-H1-SD2	10.5	X	NA	X	X	X
MSP-H1-SD3	15.5	X	X	X	X	X
MSP-H1-SD4	20.5	X	NA	NA	X	NA
MSP-H1-SD5	25.5	X	X	X	X	X
MSP-H2-SD2	11.5	X	X	X	X	X
MSP-H2-SD3	16.5	X	NA	X	X	NA
MSP-H2-SD4	21.5	NA	NA	NA	NA	NA
MSP-H2-SD5	26.5	X	X	X	X	X
MSP-H2-SD6	31.5	X	NA	X	X	NA
MSP-H2-SD7	36.5	NA	NA	NA	NA	NA
MSP-H3-SD1	5.5	NA	NA	NA	NA	NA
MSP-H3-SD2	10.5	NA	NA	NA	NA	NA
MSP-H3-SD3	15	X	X	X	X	NA
MSP-H3-SD4	20	NA	NA	NA	NA	NA
MSP-H3-SD5	25	X	X	X	X	NA
MSP-H4-SD1	6.5	X	NA	X	X	X
MSP-H4-SD3	16.5	X	NA	X	X	X
MSP-H4-SD5	26.5	X	X	X	X	X
MSP-H4-SD6	29	X	NA	NA	X	NA
MSP-H5-SD1	5.5	X	NA	X	NA	NA
MSP-H5-SD2	10.5	X	NA	X	X	NA
MSP-H5-SD3	15.5	NA	NA	NA	NA	NA
MSP-H5-SD4	20.5	NA	NA	NA	NA	NA
MSP-H5-SD5	25.5	X	X	X	X	NA
MSP-H6-SD1	5.5	NA	NA	NA	NA	NA
MSP-H6-SD2	9.5	X	X	X	X	NA
MSP-H6-SD4	20.5	X	NA	NA	X	NA
MSP-H6-SD5-1	25.5	X	X	X	X	NA
MSP-H6-SD5-2	25.5	X	X	X	X	NA
MSP-H7-SD1	6.5	X	NA	NA	x	x
MSP-H7-SD3	16.5	X	NA	NA	X	NA
MSP-H7-SD4	21	X	NA	NA	X	NA
MSP-H7-SD5	26.5	X	X	X	X	NA
MSP-H8-SD1	5.5	NA	NA	NA	NA	NA
MSP-H8-SD2	10.5	X	NA	X	X	NA
MSP-H8-SD3	15.5	X	X	X	X	NA
MSP-H8-SD4	20	NA	NA	NA	NA	NA
MSP-H8-SD5	25.5	X	X	X	X	NA
MSP-H9-SD2	10.5	X	X	X	X	NA
MSP-H9-SD3-1	16.5	X	X	X	X	NA
MSP-H9-SD3-2	16.5	X	X	X	X	NA
MSP-H9-SD4	21	NA	NA	NA	NA	NA
MSP-H9-SD5-1	26	X	X	X	X	NA
MSP-H9-SD5-2	26	X	X	X	X	NA
MSP-H9-SD6	31.5	NA	NA	NA	NA	NA
MSP-H9-SD7	35.5	X	NA	NA	X	NA
MSP-H10-SD2	11.5	NA	NA	NA	NA	NA
MSP-H10-SD3	16	X	X	X	X	NA
MSP-H10-SD5	26.5	X	X	X	X	NA
MSP-H11-SD1	6.5	NA	NA	NA	NA	NA
MSP-H11-SD2	11.5	X	X	X	X	X
MSP-H11-SD3	16.5	NA	NA	NA	NA	NA
MSP-H11-SD4	21.5	X	NA	X	X	NA
MSP-H11-SD5	26.5	X	X	X	X	X

Notes:
1. Soil sample depths were measured relative to ground surface
2. X - indicates sample was submitted for chemical analyses indicated in column heading
3. NA - not analyzed

687157.08\SOIL-SUM.WQ1

TABLE 2

Product Thickness and Groundwater Elevation Table

Date: 09/30/95

SITE	DATE	MP ELEVATION[2] (feet)	TIME	DEPTH TO WATER (feet)	FLOATING PRODUCT THICKNESS (feet)	WATER ELEV.[2] (feet)	△ WATER ELEV.[1] (feet)	EQUIV. FRESH WATER HEAD[2] (feet)
H-01	08/11/95	476.43	00:00	28.38	.00	448.05	NA	448.05
H-01	08/14/95	476.43	00:00	28.64	.00	447.79	-.26	447.79
H-01	08/16/95	476.43	00:00	28.62	.00	447.81	.02	447.81
H-01	08/21/95	476.43	00:00	28.74	.00	447.69	-.12	447.69
H-01	08/24/95	476.43	00:00	28.82	.01	447.61	-.08	447.61
H-01	09/13/95	476.43	00:00	30.22	.00	446.21	-1.40	446.21
H-01	09/21/95	476.43	00:00	30.66	.00	445.77	-.44	445.77
H-02	08/11/95	477.56	00:00	27.28	.00	450.28	NA	450.28
H-02	08/14/95	477.56	00:00	27.32	.00	450.24	-.04	450.24
H-02	08/16/95	477.56	00:00	27.49	.00	450.07	-.17	450.07
H-02	08/21/95	477.56	00:00	27.89	.00	449.67	-.40	449.67
H-02	08/24/95	477.56	00:00	28.06	.01	449.50	-.17	449.50
H-02	09/13/95	477.56	00:00	29.20	.00	448.36	-1.14	448.36
H-02	09/21/95	477.56	00:00	29.56	.00	448.00	-.36	448.00
H-03	08/11/95	478.87	00:00	27.19	.00	451.68	NA	451.68
H-03	08/14/95	478.87	00:00	27.31	.00	451.56	-.12	451.56
H-03	08/16/95	478.87	00:00	27.46	.00	451.41	-.15	451.41
H-03	08/21/95	478.87	00:00	27.95	.00	450.92	-.49	450.92
H-03	08/24/95	478.87	00:00	28.06	.00	450.81	-.11	450.81
H-03	09/13/95	478.87	00:00	29.42	.00	449.45	-1.36	449.45
H-03	09/21/95	478.87	00:00	29.80	.00	449.07	-.38	449.07
H-04	08/11/95	478.30	00:00	25.35	.00	452.95	NA	452.95
H-04	08/14/95	478.30	00:00	25.56	.00	452.74	-.21	452.74
H-04	08/16/95	478.30	00:00	25.70	.00	452.60	-.14	452.60
H-04	08/21/95	478.30	00:00	26.22	.01	452.08	-.52	452.08
H-04	08/24/95	478.30	00:00	26.37	.00	451.93	-.15	451.93
H-04	09/13/95	478.30	00:00	28.17	.00	450.13	-1.80	450.13
H-04	09/21/95	478.30	00:00	28.20	.00	450.10	-.03	450.10
H-05	08/11/95	479.17	00:00	26.36	.00	452.81	NA	452.81
H-05	08/14/95	479.17	00:00	26.50	.00	452.67	-.14	452.67
H-05	08/16/95	479.17	00:00	26.65	.00	452.52	-.15	452.52
H-05	08/21/95	479.17	00:00	27.16	.01	452.01	-.51	452.01

(1) Change in Water Elevation since last reported measurement

(2) Measurements Based on Mean Sea Level

D = Dry NA = Not Available

TABLE 2

Product Thickness and Groundwater Elevation Table

SITE	DATE	MP ELEVATION[2] (feet)	TIME	DEPTH TO WATER (feet)	FLOATING PRODUCT THICKNESS (feet)	WATER ELEV.[2] (feet)	△ WATER ELEV[1] (feet)	EQUIV. FRESH WATER HEAD[2] (feet)
H-05	08/24/95	479.17	00:00	27.33	.00	451.84	-.17	451.84
H-05	09/13/95	479.17	00:00	28.81	.00	450.36	-1.48	450.36
H-05	09/21/95	479.17	00:00	29.14	.00	450.03	-.33	450.03
H-06	08/11/95	478.45	00:00	26.22	.00	452.23	NA	452.23
H-06	08/14/95	478.45	00:00	26.34	.00	452.11	-.12	452.11
H-06	08/16/95	478.45	00:00	26.57	.00	451.88	-.23	451.88
H-06	08/21/95	478.45	00:00	27.06	.00	451.39	-.49	451.39
H-06	08/24/95	478.45	00:00	26.21	.00	452.24	.85	452.24
H-06	09/13/95	478.45	00:00	28.66	.00	449.79	-2.45	449.79
H-06	09/21/95	478.45	00:00	29.05	.00	449.40	-.39	449.40
H-07	08/11/95	477.44	00:00	25.71	.00	451.73	NA	451.73
H-07	08/14/95	477.44	00:00	25.86	.01	451.58	-.15	451.58
H-07	08/16/95	477.44	00:00	26.00	.00	451.44	-.14	451.44
H-07	08/21/95	477.44	00:00	26.53	.00	450.91	-.53	450.91
H-07	08/24/95	477.44	00:00	26.71	.00	450.73	-.18	450.73
H-07	09/13/95	477.44	00:00	28.49	.00	448.95	-1.78	448.95
H-07	09/21/95	477.44	00:00	28.31	.00	449.13	.18	449.13
H-08	08/11/95	474.37	00:00	27.89	.00	446.48	NA	446.48
H-08	08/14/95	474.37	00:00	27.91	.00	446.46	-.02	446.46
H-08	08/16/95	474.37	00:00	28.05	.00	446.32	-.14	446.32
H-08	08/21/95	474.37	00:00	28.46	.00	445.91	-.41	445.91
H-08	08/24/95	474.37	00:00	28.68	.00	445.69	-.22	445.69
H-08	09/13/95	474.37	00:00	29.94	.00	444.43	-1.26	444.43
H-08	09/21/95	474.37	00:00	30.67	.00	443.70	-.73	443.70
H-09	08/11/95	472.10	00:00	28.30	.00	443.80	NA	443.80
H-09	08/14/95	472.10	00:00	27.93	.00	444.17	.37	444.17
H-09	08/16/95	472.10	00:00	27.97	.00	444.13	-.04	444.13
H-09	08/21/95	472.10	00:00	28.02	.01	444.08	-.05	444.08
H-09	08/24/95	472.10	00:00	27.59	.01	444.51	.43	444.51
H-09	09/13/95	472.10	00:00	28.71	.00	443.39	-1.12	443.39
H-09	09/21/95	472.10	00:00	28.67	.00	443.43	.04	443.43

(1) Change in Water Elevation since last reported measurement

(2) Measurements Based on Mean Sea Level

D = Dry NA = Not Available

TABLE 2

Product Thickness and Groundwater Elevation Table

SITE	DATE	MP ELEVATION[2] (feet)	TIME	DEPTH TO WATER (feet)	FLOATING PRODUCT THICKNESS (feet)	WATER ELEV.[2] (feet)	△ WATER ELEV.[1] (feet)	EQUIV. FRESH WATER HEAD[2] (feet)
H-10	08/11/95	473.35	00:00	27.71	.00	445.64	NA	445.64
H-10	08/14/95	473.35	00:00	27.74	.00	445.61	-.03	445.61
H-10	08/16/95	473.35	00:00	27.79	.00	445.56	-.05	445.56
H-10	08/21/95	473.35	00:00	28.24	.01	445.11	-.45	445.11
H-10	08/24/95	473.35	00:00	28.31	.01	445.04	-.07	445.04
H-10	09/13/95	473.35	00:00	29.63	.00	443.72	-1.32	443.72
H-10	09/21/95	473.35	00:00	30.16	.00	443.19	-.53	443.19
H-11	08/11/95	474.70	00:00	28.44	.00	446.26	NA	446.26
H-11	08/14/95	474.70	00:00	28.41	.00	446.29	.03	446.29
H-11	08/16/95	474.70	00:00	28.47	.00	446.23	-.06	446.23
H-11	08/21/95	474.70	00:00	28.92	.00	445.78	-.45	445.78
H-11	08/24/95	474.70	00:00	29.04	.01	445.66	-.12	445.66
H-11	09/13/95	474.70	00:00	30.03	.00	444.67	-.99	444.67
H-11	09/21/95	474.70	00:00	30.50	.00	444.20	-.47	444.20
MW-1	04/19/89	477.08	00:00	43.50	.00	433.58	NA	433.58
MW-1	05/01/89	477.08	00:00	42.74	.00	434.34	.76	434.34
MW-1	08/01/89	477.08	00:00	43.86	.00	433.22	-1.12	433.22
MW-1	09/01/89	477.08	00:00	45.35	.00	431.73	-1.49	431.73
MW-1	11/02/89	477.08	00:00	46.39	.00	430.69	-1.04	430.69
MW-1	02/02/90	477.08	00:00	45.36	.00	431.72	1.03	431.72
MW-1	05/02/90	477.08	00:00	42.58	.00	434.50	2.78	434.50
MW-1	03/06/91	477.79	00:00	41.25	.00	436.54	2.04	436.54
MW-1	05/02/91	477.79	00:00	40.05	.00	437.74	1.20	437.74
MW-1	08/07/91	477.79	00:00	53.79	.00	424.00	-13.74	424.00
MW-1	11/05/91	477.79	00:00	59.25	.00	418.54	-5.46	418.54
MW-1	02/21/92	477.79	00:00	59.27	.00	418.52	-.02	418.52
MW-1	05/04/92	477.79	00:00	54.47	.00	423.32	4.80	423.32
MW-1	02/12/93	477.79	00:00	52.02	.00	425.77	2.45	425.77
MW-1	05/04/93	477.79	00:00	39.42	.00	438.37	12.60	438.37
MW-1	02/23/95	477.79	00:00	33.10	.00	444.69	6.32	444.69
MW-1	04/28/95	477.79	00:00	26.40	.06	451.39	6.70	451.43
MW-1	06/02/95	477.79	00:00	26.16	.01	451.63	.24	451.63
MW-1	06/30/95	447.79	00:00	27.06	.01	420.73	-30.90	420.73
MW-1	07/25/95	477.79	00:00	28.55	.05	449.24	28.51	449.27

(1) Change in Water Elevation since last reported measurement

(2) Measurements Based on Mean Sea Level

D = Dry NA = Not Available

TABLE 2

Product Thickness and Groundwater Elevation Table

SITE	DATE	MP ELEVATION[2] (feet)	TIME	DEPTH TO WATER (feet)	FLOATING PRODUCT THICKNESS (feet)	WATER ELEV.[2] (feet)	△ WATER ELEV.[1] (feet)	EQUIV. FRESH WATER HEAD[2] (feet)
MW-1	08/07/95	477.79	00:00	29.49	.04	448.30	-.94	448.32
MW-1	08/11/95	477.79	00:00	29.81	.03	447.98	-.32	448.00
MW-1	08/14/95	477.79	00:00	29.75	.00	448.04	.06	448.04
MW-1	08/16/95	477.79	00:00	29.95	.00	447.84	-.20	447.84
MW-1	08/21/95	477.79	00:00	30.34	.00	447.45	-.39	447.45
MW-1	08/24/95	477.79	00:00	30.62	.00	447.17	-.28	447.17
MW-1	09/13/95	477.79	00:00	31.92	.00	445.87	-1.30	445.87
MW-1	09/21/95	477.79	00:00	32.53	.18	445.26	-.61	445.38

(1) Change in Water Elevation since last reported measurement

(2) Measurements Based on Mean Sea Level

D = Dry NA = Not Available

Table 3
Groundwater Sample Analytical Summary Table

Sample Location	TVH (Gasoline) EPA 8015 (LUFT)	TEH (Diesel) EPA 8015 (LUFT)	TEH (Fuel Oil) EPA 8015 (LUFT)	BTXE EPA 8020	MTBE EPA 8020	Other VOCs EPA 8020
MSP-MW1	X	X	X	X	X	NA
MSP-H1	X	X	X	X	X	NA
MSP-H2	X	X	X	X	X	NA
MSP-H3	X	X	X	X	X	X
MSP-H4	X	X	X	X	X	NA
MSP-H5	X	X	X	X	X	NA
MSP-H6	X	X	X	X	X	NA
MSP-H7	X	X	X	X	X	NA
MSP-H8	X	X	X	X	X	NA
MSP-H9	X	X	X	X	X	NA
MSP-H10	X	X	X	X	X	NA
MSP-H11	X	X	X	X	X	NA
GROTH-MW1	X	X	X	X	X	X

Table 4
Soil Sample Analytical Results

Sample ID	Sample Depth (ft)	Gasoline (TVH) EPA 8015 (LUFT) mg/kg	Diesel (TEH) EPA 8015 (LUFT) mg/kg	Fuel Oil (TEH) EPA 8015 (LUFT) mg/kg
MSP-H1-SD2	10.5	ND (1)	ND (1)	ND (25)
MSP-H1-SD3	15.5	ND (1)	ND (1)	ND (25)
MSP-H1-SD4	20.5	ND (1)	NA	NA
MSP-H1-SD5	25.5	ND (1)	ND (1)	ND (25)
MSP-H2-SD2	11.5	ND (1)	ND (1)	ND (25)
MSP-H2-SD3	16.5	ND (1)	ND (1)	ND (25)
MSP-H2-SD4	21.5	NA	NA	NA
MSP-H2-SD5	26.5	ND (1)	ND (1)	ND (25)
MSP-H2-SD6	31.5	ND (1)	ND (1)	ND (25)
MSP-H2-SD7	36.5	NA	NA	NA
MSP-H3-SD1	5.5	NA	NA	NA
MSP-H3-SD2	10.5	NA	NA	NA
MSP-H3-SD3	15	ND (1)	ND (1)	ND (25)
MSP-H3-SD4	20	NA	NA	NA
MSP-H3-SD5	25	ND (1)	ND (1)	ND (25)
MSP-H4-SD1	6.5	ND (1)	ND (1)	ND (25)
MSP-H4-SD3	16.5	ND (1)	ND (1)	ND (25)
MSP-H4-SD5	26.5	ND (1)	ND (1)	ND (25)
MSP-H4-SD6	29	ND (1)	NA	NA
MSP-H5-SD1	5.5	ND (1)	ND (1)	ND (25)
MSP-H5-SD2	10.5	ND (1)	ND (1)	ND (25)
MSP-H5-SD3	15.5	NA	NA	NA
MSP-H5-SD4	20.5	NA	NA	NA
MSP-H5-SD5	25.5	ND (1)	ND (1)	ND (25)
MSP-H6-SD1	5.5	NA	NA	NA
MSP-H6-SD2	9.5	ND (1)	ND (1)	ND (25)
MSP-H6-SD4	20.5	ND (1)	NA	NA
MSP-H6-SD5-1	25.5	ND (1)	ND (1)	ND (25)
MSP-H6-SD5-2	25.5	3.6	ND (1)	ND (25)
MSP-H7-SD1	6.5	ND (1)	NA	NA
MSP-H7-SD3	16.5	ND (1)	NA	NA
MSP-H7-SD4	21	ND (1)	NA	NA
MSP-H7-SD5	26.5	ND (1)	ND (1)	ND (25)
MSP-H8-SD1	5.5	NA	NA	NA
MSP-H8-SD2	10.5	ND (1)	ND (1)	ND (25)
MSP-H8-SD3	15.5	ND (1)	ND (1)	ND (25)
MSP-H8-SD4	20	NA	NA	NA
MSP-H8-SD5	25.5	ND (1)	ND (1)	ND (25)
MSP-H9-SD2	10.5	ND (1)	ND (1)	ND (25)
MSP-H9-SD3-1	16.5	ND (1)	ND (1)	ND (25)
MSP-H9-SD3-2	16.5	ND (1)	ND (1)	ND (25)
MSP-H9-SD4	21	NA	NA	NA
MSP-H9-SD5-1	26	ND (1)	ND (1)	ND (25)
MSP-H9-SD5-2	26	ND (1)	ND (1)	ND (25)
MSP-H9-SD6	31.5	NA	NA	NA
MSP-H9-SD7	35.5	ND (1)	NA	NA
MSP-H10-SD2	11.5	NA	NA	NA
MSP-H10-SD3	16	ND (1)	ND (1)	ND (25)
MSP-H10-SD5	26.5	ND (1)	ND (1)	ND (25)
MSP-H11-SD1	6.5	NA	NA	NA
MSP-H11-SD2	11.5	ND (1)	ND (1)	ND (25)
MSP-H11-SD3	16.5	NA	NA	NA
MSP-H11-SD4	21.5	ND (1)	ND (1)	ND (25)
MSP-H11-SD5	26.5	ND (1)	ND (1)	ND (25)

Notes:
1. Soil sample depths were measured relative to ground surface
2. NA - not analyzed
3. ND ( ) - non detect (reporting limit)

687157.08\SOIL-ANA.WQ1

Table 4 (cont'd)
Soil Sample BTEX and Other VOC Analytical Results

Sample ID	Sampling Depth (ft)	Benzene EPA 8020 ug/kg	Toluene EPA 8020 ug/kg	Ethylbenzene EPA 8020 ug/kg	Total Xylene EPA 8020 ug/kg	Other VOCs EPA 8010 ug/kg
MSP-H1-SD2	10.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H1-SD3	15.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H1-SD4	20.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H1-SD5	25.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H2-SD2	11.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H2-SD3	16.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H2-SD4	21.5	NA	NA	NA	NA	NA
MSP-H2-SD5	26.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H2-SD6	31.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H2-SD7	36.5	NA	NA	NA	NA	NA
MSP-H3-SD1	5.5	NA	NA	NA	NA	NA
MSP-H3-SD2	10.5	NA	NA	NA	NA	NA
MSP-H3-SD3	15	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H3-SD4	20	NA	NA	NA	NA	NA
MSP-H3-SD5	25	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H4-SD1	6.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H4-SD3	16.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H4-SD5	26.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H4-SD6	29	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H5-SD1	5.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H5-SD2	10.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H5-SD3	15.5	NA	NA	NA	NA	NA
MSP-H5-SD4	20.5	NA	NA	NA	NA	NA
MSP-H5-SD5	25.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H6-SD1	5.5	NA	NA	NA	NA	NA
MSP-H6-SD2	9.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H6-SD4	20.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H6-SD5-1	25.5	26	9.8	8.2	13	NA
MSP-H6-SD5-2	25.5	160	36	ND (5)	95	NA
MSP-H7-SD1	6.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H7-SD3	16.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H7-SD4	21	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H7-SD5	26.5	10	ND (5)	ND (5)	ND (5)	NA
MSP-H8-SD1	5.5	NA	NA	NA	NA	NA
MSP-H8-SD2	10.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H8-SD3	15.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H8-SD4	20	NA	NA	NA	NA	NA
MSP-H8-SD5	25.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H9-SD2	10.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H9-SD3-1	16.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H9-SD3-2	16.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H9-SD4	21	NA	NA	NA	NA	NA
MSP-H9-SD5-1	26	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H9-SD5-2	26	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H9-SD6	31.5	NA	NA	NA	NA	NA
MSP-H9-SD7	35.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H10-SD2	11.5	NA	NA	NA	NA	NA
MSP-H10-SD3	16	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H10-SD5	26.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H11-SD1	6.5	NA	NA	NA	NA	NA
MSP-H11-SD2	11.5	ND (5)	ND (5)	ND (5)	ND (5)	ND
MSP-H11-SD3	16.5	NA	NA	NA	NA	NA
MSP-H11-SD4	21.5	ND (5)	ND (5)	ND (5)	ND (5)	NA
MSP-H11-SD5	26.5	ND (5)	ND (5)	ND (5)	ND (5)	ND

Notes:
1. Soil sample depths were measured relative to ground surface
2. NA - not analyzed
3. ND ( ) - non detect (reporting limit)
4. Cell shaded where sample exhibited a detect

TABLE 5

Groundwater Analyses Summary Table

Date: 09/30/95

SITE	DATE	Gasoline (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethyl benzene (ug/l)	Total xylenes (ug/l)	MTBE (ug/l)
H-01	08/11/95	<50	<0.5	<0.5	<0.5	<0.5	<2.0
H-02	08/14/95	<50	<0.5	<0.5	<0.5	5.4	<2.0
H-03	08/11/95	<50	10	<0.5	<0.5	<0.5	26
H-04	08/14/95	210	9.2	<0.5	<0.5	4.8	29
H-05	08/11/95	4000	1300	270	43	350	14000
H-05	08/16/95	970	340	<5.0	<5.0	80	4800
H-06	08/14/95	16000	7700	1100	120	800	67000
H-07	08/11/95	17000	3200	820	740	1900	14000
H-08	08/11/95	7300	3000	89	140	230	15000
H-09	08/14/95	<50	<0.5	<0.5	<0.5	0.8	<2.0
H-09	08/16/95	<50	<0.5	<0.5	<0.5	<0.5	<2.0
H-10	08/14/95	<50	<0.5	<0.5	<0.5	<0.5	<2.0
H-11	08/14/95	<50	<0.5	<0.5	<0.5	<0.5	<2.0
MW-1	08/11/95	<50	<0.5	<0.5	<0.5	<0.5	<2.0
MW-1	08/14/95	11000	190	260	110	900	210

Values represent total concentrations unless noted < = Not detected at indicated reporting limit --- = Not analyzed

For RCL 8020C&T

TABLE 5 (CONT.)

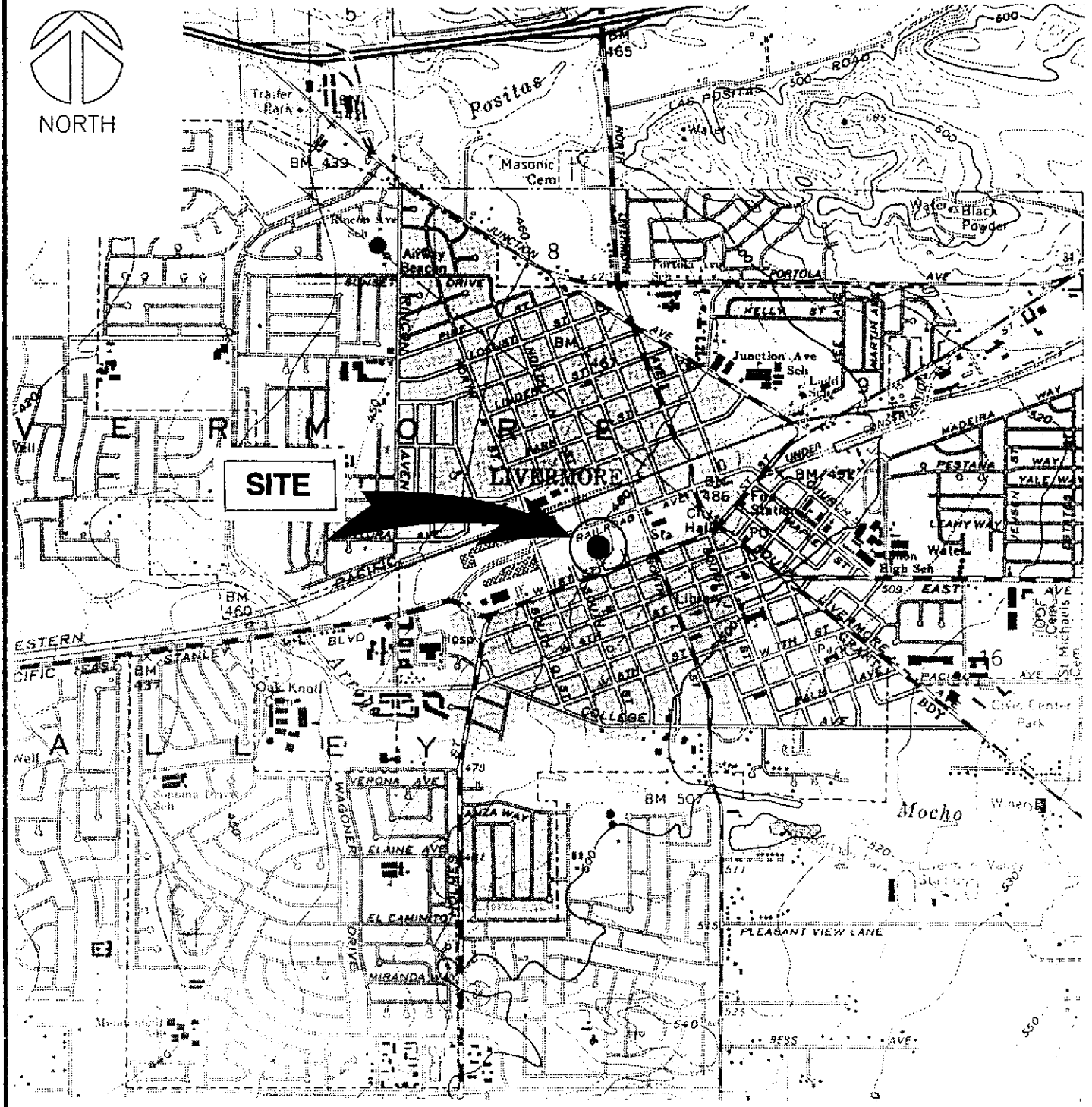
Groundwater Analyses Summary Table

Date: 09/30/95

SITE	DATE	Diesel (ug/l)	Fuel oil no. 6 (ug/l)
H-01	08/11/95	<50	<1300
H-02	08/14/95	<50	<1300
H-03	08/11/95	<50	<1300
H-04	08/14/95	<50	<1300
H-05	08/11/95	74	<1300
H-05	08/16/95	<50	<1300
H-06	08/14/95	540	<1300
H-07	08/11/95	620	<1300
H-08	08/11/95	87	<1300
H-09	08/14/95	260	<1300
H-09	08/16/95	<50	<1300
H-10	08/14/95	<50	<1300
H-11	08/14/95	<50	<1300
MW-1	08/14/95	1100	<1300

Values represent total concentrations unless noted < = Not detected at indicated reporting limit --- = Not analyzed

For RCL 8015MC&T



SOURCE: USGS 7 1/2 MINUTE TOPOGRAPHIC QUADRANGLE,
LIVERMORE, CALIFORNIA,
PHOTOREVISED 1980, AT SCALE 1:24,000

EARTH TECH

PROJECT: 687157.08

LIVERMORE CALIFORNIA

MILL SPRINGS
PARK APARTMENT

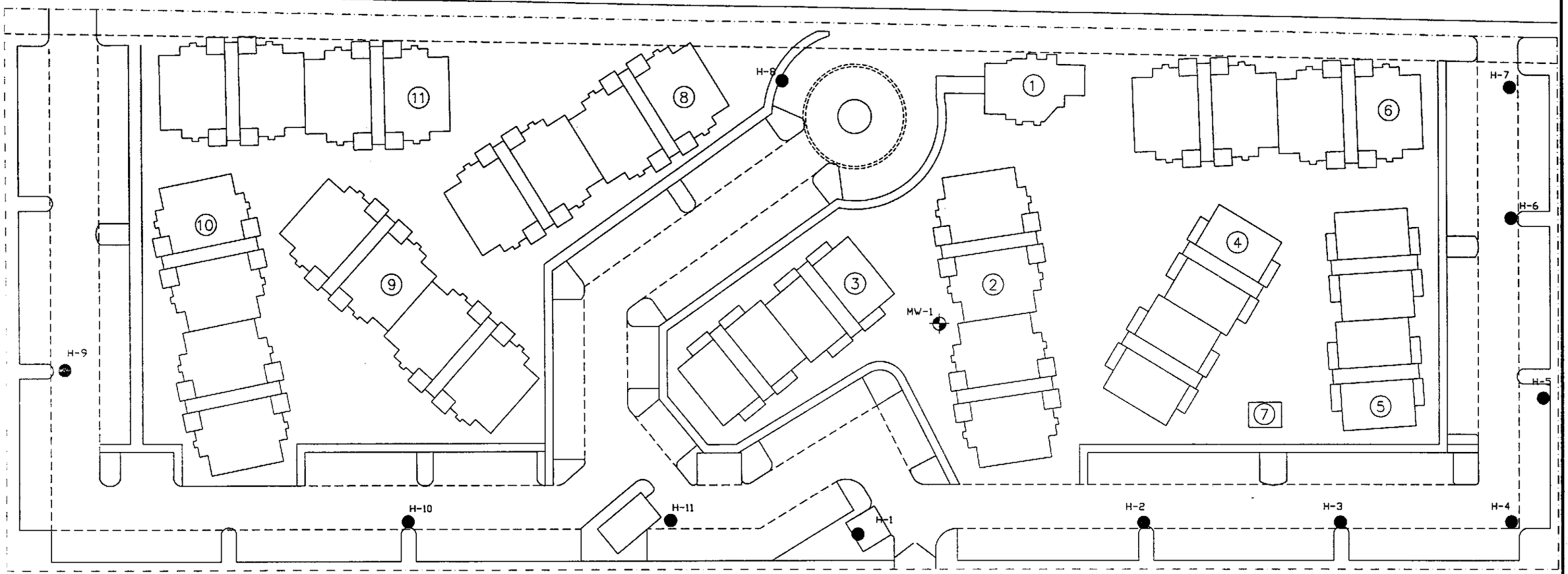
VICINITY MAP

SEPTEMBER 1995

FIGURE 1

NORTH

RAILROAD AVENUE



LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ● TEMPORARY WELL POINT AND SOIL

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH

PROJECT: 687157.08

LIVERMORE CALIFORNIA

MILL SPRINGS
PARK APARTMENT

SITE PLAN

SEPTEMBER 1995

FIGURE 2

NORTH

RAILROAD AVENUE

AREA A

AREA B

AREA C

AREA D

H-1 H-2 H-3 H-4 H-5 H-6 H-7 H-8 H-9 H-10 H-11

MW-1 B4-1 B4-2 B4-3

LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ● TEMPORARY WELL POINT AND SOIL

B4-3 ▽ BORING LOCATION (PHASE I)

▨ PHASE I EXCAVATION LIMITS (APPROX.)

▩ CONCRETE VAT STRUCTURE

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH

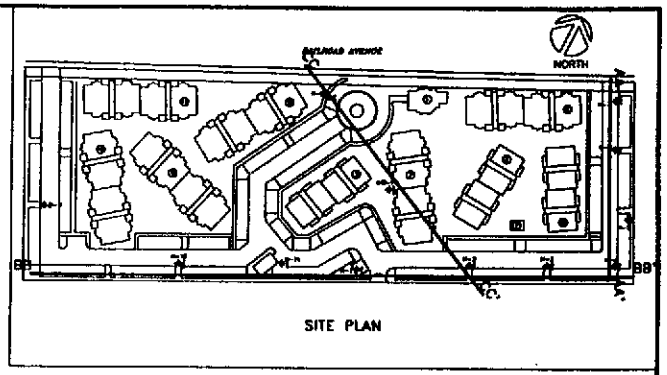
PROJECT: 687157.08

LIVERMORE CALIFORNIA

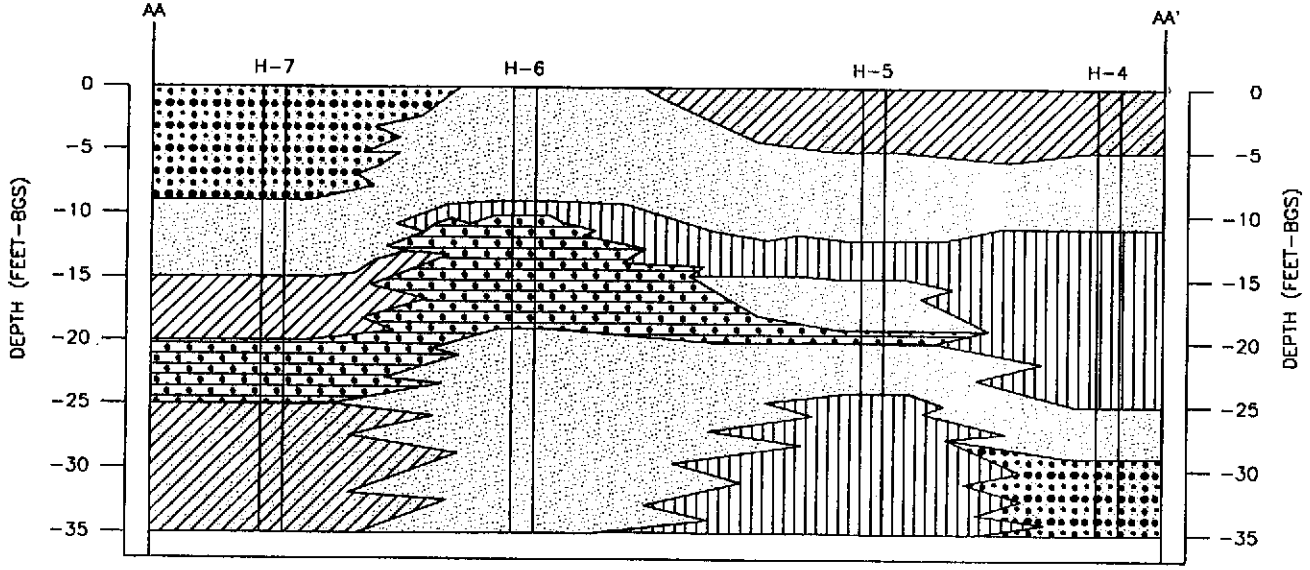
MILL SPRINGS
PARK APARTMENT

FINAL REMEDIATION AREA LIMITS

SEPTEMBER 1995 FIGURE 3



SITE PLAN



USCS CLASSIFICATION

- CL Gravelly Clay/Sandy Clay/Silty Clay/Clay
- GC Clayey Gravel
- GP Gravel/Sandy Gravel
- ML Silt/Clayey Silt/Sandy Silt
- SC Clayey Sand
- SP Gravelly Sand/Sand

0 60 120

HOR. SCALE IN FEET 1"=60'

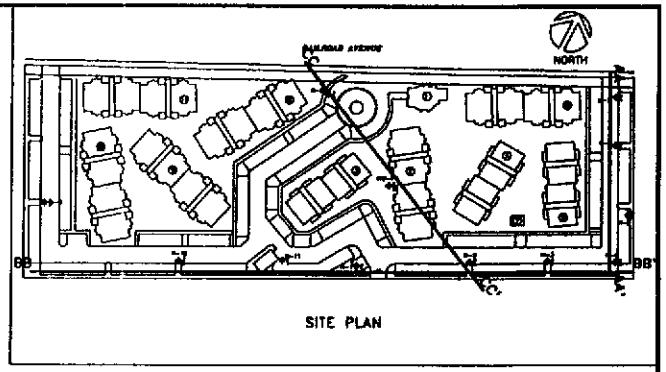
EARTH TECH

PROJECT: 687157.08
LIVERMORE CALIFORNIA

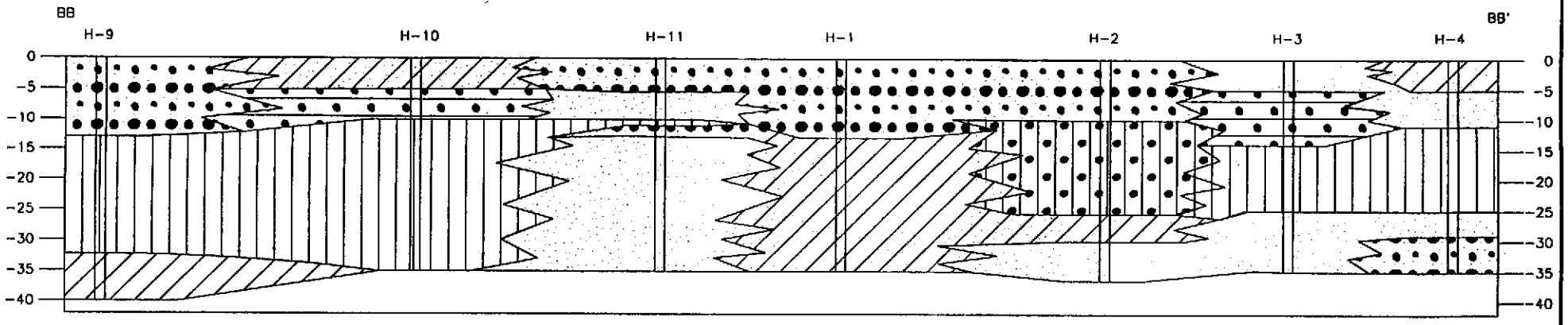
MILL SPRINGS
PARK APARTMENT

CROSS SECTION AA-AA'

SEPTEMBER 1995 FIGURE 4



SITE PLAN



USCS CLASSIFICATION

- GM Silty Gravel
- GC Clayey Gravel
- GP Gravel/Sandy Gravel
- ML Silt/Clayey Silt/Sandy Silt
- SC Clayey Sand
- SP Gravelly Sand/Sand

0 100 200

HOR. SCALE IN FEET 1"=100'

EARTH TECH

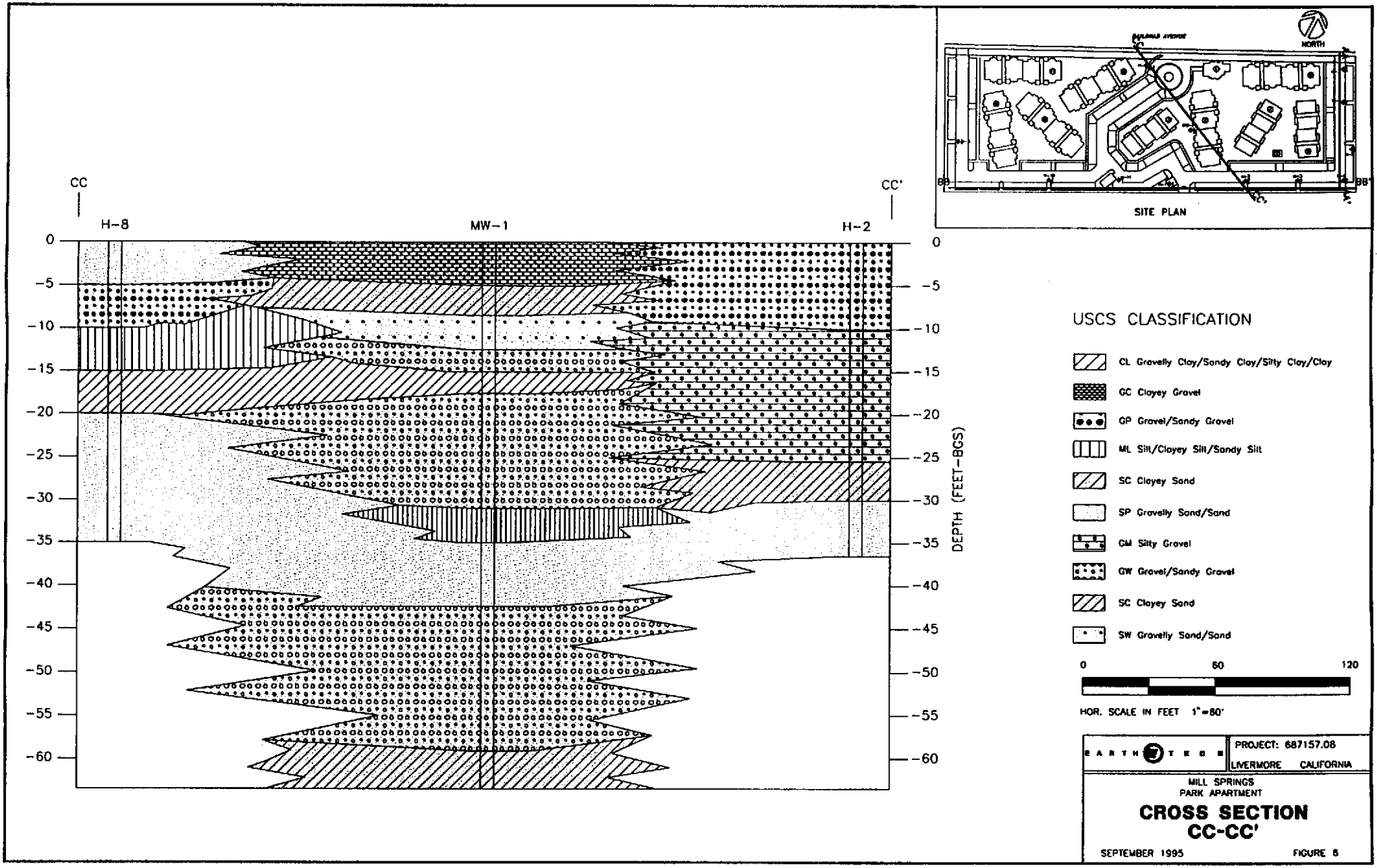
PROJECT: 687157.08

LIVERMORE CALIFORNIA

MILL SPRINGS
PARK APARTMENT

CROSS SECTION BB-BB'

SEPTEMBER 1995 FIGURE 5


CC
CC'
H-8
MW-1
H-2
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
DEPTH (FEET-BGS)
NORTH
SITE PLAN
USCS CLASSIFICATION
CL Gravelly Clay/Sandy Clay/Silty Clay/Clay
GC Clayey Gravel
GP Gravel/Sandy Gravel
ML Silt/Clayey Silt/Sandy Silt
SC Clayey Sand
SP Gravelly Sand/Sand
GM Silty Gravel
GW Gravel/Sandy Gravel
SC Clayey Sand
SW Gravelly Sand/Sand
0
60
120
HOR. SCALE IN FEET 1"=60'
EARTH TECH
PROJECT: 687157.08
LIVERMORE CALIFORNIA
MILL SPRINGS
PARK APARTMENT
CROSS SECTION
CC-CC'
SEPTEMBER 1995
FIGURE 5

Site: MW-1

Program: A

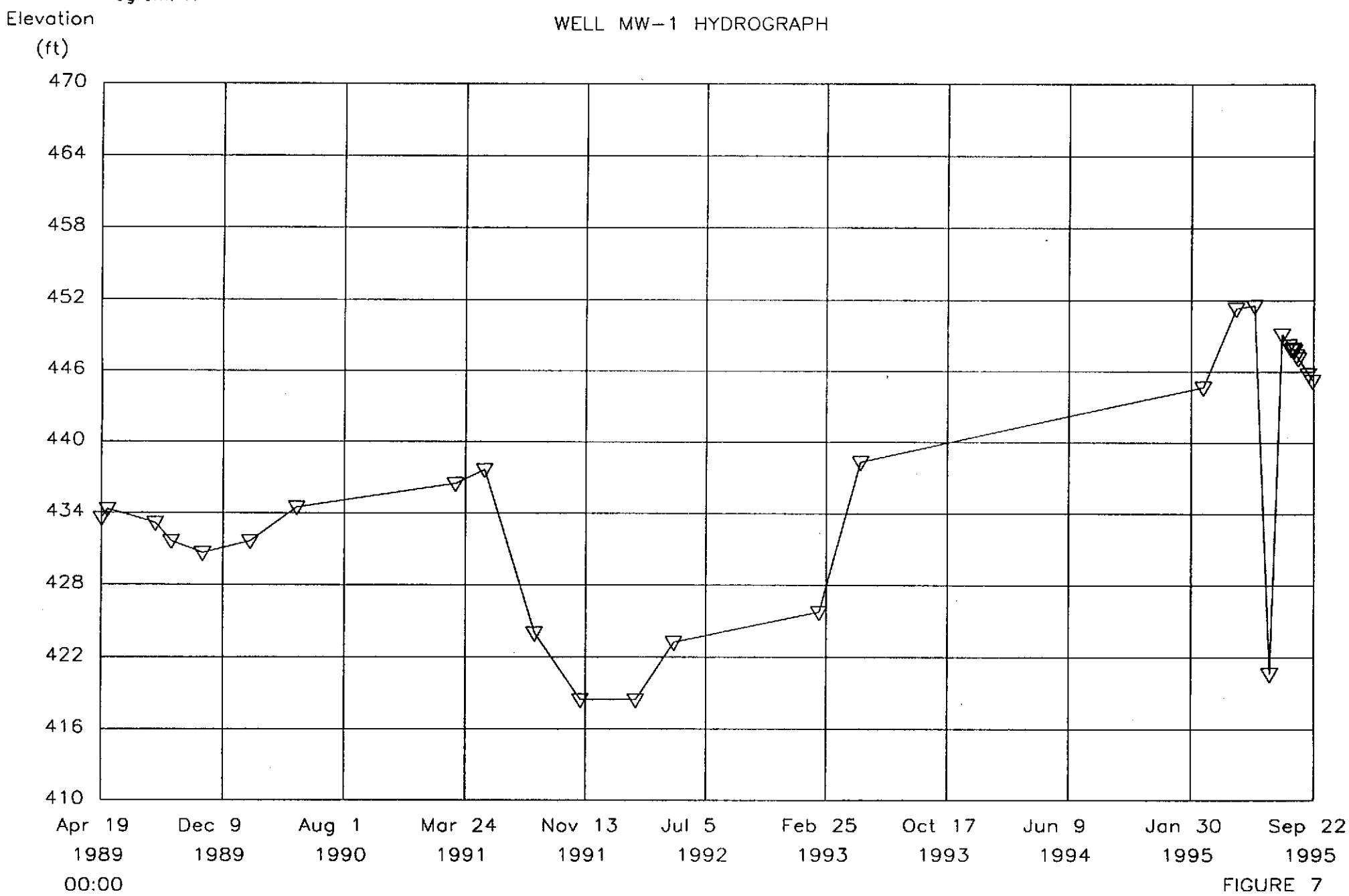


FIGURE 7

NORTH

RAILROAD AVENUE

H-08
443.70

H-07
449.13

H-06
449.40

H-09
443.43

H-05
450.03

H-10
443.19

H-11
444.20

H-01
445.27

H-02
448.00

H-03
449.07

H-04
450.10

MW-1
445.26

LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ● TEMPORARY WELL POINT AND SOIL

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH | PROJECT: 687157.08

LIVERMORE CALIFORNIA

MILL SPRINGS
PARK APARTMENT

GROUNDWATER ELEVATION CONTOUR-SEPT.21, 1995

SEPTEMBER 1995 FIGURE 11

NORTH

RAILROAD AVENUE

H-8
7300

H-7
17000

H-6
16000

H-5
4000

H-9
50K

H-10
50K

H-11
50K

H-1
50K

H-2
50K

H-3
50K

H-4
210

MW-1
11000

16000
14000
12000
10000
8000
6000
4000
2000

LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ● TEMPORARY WELL POINT AND SOIL

16000 ISO-CONCENTRATION CONTOUR FOR TVH (ug/L)

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH

PROJECT: 687157.08

LIVERMORE CALIFORNIA

MILL SPRINGS
PARK APARTMENT

ISO-CONCENTRATION CONTOUR PLOT FOR TVH (GASOLINE)

SEPTEMBER 1995 FIGURE 12

NORTH

RAILROAD AVENUE

H-8

H-7

H-6

H-5

H-9

MW-1

H-10

H-11

H-1

H-2

H-3

H-4

1000

LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ● TEMPORARY WELL POINT AND SOIL

—1000— ISO-CONCENTRATION CONTOUR FOR TVH (ug/L)

ESTIMATED EXTENT OF GASOLINE IMPACTED GROUNDWATER

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH

PROJECT: 687157.08

LIVERMORE CALIFORNIA

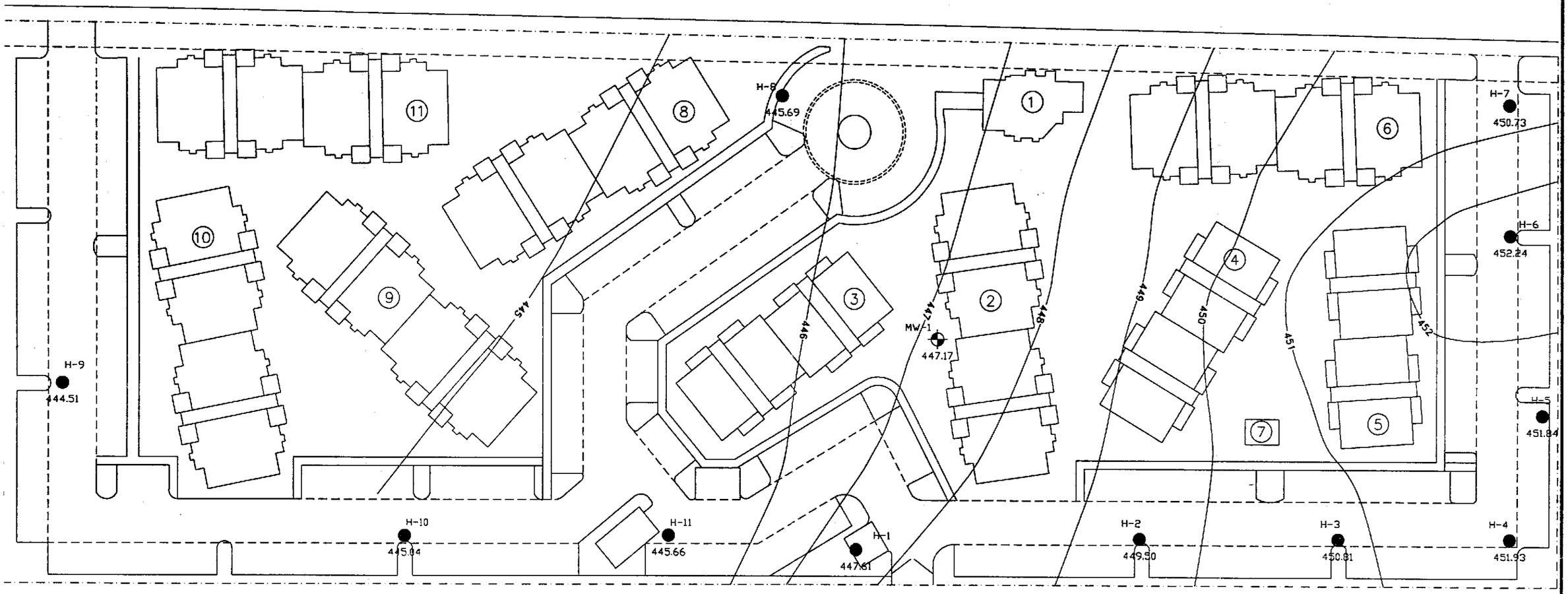
MILL SPRINGS
PARK APARTMENT

ESTIMATED EXTENT OF GASOLINE IMPACTED GROUNDWATER

SEPTEMBER 1995 FIGURE 13

NORTH

RAILROAD AVENUE



LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ■ HYDROPUNCH SAMPLE LOCATIONS

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH | PROJECT: 687157.08

LIVERMORE CALIFORNIA

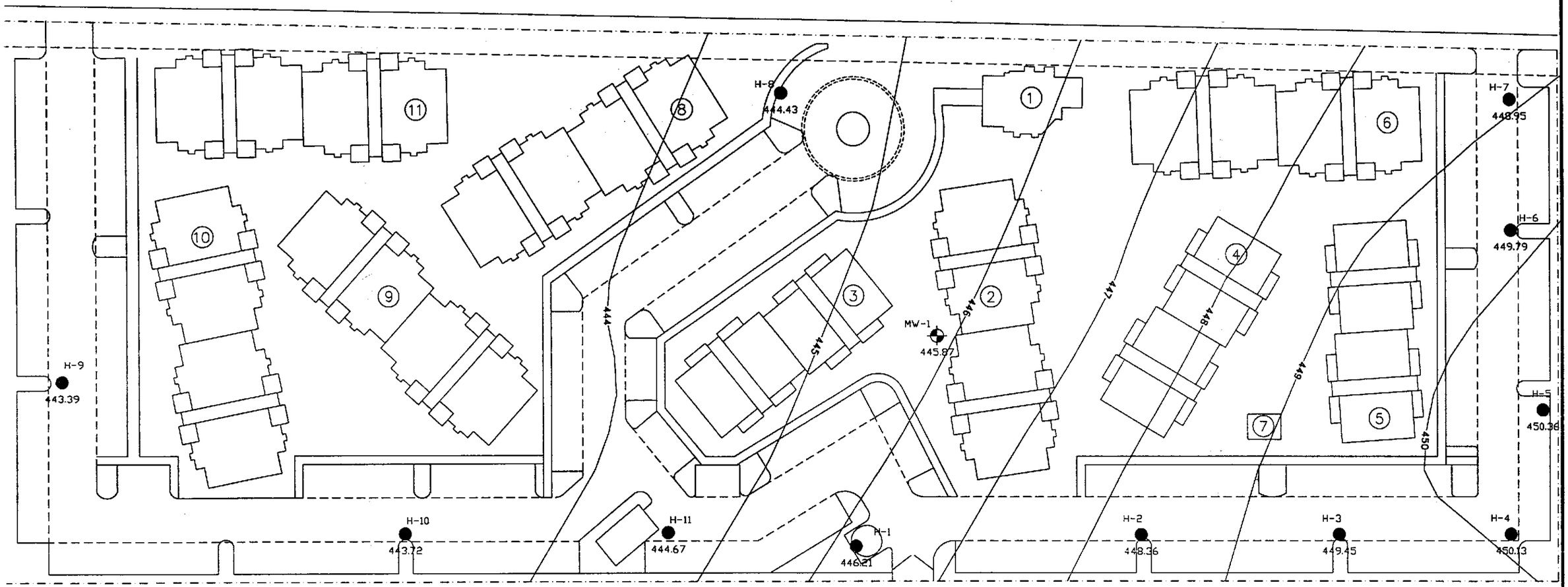
MILL SPRINGS
PARK APARTMENT

GROUNDWATER ELEVATION CONTOUR-AUG.24, 1995

SEPTEMBER 1995 FIGURE 9

NORTH

RAILROAD AVENUE



LEGEND

MW-1 ⊕ MONITORING WELL LOCATION

H-11 ■ HYDROPUNCH SAMPLE LOCATIONS

SOURCE: BABBITT CIVIL ENGINEERING INC., PLEASANTON, CALIFORNIA

0 60 120

SCALE IN FEET 1"=60'

EARTH TECH | PROJECT: 687157.08 | LIVERMORE CALIFORNIA

MILL SPRINGS
PARK APARTMENT

GROUNDWATER ELEVATION CONTOUR-SEPT.13, 1995

SEPTEMBER 1995 FIGURE 10