Versar INC. SACRAMENTO

TECHNICAL REVIEW AND EVALUATION OF REMEDIAL ACTIONS
1916 WEBSTER STREET
ALAMEDA, CALIFORNIA

Prepared for:

Housing Authority of the City of Alameda
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Versar Project No. 2490-001

May 20, 1994

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FOREWORD

This technical review and evaluation of remedial actions report was prepared by Versar, Inc. for the Housing Authority of the City of Alameda. Mr. Lawrence Kleinecke, Senior Geohydrologist, prepared this report. Mr. Michael D. Holley, P.E., Engineering Program Manager, provided technical oversight.

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1.0 INTRODUCTION

The following report provides a technical review of the current site conditions at 1916 Webster Street in Alameda, California (site). This report was prepared in accordance with our contract dated April 26, 1994. Included in this report are a review of relevant reports prepared by Environmental Science and Engineering, Inc. (ESE) and other contractors, a discussion of remedial options for the site, and recommendations for further action.

3.0 REVIEW FINDINGS

Based on our review of the Aqua Science Engineers, Inc. (ASE) report, the sampling at the southwest corner of the excavation, near the UST, was insufficient to characterize fully the contamination at the site. The ASE report identified an apparent problem with excavating south of the former UST location due to potential undermining of existing structures. A description of the onsite soil aeration laboratory analytical data indicates the stockpiled soil contained approximately 15 milligrams per kilogram (mg/kg) of petroleum hydrocarbons prior to being backfilled into the excavation in October 1986. This action resulted in the reintroduction of contaminants into the subsurface. Laboratory data from the ASE investigation also indicates that groundwater contamination extends beyond the limits of the excavation.

The ESE remediation did not address all contaminated soils at the site. Based on laboratory analytical results from the ESE work and previous investigations, contaminated soil is present at the southwest corner of the excavation where site structures prevent continued soil removal extending north to within 15 feet of the fence line, and up to 35 feet east of the excavation. Figure 3 shows the estimated maximum extent of the remaining contamination.

Laboratory analysis of a groundwater sample collected from the excavation indicates that significant groundwater contamination still exists in the former UST location. This groundwater was not removed during the most recent excavation. Additionally, the vertical extent of soil contamination has not been defined. Soil contamination below the water table may exist as a result of vertical fluctuation of the water table, which causes the smearing and entrainment of undissolved hydrocarbons as a result of the adsorption of dissolved phase contaminants to saturated soils.

During the course of the investigations conducted at the site, a well within ten feet of the former UST location in the verified downgradient direction, has not been installed and sampled as required by the San Francisco Regional Water Quality Control Board. The current wells are sufficient to delineate the downgradient edge of the groundwater plume, but are not sufficient to provide compliance with California state regulations.

2.0 BACKGROUND

During July and August 1986, a 280-gallon underground storage tank (UST) was removed from the site, and an environmental investigation was conducted to determine the extent of contamination. A series of soil borings were drilled at the site and soil samples collected for laboratory analysis. Groundwater monitoring wells were installed in two of the borings, and groundwater samples collected for laboratory analysis. According to the findings report, soil contamination remained at locations north and east of the excavation, to a depth of at least six feet below ground surface (bgs). Contaminants were identified in all soil and groundwater samples analyzed. Additional soil excavation conducted during September 1986 failed to remove the soil contamination completely. Figure 1 shows the extent of the excavation and the location of boreholes and monitoring wells at the site.

Later investigations included drilling additional boreholes and installing one additional groundwater monitoring well. The groundwater was sampled on a quarterly basis and the results of the monitoring showed an apparent decrease in contaminant concentrations at the downgradient perimeter of the contaminated area. The results of the soil sampling show that the soil contamination did not extend beyond an area approximately 55 feet square extending to the north fenceline. Potential contamination beneath the building was mentioned in the workplan (Versar, 1991) but was not addressed in the investigation.

On February 10, 1994, ESE produced a Corrective Action Plan (CAP) for the site. The remedial activities proposed in the CAP included removing up to 160 cubic yards (yds^3) of soil, 50 yds^3 of which was expected to be contaminated. Between March 3 and March 5, 1994, ESE excavated approximately 220 yd^3 of contaminated soil and stockpiled it at the site. Laboratory analysis of soil samples collected from the perimeter of the excavation indicate that two areas of contamination still remain. Figure 2 shows the extent of the excavation and the concentrations of total petroleum hydrocarbons as gasoline (TPH-G) identified at the perimeter of the excavation.

1800 ppm TPH-G at SW-2

4.0 SITE EVALUATION

According to the CAP for the site, the proposed cleanup goals are to reduce soil contamination to concentrations below 10 mg/kg of TPH-G and below 1.0 mg/kg of total benzene, toluene, ethylbenzene, and xylenes (BTEX), and to reduce groundwater contamination to concentrations below 0.05 milligrams per liter (mg/L, equivalent to parts per million) of TPH-G and below established California or U.S. Environmental Protection Agency Maximum Contaminant Levels (MCLs) (for drinking water) of BTEX. The current MCLs are 0.001 mg/L of benzene, 1.0 mg/L of toluene, 0.680 mg/L of ethylbenzene, and 1.750 mg/L of total xylenes. A proposed cleanup plan must be capable of achieving these goals for the entire site.

4.1 Soils

Continued leaching of contaminants from the unsaturated and saturated soils must be addressed in the cleanup plan. Because contaminated soils south of the excavation cannot be removed using conventional "dig and chase" methods, an alternative methodology must be selected. Options for contaminated soil remediation include providing temporary support for the site structures during the excavation process and shoring for excavated areas close to the building, conducting soil vapor extraction, and implementing in-situ biodegradation.

Providing shoring and temporary support for site structures is a difficult and expensive process. Further, for safety reasons, work within the building could not be conducted during the excavating. Because of equipment restrictions, this option also requires that the contamination not extend far beneath the building. An estimated 50 yds^3 of soil may need to be removed from beneath the building. An estimated 180 yds^3 of soil would be removed from the remainder of the yard. This option does not remediate groundwater contamination or soil contamination that may exist below the water table. Finally, tenant health and safety issues will be difficult to address when implementing this option.

Soil vapor extraction is a feasible option in the sands and sandy soils identified at the site. Because of the shallow depth to groundwater, either horizontal wells or lowering of the water table may be required for optimal recovery of contaminants. The site contaminants vaporize readily and will move easily through the sands to a vapor extraction well. The process can be enhanced at this site by backfilling the current excavation with pea gravel and placing an extraction well in a central location in the gravel bed. A liner should be placed above the pea gravel and the surface should be covered with asphalt paving. The process can be enhanced further by lowering the water table to expose potentially contaminated saturated soils.

In-situ bioremediation is a low-cost low-impact technology typically used to establish a level of compliance with the local regulators. The process requires the addition of nutrients and oxygen to the subsurface environment to elevate the naturally occurring bacteria to populations capable of degrading the contaminants. The addition of nutrients and oxygen requires the installation of injection wells. To control the migration of contaminants and nutrients during the process, extraction wells are typically used. Problems associated with this technology include the need to address stringent regulations regarding the control of nutrients added to the subsurface and potentially expensive long-term costs associated with operation and maintenance. Project completion can take many years to achieve.

4.2 Groundwater

The CAP proposes to remediate groundwater by withdrawing up to 10,000 gallons of water from the excavation. This action was not conducted as part of ESE's work at the site. Because the soil contamination has not been effectively addressed, the leaching and desorbing of contaminants into the groundwater will continue to occur. Options for contaminated groundwater remediation include pumping and treating, dewatering with vapor extraction, and air sparging.

Pumping and treating the groundwater has been shown to be an ineffective and time consuming technology due to the very low solubility of petroleum hydrocarbons. Current data from sites using pump and treat technology exclusively to remediate petroleum hydrocarbons indicate extremely long project durations and difficulties with achieving regulatory objectives.

Groundwater pump and treat technology can be successful, however, when it is used with other technologies such as soil vapor extraction and air sparging, or when used solely for temporary plume containment. When used in conjunction with soil vapor extraction, groundwater pump and treat is used to lower the water table and expose smear zones. The contaminants can then be removed more readily in the vapor phase. This method also contains the groundwater plume during remediation.

Another option, air sparging, is the addition of air below the water table using a system of closely spaced bubbler wells. The addition of air volatilizes the contaminants and brings them to the surface of the water table. Soil vapor extraction is then used to remove the contaminants for treatment. This technology requires the injection of compressed air, which, in the presence of high concentrations of gasoline, can create an explosive atmosphere beneath the surface of the site. This technology has relatively high operating costs and typically is used where dewatering is not an option.

Of these options, Versar recommends groundwater pump and treat technology used with soil vapor extraction. The combination of these technologies is a proven cost effective alternative for site with sandy soils and aquifers with moderate to high hydraulic conductivities.

5.0 RECOMMENDATIONS

The selected remedial option will need to address soil contamination beneath the site structures, east of the excavated area, west of the excavated area, and in the smear zone associated with the water table. Groundwater contamination also must be addressed. The selected option must be able to reduce contaminant concentrations to the previously discussed levels, at a minimum, to ensure that potential unfavorable regulatory decisions do not bring about excessive additional costs. Tenant health and safety issues require a method that will not create nuisance odors or potential dangers to site personnel.

Of the options available, soil vapor extraction with groundwater controls is the most feasible. This method has proven reliability, is among the most up-to-date remediation systems available, and can be implemented at a reasonable cost. This option also can be implemented without creating health and safety problems with the tenant. Implementation of this option will require the following tasks:

- backfill the excavation with pea gravel to provide a stable subsurface that will allow the free movement of vapors to a single extraction well;
- install a horizontal vapor extraction well approximately 15 feet long near the center of the excavation, lay an impermeable liner over the pea gravel, and asphalt the surface;
- install a groundwater monitoring/extraction well within 10 feet of the former UST location in the verified downgradient direction;
- construct a soil vapor treatment system that uses granular activated carbon as the primary technology; and
- construct a groundwater treatment system that uses granular activated carbon as the primary treatment technology.

A detailed breakdown of the tasks required to implement this remedial action is provided in the scope of work included as Appendix A. Figure 4 shows the possible layout of the remediation system.

6.0 REFERENCES

Aqua Science Engineers, San Ramon, California. September 4, 1986. Soils Investigation, A Summary of Findings and A Proposal for Remedial Action.

Versar, Fair Oaks, California. March 22, 1991. Work Plan for the Subsurface Evaluation at 1916 Webster Street, Alameda, California.

U.S. Environmental Protection Agency, Region 9, May 1993. Drinking Water Standards and Health Advisory Table.

California Regional Water Quality Control Board, San Francisco Bay Region, August 1990. Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites.

7.0 STATEMENT OF LIMITATIONS

The data presented and the opinions expressed in this report are qualified as follows:

- The sole purpose of the investigation and of this report is to assess the physical characteristics of the Site with respect to the presence or absence of oil or hazardous materials and substances in the environment as defined in the applicable state and federal environmental laws and regulations and to gather information regarding current and past environmental conditions at the Site.

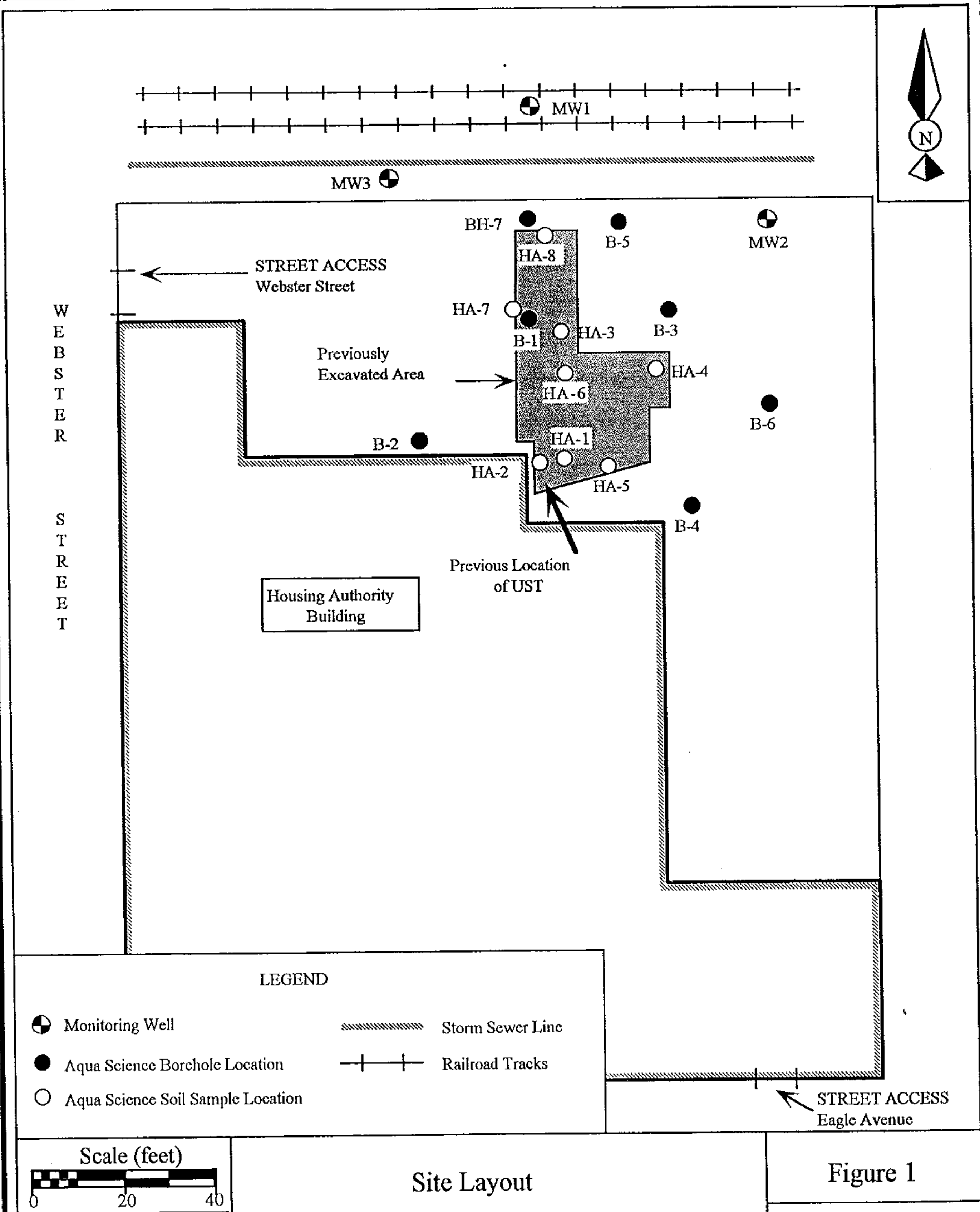
- Versar derived the data in this report primarily from visual inspections, examination of records in the public domain, interviews with individuals with information about the Site, and a limited number of environmental samples, as indicated by the Scope of Services for the Site. The passage of time, manifestation of latent conditions, or occurrence of future events may require further exploration at the Site, analysis of the data, and reevaluation of the findings, observations, conclusions, and recommendations expressed in the report.

- In preparing this report, Versar has relied upon and presumed accurate certain information (or the absence thereof) about the Site and adjacent properties provided by governmental officials and agencies, the Client, and others identified herein. Except as otherwise stated in the report, Versar has not attempted to verify the accuracy or completeness of such information.

- The data reported and the findings, observations, conclusions, and recommendations expressed in the report are limited by the Scope of Services, including the extent of environmental sampling and other tests. The Scope of Services was defined by the requests of the Client, the time and budgetary constraints imposed by the Client, and the availability of access to the Site.

- Because of the limitations stated above, the findings, observations, conclusions and recommendations expressed by Versar in this report are limited to the information obtained and the surface and subsurface investigation undertaken and should not be considered an opinion concerning the compliance of any past or current owner or operator of the Site with any federal, state, or local law or regulation. No warranty or guarantee, whether express or implied, is made with respect to the data reported or findings, observations, conclusions, and recommendations expressed in this report. Further, such data, findings, observations, conclusions, and recommendations are based solely upon Site conditions in existence at the time of investigation.

- This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the Agreement and the provisions thereof.



Project No. 2490-001

Site Layout

Housing Authority of the City of Alameda
Alameda, California

Figure 1

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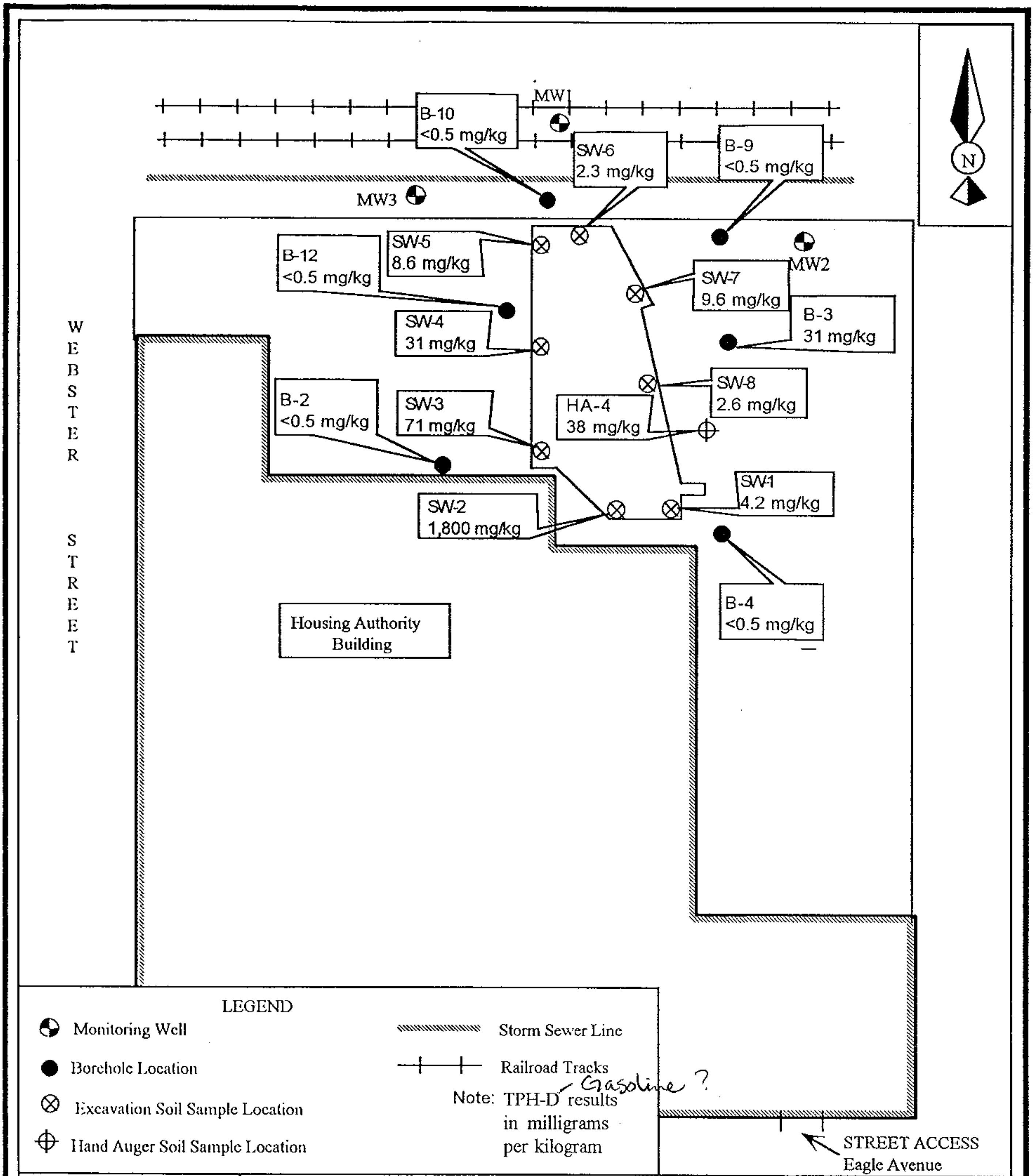

Excavation Layout with Laboratory Results

Figure 2

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Housing Authority of the City of Alameda
Alameda, California

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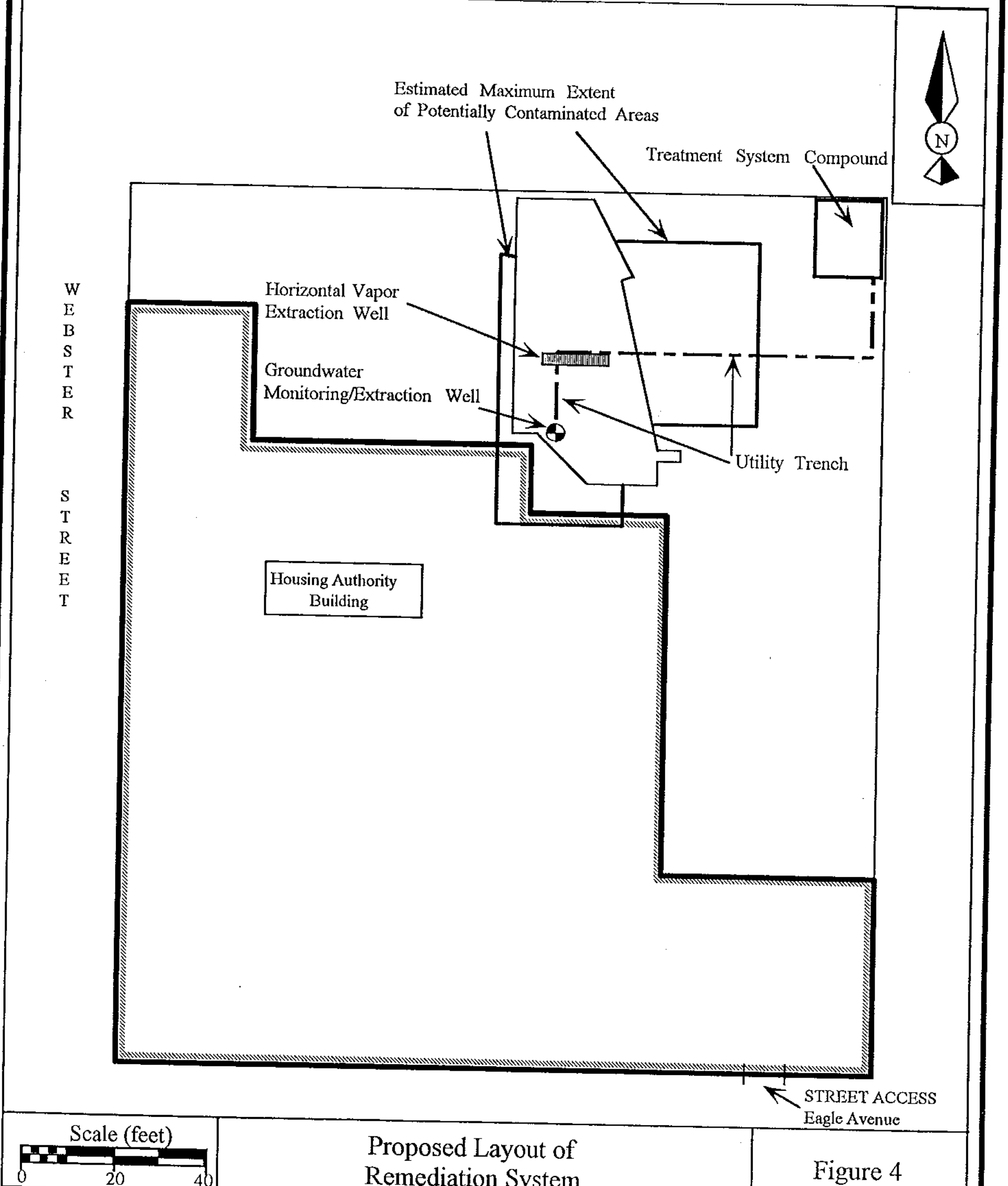

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Proposed Layout of
Remediation System

Housing Authority of the City of Alameda
Alameda, California

Figure 4

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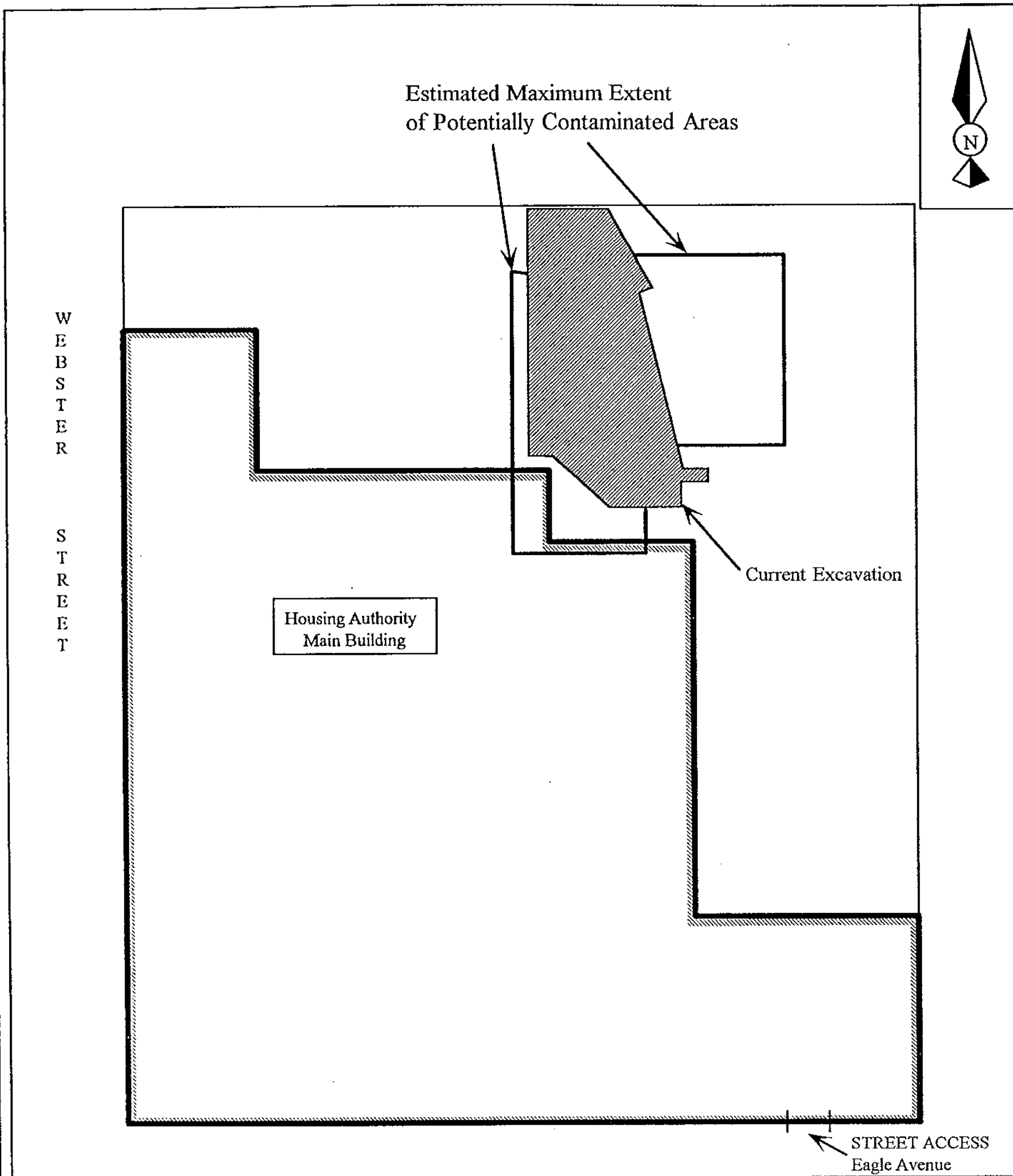

Scale (feet)

0 20 40

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Estimated Maximum Extent of Potentially Contaminated Areas

Housing Authority of the City of Alameda
Alameda, California

Figure 3

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APPENDIX A

Scope of Work

APPENDIX A

The tasks outlined in this scope of work that would bring the site into compliance are as follows: (1) remove and properly dispose of stockpiled soil; (2) install a soil vapor extraction system; (3) close the excavation with pea gravel; (4) conduct a groundwater investigation; (5) amend the existing Corrective Action Plan and; (6) implement the revised Corrective Action Plan. The following paragraphs describe the specific activities required to bring the site into compliance.

A.1 REMOVE AND DISPOSE OF STOCKPILED SOIL

The soil that is currently stockpiled onsite should be removed and transported by a hazardous waste contractor/hauler to an appropriate disposal facility. This soil should not be used as backfill. A hazardous waste manifesting system should be employed so that the final disposal of the waste can be verified.

A.2 INSTALL A SOIL VAPOR EXTRACTION SYSTEM

Before backfilling the excavation, the trenching for a horizontal soil vapor extraction piping should be completed. The location of the piping should extend from the location of soil sample HA-1, northward approximately fifteen feet. Currently, most of proposed piping area is within the open excavation. For the area not excavated, a one-foot wide by five-foot deep trench should be constructed to permit the placement of the vapor extraction piping. Additional trenching for the auxiliary piping leading to the treatment compound should be conducted at this time. All piping should be placed a minimum of 18 inches below grade.

A.3 CLOSE THE EXCAVATION

To close the underground storage tank (UST) excavation, two tasks should be completed: (1) dewater the excavation using a vacuum tanker and dispose of the water, and (2) backfill the excavation and resurface the area with pavement.

A.3.1 Dewater Excavation

The water in the excavation should be removed. The sources of this water are infiltration from surface waters, the groundwater aquifer, and surface runoff from precipitation. Removing the water from the excavation will allow for greater compaction of the backfill material. This water is likely to be contaminated with petroleum hydrocarbons; therefore, it should be removed by a hazardous waste contractor/hauler. The water should be pumped from the excavation using a vacuum tanker and delivered to a licensed disposal facility.

A.3.2 Backfill Excavation

The excavation should be backfilled to six inches below grade with an engineered pea gravel. The backfill should be compacted in six-inch lifts and compacted to 95 percent by proctor. This material is compacted easily and permits extraction of the petroleum hydrocarbon vapors without becoming contaminated in the process. The pea gravel should then be covered with 0.006-inch (6 mil) thick plastic sheeting. The sheeting should in turn be covered with three inches of road base material and overlain by three inches of asphalt.

A.4 CONDUCT A GROUNDWATER INVESTIGATION

The following sections describe the placement of the groundwater extraction well and the use of offsite wells to provide a more detailed hydrogeologic assessment. In addition, several sections describe the equipment and methodology to perform a step drawdown and continuous discharge pumping test that should be conducted at the site. The primary objective of the tests is to acquire sufficient data for the determination of aquifer characteristics.

A.4.1 Install Groundwater Extraction Well

One groundwater extraction well should be installed within ten feet downgradient of the previous UST excavation. The well materials should be six-inch-diameter schedule 40 PVC casing and extend to 15 feet below ground surface (bgs). The uppermost five feet of well construction material should consist of blank casing that should be screw-threaded into a ten-foot section of 0.03-inch slotted screen. The bottom of the well should be covered with a threaded cap. A No. 2/12 clean sand should be placed around the screen from a depth of four feet to 15 feet bgs. A one-foot-thick plug of bentonite pellets should be placed around the well casing from three to four feet bgs. The remaining well annulus should then be filled with concrete. The top of the well should be covered with a well monument box.

A.4.2 Upgradient Groundwater Monitoring Wells

The requirement for an upgradient well could be met by surveying the existing groundwater monitoring wells and the groundwater monitoring wells located on the property south of the site. Our understanding is the groundwater monitoring wells have been sampled and do not contain detected concentrations of petroleum hydrocarbons. By surveying these offsite wells and the wells located onsite, a regional groundwater gradient assessment can be made. Permission to access the offsite well will need to be obtained from the current property owner.

A.4.3 Conduct Step Drawdown Pumping Test

A step drawdown pumping test should be performed using the newly constructed six-inch-diameter well. For the purpose of this scope of work this extraction well will be called EW1. Well EW1 should be selected for the test because it is located in the area most heavily impacted by petroleum hydrocarbons and is proximate to the UST locations. The aquifer test will require the use of the following equipment: (1) a datalogger, (2) one 0-to-10 pounds-per-square-inch (psi) transducer, and (3) a submersible pump. All pumped effluent should be placed in a holding tank for later disposal.

A.4.4 Conduct Continuous Discharge Pumping Test

Based on the analysis of the step drawdown pumping test, a pumping rate will be chosen for a continuous discharge pumping test. A 48-hour continuous pumping test should be conducted at EW1 to evaluate aquifer characteristics. This aquifer test should be performed using the following equipment: (1) a datalogger, (2) three 0-to-10 psi transducers, and (3) a submersible pump. The three transducers should be used to measure drawdown in three nearby groundwater monitoring wells. An electronic sounder could be used to determine the depth to groundwater in EW1. The test should be continued until the water levels in the groundwater monitoring wells are relatively constant, indicating equilibrium conditions have been established.

All pumped effluent should be placed in a holding tank for later disposal. After the aquifer tests, the extracted groundwater should be pumped from the holding tank through granulated activated carbon to remove contaminants.

A.4.5 Model Aquifer Characteristics

Values of transmissivity and storativity should be calculated from the constant discharge pumping test data using computer modeling software. Assumptions made while executing the computer models should be documented.

A.4.6 Estimate Contaminant Mass

To properly evaluate potential remedial methods for hydrocarbon impacted soil and groundwater at the site, the contaminant mass should first be estimated. This estimate could later be used to determine the duration of the various remedial actions and to estimate their associated costs.

A.5 AMEND THE CORRECTIVE ACTION PLAN

A final investigation report that summarizes the geologic and hydrogeologic data collected at the site should be submitted to the appropriate regulatory agencies. After completion of this reporting requirement, an amendment to the Corrective Action plan should be composed and submitted for regulatory approval. Upon approval of plans and specifications, the necessary construction and waste discharge permits should be obtained from the various permitting agencies.

A.6 IMPLEMENT THE REVISED CORRECTIVE ACTION PLAN

A.6.1 Remediate Soils

Soil vapor extraction using the shallow piping as the vapor collection structure should be used to remediate the hydrocarbon impacted soils. The actual design, development of engineering plans, and specifications for this system should be based on a soil vapor extraction test performed on the site's soils. This test would identify an electric blower large enough to remediate the soils while small enough to minimize costs and electrical power use. The electric blower, which would be connected to the underground piping, would draw the soil vapor into the piping and discharge the vapors through vapor phase granular activated carbon to remove any organic contaminants before discharging the vapors to the atmosphere.

The remediation equipment should be located in the northeastern portion of the property and cordoned off from public access by fencing.

A.6.2 Remediate Groundwater

Data from the pumping tests should yield sufficient information to design a groundwater remediation system that could alter the groundwater gradient so that contaminated groundwater could be pumped into the extraction well. This system should also be designed to control the migration of contaminated groundwater. Contaminated groundwater should be treated by passing the water through a liquid-phase granular activated carbon treatment system to remove contaminants. Samples of the effluent should be collected during the remediation process to comply with required water discharge permits from the sanitary sewer district. Treated groundwater should then be discharged to the sanitary sewer for disposal.

The remediation equipment should be located in the northeastern portion of the property in the same compound as the soil remediation equipment.