HAGEMAN-AGUIAR, INC.
Environmental & Water Resources Engineering
Groundwater Consultants

February 22, 2000

Larry Seto
Alameda County Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Matheson Trucking
2500 Poplar Street, Oakland, California
Fuel Leak Case No. STID 1306

Dear Mr. Seto:

The enclosed workplan describes the scope of work for constructing two additional shallow groundwater monitoring wells at the site.

If you have any questions, please call me at 510/620-0891.

Sincerely,

Hageman-Aguiar, Inc.

K.B. Alex

Kenneth B. Alexander, RG, CH
Principal Hydrogeologist

cc: Bret Davis/Matheson Trucking, Elk Grove, California

11100 San Pablo Ave., Suite 200-A, El Cerrito, California 94530 • Tel 510-620-0891 • Fax 510-620-0894

HAGEMAN-AGUIAR, INC.
Environmental & Water Resources Engineering
Groundwater Consultants

PROPOSED WORKPLAN

FOR

MONITORING WELL INSTALLATION

MATHESON TRUCKING

2500 Poplar Street
Oakland, California

February 22, 2000

11100 SAN PABLO AVE., SUITE 200-A, EL CERRITO, CALIFORNIA 94530 • TEL 510-620-0891 • FAX 510-620-0894

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I. INTRODUCTION

The site location is the Matheson Trucking facility located at 2500 Poplar Street in Oakland, California (Figure 1). The site is located on the southern side of 26th Street between Poplar and Union Streets in Oakland. The current layout of the property, along with the location of the previous tank excavations, is shown in Figure 2. The site has been historically operated as a truck maintenance, fueling, and dispatch facility.

Background Information

On August 2, 1994, CNC Services of Antioch, California removed three underground storage tanks (USTs) in two excavations at the site. The tanks consisted of one 1,000-gallon single-wall steel tank (Union Street excavation) and two 4,000-gallon single-wall steel tanks (Poplar Street excavation) (Figure 2). According to information presented in the Underground Tank Closure Plan, filed with the Alameda County Division of Hazardous Materials in July 1994, none of the three USTs had ever been used by Matheson Trucking since they became occupants of the property in 1972. It is assumed that the tanks had contained either gasoline or diesel fuel. Gasoline and diesel were found to be present in the native soil beneath the 4,000-gallon tanks at concentrations of 1,360 mg/kg (ppm) and 44 mg/kg, respectively. Gasoline and diesel were found to be present in the native soil beneath the 1,000-gallon tank at concentrations of 550 mg/kg and 22 mg/kg, respectively.

On January 29, 1996, Hageman-Aguiar, Inc. installed two shallow groundwater-monitoring wells, MW-1 and MW-2, in the vicinity of the former tank excavations (Figure 2). Monitoring well construction details are summarized in Table 1. These monitoring wells were sampled on a quarterly basis from February 1996 to September 1997. Gasoline and diesel constituents were not detected during the last two sampling events.

On September 27, 1999, Eureka Builders of Carson City, Nevada City removed four USTs from a common excavation at the site (Figure 2). The tanks consisted of one 7,000-gallon diesel UST, one 4,000-gallon diesel UST, one 4,000-gallon gasoline UST and one 550-gallon waste oil UST. The tank excavation was over-excavated to 17 feet below ground surface. Laboratory analysis of a groundwater sample collected from within the tank excavation revealed gasoline, benzene, diesel, and motor oil at concentrations of 890 μg/L (ppb), 2.2 μg/L, 3,900 μg/L and 1,600 μg/L, respectively.

During a site visit in September 1999, Hageman-Aguiar, Inc. observed that monitoring well MW-1 had been inadvertently buried during repaving at the site. We estimate that about two feet of soil and six inches of new asphalt cover the well location. We will attempt to locate and repair monitoring well MW-1 as part of this proposed workplan.

Purpose of Monitoring Well Installation

The purpose of this workplan is to describe the scope of work for constructing two additional shallow groundwater monitoring wells at the site. One well will be upgradient and one well downgradient of the former tanks in the northwest corner of the property. Data from the new downgradient well will be used to evaluate the extent of contamination observed within the excavation. Data from the upgradient well will be used to evaluate possible offsite sources of contamination.

We will also attempt to locate monitoring well MW-1. If found, we will evaluate the condition of the well. If feasible, we will repair the wellhead and reset the well vault. Otherwise, it may be necessary to abandon the well.

This proposed workplan has been prepared in response to a request by Larry Seto of the Alameda County Environmental Health Services (ACEHS). A copy of his letter, dated October 7, 1999, is provided in Attachment A.

II. PROPOSED SCOPE OF WORK

Monitoring Well Locations

The locations of the two proposed monitoring wells are shown in Figure 3. The locations have been selected based upon (1) the historical groundwater flow direction, (2) proximity to known locations of elevated petroleum constituents in soil and groundwater, and (3) accessibility.

Permitting & Planning

Prior to initiating fieldwork at the site, we will obtain a monitoring well construction permit from the Alameda County Public Works Department.

We will contact Underground Service Alert (USA) to mark the locations of underground utilities at least two days before the scheduled fieldwork. In addition, a private utility locator will be retained to clear each proposed well location.

Monitoring Well Installation

Borings for the new wells will be drilled with a truck-mounted drill rig using 8-inch diameter hollow-stem augers. The borings will be drilled to a depth of approximately 15 feet. During drilling, soil samples will be collected at 5-foot intervals or detectable changes in lithology, whichever is more frequent. Soil samples will be classified in the field by a California Registered Geologist. Samples will be screened in the field using an organic vapor meter.

Soil samples will be selected for chemical analysis from each boring. If field observations indicate the presence of soil contamination, soil samples will be collected within the contaminated horizon for laboratory analysis. If soil contamination is not observed, one soil sample will be collected from within the capillary fringe above the water table (about 7 feet). Each sample will be collected by driving directly into the native soil below the augers with a 2-inch split-barrel sampler fitted with clean brass liners. All samples will be immediately placed on ice, then transported under chain-of-custody to the laboratory at the end of the workday.

We anticipate that the two new wells will be constructed similar to existing monitoring wells MW-1 and MW-2. The wells will be constructed of 2-inch diameter PVC with 10 feet of slotted screen pipe (0.010" slots) between depths of approximately 4 and 14 feet. The annular space of the well will be packed to one foot above the slotted section with #2/16 Monterey Sand. About two feet of wetted bentonite pellets will be placed upon the sand pack, followed by a cement-bentonite seal up to the ground surface. Each well will be completed below grade and covered by a traffic-rated well vault. A typical well completion schematic is shown in Figure 4.

Equipment Decontamination

All drilling equipment, including augers and drill stem, will be steam-cleaned prior to its use during drilling and sampling operations. All onsite steam cleaning will be conducted over a steam-cleaning trough, with the rinseate collected and stored in 55-gallon drums for later disposal. All split-barrel samplers, brass tubes, and other sampling equipment will be decontaminated by washing in a water and TSP solution followed by a double water rinse.

Well Development and Sampling

The development of the newly installed monitoring wells will not occur for at least 72 hours after well construction. The wells will be developed by removing water with a mechanical air-lift pump until the water is relatively clear, or until the apparent turbidity of the water being removed has stabilized. In addition to pumping, further development will be achieved by using a mechanical surge block and bailer.

Top-of-Casing Survey

After installation, the new well elevations (top of casing and ground surface) will be surveyed relative to the datum for the existing wells. Well elevations will be surveyed to within 0.01 feet Mean Sea Level (MSL) of an established Alameda County benchmark.

Waste Generation

Drilling and monitoring well development and sampling will generate the following wastes: (1) soil cuttings and excess soil samples; (2) development and purge water; and (3) decontamination wastewater. All soil cuttings will be placed in 55-gallon drums and stored onsite until the results of the analytical results are obtained. The disposal of the soil cuttings is the responsibility of the property owner (waste generator) and is beyond the scope of work as described in this workplan.

All water and liquid waste collected during the well installation and purging activities shall be drummed and stored onsite. The disposal of the wastewater is the responsibility of the property owner (waste generator) and is beyond the scope of work as described in this workplan.

III. LABORATORY ANALYSIS

All analyses will be conducted by a California State DOHS-certified laboratory in accordance with EPA-recommended procedures.

All soil and groundwater samples will be analyzed for:

- Total Petroleum Hydrocarbons as Gasoline (modified EPA Method 8015)
- Benzene, Toluene, Ethylbenzene, and Total Xylenes (EPA Method 8260)
- Methyl Tertiary Butyl Ether (MTBE) (EPA Method 8020)
- Total Extractable Petroleum Hydrocarbons (Diesel & Motor Oil) (modified EPA Method 8015)

IV. REPORT

A report will be written that will provide a description of all fieldwork and all laboratory results. The report will include, but not be limited to, the following:

1) Map showing monitoring wells and soil boring locations.
2) Soil and formation conditions.
3) Geologic logs.
4) Depths to groundwater.
5) Results of laboratory analyses.
6) Soil and groundwater plume definitions.
7) Waste disposal documentation.

V. SITE SAFETY PLAN

A site-specific set of health and safety operating procedures is included in Attachment B. In order to maintain a safe working environment for field personnel, a copy of these operating procedures (or similar procedures prepared by other consultants) will be kept on-site during the field operations, and will be followed in accordance with the magnitude of any contamination encountered.

TABLE 1.

Monitoring Well Completion Data
Matheson Trucking, 2500 Poplar Street, Oakland, California

Well Number:	MW-1	MW-2
Date of Installation	January 29, 1996	January 29, 1996
Installed By	Hageman-Aguiar, Inc.	Hageman-Aguiar, Inc.
Installation Method	HSA	HSA
Boring Diameter (inches)	8	8
Measuring Point Description	Top of PVC casing	Top of PVC casing
Measuring Point Elevation (feet)	8.16	8.03
Approximate Seal Depth (feet)	2.5	2.5
Total Depth (feet)	15	15
Casing Diameter (inches)	2	2
Screened Casing Interval (ft) – depth	3 to 15	3 to 15
elevation	5.2 to –6.8	5 to –7
Sand Pack Interval (ft) – depth	2.5 to 15	2.5 to 15
elevation	5.7 to –6.8	5.5 to –7
Screen Specifications	SCH 40 PVC, 0.010-in slots	SCH 40 PVC, 0.010-in slots

General Notes

(a) Elevations referenced to Mean Sea Level.

(b) Depths measured relative to ground surface.

(c) HSA = Hollow-stem augers.

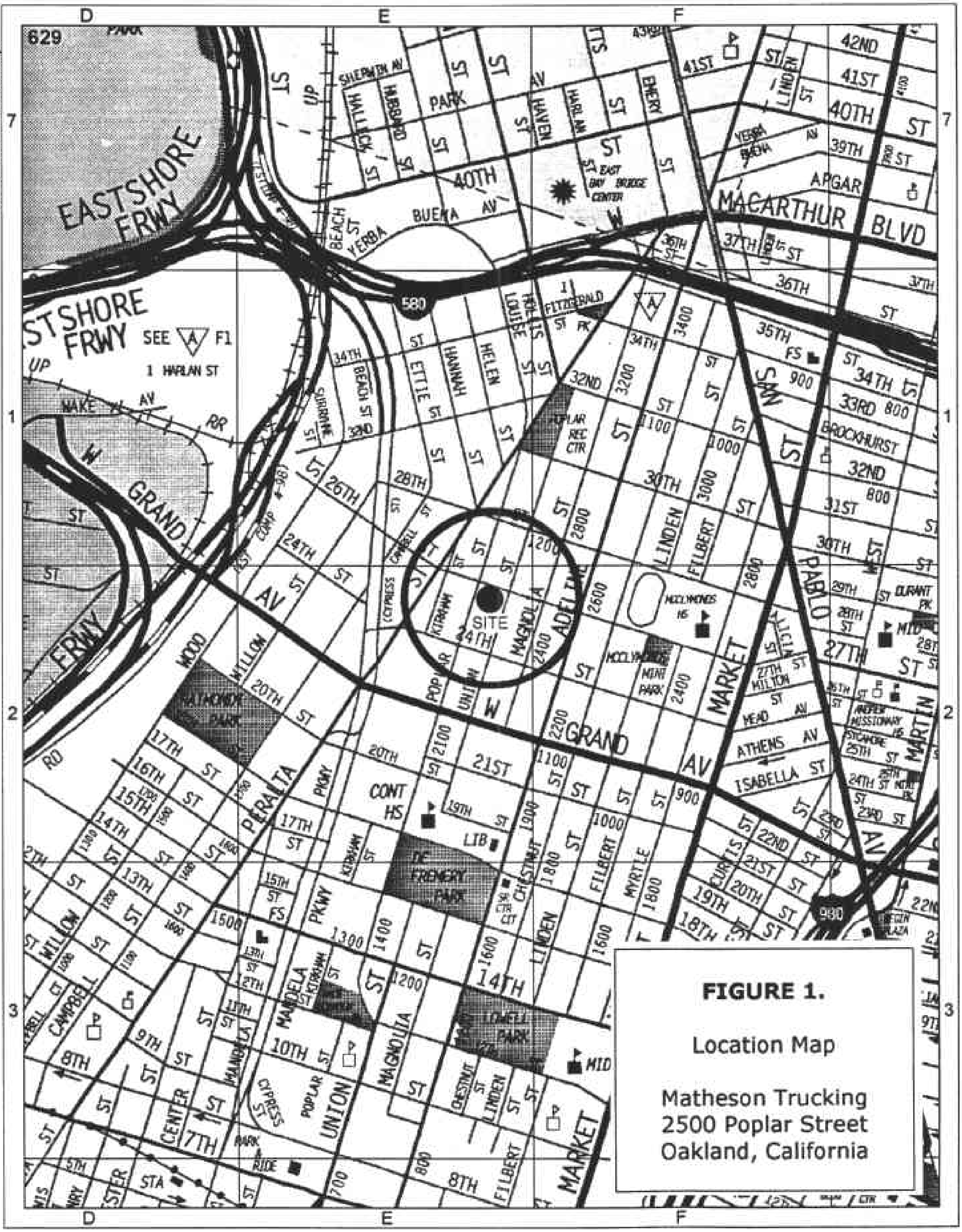


FIGURE 1.

Location Map

Matheson Trucking
2500 Poplar Street
Oakland, California

● *SITE: 2500 Poplar St, Oakland, 94607, Page & Grid 649 E2*

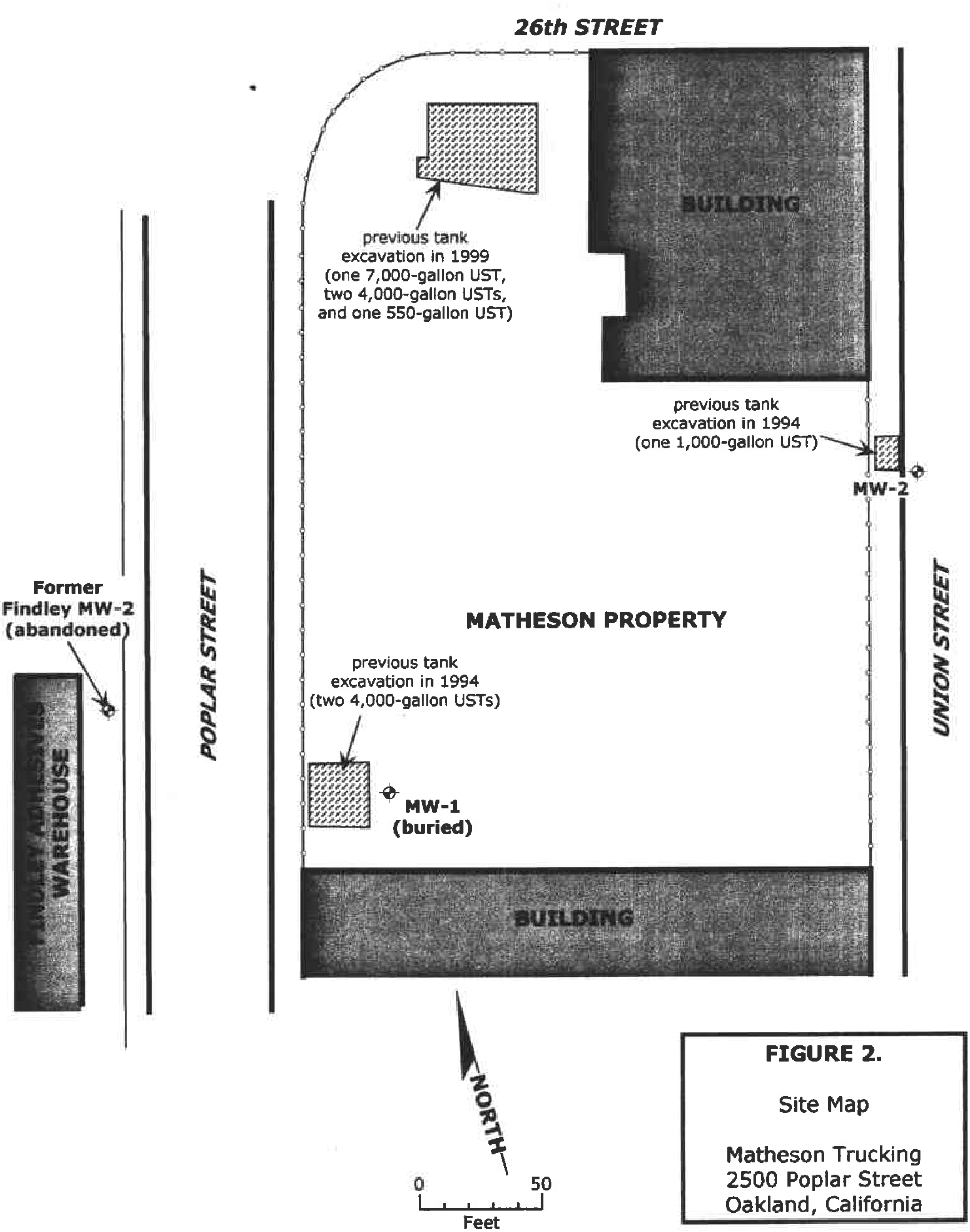


FIGURE 2.

Site Map

Matheson Trucking
2500 Poplar Street
Oakland, California

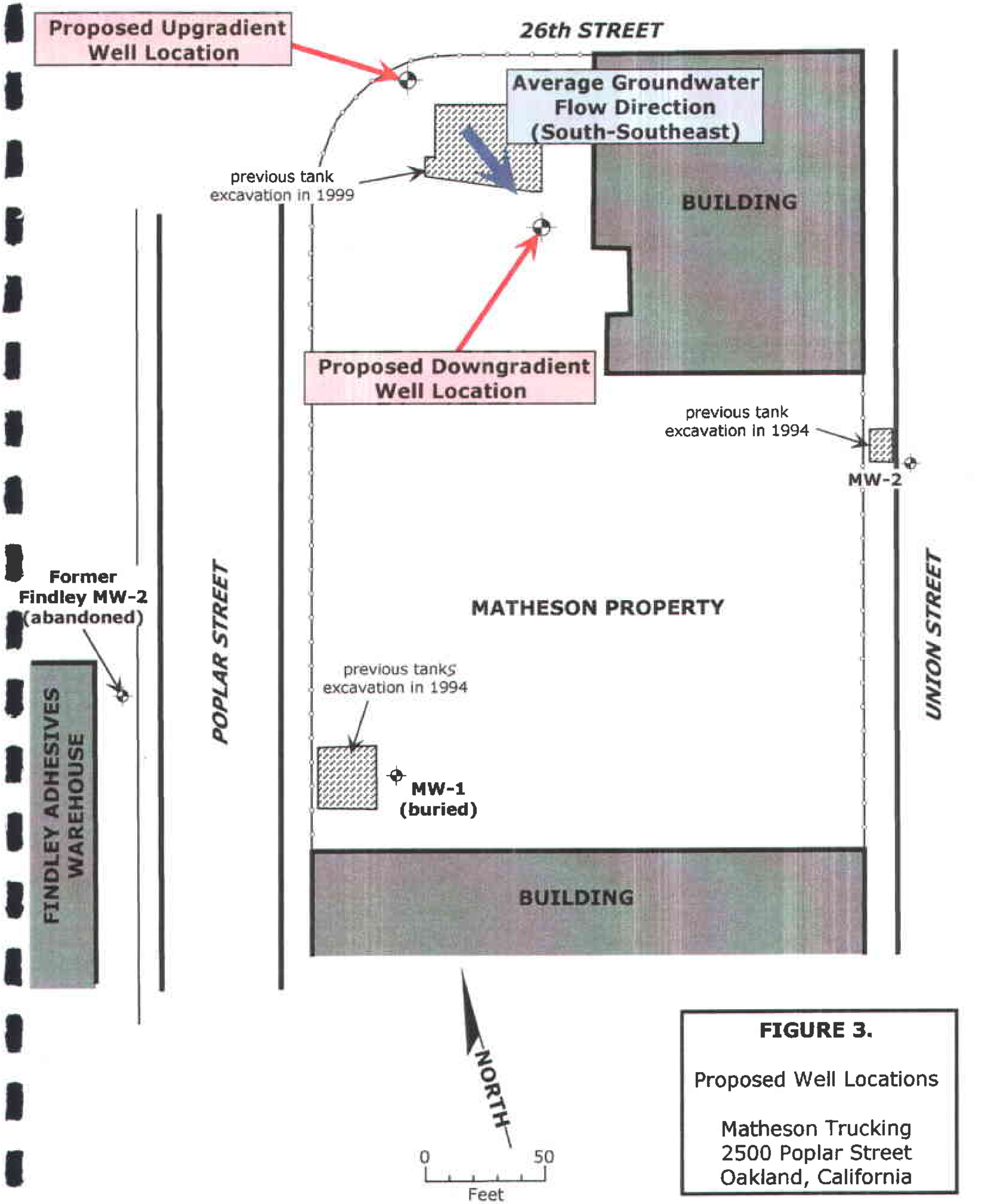
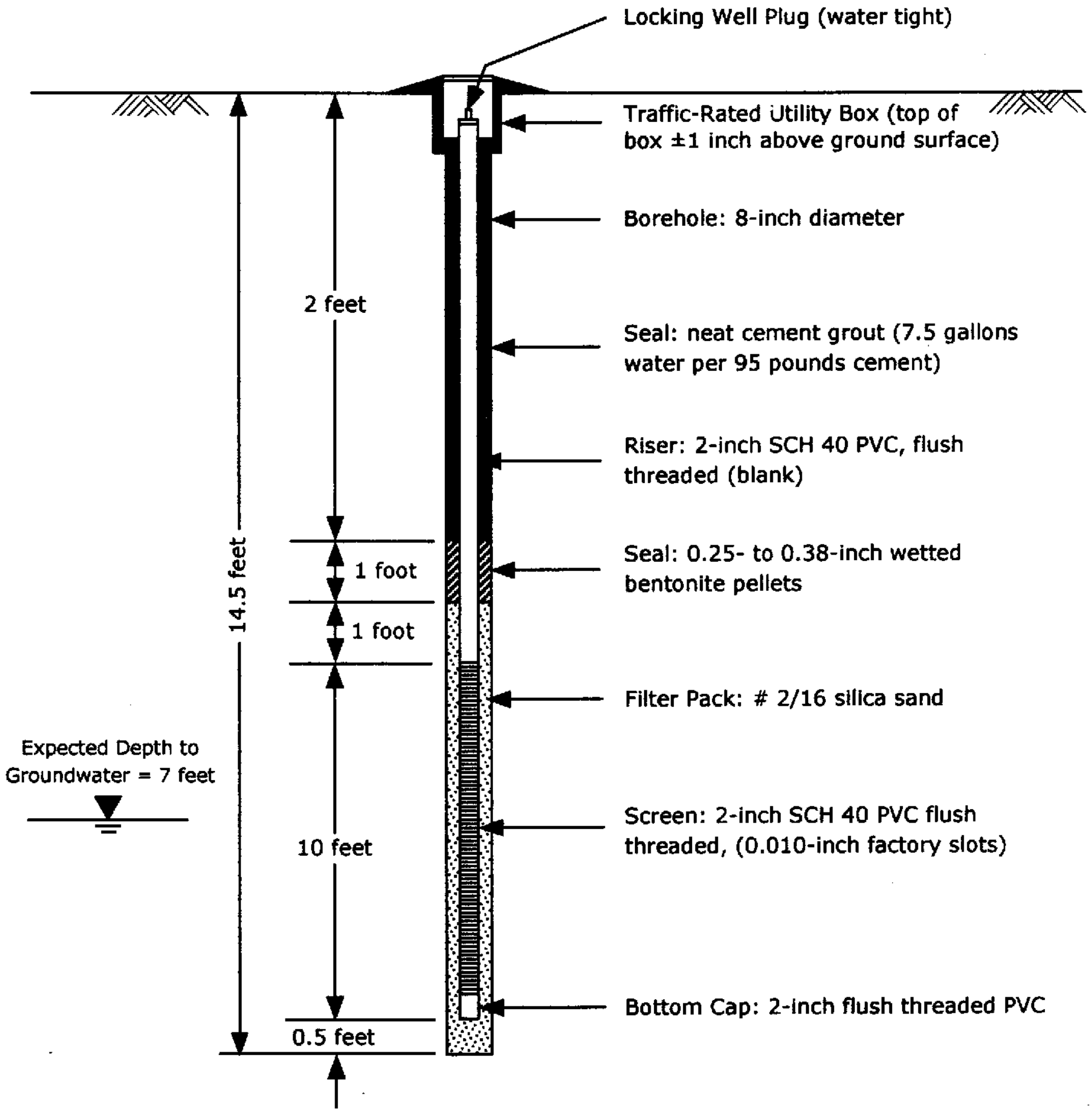


FIGURE 3.

Proposed Well Locations

Matheson Trucking
2500 Poplar Street
Oakland, California



Not to Scale

FIGURE 4.

Completion Schematic for Monitoring Wells

Matheson Trucking
2500 Poplar Street
Oakland, California

Note: This design should be modified to conform to site-specific conditions observed during drilling.

ATTACHMENT A

Correspondence

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

Certified Mailer#

October 7, 1999

Ms. Laurie Johnson
Matheson
P.O. Box 970
Elk Grove, CA 95759
STID 1306

RE: Matheson Trucking, 2500 Poplar Street, Oakland, CA 94607

Dear Ms. Johnson:

I have reviewed the laboratory report for the soil and groundwater samples collected during the removal of four underground storage tanks at the above address. Two diesel, one gasoline and one waste oil tank were removed on September 27, 1999. Chemical analysis of the soil and groundwater samples confirmed a release has occurred. The groundwater samples contained 3,900 ppb TPH(diesel), 1,600 ppb TPH(motor oil), 890 ppb TPH(gas), 2.2 ppb benzene, 3.8 ppb toluene, 3.8 ppb ethylbenzene and 15.0 ppb xylenes.

In accordance to the California Code of Regulations, Title 23, Article 11, a workplan must be submitted to this office to define the lateral and vertical extent of contamination in the subsurface at the above site. Please submit this workplan to this office within 30 days of the receipt of this letter.

If you have any questions, please contact me at (510) 567-6774.

Sincerely,

Larry Seto
Sr. Hazardous Materials Specialist

Cc: Leroy Griffin, City of Oakland Fire Services, 1603 Martin Luther King, Oakland, CA 94612
Gary Aguiar, Hageman-Aguiar Inc., 11100 San Pablo Avenue, Suite 200-A El Cerrito, CA 94530
Files

ATTACHMENT B

Site Safety Plan

SITE HAZARD INFORMATION

PLEASE PROVIDE THE FOLLOWING INFORMATION FOR THE SITE

Owner's Name: Matheson Trucking

Site Address: 2500 Poplar Street
Oakland, California

Consultant On Site: Hageman-Aguiar, Inc. Phone Number: 510/620-0891

Site Safety Officer: Kenneth B. Alexander Phone Number: 510/620-0891

Type of Facility: Truck maintenance

Anticipated Hazardous Substances - (Attach Additional Sheets, If Necessary):
(Please include concentrations below. Note if free product historically on site)

Name	Expected Concentrations (ppm) (List medium - i.e.: soil, water or air)	PEL (ppm)	Health Effects
☒ Gasoline	water: 890 ug/L	300	eye irritation, dizziness
☒ Diesel	water: 3,900 ug/L	n.a.	mild irritation to skin and upper resp. tract, headache, dizziness, nausea
☒ Waste Oil	water: 1,600 ug/L	n.a.	

Anticipated Physical Hazards:

- ☐ Heat Stress
- ☒ Noise
- ☒ Traffic
- ☒ Underground Hazards
- ☐ Overhead Hazards
- ☐ Dust
- ☐ Excavations/Trenches
- ☐ Other:

Potential Biological, Explosion and/or Fire Hazards: LEL meter will be onsite. Maintain vapors less than 10% LEL.

Monitoring Equipment To Be Used On Site:

- ☒ Organic Vapor Analyzer
- ☐ Oxygen Meter
- ☒ Combustible Gas Meter
- ☐ Other: OVM will have lamp of 10.6 eV

SITE HAZARD INFORMATION

Level Of Personal Protection Equipment: ☐ A ☐ B ☐ C ☒ D

Personal Protective Equipment:

(R = Required A = As Needed, with description of action concentrations)

R Hard Hat

R Safety Shoes

R Orange Traffic Vest

R Hearing Protection

R Safety Eyewear

A Clothing (Type): Tyvek Coveralls

A Respirator (Type): 1/2-Face Negative Pressure Resp.

___ Cartridge (Type): Carbon/HEPA

R Gloves (Type): Nitrile

___ Other: ___

Site Control Measures (i.e: Fire Extinguishers, Traffic Control Measures, etc.): Public access restricted by temporary barriers, signs, and CAUTION tape. The site will be continuously supervised.

Site Decontamination Procedures, If Any: Sampling equipment washed with TSP onsite. Rinseate stored in DOT 17H 55-gallon drums. Gloves, tyvek suits to be disposed of in facility solid waste disposal bin. Personnel to wash with soap and water prior to leaving site.

Hospital/Clinic: Summit Medical Center Phone: 510/869-6600

Hospital Address: 350 Hawthorne Ave., Oakland, CA

First Aid Equipment/Instructions Available On Site: first-aid kit

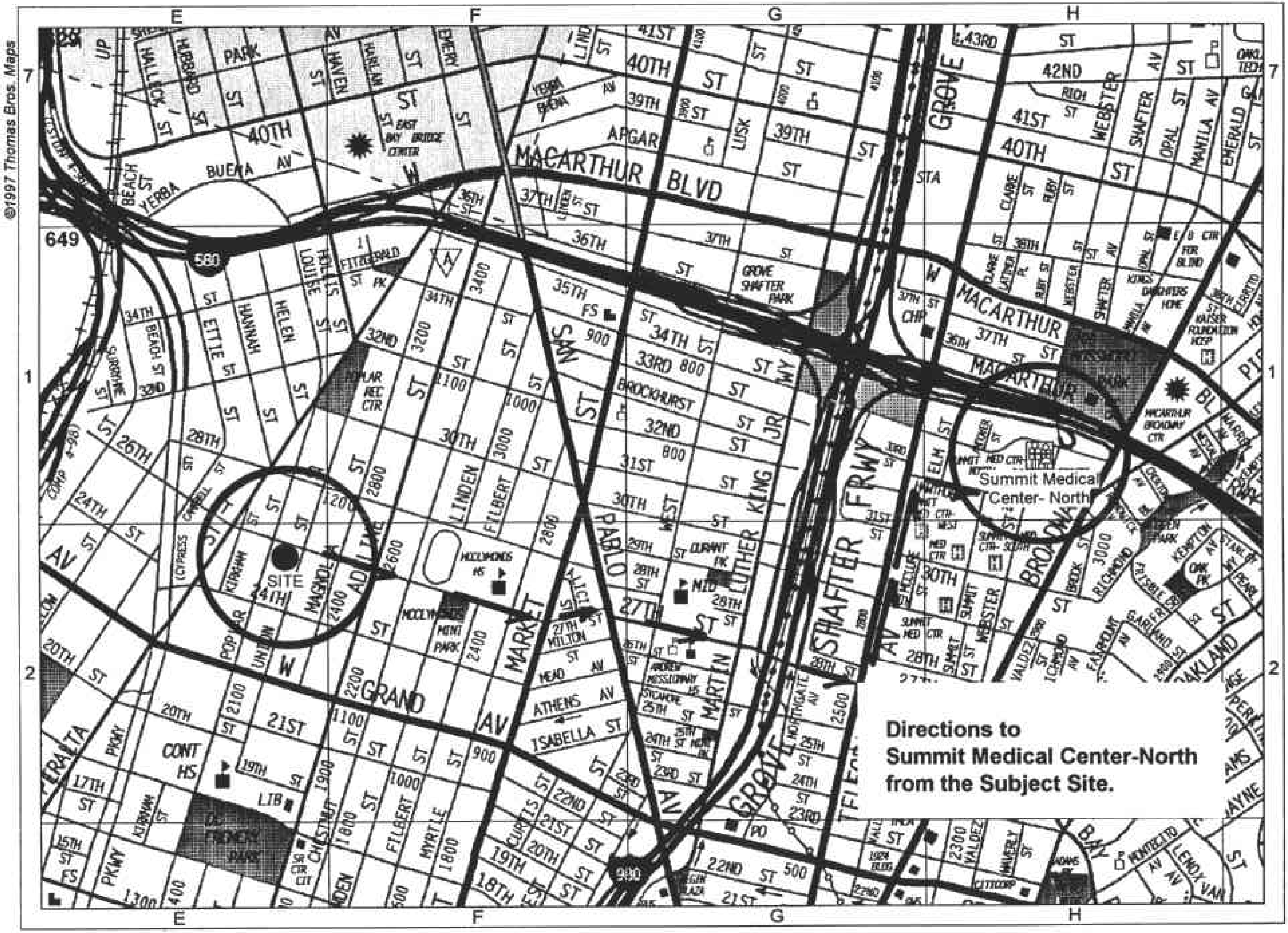
Emergency/Contingency Plans & Procedures, Special Instructions: Use emergency shut-off switch on drilling rig. Clear the area. Meet at a pre-designated staging area. Call 911.

Site Hazard Information Provided By: Kenneth B. Alexander (Print) Phone: (510)/620-0891

Principal Hydrogeologist
Hageman-Aguiar, Inc.
Company Name & Title

K.B. Alex (Signature)

18 February 2000
Date



● *SITE: 2500 Poplar St, Oakland, 94607, 649 E2*

▦ *Summit Medical Center- North: Hawthorne Av & Webster St, Oakland, 94609, 649 H1*

HAGEMAN - AGUIAR, INC.

Standard Operating Procedure HS-01

HEALTH AND SAFETY PROCEDURES

FOR

FIELD INVESTIGATION OF UNDERGROUND SPILLS OF
MOTOR OIL AND PETROLEUM DISTILLATE FUEL

December 1999

CONTENTS

1. PURPOSE

This operating procedure establishes minimum procedures for protecting personnel against the hazardous properties of motor oil and petroleum distillate fuels during the performance of field investigations of known and suspected underground releases of such materials. The procedure was developed to enable Hageman-Aguiar, Inc., health and safety personnel and project managers to quickly prepare and issue site safety plans for investigations of such releases.

2. APPLICABILITY

This procedure is applicable to field investigations conducted by Hageman-Aguiar, Inc., of underground releases of the substances listed below and involving one or more of the activities listed below:

2.1 Substances

Motor oil (used and unused)
Leaded and unleaded gasoline
No. 1 Fuel oil (kerosene, JP-1)
No. 1-D Fuel oil (light diesel)
No. 2 Fuel oil (home heating oil)
No. 2-D Fuel oil (medium diesel)
No. 4 Fuel oil (residual fuel oil)
No. 5 Fuel oil (residual fuel oil)
No. 6 Fuel oil (Bunker C fuel oil)
JP-3, 4 & 5 (jet fuels)
Gasahol

2.2 Activities

-- Collection of samples of subsurface soil with aid of truck-mounted drill rig, hand-held power auger or hand auger.

-- Construction, completion and testing of groundwater monitoring wells.

-- Collection of groundwater samples from new and existing wells.

-- Observing removal of underground fuel pipes and storage tanks.

This procedure must not be used for confined space entry (including trench entry).

No safety plans are needed for non-intrusive geophysical surveys, reconnaissance surveys and collection of surface soil, surface water and biota.

3. RESPONSIBILITY & AUTHORITY

Personnel responsible for project safety during Hageman-Aguiar, Inc., field activities are the Corporate Health and Safety Officer (**HSO**), the Project Manager (**PM**) and the Site Safety Officer (**SSO**).

The **HSO** is responsible for reviewing and approving site safety plans and any addenda and for advising both PM and SSO on health and safety matters. The **HSO** has the authority to audit compliance with the provisions of site safety plans, suspend work or modify work practices for safety reasons, and to dismiss from the site any individual whose conduct on site endangers the health and safety of others.

The **PM** is responsible for having site safety plans prepared and distributed them to all field personnel and to an authorized representative of each firm contracted to assist with on-site work. The **PM** is also responsible for ensuring that the provisions of safety plans and their addenda are carried out.

The **SSO** is responsible for assisting the **PM** with on site implementation of site safety plans. Responsibilities include:

1. Maintaining safety equipment supplies.

2. Performing or supervising air quality measurements.

3. Directing decontamination operations and emergency response operations.

4. Setting up work zone markers and signs if such zones are specified in the site safety plan.

5. Reporting all accidents, incidents and infractions of safety rules and requirements.

6. Directing other personnel to wear protective equipment when use conditions (described in **Section 5.0**) are met.

The **SSO** may suspend work anytime he/she determines that the provisions of the site safety plan are inadequate to ensure worker safety and inform the **PM** and **HSO** of individuals whose on-site behavior jeopardizes their health and safety of the health and safety of others.

4. HAZARD EVALUATION

Motor oil and petroleum distillate fuels are mixtures of aliphatic and aromatic hydrocarbons. The predominant classes of compounds in motor oil, gasoline, kerosene and jet fuels are the paraffins (e.g., benzene, toluene). Gasoline contains about 80 percent paraffins, 6 percent naphthenes, and 14 percent aromatic. Kerosene and jet fuels contain 42- 48 percent paraffins, 36-38 percent naphthenes, and 68-78 percent non-volatile aromatic. These heavier fuels contain almost no volatile aromatic compounds. Chemicals are usually added to automotive and aviation fuels to improve their burning properties. Examples are tetraethyl-lead and ethylene dibromide. Most additives are proprietary materials.

4.1 Flammability

Crude oil and petroleum distillate fuels possess two intrinsic hazardous properties, namely, flammability and toxicity. The flammable property of the oil and fuels presents a far grater hazard to field personnel than toxicity because it is difficult to protect against and can result in catastrophic consequences. Being flammable, the vapors of volatile components of crude oil and the fuels can be explosive when confined.

The lower flammable or explosive limits (LFL or LEL) of the fuels (listed in Section 2.1) range from 0.6 percent for JP-5 to 1.4 percent for gasoline. LFL and LEL are synonyms. Flash points range from -36°F for gasoline to greater than 150°F for No. 6 fuel oil. JP-5 has a flash point of 140°F. Although it has a lower LEL than gasoline, it can be considered less hazardous because its vapors must be heated to a higher temperature to ignite.

Crude oil and petroleum distillate fuels will not burn in the liquid form; only the vapors will burn and only if the vapor concentration is between the upper and lower flammable limits, sufficient oxygen is present, and an ignition source is present. If these conditions occur in a confined area an explosion may result.

The probability of fire and explosion can be minimized by eliminating any one of the three factors needed to produce combustion. Two of the factors -- ignition source and vapor concentration -- can be controlled in many cases. Ignition can be controlled by prohibiting open fires and smoking on site, installing spark arrestors on drill rig engines, and turning the engines off when LELs are approached. Vapor concentrations can be reduced by using fans. In fuel tanks, vapor concentrations in the head space can be reduced by introducing dry ice (solid carbon dioxide) into the tank; the carbon dioxide gas will displace the combustible vapors.

4.2 Toxicity

Crude oil and petroleum distillate fuels exhibit relatively low acute inhalation and dermal toxicity. Concentrations of 160 to 270 ppm gasoline vapor have been reported to cause eye, node and throat irritation after several hours of exposure. Levels of 500 to 900 ppm can cause irritation and dizziness in one hour, and 2000 ppm produces mild anesthesia in 30 minutes. Headaches have been reported with exposure to 25 ppm or more of gasoline vapors measured with a photoionization meter. Must fuels, particularly gasoline, kerosene and jet fuels are capable of causing skin irritation after several hours of contact with the skin.

Petroleum fuels exhibit moderate oral toxicity. The lethal dose of gasoline in children has been reported to be as low as 10-15 grams (2-3 teaspoons). In adults, ingestion of 20- 50 grams of gasoline may produce severe symptoms of poisoning. If liquid fuel aspirated (passes into the

lungs), gasoline and other petroleum distillate fuels may cause secondary pneumonia.
Some of the additives to gasoline, such as ethylene dichloride, ethylene dibromide, tetraethyl and tetramethyl lead, are highly toxic; however, they are present in such low concentrations that their contribution to the overall toxicity of gasoline and other fuels is negligible in most instances.

OSHA has not developed permissible workplace exposure limits for crude oil and petroleum distillate fuels. It recommends using permissible exposure limits for individual components, such as benzene. The American Conference of Government Industrial Hygienists (ACGIH) has established a permissible exposure limit of 300 ppm for gasoline. The limit took into consideration the average concentration of benzene in gasoline (one percent) as well as its common additives. Exposure limits established by other countries range from 250 to 500 ppm. Chemical data sheets, prepared for the U.S. Coast Guard's Chemical Hazard Information System (CHRIS), list 200 ppm as the permissible exposure limit for kerosene and jet fuels. This limit was not developed by NIOSH/OSHA or ACGIH.

5. HEALTH AND SAFETY DIRECTIVES

5.1 Site-Specific Safety Briefing

Before field work begins, all field personnel, including subcontractor employees, must be briefed on their work assignments and safety procedures contained in this document.

5.2 Personal Protective Equipment

The following equipment should be available on-site to each member of the field team:

- NIOSH-approved full or half-face respirator with organic vapor cartridges (color coded black)
- Saranex or polyethylene-coated Tyvek coveralls
- Splash-proof safety goggles
- Nitrile or neoprene gloves
- Neoprene or butyl boots, calf-length with steel toe and shank
- Hardhats

5.2.1 Equipment Usage

Chemical-resistant safety boots must be worn during the performance of work where surface soil is obviously contaminated with oil or fuel, when product quantities of oil or fuel are likely to be encountered, and within 10 feet of operating heavy equipment.

Respirators must be worn whenever total airborne hydrocarbon levels in the breathing zone of field personnel reach or exceed a 15-minute average of 25 ppm. If total airborne hydrocarbons in the breathing zone exceeds 100 ppm, work must be suspended, personnel directed to move a safe distance from the source, and the HSO or designee consulted.

Chemical resistant gloves must be worn whenever soil or water known or suspected of containing petroleum hydrocarbons is collected or otherwise handled.

Chemical resistant coveralls must be worn whenever product quantities of fuel are actually encountered and when oil for fuel-saturated soil is handled.

Safety goggles must be worn when working within 10 feet of any operating heavy equipment (e.g., drill rig, backhoe). Splash-proof goggles or face shields must be worn whenever product quantities of oil or fuel are encountered.

Hardhats must be worn when working within 10 feet of an operating drill rig, backhoe or other heavy equipment.

Operators of some facilities, such as refineries, often require all personnel working within facility boundaries to wear certain specified safety equipment. Such requirements shall be strictly observed.

5.3 Vapor Monitoring

5.3.1 Required Equipment

--- Organic vapor meter the flame or photoionization detector

--- Combustible gas meter

5.3.2 Monitoring Requirements and Guidelines

Vapor monitoring shall be performed as often as necessary and whenever necessary to protect field personnel from hazardous vapors. Monitoring must be performed by individuals trained in the use and care of the monitoring equipment.

During drilling operations, vapor emissions from boreholes must be measured whenever the auger is removed from the boring and whenever flights are added or removed from hollow- stem augers. This requirement does not apply to borings less than five feet deep and borings of any depth made to install monitoring wells in uncontaminated solid. Measurements should be made initially with an organic vapor meter, followed with a combustible gas meter if vapor levels exceed the highest concentration measurable with the organic vapor meter.

Initially measurements shall be made about 12 inches from the bore hole, both upwind and downwind positions. If the total hydrocarbon concentrations exceed the respirator use action level, measurements must be made in the breathing zone of the individual(s) working closest to the borehole. Decisions regarding respiratory protection should be made using vapor concentrations in the breathing zone.

Organic vapor meter capable of being operated continuously without attention may be operated in that fashion if desired. However, the instrument must be equipped with an alarm set to sound when vapor concentrations reach 25 ppm and must be protected against physical damage and spoilage.

If total organic vapor concentrations within 12 inches of the borehole exceed the capacity of the organic vapor meter, a combustible gas meter (CGM) must be used to determine if explosive conditions exist. Operations must be suspended, the drill rig motor shot down, and corrective action taken if combustible gas concentrations reach 40 percent of LEL within a 12-inch radius of the borehole of 10 percent of LEL at a distance greater than 24 inches from the borehole. This procedure must also be followed whenever the organic vapor meter goes off-scale at its highest range and no CGM is available. If corrective action cannot be taken, field personnel and all other individuals in the vicinity of the borehole must be directed to move to a safe area and the local fire department and facility management must be alerted.

Organic vapor meter with flame ionization detectors (FID) are much more sensitive to paraffins, with the major component of gasoline, kerosene, and jet fuels, then are meters with 10.0 or 10.2 eV photoionization detectors. As the data in Table 1 show, an FID instrument, such as the Century Systems OVA (Foxboro Analytical), will detect 70-90 percent of actual paraffin concentrations, whereas PID instruments, such as the HNU Model PI-101, AID Model 580, and Photovac TIP with 10.0 to 10.2 eV lamp will detect only 17-25 percent of actual paraffin concentrations when calibrated with benzene and only 24-35 percent when calibrated with isobutylene. Both types of meters are equally sensitive to most aromatic, including benzene, toluene, xylene and ethylbenzene. For these compounds, meter readings equal or exceed 100 percent of actual concentrations. PIDs with 11.7 eV lamps are extremely sensitive to paraffins and aromatic. When calibrated to isobutylene, an 11.7 eV PID will register about twice actual paraffin concentrations and 100 percent or more of actual concentrations of benzene, toluene, and xylene.

An FID meter, recently calibrated with methane and in good working condition, can be expected to provide readings close enough to actual petroleum hydrocarbon concentrations to make corrections unnecessary. Value obtained with a PID must be corrected when measured for paraffins. For 10.0 and 10.2 eV PIDs, the meter reading should be multiplied by 5 if the instrument is calibrated with benzene. If the instrument is calibrated with isobutylene, the meter readings should be multiplied by 3. If the instrument is equipped with an 11.7 eV probe and is calibrated with isobutylene, the meter reading should be divided by 2.

5.4 Area Control

Access to hazardous and potential hazardous areas of spill sites must be controlled to reduce the probability of occurrence of physical injury and chemical exposure of field personnel, visitors and the public. A hazardous or potentially hazardous area includes any area where:

1. Field personnel are required to wear respirators.
2. Borings are being drilled with powered augers.
3. Excavating operations with heavy equipment are being performed.

The boundaries of hazardous and potentially hazardous areas must be identified by cordons, barricades, or emergency traffic cones or posts, depending on conditions. If such areas are left unattended, signs warning of the danger and forbidding entry must be placed around the perimeter if the areas are accessible to the public.

Trenches and other large holes must be guarded with wooded or metal barricades spaced no further than 20 feet apart and connected with yellow or yellow and black nylon tape not less than 3/4-inches wide. The barricades must be placed no less than two feet from the edge of the excavation or hole.

Entry to hazardous areas shall be limited to individuals who must work in those areas. Unofficial visitors must not be permitted to enter hazardous areas while work in those areas are in progress. Official visitors should be discouraged from entering hazardous areas, but may be allowed to enter only if the agree to abide by the provisions of this document, follow orders issued by the site safety officer and are informed of the potential dangers that could be encountered in the areas.

5.5 Decontamination

Field decontamination of personnel and equipment is not required except when contamination is obvious (visually or by odor). Recommended decontamination procedures follow:

5.5.1 Personnel

Gasoline, kerosene, jet fuel, heating oil, gasahol and diesel oil should be removed from skin using a mild detergent and water. Hot water is more efficient than cold. Liquid dishwashing detergent is more effective than hand soap. Motor oil and the heavier fuel oils (No. 4-6) can be removed with dishwashing detergent and hot water also; however, if weathered to an asphaltic condition, mechanic's waterless hand cleaner is recommended for initial cleaning followed by detergent and water.

5.5.2 Equipment

Gloves, respirators, hardhats, boots and goggles should be cleaned as described under personnel. If boots do not become clean after washing with detergent and water, wash them with a strong solution of trisodium phosphate and hot water.

Sampling equipment, augers, vehicle under-carriages and tires should be steam cleaned. The steam cleaner is a convenient source of hot water for personnel and protective equipment cleaning.

5.6 Smoking

Smoking and open flames are strictly prohibited at sites under investigation.

TABLE 1.

Relative Sensitivities of FID and PID Instruments to Selected Components Of Oils and Petroleum Distillates

	Sensitivity in Percent of Standard		
	FID	PID	
Component		10.2 eV(1)	11.7 eV(2)
Paraffins			
Pentane	65	—	141
Hexane	70	22 (31)	189
Heptane	75	17 (24)	221
Octane	80	25 (35)	—
Nonane	90	—	—
Decane	75	—	—
Napthenes			
Cyclopentane	—	—	—
Methylcyclopentane	80	—	—
Cyclohexane	85	34 (40)	—
Ethylcyclohexane	100	—	—
Aromatics			
Benzene	150	100 (43)	122
Toluene	110	100 (43)	100
Ethylbenzene	100	—	—
p-Xylene	116	114 (60)	—
Cumene	100	—	—
n-Propylbenzene	—	—	—
Napthalene	—	—	—

Footnotes

(1) Values are relative to benzene standard. Values in parentheses are relative to isobutylene standard and were calculated.

(2) Values are relative to isobutylene standard.