APPENDIX C

Unocal
Cy of Seattle

SEATTLE CITY ATTORNEY
MARK H. SIDRAN

August 26, 1991

Gary Gunderson, P.E.
Unocal Refining & Marketing Division
P.O. Box 76
Seattle, Washington 98111

Dear Mr. Gunderson:

More than a month has passed since we wrote to you requesting an immediate response regarding the status of Unocal's current remediation work on its property adjoining the City's property at 630 Westlake Avenue, and any plans you may have for additional remediation work. We also requested Unocal reimburse the City for the costs the City has incurred to date due to contamination migrating from Unocal's property.

Further remediation work is urgently required due to the ongoing contamination of groundwater in the area, which may extend as far as Lake Union, and the presence of potentially dangerous vapors in the soil. The situation cannot be allowed to continue in its present mode.

We would like to work cooperatively with you to resolve this situation. However, if you do not contact me by September 6, we will have no choice but to consider other options, including legal action, the involvement of the Fire Department to protect the public health and safety, or a request for emergency enforcement action by the Department of Ecology, given the immediate risk to the public health and the environment.

Very truly yours,

MARK H. SIDRAN
City Attorney
Laura B. Wishik

By: LAURA B. WISHIK
Assistant City Attorney
Environmental Protection Section
206-233-2156

cc: Annette Petrie, DOE✓

UTILITIES AND ENVIRONMENTAL PROTECTION SECTIONS
1111 THIRD AVENUE, SUITE 2640, SEATTLE, WASHINGTON 98101-3207
(206) 233-2199 FAX (206) 386-0048

SEATTLE CITY ATTORNEY
MARK H. SIDRAN

Paul Berry, DAS
Mary Pearson, DAS
Sharon Metcalf, LAW
C.T. Corporation System, Unocal Registered Agent

WASHINGTON STATE DEPARTMENT OF ECOLOGY

TELEPHONE REPORT

Call From: Paul Berry Cy of Seattle

Date: 1/2/91

Time: 3:50 am-pm (circle)

Phone No.:

Call To: A Petrie

Subject: Cy of Seattle - Westlake Site

Summary: #32 Well had noticable gas odor & visual

#29 - No odor or visual of gas - appeared to be water w/ methane odor ("methane odorless - possibly other breakdown)

#22 #23 are asphalted over on street.

#6 could not find

5, 4, 10, 25, 27 manholes that are locked & say "Drain".

#1, 2 & 3 were found - in #2 more than 2" of product.

They found [illegible] product in PVC pipe

Signature [illegible]

ECY 010-46(a)

Date 1/2/91

WASHINGTON STATE DEPARTMENT OF ECOLOGY

TELEPHONE REPORT

Call From: Paul Beaty Date: 11/19/90

Time: 2:20 am-pm (circle)

Phone No.: 684-0422

Call To: A. Petrie

Subject: City of Seattle - Westlake Site.

Summary: There are 5 MW's on City of Seattle Property that Unocal must have put in.

They want to take GW samples of these wells.

He wants to know of any soil boring data & GW monitoring data. I sent letter to Unocal requesting this information.

Signature A. Petrie

ECY 010-46(a)

Date 11/19/90

DEPT. OF ECOLOGY-NWRO
ENVIRONMENTAL FORM

UNDERGROUND STORAGE TANK
NOTICE OF RELEASE
Pursuant to 40 CFR Part 280, Sept. 1988

Complaint recieved by Joe Hickey Date 2/28/90
Reporter name Richard Alvord - SCS Engineers
address 2950 Northup Wy
phone no. Bellevue WA 98004

Site name Seattle City of - Westlake St. Site site ph. no.
site address Westlake St & Valley St Corner
site city Seattle county King zip
Operator - Pennzoil
Site owner Seattle, City of; Dept Admin. Services - Paul Berry
owner's address Alaska Bldg., 14th Fl.; 618 Second Ave
city Seattle zip 98104

Consultant name Rick Alvord
company SCS Engineers ph.no. 822-5800

Other ~~party~~ Consultant Centrac - Engr. & Scientist ph.no. 486-6600
Consultant - Donna Hewitt

Description of Incident

Material: gasoline 4 diesel ___ waste oil 1 heat fuel ___
other material (describe)
No. of tanks 5 tank removal date 2/26-27/90
Status of clean-up on-going
Comments On 2/26/90 the tanks were removed and soil contamination was found using the HNU, areas of 5000PM readings. They have excavated to 13ft (GW at 13') and removed 600 yds of soil. Site inspection on 3/1/90, subcontractor Centrac was on site, they have sent in soil & GW samples; analysis expected within 2 wks. Contamination appears greater [redacted] of the site which is upgradient. Consultant thinks contamination may be from a 1/100,000 gal gasoline spill 5 yrs. ago from the Union 76 station [redacted] of the site. They have lined excavation with filter fabric and are backfilling. They will put in GW monitoring wells to further characterize areas & concentrations of contamination. Considering extraction wells & vapor treating system for remediation.

Date inspected 3/1/90 Investigator Annette Petrie
Referred to A. Petrie, J. Hickey

Site Inspections (2 sites)

Site Name: "Unocal #5353" & "Cy of Seattle - Westlake Site."
Address: [redacted] Westlake Ave. between Mercer & Valley St.
Date: 1/29/91
Inspector: Annette Petrie

Arrived on-site approximately 11:30 am accompanied by Paul Berry, City of Seattle. We walked the block locating most of the monitoring wells. The first week of Jan. '91, SCS Engineers for the City measured 1½" of product in MW #2, directly east of the incinerator for the Vapor Recovery System at Unocal.

They also measured product (thin film) [redacted] from well on Cy of Seattle property located north of MW #1.

The VES was running when we were on-site.

The City just drilled a new monitoring well on the north side of their property along Valley St. It was just being completed as we arrived. Well was drilled using a 6" hollow stem auger & well was finished off at 15' using 2" PVC with bentonite seal. They have plans to install more MWs, 2 more on the North side of Valley St. & 1 on the NW corner

c-6

File

CHRISTINE O GREGOIRE
Director

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

4350-150th Ave. N.E. • Redmond, Washington 98052-5301 • (206) 867-7000

October 26, 1990

Mr. Gary Gunderson, P.E.
Unocal Refining & Marketing Div.
PO Box 76
Seattle, WA 98111

Re: Union 76 Station at Westlake Ave. N. & Mercer St.

Dear Mr. Gunderson:

A site investigation and tank removal was conducted at the "City of Seattle - Westlake Ave. N. & Valley St." site, located downgradient (north) of the above referenced Union 76 station. Contamination was observed at the upgradient property boundary of this site, indicating that contamination may have originated from an upgradient source.

A review of Dept. of Ecology files indicates we do not have information regarding the 75,000 gallon release which occurred at the Union 76 station in June of 1980, or of any subsequent monitoring.

The following information from Unocal on this site would aid us in our investigation of off-site impacts as required by 40 CFR part 280.51 and RCW 70.105D.030:

- Cleanup reports from remedial activities conducted after any releases or spills.
- Site assessment information and analytic results including data from soil borings and monitoring wells.

If you have the above referenced information, please mail it to me at this office. Please contact me at (206) 867-7257 if you have questions about this request for information.

Sincerely,

Annette Petrie
Site Inspector, Toxics Cleanup Program

cc: Gail Colburn, Supervisor, Site Assessment Unit, Ecology
√Paul Berry, Projects Coordinator, City of Seattle-Dept. of Administrative Services

AMP:ap

file: SEA CTY WOOD. PARK

S.R. Stone 7/11/90 Ecology Received

City of Seattle
Department of Administrative Services

James P. Ritch
Norman B. Rice, Mayor

July 6, 1990

Department of Ecology
State of Washington
Northwest Regional Office
4350 - 150th Avenue N.E.
Redmond, WA 98052

Attn: Annette M. Petrie
Site Information Coordinator

Dear Ms. Petrie:

Enclosed please find Summary reports on the removal of underground tanks from four sites, Westlake & Valley Sts., Mercer St. Bus Barns, 9200 8th Ave SW, and Woodland Park Zoo.

Within these reports are included Notices of Permanent Closure, documentation of labratory tests on soil samples taken, documentation of sampling locations, Fire Department Removal Permits, conclusions and recommendations of our consulting engineers, documentation of contaminated soil disposal, and other description of activities and findings related to these tank removals and sites.

It is our understanding that these reports conclude our reporting responsibilities regarding two of the sites, Woodland Park Zoo and 9200 8th Ave SW. Both of these sites had all contaminated soil removed of, and properly disposed of, as documented in the reports. No tanks remain at these sites. If further information is required, please let me know immediately and we will submit it if possible.

The other two sites present quite a different situation.

As noted in the report for the Mercer St. Bus Barns, we discovered extensive contamination while removing these tanks. The indications are that large amounts of diesel were released into the soils at this site, and that other areas were contaminated by deliberate surface spreading of old oils several decades ago. Fortunately, (at least in some contexts) the underlying soil is extremely dense and plastic grey clay. This has trapped the contamination not allowing it to reach ground water or spread off

Above it

site. Given this condition, the fact that the surface was urgently needed for temporary Goodwill Games Broadcast Center Operations, and that no immediate method of treatment or disposal was available, we determined to reseal the site under a layer of asphalt,further study site conditions, and prepare a cleanup program to go into effect immediately after the Games completion. That is how we have proceeded.

We are currently studying alternatives for cleanup and expect to physically address the site starting in September. As our current estimate is there is 3500 cu. yds. of material, some contaminated as high as 4 or 5%, this represents a major cleanup program. It is our intention to review our proposed approach with you prior to actual implimentation.

The other removal site was at Westlake & Valley Sts. We had not been aware tanks existed at this site until late 1989. The tanks had not been in service for at least 20 years (excepting one used to store used waste oil). Upon excavation and removal of the tanks, we discovered exstensive contamination of the surrounding soils by gasoline products.

800 cu. yds. of contaminated soil was removed and stockpiled off site. Further excavation was prevented by the presence of buildings and major street arterials. We did install two monitoring wells at either end of the site to allow further study of site conditions. Again the underlying soil was dense clay, but this time a foot or so below ground water level.

Research of the adjacent property history revealed that a major release of gasoline occured on the adjacent property to the South (a Union Oil Service Station) in 1980 with an estimated 80,000 to 100,000 gallons released into the soils and only about 15,000 gal. recovered. Whole square blocks in the area were closed and block-long ditches were dug to remove product. We believe the present contamination of our property to be due to this 1980 release and strongly expect that other surrounding soils are also similarly contaminated.

The enclosed report on this site recommends further site characterization and exploration to verify extent of the contamination in the area as well as probable source. In addition we have a proposal from our consulting engineer detailing a drilling and sampling program and study. We expect to proceed with this program promptly.

We are also seeking appropriate disposal/treatment options for the stockpiled contaminated soils. We hope to have completed that disposal very shortly, but would prefer to avoid dumping at Cedar Hills Landfill.

Again, we expect to consult closely with you on cleanup alternatives and procedures, as well as to keep you informed of our findings regarding contamination beyond our site.

Finally, I would like to take this opportunity to also address our intentions regarding another release site at 814 - 8th Ave S. (Charles St. Complex Service Station). As we have discussed with you, we discovered leaking lines from our tanks, to our dispensers at this site. We removed most of those lines, and reconnected the dispensers to other existing tanks in the area with new fiberglass pipes. We also discovered contaminated soils from this leak. We removed all of them in the area of the leak and followed them some distance, removing them as we went. In all, about 200 cu. yds. of material was removed and stockpiled off site. Testing showed that all but one portion of the excavation was cleaned below cleanup standards. Some small amount of contaminated soil was left in an area indicating it was in the old excavation for line installation from the tanks behind the building. As it would have required the removal of some structures added later over these lines, and as we intend to remove the tanks and these remaining lines later this year, we deferred removal of the contaminated soils in this area until that time. The contamination involved is well above ground water and is contained in dense clay soils.

The full report on this site will be sent to you soon, but we wanted to convey our assurance that the remaining contaminated soils will be removed this year (as per our phone conversations).

Full reports on two other minor releases are also pending and will be to you soon; 5th and Cherry Police Garage Fueling site leak, and 1933 Minor Heating Oil Tank Removal.

I want to again thank you for you patience and understanding of our problems regarding these issues. It is very nice to be able to discuss these matters simply and directly with someone who is interested in practical solutions, rather than blind bureaucracy. Thank you again.

Should you need more immediate information, or if I can otherwise assist you, please contact me at 684-0422.

Sincerely,

Paul Berry

Paul Berry
Architectural Projects Coordinator

CC: SCS Engineers

CITY OF SEATTLE

SITE INVESTIGATION REPORT FOR 630 WESTLAKE AVENUE UST SITE

Prepared for:

City of Seattle
Department of Administrative Services
618 2nd Avenue, 14th Floor
Seattle, Washington 98104

Prepared by:

SCS Engineers
2950 Northup Way
Bellevue, Washington 98004

May 1991

48921.02

SEATTLE CITY ATTORNEY
MARK H. SIDRAN

July 12, 1991

443-7525

Gary Gunderson, P.E.
Unocal Refining & Marketing Division
P. O. Box 76
Seattle, Washington 98111

Dear Mr. Gunderson:

Enclosed with this letter is a site investigation report on 630 Westlake Avenue, prepared for the City of Seattle by its consultant SCS Engineers. As you will see from reviewing this report, City-owned property is being significantly contaminated by petroleum hydrocarbons in soil and groundwater. The likely source of the contamination is the Unocal property upgradient of the site. This contamination has not only affected the City commercial property on Westlake Avenue, but also City-owned streets, and park property located between the site and Lake Union.

The purpose of this letter is to put Unocal on notice that the City considers it responsible for the past and continuing contamination of the City property. We are aware that Unocal has done some cleanup and monitoring work, but it is clear that additional remediation will be required to meet state and federal cleanup requirements. We would like to be advised of the status of Unocal's efforts to deal with this ongoing problem and to cease the continuing contamination of City property. In particular, we are concerned that if the site is not promptly addressed, potentially dangerous levels of explosive vapors may build up in the soil. It is in all of our interests to ensure that that does not occur.

In addition, the City of Seattle requests reimbursement from Unocal for its remediation costs. To date, the City has spent approximately $150,000 in response costs for the emergency removal and stockpiling of some 800 yards of contaminated soil. That sum also includes engineering services related to initial assessment of the contamination, characterization of the problem, and preparation of the enclosed report.

The City is anxious to proceed to resolution of this matter at the earliest possible date. The project manager on behalf of the City for cleanup work at the Westlake site is Paul Berry of the Department of Administrative Services. He can be reached at 684-0422 if Unocal technical staff would like further information about this report, or other site conditions. Unocal's response to this letter should be directed to me at the Law Department.

ENVIRONMENTAL PROTECTION SECTION
1111 THIRD AVENUE, SUITE 2640, SEATTLE, WASHINGTON 98101-3207
(206) 233-2157 FAX (206) 386-0048

I look forward to working with you, and trust that we can arrive at a mutually satisfactory result that protects public health and safety.

Very truly yours,

MARK H. SIDRAN
City Attorney

By: Sharon S. Metcalf
SHARON S. METCALF
Assistant City Attorney
and Director
Environmental Protection Section
(206) 233-2161

SSM:bkm

cc: Annette Petrie, DOE
Paul Berry, DAS
Mary Pearson, DAS

A:SSM2:GUNDERSN.LTR

Environmental Consultants

2950 Northup Way
Bellevue, WA 98004

206 822-5800
FAX 206 889-2267

SCS ENGINEERS

May 21, 1991
File No. 48921.02

Mr. Paul Berry
Seattle Dept. of Administrative Services
618 2nd Avenue, 14th Floor
Seattle, Washington 98104

Subject: Site Investigation Report,
630 Westlake Avenue, Seattle, Washington

Dear Mr. Berry:

Enclosed are three copies of our Site Investigation Report for property located at 630 Westlake Avenue, Seattle, Washington. The report provides documentation of subsurface petroleum hydrocarbon contamination in soils and groundwater.

The scope of this investigation included the installation of five groundwater monitoring wells, one soil boring, sampling and testing of soil and groundwater, determining the extent of contamination, and evaluating the direction and rate of groundwater movement at the site.

Our findings provide supporting evidence that the site has been impacted by contaminant sources upgradient of the site. The Unocal property to the south is a likely source of the contamination because of the occurrence of a massive gasoline spill at the site in 1980 and recent (March 1991) observations of free product in one of the Unocal monitoring wells.

The extent of contamination appears to be widespread- from Mercer Street, south of the site to across Valley Street, north of the site. Petroleum hydrocarbon contamination exeeded Washington State Department of Ecology Method A Compliance Cleanup Levels (Model Toxics Control Act) at each well site sampled during this investigation- both on and off-site.

We recommend providing notification to the Washington State Department of Ecology (WDOE) of the results of this investigation in accordance with reporting requirements for contaminated sites. We also suggest that immediate steps be initiated to remove free product from the water table on the Unocal property, immediately south of the site. In addition, potential remedial actions should be reviewed with WDOE to determine the most feasible approach to proceed with clean-up actions.

If you have any questions regarding the enclosed report, please do not hesitate to contact either of the undersigned.

Respectfully yours,

Richard C. Alvord, C.P.G.
Project Manager
SCS ENGINEERS

David E. Roberson, CHMM
Vice President
SCS ENGINEERS

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SECTION 1

INTRODUCTION

PURPOSE AND SCOPE

This report was prepared by SCS Engineers in response to a request by the City of Seattle to conduct an investigation to evaluate the magnitude of petroleum hydrocarbon contamination discovered during the removal of five USTs at 630 Westlake Avenue, Seattle, Washington. The location of the site is illustrated in Figure 1.

The purpose of this investigation is to provide documentation of existing site conditions and to delineate the extent of petroleum hydrocarbon contamination in the soil and groundwater. The scope of this investigation included installing five groundwater monitoring wells, one soil boring, collecting soil and groundwater samples for analytical testing, determining the extent of contamination, and evaluating the direction of groundwater movement near the site.

In February 1990, significant levels of petroleum hydrocarbon contamination were detected at the site during the removal of several underground storage tanks. The tanks consisted of four gasoline tanks ranging from 2,000-gallons to 5,000-gallons, and one 500-gallon waste oil tank. The contamination appeared to be widespread in extent and beyond the property boundaries. No obvious damage or holes were observed in the fuel tanks or fuel lines that were excavated from the site. Although the source of contamination was not specifically identified, previous on-site fueling stations and upgradient sources could have impacted the property.

An historical review indicated that the Unocal Station immediately south of the site was the source of a major underground gasoline spill in 1980. The effects of this spill probably impacted the City's property and was a primary consideration in preparing a plan to proceed with this investigation.

The following sections of this report include a description of the site, a summary of previous site investigations, documentation of existing site conditions, and an evaluation of our findings.

SITE DESCRIPTION

The Westlake site is located at 630 Westlake Avenue, approximately 300 feet south of Lake Union in Seattle, Washington. The site is bordered on the north by Valley Street, on the south by Union 76 Service Station, on the east by a marine/boat sales and service yard, and on the west by Westlake Avenue.

The site has been owned by the City of Seattle since 1972 and operated primarily by a private auto service business. The current tenant uses the site for vehicle maintenance, including oil changes, brake work, tune-ups, steam cleaning, engine degreasing, etc.

The property is occupied by two permanent one story concrete block buildings as illustrated in Figure 2. The office building now stands where the original gasoline station at the site was constructed. The auto service garage is an "L" shaped structure with four car bays and a small store room. A temporary skid-mount trailer and wash rack for cleaning automobiles is located on the north side of the service garage. A catch basin serving this part of the property is located adjacent to the wash rack on Valley Street. Five abandoned underground tanks were removed from the site in February 1990 under the direction of SCS Engineers as requested by the City of Seattle.

The property is paved with asphalt in the driveway areas between the two existing buildings, and ramp entries to the service garage are constructed of concrete. City sidewalks, sewer and storm systems, and water lines bound the north and west perimeter of the property. Main storm and sewer lines near the site are identified in Figure 2.

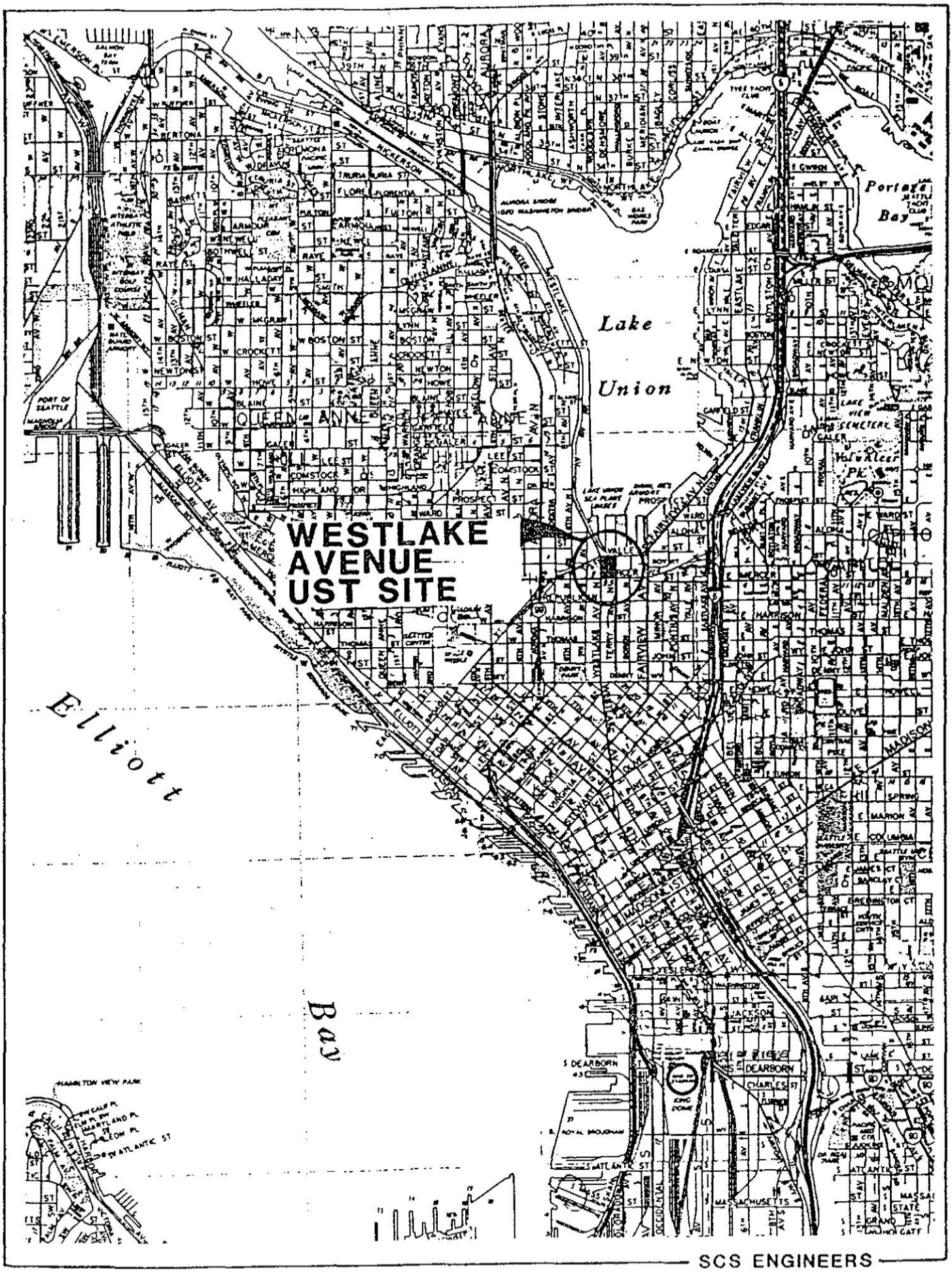


FIGURE 1 WESTLAKE AVENUE UST SITE

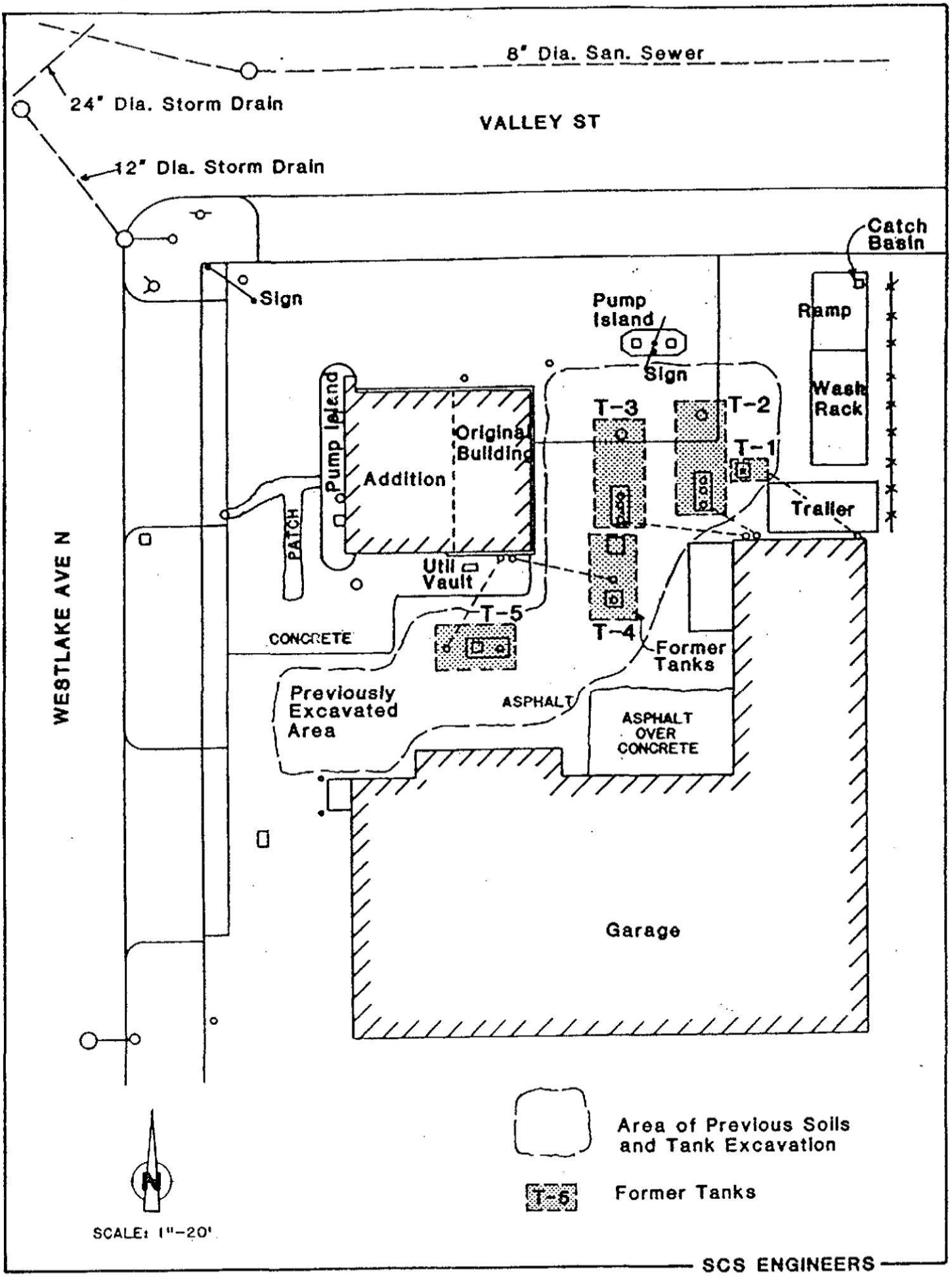


FIGURE 2 WESTLAKE SITE PLAN MAP

SECTION 2

PREVIOUS SITE INVESTIGATIONS

Based on information available at the time of this report, the only known previous investigations for contamination at the site were conducted in 1990 and 1991 by SCS Engineers, under contract to the City of Seattle. However, during the last ten years, subsurface investigations at the Unocal property immediately to the south included free product recovery efforts, monitoring, and installation of a vapor extraction system. A brief summary of these previous investigations is provided below.

UNDERGROUND TANK INVESTIGATION

In early 1990, the City of Seattle retained SCS Engineers to provide engineering services for the removal of several underground storage tanks at 630 Westlake Avenue, and to conduct an investigation of subsurface soils for site closure, in accordance with State and Federal requirements. The results of the investigation were reported (report entitled "Underground Tank Investigation Summary Report, Westlake Avenue") to the City of Seattle and Washington State Department of Ecology in June 1990.

In February 1990, five underground storage tanks were removed from the Westlake site. No holes or obvious signs of leaks were observed in any of the tanks or fuel lines. The tanks appeared to be in fair condition, having only some areas of surface rust; however, the fill pipes and fuel lines generally exhibited a greater degree of surface rust and more extensive pitting.

During tank removal activities, it was discovered that three of the abandoned tanks (T-2, T-3, and T-5) contained water, and fill pipes for these tanks were plugged with concrete. The fact that these tanks contained water indicated that they probably were not leaking when they were in use.

High levels of petroleum hydrocarbon contamination (TPH and BTEX) were detected in soil at the site. Subsequently, about 800 cubic yards of petroleum hydrocarbon contaminated soil was excavated and transported to another site for future treatment. An undetermined amount of contaminated soil was left in place, primarily under existing buildings and possibly beyond the property boundaries. Preliminary testing indicated that groundwater at the site was also contaminated with excessive levels of petroleum hydrocarbons and possibly lead.

The results of the investigation indicated a likely occurrence of off-site migration of contamination. Migration of contamination onto the Westlake site from up-gradient sources (from properties south of the Westlake site)

also appeared to be a possibility, based on detected and observed contamination in the tank excavations on the south end (upgradient) of the site.

The fact that contaminated soil was observed to be extensive throughout the site, including at the upgradient property boundary, suggested that an upgradient (off-site) source of contamination may have contributed to the petroleum hydrocarbon contamination detected at the Westlake site. Based on the findings of the initial investigation, additional work was recommended to determine the extent of contamination at the site.

In January 1991 SCS Engineers conducted an investigation of two existing monitoring wells installed at the Westlake Site and seven other monitoring wells previously installed in the area by Unocal. Free petroleum hydrocarbon product was observed in one well on the Unocal property and a sheen of product was observed in a well at the City's Westlake site. Combustible gas levels up to 25% in air and petroleum hydrocarbon vapors up to 300 ppm were also detected in several wells. A letter report of the monitoring well investigation was forwarded to the City of Seattle on January 9, 1991. A copy of this report is provided in Appendix A.

methane

ADJACENT PROPERTY

In May 1980 a large underground gasoline spill occurred at the Unocal property, south of the site. According to local newspapers, the spill was estimated to be more than 80,000-gallons and occurred over a six month period. The spill affected several City blocks around the service station and resulted in the closure of local streets and businesses during recovery operations.

Wells and trenches were constructed on the property and in the streets to recover the gasoline. Explosive vapors were detected in sewer lines along Westlake, Valley, and Mercer Streets. Approximately 15,000-gallons of gasoline was recovered from the wells and trenches during the initial cleanup.

According to a memorandum from Geo Engineers to the Department of Ecology, dated November 26, 1990 (see Appendix A), the lost product was reportedly leaded premium gasoline. The memorandum indicates that by October 1982, a total of 41,900 gallons of gasoline had been recovered and that the program was terminated because of slow recovery response.

During 1985 to 1988, free product was discovered in "numerous on-site and off-site wells" according to the memorandum. Maximum product thickness ranged from 0.23 feet (about 3 inches) to 0.41 feet (about 5 inches). Unocal subsequently installed a vapor extraction system on their northern property boundary and has operated the system periodically during 1988 to 1991.

SECTION 3

SITE CHARACTERIZATION

SUBSURFACE INVESTIGATION

During January 1991, five groundwater monitoring wells (MW-1 to MW-5) and one soil borehole (BH-1) were constructed on and off-site in an attempt to delineate the extent of petroleum hydrocarbon contamination in the soil and groundwater, and to determine the direction of groundwater movement. The monitoring wells were installed at depths ranging from 15 to 20 feet and the borehole was drilled to depth of eight feet. Figure 3 illustrates the location of each monitoring well and borehole.

Monitoring well MW-1 was installed south of the Unocal property to serve as an upgradient and background monitoring well based on the initial assumption that shallow groundwater near the site discharges into Lake Union, to the north. Monitoring wells MW-4 and MW-5 were constructed on the north (downgradient) and south (upgradient) property boundaries, respectively, of the Westlake Site. Monitoring wells MW-2 and MW-3 were installed northwest and north of the site, respectively, to investigate the northern extent of a possible plume of petroleum hydrocarbon contamination and to collect additional water level information for determining direction of groundwater movement. Borehole BH-1 was intended to be converted to an off-site groundwater monitoring well, but drilling was terminated after discovering the well location would interfere with the owner's plans for the site.

Drilling

Drilling was performed by Hokkaido Drilling (Graham, Washington), under the direction of SCS Engineers. Drilling and well installation was conducted using a Mobil B-61 drill rig equipped with 6.25-inch inside diameter hollow stem auger.

Soil cuttings from each boring were collected and placed into 55-gallon drums for future disposal. The drill augers were steam cleaned at a staging area near the south end of the site prior to drilling each borehole. Plastic sheeting was placed on the ground to contain the decontamination water and to prevent infiltration into surface soils. The decontamination water was placed in 55-gallon drums and stored on-site to await proper disposal at the completion of this investigation.

Soil Sampling

Approximately three soil samples were collected from each boring- one at about 5 feet, one immediately above the water table, and one at the bottom of the borehole. Soil samples were collected by driving a split-spoon

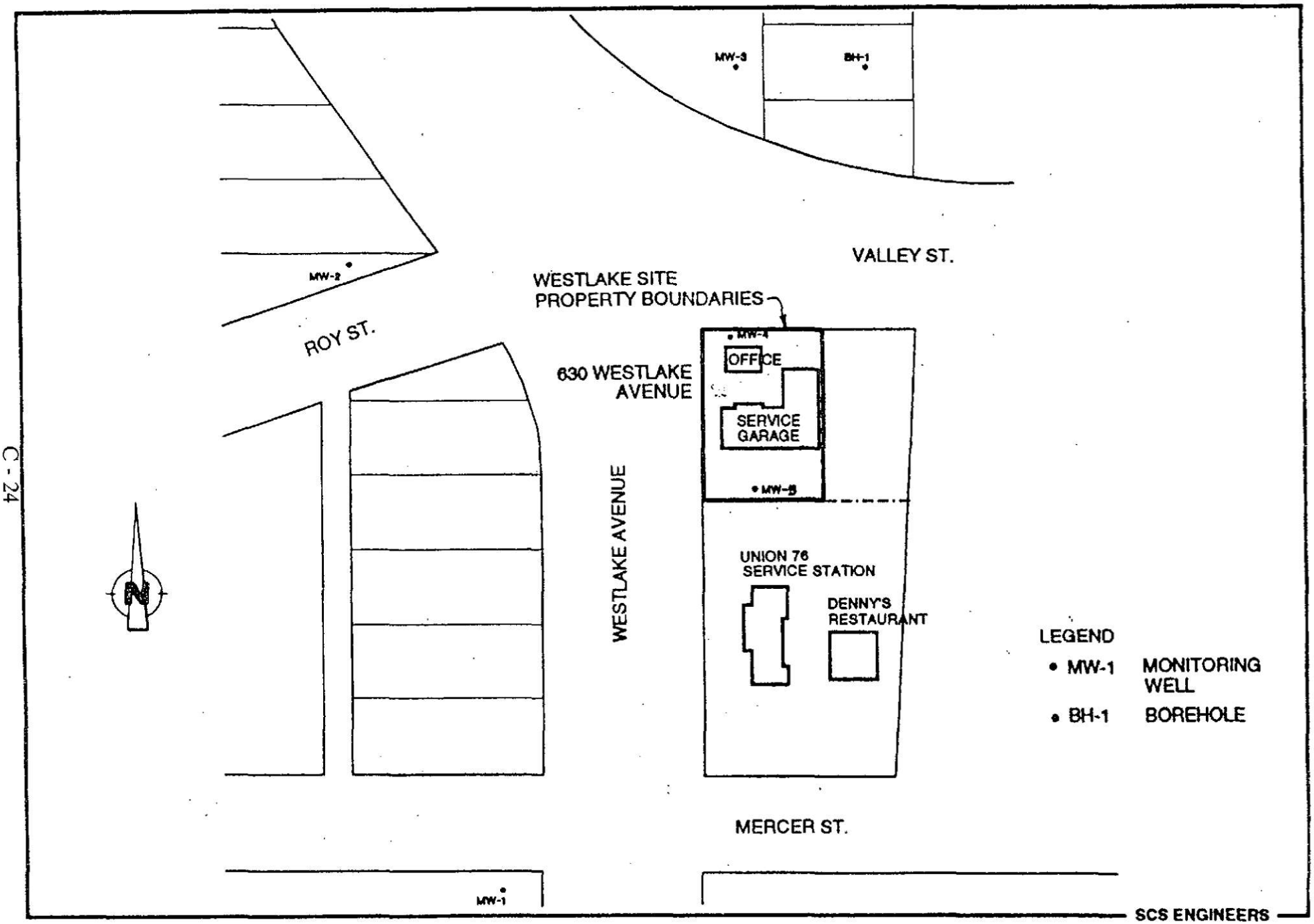


FIGURE 3 LOCATION OF MONITORING WELLS AND BOREHOLE INSTALLED DURING THIS INVESTIGATION

sample barrel into the undisturbed soil beneath the lead hollow-stem auger section. Each sample was inspected visually for signs of contamination and then tested for volatile organic vapors using a photoionization analyzer (HNu meter, Model 101). Samples were placed into labelled glass jars, capped with Teflon-lined lids, and then placed into an ice cooler prior to transport to the analytical laboratory.

To prevent cross-contamination of soil samples during drilling and sampling activities, the split-spoon sampler and drill augers were decontaminated prior to each use. The sampler was scrubbed with a brush in TSP detergent, and then rinsed with distilled water.

Monitoring Well Construction

The groundwater monitoring wells were constructed of two-inch diameter Schedule 40 PVC with 10 feet of screen. Each well was constructed such that the screen intercepted the water table surface, in order to allow direct measurement and observation of free floating product. The annular space around the outside of each well was backfilled with clean sand filter pack to a height of approximately two to three feet above the top of the screen, and then sealed with bentonite to within one to two feet of the ground surface. A flush-mounted traffic cover was cemented into place at the surface of each well. All monitoring wells were installed in accordance with Washington State Department of Ecology well construction standards.

After installation, the wells were developed to provide a good hydraulic connection to the water bearing formation. Well development procedures consisted of surging, bailing, and pumping to remove sediment from each well, and to settle the filter pack around the screen. The wells were considered reasonably developed after removing approximately 15 to 20 gallons of water from each well and observing improved clarity (less sediment) in the water.

A summary of well installation data is provided in Table 1, and borehole logs and monitoring well construction details are provided in Appendix B.

Groundwater Sampling

Groundwater samples were collected from the monitoring wells during March 1991, approximately four weeks after well installation. The depth to the water surface was measured and recorded at each site prior to sampling. Water samples were then collected from the water table surface using a clear plastic rigid tube (referred to as a "Sludge Judge" by the manufacturer) to inspect for the presence of immiscible product.

Water samples were first collected at the water table surface without removing any water in each of the wells. Since the water table intercepted the well screen at each site, these samples were representative of actual site conditions and did not require evacuation of any "stagnant" water from the wells prior to sampling. Water samples for analytical testing were collected using a two-foot long Teflon bailer after inspecting for the presence of immiscible product.

For a comparison of test results and a determination of the presence of product below the water table surface, additional water samples from wells

TABLE 1. GROUNDWATER MONITORING WELL DATA

MONITORING WELL	DATE OF INSTALLATION	DEPTH (feet)	SCREENED INTERVAL (feet)	MEASURING POINT[1] (elev.)
MW-1	01/28/91	20	9.0 - 19.0	29.31
MW-2	01/30/91	15	4.0 - 14.0	25.75
MW-3	01/29/91	17.5	6.5 - 16.5	25.76
MW-4	01/29/91	15	4.0 - 14.0	24.52
MW-5	01/31/91	17	6.5 - 16.5	25.48

Notes: 1 The measuring point is located on the top edge of the well casing and is used as a reference for determining groundwater elevation (feet above MSL).

MW-5 and U-2 were collected after removing approximately 10 gallons of water from the wells. The water was removed using a PVC bailer and then samples were collected using a Teflon bailer.

Water samples from each well were collected in VOA vials (40 ml glass vials) for BTEX analysis and in one liter amber colored glass containers for TPH and total lead analysis. No head space was allowed in the VOA vials in accordance with standard sample collection procedures for volatile organic analysis.

On April 9, 1991 four additional samples were collected (results discussed in Section 5) from wells MW-1 and MW-5 for verification of previous total lead test results and evaluation of the soluble fraction of the total lead. One sample from each well was filtered and acidified in the field. The other sample was not filtered or acidified. These samples were collected after pumping both wells dry and allowing approximately 75 percent full recovery.

Aquifer Testing

During April 1991, aquifer testing was conducted at selected monitoring well sites (MW-1, MW-3, MW-4, MW-5) to determine the approximate hydraulic conductivity of the water table aquifer materials. Hydraulic conductivity refers to the ability of a formation to transmit water through a porous material. This numerical value is one variable used in calculating groundwater flow velocity.

Aquifer testing consisted of simple bail and pump tests in which the rate of water level recovery was observed after removing a certain volume of water from the well. An electric sounding tape (E-tape) was used to measure water level response.

An analysis of bail test data indicated hydraulic conductivity ranged from about 3.6×10^{-5} ft/min at MW-4 to 9.0×10^{-5} ft/min at MW-1, and up to 7.5×10^{-3} ft/min at MW-3. Bail test data was analyzed by methodology of Ferris and Knowles, 1963 (presented in McWhorter and Sunada, 1977) and Hvorslev, 1953 (presented in Freeze and Cherry, 1979). Additional details regarding the analysis of test data using these two procedures is provided in Appendix C, and a discussion of groundwater flow rates at the site is provided below.

Water level recovery was too rapid to accurately measure with an E-tape in monitoring well MW-5, indicating that the aquifer is very permeable at this location. The estimated hydraulic conductivity of subsurface materials at MW-5 may approach 1.0×10^{-2} to 1.0×10^{-3} ft/min, based on the rapid rate of water level recovery and the nature of sediment occurring at this location.

SITE HYDROGEOLOGY

Subsurface soils in the vicinity of the site consist of approximately 10 to 15 feet of fill material underlain by gray plastic clay. The fill material generally consists of an assortment of sand, gravel, cobbles, clay, wood

chips, and occasional concrete and brick construction debris. The underlying clay is gray, sandy to silty in texture, plastic, and moist to wet. Figure 4 illustrates a cross-sectional view of our interpretation of subsurface conditions at the site, based on borehole log data and water level information.

Shallow groundwater occurs at the site under water table conditions at a depth of about eight to nine feet, based on water level measurements in on-site monitoring wells during March and April 1991. A summary of water level information collected during this investigation is provided in Table 2.

A groundwater level contour map was prepared from data in Table 2 and is provided in Figure 5. The map is based on water level information collected in March 1991 and illustrates a predominant groundwater flow direction to the north from the Westlake site. Water level elevations and hydraulic gradients indicate that groundwater west of the site maintains an east-northeast component of flow and groundwater south of the site maintains a northerly component of flow. The data suggests that the Westlake site is in the path of groundwater discharge for areas directly west and south of the site.

Based on groundwater level information and local topography, the shallow groundwater flow system appears to discharge into Lake Union to the north. The aquifer system is likely recharged from precipitation and upgradient sources.

The rate of groundwater movement across the site was calculated to range from less than 1 foot per year to 58 feet per year, assuming a hydraulic conductivity between 3.6×10^{-5} ft/min to 1.0×10^{-2} ft/min, a hydraulic gradient of 0.005 ft/ft, and a porosity of 45% in subsurface materials. A higher gradient (0.025 ft/ft) between wells MW-2 and MW-3 resulted in an estimated groundwater flow rate ranging from about 1 to 220 feet per year to the northeast in this area of the site. A discussion regarding the determination of groundwater velocity, hydraulic conductivity, hydraulic gradient, and porosity is provided in Appendix C.

Based on the interpretation of the groundwater flow system at the site, a point source of contamination could possibly move from the southern to northern property boundary, a distance of 150 feet, in about 5.0 years, assuming an average flow rate of about 30 feet per year. Several factors which could affect the estimated rate and direction of movement of a plume of contamination in the vicinity of the site include heterogeneous subsurface materials, variable hydraulic gradients, subsurface storm lines, sewers, or other buried structures, and characteristics of contaminants (for example, quantity of contaminant, rate of previous leak or spill, solubility, dispersion, etc.).

TABLE 2. SUMMARY OF GROUNDWATER ELEVATIONS AT SELECTED MONITORING WELL LOCATIONS

MONITORING WELL	DATE	DEPTH TO GROUNDWATER (feet)	ELEVATION OF GROUNDWATER (feet)
City of Seattle Wells:			
MW-1	03/06/91	11.65	17.66
	04/09/91	11.58	17.73
MW-2	03/06/91	4.25	21.50
MW-3	03/06/91	11.49	14.27
	04/09/91	10.77	14.99
MW-4	03/06/91	8.87	15.65
	04/09/91	8.55	15.97
MW-5	03/07/91	9.11	16.37
	04/16/91	9.05	16.43
Unocal Wells:			
U-1	03/07/91	9.53	16.40
	01/07/91	9.95	15.98
U-2	01/02/91	10.45	15.61
U-3	03/07/91	8.73	16.50
	01/02/91	9.50	15.73
	01/07/91	9.02	16.21
U-11	01/07/91	8.85	16.85
U-14	03/07/91	9.04	16.18
U-15	03/07/91	10.26	16.08
U-16	03/07/91	10.70	16.40
U-19	03/07/91	10.67	16.09
U-27	01/07/91	10.70	16.19
U-29	01/02/91	8.52	16.06
	01/07/91	9.10	15.48
	03/07/91	8.44	16.14
U-32	01/02/91	3.90	15.40
	01/07/91	3.45	15.85
	03/07/91	2.97	16.33

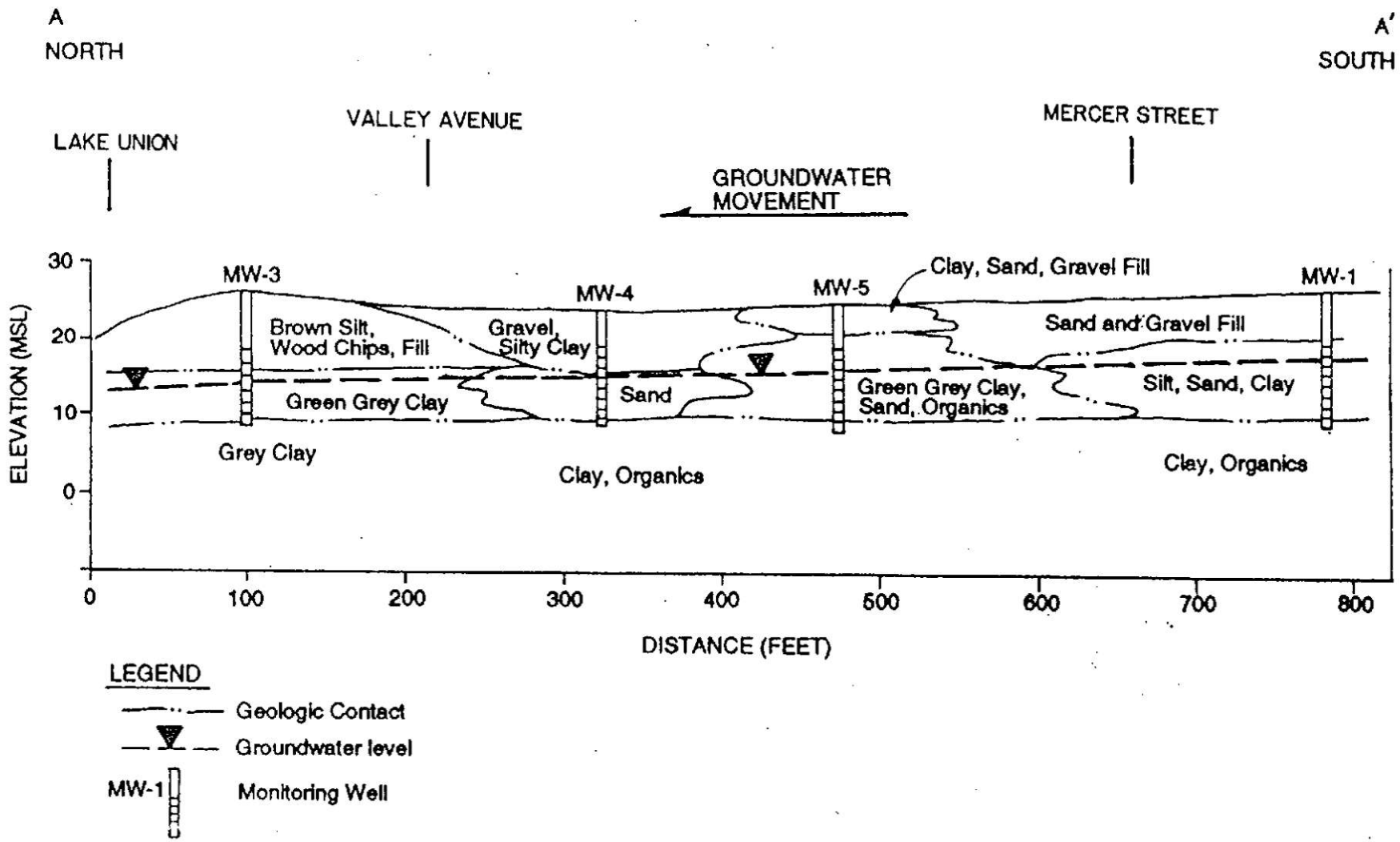


FIGURE 4 CROSS SECTION A-A'

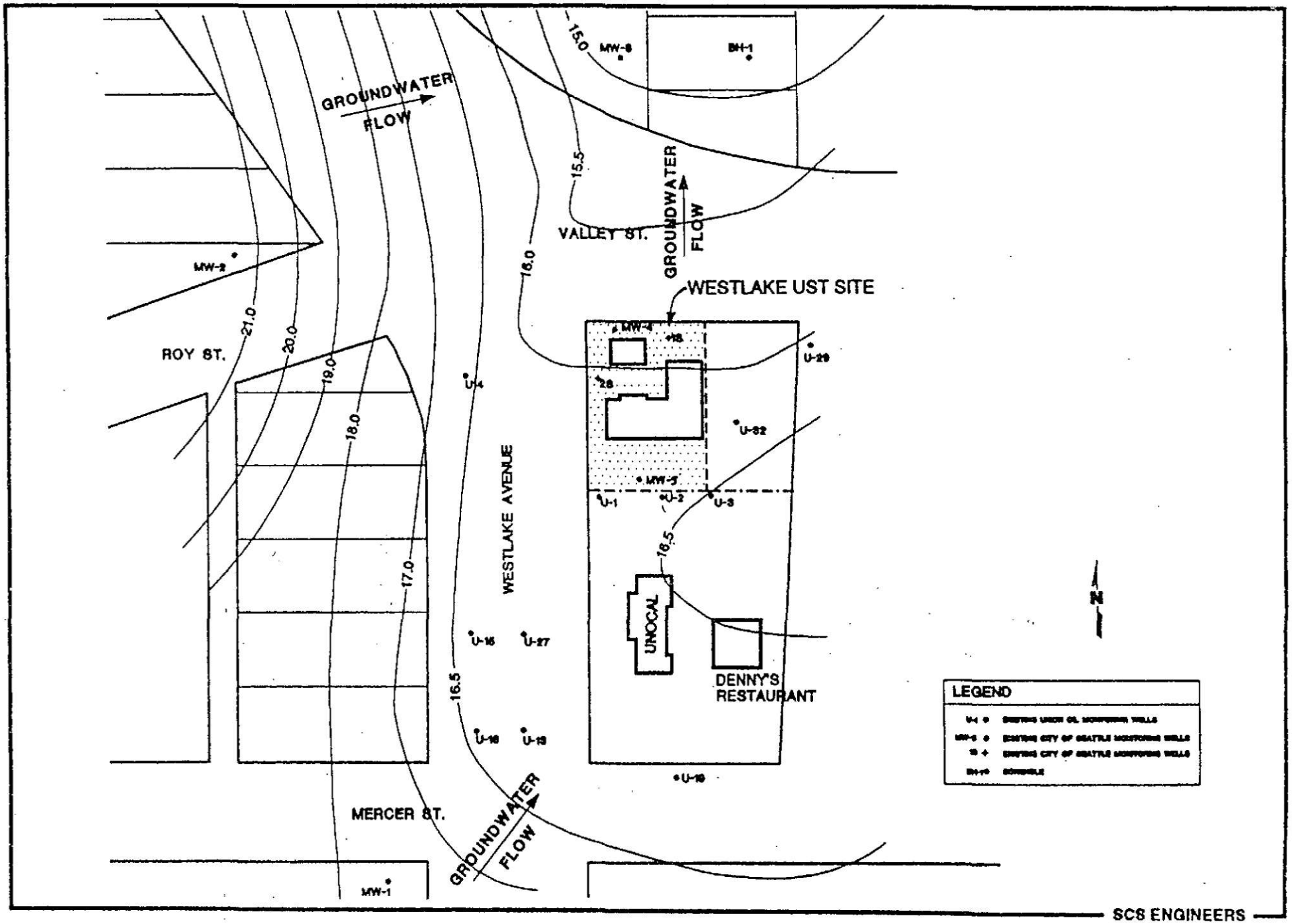


FIGURE 5 GROUNDWATER CONTOUR MAP

SECTION 4

FINDINGS

Analytical test results for this investigation were compared to soil and groundwater cleanup levels referenced in the State's new Model Toxics Control Act (MTCA). A copy of "Method A Compliance Levels" for soil and groundwater has been excerpted from MTCA and is provided in Appendix D. Analytical Laboratory Reports for soil and groundwater samples, and Chain of Custody Records are provided in Appendix E for reference. Our findings are discussed below.

SOIL CONTAMINATION

Soil samples collected from each monitoring well location were tested for TPH, and BTEX by Alden Analytical Laboratories, Inc. (Seattle, Washington). Table 3 includes a summary of testing protocol for these samples.

Soil contaminated with total petroleum hydrocarbons (TPH) was detected above Washington State Department of Ecology soil cleanup levels of 200 ppm at each well and borehole location except for MW-1. Analytical test results indicated that TPH levels in the upper five feet of soil ranged from 38 ppm in MW-1 (background well site) to 750 ppm in MW-3 (across Valley Street north of the site). TPH was detected at 290 ppm (MW-4) and 390 ppm (MW-5) in the upper five feet of soil on site. TPH contamination did not exceed soil cleanup levels below a depth of five feet at any of the well or borehole locations. A summary of analytical test results for TPH in soil at each well site is provided in Table 4.

Soil contaminated with benzene, toluene, and xylene was detected above soil cleanup levels at a depth of ten feet at MW-5, and benzene and toluene exceeded soil cleanup levels at a depth of ten feet at MW-4. Soil cleanup levels for BTEX were not exceeded at MW-1, MW-2, MW-3, or BH-1. A summary of analytical test results for BTEX contamination is provided in Table 5.

GROUNDWATER CONTAMINATION

Groundwater samples were collected for inspection and analytical testing from City of Seattle wells MW-1, MW-2, MW-3, MW-4, MW-5, 1s, and 2s and Unocal wells U-1 and U-2. Figure 3 illustrates the location of these monitoring wells.

During March and April 1991 an iridescent sheen of petroleum hydrocarbon product was observed in each well located on site (MW-4, MW-5, 1s, and 2s). During this same period, approximately one inch of black oily product was observed in Unocal well U-2, located immediately south (upgradient) of the

site and a sheen of product was observed in Unocal well U-1. No other wells on the Unocal property were sampled during this investigation.

Groundwater samples collected during this investigation were tested for TPH, purgeable volatile organics (including BTEX) and total lead. Alden Analytical Laboratories, Inc. provided analytical testing services for petroleum hydrocarbons, and Sound Analytical (Fife, Washington) and SCS Analytical (Long Beach, California) provided testing services for total lead analysis. Table 3 includes a summary of testing protocol for groundwater samples collected during this investigation.

TPH Contamination in Groundwater

Total petroleum hydrocarbon contamination (TPH) was detected above Ecology cleanup levels in groundwater at each monitoring well site sampled during this investigation. Table 6 provides a summary of analytical test results for TPH.

TPH contamination ranged from 2.2 ppm in monitoring well MW-2 to 8,000 ppm in Unocal well U-2. TPH was detected in the background well (MW-1) at 3.1 ppm. The level of TPH contamination in on-site groundwater monitoring wells ranged from 5.2 ppm (MW-4) to 960 ppm (1s) near the northern (downgradient) property boundary. TPH was detected at 6.2 ppm (MW-5) near the southern property boundary (upgradient). TPH was detected at 58 ppm in well 2s, which is located near the center of the site.

It should be noted that wells 1s and 2s were installed in excavations of the former underground tanks at the site, prior to backfilling with clean imported sand and gravel. The wells were originally intended to provide a rough indication of the level of groundwater contamination to be expected at the site. Since these wells were not constructed or installed according to Ecology well construction standards, groundwater samples collected from these wells may not be considered representative samples.

Purgeable Volatile Organic Contamination in Groundwater

Analytical testing for BTEX was conducted on groundwater samples collected from the following monitoring wells: MW-1, MW-2, MW-3, MW-4, MW-5, 1s, 2s, U-1, and U-2. In addition, a complete scan of purgeable hydrocarbons (U.S. EPA Method 624, see analytical test results for list of compounds) was conducted on samples collected from MW-4 and U-2 to investigate for the possible presence of solvents and other volatile organics. Tables 7 and 8 provide a summary of these analytical test results.

BTEX was detected in groundwater samples collected from each monitoring well. Benzene was detected above Ecology cleanup levels in each well with the possible exception of MW-3. The analytical detection limit used for benzene in MW-3 was 0.050 ppm (50 ppb) and the cleanup level for benzene in groundwater is 0.005 ppm (5 ppb). Therefore, since the laboratory reported benzene less than the detection limit used for this analysis, benzene could actually be over the cleanup level at MW-3.

Benzene was detected over ten times (0.063 ppm) it's cleanup level of

0.005 ppm in MW-1, upgradient of the site. Benzene was detected on-site at levels ranging from 1.4 ppm (well 2s) to 7.9 ppm (MW-4). These levels are approximately 300 to 1,500 times over Ecology cleanup levels for benzene in groundwater. Benzene was detected immediately upgradient of the site in Unocal wells U-1 and U-2, ranging from 5.4 ppm to 5.9 ppm.

Ethylbenzene was detected above Ecology cleanup levels in each well sampled on site (MW-4, MW-5, 1s, 2s) and both wells (U-1, U-2) sampled on Unocal property. Ethylbenzene was not detected in off-site monitoring wells MW-1, MW-2, and MW-3 above the laboratory detection limit of 0.050 ppm for this analysis. However, it should be noted that Ecology's cleanup level for ethylbenzene in groundwater is 0.030 ppm, and it is possible that ethylbenzene could actually exceed its cleanup level but be less than the laboratory detection limit.

Toluene and xylene exceeded Ecology cleanup levels at each monitoring well location. Toluene was detected up to 4 ppm (well 1s) on site, which is 100 times its cleanup level of 0.040 ppm. Toluene was detected at 28.0 ppm (700 times its cleanup level) at Unocal well U-2, immediately upgradient of the site. Xylene was detected on site at levels ranging from 0.40 ppm (MW-1) to 14.00 ppm (well 1s). These levels are about 20 to 700 times cleanup levels for xylene in groundwater. Xylene exceeded its cleanup level of 0.020 ppm by over 1500 times in Unocal well U-2, upgradient from the site.

A laboratory analytical scan for purgeable volatile organics (EPA Method 624) conducted on groundwater samples collected from wells MW-5 and U-2 indicated the presence of acetone and carbon disulfide in MW-5 and methylene chloride in U-2 (see Table 8). These contaminants may have been introduced during the laboratory analytical procedure because they are commonly used in analytical extractions for organic analysis. Considering the type of contamination detected in the groundwater at the site, it is unlikely that these constituents are actually present in groundwater at the site.

Total Lead Contamination in Groundwater

Groundwater samples were tested for the presence of total lead, in accordance with Ecology's requirement for analytical testing ("Guidance for Site Checks and Site Assessments for Underground Storage Tanks", dated February 1991) at UST sites.

Analytical test results for unfiltered groundwater samples collected on March 6, 1991 indicated total lead exceeded Ecology's cleanup level of 0.005 ppm in all wells sampled during this investigation. Total lead ranged from 0.06 ppm (MW-5) to 0.86 ppm (well 1s) on site and up to 15.4 ppm in Unocal well U-2, upgradient of the site. Total lead was also detected in MW-1 ("background well") at a level of 0.80 ppm, which is over Ecology's cleanup level of 0.005 ppm in groundwater by 160 times.

A second sampling effort was conducted on April 9, 1991 to collect additional groundwater samples for confirmation and further evaluation of test results for total lead. Filtered and unfiltered groundwater samples were collected from MW-1 and MW-4 in an attempt to distinguish the fraction of total lead absorbed to sediment particulates from that dissolved in the

groundwater. No lead was detected in any of these samples using a detection limit of 0.50 ppm. However, it should be noted that the analytical test procedure for "second round" samples used a detection limit of 0.50 ppm and "first round" samples were tested using a detection limit of 0.005 ppm. Total lead may not have been detected in second round samples because of this higher detection limit. At the time of this report, the laboratory was in the process of re-testing second round samples using a lower detection limit.

Laboratory Chromatographs

A series of chromatographs are provided in Appendix F for groundwater samples collected from wells MW-4, MW-5, U-1, and U-2. The graphs illustrate a similar pattern for the detection of lighter fraction petroleum hydrocarbons in an elution range approximately less than 10 minutes and similar characteristics for heavier fractions of hydrocarbons near an elution range of 20 minutes. According to Alden Analytical Laboratory (personal communication, April 29, 1991) these chromatographs likely represent a common fuel type. — ? what fuel ?

TABLE 3. SUMMARY OF ANALYTICAL TESTING PROTOCOL
FOR SOIL AND GROUNDWATER SAMPLES

MATRICE	ANALYTICAL TEST PROCEDURE
Soil	Total Petroleum Hydrocarbons (TPH) - U.S. EPA Method 418.1
Soil	Benzene, Ethylb., Toluene, Xylene - U.S. EPA Method 8240
Groundwater	Total Petroleum Hydrocarbons (TPH) - U.S. EPA Method 418.1
Groundwater	Benzene, Ethylb., Toluene, Xylene - U.S. EPA Method 624
Groundwater	Purgeable Aromatics - U.S. EPA Method 624
Groundwater	Total Lead - U. S. EPA 7421/ 200.7

TABLE 4. SUMMARY OF ANALYTICAL TEST RESULTS FOR TPH IN SOIL

SAMPLE NO.	LOCATION	DEPTH (feet)	DATE OF COLLECTION	TEST PARAMETER[1]	SOIL (ppm)	CLEANUP LEVEL[2] (ppm)
19631	MW-1	5	01/28/91	TPH	38	200
19633	MW-1	10	01/28/91	TPH	8.6	200
19637	MW-4	10	01/28/91	TPH	290	200
19639	MW-4	15	01/28/91	TPH	33	200
19642	MW-3	5	01/28/91	TPH	750	200
19644	MW-3	10	01/28/91	TPH	73	200
19280	BH-1	5	01/30/91	TPH	500	200
19282	BH-1	8	01/30/91	TPH	29	200
19285	MW-2	5	01/30/91	TPH	450	200
19287	MW-2	8	01/30/91	TPH	77	200
19290	MW-5	5	01/30/91	TPH	390	200
19292	MW-5	10	01/30/91	TPH	17	200

Notes: 1 TPH is Total Petroleum Hydrocarbons.

2 Model Toxics Control Act, 1991, Washington State Department of Ecology.

100 ppm

GW level at sampling?

TABLE 5. SUMMARY OF ANALYTICAL TEST RESULTS THAT EXCEEDED SOIL CLEANUP LEVELS FOR BTEX

SAMPLE NO.	LOCATION	DEPTH (feet)	DATE OF COLLECTION	TEST PARAMETER[1]	SOIL (ppm)	CLEANUP LEVEL[2] (ppm)
19289	MW-5	5	01/30/91	Benzene	0.56	0.5
19291	MW-5	10	01/30/91	Benzene	11.0	0.5
				Toluene	57.0	40.0
				Xylenes	87.0	20.0
19636	MW-4	10	01/29/31	Benzene	4.3	0.5
				Toluene	40.0	40.0

Notes: 1 Test parameter for BTEX includes benzene, toluene, ethylbenzene, and xylene.

2 Model Toxics Control Act, 1991, Washington State Department of Ecology.

TABLE 6. SUMMARY OF ANALYTICAL TEST RESULTS FOR TPH IN GROUNDWATER

SAMPLE NO.-	LOCATION	DATE OF COLLECTION	TEST PARAMETER[1]	TEST RESULTS (ppm)	CLEANUP LEVEL[2] (ppm)
19654	MW-1	03/06/91	TPH	3.1*	1.0
19658	MW-2	03/06/91	TPH	2.2*	1.0
19663	MW-3	03/06/91	TPH	3.0*	1.0
19677	1s	03/06/91	TPH	960.0*	1.0
19683	2s	03/06/91	TPH	58.0*	1.0
19669	MW-4	03/13/91	TPH	5.2*	1.0
19689	U-2	03/13/91	TPH	8,000.0*	1.0
19696	U-1	03/13/91	TPH	66.0*	1.0
19696	MW-5	03/13/91	TPH	6.2*	1.0

Notes: * Exceed Ecology Cleanup Standards, MTCA 1991, 173-340 WAC.

1 TPH is total petroleum hydrocarbons.

2 Model Toxics Control Act, 1991, Washington State Department of Ecology.

TABLE 7. SUMMARY OF ANALYTICAL TEST RESULTS THAT EXCEEDED GROUNDWATER CLEANUP LEVELS FOR BTEX

SAMPLE NO.	LOCATION	DATE OF COLLECTION	TEST PARAMETER	TEST RESULTS (ppm)	CLEANUP LEVEL[1] (ppm)
19650	MW-1	03/06/91	Benzene	0.063*	0.005
			Toluene	0.077*	0.040
			Xylenes	0.400*	0.020
19655	MW-2	03/06/91	Benzene	0.094*	0.005
			Toluene	0.120*	0.040
			Xylenes	2.100*	0.020
19660	MW-3	03/06/91	Benzene	< 0.050[2]	0.005
			Toluene	0.060*	0.040
			Xylenes	0.360*	0.020
19665[3]	MW-4	03/06/91	Benzene	7.000*	0.005
			Ethylb.	0.610*	0.030
			Toluene	3.200*	0.040
			Xylenes	7.300*	0.020
19667[4]	MW-4	03/06/91	Benzene	7.700*	0.005
			Ethylb.	0.410*	0.030
			Toluene	3.900*	0.040
			Xylenes	7.900*	0.020
19673[5]	MW-4	03/06/91	Benzene	7.900*	0.005
			Ethylb.	0.990*	0.030
			Toluene	4.500*	0.040
			Xylenes	6.600*	0.020
19699	MW-5	03/07/91	Benzene	3.500*	0.005
			Ethylb.	0.180*	0.030
			Toluene	2.900*	0.040
			Xylenes	4.200*	0.020
19704[5]	MW-5	03/07/91	Benzene	4.900*	0.005
			Ethylb.	0.520*	0.030
			Toluene	8.900*	0.040
			Xylenes	8.600*	0.020
19675	1s	03/06/91	Benzene	1.700*	0.005
			Ethylb.	3.000*	0.030
			Toluene	4.000*	0.040
			Xylenes	14.000*	0.020

(continued on next page)

TABLE 7. SUMMARY OF ANALYTICAL TEST RESULTS THAT EXCEEDED GROUNDWATER CLEANUP LEVELS FOR BTEX

(continued from previous page)

SAMPLE NO.	LOCATION	DATE OF COLLECTION	TEST PARAMETER	TEST RESULTS (ppm)	CLEANUP LEVEL[1] (ppm)
19680	2s	03/06/91	Benzene	1.400*	0.005
			Ethylb.	1.400*	0.030
			Toluene	1.800*	0.040
			Xylenes	13.100*	0.020
19688[3]	U-2	03/07/91	Benzene	5.400*	0.005
			Ethylb.	6.600*	0.030
			Toluene	28.000*	0.040
			Xylenes	31.400*	0.020
19692[5]	U-2	03/07/91	Benzene	5.800*	0.005
			Ethylb.	1.400*	0.030
			Toluene	1.000*	0.040
			Xylenes	7.600*	0.020
19694	U-1	03/07/91	Benzene	5.900*	0.005
			Ethylb.	1.400*	0.030
			Toluene	1.000*	0.040
			Xylenes	7.400*	0.020

Notes:
* Exceeds Ecology Cleanup Standards, MTCA 1991, 173-340 WAC.

1 Model Toxics Control Act, 1991, Washington State Department of Ecology.

2 Test result less than detection limit of 0.050 ppm.

3 Test results are from complete 624 scan of sample collected from water table surface.

4 Partial 624- BTEX, sample collected from water table surface. Compare to 19665.

5 Sample collected after removing 10-gallons of water. (well volumes?)

TABLE 8. SUMMARY OF OTHER VOLATILE ORGANIC COMPOUNDS REPORTED IN GROUNDWATER SAMPLES[1]

SAMPLE NO.	LOCATION	DATE OF COLLECTION	TEST PARAMETER	TEST RESULTS (ppm)	CLEANUP LEVEL[2] (ppm)
19665	MW-5	03/06/91	Acetone	0.017	---
			Carbon Disulfide	0.0049	---
19688	U-2	03/07/91	Methylene Chloride	1.200	---

Notes: 1 Volatile organic compounds other than BTEX.

2 No cleanup standards presently exist for acetone, carbon disulfide, or methylene chloride. - Method 8 - Yes

TABLE 9. SUMMARY OF ANALYTICAL TEST RESULTS FOR TOTAL LEAD IN GROUNDWATER

SAMPLE NO.	LOCATION	DATE OF COLLECTION	TEST PARAMETER	TEST RESULTS (ppm)	CLEANUP LEVEL[1] (ppm)
19654	MW-1	03/06/91	Total Lead[2u]	0.80*	0.005
19659	MW-2	03/06/91	Total Lead[2u]	1.30*	0.005
19664	MW-3	03/06/91	Total Lead[2u]	0.04*	0.005
19671	MW-4	03/06/91	Total Lead[2u]	0.15*	0.005
19679	1s	03/06/91	Total Lead[2u]	0.86*	0.005
19671	2s	03/06/91	Total Lead[2u]	0.15*	0.005
19698	U-1	03/06/91	Total Lead[2u]	1.00*	0.005
19691	U-2	03/06/91	Total Lead[2u]	15.40*	0.005
19703	MW-5	03/06/91	Total Lead[2u]	0.06*	0.005
19715	MW-1	04/09/91	Total Lead[3u]	ND	0.005
19716	MW-1	04/09/91	Total Lead[3f]	ND	0.005
19717	MW-4	04/09/91	Total Lead[3u]	ND	0.005
19718	MW-4	04/09/91	Total Lead[3f]	ND	0.005

detection limit[2].

Notes: * Exceed Ecology Cleanup Standards, MTCA 1991, 173-340 WAC.

1 Model Toxics Control Act, 1991, Washington State Department of Ecology.

2 Total lead tested using EPA Method 7421; "u" is unfiltered.

3 Total lead tested using EPA Method 200.7; "f" is filtered, "u" is unfiltered.

SECTION 5

CONCLUSIONS

This investigation provides supporting evidence that the City's property located at 630 Westlake Avenue has been impacted by contaminant sources upgradient of the site. Petroleum hydrocarbon contamination was detected in the soil and groundwater on and offsite. The extent of contamination appears to be widespread- extending from Mercer Street, south of the site (upgradient) to across Valley Street, to the north of the site.

TPH, BTEX, and total lead contamination in groundwater exceeded Ecology cleanup levels at each well site sampled during this investigation. The highest levels of contamination were detected in wells on the Unocal property, immediately south (upgradient) of the site.

Excessive levels of petroleum hydrocarbon contamination detected in on-site wells 1s and 2s during this investigation, provides evidence that the City's Westlake Site continues to be significantly impacted by an upgradient source of groundwater contamination. This is based on the determination of the direction of groundwater flow and the fact that in February 1990, wells 1s and 2s were installed in imported clean sand and gravel backfill after removing all underground tanks and contaminated soil (no soil was excavated below existing building foundations at the site) from the site.

Based on our interpretation of the groundwater flow system at the site, any sources of groundwater contamination to the south and west could environmentally impact the City's Westlake site since the site appears to be in the path of local groundwater discharge. However, based on similar characteristics of a series of laboratory analytical chromatagraphs for groundwater samples collected from the Westlake Site and the Unocal property, the source of groundwater contamination discovered at the Westlake site is likely from the Unocal property to the south.

High concentrations of petroleum hydrocarbons in well upgradient well MW-1 may indicate that the well is within the area of influence of the 1980 Unocal spill or that the contamination represents another source of contamination upgradient of MW-1. However, the fact that the hydraulic gradient is very low in this area, petroleum hydrocarbon contamination in MW-1 could be a result of contaminant dispersion even in an upgradient direction.

The data presented in this report does not provide a quantitative indication of the age of product discovered at the site. In addition, there is no conclusive evidence at this time that correlates this product with the Unocal spill in 1980. Therefore, in the absence of any leak detection test records of Unocal's fuel system, it is not known if existing

site contamination is a result of the 1980 fuel spill or possibly current problems that may exist at the Unocal facility.

High concentrations of petroleum hydrocarbon contamination were also detected in shallow subsurface soil and groundwater at well MW-2, which indicates the possibility of one or more additional sources of contamination contributing to the existing problem near the Westlake site, since MW-2 is located hydraulically upgradient of the site. Local groundwater gradients suggest that any sources of groundwater contamination directly to the west could also impact the Westlake Site (see Figure 5).

Total lead detected in the groundwater at and near the site could be a result of natural background levels in the groundwater or sediments, fuel spills, or other upgradient sources of contamination. No conclusive evidence is available at this time which relates the detected total lead to any organic lead which may be present in petroleum hydrocarbon contamination at the site.

Based on an interpretation of water level information at the site, the predominant direction of groundwater flow at the site is to the north at a rate ranging from less than 1 foot per year to 58 feet per year. A higher gradient between wells MW-2 and MW-3 resulted in an estimated groundwater flow rate ranging from about 1 to 220 feet northwest of the site.

Based on the present interpretation of the groundwater flow system at the site, a point source of contamination could possibly move from the southern to northern property boundary (a distance of 150 feet) in about 5.0 years, assuming an average flow rate of about 30 feet per year. Very low hydraulic gradients at the site are likely to result in slow contaminant transport.

Several factors which could affect the estimated rate and direction of movement of a plume of contamination in the vicinity of the site include heterogeneous subsurface materials, variable hydraulic gradients, subsurface storm lines, sewers, or other buried structures, and characteristics of contaminants (for example, quantity of contaminant, rate of previous leak or spill, solubility, dispersion, etc.).

TPH contamination in soil exceeded Ecology cleanup levels at each well site installed during this investigation except for MW-1. TPH contamination above 200 ppm was not detected below a depth of five feet at these well locations. Benzene, toluene, and xylene contamination in soil exceeded Ecology cleanup levels in only on-site wells MW-4 and MW-5. No analytical test results for soil were available for wells drilled previously on the Unocal property immediately north of the Westlake Site.

SECTION 6

RECOMMENDATIONS

Based on the results of this investigation, we recommend the following:

- Submit this Site Investigation Report to WDOE in accordance with 90-day reporting requirements of The Model Toxics Control Act for releases at UST sites.
- Follow-up earlier reports to WDOE to confirm that free product was recently (March 1991) observed in a well on Unocal Property to the south (upgradient) and that a sheen of product was visible in all wells located on City property located at 630 Westlake Avenue.
- Additional characterization of subsurface contamination west of the site is necessary to determine the possibility of an additional source of contamination impacting the site and other property downgradient of MW-2. We recommend installing one or two additional monitoring wells to investigate for contamination and to further characterize the direction of groundwater flow.
- Clean-up of free product on the Unocal property to the south should be the first step in attempting to remediate contamination discovered on the City's property on Westlake Avenue.
- Since groundwater contamination (free product) was detected at the site, the Department of Ecology may require a State Remedial Investigation and Feasibility Study, in accordance with The Model Toxics Control Act.
- The results of this investigation and potential remedial options should be reviewed with WDOE to determine the most feasible approach to clean up the site.

APPENDIX A

Investigation of Monitoring Wells at the Westlake Site
January 9, 1991

Environmental Consultants

2950 Northup Way
Bellevue, WA 98004

206 822-5800
FAX 206 889-2267

SCS ENGINEERS

January 9, 1991
File No. 48921.02

Mr. Paul Berry
City of Seattle
Dept. of Administrative Services
618 2nd Avenue, 14th Floor
Seattle, Washington 98104

Subject: Investigation of Monitoring Wells at Westlake Site

Dear Mr. Berry:

This letter includes a summary of information collected on January 2 and 7, 1991 from existing monitoring wells at the Unocal Station, located at Mercer Street and Westlake Avenue, and Seattle's Westlake site at 630 Westlake Avenue, in Seattle. The purpose of our site investigation was to determine the possible presence of free gasoline product, which could be a potential hazard and source of contamination to the area.

BACKGROUND

Unocal installed more than 30 monitoring and recovery wells on and around their facility in 1980 as a result of an underground release of gasoline. According to a memorandum, dated November 26, 1990 from GeoEngineers to the Department of Ecology (Appendix A), more than 80,000 gallons of leaded premium gasoline was released at the site. By October 1982, a total of about 41,900 gallons of product was recovered. As recent as May 1990, free product was identified in three of the wells.

In February 1990, five abandoned underground fuel storage tanks were removed from City of Seattle property located at 630 Westlake Avenue, immediately north of the Unocal property. An investigation conducted by SCS Engineers (Underground Tank Summary Report, dated June 1990) indicated that subsurface soil and groundwater was contaminated with petroleum hydrocarbons. Approximately 800 cubic yards of contaminated soil was excavated from the site after the tanks were removed from the ground. The source of contamination discovered on the property was not specifically identified, although the gasoline spill that occurred at Unocal in 1980 was one suspected source. SCS recommended an additional investigation to determine the source and extent of contamination.

SITE INVESTIGATION

On January 2, 1991, representatives from the City of Seattle and SCS Engineers investigated several existing wells at the site to determine the possible presence of free product. Additional well information was obtained on January 7, 1991. Table 1 presents a summary of data collected from these wells.

Only wells located near property at 630 Westlake Avenue (see Figure 1) were investigated. These wells included Unocal Wells 1, 2, and 3, on the north side of the service station; Unocal Wells 11 and 27 in the middle of Westlake Avenue; and Unocal Wells 29 and 32, northeast of the service station. Unocal Well 6 was reportedly installed on City property immediately north of the recovery wells but could not be located during this investigation. Two City of Seattle monitoring wells (1s and 2s) at 630 Westlake Avenue were also inspected.

During our site investigation, the wells were checked for the presence of free product using a teflon bailer and gas-finding paste; the water level in each well was measured; and a natural gas meter and HNu meter was used to test for combustible gases and volatile organic vapors, respectively. The teflon bailer and water level probe were thoroughly decontaminated with detergent to avoid cross-contaminating the wells.

Approximately one inch of free, oily, gasoline product was observed in Unocal Well No. 2 (See Figure 1). Free product was not identified in any other wells that were accessed. However, an oily sheen was observed in City of Seattle Well No. 2s, located near the south side of City property, (Figure 1). In addition, volatile organic vapors were detected in City of Seattle Well 2s and Unocal Wells 3 and 32 using an HNu Meter, calibrated to benzene as a standard.

Combustible gas was detected in several wells using a D-15 Gastester, which may confirm earlier reports of methane gas (GeoEngineers, November 26, 1990). However, the D-15 Gastester instrument is sensitive to methane gas and lighter fraction petroleum hydrocarbon vapors. Therefore, laboratory analytical testing is needed to determine specific gas types and respective concentrations.

During this investigation, combustible gas levels were detected up to 25% volume in air in the wells. Petroleum hydrocarbon vapors were detected up to 300 ppm (.03%) using the HNu meter. Methane is considered explosive at levels ranging from 5% to 15% in air, and is flammable above 15%. Petroleum hydrocarbon vapors are considered flammable between a range of 1% to 10% volume in air.

Volatile organic vapor readings may have been on the low side because the HNu meter tends to be less sensitive in the presence of moisture. Water condensation in the wells could have affected these readings. HNu readings were not obtained during the site inspection on January 7, 1991 because the meter was affected by rain. A summary of our findings is provided in Table 1.

CONCLUSIONS

Based on the results of this investigation, it appears that gasoline product floating on the water table at the Unocal facility could be a

continuing source of contamination to adjacent property, including City of Seattle property, located at 630 Westlake Avenue.

Additional investigation is needed to determine the magnitude and direction of movement of groundwater contamination at the site. Gas vapors detected in the wells are most likely related to the fuel contamination, but additional investigation is needed for confirmation.

RECOMMENDATIONS

On January 2, 1991, the City of Seattle reported the discovery of free product at the north property boundary of the Unocal facility, to the Department of Ecology. The Seattle Fire Department should also be informed of these findings.

Based on the discovery of free product in May 1990, as reported by GeoEngineers, and free product in one well during this investigation, the fueling system at Unocal should be tested to determine the possibility of any existing leaks that may be contributing to the current problem. Because of the nature of potentially hazardous conditions at the site, efforts to clean up free product should commence immediately.

We also recommend proceeding with an investigation to determine the magnitude of contamination, path of migration, and impact of the contamination to City of Seattle property. Any additional information such as spill cleanup records, construction details of Unocal monitoring and recovery wells, borehole logs, water level measurement records, previous reports and documentation, and fuel system tightness test records would be helpful to this investigation.

The presence of combustible gas is a potential safety hazard. Therefore, we recommend collecting gas (vapor) samples from several of the wells to confirm the type and concentration of specific gases. Based on laboratory analytical test results, appropriate recommendations can then be addressed.

If you have any questions regarding this report, please do not hesitate to contact us.

Respectfully yours,

Richard C. Alvord, C.P.G.
Project Manager
SCS ENGINEERS

David E. Roberson, CHMM
Project Director
SCS ENGINEERS

G:/jobs/4892102/watlev1

TABLE 1. SUMMARY OF INFORMATION COLLECTED FROM UNOCAL AND CITY OF SEATTLE GROUNDWATER MONITORING WELLS

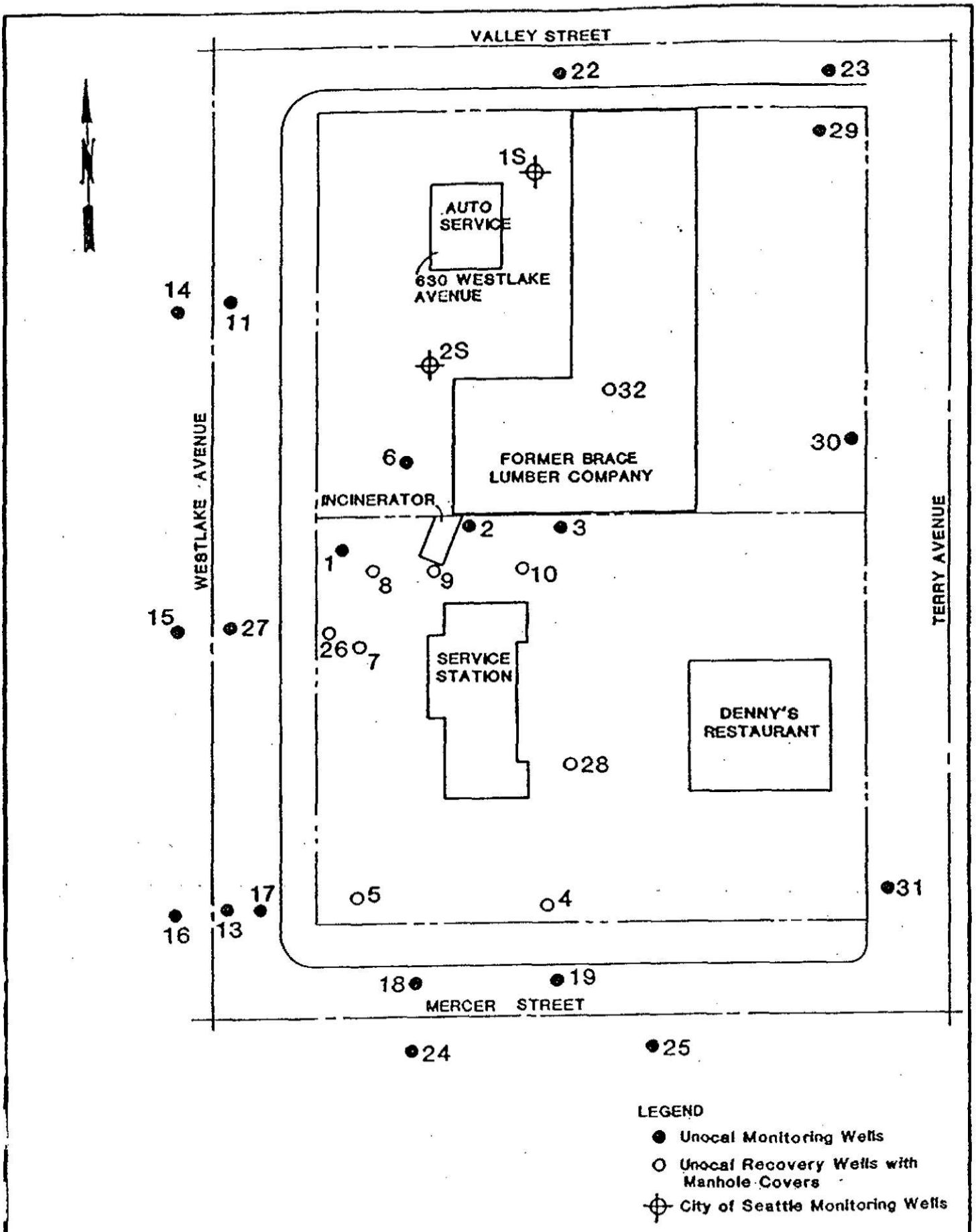
D.R.I. or Chemical Laboratory

DATE	WELL ID (In.)	DEPTH OF WELL (Feet)	WELL DIAM. (In.)	DEPTH TO WATER (Feet)	OBSERVED PRODUCT THICKNESS	COMBUSTIBLE GAS (%)	DETECTED ORGANIC VAPORS
UNOCAL WELLS:							
1/2/91	1*1						
1/7/91	1	15	2	9.95	0	<1	
1/2/91	2	~15	2	10.45	~1-in.	10-15	Strong odor
1/7/91	2*1						
1/2/91	3	14.5	2	9.50	0	15	+100 ppm*2
1/7/91	3			9.02	0	25	
1/7/91	11	9.6	1.5	8.85	0	4	
1/7/91	27	17	1.5	10.70	0	0	
1/2/91	29	57	1.5	8.52	0	0	
1/7/91	29			9.10	0	1-2	
1/2/91	32	15.3	1.5	3.90	0	5-10	20-200 ppm*2
1/7/91	32			3.45	0	10	
CITY OF SEATTLE WELLS:							
1/2/91	1s*3	15	2				
1/2/91	2s	15	2	9.15	sheen	5-10	300 ppm*2
1/7/91	2s			8.85		4	

Unocal Wells Not Measured:

4-5, 12-13, 16-21, 24-25, 28, 31, (see note *4)
6, 22-23, 30, (see note *5)
8-10, (see note *6)
7, 14, 15, 26, (see note *7)

Notes:
*1 Vehicle parked over well cover prevented access to well.
*2 HNu Meter results calibrated to benzene as a standard.
*3 Did not measure; pipe extension needed to prevent infiltration of surface runoff.
*4 Did not attempt to locate or access well.
*5 Could not locate well.
*6 Locked cover prevented access to well.
*7 Located well but did not attempt to gain access.



Adapted from Geo Engineers

SCS ENGINEERS

APPENDIX A

GeoEngineers Memorandum
November 26, 1990

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

4350-150th Ave. N.E. • Redmond, Washington 98052-5301 • (206) 867-7000

V.L. CARLSON
GeoEngineers JUN 23 1988

JUN 27 1988

June 22, 1988

Mr. V. L. Carlson
Unocal Corporation
3131 Elliott Avenue
P.O. Box 76
Seattle, Washington 98111

Dear Mr. Carlson:

On June 14, 1988, we received your proposal for vapor recovery and incineration at service station 5353, located at Westlake and Mercer.

Upon review of the subject document, our approval has been given.

Sincerely,

Craig S. Baker

Craig S. Baker
Spill Response Manager
Environmental Quality

CSB:s

RECEIVED
JUN 23 1988
MAINT. & CONT.

We request that you review this proposed program to determine if it satisfies the requirements of Ecology for remediation at this site. If you have any further questions about our plans for this vapor recovery system, please contact Mr. Steve Perrigo of GeoEngineers at 746-5200. Please concur with our plans by executing and returning one copy of this letter to UNOCAL.

Yours very truly,

V. L. CARLSON
Construction Engineer

VLC:ct

Attachment

cc: J. L. Ashlock
A. L. Barone
J. Miller, GeoEngineers, Inc. (w/attach)

Proposal accepted this _____ day of _____, 1988

_____
Department of Ecology

Unocal Refining & Marketing Division
Unocal Corporation
3131 Elliott Avenue, P.O. Box 76
Seattle, Washington 98111
Telephone (206) 281-7666

GeoEngineers

UNOCAL 76

SEP 1 1988

Routing SCI

File

August 31, 1988

Craig S. Baker
Department of Ecology
4350 150th Ave. NE
Redmond, Wa. 98052-5301

Dear Mr. Baker

Re: STATION 5353
WESTLAKE & MERCER
SEATTLE, WASHINGTON

The attached Progress Report No. 1 for the vapor extraction program at Station 5353, Westlake and Mercer Streets, is for your review and comment.

Please contact Mr. Steve Perrigo at GeoEngineers (746-5200) or myself at 443-7523 if you have any questions.

Yours very truly,

V. L. CARLSON
Construction Engineer

VLC:ct

Attachment

cc: S. Perrigo, GeoEngineers, Inc.
J. L. Ashlock
A. L. Barone
J. E. Mason

RECEIVED
NOV 27 1990
DEPT. OF ECOLOGY Bellevue

GeoEngineers

MEMORANDUM

TO: Gary Gunderson, Unocal and
Annette Petri, Washington Department of Ecology

FROM: Stephen Perrigo, GeoEngineers SEP

RECEIVED
DAS
DEC 28 1990

DATE: November 26, 1990

FILE: 0161-013-B04

SUBJECT: Historical Summary of Activities at Unocal Station 5353, Located at Westlake & Mercer in Seattle, WA

This memorandum describes the chronology of main events that have taken place as a result of the release of gasoline prior to 1980 at Unocal Station 5353. The station is located at the northeast corner of the intersection of Westlake and Mercer in Seattle, Washington. A response to Ecology's letter of October 26, 1990 is also attached.

CHRONOLOGY OF EVENTS

May 1980
Gasoline leak detected at Service Station 5353. Loss of more than 80,000 gallons of leaded premium gasoline. Seven on-site gasoline recovery wells and an extensive network of monitor wells were installed in June and July.

June 1980
Free product recovery commenced.

October 1980
Recovery well installed in Brace Lumber Yard.

November 1980
Gasoline recovery totals 33,000 gallons, recovery rates decline. Additional monitor wells installed.

December 1980
Gasoline recovery totals 34,500 gallons.

February 1981
Pilot studies of the use of surfactants are conducted by Roger Lowe Associates for possible site application.

January 1982
Alternative cleanup methods including biodegradation, surfactants and venting are evaluated for the site by Harding Lawson Associates.

CHRONOLOGY OF EVENTS - (continued)

October 1982

Gasoline recovery totals 41,900 gallons. Recovery program terminated due to slow recovery.

October 1985

GeoEngineers measures ground water levels, product thickness and vapor concentrations in monitor wells. Free product was found in numerous on-site and off-site wells. Maximum free product thickness was 0.41 feet.

February 1988

GeoEngineers measures ground water levels, product thickness and vapor concentrations in monitor wells. Free product was found in numerous on-site and off-site monitor wells. Maximum product thickness was 0.23 feet.

April 1988

GeoEngineers recommends a subsurface vapor extraction program utilizing components of the existing free product recovery system.

June 1988

Vapor recovery initiated with thermal destruction of vapor effluent (02-90 through 05-90 vapor recovery terminated to evaluate site conditions under non-operational conditions).

February 1990

Well monitoring does not detect the presence of free product in any monitor wells.

May 1990

Well monitoring detects free product in three wells which had no measurable free product in February 1990.

August 1990

Vapor recovery terminated pending review of system operation.

October 1990

Ecology requests site information due to the discovery of subsurface contamination on adjoining property

CHRONOLOGY OF SITE REPORTS

Consultation services and reports of site-related activities have been prepared by the following consulting firms for Unocal:

Roger Lowe Associates, Inc.	(RLAI)
Harding Lawson Associates	(HLA)
GeoEngineers, Inc.	(GEI)

Reports prepared for Unocal are summarized below by date, general subject content and with identification of the consulting firm preparing the report:

Initial Site Characterization and Free Product Recovery Phase: 1980-1982

08/12/80	Initial site characterization report	(RLAI)
10/23/80	Progress Report #1, through #16 (07/23/81)	(RLAI)
08/07/81	Progress Report #17 through #45 (10/27/82)	(HLA)

Study of Alternatives

03/23/81	Degreasing (surfactant) agent evaluation	(RLAI)
01/26/82	Recovery method assessment study	(HLA)

Monitoring Activities

11/14/85	Results of site monitoring (October 1985)	(GEI)

Active Vapor Recovery (Withdrawal & Destruction) at Site: 1988-1990

06/08/88	Vapor extraction system overview	(GEI)
07/27/88	Progress Report #1	(GEI)
10/03/88	Interim Status Report	(GEI)

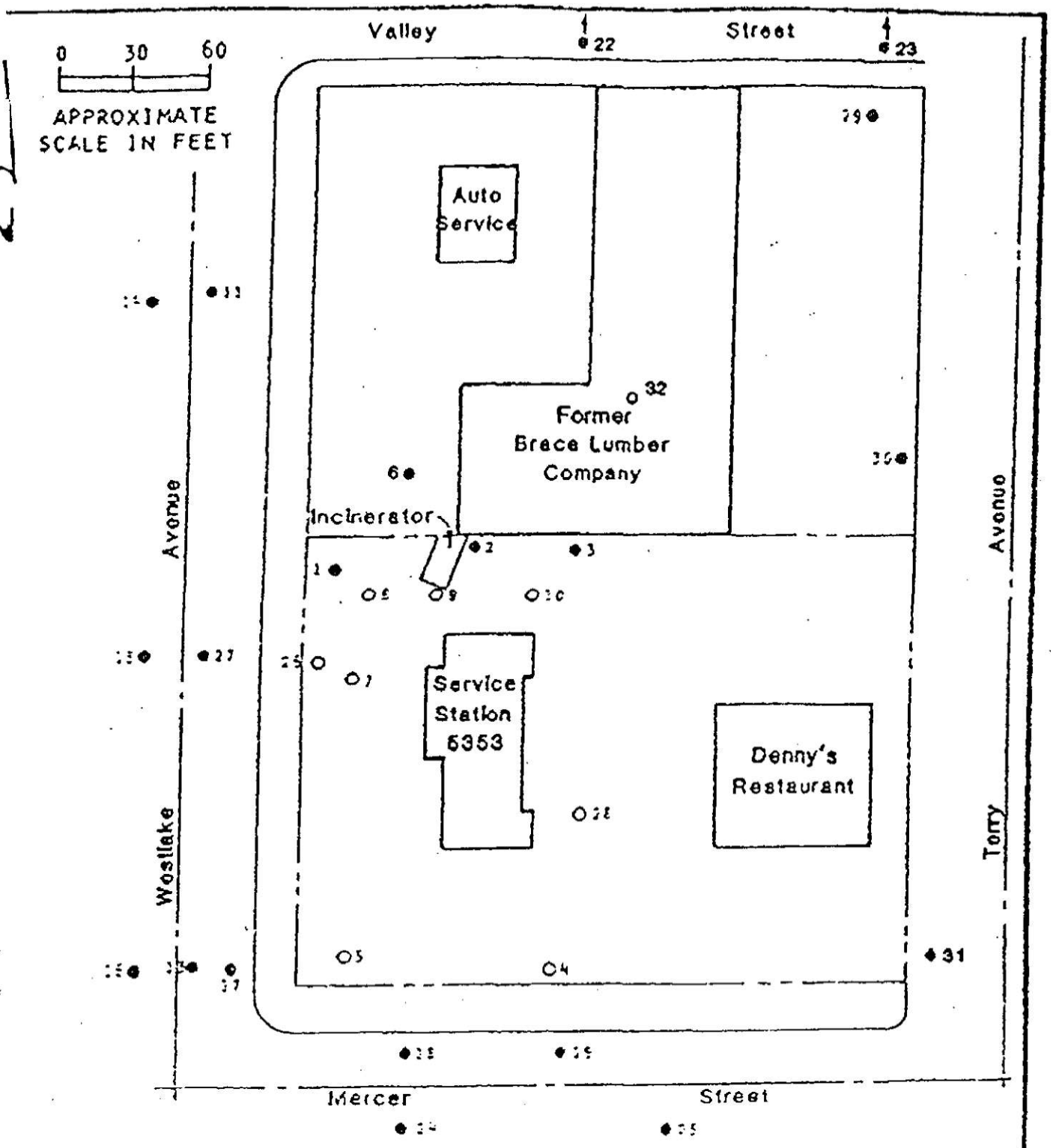


FIG. 60 SITE PLAN

RESPONSE TO ECOLOGY'S LETTER OF OCTOBER 26, 1990

Unocal has provided information to Ecology regarding the past activities and monitoring of the site. Attached are copies of correspondence between Unocal and Ecology that describe the proposal for implementation of the vapor recovery system and reporting on its operation. Ecology's representative during the initial response to the release in 1980 was Mr. Craig Baker of the Northwest Regional Office. We understand that Mr. Baker has recently accepted a transfer within the Department. It may be appropriate at this time for Unocal and GeoEngineers to meet with Ecology so that a new representative of Ecology can be briefed on past, current, and planned actions at the site.

If any of the reports cited on the previous page are required by Ecology for evaluation, please contact Stephen Perrigo at GeoEngineers (746-5200).

The site has not been evaluated relative to the draft cleanup standards contained in the Model Toxics Controls Act Regulation. We recognize that such an evaluation, including testing of soil and ground water conditions, is appropriate at this time. No chemical testing of soil or ground water has been performed at this site. All of the existing monitor wells were installed in 1980. No additional subsurface explorations have occurred since that date.

The on-going site cleanup activities by vapor extraction have been hindered somewhat by the presence of methane gas in the subsurface environment. The methane would not be generated as a result of the gasoline leak and likely represents an off-site source relative to the Unocal site. The source of the methane gas has not been ascertained but it is expected that it is being generated within sawdust fill which is present in the general area. However, the possibility of the methane being derived from leaks from buried natural gas distribution lines has not been ruled out. The concentrations of methane gas measured on and around the site exceed Ecology's current reporting criteria which are outlined in Ecology's policy document POL 102 (May 25, 1990). Unocal has directed GeoEngineers to provide Ecology with data regarding subsurface methane gas which is gathered as part of our studies and cleanup activities at the Station 5353 site.

Unocal Refining & Marketing Division
Unocal Corporation
3131 Elliott Avenue, P.O. Box 76
Seattle, Washington 98111
Telephone (206) 281-7866

GeoEngineers

UNOCAL 76

JUN 14 1988
Routing
File 161-13

June 13, 1988

Mr. Craig S. Baker
Washington Dept. of Ecology
Northwest Regional Office
4350 - 150th Avenue Northeast
Redmond, Washington 98052-5301

Dear Mr. Baker:

Re: <u>SERVICE STATION 5353</u>
Remedial Operations

UNOCAL is presently planning to resume remedial operations at the site of a leak of gasoline from our Service Station 5353 at Westlake and Mercer Street in Seattle, Washington. The spill occurred prior to May, 1980. Your department was involved at that time. From 1980 through October, 1982 a recovery system was able to recover about 41,000 gallons of fuel. Recovery efforts were terminated in 1982 with Washington Department of Ecology's concurrence.

As we all know, environmental standards have changed considerably since 1982. Based on UNOCAL's current corporate policies, we feel that it is necessary to return to the site and implement further remedial measures. We plan to install and operate a vapor extraction/incineration system to remove and treat hydrocarbon vapors that are present in the soil beneath the site. The duration of the vapor extraction program is not known at this time, but we are tentatively planning on operating such a system for up to two years.

We have contacted GeoEngineers, Inc., to assist with the design, operation and monitoring of the vapor recovery system. Attached to this letter is a brief overview of the design and operation of the system planned for this site. We expect to begin system operation during mid to late June.

We will keep Ecology informed of the operation and effectiveness of this sytem. Regular progress reports submitted by GeoEngineers will be forwarded to Ecology.

APPENDIX B

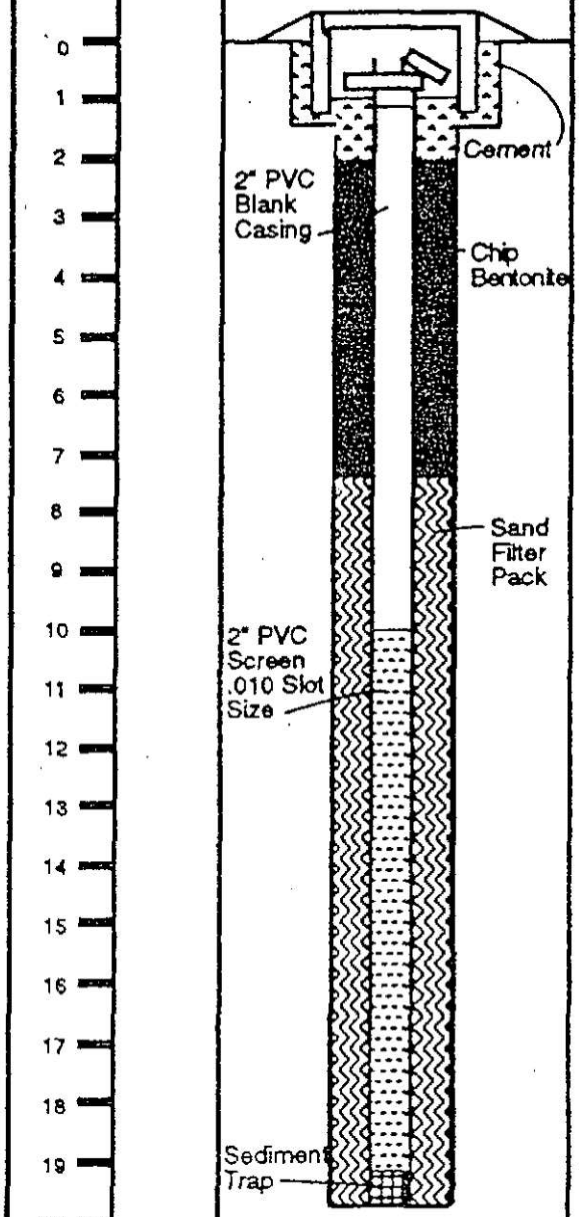
Borehole Logs and Monitoring Well Construction Details

BORING LOG

SCS ENGINEERS
Environmental Consultants
2950 Northup Way
Bellevue, Wa 98004
(206) 822-5800
FAX (206) 889-2257

PROJECT: CITY OF SEATTLE
LOCATION: WESTLAKE
JOB NUMBER: 0489021.02
GEOLOGIST/ENGINEER: D. VENCHIARUTTI
DRILLER: HOKKAIDO
DRILL RIG: MOBIL B - 61
DRILLING METHOD: HOLLOW STEM AUGER

HOLE/WELL #: MW-1
DIAMETER: 6 1/4" I.D.
TOTAL DEPTH: 19' 10"
DATE STARTED: 1/28/91
DATE COMPLETED: 1 / 28 / 91
SAMPLING DEVICE: SPLIT SPOON
PAGE: 1 OF: 1

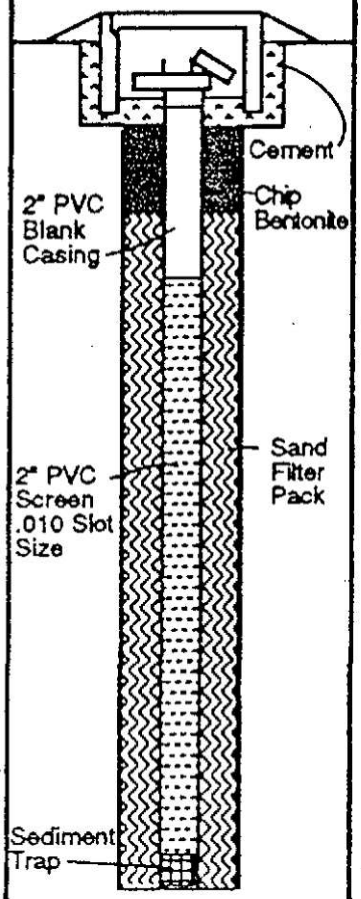


DEPTH (FEET)	SAMPLE	SAMPLE #	BLOW COUNTS/ 18"	USCS SYMBOL	DESCRIPTION
0					Asphalt
2				Gm	Gravel fill, 1/2" - 1" gravel, brown silt.
5		19630 19631	14	Gm	Sandy gravel, 1/2" - 1" gravel, silty brown soil, some grey clay. HNu 0 ppm.
10		19632 19633	11	SC	Silty grey clay, with med. coarse sand. HNu 0 ppm.
12					Water level
13				SC	Sand, med. coarse, silty with grey clay. Wet. HNu 0 ppm.
17				SC	Medium coarse sand with some clay, grey, plastic. HNu 0 ppm.
19		19634 19635		OH	Grey plastic clay. Decomposed wood and peat. HNu 0 ppm.

BORING LOG

SCS ENGINEERS
Environmental Consultants
2950 Northup Way
Bellevue, Wa 98004
(206) 822-5600
FAX (206) 889-2267

PROJECT: CITY OF SEATTLE
HOLE/WELL #: MW-2
LOCATION: WESTLAKE
DIAMETER: 6 1/4" I.D.
JOB NUMBER: 0489021.02
TOTAL DEPTH: 14' 4"
GEOLOGIST/ENGINEER: D. VENCHIARUTTI
DATE STARTED: 1/30/91
DRILLER: HOKKAIDO
DATE COMPLETED: 1/30/91
DRILL RIG: MOBIL B - 61
SAMPLING DEVICE: SPLIT SPOON
DRILLING METHOD: HOLLOW STEM AUGER
PAGE: 1 OF: 1



DEPTH (FEET)	SAMPLE	SAMPLE #	BLOW COUNTS/ 18"	USCS SYMBOL	DESCRIPTION
0					Asphalt
1				Gm	Silty gravel soil, cobbles to 1". Some organic debris.
2					
3					
4					
5		19284 19285	30	Gm	Dark green silt, with cobbles and assorted debris. Dry. HNu 0 ppm
6					
7					Water level
8		19286 19287	35	Sm	Wet, clay rich green silt with some coarse sand. Concrete debris occur.
9					
10					
11					
12					
13					
14		19288	25	SC	Concrete debris still present. Less sandy, more clay rich, plastic. Very wet. HNu 0 ppm
15					
16					
17					
18					
19					
20					

BORING LOG

SCS ENGINEERS
Environmental Consultants
2950 Northup Way
Bellevue, Wa 98004
(206) 822-5800
FAX (206) 889-2267

PROJECT: CITY OF SEATTLE — HOLE/WELL #: MW-3
LOCATION: WESTLAKE — DIAMETER: 6 1/4" I.D.
JOB NUMBER: 0489021.02 — TOTAL DEPTH: 17'
GEOLOGIST/ENGINEER: D. VENCHIARUTTI — DATE STARTED: 1/29/91
DRILLER: HOKKAIDO — DATE COMPLETED: 1/29/91
DRILL RIG: MOBIL B - 61 — SAMPLING DEVICE: SPLIT SPOON
DRILLING METHOD: HOLLOW STEM AUGER — PAGE: 1 OF: 1

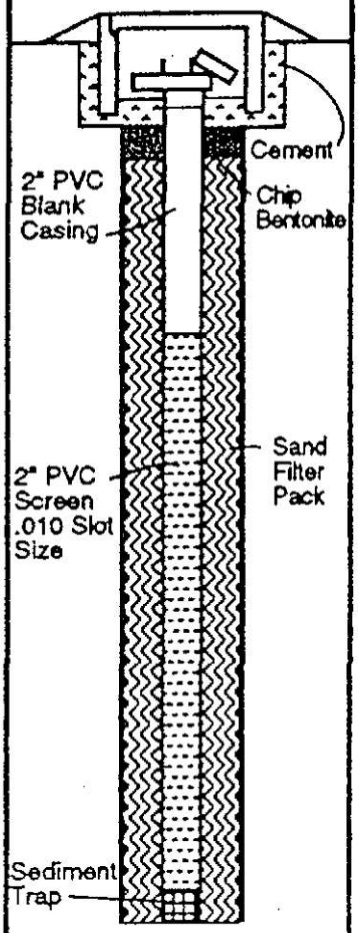
DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS/ 18"	USCS SYMBOL	DESCRIPTION
0					OL	Grass; on brown clayish silt. 10% gravel to 1".
1						
2		Cement				
3		2" PVC Blank Casing				
4		Chip Bentonite				
5			19641 19642	17	OL	Green brown silt with some gray clay. Wood chips. 10% pebbles to 1". HNu 0 ppm.
6						
7		Sand Filter Pack				
8		2" PVC Screen .010 Slot Size				Green-grey plastic clay, with minor silt. Wet. HNu 0 ppm.
9						
10			19643 19644	11	OH	Water level
11						
12						
13						
14						
15						
16						
17		Sediment Trap	19645	19	OH	Wet green, gray plastic clay. HNu 0 ppm.
18						
19						
20						

BORING LOG

SCS ENGINEERS
Environmental Consultants
2950 Northup Way
Bellevue, Wa 98004
(206) 822-5800
FAX (206) 889-2267

PROJECT: CITY OF SEATTLE
LOCATION: WESTLAKE
JOB NUMBER: 0489021.02
GEOLOGIST/ENGINEER: D. VENCHIARUTTI
DRILLER: HOKKAIDO
DRILL RIG: MOBIL B - 61
DRILLING METHOD: HOLLOW STEM AUGER

HOLE/WELL #: MW-4
DIAMETER: 6 1/4" I.D.
TOTAL DEPTH: 15'
DATE STARTED: 1/29/91
DATE COMPLETED: 1 / 29 / 91
SAMPLING DEVICE: SPLIT SPOON
PAGE: 1 OF: 1



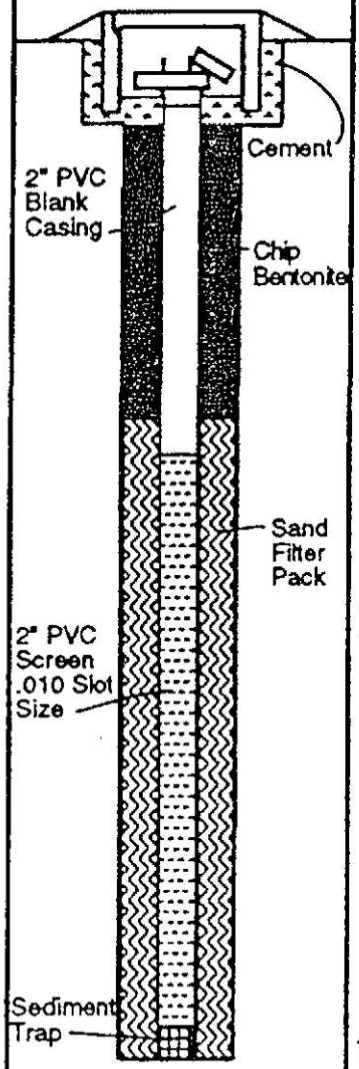
DEPTH (FEET)	SAMPLE	SAMPLE #	BLOW COUNTS/ 18"	USCS SYMBOL	DESCRIPTION
0					Concrete
1				GC	Grey silty clay, some gravel. Petro hydrocarbon vapors. HNu 20 - 25 ppm.
2					
3					
4					
5		19636	14	GC	Gravel and cobbles to 6", with grey silty clay. Strong gas odor. HNu 50 -100 ppm.
6					
7					
8				SC	Water level. Grey, silty medium sand. Wet. HNu 300 ppm.
9					
10		19637 19638	6		
11					
12					
13					
14					
15		19639 19640	4	OH	Plastic, grey silty clay. Some decomposed wood. Wet. HNu<5 ppm.
16					
17					
18					
19					
20					

BORING LOG

SCS ENGINEERS
Environmental Consultants
2950 Northup Way
Bellevue, Wa 98004
(206) 822-5800
FAX (206) 889-2267

PROJECT: CITY OF SEATTLE
LOCATION: WESTLAKE
JOB NUMBER: 0489021.02
GEOLOGIST/ENGINEER: D. VENCHIARUTTI
DRILLER: HOKKAIDO
DRILL RIG: MOBIL B - 61
DRILLING METHOD: HOLLOW STEM AUGER

HOLE/WELL #: MW-5
DIAMETER: 6 1/4" I.D.
TOTAL DEPTH: 17' 4"
DATE STARTED: 1/31/91
DATE COMPLETED: 1/31/91
SAMPLING DEVICE: SPLIT SPOON
PAGE: 1 OF: 1



DEPTH (FEET)	SAMPLE	SAMPLE #	BLOW COUNTS/ 18"	USCS SYMBOL	DESCRIPTION
0					Asphalt
1–4				CL	Green clay rich fill. Sand, silt and gravel mix. HNu 10 ppm.
5–8		19289 19290	38	OH	Green-grey clay, very plastic. Some organic debris. Dry, some petro hydrocarbon vapors. HNu 5 - 7 ppm.
9–11		19291 19292	8	OH	Green/grey plastic clay. Some sand. Organics present. Dry. HNu 250 ppm. Water level
12–16					
17		19294	11	OH	Very wet. Residual sand, with clay washed away. Smell of petroleum hydrocarbons. Wood debris common.
18–20					

BORING LOG

SCS ENGINEERS
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2950 Northup Way
Bellevue, Wa 98004
(206) 822-5800
FAX (206) 889-2267

PROJECT: CITY OF SEATTLE
LOCATION: WESTLAKE
JOB NUMBER: 0489021.02
GEOLOGIST/ENGINEER: D. VENCHIARUTTI
DRILLER: HOKKAIDO
DRILL RIG: MOBIL B - 61
DRILLING METHOD: HOLLOW STEM AUGER

HOLE/WELL #: BH-4
DIAMETER: 6 1/4" I.D.
TOTAL DEPTH: 8'
DATE STARTED: 1 /30 / 91
DATE COMPLETED: 1 /230 / 91
SAMPLING DEVICE: SPLIT SPOON
PAGE: 1 OF: 1

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS/ 18"	USCS SYMBOL	DESCRIPTION
0						Asphalt
1					Gm	Brown silty soil with 1" - 2" gravel.
2						
3						
4						
5			19279 19280	25	OL	Green clay rich silt with cobbles and some organics. HNu 0 ppm.
6						
7						
8			19281 19282	29	OL	▽ Water level Same as above, but with more sandy silt, less clay. Some organics. HNu 0 ppm.
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						T.D. = 8'

APPENDIX C

Determination of Groundwater Flow Parameters

APPENDIX C

DETERMINATION OF GROUNDWATER FLOW PARAMETERS

Groundwater Flow Velocity

The average linear velocity of groundwater flow is generally defined as:

$$V = \frac{K\,(dh/dl)}{n}$$

where,

V = average linear velocity in unit length per unit time

k = hydraulic conductivity (permeability) in unit length per unit time

dh/dl = hydraulic gradient, dimensionless

n = porosity

The average linear velocity of flow in the water table aquifer was calculated across the site using hydraulic conductivity (k), hydraulic gradient (ft/ft), and porosity (n). The rate of groundwater movement to the north was estimated to range from less than 1 foot per year to 58 feet per year at monitoring wells MW-1, MW-3, MW-4 and MW-5. A low hydraulic gradient (0.005 ft/ft) at the site appears to be the limiting factor in the rate of groundwater flow. A higher gradient (0.025 ft/ft) between wells MW-2 and MW-3 resulted in an estimated groundwater flow rate ranging from about 1 to 220 feet per year to the northeast in this area of the site.

Table C-1 provides a summary of groundwater velocities calculated at each monitoring well site. The variables used in the calculation of groundwater flow at the site are discussed below.

Hydraulic Conductivity

Hydraulic conductivity refers to the ability of water to move through a porous material. The hydraulic conductivity of the water table aquifer materials at the Westlake Site was estimated to range from 3.6×10^{-5} ft/min to 1.0×10^{-2} ft/min. This range in values is typical for fill materials. It is also common to have a variation in results such as this when analyzing bail or slug test data.

Hydraulic conductivity of a formation may be determined by several methods, depending upon the aquifer type, aquifer response, and design

and spacing of test wells. Time recovery data was analyzed at the Westlake Site using the Ferris and Knowles method (McWhorter and Sunada, 1977) and the Horslev Method (Freeze and Cherry, 1979). An analysis of the data for the determination of hydraulic conductivity values by both procedures is provided below.

Hydraulic Gradient

The hydraulic gradient (dh/dl) of a water bearing formation is calculated by determining the difference in water level elevations (dh) at two points and the distance (dl) between these two points.

The average hydraulic gradient of the water table aquifer during March 1991 was calculated to be 0.005 ft/ft across the site. The predominant flow direction is towards the north, from the Westlake site. A gradient of 0.025 ft/ft was calculated between wells MW-2 and MW-3, which indicates a northeasterly component of flow northwest of the site.

Porosity

The porosity of a formation is the ratio of the volume of the interstices or void space to the total bulk volume. Porosity is influenced by particle shape, degree of compaction and cementation, and particle size distribution. In general, poorly sorted gravels, sands, and silts have lower porosities than well sorted deposits.

An estimated porosity of 45% was assumed in the groundwater velocity equation discussed previously. This porosity is representative of observed subsurface materials occurring at the site based on porosity values provided for sand, silt, and clay.

TABLE C-1. SUMMARY OF GROUNDWATER VELOCITY ESTIMATES

LOCATION	CONDUCTIVITY (ft/min)	GRADIENT (1) (ft/ft)	POROSITY	VELOCITY ft/min	VELOCITY ft/yr
MW-1	4.5×10^{-5} (2)	0.005	0.45	5.0×10^{-7}	0.3
	9.0×10^{-5} (3)	0.005	0.45	1.0×10^{-6}	0.5
MW-2	3.6×10^{-5} (2)	0.025	0.45	2.0×10^{-6}	1
	7.5×10^{-3} (2)	0.025	0.45	4.2×10^{-4}	220
MW-3	7.5×10^{-3} (2)	0.005	0.45	8.3×10^{-5}	43
	1.9×10^{-3} (3)	0.005	0.45	2.1×10^{-5}	11
MW-5	3.6×10^{-5} (2)	0.005	0.45	4.0×10^{-7}	0.2
	5.2×10^{-5} (3)	0.005	0.45	5.8×10^{-7}	0.3
MW-6	1.0×10^{-2} (4)	0.005	0.45	1.1×10^{-4}	58

Notes:
1 - Average hydraulic gradient from MW-1 to MW-3 is 0.005 ft/ft. Hydraulic gradient from MW-2 to MW-3 is 0.025 ft/ft.

2 - Value determined using Ferris and Knowles Methodology; Hydraulic conductivity values assumed for MW-2 are based on values determined for MW-3 and MW-5.

3 - Value determined from Hvorslev methodology.

4 - Estimated value based on higher permeable materials.

TWO METHODS OF DETERMINING HYDRAULIC CONDUCTIVITY

A) HVORSLEV METHOD (1951)

$$K = \frac{r2 \ln (L/r)}{2L \ To}$$ (Freeze & Cherry, 1979)

where:
- K = hydraulic conductivity
- r = radius of well casing
- L = length of screen
- To = time corresponding to normalized recovery of 0.37
- H = water level prior to test
- Ho = water level at start of test
- h = water level during test at time (t)

B) FERRIS AND KNOWLES METHOD (1963)

$$T = \frac{v}{(4)\ (3.14)\ (t)\ (-s)}$$

where:
- T = transmissivity
- v = volume of water removed for test
- t = time
- s = recovery at time (t)

then:

$$K = \frac{T}{\text{Saturation thickness}}$$

HYDRAULIC CONDUCTIVITY VALUES
CALCULATED USING TWO METHODS

WELL #	FERRIS AND KNOWLES METHOD	HVORSLEV METHOD
MW-1	4.5×10^{-5} ft/min	9.04×10^{-5} ft/min
MW-3	7.5×10^{-3} ft/min	1.87×10^{-3} ft/min
MW-5	3.57×10^{-5} ft/min	5.23×10^{-5} ft/min

DETERMINATION OF HYDRAULIC CONDUCTIVITY AT MW-1

Hvorslev Method, 1951

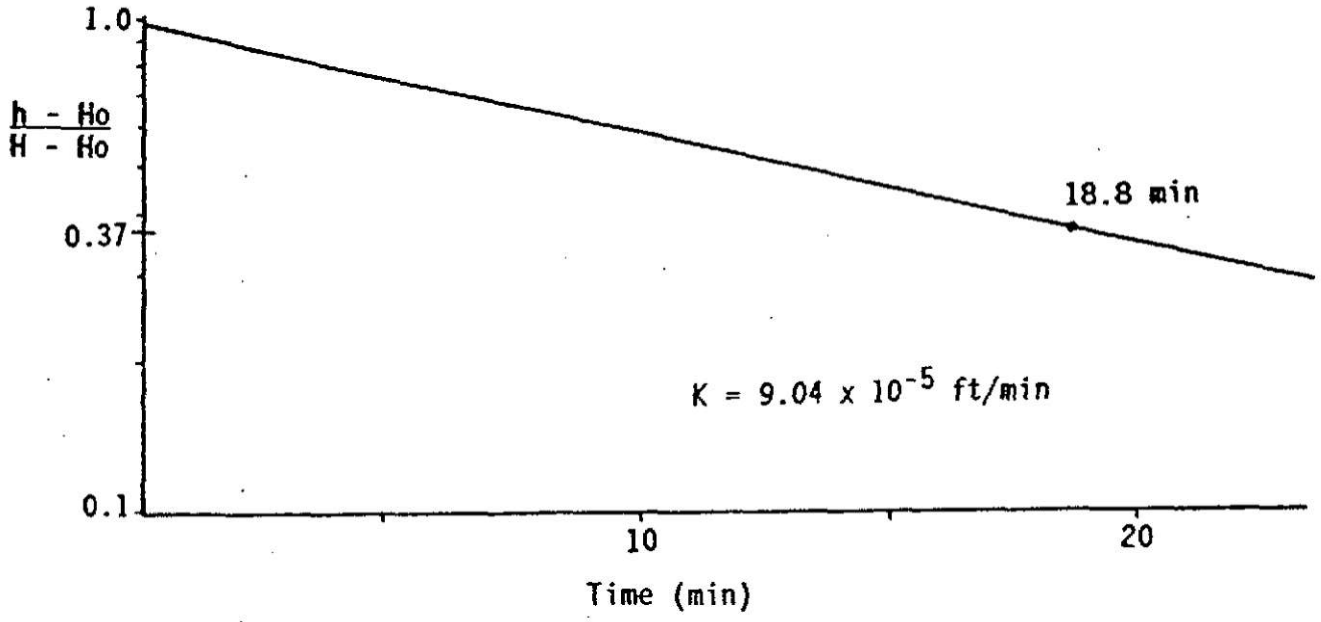
DATA:

Time (min)	h (ft)	h - Ho (ft)	$\frac{h - Ho}{H - Ho}$
0.0	17.82	6.24	1.0
0.5	17.08	5.50	0.88
1.0	16.90	5.32	0.85
1.5	16.78	5.20	0.83
2.0	16.65	5.07	0.81
2.5	16.54	4.98	0.79
3.0	16.42	4.84	0.76
3.5	16.31	4.73	0.75
4.0	16.20	4.62	0.74
4.5	16.12	4.54	0.73
5.0	16.00	4.42	0.71
6.0	15.84	4.26	0.68
7.0	15.64	4.06	0.65
8.0	15.48	3.90	0.62
9.0	15.30	3.72	0.60
11.0	14.89	3.31	0.53
13.0	14.59	3.01	0.48
15.0	14.30	2.72	0.43
20.0	13.76	2.18	0.35

Ho = 11.58 ft

H = 17.82 ft

H - Ho = 6.24 ft



DETERMINATION OF TRANSMISSIVITY AND HYDRAULIC CONDUCTIVITY AT MW-1

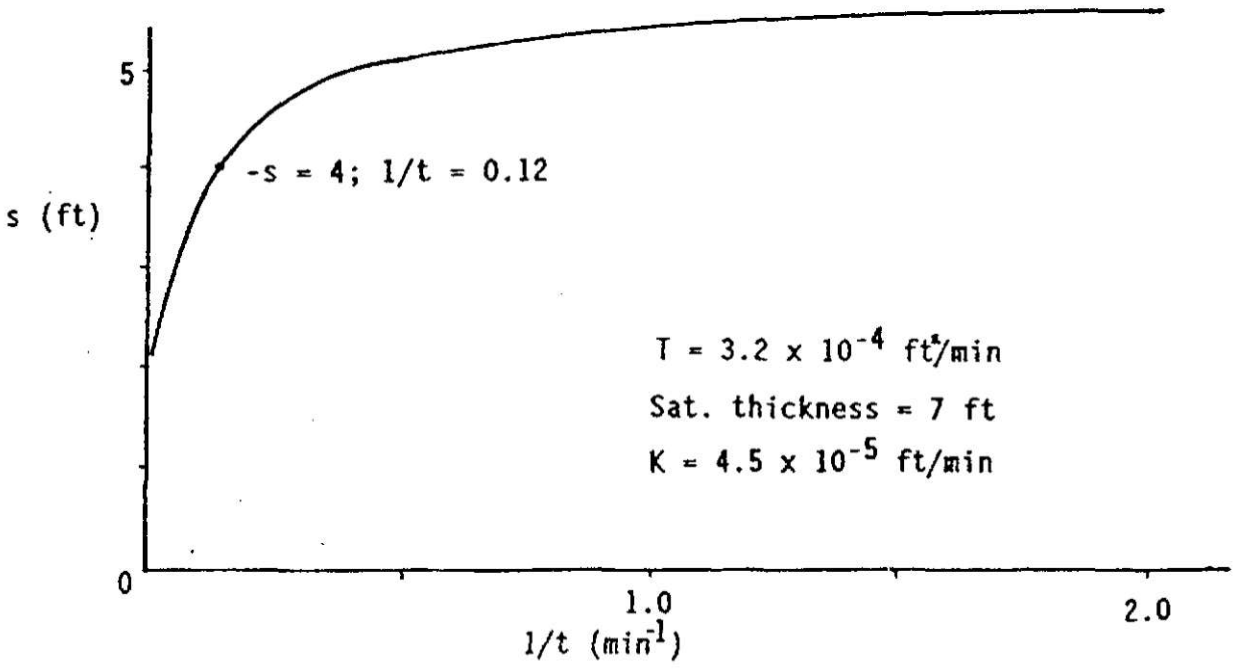
Ferris and Knowles Method, 1963

DATA:

Time (min)	1/t	h (ft)	s (ft)
0.0	0.0	17.82	0.0
0.5	2.0	17.08	5.50
1.0	1.0	16.90	5.32
1.5	0.67	16.78	5.20
2.0	0.5	16.65	5.07
2.5	0.4	16.54	4.98
3.0	0.33	16.42	4.84
3.5	0.28	16.31	4.73
4.0	0.25	16.20	4.62
4.5	0.22	16.12	4.54
5.0	0.20	16.00	4.42
6.0	0.16	15.84	4.26
7.0	0.14	15.64	4.06
8.0	0.13	15.48	3.90
9.0	0.11	15.30	3.72
11.0	0.09	14.89	3.31
13.0	0.07	14.59	3.01
15.0	0.06	14.30	2.72
20.0	0.05	13.76	2.18

h = 17.82 ft at start of test.

v = 0.136 ft^3 removed to conduct test



$T = 3.2 \times 10^{-4}$ ft^2/min

Sat. thickness = 7 ft

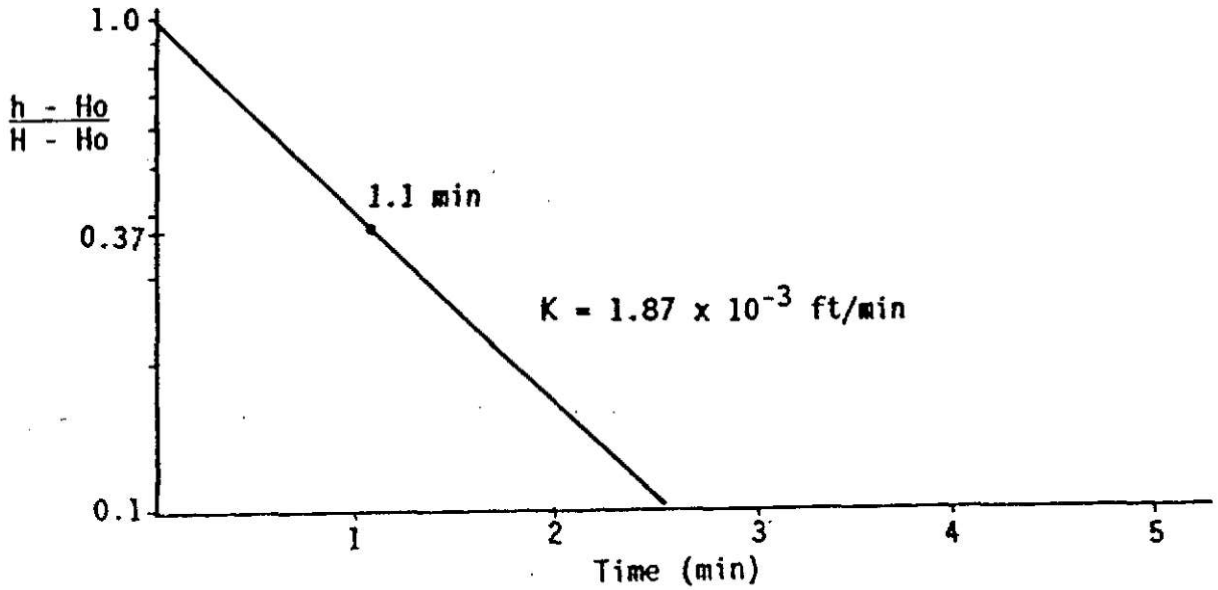
$K = 4.5 \times 10^{-5}$ ft/min

DETERMINATION OF HYDRAULIC CONDUCTIVITY AT MW-3

Hvorslev Method, 1951

DATA:

Time (min)	h (ft)	h - Ho (ft)	$\frac{h - Ho}{H - Ho}$	
0.0	10.96	0.19	1.0	Ho = 10.77 ft
0.5	10.88	0.11	0.58	
1.0	10.85	0.08	0.42	H = 10.96 ft
1.5	10.82	0.05	0.26	
2.0	10.80	0.03	0.16	H - Ho = 0.19 ft
2.5	10.79	0.02	0.11	
3.0	10.79	0.02	0.11	
4.0	10.78	0.01	0.05	



DETERMINATION OF TRANSMISSIVITY AND HYDRAULIC CONDUCTIVITY AT MW-3

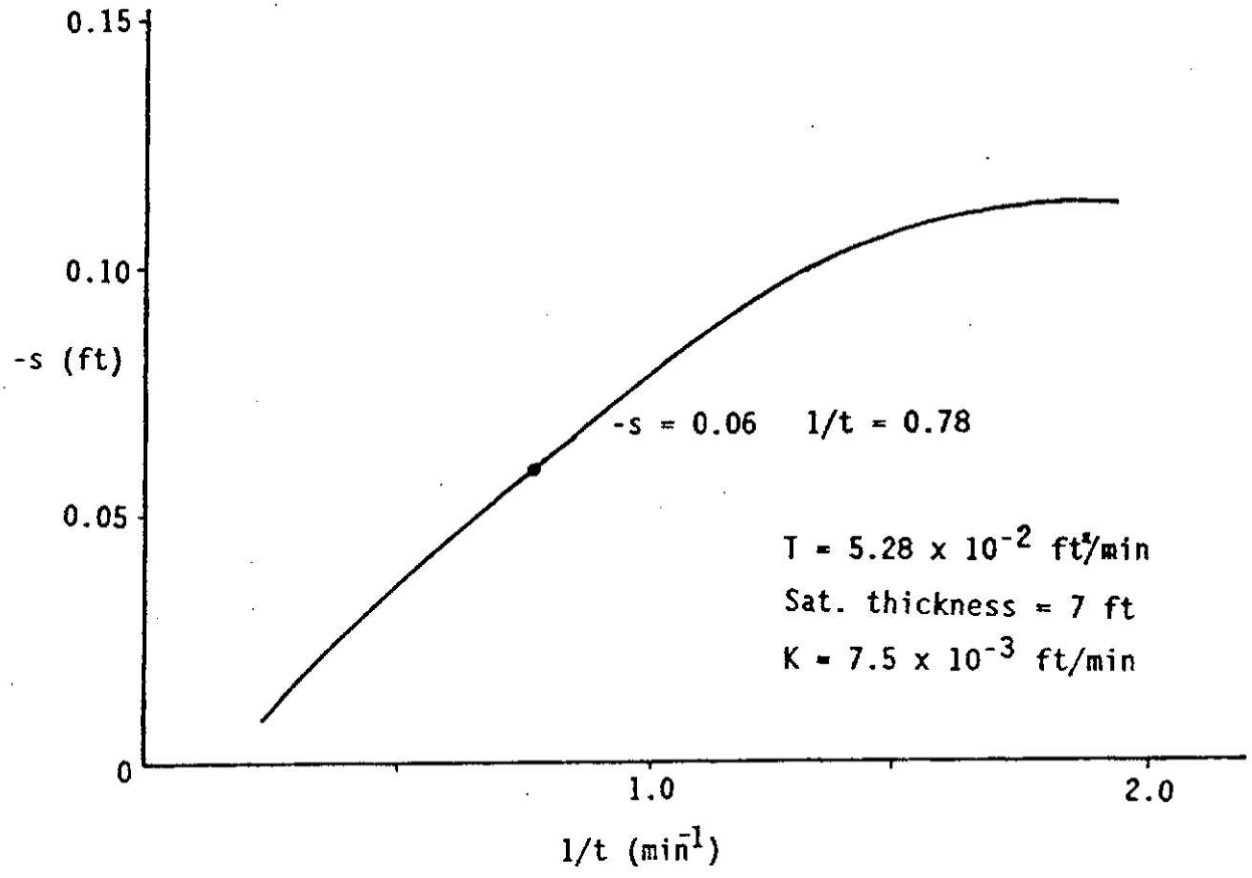
Ferris and Knowles Method, 1963

DATA:

Time (min)	1/t	h (ft)	s (ft)
0.0	0.0	10.96	0.0
0.5	2.0	10.88	0.11
1.0	1.0	10.85	0.08
1.5	0.67	10.82	0.05
2.0	0.5	10.80	0.03
2.5	0.4	10.79	0.02
3.0	0.33	10.79	0.02
4.0	0.25	10.78	0.01

h = 10.96 ft at start of test

v = 0.051 ft^3 removed to conduct test



DETERMINATION OF TRANSMISSIVITY AND HYDRAULIC CONDUCTIVITY AT MW-4

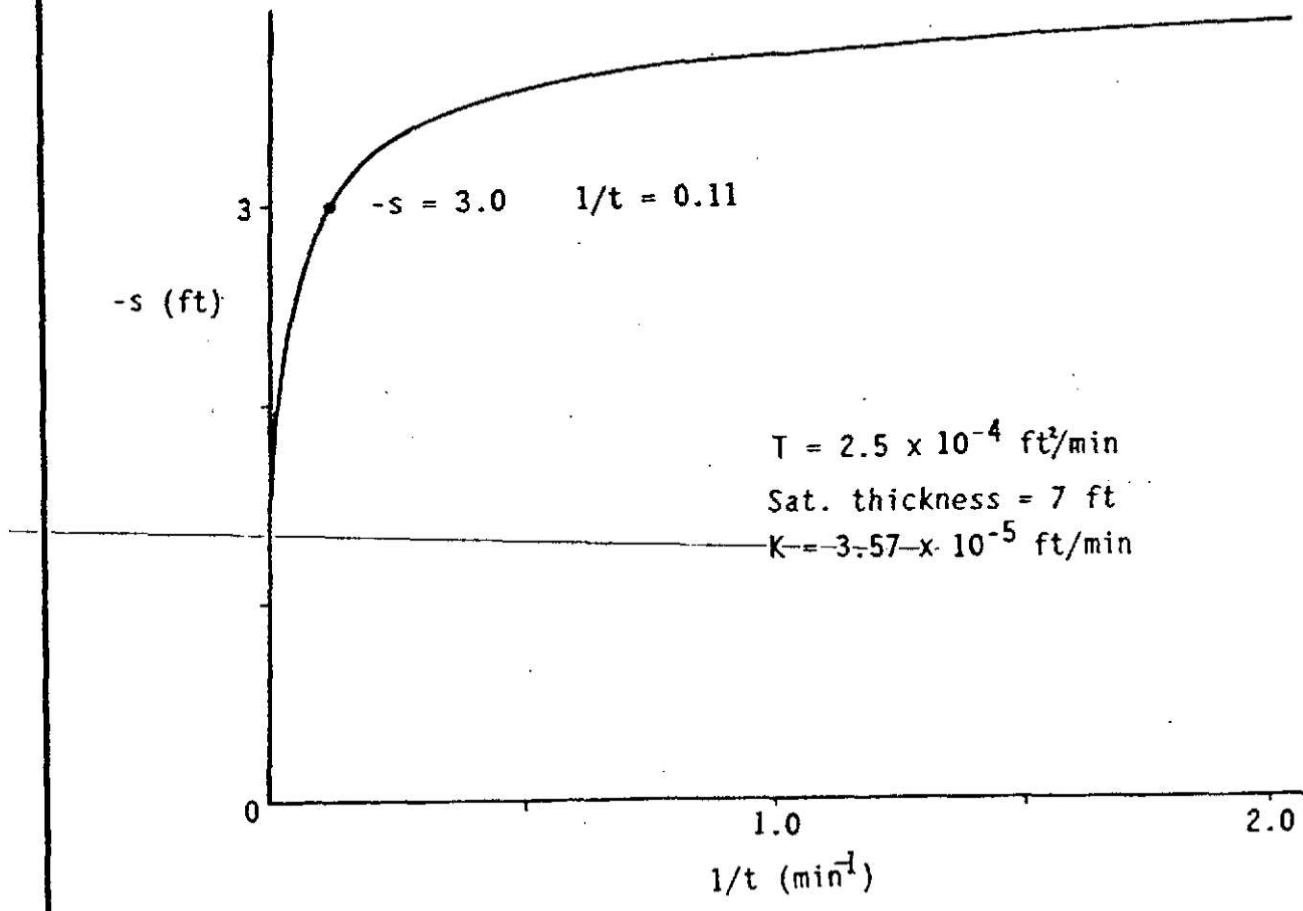
Ferris and Knowles Method, 1963

DATA:

Time (min)	1/t	h (ft)	s (ft)
0.0	0.0	12.50	0.0
0.5	2.0	12.12	3.87
1.0	1.0	12.27	3.72
1.5	0.67	12.21	3.66
2.0	0.5	12.14	3.59
2.5	0.4	12.03	3.48
3.0	0.33	12.04	3.47
4.0	0.25	11.90	3.35
5.0	0.20	11.82	3.27
6.0	0.16	11.74	3.19
7.0	0.14	11.65	3.10
8.0	0.13	11.58	3.03
10.5	0.09	11.40	2.85
15.0	0.06	11.05	2.50

h = 12.50 ft at start of test

v = 0.086 ft^3 removed to conduct test

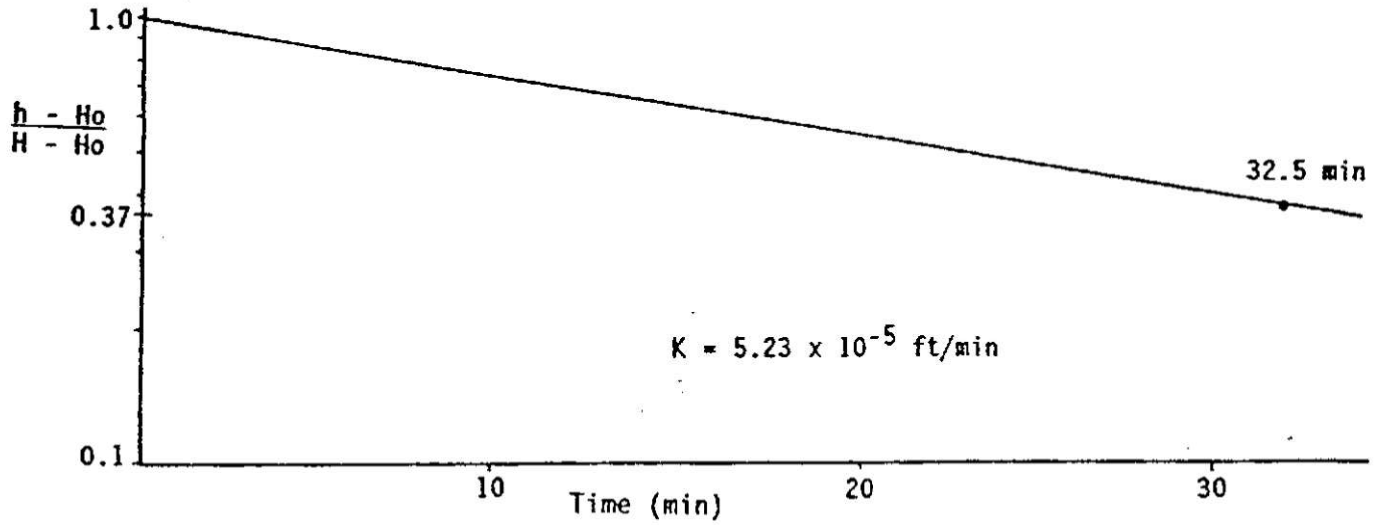


DETERMINATION OF HYDRAULIC CONDUCTIVITY AT MW-4

Hvorslev Method, 1951

DATA:

Time (min)	h (ft)	h - Ho (ft)	$\frac{h - Ho}{H - Ho}$	
0.0	12.50	3.95	1.0	Ho = 8.55 ft
0.5	12.12	3.87	0.98	
1.0	12.27	3.72	0.94	H = 12.50 ft
1.5	12.21	3.66	0.93	
2.0	12.14	3.59	0.91	H - Ho = 3.95 ft
2.5	12.03	3.48	0.88	
3.0	12.04	3.47	0.87	
4.0	11.90	3.35	0.85	
5.0	11.82	3.27	0.82	
6.0	11.74	3.19	0.81	
7.0	11.65	3.10	0.78	
8.0	11.58	3.03	0.77	
10.5	11.40	2.85	0.72	
15.0	11.05	2.50	0.63	



APPENDIX D

MTCA Cleanup Levels for Soil and Groundwater

(2) Method A cleanup levels.

(a) Where the ground water is a current or potential future source of drinking water, method A cleanup levels shall be at least as stringent as all of the following:

(i) Concentrations listed in Table 1:

Table 1

Method A Cleanup Levels - Ground Water [a]

Hazardous Substance	CAS Number	Cleanup Level
Arsenic	7440-38-2	5.0 ug/liter [b]
Benzene	71-43-2	5.0 ug/liter [c]
Cadmium	7440-43-9	5.0 ug/liter [d]
Chromium (Total)	7440-47-3	50.0 ug/liter [e]
DDT	50-29-3	0.1 ug/liter [f]
1,2 Dichloroethane	107-06-2	5.0 ug/liter [g]
Ethylbenzene	100-41-4	30.0 ug/liter [h]
Ethylene dibromide	106-93-4	0.01 ug/liter [i]
Gross Alpha Particle Activity		15.0 pCi/liter [j]
Gross Beta Particle Activity		4.0 mrem/yr [k]
Lead	7439-92-1	5.0 ug/liter [l]
Lindane	58-89-9	0.2 ug/liter [m]
Methylene chloride	75-09-2	5.0 ug/liter [n]
Mercury	7439-97-6	2.0 ug/liter [o]
PAHs (carcinogenic)		0.1 ug/liter [p]
PCB mixtures		0.1 ug/liter [q]
Radium 226 and 228		5.0 pCi/liter [r]
Radium 226		3.0 pCi/liter [s]
Tetrachloroethylene	127-18-4	5.0 ug/liter [t]
Toluene	108-88-3	40.0 ug/liter [u]
Total Petroleum Hydrocarbons		1000.0 ug/liter [v]
1,1,1 Trichloroethane	71-55-6	200.0 ug/liter [w]
Trichloroethylene	79-01-5	5.0 ug/liter [x]
Vinyl chloride	75-01-4	0.2 ug/liter [y]
Xylenes	1330-20-7	20.0 ug/liter [z]

[a] Caution on misusing method A tables. Method A tables have been developed for specific purposes. They are intended to provide conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in these tables should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter.

[b] Arsenic. Cleanup level based on background concentrations for state of Washington.

[c] Benzene. Cleanup level based on applicable state and federal law.

(e) Soil cleanup levels shall be established at concentrations which do not directly or indirectly cause violations of ground water, surface water, sediment, or air cleanup standards established under this chapter or applicable state and federal laws.

(2) Method A cleanup levels.

(a) Method A cleanup levels shall be at least as stringent as all of the following:

(i) Concentrations in the following table; and

Table 2

Method A Cleanup Levels - Soil [a]

Hazardous Substance	CAS Number	Cleanup Level
Arsenic	7440-38-2	20.0 mg/kg [b]
Benzene	71-43-2	0.5 mg/kg [c]
Cadmium	7440-43-9	2.0 mg/kg [d]
Chromium	7440-47-3	100.0 mg/kg [e]
DDT	50-29-3	1.0 mg/kg [f]
Ethylbenzene	100-41-4	20.0 mg/kg [g]
Ethylene dibromide	106-93-4	0.001 mg/kg [h]
Lead	7439-92-1	250.0 mg/kg [i]
Lindane	58-89-9	1.0 mg/kg [j]
Methylene chloride	75-09-2	0.5 mg/kg [k]
Mercury (inorganic)	7439-97-6	1.0 mg/kg [l]
PAHs (carcinogenic)		1.0 mg/kg [m]
PCB Mixtures		1.0 mg/kg [n]
Tetrachloroethylene	127-18-4	0.5 mg/kg [o]
Toluene	108-88-3	40.0 mg/kg [p]
TPH (gasoline)		100.0 mg/kg [q]
TPH (diesel)		200.0 mg/kg [r]
TPH (other)		200.0 mg/kg [s]
1,1,1 Trichloroethane	71-55-6	20.0 mg/kg [t]
Trichloroethylene	79-01-5	0.5 mg/kg [u]
Xylenes	1330-20-7	20.0 mg/kg [v]

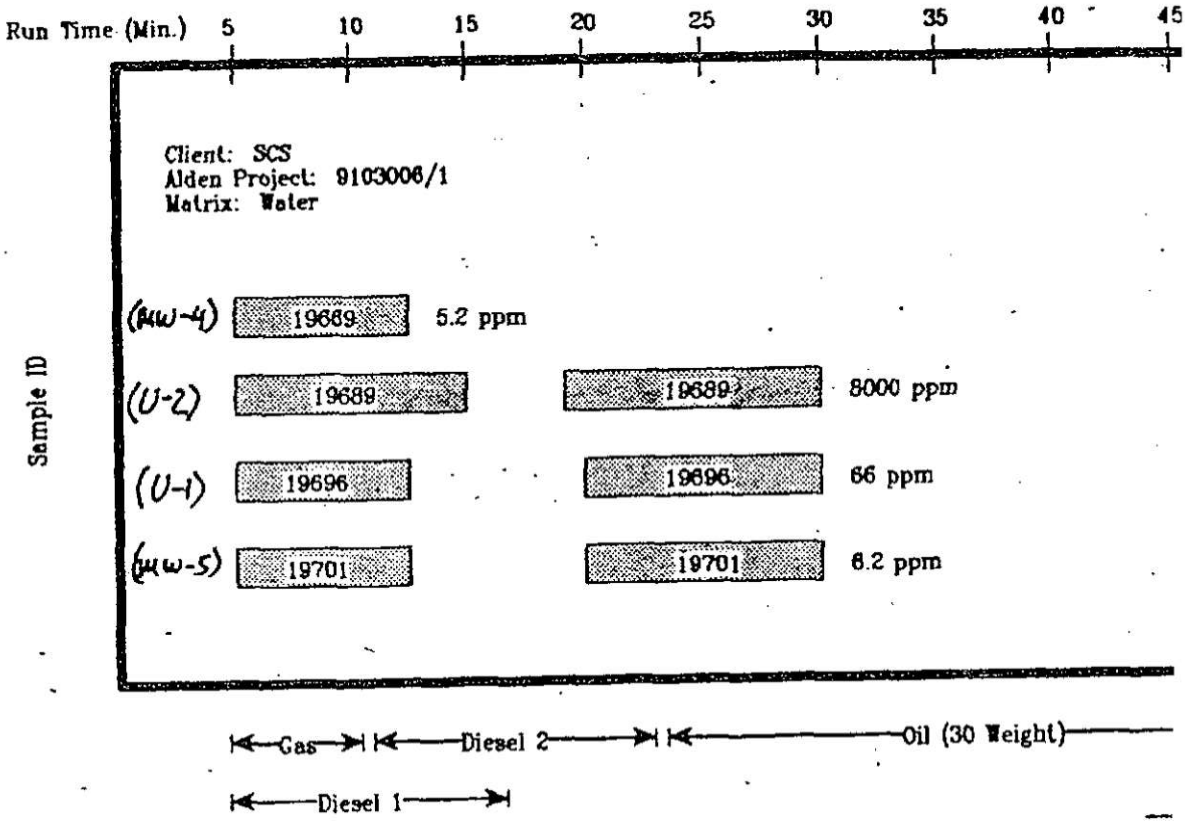
[a] Caution on misusing method A tables. Method A tables have been developed for specific purposes. They are intended to provide conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in these tables should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter.

[b] Arsenic. Cleanup level based on background concentrations in the state of Washington.

[c] Benzene. Cleanup level based on protection of ground water.

Alden Analytical
Laboratories, Inc.

TPH (8015-Mod) GRAPHICAL SUMMARY*



Elution Ranges: Gasoline 5-10 minutes
Diesel 1 5-17 minutes
Diesel 2 10-22 minutes
Oil (30W) 22-50 minutes

*Note: This graphical representation is inte
measurement of the elution range of
sample versus known petroleum star

ENVIRONMENTAL LABORATORY SAMPLE TRACKING SHEET

ten Analytical
ratories, Inc.

SAMPLE ID: 19696. (U-1)
LAB I.D. 6696

ANALYSIS: ~~Total Extractable Petroleum Hydrocarbons~~ WATER
SAMPLED:
RECEIVED:

COMMENTS:

COLUMN	RTX-5		
DATE	3/18/91		
DILUTION	1:10		
WORKER	EB/CA		
LAB I.D.			

WGT: 920 ml. (LINE 1)	FINAL EXTRACT VOL: 10 ml. (LINE 2)	DATE PREPD: 3/13/91	DATE ANAL: 3/18/91

mg/L

VOL	ANALYTE(S)	FINAL	
35	Total Extractable Petroleum Hydrocarbons 66	66	
12	Elution Range >12 min. <18 min		
	>20 min. <30 min		

MAXIMA 820 CUSTOM REPORT

Printed: 19-MAR-1991 9:34:48

SAMPLE: 6696 1:10
U-1
86 in Method: Total Extractable Hydrocarbons
Acquired: 18-MAR-1991 13:23
Rate: 5.0 points/sec
Duration: 45.000 minutes
Operator:

Type: UNKN
Instrument: FID/NPD
Filename: T0318-6
Index: Disk
Injection Volume: 1.0
Amount: 1.000

DETECTOR: detector 1

PK#	Retention Time (minutes)	Peak Start (minutes)	Peak End (minutes)	Area
1	1.430	0.997	3.920	>15966127
2	4.003	3.920	4.977	2573496
3	4.980	4.977	44.997	14831701
TOTAL				17405198

$17405198 - 2592974 = 14812224$

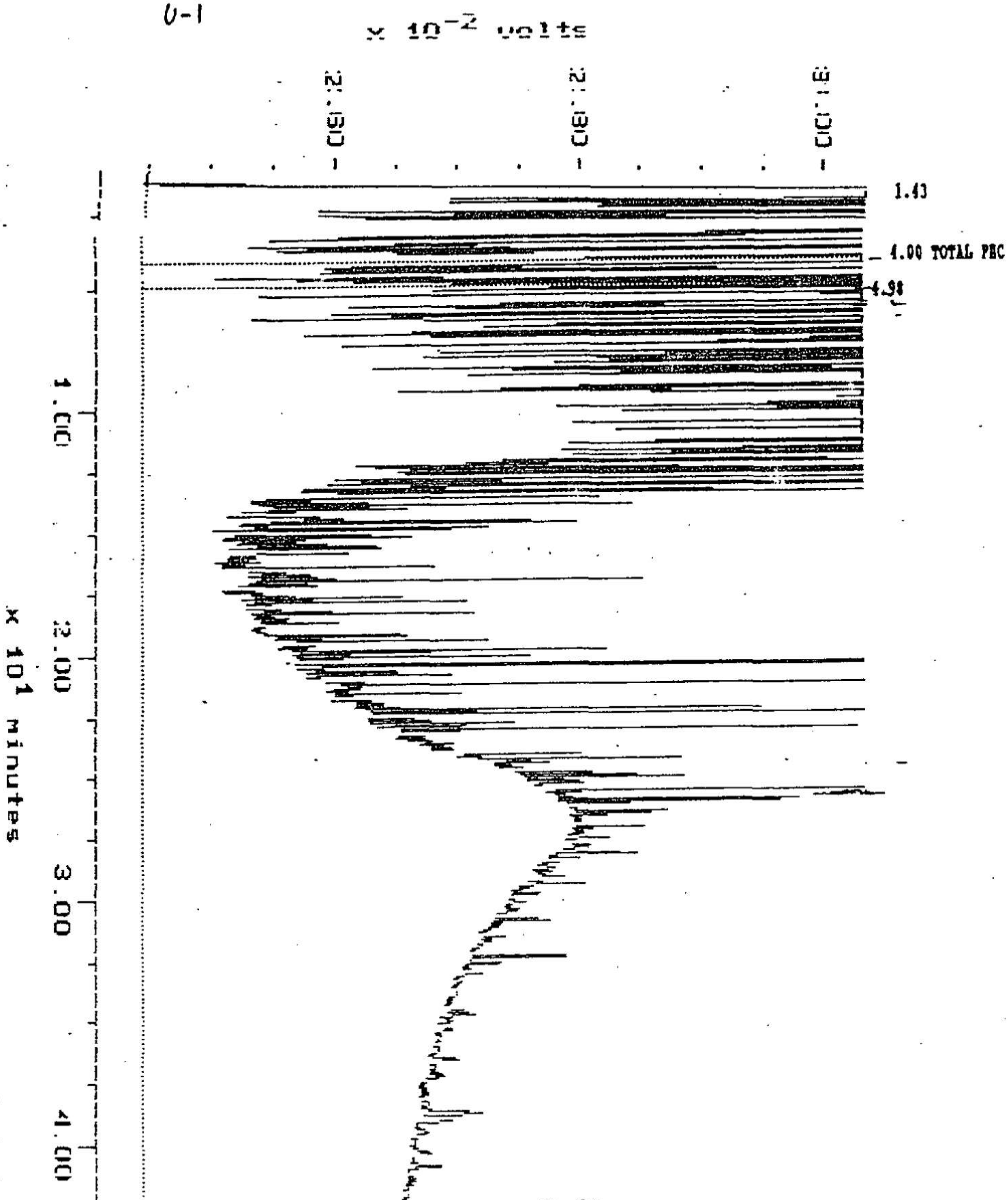
$\frac{14812224}{1025827} \times 51.2 \text{ mg/L} \times \frac{0.010 L}{0.920 L} \times \frac{10}{1} = 80.36 \text{ mg/L}$

$14831701 - 2592974 = 12238727$

$\frac{12238727}{1025827} \times 51.2 \text{ mg/L} \times \frac{0.010 L}{0.920 L} \times \frac{10}{1} = 66.4 \text{ mg/L}$

Sample: 6696 1:10 Channel: detector 1 Filename: T0318-6
Acquired: 18-MAR-91 13:23 Method: C:\MAX\DATA3\TEH0318 Operator:
Amount: 1.000 Inj Vol: 1.00

U-1



ENVIRONMENTAL LABORATORY SAMPLE TRACKING SHEET

Sierra Analytical Laboratories, Inc.

ANALYSIS: Total Extractable Petroleum Hydrocarbons

MATRIX: Water

DATE SAMPLED:

DATE RECEIVED:

COMMENTS:

SAMPLER I.D.: 19689 V-2

LAB I.D.: 6692

COLUMN	RTX-5		
DATE	3/13/91		
DILUTION	1:1000		
WORKER	EB/CA		
LAB I.D.			
FINAL			

SAMPLE WGT: 900 ml. (LINE 1) FINAL EXTRACT VOL: 50 ml (LINE 2)

DATE PREP'D: 3/13/91

DATE ANAL: 3/15/91

MDL	mg/L	ANALYTE(S)			
0.50		Total Extractable Petroleum Hydrocarbons	8000	8000	
		Elution Range 7.5 min			
		< 15 min			
		19 min			
		< 23.30 min			

XIMA (c)1987 Dynamic Solutions, Division of Millipore

MAXIMA 820 CUSTOM REPORT

Printed: 19-MAR-1991 14:37:00

SAMPLE: 6692 1:1000
#12 in Method: Total Extractable Hydrocarbons
U-2 Acquired: 15-MAR-1991 21:15
Rate: 5.0 points/sec
Duration: 45.000 minutes
Operator:

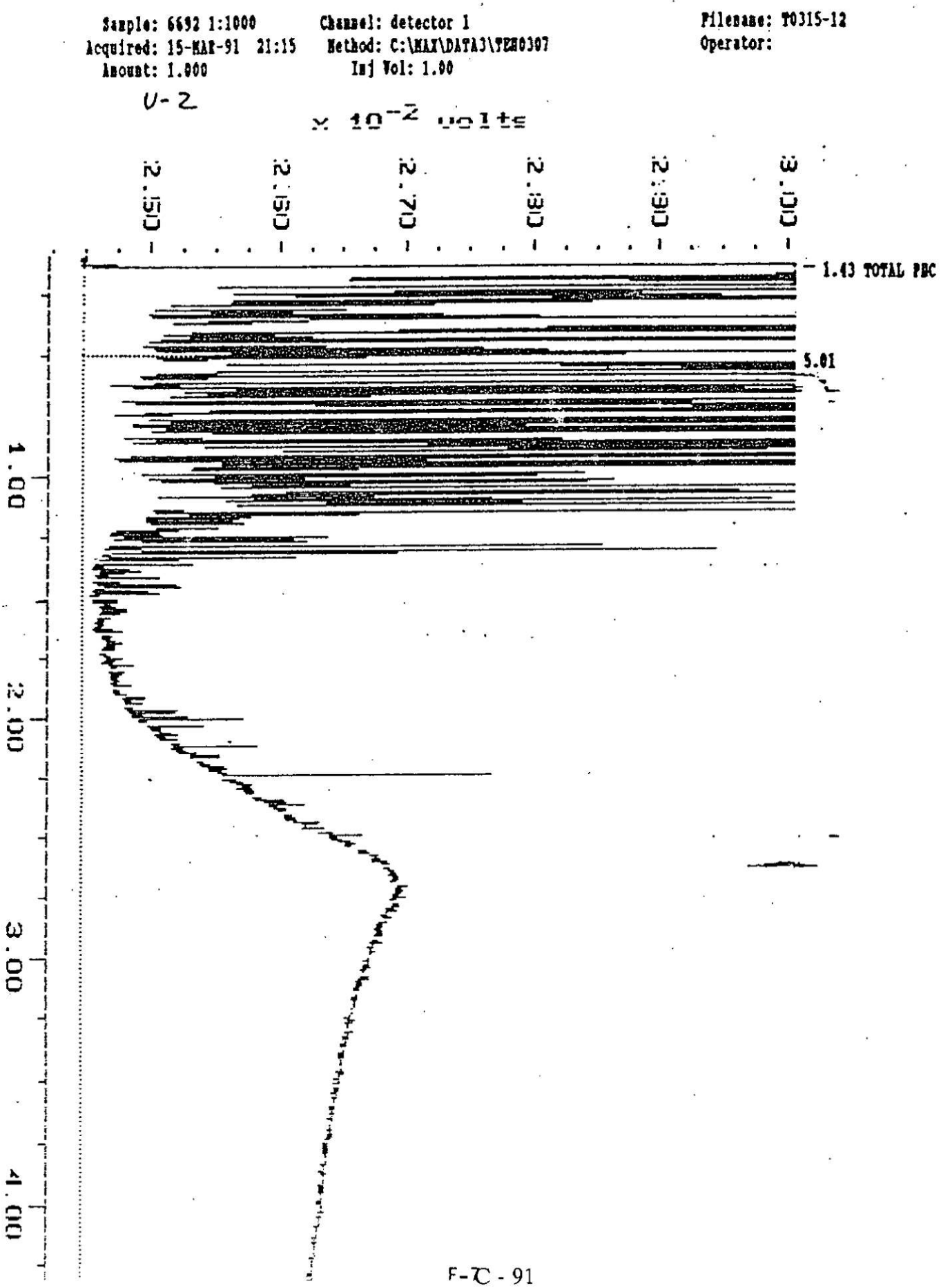
Type: UNKN
Instrument: FID/NPD
Filename: T0315-12
Index: 12
Injection Volume: 1.0
Amount: 1.000

DETECTOR: detector 1

PK#	Retention Time (minutes)	Peak Start (minutes)	Peak End (minutes)	Area
1	1.427	0.997	4.977	>15929356
2	5.007	4.977	44.997	5528592
TAL				5528592

$5528592 - 2570350 = 2958242$

$$\frac{2958242}{1057773} \times 51.2\ mg/L \times \frac{0.050\ L}{0.900\ L} \times \frac{1000}{1} = 795\ mg/L$$


Sample: 6692 1:1000
Acquired: 15-MAR-91 21:15
Amount: 1.000
Channel: detector 1
Method: C:\MAX\DATA3\TEH0307
Inj Vol: 1.00
Filename: T0315-12
Operator:
U-2
x 10⁻² volts
2.150
2.190
2.230
2.270
2.310
2.350
1.43 TOTAL PBC
5.01
1.00
2.00
3.00
4.00
x 10¹ minutes

ENVIRONMENTAL LABORATORY SAMPLE TRACKING SHEET

n Analytical
stories, Inc.

SAMPLER I.D. 19669 LAB I.D. 6680

MW-4

TRIX: ~~Total Extractable Petroleum Hydrocarbons~~ Water

RECEIVED
APR 3 1991
S.C.S. ENGINEERS

SAMPLED:
RECEIVED:

ENTS:

WGT: 1.000 L	FINAL EXTRACT VOL: 10 ml	COLUMN	RTX-5
LOG: UNITS	UNITS	DATE	3/18/91
D.:	DATE PREP'D: 3/13/91	DILUTION	1:10
mg/L	DATE ANAL: 3/18/91	WORKER	EB/CA
		LAB I.D.	

MDL	ANALYTE(S)	FINAL		
.5	Total Extractable Petroleum Hydrocarbons	5.2	5.2	
.50	Elution range >5 min			
	< 12 min			

MAXIMA 820 CUSTOM REPORT

Printed: 19-MAR-1991 9:34:17

SAMPLE: 6680 1:10
MW-4
#5 in Method: Total Extractable Hydrocarbons
Acquired: 18-MAR-1991 12:33
Rate: 5.0 points/sec
Duration: 45.000 minutes
Operator:

Type: UNKN
Instrument: FID/HPD
Filename: T0318-5
Index: Disk
Injection Volume: 1.0
Amount: 1.000

DETECTOR: detector 1

PK#	Retention Time (minutes)	Peak Start (minutes)	Peak End (minutes)	Area
1	1.427	0.997	4.977	>15763913
2	5.007	4.977	44.997	3636472
ALL				3636472

$3636472 - 2592974 = 1043498$

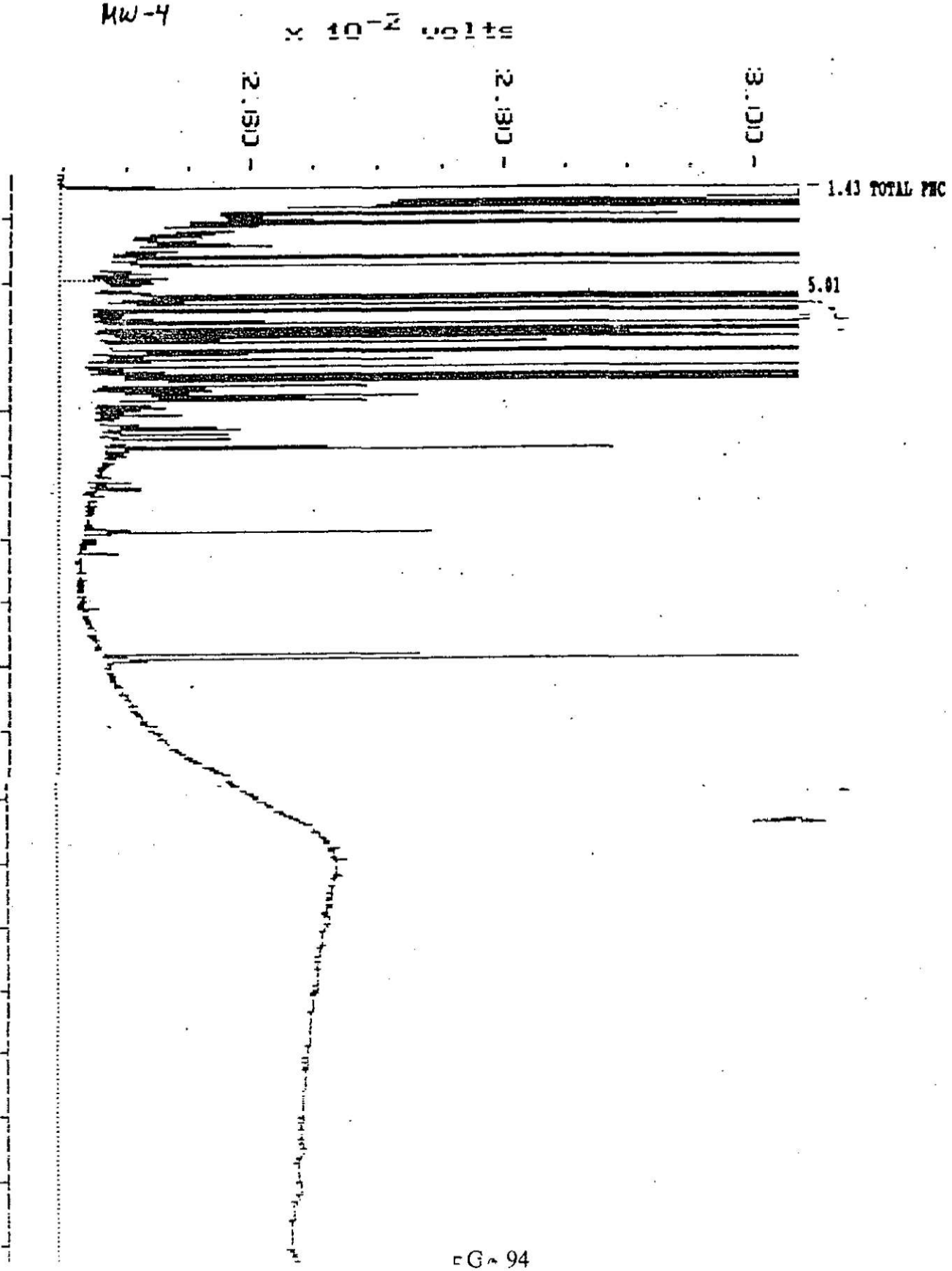
$$\frac{1043498}{1025827} \times 57.2\ mg/L \times \frac{0.90L}{1.000L} \times \frac{10}{1} = 5.21\ mg/L$$

Sample: 6640 1:10
Acquired: 18-MAR-91 12:33
Amount: 1.000

Channel: detector 1
Method: C:\MAX\DATA3\TEH0318
Inj Vol: 1.00

Filename: T0318-5
Operator:

MW-4



ENVIRONMENTAL LABORATORY SAMPLE TRACKING SHEET

n Analytical
aboratories, Inc.

SAMPLER I.D. 19701 MW-5 | LAB I.D. ~~6299~~ 6699

Total Extractable Petroleum Hydrocarbons
Water

SAMPLED:
RECEIVED:

MENTS:

E MGT: 995 ml (LINE 1)	FINAL EXTRACT VOL: 6 ml (LINE 2)	COLUMN	RTX-5
E I.D.:		DATE	3/18/91
	DATE PREP'D: 3/13/91	DILUTION	1:10
mg/L	DATE ANAL: 3/18/91	WORKER	CwA
		LAB I.D.	

QC	ANALYTE(S)	FINAL		
~~35~~	Total Extractable Petroleum Hydrocarbons	6.2	6.2	
50	Elution range > 5 min			
	< 11 min			
	> 20 min			
	< 30 min			

MAXIMA 820 CUSTOM REPORT

Printed: 19-MAR-1991 9:16:45

6699 CA

SAMPLE: ~~6699~~ 1:10

MW-5 #7 in Method: Total Extractable Hydrocarbons
Acquired: 18-MAR-1991 14:14
Rate: 5.0 points/sec
Duration: 45.000 minutes
Operator:

Type: UNKN
Instrument: FID/NPD
Filename: T0318-7
Index: Disk
Injection Volume: 1.0
Amount: 1.000

DETECTOR: detector 1

PK#	Retention Time (minutes)	Peak Start (minutes)	Peak End (minutes)	Area
1	1.427	0.997	5.037	15264904
2	5.097	5.037	44.997	3823641
TAL				3823641

$3823641 - 2592974 = 1230667$

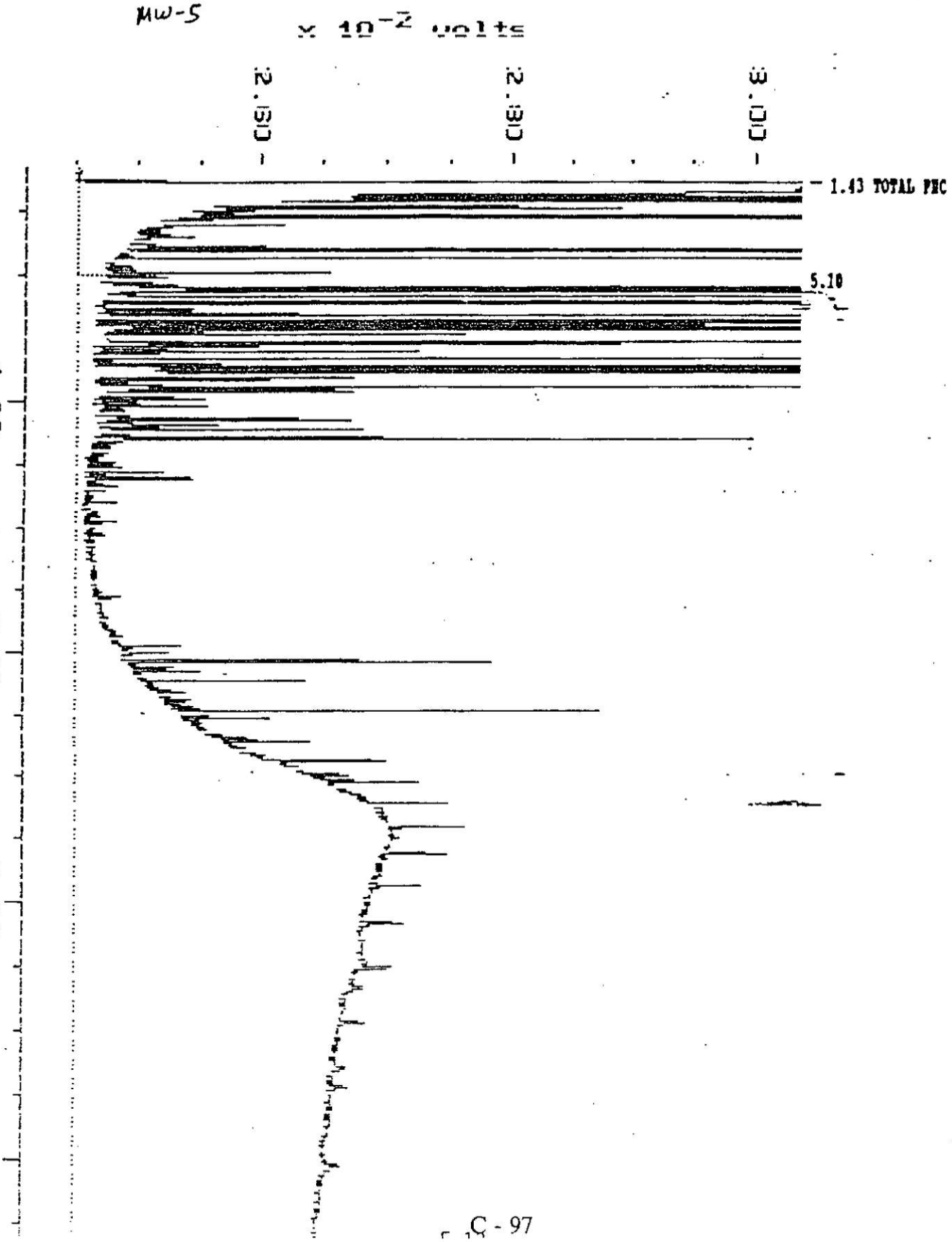
$$\frac{1230667}{1025827} \times 51.2\ mg/L \times \frac{0.010L}{0.995L} \times \frac{10}{1} = 6.17$$

$= 62mg$

6699 CA

Sample: ~~6399~~ 1:10 Channel: detector 1 Filename: T0318-7
Acquired: 18-MAR-91 14:14 Method: C:\MAX\DATA3\TEH0318 Operator:
Amount: 1.000 Inj Vol: 1.00

MW-5



Environmental Consultants

SCS ENGINEERS

UNDERGROUND TANK INVESTIGATION

SUMMARY REPORT
WESTLAKE AVENUE
CITY OF SEATTLE

PREPARED FOR

SEATTLE DEPARTMENT OF ADMINISTRATIVE SERVICES

PREPARED BY

SCS ENGINEERS

JUNE 1990

CITY OF SEATTLE
UNDERGROUND TANK INVESTIGATION
WESTLAKE AVENUE UST SITE
SITE INVESTIGATION AND TANK REMOVAL
SUMMARY REPORT

Prepared for:

City of Seattle
Department of Administrative Services
618 2nd Avenue, 14th Floor
Seattle, Washington 98104

Prepared by:

SCS Engineers
2950 Northup Way
Bellevue, Washington 98004

June 18, 1990
48921

Bellevue, WA 98004 FAX 206 889-2267

SCS ENGINEERS

June 18, 1990
File No. 48921

Mr. Paul Berry
Seattle Dept. of Administrative Services
618 2nd Avenue, 14th Floor
Seattle, Washington 98104

Subject: Westlake Avenue Tank Removal Report

Dear Mr. Berry:

Enclosed are three copies of our Tank Removal Summary Report for the Westlake Avenue UST Site. The report provides documentation for the removal of five underground fuel storage tanks and an environmental assessment of site conditions at 630 Westlake Avenue in Seattle, Washington.

The enclosed report was prepared jointly by SCS Engineers and Centrac. For this investigation, SCS provided project oversight, data evaluation, and field support. Centrac provided on-site documentation of tank removal and subsurface conditions, conducted extensive sampling, and completed an historical review of the site.

A total of five underground storage tanks, ranging in size from 500-gallons to 5,000-gallons, were excavated from the site. The 500-gallon tank was used to store expended motor oil and the four other tanks, which were abandoned, previously stored leaded gasoline. No obvious signs of leaks or damage to the tanks and fuel lines were identified during this investigation.

However, high levels of petroleum hydrocarbon contamination were detected in the soil and groundwater at the site. Analytical laboratory testing indicated petroleum hydrocarbon contamination was well above the recommended Washington Department of Ecology (WDOE) cleanup levels.

Approximately 800 cubic yards of contaminated soil was removed from the site and temporarily stockpiled at Seattle's Engineering Department Operations Division Yard at 6th and Harrison. An undetermined volume of contaminated soil still remains at the site below two existing buildings and possibly beyond the property boundaries. The depth of soil contamination near the property boundaries was not defined during the excavation of the tanks, but soil contamination is not expected to be much deeper than about 15 feet, because this is the level at which groundwater and clay were encountered.

Two groundwater monitoring wells were installed in the tank excavations, prior to backfilling and asphalting the site. These wells can be used for future groundwater monitoring and water level information after they are properly developed.

Based on the results of this investigation, off-site migration of hydrocarbon contamination is suspected. Although this investigation did not specifically identify a source of contamination, previous on-site fuel systems and potential upgradient sources are likely to have impacted the property.

To determine the extent and levels of contamination, we recommend constructing several borings and monitoring wells along the property boundary and possibly off-site. The enclosed report provides additional details regarding these recommendations.

We also recommend notifying WDOE that the tanks were removed from the site and that additional work is necessary to determine the magnitude of contamination. After this additional investigation is conducted, alternatives can be evaluated for site remediation.

If you have any questions regarding the enclosed report, please do not hesitate to contact either of the undersigned.

Respectfully yours,

Richard C. Alvord, C.P.G.
Project Manager
SCS ENGINEERS

Terrill J. Chang, P.E.
Project Director
SCS ENGINEERS

48921/westlake

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SECTION 1

INTRODUCTION

SCS Engineers and Centrac jointly conducted an underground storage tank investigation for the City of Seattle during January to April 1990 at 630 Westlake Avenue in Seattle, Washington. The site is owned by the City of Seattle and is currently occupied by an auto custom detailing shop. The location of the site is illustrated in Figure 1.

The purpose of this report is to provide documentation of tank removal activities and an environmental assessment of site conditions. The investigation consisted of removing five abandoned underground tanks, testing subsurface soils and groundwater for petroleum hydrocarbon contamination, and excavating approximately 800 cubic yards of contaminated soil.

Significant levels of petroleum hydrocarbon contamination were detected at the site. The contamination appears to be widespread in extent and is probably present beyond the property boundaries. The depth and extent of contamination at the site was not determined during this investigation. Although the source of contamination was not specifically identified during this investigation, previous on-site fuel systems and possibly activities that occurred upgradient of the site in the past could have impacted the property.

This investigation was completed in two Phases as described below.

- Phase I - Site Characterization
- Phase II - Tank Removal and Soil Excavation

Phase I consisted of a soil vapor survey and an historical review of the site. The soil vapor survey was conducted prior to excavating the underground tanks. The results of the soil vapor survey indicated that contaminated soil would most likely be encountered during the excavation of the tanks. Historical records indicate that fueling stations have occupied the site since the early 1900's and a brewery, lumber mill, and other fuel service stations occupied adjacent properties in the past. A Union 76 Service Station south of the site was the source of a major underground gasoline spill approximately 10 years ago. The impact of this spill on the Westlake site is unknown at this time.

During Phase II of this investigation, a total of five underground storage tanks (T-1 through T-5) were removed from the site. These tanks included one 500-gallon waste oil tank (T-1), and four gasoline tanks (T-2 through T-5) ranging in size from 2,000 to 5,000-gallons.

Soil contaminated with up to 13,000 ppm total petroleum hydrocarbons (TPH) was detected at the Westlake site. Benzene, toluene, ethylbenzene, and xylene (BTEX) were detected in the soil up to 47 ppm, 160 ppm, 93 ppm, and

440 ppm, respectively. Approximately 800 cubic yards of contaminated soil was excavated and temporarily stockpiled at Seattle's Engineering Department Operations Division Yard at 6th and Harrison. Remediation plans for treatment of this soil are currently in progress. Plans for additional investigatory work are also being developed to further characterize sub-surface contamination at the site.

The following sections of this report include a site historical review, documentation of soil vapor testing, sampling and analytical test results, documentation of tank removal activities, and an evaluation of data.

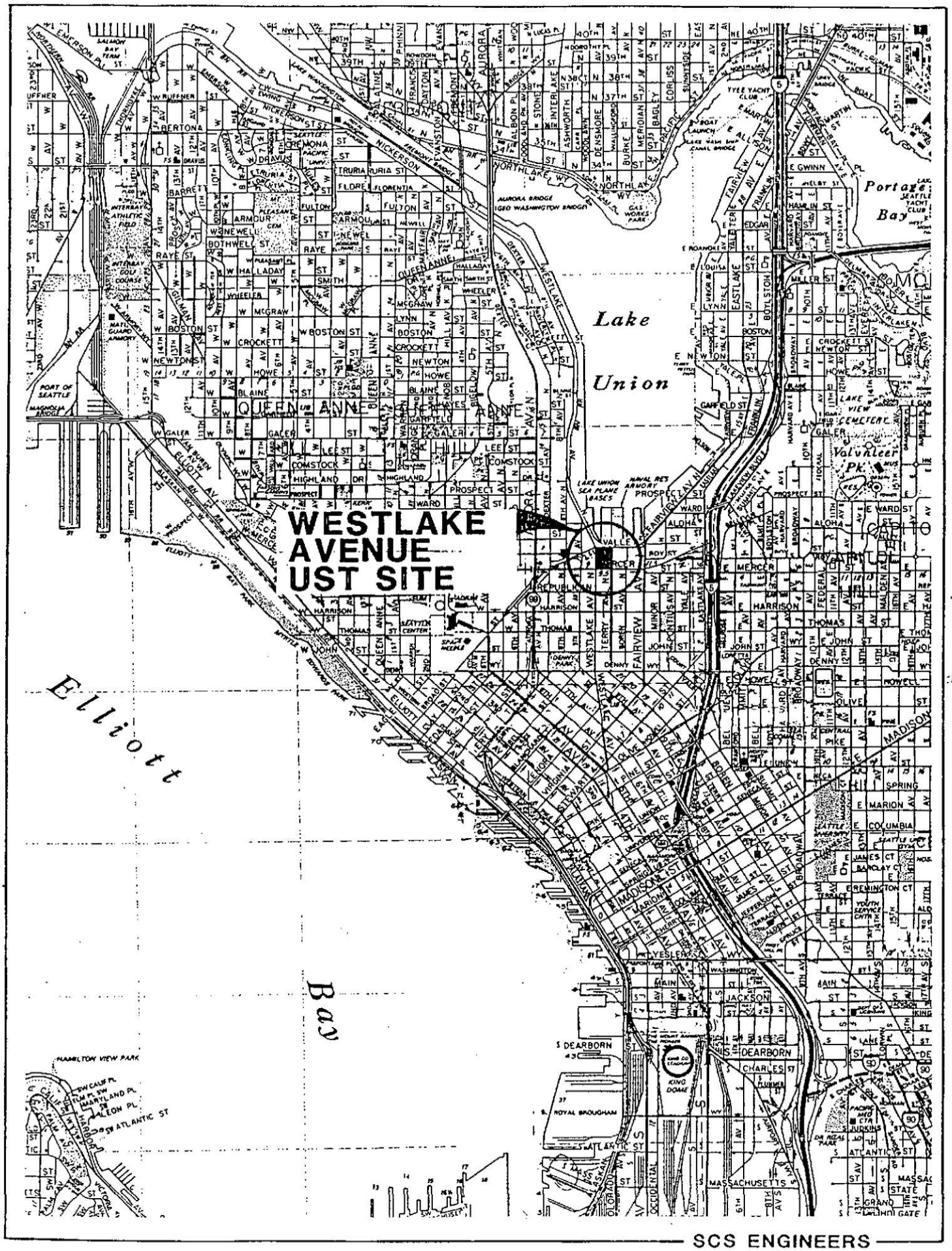


FIGURE 1 WESTLAKE AVENUE UST SITE

SECTION 2

SITE HISTORY

Available historical information, records, and documents for the site were obtained for review from the following sources:

- Washington State Archives
- Sanborn Fire Insurance Maps
- Seattle Engineering Office
- Walker and Associates Aerial Photography
- University of Washington Maps and Documents
- King County Assessor's Office
- Seattle Engineering Office
- City of Seattle Property Files

King County tax records indicate that the Westlake site occupies the west part of Lot 1 of Block 77, Denny's 1st Addition and Lake Union Shorelands Addition. Figure 2 illustrates the approximate location of the Westlake site and Block 77.

Historical records indicate that Block 77 was owned by the Brace and Hergert Mill Company in the early 1900's. J.S. Brace Inc. owned the property from about 1924 to 1972, at which time the property was acquired by the City of Seattle. The property has been primarily the site of lumber mills and gasoline service stations throughout its history. Actual periods of property transition and tenant occupancy are not clear in each case. Based on information available for this investigation, a compilation of historical ownership and tenant occupancy is provided in Table 1.

A copy of the 1904 Sanborn Fire Insurance Map of the site is provided in Figure 3. This map illustrates the presence of a lumber shed, planing mill, and machine shop in the area of this current investigation. Property directly to the south and east of the site (on Block 77) was also owned by the Brace and Hergert Mill Co. and was used for lumber and warehouse storage.

Washington State Archive information indicates that a gasoline station and service garage was built on the property in 1930. At that time the owner of the property was J.S. Brace Inc. and the gas station was known as "McKales". Records indicate that the original gasoline station was demolished in 1948 and later replaced in 1959. A photograph of the gasoline station during the 1930's is provided in Figure 4. In the far right side of the photograph is an automobile service garage that still stands today. Figure 5 is a photograph of this garage and an adjoining "Diamond Tires" building during the 1940's. Finally, Figure 6 shows the site as it was in 1959.

Historical records are unclear as to when underground fuel tanks were installed at the Westlake site. Washington State Archive information indicated that a 2,000-gallon and 3,000-gallon gasoline tank, and a 500-gallon waste oil tank were installed when the service station was constructed in 1930. A Union Oil of California tank construction diagram, obtained from the Washington State Archives, indicates that in 1959, two additional 5,000-gallon gasoline tanks (T-2 and T-3) were installed at the site.

The City of Seattle purchased the site in 1972 and then leased it to the current tenants. The area where the gasoline service station once stood is now occupied by a small one story concrete block office that was constructed in the late 1940's or 1950's. The automobile service garage is currently used for basic vehicle maintenance, oil changes, and auto custom detailing.

All of the underground tanks on the property, except for the 500-gallon waste oil tank, were abandoned and not in use since at least 1972, when the City of Seattle acquired the site. Based on available information, it appears that tanks were abandoned sometime between 1959 and 1972. The former 500-gallon waste oil tank (T-1) was actively used by the current property tenant until its removal in January 1990. Additional details regarding these tanks are provided in Section 4.

ADJACENT SITE HISTORY

Historical property ownership adjacent to the Westlake site includes lumber companies, wood yards, blacksmith and wagon repair shops, a brewing company, warehouses and storage sheds, an auto service station, and a creamery. Currently, adjacent property ownership/occupancy includes railway right-of-ways across Valley Street to the north, a gasoline service station (Union 76 as discussed below) to the south, a restaurant to the southeast, and boat and automobile dealerships to the east and west, respectively.

Information obtained from the Washington State Archives indicates that during the 1930's property to the north (across Valley Street) and east (on Block 77) of the Westlake site was occupied by Brace Lumber Company. Horlucks Brewing Company, owned by Frank Hergert, was built in 1933 south (on Block 77) of the site. Sanborn Fire Insurance maps indicate that Horluck Creameries Inc. once occupied the southwest part of Block 77, south of the current Westlake site. A 1960 King County Kroll Platt Map indicated that in approximately 1933 property on the south end of Block 77 was occupied by Sicks Century Brewery. This brewery, which was owned by J.S. Brace and Roy Investment Co., was demolished in 1965.

Property to the west of the Westlake site has been occupied by William O. McKay Automobile Sales and Repair since approximately 1917. Fire Insurance Maps indicate that a gasoline station may have been present in the early 1900's on the north end of W. O. McKay's property, directly west of the Westlake site, across Westlake Avenue.

In 1965, property south of the current Westlake site (part of Lots 4, 5, and 6 of Block 77) was purchased by Union Oil of California in order to construct and operate a gasoline service station. The property is currently occupied by a Union 76 station.

In 1980, a large underground gasoline spill was reported at the Union 76 site. According to the *Seattle Times* and *Post Intelligencer* newspapers, an estimated 75,000 to 82,000 gallons of gasoline leaked from an underground fuel line over about a six month period. The spill affected an area of several city blocks around the Union 76 station. Streets and businesses were closed down for two weeks while groundwater wells and trenches were constructed to recover the gasoline. Explosive vapors were detected in sewer lines along Westlake, Valley, and Mercer Streets. Approximately 15,000 gallons of gasoline was recovered from the wells and trenches during the cleanup.

According to our recent discussions with local regulatory agencies (Seattle Fire Department, U.S. EPA, and the Washington State Department of Ecology), the City of Seattle Fire Department took the lead on the cleanup. The Fire Department reported that they evacuated several nearby businesses due to strong gasoline odors but had no records that documented the spill. Our discussions with U.S. EPA and WDOE indicated that no additional information was on file at either of these agencies. Several newspaper articles that covered this spill event have been reproduced and are provided in Appendix A.

TABLE 1. HISTORICAL INFORMATION REGARDING OWNERSHIP AND OCCUPANCY OF SITE

Date	Owner/Occupant	Source of Information
1900's - 1930's	Brace & Hergert Lumber	Sanborn Fire Ins. Maps
1924	McKales Gas & Cafe	Sanborn Fire Ins. Maps
1930's - 1948	J.S. Brace/McKales Gas	Washington State Archives
1948 - 1959	J.S. Brace/McKales Tires	Seattle Engineering Office
1972 - Present	City of Seattle/Auto Service Company	Washington State Archives City Property Files

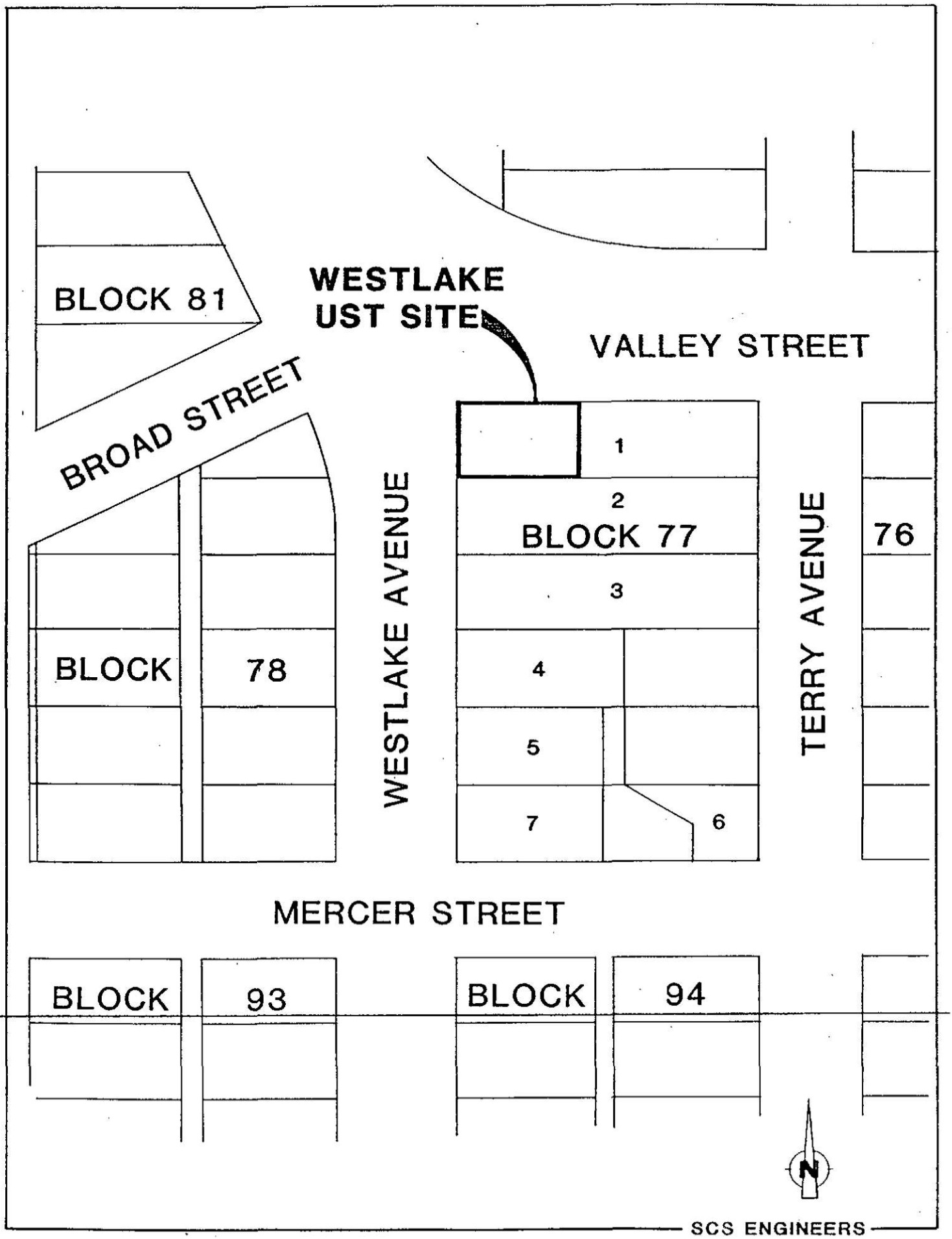
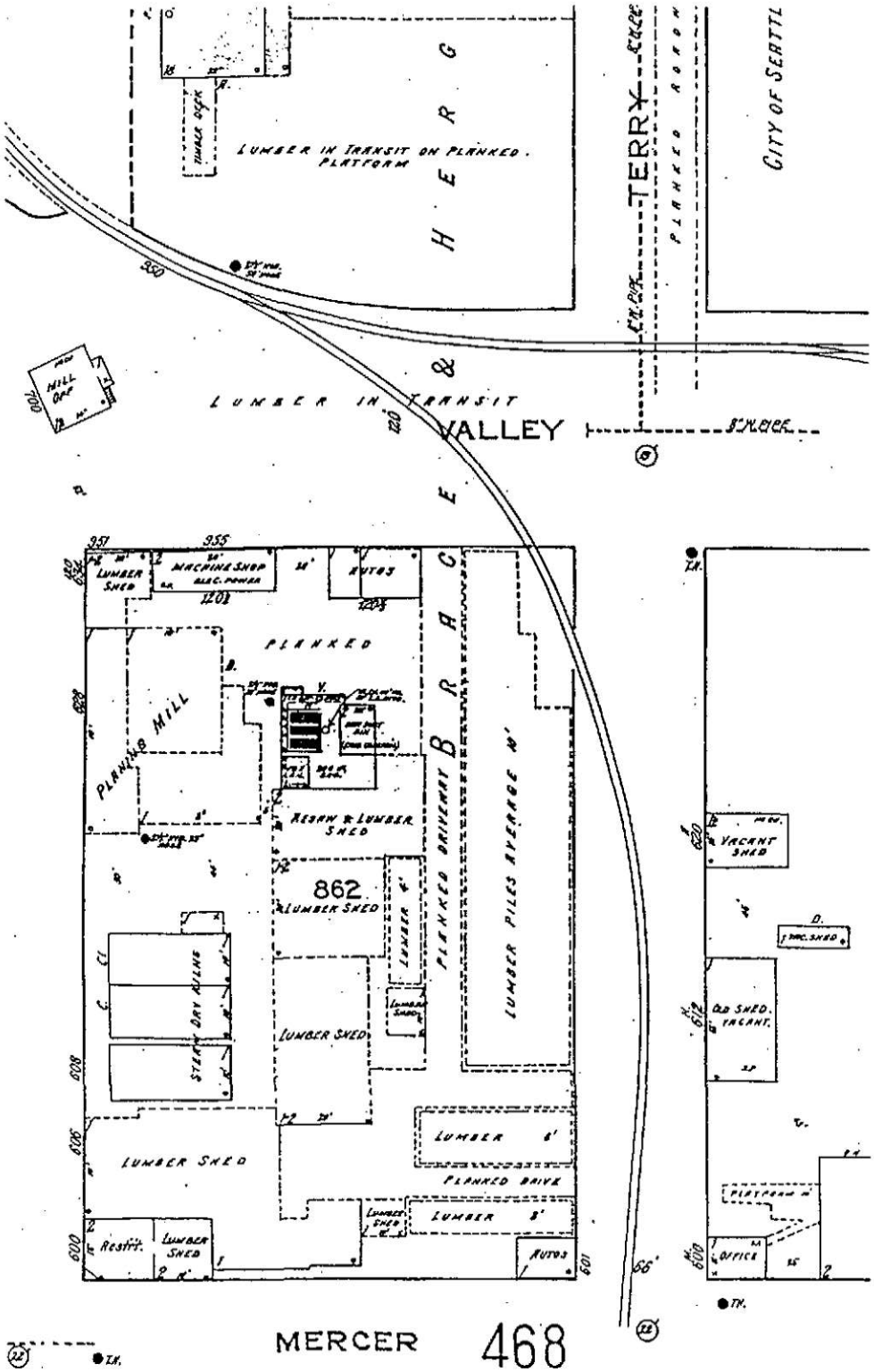
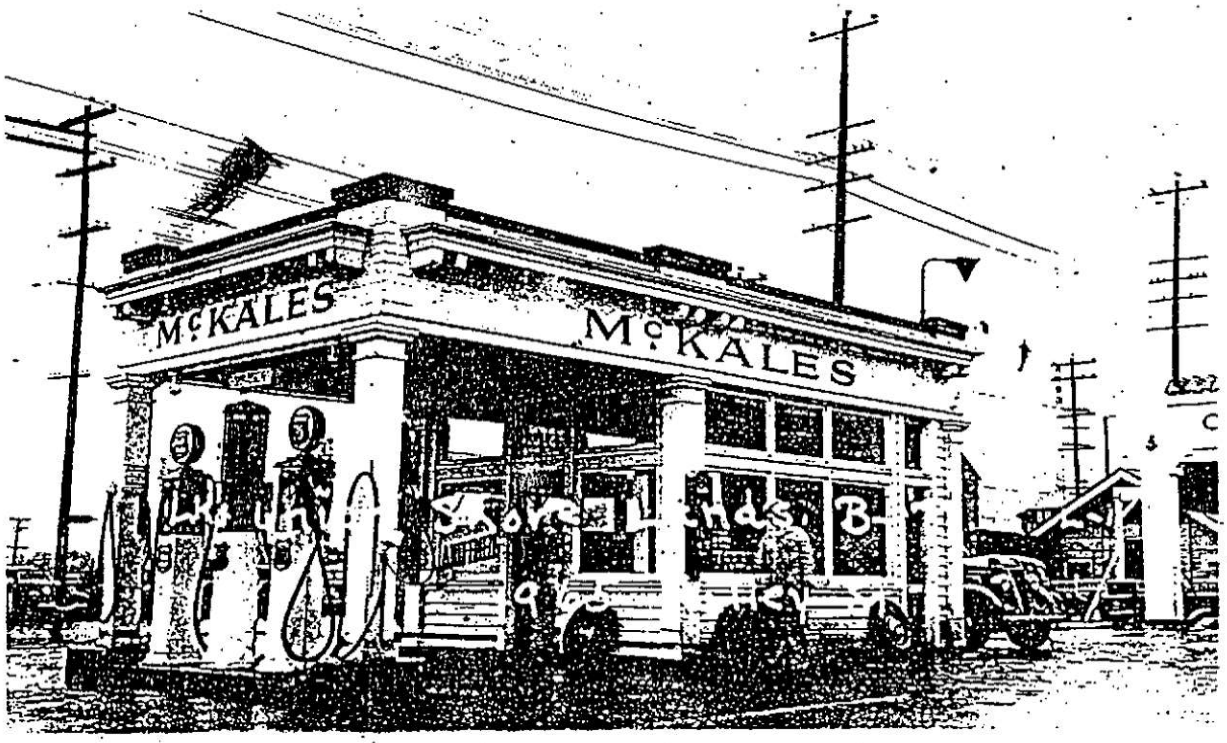


FIGURE 2 LOCATION OF WESTLAKE UST SITE AND BLOCK 77



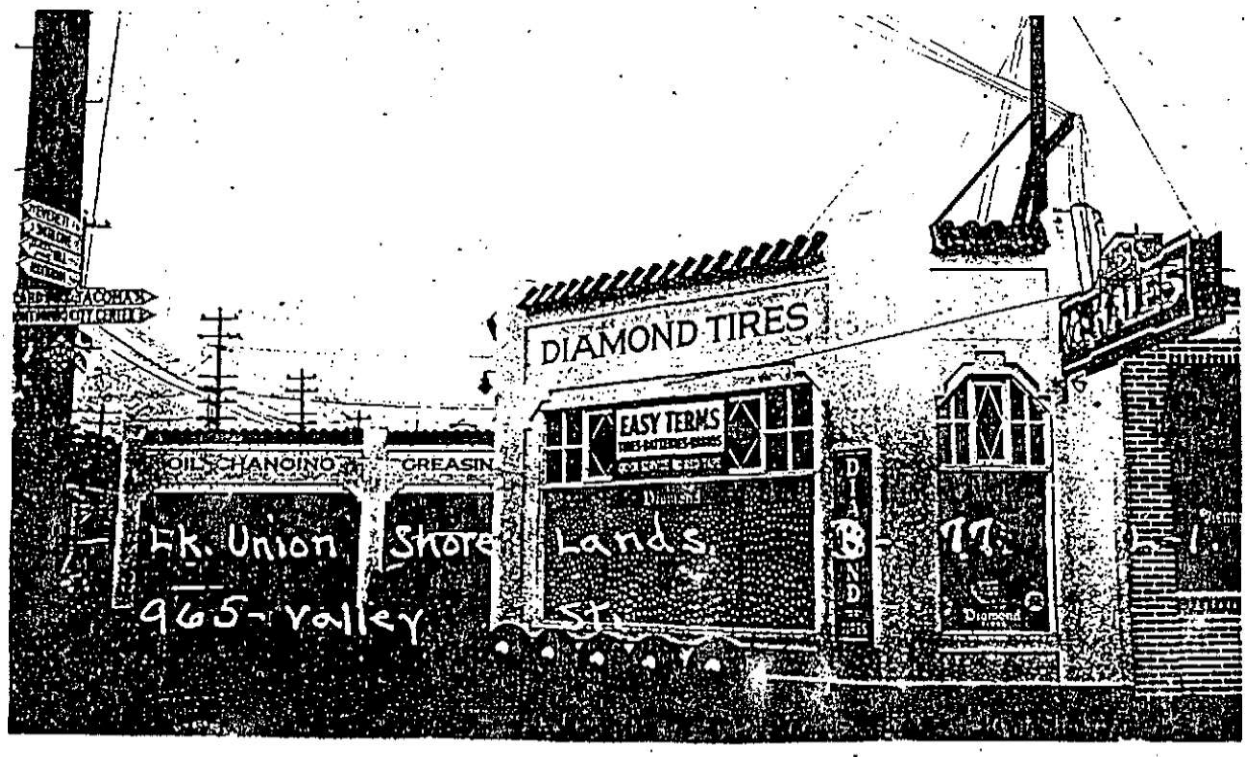
SCS ENGINEERS

FIGURE 3 1904 SANBORN FIRE INSURANCE MAP OF THE SITE



SCS ENGINEERS

FIGURE 4 McKALES SERVICE STATION IN THE 1930'S AT THE PRESENT-DAY WESTLAKE UST SITE (Washington State Archives)



SCS ENGINEERS

FIGURE 5 WESTLAKE UST SITE DURING THE 1940'S
(Washington State Archives)

SCS ENGINEERS

FIGURE 6 WESTLAKE UST SITE IN 1959
(Washington State Archives)

SECTION 3

PHASE I - SITE CHARACTERIZATION

SCS Engineers conducted a Phase I site investigation at the Westlake site during January 1990. The investigation consisted of the following activities:

- Site walk.
- Record review.
- Verification of tank contents.
- Soil vapor survey.

During Phase I site activities, approximate tank locations were identified, tank contents were verified, available site plans and hydrogeologic information were reviewed, possible contaminant migratory routes were identified, and a soil vapor survey was conducted. A summary of the Phase I findings for the site is provided below.

SITE DESCRIPTION

The Westlake site is located at 630 Westlake Avenue, approximately 300 feet south of Lake Union in Seattle, Washington. The site is bordered on the north by Valley Street, on the south by an old building, a small parking lot, and Union 76 Service Station, on the east by a marine/boat sales and service yard, and on the west by Westlake Avenue.

The site has been owned by the City of Seattle since 1972 and operated primarily by a private auto service business. The current tenant uses the site for vehicle maintenance, including oil changes, brake work, tune-ups, steam cleaning, engine degreasing, etc.

The property is occupied by two permanent one story concrete block buildings as illustrated in Figure 7. The office building now stands where the original gasoline station was constructed. The auto service garage is an "L" shaped structure with four car bays and a small store room. A temporary skid-mount trailer and wash rack for cleaning automobiles is located on the north side of the service garage. A catch basin serving this part of the property is located adjacent to the wash rack on Valley Street. Five abandoned underground tanks were removed from the site in January 1990 during this investigation. One of the tanks (T-1) was used by the current property tenant to store waste motor oil prior to its removal. This tank was formerly located adjacent to the skid-mount trailer.

The property is paved with asphalt in the driveway areas between the two existing buildings, and ramp entries to the service garage are constructed of concrete. City sidewalks, sewer and storm systems, and water lines bound the north and west perimeter of the property.

SITE WALK

A site walk was conducted at the Westlake site during January 1990 by representatives from SCS Engineers and the City of Seattle. Five underground tank locations were estimated based on the locations of tank vents, fill ports, and cracks in overlying asphalt and concrete.

RECORD REVIEW

A Union Oil Company of California site construction diagram, dated June 1959, illustrates the proposed locations for the installation of two 5,000-gallon underground gasoline tanks. The diagram also shows the location of an existing waste oil tank, a 2,000-gallon and 3,000-gallon tank, and a proposed pump island adjacent to Valley Street. A copy of the Union Oil construction diagram is provided in Figure 8.

No public utilities were identified on site by a utility locating service. However, old electrical conduits and water lines were encountered during the excavation of the tanks during this investigation. Water and sewer lines were identified in the street and sidewalk along Valley Street and Westlake Avenue, on the north and west sides of the property, respectively. The location of these utility lines are important because the backfill around these lines could potentially act as a pathway for the migration of fuel product and volatile organic vapors.

No public or private water supply wells or groundwater monitoring wells exist in the vicinity of the site, according to records maintained by the Washington State Department of Ecology's Northwest District in Redmond, Washington. However, according to information collected during our historical review, Union Oil installed several gasoline recovery wells at the Union 76 site in 1980.

The depth to groundwater at the site is approximately 14 feet, as determined during the excavation of the underground tanks. Regional hydrologic and topographic information indicates that shallow groundwater flow and surface drainage in this area discharge into Lake Union, north of the site.

VERIFICATION OF TANK CONTENTS

Phase I of this investigation included locating tank fill ports and measuring the tank contents. Five tanks were identified on the property based on the location of tank fill ports. Approximately two feet of waste motor oil was present in the bottom of tank T-1. The soil around the top of the fill pipe was saturated with waste oil, probably as a result of poor filling practices. The contents of tank T-1 were removed and disposed of by the tenant prior to removing the tanks during this investigation. Tank T-4 was empty and the other tanks (T-2, T-3, and T-5) could not be measured because their fill ports were plugged with concrete. During tank removal activities, it was discovered that tanks T-2, T-3, and T-5 contained water.

Based on available information, it appears that tanks T-2, T-3, and T-5 were abandoned sometime between 1959 and 1972. During the 1960's and 1970's, it was common practice to inactivate a tank by filling it with water and then plugging access ports with concrete.

SOIL VAPOR SURVEY

A soil vapor survey was conducted by SCS Engineers and CENTRAC during January 1990. A total of 17 locations were tested for the presence of volatile organic vapors in the shallow subsurface soil. The locations and results of the survey are illustrated in Figure 9.

At each test location, a one-half-inch diameter hole, approximately one to three feet in depth, was constructed using a hand-driven bar punch rod. A portable photoionization analyzer (HNU meter), which was calibrated to a direct reading for benzene, was used to test for volatile organic vapors in the soil at each test location. The analyzer probe was inserted into each hole and a reading was then recorded.

Soil vapor test results at the site indicated volatile organic vapors were generally less than 50 ppm in the surface soil. The highest reading was 130 ppm near the north end of tank T-3. Except for areas adjacent to the tanks, the highest organic vapors were generally detected along the north and southeast property boundaries.

Based on the results of the soil vapor survey, SCS Engineers and Centrac concluded that the site was most likely contaminated with petroleum fuel product and that there was a likely possibility of off-site migration. Potential sources of volatile organic vapors in the soil at the site include previously leaking underground tanks or fuel lines, surface drainage, old surface spills, or migration of contamination from upgradient sources.

Additional investigatory work is recommended to determine the extent of contamination based on the findings of the soil vapor survey conducted during Phase I and analytical laboratory testing of soil and groundwater samples conducted during Phase II. An evaluation of Phase II analytical test results as well as recommendations for additional work is provided in Sections 5 and 7, respectively.

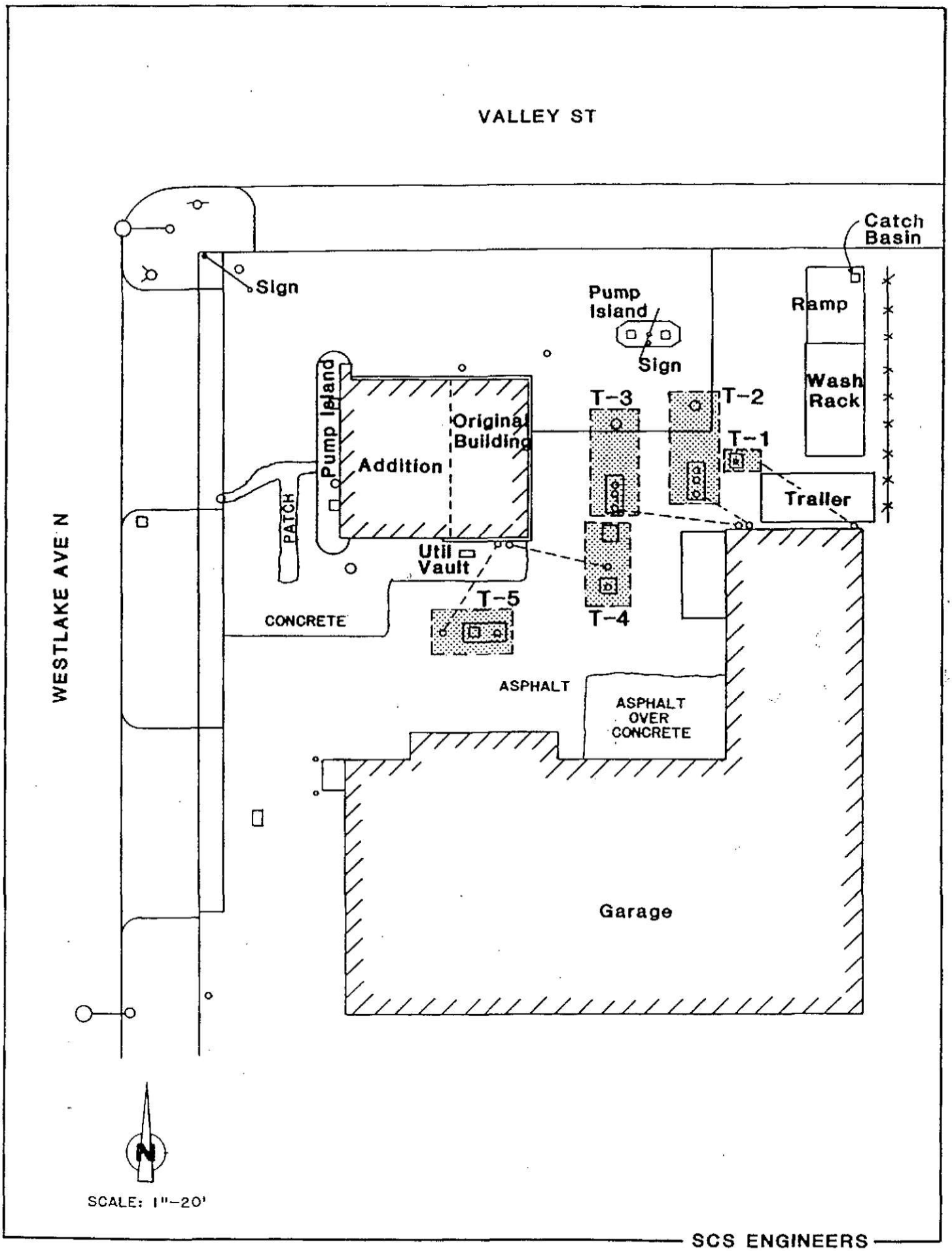
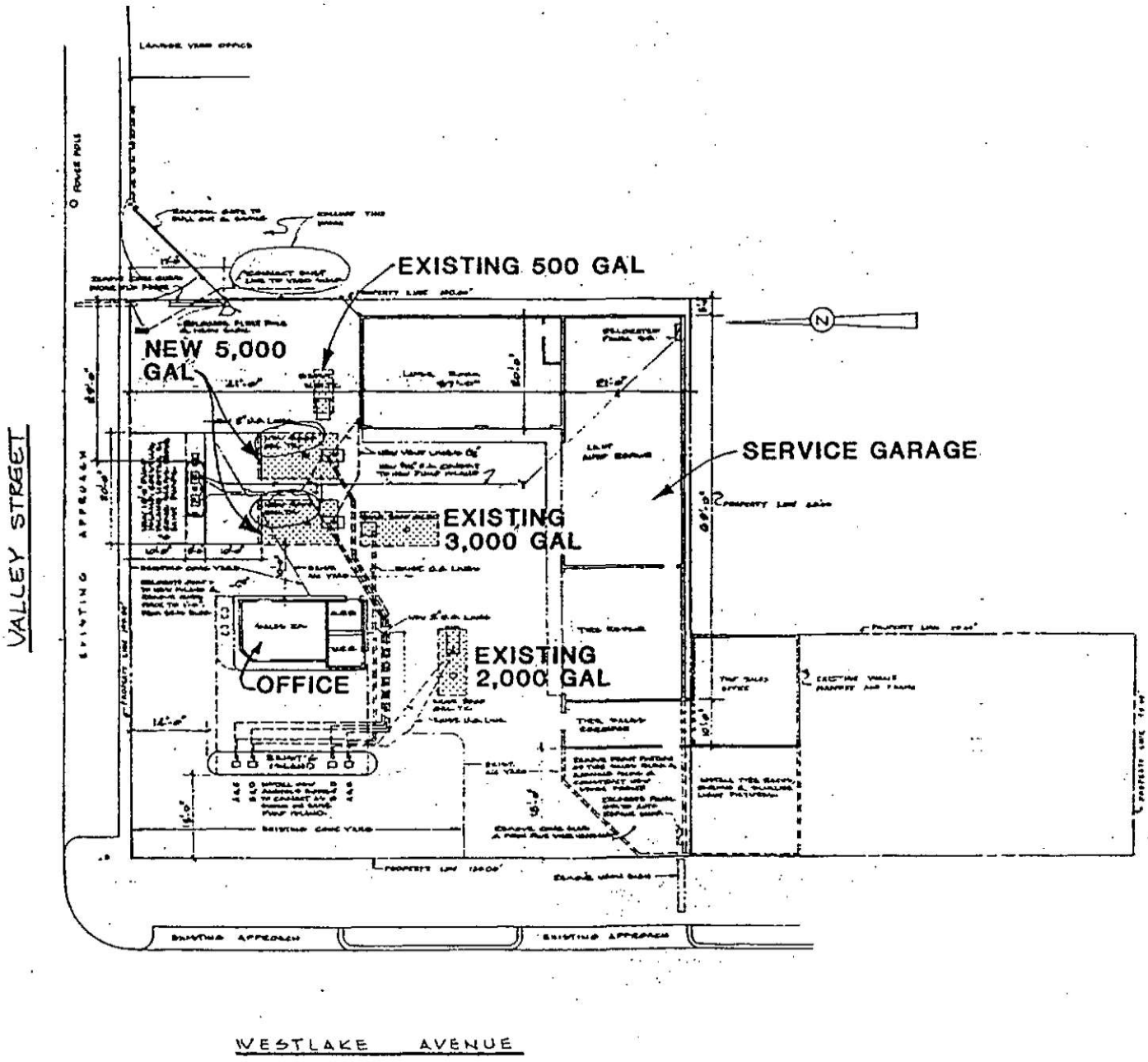


FIGURE 7 WESTLAKE SITE PLAN



SCS ENGINEERS

FIGURE 8 UNION OIL TANK INSTALLATION DIAGRAM, 1959
(MODIFIED BY SCS TO ILLUSTRATE TANK LOCATION)

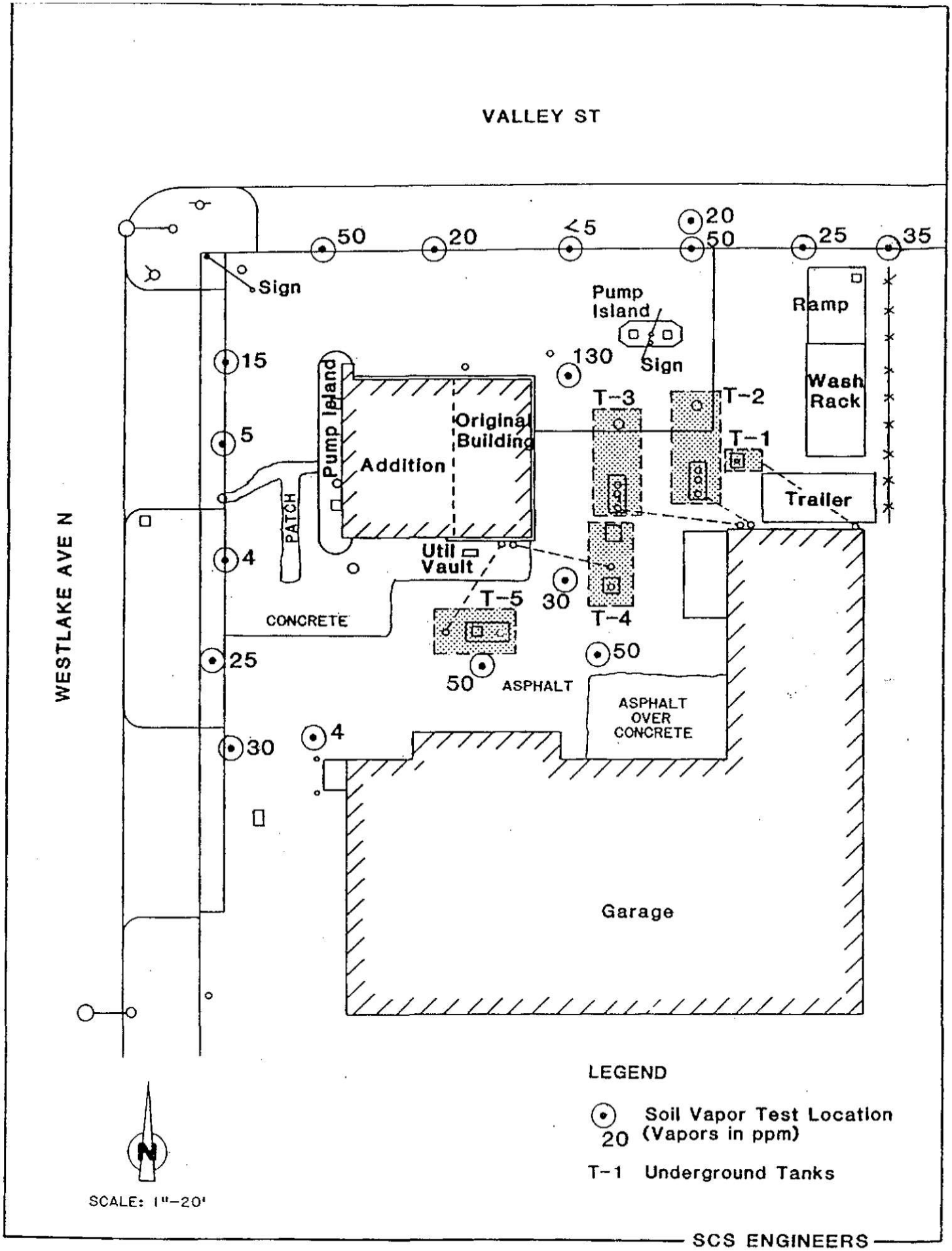


FIGURE 9 SOIL VAPOR TEST RESULTS

SECTION 4

PHASE II - TANK REMOVAL

During February 1990, five underground storage tanks were excavated from the Westlake site. The underground tanks ranged in size from 500-gallons to 5,000-gallons and were previously used to store gasoline (T-2, 3, 4, and 5) and waste motor oil (T-1). These tanks were located approximately as illustrated in Figure 10. A summary of information related to each tank is also provided in Figure 10. Photographic documentation of the tanks and excavation process is provided in Plates 1 to 16.

The primary tasks that were conducted during Phase II of this investigation included:

- Preparations of plans and specifications for tank removal.
- Removal of the tanks.
- Construction oversight.
- Sampling and testing for the presence of contamination.
- Soils remediation.

SCS prepared plans and specifications for the removal of the tanks as requested by the City of Seattle. These plans were approved by the City of Seattle in December 1989. The City retained Gaston Brothers Excavating to excavate the underground tanks and any contaminated soil located adjacent to the tanks at the site.

An SCS representative (CENTRAC) was on site during the entire project in order to provide documentation of activities and to collect soil samples for analysis. The following tank removal and testing procedures were used at the site:

- Expose the fill port and top of tank.
- Removal of tank contents, if any.
- Pump, rinse, and wash tank(s).
- Inertion (with dry ice) of each tank prior to excavation.
- Inspection by the Fire Department.
- Tank removal.
- Inspection for transport by Fire Department.
- Soil vapor monitoring by an on-site geologist.
- Removal of contaminated soils.
- Placement of visquene prior to backfilling operations.
- Backfill excavation with clean sand and gravel.

During this investigation, it was discovered that three of the abandoned tanks (T-2, T-3, and T-5) contained water, and fill pipes for these tanks were plugged with concrete. During the 1960's and 1970's, it was common practice to inactivate a tank by filling it with water and then plugging access ports with concrete. Tank T-4 was determined to be empty, and tank T-1 had about 250 gallons of waste motor oil that was removed prior

to its excavation. The fact that tanks T-2, T-3, and T-5 contained water indicates that they probably were not leaking when they were in use.

During tank removal operations, the tanks and fuel lines were inspected for obvious signs of damage, rust, or leaks. Although each of the tanks showed signs of surface rust, no obvious holes were observed in any of the tanks, except for those which were a result of excavating operations. Any tank punctures that were caused during removal were plugged prior to transport. Tank fill pipes and fuel lines were observed to be in fair condition.

Soil samples from the tank excavations were analyzed for total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylene (BTEX). The test results indicated that TPH and BTEX contamination were above recommended clean-up levels and that soil remediation was required.

Approximately 800 cubic yards of contaminated soil was removed from two large tank excavations (Excavation No. 1 and 2) at the site. The approximate location of the excavations are shown in Figure 10. The excavations covered nearly the entire driveway area between the two buildings to a depth of about 10 to 14 feet. No additional contaminated soil could be removed from the site without undermining the foundation of the buildings. Remedial alternatives are currently under investigation for the contaminated soil that remains below the buildings at the site.

An area on the west side of the office building was excavated (Excavation No. 3) to a depth of about four feet to investigate for the presence of a tank (see Figure 10). No tank was found at this location; however, an abandoned two-inch fuel line was discovered at a depth of about two feet. The line lies east to west, and using a steel tape measure, was determined to end at a distance of 20 feet from the excavation, under Westlake Avenue. The line contained fuel vapors but no free product. After determining that the line was previously abandoned and did not present a hazard, it was capped and buried. Analytical laboratory testing indicated that the soil in the northeast corner of Excavation No. 3 was contaminated with TPH above cleanup levels.

The soil stockpile at Seattle's Engineering Department Operations Division Yard at 6th and Harrison is currently contained between "ecology blocks" (concrete blocks with dimensions of about 6 ft x 2 ft x 2 ft) and is underlain and covered by visquene, awaiting its final disposition. The City of Seattle is currently investigating remedial options for treating the soil.

After removing the tanks and contaminated soil, filter fabric (stabilization cloth) was placed in the tank excavations to separate clean backfill material from any contaminated soil that remains on site. However, the fabric is permeable to water and will not prevent clean backfill from becoming contaminated where there is contact with contaminated water. In addition, two groundwater monitoring wells were installed in the tank excavations (see Section 5.0 for details) for future monitoring. The excavations were then backfilled with clean sand and gravel to more than 95% compaction. The entire site was then resurfaced with asphalt.

Compaction testing and density records provided by Hong West & Associates are included in Appendix B. Copies of tank removal permits from the Seattle Fire Department and a letter certifying that the tanks were scrapped and disposed of are provided in Appendix C.

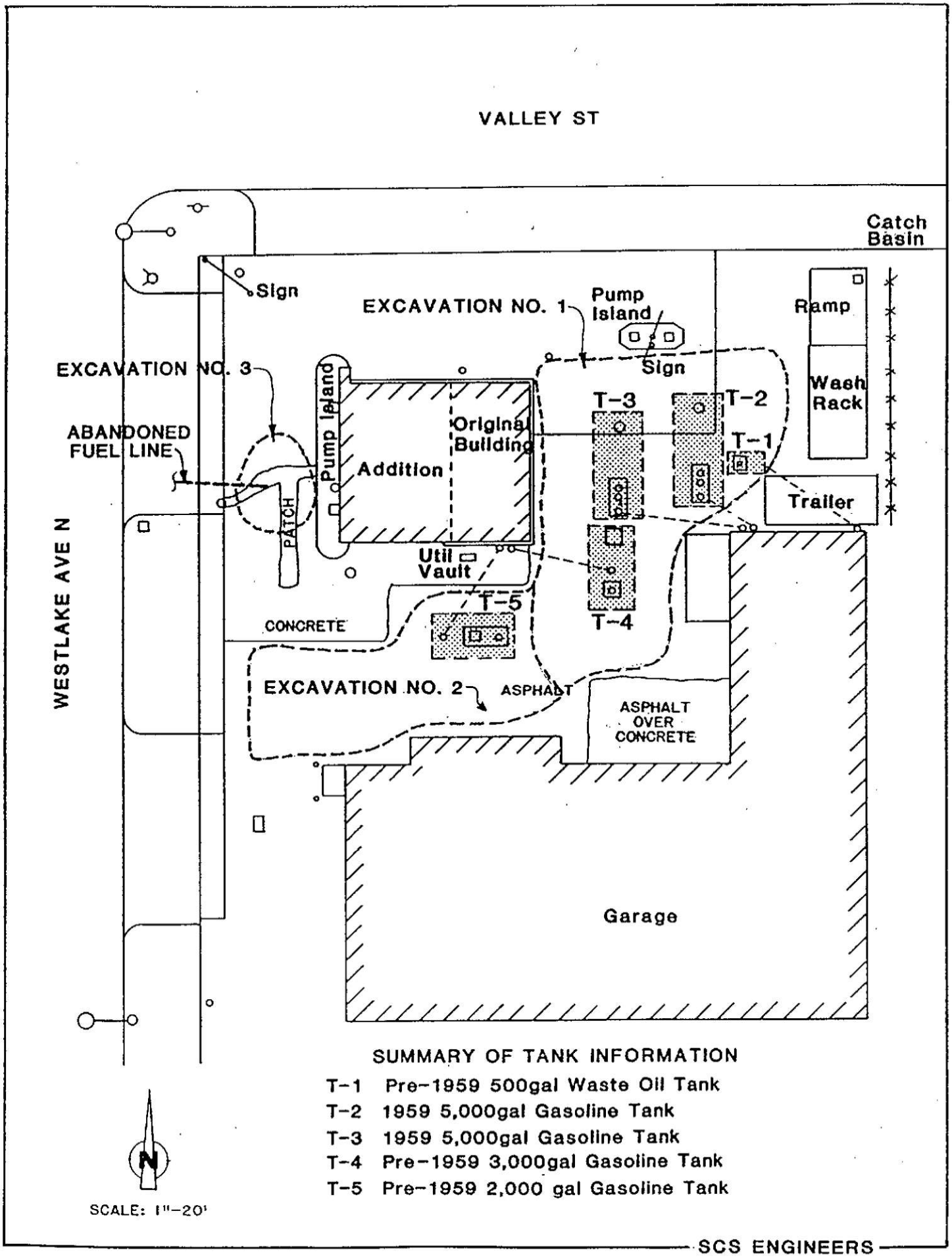


FIGURE 10 LOCATION OF UNDERGROUND TANKS

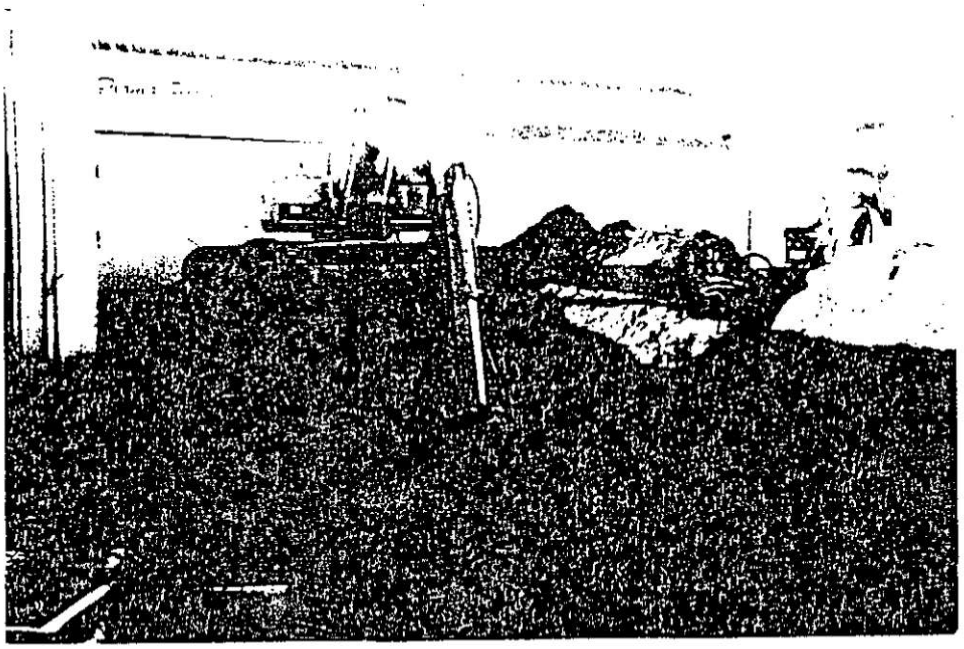


Plate 1. Breaking ground at Westlake Avenue UST site. View to sou

Plate 2. Removal of 500-gallon waste oil tank (T-1).

Plate 3. Exposing two 5,000-gallon gasoline tanks (T-2 and T-3) View to south.

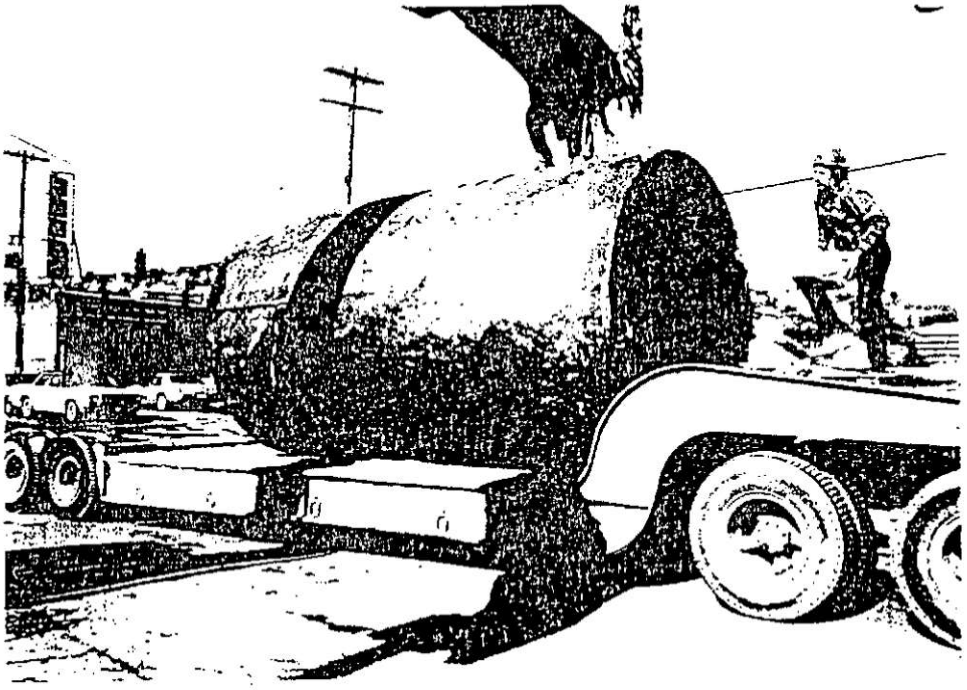


Plate 4. Loading 5,000-gallon tank (T-2) for transport.

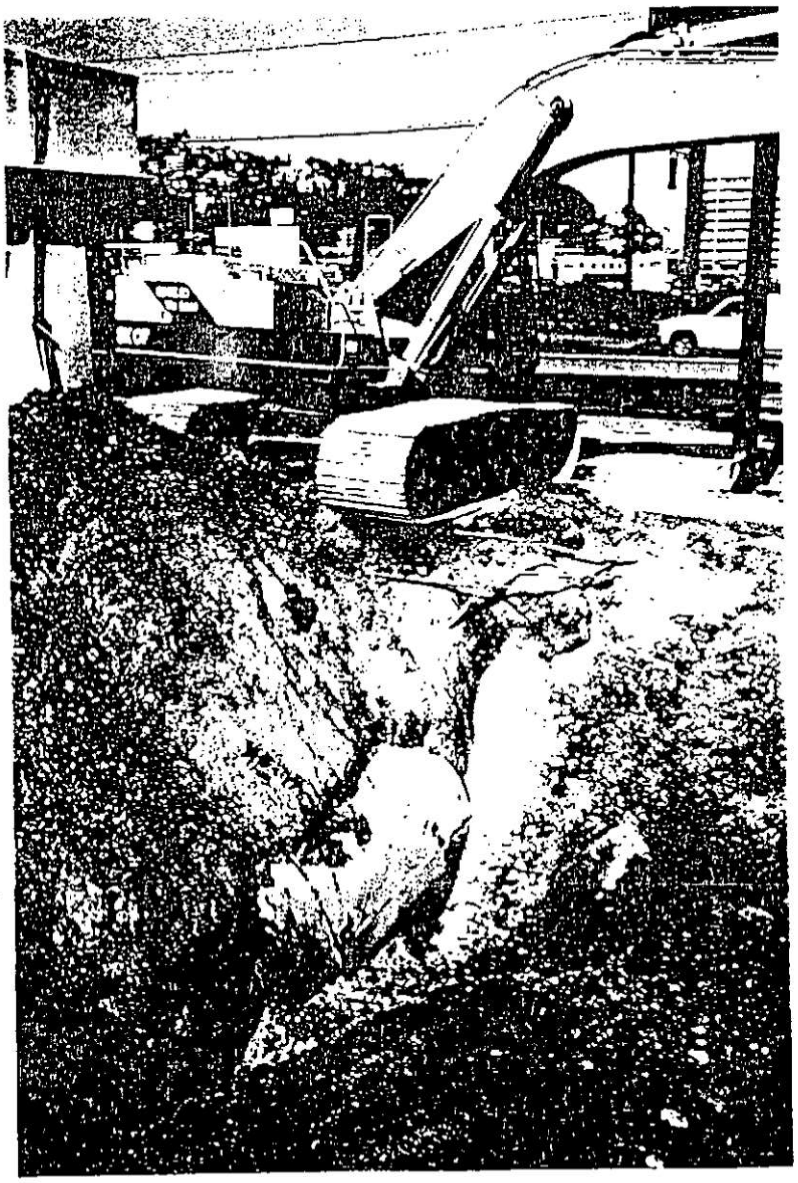


Plate 5. Exposing 5,000-gallon gasoline tank (T-3).

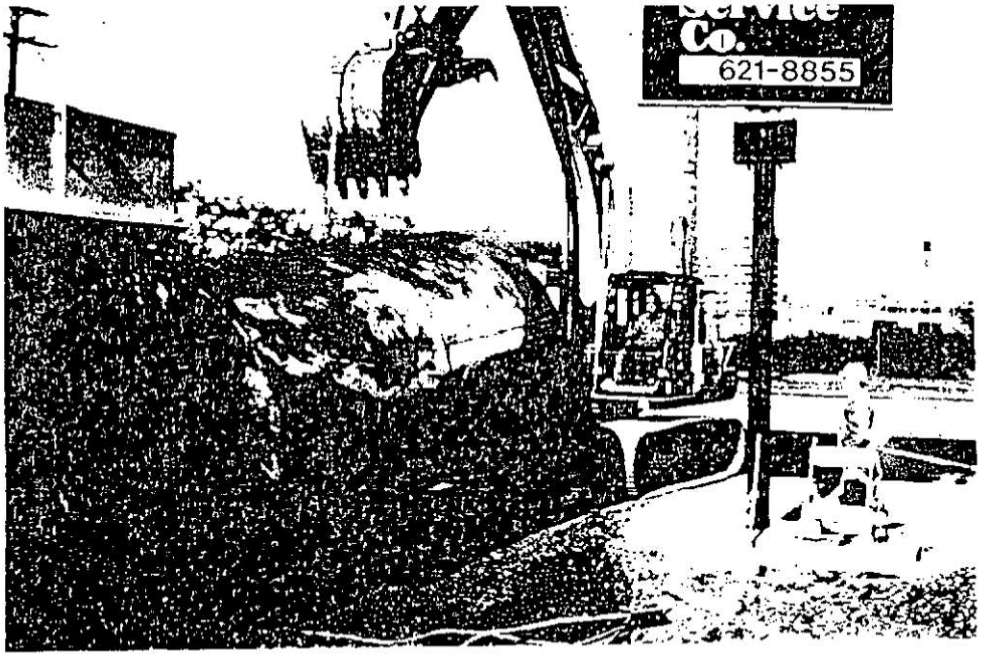


Plate 6. Removal of 5,000-gallon gasoline tank (T-3). View to north.

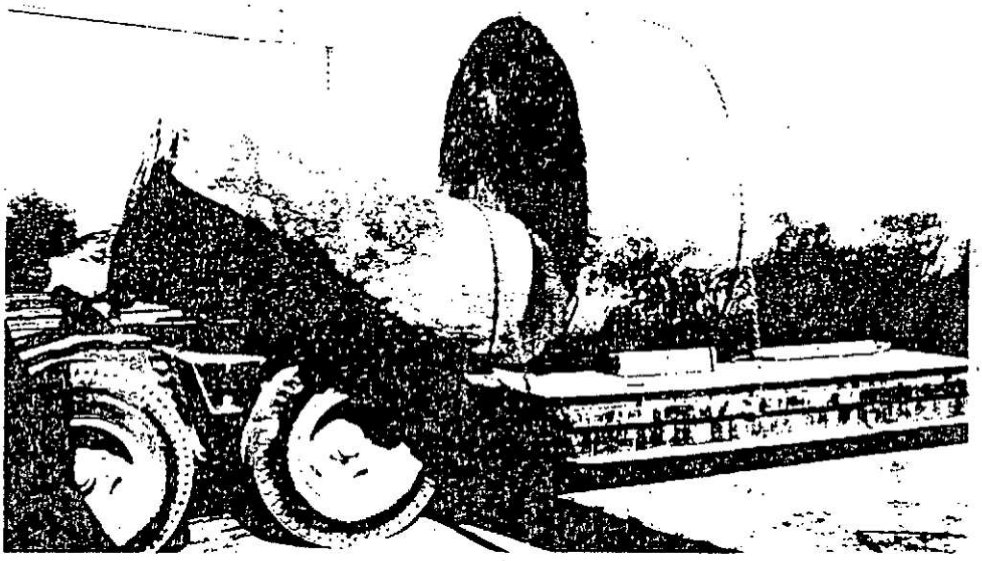


Plate 7. Loading 5,000-gallon tank (T-3) and 500-gallon tank (T-1) for transport.

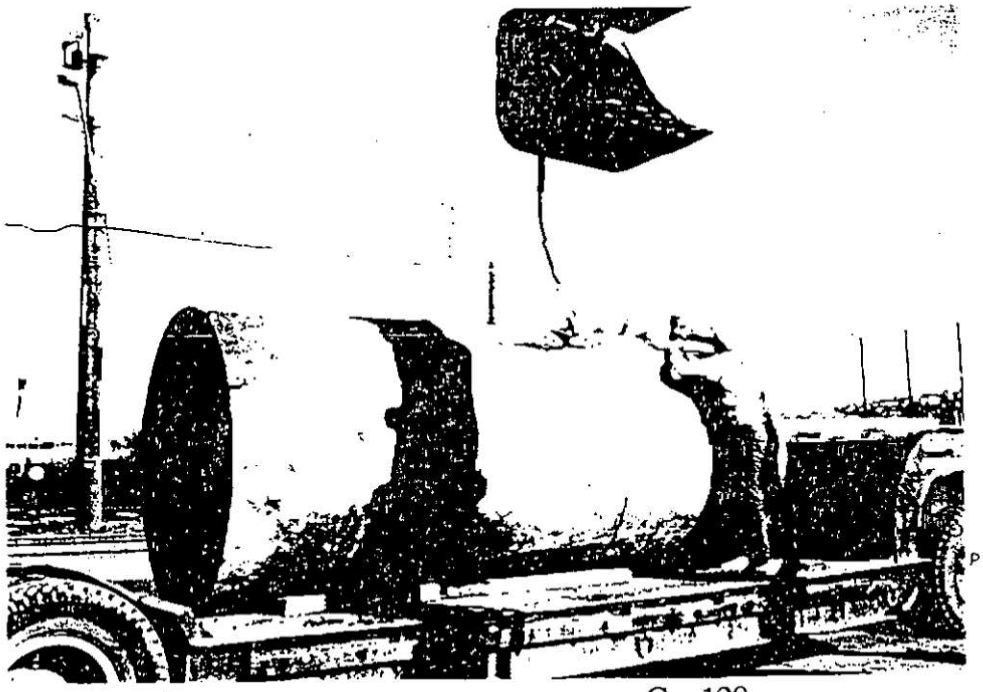


Plate 8. Loading 3,000-gallon gasoline tank (T-4) for transport.

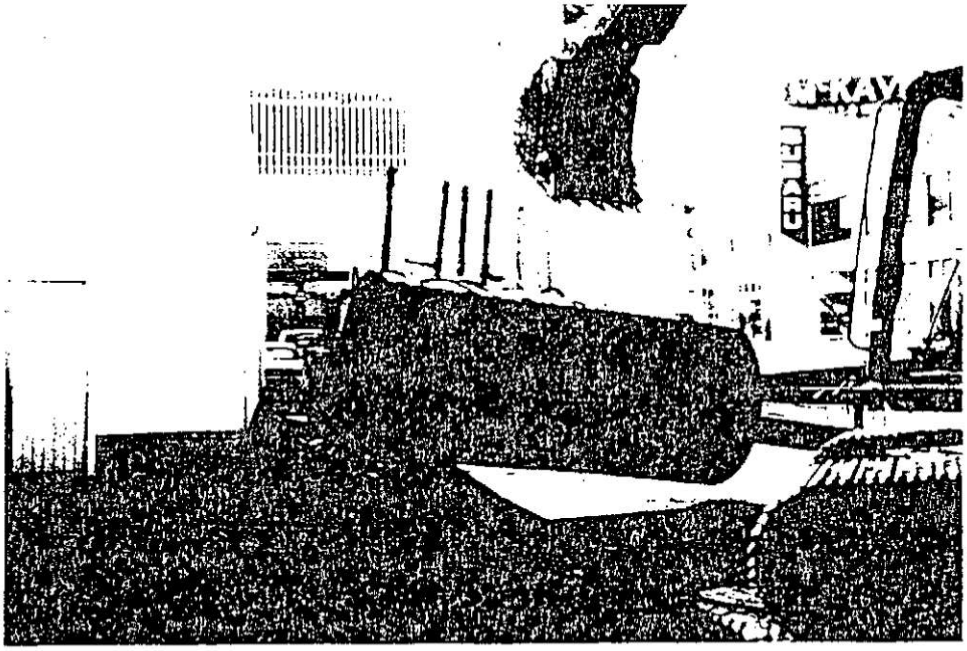


Plate 9. Removal of 2,000-gallon gasoli tank (T-5). View to south.

Plate 10. Contaminated groundwater at southwest corner of site in tank excavation for T-5. Depth is about 14 ft.

Plate 11. Contaminated groundwater at north end of site in tank excavation for T-3. Depth is about 14 ft.

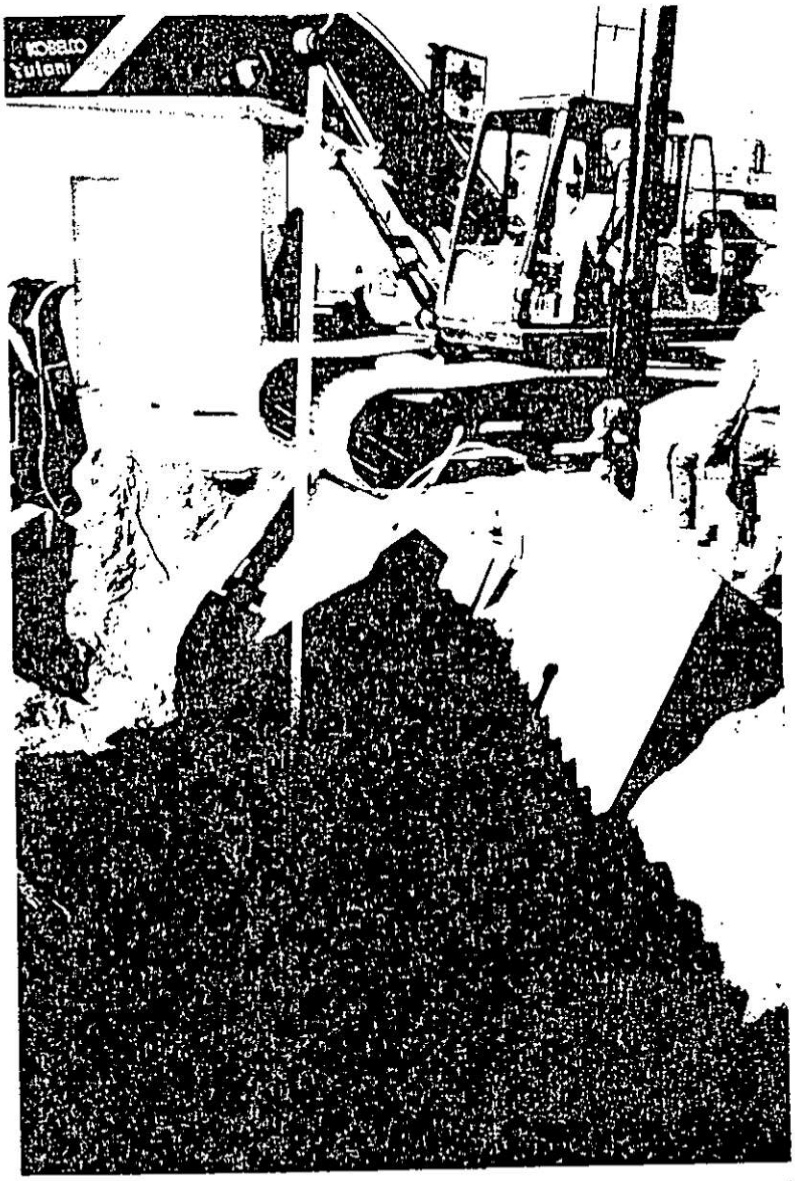


Plate 12. Installation of groundwater monitoring well at north end of site. Note shoring plates in excavation.

Plate 13. Placing filter fabric in excavation.

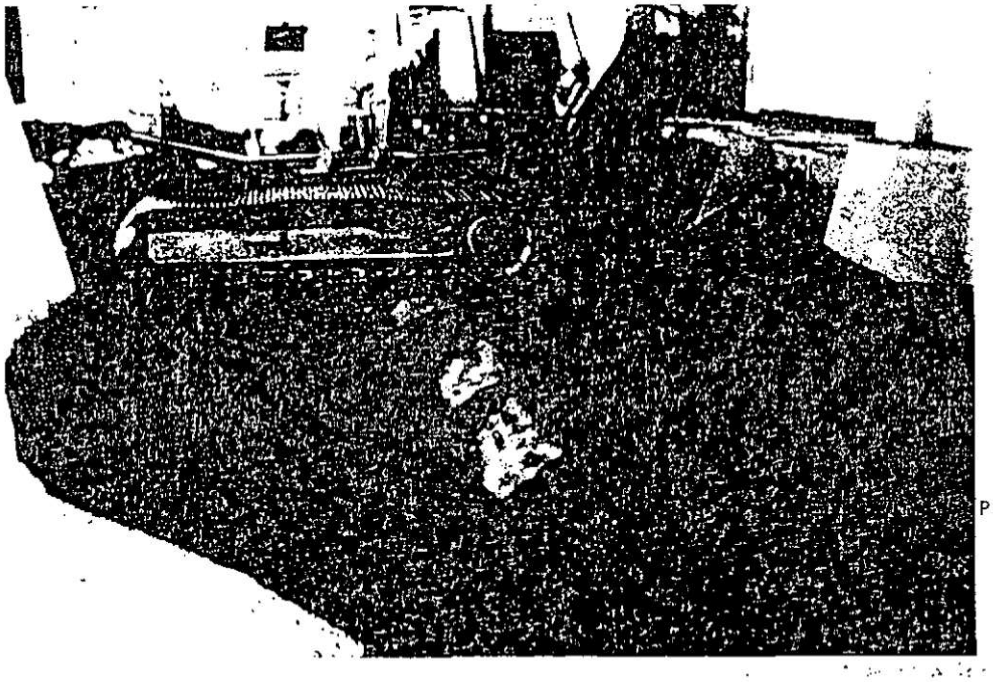


Plate 14. Backfilling tank excavation with clean sand and gravel. Note filter fabric and shor plates on right.

Plate 15. Compacting backfill material in tank excavation.

Plate 16. Exploratory hole adjacent to Westlake Avenue. Discovered an abandoned fuel line, but no tanl

SECTION 5

SITE CONTAMINATION

SOIL

Subsurface soils at the site consist of approximately 15 feet of fill material, underlain by native clay. The fill material includes an assortment of sand, gravel, clay, brick, wood, and concrete. In addition, railroad timbers and pilings covered with creosote were observed at a depth of approximately 10 to 15 feet in the tank excavations. The underlying native clay is gray, massive, plastic, and moist to wet, having similar characteristics to other subsurface deposits in the area.

Subsurface fill material on top of the native clay was contaminated with petroleum hydrocarbons over the entire area of the site. Over 800 cubic yards of contaminated soil was removed from the site during the excavation of the tanks. Dark-stained petroleum hydrocarbon contaminated soil was generally observed from about two feet in depth to the bottom of each tank excavation and at the south (upgradient), north (downgradient) and east property boundaries. The Fuel odors were very strong in each tank excavation and in much of the soil at the site.

A total of 42 soil samples and 4 water samples were collected from the tank excavations. Twenty-six of these soil samples and two water samples were selected for testing, and the remaining samples were archived. Analytical tests were conducted by Alden Analytical Laboratories Inc. for total petroleum hydrocarbons (TPH) using EPA Method 418.1, and benzene, toluene, ethylbenzene, and xylene (BTEX) using EPA Method 602/8020. In addition, four soil samples and one water sample were tested by Aquatic Research Inc. for total lead content.

Analytical test results indicated that 14 out of 16 soil samples tested for TPH exceeded WDOE's recommended clean up level of 200 ppm for TPH. The detected level of TPH contamination in soil at the site ranged from 2.9 ppm (Sample No. 3364) to 13,000 ppm (Sample No. 3367). The average level of TPH contamination in soil samples exceeding cleanup levels was about 2,000 ppm and the median level was 920 ppm.

Analytical test results indicated that 4 out of 10 soil samples tested for benzene exceeded WDOE's recommended clean up level of 0.66 ppm for benzene. The maximum level of benzene contamination was detected at 47 ppm (Sample No. 3367) in the soil on the southwest side of the site. Toluene was detected slightly above WDOE's recommended cleanup level of 143 ppm at this same location. Ethylbenzene was detected above its cleanup level of 14 ppm in three soil samples collected from the site. The maximum detected level of ethylbenzene contamination was 93 ppm (Sample No. 3367). The maximum detected level of total xylene was 440 ppm (Sample No. 3367); however, no cleanup levels have been established for xylene at the present time.

Analytical test results for total lead in four soil samples indicated a maximum concentration of 19.1 ppm (Sample No. 3312). Typical background concentration of total lead in soil is 100 to 200 ppm. Therefore, lead contamination in soil at the site appears to be insignificant.

Analytical test results for soil samples exceeding recommended WDOE cleanup levels for TPH and BTEX are summarized in Tables 2 and 3, respectively. Analytical laboratory reports for TPH, BTEX and lead, and chain of custody records are provided in Appendix D.

GROUNDWATER

Groundwater was encountered in the tank excavations at approximately 14 feet in depth, immediately above the native clay. An iridescent hydrocarbon sheen and a black, oily, tar-like substance were observed in the water on the north and south end of the site. The oily, tar-like substance was observed mostly on the south end of the site (upgradient) at approximately the level of the groundwater. As a result of these observations, a groundwater monitoring well was installed in the excavations on the north and southwest ends of the site for future testing. Each well was constructed of 2-inch diameter PVC, with the bottom two to three feet slotted. Gravel was backfilled around the screen at water level to prevent the well from filling with finer-grained sediment.

Two groundwater samples were collected directly from the tank excavations after the tanks were removed from the ground. These samples were tested for levels of TPH, BTEX, and total lead. Although sampling groundwater from the wells would have been more desirable, there was little time available during the tank removal process to allow for proper well development, groundwater stabilization, and sampling. However, these groundwater sample test results provide a rough indication of the levels of contamination that may be expected during future testing of the monitoring wells. Analytical laboratory reports for TPH, BTEX and lead test results, and chain of custody records are provided in Appendix D.

Maximum TPH in the groundwater was detected at 700 ppm (Sample No. 3365). WDOE's recommended cleanup level for TPH contamination in groundwater is 15 ppm. One groundwater sample (Sample No. 3289) was tested for BTEX levels. Benzene and ethylbenzene exceeded WDOE's recommended cleanup level in this sample by 112 and 2 times, respectively. A summary of the analytical test results exceeding recommended WDOE cleanup levels for TPH and BTEX in groundwater is provided in Table 4.

Total lead was detected at 3.1 ppm in one groundwater sample (Sample No. 3368) collected from the site. This level may be compared to a National Drinking Water Standard of 0.05 ppm for lead. Although groundwater at the site is not used for any drinking water supply, it probably flows to the north and eventually discharges into Lake Union. Therefore, contamination detected at the site is an obvious concern to the environment.

The source of total lead in groundwater at the site is unclear. The test results for lead in groundwater significantly contrast with levels of lead detected in soil at the site. For example, lead concentrations in soil are

expected to be much greater than 19 ppm (maximum detected level of lead at the site) for the same area in which lead in groundwater was detected at 3.1 ppm. Since the water sample was not filtered prior to testing, the results may reflect lead adsorbed on to suspended soil particles, instead of lead dissolved in the groundwater sample. Therefore, these test results may be indicative of background levels of lead detected in soil at the site rather than dissolved lead in the groundwater.

In order to provide a more thorough assessment of the quality and conditions of contamination in groundwater at the site and its potential impact on Lake Union, a number of wells must be properly installed, developed, and tested. Recommendations for providing this assessment are discussed in Section 7.

TABLE 2. SUMMARY OF ANALYTICAL TEST RESULTS
THAT EXCEEDED SOIL CLEANUP LEVELS FOR TPH AT WESTLAKE UST SITE

SAMPLE NO.	TANK LOCATION	DATE OF COLLECTION	TEST PARAMETER[1]	SOIL (ppm)	CLEANUP LEVEL[2] (ppm)
3279	T-1 (bottom)	02/28/90	TPH	3,800	200
3281	T-2 (bottom)	02/28/90	TPH	870	200
3283	T-3 (bottom)	02/28/90	TPH	820	200
3285	T-4 (bottom)	02/28/90	TPH	2,100	200
3287	T-5 (bottom)	02/28/90	TPH	1,700	200
3290	Exc. 1- N wall	02/28/90	TPH	1,400	200
3291	Exc. 1- NE wall	02/28/90	TPH	220	200
3293	Exc. 1- S wall	02/28/90	TPH	1,100	200
3294	Exc. 2- S wall	02/28/90	TPH	580	200
3295	Exc. 1- W wall	02/28/90	TPH	340	200
3362	Exc. 2- N wall	03/02/90	TPH	660	200
3363	Exc. 3- NE wall	03/02/90	TPH	970	200
3366	Exc. 2- W wall	03/02/90	TPH	220	200
3367	Exc. 2- S wall	03/02/90	TPH	13,000	200

Notes: [1] TPH is Total Petroleum Hydrocarbons.

[2] WDOE draft cleanup guidelines, August 1, 1988.

TABLE 3. SUMMARY OF ANALYTICAL TEST RESULTS
THAT EXCEEDED SOIL CLEANUP LEVELS FOR BTEX AT WESTLAKE UST SITE

SAMPLE NO.	TANK LOCATION	DATE OF COLLECTION	TEST PARAMETER[1]	SOIL (ppm)	CLEANUP LEVEL[2] (ppm)
3282	T-2 (bottom)	02/28/90	Benzene	3.1	0.66
			Ethyl-B	55	14
3284	T-3 (bottom)	02/28/90	Benzene	2.9	0.66
			Ethyl-B	35	14
3286	T-4 (bottom)	02/28/90	Ethyl-B	20	14
3288	T-5 (bottom)	02/28/90	Benzene	0.97	0.66
3367	Exc. 2- S wall	03/02/90	Benzene	47.0	0.66
			Toluene	160	143
			Ethyls-B	93	14

Notes: [1] Test parameter for BTEX includes benzene, toluene, ethylbenzene, and xylene.

[2] WDOE draft cleanup guidelines, August 1, 1988.

TABLE 4. SUMMARY OF ANALYTICAL TEST RESULTS FOR GROUNDWATER SAMPLES AT WESTLAKE UST SITE

SAMPLE NO.	LOCATION	DATE OF COLLECTION	TEST PARAMETER[1]	TEST RESULTS (ppm)	CLEANUP LEVEL[2] (ppm)
3289	Exc. 1	02/28/90	Benzene	7.4	.066
			Ethyl-B	2.5	1.4
3365	Exc. 2	03/02/90	TPH	700	15
3368	Exc. 2	03/02/90	Total Lead	3.1	.05[3]

Notes:

[1] Test parameter for BTEX includes benzene, toluene, ethylbenzene, and xylene. TPH is total petroleum hydrocarbons.

[2] WDOE draft cleanup guidelines, August 1, 1988.

[3] National Primary Drinking Water Standard, August 1987

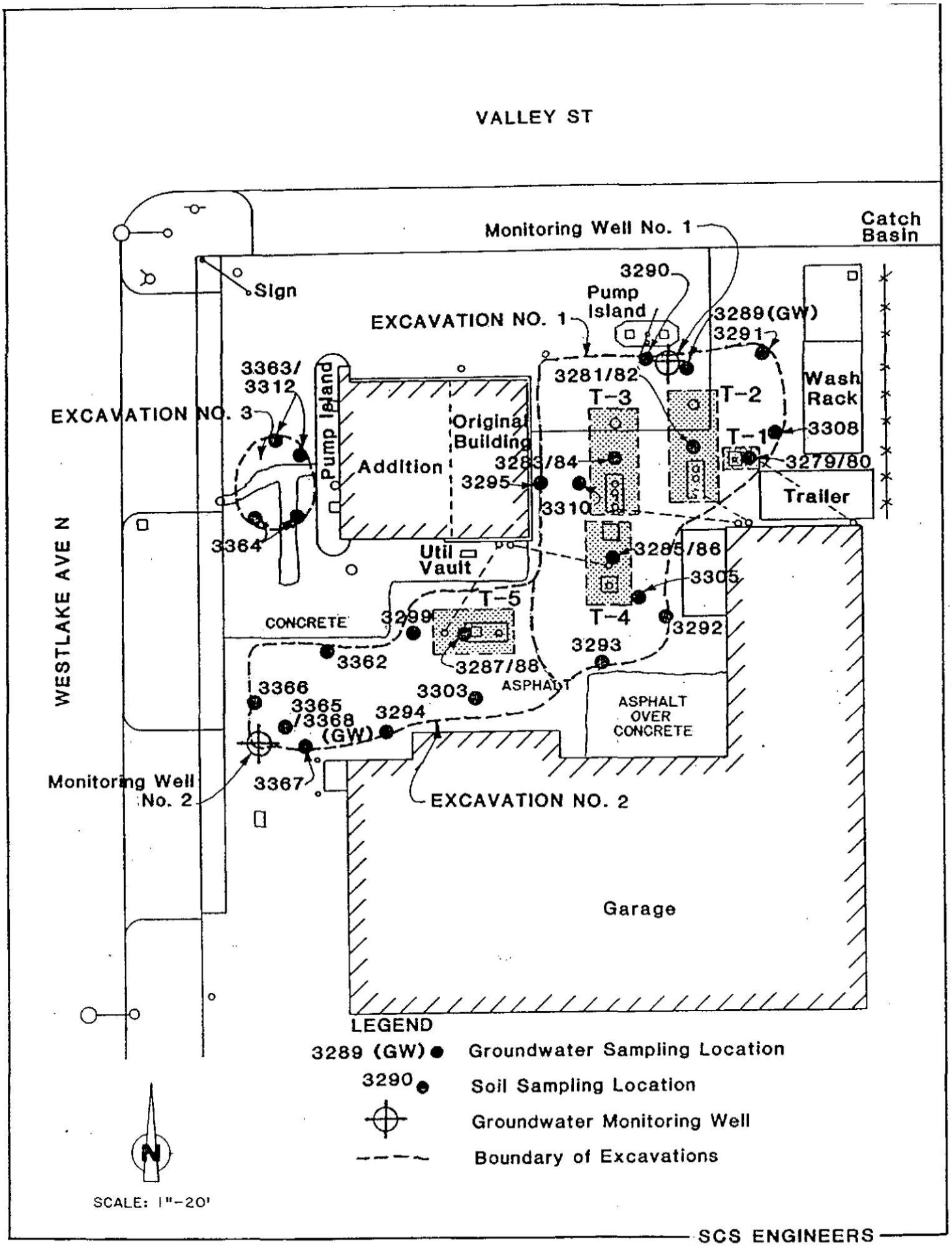


FIGURE 11 SOIL AND GROUNDWATER SAMPLING LOCATIONS

SECTION 6

CONCLUSIONS

Five underground storage tanks were removed from the Westlake site. No holes or obvious signs of leaks were observed in any of the tanks or fuel lines. The tanks appeared to be in fair condition, having only some areas of surface rust; however, the fill pipes and fuel lines generally exhibited a greater degree of surface rust and more extensive pitting.

During this investigation, it was discovered that three of the abandoned tanks (T-2, T-3, and T-5) contained water, and fill pipes for these tanks were plugged with concrete. During the 1960's and 1970's, it was common practice to inactivate a tank by filling it with water and then plugging access ports with concrete. The fact that these tanks contained water indicates that they probably were not leaking when they were in use.

High levels of petroleum hydrocarbon contamination (TPH and BTEX) were detected at the site. Although the source of this contamination was not specifically identified during this investigation, the contamination could be a result of previously leaking underground tanks, fuel lines, old spills, or migration of contamination from upgradient sources.

Approximately 800 cubic yards of petroleum hydrocarbon contaminated soil was removed from the site for treatment. An undetermined amount of contaminated soil remains at the site, primarily under the existing buildings and possibly beyond the property boundaries. Preliminary testing indicates that groundwater at the site is also contaminated with excessive levels of petroleum hydrocarbons and possibly lead.

Based on the location and detected levels of contamination at the site, there is a likely possibility of off-site migration of contamination. The predominant direction of contaminant migration would probably be to the north, because the regional topography and groundwater gradients both slope to the north. Migration of contamination to the Westlake site from upgradient sources (from properties south of the Westlake site) also appears to be a possibility, based on detected and observed contamination in the tank excavations on the south end (upgradient) of the site.

The fact that contaminated soil was observed to be extensive throughout the site including at the upgradient property boundary, indicates that contamination at the Westlake site potentially may have originated from an upgradient source. Based on our historical review, the underground gasoline spill that occurred south of the site 10 years ago is one suspected source of contamination. However, additional investigation is needed to substantiate this. Additional investigation is also needed to determine if the Westlake site is currently being impacted by contamination from other properties, by the transport of contaminated groundwater or volatile vapors.

Based on the findings of this investigation, additional work is needed to characterize the site before effective remedial alternatives for site cleanup can be considered. This will primarily involve determining the extent and level of contamination in the soil and groundwater, and possibly the direction and rate of plume migration in the groundwater. Recommendations for additional site work are provided in Section 7.

SECTION 7

RECOMMENDATIONS

Based on the results of this investigation, we recommend the following:

- Contact WDOE to satisfy notification requirements that the tanks have been removed from the site, and that plans for determining the extent of contamination are currently being developed. A completed WDOE tank closure form for this site will be forwarded to WDOE upon your request. A copy of this documentation is provided in Appendix E.

- Investigate levels of petroleum hydrocarbon contamination along the perimeter of the property, especially at the north end (downgradient) and south end (upgradient) of the site. This may assist in determining if on-site and off-site migration of contamination has occurred.

- Construct approximately 6 to 8 soil borings to a depth of approximately 20 feet in areas that are easily accessible by a drill rig, such as on the southwest, west, and north boundaries of the site. Based on analytical testing of soil samples collected from these borings, additional off-site borings may be necessary. Collect representative soil samples near the surface, middle, and bottom of each boring for testing.

- Convert two upgradient (on south property boundary) and two downgradient borings (on north property boundary) to groundwater monitoring wells after collecting soil samples from the borings. Determine the level of contamination in the groundwater, groundwater gradients, and direction of flow. In addition, install an upgradient background well to determine background levels of contamination. This upgradient well should be located south of the Union 76 Service Station, outside of areas previously impacted by the gasoline spill in 1980. Based on the analytical test results, it may be necessary to install additional monitoring wells to determine the downgradient extent of contamination. Strategic downgradient locations for these additional wells will be estimated after groundwater level gradients and contaminant levels are determined; however, based on existing data, the wells should be installed directly downgradient of the site, north of Valley Street. The approximate location of proposed monitoring wells and soil borings is illustrated in Figure 12.

- Develop the two existing groundwater monitoring wells that were installed at the site during this investigation. Once these wells are properly developed, they can be used to collect groundwater level and water quality information at the site. Well development procedures should consist of surge and bail techniques to remove all sediment from inside each well and provide an effective packing around the outside of the well screens.

- Test soil and groundwater samples for the presence of TPH (EPA Method 418.1) and BTEX (EPA Method 8020/602). In addition, we recommend testing for organic lead in upgradient and downgradient soil and groundwater samples to possibly assist in determining the source of contamination. Since the waste oil tank was recently in use and may have contained engine degreasing solvents, we recommend testing downgradient groundwater samples for the presence of halogenated volatile organics (EPA Method 8010).

- After completing this additional work to further characterize the site, evaluate remedial alternatives to clean up the site. Review alternatives with WDOE for approval and selection of the most feasible approach.

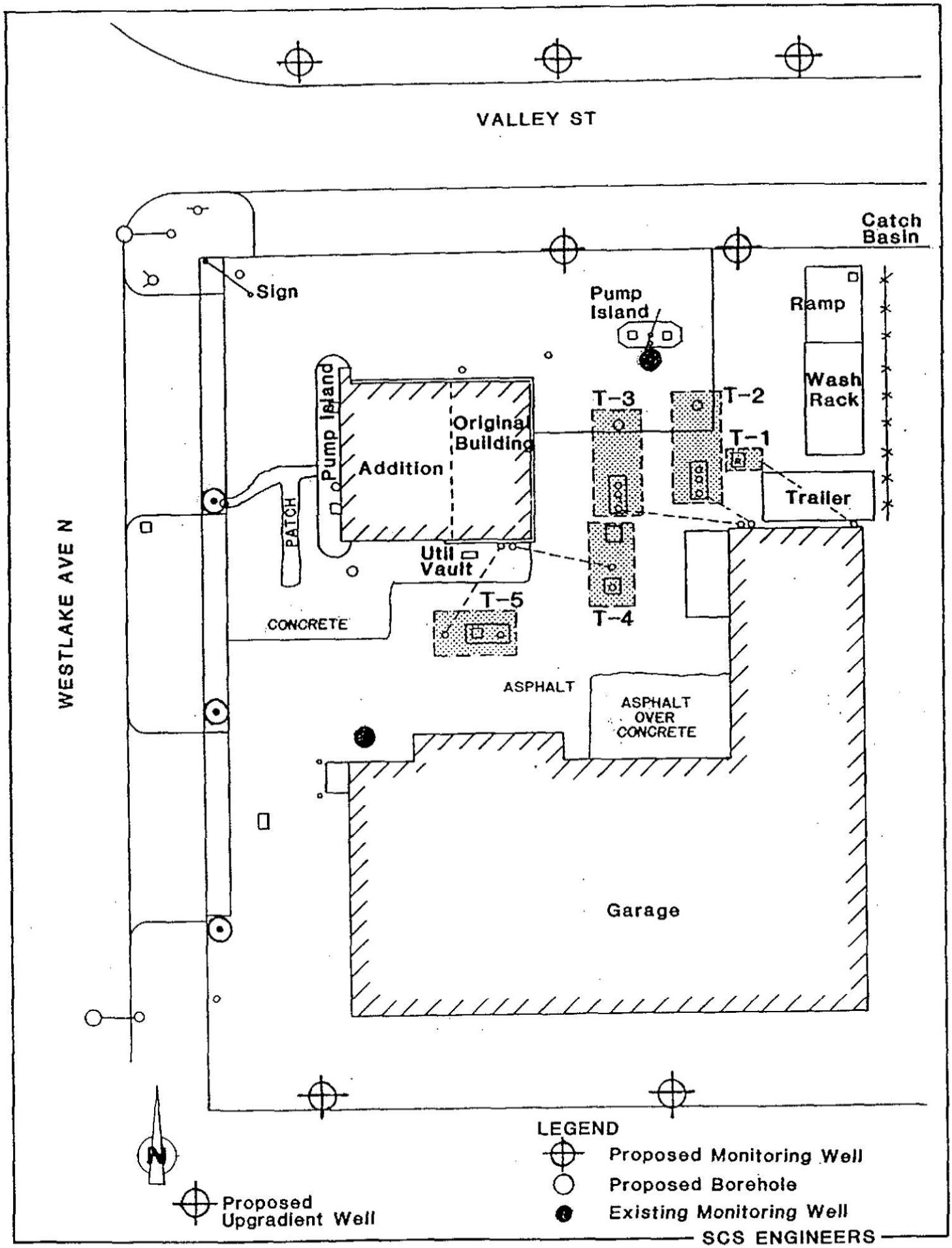


FIGURE 12 LOCATION OF PROPOSED MONITORING WELLS AND SOIL BORINGS

APPENDIX A

NEWSPAPER ARTICLES REGARDING GASOLINE SPILL AT UNION 76 STATION, SEATTLE, WASHINGTON

Gas leak blocks wider Westlake-Mercer area

by Herb Belanger and
Steve Johnston
Times staff reporters

More blocks were sealed off today around a Union 76 service station at Westlake Avenue North and Mercer Street where as many as 75,000 gallons of gasoline have leaked from an underground tank in the past six months.

Fire Department officials ordered closure of the area from Boren to Ninth Avenues North between Valley and Harrison Streets after finding more dangerous fumes in sewers. The highest readings were from sewers along Westlake.

Exits to Mercer Street from the freeway were closed at noon.

Jafco, William O. McKay and a Denney's restaurant were among businesses ordered closed this morning.

Union Oil crews meanwhile continued pumping gasoline from holes drilled behind the service station.

Battalion Chief P.A. Hargrove, assistant fire marshal, said as much as 75,000 gallons may have leaked over the past six months from a line connecting a 10,000-gallon tank to the station's pumps.

Police cordoned off a four-block area shortly after 3 p.m. yesterday when the Fire Department was notified of the leak.

Battalion Fire Chief R.B. Bower said the department was called when a passerby noticed service-station personnel pumping gasoline from holes behind the station into 55-gallon drums.

Bower said officials were told the leak was discovered Friday by the station crew. After taking readings for explosive fumes in surrounding sewer lines, it was decided to close the streets. Some nearby businesses also were closed.

Andrew Barone, a Union engineer, said employes suspected the tank was leaking and confirmed it when "a couple holes" were drilled in the ground behind the station. Gasoline 4 to 5 feet deep was found in the holes.

Barone said the Fire Department was notified about the leak Friday when it was discovered, but Bower said the department didn't know about it until yesterday afternoon.

Fire Lt. Stan Yantis said the gasoline fumes in the sewer lines could have been ignited by a cigaret or any open flame. Some gasoline was going directly into the Metro sewer system; other pools were drifting around underground.

Fire officials were checking fume readings in the sewers throughout the area.

Jeff Benoit, construction engineer for the company's Western division, said the pumping had continued for about 18 hours by midmorning.

Benoit said the recovered fuel probably would be unusable except for use with road-surfacing material.

Gasoline leak keeps intersection closed

by Herb Belanger
Times staff reporter

Additional steps aimed at opening Westlake Avenue North and Mercer Street to traffic were taken yesterday at a Union 76 service station where about 75,000 gallons of gasoline leaked underground.

Since June 9, when the leak was disclosed, traffic in the vicinity has been disrupted while crews work around the clock, seven days a week, to recover the gasoline and eliminate dangerous vapors.

The area surrounding the leaky station remained blocked off today.

Deputy Fire Chief William Landers last night said the area surrounding the leaky station probably will remain blocked off today.

Work crews dug another deep trench at the southwest corner of the station and installed a steel casing to be used for pumping out gasoline. Two trenches were dug last week.

Two six-inch sewers also were connected from the station to the main sewer in the center of Westlake. High levels of gasoline fumes have been recorded in manholes opposite the service station.

Area businessmen, meanwhile, have not been happy with the situation.

John Nerney, president of the William O. McKay Subaru dealership at 609 Westlake Ave. N., directly opposite the station, said he feels "this is all a horrible dream, and I'll wake up and find it isn't true."

"I can't understand how a company as big as Union Oil can have a leak over a long period of time and not know about it."

Nerney said he did not plan legal action, but asked the oil company to pay his expenses while Westlake was closed. The company refused to pay.

The Denny's Restaurant at the corner of Mercer Street and Terry Avenue North had a 45 per cent drop in sales last week, according to Mike Corbell, manager. After closing one day, the restaurant was allowed to reopen. But Corbell has hired watchmen round the clock to keep customers from smoking outside the restaurant.

He said he is keeping a record of average sales at this time of year and the actual sales while traffic is rerouted. In addition, he is logging the wages employes lose when they are sent home because of lack of business.

He said any negotiations for compensation from Union Oil will be on the corporate level.

The Jafco store on Westlake Avenue North was closed one day last week. The store reopened with limited access along Westlake and Mercer to its parking areas.

Bernard Gordon, Jafco's general manager, said business was pretty low at first, but it has been improving steadily. He has talked with Union Oil's insurance representatives, and said Jafco's lawyers will be handling the matter.

At the Pacific Lincoln-Mercury dealership, 601 Westlake Ave. N., Mike O'Brien said, "The results have been disastrous. I've never experienced anything like this in 25 years. There's been a complete stoppage of business since Tuesday of last week."

Crews still reclaiming gasoline at leak site

by Peter Lewis
and Herb Belanger
Times staff reporters

Lessening danger may permit reopening of the area around Westlake Avenue North and Mercer Street, where about 75,000 gallons of gasoline was lost through an underground leak, Fire Marshal Robert Hansen said today.

Mercer Street was to be opened, for rush-hour traffic only, this afternoon if flushing of sewers reduced the explosive potential of fuel in the sewers.

Hansen expected Westlake and Mercer would be open to normal traffic over the weekend.

The Union Oil Co. said it would replace all the underground fuel lines at the station, which will remain closed for about two weeks.

A 60-foot-long ditch was partly completed last night alongside the station in a project to drain gasoline from fuel-saturated soil. Another ditch will be dug tonight on the north side of the station.

The "French drains," 4 feet wide and 15 feet deep, will have "scavenger pumps" to draw gasoline into hoses for pumping into tank trucks. The pumps will have a capacity of 15,000 gallons a day.

As digging proceeded last night, dump trucks were lined up to haul the excavated material, under plastic sheets, to the Union Oil plant at Edmonds. Trucks were driven to Edmonds in convoy, escorted by Seattle police.

The area was sealed off Monday when the Fire Department learned of the leak. Businesses in the area have been reopening as the danger subsides. The Jafco discount store reopened today.

Storm sewers are being capped on the northwest and southwest corners of the station to stop the migration of gasoline vapors into underground utility lines.

Ken Mauermann, district inspector for the state Department of Ecology, said it is hoped that much of the gasoline is contained along the basement floor and wall of an old building foundation under the service station.

Hansen said last evening that test readings were showing reduced levels of vapors in manholes and nearby building basements. "It's not an atomic bomb sitting in the street," he said.

Mauermann said he doesn't expect any of the leaked gasoline to work its way into Lake Union. He said he would wait until the recovery is finished before beginning to assess damage and possible liability.

Union Oil representatives estimated that about 6,000 gallons of gasoline had been pumped from two holes drilled at the station, Mauermann said. Most of what was drawn yesterday from two "wells" drilled earlier was water, he added.

Gasoline has leaked from a line connecting the station's underground storage to the pumps, possibly over a six-month period.

Oil-company billing procedures apparently permitted the gasoline to leak without discovery.

Mauermann said the cooperation of Union Oil in containing the leak has been "astonishing."

Traffic returns to normal around site of lea

by Peter Lewis
and Herb Belanger
Times staff reporters

Traffic along Mercer Street has returned to normal for the first time since Monday after gasoline vapors subsided and a project to recover 75,000 gallons of leaked gas appeared to be doing the trick.

Only Westlake North between Mercer and Valley Streets remained closed this morning. It was to be reopened today if readings of vapor levels in sewers indicated there was no danger.

A trench was completed last night along the north side of the Union 76 service station, scene of the gasoline leak. A trench had been dug the previous night along Westlake Avenue North.

Crews last night loaded plastic-lined trucks with tons of gasoline-soaked soil. The soil was being taken to the Union 76 plant at Edmonds where it will be aerated.

Daytime traffic snarls caused by detours around a four-square-block area surrounding the station should be over.

Battalion Chief Merl Weatherhogg said all businesses in the area reopened yesterday except for one millwork building owned by the Brace Lumber Co., 965 Valley St.

But two automobile dealerships along the closed portion of Westlake Avenue North, William O. McKay Subaru and Pacific Lincoln-Mercury, reported extremely slow business because of the limited access.

"We don't know when the gasoline will all be out," Fire Marshal Robert Hansen said. "It may take several months, but as long as there's no hazard, we don't care how long it takes."

Yesterday, crews completed capping storm sewers running off the Union 76 station, stopping the spread of vapors underground.

Pipes were being laid in the trenches, then were being filled in with gravel and dirt. A storage tank to hold the recovered gasoline will be installed.

An estimated 75,000 gallons of high-octane gasoline leaked, perhaps for as long as six months, because of a rupture in a pipe connecting an underground storage tank with the station pumps.

Company billing procedures for the station allowed the missing gasoline to go unnoticed, Union officials said.

Westlake-Mercer area still closed

Stretches of Westlake Avenue North and Mercer Street remained closed to traffic today because of dangerous readings of gasoline fumes in sewer manholes.

The streets near their intersection have been closed most of the past week because of discovery that about 75,000 gallons of gasoline had leaked underground at a Union 76 service station.

Five test wells were drilled in Westlake last night in search of pools of gasoline, but only fumes were found. More wells were to be drilled today.

"We are concerned that there may be gasoline floating in the sump area (the gravel around the sewer itself)," said Paul Dennis, manager of division services for Union Oil Co. "We want to see if we can draw off the fumes that seem to be plaguing that line."

Two manholes have been the major problem — one at the corner of Mercer and Westlake, and another on Westlake south of Mercer. These and another manhole at the junction of Westlake, Broad and Valley Streets have registered dangerously high fume readings.

Scavenger pumps installed at trenches dug in the station property are drawing off mixed gasoline and water and pumping it into tank trucks to be transported to the Union Oil plant at Edmonds. More than 15,000 gallons already have been recovered.

Gas fumes again close intersection

Dangerous readings of fumes in sewer manholes prompted the Fire Department to order closure again yesterday of Westlake Avenue North and Mercer Street at their intersection.

The streets in the area remained closed at rush hour this morning.

Work has been going on for a week to contain an estimated 75,000 gallons of gasoline which leaked underground at the Union 76 station at the northeast corner of the intersection.

The new readings at the intersection showed a 100 per cent possibility of an explosion if there was a spark or flame.

Trenches have been dug alongside the station to draw off the gasoline water mixture and pump it into tank trucks for transportation to the Union Oil plant at Edmonds.

Through yesterday 15,000 gallons of mixed gas and water had been removed from the station.

Mercer gas-leak detour to end today

by Peter Lewis
[illegible]

Barring some last-minute hitch, motorists should be able to travel along Mercer Street this afternoon to reach Interstate 5, the Seattle Fire Department said yesterday.

With the exception of a day or two in between, it will be the first time since June 9 that the heavily traveled thoroughfare has been open at Westlake Avenue North.

The Union 76 station at that intersection, near the south end of Lake Union, has been the site of a major gas-recovery project since it was discovered that an estimated 75,000 to 82,000 gallons of gasoline leaked from underground tanks.

Crews yesterday were erecting a 6-foot-high chain-link fence down the middle of Westlake Avenue North between Mercer and Valley Streets, and around the station to permit further recovery work to continue. The two west lanes of Westlake Avenue North also were expected to reopen today.

Seattle Fire Chief Robert Swartout yesterday said the fence probably would remain up at least through July 4 as a precautionary measure against fireworks that could ignite any remaining gasoline. About 15,000 gallons had been recovered as of yesterday, the chief estimated.

Meanwhile, Barry Lane, a spokesman for Union Oil in Los Angeles, said yesterday that the company "is not trying to avoid any responsibility because we know it's ours." He set the amount of missing gas at 82,000 gallons, about 7,000 gallons more than generally has been estimated so far.

Lane could not explain how the gas, which apparently leaked over a several-month period due to corrosion of a steel storage tank or pipe leading to the station pumps, went undetected.

"We have no answers yet," he said, adding that the matter was under investigation and that "our attention has been mainly directed toward solving the main problem (of safety and recovery)."

Lane said the station, at 600 Westlake Ave. N., was the company's largest in the Northwest, pumping nearly 250,000 gallons a month. He said the station was among a minority of Union 76 stations that work on a "consignment" basis as opposed to "outright sale."

The operator of the consignment-type station "does not own the gasoline until such time as he pumps it," Lane said. Because of the billing process, a consignment operator would have no way of knowing how much gas was in the storage tanks. "All he knows is what he's pumping," Lane said.

An adjustor hired by the company to compensate area businesses for loss of business suffered as a result of traffic restrictions confirmed that her mission "is to settle, not to investigate."

One thing complicating settlements, however, is uncertainty over whether the area will be closed again, an affected businessman said.

New underground storage tanks going in at site of big gas leak

Heavy-construction equipment was crowded onto the Union 76 service-station site at Westlake Avenue North and Mercer Street yesterday as workmen try to get the station back into operation by July 14.

The station was the site of a massive gasoline leak that closed the two streets to traffic for more than two weeks.

Paul Dennis, manager of division services for the Union Oil Co., said three underground storage tanks, two of 10,000 gallons and one of 8,000, are to be replaced soon.

Four new fiberglass tanks, each holding 10,000 gallons, will be installed, he said. Three will be used to store gasoline for sale, the other will be to store leaked gasoline that is recovered from the ground.

Dennis said work is well along on all the underground installations, including the piping to the pumps from the new tanks and the scavenger pumps used to recover the gasoline from the leak.

The pumps, which skim off gasoline from the top of the water table, are installed in casings sunk about 15 feet into the ground.

An estimated 75,000 to 82,000 gallons of gasoline leaked underground over a period of months. Through last week some 15,000 gallons of gasoline was recovered.

With permanent installation of the scavenger pumps, Dennis said, "If the water table changes, we'll always be able to recover any of the gasoline floating on the surface."

The Seattle Times Thursday, June 26, 1980

Traffic back to normal as Mercer Street reopens after gas leak

by Herb Belanger
Times staff reporter

Traffic returned to normal on Mercer Street yesterday afternoon for the first time, except for one or two days, since June 9 when a major gasoline leak was discovered at a Union 76 service station.

The resumption of traffic came after a 6-foot chain-link fence, backed by a plywood barricade, was erected around the station, and after a ventilation system was installed in the sewer main running under Westlake Avenue North.

Traffic also was flowing on Westlake between Mercer and Valley Streets, but it was restricted by the fence to the two west lanes.

Seattle Fire Marshal Bob Hansen said the resumption of traffic was approved after tests of the sewer mains under the busy intersection indicated no gasoline-fume accumulation following installation of the ventilation system.

Hansen said the sewer line will be ventilated for at least six months.

About 14,500 gallons of gasoline have been pumped out of the ground around the station. Union Oil Co. officials said a break in the station's underground-storage system allowed between 75,000 and 82,000 gallons of gasoline to leak into the ground in the past several months.

Hansen said he expects up to another 10,000 gallons to be pumped from the ground, with the rest remaining to be broken down "by bacterial action." Hansen declined to estimate how long that might take.

All test wells sunk around the service station will be monitored regularly to make sure migration of the gasoline or bul- site on a 24-hour basis from the time the leak was discovered, will be returned to their normal duties, probably by the end of the week, Hansen said.

The job of monitoring the test wells and sewer for gasoline fume buildup will be taken over by the oil company, which will report regularly to the Fire Department.

Mercer Area Storeowners Are Cryin

By S.L. Sauger

The Union 76 service station at Westlake and Mercer is back in business but some people in the neighborhood still are burned up over the gasoline leakage incident at the station.

Skip Schermer, owner of The Magic Flute, a nearby stereo and music store, is so incensed that he put up a sign outside his building that says "Public Enemy No. 1, Union Oil; Refuses to Pay Damages for Gas Spill."

Bill Cargill, who sells used cars for Pacific Lincoln Mercury across the street from the gas leak location, says it was "a disaster" for him.

"It was so bad there for a while, my wife almost threw me out. I wasn't bringing any money home."

The station closed June 9 after a strong smell of gasoline was noticed. The fire department later closed off a four-block area to traffic because of the danger of explosion.

The closure lasted until June 25 — two weeks. But local business people say the effects of closing the street, and the resulting publicity about danger, cost them customers for a month to six weeks.

Some 75,000 gallons of gas leaked from a line be-

claims payments have been extensive, but he does not have any numbers.

"We have made final settlements with better than half of the 34 claims. They submit a claim, showing their books of past records compared with sales during the closed period, and we make restitution based on the difference. If somebody says, 'We lost $300,000,' we say, 'Prove it.'"

No lawsuits have been filed yet, Dennis said.

Bernard Gordon, general manager of Jafco, which runs a catalog showroom across the street from the station, said business is returning to normal but that attorneys are working on Jafco's loss claim.

"We were closed down one full day, and otherwise it was extremely difficult to get to our store when the streets were closed," Gordon said.

Denny's, right next door to the 76 station, experienced a business drop of about 50 percent during a four-week period, said manager Mike Corbell.

Corbell was confident that Union would pay as soon as Denny's got its claim together.

Over Spilled Gas

Stan Croff, general manager of William O. McKay Co., a large auto dealer, was one of the hardest hit by the leak incident.

"We are still negotiating with Union. I would say our business was down to 20 percent of normal. Part of the time, there was hardly any access to us unless customers came in through the alley. One day, the fire department ordered us out completely.

"Another problem was that the papers and television were saying how dangerous it was around the station located across West-lake from McKay's, so people were afraid to come here for fear of getting killed.

"We lost our allocation of cars for a month because we did not sell our quota. It was one of the more unpleasant things I've seen in 15 years. It was very costly to us.

APPENDIX B

COMPACTION TESTING AND DENSITY RECORDS

HONG WEST & ASSOCIATES

• Geotechnical Engineering • Hydrogeology • Materials Testing • Construction Inspection •

INSPECTION REPORT

PROJECT: Pennzoil Auto Service Co.
DATE: 3-5-90
LOCATION: Valley ST. and Westlake AVE N. Seattle, WA.
GENERAL CONTRACTOR: SCS
CONTRACTOR'S REP: Richard Alvord
JOB NUMBER: 8995
OUR REPRESENTATIVE: T. Maddock
PERMIT NO:
SUB. CONTRACTOR: Meridian Const.
ARCH:
SUB. REP:
ENGR:

Performed in-place density tests @ Sub Grade. Material tested was imported "Pit Run" (gravelly, Sand). Test equipment was nuclear density/moisture gauge (Troxler model 3411B). Test results were 98%, 98%, 98%, and 100% compaction, w/ 90% specified minimum compaction.

T. Maddock

PAGE 1 OF 1

HWA 101-90

HONG WEST & ASSOCIATES

• Geotechnical Engineering • Hydrogeology • Materials Testing • Construction Inspection •

INSPECTION REPORT

PROJECT: Pennzoil Auto Service Co. DATE: 3-2-90

LOCATION: Valley ST. and Westlake AVE. N. Seattle, WA. GENERAL CONTRACTOR: SCS

CONTRACTOR'S REP: Richard Alwood

JOB NUMBER: 8995 OUR REPRESENTATIVE: T. Mostbook

PERMIT NO: SUB. CONTRACTOR: Meridian Const.

ARCH: SUB. REP:

ENGR:

Performed random in-place, during backfilling activities, 1 @ S., E., and W. of office. Test results were 97%, 97%, 98%, 100%, 100%, 100%, and 100% compaction (w/ 90% specified minimum compaction). Material tested was imported "Pit Run" (gravelly, sand). Tests were taken w/ Campbell Pacific nuclear density/moisture gauge. Crew backfilled to nearly sub-grade and are starting to excavate utilities trenches, by end of workday.

T. Mostbook

PAGE 1 OF 1

HWA 101-90

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

FIELD DENSITY REPORT

Project: Pennzoil - Auto Service Co.
Address: Valley ST. and Westlake AVE. D.

Job Number: 8995
Date Tested: 3-2-90 By: T. Maddock
Client: S.C.S.

Attention: Richard Alvord

Test Apparatus: Campbell Pacific Nuclear moisture/density gauge Mach. No. 1
Soil Description: imported "pit Run" gravelly, Sand
Temperature Air: .....°C Soil: .....°C
Specified Compaction: 90 %
Compaction Standard: ASTM D1557
Minimum Dry Density: ..... PCF
Maximum Dry Density: 128.5 PCF
Optimum M.C.: 8.5 %

Test No.	1	2	3	4	5
Location	15'S. 20'E. of SE. corner Pennzoil Office Bldg	15'S. 10'E →	C'S. 12'E of NE. corner →	10'S. 10'E →	15'S. 15'E →
Elevation	2' Below Grade	1' BG.	4' BG.	3' BG.	2' BG.
Wet Density — PCF					
Moisture Content — %	4.0	4.0	4.0	4.4	4.5
Dry Density — PCF	125.0	124.3	126.2	128.0	128.5
Compaction — %	97	97	98	100	100

Test No.	6	7			
Location	10'S. 12'E of NE. corner Pennzoil Office	10'S, 22'W NW. corner Bldg →			
Elevation	1' BG.	1' BG.			
Wet Density — PCF					
Moisture Content — %	4.0	4.1			
Dry Density — PCF	128.0	128.3			
Compaction — %	100	100			

SIDE

All tests performed in accordance with ASTM

HONG WEST & ASSOCIATES

• Geotechnical Engineering • Hydrogeology • Materials Testing • Construction Inspection •

INSPECTION REPORT

PROJECT: Pennzoil Auto Service Co. DATE: 3-1-90

LOCATION: Valley ST. and Westlake AVE. N. Seattle WA. GENERAL CONTRACTOR: SCS.

CONTRACTOR'S REP: Richard Alvord

JOB NUMBER: 8995 OUR REPRESENTATIVE: T. Maddock

PERMIT NO: SUB. CONTRACTOR: Meridian Const.

ARCH: SUB. REP:

ENGR:

Performed in-place density tests @ S. and E. of office. Test results were 99%, 97%, 100%, 99% 96%, 98%, 98%, 99%, and 100% compaction (w/ 90% specified minimum compaction). Crew excavated down to designated depth (10' to 11') and hauled contaminated soils from site. Crew then placed moderate lifts (1') of imported 6" pit run in excavated area and compacted lifts (BOMAG BW 142 D vibratory steel drum compactor). Stabilization fabric was placed @ base of excavation prior to backfilling. In-place density tests were performed w/ Cambell Pacific Nuclear density / moisture gauge. Backfill activities are scheduled to continue tomorrow.

T. Maddock

PAGE 1 OF 1

HWA 101-90

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

FIELD DENSITY REPORT

Project: Pennyoil - Auto Service Co.
Address: Valley ST. and Westlake AVE. N. Seattle, WA.
Job Number: 8995
Date Tested: 3-1-90 By: T. Maddock
Client: SCS
Attention: Richard Alvord

Test Apparatus: Campbell Pacific nuclear moisture/density gauge Mach. No.: 1"
Soil Description: imported "pit Run" gravelly, Sand
Temperature Air: °C Soil: °C
Specified Compaction: 90 %
Compaction Standard: ASTM D1557
Minimum Dry Density: PCF
Maximum Dry Density: 128.5 PCF
Optimum M.C.: 8.5 %

Test No.	1	2	3	4	5
Location	15'S, 20'E. of SE. corner Pennyoil Office Bldg	10'S, 20'W.	12'S, 10'W.	12'S. 15'W	12'S. 8'W. S.W. corner
Elevation	3' Below Grade	8'BG.	5'BG.	4'BG.	6'BG.
Wet Density — PCF					
Moisture Content — %	4.0	3.8	4.0	4.0	4.0
Dry Density — PCF	127.2	124.3	129.0	127.5	124.0
Compaction — %	99	97	100+	99	96

Test No.	6	7	8	9	
Location	10'S of SW. corner Pennyoil Office Bldg	12'S, 4'W	12'S, 6'W	15'S 5'W	
Elevation					
Wet Density — PCF					
Moisture Content — %	4.3	4.0	4.0	4.4	
Dry Density — PCF	125.7	124.5	127.3	128.6	
Compaction — %	98	98	99	100	

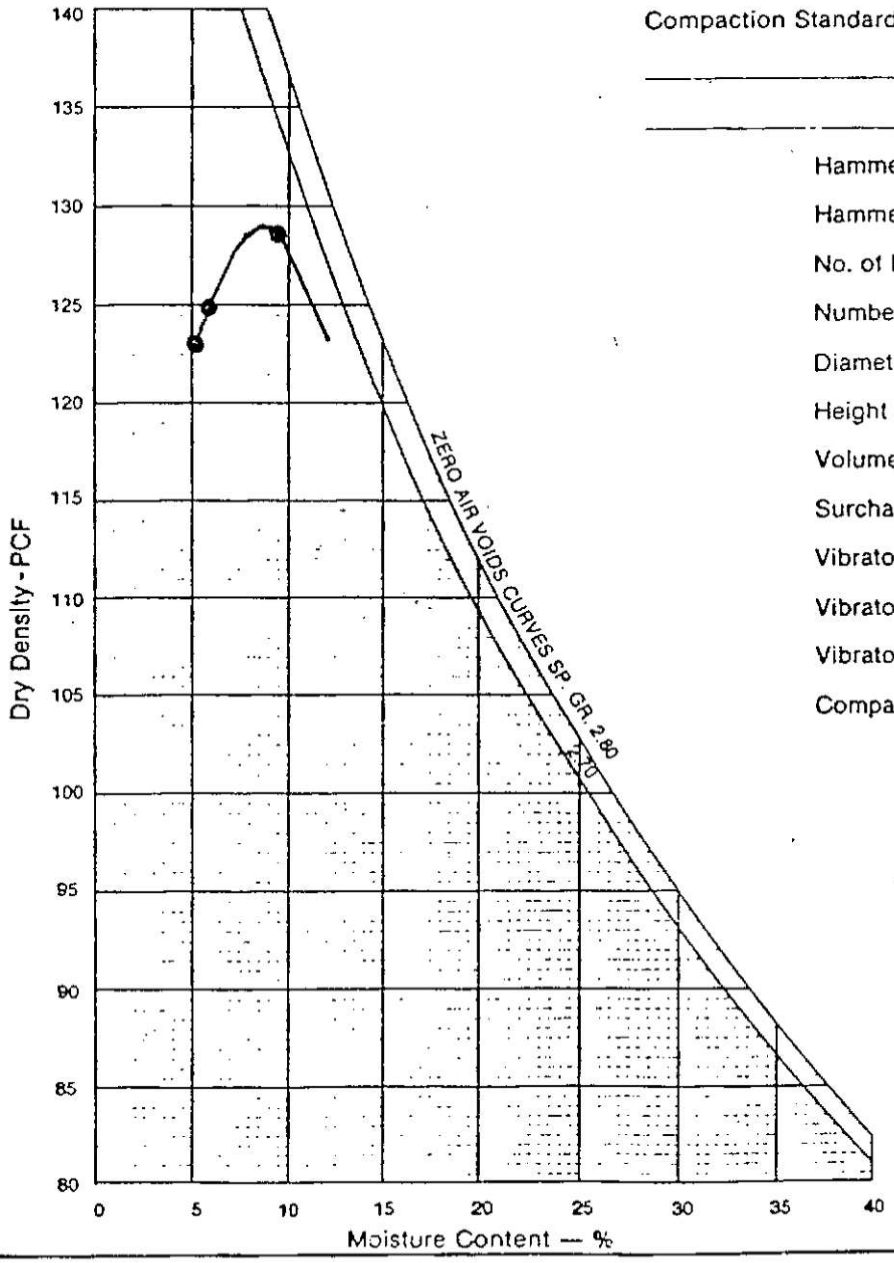
SITE

All tests performed in accordance with ASTM

COMPACTION TEST RESULTS

Project: City of Seattle
Address: S. end Lake Union
Job Number: 8995
Date Tested: 2-29-90 By: S.Y.
Client: SCS
Attention:

Sample Number:
Sample Location: Imported from general Constr Pit
Sample Description: Gravelly SAND (medium to coarse)
Minimum Dry Density: PCF
Maximum Dry Density: 128.5 PCF
Optimum Moisture Content: 8.5 %
Natural Moisture Content: 5.3 %
Compaction Standard: ASTM D-1557



Hammer Weight: 10 lbs.
Hammer Drop: 18 ins.
No. of layers: 5
Number of blows/layer: 25
Diameter of mold: 4 ins.
Height of mold: 4 ins.
Volume of mold: 1/30 cu.ft.
Surcharge Weight: lbs.
Vibratory Amplitude: ins.
Vibratory Frequency: vib./min.
Vibratory Time: min.
Compactive Effort: ft.lbs./cu.ft.

RECEIVED
MAR 7 1990
S.C.S. ENGINEERS

All tests performed in accordance with ASTM

HONG WEST & ASSOCIATES

• Geotechnical Engineering • Hydrogeology • Materials Testing • Construction Inspection •

INSPECTION REPORT

PROJECT: Pennzoil: Auto Service Co. DATE: 2-28-90

LOCATION: Valley ST. and Westlake AVE. N. Seattle Wa. GENERAL CONTRACTOR: S.C.S.

CONTRACTOR'S REP: Richard Alvord

JOB NUMBER: 8995 OUR REPRESENTATIVE: T. Matlock

PERMIT NO: SUB. CONTRACTOR: Meridian Const.

ARCH: SUB. REP:

ENGR:

Monitored backfill activities @ S. and E. of Office. Performed in-place density tests, during backfill activities. Crew excavated down to designated depth (approx 10' to 11') and hauled contaminated soils & debris from site. Crew placed stabilization fabric @ base of excavation and proceeded to backfill. Observed moderate lifts (1') of imported "Pit Run" placed in excavated area and compacted (BOMAG BW142D vibratory steel drum compactor and pac-pack attachment on CASE 580C (backhoe). Random in-place density tests results were 100%, 99%, 100%, 100%, 99%, 100%, 96%, and 99% compaction (w/ 90% specified minimum compaction ASTM D1557). Obtained representative sample of imported "Pit Run" (backfill material) and delivered to laboratory for testing (Proctor ASTM D1557). Backfill activities are scheduled to continue tomorrow. In-place density tests were taken, w/ Camdell Pacific Nuclear density/moisture gauge.

T. Matlock

PAGE 1 OF 1

HWA 101-90

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

FIELD DENSITY REPORT

Project: Pennzoil-Auto Service Co.
Address: Valley ST. and Westlake AVE. N. Seattle, WA.
Job Number: 8995
Date Tested: 2-28-90 By: T. Maddock
Client: S.C.S.
Attention: Richard Alrord

Test Apparatus: Campbell Pacific Nuclear moisture/density gauge Mach No.: 1
Soil Description: imported "Pit Run" gravelly, Sand
Temperature Air: °C Soil: °C
Specified Compaction: 90% %
Compaction Standard: ASTM D1557
Minimum Dry Density: PCF
Maximum Dry Density: 128.5 PCF
Optimum M.C.: 8.5 %

Test No.	1	2	3	4	5
Location	10'N., 20'E. of S.E. corner Pennzoil Office Bldg	15'S., 15'E.	10'S., 10'E.	15'S. 20'E.	15'S., 15'E.
Elevation	7' Below Grade	7'B.G.	6'B.G.	6'B.G.	5'B.G.
Wet Density — PCF					
Moisture Content — %	3.5	3.1	4.4	4.2	4.0
Dry Density — PCF	128.5	127.5	128.4	128.8	127.2
Compaction — %	100%	99	100	100+	99

Test No.	6	7	8		
Location	15'S., 22'E. of S.E. corner Pennzoil Office Bldg	15'S, 8'W.	10'S.		
Elevation	4'B.G.	8'B.G.	6'B.G.		
Wet Density — PCF					
Moisture Content — %	4.1	4.0	3.9		
Dry Density — PCF	128.3	124.0	127.4		
Compaction — %	100	96	99		

SHE

All tests performed in accordance with ASTM

APPENDIX C

TANK REMOVAL PERMIT AND CERTIFICATION OF TANK DISPOSAL

APPENDIX D

ANALYTICAL LABORATORY REPORT AND CHAIN OF CUSTODY RECORDS

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers
Client Sample Number: See below
Date of Sample Receipt: 2/28/90
Date of Sample Extraction: 3/5/90
Date of Sample Analysis: 3/5/90

Alden Job Number: 9002023/1
Alden Sample Number: See below
Analysis Method: 418.1
Matrix: Soil
Reporting Units: mg/kg

Client Sample ID	Alden Sample Number	Total Petroleum Hydrocarbons
C1	3273	10
C3	3275	21
C5	3277	6.8
T1-B1 WESTLAKE AVENUE UST SITE	3279	3800
T2-B1	3281	870
T3-B1	3283	820
T4-B1	3285	2100
T5-B1	3287	1700
W-6	3290	1400
W-7	3291	220
W-8	3292	190
W-9	3293	1100
W-10	3294	580
W-12	3295	340
N/A	Blank	< 4.0

Note: Results are reported to two significant figures.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers
Client Sample Number: See below
Date of Sample Receipt: 3/2/90
Date of Sample Extraction: 3/8/90
Date of Sample Analysis: 3/8/90

Alden Job Number: 9003004/1
Alden Sample Number: See below
Analysis Method: 418.1
Matrix: Soil
Reporting Units: mg/kg

Client Sample ID	Alden Sample Number	Total Petroleum Hydrocarbons
W-11	3362	660
W-13	3363	970
W-14	3364	2.9
W-17	3366	220
X-1	3367	13000
N/A	Blank	< 5.0

Note: Results are reported to two significant figures.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9003004/1
Client Sample Number: See below	Alden Sample Number: See below
Date of Sample Receipt: 3/2/90	Analysis Method: 418.1
Date of Sample Extraction: 3/8/90	Matrix: Water
Date of Sample Analysis: 3/8/90	Reporting Units: mg/L

Client Sample ID	Alden Sample Number	Total Petroleum Hydrocarbons
H20-16	3365	700
N/A	Blank	< 0.02

Note: Results are reported to two significant figures.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9003004/1
Client Sample Number: W-13	Alden Sample Number: 3363
Date of Sample Receipt: 3/2/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/8/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	5.0	26	
Toluene	5.0	10	
Ethylbenzene	5.0	200	
m,p-Xylene**	5.0	250	
o-Xylene	5.0	52	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9003004/1
Client Sample Number: X-1	Alden Sample Number: 3367
Date of Sample Receipt: 3/2/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: ~~Soil~~
Date of Sample Analysis: 3/8/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	2500	47000	
Toluene	2500	160000	
Ethylbenzene	2500	93000	
m,p-Xylene**	2500	320000	
o-Xylene	2500	120000	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T1-B2	Alden Sample Number: 3280
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/7/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	2.0	110	
Toluene	2.0	120	
Ethylbenzene	2.0	50	
m,p-Xylene**	2.0	130	
o-Xylene	2.0	38	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T2-E2	Alden Sample Number: 3282
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/6/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	1000	3100	
Toluene	1000	54000	
Ethylbenzene	1000	55000	
m,p-Xylene**	1000	210000	
o-Xylene	1000	80000	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T3-B2	Alden Sample Number: 3284
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/6/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	1000	2900	
Toluene	1000	34000	
Ethylbenzene	1000	35000	
m,p-Xylene**	1000	130000	
o-Xylene	1000	47000	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T4-B2	Alden Sample Number: 3286
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/6/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	1000	< 1000	
Toluene	1000	4200	
Ethylbenzene	1000	20000	
m,p-Xylene**	1000	76000	
o-Xylene	1000	27000	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T5-B2	Alden Sample Number: 3288
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/6/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	100	970	
Toluene	100	350	
Ethylbenzene	100	1400	
m,p-Xylene**	100	3000	
o-Xylene	100	870	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: H2O-15	Alden Sample Number: 3289
Date of Sample Receipt: 2/28/90	Analysis Method: 624
Date of Sample Extraction: N/A	Matrix: Water
Date of Sample Analysis: 3/7/90	Reporting Units: ug/L

Compound Name	Detection Limit	Result	Qualifier
Benzene	100	7400	
Toluene	100	3800	
Ethylbenzene	100	2500	
m,p-Xylene**	100	7700	
o-Xylene	100	2500	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T4-C1	Alden Sample Number: 3305
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/7/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	3.0	28	
Toluene	3.0	17	
Ethylbenzene	3.0	60	
m,p-Xylene**	3.0	160	
o-Xylene	3.0	50	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T1-C2	Alden Sample Number: 3308
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/7/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	2.0	7.0	
Toluene	2.0	17	
Ethylbenzene	2.0	6.4	
m,p-Xylene**	2.0	50	
o-Xylene	2.0	28	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: SCS Engineers	Alden Job Number: 9002023/1
Client Sample Number: T3-C2	Alden Sample Number: 3310
Date of Sample Receipt: 2/28/90	Analysis Method: 8240
Date of Sample Extraction: N/A	Matrix: Soil
Date of Sample Analysis: 3/7/90	Reporting Units: ug/kg

Compound Name	Detection Limit	Result	Qualifier
Benzene	200	360	
Toluene	200	250	
Ethylbenzene	200	7900	
m,p-Xylene**	200	25000	
o-Xylene	200	5500	

** m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical Laboratories, Inc.

SAMPLE LOG-IN & CHAIN-OF-CUSTODY FORM

Client Sample I.D.	Matrix	Sample Container	Alden Sample I.D.	Haiocarbons by GC Method 601/8010	Aromatics by GC Method 602/8020	Pesticides, PCBs by GC Method 608/8080	PAHs by GC Method 610/8100	Herbicides by GC Method 615/8150	VOA Organics by GC/MS Method 624/8240	A/BN Extractables by GC/MS Method 625/8270	TOC by IR Method 415.2	TPH by IR Method 418.1	Other (Specify) BTEX	Other (Specify)	Other (Specify)
T1-B1	Soil											X			
T1-B2	"	(VOA)											X		
T2-B1	"											X			
T2-B2	"	(VOA)											X		
T3-B1	"											X			
T3-B2	"	(VOA)											X		
T4-B1	"											X			
T4-B2	"	(VOA)											X		

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Client Information:

Firm/Agency Name: SCS / CENTRAC

Address: 2950 Northup Way

City, State ZIP: Bellevue, WA

Project No./PO No.:

Contact Name, Title: Rick Alvord / Donna

Phone: 822-5880 Fax: 889-2267

Relinquished by:

Firm/Agency: CENTRAC

Name (Print): Donna Hewitt

Signature: Donna Hewitt Date: 2-28-90

Received by:

Firm/Agency: ALDEN ANALYTICAL LABS Inc.

Name (Print): BRYAN S GRAHAM

Signature: Bryan S Graham Date: 2-28-90

Alden Analytical
Laboratories, Inc.

SAMPLE LOG-IN &
CHAIN-OF-CUSTODY FORM

Client Sample I.D.	Matrix	Sample Container	Alden Sample I.D.	Halocarbons by GC Method 601/8010	Aromatics by GC Method 602/8020	Pesticides, PCBs by GC Method 608/8080	PAHs by GC Method 610/8100	Herbicides by GC Method 615/8150	VOA Organics by GC/MS Method 624/8240	A/BN Extractables by GC/MS Method 625/8270	TOC by IR Method 415.2	TPH by IR Method 418.1	Other (Specify) BTEX	Other (Specify)	Other (Specify)
TS - B1	Soil	8oz										X			
TS - B2	"											X			
H2O - 15	H_2O	VOA											X		
W - 6	Soil											X			
W - 7	"											X			
W - 8	"											X			
W - 9	"											X			
W - 10	"											X			

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Client Information:

Firm/Agency Name: SCS / CONTRAC

Address: 2950 NORTHUP WAY

City, State ZIP: Bellevue, WA

Project No./PO No.:

Contact Name, Title: Rick Alvord / Donna

Phone: 822-5800 Fax: 889-2267

Relinquished by:

Firm/Agency: CONTRAC

Name (Print): Donna Hewitt

Signature: [signature] Date: 7-28-90

Received by:

Firm/Agency: Alden Analytical Laboratories Inc

Name (Print): Bryan S. Graham

Signature: [signature] Date: 7-28-90

Alden Analytical
Laboratories, Inc.

SAMPLE LOG-IN &
CHAIN-OF-CUSTODY FORM

Req for Tests

Client Sample I.D.	Matrix	Sample Container	Alden Sample I.D.	Halocarbons by GC Method 601/8010	Aromatics by GC Method 602/8020	Pesticides, PCBs by GC Method 608/8080	PAHs by GC Method 610/8100	Herbicides by GC Method 615/8150	VOA Organics by GC/MS Method 624/8240	A/BN Extractables by GC/MS Method 625/8270	TOC by IR Method 415.2	TPH by IR Method 418.1	Other (Specify)	Other (Specify)	Other (Specify)
W-12	Soil											X			

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Client Information:

Firm/Agency Name: SCS/CENTRAC

Address: 2950 Northup Way

City, State ZIP: Bellevue

Project No./PO No.:

Contact Name, Title: Rick Alvord

Phone: 822-5800 Fax:

Relinquished by:

Firm/Agency: Centrac

Name (Print): Donna Hewitt

Signature: Date: 2-28-90

Received by:

Firm/Agency: Alden Analytical Laboratories Inc

Name (Print): Bryan S Graham

Signature: Date: 2-28-90

AQUATIC RESEARCH INCORPORATED
1100 E. UNION // SEATTLE , WA 98122 // (206) 322-3572

CASE FILE NUMBER: AL030-01
DATE: 04/12/90
RECEIVED: 04/06/90
FINAL REPORT, LABORATORY ANALYSIS OF TOTAL LEAD ON SOIL AND WATER SAMPLE FROM ALDEN ANALYTICAL (CLIENT PROJECT NO. 9004005/1)

C A S E N A R R A T I V E

Four soil samples and one water samples were submitted to the laboratory and were received in good condition. The samples were digested for total metals using EPA CLP procedures and then analyzed for lead only. No difficulties were encountered during the digestion or analysis of these samples. Sample data follows, while QA/QC data is contained on the next page.

S A M P L E D A T A

SOIL SAMPLES

METHOD SAMPLE ID	Concentration (mg/kg; dry weight) GFAA LEAD	PERCENT SOLIDS
A8 (3303)	4.72	86.53%
T2-C-1 COMP (3312)	19.1	80.32%
A4 (3299)	12.9	81.14%
T2B1 (3281)	5.69	87.14%

DIGEST RESULTS OF SOIL SAMPLES AND OF ONE WATER SAMPLE

SAMPLE ID	(mg/l) LEAD	MATRIX
A8 (3303)	0.0254	Soil
T2-C-1 COMP (3312)	0.0899	Soil
A4 (3299)	0.0563	Soil
T2B1 (3281)	0.0277	Soil
A10 (3368)	3.103	Water

Alden Analytical
Laboratories, Inc.

SAMPLE LOG-IN &
CHAIN-OF-CUSTODY FORM

Client Sample I.D.	Matrix	Sample Container	Alden Sample I.D.	Halocarbons by GC Method 601/8010	Aromatics by GC Method 602/8020	Pesticides, PCBs by GC Method 608/8080	PAHs by GC Method 610/8100	Herbicides by GC Method 615/8150	VOA Organics by GC/MS Method 624/8240	A/BN Extractables by GC/MS Method 625/8270	TOC by IR Method 415.2	TPH by IR Method 418.1	Other (Specify) Archive	Other (Specify)	Other (Specify)
A-10	H_2O												X		
A-11	H_2O												X		
A12	Soil												X		

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Client Information:

Firm/Agency Name: SCS/CONTRAC

Address: 2950 NORTHUP WAY

City, State ZIP: Bellevue, WA 98004

Project No./PO No.:

Contact Name, Title: Rick Alvord / Donna Hewitt

Phone: 822-5800 Fax: 889-2267

Relinquished by:

Firm/Agency: CENTRAC

Name (Print): DONNA HEWITT

Signature: Donna Hewitt Date: 3-2-90

Received by:

Firm/Agency: ALDEN ANALYTICAL LABS INC.

Name (Print): STEPHEN KOURI

Signature: Stephen Kouri Date: 3/2/90

Alden Analytical Laboratories, Inc.

ARCHIVE

SAMPLE LOG-IN & CHAIN-OF-CUSTODY FORM

Client Sample I.D.	Matrix	Sample Container	Alden Sample I.D.	Halocarbons by GC Method 601/8010	Aromatics by GC Method 602/8020	Pesticides, PCBs by GC Method 608/8080	PAHs by GC Method 610/8100	Herbicides by GC Method 615/8150	VOA Organics by GC/MS Method 624/8240	A/BN Extractables by GC/MS Method 625/8270	TOC by IR Method 415.2	TPH by IR Method 418.1	Other BTEX (Specify)	Other (Specify)	Other (Specify)
A9	Soil														
T4C1	↓												X		
T5C1															
T5C2															
T1C2													X		
T1C1															
T3C2													X		
T3C1	↓														

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Client Information:

Firm/Agency Name: SCS / Centroc

Address: 2950 Northup Way

City, State ZIP: Bellevue WA 98004

Project No./PO No.:

Contact Name, Title: Rick Alvord / Donna Hewett

Phone: 822-5800 Fax: 889-2267

Relinquished by:

Firm/Agency:

Name (Print):

Signature: Date:

Received by:

Firm/Agency:

Name (Print):

Signature: Date:

AQUATIC RESEARCH INCORPORATED
1100 E. UNION // SEATTLE , WA 98122 // (206) 322-3572

CASE FILE NUMBER: AL030-01
DATE: 04/12/90
RECEIVED: 04/06/90
FINAL REPORT, LABORATORY ANALYSIS OF TOTAL LEAD ON SOIL AND WATER SAMPLE FROM ALDEN ANALYTICAL (CLIENT PROJECT NO. 9004005/1)

Q A / Q C D A T A

QC PARAMETER	LEAD (mg/l)	PERCENT SOLIDS
DATE ANALYZED	4/11/90	4/10/90
DETECTION LIMIT	0.0008	NA
DUPLICATE ANALYSIS		
Sample ID->	3565	3312
Original	<0.0008	80.32%
Duplicate	<0.0008	80.88%
RPD	NC	0.69%
QC CHECK		
Found	0.0482	
True	0.0490	
Percent Recovery	98.37%	NA
BLANK ANALYSIS	<0.0008	NA

RPD = Relative Percent Difference.
NC = Not Calculable due to one or more values being below the detection limit.
NA = Not Available.

AQUATIC RESEARCH INCORPORATED

William J. Bruton Jr.
Quality Assurance Manager

APPENDIX E

WDOE TANK CLOSURE RECORD

NOTICE OF PERMANENT CLOSURE OF UNDERGROUND STORAGE TANK(S)

Site Owner/Operator: City of Seattle/Paul Berry
Site Address: 630 Westlake Avenue, Seattle, Washington
Telephone: (206) 684-0422

Site Notification Number (If known; this is assigned by Ecology): _____
Tank has been registered with Ecology (__); tank was not registered (X).

Local closure permit (if any) obtained from: City of Seattle Fire Dept.
(Always contact local authorities regarding permit requirements.)

Tank closure performed by:
Company/Individual: SCS Engineers/Richard Alvord
Telephone: (206) 822-5800 Date of Tank Closure: February 1990
Method of Closure: (X) Removal (__) In-Place Closure
If closed in place, type of fill material used: _____

If removed, how will the tank(s) be disposed of? (X) Scrap (__) Landfill
(__) Other method (please specify): _____
Disposal Location: _____

Tank(s) Closed

Tank ID Number	Age	Size	Last Material Stored
T-1	Pre-1959	500	Waste motor oil
T-2	1959	5,000	Gasoline
T-3	1959	5,000	Gasoline
T-4	Pre-1959	3,000	Gasoline
T-5	Pre-1959	2,000	Gasoline

Will the tanks be replaced by new underground tanks? (__) Yes (X) No
(NOTE: If YES, you need to submit a notification form for the new tanks.)

Was a site assessment completed? (X) Yes (__) No If so, was contamination found? (X) Yes (__) No

(NOTE: The appropriate regional office of the Washington Department of Ecology should be contacted for assistance if contamination is found (see attached map). Records of the site closure must also be maintained at the site and must be available upon an inspector's request for at least three years after closure.)

Inspecting Agency: Seattle Fire Dept. Inspector Name: T. Nigretto
(NOTE: This is generally the local fire department or agency enforcing the Uniform Fire Code; in some cases (usually involving contamination) it may be Ecology. In some instances there may be no inspecting agency.)

Signature: Paul Berry Date: 6/12/90
Title: Assistant Project Coord.

Please return the completed form to:

Storage Tank Unit
Department of Ecology
M/S PV-11
Olympia, WA 98504-8711