

ENGEO INCORPORATED

GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS

In Reply
Please Refer to:
N1-3174-F1

September 3, 1991

Livermore Valley Joint Unified School District
685 Las Positas Boulevard
Livermore, CA 94550

Attention: Mr. R. F. D'Ambra

Subject: Transportation Facility
2900 Ladd Avenue
Livermore, California

SOIL AND GROUND-WATER STUDY

- References:
1. ENGEO Inc.; Work Plan to Study Soil and Ground-Water Contamination; December 5, 1991.
 2. BSK and Associates; Soil Boring/Sampling and Chemical Testing, Existing Underground Gasoline Tank, Bus Maintenance Yard, 2900 Ladd Avenue, Livermore, California; August 10, 1990.


Gentlemen:

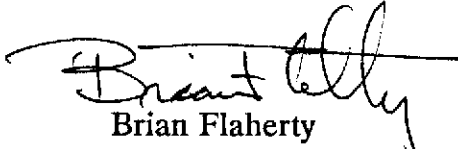
We are pleased to present this report which provides a description of field services, soil/ground-water sampling, laboratory testing, and data analysis conducted for the subject property. The scope of services provided was performed in accordance with the referenced work plan. A copy of this report should be forwarded to Mr. Gil Wistar with Alameda County Department of Environmental Health, Hazardous Materials Division for review and comment.

If you have any questions regarding this report, or ENGEO's services conducted to date at the subject property, please contact our office.

Very truly yours,

ENGEO INCORPORATED


Shawn Munger
Environmental Geologist


Brian Flaherty
CEG 1256

REPORT
to
LIVERMORE VALLEY JOINT UNIFIED SCHOOL DISTRICT
LIVERMORE, CALIFORNIA

on the
SOIL AND GROUND-WATER STUDY
for the
TRANSPORTATION FACILITY
LIVERMORE, CALIFORNIA

ENGEO INCORPORATED N1-3174-F1

SEPTEMBER 3, 1991

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INTRODUCTION

Site Description and Background

The subject facility is located on the north side of Ladd Avenue in Livermore, California (Figure 1). The facility includes an operations building, maintenance yard area, fuel dispensing pumps with associated underground piping and vents from three underground fuel storage tanks. The tank complex consists of a 6,000 gallon regular gasoline tank, a 6,000 gallon low-leaded gasoline tank and a 10,000 gallon diesel tank. From a review of earlier reports it appears that the tanks are located within a common excavation and rest on a concrete hold-down pad.

The regular gasoline tank failed a precision test in 1990. In order to make a preliminary assessment of possible soil contamination, the School District contracted BSK & Associates to conduct a limited subsurface investigation (Reference 2). Soil samples were collected from beneath the 6,000 gallon regular unleaded gasoline tank. Laboratory testing of the soils beneath the tank exposed total petroleum hydrocarbons (TPH as gasoline) at concentrations of 2,300 ppm at 14 feet and 1,500 ppm at 17 feet. These gasoline concentrations exceeded the Regional Water Quality Control Board (RWQCB) guideline level of 100 ppm for gasoline in soil. The scope of services provided in the BSK report did not allow a determination of potential ground-water impacts. We understand that an *Underground Storage Tank Unauthorized Release Report* was prepared.

In December 1990, ENGEO prepared a work plan for further subsurface studies at the subject facility. The work plan recommended the installation of a ground-water monitoring well immediately adjacent to the leaking underground fuel tank, along with exploratory soil borings around the tank complex. This work plan was subsequently reviewed and approved by the Alameda County Environmental Health Department, Hazardous Materials Division. This report presents the results of the study outlined in the referenced work plan.

Purpose and Scope of Services

The purpose of the soil and ground-water study was to evaluate the vertical and lateral extent of the petroleum hydrocarbon contamination in the vadose zone soils, at the top of the saturated zone, and in the ground water below the tank complex.

The scope of services associated with the study included the following:

- Drilling and logging of three exploratory test borings around the underground tank complex. An Organic Vapor Meter (PID) was used during the drilling of the boreholes to monitor for the presence of volatile vapors associated with possible product leakage.
- Installation of a ground-water monitoring well within one of the exploratory borings, located adjacent to the leaking underground fuel storage tank.
- Collection of soil samples from each of the boreholes for laboratory testing. Collection of a ground-water sample from the monitoring well with laboratory analysis.
- Laboratory analyses of the ground water and soil samples for total petroleum hydrocarbons (TPH) as gasoline and volatile aromatic compounds (BTXE).
- Analyses of the field and laboratory data.
- Preparation of a report documenting the work performed and the findings of the laboratory testing with recommendations for further studies.

FIELD SERVICES

Exploratory Soil Borings

Exploratory drilling was conducted December 13, 1990. Three exploratory soil borings were drilled to depths ranging from 57 to 67 feet below the existing ground surface. The approximate location of the exploratory borings is shown on Figure 2.

A fourth exploratory boring located at the southeast corner of the tank complex encountered the south end of the empty 6,000 gallon regular gasoline tank. This tank had apparently been incorrectly plotted on the facility plan which was provided by the School District. Drilling at this location was discontinued after the discrepancies in the plan were discovered. The area south and west of the tank complex appears to underlain by a complex of piping and venting leading from the fuel pump island. It was extremely difficult to drill exploratory borings in this area.

The exploratory borings were advanced using a Mobile B-53 drill rig equipped with 6-inch diameter hollow stem auger. The soil samples were collected using a 3-inch diameter split-spoon sampler retaining 6-inch long brass tubes. Following recovery, the samples were immediately sealed with aluminum foil, plastic end caps and tape. Samples were retained in a cooled ice chest prior to transportation to the analytical laboratory.

Sampling equipment was washed with a trisodium phosphate (TSP) solution and rinsed with distilled water between each sampling event. Clean flight augers and drill bits were utilized for each boring location.

Drilling was performed under the direction of an ENGEO Environmental Geologist who logged the borings in accordance with the Unified Soil Classification System. Soil samples were retrieved at approximately five foot intervals down to the saturated zone.

Soil samples and auger cuttings were screened in the field using a Thermo Electron 580A photoionization detector (PID) to measure detectable volatile compounds, relative to the calibration standard (Isobutylene 100 ppm). Boring log information including soil descriptions, resistance and field PID screenings are provided in Appendix B.

The soil exposed in the exploratory borings generally consists of 15 to 25 feet of clayey gravels and gravelly clay overlying interbedded silty clays with varying amounts of coarse material. Ground water was encountered at an approximate depth of 57 feet below the ground surface; however, water levels were noted to rise approximately 10 feet in the borings after drilling.

Selected soil cuttings were placed in sealed plastic bags and retained 5 to 10 minutes prior to PID screenings. **High organic vapor readings were recorded in boring B-1 at depths of 14 to 35 feet.** Substantial organic vapor readings were also recorded within **boring MW-1 at 15 to 20 feet below** the ground surface. Trace organic vapor readings were noted within boring B-2 between 15 and 20 feet below the ground surface.

The drill cuttings were placed in DOT approved 55-gallon steel drums. The boreholes were backfilled with neat cement following completion of the borings. Steam clean rinseate from the flight augers was pumped into 55-gallon drums stored on-site.

Ground-Water Monitoring Well Installation

Ground-water monitoring well MW-1 was installed on December 14, 1990, at the approximate location shown on Figure 2. The location of the ground-water monitoring well

was based on the reported ground-water gradient¹ (northeast) and accessibility within the tank complex area.

The monitoring well consists of 2-inch diameter PVC casing with flush joints, which was installed down through the hollow stem auger. The well was constructed with 25 feet of screened casing (0.02-inch slot width) and an appropriate length of solid PVC well casing. The total depth of the monitoring well was 67 feet below the existing ground surface. A #2 sand filter pack was placed from the base of the well to two feet above the top of the screened interval. A 24-inch bentonite seal was placed at the top of the filter pack. The remaining annular space was backfilled with a neat cement seal. The well was completed in a flush mounted christie box with a waterproof, locking well cap.

After the neat cement grout had set, the well was developed using a surge block and bailer to produce relatively non-turbid ground water. Approximately 16 casing volumes of water were removed from the well during the development process. The purged ground water was stored on site within a 55-gallon drum.

Ground-Water Sampling

Twenty-four hours after development, the depth to the top of the ground-water was verified and the well was checked for the presence of free product. No free product or petroleum sheen was noted within the monitoring well. Prior to sampling, four casing volumes of water were removed from the well using a PVC bailer. Water quality parameters including, temperature, Ph, dissolved solids and oxidation-reduction potential were monitored to provide for adequate purging. The ground-water sample was collected for laboratory testing using a Voss Technologies dedicated polyethylene bailer. The sample was then decanted

¹Alameda County Flood Control and Water Conservation District (Zone 7), Fall 1990 Groundwater Level Report; January 16, 1991.

into two 40-milliliter volatile organic analysis vials (VOA) and cooled in an ice chest until delivery under a documented chain-of-custody to NET Pacific Laboratories in Santa Rosa, California. Sample collection, preservation, chain-of-custody procedures and equipment decontamination were performed in accordance with ENGEO's standard quality assurance and control procedures.

LABORATORY ANALYSES

Laboratory testing was performed in accordance with the minimum verification analyses specified by the RWQCB *Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites (August 1990)*.

A total of nine soil samples from the three borings were submitted for laboratory analyses. The selection of vadose zone samples was based on visual observations and PID screenings.

The ground-water and soil samples were analyzed for total petroleum hydrocarbons as gasoline and volatile aromatic compounds (BTEX) according to EPA test methods 8015/5030 and 602/8020.

Table I provides a summary of the soil and ground water analyses. Copies of the certified laboratory analyses reports and chain of custody documents are also included in Appendix C.

TABLE I
Soil Sample Laboratory Analyses Summary

(Concentrations reported in parts per million)

SAMPLE NO.	DEPTH	TPH (GAS)	BENZENE	E. BENZENE	TOLUENE	XYLENE
1-2	16 FT.	1.1	.180	.0053	.036	.032
1-3	21 FT.	1.5	.160	.0081	.071	.051
1-5	31 FT.	ND	.013	ND	ND	ND
1-11	44 FT.	ND	.004	ND	ND	ND
2-2	16 FT.	ND	.016	ND	.0026	ND
MW1-2	16 FT.	970	4.1	13	27	77
MW1-4	26 FT.	1000	ND	10	27	53
MW1-6	36 FT.	2700	ND	10	27	53
MW1-8	46 FT.	ND	.011	ND	.004	.0099

Ground Water Sample MW-1 Laboratory Analyses Summary

(Concentrations reported in parts per billion)

TPH (GAS)	BENZENE	E. BENZENE	TOLUENE	XYLENE
1400 (NA)	63 (1.0)	8.0 (630)	52 (100)	590 (1750)

(1.0) - State Department of Health Services MCL or AAL

DISCUSSION

Review of the laboratory analyses and organic vapor screenings found significant soil contamination in the monitoring well borehole(MW-1), from depths of approximately 15 to 40 feet below the ground surface. Significant organic vapor readings were recorded in boring B-1 from 15 to 20 feet in depth; however, laboratory analyses of samples at depths of 16 and 21 feet found only trace concentrations of gasoline and BTEX.

Laboratory analyses of the ground-water sample recovered from monitoring well MW-1 found a benzene concentration of 63 ppb. This concentration exceeds the Maximum Contaminant Level (MCL) maintained by the State Department of Health Services(DHS). The remaining aromatic compounds were reported at concentrations below State drinking water criteria.

Based on the findings of the soil and ground water study, the following additional work is recommended to address the known petroleum hydrocarbon contamination in the site soil and ground water:

1. The existing ground-water monitoring well should be sampled on a quarterly basis to determine possible fluctuations or attenuation of contaminant concentrations.
2. A work plan should be prepared for the installation of two to three additional ground-water monitoring wells to determine the extent of the contaminant plume. The work plan should be submitted to the Alameda County Department of Environmental Health for their approval prior to the commencement of work. Due to the complex piping layout and configurations under the site, we recommend the wells be installed following the removal of the underground storage tanks. We understand that the tanks will be removed in the fall of 1991.

3. Additional soil samples should be recovered at the time of tank removal to determine the degree and extent of soil impairments beneath the tank complex. The soil sampling and laboratory testing undertaken at the time of the tank removal should follow the guidelines provided in the *Tri Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites*.

LIMITATIONS

The recommendations and conclusions presented in this report were based on the findings of our study which was developed solely from the contracted services. The scope of this investigation included three exploratory soil borings with organic vapor screenings, the installation of one ground water monitoring well, sampling of soil and ground water, laboratory analysis of nine soil samples, and a review/interpretation of the field and laboratory data.

The field services completed at this site were performed to assess specific soil and ground water conditions at the points of collection. Soil/water samples collected for this study represent that portion of the substrata encountered. The test results presented within this report reflect only the laboratory analyses performed on selected soil samples. These results do not reflect the presence of organic or inorganic substances which were not analyzed or included in the reported laboratory analyses.

It is recognized and agreed that ENGEEO has assumed responsibility only for undertaking the study for the Client. The responsibility for disclosures or reports to a third party and for remedial or mitigative action, shall be solely that of the Client. ENGEEO agrees not to provide a report to any third party not legally required, unless authorized by the Client.

ENGEEO Incorporated has prepared this report for the exclusive use of our client, The Livermore Valley Joint Unified School District. This assessment was performed in accordance with the standard of practice in Northern California in 1991. No other warranties, expressed or implied, as to the services provided are made.

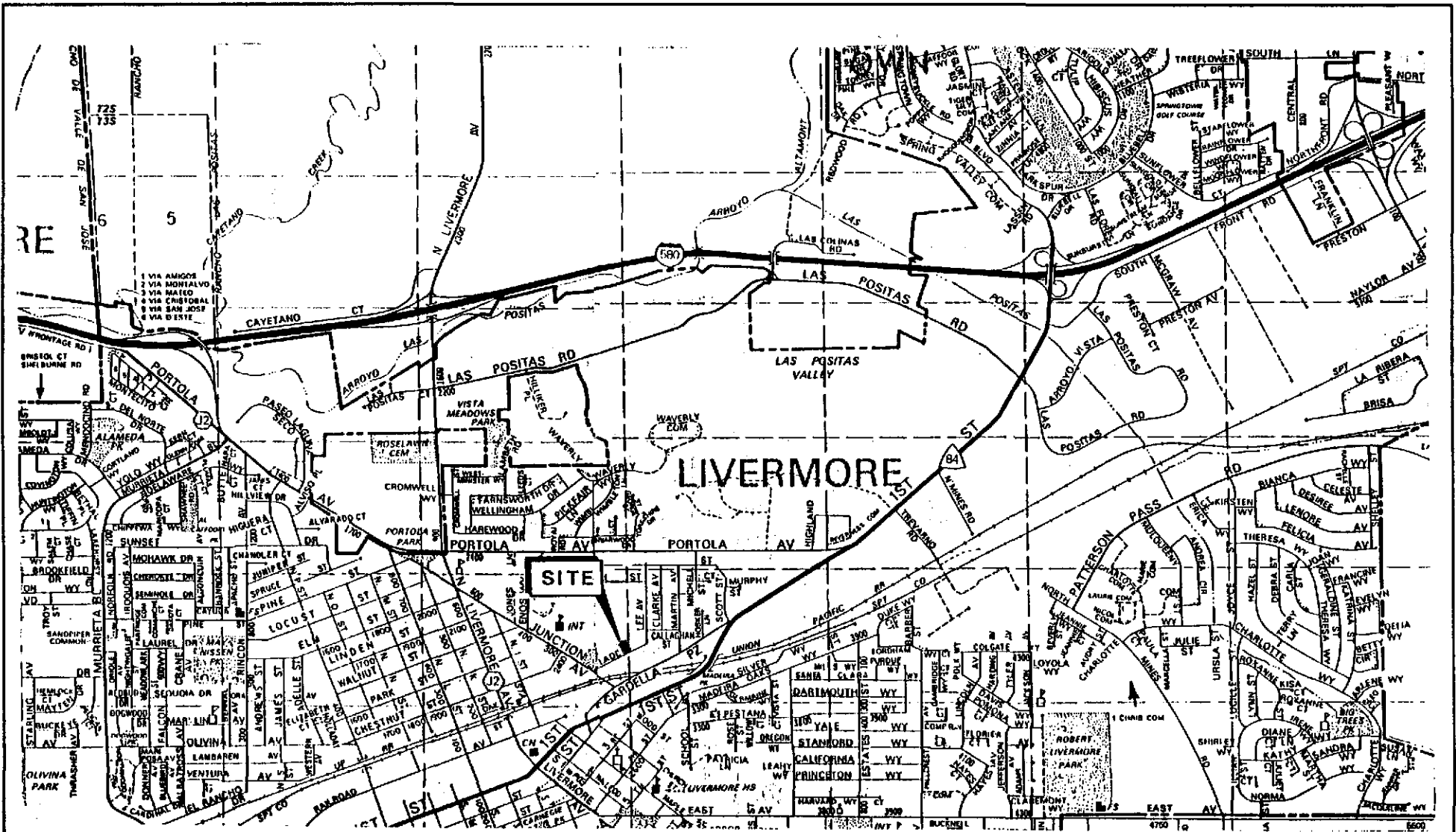
APPENDIX A

Figure 1

Site Location

Figure 2

Existing Underground Gasoline Storage Tanks



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 CONSULTANTS

SITE LOCATION

BUS MAINTENANCE YARD, 2908 LADD AVENUE
 LIVERMORE, CALIFORNIA

FIGURE
 NO.

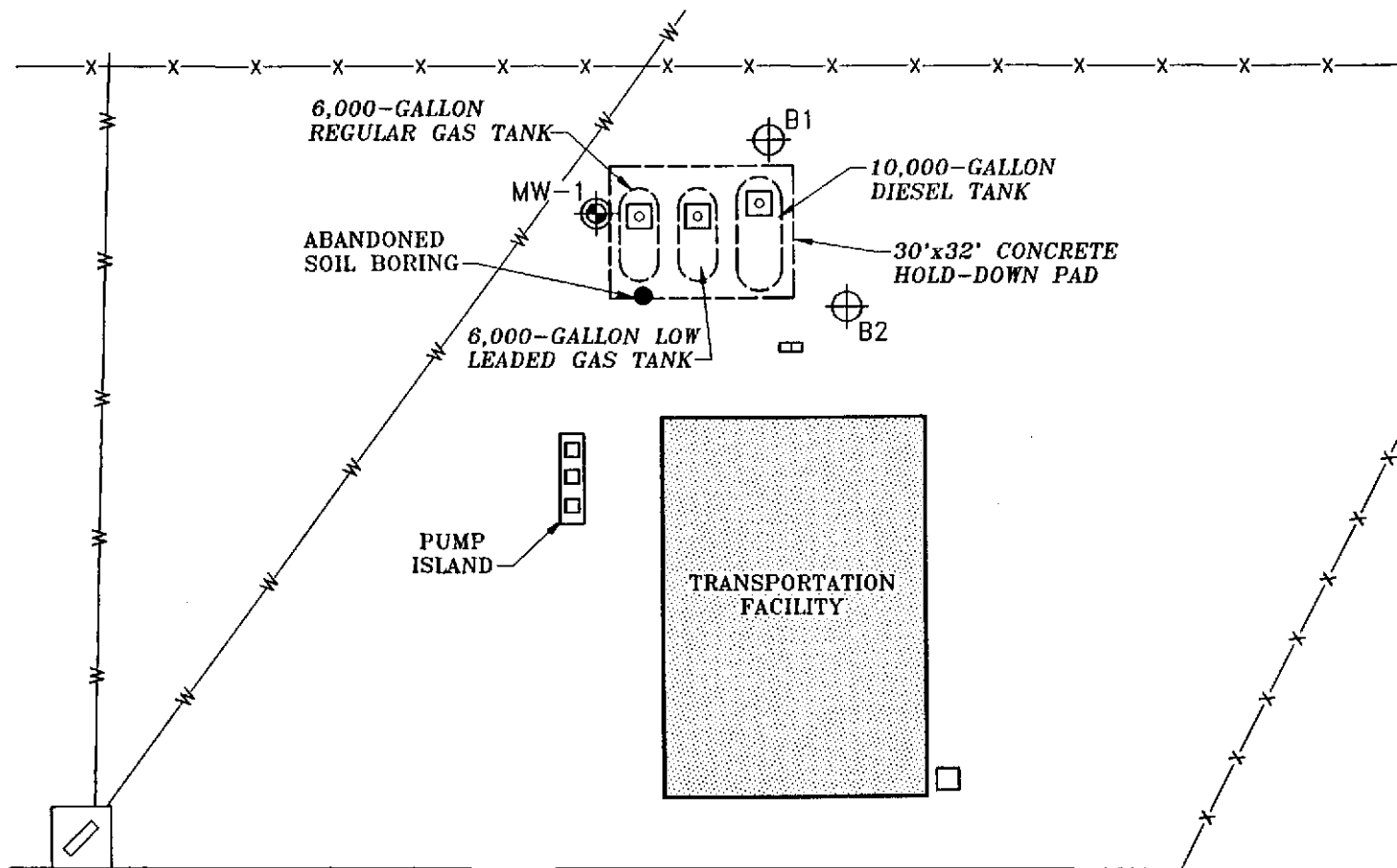
1

SCALE: 1" = 2200'



DATE: MARCH 1991

JOB
 NO.

N1-3174-F1



EXPLANATION

- MW-1  APPROXIMATE LOCATION OF GROUNDWATER MONITORING WELL
- B1  APPROXIMATE LOCATION OF SOIL BORING



<h1>ENGEO</h1> <p>INCORPORATED</p> <p>GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS</p>	EXISTING UNDERGROUND GASOLINE STORAGE TANKS BUS MAINTENANCE YARD, 2908 LADD AVENUE LIVERMORE, CALIFORNIA		FIGURE NO. <h1>2</h1>
	SCALE: N.T.S. DATE: MARCH 1991	JOB NO. N1-3174-F1	

APPENDIX B

Exploratory Soil Boring Logs
Ground-Water Monitoring Well Information

N1-3174-F1
September 3, 1991

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 13, 1990	N S.P.T. BLOWS/FT	qu UNCON. COMP. STRENGTH (TSF)	IN PLACE	
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT (PCF)	MOIST. CONTENT % DRY WEIGHT
DESCRIPTION			*MODIFIED FOR 3" O.D. SAMPLER	*FIELD PENET. APPROX.			
0			ASPHALT				
			PEA GRAVEL.				
			Reddish-brown silty CLAY, some gravels. (CL)		0		
5			Brown clayey GRAVEL, medium to coarse. (GC)		0		
			Coarser gravel.		0		
10	1-1		Brown sandy clayey GRAVEL, moist, very dense, slight odor. (GC)	50/5"	30		
15			Strong petroleum odor at 14 feet.		410		
	1-2			22*	500		
			180 ppb benzene		532		
20	1-3		Medium dense, strong petroleum hydrocarbon odor.	30*	180		
			160 benzene		102		
25	1-4		Light brown sandy gravelly CLAY, moist, very stiff, clay. (CL)	28*	75		
30					50		
			Livermore Valley Unified School District Livermore, California	BORING NO. 1 DATE: September 1991 JOB NO: N1-3174-F1	FIGURE NO.		


DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 13, 1990	N S.P.T. BLOWS/FT	qu UNCON. COMP. STRENGTH (TSF)	IN PLACE	
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT (PCF)	MOIST. CONTENT % DRY WEIGHT
DESCRIPTION			*MODIFIED FOR 3" O.D. SAMPLER	*FIELD PENET. APPROX.			
30	1-5 <i>(13 ben)</i>		Moist, harder, slight odor (CL)	33*	50		
35			Reddish-brown sandy silty CLAY, with gravels, moist, stiff. (CL)		57		
	1-6			9*	30		
	1-7			9*			
40	1-8			36*	2		
	1-9			50/5"	30		
	1-10			50/5"	18		
	1-11 <i>(4 ben)</i>			46*	20		
50	1-12			63*	5		
55	1-13			50/6"*	0		
60					0		

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Livermore Valley Unified School District
Livermore, California

BORING NO.: 1
DATE: September 1991
JOB NO: N1-3174-F1

FIGURE
NO.

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 13, 1990	N S.P.T. BLOWS/FT	qu UNCON. COMP. STRENGTH (TSF)	IN PLACE	
			SURFACE ELEVATION: Approx. 490.0 feet			*MODIFIED FOR 3" O.D. SAMPLER	*FIELD PENET. APPROX.
DESCRIPTION							
68	1-14		Brown gravelly silty CLAY, saturated, hard. (CL)	57	0		
			Bottom of boring at approximately 61.5 feet.				
65							
70							
75							
80							
85							
90							

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Livermore Valley Unified School District
Livermore, California


BORING NO.: 1
DATE: September 1991
JOB NO: N1-3174-F1

FIGURE
NO.

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 13, 1990	N S.P.T. BLOWS/FT	qu UNCON. COMP. STRENGTH (TSF)	IN PLACE	
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT (PCF)	MOIST. CONTENT % DRY WEIGHT
			DESCRIPTION	*MODIFIED FOR 3" O.D. SAMPLER	*FIELD PENET. APPROX.		
0			ASPHALT				
			PEA GRAVEL.		0		
5			Brown clayey GRAVEL, coarse, moist, dense. (GC)		0		
10	2-1			48*	0		
15			Brown silty CLAY with gravel, brown moist, hard, very slight color. (CL)		4		
20					7		
25	2-3		Brown sandy silty CLAY with minor gravels, moist, hard. (CL)	34*	1		
25					1		
30	2-4		Brown silty CLAY (CL), with some gravels, moist, hard. (CL)	50*	1		
ENGEO INCORPORATED			Livermore Valley Unified School District Livermore, California		BORING NO: 2 DATE: September 1991 JOB NO: N1-3174-F1		FIGURE NO.

(2-2)

ppb 16 beams
N.D. TRAG

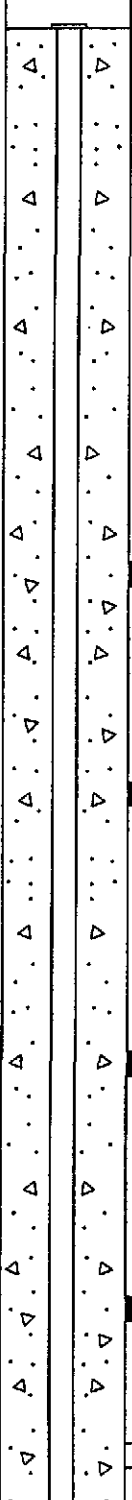
DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 13, 1990	N S.P.T. BLOWS/FT	qu UNCON. COMP. STRENGTH (TSF)	IN PLACE		
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT (PCF)	MOIST. CONTENT % DRY WEIGHT	
			DESCRIPTION	*MODIFIED FOR 3" O.D. SAMPLER	*FIELD PENET. APPROX.			
30	2-5			48*	0			
			Brown silty gravelly CLAY, moist, very stiff. (CL)					
35			Brown silty CLAY with minor gravels, moist, very stiff. (CL)					
40	2-6		Light brown silty sandy CLAY, moist, very stiff. (CL)		22*	0		
45					0			
50								
55	2-7		Brown silty sandy CLAY, some gravel, moist, very stiff. (CL)					
			Water encountered at approximately 57 feet. Bottom of boring at approximately 57 feet.		22*	0		
60								

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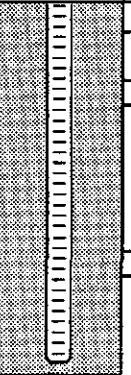

Livermore Valley Unified School District
Livermore, California

BORING NO.: 2
DATE: September 1991
JOB NO: N1-3174-F1

FIGURE
NO.

DEPTH (FEET)	MONITORING WELL CONSTRUCTION DETAIL	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 14, 1990	N S.P.T. BLOWS/FT	OUM READING P.I.D. (10.0 <u>u</u>)	IN PLACE		
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT (PCF)	MOIST. CONTENT % DRY WEIGHT	
DESCRIPTION			*MODIFIED FOR 3" O.D. SAMPLER	(parts per million)				
0			ASPHALT cover.					
			Brown silty CLAY, dry. (CL)		0			
			PEA GRAVEL.					
10			MW1-1 Brown clayey GRAVEL, medium to coarse, moist, medium dense, odor . (GC)	7*	0			
15			MW1-2 Very dense, strong odor .	50/5"	542	970 ppb THG 8,100 ppb benz		
20			MW1-3	34*	540			
25			MW1-4 Brown gravelly sandy CLAY, moist, hard, strong petroleum hydrocarbon odor . (CL)	15*	400	1000/N.D.		
30			Brown silty sandy CLAY, moist, hard, strong odor . (CL)		602			
			ENGEO INCORPORATED		Livermore Valley Unified School District Livermore, California		WELL NO.: MW1 DATE: September 1991 JOB NO.: N1-3174-F1	FIGURE NO.

DEPTH (FEET)	MONITORING WELL CONSTRUCTION DETAIL	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 14, 1990	N S.P.T. BLOWS/FT	OUM READING P.I.D. (10.0±V)	IN PLACE		
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT (PCF)	MOIST. CONTENT % DRY WEIGHT	
DESCRIPTION			*MODIFIED FOR 3" O.D. SAMPLER	(parts per million)				
30			MW1-5 Brown gravelly sandy CLAY, moist, hard, odor. (CL)	44*	250			
35			MW1-6 Mottled brown silty CLAY some sand and gravels, moist, very stiff, odor. (CL)	27*	153 <u>2700/ND.</u>			
40			Brown sandy silty CLAY, moist, very stiff, odor. (CL)		300			
45			MW1-7 Brown silty CLAY, minor sand and gravel, moist, very stiff, odor. (CL)	30*	413			
50			MW1-8 Brown gravelly CLAY, moist, hard, odor. (CL)	42*	38 <u>ND/11</u>			
55			Brown silty CLAY, minor gravel, moist, hard, odor. (CL)		6			
60			MW1-9 Brown sandy gravelly CLAY, moist, hard, slight ∇ odor. (CL) Approximate water level at the time of drilling.	50*	2			
			ENGEO INCORPORATED		Livermore Valley Unified School District Livermore, California		WELL NO.: MW1 DATE: September 1991 JOB NO.: N1-3174-F1	FIGURE NO.

DEPTH (FEET)	MONITORING WELL CONSTRUCTION DETAIL	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: December 14, 1990	N S.P.T. BLOWS/FT	OUM READING P.I.D. (10.0eV)	IN PLACE	
			SURFACE ELEVATION: Approx. 490.0 feet			DRY UNIT WEIGHT	MOIST. CONTENT
			DESCRIPTION			*MODIFIED FOR 3" O.D. SAMPLER	(parts per million)
60					0		
65			Yellow-brown clayey gravelly SAND, saturated. (SP) Running sands at approximately 63.5 feet.		0		
70			Bottom of boring at approximately 67 feet. NOTE: After removal of augers from hole, water measured at approximately 46 feet.				
75							
80							
85							
90							

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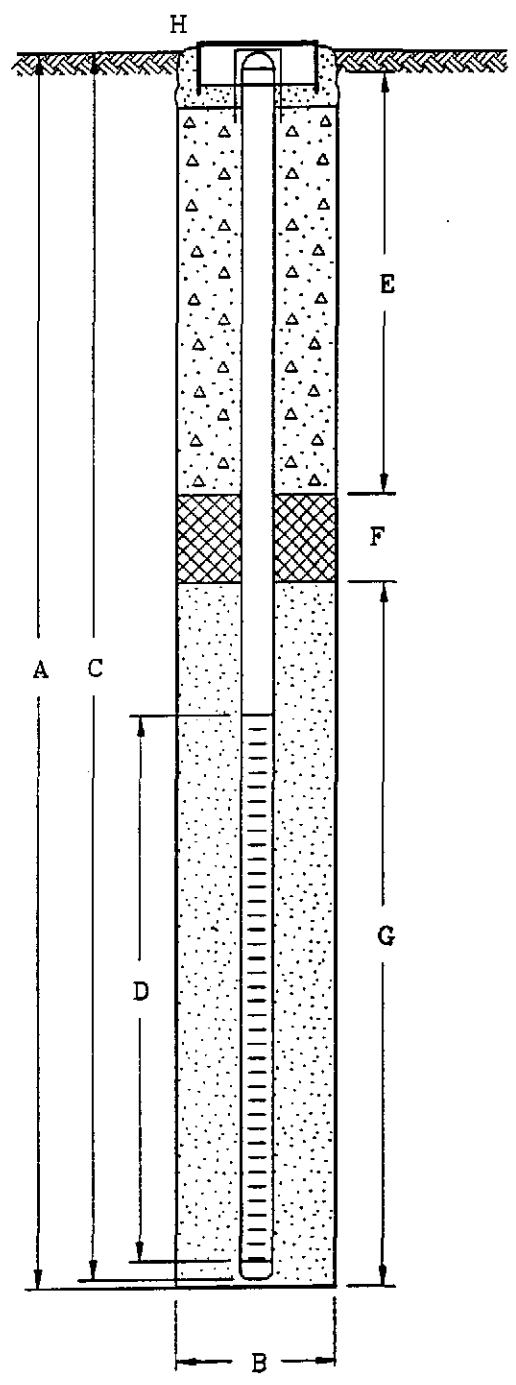
Livermore Valley Unified School District
Livermore, California

WELL NO.: MW1
DATE: September 1991
JOB NO.: N1-3174-F1

FIGURE NO.

MONITORING WELL DETAIL

PROJECT NUMBER N90-3174-F1 DATE OF INSTALLATION December 14, 1990
 PROJECT NAME Livermore Vlly Sch. Dist. TOP OF CASING ELEV. ±489.5
 COUNTY Alameda GROUND SURFACE ELEV. ±490
 WELL PERMIT NO. 90702 DATUM MSL



EXPLORATORY BORING

A. TOTAL DEPTH 67 FT.
 B. DIAMETER 6 IN.
 DRILLING METHOD Hollow stem augers

WELL CONSTRUCTION

C. CASING LENGTH 67 FT.
 MATERIAL Sch 40 PVC
 DIAMETER 2 IN.
 D. SLOTTED INTERVAL LENGTH 25 FT.
~~SLOTTED~~ SLOTTED INTERVAL FROM 2 TO 67 FT.
 SLOT SIZE .020 IN.
 E. GROUT INTERVAL 0 TO 38 FT.
 GROUT MATERIAL neat cement
 F. FILTER PACK SEAL 38 TO 40 FT.
 SEAL MATERIAL Bentonite
 G. FILTER PACK INTERVAL 40 TO 67 FT.
 FILTER MATERIAL #2 sand
 H. Christy box (flush with surface)
and locking well cap.

APPENDIX C

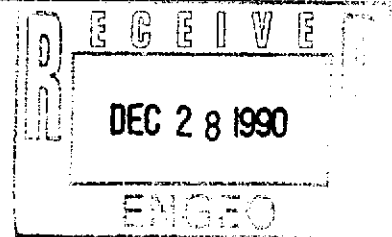
Sampling Information Forms
Laboratory Test Reports
Chain of Custody Documents
Monitoring Well Permit

N1-3174-F1
September 3, 1991



NATIONAL
ENVIRONMENTAL
TESTING, INC.

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Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623



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2280 Diamond Blvd., Ste 200
Concord, CA 94520-5719

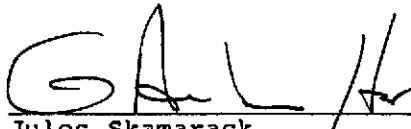
Date: 12-27-90
NET Client Acct No: 442
NET Pacific Log No: 5387
Received: 12-19-90 0800

Client Reference Information

Livermore Valley Joint Unified School; Project: N903174F1

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:


Jules Skamarack
Laboratory Manager

Enclosure(s)



NET Pacific, Inc.

Client Acct: 442
Client Name: ENGEO
NET Log No: 5387

Date: 12-27-90
Page: 2

Ref: Livermore Valley Joint Unified School; Project: N903174F1

Descriptor, Lab No. and Results

Parameter	Reporting Limit	1-2 16'	1-3 21'	1-5 31'	Units
		12-13-90 1112	12-13-90 1122	12-13-90 1146	
		71049	71050	71051	
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		1	1	1	
DATE ANALYZED		12-20-90	12-20-90	12-21-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	1.1	1.5	ND	mg/Kg
METHOD 8020		--	--	--	
DILUTION FACTOR *		1	1	1	
DATE ANALYZED		12-20-90	12-20-90	12-21-90	
Benzene	2.5	180	160	13	ug/Kg
Ethylbenzene	2.5	5.3	8.1	ND	ug/Kg
Toluene	2.5	36	71	ND	ug/Kg
Xylenes, total	2.5	32	51	ND	ug/Kg



NET Pacific, Inc.

Client Acct: 442
Client Name: ENGEO
NET Log No: 5387

Date: 12-27-90
Page: 3

Ref: Livermore Valley Joint Unified School; Project: N903174F1

Descriptor, Lab No. and Results

Parameter	Reporting Limit	1-11 44'	2-2 16'	1-11 16'	Units
		12-13-90 1257	12-13-90 1522	12-14-90 0850	
		71052	71053	71054	
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		1	1	200	
DATE ANALYZED		12-20-90	12-20-90	12-20-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	ND	ND	970	ug/Kg
METHOD 8020		--	--	--	
DILUTION FACTOR *		1	1	200	
DATE ANALYZED		12-20-90	12-20-90	12-20-90	
Benzene	2.5	4.0	16	9,100	ug/Kg
Ethylbenzene	2.5	ND	ND	13,000	ug/Kg
Toluene	2.5	ND	2.6	27,000	ug/Kg
Xylenes, total	2.5	ND	ND	77,000	ug/Kg



NET Pacific, Inc.

Client Acct: 442
Client Name: ENGEO
NET Log No: 5387

Date: 12-27-90
Page: 4

Ref: Livermore Valley Joint Unified School; Project: N903174F1

Descriptor, Lab No. and Results

Parameter	Reporting Limit	MW1-4 26'	MW1-6 36'	MW1-8 46'	Units
		12-14-90 0908 71055	12-14-90 0930 71056	12-14-90 1005 71057	
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		500	500	1	
DATE ANALYZED		12-21-90	12-21-90	12-20-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	1000 *	1000 *	ND	ug/Kg
METHOD 8020		--	--	--	
DILUTION FACTOR *		500	500	1	
DATE ANALYZED		12-21-90	12-21-90	12-20-90	
Benzene	2.5	ND	ND	11	ug/Kg
Ethylbenzene	2.5	10,000	38,000	ND	ug/Kg
Toluene	2.5	27,000	70,000	4.0	ug/Kg
Xylenes, total	2.5	53,000	230,000	9.9	ug/Kg

- < : Less than; When appearing in results column indicates analyte not detected at the value following. This datum supercedes the listed Reporting Limit.
- * : Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated Reporting Limits by the dilution factor (but do not multiply reported values).
- ICVS : Initial Calibration Verification Standard (External Standard).
- mean : Average; sum of measurements divided by number of measurements.
- mg/Kg (ppm) : Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
- mg/L : Concentration in units of milligrams of analyte per liter of sample.
- mL/L/hr : Milliliters per liter per hour.
- MPN/100 mL : Most probable number of bacteria per one hundred milliliters of sample.
- N/A : Not applicable.
- NA : Not analyzed.
- ND : Not detected; the analyte concentration is less than applicable listed reporting limit.
- NTU : Nephelometric turbidity units.
- RPD : Relative percent difference, $100 \text{ [Value 1 - Value 2] / mean value}$.
- SNA : Standard not available.
- ug/Kg (ppb) : Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
- ug/L : Concentration in units of micrograms of analyte per liter of sample.
- umhos/cm : Micromhos per centimeter.

Method References

Methods 100 through 493: see "Methods for Chemical Analysis of Water & Wastes", U.S. EPA, 600/4-79-020, rev. 1983.

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

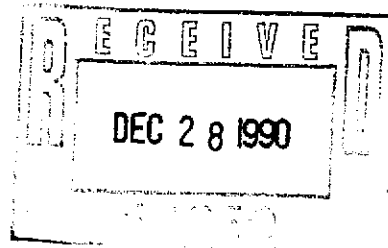
Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

SM: see "Standard Methods for the Examination of Water & Wastewater, 16th Edition, APHA, 1985.



NATIONAL
ENVIRONMENTAL
TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623



Rachel Hess
ENGEO
2280 Diamond Blvd., Ste 200
Concord, CA 94520-5719

Date: 12-27-90
NET Client Acct. No: 442
NET Pacific Log No: 5403
Received: 12-20-90 0800

Client Reference Information

Livermore Valley Joint Unified School; Project: N903174F1

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

Enclosure(s)

5387

ENGEO INCORPORATED

2280 DIAMOND BOULEVARD, SUITE 200
CONCORD, CALIFORNIA 94520
PHONE (415) 687-9700

December 1990 CHAIN OF CUSTODY RECORD

PROJECT NUMBER		PROJECT NAME					TPH - GASOLINE (EPA 8015/5030)	TPH - DIESEL (EPA 8015/3550/3510)	PURGEABLE AROMATICS BTX (EPA 602, 8020)	PURGEABLE HALOCARBONS (EPA 601, 8010)	VOLATILE ORGANICS (EPA 624, 8240)	BASE/NEUTRALS, ACIDS (EPA 525, 8270)	TOTAL OIL & GREASE (SMWW 5520(F))	OC PESTICIDES/PCB (EPA 808, 8080)	OP PESTICIDES (EPA 814/8140)	TITLE 26 METALS (17)	PRIORITY METALS (13)	FUEL PUMPED PRINT EPA 8260 + BTX	REMARKS REQUIRED DETECTION LIMITS		
SAMPLED BY: (SIGNATURE)																					
NA03174F1		Livermore Villy Joint Unified School					Rachel Bldess														
SAMPLE NUMBER	DATE	TIME	MATRIX	NUMBER OF CONTAINERS	CONTAINER SIZE	PRESERVATIVE															
1-2	12-13-90	11:12	Soil	1	2 1/2" x 6"	Ice	X	X											16'		
1-3	12-13	11:22	Soil	1	2 1/2" x 6"	Ice	X	X											21'		
1-5	12-13	11:46	Soil	1	2 1/2" x 6"	Ice	X	X											31'		
1-11	12-13	12:57	Soil	1	2 1/2" x 6"	Ice	X	X											44'		
2-2	12-13	15:22	soil	1	2 1/2" x 6"	ice	X	X											16'		
MW1-2	12-14-90	8:50	soil	1	2 1/2" x 6"	ice	X	X											16'		
MW1-4	12-14	9:08	soil	1	2 1/2" x 6"	ice	X	X											26'		
MW1-6	12-14	9:30	soil	1	2 1/2" x 6"	ice	X	X											36'		
MW1-8	12-14	10:05	soil	1	2 1/2" x 6"	ice	X	X											46'		
<p>(CUSTODY SEALED 12/18/90) @ 1900 Mike Tavares <i>read instr + log</i></p>																					
RELINQUISHED BY: (SIGNATURE)			DATE/TIME			RECEIVED BY: (SIGNATURE)			DATE/TIME			RELINQUISHED BY: (SIGNATURE)			DATE/TIME			RECEIVED BY: (SIGNATURE)			
Rachel Bldess			12-18-90 12:29			Michael W Tavares															
RELINQUISHED BY: (SIGNATURE)			DATE/TIME			RECEIVED BY: (SIGNATURE)			DATE/TIME			RELINQUISHED BY: (SIGNATURE)			DATE/TIME			RECEIVED BY: (SIGNATURE)			
Mike Tavares			12/18/90																		
RELINQUISHED BY: (SIGNATURE)			DATE/TIME			RECEIVED FOR LABORATORY BY: (SIGNATURE)			DATE/TIME			REMARKS									
(VIANCS)						Heimle			12/17/90 0800			TEST FOR TPH (GASOLINE) + BTX 5 DAY TURNAROUND.									

DISTRIBUTION: ORIGINAL ACCOMPANIES SHIPMENT; COPY TO PROJECT FIELD FILES



NET Pacific, Inc.

Client Acct: 442
Client Name: ENGEO
NET Log No: 5403

Date: 12-27-90
Page: 2

Ref: Livermore Valley Joint Unified School; Project: N903174F1

SAMPLE DESCRIPTION: ~~100-1~~ 12-19-90 0950
LAB Job No: (-71131)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS				
VOLATILE (WATER)				
DILUTION FACTOR *			1	
DATE ANALYZED			12-21-90	
METHOD GC FID/5030				
as Gasoline			0.05	ug/L
METHOD 602				
DILUTION FACTOR *			10	
DATE ANALYZED			12-26-90	
Benzene		0.5	63	ug/L
Ethylbenzene		0.5	8.0	ug/L
Toluene		0.5	52	ug/L
Xylenes, total		0.5	590	ug/L

- < : Less than; When appearing in results column indicates analyte not detected at the value following. This datum supercedes the listed Reporting Limit.
- * : Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated Reporting Limits by the dilution factor (but do not multiply reported values).
- ICVS : Initial Calibration Verification Standard (External Standard).
- mean : Average; sum of measurements divided by number of measurements.
- mg/Kg (ppm) : Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
- mg/L : Concentration in units of milligrams of analyte per liter of sample.
- mL/L/hr : Milliliters per liter per hour.
- MPN/100 mL : Most probable number of bacteria per one hundred milliliters of sample.
- N/A : Not applicable.
- NA : Not analyzed.
- ND : Not detected; the analyte concentration is less than applicable listed reporting limit.
- NTU : Nephelometric turbidity units.
- RPD : Relative percent difference, $100 \text{ [Value 1 - Value 2] / mean value}$.
- SNA : Standard not available.
- ug/Kg (ppb) : Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
- ug/L : Concentration in units of micrograms of analyte per liter of sample.
- umhos/cm : Micromhos per centimeter.

Method References

Methods 100 through 493: see "Methods for Chemical Analysis of Water & Wastes", U.S. EPA, 600/4-79-020, rev. 1983.

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

SM: see "Standard Methods for the Examination of Water & Wastewater, 16th Edition, APHA, 1985.

5403

ENGEO INCORPORATED

2280 DIAMOND BOULEVARD, SUITE 200
CONCORD, CALIFORNIA 94520
PHONE (415) 687-9700

December 1990 CHAIN OF CUSTODY RECORD NET

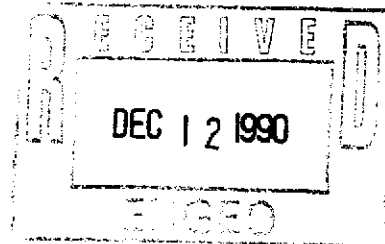
PROJECT NUMBER		PROJECT NAME					TPH - GASOLINE (EPA 8015/5030)	TPH - DIESEL (EPA 8015/3550/3510)	PURGEABLE AROMATICS BTX (EPA 602, 8020)	PURGEABLE HALOCARBONS (EPA 601, 8010)	VOLATILE ORGANICS (EPA 824, 8240)	BASE/NEUTRALS, ACIDS (EPA 825, 8270)	TOTAL OIL & GREASE (SMMW 5520(F))	OC PESTICIDES/PCB (EPA 808, 8080)	OP PESTICIDES (EPA 814/8140)	TITLE 26 METALS (17)	PRIORITY METALS (13)	REMARKS REQUIRED DETECTION LIMITS	
SAMPLED BY: (SIGNATURE)																			
SAMPLE NUMBER	DATE	TIME	MATRIX	NUMBER OF CONTAINERS	CONTAINER SIZE	PRESERVATIVE													
N903174F1		Livermore Villy Joint Unified Sch																	
Rachel Bress																			
MW1	12-19-90	9:50	Water	4	40ml	HCL	X	X										5 day TAT	
<p>(CUSTODY SEALED 12/19/90) @ 1900 Mike Tvaris</p>																			
RELINQUISHED BY: (SIGNATURE)				DATE/TIME	RECEIVED BY: (SIGNATURE)				DATE/TIME	RELINQUISHED BY: (SIGNATURE)				DATE/TIME	RECEIVED BY: (SIGNATURE)				
Rachel Bress				12/19/90 4:00	Mike Tvaris				12/19	Mike Tvaris				12/19					
RELINQUISHED BY: (SIGNATURE)				DATE/TIME	RECEIVED BY: (SIGNATURE)				DATE/TIME	RELINQUISHED BY: (SIGNATURE)				DATE/TIME	RECEIVED BY: (SIGNATURE)				
RELINQUISHED BY: (SIGNATURE)				DATE/TIME	RECEIVED FOR LABORATORY BY: (SIGNATURE)				DATE/TIME	REMARKS									
(VLA NLS)					K. Gough				12/20/90 0800	TEST FOR TPHg & BTX 5 day Turnaround									



ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94588 (415) 484-2600

11 December 1990



Engeo, Inc.
2280 Diamond Boulevard, #200
Concord, CA 94520

Gentlemen:

Enclosed is Groundwater Protection Ordinance permit 90702 for a monitoring well construction project at 2900 Ladd Avenue in Livermore for Livermore Valley Joint Unified School District.

Please note that permit condition A-3 requires that a well construction report be submitted after completion of the work. The report should include drilling and completion logs, location sketch, and permit number.

If you have any questions, please contact Todd Wendler or Craig Mayfield at 484-2600.

Very truly yours,

A handwritten signature in black ink, appearing to read "J. Killingstad".

J. Killingstad, Chief
Water Resources Engineering

TW:mm
Enc.



ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94566 (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

FOR OFFICE USE

(1) LOCATION OF PROJECT Livermore Valley School District Transportation Facility 2900 LADD AVE, Livermore

PERMIT NUMBER 90702 LOCATION NUMBER

(2) CLIENT R.F. D'AMBRA c/o Livermore Valley Joint Unified School District 685 Las Positas Blvd Phone 447 9500 City Livermore Zip 94550

Approved Todd N. Wendler Date 7 Dec 90

(3) APPLICANT BRIAN FLAHERTY c/o ENGEO INCORPORATED 2280 Diamond Blvd #200 Phone 415 687 9700 City CONCORD Zip 94520

PERMIT CONDITIONS

Circled Permit Requirements Apply

(4) DESCRIPTION OF PROJECT Water Well Construction X Geotechnical X Cathodic Protection Well Destruction

- A. GENERAL 1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date. 2. Notify this office (484-2600) at least one day prior to starting work on permitted work and before placing well seals. 3. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or bore hole logs and location sketch for geotechnical projects. Permitted work is completed when the last surface seal is placed or the last boring is completed. 4. Permit is void if project not begun within 90 days of approval date.

(5) PROPOSED WATER WELL USE Domestic Industrial Irrigation Municipal Monitoring X Other

(6) PROPOSED CONSTRUCTION Drilling Method: Mud Rotary Air Rotary Auger X Cable Other

WELL PROJECTS 6" AUGER Drill Hole Diameter 8 In. Depth(s) 40-50 ft. Casing Diameter 2 In. Number Surface Seal Depth 30 ft. of Wells 1 Driller's License No. Kvilhaug # 482390

- B. WATER WELLS, INCLUDING PIEZOMETERS 1. Minimum surface seal thickness is two inches of cement grout placed by tremie, or equivalent. 2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic, irrigation, and monitoring wells unless a lesser depth is specially approved.

GEOTECHNICAL PROJECTS Number 4-6 Diameter 8 In. Maximum Depth 40 ft.

- C. GEOTECHNICAL. Backfill bore hole with compacted cast-in-place or heavy bentonite and upper two feet with compacted material. D. CATHODIC. Fill hole above anode zone with concrete placed by tremie, or equivalent. E. WELL DESTRUCTION. See attached.

(7) ESTIMATED STARTING DATE DEC 13, 1990 ESTIMATED COMPLETION DATE DEC 14, 1990

(8) I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE Brian Flaherty Date 12.5.90