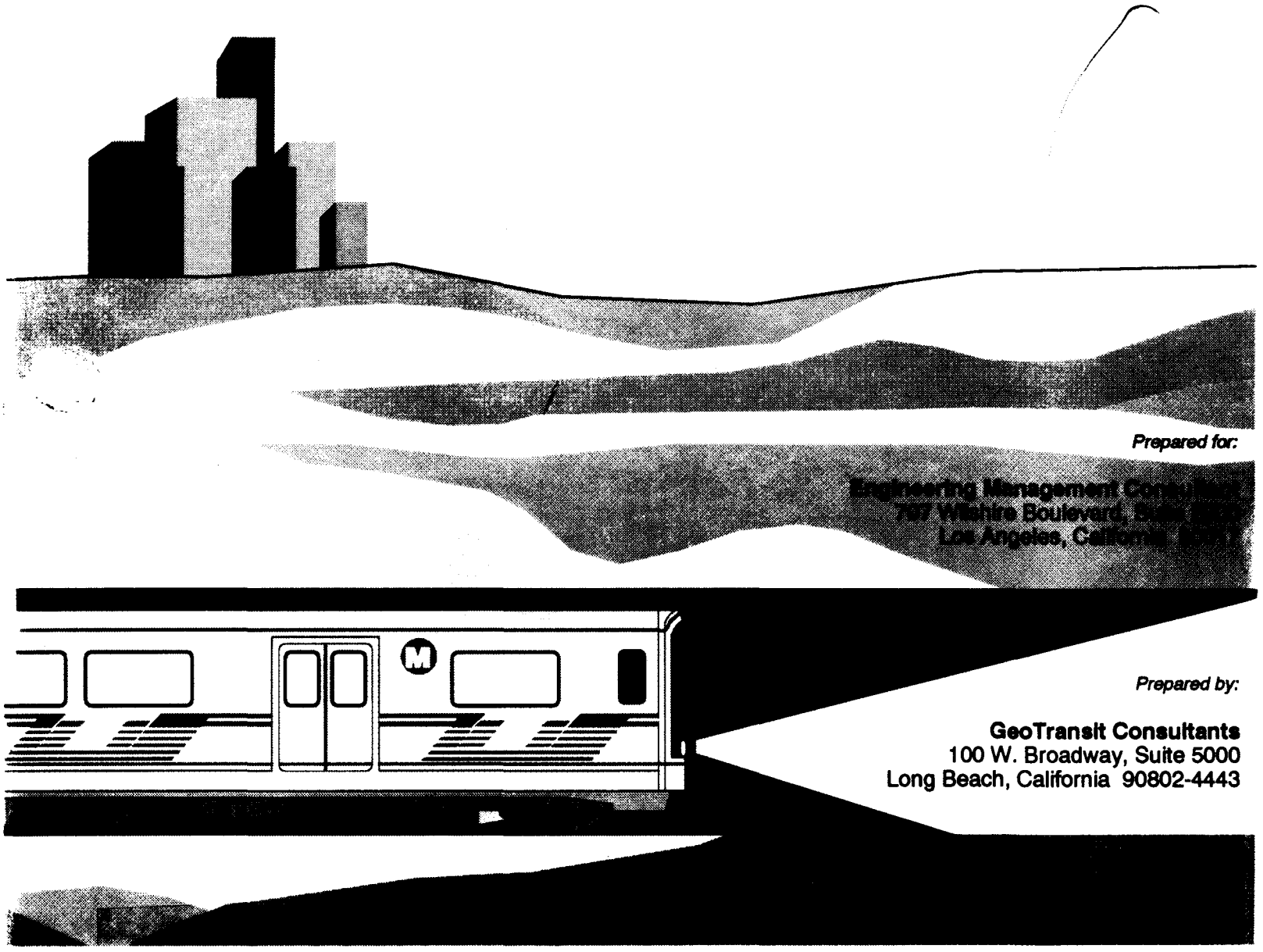
Geotechnical Investigation for:

Preliminary Engineering Program
Eastside Extension
Metro Red Line Project
Volume II of II



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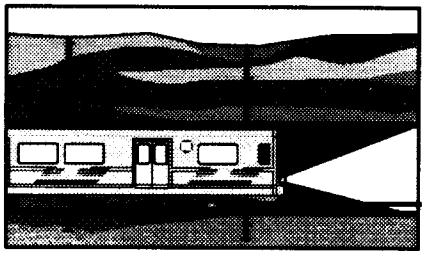

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Consultants

Geotechnical Investigation for:

Preliminary Engineering Program
Eastside Extension
Metro Red Line Project
Volume II of II

A Teaming Partnership of:
The Earth Technology Corporation
Diaz•Yourman & Associates
Geotechnique Consultants
Bing Yen & Associates

Geotechnical Investigation for:

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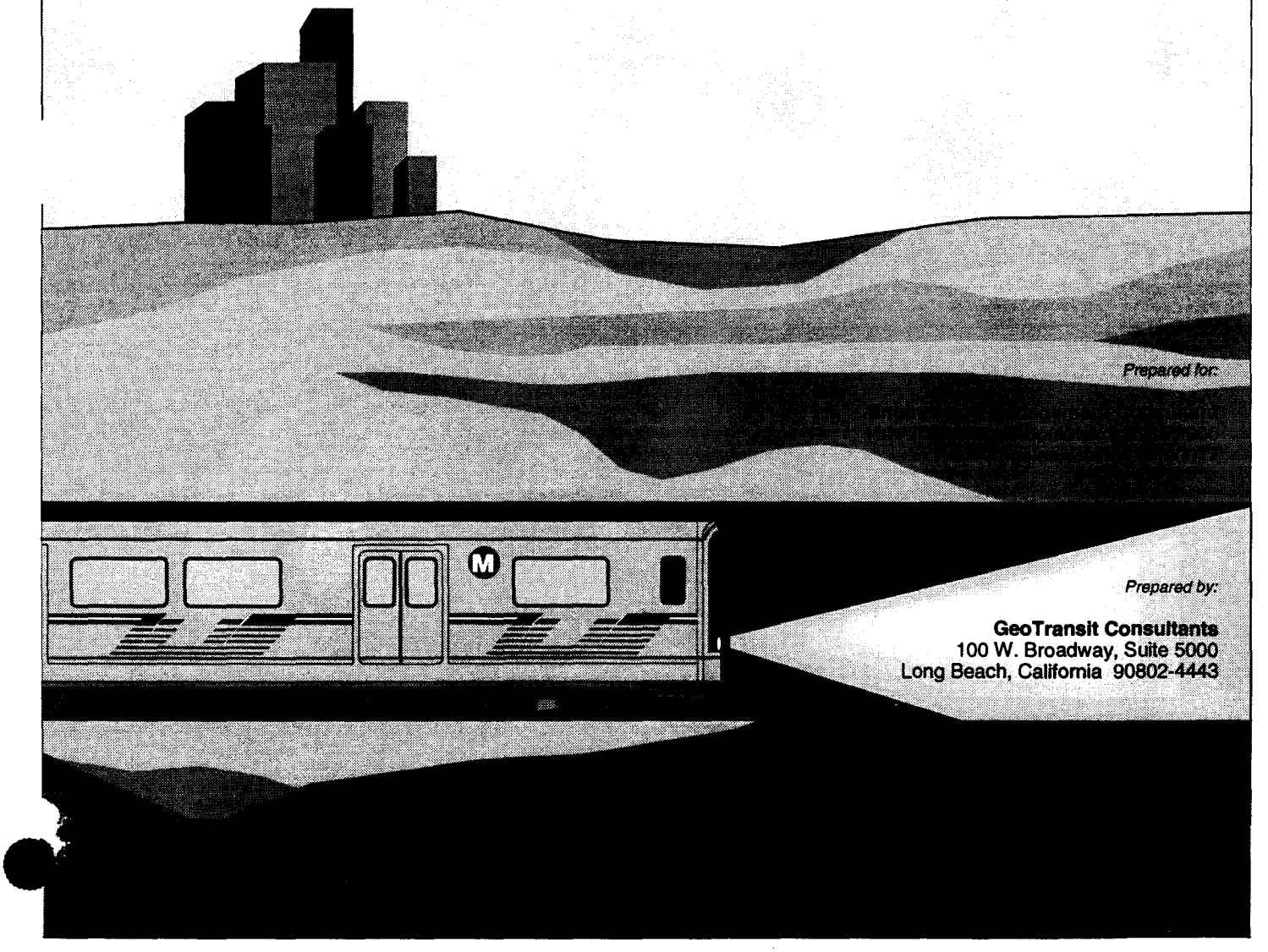
Volume II of II



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Appendix A

APPENDIX A

FIELD EXPLORATION

FIELD EXPLORATION

GENERAL

The field exploration program consisting of 31 geotechnical borings, six fault investigation borings and six CPT soundings was conducted from November 8 to December 13, 1993. The CPTs were conducted by Earth Technology. The mud rotary and hollow stem auger drilling was performed by the drilling subcontractors C & L Drilling, Inc. and A & R Drilling, Inc., respectively. Logging of borings and soil sampling were performed by qualified geologists and engineers from Earth Technology and their subcontractors Diaz Yourman and Associates, S.C. Environmental, and Geotechnique Consultants, under the supervision of an Earth Technology Certified Engineering Geologist (CEG). Sixteen piezometers were installed at selected boring locations to monitor groundwater levels. Seven of these piezometers were developed to obtain groundwater samples and hereafter will be referred to as being monitoring wells. The boring and CPT sounding locations were established in the field by an Earth Technology engineer by tape measurements from adjacent street curbs and other fixed features. The approximate locations of exploration points along the alignment are shown in Plates 1A and 1B. Detailed location maps accompany the borings and CPT logs.

BORINGS AND PIEZOMETER INSTALLATION

Exploratory borings were drilled using a truck-mounted MAYHEW-1000 mud rotary, and CME-75 and CME-85 hollow stem auger rigs. The mud rotary borings for the geotechnical exploration were approximately 5 to 6 inches in diameter and the depths ranged from 70.5 feet to 111.5 feet below ground surface (BGS). In general, soil samples were obtained at 5-foot-depth intervals and at significant changes in stratigraphy, by alternately using standard split-spoon samplers (Standard Penetration Test Method) and 2.4-inch inner diameter California-type drive samplers lined with 1-inch high brass rings. A cone-type plastic catcher and a sample catcher assembly consisting of a brass ring containing 8 metallic teeth and a rubber donut were used with the split-spoon samplers and California drive samplers, respectively. The hollow stem auger borings for the fault investigation, were 6 inches to 8 inches in diameter and the depths ranged from 27.0 feet to 96.5 feet BGS. Representative soil samples were obtained continuously using a California drive sampler.

Standard Penetration Tests (SPT) were performed according to the American Society for Testing Materials (ASTM) Standard Procedure D1586. This method consists of driving the standard split-spoon sampler 18 inches into the soil with a 140-pound hammer falling 30 inches. Blow counts were recorded for each 6-inch driving increment. The number of blows required to drive a standard split-spoon sampler for the last 12 of 18 inches is called the standard penetration resistance.

The driving was terminated when one of the following occurred:

- A total of 100 blows was reached for penetration of 12 inches or less
- No obvious sampler advance was observed during driving
- Sampler was advanced 18 inches.

Split spoon samples were examined and carefully removed from the spoon, logged, sealed and transported to the laboratory for testing.

Relatively undisturbed soil samples were obtained with the California-type drive sampler by driving the sampler with a 300-, 380- or 400-pound downhole hammer falling 18 inches. Hammer weights and the corresponding drop heights used for driving the sampler are indicated in boring logs. Blow counts were recorded for each 6-inch driving increment. The 12-inch long samples were examined and the middle six rings were collected in a plastic tube for transportation to the laboratory for testing. In order to compare the blow counts on a uniform basis, the California sampler downhole hammer blow counts were corrected for sampler dimensions, different hammer weights, height of fall, and buoyancy and viscous drag in the bentonite drilling mud. The corrected blow counts designated as "Equivalent SPT Value" are presented in Table 3-4.

Sixteen piezometers were installed after the completion of soil sampling at selected station locations to monitor groundwater levels. Seven of these piezometers were developed to obtain groundwater samples for chemical analyses and hereafter are considered to be monitoring wells. The piezometers were constructed using two-inch-diameter PVC casings with 0.01-inch slotted well screens. Within the eastern segment, the piezometers were generally screened over a 30-foot zone covering the estimated tunnel envelope. Within the Western Segment, the piezometers were generally screened from about 5 to 10 feet above the anticipated groundwater level of approximately 30 feet BGS to the bottom of borings. In the rotary wash drilling method, observation of groundwater levels during drilling is generally not possible since the borings are filled with drilling fluid. Estimates of the groundwater level were, however, made by observing the moisture conditions of the samples.

Tap water was used to flush each boring to remove or thin the drilling fluid prior to piezometer installation. Up to 25 feet of backfill sand (#2/12 Monterey)/1/2-inch size bentonite pellets/sluff was placed at the bottom of borings. Following this, PVC casing assembly was inserted into the boring, backfill sand was placed to about 1.5 to 13 feet above the top of the screened interval of the casing assembly, and 1/2-inch size bentonite pellets were then dropped in to form a 3-to 8.5-foot thick bentonite plug. Cement grout was then poured into the annulus between the PVC casing and the boring wall from the top of the bentonite plug to within 12 inches to 18 inches of the ground surface. At completion, a circular 8-inch diameter metal traffic box was installed at the piezometer location flush with the ground surface. Piezometer installation diagrams are presented in Figures A-3B, A-5B, A-9B, A-10B, A-13B, A-15B, A-18B, A-19B, A-20B, A-21B, A-23B, A-25B, A-27B, A-31B, A-32B and A-33B.

Monitoring Wells PE-8, PE-16, PE-18 and PE-23 were developed and sampled from December 1 through December 3, 1993; Monitoring Wells PE-29, PE-30 and PE-31 were developed and sampled from December 13 through December 16, 1993. On December 21, 1993, an attempt to resample monitoring well PE-8 was made to confirm the groundwater contamination detected in the earlier sampling event. However, the monitoring well was dry. In general, at every sampling event, at least three well volumes of water were bailed out from each well before obtaining the groundwater samples for chemical analyses.

The logs of borings accompany this appendix. Stratification lines on the logs represent approximate boundaries between predominant soil types. Geologic and engineering descriptions and material classifications used on the boring logs are in general accordance with the Unified Soil Classification System (USCS) and the American Society for Testing and Materials (ASTM D2487 and D2488) Methods. The material was visually classified in the field and independently verified in the laboratory using the general guidelines presented in ASTM D-2488. For samples on which laboratory classification (gradation and/or Atterberg Limits) were performed, material classification was done in general accordance with ASTM D-2487. Figure A-1 presents the Laboratory and Field Soil Classification Systems used in material classification, as presented on the logs. Figure A-2 presents an explanation for the log symbols and terminology.

CONE PENETRATION TESTING (CPT)

The Cone Penetration Test consists of pushing a cone-tipped probe into a soil deposit while simultaneously recording the end bearing and side friction resistance of the soil to that penetration.

The Cone Penetration tests described in this report were conducted in general accordance with ASTM specifications (ASTM-D3441-86) using an electric cone penetrometer.

The CPT equipment operated by The Earth Technology Corporation consists of a cone assembly mounted at the end of a series of hollow sounding rods. A set of hydraulic rams is used to push the cone and rods into the soil, while a continuous record of cone and friction resistance versus depth is obtained in both analog and digital form. A specially designed all wheel drive 20-ton truck is used to transport and house the test equipment, and provide the necessary reaction force during penetration testing.

The cone penetrometer assembly used for this study consists of a conical tip and a cylindrical friction sleeve. The conical tip has a 60° apex angle and a projected cross-sectional area of 10 square centimeters. The cylindrical friction sleeve has a surface area of 150 square centimeters. Both the conical tip and the cylindrical friction sleeve have outer diameters of about 3.60 centimeters.

The interior of the cone penetrometer is instrumented with strain gauges that allow simultaneous measurement of cone tip and friction sleeve resistance during penetration. Continuous electric

signals from the strain gauges are transmitted by a cable in the sounding rods to analog and digital data recorders in the CPT truck.

The CPT data processing is performed using a computer based data acquisition system. The computer generated plots include cone resistance, friction resistance and friction ratio versus depth at a general data scale.

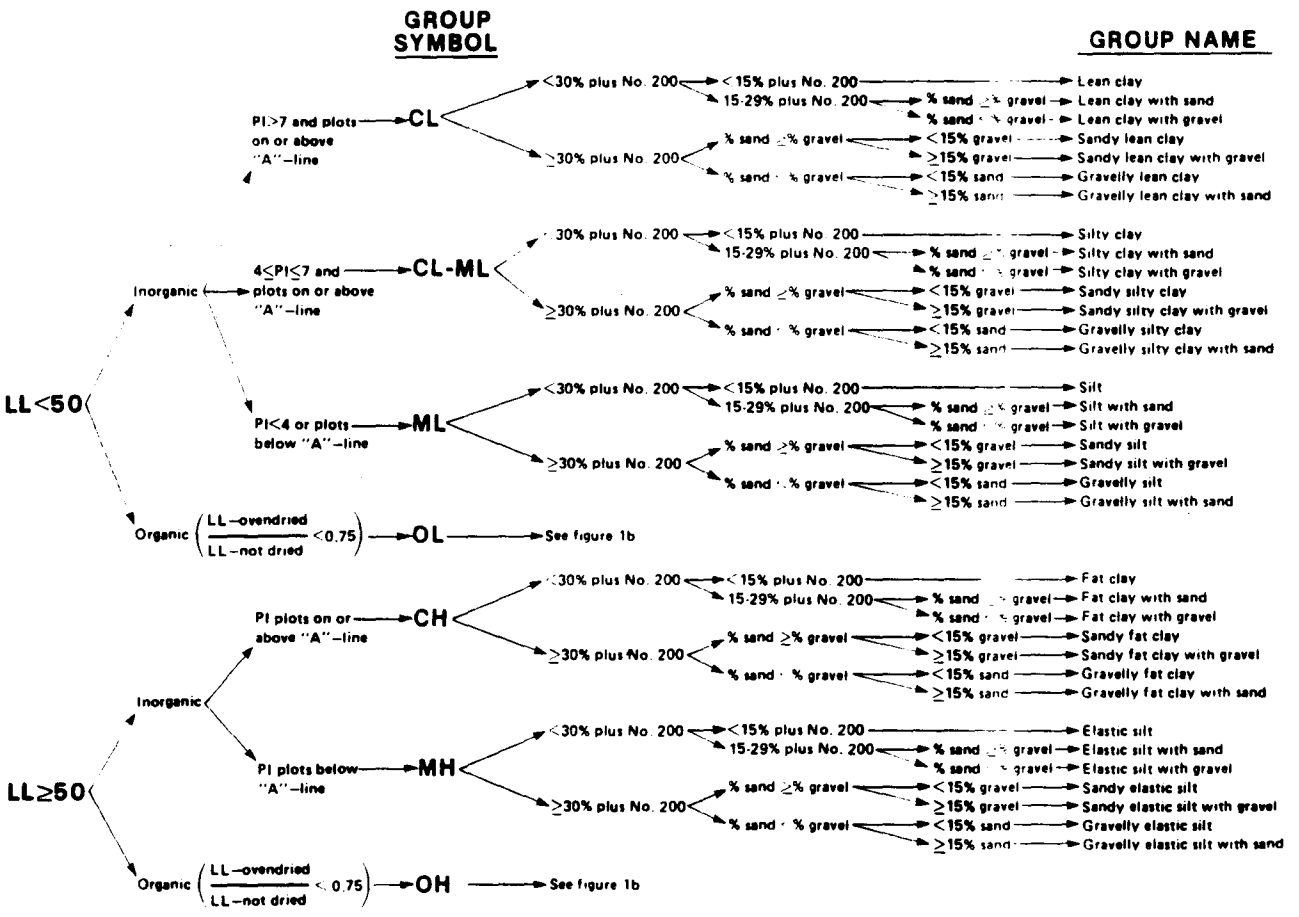
Data and interpretations (based on existing correlations) are tabulated at 0.5-foot intervals and include normalized cone tip resistance, friction ratio, soil behavior type, overburden-normalized equivalent SPT (N_1) value, fines-content adjusted equivalent SPT (N_{1-f}) value, equivalent relative density, undrained shear strength and equivalent friction angle.

Continuous stratigraphic information and parametric interpretations are based on relationships between cone end bearing and friction resistance. The calculated friction ratio (CPT friction sleeve resistance divided by cone end bearing) is used as an indicator of soil type. Granular soils typically have low friction ratios and low cone resistance, while cohesive or organic soils have high friction ratios and low cone resistance. These stratigraphic material categories form the basis for all subsequent interpretations. The geotechnical parameters derived for these materials categories are tabulated at 0.5-ft. intervals for each of the soundings performed.

It is important to note that most of the correlative methods presented herein are based on a combination of theory, field research, research performed under laboratory conditions, and literature review. The tabulated information should, therefore, be viewed as guidelines rather than as precise measurements.

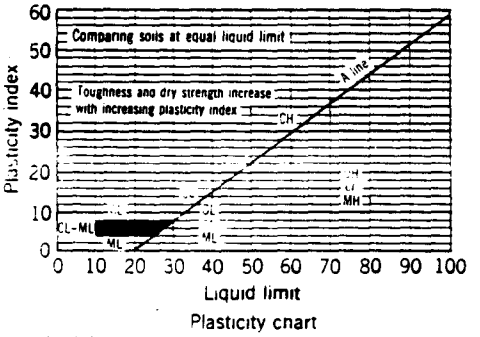
Some care is recommended when using the Soil Behavior Type tabulations. If a tabulation depth happens to fall on a soil layer interface, or a seam of soil differing from the rest of the layer, the tabulated data can be misleading. The solution to this problem is the proper use of the CPT logs. The continuous penetration resistance is the primary source of profile description; the Soil Behavior Type tabulations are supplemental. The continuous logs should be examined and layer boundaries delineated in accordance with the project requirements. The Soil Behavior Type tabulations are only representative of the response of the soil to the large shear deformations imposed during cone penetration. This is not necessarily a prediction of grain size distribution. However, it has been found that Soil Behavior Types generally agree well with the soil types defined in accordance with the grain size distribution methods such as used in the Unified Soil Classification System.

Computer generated cone penetration test plots and the results of cone penetrometer test data are included in this appendix.



Flow Chart for Classifying Fine-Grained Soil (50 % or More Passes No. 200 Sieve)

Laboratory Classification Criteria	
Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5 %: *GW, GP, SW, SP*; More than 12 %: *GM, GC, SM, SC*; 5 % to 12 %: *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
	Not meeting all gradation requirements for *GW*
Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
Atterberg limits above "A" line, with *PI* greater than 7	
	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
	Not meeting all gradation requirements for *SW*
Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
Atterberg limits below "A" line with *PI* greater than 7	



Plasticity chart
for laboratory classification of fine grained soils

From: ASTM 2487 [b] All Sieve Sizes on this Chart are U.S. Standard.

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Laboratory Soil Classification System (Sheet 1 of 4)

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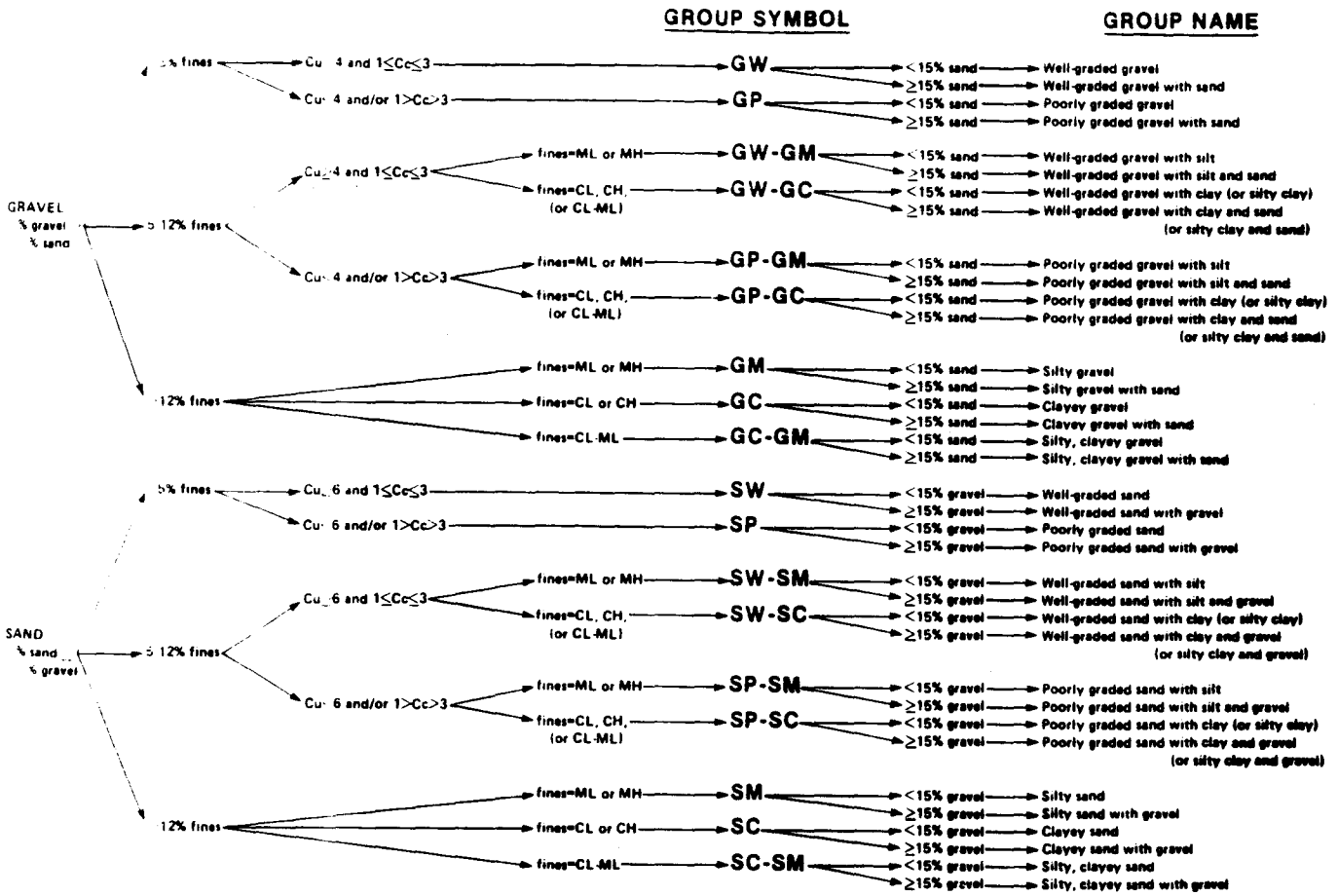
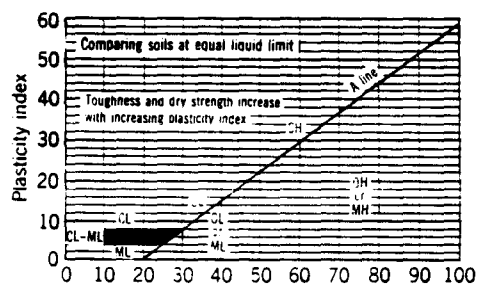
Figure A-1



Flow Chart for Classifying Coarse-Grained Soils (More Than 50 % Retained on No. 200 Sieve)

Laboratory Classification Criteria	
Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5 %: *GW, GP, SW, SP* — More than 12 %: *GM, GC, SM, SC* — 5 % to 12 %: *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
	Not meeting all gradation requirements for *GW*
Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
Atterberg limits above "A" line, with *PI* greater than 7	
	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
	Not meeting all gradation requirements for *SW*
Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
Atterberg limits below "A" line with *PI* greater than 7	



Plasticity chart
for laboratory classification of fine grained soils

From: ASTM 2487 [b] All Sieve Sizes on this Chart are U.S. Standard.

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Laboratory Soil Classification System (Sheet 2 of 4)

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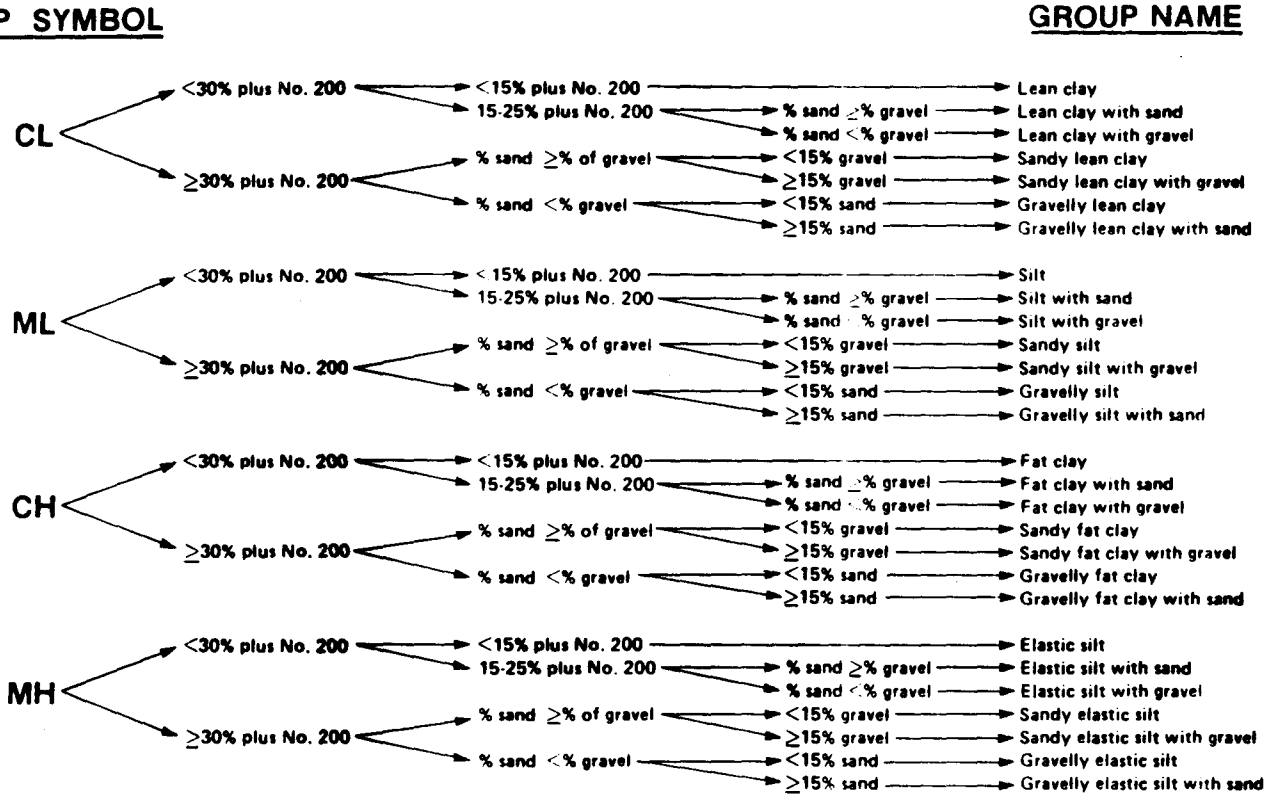
Figure A-1



NOTE—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)

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Field Soil Classification System (Sheet 3 of 4)

From: ASTM D2488

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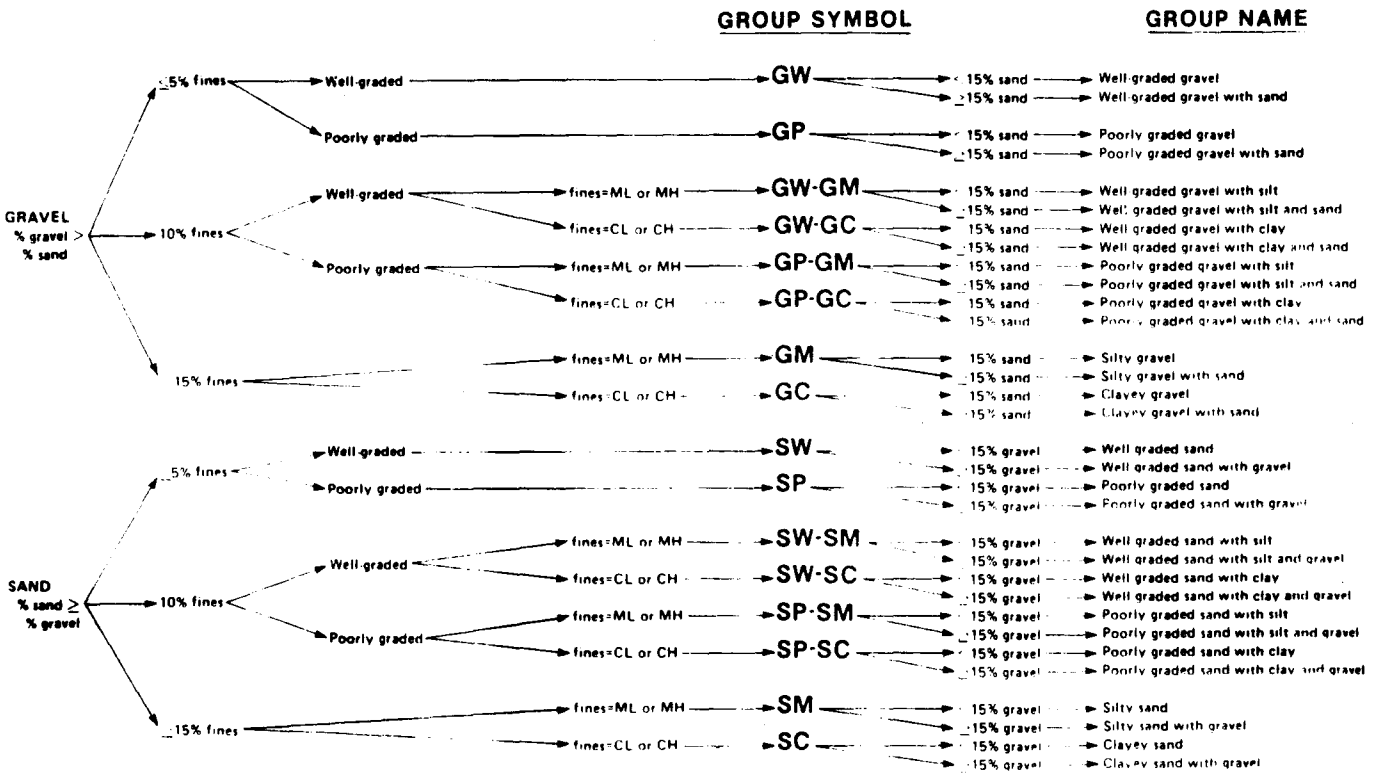
Figure A-1



NOTE—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)

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Field Soil Classification System (Sheet 4 of 4)

From: ASTM D2488

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Figure A-1

SAMPLE/TYPE	
S	STANDARD SPLIT SPOON SAMPLE
D	2½" DIA., 12" DRIVE SAMPLE
B	BAG SAMPLE

SIZE PROPORTIONS

FINE-GRAINED SOILS		COARSE-GRAINED SOILS	
Coarse-grained Proportions		Fine-grained Proportions	
TRACE	<5%	TRACE	<5%
SOME	5 TO 15%	WITH	5 TO 15%
WITH	15 TO 30%	USE MODIFIER	≥15%
USE MODIFIER	>30%		

SOIL MOISTURE

DRY - ABSENCE OF WATER, DRY TO TOUCH

MOIST - DAMP BUT NO VISIBLE WATER

WET - VISIBLE FREE WATER, USUALLY SOIL IS BELOW WATER TABLE

EXPLANATIONS

BLOW COUNT (PENETRATION RESISTANCE)

- BLOW COUNTS FOR 6" INTERVALS EXCEPT AS NOTED

BLOW COUNTS FOR THE CALIFORNIA DRIVE SAMPLER ARE OBTAINED WITH EITHER A 300-, A 380- OR A 400- POUND DOWNHOLE HAMMER FALLING 18 INCHES. EQUIVALENT SPT VALUES ARE OBTAINED BY APPLYING APPROPRIATE CORRECTIONS, AS INDICATED ON FIGURE A-2 (SHEETS 2 OF 4 AND 3 OF 4)

RECOVERY (INCHES RECOVERED/INCHES TOTAL SAMPLE)

MOISTURE CONTENT (%) - LABORATORY DETERMINED MOISTURE CONTENT

PPM -	PARTS PER MILLION
PCF -	POUNDS PER CUBIC FOOT
OVA -	ORGANIC VAPOR ANALYZER
[BACKGROUND] -	BACKGROUND OVA READING
N/A -	NOT APPLICABLE
/ -	DENOTES ALTERNATING SOIL TYPES IN A LAYER (EXAMPLE: SP/SW i.e. ALTERNATING POORLY AND WELL GRADED SANDS IN A PREDOMINANTLY SANDY LAYER)

TERMS FOR THE DESCRIPTION OF BEDROCK (SHEET 4 OF 4)

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Eastside Extension
Metro Red Line

Explanation of Boring Logs (Sheet 1 of 4)

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Figure A-2

EQUIVALENT SPT BLOWCOUNTS FOR CALIFORNIA DRIVE SAMPLES

FOR CALIFORNIA DRIVE SAMPLES, EQUIVALENT SPT VALUES ARE OBTAINED BY APPLYING THE APPROPRIATE CORRECTIONS FOR DIFFERENT HAMMER WEIGHTS, HAMMER DROP, SAMPLER DIMENSIONS, AND BUOYANCY AND VISCOUS DRAG WITHIN THE DRILLING MUD. THESE CORRECTIONS ARE INDICATED BELOW:

FINE-GRAINED SOILS

EQUATION 1

$$N_{SPT} = Nx \frac{W \times H\ (2.0^2 - 1.375^2)}{4200\ (D_o^2 - D_i^2)}$$

WHERE:

R_C	=	SAMPLER HAMMER RATIO (FT/LB)
W	=	WEIGHT OF DOWNHOLE HAMMER (300 LBS, 380 LBS OR 400 LBS)
H	=	HAMMER DROP (18-INCHES)
Do, Di	=	OUTER (3.25 INCHES) AND INNER (2.41 INCHES) DIAMETERS OF THE CALIFORNIA DRIVE SAMPLER

EQUATION 2 (for Standard Penetration Hammer)

$$R_C = 4.185 \times 10^{-5}$$

BASED ON EQUATIONS 1 AND 2 AND SHEAR STRENGTH OF SOIL (FOUNDATION ENGINEERING HANDBOOK, WINTERKORN & FANG, FIGURE 1-22); AND ASSUMING A 20% REDUCTION FOR THE BUOYANCY AND VISCOUS DRAG WITHIN THE DRILLING MUD, EQUIVALENT SPT VALUES ARE OBTAINED AS FOLLOWS:

FOR 300 LBS DOWNHOLE HAMMER:	$N_{SPT} = 0.65\ N\ (N \leq 48)$	$N_{SPT} = 0.50\ N\ (N > 48)$
FOR 380 LBS DOWNHOLE HAMMER:	$N_{SPT} = 0.75\ N\ (N \leq 39)$	$N_{SPT} = 0.63\ N\ (N > 39)$
FOR 400 LBS DOWNHOLE HAMMER:	$N_{SPT} = 0.77\ N\ (N \leq 37)$	$N_{SPT} = 0.66\ N\ (N > 37)$

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Metro Red Line

Explanation of Boring Logs (Sheet 2 of 4)

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Figure A-2

EQUIVALENT SPT BLOWCOUNTS FOR CALIFORNIA DRIVE SAMPLES (CONTINUED)

FOR CALIFORNIA DRIVE SAMPLES, EQUIVALENT SPT VALUES ARE OBTAINED BY APPLYING THE APPROPRIATE CORRECTIONS FOR DIFFERENT HAMMER WEIGHTS, HAMMER DROP, SAMPLER DIMENSIONS, AND BUOYANCY AND VISCOUS DRAG WITHIN THE DRILLING MUD. THESE CORRECTIONS ARE INDICATED BELOW:

COARSE-GRAINED SOILS

EQUATION 1

$$N_{SPT} = Nx \frac{W \times H\ (2.0^2 - 1.375^2)}{4200\ (D_o^2 - D_i^2)}$$

WHERE:

N_{SPT}	=	EQUIVALENT SPT BLOW COUNTS
N	=	DOWNHOLE HAMMER BLOW COUNTS FOR 12" PENETRATION OF CALIFORNIA DRIVE SAMPLER
W	=	WEIGHT OF DOWNHOLE HAMMER (300 LBS, 380 LBS OR 400 LBS)
H	=	HAMMER DROP (18-INCHES)
Do, Di	=	OUTER (3.25 INCHES) AND INNER (2.41 INCHES) DIAMETERS OF THE CALIFORNIA DRIVE SAMPLER

ASSUMING A 20% REDUCTION FOR THE BUOYANCY AND VISCOUS DRAG WITHIN THE DRILLING MUD, EQUIVALENT SPT VALUES OBTAINED FROM EQUATION 1 ARE AS FOLLOWS:

FOR 300 LBS DOWNHOLE HAMMER:	$N_{SPT} = 0.46\ N$
FOR 380 LBS DOWNHOLE HAMMER:	$N_{SPT} = 0.58\ N$
FOR 400 LBS DOWNHOLE HAMMER:	$N_{SPT} = 0.61\ N$

Terms for the Description of Bedrock

ROCK STRENGTH

DESCRIPTOR	CRITERIA
Extremely Hard	Core, fragment, or exposure cannot be scratched with knife or sharp pick, can only be chipped with repeated heavy hammer blows.
Very Hard	Cannot be scratched with knife or sharp pick. Core or fragment breaks with repeated hammer blows.
Hard	Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.
Moderately Hard	Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.
Moderately Soft	Can be grooved 1/16 inch (2mm) deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.
Soft	Can be grooved or gouged easily by knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Can be readily indented, grooved with fingernail, or carved with a knife. Breaks with light manual pressure.

Any bedrock unit softer than H7, very soft, is to be described using USBR 5000 consistency descriptors.

Note: Although "sharp pick" is included in these definitions, descriptions of ability to be scratched, grooved or gouged by a knife is the preferred criteria.

DISCONTINUITY ROUGHNESS

CLASSIFICATION	DESCRIPTION
Smooth	Appears smooth and is essentially smooth to the touch. May be slickensides.
Slightly Rough	Asperities (undulations) on the fracture surfaces are visible and can be distinctly felt.
Medium Rough	Asperities are clearly visible and fracture surface feels abrasive.
Rough	Large angular asperities can be seen. Some ridges and high angular steps evident.
Very Rough	Near-vertical steps and ridges occur on the fracture surface.

FRACTURE FILLING

DESCRIPTION	DEFINITION
Clean	No film or coating
Very Thin	0 - 1 mm
Moderately Thin	1 - 3 mm
Thin	3 - 10 mm
Moderately Thick	10 - 30 mm
Thick	> 30 mm

WEATHERING

DESIGNATION	ABBREVIATION	DESCRIPTION
Fresh	W1	Rock shows no discoloration, loss of strength or other effects due to weathering.
Slightly Weathered	W3	Rock is partly discolored, notably near fracture surfaces. Fractures may be open and stained. Intact rock is not noticeably weaker than fresh rock.
Moderately Weathered	W5	Rock is predominately discolored. Fractures are open, contain filling and may have greater discoloration with alteration penetrating inwards. Intact rock is noticeably weaker than fresh rock.
Intensely Weathered	W7	Rock is discolored throughout. Fractures discolored and contain thick filling. Rock is partly friable but lithorelicts are present. Original rock fabric is mainly preserved.
Decomposed	W9	Discolored or oxidized throughout, resistant minerals such as quartz may be unaltered, complete separation of grain boundaries, resembles soil but remnant rock structure may be preserved.
Residual Soil	RS	Rock is completely weathered to soil and original structure, and texture is completely destroyed.

DISCONTINUITY SPACING

SPACING	FRACTURE	BEDDING & FOLIATION
Less than 1/2 inch (<12 mm)	Extremely Close	Laminated
0.05 to 0.1 foot (12 mm to 30 mm)	Very Close	Very Thin
0.1 foot to 0.3 foot (30 mm to 1 cm)	Close	Thin
0.3 foot to 1 foot (1 cm to 30 cm)	Moderately Close	Medium
1 foot to 3 feet (30 cm to 1 m)	Wide	Thick
More than 3 feet (<1 m)	Very Wide	Very Thick

SEPARATION OF FRACTURE WALLS (FRACTURE OPENNESS)

DESCRIPTION	SEPARATION OF WALL (mm)
Tight	0
Slightly Open	1.0
Moderately Open	1.0 - 3.0
Open	3.0 - 10.0
Moderately Wide	10.0 - 30.0
Wide	> 30.0

Note:

1) Terminology adopted and modified from Engineering Geology Field Manual, U.S. Department of the Interior Bureau of Reclamation.
2) Color description from the Geological Society of America's Rock Color Chart.
3) For descriptions of weak sedimentary rocks also see key to soil definitions.

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Explanation of Boring Logs (Sheet 4 of 4)

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Figure A-2

BORING LOGS

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 1**	Sheet **1** of **4**
Boring Location:	**Atlantic/Whittier**	Elevation and Datum(feet):	**192 MSL**
Health and Safety:	**Level D**	Date Started: **11/8/93**	Date Finished: **11/8/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **91.0**	Depth to Bedrock(feet): ---
Drilling Method:	**Mud Rotary**	Number of Samples: **19**	Depth to Water (feet): ---
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
		ALLUVIUM CLAY; dark yellowish brown, moist, stiff, medium plasticity, trace fine-grained sand and subrounded fine gravel	CL	Qya		D	8 9	2/12				
5					1	D	8 10	6/12	9.6 [8.7]	108	20	0740
10		increased sand content, CLAY with SAND, hard, fine- to medium-grained sand			2	S	7 15 16	12/18	11 [11]			0742
15		CLAYEY SAND; dark yellowish brown, moist, medium dense, fine- to medium-grained, low to medium plasticity clay	SC		3	D	8 9	12/12	9.0 [9.0]	115	14	0800

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 1	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAY; dark yellowish brown, moist, very stiff, medium plasticity, trace fine-grained sand	CL	Qya	4	S	5 11 14	12/18	14 [14]			0805
25		CLAYEY SAND; dark yellowish brown, moist, medium dense, fine-grained, low plasticity clay	SC		5	D	14 15	12/12	9.0 [8.0]	105	15	0825
30		SILTY SAND; dark olive brown, moist, medium dense, fine- to medium-grained, trace coarse-grained, nonplastic silt, trace fine angular gravel to 1/4 " in size [rig chatter from 32' to 33.5']	SM		6	S	8 12 12	7/18	9.0 [8.0]		21	0830
35		CLAY with SAND; dark yellowish brown, moist, very stiff, medium plasticity, fine-grained sand, trace fine gravel to 1/4" in size	CL		7	D	11 12	7/12	9.0 [9.0]	106	19	0850
40					8	S	10 18 21	2/18				
		decreased sand content, CLAY, trace coarse-grained sand, trace gravel to 1" in size			9	D	10 12	8/12	10 [10]		21	0904
45		increased sand content, SANDY CLAY, fine- to coarse-grained sand			10	D	11 12	10/12	9.0 [9.0]	121	13	0913

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 1	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SAND/SILTY SAND; yellowish brown, moist, dense, fine- to medium-grained, trace coarse-grained sand, nonplastic silt to low plasticity clay	SC/SM	Qya	11	S	11 19 22	8/18	9.0 [9.0]			0928
55		SANDY SILT; yellowish brown, moist, very stiff, low plasticity, fine- to medium-grained sand	ML		12	D	16 22	10/12	9.0 [9.0]	98	21	0940
60		SAND with SILT; dark grayish brown, moist, very dense, medium- to coarse-grained, non plastic silt, some fine gravel, [rig chatter at 61']	SP-SM		13	S	30 80/5"	4/11	8.0 [8.0]			0954
65		olive brown, dense, fine- to medium-grained, trace coarse-grained, some rounded to subangular gravel to 1/4" in size			14	D	30 35	8/12	9.0 [9.0]	108	10	1020
70		increased silt content, SILTY SAND, very dense, trace gravel to 1/4" in size	SM		15	S	40 65	8/12	9.0 [9.0]			1038
75		decreased silt content, SAND with SILT, light olive brown, dense	SP-SM		16	D	30 35	9/12	9.0 [9.0]	93	13	1050

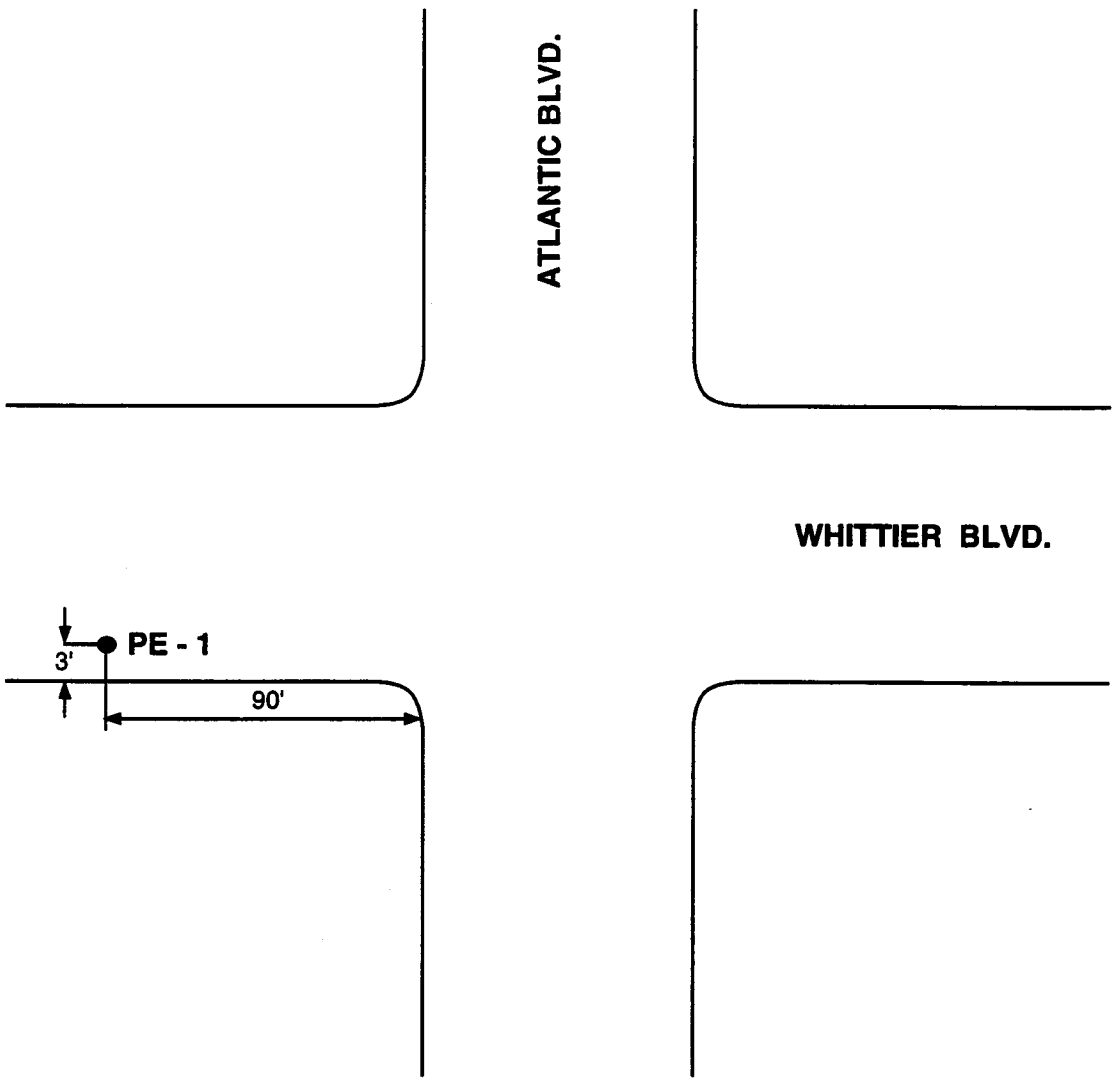
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 1	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SANDY SILT; olive brown, moist, hard, nonplastic to low plasticity, fine-grained sand, some coarse-grained sand	ML	Qya	17	S	14 22 26	15/18	10 [9.0]			1108
85		SILTY SAND; light yellowish brown, moist, dense, fine-grained, some medium- to coarse-grained sand, nonplastic silt	SM		18	D	30 45	8/12	10 [9.0]	91	17	1120
90		decreased silt content and increased gravel content, SAND with SILT and GRAVEL, grayish brown, very dense, medium- to coarse-grained, gravel to 1/2" in size	SP-SM		19	S	25 75	8/12	10 [9.0]			1140
		Boring terminated at 91.0 feet. Piezometer dry on 1/11/94.										
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

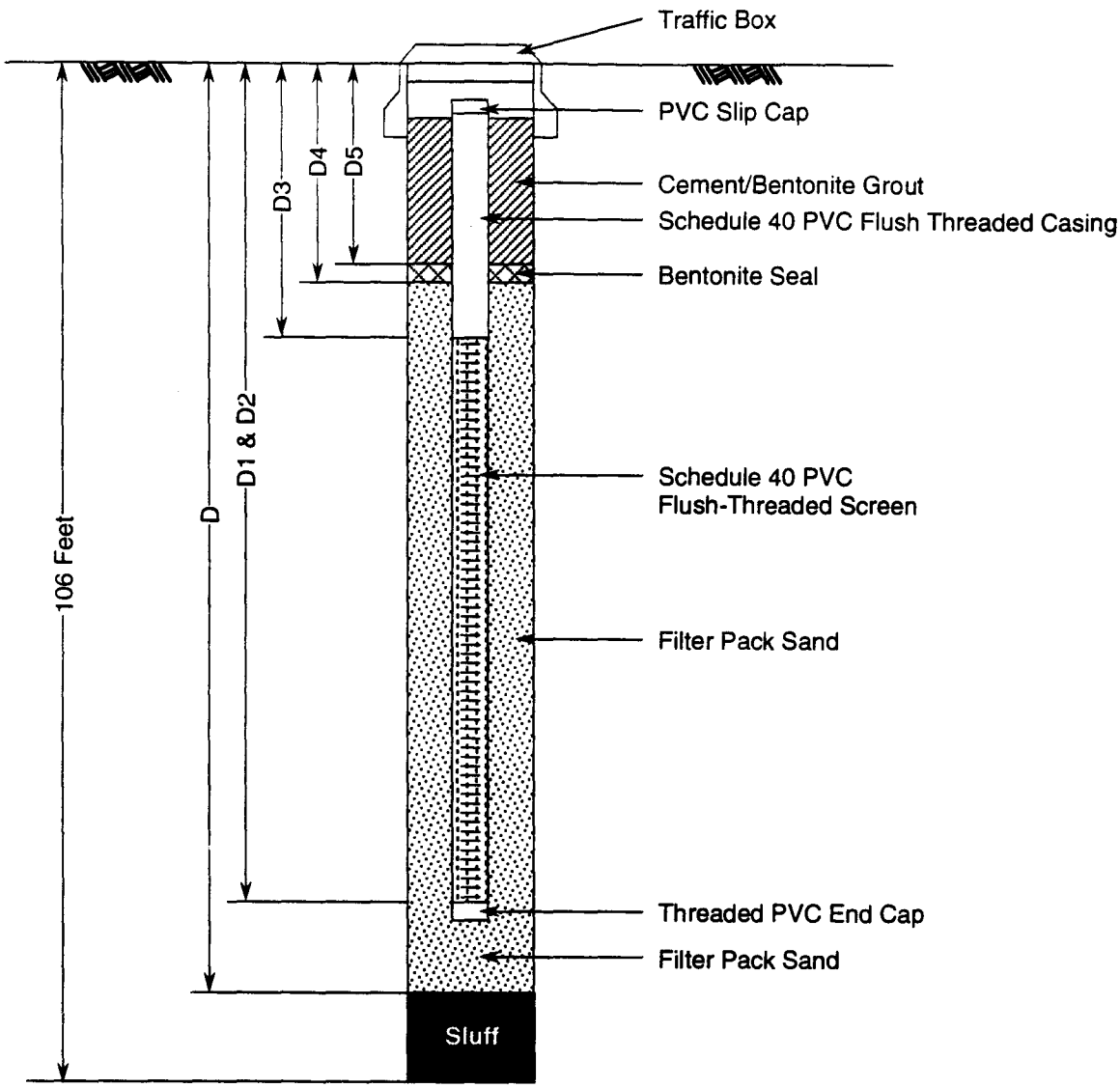
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 1

1-94

Figure A -3A



Total Depth (D)	=	87.5	Feet
Total Depth of Casing (D1)	=	65	Feet
Depth to Bottom of Well Screen (D2)	=	64.8	Feet
Depth to Top of Well Screen (D3)	=	34.8	Feet
Depth to Bottom of Top Seal (D4)	=	33	Feet
Depth to Top of Top Seal (D5)	=	29	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-1

2-94

Figure A-3B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 2**	Sheet **1** of **3**
Boring Location:	**Ferris/Whittier**	Elevation and Datum(feet):	**192 MSL**
Health and Safety:	**Level D**	Date Started: **11/8/93**	Date Finished: **11/8/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **70.8**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **14**	Depth to possible Water (feet): **52**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, fine- to coarse-grained sand with gravel		af								
		ALLUVIUM CLAY; dark yellowish brown, moist, stiff, medium plasticity, some fine- to medium-grained sand	CL	Qya								
5					1	S	4 4 5	13/18	5.0 [5.0]			--
10		yellowish red, very stiff, trace fine- to coarse-grained sand, trace fine subangular to subrounded gravel, slightly porous		Qoa	2	D	16 20	3/12	5.0 [5.0]	109	22	--
15		reddish brown, hard			3	S	10 21 30	15/18	5.0 [5.0]			--
		[rig chatter from 17.5' to 19.5'] possible interval of SAND with GRAVEL	SW									
		increased sand content, SANDY CLAY	CL									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE- 2** | Sheet 2 of 3

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SANDY CLAY; reddish brown, moist, hard, medium plasticity, fine- to medium-grained sand, slightly porous	CL	Qoa	4	D	27 41	4/12	5.0 [5.0]	114	16	--
25		decreased sand content, CLAY, yellowish brown			5	S	14 21 30	15/18	5.0 [5.0]			--
30		dark yellowish brown, very stiff, blocky soil formation with clay skins, possible paleosol			6	D	18 35	12/12	5.0 [5.0]	105	22	--
35		interval of SILTY SAND, reddish brown, dense, fine- to medium-grained	SM		7	S	12 18 25	18/18	5.0 [5.0]			--
		[rig chatter at 37'], interval of SAND, coarse-grained	SP									
		SANDY CLAY, yellowish brown, nonplastic to low plasticity, fine-grained sand, micaceous	CL									
40					8	D	24 30	12/12	5.0 [5.0]	92	21	--
45		reddish brown, hard, occasional coarse-grained sand			9	S	14 18 22	18/18	5.0 [5.0]			--

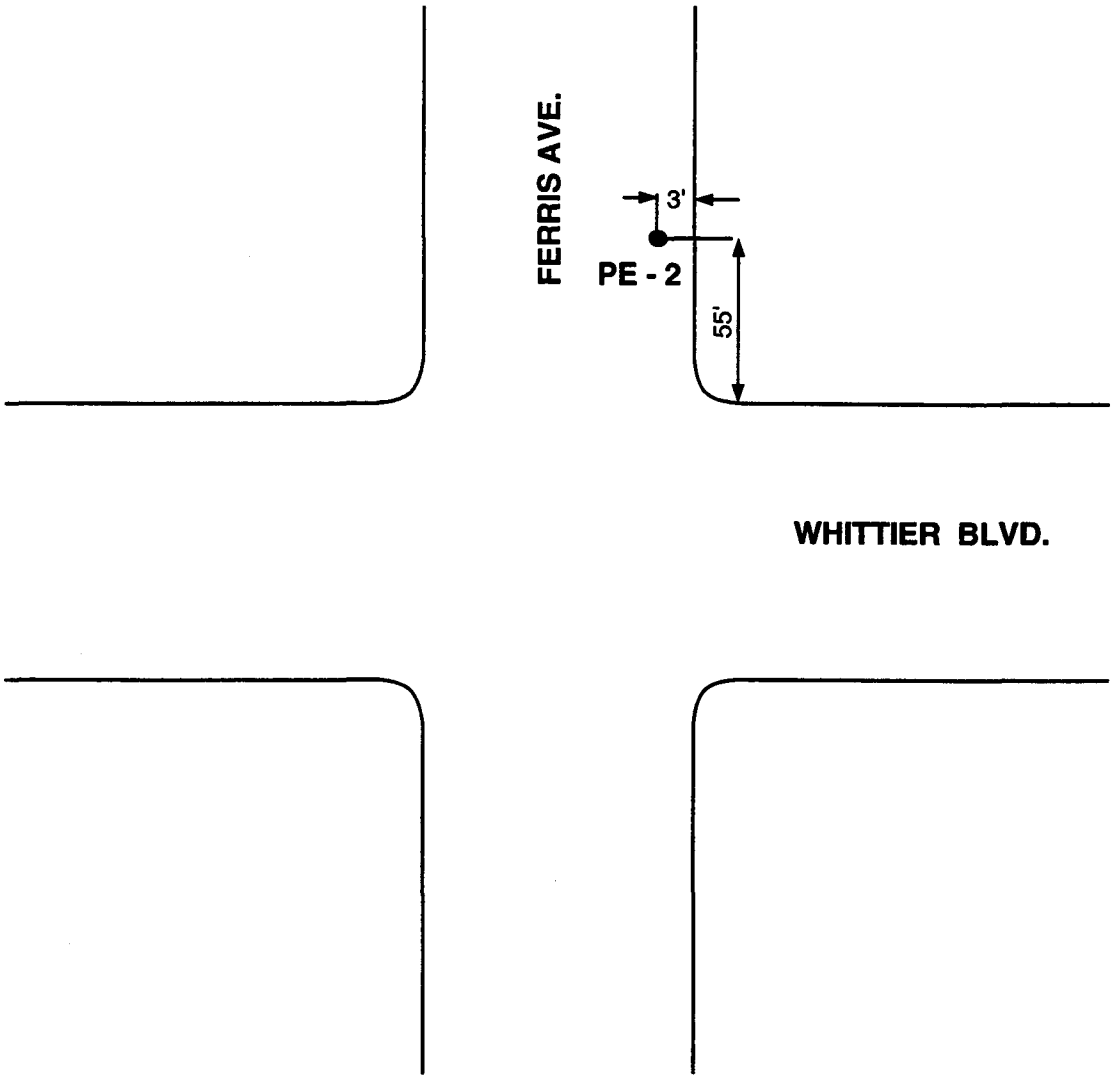
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 2	Sheet 3 of 3	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SANDY CLAY; yellowish brown, moist, hard, medium plasticity, fine- to coarse-grained sand	CL	Qoa	10	D	100/7"	6/7	5.0 [5.0]	125	13	--
		SILTY SAND; yellowish brown, wet, very dense, fine- to medium-grained, nonplastic silt [rig chatter at 52', fine gravel layer]	SM									
55					11	S	37 50/5"	11/11	5.0 [5.0]			--
60		decreased silt content, SAND with SILT; yellowish red, fine- to coarse-grained, some fine to coarse gravel coarse-grained sand past 61', gravel to 2" in size	SW-SM		12	D	100	2/6	5.0 [5.0]	114	16	--
65		increased silt content, SILTY SAND, yellowish brown, fine- to medium-grained, micaceous	SM		13	S	23 30 40	11/18	5.0 [5.0]			--
70		CLAYEY SAND with GRAVEL; yellowish brown, wet, very dense, fine- to coarse-grained, medium plasticity clay, fine subangular to subrounded gravel	SC		14	D	100	2/6	5.0 [5.0]	111	11	--
		Boring terminated at 70.8 feet. Possible groundwater at 52.0 feet below surface.										
75												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 2

1-94

Figure A -4

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 3**	Sheet 1 of 4
Boring Location:	**Mc Donnel/Whittier**	Elevation and Datum(feet):	**195 MSL**
Health and Safety:	**Level D**	Date Started: **11/9/93**	Date Finished: **11/9/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **106.0**	Depth to Bedrock(feet): ---
Drilling Method:	**Mud Rotary**	Number of Samples: **21**	Depth to Water (feet): ---
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
		ALLUVIUM CLAY with SAND; reddish brown, moist, stiff, medium plasticity, fine-grained sand, trace medium- to coarse-grained sand, trace gravel to 1/4" in size	CL	Qoa								
5					1	D	8 8	7/12	9.0 [8.0]	115	18	0730
10		decreased sand content, CLAY, very stiff, trace fine- to coarse-grained sand and fine gravel			2	S	5 11 14	16/18	9.5 [8.0]			0738
15		dark reddish brown, stiff, trace fine-grained sand			3	D	5 7	7/12	9.0 [8.0]	102	23	0743

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE- 3** | Sheet 2 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SAND/SANDY CLAY; dark reddish brown, moist, medium dense/stiff, fine-grained sand, trace medium- to coarse-grained sand, medium plasticity clay, trace angular gravel to 1/2" in size	SC/CL	Qoa	4	S	4 6 8	18/18	9.5 [8.0]			0750
25		CLAY; dark yellowish brown, moist, very stiff, medium plasticity, some fine-grained sand, trace medium- to coarse-grained sand	CL		5	D	20 24	9/12	6.0 [5.1]	119	15	0800
30		increased sand content, CLAY with SAND, hard, fine- to medium-grained sand			6	S	8 17 15	12/18	5.8 [4.1]			0808
35		stiff, fine-grained sand			7	D	9 9	12/12	4.6 [3.9]	101	20	0820
40		SILTY SAND; olive, moist, very dense, fine- to coarse-grained, nonplastic silt, some subangular to subrounded fine gravel	SM		8	S	12 28 25	8/18	4.7 [3.9]			0825
45		SANDY CLAY; dark yellowish brown, moist, stiff, low to medium plasticity, fine- to coarse-grained sand	CL		9	D	7 10	12/12	5.2 [4.5]	104	19	0833

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 3	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; olive brown, moist, dense, fine- to medium-grained, nonplastic silt, trace coarse-grained sand and clay	SM	Qoa	10	S	11 20 24	10/18	5.1 [4]			0839
55		SANDY CLAY; dark reddish brown, moist, very stiff, low to medium plasticity, fine- to coarse-grained sand	CL		11	D	12 14	10/12	4.7 [3.8]	116	13	0846
60		SILTY SAND; olive brown, moist, dense, medium- to coarse-grained, nonplastic to low plastic silt, trace clay	SM		12	S	8 18 23	12/18	5.3 [4.4]			0900
65		increased coarse-grained sand content, medium dense			13	D	14 25	7/12	5.3 [4.4]	111	15	0912
70		SANDY CLAY/CLAYEY SAND; light yellowish brown mottled with light gray and black, moist, hard/dense, low to medium plasticity, fine- to coarse-grained sand, some gravel to 1/4" in size	CL/SC		14	S	10 23 25	12/18	5.4 [4.7]			0930
75		SAND with CLAY and GRAVEL; dark brown mottled with white, moist, very dense, fine- to coarse-grained, gravel to 1" in size	SW-SC		15	D	40 40/4"	7/10	4.9 [4.5]	113	14	0945

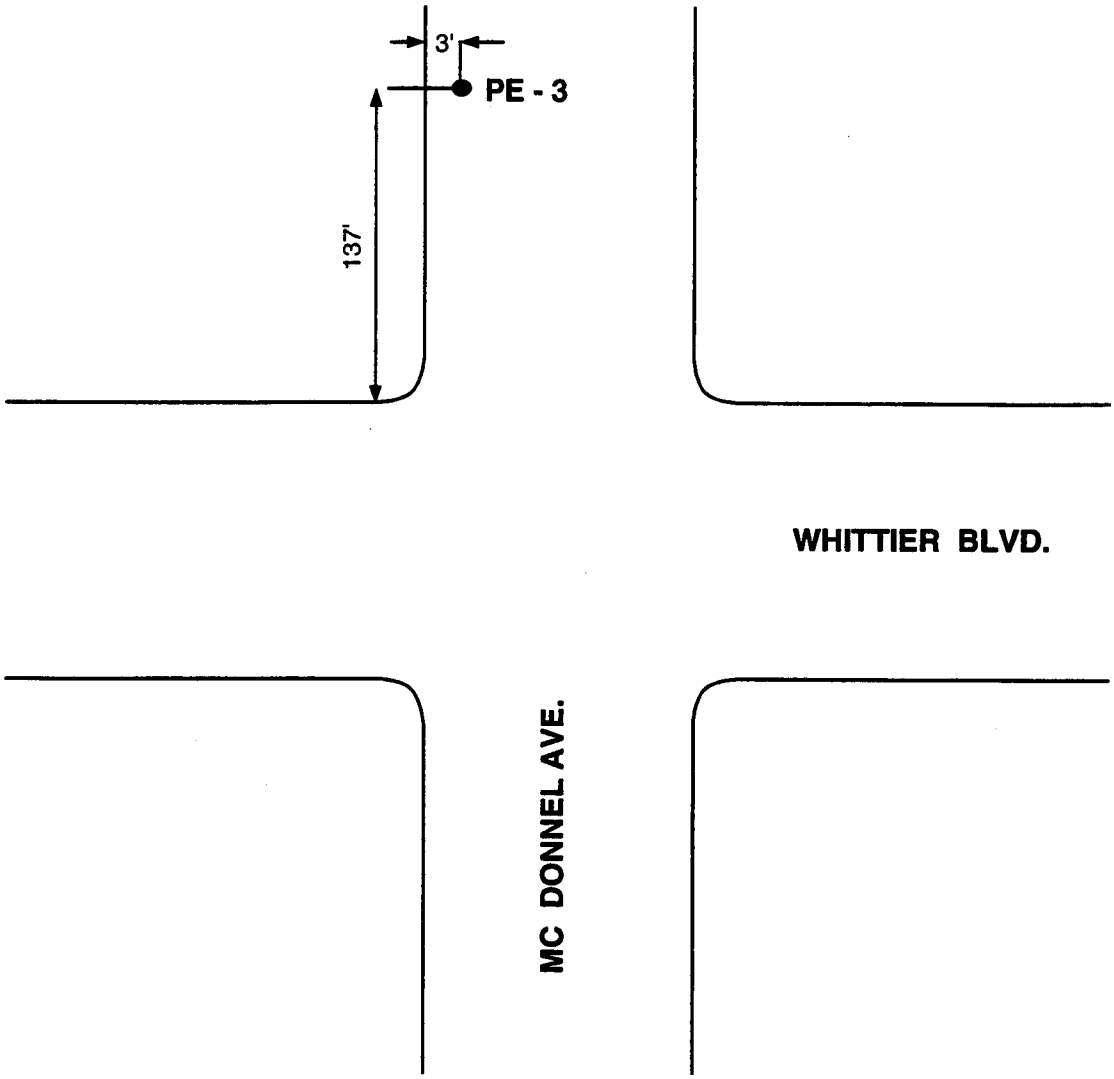
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 3	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SAND; light gray with white mottling, moist, very dense, fine- to coarse-grained, low plasticity clay, some gravel to 1/4" in size	SC	Qoa	16	S	30 75	3/12	--			0957
85		SAND with GRAVEL; light brown, moist, very dense, fine- to coarse-grained, dark angular to rounded gravel to 2" in size, trace nonplastic silt	SW		17	D	100	5/6	--		5	1020
90		increased silt content, decreased gravel content, SAND with SILT/SILTY SAND, trace gravel	SW-SM /SM		18	S	35 75/3"	5/9	--			1030
95		trace angular to subrounded gravel to 1/2" in size			19	D	45 60	5.5/12	5.7 [4.3]	115	15	1054
		SILTY SAND/SANDY SILT, dark olive brown, moist, very dense/hard, fine-grained sand, trace medium- to coarse-grained sand, low plasticity silt	SM/ML									
100					20	S	22 40 45/4"	10/16	6.1 [5.0]			1112
105		decreased silt content, SILTY SAND, dense, nonplastic silt	SM		21	D	28 40	7/12	6.1 [5.1]	97	21	1135
		Boring terminated at 106.0 feet. Piezometer dry on 1/11/94.										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

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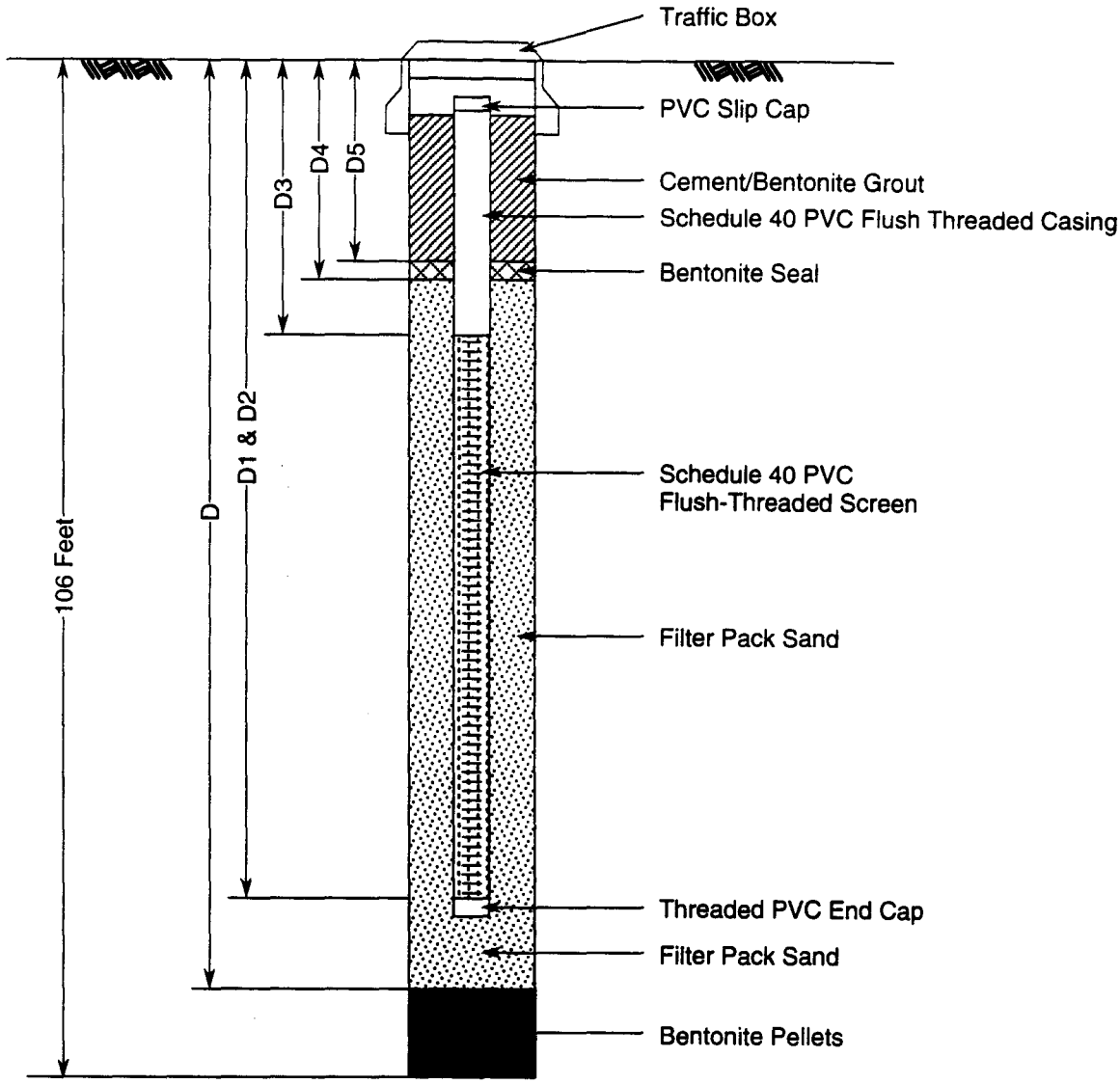
Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 3

1-94

Figure A -5A



Total Depth (D)	=	75.2	Feet
Total Depth of Casing (D1)	=	75	Feet
Depth to Bottom of Well Screen (D2)	=	75	Feet
Depth to Top of Well Screen (D3)	=	45	Feet
Depth to Bottom of Top Seal (D4)	=	42	Feet
Depth to Top of Top Seal (D5)	=	37	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

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Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-3

2-94

Figure A-5B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 4**	Sheet **1** of **4**
Boring Location:	**Duncan/Whittier**	Elevation and Datum(feet):	**196 MSL**
Health and Safety:	**Level D**	Date Started: **11/9/93**	Date Finished: **11/9/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **85.7**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **16**	Depth to possible Water (feet): **50**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, sand with gravel		af								
		ALLUVIUM CLAY; yellowish brown, moist, very stiff, medium plasticity, trace medium- to coarse-grained sand, slightly porous	CL	Qya								
5					1	S	5 11 15	11/18	5.5 [5.5]			--
10		possible interval of SAND	SW									
		CLAY with SAND; dark yellowish brown, fine- to coarse-grained sand	CL		2	D	16 26	6/12	5.5 [5.5]	103	24	--
15		yellowish red, hard, increased fine-grained sand content		Qoa	3	S	6 11 20	15/18	5.5 [5.5]			--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line																				
Project Number:	94-1100	Boring Number:	PE- 4																Sheet 2 of 4		

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples							Drilling Time
					Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	
		CLAY with SAND; dark reddish brown, moist, hard, medium plasticity, fine- to coarse-grained sand	CL	Qoa	4	D	24 44	6/12	5.5 [5.5]	114	17	--
25		SILTY SAND; yellowish brown, moist, very dense, fine- to medium-grained, trace coarse-grained sand, nonplastic silt, some clay, micaceous	SM		5	S	21 30 34	18/18	5.5 [5.5]			--
30		dense			6	D	21 50	6/12	5.5 [5.5]	111	17	--
35					7	S	36 50/5.5"	10 /11.5	5.5 [5.5]			--
40		SILTY CLAY with SAND; reddish yellow, moist, hard, nonplastic to low plasticity, fine-grained sand	CL/ML		8	D	70/7"	6/7	6.5 [5.5]	101	26	--
45		increased sand content, SANDY CLAY, dark reddish brown, medium plasticity, fine- to medium-grained sand, some fine gravel	CL		9	S	20 30 34	18/18	5.5 [5.5]			--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE- 4** | Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYEY SAND; reddish yellow to yellowish brown, wet, very dense, fine- to coarse-grained, medium plasticity clay, some fine gravel	SC	Qoa	10	D	90	3/6	6.0 [5.5]	125	11	--
55		[slow drilling and chatter; 54'- 85'] SAND with CLAY and GRAVEL; reddish yellow to yellowish brown, wet, very dense, fine- to coarse-grained, medium plasticity clay, fine to coarse gravel to 1-1/4" in size	SW-SC		11	S	60/3"	2/3	5.5 [5.5]			--
60					12	D	100/3"	< 1/3	6.0 [5.5]		10	--
65		SAND with SILT and GRAVEL; yellowish brown, wet, very dense, fine- to coarse-grained, nonplastic silt, angular to subangular gravel to 1-1/4" in size	SP-SM		13	S	60/3"	< 1/3	5.5 [5.5]			--
70					14	D	70/2.5"	< 1/2.5	6.5 [5.5]		11	--
75						S	60/3"	0/3	6.0 [5.5]			--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

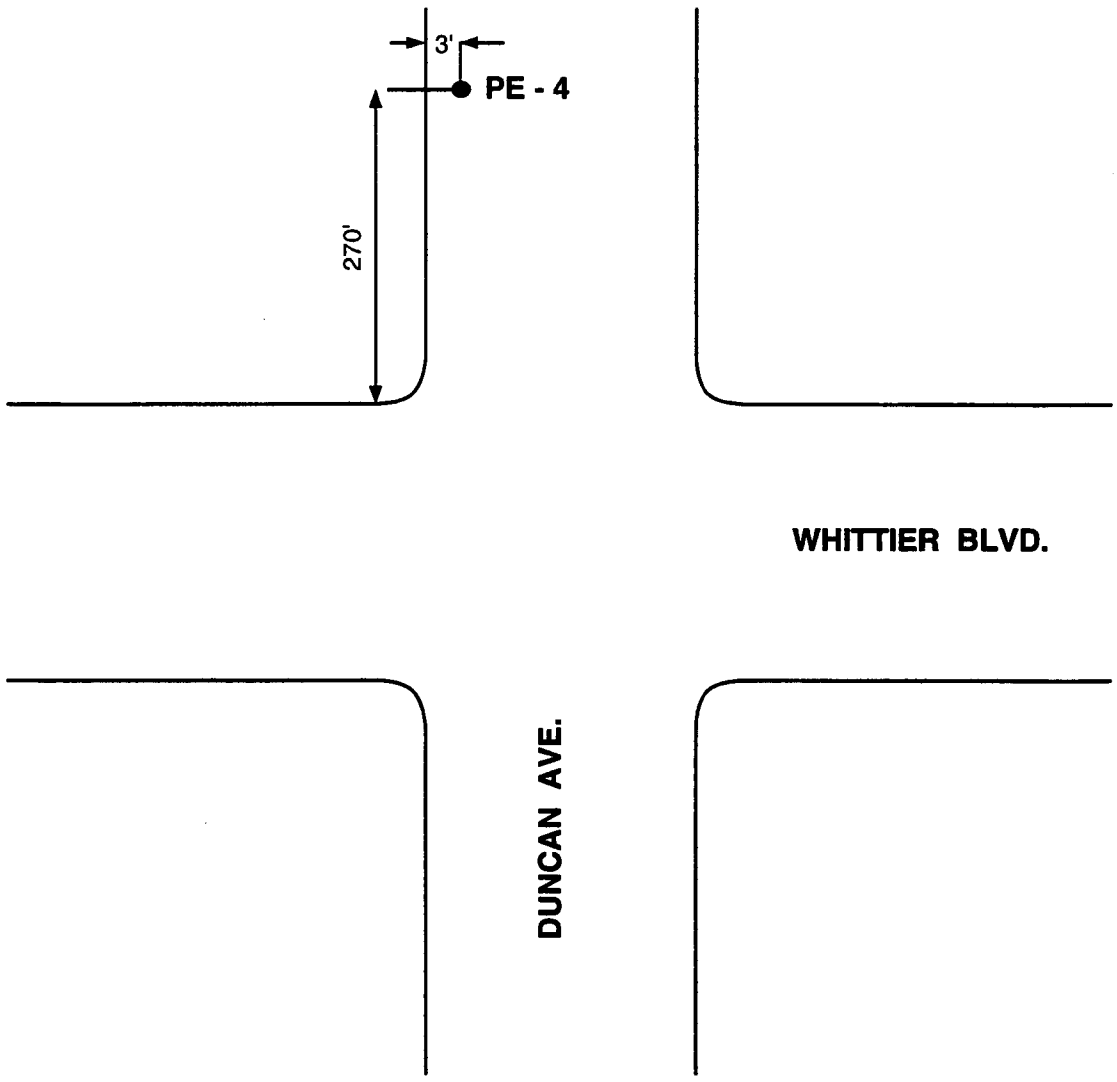
GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number:	PE- 4

Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT and GRAVEL; reddish yellow to yellowish brown, wet, very dense, fine- to coarse-grained, gravel to 1" in size, nonplastic silt	SP-SM	Qoa	15	D	70/2.5"	< 1 /2.5	6.0 [5.5]		6	--
85					16	D	70/4"	< 1/4	6.0 [5.5]		5	--
		Boring terminated at 85.7 feet. Possible groundwater at 50 feet below surface.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 4

1-94

Figure A -6

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 5**	Sheet **1** of **4**
Boring Location:	**Eastern/Whittier**	Elevation and Datum(feet):	**209 MSL**
Health and Safety:	**Level D**	Date Started: **11/10/93**	Date Finished: **11/10/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **80.4**	Depth to Bedrock(feet): ---
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): ---
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, sandy clay with abundant roots		af								
		ALLUVIUM SANDY CLAY; dark reddish brown, moist, very stiff, medium plasticity, fine- to coarse-grained sand and fine gravel to 1/4" in size, some roots	CL	Qoa								
5					1	D	9 11	9/12	3.7 [3.5]	109	15	0748
10		CLAYEY SAND; light olive brown, moist, dense, fine- to medium-grained, nonplastic to low plasticity clay, trace subangular to subrounded gravel, trace roots	SC		2	S	19 22 27	10/18	5.6 [3.8]			0754
15		dark yellowish brown, medium dense, fine- to coarse-grained sand, some coarse gravel			3	D	12 14	7/12	3.9 [3.5]	116	10	0805

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 5	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SANDY SILT; dark yellowish brown, moist, very stiff, low plasticity, fine- to medium-grained sand	ML	Qoa	4	S	9 16 14	8/18	4.8 [3.8]			0809
25		SANDY CLAY; dark reddish brown, moist, very stiff, medium plasticity, nonplastic silt, fine- to medium-grained sand, trace coarse-grained sand and gravel to 1/2" in size	CL		5	D	9 17	8/12	5.1 [3.7]	110	16	0818
30		interval of SILTY SAND, dark yellowish brown, moist, medium dense, fine- to coarse-grained, nonplastic to low plastic silt, trace gravel to 1/4" in size	SM		6	S	6 9 11	10/18	5.0 [3.7]			0824
		GRAVEL with SAND; light olive brown, moist, very dense, fine- to coarse-grained sand, [rig chatter at 32'], some cobbles	GP									
35		[no recovery due to gravel and cobbles]				D	50/3"	0/3	--			0835
40		increased sand and silt content, SAND with SILT and GRAVEL, light olive brown mottled with white, nonplastic silt, subangular to subrounded gravel to 1/2" in size	SP-SM		7	S	20 31 50/4"	8/16	4.9 [3.8]			0859
45		decreased sand and silt content, GRAVEL with SAND, gravel to 1" in size	GP		8	D	75	3/6	4.2 [3.6]		11	0909

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 5	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; dark olive brown, moist, very dense, fine- to medium-grained, nonplastic silt, some subangular to subrounded gravel to 3/4" in size, layered	SM	Qoa	9	S	20 35 30	8/18	4.7 [3.6]			0927
55		alternating layers of SILTY SAND and GRAVEL; greenish brown, fine- to coarse-grained	SM/GP		10	D	75/7"	5/7	4.2 [3.6]		13	0938
60		decreased gravel content, SILTY SAND, dark yellowish brown mottled with reddish brown, medium dense, medium- to coarse-grained, trace gravel to 1/4" in size	SM		11	D	15 25	10/12	4.0 [3.7]	105	21	0959
65		olive brown mottled with black, very dense, fine- to coarse-grained, trace subrounded fine gravel			12	S	30 75	7/12	4.1 [3.7]			1009
70		SAND with GRAVEL, light brown, moist, very dense, fine- to coarse-grained sand, gravel to 1/4" in size, trace nonplastic silt	SP/SW		13	D	75	4/6	4.3 [3.6]	115	12	1030
75					14	S B	30 75/4"	0/10	--			1052

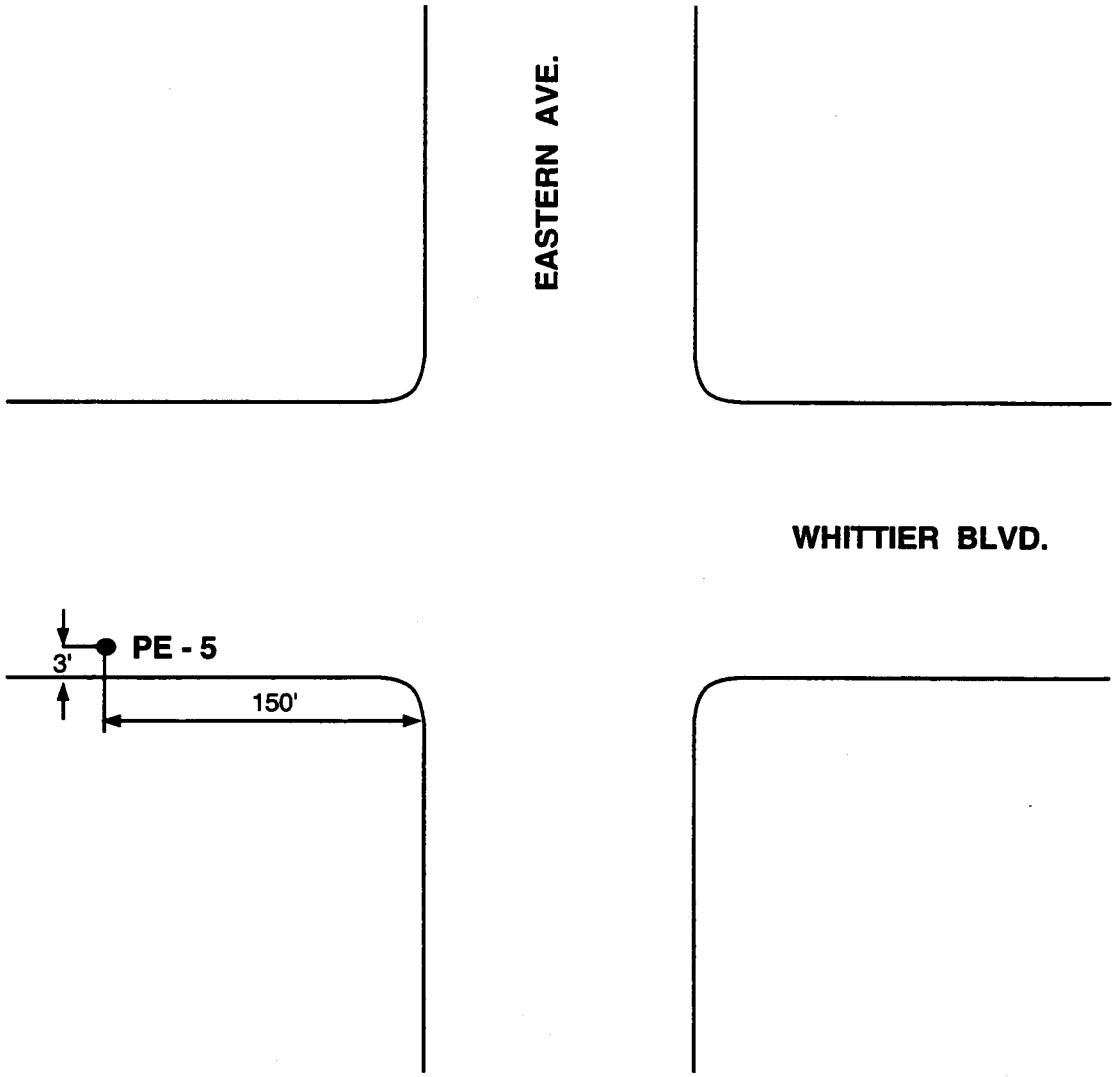
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 5	Sheet 4	of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
		SAND with GRAVEL; light brown, moist, very dense, fine- to coarse-grained, gravel to 1/4" in size, trace nonplastic silt	SP/SW	Qoa	15	D	100/5"	4/5	4.3 [3.7]	101	20	1110
		Boring terminated at 80.4 feet. Groundwater was not apparent.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 5

1-94

Figure A -7

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 6**	Sheet **1** of **4**
Boring Location:	**Brannick/Whittier**		Elevation and Datum(feet): **209 MSL**
Health and Safety:	**Level D**	Date Started: **11/10/93**	Date Finished: **11/10/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **80.0**	Depth to Bedrock(feet): ---
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): ---
Boring Diameter:	**5 inches**	Completion Information: **Grouted to surface**	
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base 1.5' thick, gravel and sand		af								
		ALLUVIUM SANDY CLAY; reddish brown, moist to wet, hard, medium plasticity, fine- to coarse-grained sand, slightly porous	CL	Qoa								
5					1	D	34 60/4"	5/10	4.5 [4.5]	115	12	--
		[rig chatter to 14.5'] SAND with GRAVEL; yellowish brown, moist, dense, fine- to coarse-grained, angular gravel to 1" in size, trace nonplastic silt	SW									
10					2	S	14 20 30	6/18	4.5 [4.5]			--
15		SILTY SAND; reddish brown, moist, medium dense, fine- to coarse-grained, nonplastic silt, trace clay	SM		3	D	16 20	12/12	4.5 [4.5]	110	17	--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 6	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILTY SAND; reddish to yellowish brown, very moist to wet, very dense, fine- to coarse-grained, nonplastic silt	SM	Qoa	4	S	25 50	8/12	4.5 [4.5]			--
		[strong rig chatter at 23']										
25		GRAVEL with SILT and SAND; yellowish brown, wet, very dense, angular to subrounded gravel to 1-1/4" in size, fine- to coarse-grained sand, nonplastic silt, some cobbles and boulders	GW-GM		5	D	90	2/6	4.5 [4.5]	123	14	--
30		[strong chatter continues to 57'] abundant gravel				S	50/3"	0/3	4.5 [4.5]			--
		probable cobbles present past 33'										
35		boulder about 1'in size			6	B			--			--
40		[bag sample from shoe, rock fragments, probably some cobbles]			7	D	100 /2.5"	<1 /2.5	4.5 [4.5]		6	--
45					8	B			4.5 [4.5]			--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 6	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SILT and SAND ; yellowish brown, wet, very dense, angular to subrounded gravel to 1-1/4" in size, fine- to coarse-grained sand and nonplastic silt	GW-GM	Qoa	9	B			4.5 [4.5]			--
55		SANDY SILT; yellowish to reddish brown, wet, hard, nonplastic, fine-grained sand	ML		10	D	140	4/6	4.5 [4.5]	101	24	--
60					11	D	100	3/6	4.5 [4.5]	96	28	--
		[rig chatter at 63', some coarse gravel or cobbles]										
		SAND with SILT; yellowish brown, wet, very dense, fine- to coarse-grained, nonplastic silt, some subrounded fine gravel	SP-SM									
65					12	D	100/3"	< 1/3	4.5 [4.5]		12	--
70		interval of SILTY SAND, dark yellowish brown, fine-grained	SM		13	D	100/3"	2/3	4.5 [4.5]	101	24	--
		[rig chatter to 76']										
		SAND with SILT	SP-SM									
75		[strong rig chatter to 80']			14	D	100/3"	< 1/3	4.5 [4.5]		12	--
		GRAVEL with COBBLES and BOULDERS	GW									
					15	B			4.5 [4.5]			--

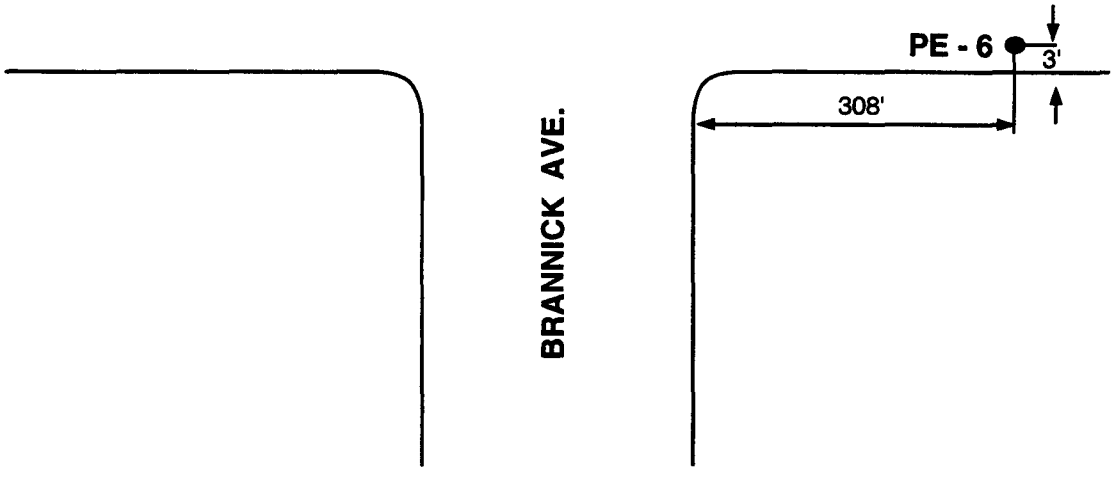
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE- 6	Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
85		Boring terminated at 80.0 feet. Groundwater was not apparent.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 6

1-94

Figure A -8

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 7**	Sheet **1** of **3**
Boring Location:	**Bonnie Beach/Whittier**	Elevation and Datum(feet):	**212 MSL**
Health and Safety:	**Level D**	Date Started: **11/11/93**	Date Finished: **11/11/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **70.5**	Depth to Bedrock(feet): ---
Drilling Method:	**Mud Rotary**	Number of Samples: **14**	Depth to Water (feet): ---
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		FILL 8" Asphaltic concrete and base		af								
5		**ALLUVIUM** CLAY; grayish to yellowish brown, moist to wet, medium stiff, medium plasticity, trace fine- to medium-grained sand	CL	Qya	1	S	2 3 3	18/18	5.0 [5.0]			--
10		SILTY SAND; yellowish brown, moist to wet, medium dense, fine- to coarse-grained, low plasticity silt, trace fine subangular to subrounded gravel	SM		2	D	12 16	8/12	5.0 [5.0]	120	6	--
		interval of SAND with GRAVEL, moist, gravel to 1-1/4" in size	SW									
15		SANDY CLAY; yellowish brown, very moist to wet, very stiff, low plasticity, fine-grained sand, micaceous	CL		3	S	10 14 14	7/18	5.0 [5.0]			--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE- 7	Sheet 2 of 3

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SANDY CLAY; yellowish brown, moist, stiff, low plasticity, fine-grained sand	CL	Qya	4	D	8 14	8/12	5.0 [5.0]	109	17	--
		[constant rig chatter to 34.5'] SAND with SILT and GRAVEL; yellowish brown, moist, very dense, fine- to coarse-grained, nonplastic silt, rounded gravel to 1-1/2" in size	SW-SM									
25		[collected sample of cuttings]			5	S	50/3"	0/3	5.0 [5.0]			--
30					6	D	60	3/6	5.0 [5.0]	114	16	--
35		SILT; yellowish brown, moist, hard, nonplastic to low plasticity, some fine-grained sand, micaceous	ML		7	S	10 17 18	12/18	5.0 [5.0]			--
40		interval of SILTY SAND, yellowish brown, moist, very dense, fine-grained, nonplastic to low plasticity silt	SM		8	D	60/5.5"	3/5.5	5.0 [5.0]	102	13	--
		[strong rig chatter to 50'] SAND with GRAVEL/GRAVEL with SAND; yellowish brown, fine- to coarse-grained sand, with cobbles and boulders	SP/GP									
45					9	B						--

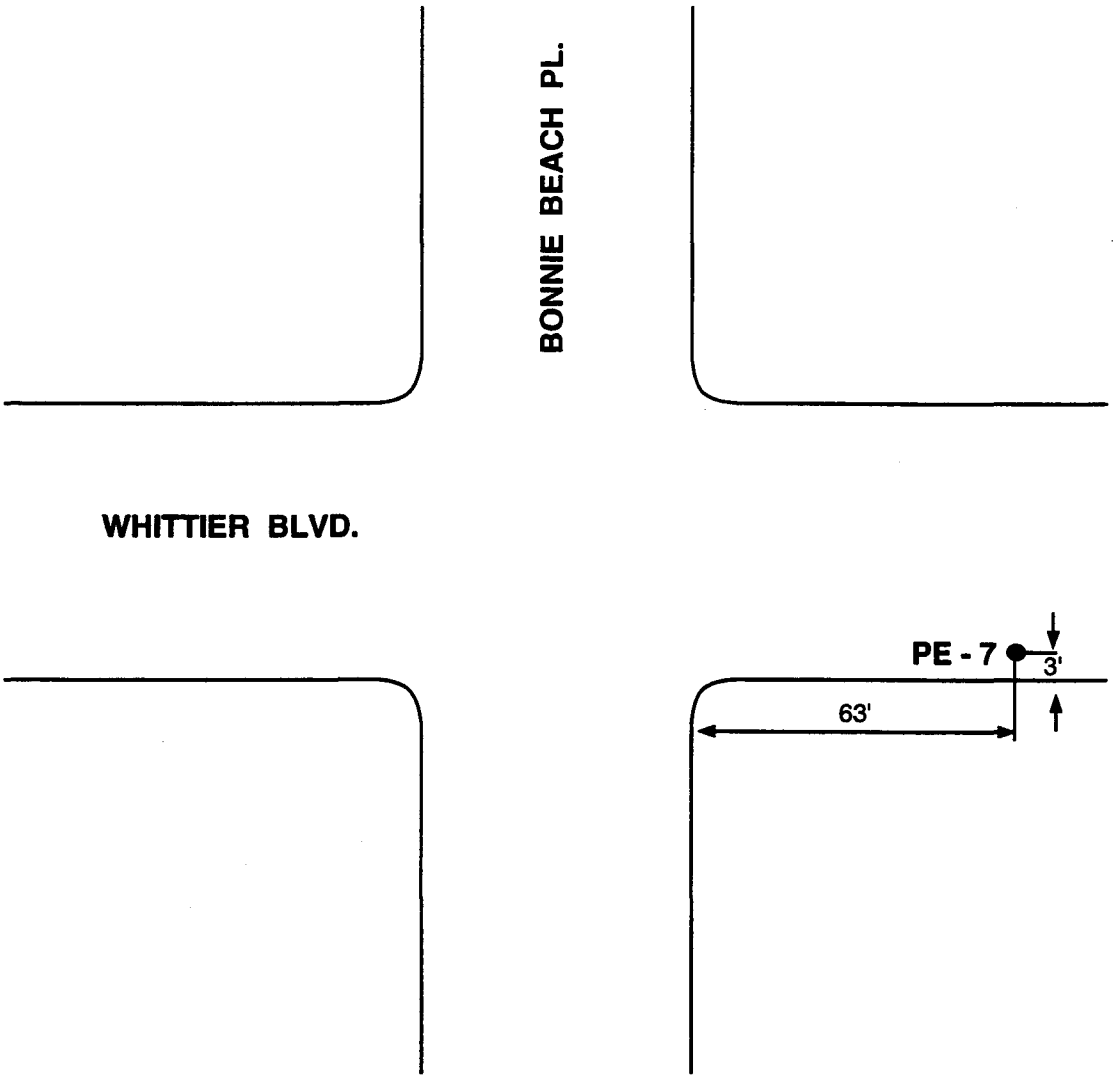
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 7	Sheet 3 of 3	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; yellowish brown, moist, very dense, fine- to medium-grained, nonplastic silt, micaceous	SM	Qya	10	D	130/5"	1/5	5.0 [5.0]	111	15	--
		SAND with GRAVEL/GRAVEL with SAND; yellowish brown, wet, very dense, fine- to coarse-grained sand and gravel, trace nonplastic silt, angular fragments in cuttings probably represent cobbles	SP/GP									
55					11	D	130	2/6	5.0 [5.0]	112	10	--
60		fine- to medium grained sand, decreased gravel content, [bagged sample from sampler shoe]			12	B	130/5"	< 1/5	5.0 [5.0]			--
65		[strong rig chatter from 64.5' to 70'] increased gravel/cobble content			13	B			5.0 [5.0]			--
70		SANDY CLAY; yellowish red, moist, hard, medium plasticity, fine- to coarse-grained sand	CL	Qoa	14	D	130	5/6	5.0 [5.0]	113	20	--
		Boring terminated at 70.5 feet below surface. Piezometer was dry on 1/11/94.										
75												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

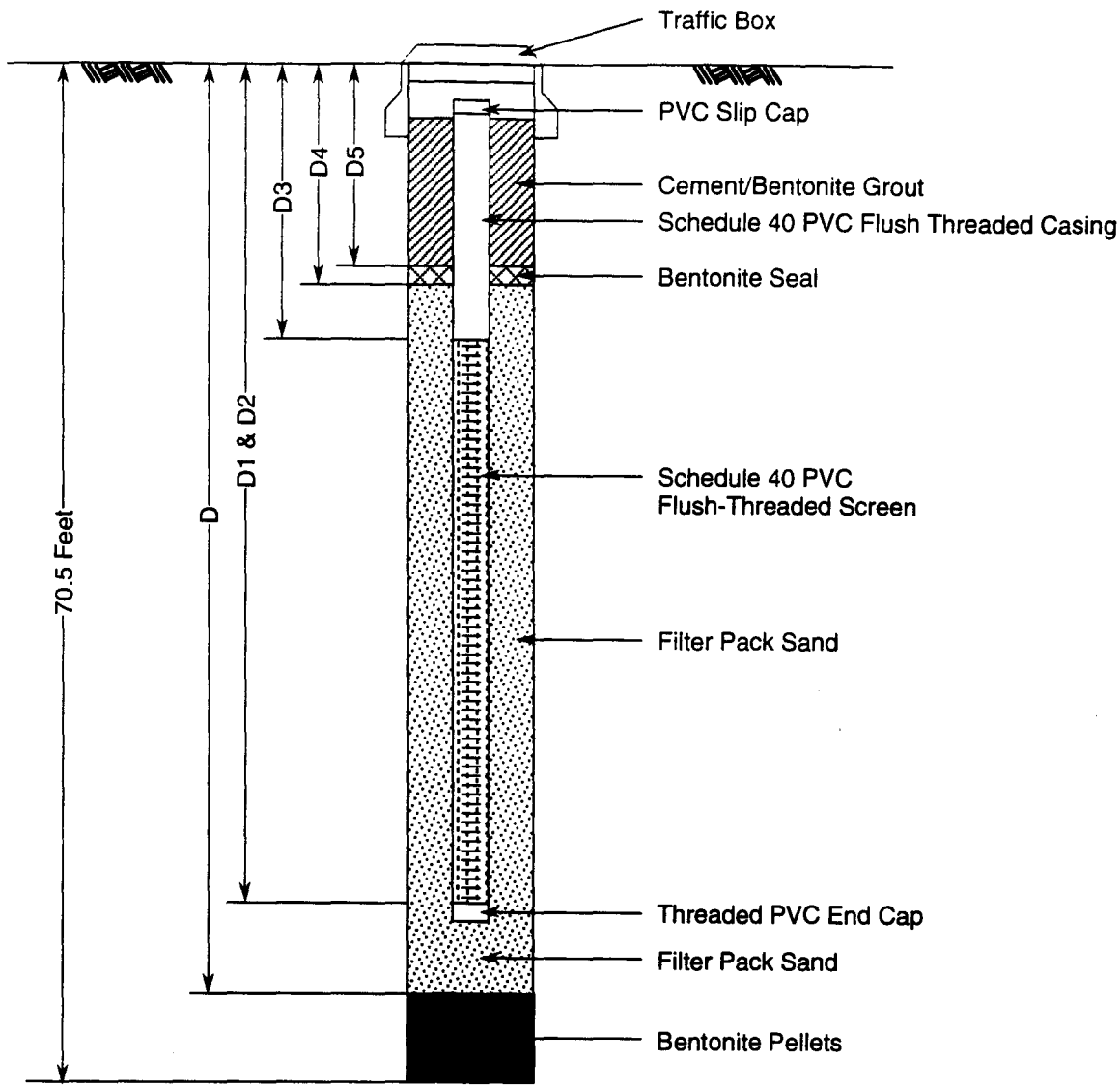
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 7

1-94

Figure A -9A



Total Depth (D)	=	57	Feet
Total Depth of Casing (D1)	=	55	Feet
Depth to Bottom of Well Screen (D2)	=	55	Feet
Depth to Top of Well Screen (D3)	=	25	Feet
Depth to Bottom of Top Seal (D4)	=	20	Feet
Depth to Top of Top Seal (D5)	=	13.5	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-7

2-94

Figure A-9B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 8**	Sheet **1** of **4**
Boring Location:	**Eastman/Whittier**	Elevation and Datum(feet):	**222 MSL**
Health and Safety:	**Level D**	Date Started: **11/11/93**	Date Finished: **11/11/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **90.6**	Depth to Bedrock(feet): ---
Drilling Method:	**Mud Rotary**	Number of Samples: **18**	Depth to Water (feet): ---
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed, converted to monitoring well**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
5		**ALLUVIUM** SANDY CLAY; dark reddish brown, moist, very stiff, medium plasticity, fine- to coarse-grained sand and fine gravel	CL	Qoa	1	D	14 14	9/12	1.9 [1.1]	119	13	0805
10		SANDY SILT; yellowish brown, moist, hard, low plasticity, fine- to coarse-grained sand	ML		2	S	7 18 15	13/18	1.9 [1.4]			0812
15		SILTY SAND; olive brown, moist, medium dense, fine- to medium-grained, trace coarse-grained, nonplastic silt	SM		3	D	17 20	12/12	2.0 [1.4]	93	22	0817

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number:	PE- 8

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SAND with GRAVEL and SILT; light brown to light gray, moist, very dense, fine- to coarse-grained, nonplastic silt, subangular to subrounded fine gravel to 1/4" in size	SW-SM	Qoa	4	S	17 25 50	7/18	2.4 [1.7]			0820
25		SANDY CLAY; strong brown, moist, very stiff, low to medium plasticity, fine- to medium-grained sand, slight organic odor	CL		5	D	16 11	12/12	5.4 [2.1]	106	20	0825
30		decreased sand content, CLAY, strong brown mottled with dark gray, hard, some fine- to medium-grained sand			6	S	5 14 18	15/18	3.9 [2.5]			0833
35		dark brown, trace fine gravel to 1/2" in size			7	D	17 25	12/12	4.4 [2.8]	109	20	0840
40		SANDY CLAYEY SILT; dark brown, moist, very stiff, low plasticity, fine- to coarse-grained sand, some fine gravel	CL/ML		8	S	6 12 12	14/18	5.8 [2.8]			0848
45		decreased gravel content			9	D	12 14	12/12	8.5 [2.9]	116	16	0855

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 8	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SAND/SANDY CLAY; dark brown, moist, medium dense/very stiff, fine- to coarse-grained sand, low to medium plasticity clay, trace gravel to 1/2" in size	SC/CL	Qoa	10	S	9 11 15	18/18	8 [3.1]			0903
55		dark yellowish brown, fine- to medium-grained sand, low plasticity clay, coarse-grained sand and gravel to 1/2" in size			11	D	10 14	8/12	10 [3.6]	108	19	0909
60		yellowish brown			12	S	8 12 14	15/18	4.0 [2.5]			0918
65		interval of SANDY SILT/SILTY SAND, nonplastic, fine- to coarse-grained sand, trace fine gravel	ML/SM		13	D	18 26	10/12	10 [2.0]	110	19	0935
		[rig chatter] high gravel content										
70		CLAYEY SAND/SANDY CLAY, very dense/hard, fine- to medium-grained sand, trace coarse-grained sand, low plasticity clay	SC/CL		14	S	22 40 45	15/18	20 [3.1]			0948
75		SILTY SAND; yellowish brown, moist, medium dense, fine- to medium-grained, trace coarse-grained, low plasticity silt, some plastic clay	SM		15	D	15 19	12/12	11 [3.1]	111	19	0958
		decreased silt content										

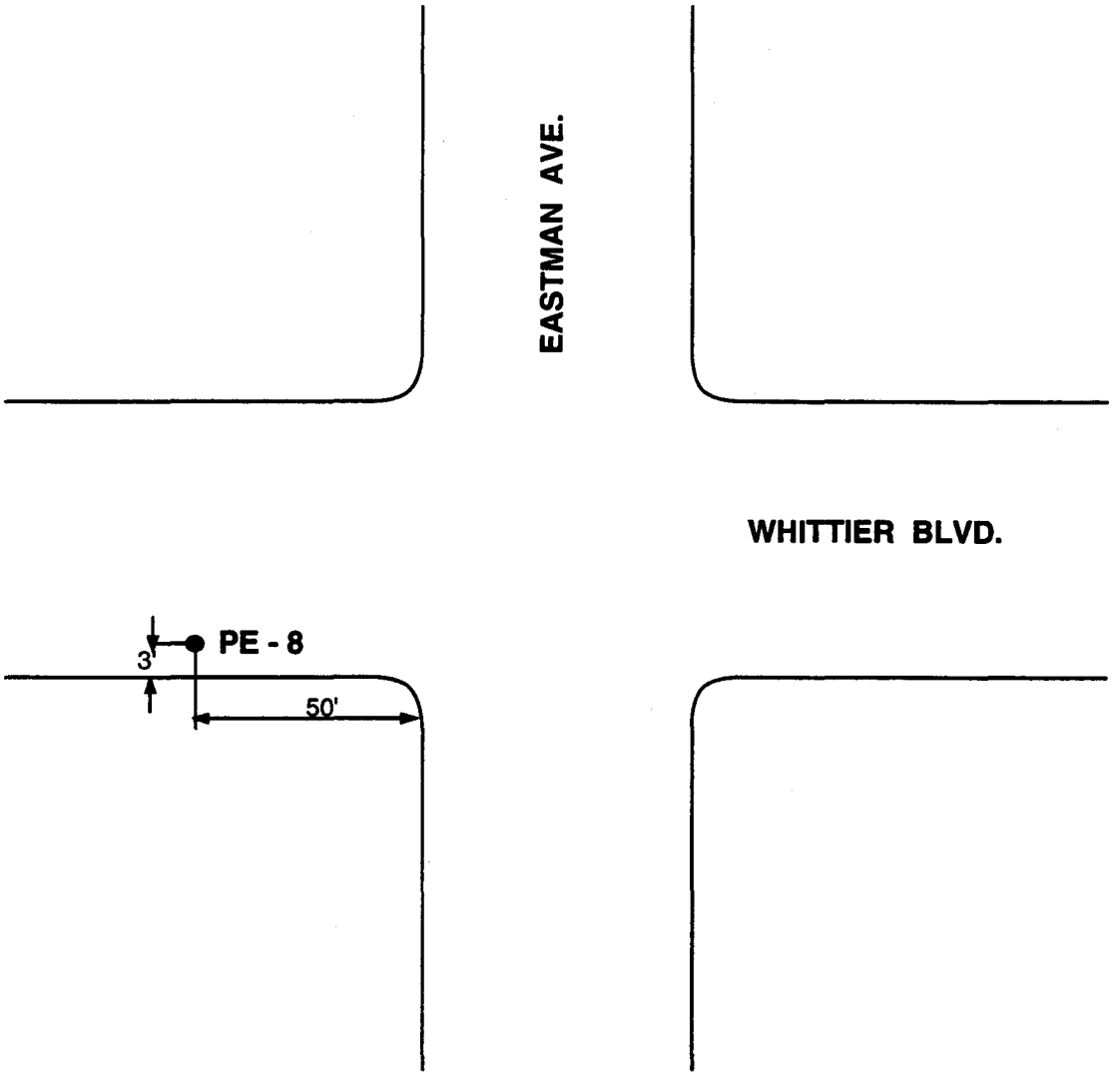
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 8	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SAND with SILT; dark greenish gray, moist, very dense, fine- to coarse-grained, nonplastic silt, trace subangular fine gravel	SP-SM	Qoa	16	S	30 75/4"	6/10	6.1 [2.9]			1010
85		increased silt content, SILTY SAND, light gray	SM		17	D	100	5/6	6.5 [3.1]	108	11	1030
90		decreased silt content, SAND, light yellowish brown	SP		18	D	100/7"	4/7	11 [3.3]		13	1048
		Boring terminated at 90.6 feet below surface. Piezometer was dry on 1/11/94.										
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

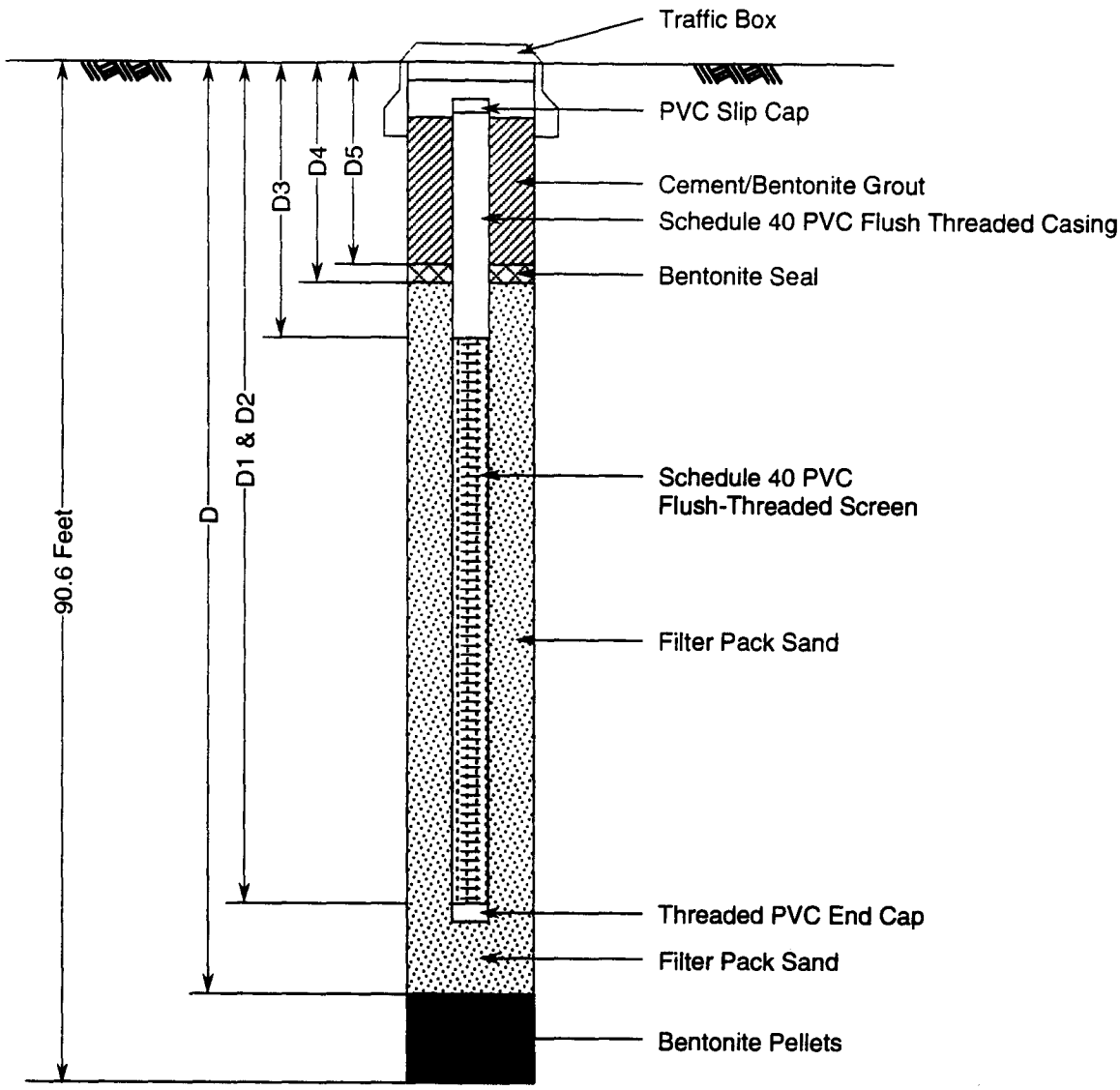
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 8

1-94

Figure A -10A



Total Depth (D)	=	65.2	Feet
Total Depth of Casing (D1)	=	65	Feet
Depth to Bottom of Well Screen (D2)	=	65	Feet
Depth to Top of Well Screen (D3)	=	35	Feet
Depth to Bottom of Top Seal (D4)	=	33	Feet
Depth to Top of Top Seal (D5)	=	28	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-8

2-94

Figure A-10B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE- 9**	Sheet **1** of **4**
Boring Location:	**Ditman/Whittier**		Elevation and Datum(feet): **222 MSL**
Health and Safety:	**Level D**	Date Started: **11/12/93**	Date Finished: **11/12/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **80.8**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **16**	Depth to Water (feet): **---**
Boring Diameter:	**5 inches**	Completion Information: **Grouted to surface**	
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
5		**ALLUVIUM** SANDY CLAY with GRAVEL; reddish brown mottled with white, moist, hard, medium plasticity, fine- to coarse-grained sand and fine gravel	CL	Qoa	1	D	24	6/6	4.5 [3.9]	118	13	0715
10		SAND with SILT; reddish brown mottled with white, moist, dense, medium- to coarse-grained, nonplastic silt, some gravel to 1" in size	SW-SM		2	S	12 20 17	8/18	5.1 [4.0]			0725
15		SILTY SAND/SANDY SILT; olive brown, moist, medium dense/very stiff, nonplastic to low plasticity silt, fine-grained sand, some gravel to 1/2" in size	SM/ML		3	D	10 12	5/12	4.8 [4.1]	98	18	0736
		decreased silt content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line														
Project Number:	94-1100	Boring Number:	PE- 9											Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT; light brown mottled with white, moist, dense, fine- to coarse-grained, nonplastic silt, some gravel to 1/2" in size	SW-SM	Qoa	4	S	9 20 27	8/18	5.0 [4.1]			0746
25		dark reddish brown, medium dense, increasing silt content, gravel to 1-1/2" in size			5	D	18 30	5/12	5.2 [4.1]	109	12	0759
30		CLAYEY SAND; dark olive brown, moist, medium dense, fine- to medium-grained, low plasticity clay, some subangular to subrounded gravel to 1/2" in size	SC		6	S	12 8 11	8/18	6.2 [3.9]			0804
35		SAND with SILT; light brown, moist, dense, fine- to medium-grained, nonplastic silt and some gravel to 1/2" in size	SP-SM		7	D	30 40	7/12	5.0 [3.9]	97	13	0815
40		increased silt content, SILTY SAND, olive brown, very dense, trace fine gravel	SM		8	S	27 40 55	10/18	5.5 [4.1]			0835
45		decreased silt content, SAND with SILT, fine- to coarse-grained, some gravel to 1/4" in size	SP-SM		9	D	75/7"	4/7	4.9 [3.9]		12	0845
		increased gravel content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE- 9	Sheet 3	of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT and GRAVEL; light brown, moist, very dense, fine- to coarse-grained, nonplastic silt, some subrounded gravel to 1/2" in size	SW-SM	Qoa	10	S	30 80	6/12	5.0 [3.9]			0902
55					11	D	70/8"	5/8	4.7 [4.0]	104	15	0911
60		gravel to 1/4" in size			12	S	35 75	6/12	5.1 [3.9]			0939
65		CLAYEY SAND, reddish brown, moist, dense, fine- to coarse-grained, low to medium plasticity clay, some rounded gravel to 1" in size	SC		13	D	25 30	10/12	4.9 [3.9]	127	10	0957
70		SAND with SILT, light olive brown, moist to wet, very dense, medium- to coarse-grained, nonplastic silt, some gravel to 1/4" in size	SP-SM		14	S	50 50/4"	5/10	5.1 [3.9]			1010
75		olive brown, fine- to medium-grained, trace coarse-grained and fine gravel			15	D	100/7"	4/7	5.0 [4.0]	99	17	1025

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

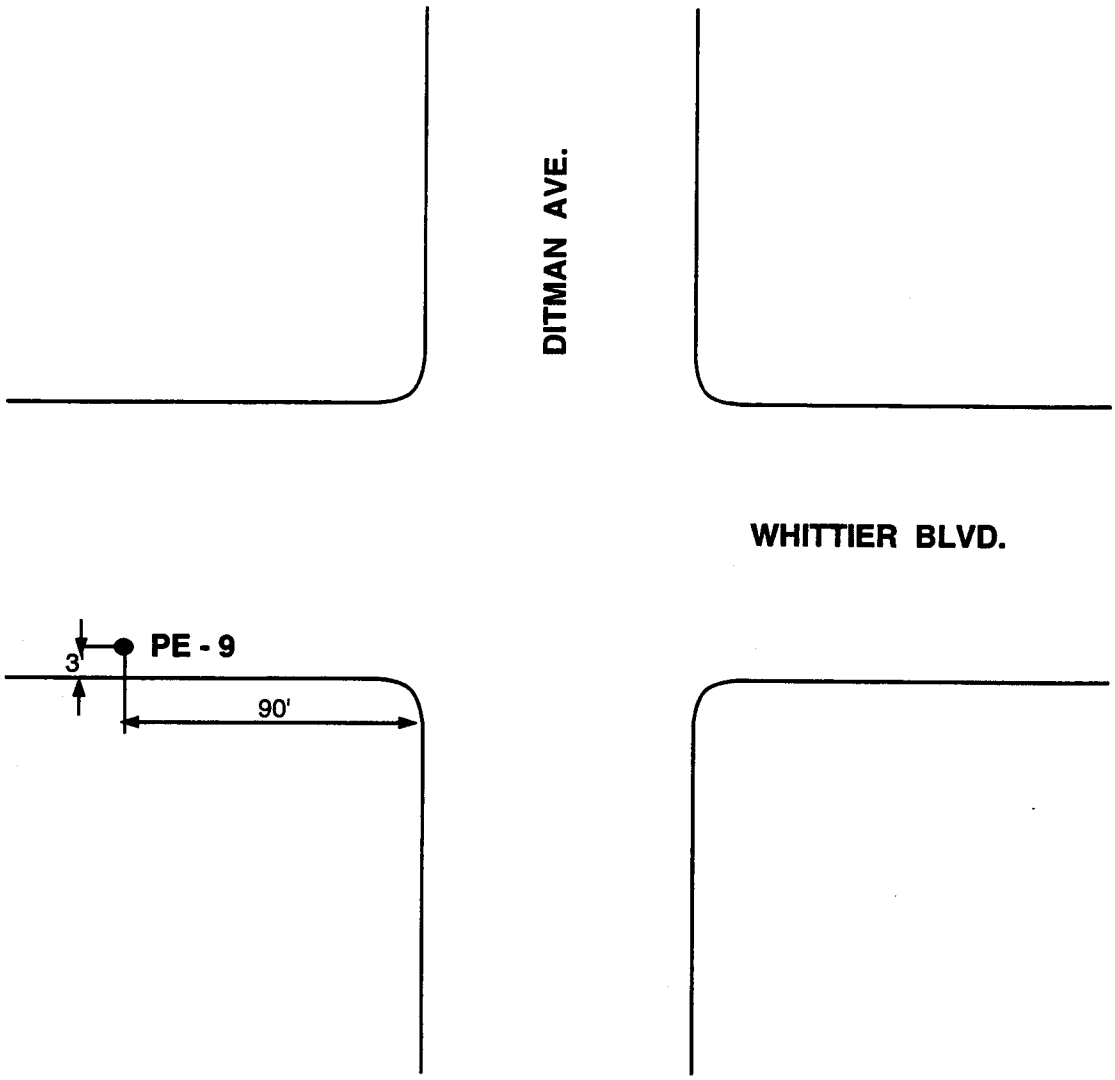
GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number:	PE- 9

Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content(%)	Drilling Time
		SAND with SILT; dark olive brown, moist to wet, very dense, fine- to medium-grained, trace coarse-grained and fine gravel, nonplastic silt	SP-SM	Qoa	16	D	50 50/3"	5/9	5.0 [4.0]	104	15	1040
		Boring terminated at 80.8 feet below surface. Groundwater was not apparent.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 9

1-94

Figure A -11

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-10**	Sheet **1** of **4**
Boring Location:	**Hubbard/Indiana**	Elevation and Datum(feet):	**255 MSL**
Health and Safety:	**Level D**	Date Started: **11/12/93**	Date Finished: **11/12/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **80.3**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **13**	Depth to possible Water (feet): **66**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Marshall Payne**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
		ALLUVIUM SAND with SILT; reddish yellow, moist, medium dense to dense, fine- to medium-grained, nonplastic silt	SP-SM	Qoa								
5					1	D	10 20	8/12	5.5 [5.5]	110	8	0745
		increased silt content, SILTY SAND, yellowish red, dense, fine-grained, micaceous	SM									
		high gravel content, gravel to 1/2" in size										
10		interval of SILT with SAND, yellowish brown, hard	ML		2	S	10 14 25	16/18	5.5 [5.5]			0755
		high gravel content										
		SILTY SAND; yellowish brown, moist, medium dense, fine-grained , nonplastic silt	SM									
15					3	D	16 30	7/12	5.5 [5.5]	93	17	0805
		decreased silt content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-10	Sheet 2	of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SAND with SILT; yellowish brown, moist, very dense, fine- to coarse-grained, nonplastic silt and subangular to angular gravel to 3/4" in size	SP-SM	Qoa	4	S	15 20 34	11/18	5.5 [5.5]			0815
		high gravel content										
25		SANDY SILT; yellowish brown, moist, hard, low plasticity, fine-grained sand, micaceous	ML		5	D	20 27	7/12	5.5 [5.5]	80	39	0825
		SILTY SAND; yellowish brown, moist, dense, fine- to coarse-grained, nonplastic silt, micaceous	SM									
30					6	S	15 18 20	14/18	5.5 [5.5]			0840
		very dense, fine- to medium-grained, trace coarse-grained, some gravel, low plasticity										
35					7	D	60/3"	< 1/3	5.5 [5.5]		19	0850
		[rig chatter from 37' to 44'] GRAVEL with SAND; very dense, gravel ranges from 3/4" to 2" in size	GW/GP									
40						S	50/5.5"	0/5.5	5.5 [5.5]			0855
		SILT; olive brown, moist, hard, low plasticity, micaceous, possibly interlayered with fine-grained sand	ML									
45					8	D	30 50/2"	7/8	5.5 [5.5]			0915

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-10	Sheet 3 of 4	

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
	GRAVEL with SAND/SAND with GRAVEL; reddish yellow, moist to wet, very dense, gravel to 1-1/4" in size	GW/SW	Qoa	9	S	50/3"	2/3	5.5 [5.5]			--
	[possible coarse gravel to cobbles]										
55											
	possible cobble layer at 59' [hard drilling]										
60											
	interval of CLAYEY SAND, yellowish red, fine- to coarse-grained, medium plasticity clay, trace fine gravel	SC		10	D	100/5"	2/5	5.5 [5.5]	116	18	0940
	[strong rig chatter from 63.5' to 80']										
	GRAVEL with SAND/SAND with GRAVEL, light yellowish brown, wet, gravel to 1/4" in size, trace nonplastic silt	GP/SP									
65				11	D	100/4"	1/4	5.5 [5.5]		13	
70	rock fragments in cuttings, possible coarse gravel to cobble interval			12	B			5.5 [5.5]			0950
	gravel to 1/4" in size										
75				13	B			5.5 [5.5]			1005

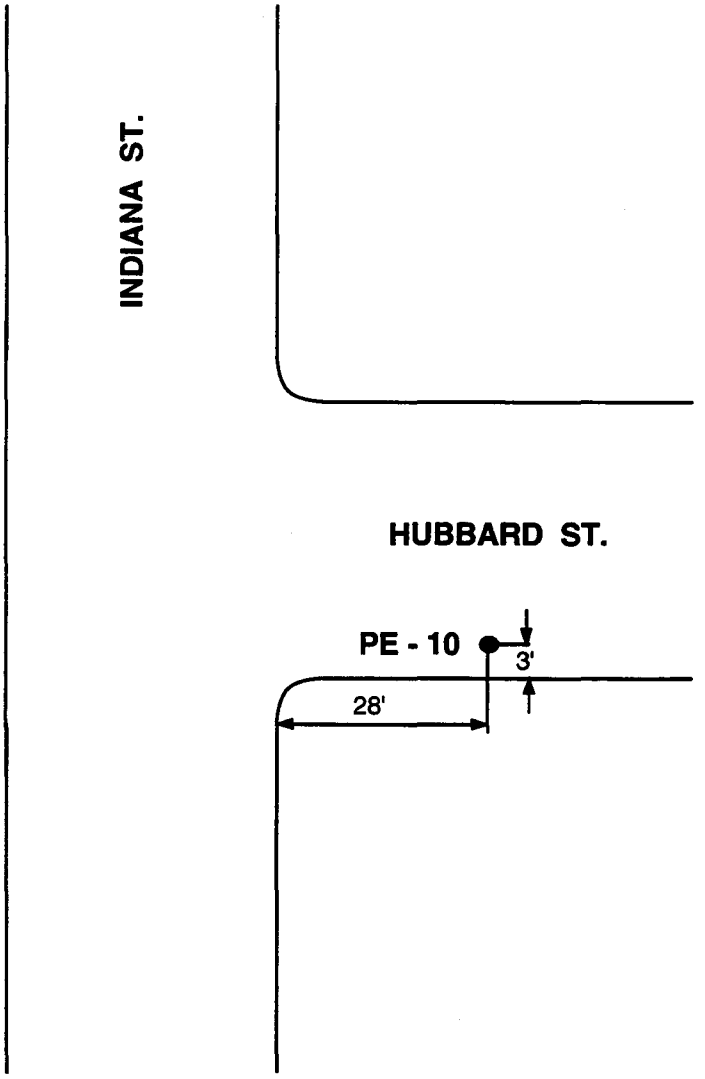
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-10	Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
		GRAVEL with SAND/SAND with GRAVEL; light yellowish brown, moist to wet, very dense, gravel to 1" in size, fine- to coarse-grained sand	~~GP/SP~~	~~Qoa~~			130/3"	0/3	5.5 [5.5]			1020
		Boring terminated at 80.3 feet below surface.										
		Possible groundwater at 66 feet below surface.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 10

1-94

Figure A -12

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-11**	Sheet **1** of **4**
Boring Location:	**Lan Franco/Indiana**	Elevation and Datum(feet):	**290 MSL**
Health and Safety:	**Level D**	Date Started: **11/15/93**	Date Finished: **11/15/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **85.2**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **16**	Depth to possible Water (feet): **74**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 6", fine gravel (crushed rock) to 18" and base		af								
		ALLUVIUM SANDY CLAY; dark yellowish brown, moist, hard, medium plasticity, fine- to coarse-grained sand	CL	Qya								
5					1	S	22 27 27	10/18	5.0 [5.0]			0800
		SILTY SAND; yellowish brown, moist, medium dense, fine-grained, nonplastic silt, trace gravel to 1/2" in size	SM									
10					2	D	9 14	10/12	5.0 [5.0]	96	17	0810
		high gravel content, subangular gravel to 1/2" in size										
		SAND with SILT; reddish yellow, moist, very dense, fine- to medium-grained, nonplastic silt, fine subangular gravel to 1/4" in size	SW-SM	Qoa								
15					3	S	19 22 29	9/18	5.0 [5.0]			0830

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-11** | Sheet **2** of **4**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
25		SAND with SILT; reddish yellow, moist, very dense, fine- to coarse-grained, nonplastic silt, some subrounded gravel to 2" in size	SW-SM	Qoa	4	D	40 50/3"	6/9	5.0 [5.0]	113	17	0835
		SILTY SAND; yellowish red, moist, dense, fine-grained, nonplastic silt, trace subangular gravel to 1/4" in size	SM		5	S	19 20 14	13/18	5.0 [5.0]			0850
		high gravel content, gravel to 1-3/4" in size										
30		dark yellowish brown, nonplastic to low plasticity silt, micaceous			6	D	30 40	6/12	5.0 [5.0]	93	17	0905
35		very dense			7	S	20 22 30	13/18	5.0 [5.0]			0920
		SAND with GRAVEL/GRAVEL with SAND; reddish yellow, moist, very dense, fine- to coarse-grained sand, rounded gravel to 3/4" in size, trace silt	SW/GW									
40					8	D	80/3"	0/3	5.0 [5.0]			0937
45		[hard rig chatter] possible cobble layer										
		CLAY with SAND; strong brown, moist, hard, medium plasticity, fine- to coarse-grained sand, trace gravel to 1-1/2" in size	CL		9	S	12 20 22	18/18	5.0 [5.0]			0950

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line																
Project Number:	94-1100	Boring Number:	PE-11													Sheet 3 of 4	
								Samples									
Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		interval of SAND with SILT; yellowish red, moist to wet, dense, fine- to coarse-grained, some subrounded gravel to 3/4" in size	SP-SM	Qoa	10	D	50	0/6	5.0 [5.0]		14	1005
		SAND with GRAVEL/GRAVEL with SAND; reddish yellow, wet, very dense, fine- to coarse-grained sand, gravel to 1/2" in size	SW/GW									
55		increased silt content at 55'			11	S	36 50/2.5"	6/8.5	5.0 [5.0]			1020
		SILTY SAND/SANDY SILT; reddish yellow, moist, very dense/hard, fine-grained sand, trace medium- to coarse-grained sand, low plasticity silt, trace fine gravel	SM/ML									
60		[hard drilling at 61']			12	D	60	3/6	5.0 [5.0]	119	14	1035
65		SANDY CLAY; yellowish brown, moist, hard, low plasticity, fine-grained sand	CL		13	S	30 50	12/12	5.0 [5.0]			1055
		increasing sand content										
70		SILTY SAND; light olive brown, moist, very dense, fine grained, nonplastic silt, micaceous	SM		14	D	67	2/6	5.0 [5.0]	108	17	1120
		cobble at 75', about 7" in size	GW/SW									
75		GRAVEL with SAND/SAND with GRAVEL; reddish yellow, wet, very dense [very slow drilling from 74' to 85']			15	B			5.0 [5.0]			--

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

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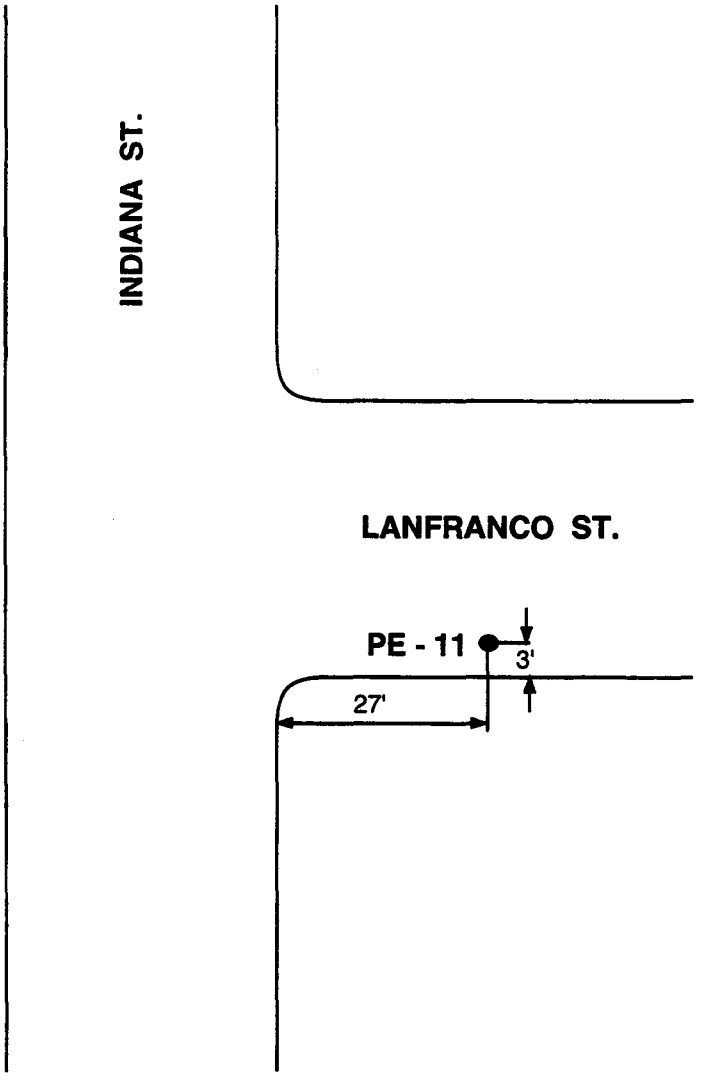
Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-11	Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
85		GRAVEL with SAND/SAND with GRAVEL; reddish yellow, wet, very dense	GW/SW	Qoa								
		yellowish brown, subangular to rounded gravel to 2" in size			16	D	130 /2.5"	< 1/2.5	5.5 [5.0]		5	1230
		Boring terminated at 85.2 feet. Possible groundwater at 74' below surface. Piezometer was dry on 1/11/94.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

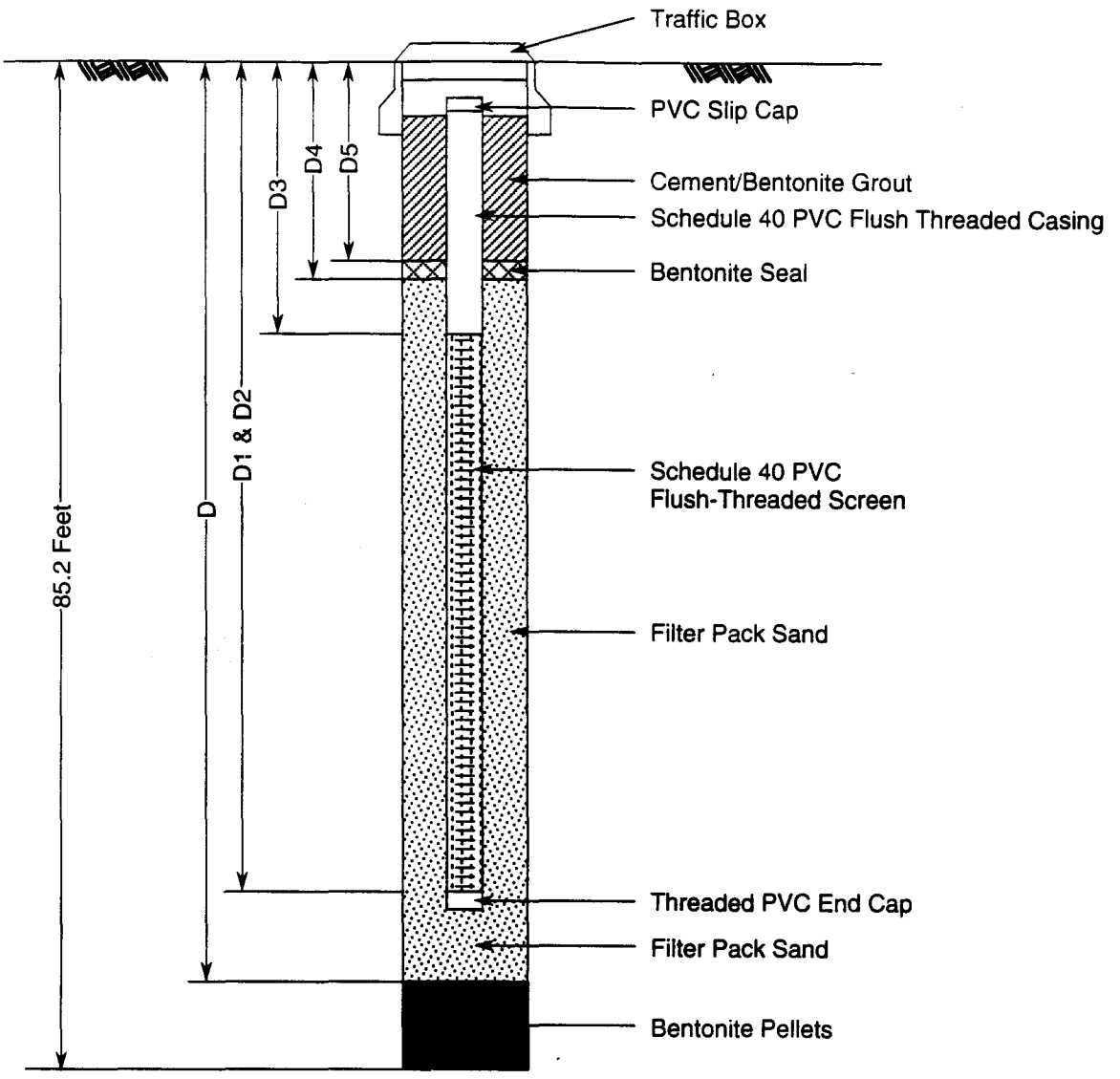
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring PE - 11

1-94

Figure A -13A



Total Depth (D)	=	72	Feet
Total Depth of Casing (D1)	=	70	Feet
Depth to Bottom of Well Screen (D2)	=	70	Feet
Depth to Top of Well Screen (D3)	=	40	Feet
Depth to Bottom of Top Seal (D4)	=	37	Feet
Depth to Top of Top Seal (D5)	=	25	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-11

2-94

Figure A-13B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**				
Project Number:	**94-1100**	Boring Number:	**PE-12**	Sheet 1 of 4	
Boring Location:	**Sixth/Indiana**			Elevation and Datum(feet): **315 MSL**	
Health and Safety:	**Level D**	Date Started: **11/15/93**		Date Finished: **11/15/93**	
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **95.4**		Depth to Bedrock(feet): ---	
Drilling Method:	**Mud Rotary**	Number of Samples: **19**		Depth to Water (feet): ---	
Boring Diameter:	**5 inches**	Completion Information: **Grouted to surface**			
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Fred Schilling**		Checked By: **Grant Miller**	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
		ALLUVIUM SANDY CLAY with GRAVEL; reddish brown, moist, hard, medium plasticity, fine- to coarse-grained sand, subangular to subrounded gravel to 1" in size [intermittent chatter to 15']	CL	Qoa								
5					1	D	25 30	4/12	5.8 [5.0]	114	16	0730
10		SAND with SILT and GRAVEL; brown to gray, moist, very dense, fine- to coarse-grained, subangular to subrounded gravel to 1" in size	SW-SM		2	S	11 35 50	8/18	5.8 [5.0]			--
15		GRAVEL with SAND; brown to gray, moist, dense, subangular to subrounded gravel to 2" in size, fine- to coarse-grained sand, some interbedding with clayey sands [continuous rig chatter from 15' to 20']	GP		3	D	23 30	10/12	6.5 [5.0]	136	8	0745
		increased silt content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-12	Sheet 2 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		GRAVEL with SILT and SAND; gray to brown, moist, very dense, subangular to subrounded gravel to 1/2" in size, nonplastic silt, fine- to coarse-grained sand, [strong rig chatter at 21']	GP-GM	Qoa	4	S	22 30 40	6/18	6.6 [5.0]			0800
		possible clayey layer at 24', [rig chatter below to 25']										
25		SAND with GRAVEL; reddish brown, moist, dense, fine- to coarse-grained, gravel to 1-1/2" in size	SP		5	D	20 35	10/12	6.4 [5.0]	111	15	0830
30		increased silt content and no gravel, SILTY SAND, brownish gray, fine-grained, trace medium- to coarse-grained, nonplastic silt, 1" and 2" thick layers	SM		6	S	8 16 20	8/18	7.5 [6.7]			0835
35		decreased silt content, SAND/SAND with SILT, brownish gray, fine- to medium-grained, trace coarse-grained	SP/ SP-SM		7	D	25 33	6/12	7.1 [6.0]	101	12	0850
40		CLAY; brownish gray, moist, hard, medium plasticity, trace fine- to medium-grained sand	CL		8	S	8 15 17	18/18	7.6 [6.0]			0900
45		increased sand content, SANDY CLAY/CLAYEY SAND, hard/very dense, fine- to coarse-grained sand, some gravelly layers about 6" apart, gravel to 2" in size	CL/SC		9	D	30 50/5"	9/11	7.6 [6.0]	126	9	0915

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GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-12	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILTY SAND with GRAVEL; brownish gray, moist, very dense, fine- to coarse-grained, subangular to subrounded gravel to 1/4" in size, nonplastic silt, clayey layer at 52'	SM	Qoa	10	S	25 50 25/2"	12/14	7.5 [6.7]			0930
		[rig chatter at 54']										
55		SAND with GRAVEL; brownish gray, moist, very dense, coarse-grained, gravel to 1" in size, trace nonplastic silt, [smooth drilling]	SW		11	D	80	3/6	8.0 [7.0]		17	0940
60		fine-grained sand matrix, [slight periodic rig chatter]			12	S	30 70	4/12	8.2 [7.3]			1000
65		fine- to coarse-grained			13	D	75	4/6	8.6 [7.4]	112	13	1015
70		fine subrounded to subangular gravel			14	S	55 50/3"	7/9	8.5 [7.4]			1030
75		interval of SILTY SAND, grayish brown, medium dense, fine-grained	SM		15	D	20 24	9/12	8.1 [7.2]	89	25	1045
		GRAVEL with SILT and SAND; brownish gray, moist, very dense, subangular to subrounded fine gravel, nonplastic silt, fine- to coarse-grained sand	GP-GM									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-12	Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		GRAVEL with SILT and SAND; brownish gray, moist, very dense, subangular to subrounded fine gravel, nonplastic silt, fine- to coarse-grained sand	GP-GM	Qoa	16	S	100	2/6	--			1100
85		brownish yellow, gravel to 1-1/2" in size			17	D	100/5"	2/5	8.4 [7.4]	97	11	1115
90		yellowish brown, medium- to coarse-grained sand matrix, gravel to 1/4" in size			18	S	50 50/3"	4/9	8.3 [7.4]			1130
		SILTY SAND; yellowish brown, moist, very dense, fine- to coarse-grained, nonplastic silt	SM									
95					19	D	100/5"	2/5	8.3 [7.6]	118	8	1210
		Boring terminated at 95.4 feet. Groundwater not apparent.										
100												
105												

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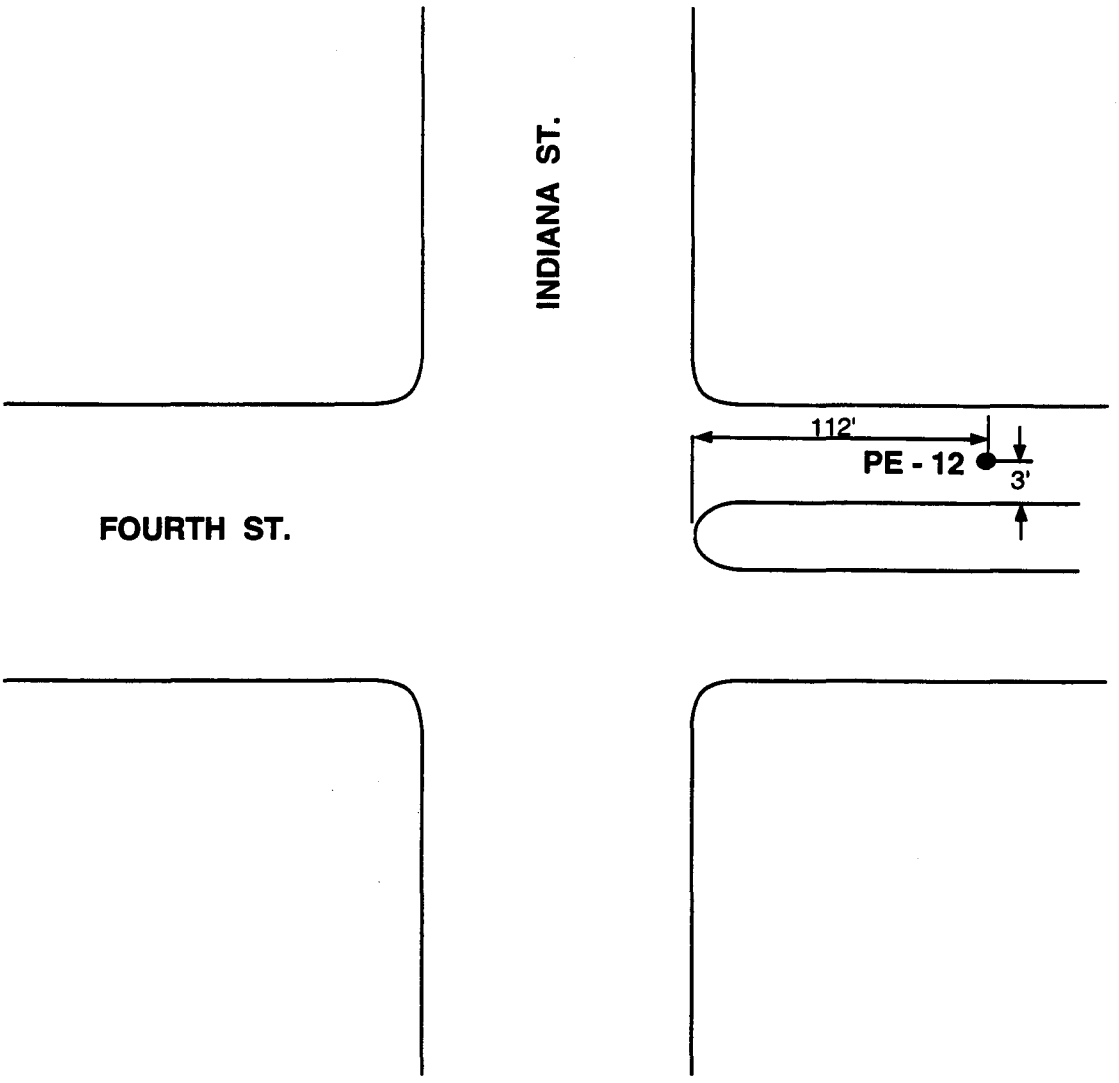

North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 12

1-94

Figure A -14

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-13**	Sheet **1** of **4**
Boring Location:	**First/Lorena**	Elevation and Datum(feet):	**292 MSL**
Health and Safety:	**Level D**	Date Started: **11/17/93**	Date Finished: **11/17/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **90.5**	Depth to Bedrock(feet): **88.5**
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): **---**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 8", concrete to 12" and base to 30"		af								
		ALLUVIUM CLAY with SAND; reddish yellow, moist to wet, medium stiff, medium plasticity, fine- to medium-grained sand, trace coarse-grained, trace subangular gravel to 1/4" in size	CL	Qoa								
5					1	S	2 3 3	8/18	8.5 [8.0]			0925
10		increased sand content, SANDY CLAY, yellowish red, low to medium plasticity, fine- to coarse-grained sand, trace angular to subangular gravel to 3/4" in size			2	D	6 7	0/12	8.6 [8.0]		27	0935
15		dark reddish brown, moist			3	S	1 2 3	12/18	8.1 [8.0]			0950

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Project Name:	Metro Rail: Eastside Extension - Metro Red Line																
Project Number:	94-1100	Boring Number:	PE-13													Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SAND; reddish yellow, moist, medium dense, fine- to coarse-grained, medium plasticity clay, trace gravel to 2" in size	SC	Qoa	4	D	9 10	0/12	8.5 [8.0]		16	1000
25		SILTY SAND/SANDY SILT; reddish yellow, moist, medium dense/very stiff, fine-grained sand, nonplastic silt	SM/ML		5	S	6 7 17	< 1/18	8.0 [8.0]			1020
30		decreased silt content, SILTY SAND, very dense, fine- to coarse-grained, with fine-gravel to 3/4" in size	SM		6	D	60	2/6	12 [7.4]	114	16	1040
35		fine-grained, trace gravel to 1/2" in size, micaceous			7	S	38 45 50	8/18	8.2 [8.0]			1050
40		dense			8	D	50	2/6	14 [7.5]	94	19	1100
		[strong rig chatter from 44' to 46']										
45		GRAVEL with SILT and SAND/SAND with SILT and GRAVEL; reddish yellow to brownish yellow, moist, very dense, fine- to coarse-grained sand, subangular gravel to 3/4" in size, nonplastic silt	GP-GM / SP-SM		9	S	50	4/6	8.0 [8.0]			1120

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-13	Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
55		GRAVEL with SILT and SAND/SAND with SILT and GRAVEL; brownish yellow, moist to wet, very dense, fine- to coarse-grained sand, angular gravel to 1" in size, nonplastic silt	GP-GM / SP-SM	Qoa	10	D	130	2/3	11 [7.3]	119	13	1145
60		gravel to 3/4" in size										
65		gravel to 1" in size			11	S	50/3"	2/3	8.5 [8.0]			
70												1215
75		interval of SILT	ML		12	D	80/ 4.5"	<1/ 4.5	8.1 [8.0]		21	
		interval of SAND with SILT, fine- to medium-grained, trace coarse-grained	SP-SM									
		[strong chatter from 76.5' to 80'] decreased silt content, GRAVEL with SAND/SAND with GRAVEL, fine- to coarse-grained sand	GW/SW									

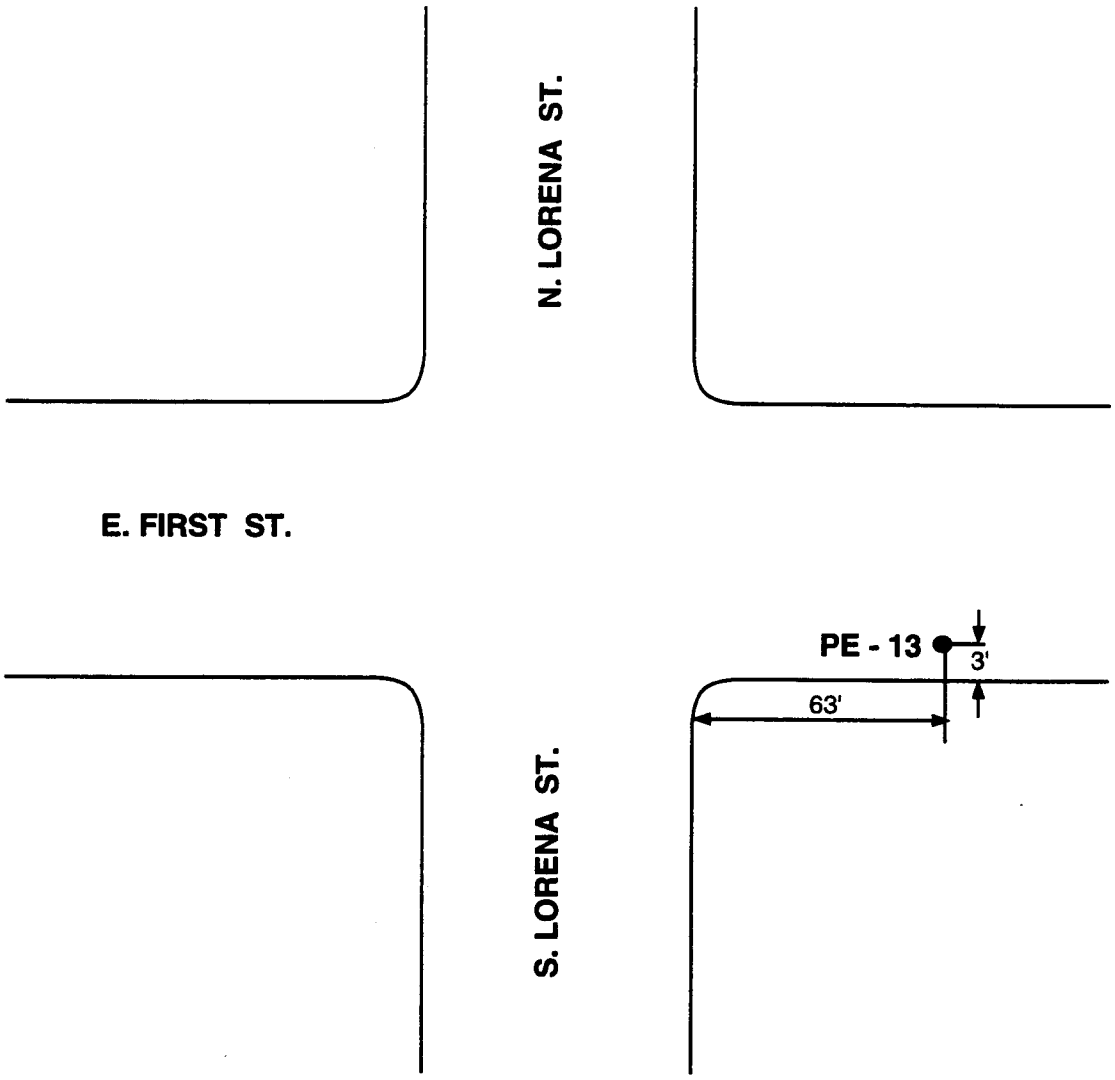
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-13	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAY; strong brown, moist to wet, hard, medium plasticity	CL	Qoa	13	S	12 23 29	18/18	8.0 [8.0]			1250
85		interval of CLAYEY SILT, yellowish brown, moist, low to medium plasticity, micaceous	ML/CL		14	D	60	1/6	11 [7.3]	105	22	1315
		possible interval of SILTY GRAVEL/SILTY SAND	GM/SM									
		FERNANDO/PUENTE FORMATION SILTSTONE; olive yellow, moist to wet, soft rock, nonplastic, fine-grained sand, highly micaceous, intensely weathered to decomposed	ML	Tf/Tp								
90					15	S	50	5/6	9.2 [8.0]			1340
		Boring terminated at 90.5 feet. Piezometer was dry on 1/11/94.										
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

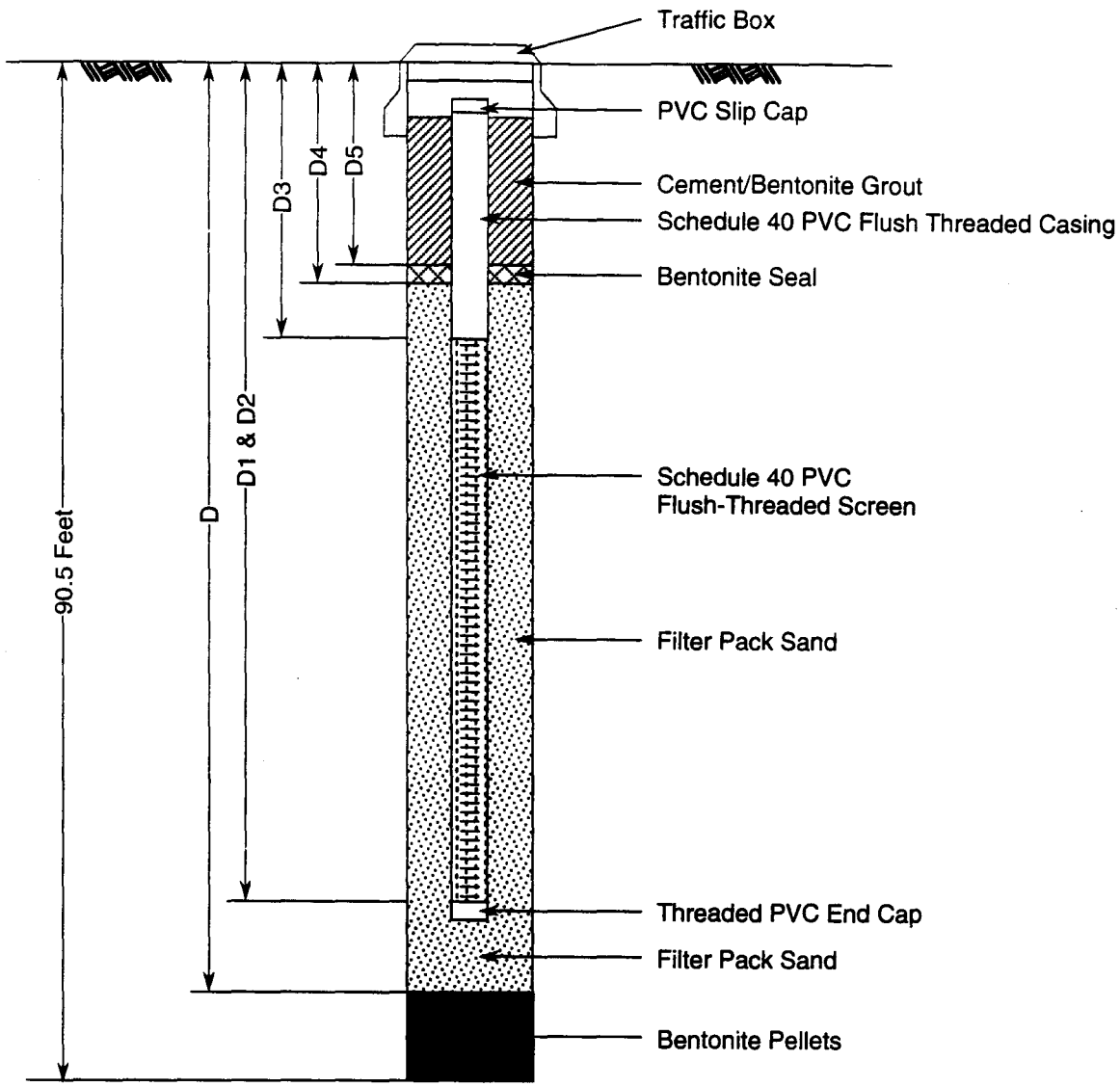
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 13

1-94

Figure A -15A



Total Depth (D)	=	67.5	Feet
Total Depth of Casing (D1)	=	65	Feet
Depth to Bottom of Well Screen (D2)	=	65	Feet
Depth to Top of Well Screen (D3)	=	35	Feet
Depth to Bottom of Top Seal (D4)	=	32.5	Feet
Depth to Top of Top Seal (D5)	=	29.5	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-13

2-94

Figure A-15B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-14**	Sheet **1** of **4**
Boring Location:	**First/Fresno**	Elevation and Datum(feet):	**320 MSL**
Health and Safety:	**Level D**	Date Started: **11/17/93**	Date Finished: **11/17/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **101.5**	Depth to Bedrock(feet): **101**
Drilling Method:	**Mud Rotary**	Number of Samples: **20**	Depth to possible Water (feet): **76.5**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Fred Schilling**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base to about 3'		af								
5		**ALLUVIUM** SANDY CLAY; reddish brown, moist, hard, low to medium plasticity, fine- to medium-grained sand	CL	Qoa	1	D	22 25	8/12	7.3 [6.6]	118	15	0830
10		SILTY SAND; yellowish brown, moist, medium dense, fine- to medium-grained, nonplastic silt	SM		2	S	6 6 7	11/18	7.2 [6.6]			0840
15		trace coarse-grained			3	D	12 14	8/12	7.8 [6.6]	95	22	0845

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-14	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; yellowish brown, moist, dense, fine- to medium-grained, thinly stratified (coarser and finer), nonplastic to low plasticity silt	SM	Qoa	4	S	11 20 25	12/18	7.7 [7.0]			0850
25		brown, medium dense, fine-grained, low plasticity silt			5	D	16 20	10/12	7.7 [7.0]	103	17	0855
30		strong brown, dense, fine- to medium-grained, increased silt content, trace fine subangular to subrounded gravel			6	S	14 20 22	10/18	8.3 [7.2]			0905
35		trace coarse grained, nonplastic silt			7	D	25 50	5/12	8.4 [7.6]	114	11	0913
40		yellowish brown			8	S	12 20 21	12/18	8.3 [7.6]			0925
45					9	D	20 30	8/12	8.3 [7.6]	91	13	0933

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-14	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; very pale brown, moist, very dense, fine- to medium-grained, nonplastic silt	SM	Qoa	10	S	24 45 45	13/18	8.5 [7.7]			0940
55		yellowish brown			11	D	40 45	8/12	8.7 [8.0]	104	12	0955
60		increased silt content, nonplastic to low plasticity, dense			12	S	14 22 23	13/18	8.7 [8.0]			1005
65		CLAY with SAND; yellowish brown, moist, hard, low to medium plasticity, fine-grained sand	CL		13	D	25 30	8/12	9.0 [8.2]	105	22	1020
70		decreased sand content, CLAY, dark yellowish brown, medium plasticity, trace fine-grained sand			14	S	11 17 20	18/18	9.3 [9.0]			1034
75		SILTY SAND; light yellowish brown, moist, dense, fine- to medium-grained, nonplastic to low plasticity silt	SM		15	D	25 30	9/12	9.6 [9.0]	112	19	1045

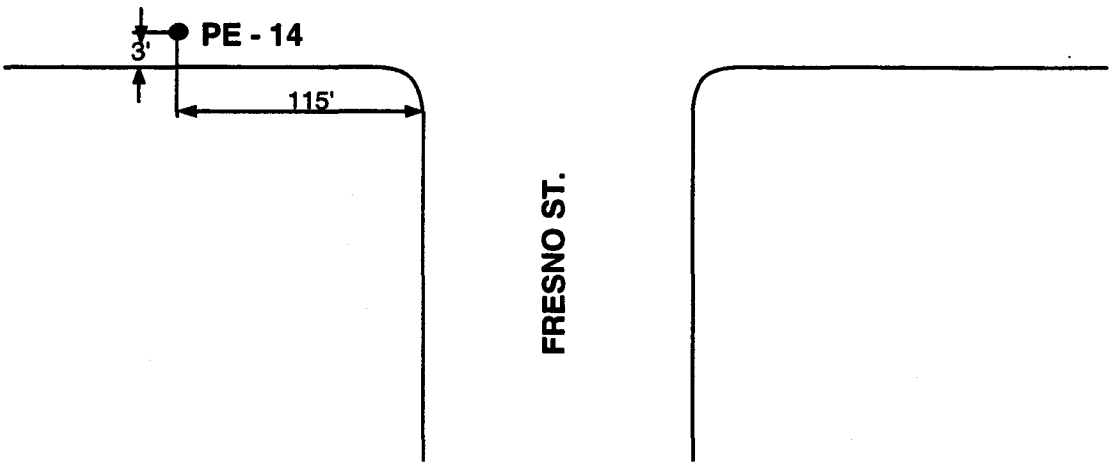
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-14	Sheet 4 of 4	

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
	SILTY SAND; light yellowish brown, moist, very dense, fine- to medium-grained, nonplastic silt	SM	Qoa	16	S	25 35 45	13/18	9.3 [9.0]			1100
85				17	D	50 50/4"	10/10	10 [9.3]	111	15	1115
	interval of SAND, coarse-grained, possible groundwater source	SP									
	CLAY; bluish gray, moist, hard, medium plasticity, hydrocarbon odor	CL									
90				18	S	8 17 20	18/18	9.5 [9.5]			1130
	SAND with SILT; bluish gray, moist, very dense, fine- to medium-grained, nonplastic silt	SP-SM									
95				19	D	60 40/4"	5/10	9.5 [9.5]	110	18	1155
	SANDY SILT;light yellowish brown, moist, hard, medium plasticity, thinly bedded to laminated (stratification- coarser and finer grained material)	ML									
100				20	S	12 29 50	13/18	10 [9.5]			1220
	FERNANDO/PUENTE FORMATION SILTSTONE; soft rock	ML	Tf/Tp								
	Boring terminated at 101.5 feet. Possible groundwater at 76.5 feet below surface.										
105											

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 14

1-94

Figure A -16

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-15**	Sheet **1** of **4**
Boring Location:	**First/Jullien**	Elevation and Datum(feet):	**300 MSL**
Health and Safety:	**Level D**	Date Started: **11/18/93**	Date Finished: **11/18/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **91.0**	Depth to Bedrock(feet): **86.5**
Drilling Method:	**Mud Rotary**	Number of Samples: **17**	Depth to possible Water (feet): **75**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base to about 3'		af								
5		CLAYEY SILT; olive, moist, soft, low to medium plasticity, trace fine-grained sand, micaceous, [black plastic pipe at 4']	ML/CL		1	S	1 1 3	10/18	8.5 [7.5]			0845
10		interval of GRAVEL, rounded gravel to 1-3/4" in size, rebar	GP									
		interval of SANDY CLAY, strong brown, wet, medium stiff, [lost circulation, added bentonite]	CL		2	D	2 5	8/12	8.2 [7.5]	86	35	0920
		interval of SAND with SILT, grayish brown, dense, fine- to medium-grained, trace gravel to 3/4" in size	SP-SM									
		ALLUVIUM SANDY SILT; yellowish brown, moist, hard, low plasticity, fine- to medium-grained sand, trace rounded gravel to 1/4" in size	ML	Qya								
15					3	S	10 20 29	16/18	8.3 [7.5]			0937

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-15	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILT; brownish yellow, moist, very stiff, low plasticity, trace clay and fine-grained sand, micaceous	ML	Qya	4	D	14 19	8/12	8.4 [7.5]	84	29	1010
25		increased sand content, SILT with SAND, dark yellowish brown, hard, nonplastic to low plasticity			5	S	20 30 38	16/18	8.4 [7.5]			1025
		SAND with SILT; dark yellowish brown, moist, medium dense, fine-grained, grading to SANDY SILT/SILTY SAND, strong brown to reddish brown, very stiff/medium dense, low to medium plasticity, trace clay, micaceous	SP-SM to ML/SM		6	D	14 15	7/12	8.6 [7.6]	91	27	1040
35					7	S	14 25 35	15/18	8.5 [7.6]			1055
		SANDY SILT; strong brown, moist, very stiff, low to medium plasticity, some fine- to medium-grained sand	ML	Qoa								
40					8	D	14 14	7/12	8.4 [7.6]	105	21	1112
45		increased sand content, olive, hard, fine-grained sand, micaceous			9	S	16 30 37	15/18	8.5 [7.6]			1130

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-15	Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; brownish yellow, moist, medium dense, fine-grained, nonplastic silt, micaceous	SM	Qoa	10	D	20 30	8/12	7.9 [7.6]	99	26	1150
55		very dense			11	S	25 34 46	0/18				1205
60		decreased silt content, SAND with SILT, wet	SP-SM		12	D	21 28	8/12	8.4 [7.6]	96	28	1240
		CLAY; dark bluish gray, moist to wet, hard, medium plasticity, trace fine-grained sand, micaceous	CL									
65					13	S	18 25 38	18/18	110 [7.8]			1300
70		increased sand content, SANDY CLAY, very stiff, some white sand pockets, trace rounded gravel to 1/2" in size			14	D	14 20	12/12	270 [7.9]	109	19	1325
		SILTY SAND; dark bluish gray with white grains, moist to wet, very dense, fine- to medium-grained, nonplastic silt, trace gravel to 1/4" in size	SM									
75					15	S	20 40 40/4"	15/16	310 [8.1]			1350

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

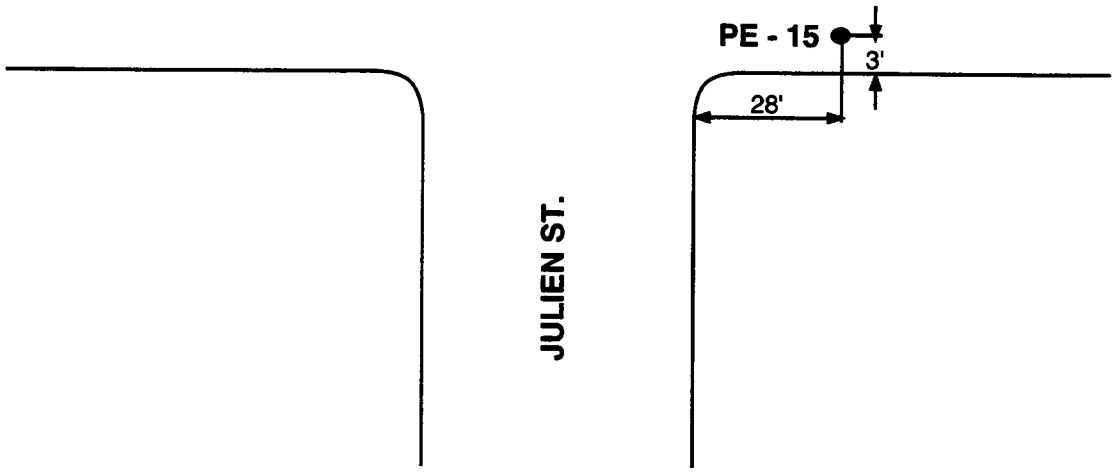
GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line																
Project Number:	94-1100	Boring Number:	PE-15													Sheet 4 of 4	
Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples												
					Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time					
		SAND; dark bluish gray, wet, medium dense, fine- to coarse-grained, trace subangular fine gravel, trace nonplastic silt	SW	Qoa	16	D	21 30	8/12	780 [8.1]	115	15	1405					
		interval of SILTY SAND, very dense, fine-grained	SM														
85					17	S	20 35/4"	9/10	780 [7.8]			1420					
		FERNANDO/PUENTE FORMATION SILTSTONE; dark olive gray, moist, soft rock, medium plasticity, thinly laminated in places, fossiliferous (gastropod), slightly weathered to fresh, no obvious fractures	MH	Tf/Tp													
90					18	D	17 17	--	300 [8.2]	98	26	1450					
		Boring terminated at 91.0 feet. Possible groundwater at 75' below surface.															
95																	
100																	
105																	

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

EVERGREEN CEMETERY

E. FIRST ST.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 15

1-94

Figure A -17

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-16**	Sheet **1** of **5**
Boring Location:	**Michigan/Saratoga**	Elevation and Datum(feet):	**313 MSL**
Health and Safety:	**Level D**	Date Started: **11/18/93**	Date Finished: **11/18/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **111.5**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **22**	Depth to Water (feet): **51.8**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed, converted to monitoring well**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Fred Schilling**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, reddish brown clay		af								
5		**ALLUVIUM** CLAY; yellowish red, moist, very stiff, trace fine-grained sand	CL	Qoa	1	D	12 14	8/12	5.0 [4.5]	115	16	0730
10		CLAYEY SAND; yellowish red, moist, medium dense, fine- to medium-grained, low plasticity clay	SC		2	S	5 6 6	12/18	5.6 [4.4]			0740
15		SANDY SILT; yellowish red, moist, very stiff, low plasticity, fine- to medium-grained sand	ML		3	D	12 14	8/12	5.4 [4.4]	110	18	0750

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line															
Project Number:	94-1100	Boring Number:	PE-16												Sheet 2 of 5	
Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time				
		SILTY SAND/SANDY SILT; yellowish red, moist, medium dense/very stiff, fine- to medium-grained sand, nonplastic silt	SM/ML	Qoa	4	S	5 10 12	10/18	6.3 [4.9]			0800				
		abundant coarse-grained sand from 22' to 24'														
25		CLAY; layered coloring (yellow, gray, dark reddish gray), moist, very stiff, medium plasticity, trace fine-grained sand	CL		5	D	12 14	11/12	6.8 [5.2]	99	26	0812				
30		interval of SILTY SAND, yellowish red, medium dense, fine- to coarse-grained, nonplastic silt	SM		6	S	6 11 17	15/18	6.9 [5.8]			0820				
		light brown	CL													
35					7	D	18 20	8/12	7.8 [6.2]	109	18	0825				
40		brown, hard, trace fine- to coarse-grained sand			8	S	12 18 20	2/18	--			0835				
45		increased silt content, SILTY CLAY, yellowish brown, low to medium plasticity, trace fine-grained sand	CL/ML		9	D	14 17	8/12	7.8 [6.9]	101	23	0842				

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-16	Sheet 3 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILTY SAND; reddish yellow, moist, dense, fine- to coarse-grained, nonplastic silt	SM	Qoa	10	S	12 20 28	12/18	8.4 [6.9]			0845
		[rig chatter from 51.5' to 54'], gravel to 1/2" in size from 51.5' to 54'										
55		decreased silt content, SAND with SILT, light brown, fine- to medium-grained	SP-SM		11	D	30 35	7/12	8.8 [7.1]	104	21	0852
60		increased silt content, SILTY SAND, coarse-grained sand and gravel at 61.5'	SM		12	S	6 9 22	12/18	8.0 [7.2]			0905
65		SILT/SILTY CLAY; brown, moist, very stiff, low to medium plasticity	ML/CL		13	D	15 17	8/12	8.5 [7.4]	88	34	0914
70		SILTY SAND; brown, moist, very dense, fine- to medium-grained, nonplastic silt	SM		14	S	27 50 25/3"	10/15	10 [7.6]			0925
75		SANDY CLAY; brown, moist, very stiff, medium plasticity, fine- to medium-grained sand	CL		15	D	16 21	10/12	8.6 [8.0]	115	17	0935
		decreased sand content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-16	Sheet 4 of 5	

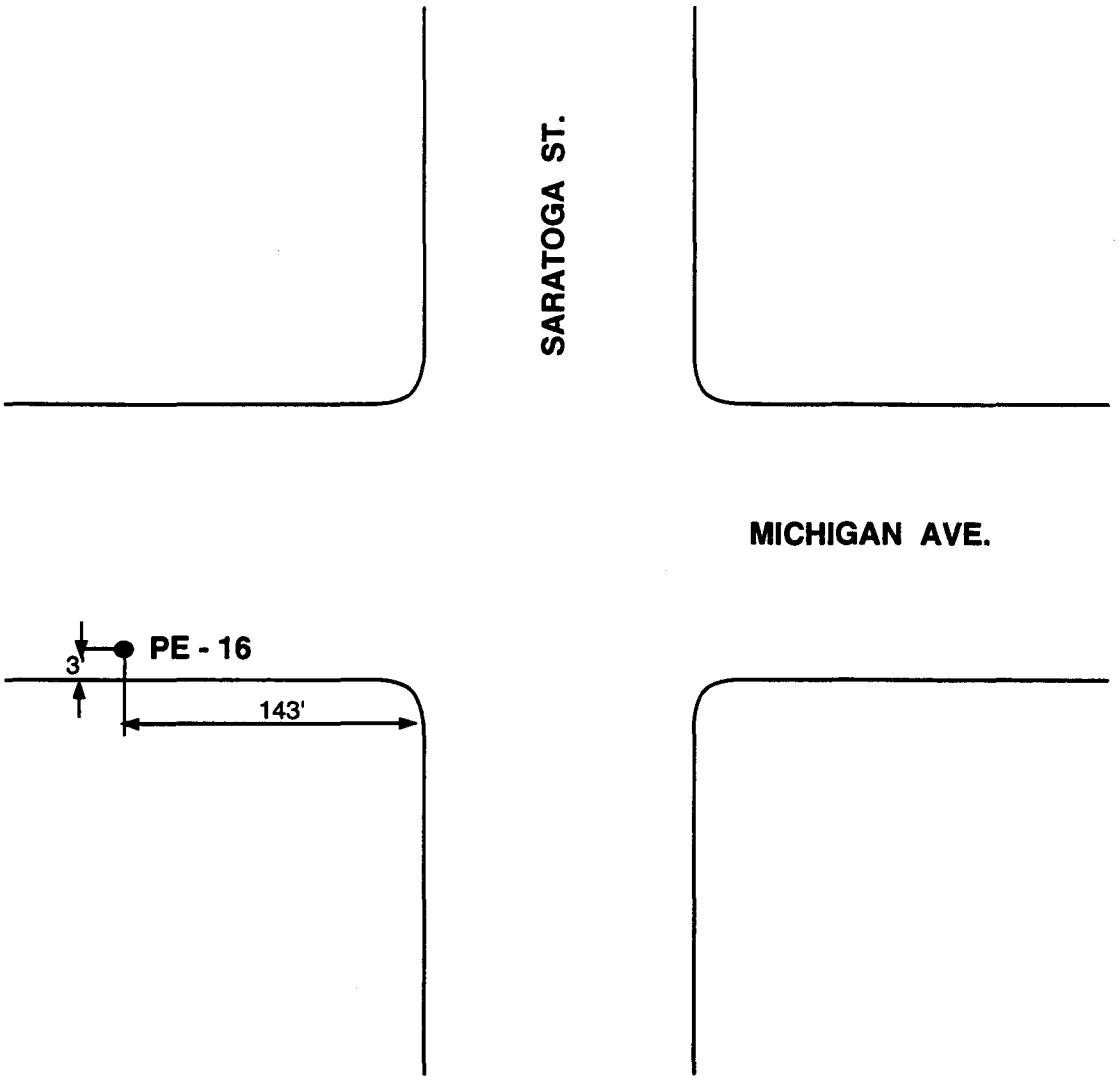
Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAY with SAND; brown, moist, hard, medium plasticity, fine-grained sand	CL	Qoa	16	S	12 20 24	15/18	8.6 [8.0]			1000
85		SILT; light yellowish brown, moist, very stiff, low plasticity, trace fine-grained sand	ML		17	D	17 19	8/12	8.8 [8.2]	95	28	1010
90		SILTY SAND/SANDY SILT; light yellowish brown, moist, very dense/hard, fine-grained sand, nonplastic to low plasticity silt	SM/ML		18	S	18 28 40	10/18	--			1015
95		decreased silt content, SILTY SAND, nonplastic silt, laminated	SM		19	D	40 50	4/12	9.1 [8.5]	100	26	1030
100		SANDY CLAY/CLAYEY SAND; light yellowish brown, moist, hard/dense, medium plasticity clay, fine- to medium-grained sand	CL/SC		20	S	12 18 20	18/18	6.9 [5.2]			1054
105		yellowish brown, very stiff/medium dense			21	D	18 26	9/12	8.1 [6.2]	119	15	1109

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line															
Project Number:	94-1100	Boring Number:	PE-16												Sheet 5 of 5	
Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples											Drilling Time
					Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]		Dry Density (pcf)	Moisture Content (%)				
		SANDY CLAY/CLAYEY SAND; yellowish brown, moist, hard/dense, fine- to coarse-grained sand, medium plasticity clay	CL/SC	Qoa	22	S	11 22 27	16/18	6.8 [5.6]							1130
		Boring terminated at 111.5 feet. Groundwater measured on 1/11/94 at 51.8 feet below surface.														
115																
120																
125																
130																
135																
140																

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

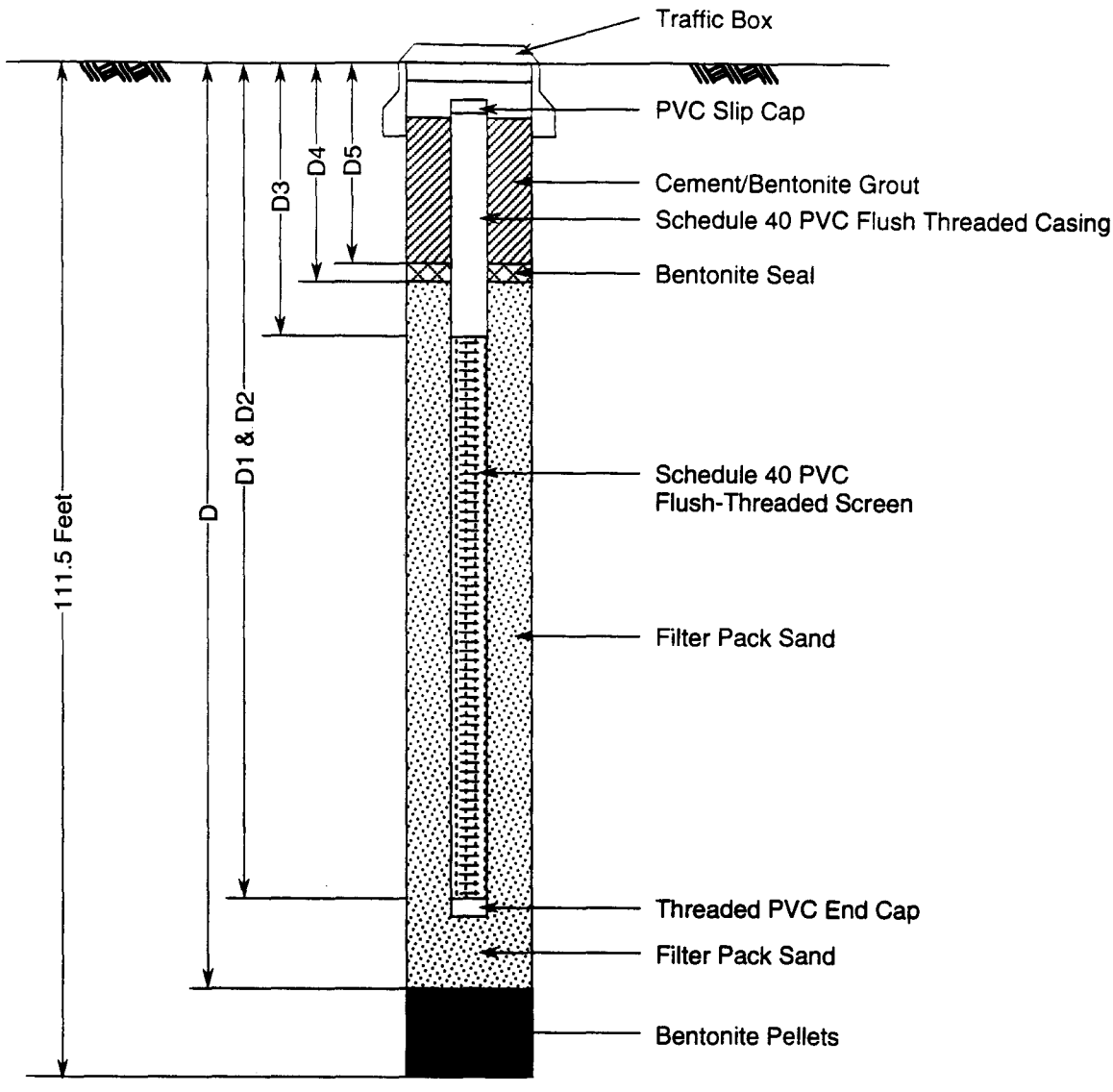
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 16

1-94

Figure A -18A



Total Depth (D)	=	94.5	Feet
Total Depth of Casing (D1)	=	94.5	Feet
Depth to Bottom of Well Screen (D2)	=	94.5	Feet
Depth to Top of Well Screen (D3)	=	64.5	Feet
Depth to Bottom of Top Seal (D4)	=	62	Feet
Depth to Top of Top Seal (D5)	=	59	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-16

2-94

Figure A-18B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-17**	Sheet **1** of **4**
Boring Location:	**Mathews/Brooklyn**	Elevation and Datum(feet):	**345 MSL**
Health and Safety:	**Level D**	Date Started: **11/19/93**	Date Finished: **11/19/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **91.5**	Depth to Bedrock(feet): **62**
Drilling Method:	**Mud Rotary**	Number of Samples: **18**	Depth to Water (feet): **57.7**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Fred Schilling**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, silty clay, brown		af								
		ALLUVIUM SILTY SAND with GRAVEL/GRAVEL with SILT and SAND; reddish brown, moist, dense, fine- to coarse-grained sand, gravel to 1/2" in size, nonplastic silt, layered	SM/ GP-GM	Qoa								
5					1	D	18 35	7/12	7.2 [6.2]	121	11	0715
10		SAND with CLAY; reddish brown, moist, very dense, fine- to coarse-grained, low plasticity clay, trace subangular fine gravel	SP-SC		2	S	21 33 38	8/18	7.4 [5.8]			0722
15		interval of SAND with SILT, yellowish brown, nonplastic silt, some subangular to subrounded gravel to 1/2" in size	SP-SM		3	D	45 50	8/12	7.5 [6.2]	116	13	0735
		SANDY CLAY; yellowish brown, moist, very stiff, low to medium plasticity, fine- to coarse-grained sand	CL									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-17	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SANDY CLAY; yellowish brown, moist, very stiff, low to medium plasticity, fine- to coarse-grained sand	CL	Qoa	4	S	9 11 16	12/18	7.9 [6.4]			0745
25		SILT; light olive brown, moist, very stiff, low plasticity, trace fine-grained sand	ML		5	D	18 22	8/12	7.8 [6.5]	93	27	0755
		increased sand content, SANDY SILT, olive, hard, nonplastic										
30					6	S	7 15 25	8/18	8.1 [6.8]			0800
35		interval of SILTY CLAY, reddish brown and pale yellow, very stiff, low plasticity, trace fine-grained sand	CL/ML		7	D	9 12	11/12	8.5 [7.7]	87	35	0808
		SILTY SAND; light yellowish brown, moist, very dense, fine-grained, nonplastic silt	SM									
40					8	S	42 55	2/12	9.0 [5.8]			0820
		SAND; yellowish brown, slightly moist, very dense, fine-grained, trace nonplastic silt	SP									
45					9	D	40 45	8/12	7.8 [7.0]	97	8	0830

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-17** | Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND; reddish brown with gray layers, slightly moist, very dense, fine- to medium-grained, horizontally laminated, trace nonplastic silt	SP	Qoa	10	S	40 65	12/12	8.7 [7.0]			0835
55		SILTY SAND; light yellowish brown, moist, very dense, fine-grained, nonplastic silt, minor clayey layers	SM		11	D	60 60	8/12	8.7 [7.2]	93	18	0850
60		reddish brown, highly micaceous			12	S	17 30 42	14/18	8.6 [7.2]			0900
		FERNANDO/PUENTE FORMATION CLAYSTONE; light yellowish brown, moist, soft rock, medium plasticity, massive, intensely weathered, no obvious fractures	CL	Tf/Tp								
65					13	D	20 25	12/12	8.4 [7.5]	98	26	0910
70		CLAYEY SILTSTONE; olive, moist, soft rock, low to medium plasticity, trace fine-grained sand, indistinct laminations inclined 35 to 40 degrees, intensely to moderately weathered, no obvious fractures	ML/CL		14	S	9 15 20	18/18	8.0 [7.7]			0920
75		moderately to intensely weathered, laminations inclined 45 degrees			15	D	18 40	11/12	8.2 [8.0]	101	26	0938

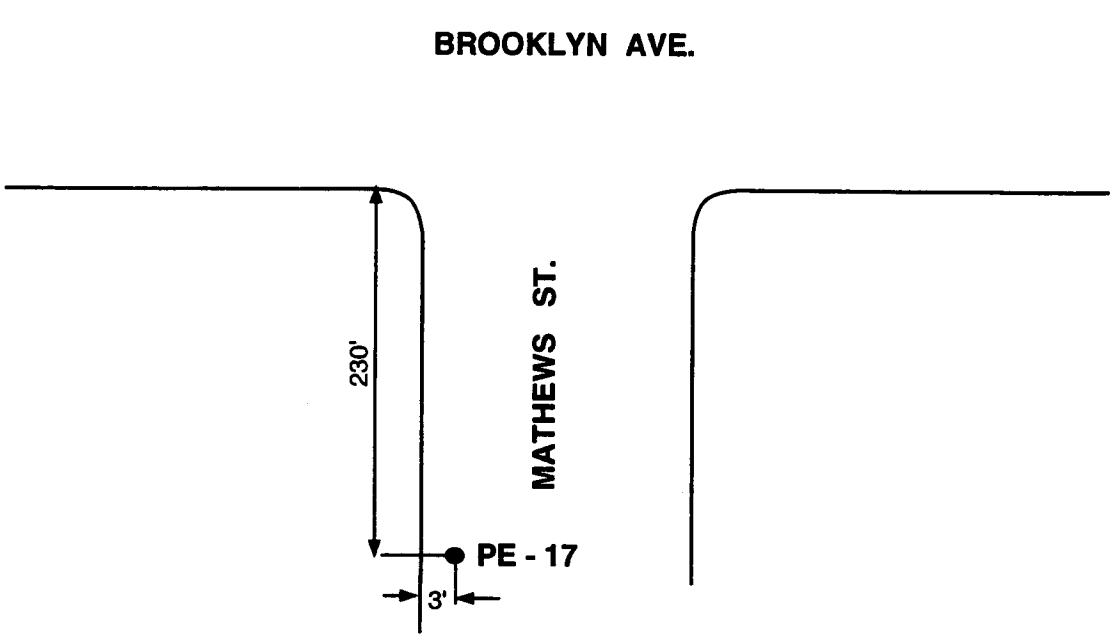
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-17	Sheet 4	of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content(%)	Drilling Time
		CLAYEY SILTSTONE; light yellowish gray, moist, hard, medium plasticity, trace fine-grained sand, massive, moderately weathered, no obvious fractures	ML/CL	Tf/Tp	16	S	11 17 21	18/18	6.0 [5.8]			0950
85		very dark gray and light olive brown, soft rock, slightly increased plasticity, fresh to slightly weathered, laminated, laminations inclined 60 degrees, fossiliferous			17	D	17 20	10/12	5.8 [4.9]	100	26	1005
90		decreased plasticity, SILTSTONE, very dark gray, hard, massive, fresh, fossiliferous (bi-valves)	ML		18	S	12 20 24	18/18	5.6 [4.8]			1020
		Boring terminated at 91.5 feet. Groundwater measured on 1/11/94 at 57.7 feet below surface.										
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

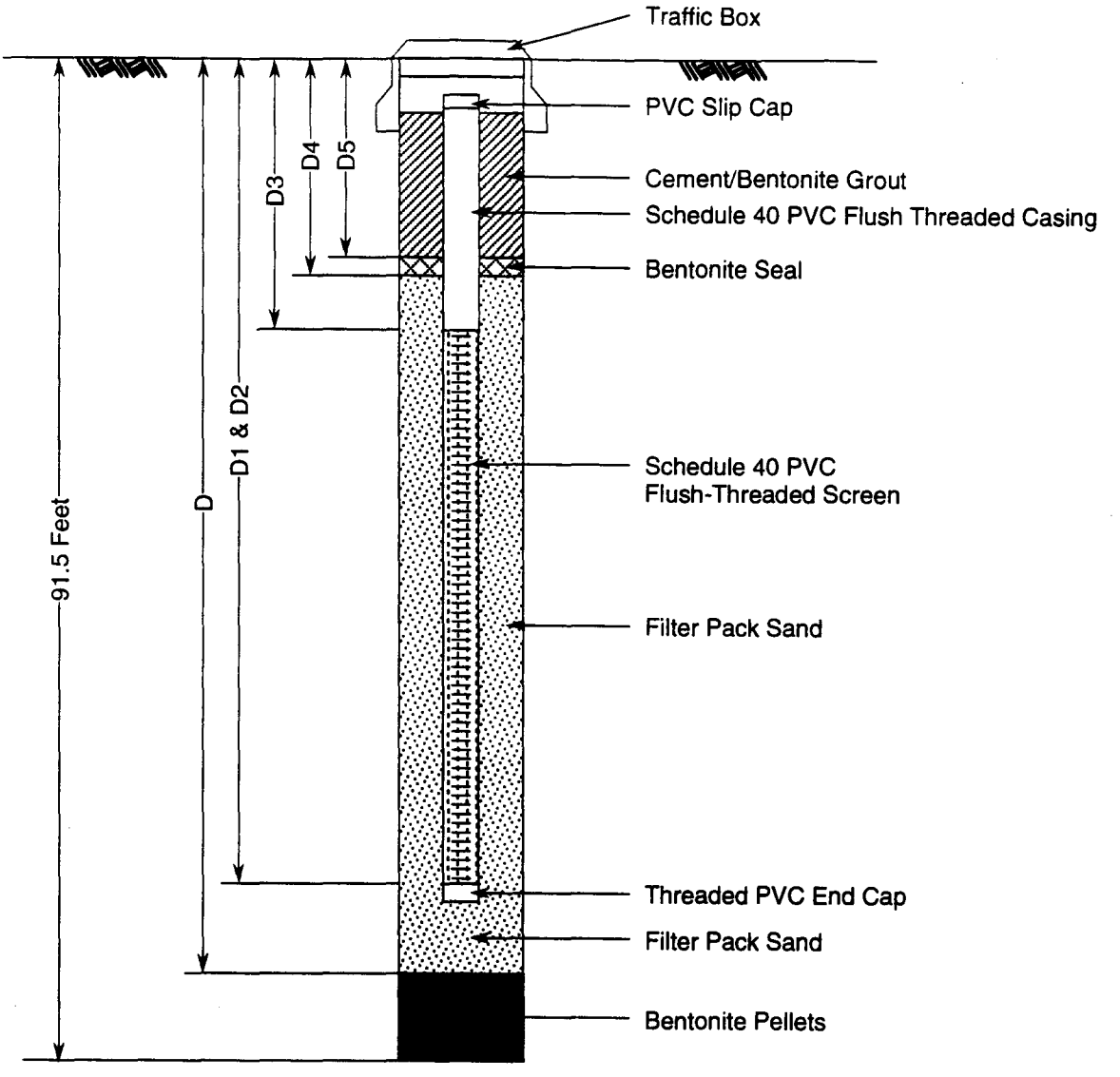
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 17

1-94

Figure A -19A



Total Depth (D)	=	65	Feet
Total Depth of Casing (D1)	=	65	Feet
Depth to Bottom of Well Screen (D2)	=	65	Feet
Depth to Top of Well Screen (D3)	=	35	Feet
Depth to Bottom of Top Seal (D4)	=	32	Feet
Depth to Top of Top Seal (D5)	=	29	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-17

2-94

Figure A-19B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-18**	Sheet **1** of **4**
Boring Location:	**Third/Santa Fe**	Elevation and Datum(feet):	**265 MSL**
Health and Safety:	**Level D**	Date Started: **11/29/93**	Date Finished: **11/29/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **86.0**	Depth to Bedrock(feet): **85.7**
Drilling Method:	**Mud Rotary**	Number of Samples: **16**	Depth to Water (feet): **79.2**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed, converted to monitoring well**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 4.5"and concrete to 9"		af								
		ALLUVIUM SANDY SILT; dark yellowish brown, moist to wet, soft, low plasticity, fine-grained sand, micaceous	ML	Qya								
5					1	S	1 1 1	11/18	5.3 [4.2]			0715
10		GRAVEL with SAND/SAND with GRAVEL; brown to light olive brown, moist, medium dense, fine to coarse subangular to angular gravel to 2" in size, fine- to coarse-grained sand	GW/SW		2	D	15 21	4/12	5.6 [4.7]	129	8	0725
15		gravel to 1-1/4" in size, trace silt			3	S	8 10 14	9/18	5.7 [4.6]			0735
		decreased sand content, GRAVEL with SAND, moist to wet, subangular to angular gravel to 3/4" in size, few cobbles 4" to 6" in size	GW									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-18	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		GRAVEL with SAND; brown to light olive brown, moist to wet, medium dense, rounded to subangular gravel and cobbles to 6" in size, fine- to coarse-grained sand, some nonplastic silt	GW	Qya	4	D	20 25	6/12	--	121	11	0755
		increased sand content, GRAVEL with SAND/SAND with GRAVEL, very dense, fine to coarse gravel to 2-1/4" in size	GW/SW									
25					5	S	17 23 35	4/18	5.7 [4.3]			0810
		decreased sand content, GRAVEL with SAND, brown to light olive brown, rounded to subangular gravel to 2-1/4" in size	GW									
30		gravel to 2-1/2" in size			6	D	40 50	5/12	--	123	7	0900
35		gravel to 1-3/4" in size, some finer gravel to 1/2" in size below 35'			7	S	60 40/2"	5/8	5.5 [4.8]			0930
40		cobble to 5" in size			8	D	100	4/6	5.4 [4.8]	129	12	0955
45		gravel to 1-1/4" in size			9	S	100/7"	4/7	5.3 [4.8]			1018

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-18	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SAND; brown to light olive brown, moist, very dense, rounded to subangular gravel to 2-1/2" in size, fine- to coarse-grained sand, trace silt	GW	Qya	10	D	100/4"	<1/4	5.5 [5.1]		7	1050
55		SILTY SAND; light olive brown, moist to wet, very dense, fine- to coarse-grained, nonplastic silt, some subangular to subrounded gravel to 1-1/2" in size	SM		11	S	40 60/4"	7/10	6.1 [5.8]			1110
		dense, fine-grained with trace medium-grained, nonplastic to low plasticity silt, micaceous interval of SAND, fine- to medium-grained	SP SM		12	D	30 35	8/12	6.2 [5.9]	110	17	1120
65		very dense, fine- to medium-grained, nonplastic silt, trace fine gravel			13	S	25 55 20/2"	12/14	6.6 [5.9]			1140
70		SAND with SILT and GRAVEL/GRAVEL with SILT and SAND; brown to light olive brown, wet, very dense, fine- to coarse-grained sand, subangular gravel to 1-1/4" in size, nonplastic silt	SW-SM / GW-GM		14	D	100/7"	3/7	6.6 [6.3]	124	13	1200
75		angular rock fragments in cuttings, possible gravel and cobbles to 78.5'										
		SILTY SAND; see next sheet	SM		15	S	40 60	10/12	8.6 [8.0]			1220

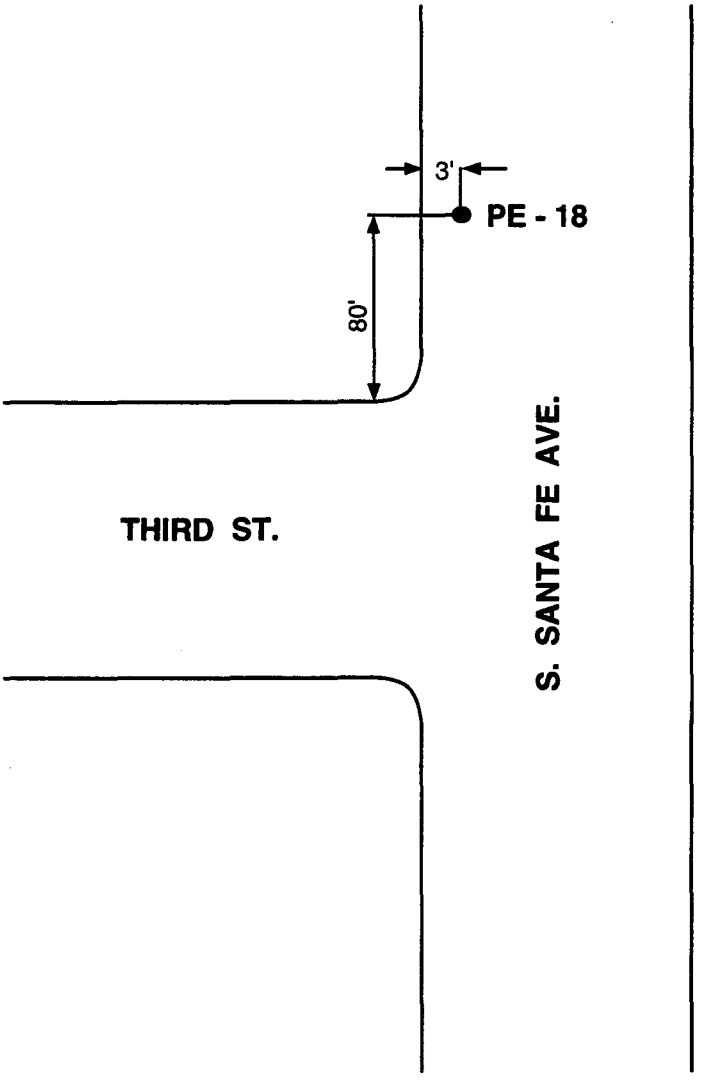
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-18	Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
		SILTY SAND; light olive brown, wet, very dense, fine-grained, trace medium- to coarse-grained, gravel to 3/4" in size	SM	Qya								
		increased silt content, SILTY SAND/SANDY SILT, medium dense/hard, nonplastic to low plasticity silt	SM/ML									
85		**FERNANDO/PUENTE FORMATION**	MH	Tf/Tp	16	D	20 30	6/12	8.4 [8.2]	107	20	1255
		SILTSTONE; olive brown, wet, soft rock, laminated, high plasticity, moderately to slightly weathered										
		Boring terminated at 86.0 feet. Groundwater measured on 1/11/94 at 79.2 feet below surface.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

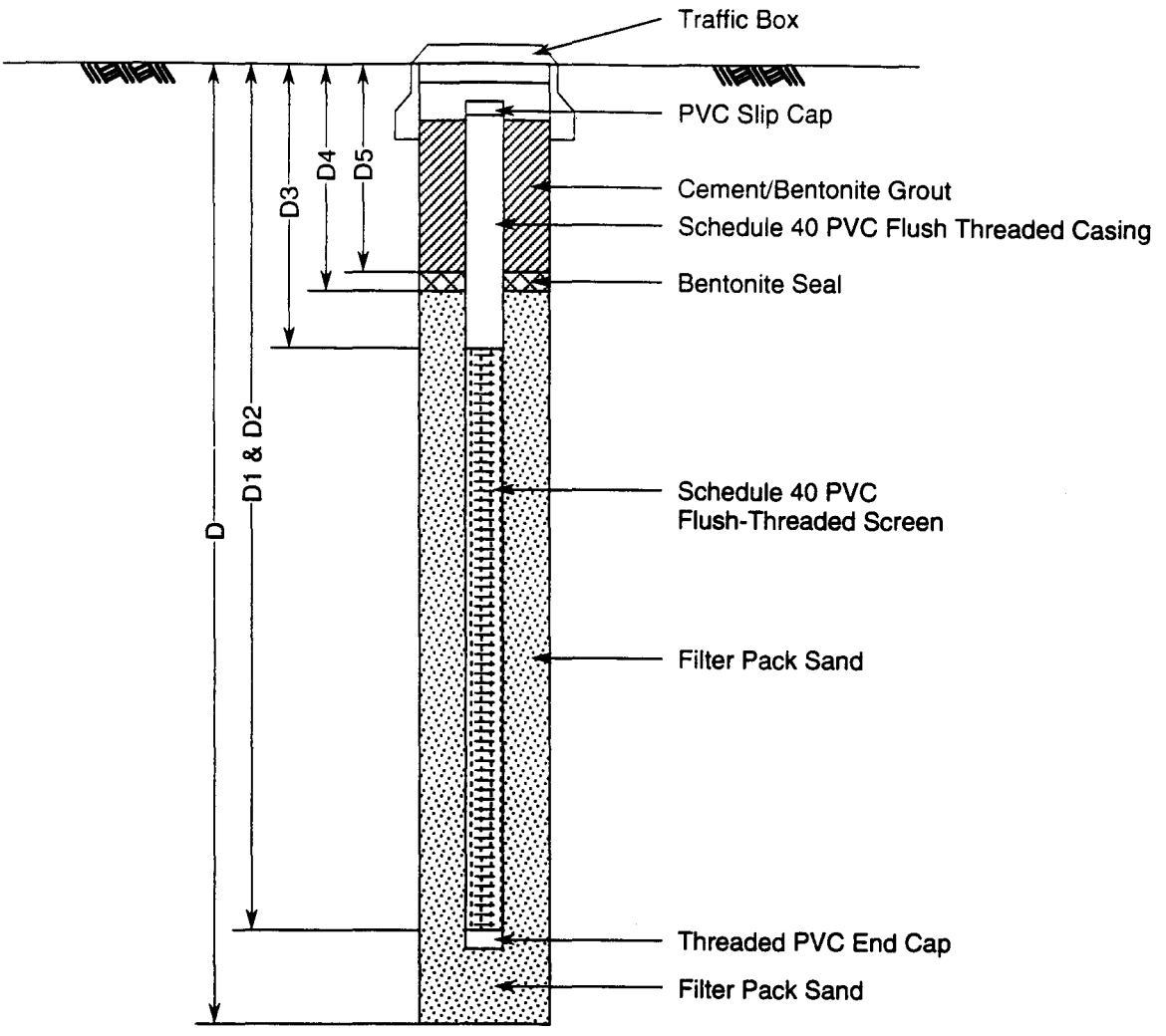
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring PE - 18

1-94

Figure A -20A



Total Depth (D)	=	86	Feet
Total Depth of Casing (D1)	=	84	Feet
Depth to Bottom of Well Screen (D2)	=	84	Feet
Depth to Top of Well Screen (D3)	=	24	Feet
Depth to Bottom of Top Seal (D4)	=	22	Feet
Depth to Top of Top Seal (D5)	=	18	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-18

2-94

Figure A-20B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-19**	Sheet **1** of **3**
Boring Location:	**St. Louis/Brooklyn**	Elevation and Datum(feet):	**310 MSL**
Health and Safety:	**Level D**	Date Started: **11/19/93**	Date Finished: **11/19/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **72.5**	Depth to Bedrock(feet): **45**
Drilling Method:	**Mud Rotary**	Number of Samples: **14**	Depth to Water (feet): **32.1**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 6" and base to 10", clayey sand		af								
		ALLUVIUM SILTY CLAY with SAND; brownish yellow, moist, hard, medium plasticity, fine- to medium-grained sand	CL/ML	Qya								
5					1	S	6 14 30	18/18	7.4 [6.6]			0810
		SILTY SAND; brownish yellow, moist, dense, fine- to medium-grained, nonplastic silt, subangular to angular gravel to 1" in size	SM									
10					2	D	24 25/3"	6/9	8.4 [6.8]	119	11	0830
		high gravel content, gravel to 1/4" in size										
15					3	S	23 40 40	15/18	7.4 [6.9]			0840
		SAND with SILT; strong brown, moist, very dense, fine- to coarse-grained, nonplastic silt, some gravel to 1/4" in size	SW-SM	Qoa								

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-19	Sheet 2 of 3	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT; strong brown, moist, dense, fine- to coarse-grained, nonplastic silt, some gravel to 1/4" in size	SW-SM	Qoa	4	D	50 55	3/12	7.5 [7.3]	110	18	0855
25		SILTY SAND; light olive brown, moist, very dense, fine-grained, nonplastic silt, thinly laminated with some iron oxide stained laminations, undulating layers	SM		5	S	20 40 40/5"	11/17	8.4 [7.6]			0905
30		medium dense			6	D	24 40	8/12	9.4 [7.9]	96	23	0920
		interval of GRAVEL, fine gravel to 1/4" in size, subrounded to subangular and occasional angular fine gravel at 30.5'	GP									
			SM									
35		very dense			7	S	23 40 47	18/18	10 [8.1]			0940
		interval of GRAVEL and SAND	GP/SW									
40		SILT with SAND; light yellowish brown, hard, low plasticity, fine-grained sand, thinly laminated, cross bedded	ML		8	D	23 40	9/12	9.7 [8.4]	94	30	1000
45		**FERNANDO/PUENTE FORMATION** CLAYSTONE; dark olive gray, moist, soft rock, medium plasticity, trace fine-grained sand, very thinly laminated, slightly weathered to fresh, bioturbated	CL	Tf/Tp	9	S	11 18 20	10/18	7.4 [6.4]			1040
					10	D	17 22	10/12	7.4 [6.4]	97	26	1050

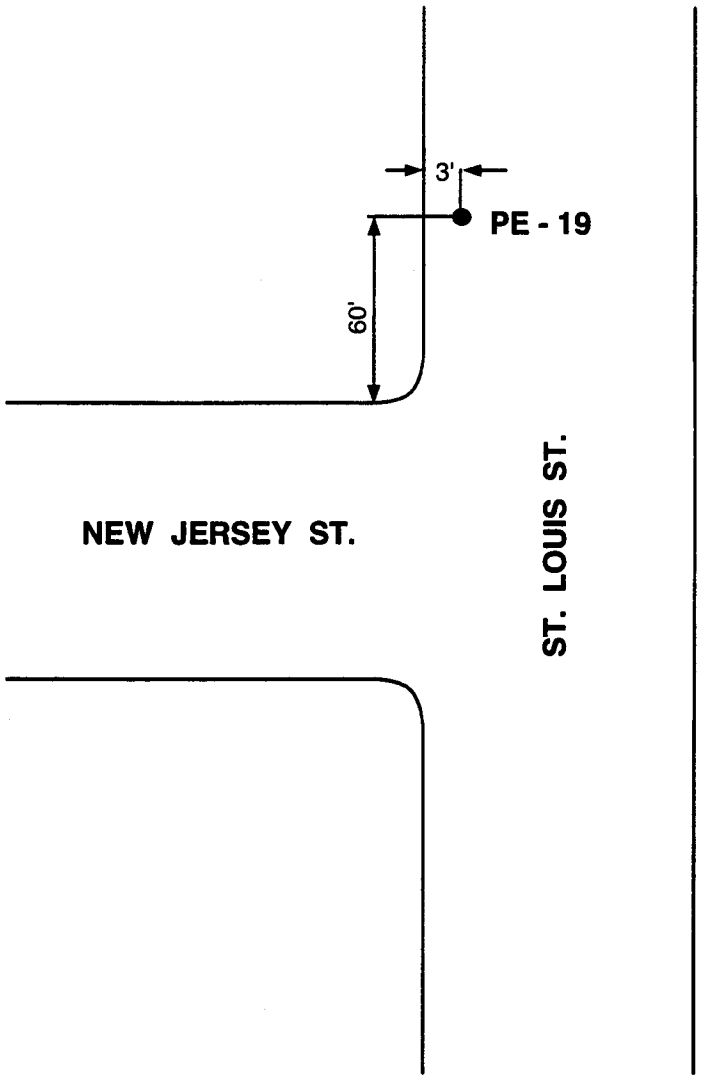
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-19	Sheet 3 of 3	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYSTONE; dark olive gray, moist, soft rock, low to medium plasticity, trace fine-grained sand, very thinly laminated, fresh, bioturbated	CL	Tf/Tp								
55		bioturbated (worm tubes)			11	S	11 22 27	18/18	7.2 [6.8]			1100
60		olive, moist to wet, low plasticity, with lenses of SILTY SANDSTONE to POORLY GRADED SANDSTONE, slightly weathered, fossiliferous			12	D	19 21	11/12	7.7 [7.2]	99	26	1115
65					13	S	17 35 40/5"	17/17	8.4 [7.4]			1130
70		low to medium plasticity, fresh, bioturbated, sandstone stringers inclined 30 degrees			14	D	22 40	11/12	8.6 [7.4]	102	23	1150
		Boring terminated at 72.5 feet. Groundwater measured on 1/11/94 at 32.1 feet below surface.										
75												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

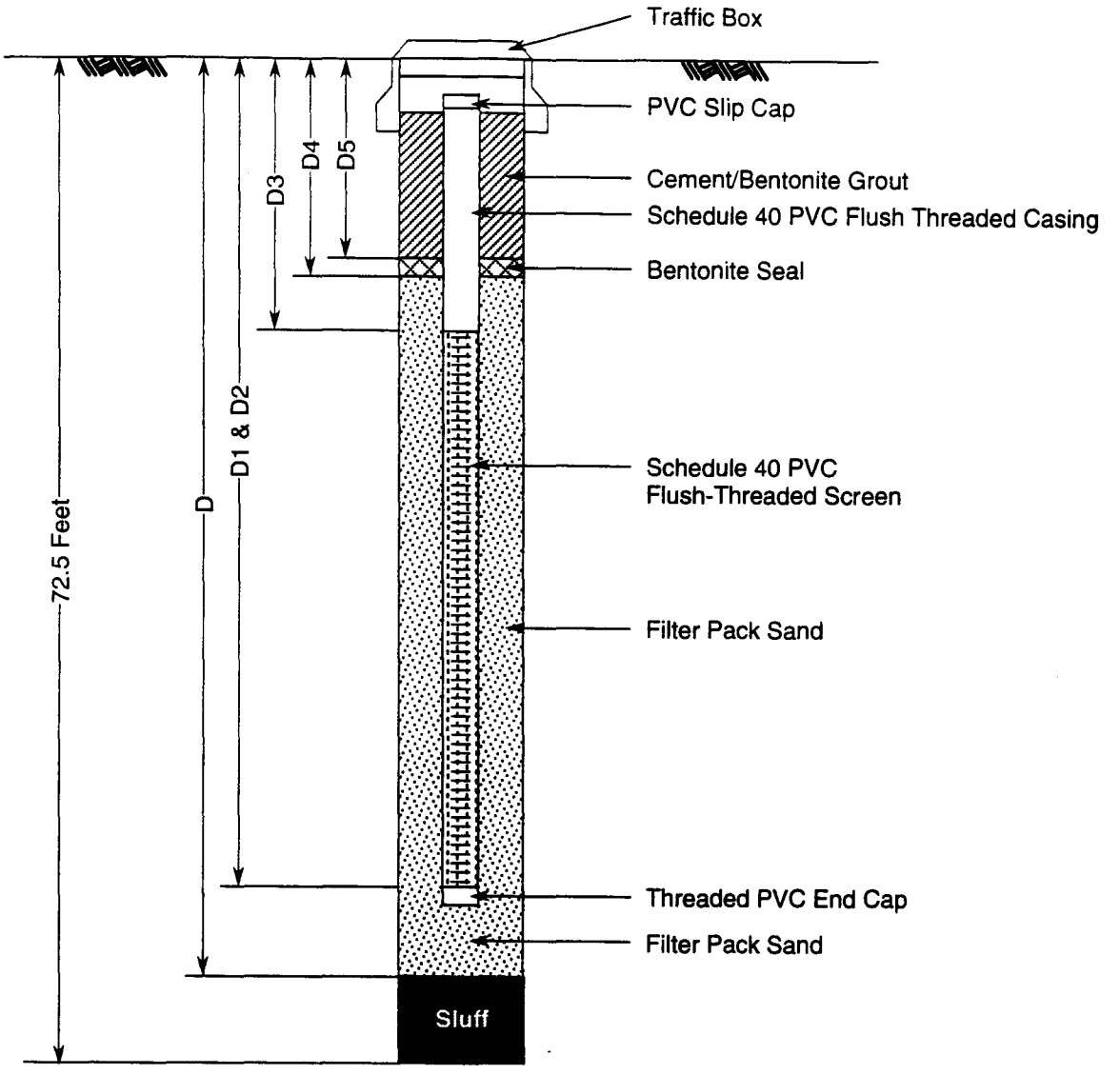
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 19

1-94

Figure A -21A



Total Depth (D)	=	69.1	Feet
Total Depth of Casing (D1)	=	69.1	Feet
Depth to Bottom of Well Screen (D2)	=	69.1	Feet
Depth to Top of Well Screen (D3)	=	24.1	Feet
Depth to Bottom of Top Seal (D4)	=	21.5	Feet
Depth to Top of Top Seal (D5)	=	15	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-19

2-94

Figure A-21B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-20**	Sheet **1** of **3**
Boring Location:	**New Jersey/State**	Elevation and Datum(feet):	**350 MSL**
Health and Safety:	**Level D**	Date Started: **11/22/93**	Date Finished: **11/22/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **76.0**	Depth to Bedrock(feet): **22.5**
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): **---**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphalt concrete and base		af								
		ALLUVIUM/RESIDUAL SOIL CLAY; olive gray, moist, soft, medium to high plasticity	CH	Qoa								
5					1	D	2 2	5/12	2.1 [1.4]	90	34	0742
10		mottled with reddish brown, medium stiff, trace coarse-grained sand			2	S	2 2 3	12/18	1.7 [1.2]			0750
15					3	D	4 4	7/12	1.9 [1.2]	101	25	0800

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-20	Sheet 2 of 3

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAY with SAND; olive gray, moist, stiff, medium plasticity, fine-grained sand	CL	Qoa	4	S	3 4 6	12/18	1.6 [0.7]			0808
25		**FERNANDO/PUENTE FORMATION** SILTSTONE; white, pinkish to greenish gray, moist, soft rock, low to medium plasticity, trace fine-grained sand, vertically bedded, vertical fractures, highly calcareous zones, moderately weathered	ML	Tf/Tp	5	D	12 14	10/12	2.2 [1.0]	97	28	0820
30		medium plasticity			6	S	6 11 15	12/18	0.9 [0.9]			0832
35		low plasticity			7	D	18 24	10/12	1.9 [1.0]	99	26	0845
40		low to medium plasticity, some fine-grained sand			8	S	8 12 15	18/18	0.7 [0.6]			0900
45		vertical bedding, moderately calcareous, soft rock			9	D	16 20	12/12	1.7 [1.0]	96	28	0924

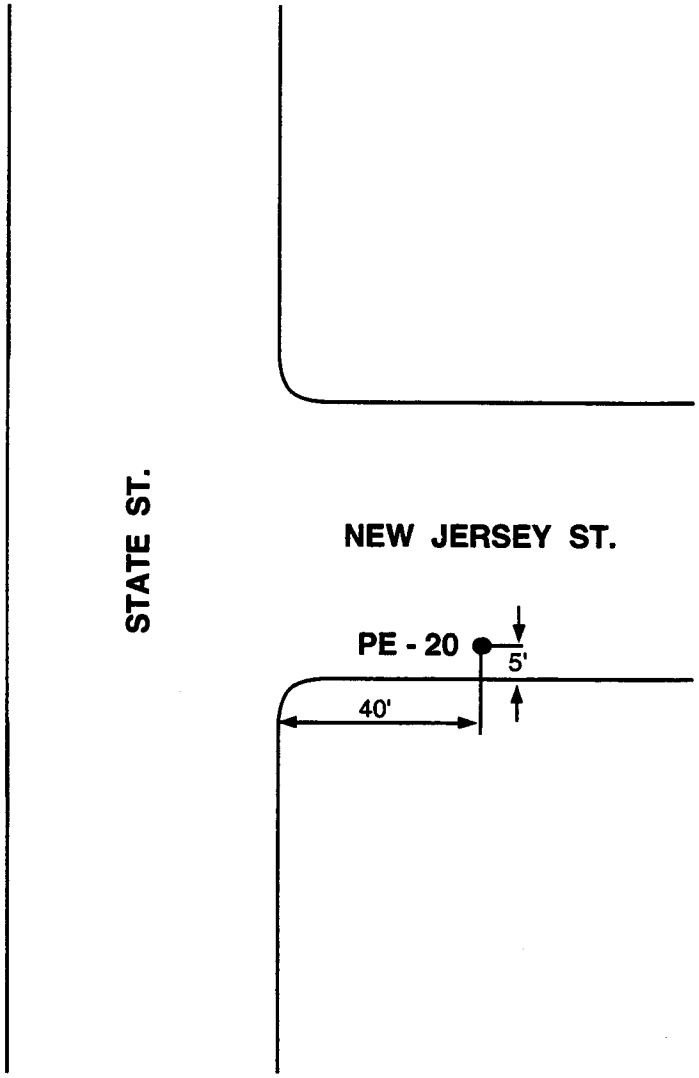
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-20	Sheet 3 of 3	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTSTONE; olive brown, moist, soft rock, low to medium plasticity, trace fine-grained sand, vertically bedded, moderately weathered	ML	Tf/Tp	10	S	6 9 14	14/18	2.2 [1.1]			0938
55		olive gray			11	D	12 16	10/12	2.1 [1.1]	97	27	0955
		greenish black, medium plasticity, with thin layers of reddish brown color, slightly weathered	ML/MH									
60					12	S	5 8 16	12/18	1.7 [0.9]			1018
65		slightly calcareous			13	D	16 21	10/12	2.0 [1.1]	99	25	1032
70		low to medium plasticity	ML		14	S	12 18 25	16/18	2.0 [1.2]			1044
75					15	D	16 23	11/12	2.1 [1.2]	101	24	1100
		Boring terminated at 76.0 feet. Groundwater was not apparent.										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 20

1-94

Figure A -22

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-21**	Sheet **1** of **5**
Boring Location:	**First/Boyle**	Elevation and Datum(feet):	**313 MSL**
Health and Safety:	**Level D**	Date Started: **11/22/93**	Date Finished: **11/23/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **110.4**	Depth to Bedrock(feet): **89**
Drilling Method:	**Mud Rotary**	Number of Samples: **22**	Depth to Water (feet): **58.4**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Concrete to 9" and base		af								
		ALLUVIUM CLAY; dark yellowish brown, moist, very stiff, medium plasticity, some fine- to medium-grained sand	CL	Qoa								
5					1	D	15 27	6/12	8.1 [6.4]	118	15	0830
10		increased sand content, SANDY CLAY, hard, trace subangular to angular gravel to 3/4" in size, slightly porous			2	S	12 15 20	16/18	8.6 [6.4]			0845
15		very stiff, fine- to coarse-grained sand			3	D	9 20	8/12	7.4 [6.9]	115	15	0855
		increased sand content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-21	Sheet 2 of 5

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SAND; dark yellowish brown, moist, very dense, fine-grained, low plasticity clay, trace subangular to angular gravel to 3/4" in size, slightly porous	SC	Qoa	4	S	20 50/5"	11/11	7.4 [6.9]			0905
			SM									
		SILTY SAND; dark yellowish brown, moist, dense, fine-grained, low plasticity silt, few angular gravel to 1" in size, slightly porous, mica flakes										
25					5	D	30 34	6/12	7.1 [7.1]	108	18	0915
		yellowish brown, very dense, nonplastic silt										
30					6	S	35 48	12/12	7.4 [7.0]			0930
35		CLAY with SAND; yellowish brown, moist to wet, very stiff, medium plasticity, fine-grained sand, infrequent intervals with medium- to coarse-grained sand	CL		7	D	25 28	10/12	8.4 [7.2]	114	19	0940
40		increased sand content, SANDY CLAY			8	S	19 20 24	16/18	8.6 [7.6]			0950
		[vigorous rig chatter]										
		SAND with GRAVEL/GRAVEL with SAND; grayish brown, moist to wet, very dense, fine- to coarse-grained sand, subrounded to angular gravel to 2" in size, trace low plasticity silt	SW/GW									
45					9	D	80/4"	<1/4	8.8 [7.6]	130	9	1008
		SANDY CLAY; grayish brown to yellowish brown, moist to wet, hard, low plasticity, fine-grained sand, laminated, micaceous	CL									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-21	Sheet 3 of 5

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SANDY CLAY; grayish brown to yellowish brown, moist to wet, hard, low plasticity, fine-grained sand, laminated, micaceous	CL	Qoa	10	S	20 50	9/12	9.8 [7.4]			1020
55		interval of SAND with GRAVEL, olive gray, moist, very dense, fine- to coarse-grained, subangular gravel to 1-1/4" in size	SW		11	D	80/3"	1/3	8.6 [7.5]	109	12	1034
		SANDY CLAY, strong brown, wet	CL									
		SAND with SILT and GRAVEL; olive gray, moist, very dense, fine- to coarse-grained, nonplastic silt, gravel to 1-1/4" in size	SW-SM									
60					12	S	50/5"	2.5/5	9.5 [7.6]			1050
65		yellowish brown, gravel to 1" in size, clayey interbeds			13	D	80/4"	<1/4	8.6 [8.1]		11	1110
70		decreased silt			14	S	45/5.5"	4/5.5	8.7 [7.8]			1125
75		rounded gravel to 1-1/4" in size			15	D	60/3"	<1/3	8.4 [7.8]		17	1143
		[very hard drilling]										
		decreased silt content, increased gravel, boulders to 12" in size	GW/SW									
		see next sheet										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-21	Sheet 4 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SAND/SAND with GRAVEL; brownish yellow, wet, very dense, fine- to coarse-grained sand, boulders to 12" in size	GW/SW	Qoa	16	S	20/0.5"	0/0.5				1200
			SP-SM									
		SAND with SILT; yellowish brown, wet, very dense, fine-grained, nonplastic silt										
85												
		interval of SANDY SILT/SILTY SAND, fine- to coarse-grained, possibly sand and silt interbedded	ML/SM		17	D	86/3"	< 1/3	8.5 [7.8]		21	1245
		FERNANDO/PUENTE FORMATION	CH	Tf/Tp								
90		CLAYSTONE; olive, moist to wet, soft rock, high plasticity, laminated			18	S	18 50	10/12	7.9 [7.9]			1345
		[resumed drilling at 0730 on 11/23/93]										
95					19	D	50	5/6	7.8 [6.2]	89	34	0815
		[rig chatter]										
		SANDSTONE; brownish yellow, wet, soft rock, well graded, some fine gravel, interbedded with SILTSTONE, subrounded to angular gravel to 3/4" in size, low angle bedding	SW/ML									
100					20	S	50/3"	0/3	6.2 [5.6]			0835
105		iron oxide staining, gravel to 1-1/4" in size			21	D	87	2/6	7.8 [6.6]	105	17	0915

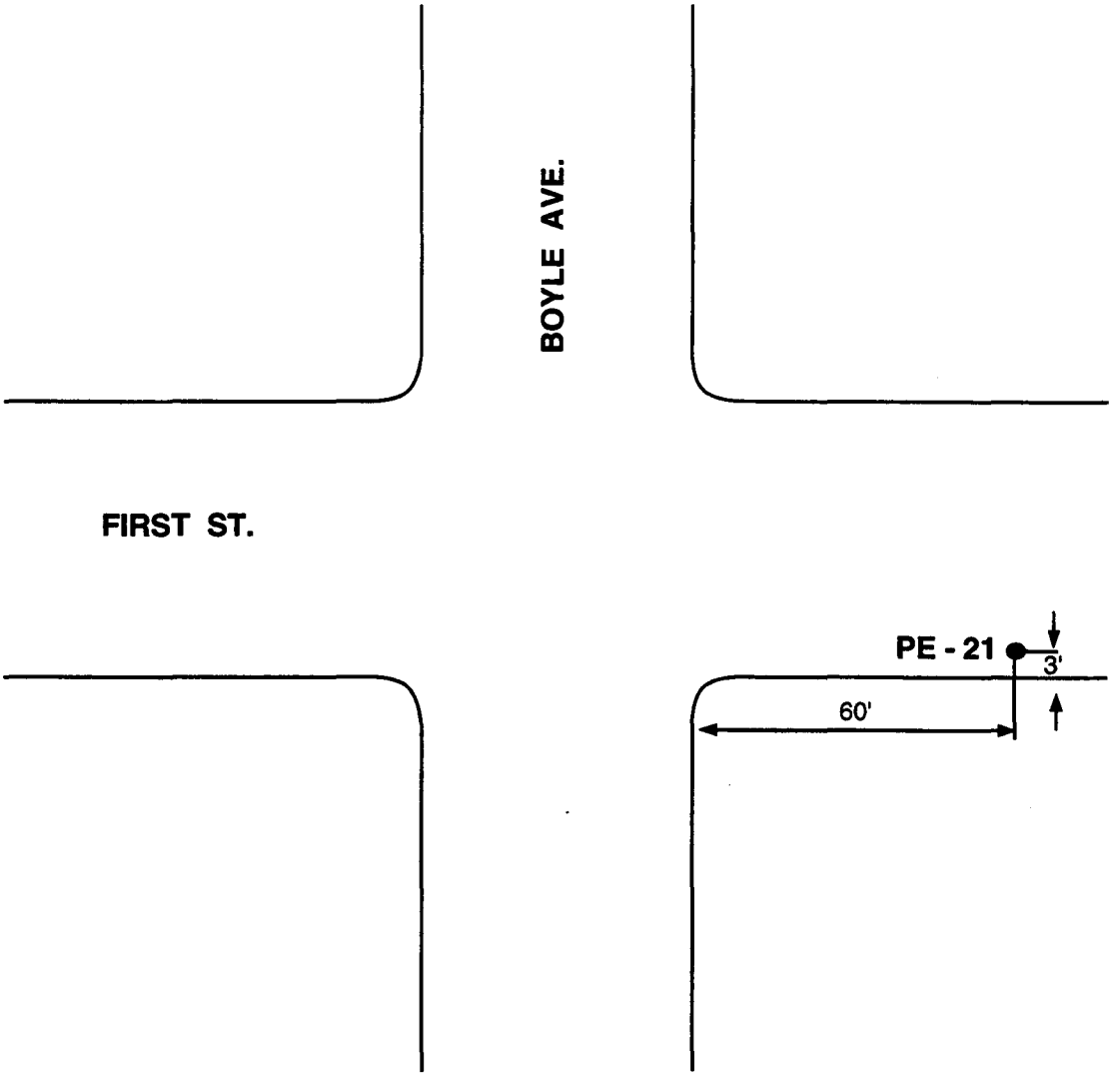
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-21	Sheet 5	of 5

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content(%)	Drilling Time
		SANDSTONE; brownish yellow, wet, soft rock, well graded, some fine gravel, interbedded with SILTSTONE, subrounded to angular gravel to 1/4" in size, low angle bedding	~~SW/ML~~	~~Tf/Tp~~	22	D	100/ 4.5"	<1/4.5	8.1 [7.0]		18	0937
		Boring terminated at 110.4 feet. Groundwater measured on 1/11/94 at 58.4 feet below surface.										
115												
120												
125												
130												
135												
140												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

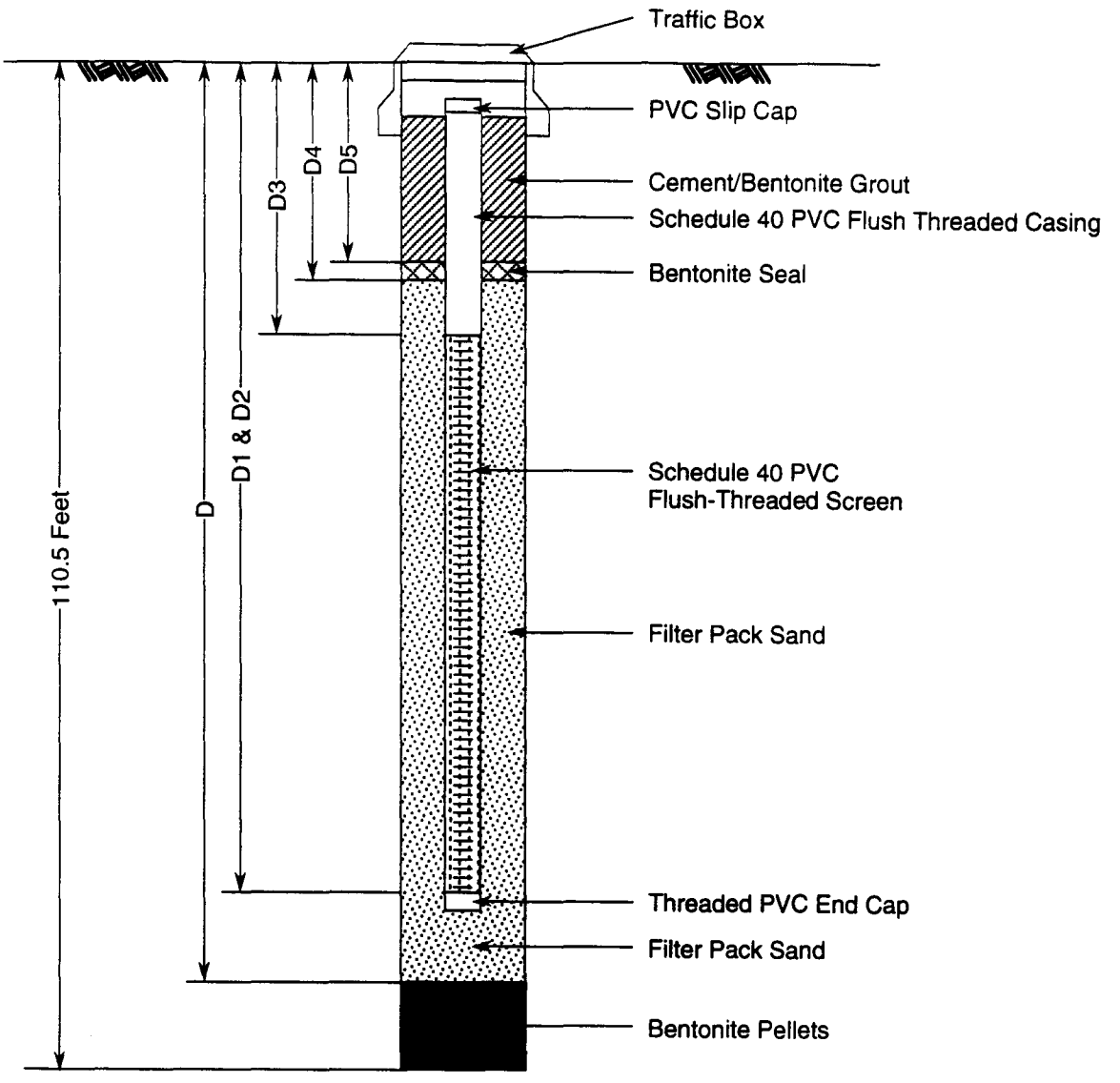
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 21

1-94

Figure A -23A



Total Depth (D)	=	92.5	Feet
Total Depth of Casing (D1)	=	90	Feet
Depth to Bottom of Well Screen (D2)	=	90	Feet
Depth to Top of Well Screen (D3)	=	25	Feet
Depth to Bottom of Top Seal (D4)	=	25	Feet
Depth to Top of Top Seal (D5)	=	17.5	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-21

2-94

Figure A-23B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-22**	Sheet **1** of **4**
Boring Location:	**Third/Pecan**	Elevation and Datum(feet):	**260 MSL**
Health and Safety:	**Level D**	Date Started: **11/23/93**	Date Finished: **11/23/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **85.5**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **19**	Depth to possible Water (feet): **40.5**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
5		**ALLUVIUM** [rig chatter] SANDY SILT; olive gray, moist, soft, nonplastic, fine-grained sand, trace medium- to coarse-grained sand	ML	Qya	1	D	2 2	10/12	1.6 [1.6]	105	13	0718
		SILTY SAND; pale olive, moist, medium dense, fine- to coarse-grained, nonplastic silt, few rounded to subangular gravel to 1" in size	SM									
10		[strong rig chatter at 12']			2	S	5 7 11	10/18	2.6 [1.6]			0730
		SAND with GRAVEL; grayish olive, moist, medium dense, fine- to coarse-grained, subangular to subrounded gravel to 1-1/4" in size	SW		3	B						0735
15		cobble to 6" in size			4	D	18 23	8/12	2.6 [1.6]		9	0741

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-22	Sheet 2 of 4	

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
	SAND with SILT and GRAVEL; grayish olive, moist, very dense, fine- to coarse-grained, subangular to subrounded gravel to 1-1/4" in size [very slow drilling, constant rig chatter]	SW-SM	Qya	5	S	17 30 33	6/18	2.8 [1.4]			0805
25	gravel to 1-1/2" in size			6	D	27 40	7/12	2.2 [1.4]	118	7	0828
30	GRAVEL with SILT and SAND; grayish olive, moist, very dense, fine to coarse subangular to subrounded gravel to 1" in size, fine- to coarse-grained sand	GP-GM		7	S	40 60	6/12	2.5 [1.4]			0854
35	interval of SILTY CLAY with SAND, low to medium plasticity	CL/ML		8	D	25	8/12	2.9	117	14	0921
	light brown mottled with black, grayish black subangular to subrounded gravel to 2-1/2" in size	GP-GM		9	B	50		[1.4]			
	interval of CLAYEY SILT	ML/CL									
	[strong rig chatter]										
40	SAND with SILT and GRAVEL; pale yellowish brown, moist to wet, very dense, fine- to coarse-grained, subangular to subrounded fine gravel, low plasticity silt	SW-SM		10	S	35 50/1"	4/7	2.5 [1.4]			0938
	cobbles to small boulders										
	decreased gravel, SAND with SILT, trace fine gravel										
45				11	D	50 50/4"	8/10	2.5 [1.7]	120	12	1002
	CLAY; olive green, moist, hard, high plasticity, some silt, bedded at 30 degrees, slightly weathered	CH									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-22	Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAY; olive green, moist, hard, high plasticity, some silt, bedded at 30 degrees, slightly weathered	CH	Qya	12	S	9 17 21	0/18	3.5 [1.7]			1015
55		SAND with SILT; dark gray, moist, very dense, fine-grained, trace nonplastic silt	SP-SM		13	D	40 45	7/12	4.0 [2.2]	103	20	1033
60		becomes well graded, medium dark gray, fine- to coarse-grained sand, some fine gravel	SW-SM		14	S	50 50/5"	5/11	3.9 [2.1]			1045
65		[strong rig chatter] increased gravel content, SAND with SILT and GRAVEL, dark gray, medium plasticity silt, rounded and angular gravel to 1/2" in size			15	D	35 37	5/12	3.8 [2.1]	121	14	1055
70		decreased gravel content, fine subangular gravel			16	S	95	4/6	3.9 [2.1]			1115
75		decreased gravel content, becomes poorly graded, SAND with SILT, medium dark gray, wet, fine- to medium-grained	SP-SM		17 18	D B	100/7"	6/7	4.0 [2.2]	102	22	1137

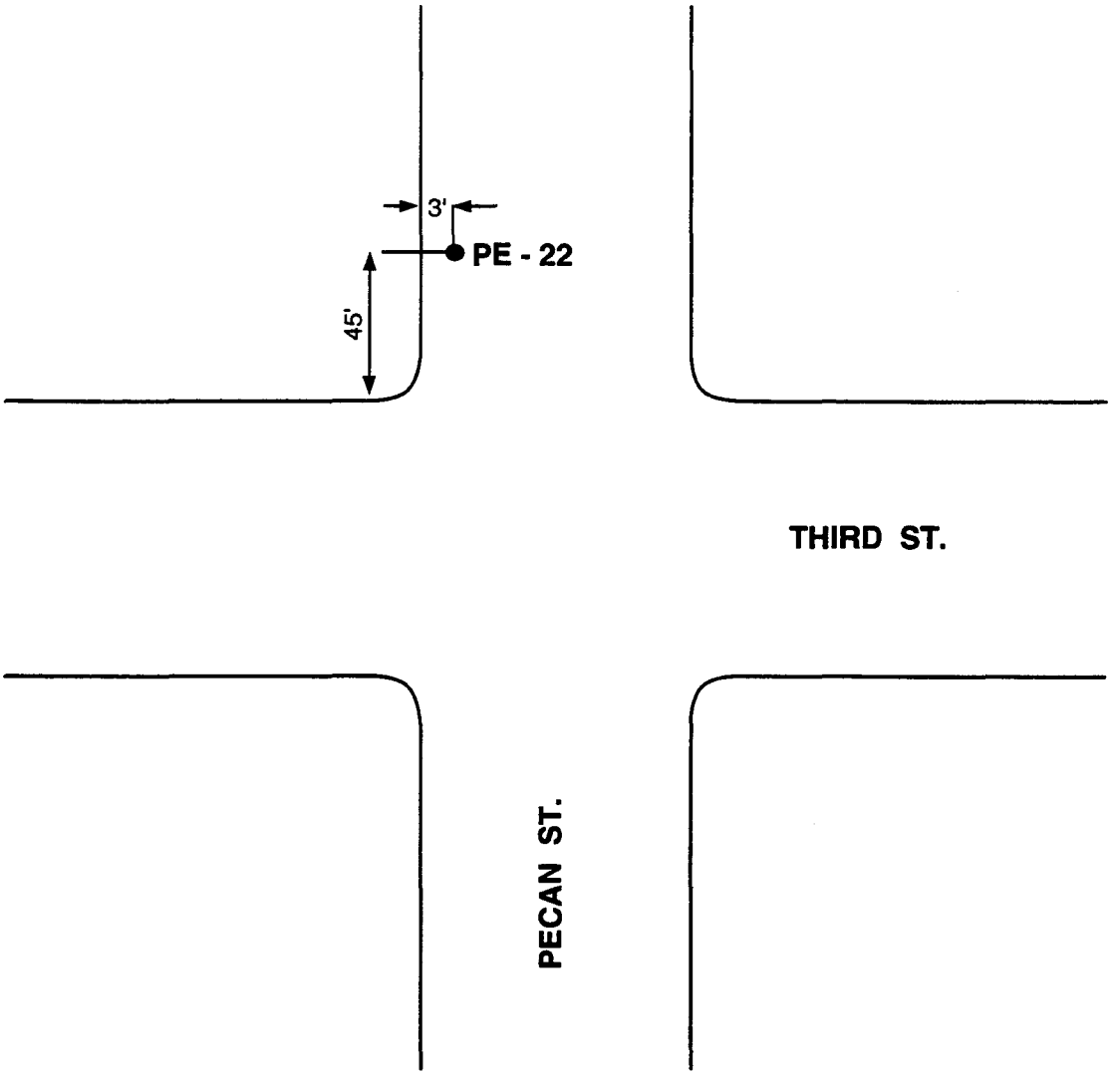
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-22	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content(%)	Drilling Time
85		SAND with SILT; medium dark gray, wet, very dense, fine- to medium-grained, medium plasticity silt, [very hard drilling], possibly with coarse gravel and cobbles	SP-SM	Qya								
		increased silt content and gravel, SILTY SAND with GRAVEL, medium- to coarse-grained, rounded and subangular gravel to 1" in size, SILTSTONE fragment in sample shoe	SM		19	D	100	4/6	4.0 [2.5]		12	1200
		Boring terminated at 85.5 feet. Possible groundwater at 40.5 feet below surface.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 22

1-94

Figure A -24

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-23**	Sheet **1** of **4**
Boring Location:	**Third/Clarence**	Elevation and Datum(feet):	**257 MSL**
Health and Safety:	**Level D**	Date Started: **11/24/93**	Date Finished: **11/24/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **91.0**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **17**	Depth to Water (feet): **54.2**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed, converted to monitoring well**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 380-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, 6" sand and subangular to angular gravel to 1" in size		af								
		ALLUVIUM SILTY SAND; brown, moist, loose, fine- to medium-grained, nonplastic silt, some biotite mica	SM	Qya								
5					1	S	2 2 3	13/18	--			0805
		gravel at 9'										
10		wet, medium dense			2	D	10 14	8/12	--	100	9	0810
		increased gravel content, SILTY SAND with GRAVEL, dense to very dense, fine- to coarse-grained, subrounded to subangular gravel to 1-1/2" in size										
15		high gravel content, gravel to 1/4" in size			3	S	11 20 30	15/18	--	125	10	0820
		high gravel content, gravel to 1/4" in size										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-23	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT and GRAVEL/GRAVEL with SILT and SAND; brown, wet, dense, fine- to coarse-grained sand, rounded gravel to 1" in size, trace nonplastic silt	SP-SM / GP-GM	Qya	4	D	21 21	6/12	6.9 [6.8]	125	10	0830
		interval of SILTY SAND	SM									
25		dense to very dense, rounded gravel to 3/4" in size	SP-SM / GP-GM		5	S	24 34 34	14/18	7.9 [6.9]			0845
		decreased silt and sand content, GRAVEL with SAND, very dense, rounded gravel to 1-1/4" in size, 1/4" common	GW									
30		boulder at 31', about 13" in size			6	D	55/1"	< 1/1	8.3 [7.1]		4	0910
		increased sand and silt content, SAND with SILT and GRAVEL, rounded gravel to 1-1/2" in size	SP-SM									
35		[oily film on surface of mud tank]			7	S	40 60	9/12	7.5 [7.3]			0935
		GRAVEL with SAND/SAND with GRAVEL; brown, wet, rounded gravel to 2" in size, 1-1/4" common, fine- to coarse-grained sand, some thin clayey silt layers	GP/SW									
40		boulder at 41', about 18" in size			8	D	25 50/5.5"	6/11.5	8.2 [7.4]	128	11	1000
		increased gravel content, rounded gravel to 1-1/2" in size, clayey silt layers absent	GP									
45					9	S	50/3"	2/3	8.1 [7.4]			1045

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-23** | Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND; light yellowish brown, moist to wet, very dense, grades from fine- to coarse-grained to fine- to medium-grained	SP	Qya	10	D	50 30/3"	6/9	8.2 [7.7]	100	21	1055
55		SANDY SILT; light olive brown, wet, hard, medium plasticity, fine-grained sand	ML		11	S	13 37 50/4.5"	16/ 16.5	8.9 [7.8]			1115
		interval of SAND with GRAVEL										
60		interval of SAND with SILT, brown, very dense, nonplastic silt	SP-SM		12	D	50 30/3"	5/9	8.6 [7.9]	102	24	1135
		high gravel content										
		SILTY SAND; brown, wet, very dense, fine- to coarse-grained, nonplastic silt, subangular gravel to 1/4" in size	SM									
65					13	S	61 39/3"	8/9	9.0 [8.0]			1150
		[rig chatter at 67', gravel to 1" in size]										
70		[rig chatter from 69' to 71'] gravel to 2" in size										
		SAND with SILT and GRAVEL; dark bluish green, wet, very dense, fine- to coarse-grained, nonplastic silt, gravel to 1-1/4" in size	SW-SM		14	D	70 30/2"	5/8	8.6 [8.0]	117	15	1210
		gravel to 1/4" in size, cobbles to 4" in size										
75		trace clay, gravel to 1-1/4" in size			15	S	50/3"	1/3	8.5 [8.1]			1230

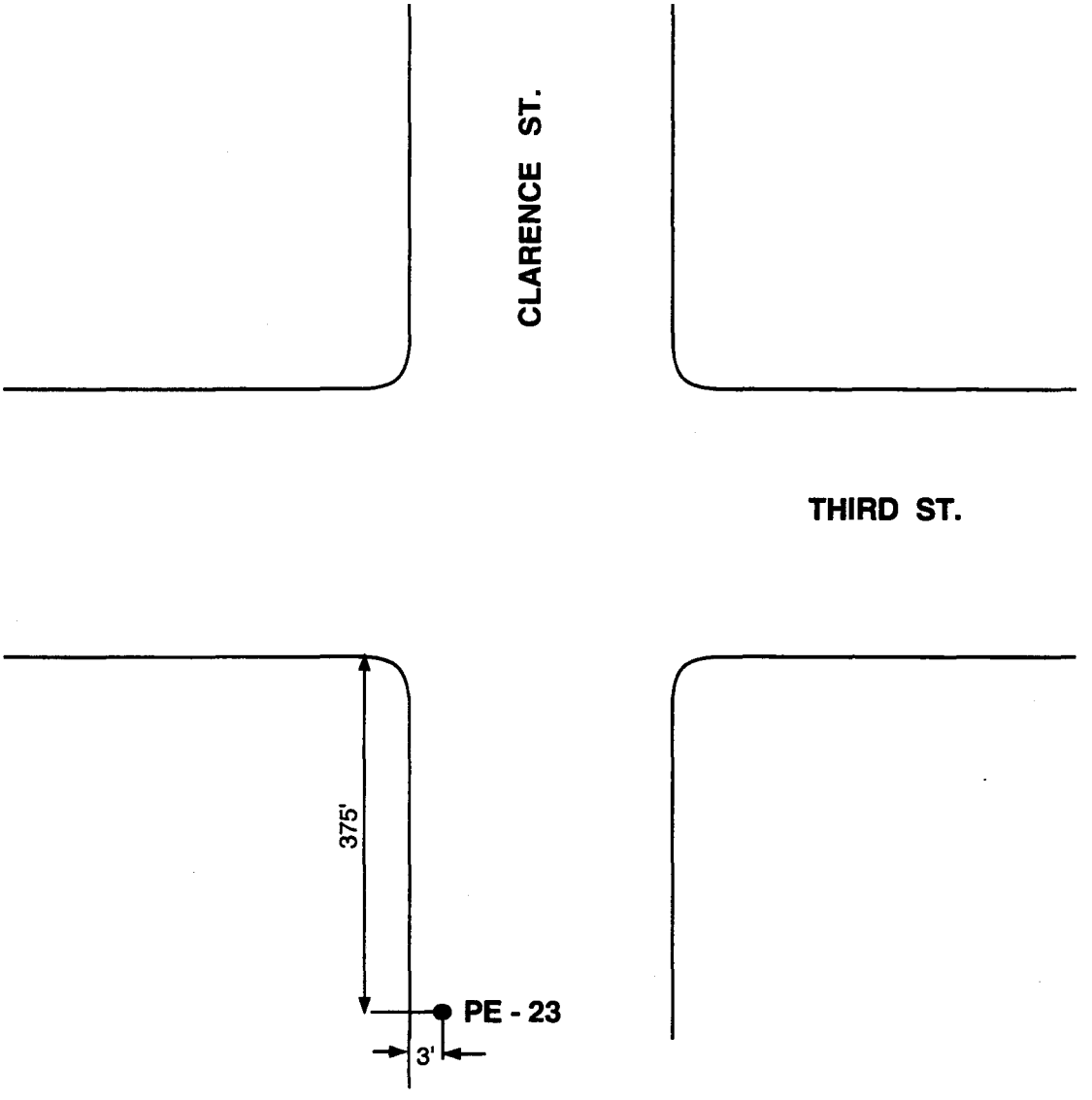
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-23	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content(%)	Drilling Time
		SAND with SILT and GRAVEL; dark bluish green, wet, very dense, fine- to coarse-grained, subangular gravel to 1-1/4" in size	SW-SM	Qya	16	D	55 50/3"	4/9	8.5 [8.2]	117	14	1245
		GRAVEL with SAND; gravel to 2" in size common, cobbles to 6" in size present from 82.5' to 84'	GW									
85					17	S	50/1.5"	<1/ 1.5	9.5 [9.0]			1310
90												
		Boring terminated at 91.0 feet. Groundwater measured on 1/11/94 at 54.2 feet below surface.										
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

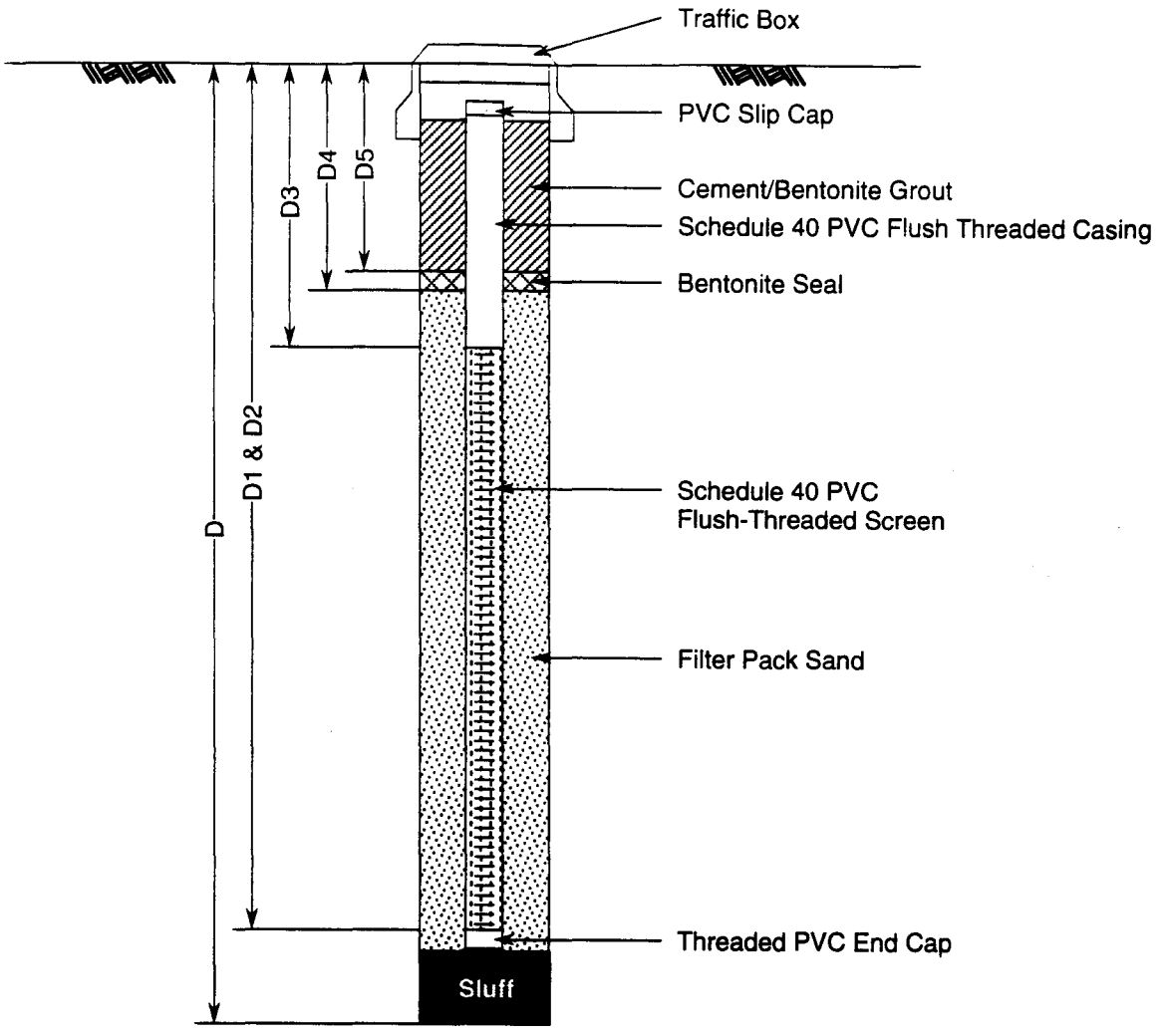
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring PE - 23

1-94

Figure A -25A



Total Depth (D)	=	91	Feet
Total Depth of Casing (D1)	=	85	Feet
Depth to Bottom of Well Screen (D2)	=	85	Feet
Depth to Top of Well Screen (D3)	=	25	Feet
Depth to Bottom of Top Seal (D4)	=	12	Feet
Depth to Top of Top Seal (D5)	=	3.5	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-23

2-94

Figure A-25B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-24**	Sheet **1** of **4**
Boring Location:	**Fourth/Mission**	Elevation and Datum(feet):	**260 MSL**
Health and Safety:	**Level D**	Date Started: **11/24/93**	Date Finished: **11/24/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **85.3**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **17**	Depth to possible Water (feet): **60**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
		ALLUVIUM SAND with SILT; moderate olive brown, moist, very loose to loose, fine- to medium-grained, trace coarse-grained, nonplastic silt, trace rounded gravel to 3/4" in size	SP-SM	Qya								
5		[frequent loud rig chatter, from 7'to 12']			1	D	3 4	8/12	5.1 [4.2]	91	20	0735
		SAND with GRAVEL; moderate olive brown, moist, medium dense, fine- to coarse-grained, rounded gravel to 3" in size	SP									
10		light brown, rounded to subangular gravel to 2" in size			2	S	7 12 8	3/18				0749
15					3	D	15 23	5/12	5.3 [5.2]	119	11	0804

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-24** | Sheet 2 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT; light brown, moist, very dense, fine- to coarse-grained, nonplastic silt, some rounded to subangular gravel to 3/4" in size	SP-SM	Qya	4	S	9 33 35	--	6.6 [5.2]			0812
25		increased silt content, SILTY SAND, olive brown, wet, medium dense, low plasticity silt, some gravel to 2" in size	SM		5	D	20 33	8/12	6.8 [5.4]	112	18	0825
30		GRAVEL with SAND; olive brown, wet, very dense, fine- to coarse-grained sand [constant rig chatter]	GW		6	S	25 50 25/3"	6/15	6.6 [5.5]			0840
35					7	D	40 60/5"	5/11	6.2 [5.6]	118	11	0900
40		[very strong rig chatter at 39'], increased gravel content			8	S	30 60 10/1"	8/13	6.6 [5.2]			0925
45		gravel to 1/2" in size cobbles to 8" in size			9	D	50 50/4"	6/10	6.2 [5.4]		8	0945
		interval of SILTY CLAY	CL/ML									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-24** | Sheet 3 of 4

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
	SAND with SILT; yellowish brown, moist, very dense, fine- to coarse-grained, nonplastic silt, some subangular to subrounded gravel to 1/2" in size	SP-SM	Qya	10	S	40 60	6/12	6.8 [5.4]			1014
55	medium- to coarse-grained, trace gravel			11	D	80	3/6	6.6 [5.5]	109	21	1030
60	SILTY SAND; light brown, moist, very dense, fine- to medium-grained, nonplastic silt	SM		12	S	27 50 25/3"	12/15	7.2 [6.4]			1042
	interval of SILT	ML									
	light brown and yellowish brown, wet, very dense, trace coarse-grained, occasional gravel, layered	SM									
65				13	D	45 55/4"	6/10	7.0 [5.6]	109	19	1105
	SANDY SILT/SILTY SAND; very dark gray, moist, hard/very dense, nonplastic to low plasticity silt, fine-grained sand	ML/SM									
70				14	S	25 30 38	12/18	6.8 [5.6]			1118
75	increased silt			15	D	35 40	7/12	7.4 [6.3]	101	25	1130

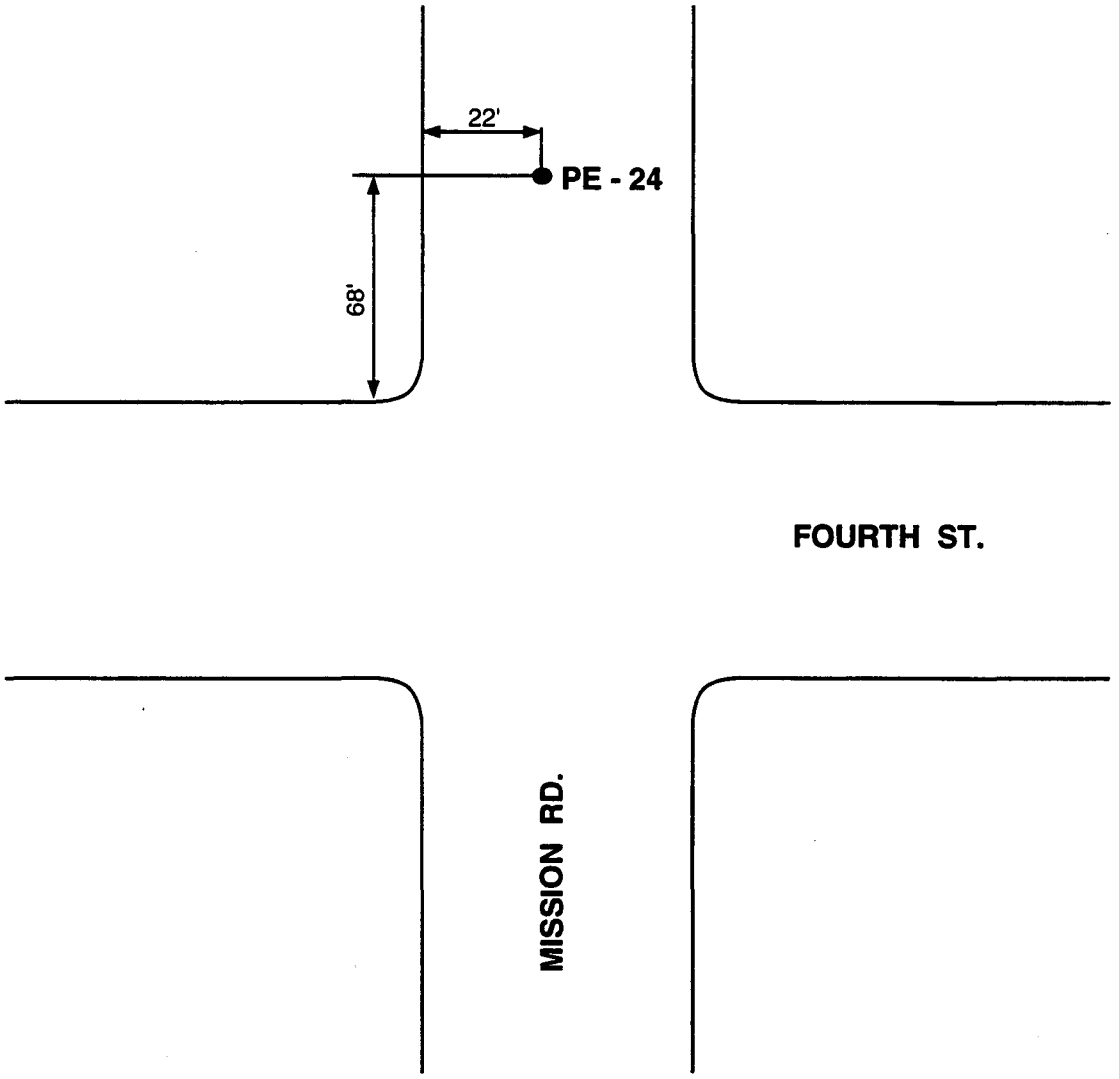
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-24	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
		SILTY SAND with GRAVEL; very dark gray, moist, very dense, fine-grained, trace medium-grained, nonplastic silt, subangular to subrounded gravel to 1" in size	SM	Qya	16	S	60 40/3"	5/9	--			1140
		[rig chatter at 82']										
		GRAVEL with SAND; medium dark gray, moist, very dense, rounded and angular gravel to 1-1/2" in size, fine- to coarse-grained sand, trace nonplastic silt	GP									
85					17	D	100/4"	< 1/4	7.5 [6.8]		5	1202
		Boring terminated at 85.3 feet. Possible groundwater at 60 feet below surface.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 24

1-94

Figure A -26

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-25**	Sheet **1** of **4**
Boring Location:	**Inside MTA yard**		Elevation and Datum(feet): **263 MSL**
Health and Safety:	**Level D**	Date Started: **12/6/93**	Date Finished: **12/7/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **86.0**	Depth to Bedrock(feet): **---**
Drilling Method:	**Mud Rotary**	Number of Samples: **17**	Depth to Water (feet): **72.3**
Boring Diameter:	**5 inches**	Completion Information: **Piezometer installed**	
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base, crushed rock		af								
		ALLUVIUM SILTY SAND; light olive brown to olive brown, moist to wet, loose to medium dense, fine- to medium-grained, nonplastic silt	SM	Qya								
5					1	D	8 9	7/12	4.7 [4.3]	96	18	0935
10		interval of SANDY SILT, olive brown, wet, soft, low plasticity, fine- to coarse-grained sand, subangular gravel to 1" in size	ML		2	S	1 2 2	3/18	5.1 [4.8]			0940
		SAND; light olive brown, moist, medium dense, fine- to coarse-grained, some subangular to subrounded gravel to 1-3/4" in size	SW									
15					3	D	11 12	--	7.1 [5.1]	119	13	0945
		[rig chatter], see next sheet	GP-GM / SP-SM									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-25	Sheet 2 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SILT and SAND/SAND with SILT and GRAVEL; light olive brown, moist to wet, dense, subrounded to angular gravel to 1-1/2" in size, fine- to coarse-grained sand, nonplastic silt	GP-GM / SP-SM	Qya	4	S	3 14 17	7/18	5.6 [5.4]			0955
25		decreased silt content, gravel to 3" in size, subangular gravel of 1" to 1-1/2" common			5	D	14 25	4/12	5.5 [5.5]		10	1010
30		wet, very dense, gravel to 1-1/2" in size			6	S	16 23 40	5/18	6.4 [5.6]			1025
		interval of SAND with GRAVEL, subrounded to subangular gravel to 1-1/4" in size	SW									
35		decreased sand content, GRAVEL with SILT and SAND, light olive brown, fine to coarse gravel to 2-1/4" in size	GP-GM		7	D	40 60/5"	4/11	--	125	11	1050
40					8	S	34 67/4"	6/10	6.5 [5.8]			1125
45		decreased silt content, GRAVEL and COBBLE with SAND, cobbles to 4" in size	GP		9	D	100/7"	3/7	--		9	1150
		boulder approximately 12" in size										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-25	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		GRAVEL and COBBLE with SAND; olive brown, wet, very dense, angular gravel to 1-1/2"in size, fine- to coarse-grained sand, trace nonplastic silt [resumed drilling at 0735 on 12/7/93]	GP	Qya	10	S	110/9"	7/9	4.8 [4.6]			1355
55		light olive brown to strong brown (iron oxide stained)			11	D	40 60	7/12	4.9 [4.8]	131	9	0820
		CLAY; light yellowish brown, wet, hard, low to medium plasticity, trace fine-grained sand, laminated, low angle laminations, slightly porous, increasing fine sand content with depth	CL									
60					12	S	7 14 20	12/18	5.4 [5.0]			0845
65		SILTY SAND/SANDY SILT; yellowish brown, wet, dense/hard, fine-grained sand, trace medium-grained sand, nonplastic silt	SM/ML		13	D	15 23	10/12	5.7 [5.1]	115	17	0905
		high gravel content										
70		interval of SAND with SILT, light olive brown, very dense, fine- to medium-grained, some biotite mica	SP-SM		14	S	33 70	10/12	6.4 [5.3]			0925
		SAND with GRAVEL; light olive brown to strong brown (iron oxide stained), wet, very dense, fine- to coarse-grained, fine to coarse subangular gravel to 1" in size	SP									
75					15	D	60 40/4"	6/10	6.1 [5.3]	111	18	0940
		SILT with SAND; see next sheet	ML									

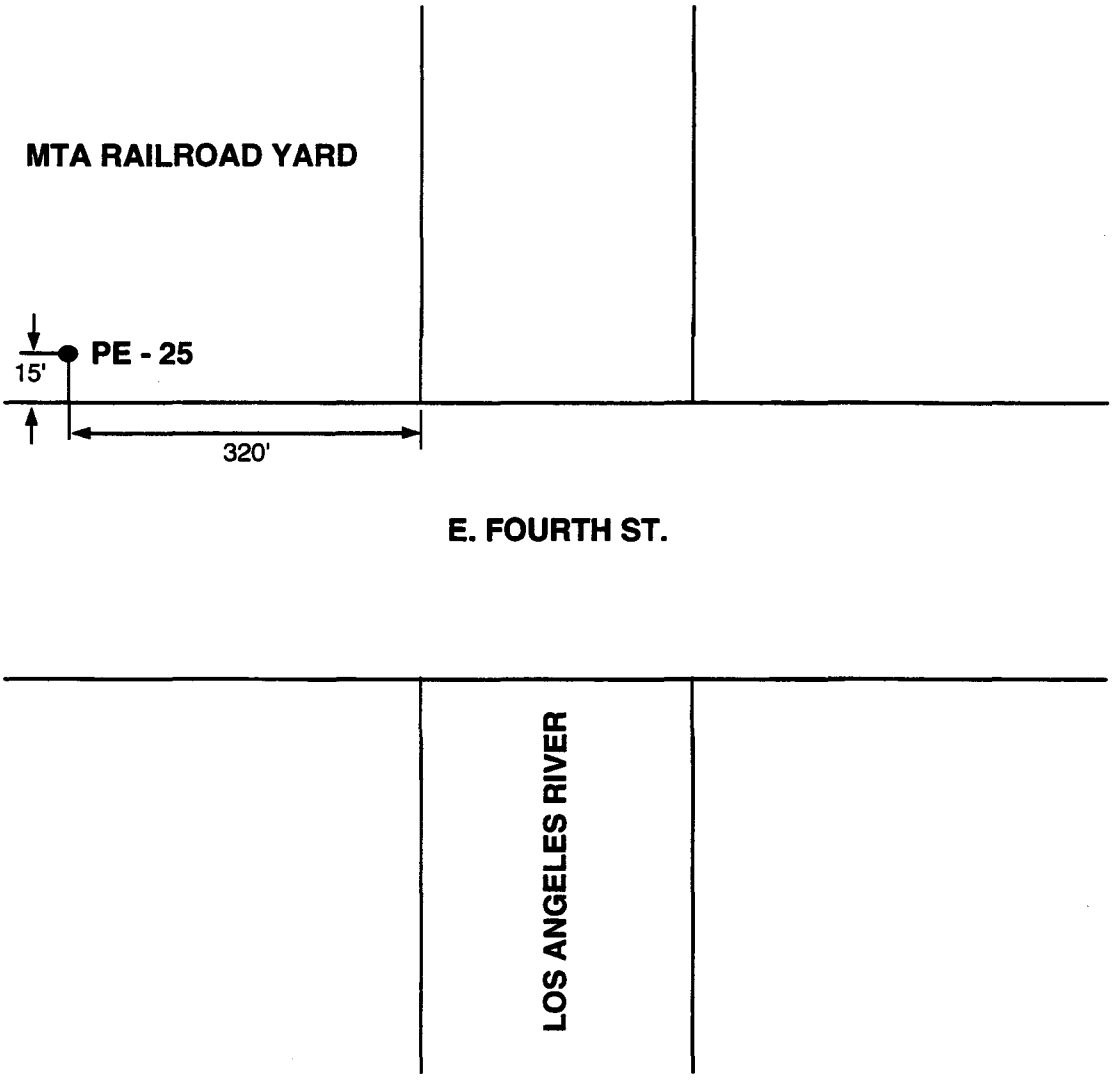
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-25	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILT WITH SAND; olive gray, wet, hard, nonplastic, fine-grained sand	ML	Qya	16	S	6 29 43	17/18	6.1 [5.4]			1000
85		increased silt content, very thinly laminated			17	D	30 67	7/12	5.9 [5.6]	105	21	1020
		Boring terminated at 86.0 feet. Groundwater measured on 1/11/94 at 72.3 feet below surface.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



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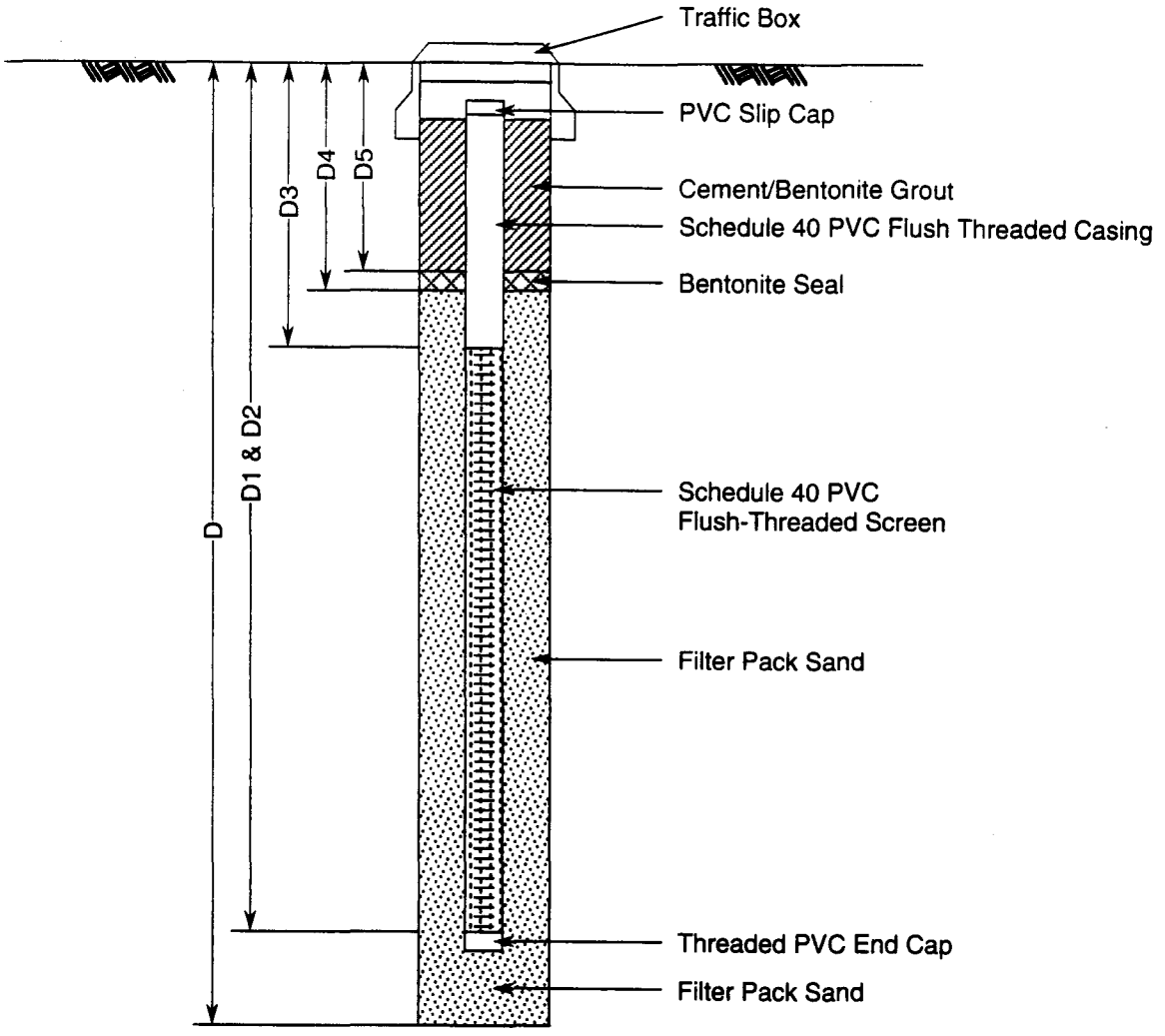
Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 25

1-94

Figure A -27A



Total Depth (D)	=	86	Feet
Total Depth of Casing (D1)	=	85	Feet
Depth to Bottom of Well Screen (D2)	=	85	Feet
Depth to Top of Well Screen (D3)	=	25	Feet
Depth to Bottom of Top Seal (D4)	=	22.5	Feet
Depth to Top of Top Seal (D5)	=	18.5	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic PE-25

2-94

Figure A-29B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-26**	Sheet **1** of **4**
Boring Location:	**Inside MTA yard**	Elevation and Datum(feet):	**262 MSL**
Health and Safety:	**Level D**	Date Started: **12/6/93**	Date Finished: **12/7/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **85.4**	Depth to Bedrock(feet): **85**
Drilling Method:	**Mud Rotary**	Number of Samples: **13**	Depth to possible Water (feet): **80**
Boring Diameter:	**5 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
5		**FILL** SAND with SILT and GRAVEL; olive brown, moist, fine- to coarse-grained, nonplastic silt, some rounded to subangular gravel to 3" in size and cobbles	SP-SM	af								
		[continuous rig chatter from 5' to 9'], shells and brick fragments			1	B			4.6 [4.4]			0935
10		**ALLUVIUM** SANDY SILT with GRAVEL; very dark gray, moist, very stiff, nonplastic, fine-grained sand, gravel to 3" in size and cobbles	ML	Qya	2	D	25 15	3/12	4.5 [4.2]		14	1100
15		SAND with SILT and GRAVEL; dark gray, moist, loose, fine- to coarse-grained, nonplastic silt, rounded to subangular gravel to 1" in size	SP-SM		3	S	4 5 4	2/18	4.8 [4.8]			1120
		high gravel content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-26	Sheet 2 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SAND with SILT; brown, moist to wet, very dense, fine- to coarse-grained, nonplastic silt, some angular to subrounded gravel to 1" in size	SP-SM	Qya	4	D	50	3/6	4.7 [4.6]		18	1130
25		GRAVEL with SILT and SAND; brown mixed with light gray to dark gray, moist, very dense, gravel to 1-1/2" in size, nonplastic silt, fine- to coarse-grained sand [strong rig chatter at 27']	GP-GM		5	S	30 60	4/12	5.0 [4.8]			1150
30		interval of SILTY SAND, dark olive brown medium- to coarse-grained sand	SM GP-GM		6	D	30 50/3"	8/9	4.9 [4.8]	115	12	1215
35		[constant rig chatter]										
		[bit change at 36']										
		[extremely slow drilling], possible cobbles										
40					7	B						1305
45						D	100/1"	0/1				1405
		[up to 3/4" fragments of cemented gravel and sand in cuttings, possible concrete]										
		[resumed drilling at 0730 on 12/7/93]										1600

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

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Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-26** | Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SILT and SAND; dark olive brown, moist, very dense, rounded to subangular gravel to 1" in size, medium- to coarse-grained sand, possible cobbles	GP-GM	Qya								0820
		[slow drilling]										
					8	B						0845
		[hole caved while attempting to sample]										
55		[smooth drilling]										
		CLAY with SAND; olive brown, moist, hard, low plasticity, fine-grained sand	CL									
					9	D	27 73/5"	10/11	4.0 [3.6]	102	23	1015
60												
		mottled with light gray			10	S	19 68	10/12	4.0 [3.6]			1107
65												
		[rig chatter], high gravel content										
		trace medium- to coarse-grained sand										
70		iron oxide staining, increased sand content			11	D	29 55/5"	8/11	4.0 [3.6]	100	27	1130
75		GRAVEL with SAND; olive, coarse-grained sand, possible cobbles	GP			S	67	0/6	4.0 [3.6]			1153

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

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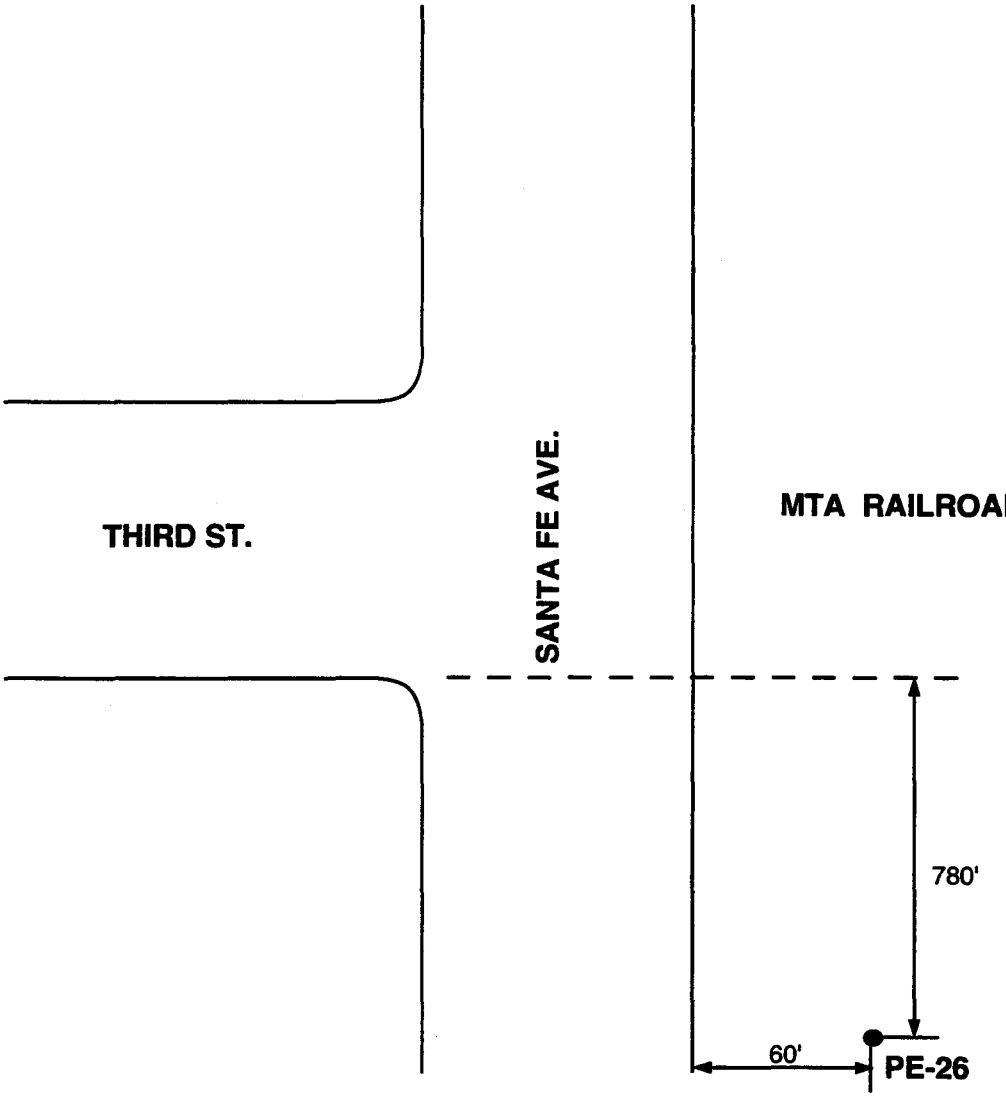
Project Name:	Metro Rail: Eastside Extension - Metro Red Line																
Project Number:	94-1100	Boring Number:	PE-26													Sheet 4 of 4	
Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples												Drilling Time
					Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]		Dry Density (pcf)	Moisture Content (%)					
		SILTY SAND; olive, wet, very dense, fine- to medium-grained, trace coarse-grained	SM	Qya	12	D	100/5"	4/5	4.0 [3.8]		105	19					1220
85		**FERNANDO/PUENTE FORMATION** CLAYSTONE; dark olive brown, moist, soft rock, horizontal bedding, moderately weathered	CL	Tf/Tp	13	D	90/5"	5/5	4.0 [3.8]		106	22					–
		Boring terminated at 85.4 feet. Possible groundwater at 80 feet below surface.															
90																	
95																	
100																	
105																	

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE-26

1-94

Figure A -28

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-27**	Sheet **1** of **4**
Boring Location:	**Banning/Santa Fe**		Elevation and Datum(feet): **269 MSL**
Health and Safety:	**Level D**	Date Started: **12/8/93**	Date Finished: **12/8/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **81.5**	Depth to Bedrock(feet): **50**
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): **---**
Boring Diameter:	**5 inches**	Completion Information: **Grouted to surface**	
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete and base		af								
		ALLUVIUM SAND with SILT; olive brown, moist, loose, fine-grained, trace medium-grained, nonplastic silt	SP-SM	Qya								
5					1	D	4 3	8/12	7.0 [7.0]	99	10	0700
		GRAVEL with SILT and SAND/SAND with SILT and GRAVEL; light olive brown, moist, medium dense, subangular to subrounded gravel to 1-1/4" in size, nonplastic silt, fine- to coarse-grained sand	GP-GM / SP-SM									
10					2	S	2 10 12	8/18	7.0 [7.0]			0705
15		decreased silt and sand content, GRAVEL with SAND, dense, gravel to 2-1/2" in size	GP/GW		3	D	18 30	6/12	8.5 [7.0]		2	0715

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

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Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **PE-27** | Sheet 2 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SAND; light olive brown, moist, dense, gravel to 1-1/2" in size, fine- to coarse-grained sand, trace nonplastic silt, trace cobbles suggested by 2" angular fragments in cuttings, 1/4" to 1-1/4" rounded gravel common	GP/GW	Qya	4	S	11 14 26	3/18	7.5 [7.0]			0740
25		gravel to 1-1/2" in size			5	D	20 35	5/12	8.0 [7.0]	121	10	0755
30		light olive brown to dark yellowish brown, very dense			6	S	15 26 30	6/18	8.0 [7.0]			0810
35		interbedded sand layers to 4" thick, fine- to medium-grained sand, coarse gravel to 3" with few cobbles			7	D	30 45	6/12	8.0 [7.0]	123	10	0840
40		grayish brown			8	S	50/4"	3/4	7.5 [7.0]			0900
45		SAND with GRAVEL/GRAVEL with SAND; dark greenish gray, wet, very dense, fine- to coarse-grained sand, subrounded to subangular gravel to 2-1/2" in size	SW/GW		9	D	100	3/6	11 [7.0]		11	–

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

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Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-27	Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		FERNANDO/PUENTE FORMATION SILTSTONE; dark olive gray, wet, soft rock, low to medium plasticity, trace fine-grained sand, 1-1/2" rounded clast in siltstone, thinly laminated, fossiliferous, slightly weathered to fresh, laminations inclined at low angles generally less than 10 degrees	ML	Tf/Tp	10	S	6 12 20	2/18	7.0 [7.0]			0950
55					11	D	20 30	12/12	9.0 [7.0]		26	1010
60					12	S	8 12 17	11/18	8.0 [7.0]			1022
65					13	D	20 35	12/12	10 [7.0]		25	1040
70		dark olive brown, slightly weathered			14	S	9 23 28	1/18	7.0 [7.0]			1050
75					15	D	20 25	12/12	7.0 [7.0]		25	1105

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

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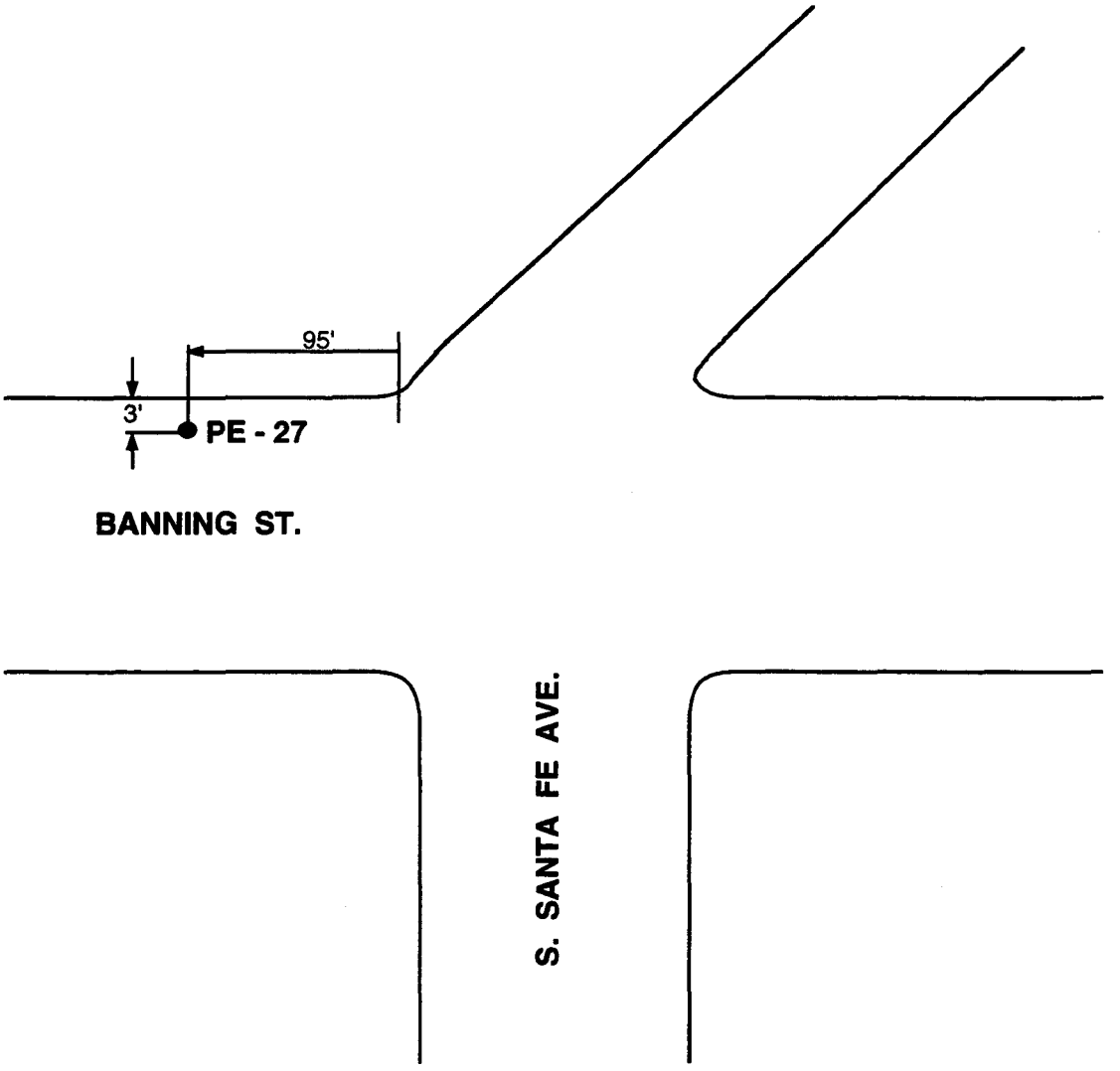
Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** Boring Number: **PE-27** Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
	▤	SILTSTONE; dark olive brown	ML	**Tf/Tp**		S	8 20 27	0/18				1120
		Boring terminated at 81.5 feet. Groundwater was not apparent.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring PE - 27

1-94

Figure A -29

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-28**	Sheet **1** of **4**
Boring Location:	**Vignes/Temple**		Elevation and Datum(feet): **270 MSL**
Health and Safety:	**Level D**	Date Started: **12/8/93**	Date Finished: **12/8/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **80.9**	Depth to Bedrock(feet): **45**
Drilling Method:	**Mud Rotary**	Number of Samples: **16**	Depth to Water (feet): **---**
Boring Diameter:	**5 inches**	Completion Information: **Grouted to surface**	
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 3" and base to 12"		af								
		ALLUVIUM SILTY SAND/CLAYEY SAND; dark brown, moist, very loose, fine- to coarse-grained, low plasticity, some rounded gravel to 3/4" in size	SM/SC	Qya								
5					1	D	1 2	9/12	6.5 [6.5]	101	22	0758
		GRAVEL with SAND; white to light brown, moist, dense, gravel to 2" in size, fine- to coarse-grained sand, trace nonplastic silt	GW									
10					2	S	16 23 23	4/18	6.5 [6.5]			0815
		rounded to subangular gravel to 1" in size										
15		SAND with GRAVEL; yellowish brown, moist, very dense, fine- to coarse-grained, rounded to subangular gravel to 1-1/2" in size, trace nonplastic silt	SP		3	D	20 45	7/12	6.5 [6.5]	130	9	0837

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-28	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		GRAVEL with SAND; yellowish brown, moist, mostly subangular to angular gravel, some rounded gravel, trace coarse-grained sand	GW	Qya	4	B						0845
25		SAND with SILT; dark olive brown, moist, very dense, fine- to coarse-grained, nonplastic silt, trace fine gravel to 1/4" in size	SP-SM		5	S	23 50/ 5.5"	6/11.5	6.5 [6.5]			0900
		gravel to 1/2" in size										
		decreased silt content, SAND, dark grayish brown, moist to wet, trace rounded gravel to 1" in size	SP									
30		[strong rig chatter at 31'], possible cobble to 10 " in size			6	D	50 50/4"	5/10	6.5 [6.5]	116	15	0920
		GRAVEL with SAND; moist, gravel to 1" in size, coarse-grained sand	GW/GP									
35					7	B	50/1"	0/1	6.5 [6.5]			0950
		[strong rig chatter]										
40		large cobbles to 10" in size, possible boulders to 36" in size			8	B						1015
45		**FERNANDO/PUENTE FORMATION** CLAYSTONE; dark olive, moist, soft to moderately hard rock, medium plasticity, laminated, layers of cemented claystone to 1/2" thick causing rig chatter, laminations possibly inclined 45 degrees, fresh, strong sulfur odor	CL/CH	Tf/Tp	9	D	40 40	7/12	21.5 [6.5]	92	32	1120

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-28	Sheet 3 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTSTONE; dark olive, moist, soft to moderately hard rock, low plasticity, trace fine-grained sand, laminated, layers of cemented siltstone to 1/2" thick causing rig chatter, fresh, strong sulfur odor	ML	Tf/Tp	10	S	50	0/6	21.5 [6.5]			1215
55		no odor, increased plasticity			11	D	30 40	10/12	21.5 [6.5]	100	26	1235
		SANDY CLAYSTONE; yellowish brown, moist, soft to moderately hard rock, medium plasticity, fine- to coarse-grained sand, with cemeted intervals and beds present	CL									
		[violent rig chatter from 59' to 63.5'], cemented beds to 1/2" thick, moderately hard to hard rock				S	50/3"	0/3				1253
60					12	B			16.5 [6.5]			1310
65		decreased sand content, CLAYSTONE; dark olive, soft rock, massive, no obvious bedding, fresh			13	D	80	6/6	26.5 [6.5]	103	22	1330
70		scattered fossils, (bi-valves, gastropods)			14	S	28 50	8/12	36.5 [6.5]			1350
75					15	D	70	4/6	110 [6.5]	101	24	1420

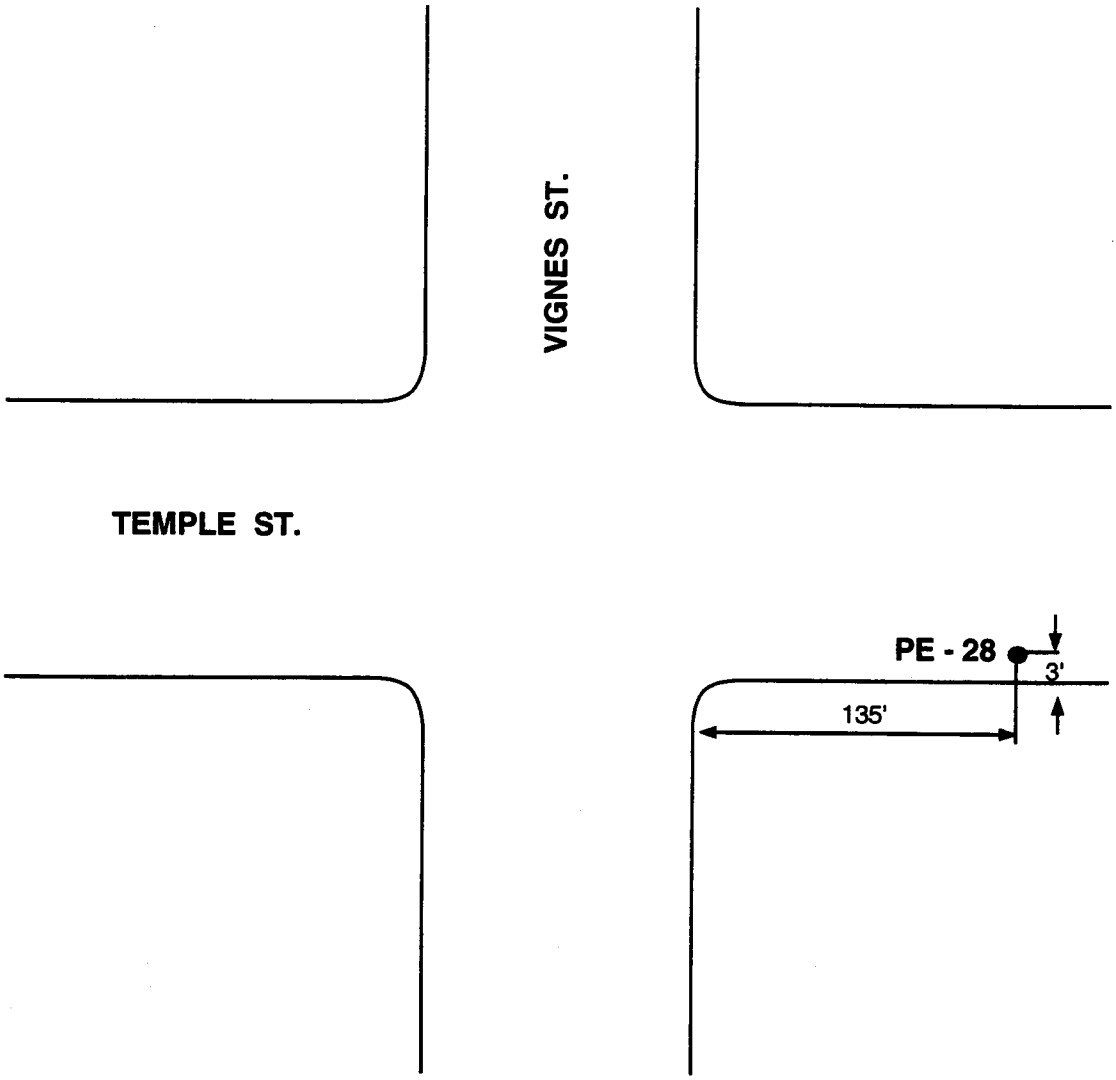
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-28	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYSTONE; dark olive, moist, soft rock, medium plasticity, trace fine-grained sand, massive, no obvious bedding, no fossils, fresh	CL	Tf/Tp	16	S	38 60/5"	8/11	110 [6.5]			1446
		Boring terminated at 80.9 feet. Groundwater was not apparent.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 28

1-94

Figure A -30

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-29**	Sheet **1** of **4**
Boring Location:	**Vignes/Ducommun**	Elevation and Datum(feet):	**270 MSL**
Health and Safety:	**Level D**	Date Started: **12/9/93**	Date Finished: **12/10/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **82.0**	Depth to Bedrock(feet): **70**
Drilling Method:	**Mud Rotary**	Number of Samples: **16**	Depth to Water (feet): **35.0**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed, converted to monitoring well**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
	FILL Asphaltic concrete and base, mostly subangular 3/4" gravel [relocated twice, encountered concrete at two locations at 18"]		af								
	SILTY SAND; olive brown, moist to wet, medium dense, fine- to coarse-grained, trace fine subrounded gravel, asphalt chunks	SM									
5				1	D	11 17	8/12	8.0 [7.0]	106	18	0750
	[rig chatter at 6'], gravel to 3" in size, brick and mortar fragments, asphalt chunks	GW									
	ALLUVIUM SILTY SAND; olive brown to dark yellowish brown, moist, medium dense, fine- to coarse-grained, some fine to coarse subangular gravel to 1-1/2" in size	SM	Qya								
10				2	S	2 6 8	6/18	7.5 [7.0]			0845
	[black film on surface of mud tank]										
	[due to deviation of drill rod in third hole, started new hole] [samples beyond 15' are from fourth hole] GRAVEL; dark yellowish brown to light olive brown, moist, medium dense, angular to subrounded, fine to coarse, to 3" in size, some fine- to coarse-grained sand, trace silt	GP/GW									
15				3	D	11 15	4/12	8.0 [7.0]		5	0935
	increased sand content										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-29	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SAND; dark yellowish brown to light olive brown, moist to wet, very dense, subangular to angular gravel to 2" in size, fine- to coarse-grained sand, trace nonplastic silt	GP/GW	Qya	4	S	12 27 35	6/18	7.5 [7.0]			1000
		interval of light olive brown SAND from 20.7'to 21.5', fine- to medium-grained, with very thin silt interbeds, some gravel to 2" in size										
25					5	D	20 80/3"	2/9	7.5 [7.0]			1025
		[easier drilling], increased sand, less gravel										
30		boulders, 1-1/2" to 2" subrounded to subangular gravel										
		interval of SAND with SILT and GRAVEL, dark gray, wet, subrounded to subangular gravel to 1-1/4" in size, sulfur odor	SP-SM		6	S	37 60/5"	5/11	10 [7.0]			1300
		dark gray, trace silt, cobbles to 6" in size	GP									
35					7	D	60 40/4"	3/10	80 [7.0]	128	7	1345
		small cobbles common at 38', sulfur odor										
40					8	S	40 60	7/12	20 [7.0]			1430
		[resumed drilling on 12/10/93]										
		increased silt content, GRAVEL with SILT and SAND, dark greenish gray, with thin layers of silty clay of medium plasticity, subrounded gravel to 3", strong sulfur odor	GP-GM									
45					9	D	25 30	5/12	150 [4.6]	124	9	0715
		interval of CLAYEY SILT	ML/CL									
		decreased silt content, GRAVEL with SAND, dark gray, trace silt	GP									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line																				
Project Number:	94-1100	Boring Number:	PE-29																Sheet 3 of 4		

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples							Drilling Time
					Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	
		GRAVEL with SAND; dark gray, wet, very dense, trace silt, cobbly	GP	Qya	10	S	100	0/6	14 [5.0]			0740
		interval of SILT	ML									
		[rig chatter]	GP-GM									
55		increased silt content, GRAVEL with SILT and SAND, angular to subangular gravel to 1" in size, nonplastic silt, fine- to coarse-grained sand, strong sulfur odor			11	D	100/4"	1/4	70 [5.0]	98	9	0755
60												
		SAND with SILT and GRAVEL/GRAVEL with SILT and SAND; dark greenish gray, wet, very dense, fine- to coarse-grained sand, predominantly medium-grained sand, nonplastic silt, angular to subrounded gravel to 1-1/4" in size, some thin silt layers, some 3" gravel, strong sulfur odor	SW-SM / GP-GM		12	S	37 51 20/2"	12/14	80 [4.6]			0820
65					13	D	40 60/5"	8/11	60 [7.6]	125	12	0845
70		**FERNANDO/PUENTE FORMATION** CLAYSTONE; dark olive gray, wet, soft rock, medium to high plasticity, very thinly laminated with variable dips (cross-laminations), calcareous fossiliferous (possible shell fragments), fresh, trace fine-grained sand, strong sulfur odor	CH	Tf/Tp	14	S	36 35 23	15/18	410 [7.6]			0915
75		low angle laminations, less than 20 degrees			15	D	20 25	12/12	780 [9.5]		31	0935

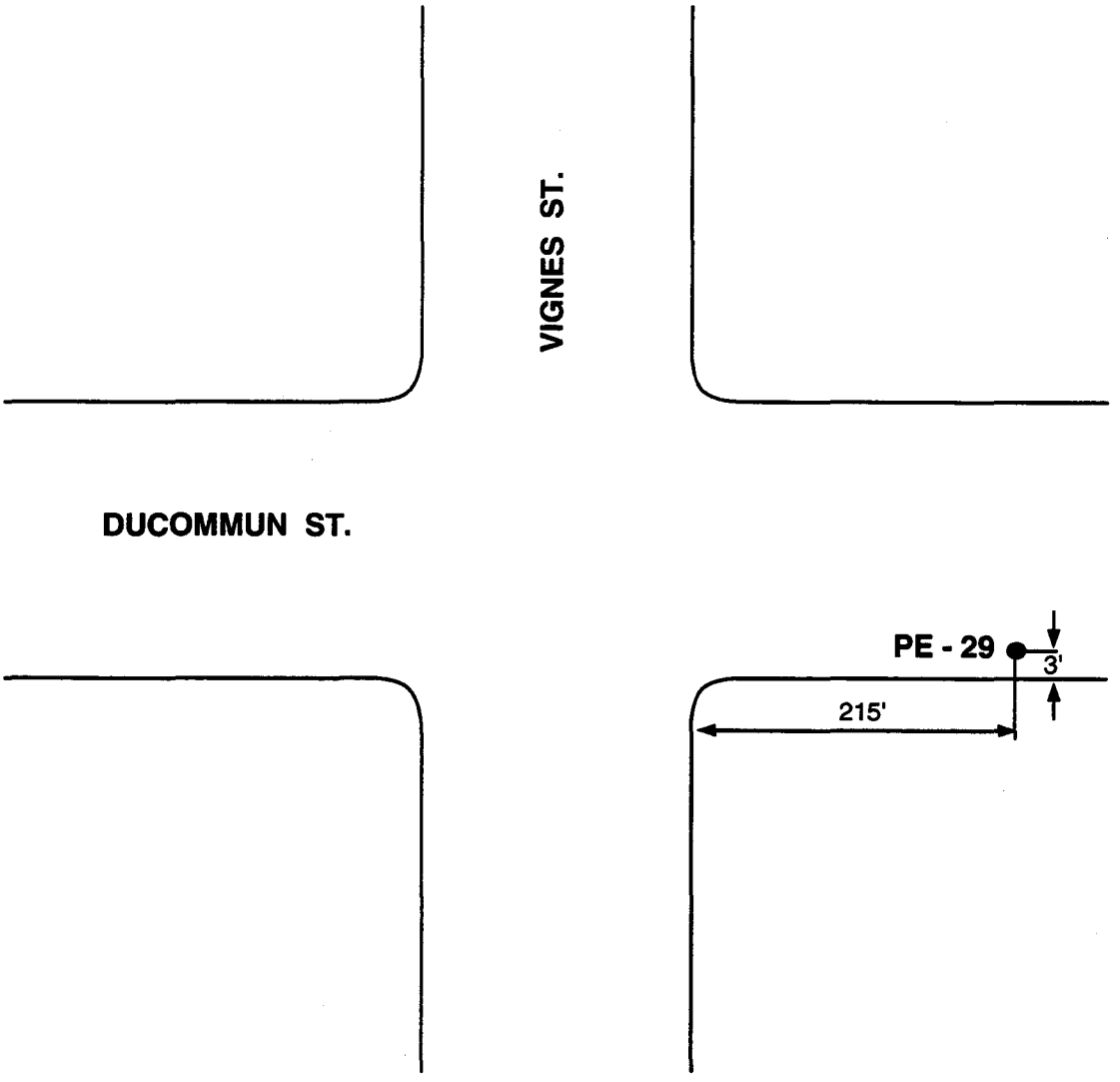
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-29	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYSTONE; dark olive gray, wet, soft rock, medium to high plasticity, fresh	CH	Tf/Tp	16	S	23 28 31	18/18	950 [9.5]			--
		Boring terminated at 82.0 feet. Groundwater measured on 1/11/94 at 35.0 feet below surface.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

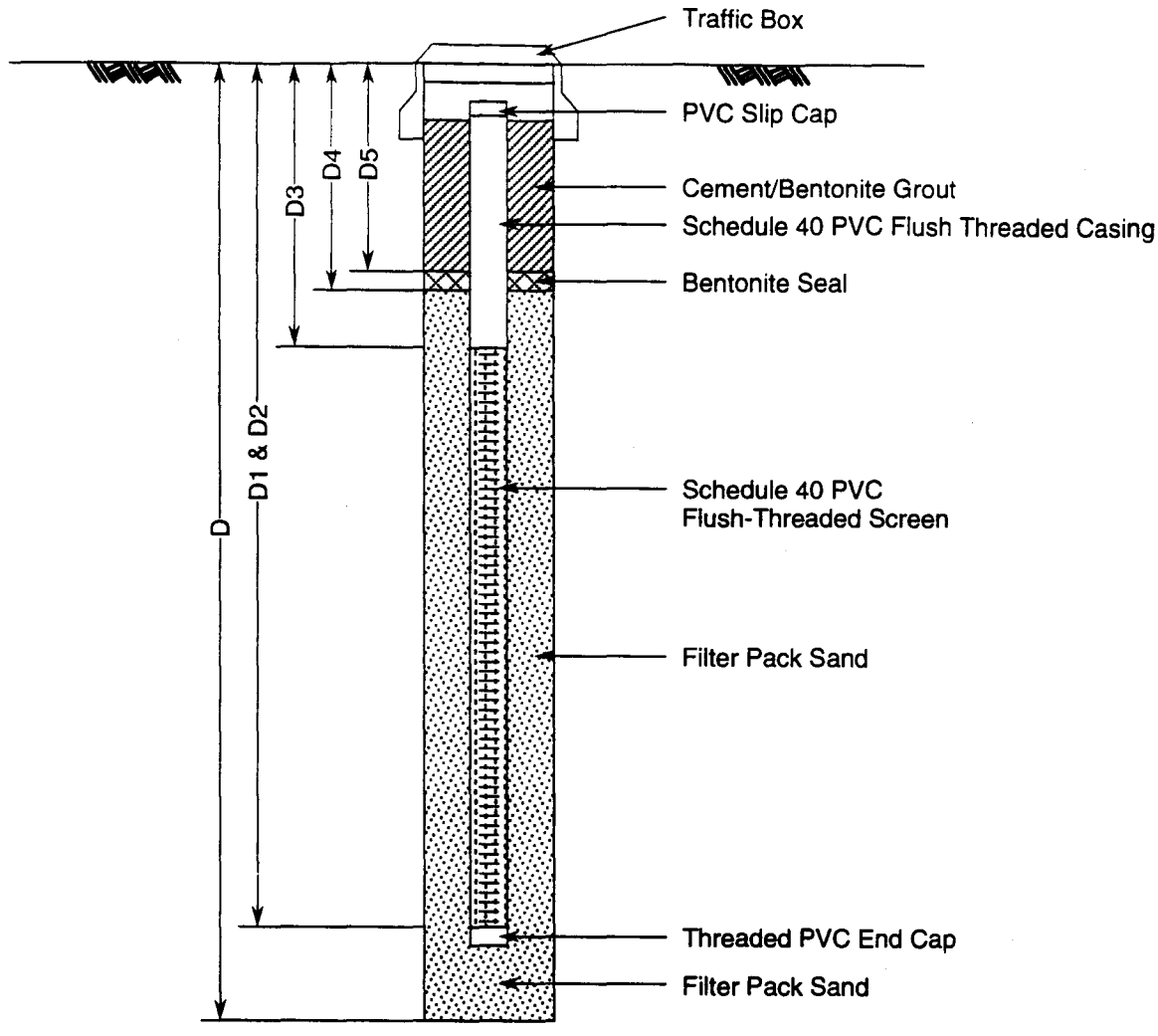
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 29

1-94

Figure A -31A



Total Depth (D)	=	82	Feet
Total Depth of Casing (D1)	=	80	Feet
Depth to Bottom of Well Screen (D2)	=	80	Feet
Depth to Top of Well Screen (D3)	=	20	Feet
Depth to Bottom of Top Seal (D4)	=	17.5	Feet
Depth to Top of Top Seal (D5)	=	13.7	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-29

2-94

Figure A-31B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-30**	Sheet **1** of **4**
Boring Location:	**Vignes/Commercial**	Elevation and Datum(feet): **275 MSL**	
Health and Safety:	**Level D**	Date Started: **12/9/93**	Date Finished: **12/10/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **80.8**	Depth to Bedrock(feet): **73.5**
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): **36.5**
Boring Diameter:	**5 inches**	Completion Information: **Piezometer installed, converted to monitoring well**	
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 300-lb and 18-inch drop.**		Logged By: **Hossein Rashidi**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 2" and brick pavement to 12"	GP	af								
		GRAVEL [abandoned 2" pipe at 2' below surface]	SM/GM									
		SAND, SILT, and GRAVEL fill										
5		piece of concrete 2-3" in size in shoe and gravel on screen			1	D B	5 7	0/12	5.6 [5.6]			0820
		ALLUVIUM SAND with SILT and GRAVEL/GRAVEL with SILT and SAND; light yellowish brown, moist, medium dense, fine- to coarse-grained sand, rounded to subangular gravel to 1-1/2" in size	SP-SM / GP-GM	Qya	2	S	7 11 11	4/18	8.4 [7.0]			0845
15		increased gravel content, to 2" in size			3	D	12 26	6/12	--			0920

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-30	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SAND with SILT and GRAVEL/GRAVEL with SILT and SAND; light yellowish brown, moist, medium dense, fine- to medium-grained sand, trace coarse-grained sand, rounded to subangular coarse gravel to 1-1/2" in size [moderate rig chatter]	SP-SM / GP-GM	Qya								0927
25		GRAVEL with SILT and SAND; olive yellow, moist, very dense, subangular to subrounded gravel to 1" in size, nonplastic silt, fine- to coarse-grained sand	GP-GM		4	S	28 20/2"	4/8	9.6 [7.0]			0950
30		SAND; dark gray, moist to wet, very dense, mostly coarse-grained, some medium-grained and fine gravel, sulfur odor	SP		5	D	70/5"	3/5	7.5 [7.5]			1005
35		[extremely slow drilling], cobbles to possibly 12" in size	GP		6	B			15 [8.0]			1020
40					7	B			8.0 [8.0]			1220
45		GRAVEL with SILT and SAND; dark bluish gray, moist to wet, very dense, rounded to subangular gravel to 1-1/2" in size, nonplastic silt, fine- to coarse-grained sand, sulfur odor	GW-GM		8	B			12 [7.5]			1254

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-30	Sheet 3	of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SILT and SAND; dark bluish gray, moist to wet, very dense, rounded to subangular gravel to 1-1/2" in size, nonplastic silt, fine- to coarse-grained sand, strong sulfur odor	GW-GM	Qya	9	D	73	4/6	100 [7.0]		16	1315
55					10	S	50/5.5"	3/5.5	20 [8.5]			1340
		[strong rig chatter]										
60												1415
65					11	B			14 [8.5]			1430
		6" to 8" cobble, cobbly to 73.5'										
70					12	B			30 [9.5]			1445
		[resumed drilling on 12/10/93]										1530
		FERNANDO/PUENTE FORMATION CLAYSTONE/SILTSTONE; dark olive, moist, soft rock, medium to high plasticity, trace medium- to coarse-grained sand, massive, vertical bedding, fresh, sulfur odor	CH/MH	Tf/Tp	13	B			55 [7.8]			0855
75					14	S	17 29	10/12	220 [7.8]			0930

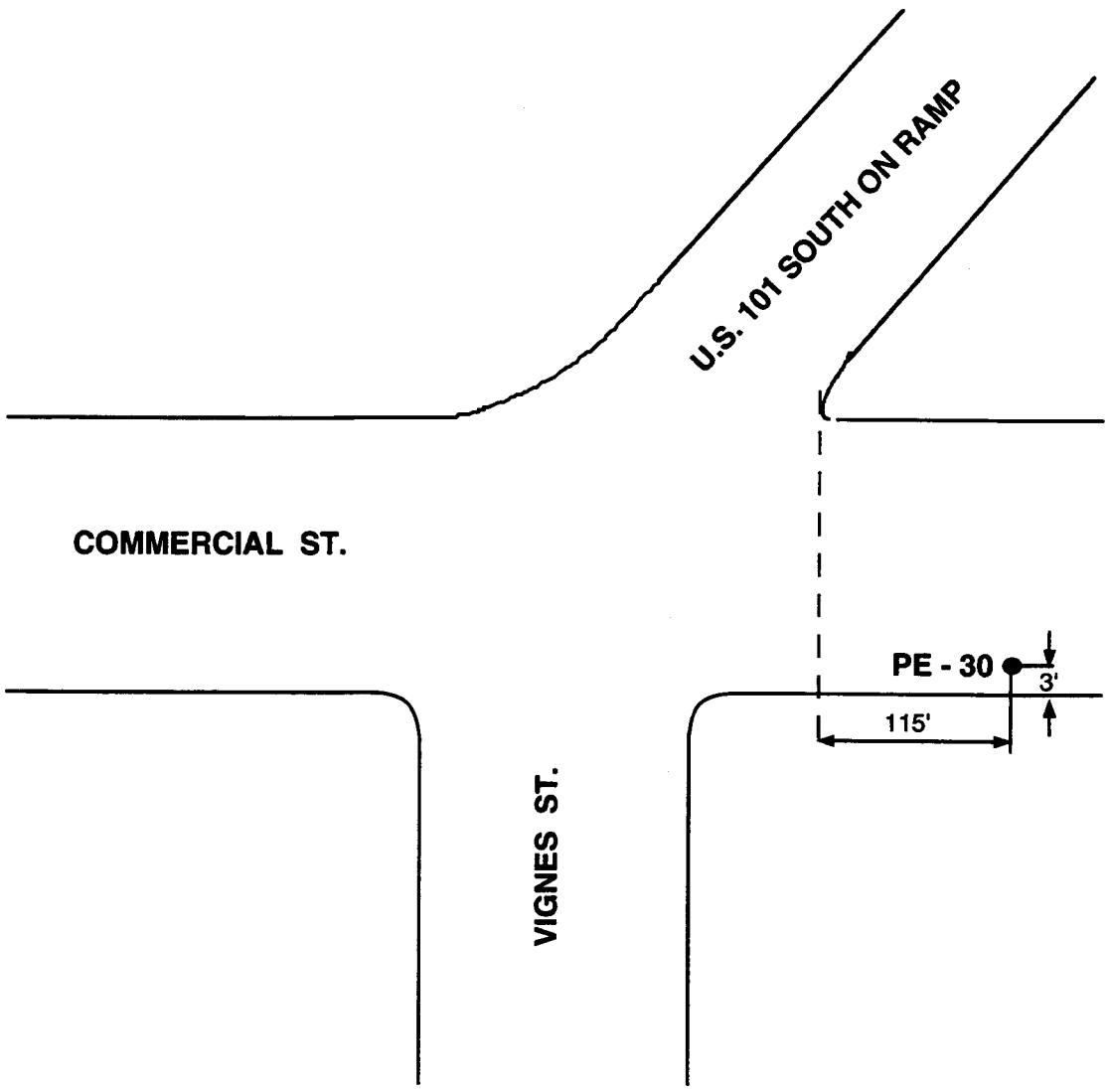
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-30	Sheet 4	of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
		CLAYSTONE/SILTSTONE; dark olive, moist, soft rock, medium to high plasticity, massive, no obvious bedding, fresh, sulfur odor	CH/MH	Tf/Tp	15	S	33 50/3"	9/9	>1000 [7.8]			0953
		Boring terminated at 80.8 feet. Groundwater measured on 1/11/94 at 36.5 feet below surface.										
85												
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

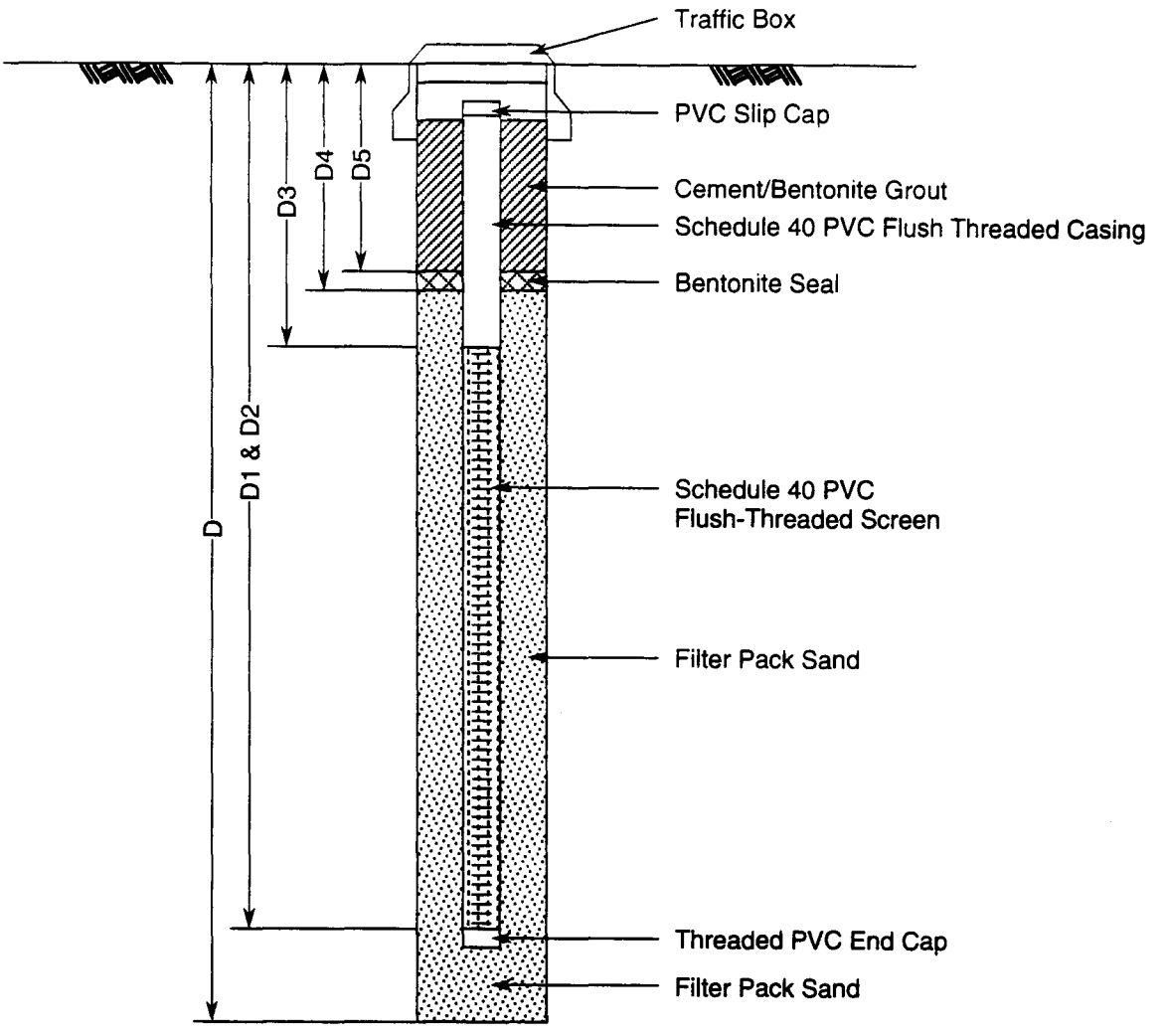
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
PE - 30

1-94

Figure A -32A



Total Depth (D)	=	80.8	Feet
Total Depth of Casing (D1)	=	78	Feet
Depth to Bottom of Well Screen (D2)	=	78	Feet
Depth to Top of Well Screen (D3)	=	17.5	Feet
Depth to Bottom of Top Seal (D4)	=	17	Feet
Depth to Top of Top Seal (D5)	=	14	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-30

2-94

Figure A-32B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **PE-31**	Sheet **1** of **4**
Boring Location:	**Jackson cul-de-sac**	Elevation and Datum(feet):	**270 MSL**
Health and Safety:	**Level D**	Date Started: **12/13/93**	Date Finished: **12/13/93**
Drilling Equipment:	**Mayhew 1000**	Total Depth (feet): **83.0**	Depth to Bedrock(feet): **73**
Drilling Method:	**Mud Rotary**	Number of Samples: **15**	Depth to Water (feet): **38.3**
Boring Diameter:	**5 inches**	Completion Information:	**Piezometer installed, converted to monitoring well**
Hammer Information: **SPT Hammer: 140-lb and 30-inch drop. Downhole Hammer: 400-lb and 18-inch drop.**		Logged By: **Greg Renfrew**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		FILL Asphaltic concrete to 5" and base		af								
		ALLUVIUM SILTY SAND; dark yellowish brown, moist, medium dense, fine- to medium-grained, trace clay, some gravel	SM	Qya								
5		SAND with GRAVEL; light olive brown, moist, medium dense, fine- to coarse-grained, possibly angular to subrounded gravel between 4' and 5'	SP		1	D	5 6	8/12	5.4 [5.0]	90	15	0655
10		GRAVEL with SAND/SAND with GRAVEL; yellowish brown, moist, medium dense, fine to coarse angular to mostly subangular gravel to 2-1/2" in size, fine- to coarse-grained sand, trace nonplastic silt	GP/SP		2	S	7 8 12	4/18	5.6 [5.2]			0700
15		strong brown (iron oxide stained)			3	D	17 18	6/12	6.2 [5.2]	122	11	0708

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-31	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		GRAVEL with SAND/SAND with GRAVEL; yellowish brown, moist, medium dense, fine to coarse subrounded to subangular gravel to 2-1/2" in size, fine- to coarse-grained sand, trace nonplastic silt	GP/SP	Qya	4	S	14 15 11	2.5/18	6.6 [5.4]			0720
25		moist to wet, dense			5	D	20 45	8/12	7.0 [5.4]		25	0735
30		very dense			6	S	3 31 35	7/18	10 [5.4]			0750
		[hard drilling] dark gray, wet, cobbles from 6" to 12" in size, gravel commonly from 1-1/2" to 3" in size, strong hydrocarbon odor										
35					7	D	50/5"	4/5	74 [5.8]		9	0825
40		moderate hydrocarbon odor			8	S	27 57 18/1"	3/13	10 [7.2]			0850
45					9	D	100	3/6	10 [5.4]	119	13	0920
		4" cobble										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: PE-31	Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./6 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		GRAVEL with SAND/SAND with SILT and GRAVEL; dark greenish gray, wet, very dense, fine to coarse subangular to subrounded gravel to 2" in size, fine- to coarse-grained sand, nonplastic silt, strong hydrocarbon odor	GP/SP-SM	Qya	10	S	14 34 35	6/18	10 [6.6]			0940
		interval of SILTY SAND, fine- to medium-grained, strong sulfur odor	SM									
55					11	D	35 40	8/12	20 [5.4]	111	17	1010
		SANDY CLAYEY SILT; dark greenish gray, wet, hard, medium plasticity, fine- to coarse-grained sand, trace subangular fine gravel	ML/CL									
60					12	S	21 45 33/3"	0/15	25 [7.2]			1035
		SANDY SILT/SILTY SAND/SAND; dark greenish gray, wet, hard/very dense, silt shows very thin laminations, low to medium plasticity, fine-grained sand, strong sulfur odor	ML/SM/SP									
65					13	D	18 20	9/12	280 [10]	100	27	1050
70		interval of SILTY GRAVEL, gray, fine to coarse to 1" in size	GM									
		FERNANDO/PUENTE FORMATION CLAYEY SILTSTONE; dark olive gray, moist to wet, soft rock, medium plasticity, very thinly laminated, inclined about 40 degrees to low angles at 80 feet, moderate to highly calcareous, fresh, weak sulfur odor, trace fine-grained sand, fossil shell fragments	ML/CL	Tf/Tp								
75					14	S	10 20 30	9/18	320 [6.0]			1130

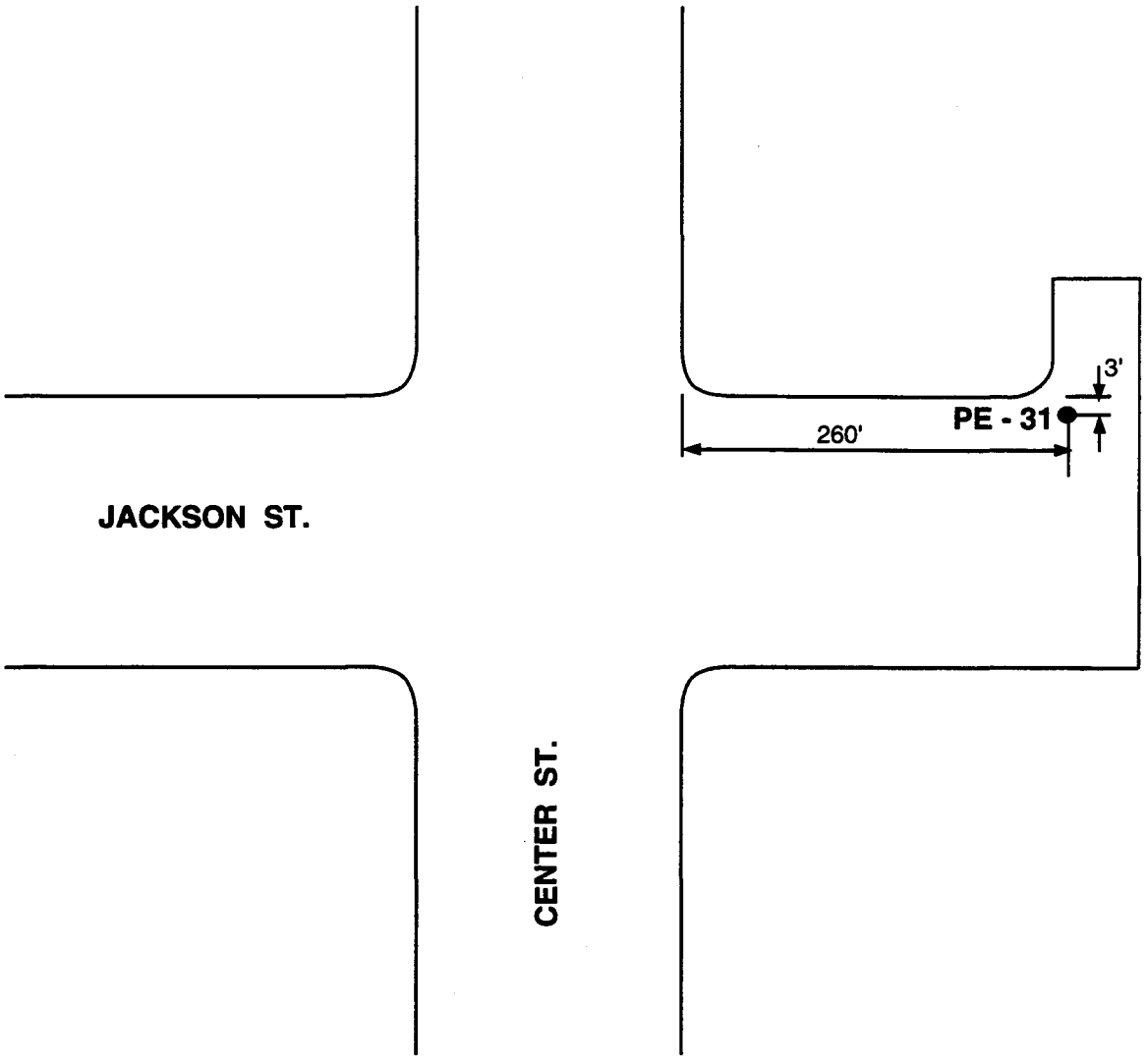
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	PE-31	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./6 inches)	Samples: Recovery (inches/inches)	Samples: OVA (ppm) [Background]	Samples: Dry Density (pcf)	Samples: Moisture Content (%)	Drilling Time
		CLAYEY SILTSTONE; dark olive gray, moist to wet, soft rock, medium plasticity, very thinly laminated, inclined at low angles at 80 feet, moderate to highly calcareous, weak sulfur odor, trace fine-grained sand, fresh, fossil shell fragments	ML/CL	Tf/Tp	15	S	11 29 30	10/18	680 [10]			1145
		Boring terminated at 83.0 feet.										
		Groundwater measured on 1/11/94 at 38.3 feet below surface.										
85		Note: Adjacent cut exposes occasional large cobbles (to 12") about 10 feet below street level.										
90												
95												
100												
105												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent approximate boundaries between subsurface material types and the transitions may be gradual.



North

Not to Scale

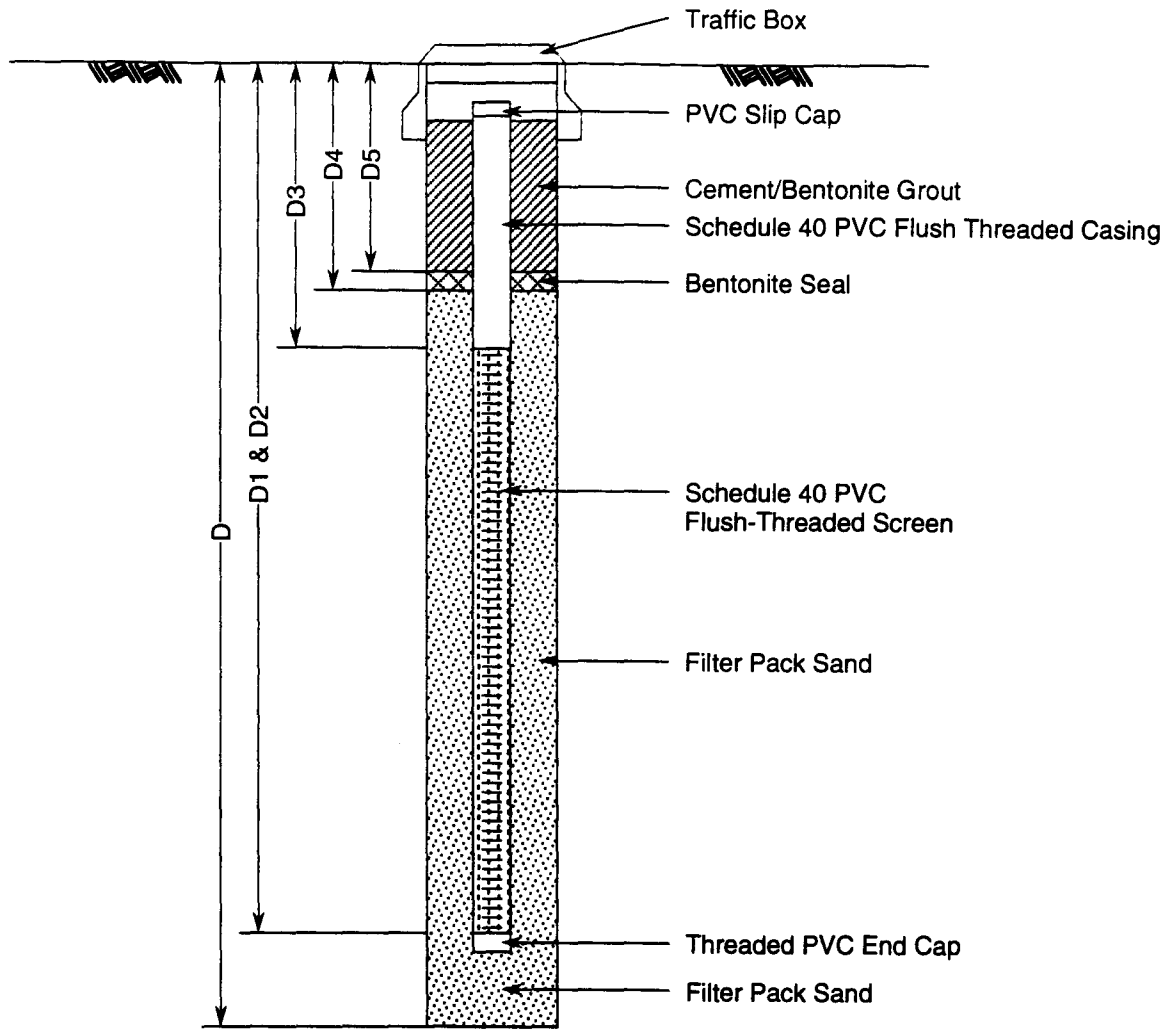
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring PE - 31

1-94

Figure A -33A



Total Depth (D)	=	83	Feet
Total Depth of Casing (D1)	=	80	Feet
Depth to Bottom of Well Screen (D2)	=	80	Feet
Depth to Top of Well Screen (D3)	=	20	Feet
Depth to Bottom of Top Seal (D4)	=	17.8	Feet
Depth to Top of Top Seal (D5)	=	14.4	Feet
Well Casing Diameter	=	2	Inches
Well Screen Slot Size	=	0.01	Inch
Filter Pack Sand Type	=	#2/12	Monterey
Bentonite Seal Type	=	1/2	Inch Pellets

GeoTransit Consultants

Project No. 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Piezometer Installation Schematic
PE-31

2-94

Figure A-33B

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **FL- 1**	Sheet **1** of **5**
Boring Location:	**Evergreen between Brooklyn and New Jersey**	Elevation(feet):	**326**
Health and Safety:	**Level D**	Date Started: **11/22/93**	Date Finished: **11/22/93**
Drilling Equipment:	**CME85**	Total Depth (feet): **60**	Depth to Bedrock(feet): **---**
Drilling Method:	**Flight Auger**	Number of Samples: **39**	Depth to Water (feet): **---**
Boring Diameter:	**8 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **140-lb hydraulic.**		Logged By: **D. Burke**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		Asphalt Concrete		Fill								
		SANDY GRAVEL; moderate brown to gray, moist, loose	GW	Residual soil on old alluvial deposits								
		SILTY SAND and GRAVEL with CLAY; moderate reddish brown, moist, dense, clasts to 1/2"	SM-SC / GM-GC		1	D	80					
		SANDY SILT; very pale brown, moist, firm	ML	Old alluvial deposits	2	D	85					
5		· grades to SANDY SILT with CLAY; moderate yellowish brown, moist, firm			3	D	175					
		CLAYEY SAND with GRAVEL, clasts to 2"	SC									
		SANDY SILT with CLAY; brownish yellow, moist, firm	ML		4	D	119					
		· yellowish brown, increasing clay			5	D	250					
					6	D	70					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 1	Sheet 2 of 5

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
	SILTY SAND with CLAY; moderate yellowish brown, moist, very dense, scattered clasts to 1/4"	SM	Old alluvial deposits								
	· increasing silt and scattered fine carbon fragments			7	D	115					
	· grades to SILTY SAND; moderate brown, dense			8	D	48					
	SANDY SILT	ML									
				9	D	47					
15	· grades to SILT										
	· grades to SANDY SILT with GRAVEL			10	D	96					
	· grades to SILT			11	D	29					
	SANDY GRAVEL with SILT; moderate brown, moist, friable, granitic clasts to 2"	GM		12	D	110					
20				13	D	160					
				14	D	77					
	CLAY; dark grayish brown, moist, stiff	CH		15	D	30					
	CLAYEY SILT; light yellowish brown, moist, firm, common fine carbon fragments	MH		16	D	28					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 1	Sheet 3 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYEY SILT as above	MH	Old alluvial deposits								
		· grades to SILT	ML		17	D	68					
					18	D	32					
					19	D	75					
30		· grades to SILT with SAND; fine grained sand			20	D	62					
		SILTY SAND; yellow, moist, loose	SM		21	D	74					
		CLAY; dark grayish brown, moist, stiff	CH		22	D	55					
		CLAYEY SILT; light yellowish brown, moist, firm, common fine carbon fragments	ML									
35		· steep cylindrical concave contact between silt and fine- to coarse-grained sand			23	D	62					
		· mottled light yellowish brown and light brownish gray			24	D	100					
					25	D	65					
					26	D	42					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **FL- 1** | Sheet 4 of 5

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
	CLAYEY SILT as above	ML	Old alluvial deposits	27	D	99					
	SILTY SAND and GRAVEL; moderate yellowish brown, moist, dense	SM/GM									
	CLAYEY SILT with SAND; light yellowish brown, moist, stiff	MH		28	D	46					
				29	D	49					
45	SILTY SAND and GRAVEL with CLAY; moderate yellowish brown, moist, dense to very dense, clasts to 2"	SM-SC / GM-GC									
	· very silty from 45.5' to 46'			30	D	118					
	CLAY; moderate grayish brown, moist, stiff	CH		31	D	40					
	CLAYEY SILT; pale yellowish brown, moist, firm	ML									
				32	D	32					
	· grades to SILT, soft										
50				33	D	68					
				34	D	40					
				35	D	61					
	· grades to firm										
				36	D	46					

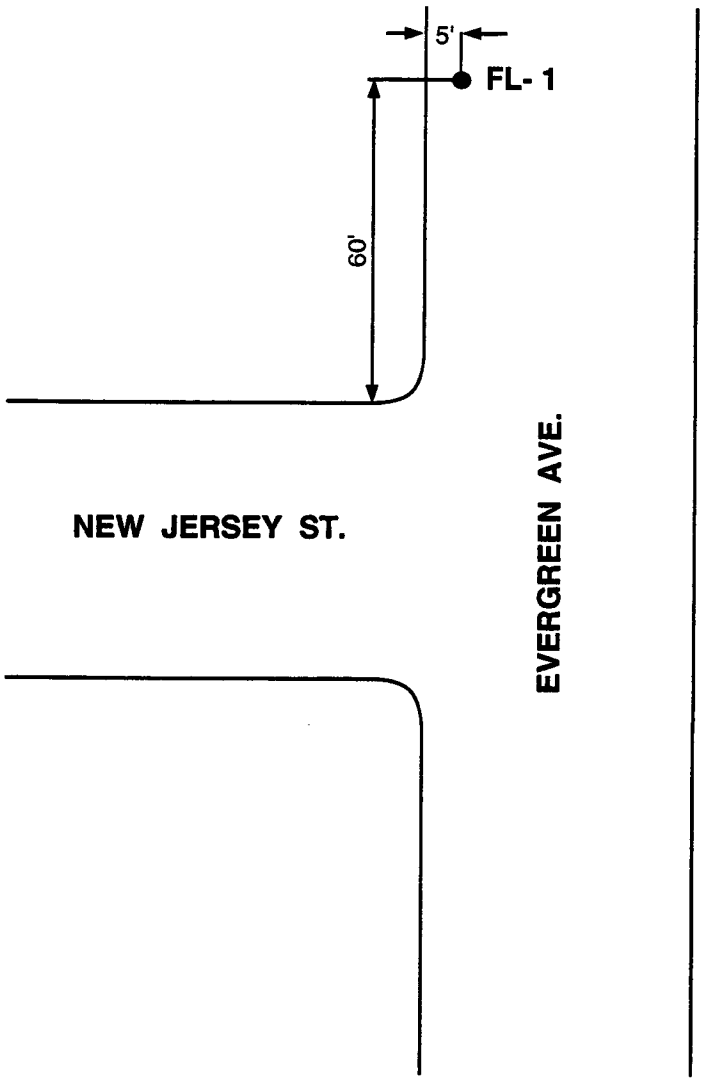
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 1	Sheet 5 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILT; firm	ML	Old alluvial deposits								
					37	D	68					
		· grades to SANDY SILT										
					38	D	48					
		SILTY SAND	SM									
		· scattered clasts to 1"										
					39	D	75					
60		Boring terminated at 60.0 feet. No groundwater observed.										
65												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring FL- 1

1-94

Figure A -34

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **FL- 2**	Sheet **1** of **7**
Boring Location:	**Evergreen between Brooklyn and New Jersey**	Elevation(feet):	**321**
Health and Safety:	**Level D**	Date Started: **11/23/93**	Date Finished: **11/23/93**
Drilling Equipment:	**CME85**	Total Depth (feet): **96.5**	Depth to Bedrock(feet): **---**
Drilling Method:	**Flight Auger**	Number of Samples: **55**	Depth to Water (feet): **63.5**
Boring Diameter:	**8 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **140-lb hydraulic.**		Logged By: **D. Burke**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		Asphalt concrete		Fill								
		GRAVEL with SAND; moderate brown to gray, moist, loose	GW	Residual soil on old alluvial deposits								
		SILTY SAND with CLAY; moderate brown, moist, medium dense, with scattered clasts to 1/4", numerous fine pores	SC-SM		1	D	15					
		· grades to CLAYEY SAND/CLAYEY GRAVEL; moderate reddish brown with dark brown mottling	SC/GC									
		SANDY CLAY with SILT; moderate olive gray, moist, firm, scattered granitic clasts to 1/4"	CH	Old alluvial deposits	2	D	41					
5		· mottled olive gray and pale olive										
		· mottled dark yellowish brown and pale olive			3	D	60					
		· pale yellowish brown			4	D	107					
		· increasing silt and sand			5	D	166					
		CLAYEY SILT with SAND; brownish yellow and yellowish brown mottled, scattered clasts to 1/4", scattered small carbonate masses	ML		6	D	106					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 2	Sheet 2 of 7	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SILT with SAND; brownish yellow and yellowish brown mottled, scattered clasts to 1/4", scattered small carbonate masses	ML	Old alluvial deposits	7	D	204					
					8	D	50					
		· dark yellowish brown, scattered clasts to 1"			9	D	120					
15		SILTY SAND with GRAVEL; moderate yellowish brown, moist, dense to very dense, clasts to 1/2"	SM		10	D	59					
					11	D	100					
					12	D	41					
20		GRAVEL with SAND and SILT; moderate yellowish brown, moist, dense, clasts to 1"	GW-GM		13	D	40					
		· friable			14	D	69					
					15	D	48					
		SAND with GRAVEL and SILT; clasts to 1/4"	SW-SM		16	D	76					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 2	Sheet 3 of 7	

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
	CLAY; pale brownish yellow at contact, dark grayish brown with pale mottling, moist, stiff	CH	Old alluvial deposits								
	· moderate grayish brown clay seam, >1", vertical, approx. 25' to 26'			17	D	68					
	CLAYEY SILT with SAND; moderate yellowish brown, moist, firm, scattered fine carbon fragments	ML									
		SM-SC		18	D	86					
	SILTY SAND with CLAY and GRAVEL; dark yellowish brown, moist, dense, fine gravel clasts										
	· dark grayish brown clay in seam with possible shearing, 29' to 29.5'			19	D	37					
30	SILT with SAND; moderate yellow, moist, soft, scattered fine carbon fragments	ML									
				20	D	85					
	· steep cylindrical sharp concave contact between dark yellowish brown clayey silt with sand and yellow silt										
	SILTY SAND; fine grained	SM		21	D	49					
	· sand coarser with depth			22	D	99					
	· steep sharp cylindrical convex contact between sand and yellowish brown clayey silt										
35	CLAYEY SILT; moderate yellowish brown, moist, soft	ML		23	D	39					
	CLAY; dark grayish brown, moist, stiff	CH									
	· circular isolated mass of coarse sand in clay										
	· mottled dark and moderate grayish brown			24	D	95					
	· steep cylindrical sharp concave contact between coarse sand and clay			25	D	70					
	· grades to moderate yellowish brown, silty										
				26	D	128					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 2	Sheet 4 of 7

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAY; moderate yellowish brown, silty	CH	Old alluvial deposits								
		· steep cylindrical sharp concave contact between coarse sand and clay			27	D	82					
		SILTY CLAY; moderate brownish yellow, moist, firm, scattered sand and fine gravel	CL		28	D	87					
		· 2" beds of clayey silt, sand and gravel with clasts to 1/2", 43.5' to 44.5'			29	D	69					
45					30	D	75					
		CLAYEY SILT; brownish yellow, damp, soft	ML		31	D	70					
		· yellowish brown, scattered sand and fine gravel			32	D	76					
50					33	D	78					
		SANDY SILT with GRAVEL; moderate yellowish brown, moist, firm, clasts to 1/4"	ML		34	D	70					
		· clasts to 1"										
		SILTY SAND with GRAVEL; moderate yellowish brown, moist, friable, clasts to 1"	SM		35	D	105					
					36	D	108					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 2	Sheet 5 of 7	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILTY SAND with GRAVEL; moderate yellowish brown, moist, friable, clasts to 1"	SM	Old alluvial deposits	37	D	95					
		· silty interval, 57.5' to 58'			38	D	87					
		· loose			39	D	69					
60					40	D	77					
		· silty interval, 62' to 63'			41	D	73					
		· sand becomes wet			42	D	65					
		· silty interval, 64' to 64.5'										
65		CLAY; dark grayish brown, very moist, stiff	CH		43	D	46					
		CLAYEY SILT; moderate yellowish brown, wet, soft, common fine carbon fragments	ML		44	D	57					
		· grades to SILT			45	D	45					
					46	D	68					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 2	Sheet 6 of 7	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILT; moderate yellowish brown, wet, soft	ML	Old alluvial deposits	47	D	57					
		CLAY; dark grayish brown, wet, stiff	CH									
		CLAYEY SILT with SAND and GRAVEL; moderate yellowish brown, wet, soft, clasts to 1/4"	ML		48	D	64					
		· grades to SILT with SAND and GRAVEL; moderate yellowish brown, wet, soft, clasts to 1/4"			49	D	76					
75					50	D	35					
		CLAYEY SILTY SAND; dark yellowish brown, wet, dense to very dense	SC-SM		51	D	130					
		SILTY SAND; moderate yellowish brown, wet, very dense	SM		52	D						
		[end of continuous sampling]										
80												

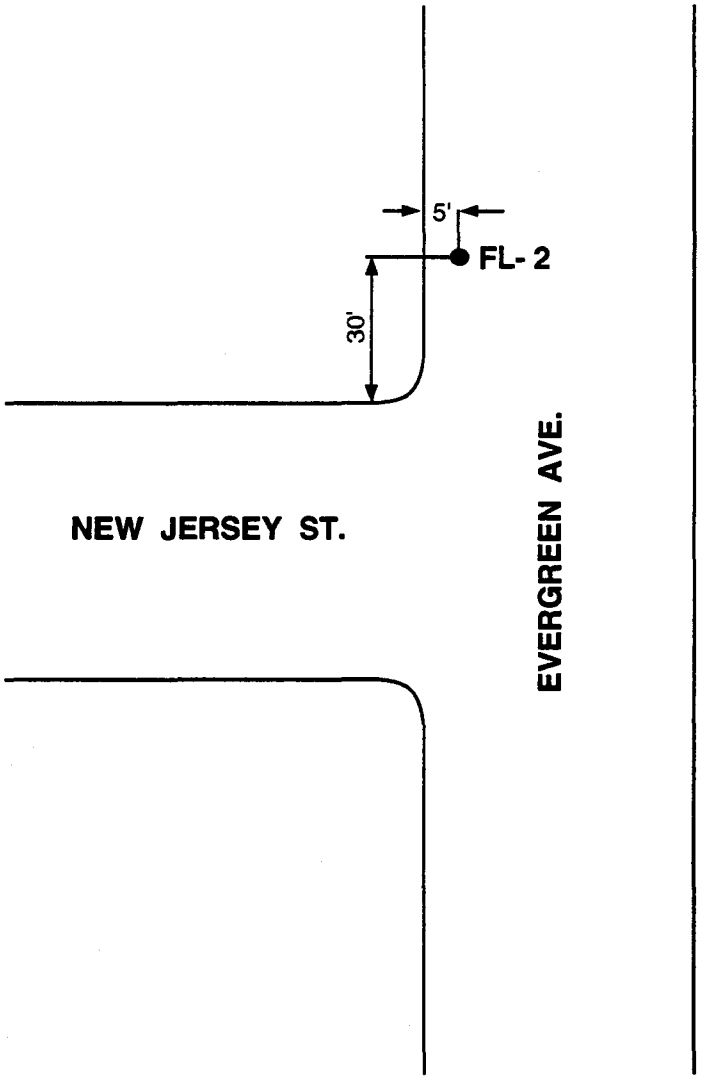
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 2	Sheet 7 of 7

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYEY SILT with SAND; moderate yellowish brown, wet, soft	MH	Old alluvial deposits	53	D	55					
90		CLAYEY SILT; moderate yellowish brown, wet, firm	MH		54	D	96					
95		CLAY; dark grayish brown, wet, stiff	CH		55	D	80					
		Boring terminated at 96.5 feet. Groundwater observed at 63.5 feet.										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring FL- 2

1-94

Figure A -35

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **FL- 3**	Sheet **1** of **3**
Boring Location:	**Evergreen between Brooklyn and New Jersey**	Elevation(feet):	**332**
Health and Safety:	**Level D**	Date Started: **11/24/93**	Date Finished: **11/24/93**
Drilling Equipment:	**CME85**	Total Depth (feet): **27**	Depth to Bedrock(feet): **---**
Drilling Method:	**Flight Auger**	Number of Samples: **17**	Depth to Water (feet): **---**
Boring Diameter:	**8 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **140-lb hydraulic.**		Logged By: **D. Burke**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		Asphalt concrete		Fill								
		GRAVEL with SAND; moderate brown to gray, moist, loose	GW									
		GRAVEL with SAND and SILT; dark yellowish brown, moist, friable, granitic clasts to 3"	GM	Old alluvial deposits	1	D	20					
		SAND with SILT; brownish yellow, moist, friable	SP-SM									
		SILTY SAND; moderate brown, moist, medium dense	SP		2	D	90					
		GRAVEL with SAND and SILT; clasts to 1"	GM									
5		CLAY; dark grayish brown, moist, firm	CH		3	D	84					
		CLAYEY SILT; brownish yellow, moist, firm	ML									
		CLAYEY SAND/GRAVEL; dark brown, moist, medium dense	SC/GC									
		SILT; brownish yellow, moist, firm, common fine carbon fragments · sandy, 7' to 7.5'	ML		4	D	33					
		· sandy, 8' to 8.5'			5	D	42					
		SILTY SAND; yellowish brown, moist, friable	SM		6	D	46					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 3	Sheet 2 of 3	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		· decreased silt content · increased silt content	SM	Old alluvial deposits								
		SAND with SILT and GRAVEL; dark yellowish brown, moist, friable · increased silt content	SM-SP		7	D	58					
					8	D	73					
		SILTY CLAY; moderate grayish brown, moist, stiff · sandy, 13.5' to 14'	CH		9	D	42					
15		· sandy, 15' to 15.5'			10	D	57					
		CLAYEY SILT; moderate brown, moist, stiff, common fine carbon fragments	ML									
		· grades to brownish yellow, decreased clay content			11	D	105					
					12	D	43					
20		· common fine carbon fragments · sandy, 20.5' to 21'			13	D	36					
					14	D	96					
		SILTY SAND with CLAY; dark yellowish brown, moist, dense, scattered clasts to 1/4"	SC-SM		15	D	40					
		CLAY; dark yellowish brown, moist, stiff, sand in thin seams, polish on	CH		16	D	46					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

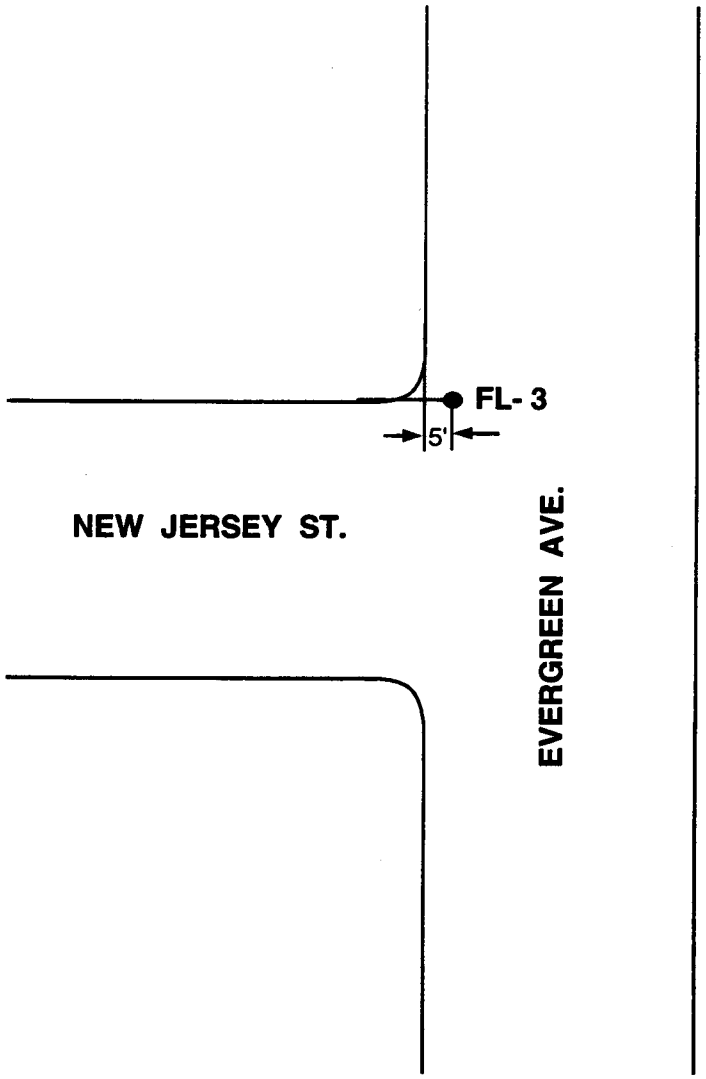
GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number:	FL- 3

Sheet 3 of 3

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Samples: Type	Samples: Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		wavy partings, dips 20 degrees	CH	Old alluvial deposits								
		· grades to SILTY CLAY; moderate yellowish brown and grayish brown mottled	ML		17	D	74					
		CLAYEY SILT; brownish yellow, moist, firm, scattered fine carbon fragments										
		Boring terminated at 27.0 feet. No groundwater observed.										
30												
35												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring FL- 3

1-94

Figure A -36

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **FL- 4**	Sheet **1** of **5**
Boring Location:	**Michigan/Evergreen**	Elevation(feet):	**318**
Health and Safety:	**Level D**	Date Started: **12/6/93**	Date Finished: **12/6/93**
Drilling Equipment:	**CME75**	Total Depth (feet): **62**	Depth to Bedrock(feet): ---
Drilling Method:	**Flight Auger**	Number of Samples: **40**	Depth to Water (feet): ---
Boring Diameter:	**6 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **140-lb hydraulic.**		Logged By: **D. Burke**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		Asphalt concrete		Fill								
		GRAVEL with SAND; medium brown to medium gray, moist, loose	GW									
		SILTY SAND and GRAVEL with CLAY; dark reddish gray to yellowish red, moist, firm, mottling and clay skins on apparent blocky structure, granitic clasts to 1/4" commonly weathered and friable, common pores	SM-SC / GM-GC	Residual soil on old alluvial deposits	1	D	64					
		· very clayey, mottled grayish brown and reddish gray			2	D	67					
5		· clayey, reddish gray to yellowish red			3	D	43					
		SANDY SILT with CLAY; grayish brown and brown mottled, moist, stiff, scattered clasts to 1/4"	ML	Old alluvial deposits	4	D	56					
		· light yellowish brown			5	D	52					
		· increasing sand content and decreasing clay content, scattered fine carbon fragments										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 4	Sheet 2 of 5

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) (Background)	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SANDY SILT with CLAY; light yellowish brown, moist, stiff, scattered clasts to 1/4"	ML	Old alluvial deposits	6	D	70					
					7	D	80					
					8	D	51					
		SILTY SAND with GRAVEL; reddish brown, moist, dense, granitic clasts to 1/2"	SM		9	D	88					
15		GRAVEL with SAND and SILT, clasts to 1"	GM		10	D	103					
		· friable, clasts to 2"			11	D	52					
		· loose										
		SILTY SAND with GRAVEL	SM		12	D	54					
20					13	D	73					
		CLAY; dark grayish brown, moist, stiff, common small carbon fragments	CH									
		SILTY CLAY; dark yellowish brown	CH-MH									
		SILT with CLAY; moderate yellowish brown	ML		14	D	150+					
		· grades to SANDY SILT; moderate brown, scattered clasts to 1/8"			15	D	63					
		· grades to SILT; brownish yellow, soft, common fine carbon fragments										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 4	Sheet 3 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		SILTY SAND; yellowish brown, moist, friable, fine grained	SM	Old alluvial deposits	16	D	69					
		· sand coarser with depth · gravel to 1/4"			17	D	62					
		CLAY with SAND; dark grayish brown, moist, stiff	CH		18	D	79					
30		· mottled grayish brown and brown, decreased sand content · pale grayish brown			19	D	64					
		· dark grayish brown			20	D	71					
		SILTY CLAY; moderate yellowish brown, moist, stiff, common fine carbon fragments	CL		21	D	87					
		· light yellowish brown			22	D	92					
35		· sandy · polish on wavy partings dips about 20 degrees			23	D	83					
		CLAYEY SAND and GRAVEL; dark yellowish brown, moist, dense, granitic clasts to 1/2"	SC		24	D	76					
		SANDY SILT; moderate yellowish brown, moist, firm	ML									
		SILTY CLAY	CH		25	D	95					
		CLAYEY SILT	MH									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 4	Sheet 4 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content (%)	Drilling Time
		CLAYEY SILT	MH	Old alluvial deposits	26	D	>50					
					27	D	56					
		SILTY SAND; moderate brown, moist, medium dense, scattered fine gravel increasing with depth	SM		28	D	65					
45		SANDY SILT; moderate yellowish brown, moist, soft	ML		29	D	77					
		· pale yellowish brown, scattered fine gravel			30	D	83					
		SILTY SAND with GRAVEL; moderate brown, moist, dense, common fine carbon fragments, clasts to 1/2"	SM		31	D	128					
					32	D	80					
50		SAND and GRAVEL with SILT; pale yellowish brown, moist, friable, clasts to 1/2"	SW-SM / GW-GM		33	D	116					
		· moderate yellowish brown, very dense, very silty										
		SAND; brownish yellow, moist, friable to loose	SW		34	D	115					
					35	D	89					

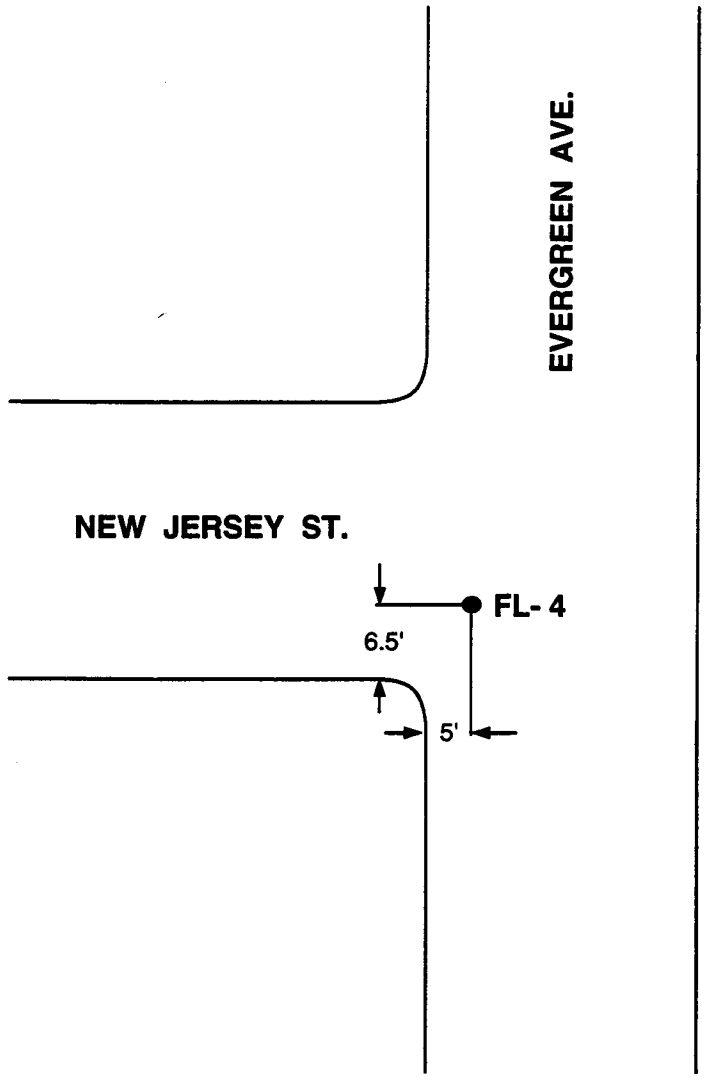
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 4	Sheet 5 of 5	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SAND; brownish yellow, moist, friable to loose	SW	Old alluvial depsoits	36	D	90					
					37	D	100					
		SILTY SAND; moderate grayish brown, moist, dense	SM		38	D	94					
60					39	D	97					
		CLAY; moderate yellowish brown, moist, stiff · dark grayish brown	CH		40	D	54					
		Boring terminated at 62 feet. No groundwater observed.										
65												

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
FL- 4

1-94

Figure A -37

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **FL- 5**	Sheet **1** of **4**
Boring Location:	**Evergreen between Michigan and New Jersey**	Elevation(feet):	**314**
Health and Safety:	**Level D**	Date Started: **12/7/93**	Date Finished: **12/7/93**
Drilling Equipment:	**CME75**	Total Depth (feet): **54.5**	Depth to Bedrock(feet): **---**
Drilling Method:	**Flight Auger**	Number of Samples: **35**	Depth to Water (feet): **---**
Boring Diameter:	**6 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **140-lb hydraulic.**		Logged By: **D. Burke**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		Asphalt concrete		Fill								
		SANDY GRAVEL; medium brown to medium gray, moist, loose	GW									
		SILTY SAND and GRAVEL with CLAY; dark reddish gray to yellowish red, moist, medium dense to dense, mottling and clay skins on blocky structure, granitic clasts to 1/4" commonly weathered and friable, common pores	SM-SC / GM-GC	Residual soil on old alluvial deposits	1	D	24					
					2	D	55					
5					3	D	58					
		SILTY SAND with GRAVEL and CLAY; moderate reddish brown, moist, dense, friable, granitic clasts to 1"	SM	Old alluvial deposits	4	D	90					
		CLAYEY SILT; moderate brown, moist, friable to firm	ML		5	D	65					
		SILTY SAND; fine-grained	SM									

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 5	Sheet 2 of 4

Depth (feet)	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
	SILTY SAND; fine-grained	SM	Old alluvial deposits	6	D	52					
	SANDY GRAVEL; moderate reddish brown, moist, friable	GW									
	· dense, silty			7	D	44					
	CLAYEY SILT with SAND; moderate olive gray, moist, firm	ML		8	D	31					
	SILTY CLAY; dark grayish brown, moist, stiff	CH		9	D	44					
15	CLAYEY SILT; moderate brown, firm, scattered fine carbon fragments	MH		10	D	51					
	· grades to SILT; light yellowish brown, soft	ML		11	D	39					
	· grades to SANDY SILT			12	D	49					
	SAND with GRAVEL and SILT; very pale brown, moist, loose	SW-SM									
20	SILTY CLAY; dark grayish brown, moist, stiff	CH		13	D	45					
	CLAYEY SILT; moderate brown to yellowish brown, firm, scattered fine carbon fragments	MH		14	D	56					
				15	D	45					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 5	Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SILT; moderate brown to yellowish brown, firm, scattered fine carbon fragments	MH	Old alluvial deposits	16	D	40					
		CLAYEY SILT with SAND and GRAVEL; light yellowish brown, moist, firm	ML		17	D	47					
		· grades to CLAYEY SILT; light yellowish brown			18	D	49					
30					19	D	50					
					20	D	58					
		· sandy			21	D	56					
		SILTY SAND with GRAVEL; moderate brown, moist, dense	SM		22	D	60					
35		· light brown, decreasing silt content, friable			23	D	75					
					24	D	85					
					25	D	96					

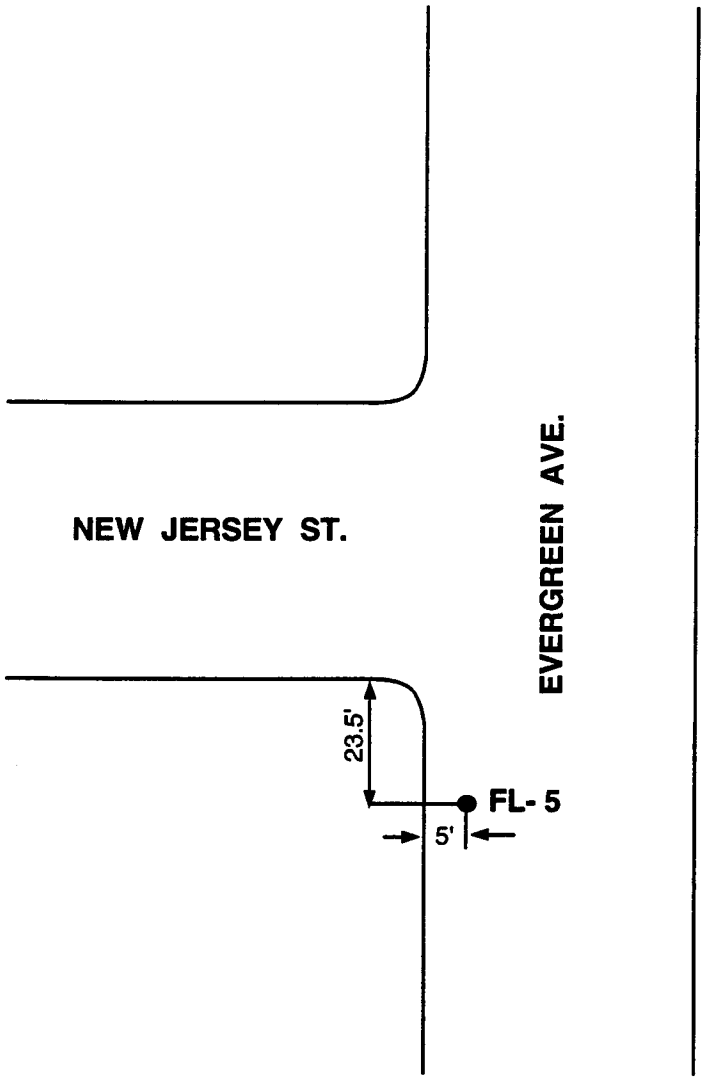
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line		
Project Number:	94-1100	Boring Number: FL- 5	Sheet 4 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		· medium brown, silty	SM	Old alluvial deposits	26	D	107					
		SAND with SILT and GRAVEL; light yellowish to very pale brown, moist, friable to loose	SW-SM		27	D	105					
					28	D	79					
45					29	D	70					
					30	D	84					
					31	D	92					
					32	D	82					
50		SILTY CLAY; moderate yellowish brown, moist, firm	CH-CL		33	D	87					
		· dark grayish brown, stiff	CH									
		· moderate brown, firm			34	D	53					
					35	D	71					
		Boring terminated at 54.5 feet. No groundwater observed.										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.



North

Not to Scale

GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
FL- 5

1-94

Figure A -38

GeoTransit Consultants

Project Name:	**Metro Rail: Eastside Extension - Metro Red Line**		
Project Number:	**94-1100**	Boring Number: **FL- 6**	Sheet **1** of **4**
Boring Location:	**Evergreen between Brooklyn and New Jersey**	Elevation(feet):	**336**
Health and Safety:	**Level D**	Date Started: **12/8/93**	Date Finished: **12/8/93**
Drilling Equipment:	**CME75**	Total Depth (feet): **52**	Depth to Bedrock(feet): **---**
Drilling Method:	**Flight Auger**	Number of Samples: **34**	Depth to Water (feet): **---**
Boring Diameter:	**6 inches**	Completion Information:	**Grouted to surface**
Hammer Information: **140-lb hydraulic.**		Logged By: **D. Burke**	Checked By: **Grant Miller**

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		Asphalt concrete		Fill								
		GRAVEL with SAND; moderate brown to gray, moist, loose	GW / SM-SC	Residual soil on old alluvial deposits from 0.5' to 1'								
		SILTY SAND with CLAY; reddish brown, moist, dense	CH									
		CLAY; moderate brown, moist, stiff			1	D	71					
		SILTY CLAY; moderate yellowish brown, moist, stiff	CL									
		CLAYEY SILT; light yellowish brown, firm	ML	Old alluvial deposits begins at 1'								
		· grades to SANDY SILT; dark yellowish brown, moist, firm			2	D	71					
					3	D	50					
5		SILTY SAND; dark yellowish brown, moist, loose	SM									
		SAND and FINE GRAVEL with SILT; moderate brown, moist, loose	SW-SM / GW-GM		4	D	55					
		SILTY SAND	SM									
					5	D	47					
		CLAYEY SILT; moderate brown, moist, soft, common fine carbon fragments	ML									
		· light yellowish brown, less clay			3	D	58					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 6	Sheet 2 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		CLAYEY SILT; light yellowish brown, moist, soft, common fine carbon fragments	ML	Old alluvial deposits	7	D	55					
		· sandy · scattered clasts to 1"			8	D	57					
		SILTY SAND with CLAY; moderate yellowish brown, moist, medium dense	SC-SM		9	D	40					
15		CLAY; dark grayish brown, moist, stiff	CH		10	D	64					
		SILTY CLAY; moderate yellowish brown, moist, stiff	CL									
		CLAYEY SILT; moderate yellowish brown, moist, soft, common fine carbon fragments	ML		11	D	49					
					12	D	47					
		· grades to SILT; light yellowish brown, moist, soft			13	D	45					
20					14	D	60					
		· clayey			15	D	42					
		SILTY SAND; moderate brown, moist, friable	SM		16	D	58					

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name: **Metro Rail: Eastside Extension - Metro Red Line**

Project Number: **94-1100** | Boring Number: **FL- 6** | Sheet 3 of 4

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILT; light yellowish brown, moist, soft	ML	Old alluvial deposits	17	D	39					
					18	D	31					
		· common fine carbon fragments			19	D	31					
30		· grades to SANDY SILT with GRAVEL and CLAY; moderate brown, moist, firm, clasts to 1/4"			20	D	45					
		SILTY CLAY with SAND; dark brown, moist, stiff, scattered clasts to 1/2"	CH		21	D	60					
		CLAYEY SAND and GRAVEL; dark yellowish brown, moist, dense	SC/GC		22	D	83					
		· yellowish brown, decreasing clay content										
		SILTY SAND and GRAVEL; moderate yellowish brown, moist, friable, clasts to 1/2"	SM/GM		23	D	83					
35					24	D	89					
					25	D	83					
		· clasts to 1"			26	D	94					

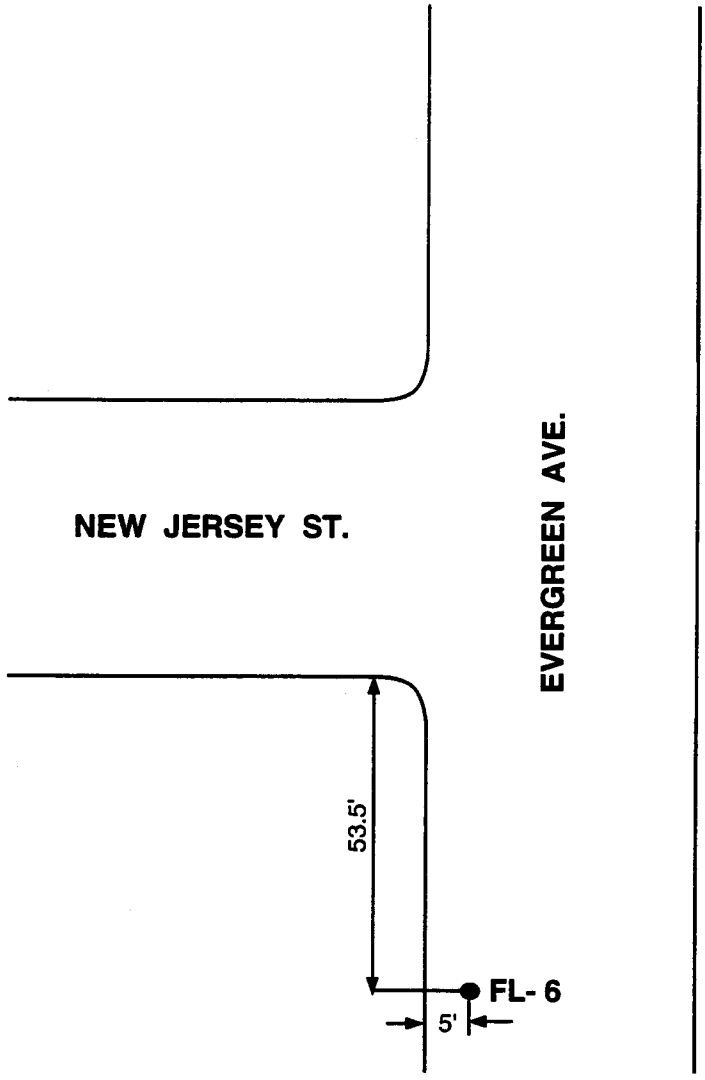
Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.

GeoTransit Consultants

Project Name:	Metro Rail: Eastside Extension - Metro Red Line				
Project Number:	94-1100	Boring Number:	FL- 6	Sheet 4 of 4	

Depth (feet)	Lithology	Description	USCS Classification	Geologic Unit	Samples: Number	Type	Blow Count (no./18 inches)	Recovery (inches/inches)	OVA (ppm) [Background]	Dry Density (pcf)	Moisture Content(%)	Drilling Time
		SILTY SAND and GRAVEL; light yellowish brown, moist, loose, decreasing silt content	SM/GM	Old alluvial deposits	27	D	88					
					28	D	104					
					29	D	94					
45		· moderate yellowish brown, increasing silt and decreasing gravel content			30	D	74					
		SAND and GRAVEL; moderate yellowish brown, moist, loose, fine gravel	SW/GW		31	D	115					
					32	D	135					
		SILT; light yellowish brown, moist, stiff	ML									
50		· grades to CLAYEY SILT; dark yellowish brown, moist, stiff			33	D	63					
		CLAY; dark grayish brown, moist, stiff	CH		34	D	77					
		Boring terminated at 52.0 feet. No groundwater observed.										

Note: This boring log is based on field classification and visual soil description and is further modified to include results of laboratory classification tests, where available. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented are a simplification of the actual conditions encountered. Lithologic patterns are generalizations and necessarily imprecise. Lithologic contacts indicated represent the approximate boundary between subsurface material types and the transition may be gradual.



North

Not to Scale

GeoTransit Consultants

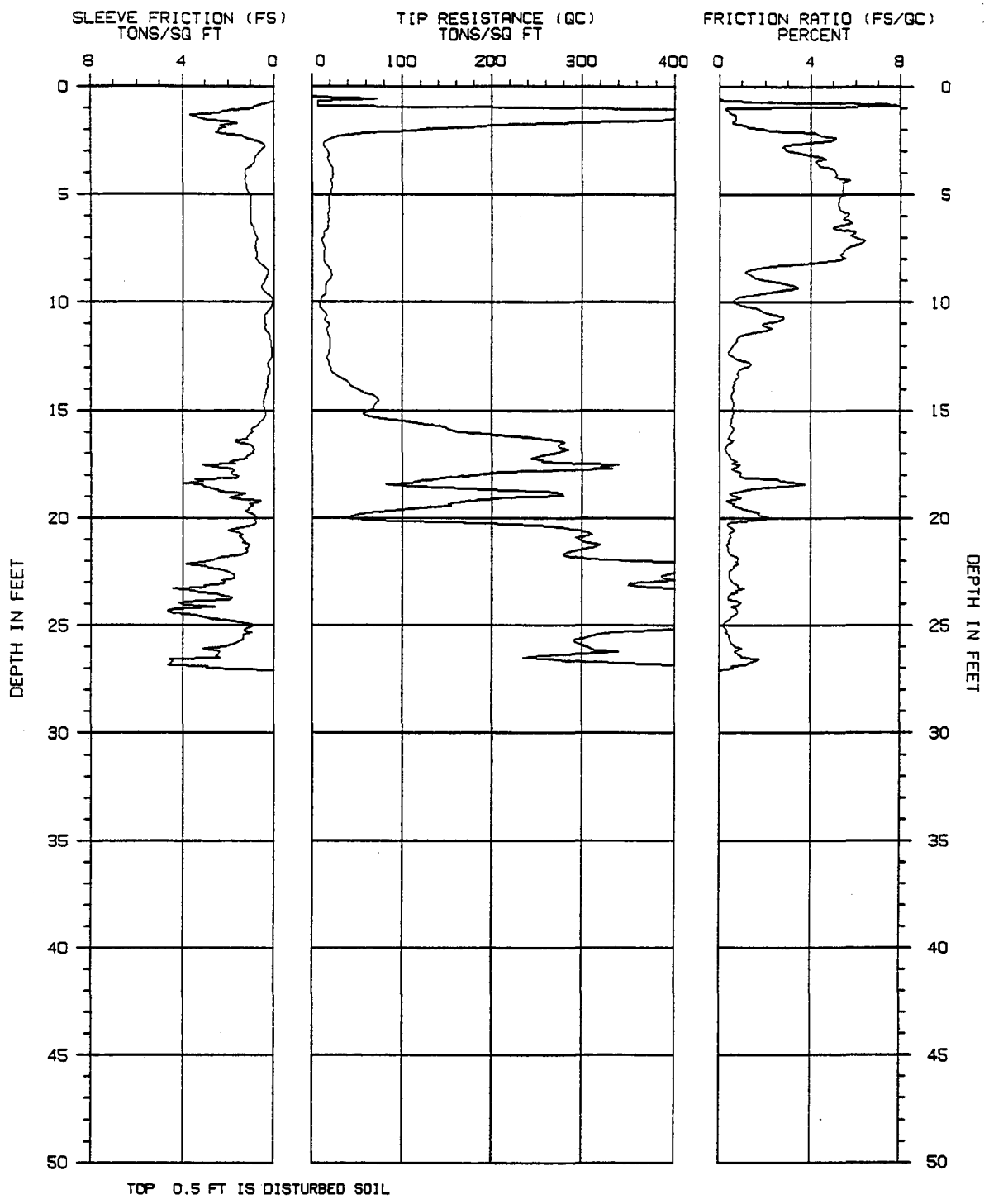
Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of Boring
FL- 6

1-94

Figure A -39

CPT LOGS



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-1

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 470/R#3

DATE/TIME: 11-10-93 08:18

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-1 PROJECT No.: 94-380-00005
PROJECT : TETC/METRO RED CONE/RIG : 470/R#3
DATE/TIME: 11-10-93 08:18

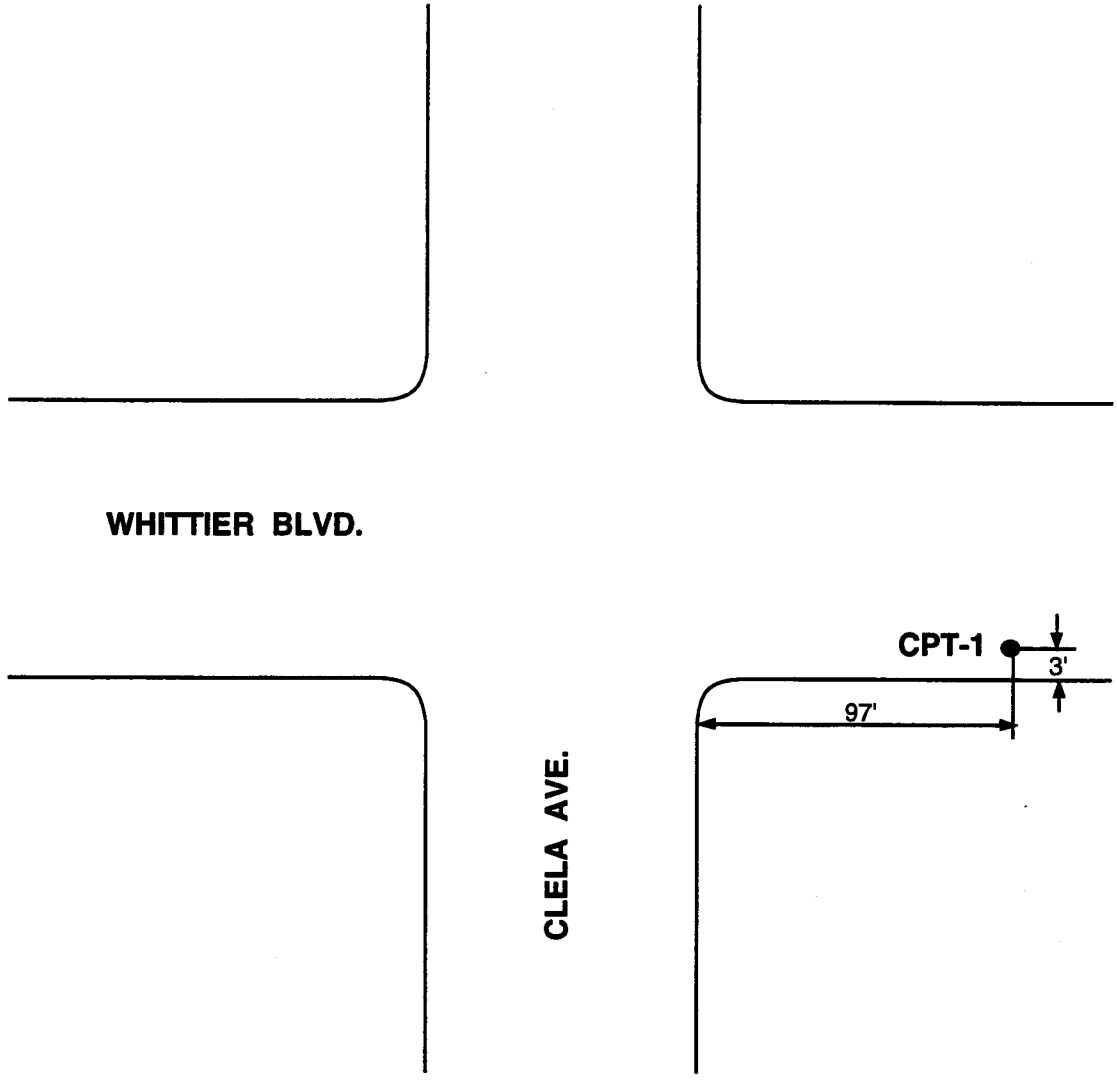
DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	.0	.00						
.98	585.2	.34	SANDY GRAVEL to SAND	>40	>40	80-90		45-48
1.48	891.7	.75	SANDY GRAVEL to SAND	>40	>40			
1.97	249.3	1.86	SAND to SILTY SAND	>40	>40	90-100		40-42
2.46	34.5	5.05	*SANDY CLAY to SILTY CLAY	25-40	>40		.62	
2.95	32.0	2.88	SANDY SILT to CLAYEY SILT	15-20	20-25	60-70	1.21	27-31
3.44	32.1	4.31	CLAYEY SILT to SILTY CLAY	20-25	25-40		1.26	
3.94	39.3	5.05	*SANDY CLAY to SILTY CLAY	25-40	>40		.80	
4.43	35.8	5.39	*SANDY CLAY to SILTY CLAY	25-40	>40		.75	
4.92	31.1	5.44	*SANDY CLAY to SILTY CLAY	25-40	25-40		.67	
5.41	28.8	5.21	*SANDY CLAY to SILTY CLAY	20-25	25-40		.64	
5.91	26.3	5.69	*SANDY CLAY to SILTY CLAY	20-25	25-40		.59	
6.40	25.1	5.40	CLAYEY SILT to SILTY CLAY	20-25	25-40		1.16	
6.89	19.0	5.72	SILTY CLAY TO CLAY	15-20	25-40		.89	
7.38	19.1	5.87	SILTY CLAY TO CLAY	15-20	25-40		.91	
7.87	18.5	5.38	SILTY CLAY TO CLAY	15-20	20-25		.90	
8.37	25.0	1.97	SANDY SILT to CLAYEY SILT	5-10	15-20	40-50	1.25	27-31
8.86	27.6	1.48	SILTY SAND to SANDY SILT	5-10	10-15	30-40		31-35
9.35	20.1	3.43	CLAYEY SILT to SILTY CLAY	10-15	15-20		1.03	
9.84	13.3	.72	SILTY SAND to SANDY SILT	3-5	7-10	10-20		27-31
10.33	13.5	1.74	SANDY SILT to CLAYEY SILT	3-5	10-15	20-30	.70	27-31
10.83	17.7	2.65	SANDY SILT to CLAYEY SILT	5-10	15-20	40-50	.95	27-31
11.32	20.5	2.05	SANDY SILT to CLAYEY SILT	5-10	10-15	30-40	1.12	27-31
11.81	23.3	.76	SILTY SAND to SANDY SILT	3-5	7-10	20-30		31-35
12.30	21.8	.42	SILTY SAND to SANDY SILT	3-5	7-10	10-20		31-35
12.80	21.2	1.32	SILTY SAND to SANDY SILT	5-10	10-15	20-30		31-35
13.29	27.1	.76	SILTY SAND to SANDY SILT	5-10	10-15	20-30		31-35
13.78	45.5	.70	SAND to SILTY SAND	5-10	10-15	30-40		35-40
14.27	70.7	.56	SAND to SILTY SAND	10-15	10-15	30-40		35-40
14.76	73.3	.63	SAND to SILTY SAND	10-15	15-20	30-40		35-40
15.26	62.6	.60	SAND to SILTY SAND	10-15	10-15	30-40		35-40
15.75	145.5	.54	SAND to SILTY SAND	20-25	20-25	50-60		40-42
16.24	242.6	.48	SANDY GRAVEL to SAND	25-40	>40	60-70		42-45
16.73	274.7	.33	SANDY GRAVEL to SAND	25-40	25-40	60-70		42-45
17.22	239.2	.48	SANDY GRAVEL to SAND	25-40	25-40	60-70		42-45
17.72	324.6	.54	SANDY GRAVEL to SAND	>40	>40	70-80		42-45
18.21	133.4	2.48	SILTY SAND to SANDY SILT	>40	>40	90-100		35-40
18.70	205.4	1.07	SAND to SILTY SAND	>40	>40	60-70		40-42
19.19	164.1	.33	SANDY GRAVEL to SAND	20-25	20-25	50-60		40-42
19.69	82.1	1.38	SAND to SILTY SAND	25-40	25-40	50-60		35-40
20.18	132.6	.56	SAND to SILTY SAND	20-25	20-25	50-60		40-42

TOP .5 FT IS DISTURBED SOIL
*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = **** FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-1

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
20.67	278.3	.51	SANDY GRAVEL to SAND	>40	>40	60-70		42-45
21.16	275.1	.45	SANDY GRAVEL to SAND	>40	>40	60-70		42-45
21.65	247.6	.46	SANDY GRAVEL to SAND	25-40	>40	60-70		42-45
22.15	389.8	.87	SANDY GRAVEL to SAND	>40	>40	80-90		42-45
22.64	341.8	.45	SANDY GRAVEL to SAND	>40	>40	70-80		42-45
23.13	300.6	.87	SAND to SILTY SAND	>40	>40	70-80		42-45
23.62	404.7	.47	SANDY GRAVEL to SAND	>40	>40	70-80		45-48
24.11	404.6	.53	SANDY GRAVEL to SAND	>40	>40	70-80		45-48
24.61	452.4	.55	SANDY GRAVEL to SAND	>40	>40	70-80		45-48
25.10	373.8	.23	SANDY GRAVEL to SAND	>40	>40	60-70		45-48
25.59	245.8	.45	SANDY GRAVEL to SAND	25-40	25-40	60-70		42-45
26.08	249.2	1.01	SAND to SILTY SAND	>40	>40	70-80		42-45
26.57	210.4	1.73	SAND to SILTY SAND	>40	>40	80-90		40-42
27.07	368.7	*****						

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = **** FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



North

Not to Scale

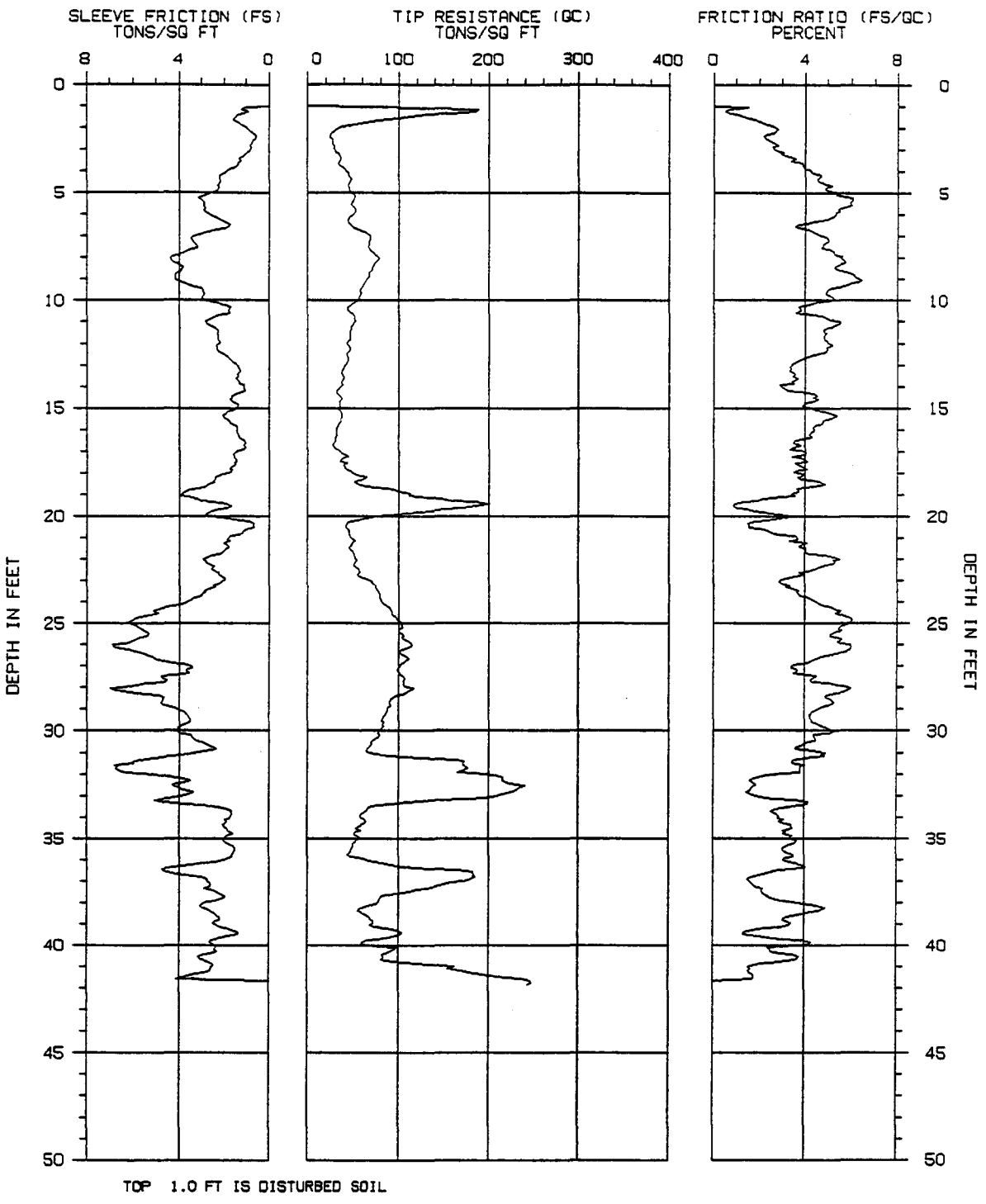
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of CPT-1

1-94

Figure A -40



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-2

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 469/R#3

DATE/TIME: 12-20-93 06:49

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-2 PROJECT No.: 94-380-00005
PROJECT : TETC/METRO RED CONE/RIG : 469/R#3
DATE/TIME: 12-20-93 06:49

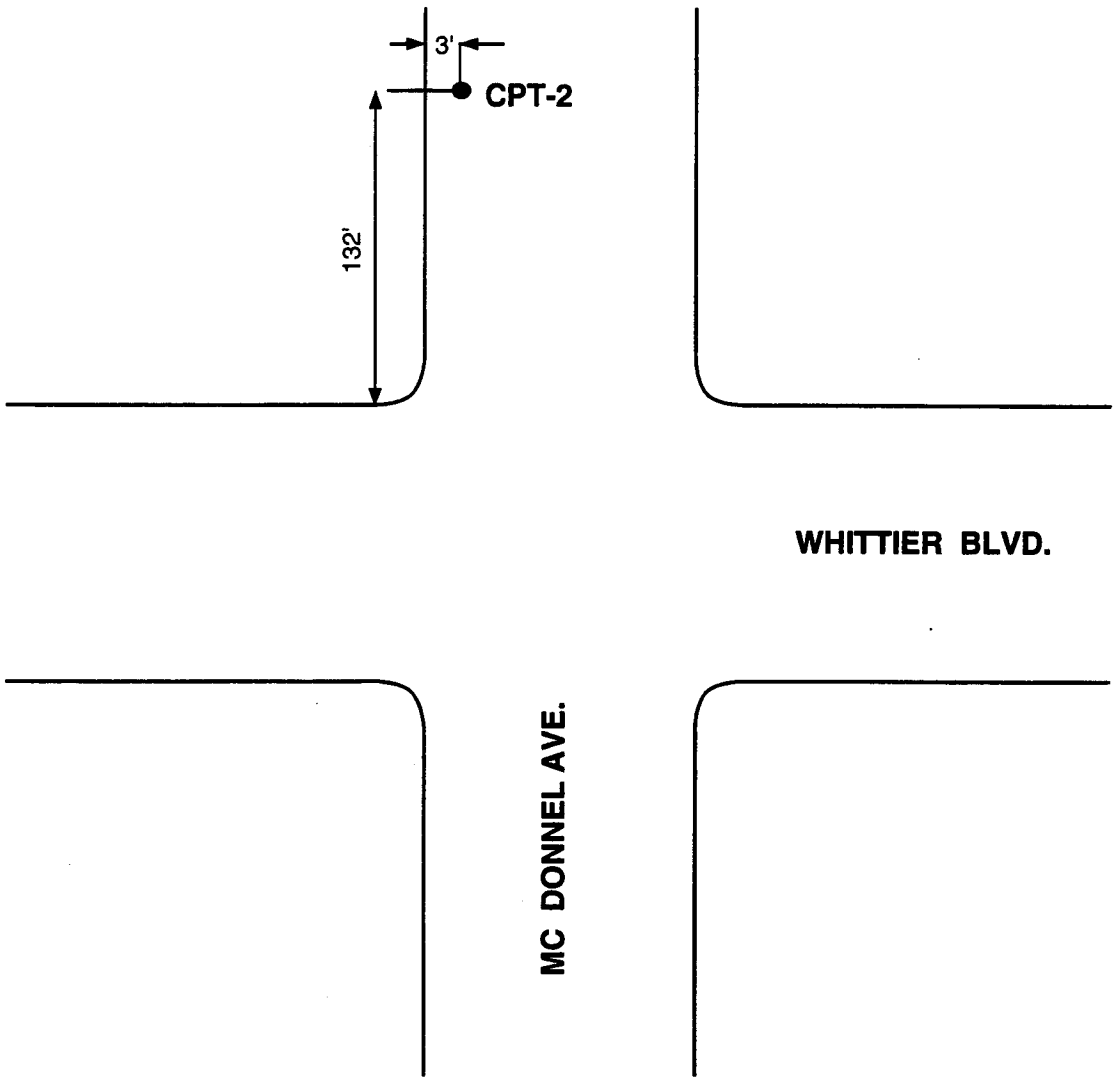
DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	.0	.00						
.98	.0	.00						
1.48	232.7	1.31	SAND to SILTY SAND	>40	>40	70-80		40-42
1.97	73.4	2.69	SILTY SAND to SANDY SILT	25-40	>40	70-80		31-35
2.46	47.7	2.29	SILTY SAND to SANDY SILT	20-25	25-40	60-70		31-35
2.95	52.2	2.65	SANDY SILT to CLAYEY SILT	25-40	25-40	60-70	1.97	31-35
3.44	61.8	3.61	SANDY SILT to CLAYEY SILT	>40	>40	90-100	2.43	27-31
3.94	68.5	4.28	*SANDY CLAY to SILTY CLAY	>40	>40		1.40	
4.43	74.9	4.55	*SANDY CLAY to SILTY CLAY	>40	>40		1.58	
4.92	70.7	5.22	*SANDY CLAY to SILTY CLAY	>40	>40		1.53	
5.41	73.2	5.97	*SANDY CLAY to SILTY CLAY	>40	>40		1.63	
5.91	76.4	5.32	*SANDY CLAY to SILTY CLAY	>40	>40		1.74	
6.40	65.5	4.03	*CLAYEY SAND to SANDY CLAY	>40	>40		1.53	
6.89	91.5	4.47	*SANDY CLAY to SILTY CLAY	>40	>40		2.19	
7.38	92.3	4.81	*SANDY CLAY to SILTY CLAY	>40	>40		2.26	
7.87	99.4	5.41	*SANDY CLAY to SILTY CLAY	>40	>40		2.48	
8.37	94.8	5.39	*SANDY CLAY to SILTY CLAY	>40	>40		2.41	
8.86	86.3	6.13	*SANDY CLAY to SILTY CLAY	>40	>40		2.24	
9.35	74.8	5.57	*SANDY CLAY to SILTY CLAY	>40	>40		1.98	
9.84	70.6	5.20	*SANDY CLAY to SILTY CLAY	>40	>40		1.89	
10.33	54.4	3.75	SANDY SILT to CLAYEY SILT	25-40	>40	90-100	2.96	27-31
10.83	61.3	4.95	*SANDY CLAY to SILTY CLAY	>40	>40		1.70	
11.32	56.0	4.96	*SANDY CLAY to SILTY CLAY	>40	>40		1.58	
11.81	53.8	4.85	*SANDY CLAY to SILTY CLAY	>40	>40		1.54	
12.30	52.8	4.97	*SANDY CLAY to SILTY CLAY	>40	>40		1.53	
12.80	49.4	3.84	SANDY SILT to CLAYEY SILT	25-40	>40	90-100	2.90	27-31
13.29	41.9	3.34	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	2.49	27-31
13.78	41.7	3.45	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	2.51	27-31
14.27	34.3	3.76	SANDY SILT to CLAYEY SILT	20-25	25-40	80-90	2.08	
14.76	38.1	4.03	CLAYEY SILT to SILTY CLAY	25-40	25-40		2.35	
15.26	39.0	5.10	*SANDY CLAY to SILTY CLAY	25-40	>40		1.22	
15.75	35.5	4.76	*SANDY CLAY to SILTY CLAY	25-40	25-40		1.12	
16.24	32.6	4.23	CLAYEY SILT to SILTY CLAY	20-25	25-40		2.08	
16.73	28.6	3.82	CLAYEY SILT to SILTY CLAY	15-20	25-40		1.84	
17.22	44.4	3.45	SANDY SILT to CLAYEY SILT	25-40	25-40	80-90	2.94	27-31
17.72	40.6	3.90	SANDY SILT to CLAYEY SILT	25-40	25-40	80-90	2.71	27-31
18.21	62.2	3.68	*CLAYEY SAND to SANDY CLAY	>40	>40	90-100	2.12	27-31
18.70	81.8	3.65	*CLAYEY SAND to SANDY CLAY	>40	>40		2.83	
19.19	138.2	2.19	SILTY SAND to SANDY SILT	>40	>40	80-90		35-40
19.69	138.1	1.48	SAND to SILTY SAND	>40	>40	60-70		40-42
20.18	50.7	2.35	SILTY SAND to SANDY SILT	20-25	25-40	60-70		31-35

TOP 1.0 FT IS DISTURBED SOIL
*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = **** FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-2

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
20.67	41.2	2.40	SANDY SILT to CLAYEY SILT	15-20	20-25	50-60	2.95	31-35
21.16	46.7	3.35	SANDY SILT to CLAYEY SILT	25-40	25-40	80-90	3.39	27-31
21.65	44.3	4.07	CLAYEY SILT to SILTY CLAY	25-40	>40		3.24	
22.15	45.6	5.33	*SANDY CLAY to SILTY CLAY	>40	>40		1.69	
22.64	50.1	3.80	SANDY SILT to CLAYEY SILT	25-40	>40	90-100	3.76	27-31
23.13	62.5	2.96	SANDY SILT to CLAYEY SILT	25-40	>40	70-80	4.77	31-35
23.62	67.1	3.76	*CLAYEY SAND to SANDY CLAY	>40	>40		2.59	
24.11	71.0	4.72	*SANDY CLAY to SILTY CLAY	>40	>40		2.77	
24.61	77.8	5.62	*SANDY CLAY to SILTY CLAY	>40	>40		3.07	
25.10	85.3	5.64	*SANDY CLAY to SILTY CLAY	>40	>40		3.41	
25.59	85.9	5.10	*SANDY CLAY to SILTY CLAY	>40	>40		3.47	
26.08	91.4	6.02	*SANDY CLAY to SILTY CLAY	>40	>40		3.73	
26.57	86.6	4.74	*SANDY CLAY to SILTY CLAY	>40	>40		3.57	
27.07	79.4	3.41	*CLAYEY SAND to SANDY CLAY	>40	>40	90-100	3.30	31-35
27.56	83.9	4.40	*SANDY CLAY to SILTY CLAY	>40	>40		3.52	
28.05	90.0	6.00	*SANDY CLAY to SILTY CLAY	>40	>40		3.82	
28.54	69.7	5.15	*SANDY CLAY to SILTY CLAY	>40	>40		2.97	
29.04	67.0	4.56	*SANDY CLAY to SILTY CLAY	>40	>40		2.88	
29.53	61.2	4.32	*SANDY CLAY to SILTY CLAY	>40	>40		2.66	
30.02	57.7	5.28	*SANDY CLAY to SILTY CLAY	>40	>40		2.52	
30.51	51.9	4.19	*SANDY CLAY to SILTY CLAY	>40	>40		2.29	
31.00	50.1	4.92	*SANDY CLAY to SILTY CLAY	>40	>40		2.22	
31.50	123.7	3.49	*CLAYEY SAND to SANDY CLAY	>40	>40		5.64	
31.99	132.5	3.05	*SILTY SAND to CLAYEY SAND	>40	>40			
32.48	163.4	1.86	SAND to SILTY SAND	>40	>40	70-80		40-42
32.97	149.6	1.76	SAND to SILTY SAND	>40	>40	70-80		40-42
33.46	53.4	3.80	SANDY SILT to CLAYEY SILT	25-40	>40	90-100	4.97	27-31
33.96	39.9	2.88	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70	3.71	27-31
34.45	39.8	3.44	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	3.73	27-31
34.94	39.1	3.37	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	3.70	27-31
35.43	33.3	3.07	SANDY SILT to CLAYEY SILT	15-20	20-25	60-70	3.16	27-31
35.93	37.7	3.14	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	3.63	27-31
36.42	89.1	3.51	*CLAYEY SAND to SANDY CLAY	>40	>40		4.42	
36.91	117.9	1.52	SAND to SILTY SAND	>40	>40	60-70		35-40
37.40	78.7	2.14	SILTY SAND to SANDY SILT	25-40	>40	60-70		35-40
37.89	50.4	3.04	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	5.07	27-31
38.39	35.8	4.64	*SANDY CLAY to SILTY CLAY	25-40	25-40		1.79	
38.88	46.1	3.25	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	4.71	27-31
39.37	64.6	1.34	SILTY SAND to SANDY SILT	15-20	20-25	40-50		35-40
39.86	37.8	4.30	CLAYEY SILT to SILTY CLAY	25-40	25-40		3.90	
40.35	53.0	2.99	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	5.58	31-35
40.85	73.2	2.11	SILTY SAND to SANDY SILT	25-40	25-40	60-70		35-40
41.34	112.5	1.75	SILTY SAND to SANDY SILT	>40	>40	60-70		35-40
41.83	146.0	*****						

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = **** FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



North

Not to Scale

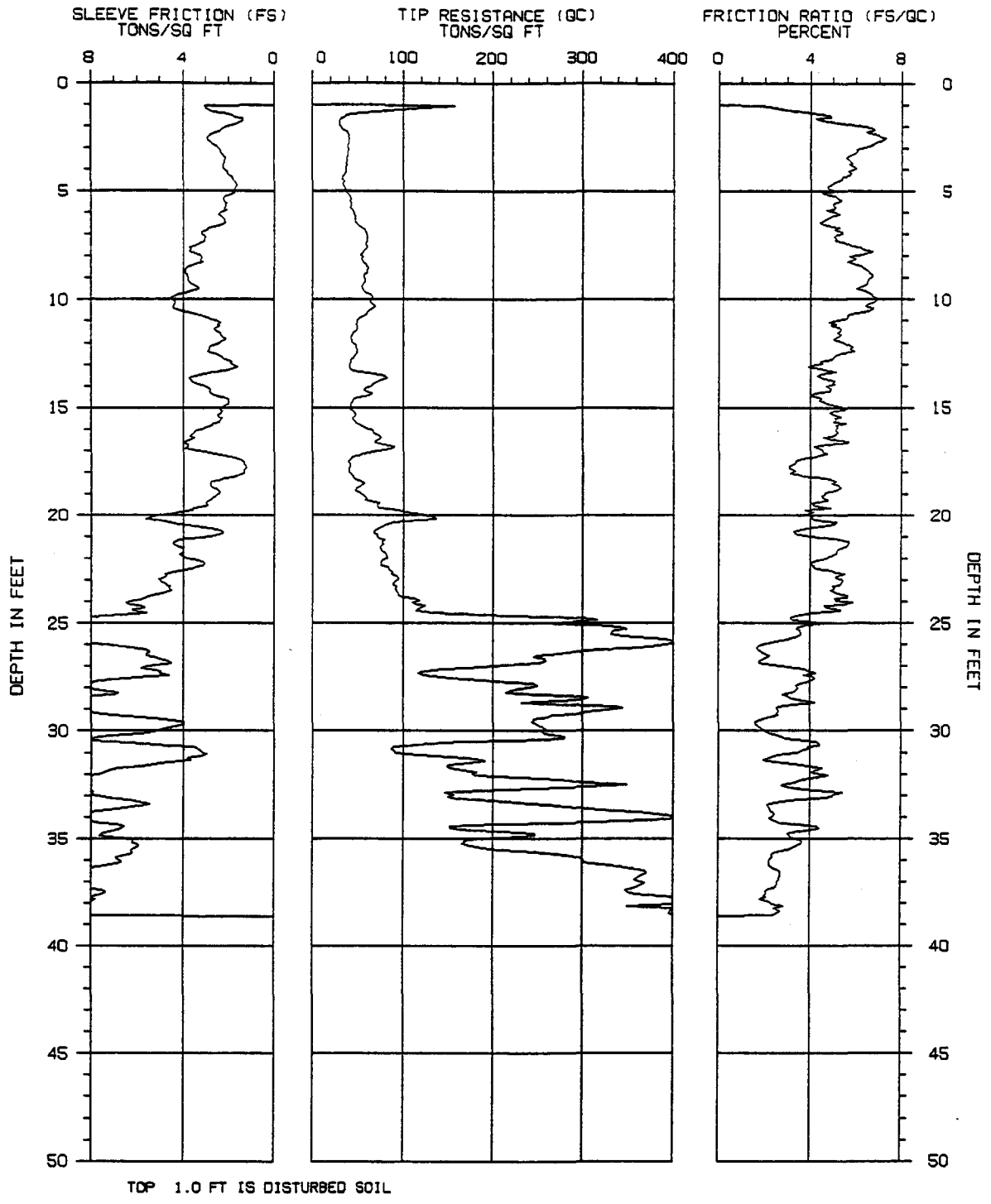
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of CPT-2

1-94

Figure A -41



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-3

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 469/R#3

DATE/TIME: 12-20-93 07:48

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-3 PROJECT No.: 94-380-00005
PROJECT : TETC/METRO RED CONE/RIG : 469/R#3
DATE/TIME: 12-20-93 07:48

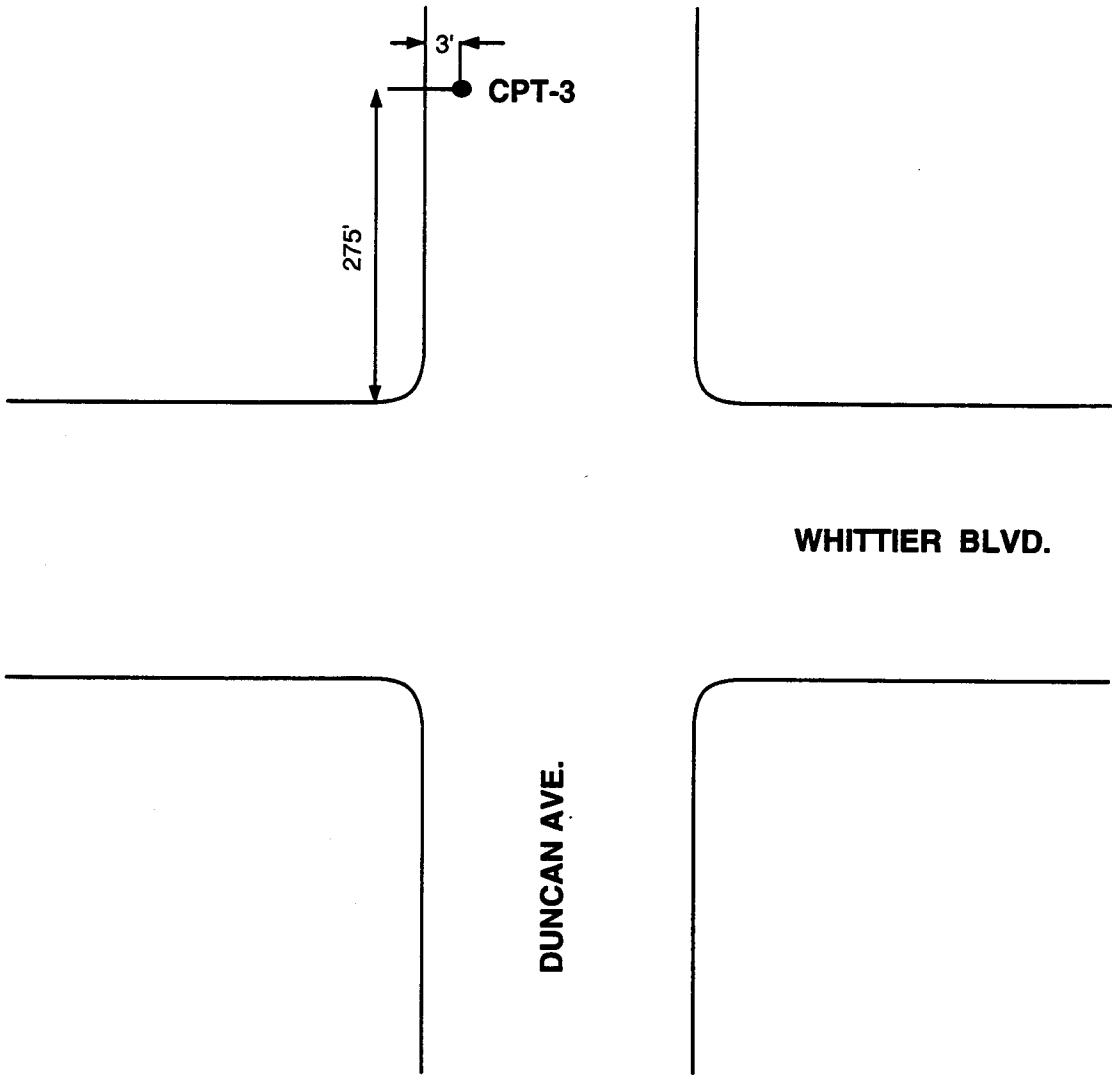
DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	.0	.00						
.98	.0	.00						
1.48	76.4	4.87	*SANDY CLAY to SILTY CLAY	>40	>40		1.24	
1.97	59.4	6.11	*SANDY CLAY to SILTY CLAY	>40	>40		1.02	
2.46	74.1	7.08	*SANDY CLAY to SILTY CLAY	>40	>40		1.34	
2.95	68.7	6.36	*SANDY CLAY to SILTY CLAY	>40	>40		1.30	
3.44	64.7	5.58	*SANDY CLAY to SILTY CLAY	>40	>40		1.27	
3.94	59.7	6.01	*SANDY CLAY to SILTY CLAY	>40	>40		1.22	
4.43	53.9	5.37	*SANDY CLAY to SILTY CLAY	>40	>40		1.13	
4.92	55.4	4.84	*SANDY CLAY to SILTY CLAY	>40	>40		1.20	
5.41	62.2	5.35	*SANDY CLAY to SILTY CLAY	>40	>40		1.38	
5.91	65.3	4.66	*SANDY CLAY to SILTY CLAY	>40	>40		1.49	
6.40	67.1	4.55	*SANDY CLAY to SILTY CLAY	>40	>40		1.57	
6.89	81.4	5.40	*SANDY CLAY to SILTY CLAY	>40	>40		1.95	
7.38	80.0	5.39	*SANDY CLAY to SILTY CLAY	>40	>40		1.96	
7.87	71.9	6.37	*SANDY CLAY to SILTY CLAY	>40	>40		1.79	
8.37	76.3	5.89	*SANDY CLAY to SILTY CLAY	>40	>40		1.94	
8.86	72.3	6.72	*SANDY CLAY to SILTY CLAY	>40	>40		1.87	
9.35	68.5	6.34	*SANDY CLAY to SILTY CLAY	>40	>40		1.81	
9.84	80.2	6.69	*SANDY CLAY to SILTY CLAY	>40	>40		2.16	
10.33	83.5	6.42	*SANDY CLAY to SILTY CLAY	>40	>40		2.28	
10.83	62.3	5.66	*SANDY CLAY to SILTY CLAY	>40	>40		1.73	
11.32	57.1	5.23	*SANDY CLAY to SILTY CLAY	>40	>40		1.61	
11.81	48.7	5.05	*SANDY CLAY to SILTY CLAY	>40	>40		1.39	
12.30	56.2	5.73	*SANDY CLAY to SILTY CLAY	>40	>40		1.63	
12.80	48.0	4.95	*SANDY CLAY to SILTY CLAY	>40	>40		1.41	
13.29	49.2	4.81	*SANDY CLAY to SILTY CLAY	>40	>40		1.47	
13.78	77.9	5.06	*SANDY CLAY to SILTY CLAY	>40	>40		2.37	
14.27	62.7	4.80	*SANDY CLAY to SILTY CLAY	>40	>40		1.93	
14.76	45.4	4.66	*SANDY CLAY to SILTY CLAY	25-40	>40		1.41	
15.26	48.8	4.87	*SANDY CLAY to SILTY CLAY	>40	>40		1.54	
15.75	49.3	5.54	*SANDY CLAY to SILTY CLAY	>40	>40		1.57	
16.24	71.0	5.11	*SANDY CLAY to SILTY CLAY	>40	>40		2.31	
16.73	79.2	4.74	*SANDY CLAY to SILTY CLAY	>40	>40		2.61	
17.22	49.1	4.34	*SANDY CLAY to SILTY CLAY	25-40	>40		1.63	
17.72	40.0	3.06	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	2.67	27-31
18.21	43.3	3.63	SANDY SILT to CLAYEY SILT	25-40	25-40	80-90	2.93	27-31
18.70	48.2	5.34	*SANDY CLAY to SILTY CLAY	>40	>40		1.65	
19.19	56.0	4.55	*SANDY CLAY to SILTY CLAY	>40	>40		1.95	
19.69	67.1	4.88	*SANDY CLAY to SILTY CLAY	>40	>40		2.37	
20.18	125.0	4.14	*CLAYEY SAND to SANDY CLAY	>40	>40		4.50	

TOP 1.0 FT IS DISTURBED SOIL
*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = **** FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-3

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
20.67	63.9	3.60	SANDY SILT to CLAYEY SILT	>40	>40	90-100	4.61	27-31
21.16	71.2	5.30	*SANDY CLAY to SILTY CLAY	>40	>40		2.60	
21.65	68.3	5.15	*SANDY CLAY to SILTY CLAY	>40	>40		2.53	
22.15	66.3	4.15	*CLAYEY SAND to SANDY CLAY	>40	>40		2.48	
22.64	76.3	4.98	*SANDY CLAY to SILTY CLAY	>40	>40		2.89	
23.13	76.1	5.39	*SANDY CLAY to SILTY CLAY	>40	>40		2.91	
23.62	80.0	5.21	*SANDY CLAY to SILTY CLAY	>40	>40		3.10	
24.11	97.5	5.44	*SANDY CLAY to SILTY CLAY	>40	>40		3.82	
24.61	154.2	3.60	*CLAYEY SAND to SANDY CLAY	>40	>40		6.14	
25.10	257.9	3.81	*CLAYEY SAND to SANDY CLAY	>40	>40		10.40	
25.59	280.8	3.46	*SILTY SAND to CLAYEY SAND	>40	>40			
26.08	302.8	1.75	SAND to SILTY SAND	>40	>40	90-100		42-45
26.57	195.3	2.16	SILTY SAND to SANDY SILT	>40	>40	90-100		40-42
27.07	135.8	3.37	*CLAYEY SAND to SANDY CLAY	>40	>40		5.68	
27.56	119.6	4.21	*CLAYEY SAND to SANDY CLAY	>40	>40		5.05	
28.05	177.7	3.47	*CLAYEY SAND to SANDY CLAY	>40	>40		7.60	
28.54	226.6	3.49	*CLAYEY SAND to SANDY CLAY	>40	>40		9.80	
29.04	247.5	2.63	*SILTY SAND to CLAYEY SAND	>40	>40			
29.53	184.2	1.68	SAND to SILTY SAND	>40	>40	70-80		40-42
30.02	190.0	2.09	SILTY SAND to SANDY SILT	>40	>40	90-100		40-42
30.51	122.2	4.29	*CLAYEY SAND to SANDY CLAY	>40	>40		5.46	
31.00	66.6	3.44	SANDY SILT to CLAYEY SILT	>40	>40	90-100	5.95	27-31
31.50	125.8	2.89	*SILTY SAND to CLAYEY SAND	>40	>40			35-40
31.99	126.9	4.24	*CLAYEY SAND to SANDY CLAY	>40	>40		5.84	
32.48	248.0	2.80	*SILTY SAND to CLAYEY SAND	>40	>40			
32.97	110.5	5.04	*SANDY CLAY to SILTY CLAY	>40	>40		5.17	
33.46	182.4	2.14	SILTY SAND to SANDY SILT	>40	>40	90-100		40-42
33.96	276.4	2.41	*SILTY SAND to CLAYEY SAND	>40	>40			
34.45	103.9	4.33	*CLAYEY SAND to SANDY CLAY	>40	>40		4.99	
34.94	144.0	3.22	*CLAYEY SAND to SANDY CLAY	>40	>40		7.01	
35.43	126.4	3.25	*CLAYEY SAND to SANDY CLAY	>40	>40		6.19	
35.93	198.9	2.32	*SILTY SAND to CLAYEY SAND	>40	>40	90-100		40-42
36.42	238.4	2.52	*SILTY SAND to CLAYEY SAND	>40	>40			
36.91	234.9	2.68	*SILTY SAND to CLAYEY SAND	>40	>40			
37.40	226.5	2.15	*SILTY SAND to CLAYEY SAND	>40	>40	90-100		40-42
37.89	274.7	2.16	*SILTY SAND to CLAYEY SAND	>40	>40			
38.39	253.2	2.70	*SILTY SAND to CLAYEY SAND	>40	>40			
38.88	303.2	*****						

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = **** FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



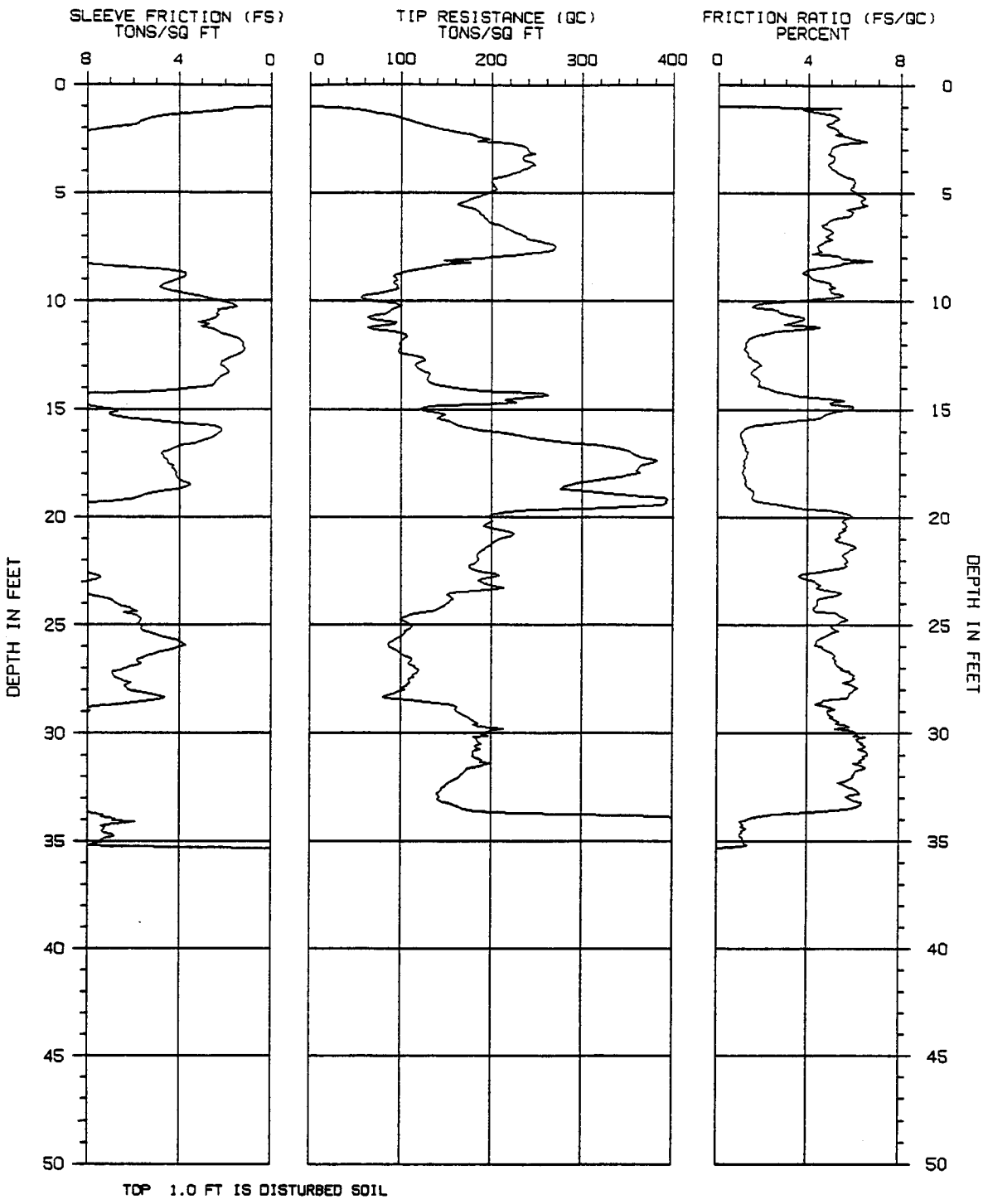
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of CPT-3

1-94

Figure A -42



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-4

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 469/R#3

DATE/TIME: 12-20-93 08:13

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-4 PROJECT No.: 94-380-00005
PROJECT : TETC/METRO RED CONE/RIG : 469/R#3
DATE/TIME: 12-20-93 08:13

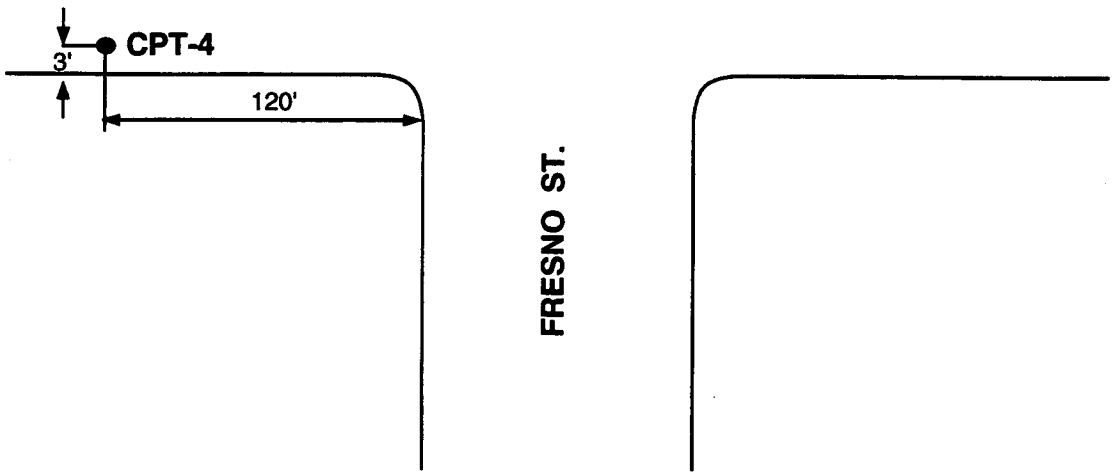
DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	.0	.00						
.98	.0	.00						
1.48	193.2	5.24	*SANDY CLAY to SILTY CLAY	>40	>40		3.14	
1.97	258.5	5.07	*SANDY CLAY to SILTY CLAY	>40	>40		4.47	
2.46	347.9	5.93	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
2.95	418.5	4.99	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
3.44	392.6	5.12	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
3.94	376.9	5.15	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
4.43	314.5	5.98	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
4.92	302.7	6.03	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
5.41	255.2	6.28	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
5.91	270.3	5.92	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
6.40	282.2	4.81	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
6.89	318.7	4.94	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
7.38	360.0	4.49	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
7.87	294.9	5.29	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
8.37	183.2	5.06	*SANDY CLAY to SILTY CLAY	>40	>40		4.68	
8.86	116.3	4.09	*CLAYEY SAND to SANDY CLAY	>40	>40		3.02	
9.35	118.3	5.14	*SANDY CLAY to SILTY CLAY	>40	>40		3.13	
9.84	69.2	5.01	*SANDY CLAY to SILTY CLAY	>40	>40		1.86	
10.33	112.0	1.85	SILTY SAND to SANDY SILT	>40	>40	60-70		35-40
10.83	80.1	3.83	*CLAYEY SAND to SANDY CLAY	>40	>40		2.23	
11.32	80.9	3.61	*CLAYEY SAND to SANDY CLAY	>40	>40		2.28	
11.81	115.2	1.32	SAND to SILTY SAND	25-40	25-40	50-60		40-42
12.30	109.1	1.26	SAND to SILTY SAND	25-40	25-40	50-60		40-42
12.80	138.0	1.74	SAND to SILTY SAND	>40	>40	70-80		35-40
13.29	140.1	1.47	SAND to SILTY SAND	>40	>40	60-70		40-42
13.78	143.8	1.84	SILTY SAND to SANDY SILT	>40	>40	70-80		35-40
14.27	272.6	3.10	*SILTY SAND to CLAYEY SAND	>40	>40			
14.76	198.2	5.04	*SANDY CLAY to SILTY CLAY	>40	>40		6.25	
15.26	154.6	4.73	*SANDY CLAY to SILTY CLAY	>40	>40		4.93	
15.75	165.6	1.74	SAND to SILTY SAND	>40	>40	70-80		40-42
16.24	237.2	1.06	SAND to SILTY SAND	>40	>40	70-80		42-45
16.73	326.7	1.23	SAND to SILTY SAND	>40	>40	80-90		42-45
17.22	359.5	1.28	SAND to SILTY SAND	>40	>40	80-90		42-45
17.72	352.7	1.20	SAND to SILTY SAND	>40	>40	80-90		42-45
18.21	317.9	1.23	SAND to SILTY SAND	>40	>40	80-90		42-45
18.70	261.7	1.50	SAND to SILTY SAND	>40	>40	80-90		42-45
19.19	370.9	1.57	SAND to SILTY SAND	>40	>40	90-100		42-45
19.69	226.9	4.88	*SANDY CLAY to SILTY CLAY	>40	>40		8.11	
20.18	184.5	5.50	*SANDY CLAY to SILTY CLAY	>40	>40		6.67	

TOP 1.0 FT IS DISTURBED SOIL
*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 50.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-4

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
20.67	197.2	5.48	*SANDY CLAY to SILTY CLAY	>40	>40		7.21	
21.16	181.8	5.46	*SANDY CLAY to SILTY CLAY	>40	>40		6.72	
21.65	164.1	5.61	*SANDY CLAY to SILTY CLAY	>40	>40		6.13	
22.15	160.2	5.62	*SANDY CLAY to SILTY CLAY	>40	>40		6.05	
22.64	177.4	3.84	*CLAYEY SAND to SANDY CLAY	>40	>40		6.78	
23.13	169.1	4.57	*CLAYEY SAND to SANDY CLAY	>40	>40		6.52	
23.62	128.2	5.24	*SANDY CLAY to SILTY CLAY	>40	>40		4.99	
24.11	124.4	4.38	*CLAYEY SAND to SANDY CLAY	>40	>40		4.89	
24.61	87.6	5.51	*SANDY CLAY to SILTY CLAY	>40	>40		3.47	
25.10	92.1	5.05	*SANDY CLAY to SILTY CLAY	>40	>40		3.68	
25.59	79.0	4.60	*SANDY CLAY to SILTY CLAY	>40	>40		3.18	
26.08	72.3	4.67	*SANDY CLAY to SILTY CLAY	>40	>40		2.94	
26.57	89.3	5.18	*SANDY CLAY to SILTY CLAY	>40	>40		3.68	
27.07	94.6	5.48	*SANDY CLAY to SILTY CLAY	>40	>40		3.94	
27.56	85.6	5.93	*SANDY CLAY to SILTY CLAY	>40	>40		3.59	
28.05	76.8	6.02	*SANDY CLAY to SILTY CLAY	>40	>40		3.25	
28.54	97.8	4.68	*SANDY CLAY to SILTY CLAY	>40	>40		4.20	
29.04	123.9	4.87	*SANDY CLAY to SILTY CLAY	>40	>40		5.38	
29.53	139.4	5.24	*SANDY CLAY to SILTY CLAY	>40	>40		6.12	
30.02	140.8	6.17	*SANDY CLAY to SILTY CLAY	>40	>40		6.24	
30.51	139.2	6.32	*SANDY CLAY to SILTY CLAY	>40	>40		6.23	
31.00	131.7	6.61	*SANDY CLAY to SILTY CLAY	>40	>40		5.95	
31.50	137.2	6.29	*SANDY CLAY to SILTY CLAY	>40	>40		6.26	
31.99	118.7	5.96	*SANDY CLAY to SILTY CLAY	>40	>40		5.46	
32.48	106.0	5.73	*SANDY CLAY to SILTY CLAY	>40	>40		4.91	
32.97	100.9	5.70	*SANDY CLAY to SILTY CLAY	>40	>40		4.72	
33.46	115.5	6.11	*SANDY CLAY to SILTY CLAY	>40	>40		5.46	
33.96	328.4	1.43	SAND to SILTY SAND	>40	>40	80-90		42-45
34.45	385.2	1.29	SAND to SILTY SAND	>40	>40	90-100		42-45
34.94	421.0	1.19	SAND to SILTY SAND	>40	>40	90-100		42-45
35.43	436.5	*****						

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 50.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



North

Not to Scale

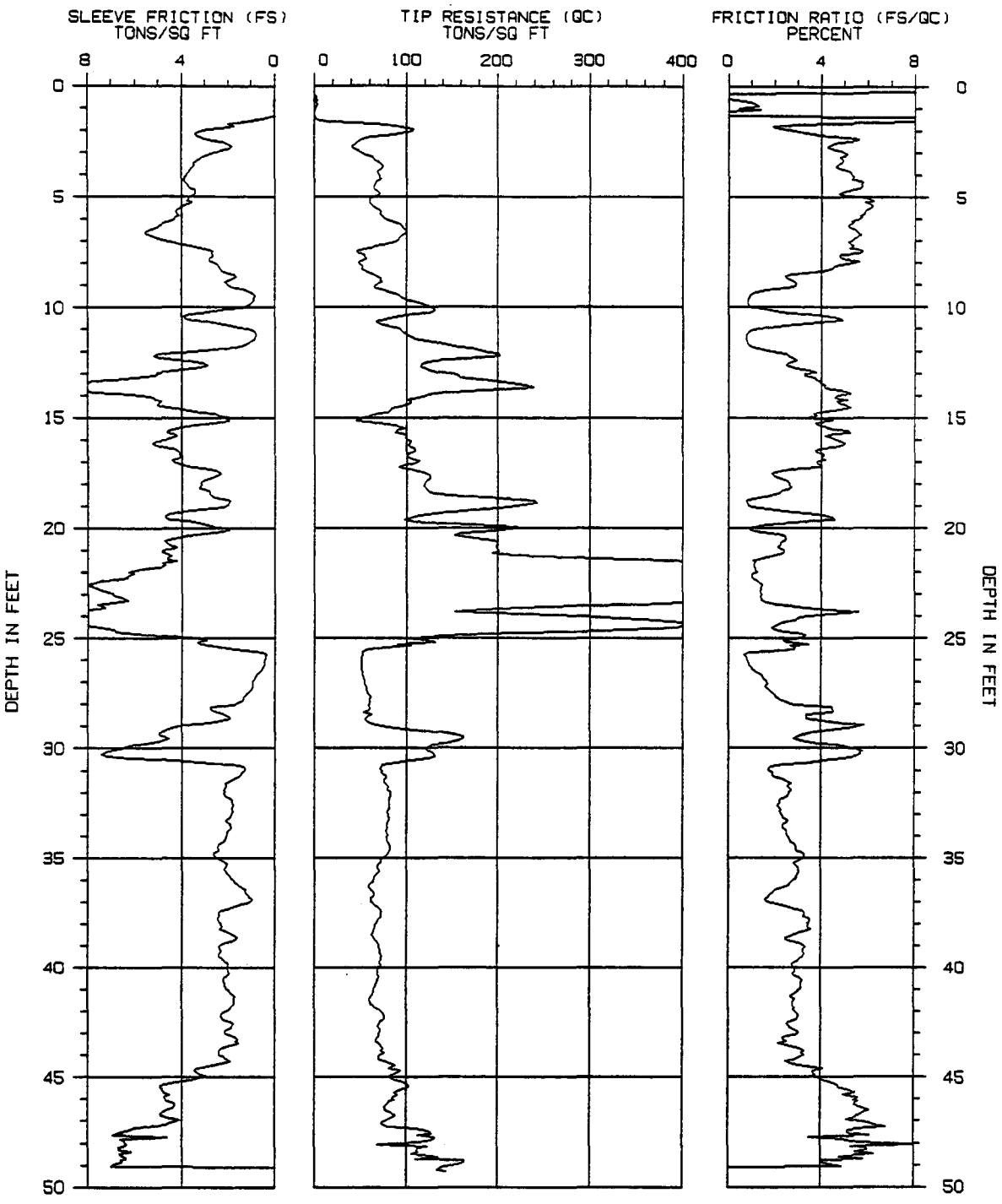
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of CPT-4

1-94

Figure A -43



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-5

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 469/R#3

DATE/TIME: 12-20-93 09:25

THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-5 PROJECT No.: 94-380-00005
PROJECT : TETC/METRO RED CONE/RIG : 469/R#3
DATE/TIME: 12-20-93 09:25

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	5.6	-.30						
.98	2.7	.48	SANDY SILT to CLAYEY SILT	1-3	7-10		.08	
1.48	2.1	15.00	ORGANIC MATERIAL	3-5	10-15		.09	
1.97	208.9	2.65	*SILTY SAND to CLAYEY SAND	>40	>40			
2.46	90.5	5.27	*SANDY CLAY to SILTY CLAY	>40	>40		1.64	
2.95	85.5	4.94	*SANDY CLAY to SILTY CLAY	>40	>40		1.62	
3.44	117.7	4.88	*SANDY CLAY to SILTY CLAY	>40	>40		2.32	
3.94	113.5	5.31	*SANDY CLAY to SILTY CLAY	>40	>40		2.32	
4.43	104.3	5.69	*SANDY CLAY to SILTY CLAY	>40	>40		2.20	
4.92	105.2	5.11	*SANDY CLAY to SILTY CLAY	>40	>40		2.28	
5.41	94.8	6.17	*SANDY CLAY to SILTY CLAY	>40	>40		2.11	
5.91	107.6	5.72	*SANDY CLAY to SILTY CLAY	>40	>40		2.46	
6.40	137.4	5.30	*SANDY CLAY to SILTY CLAY	>40	>40		3.22	
6.89	127.0	5.41	*SANDY CLAY to SILTY CLAY	>40	>40		3.04	
7.38	72.4	5.52	*SANDY CLAY to SILTY CLAY	>40	>40		1.77	
7.87	70.1	5.32	*SANDY CLAY to SILTY CLAY	>40	>40		1.75	
8.37	72.4	4.03	*CLAYEY SAND to SANDY CLAY	>40	>40		1.84	
8.86	94.2	2.87	SILTY SAND to SANDY SILT	>40	>40	90-100		31-35
9.35	107.1	1.09	SAND to SILTY SAND	25-40	25-40	50-60		40-42
9.84	143.3	.88	SAND to SILTY SAND	25-40	25-40	50-60		40-42
10.33	128.8	3.40	*CLAYEY SAND to SANDY CLAY	>40	>40		3.53	
10.83	92.7	2.44	SILTY SAND to SANDY SILT	>40	>40	70-80		35-40
11.32	119.1	.77	SAND to SILTY SAND	20-25	20-25	50-60		40-42
11.81	181.2	1.05	SAND to SILTY SAND	>40	>40	60-70		40-42
12.30	205.4	2.72	*SILTY SAND to CLAYEY SAND	>40	>40			
12.80	135.2	2.88	*SILTY SAND to CLAYEY SAND	>40	>40			
13.29	200.2	3.81	*CLAYEY SAND to SANDY CLAY	>40	>40		6.05	
13.78	200.3	4.78	*SANDY CLAY to SILTY CLAY	>40	>40		6.14	
14.27	112.0	4.67	*SANDY CLAY to SILTY CLAY	>40	>40		3.47	
14.76	84.2	3.94	*CLAYEY SAND to SANDY CLAY	>40	>40		2.64	
15.26	71.7	3.79	*CLAYEY SAND to SANDY CLAY	>40	>40		2.27	
15.75	97.9	4.53	*SANDY CLAY to SILTY CLAY	>40	>40		3.15	
16.24	103.7	4.93	*SANDY CLAY to SILTY CLAY	>40	>40		3.38	
16.73	99.6	4.10	*CLAYEY SAND to SANDY CLAY	>40	>40		3.29	
17.22	89.6	3.90	*CLAYEY SAND to SANDY CLAY	>40	>40		3.00	
17.72	122.6	2.16	SILTY SAND to SANDY SILT	>40	>40	70-80		35-40
18.21	117.1	2.67	SILTY SAND to SANDY SILT	>40	>40	90-100		35-40
18.70	210.7	.91	SAND to SILTY SAND	>40	>40	60-70		42-45
19.19	162.6	2.08	SILTY SAND to SANDY SILT	>40	>40	80-90		35-40
19.69	93.7	3.67	*CLAYEY SAND to SANDY CLAY	>40	>40		3.33	
20.18	166.1	1.39	SAND to SILTY SAND	>40	>40	60-70		40-42

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 52.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-5

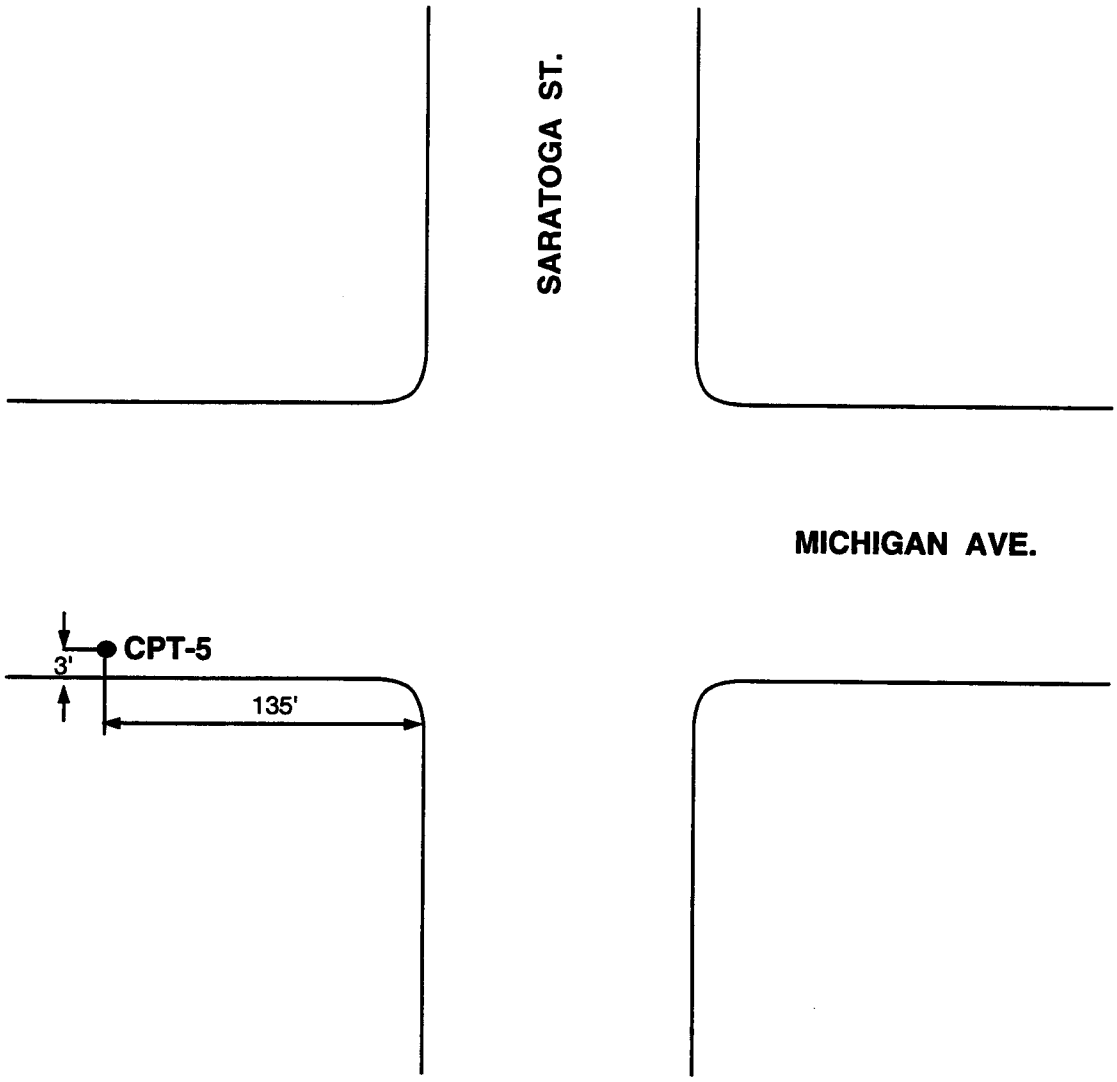
DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
20.67	181.0	2.30	SILTY SAND to SANDY SILT	>40	>40	90-100		35-40
21.16	174.6	2.37	SILTY SAND to SANDY SILT	>40	>40	90-100		35-40
21.65	372.6	1.12	SAND to SILTY SAND	>40	>40	80-90		42-45
22.15	518.6	1.06	SAND to SILTY SAND	>40	>40	90-100		45-48
22.64	457.3	1.49	*SAND to SILTY SAND	>40	>40			
23.13	401.4	1.40	SAND to SILTY SAND	>40	>40	90-100		42-45
23.62	190.3	3.23	*SILTY SAND to CLAYEY SAND	>40	>40			
24.11	299.1	2.95	*SILTY SAND to CLAYEY SAND	>40	>40			
24.61	280.9	2.03	*SAND to SILTY SAND	>40	>40			
25.10	101.1	2.37	SILTY SAND to SANDY SILT	>40	>40	70-80		35-40
25.59	42.7	1.69	SILTY SAND to SANDY SILT	10-15	15-20	40-50		31-35
26.08	41.6	.86	SAND to SILTY SAND	5-10	10-15	30-40		35-40
26.57	42.1	1.28	SILTY SAND to SANDY SILT	10-15	15-20	30-40		31-35
27.07	43.3	1.71	SILTY SAND to SANDY SILT	15-20	15-20	40-50		31-35
27.56	46.4	2.00	SILTY SAND to SANDY SILT	15-20	20-25	50-60		31-35
28.05	46.2	2.91	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	3.87	27-31
28.54	44.1	3.38	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	3.73	27-31
29.04	60.0	5.46	*SANDY CLAY to SILTY CLAY	>40	>40		2.58	
29.53	122.0	2.81	*SILTY SAND to CLAYEY SAND	>40	>40	90-100		35-40
30.02	90.6	5.47	*SANDY CLAY to SILTY CLAY	>40	>40		3.99	
30.51	83.5	4.43	*SANDY CLAY to SILTY CLAY	>40	>40		3.71	
31.00	53.4	1.76	SILTY SAND to SANDY SILT	15-20	20-25	50-60		31-35
31.50	55.0	2.51	SILTY SAND to SANDY SILT	25-40	25-40	60-70		31-35
31.99	58.9	2.61	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	5.35	31-35
32.48	57.7	2.24	SILTY SAND to SANDY SILT	25-40	25-40	60-70		31-35
32.97	56.1	2.28	SILTY SAND to SANDY SILT	25-40	25-40	60-70		31-35
33.46	55.2	2.42	SILTY SAND to SANDY SILT	25-40	25-40	60-70		31-35
33.96	55.5	2.55	SILTY SAND to SANDY SILT	25-40	25-40	60-70		31-35
34.45	56.4	2.91	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	5.35	31-35
34.94	52.2	3.31	SANDY SILT to CLAYEY SILT	25-40	>40	80-90	4.99	27-31
35.43	46.6	3.02	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	4.48	27-31
35.93	43.0	2.93	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.16	27-31
36.42	40.5	2.05	SILTY SAND to SANDY SILT	15-20	20-25	50-60		31-35
36.91	39.9	1.61	SILTY SAND to SANDY SILT	10-15	15-20	40-50		31-35
37.40	47.3	3.19	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	4.70	27-31
37.89	43.7	3.51	SANDY SILT to CLAYEY SILT	25-40	25-40	80-90	4.38	27-31
38.39	40.8	3.13	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.11	27-31
38.88	43.5	3.05	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.43	27-31
39.37	45.3	3.30	SANDY SILT to CLAYEY SILT	25-40	25-40	70-80	4.67	27-31
39.86	44.7	2.78	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70	4.64	27-31
40.35	43.3	2.91	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.53	27-31
40.85	40.7	3.17	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.28	27-31
41.34	37.3	2.71	SANDY SILT to CLAYEY SILT	15-20	20-25	60-70	3.94	27-31
41.83	40.2	2.84	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70	4.29	27-31
42.32	44.9	2.98	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.86	27-31
42.81	42.3	2.80	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70	4.61	27-31
43.31	39.4	2.40	SANDY SILT to CLAYEY SILT	15-20	20-25	50-60	4.31	31-35
43.80	41.9	3.29	SANDY SILT to CLAYEY SILT	20-25	25-40	70-80	4.63	27-31
44.29	44.3	2.49	SANDY SILT to CLAYEY SILT	20-25	25-40	60-70	4.96	31-35
44.78	51.4	3.69	SANDY SILT to CLAYEY SILT	25-40	>40	90-100	5.83	27-31

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 52.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

SOUNDING : CPT-5

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
45.28	55.6	4.53	*SANDY CLAY to SILTY CLAY	>40	>40		3.19	
45.77	50.8	4.99	*SANDY CLAY to SILTY CLAY	>40	>40		2.93	
46.26	43.7	5.48	*SANDY CLAY to SILTY CLAY	>40	>40		2.52	
46.75	48.4	5.54	*SANDY CLAY to SILTY CLAY	>40	>40		2.83	
47.24	44.2	6.82	*SANDY CLAY to SILTY CLAY	>40	>40		2.60	
47.74	71.3	3.50	*CLAYEY SAND to SANDY CLAY	>40	>40	90-100	4.28	27-31
48.23	60.6	5.96	*SANDY CLAY to SILTY CLAY	>40	>40		3.66	
48.72	58.8	5.81	*SANDY CLAY to SILTY CLAY	>40	>40		3.57	
49.21	70.9	*****						

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 52.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



North

Not to Scale

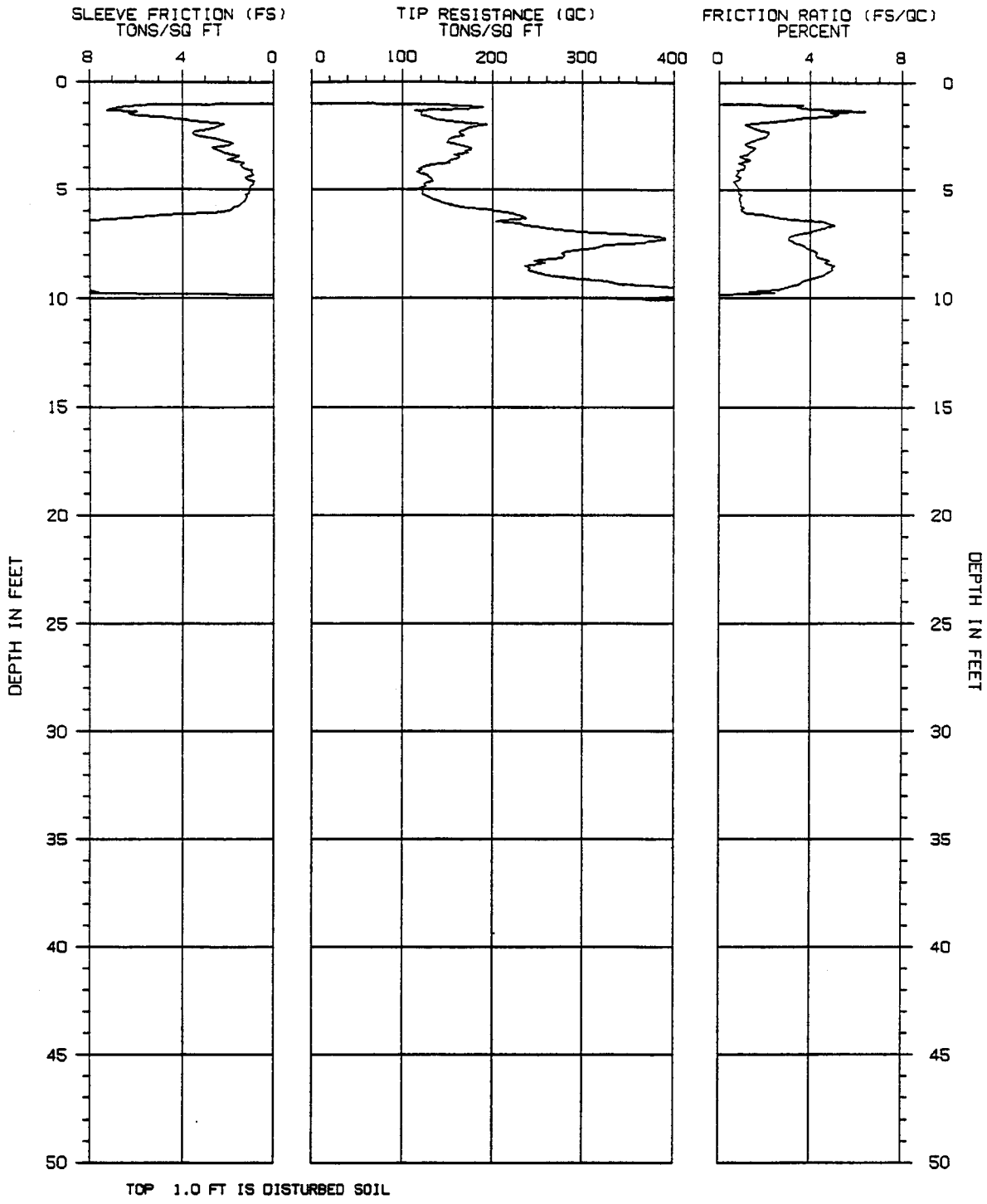
GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Location of CPT-5

1-94

Figure A -44



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-6A

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 469/R#3

DATE/TIME: 12-20-93 10:36

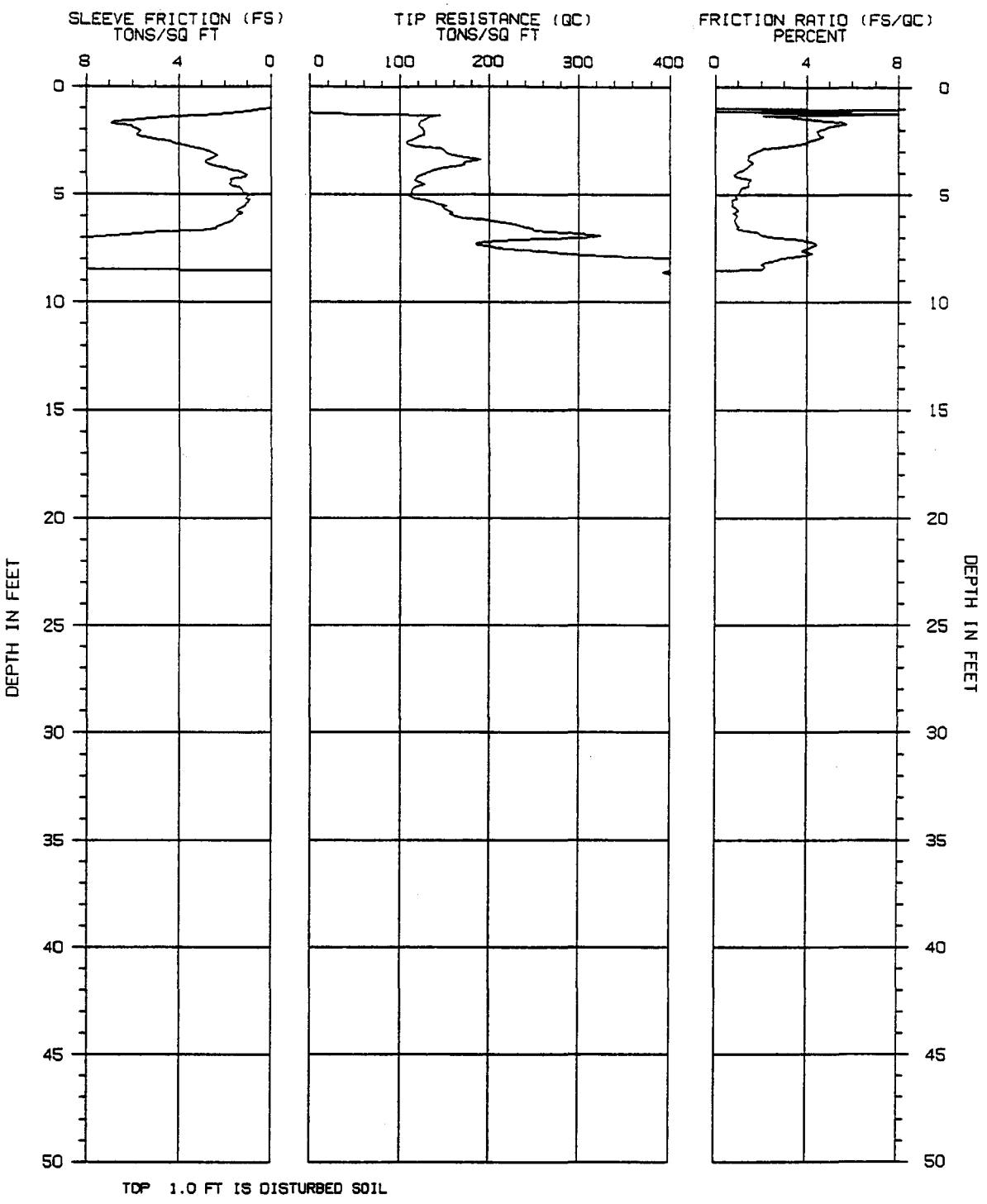
THE EARTH TECHNOLOGY CORPORATION

CPT INTERPRETATIONS

SOUNDING : CPT-6A
PROJECT : TETC/METRO RED
DATE/TIME: 12-20-93 10:36
PROJECT No.: 94-380-00005
CONE/RIG : 469/R#3

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	.0	.00						
.98	.0	.00						
1.48	246.5	5.23	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
1.97	371.7	1.13	SAND to SILTY SAND	>40	>40	80-90		42-45
2.46	307.2	2.05	*SAND to SILTY SAND	>40	>40			
2.95	290.8	1.20	SAND to SILTY SAND	>40	>40	70-80		42-45
3.44	274.0	.91	SAND to SILTY SAND	>40	>40	70-80		42-45
3.94	201.0	1.12	SAND to SILTY SAND	>40	>40	60-70		40-42
4.43	201.9	.96	SAND to SILTY SAND	>40	>40	60-70		40-42
4.92	180.3	.85	SAND to SILTY SAND	>40	>40	60-70		40-42
5.41	194.7	.90	SAND to SILTY SAND	>40	>40	60-70		40-42
5.91	276.1	.94	SAND to SILTY SAND	>40	>40	70-80		42-45
6.40	299.0	3.77	*CLAYEY SAND to SANDY CLAY	>40	>40		7.03	
6.89	393.2	4.20	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
7.38	504.2	3.20	*SILTY SAND to CLAYEY SAND	>40	>40			
7.87	367.2	4.30	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
8.37	335.3	4.62	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
8.86	320.8	4.74	*HEAVILY O.C./CEMENT. MAT.	>40	>40			
9.35	427.0	3.49	*SILTY SAND to CLAYEY SAND	>40	>40			
9.84	564.6	*****						

TOP 1.0 FT IS DISTURBED SOIL
*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 50.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



CONE PENETRATION TEST

SOUNDING NUMBER: CPT-6

PROJECT NAME : TETC/METRO RED

PROJECT NUMBER : 94-380-00005

CONE/RIG : 469/R#3

DATE/TIME: 12-20-93 12:11

THE EARTH TECHNOLOGY CORPORATION

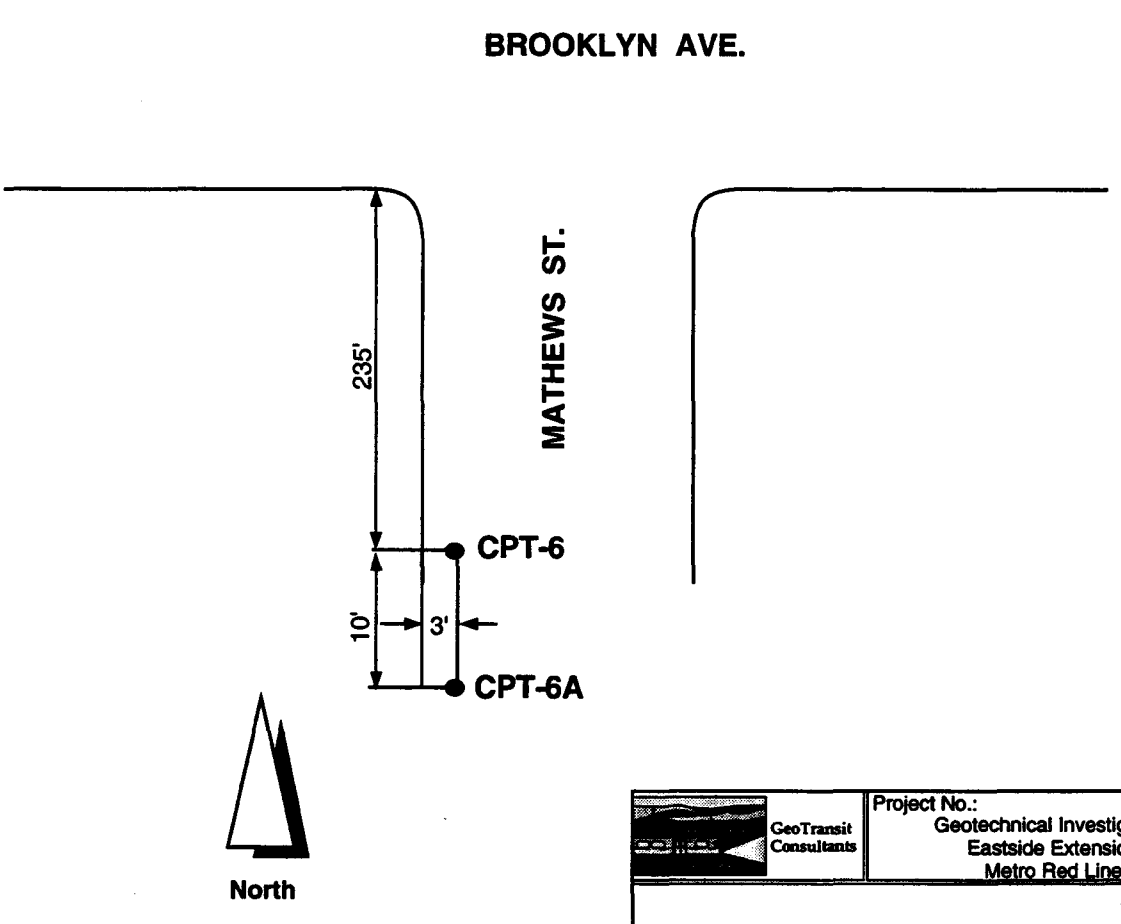
CPT INTERPRETATIONS

SOUNDING : CPT-6
PROJECT : TETC/METRO RED
DATE/TIME: 12-20-93 12:11

PROJECT No.: 94-380-00005
CONE/RIG : 469/R#3

DEPTH (ft)	NORMALIZED TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N1	N1-F	Dr (%)	Su (tsf)	PHI (Degrees)
.49	.0	.00						
.98	.0	.00						
1.48	267.9	3.99	*CLAYEY SAND to SANDY CLAY	>40	>40		4.35	
1.97	242.8	4.66	*CLAYEY SAND to SANDY CLAY	>40	>40		4.19	
2.46	208.3	4.24	*CLAYEY SAND to SANDY CLAY	>40	>40		3.79	
2.95	260.7	1.91	SAND to SILTY SAND	>40	>40	90-100		40-42
3.44	309.8	1.54	SAND to SILTY SAND	>40	>40	90-100		42-45
3.94	216.0	.98	SAND to SILTY SAND	>40	>40	60-70		42-45
4.43	190.6	1.44	SAND to SILTY SAND	>40	>40	70-80		40-42
4.92	172.8	1.03	SAND to SILTY SAND	>40	>40	60-70		40-42
5.41	208.7	.78	SAND to SILTY SAND	>40	>40	60-70		42-45
5.91	224.5	.90	SAND to SILTY SAND	>40	>40	60-70		42-45
6.40	330.5	.95	SAND to SILTY SAND	>40	>40	70-80		42-45
6.89	448.7	2.11	*SAND to SILTY SAND	>40	>40			
7.38	268.7	4.21	*CLAYEY SAND to SANDY CLAY	>40	>40		6.60	
7.87	481.5	3.29	*SILTY SAND to CLAYEY SAND	>40	>40			
8.37	716.1	2.17	*SAND to SILTY SAND	>40	>40			

TOP 1.0 FT IS DISTURBED SOIL
*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 PCF
ASSUMED DEPTH OF WATER TABLE = 50.0 FT
N1 = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE
N1-F = OVERBURDEN NORMALIZED FINES-CONTENT ADJUSTED EQUIVALENT SPT VALUE
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE



GeoTransit Consultants

Project No.: 94-1100
Geotechnical Investigation
Eastside Extension
Metro Red Line

Locations of CPT-6 & CPT-6A

1-94

Figure A -45

Appendix B

Appendix B

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

LABORATORY TESTING

GENERAL

The results of laboratory testing performed in conjunction with this project accompany this appendix. The following laboratory tests were performed on representative samples in accordance with the latest applicable American Society for Testing Materials (ASTM) and California Department of Transportation (Caltrans) standards. Laboratory test results are summarized in Tables 3-4 and 5-1.

CLASSIFICATION

Soils were classified visually in accordance with ASTM Test Method D2488-90. Where laboratory test results were available classification was in accordance with ASTM Test Method D2487-90. The soil classifications are presented in the test data and boring logs.

MOISTURE AND IN PLACE DENSITY

The field moisture content and in place dry density determinations were performed on relatively undisturbed California Drive samples obtained from test borings. The moisture content was obtained in accordance with ASTM Test Method D2216. The in place dry density was computed using the net weight of the entire (ring) sample. The results of these tests are presented in the boring logs.

PARTICLE SIZE ANALYSIS

Grain size distribution of soil samples were obtained in accordance with ASTM Test Method D422. Laboratory test results for the grain size analysis are summarized in Table B-1. Figures B-1 through B-101 present the grain size distribution curves.

FINES CONTENT ANALYSIS

Fines content (percent passing #200 sieve) of soil samples was obtained in accordance with ASTM Test Method D1140. Laboratory test results for the fines content analysis are summarized in Table B-1.

ATTERBERG LIMITS

Tests for Atterberg Limits (Liquid Limit and Plasticity Index) were performed according to ASTM Tests Method D4318. Laboratory test results for the Atterberg Limits are summarized in Table B-2. These results are also presented along with grain size distribution curves.

SPECIFIC GRAVITY

Specific gravity tests were performed on fine-grained (passing #4 sieve) soil samples in accordance with ASTM Test Method D854.

DIRECT SHEAR TESTS

Direct shear tests were performed on selected relatively undisturbed soil samples which were saturated under surcharge equal to the applied normal force during testing. The apparatus used is in conformance with the requirements outlined in ASTM Test Method D3080. The test specimens, 2.4 inches in diameter and 1 inch in height, were subjected to shear along a plane mid-height after allowing time for pore pressure dissipation prior to application of shearing force.

The samples were tested under normal loads of 3, 6, and 12 ksf or 4, 8 and 16 ksf with a different specimen being used for each normal load. Drained and undrained direct shear tests were performed on coarse- and fine-grained soil samples, respectively. The samples were sheared at constant rates of strain ranging 0.0017 to 0.0050 inches per minute. Shearing of each specimens was continued until the shear stress became essentially constant or until a deformation of approximately 10% of the original diameter had been reached. Laboratory test results for the direct shear tests are summarized in Table B-3, and are graphically presented in Figures B-102 through B-125.

UNCONFINED COMPRESSION TESTS

Unconfined compression tests were performed on selected relatively undisturbed soil samples in accordance with procedures outlined in ASTM Test Method D2168. The soil samples (Height/Diameter ratio of about 2) were subjected to a constant strain rate of 1% per minute. Laboratory test results for the unconfined compression tests are summarized in Table B-4 and graphically presented in Figures B-126 through B-132.

CONSOLIDATION AND COLLAPSE TESTS

Consolidation tests were performed on selected relatively undisturbed soil samples in accordance with procedures outlined in ASTM Test Method D2435. The samples were placed in a consolidometer and loads were applied incrementally in geometric progression. The samples (2.4 inches in diameter and 1 inch in height) were permitted to consolidate under each load increment until the slope of the characteristic linear secondary compression portion of the thickness versus log of time plot was apparent.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydroconsolidation (collapse) and/or expansion characteristics were also evaluated by monitoring the change in volume with the addition of water while the specimen was confined under a constant normal stress close to the in-situ vertical

stress. The consolidation test results are summarized in Table B-5 and are graphically presented in Figures B-133 through B-144.

pH, CHLORIDE CONTENT, SULFIDES CONTENT, SULFATE CONTENT AND ELECTRICAL RESISTIVITY TESTS

The concentrations of water soluble sulfate ions of selected soil samples were determined in accordance with the Caltrans Method No. 417-B. Soil pH values were determined in accordance with USEPA Method 9045. Sulfides content was determined in accordance with USEPA Method 9030. Chloride content was determined in accordance with Caltrans Method No 422. Tests to determine the electrical resistivity were conducted in general accordance with Caltrans Method No. 532. Electrical resistivity tests were conducted at in situ moisture content on all samples. On several near-surface samples resistivity tests were also performed at saturation. The results of pH, chloride content, soluble sulfate content and electrical resistivity evaluations are presented in Table B-6.

TABLE B-1. RESULTS OF GRAIN SIZE AND FINES CONTENT TESTS (PAGE 1 OF 6)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Grain Size Distribution [1]		
						Gravel Content (%)	Sand Content (%)	Fines Content [2] (%)
Eastern Tunnel Segment	PE-1	D-3	15.0	SC	Qya			44
		S-6	30.0	SM				40
		D-7	35.0	CL		0	28	72
		D-10	45.0	CL				53
		D-12	55.0	ML				55
		S-13	60.0	SP-SM				8
		D-14	65.0	SP-SM				11
		D-16	75.0	SP-SM				6
	PE-2	D-4	20.0	CL	Qoa			69
		D-6	30.0	CL		0	6	94
		S-11	55.0	SM				14
		D-12	60.0	SW-SM				9
		S-13	65.3	SM				29
	PE-3	S-8	40.0	SM	Qoa			17
		D-9	45.0	CL				54
		S-10	50.0	SM				26
		D-13	65.0	SM		0	67	33
		D-15	75.0	SW-SC		6	80	14
	PE-4	S-7	35.3	SM	Qoa			21
		D-8	40.2	CL/ML		0	16	84
		D-10	50.0	SC		1	85	14
	PE-5	S-6	30.0	SM	Qoa			46
		S-7	40.0	SP-SM		23	68	9
		D-10	55.0	SM/GP				18
		D-11	60.0	SM				45
		S-12	65.0	SM				16
	PE-6	D-5	25.0	GW-GM	Qoa	10	83	7
		D-10	58.0	ML		0	36	64
		D-11	60.0	ML				60
		D-12	65.0	SP-SM		16	79	5
		D-14	75.0	SP-SM				5
	PE-7	D-4	20.0	CL	Qya			57
		D-6	30.0	SW-SM		18	76	6
		S-7	35.0	ML				84

TABLE B-1. RESULTS OF GRAIN SIZE AND FINES CONTENT TESTS (PAGE 2 OF 6)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Grain Size Distribution [1]		
						Gravel Content (%)	Sand Content (%)	Fines Content [2] (%)
Eastern Tunnel Segment	PE-7	D-8	40.0	SM	Qya			16
		S-9	45.0	SP/GP				3
		D-11	55.0	SP/GP				4
	PE-8	D-3	15.0	SM	Qoa			26
		S-4	20.0	SW-SM		7	85	8
		D-9	45.0	CL/ML		0	34	66
		S-10	50.0	SC/CL				49
		S-12	60.0	SC/CL				53
		D-13	65.0	ML/SM				51
		S-16	80.0	SP-SM				12
	PE-9	S-6	30.0	SC	Qoa			47
		D-7	35.0	SP-SM				8
		S-8	40.0	SM				21
		D-9	45.0	SP-SM		7	85	8
		S-10	50.0	SW-SM		16	77	7
		D-13	65.0	SC				27
	PE-10	D-7	35.0	SM	Qoa			18
		D-8	45.0	ML		0	4	96
		D-10	61.0	SC				40
	PE-11	D-6	30.0	SM	Qoa			37
		S-11	55.0	SW/GW		3	79	18
		D-12	60.4	SM/ML				45
		S-13	65.0	CL				61
		D-14	70.5	SM				44
	PE-12	S-8	40.0	CL	Qoa			69
		S-10	50.0	SM				14
		D-11	55.0	SW		2	87	11
		D-13	65.0	SW				8
		S-14	70.0	SW		23	69	8
		S-16	80.0	GP-GM		28	62	10
		S-18	90.0	GP-GM				10
		D-19	95.0	SM				14
	PE-13	S-3	15.0	CL	Qoa	0	33	67
		D-4	20.0	SC				38

TABLE B-1. RESULTS OF GRAIN SIZE AND FINES CONTENT TESTS (PAGE 3 OF 6)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Grain Size Distribution [1]		
						Gravel Content (%)	Sand Content (%)	Fines Content [2] (%)
Eastern Tunnel Segment	PE-13	D-6	30.0	SM	Qoa			13
		S-7	35.0	SM		3	83	14
		S-9	46.0	GP-GM/SP-SM		0	72	28
		D-10	55.5	GP-GM/SP-SM		24	69	7
	PE-14	D-5	25.0	SM	Qoa			25
		S-6	30.0	SM				47
		D-9	45.0	SM				38
		S-10	50.0	SM		0	87	13
		D-11	55.0	SM				35
		S-12	60.0	SM				50
		D-13	65.0	CL		0	21	79
		S-16	80.0	SM				25
		S-20	100.0	ML	Tf/Tp			89
	PE-15	D-8	40.0	ML	Qoa			68
		S-9	45.5	ML				58
		D-10	50.0	SM		0	67	33
		D-12	60.0	SP-SM		0	90	10
		D-14	69.5	CL		0	41	59
		S-15	75.0	SM				22
	PE-16	S-6	30.0	SM	Qoa			42
		S-10	50.0	SM				31
		D-11	55.0	SP-SM				6
		D-13	65.0	ML/CL				83
		S-14	70.0	SM				20
		D-15	75.0	CL		0	41	59
		S-16	80.0	CL				79
		D-17	85.0	ML				99
	PE-17	D-1	5.0	SM/GP-GM	Qoa	5	76	19
		D-3	15.0	SP-SM		11	77	12
		D-5	25.0	ML		0	5	95
		S-6	30.0	ML				60
		S-8	40.0	SM				23
		D-9	45.0	SP		0	95	5
		D-11	55.0	SM				20

TABLE B-1. RESULTS OF GRAIN SIZE AND FINES CONTENT TESTS (PAGE 4 OF 6)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Grain Size Distribution [1]		
						Gravel Content (%)	Sand Content (%)	Fines Content [2] (%)
Eastern Tunnel Segment	PE-17	D-13	65.0	CL	Tf/Tp	0	4	96
	PE-19	S-3	16.0	SW-SM	Qya	2	88	10
		S-5	25.0	SM	Qoa			19
		S-7	35.0	SM		0	73	27
		D-8	40.0	ML		0	20	80
		D-10	49.0	CL	Tf/Tp	0	2	98
		S-13	65.0	CL				90
	PE-20	S-4	20.0	CL	Qoa			79
		D-7	35.0	ML	Tf/Tp	0	3	97
	PE-21	S-6	30.0	SM	Qoa	0	73	27
		D-7	35.0	CL		0	26	74
		S-8	40.0	CL				57
		S-10	50.2	CL				53
		S-12	60.0	SW-SM				12
		S-14	70.0	SW-SM		4	85	11
		D-19	95.0	CH	Tf/Tp			99
Western Tunnel Segment	PE-18	S-3	15.0	GW	Qya	1	92	7
		S-7	35.0	GW		20	72	8
		S-9	45.0	GW		59	37	4
		S-11	55.0	SM				20
		D-12	60.0	SM		0	45	55
		S-13	65.0	SM		2	77	21
		S-15	78.5	SM		0	84	16
	PE-22	S-5	20.0	SW-SM	Qya	33	59	8
		D-6	25.0	SW-SM		6	88	6
		S-7	30.0	GP-GM		49	46	5
		S-10	40.0	SW-SM		30	57	13
		D-11	45.0	SW-SM		4	89	7
		S-14	60.0	SW-SM		10	82	8
		S-16	70.0	SW-SM		18	74	8
		D-17	75.0	SP-SM		1	93	6
	PE-23	S-1	5.0	SM	Qya	0	62	38
		S-3	15.0	SM		12	75	13
		S-5	25.0	SP-SM/GP-GM		10	82	8

TABLE B-1. RESULTS OF GRAIN SIZE AND FINES CONTENT TESTS (PAGE 5 OF 6)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Grain Size Distribution [1]		
						Gravel Content (%)	Sand Content (%)	Fines Content [2] (%)
Western Tunnel Segment	PE-23	S-7	35.0	SP-SM	Qya	16	76	8
		D-8	40.0	GP/SW		21	74	5
		S-11	55.0	ML		0	31	69
		D-12	60.0	SP-SM		0	90	10
		S-13	65.0	SM		2	82	16
	PE-24	D-1	5.0	SP-SM	Qya			7
		S-4	20.0	SP-SM		8	83	9
		S-6	30.0	GW		20	72	8
		S-8	40.0	GW		35	60	5
		S-10	50.0	SP-SM		8	81	11
		S-12	60.0	SM		0	84	16
		S-14	69.0	ML/SM				50
		D-15	75.0	ML/SM		0	43	57
		S-16	80.0	SM		19	64	17
	PE-25	S-4	20.0	GP-GM/SP-SM	Qya	7	84	9
		S-6	30.0	GP-GM/SP-SM		20	70	10
		S-8	41.0	GP-GM		37	56	7
		S-10	50.0	GP		52	43	5
		D-13	65.0	SM/ML		0	51	49
		S-14	70.0	SP-SM		0	90	10
		S-16	80.0	ML		0	25	75
	PE-26	D-4	20.0	SP-SM	Qya	14	81	5
		S-5	25.0	GP-GM		55	37	8
		D-9	57.0	CL		0	24	76
		S-10	64.0	CL				72
		D-12	80.0	SM		0	85	15
		D-13	85.0	CL	Tf/Tp			84
	PE-27	D-1	5.0	SP-SM	Qya			12
		S-2	10.0	GP-GM/SP-SM		33	62	5
		S-6	30.0	GP/GW		23	71	6
		S-8	40.0	GP/GW		80	17	3
		D-11	55.0	ML	Tf/Tp	0	3	97
	PE-28	S-2	10.0	GW	Qya	30	60	10
		D-3	15.0	SP		46	51	3

TABLE B–1. RESULTS OF GRAIN SIZE AND FINES CONTENT TESTS (PAGE 6 OF 6)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Grain Size Distribution [1]		
						Gravel Content (%)	Sand Content (%)	Fines Content [2] (%)
Western Tunnel Segment	PE–28	S–5	25.0	SP–SM	Qya	2	86	12
		D–15	75.0	CL	Tf/Tp	0	2	98
	PE–29	S–4	20.0	GP/GW	Qya	2	77	21
		S–6	32.0	SP–SM		20	69	11
		S–8	41.0	GP		95	4	1
		S–12	61.0	SW–SM/GP–GM		21	68	11
	PE–30	S–2	10.0	SP–SM/GP–GM	Qya	22	71	7
		D–9	50.0	GW–GM		0	89	11
	PE–31	D–5	25.0	GP/SP	Qya	85	13	2
		S–10	50.0	GP/SP–SM		41	51	8
		D–11	55.0	SM		0	79	21
		D–13	65.0	ML/SM/SP		0	44	56

NOTES

[1] Since gravels and cobbles larger than the sampler diameter were present in layers classified as gravel, clayey gravel, silty gravel, gravel with sand and sand with gravel, results of gradation tests on these materials may not be truly representative

[2] Sample is analyzed only for fines content (percent passing # 200 Sieve), wherever gravel and sand contents are not indicated

TABLE B-2. RESULTS OF ATTERBERG LIMITS TEST

(Page 1 of 3)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Atterberg Limits	
						Liquid Limit (%)	Plasticity Index (%)
Eastern Tunnel Segment	PE-1	D-7	35.0	CL	Qya	37	21
		S-8	40.0	CL		44	28
		D-12	55.0	ML		32	8
	PE-2	D-6	30.0	CL	Qoa	45	23
		D-8	40.0	CL		29	7
	PE-3	D-9	45.0	CL	Qoa	24	8
		D-13	65.0	SM		NP[1]	
	PE-4	D-8	40.2	CL/ML	Qoa	20	7
	PE-5	D-11	60.0	SM	Qoa	NP	
	PE-6	D-11	60.0	ML	Qoa	NP	
	PE-7	D-4	20.0	CL	Qya	27	12
	PE-8	D-9	45.0	CL/ML	Qoa	18	5
	PE-9	S-6	30.0	SC	Qoa	30	8
	PE-10	D-8	45.0	ML	Qoa	34	6
	PE-11	S-9	47.0	CL	Qoa	43	23
		S-13	65.0	CL		30	12
	PE-12	S-8	40.0	CL	Qoa	47	25
	PE-13	S-3	15.0	CL	Qoa	24	10
		D-4	20.0	SC		25	11
	PE-14	D-13	65.0	CL	Qoa	29	9
		S-14	70.0	CL		39	20
		S-18	90.0	CL		47	28
	PE-15	S-9	45.5	ML	Qoa	NP	
		S-13	65.0	CL		39	21
		D-14	69.5	CL		47	27
	PE-16	D-15	75.0	CL	Qoa	29	14
		S-16	80.0	CL		42	22
	PE-17	D-5	25.0	ML	Qoa	34	4
		D-13	65.0	CL	Tf/Tp	48	24
	PE-19	D-10	49.0	CL	Tf/Tp	38	13
		S-13	65.0	CL		37	13
	PE-20	S-2	10.0	CH	Qoa	55	33
		S-4	20.0	CL		26	9
		D-5	25.0	ML	Tf/Tp	43	16
		S-6	30.0	ML		42	9

TABLE B-2. RESULTS OF ATTERBERG LIMITS TEST

(Page 2 of 3)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Atterberg Limits	
						Liquid Limit (%)	Plasticity Index (%)
Eastern Tunnel Segment	PE-20	D-7	35.0	ML	Tf/Tp	42	16
		S-8	40.0	ML		44	18
		D-11	55.0	ML		46	18
		S-12	60.0	ML/MH		51	21
		D-13	65.0	ML/MH		49	18
		D-15	75.0	ML		45	16
	PE-21	D-7	35.0	CL	Qoa	24	8
		S-8	40.0	CL		33	18
		S-10	50.2	CL		38	15
		S-18	90.0	CH	Tf/Tp	55	31
		D-19	95.0	CH		61	37
Western Tunnel Segment	PE-18	D-12	60.0	SM	Qya	28	6
	PE-22	S-12	50.0	CH	Qya	57	37
	PE-23	S-11	55.0	ML	Qya	29	6
	PE-24	S-14	69.0	ML/SM	Qya	26	3
		D-15	75.0	ML/SM		NP	
	PE-25	S-2	10.0	ML	Qya	NP	
		S-12	59.0	CL		43	20
		D-13	65.0	SM/ML		NP	
	PE-26	D-9	57.0	CL	Qya	34	13
		S-10	64.0	CL		28	8
		D-13	85.0	CL	Tf/Tp	36	12
	PE-27	D-11	55.0	ML	Tf/Tp	36	7
		S-12	60.0	ML		47	17
		D-13	65.0	ML		29	1
		D-15	75.0	ML		47	20
	PE-28	D-9	45.0	CL/CH	Tf/Tp	50	29
		S-10	50.0	ML		29	6
		D-11	55.0	ML		38	12
		D-13	65.0	CL		42	20
		S-14	70.0	CL		49	26
		D-15	75.0	CL		42	17
	PE-29	S-14	70.0	CH	Tf/Tp	53	31
		D-15	75.0	CH		54	32
	PE-30	S-14	75.0	CH/MH	Tf/Tp	69	36

TABLE B-2. RESULTS OF ATTERBERG LIMITS TEST
(Page 3 of 3)

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Atterberg Limits	
						Liquid Limit (%)	Plasticity Index (%)
Western Tunnel Segment	PE-31	D-13	65.0	ML/SM/SP	Qya	NP	

NOTE:

[1] NP = Non – plastic

TABLE B-3. RESULTS OF DIRECT SHEAR TESTS

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Direct Shear (Peak Strength)	
						Friction Angle (degrees)	Cohesion (psf)
Eastern Tunnel Segment	PE-1	D-7	35.0	CL	Qya	28	900
	PE-3	D-13	65.0	SM	Qoa	34	600
	PE-4	D-8	40.2	CL/ML	Qoa	31	150
	PE-8	D-9	45.0	CL/ML	Qoa	38	500
	PE-10	D-8	45.0	ML	Qoa	25	1000
	PE-14	D-13	65.0	CL	Qoa	26	1600
	PE-15	D-10	50.0	SM	Qoa	29	700
		D-14	69.5	CL		24	1700
	PE-16	D-15	75.0	CL	Qoa	29	1100
	PE-17	D-5	25.0	ML	Qoa	30	800
		D-9	45.0	SP		34	650
		D-13	65.0	CL	Tf/Tp	30	750
	PE-19	D-8	40.0	ML	Qoa	32	650
		D-10	49.0	CL	Tf/Tp	32	1200
	PE-20	D-7	35.0	ML	Tf/Tp	32	600
		D-13	65.0	ML		23	2750
	PE-21	D-7	35.0	CL	Qoa	34	450
Western Tunnel Segment	PE-24	D-15	75.0	ML/SM	Qya	33	1250
	PE-25	D-13	65.0	SM/ML	Qya	27	1600
	PE-26	D-9	57.0	CL	Qya	30	900
	PE-27	D-11	55.0	ML	Tf/Tp	31	1150
	PE-28	D-9	45.0	CL	Tf/Tp	29	700
		D-15	75.0	CL		31	1250
	PE-31	D-13	65.0	ML/SM/SP	Qya	31	950

TABLE B–4. RESULTS OF UNCONFINED COMPRESSION TESTS

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Unconfined Compressive Strength (psi)
Western Tunnel Segment	PE–20	D–11	55.0	ML	Tf/Tp	64
		D–15	75.0	ML		98
	PE–27	D–13	65.0	ML	Tf/Tp	61
		D–15	75.0	ML		74
	PE–28	D–11	55.0	ML	Tf/Tp	54
		D–13	65.0	CL		34
	PE–29	D–15	75.0	CH	Tf/Tp	120

TABLE B–5. RESULTS OF CONSOLIDATION TESTS

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Consolidation Characteristics			Swell/ Collapse (%)
						Cc [1]	Cs [1]	Cx [1]	
Eastern Tunnel Segment	PE– 1	D–7	35.0	CL	Qya	0.13	0.02	0.0028	+0.1
	PE– 8	D–9	45.0	CL/ML	Qoa	0.09	0.01	0.0023	+0.21
	PE–17	D–13	65.0	CL	Tf/Tp	0.11	0.02	0.0017	–0.14
	PE–21	D–7	35.0	CL	Qoa	0.09	0.01	0.0028	+0.02
		D–19	95.0	CH	Tf/Tp	0.16	0.04	0.0021	–0.53
Western	PE–18	D–12	60.0	ML	Qya	0.07	0.01	0.0014	–0.01

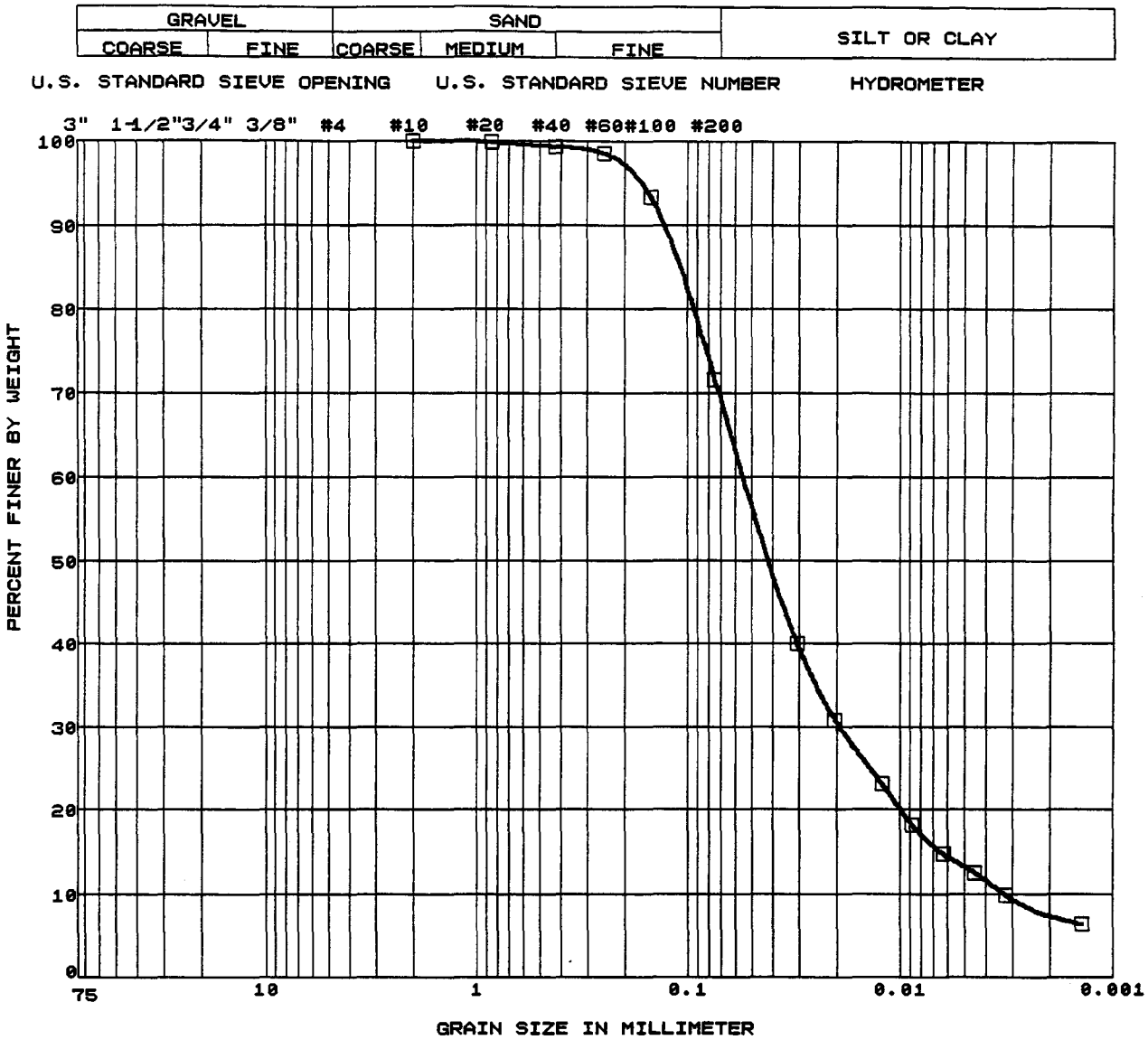
NOTE:

[1] Cc, Cs and Cx based on vertical strain – log stress plots

TABLE B-6. RESULTS OF CORROSIVITY TESTS

Alignment Segment	Boring No.	Sample No.	Depth (feet)	USCS Symbol	Geological Unit	Corrosivity				
						pH	Chloride Content (ppm)	Sulfides Content (mg/kg)	Sulphate Content (ppm)	Electrical Resistivity [1] (ohms-cm)
Eastern Tunnel Segment	PE-1	D-1	5.0	CL	Qya	7.25	102	ND	84	1250 (2083)
		D-10	45.0	CL		8.1	256		92	4000
	PE-2	D-6	30.0	CL	Qoa	8.3	167		2071	1538
	PE-3	D-1	5.0	CL	Qya	6.88	98	1.80	25	2500 (1538)
		S-12	60.0	SM	Qoa	5.5	92		24	4167
	PE-5	D-10	55.0	SM/GP	Qoa	7.26	89		50	2128
	PE-6	D-10	58.0	ML	Qoa	6.70	243		11	1351
	PE-7	D-6	30.0	SW-SM	Qya	7.37	230		136	4545
	PE-8	D-1	5.0	CL	Qoa	7.64	94	1.27	43	3703 (2381)
		S-12	60.0	SC/CL		7.35	149		52	3191
	PE-9	S-8	40.0	SM	Qoa	7.10	96		45	6667
	PE-10	D-8	45.0	ML	Qoa	6.52	104		22	2000
	PE-11	S-9	47.0	CL	Qoa	7.46	215		207	990
	PE-12	S-14	70.0	SW	Qoa	8.88	90		87	2833
	PE-13	S-1	5.0	CL	Qoa	7.80	95	2.80	54	1923 (2442)
		D-10	55.5	GP-GM/SP-SM		8.68	92		71	3378
	PE-14	S-12	60.0	SM	Qoa	5.75	227		36	1395
	PE-15	S-13	65.0	CL	Qoa	8.80	99		112	958
	PE-16	D-17	85.0	ML	Qoa	7.44	113		122	1024
	PE-17	D-1	5.0	SM/GP-GM	Qoa	7.21	210	1.80	144	2941 (2128)
		D-11	55.0	SM		7.03	33		37	9937
	PE-18	S-1	5.0	ML	Qya	7.74	109	1.80	73	1538 (2857)
	PE-19	S-9	45.0	CL	Tf/Tp	5.96	120		43	638
	PE-20	S-8	40.0	ML	Tf/Tp	7.29	113		29	1081
		S-12	60.0	ML/MH		7.18	113		99	1053
	PE-21	D-1	5.0	CL	Qoa	7.60	36	2.30	45	2083 (1786)
		S-8	40.0	CL		8.44	158		210	12987
Western Tunnel Segment	PE-18	S-13	65.0	SM	Qya	7.82	97		115	4000
	PE-22	D-6	25.0	SW-SM	Qya	6.98	152		62	3571
		S-7	30.0	GP-GM		8.77	200		128	408
	PE-23	S-7	35.0	SP-SM	Qya	9.09	98		61	286
	PE-24	S-12	60.0	SM	Qya	8.17	98		76	4000
	PE-25	S-12	59.0	CL	Qya	8.59	112		289	3333
	PE-26	D-9	57.0	CL	Qya	7.89	172		87	1887
	PE-27	S-12	60.0	ML	Tf/Tp	7.52	119		183	7692
	PE-28	S-14	70.0	CL	Tf/Tp	7.71	777		701	1333
	PE-29	S-12	61.0	SW-SM/GP-GM	Qya	2.37	203		1645	625
	PE-30	S-10	55.0	GW-GM	Qya	6.74	674		163	1220

[1] Electrical resistivity tests, in general, were conducted at in-situ moisture content. The values in parenthesis correspond to saturated condition of the samples



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-1	D-7	35.0	Drive	CL	37	21

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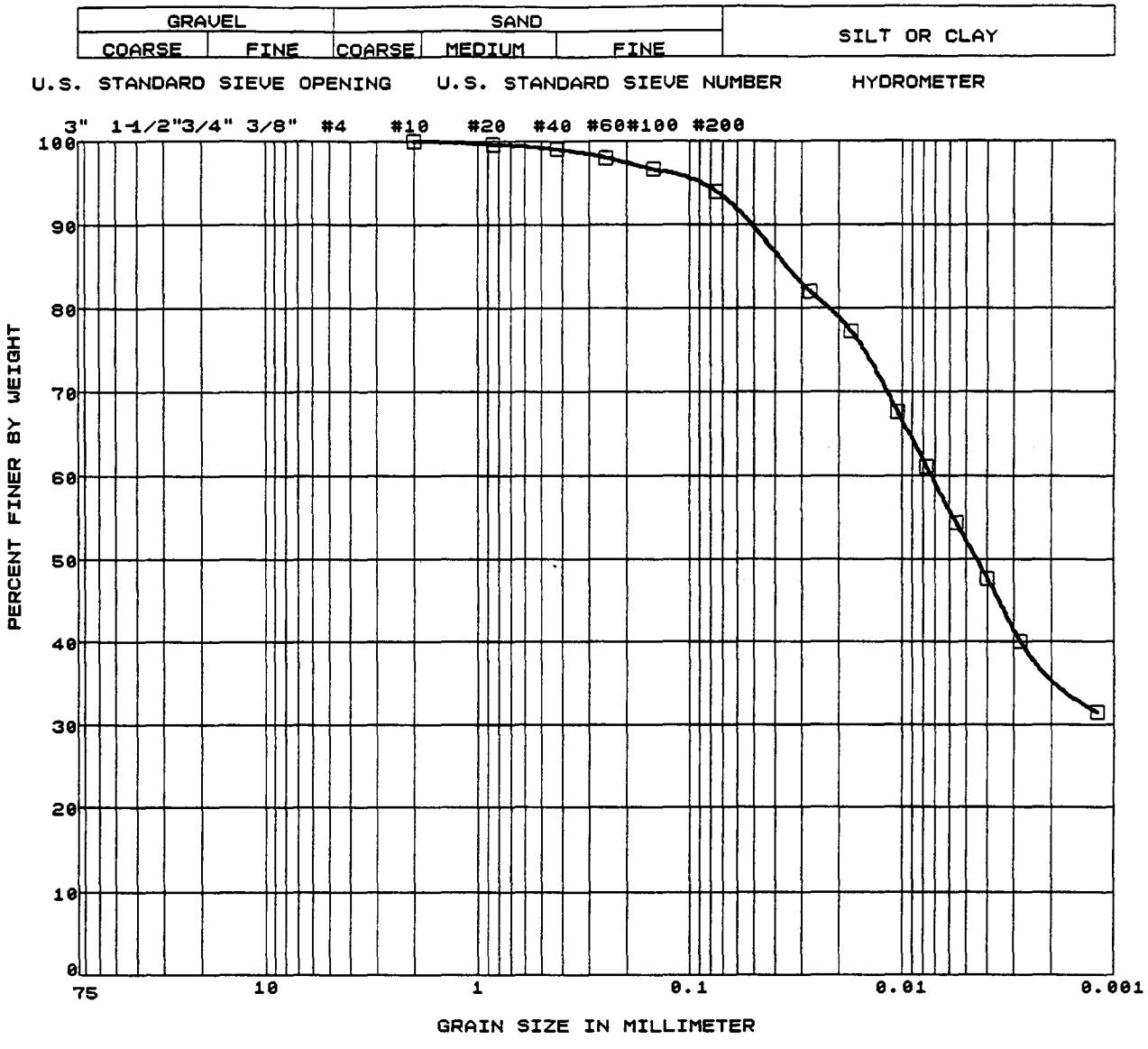
Figure B-1



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-2	D-6	30.0	Drive	CL	45	23

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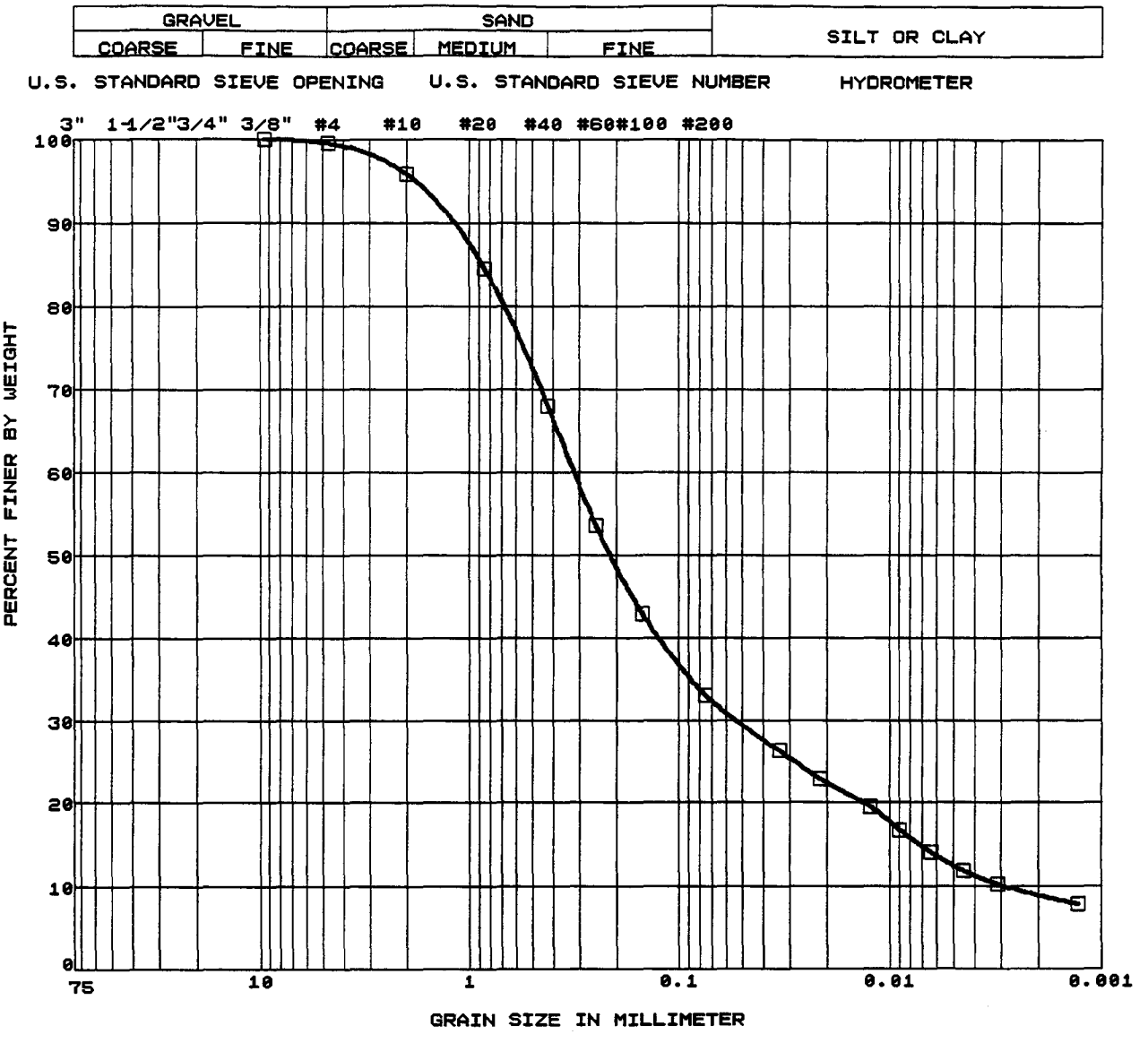
Figure B-2



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-3	D-13	65.0	Drive	SM	NP	NP

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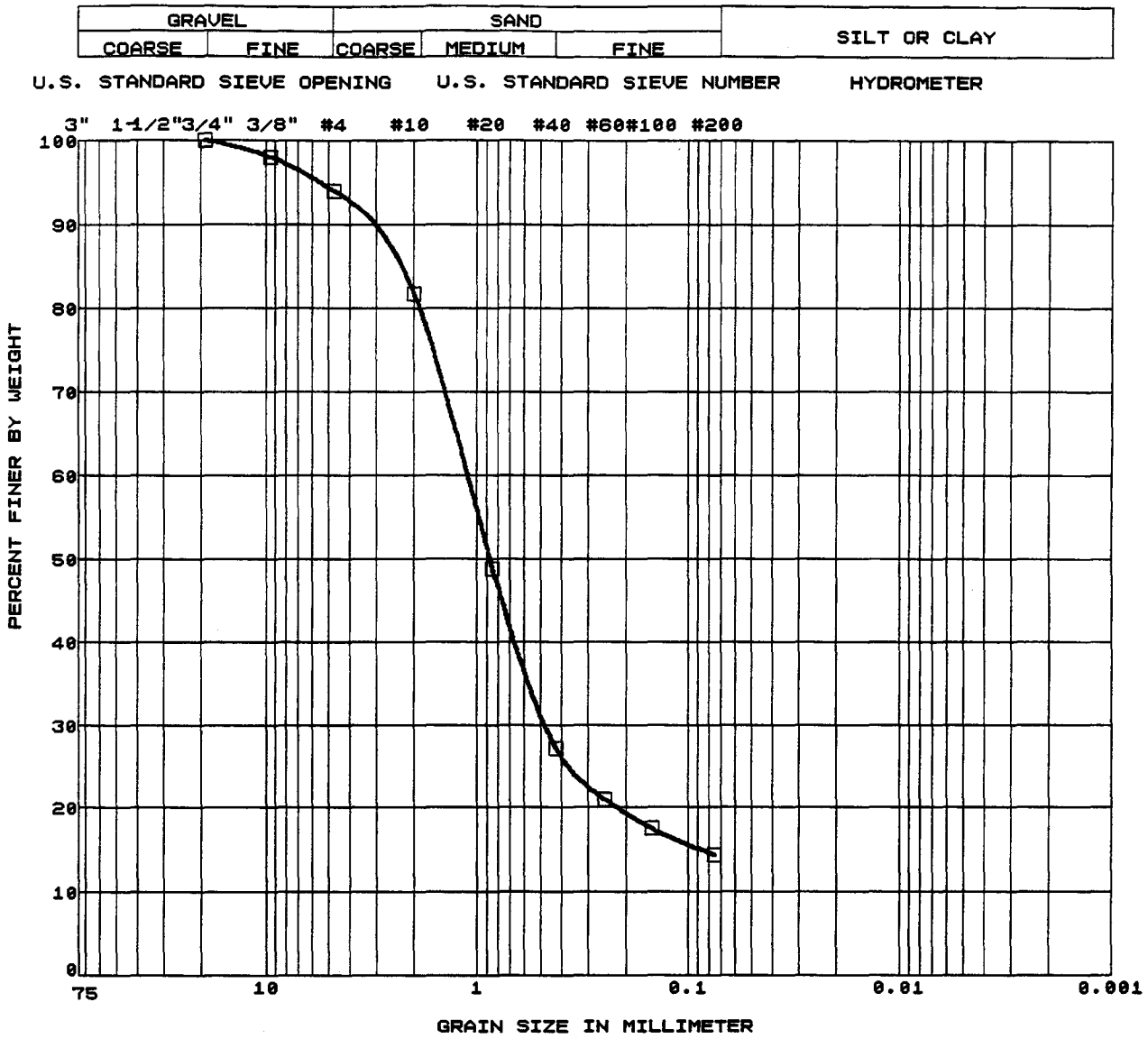
Figure B-3



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-3	D-15	75.0	Drive	SC		

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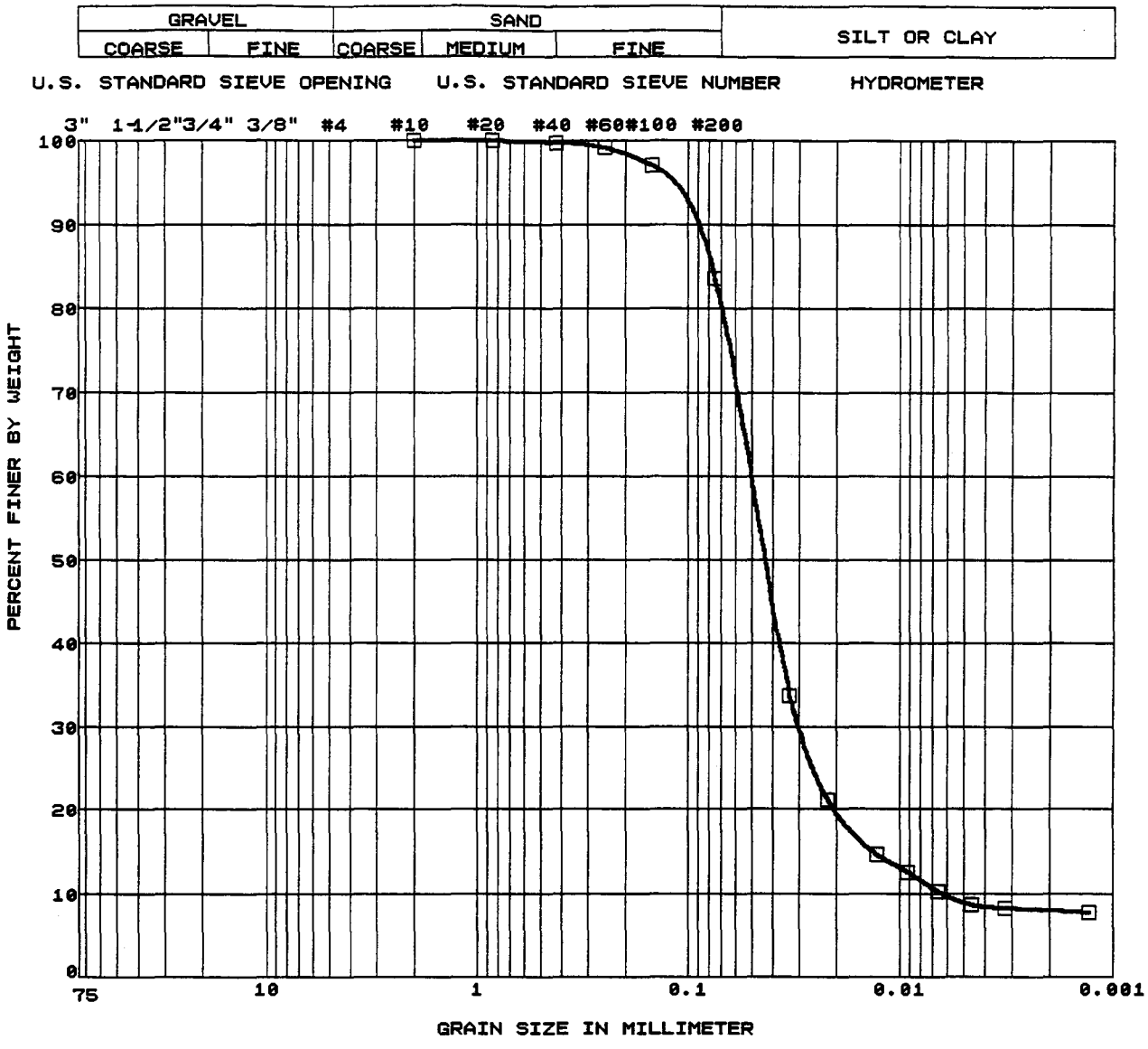
Figure B-4



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-4	D-8	40.0	Drive	CL-ML	20	7

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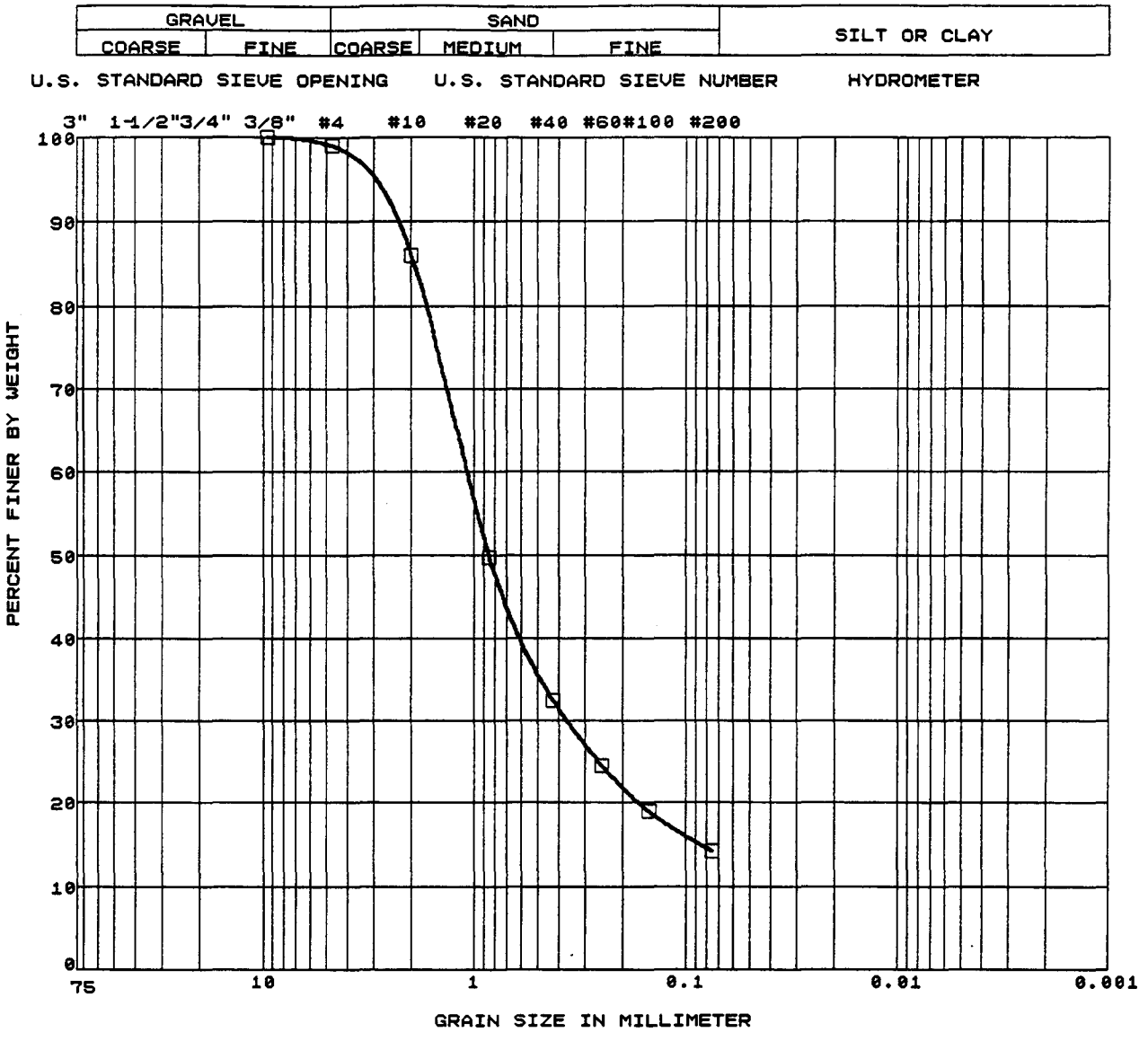
Figure B-5



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-4	D-10	50.0	Drive	SM		

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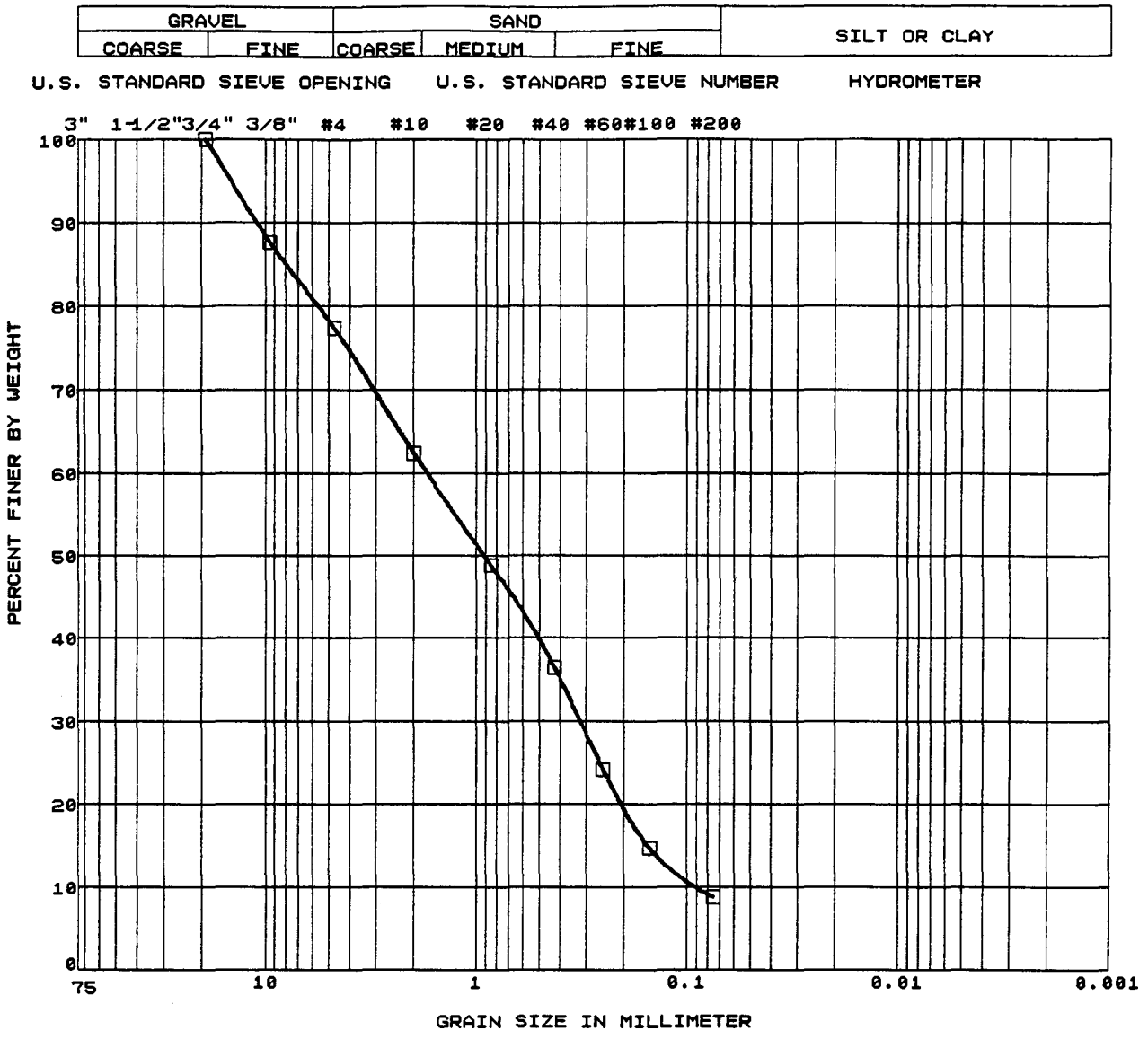
Figure B-6



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-5	S-7	40.0	Bag	SP-SM		

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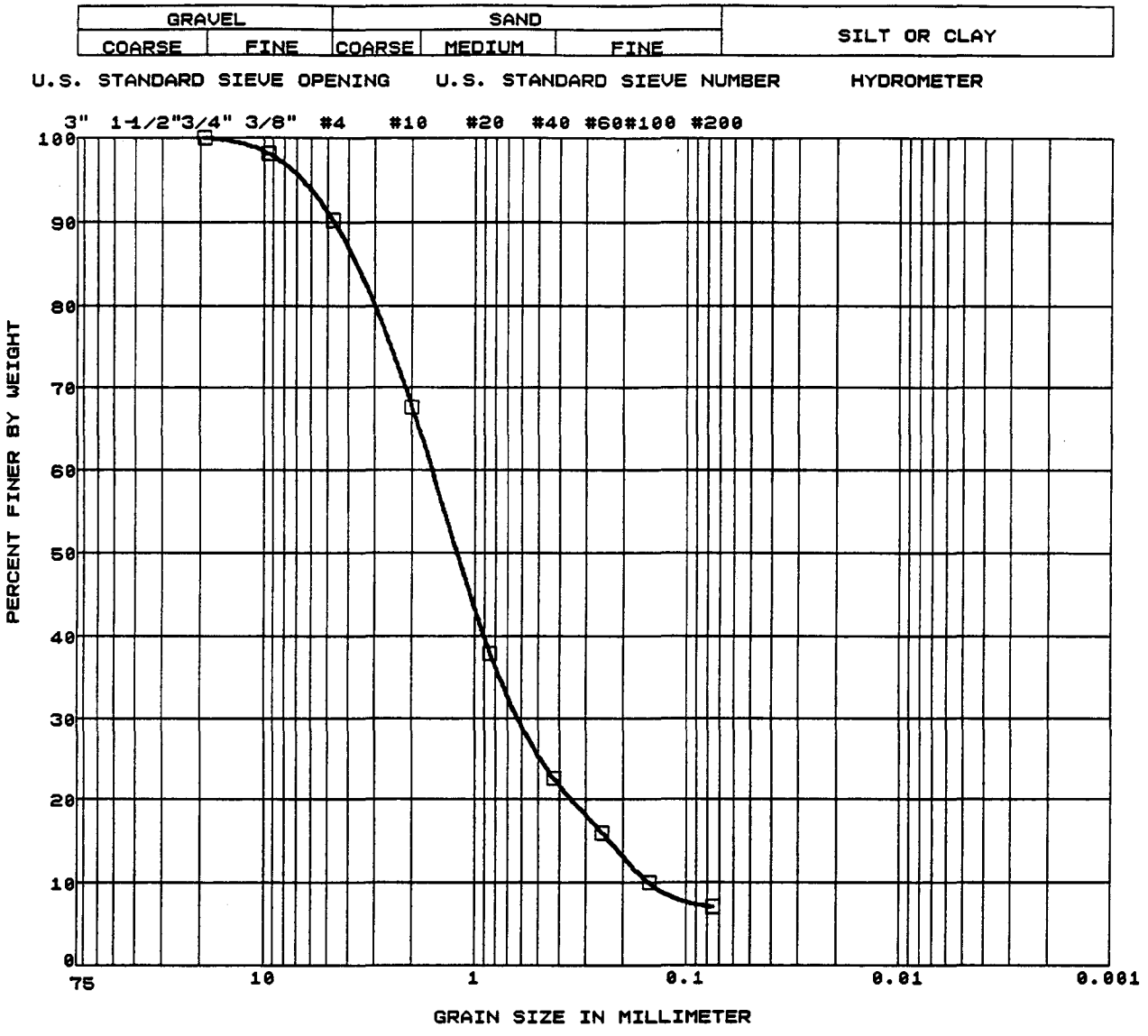
Figure B-7



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-6	D-5	25.0	Drive	SW-SM		

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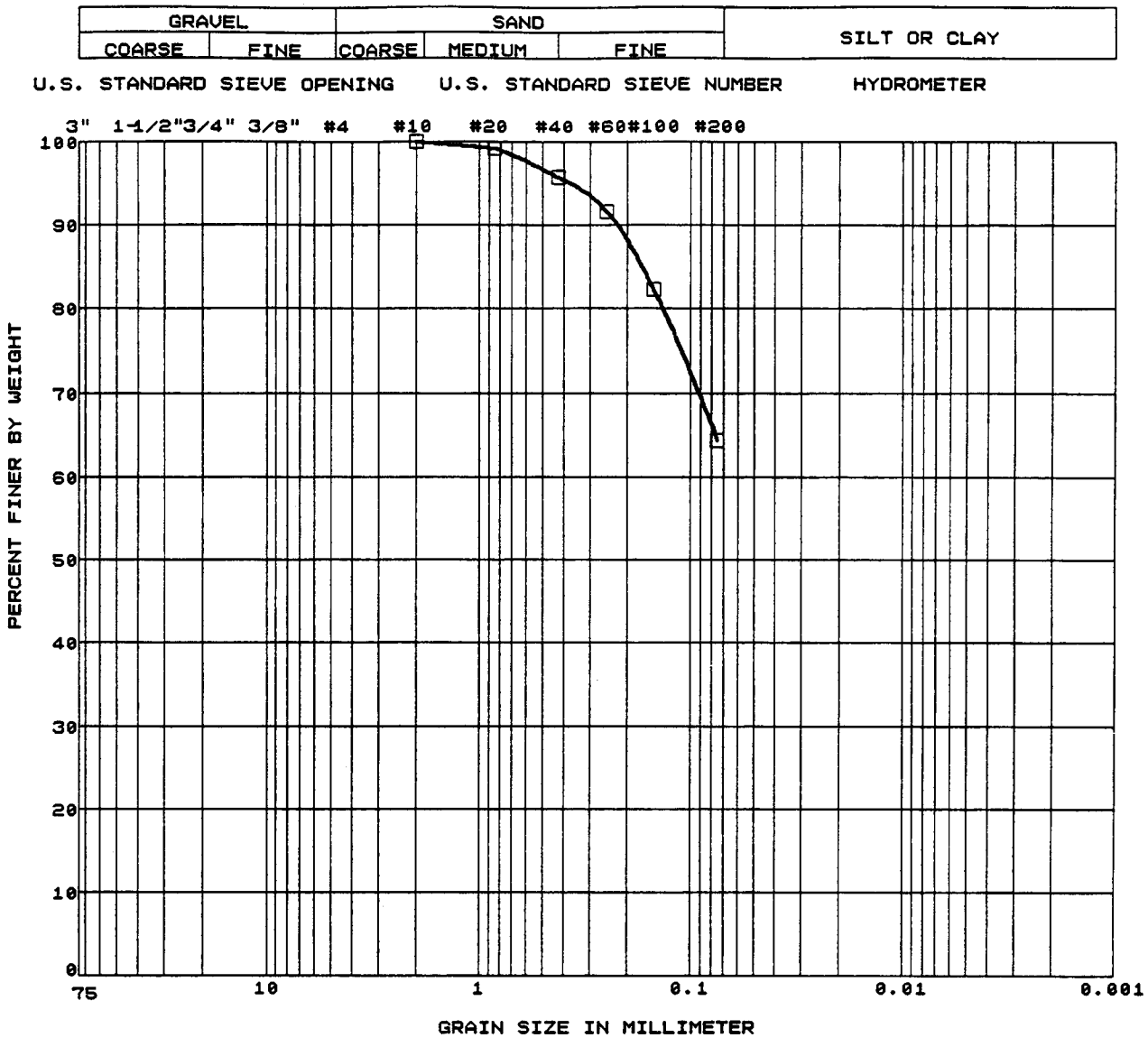
Figure B-8



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-6	D-10	57.0	Drive	ML		

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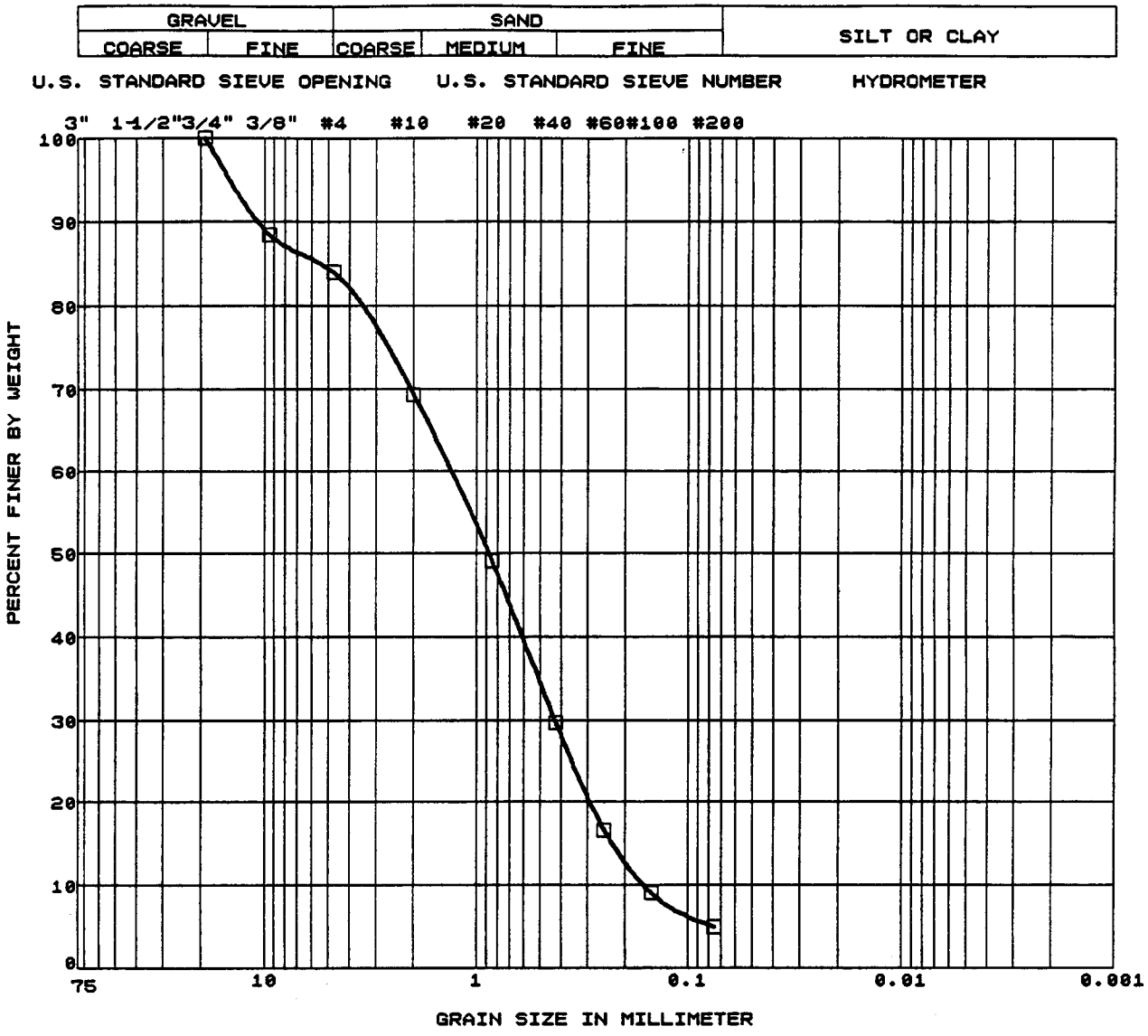
Figure B-9



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-6	D-12	65.0	Drive	SP-SM		

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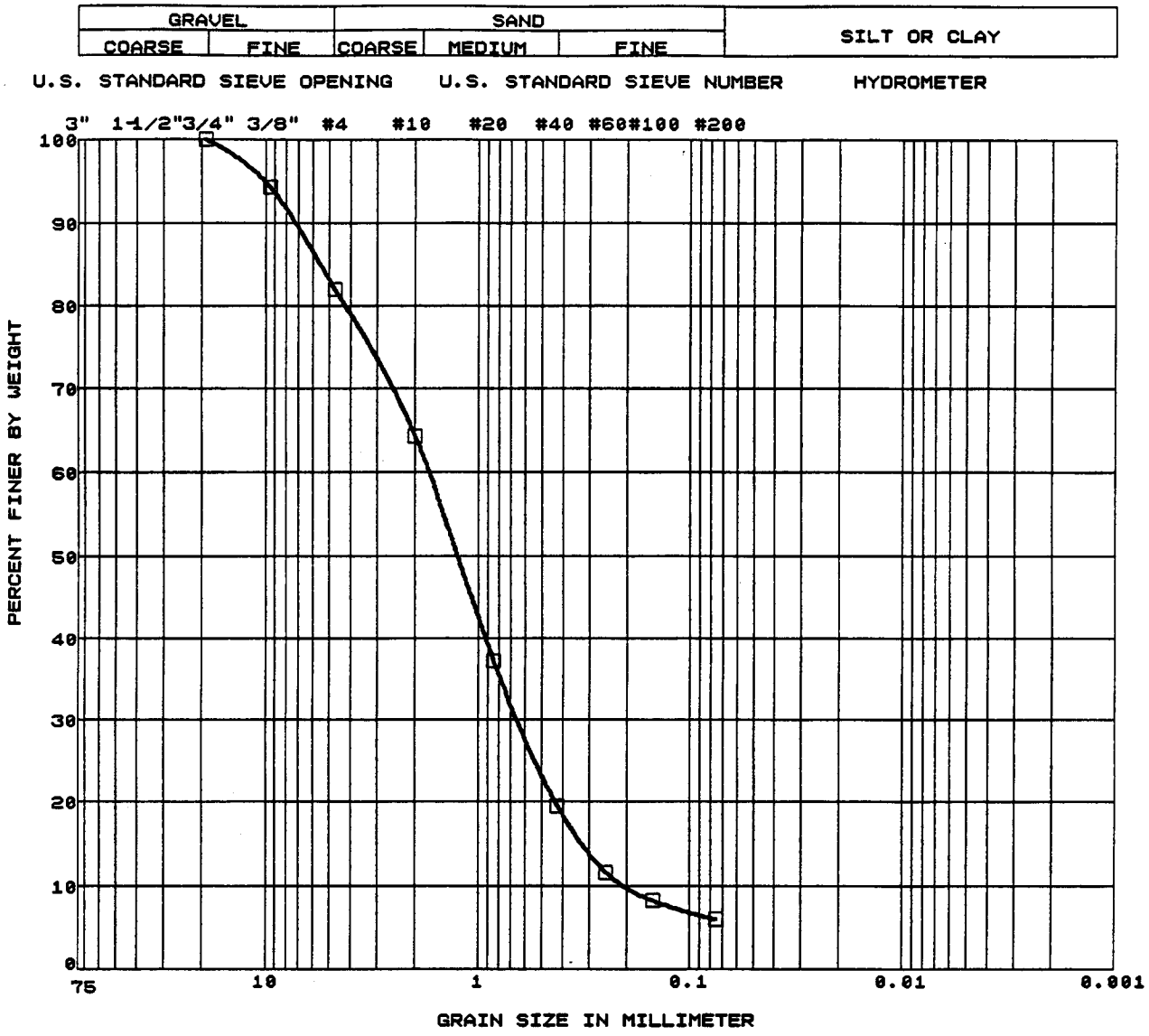
Figure B-10



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-7	D-6	30.0	Drive	SW-SM		

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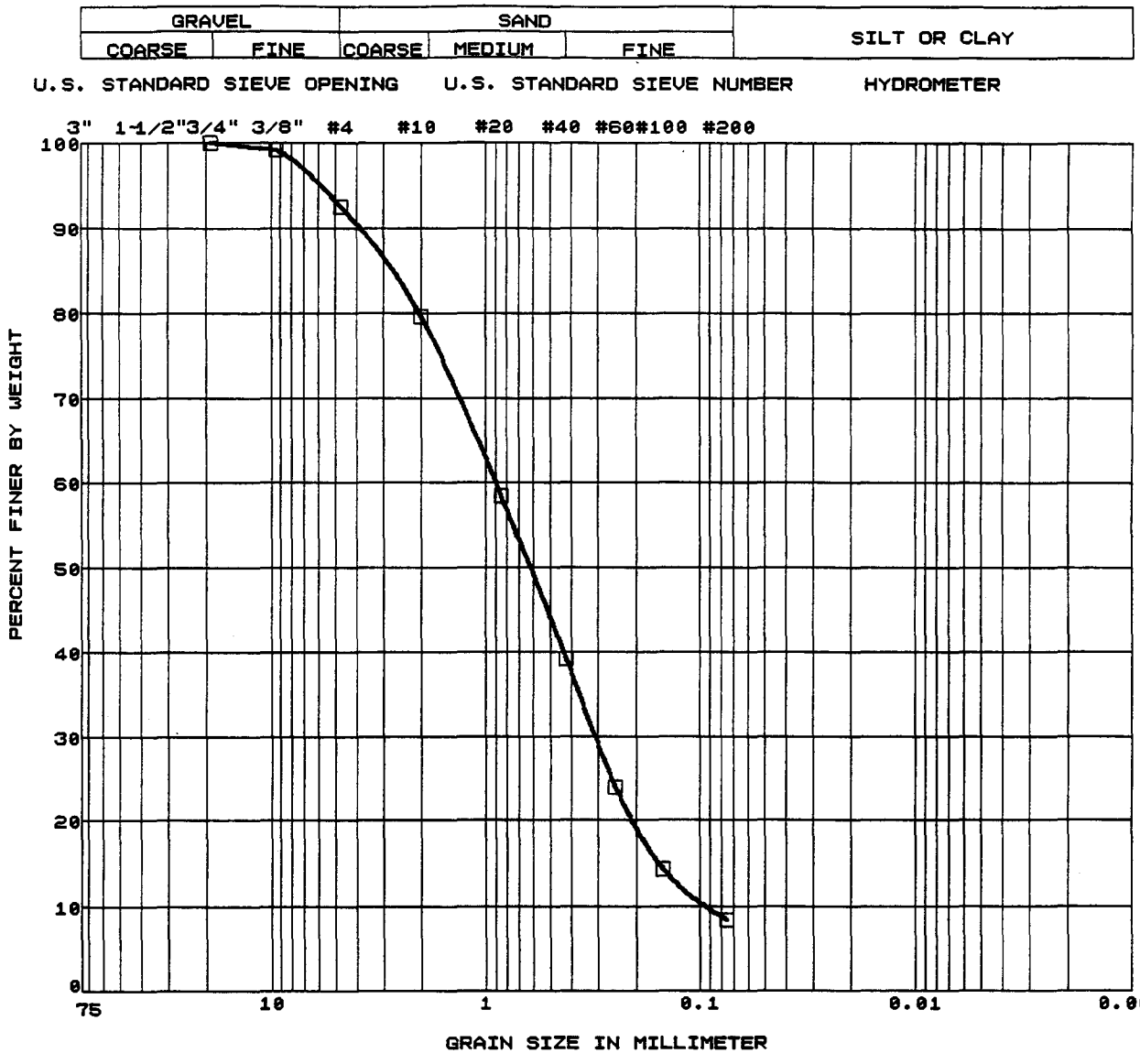
Figure B-11



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-8	S-4	20.0	Bag	SW-SM		

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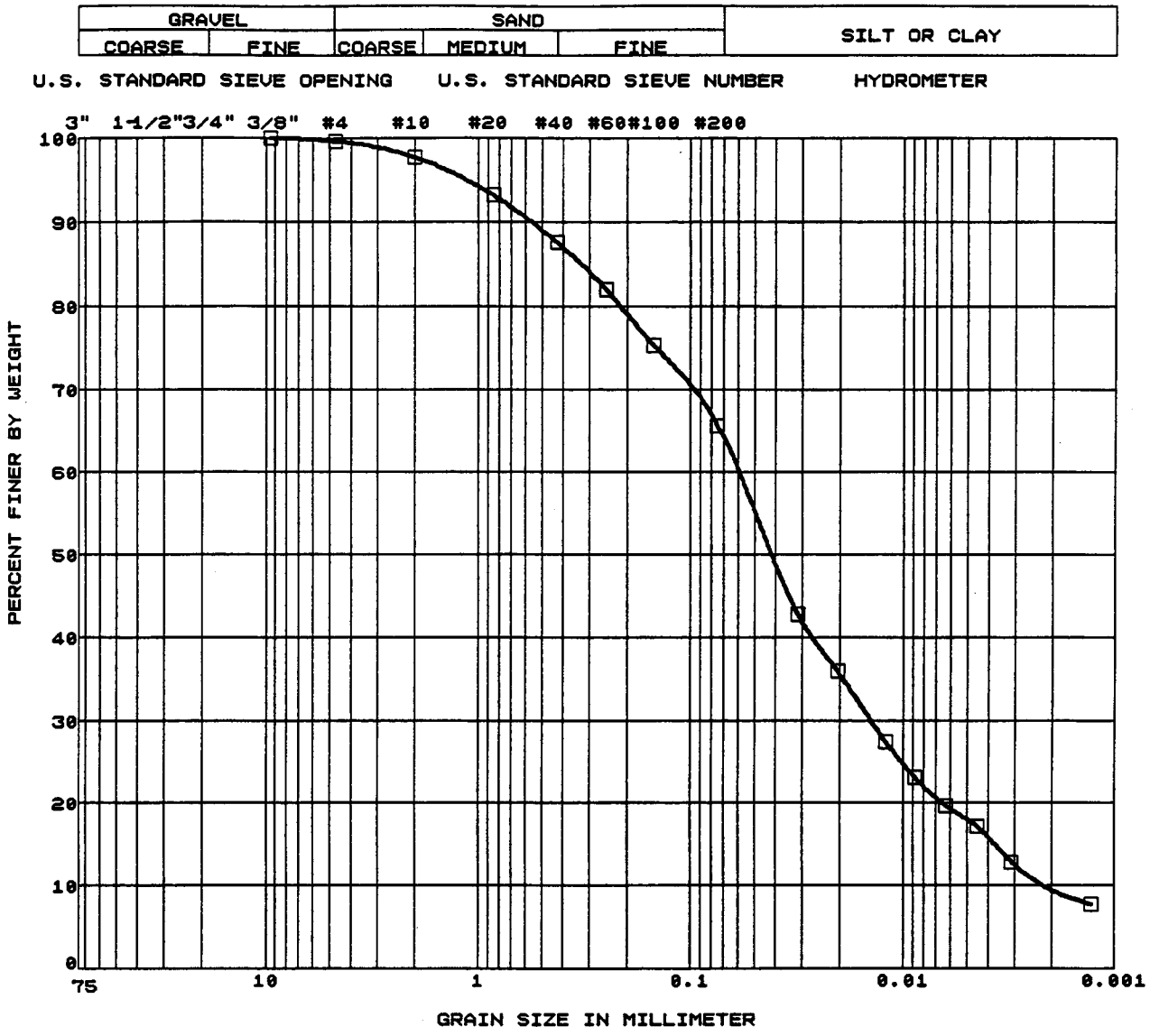
Figure B-12



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-8	D-9	45.0	Drive	CL-ML	18	5

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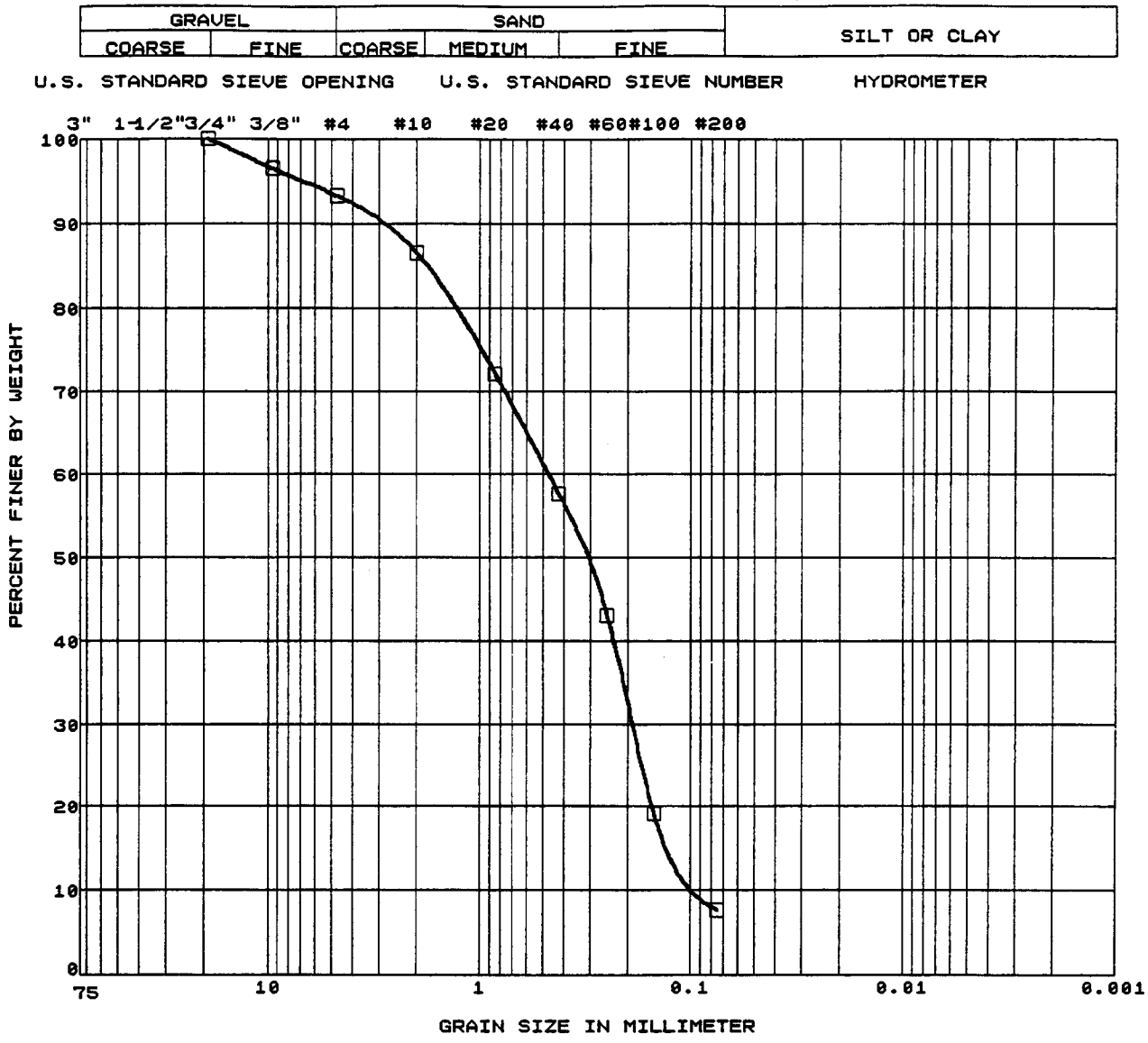
Figure B-13



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-9	D-9	45.0	Drive	SP-SM		

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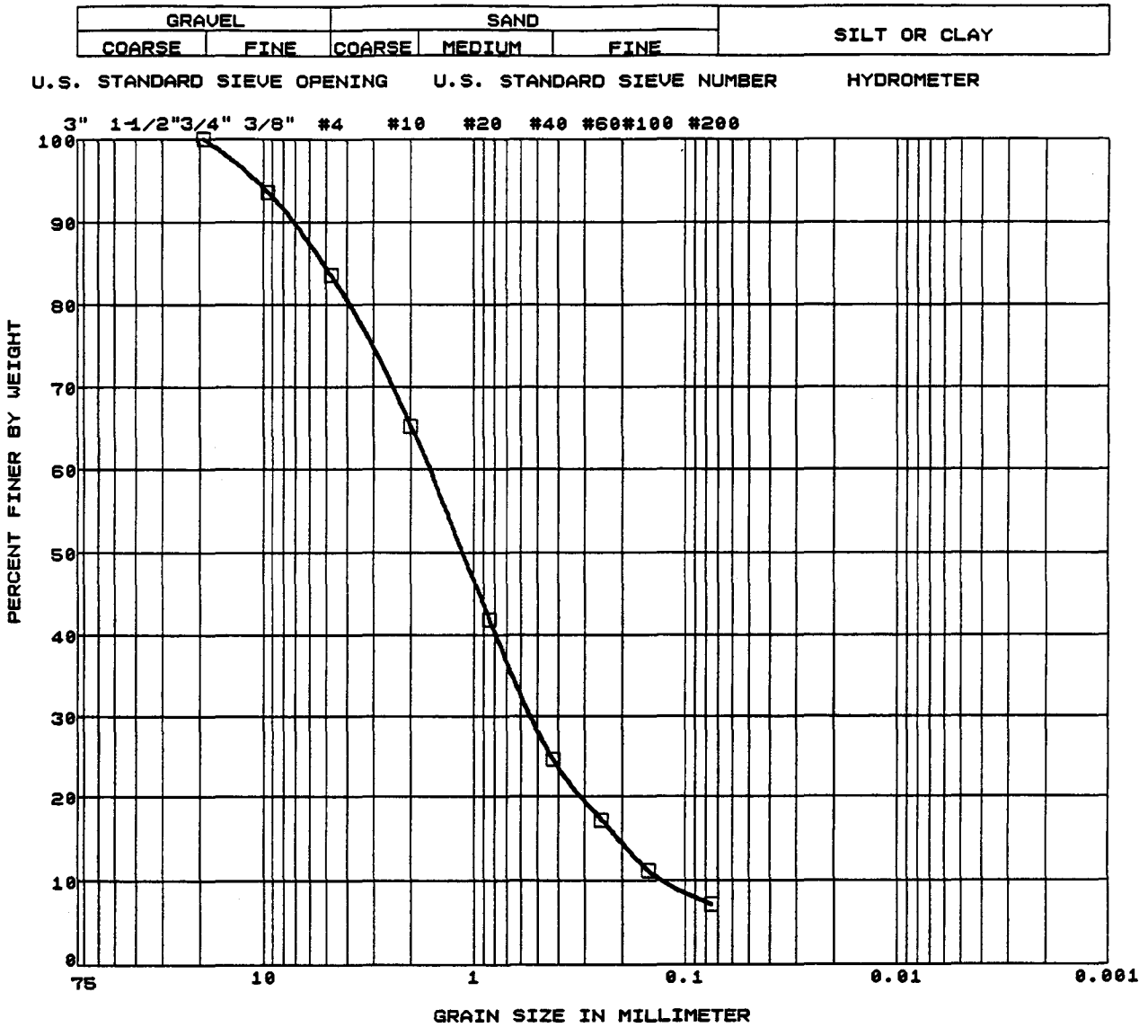
Figure B-14



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-9	S-10	50.0	Bag	SW-SM		

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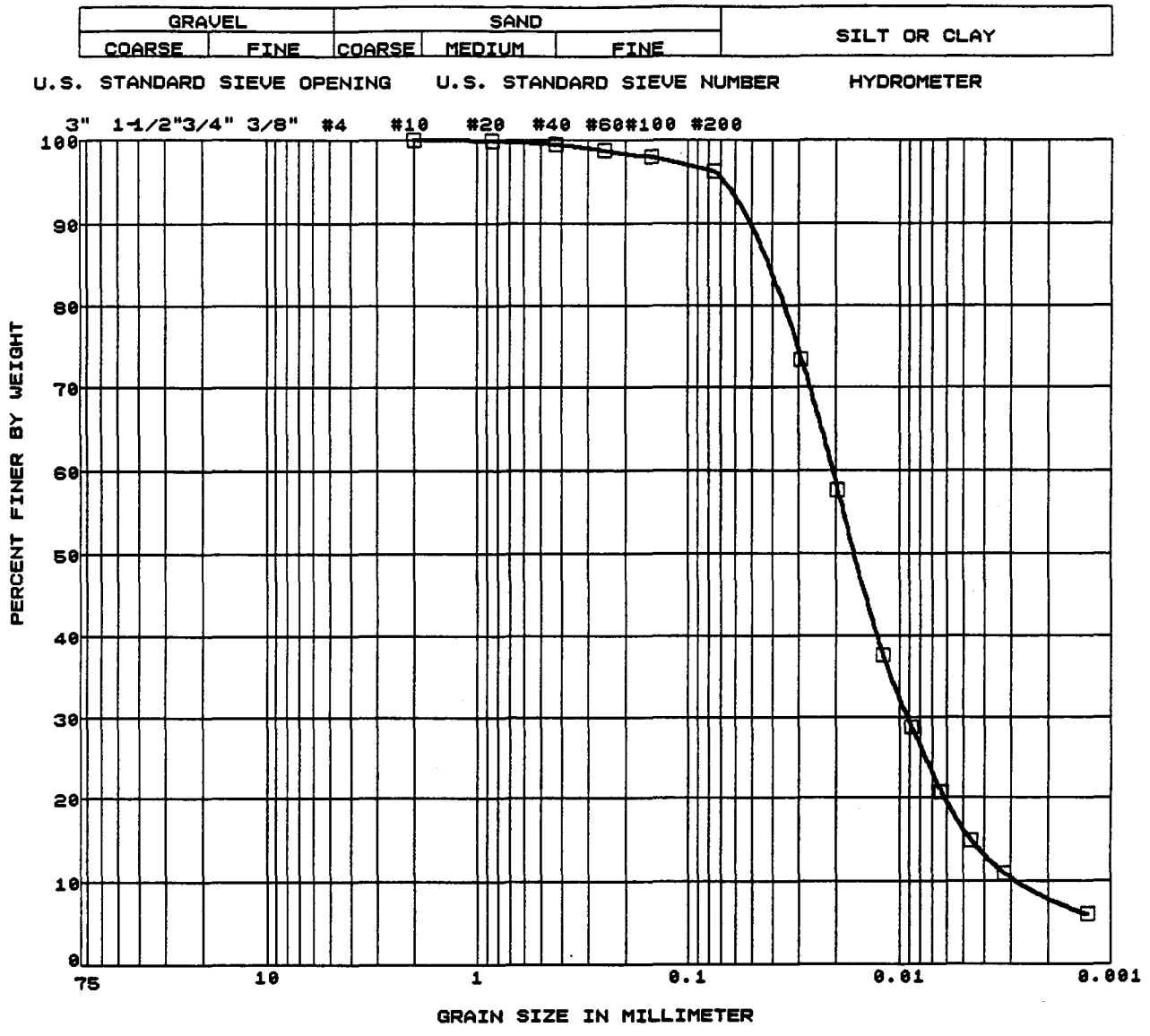
Figure B-15



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-10	D-8	45.0	Drive	ML	34	6

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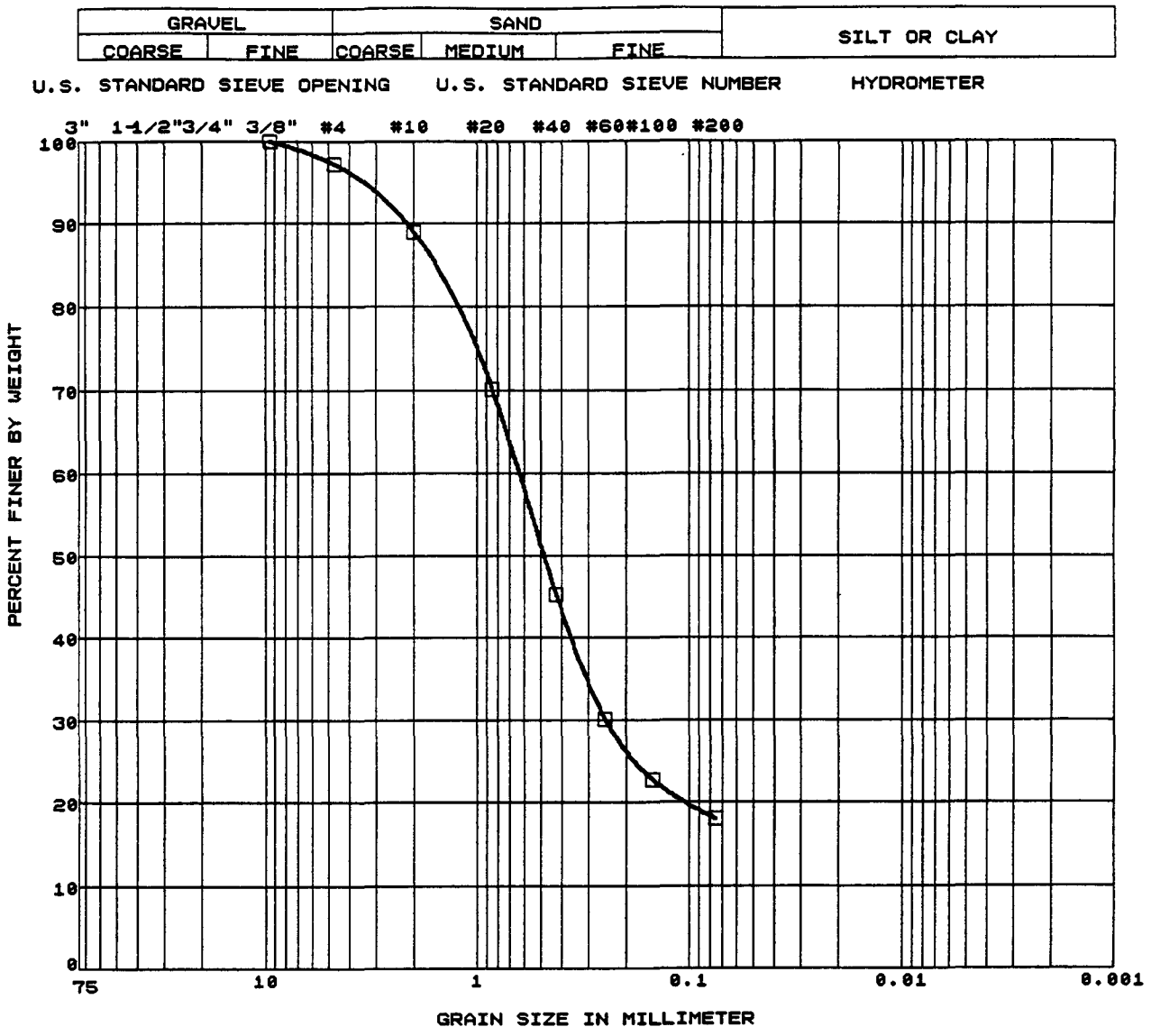
Figure B-16



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-11	S-11	55.0	Bag	SM		

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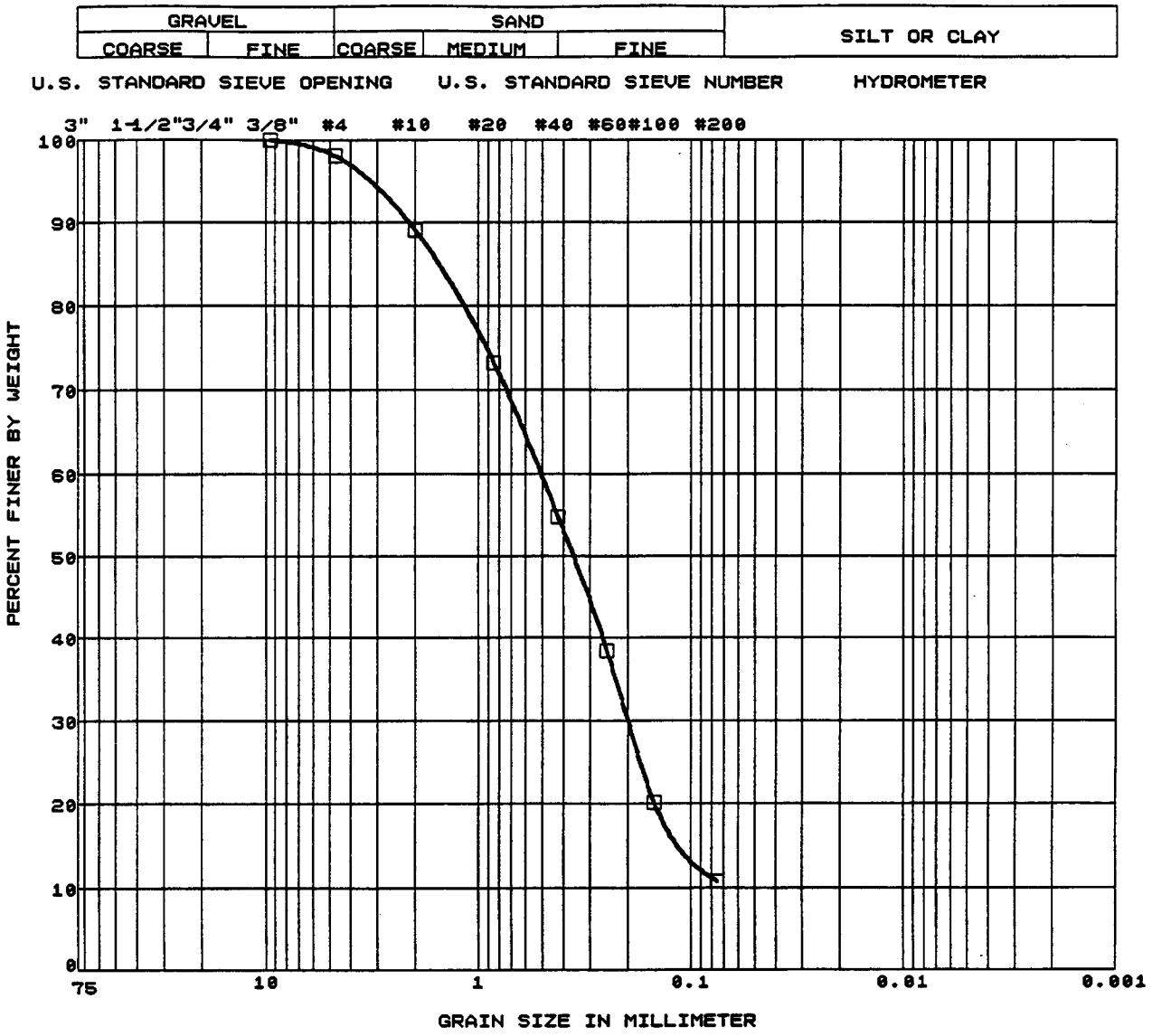
Figure B-17



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-12	D-11	55.0	Bag	SW-SM		

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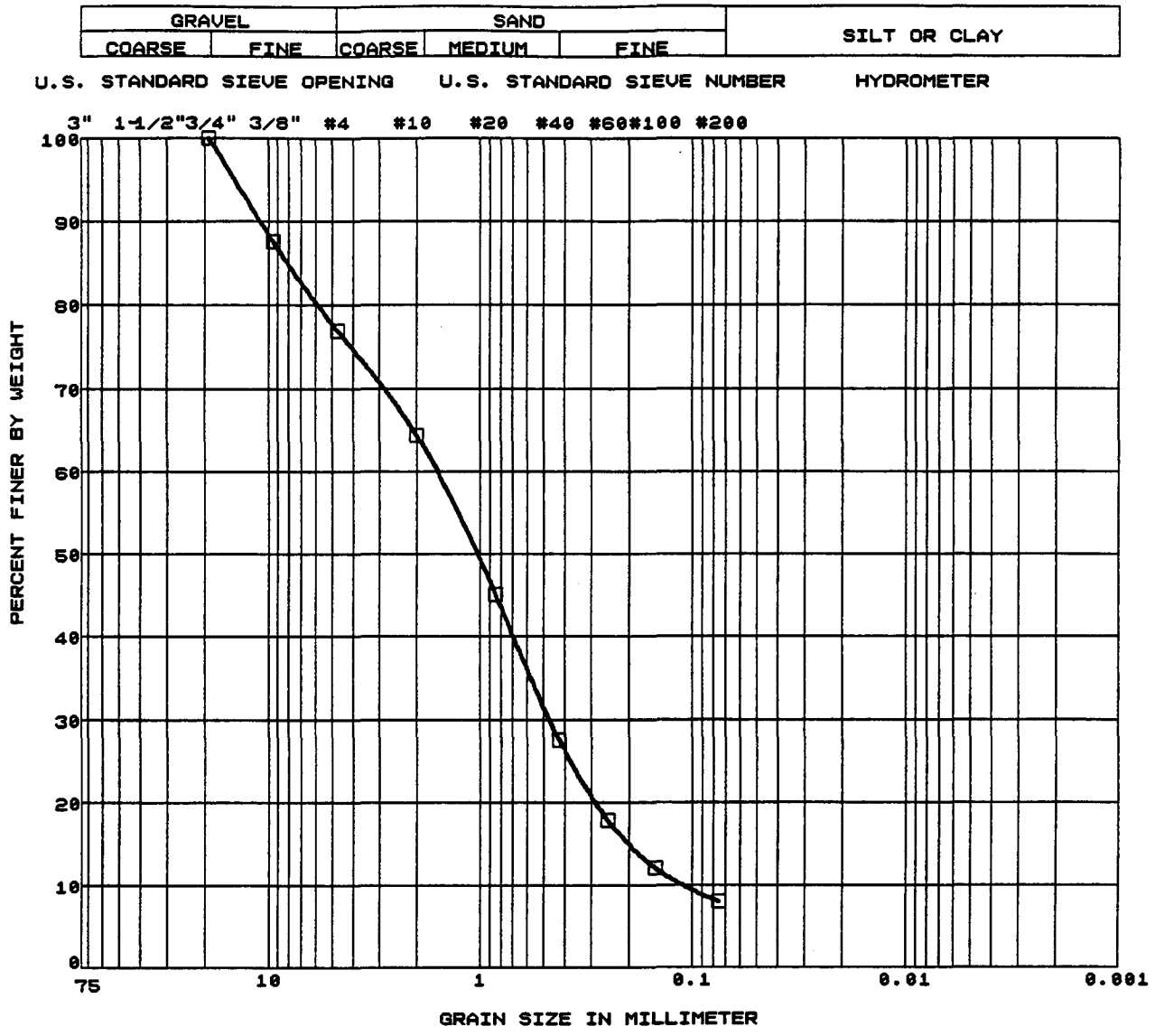
Figure B-18



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-12	S-14	70.0	Bag	SW-SM		

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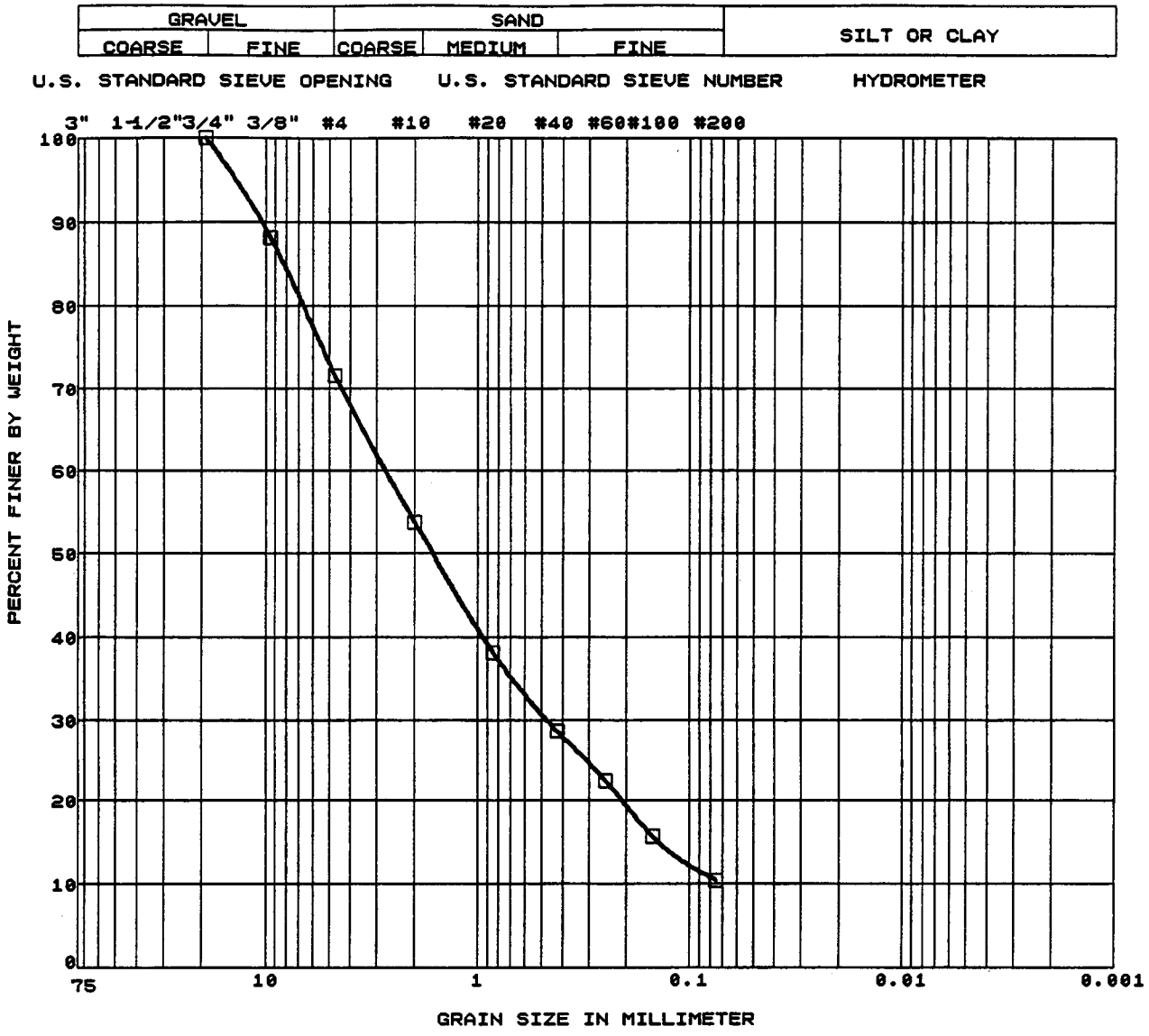
Figure B-19



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-12	S-16	80.0	Bag	SW-SM		

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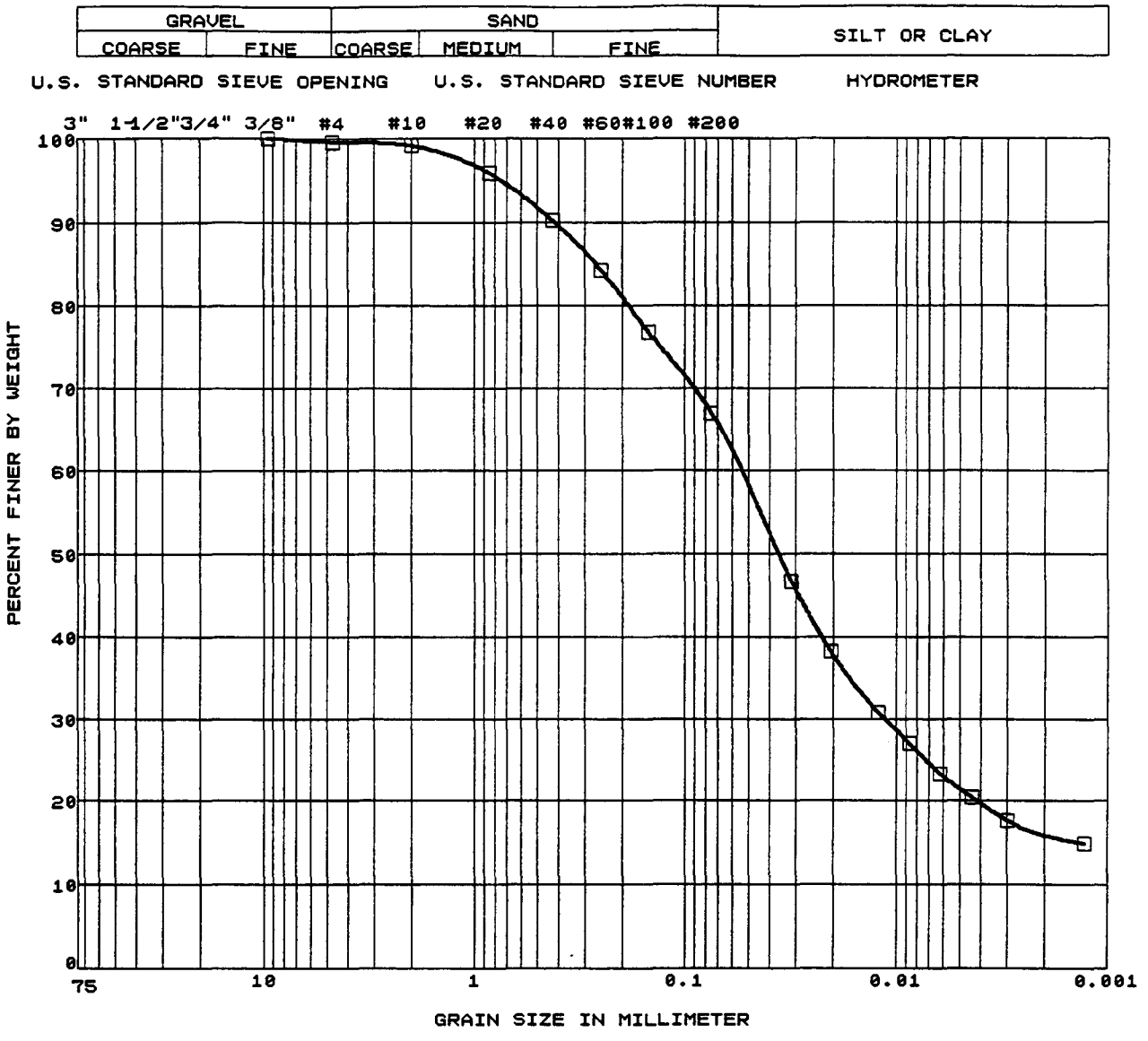
Figure B-20



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-13	S-3	15.0	Bag	CL	24	10

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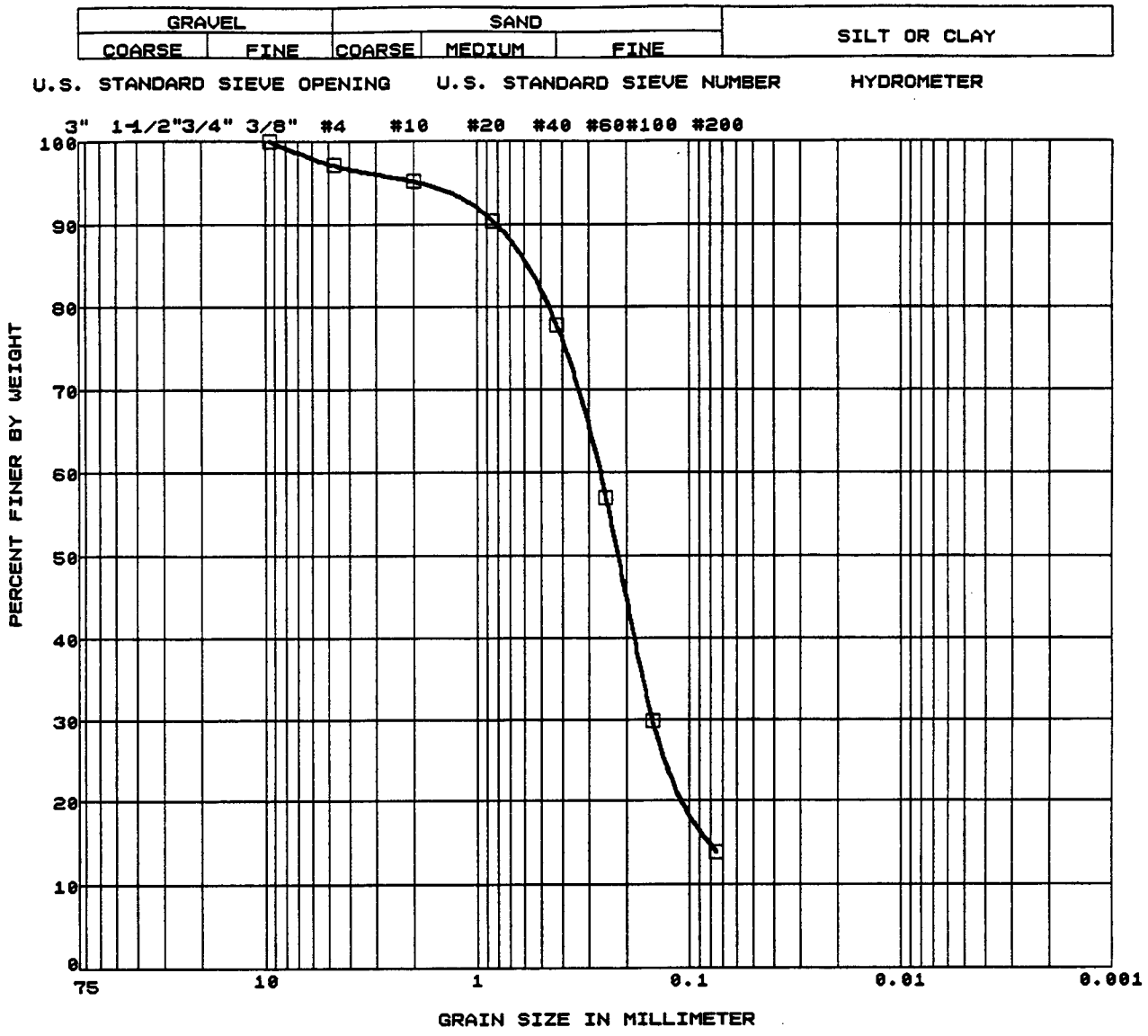
Figure B-21



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-13	S-7	35.0	Bag	SM		

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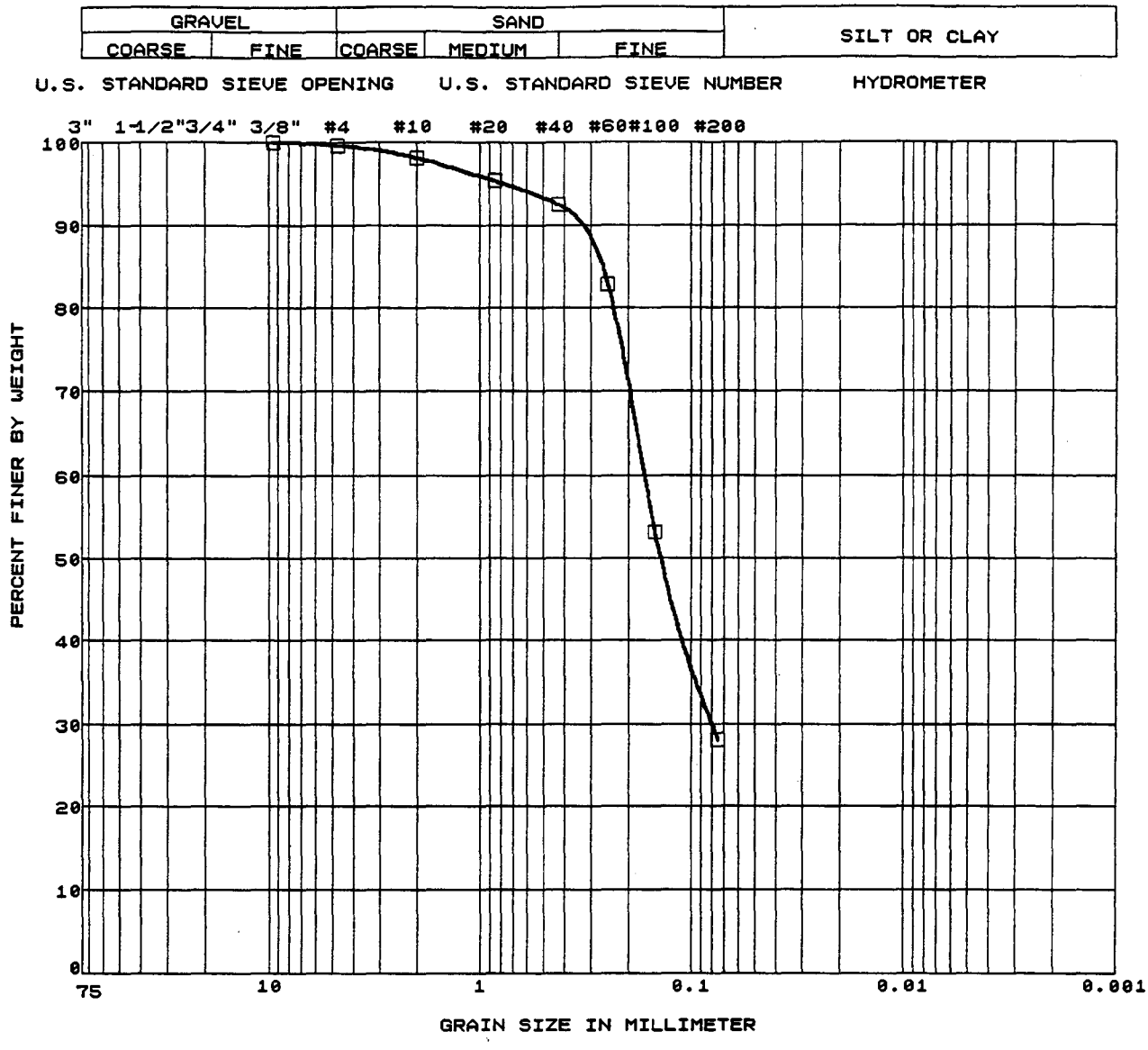
Figure B-22



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-13	S-9	46.0	Bag	SM		

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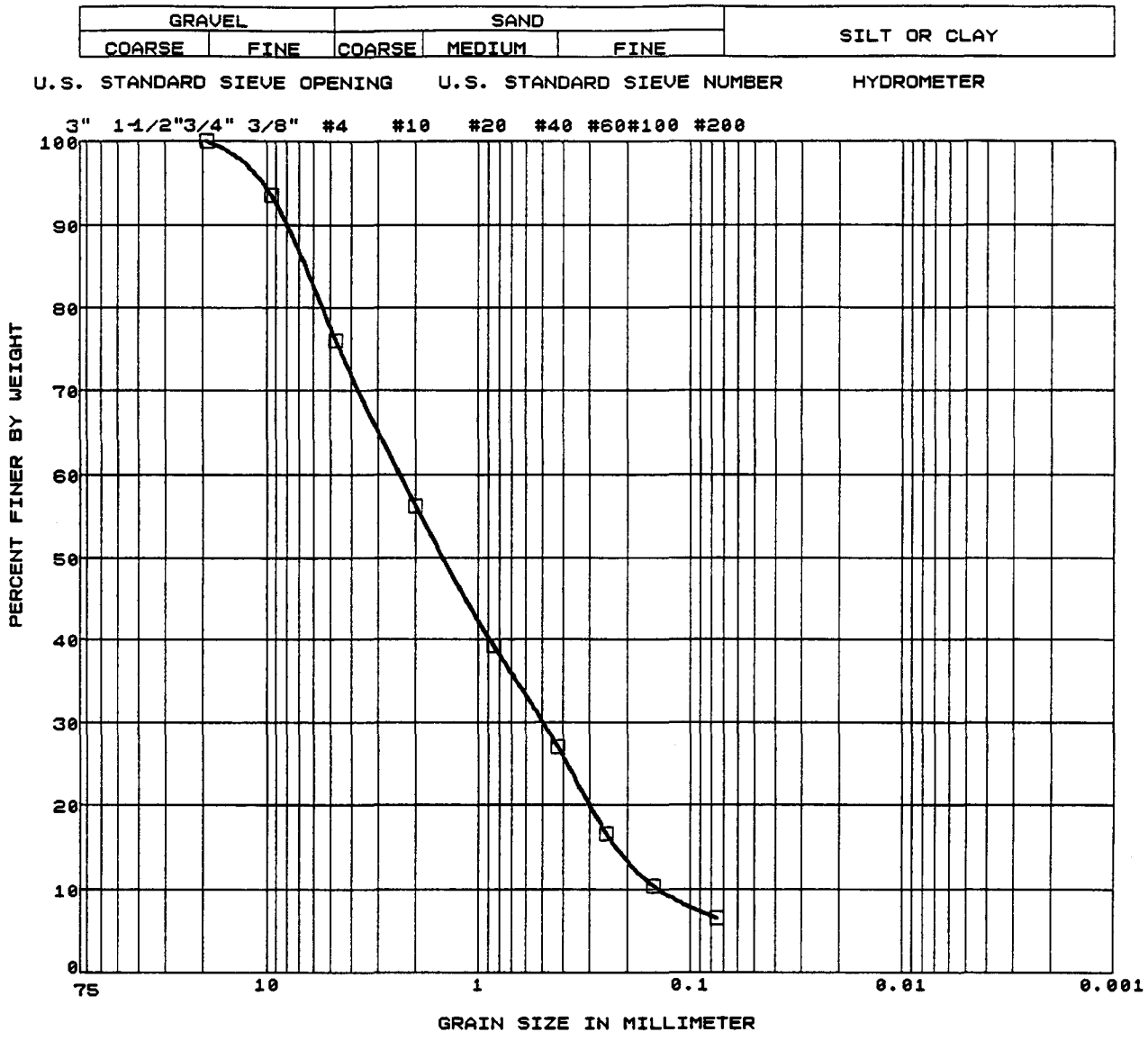
Figure B-23



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-13	D-10	55.0	Drive	SP-SM		

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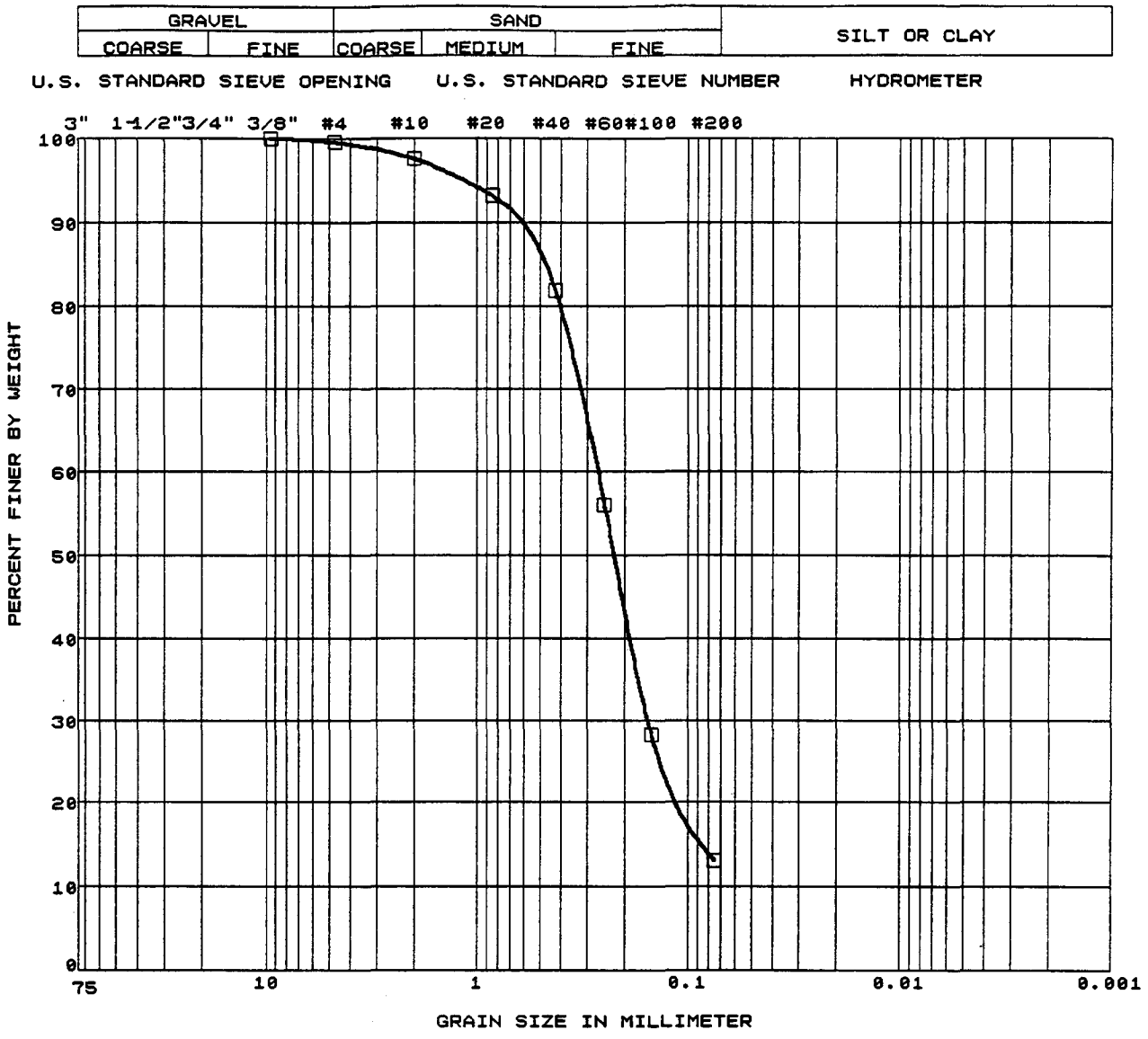
Figure B-24



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-14	S-10	50.0	Bag	SM		

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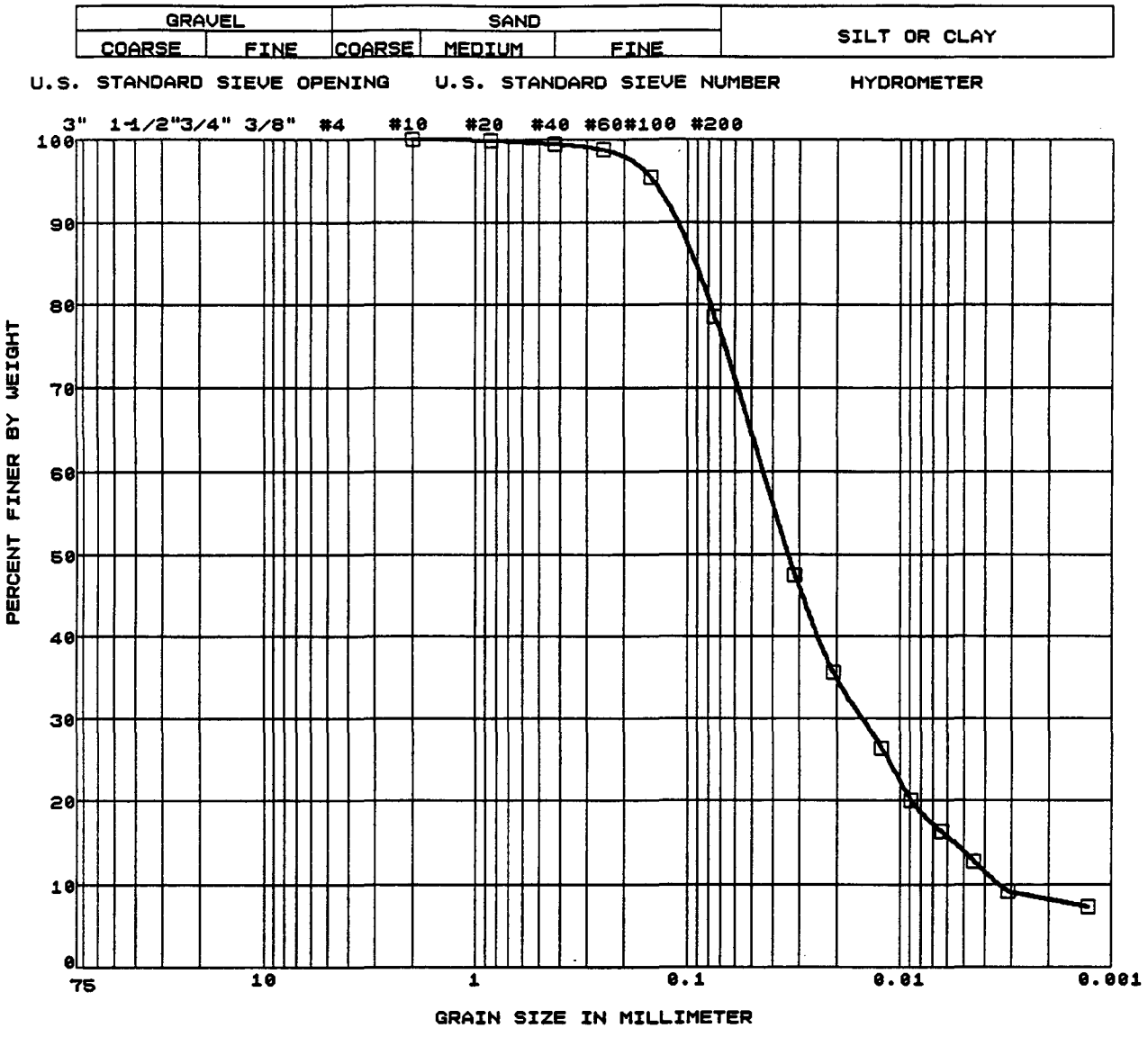
Figure B-25



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-14	D-13	65.0	Drive	CL	29	9

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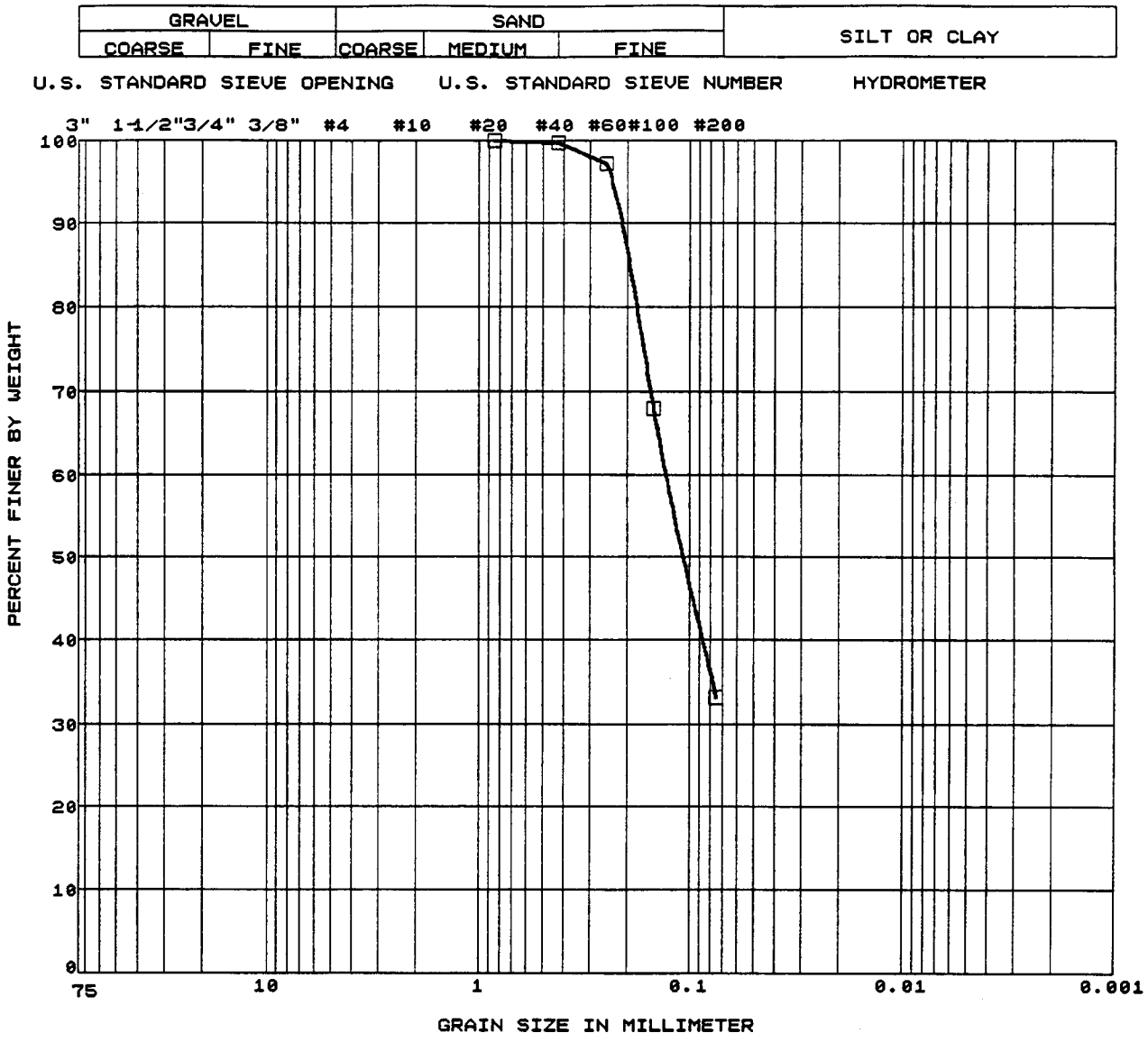
Figure B-26



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-15	D-10	50.0	Drive	SM		

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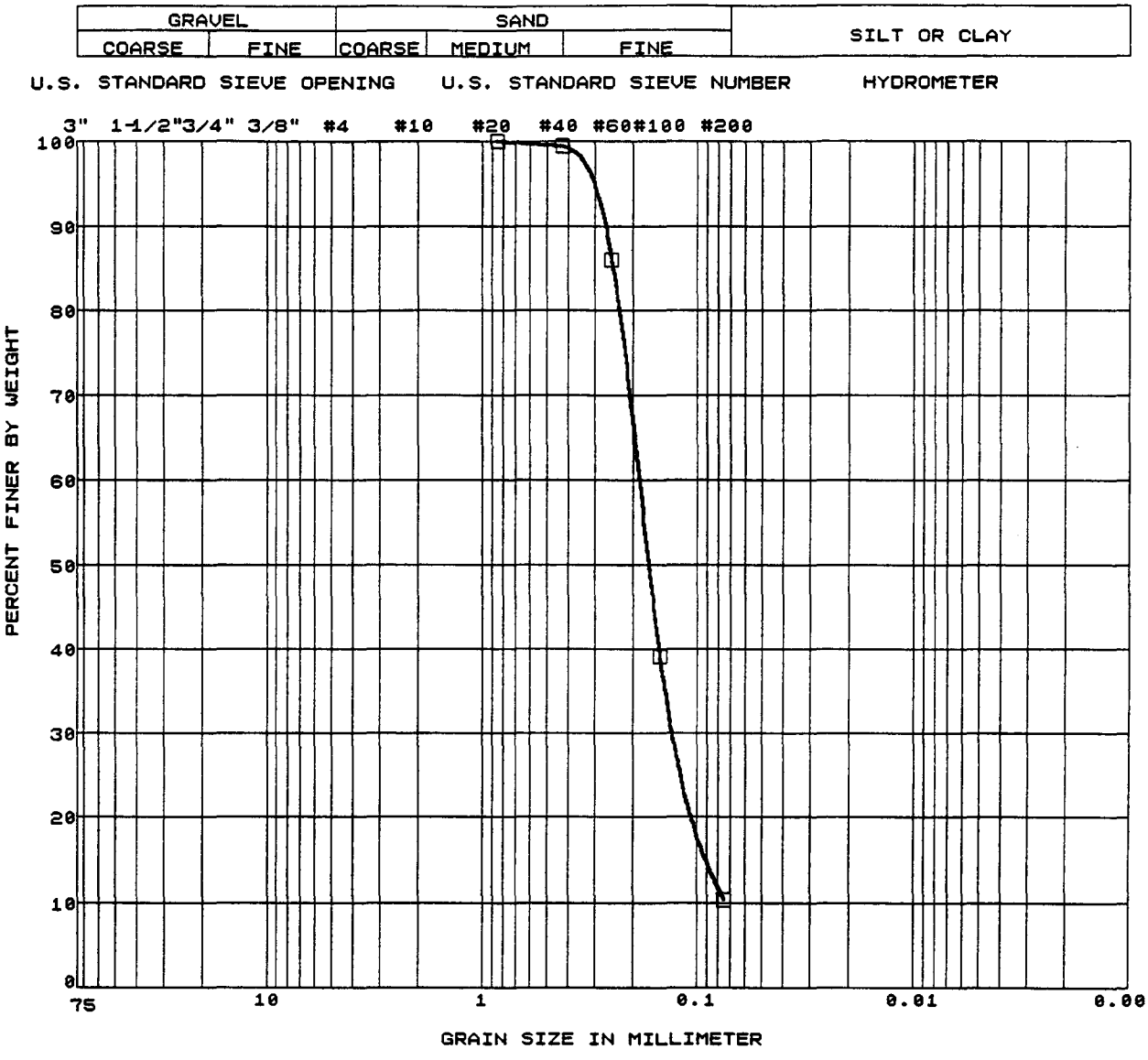
Figure B-27



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-15	D-12	60.0	Drive	SP-SM		

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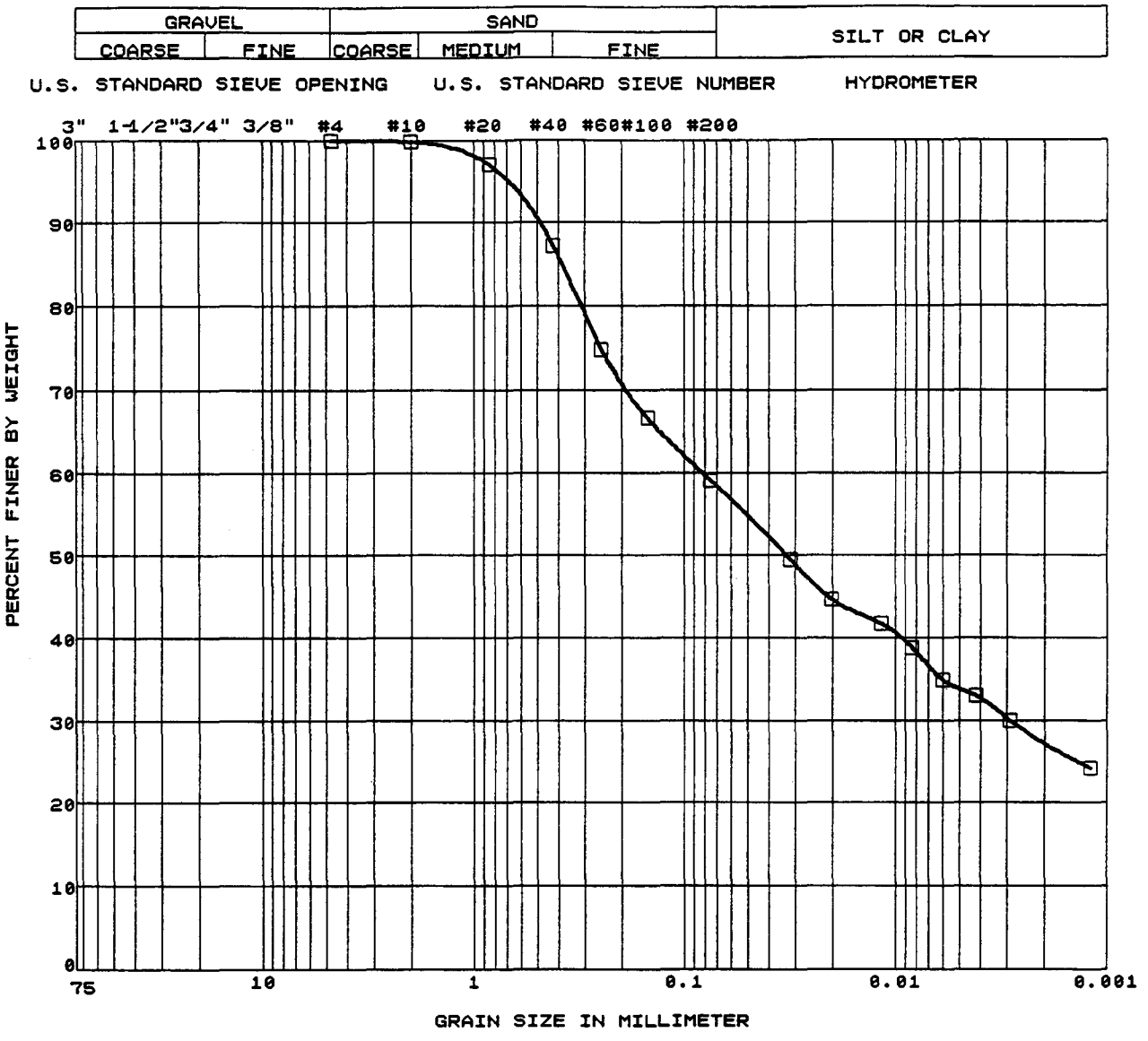
Figure B-28



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-15	D-14	69.5	Drive	CL	47	27

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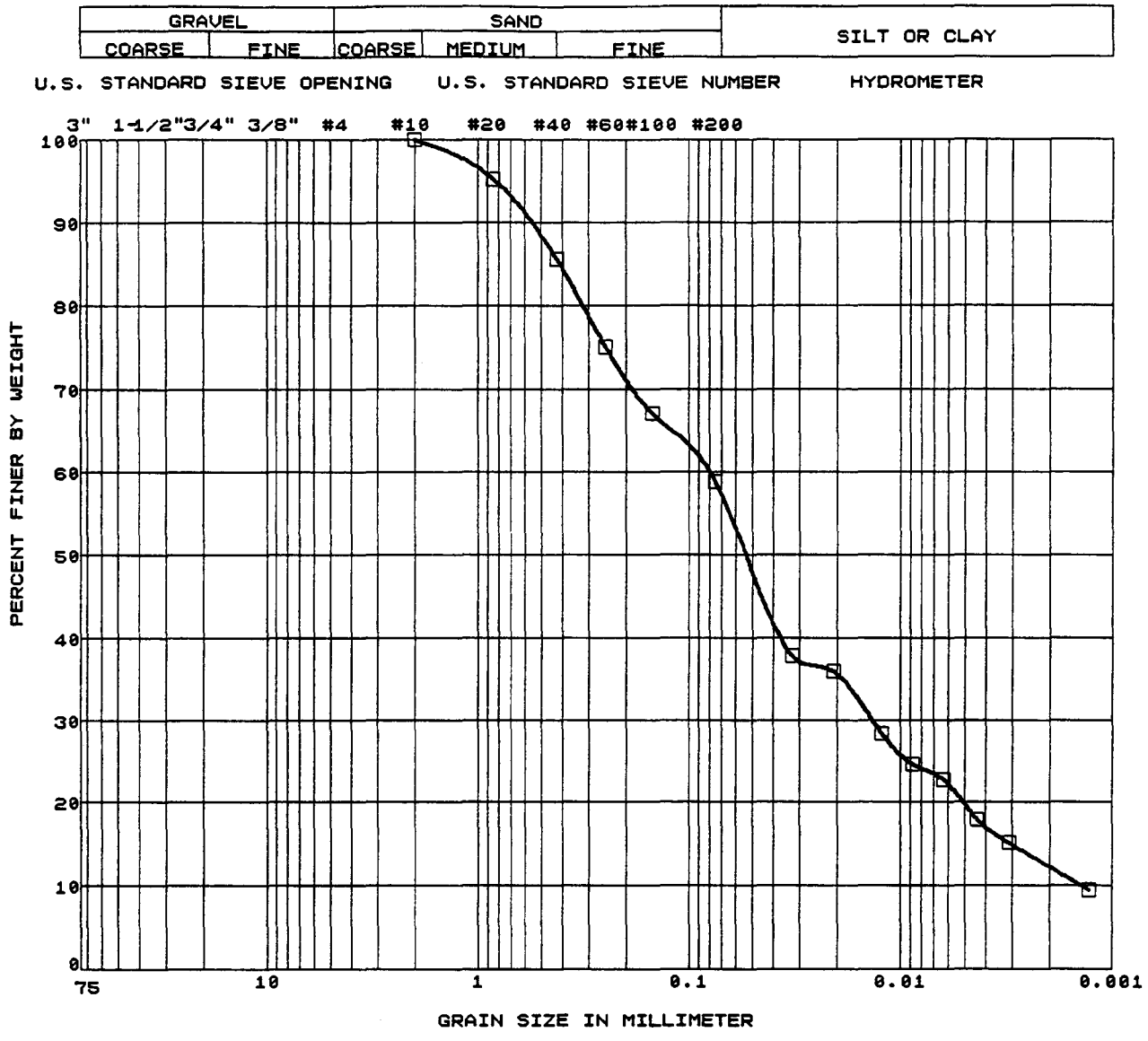
Figure B-29



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-16	D-15	75.0	Drive	CL	29	14

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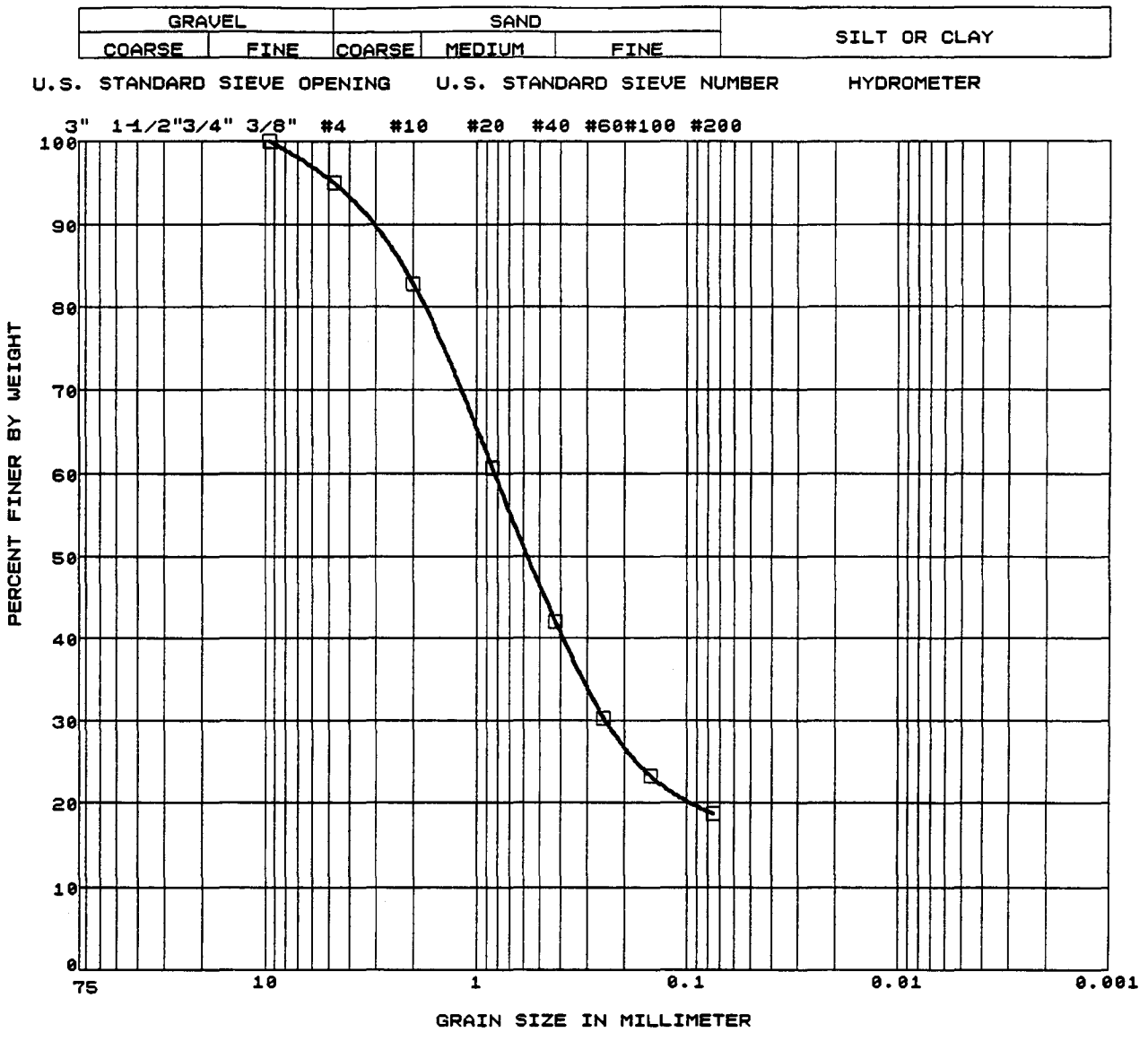
Figure B-30



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-17	D-1	5.0	Drive	SM		

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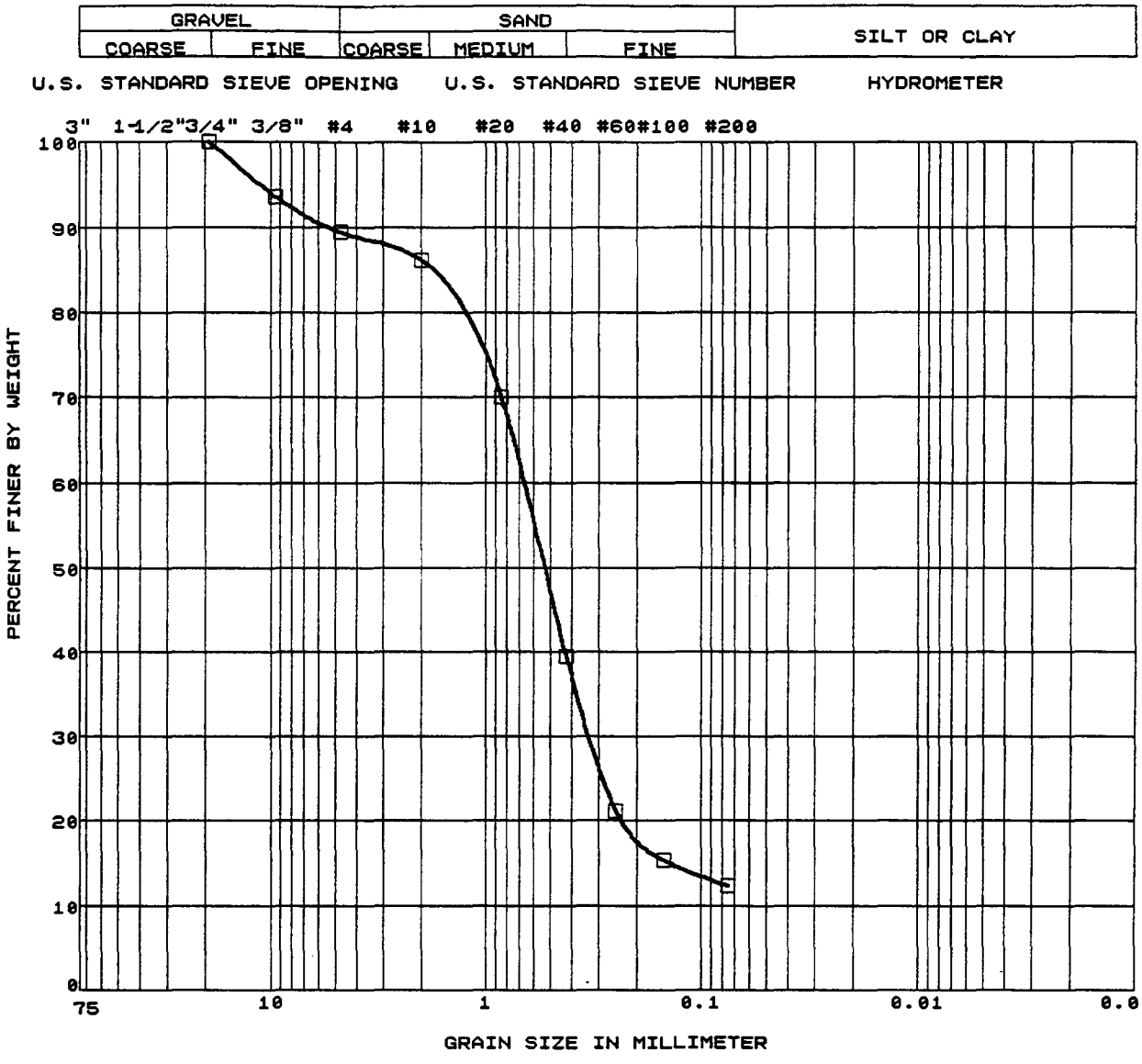
Figure B-31



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-17	D-3	15.0	Drive	SM		

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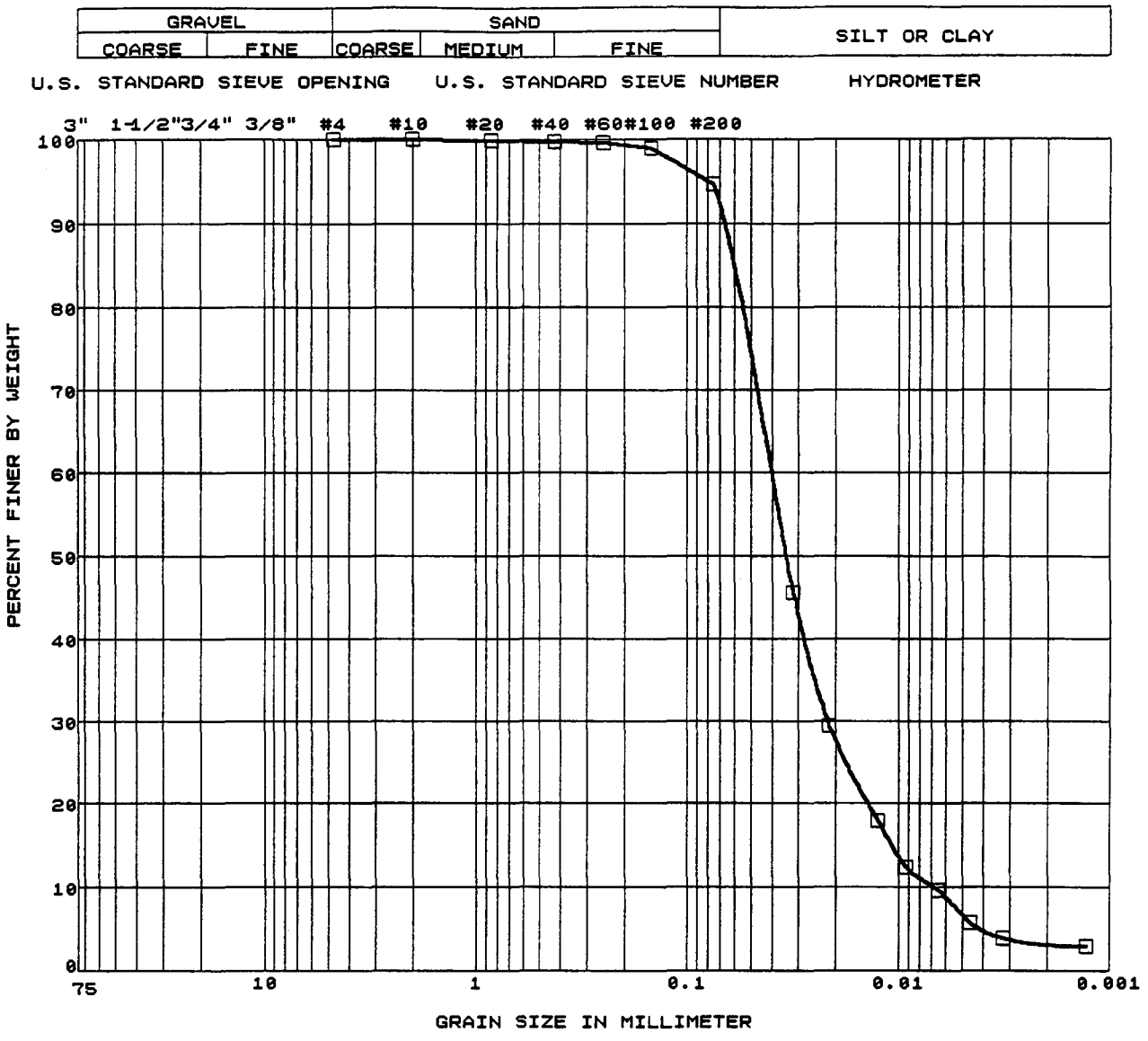
Figure B-32



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-17	D-5	25.0	Drive	ML	34	4

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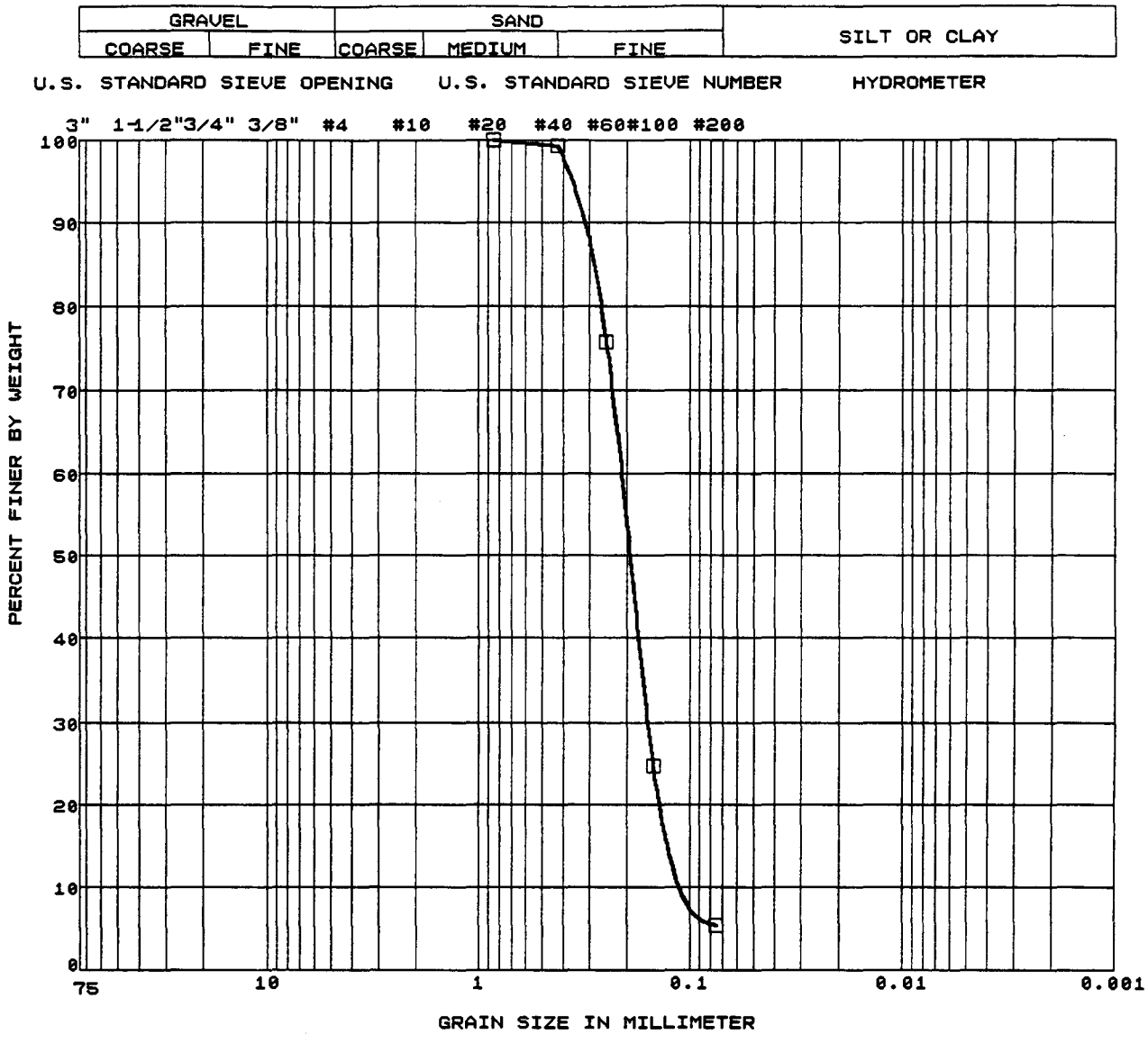
Figure B-33



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-17	D-9	45.0	Drive	SP-SM		

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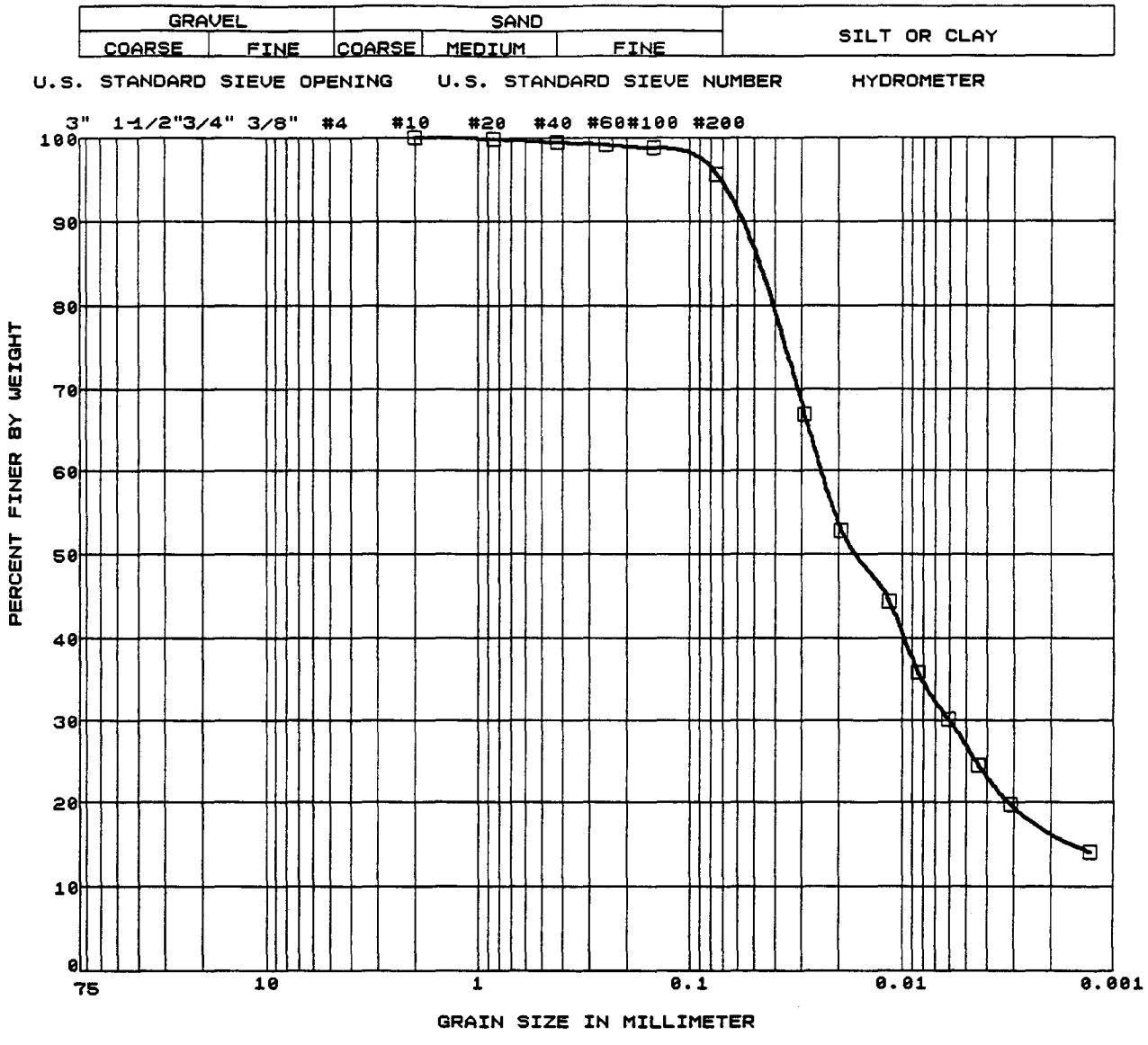
Figure B-34



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-17	D-13	65.0	Drive	CL	48	24

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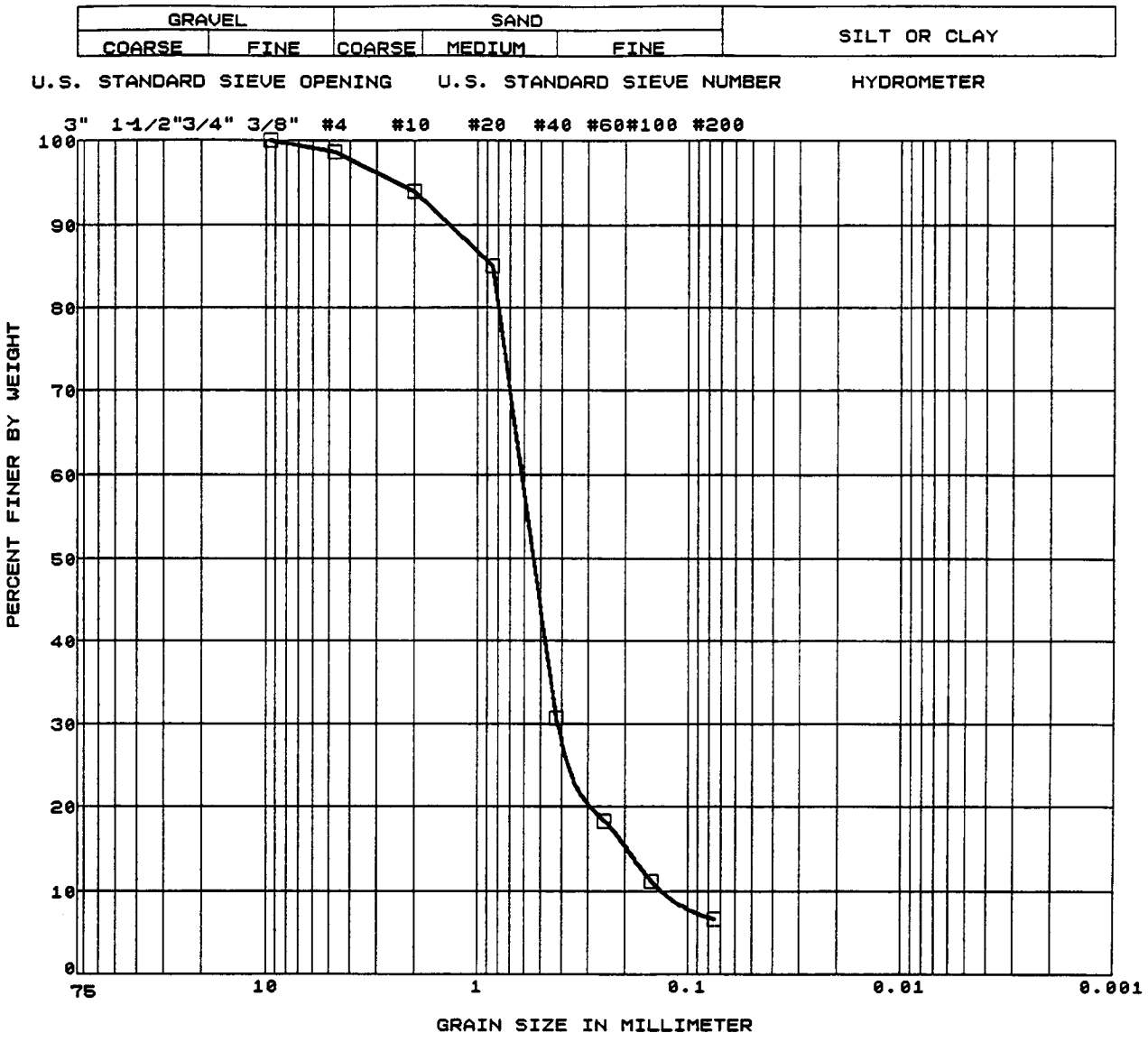
Figure B-35



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-18	S-3	15.0	Bag	SP-SM		

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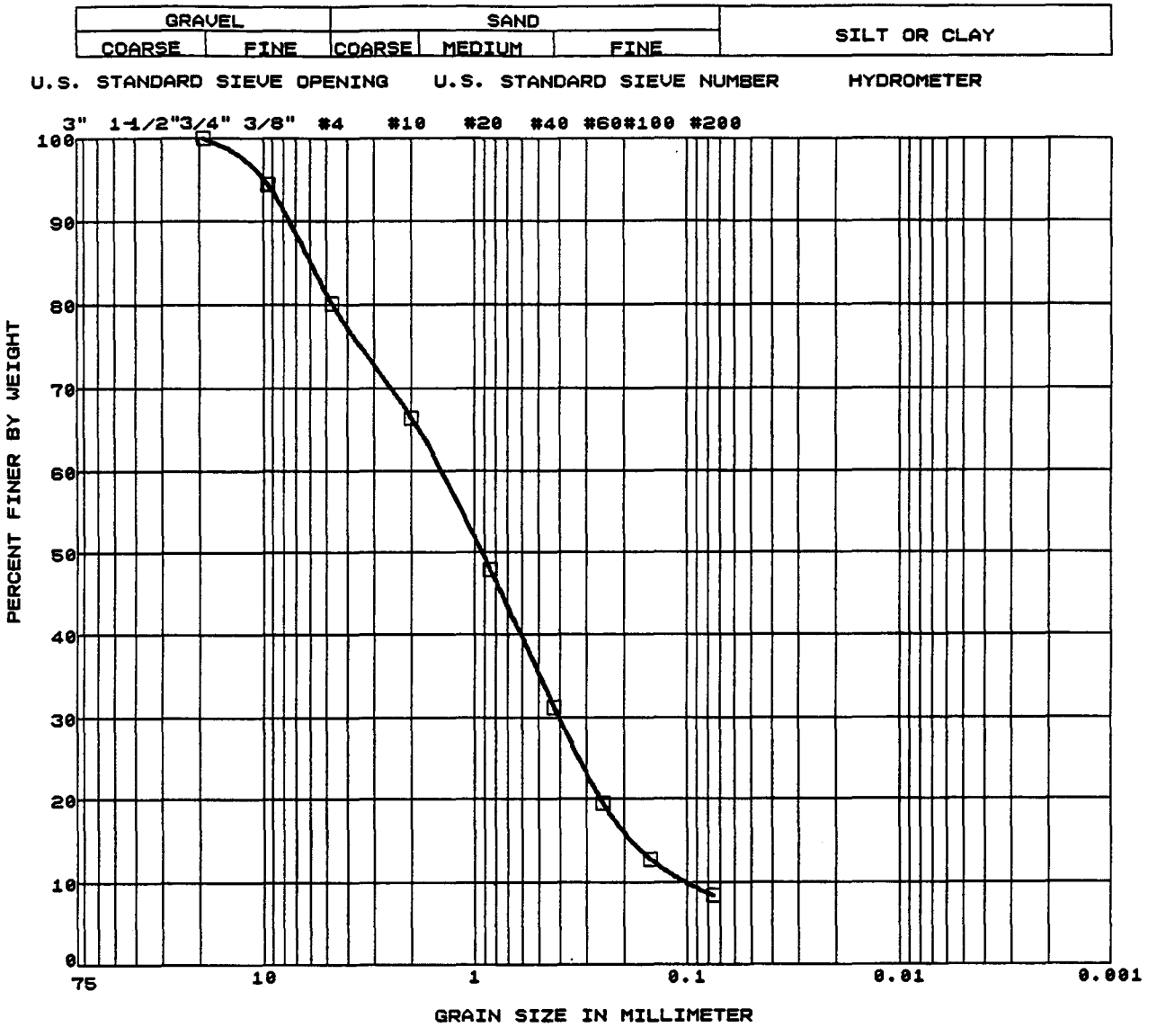
Figure B-36



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-18	S-7	35.0	Bag	SW-SM		

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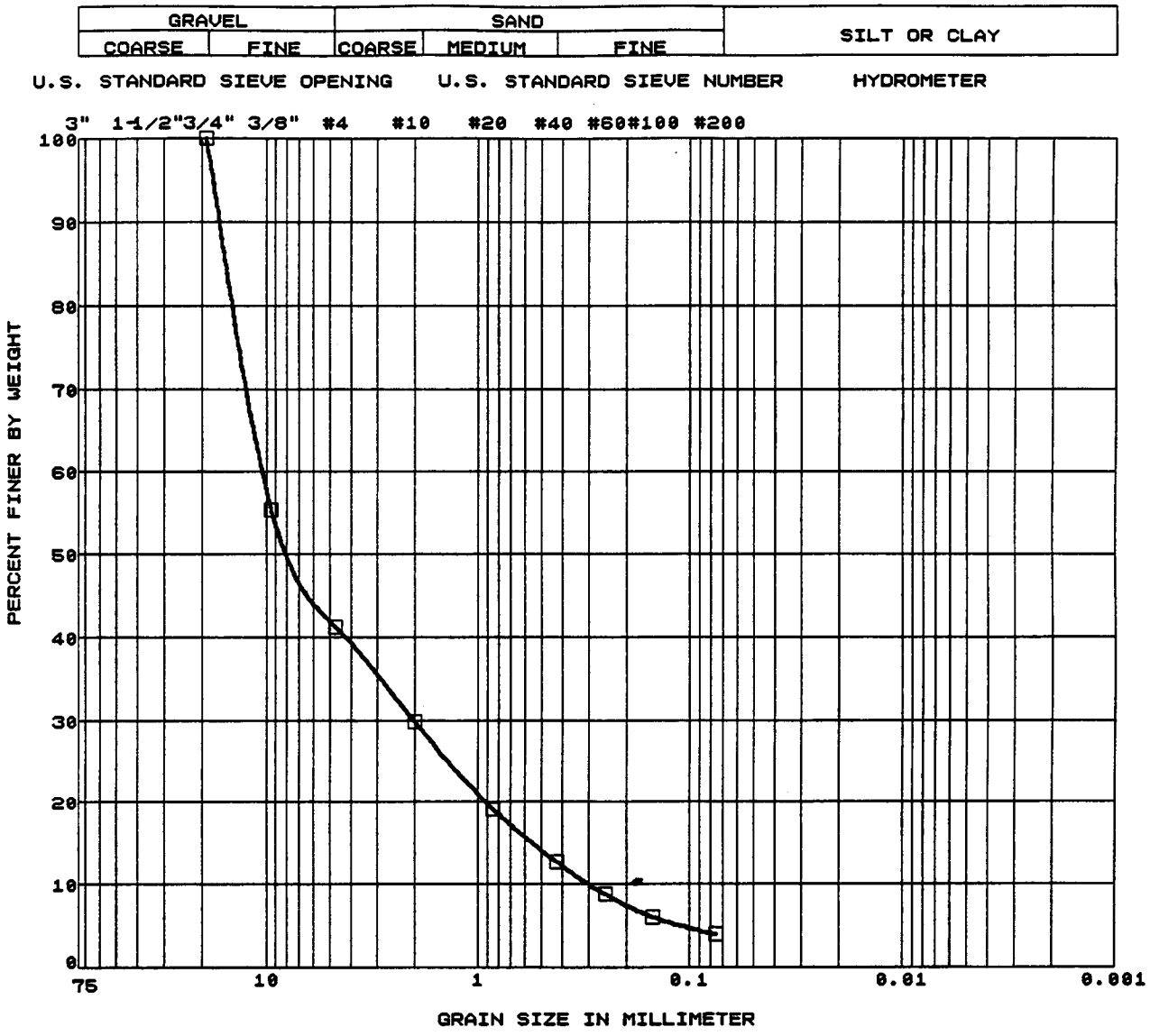
Figure B-37



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-18	S-9	45.0	Bag	GW		

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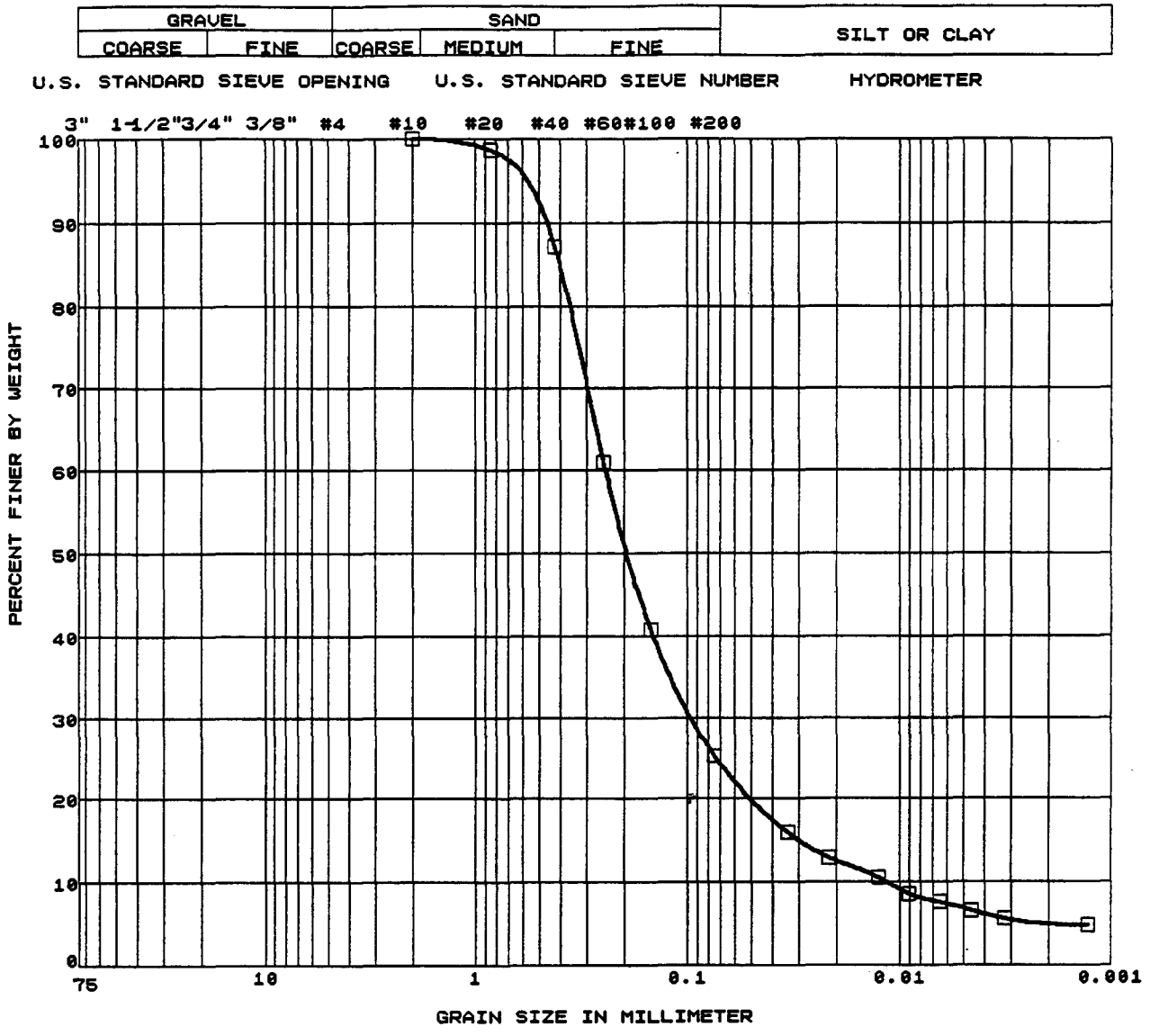
Figure B-38



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-18	D-12	60.0	Drive	SM	28	6

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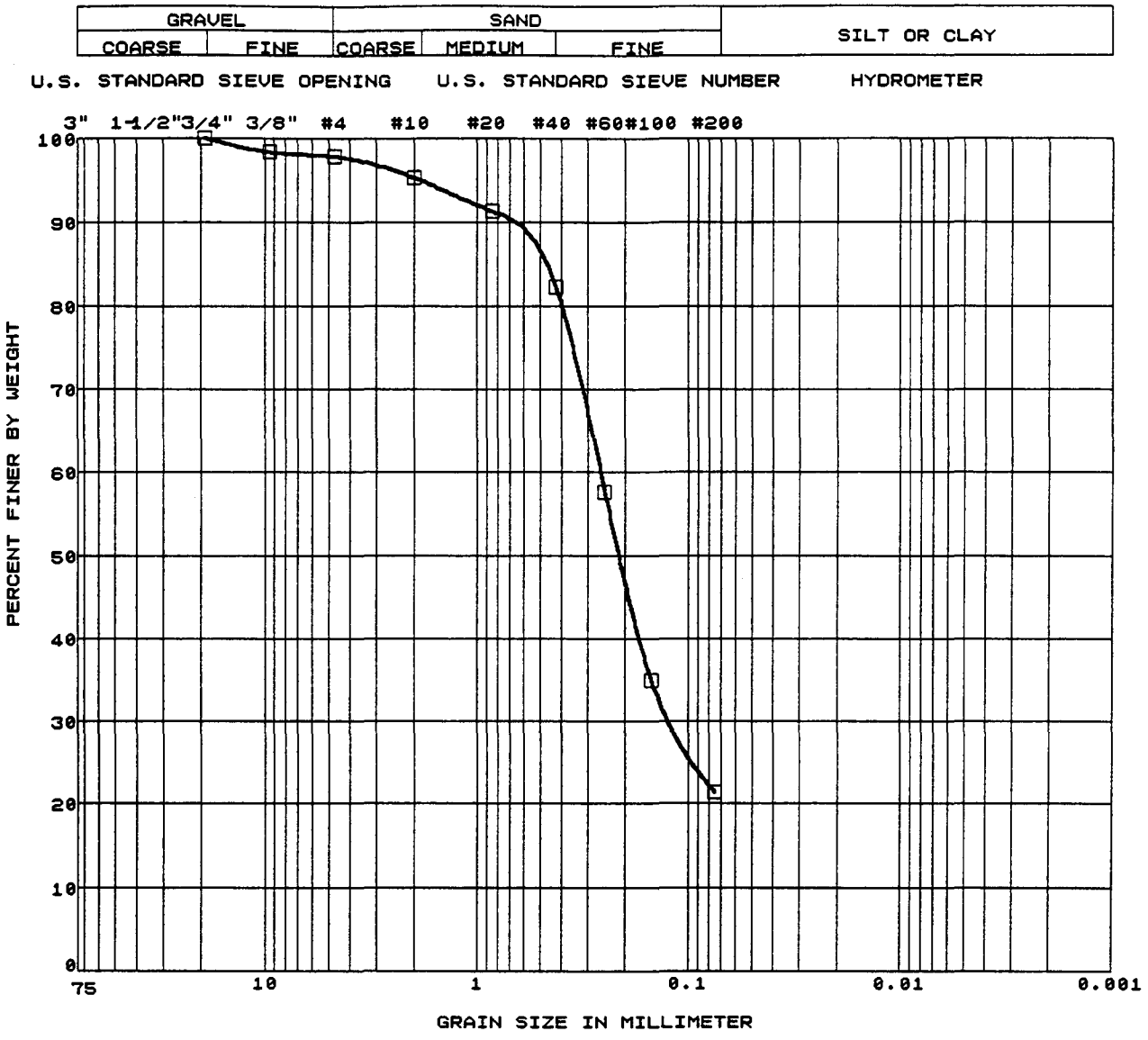
Figure B-39



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-18	S-13	65.0	Bag	SM		

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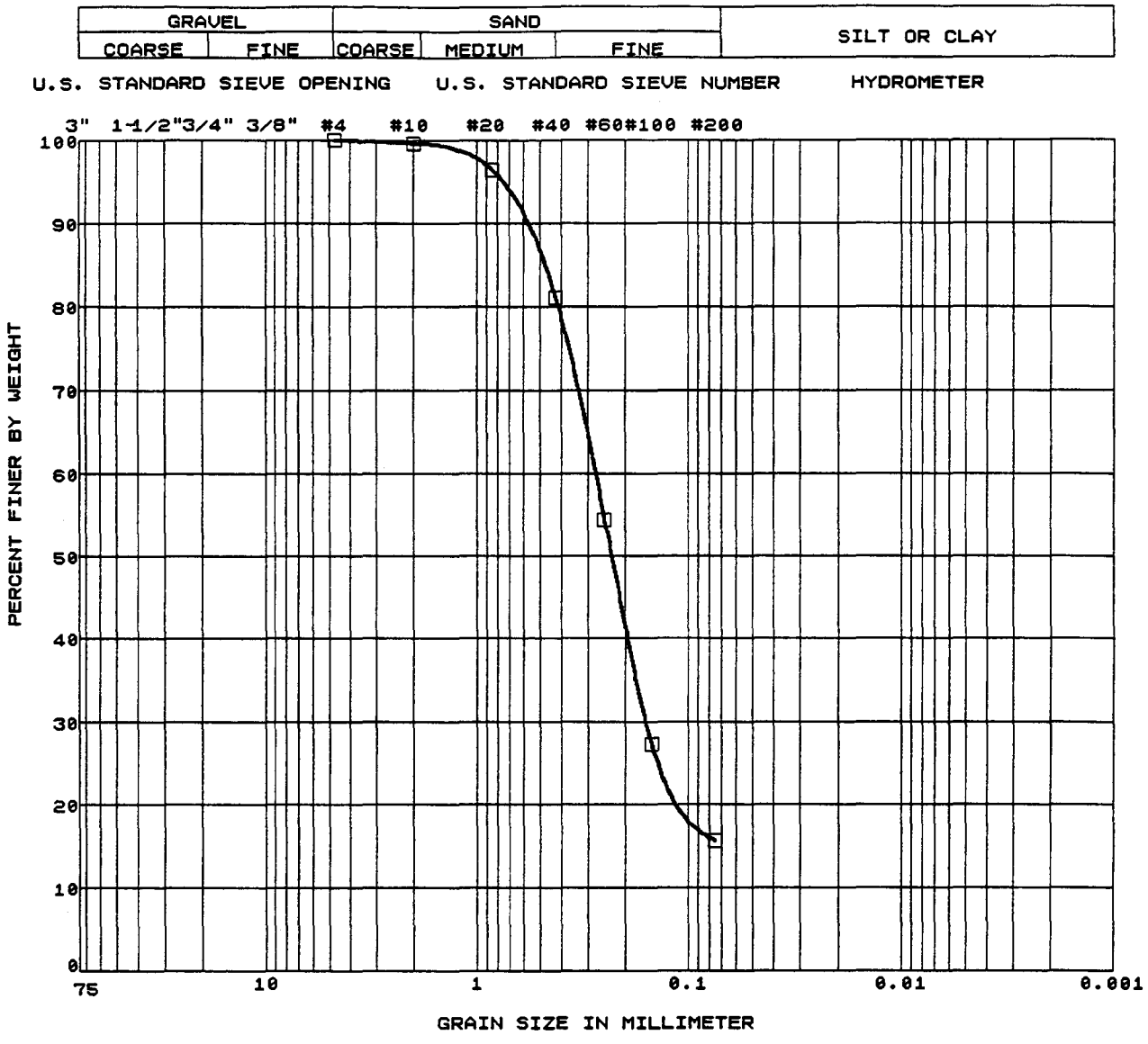
Figure B-40



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-18	S-15	78.5	Bag	SM		

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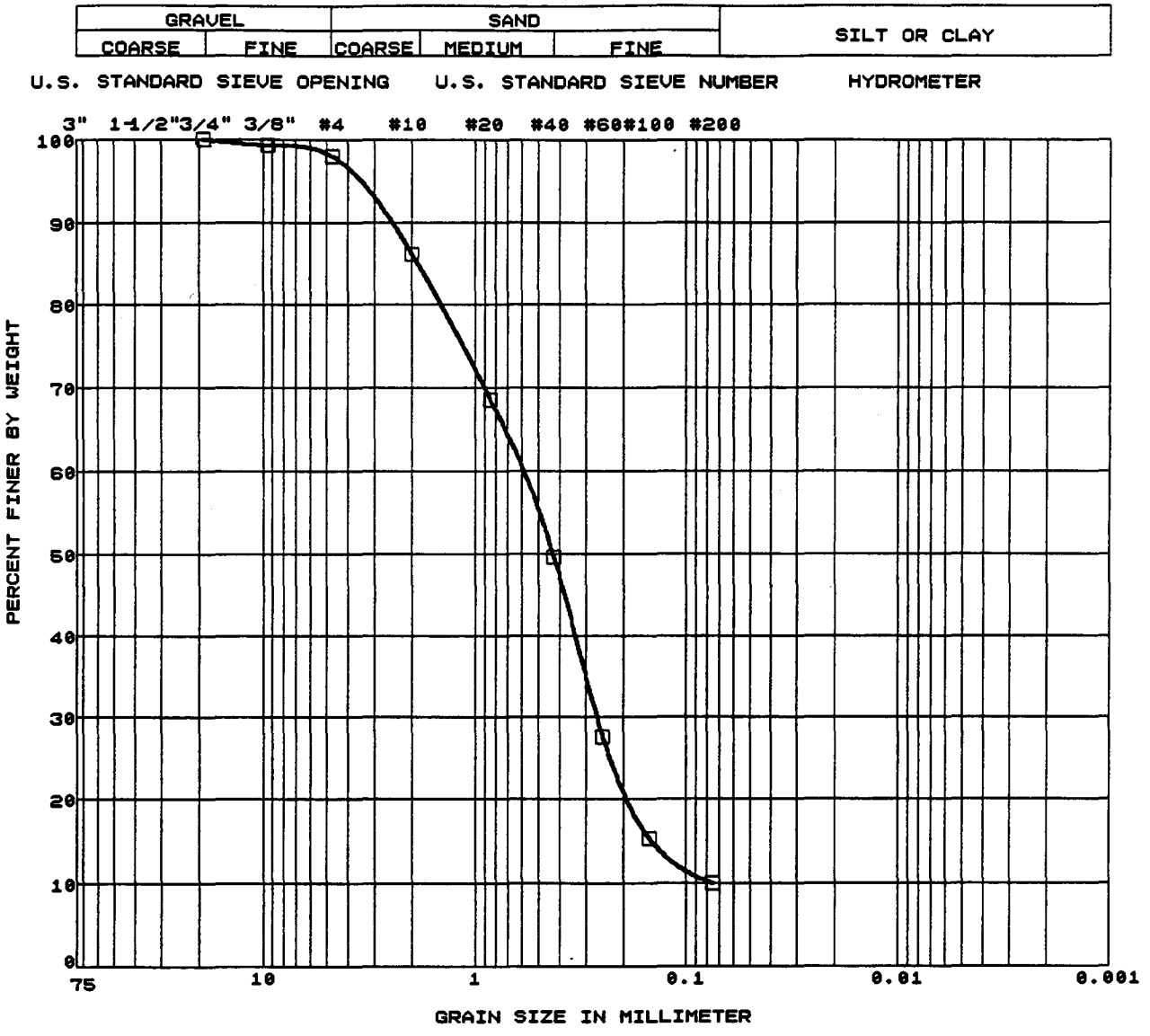
Figure B-41



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-19	S-3	15.0	Bag	SW-SM		

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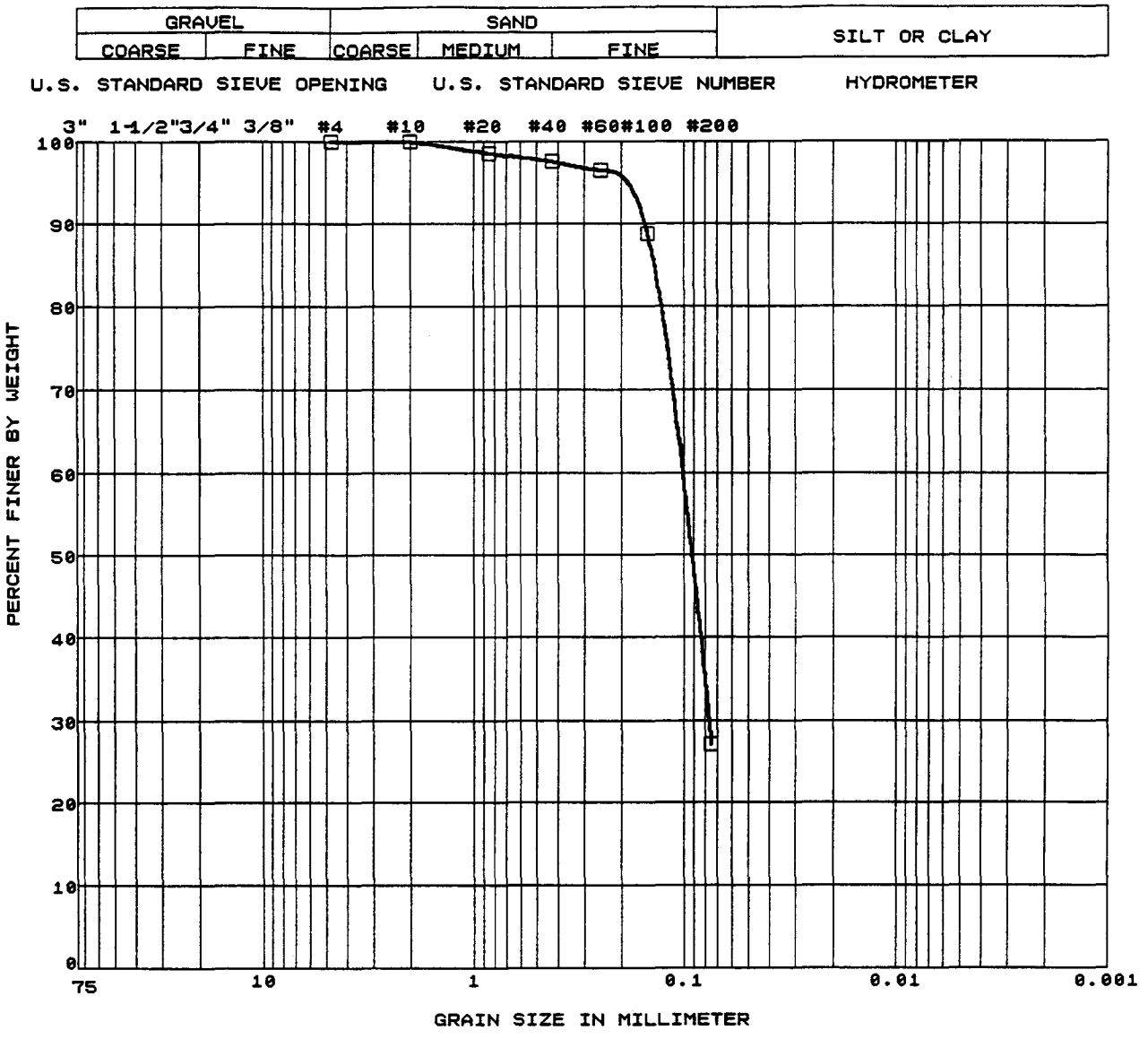
Figure B-42



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-19	S-7	35.0	Bag	SM		

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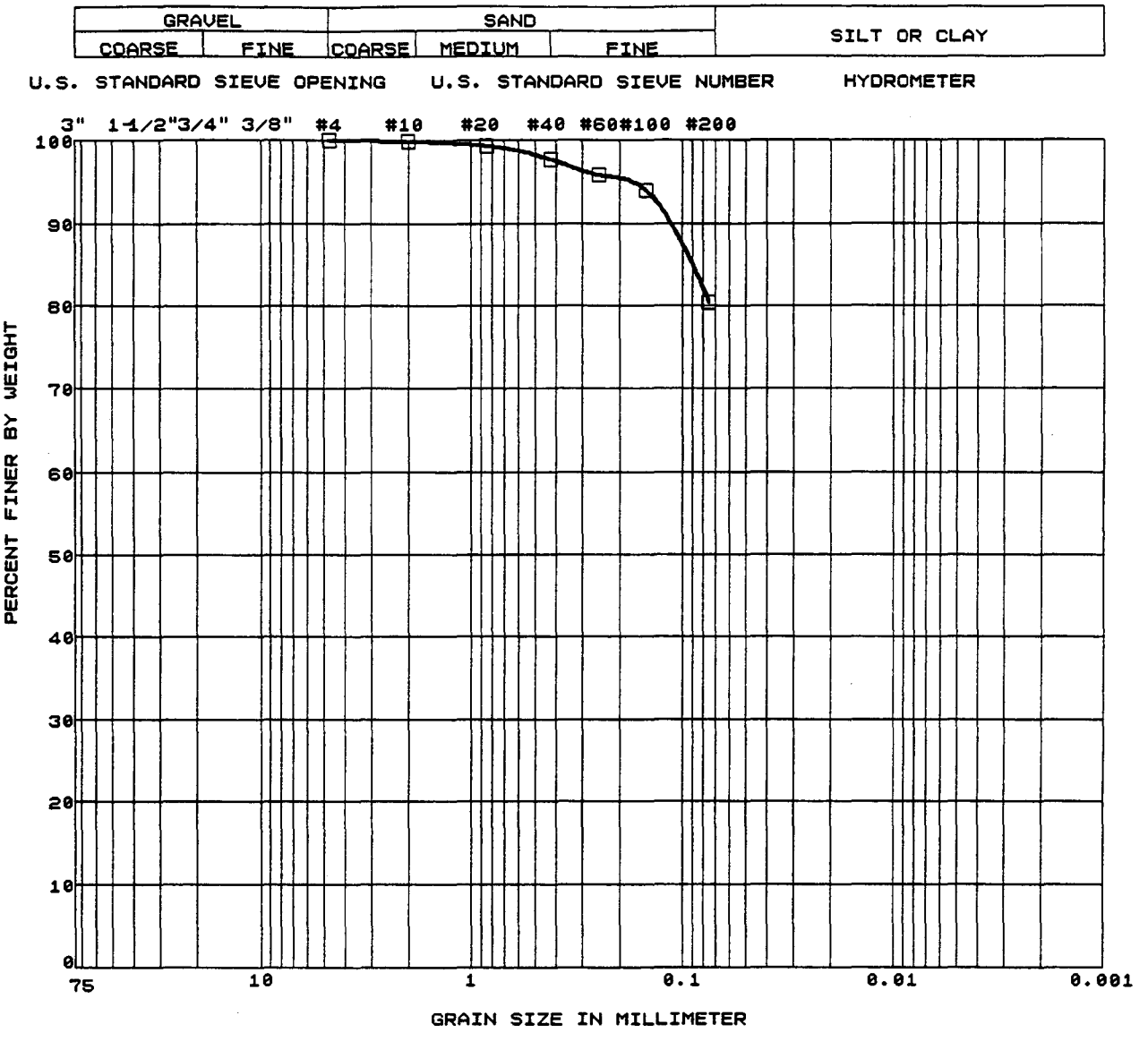
Figure B-43



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-19	D-8	40.0	Drive	ML		

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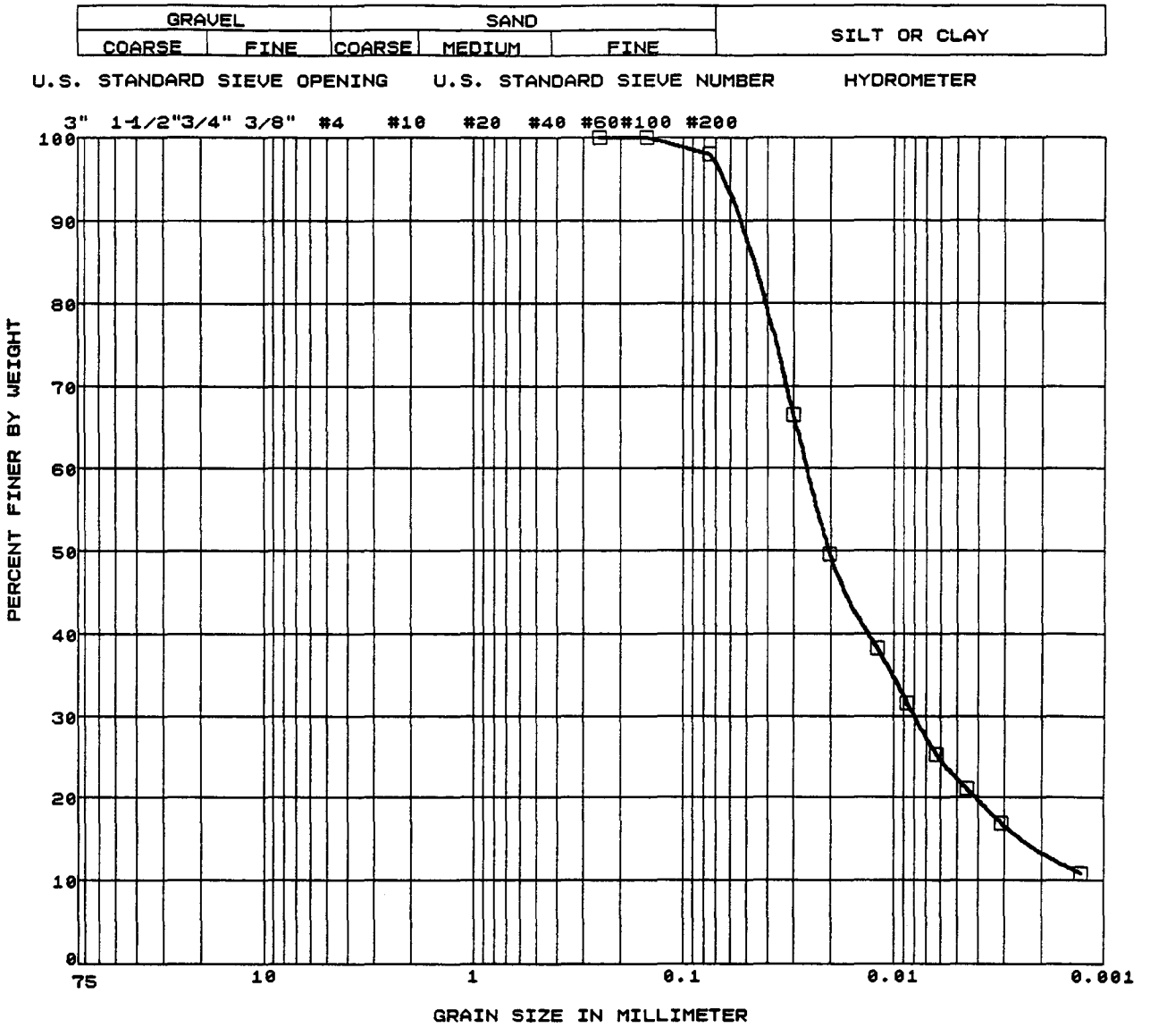
Figure B-44



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-19	D-10	49.0	Drive	ML	38	13

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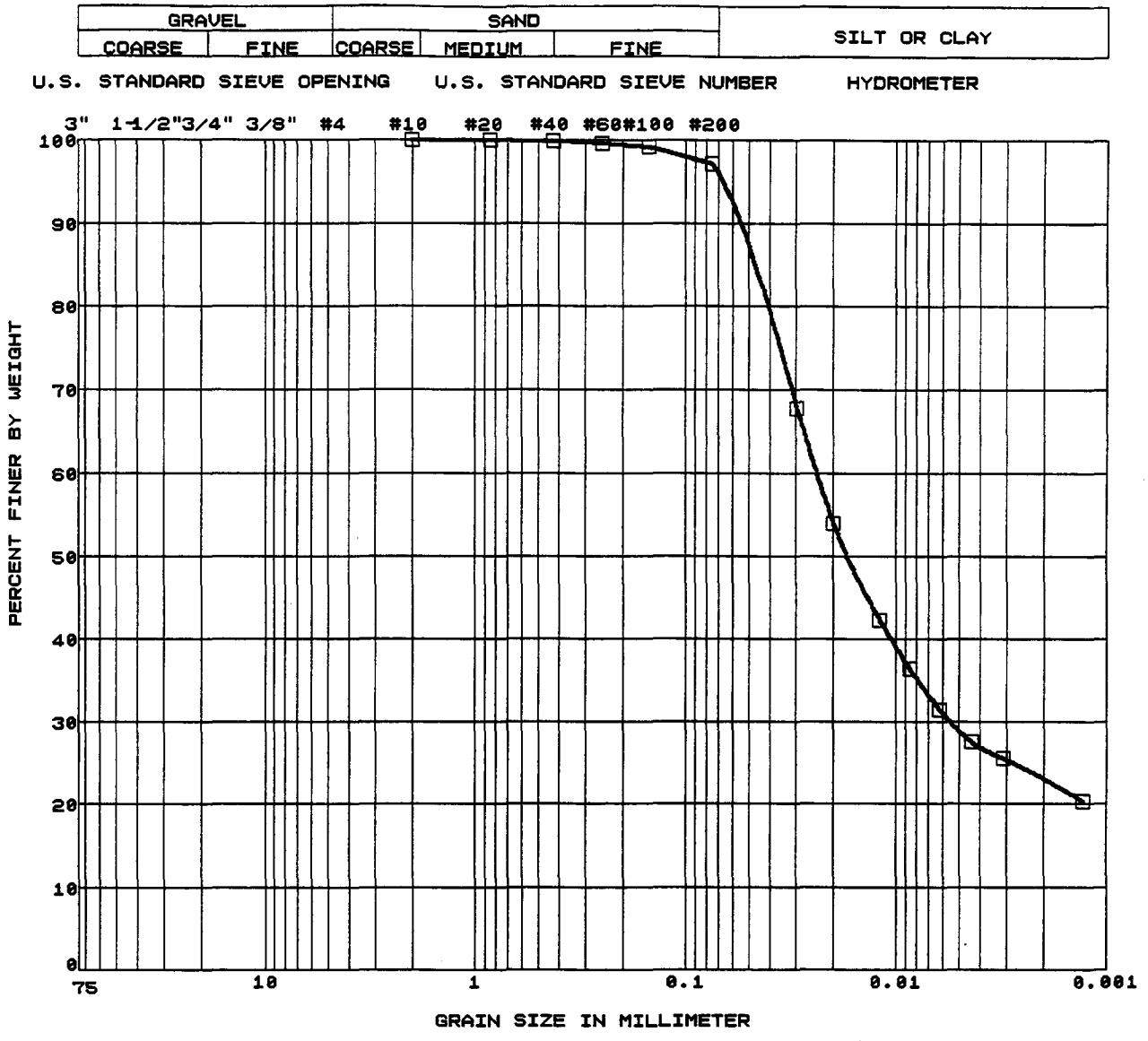
Figure B-45



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-20	D-7	35.0	Drive	CL	42	16

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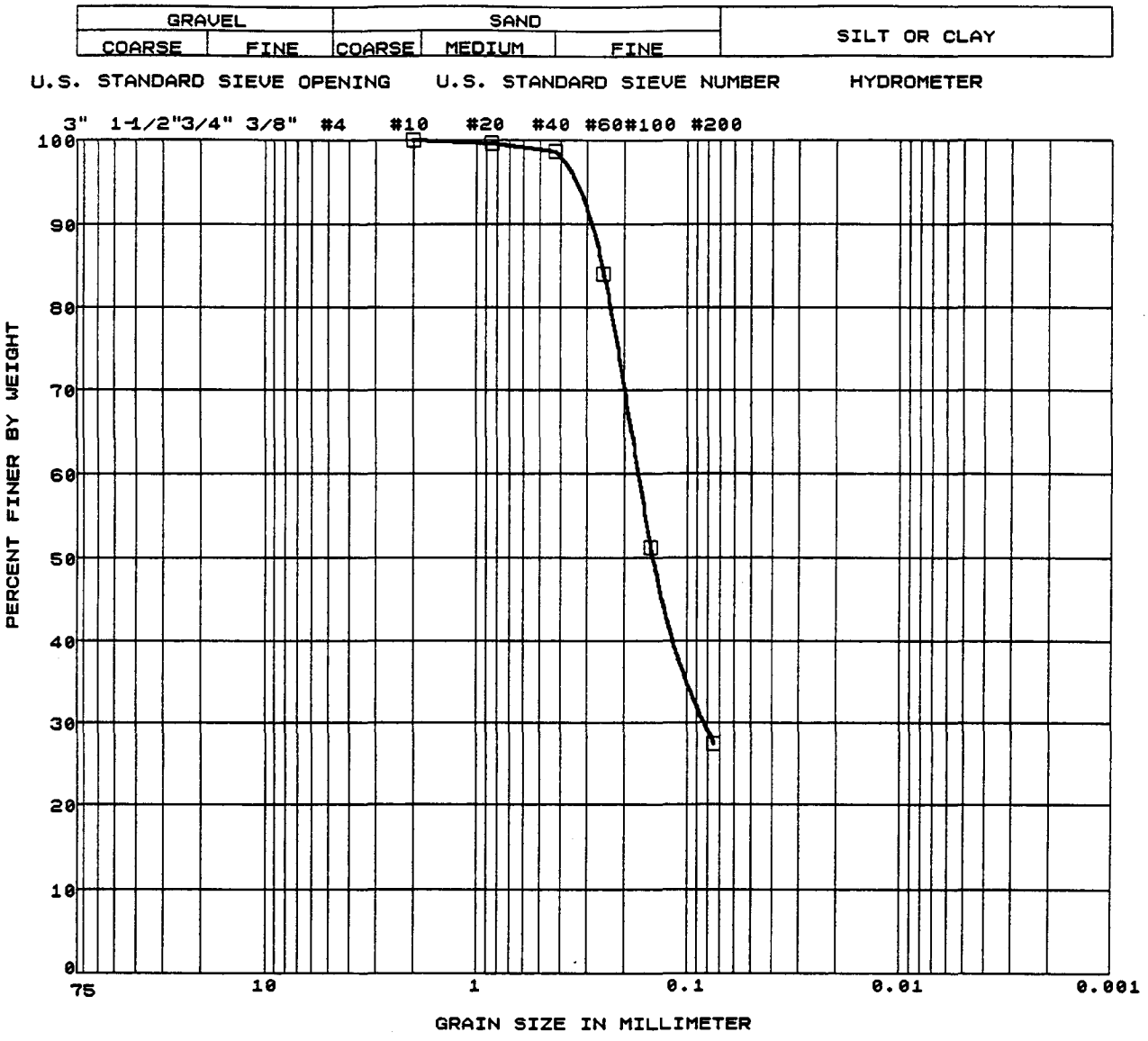
Figure B-46



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-21	S-6	30.0	Bag	SM		

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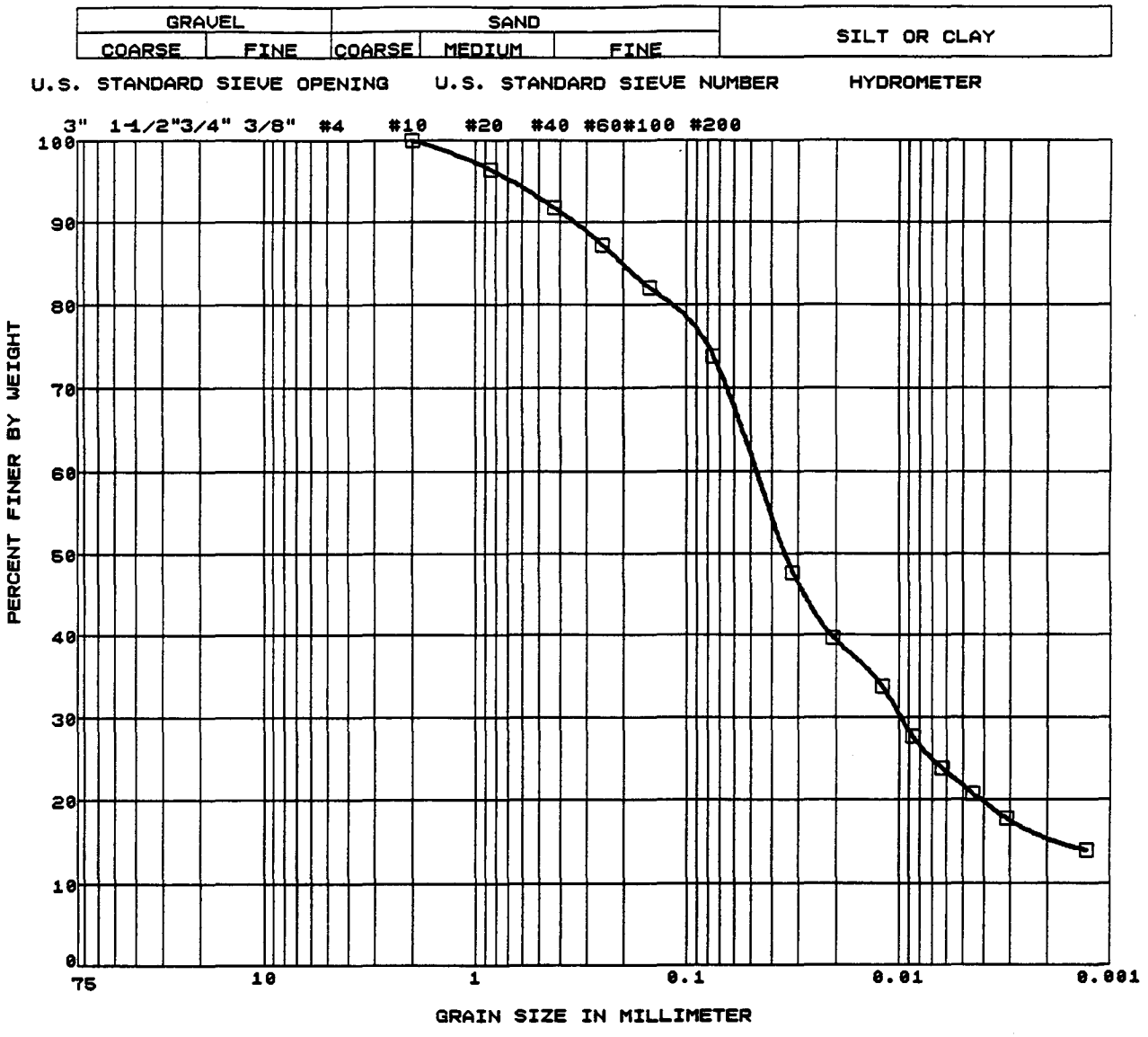
Figure B-47



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-21	D-7	35.0	Drive	CL	24	9

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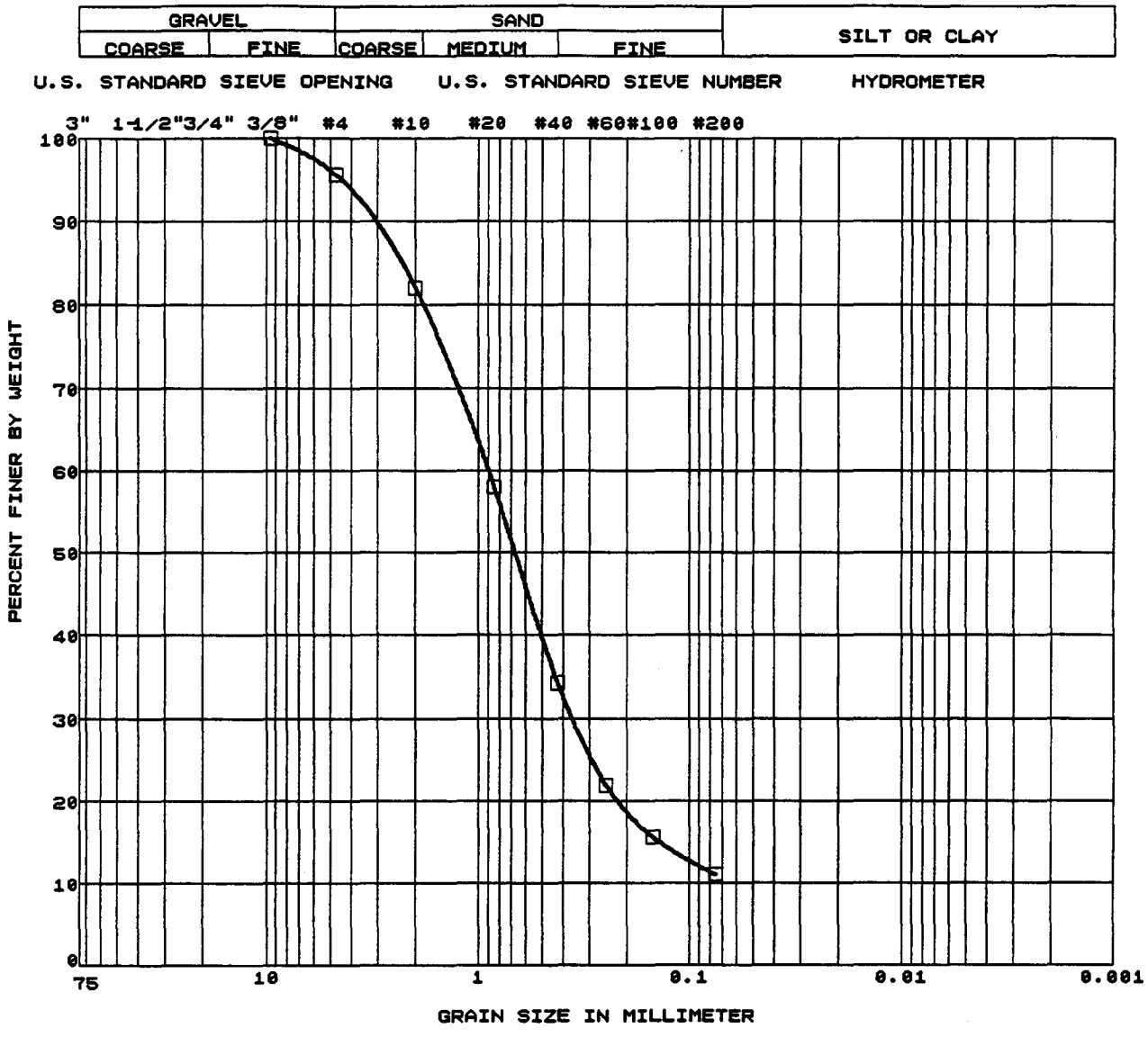
Figure B-48



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-21	S-14	70.0	Bag	SW-SM		

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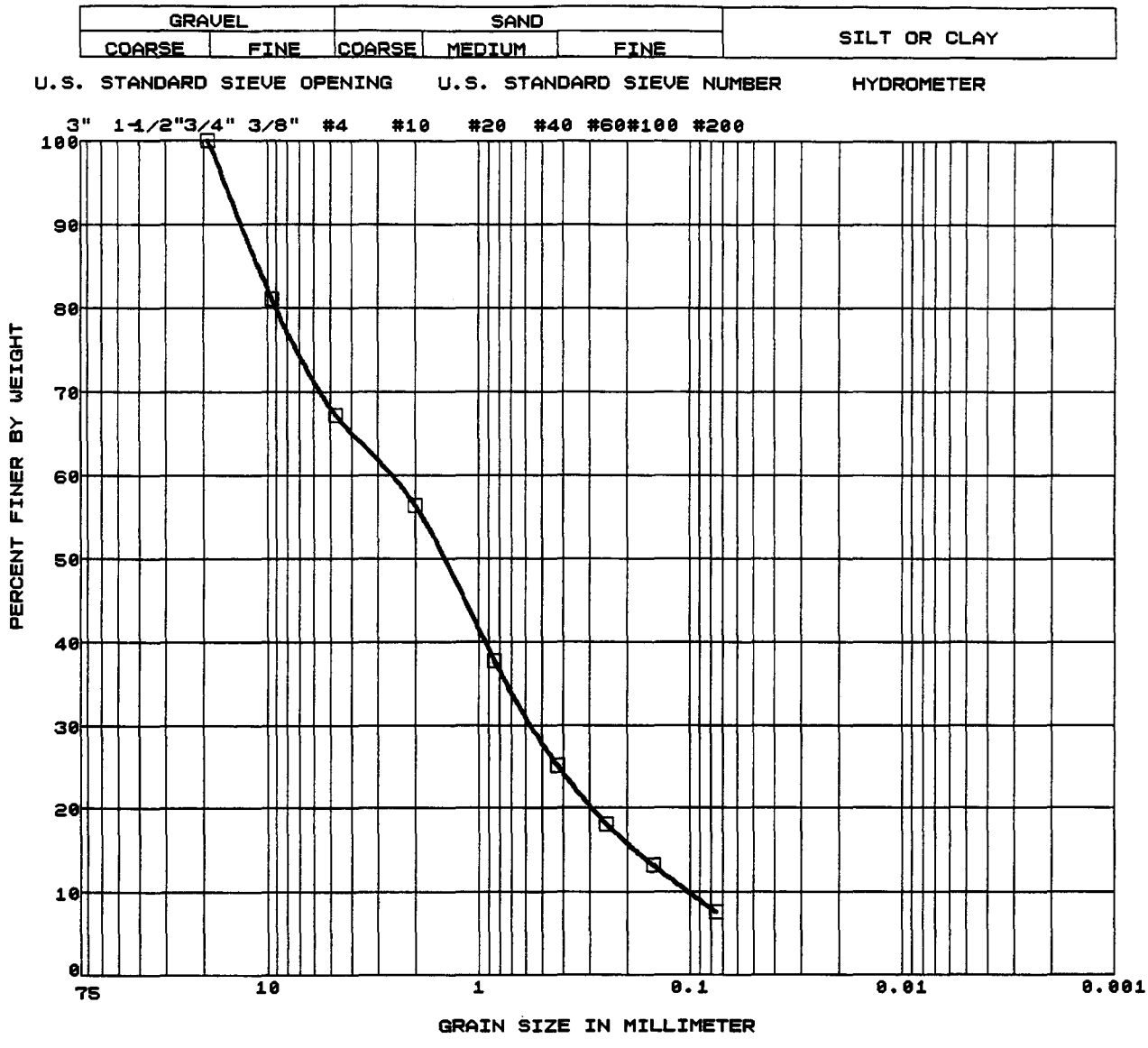
Figure B-49



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-22	S-5	20.0	Bag	SW-SM		

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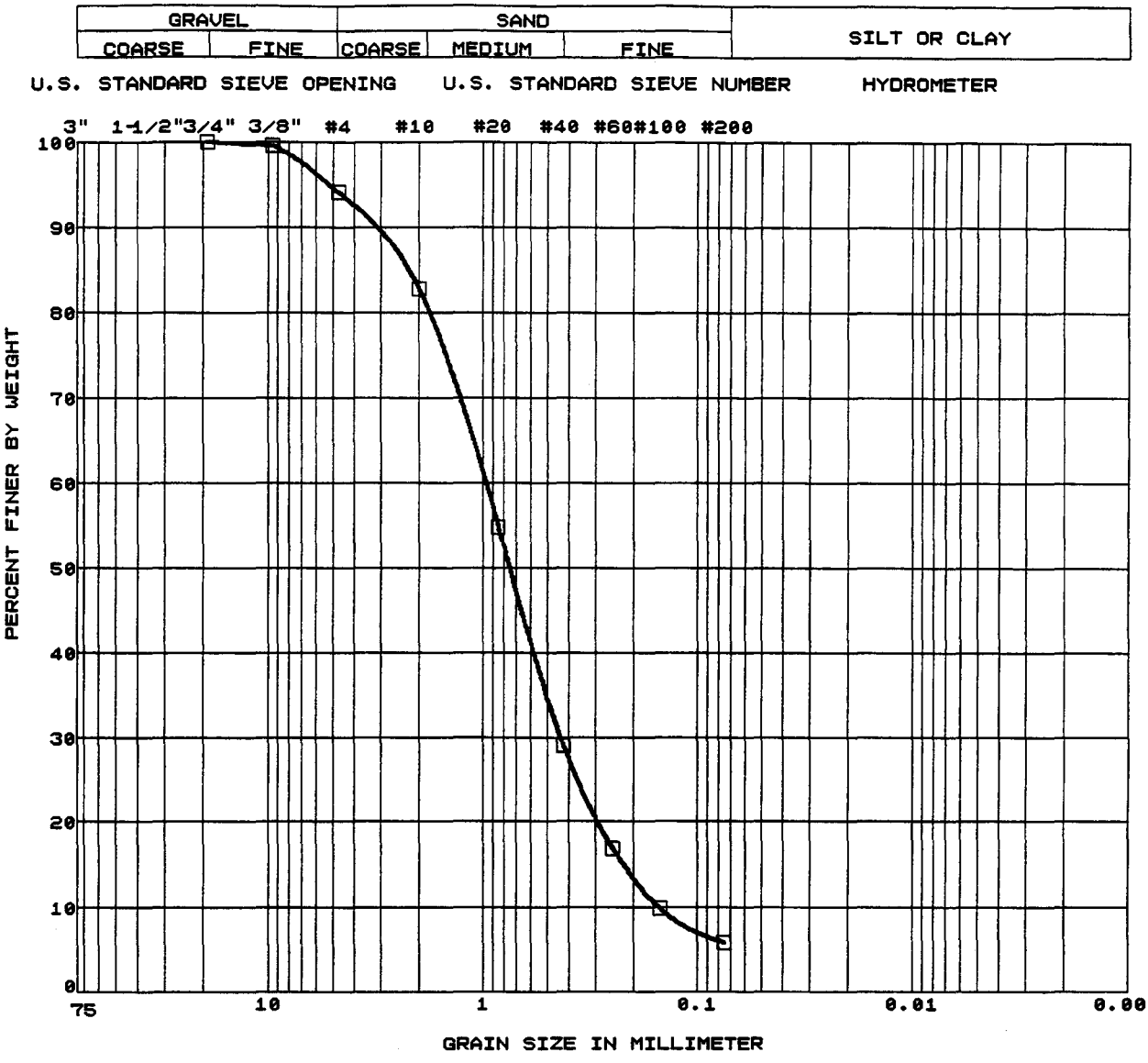
Figure B-50



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-22	D-6	25.0	Drive	SW-SM		

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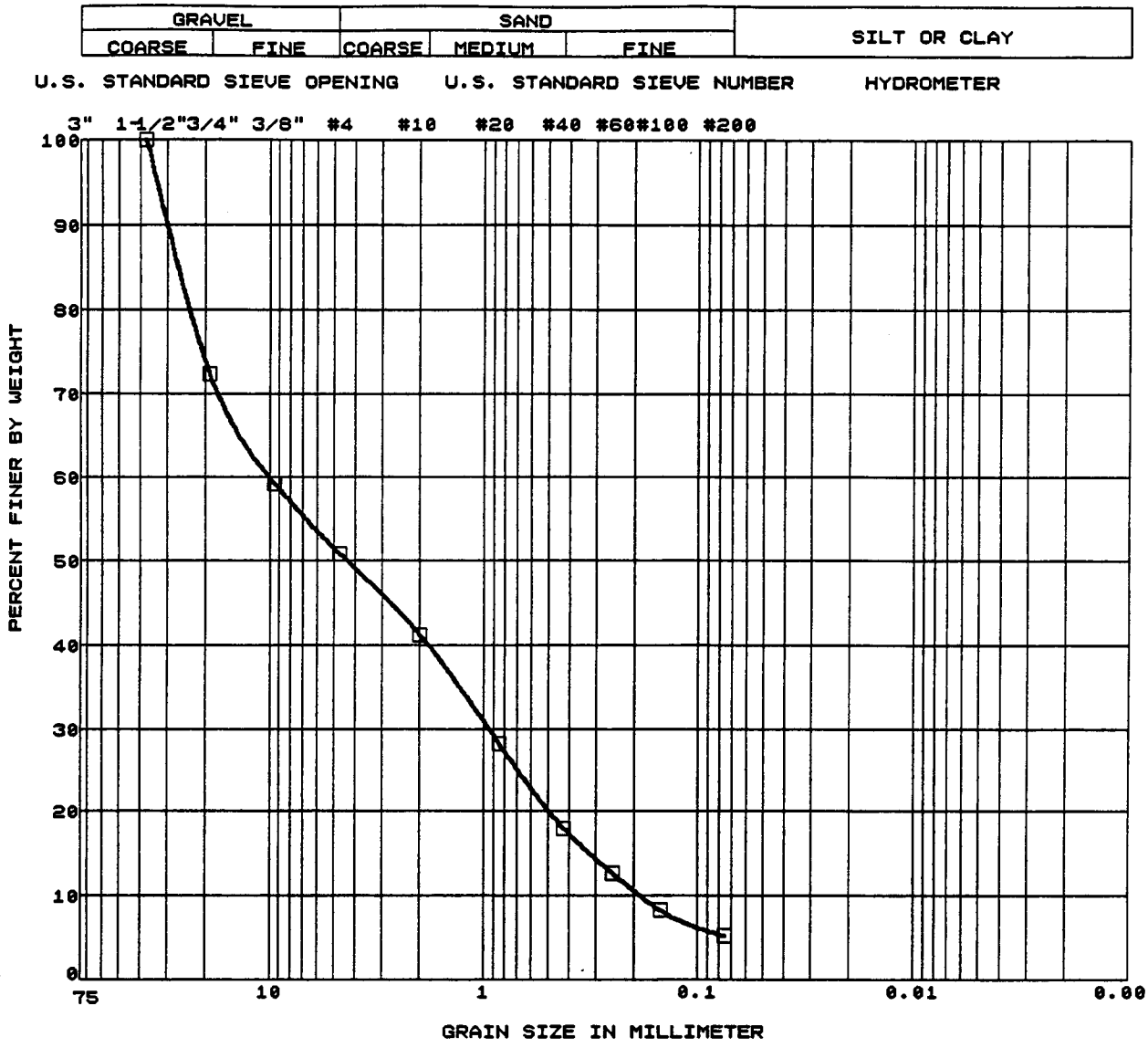
Figure B-51



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-22	S-7	30.0	Bag	GP-GM		

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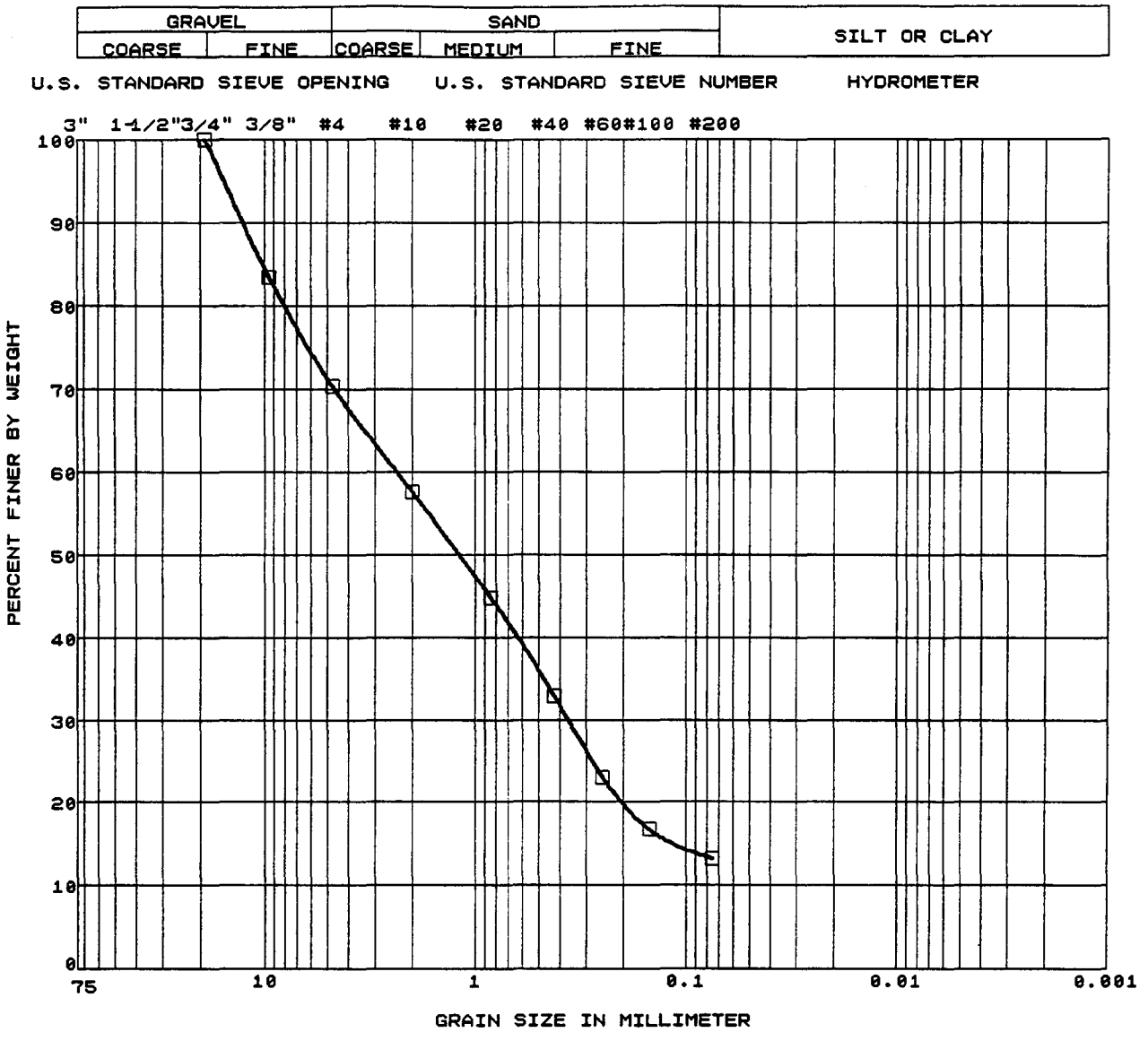
Figure B-52



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-22	S-10	40.0	Bag	SM		

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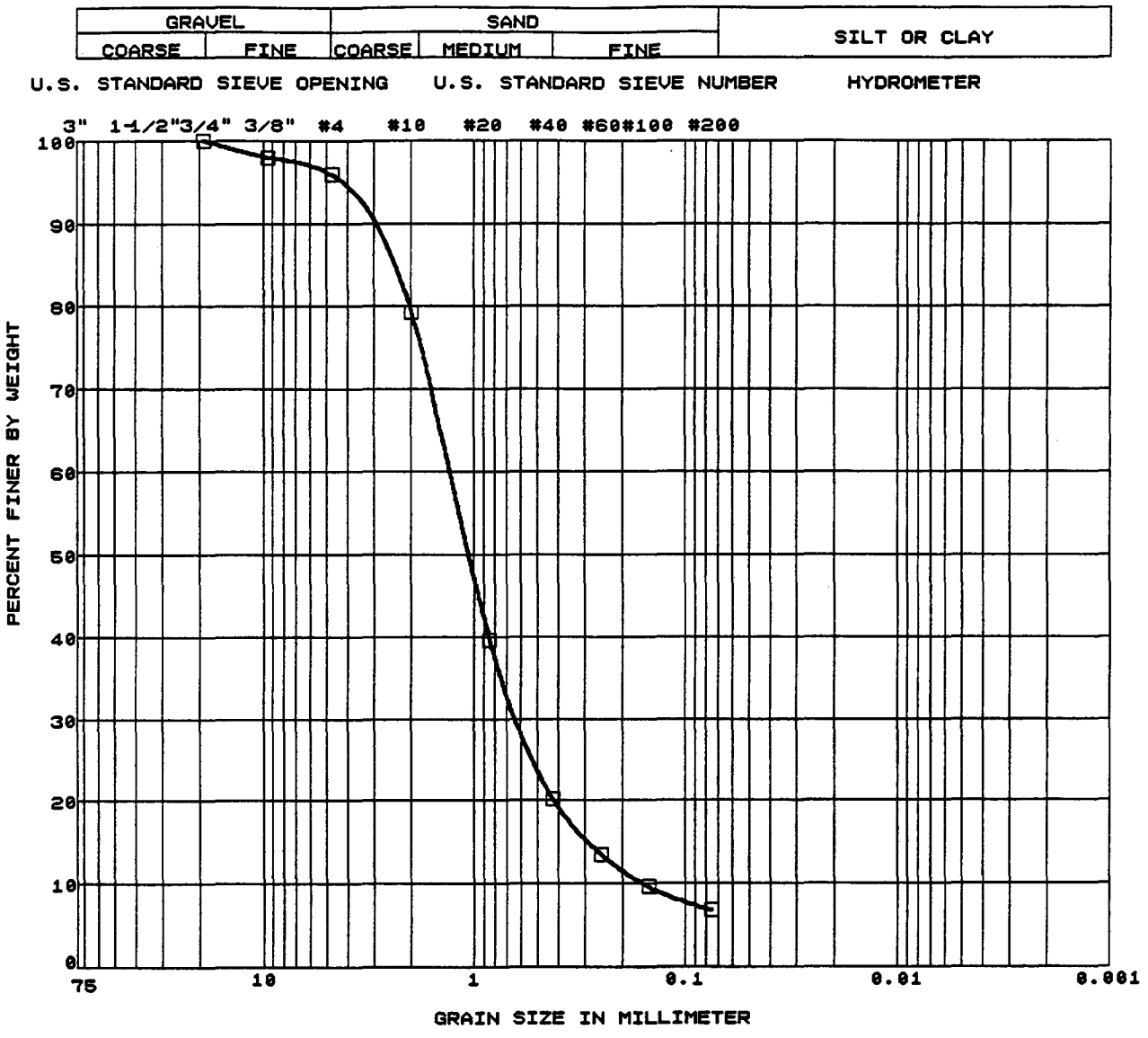
Figure B-53



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-22	D-11	45.0	Drive	SW-SM		

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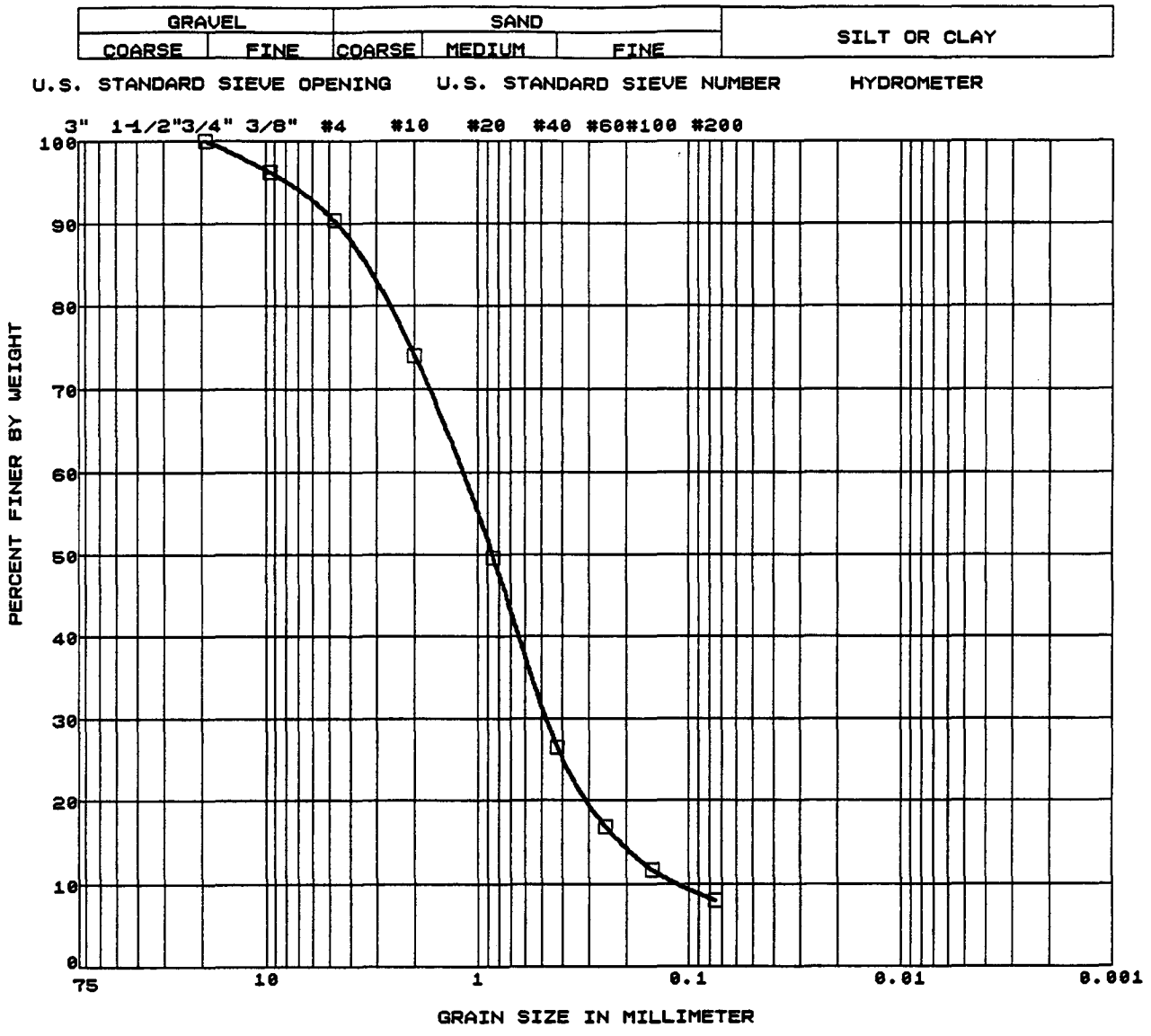
Figure B-54



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-22	S-14	60.0	Bag	SW-SM		

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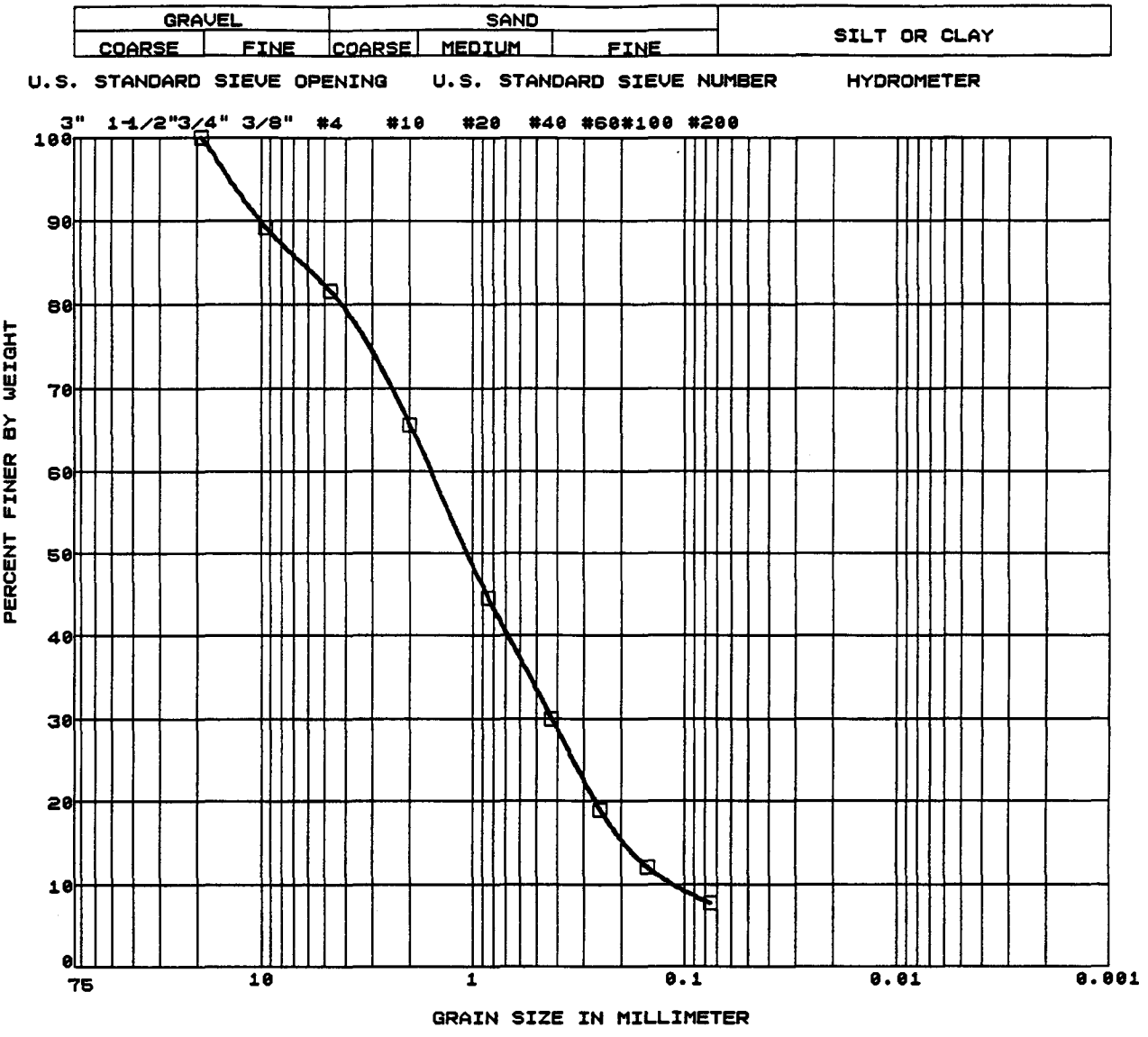
Figure B-55



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-22	S-16	70.0	Bag	SW-SM		

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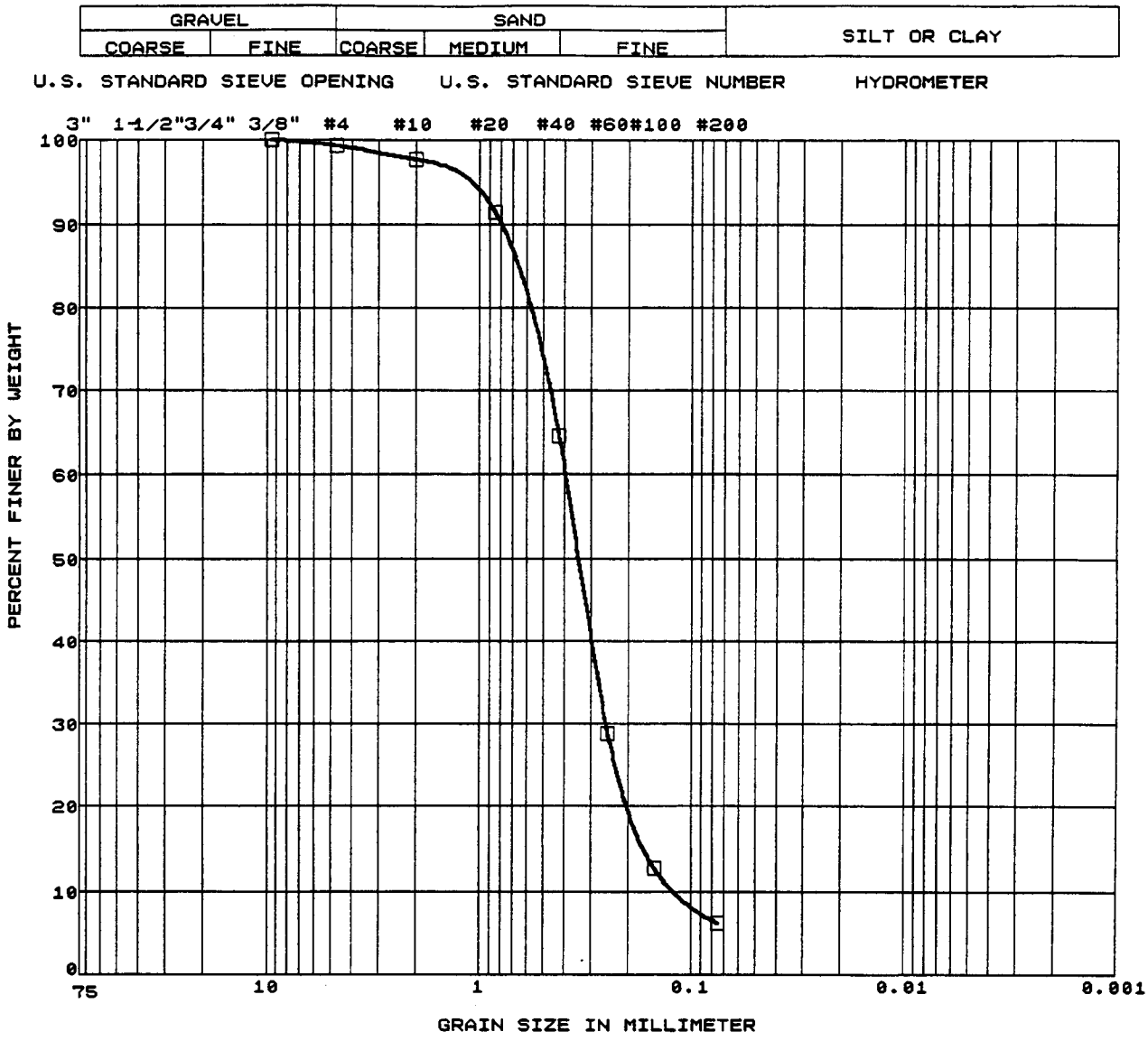
Figure B-56



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-22	D-17	75.0	Drive	SP-SM		

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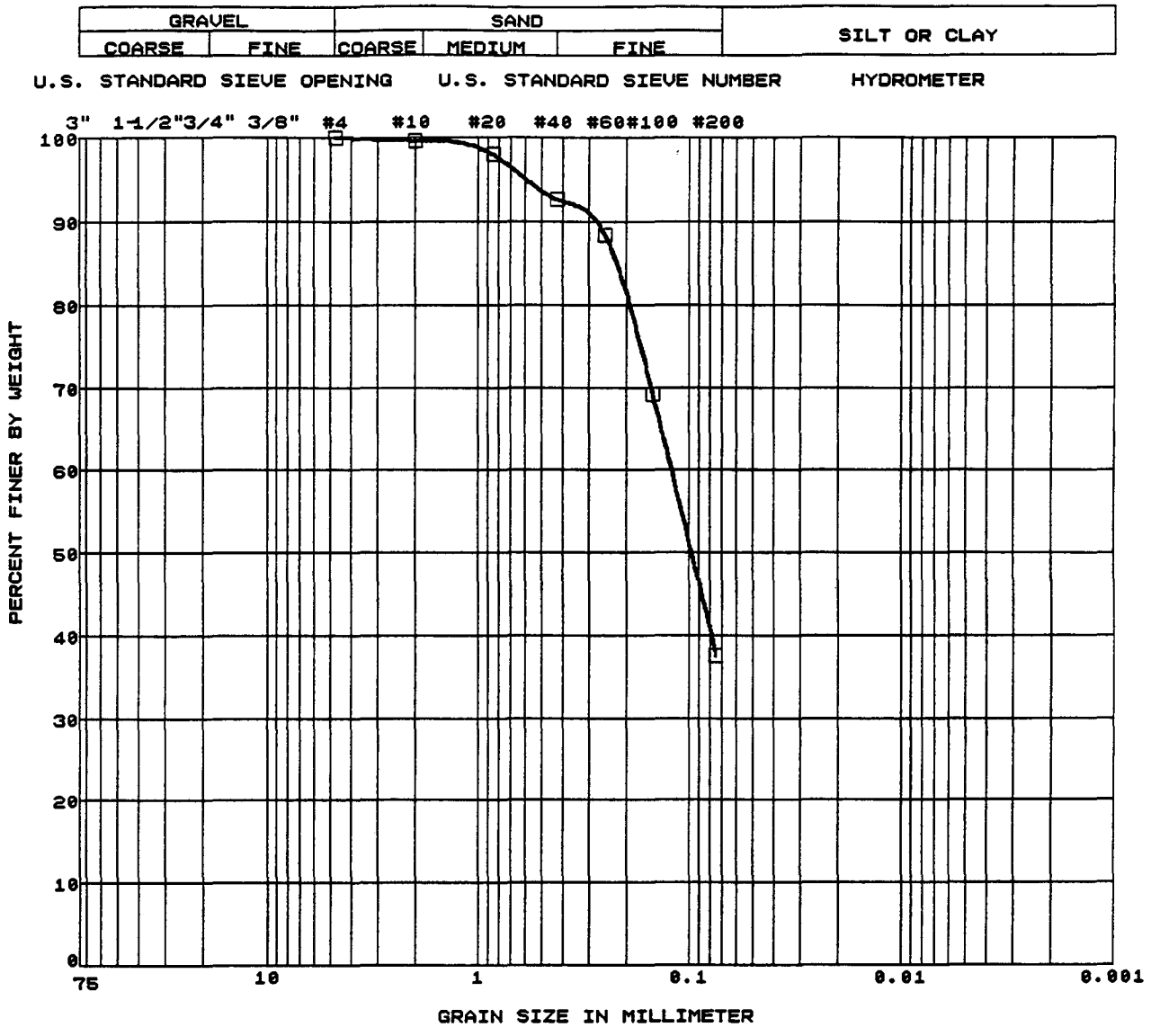
Figure B-57



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-23	S-1	5.0	Bag	SM		

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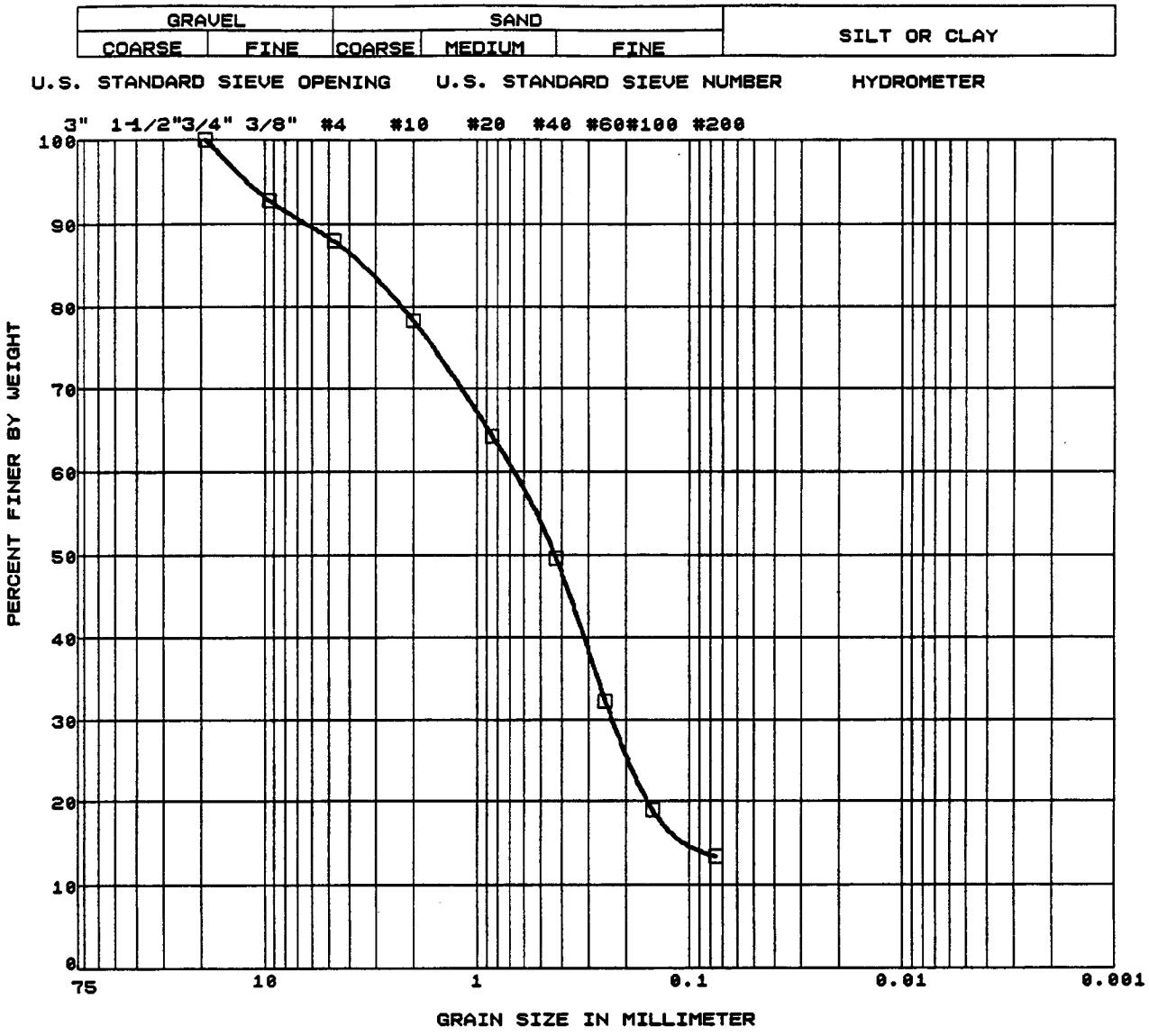
Figure B-58



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-23	S-3	15.0	Bag	SM		

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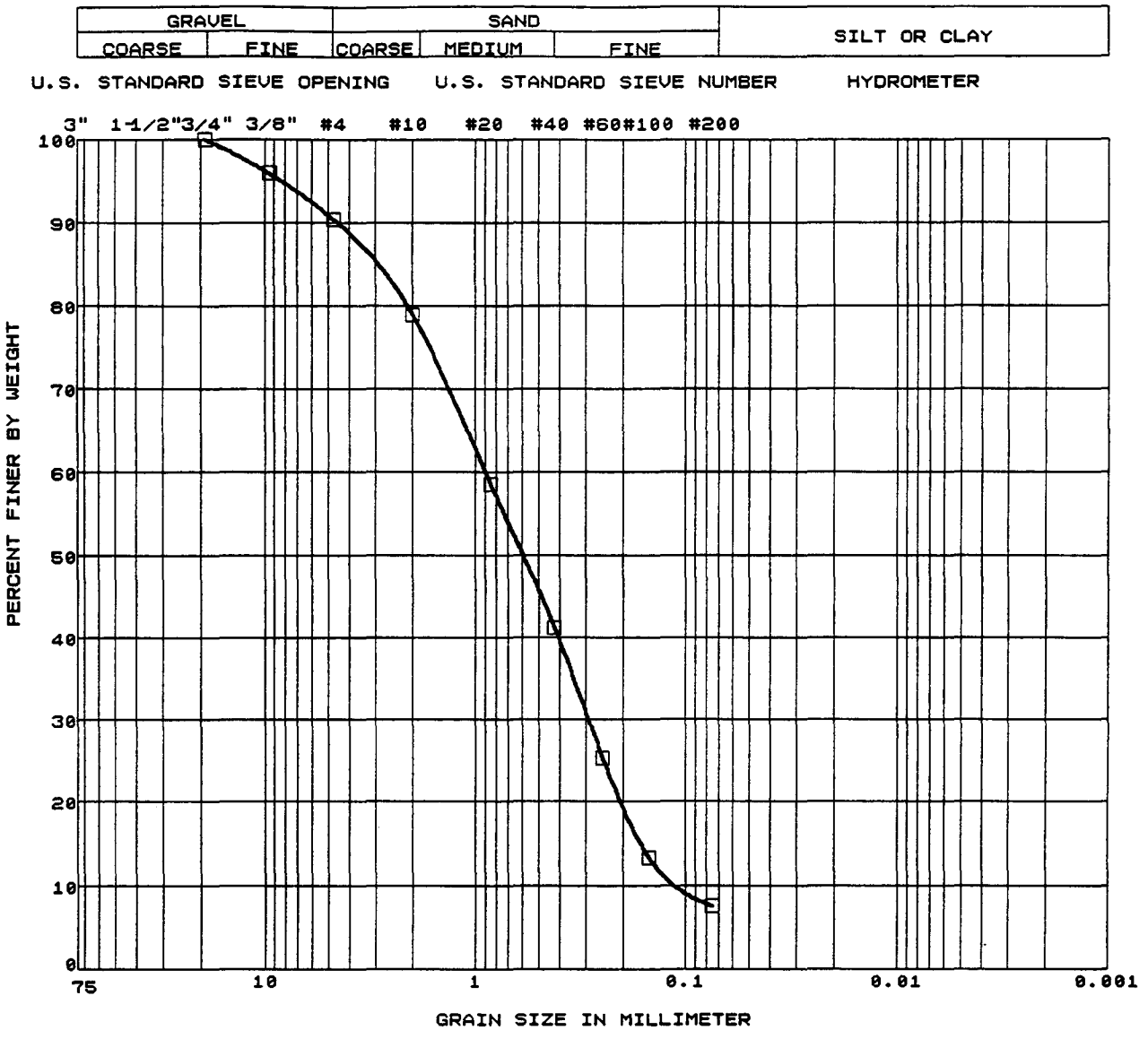
Figure B-59



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-23	S-5	25.0	Bag	SP-SM		

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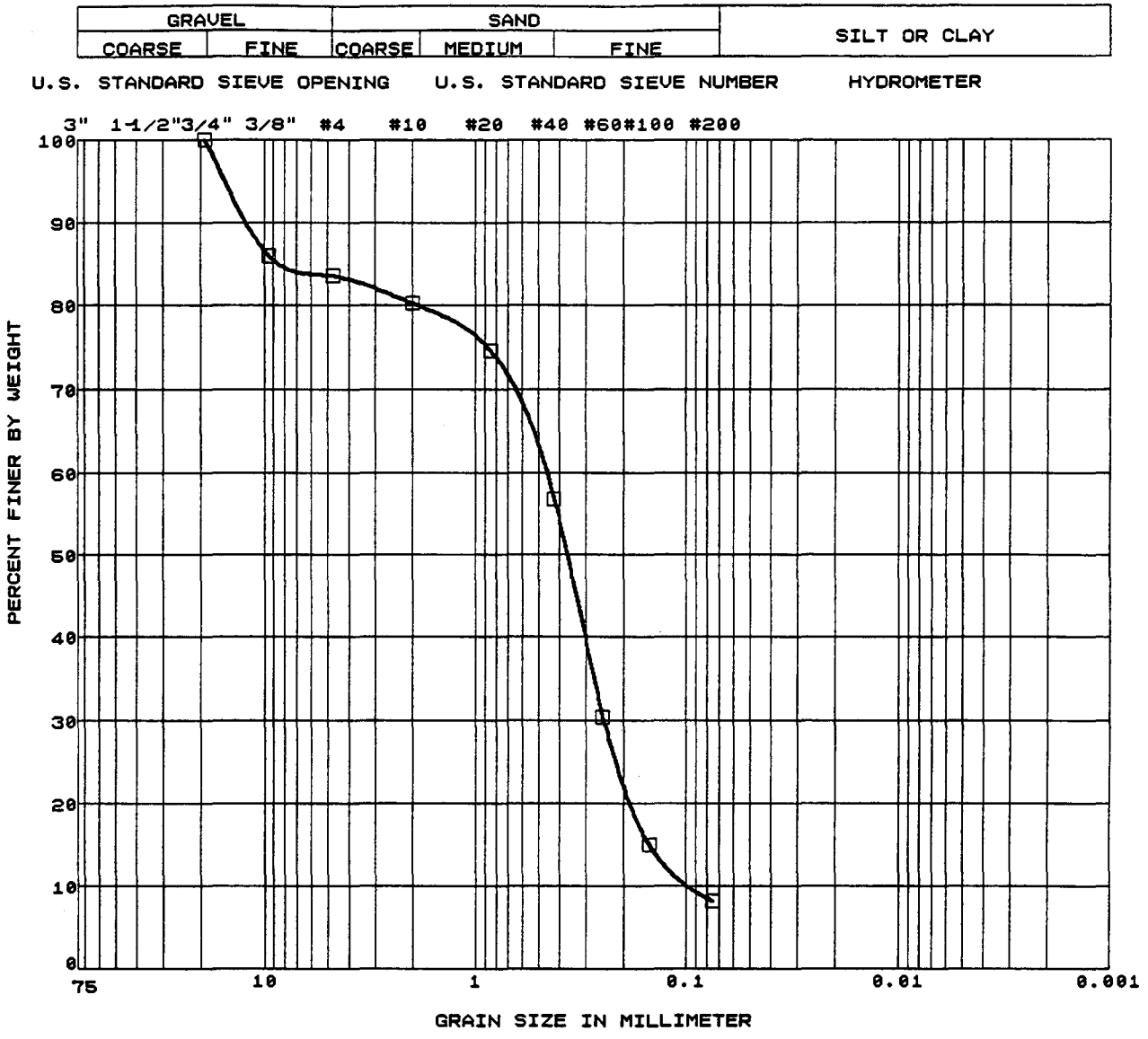
Figure B-60



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-23	S-7	35.0	Bag	SP-SM		

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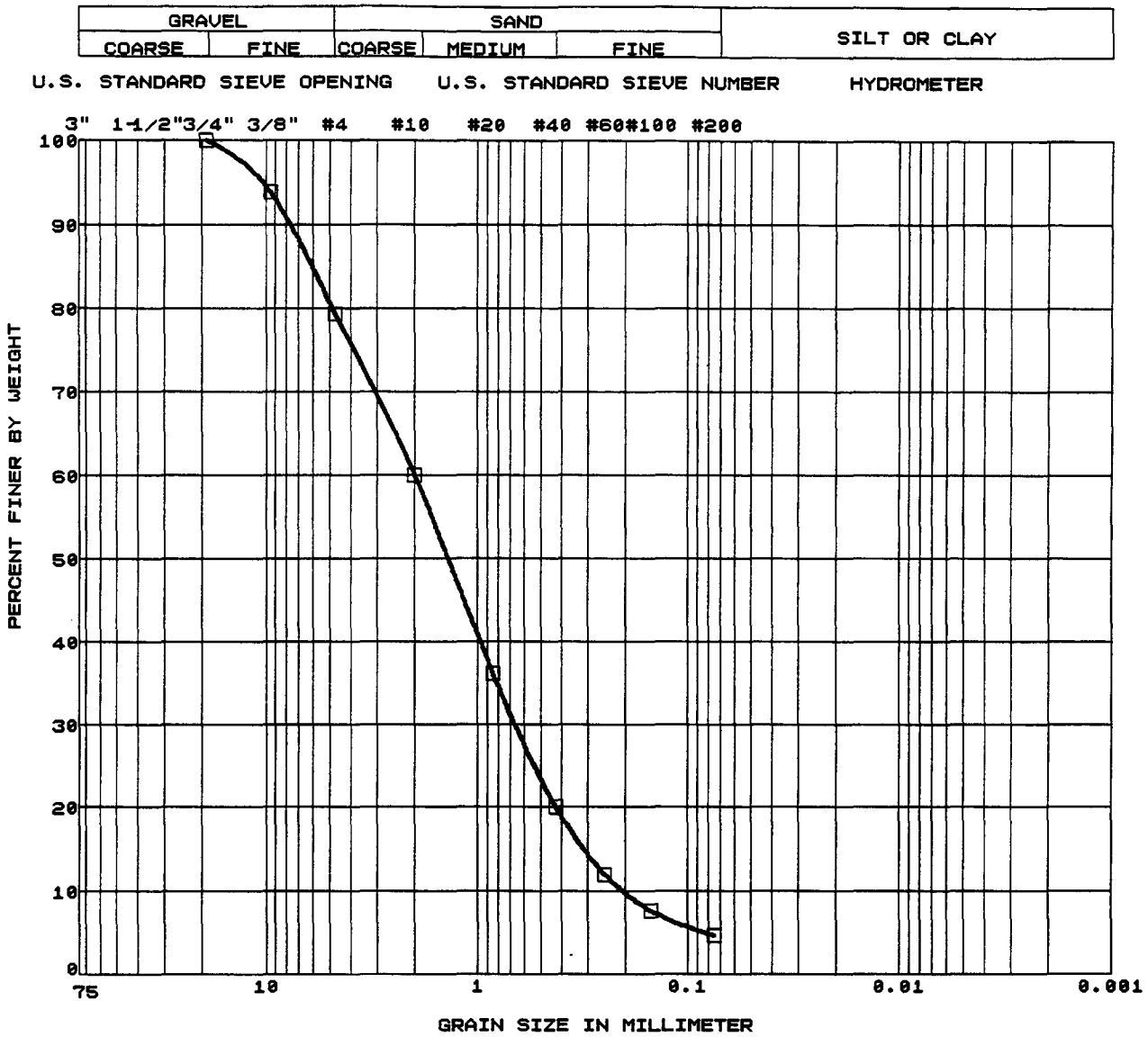
Figure B-61



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-23	D-8	40.0	Drive	SW-SM		

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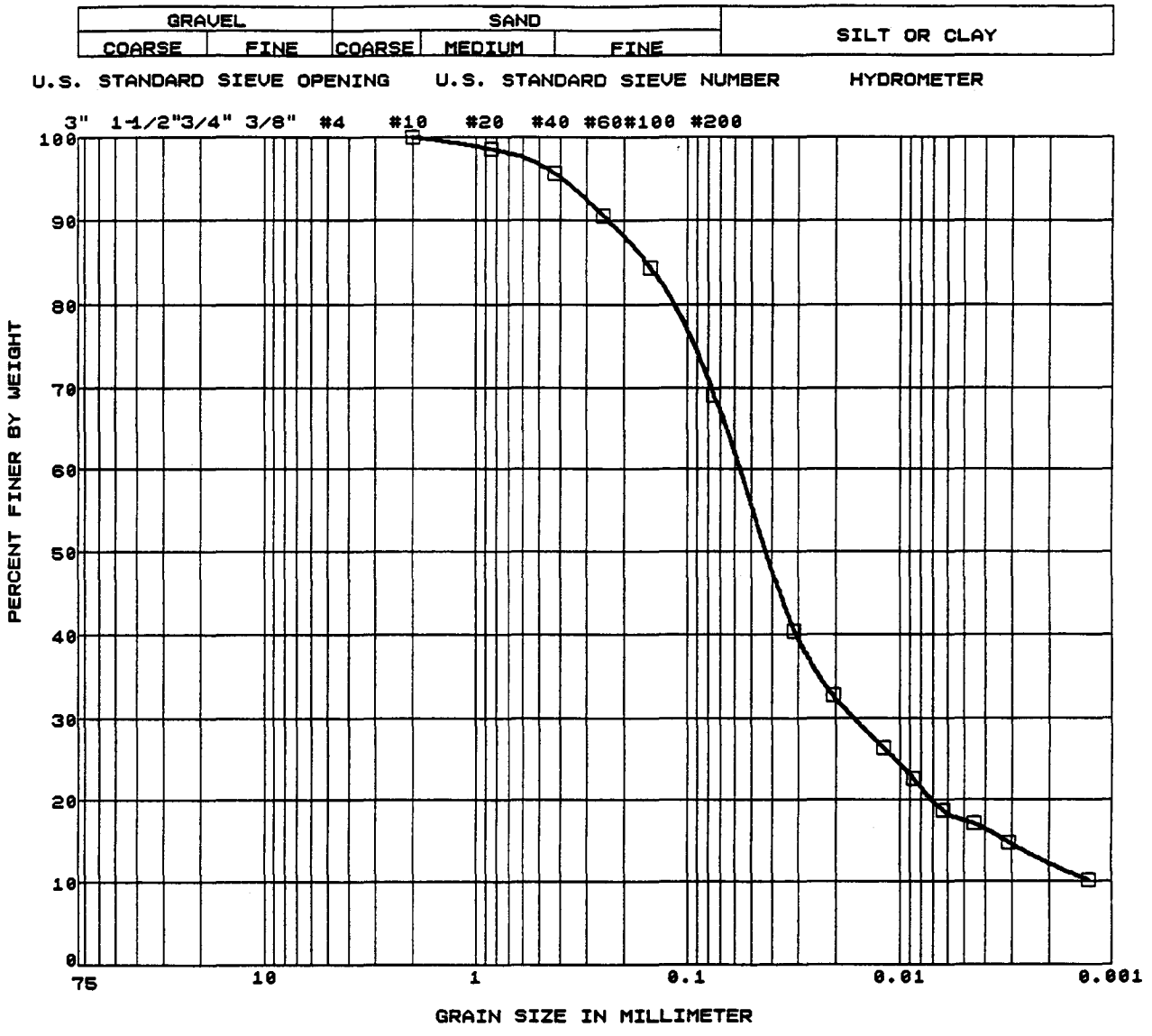
Figure B-62



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-23	S-11	55.0	Bag	ML	29	6

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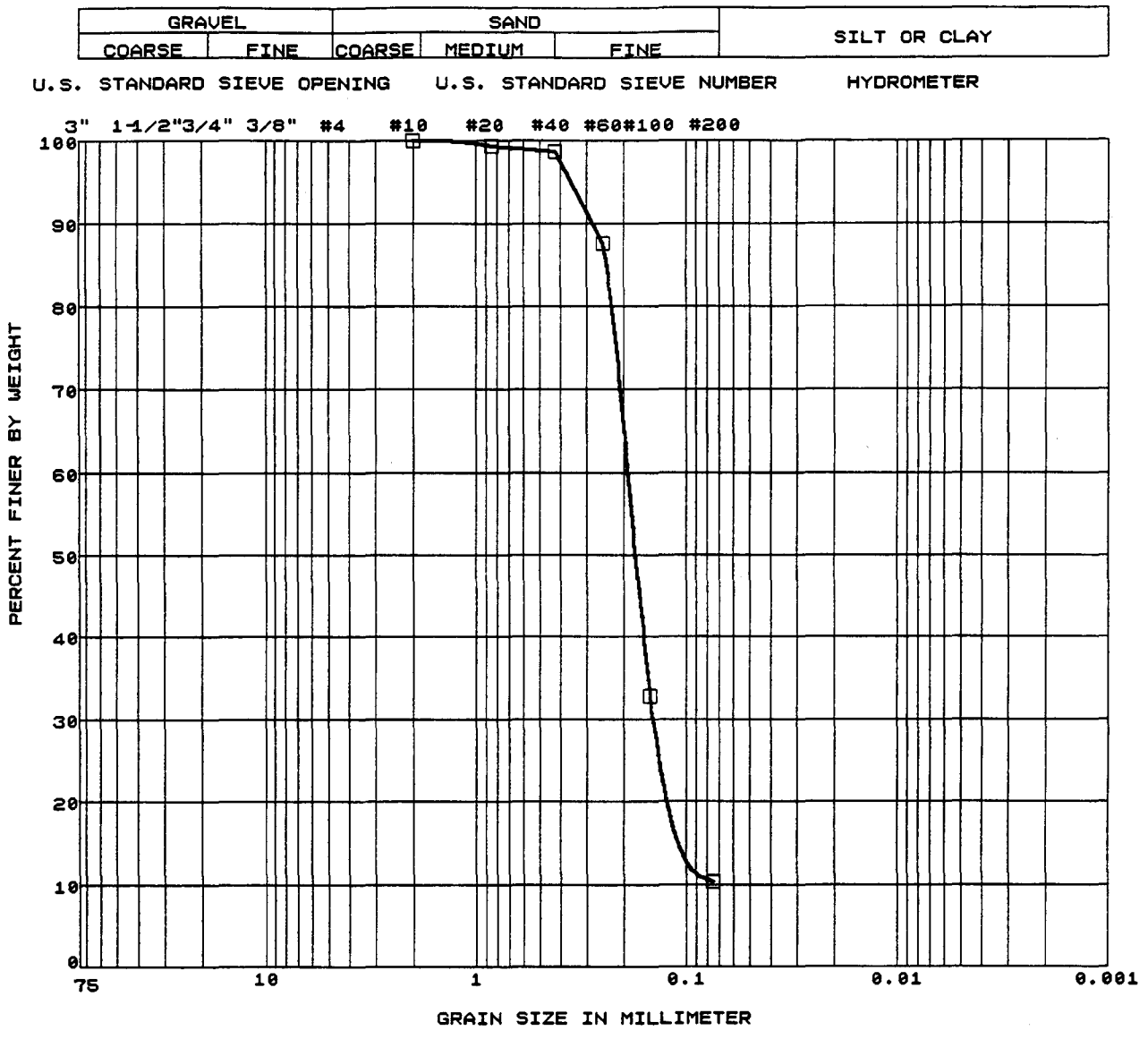
Figure B-63



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-23	D-12	60.0	Drive	SP-SM		

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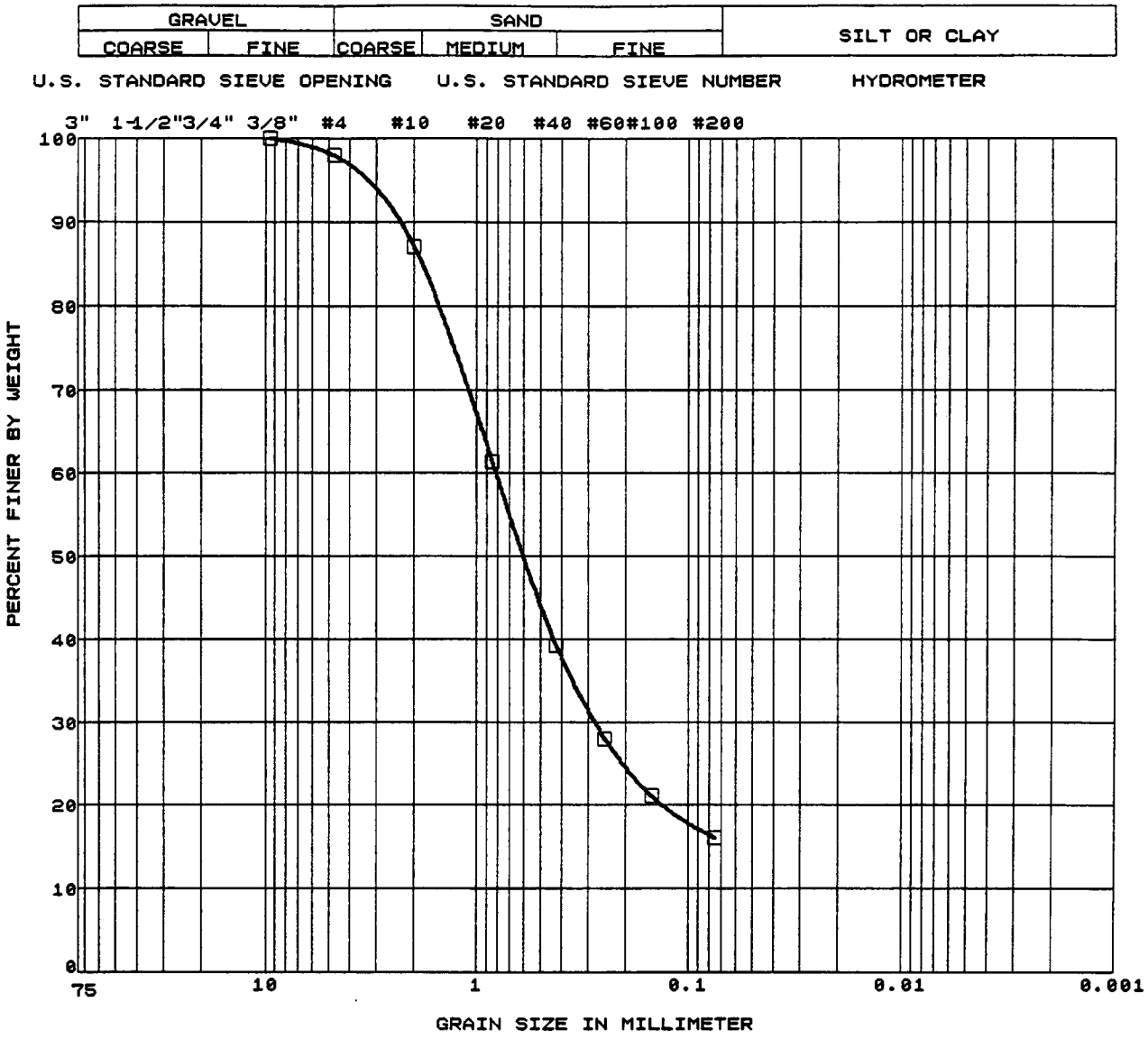
Figure B-64



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-23	S-13	65.0	Bag	SM		

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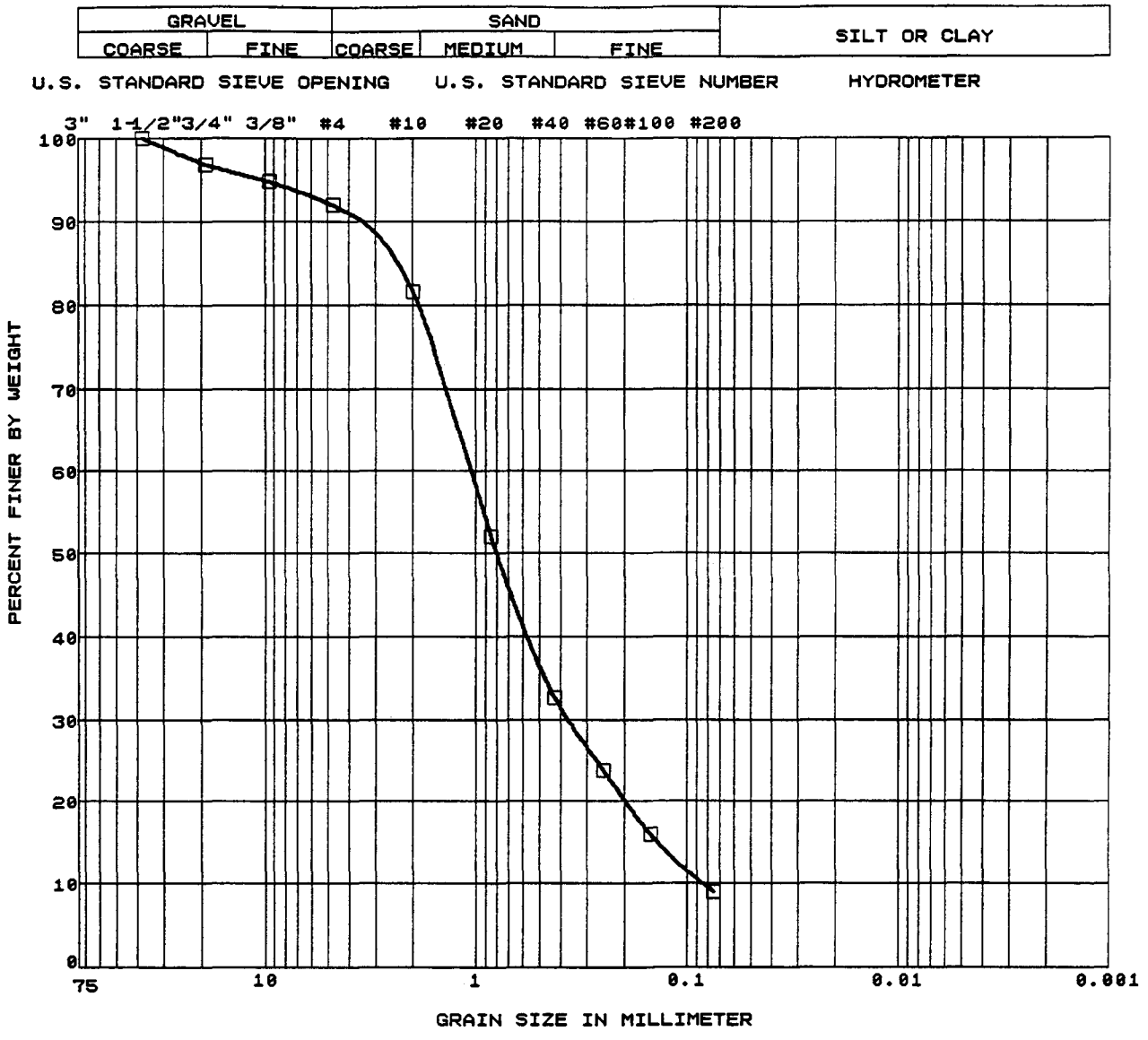
Figure B-65



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-24	S-4	20.0	Bag	SP-SM		

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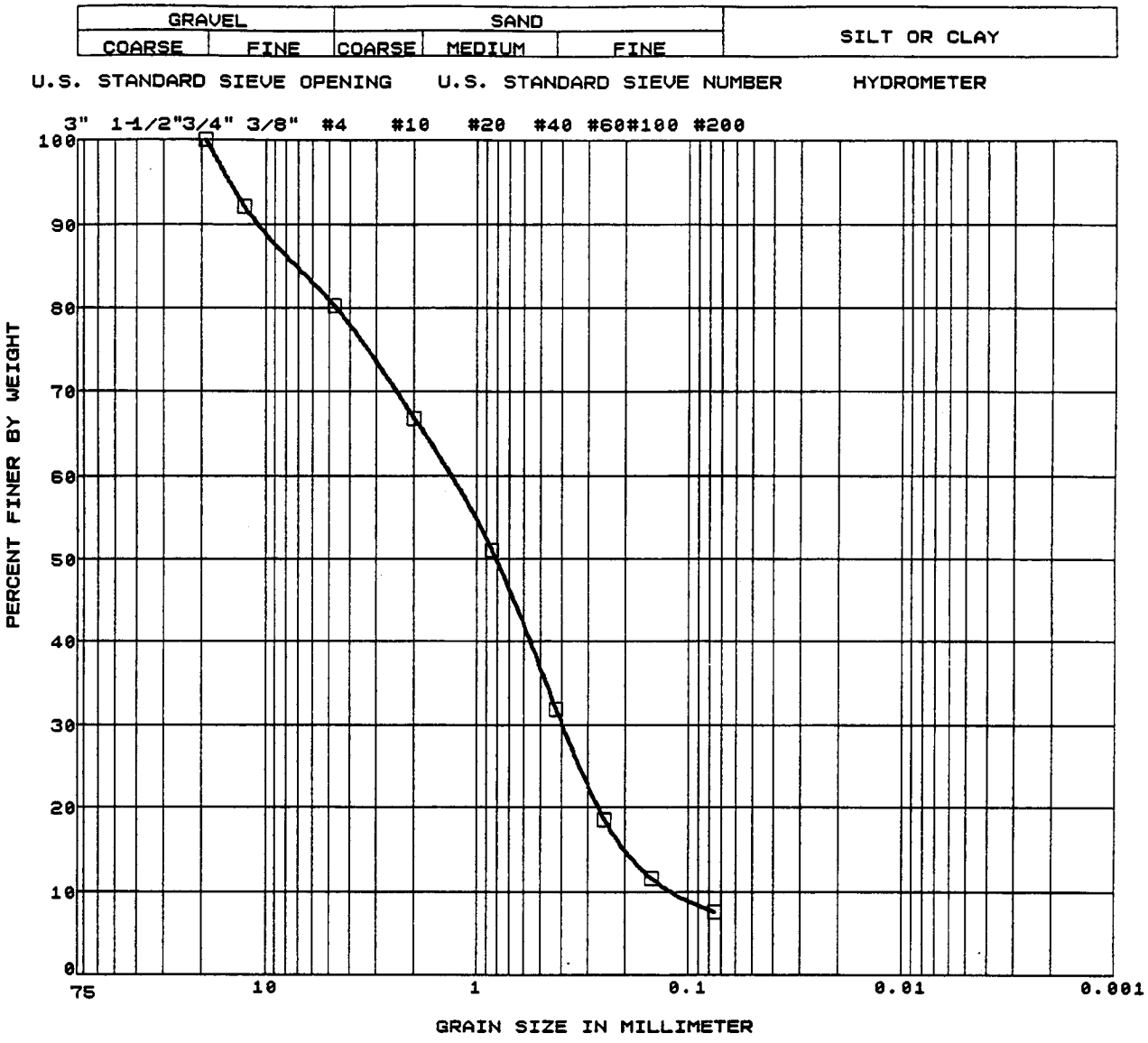
Figure B-66



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-24	S-6	30.0	Bag	SP-SM		

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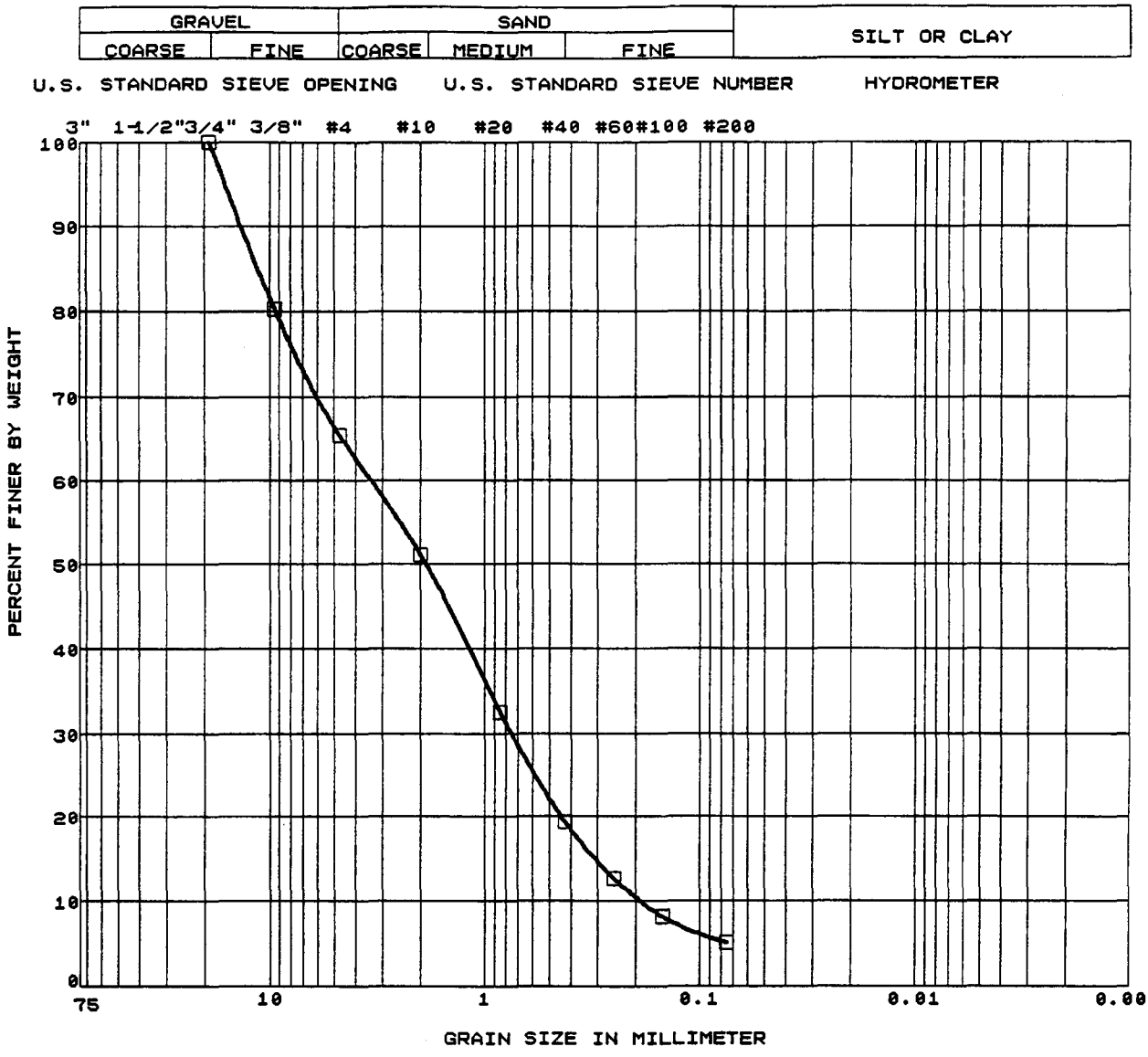
Figure B-67



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-24	S-8	40.0	Bag	SP-SM		

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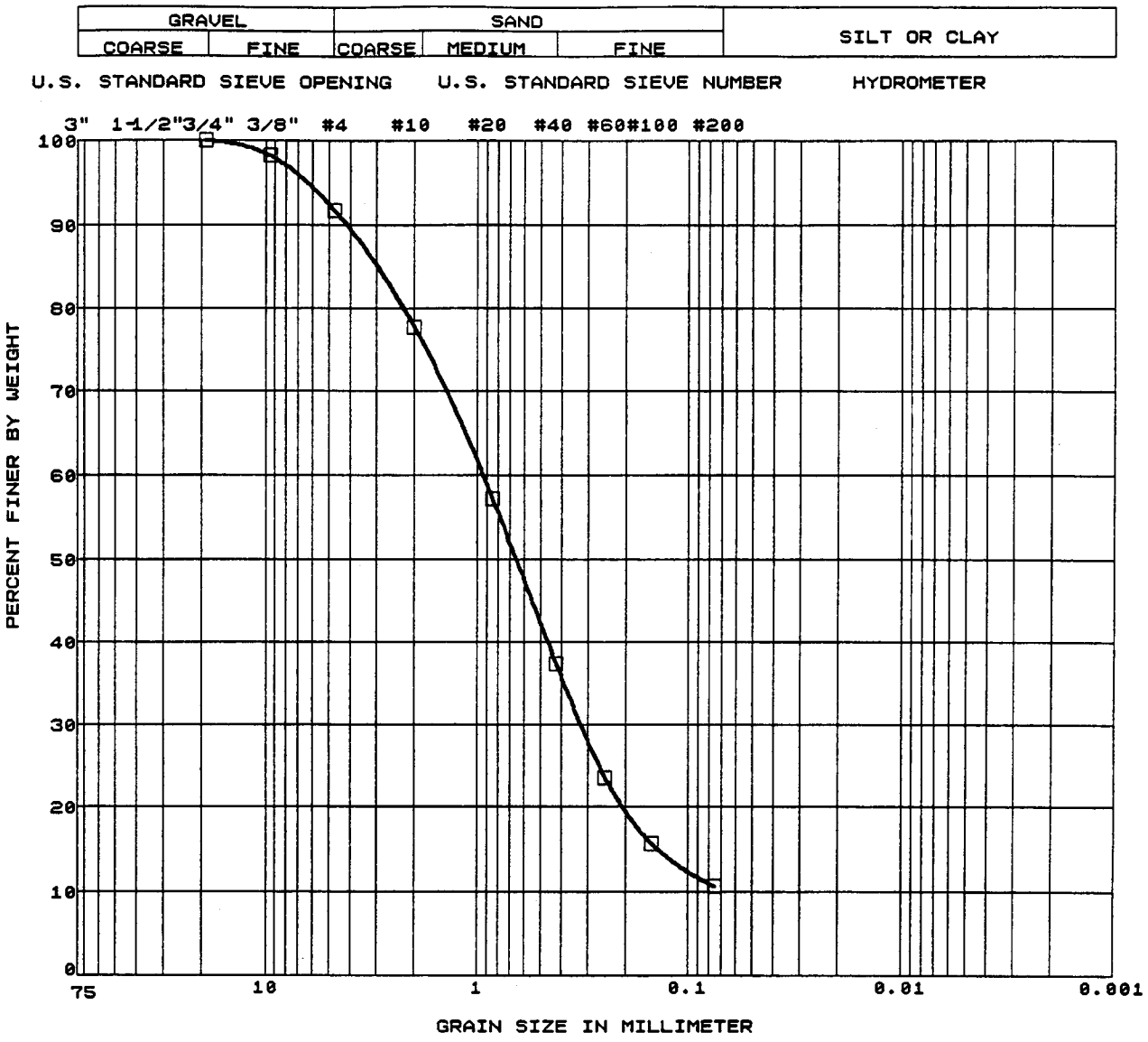
Figure B-68



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-24	S-10	50.0	Bag	SP-SM		

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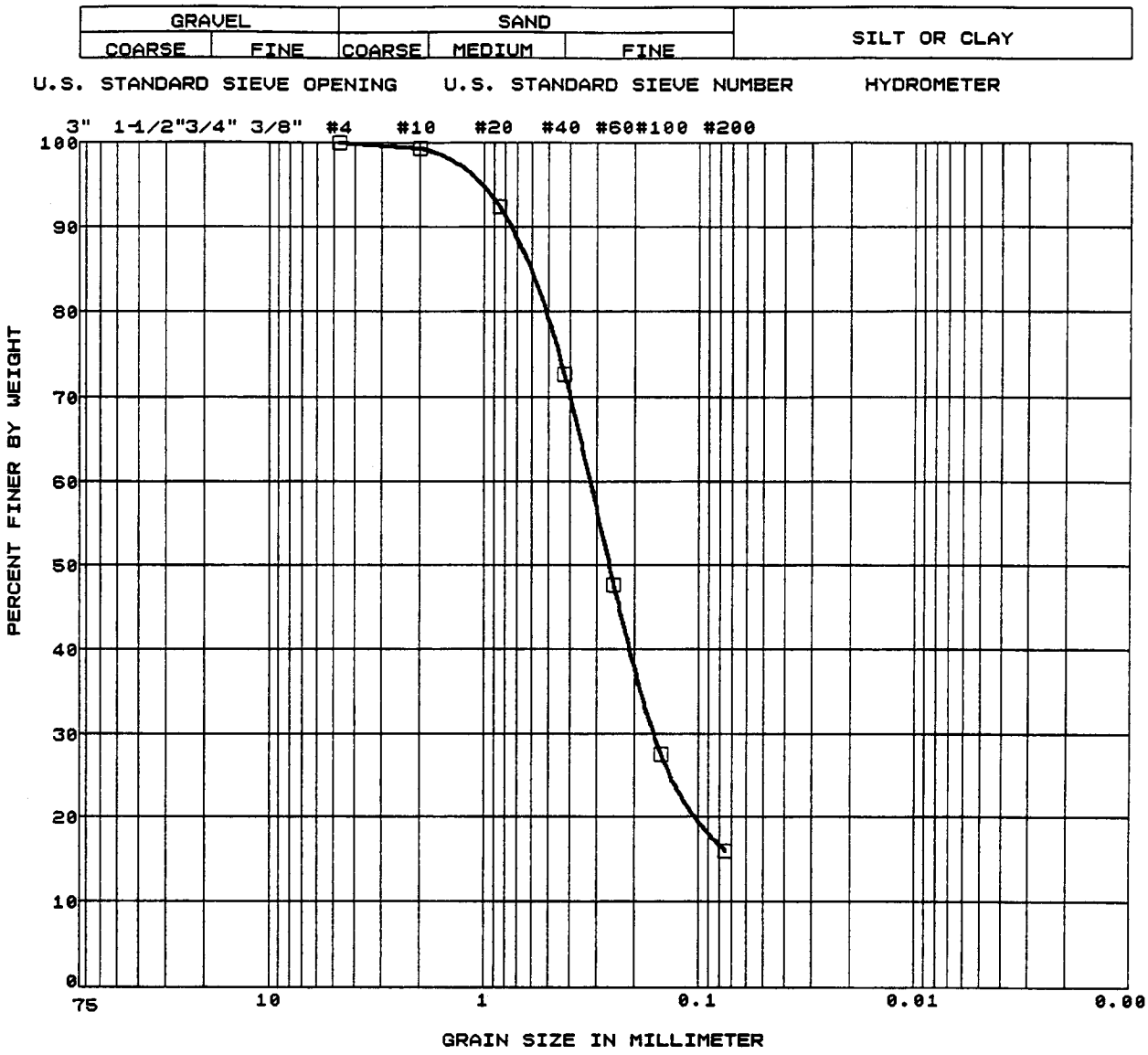
Figure B-69



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-24	S-12	60.0	Bag	SM		

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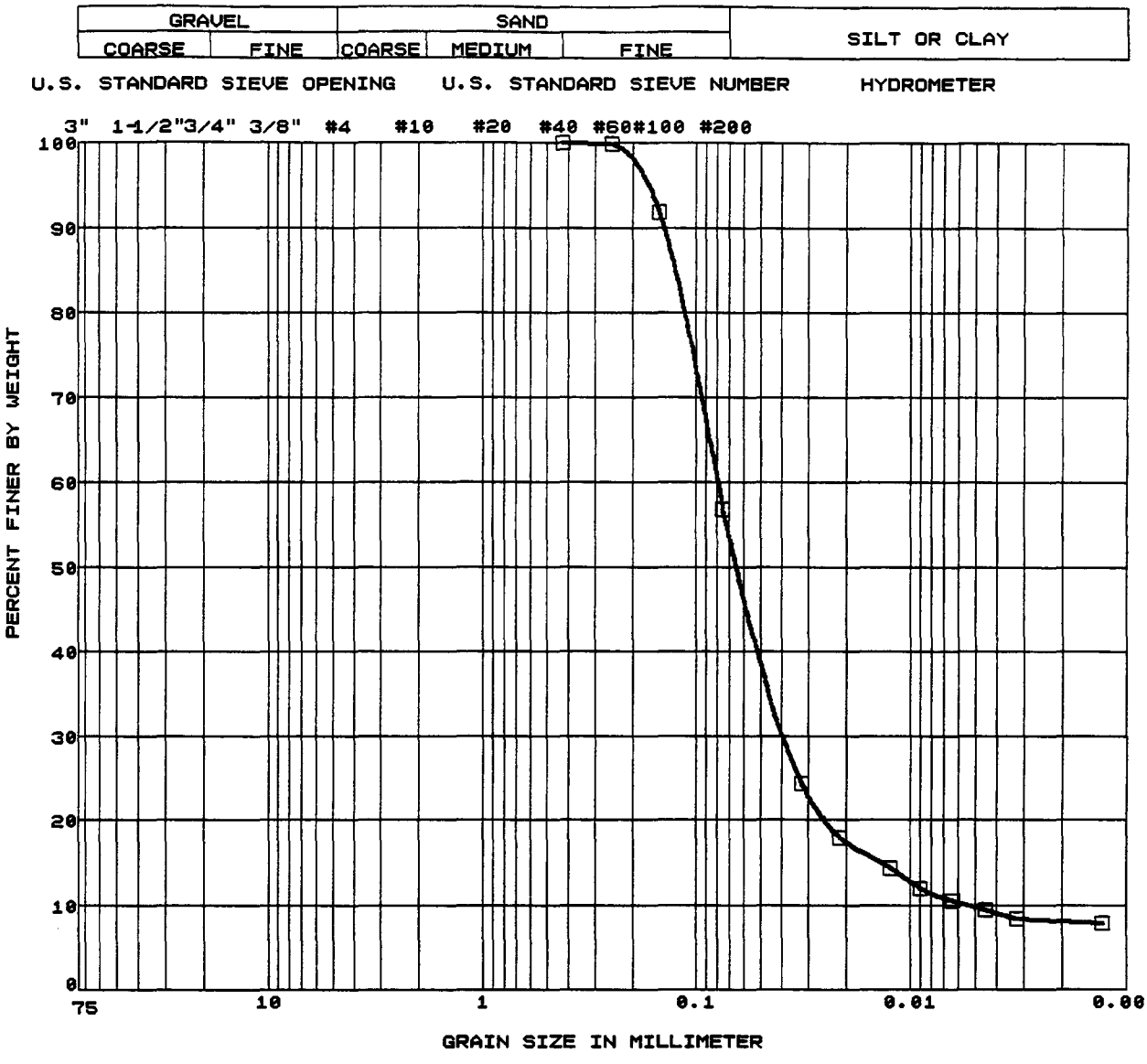
Figure B-70



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-24	D-15	75.0	Drive	SM	NP	NP

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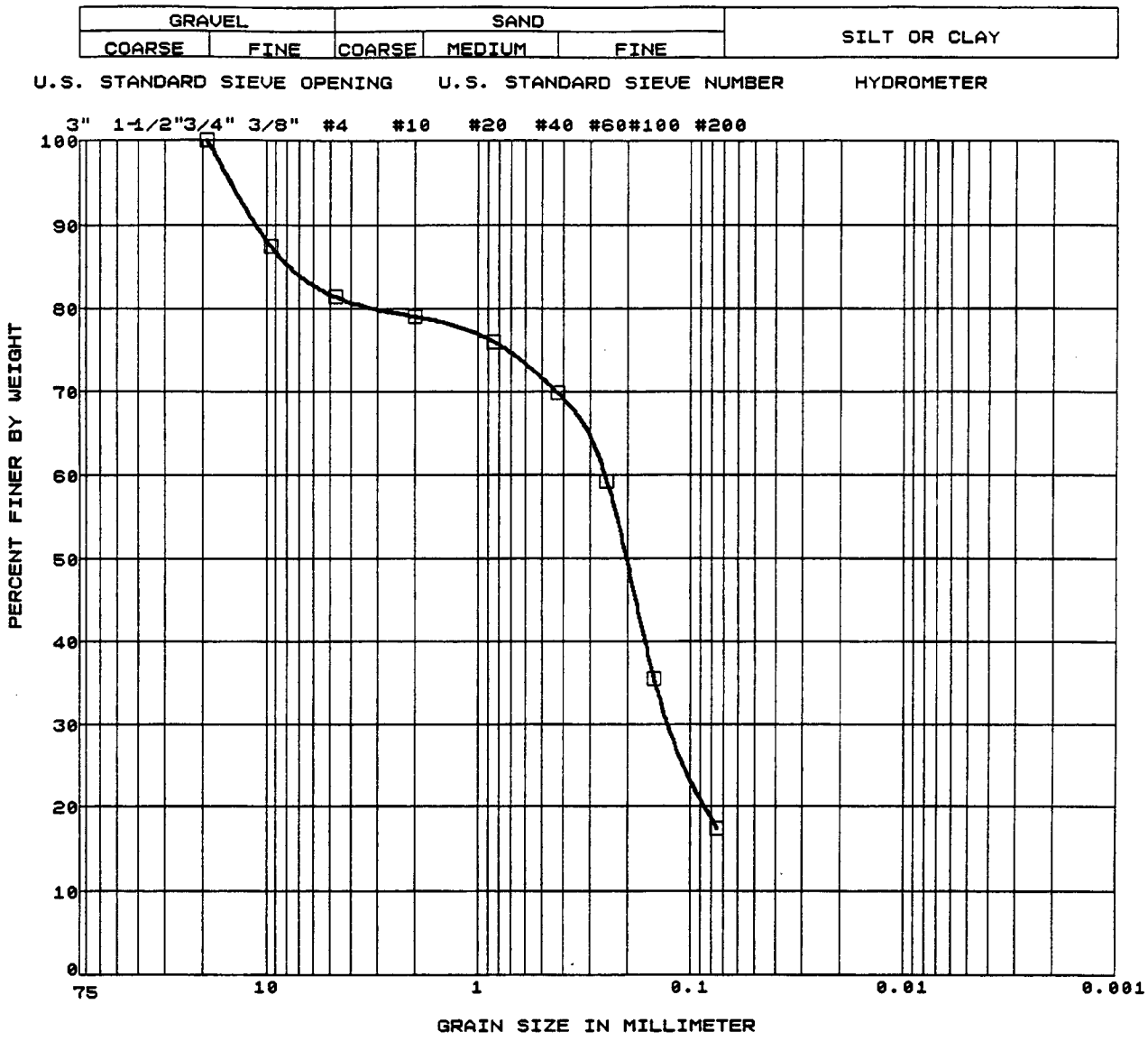
Figure B-71



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-24	S-16	80.0	Bag	SM		

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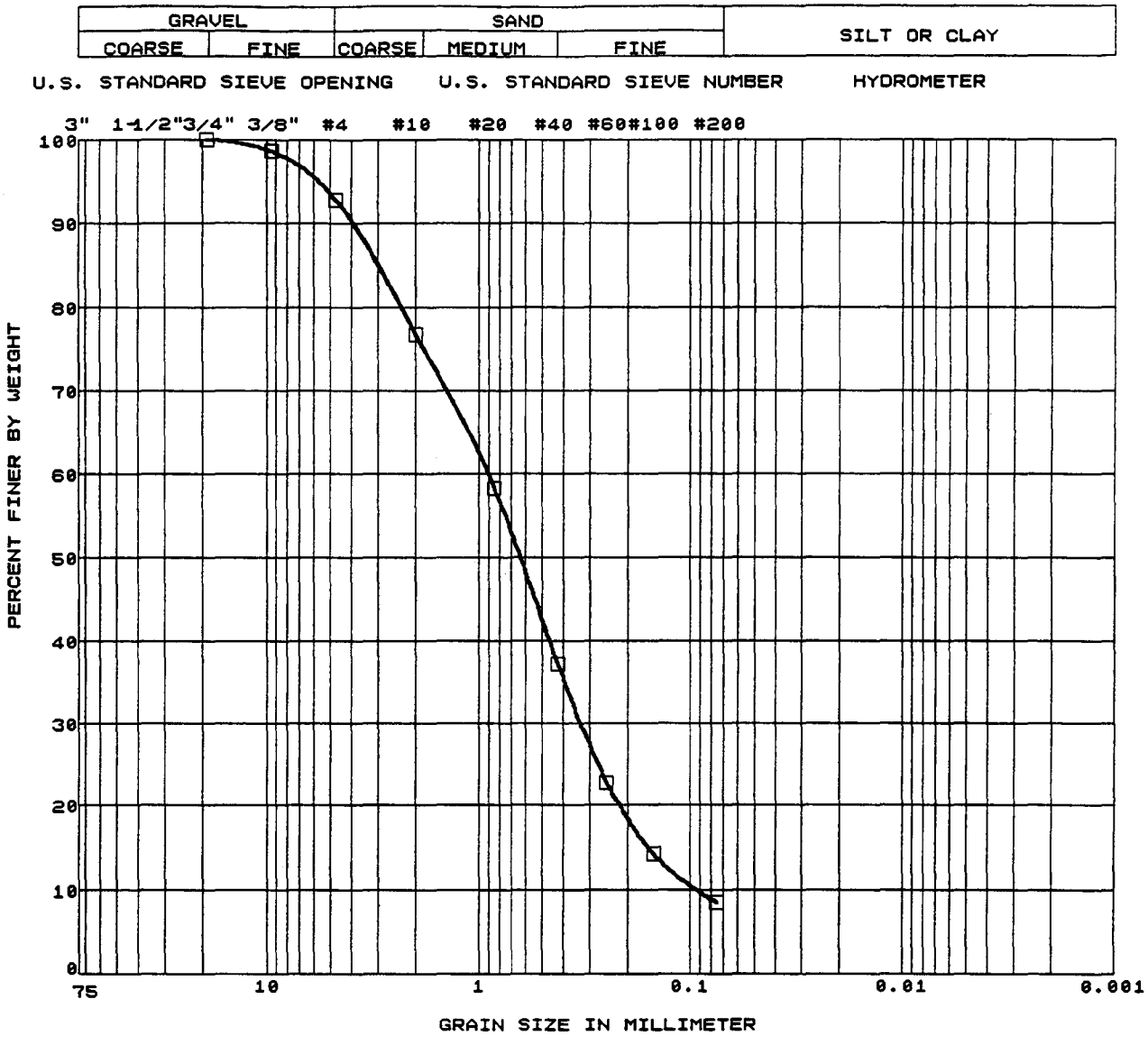
Figure B-72



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-25	S-4	20.0	Bag	SP-SM		

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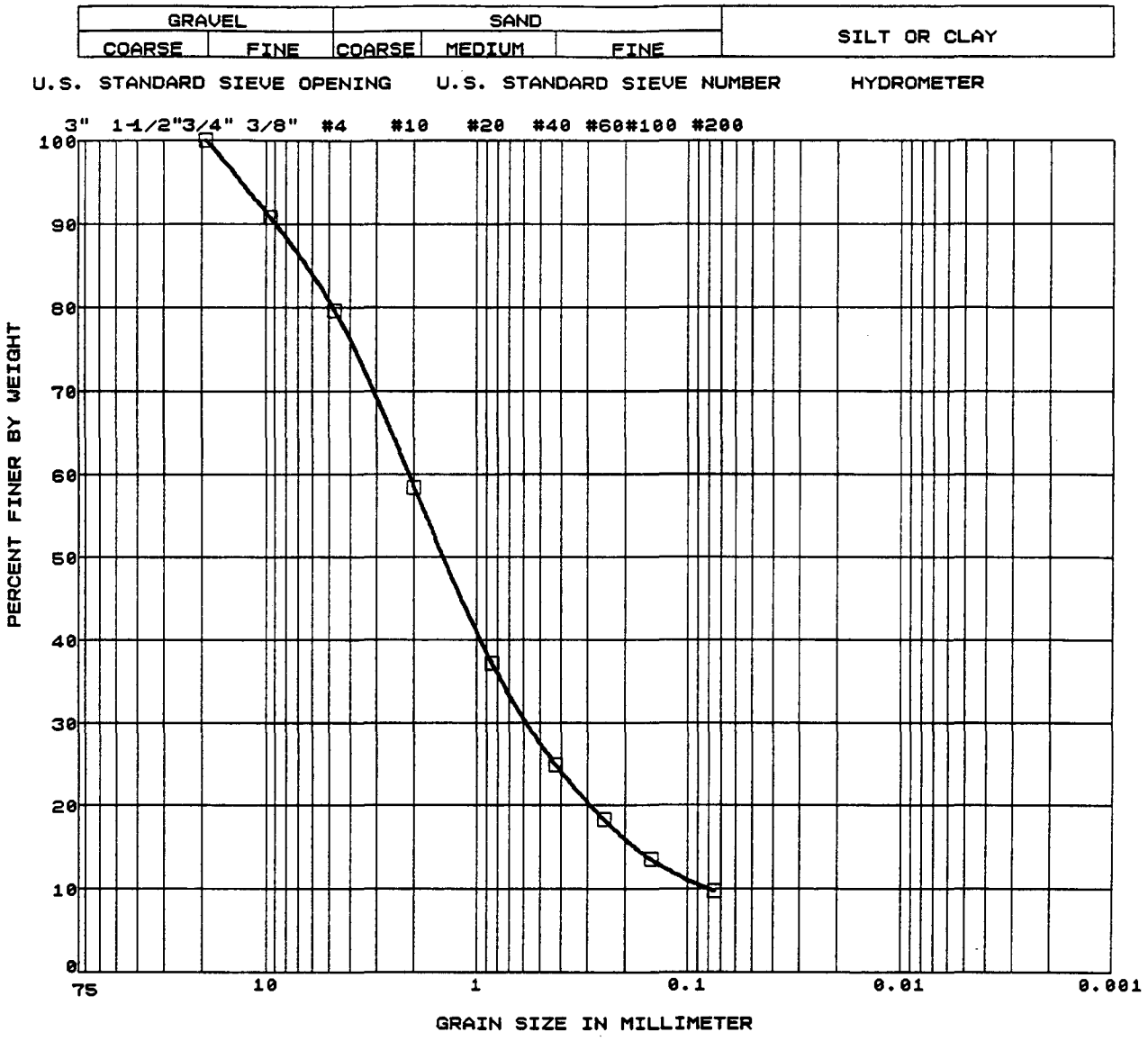
Figure B-73



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-25	S-6	30.0	Bag	SP-SM		

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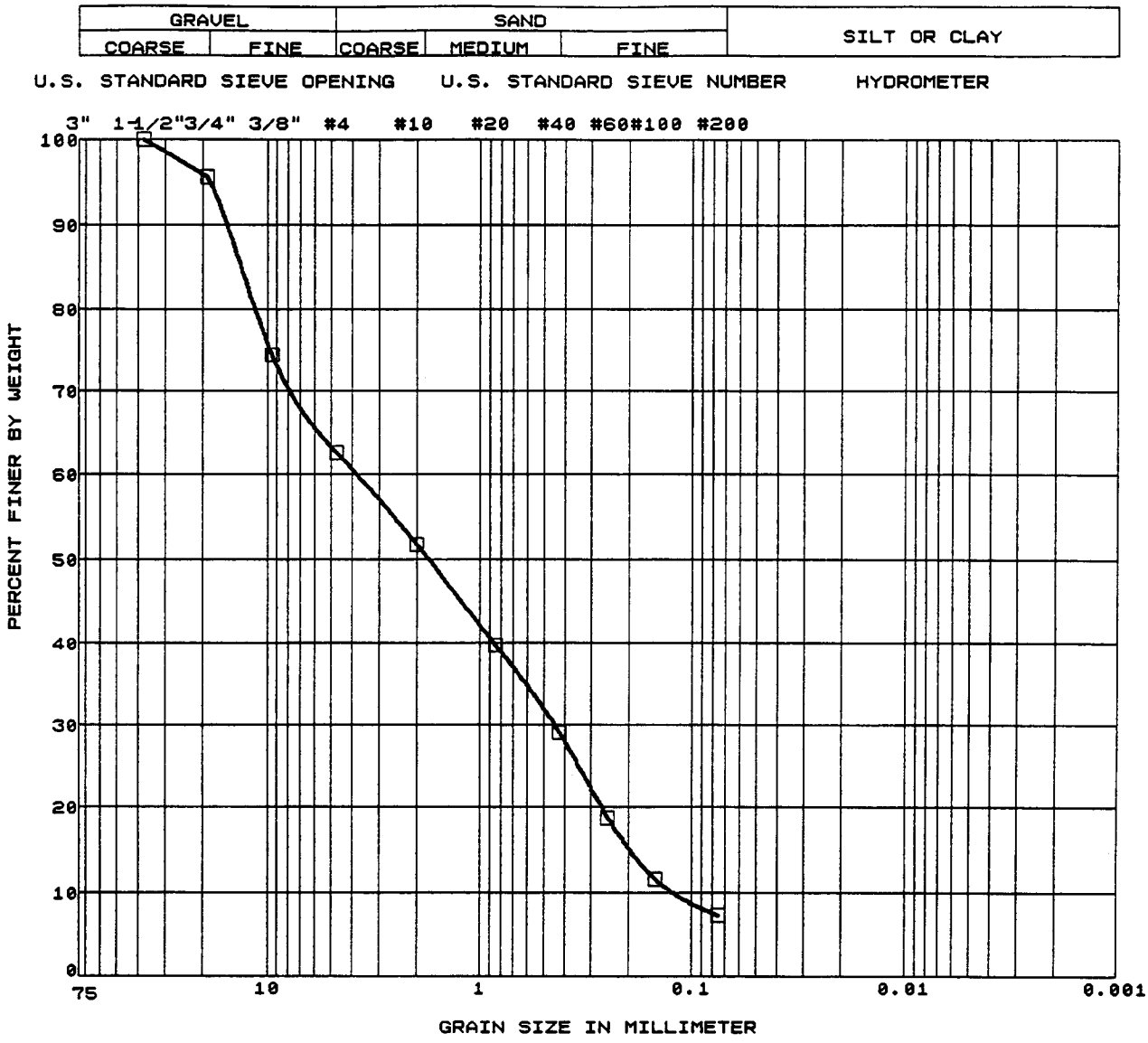
Figure B-74



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-25	S-8	41.0	Bag	SP-SM		

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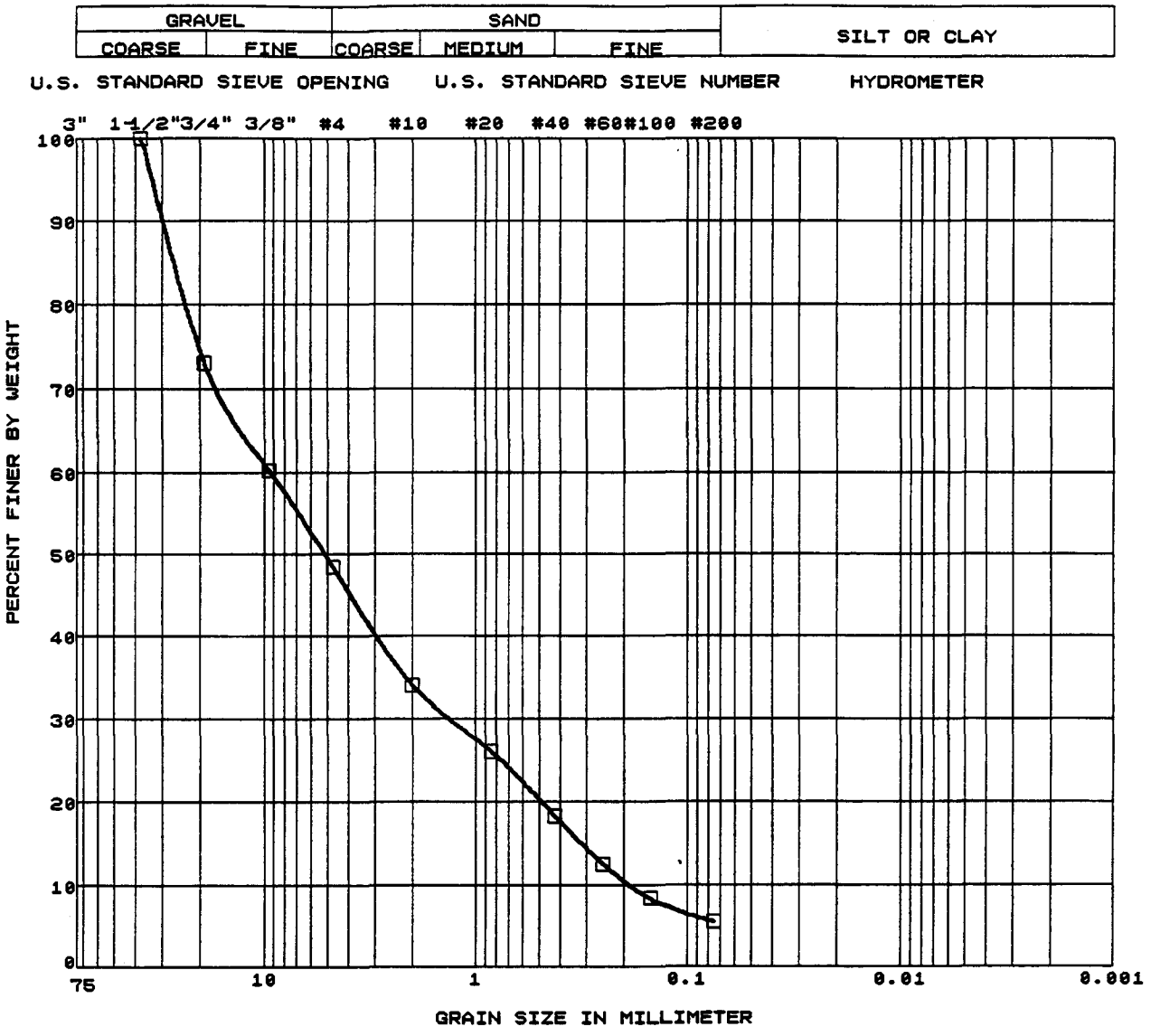
Figure B-75



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-25	S-10	50.0	Bag	GP-GM		

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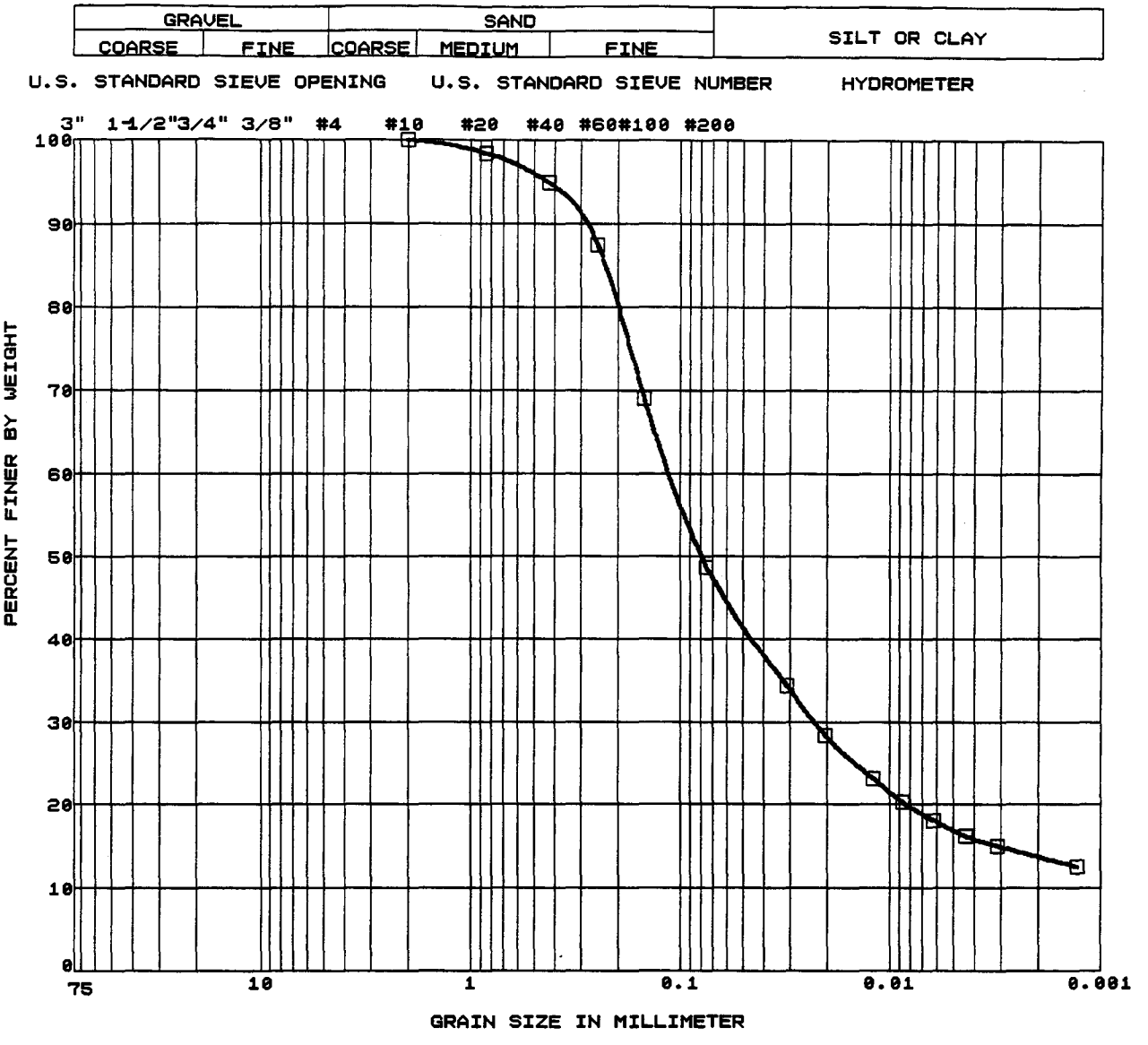
Figure B-76



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-25	D-13	65.0	Drive	SM	NP	NP

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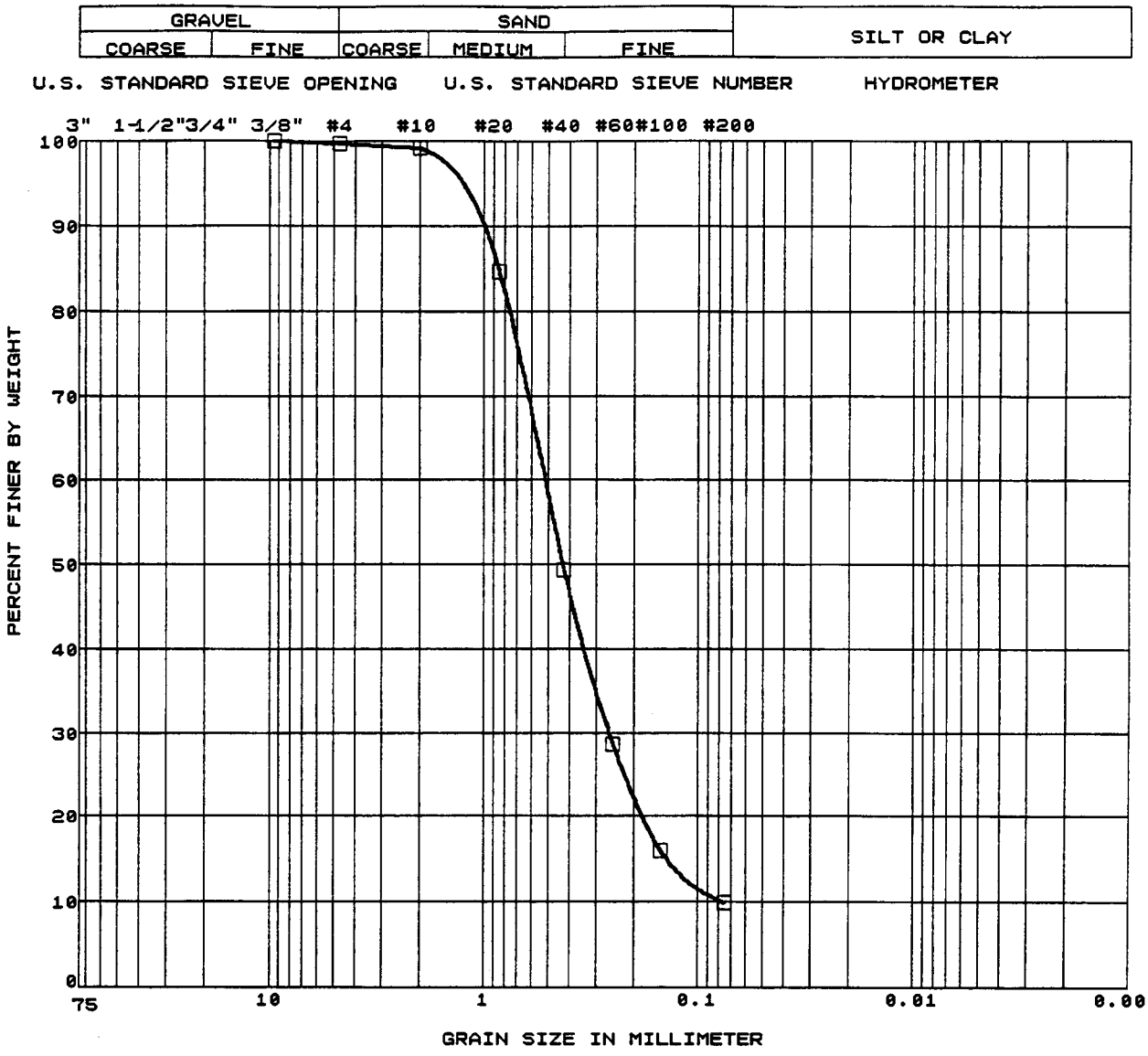
Figure B-77



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-25	S-14	70.0	Bag	SP-SM		

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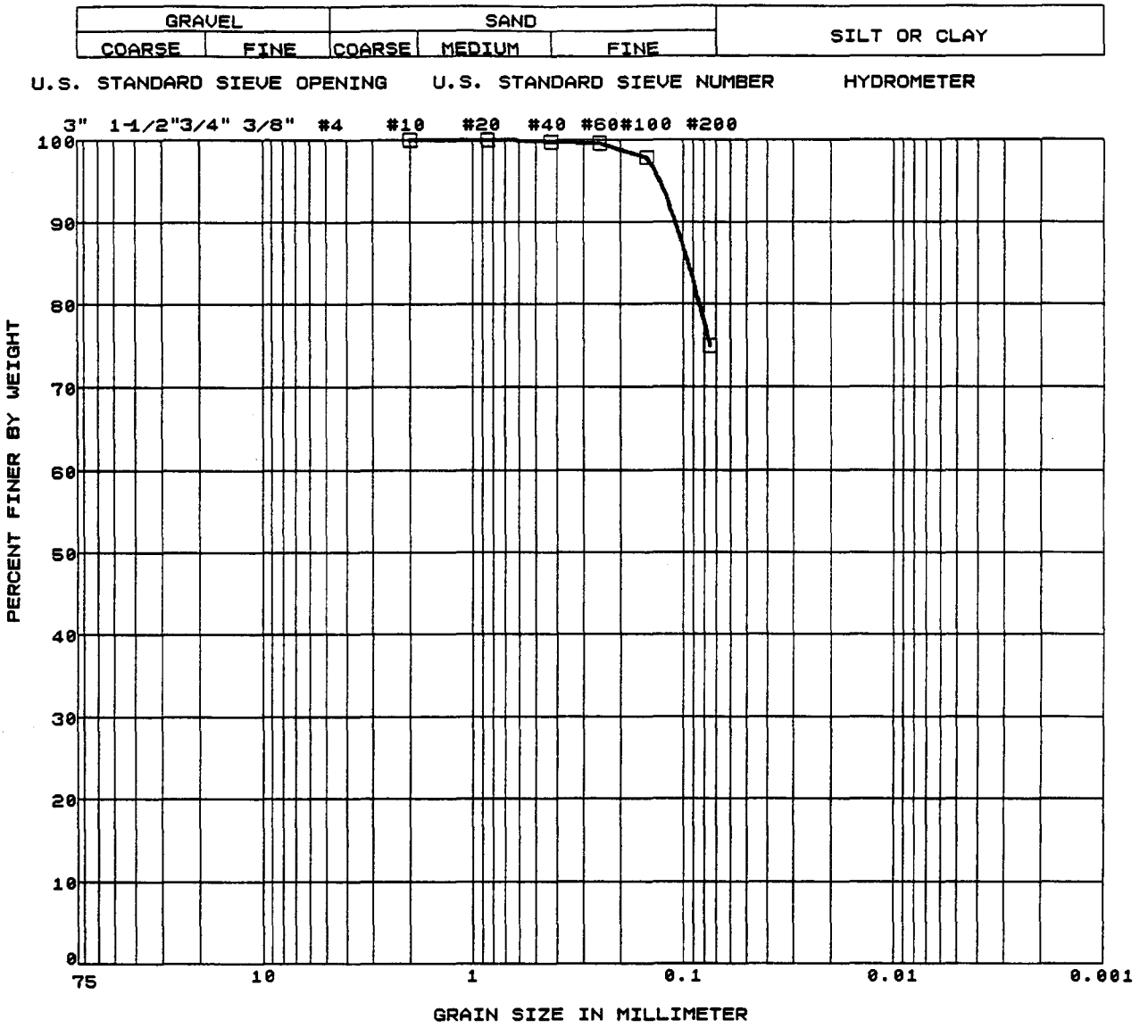
Figure B-78



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-25	S-16	80.0	Bag	ML		

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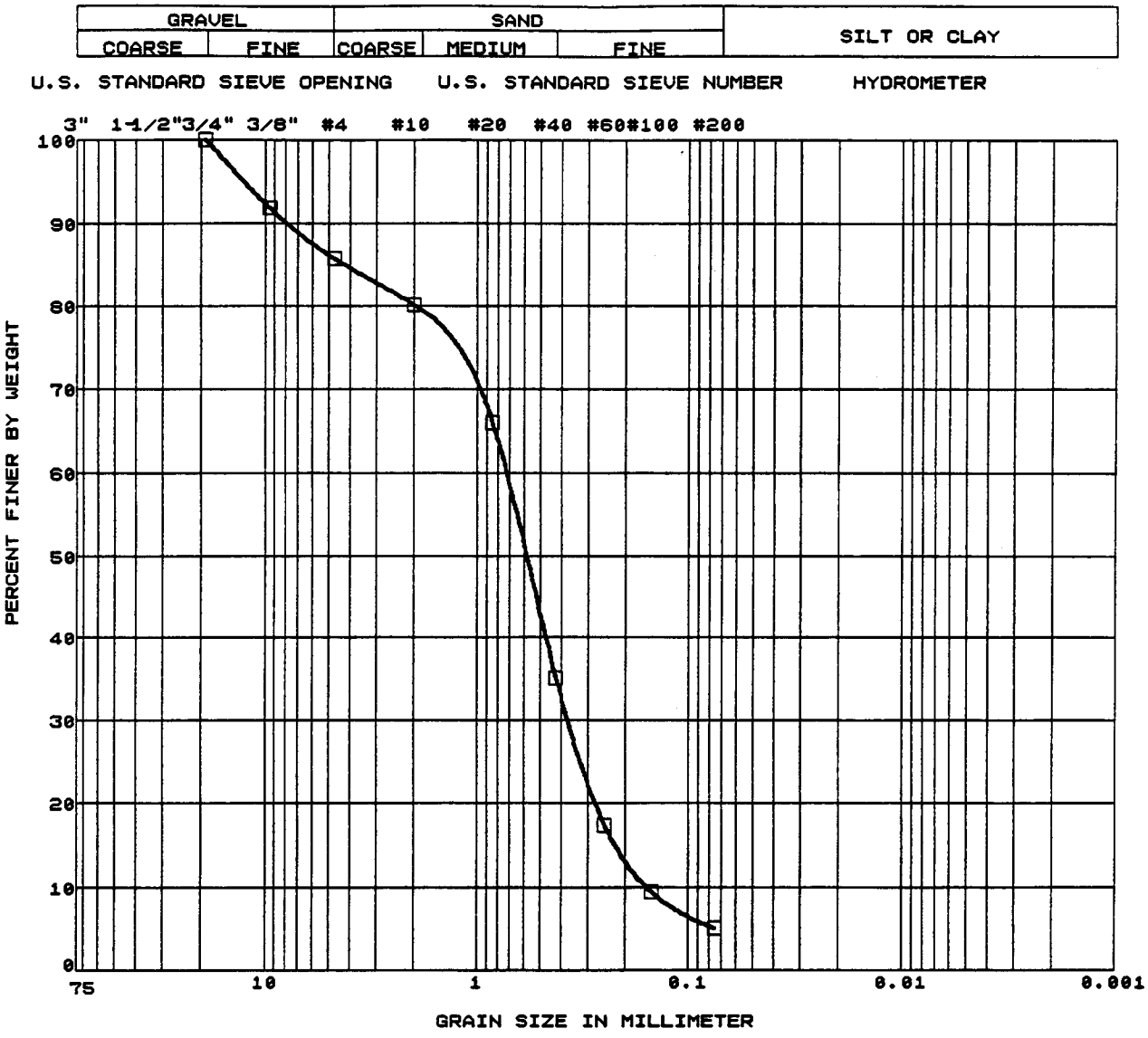
Figure B-79



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-26	D-4	20.0	Bag	SP-SM		

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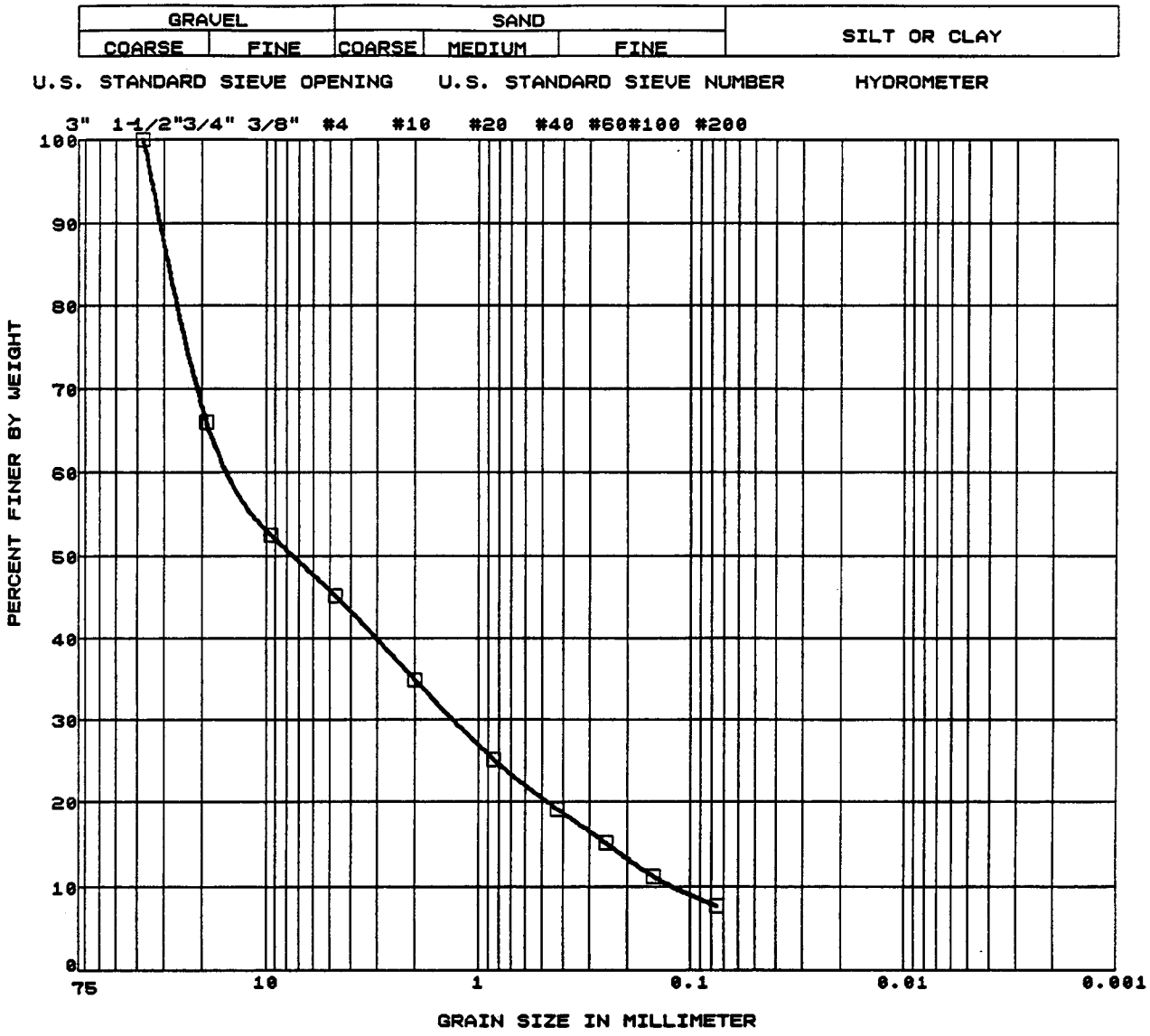
Figure B-80



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-26	S-5	25.0	Bag	GW-GM		

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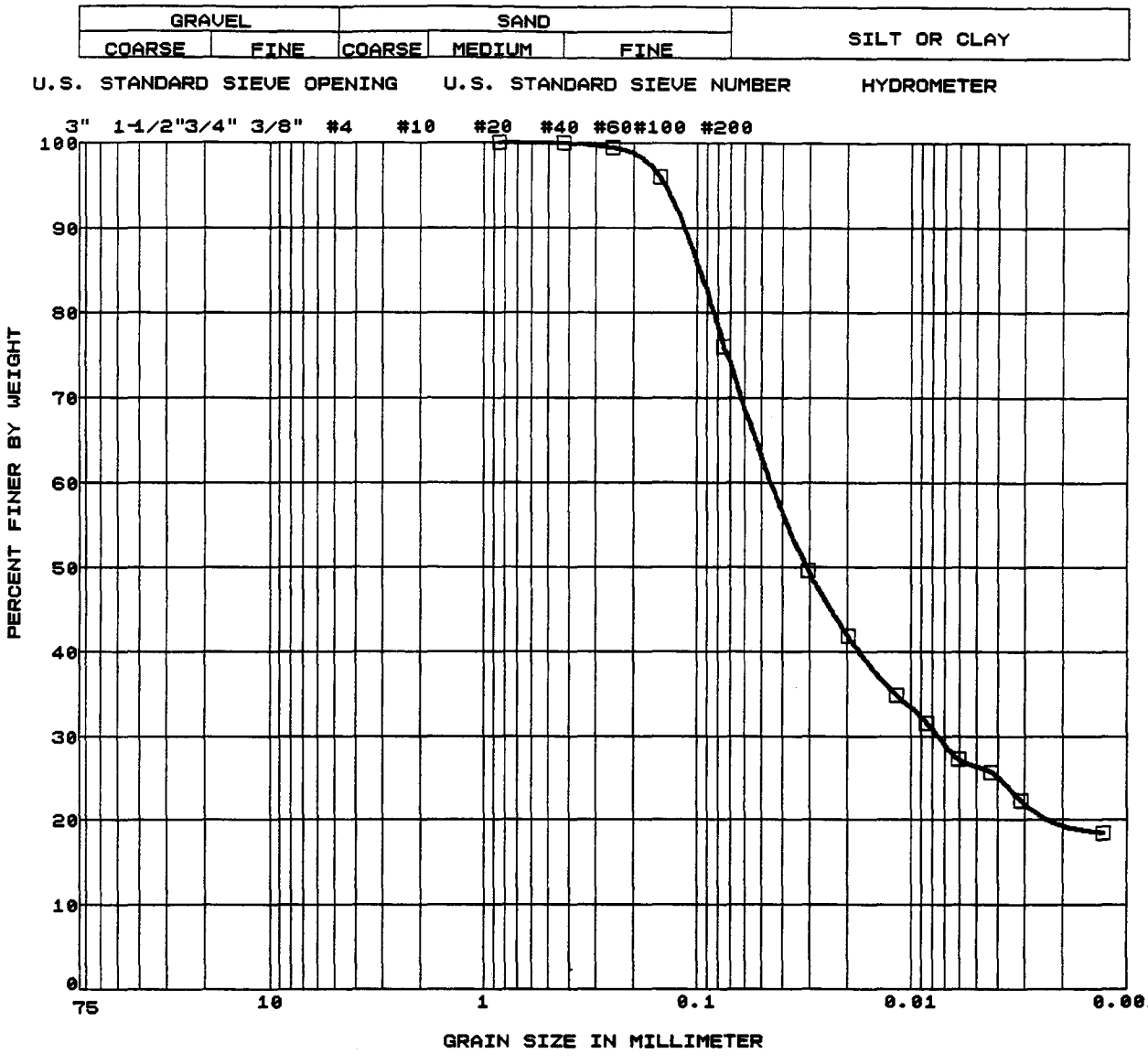
Figure B-81



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-26	D-9	57.0	Drive	CL	34	13

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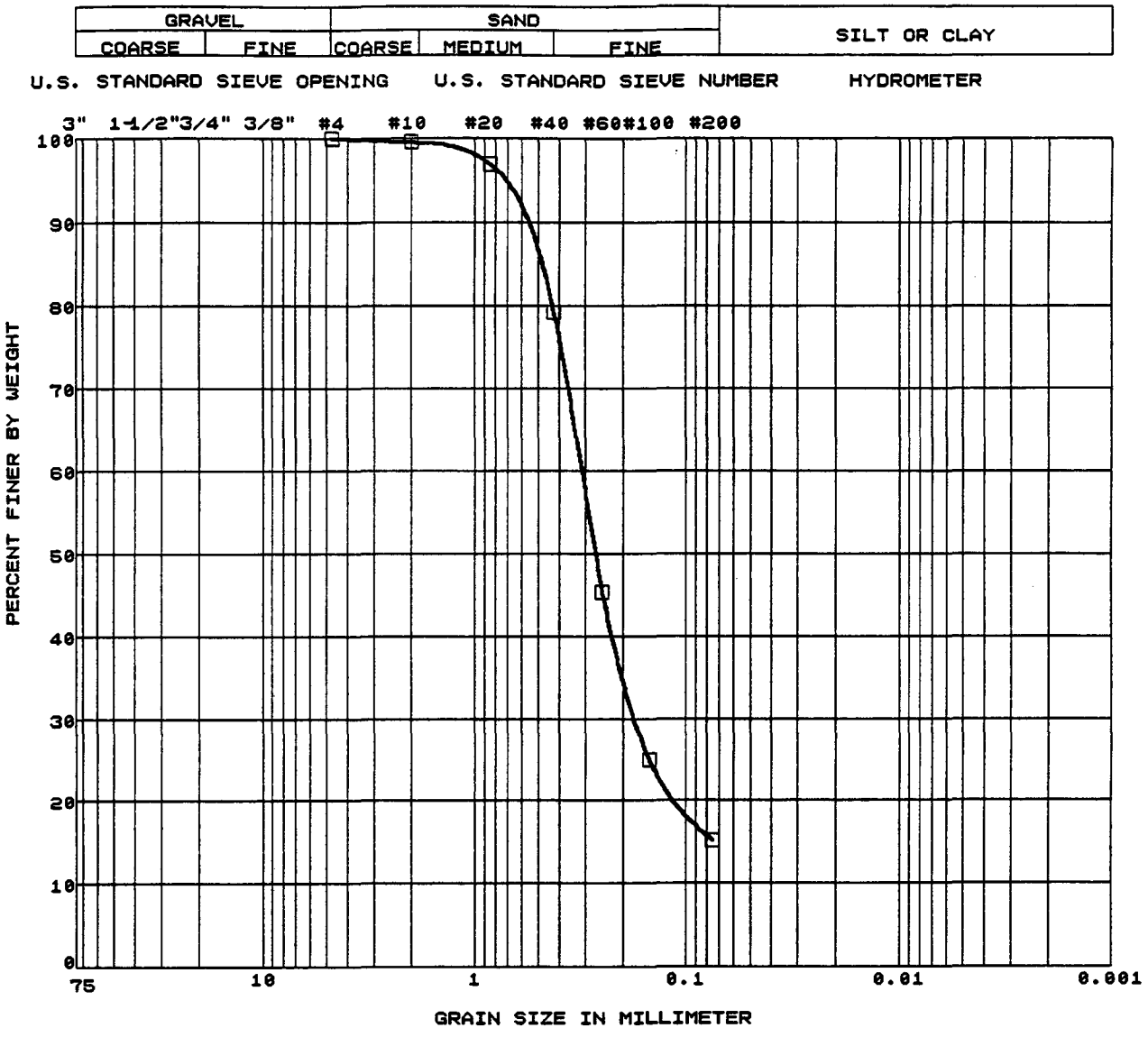
Figure B-82



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-26	D-12	80.0	Drive	SM		

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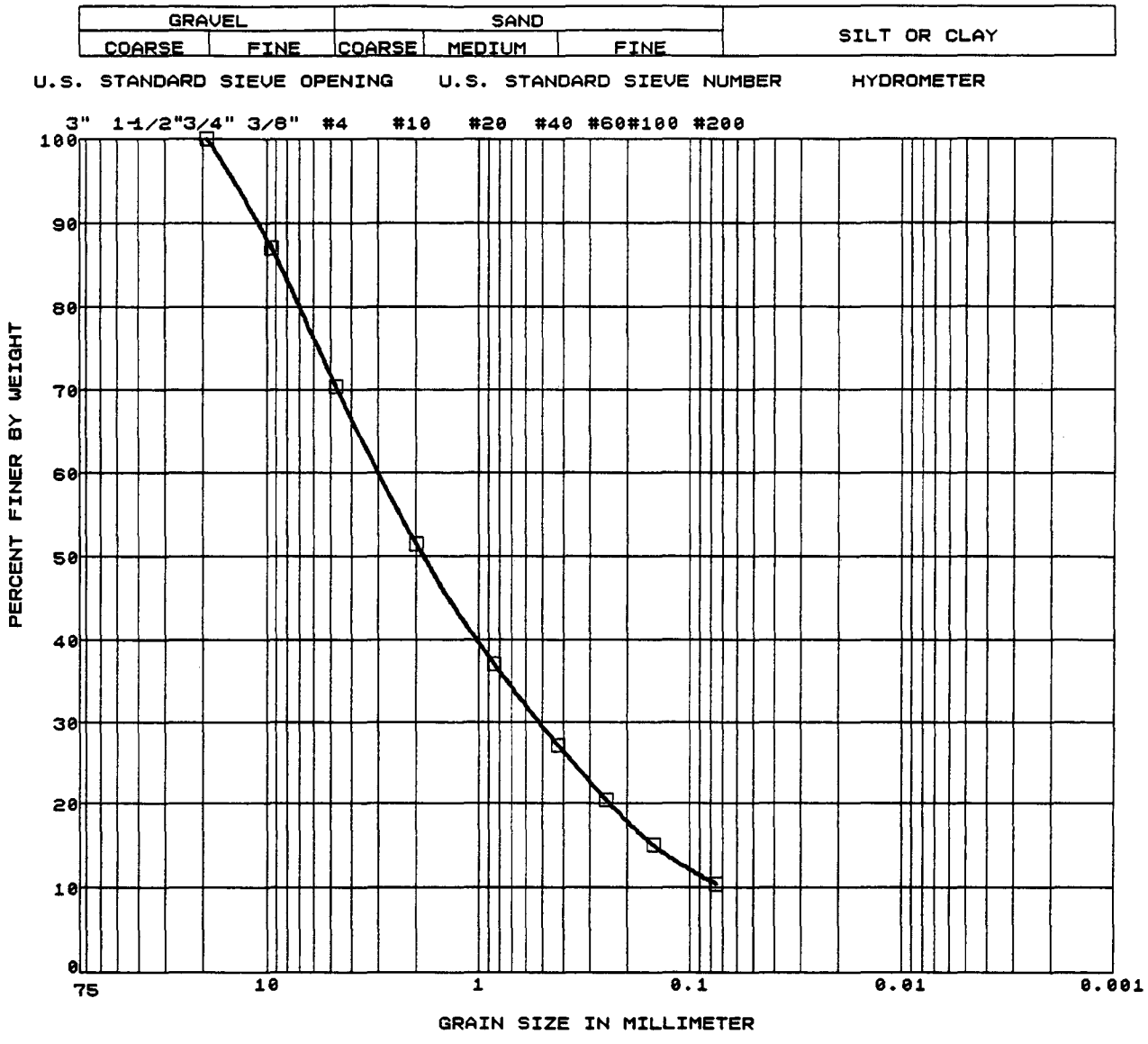
Figure B-83



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-28	S-2	10.0	Bag	SP-SM		

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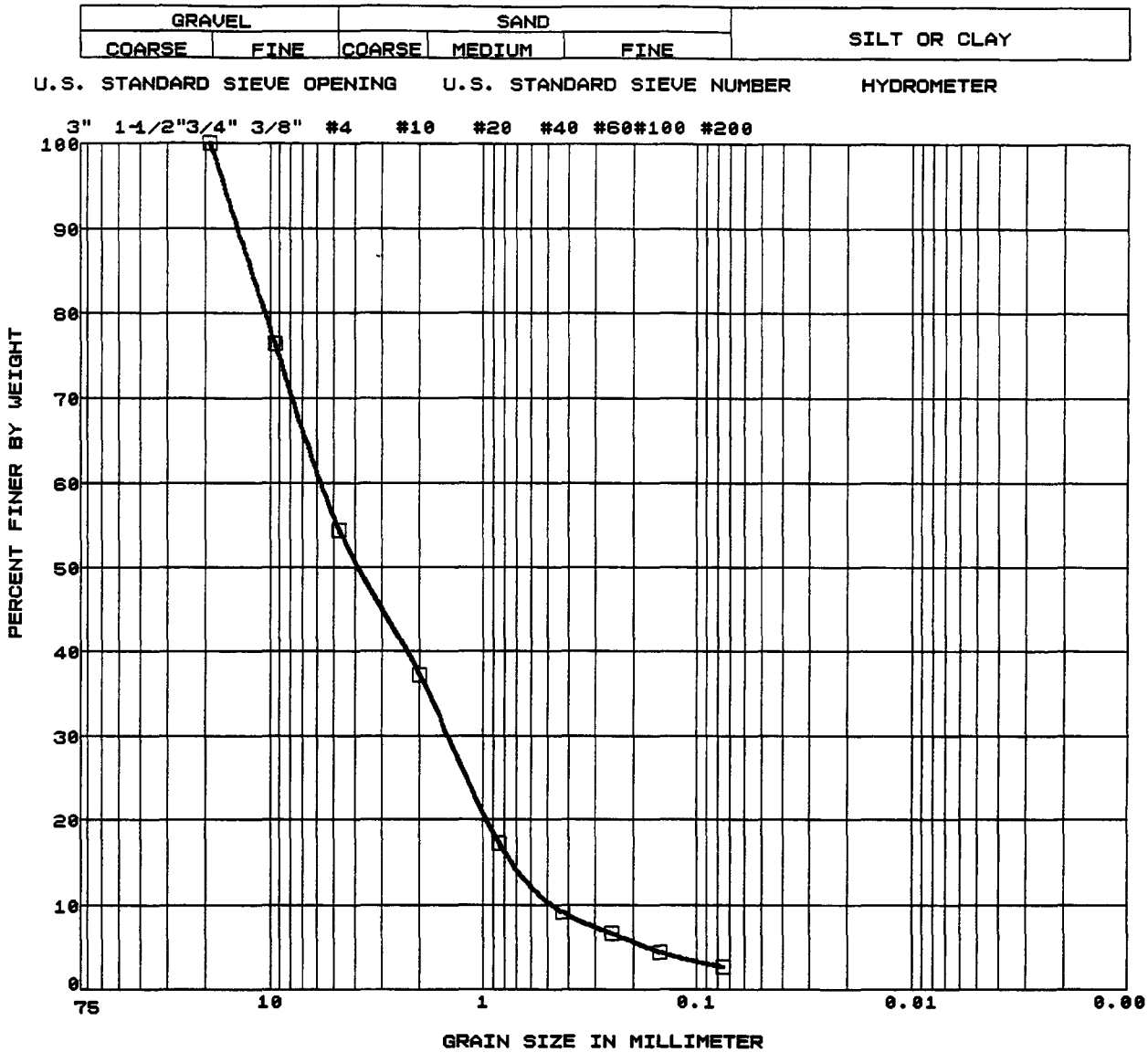
Figure B-84



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-28	D-3	15.0	Drive	SP		

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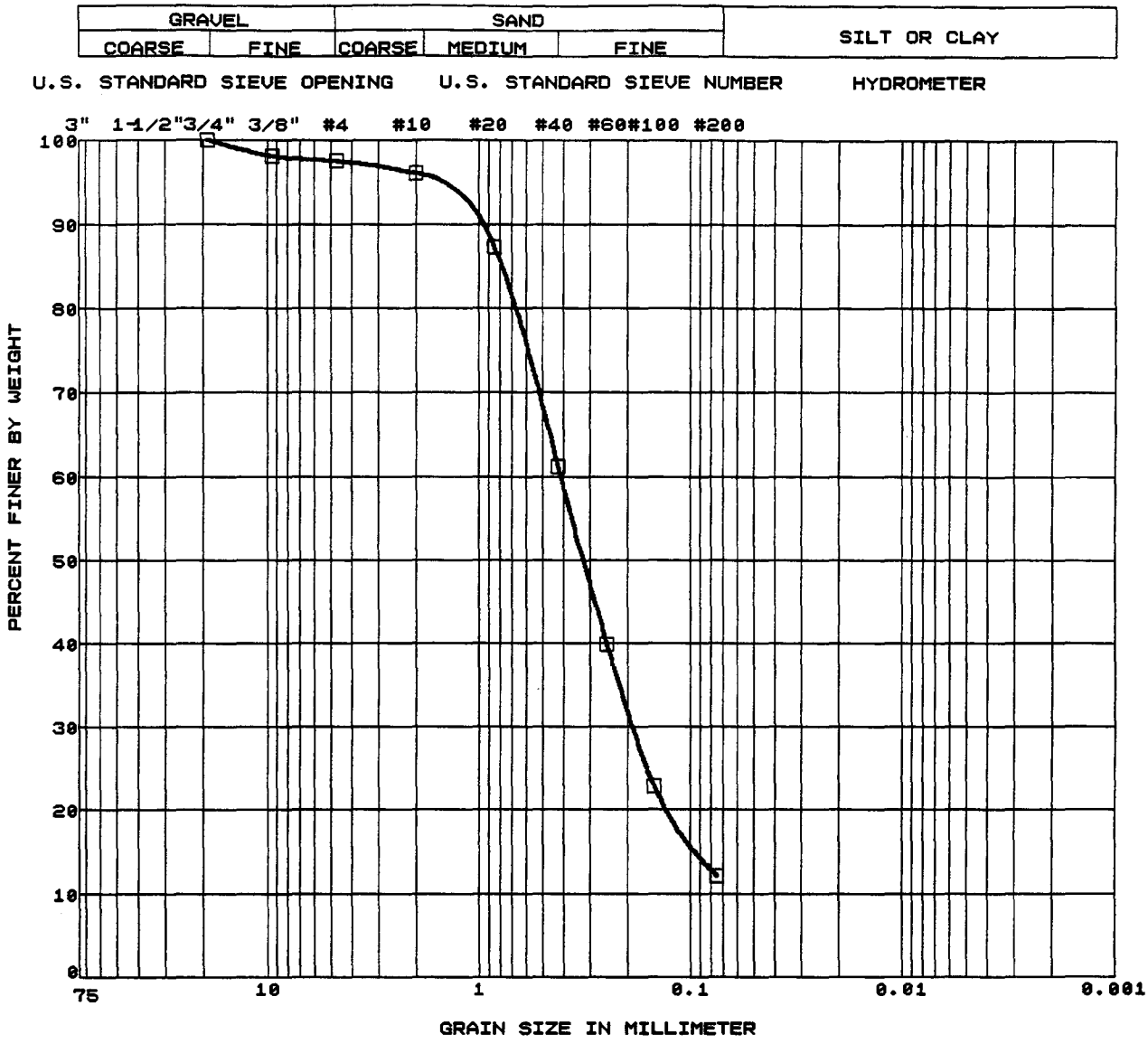
Figure B-85



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-28	S-5	25.0	Bag	SP-SM		

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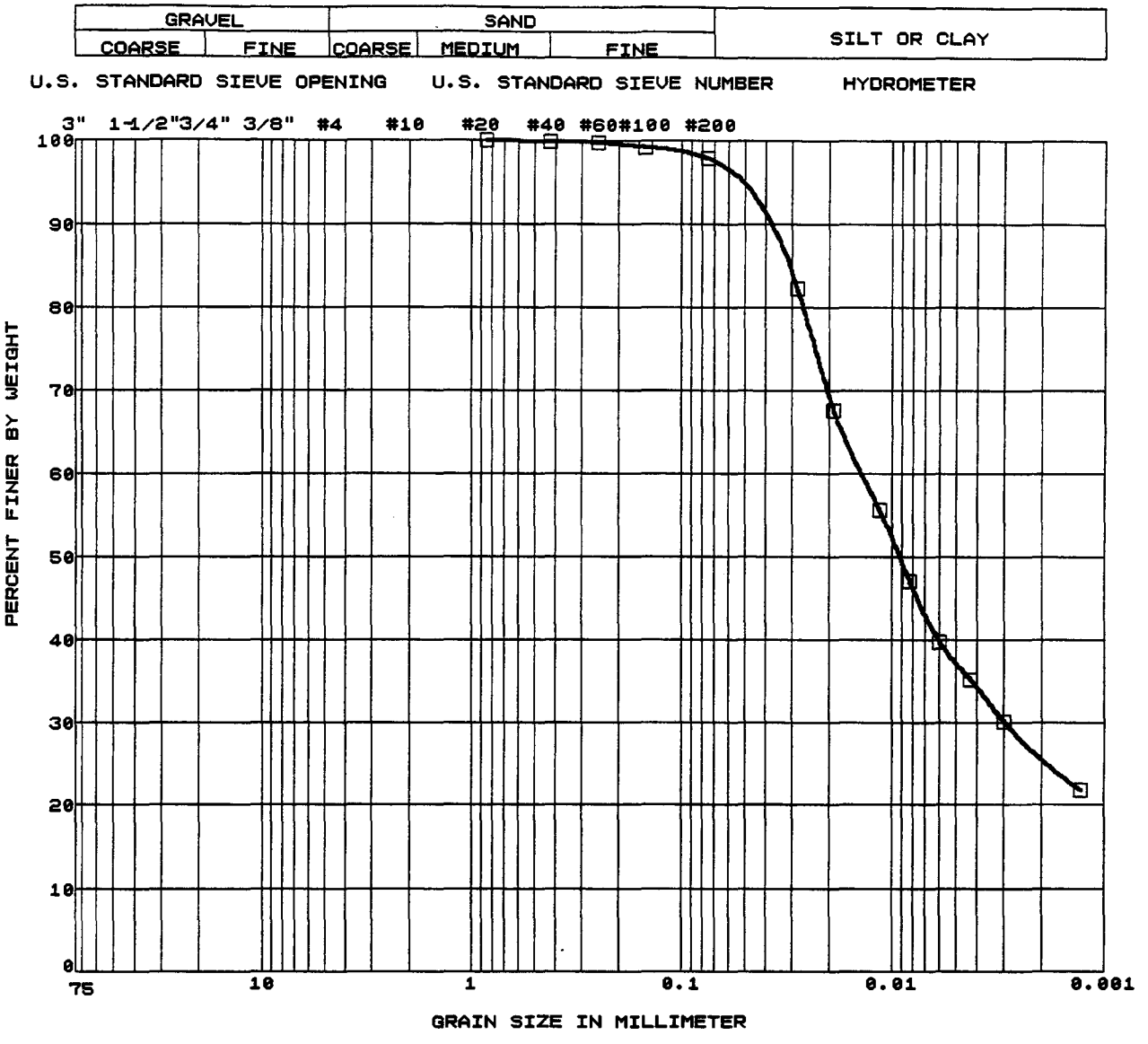
Figure B-86



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-28	D-15	75.0	Drive	CL	42	17

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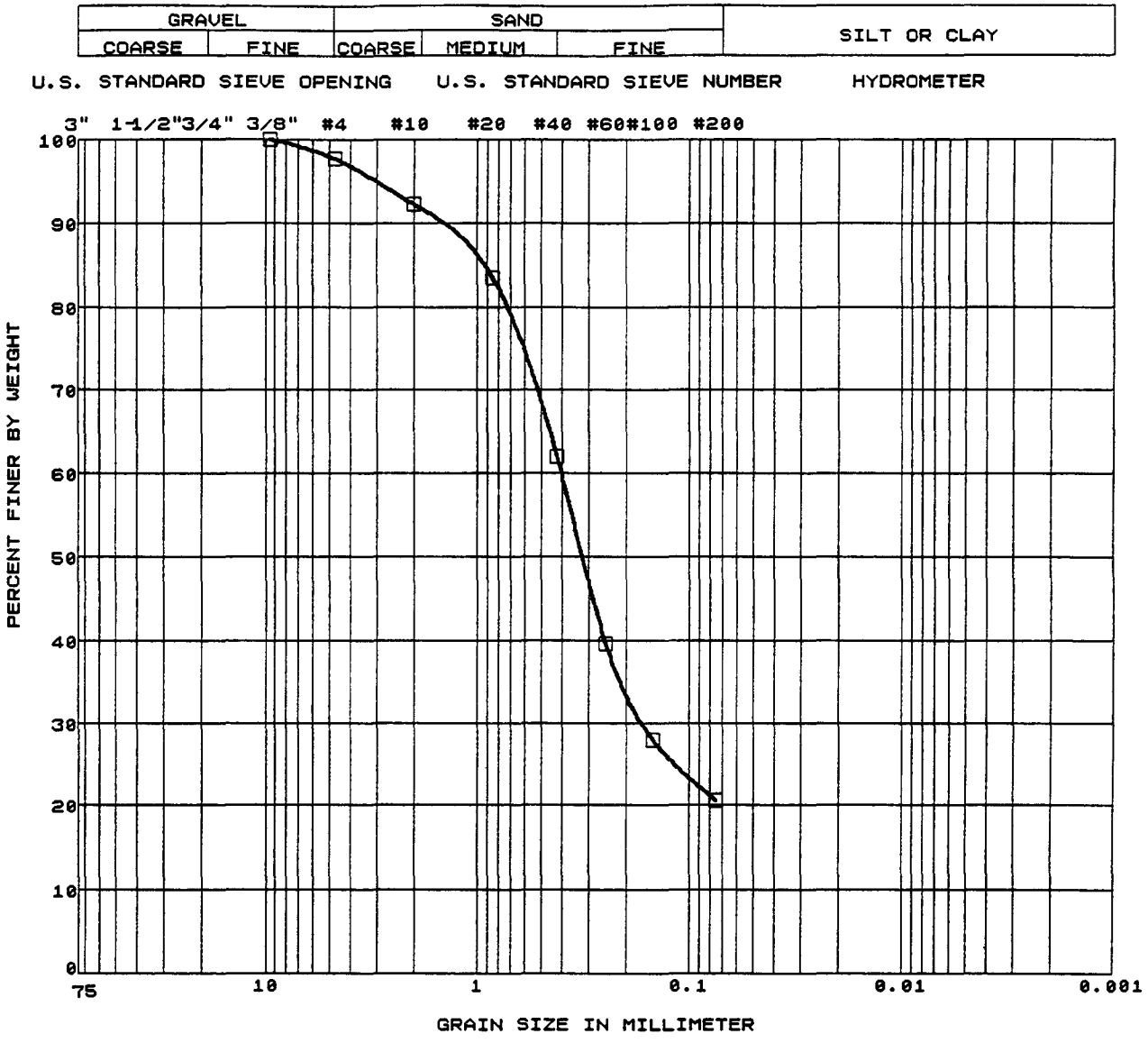
Figure B-87



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-29	S-4	20.0	Bag	SM		

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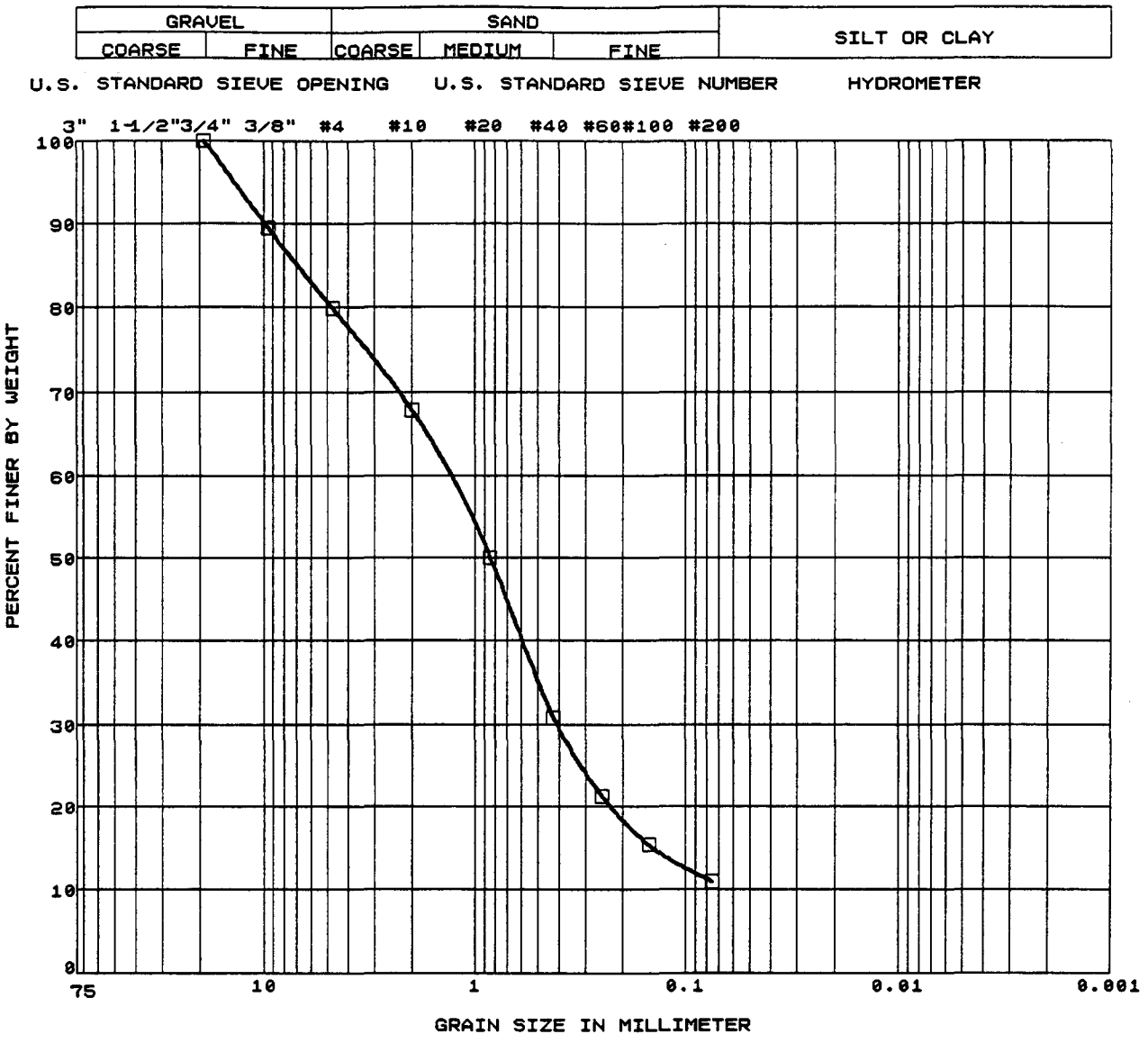
Figure B-88



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-29	S-6	32.0	Bag	SP-SM		

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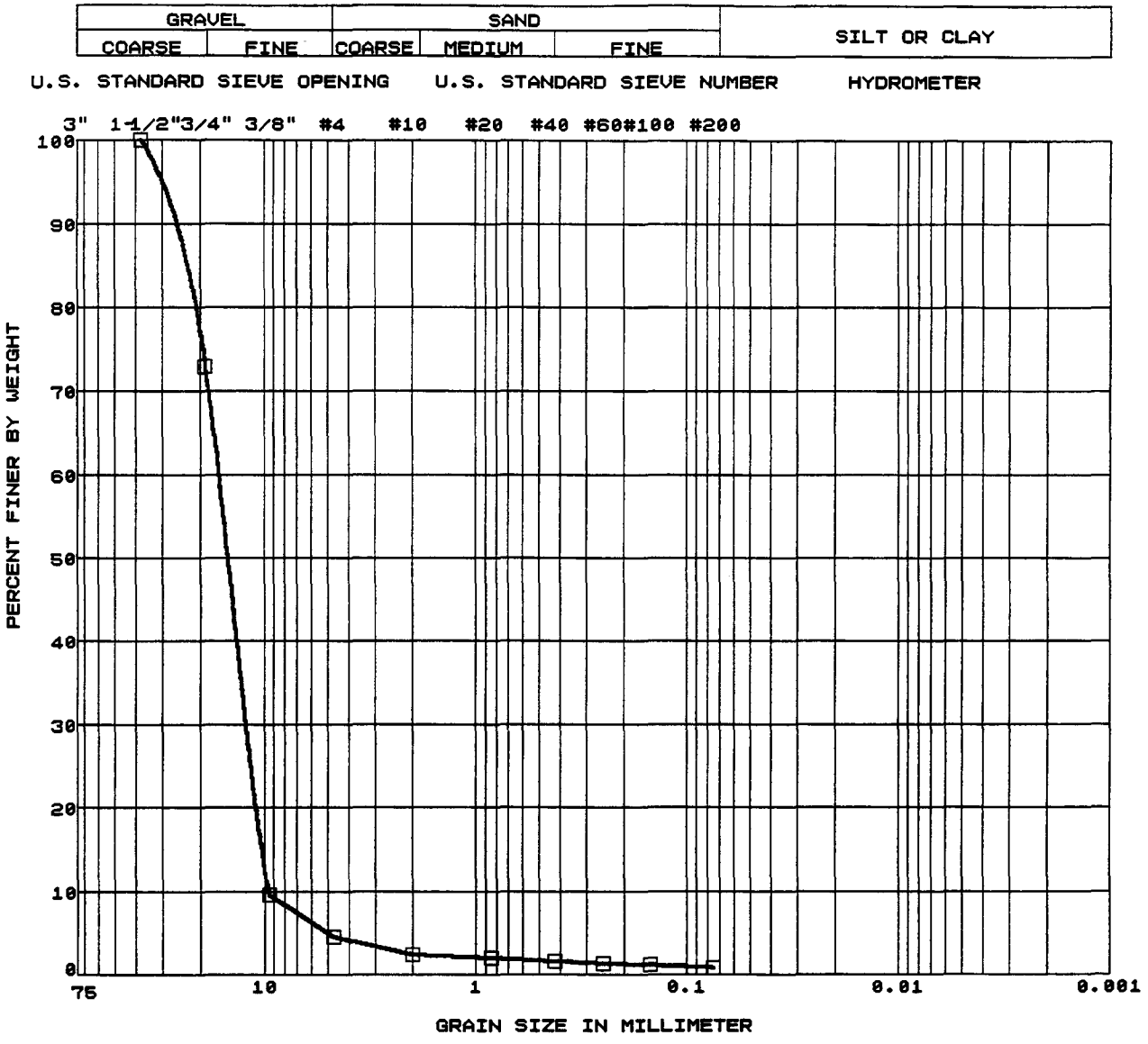
Figure B-89



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-29	S-8	41.0	Bag	GP		

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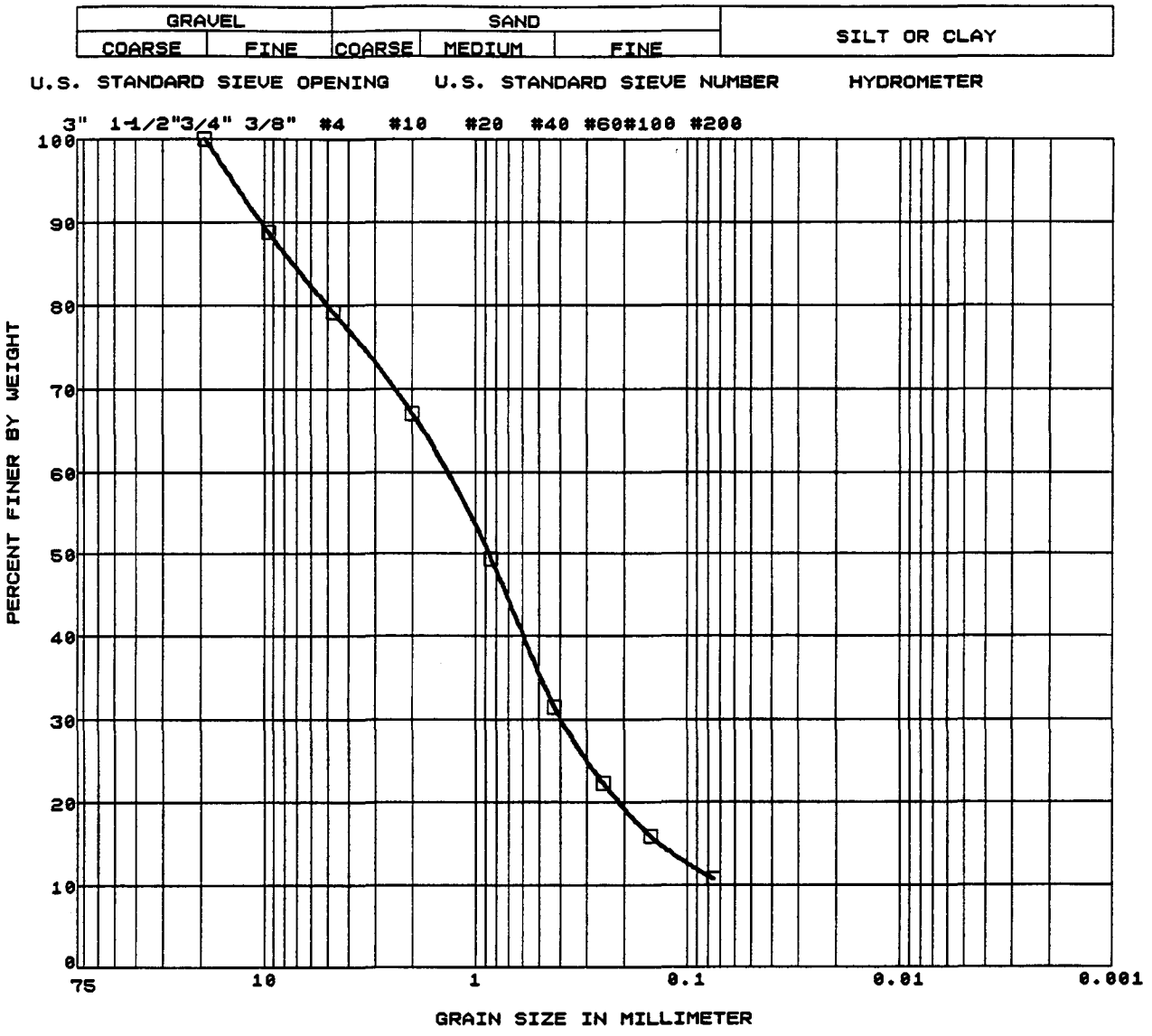
Figure B-90



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-29	S-12	61.0	Bag	SW-SM		

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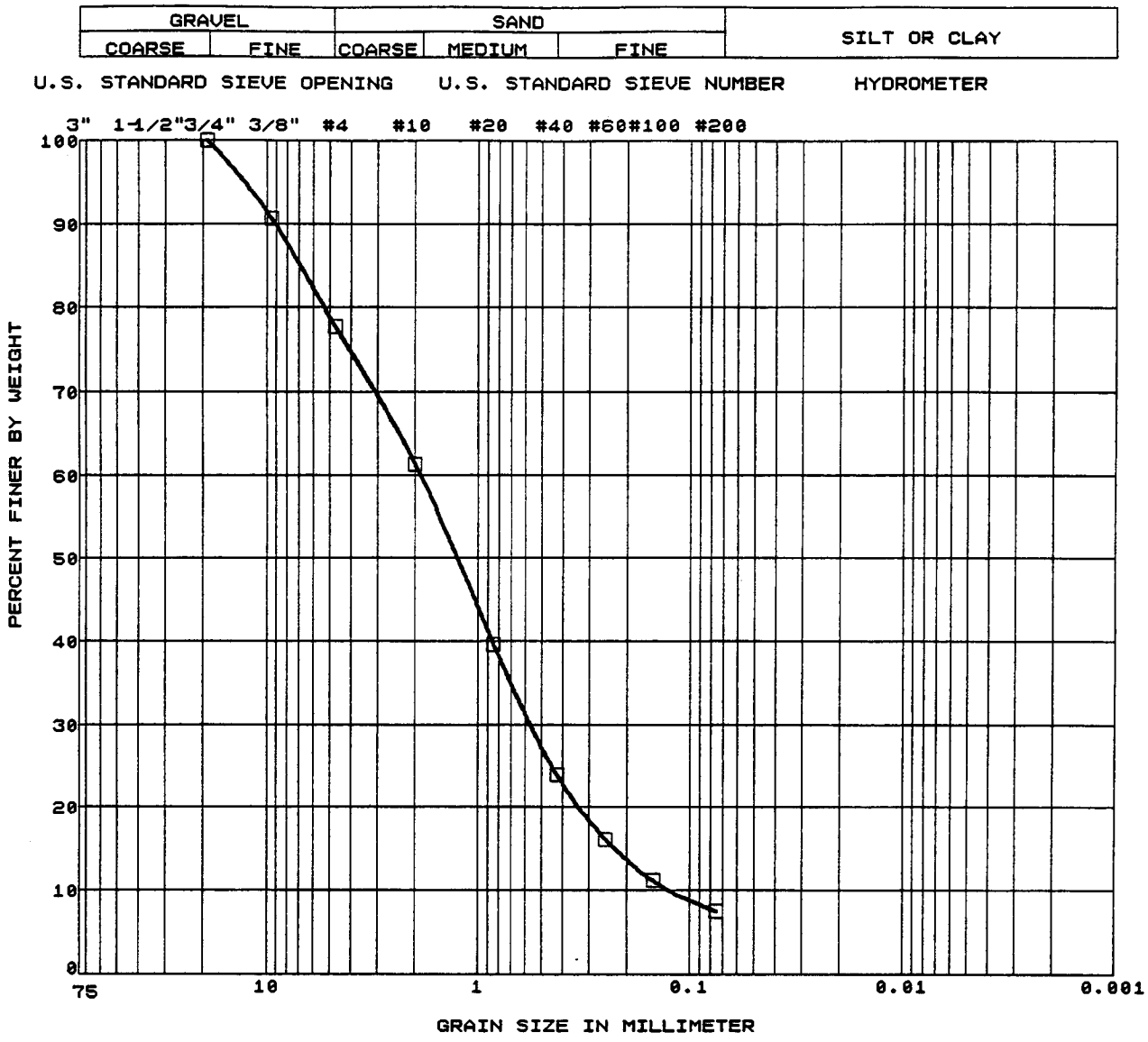
Figure B-91



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-30	S-2	10.0	Bag	SP-SM		

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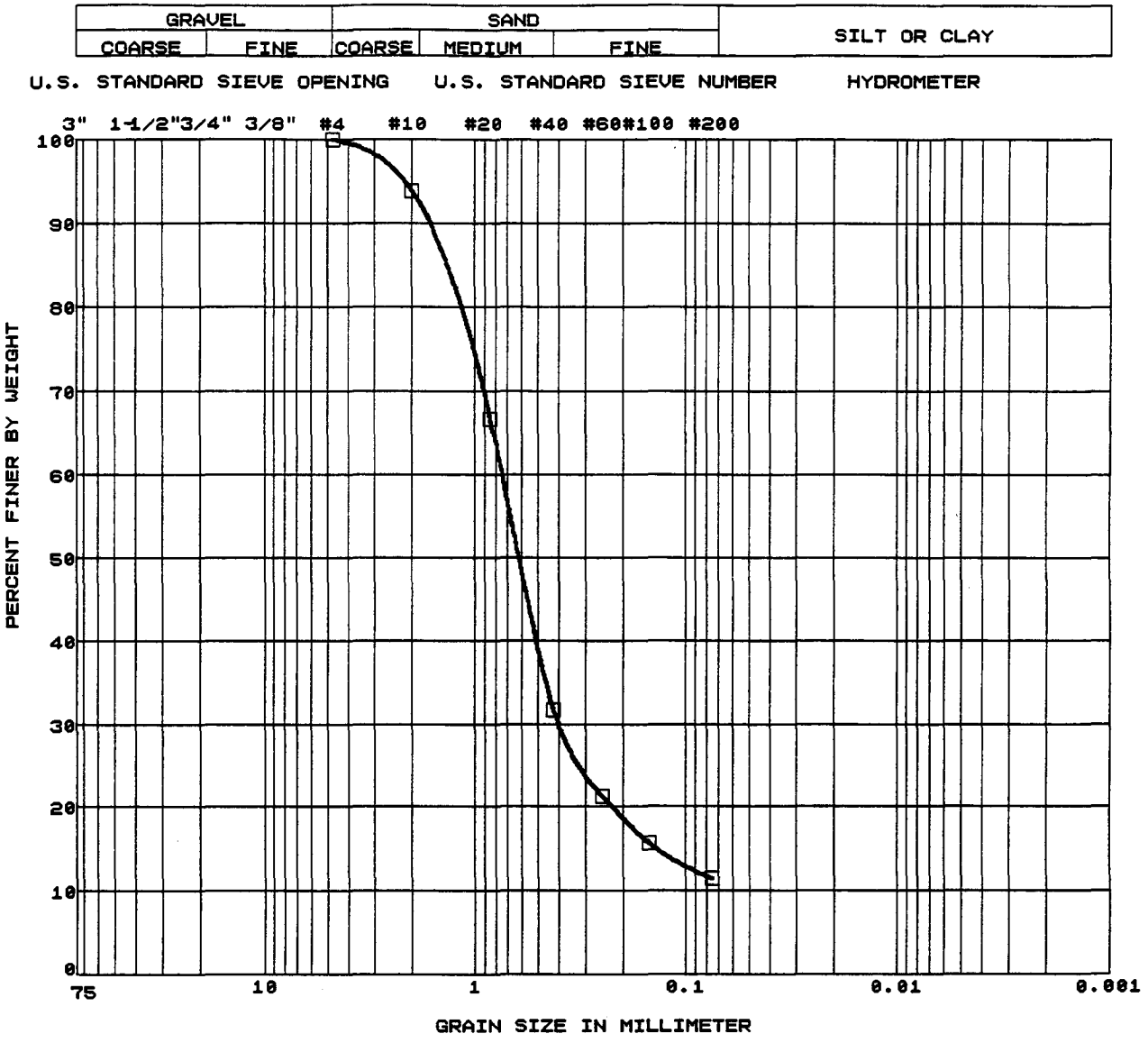
Figure B-92



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-30	D-9	50.0	Bag	SP-SM		

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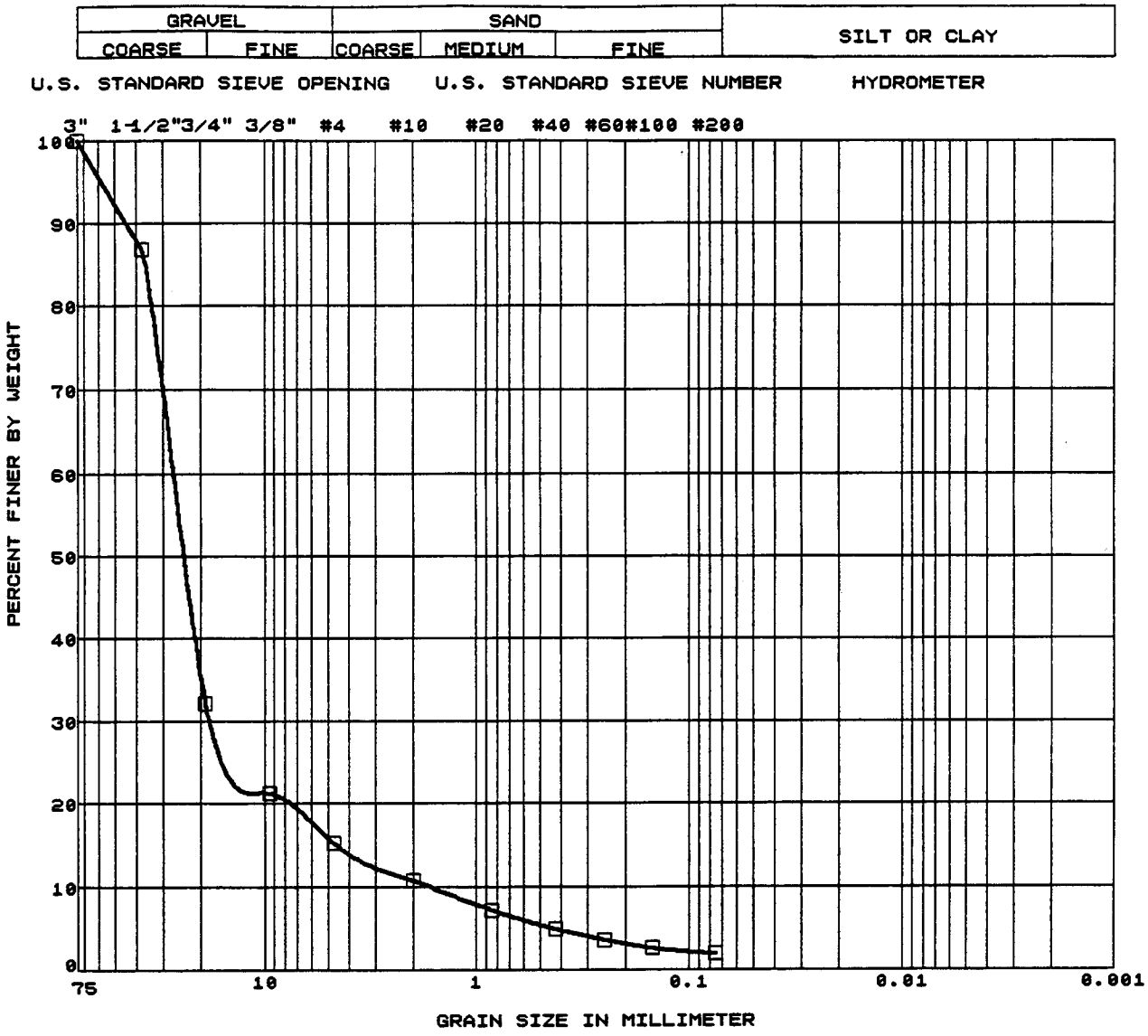
Figure B-93



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-31	D-5	25.0	Bag	GP		

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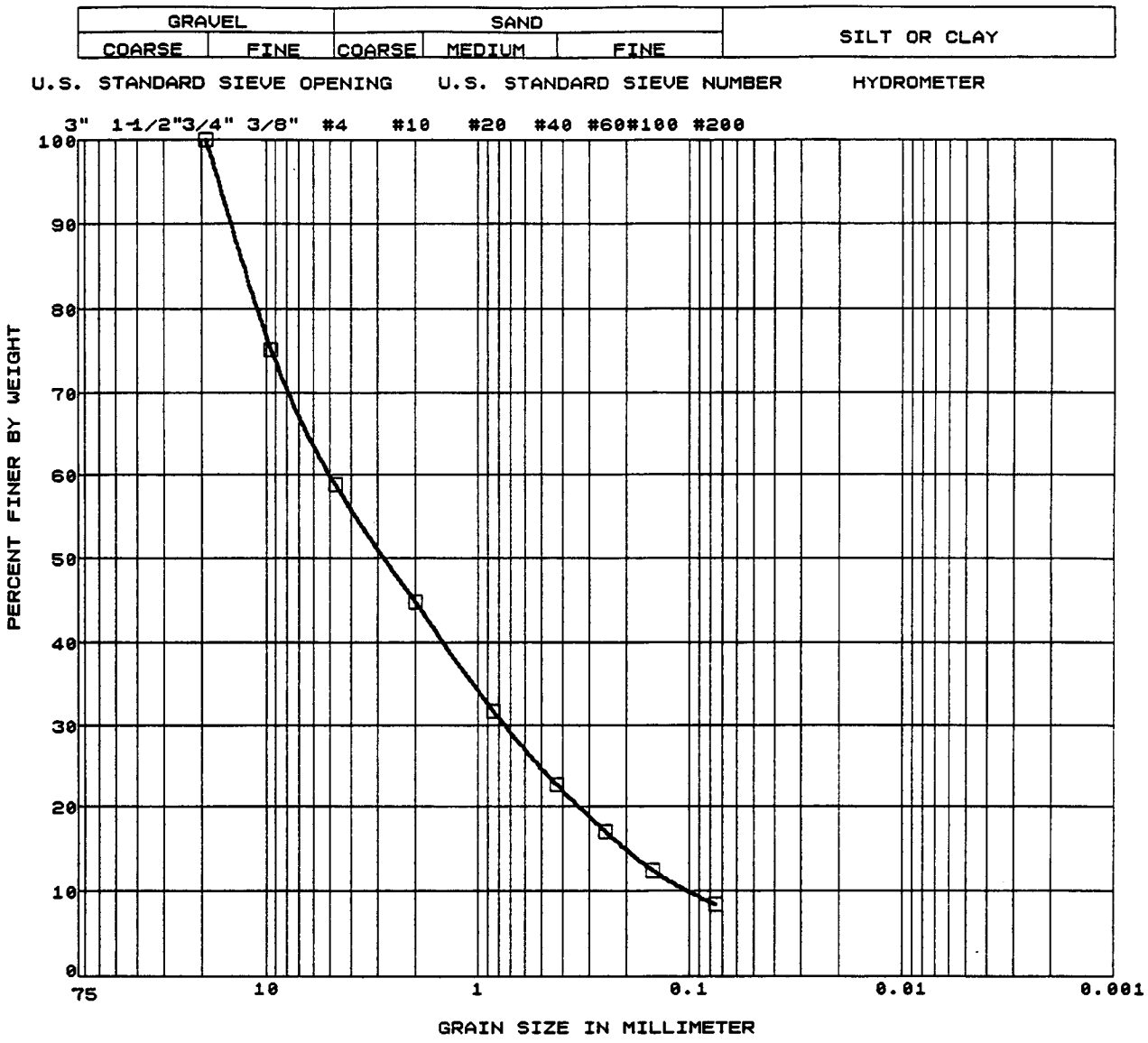
Figure B-94



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-31	S-10	50.0	Bag	SP-SM		

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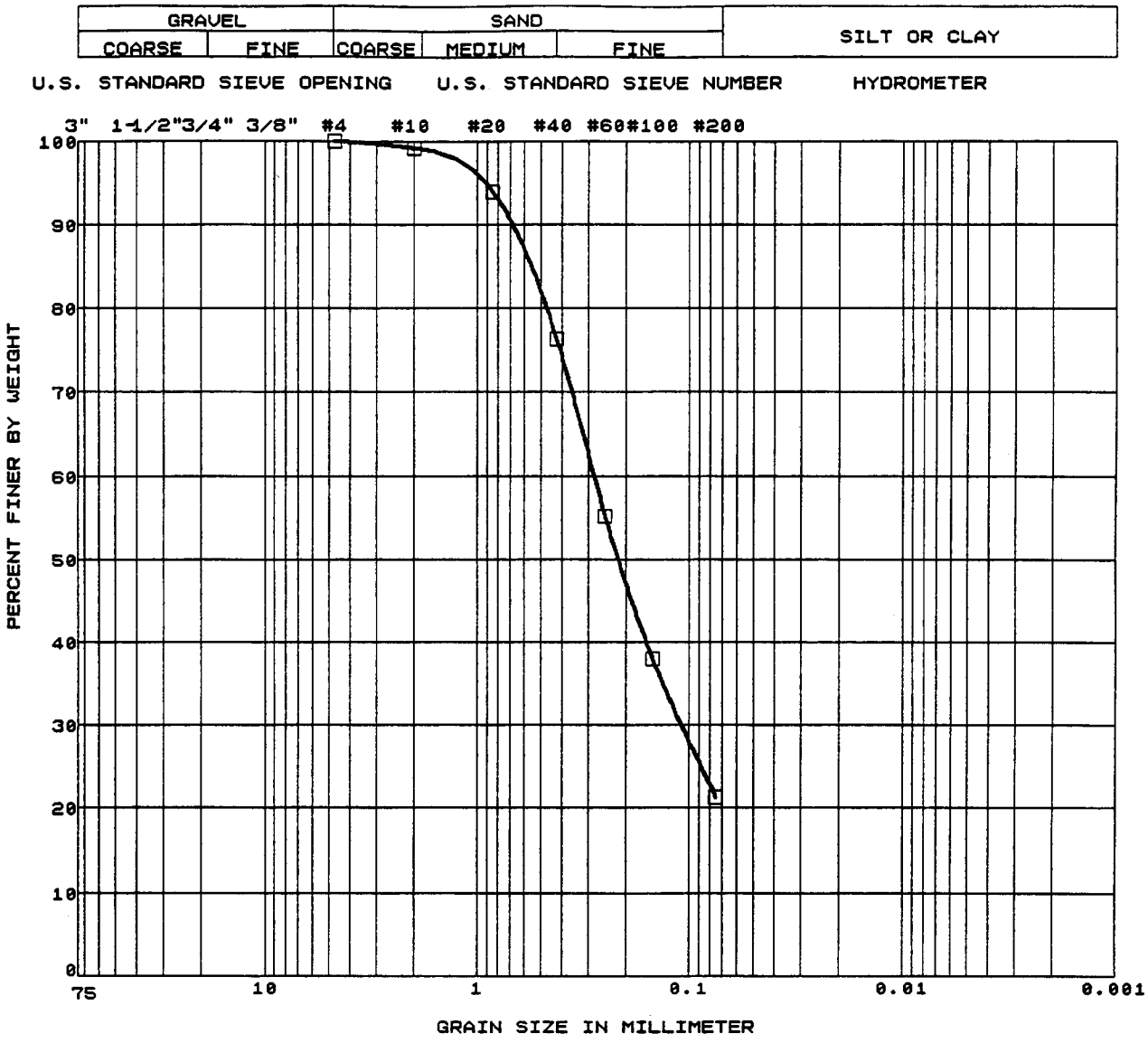
Figure B-95



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-31	D-11	55.0	Drive	SM		

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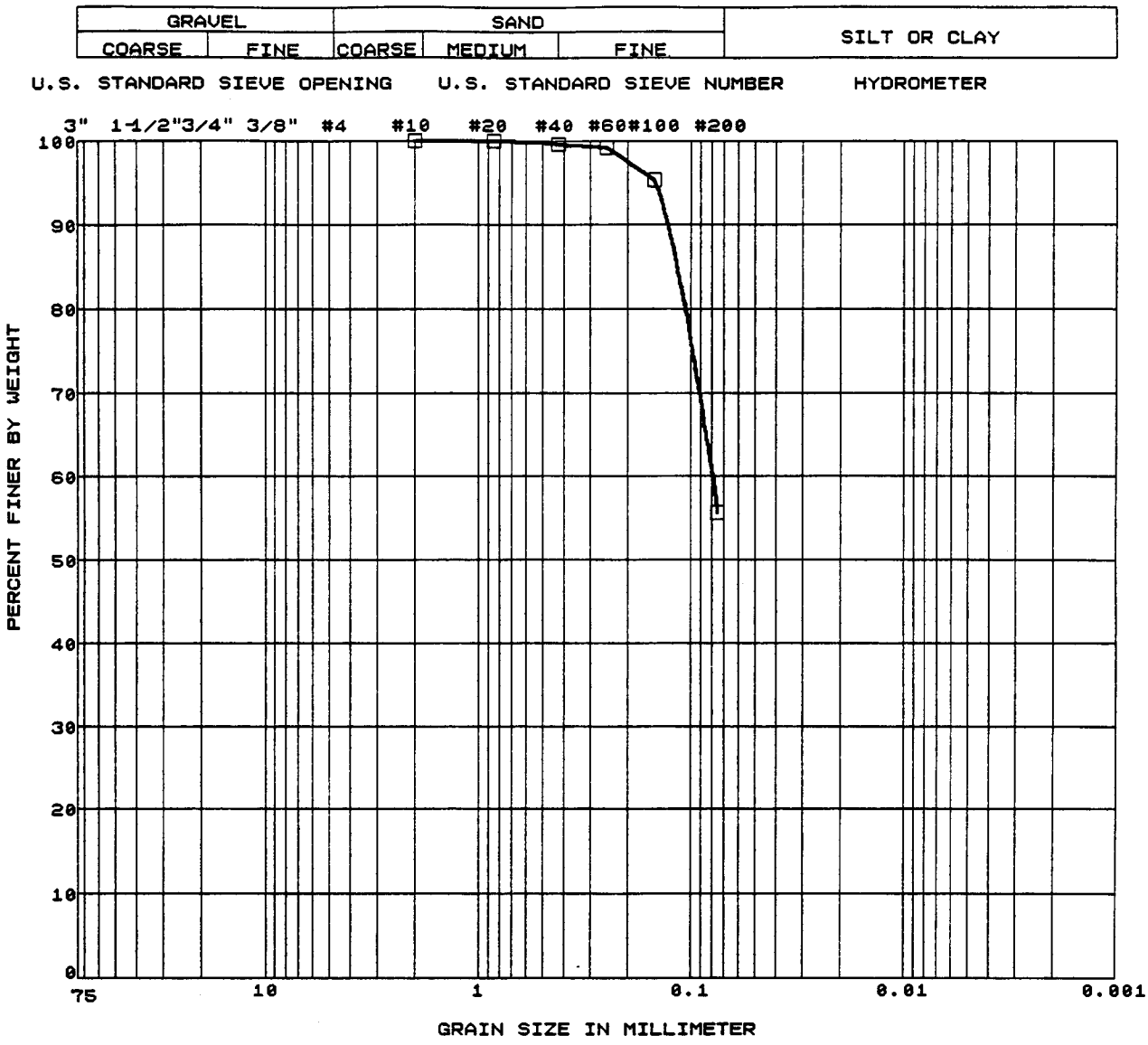
Figure B-96



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-31	D-13	65.0	Drive	ML	NP	NP

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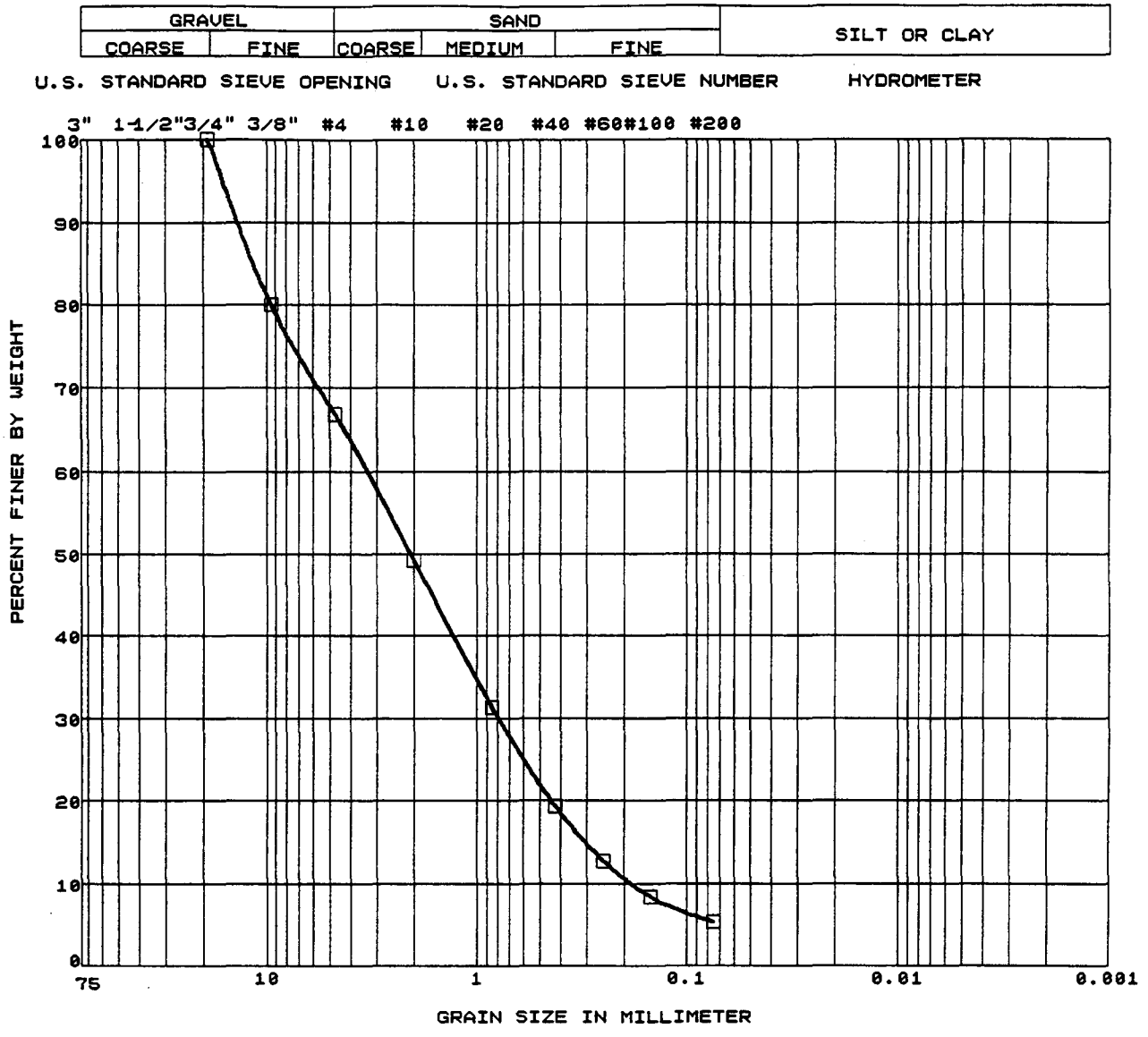
Figure B-97



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-27	S-2	10.0	Bag	SP-SM		

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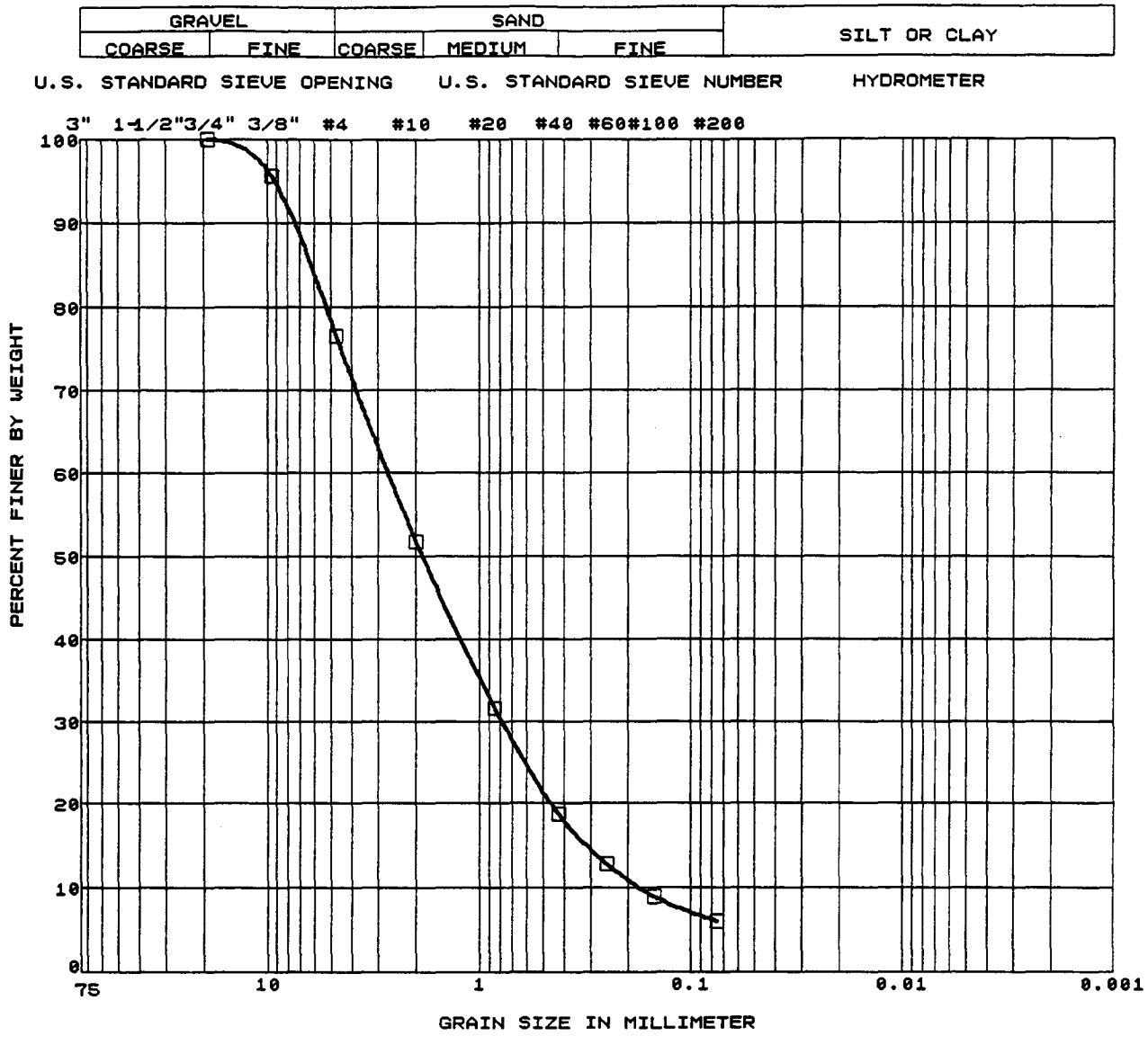
Figure B-98



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-27	S-6	30.0	Bag	SP-SM		

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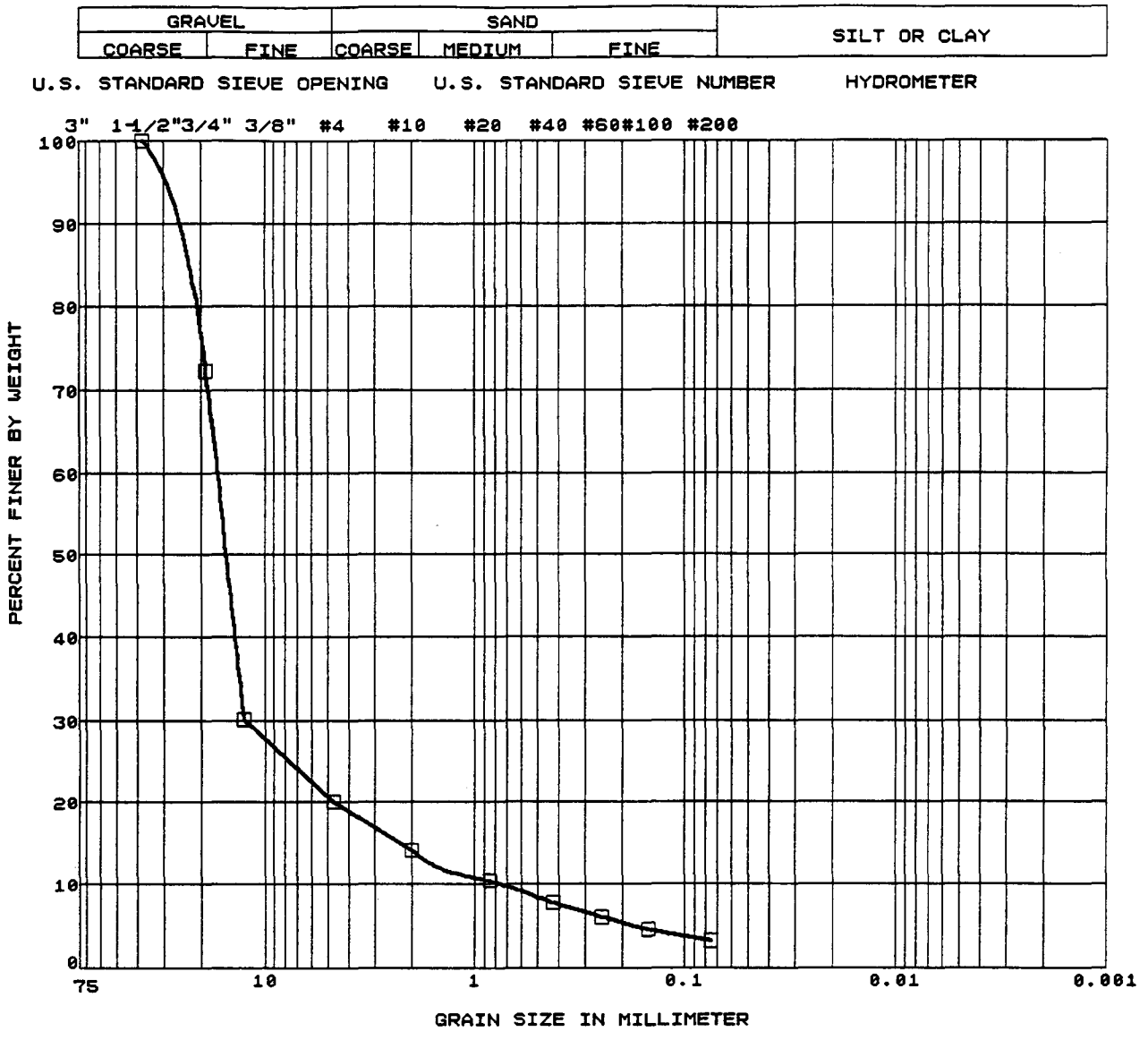
Figure B-99



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	PE-27	S-8	40.0	Bag	GP		

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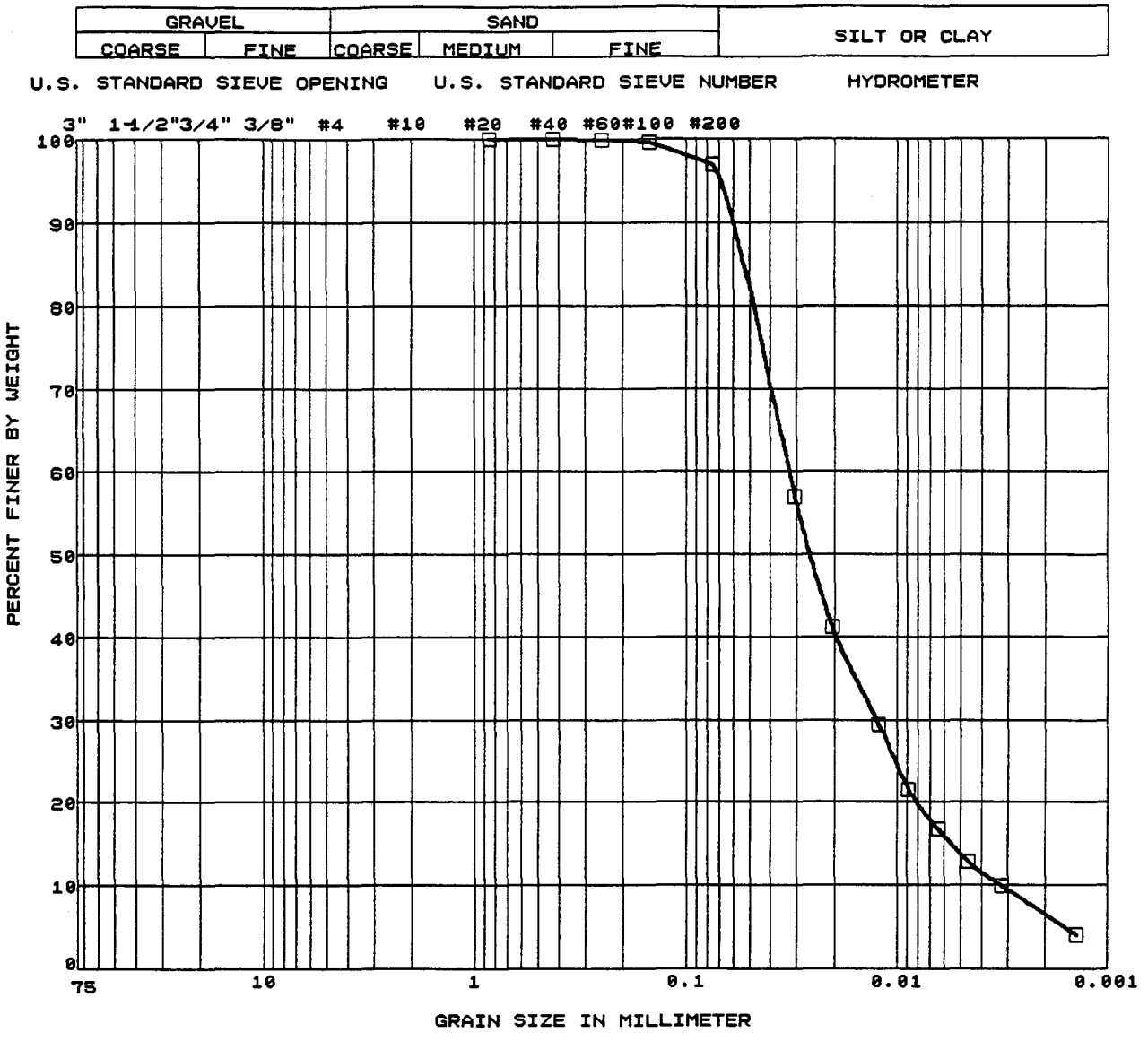
Figure B-100



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTI-CITY INDEX
□	PE-27	D-11	55.0	Drive	ML	36	7

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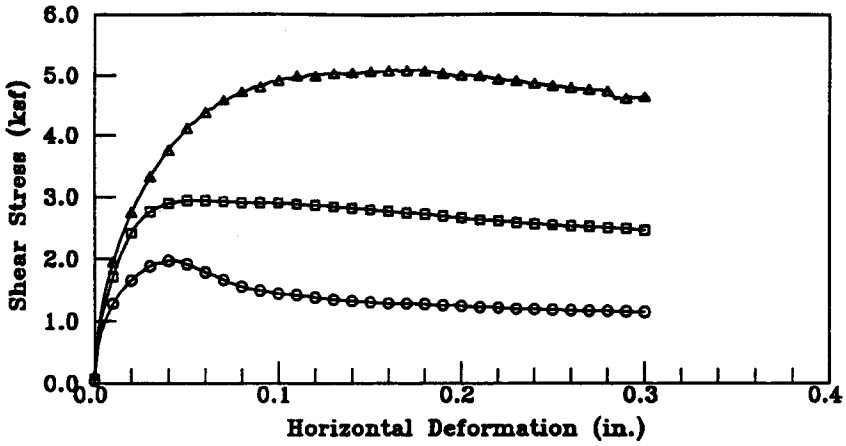
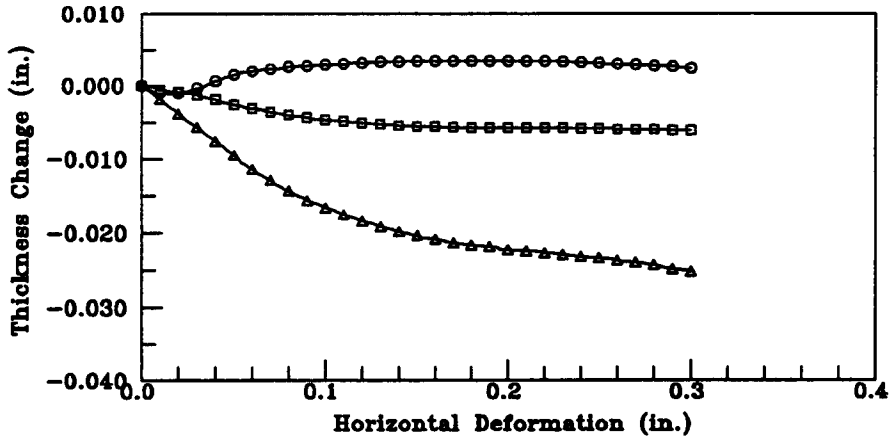
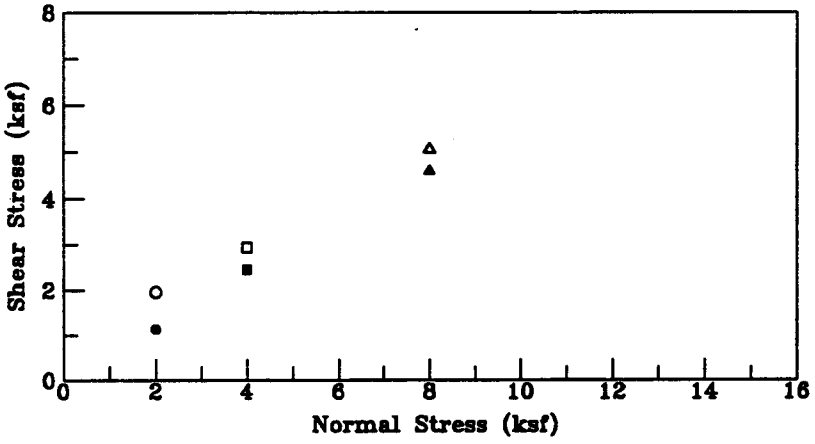
Figure B-101







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	2.000	1.963	●●●●●	1.138
□□□□□	4.000	2.938	■■■■■	2.460
△△△△△	8.000	5.093	▲▲▲▲▲	4.624

Boring No.: PE-1
Sample No.: D-7
Depth (ft.): 35.0
Sample Type: Undisturbed
Soil Type: Dark Reddish Brown lean Clay (CL)

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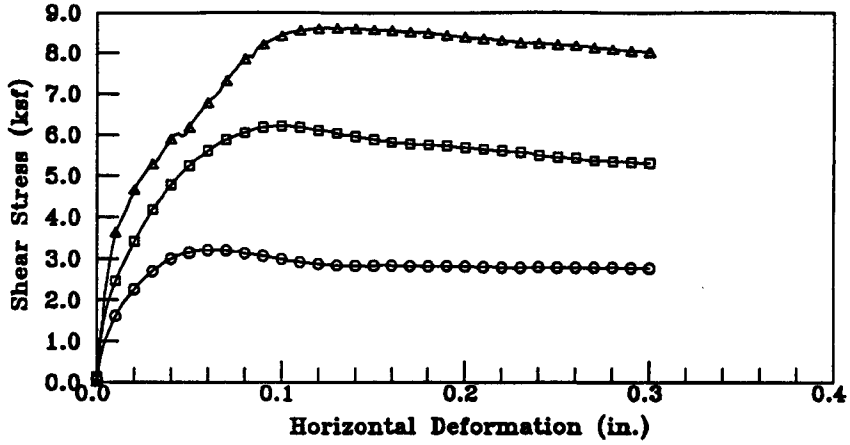
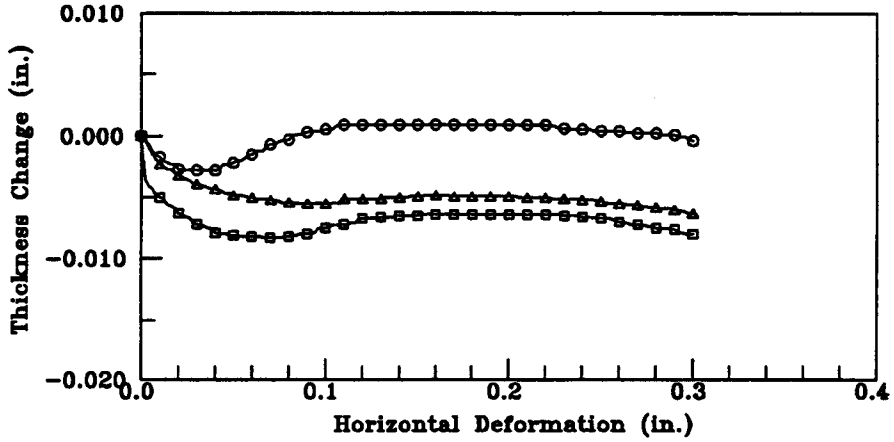
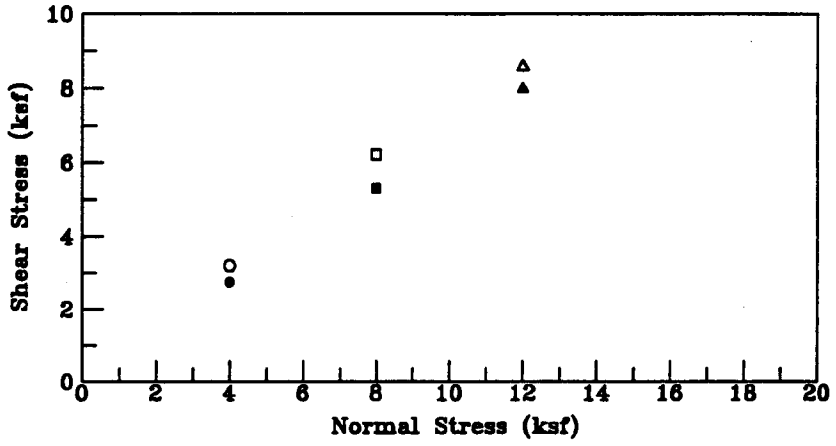
Figure B-102







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	4.000	3.207	2.762
□□□□□	8.000	6.221	5.317
△△△△△	12.000	8.624	8.021

Boring No.: PE−3
Sample No.: D−13
Depth (ft.): 65.0
Sample Type: Undisturbed
Soil Type: Drk Reddish Brwn Silty Sand (SM)

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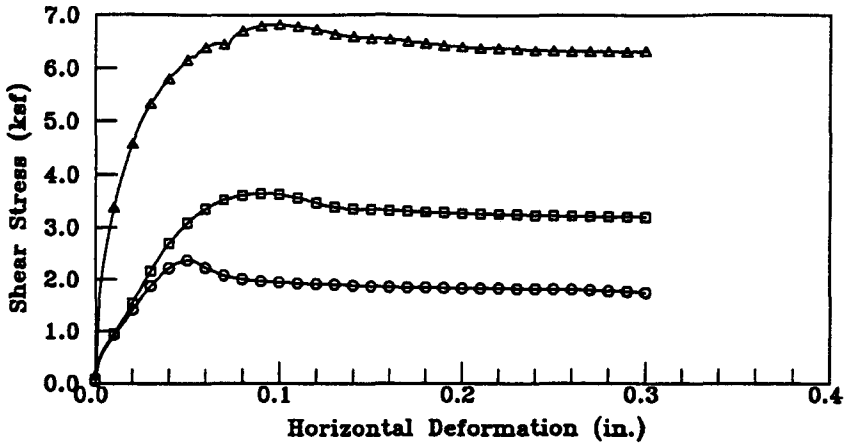
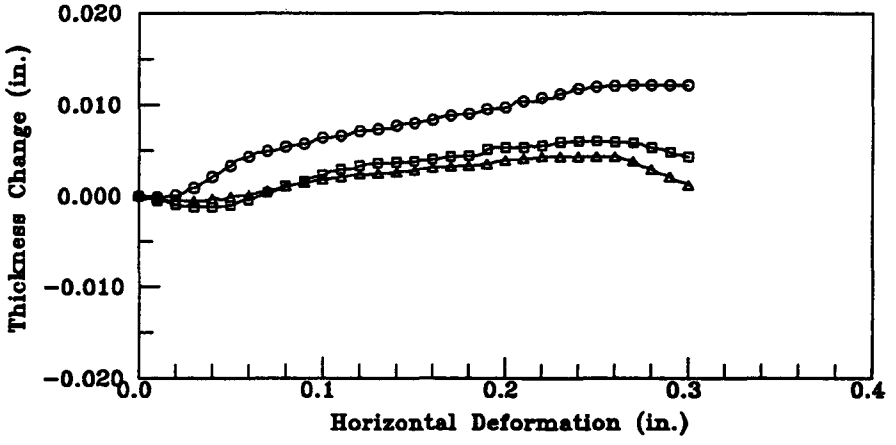
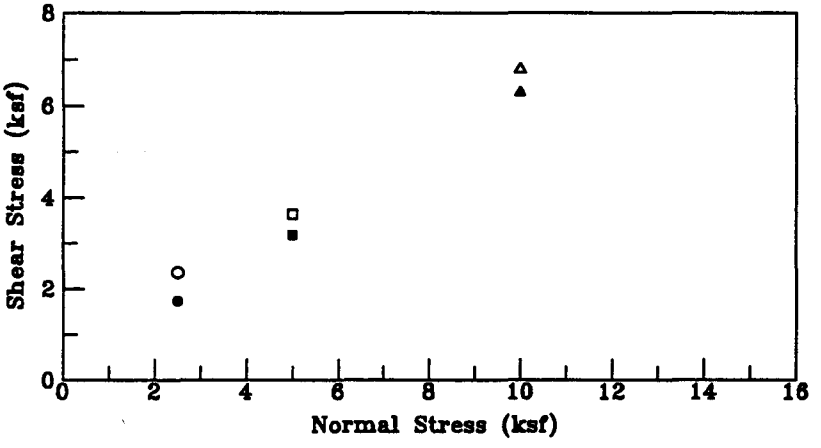
Figure B-103







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	2.500	2.367	●●●●●	1.738
□□□□□	5.000	3.641	■■■■■	3.183
△△△△△	10.000	6.828	▲▲▲▲▲	6.316

Boring No.: PE−4
Sample No.: D−8
Depth (ft.): 40.0
Sample Type: Undisturbed
Soil Type: Dark Reddish Brown lean Clay (CL)

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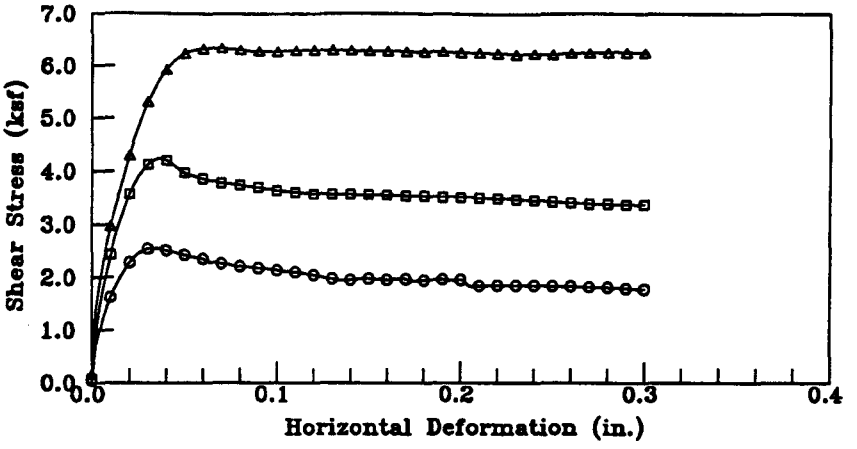
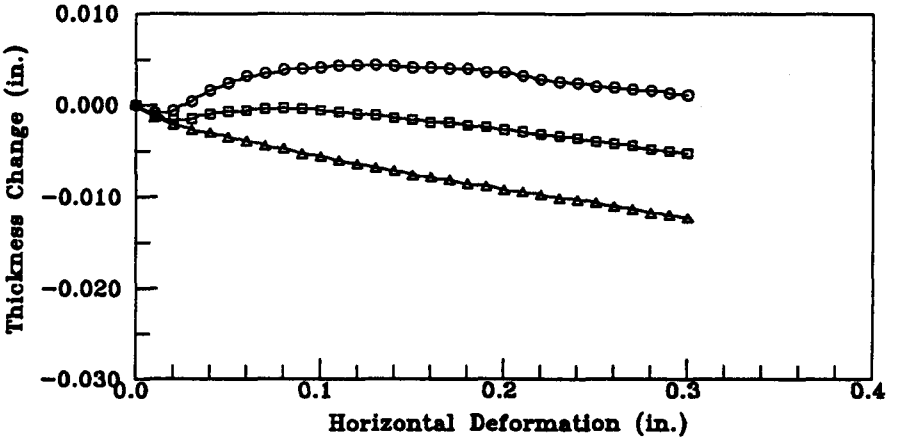
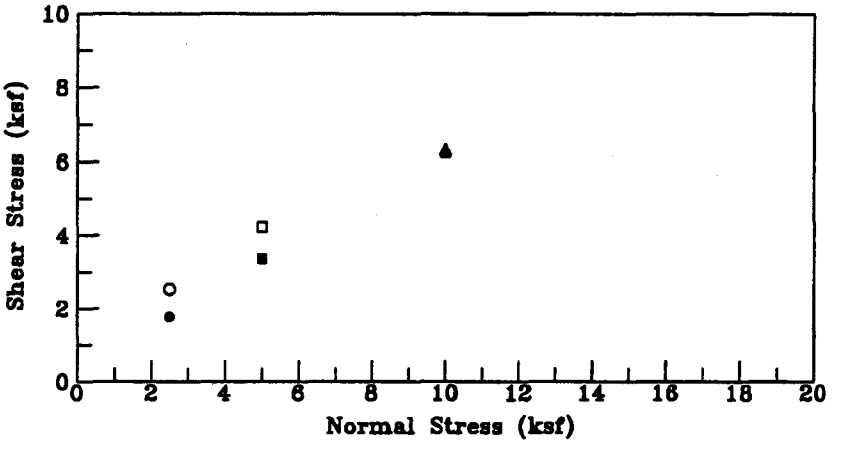
Figure B-104







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	2.500	2.545	●●●●●	1.782
□□□□□	5.000	4.238	■■■■■	3.373
△△△△△	10.000	6.340	▲▲▲▲▲	6.244

Boring No.: PE-8
Sample No.: D-9
Depth (ft.): 45.0
Sample Type: Undisturbed
Soil Type: Strong Brown Sandy Clay (CL) Stiff

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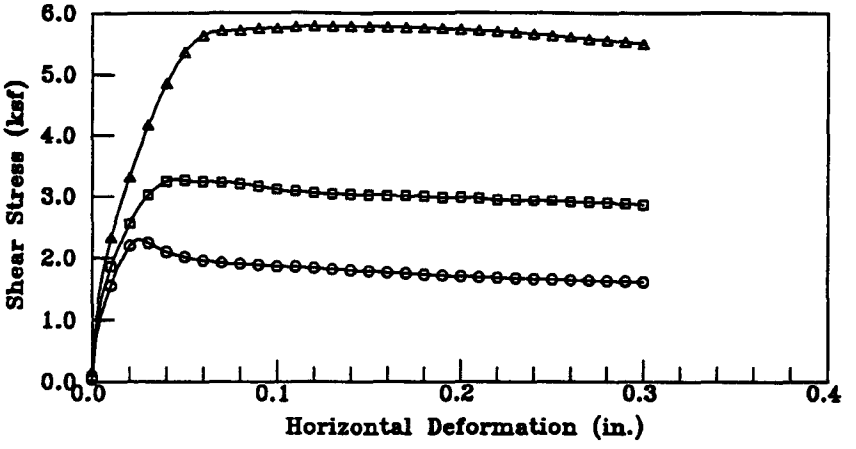
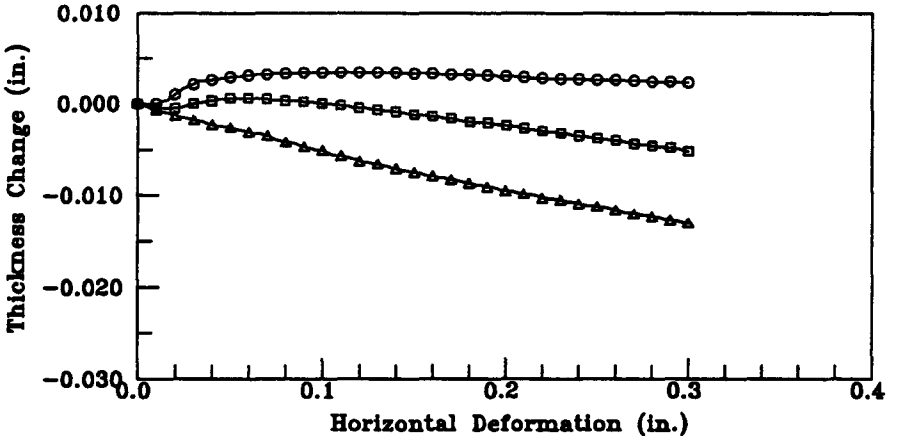
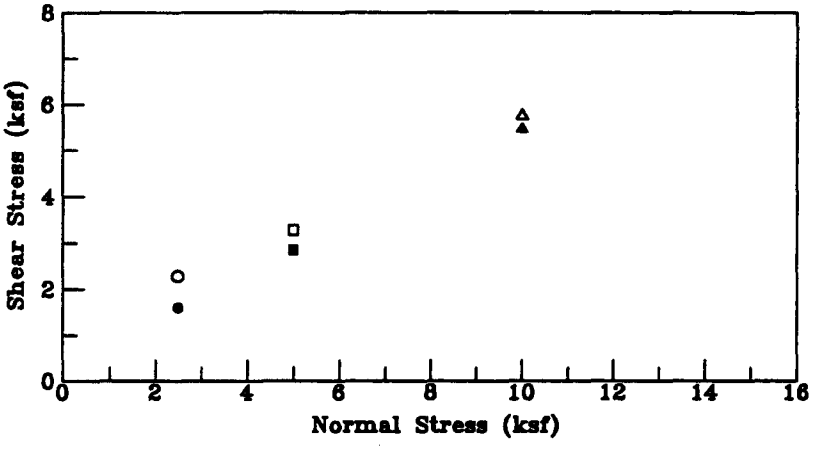
Figure B-105







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
●●●●●	2.500	2.291	1.607
■■■■■	5.000	3.282	2.859
▲▲▲▲▲	10.000	5.791	5.499

Boring No.: PE-10
Sample No.: D-8
Depth (ft.): 45.0
Sample Type: Undisturbed
Soil Type: Olive Yellow Silt (ML)

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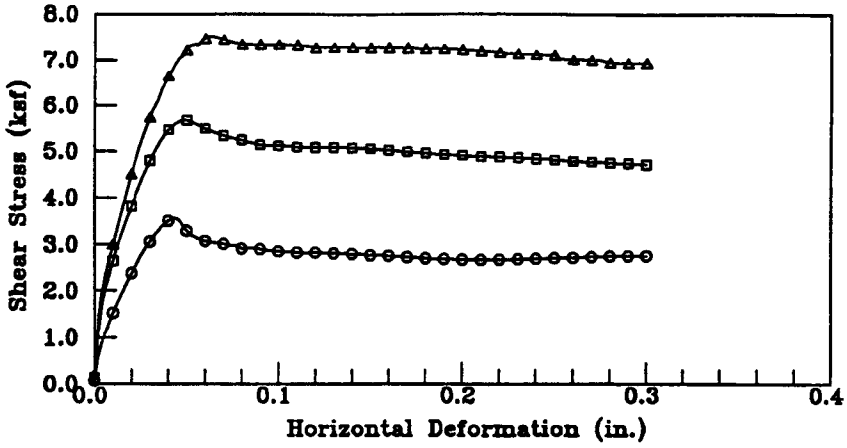
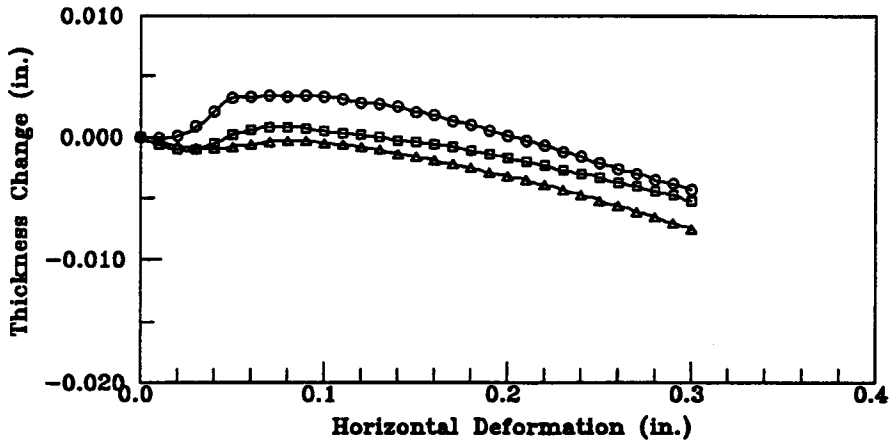
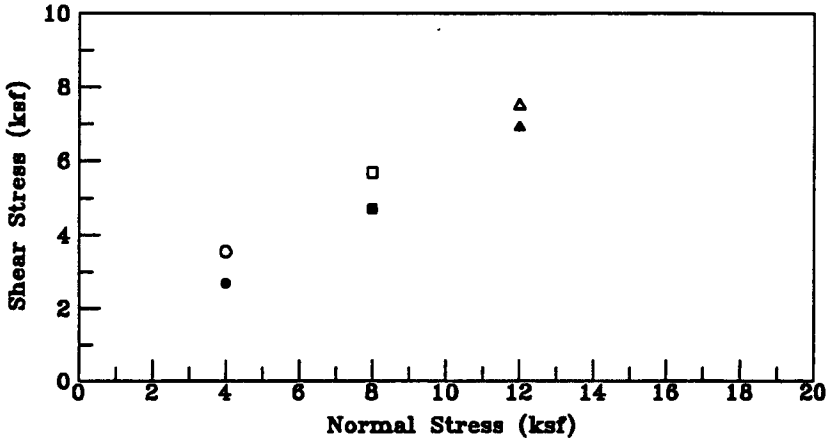
Figure B-106







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	4.000	3.554	2.695
□□□□□	8.000	5.683	4.719
△△△△△	12.000	7.500	6.946

Boring No.: PE-14
Sample No.: D-13
Depth (ft.): 65.0
Sample Type: Undisturbed
Soil Type: Yellowish Brown Sandy Clay (CL)

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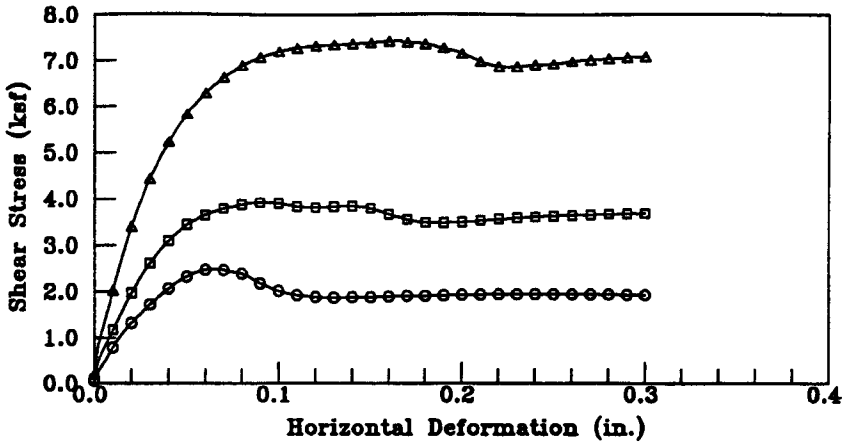
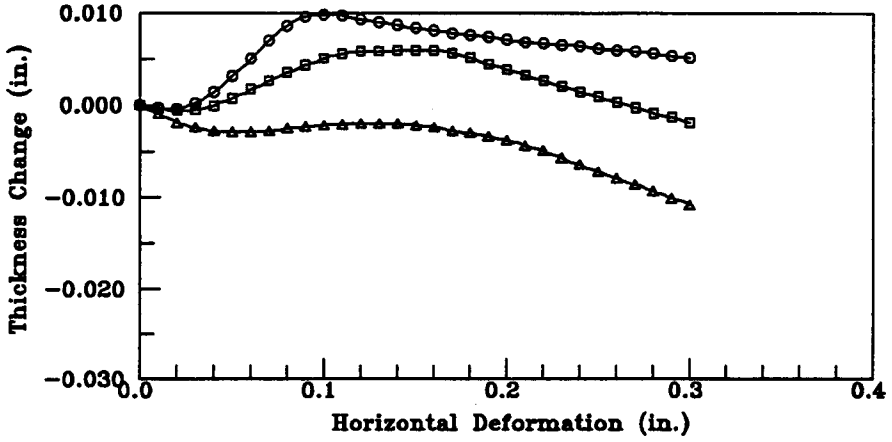
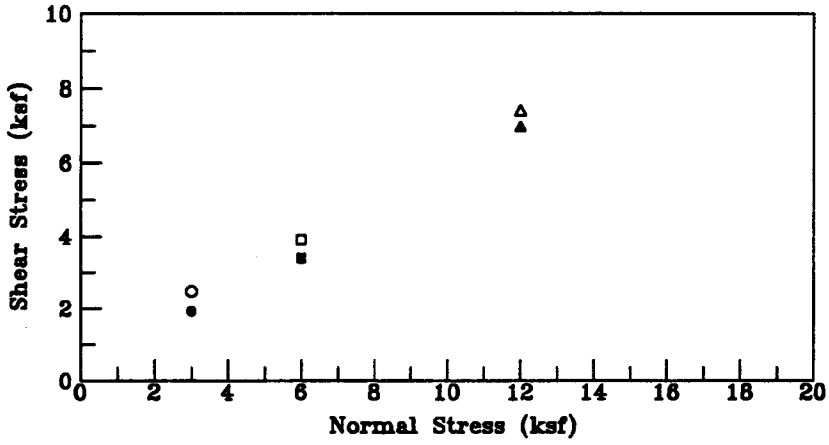
Figure B-107







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	3.000	2.477	●●●●●	1.923
□□□□□	6.000	3.912	■■■■■	3.410
△△△△△	12.000	7.425	▲▲▲▲▲	6.989

Boring No.: PE-15
Sample No.: D-10
Depth (ft.): 50.0
Sample Type: Undisturbed
Soil Type: Yellowish Brown Silty Sand (SM)

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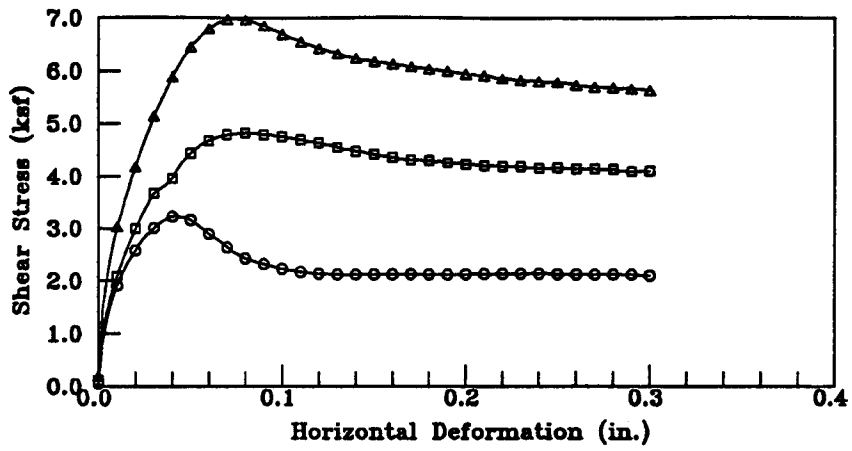
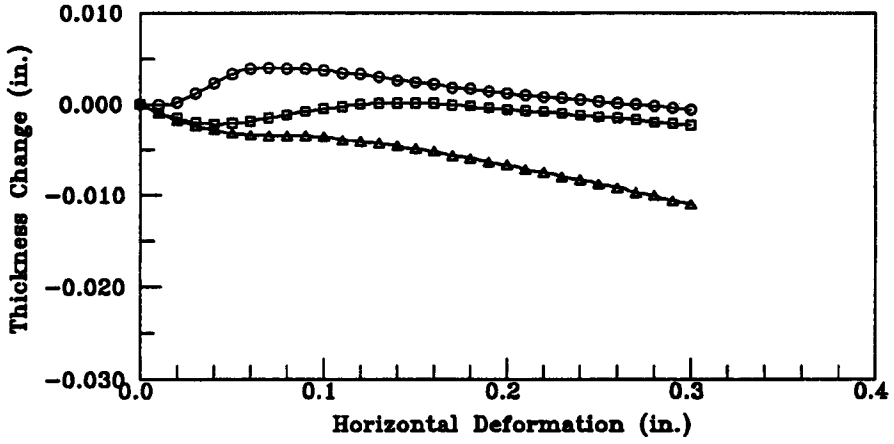
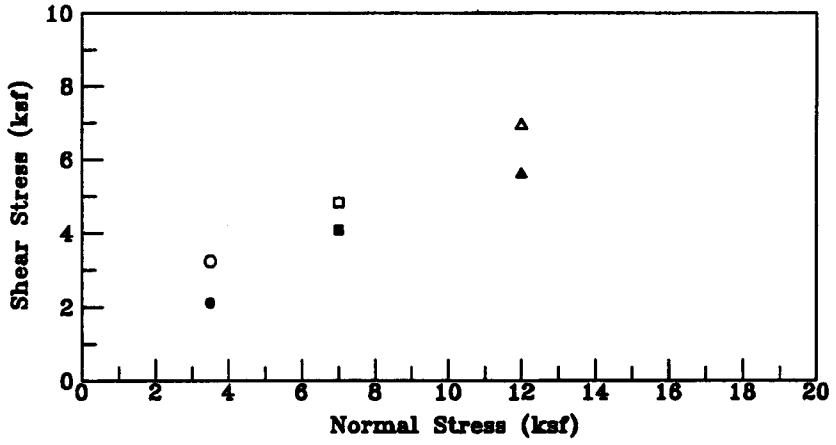
Figure B-108







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	3.500	3.233	●●●●●	2.123
□□□□□	7.000	4.829	■■■■■	4.090
△△△△△	12.000	6.975	▲▲▲▲▲	5.636

Boring No.: PE-15
Sample No.: D-14
Depth (ft.): 69.5
Sample Type: Undisturbed
Soil Type: Olive Sandy Lean Clay (CL)

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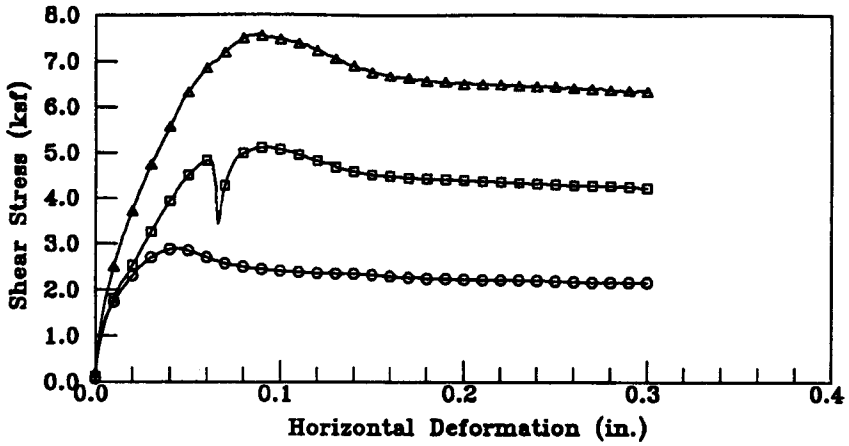
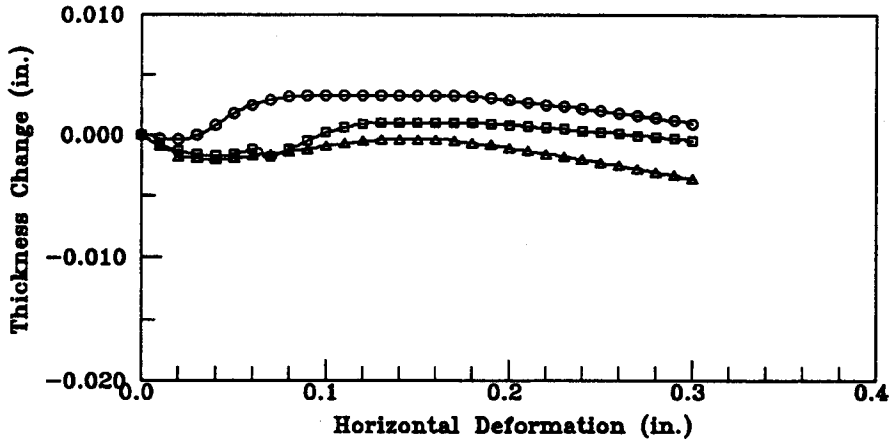
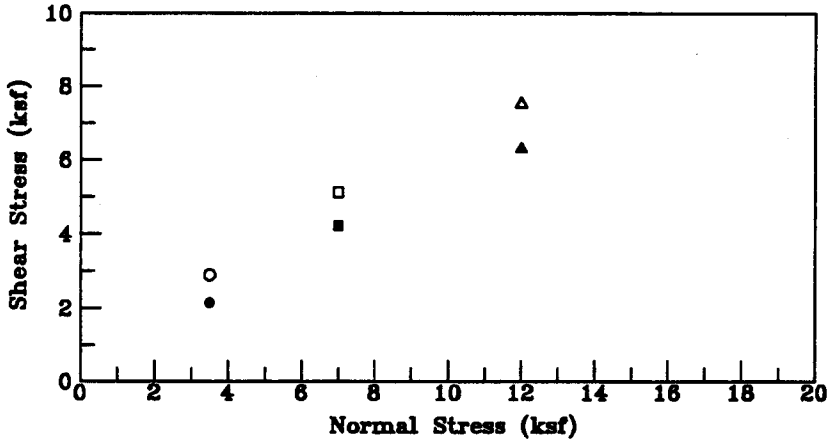
Figure B-109







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	3.500	2.894	●●●●●	2.150
□□□□□	7.000	5.122	■■■■■	4.224
△△△△△	12.000	7.569	▲▲▲▲▲	6.340

Boring No.: PE−16
Sample No.: D−15
Depth (ft.): 75.0
Sample Type: Undisturbed
Soil Type: Yellowish Brown Sandy Clay (SC) Stiff

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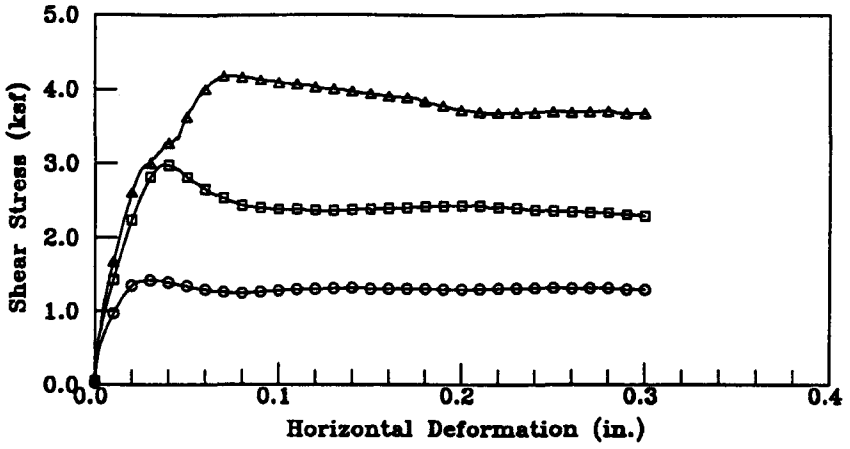
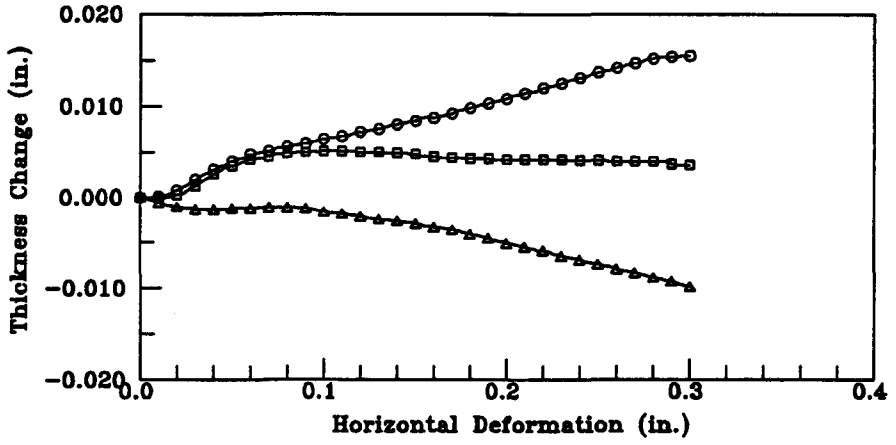
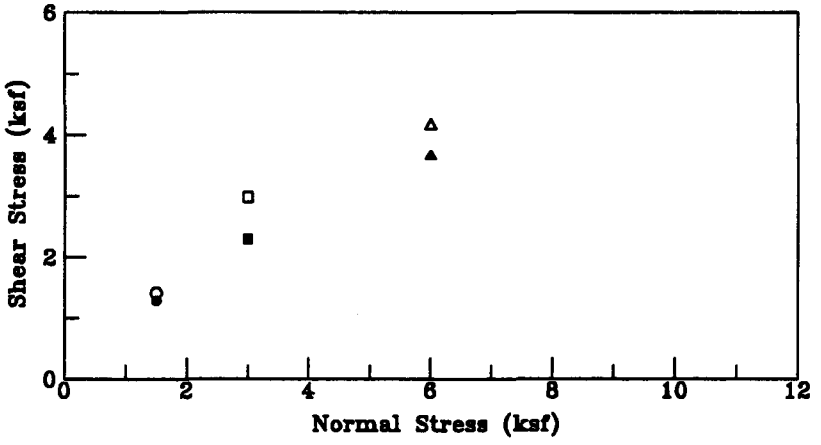
Figure B-110







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	1.500	1.412	●●●●●	1.286
□□□□□	3.000	2.981	■■■■■	2.291
△△△△△	6.000	4.184	▲▲▲▲▲	3.678

Boring No.: PE−17
Sample No.: D−5
Depth (ft.): 25.0
Sample Type: Undisturbed
Soil Type: Brown Silt w/ Sand (ML)

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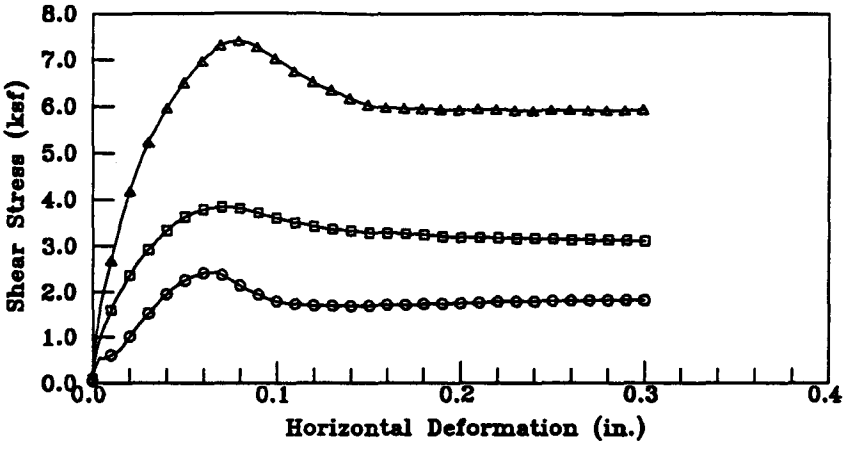
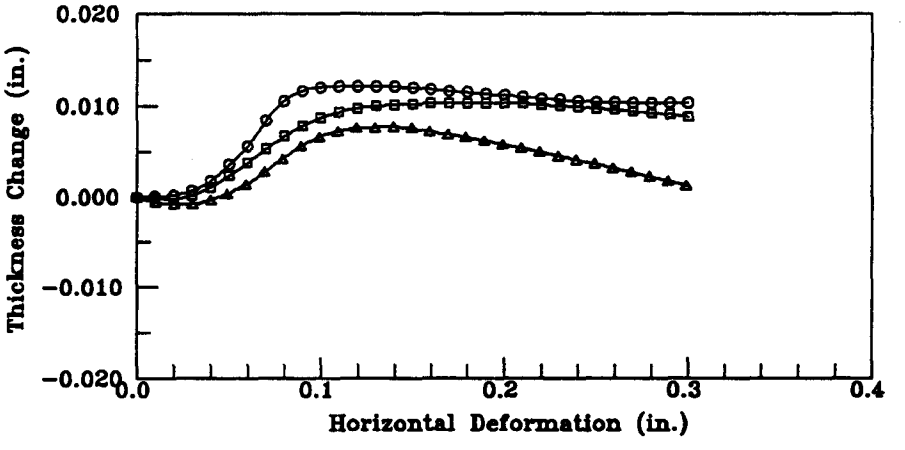
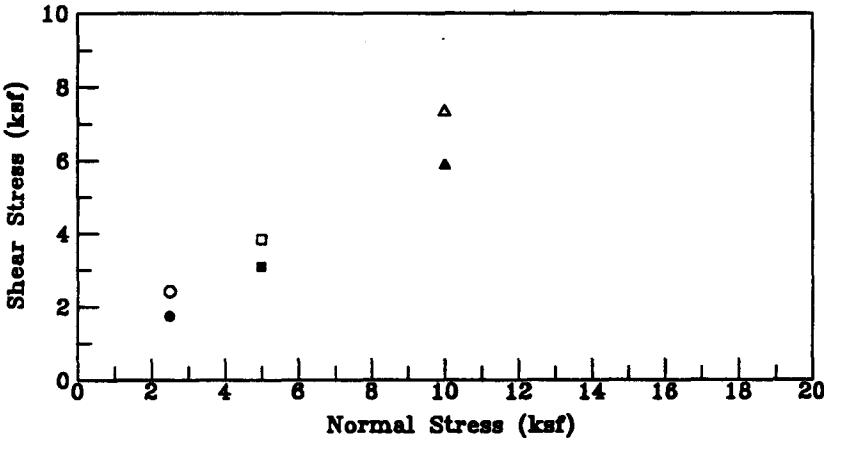
Figure B-111







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	2.500	2.425	●●●●●	1.748
□□□□□	5.000	3.843	■■■■■	3.097
△△△△△	10.000	7.391	▲▲▲▲▲	5.927

Boring No.: PE-17
Sample No.: D-9
Depth (ft.): 45.0
Sample Type: Undisturbed
Soil Type: Olive Brwn Poorly-Graded Sand w/ Silt

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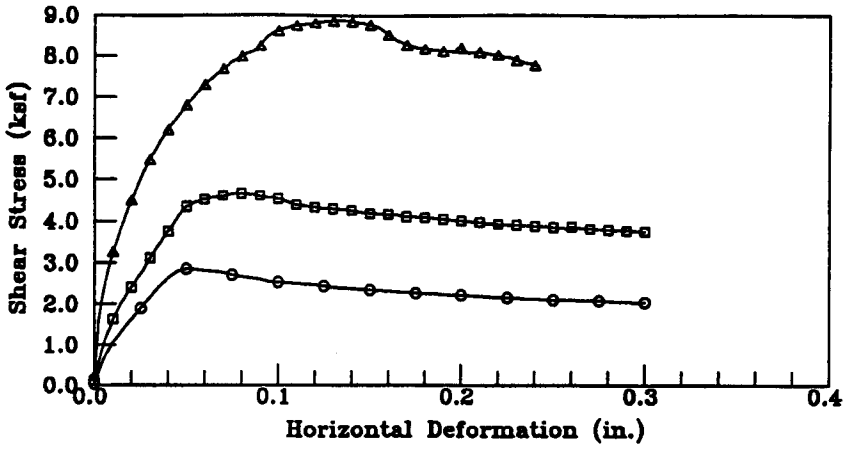
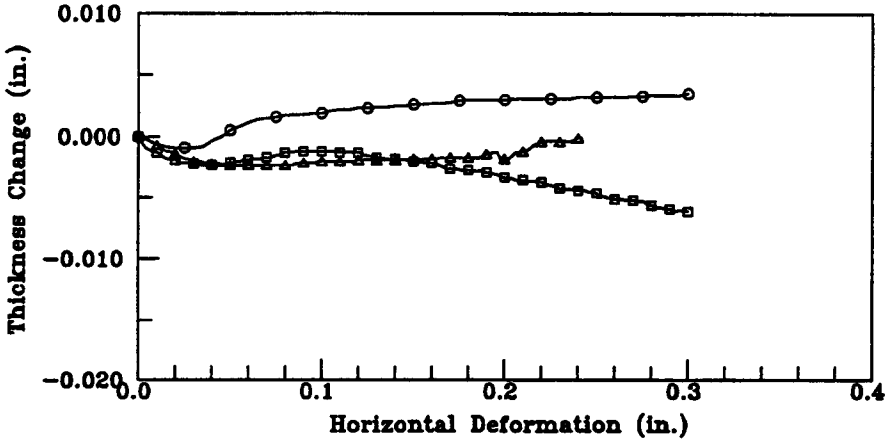
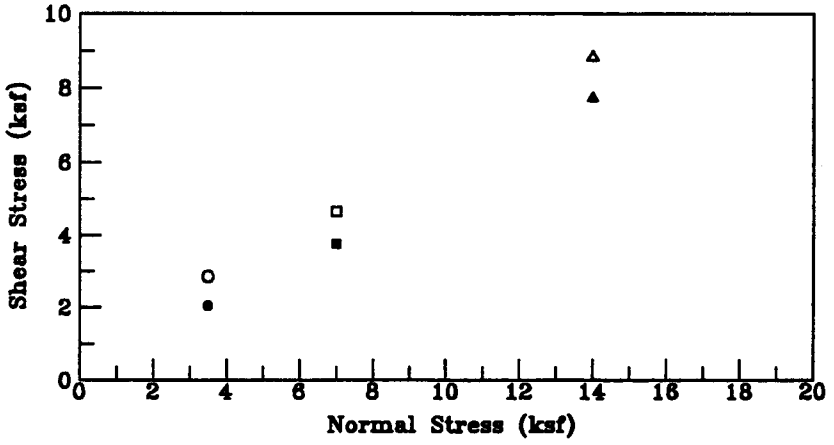
Figure B-112







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	3.500	2.854	2.052
□□□□□	7.000	4.663	3.767
△△△△△	14.000	8.879	7.769

Boring No.: PE-17
Sample No.: D-13
Depth (ft.): 65.0
Sample Type: Undisturbed
Soil Type: Olive Brown Lean Clay (CL)

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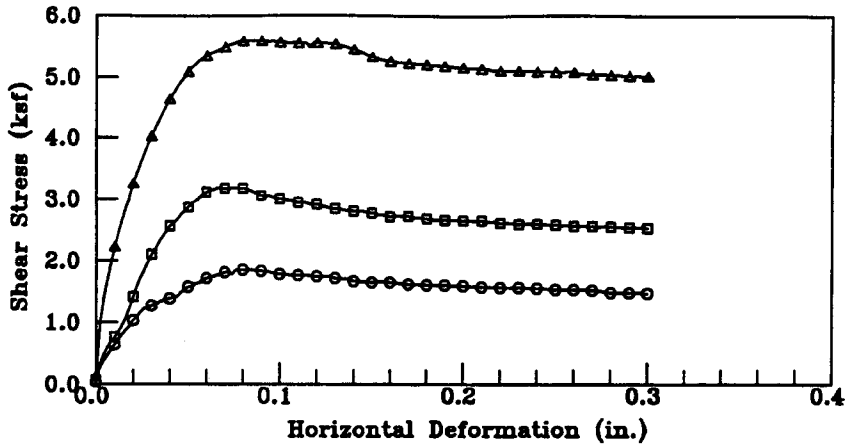
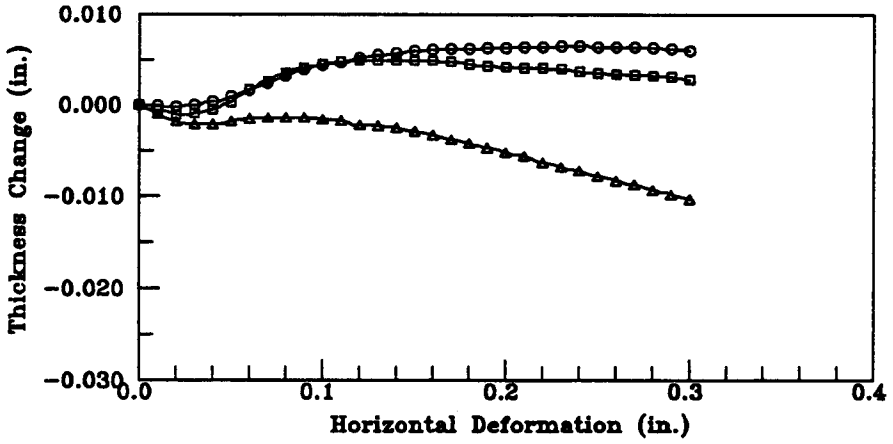
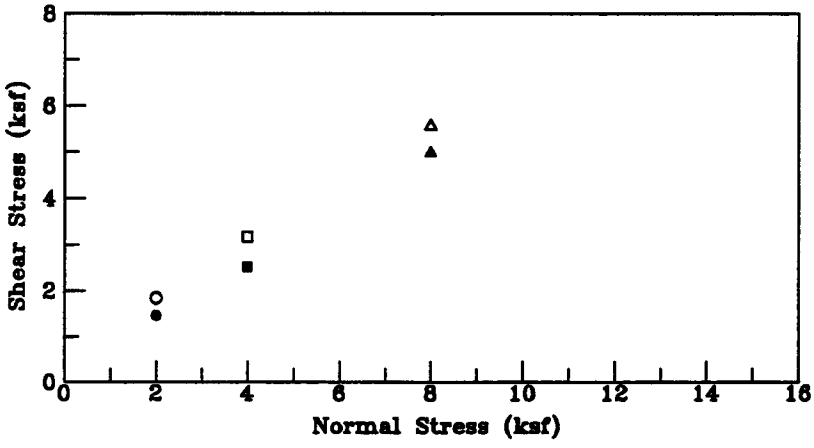
Figure B-113







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	2.000	1.849	●●●●●	1.469
□□□□□	4.000	3.177	■■■■■	2.528
△△△△△	8.000	5.602	▲▲▲▲▲	5.016

Boring No.: PE-19
Sample No.: D-8
Depth (ft.): 40.0
Sample Type: Undisturbed
Soil Type: Olive Brown Silt (ML)

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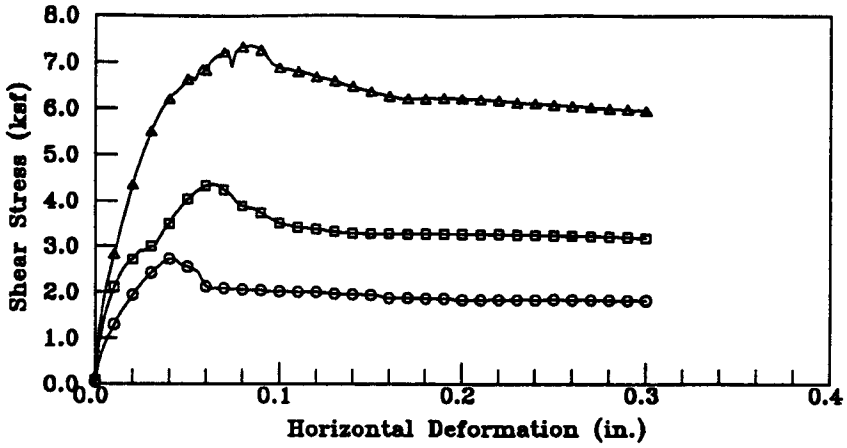
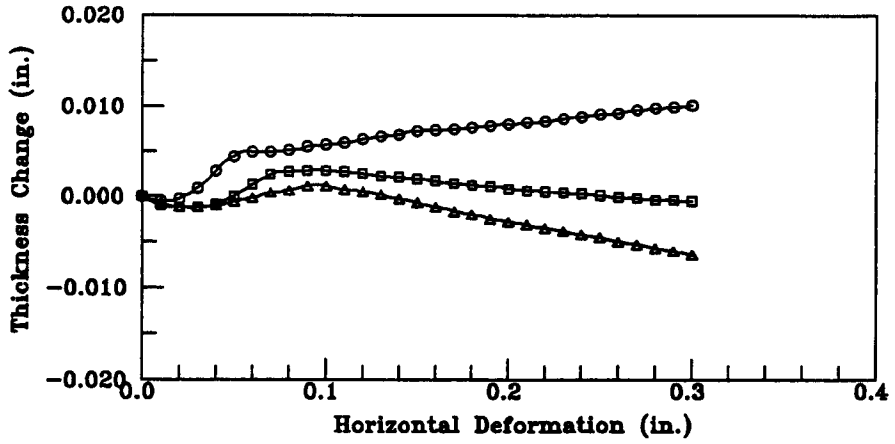
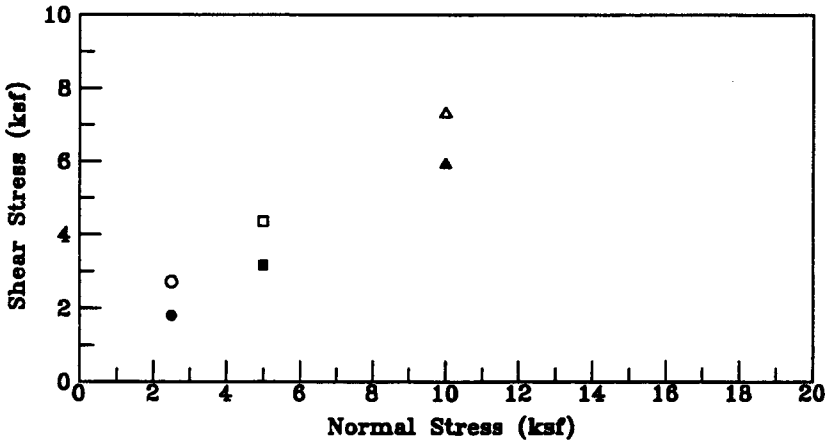
Figure B-114







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
●●●●●	2.500	2.718	●●●●●	1.811
■■■■■	5.000	4.360	■■■■■	3.177
▲▲▲▲▲	10.000	7.351	▲▲▲▲▲	5.948

Boring No.: PE−19
Sample No.: D−10
Depth (ft.): 49.0
Sample Type: Undisturbed
Soil Type: Dark Olive Silty (ML)

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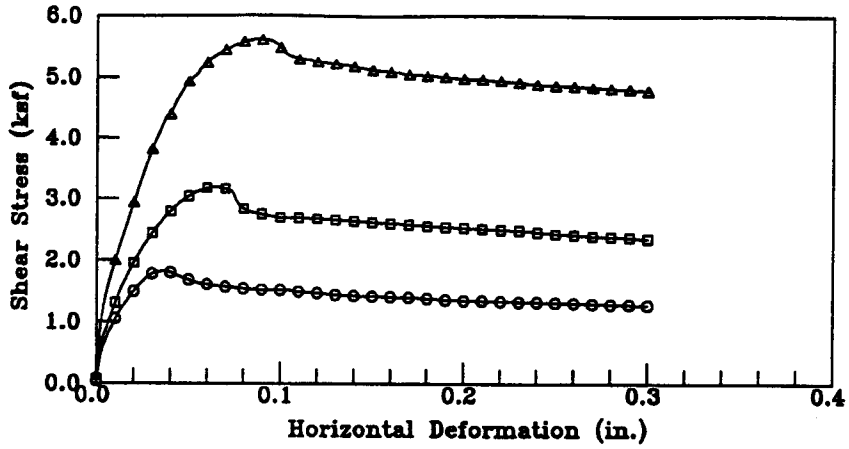
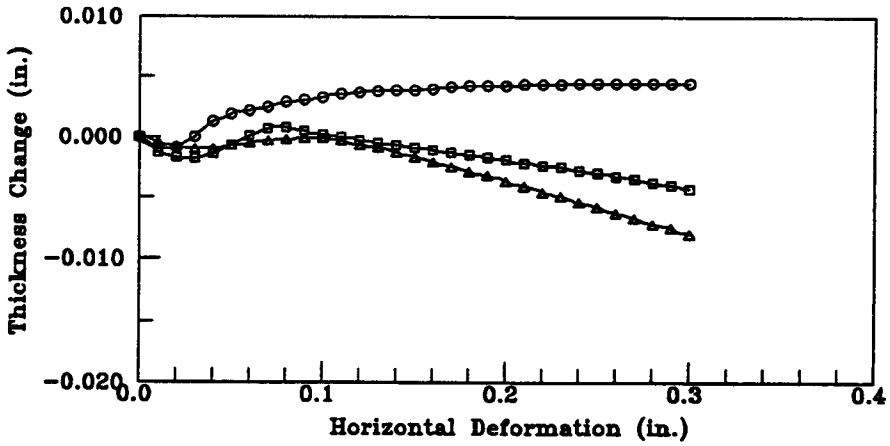
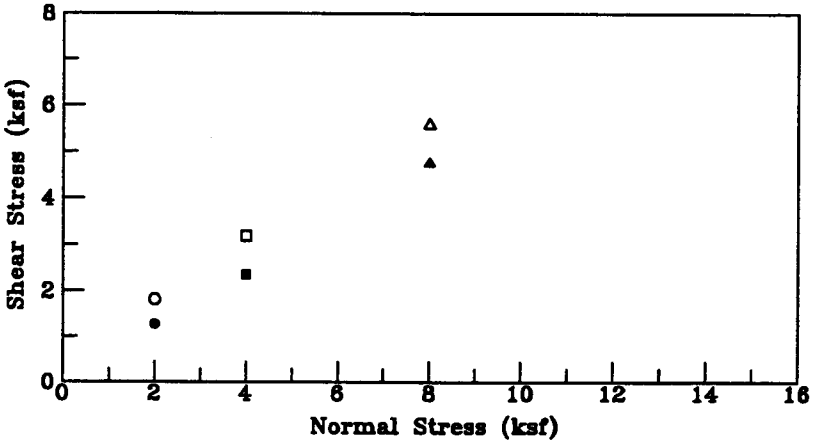
Figure B-115







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	2.000	1.818	●●●●●	1.276
□□□□□	4.000	3.188	■■■■■	2.357
△△△△△	8.000	5.618	▲▲▲▲▲	4.785

Boring No.: PE-20
Sample No.: D-7
Depth (ft.): 35.0
Sample Type: Undisturbed
Soil Type: Olive Yellow Lean Clay (CL)

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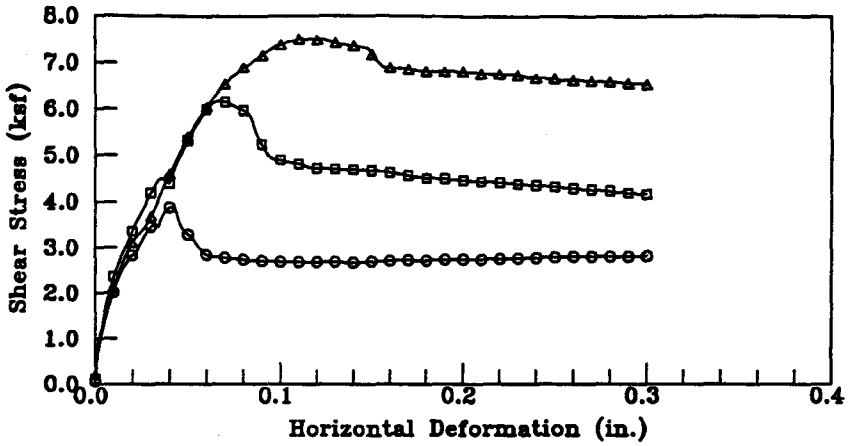
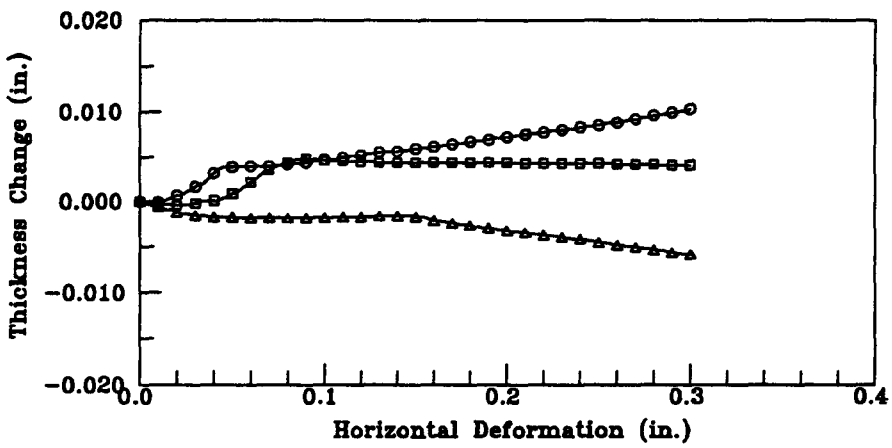
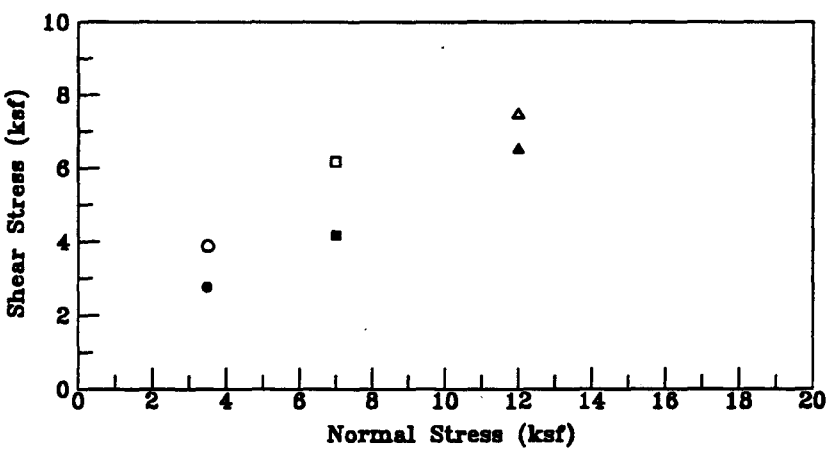
Figure B-116







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	3.500	3.882	2.777
□□□□□	7.000	6.182	4.182
△△△△△	12.000	7.513	6.549

Boring No.: PE−20
Sample No.: D−13
Depth (ft.): 65.0
Sample Type: Undisturbed
Soil Type: Dark Olive Silt (ML) stiff

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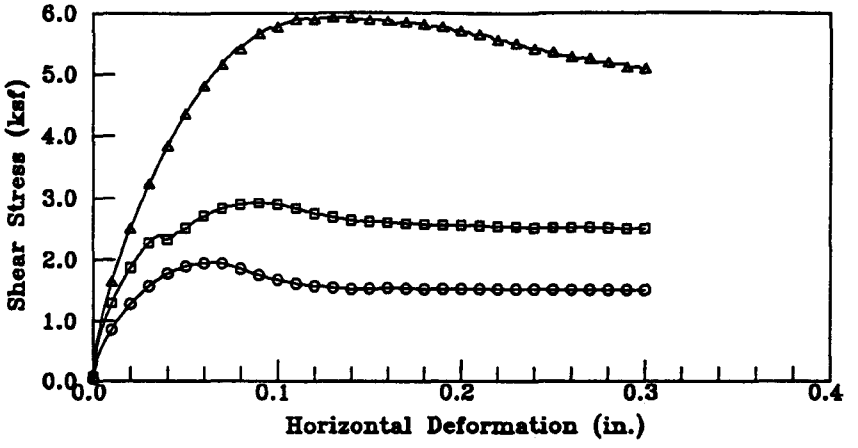
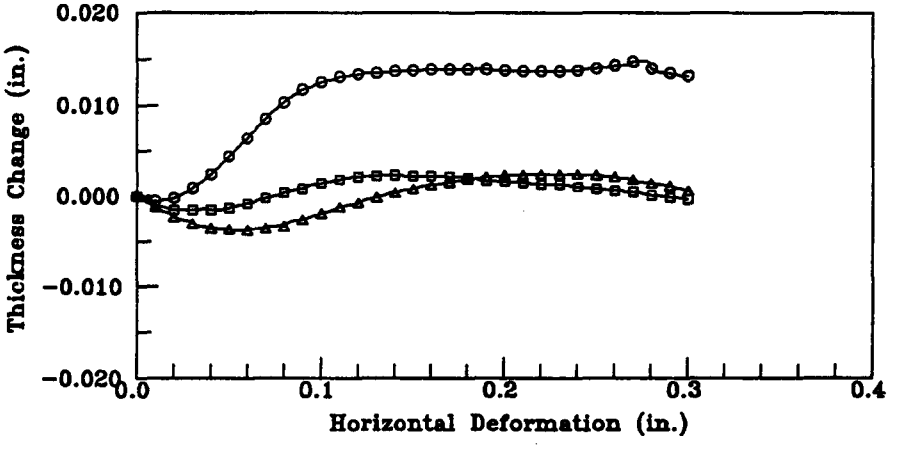
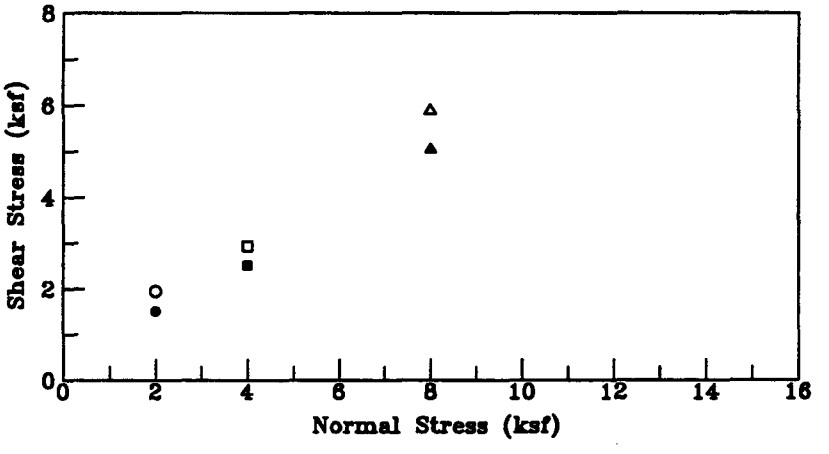
Figure B-117







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	2.000	1.957	1.516
□□□□□	4.000	2.935	2.518
△△△△△	8.000	5.931	5.079

Boring No.: PE−21
Sample No.: D−7
Depth (ft.): 35.0
Sample Type: Undisturbed
Soil Type: Yellowish Brown Sandy Clay (CL)

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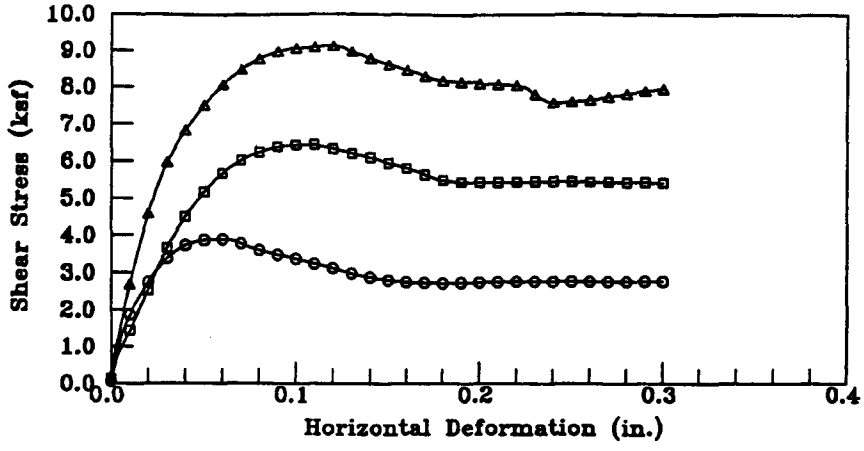
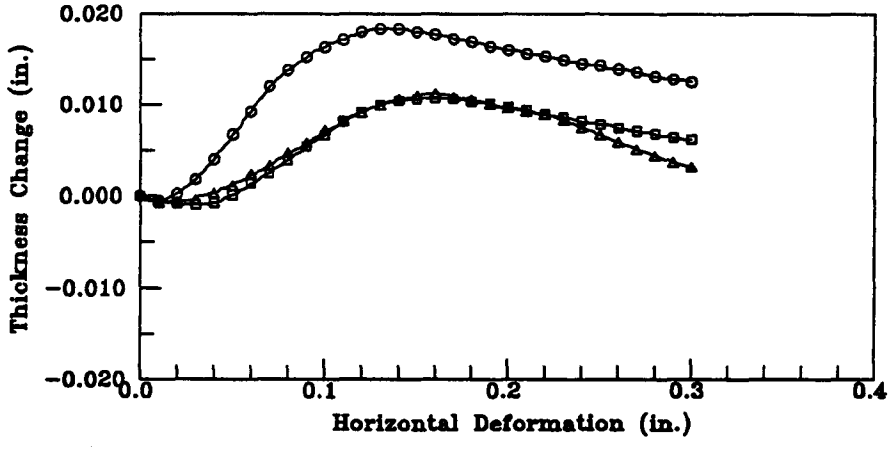
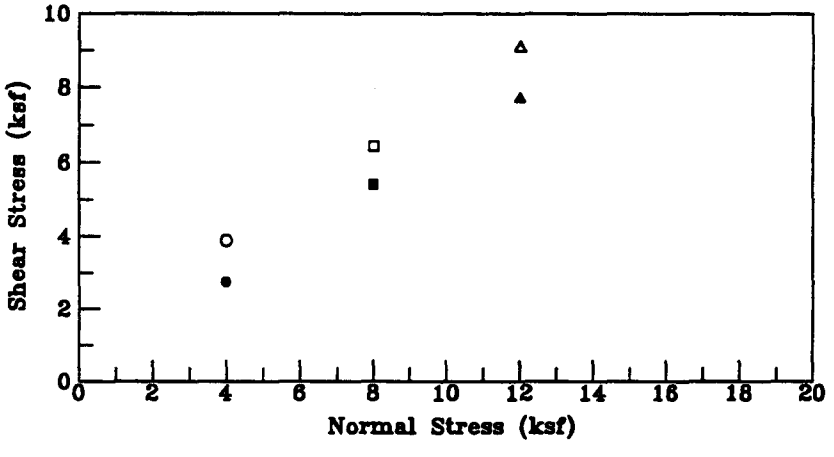
Figure B-118







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	4.000	3.888	●●●●●	2.759
□□□□□	8.000	6.448	■■■■■	5.418
△△△△△	12.000	9.124	▲▲▲▲▲	7.743

Boring No.: PE-24
Sample No.: D-15
Depth (ft.): 75.0
Sample Type: Undisturbed
Soil Type: Dark Grey Silty Sand (SM)

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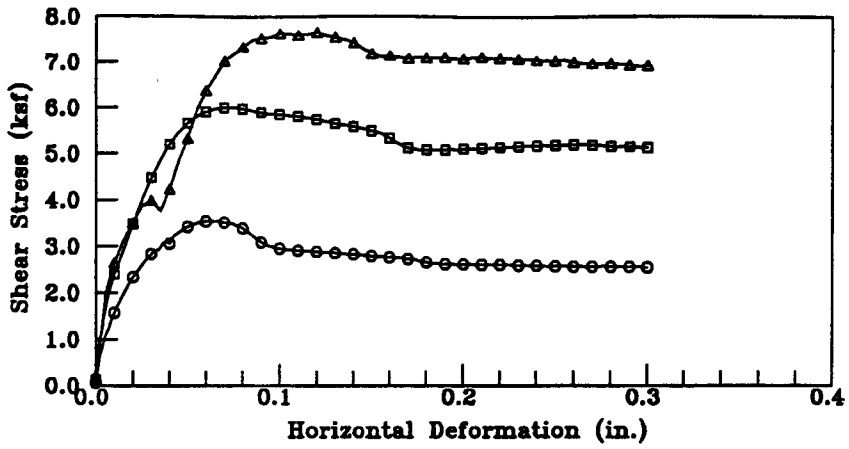
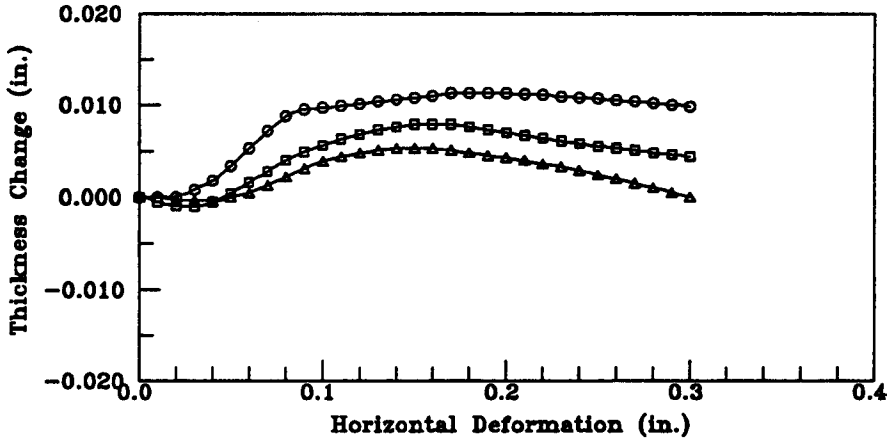
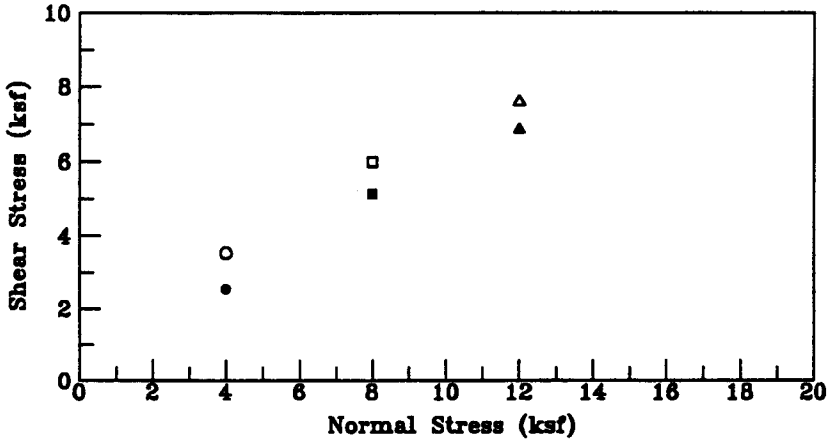
Figure B-119







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	4.000	3.532	2.544
□□□□□	8.000	6.000	5.140
△△△△△	12.000	7.652	6.908

Boring No.: PE-25
Sample No.: D-13
Depth (ft.): 65.0
Sample Type: Undisturbed
Soil Type: Olive Brown Silty Sand (SM)

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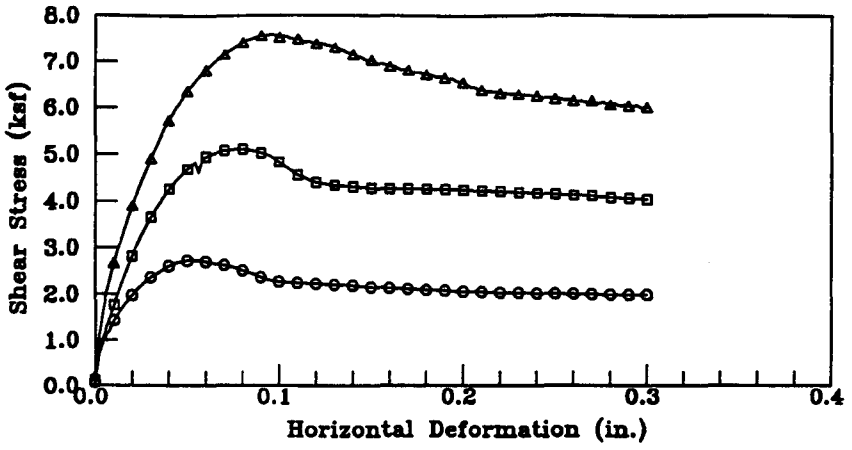
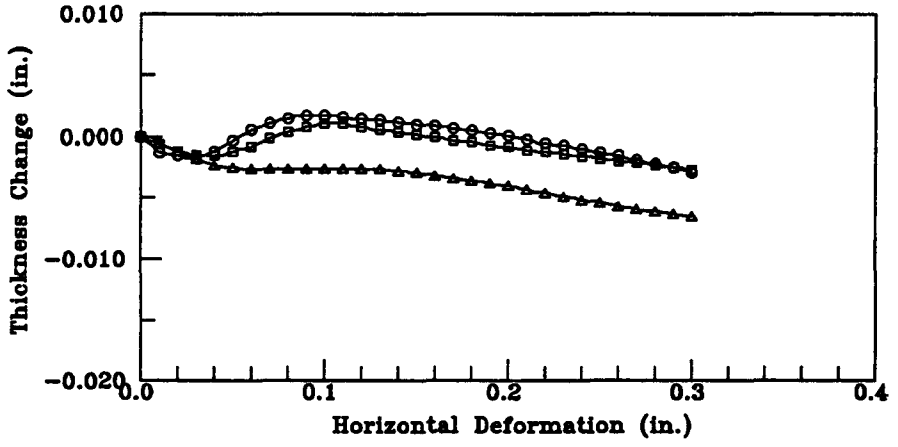
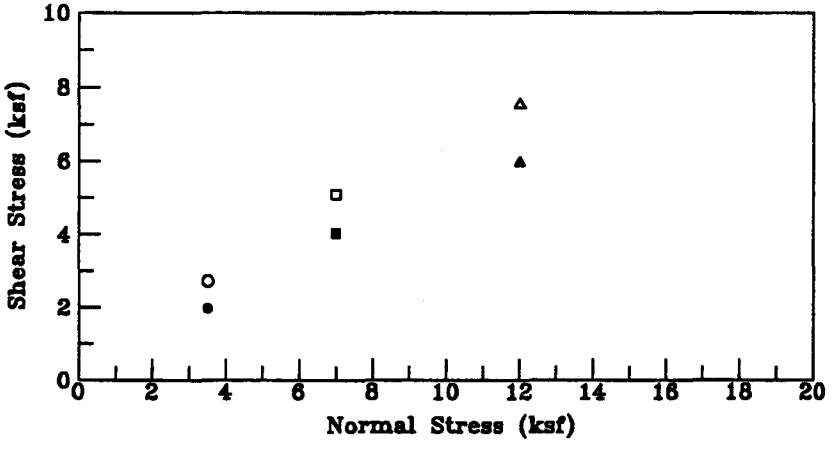
Figure B-120







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	3.500	2.723	●●●●●	1.978
□□□□□	7.000	5.102	■■■■■	4.033
△△△△△	12.000	7.581	▲▲▲▲▲	6.005

Boring No.: PE−26
Sample No.: D−9
Depth (ft.): 57.0
Sample Type: Undisturbed
Soil Type: Olive Brown Sandy Clay (CL)

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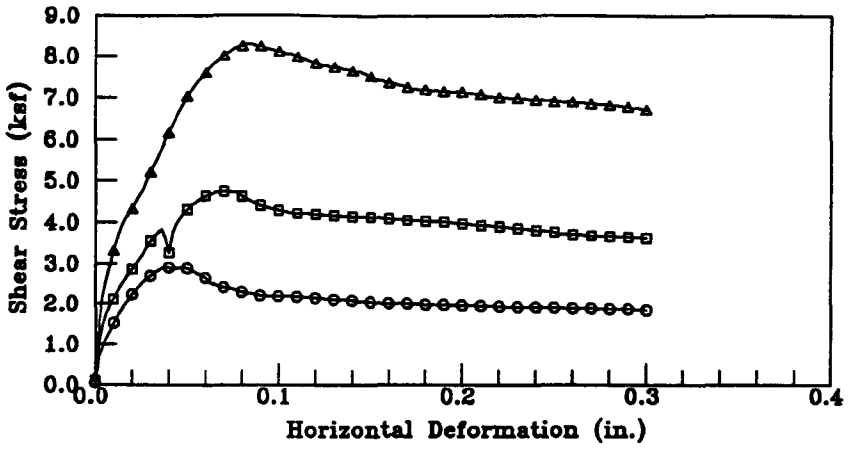
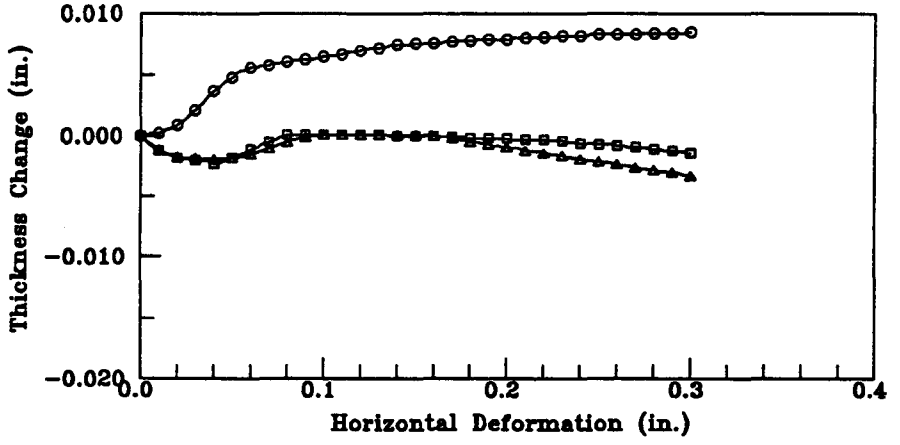
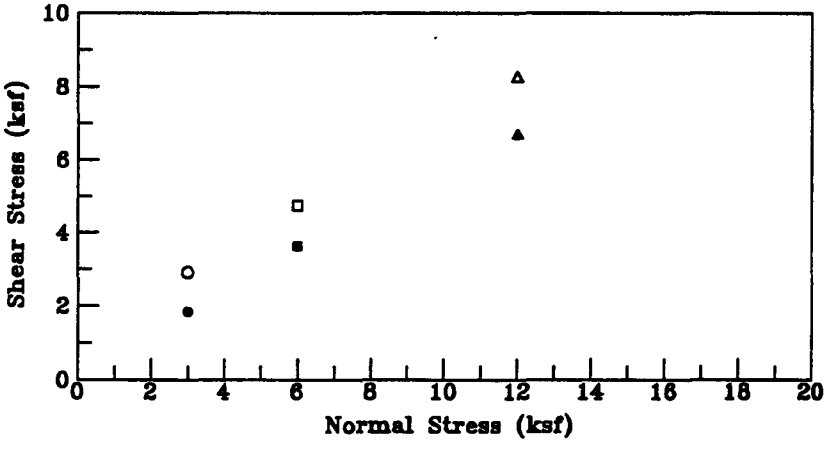
Figure B-121







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	3.000	2.913	●●●●●	1.845
□□□□□	6.000	4.755	■■■■■	3.629
△△△△△	12.000	8.288	▲▲▲▲▲	6.724

Boring No.: PE−27
Sample No.: D−11
Depth (ft.): 55.0
Sample Type: Undisturbed
Soil Type: Dark Olive Silt (ML) Stiff

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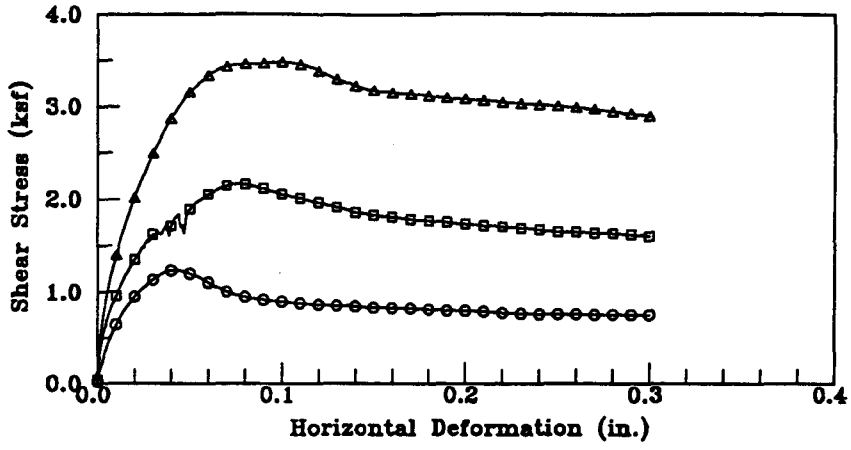
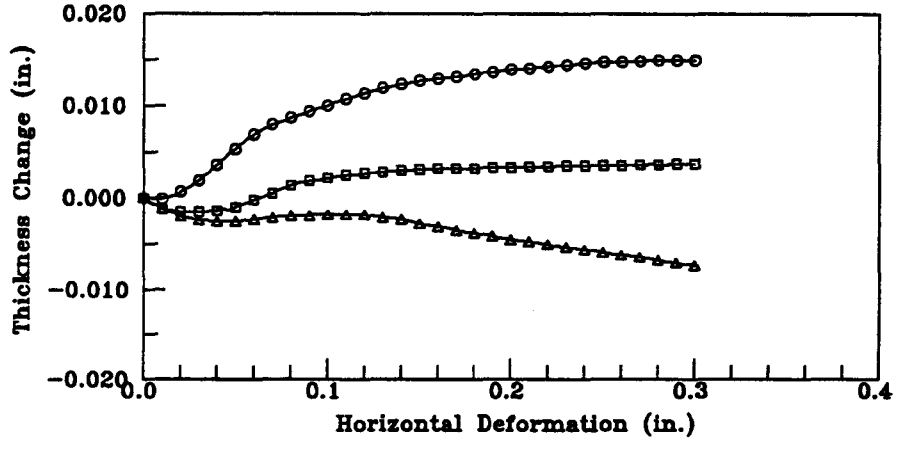
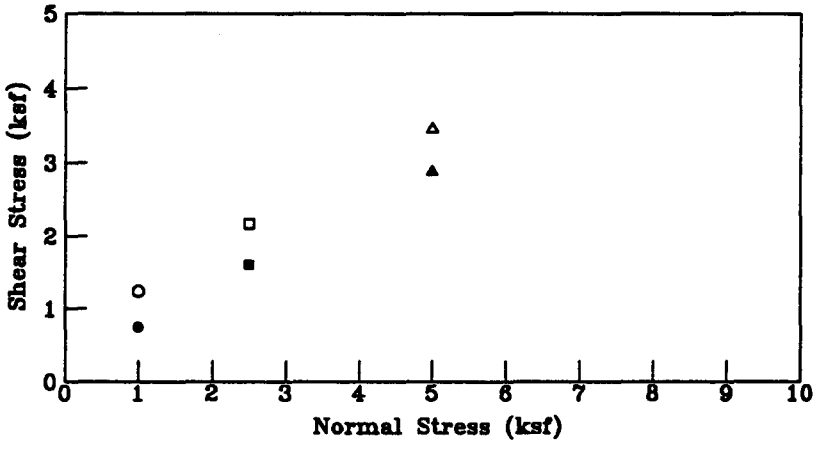
Figure B-122







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	1.000	1.239	●●●●●	0.752
□□□□□	2.500	2.173	■■■■■	1.607
△△△△△	5.000	3.482	▲▲▲▲▲	2.899

Boring No.: PE−28
Sample No.: D−9
Depth (ft.): 45.0
Sample Type: Undisturbed
Soil Type: Olive Fat Clay (CL)

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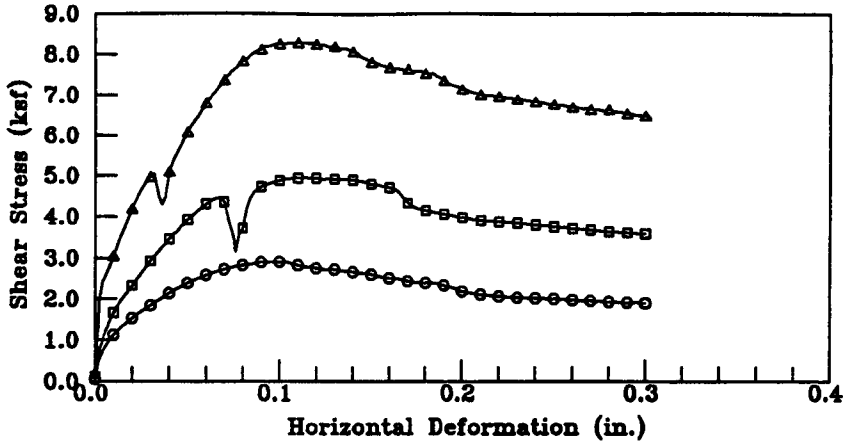
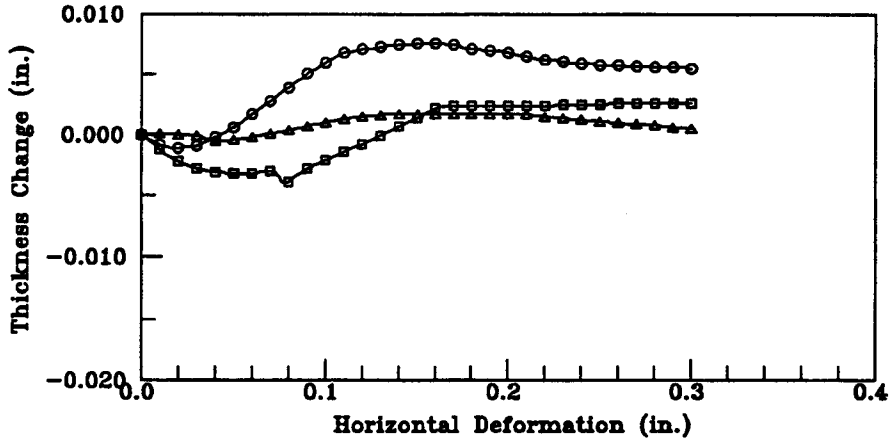
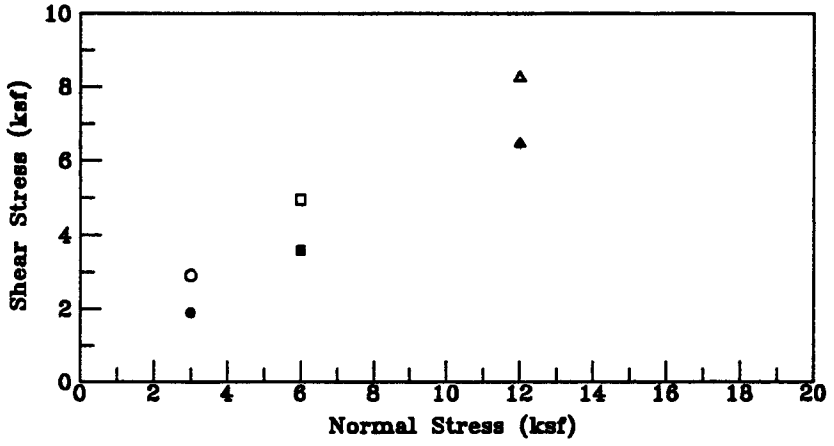
Figure B-123







	Normal Stress (ksf)	Peak Shear Stress (ksf)	Residual Shear Stress (ksf)
○○○○○	3.000	2.913	1.898
□□□□□	6.000	4.954	3.592
△△△△△	12.000	8.298	6.496

Boring No.: PE−28
Sample No.: D−15
Depth (ft.): 75.0
Sample Type: Undisturbed
Soil Type: Dark Olive Lean Clay (CL) Stiff

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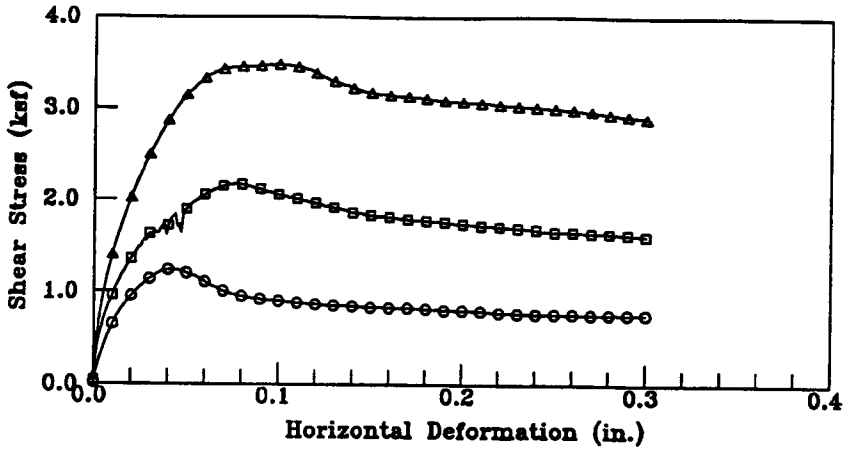
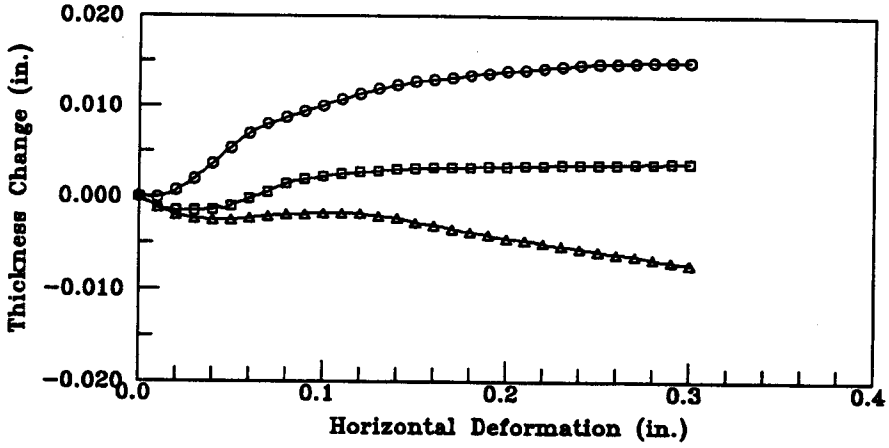
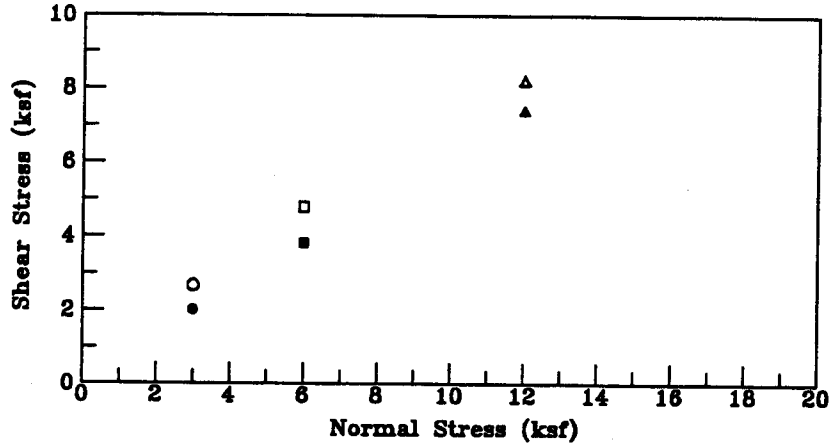
Figure B-124







	Normal Stress (ksf)	Peak Shear Stress (ksf)		Residual Shear Stress (ksf)
○○○○○	3.000	2.680	●●●●●	2.023
□□□□□	6.000	4.788	■■■■■	3.822
△△△△△	12.000	8.240	▲▲▲▲▲	7.424

Boring No.: PE-31
Sample No.: D-13
Depth (ft.): 65.0
Sample Type: Undisturbed
Soil Type: Dark Olive Grey Sandy Silt (ML)

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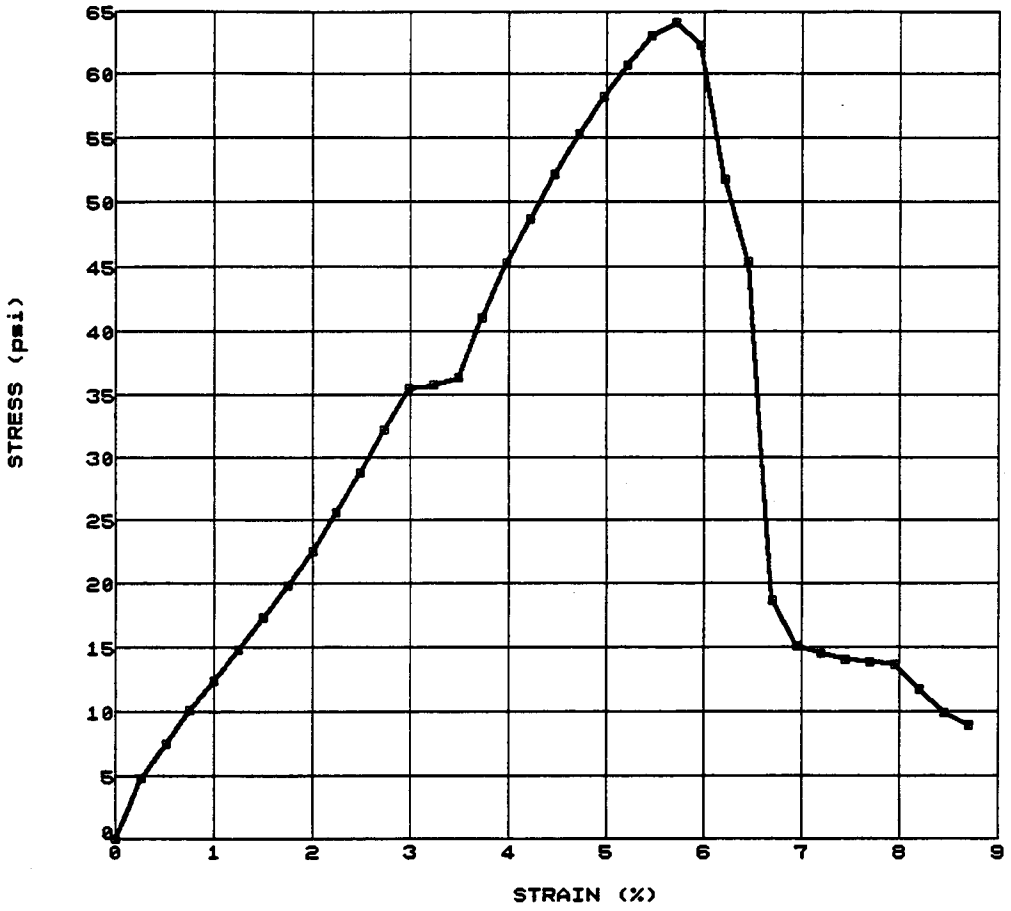
Figure B-125



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-20	D-11	55.0	97.1	26.6	CL	64.1

Specimen Dimension:

Height (H) = 4.028in.

Diameter (D) = 2.425 in.

H/D = 1.7

Strain rate = 1 %/min.

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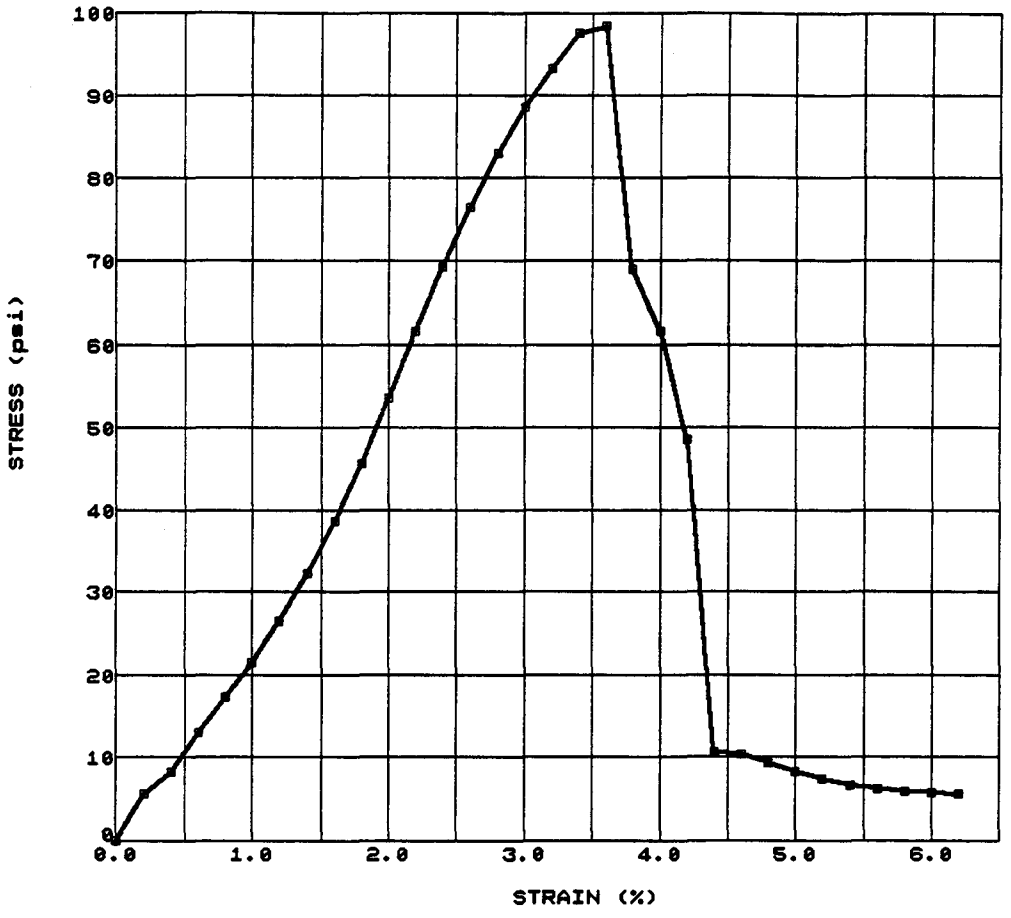
Figure B-126



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-20	D-15	75.0	102.0	23.5	ML	98.5

Specimen Dimension:

Height (H) = 5.003in.

Diameter (D) = 2.425 in.

H/D = 2.1

Strain rate = 1 %/min.

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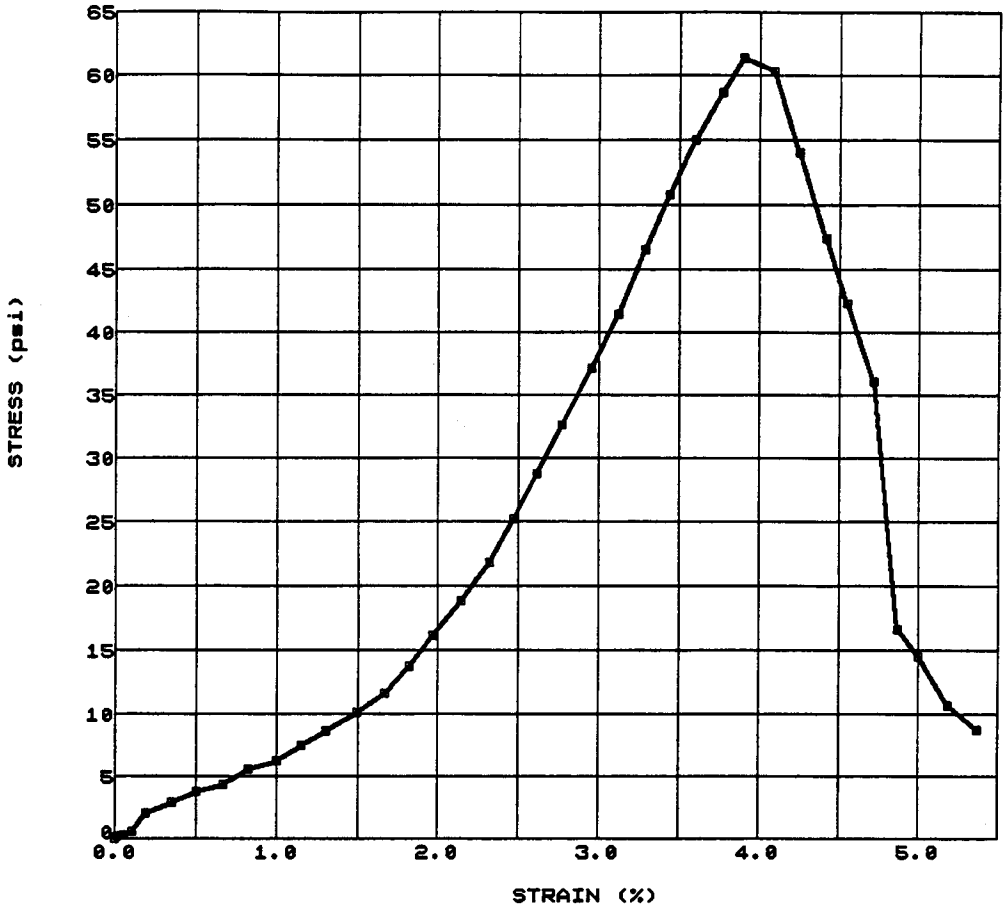
Figure B-127



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-27	D-13	65.0	101.4	24.6	ML	61.4

Specimen Dimension:

Height (H) = 5.00 in.

Diameter (D) = 2.42 in.

H/D = 2.1

Strain rate = 1 %/min.

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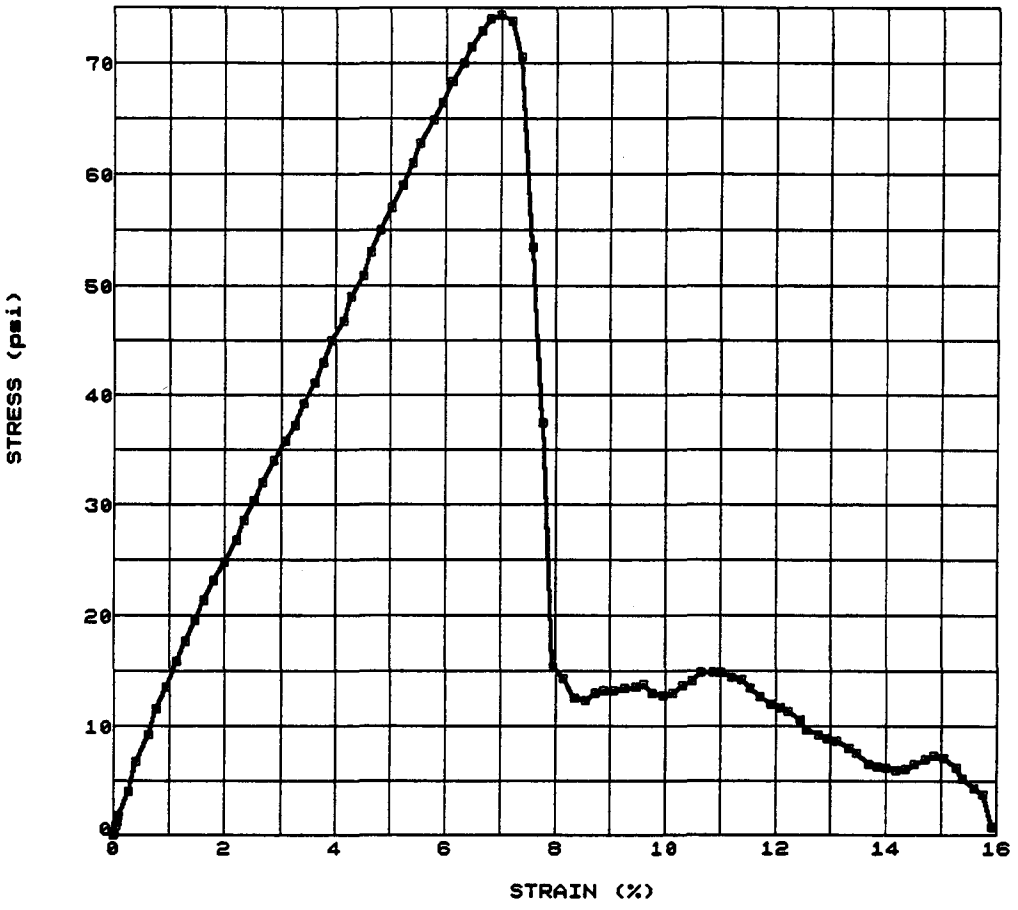
Figure B-128



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-27	D-15	75.0	101.2	24.6	ML	74.3

Specimen Dimension:

Height (H) = 5.00 in.

Diameter (D) = 2.42 in.

H/D = 2.1

Strain rate = 1 %/min.

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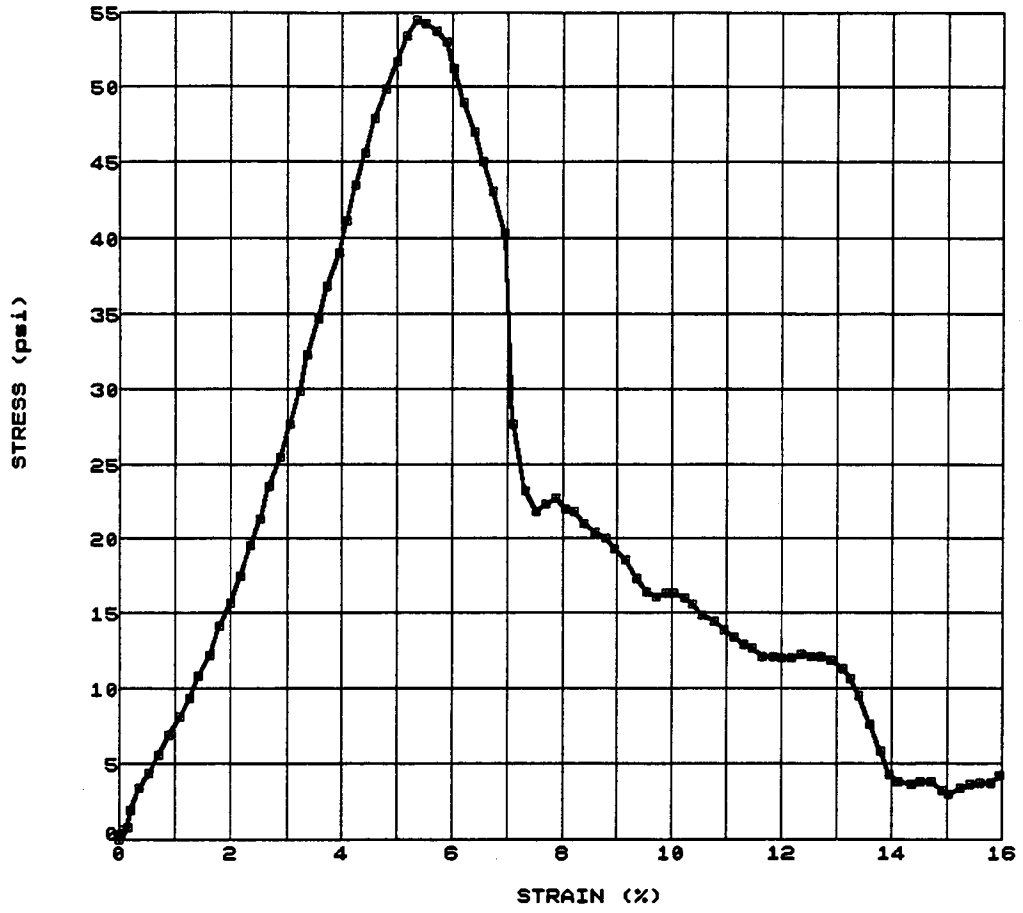
Figure B-129



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-28	D-11	55.0	100.4	25.5	ML	54.5

Specimen Dimension:

Height (H) = 5.00 in.

Diameter (D) = 2.42 in.

H/D = 2.1

Strain rate = 1 %/min.

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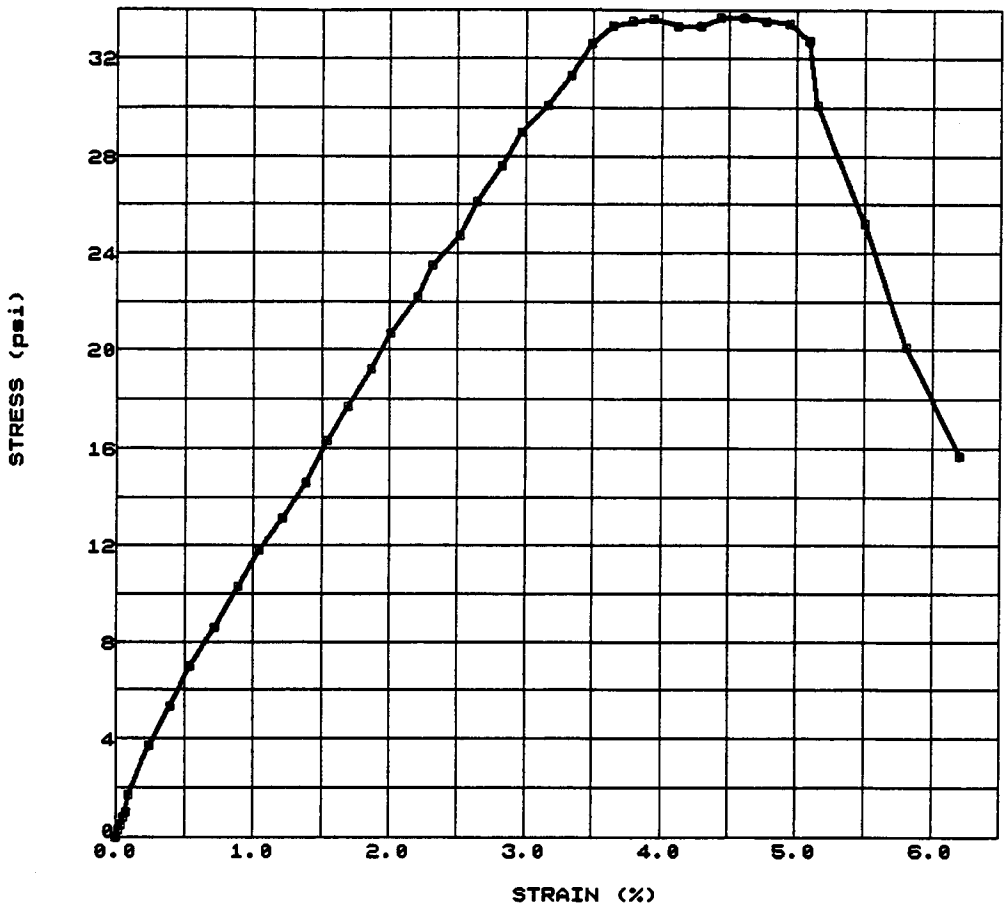
Figure B-130



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-28	D-13	65.0	102.7	22.0	ML	33.7

Specimen Dimension:

Height (H) = 5.00 in.

Diameter (D) = 2.42 in.

H/D = 2.1

Strain rate = 1 %/min.

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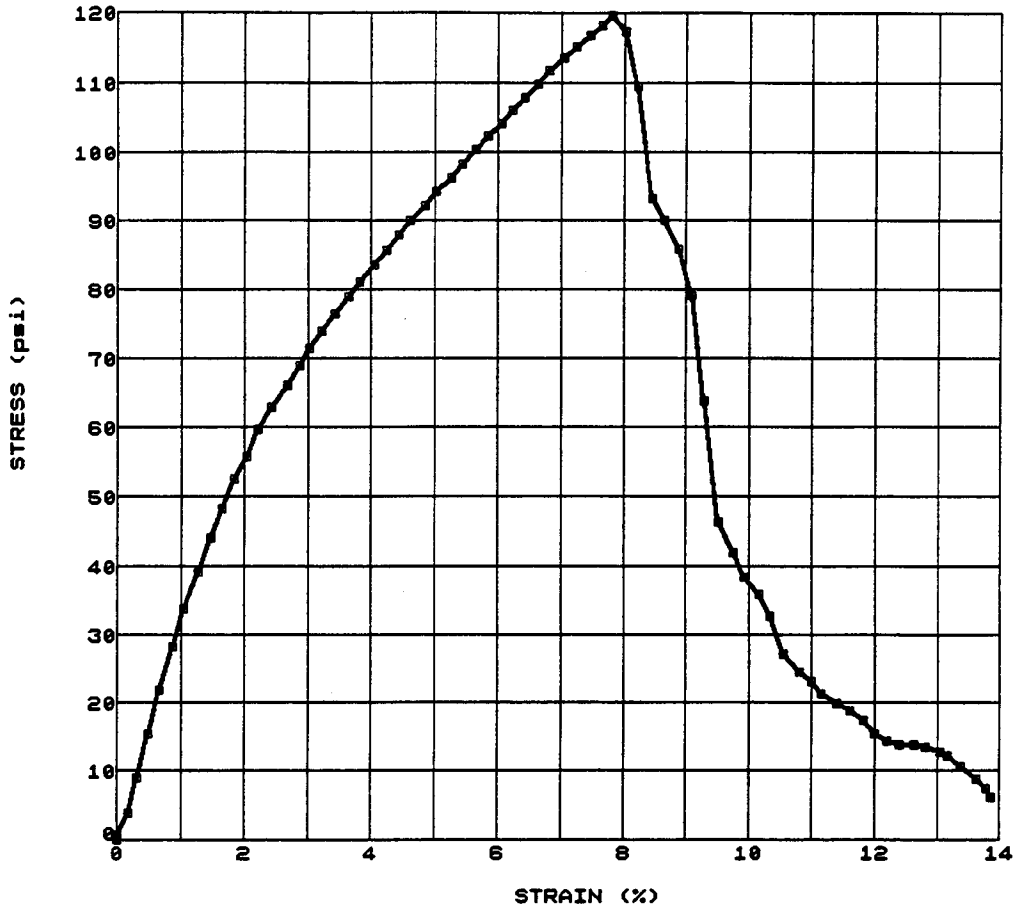
Figure B-131



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft)	DRY DENSITY(pcf)	MOISTURE CONTENT(%)	SOIL TYPE	MAX. STRESS(psi)
□	PE-29	D-15	75.0	89.7	30.9	CL	119.5

Specimen Dimension:

Height (H) = 5.055in.

Diameter (D) = 2.425 in.

H/D = 2.1

Strain rate = 1 %/min.

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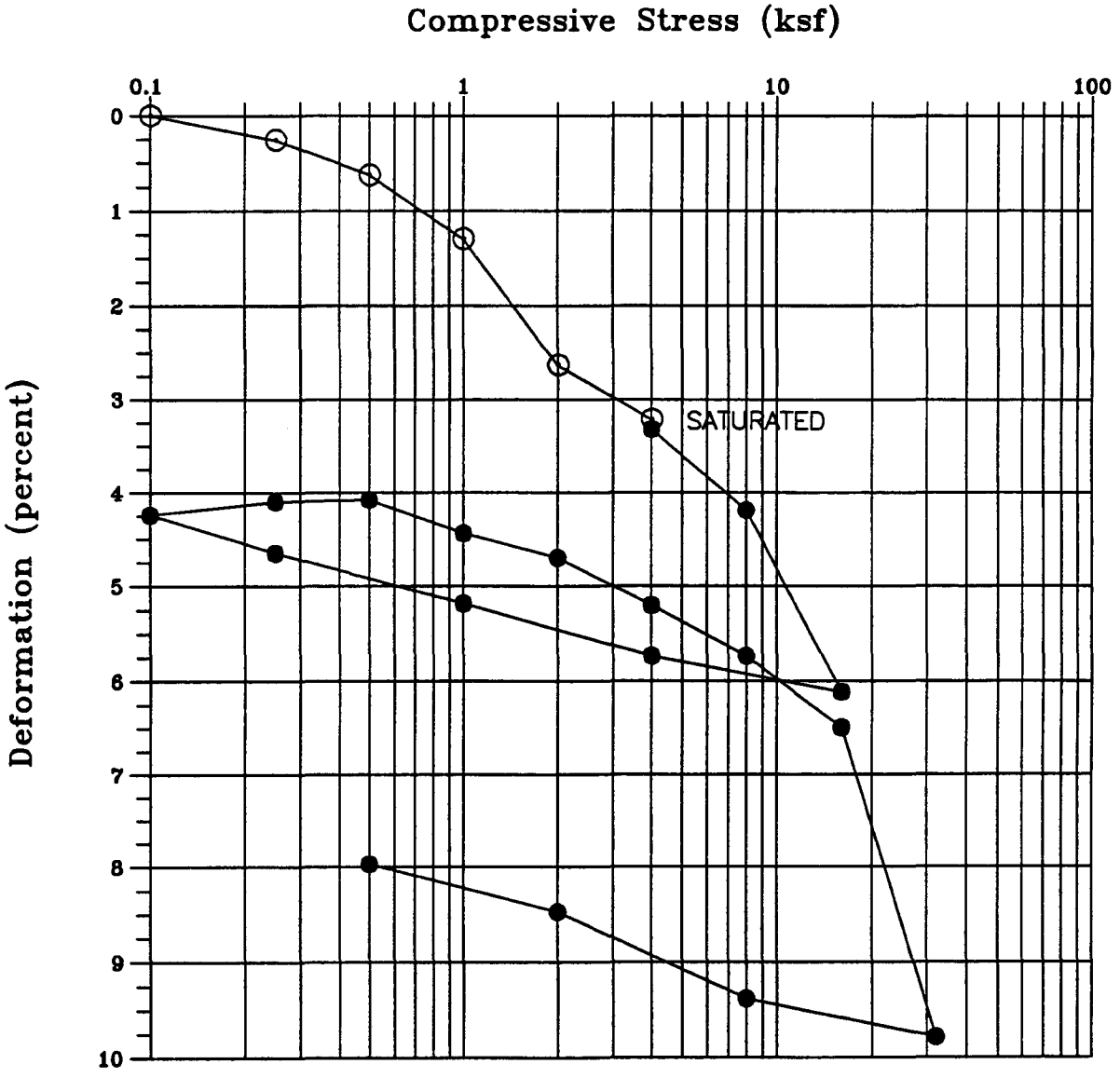
Figure B-132



Boring No.:	PE–1
Sample No.:	D–7
Depth(ft.):	35
Initial Dry Density(pcf)	104.5
Initial Moisture Content(pct)	18.9
Initial Void Ratio:	0.613
Final Dry Density(pcf):	114.0
Final Moisture Content(pct):	19.1
Soil Type:	CL

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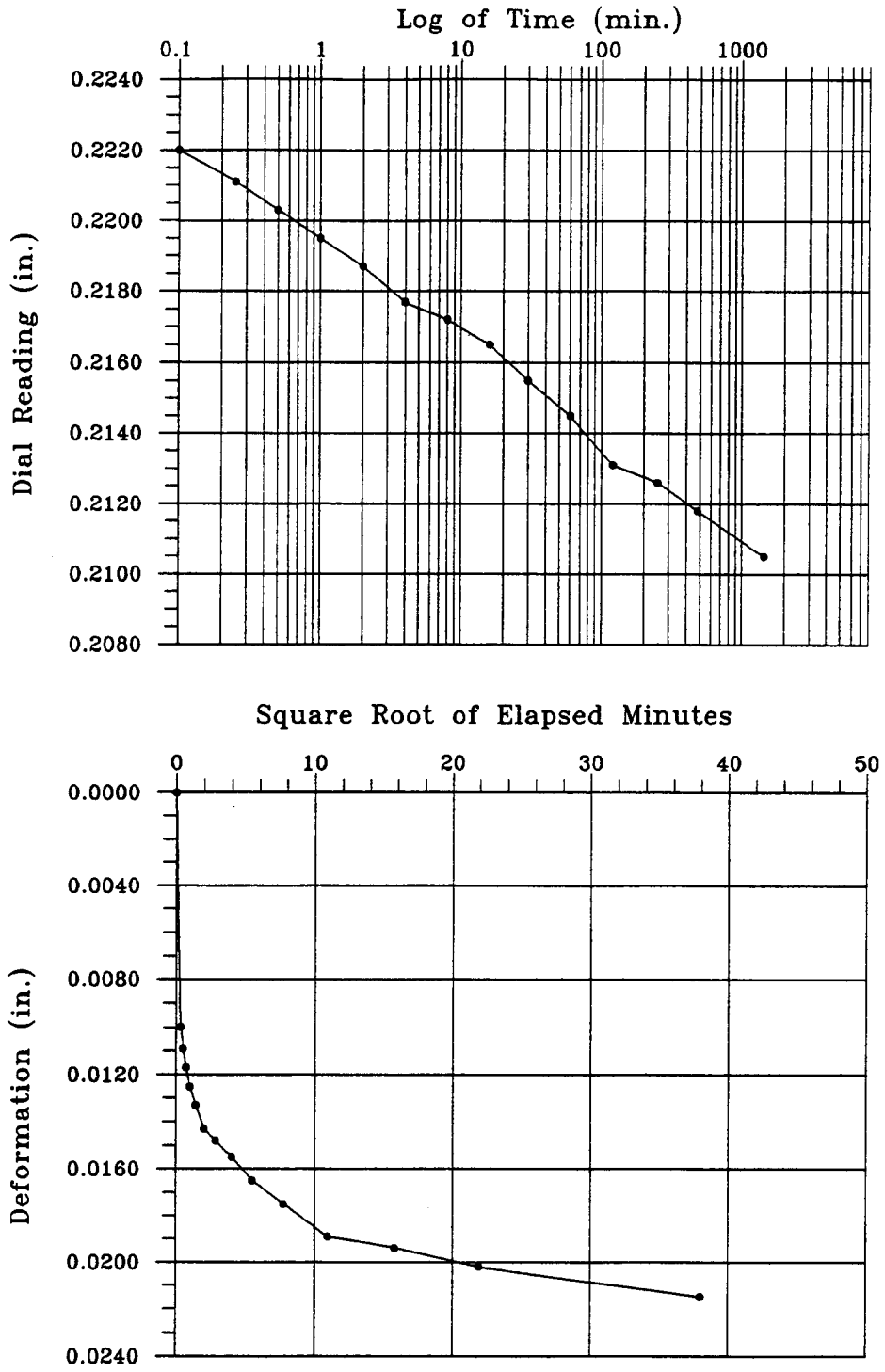
Figure B-133



BORING NO.: PE-1
SAMPLE NO.: D-7
DEPTH(ft.): 35
COMPRESSIVE STRESS (ksf): 16.0

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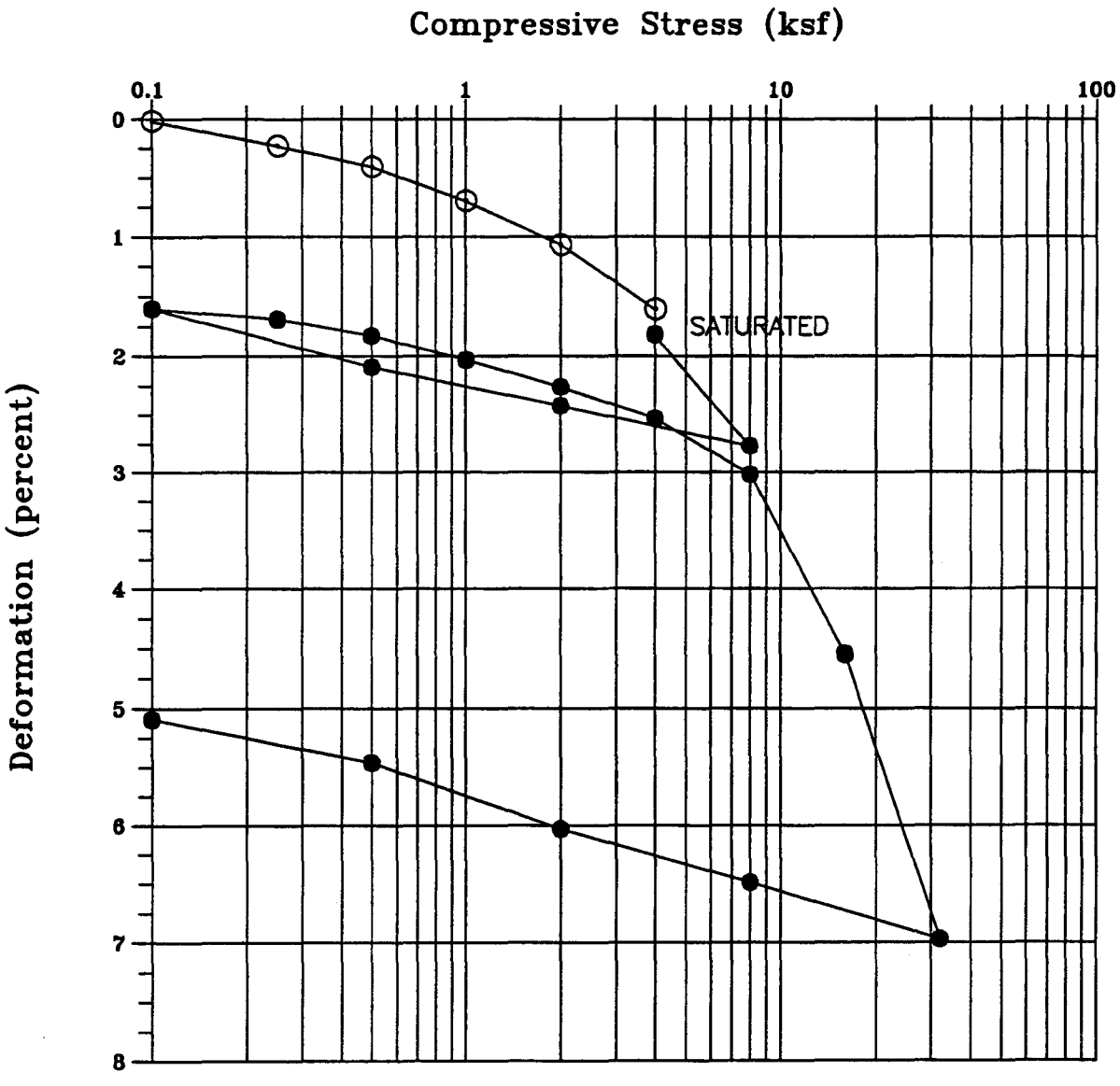
Figure B-134



Boring No.:	PE-8
Sample No.:	D-9
Depth(ft.):	45
Initial Dry Density(pcf)	113.4
Initial Moisture Content(pct)	15.0
Initial Void Ratio:	0.486
Final Dry Density(pcf):	119.5
Final Moisture Content(pct):	14.7
Soil Type:	CL

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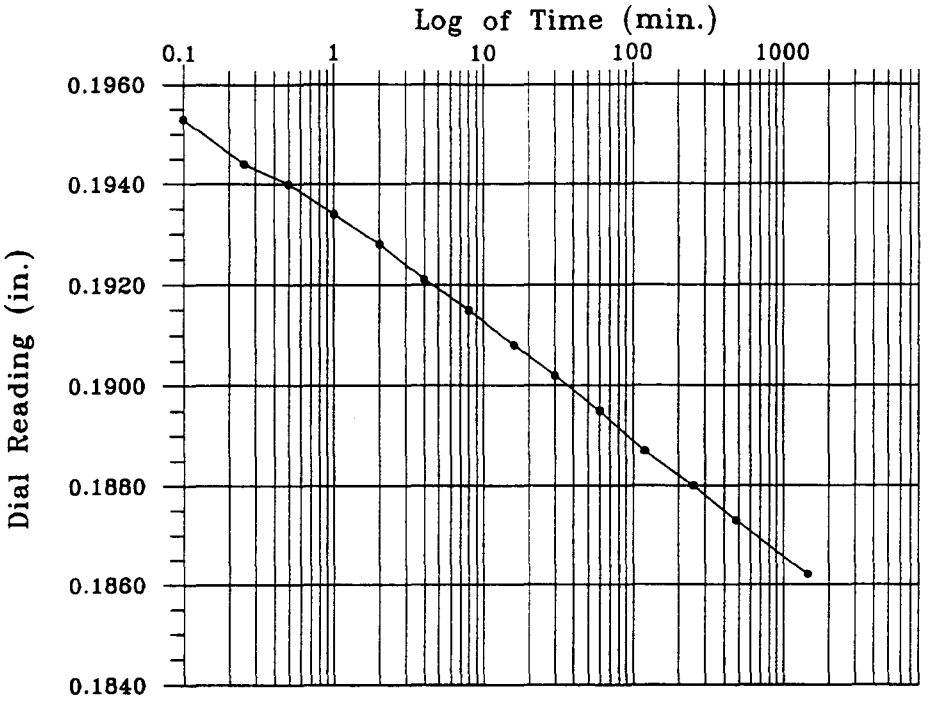
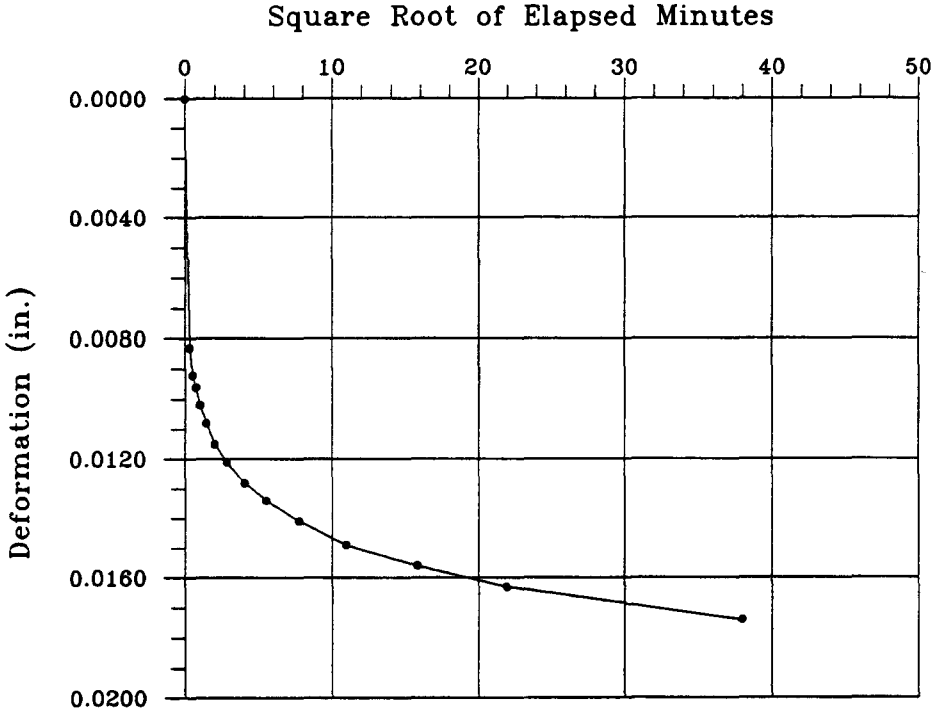
Figure B-135





BORING NO.: PE-8
SAMPLE NO.: D-9
DEPTH(ft.): 45
COMPRESSIVE STRESS (ksf): 16.0

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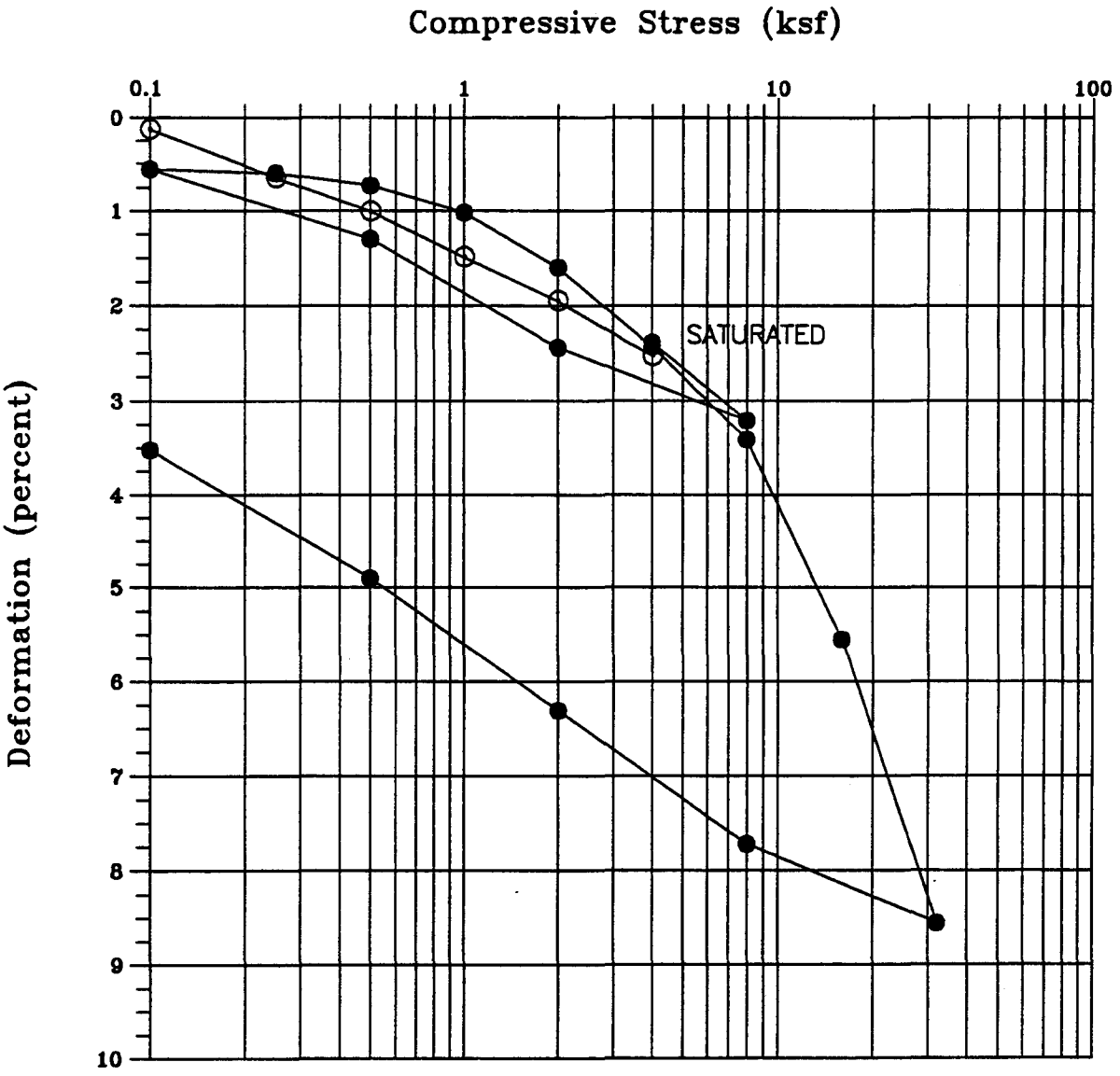
Figure B-136



Boring No.:	PE-17
Sample No.:	D-13
Depth(ft.):	65
Initial Dry Density(pcf)	95.3
Initial Moisture Content(pct)	27.5
Initial Void Ratio:	0.768
Final Dry Density(pcf):	98.7
Final Moisture Content(pct):	27.6
Soil Type:	ML

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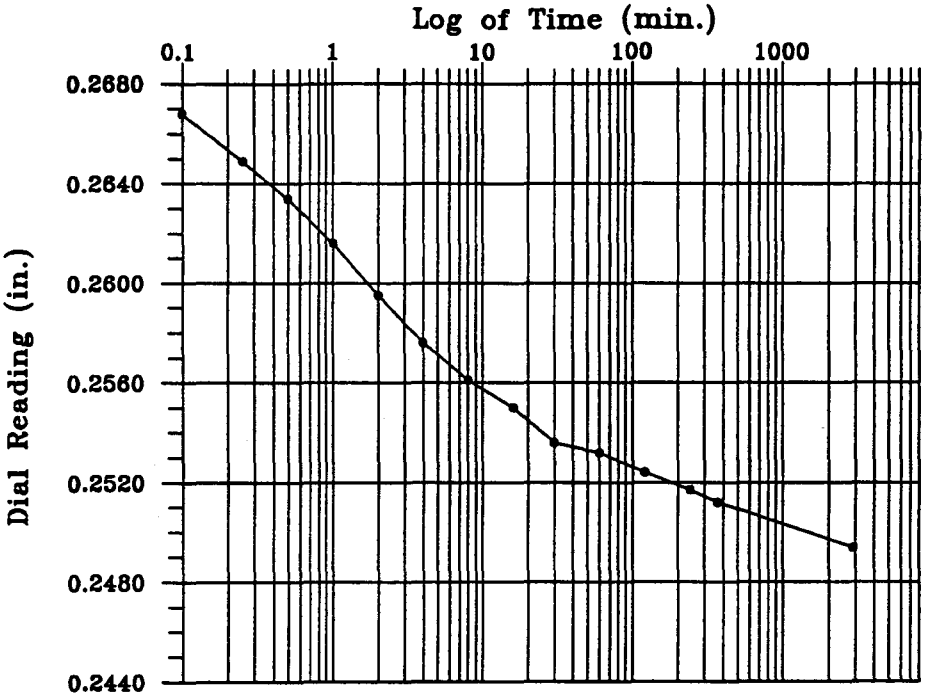
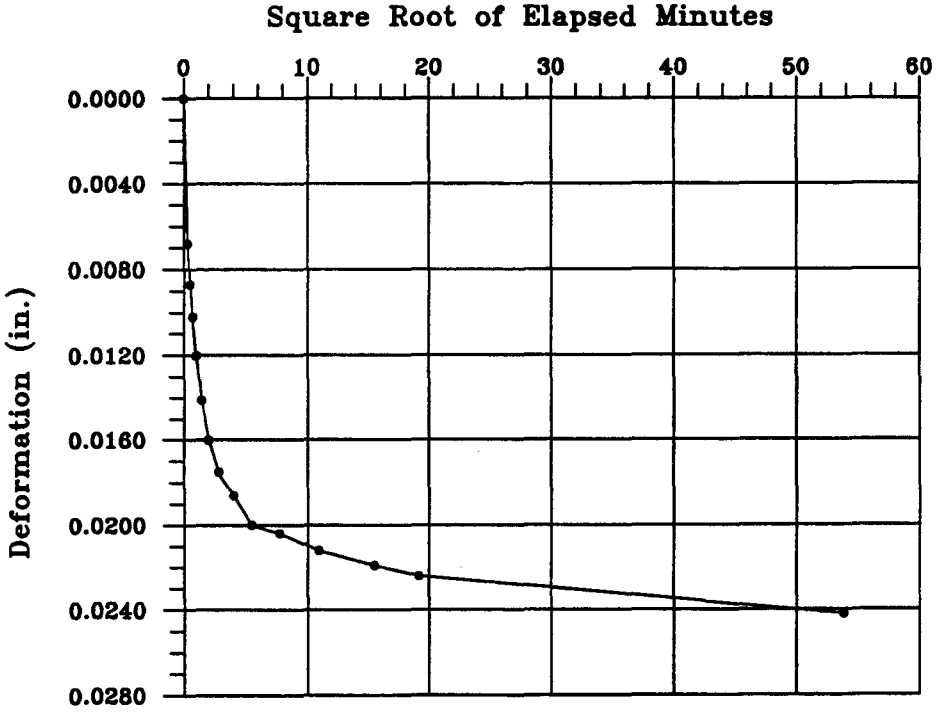
Figure B-137





BORING NO.: PE-17
SAMPLE NO.: D-13
DEPTH(ft.): 65
COMPRESSIVE STRESS (ksf): 16.0

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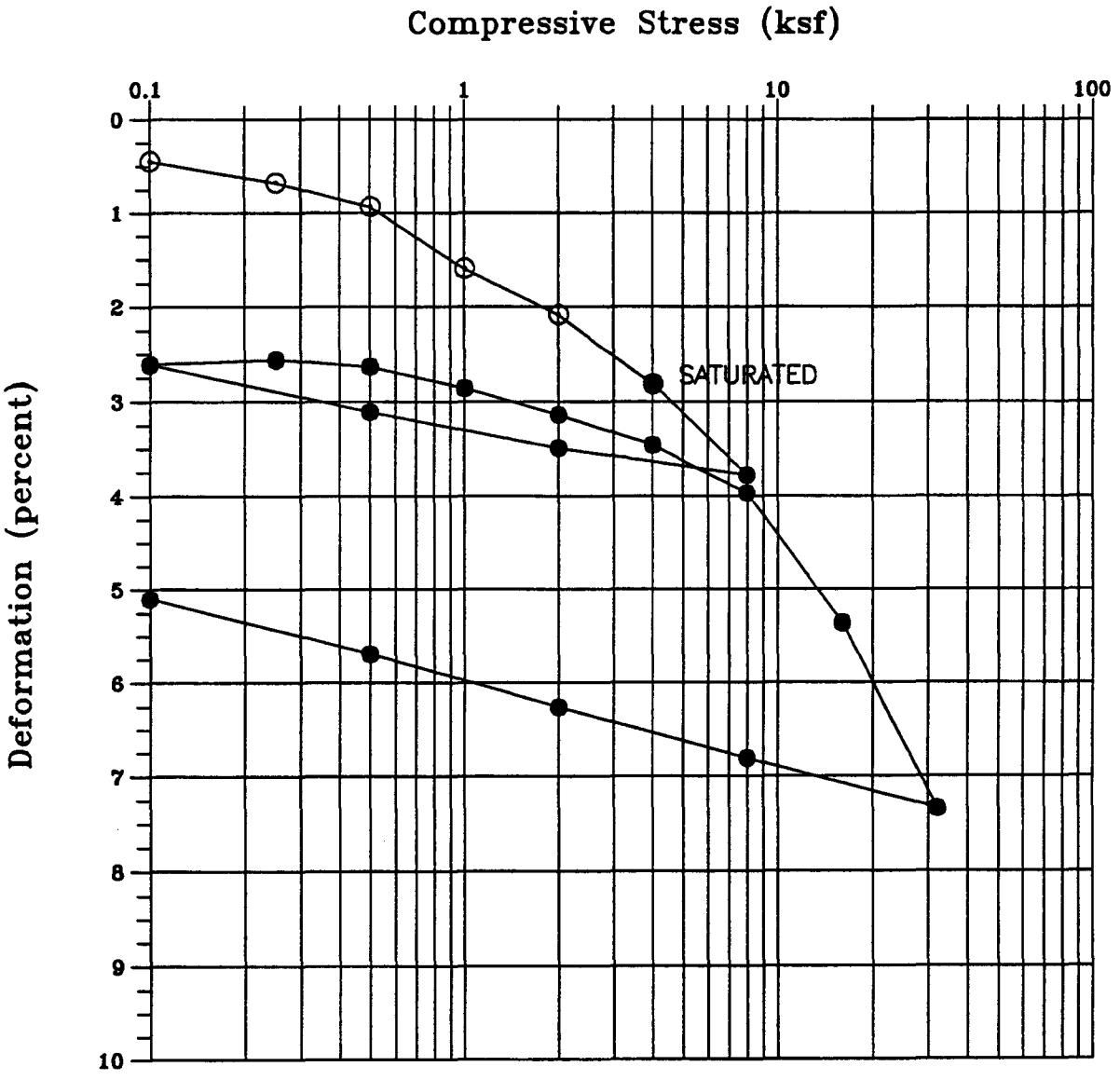
Figure B-138



Boring No.:	PE−18
Sample No.:	D−12
Depth(ft.):	60
Initial Dry Density(pcf)	108.4
Initial Moisture Content(pct)	21.0
Initial Void Ratio:	0.555
Final Dry Density(pcf):	114.2
Final Moisture Content(pct):	17.7
Soil Type:	ML

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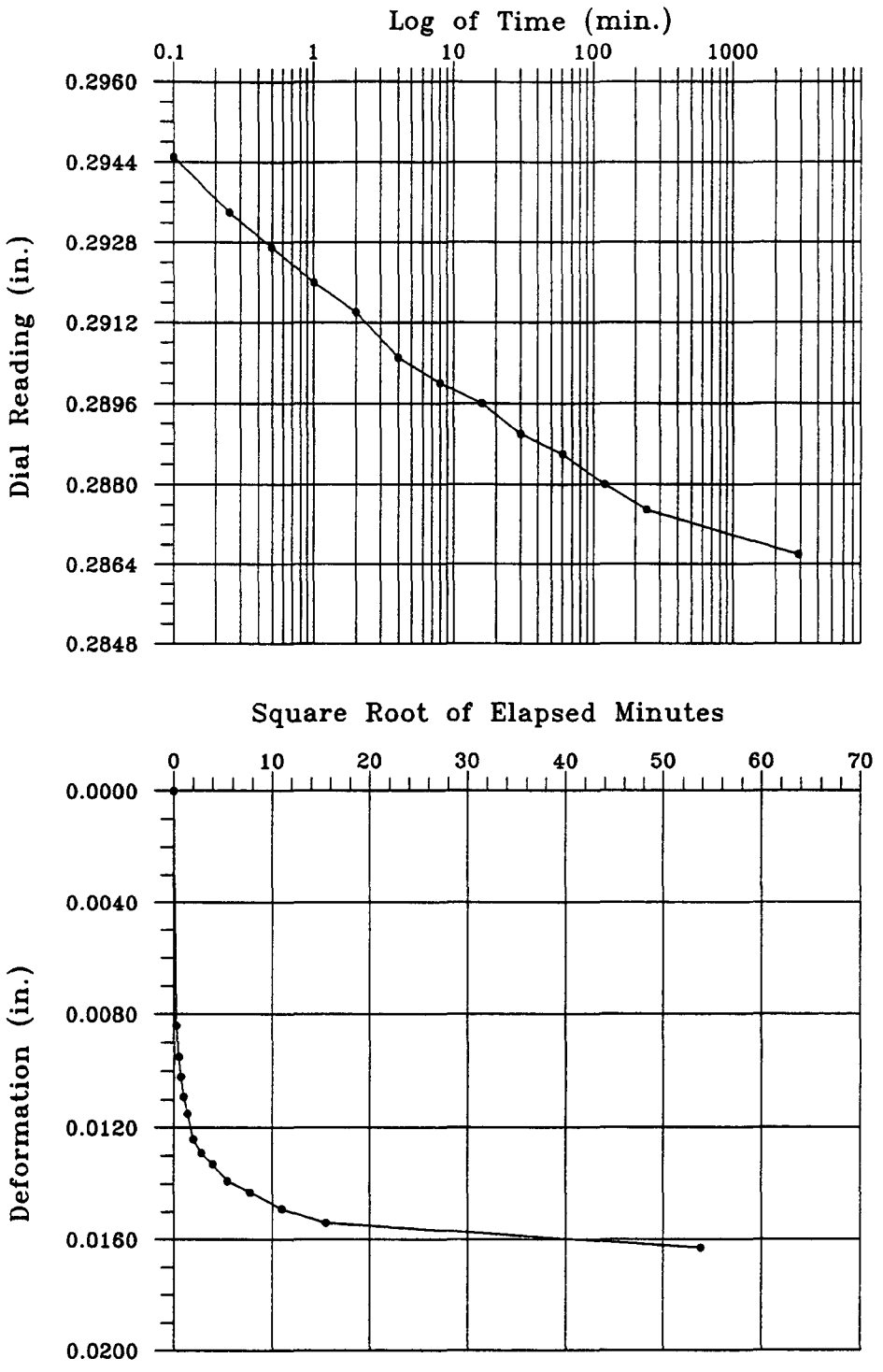
Figure B-139



BORING NO.: PE-18
SAMPLE NO.: D-12
DEPTH(ft.): 60
COMPRESSIVE STRESS (ksf): 16.0

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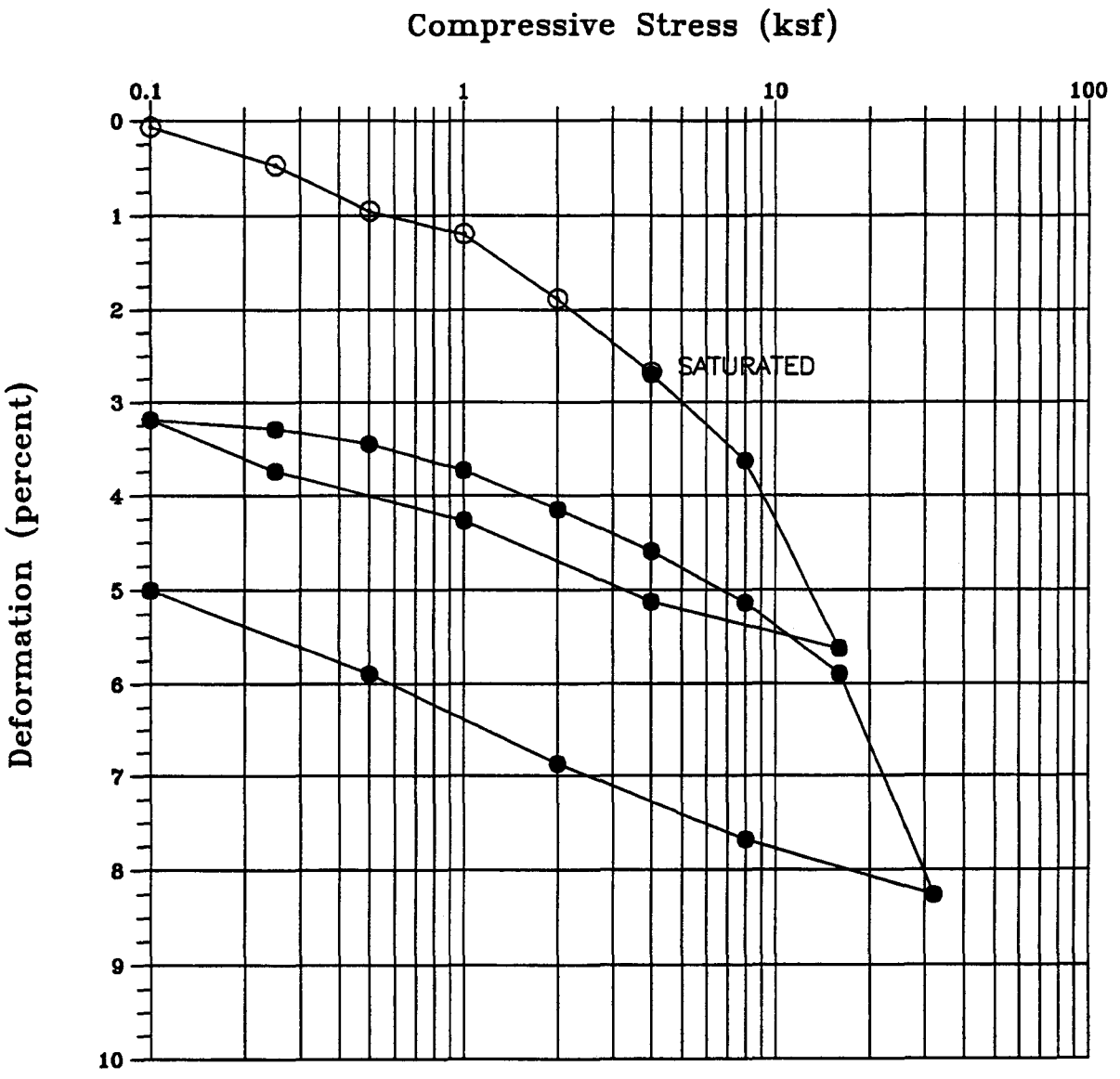
Figure B-140



Boring No.:	PE-21
Sample No.:	D-7
Depth(ft.):	35
Initial Dry Density(pcf)	111.2
Initial Moisture Content(pct)	18.7
Initial Void Ratio:	0.517
Final Dry Density(pcf):	117.0
Final Moisture Content(pct):	17.2
Soil Type:	CL

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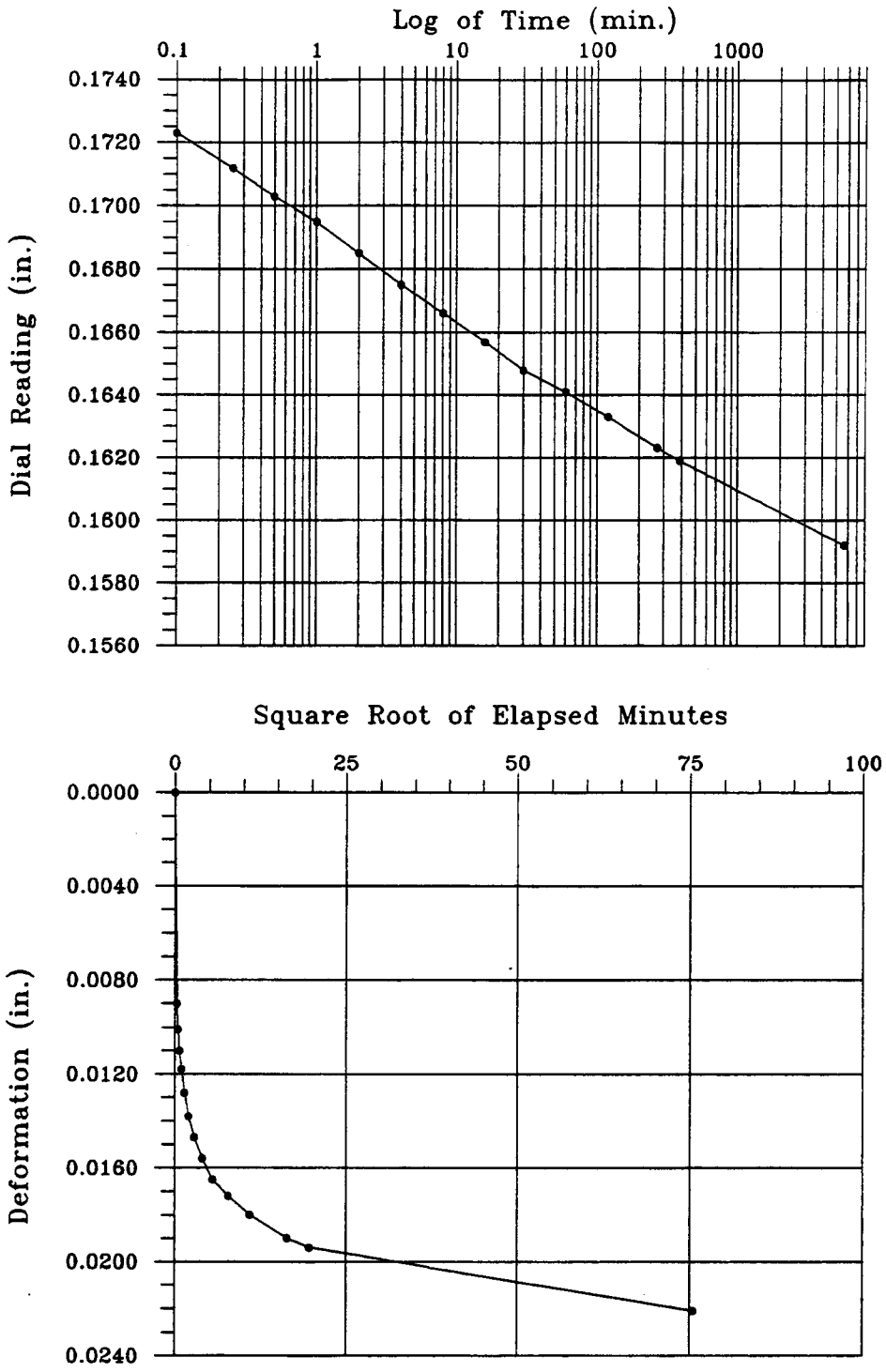
Figure B-141



BORING NO.: PE-21
SAMPLE NO.: D-7
DEPTH(ft.): 35
COMPRESSIVE STRESS (ksf): 16.0

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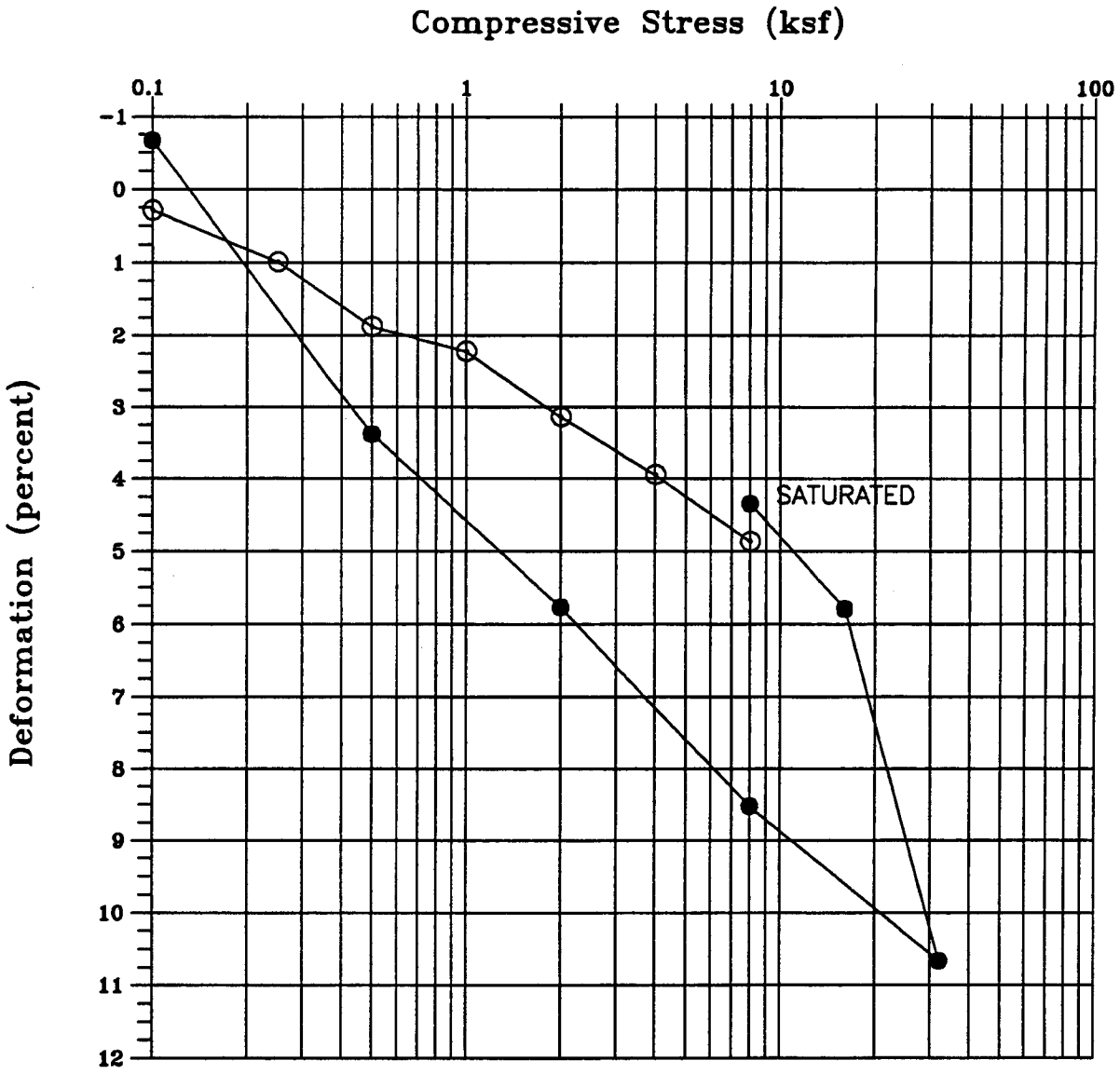
Figure B-142



Boring No.:	PE-21
Sample No.:	D-19
Depth(ft.):	95
Initial Dry Density(pcf)	81.3
Initial Moisture Content(pct)	40.1
Initial Void Ratio:	1.073
Final Dry Density(pcf):	80.7
Final Moisture Content(pct):	41.2
Soil Type:	CL

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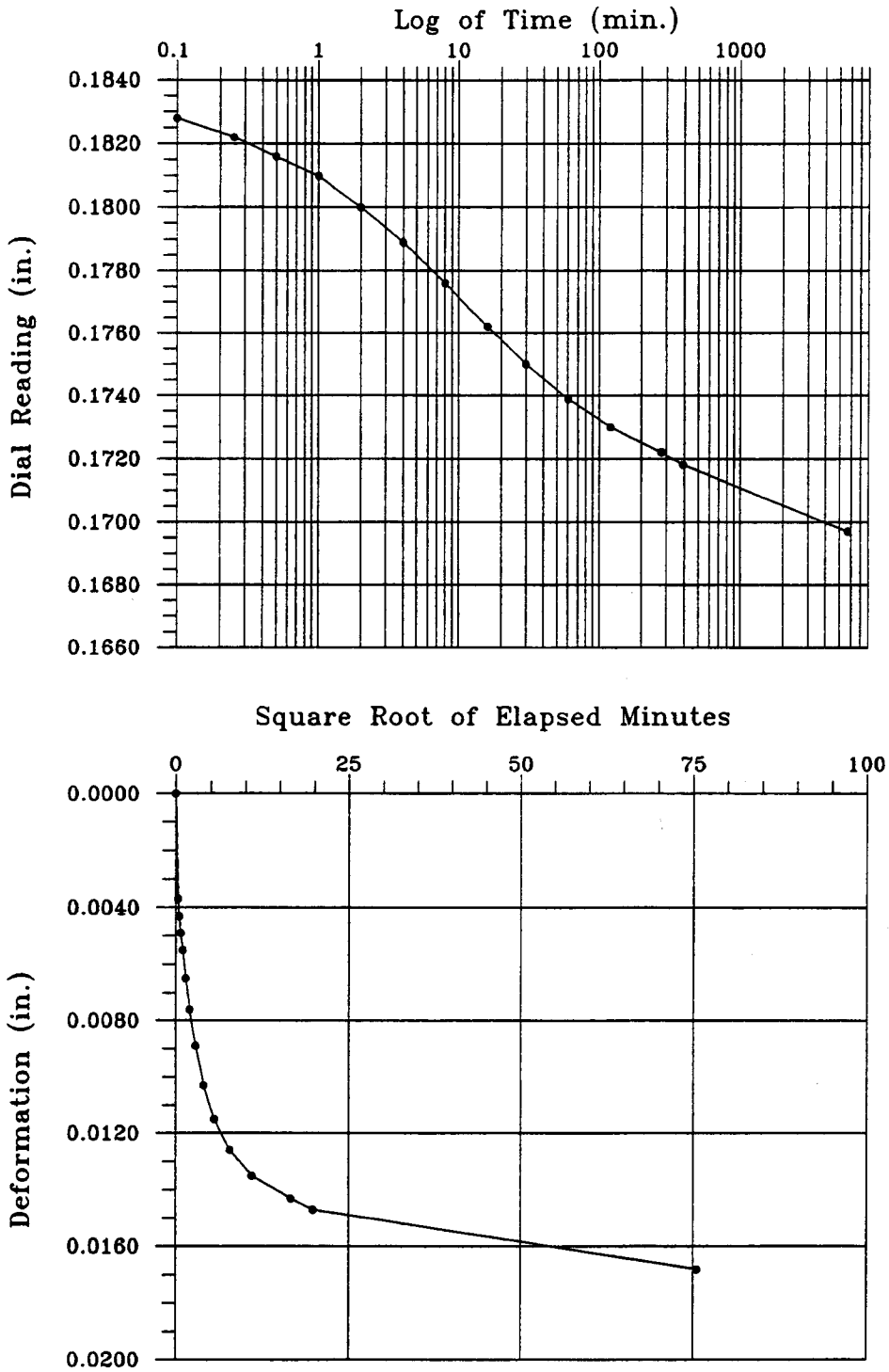
Figure B-143



BORING NO.: PE-21
SAMPLE NO.: D-19
DEPTH(ft.): 95
COMPRESSIVE STRESS (ksf): 16.0

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Figure B-144

Appendix C

APPENDIX C

CHEMICAL LABORATORY TEST RESULTS

The laboratory test results pertaining to chemical analyses of groundwater samples collected from Monitoring Wells PE-8, PE-16, PE-18, PE-23, PE-29, PE-30 and PE-31 are presented in this appendix. Four groundwater samples collected from Monitoring Wells PE-8, PE-16, PE-18 and PE-23 were transported to Pace, of Huntington Beach, California, and three groundwater samples collected from Monitoring Wells PE-29, PE-30 and PE-31 were transported to CKY, Inc. of Torrance, California, for a limited Characterization of potential chemical contamination. The chemical results on groundwater samples are summarized in Table 3-6 of Section 3.2.

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REPORT OF LABORATORY ANALYSIS

December 15, 1993

Mr. Grant Miller
Earth Technology Corporation
13900 Alton Pkwy.
Suite 120
Irvine, CA 92718

RE: PACE Project No. 731202.508
Client Reference: Metro Rail-Red Line Extension

Dear Mr. Miller:

Enclosed is the report of laboratory analyses for samples received December 02, 1993.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Melanie R. Concepcion

Melanie R. Concepcion
Project Manager

Enclosures

5702 Bolsa Avenue
Huntington Beach, CA 92649
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FAX: 714-890-4032

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REPORT OF LABORATORY ANALYSIS

Earth Technology Corporation
13900 Alton Pkwy.
Suite 120
Irvine, CA 92718

December 15, 1993
PACE Project Number: 731202508

Attn: Mr. Grant Miller

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190826		
Date Collected:			12/02/93		
Date Received:			12/02/93		
Client Sample ID:			PE-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Gravimetric-Sulfate	mg/L	10	174	375.3	12/12/93
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	376.2	12/07/93
Titrimetric-Chloride	mg/L	0.5	86.9	325.3	12/12/93
TITLE 22 TTLC METALS BY ICP				6010	
TTLC, ICP Date Digested			-		12/11/93
TTLC, ICP Antimony	mg/L	0.2	ND		12/13/93
TTLC, ICP Barium	mg/L	0.004	0.13		12/13/93
TTLC, ICP Beryllium	mg/L	0.002	ND		12/13/93
TTLC, ICP Cadmium	mg/L	0.006	ND		12/13/93
TTLC, ICP Chromium	mg/L	0.004	ND		12/13/93
TTLC, ICP Cobalt	mg/L	0.004	ND		12/13/93
TTLC, ICP Copper	mg/L	0.005	ND		12/13/93
TTLC, ICP Lead	mg/L	0.05	ND		12/13/93
TTLC, ICP Molybdenum	mg/L	0.006	ND		12/13/93
TTLC, ICP Nickel	mg/L	0.02	ND		12/13/93
TTLC, ICP Silver	mg/L	0.02	ND		12/13/93
TTLC, ICP Vanadium	mg/L	0.005	0.007		12/13/93
TTLC, ICP Zinc	mg/L	0.02	0.15		12/13/93
TITLE 22 TTLC METALS BY GFAA				GFAA	
TTLC, GFAA Date Digested			-		12/11/93
TTLC, GFAA Arsenic	mg/L	0.0025	ND		12/12/93
TTLC, GFAA Selenium	mg/L	0.0025	ND		12/12/93
TTLC, GFAA Thallium	mg/L	0.0025	ND		12/12/93
TITLE 22 TTLC MERCURY BY CV				7470	
TTLC, CV Date Digested			-		12/06/93
TTLC, CV Mercury	mg/L	0.0003	ND		12/06/93

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Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190826		
Date Collected:			12/02/93		
Date Received:			12/02/93		
Client Sample ID:			PE-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
AROMATIC VOLATILE ORGANICS-BTEX				8020	
Benzene	ug/L	0.3	7450		12/06/93
Toluene	ug/L	0.3	780		12/06/93
Ethylbenzene	ug/L	0.3	520		12/06/93
Xylenes, Total	ug/L	0.6	1070		12/06/93
a,a,a-Trifluorotoluene Surrogate Rec.	%		99		12/06/93
VOLATILE ORGANICS			(1)	8240	
Chloromethane	ug/L	10	ND		12/03/93
Vinyl chloride	ug/L	10	ND		12/03/93
Bromomethane	ug/L	10	ND		12/03/93
Chloroethane	ug/L	10	ND		12/03/93
Trichlorofluoromethane	ug/L	10	ND		12/03/93
1,1-Dichloroethene	ug/L	5	ND		12/03/93
Acetone	ug/L	50	140		12/03/93
Carbon disulfide	ug/L	5	ND		12/03/93
Methylene chloride	ug/L	5	ND		12/03/93
trans-1,2-Dichloroethene	ug/L	5	ND		12/03/93
1,1-Dichloroethane	ug/L	5	ND		12/03/93
2-Butanone	ug/L	50	ND		12/03/93
cis-1,2-Dichloroethene	ug/L	5	ND		12/03/93
Chloroform	ug/L	5	ND		12/03/93
1,2-Dichloroethane	ug/L	5	ND		12/03/93
1,1,1-Trichloroethane	ug/L	5	ND		12/03/93
Carbon tetrachloride	ug/L	5	ND		12/03/93
Benzene	ug/L	500	7800 (2)		12/03/93
Trichloroethene	ug/L	5	ND		12/03/93
1,2-Dichloropropane	ug/L	5	ND		12/03/93
Bromodichloromethane	ug/L	5	ND		12/03/93
cis-1,3-Dichloropropene	ug/L	5	ND		12/03/93
trans-1,3-Dichloropropene	ug/L	5	ND		12/03/93
1,1,2-Trichloroethane	ug/L	5	ND		12/03/93
Dibromochloromethane	ug/L	5	ND		12/03/93

Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190826		
Date Collected:			12/02/93		
Date Received:			12/02/93		
Client Sample ID:			PE-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS			(1)	8240	
Bromoform	ug/L	5	ND		12/03/93
4-Methyl-2-pentanone	ug/L	50	ND		12/03/93
Toluene	ug/L	50	770 (2)		12/03/93
2-Hexanone	ug/L	50	ND		12/03/93
1,1,2,2-Tetrachloroethane	ug/L	5	ND		12/03/93
Tetrachloroethene	ug/L	5	ND		12/03/93
Chlorobenzene	ug/L	5	ND		12/03/93
Ethylbenzene	ug/L	50	520 (2)		12/03/93
Styrene	ug/L	5	ND		12/03/93
Xylenes (Total)	ug/L	50	1120 (2)		12/03/93
1,3-Dichlorobenzene	ug/L	5	ND		12/03/93
1,4-Dichlorobenzene	ug/L	5	ND		12/03/93
1,2-Dichlorobenzene	ug/L	5	ND		12/03/93
1,2-Dichloroethane-d4 (Surrog. Recovery)	%		112		12/03/93
Toluene-d8 (Surrog. Recovery)	%		106		12/03/93
4-Bromofluorobenzene (Surrog. Recovery)	%		90		12/03/93
SEMI-VOLATILES				8270	
8270 Date Extracted			12/06/93		
n-Nitrosodimethylamine	ug/L	10	ND		12/10/93
Phenol	ug/L	10	ND		12/10/93
Aniline	ug/L	10	ND		12/10/93
bis(2-Chloroethyl)ether	ug/L	10	ND		12/10/93
2-Chlorophenol	ug/L	10	ND		12/10/93
1,3-Dichlorobenzene	ug/L	10	ND		12/10/93
1,4-Dichlorobenzene	ug/L	10	ND		12/10/93
Benzyl alcohol	ug/L	10	ND		12/10/93
1,2-Dichlorobenzene	ug/L	10	ND		12/10/93
2-Methylphenol	ug/L	10	ND		12/10/93
bis(2-Chloroisopropyl)ether	ug/L	10	ND		12/10/93
4-Methylphenol	ug/L	10	ND		12/10/93
n-Nitroso-di-n-propylamine	ug/L	10	ND		12/10/93

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Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190826		
Date Collected:			12/02/93		
Date Received:			12/02/93		
Client Sample ID:			PE-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
Hexachloroethane	ug/L	10	ND		12/10/93
Nitrobenzene	ug/L	10	ND		12/10/93
Isophorone	ug/L	10	ND		12/10/93
2-Nitrophenol	ug/L	10	ND		12/10/93
2,4-Dimethylphenol	ug/L	10	ND		12/10/93
Benzoic acid	ug/L	50	ND		12/10/93
bis(2-Chloroethoxy)methane	ug/L	10	ND		12/10/93
2,4-Dichlorophenol	ug/L	10	ND		12/10/93
1,2,4-Trichlorobenzene	ug/L	10	ND		12/10/93
Naphthalene	ug/L	10	ND		12/10/93
4-Chloroaniline	ug/L	20	ND		12/10/93
Hexachlorobutadiene	ug/L	10	ND		12/10/93
4-Chloro-3-methylphenol	ug/L	10	ND		12/10/93
2-Methylnaphthalene	ug/L	10	ND		12/10/93
Hexachlorocyclopentadiene	ug/L	10	ND		12/10/93
2,4,6-Trichlorophenol	ug/L	10	ND		12/10/93
2,4,5-Trichlorophenol	ug/L	10	ND		12/10/93
2-Chloronaphthalene	ug/L	50	ND		12/10/93
2-Nitroaniline	ug/L	50	ND		12/10/93
Dimethylphthalate	ug/L	10	ND		12/10/93
Acenaphthylene	ug/L	10	ND		12/10/93
2,6-Dinitrotoluene	ug/L	10	ND		12/10/93
3-Nitroaniline	ug/L	50	ND		12/10/93
Acenaphthene	ug/L	10	ND		12/10/93
2,4-Dinitrophenol	ug/L	50	ND		12/10/93
4-Nitrophenol	ug/L	50	ND		12/10/93
Dibenzofuran	ug/L	10	ND		12/10/93
2,4-Dinitrotoluene	ug/L	10	ND		12/10/93
Diethylphthalate	ug/L	10	ND		12/10/93
4-Chlorophenyl-phenylether	ug/L	10	ND		12/10/93
Fluorene	ug/L	10	ND		12/10/93

Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190826		
Date Collected:			12/02/93		
Date Received:			12/02/93		
Client Sample ID:			PE-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
4-Nitroaniline	ug/L	50	ND		12/10/93
4,6-Dinitro-2-methylphenol	ug/L	50	ND		12/10/93
n-Nitrosodiphenylamine	ug/L	10	ND		12/10/93
4-Bromophenyl-phenylether	ug/L	10	ND		12/10/93
Hexachlorobenzene	ug/L	10	ND		12/10/93
Pentachlorophenol	ug/L	10	ND		12/10/93
Phenanthrene	ug/L	10	ND		12/10/93
Anthracene	ug/L	10	ND		12/10/93
Di-n-butylphthalate	ug/L	10	ND		12/10/93
Fluoranthene	ug/L	10	ND		12/10/93
Benzidine	ug/L	50	ND		12/10/93
Pyrene	ug/L	10	ND		12/10/93
Butylbenzylphthalate	ug/L	10	ND		12/10/93
Benzo(a)anthracene	ug/L	10	ND		12/10/93
Chrysene	ug/L	10	ND		12/10/93
bis(2-Ethylhexyl)phthalate	ug/L	10	ND		12/10/93
Di-n-octylphthalate	ug/L	10	ND		12/10/93
Benzo(b)fluoranthene	ug/L	10	ND		12/10/93
Benzo(k)fluoranthene	ug/L	10	ND		12/10/93
Benzo(a)pyrene	ug/L	10	ND		12/10/93
Indeno(1,2,3-cd)pyrene	ug/L	10	ND		12/10/93
Dibenzo(a,h)anthracene	ug/L	10	ND		12/10/93
Benzo(g,h,i)perylene	ug/L	10	ND		12/10/93
2-Fluorophenol (Surrog. Recovery)	%		64		12/10/93
Phenol-d5 (Surrog. Recovery)	%		36		12/10/93
Nitrobenzene-d5 (Surrog. Recovery)	%		78		12/10/93
2-Fluorobiphenyl (Surrog. Recovery)	%		71		12/10/93
2,4,6-Tribromophenol (Surrog. Recovery)	%		66		12/10/93
Terphenyl-d14 (Surrog. Recovery)	%		44		12/10/93
TPH CARBON CHAIN				8015	
TPH Carbon Chain Date Extracted			12/06/93		

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190826		
Date Collected:			12/02/93		
Date Received:			12/02/93		
Client Sample ID:			PE-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
TPH CARBON CHAIN				8015	
Carbon Chain Range C10-C11	ug/L	100	330		12/08/93
Carbon Chain Range C12-C14	ug/L	100	ND		12/08/93
Carbon Chain Range C16-C18	ug/L	100	ND		12/08/93
Carbon Chain Range C20-C24	ug/L	100	ND		12/08/93
Carbon Chain Range C28-C32	ug/L	100	ND		12/08/93
Carbon Chain Range C36-C44	ug/L	100	ND		12/08/93

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

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Mr. Grant Miller | FOOTNOTES | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
(1)	Unidentified peaks present in chromatogram of this sample.
(2)	Compound identified at secondary dilution factor.

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Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

Gravimetric-Sulfate
Batch: 75 10522
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Gravimetric-Sulfate	mg/L	10	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
Gravimetric-Sulfate	mg/L	10	232	451	102%	106%	4%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Gravimetric-Sulfate	mg/L	10	451	100%

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Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

Spectrophotometric-Total Sulfide
Batch: 75 10467
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Spectrophotometric-Total Sulfide	mg/L	0.05	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	0.340	112%	112%	0%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Spectrophotometric-Total Sulfide	mg/L	0.05	0.340	100%

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Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

TTLC, GFAA Arsenic
Batch: 75 10516
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, GFAA Arsenic	mg/L	0.0025	ND
TTLC, GFAA Selenium	mg/L	0.0025	ND
TTLC, GFAA Thallium	mg/L	0.0025	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, GFAA Arsenic	mg/L	0.0025	ND	0.030	107%	93%	14%
TTLC, GFAA Selenium	mg/L	0.0025	0.0059	0.030	80%	74%	8%
TTLC, GFAA Thallium	mg/L	0.0025	ND	0.030	80%	73%	9%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, GFAA Arsenic	mg/L	0.0025	0.030	100%
TTLC, GFAA Selenium	mg/L	0.0025	0.030	107%
TTLC, GFAA Thallium	mg/L	0.0025	0.030	93%

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Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

Titrimetric-Chloride
Batch: 75 10518
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Titrimetric-Chloride	mg/L	0.5	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190826 PE-8	Spike	Spike Recv	Spike Dupl Recv	RPD
Titrimetric-Chloride	mg/L	0.5	86.9	70	103%	102%	1%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Titrimetric-Chloride	mg/L	0.5	70	101%

Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

TITLE 22 TTLC MERCURY BY CV
Batch: 75 10388
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, CV Mercury	mg/L	0.0003	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190800	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, CV Mercury	mg/L	0.0003	ND	0.005	96%	104%	8%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, CV Mercury	mg/L	0.0003	0.005	96%

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Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

TITLE 22 TTLC METALS BY ICP
Batch: 75 10519
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, ICP Antimony	mg/L	0.2	ND
TTLC, ICP Barium	mg/L	0.004	ND
TTLC, ICP Beryllium	mg/L	0.002	ND
TTLC, ICP Cadmium	mg/L	0.006	ND
TTLC, ICP Chromium	mg/L	0.004	ND
TTLC, ICP Cobalt	mg/L	0.004	ND
TTLC, ICP Copper	mg/L	0.005	ND
TTLC, ICP Lead	mg/L	0.05	ND
TTLC, ICP Molybdenum	mg/L	0.006	ND
TTLC, ICP Nickel	mg/L	0.02	ND
TTLC, ICP Silver	mg/L	0.02	ND
TTLC, ICP Vanadium	mg/L	0.005	ND
TTLC, ICP Zinc	mg/L	0.02	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, ICP Antimony	mg/L	0.2	ND	0.500	100%	100%	0%
TTLC, ICP Barium	mg/L	0.004	0.10	0.500	96%	98%	2%
TTLC, ICP Beryllium	mg/L	0.002	ND	0.500	96%	100%	4%
TTLC, ICP Cadmium	mg/L	0.006	ND	0.500	96%	98%	2%
TTLC, ICP Chromium	mg/L	0.004	ND	0.500	92%	94%	2%
TTLC, ICP Cobalt	mg/L	0.004	ND	0.500	92%	96%	4%
TTLC, ICP Copper	mg/L	0.005	0.010	0.500	94%	98%	4%
TTLC, ICP Lead	mg/L	0.05	ND	0.500	94%	96%	2%
TTLC, ICP Molybdenum	mg/L	0.006	ND	0.500	96%	98%	2%
TTLC, ICP Nickel	mg/L	0.02	ND	0.500	94%	96%	2%
TTLC, ICP Silver	mg/L	0.02	ND	0.500	90%	92%	2%
TTLC, ICP Vanadium	mg/L	0.005	ND	0.500	96%	100%	4%
TTLC, ICP Zinc	mg/L	0.02	0.07	0.500	92%	94%	2%

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

TITLE 22 TTLC METALS BY ICP
Batch: 75 10519
Samples: 75 0190826

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, ICP Antimony	mg/L	0.2	0.500	100%
TTLC, ICP Barium	mg/L	0.004	0.500	98%
TTLC, ICP Beryllium	mg/L	0.002	0.500	102%
TTLC, ICP Cadmium	mg/L	0.006	0.500	102%
TTLC, ICP Chromium	mg/L	0.004	0.500	98%
TTLC, ICP Cobalt	mg/L	0.004	0.500	100%
TTLC, ICP Copper	mg/L	0.005	0.500	98%
TTLC, ICP Lead	mg/L	0.05	0.500	98%
TTLC, ICP Molybdenum	mg/L	0.006	0.500	100%
TTLC, ICP Nickel	mg/L	0.02	0.500	100%
TTLC, ICP Silver	mg/L	0.02	0.500	96%
TTLC, ICP Vanadium	mg/L	0.005	0.500	100%
TTLC, ICP Zinc	mg/L	0.02	0.500	104%

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Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

AROMATIC VOLATILE ORGANICS-BTEX
Batch: 75 10404
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Benzene	ug/L	0.3	ND
Toluene	ug/L	0.3	ND
Ethylbenzene	ug/L	0.3	ND
Xylenes, Total	ug/L	0.6	ND
a,a,a-Trifluorotoluene Surrogate Rec.	%		99

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191377	Spike	Spike Recv	Spike Dupl Recv	RPD
Benzene	ug/L	0.3	ND	20	103%	100%	3%
Toluene	ug/L	0.3	ND	20	103%	100%	3%
Ethylbenzene	ug/L	0.3	ND	20	106%	102%	4%
Xylenes, Total	ug/L	0.6	ND	60	107%	103%	4%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TPH Quantified as Gasoline	ug/L	50	450	89%
Benzene	ug/L	0.3	20	92%
Toluene	ug/L	0.3	20	93%
Ethylbenzene	ug/L	0.3	20	96%
Xylenes, Total	ug/L	0.6	60	97%

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FAX: 714-890-4032

Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
n-Nitrosodimethylamine	ug/L	10	ND
Phenol	ug/L	10	ND
Aniline	ug/L	10	ND
bis(2-Chloroethyl)ether	ug/L	10	ND
2-Chlorophenol	ug/L	10	ND
1,3-Dichlorobenzene	ug/L	10	ND
1,4-Dichlorobenzene	ug/L	10	ND
Benzyl alcohol	ug/L	10	ND
1,2-Dichlorobenzene	ug/L	10	ND
2-Methylphenol	ug/L	10	ND
bis(2-Chloroisopropyl)ether	ug/L	10	ND
4-Methylphenol	ug/L	10	ND
n-Nitroso-di-n-propylamine	ug/L	10	ND
Hexachloroethane	ug/L	10	ND
Nitrobenzene	ug/L	10	ND
Isophorone	ug/L	10	ND
2-Nitrophenol	ug/L	10	ND
2,4-Dimethylphenol	ug/L	10	ND
Benzoic acid	ug/L	50	ND
bis(2-Chloroethoxy)methane	ug/L	10	ND
2,4-Dichlorophenol	ug/L	10	ND
1,2,4-Trichlorobenzene	ug/L	10	ND
Naphthalene	ug/L	10	ND
4-Chloroaniline	ug/L	20	ND
Hexachlorobutadiene	ug/L	10	ND
4-Chloro-3-methylphenol	ug/L	10	ND
2-Methylnaphthalene	ug/L	10	ND
Hexachlorocyclopentadiene	ug/L	10	ND
2,4,6-Trichlorophenol	ug/L	10	ND
2,4,5-Trichlorophenol	ug/L	10	ND
2-Chloronaphthalene	ug/L	50	ND
2-Nitroaniline	ug/L	50	ND

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Client Reference: Metro Rail-Red Line Extension

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Dimethylphthalate	ug/L	10	ND
Acenaphthylene	ug/L	10	ND
2,6-Dinitrotoluene	ug/L	10	ND
3-Nitroaniline	ug/L	50	ND
Acenaphthene	ug/L	10	ND
2,4-Dinitrophenol	ug/L	50	ND
4-Nitrophenol	ug/L	50	ND
Dibenzofuran	ug/L	10	ND
2,4-Dinitrotoluene	ug/L	10	ND
Diethylphthalate	ug/L	10	ND
4-Chlorophenyl-phenylether	ug/L	10	ND
Fluorene	ug/L	10	ND
4-Nitroaniline	ug/L	50	ND
4,6-Dinitro-2-methylphenol	ug/L	50	ND
n-Nitrosodiphenylamine	ug/L	10	ND
4-Bromophenyl-phenylether	ug/L	10	ND
Hexachlorobenzene	ug/L	10	ND
Pentachlorophenol	ug/L	10	ND
Phenanthrene	ug/L	10	ND
Anthracene	ug/L	10	ND
Di-n-butylphthalate	ug/L	10	ND
Fluoranthene	ug/L	10	ND
Benzidine	ug/L	50	ND
Pyrene	ug/L	10	ND
Butylbenzylphthalate	ug/L	10	ND
Benzo(a)anthracene	ug/L	10	ND
Chrysene	ug/L	10	ND
bis(2-Ethylhexyl)phthalate	ug/L	10	ND
Di-n-octylphthalate	ug/L	10	ND
Benzo(b)fluoranthene	ug/L	10	ND
Benzo(k)fluoranthene	ug/L	10	ND
Benzo(a)pyrene	ug/L	10	ND

Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0190826

METHOD BLANK:

Parameter		Units	MDL	Method Blank
Indeno(1,2,3-cd)pyrene		ug/L	10	ND
Dibenzo(a,h)anthracene		ug/L	10	ND
Benzo(g,h,i)perylene		ug/L	10	ND
2-Fluorophenol	(Surrog. Recovery	%		73
Phenol-d5	(Surrog. Recovery	%		69
Nitrobenzene-d5	(Surrog. Recovery	%		84
2-Fluorobiphenyl	(Surrog. Recovery	%		82
2,4,6-Tribromophenol	(Surrog. Recovery	%		65
Terphenyl-d14	(Surrog. Recovery	%		91

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Phenol	ug/L	10	200	69%	78%	12%
2-Chlorophenol	ug/L	10	200	77%	80%	4%
1,4-Dichlorobenzene	ug/L	10	100	78%	83%	6%
n-Nitroso-di-n-propylamine	ug/L	10	100	81%	91%	12%
1,2,4-Trichlorobenzene	ug/L	10	100	76%	78%	3%
4-Chloro-3-methylphenol	ug/L	10	200	84%	86%	2%
Acenaphthylene	ug/L	10	100	79%	93%	16%
4-Nitrophenol	ug/L	50	200	61%	82%	29%
2,4-Dinitrotoluene	ug/L	10	100	73%	88%	19%
Pentachlorophenol	ug/L	10	200	69%	75%	8%
Pyrene	ug/L	10	100	91%	106%	15%

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Client Reference: Metro Rail-Red Line Extension

TPH CARBON CHAIN
Batch: 75 10470
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Carbon Chain Range C10-C11	ug/L	100	ND
Carbon Chain Range C12-C14	ug/L	100	ND
Carbon Chain Range C16-C18	ug/L	100	ND
Carbon Chain Range C20-C24	ug/L	100	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Carbon Chain Range C10-C11	ug/L	100	720.0	125%	126%	1%
Carbon Chain Range C12-C14	ug/L	100	720.0	123%	129%	5%
Carbon Chain Range C16-C18	ug/L	100	450.0	129%	130%	1%
Carbon Chain Range C20-C24	ug/L	100	120.0	156%	155%	1%
Carbon Chain Range C28-C32	ug/L	100	60.0	215%	217%	1%

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Client Reference: Metro Rail-Red Line Extension

VOLATILE ORGANICS
Batch: 75 10368
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Chloromethane	ug/L	10	ND
Vinyl chloride	ug/L	10	ND
Bromomethane	ug/L	10	ND
Chloroethane	ug/L	10	ND
Trichlorofluoromethane	ug/L	10	ND
1,1-Dichloroethene	ug/L	5	ND
Acetone	ug/L	50	ND
Carbon disulfide	ug/L	5	ND
Methylene chloride	ug/L	5	ND
trans-1,2-Dichloroethene	ug/L	5	ND
1,1-Dichloroethane	ug/L	5	ND
2-Butanone	ug/L	50	ND
cis-1,2-Dichloroethene	ug/L	5	ND
Chloroform	ug/L	5	ND
1,2-Dichloroethane	ug/L	5	ND
1,1,1-Trichloroethane	ug/L	5	ND
Carbon tetrachloride	ug/L	5	ND
Benzene	ug/L	5	ND
Trichloroethene	ug/L	5	ND
1,2-Dichloropropane	ug/L	5	ND
Bromodichloromethane	ug/L	5	ND
cis-1,3-Dichloropropene	ug/L	5	ND
trans-1,3-Dichloropropene	ug/L	5	ND
1,1,2-Trichloroethane	ug/L	5	ND
Dibromochloromethane	ug/L	5	ND
Bromoform	ug/L	5	ND
4-Methyl-2-pentanone	ug/L	50	ND
Toluene	ug/L	5	ND
2-Hexanone	ug/L	50	ND
1,1,2,2-Tetrachloroethane	ug/L	5	ND
Tetrachloroethene	ug/L	5	ND
Chlorobenzene	ug/L	5	ND

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Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731202508

Client Reference: Metro Rail-Red Line Extension

VOLATILE ORGANICS
Batch: 75 10368
Samples: 75 0190826

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Ethylbenzene	ug/L	5	ND
Styrene	ug/L	5	ND
Xylenes (Total)	ug/L	5	ND
1,3-Dichlorobenzene	ug/L	5	ND
1,4-Dichlorobenzene	ug/L	5	ND
1,2-Dichlorobenzene	ug/L	5	ND
1,2-Dichloroethane-d4 (Surrog. Recovery	%		114
Toluene-d8 (Surrog. Recovery	%		99
4-Bromofluorobenzene (Surrog. Recovery	%		91

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190800	Spike	Spike Recv	Spike Dupl Recv	RPD
1,1-Dichloroethene	ug/L	5	ND	50	87%	85%	2%
Benzene	ug/L	5	ND	50	91%	92%	1%
Trichloroethene	ug/L	5	ND	50	99%	101%	2%
Toluene	ug/L	5	ND	50	99%	100%	1%
Chlorobenzene	ug/L	5	ND	50	98%	105%	7%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
1,1-Dichloroethene	ug/L	5	50	86%
Benzene	ug/L	5	50	90%
Trichloroethene	ug/L	5	50	95%
Toluene	ug/L	5	50	99%
Chlorobenzene	ug/L	5	50	102%

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Mr. Grant Miller | FOOTNOTES | December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

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REPORT OF LABORATORY ANALYSIS

December 15, 1993

Mr. Grant Miller
Earth Technology Corporation
13900 Alton Pkwy.
Suite 120
Irvine, CA 92718

RE: PACE Project No. 731203.509
Client Reference: Metro Rail(94-1100-02)

Dear Mr. Miller:

Enclosed is the report of laboratory analyses for samples received December 03, 1993.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Melanie R. Concepcion

Melanie R. Concepcion
Project Manager

Enclosures

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Huntington Beach, CA 92649
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FAX: 714-890-4032

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REPORT OF LABORATORY ANALYSIS

Earth Technology Corporation
13900 Alton Pkwy.
Suite 120
Irvine, CA 92718

December 15, 1993
PACE Project Number: 731203509

Attn: Mr. Grant Miller

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191377		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			B-16		
Parameter	Units	MDL		METHOD	DATE ANALYZED
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Gravimetric-Sulfate	mg/L	10	351	375.3	12/12/93
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	376.2	12/07/93
Titrimetric-Chloride	mg/L	0.5	166	325.3	12/12/93
TITLE 22 TTLC METALS BY ICP				6010	
TTLC, ICP Date Digested			-		12/11/93
TTLC, ICP Antimony	mg/L	0.2	ND		12/13/93
TTLC, ICP Barium	mg/L	0.004	0.076		12/13/93
TTLC, ICP Beryllium	mg/L	0.002	ND		12/13/93
TTLC, ICP Cadmium	mg/L	0.006	ND		12/13/93
TTLC, ICP Chromium	mg/L	0.004	ND		12/13/93
TTLC, ICP Cobalt	mg/L	0.004	ND		12/13/93
TTLC, ICP Copper	mg/L	0.005	ND		12/13/93
TTLC, ICP Lead	mg/L	0.05	ND		12/13/93
TTLC, ICP Molybdenum	mg/L	0.006	ND		12/13/93
TTLC, ICP Nickel	mg/L	0.02	ND		12/13/93
TTLC, ICP Silver	mg/L	0.02	ND		12/13/93
TTLC, ICP Vanadium	mg/L	0.005	ND		12/13/93
TTLC, ICP Zinc	mg/L	0.02	0.09		12/13/93
TITLE 22 TTLC METALS BY GFAA				GFAA	
TTLC, GFAA Date Digested			-		12/11/93
TTLC, GFAA Arsenic	mg/L	0.0025	0.0046		12/12/93
TTLC, GFAA Selenium	mg/L	0.0025	ND		12/12/93
TTLC, GFAA Thallium	mg/L	0.0025	ND		12/12/93
TITLE 22 TTLC MERCURY BY CV				7470	
TTLC, CV Date Digested			-		12/12/93
TTLC, CV Mercury	mg/L	0.0003	ND		12/12/93

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REPORT OF LABORATORY ANALYSIS

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191377		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			B-16		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
AROMATIC VOLATILE ORGANICS-BTEX				8020	
Benzene	ug/L	0.3	ND		12/06/93
Toluene	ug/L	0.3	ND		12/06/93
Ethylbenzene	ug/L	0.3	ND		12/06/93
Xylenes, Total	ug/L	0.6	ND		12/06/93
a,a,a-Trifluorotoluene Surrogate Rec.	%		102		12/06/93
VOLATILE ORGANICS				8240	
Chloromethane	ug/L	10	ND		12/08/93
Vinyl chloride	ug/L	10	ND		12/08/93
Bromomethane	ug/L	10	ND		12/08/93
Chloroethane	ug/L	10	ND		12/08/93
Trichlorofluoromethane	ug/L	10	ND		12/08/93
1,1-Dichloroethene	ug/L	5	ND		12/08/93
Acetone	ug/L	50	ND		12/08/93
Carbon disulfide	ug/L	5	ND		12/08/93
Methylene chloride	ug/L	5	ND		12/08/93
trans-1,2-Dichloroethene	ug/L	5	ND		12/08/93
1,1-Dichloroethane	ug/L	5	ND		12/08/93
2-Butanone	ug/L	50	ND		12/08/93
cis-1,2-Dichloroethene	ug/L	5	ND		12/08/93
Chloroform	ug/L	5	ND		12/08/93
1,2-Dichloroethane	ug/L	5	ND		12/08/93
1,1,1-Trichloroethane	ug/L	5	ND		12/08/93
Carbon tetrachloride	ug/L	5	ND		12/08/93
Benzene	ug/L	5	ND		12/08/93
Trichloroethene	ug/L	5	ND		12/08/93
1,2-Dichloropropane	ug/L	5	ND		12/08/93
Bromodichloromethane	ug/L	5	ND		12/08/93
cis-1,3-Dichloropropene	ug/L	5	ND		12/08/93
trans-1,3-Dichloropropene	ug/L	5	ND		12/08/93
1,1,2-Trichloroethane	ug/L	5	ND		12/08/93
Dibromochloromethane	ug/L	5	ND		12/08/93

REPORT OF LABORATORY ANALYSIS

Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191377		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			B-16		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Bromoform	ug/L	5	ND		12/08/93
4-Methyl-2-pentanone	ug/L	50	ND		12/08/93
Toluene	ug/L	5	ND		12/08/93
2-Hexanone	ug/L	50	ND		12/08/93
1,1,2,2-Tetrachloroethane	ug/L	5	ND		12/08/93
Tetrachloroethene	ug/L	5	ND		12/08/93
Chlorobenzene	ug/L	5	ND		12/08/93
Ethylbenzene	ug/L	5	ND		12/08/93
Styrene	ug/L	5	ND		12/08/93
Xylenes (Total)	ug/L	5	ND		12/08/93
1,3-Dichlorobenzene	ug/L	5	ND		12/08/93
1,4-Dichlorobenzene	ug/L	5	ND		12/08/93
1,2-Dichlorobenzene	ug/L	5	ND		12/08/93
1,2-Dichloroethane-d4 (Surrog. Recovery)	%		100		12/08/93
Toluene-d8 (Surrog. Recovery)	%		103		12/08/93
4-Bromofluorobenzene (Surrog. Recovery)	%		101		12/08/93
SEMI-VOLATILES				8270	
8270 Date Extracted			12/06/93		
n-Nitrosodimethylamine	ug/L	10	ND		12/10/93
Phenol	ug/L	10	ND		12/10/93
Aniline	ug/L	10	ND		12/10/93
bis(2-Chloroethyl)ether	ug/L	10	ND		12/10/93
2-Chlorophenol	ug/L	10	ND		12/10/93
1,3-Dichlorobenzene	ug/L	10	ND		12/10/93
1,4-Dichlorobenzene	ug/L	10	ND		12/10/93
Benzyl alcohol	ug/L	10	ND		12/10/93
1,2-Dichlorobenzene	ug/L	10	ND		12/10/93
2-Methylphenol	ug/L	10	ND		12/10/93
bis(2-Chloroisopropyl)ether	ug/L	10	ND		12/10/93
4-Methylphenol	ug/L	10	ND		12/10/93
n-Nitroso-di-n-propylamine	ug/L	10	ND		12/10/93

REPORT OF LABORATORY ANALYSIS

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191377		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			B-16		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
Hexachloroethane	ug/L	10	ND		12/10/93
Nitrobenzene	ug/L	10	ND		12/10/93
Isophorone	ug/L	10	ND		12/10/93
2-Nitrophenol	ug/L	10	ND		12/10/93
2,4-Dimethylphenol	ug/L	10	ND		12/10/93
Benzoic acid	ug/L	50	ND		12/10/93
bis(2-Chloroethoxy)methane	ug/L	10	ND		12/10/93
2,4-Dichlorophenol	ug/L	10	ND		12/10/93
1,2,4-Trichlorobenzene	ug/L	10	ND		12/10/93
Naphthalene	ug/L	10	ND		12/10/93
4-Chloroaniline	ug/L	20	ND		12/10/93
Hexachlorobutadiene	ug/L	10	ND		12/10/93
4-Chloro-3-methylphenol	ug/L	10	ND		12/10/93
2-Methylnaphthalene	ug/L	10	ND		12/10/93
Hexachlorocyclopentadiene	ug/L	10	ND		12/10/93
2,4,6-Trichlorophenol	ug/L	10	ND		12/10/93
2,4,5-Trichlorophenol	ug/L	10	ND		12/10/93
2-Chloronaphthalene	ug/L	50	ND		12/10/93
2-Nitroaniline	ug/L	50	ND		12/10/93
Dimethylphthalate	ug/L	10	12		12/10/93
Acenaphthylene	ug/L	10	ND		12/10/93
2,6-Dinitrotoluene	ug/L	10	ND		12/10/93
3-Nitroaniline	ug/L	50	ND		12/10/93
Acenaphthene	ug/L	10	ND		12/10/93
2,4-Dinitrophenol	ug/L	50	ND		12/10/93
4-Nitrophenol	ug/L	50	ND		12/10/93
Dibenzofuran	ug/L	10	ND		12/10/93
2,4-Dinitrotoluene	ug/L	10	ND		12/10/93
Diethylphthalate	ug/L	10	ND		12/10/93
4-Chlorophenyl-phenylether	ug/L	10	ND		12/10/93
Fluorene	ug/L	10	ND		12/10/93

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REPORT OF LABORATORY ANALYSIS

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191377		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			B-16		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
4-Nitroaniline	ug/L	50	ND		12/10/93
4,6-Dinitro-2-methylphenol	ug/L	50	ND		12/10/93
n-Nitrosodiphenylamine	ug/L	10	ND		12/10/93
4-Bromophenyl-phenylether	ug/L	10	ND		12/10/93
Hexachlorobenzene	ug/L	10	ND		12/10/93
Pentachlorophenol	ug/L	10	ND		12/10/93
Phenanthrene	ug/L	10	ND		12/10/93
Anthracene	ug/L	10	ND		12/10/93
Di-n-butylphthalate	ug/L	10	ND		12/10/93
Fluoranthene	ug/L	10	ND		12/10/93
Benzidine	ug/L	50	ND		12/10/93
Pyrene	ug/L	10	ND		12/10/93
Butylbenzylphthalate	ug/L	10	ND		12/10/93
Benzo(a)anthracene	ug/L	10	ND		12/10/93
Chrysene	ug/L	10	ND		12/10/93
bis(2-Ethylhexyl)phthalate	ug/L	10	12		12/10/93
Di-n-octylphthalate	ug/L	10	ND		12/10/93
Benzo(b)fluoranthene	ug/L	10	ND		12/10/93
Benzo(k)fluoranthene	ug/L	10	ND		12/10/93
Benzo(a)pyrene	ug/L	10	ND		12/10/93
Indeno(1,2,3-cd)pyrene	ug/L	10	ND		12/10/93
Dibenzo(a,h)anthracene	ug/L	10	ND		12/10/93
Benzo(g,h,i)perylene	ug/L	10	ND		12/10/93
2-Fluorophenol (Surrog. Recovery)	%		70		12/10/93
Phenol-d5 (Surrog. Recovery)	%		65		12/10/93
Nitrobenzene-d5 (Surrog. Recovery)	%		82		12/10/93
2-Fluorobiphenyl (Surrog. Recovery)	%		80		12/10/93
2,4,6-Tribromophenol (Surrog. Recovery)	%		70		12/10/93
Terphenyl-d14 (Surrog. Recovery)	%		41		12/10/93
TPH CARBON CHAIN				8015	
TPH Carbon Chain Date Extracted			12/06/93		

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REPORT OF LABORATORY ANALYSIS

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191377		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			B-16		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
TPH CARBON CHAIN				8015	
Carbon Chain Range C10-C11	ug/L	100	ND		12/08/93
Carbon Chain Range C12-C14	ug/L	100	ND		12/08/93
Carbon Chain Range C16-C18	ug/L	100	ND		12/08/93
Carbon Chain Range C20-C24	ug/L	100	ND		12/08/93
Carbon Chain Range C28-C32	ug/L	100	ND		12/08/93
Carbon Chain Range C36-C44	ug/L	100	ND		12/08/93

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December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191385		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			PE-18		
Parameter	Units	MDL		METHOD	DATE ANALYZED
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Gravimetric-Sulfate	mg/L	10	232	375.3	12/12/93
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	376.2	12/07/93
Titrimetric-Chloride	mg/L	0.5	161	325.3	12/12/93
TITLE 22 TTLC METALS BY ICP				6010	
TTLC, ICP Date Digested			-		12/11/93
TTLC, ICP Antimony	mg/L	0.2	ND		12/13/93
TTLC, ICP Barium	mg/L	0.004	0.10		12/13/93
TTLC, ICP Beryllium	mg/L	0.002	ND		12/13/93
TTLC, ICP Cadmium	mg/L	0.006	ND		12/13/93
TTLC, ICP Chromium	mg/L	0.004	ND		12/13/93
TTLC, ICP Cobalt	mg/L	0.004	ND		12/13/93
TTLC, ICP Copper	mg/L	0.005	0.010		12/13/93
TTLC, ICP Lead	mg/L	0.05	ND		12/13/93
TTLC, ICP Molybdenum	mg/L	0.006	ND		12/13/93
TTLC, ICP Nickel	mg/L	0.02	ND		12/13/93
TTLC, ICP Silver	mg/L	0.02	ND		12/13/93
TTLC, ICP Vanadium	mg/L	0.005	ND		12/13/93
TTLC, ICP Zinc	mg/L	0.02	0.07		12/13/93
TITLE 22 TTLC METALS BY GFAA				GFAA	
TTLC, GFAA Date Digested			-		12/11/93
TTLC, GFAA Arsenic	mg/L	0.0025	ND		12/12/93
TTLC, GFAA Selenium	mg/L	0.0025	0.0059		12/12/93
TTLC, GFAA Thallium	mg/L	0.0025	ND		12/12/93
TITLE 22 TTLC MERCURY BY CV				7470	
TTLC, CV Date Digested			-		12/12/93
TTLC, CV Mercury	mg/L	0.0003	ND		12/12/93
ORGANIC ANALYSIS					
AROMATIC VOLATILE ORGANICS-BTEX				8020	
Benzene	ug/L	0.3	ND		12/06/93

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December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191385		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			PE-18		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
AROMATIC VOLATILE ORGANICS-BTEX				8020	
Toluene	ug/L	0.3	ND		12/06/93
Ethylbenzene	ug/L	0.3	ND		12/06/93
Xylenes, Total	ug/L	0.6	ND		12/06/93
a,a,a-Trifluorotoluene Surrogate Rec.	%		96		12/06/93
VOLATILE ORGANICS				8240	
Chloromethane	ug/L	10	ND		12/08/93
Vinyl chloride	ug/L	10	ND		12/08/93
Bromomethane	ug/L	10	ND		12/08/93
Chloroethane	ug/L	10	ND		12/08/93
Trichlorofluoromethane	ug/L	10	ND		12/08/93
1,1-Dichloroethene	ug/L	5	ND		12/08/93
Acetone	ug/L	50	ND		12/08/93
Carbon disulfide	ug/L	5	ND		12/08/93
Methylene chloride	ug/L	5	ND		12/08/93
trans-1,2-Dichloroethene	ug/L	5	ND		12/08/93
1,1-Dichloroethane	ug/L	5	ND		12/08/93
2-Butanone	ug/L	50	ND		12/08/93
cis-1,2-Dichloroethene	ug/L	5	ND		12/08/93
Chloroform	ug/L	5	ND		12/08/93
1,2-Dichloroethane	ug/L	5	ND		12/08/93
1,1,1-Trichloroethane	ug/L	5	ND		12/08/93
Carbon tetrachloride	ug/L	5	ND		12/08/93
Benzene	ug/L	5	ND		12/08/93
Trichloroethene	ug/L	5	ND		12/08/93
1,2-Dichloropropane	ug/L	5	ND		12/08/93
Bromodichloromethane	ug/L	5	ND		12/08/93
cis-1,3-Dichloropropene	ug/L	5	ND		12/08/93
trans-1,3-Dichloropropene	ug/L	5	ND		12/08/93
1,1,2-Trichloroethane	ug/L	5	ND		12/08/93
Dibromochloromethane	ug/L	5	ND		12/08/93
Bromoform	ug/L	5	ND		12/08/93

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Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191385		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			PE-18		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
4-Methyl-2-pentanone	ug/L	50	ND		12/08/93
Toluene	ug/L	5	ND		12/08/93
2-Hexanone	ug/L	50	ND		12/08/93
1,1,2,2-Tetrachloroethane	ug/L	5	ND		12/08/93
Tetrachloroethene	ug/L	5	ND		12/08/93
Chlorobenzene	ug/L	5	ND		12/08/93
Ethylbenzene	ug/L	5	ND		12/08/93
Styrene	ug/L	5	ND		12/08/93
Xylenes (Total)	ug/L	5	ND		12/08/93
1,3-Dichlorobenzene	ug/L	5	ND		12/08/93
1,4-Dichlorobenzene	ug/L	5	ND		12/08/93
1,2-Dichlorobenzene	ug/L	5	ND		12/08/93
1,2-Dichloroethane-d4 (Surrog. Recovery)	%		101		12/08/93
Toluene-d8 (Surrog. Recovery)	%		100		12/08/93
4-Bromofluorobenzene (Surrog. Recovery)	%		102		12/08/93
SEMI-VOLATILES				8270	
8270 Date Extracted			12/06/93		
n-Nitrosodimethylamine	ug/L	10	ND		12/10/93
Phenol	ug/L	10	ND		12/10/93
Aniline	ug/L	10	ND		12/10/93
bis(2-Chloroethyl)ether	ug/L	10	ND		12/10/93
2-Chlorophenol	ug/L	10	ND		12/10/93
1,3-Dichlorobenzene	ug/L	10	ND		12/10/93
1,4-Dichlorobenzene	ug/L	10	ND		12/10/93
Benzyl alcohol	ug/L	10	ND		12/10/93
1,2-Dichlorobenzene	ug/L	10	ND		12/10/93
2-Methylphenol	ug/L	10	ND		12/10/93
bis(2-Chloroisopropyl)ether	ug/L	10	ND		12/10/93
4-Methylphenol	ug/L	10	ND		12/10/93
n-Nitroso-di-n-propylamine	ug/L	10	ND		12/10/93
Hexachloroethane	ug/L	10	ND		12/10/93

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December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191385		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			PE-18		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
Nitrobenzene	ug/L	10	ND		12/10/93
Isophorone	ug/L	10	ND		12/10/93
2-Nitrophenol	ug/L	10	ND		12/10/93
2,4-Dimethylphenol	ug/L	10	ND		12/10/93
Benzoic acid	ug/L	50	ND		12/10/93
bis(2-Chloroethoxy)methane	ug/L	10	ND		12/10/93
2,4-Dichlorophenol	ug/L	10	ND		12/10/93
1,2,4-Trichlorobenzene	ug/L	10	ND		12/10/93
Naphthalene	ug/L	10	ND		12/10/93
4-Chloroaniline	ug/L	20	ND		12/10/93
Hexachlorobutadiene	ug/L	10	ND		12/10/93
4-Chloro-3-methylphenol	ug/L	10	ND		12/10/93
2-Methylnaphthalene	ug/L	10	ND		12/10/93
Hexachlorocyclopentadiene	ug/L	10	ND		12/10/93
2,4,6-Trichlorophenol	ug/L	10	ND		12/10/93
2,4,5-Trichlorophenol	ug/L	10	ND		12/10/93
2-Chloronaphthalene	ug/L	50	ND		12/10/93
2-Nitroaniline	ug/L	50	ND		12/10/93
Dimethylphthalate	ug/L	10	ND		12/10/93
Acenaphthylene	ug/L	10	ND		12/10/93
2,6-Dinitrotoluene	ug/L	10	ND		12/10/93
3-Nitroaniline	ug/L	50	ND		12/10/93
Acenaphthene	ug/L	10	ND		12/10/93
2,4-Dinitrophenol	ug/L	50	ND		12/10/93
4-Nitrophenol	ug/L	50	ND		12/10/93
Dibenzofuran	ug/L	10	ND		12/10/93
2,4-Dinitrotoluene	ug/L	10	ND		12/10/93
Diethylphthalate	ug/L	10	ND		12/10/93
4-Chlorophenyl-phenylether	ug/L	10	ND		12/10/93
Fluorene	ug/L	10	ND		12/10/93
4-Nitroaniline	ug/L	50	ND		12/10/93

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December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191385		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			PE-18		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
4,6-Dinitro-2-methylphenol	ug/L	50	ND		12/10/93
n-Nitrosodiphenylamine	ug/L	10	ND		12/10/93
4-Bromophenyl-phenylether	ug/L	10	ND		12/10/93
Hexachlorobenzene	ug/L	10	ND		12/10/93
Pentachlorophenol	ug/L	10	ND		12/10/93
Phenanthrene	ug/L	10	ND		12/10/93
Anthracene	ug/L	10	ND		12/10/93
Di-n-butylphthalate	ug/L	10	ND		12/10/93
Fluoranthene	ug/L	10	ND		12/10/93
Benzidine	ug/L	50	ND		12/10/93
Pyrene	ug/L	10	ND		12/10/93
Butylbenzylphthalate	ug/L	10	ND		12/10/93
Benzo(a)anthracene	ug/L	10	ND		12/10/93
Chrysene	ug/L	10	ND		12/10/93
bis(2-Ethylhexyl)phthalate	ug/L	10	ND		12/10/93
Di-n-octylphthalate	ug/L	10	ND		12/10/93
Benzo(b)fluoranthene	ug/L	10	ND		12/10/93
Benzo(k)fluoranthene	ug/L	10	ND		12/10/93
Benzo(a)pyrene	ug/L	10	ND		12/10/93
Indeno(1,2,3-cd)pyrene	ug/L	10	ND		12/10/93
Dibenzo(a,h)anthracene	ug/L	10	ND		12/10/93
Benzo(g,h,i)perylene	ug/L	10	ND		12/10/93
2-Fluorophenol (Surrog. Recovery)	%		55		12/10/93
Phenol-d5 (Surrog. Recovery)	%		58		12/10/93
Nitrobenzene-d5 (Surrog. Recovery)	%		62		12/10/93
2-Fluorobiphenyl (Surrog. Recovery)	%		73		12/10/93
2,4,6-Tribromophenol (Surrog. Recovery)	%		63		12/10/93
Terphenyl-d14 (Surrog. Recovery)	%		44		12/10/93
TPH CARBON CHAIN				8015	
TPH Carbon Chain Date Extracted			12/06/93		
Carbon Chain Range C10-C11	ug/L	100	ND		12/08/93

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December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

PACE Sample Number:			75 0191385		
Date Collected:			12/03/93		
Date Received:			12/03/93		
Client Sample ID:			PE-18		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
TPH CARBON CHAIN				8015	
Carbon Chain Range C12-C14	ug/L	100	ND		12/08/93
Carbon Chain Range C16-C18	ug/L	100	ND		12/08/93
Carbon Chain Range C20-C24	ug/L	100	ND		12/08/93
Carbon Chain Range C28-C32	ug/L	100	ND		12/08/93
Carbon Chain Range C36-C44	ug/L	100	ND		12/08/93

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

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Client Reference: Metro Rail(94-1100-02)

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Client Reference: Metro Rail(94-1100-02)

Gravimetric-Sulfate
Batch: 75 10522
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Gravimetric-Sulfate	mg/L	10	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385 PE-18	Spike	Spike Recv	Spike Dupl Recv	RPD
Gravimetric-Sulfate	mg/L	10	232	451	102%	106%	4%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Gravimetric-Sulfate	mg/L	10	451	100%

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Client Reference: Metro Rail(94-1100-02)

Spectrophotometric-Total Sulfide
Batch: 75 10467
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Spectrophotometric-Total Sulfide	mg/L	0.05	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385 PE-18	Spike	Spike Recv	Spike Dupl Recv	RPD
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	0.340	112%	112%	0%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Spectrophotometric-Total Sulfide	mg/L	0.05	0.340	100%

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Client Reference: Metro Rail(94-1100-02)

TTLC, GFAA Arsenic
Batch: 75 10516
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, GFAA Arsenic	mg/L	0.0025	ND
TTLC, GFAA Selenium	mg/L	0.0025	ND
TTLC, GFAA Thallium	mg/L	0.0025	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385 PE-18	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, GFAA Arsenic	mg/L	0.0025	ND	0.030	107%	93%	14%
TTLC, GFAA Selenium	mg/L	0.0025	0.0059	0.030	80%	74%	8%
TTLC, GFAA Thallium	mg/L	0.0025	ND	0.030	80%	73%	9%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, GFAA Arsenic	mg/L	0.0025	0.030	100%
TTLC, GFAA Selenium	mg/L	0.0025	0.030	107%
TTLC, GFAA Thallium	mg/L	0.0025	0.030	93%

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

Titrimetric-Chloride
Batch: 75 10518
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Titrimetric-Chloride	mg/L	0.5	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190826	Spike	Spike Recv	Spike Dupl Recv	RPD
Titrimetric-Chloride	mg/L	0.5	86.9	70	103%	102%	1%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Titrimetric-Chloride	mg/L	0.5	70	101%

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

TITLE 22 TTLC MERCURY BY CV
Batch: 75 10515
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, CV Mercury	mg/L	0.0003	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191377 B-16	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, CV Mercury	mg/L	0.0003	ND	0.0050	96%	98%	2%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, CV Mercury	mg/L	0.0003	0.0050	98%

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Client Reference: Metro Rail(94-1100-02)

TITLE 22 TTLC METALS BY ICP
Batch: 75 10519
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, ICP Antimony	mg/L	0.2	ND
TTLC, ICP Barium	mg/L	0.004	ND
TTLC, ICP Beryllium	mg/L	0.002	ND
TTLC, ICP Cadmium	mg/L	0.006	ND
TTLC, ICP Chromium	mg/L	0.004	ND
TTLC, ICP Cobalt	mg/L	0.004	ND
TTLC, ICP Copper	mg/L	0.005	ND
TTLC, ICP Lead	mg/L	0.05	ND
TTLC, ICP Molybdenum	mg/L	0.006	ND
TTLC, ICP Nickel	mg/L	0.02	ND
TTLC, ICP Silver	mg/L	0.02	ND
TTLC, ICP Vanadium	mg/L	0.005	ND
TTLC, ICP Zinc	mg/L	0.02	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385 PE-18	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, ICP Antimony	mg/L	0.2	ND	0.500	100%	100%	0%
TTLC, ICP Barium	mg/L	0.004	0.10	0.500	96%	98%	2%
TTLC, ICP Beryllium	mg/L	0.002	ND	0.500	96%	100%	4%
TTLC, ICP Cadmium	mg/L	0.006	ND	0.500	96%	98%	2%
TTLC, ICP Chromium	mg/L	0.004	ND	0.500	92%	94%	2%
TTLC, ICP Cobalt	mg/L	0.004	ND	0.500	92%	96%	4%
TTLC, ICP Copper	mg/L	0.005	0.010	0.500	94%	98%	4%
TTLC, ICP Lead	mg/L	0.05	ND	0.500	94%	96%	2%
TTLC, ICP Molybdenum	mg/L	0.006	ND	0.500	96%	98%	2%
TTLC, ICP Nickel	mg/L	0.02	ND	0.500	94%	96%	2%
TTLC, ICP Silver	mg/L	0.02	ND	0.500	90%	92%	2%
TTLC, ICP Vanadium	mg/L	0.005	ND	0.500	96%	100%	4%
TTLC, ICP Zinc	mg/L	0.02	0.07	0.500	92%	94%	2%

Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

TITLE 22 TTLC METALS BY ICP
Batch: 75 10519
Samples: 75 0191377, 75 0191385

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, ICP Antimony	mg/L	0.2	0.500	100%
TTLC, ICP Barium	mg/L	0.004	0.500	98%
TTLC, ICP Beryllium	mg/L	0.002	0.500	102%
TTLC, ICP Cadmium	mg/L	0.006	0.500	102%
TTLC, ICP Chromium	mg/L	0.004	0.500	98%
TTLC, ICP Cobalt	mg/L	0.004	0.500	100%
TTLC, ICP Copper	mg/L	0.005	0.500	98%
TTLC, ICP Lead	mg/L	0.05	0.500	98%
TTLC, ICP Molybdenum	mg/L	0.006	0.500	100%
TTLC, ICP Nickel	mg/L	0.02	0.500	100%
TTLC, ICP Silver	mg/L	0.02	0.500	96%
TTLC, ICP Vanadium	mg/L	0.005	0.500	100%
TTLC, ICP Zinc	mg/L	0.02	0.500	104%

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Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
Page 21 | PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

AROMATIC VOLATILE ORGANICS-BTEX
Batch: 75 10404
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Benzene	ug/L	0.3	ND
Toluene	ug/L	0.3	ND
Ethylbenzene	ug/L	0.3	ND
Xylenes, Total	ug/L	0.6	ND
a,a,a-Trifluorotoluene Surrogate Rec.	%		99

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191377 B-16	Spike	Spike Recv	Spike Dupl Recv	RPD
Benzene	ug/L	0.3	ND	20	103%	100%	3%
Toluene	ug/L	0.3	ND	20	103%	100%	3%
Ethylbenzene	ug/L	0.3	ND	20	106%	102%	4%
Xylenes, Total	ug/L	0.6	ND	60	107%	103%	4%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TPH Quantified as Gasoline	ug/L	50	450	89%
Benzene	ug/L	0.3	20	92%
Toluene	ug/L	0.3	20	93%
Ethylbenzene	ug/L	0.3	20	96%
Xylenes, Total	ug/L	0.6	60	97%

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Client Reference: Metro Rail(94-1100-02)

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
n-Nitrosodimethylamine	ug/L	10	ND
Phenol	ug/L	10	ND
Aniline	ug/L	10	ND
bis(2-Chloroethyl)ether	ug/L	10	ND
2-Chlorophenol	ug/L	10	ND
1,3-Dichlorobenzene	ug/L	10	ND
1,4-Dichlorobenzene	ug/L	10	ND
Benzyl alcohol	ug/L	10	ND
1,2-Dichlorobenzene	ug/L	10	ND
2-Methylphenol	ug/L	10	ND
bis(2-Chloroisopropyl)ether	ug/L	10	ND
4-Methylphenol	ug/L	10	ND
n-Nitroso-di-n-propylamine	ug/L	10	ND
Hexachloroethane	ug/L	10	ND
Nitrobenzene	ug/L	10	ND
Isophorone	ug/L	10	ND
2-Nitrophenol	ug/L	10	ND
2,4-Dimethylphenol	ug/L	10	ND
Benzoic acid	ug/L	50	ND
bis(2-Chloroethoxy)methane	ug/L	10	ND
2,4-Dichlorophenol	ug/L	10	ND
1,2,4-Trichlorobenzene	ug/L	10	ND
Naphthalene	ug/L	10	ND
4-Chloroaniline	ug/L	20	ND
Hexachlorobutadiene	ug/L	10	ND
4-Chloro-3-methylphenol	ug/L	10	ND
2-Methylnaphthalene	ug/L	10	ND
Hexachlorocyclopentadiene	ug/L	10	ND
2,4,6-Trichlorophenol	ug/L	10	ND
2,4,5-Trichlorophenol	ug/L	10	ND
2-Chloronaphthalene	ug/L	50	ND
2-Nitroaniline	ug/L	50	ND

Mr. Grant Miller | QUALITY CONTROL DATA | December 15, 1993
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Client Reference: Metro Rail(94-1100-02)

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Dimethylphthalate	ug/L	10	ND
Acenaphthylene	ug/L	10	ND
2,6-Dinitrotoluene	ug/L	10	ND
3-Nitroaniline	ug/L	50	ND
Acenaphthene	ug/L	10	ND
2,4-Dinitrophenol	ug/L	50	ND
4-Nitrophenol	ug/L	50	ND
Dibenzofuran	ug/L	10	ND
2,4-Dinitrotoluene	ug/L	10	ND
Diethylphthalate	ug/L	10	ND
4-Chlorophenyl-phenylether	ug/L	10	ND
Fluorene	ug/L	10	ND
4-Nitroaniline	ug/L	50	ND
4,6-Dinitro-2-methylphenol	ug/L	50	ND
n-Nitrosodiphenylamine	ug/L	10	ND
4-Bromophenyl-phenylether	ug/L	10	ND
Hexachlorobenzene	ug/L	10	ND
Pentachlorophenol	ug/L	10	ND
Phenanthrene	ug/L	10	ND
Anthracene	ug/L	10	ND
Di-n-butylphthalate	ug/L	10	ND
Fluoranthene	ug/L	10	ND
Benzidine	ug/L	50	ND
Pyrene	ug/L	10	ND
Butylbenzylphthalate	ug/L	10	ND
Benzo(a)anthracene	ug/L	10	ND
Chrysene	ug/L	10	ND
bis(2-Ethylhexyl)phthalate	ug/L	10	ND
Di-n-octylphthalate	ug/L	10	ND
Benzo(b)fluoranthene	ug/L	10	ND
Benzo(k)fluoranthene	ug/L	10	ND
Benzo(a)pyrene	ug/L	10	ND

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter		Units	MDL	Method Blank
Indeno(1,2,3-cd)pyrene		ug/L	10	ND
Dibenzo(a,h)anthracene		ug/L	10	ND
Benzo(g,h,i)perylene		ug/L	10	ND
2-Fluorophenol	(Surrog. Recovery	%		73
Phenol-d5	(Surrog. Recovery	%		69
Nitrobenzene-d5	(Surrog. Recovery	%		84
2-Fluorobiphenyl	(Surrog. Recovery	%		82
2,4,6-Tribromophenol	(Surrog. Recovery	%		65
Terphenyl-d14	(Surrog. Recovery	%		91

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Phenol	ug/L	10	200	69%	78%	12%
2-Chlorophenol	ug/L	10	200	77%	80%	4%
1,4-Dichlorobenzene	ug/L	10	100	78%	83%	6%
n-Nitroso-di-n-propylamine	ug/L	10	100	81%	91%	12%
1,2,4-Trichlorobenzene	ug/L	10	100	76%	78%	3%
4-Chloro-3-methylphenol	ug/L	10	200	84%	86%	2%
Acenaphthylene	ug/L	10	100	79%	93%	16%
4-Nitrophenol	ug/L	50	200	61%	82%	29%
2,4-Dinitrotoluene	ug/L	10	100	73%	88%	19%
Pentachlorophenol	ug/L	10	200	69%	75%	8%
Pyrene	ug/L	10	100	91%	106%	15%

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Client Reference: Metro Rail(94-1100-02)

TPH CARBON CHAIN
Batch: 75 10470
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Carbon Chain Range C10-C11	ug/L	100	ND
Carbon Chain Range C12-C14	ug/L	100	ND
Carbon Chain Range C16-C18	ug/L	100	ND
Carbon Chain Range C20-C24	ug/L	100	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Carbon Chain Range C10-C11	ug/L	100	720.0	125%	126%	1%
Carbon Chain Range C12-C14	ug/L	100	720.0	123%	129%	5%
Carbon Chain Range C16-C18	ug/L	100	450.0	129%	130%	1%
Carbon Chain Range C20-C24	ug/L	100	120.0	156%	155%	1%
Carbon Chain Range C28-C32	ug/L	100	60.0	215%	217%	1%

Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

VOLATILE ORGANICS
Batch: 75 10455
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Chloromethane	ug/L	10	ND
Vinyl chloride	ug/L	10	ND
Bromomethane	ug/L	10	ND
Chloroethane	ug/L	10	ND
Trichlorofluoromethane	ug/L	10	ND
1,1-Dichloroethene	ug/L	5	ND
Acetone	ug/L	50	ND
Carbon disulfide	ug/L	5	ND
Methylene chloride	ug/L	5	ND
trans-1,2-Dichloroethene	ug/L	5	ND
1,1-Dichloroethane	ug/L	5	ND
2-Butanone	ug/L	50	ND
cis-1,2-Dichloroethene	ug/L	5	ND
Chloroform	ug/L	5	ND
1,2-Dichloroethane	ug/L	5	ND
1,1,1-Trichloroethane	ug/L	5	ND
Carbon tetrachloride	ug/L	5	ND
Benzene	ug/L	5	ND
Trichloroethene	ug/L	5	ND
1,2-Dichloropropane	ug/L	5	ND
Bromodichloromethane	ug/L	5	ND
cis-1,3-Dichloropropene	ug/L	5	ND
trans-1,3-Dichloropropene	ug/L	5	ND
1,1,2-Trichloroethane	ug/L	5	ND
Dibromochloromethane	ug/L	5	ND
Bromoform	ug/L	5	ND
4-Methyl-2-pentanone	ug/L	50	ND
Toluene	ug/L	5	ND
2-Hexanone	ug/L	50	ND
1,1,2,2-Tetrachloroethane	ug/L	5	ND
Tetrachloroethene	ug/L	5	ND
Chlorobenzene	ug/L	5	ND

Mr. Grant Miller
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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731203509

Client Reference: Metro Rail(94-1100-02)

VOLATILE ORGANICS
Batch: 75 10455
Samples: 75 0191377, 75 0191385

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Ethylbenzene	ug/L	5	ND
Styrene	ug/L	5	ND
Xylenes (Total)	ug/L	5	ND
1,3-Dichlorobenzene	ug/L	5	ND
1,4-Dichlorobenzene	ug/L	5	ND
1,2-Dichlorobenzene	ug/L	5	ND
1,2-Dichloroethane-d4 (Surrog. Recovery	%		97
Toluene-d8 (Surrog. Recovery	%		100
4-Bromofluorobenzene (Surrog. Recovery	%		99

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385 PE-18	Spike	Spike Recv	Spike Dupl Recv	RPD
1,1-Dichloroethene	ug/L	5	ND	50	98%	105%	7%
Benzene	ug/L	5	ND	50	99%	99%	0%
Trichloroethene	ug/L	5	ND	50	91%	90%	1%
Toluene	ug/L	5	ND	50	95%	103%	8%
Chlorobenzene	ug/L	5	ND	50	95%	96%	1%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
1,1-Dichloroethene	ug/L	5	50	106%
Benzene	ug/L	5	50	109%
Trichloroethene	ug/L	5	50	93%
Toluene	ug/L	5	50	100%
Chlorobenzene	ug/L	5	50	96%

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Client Reference: Metro Rail(94-1100-02)

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

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REPORT OF LABORATORY ANALYSIS

December 15, 1993

Mr. Grant Miller
Earth Technology Corporation
13900 Alton Pkwy.
Suite 120
Irvine, CA 92718

RE: PACE Project No. 731201.508
Client Reference: Metro Rail-Red Line Extension

Dear Mr. Miller:

Enclosed is the report of laboratory analyses for samples received December 01, 1993.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Melanie R. Concepcion

Melanie R. Concepcion
Project Manager

Enclosures

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REPORT OF LABORATORY ANALYSIS

Earth Technology Corporation
13900 Alton Pkwy.
Suite 120
Irvine, CA 92718

December 15, 1993
PACE Project Number: 731201508

Attn: Mr. Grant Miller

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190800		
Date Collected:			12/01/93		
Date Received:			12/01/93		
			PE-23		
Parameter	Units	MDL		METHOD	DATE ANALYZED
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Gravimetric-Sulfate	mg/L	10	303	375.3	12/12/93
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	376.2	12/07/93
Titrimetric-Chloride	mg/L	0.5	168	325.3	12/12/93
TITLE 22 TTLC METALS BY ICP				6010	
TTLC, ICP Date Digested			-		12/11/93
TTLC, ICP Antimony	mg/L	0.2	ND		12/13/93
TTLC, ICP Barium	mg/L	0.004	0.11		12/13/93
TTLC, ICP Beryllium	mg/L	0.002	ND		12/13/93
TTLC, ICP Cadmium	mg/L	0.006	ND		12/13/93
TTLC, ICP Chromium	mg/L	0.004	ND		12/13/93
TTLC, ICP Cobalt	mg/L	0.004	ND		12/13/93
TTLC, ICP Copper	mg/L	0.005	ND		12/13/93
TTLC, ICP Lead	mg/L	0.05	ND		12/13/93
TTLC, ICP Molybdenum	mg/L	0.006	0.011		12/13/93
TTLC, ICP Nickel	mg/L	0.02	ND		12/13/93
TTLC, ICP Silver	mg/L	0.02	ND		12/13/93
TTLC, ICP Vanadium	mg/L	0.005	ND		12/13/93
TTLC, ICP Zinc	mg/L	0.02	0.028		12/13/93
TITLE 22 TTLC METALS BY GFAA				GFAA	
TTLC, GFAA Date Digested			-		12/11/93
TTLC, GFAA Arsenic	mg/L	0.0025	ND		12/12/93
TTLC, GFAA Selenium	mg/L	0.0025	0.0026		12/12/93
TTLC, GFAA Thallium	mg/L	0.0025	ND		12/12/93
TITLE 22 TTLC MERCURY BY CV				7470	
TTLC, CV Date Digested			-		12/06/93
TTLC, CV Mercury	mg/L	0.0003	ND		12/06/93

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REPORT OF LABORATORY ANALYSIS

Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190800		
Date Collected:			12/01/93		
Date Received:			12/01/93		
Client Sample ID:			PE-23		
Parameter	**Units**	**MDL**		**METHOD**	**DATE ANALYZED**
ORGANIC ANALYSIS					
AROMATIC VOLATILE ORGANICS-BTEX				8020	
Benzene	ug/L	0.3	ND		12/10/93
Toluene	ug/L	0.3	ND		12/10/93
Ethylbenzene	ug/L	0.3	ND		12/10/93
Xylenes, Total	ug/L	0.6	ND		12/10/93
a,a,a-Trifluorotoluene Surrogate Rec.	%		102		12/10/93
VOLATILE ORGANICS				8240	
Chloromethane	ug/L	10	ND		12/03/93
Vinyl chloride	ug/L	10	ND		12/03/93
Bromomethane	ug/L	10	ND		12/03/93
Chloroethane	ug/L	10	ND		12/03/93
Trichlorofluoromethane	ug/L	10	ND		12/03/93
1,1-Dichloroethene	ug/L	5	ND		12/03/93
Acetone	ug/L	50	ND		12/03/93
Carbon disulfide	ug/L	5	ND		12/03/93
Methylene chloride	ug/L	5	ND		12/03/93
trans-1,2-Dichloroethene	ug/L	5	ND		12/03/93
1,1-Dichloroethane	ug/L	5	ND		12/03/93
2-Butanone	ug/L	50	ND		12/03/93
cis-1,2-Dichloroethene	ug/L	5	ND		12/03/93
Chloroform	ug/L	5	ND		12/03/93
1,2-Dichloroethane	ug/L	5	ND		12/03/93
1,1,1-Trichloroethane	ug/L	5	ND		12/03/93
Carbon tetrachloride	ug/L	5	ND		12/03/93
Benzene	ug/L	5	ND		12/03/93
Trichloroethene	ug/L	5	ND		12/03/93
1,2-Dichloropropane	ug/L	5	ND		12/03/93
Bromodichloromethane	ug/L	5	ND		12/03/93
cis-1,3-Dichloropropene	ug/L	5	ND		12/03/93
trans-1,3-Dichloropropene	ug/L	5	ND		12/03/93
1,1,2-Trichloroethane	ug/L	5	ND		12/03/93
Dibromochloromethane	ug/L	5	ND		12/03/93

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REPORT OF LABORATORY ANALYSIS

December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190800		
Date Collected:			12/01/93		
Date Received:			12/01/93		
Client Sample ID:			PE-23		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Bromoform	ug/L	5	ND		12/03/93
4-Methyl-2-pentanone	ug/L	50	ND		12/03/93
Toluene	ug/L	5	ND		12/03/93
2-Hexanone	ug/L	50	ND		12/03/93
1,1,2,2-Tetrachloroethane	ug/L	5	ND		12/03/93
Tetrachloroethene	ug/L	5	ND		12/03/93
Chlorobenzene	ug/L	5	ND		12/03/93
Ethylbenzene	ug/L	5	ND		12/03/93
Styrene	ug/L	5	ND		12/03/93
Xylenes (Total)	ug/L	5	ND		12/03/93
1,3-Dichlorobenzene	ug/L	5	ND		12/03/93
1,4-Dichlorobenzene	ug/L	5	ND		12/03/93
1,2-Dichlorobenzene	ug/L	5	ND		12/03/93
1,2-Dichloroethane-d4 (Surrog. Recovery)	%		106		12/03/93
Toluene-d8 (Surrog. Recovery)	%		103		12/03/93
4-Bromofluorobenzene (Surrog. Recovery)	%		92		12/03/93
SEMI-VOLATILES				8270	
8270 Date Extracted			12/06/93		
n-Nitrosodimethylamine	ug/L	10	ND		12/10/93
Phenol	ug/L	10	ND		12/10/93
Aniline	ug/L	10	ND		12/10/93
bis(2-Chloroethyl)ether	ug/L	10	ND		12/10/93
2-Chlorophenol	ug/L	10	ND		12/10/93
1,3-Dichlorobenzene	ug/L	10	ND		12/10/93
1,4-Dichlorobenzene	ug/L	10	ND		12/10/93
Benzyl alcohol	ug/L	10	ND		12/10/93
1,2-Dichlorobenzene	ug/L	10	ND		12/10/93
2-Methylphenol	ug/L	10	ND		12/10/93
bis(2-Chloroisopropyl)ether	ug/L	10	ND		12/10/93
4-Methylphenol	ug/L	10	ND		12/10/93
n-Nitroso-di-n-propylamine	ug/L	10	ND		12/10/93

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REPORT OF LABORATORY ANALYSIS

Mr. Grant Miller
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December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190800		
Date Collected:			12/01/93		
Date Received:			12/01/93		
Client Sample ID:			PE-23		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
Hexachloroethane	ug/L	10	ND		12/10/93
Nitrobenzene	ug/L	10	ND		12/10/93
Isophorone	ug/L	10	ND		12/10/93
2-Nitrophenol	ug/L	10	ND		12/10/93
2,4-Dimethylphenol	ug/L	10	ND		12/10/93
Benzoic acid	ug/L	50	ND		12/10/93
bis(2-Chloroethoxy)methane	ug/L	10	ND		12/10/93
2,4-Dichlorophenol	ug/L	10	ND		12/10/93
1,2,4-Trichlorobenzene	ug/L	10	ND		12/10/93
Naphthalene	ug/L	10	ND		12/10/93
4-Chloroaniline	ug/L	20	ND		12/10/93
Hexachlorobutadiene	ug/L	10	ND		12/10/93
4-Chloro-3-methylphenol	ug/L	10	ND		12/10/93
2-Methylnaphthalene	ug/L	10	ND		12/10/93
Hexachlorocyclopentadiene	ug/L	10	ND		12/10/93
2,4,6-Trichlorophenol	ug/L	10	ND		12/10/93
2,4,5-Trichlorophenol	ug/L	10	ND		12/10/93
2-Chloronaphthalene	ug/L	50	ND		12/10/93
2-Nitroaniline	ug/L	50	ND		12/10/93
Dimethylphthalate	ug/L	10	ND		12/10/93
Acenaphthylene	ug/L	10	ND		12/10/93
2,6-Dinitrotoluene	ug/L	10	ND		12/10/93
3-Nitroaniline	ug/L	50	ND		12/10/93
Acenaphthene	ug/L	10	ND		12/10/93
2,4-Dinitrophenol	ug/L	50	ND		12/10/93
4-Nitrophenol	ug/L	50	ND		12/10/93
Dibenzofuran	ug/L	10	ND		12/10/93
2,4-Dinitrotoluene	ug/L	10	ND		12/10/93
Diethylphthalate	ug/L	10	ND		12/10/93
4-Chlorophenyl-phenylether	ug/L	10	ND		12/10/93
Fluorene	ug/L	10	ND		12/10/93

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Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190800		
Date Collected:			12/01/93		
Date Received:			12/01/93		
Client Sample ID:			PE-23		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
SEMI-VOLATILES				8270	
4-Nitroaniline	ug/L	50	ND		12/10/93
4,6-Dinitro-2-methylphenol	ug/L	50	ND		12/10/93
n-Nitrosodiphenylamine	ug/L	10	ND		12/10/93
4-Bromophenyl-phenylether	ug/L	10	ND		12/10/93
Hexachlorobenzene	ug/L	10	ND		12/10/93
Pentachlorophenol	ug/L	10	ND		12/10/93
Phenanthrene	ug/L	10	ND		12/10/93
Anthracene	ug/L	10	ND		12/10/93
Di-n-butylphthalate	ug/L	10	ND		12/10/93
Fluoranthene	ug/L	10	ND		12/10/93
Benzidine	ug/L	50	ND		12/10/93
Pyrene	ug/L	10	ND		12/10/93
Butylbenzylphthalate	ug/L	10	ND		12/10/93
Benzo(a)anthracene	ug/L	10	ND		12/10/93
Chrysene	ug/L	10	ND		12/10/93
bis(2-Ethylhexyl)phthalate	ug/L	10	ND		12/10/93
Di-n-octylphthalate	ug/L	10	ND		12/10/93
Benzo(b)fluoranthene	ug/L	10	ND		12/10/93
Benzo(k)fluoranthene	ug/L	10	ND		12/10/93
Benzo(a)pyrene	ug/L	10	ND		12/10/93
Indeno(1,2,3-cd)pyrene	ug/L	10	ND		12/10/93
Dibenzo(a,h)anthracene	ug/L	10	ND		12/10/93
Benzo(g,h,i)perylene	ug/L	10	ND		12/10/93
2-Fluorophenol (Surrog. Recovery)	%		84		12/10/93
Phenol-d5 (Surrog. Recovery)	%		86		12/10/93
Nitrobenzene-d5 (Surrog. Recovery)	%		90		12/10/93
2-Fluorobiphenyl (Surrog. Recovery)	%		84		12/10/93
2,4,6-Tribromophenol (Surrog. Recovery)	%		71		12/10/93
Terphenyl-d14 (Surrog. Recovery)	%		53		12/10/93
TPH CARBON CHAIN				8015	
TPH Carbon Chain Date Extracted			12/06/93		

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December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

PACE Sample Number:			75 0190800		
Date Collected:			12/01/93		
Date Received:			12/01/93		
Client Sample ID:			PE-23		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
TPH CARBON CHAIN				8015	
Carbon Chain Range C10-C11	ug/L	100	ND		12/08/93
Carbon Chain Range C12-C14	ug/L	100	ND		12/08/93
Carbon Chain Range C16-C18	ug/L	100	ND		12/08/93
Carbon Chain Range C20-C24	ug/L	100	ND		12/08/93
Carbon Chain Range C28-C32	ug/L	100	ND		12/08/93
Carbon Chain Range C36-C44	ug/L	100	ND		12/08/93

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

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FOOTNOTES
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MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

Gravimetric-Sulfate
Batch: 75 10522
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Gravimetric-Sulfate	mg/L	10	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
Gravimetric-Sulfate	mg/L	10	232	451	102%	106%	4%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Gravimetric-Sulfate	mg/L	10	451	100%

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Client Reference: Metro Rail-Red Line Extension

Spectrophotometric-Total Sulfide
Batch: 75 10467
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Spectrophotometric-Total Sulfide	mg/L	0.05	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
Spectrophotometric-Total Sulfide	mg/L	0.05	ND	0.340	112%	112%	0%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Spectrophotometric-Total Sulfide	mg/L	0.05	0.340	100%

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Client Reference: Metro Rail-Red Line Extension

TTLC, GFAA Arsenic
Batch: 75 10516
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, GFAA Arsenic	mg/L	0.0025	ND
TTLC, GFAA Selenium	mg/L	0.0025	ND
TTLC, GFAA Thallium	mg/L	0.0025	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, GFAA Arsenic	mg/L	0.0025	ND	0.030	107%	93%	14%
TTLC, GFAA Selenium	mg/L	0.0025	0.0059	0.030	80%	74%	8%
TTLC, GFAA Thallium	mg/L	0.0025	ND	0.030	80%	73%	9%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, GFAA Arsenic	mg/L	0.0025	0.030	100%
TTLC, GFAA Selenium	mg/L	0.0025	0.030	107%
TTLC, GFAA Thallium	mg/L	0.0025	0.030	93%

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QUALITY CONTROL DATA

December 15, 1993
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Client Reference: Metro Rail-Red Line Extension

Titrimetric-Chloride
Batch: 75 10518
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Titrimetric-Chloride	mg/L	0.5	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190826	Spike	Spike Recv	Spike Dupl Recv	RPD
Titrimetric-Chloride	mg/L	0.5	86.9	70	103%	102%	1%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Titrimetric-Chloride	mg/L	0.5	70	101%

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

TITLE 22 TTLC MERCURY BY CV
Batch: 75 10388
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, CV Mercury	mg/L	0.0003	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190800 PE-23	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, CV Mercury	mg/L	0.0003	ND	0.005	96%	104%	8%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, CV Mercury	mg/L	0.0003	0.005	96%

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Client Reference: Metro Rail-Red Line Extension

TITLE 22 TTLC METALS BY ICP
Batch: 75 10519
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TTLC, ICP Antimony	mg/L	0.2	ND
TTLC, ICP Barium	mg/L	0.004	ND
TTLC, ICP Beryllium	mg/L	0.002	ND
TTLC, ICP Cadmium	mg/L	0.006	ND
TTLC, ICP Chromium	mg/L	0.004	ND
TTLC, ICP Cobalt	mg/L	0.004	ND
TTLC, ICP Copper	mg/L	0.005	ND
TTLC, ICP Lead	mg/L	0.05	ND
TTLC, ICP Molybdenum	mg/L	0.006	ND
TTLC, ICP Nickel	mg/L	0.02	ND
TTLC, ICP Silver	mg/L	0.02	ND
TTLC, ICP Vanadium	mg/L	0.005	ND
TTLC, ICP Zinc	mg/L	0.02	ND

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750191385	Spike	Spike Recv	Spike Dupl Recv	RPD
TTLC, ICP Antimony	mg/L	0.2	ND	0.500	100%	100%	0%
TTLC, ICP Barium	mg/L	0.004	0.10	0.500	96%	98%	2%
TTLC, ICP Beryllium	mg/L	0.002	ND	0.500	96%	100%	4%
TTLC, ICP Cadmium	mg/L	0.006	ND	0.500	96%	98%	2%
TTLC, ICP Chromium	mg/L	0.004	ND	0.500	92%	94%	2%
TTLC, ICP Cobalt	mg/L	0.004	ND	0.500	92%	96%	4%
TTLC, ICP Copper	mg/L	0.005	0.010	0.500	94%	98%	4%
TTLC, ICP Lead	mg/L	0.05	ND	0.500	94%	96%	2%
TTLC, ICP Molybdenum	mg/L	0.006	ND	0.500	96%	98%	2%
TTLC, ICP Nickel	mg/L	0.02	ND	0.500	94%	96%	2%
TTLC, ICP Silver	mg/L	0.02	ND	0.500	90%	92%	2%
TTLC, ICP Vanadium	mg/L	0.005	ND	0.500	96%	100%	4%
TTLC, ICP Zinc	mg/L	0.02	0.07	0.500	92%	94%	2%

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TITLE 22 TTLC METALS BY ICP
Batch: 75 10519
Samples: 75 0190800

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TTLC, ICP Antimony	mg/L	0.2	0.500	100%
TTLC, ICP Barium	mg/L	0.004	0.500	98%
TTLC, ICP Beryllium	mg/L	0.002	0.500	102%
TTLC, ICP Cadmium	mg/L	0.006	0.500	102%
TTLC, ICP Chromium	mg/L	0.004	0.500	98%
TTLC, ICP Cobalt	mg/L	0.004	0.500	100%
TTLC, ICP Copper	mg/L	0.005	0.500	98%
TTLC, ICP Lead	mg/L	0.05	0.500	98%
TTLC, ICP Molybdenum	mg/L	0.006	0.500	100%
TTLC, ICP Nickel	mg/L	0.02	0.500	100%
TTLC, ICP Silver	mg/L	0.02	0.500	96%
TTLC, ICP Vanadium	mg/L	0.005	0.500	100%
TTLC, ICP Zinc	mg/L	0.02	0.500	104%

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BTEX & TPH QUANTIFIED AS GASOLINE
Batch: 75 10541
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
TPH Quantified as Gasoline	ug/L	50	ND
Benzene	ug/L	0.3	ND
Toluene	ug/L	0.3	ND
Ethylbenzene	ug/L	0.3	ND
Xylenes, Total	ug/L	0.6	ND
a,a,a-Trifluorotoluene Surrogate Rec.	%		99

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190800 PE-23	Spike	Spike Recv	Spike Dupl Recv	RPD
Benzene	ug/L	0.3	ND	20	100%	109%	9%
Toluene	ug/L	0.3	ND	20	101%	109%	8%
Ethylbenzene	ug/L	0.3	ND	20	104%	113%	8%
Xylenes, Total	ug/L	0.6	ND	60	104%	113%	8%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
TPH Quantified as Gasoline	ug/L	50	450	91%
Benzene	ug/L	0.3	20	98%
Toluene	ug/L	0.3	20	100%
Ethylbenzene	ug/L	0.3	20	103%
Xylenes, Total	ug/L	0.6	60	163%

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QUALITY CONTROL DATA

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Client Reference: Metro Rail-Red Line Extension

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
n-Nitrosodimethylamine	ug/L	10	ND
Phenol	ug/L	10	ND
Aniline	ug/L	10	ND
bis(2-Chloroethyl)ether	ug/L	10	ND
2-Chlorophenol	ug/L	10	ND
1,3-Dichlorobenzene	ug/L	10	ND
1,4-Dichlorobenzene	ug/L	10	ND
Benzyl alcohol	ug/L	10	ND
1,2-Dichlorobenzene	ug/L	10	ND
2-Methylphenol	ug/L	10	ND
bis(2-Chloroisopropyl)ether	ug/L	10	ND
4-Methylphenol	ug/L	10	ND
n-Nitroso-di-n-propylamine	ug/L	10	ND
Hexachloroethane	ug/L	10	ND
Nitrobenzene	ug/L	10	ND
Isophorone	ug/L	10	ND
2-Nitrophenol	ug/L	10	ND
2,4-Dimethylphenol	ug/L	10	ND
Benzoic acid	ug/L	50	ND
bis(2-Chloroethoxy)methane	ug/L	10	ND
2,4-Dichlorophenol	ug/L	10	ND
1,2,4-Trichlorobenzene	ug/L	10	ND
Naphthalene	ug/L	10	ND
4-Chloroaniline	ug/L	20	ND
Hexachlorobutadiene	ug/L	10	ND
4-Chloro-3-methylphenol	ug/L	10	ND
2-Methylnaphthalene	ug/L	10	ND
Hexachlorocyclopentadiene	ug/L	10	ND
2,4,6-Trichlorophenol	ug/L	10	ND
2,4,5-Trichlorophenol	ug/L	10	ND
2-Chloronaphthalene	ug/L	50	ND
2-Nitroaniline	ug/L	50	ND

Client Reference: Metro Rail-Red Line Extension

SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Dimethylphthalate	ug/L	10	ND
Acenaphthylene	ug/L	10	ND
2,6-Dinitrotoluene	ug/L	10	ND
3-Nitroaniline	ug/L	50	ND
Acenaphthene	ug/L	10	ND
2,4-Dinitrophenol	ug/L	50	ND
4-Nitrophenol	ug/L	50	ND
Dibenzofuran	ug/L	10	ND
2,4-Dinitrotoluene	ug/L	10	ND
Diethylphthalate	ug/L	10	ND
4-Chlorophenyl-phenylether	ug/L	10	ND
Fluorene	ug/L	10	ND
4-Nitroaniline	ug/L	50	ND
4,6-Dinitro-2-methylphenol	ug/L	50	ND
n-Nitrosodiphenylamine	ug/L	10	ND
4-Bromophenyl-phenylether	ug/L	10	ND
Hexachlorobenzene	ug/L	10	ND
Pentachlorophenol	ug/L	10	ND
Phenanthrene	ug/L	10	ND
Anthracene	ug/L	10	ND
Di-n-butylphthalate	ug/L	10	ND
Fluoranthene	ug/L	10	ND
Benzidine	ug/L	50	ND
Pyrene	ug/L	10	ND
Butylbenzylphthalate	ug/L	10	ND
Benzo(a)anthracene	ug/L	10	ND
Chrysene	ug/L	10	ND
bis(2-Ethylhexyl)phthalate	ug/L	10	ND
Di-n-octylphthalate	ug/L	10	ND
Benzo(b)fluoranthene	ug/L	10	ND
Benzo(k)fluoranthene	ug/L	10	ND
Benzo(a)pyrene	ug/L	10	ND

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SEMI-VOLATILES
Batch: 75 10527
Samples: 75 0190800

METHOD BLANK:

Parameter		Units	MDL	Method Blank
Indeno(1,2,3-cd)pyrene		ug/L	10	ND
Dibenzo(a,h)anthracene		ug/L	10	ND
Benzo(g,h,i)perylene		ug/L	10	ND
2-Fluorophenol	(Surrog. Recovery	%		73
Phenol-d5	(Surrog. Recovery	%		69
Nitrobenzene-d5	(Surrog. Recovery	%		84
2-Fluorobiphenyl	(Surrog. Recovery	%		82
2,4,6-Tribromophenol	(Surrog. Recovery	%		65
Terphenyl-d14	(Surrog. Recovery	%		91

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Phenol	ug/L	10	200	69%	78%	12%
2-Chlorophenol	ug/L	10	200	77%	80%	4%
1,4-Dichlorobenzene	ug/L	10	100	78%	83%	6%
n-Nitroso-di-n-propylamine	ug/L	10	100	81%	91%	12%
1,2,4-Trichlorobenzene	ug/L	10	100	76%	78%	3%
4-Chloro-3-methylphenol	ug/L	10	200	84%	86%	2%
Acenaphthylene	ug/L	10	100	79%	93%	16%
4-Nitrophenol	ug/L	50	200	61%	82%	29%
2,4-Dinitrotoluene	ug/L	10	100	73%	88%	19%
Pentachlorophenol	ug/L	10	200	69%	75%	8%
Pyrene	ug/L	10	100	91%	106%	15%

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QUALITY CONTROL DATA

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PACE Project Number: 731201508

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TPH CARBON CHAIN
Batch: 75 10470
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Carbon Chain Range C10-C11	ug/L	100	ND
Carbon Chain Range C12-C14	ug/L	100	ND
Carbon Chain Range C16-C18	ug/L	100	ND
Carbon Chain Range C20-C24	ug/L	100	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Carbon Chain Range C10-C11	ug/L	100	720.0	125%	126%	1%
Carbon Chain Range C12-C14	ug/L	100	720.0	123%	129%	5%
Carbon Chain Range C16-C18	ug/L	100	450.0	129%	130%	1%
Carbon Chain Range C20-C24	ug/L	100	120.0	156%	155%	1%
Carbon Chain Range C28-C32	ug/L	100	60.0	215%	217%	1%

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QUALITY CONTROL DATA

December 15, 1993
PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

VOLATILE ORGANICS
Batch: 75 10368
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Chloromethane	ug/L	10	ND
Vinyl chloride	ug/L	10	ND
Bromomethane	ug/L	10	ND
Chloroethane	ug/L	10	ND
Trichlorofluoromethane	ug/L	10	ND
1,1-Dichloroethene	ug/L	5	ND
Acetone	ug/L	50	ND
Carbon disulfide	ug/L	5	ND
Methylene chloride	ug/L	5	ND
trans-1,2-Dichloroethene	ug/L	5	ND
1,1-Dichloroethane	ug/L	5	ND
2-Butanone	ug/L	50	ND
cis-1,2-Dichloroethene	ug/L	5	ND
Chloroform	ug/L	5	ND
1,2-Dichloroethane	ug/L	5	ND
1,1,1-Trichloroethane	ug/L	5	ND
Carbon tetrachloride	ug/L	5	ND
Benzene	ug/L	5	ND
Trichloroethene	ug/L	5	ND
1,2-Dichloropropane	ug/L	5	ND
Bromodichloromethane	ug/L	5	ND
cis-1,3-Dichloropropene	ug/L	5	ND
trans-1,3-Dichloropropene	ug/L	5	ND
1,1,2-Trichloroethane	ug/L	5	ND
Dibromochloromethane	ug/L	5	ND
Bromoform	ug/L	5	ND
4-Methyl-2-pentanone	ug/L	50	ND
Toluene	ug/L	5	ND
2-Hexanone	ug/L	50	ND
1,1,2,2-Tetrachloroethane	ug/L	5	ND
Tetrachloroethene	ug/L	5	ND
Chlorobenzene	ug/L	5	ND

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Client Reference: Metro Rail-Red Line Extension

VOLATILE ORGANICS
Batch: 75 10368
Samples: 75 0190800

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Ethylbenzene	ug/L	5	ND
Styrene	ug/L	5	ND
Xylenes (Total)	ug/L	5	ND
1,3-Dichlorobenzene	ug/L	5	ND
1,4-Dichlorobenzene	ug/L	5	ND
1,2-Dichlorobenzene	ug/L	5	ND
1,2-Dichloroethane-d4 (Surrog. Recovery	%		114
Toluene-d8 (Surrog. Recovery	%		99
4-Bromofluorobenzene (Surrog. Recovery	%		91

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	750190800 PE-23	Spike	Spike Recv	Spike Dupl Recv	RPD
1,1-Dichloroethene	ug/L	5	ND	50	87%	85%	2%
Benzene	ug/L	5	ND	50	91%	92%	1%
Trichloroethene	ug/L	5	ND	50	99%	101%	2%
Toluene	ug/L	5	ND	50	99%	100%	1%
Chlorobenzene	ug/L	5	ND	50	98%	105%	7%

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
1,1-Dichloroethene	ug/L	5	50	86%
Benzene	ug/L	5	50	90%
Trichloroethene	ug/L	5	50	95%
Toluene	ug/L	5	50	99%
Chlorobenzene	ug/L	5	50	102%

Mr. Grant Miller | FOOTNOTES | December 15, 1993
Page 22 | for pages 8 through 21 | PACE Project Number: 731201508

Client Reference: Metro Rail-Red Line Extension

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714-892-2565
FAX: 714-890-4032

C K Y incorporated
Analytical Laboratories

Date: 12-28-1993
CKY Batch No.: 93L064

Attn.: K. Khilnani

Earth Technology Corp.
13900 Alton Parkway #120
Irvine, CA 92718

Subject: Laboratory Report
Project: Metro Rail - East Side Ext.

Enclosed is the Laboratory report for samples received on 12/16/93. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported include :

Sample ID	Control No.	Matrix	Analysis
PE-29	L064-01	water	EPA 8240
PE-29	L064-02	water	EPA 602
PE-29	L064-03	water	EPA 8270
PE-29	L064-04	water	M8015 (CCID)
PE-29	L064-05	water	Sulfide
PE-29	L064-06	water	Dissolved CAM Metals
PE-29	L064-07	water	Chloride
			Sulfate

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Kam Y. Pang, Ph.D.
Laboratory Director

P.S. - All analyses requested for the above referenced project have been completed. Therefore, unless instructed, the remaining portions of the samples will be disposed after fifteen (15) days from the date of this report.

630 Maple Ave., Torrance, Calif. 90503 • Telephone 310-618-8889 • Fax: 310-618-0818

EPA METHOD 602
BTEX

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/21/93

				RESULTS (ug/L)				% Rcvy
SAMPLE ID	CNTRL NO	DL F	MDL	BENZ	TOLUENE	E BENZ	XYLS	SURR
PE-29	L064-02	5	5	250	40	870	320	99
VBLK1W	L061-B1W	1	1	ND	ND	ND	ND	96

QC LIMIT: 65-135

DL F : Dilution Factor
SURR : Bromofluorobenzene
MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 602
MATRIX: WATER

==========

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: NA
CONTROL NO.: L061-L1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065 93L067 93L077

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Benzene	25	26	104
Toluene	170	170	100
Ethyl Benzene	25	26	104
Xylenes	140	162	116

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 602
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: VBLK1W DATE EXTRACTED: NA
CONTROL NO.: L061-B1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065 93L067 93L077

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
Benzene	ND	25	23	92	25	22	88	4
Toluene	ND	170	163	96	170	176	104	8
Ethyl Benzene	ND	25	26	104	25	27	108	4
Xylenes	ND	145	152	105	145	166	114	8

EPA METHOD 8240
VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	NA
SAMPLE ID:	PE-29	DATE ANALYZED:	12/16/93
CONTROL NO.:	L064-01	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	5

PARAMETERS	results (ug/L)	MDL (ug/L)
Acetone	ND	100
Benzene	230	5
Bromodichloromethane	ND	5
Bromoform	ND	10
Bromomethane	ND	50
2-Butanone (MEK)	ND	100
Carbon Disulfide	ND	5
Carbon Tetrachloride	ND	5
Chlorobenzene	ND	5
Chlorodibromomethane	ND	50
Chloroethane	ND	50
2-Chloroethyl Vinyl Ether	ND	50
Chloroform	ND	5
Chloromethane	ND	50
Dibromoethane	ND	5
Dichlorodifluoromethane	ND	50
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
cis-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethylbenzene	920	5
2-Hexanone	ND	50
Methylene Chloride	ND	50
4-Methyl-2-pentanone (MIBK)	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	54	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Trichlorofluoromethane	ND	10
Vinyl Acetate	24	50
Vinyl Chloride	270	50
Xylenes	ND	5

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
1,2 Dichloroethane-d4	97	76-114
Toluene -d8	96	88-110
Bromofluorobenzene	95	86-115

MDL : Method Detection Limit

EPA METHOD 8240
VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L064	DATE EXTRACTED:	NA
SAMPLE ID:	VBLK1W	DATE ANALYZED:	12/16/93
CONTROL NO.:	L064-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	results (ug/L)	MDL (ug/L)
Acetone	ND	20
Benzene	ND	1
Bromodichloromethane	ND	1
Bromoform	ND	2
Bromomethane	ND	10
2-Butanone (MEK)	ND	20
Carbon Disulfide	ND	1
Carbon Tetrachloride	ND	1
Chlorobenzene	ND	1
Chlorodibromomethane	ND	10
Chloroethane	ND	10
2-Chloroethyl Vinyl Ether	ND	10
Chloroform	ND	1
Chloromethane	ND	10
Dibromoethane	ND	1
Dichlorodifluoromethane	ND	10
1,1-Dichloroethane	ND	1
1,2-Dichloroethane	ND	1
1,1-Dichloroethene	ND	1
trans-1,2-Dichloroethene	ND	1
cis-1,2-Dichloroethene	ND	1
1,2-Dichloropropane	ND	1
cis-1,3-Dichloropropene	ND	1
trans-1,3-Dichloropropene	ND	1
Ethylbenzene	ND	1
2-Hexanone	ND	10
Methylene Chloride	ND	10
4-Methyl-2-pentanone (MIBK)	ND	2
Styrene	ND	1
1,1,2,2-Tetrachloroethane	ND	1
Tetrachloroethene	ND	1
Toluene	ND	1
1,1,1-Trichloroethane	ND	1
1,1,2-Trichloroethane	ND	1
Trichloroethene	ND	1
Trichlorofluoromethane	ND	2
Vinyl Acetate	ND	10
Vinyl Chloride	ND	10
Xylenes	ND	1

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
1,2 Dichloroethane-d4	93	76-114
Toluene -d8	109	88-110
Bromofluorobenzene	95	86-115

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 624/8240
MATRIX: WATER

==========

BATCH NO.: 93L064
SAMPLE ID: LCS01
CONTROL NO.: L064-B1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L064

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)	QC LIMIT
1,1-DCE	50	53	106	61-145
Benzene	50	47	94	76-127
TCE	50	47	94	71-120
Toluene	50	49	98	76-125
Chlorobenzene	50	47	94	75-130

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 624/8240
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: VBLK1W DATE EXTRACTED: NA
CONTROL NO.: L064-B1W DATE ANALYZED: 12/16/93

ACCESSION: 93L064

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
1,1-DCE	ND	50	64	128	50	58	116	10
Benzene	ND	50	53	106	50	56	112	6
TCE	ND	50	50	100	50	50	100	0
Toluene	ND	50	50	100	50	50	100	0
Chlorobenzene	ND	50	51	102	50	50	100	2

EPA METHOD 3005/6010
DISSOLVED CAM METALS BY ICP

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	12/17/93
SAMPLE ID:	PE-29	DATE ANALYZED:	12/20/93
CONTROL NO.:	L064-06	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

Element	Det Limit (ug/L)	RESULT (ug/L)
Antimony	100	ND
Arsenic	200	ND
Barium	10	1240
Beryllium	10	ND
Cadmium	10	ND
Chromium	10	ND
Cobalt	10	ND
Copper	10	ND
Lead	100	ND
Mercury^	0.2	ND
Molybdenum	50	ND
Nickel	20	ND
Selenium	200	ND
Silver	10	ND
Thallium	200	ND
Vanadium	10	ND
Zinc	20	ND

^ EPA METHOD 7471

EPA METHOD 3005/6010
DISSOLVED CAM METALS BY ICP

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L064	DATE EXTRACTED:	12/17/93
SAMPLE ID:	IBLK1W	DATE ANALYZED:	12/20/93
CONTROL NO.:	L061-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

Element	Det Limit (ug/L)	RESULT (ug/L)
Antimony	100	ND
Arsenic	200	ND
Barium	10	ND
Beryllium	10	ND
Cadmium	10	ND
Chromium	10	ND
Cobalt	10	ND
Copper	10	ND
Lead	100	ND
Mercury^	0.2	ND
Molybdenum	50	ND
Nickel	20	ND
Selenium	200	ND
Silver	10	ND
Thallium	200	ND
Vanadium	10	ND
Zinc	20	ND

^ EPA METHOD 7471

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-L1W DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Antimony	1000	1050	105
Arsenic	1000	998	100
Barium	1000	1020	102
Beryllium	1000	1020	102
Cadmium	1000	1050	105
Chromium	1000	1050	105
Cobalt	1000	1040	104
Copper	1000	1000	100
Lead	1000	1060	106
Mercury^	5.0	5.11	102
Molybdenum	1000	1020	102
Nickel	1000	1060	106
Selenium	1000	1050	105
Silver	1000	996	100
Thallium	1000	952	95
Vanadium	1000	1040	104
Zinc	1000	1050	105

^ EPA METHOD 7471

CKY QUALITY CONTROL DATA
SPIKE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-06 DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE RESULT (ug/L)	SPIKE CONC. (ug/L)	SPIKE RESULT (ug/L)	SPIKE RECRY. (%)
Antimony	ND	1000	1030	103
Arsenic	ND	1000	1100	110
Barium	684	1000	1680	100
Beryllium	ND	1000	1010	101
Cadmium	ND	1000	1030	103
Chromium	ND	1000	1010	101
Cobalt	ND	1000	997	100
Copper	ND	1000	987	99
Lead	ND	1000	1030	103
Mercury^	ND	0.5	0.5	100
Molybdenum	ND	1000	1030	102
Nickel	ND	1000	985	98
Selenium	ND	1000	444	44+
Silver	ND	1000	936	94
Thallium	ND	1000	981	98
Vanadium	ND	1000	1030	103
Zinc	104	1000	1140	103

^ EPA METHOD 7471
+ Selenium is out of the control limit of 75-125% matrix spike recovery. Since the method blank, duplicate, and lab control sample are within the QC limits, no further corrective action was taken.

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-06 DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE RESULT (ug/L)	DUP SAMPLE RESULT (ug/L)	RPD RESULT (%)
Antimony	ND	ND	0
Arsenic	ND	ND	0
Barium	684	691	1
Beryllium	ND	ND	0
Cadmium	ND	ND	0
Chromium	ND	ND	0
Cobalt	ND	ND	0
Copper	ND	ND	0
Lead	ND	ND	0
Mercury^	ND	ND	0
Molybdenum	ND	ND	0
Nickel	ND	ND	0
Selenium	ND	ND	0
Silver	ND	ND	0
Thallium	ND	ND	0
Vanadium	ND	ND	0
Zinc	104	105	0

^ EPA METHOD 7471

EPA METHOD M8015
TOTAL PETROLEUM HYDROCARBONS BY EXTRACTION
CARBON CHAIN IDENTIFICATION

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	12/20/93
MATRIX:	WATER	DATE ANALYZED:	12/21/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	H-C RANGE	% RECOVERY SURR1	% RECOVERY SURR2	DL FACTOR	MDL (mg/L)
PE-29	L064-04	1.3	C8-C9	122	132	1	.5
		1.1	C9-C10				
		1.7	C10-C11				
		0.12~	C11-C13				
		1.9	C13-C14				
		0.11~	C15-C16				
	(Total)	8.4**	C6-C21				
DBLK1W	L069-B1W*	ND	N.A.	101	123	1	.5
QC LIMIT:				65-135	60-140		

SURR1 : Bromobenzene
SURR2 : Hexacosane
MDL : Method Detection Limit
* : Date Analyzed, 12/20/93
~ : Estimate
** : Result based on calibration for total diesel

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA M8015
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: DBLK1W DATE EXTRACTED: 12/20/93
CONTROL NO.: L069-B1W DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065 93L069 93L079 93L067

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC	SPIKE ADDED (mg/L)	MSD CONC (mg/L)	MSD % REC	% RPD
DIESEL	ND	1	.94	94	1	.90	90	4

EPA METHOD 376.1
TOTAL SULFIDE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-29	L064-05	150	20	4
WBLK1W	L064-B1W	ND	1	.2

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

==========

BATCH NO.: 93L064
SAMPLE ID: LCS01
CONTROL NO.: L065-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L064 93L065

PARAMETER	TRUE VALUE (mg/L)	FOUND VALUE (mg/L)	LCS RECOVERY (%)
SULFIDE	5.00	4.40	88

CKY QUALITY CONTROL DATA
SPIKE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: PE-31 DATE EXTRACTED: NA
CONTROL NO.: L065-05 DATE ANALYZED: 12/16/93

ACCESSION: 93L064 93L065

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC
SULFIDE	10.50	50.00	64.40	108

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

BATCH NO.: 93L064
SAMPLE ID: PE-31
CONTROL NO.: L065-05

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L064 93L065

PARAMETER	Sample (mg/L)	Dup. Sample (mg/L)	RPD (%)
SULFIDE	10.50	9.80	7

EPA METHOD 300
SULFATE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-29	L064-07	25	20	20
WBLK1W	L061-B1W	ND	1	1

MDL : Method Detection Limit

EPA METHOD 300
CHLORIDE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-29	L064-07	280	20	4
WBLK1W	L061-B1W	ND	1	.2

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

==========

BATCH NO.: 93L064
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

PARAMETER	TRUE VALUE (mg/L)	FOUND VALUE (mg/L)	LCS RECOVERY (%)
Sulfate	150	138	92
Chloride	30.00	27.50	92

CKY QUALITY CONTROL DATA
SPIKE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: NA
CONTROL NO.: L061-07 DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC
Sulfate	246	200	440	97
Chloride	241	100	357	116

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

==========

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: NA
CONTROL NO.: L061-07 DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

PARAMETER	Sample (mg/L)	Dup. Sample (mg/L)	RPD (%)
Sulfate	246	260	6
Chloride	241	244	1

EPA METHOD 625
SEMI VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L064	DATE EXTRACTED:	12/20/93
SAMPLE ID:	PE-29	DATE ANALYZED:	12/21/93
CONTROL NO.:	L064-03	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	(ug/L) RESULT	MDL	PARAMETERS	(ug/L) RESULT	MDL
N-Nitrosodimethylamine	ND	10	3-Nitroaniline	ND	50
Pyridine	ND	10	Acenaphthene	33	10
Aniline	ND	10	2,4-Dinitrophenol	ND	50
Phenol	16	10	4-Nitrophenol	ND	50
bis(2-Chloroethyl)ether	ND	10	Dibenzofuran	ND	10
2-Chlorophenol	ND	10	2,4-Dinitrotoluene	ND	10
1,3-Dichlorobenzene	ND	10	Diethylphthalate	ND	10
1,4-Dichlorobenzene	ND	10	4-Chlorophenyl-phenylether	ND	10
Benzyl Alcohol	ND	10	Fluorene	ND	10
1,2-Dichlorobenzene	ND	10	1,2-Diphenylhydrazine	ND	50
2-Methylphenol	ND	10	4-Nitroaniline	ND	50
2,2'-oxybis(1-Chloropropane)	ND	10	4,6-Dinitro-2-methylphenol	ND	50
4-Methylphenol	13	10	N-Nitrosodiphenylamine (1)	ND	10
N-Nitroso-di-n-propylamine	ND	10	4-Bromophenyl-phenylether	ND	10
Hexachloroethane	ND	10	Hexachlorobenzene	ND	10
Nitrobenzene	ND	10	Pentachlorophenol	ND	10
Isophorone	ND	10	Benzidine	ND	50
2-Nitrophenol	ND	10	Phenanthrene	ND	50
2,4-Dimethylphenol	ND	10	Anthracene	ND	10
Benzoic Acid	ND	50	Carbazole	ND	50
bis(2-Chloroethoxy)methane	ND	10	Di-n-butylphthalate	ND	10
2,4-Dichlorophenol	ND	10	Fluoranthene	ND	10
1,2,4-Trichlorobenzene	ND	10	4,4'-Methylene Dianiline	ND	50
Naphthalene	600~	10	Pyrene	ND	10
4-Chloroaniline	ND	20	Bisphenol-A	ND	10
Hexachloro-1,3-butadiene	ND	10	Butylbenzylphthalate	ND	10
4-Chloro-3-methylphenol	ND	20	3,3'-Dichlorobenzidine	ND	20
2-Methylnaphthalene	12	10	Benzo(a)anthracene	ND	10
Hexachlorocyclopentadiene	ND	10	Chrysene	ND	10
2,4,6-Trichlorophenol	ND	10	bis(2-Ethylhexyl)phthalate	ND	10
2,4,5-Trichlorophenol	ND	10	Di-n-octylphthalate	ND	10
2-Chloronaphthalene	ND	10	Benz(b)fluoranthene	ND	10
1-Chloronaphthalene	ND	10	Benzo(k)fluoranthene	ND	10
2-Nitroaniline	ND	50	Benzo(a)pyrene	ND	10
Dimethylphthalate	ND	10	Indeno(1,2,3-cd)pyrene	ND	10
Acenaphthylene	ND	10	Dibenzo(a,h)anthracene	ND	10
2,6-Dinitrotoluene	ND	10	Benzo(g,h,i)perylene	ND	10

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
Nitrobenzene-d5	83	35-114
2-Fluorobiphenyl	82	43-116
Terphenyl-d14	86	33-141
Phenol-d5	78	10-110
2-Fluorophenol	73	21-110
2,4,6-Tribromophenol	+0	10-123

~ Reported from 1/10 dilution
+ Surrogate loss due to matrix interference
MDL: Method Detection Limit

EPA METHOD 625
SEMI VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L064	DATE EXTRACTED:	12/20/93
SAMPLE ID:	SBLK01	DATE ANALYZED:	12/21/93
CONTROL NO.:	L064-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	(ug/L) RESULT	MDL	PARAMETERS	(ug/L) RESULT	MDL
N-Nitrosodimethylamine	ND	10	3-Nitroaniline	ND	50
Pyridine	ND	10	Acenaphthene	ND	10
Aniline	ND	10	2,4-Dinitrophenol	ND	50
Phenol	ND	10	4-Nitrophenol	ND	50
bis(2-Chloroethyl)ether	ND	10	Dibenzofuran	ND	10
2-Chlorophenol	ND	10	2,4-Dinitrotoluene	ND	10
1,3-Dichlorobenzene	ND	10	Diethylphthalate	ND	10
1,4-Dichlorobenzene	ND	10	4-Chlorophenyl-phenylether	ND	10
Benzyl Alcohol	ND	10	Fluorene	ND	10
1,2-Dichlorobenzene	ND	10	1,2-Diphenylhydrazine	ND	50
2-Methylphenol	ND	10	4-Nitroaniline	ND	50
2,2'-oxybis(1-Chloropropane)	ND	10	4,6-Dinitro-2-methylphenol	ND	50
4-Methylphenol	ND	10	N-Nitrosodiphenylamine (1)	ND	10
N-Nitroso-di-n-propylamine	ND	10	4-Bromophenyl-phenylether	ND	10
Hexachloroethane	ND	10	Hexachlorobenzene	ND	10
Nitrobenzene	ND	10	Pentachlorophenol	ND	10
Isophorone	ND	10	Benzidine	ND	50
2-Nitrophenol	ND	10	Phenanthrene	ND	50
2,4-Dimethylphenol	ND	10	Anthracene	ND	10
Benzoic Acid	ND	50	Carbazole	ND	50
bis(2-Chloroethoxy)methane	ND	10	Di-n-butylphthalate	ND	10
2,4-Dichlorophenol	ND	10	Fluoranthene	ND	10
1,2,4-Trichlorobenzene	ND	10	4,4'-Methylene Dianiline	ND	50
Naphthalene	ND	10	Pyrene	ND	10
4-Chloroaniline	ND	20	Bisphenol-A	ND	10
Hexachloro-1,3-butadiene	ND	10	Butylbenzylphthalate	ND	10
4-Chloro-3-methylphenol	ND	20	3,3'-Dichlorobenzidine	ND	20
2-Methylnaphthalene	ND	10	Benzo(a)anthracene	ND	10
Hexachlorocyclopentadiene	ND	10	Chrysene	ND	10
2,4,6-Trichlorophenol	ND	10	bis(2-Ethylhexyl)phthalate	ND	10
2,4,5-Trichlorophenol	ND	10	Di-n-octylphthalate	ND	10
2-Chloronaphthalene	ND	10	Benz(b)fluoranthene	ND	10
1-Chloronaphthalene	ND	10	Benzo(k)fluoranthene	ND	10
2-Nitroaniline	ND	50	Benzo(a)pyrene	ND	10
Dimethylphthalate	ND	10	Indeno(1,2,3-cd)pyrene	ND	10
Acenaphthylene	ND	10	Dibenzo(a,h)anthracene	ND	10
2,6-Dinitrotoluene	ND	10	Benzo(g,h,i)perylene	ND	10

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
Nitrobenzene-d5	93	35-114
2-Fluorobiphenyl	86	43-116
Terphenyl-d14	91	33-141
Phenol-d5	85	10-110
2-Fluorophenol	83	21-110
,4,6-Tribromophenol	89	10-123

MDL: Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 625
MATRIX: WATER

BATCH NO.: 93L064 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: 12/16/93
CONTROL NO.: L061-L1W DATE ANALYZED: 12/17/93

ACCESSION: 93L060 93L061 93L063 93L064 93L065

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Phenol	150	108	72
2-Chlorophenol	150	114	76
1,4-DCB	100	76	76
N-Nitroso-di-n	100	90	90
1,2,4-TCB	100	80	80
4-Chl-3-Methyl	150	125	84
Acenaphthene	100	80	80
4-Nitrophenol	150	126	84
2,4-Dinitrotol	100	94	94
Pentachlorophe	150	151	101
Pyrene	100	79	79

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 625
MATRIX: WATER

BATCH NO.: 93L064
SAMPLE ID: SBLK01
CONTROL NO.: L064-B1W

DATE RECEIVED: NA
DATE EXTRACTED: 12/20/93
DATE ANALYZED: 12/21/93

ACCESSION: 93L064 93L065

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
Phenol	ND	150	111	74	150	103	69	7
2-Chlorophenol	ND	150	121	81	150	113	75	7
1,4-DCB	ND	100	82	82	100	75	75	9
N-Nitroso-di-n	ND	100	102	102	100	96	96	6
1,2,4-TCB	ND	100	81	81	100	75	75	8
4-Chl-3-Methyl	ND	150	123	82	150	117	78	6
Acenaphthene	ND	100	85	85	100	79	79	8
4-Nitrophenol	ND	150	125	83	150	116	77	7

C K Y incorporated
Analytical Laboratories

Date: 12-28-1993
CKY Batch No.: 93L061

Attn.: K. Khilnani H. Chen / J. Dahm

Earth Technology Corp.
13900 Alton Parkway #120
Irvine, CA 92718

Subject: Laboratory Report
Project: Metro Rail - East Side Ext.

Enclosed is the Laboratory report for samples received on 12/15/93. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported include :

Sample ID	Control No.	Matrix	Analysis
PE-30	L061-01	water	EPA 8240
PE-30	L061-02	water	EPA 602
PE-30	L061-03	water	EPA 8270
PE-30	L061-04	water	M8015 (CCID)
PE-30	L061-05	water	Sulfide
PE-30	L061-06	water	Dissolved CAM Metals
PE-30	L061-07	water	Chloride
			Sulfate

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

K. Y. Pang

Kam Y. Pang, Ph.D.
Laboratory Director

P.S. - All analyses requested for the above referenced project have been completed. Therefore, unless instructed, the remaining portions of the samples will be disposed after fifteen (15) days from the date of this report.

630 Maple Ave., Torrance, Calif. 90503 • Telephone 310-618-8889 • Fax: 310-618-0818

EPA METHOD 376.1
TOTAL SULFIDE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/15/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-30	L061-05	54.0	4	.8
WBLK1W	L061-B1W	ND	1	.2

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

BATCH NO.: 93L061
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/15/93

ACCESSION: 93L061

PARAMETER	TRUE VALUE (mg/L)	FOUND VALUE (mg/L)	LCS RECOVERY (%)
SULFIDE	5.00	4.50	90

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

BATCH NO.: 93L061
SAMPLE ID: PE-30
CONTROL NO.: L061-05

DATE RECEIVED: 12/15/93
DATE EXTRACTED: NA
DATE ANALYZED: 12/15/93

ACCESSION: 93L061

PARAMETER	Sample (mg/L)	Dup. Sample (mg/L)	RPD (%)
SULFIDE	54.0	53.0	2

EPA METHOD 3005/6010
DISSOLVED CAM METALS BY ICP

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	12/17/93
SAMPLE ID:	PE-30	DATE ANALYZED:	12/20/93
CONTROL NO.:	L061-06	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

Element	Det Limit (ug/L)	RESULT (ug/L)
Antimony	100	ND
Arsenic	200	ND
Barium	10	684
Beryllium	10	ND
Cadmium	10	ND
Chromium	10	ND
Cobalt	10	ND
Copper	10	ND
Lead	100	ND
Mercury^	0.2	ND
Molybdenum	50	ND
Nickel	20	ND
Selenium	200	ND
Silver	10	ND
Thallium	200	ND
Vanadium	10	ND
Zinc	20	104

^ EPA METHOD 7471

EPA METHOD 3005/6010
DISSOLVED CAM METALS BY ICP

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L061	DATE EXTRACTED:	12/17/93
SAMPLE ID:	IBLK1W	DATE ANALYZED:	12/20/93
CONTROL NO.:	L061-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

Element	Det Limit (ug/L)	RESULT (ug/L)
Antimony	100	ND
Arsenic	200	ND
Barium	10	ND
Beryllium	10	ND
Cadmium	10	ND
Chromium	10	ND
Cobalt	10	ND
Copper	10	ND
Lead	100	ND
Mercury^	0.2	ND
Molybdenum	50	ND
Nickel	20	ND
Selenium	200	ND
Silver	10	ND
Thallium	200	ND
Vanadium	10	ND
Zinc	20	ND

^ EPA METHOD 7471

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-L1W DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Antimony	1000	1050	105
Arsenic	1000	998	100
Barium	1000	1020	102
Beryllium	1000	1020	102
Cadmium	1000	1050	105
Chromium	1000	1050	105
Cobalt	1000	1040	104
Copper	1000	1000	100
Lead	1000	1060	106
Mercury^	5.0	5.11	100
Molybdenum	1000	1020	102
Nickel	1000	1060	106
Selenium	1000	1050	105
Silver	1000	996	100
Thallium	1000	952	95
Vanadium	1000	1040	104
Zinc	1000	1050	105

^ EPA METHOD 7471

CKY QUALITY CONTROL DATA
SPIKE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: 12/15/93
SAMPLE ID: PE-30 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-06 DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE RESULT (ug/L)	SPIKE CONC. (ug/L)	SPIKE RESULT (ug/L)	SPIKE RECRY. (%)
Antimony	ND	1000	1030	103
Arsenic	ND	1000	1100	110
Barium	684	1000	1680	100
Beryllium	ND	1000	1010	101
Cadmium	ND	1000	1030	103
Chromium	ND	1000	1010	101
Cobalt	ND	1000	997	100
Copper	ND	1000	987	99
Lead	ND	1000	1030	103
Mercury^	ND	0.50	0.50	100
Molybdenum	ND	1000	1030	102
Nickel	ND	1000	985	98
Selenium	ND	1000	444	44+
Silver	ND	1000	936	94
Thallium	ND	1000	981	98
Vanadium	ND	1000	1030	103
Zinc	104	1000	1140	103

^ EPA METHOD 7471
+ Selenium is out of the control limit of 75-125% matrix spike recovery. Since the method blank, duplicate, and lab control sample are within the QC limits, no further corrective action was taken.

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: 12/15/93
SAMPLE ID: PE-30 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-06 DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE RESULT (ug/L)	DUP SAMPLE RESULT (ug/L)	RPD RESULT (%)
Antimony	ND	ND	0
Arsenic	ND	ND	0
Barium	684	691	1
Beryllium	ND	ND	0
Cadmium	ND	ND	0
Chromium	ND	ND	0
Cobalt	ND	ND	0
Copper	ND	ND	0
Lead	ND	ND	0
Mercury^	ND	ND	0
Molybdenum	ND	ND	0
Nickel	ND	ND	0
Selenium	ND	ND	0
Silver	ND	ND	0
Thallium	ND	ND	0
Vanadium	ND	ND	0
Zinc	104	105	0

^ EPA METHOD 7471

EPA METHOD 300
SULFATE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-30	L061-07	246	20	20
WBLK1W	L061-B1W	ND	1	1

MDL : Method Detection Limit

EPA METHOD 300
CHLORIDE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-30	L061-07	241	20	4
WBLK1W	L061-B1W	ND	1	.2

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

BATCH NO.: 93L061
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

PARAMETER	TRUE VALUE (mg/L)	FOUND VALUE (mg/L)	LCS RECOVERY (%)
Sulfate	150	138	92
Chloride	30.00	27.50	92

CKY QUALITY CONTROL DATA
SPIKE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: 12/15/93
SAMPLE ID: PE-30 DATE EXTRACTED: NA
CONTROL NO.: L061-07 DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC
Sulfate	246	200	440	97
Chloride	241	100	357	116

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

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BATCH NO.: 93L061 DATE RECEIVED: 12/15/93
SAMPLE ID: PE-30 DATE EXTRACTED: NA
CONTROL NO.: L061-07 DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

PARAMETER	Sample (mg/L)	Dup. Sample (mg/L)	RPD (%)
Sulfate	246	260	6
Chloride	241	244	1

EPA METHOD 8240
VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	NA
SAMPLE ID:	PE-30	DATE ANALYZED:	12/15/93
CONTROL NO.:	L061-01	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	5

PARAMETERS	results (ug/L)	MDL (ug/L)
Acetone	ND	100
Benzene	45	5
Bromodichloromethane	ND	5
Bromoform	ND	10
Bromomethane	ND	50
2-Butanone (MEK)	ND	100
Carbon Disulfide	ND	5
Carbon Tetrachloride	ND	5
Chlorobenzene	ND	5
Chlorodibromomethane	ND	50
Chloroethane	ND	50
2-Chloroethyl Vinyl Ether	ND	50
Chloroform	ND	5
Chloromethane	ND	50
Dibromoethane	ND	5
Dichlorodifluoromethane	ND	50
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
cis-1,2-Dichloroethene	5	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethylbenzene	1200	5
2-Hexanone	ND	50
Methylene Chloride	ND	50
4-Methyl-2-pentanone (MIBK)	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	210	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Trichlorofluoromethane	ND	10
Vinyl Acetate	ND	50
Vinyl Chloride	ND	50
Xylenes	750	5

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
1,2 Dichloroethane-d4	80	76-114
Toluene -d8	105	88-110
Bromofluorobenzene	111	86-115

MDL : Method Detection Limit

EPA METHOD 8240
VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L061	DATE EXTRACTED:	NA
SAMPLE ID:	VBLK1W	DATE ANALYZED:	12/15/93
CONTROL NO.:	L061-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	results (ug/L)	MDL (ug/L)
Acetone	ND	20
Benzene	ND	1
Bromodichloromethane	ND	1
Bromoform	ND	2
Bromomethane	ND	10
2-Butanone (MEK)	ND	20
Carbon Disulfide	ND	1
Carbon Tetrachloride	ND	1
Chlorobenzene	ND	1
Chlorodibromomethane	ND	10
Chloroethane	ND	10
2-Chloroethyl Vinyl Ether	ND	10
Chloroform	ND	1
Chloromethane	ND	10
Dibromoethane	ND	1
Dichlorodifluoromethane	ND	10
1,1-Dichloroethane	ND	1
1,2-Dichloroethane	ND	1
1,1-Dichloroethene	ND	1
trans-1,2-Dichloroethene	ND	1
cis-1,2-Dichloroethene	ND	1
1,2-Dichloropropane	ND	1
cis-1,3-Dichloropropene	ND	1
trans-1,3-Dichloropropene	ND	1
Ethylbenzene	ND	1
2-Hexanone	ND	10
Methylene Chloride	ND	10
4-Methyl-2-pentanone (MIBK)	ND	2
Styrene	ND	1
1,1,2,2-Tetrachloroethane	ND	1
Tetrachloroethene	ND	1
Toluene	ND	1
1,1,1-Trichloroethane	ND	1
1,1,2-Trichloroethane	ND	1
Trichloroethene	ND	1
Trichlorofluoromethane	ND	2
Vinyl Acetate	ND	10
Vinyl Chloride	ND	10
Xylenes	ND	1

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
1,2 Dichloroethane-d4	92	76-114
Toluene -d8	105	88-110
Bromofluorobenzene	103	86-115

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 624/8240
MATRIX: WATER

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BATCH NO.: 93L061
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/15/93

ACCESSION: 93L061

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)	QC LIMIT
1,1-DCE	50	55	110	61-145
Benzene	50	51	102	76-127
TCE	50	52	104	71-120
Toluene	50	52	104	76-125
Chlorobenzene	50	52	104	75-130

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 624/8240
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: VBLK1W DATE EXTRACTED: NA
CONTROL NO.: L061-B1W DATE ANALYZED: 12/15/93

ACCESSION: 93L061

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
1,1-DCE	ND	50	57	114	50	57	114	0
Benzene	ND	50	52	104	50	52	104	0
TCE	ND	50	53	106	50	54	108	2
Toluene	ND	50	57	114	50	52	104	9
Chlorobenzene	ND	50	52	104	50	52	104	0

EPA METHOD 625
SEMI VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	12/16/93
SAMPLE ID:	PE-30	DATE ANALYZED:	12/18/93
CONTROL NO.:	L061-03	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	(ug/L) RESULT	MDL	PARAMETERS	(ug/L) RESULT	MDL
N-Nitrosodimethylamine	ND	10	3-Nitroaniline	ND	50
Pyridine	ND	10	Acenaphthene	18	10
Aniline	ND	10	2,4-Dinitrophenol	ND	50
Phenol	ND	10	4-Nitrophenol	ND	50
bis(2-Chloroethyl)ether	ND	10	Dibenzofuran	ND	10
2-Chlorophenol	ND	10	2,4-Dinitrotoluene	ND	10
1,3-Dichlorobenzene	ND	10	Diethylphthalate	ND	10
1,4-Dichlorobenzene	ND	10	4-Chlorophenyl-phenylether	ND	10
Benzyl Alcohol	ND	10	Fluorene	ND	10
1,2-Dichlorobenzene	ND	10	1,2-Diphenylhydrazine	ND	50
2-Methylphenol	ND	10	4-Nitroaniline	ND	50
2,2'-oxybis(1-Chloropropane)	ND	10	4,6-Dinitro-2-methylphenol	ND	50
4-Methylphenol	ND	10	N-Nitrosodiphenylamine (1)	ND	10
N-Nitroso-di-n-propylamine	ND	10	4-Bromophenyl-phenylether	ND	10
Hexachloroethane	ND	10	Hexachlorobenzene	ND	10
Nitrobenzene	ND	10	Pentachlorophenol	ND	10
Isophorone	ND	10	Benzidine	ND	50
2-Nitrophenol	ND	10	Phenanthrene	ND	50
2,4-Dimethylphenol	ND	10	Anthracene	ND	10
Benzoic Acid	ND	50	Carbazole	ND	50
bis(2-Chloroethoxy)methane	ND	10	Di-n-butylphthalate	ND	10
2,4-Dichlorophenol	ND	10	Fluoranthene	ND	10
1,2,4-Trichlorobenzene	ND	10	4,4'-Methylene Dianiline	ND	50
Naphthalene	2900~	500	Pyrene	ND	10
4-Chloroaniline	ND	20	Bisphenol-A	ND	10
Hexachloro-1,3-butadiene	ND	10	Butylbenzylphthalate	ND	10
4-Chloro-3-methylphenol	ND	20	3,3'-Dichlorobenzidine	ND	20
2-Methylnaphthalene	26	10	Benzo(a)anthracene	ND	10
Hexachlorocyclopentadiene	ND	10	Chrysene	ND	10
2,4,6-Trichlorophenol	ND	10	bis(2-Ethylhexyl)phthalate	ND	10
2,4,5-Trichlorophenol	ND	10	Di-n-octylphthalate	ND	10
2-Chloronaphthalene	ND	10	Benz(b)fluoranthene	ND	10
1-Chloronaphthalene	ND	10	Benzo(k)fluoranthene	ND	10
2-Nitroaniline	ND	50	Benzo(a)pyrene	ND	10
Dimethylphthalate	ND	10	Indeno(1,2,3-cd)pyrene	ND	10
Acenaphthylene	ND	10	Dibenzo(a,h)anthracene	ND	10
2,6-Dinitrotoluene	ND	10	Benzo(g,h,i)perylene	ND	10

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
Nitrobenzene-d5	100	35-114
2-Fluorobiphenyl	70	43-116
Terphenyl-d14	73	33-141
Phenol-d5	73	10-110
2-Fluorophenol	67	21-110
2,4,6-Tribromophenol	87	10-123

~ Dilution Factor, 50
MDL: Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 625
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: 12/16/93
CONTROL NO.: L061-L1W DATE ANALYZED: 12/17/93

ACCESSION: 93L060 93L061 93L063 93L064 93L065

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Phenol	150	108	72
2-Chlorophenol	150	114	76
1,4-DCB	100	76	76
N-Nitroso-di-n	100	90	90
1,2,4-TCB	100	80	80
4-Chl-3-Methyl	150	125	84
Acenaphthene	100	80	80
4-Nitrophenol	150	126	84
2,4-Dinitrotol	100	94	94
Pentachlorophe	150	151	101
Pyrene	100	79	79

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 625
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: SBLK01 DATE EXTRACTED: 12/20/93
CONTROL NO.: L061-B1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
Phenol	ND	150	111	74	150	103	69	7
2-Chlorophenol	ND	150	121	81	150	113	75	7
1,4-DCB	ND	100	82	82	100	75	75	9
N-Nitroso-di-n	ND	100	102	102	100	96	96	6
1,2,4-TCB	ND	100	81	81	100	75	75	8
4-Chl-3-Methyl	ND	150	123	82	150	117	78	6
Acenaphthene	ND	100	85	85	100	79	79	8
4-Nitrophenol	ND	150	125	83	150	116	77	7

EPA METHOD 602
BTEX

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/21/93

SAMPLE ID	CNTRL NO	DL F	MDL	RESULTS (ug/L) BENZ	TOLUENE	E BENZ	XYLS	% Rcvy SURR
PE-30	L061-02	10	10	37	160	1100	950	101
VBLK1W	L061-B1W	1	1	ND	ND	ND	ND	96

QC LIMIT: 65-135

DL F : Dilution Factor
SURR : Bromofluorobenzene
MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 602
MATRIX: WATER

==========

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: NA
CONTROL NO.: L061-L1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065 93L067 93L077

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Benzene	25	26	104
Toluene	170	170	100
Ethyl Benzene	25	26	104
Xylenes	140	162	116

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 602
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: VBLK1W DATE EXTRACTED: NA
CONTROL NO.: L061-B1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065 93L067 93L077

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
Benzene	ND	25	23	92	25	22	88	4
Toluene	ND	170	163	96	170	176	104	8
Ethyl Benzene	ND	25	26	104	25	27	108	4
Xylenes	ND	145	152	105	145	166	114	8

EPA METHOD M8015
TOTAL PETROLEUM HYDROCARBONS BY EXTRACTION
CARBON CHAIN IDENTIFICATION

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/15/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/15/93
BATCH NO.:	93L061	DATE EXTRACTED:	12/20/93
MATRIX:	WATER	DATE ANALYZED:	12/21/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	H-C RANGE	% RECOVERY SURR1	% RECOVERY SURR2	DL FACTOR	MDL (mg/L)
PE-30	L061-04	1.5	C8-C9	92	115	1	.5
		0.82	C9-C10				
		1.9	C10-C11				
		3.4	C11-C13				
		0.44~	C13-C14				
	(Total)	10**	C6-C20				
DBLK1W	L069-B1W*	ND	N.A.	101	123	1	.5
QC LIMIT:				65-135	60-140		

SURR1 : Bromobenzene
SURR2 : Hexacosane
MDL : Method Detection Limit
* : Date Analyzed, 12/20/93
~ : Estimate
** : Result based on calibration for total diesel

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA M8015
MATRIX: WATER

BATCH NO.: 93L061 DATE RECEIVED: NA
SAMPLE ID: DBLK1W DATE EXTRACTED: 12/20/93
CONTROL NO.: L069-B1W DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065 93L069 93L079 93L067

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC	SPIKE ADDED (mg/L)	MSD CONC (mg/L)	MSD % REC	% RPD
DIESEL	ND	1	.94	94	1	.90	90	4

C K Y incorporated
Analytical Laboratories

Date: 12-28-1993
CKY Batch No.: 93L065

Attn.: K. Khilnani

Earth Technology Corp.
13900 Alton Parkway #120
Irvine, CA 92718

Subject: Laboratory Report
Project: Metro Rail - East Side Ext.

Enclosed is the Laboratory report for samples received on 12/16/93. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported include :

Sample ID	Control No.	Matrix	Analysis
PE-31	L065-01	water	EPA 8240
PE-31	L065-02	water	EPA 602
PE-31	L065-03	water	EPA 8270
PE-31	L065-04	water	M8015 (CCID)
PE-31	L065-05	water	Sulfide
PE-31	L065-06	water	Dissolved CAM Metals
PE-31	L065-07	water	Chloride
			Sulfate

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Kam Y. Pang, Ph.D.
Laboratory Director

P.S. - All analyses requested for the above referenced project have been completed. Therefore, unless instructed, the remaining portions of the samples will be disposed after fifteen (15) days from the date of this report.

630 Maple Ave., Torrance, Calif. 90503 • Telephone 310-618-8889 • Fax: 310-618-0818

EPA METHOD 602
BTEX

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/21/93

SAMPLE ID	CNTRL NO	DL F	MDL	RESULTS (ug/L) BENZ	TOLUENE	E BENZ	XYLS	% Rcvy SURR
PE-31	L065-02	1	1	120	2.4	5.4	4.5	116
VBLK1W	L061-B1W	1	1	ND	ND	ND	ND	96

QC LIMIT: 65-135

DL F : Dilution Factor
SURR : Bromofluorobenzene
MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 602
MATRIX: WATER

==========

BATCH NO.: 93L065
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065 93L067 93L077

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Benzene	25	26	104
Toluene	170	170	100
Ethyl Benzene	25	26	104
Xylenes	140	162	116

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 602
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: VBLK1W DATE EXTRACTED: NA
CONTROL NO.: L061-B1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065 93L067 93L077

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
Benzene	ND	25	23	92	25	22	88	4
Toluene	ND	170	163	96	170	176	104	8
Ethyl Benzene	ND	25	26	104	25	27	108	4
Xylenes	ND	145	152	105	145	166	114	8

EPA METHOD 8240
VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	NA
SAMPLE ID:	PE-31	DATE ANALYZED:	12/20/93
CONTROL NO.:	L065-01	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	results (ug/L)	MDL (ug/L)
Acetone	ND	20
Benzene	130	1
Bromodichloromethane	ND	1
Bromoform	ND	2
Bromomethane	ND	10
2-Butanone (MEK)	ND	20
Carbon Disulfide	ND	1
Carbon Tetrachloride	ND	1
Chlorobenzene	ND	1
Chlorodibromomethane	ND	10
Chloroethane	ND	10
2-Chloroethyl Vinyl Ether	ND	10
Chloroform	ND	1
Chloromethane	ND	10
Dibromoethane	ND	1
Dichlorodifluoromethane	ND	10
1,1-Dichloroethane	ND	1
1,2-Dichloroethane	ND	1
1,1-Dichloroethene	ND	1
trans-1,2-Dichloroethene	ND	1
cis-1,2-Dichloroethene	100	1
1,2-Dichloropropane	ND	1
cis-1,3-Dichloropropene	ND	1
trans-1,3-Dichloropropene	ND	1
Ethylbenzene	4	1
2-Hexanone	ND	10
Methylene Chloride	ND	10
4-Methyl-2-pentanone (MIBK)	ND	2
Styrene	ND	1
1,1,2,2-Tetrachloroethane	ND	1
Tetrachloroethene	ND	1
Toluene	2	1
1,1,1-Trichloroethane	ND	1
1,1,2-Trichloroethane	ND	1
Trichloroethene	3	1
Trichlorofluoromethane	ND	2
Vinyl Acetate	ND	10
Vinyl Chloride	13	10
Xylenes	2	1

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
1,2 Dichloroethane-d4	103	76-114
Toluene -d8	106	88-110
Bromofluorobenzene	102	86-115

MDL : Method Detection Limit

EPA METHOD 8240
VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L065	DATE EXTRACTED:	NA
SAMPLE ID:	VBLK1W	DATE ANALYZED:	12/20/93
CONTROL NO.:	L065-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	results (ug/L)	MDL (ug/L)
Acetone	ND	20
Benzene	ND	1
Bromodichloromethane	ND	1
Bromoform	ND	2
Bromomethane	ND	10
2-Butanone (MEK)	ND	20
Carbon Disulfide	ND	1
Carbon Tetrachloride	ND	1
Chlorobenzene	ND	1
Chlorodibromomethane	ND	10
Chloroethane	ND	10
2-Chloroethyl Vinyl Ether	ND	10
Chloroform	ND	1
Chloromethane	ND	10
Dibromoethane	ND	1
Dichlorodifluoromethane	ND	10
1,1-Dichloroethane	ND	1
1,2-Dichloroethane	ND	1
1,1-Dichloroethene	ND	1
trans-1,2-Dichloroethene	ND	1
cis-1,2-Dichloroethene	ND	1
1,2-Dichloropropane	ND	1
cis-1,3-Dichloropropene	ND	1
trans-1,3-Dichloropropene	ND	1
Ethylbenzene	ND	1
2-Hexanone	ND	10
Methylene Chloride	ND	10
4-Methyl-2-pentanone (MIBK)	ND	2
Styrene	ND	1
1,1,2,2-Tetrachloroethane	ND	1
Tetrachloroethene	ND	1
Toluene	ND	1
1,1,1-Trichloroethane	ND	1
1,1,2-Trichloroethane	ND	1
Trichloroethene	ND	1
Trichlorofluoromethane	ND	2
Vinyl Acetate	ND	10
Vinyl Chloride	ND	10
Xylenes	ND	1

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
1,2 Dichloroethane-d4	101	76-114
Toluene -d8	105	88-110
Bromofluorobenzene	98	86-115

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 624/8240
MATRIX: WATER

==========

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: NA
CONTROL NO.: L065-L1W DATE ANALYZED: 12/20/93

ACCESSION: 93L065

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)	QC LIMIT
1,1-DCE	50	69	138	61-145
Benzene	50	63	126	76-127
TCE	50	58	116	71-120
Toluene	50	59	118	76-125
Chlorobenzene	50	56	112	75-130

EPA METHOD 625
SEMI VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	12/20/93
SAMPLE ID:	PE-31	DATE ANALYZED:	12/21/93
CONTROL NO.:	L065-03	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	(ug/L) RESULT	MDL	PARAMETERS	(ug/L) RESULT	MDL
N-Nitrosodimethylamine	ND	10	3-Nitroaniline	ND	50
Pyridine	ND	10	Acenaphthene	ND	10
Aniline	ND	10	2,4-Dinitrophenol	ND	50
Phenol	ND	10	4-Nitrophenol	ND	50
bis(2-Chloroethyl)ether	ND	10	Dibenzofuran	ND	10
2-Chlorophenol	ND	10	2,4-Dinitrotoluene	ND	10
1,3-Dichlorobenzene	ND	10	Diethylphthalate	ND	10
1,4-Dichlorobenzene	ND	10	4-Chlorophenyl-phenylether	ND	10
Benzyl Alcohol	ND	10	Fluorene	ND	10
1,2-Dichlorobenzene	ND	10	1,2-Diphenylhydrazine	ND	50
2-Methylphenol	ND	10	4-Nitroaniline	ND	50
2,2'-oxybis(1-Chloropropane)	ND	10	4,6-Dinitro-2-methylphenol	ND	50
4-Methylphenol	ND	10	N-Nitrosodiphenylamine (1)	ND	10
N-Nitroso-di-n-propylamine	ND	10	4-Bromophenyl-phenylether	ND	10
Hexachloroethane	ND	10	Hexachlorobenzene	ND	10
Nitrobenzene	ND	10	Pentachlorophenol	ND	10
Isophorone	ND	10	Benzidine	ND	50
2-Nitrophenol	ND	10	Phenanthrene	ND	50
2,4-Dimethylphenol	ND	10	Anthracene	ND	10
Benzoic Acid	ND	50	Carbazole	ND	50
bis(2-Chloroethoxy)methane	ND	10	Di-n-butylphthalate	ND	10
2,4-Dichlorophenol	ND	10	Fluoranthene	ND	10
1,2,4-Trichlorobenzene	ND	10	4,4'-Methylene Dianiline	ND	50
Naphthalene	ND	10	Pyrene	ND	10
4-Chloroaniline	ND	20	Bisphenol-A	ND	10
Hexachloro-1,3-butadiene	ND	10	Butylbenzylphthalate	ND	10
4-Chloro-3-methylphenol	ND	20	3,3'-Dichlorobenzidine	ND	20
2-Methylnaphthalene	ND	10	Benzo(a)anthracene	ND	10
Hexachlorocyclopentadiene	ND	10	Chrysene	ND	10
2,4,6-Trichlorophenol	ND	10	bis(2-Ethylhexyl)phthalate	ND	10
2,4,5-Trichlorophenol	ND	10	Di-n-octylphthalate	ND	10
2-Chloronaphthalene	ND	10	Benz(b)fluoranthene	ND	10
1-Chloronaphthalene	ND	10	Benzo(k)fluoranthene	ND	10
2-Nitroaniline	ND	50	Benzo(a)pyrene	ND	10
Dimethylphthalate	ND	10	Indeno(1,2,3-cd)pyrene	ND	10
Acenaphthylene	ND	10	Dibenzo(a,h)anthracene	ND	10
2,6-Dinitrotoluene	ND	10	Benzo(g,h,i)perylene	ND	10

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
Nitrobenzene-d5	78	35-114
2-Fluorobiphenyl	79	43-116
Terphenyl-d14	85	33-141
Phenol-d5	77	10-110
2-Fluorophenol	72	21-110
2,4,6-Tribromophenol	+0	10-123

+ Surrogate loss due to matrix interference
MDL: Method Detection Limit

EPA METHOD 625
SEMI VOLATILE ORGANICS BY GC/MS

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L065	DATE EXTRACTED:	12/20/93
SAMPLE ID:	SBLK01	DATE ANALYZED:	12/21/93
CONTROL NO.:	L064-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

PARAMETERS	(ug/L) RESULT	MDL	PARAMETERS	(ug/L) RESULT	MDL
N-Nitrosodimethylamine	ND	10	3-Nitroaniline	ND	50
Pyridine	ND	10	Acenaphthene	ND	10
Aniline	ND	10	2,4-Dinitrophenol	ND	50
Phenol	ND	10	4-Nitrophenol	ND	50
bis(2-Chloroethyl)ether	ND	10	Dibenzofuran	ND	10
2-Chlorophenol	ND	10	2,4-Dinitrotoluene	ND	10
1,3-Dichlorobenzene	ND	10	Diethylphthalate	ND	10
1,4-Dichlorobenzene	ND	10	4-Chlorophenyl-phenylether	ND	10
Benzyl Alcohol	ND	10	Fluorene	ND	10
1,2-Dichlorobenzene	ND	10	1,2-Diphenylhydrazine	ND	50
2-Methylphenol	ND	10	4-Nitroaniline	ND	50
2,2'-oxybis(1-Chloropropane)	ND	10	4,6-Dinitro-2-methylphenol	ND	50
4-Methylphenol	ND	10	N-Nitrosodiphenylamine (1)	ND	10
N-Nitroso-di-n-propylamine	ND	10	4-Bromophenyl-phenylether	ND	10
Hexachloroethane	ND	10	Hexachlorobenzene	ND	10
Nitrobenzene	ND	10	Pentachlorophenol	ND	10
Isophorone	ND	10	Benzidine	ND	50
2-Nitrophenol	ND	10	Phenanthrene	ND	50
2,4-Dimethylphenol	ND	10	Anthracene	ND	10
Benzoic Acid	ND	50	Carbazole	ND	50
bis(2-Chloroethoxy)methane	ND	10	Di-n-butylphthalate	ND	10
2,4-Dichlorophenol	ND	10	Fluoranthene	ND	10
1,2,4-Trichlorobenzene	ND	10	4,4'-Methylene Dianiline	ND	50
Naphthalene	ND	10	Pyrene	ND	10
4-Chloroaniline	ND	20	Bisphenol-A	ND	10
Hexachloro-1,3-butadiene	ND	10	Butylbenzylphthalate	ND	10
4-Chloro-3-methylphenol	ND	20	3,3'-Dichlorobenzidine	ND	20
2-Methylnaphthalene	ND	10	Benzo(a)anthracene	ND	10
Hexachlorocyclopentadiene	ND	10	Chrysene	ND	10
2,4,6-Trichlorophenol	ND	10	bis(2-Ethylhexyl)phthalate	ND	10
2,4,5-Trichlorophenol	ND	10	Di-n-octylphthalate	ND	10
2-Chloronaphthalene	ND	10	Benz(b)fluoranthene	ND	10
1-Chloronaphthalene	ND	10	Benzo(k)fluoranthene	ND	10
2-Nitroaniline	ND	50	Benzo(a)pyrene	ND	10
Dimethylphthalate	ND	10	Indeno(1,2,3-cd)pyrene	ND	10
Acenaphthylene	ND	10	Dibenzo(a,h)anthracene	ND	10
2,6-Dinitrotoluene	ND	10	Benzo(g,h,i)perylene	ND	10

SURROGATE PARAMETER	% RECOVERY	QC LIMIT
Nitrobenzene-d5	93	35-114
2-Fluorobiphenyl	86	43-116
Terphenyl-d14	91	33-141
Phenol-d5	85	10-110
2-Fluorophenol	83	21-110
2,4,6-Tribromophenol	89	10-123

MDL: Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 625
MATRIX: WATER

BATCH NO.: 93L065
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: 12/16/93
DATE ANALYZED: 12/17/93

ACCESSION: 93L060 93L061 93L063 93L064 93L065

PARAMETER	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Phenol	150	108	72
2-Chlorophenol	150	114	76
1,4-DCB	100	76	76
N-Nitroso-di-n	100	90	90
1,2,4-TCB	100	80	80
4-Chl-3-Methyl	150	125	84
Acenaphthene	100	80	80
4-Nitrophenol	150	126	84
2,4-Dinitrotol	100	94	94
Pentachlorophe	150	151	101
Pyrene	100	79	79

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 625
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: SBLK01 DATE EXTRACTED: 12/20/93
CONTROL NO.: L061-B1W DATE ANALYZED: 12/21/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE CONC (ug/L)	SPIKE ADDED (ug/L)	MS CONC (ug/L)	MS % REC	SPIKE ADDED (ug/L)	MSD CONC (ug/L)	MSD % REC	% RPD
Phenol	ND	150	111	74	150	103	69	7
2-Chlorophenol	ND	150	121	81	150	113	75	7
1,4-DCB	ND	100	82	82	100	75	75	9
N-Nitroso-di-n	ND	100	102	102	100	96	96	6
1,2,4-TCB	ND	100	81	81	100	75	75	8
4-Chl-3-Methyl	ND	150	123	82	150	117	78	6
Acenaphthene	ND	100	85	85	100	79	79	8
4-Nitrophenol	ND	150	125	83	150	116	77	7

EPA METHOD M8015
TOTAL PETROLEUM HYDROCARBONS BY EXTRACTION

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	12/20/93
MATRIX:	WATER	DATE ANALYZED:	12/21/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	H-C RANGE	% RECOVERY SURR1	% RECOVERY SURR2	DL FACTOR	MDL (mg/L)
PE-31	L065-04	ND	N.A.	114	127	1	.5
DBLK1W	L069-B1W*	ND	N.A.	101	123	1	.5
QC LIMIT:				65-135	60-140		

SURR1 : Bromobenzene
SURR2 : Hexacosane
MDL : Method Detection Limit
* : Date Analyzed, 12/20/93

CKY QUALITY CONTROL DATA
SPIKE/SPIKE DUPLICATE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA M8015
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: DBLK1W DATE EXTRACTED: 12/20/93
CONTROL NO.: L069-B1W DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065 93L069 93L079 93L067

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC	SPIKE ADDED (mg/L)	MSD CONC (mg/L)	MSD % REC	% RPD
DIESEL	ND	1	.94	94	1	.90	90	4

EPA METHOD 376.1
TOTAL SULFIDE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-31	L065-05	10.5	10	2
WBLK1W	L061-B1W	ND	1	.2

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

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BATCH NO.: 93L065
SAMPLE ID: LCS01
CONTROL NO.: L065-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L064 93L065

PARAMETER	TRUE VALUE (mg/L)	FOUND VALUE (mg/L)	LCS RECOVERY (%)
SULFIDE	5.00	4.40	88

CKY QUALITY CONTROL DATA
SPIKE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

BATCH NO.: 93L065
SAMPLE ID: PE-31
CONTROL NO.: L065-05

DATE RECEIVED: 12/16/93
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L064 93L065

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC
SULFIDE	10.50	50.00	64.40	108

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 376.1
MATRIX: WATER

BATCH NO.: 93L065
SAMPLE ID: PE-31
CONTROL NO.: L065-05

DATE RECEIVED: 12/16/93
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L064 93L065

PARAMETER	Sample (mg/L)	Dup. Sample (mg/L)	RPD (%)
SULFIDE	10.50	9.80	7

EPA METHOD 3005/6010
DISSOLVED CAM METALS BY ICP

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	12/17/93
SAMPLE ID:	PE-31	DATE ANALYZED:	12/20/93
CONTROL NO.:	L065-06	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

Element	Det Limit (ug/L)	RESULT (ug/L)
Antimony	100	ND
Arsenic	200	ND
Barium	10	76.5
Beryllium	10	ND
Cadmium	10	ND
Chromium	10	ND
Cobalt	10	ND
Copper	10	ND
Lead	100	ND
Mercury^	0.2	ND
Molybdenum	50	ND
Nickel	20	ND
Selenium	200	ND
Silver	10	ND
Thallium	200	ND
Vanadium	10	ND
Zinc	20	ND

^ EPA METHOD 7471

EPA METHOD 3005/6010
DISSOLVED CAM METALS BY ICP

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	NA
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	NA
BATCH NO.:	93L065	DATE EXTRACTED:	12/17/93
SAMPLE ID:	IBLK1W	DATE ANALYZED:	12/20/93
CONTROL NO.:	L061-B1W	MATRIX:	WATER
% MOISTURE:	NA	DILUTION FACTOR:	1

Element	Det Limit (ug/L)	RESULT (ug/L)
Antimony	100	ND
Arsenic	200	ND
Barium	10	ND
Beryllium	10	ND
Cadmium	10	ND
Chromium	10	ND
Cobalt	10	ND
Copper	10	ND
Lead	100	ND
Mercury^	0.2	ND
Molybdenum	50	ND
Nickel	20	ND
Selenium	200	ND
Silver	10	ND
Thallium	200	ND
Vanadium	10	ND
Zinc	20	ND

^ EPA METHOD 7471

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: LCS01 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-L1W DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	TRUE VALUE (ug/L)	FOUND VALUE (ug/L)	LCS RECOVERY (%)
Antimony	1000	1050	105
Arsenic	1000	998	100
Barium	1000	1020	102
Beryllium	1000	1020	102
Cadmium	1000	1050	105
Chromium	1000	1050	105
Cobalt	1000	1040	104
Copper	1000	1000	100
Lead	1000	1060	106
Mercury^	5.0	5.11	102
Molybdenum	1000	1020	102
Nickel	1000	1060	106
Selenium	1000	1050	105
Silver	1000	996	100
Thallium	1000	952	95
Vanadium	1000	1040	104
Zinc	1000	1050	105

^ EPA METHOD 7471

CKY QUALITY CONTROL DATA
SPIKE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-06 DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE RESULT (ug/L)	SPIKE CONC. (ug/L)	SPIKE RESULT (ug/L)	SPIKE RECRY. (%)
Antimony	ND	1000	1030	103
Arsenic	ND	1000	1100	110
Barium	684	1000	1680	100
Beryllium	ND	1000	1010	101
Cadmium	ND	1000	1030	103
Chromium	ND	1000	1010	101
Cobalt	ND	1000	997	100
Copper	ND	1000	987	99
Lead	ND	1000	1030	103
Mercury^	ND	0.50	0.50	100
Molybdenum	ND	1000	1030	102
Nickel	ND	1000	985	98
Selenium	ND	1000	444	44+
Silver	ND	1000	936	94
Thallium	ND	1000	981	98
Vanadium	ND	1000	1030	103
Zinc	104	1000	1140	103

^ EPA METHOD 7471
+ Selenium is out of the control limit of 75-125% matrix spike recovery. Since the method blank, duplicate, and lab control sample are within the QC limits, no further corrective action was taken.

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 3005/6010
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: 12/17/93
CONTROL NO.: L061-06 DATE ANALYZED: 12/20/93

ACCESSION: 93L061 93L064 93L065

Parameter	SAMPLE RESULT (ug/L)	DUP SAMPLE RESULT (ug/L)	RPD RESULT (%)
Antimony	ND	ND	0
Arsenic	ND	ND	0
Barium	684	691	1
Beryllium	ND	ND	0
Cadmium	ND	ND	0
Chromium	ND	ND	0
Cobalt	ND	ND	0
Copper	ND	ND	0
Lead	ND	ND	0
Mercury^	ND	ND	0
Molybdenum	ND	ND	0
Nickel	ND	ND	0
Selenium	ND	ND	0
Silver	ND	ND	0
Thallium	ND	ND	0
Vanadium	ND	ND	0
Zinc	104	105	0

^ EPA METHOD 7471

EPA METHOD 300
SULFATE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-31	L065-07	361	20	20
WBLK1W	L061-B1W	ND	1	1

MDL : Method Detection Limit

EPA METHOD 300
CHLORIDE

CLIENT:	Earth Technology Corp.	DATE COLLECTED:	12/16/93
PROJECT:	Metro Rail - East Side Ext.	DATE RECEIVED:	12/16/93
BATCH NO.:	93L065	DATE EXTRACTED:	NA
MATRIX:	WATER	DATE ANALYZED:	12/16/93

SAMPLE ID	CONTROL NO	RESULT (mg/L)	DILUTION FACTOR	MDL (mg/L)
PE-31	L065-07	191	20	4
WBLK1W	L061-B1W	ND	1	.2

MDL : Method Detection Limit

CKY QUALITY CONTROL DATA
LABORATORY CONTROL SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

BATCH NO.: 93L065
SAMPLE ID: LCS01
CONTROL NO.: L061-L1W

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

PARAMETER	TRUE VALUE (mg/L)	FOUND VALUE (mg/L)	LCS RECOVERY (%)
Sulfate	150	138	92
Chloride	30.00	27.50	92

CKY QUALITY CONTROL DATA
SPIKE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

BATCH NO.: 93L065 DATE RECEIVED: NA
SAMPLE ID: PE-30 DATE EXTRACTED: NA
CONTROL NO.: L061-07 DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

Parameter	SAMPLE CONC (mg/L)	SPIKE ADDED (mg/L)	MS CONC (mg/L)	MS % REC
Sulfate	246	200	440	97
Chloride	241	100	357	116

CKY QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: Earth Technology Corp.
PROJECT: Metro Rail - East Side Ext.
METHOD: EPA 300
MATRIX: WATER

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BATCH NO.: 93L065
SAMPLE ID: PE-30
CONTROL NO.: L061-07

DATE RECEIVED: NA
DATE EXTRACTED: NA
DATE ANALYZED: 12/16/93

ACCESSION: 93L061 93L063 93L064 93L065

PARAMETER	Sample (mg/L)	Dup. Sample (mg/L)	RPD (%)
Sulfate	246	260	6
Chloride	241	244	1