Ashe Co. 05-01

SOIL & MATERIAL ENGINEERS INC. ENGINEERING-TESTING-INSPECTION

1903 Harrison Avenue, Box 609, Cary, NC 27511, Phone (919) 481-0397 Horizontal Exp.

January 8, 1985

Municipal Engineering Service
P. O. Box 97
Garner, NC 27529

Attention: Mr. Jimmy D. Woodie

Reference: Ashe County Landfill Geologic Study
Ashe County, North Carolina
S&ME Project Number: 055-84-018-A

Gentlemen:

Based on your authorization, Soil & Material Engineers, Inc. (S&ME) has completed a geological investigation for a proposed 78 acre landfill expansion site which is adjacent to the existing Ashe County landfill. This land is located approximately 1¼ miles northwest of Chestnut Hill, North Carolina, off State Road 1558, as depicted on Figure 1. The purpose of this investigation is to describe the subsurface soil, rock, ground water, and topographic and geologic conditions indicated by the test borings, laboratory analysis, and observations, in accordance with Solid and Hazardous Waste Management Branch, regulations for Solid Waste Management 10NCAC 10G. Discussion is also provided regarding the suitability and limitations of this site for landfilling purposes based on the data developed.

This report will be used by Municipal Engineering Service and the County for submittal of a site approval application and ultimately to develop an operations plan. It is our understanding that this landfill is to be used for the disposal of residential and non-toxic industrial wastes. No hazardous wastes will be disposed at this site.

split-barrel sampling procedure (ASTM D-1586). All soil samples collected were classified by the Unified Soil Classification System (ASTM D-2487) and recorded on the attached Test Boring Records. In addition to the soil test borings, three auger probes were performed (Borings 1, 7, and 8) to determine depth to rock in areas that were likely to be used as cover material. Visual soil classification was made during the boring and is also contained on the attached Test Boring Records.

At the completion of drilling each borehole, a temporary piezometer was constructed and observations made for water accumulating in the borehole. A representative of S&ME also measured water levels in the boreholes approximately two weeks later. Based on current solid waste and ground water regulations, these temporary monitoring wells must be grouted closed prior to construction of the landfill or after any further water level observations are completed.

SITE CONDITIONS

The proposed landfill site area is estimated to be approximately 78 acres. However, due to perennial drainage features and buffer zones, only approximately 40 to 50 acres are being considered as a proposed landfill. This tract has a high topographic point along its eastern border (elevation 2,800 to 2,840) with a moderate to steep slope to the northwest and overall topographic relief of approximately 200 feet. The drainage at the site is characterized by three northwest trending drainage swales which connect just to the north of the site to a northward draining perennial stream. These swales divide the site into a series of north to northwest trending ridges. During the field reconnaissance, surface water was noticed at the lower (northern) reaches of the the drainage swales near the property boundaries. The perennial stream also crosses the property to the west of the area proposed for landfilling.

A north-south trending ridge to the west of the perennial stream is tentatively proposed as a future borrow area.

The results of the test borings and auger probes indicate that the surface conditions at this site consist of a very thin organic topsoil cover with a number

Ground Water

Ground water was observed in four boreholes ranging between 8.8 and 40.7 feet below ground surface. The phreatic surface is apparently below the bottom of the boreholes at the other test borings. Ground water levels may be expected to fluctuate due to many factors, including precipitation, evapotranspiration, and surface drainage. The North Carolina Department of Human Resources requires that the bottom of the landfill be a minimum of 4 feet above the seasonal high phreatic surface.

It is understood that the proposed method of landfilling at this site will be similar to the adjacent existing site. This is a "terracing" or "stair-stepping" method which will involve disposal in the dry upper portions of the existing swales with cover being excavated from the adjoining ridges. Based on observed water levels, the lower (northern) reaches of the three drainage swales cannot be used for landfilling since ground water is expected to exist at/or within 4 feet of the ground surface.

Excavation

One of the major considerations regarding the use of a landfill site is whether difficult excavation will be encountered due to weathered or sound rock. Although thin rock lenses were encountered in some borings, overall results indicate that the general depth of weathered rock ranges between 15 to 60 feet below land surface. When examining the weathered rock on existing highwalls of the present landfill, there is also a 10 to 20 foot section of weathered saprolite. In communication with the superintendent of the landfill, he explained that the front end loader presently used for excavation has historically had no problems excavating the weathered saprolite. Therefore, S&ME feels that the 15 to 60 foot excavation depths are reasonable figures and that the limiting criteria for depth in most areas will apparently be ground water.

Excavation to the proposed depths will create a number of high temporary slopes. No laboratory soil strength testing or slope stability analysis has been performed as a part of this study. Most soils of this type will stand on 1(v):1(h) temporary slope to heights of 30 to 50 feet. However, all such slopes should be

ground water monitoring wells will be required hydraulically downgradient from the landfill to detect any leachate infiltrating into the ground water.

Also, several deep domestic ground water wells exist along the eastern border of the proposed landfill property. Solid Waste Management Regulations require a minimum distance of 500 feet between domestic wells and buried wastes. It is recommended that at least one ground water monitoring well be located along this boundary and that periodic ground water quality sampling also be performed from the domestic wells to assess any possible contamination.

CONCLUSIONS

Overall, this site appears suitable for a properly designed and operated sanitary landfill. Careful design and operation will be required due to the nearby domestic wells, topographic slopes, and the proximity of shallow ground and surface water at the lower elevations.

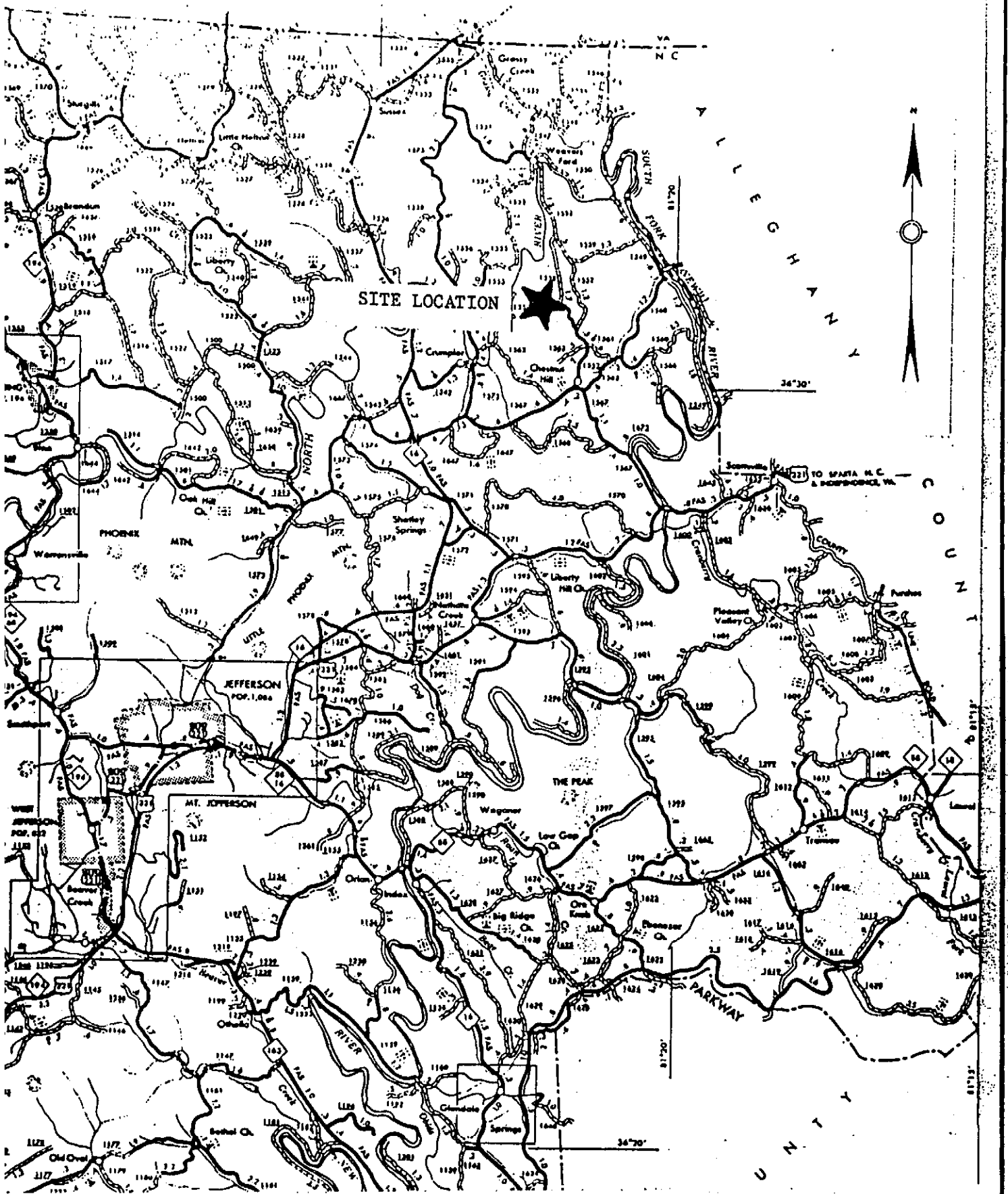
We appreciate the opportunity to be of service to you. If you have any questions or if we can be of further assistance, please contact us.

Sincerely yours,
Soil & Material Engineers, Inc.

Phillip L. Rahn, Geologist

Ernest F. Parker, Jr. P.E.

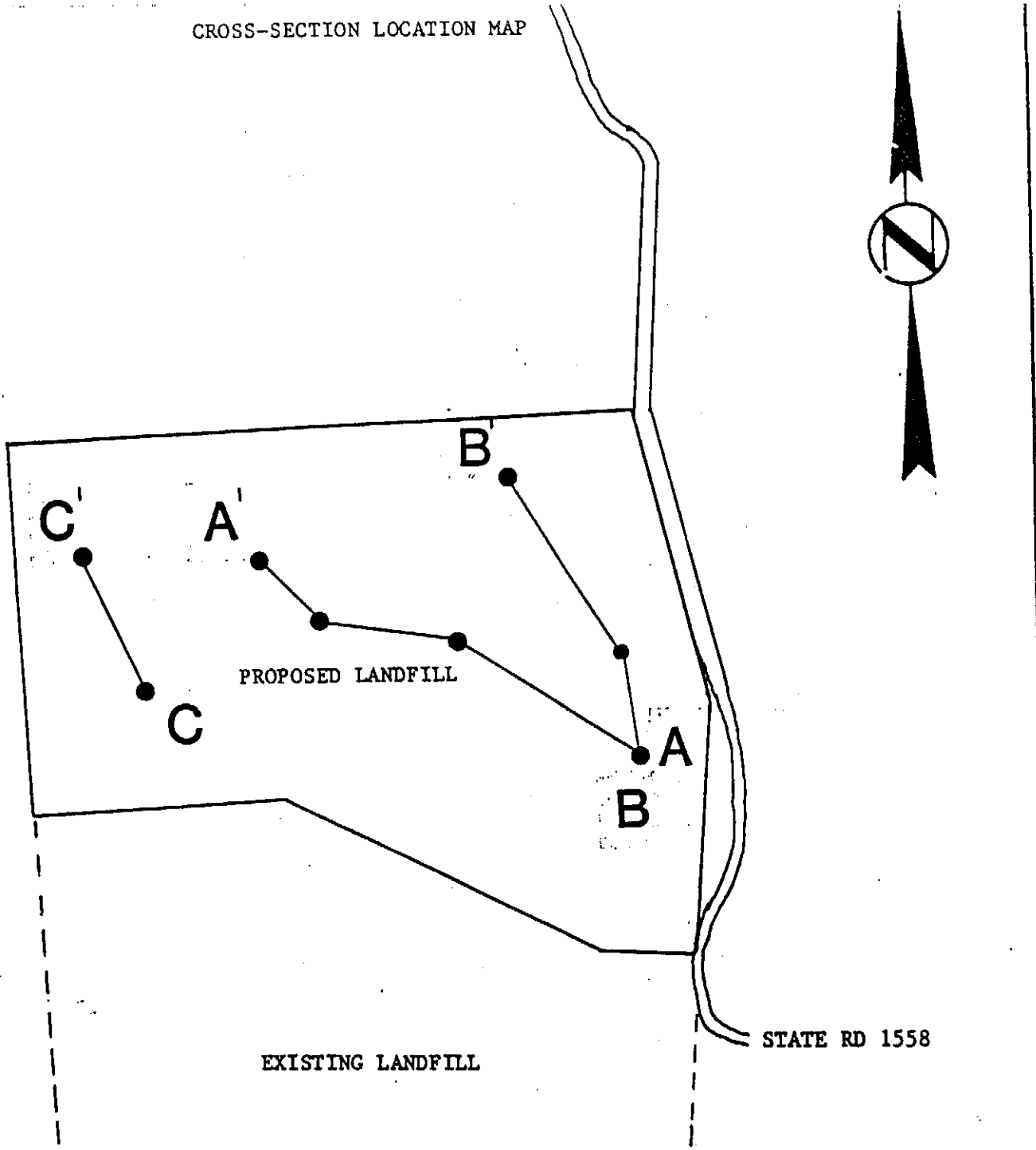
PLR/pjc



OJECT	SOIL & MATERIAL ENGINEERS, INC.	SCALE: N.T.S.
SHE COUNTY LANDFILL	RALEIGH, NORTH CAROLINA	JOB NO: 055-84-018A
EOLOGIC STUDY		FIG. NO: 1
HESTNUT HILL, N.C.		

CAH-PARNELL, INC., RALEIGH 2/84

CROSS-SECTION LOCATION MAP

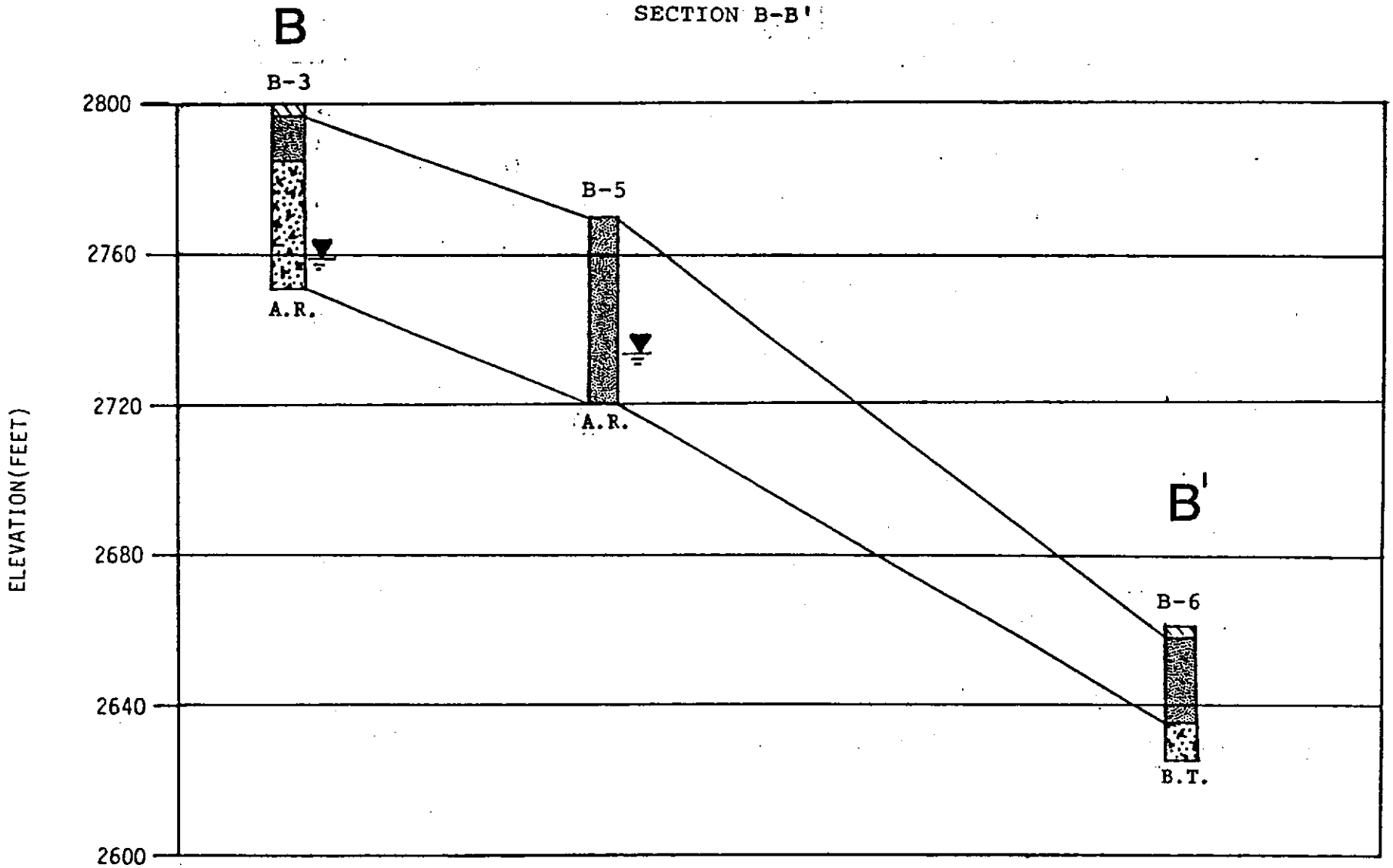


E: BORING LOCATIONS ARE APPROXIMATE

JECT HE COUNTY LANDFILL)LOGIC STUDY ESTNUT HILL, N.C.	SOIL & MATERIAL ENGINEERS, INC. RALEIGH, NORTH CAROLINA	SCALE: APPROX. 1"=500' JOB NO: 055-84-018A FIG. NO: 3

-PARNELL, INC., RALEIGH 8/64

SECTION B-B'



A.R.=AUGER REFUSAL

B.T.=BORING TERMINATED

NOTE: TEST BORING ELEVATIONS ARE ESTIMATED

LEGEND:

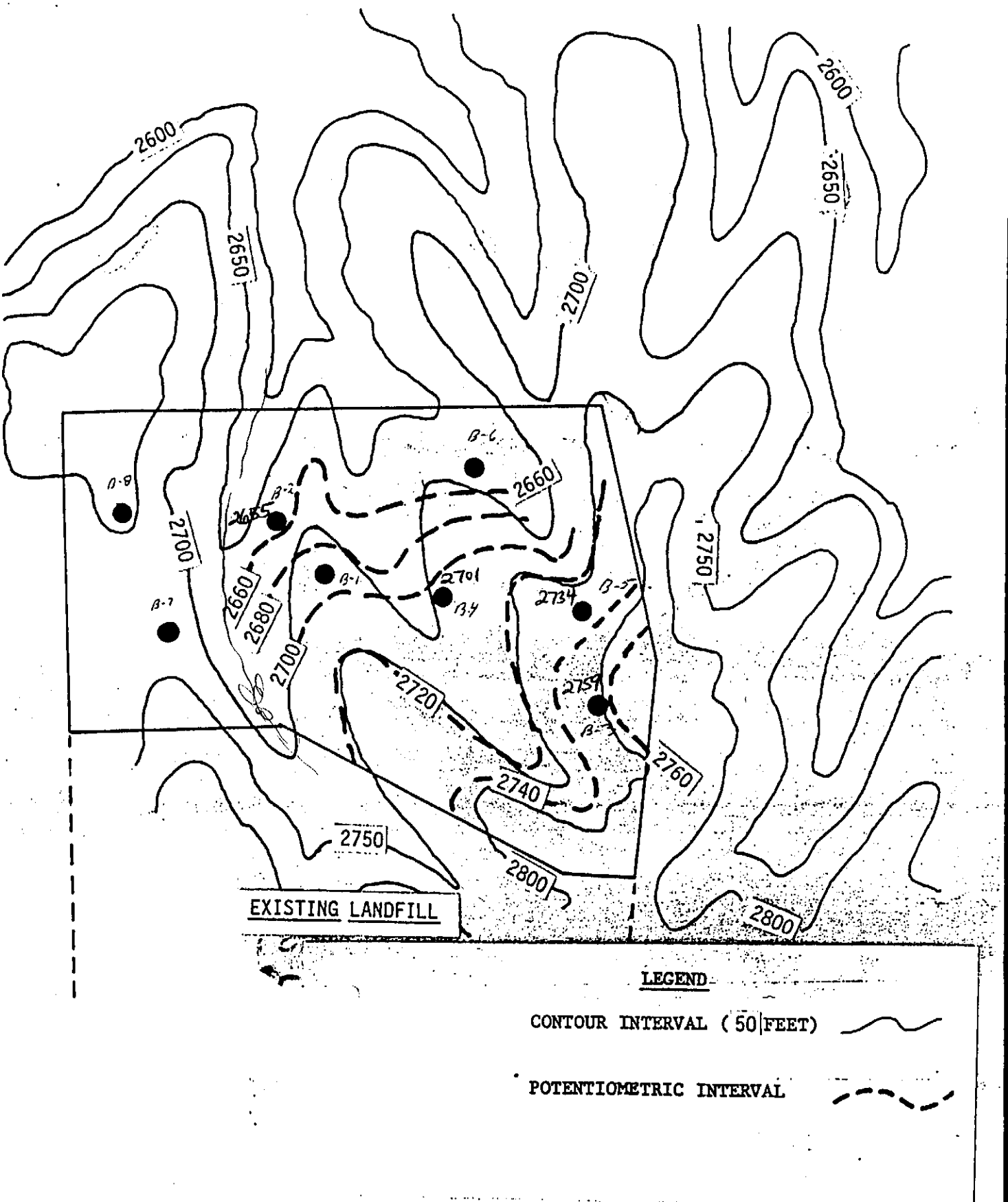
CLAY, SAND-SILT-CLAY MIXTURE

SILT, CLAY-SAND-SILT MIXTURE

WEATHERED ROCK

PROJECT ASHE COUNTY LANDFILL GEOLOGIC STUDY CHESTNUT HILL, N.C.	SOIL & MATERIAL ENGINEERS, INC. RALEIGH, NORTH CAROLINA	SCALE: H:1"=200' V:1"=40' JOB NO: 055-84-018A FIG NO: 5

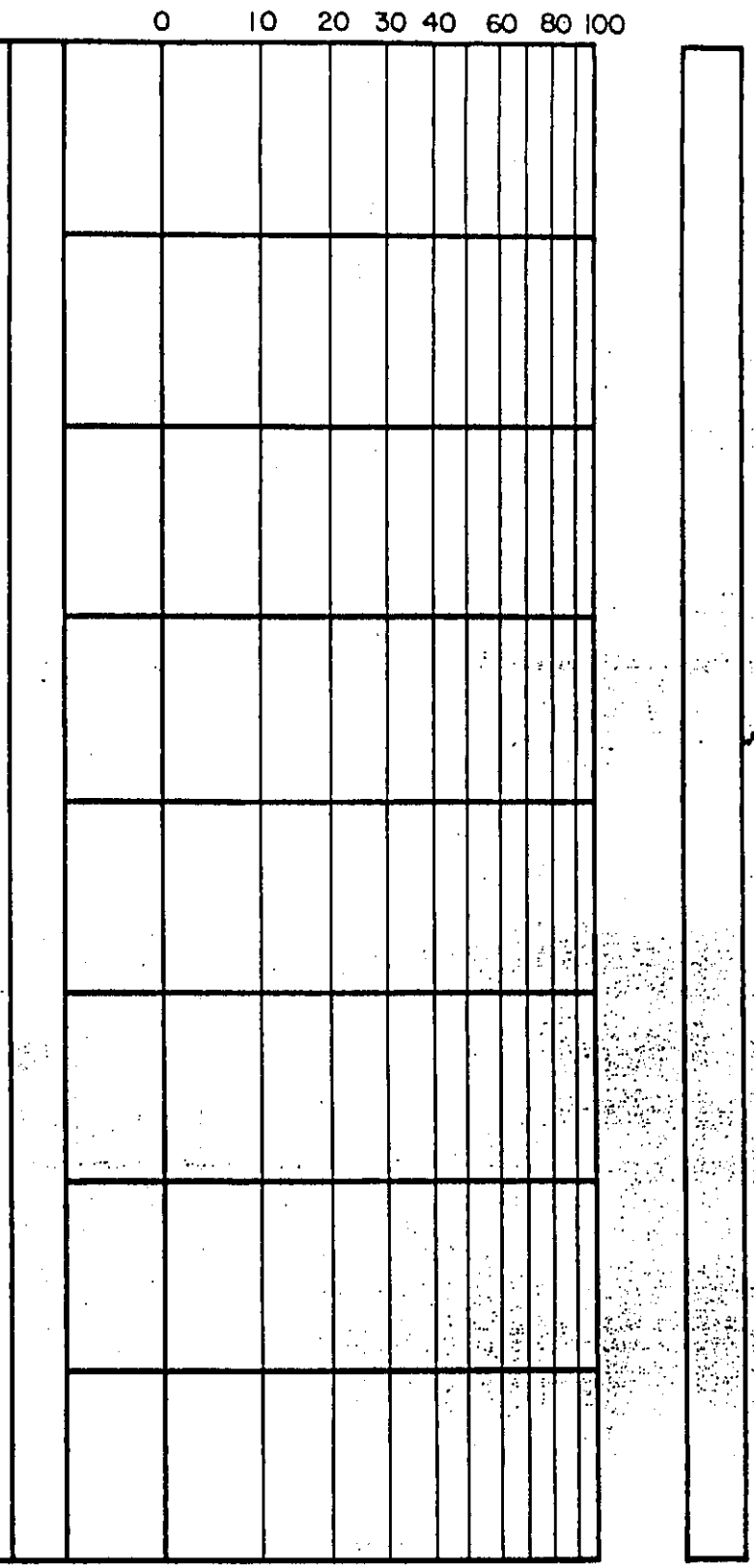
ESTIMATED POTENTIOMETRIC CONTOUR MAP



OJECT HE COUNTY LANDFILL OLOGIC STUDY ESTNUT HILL, N.C.	SOIL & MATERIAL ENGINEERS, INC. RALEIGH, NORTH CAROLINA	SCALE: APPROX. 1"=500' JOB NO: 055-84-018A FIG. NO: 7

DUNCAN-PARNELL, INC., RALEIGH

Auger Probe



Red-Tan Micaceous Slightly Clayey Sandy SILT (ML)

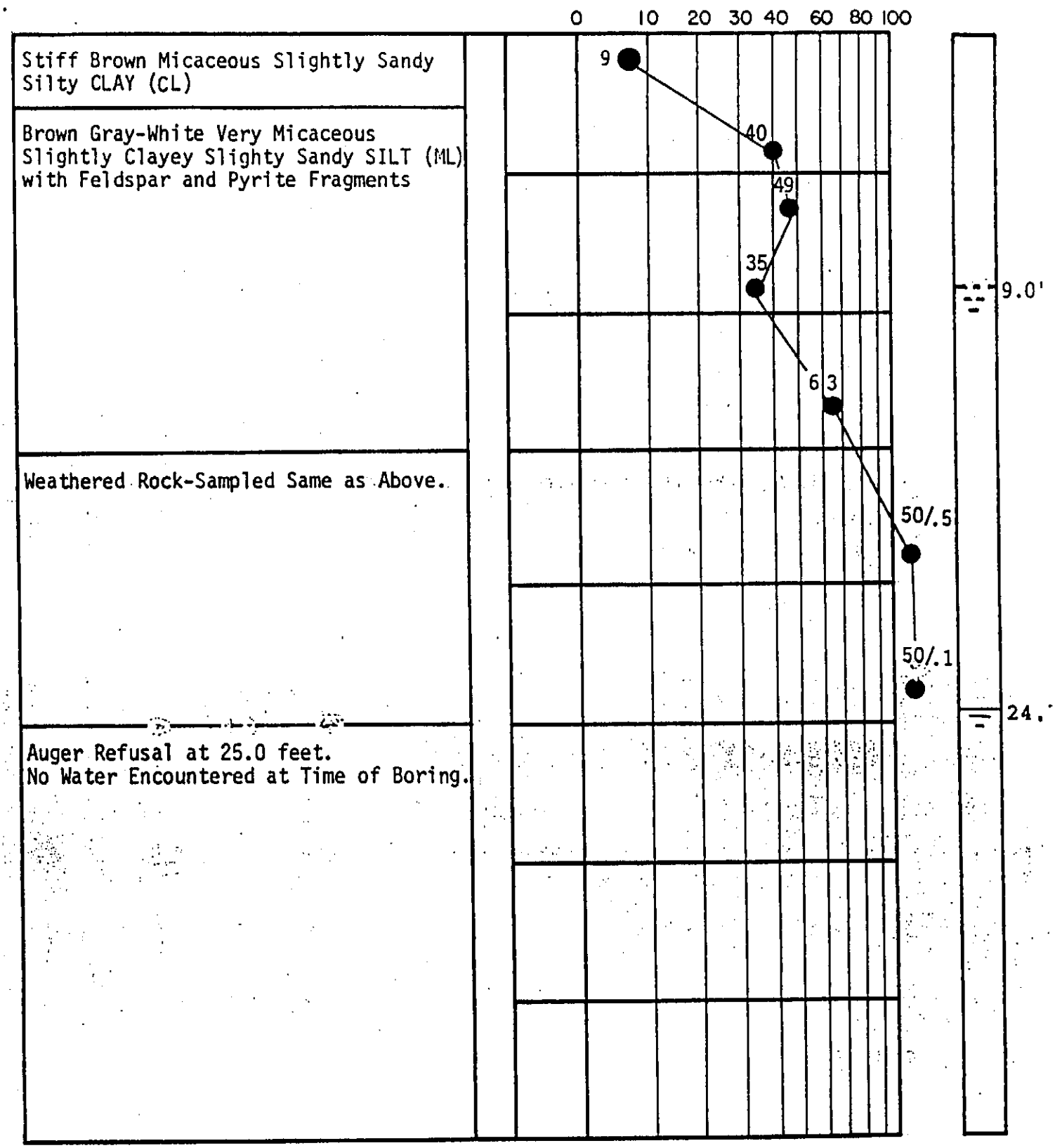
NG AND SAMPLING MEETS ASTM D-1586
: DRILLING MEETS ASTM D-2113
TRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
ING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
% ROCK CORE RECOVERY
OSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-1
DATE DRILLED 12/11/84
JOB NO. 055-84-018-A

SOIL & MATERIAL ENGINEERS, INC.



DRING AND SAMPLING MEETS ASTM D-1586
ORE DRILLING MEETS ASTM D-2113

ENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER ALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-2
DATE DRILLED 12/07/84
JOB NO. 055-84-018-A

SOIL & MATERIAL ENGINEERS, INC.

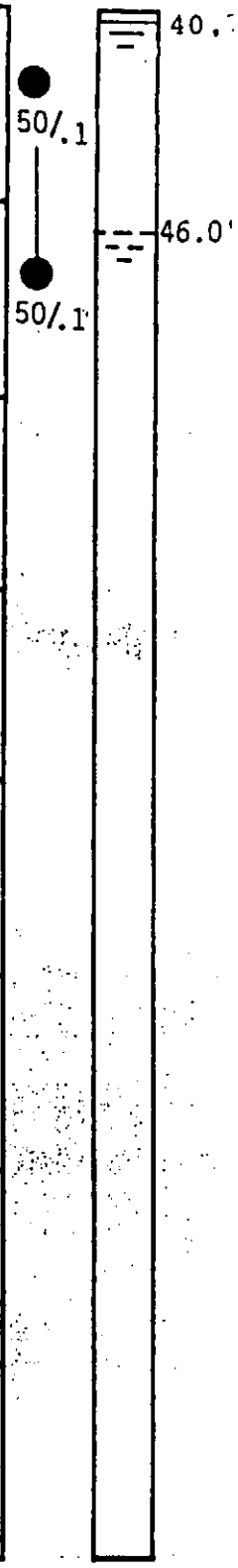
T.

ELEV. ● PENETRATION-BLOWS PER FT.

0 10 20 30 40 60 80 100

Continued

Auger refusal at 49.0 feet.



ORING AND SAMPLING MEETS ASTM D-1586
ORE DRILLING MEETS ASTM D-2113

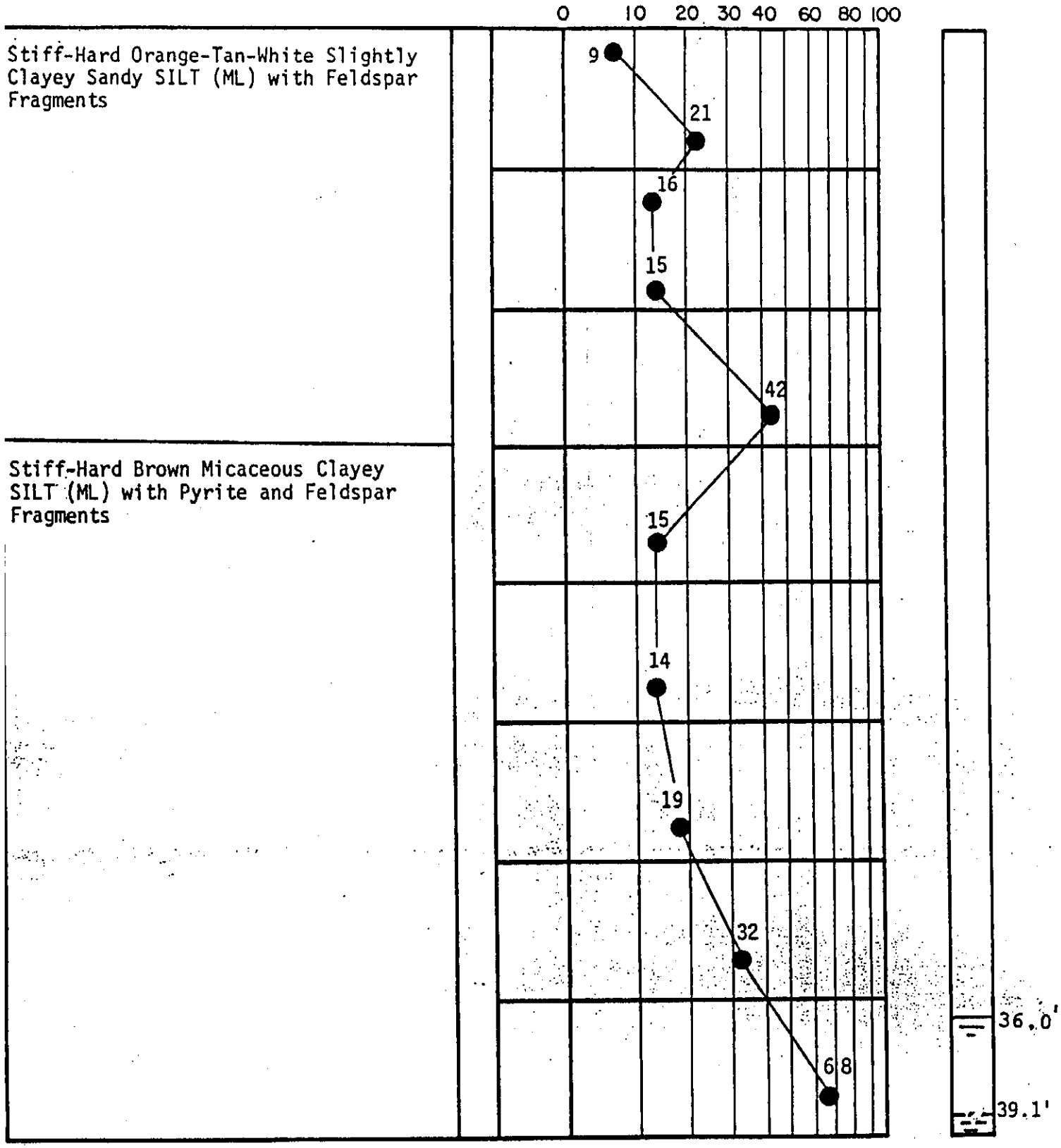
ENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
ALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

■ UNDISTURBED SAMPLE
0% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24 HR.
WATER TABLE-1 HR.

TEST BORING RECORD

BORING NO. B-3
DATE DRILLED 12/04/84
JOB NO. 055-84-018-A

SOIL & MATERIAL ENGINEERS, INC.



ING AND SAMPLING MEETS ASTM D-1586
E DRILLING MEETS ASTM D-2113

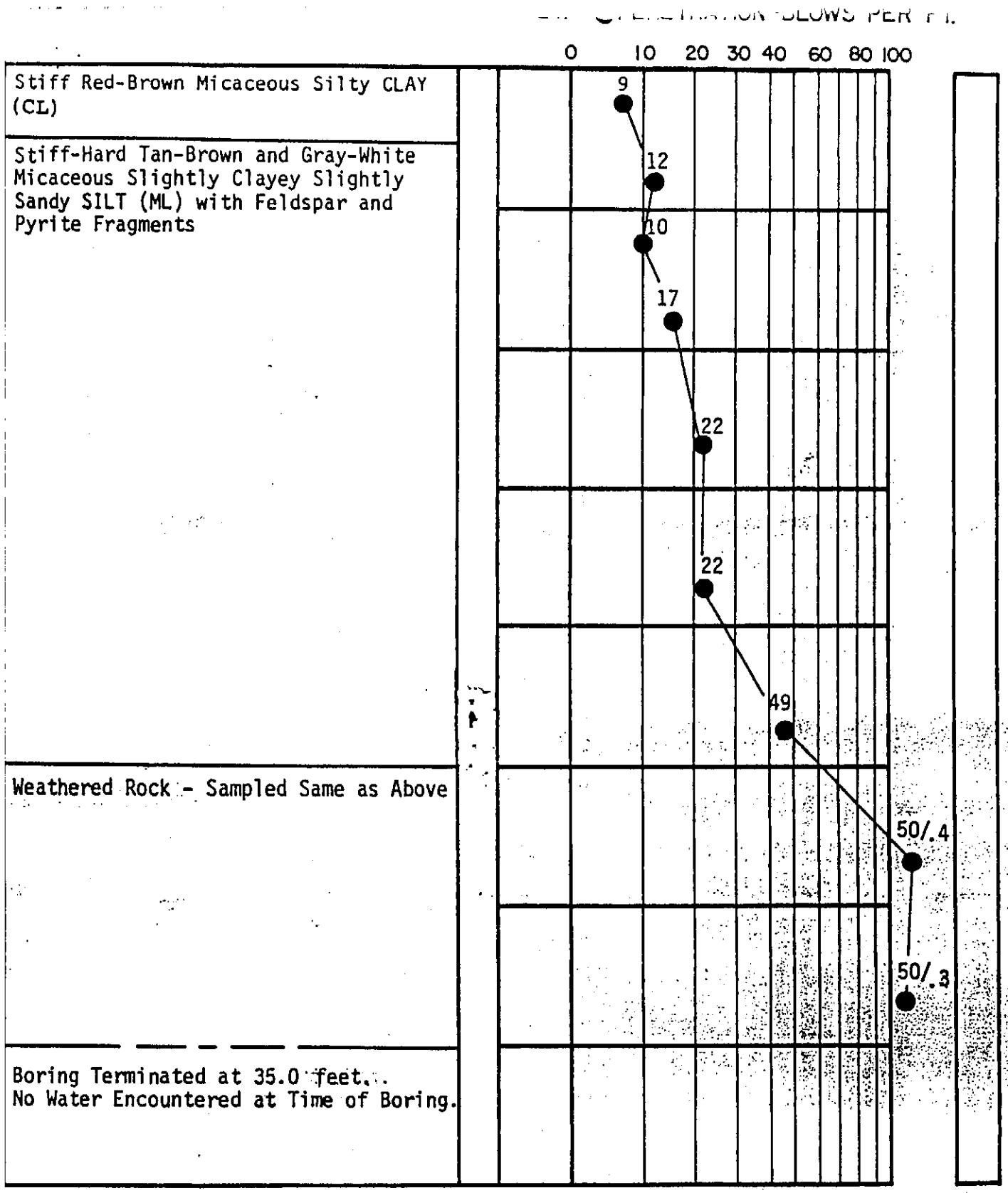
ETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
LING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24 HR.
WATER TABLE-1 HR.

TEST BORING RECORD

BORING NO. B-5
DATE DRILLED 12/06/84
JOB NO. 055-84-018-A

SOIL & MATERIAL ENGINEERS, INC.



NG AND SAMPLING MEETS ASTM D-1586
E DRILLING MEETS ASTM D-2113

ETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
ING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
% ROCK CORE RECOVERY
OSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-6
DATE DRILLED 12/07/84
JOB NO. 055-84-018-A

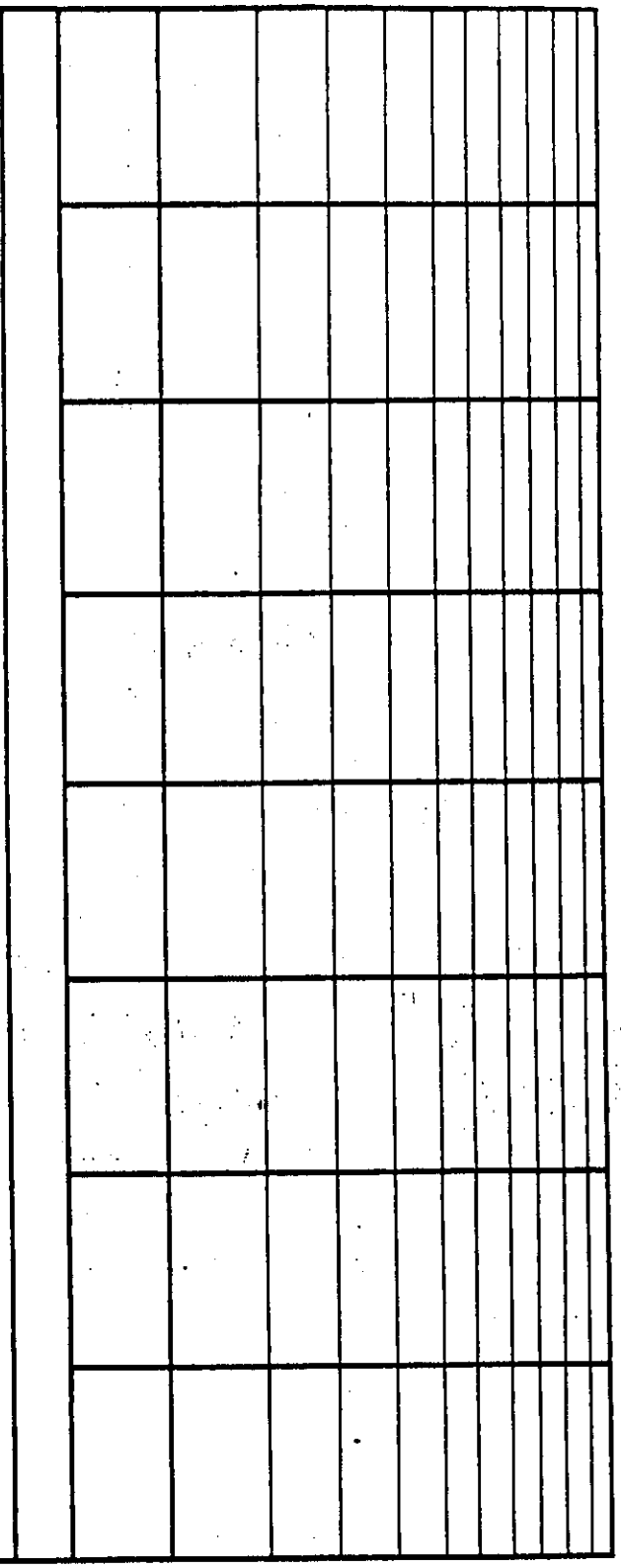
SOIL & MATERIAL ENGINEERS, INC.

T.

ELEV. ● PENETRATION-BLOWS PER FT.

0 10 20 30 40 60 80 100

Brown-Orange Micaceous Slightly Clayey Slightly Sandy SILT (ML)



BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

■ UNDISTURBED SAMPLE
50% ROCK CORE RECOVERY
◀ LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-8
DATE DRILLED 12/11/84
JOB NO. 055-84-018-A

SOIL & MATERIAL ENGINEERS, INC.

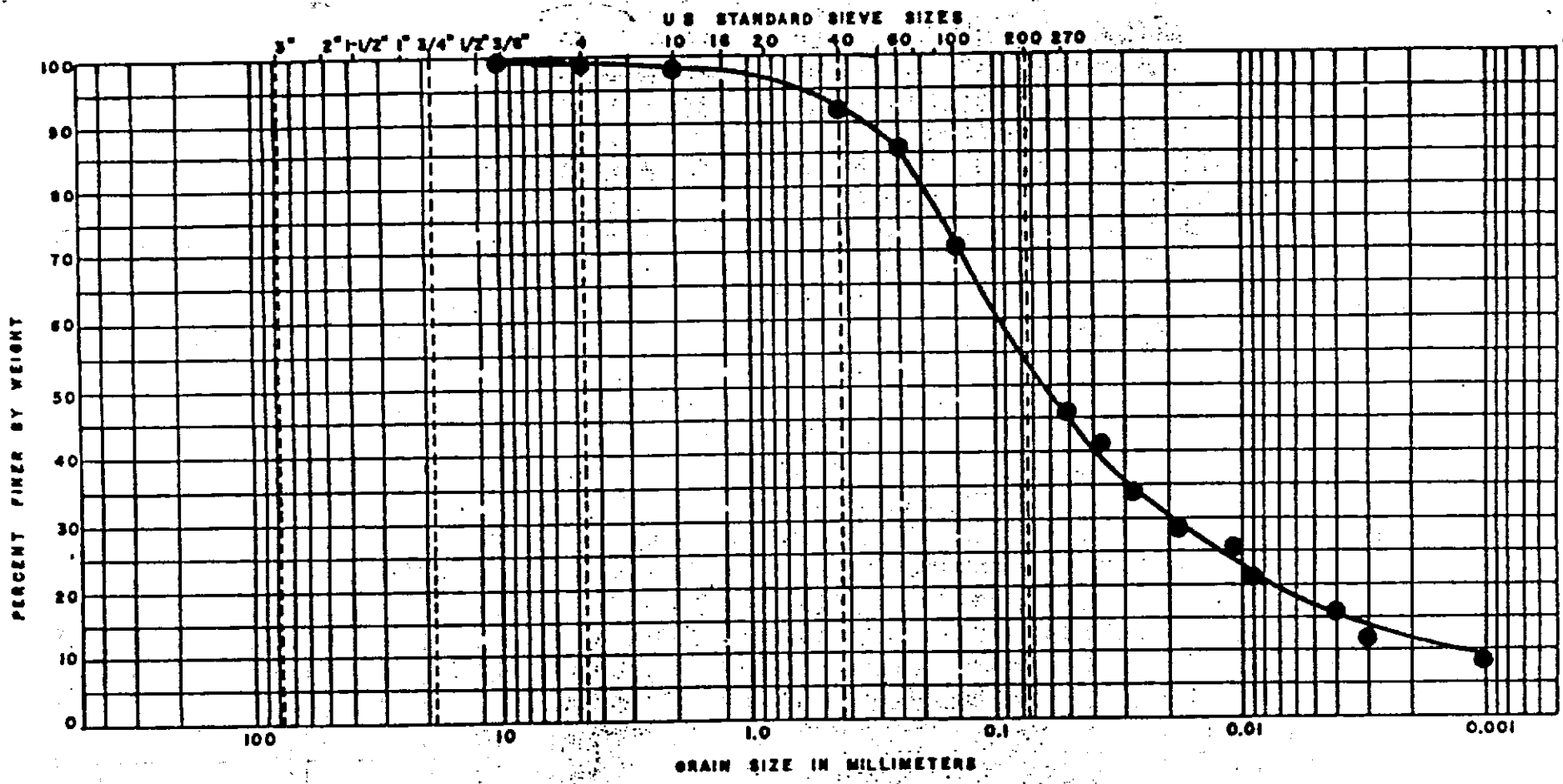
Tables

Table 2
Laboratory Data Summary
Ashe County Proposed Landfill
Chestnut Hill, North Carolina
S&ME Project Number: 055-84-018-A

Boring Number	Sample Type	Sample Depth (ft)	Natural Moisture (%)	Liquid Limit	Plasticity Index	Specific Gravity	Dry Unit Weight (pcf)	Saturated Conductivity(cm/sec)
B-1	Bag	0 - 2'	6.2	32	5	2.712	108.4	5.0×10^{-4} * X Remolded
B-3	Bag	0 - 2'	5.2	-	N.P.	2.676		
B-4	U.D.	10 - 12'	22.06	-	N.P.	2.872	108.02	7.0×10^{-4}
B-8	Bag	0 - 2'	7.3	36	1.0	2.733		

U.D. = Undisturbed Sample
N.P. = Non-Plastic

* Remolded to Approximately 95% of Maximum Dry Density



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

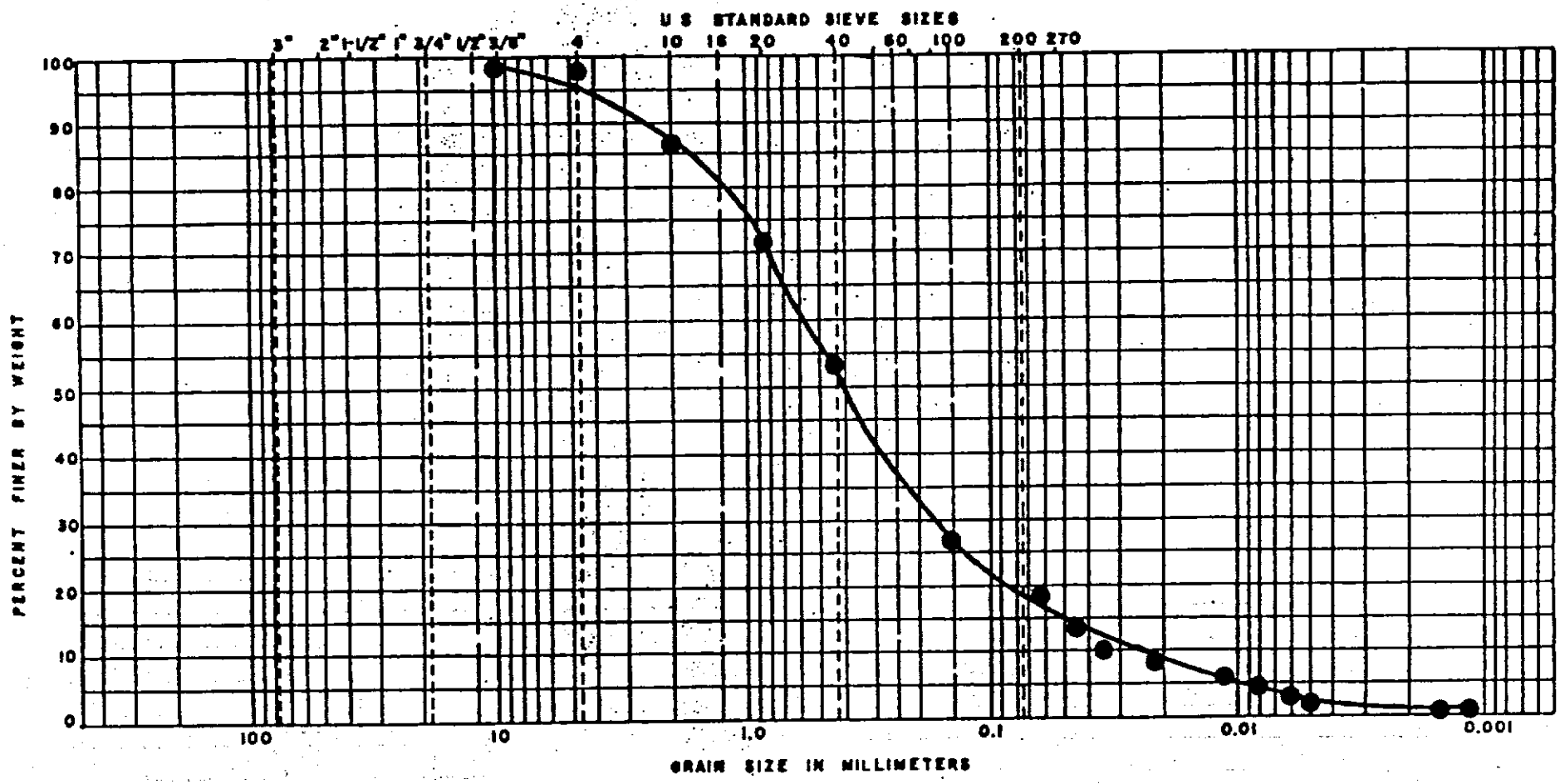
BORING NO	ELEV. OR DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-1	0-2'	6.2	32	27	5	Brown Micaceous ~~Silty SAND~~ ML ■ Sdy. Silt A-4

GRAIN SIZE DISTRIBUTION

JOB NO. 055-84-018-A

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 988



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV. OR DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-4	10 - 12'	22.06%	Non-Plastic			Brown Micaceous Silty SAND SM Sand A-2-4

GRAIN SIZE DISTRIBUTION

JOB NO. 055-84-006-A

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH N.C.

SM-19

does not match boring log description

Proctor Test Results

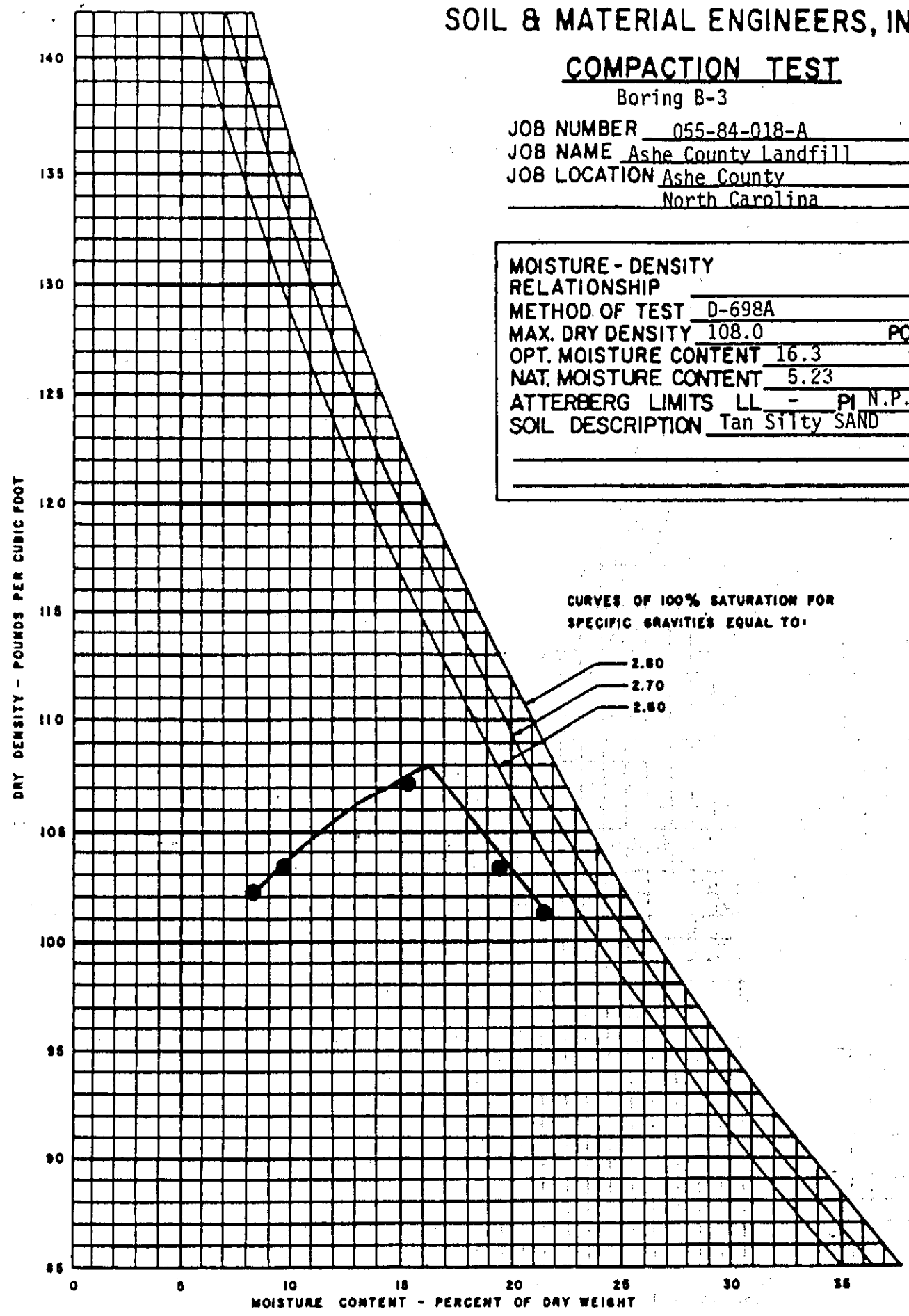
SOIL & MATERIAL ENGINEERS, INC.

COMPACTION TEST

Boring B-3

JOB NUMBER 055-84-018-A
JOB NAME Ashe County Landfill
JOB LOCATION Ashe County
North Carolina

MOISTURE - DENSITY RELATIONSHIP
METHOD OF TEST D-698A
MAX. DRY DENSITY 108.0 PCF
OPT. MOISTURE CONTENT 16.3 %
NAT. MOISTURE CONTENT 5.23 %
ATTERBERG LIMITS LL - PI N.P.
SOIL DESCRIPTION Tan Silty SAND



DUNCAN-PARNELL, INC., RALEIGH 4/84