DRAFT

Subsurface Conditions Data Report
West MSE Wall
Third Runway Embankment
Sea-Tac International Airport

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Prepared for
Port of Seattle and
HNTB

June 2000
J-4978-21

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WEST MSE WALL
THIRD RUNWAY EMBANKMENT
SEA-TAC INTERNATIONAL AIRPORT

INTRODUCTION

This data report presents information on subsurface conditions, based on geotechnical and hydrogeologic field and laboratory testing to support design of the West MSE Wall and adjacent embankment for the Third Runway Project at the Sea-Tac International Airport.

The site is located at the Sea-Tac International Airport, in SeaTac, Washington (refer to Figure 1, Vicinity Map). The shaded area on Figure 1 is presented on Figure 2, Site and Expioration Plan, showing exploration locations both for this report and those performed previously by Hart Crowser and others. A profile along the proposed mechanically stabilized earth (MSE) wall alignment showing subsurface conditions beneath the proposed wall is presented on Figure 3. Cross sections through the MSE wall showing inferred geologic conditions are provided on Figures 4 through 6. A groundwater elevation contour map is presented on Figure 7.

This report discusses the subsurface soil conditions in the area of the West MSE Wall followed by a discussion of the hydrogeologic conditions. Appendices A and B follow the main text and present results of our subsurface explorations and laboratory testing, respectively.

Subsequent to completion of the explorations and laboratory tests presented in Appendices A and B, additional explorations and tests were accomplished in an area where right-of-entry had not previously been available (Parcel Numbers 302, 303, 304, and 305). Logs of the additional explorations and results of laboratory tests on samples from the additional explorations are presented in Appendix C. The explorations and test results presented in Appendix C were completed in general accordance with the method presented in Appendices A and B.

PURPOSE AND SCOPE

The purpose of this report is to provide information on subsurface soil and groundwater conditions affecting construction in the area of the West MSE Wall. Proposed construction in this area includes the Third Runway embankment and

the West MSE Wall adjacent to Miller Creek near Wetland 37. Additional information in other reports is listed in the references at the end of this report. The information presented herein provides the basis for our geotechnical engineering analyses and recommendations.

Information presented herein was obtained in general accordance with Task 5.0—Explorations and Tests, presented in our proposal dated August 23, 1999, and subsequent modification.

GENERALIZED GEOLOGIC DESCRIPTION AND SUBSURFACE SOIL CONDITIONS

This section provides a description of the geologic and subsurface soil conditions within the area of the West MSE Wall, shown on Figure 2, based on Hart Crowser's explorations at the site and explorations by others.

Generalized Geologic Conditions

Generalized geologic conditions in the project area have been described in the Preliminary Engineering Report, Volume 2 (Applied Geotechnology Inc., 1994). The following is a summary of the geologic units identified at the Third Runway project site:

- Fill (loose to medium dense, locally dense, variably graded, silt, sand, and gravel);
- Alluvium (primarily soft to stiff peat, clay, and silt; and very loose to medium dense, fine to medium sand);
- Recessional Outwash (primarily loose to dense, silty sand and gravel, and/or medium stiff to hard, sandy silt and/or sandy clay);
- Glacial Till (dense to very dense, silty sand and gravel, and hard sandy silt);
- Advance Outwash (dense to very dense, non-silty to silty sand and gravel); and
- Lawton Clay (very stiff to hard silt and clay).

Subsurface Conditions

Subsurface soil conditions interpreted from materials encountered in explorations at the site and soil properties inferred from laboratory tests formed

the basis for the information contained in this report. Variations between explorations occur due to the variability in gradation, moisture content, and density/consistency of soils at the site. The nature and extent of these variations may not become evident until construction. If variations become evident, it will be necessary to re-evaluate our interpretation of the soil conditions at the site, as well as any recommendations based on those interpretations.

Generalized subsurface conditions in the area are shown on the wall alignment Profile on Figure 3 and Cross Sections A-A' (Runway Station 173+62), B-B' (Runway Station 181+90), and F-F' (Runway Station 180+06) on Figures 4 through 6, respectively.

The following soil materials were observed in this area:

Soft to stiff interbedded Clay and loose to medium dense Sand with organic material (Peat). Several borings (HC00-B128, HC00-B114, HC00-B115, etc.) encountered peat at the ground surface or interbedded to depths of about 15 feet.

Stiff to hard, slightly sandy to very sandy CLAY and slightly silty CLAY to clayey SILT. These fine-grained soils were encountered at depths ranging to about 6 feet from the ground surface to more than 50 feet (i.e., below the bottom of our borings). These soil units range from about 10 feet to more than 20 feet in thickness.

Medium dense to very dense, slightly gravelly to gravelly, slightly silty to very silty SAND. These soils and the interbedded hard CLAY described above are the primary unit underlying the soft or loose surficial soils described above. The sands are typically fine to medium in gradation. The top of these soils typically extend below depths of about 10 feet to 20 feet below the surface.

Summary of Results from Laboratory Tests

Tables 1 through 3 summarize the parameters determined from tests performed on specimens taken from Shelby tube samples obtained during drilling. The samples within the Shelby tubes were extruded and prepared for assigned laboratory tests in general accordance with the applicable ASTM standards as discussed in Appendix B.

Hydrogeologic Conditions

Groundwater Occurrence

Seventeen new wells were installed during this phase of work; HC00-B106, HC00-B111, HC00-B118, HC00-B120, HC00-B121, HC00-B123, HC00-B125, HC00-B126, HC00-B129, HC00-B130, HC00-B132, HC00-B133, HC00-B141, HC00-B142, and HC00-B144 through HC00-B146. The water levels observed in the open borings at the time of drilling (ATD) and subsequent to monitoring well installation and development are shown on the boring logs (Appendix A).

Groundwater Monitoring

Groundwater elevation data are now being collected monthly from 26 wells in the area of the West MSE Wall, beginning with the monitoring event on April 11, 2000. The wells that are being monitored monthly include the 19 new wells listed above, and 7 existing wells. Well construction information, depth to water, and groundwater elevation data are compiled and presented in Table 4. As future monitoring events are completed, seasonal changes in groundwater elevation and flow patterns will be evaluated in the area of West MSE Wall.

Groundwater Flow Mapping

Shallow groundwater elevations observed in April 2000 are contoured on Figure 7. These groundwater levels represent wet season conditions, with elevations that are typically about 2 to 3 feet above the dry season lows observed around October 1999.

Groundwater flow patterns appear to be generally unchanged by seasonal water level variations, with flow generally toward Miller Creek from the higher ground of the airport. This is consistent with conceptual models of local hydrogeology (Applied Geotechnology Inc., 1996), where recharge occurs on the higher ground of the airport, and water moves down into the Shallow Regional Aquifer before discharging to the creek. Artesian conditions observed in some wells (e.g., AT94A-B3 and AT96-B4) indicate an upward hydraulic gradient, consistent with the regional discharge of groundwater to the creek drainage basin, and the effects of local interbedding of more and less permeable soil units. Elsewhere water confined in stratified soil units (e.g., HC00-B118) may be artesian where these soil units are encountered down slope.

The pattern of groundwater flow is broadly consistent with the implied occurrence of significant recharge beneath the existing airport. Not all water levels are necessarily reflective of conditions in the Shallow Regional Aquifer,

since perched zones occur above the main water table, and many of the wells are screened in shallower water-bearing zones.

USE OF THIS REPORT

This report has been prepared for the exclusive use of HNTB and the Port of Seattle, for the site and project described herein. We completed this work according to generally accepted geotechnical engineering practices in the same or similar localities, related to the nature of the work accomplished, at the time the services were accomplished. We make no other warranty, express or implied.

Hart Crowser appreciates the opportunity to provide this information. Please call if you have any questions.

Sincerely,

HART CROWSER, INC.

MICHAEL J. BAILEY, P.E.
Project Manager

JOSEPHA D. CELES, E.I.T.
Staff Geotechnical Engineer

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Key to Tables 1 through 3

Symbol	Description
w_n	Natural Moisture Content in Percent
γ_T	Total Unit Weight in pcf
σ_{v0}'	Initial Effective Vertical Stress in ksf
σ_p'	Past Effective Vertical Stress in ksf
σ_c'	Confining Stress in ksf
$\sigma_1 - \sigma_3$	Principal Stress Difference (or axial stress) in ksf
c'	Cohesion Intercept (based on effective stresses) in psf
ϕ'	Effective Friction Angle in Degrees
ϕ_{ave}'	Average Effective Friction Angle in Degrees
OCR	Overconsolidation Ratio
C_c	Compression index
C_r	Recompression Index
e_0	Initial Void Ratio
c_v	Coefficient of Consolidation in ft^2/day
E_{50}	Modulus of Elasticity (determined at 50% of Peak Strength) in ksf
LL	Liquid Limit in Percent
PI	Plasticity Index in Percent
s_u	Undrained Shear Strength in psf

Table 1 - Summary of Consolidation Results

Boring Number	Sample Number	Depth in Feet	Soil Description	w_{ni} in %	γ_T in pcf	σ_{vo}' in ksf	σ_p' in ksf	OCR	C_c	C_r	e_0	c_v at σ_p' in ft²/day
HC00-B132A	S-1	8.5 to 10.5	Very soft to soft, very silty CLAY	32	120	1.105	1.6	1	0.181	0.010	0.817	0.75
HC00-B115	S-4	10 to 11	Medium stiff, very sandy SILT	18	131	1.3	> 64	> 30	not determined	0.007	0.49	not determined
HC00-B118	S-2	5.5 to 6.5	Medium stiff, slightly sandy, clayey SILT	32	119	0.6875	10	15	0.184	0.026	0.837	2.5
HC00-B111	S-3	5.5 to 7.5	Stiff, clayey SILT	31	118	0.715	12	17	0.307	0.017	0.837	2.4
HC00-B142	S-3	5.5 to 7.5	Stiff, sandy SILT	26	125	0.715	**56**	78	0.167	0.016	0.67	1.5
HC00-B111	S-6	15.5 to 16.6	Medium dense, gravelly, very silty SAND	15	135	2.015	**44**	22	0.200	0.007	0.401	2.3
HC00-B118	S-6	15.5 to 17.4	Hard, sandy CLAY	25	123	1.9375	20	10	0.147	0.024	0.687	3
HC00-B110	S-11	40.5 to 41.8	Hard, very clayey SILT	31	119.0	5.265	**42**	8	0.178	0.026	0.817	2.4

Note: 1. Values for σ_p' shown in **bold were determined by extrapolation of the virgin compression curve due to load frame limitations*

2. The value of σ_p' for HC00-B115, S-4 exceeded the maximum load frame load capability

Table 2 - Summary of Isotropically Consolidated Undrained Triaxial Compression (CU) Test Results

Boring Number	Sample Number	Depth in Feet	Soil Description	w_n in %	γ_T in pcf	σ_c' in ksf	$\sigma_1 - \sigma_3$ in ksf	ϕ' in deg	ϕ_{ave}' in deg	E_{50} in ksf	$\sigma_1 - \sigma_3/\sigma_c'$	E_{50}/σ_c'
HC00-B132	S-5	9.0 to 11.0	Medium stiff, sandy CLAY	40.5	114.0	6.0	6.0	36.7		744.6	0.993	124.1
				32.7	124.3	9.0	8.5	35.1	35.1	426.4	0.948	47.4
				25.3	125.1	12.0	16.4	33.4		341.8	1.367	28.5
HC00-B110	S-4	15.5 to 17.4	Very stiff to hard, slightly sandy, very clayey SILT	25.2	125.0	6.0	7.5	33.2		312.6	1.251	52.1
				23.0	130.5	9.0	17.9	32.9	33.1	497.0	1.988	55.2
				14.2	135.4	12.0	20.0	33.1		4162.6	1.665	346.9
HC00-B111	S-12	40.5 to 42.1	Hard CLAY	29.6	121.3	6.0	13.9	33.0		256.6	2.317	42.8
				30.5	122.2	9.0	22.3	34.6	34.1	557.5	2.478	61.9
				31.2	122.8	12.0	22.0	34.8		915.2	1.833	76.3

Table 3 - Summary of Unconsolidated Undrained (UU) Triaxial Compression Test Results

Boring Number	Sample Number	Depth in Feet	Soil Description	w_n in %	γ_T in pcf	LL in %	PI in %	s_u in psf
HC00-B118	S-2	5.5 to 6.5	Medium stiff, slightly sandy, clayey SILT	31.7	123.3	30	4	2023
HC00-B129	S-3	5.5 to 6.8	Stiff, slightly sandy CLAY	28.7	128.5	38	15	1313
HC00-B110	S-11	40.5 to 41.8	Hard, very clayey SILT	31.1	122.8	41	13	9259
HC00-B118	S-6	15.5 to 17.4	Hard, sandy, very clayey SILT	25.0	124.8	41	16	5486

Table 4 - West Wall Area Water Level Data

	AT94A-B3		AT96-B4		AT97-B69		HC99-B37		HC99-B38		HC99-B39		HC99-B40	
	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet
Measuring Point	0.00	*273.4*	0.00	*279.7*	0.00	*337.2*	0.00	237.65	0.00	230.88	0.00	230.80	0.00	250.63
Ground Level*	1.4	*272*	*-0.3*	*280*	3.2	*334*	3.1	234.6	3.3	227.6	-0.3	231.1	2.0	248.6
Top of Screen*	23.4	*250.0*	36.7	*243.0*	*27.7*	*310*	9.1	228.6	12.3	218.6	4.7	226.1	14.0	236.6
Bottom of Screen*	33.4	*240.0*	46.7	*233.0*	*29.7*	*308*	19.1	218.6	22.3	208.6	14.7	216.1	24.0	226.6
Date: 3/8/1999					-	-	3.52	234.13	4.40	226.48	0.69	230.11	4.88	245.75
3/10/1999					6.18	331.0								
4/5/1999					6.59	330.6	3.58	234.07	4.41	226.47	0.74	230.06	5.26	245.37
5/4/1999					7.43	329.8	3.82	233.83	4.60	226.28	0.86	229.94	5.75	244.88
5/15/1999					-	-								
6/14/1999					8.08	329.1	5.12	232.53	5.90	224.98	1.68	229.12	6.89	243.74
7/13/1999					8.41	328.8	4.72	232.93	5.93	224.95	2.05	228.75	7.18	243.45
8/13/1999					8.83	328.4	5.70	231.95	6.08	224.80	2.18	228.62	7.13	243.50
9/14/1999					9.16	328.0	6.47	231.18	6.48	224.40	2.51	228.29	7.67	242.96
10/13/1999					9.12	328.1	4.50	233.15	5.98	224.90	2.09	228.71	7.32	243.31
11/11/1999					8.13	329.1	3.22	234.43	4.25	226.63	2.90	227.90	5.80	244.83
12/9/1999					6.80	330.4	3.27	234.38	4.38	226.50	0.27	230.53	5.00	245.63
1/13/2000					6.48	330.7	3.20	234.45	4.35	226.53	0.54	230.26	4.86	245.77
2/14/2000					6.54	330.7	3.12	234.53	4.33	226.55	0.59	230.21	4.49	246.14
3/9/2000	Flowing	>272	Flowing	>280	6.82	330.4	3.17	234.48	4.43	226.45	0.61	230.19	5.57	245.06
4/11/2000	Flowing	>272	Flowing	>280	7.45	329.8	3.35	234.30	4.60	226.28	0.88	229.92	5.08	245.55
5/10/2000	Flowing	>272	Flowing	>280	7.78	329.4	3.19	234.46	4.32	226.56	0.88	229.92	5.14	245.49

Italics = Estimated
Depth* All depths are below measuring point (NOT below the ground surface)
- Indicates data not available.

Table 4 - West Wall Area Water Level Data

	HC00-B106		HC00-B111		HC00-B118		HC00-B120		HC00-B121		HC00-B123		HC00-B125	
	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet
Measuring Point	0.00	315.81	0.00	286.06	0.00	298.61	0.00	236.93	0.00	231.78	0.00	237.64	0.00	257.8
Ground Level*	1.7	314.1	0.8	285.3	1.0	297.7	2.9	234.0	2.1	229.7	2.9	234.7	-0.4	258.2
Top of Screen*	11.7	304.1	9.8	276.3	7.0	291.7	17.6	219.3	6.8	225.0	14.0	223.7	3.6	254.2
Bottom of Screen*	21.7	294.1	19.8	266.3	12.0	286.7	22.6	214.3	16.8	215.0	24.0	213.7	8.6	249.2
Date: 3/8/1999														
3/10/1999														
4/5/1999														
5/4/1999														
5/15/1999														
6/14/1999														
7/13/1999														
8/13/1999														
9/14/1999														
10/13/1999														
11/11/1999														
12/9/1999														
1/13/2000														
2/14/2000	5.49	310.32	6.80	279.26	6.63	291.98								
3/9/2000	5.50	310.31	6.94	279.12	6.71	291.90								
4/11/2000	6.21	309.60	8.34	277.72	7.84	290.77	5.1	231.83	0.80	230.98	2.06	235.58	3.74	254.06
5/10/2000	6.38	309.43	8.59	277.47	7.64	290.97	4.92	232.01	0.62	231.16	1.90	235.74	3.89	253.91

Italics = Estimated

Depth* All depths are below measuring point (NOT below the ground surface)

– Indicates data not available.

Table 4 - West Wall Area Water Level Data

	HC00-B126		HC00-B129		HC00-B130		HC00-B132		HC00-B133		HC00-B141		HC00-B142	
	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet
Measuring Point	0.00	251.56	0.00	245.83	0.00	225.46	0.00	229.96	0.00	243.47	0.00	258.64	0.00	272.72
Ground Level*	1.4	250.2	2.6	243.2	2.3	223.1	2.6	227.4	2.4	241.1	0.9	257.8	2.7	270.1
Top of Screen*	8.4	243.2	9.6	236.2	7.3	218.1	3.6	226.4	7.4	236.1	12.9	245.8	17.2	255.6
Bottom of Screen*	13.4	238.2	14.6	231.2	11.4	214.1	18.6	211.4	12.4	231.1	22.9	235.8	22.2	250.6
Date: 3/8/1999														
3/10/1999														
4/5/1999														
5/4/1999														
5/15/1999														
6/14/1999														
7/13/1999														
8/13/1999														
9/14/1999														
10/13/1999														
11/11/1999														
12/9/1999														
1/13/2000														
2/14/2000	2.02	249.54	3.07	242.76					2.51	240.96	7.94	250.70		
3/9/2000	1.82	249.74	3.15	242.68					2.44	241.03	8.91	249.73	3.27	269.45
4/11/2000	1.97	249.59	3.59	242.24	1.73	223.73	2.65	227.31	2.53	240.94	10.21	248.43	3.53	269.19
5/10/2000	2.07	249.49	3.6	242.23	1.67	223.79	2.55	227.41	2.61	240.86	10.75	247.89	3.58	269.14

Italics = Estimated

Depth* All depths are below measuring point (NOT below the ground surface)

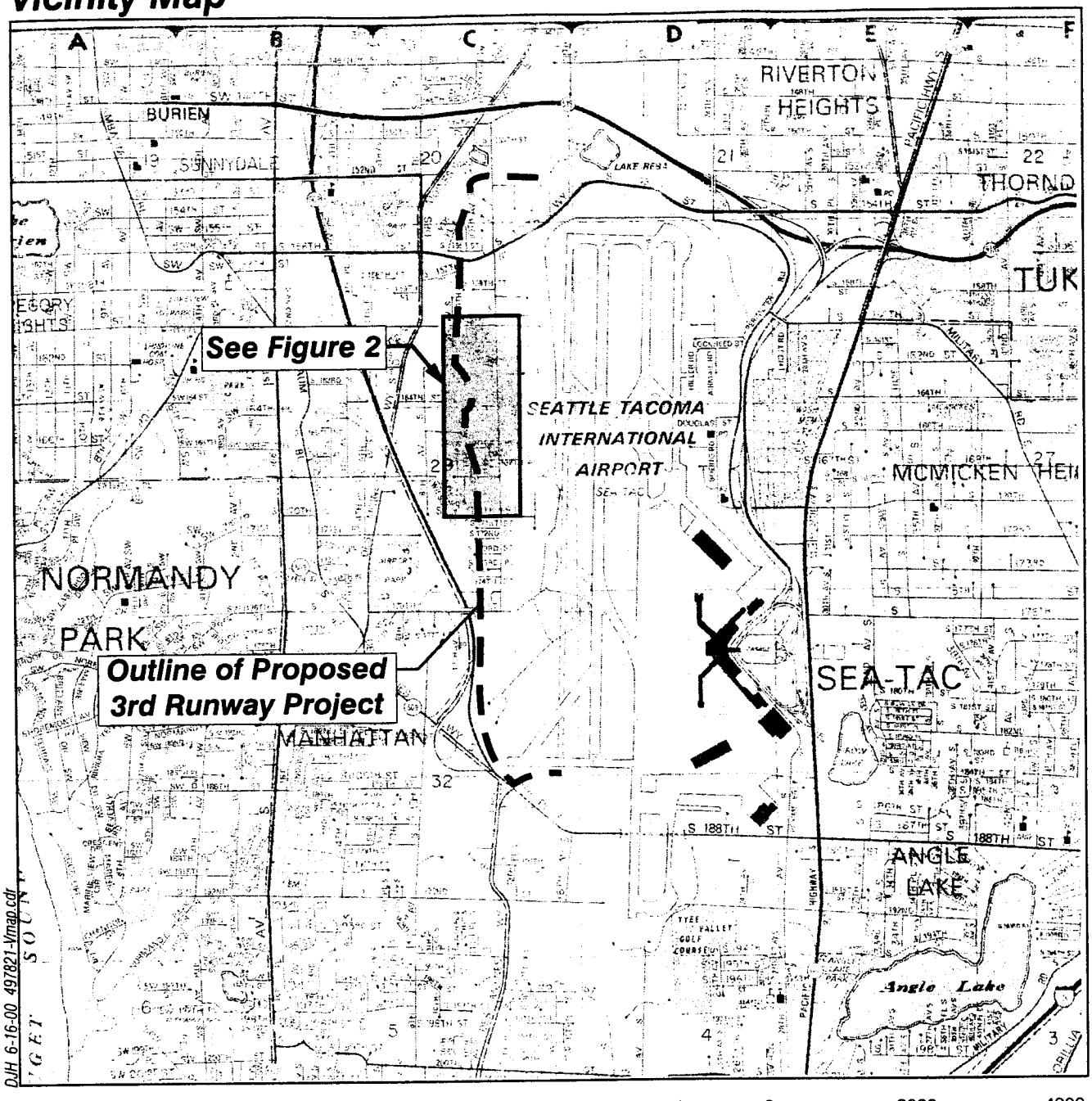
– Indicates data not available.

Table 4 - West Wall Area Water Level Data

	HC00-B144		HC00-B145		HC00-B146	
	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet	Depth* in Feet	Elevation in Feet
Measuring Point	0.00	248.99	0.00	265.11	0.00	263.55
Ground Level*	2.4	246.6	2.3	262.8	2.9	260.7
Top of Screen*	8.9	240.1	12.3	252.8	11.9	251.7
Bottom of Screen*	13.9	235.1	17.3	247.8	16.9	246.7
Date: 3/8/1999						
3/10/1999						
4/5/1999						
5/4/1999						
5/15/1999						
6/14/1999						
7/13/1999						
8/13/1999						
9/14/1999						
10/13/1999						
11/11/1999						
12/9/1999						
1/13/2000						
2/14/2000			2.94	262.17		
3/9/2000	2.98	246.01	3.14	261.97	3.81	259.74
4/11/2000	3.17	245.82	3.51	261.60	4.02	259.53
5/10/2000	3.00	245.99	3.18	261.93	3.79	259.76

Italics = Estimated
Depth* All depths are below measuring point (NOT below the ground surface)
– Indicates data not available.

Vicinity Map



0 2000 4000

Scale in Feet

N

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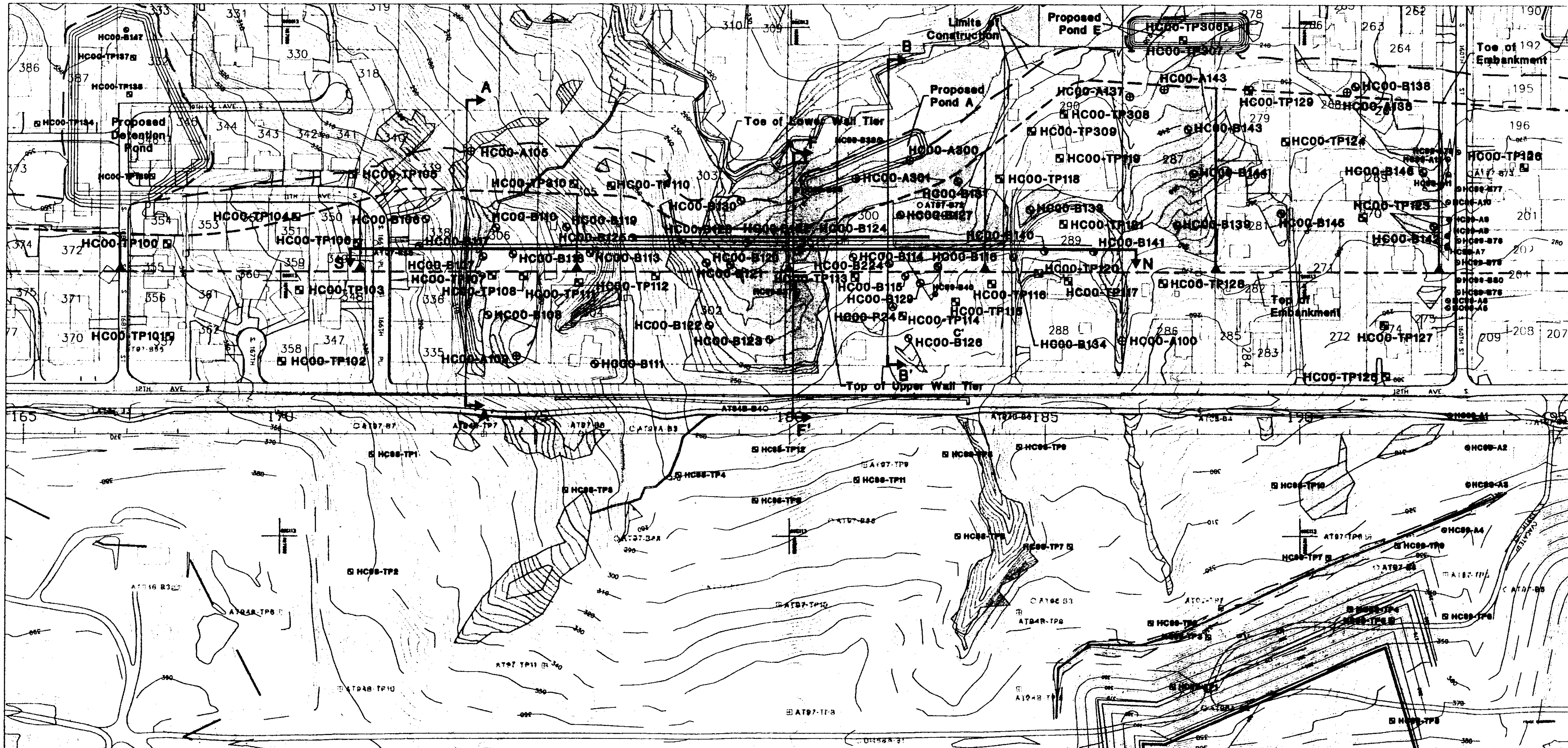
J-4978-21 6/00

Figure 1

AR 045270

Site and Exploration Plan

West MSE Wall



Note: Base map prepared from drawing provided by HNTB entitled "Topo_Full.dwg," dated October 4, 1999. Wetland delineation prepared from drawing provided by Parametrix entitled "W_020800.dwg," dated February 8, 2000.

Exploration Location and Number

⊖HC00-B214	Boring, Hart Crowser (Current Study)
⊕HC00-A301	Hand-Auger Boring, Hart Crowser (Current Study)
⊠ HC99-TP29	Test Pit, Hart Crowser (Current Study)
	Boring, by Others (Previous Study)
	Test Pit, by Others (Previous Study)

AA' Profile/Cross Section Location and Designation

Wetland Location

N

0 200 400

Scale in Feet

AR 045271

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J-4978-21 3/00

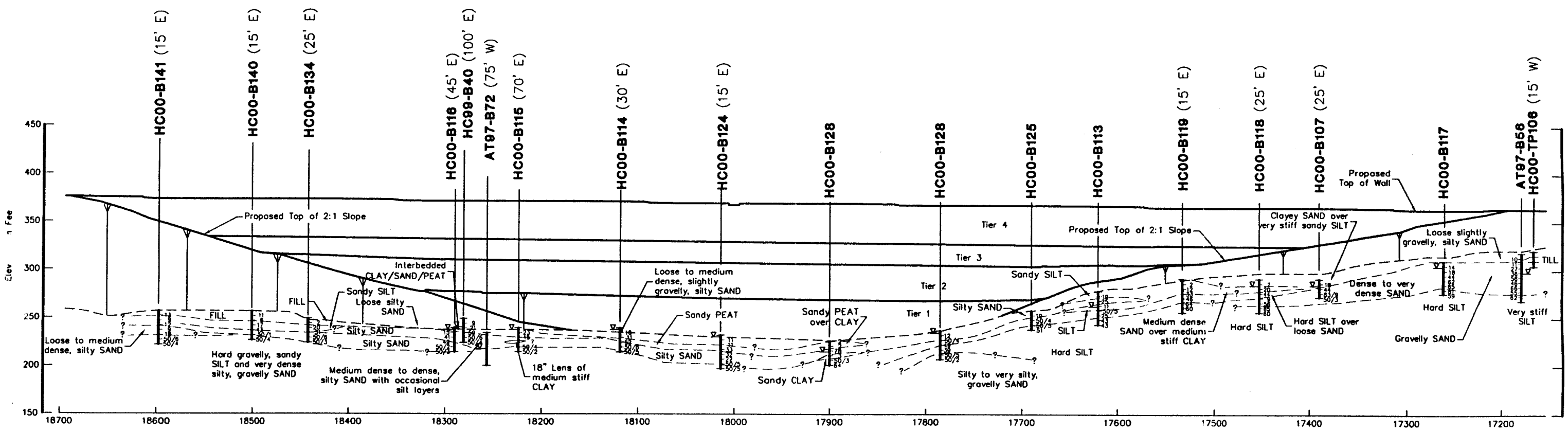
Figure 2

RC 6/15/00 1=100 (xref)see drawing file/755-color.pcp

49782110.dwg

Generalized Subsurface Profile

West MSE Wall (Looking East)



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

MSE wall tiers and other geometric details are only conceptual.

HC00-B134 Exploration Number
(25' E) (Offset Distance and Direction)
Exploration Location
Water Level
N Value

0 50 100 200
Scale in Feet

AR 045272

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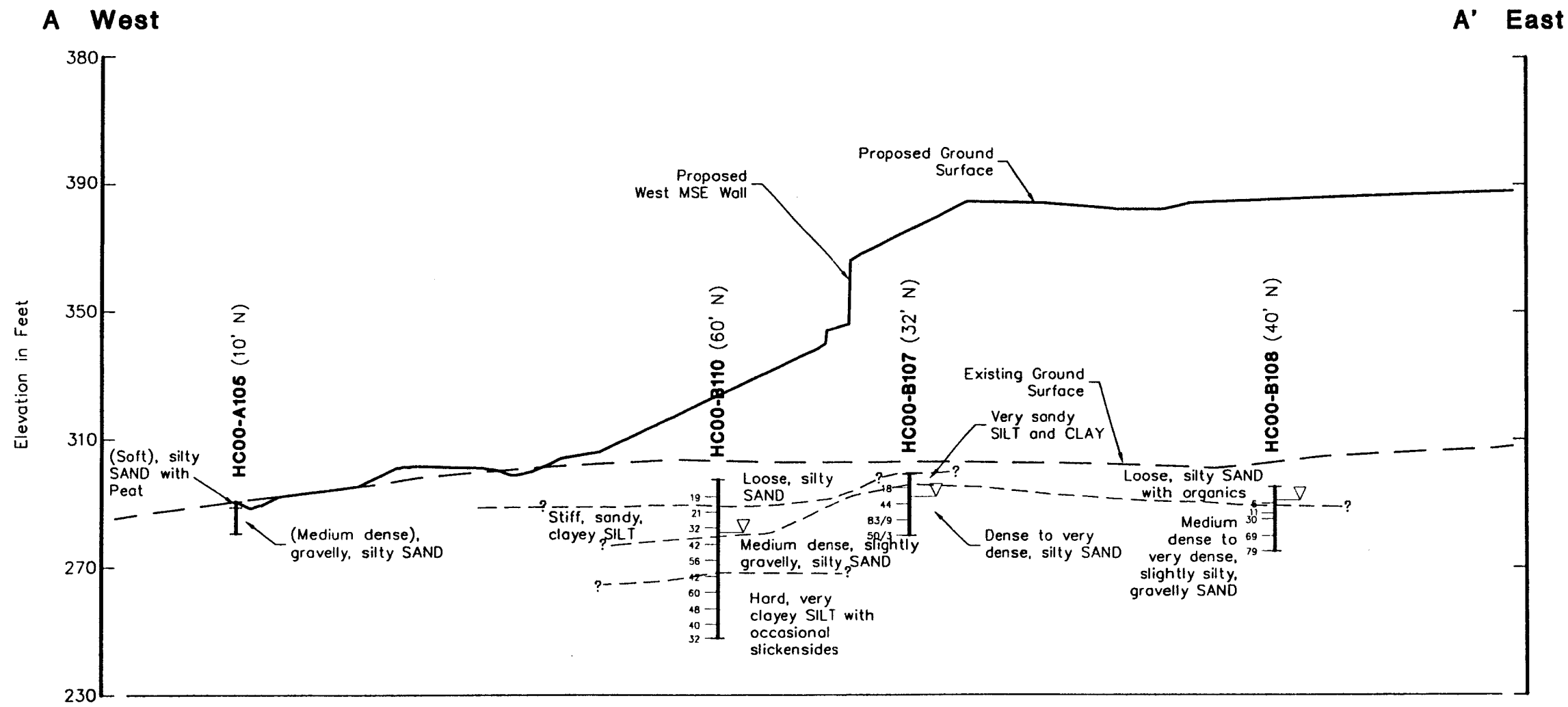
J-4978-21 4/00
Figure 3

DJH 6/16/00 1=100 cnorris.pc2
4978211A.dwg

Generalized Subsurface Cross Section A-A'

West MSE Wall (Station 173+62) (Looking North)



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

HC00-B107 (40' N) — Exploration Number (Offset Distance and Direction)

Exploration Location

ATD — Water Level

32 — N Value

D.# 6/16/00 1=40 woodstock.pc2
49782106

AR 045273

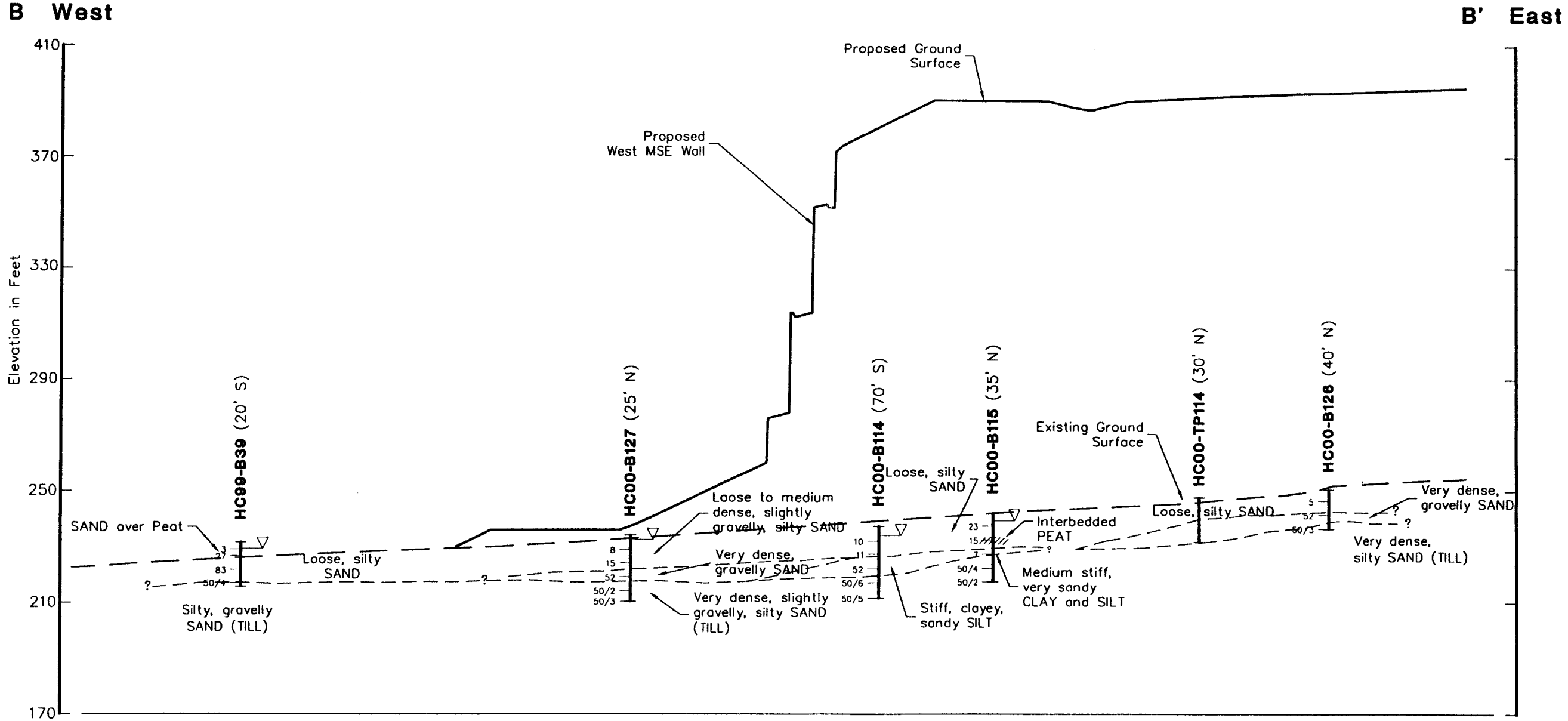
HARTCROWSER

J-4978-21 3/00

Figure 4

Generalized Subsurface Cross Section B-B'

West MSE Wall (Station 181+90) (Looking North)



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

0 40 80
Scale in Feet

HC00-B107 (40' N) — Exploration Number (Offset Distance and Direction)

Exploration Location

ATD — Water Level

50/5 — N Value

Dwn 6/16/00 1=40 woodstock.pc2
49782107

AR 045274

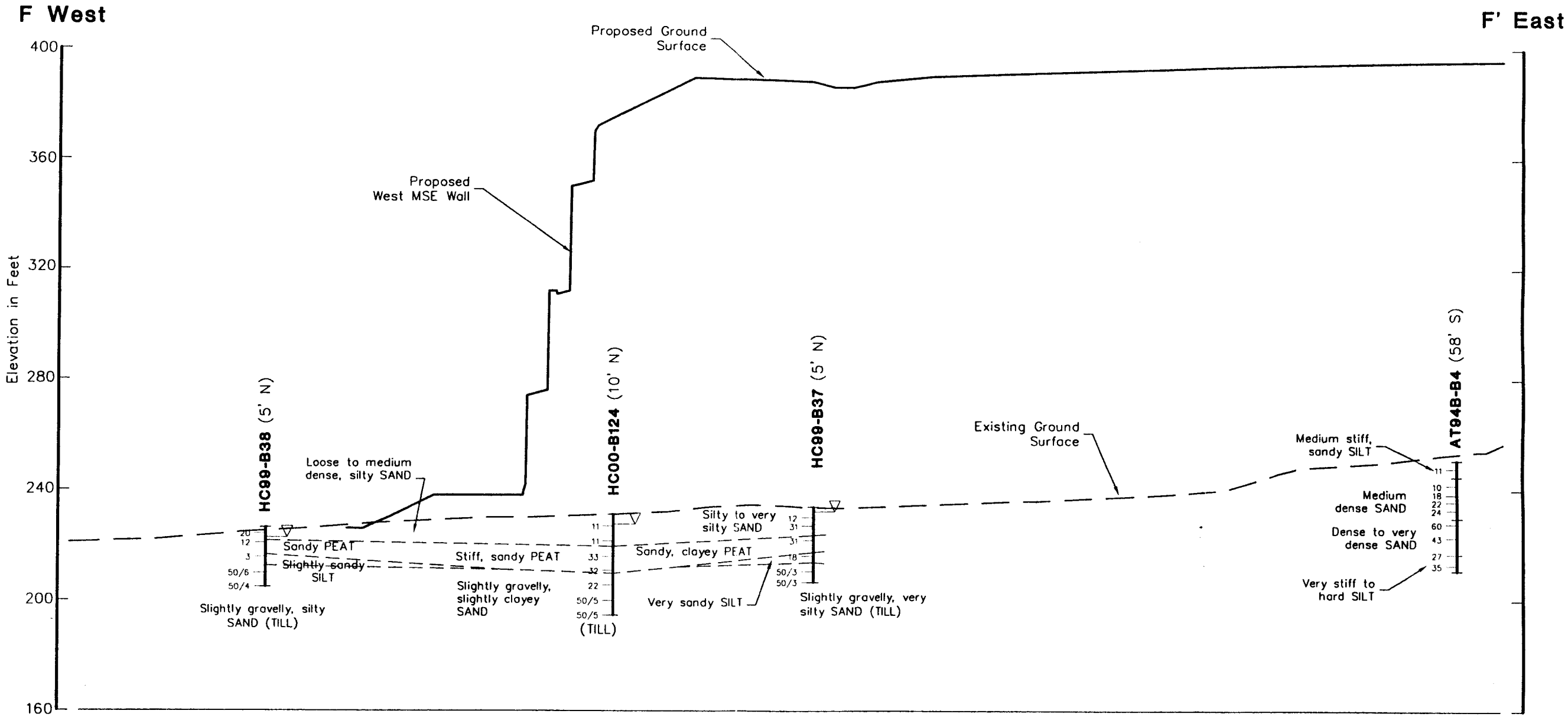
HARTCROWSER

J-4978-21 3/00

Figure 5

Generalized Subsurface Cross Section F-F'

West MSE Wall (Station 180+06) (Looking North)



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

HC00-B38 (5' N) — Exploration Number (Offset Distance and Direction)

Exploration Location

Water Level

50/5 — N-Value

0 40 80

Scale in Feet

AR 045275

HARTCROWSER

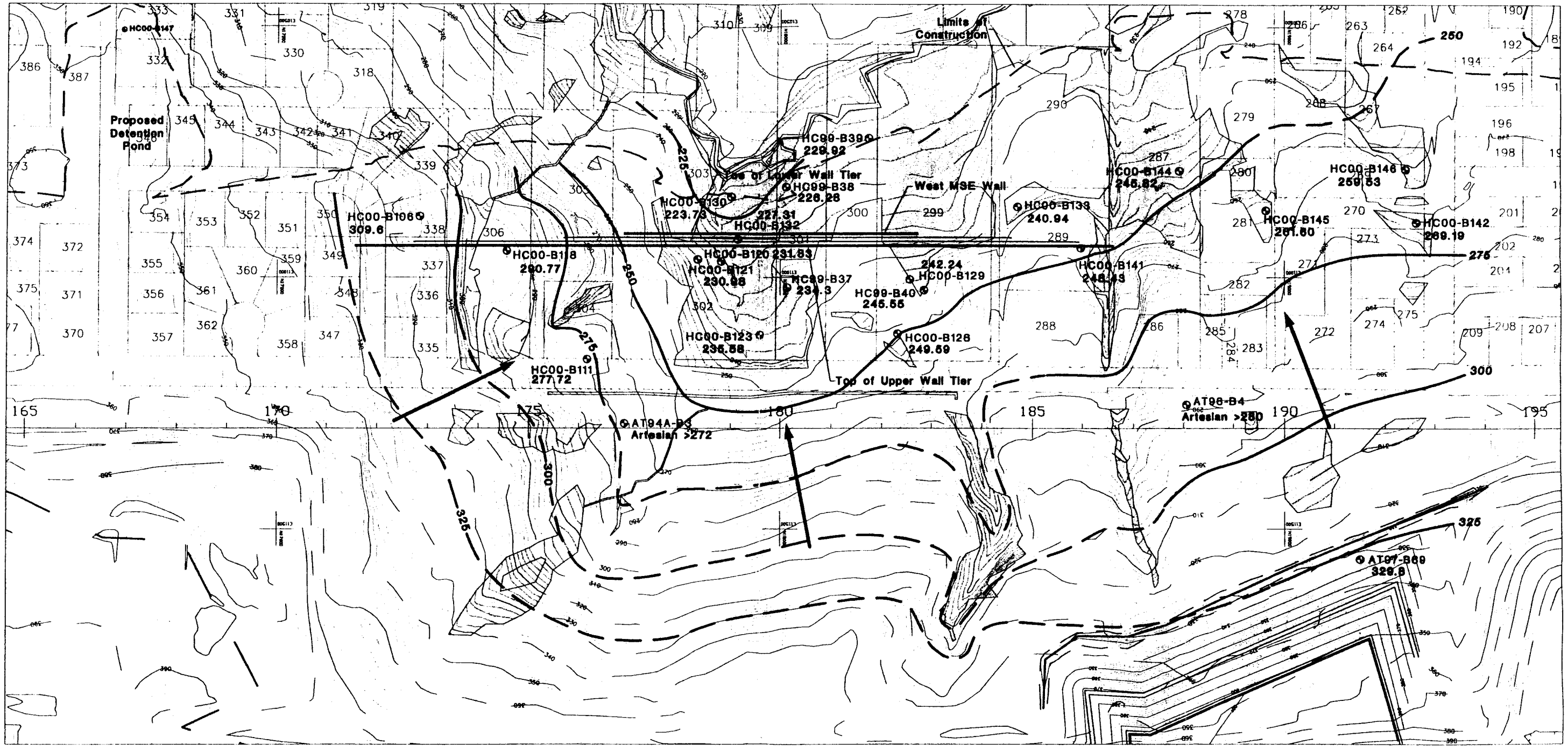
J-4978-21 6/00

Figure 6

CVD 6/20/00 1=40 charlie.pc2
49782108

Groundwater Elevation Contour Map

West MSE Wall



Note: Base map prepared from drawing provided by HNTB entitled "Topo_Full.dwg," dated October 4, 1999. Wetland delineation prepared from drawing provided by Parametrix entitled "W_020800.dwg," dated February 8, 2000.

HC00-B118 Monitoring Well Location and Number (Hart Crowser, Current Study)

290.77 Groundwater Elevation in Feet (April 11, 2000)

Artesian Water Level Above Ground Surface

Wetland Location

250 Groundwater Elevation Contour in Feet (Dashed where Inferred)

Inferred Groundwater Flow Direction

N

0 200 400

Scale in Feet

AR 045276

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J-4978-21 5/00

Figure 7

RC 6/15/00 1"=200' (xref)see drawing file/charlie.pc2
49782116

APPENDIX A
FIELD EXPLORATIONS METHODS AND ANALYSIS

APPENDIX A
FIELD EXPLORATIONS METHODS AND ANALYSIS

This appendix documents the processes Hart Crowser used in determining the nature of the soils underlying the project site addressed by this report. The discussion includes information on the following subjects:

- Explorations and Their Location;
- The Use of Auger Borings;
- Standard Penetration Test (SPT) Procedures;
- Use of Shelby Tubes
- Pocket Penetrometer (PP) and Torvane (TV);
- Excavation of Test Pits;
- Monitoring Well Installation;
- Monitoring Well Development;
- Water Level Measurement; and
- References for Appendix A.

Explorations and Their Location

Subsurface explorations for this project include the following:

Borings
Our first phase of exploration included borings HC00-B106 through HC00-B108, HC00-B110, HC00-B111, HC00-B114 through HC00-B118, HC00-B124, HC00-B126, HC00-B127, HC00-N129, HC00-B131, HC00-B133, HC00-B134, HC00-B139 through HC00-B142, and HC00-B144 through HC00-B146. Logs for these borings are presented in Appendix A. Our second phase of exploration included borings HC00-B113, HC00-B119 through HC00-B123, HC00-B125, HC00-B128, HC00-B130, and HC00-B132. Logs for these borings are presented in Appendix C.

Hand-Auger Borings
Our first phase of exploration included hand-auger borings HC00-A100, HC00-A105, HC00-A109, HC00-A137, and HC00-A143. Logs of these borings are presented in Appendix A.

Test Pits
Our first phase of exploration included test pits HC00-TP100 through HC00-TP108, HC00-TP113 through HC00-TP121, and HC00-TP123 through HC00-TP129. Logs for these test pits are presented in Appendix A. Our second

phase of exploration included test pits HC00-TP110 through HC00-TP112. Logs of these test pits are presented in Appendix C.

The exploration logs within this appendix show our interpretation of the material encountered based on drilling (or excavation), sampling, and testing data. They indicate the depth where the soils change. Note that the change may be gradual. In the field, we classified the samples taken from the explorations according to the methods presented on Figure A-1 - Key to Exploration Logs. This figure also provides a legend explaining the symbols and abbreviations used in the logs.

Location of Explorations. Figure 2 shows the location of explorations. Borings and test pits were located using a global positioning system (GPS) survey by Hart Crowser. Port of Seattle surveyors performed an x, y, z survey for the top of casing elevations of the wells and ground elevations for test pits and some borings completed without wells. Where available, the Port's survey supersedes the GPS locations. Where Port survey data are not available, ground surface elevations were interpreted from the aerial survey topography shown on Figure 2. The method used determines the accuracy of the location and elevation of the explorations.

The Use of Auger Borings

With depths ranging from 14.3 to 74.5 feet below the ground surface, twenty-four hollow-stem auger borings, designated HC00-B106 through HC00-B108, HC00-B110, HC00-B111, HC00-B114 through HC00-B118, HC00-B124, HC00-B126, HC00-B127, HC00-N129, HC00-B131, HC00-B133, HC00-B134, HC00-B139 through HC00-B142, and HC00-B144 through HC00-B146, were drilled from January 27 through February 15, 2000. Samples were obtained by use of the Standard Penetration Test (SPT) samples or a hydraulically pushed thin wall sampler referred to as a "Shelby tube." The borings used a 3-3/8-inch inside diameter hollow-stem auger and were advanced with a truck-mounted drill rig subcontracted by Hart Crowser.

In five locations, hand-auger borings, designated HC00-A100, HC00-A105, HC00-A109, HC00-A137, and HC00-A143, were drilled using portable gear rather than hollow-stem auger borings because of access restraints. Hand-auger boring HC00-A100 was drilled on January 18, 2000, and the other four were drilled on February 14, 2000. In addition, other borings planned for this phase of work have been delayed because of access restrictions and will be reported in the final of this report.

An engineering geologist from Hart Crowser continuously observed the drilling. Detailed field logs were prepared of each boring. Using the Standard

Penetration Test (SPT), we generally obtained split-spoon samples at 5-foot-depth intervals with Shelby tube samples interspersed between from these borings.

Groundwater levels in the borings were noted at the time of drilling (ATD) and following installation and development of observation wells where noted on the boring logs and shown in Table 4.

The borings logs are presented on Figures A-2 through A-25 at the end of this appendix. Figures A-26 through A-28 present the hand-auger boring logs.

Standard Penetration Test (SPT) Procedures

This test is an approximate measure of soil density and consistency. To be useful, the results must be used with engineering judgment in conjunction with other tests. The SPT (as described in ASTM D 1587) was used to obtain disturbed samples. This test employs a standard 2-inch outside diameter split-spoon sampler. Using a 140-pound hammer, free falling 30 inches; the sampler is driven into the soil for 18 inches. The number of blows (N value) required to drive the sampler the last 12 inches only is the Standard Penetration Resistance. This resistance, or blow count, measures the relative density of granular soils and the consistency of cohesive soils. The blow counts are plotted on the boring logs at their respective sample depths.

Soil samples are recovered from the split-barrel sampler, field classified, and placed into water tight jars. They are then taken to Hart Crowser's laboratory for further testing.

In the Event of Hard Driving

Occasionally very dense materials or the presence of gravel and/or cobbles prevented driving the total 18-inch sample. When this happens, the penetration resistance is entered on logs as follows:

Penetration less than six inches. The log indicates the total number of blows over the number of inches of penetration.

Penetration greater than six inches. The blow count noted on the log is the sum of the total number of blows completed after the first 6 inches of penetration. This sum is expressed over the number of inches driven that exceed the first 6 inches. The number of blows needed to drive the first 6 inches is not reported. For example, a blow count series of 12 blows for 6 inches, 30 blows for 6 inches, and 50 (the maximum number of blows counted within a 6-inch increment for SPT) for 3 inches would be recorded as 80/9.

Use of Shelby Tubes

At some boring locations, as noted on the logs, a 3-inch-diameter thin-walled steel (Shelby) tube sampler was pushed hydraulically below the auger to obtain a relatively undisturbed sample for classification and testing of fine-grain soils. The tubes were sealed in the field and taken to our laboratory for extrusion and classification. The undisturbed samples were typically obtained for consolidation and shear strength testing.

Pocket Penetrometer (PP) and Torvane (TV)

The pocket penetrometer and torvane procedures provide quick approximate tests of the consistency (undrained shear strength) of a cohesive soil sample.

The pocket penetrometer device consists of a calibrated spring mechanism that measures penetration resistance of a 1/4-inch-diameter steel tip over a given distance. The penetration resistance is correlated to the unconfined compressive strength of the soil, which is typically twice the undrained shear strength of a saturated, cohesive soil.

The torvane device consists of a 1-inch-diameter plate with eight equally spaced and radially arranged 1/4-inch vanes. The vanes are pressed into the soil and the device is rotated. The vanes force a shear failure to take place over the area of plate face. The resistance at failure, as measured by a calibrated spring, correlates to the undrained shear strength of the sample tested. The exploration logs show the results of the pocket penetrometer and torvane tests.

Pocket penetrometer and torvane test results are generally considered valid only for predominantly fine-grained (non-sandy soils). Results may be artificially low for tests on disturbed samples (i.e., SPT) compared to relatively undisturbed samples from test pits or Shelby tubes.

Excavation of Test Pits

Twenty-five test pits, designated HC00-TP100 through HC00-TP108, HC00-TP113 through HC00-TP121, and HC00-TP123 through HC00-TP129, were excavated across the site with a tractor-mounted backhoe provided by Port Construction Services. The test pits were excavated between January 25 and 28, 2000. The sides of these excavated pits offer direct observation of the subgrade soils. The test pits were located by and excavated under the direction of an engineering geologist from Hart Crowser. The geologist observed the soil exposed in the test pits and reported the findings on a field log. Our geologist

took representative samples of soil types for testing at Hart Crowser's laboratory was noted The geologist noted groundwater levels or seepage during excavation on the log. The density/consistency of the soils (as presented parenthetically on the test pit logs to indicate their having been estimated) is based on visual observation only, as disturbed soils cannot be measured for in-place density.

The test pit logs are presented on Figures A-29 through A-41.

Monitoring Well Installation

Monitoring wells were completed in selected wells as noted on the logs to allow long-term groundwater elevation monitoring. The wells were drilled using standard hollow-stem auger equipment. Two-inch-diameter Schedule 40 PVC riser pipe and 2-inch-diameter 0.020-inch machine-slotted screen were used for the well casings and screens. The well screen and casing riser are lowered down through the hollow-stem auger. As the auger is withdrawn, No. 10/20 silica sand is placed in the annular space from the base of the boring to approximately 2 to 3 feet above the top of the well screen. In some borings the bottom of the borehole was backfilled with bentonite chips prior to placement of the screen and in one case the bottom of the borehole caved prior to installation of the screen.

Well seals were constructed by placing bentonite chips in the annular space on top of the filter sand to within 3 feet of ground surface. The remaining annular space was backfilled with concrete to complete the surface seal. For security, the monitoring wells were completed with locking stick-up steel monuments set in concrete. The monitoring well construction details are illustrated on the boring logs.

The monitoring well installations were constructed in accordance with Washington State Department of Ecology regulations.

Monitoring Well Development

The monitoring wells were developed using a Whale electric submersible pump, surge block, and/or a stainless steel bailer. First, sediment was removed from the bottom of the wells using a stainless steel bailer. Then the wells were surged during development using either a surge block, a stainless steel bailer, or by moving the submersible pump up and down within the well screen depth interval.

A minimum of ten casing volumes was removed during development, in addition to the volume of water added during drilling, if any. Where possible, development continued until negligible turbidity was visible. Sediment thickness at the bottom of the well was measured and recorded before and after development. Observations were recorded on a Well Development data form. Visual changes in turbidity during development were recorded in the comments space on this form. All development water was discharged to the ground surface in accordance with the Third Runway project Storm Water Pollution Prevention Plan (Parametrix, 1999).

Water Level Measurement

Water levels were measured using a Solinst water level probe, graduated in 0.01-foot increments. Depth to water was measured below the top of casing and recorded to the nearest hundredth of a foot. Depth to water was converted to groundwater elevation using survey information for the top of casing in the wells. Depth to water data and groundwater elevations are summarized in Table 4.

References for Appendix A

Parametrix 1999. Seattle-Tacoma International Airport Third Runway Project Geotechnical Explorations Stormwater Pollution Prevention Plan, Prepared for Port of Seattle, January 29, 1999.

F:\docs\jobs\497821\WestMSEWall(rpt).doc

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

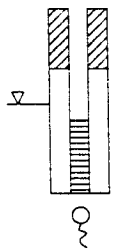
BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

- Grab (Jar)
- Bag
- Shelby Tube

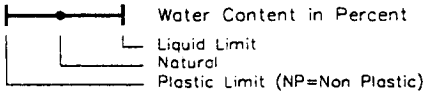
Groundwater Observations



- Surface Seal
- Groundwater Level on Date (ATD) At Time of Drilling
- Observation Well Tip or Slotted Section
- Groundwater Seepage (Test Pits)

Test Symbols

GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	In Situ Density Test



1=1 497821 BORING1.DWG

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J-4978-21 3/00

Figure A-1

AR 045284

Boring Log HC00-B106

N 17284
E 10878

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 314
Top of Casing Elevation in Feet: 315.81

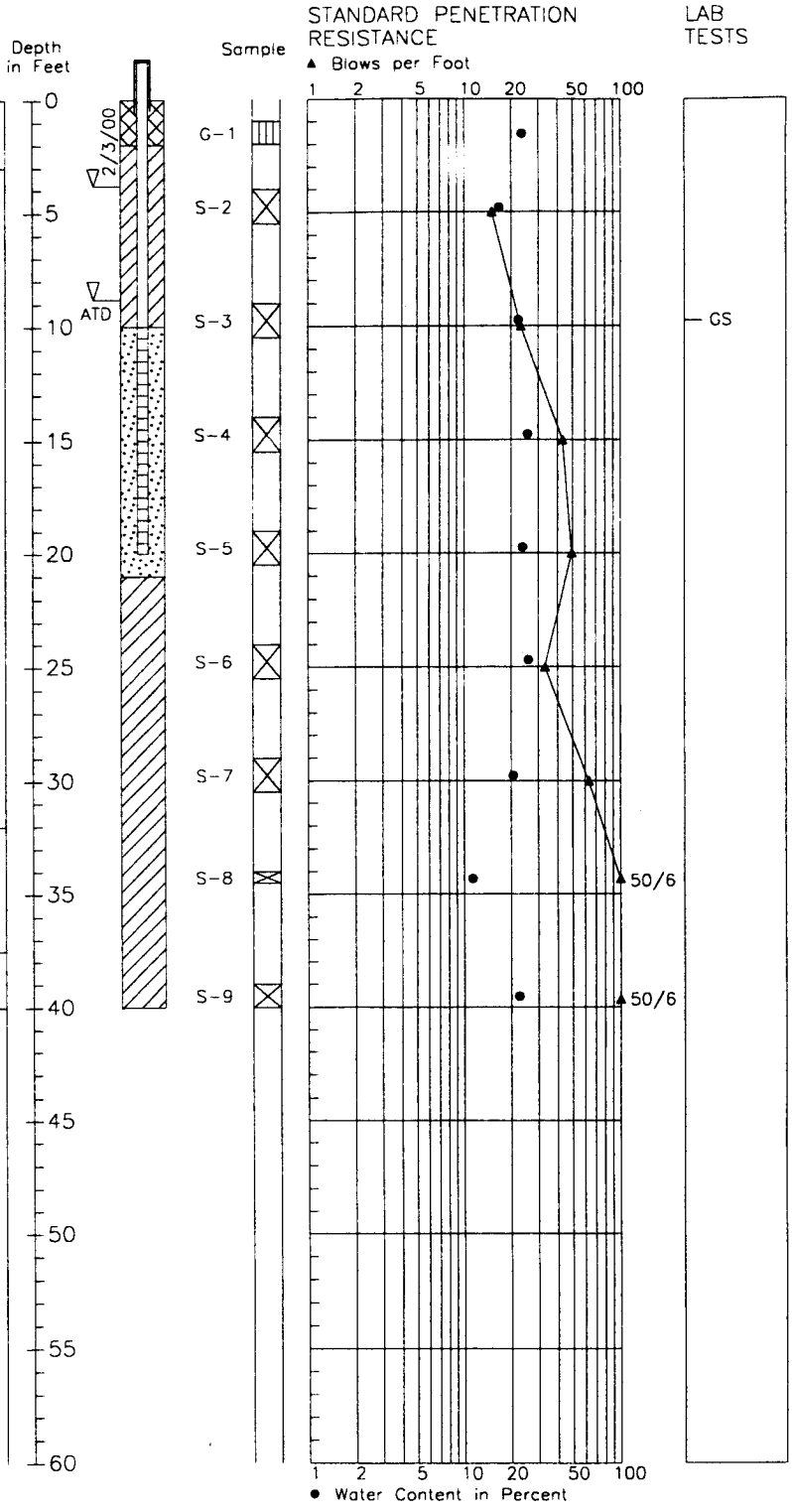
Loose, wet, brown, silty SAND with trace organic material.

Medium dense to very dense, wet, brown gray, non-silty to silty SAND.

Very dense, wet, gray, slightly gravelly, very silty SAND.

Hard, moist, gray SILT.

Bottom of Boring at 40.0 Feet.
Completed 2/3/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 2/00
Figure A-2

AR 045285

Boring Log HC00-B107

N 17398
E 10953

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 299

Depth in Feet

Stiff to very stiff, wet, gray and brown, very sandy SILT and CLAY.

Dense, wet, gray, slightly silty to silty, fine to medium SAND.

Slightly gravelly.

Very dense, wet, gray, silty, fine to medium SAND.

Bottom of Boring at 19.3 Feet.
Completed 2/9/00.

0 5 10 15 20 25 30 35 40 45 50 55 60

▽ ATD

Sample

STANDARD PENETRATION RESISTANCE
▲ Blows per Foot
1 2 5 10 20 50 100

G-1 S-2 S-3 P S-4 S-5 S-6

50/3

LAB TESTS
AL
AL, GS
GS

1 2 5 10 20 50 100
● Water Content in Percent

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 2/00
Figure A-3

HEM 2/28/0// 1=1 woodstock pc2
497821 LOGS

AR 045286

Boring Log HC00-B108

N 17407
E 11067

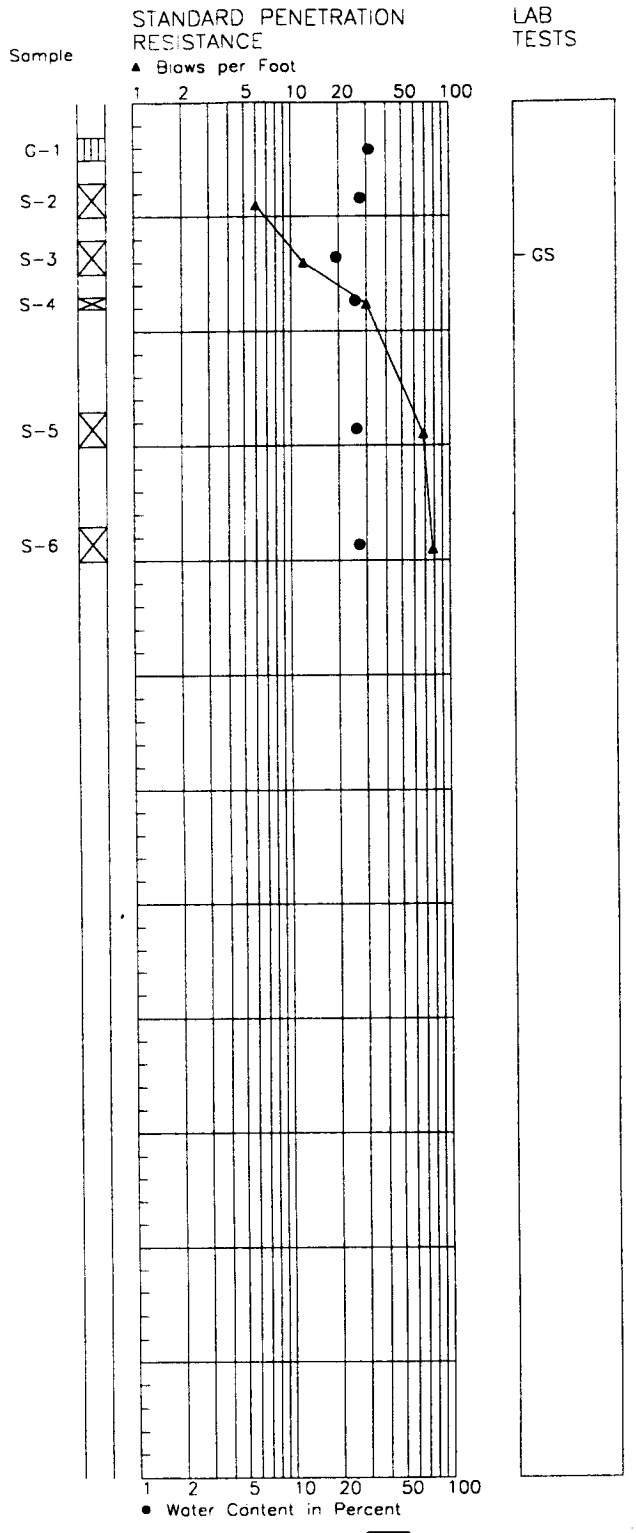
Soil Descriptions

Approx. Ground Surface Elevation in Feet: 295

Loose, wet, dark brown to brown, silty SAND with wood and organic material.

Medium dense to very dense, wet, gray, slightly silty, gravelly SAND, and slightly silty SAND.

Bottom of Boring at 20.0 Feet.
Completed 2/9/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-4

AR 045287

HEM 2/28/0// 1=1 woodstock pc2
497821 LOGS

Boring Log HC00-B110

N 17422

E 10895

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 298

Depth in Feet

Loose to medium dense, moist to wet, brown to gray and brown mottled, silty SAND with silt layers.

Very stiff to hard, moist to wet, gray, slightly gravelly, slightly sandy to sandy SILT and CLAY.

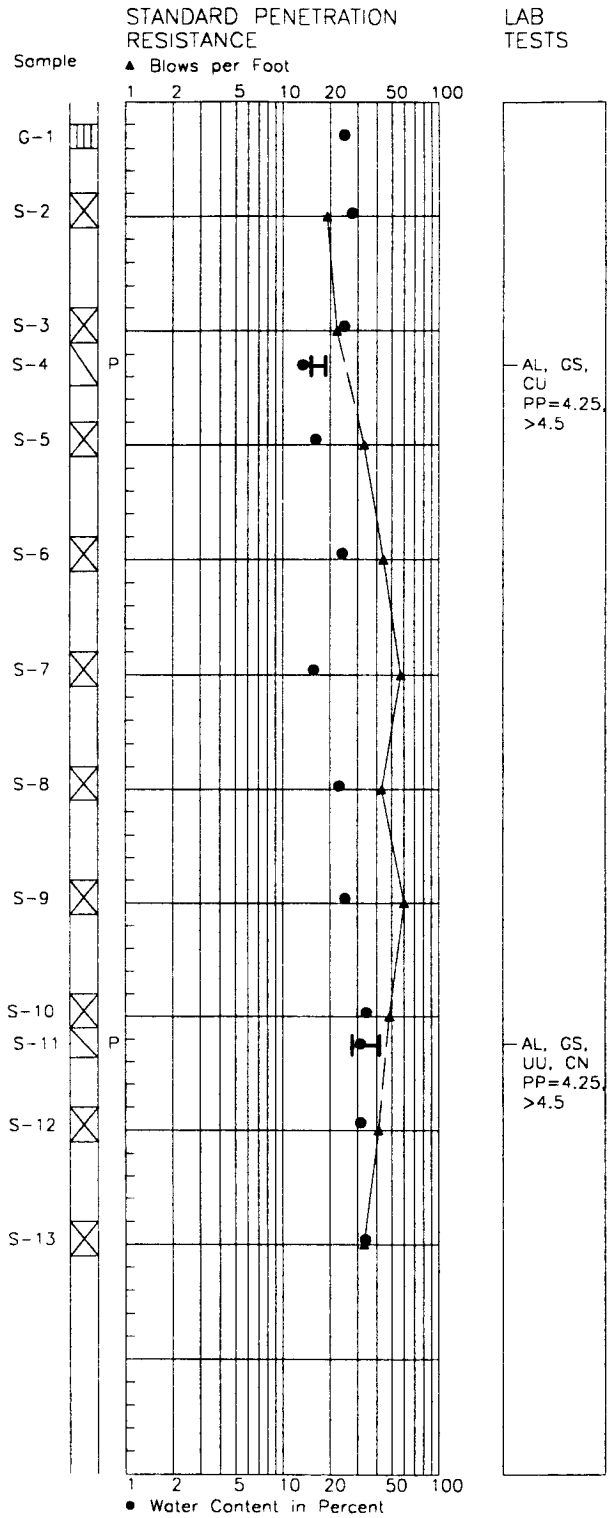
Dense to very dense, wet, gray, slightly gravelly, non-silty to silty SAND.

Hard, moist to wet, gray, very clayey SILT, layered with occasional shear zones.

Bottom of Boring at 50.5 Feet.
Completed 2/9/00.

0 5 10 15 20 25 30 35 40 45 50 55 60

▽ ATD



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-5

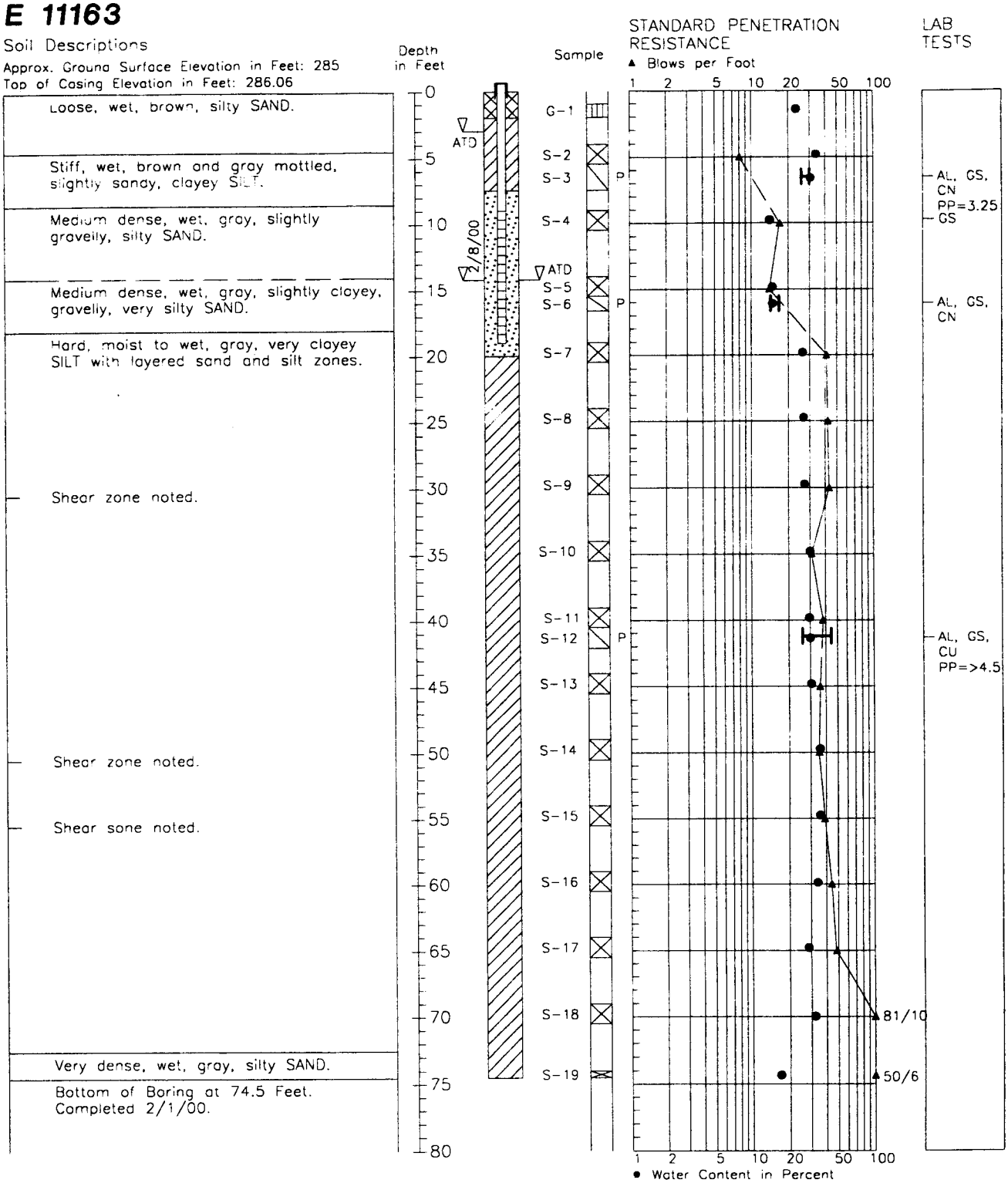
AR 045288

HEM 2/28/0// 1=1 woodstock pc2
497821 LOGS

Boring Log HC00-B111

N 17617

E 11163



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

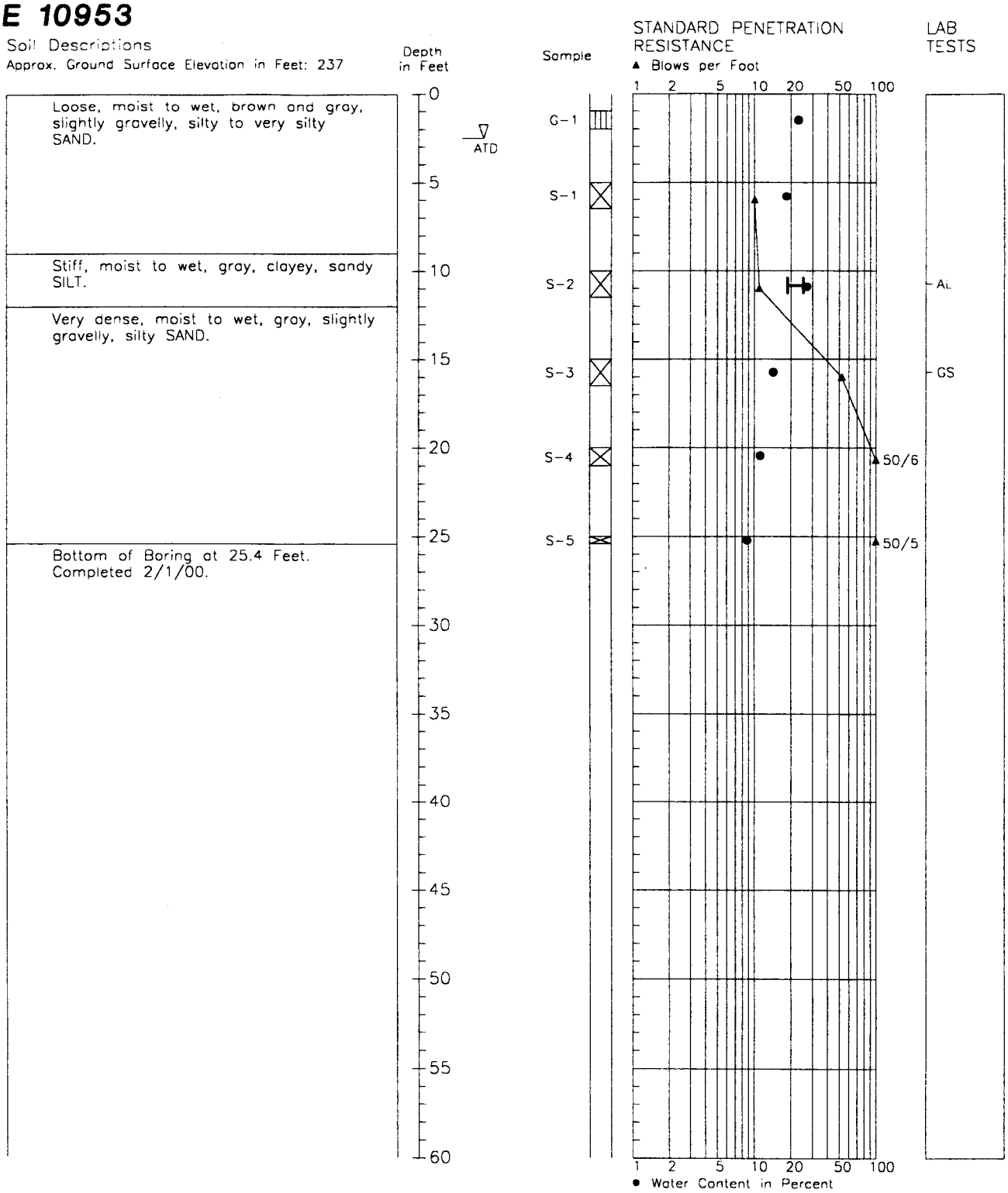
Figure A-6

AR 045289

Boring Log HC00-B114

N 18122

E 10953



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-7

AR 045290

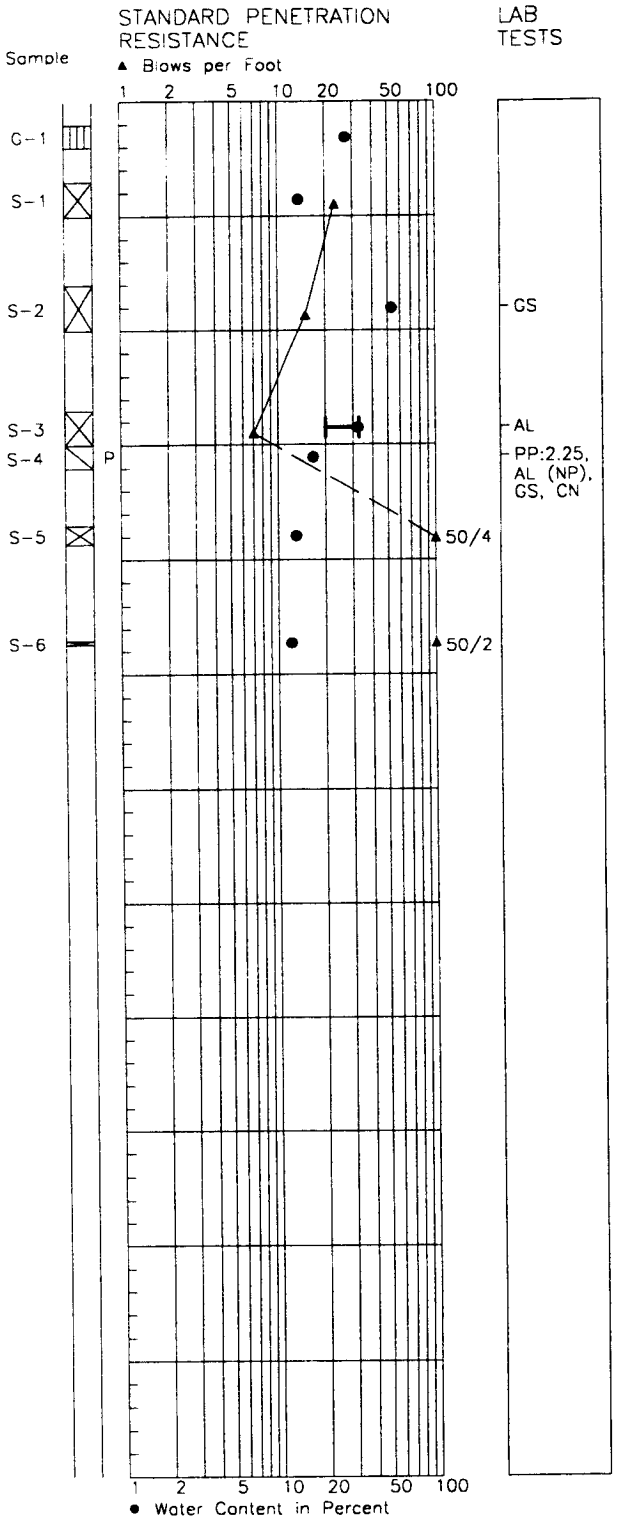
Boring Log HC00-B115

N 18225
E 10990

Soil Descriptions
Approx. Ground Surface Elevation in Feet: 242

	Depth in Feet
(Loose), moist to wet, gray and black, silty SAND.	0
Medium dense, moist to wet, brown and gray, slightly gravelly, silty SAND with organic material.	5
	10
Medium stiff, moist, gray, very sandy CLAY and SILT.	15
Very dense, moist to wet, gray, slightly gravelly, silty SAND.	20
	25
Bottom of Boring at 23.7 Feet. Completed 1/28/00.	30
	35
	40
	45
	50
	55
	60

ATD
ATD



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-8

AR 045291

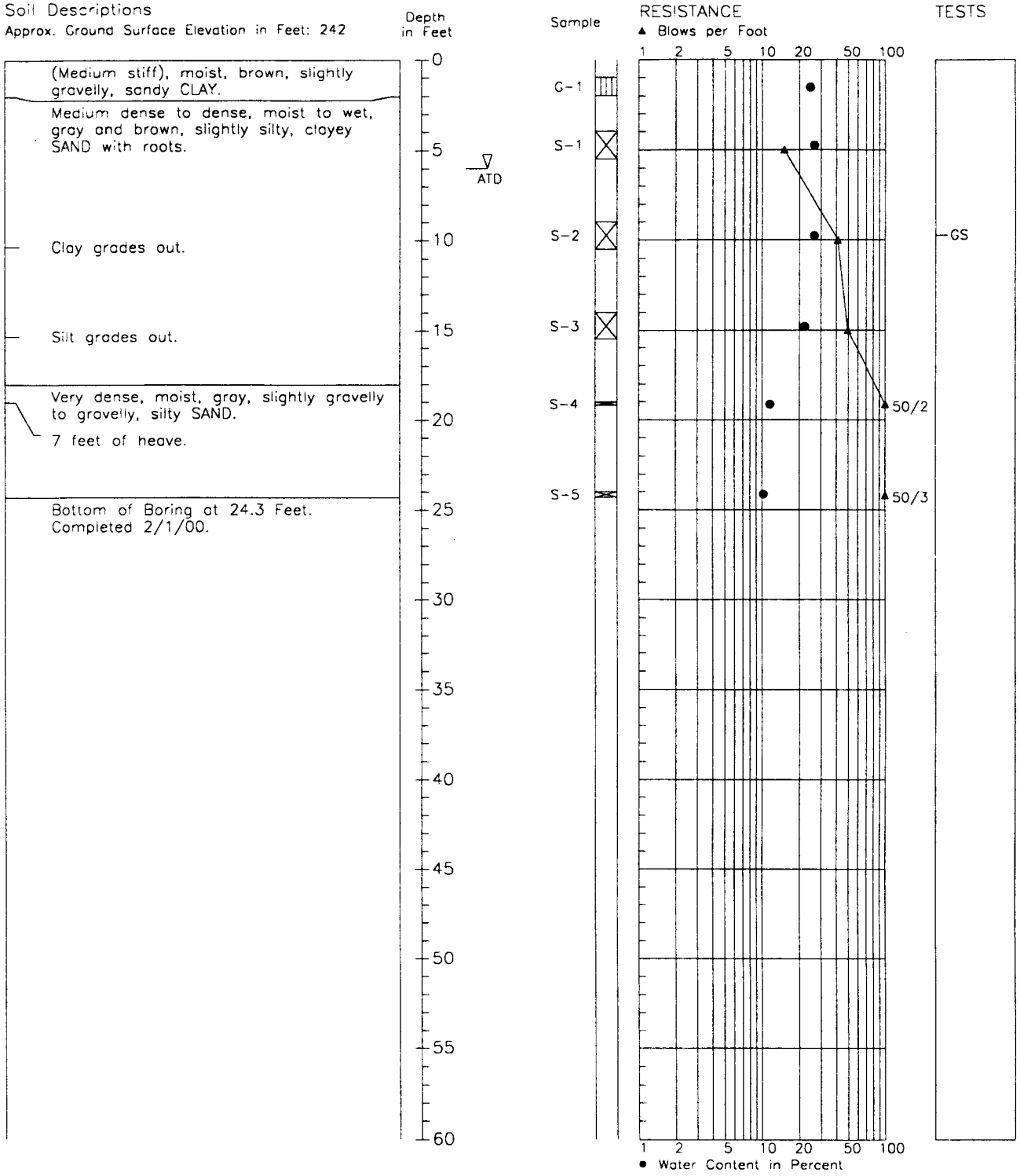
HEM 2/28/0//1=1 woodstock pc2
49/821 LOGS

Boring Log HC00-B116

N 18291
E 10971

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 242



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-9

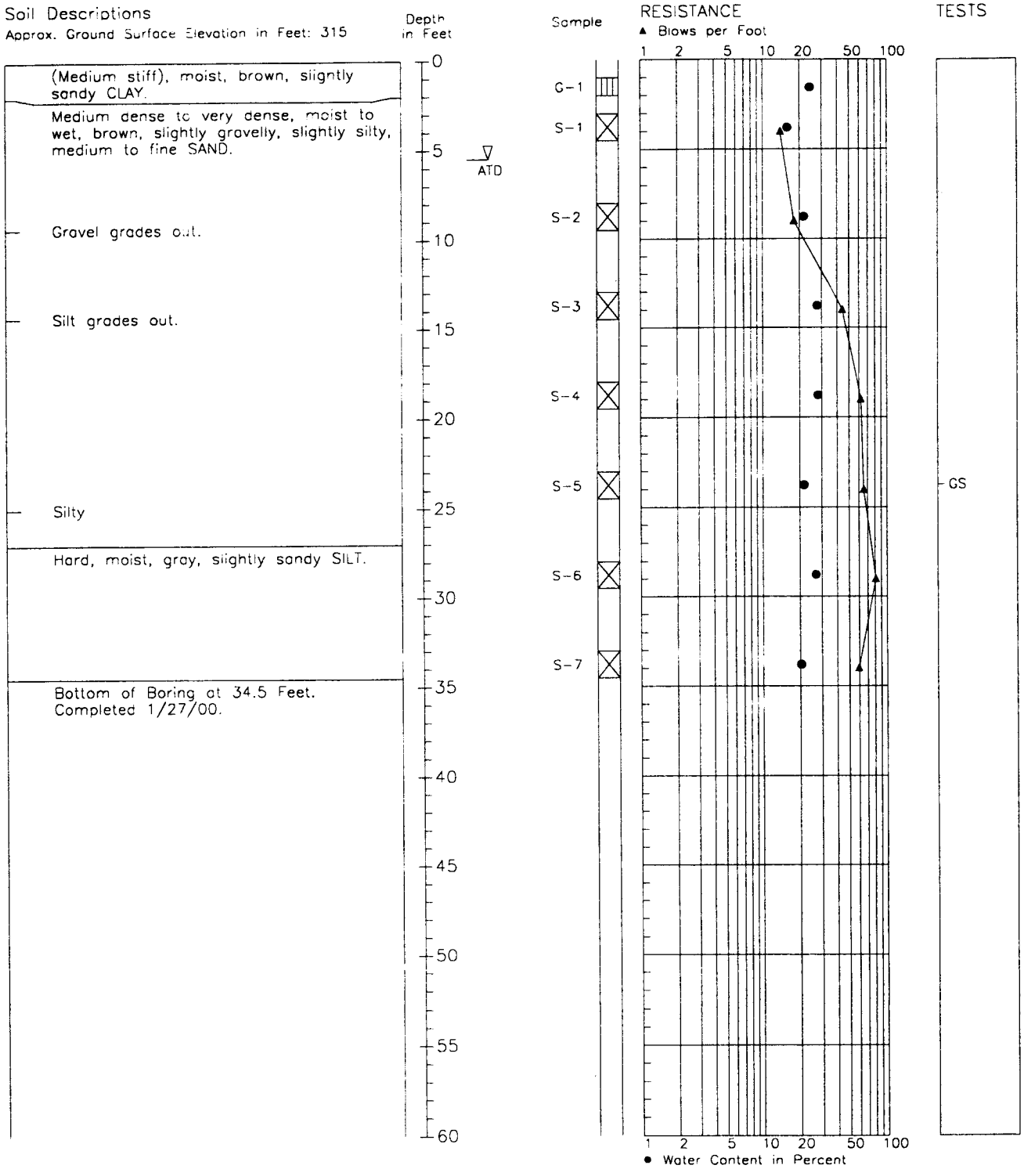
AR 045292

Boring Log HC00-B117

N 17271
E 10931

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 315



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 1/00

Figure A-10

HEM 2/28/0//1=1 woodstock pc2
497821 LOGS

AR 045293

Boring Log HC00-B118

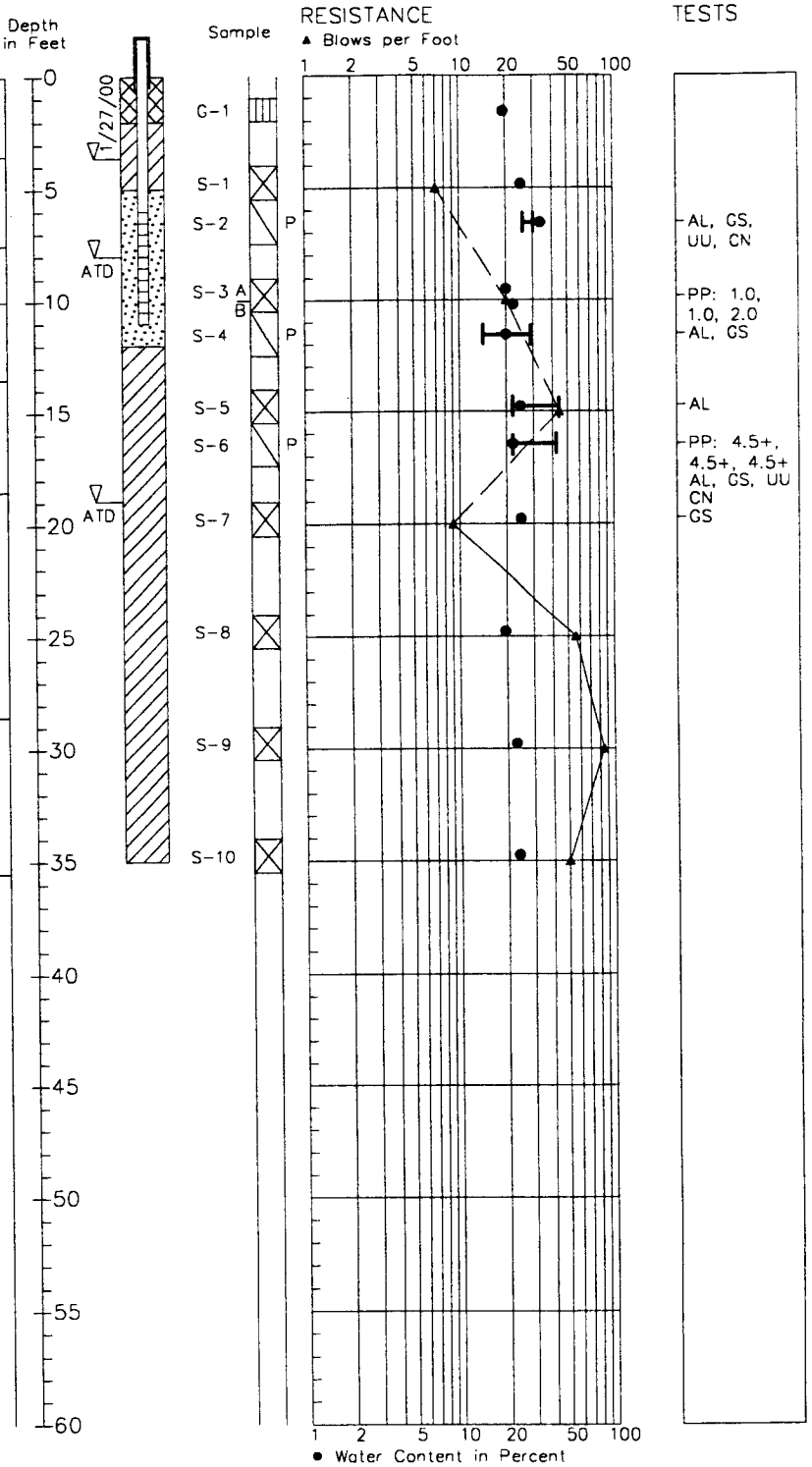
N 17456
E 10947

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 298

Top of Casing Elevation in Feet: 298.61

Soil Description
(Loose), moist, dark brown, slightly silty SAND.
Medium stiff, tan and orange mottled, slightly sandy, clayey SILT with organic material.
(Medium dense), wet, brown, slightly gravelly SAND.
(Very stiff), moist, gray, slightly sandy, slightly gravelly CLAY.
Hard, moist, gray, sandy CLAY to very clayey SILT.
(Loose to) very dense, wet, gray SAND. Note: 5–7 N-value apparently not representative of in situ density, due to disturbance by groundwater.
Hard, moist, gray, clayey SILT.
Bottom of Boring at 35.5 Feet. Completed 1/27/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 1/00

Figure A-11

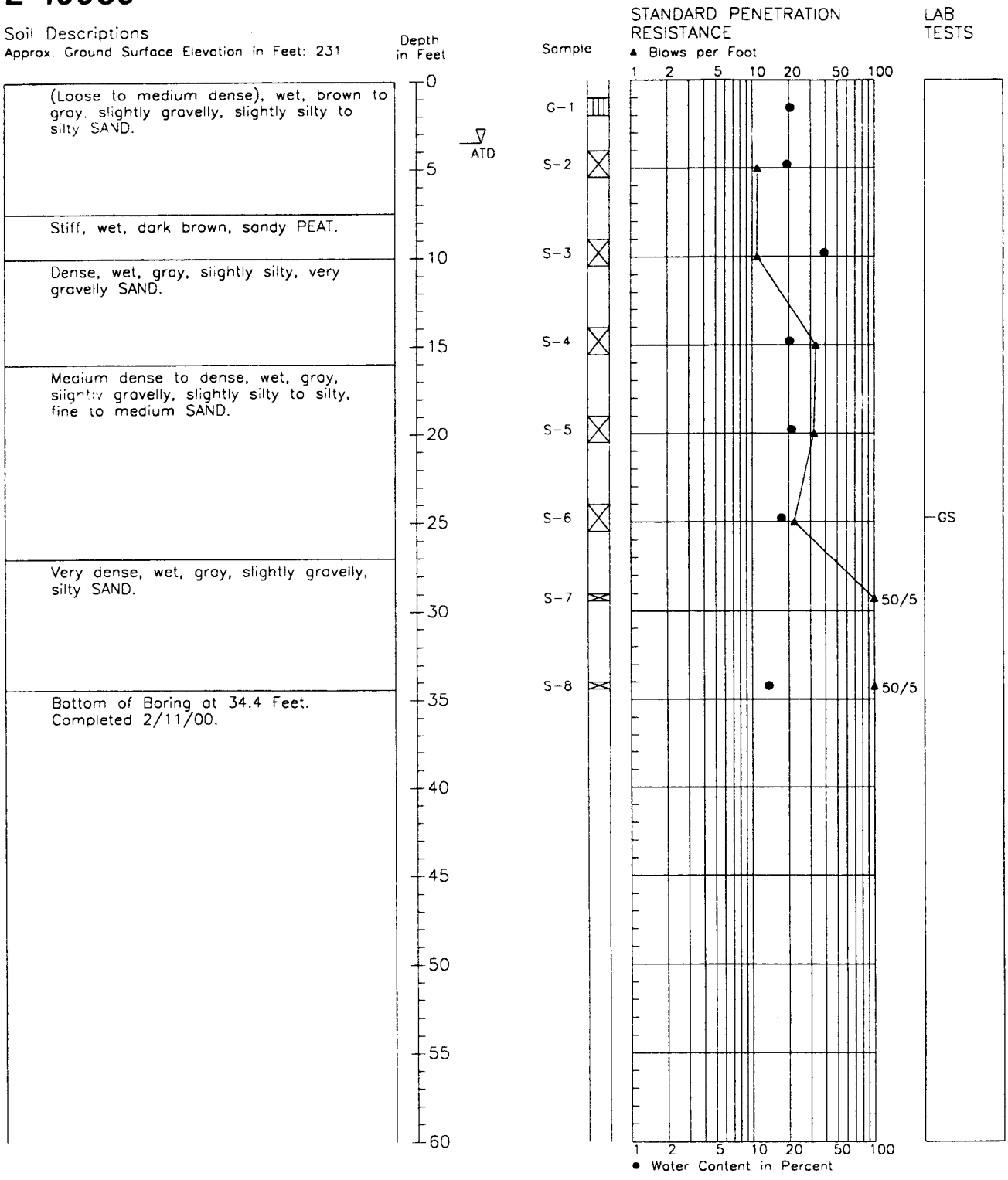
AR 045294

HEM 2/28/0// 1=1 woodstock pc2
497821 LOGS

Boring Log HC00-B124

N 18016

E 10939



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-12

AR 045295

Boring Log HC00-B126

N 18232

E 11112

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 250

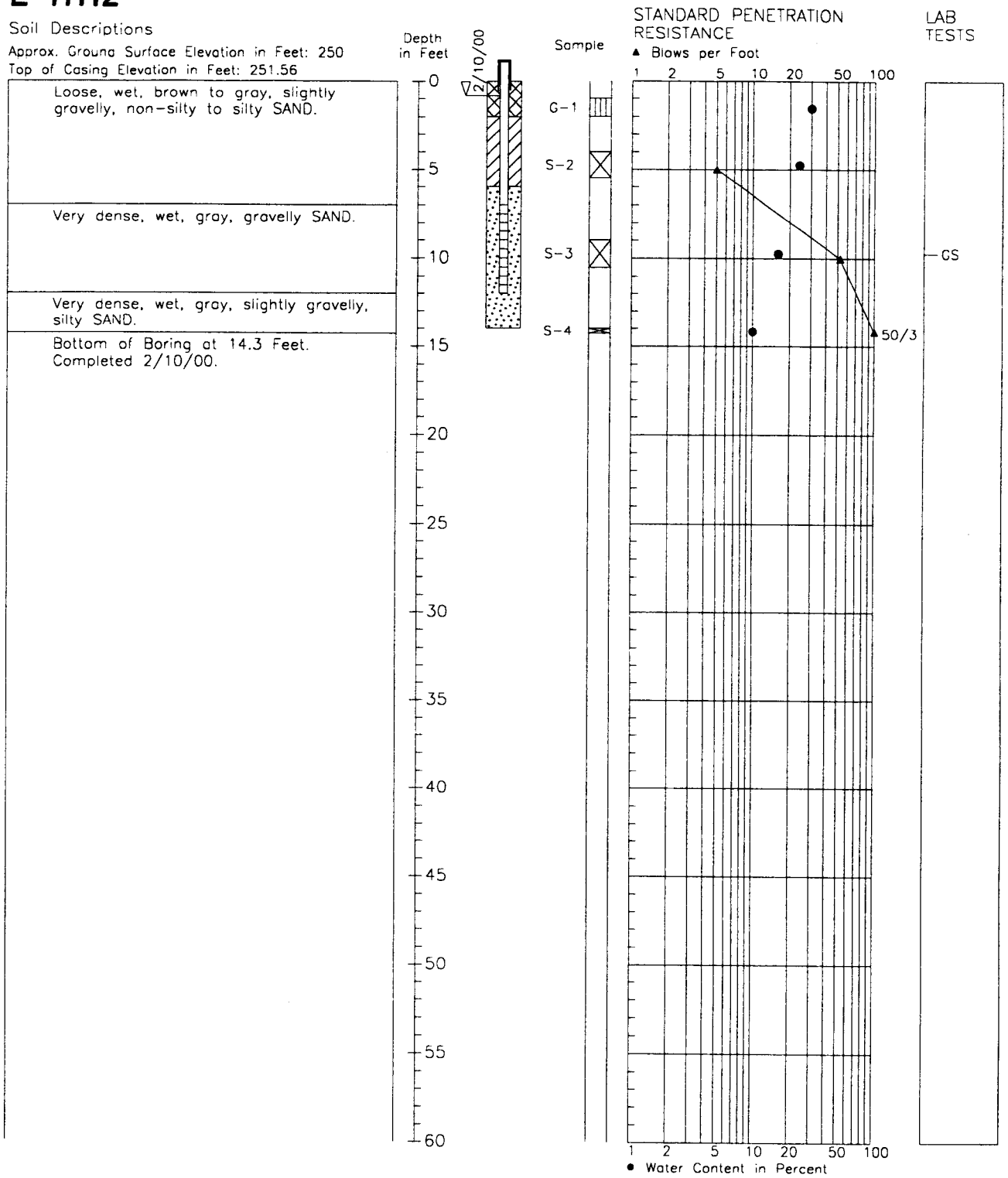
Top of Casing Elevation in Feet: 251.56

Loose, wet, brown to gray, slightly gravelly, non-silty to silty SAND.

Very dense, wet, gray, gravelly SAND.

Very dense, wet, gray, slightly gravelly, silty SAND.

Bottom of Boring at 14.3 Feet. Completed 2/10/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-13

AR 045296

HEM 2/28/0// 1=1 woodstock pc2

497821 LOGS

Boring Log HC00-B127

N 18215
E 10869

Soil Descriptions
Approx. Ground Surface Elevation in Feet: 234

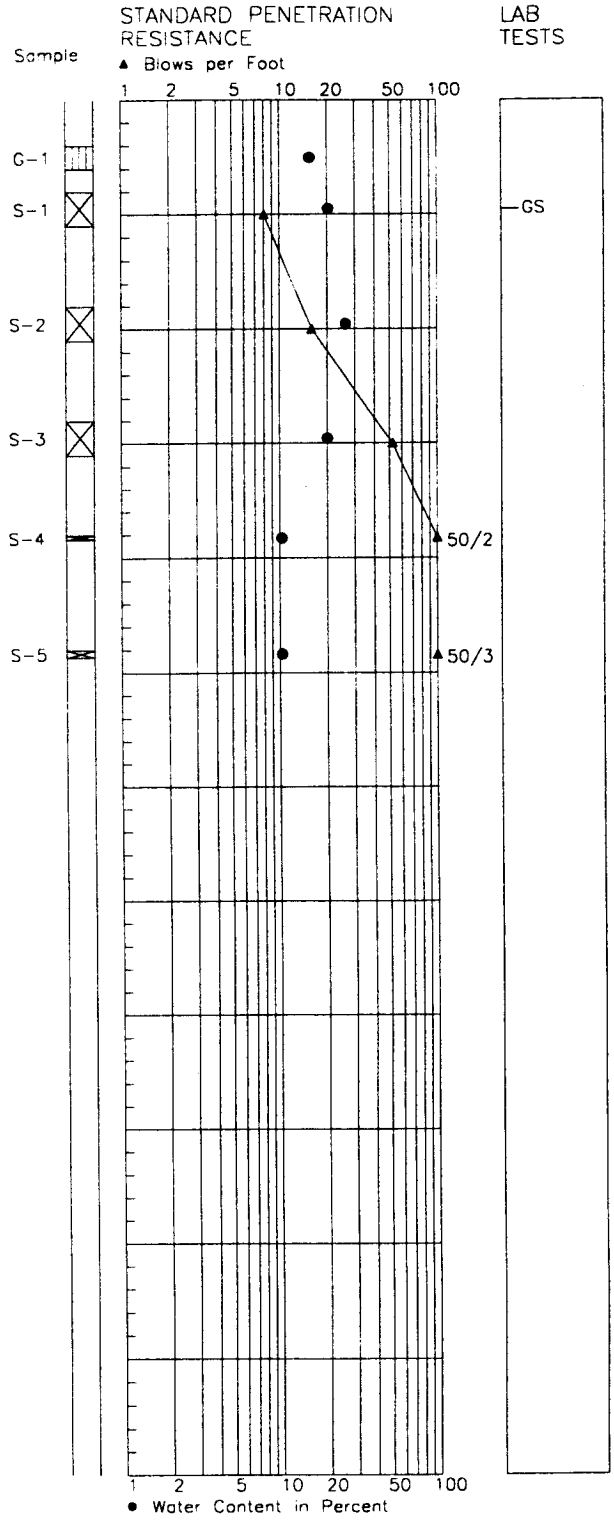
Depth in Feet

Loose to medium dense, wet, brown to gray with brown mottling, slightly gravelly, slightly silty to silty SAND with silt layers.

Very dense, wet, gray, gravelly SAND.

Very dense, moist, gray, slightly gravelly, silty SAND.

Bottom of Boring at 24.3 Feet.
Completed 1/31/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-14

AR 045297

HEM 2/28/01 1=1 woodstock gc2
497821 LOGS

Boring Log HC00-B129

N 18256
E 11004

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 243
Top of Casing Elevation in Feet: 245.83

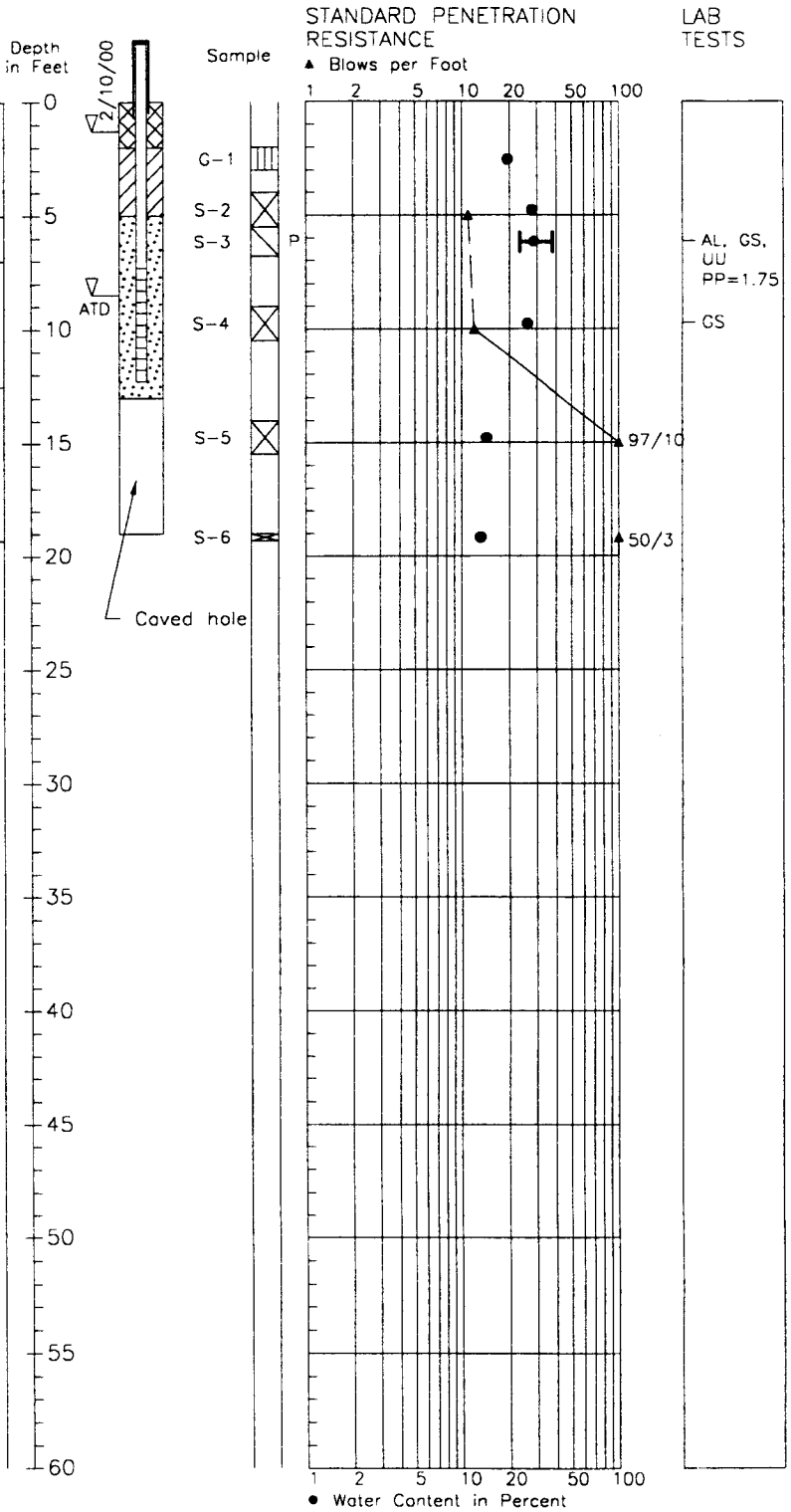
Medium dense, wet, brown to gray medium to fine SAND.

(Stiff), wet, gray, slightly sandy CLAY.

Medium dense, wet, brown, slightly silty, medium to fine SAND.

Very dense, wet, gray, silty, slightly gravelly to gravelly SAND.

Bottom of Boring at 19.3 Feet.
Completed 2/10/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 2/00
Figure A-15

AR 045298

HEM 2/28/0/ 1=1 woodstock pc2
497821 LOGS

Boring Log HC00-B131

N 18329

E 10804

Soil Descriptions
Approx. Ground Surface Elevation in Feet: 231

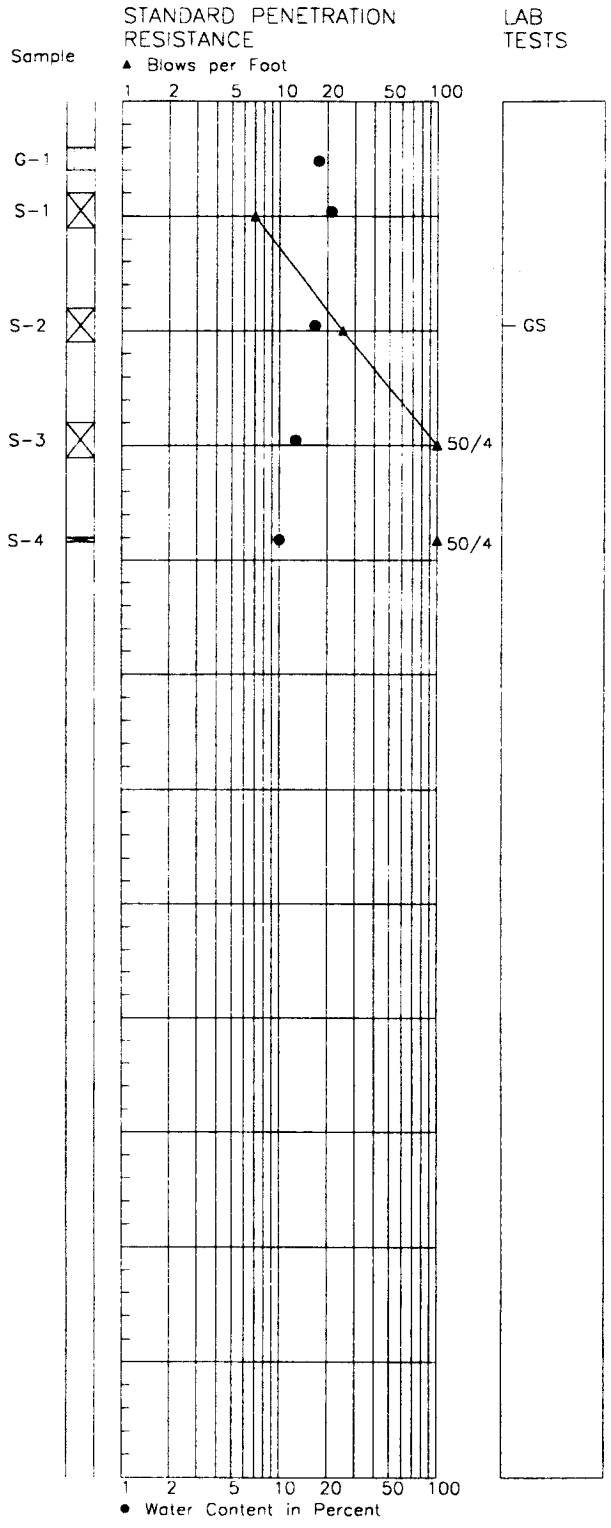
Depth in Feet

Loose, wet, gray, silty SAND with trace organic material.

Medium dense, wet, gray, gravelly, very silty SAND and SILT.

Very dense, moist, gray, slightly gravelly, silty SAND.

Bottom of Boring at 19.3 Feet. Completed 1/31/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-16

AR 045299

Boring Log HC00-B133

N 18471
E 10859

Soil Descriptions

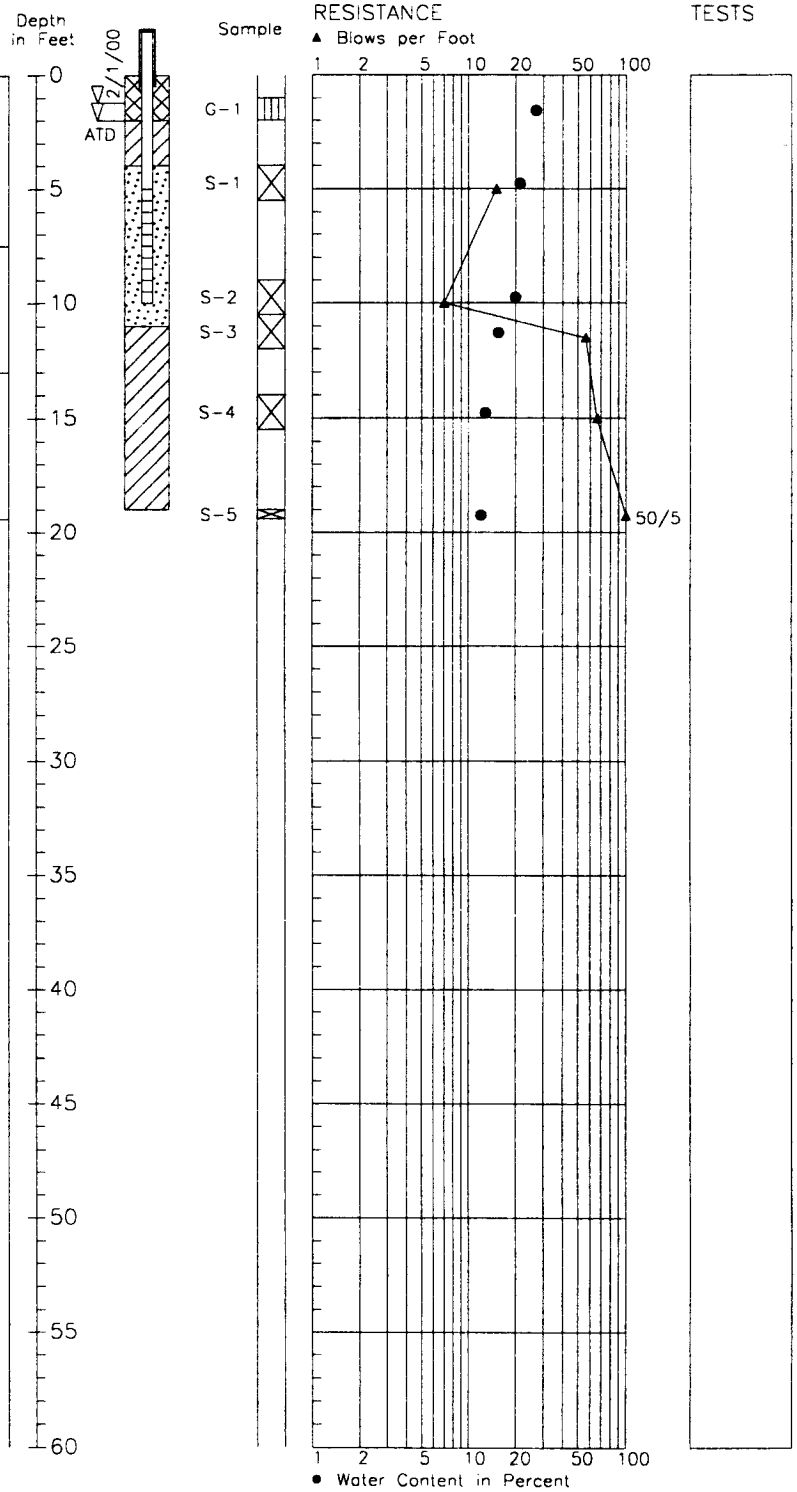
Approx. Ground Surface Elevation in Feet: 241
Top of Casing Elevation in Feet: 243.47

(Loose to medium dense), wet, brown to gray, slightly silty to silty SAND.

Loose to very dense, wet, gray, silty, gravelly SAND with CLAY layers.

Very dense, wet, gray, slightly gravelly to gravelly, silty SAND.

Bottom of Boring at 19.4 Feet.
Completed 2/1/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

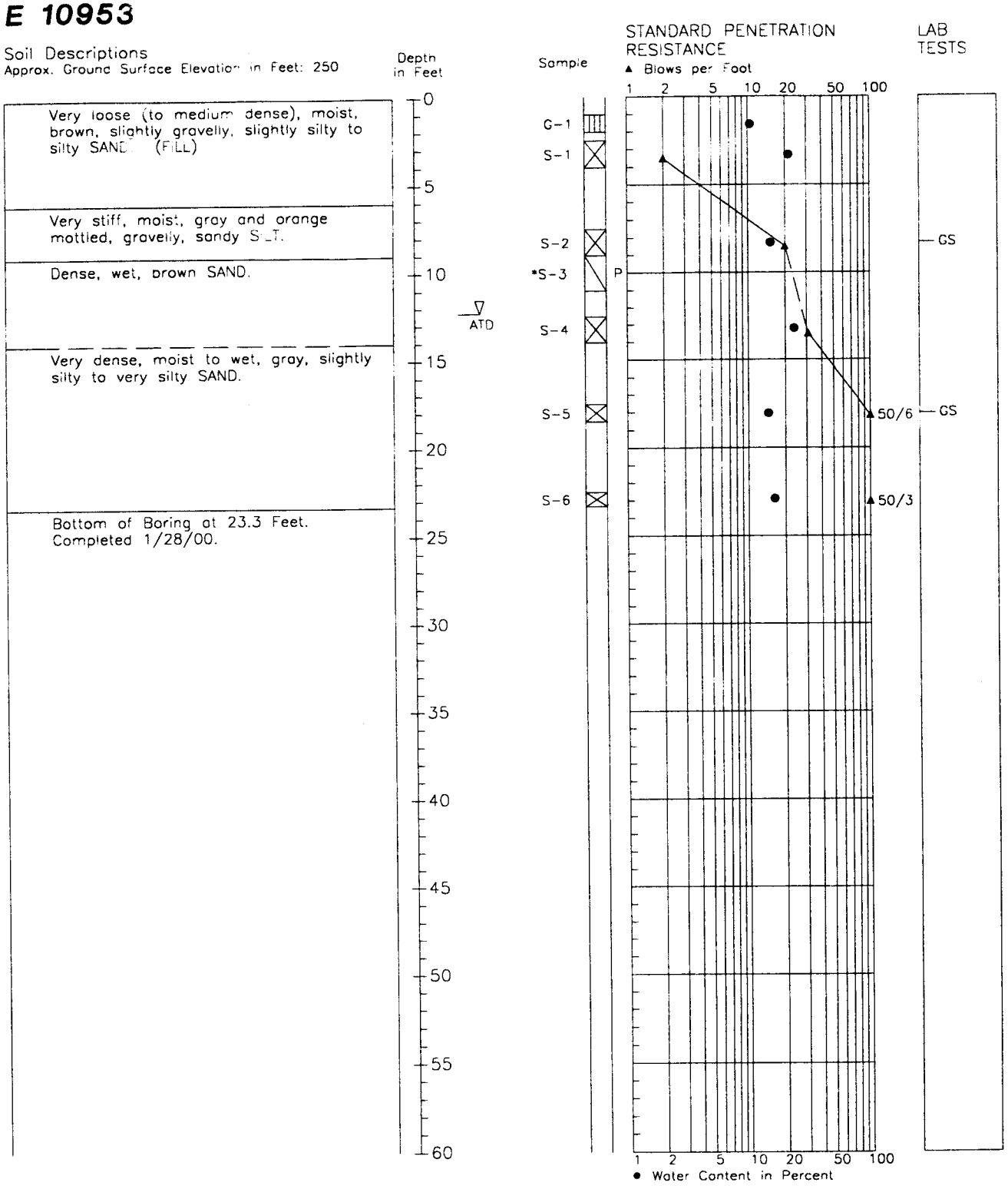
HARTCROWSER
J-4978-21 2/00
Figure A-17

AR 045300

HEM 2/28/0/ 1=1 woodstock pc2
49/821 LOGS

Boring Log HC00-B134

N 18438
E 10953



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

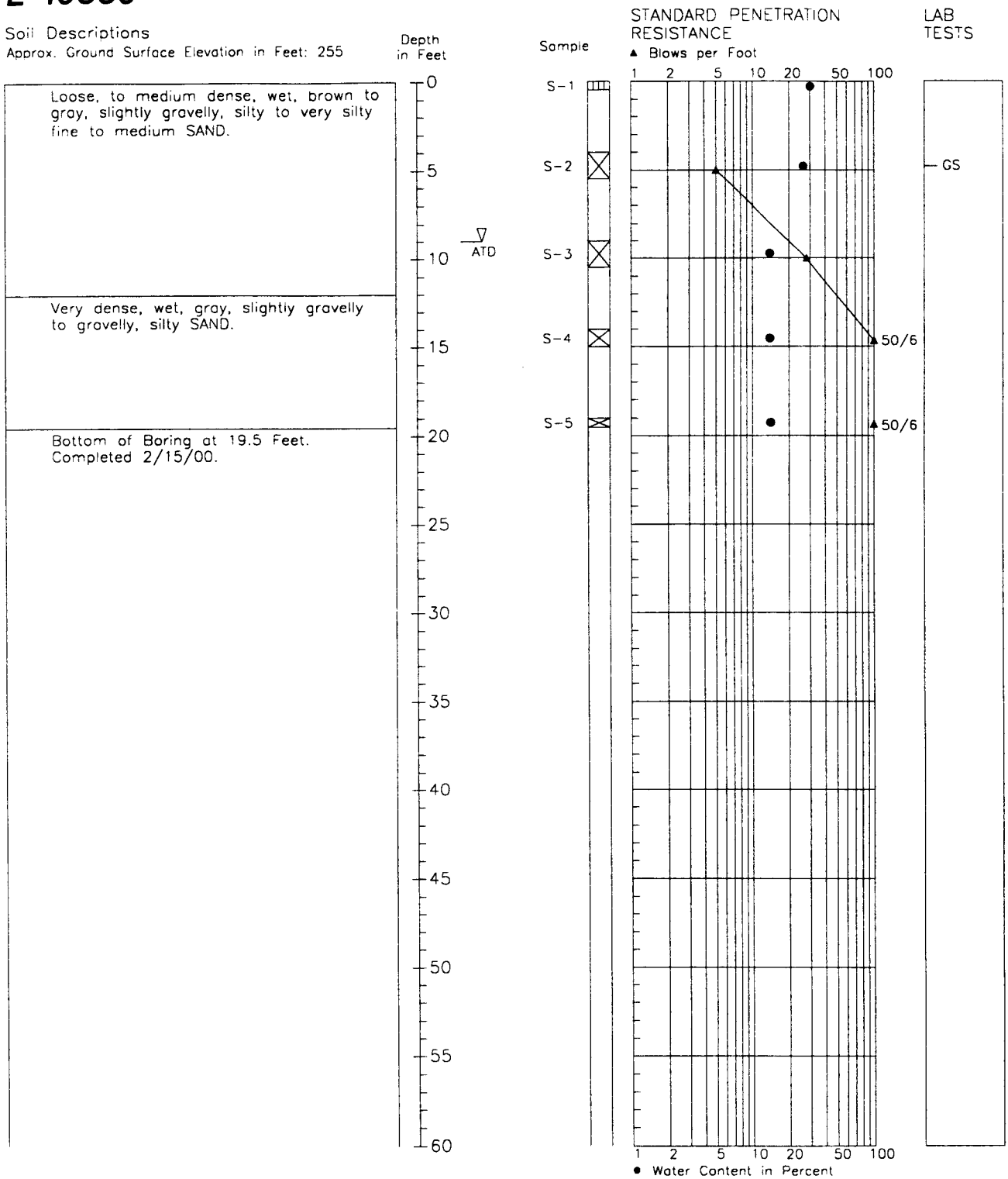
J-4978-21 1/00

Figure A-18

Boring Log HC00-B139

N 18759

E 10889



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 1/00

Figure A-19

AR 045302

Boring Log HC00-B140

N 18498
E 10940

Soil Descriptions
Approx. Ground Surface Elevation in Feet: 257

Depth in Feet

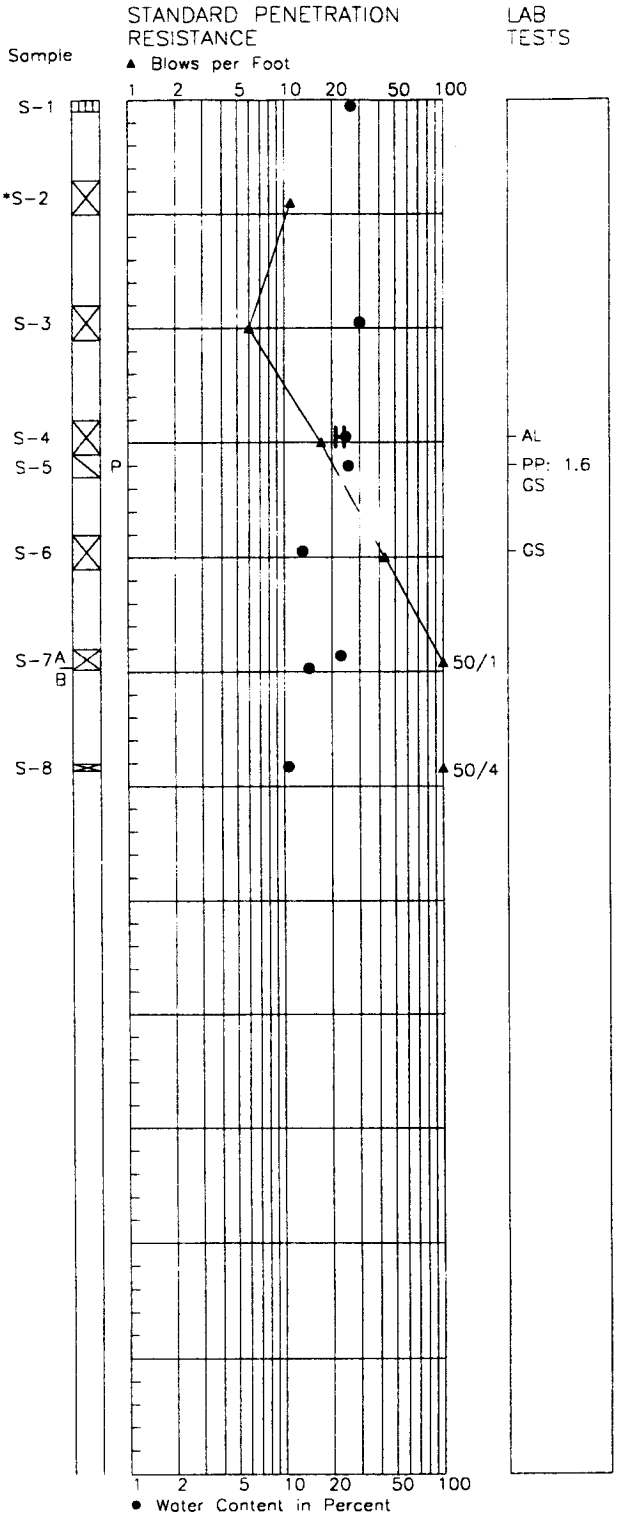
Loose to medium dense, wet, brown, slightly gravelly, silty to very silty SAND.

Very soft, wet, gray with brown mottling, gravelly, sandy SILT to very silty SAND.

ATD

Dense to very dense, wet, gray, gravelly, silty to very silty SAND.

Bottom of Boring at 29.3 Feet.
Completed 2/14/00.



0 5 10 15 20 25 30 35 40 45 50 55 60

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-20

HEM 2/28/0/ / 1=1 woodstock pc2
497821 LOGS

AR 045303

Boring Log HC00-B141

N 18597

E 10941

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 258

Top of Casing Elevation in Feet: 258.64

Loose (to dense), wet, brown to gray, silty, gravelly SAND with concrete debris. (FILL)

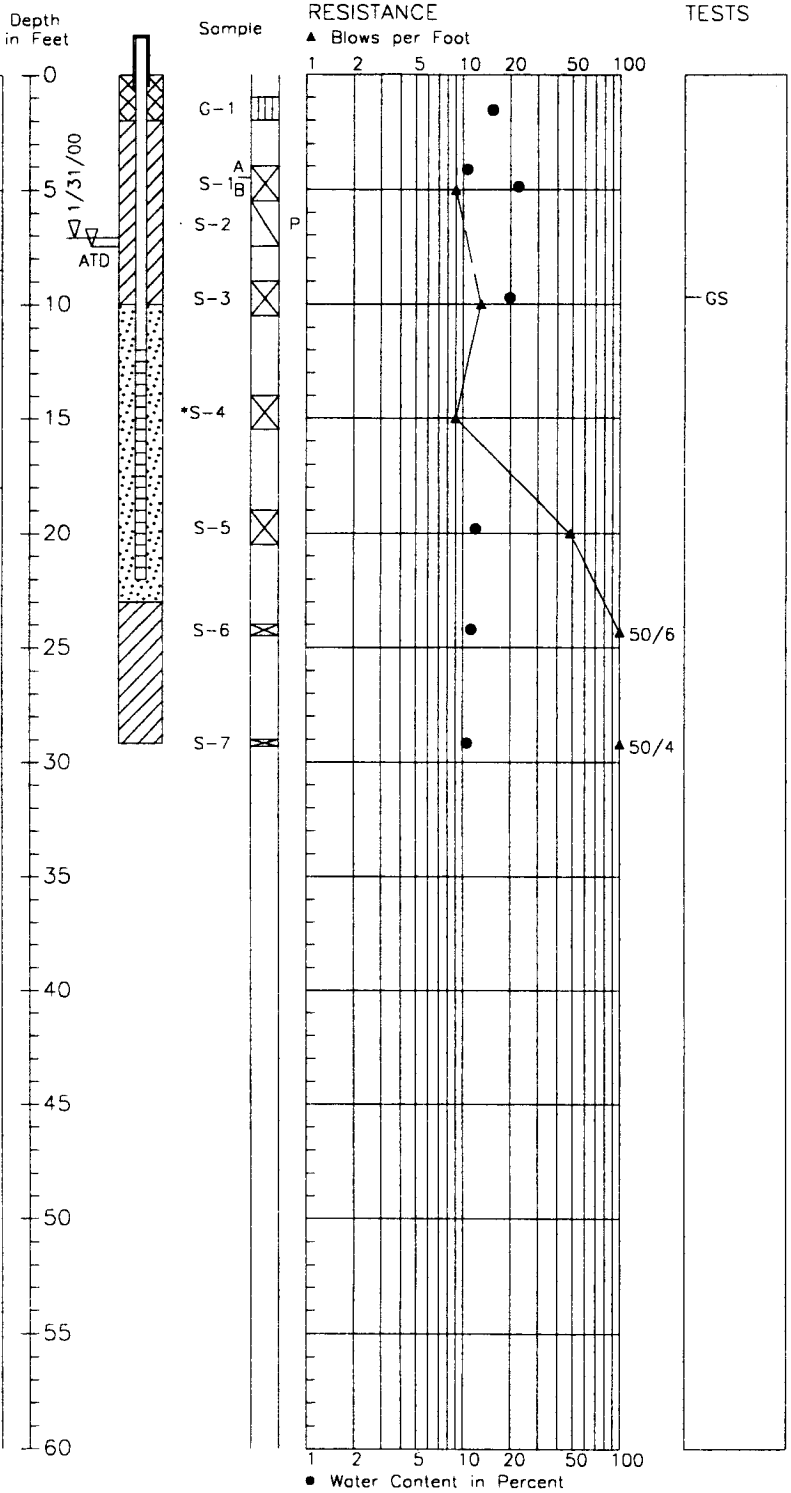
Stiff, wet, gray, slightly gravelly, sandy SILT with organic material.

Loose to medium dense, wet, gray with orange mottling, slightly gravelly, very silty SAND with trace organic material.

Very soft drilling noted.

Dense to very dense, wet to moist, gray, slightly gravelly, silty SAND.

Bottom of Boring at 29.3 Feet.
Completed 1/28/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 1/00

Figure A-21

AR 045304

HEM 2/28/0/ 1=1 woodstock pc2
497821 LOGS

Boring Log HC00-B142

N 19263

E 10890

Soil Descriptions

Approx. Grounc Surface Elevation in Feet: 270

Top of Casing Elevation in Feet: 272.72

(Loose) to medium dense, wet, brown to dark brown, silty, gravelly fine to medium SAND.

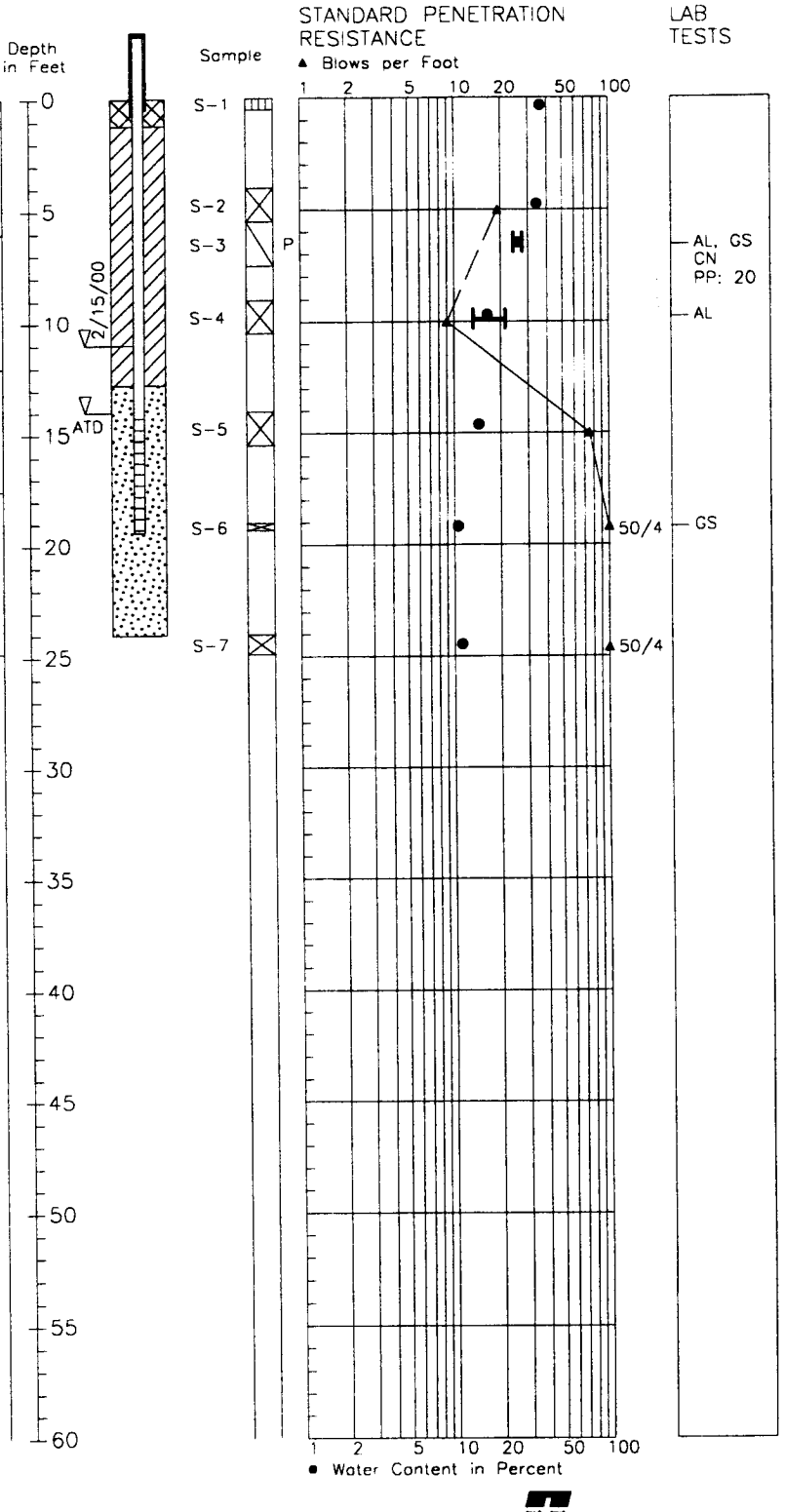
Peat noted.

Stiff, wet, gray, gravelly, sandy SILT.

Medium dense, wet, gray, silty, gravelly SAND.

Very dense, wet, gray, slightly gravelly, very silty SAND.

Bottom of Boring at 24.8 Feet.
Completed 2/15/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 1/00

Figure A-22

AR 045305

HEM 2/28/0//1=1 woodstock pc2

497821 LOGS

Boring Log HC00-B144

N 18792

E 10787

Soil Descriptions

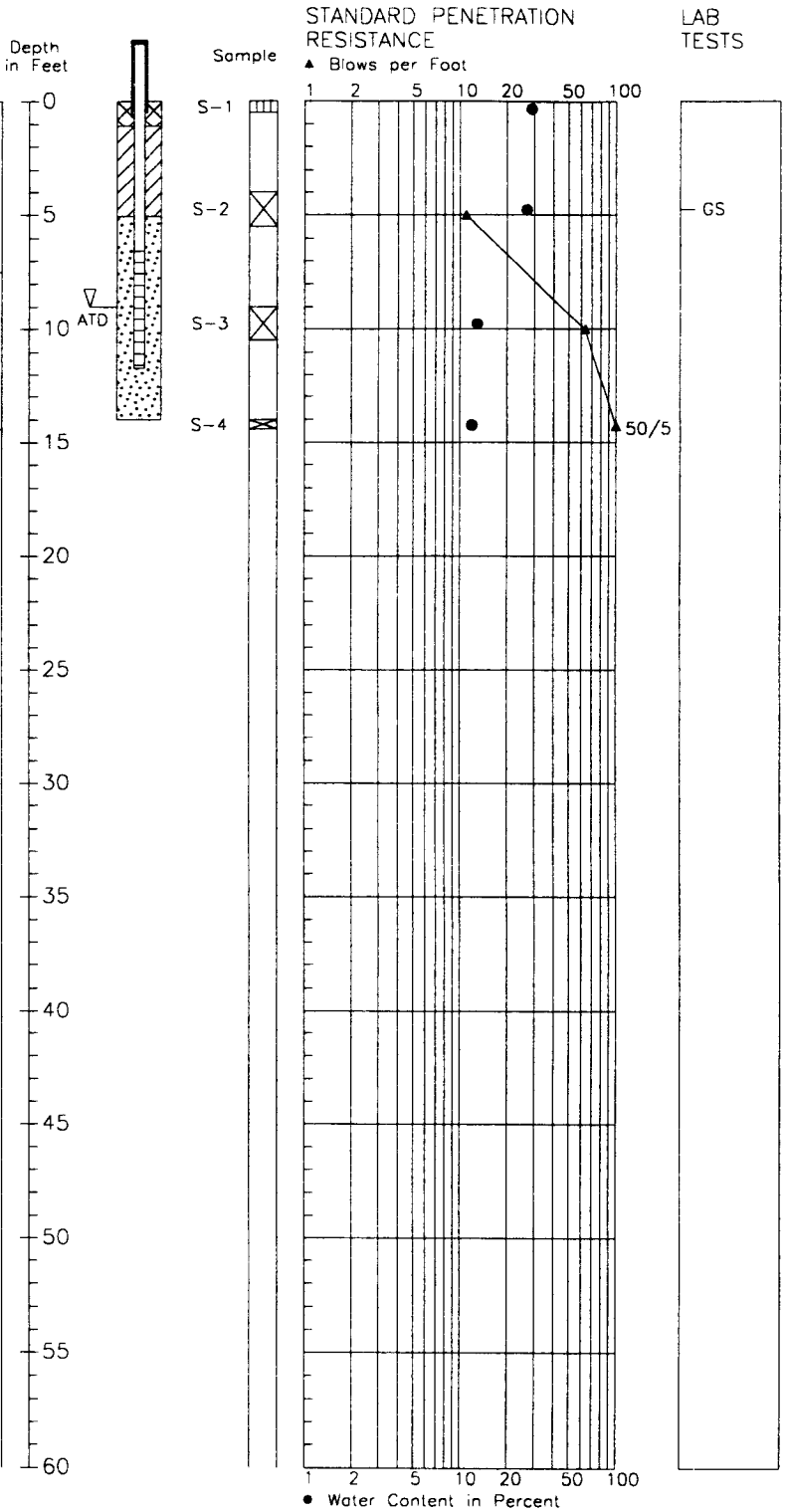
Approx. Ground Surface Elevation in Feet: 247

Top of Casing Elevation in Feet: 248.99

Loose to medium dense, dark brown to gray, slightly gravelly, non-silty to silty SAND with trace organic material.

Very dense, wet, gray, silty, slightly gravelly to very gravelly SAND.

Bottom of Boring at 14.4 Feet.
Completed 2/15/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 1/00

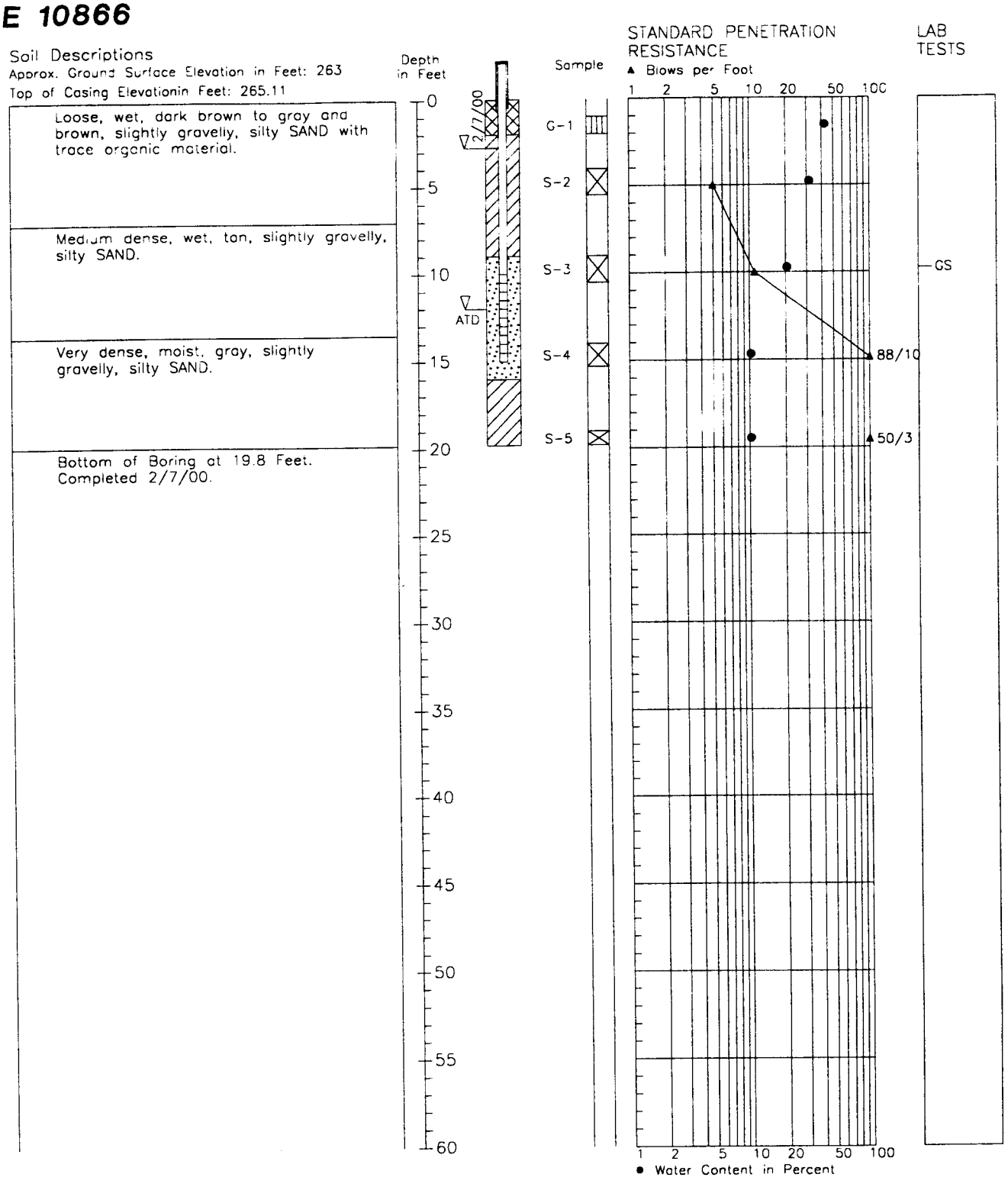
Figure A-23

AR 045306

HEW 2/28/01/1=1 woodstock pc2
497821 LOGS

Boring Log HC00-B145

N 18964
E 10866



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-24

AR 045307

Boring Log HC00-B146

N 19242

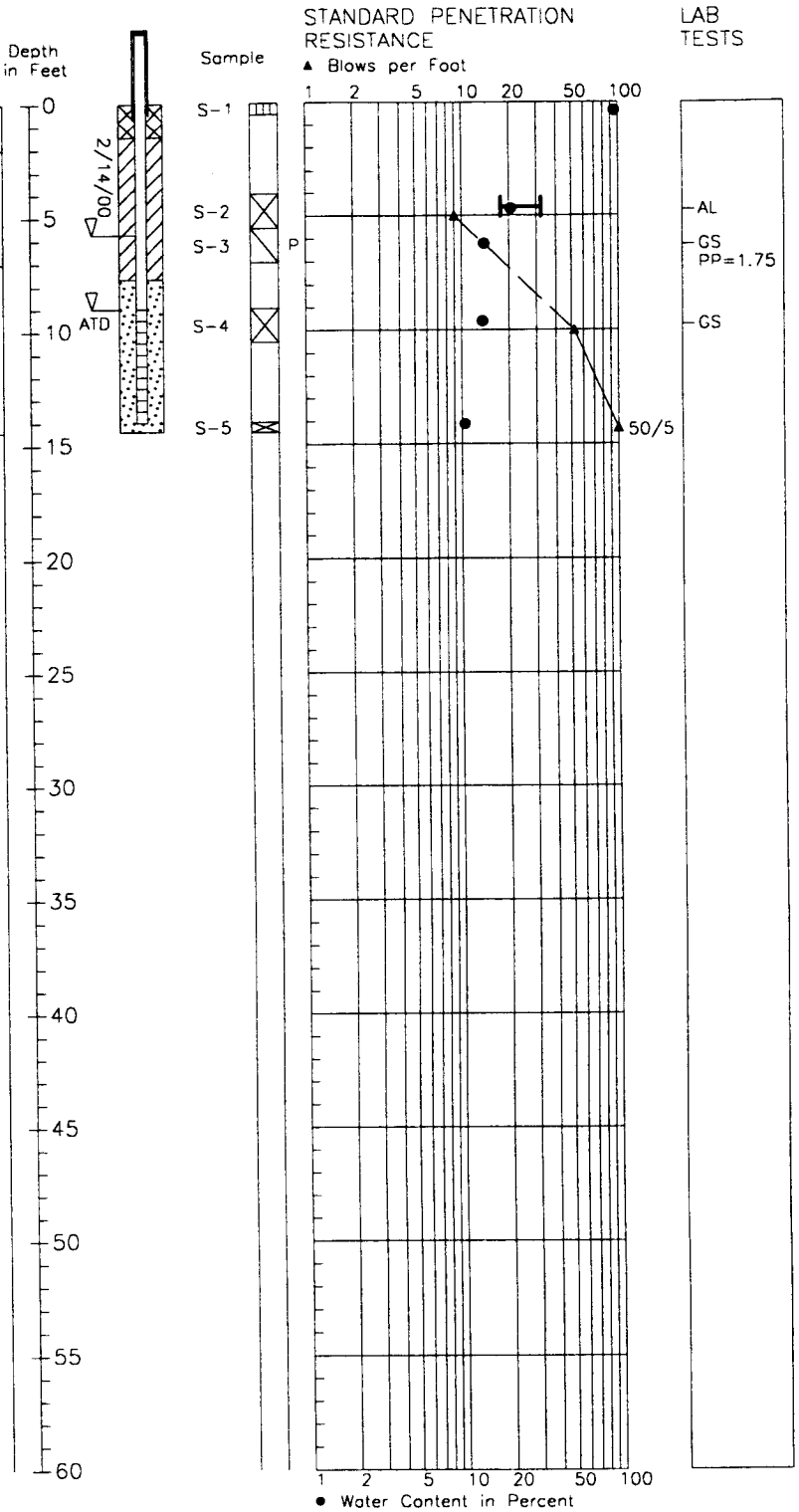
E 10784

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 261

Top of Casing Elevation in Feet: 263.55

Soft, wet, dark brown, sandy PEAT.
Stiff, wet, gray, gravelly, very sandy SILT and CLAY with trace organic material.
Very dense, wet, gray, slightly gravelly, very silty SAND.
Bottom of Boring at 14.4 Feet. Completed 2/14/00.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 2/00

Figure A-25

AR 045308

HEM 2/28/01// 1=1 woodstock pc2

497821 LOGS

Hand-Auger Boring Log HC00-A100

N 18652
E 11117

Sample	Water Content	Lab Tests	Depth in feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 268
S-1			0–2	(Very soft to soft), wet, dark brown, slightly sandy PEAT with roots.
S-2	26	GS	2–7	(Medium dense), wet, gray, silty, fine SAND. Grading to gravelly SAND.
			7–7½	(Medium dense), wet, gray GRAVEL.
			7½	Bottom of Hand Auger at 7½ Feet. Completed 1/18/00.

Hand-Auger Boring Log HC00-A105

N 17373
E 10745

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 291
S-1	112		0–2	(Soft), wet, dark brown, silty SAND with PEAT.
S-2	17	GS	2–5	(Medium dense), wet, tan, gravelly, silty to very silty SAND.
			5	Bottom of Hand Auger at 5 Feet. Completed 2/14/00.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HARTCROWSER
J-4978-21 3/00
Figure A-26

HEM 3/27/00 1=1 497821 H_augers woodstck pc2

AR 045309

Hand-Auger Boring Log HC00-A109

N 17464
E 11147

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 291
S-1	34		0	(Soft), wet, dark brown, sandy SILT with organic material.
S-2	24		2	(Medium dense), wet, brown, silty SAND with trace organic material.
S-3	30		4	(Medium dense), wet, gray, slightly silty to silty fine SAND with trace organic material.
S-4	31	GS	7	(Medium dense), wet, gray, slightly silty fine SAND.
			8	Bottom of Hand Auger at 8 Feet. Completed 2/14/00.
				Note: no seepage noted.

Hand-Auger Boring Log HC00-A137

N 18666
E 10636

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 235
S-1	94		0	(Loose), wet, brown, silty SAND with PEAT.
S-2	33		3	(Loose), wet, brown, very silty SAND.
S-3	29	GS	6	(Medium dense), wet, gray SAND.
S-4	30		7	(Stiff), wet, gray, gravelly, sandy SILT and CLAY.
S-5	27	AL	8	Bottom of Hand Auger at 8 Feet. Completed 2/14/00.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

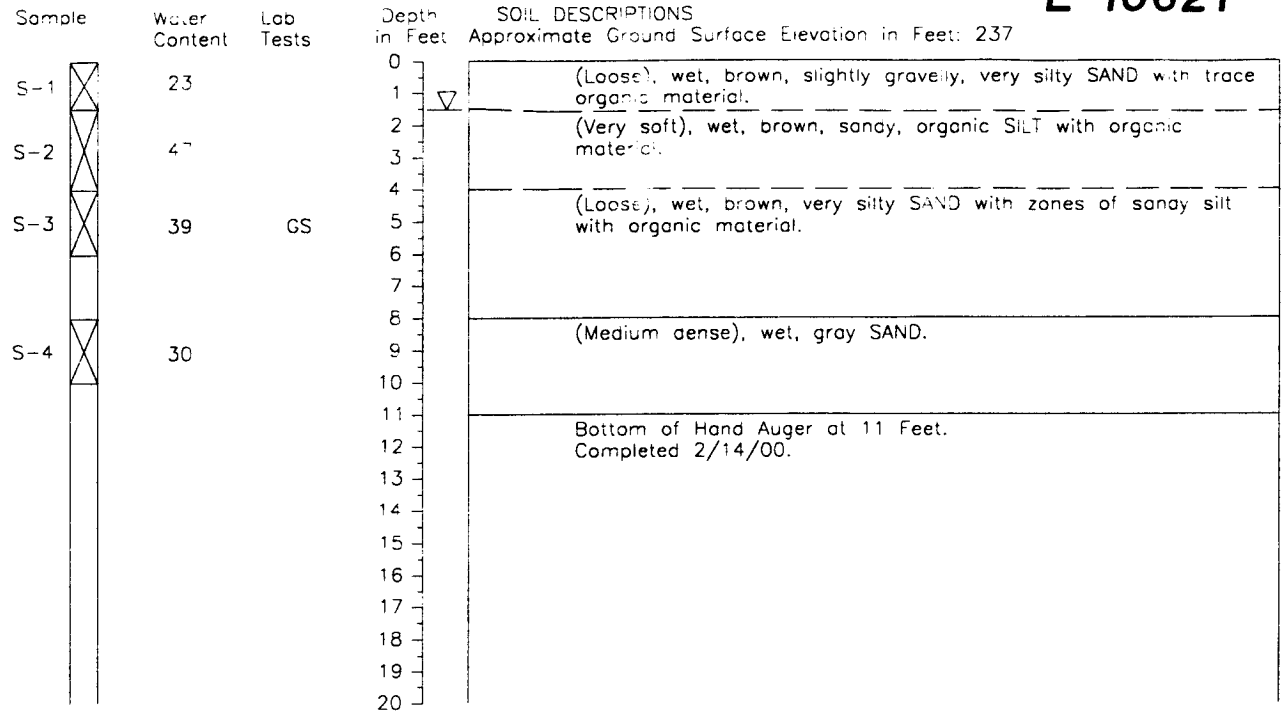
HEM 3/27/00 1=1 497821 H_augers woodstick pc2

HARTCROWSER
J-4978-21 2/00
Figure A-27

AR 045310

Hand-Auger Boring Log HC00-A143

N 18733
E 10621



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

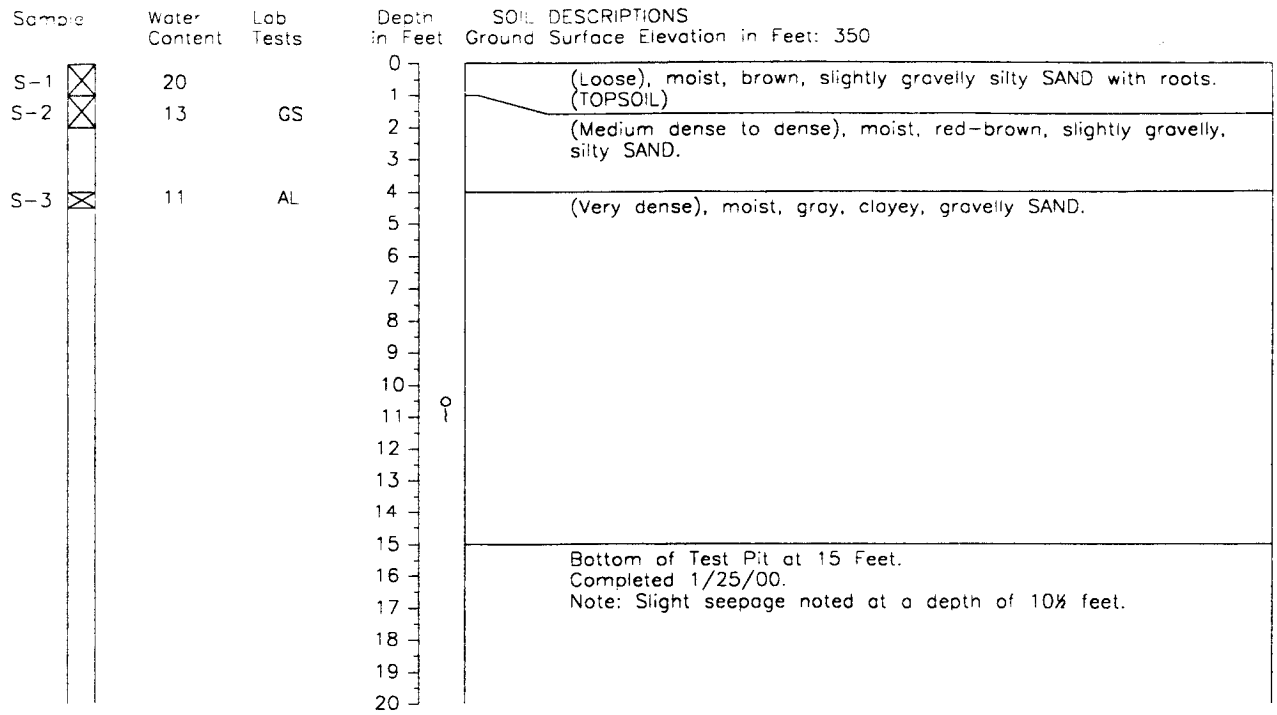
HARTCROWSER
J-4978-21 2/00
Figure A-28

AR 045311

HEM 3/27/00 1=1 497821 H_augers woodstick pc2

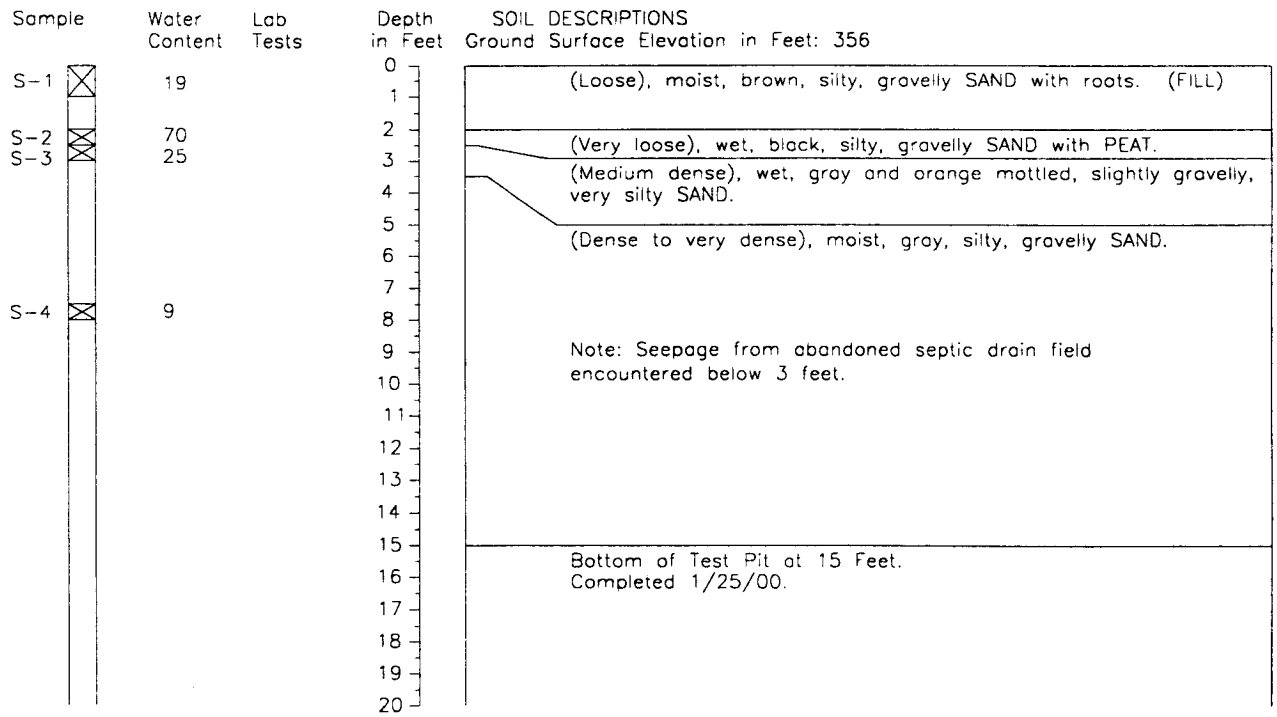
Test Pit Log HC00-TP100

N 16778
E 10927



Test Pit Log HC00-TP101

N 16784
E 11109



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/15/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-29

AR 045312

Test Pit Log HC00-TP102

N 17003
E 11158

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 344
S-1	19		0–1	(Loose), moist, gray and brown, silty, gravelly SAND with trace organic material.
S-2	18		1–4	(Loose to medium dense), moist, brown, silty, gravelly SAND.
S-3	12	GS	4–9	(Very dense), moist, gray with brown mottling, gravelly, very silty SAND.
S-4	13		9–15	(Dense), moist, gray, slightly gravelly, slightly silty to silty SAND.
			15	Bottom of Test Pit at 15 Feet. Completed 1/25/00. Note: No seepage noted.

Test Pit Log HC00-TP103

N 17037
E 11018

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 339
S-1	15	GS	0–3	(Loose), moist, brown, gravelly, silty SAND. (FILL)
S-2	25		3–4	(Loose), moist, dark brown, silty, gravelly SAND. (TOPSOIL)
S-3	15		4–6	(Medium dense), moist, brown, silty, gravelly SAND.
S-4	13		6–15	(Very dense), moist, gray with brown mottling to gray, silty, gravelly SAND.
			15	Bottom of Test Pit at 15 Feet. Completed 1/25/00. Note: Slight groundwater seepage noted at a depth of 10½ feet. Septic drainfield encountered 2 to 3 feet deep.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

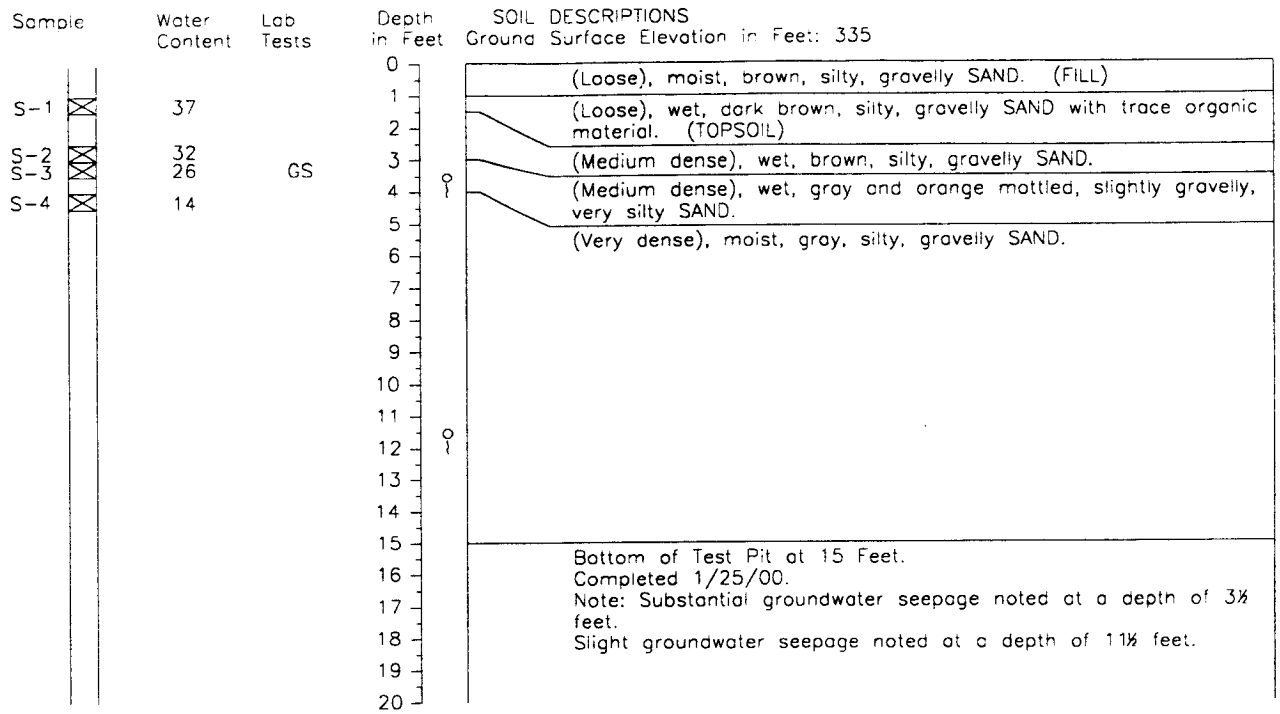
HARTCROWSER
J-4978-21 1/00
Figure A-30

HEM 3/15/00 1=1 4978?21 testpits woodstck pc2

AR 045313

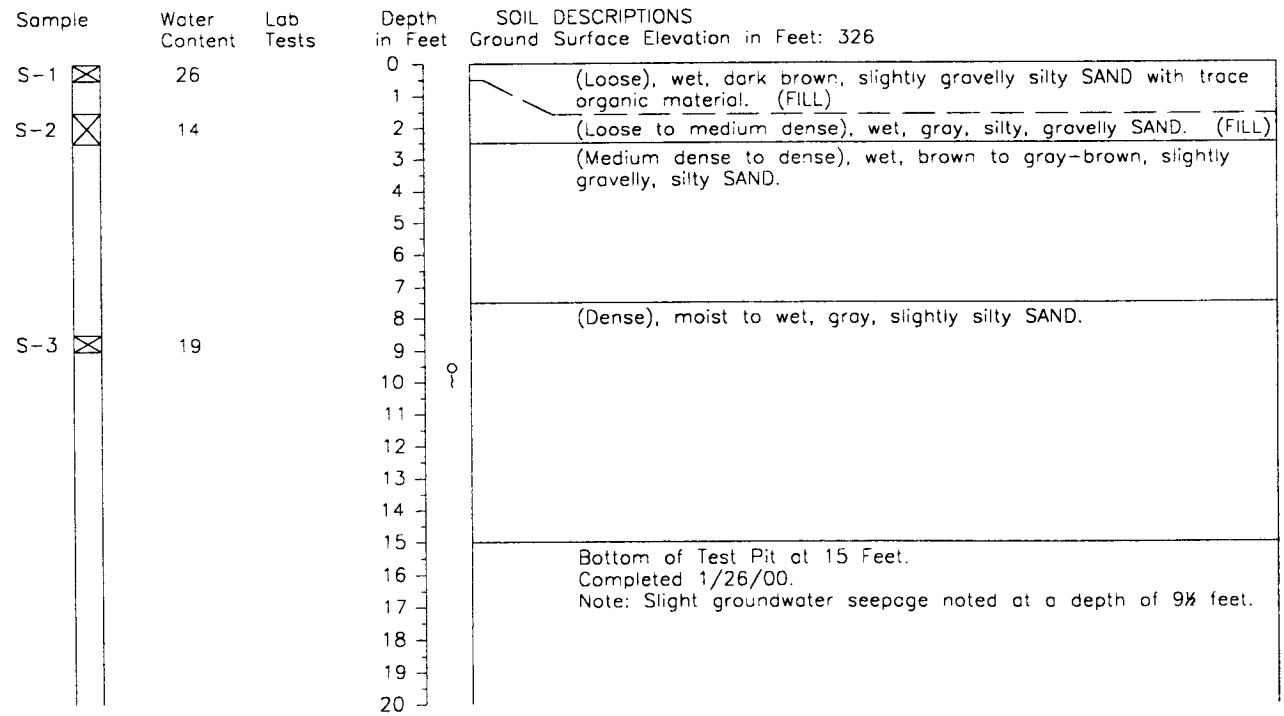
Test Pit Log HC00-TP104

N 17030
E 10874



Test Pit Log HC00-TP105

N 17141
E 10790



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

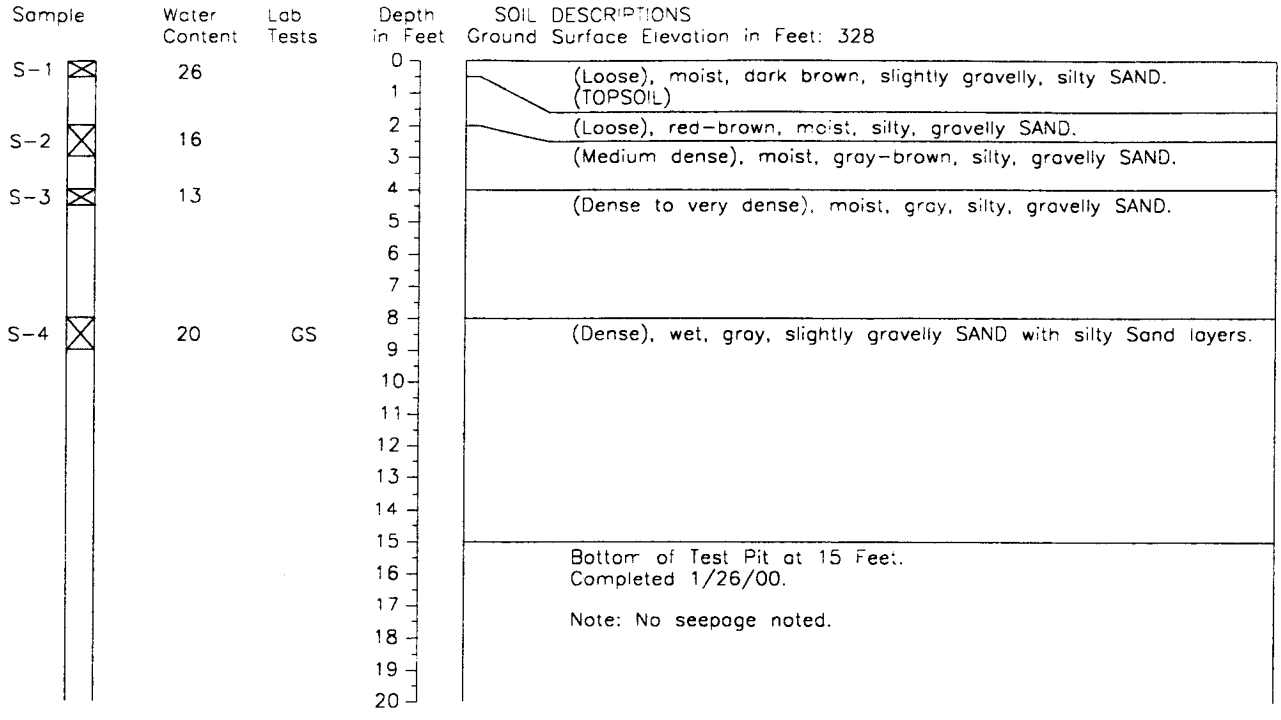
HEM 3/9/00 1=1 497821 testpits woodstck pc2

HARTCROWSER
J-4978-21 1/00
Figure A-31

AR 045314

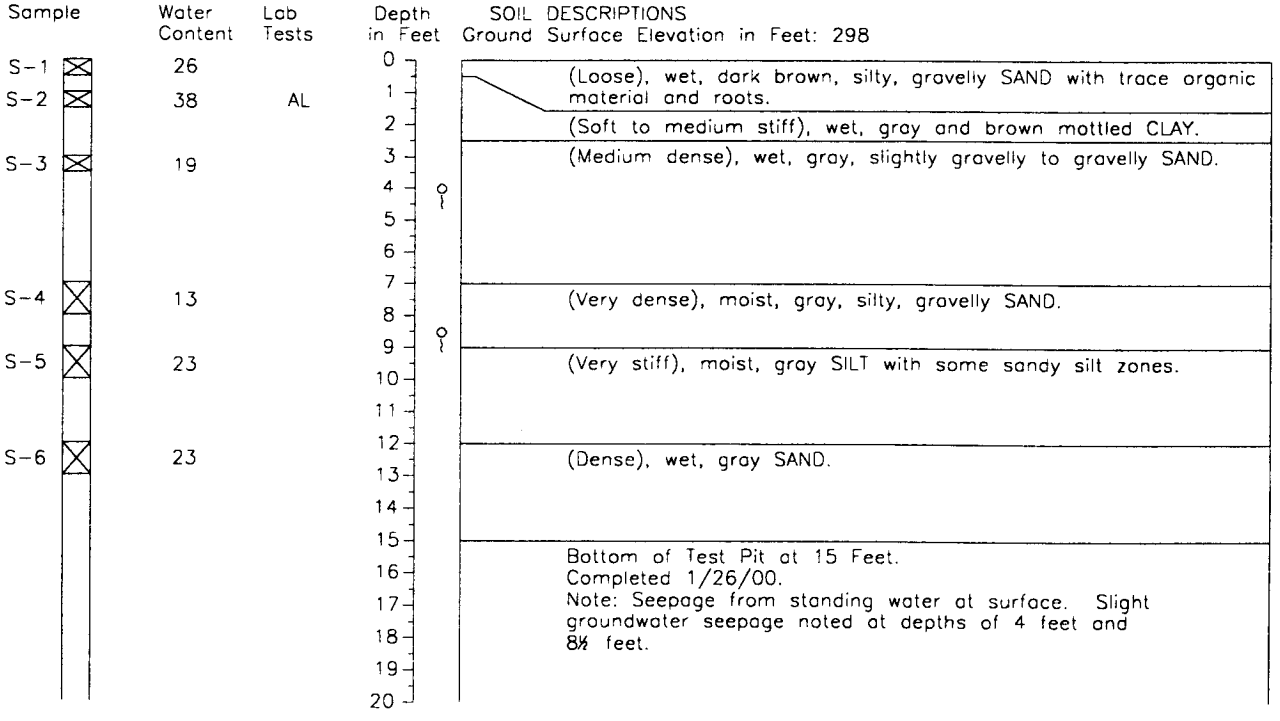
Test Pit Log HC00-TP106

N 17151
E 10925



Test Pit Log HC00-TP107

N 17415
E 10989



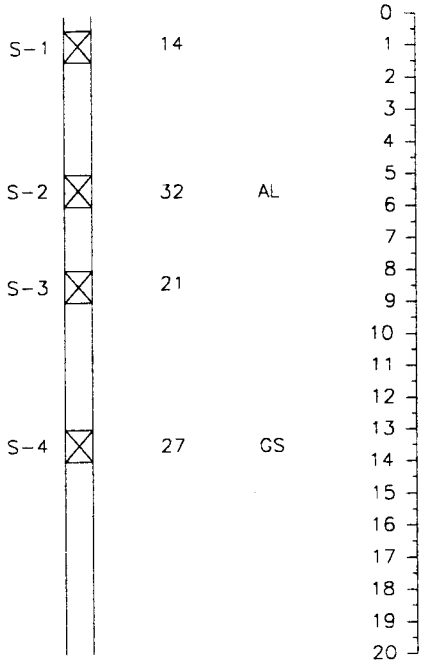
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

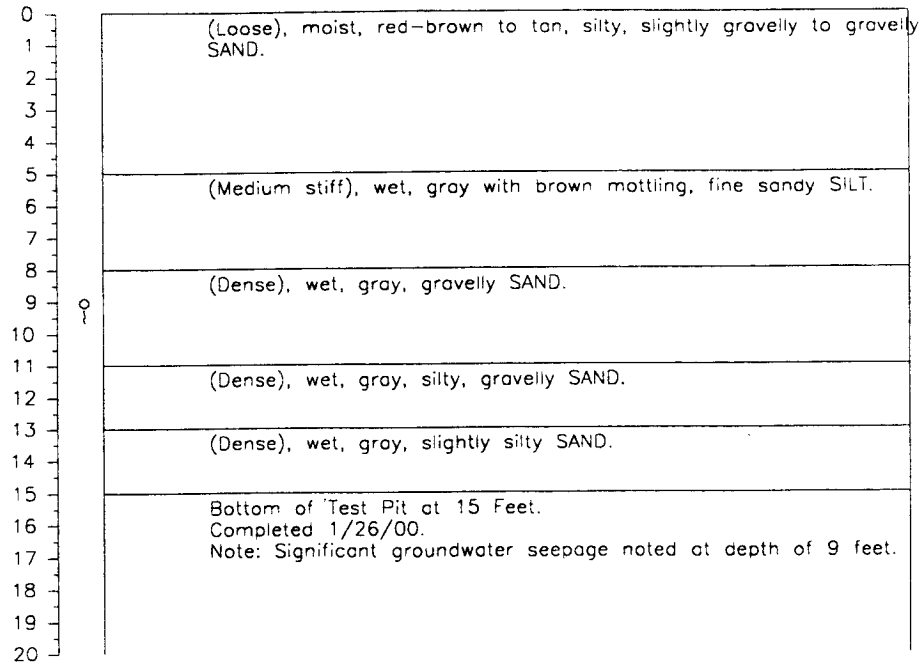
HARTCROWSER
J-4978-21 1/00
Figure A-32

AR 045315

Test Pit Log HC00-TP108

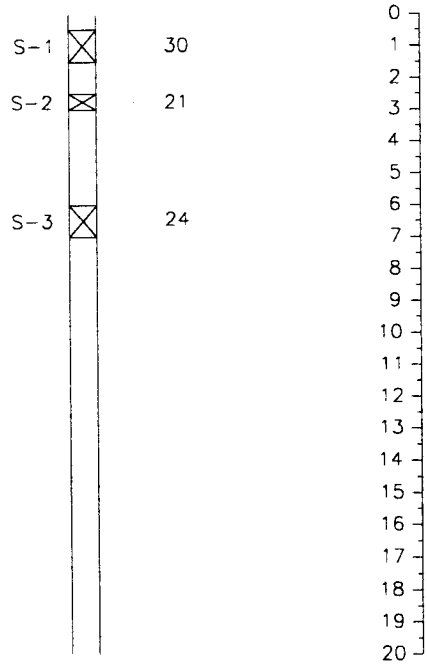
N 17477
E 10990

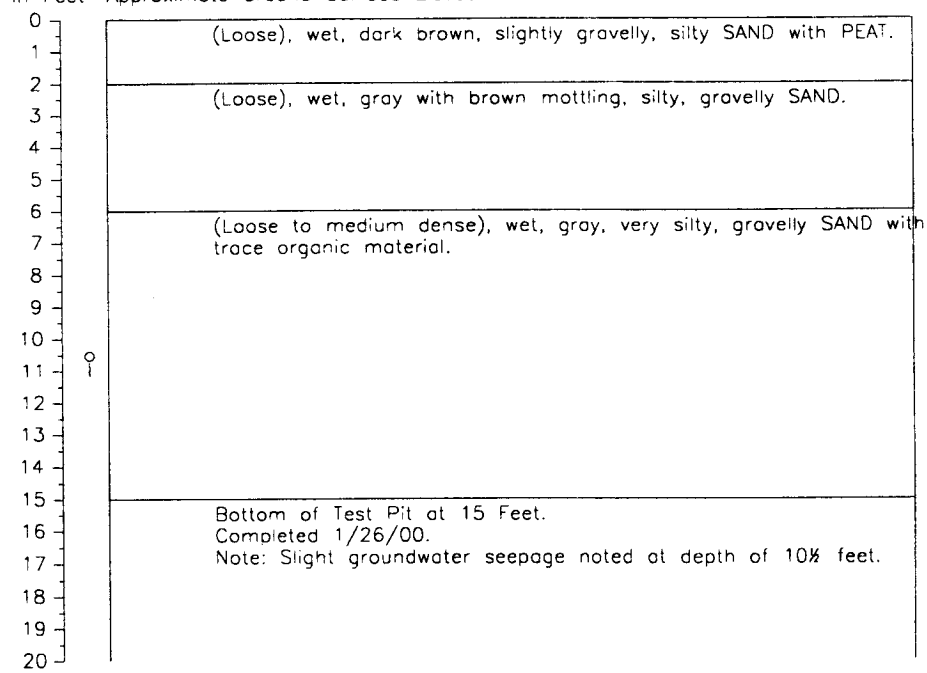




Test Pit Log HC00-TP113

N 18126
E 10993





1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-33

AR 045316

Test Pit Log HC00-TP114

N 18220
E 11068

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 248
S-1	27		0–1	(Loose), wet, black, silty, gravelly SAND with PEAT. (TOPSOIL)
S-2	17	GS	1–7	(Loose to medium dense), wet, gray, slightly silty to silty, gravelly SAND. Silty layers noted.
S-3	20		7–15	(Medium dense), wet, gray, gravelly SAND.
			15–20	Bottom of Test Pit at 15 Feet. Completed 1/26/00. Note: Significant groundwater seepage noted at 2 feet to 6 feet deep. Slight seepage below 7 feet.

Test Pit Log HC00-TP115

N 18325
E 11041

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 250
S-1	26		0–2	(Loose), moist, dark brown, slightly gravelly, silty SAND with trace organic material and roots. (FILL)
S-2	36		2–3	(Loose), moist, gray and brown, silty, gravelly SAND. (FILL)
S-3	14		3–6	(Loose), wet, dark brown, slightly gravelly, silty SAND with peat and trace organic material. (TOPSOIL) (Medium dense), wet, gray, slightly silty SAND.
S-4	25		6–11	(Medium dense), wet, slightly gravelly SAND.
S-5	17	AL	11–15	(Stiff), wet, gray, slightly gravelly, sandy CLAY with sand lenses. (Dense), wet, gray, gravelly SAND.
			15–20	Bottom of Test Pit at 15 Feet. Completed 1/26/00. Note: Observed abandoned septic drain line with gravel at 3½ feet deep; no seepage noted.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-34

AR 045317

Test Pit Log HC00-TP116

N 18396
E 11005

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 257
S-1	14		0–4	(Loose to medium dense), moist, gray and brown mottled, non-silty to silty SAND.
S-2	6	GS	4–11	(Medium dense), moist, gray, SAND with slightly silty zones.
			11–15	(Dense), moist, gray, fine to medium SAND.
			12	(Dense) wet, gray, slightly gravelly SAND.
			13	Becomes gravelly.
S-3	19		15	Bottom of Test Pit at 15 Feet. Completed 1/26/00. Note: Slight groundwater seepage noted at a depth of 11½ feet.

Test Pit Log HC00-TP117

N 18547
E 10999

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 261
			0–1	(Loose), moist, silty SAND. (FILL)
S-1	8		1–2	Concrete slab.
			2–4	(Medium dense), moist, gray-brown, slightly silty SAND.
S-2	18		4–8	(Dense), moist, gray and orange mottled, gravelly, very silty SAND.
S-3	12		8–12	(Dense), wet, gray, slightly silty, very gravelly SAND.
			12	Grades to sandy GRAVEL.
S-4	18		15	Bottom of Test Pit at 15 Feet. Completed 1/26/00.
				Note: No seepage noted.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

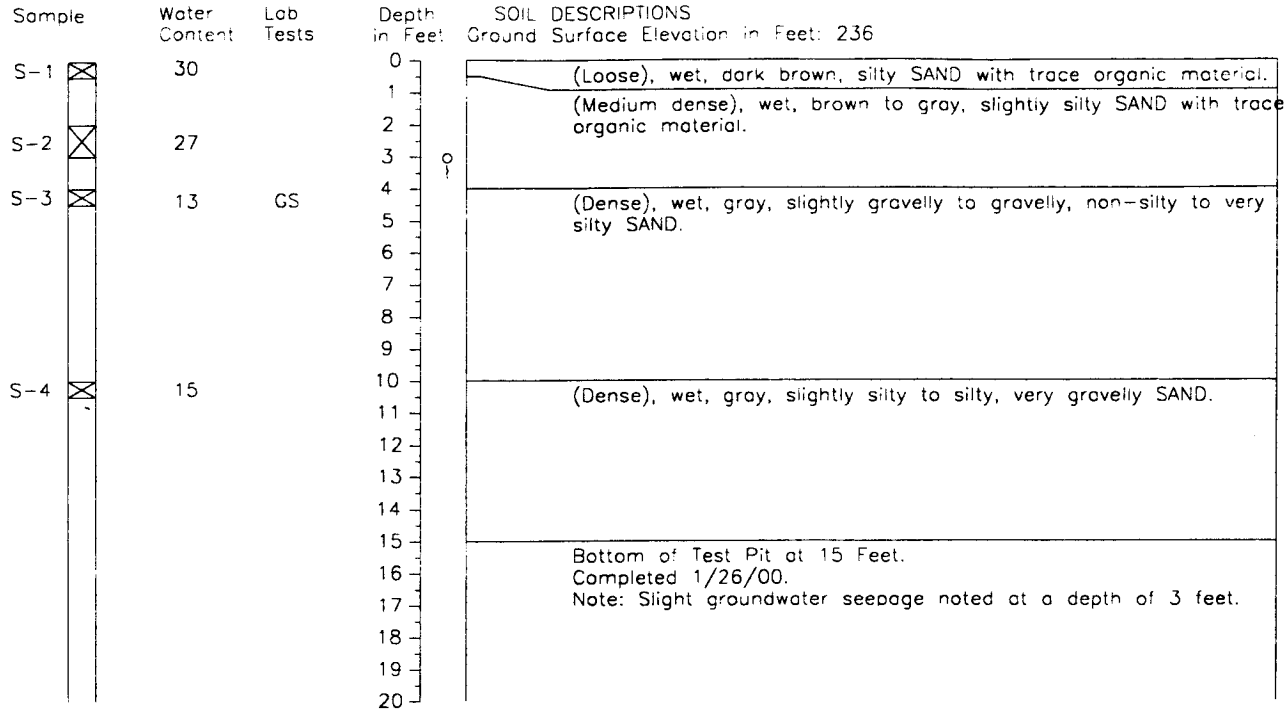
HFW 3/9/00 1=1 49/821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-35

AR 045318

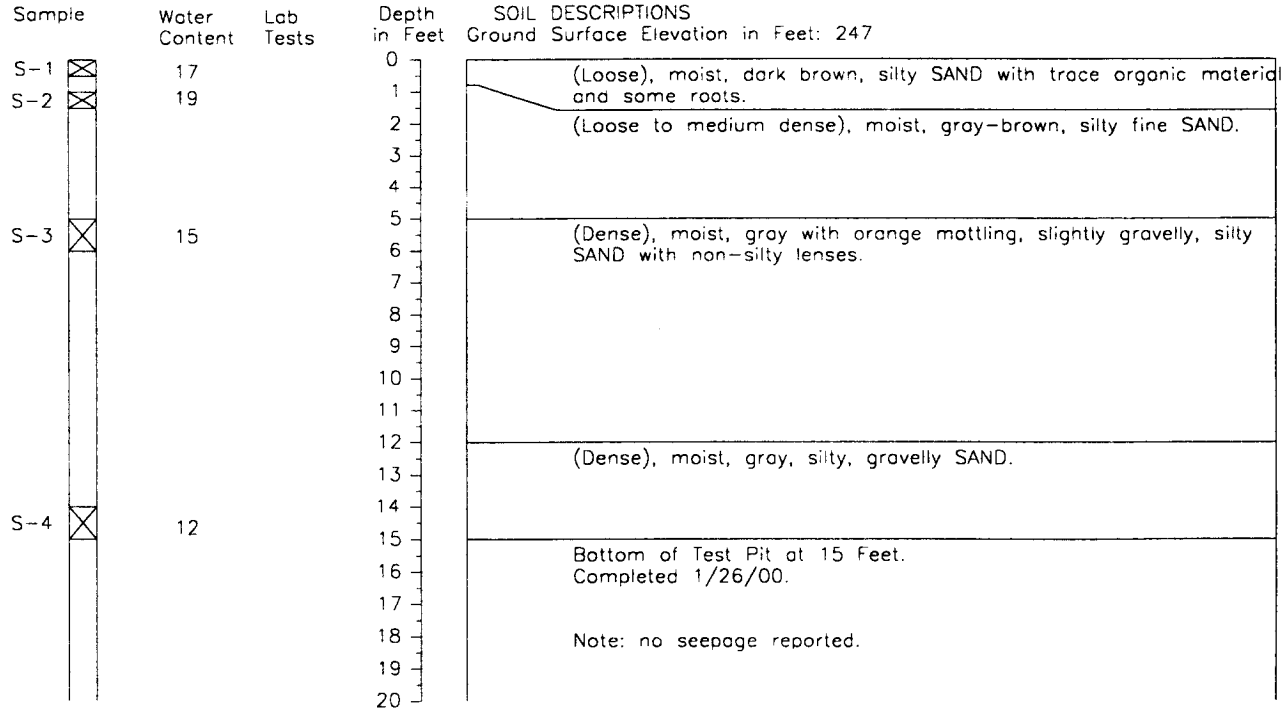
Test Pit Log HC00-TP118

N 18412
E 10798



Test Pit Log HC00-TP119

N 18529
E 10757



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-36

AR 045319

Test Pit Log HC00-TP120

N 18487
E 10986

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 260
S-1	13	GS	0–1	ASPHALT
			1–3	(Medium dense), moist, brown, silty SAND.
			3–5	(Dense), moist, brown, silty, gravelly SAND.
S-2	6		5–13	(Dense), moist, gray, gravelly SAND with slightly silty zones.
			13–15	(Dense), moist, gray, very gravelly SAND.
			15–20	Bottom of Test Pit at 15 Feet. Completed 1/26/00. Note: no seepage noted.

Test Pit Log HC00-TP121

N 18537
E 10886

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 254
S-1	18		0–11	(Loose to medium dense), moist, brown, slightly silty, gravelly SAND with 50 to 70 percent concrete debris, scattered wood and metal debris. (FILL)
S-2	31		11–13	(Loose), wet, black, silty SAND with PEAT.
S-3	24		13–15	(Medium dense), wet, gray, silty SAND stiff sandy SILT layers with a trace of organic material.
			15–20	Bottom of Test Pit at 15 Feet. Completed 1/26/00. Note: Significant groundwater seepage noted at a depth of 10½ feet.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-37

AR 045320

Test Pit Log HC00-TP123

N 19126
E 10873

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 275
S-1	19		0	(Loose), moist, brown, silty SAND.
S-2	26	AL	5	(Soft to medium stiff), wet, gray, sandy SILT with (medium dense), very silty to silty SAND layers.
S-3	14	GS	7	(Dense), wet, gray with orange mottling, gravelly, silty SAND.
			15	Bottom of Test Pit at 15 Feet. Completed 1/28/00. Note: Groundwater seepage noted from a depth of 4 to 5 feet. Significant groundwater seepage noted from a sand lens at 6 to 7 feet.

Test Pit Log HC00-TP124

N 18973
E 10724

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 258
S-1	32		0	(Loose), moist, brown, silty SAND with trace organic material and roots.
S-2	25		2	(Loose), wet, gray-brown, very silty SAND.
S-3	22		3	(Medium dense), wet, gray-brown, slightly silty SAND.
S-4	25	AL	4	(Medium stiff), wet, gray with orange mottling, sandy SILT.
			5	(Medium dense), wet, gray, slightly silty SAND.
S-5	12			(Dense), moist, gray with orange mottling, silty, gravelly SAND.
			11	(Dense), moist, gray, silty, gravelly SAND.
			15	Bottom of Test Pit at 15 Feet. Completed 1/28/00. Note: Groundwater seepage noted at a depth of 4 ½ feet.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HARTCROWSER
J-4978-21 1/00
Figure A-38

AR 045321

HEM 3/9/00 1=1 497821 testpits woodstick pc2

Test Pit Log HC00-TP125

N 19168
E 11187

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 299
S-1	24		0	(Loose), moist, brown, silty SAND with trace organic material and roots.
S-2	24		1	
			2	(Soft to medium stiff), moist, gray and orange mottled, sandy SILT.
S-3	10	GS	3	
			4	(Medium dense to dense), moist, gray with orange mottling, very gravelly, silty SAND with some non-sandy zones.
			5	(Dense), gray, non-silty to silty, gravelly SAND. (TILL)
			6	
			7	
			8	
			9	
			10	
			11	
			12	
			13	
S-4	10		14	
			15	Bottom of Test Pit at 15 Feet. Completed 1/28/00.
			16	
			17	
			18	Note: no seepage noted.
			19	
			20	

Test Pit Log HC00-TP126

N 19443
E 10773

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 272
S-1	26		0	(Loose), wet, brown, silty SAND with some roots and trace organic material.
S-2	20		1	
			2	(Medium dense), wet, gray with orange mottling, silty, gravelly SAND.
			3	
			4	
			5	
			6	
			7	
S-3	8		8	(Very dense), moist, gray, silty, gravelly SAND.
			9	
			10	
			11	Bottom of Test Pit at 11 Feet. Completed 1/28/00.
			12	
			13	
			14	
			15	Note: Septic drainfield encountered at 3 feet.
			16	
			17	
			18	
			19	
			20	

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstck pc2

HARTCROWSER
J-4978-21 1/00
Figure A-39

AR 045322

Test Pit Log HC00-TP127

N 19166
E 11086

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 292
S-1	11		0–1	(Loose), moist, gray,silty, gravelly SAND. (FILL)
			1–2	(Loose), moist, brown, slightly silty SAND.
S-2	6		2–6	(Loose to medium dense), moist, gray, slightly gravelly SAND.
S-3	13	GS	6–15	(Dense), moist, gray with orange mottling, gravelly, very silty SAND.
			15	Bottom of Test Pit at 15 Feet. Completed 1/28/00.
				Note: no seepage noted.

Test Pit Log HC00-TP128

N 18732
E 11003

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 273
S-1	18		0–1	(Loose), moist, brown, silty SAND with some roots.
S-2	8		1–3	(Medium dense), moist, gray-brown SAND.
S-3	11		3–15	(Medium dense), wet, gray with orange mottling, silty, gravelly SAND with some non-silty zones.
S-4	11		15	Bottom of Test Pit at 15 Feet. Completed 1/28/00.
				Note: no seepage noted.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-40

AR 045323

Test Pit Log HC00-TP129

N 18899
E 10623

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Approximate Ground Surface Elevation in Feet: 250
S-1	28		0–1	(Loose), moist, brown, very silty SAND with trace organic material and roots.
S-2	22	GS	1–4	(Medium dense), wet, gray, very sandy SILT.
S-3	16		4–6	(Stiff), wet, gray and orange mottled, sandy SILT.
			6–15	(Dense), moist, gray and orange mottled, silty, gravelly SAND.
			15	Bottom of Test Pit at 15 Feet. Completed 1/28/00.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

HEM 3/9/00 1=1 497821 testpits woodstick pc2

HARTCROWSER
J-4978-21 1/00
Figure A-41

AR 045324

APPENDIX B
LABORATORY TESTING PROGRAM

APPENDIX B
LABORATORY TESTING PROGRAM

A laboratory testing program was performed for this study to evaluate the basic index and geotechnical engineering properties of the site soils. Disturbed and relatively undisturbed samples were tested. The tests performed and the procedures followed are outlined below.

Soil Classification

Field Observation and Laboratory Analysis. Soil samples from the explorations were visually classified in the field and then taken to our laboratory where the classifications were verified in a relatively controlled laboratory environment. Field and laboratory observations include density/consistency, moisture condition, and grain size and plasticity estimates.

The classifications of selected samples were checked by laboratory tests such as Atterberg limits determinations and grain size analyses. Classifications were made in general accordance with the Unified Soil Classification (USC) System, ASTM D 2487, as presented on Figure B-1.

Note that the term "trace" used on exploration logs generally indicate a material within the soil matrix that constitutes a relatively small fraction by weight of the total soil. The usage of this term in not associated with the ASTM simplified classification procedure.

Water Content Determinations

Water contents were determined for most samples recovered in the explorations in general accordance with ASTM D 2216, as soon as possible following their arrival in our laboratory. The results of these tests are plotted or recorded at the respective sample depth on the exploration logs. In addition, water contents are routinely determined for samples subjected to other testing. These are also presented on the exploration logs.

Grain Size Analysis (GS)

Grain size distribution was analyzed on representative samples in general accordance with ASTM D 422. Wet sieve analysis was used to determine the size distribution greater than the U.S. No. 200 mesh sieve. The size distribution for particles smaller than the No. 200 mesh sieve was determined by the hydrometer method for selected samples. The results of the tests are presented

as curves on Figures B-2 through B-22 plotting percent finer by weight versus sieve size.

Atterberg Limits (AL)

We determined Atterberg limits for selected fine-grained soil samples. The liquid limit and plastic limit were determined in general accordance with ASTM D 4318-84. The results of the Atterberg Limits analyses and the plasticity characteristics are summarized in the Liquid and Plastic Limits Test Report, Figures B-23 through B-29. This relates the plasticity index (liquid limit minus the plastic limit) to the liquid limit. The results of the Atterberg limits tests are also shown graphically on the boring logs.

Consolidation Test (CN)

The one-dimensional consolidation test provides data for estimating settlement and preconsolidation pressure. The test was performed in general accordance with ASTM D 2435. A relatively undisturbed, fine-grained sample was carefully trimmed and fit into a rigid ring with porous stones placed on the top and bottom of the sample to allow drainage. Vertical loads were then applied incrementally to the sample in such a way that the sample was allowed to consolidate under each load increment. Measurements were made of the compression of the sample (with time) under each load increment. Rebound was measured during the unloading phase. In general, each load was left in place until the completion of 100 percent primary consolidation, as computed using Taylor's square root of time method. The next load increment was applied soon after attaining 100 percent primary consolidation. For the 4 tsf load increment, the load was left in-place for about 16 hours to record secondary compression characteristics. The test results plotted in terms of axial strain and coefficient of consolidation versus applied load (stress) are presented on Figures B-30 through B-36.

Consolidated Undrained Triaxial Compression Test (CU)

The consolidated undrained triaxial compression test with pore pressure measurements estimates the effective strength of the soil at various stress levels. The test was performed in general accordance with ASTM D 4767.

A relatively undisturbed fine-grained sample was trimmed to a length of about 6 inches, encased in a rubber membrane, and placed in the triaxial cell. With the sample in the triaxial test cell, an all-around pressure was applied hydraulically. The sample was allowed to consolidate under the applied pressure with drainage occurring through porous stones and slotted filter paper placed around the

sample. When consolidation was completed, drainage lines from the sample were closed, a back pressure was applied to saturate the sample, and the sample was loaded to failure under undrained conditions by application of increasing axial load at a constant strain rate.

During loading, we recorded the magnitude of excess pore water pressure developed. From the data, an effective stress plot was developed to illustrate the variation in effective shear strength with varying consolidation (or overburden) pressures. The data are plotted using shear stress versus principal stress as Mohr's circles. The tangent to the Mohr's circles for a test series represents the effective angle of internal friction (ϕ'). The intercept along the vertical axis is the effective cohesion (c').

Test results for the samples tested are presented on Figures B-37 through B-40. For each sample the first figure presents shear stress and normal stress data in a Mohr's circle format along with stress-strain plots, while the second figure in the set presents the stress-stain data and a stress path plot. The effective friction angles (ϕ') provided in Table 2 of the main text were determined by assuming that $c' = 0$ for drained conditions.

Unconsolidated Undrained Triaxial Compression Test (UU)

The unconsolidated undrained triaxial compression test estimates the total strength of the soil at various stress levels. The test was performed in general accordance with ASTM D 2850. A relatively undisturbed fine-grained sample was trimmed to a length of about 6 inches, encased in a rubber membrane, and placed in the triaxial cell. With the sample in the triaxial test cell, an all-around pressure was applied hydraulically, although the drainage valves remained closed. Thus the sample was not allowed to consolidate. The sample was loaded to failure under undrained conditions by application of increasing axial load at a constant strain rate.

The data are plotted (Figures B-41 through B-44) using shear stress versus principal stress as Mohr's circles. Because the test is a measure of the total stress strength of a soil, the tangent to the Mohr's circle for a test extends horizontally to the vertical axis in a straight line. The intercept along the vertical axis is the cohesion (c = undrained shear strength, τ, of the soil).

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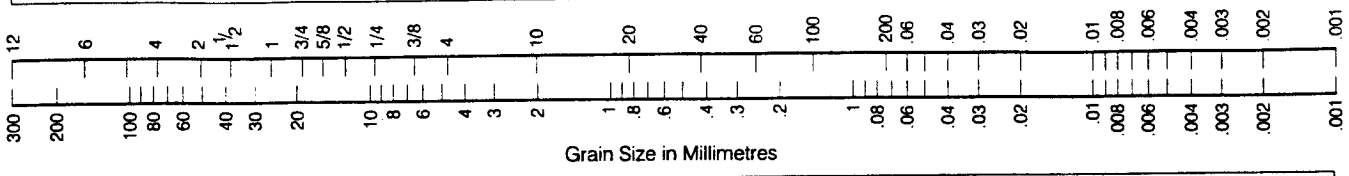
Unified Soil Classification (USC) System

Soil Grain Size

Size of Opening In Inches	Number of Mesh per Inch (US Standard)	Grain Size in Millimetres



COBBLES	GRAVEL	SAND	SILT and CLAY
Coarse-Grained Soils			Fine-Grained Soils

Coarse-Grained Soils

G W	G P	G M	G C	S W	S P	S M	S C
Clean GRAVEL <5% fines	*	GRAVEL with >12% fines		Clean SAND <5% fines	*	SAND with >12% fines	
GRAVEL >50% coarse fraction larger than No. 4				SAND >50% coarse fraction smaller than No. 4			
Coarse-Grained Soils >50% larger than No. 200 sieve							

G W and S W $\left(\frac{D_{60}}{D_{10}}\right)$ >4 for G W, >6 for S W & $1 \leq \left(\frac{(D_{30})^2}{D_{10} \times D_{60}}\right) \leq 3$

G P and S P Clean GRAVEL or SAND not meeting requirements for G W and S W

G M and S M Atterberg limits below A line with PI <4

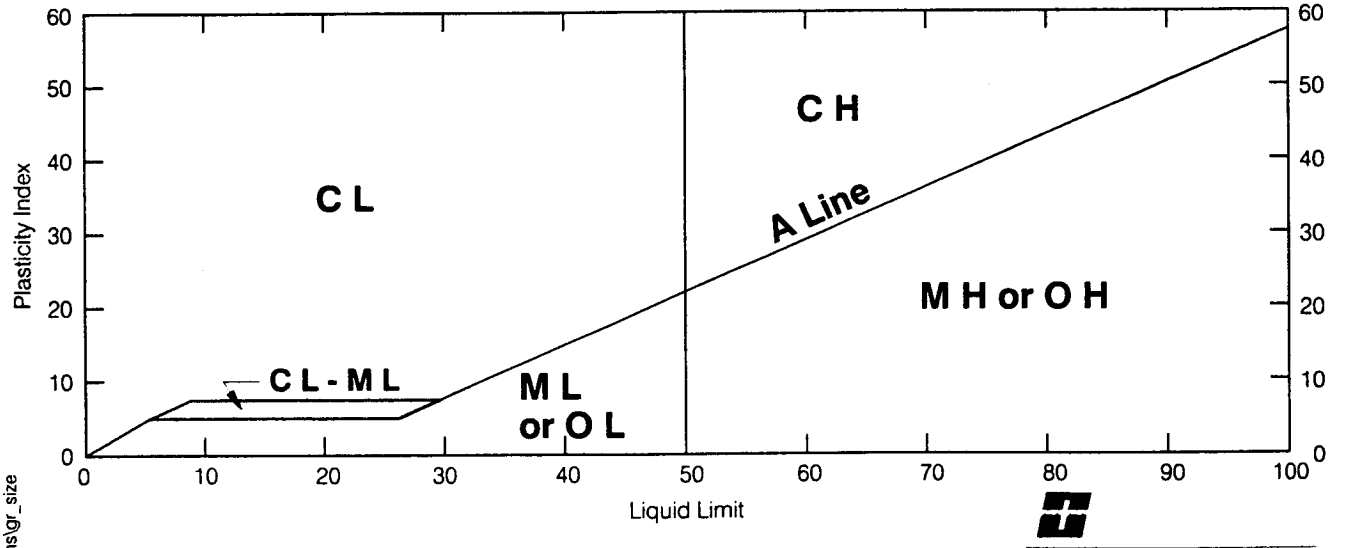
G C and S C Atterberg limits above A Line with PI >7

* Coarse-grained soils with percentage of fines between 5 and 12 are considered borderline cases required use of dual symbols.

D_{10}, D_{30}, and D_{60} are the particles diameter of which 10, 30, and 60 percent, respectively, of the soil weight are finer.

Fine-Grained Soils

M L	C L	O L	M H	C H	O H	Pt
SILT	CLAY	Organic	SILT	CLAY	Organic	Highly Organic Soils
Soils with Liquid Limit <50%			Soils with Liquid Limit >50%			
Fine-Grained Soils >50% smaller than No. 200 sieve						



CoreNorms\gr_size

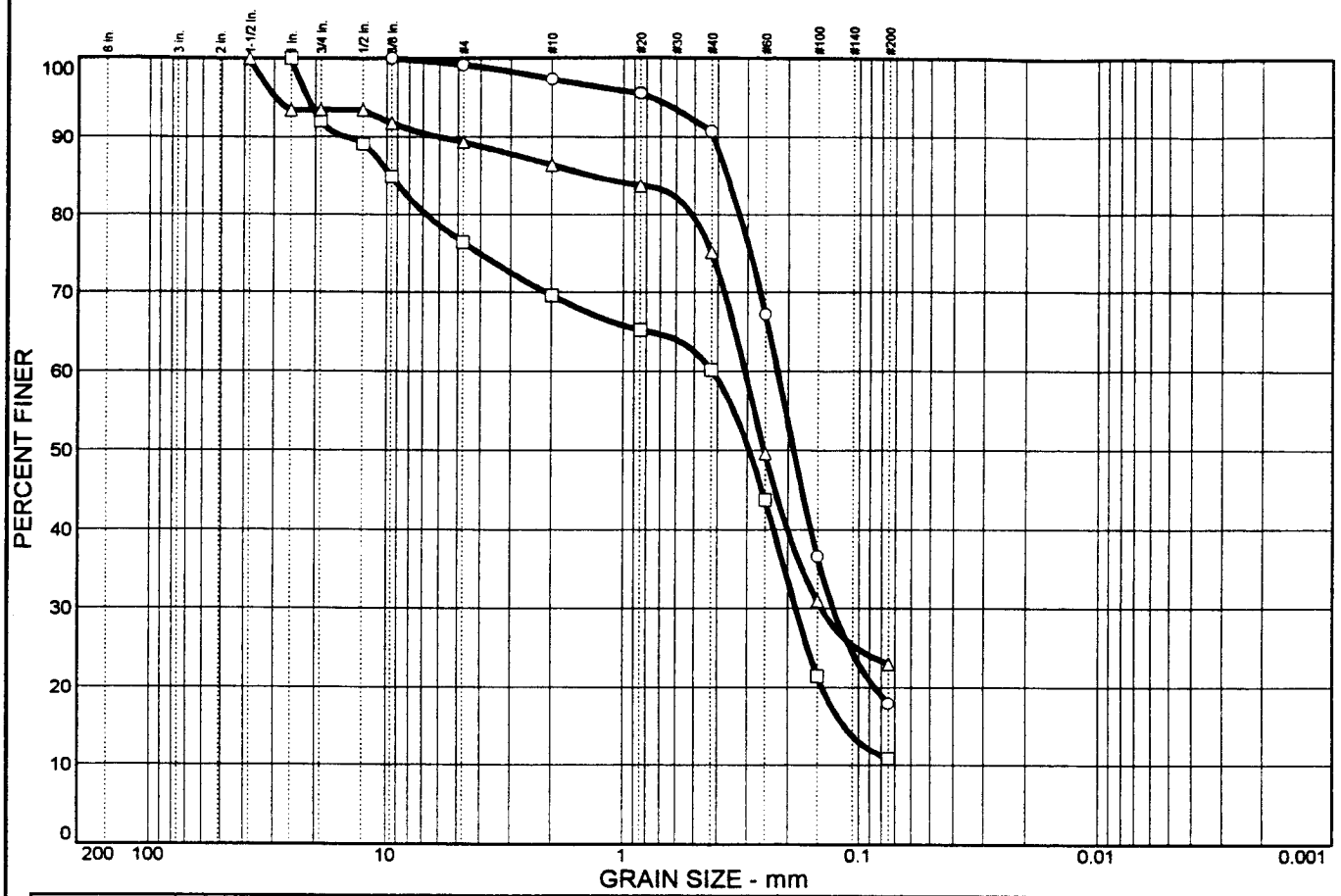
HARTCROWSER

J-4978-21 3/00

Figure B-1

AR 045329

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.8	1.9	6.6	72.8	17.9	
□	0.0	7.9	15.7	6.8	9.4	49.3	10.9	
△	0.0	6.6	4.1	3.0	11.2	52.1	23.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.366	0.222	0.189	0.128				
□			9.64	0.420	0.292	0.185	0.115			
△			1.38	0.306	0.252	0.144				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Silty, medium to fine SAND	SM	22%
□ Slightly silty, gravelly SAND	SP-SM	19%
△ Slightly gravelly, silty, medium to fine SAND	SM	15%

Remarks:

○

□

△

Project: Third Runway West Wall

Client: HNTB

○ **Source:** HC00-B106 **Sample No.:** S-3

□ **Source:** HC00-B108 **Sample No.:** S-3

△ **Source:** HC00-B111 **Sample No.:** S-4

HARTCROWSER

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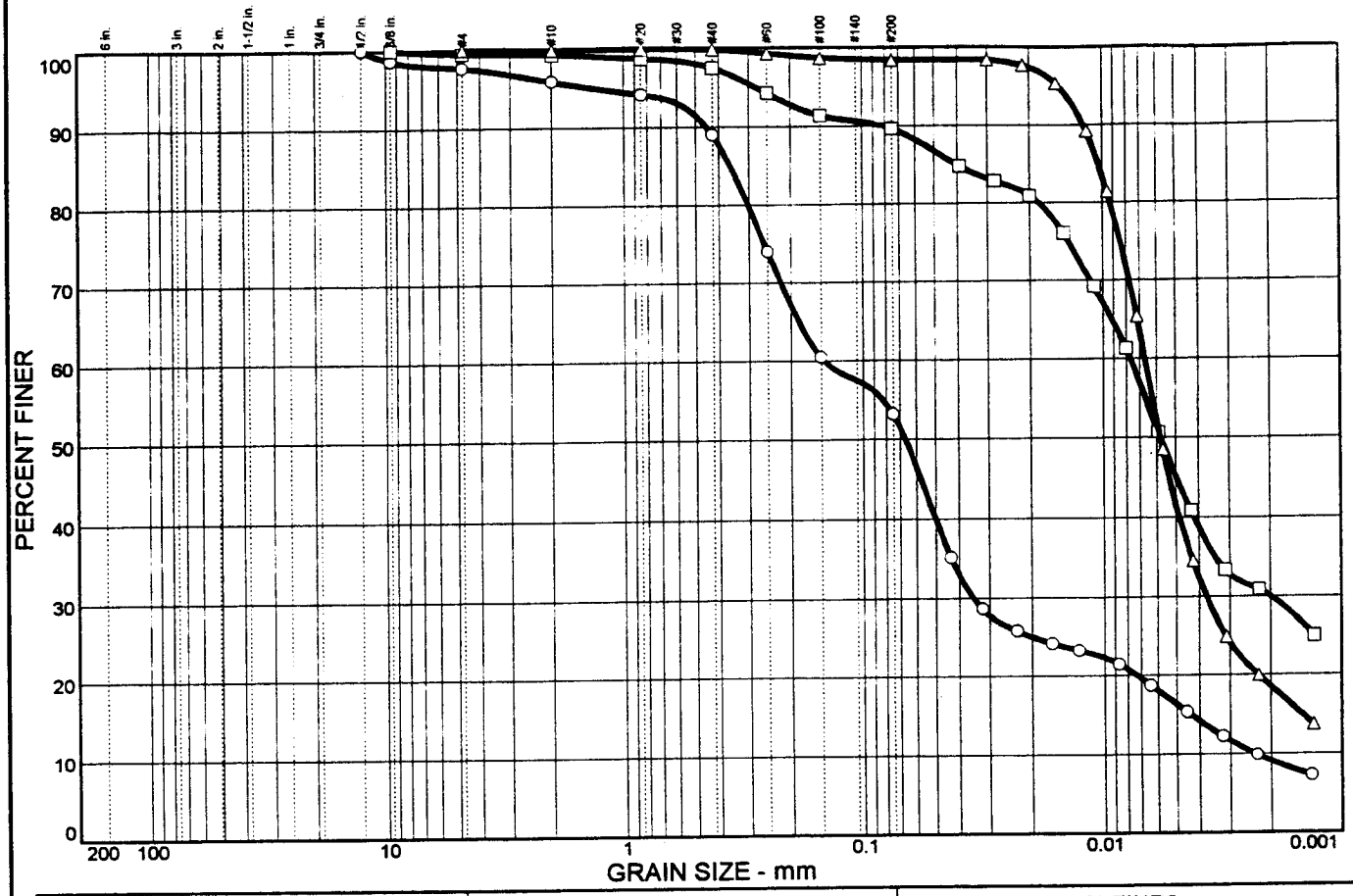
Figure No. B-2

AR 045330

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	2.3	1.8	6.9	35.8	36.9	16.3
□	0.0	0.0	0.5	0.2	1.8	7.8	44.5	45.2
△	0.0	0.0	0.0	0.1	0.1	1.4	56.8	41.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27	12	0.357	0.145	0.0666	0.0349	0.0043	0.0023	3.61	62.21
□	19	4	0.0398	0.0077	0.0058	0.0020				
△	41	13	0.0104	0.0067	0.0058	0.0037	0.0015			

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Very sandy, lean CLAY	CL	23%
□ Slightly sandy CLAY-SILT	CL-ML	14%
△ Very clayey SILT	ML	31%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B107 **Sample No.:** S-3

□ **Source:** HC00-B110 **Sample No.:** S-4

△ **Source:** HC00-B110 **Sample No.:** S-11

HARTCROWSER

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Figure No. B-3

AR 045331

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.2	2.2	79.2	18.4
□	0.0	0.0	14.5	1.1	7.4	30.7	40.9	5.4
△	0.0	0.0	0.0	0.0	0.1	0.4	64.8	34.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	4	0.0349	0.0191	0.0156	0.0091	0.0041	0.0024	1.76	7.81
□	18	3	3.14	0.192	0.0891	0.0492	0.0191	0.0101	1.24	19.04
△	43	17	0.0152	0.0091	0.0074	0.0041				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Clayey SILT	ML	31%
□ Slightly clayey, gravelly, very silty, medium to fine SAND	SM	15%
△ Very clayey SILT	CL	30%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B111 **Sample No.:** S-3

□ **Source:** HC00-B111 **Sample No.:** S-6

△ **Source:** HC00-B111 **Sample No.:** S-12

HARTCROWSER

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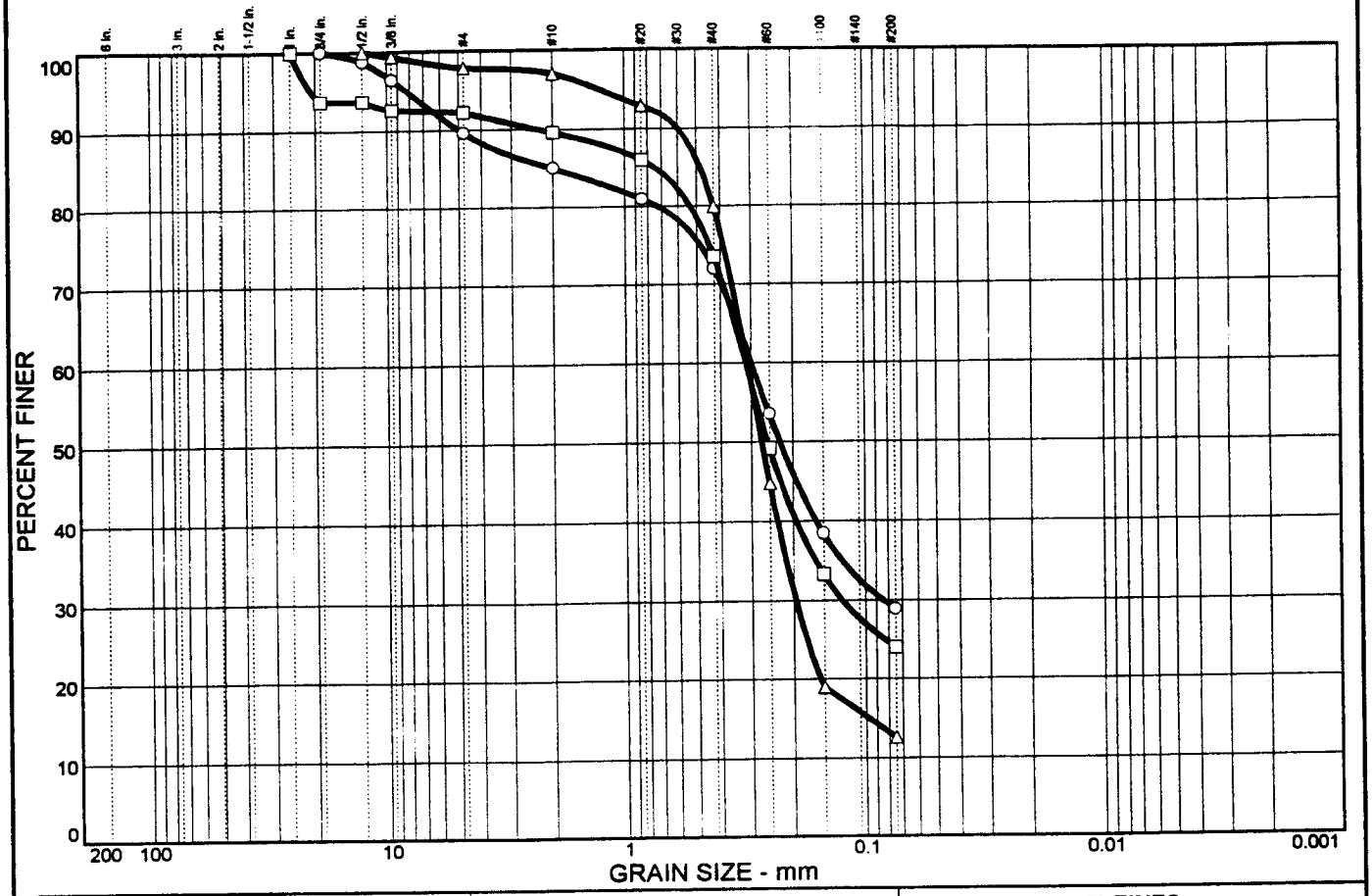
Figure No. B-4

AR 045332

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	10.4	4.6	13.0	43.1	28.9	
□	0.0	6.3	1.5	2.6	16.1	49.5	24.0	
△	0.0	0.0	2.1	0.8	17.2	67.3	12.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			2.00	0.298	0.226	0.0839				
□			0.748	0.314	0.255	0.125				
△			0.482	0.310	0.270	0.196	0.0973			

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, silty, medium to fine SAND	SM	15%
□ Slightly gravelly, silty, medium to fine SAND	SM	51%
△ Silty, medium to fine SAND	SM	27%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B114 **Sample No.:** S-3

□ **Source:** HC00-B115 **Sample No.:** S-2

△ **Source:** HC00-B116 **Sample No.:** S-2

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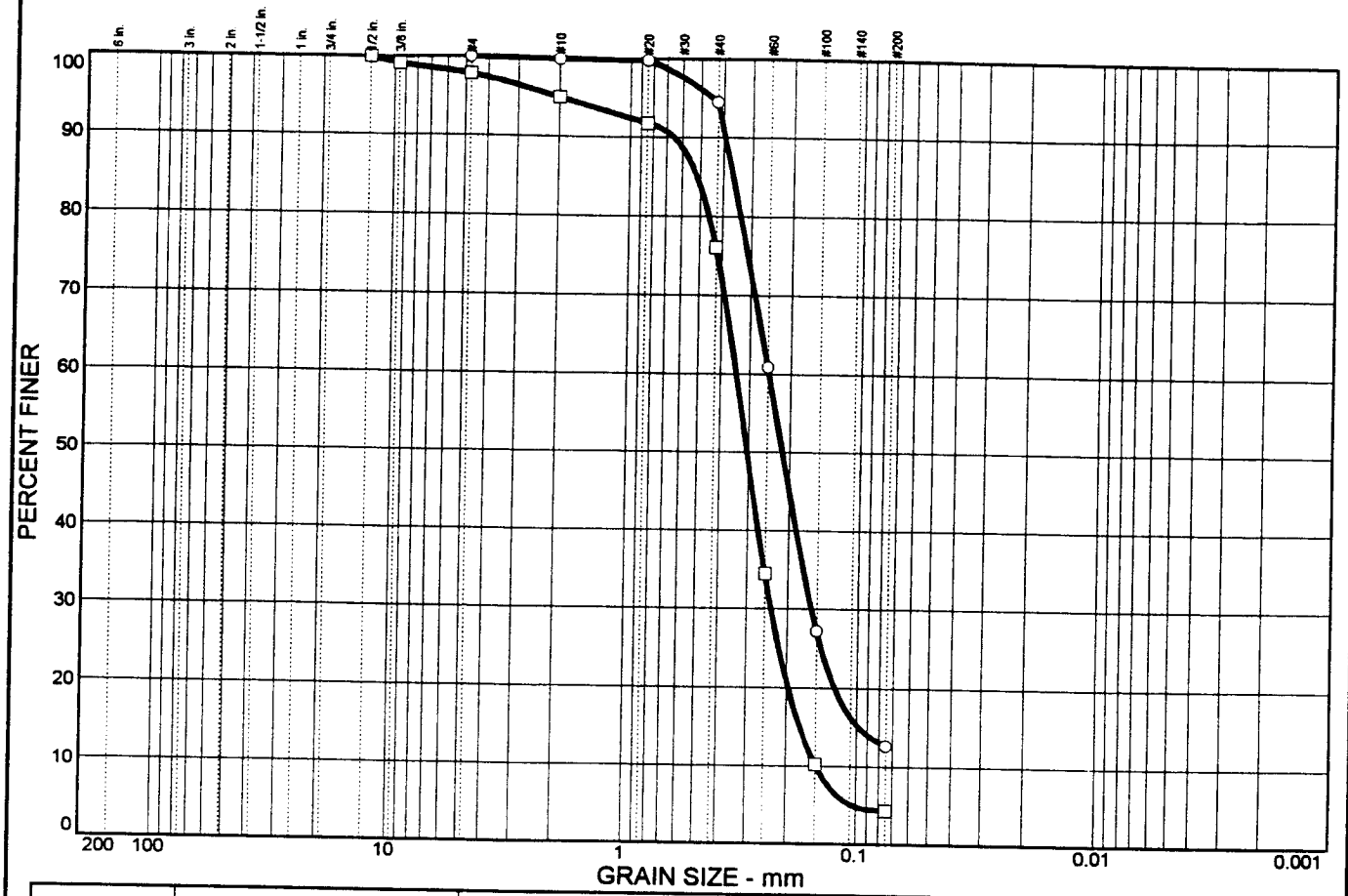
Figure No. B-5

AR 045333

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	5.4	81.8	12.7	
□	0.0	0.0	2.1	2.9	18.9	71.7	4.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.362	0.247	0.215	0.158	0.0969			
□			0.516	0.342	0.303	0.235	0.175	0.148	1.09	2.30

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Silty, medium to fine SAND	SM	21%
□ Medium to fine SAND	SP	25%

Remarks:

○

□

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B117 **Sample No.:** S-5

□ **Source:** HC00-B118 **Sample No.:** S-7

HARTCROWSER

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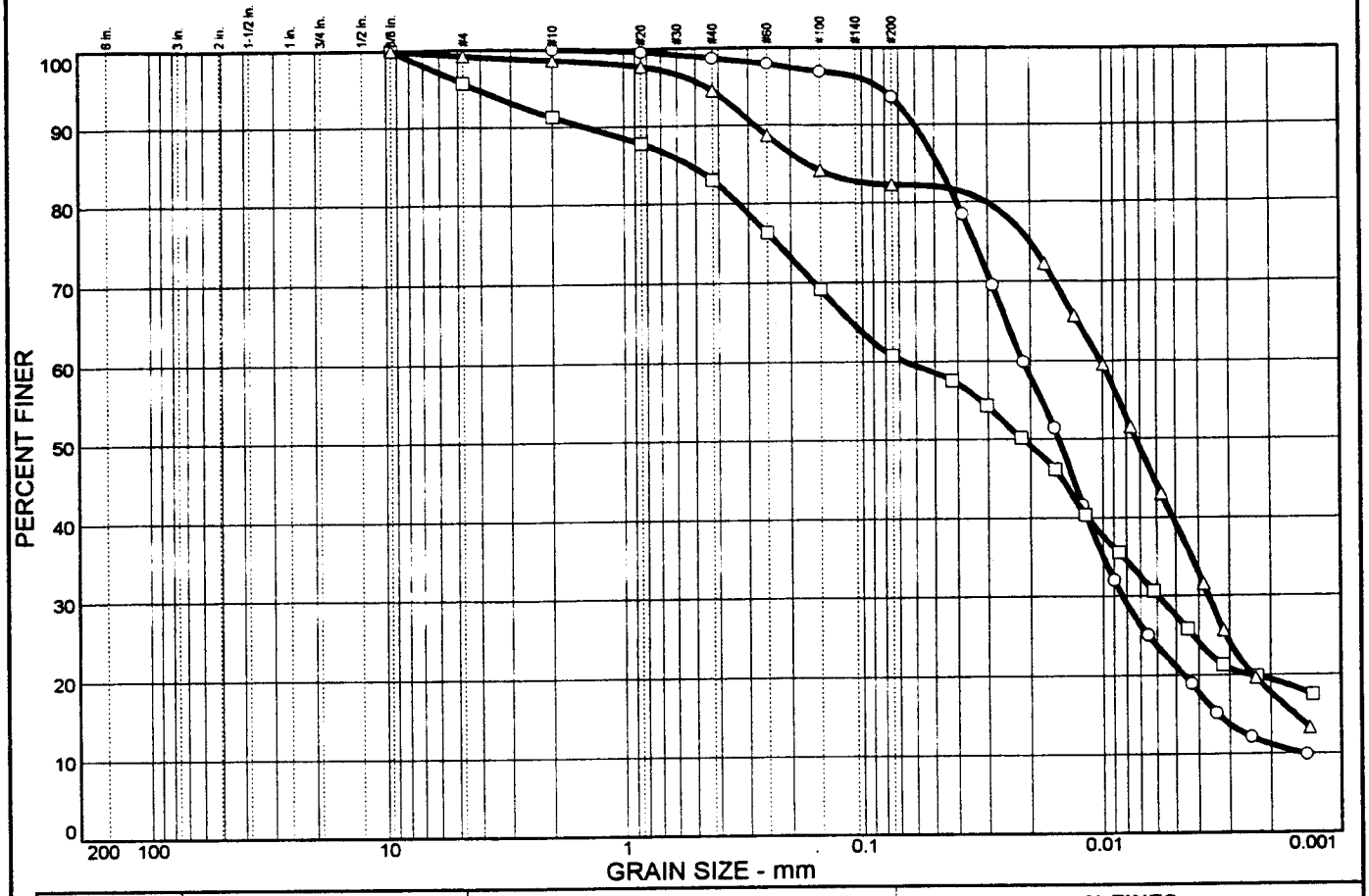
Figure No. B-6

AR 045334

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	1.3	5.1	72.4	21.2
□	0.0	0.0	4.3	4.4	8.3	22.2	33.3	27.5
△	0.0	0.0	0.8	0.6	4.1	12.2	43.0	39.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	4	0.0483	0.0215	0.0152	0.0083	0.0033	0.0015	2.20	14.80
□	29	14	0.531	0.0666	0.0216	0.0059				
△	41	16	0.169	0.0102	0.0073	0.0036	0.0016			

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly sandy, clayey SILT	ML	32%
□ Very sandy, lean CLAY	CL	20%
△ Very clayey SILT	CL	25%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B118 **Sample No.:** S-2

□ **Source:** HC00-B118 **Sample No.:** S-4

△ **Source:** HC00-B118 **Sample No.:** S-6

HARTCROWSER

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Figure No. B-7

AR 045335

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	6.1	0.2	0.2	2.2	77.7	13.6	
□	0.0	0.0	10.7	2.9	13.1	61.0	12.3	
△	0.0	7.5	9.7	11.9	39.2	28.5	3.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.331	0.210	0.186	0.140	0.0833			
□			1.36	0.357	0.311	0.211	0.0922			
△			5.80	1.06	0.714	0.408	0.281	0.236	0.66	4.51

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, silty, fine SAND	SM	21%
□ Slightly gravelly, silty, medium to fine SAND	SM	18%
△ Gravelly SAND	SP	17%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B107 **Sample No.:** S-5

□ **Source:** HC00-B124 **Sample No.:** S-6

△ **Source:** HC00-B126 **Sample No.:** S-3

HARTCROWSER

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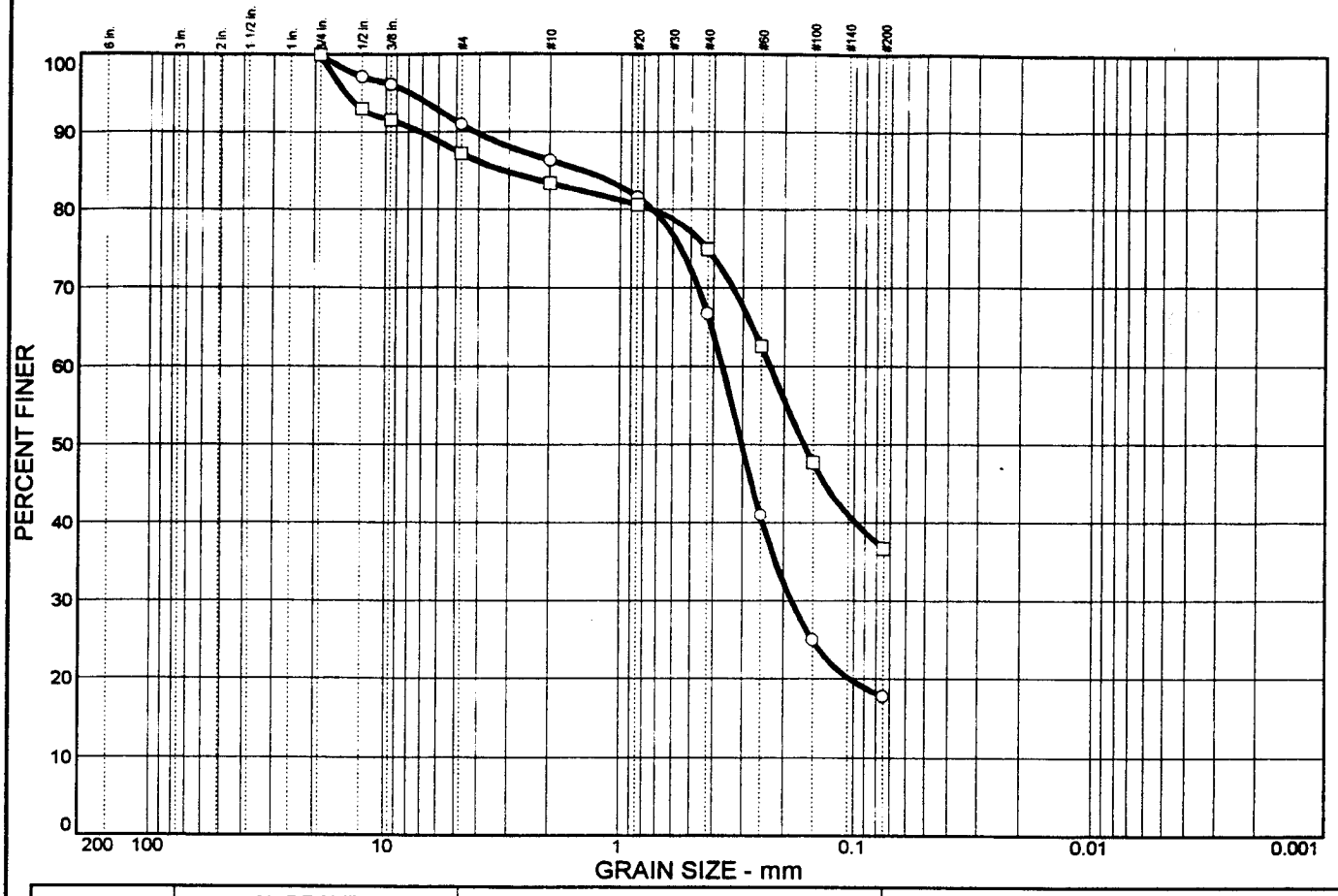
Figure No. B-8

AR 045336

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	9.0	4.7	19.6	48.9	17.8	
□	0.0	0.0	12.8	3.8	8.5	38.3	36.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.44	0.366	0.301	0.185				
□			3.12	0.229	0.164					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, silty, medium to fine SAND	SM	20%
□ Gravelly, very silty, medium to fine SAND	SM	17%

Remarks:

○

□

Project: Third Runway West Wall

Client: HNTB

○ **Source:** HC00-B127 **Sample No.:** S-1

□ **Source:** HC00-B131 **Sample No.:** S-2

HARTCROWSER

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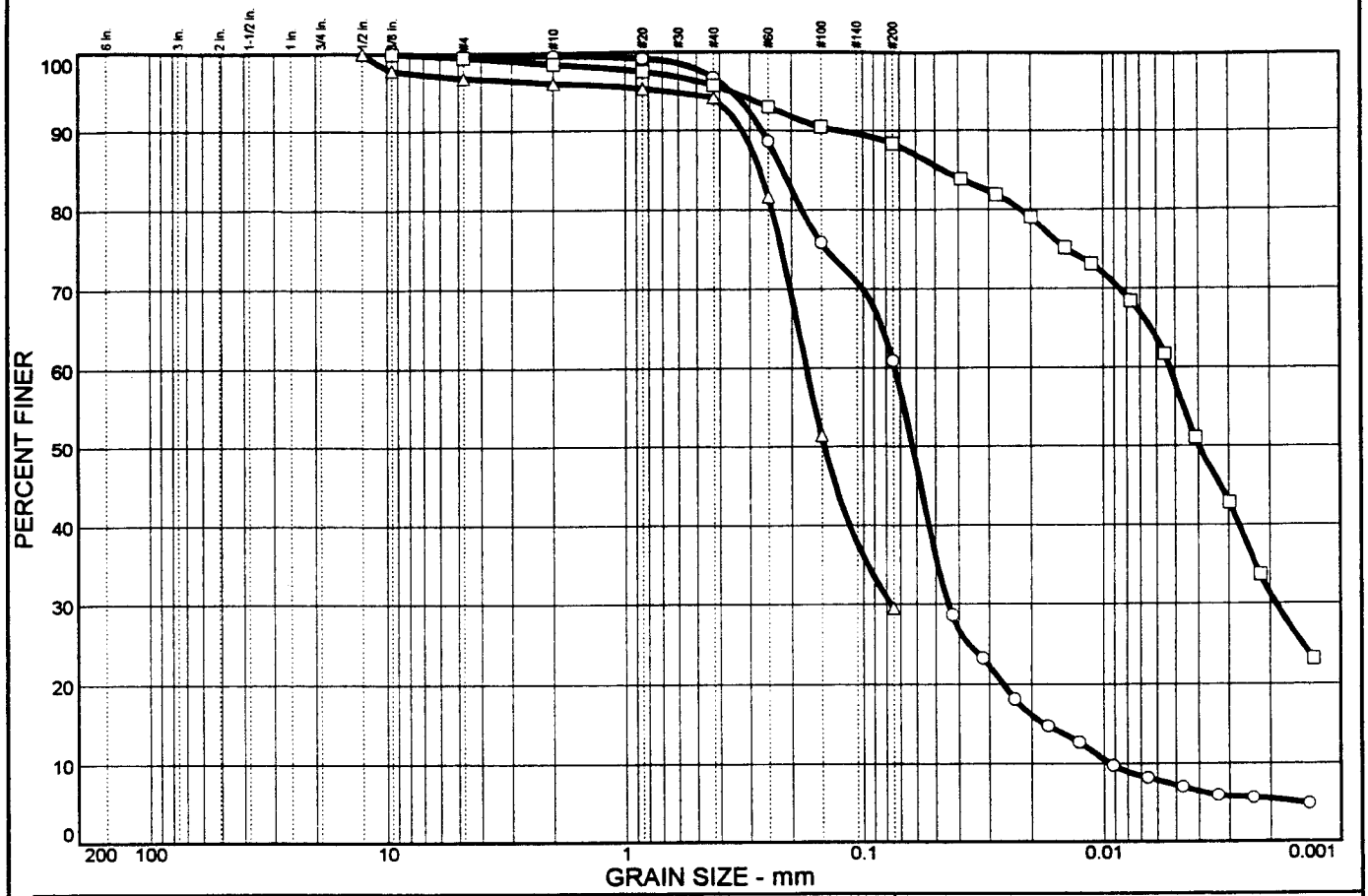
Figure No. B-9

AR 045337

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.2	0.2	2.8	35.9	53.7	7.2
□	0.0	0.0	0.5	0.9	2.8	7.4	30.3	58.1
△	0.0	0.0	3.1	0.8	1.9	64.7	29.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.217	0.0736	0.0622	0.0443	0.0175	0.0094	2.83	7.84
□	38	15	0.0464	0.0053	0.0040	0.0019				
△			0.271	0.173	0.146	0.0768				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Very sandy SILT	ML	18%
□ Slightly sandy, lean CLAY	CL	29%
△ Silty, fine SAND	SM	25%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B115 **Sample No.:** S-4

□ **Source:** HC00-B129 **Sample No.:** S-3

△ **Source:** HC00-B140 **Sample No.:** S-5

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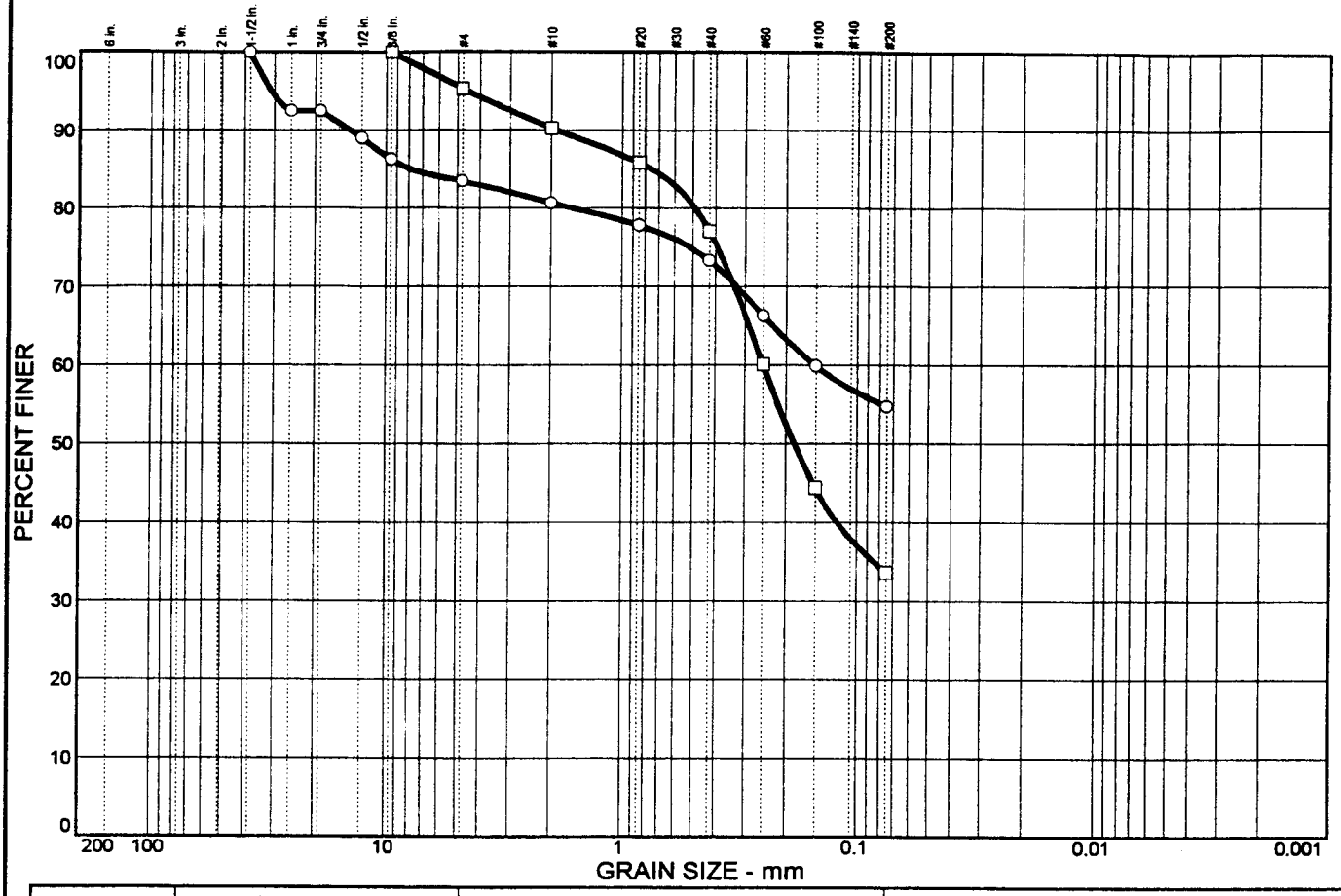
Figure No. B-10

AR 045338

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	7.5	9.0	2.8	7.4	18.5	54.8	
□	0.0	0.0	4.6	5.1	13.2	43.5	33.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.74	0.151						
□			0.742	0.249	0.184					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Gravelly, sandy SILT	ML	15%
□ Very silty SAND	SM	14%

Remarks:

○

□

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B134 **Sample No.:** S-2

□ **Source:** HC00-B134 **Sample No.:** S-5

HARTCROWSER

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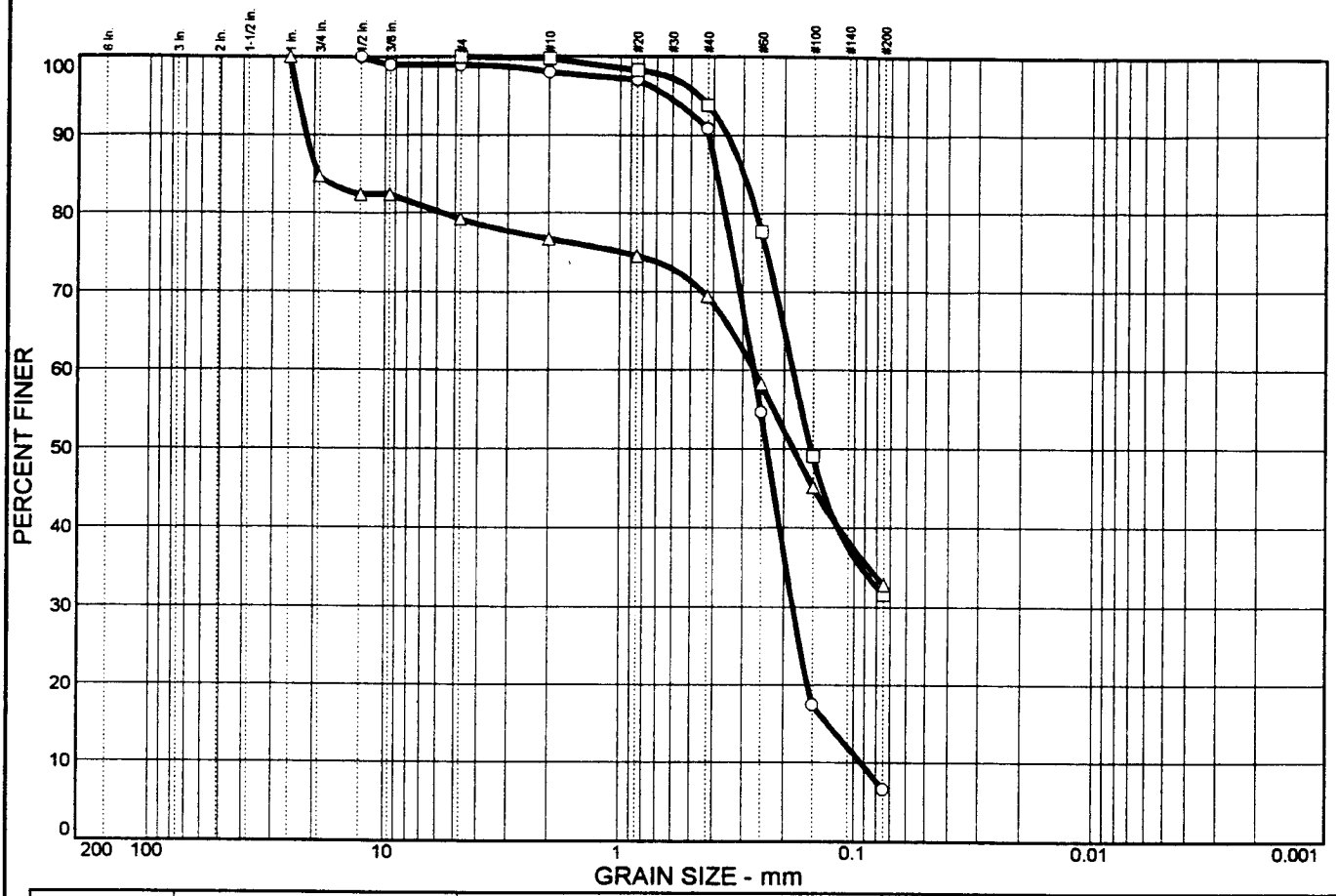
Figure No. B-11

AR 045339

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.0	1.0	7.1	84.2	6.7	
□	0.0	0.0	0.0	0.3	5.8	62.3	31.6	
△	0.0	15.3	5.4	2.6	7.3	36.6	32.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.387	0.268	0.236	0.183	0.128	0.0927	1.34	2.89
□			0.297	0.183	0.153					
△			19.2	0.267	0.182					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly silty, medium to fine SAND	SP-SM	27%
□ Very silty, medium to fine SAND	SM	26%
△ Gravelly, very silty, medium to fine SAND	SM	13%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B129 **Sample No.:** S-4

□ **Source:** HC00-B139 **Sample No.:** S-2

△ **Source:** HC00-B140 **Sample No.:** S-6

HARTCROWSER

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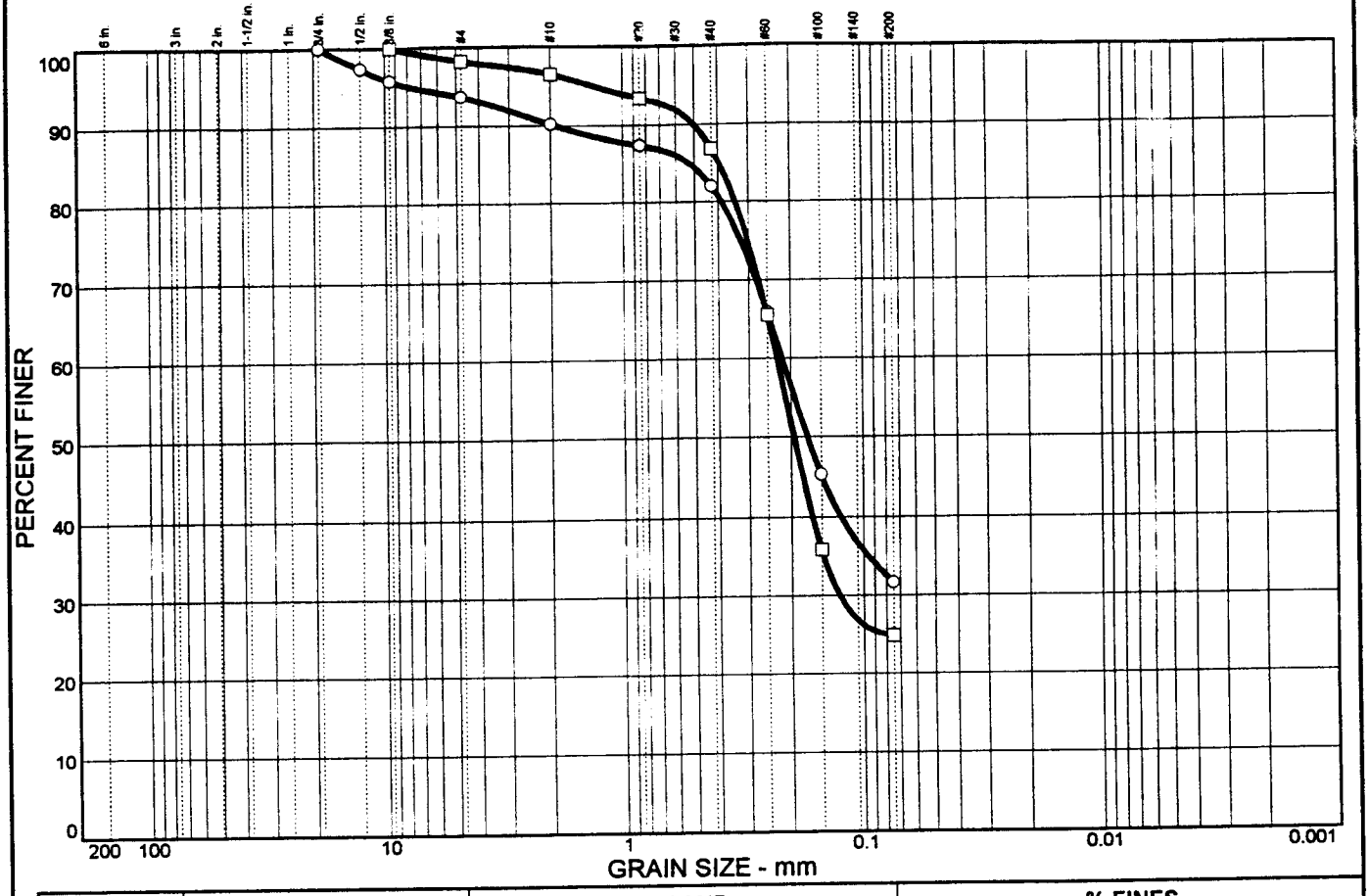
Figure No. B-12

AR 045340

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	6.2	3.6	8.2	50.3	31.7	
□	0.0	0.0	1.7	1.7	9.7	62.0	24.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.524	0.217	0.171					
□			0.395	0.228	0.194	0.126				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, very silty, medium to fine SAND	SM	20%
□ Silty, medium to fine SAND	SM	21%

Remarks:

○

□

Project: Third Runway West Wall

Client: HNTB

○ **Source:** HC00-B141 **Sample No.:** S-3

□ **Source:** HC00-B145 **Sample No.:** S-3

HARTCROWSER

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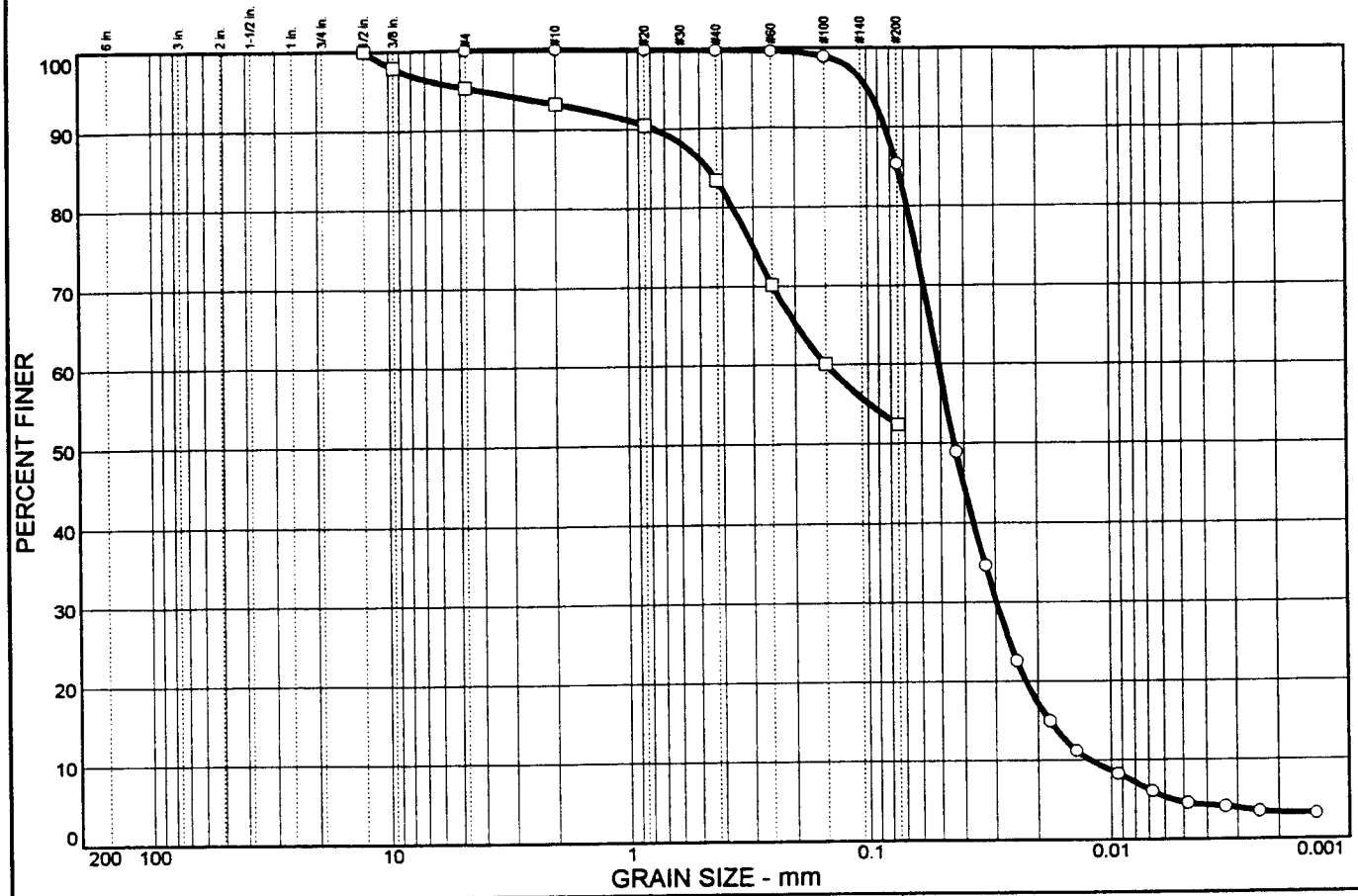
Figure No. B-13

AR 045341

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	0.2	14.5	80.7	4.6
□	0.0	0.0	4.7	2.1	9.8	30.9	52.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	25	NP	0.0746	0.0509	0.0439	0.0296	0.0178	0.0121	1.42	4.19
□			0.464	0.149						

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Sandy SILT	ML	26%
□ Very sandy SILT–CLAY	ML	14%

Remarks:

○

□

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B142 **Sample No.:** S-3

□ **Source:** HC00-B146 **Sample No.:** S-3

HARTCROWSER

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Figure No. B–14

AR 045342

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	5.7	4.3	14.0	36.4	39.6	
□	0.0	0.0	0.3	0.6	8.9	78.8	11.4	
△	0.0	0.0	5.5	2.9	13.1	40.7	37.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.760	0.247	0.164					
□			0.391	0.267	0.232	0.172	0.116			
△			0.607	0.239	0.167					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, very silty, medium to fine SAND	SM	11%
□ Slightly silty, medium to fine SAND	SP-SM	26%
△ Slightly gravelly, very silty, medium to fine SAND	SM	13%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-B142 **Sample No.:** S-6

□ **Source:** HC00-B144 **Sample No.:** S-2

△ **Source:** HC00-B146 **Sample No.:** S-4

HARTCROWSER

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Figure No. B-15

AR 045343

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.1	0.2	6.5	73.4	19.8	
□	0.0	7.8	14.2	5.2	13.6	32.8	26.4	
△	0.0	0.0	0.0	0.1	1.5	88.3	10.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.353	0.227	0.197	0.139				
□			13.9	0.441	0.301	0.114				
△			0.267	0.196	0.177	0.138	0.0959			

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Silty, medium to fine SAND	SM	26
□ Gravelly, silty SAND	SM	17%
△ Slightly silty, fine SAND	SP-SM	31%

Remarks:

○

□

△

Project: Third Runway

Client: HNTB

○ **Source:** HC00-A100 **Sample No.:** S-2

□ **Source:** HC00-A105 **Sample No.:** S-2

△ **Source:** HC00-A109 **Sample No.:** S-4

HARTCROWSER

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Figure No. B-16

AR 045344

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.5	6.5	62.9	30.1	
□	0.0	0.0	0.4	1.1	6.6	57.4	34.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.347	0.210	0.175					
□			0.332	0.195	0.159					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Very silty, medium to fine SAND	SM	29%
□ Very silty, medium to fine SAND	SM	39%

Remarks:

○

□

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-A137 **Sample No.:** S-3

□ **Source:** HC00-A143 **Sample No.:** S-3

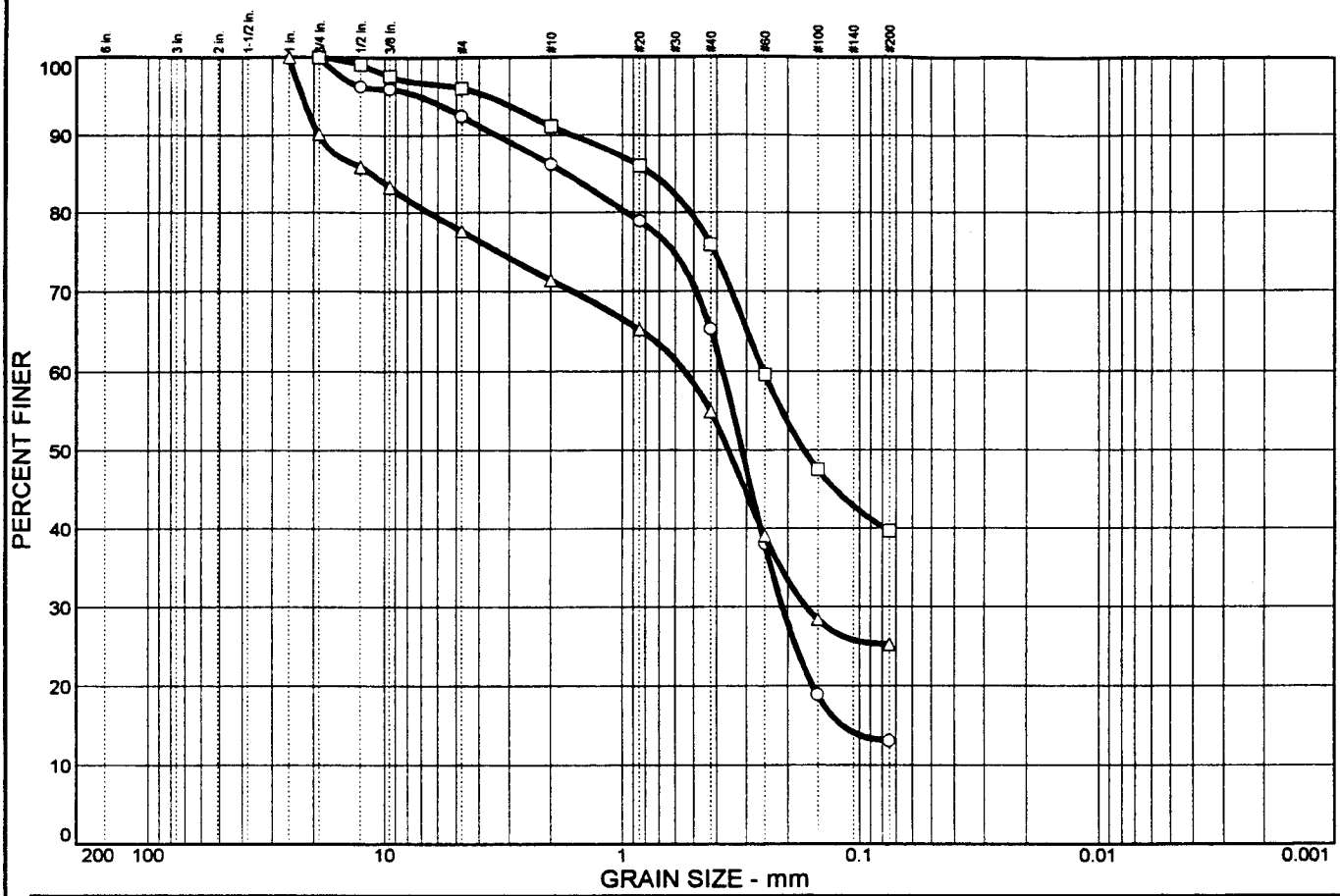
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-17

AR 045345

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	7.6	6.3	20.8	52.2	13.1	
□	0.0	0.0	4.0	4.8	15.3	36.3	39.6	
△	0.0	9.9	12.5	6.2	16.5	29.7	25.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.74	0.378	0.312	0.211	0.118			
□			0.762	0.253	0.171					
△			11.4	0.545	0.357	0.168				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slighlty gravelly, silty SAND	SM	13%
□ Very silty, medium to fine SAND	SM	12%
△ Gravelly, silty SAND	SM	15%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-TP100 **Sample No.:** S-2

□ **Source:** HC00-TP102 **Sample No.:** S-3

△ **Source:** HC00-TP103 **Sample No.:** S-1

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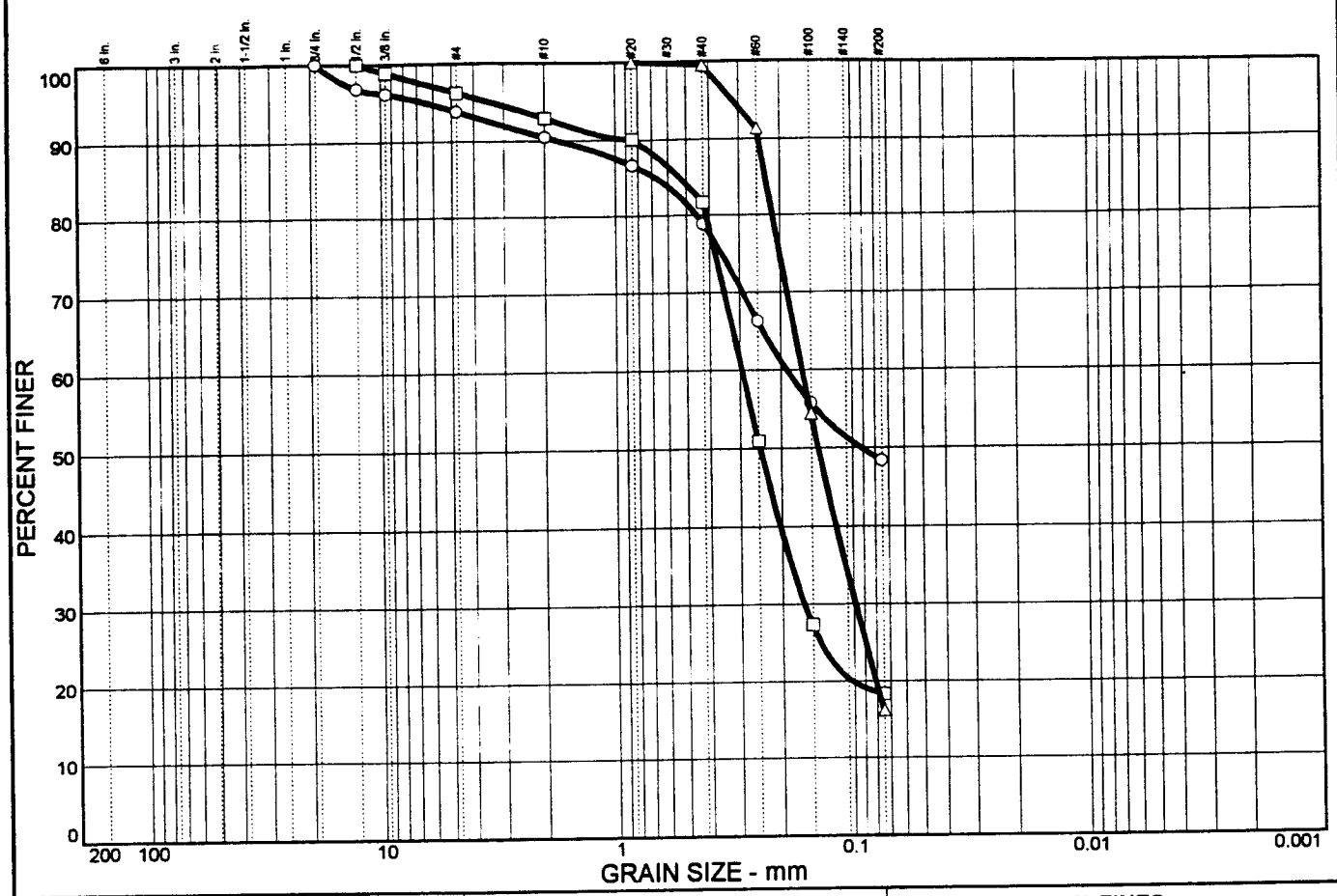
J4978-21 3/10/2000

Figure No. B-18

AR 045346

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	6.1	3.4	11.6	30.6	48.3	
□	0.0	0.0	3.7	3.3	11.3	63.4	18.3	
△	0.0	0.0	0.0	0.0	0.5	83.3	16.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.672	0.189	0.0916					
□			0.531	0.293	0.246	0.162				
△			0.230	0.163	0.140	0.0982				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, very silty, medium to fine SAND	SM	26%
□ Silty, medium to fine SAND	SM	20%
△ Silty, fine SAND	SM	27%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-TP104 **Sample No.:** S-3

□ **Source:** HC00-TP106 **Sample No.:** S-4

△ **Source:** HC00-TP108 **Sample No.:** S-4

HARTCROWSER

J4978-21 3/10/2000

Figure No. B-19

AR 045347

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	7.9	17.0	4.6	12.8	42.1	15.6	
□	0.0	0.0	0.0	0.0	4.8	86.2	9.0	
△	0.0	0.0	8.2	3.0	11.8	41.9	35.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			13.5	0.465	0.338	0.195				
□			0.356	0.243	0.213	0.161	0.113	0.0831	1.29	2.92
△			0.776	0.251	0.181					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Silty, gravelly, medium to fine SAND	SM	17%
□ Slightly silty, fine SAND	SP-SM	6%
△ Slightly gravelly, very silty, medium to fine SAND	SM	13%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-TP114 **Sample No.:** S-2

□ **Source:** HC00-TP116 **Sample No.:** S-2

△ **Source:** HC00-TP118 **Sample No.:** S-3

HARTCROWSER

J4978-21 3/10/2000

Figure No. B-20

AR 045348

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.2	1.6	82.8	15.4	
□	0.0	0.0	15.7	5.0	14.3	36.1	28.9	
△	0.0	0.0	12.6	4.5	14.1	38.5	30.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.238	0.179	0.158	0.112				
□			5.80	0.357	0.261	0.0851				
△			3.04	0.319	0.236					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Silty, fine SAND	SM	13%
□ Gravelly, silty SAND	SM	14%
△ Gravelly, very silty, medium to fine SAND	SM	10%

Remarks:

○

□

△

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-TP120 **Sample No.:** S-1

□ **Source:** HC00-TP123 **Sample No.:** S-3

△ **Source:** HC00-TP125 **Sample No.:** S-3

HARTCROWSER

J4978-21 3/10/2000

Figure No. B-21

AR 045349

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	7.1	2.3	10.3	38.6	41.7	
□	0.0	0.0	2.3	0.3	1.9	29.7	65.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.564	0.211	0.137					
□			0.263							

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, very silty, medium to fine SAND	SM	13%
□ Very sandy SILT	ML	22%

Remarks:

○

□

Project: Third Runway Westside

Client: HNTB

○ **Source:** HC00-TP127 **Sample No.:** S-3

□ **Source:** HC00-TP129 **Sample No.:** S-2

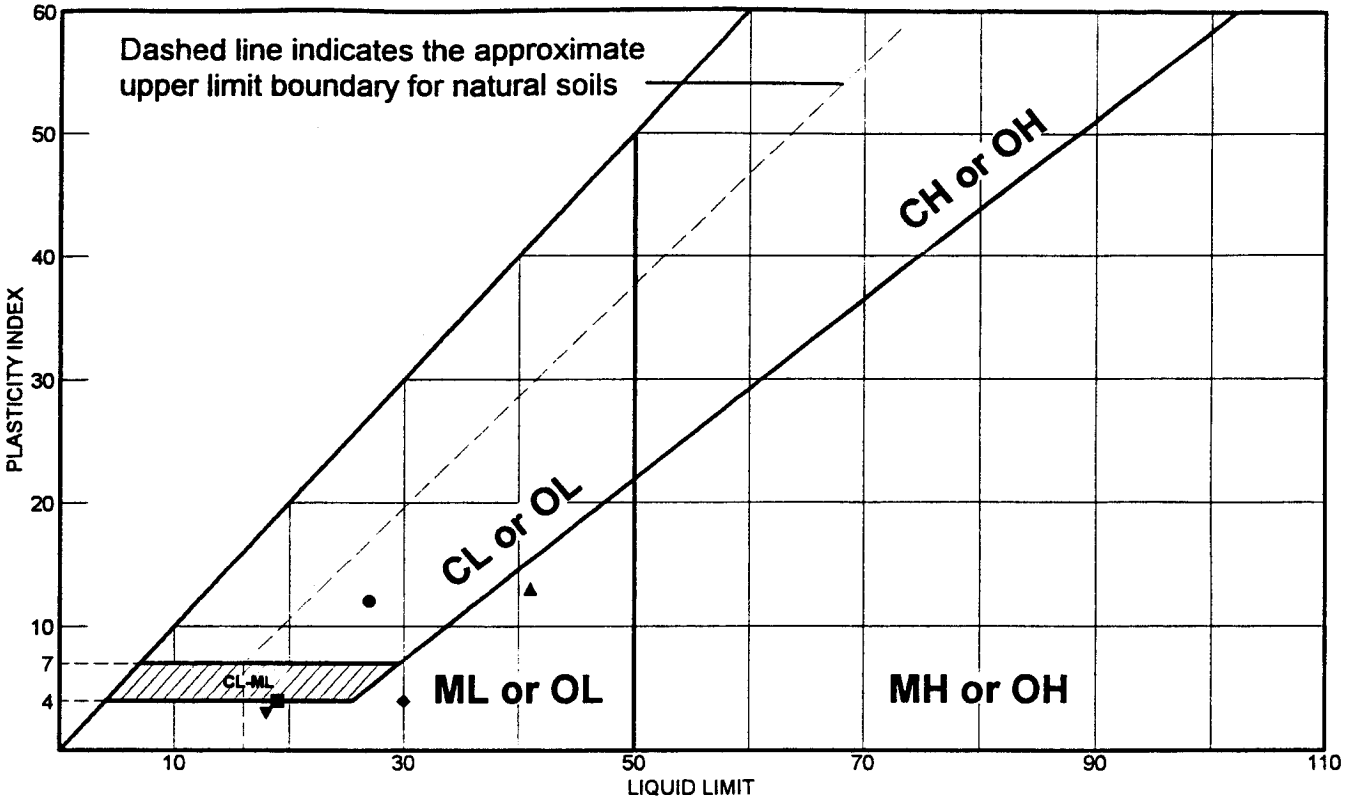
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-22

AR 045350

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-B107 Sample No.: S-3 Very sandy, lean CLAY	27	15	12	53.2	CL
■ Source: HC00-B110 Sample No.: S-4 Slightly sandy CLAY-SILT	19	15	4	89.7	CL-ML
▲ Source: HC00-B110 Sample No.: S-11 Very clayey SILT	41	28	13	98.4	ML
◆ Source: HC00-B111 Sample No.: S-3 Clayey SILT	30	26	4	97.6	ML
▼ Source: HC00-B111 Sample No.: S-6 Slightly clayey, gravelly, very silty, medium to fine SAND	18	15	3	46.3	SM

Remarks:

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Project: Third Runway Westside

Client: HNTB

Location:

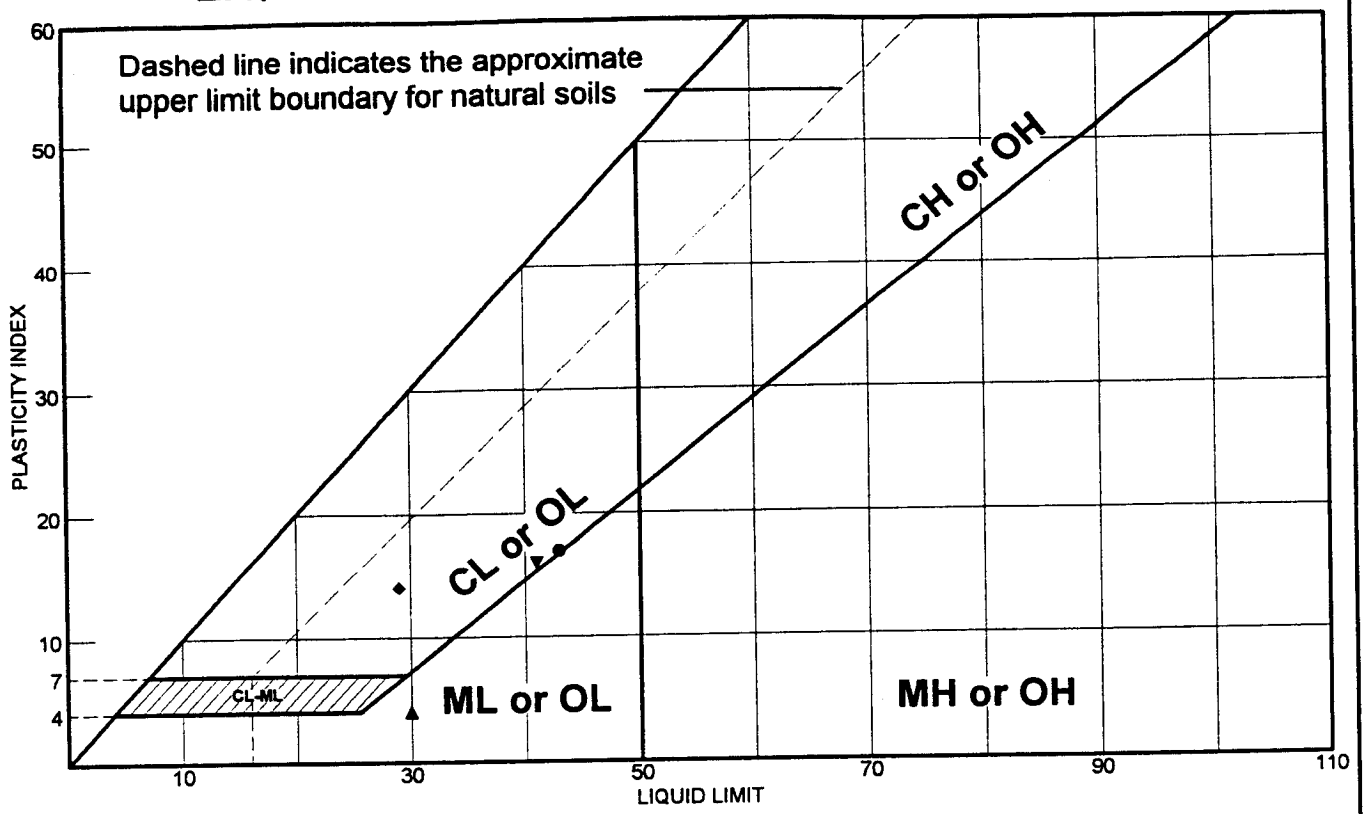
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-23

AR 045351

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC00-B111 Very clayey SILT	Sample No.: S-12	43	26	17	99.5	CL
■ Source: HC00-B115 Very sandy SILT	Sample No.: S-4	NV	NP	NP	60.9	ML
▲ Source: HC00-B118 Slightly sandy, clayey SILT	Sample No.: S-2	30	26	4	93.6	ML
◆ Source: HC00-B118 Very sandy, lean CLAY	Sample No.: S-4	29	15	14	60.8	CL
▼ Source: HC00-B118 Sandy, lean CLAY	Sample No.: S-6	41	25	16	82.3	CL

Remarks:

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Project: Third Runway Westside

Client: HNTB

Location:

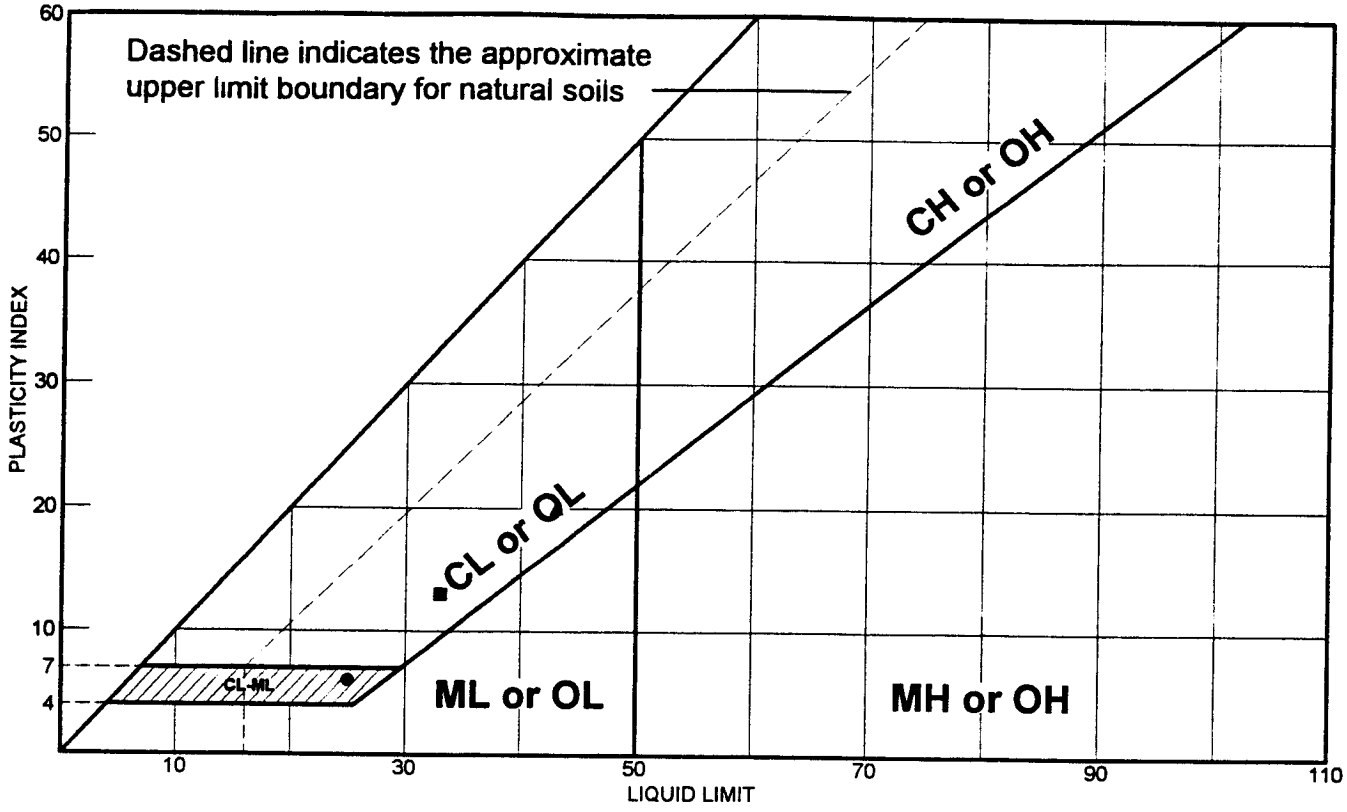
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-24

AR 045352

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-B114 Sample No.: S-2 CLAY-SILT	25	19	6		CL-ML
■ Source: HC00-B115 Sample No.: S-3 Lean CLAY	33	20	13		CL
▲ Source: HC00-B118 Sample No.: S-5 Lean CLAY	43	23	20		CL

Remarks:

●

■

▲

Project: Third Runway Westside

Client: HNTB

Location:

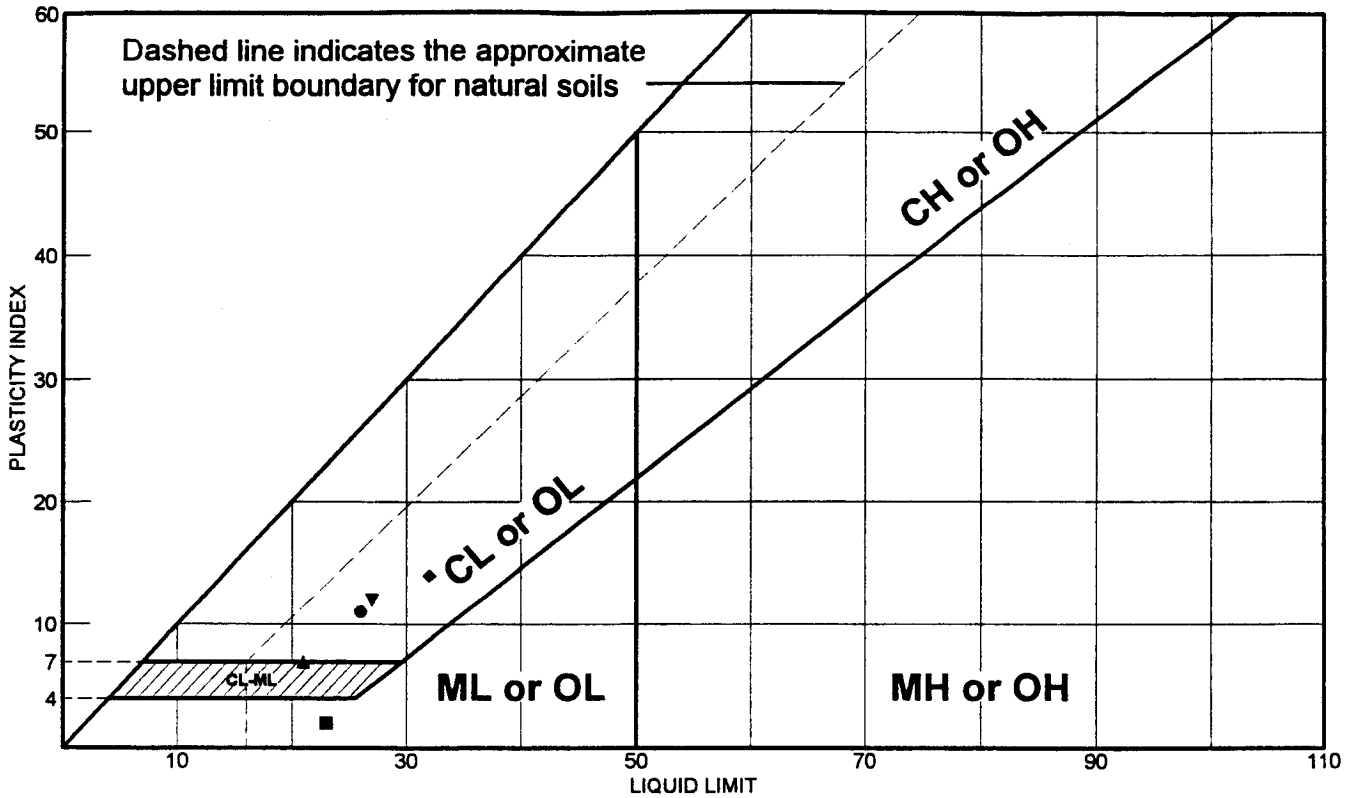
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-25

AR 045353

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-B107 Sample No.: S-2 Lean CLAY	26	15	11		CL
■ Source: HC00-B140 Sample No.: S-4 SILT	23	21	2		ML
▲ Source: HC00-B142 Sample No.: S-4 CLAY-SILT	21	14	7		CL-ML
◆ Source: HC00-B146 Sample No.: S-2 Lean CLAY	32	18	14		CL
▼ Source: HC00-A137 Sample No.: S-5 Lean CLAY	27	15	12		CL

Remarks:

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Project: Third Runway Westside

Client: HNTB

Location:

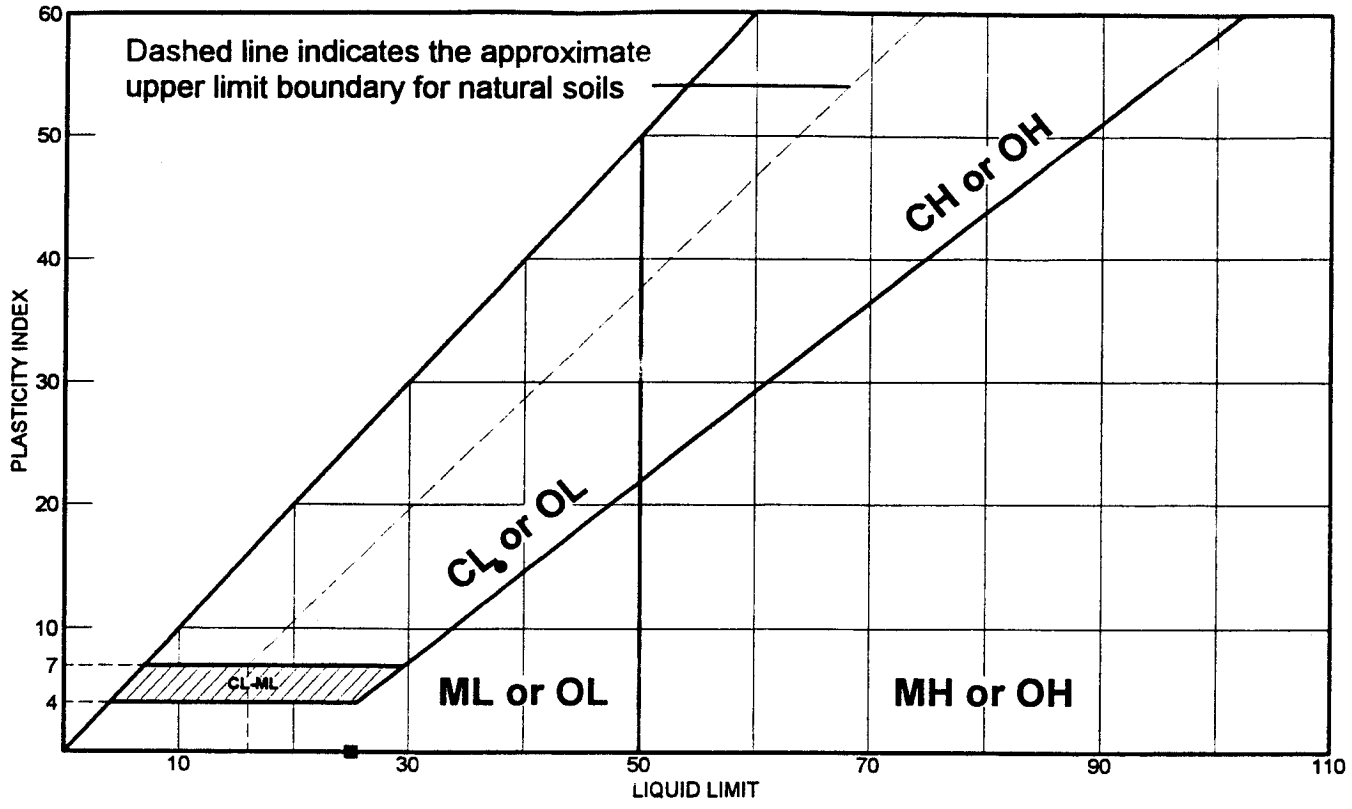
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-26

AR 045354

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description		LL	PL	PI	-200	USCS
●	Source: HC00-B129 Slightly sandy, lean CLAY	Sample No.: S-3	38	23	15	88.4	CL
■	Source: HC00-B142 Sandy SILT	Sample No.: S-3	25	27	NP	85.3	ML

Remarks:

●

■

Project: Third Runway Westside

Client: HNTB

Location:

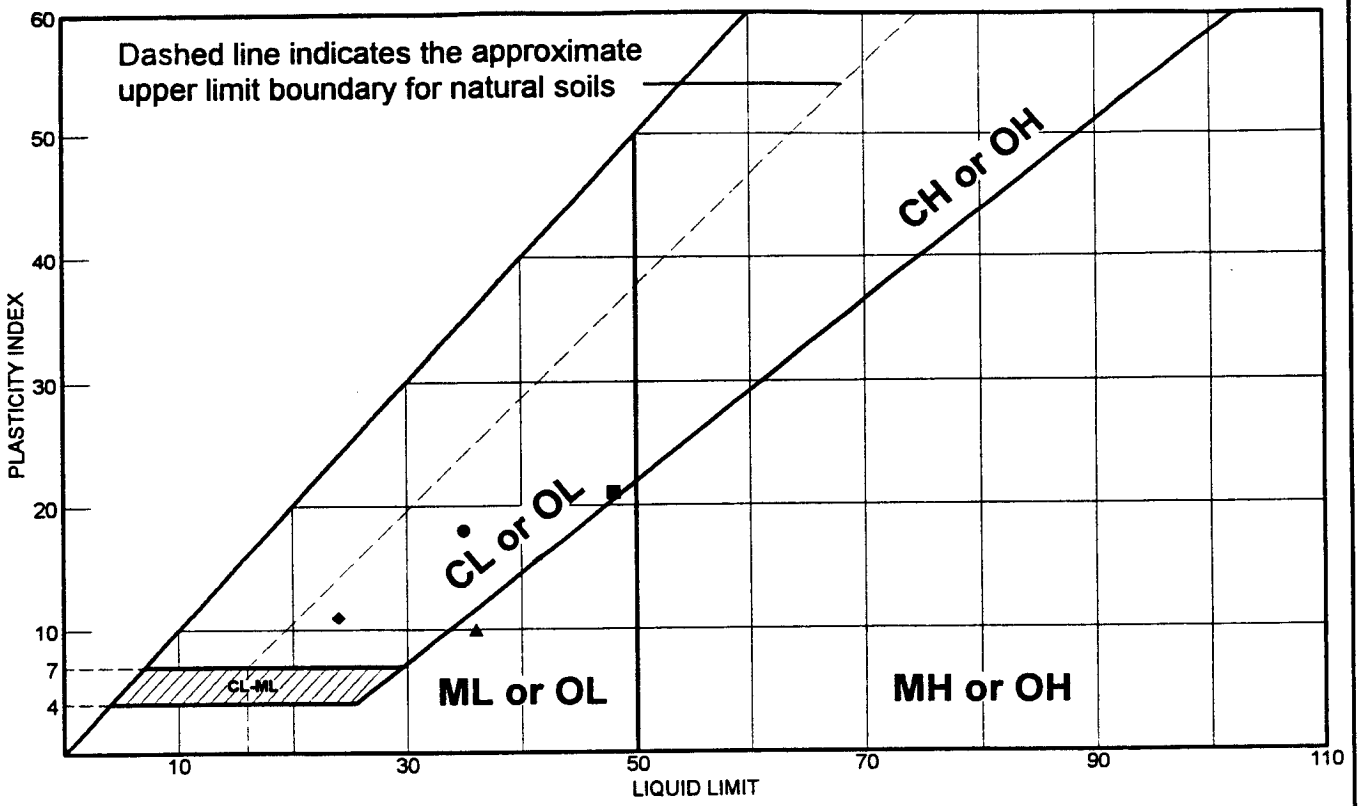
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-27

AR 045355

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-TP100 Sample No.: S-3 Lean CLAY	35	17	18		CL
■ Source: HC00-TP107 Sample No.: S-2 Lean CLAY	48	27	21		CL
▲ Source: HC00-TP108 Sample No.: S-2 SILT	36	26	10		ML
◆ Source: HC00-TP115 Sample No.: S-5 Lean CLAY	24	13	11		CL

Remarks:

●

■

▲

◆

Project: Third Runway Westside

Client: HNTB

Location:

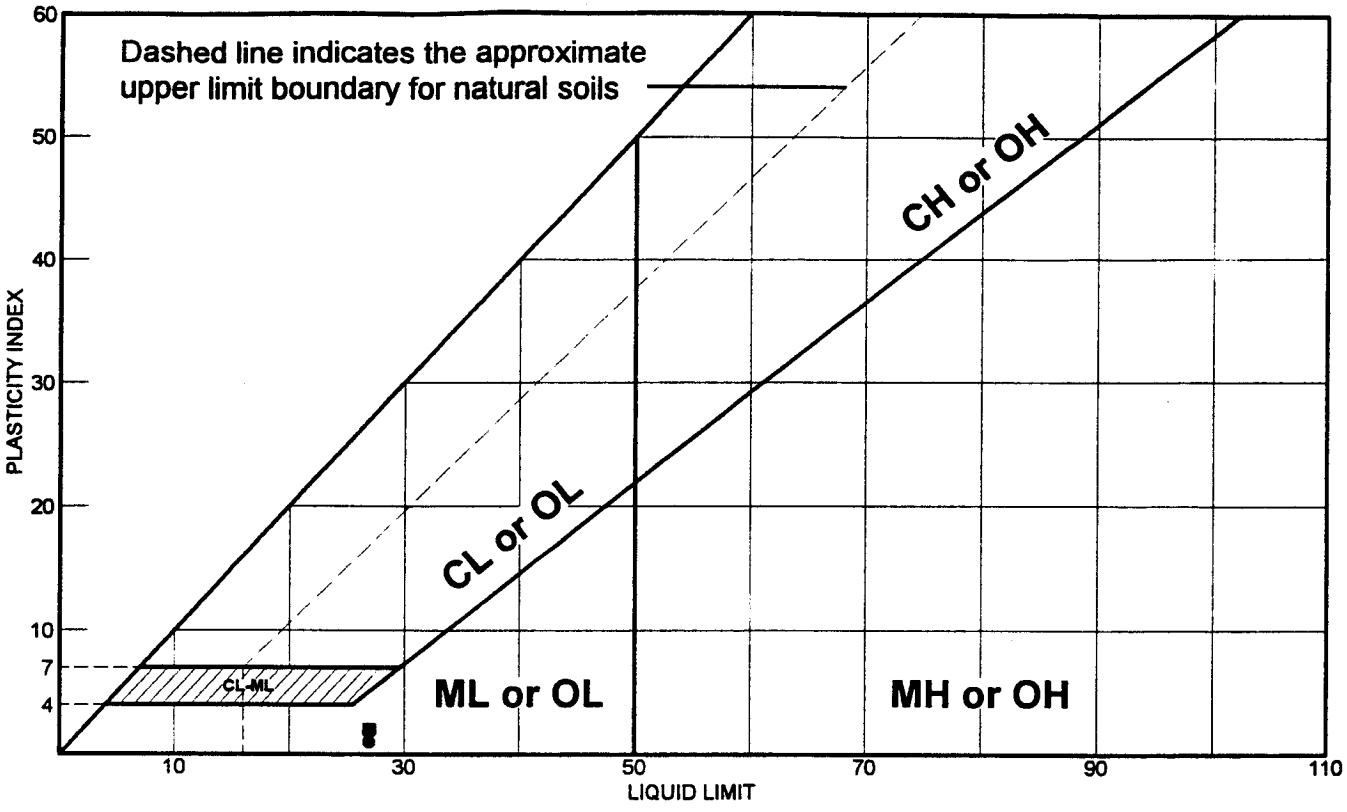
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-28

AR 045356

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-TP123 Sample No.: S-2 SILT	27	26	1		ML
■ Source: HC00-TP124 Sample No.: S-4 SILT	27	25	2		ML

Remarks:

●

■

Project: Third Runway Westside

Client: HNTB

Location:

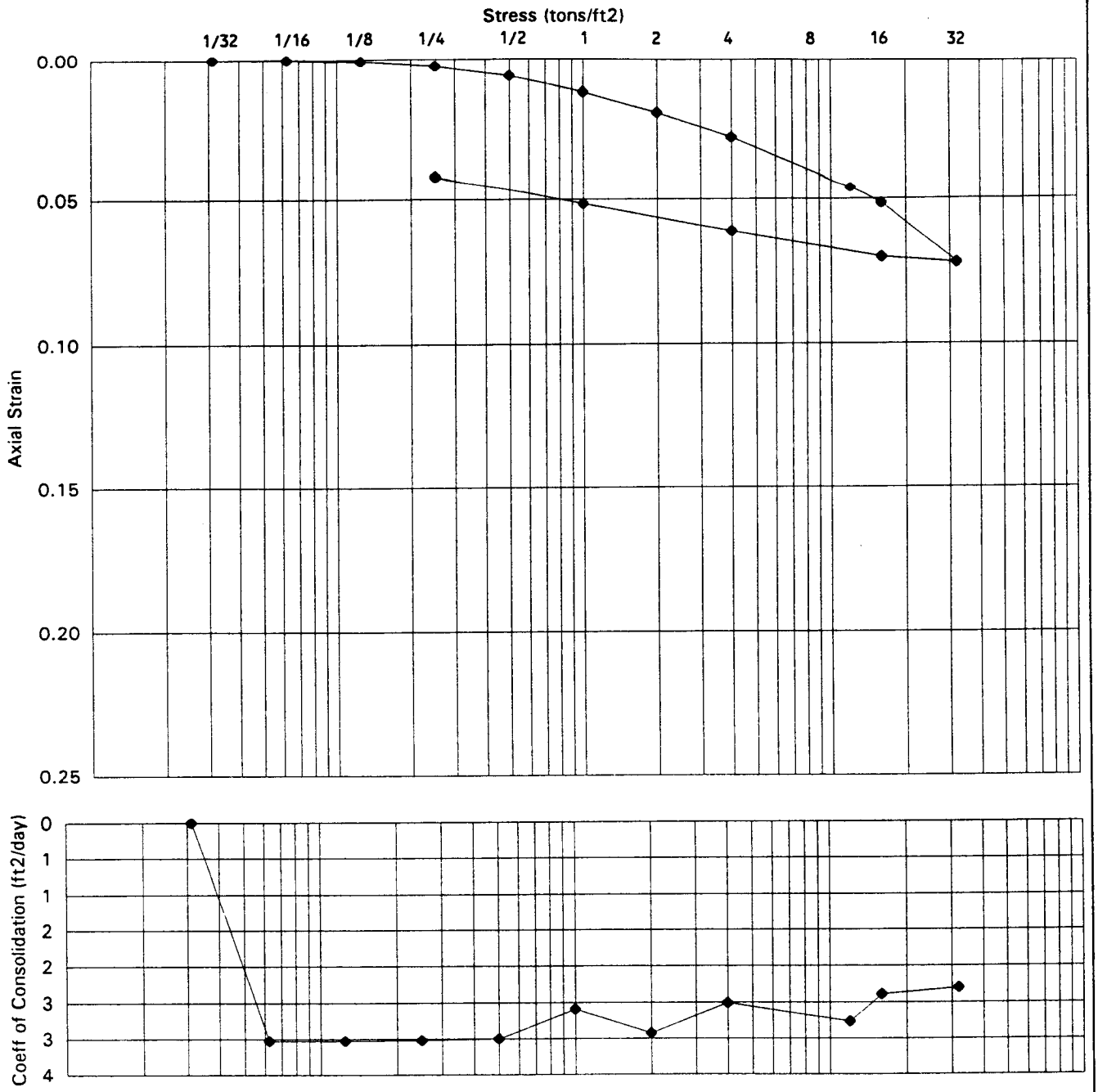
HARTCROWSER

J4978-21 3/10/2000

Figure No. B-29

AR 045357

CONSOLIDATION TEST RESULTS



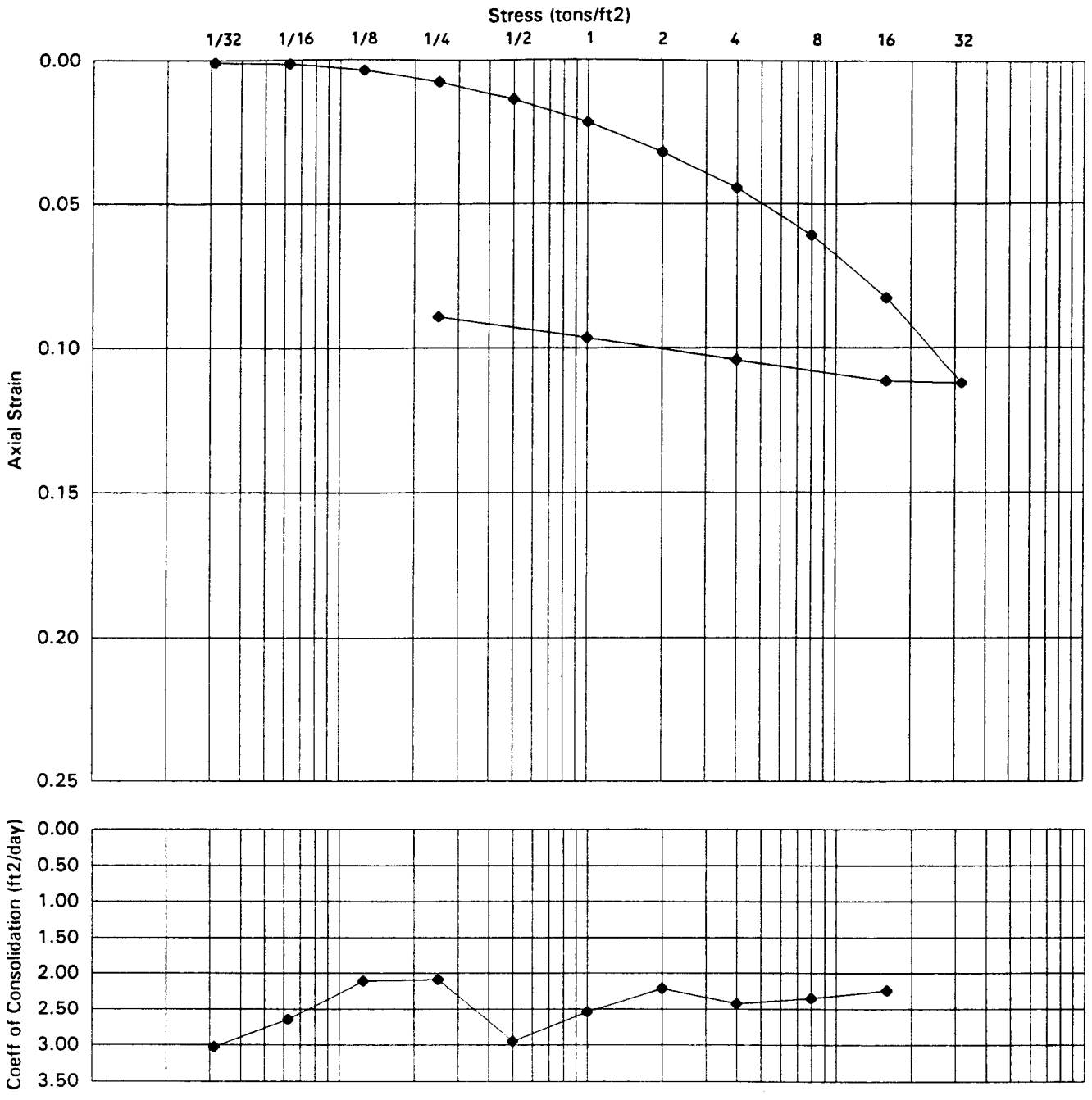
Expl. No.	Sample No.	Depth (ft)	W.C. % Before	W.C. % After	Atterberg Limit LL	Atterberg Limit PL	Atterberg Limit PI	Wet Wt (pcf)	USC	Description
B110	S-11	40.5'-41.8'	31%	31%	30	26	4	119 pcf	ML	Very clayey SILT

Remarks:

HARTCROWSER J-4978-21 2/29/2000
Figure B-30

AR 045358

CONSOLIDATION TEST RESULTS

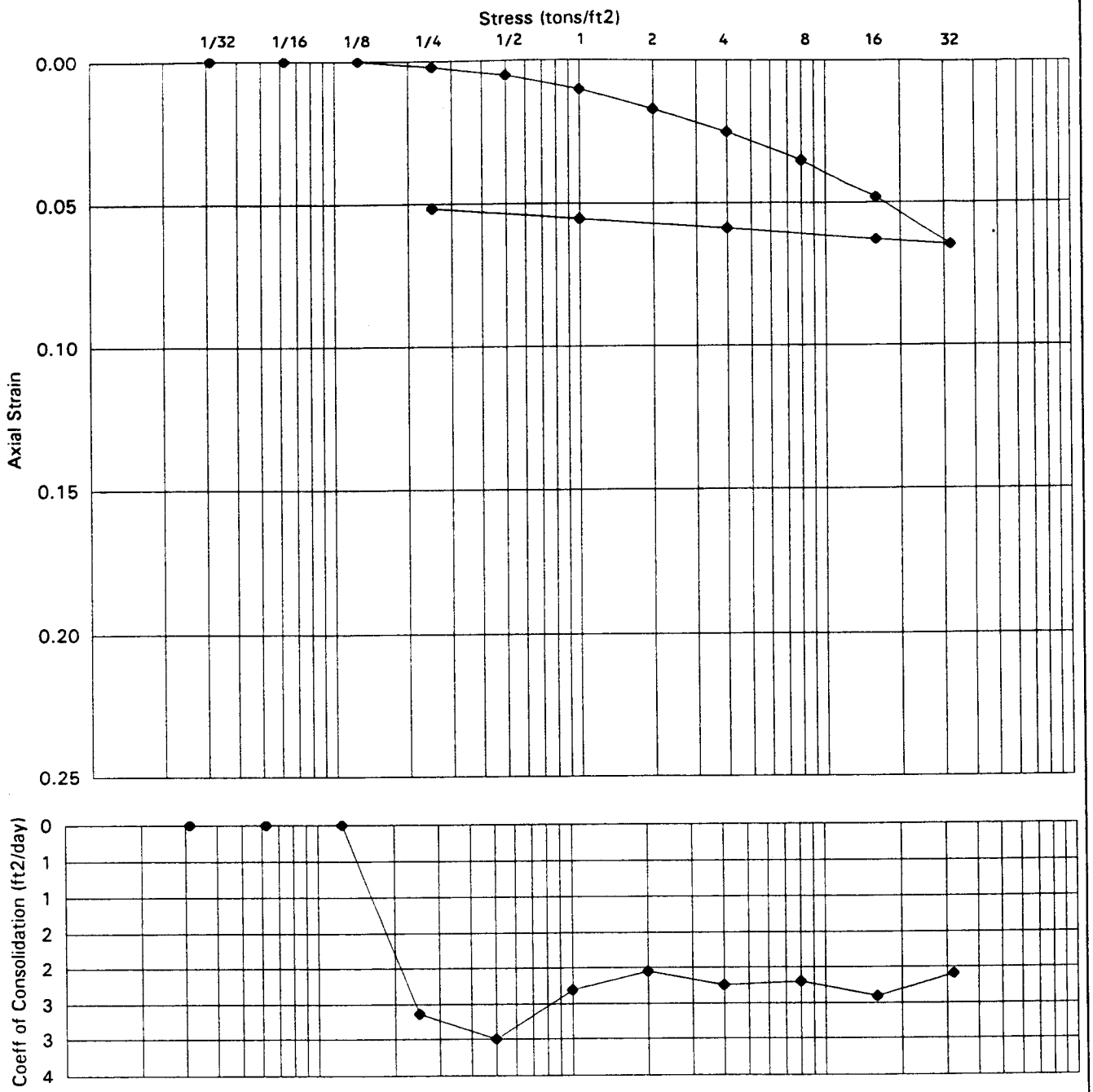


Expl. No.	Sample No.	Depth (ft)	W.C. % Before	W.C. % After	Atterberg Limit LL	Atterberg Limit PL	Atterberg Limit PI	Wet Wt (pcf)	USC	Description
B111	S-3	5.5'-7.5'	31%	28%	30	26	4	118 pcf	ML	Clayey SILT

Remarks:

HARTCROWSER J-4978-21 2/12/2000
Figure B-31

CONSOLIDATION TEST RESULTS

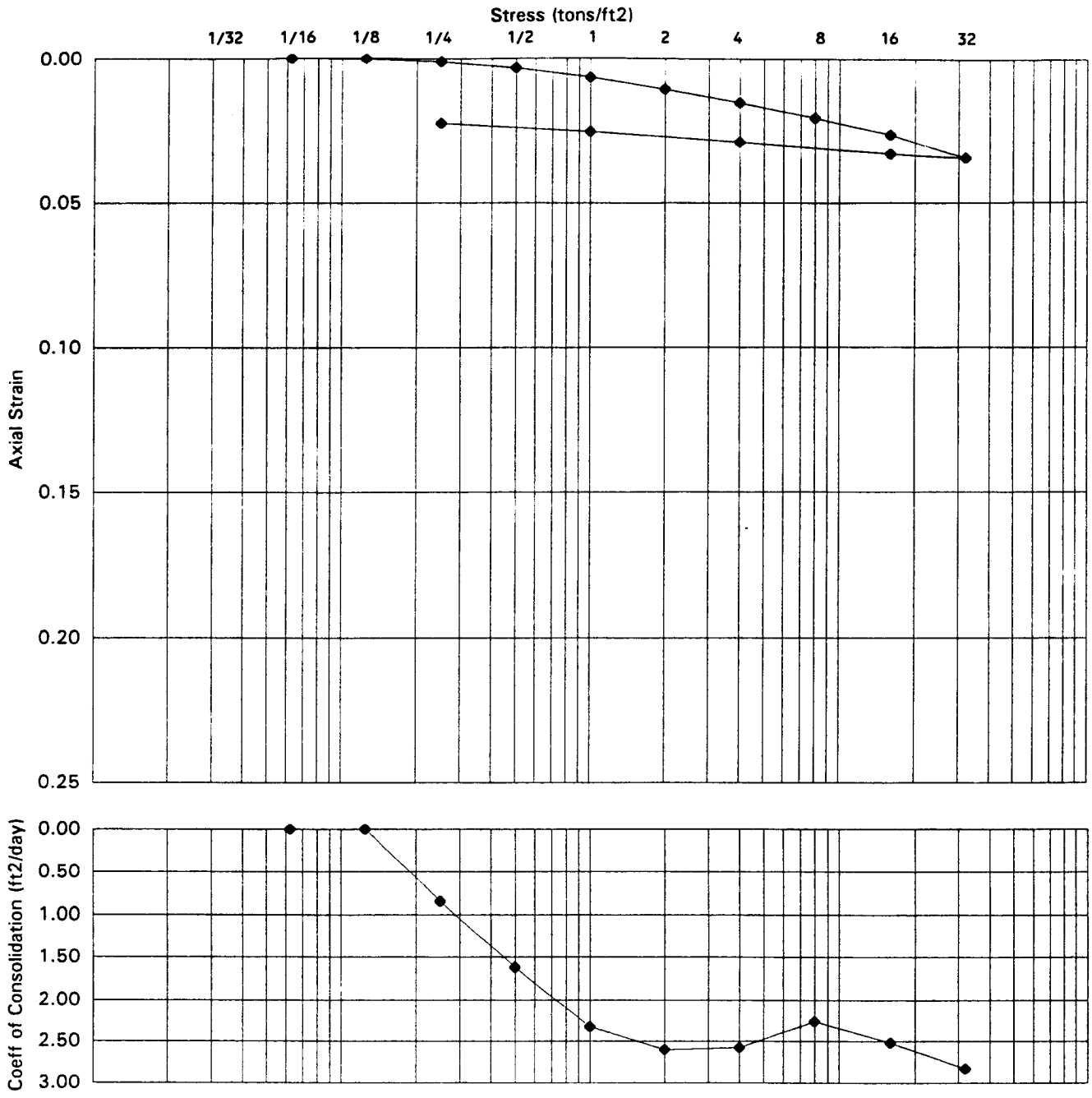


Expl. No.	Sample No.	Depth (ft)	W.C. %		Atterberg Limit			Wet Wt (pcf)	USC	Description
			Before	After	LL	PL	PI			
B111	S-6	15.5'-16.6'	15%	14%	18	15	3	135 pcf	SM	Grav., v. silty SAND

Remarks:

HARTCROWSER J-4978-21 3/2/2000
Figure B-32

CONSOLIDATION TEST RESULTS



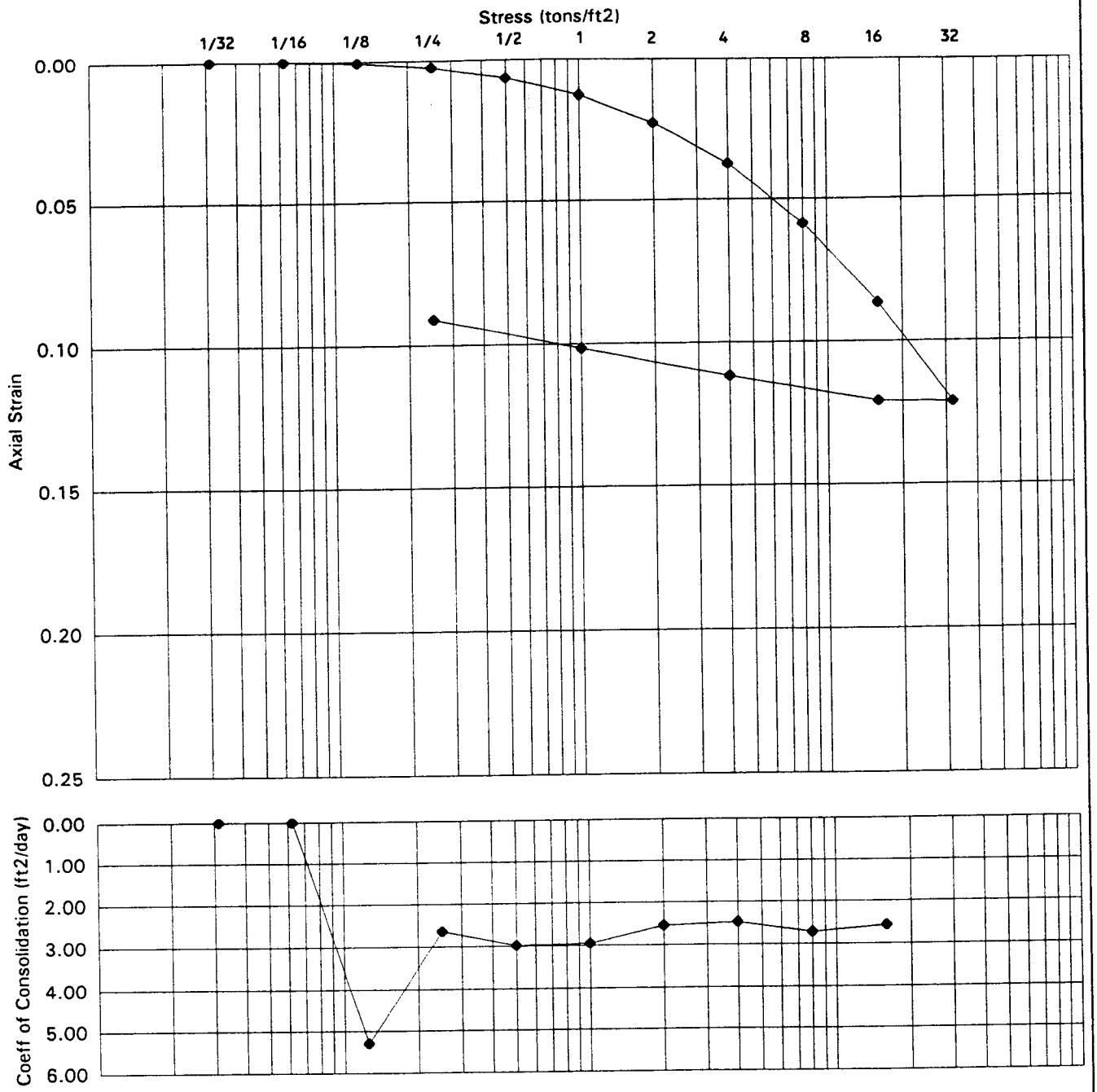
Expl. No.	Sample No.	Depth (ft)	W.C. % Before	W.C. % After	Atterberg Limit LL	Atterberg Limit PL	Atterberg Limit PI	Wet Wt (pcf)	USC	Description
B115	S-4	10'-11'	18%	18%	NV	NP		131 pcf	ML	Very sandy SILT

Remarks:

HARTCROWSER J-4978-21 3/6/2000
Figure B-33

AR 045361

CONSOLIDATION TEST RESULTS



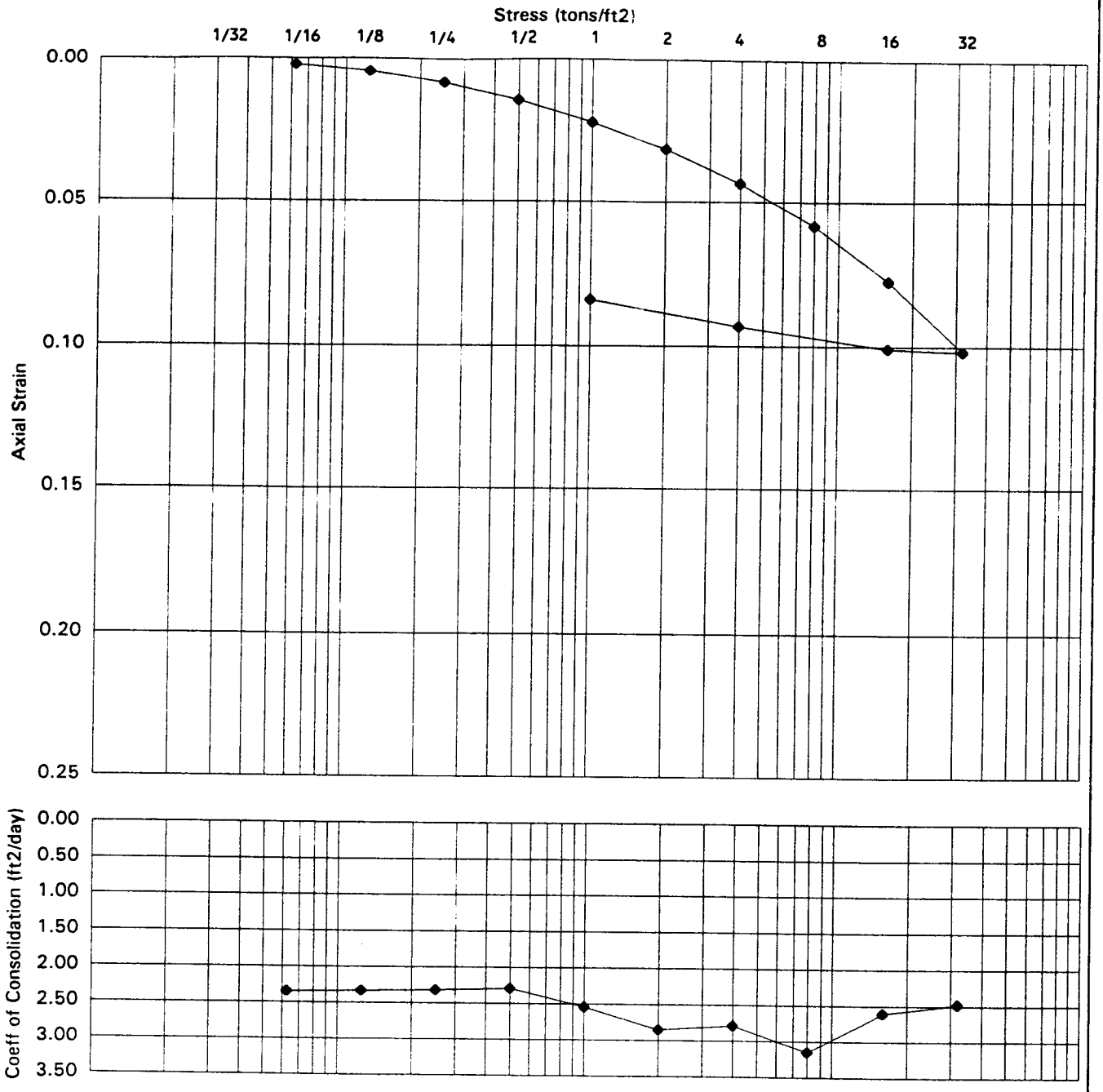
Expl. No.	Sample No.	Depth (ft)	W.C. %		Atterberg Limit			Wet Wt (pcf)	USC	Description
			Before	After	LL	PL	PI			
B118	S-2	5.5'-6.5'	32%	28%	30	26	4	119 pcf	ML	Sl. sandy, clayey SILT

Remarks:

HARTCROWSER J-4978-21 2/10/2000

Figure B-34

CONSOLIDATION TEST RESULTS

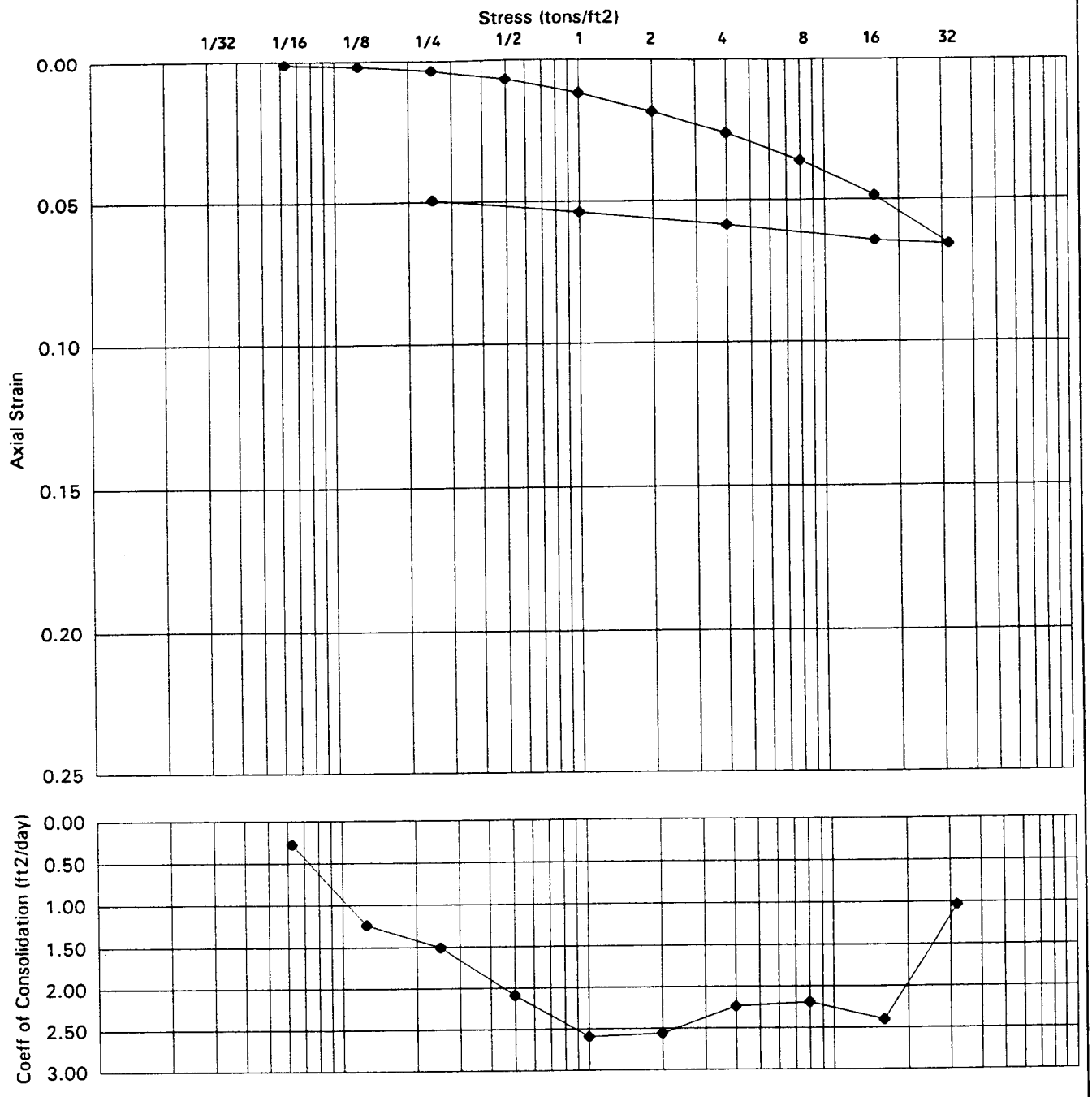


Expl. No.	Sample No.	Depth (ft)	W.C. %		Atterberg Limit			Wet Wt (pcf)	USC	Description
			Before	After	LL	PL	PI			
B118	S-6	15.5'-17.4'	25%	25%	41	25	16	123 pcf	CL	Sandy, lean CLAY

Remarks:

HARTCROWSER J-4978-21 2/15/2000
Figure B-35

CONSOLIDATION TEST RESULTS

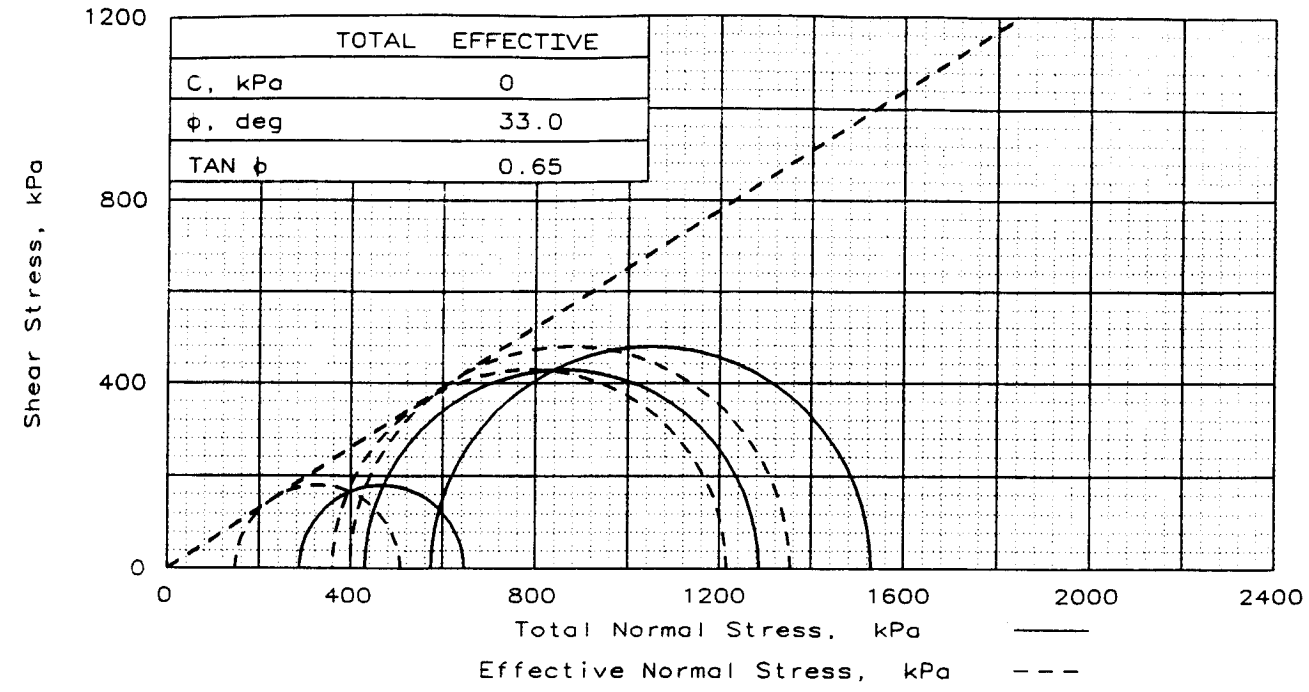


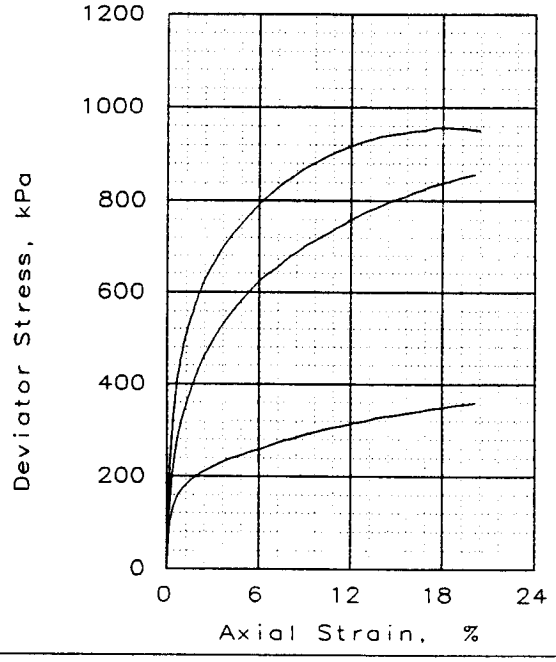
Expl. No.	Sample No.	Depth (ft)	W.C. %		Atterberg Limit			Wet Wt (pcf)	USC	Description
			Before	After	LL	PL	PI			
B142	S-3	5.5'-7.5'	26%	25%	25	27	NP	125 pcf	ML	Sandy SILT

Remarks:

HARTCROWSER J-4978-21 2/28/2000
Figure B-36

AR 045364





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	25.2	23.0	14.2
	DRY DENSITY, g/cc	1.6	1.7	1.9
	SATURATION, %	104.3	105.3	95.4
	VOID RATIO	0.640	0.578	0.394
	DIAMETER, cm	7.20	7.21	7.19
	HEIGHT, cm	15.54	15.27	14.63
AT TEST	WATER CONTENT, %	22.9	21.1	15.1
	DRY DENSITY, g/cc	1.7	1.8	2.0
	SATURATION, %	113.9	114.8	126.6
	VOID RATIO	0.534	0.486	0.317
	DIAMETER, cm	7.04	7.07	7.06
	HEIGHT, cm	15.20	14.98	14.35
BACK PRESSURE, kPa		138	138	138
CELL PRESSURE, kPa		425	569	712
FAILURE STRESS, kPa		359	856	956
PORE PRESSURE, kPa		278	209	315
STRAIN RATE, %/min.		0.018	0.035	0.035
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		507	1216	1354
$\bar{\sigma}_3$ FAILURE, kPa		148	360	398

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Slightly sandy CLAY-SILT

LL= 19 PL= 15 PI= 4.0
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: HNTB

PROJECT: Third Runway West Side

SAMPLE LOCATION: HC00-B110/S-4

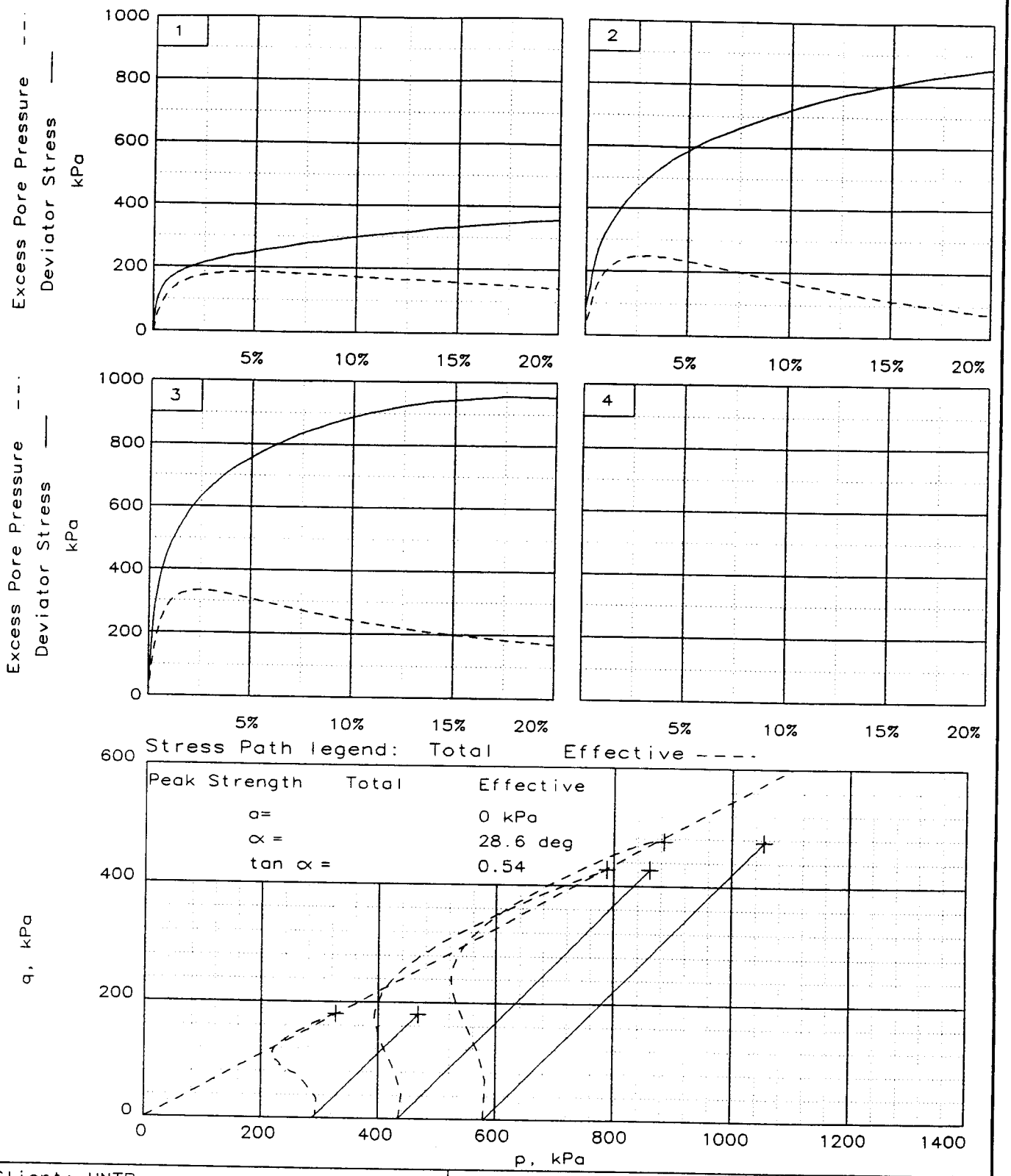
HART CROWSER

J4978-21 3/9/00

Figure B-37

AR 045365

STRESS-STRAIN AND STRESS PATHS REPORT



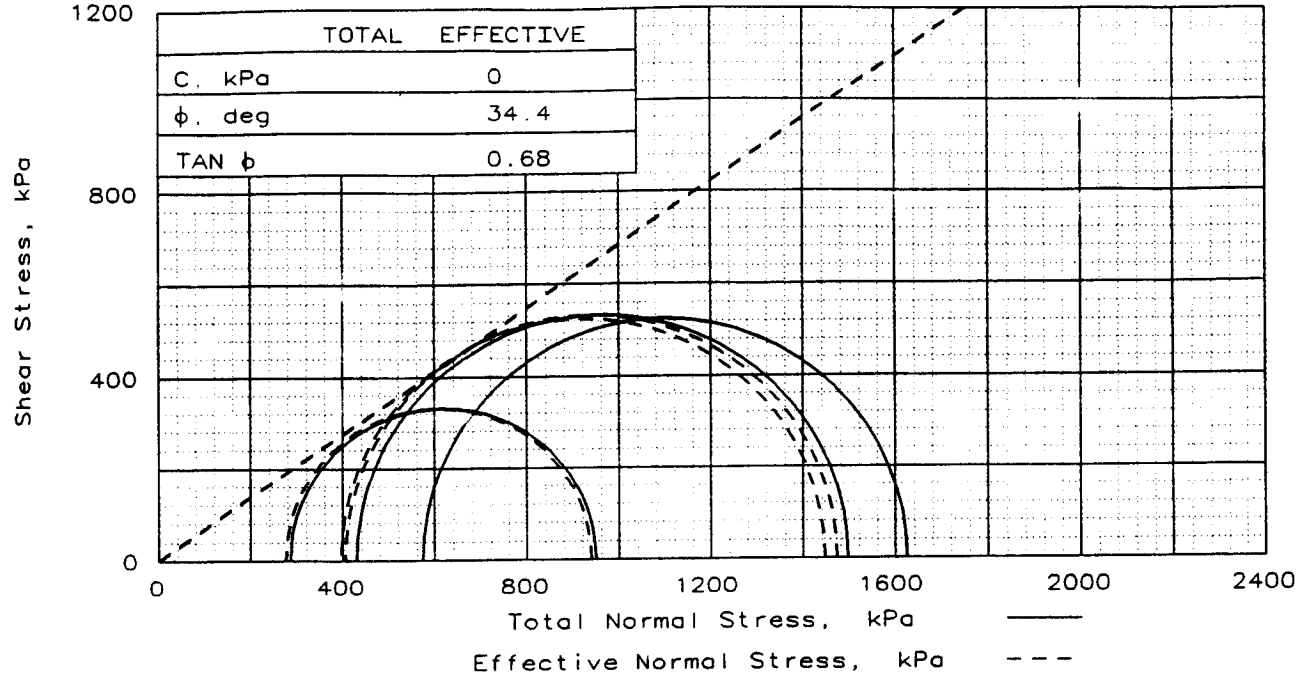
Client: HNTB
Project: Third Runway West Side
Location: HC00-B110/S-4
File: 3RWL

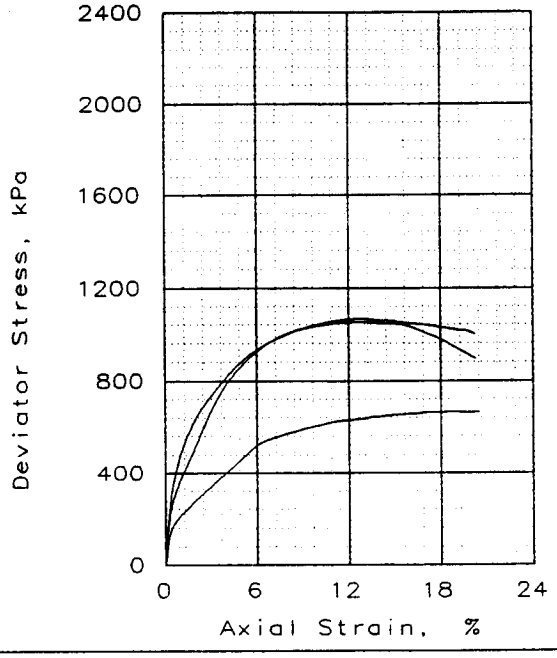
J4978-21 3/9/00

HARTCROWSER

Figure B-38

AR 045366





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	31.2	30.5	29.6
	DRY DENSITY, g/cc	1.5	1.5	1.5
	SATURATION, %	113.1	102.1	102.5
	VOID RATIO	0.730	0.793	0.767
	DIAMETER, cm	6.92	7.00	6.65
	HEIGHT, cm	14.12	13.80	13.98
AT TEST	WATER CONTENT, %	30.0	30.0	28.9
	DRY DENSITY, g/cc	1.6	1.5	1.5
	SATURATION, %	122.3	104.2	104.9
	VOID RATIO	0.650	0.764	0.730
	DIAMETER, cm	6.81	6.96	6.60
	HEIGHT, cm	13.90	13.73	13.88
BACK PRESSURE, kPa		172	172	172
CELL PRESSURE, kPa		747	603	460
FAILURE STRESS, kPa		1051	1067	662
PORE PRESSURE, kPa		351	197	183
STRAIN RATE, %/min.		0.040	0.040	0.040
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		1447	1473	940
$\bar{\sigma}_3$ FAILURE, kPa		396	406	277

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Very clayey SILT

LL= 43 PL= 26 PI= 17.0
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: HNTB

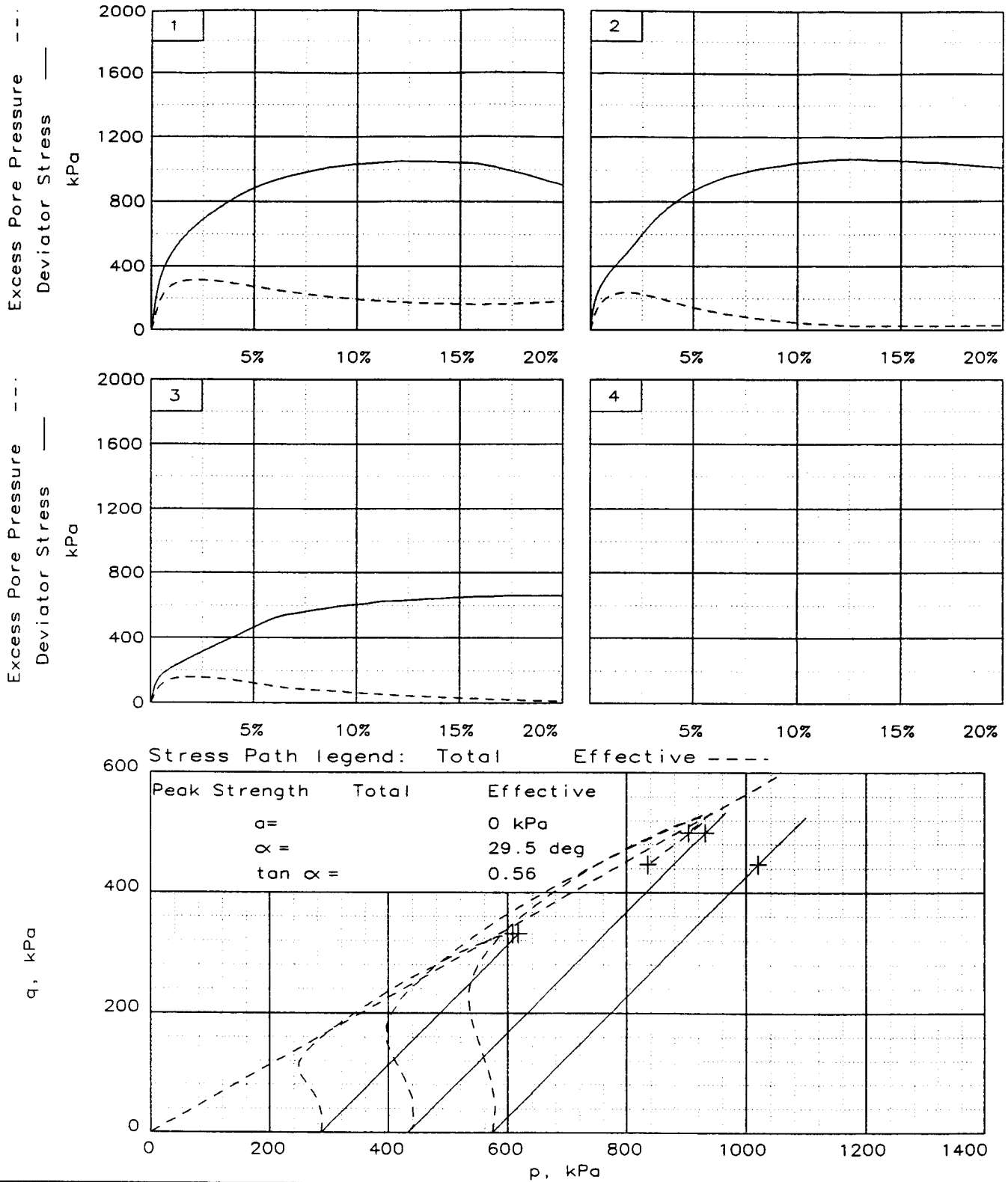
PROJECT: Third Runway West Side

SAMPLE LOCATION: HC00-B111/S-12

HARTCROWSER J4978-21 2/22/00
Figure B-39

AR 045367

STRESS-STRAIN AND STRESS PATHS REPORT



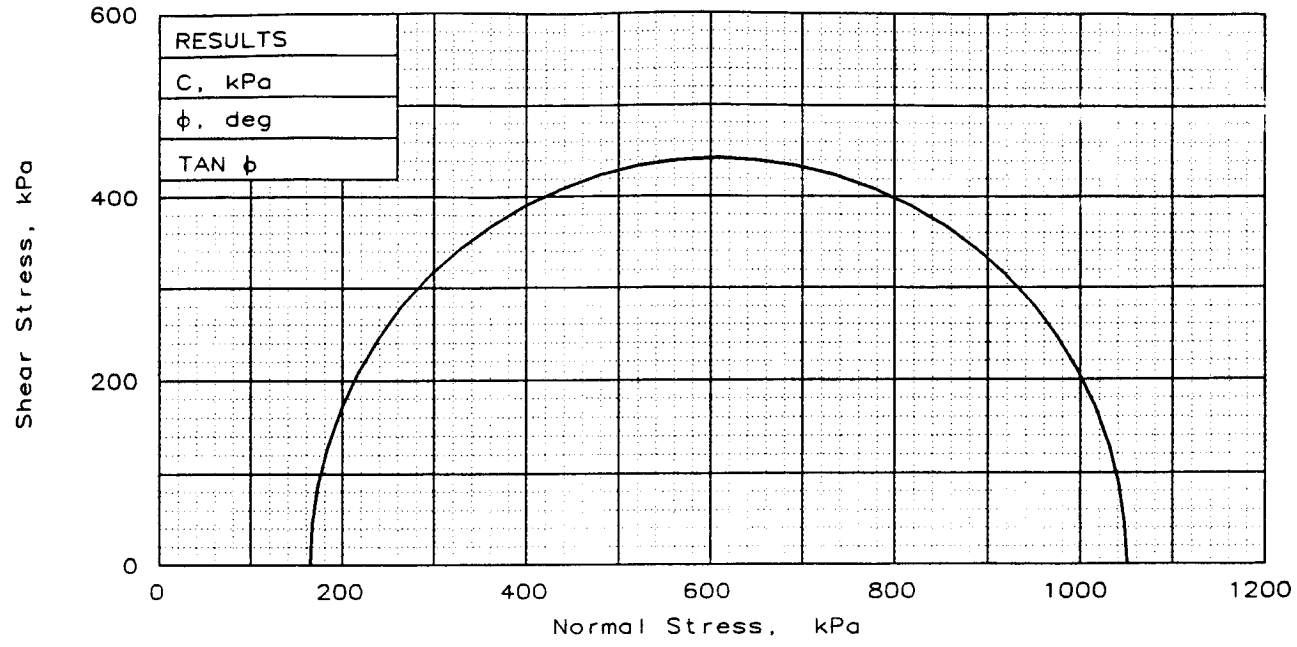
Client: HNTB
Project: Third Runway West Side
Location: HC00-B111/S-12
File: 3RWM

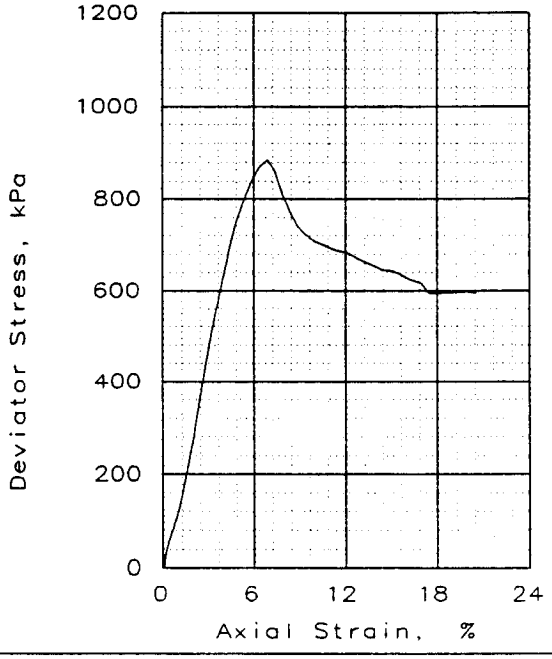
J4978-21 2/22/00

HARTCROWSER

Figure B-40

AR 045368





SAMPLE NO.		1
INITIAL	WATER CONTENT, %	31.1
	DRY DENSITY, g/cc	1.5
	SATURATION, %	106.2
	VOID RATIO	0.777
	DIAMETER, cm	7.26
	HEIGHT, cm	15.41
AT TEST	WATER CONTENT, %	31.0
	DRY DENSITY, g/cc	1.5
	SATURATION, %	105.8
	VOID RATIO	0.777
	DIAMETER, cm	7.26
	HEIGHT, cm	15.41
BACK PRESSURE, kPa		0
CELL PRESSURE, kPa		165
FAILURE STRESS, kPa		885
PORE PRESSURE, kPa		
STRAIN RATE, %/min.		0.300
ULTIMATE STRESS, kPa		
PORE PRESSURE, kPa		
σ_1 FAILURE, kPa		1051
σ_3 FAILURE, kPa		165

TYPE OF TEST:
Unconsolidated undrained
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Very clayey SILT

LL= 41 PL= 28 PI= 13.0
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: HNTB

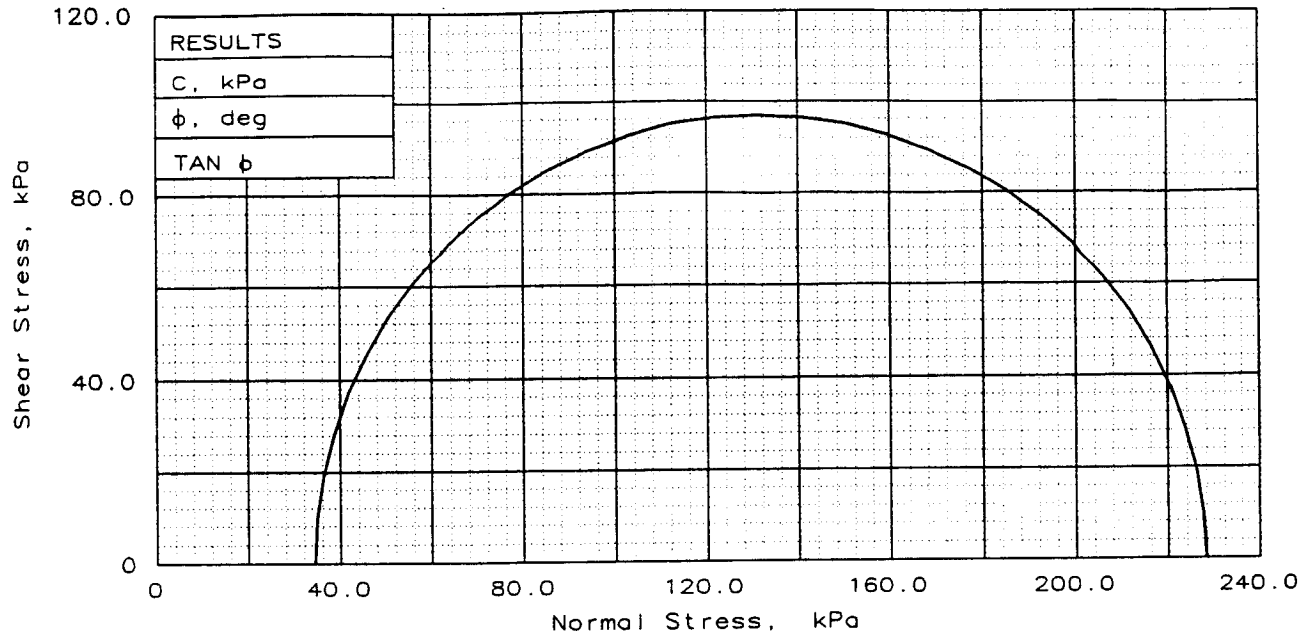
PROJECT: Third Runway West Side

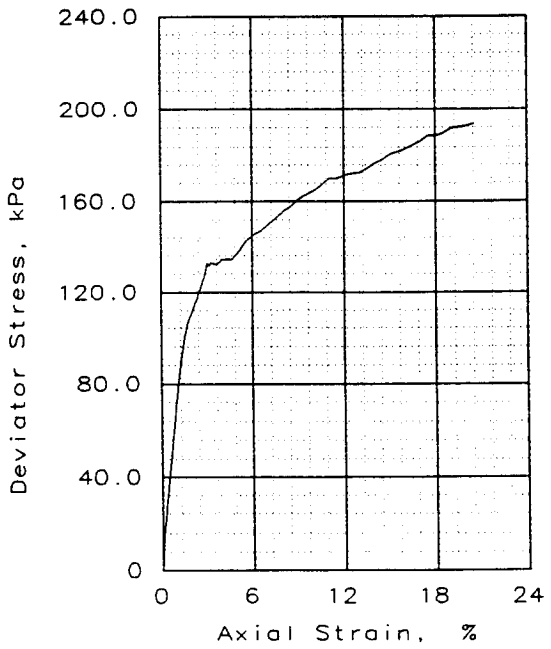
SAMPLE LOCATION: HC00-B110/S-11

HARTCROWSER J4978-21 3/3/00

Figure B-41

AR 045369





SAMPLE NO.		1
INITIAL	WATER CONTENT, %	31.7
	DRY DENSITY, g/cc	1.5
	SATURATION, %	104.5
	VOID RATIO	0.803
	DIAMETER, cm	7.24
	HEIGHT, cm	15.35
AT TEST	WATER CONTENT, %	31.6
	DRY DENSITY, g/cc	1.5
	SATURATION, %	104.4
	VOID RATIO	0.803
	DIAMETER, cm	7.24
	HEIGHT, cm	15.35
BACK PRESSURE, kPa		0.0
CELL PRESSURE, kPa		34.5
FAILURE STRESS, kPa		193.6
PORE PRESSURE, kPa		
STRAIN RATE, %/min.		0.300
ULTIMATE STRESS, kPa		
PORE PRESSURE, kPa		
σ_1 FAILURE, kPa		228.1
σ_3 FAILURE, kPa		34.5

TYPE OF TEST:
Unconsolidated undrained
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Slightly sandy, clayey SILT
LL= 30 PL= 26 PI= 4.0
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: HNTB

PROJECT: Third Runway West Side

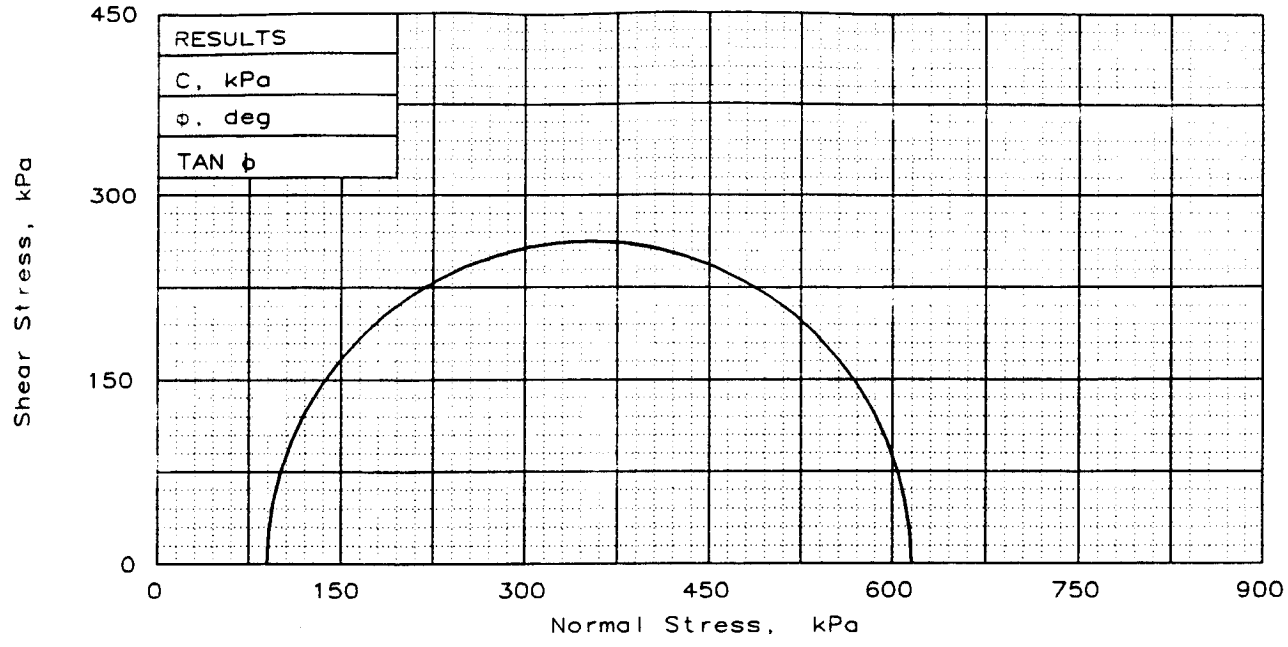
SAMPLE LOCATION: HC00-B118/S-2

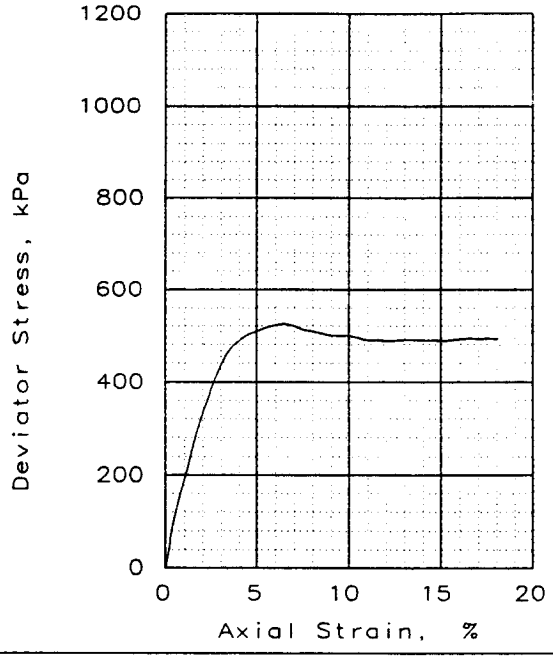
HART CROWSER

J4978-21 2/21/00

Figure B-42

AR 045370





SAMPLE NO.		1
INITIAL	WATER CONTENT, %	25.0
	DRY DENSITY, g/cc	1.6
	SATURATION, %	104.5
	VOID RATIO	0.635
	DIAMETER, cm	7.27
	HEIGHT, cm	15.68
AT TEST	WATER CONTENT, %	25.0
	DRY DENSITY, g/cc	1.6
	SATURATION, %	104.3
	VOID RATIO	0.635
	DIAMETER, cm	7.27
	HEIGHT, cm	15.68
BACK PRESSURE, kPa		0
CELL PRESSURE, kPa		90
FAILURE STRESS, kPa		525
PORE PRESSURE, kPa		
STRAIN RATE, %/min.		0.300
ULTIMATE STRESS, kPa		
PORE PRESSURE, kPa		
σ_1 FAILURE, kPa		615
σ_3 FAILURE, kPa		90

TYPE OF TEST:
Unconsolidated undrained
SAMPLE TYPE:
DESCRIPTION: Sandy, very clayey SILT

LL= 41 PL= 25 PI= 16.0
SPECIFIC GRAVITY= 2.65
REMARKS:

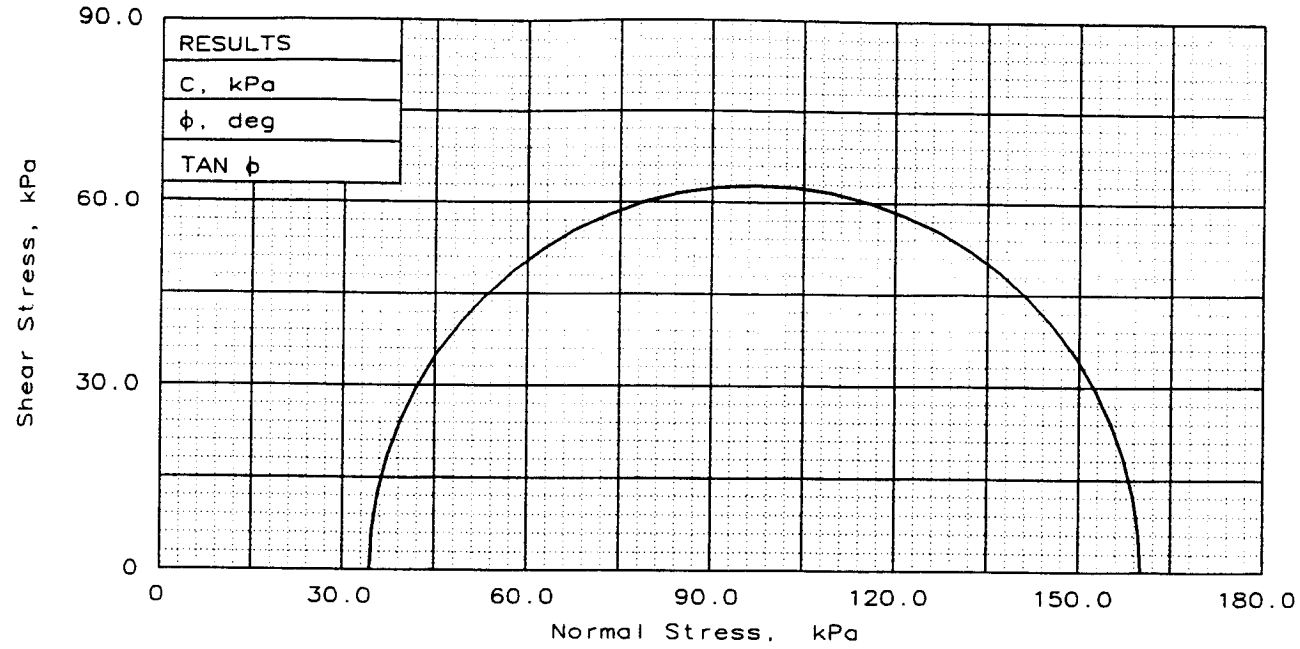
CLIENT: HNTB

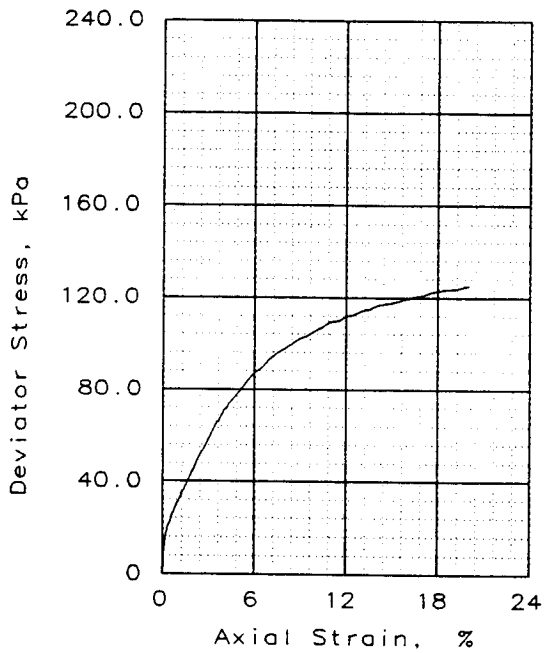
PROJECT: Third Runway West Side

SAMPLE LOCATION: HC00-B118/S-6

HARTCROWSER J4978-21 2/19/00
Figure B-43

AR 045371





SAMPLE NO.		1
INITIAL	WATER CONTENT, %	28.7
	DRY DENSITY, g/cc	1.6
	SATURATION, %	110.0
	VOID RATIO	0.691
	DIAMETER, cm	7.04
	HEIGHT, cm	14.37
AT TEST	WATER CONTENT, %	28.5
	DRY DENSITY, g/cc	1.6
	SATURATION, %	109.4
	VOID RATIO	0.691
	DIAMETER, cm	7.04
	HEIGHT, cm	14.37
BACK PRESSURE, kPa		0.0
CELL PRESSURE, kPa		34.5
FAILURE STRESS, kPa		125.6
PORE PRESSURE, kPa		
STRAIN RATE, %/min.		0.300
ULTIMATE STRESS, kPa		
PORE PRESSURE, kPa		
σ_1 FAILURE, kPa		160.1
σ_3 FAILURE, kPa		34.5

TYPE OF TEST:
Unconsolidated undrained
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Slightly sandy, lean CLAY
LL= 38 PL= 23 PI= 15.0
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: HNTB

PROJECT: 3rd Runway West Side

SAMPLE LOCATION: HC00-B129/S-3

HART CROWSER

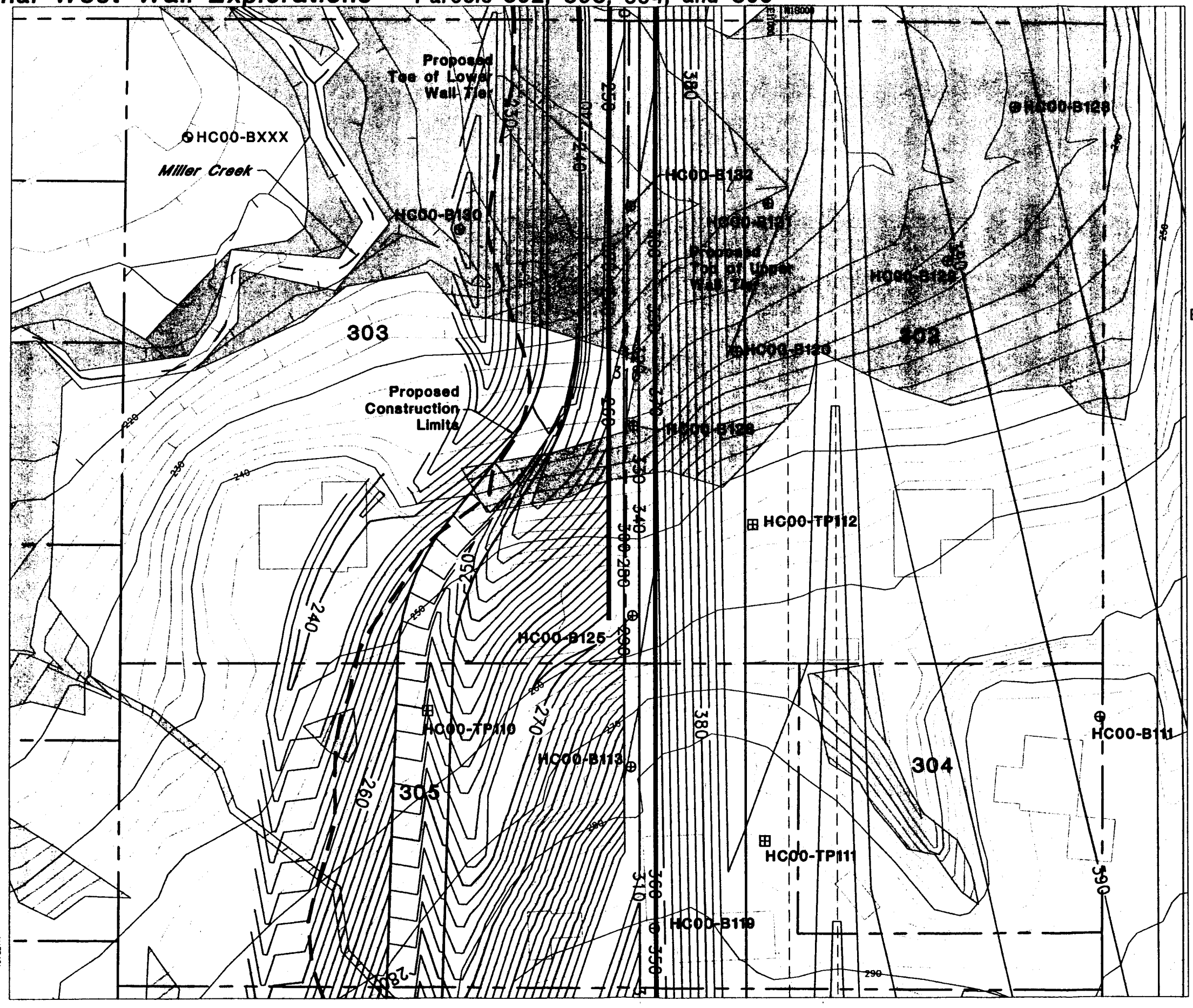
J4978-21 3/3/00

Figure B-44

AR 045372

APPENDIX C
ADDITIONAL EXPLORATIONS AND LABORATORY TESTS

Additional West Wall Explorations - Parcels 302, 303, 304, and 305



⊕ **HC00-B123** Monitoring Well Location and Number

⊞ **HC00-TP112** Test Pit Location and Number

Wetland Location

303 Parcel Number

Note: Base map prepared from electronic file provided by HNTB entitled, "Full_Topo.dwg", dated October 4, 1999. Wetland data prepared from electronic file provided by Parametrix entitled, "W_020800.dwg", dated February 8, 2000.

N

0 50 100

Scale in Feet

HARTCROWSER

J-4978-21 6/00

Figure C-0

AR 045374

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptable moisture
Damp	Some perceptable moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptable moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

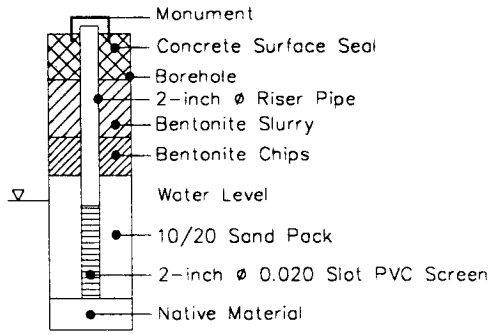
Sampling Test Symbols

BORING SAMPLES		TEST PIT SAMPLES	
⊠	Split Spoon	⊠	Grab (Jar)
▨	Shelby Tube	▨	Bag
▥	Cuttings	▨	Shelby Tube
▯	Core Run	⧓	Bucket Sample
*	No Sample Recovery		
P	Tube Pushed, Not Driven		

Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Unconsolidated Undrained Triaxial
TCU	Consolidated Undrained Triaxial
TCD	Consolidated Drained Triaxial
QU	QU
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
	Water Content in Percent Liquid Limit Natural Plastic Limit
PID	Photoionization Reading
CA	Chemical Analysis

Groundwater Observations



RAISED_MON 1=1

HARTCROWSER

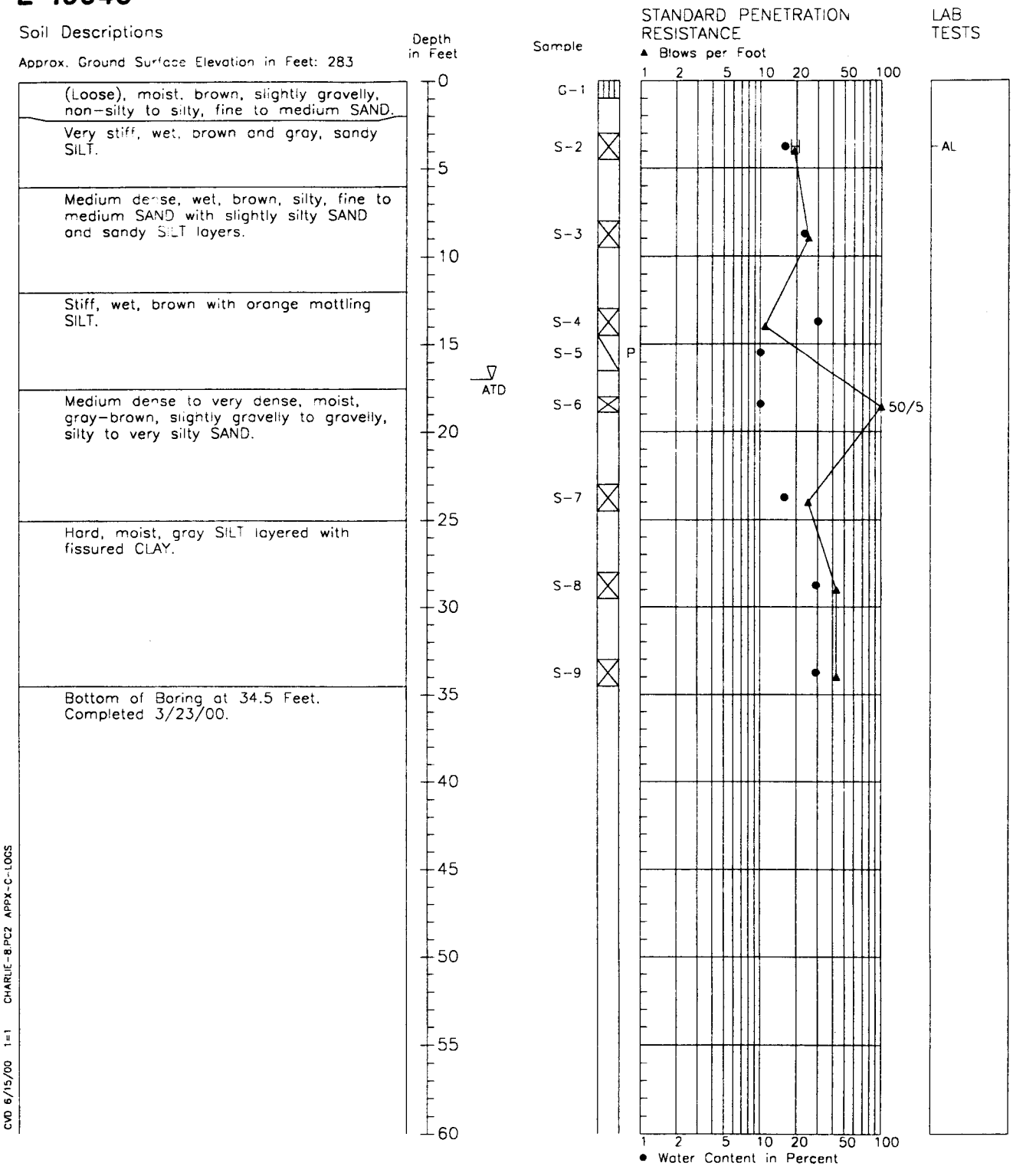
J-4978-21 6/00

Figure C-1

AR 045375

Boring Log HC00-B113

N 17607
E 10945



1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-4978-21 3/00

Figure C-2

Boring Log HC00-B119

N 17560
E 10894

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 283

Depth in Feet

(Loose), moist, brown, slightly gravelly SAND.

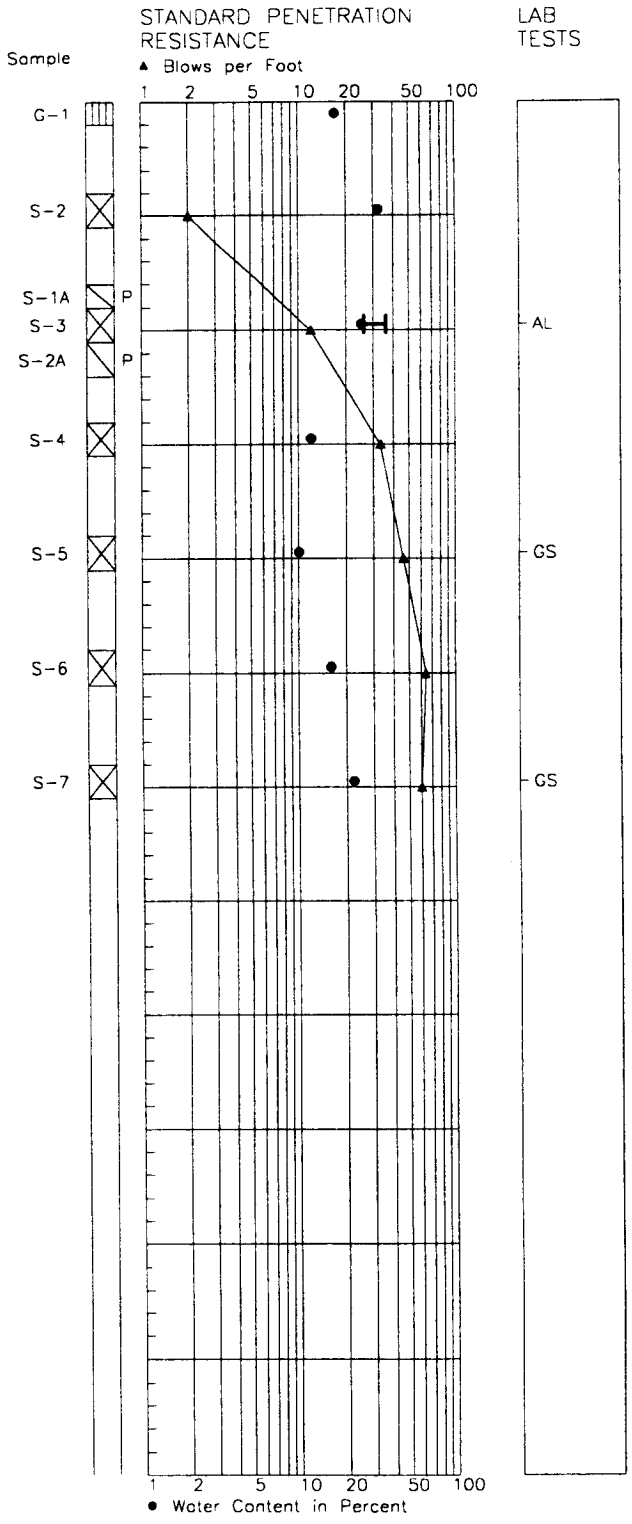
Soft to stiff, wet, brown to gray and orange mottled, sandy SILT.

Dense, moist, brown to gray, silty to very silty, slightly gravelly to gravelly SAND.

Hard, moist, gray, slightly gravelly to gravelly, sandy SILT.

Grades to slightly silty, fine to medium SAND.

Bottom of Boring at 30.5 Feet.
Completed 3/23/00.



1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Shelby tube samples S-1A and S2A pushed in adjacent boring HC00-B119A.
5. No groundwater noted at time of drilling.

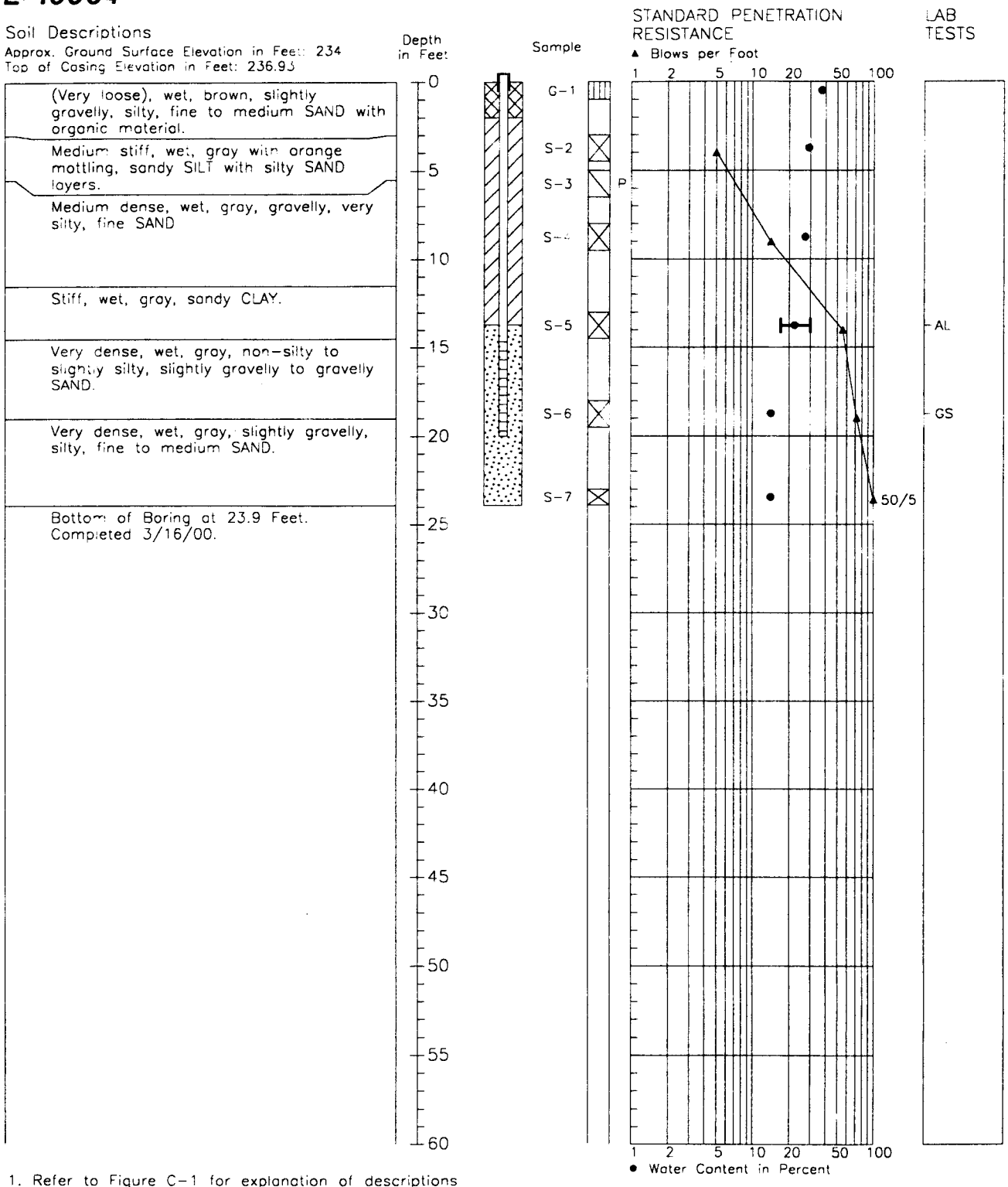
CVD 6/15/00 1=1 CHARLIE-B.PC2 APPX-C-LOGS

HARTCROWSER
J-4978-21 3/00
Figure C-3

AR 045377

Boring Log HC00-B120

N 17834
E 10964



1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. No groundwater noted at time of drilling.

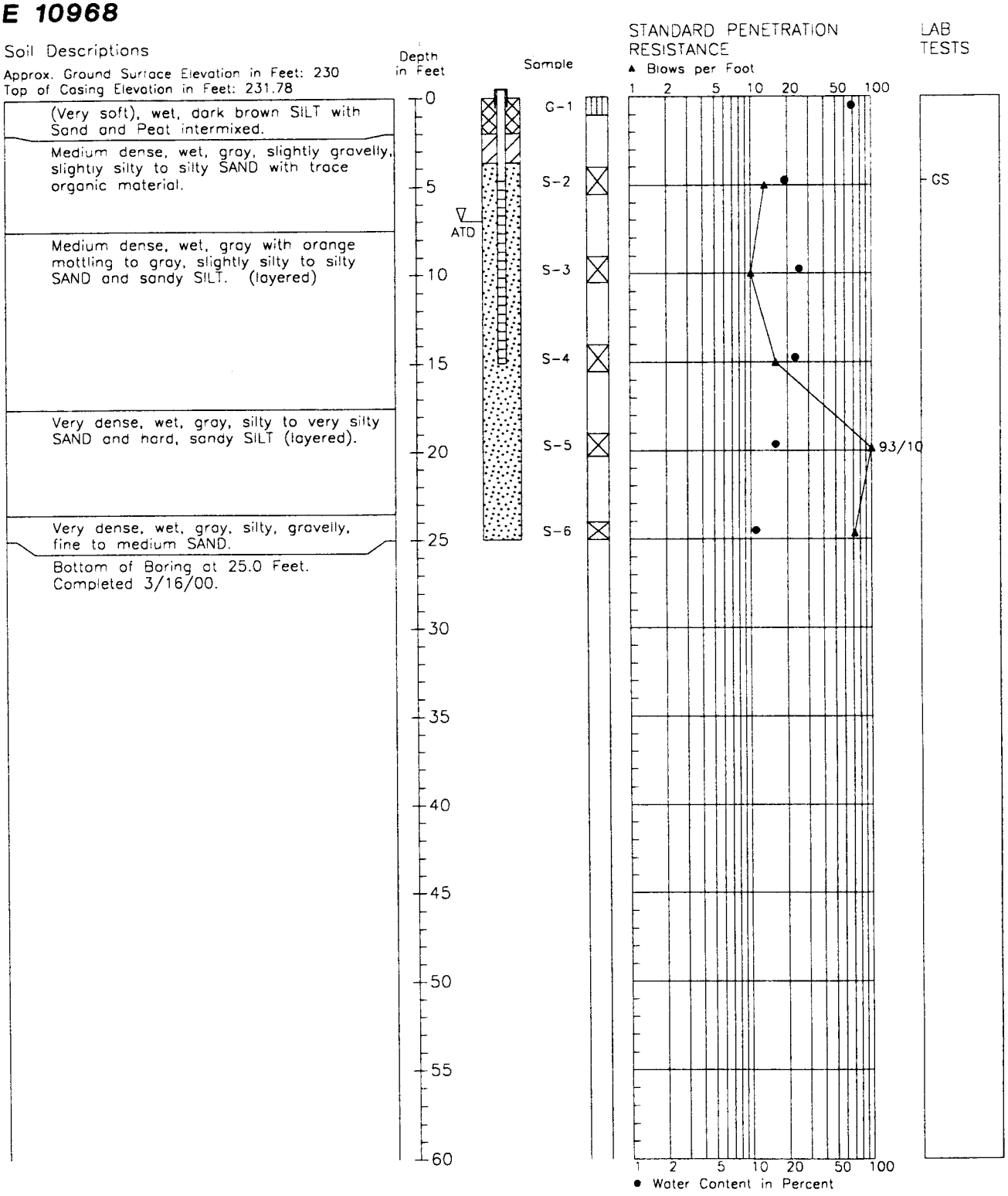
HARTCROWSER

J-4978-21 3/00

Figure C-4

Boring Log HC00-B121

N 17881
E 10968



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 3/00
Figure C-5

AR 045379

Boring Log HC00-B122

N 17840
E 11087

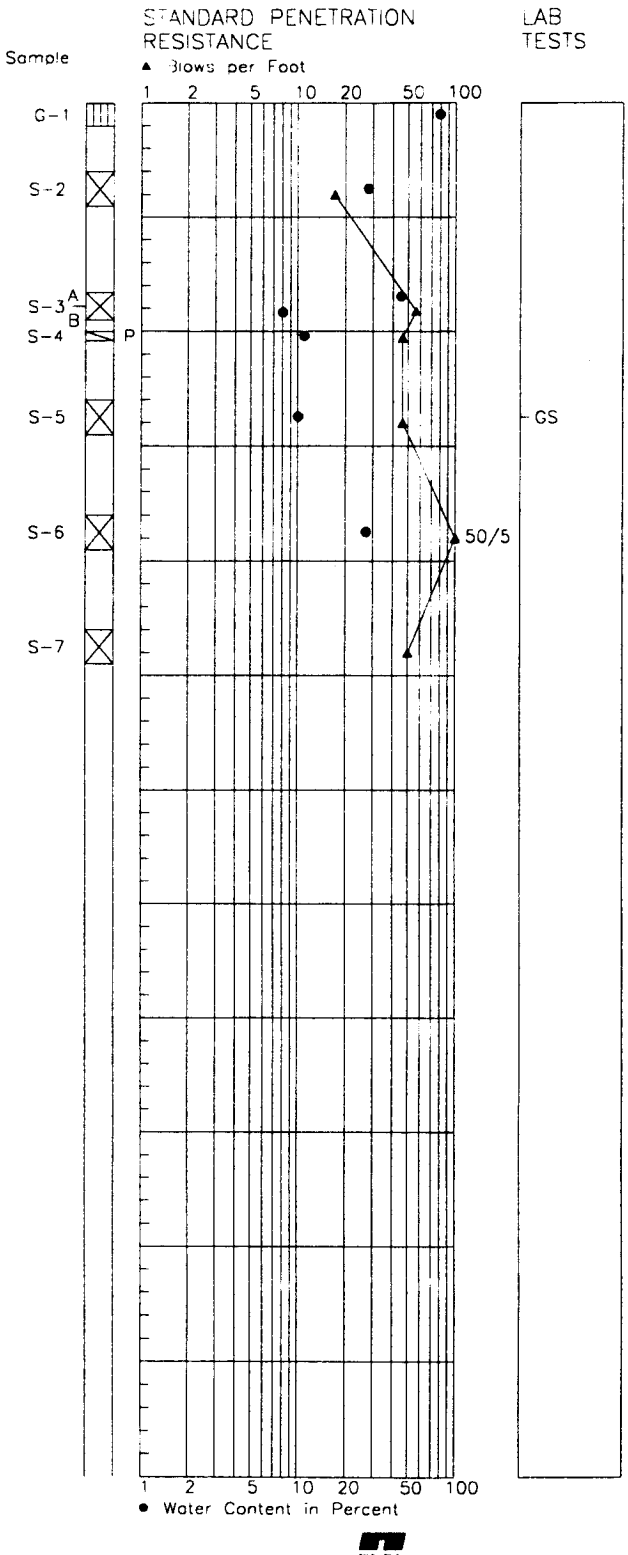
Soil Descriptions

Approx. Ground Surface Elevation in Feet: 240
Top of Casing Elevation in Feet: 231.78

Depth in Feet

Very loose, wet, dark brown, silty SAND and PEAT.	0
Very stiff, wet, gray-brown, sandy SILT.	5
Hard, wet, gray-brown, sandy SILT with a slightly gravelly, silty, fine to medium SAND lens.	10
Dense, wet, gray-brown, slightly silty to silty, gravelly SAND.	15
Very dense, wet, gray, silty, gravelly SAND.	20
Hard, moist, gray SILT (layered).	25
Bottom of Boring at 24.5 Feet. Completed 3/15/00.	30, 35, 40, 45, 50, 55, 60

▽ ATD



CVD 6/15/00 1=1 CHARLIE-8.PC2 APPX-C-LOGS

1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

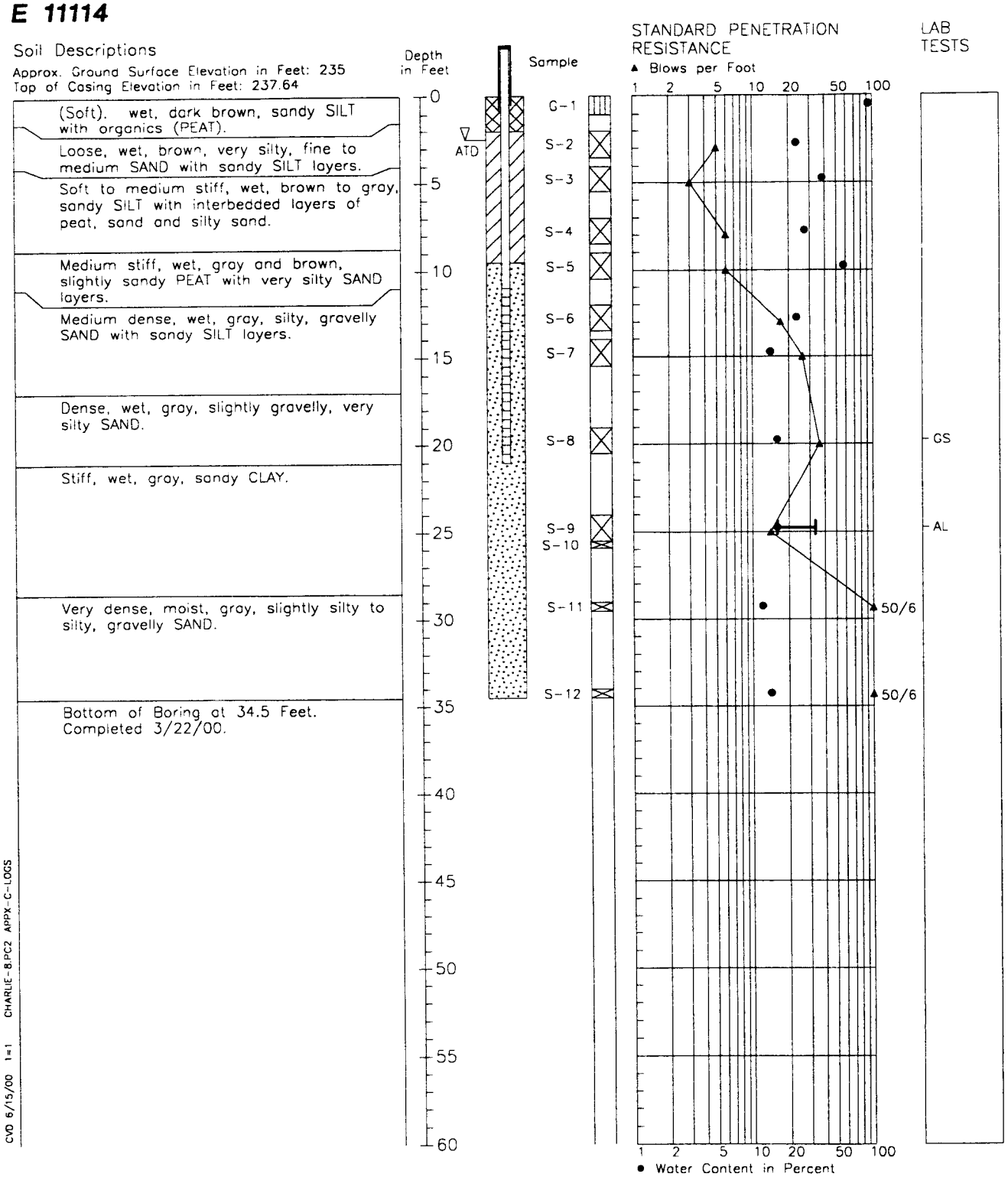
J-4978-21 3/00

Figure C-6

AR 045380

Boring Log HC00-B123

N 17958
E 11114



1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

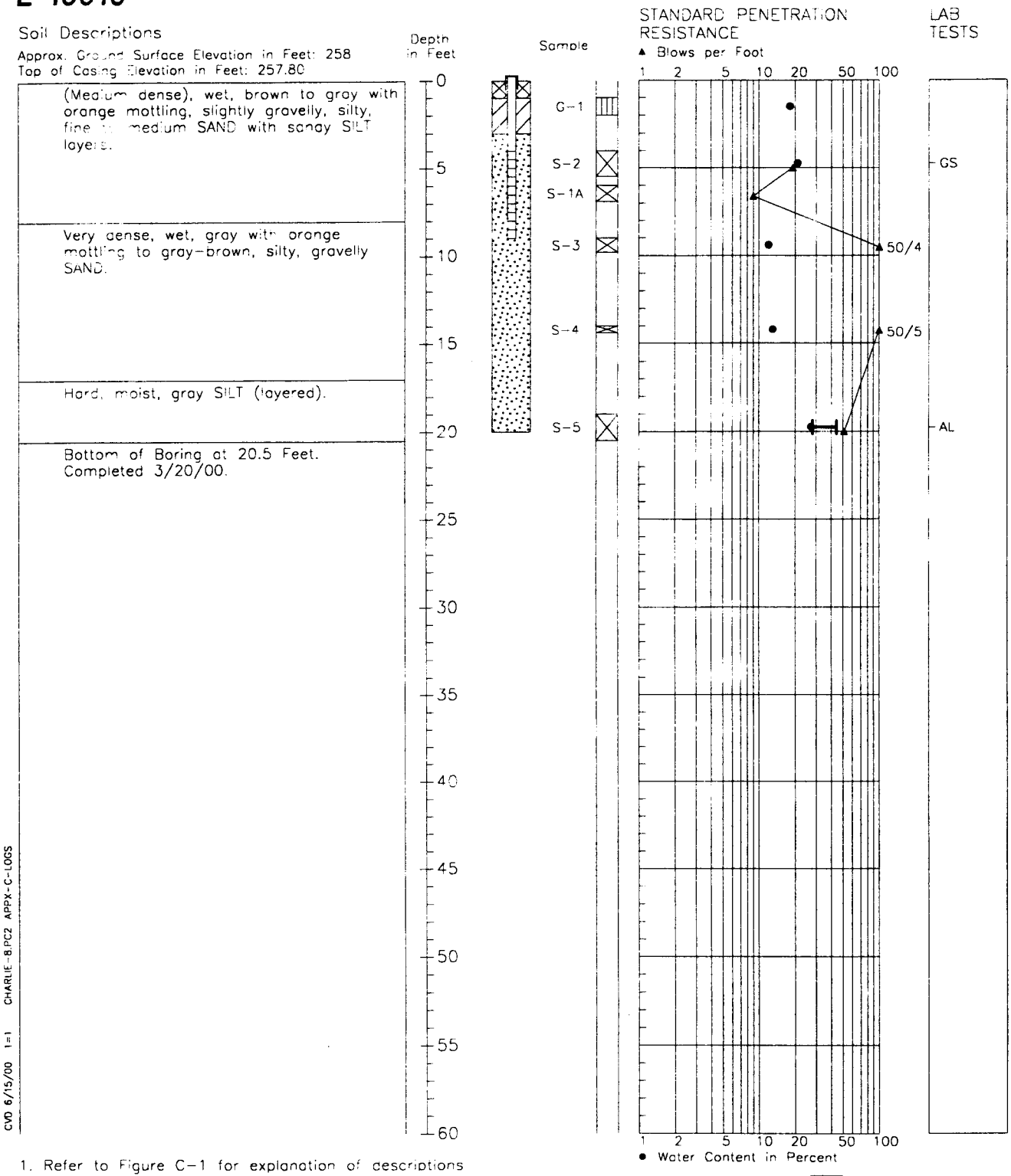
J-4978-21 3/00

Figure C-7

AR 045381

Boring Log HC00-B125

N 17686
E 10916



CVD 6/15/00 1=1 CHARLIE-B.PC2 APPX-C-LOGS

1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Shelby tube samples S-1A from adjacent boring HC00-B125A.
5. No groundwater noted at time of drilling.

HARTCROWSER

J-4978-21 3/00

Figure C-8

AR 045382

Boring Log HC00-B128

N 17786
E 10918

Soil Descriptions

Approx. Ground Surface Elevation in Feet: 237

(Loose), wet, dark brown, slightly gravelly, silty SAND.

Medium dense, wet, brown, slightly gravelly, silty, fine to medium SAND.

Very dense, moist, gray, silty, gravelly SAND.

Hard, moist, gray SILT, laminated with Clay lenses.

Very dense, moist, gray, silty to very silty, fine to medium SAND.

Grades to gravelly.

Bottom of Boring at 30.3 Feet.
Completed 3/16/00.

Depth in Feet

0 5 10 15 20 25 30 35 40 45 50 55 60

ATD

STANDARD PENETRATION RESISTANCE
Sample
▲ Blows per Foot
1 2 5 10 20 50 100

LAB TESTS

G-1
S-2
S-3
S-4
*S-5
S-6
S-7
S-8
P

50/4
50/5
50/3

GS
AL

1 2 5 10 20 50 100
● Water Content in Percent

CVD 6/15/00 1=1 CHARLIE-8.PC2 APPX-C-LOGS

1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 3/00
Figure C-9

AR 045383

Boring Log HC00-B130

N 17901
E 10839

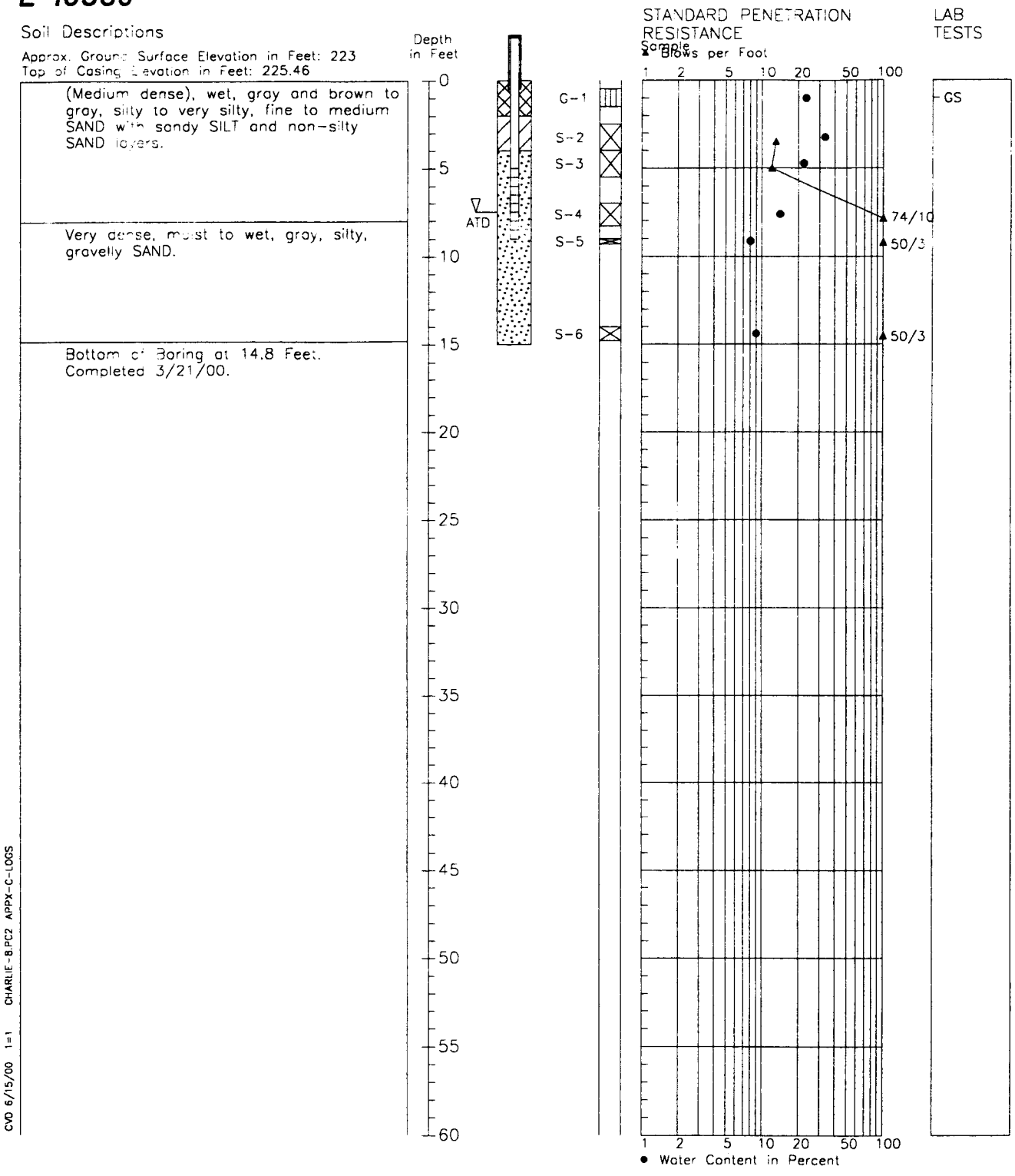
Soil Descriptions

Approx. Ground Surface Elevation in Feet: 223
Top of Casing Elevation in Feet: 225.46

(Medium dense), wet, gray and brown to gray, silty to very silty, fine to medium SAND with sandy SILT and non-silty SAND layers.

Very dense, moist to wet, gray, silty, gravelly SAND.

Bottom of Boring at 14.8 Feet.
Completed 3/21/00.



CVD 6/15/00 1=1 CHARLIE-8.PC2 APPX-C-LOGS

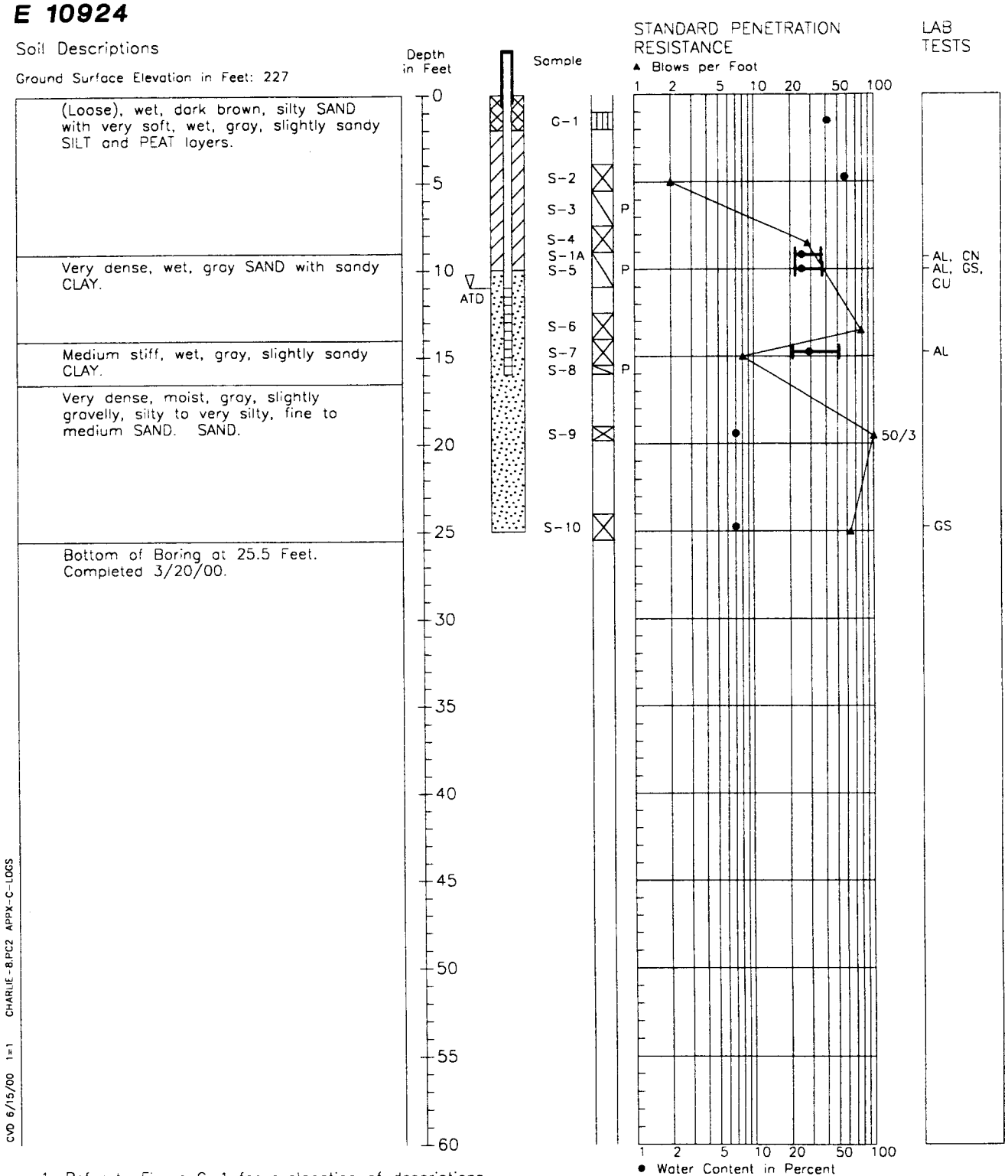
1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-4978-21 3/00
Figure C-10

AR 045384

Boring Log HC00-B132

N 17914
E 10924



1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Shelby tube samples S-1A from adjacent boring HC00-B132A.

HARTCROWSER

J-4978-21 3/00

Figure C-11

Test Pit Log HC00-TP110

N 17647
E 10813

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 256
S-1	43		0–2	(Loose), wet, dark brown, slightly gravelly, silty SAND with organic material. (TOPSOIL)
S-2	40		2–3	(Loose), wet, brown, slightly silty, gravelly, silty SAND.
S-3	32	GS	3–5	(Loose), wet, light brown, fine to medium SAND.
S-4	12		5–12	(Medium dense), wet, gray with brown mottling, silty, gravelly SAND. Grades to very dense.
S-5	32	AL	12–14	(Hard), moist, gray CLAY with silt partings.
			14–20	Bottom of Test Pit at 14 Feet. Completed 3/15/00. Note: Groundwater seepage noted at depth of 3 feet. Sand from 3 to 5 feet highly transmissive and loose, free-face flows as a sand slurry.

Test Pit Log HC00-TP111

N 17585
E 11003

Sample	Water Content	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS Ground Surface Elevation in Feet: 285
S-1	21		0–3	(Loose), moist to wet, dark brown, slightly silty, slightly gravelly, fine to medium SAND with roots and trace organic material. Roots grade out.
S-2	26		3–7	(Medium stiff), wet, gray-brown, sandy SILT.
S-3	26	AL	7–10	(Medium stiff), wet, gray with brown mottling, non-sandy to, slightly sandy CLAY.
S-4	18		10–15	(Loose), wet, gray, gravelly, fine to medium SAND. Grades to medium dense.
			15–20	Bottom of Test Pit at 15 Feet. Completed 3/15/00. Note: Slight groundwater seepage noted at depth of 6½ feet.

1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

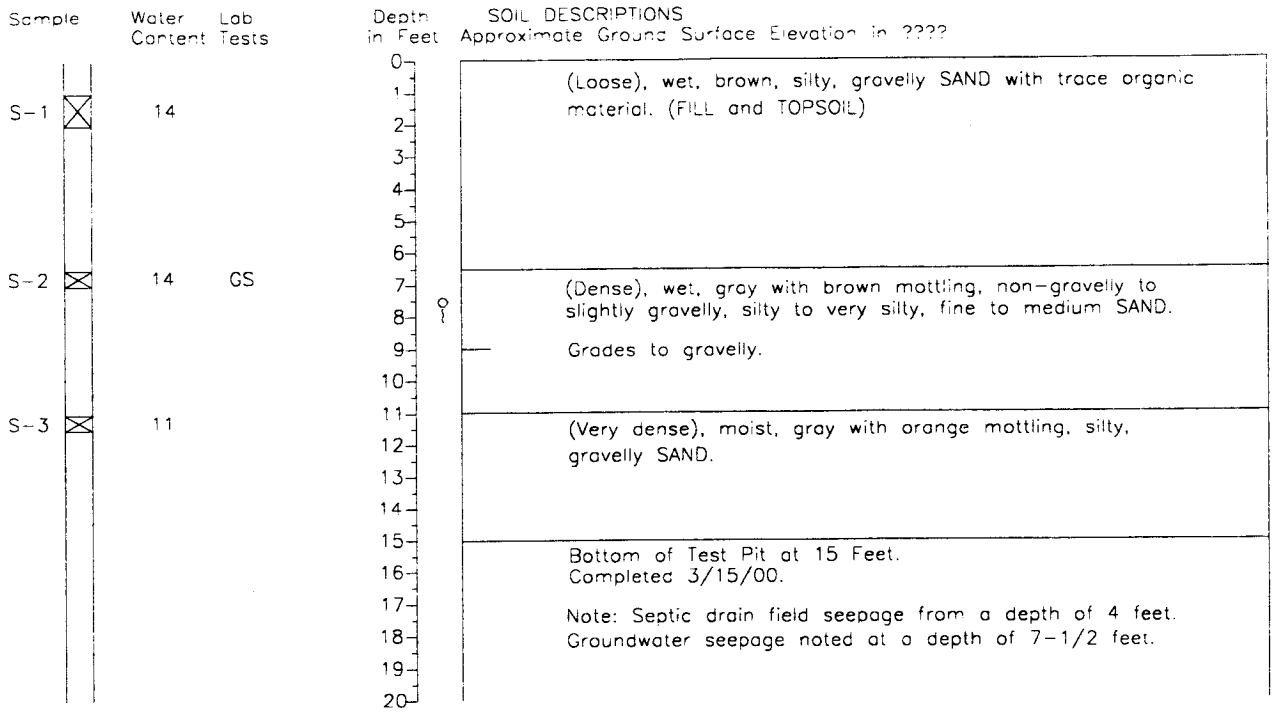
HARTCROWSER
J-4978-21 3/00
Figure C-12

CVD 6/15/00 1=1 CHARLIE-B.PC2
APPX-C-LOGS

AR 045386

Test Pit Log HC00-TP112

N 17736
E 10990



1. Refer to Figure C-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at the time of excavation. Conditions may vary with time.

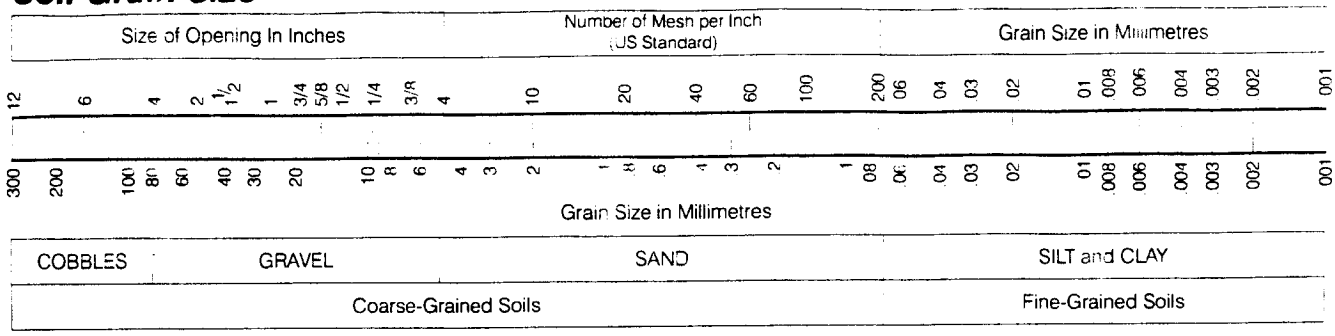
HARTCROWSER
J-4978-21 3/00
Figure C-13

AR 045387

CVD 6/15/00 1=1 CHARLIE-B.PC2
APPX-C-LOGS

Unified Soil Classification (USC) System

Soil Grain Size



Coarse-Grained Soils

G W	G P	G M	G C	S W	S P	S M	S C
Clean GRAVEL <5% fines *		GRAVEL with >12% fines		Clean SAND <5% fines *		SAND with >12% fines	
GRAVEL >50% coarse fraction larger than No. 4				SAND >50% coarse fraction smaller than No. 4			
Coarse-Grained Soils >50% larger than No. 200 sieve							

G W and S W $\left(\frac{D_{60}}{D_{10}} > 4 \text{ for G W}, > 6 \text{ for S W}\right)$ & $1 \leq \frac{(D_{30})^2}{D_{10} \times D_{60}} \leq 3$

G P and S P Clean GRAVEL or SAND not meeting requirements for G W and S W

G M and S M Atterberg limits below A line with PI <4

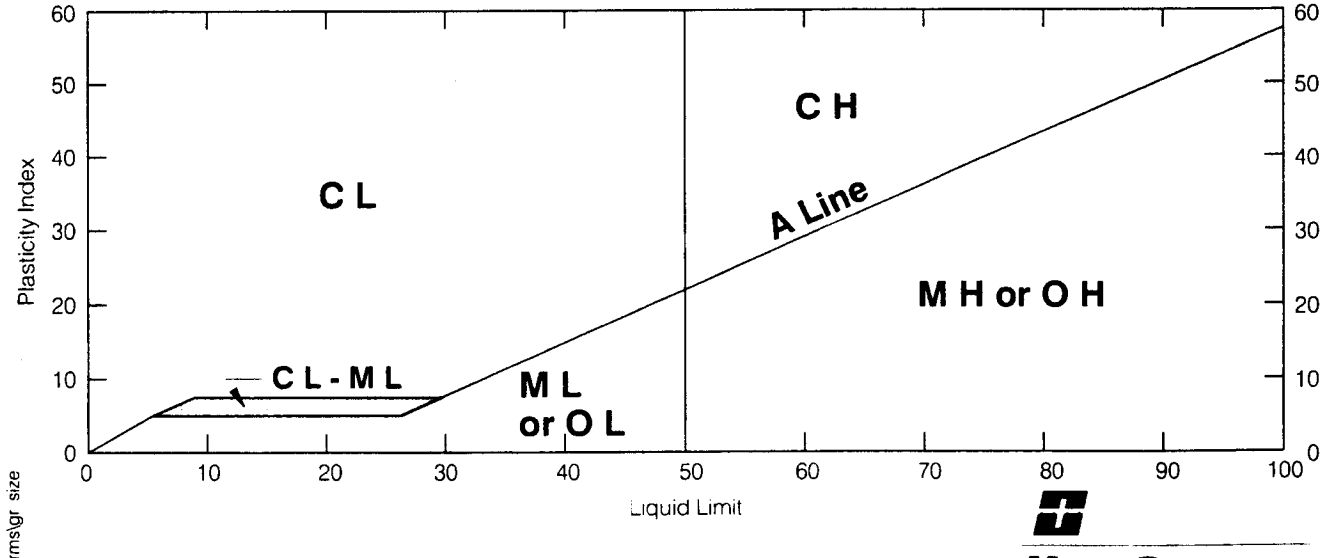
G C and S C Atterberg limits above A Line with PI >7

* Coarse-grained soils with percentage of fines between 5 and 12 are considered borderline cases required use of dual symbols.

D_{10}, D_{30}, and D_{60} are the particles diameter of which 10, 30, and 60 percent, respectively, of the soil weight are finer.

Fine-Grained Soils

M L	C L	O L	M H	C H	O H	Pt
SILT	CLAY	Organic	SILT	CLAY	Organic	Highly Organic Soils
Soils with Liquid Limit <50%			Soils with Liquid Limit >50%			
Fine-Grained Soils >50% smaller than No. 200 sieve						



HARTCROWSER

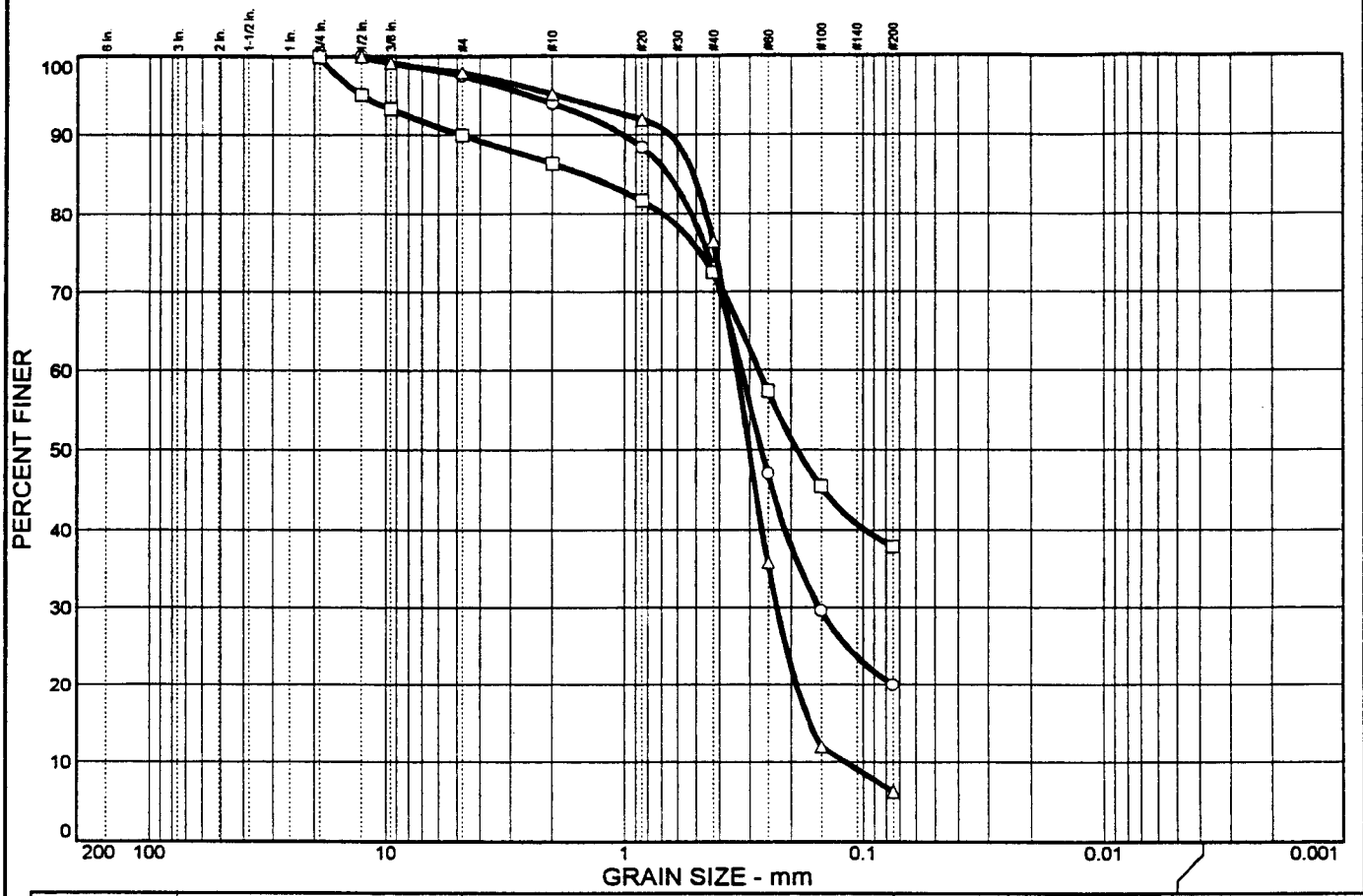
J-4978 6/00

Figure C-14

AR 045388

C:\cel\forms\gr size

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	2.5	3.6	20.9	53.0	20.0	
□	0.0	0.0	10.0	3.7	13.8	34.7	37.8	
△	0.0	0.0	2.1	2.8	18.6	70.2	6.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.658	0.324	0.266	0.153				
□			1.50	0.273	0.188					
△			0.513	0.338	0.300	0.230	0.167	0.118	1.32	2.88

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Silty, medium to fine SAND	SM	17%
□ Slightly gravelly, very silty, medium to fine SAND	SM	10%
△ Slightly silty, medium to fine SAND	SP-SM	25%

Remarks:

○

□

△

Project: Third Runway

Client: HNTB

○ **Source:** HC00-B113 **Sample No.:** G-1

□ **Source:** HC00-B119 **Sample No.:** S-5

△ **Source:** HC00-B119 **Sample No.:** S-7

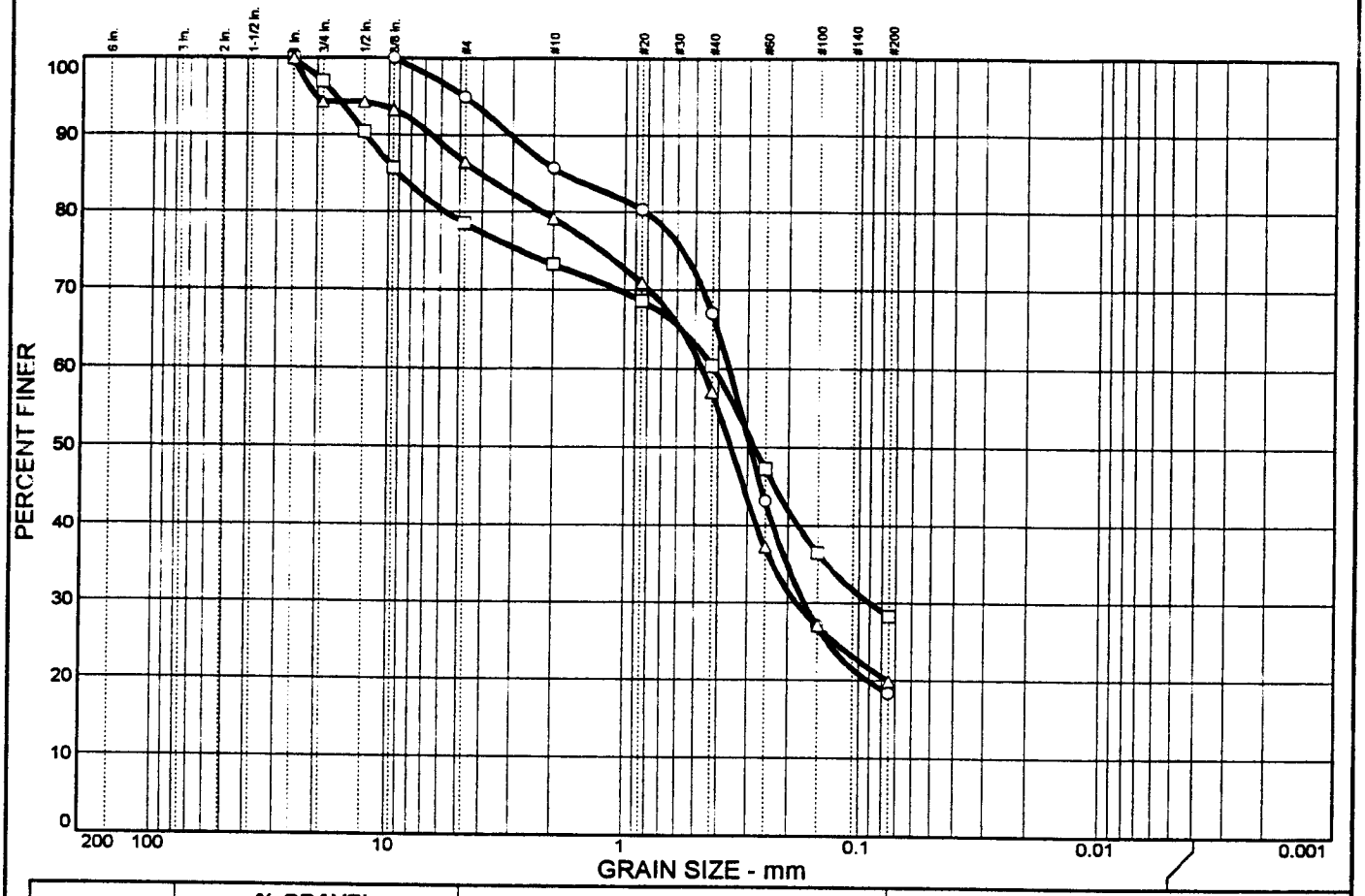
HARTCROWSER

J4978-21 3/31/2000

Figure No. C-15

AR 045389

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	5.0	9.3	18.7	48.7	18.3	
□	0.0	3.0	18.4	5.3	12.9	32.2	28.2	
△	0.0	5.7	7.8	7.3	22.1	37.2	19.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.83	0.359	0.290	0.170				
□			9.06	0.417	0.278	0.0901				
△			4.08	0.467	0.351	0.184				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, silty SAND	SM	19%
□ Gravelly, silty SAND	SM	11%
△ Gravelly, silty SAND	SM	17%

Remarks:

○

□

△

Project: Third Runway

Client: HNTB

○ **Source:** HC00-B121 **Sample No.:** S-2

□ **Source:** HC00-B122 **Sample No.:** S-5

△ **Source:** HC00-B128 **Sample No.:** S-2

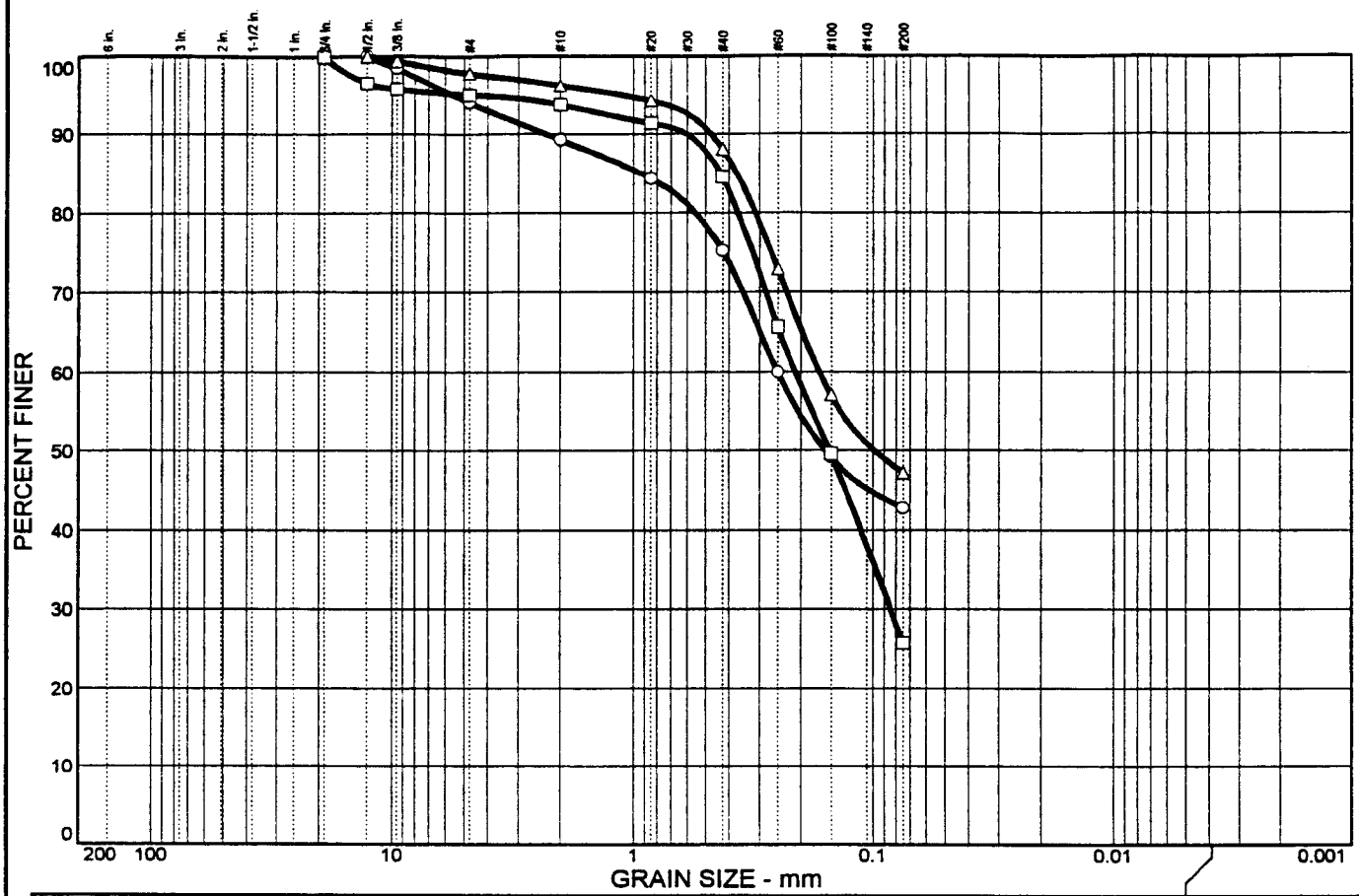
HARTCROWSER

J4978-21 3/29/2000

Figure No. C-16

AR 045390

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	5.9	4.8	14.1	32.5	42.7	
□	0.0	0.0	4.9	1.3	9.3	58.8	25.7	
△	0.0	0.0	2.1	1.6	8.2	40.8	47.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.940	0.250	0.158					
□			0.434	0.211	0.152	0.0845				
△			0.371	0.168	0.0984					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly gravelly, very silty, medium to fine SAND	SM	16%
□ Silty, medium to fine SAND	SM	21%
△ Very silty, medium to fine SAND	SM	23%

Remarks:

○

□

△

Project: Third Runway

Client: HNTB

○ **Source:** HC00-B123 **Sample No.:** S-8

□ **Source:** HC00-B125 **Sample No.:** S-2

△ **Source:** HC00-B130 **Sample No.:** G-1

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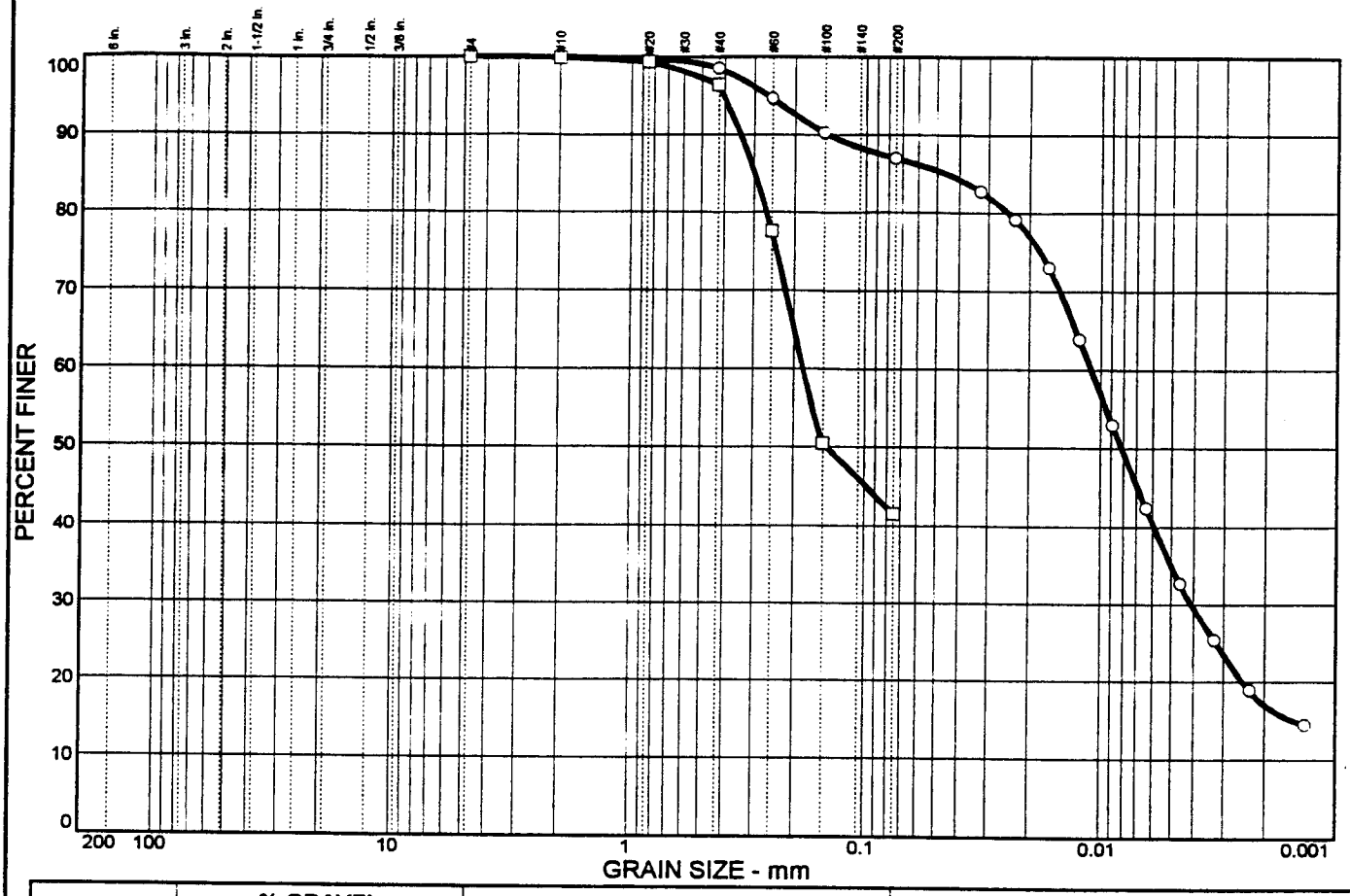
J4978-21 3/31/2000

Figure No. C-17

AR 045391

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	1.5	11.5	51.9	35.1
□	0.0	0.0	0.0	0.1	3.5	54.8	41.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37	15	0.0455	0.0109	0.0081	0.0041	0.0015			
□			0.296	0.182	0.144					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Sandy CLAY	CL	33%
□ Very silty, fine SAND	SM	17%

Remarks:

○

□

Project: Third Runway

Client: HNTB

○ **Source:** HC00-B132 **Sample No.:** S-5

□ **Source:** HC00-B132 **Sample No.:** S-10

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J4978-21 3/31/2000

Figure No. C-18

AR 045392

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.0	0.3	54.4	36.2	8.1	
□	0.0	0.0	3.3	7.1	10.8	35.5	43.3	
△	0.0	7.7	5.6	16.2	33.8	28.9	7.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.753	0.532	0.462	0.340	0.246	0.172	1.27	3.10
□			0.598	0.218	0.135					
△			4.18	1.07	0.674	0.343	0.189	0.125	0.88	8.60

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly silty, fine to medium SAND	SP-SM	32%
□ Very silty SAND	SM	14%
△ Slightly silty, gravelly SAND	SP-SM	14%

Remarks:

○

□

△

Project: Third Runway

Client: HNTB

○ **Source:** HC00-TP110 **Sample No.:** S-3

□ **Source:** HC00-TP112 **Sample No.:** S-2

△ **Source:** HC00-B120 **Sample No.:** S-6

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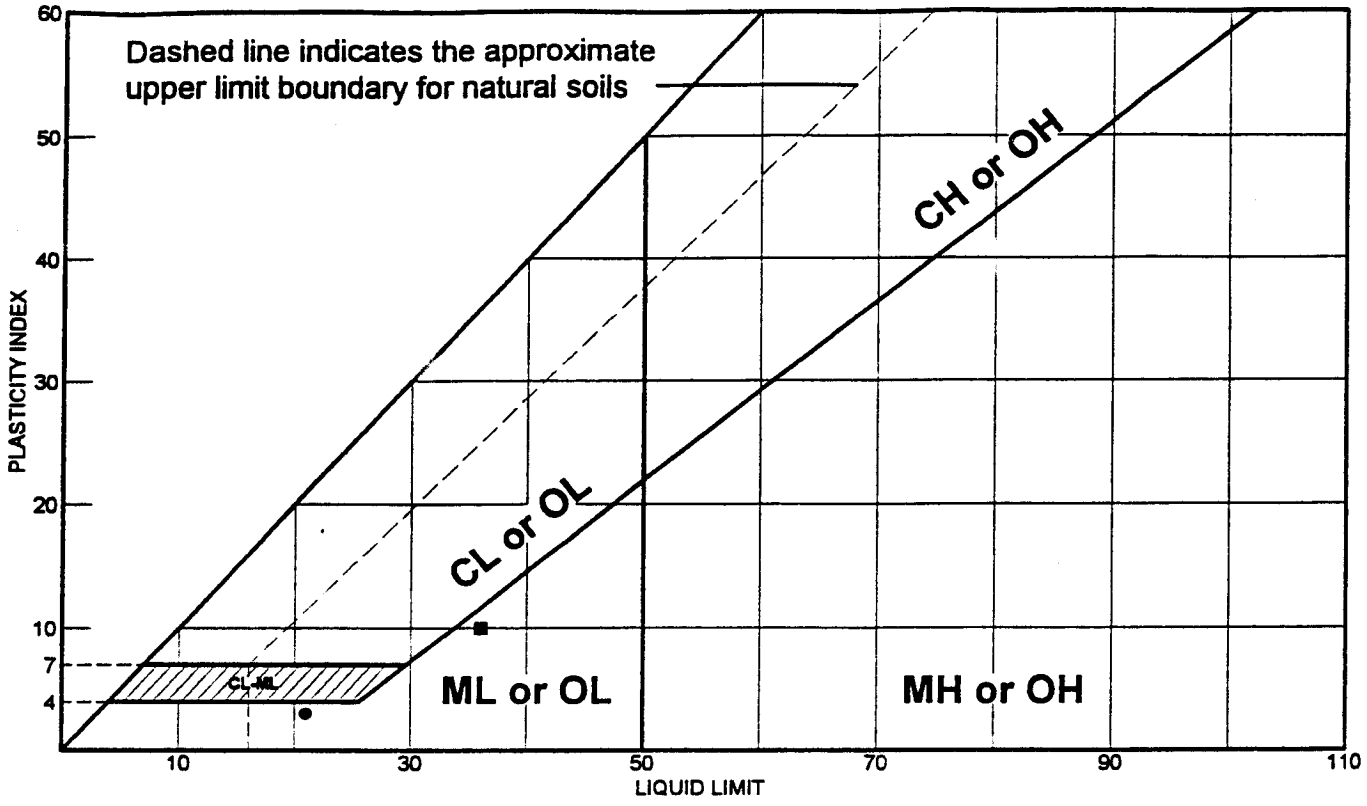
J4978-21 3/29/2000

Figure No C-19

AR 045393

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description	LL	PL	PI	-200	USCS
●	Source: HC00-B113 Sample No.: S-2 SILT	21	18	3		ML
■	Source: HC00-B119 Sample No.: S-3 SILT	36	26	10		ML

Remarks:

●

■

Project: Third Runway

Client: HNTB

Location:

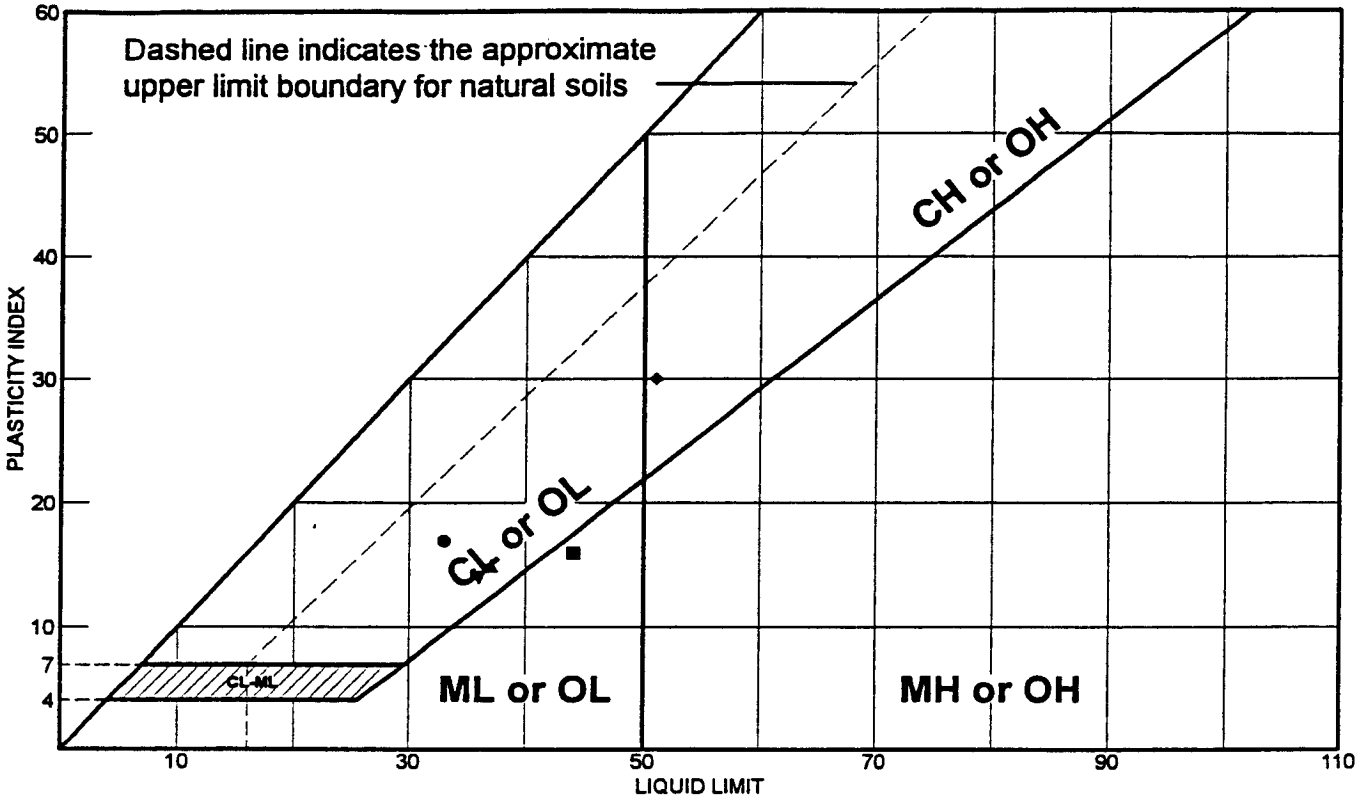
HARTCROWSER

J4978-21 3/31/2000

Figure No. C-20

AR 045394

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description		LL	PL	PI	-200	USCS
●	Source: HC00-B123 Lean CLAY	Sample No.: S-9	33	16	17		CL
■	Source: HC00-B125 SILT	Sample No.: S-5	44	28	16		ML
▲	Source: HC00-B132 Sandy CLAY	Sample No.: S-5	37	22	15	87.0	CL
◆	Source: HC00-B132 Fat CLAY	Sample No.: S-7	51	21	30		CH
▼	Source: HC00-B132A Lean CLAY	Sample No.: S-1	36	22	14		CL

Remarks:

●

■

▲

◆

▼

Project: Third Runway

Client: HNTB

Location:

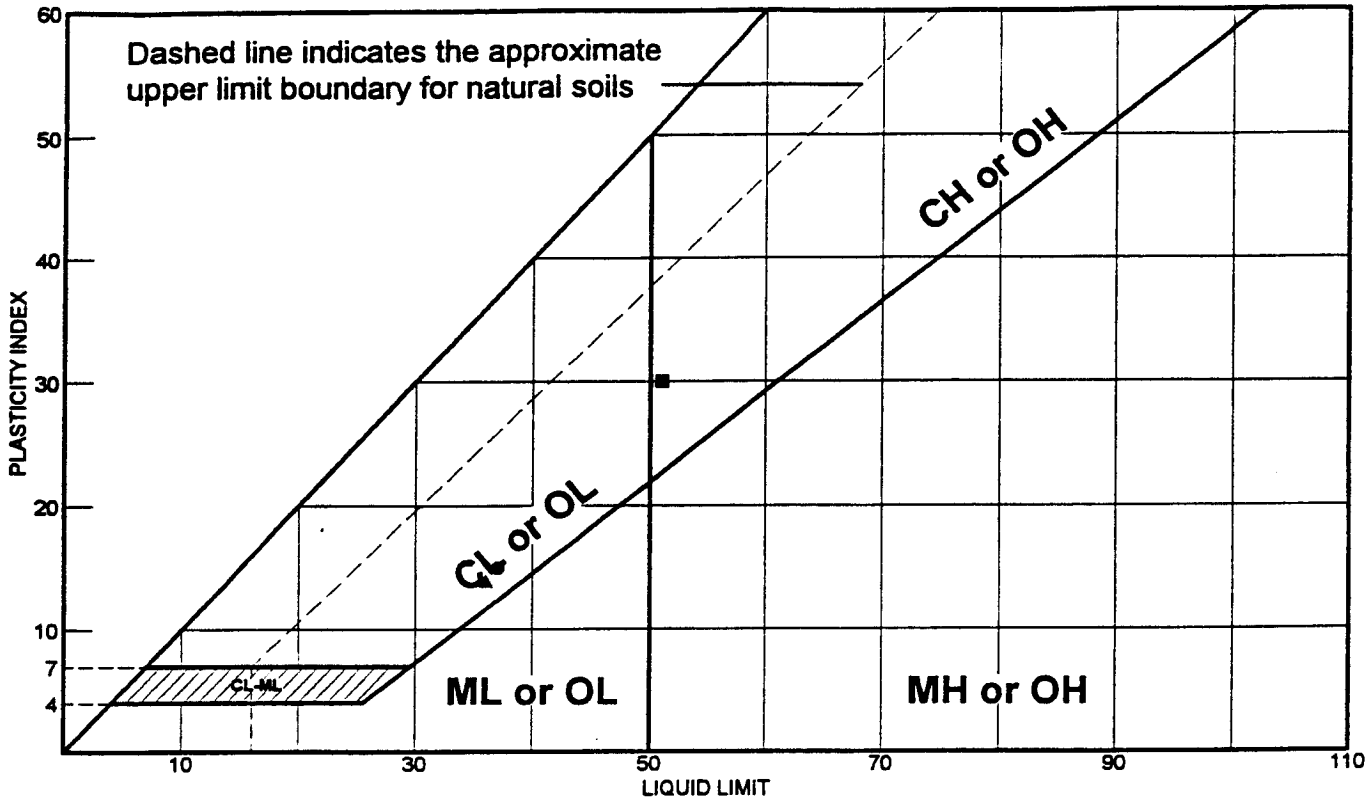
HARTCROWSER

J4978-21 3/31/2000

Figure No. C-21

AR 045395

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-B132 Sample No.: S-5 Sandy CLAY	37	22	15	87.0	CL
■ Source: HC00-B132 Sample No.: S-7 Fat CLAY	51	21	30		CH
▲ Source: HC00-B132A Sample No.: S-1 Lean CLAY	36	22	14		CL

Remarks:

●

■

▲

Project: Third Runway

Client: HNTB

Location:

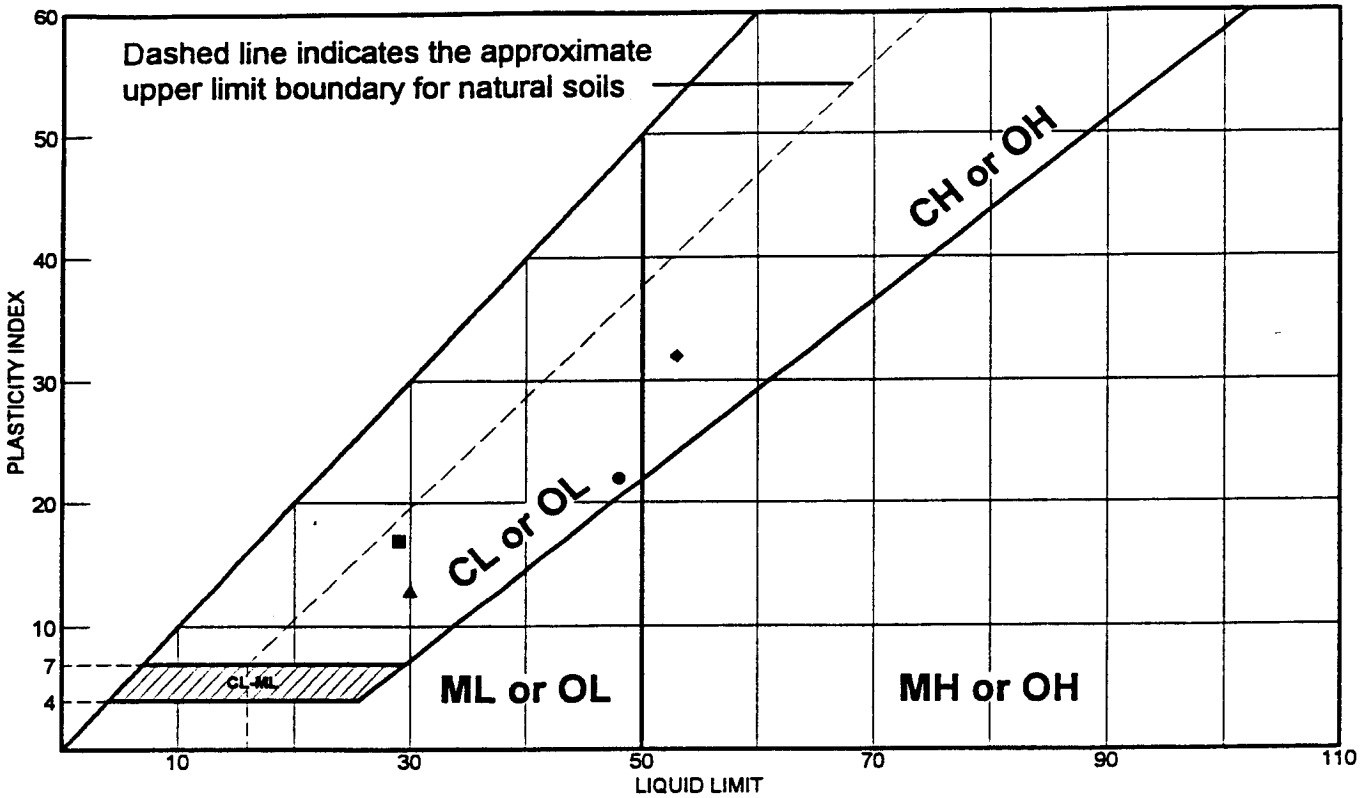
HARTCROWSER

J4978-21 3/31/2000

Figure No. C-22

AR 045396

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	USCS
● Source: HC00-TP110 Sample No.: S-5 Lean CLAY	48	26	22		CL
■ Source: HC00-TP111 Sample No.: S-3 Lean CLAY	29	12	17		CL
▲ Source: HC00-B120 Sample No.: S-5 Lean CLAY	30	17	13		CL
◆ Source: HC00-B128 Sample No.: S-6 Fat CLAY	53	21	32		CH

Remarks:

●

■

▲

◆

Project: Third Runway

Client: HNTB

Location:

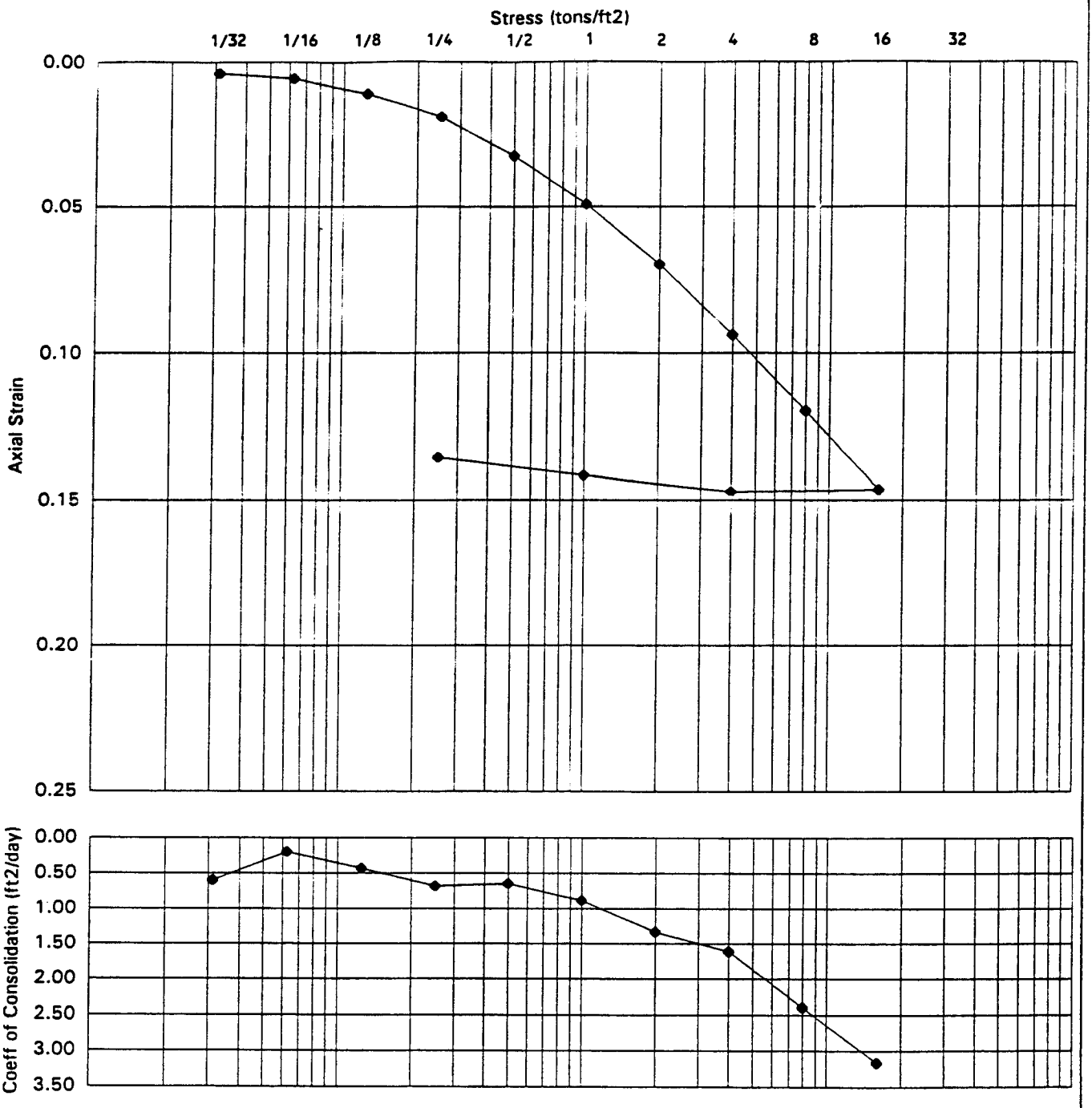
HARTCROWSER

J4978-21 3/29/2000

Figure No. C-23

AR 045397

CONSOLIDATION TEST RESULTS



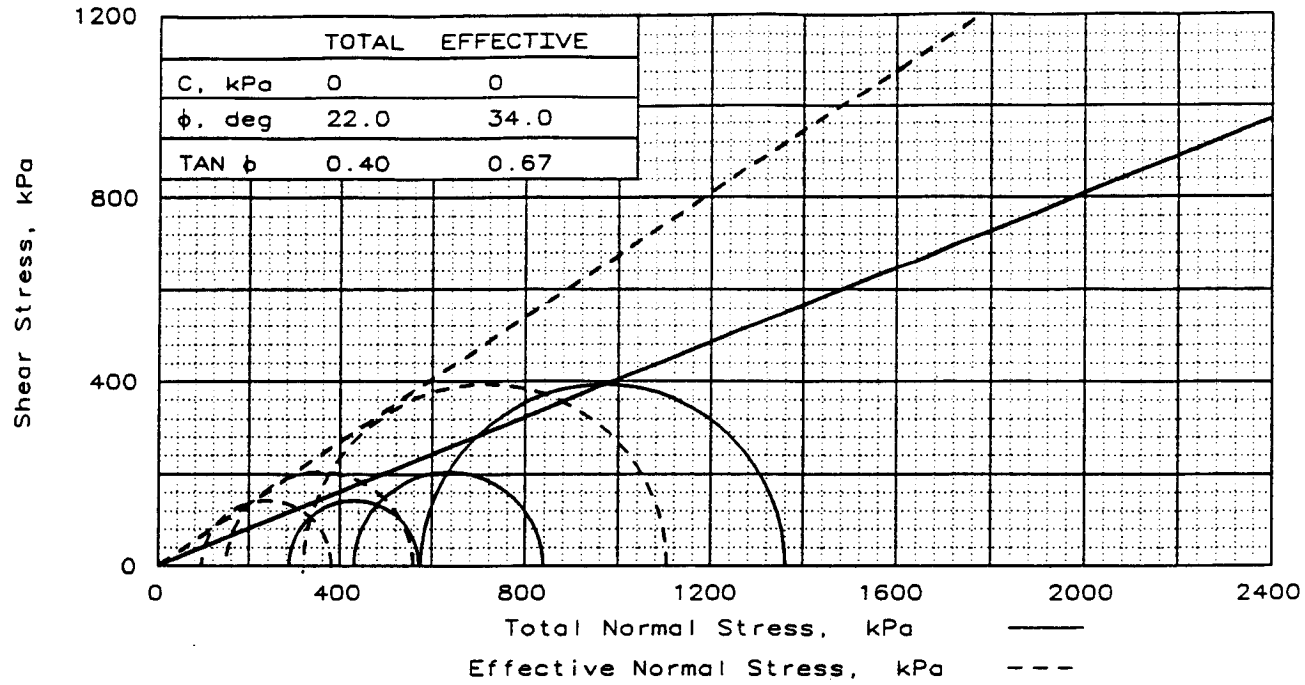
Expl. No.	Sample No.	Depth (ft)	W.C. % Before	W.C. % After	Atterberg Limit LL	Atterberg Limit PL	Atterberg Limit PI	Wet Wt (pcf)	USC	Description
B132A	S-1	8.5'-10.5'	32%	24%	36	22	14	120 pcf	CL	Lean CLAY

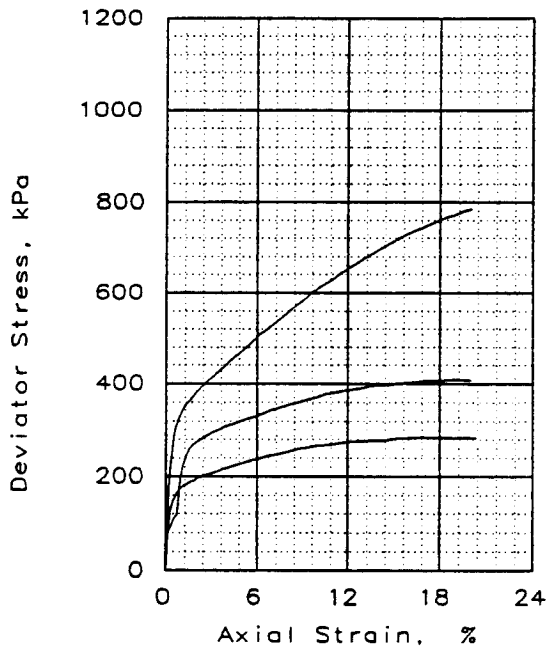
Remarks:

HARTCROWSER

J-4978-21 3/29/2000

Figure C-24





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	40.5	32.7	25.3
	DRY DENSITY, g/cc	1.3	1.5	1.6
	SATURATION, %	104.8	106.2	107.5
	VOID RATIO	1.024	0.816	0.624
	DIAMETER, cm	7.15	7.05	7.01
	HEIGHT, cm	14.95	14.67	14.23
AT TEST	WATER CONTENT, %	28.7	24.9	20.8
	DRY DENSITY, g/cc	1.5	1.6	1.7
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.761	0.659	0.551
	DIAMETER, cm	6.75	6.82	6.95
	HEIGHT, cm	14.59	14.29	13.83
BACK PRESSURE, kPa		138	138	138
CELL PRESSURE, kPa		425	569	714
FAILURE STRESS, kPa		285	408	786
PORE PRESSURE, kPa		329	418	393
STRAIN RATE, %/min.		0.011	0.018	0.036
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		381	559	1106
$\bar{\sigma}_3$ FAILURE, kPa		96	151	321

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Sandy lean CLAY

LL= 37 PL= 22 PI= 15.0
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: HNTB

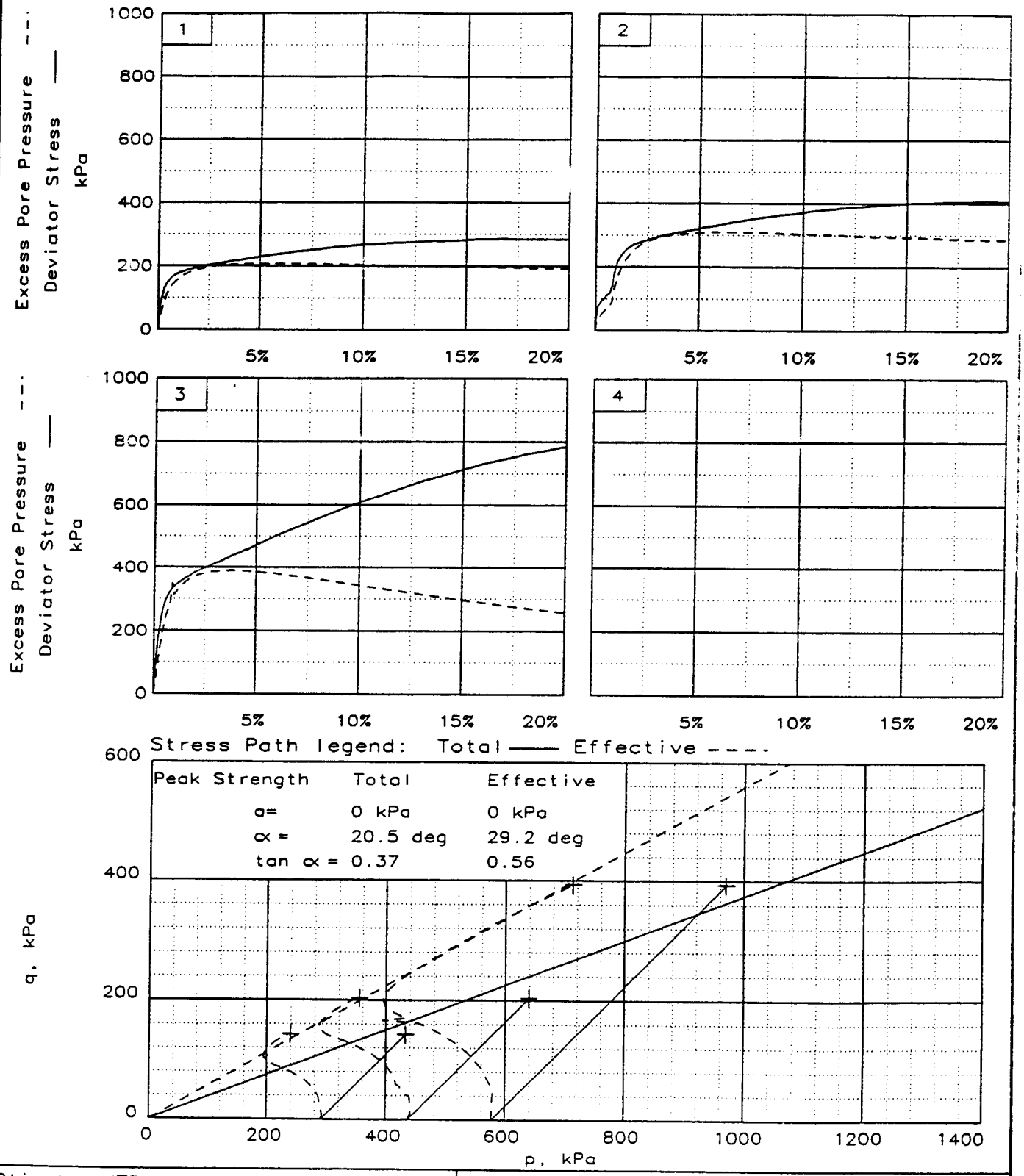
PROJECT: Third Runway

SAMPLE LOCATION: HC00-B132/S-5

HARTCROWSER J4978-21 3/31/00
Figure C-25

AR 045399

STRESS-STRAIN AND STRESS PATHS REPORT



Client: HNTB
Project: Third Runway
Location: HC00-B132/S-5
File: 3RWR

HART CROWSER

J4978-21 3/31/00

Figure C-26

AR 045400

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