The Phase III Expansion of the White Street Sanitary Landfill

Greensboro, North Carolina

Construction Permit Application

November 1995

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Report

WHITE STREET SANITARY LANDFILL
GREENSBORO, NORTH CAROLINA

DESIGN HYDROGEOLOGIC REPORT

Prepared for:

The City of Greensboro

Prepared by:

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SECTION 1
INTRODUCTION

1.1 Purpose

The North Carolina Solid Waste Management Rules (SWM Rules) and Solid Waste Management Law require that a Design Hydrogeologic Report be submitted in the application for the Permit to Construct a new Subtitle D solid waste landfill. This Design Hydrogeologic Report for the White Street Landfill expansion in Greensboro presents the results of investigations which follow up and supplement the Draft Site Hydrogeologic Study previously submitted to the Division of Solid and Hazardous Waste.

1.2 Scope

The Design Hydrogeologic Report focuses specifically on the proposed landfill expansion footprint plus a 300-foot buffer zone along its downgradient margin. In accordance with the SWM Rules, this Design Hydrogeologic Report incorporates and extends the boring program completed for the Site Study. To this end, it provides stratigraphic and hydrogeologic cross-sections and water table information including horizontal and vertical dimensions of ground-water flow, ground-water contour maps, a site boring plan map, boring logs and well and piezometer construction records, a bedrock contour map, rock coring logs, and identifies other geologic and hydrogeologic considerations. Specifically, the Design Hydrogeologic Report must also provide the results of supplemental investigations aimed at demonstrating compliance with vertical separation and foundation standards, and detailed and localized data on the hydrogeologic regime of the uppermost aquifer to facilitate design of an effective water quality monitoring system and define the relevant point of compliance for the proposed solid waste management unit.

1.3 Previous Investigations

This Design Hydrogeologic Report is a summary of the information collected through subsurface investigations conducted at the proposed landfill expansion site (the Phase III area) beginning in 1989. It incorporates the results of the previous investigation efforts, along with follow-up field work conducted by HDR in October 1995.

Two monitoring wells (MW-11 and MW-13) were installed in 1989 and 1993, respectively, initially as upgradient monitoring points for the active landfill. These wells are located in the northwest corner of the expansion site, but the bulk of subsurface investigation conducted across the Phase III site occurred between late October 1994 and early January 1995, when G. N. Richardson and Associates, Inc. (GNRA) drilled 49 borings at 39 locations, and installed 45 observation wells/piezometers.

1.4 Design Hydrogeologic Investigation

Field subsurface investigations were initiated by HDR in October 1995 to supplement the previous work. A total of 13 additional shallow borings were advanced in order to gain further data on the major stratigraphic units present within the proposed 51-acre Phase III landfill footprint. A combined total of 64 borings were advanced during all investgations at the Phase III area. The boring, monitoring well, observation well, and piezometer locations are shown on Figure D-1.

A total of 36 soil samples were obtained for the combined site and design hydrogeologic investigations and submitted for geotechnical analysis. Six of these samples were submitted specifically for the design hydrogeologic investigation.

Additional efforts were also undertaken to conduct detailed geologic mapping in the Phase III footprint and make an assessment of the ground-water flow regime in the area.

SECTION 2
INFORMATION FROM SITE HYDROGEOLOGIC REPORT

North Carolina Solid Waste Management Rule .1623(b)(2)(A) requires that information required in .1623(a)(4) through (a)(12) for the Site Hydrogeologic Report be included in the Design Hydrogeologic Report. A Site Hydrogeologic Report following Rule .1623(a) was required for the Phase III expansion area and was submitted April 7, 1995; that report was subsequently revised, the latest revision is dated June 4, 1996. The information presented in this section is a summary compilation of data from the Site Hydrogeologic Report and previous investigations.

2.1 Testing Program for Borings

Rule .1623(a)(4) requires a laboratory testing program for soil samples obtained during the subsurface investigations. Boring logs for each of the 64 borings advanced across the Phase III expansion area are provided in Appendix A. These boring logs include records of standard penetration resistance, particle size analysis, soil classification, and formation descriptions.

A total of 36 soil samples were collected for geotechnical analysis to provide a characterization of each of the lithologic units in the uppermost aquifer, and determine the suitability of on-site soils for use as cover and/or liner materials. The laboratory analyses are compiled in Appendix B.

Thirty split-spoon samples (SPTs) obtained for the Site Study were described and analyzed for grain size distribution, USCS Classification, and Atterburg Limits. Correlation of these tested samples with boring logs and surface geology indicates that 15 samples are from saprolite derived from "granite", eight samples are from saprolite derived from "felsic gneiss", five samples are from "mafic intrusive dikes", and two samples were from "greenstone dikes" that intrude the granite. Although Atterberg limits were completed on only 14 of the samples, the following are the Unified Soil Classification System names for these samples:

Granite Saprolite (average fines content = 27%)
Silty SAND (SM) - 12 samples
Silty Clayey SAND (SC-SM) - 2 samples
Poorly Graded SAND with Silt (SP-SM) - 1 sample

Felsic Gneiss Saprolite (average fines content = 47%)
Silty SAND to Silty Clayey SAND (SM to SC-SM) - 4 samples
Sandy SILT (ML) - 3 samples
Sandy Elastic SILT (MH) - 1 sample)

Mafic Intrusive Saprolite (average fines content = 62%)
Elastic SILT with Sand (MH) - 2 samples
Sandy SILT (ML) - 1 sample
Silty Clayey SAND (SC-SM) - 1 sample
Silty SAND (SM) - 1 sample

Greenstone Dike Saprolite (fines content = 50%)
Clayey SAND (SC) - 1 sample
Sandy Lean CLAY (CL) - 1 sample

Not surprisingly, there is a good correlation between parent rock type and the saprolite produced by its weathering. The coarser grained, quartz-rich granite weathers to the coarsest material, while the mafic intrusives and greenstone intrusives weather to the finest material. The relatively quartz-rich but fine-grained felsic gneiss produces a saprolite with an intermediate texture.

As a function of depth, it is generally true that saprolite soils from the site grade from more highly weathered, fine-grained, clayey soils near the ground surface to less weathered, coarser, silty and sandy soils at depth. The thickness of the saprolite and partially weathered rock ranges from 0.5 to 38.5 feet across the site, with most locations having between 10 and 25 feet of saprolite above bedrock.

Six additional geotechnical samples were analyzed for the Design Study to provide data on moisture content, porosity, and indications of hydraulic conductivity for the uppermost aquifer. This data is also compiled in Appendix B.

Laboratory hydraulic conductivity testing was determined by performing a constant head permeability test on remolded (bulk) and undisturbed (Shelby Tube or pitcher barrel) samples. The remolded samples were compacted in accordance with ASTM D698, while the undisturbed samples were not remolded or compacted. Laboratory results indicate that site soils have remolded permeabilities ranging from 3.3 to 3.9 x 10^{-7} cm/sec (0.34 to 0.40 ft/year). These results indicate that, if on-site soils are used in construction of the clay liner, some bentonite augmentation would be required to achieve the 10^{-7} cm/sec regulatory requirement for clay liners. For those samples which are representative of the saprolite just above the water table (SB-46, SB-47, and SB-50), undisturbed permeability ranged from 1.0 x 10^{-6} to 2.7 x 10^{-6} cm/sec (1.03 to 2.79 ft/year). Porosity of these undisturbed soils ranges from 17.1% to 45%. Understandably, the lowest porosity was from B-47, the sample taken closest to bedrock. It is likely that the porosity measured here is secondary in nature and is associated with fractures just above the top of bedrock. For a more detailed treatment of in-situ permeability as related to ground-water flow, see Section 2.4.

2.2 Water Table Information

Rule .1623(a)(7) requires tabulations of stabilized water table elevations, an estimate of the seasonal high water table, and a discussion of any activities that have the potential for causing water table fluctuations.

A total of 47 piezometers or monitoring wells are currently accessible as water level measurement points in the Phase III area and immediate vicinity. Of these, 45 were installed specifically for the site and design hydrogeologic investigations. See Table 2-1 and Appendix A for piezometer/well construction information.

2.2.1 Stabilized Water Table Elevations

Static water levels were obtained from each of the 45 new piezometers at the time of installation, at 24 hours, and at monthly intervals thereafter. Following completion of the first set of stabilized readings (12/27/94), water level measurements were obtained by GNRA personnel on a monthly schedule. Stabilized water table elevations are presented in Table 2-2.

TABLE 2-1

Observation Well Construction Details
Site Hydrogeologic Investigation
White Street Sanitary Landfill Expansion
Greensboro, North Carolina

WELL NUMBER	WELL DEPTH (Feet)	BOREHOLE DIAMETER (Inches)	SCREEN INTERVAL (Feet)	TOP OF SAND (Feet)	TOP OF BENTONITE (Feet)	RISER STICK-UP (Feet)
B-1	33.00	6.25	23.0 - 33.0	21.0	19.0	2.41
B-1d	43.00	5.75	38.0 - 43.0	36.0	34.0	2.08
B-2	18.50	6.25	8.0 - 18.0	6.0	4.0	3.02
B-3	15.50	6.25	5.5 - 15.5	4.0	2.0	2.98
B-4	25.00	6.25	15.0 - 25.0	13.0	11.0	3.1
B-5	28.00	6.25	18.0 - 28.0	16.0	14.0	1.99
B-6	61.00	6.25	51.0 - 61.0	48.0	45.0	2.69
B-7	24.50	6.25	14.5 - 24.5	13.0	11.0	0.66
B-8	63.00	6.25	48.0 - 63.0	46.5	44.5	1.65
B-9	36.50	6.25	26.5 - 36.5	25.0	23.0	2.73
B-9d	67.00	5.75	62.0 - 67.0	60.0	58.0	2.90
B-10	32.50	6.25	22.5 - 32.5	21.5	19.5	2.82
B-11	16.50	6.25	6.5 - 16.5	5.0	3.0	2.84
B-12	28.00	6.25	13.0 - 28.0	11.0	9.0	2.78
B-13	53.00	6.25	43.0 - 53.0	41.0	38.0	1.76
B-14	16.50	6.25	6.5 - 16.5	5.0	3.0	3.11
B-15	19.50	6.25	9.5 - 19.5	8.0	6.0	3.04
B-16	36.00	6.25	26.0 - 36.0	23.5	21.5	2.95
B-17	28.00	6.25	18.0 - 28.0	16.5	14.5	1.90
B-17d	53.00	5.75	48.0 - 53.0	46.0	44.0	1.95
B-18	49.00	6.25	39.0 - 49.0	38.0	36.0	2.80
B-19	33.00	6.25	23.0 - 33.0	21.5	19.5	2.5
B-20	63.50	6.25	53.5 - 63.5	52.0	50.0	1.5
B-21	11.00	6.25	6.0-11.0	4.5	2.5	3.02

Notes:
1 B and OW series wells installed by G. N. Richardson and Associates, Oct. 1994-Jan. 1995.
2. Total depth and screen interval depths measured from ground surface at time of drilling
3. For borehole diameters, the first value (6.25) represents diameter produced using 4.25-inch ID hollow stem augers and the second value (5.75) represents the diameter produced using a standard NQ core barrel or 5.75-inch air hammer.

TABLE 2-1 (continued)

Observation Well Construction Details
Site Hydrogeologic Investigation
White Street Sanitary Landfill Expansion
Greensboro, North Carolina

WELL NUMBER	WELL DEPTH (Feet)	BOREHOLE DIAMETER (Inches)	SCREEN INTERVAL (Feet)	TOP OF SAND (Feet)	TOP OF BENTONITE (Feet)	RISER STICK-UP (Feet)
B-22	31.00	6.25	21.0 - 31.0	18.5	16.5	2.94
B-22d	46.50	5.75	41.5 - 46.5	39.5	37.5	1.88
B-23	31.00	6.25	21.0 - 31.0	19.5	17.5	3.00
B-24	12.00	6.25	7.0 - 12.0	5.5	3.5	2.95
B-25	38.50	6.25	28.5 -38.5	27.0	25.0	3.42
B-25d	52.00	5.75	47.0 - 52.0	45.0	43.0	3.0
B-26	6.50	6.25	1.5 - 6.5	1.0	0.0	3.35
B-27	33.00	6.25	23.0 - 33.0	21.0	19.0	1.89
B-28	16.80	6.25	6.8 - 16.8	4.8	2.8	3.36
B-29a	6.50	6.25	1.5 - 6.5	1.0	0.0	2.86
B-30	32.00	6.25	22.0 - 32.0	20.5	18.5	3.15
B-31	25.00	6.25	15.0 - 25.0	13.5	11.5	3.00
B-32	21.50	6.25	11.5 - 21.5	10.0	8.0	3.11
B-33	15.00	6.25	5.0 - 15.0	3.5	1.5	3.11
B-34	7.00	6.25	2.0 - 7.0	1.0	0.0	2.95
B-34d	48.50	5.75	33.5 - 48.5	31.5	28.0	1.52
B-35	7.00	6.25	2.0 - 7.0	1.0	0.0	2.75
B-36	20.00	6.25	3.0 - 20.0	2.0	0.0	1.00
OW-1	45.00	5.75	25.0 - 45.0	24.0	22.0	3.05
OW-2	40.00	5.75	20.0 - 40.0	19.0	17.0	2.95
OW-3	48.00	5.75	28.0 - 48.0	27.0	25.0	3.00
MW-11	100.50	5.75	19.5-100.5 Open hole	–	--	3.20
MW-13	32.50	5.75	16.0-31.0	14.0	12.5	2.62

Notes:
1. B and OW series wells installed by G. N. Richardson and Associates, Oct. 1994-Jan. 1995.
2. Total depth and screen interval depths measured from ground surface at time of drilling
3. For borehole diameters, the first value (6.25) represents diameter produced using 4.25-inch ID hollow stem augers and the second value (5.75)represents the diameter produced using a standard NQ core barrel or 5.75-inch air hammer.

Table 2-2
Ground Water Table Elevations
Site Hydrogeological Investigation
White Street Sanitary Landfill Expansion
Greensboro, North Carolina

Well #	Top Casing Elevation	Total Well Depth	12/20/94 GW Elevation	12/27/94 G W Elevation	12/29/94 G W Elevation	1/10/95 G W Elevation	1/25/95 G W Elevation	3/11/95 GW Elevation	4/18/95 GW Elevation	5/22/95 GW Elevation	6/22/95 GW Elevation	7/20/95 GW Elevation	8/16/95 GW Elevation	9/15/95 GW Elevation	10/31/95 GW Elevation	11/30/95 GW Elevation	TOC adjusted December	1/4/96 GW Elevation	1/29/96 GW Elevation	3/13/96 GW Elevation	4/24/96 GW Elevation	5/23/96 GW Elevation	6/27/96 GW Elevation	7/25/96 GW Elevation	8/29/96 GW Elevation
B-1	763.21	34.88	742.48	745.35	-	746.01	746.82	747.57	746.09	745.81	745.63	746.2	745.58	746.14	747.3	747.4		746.7	746.1	747.25	746.13	745.81	745.52	745.52	746.47
B-1d	762.55	45.06	754.83	755.27	-	754.45	721.52	725.29	729.12	731.73	733.63	735.31	736.58	737.87	739.66	741.71		741.78	742.433	743.34	743.95	744.16	744.4	744.49	744.72
B-2	777.58	21.07	765.73	765.49	-	766.21	767.59	768.84	Removed																
B-3	752.85	18.32	748.01	747.56	-	748.59	748.82	748.74	747.08	748.54	748.98	747.16	746.29	748.08	747.47	748.13		747.87	748.61	748.15	747.85	747.37	746.88	746.3	747.47
B-4	759.43	25	-	-	-	742.4	742.14	744.78	740.19	739.63	740.03	740.3	739.55	739.55	741.58	742.55		741.316	744.38	742.17	740.69	740.81	740.17	739.88	740.97
B-5	760.13	28	-	-	-	739.9	739.26	740.89	741	740.78	740.98	741.36	741.19	741.24	741.06	742.04		742.26	742.9	743.16	742.88	742.61	742.13	741.7	741.75
B-6	756.21	61	-	-	-	700.68	701.69	732.42	737.03	736.59	736.25	736.78	736.69	736.35	737.5	738.08		739.56	739.86	740.03	739.64	738.87	738.04	737.15	737.41
B-7	773.75	24.74	754.03	754.01	-	751.61	752.2	753.68	753.59	752.87	752.46	752.48	752.2	751.74	751.57	751.84	767.48	754.14	754.7	755.53	755.8	755.84	755.52	754.9	755.41
B-8	758.58	65.08	-	737.67	-	737.26	735.23	738.95	737.58	737.13	736.73	734.99	733.44	733.07	734.09	734.2		733.95	734.74	734.78	734.62	734.32	733.43	732.85	733.57
B-9	781.77	38.58	-	744.05	744	744.28	744.86	745.12	744.81	744.39	743.7	741.11	740.03	739.51	739.81	739.86		739.74	740.65	740.7	741.82	740.87	740.21	739.78	739.93
B-9d	782.41	71.13	-	742.17	743.02	743.9	744.43	745.37	744.5	744.29	743.8	740.6	739.04	738.97	739.13	739.4		739.37	740.54	740.31	740.77	740.47	739.97	738.77	738.47
B-10	780.91	34.46	753.91	753.82	-	753.68	753.99	754.2	754.75	754.91	754.85	754.84	754.89	754.72	754.55	754.65		754.78	754.91	755.31	755.69	755.97	756.18	756.18	756.1
B-11	772.04	19.28	754.27	754.15	754.11	753.97	754.83	755.91	755.09	754.18	753.82	754.71	753.89	753.98	753.93	753.88		753.27		754.34	753.94	753.55	dry	dry	753.75
B-12	778.84	34.36	-	761.92	751.8	766.68	768.67	770.96	767.75	767.14	767.34	769.17	767.41	767.83	770.22	770.38		768.64	771.33	770.33	769.1	769.49	768.07	768.41	769.78
B-13	793.87	53	-	-	-	763.2	763.46	764.29	764.93	764.78	764.39	764.25	764.04	763.52	763.34	763.73		763.99	764.49	765.54	766.18	766.38	766.17	765.44	765.48
B-14	790.51	19.58	779.18	779.43	-	780.45	780.47	781.91	780.79	780.3	780.49	782.58	780.82	781.2	782.72	782.37		781.72	783.25	783.32	783.12	783.42	782.4	781.31	782.65
B-15	777.19	22.5	-	760.22	-	760.24	761.12	761.03	761.32	761.29	761.3	761.36	760.78	760.45	761.66	762		762.35	764.95	763.91	762.9	762.1	761.03	760.82	760.99
B-16	785.86	37.95	761.48	761.31	761.31	761.2	761.37	761.92	762.31	761.94	761.69	761.84	761.11	760.3	761.71	762.16	770.44	761.85	764.19	762.09	761.4	760.94	759.71	759.27	761.42
B-17	789.61	30.06	-	-	763.52	774.12	774.33	775.23	775.05	774.33	773.68	774.27	773.68	773.55	773.81	774.38	783.22	773.29	776.34	775.32	773.28	773.18	772.84	772.72	774.39
B-17d	789.66	55.52	-	-	753.62	760.57	761.29	762.54	762.76	761.8	760.75	761.55	760.13	760.15	761.09	761.81	783.98	762.22	764	763.56	763	762.32	761.27	760.1	762.21
B-18	774.4	51.82	-	-	753.18	757.22	757.81	758.82	757.5	756.82	756.33	757.2	755.97	755.77	756.2	756.44		756.35	757.79	757.88	757.27	756.81	755.45	754.43	755.94
B-19	778.28	n/a	-	-	-	757.04	758.56	758.34	758.65	758.58	758.88	758.8		758.63	759.82	760.57	772.02	760.15	762.69	761.97	761.51	761.38	760.92	760.23	761.15
B-20	772.18	83.5	-	-	-	744.72	744.95	745.73	743.23	742.89	743.3	743.34	742.33	742.78	744.74	745.17	761.12	744.45	746.24	746.17	745.37	745.1	744.02	742.84	744.28
B-21	759.84	14.11	-	751.23	751.3	751.6	751.89	752.54	751.59	751.25	751.27	751.68		751.21	752.09	752.49		752.1	752.85	752.38	752.14	751.96	751.54	751.03	752.22
B-22	757.88	33.82	747.29	746.38	746.34	746.14	746.21	746.9	745.03	744.41	744.13	744.38	743.7	743.43	744.5	744.87		744.83	746.44	746.03	745.61	745.05	743.94	742.89	743.95
B-22d	756.86	48.86	-	-	740.32	746.26	746.37	747.08	745.17	744.56	744.38	744.6	743.91	743.72	744.33	745.1		745.16	746.58	746.29	746.1	745.35	744.1	743.1	744.18
B-23	768.26	33.54	-	751.51	-	751.2	751.02	748.63	747.61	746.78	746.34	747.55	746.12	746.47	746.84	749.3	754.21	746.83	749	748.75	748.53	746.06	746.8	746.55	746.79
B-24	753.03	14.67	-	740.39	-	740.78	740.98	741.88	740.19	740.18	740.38	740.7	740	740.06	740.9	740.81		740.64	742.04	740.93	740.32	740.25	739.61	739.36	740.27
B-25	747.96	40.84	-	737.9	-	738.82	739.52	741.32	737.3	737.09	738.09	738.16	736.56	736.93	739.11	740.27		740.4	741.36	740.57	739.51	739.02	737.53	736.09	738.21
B-25d	747.54	52	-	-	-	737	737.69	739.19	735.82	735.44	735.82	736.4	735.02	735.17	736.85	737.8		737.95	739.16	738.06	737.93	737.43	736.09	734.7	736.39
B-26	742.55	10.23	-	733.76	-	734.8	734.53	735.98	732.6	733.28	733.13	733.13	732.48	732.61	734.5	735.53		736.82	737.79	736.74	736.4	735.38	733.45	733.11	734.14
B-27	736.71	12.69	-	-	-	717.84	717.84	718.05	717.78	717.78	717.75	717.74	717.72	717.7	717.8	717.74		717.85	717.91	717.78	717.69	717.67	717.63	717.49	717.7
B-28	742.69	n/a	-	-	-	735.15	735.73	736.77	732.84	733.07	733.96	736.21	733.82	734.81	737.73	737.91		737.65	738.33	737.47	735.99	735.54	733.88	732.46	736.82
B-29a	748.47	11.15	-	736.86	-	739.69	738.6	739.44	736.34	736.37	736.58	737.13	735.38	735.41	737.95	738.9		738.88	740.09	739.85	739.56	739.09	738.64	737.22	738.69
B-30	742.26	34.92	-	724.28	-	724.37	725.42	727.38	725.67	724.65	724.17	725.58	725.1	725.23	726.21	727.08		726.88	728.23	728.42	727.94	727.35	726.33	725.18	726.14
B-31	750.1	27.75	-	741.23	741.08	741.68	742.13	743.76	739.77	739.53	739.72	740.24	738.78	738.8	740.63	739.43		745.3	745.69	745.46	745.49	745.26	744.31	744.21	745.29
B-32	744.78	24.69	-	724.62	-	727.29	727.86	731.43	729.76	729.81	729.58	730.49	729.89	729.58	728.74	728.29		727.67	728.65	728.33	728.17	728.04	727.2	725.78	727
B-33	760.33	17.59	-	752.72	752.65	752.68	753.07	754.47	752.3	751.7	751.51	752.36	751.12	751.26	748.45	748.88		748.58	749.15	748.68	748.27	748.02	747.1	746.91	748.55
B-34	733.92	9.41	-	726.6	-	730.31	728.88	729.82	724.8	724.63	724.78	726.32	724.59	dry	726.67	728.97		729.3	730.42	728.87	727.86	726.85	dry	dry	726.7
B-34d	732.49	48.24	-	-	-	708.06	725.38	727.43	722.97	722.11	722.42	724.13	722.18	721.82	724.68	725.79		726.25	727.63	726.60	725.53	724.94	722.81	720.48	722.18
B-35	746.75	9.6	-	-	742.73	741.51	742.88	743.22	742.53	742.24	742.48	742.27	741.36	741.88	743.13	743.52		743.08	743.46	743.01	742.67	742.31	741.8	742.65	742.67
B-36	783	20	-	-	-	764.21	764.78	766.46	766.28	765.84	765.19	765.57	765.05	764.94	765.24	765.69		765.66	766.53	767.31	767.72	767.43	766.68	766.12	766.37
B-37	783.02		-	-	-	-	-	-	-	764.58	764.27	764.18	764	763.5	763.31	763.66		763.78	764.28	765.21	765.54	765.51	765.1		764.74
OW-1	771.05	48.24	-	742.62	-		742.96	749.08	749.36	748.93	748.34	748.1		748.26	747.31	747.75			748.6	749.45	750.08	750.08	749.56	748.74	748.53
OW-2	769.95	42.92	-	750.03	-		750.71	751.41	751.22	751.15	750.97	750	749.55	749.15	749.17	749.16			749.97	750.3	750.59	750.84	750.44	750.62	749.84
OW-3	782	51.24	-	744.04	-	-	-	-	-	744.37	743.26	739.35	738.19	737.55	738.05	738.43			741.46	740.84	740.51	739.95	738.97	738.18	738.2
GSO-11	742.2	103.45	-	718.08	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-
MW-13	741.62	33.97	-	718.5	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-
PW-2	752.91	26.52	-	740.11	-	-	740.69	-	740.86	-	740.31	-	739.67	738.74	740.04	740.6			741.71	742.4	743.06	742.51	741.54	742.75	740.47
PW-3	752.5	26.36	-	743.26	-	-	743.69	-	743.4	-	742.8	742.54	741.75	741.02	741.7	-			743.68	743.14	742.75	742.4	741.63	741.58	741.27

Note: In December, 1995, the top of casing for piezometers B-7, B-16, B-17, B-17d, B-19, B-20 and B-23 were lowered. Readings collected after November, 1995 have been evaluated with the new top of casing elevations.

2.2.2 Estimated Seasonal High Water Table

The evaluation of data for the determination of an estimated long-term seasonal high water table for the Phase III area of the White Street Landfill was performed in several phases. These phases included:

1) Evaluation and determination of the on-site seasonal high water table (minimum of 1 year).
2) Evaluation and determination of long-term regional seasonal high trends using USGS records.
3) Comparison and correction of on-site seasonal high water table elevations with long-term seasonal high correction factor.

During the first phase of the evaluation process, all available on-site water level data for the ground-water piezometers installed in or near the Phase III area were evaluated to determine which monitoring event (e.g., month) seemed to contain the greatest number of high water table readings. The period of data evaluated was from January 1995 through August 1996 (19 months of readings). Based on this evaluation, it was determined that the greatest number of the 40 shallow piezometers/wells in the Phase III area (16 total) experienced their highest potentiometric elevation on January 29, 1996. Based on the evaluation of on-site seasonal data from the White Street Landfill, as well as from other regional landfills located in the Piedmont of North Carolina, it has been previously documented (and reported by HDR) that the seasonal high ground-water table typically occurs during the winter months between January and March. The January 29, 1996, event is supported by this finding (see Table 2-2).

The second phase of the evaluation process involved the evaluation of the on-site seasonal high ground-water data against the long-term regional ground-water data in order to establish a long-term seasonal high correction factor for the White Street data. Based on a review of the "Water Resources Data, North Carolina Water Year 1995, Volume 2. Ground-Water Records," U.S. Geological Survey Water-Data Report NC-95-2 revealed only two ground-water wells near Guilford County. One well is located in Davie County (NC-142) approximately 45 miles west-southwest of the site, and the second well (NC-126) is also located approximately 45 miles east-southeast of the site in Orange County. Based on the published information concerning these wells, it appears that the Davie County

well is the more appropriate of the two wells for ground-water data comparison with the on-site piezometers. The Davie County well is located at an elevation datum of 835 feet MSL along the upper edge of a slope which drains southeasterly to a tributary of Leonard Creek. The Davie County well is a drilled well which is 30.8 feet deep and 6-inches in diameter, whereas the Orange County well is a dug well 48 feet deep with a 36-inch diameter. In addition, the Davie County well is continuously monitored with a digital recorder every 60 minutes, while the Orange County well is only periodically monitored with a steel tape. Moreover, the Orange County well has experienced two dry periods, one between October and December 1940 and another between October 1988 and January 1989. The only apparent similarity between the wells is that both wells are completed within the uppermost aquifer which is composed of a comparable lithology (weathered granite saprolite of Paleozoic age) to the on-site wells at White Street. In addition, unpublished ground-water data for the 1996 Water Year for the Davie County well was also provided by the USGS regional office in Raleigh, North Carolina, in order to check the general trend in this well as compared to the January 29, 1996, on-site seasonal high at White Street. A thorough review of these records (from 1985 through 1996) revealed that the long-term seasonal high for the Davie County well occurred during the winter months in 1993 (specifically the month of March). Well construction, location, and tabulated ground-water data (with hydrographs) for the Davie County well for the period between 1993 and 1996 is included in Appendix D.

In order to determine if a correction factor is needed to adjust the January 29, 1996, on-site seasonal high ground-water data to better approximate the regional long-term seasonal high event in 1993, the elevation on January 29, 1996 (822.15 feet MSL) for the Davie County well was subtracted from the highest elevation in 1993 (824.36 feet MSL). This produced a differential factor of 2.21 feet. See the calculation sheet included in Appendix D.

Since a majority of the on-site piezometers/wells experienced a seasonal high level in January 1996, this single data event was used as the foundation for the long-term seasonal high water table map. The January 1996 data were corrected (by adding) by a factor of 2.21 feet in order to approximate the long-term seasonal high. After this correction factor had been added, the corrected elevations were then rechecked against the available on-site data to make sure that all of the corrected elevations were equal to or higher than all of the actual seasonal high

elevations not experienced during the January 1996 event. After using the correction factor, six of the 40 piezometers/wells still had experienced on-site water elevations which exceeded the corrected January 1996 data (B-8, B-9, B-23, B-32, B-33, and OW-3). At piezometer/well locations B-8 and B-9, the corrected January 1996 value was still slightly lower than the highest recorded elevation ever at these wells. This is due to the late-spring 1995 draining of the lake located to the east-southeast of the proposed cell. The draining of this lake has resulted in the lowering of the water table in the vicinity of these wells. Therefore, this area of the site should not experience seasonal high water table elevations as high as when the lake was filled. Therefore, the corrected January 1996 values were considered conservative and were therefore utilized at these locations. For the four remaining locations (B-23, B-32, B-33, and OW-3), the maximum recorded on-site value was utilized since it was slightly higher than the corrected January 1996 value. Since B-32 and OW-3 are located outside of the proposed lined cell footprint, these approximated elevations were not a factor during the determination of the vertical separation requirements for the liner system.

In addition, since piezometer B-11 was not measured in January 1996, a value for this date was estimated by extrapolation using the trend of the potentiometric surface data using an X-Y graph of the elevation data (see Appendix D). The data immediately prior to the January date indicated a downward trend in the water table elevation was occurring at this location prior to the missing January date. The next monitoring event following the January date (March 13, 1996) showed that the water table elevation in B-11 had increased again and was once again experiencing a downward trend. When the trend in the data curve was extrapolated back through the missing January 29, 1996, event, an elevation of 754.76 feet was read off the graph. This elevation fits well within the data set. The correction factor of 2.21 feet was then added to this elevation for an estimated long-term seasonal high elevation of 756.97 feet. This estimated elevation is 1.06 feet higher than the highest recorded elevation for this piezometer. Figure D-2 depicts the estimated long-term seasonal high water table for the Phase III area based on actual high and/or the corrected January 1996 data.

2.2.3 Water Level Fluctuations

Examination of the water level data (see Table 2-2, August/September/October 1995 levels) shows a small lowering of 2-4 feet of the water table in areas along the eastern margin of the Phase III area as a result of drainage of the two lakes which previously existed in the central valley, and as a result of excavation in the B-26, B-24, B-33, and B-31 areas of the site (see Figure D-1 for piezometer locations). It appears that this drainage and excavation has primarily affected water levels in piezometers located nearest to the former lakes (B-9 and B-8), with very minor effects possibly also occurring in B-7, B-24, B-26, B-31, and B-33. As indicated above, the effect of lake drainage is probably a much more significant factor in causing the localized lowering of the water table than excavation activities were.

General excavation across much of the Phase III footprint has taken place over the last 10 months, since the observation wells/piezometers were installed. As much as 25 feet of soil has been removed in certain areas. The hydrogeologic investigations of the Phase III site were conducted prior to borrow activities as indicated previously. However, based on NCDEHNR and HDR advice, borrow activities have been discontinued in the Phase III area.

Monthly water level measurements continue to be obtained in order to characterize the nature and extent of man's impact on the water table. In spite of the change in topography and surface water hydrology, the data does not indicate a discernible change in water levels beneath the Phase III landfill footprint.

No other man-made activities or natural processes appear to have the potential to cause water table fluctuations on site.

2.3 Geologic and Hydrogeologic Considerations

2.3.1 Regional Geologic Setting

The White Street Landfill (the Landfill) is located in the upland portion of the southern Piedmont physiographic province (Fenneman, N.M., 1938, Physiography of the Eastern United States: New York, McGraw-Hill). The physiography of the Piedmont is characterized by gentle to rough, hilly terrain that becomes more hilly

towards the mountains and is dissected by a mature drainage system. The topography is developed on deeply weathered, belted metamorphic and igneous rocks that generally date from late Precambrian to Paleozoic in age.

The Landfill lies near the western margin of the Carolina Slate Belt, a regionally defined terrain that extends from Virginia to Georgia and includes volcanic and sedimentary rocks of Late Precambrian to Cambrian age that, in the Greensboro area, are metamorphosed to lower greenschist facies and intruded by a variety of plutons (North Carolina Geological Survey, 1985, Geologic map of North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section). The Carolina Slate Belt, Kings Mountain Belt to the southwest, and the Charlotte Belt to the west are all part of a larger terrain known as the Carolina Terrain. Rock relationships, fossil evidence, and geochemical data from the Carolina Terrain indicate that it was primarily formed in a subduction-related, tectonically active volcanic arc separate from the North American Craton (Butler, J. Robert, and Secor, Donald T., Jr., 1991, in Horton, J. Wright, Jr., and Zullo, Victor A., eds., The Geology of the Carolinas: Carolina Geological Society Fiftieth Anniversary Volume: Knoxville, The University of Tennessee Press, p. 59-78). The Carolina Terrain was probably sutured to North America during the Taconic Orogeny, 470-440 million years ago (Middle Ordovician), at which time deformation and associated metamorphism of the Slate Belt also peaked.

Ground water in the Piedmont occurs both intergranularly in the unconsolidated saprolite and within fractures in the bedrock. Typically, although not always, the water table is within the saprolite. Water supply wells are completed in bedrock.

Porosity in the saprolite is usually relatively high, with measured values commonly in the 40 to 50% range. "Effective" porosity is lower, typically ranging from 20 to 30%. In bedrock, porosity is normally only 3 to 5%, but the fractures are often well connected and hydraulic conductivity is comparable to or higher than that found in the saprolite. As the saprolite and bedrock are hydraulically connected, the contrast between porosities allows the saprolite to act as a ground-water reservoir for wells that pump from the bedrock. Sustained well yields for average, well-constructed bedrock wells in the Piedmont average about 12 to 24 gallons per minute (Daniel, Charles C., III, and Payne, R.A., 1990, Hydrogeologic Unit Map

of the Piedmont and Blue Ridge Provinces of North Carolina, U.S.G.S. Water-Resources Investigations Report 90-4035).

The water table in the Piedmont under natural conditions is a subdued image of the surface topography. Recharge takes place on interfluvial areas, then travels downward and laterally to discharge along perennial creeks and rivers. Thus, the vertical component of ground-water flow is directed downward in interfluvial recharge areas, comprising perhaps 80 to 90% of land surface, and then has an upward component of flow as ground water approaches discharge areas at streams.

2.3.2 Description of Rock Units - Site Geology

Each boring was drilled until at least hollow stem auger refusal depth. For purposes of this report, this depth is also correlated with the top of bedrock at the site. Using these data, a bedrock surface contour map was prepared by HDR and is here presented as Figure D-3. As can be seen on this map, bedrock is relatively shallow along the west and southwest portions of the site, as shown by the presence of two bedrock ridges, one trending north-south and another trending northeast-southwest along the eastern part of the site. A bedrock valley separates the two ridges. Some of this bedrock has recently been exposed by excavation in the west-central portions of the Phase III area.

In both surface outcrops and in borings, several rock units have been identified at the site. HDR has prepared a geologic map (Figure D-4) for the site based upon surface rock outcrops, saprolite character, and data from the borings. Three hydrostratigraphic cross-sections are presented herein on Figures D-5A and D-5B. Seven rock and saprolite types are identified on the map and cross-sections.

Granite (GR): white, coarse-grained, hornblende-bearing, typically massive, metamorphosed.
Felsic Gneiss (FG): tan to gray, medium to fine-grained, biotite-bearing, foliated
Rhyolite Intrusive (RI): white, fine-grained, porphyritic, massive
Diorite (DI): medium gray, medium-grained, equigranular, metamorphosed.
Mafic Intrusive (MD): light gray to dark green and bluish green, fine-grained, possibly metamorphosed basalt/gabbro.
Basalt/Gabbro (BG): dark gray to black, fine to medium grained, unaltered.

Greenstone Dikes (GD): light to dark green and bluish green, fine to medium-grained, sheared parallel to intrusive contacts in places, possibly extensively metamorphosed diorite or mafic intrusive.

Figure D-3 indicates that the deepest weathering has occurred in the granite near its contact with the metamorphic rocks. However, rock hardness is not readily correlated with rock type, as quite resistant granite is found at the east of the site, and both deeply weathered and resistant rocks are found in the western half of the site.

Generally, the granite occupies the east and northeast portions of the site, while the felsic gneiss is found in the western and southwestern portions of the area. The mafic intrusives, basalt/gabbro, and greenstone dikes are most obvious in the light-colored granite, but also cross-cut the felsic gneiss. Field relations indicate that the granite is intrusive into the older gneiss. The fine-grained rhyolite intrusive cross-cuts the granite and the felsic gneiss.

Field relations do not suggest generalized shearing or fracturing along the linear, generally northeast-trending, mafic or felsic intrusive features which are found as both dikes and sills. But, the results of the slug testing and rock coring efforts appear to indicate that the saprolitic portions of some dikes (B-1, B-34d) are well fractured, and may represent localized preferred conduits for ground-water flow. Based upon the hardness of the rhyolite and basalt/gabbro now exposed at the surface, these units are very likely to be barriers to ground-water flow. At depth, the dike bedrock appears to be essentially impermeable. Hydraulic conductivities also appear to be somewhat higher in granite versus the felsic gneiss. Metamorphic foliation orientations in the granitic gneiss were extremely consistent across the site, trending between N65E to N70E. Ground-water flow in the metamorphic portions of the uppermost aquifer would be expected to have a slightly higher velocity parallel to foliation.

2.3.3 Cross-Sections

Rule 1623(a)(6) requires that stratigraphic cross-sections be constructed across the proposed footprint. Three cross-sections are shown on Figures D-5A and D-5B. The lines of section are shown on Figure D-1.

The dips on rock contacts are not generally available, but field observations suggest a very steep northerly dip to these features. In an unusual occurrence in the northern portion of the Phase III area, the granite/gneiss contact dips about 30 degrees to the east, with granite overlying gneiss. Remember also that the vertical exaggeration of the cross-sections creates steeper apparent dips, so they are drawn nearly vertically in these sections. Contacts between mafic, rhyolite, diorite, and greenstone intrusives with the country rock are generally near vertical.

2.4 Synthesis of Site Hydrogeology

2.4.1 Aquifer Characteristics

As discussed above, the typical texture of soils at the Landfill are sandy silts (ML or MH) to silty sands (SM). These are very common soil textures in the Piedmont of North Carolina, and experience suggests the following characteristics for these types of aquifer materials:

total porosity = 40-50%, with effective porosity of about 20-25%
hydraulic conductivity = .5-5 ft/day.

Eleven slug tests have been performed in the study area. The results of these tests are presented in Appendix C. Slug tests were conducted on wells completed in saprolite, shallow and deep rock, in granite, gneiss, mafic dikes, and in diorite. The results of these tests are provided in Table 2-3.

Hydraulic conductivities calculated from slug testing ranged from immeasurably low in deep bedrock dikes to 17.69 ft/day. Hydraulic conductivity in the granitic saprolite averaged about 0.68 ft/day, as compared to gneissic saprolite at about 0.13 ft/day. The highest conductivity measured was on a fractured saprolite dike (diorite) at B-34. As expected, hydraulic conductivities decreased from the shallow saprolite aquifer downward to the deep rock aquifer. Slug test results appear to indicate that the saprolitic portions of the dikes have a relatively high conductivity, but that, at depth, they become extremely tight hydrostratigraphic units. In general, the slug test results also indicate that the degree of fracturing is an important control over hydraulic conductivity.

Table 2-3
Aquifer Characteristics

Boring No.	Rock Type	Aquifer	Total Porosity (%)	Slug Test (cm/sec)
B-1	Mafic Dike	Shallow Rock[s]	5[e]	6.39×10^{-4}
B-1d	Mafic Dike	Deep Rock[d]	0-5[e]	$<10^{-7}$*
B-14	Gneiss	Saprolite	50[e]	4.47×10^{-5}
B-17d	Gneiss	Deep Rock[d]	0-5[e]	1.60×10^{-4}
B-22	Granite	Saprolite	45[a]	4.15×10^{-4}
B-22d	Granite	Shallow Rock[s]	0-5[e]	3.06×10^{-5}
B-25	Granite	Saprolite	45[a]	7.24×10^{-5}
B-25d	Granite	Shallow Rock[s]	0-5[e]	5.58×10^{-5}
B-31	Granite	Half Rock/Half Sap	45[a]	6.11×10^{-5}
B-34	Diorite Dike	Saprolite	45[a]	6.24×10^{-3}
B-34d	Diorite Dike	Deep Rock[d]	0-5[e]	$<10^{-7}$*

Average Hydraulic Conductivities (K values)		Effective Porosity (%)
Saprolite Aquifer	1.86×10^{-3} cm/sec or 5.27 ft/day	20[n]
Shallow Rock Aquifer	2.42×10^{-4} cm/sec or 0.69 ft/day	5(est.)
Deep Bedrock Aquifer	5.34×10^{-5} cm/sec or 0.15 ft/day	0.1[n]
Dike Saprolite Aquifer	6.24×10^{-3} cm/sec or 17.69 ft/day	20[n]
Granite Saprolite Aquifer	2.44×10^{-4} cm/sec or 0.69 ft/day	20[n]
Gneiss Saprolite Aquifer	4.47×10^{-5} cm/sec or 0.13 ft/day	20[n]

Notes:

* = Hydraulic conductivity too small to measure using the slug test method; at depth these dikes are extremely tight. K values well below 10^{-7} cm/sec (estimated).

a = Average total porosity value from laboratory testing of saprolite samples from SB-46, SB-50, SB-53.

d = Deep rock aquifer = screen top greater than 25 feet below auger refusal depth.

e = Estimated based on values presented in Table 2.4, Freeze & Cherry, 1979.

s = Shallow rock aquifer = screen top less than 25 feet below auger refusal depth.

n = Effective porosity values taken from USEPA's RCRA Facility Investigation Guidance Document (1987), pages 10-49.

The permeability of the unsaturated saprolite is lowest near the original ground surface, where finer grained clay-rich soils (silty clays, clayey silts, clayey sands, etc.) are common. Remolded permeability measurements for these soils (see Appendix B) ranged from 2.1 to 2.8 x 10^{-7} cm/sec, values which suggest that they would be suitable for use as daily cover or possibly as clay liner material (if augmented by bentonite). At greater depth in the lower portions of the unsaturated zone, it is expected that the coarser grained soils will have hydraulic conductivities in the 10^{-4} to 10^{-5} cm/sec range. This range is comparable to the slug test results described above for the saprolite aquifer.

2.4.2 Horizontal and Vertical Dimension of Ground-Water Flow

Rule .1623(a)(8) requires a discussion of the horizontal and vertical dimensions of ground-water flow. Rule .1623(a)(9) requires submittal of a ground-water contour map.

As indicated above, Figure D-2 depicts the estimated seasonal high water table at the proposed Landfill site. As shown on this drawing, ground-water flow is strongly influenced by surface topography. Flow is generally away from areas of recharge, represented by the highest areas of natural topography and toward the discharge areas found along the streams. Discharge is taking place locally along the central drainage at the east side of the Phase III area. A significant portion of ground-water flow is moving across the old Phase I and Phase II areas north and northwest toward eventual discharge points along North Buffalo Creek.

In the case of the vertical component of ground-water flow, recharge takes place on interfluvial areas, then travels downward and laterally to discharge along the creeks. Thus, the vertical component of ground-water flow is directed downward in interfluvial recharge areas, comprising perhaps 80 to 90% of land surface, and then has a slight upward component of flow as ground water draws near discharge areas at streams.

The most influential hydrogeological features for the Phase III Area are the unnamed creek east of the site, the topographic ridge/divide along Nealtown Road and Huffine Mill Road to the west and south of the Phase III area, and North Buffalo Creek. As a result of these features, ground-water flow in the surficial aquifer generally trends to the northeast as shown on Figure D-2. The horizontal potentiometric gradients for the surficial aquifer range from 0.004 to 0.056. The horizontal potentiometric

gradients for the shallow and deep rock aquifers range from 0.023 to 0.033 and from 0.018 to 0.022, respectively.

A comparison of hydraulic head differences for nested well pairs in the Phase III area, based upon the historical water level measurements from January 10, 1995, through August 29, 1996, indicates a downward gradient in the vertical direction for every well pair (except for B-22/22D). The gradient data for B-1/1D showed the greatest magnitude change from 0.08 ft/ft to 1.96 ft/ft. All of the other piezometer pairs showed minimal fluctuation over time. Although the vertical gradients measured at B-22/22D are primarily slightly upward, these very low vertical gradients at this well pair indicate virtually horizontal ground-water flow (see Drawing D-5B). Vertical gradient information for the nested piezometers is given below.

Vertical Gradients						
	B-1/1D	B-9/9D	B-17/17D	B-22/22D	B-25/25D	B-34/34D
Delta A	12.83	32.53	27.50	18.00	16.00	36.50
1/10/95	0.658*	-0.012	-0.493	0.007	-0.114	-0.610
1/25/95	-1.956	-0.007	-0.474	0.009	-0.114	-0.091
3/11/95	-1.737	0.008	-0.461	0.010	-0.133	-0.065
4/18/95	-1.323	-0.010	-0.447	0.008	-0.093	-0.050
5/22/95	-1.082	-0.003	-0.456	0.009	-0.103	-0.069
6/22/95	-0.935	0.003	-0.477	0.014	-0.142	-0.064
7/20/95	-0.849	-0.016	-0.463	0.013	-0.110	-0.060
8/18/95	-0.700	-0.030	-0.493	0.012	-0.098	-0.066
9/15/95	-0.645	-0.017	-0.487	0.016	-0.110	NA
10/31/95	-0.595	-0.015	-0.463	-0.009	-0.141	-0.055
11/30/95	-0.443	-0.014	-0.457	0.013	-0.154	-0.087
1/4/96	-0.385	-0.011	-0.403	0.018	-0.153	-0.084
1/29/95	-0.442	-0.003	-0.449	0.008	-0.138	-0.076
3/13/96	-0.305	-0.012	-0.428	0.014	-0.119	-0.061
4/24/96	-0.170	-0.026	-0.374	0.027	-0.099	-0.064
5/23/96	-0.135	-0.006	-0.395	0.017	-0.099	-0.052
6/27/96	-0.087	-0.007	-0.421	0.009	-0.090	NA
7/25/96	-0.080	-0.031	-0.459	0.012	-0.087	NA
8/29/96	-0.135	-0.045	-0.443	0.013	-0.114	-0.124

Notes:
Negative values indicate downward component of flow.
Positive values indicate upward component of flow.
NA - Not available (shallow piezometer was dry).
* Based on subsequent data pairs, this point appears anomalous.

The average linear velocity of ground-water flow can be calculated using the following formula:

$$V_x = \frac{Kdh}{n_e dl}$$

Where:

	V_x	= average linear velocity
	K	= hydraulic conductivity
	dh/dl	= hydraulic gradient
	n_e	= effective porosity

Using the effective porosities given in the RCRA Facility Investigation Guidance Document (1987), the hydraulic conductivities given in Table 2-3, and appropriate horizontal hydraulic gradients, a range of horizontal flow velocities of between 0.01 and 6.60 feet per day results for the uppermost (saprolite) aquifer (see Table 2-4). Note that the dike material (one slug test only) is at least an order of magnitude more conductive than saprolite developed in granite or gneiss, but recall also that, at depth, these dikes may become essentially impermeable (see Table 2-3, B-1d and B-34d).

Table 2-4
Summary of Calculated Groundwater Flow Velocities

Hydrostratigraphic Unit (Aquifer)	Hydraulic Gradient	Porosity (%)	Hydraulic Conductivity (ft/day)	Groundwater Flow Velocity (ft/day)
Saprolite	0.004 - 0.056	20	5.27	0.11-1.48
Granite Saprolite	0.004 - 0.056	20	0.69	0.01 - 0.19
Gneiss Saprolite	0.004 - 0.056	15	0.13	0.0035 - 0.049
Dike Saprolite	0.004 - 0.056	15	17.69	0.47 - 6.60
Shallow Bedrock	0.023 - 0.033	5*	0.69	0.32-0.46
Deep Bedrock	0.018 - 0.022	0.1	0.15	2.70 - 3.30
* Estimated				

In the case of the deep bedrock aquifer, a published value of 0.1% for secondary porosity (Heath, 1980) and a hydraulic gradient of between 0.018 and 0.022 were used to calculate an estimated range of flow velocity of 2.7 to 3.3 ft per day.

Given that the upper portion of the bedrock aquifer is more fractured and has a correspondingly higher secondary porosity (estimated at 5%), and a hydraulic gradient of 0.023 to 0.033, a third intermediate range of ground-water velocity of between 0.32 and 0.46 ft/day was calculated.

These data, along with the information given in Table 2-4, provide a framework for understanding the hydrogeologic flow regime that prevails in the subsurface beneath the study area. First, it is apparent that hydraulic conductivities are generally highest in the saprolite aquifer, lowest in the deep rock aquifer, and intermediate in the shallow rock aquifer. In saprolite, the granite appears to be more conductive than the gneiss, but, where saprolite is developed in a sheared, foliated, or fractured dike, the measured conductivity (B-34) can be as much as an order of magnitude higher than in either gneiss or granite. In terms of ground-water flow velocity in saprolite, the same relative rates prevail with dike material having the highest value (up to 6.60 ft/day or 2,409 ft/year), granite having an intermediate value (up to 0.29 ft/day or 69 ft/year), and gneiss having the lowest pore velocity (up to 0.049 ft/day or only 18 ft/year). It is expected that flow rates should be higher parallel to the orientation of foliations in the gneiss (i.e., N65E-N70E).

The surficial/uppermost aquifer which exists in saprolite in the study area serves as the reservoir that recharges the underlying fractured rock aquifer (called shallow and deep herein). Hydraulic conductivities are lower in the rock aquifer, but actual pore water flow velocities can be relatively high due to the very low effective porosities. In rock, the available hydraulic head is forced to travel through a relatively small volume of fractures which act as conduits for flow. In shallow bedrock where an effective porosity of 5% is appropriate, flow velocities of up to 0.46 feet/day (168 ft/year) can prevail. In deep bedrock, effective porosities of 0.1% result in calculated velocities of up to 3.3 ft/day (1,200 ft/year), rates which are comparable to those found in the sheared saprolitic dike at B-34. This accounts for why recharge rates and yield for deep rock wells can be so high compared to saprolite wells, but it must be remembered that high yields in rock wells are absolutely dependent upon the existence of well connected fracture systems which allow flow of ground water to the well to take place. The intent and purpose of this study is not to define the orientation of bedrock fracture systems or to completely characterize the bedrock aquifer on site, but it is useful to discuss the relationship between the uppermost (saprolite) aquifer and the

bedrock aquifer, if only to provide a conceptual framework for designing a monitoring system.

Finally, it should be noted again that the various dikes at the site have highly variable hydrogeologic characteristics as a function of depth, degree of weathering, fracturing, and shearing, and rock type. As previously mentioned, the saprolite developed by weathering of a diorite dike at B-34 had the highest conductivity measured on site, but at depth this same dike was essentially impermeable.

Indeed, the conductivity of the mafic dike at B-1d (deep rock) is so low that recharge after well development took between four and six months. This data suggests that these dikes would be extremely poor conduits for recharge between the uppermost saprolite aquifer and the bedrock aquifers. They may also act as barriers to horizontal flow depending upon the depths at which they become impermeable.

2.5 Topographic Map of the Site

Rule .1623(a)(10) requires a topographic map with the boring locations. Figure D-1 provides a topographic map with the piezometer and boring locations and the cross-section layout.

SECTION 3
DESIGN OF MONITORING SYSTEM

Rule .1623(b)(2)(B) requires technical information necessary to determine the design of the monitoring system. The proposed Water Quality Monitoring Plan is included in the following chapter of this submittal. See Figure D-6 for a layout of the proposed monitoring system.

SECTION 4
INFORMATION FOR RELEVANT POINT OF COMPLIANCE

Rule .1623(b)(2)(C) requires technical information necessary to determine the relevant point of compliance. Rule .1631(a)(2)(A) states that the relevant point of compliance shall be located no more than 250 feet from the waste boundary and at least 50 feet from the property boundary. All of the monitoring wells that will be installed for the Phase III landfill's ground-water monitoring system will meet this criteria; most will be located within 150 feet of the waste boundary. Further discussion of monitoring well locations is provided in the Water Quality Monitoring Plan.

SECTION 5
ROCK CORE DESCRIPTIONS

Rule .163(b)(2)(D) requires a description of rock cores obtained to provide an understanding of the fractured bedrock conditions.

Rock cores were obtained from borings B-1d, B-9d, B-17d, B-22d, B-25d, B-34d, MW-11, and MW-13. Borings B-9d, B-22d, and B-25d were cored into granite, B-1d and B-34d into mafic intrusives, and B-17, MW-11, and MW-13 into gneiss.

Bedrock was encountered at depths of approximately 0.5 to 38.5 feet below ground surface across the proposed site, but generally at between 10 and 25 feet below ground. Recovery values for core samples ranged from 44 to 100 percent, with an average of 84 percent. Rock Quality Designation (RQD) values ranged from 25 (very poor/poor) to 99 (excellent). The low recovery and RQD values are indicative of poor rock quality due to extensive fracturing in the upper 10 feet of the bedrock. In general, the RQD values were the highest in cores of mafic intrusives and felsic gneiss and lowest in the granite which appears to be quite fractured and is crumbly at least in the upper portion of bedrock. At B-1d and in the lower portion of B-34d, the mafic and diorite dike rock appears to be quite competent. In contrast, the greenstone and diorite encountered at B-9d and the upper part of B-34d was only of poor or fair-poor quality. The variability in the RQD values clearly reflects the differing degrees of fracturing found from one dike to another at the Phase III site.

Published literature indicates that the secondary porosity of granitic rock is approximately 0.1 percent (Heath, 1980). The more extensive fracturing that occurs in the upper portion of the bedrock tends to increase the secondary porosity. A secondary porosity value of five percent was used in Section 2.4 for calculating flow velocities.

A number of types of fractures were present in the recovered samples and included both open and healed fractures, with healed fractures occurring more frequently. Core logs are provided as a part of the boring logs in Appendix A.

SECTION 6
GROUND-WATER CONTOUR MAP

Rule .1623(b)(2)(E) requires a ground-water contour map based on the long-term seasonal high water table. Adjusted ground-water elevations measured on January 29, 1996, were used to construct the contour map (see Figure D-2).

Ground-water flow within the Phase III area is towards the northeast with some localized influence created by the unnamed creek which trends north-south along the eastern margin of the proposed site.

SECTION 7
BEDROCK CONTOUR MAP

Rule .1623(b)(2)(F) requires a bedrock contour map illustrating the contours of the upper surface of the bedrock. Figure D-3 presents the bedrock contour map. The depth to the top of bedrock was determined primarily on auger refusal depths with additional information from blow counts and visual inspection.

The depth to the top of bedrock varies from 0.5 to 38.5 feet across the proposed expansion site. Examination of Figure D-3 shows two major northeast trending bedrock ridges which occur along the eastern and western margins of the expansion area, and a central northeast trending bedrock valley. The bedrock ridges are associated with areas which are intruded by numerous mafic and felsic dikes and sills which apparently are more resistant to chemical weathering than the surrounding granitic and gneissic country rocks. The drainage associated with the unnamed creek along the eastern margin of the Phase III area also appears to be exerting some control over the shape and orientation of bedrock contours.

SECTION 8
GROUND-WATER FLOW NETS

Rule .1623(b)(2)(G) requires several hydrogeologic cross-sections that characterize the vertical ground-water flow regime for the site. Figures D-5A and D-5B present hydrogeologic cross-sections A-A′, B-B′, and C-C′. These cross-sections were constructed using ground-water elevations obtained on January 29, 1996.

Cross-sections A-A′ and B-B′ are oriented perpendicular to the ground-water flow direction, while C-C′ is oriented parallel to ground-water flow direction. The cross-sections indicate that ground-water flow has a strong downward vertical component of flow in the higher elevation and central portions of the proposed Landfill expansion area, with decreasing downward gradients being present at lower elevations and toward the unnamed creek and former lakes. It is expected that ground-water discharge may occur along this drainage feature itself, but no direct data is available to confirm this. According to Heath (1980), the hydrogeologic setting for the Piedmont is characterized by ground-water recharge in upland areas and discharge in lowland areas along creeks/rivers. The available data suggests that this pattern also prevails in the Phase III area.

SECTION 9
GROUND-WATER FLOW REGIME

Rule .1623(b)(2)(H) requires a report on the ground-water flow regime for the site area. Section 2.4.2 provides a detailed discussion on the vertical and horizontal components of ground-water flow.

SECTION 10
BORING/PIEZOMETER ABANDONMENT

Rule .1623(b)(2)(I) requires certification by a Licensed Geologist that all borings not converted to permanent monitoring wells will be properly abandoned. All piezometers located within the Phase III area will be abandoned as delineated in 15A NCAC 2C Rule .0113(a)(2) prior to Landfill construction. Since construction is not expected to begin for several months, the piezometers will be left in place in order to gather additional water level data. After abandonment has been completed, the City of Greensboro will be responsible for providing documentation that the piezometers have been properly abandoned.

SECTION 11
VERTICAL SEPARATION CRITERIA

Rule .1623(b)(1)(A) requires adequate information to demonstrate compliance with vertical separation requirements. These requirements state that a minimum 4-foot separation shall be maintained between the bottom of the Landfill liner system and the seasonal high water table and the top of bedrock. Table 11-1 presents a summary of the vertical separation criteria and provides a comparison between base grade, top of bedrock, and seasonal high water table elevations.

The uppermost aquifer occurs within the saprolite in the Phase III area. Therefore, depth to the water table is the primary limiting factor for excavation depths. In order to ensure adequate separation, a potentiometric contour map was generated utilizing corrected long-term seasonal high water table elevations (January 29, 1996) at each piezometer (see Figure D-2). This potentiometric contour map was then used to develop the base grade for the bottom of the Phase III Landfill cell (Figure C-2). The base grades were drawn using the seasonal high water table elevations, plus at least 4 feet. As indicated on Table 11-1, the required separation between the high water table and bottom of the liner system will be maintained given the specified base grades. In addition, the required 4 feet of separation between the bottom of the clay liner and the top of rock is maintained. Given the current elevations, it is apparent that some filling will be necessary in the eastern portion of the Phase III area to build up the base grade to the specified elevations.

Table 11-1

Summary Table - Vertical Separation Criteria

Boring Number[a]	Ground Elevation[b]	Base Grade Elevation[c]	Top of Bedrock[d]	Bedrock Separation	Seasonal High Water Table Elevation[e]	Water Table Separation
B-1	760.80	757.40	747.80	9.60	750.31	7.09
B-7	773.09	762.60	748.59	14.01	756.91	5.69
B-10	778.09	772.00	745.59	26.41	757.12	14.88
B-11	769.20	764.80	752.70	12.10	756.97	7.83
B-12	776.06	779.20	765.06	14.14	773.54	5.66
B-16	782.71	772.40	746.71	25.69	766.40	6.00
B-17	787.71	782.60	773.71	8.89	778.55	4.05
B-18	771.60	767.40	758.60	8.80	760.00	7.40
B-19	775.78	770.00	764.78	5.22	764.90	5.10
B-20	770.68	759.60	754.68	4.92	748.45	11.15
B-22	754.92	755.80	723.92	31.88	748.65	7.15
B-23	765.26	757.40	734.26	23.14	751.51	5.89
B-24	750.08	758.00	738.08	19.92	744.25	13.75
B-25	744.54	749.20	706.04	43.16	743.57	5.63
B-26	739.20	755.84	732.70	23.14	740.00	15.84
B-28	739.33	744.64	738.83	5.81	740.54	4.10
B-29A	743.61	751.54	735.61	15.93	742.30	9.24
B-31	747.10	752.00	722.10	29.90	747.90	4.10
B-33	757.22	758.74	742.22	16.52	754.47	4.27

Notes:
(a) Borings located within the proposed Landfill footprint (cell limits).
(b) Ground elevation at time of boring installation.
(c) See Figure C-2.
(d) See Figure D-3.
(e) Adjusted January 29, 1996, water level readings.

APPENDIX A

BORING/CORE LOGS AND PIEZOMETER/MONITORING WELL CONSTRUCTION SHEETS

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: B-1d PAGE: 1 OF 1

CORE LOG

DATE: 12/17/94

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	14'			AUGER REFUSAL	SAPROLITE
FIRST CORE RUN	18' 22' 26'	90%	78% GOOD	BASALT: FINE-GRAINED, DARK GRAY TO BLACK, CONTAINS PYRITE, HEALED FRACTURES CONTAINING PLAGIOCLASE (?) OR CHLORITE (?), PYRITE AND MANGANESE OXIDE STAINING, TWO HORIZONTAL FRACTURES WITH IRON OXIDE STAINING VERTICAL CONTACT BETWEEN BASALT AND GABBRO	HORIZONTAL HORIZONTAL
SECOND CORE RUN	30'	91%	83% GOOD	GABBRO: COARSE-GRAINED, DARK GRAY TO BLACK, SMALL PHENOCRYSTS OF PLAGLOCLASE, FEWER HEALED FRACTURES, SOME IRON OXIDE STAINING ALONG FRACTURES	HORIZONTAL HORIZONTAL HORIZONTAL HORIZONTAL
	34' 38'			TD = 31.0'	

COREHOLE COMPLETION: 31' BELOW LAND SURFACE

WATER DEPTH: 755.27 DATE: 12/27/94

DRILLING METHOD: NX CORE (15 FT.)

LOGGED BY: CURT M. WELTY, PG

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICABLE

HDR

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: B-9d PAGE: 1 OF 1

CORE LOG

DATE: 12/20/94

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
				AUGER REFUSAL	SAPROLITE
FIRST CORE RUN	54' – 58'	81%	30% POOR	GREENSTONE: ALTERED BASALT DIKE, FINE-GRAINED, FOLIATED, CHLORITE-RICH, METAMORPHOSED, NUMEROUS, CLOSELY-SPACED (<1") VERTICAL FRACTURES THAT PARALLEL FOLIATION, FRACTURES COATED WITH IRON AND MANGANESE OXIDE, VERTICAL CONTACT WITH GRANITE AT 58'.	FRACTURE ZONE
SECOND CORE RUN	62' – 66'	93%	99% EXCELLENT	GRANITE: CONTAINS QUARTZ, FELDSPAR, BIOTITE AND MINOR EPIDOTE, COARSE-GRAINED, MASSIVE, FRACTURES FROM ≈20° TO 75° FROM HORIZONTAL, ABOUT ONE FRACTURE EVERY 6", IRON OXIDE COATING ON FRACTURE SURFACES	65° 65° 50°
	70'			TD = 67.0'	

COREHOLE COMPLETION: 67' BELOW LAND SURFACE

WATER DEPTH: 753.82 DATE: 12/27/94

DRILLING METHOD: NX CORE (15 FT.)

LOGGED BY: CURT M. WELTY, PG

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICAE

HDR

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: B-17d PAGE: 1 OF 1

CORE LOG

DATE: 12/28/94

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	4' 8' 12'			AUGER REFUSAL	SAPROLITE
FIRST CORE RUN	16' 20'	100%	83% GOOD	GNEISS: FOLIATED, WHITE, GRAY AND BLACK, FINE TO MEDIUM GRAINED, SLIGHTLY BROKEN TO MASSIVE, HARD TO VERY HARD, CONTAINS QUARTZ, FELDSPAR, BIOTITE MICA, MINOR PYRITE, FOLIATION NEARLY VERTICAL TO 70° FROM HORIZONTAL, OPEN FRACTURES NEARLY HORIZONTAL TO 55°, FELDSPAR HEALED FRACTURES (70-80°) TO NEARLY HORIZONTAL	30° 55° 35°
SECOND CORE RUN	24' 28'	78%	71% FAIR	GNEISS: LESS DISTINCT FOLIATION, FOLIATION AT 55° FROM HORIZONTAL, FRACTURES (60°) SLIGHTLY CONCOIDAL, HARD TO VERY HARD, MASSIVE	60°
	32' 36' 40'			TD = 28.0'	

COREHOLE COMPLETION: 28' BELOW LAND SURFACE

WATER DEPTH: 753.62 DATE: 12/29/94

DRILLING METHOD: NX CORE (14.5 FT.)

LOGGED BY: JOHN R. ISHAM

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICABLE

HDR

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: B-22d PAGE: 1 OF 1

CORE LOG

DATE: 12/29/94

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	24' – 28'			AUGER REFUSAL	SAPROLITE
FIRST CORE RUN	32' – 36'	81%	46% POOR	GRANITE: BROKEN TO SLIGHTLY BROKEN TO 30.5',MED. HARD, BROKEN FROM 30.5' TO 33', FRACTURED (HORZ. TO 25°), COARSE-GRAINED, QUARTZ, FELDSPAR, BIOTITE MICA, MINOR INTERGRANULAR POROSITY, MORE WEATHERED AND BROKEN 30.5-33.0', IRON OXIDE AND MANGANESE OXIDE STAINING, BECOMES BROKEN TO SLIGHTLY BROKEN 33.0-35.5', HEALED FRACTURES; 35.5-39.5' IS BROKEN, MEDIUM HARD, WHITE TO BUFF GRANITE,HIGHLY FRACTURED, WEDGE-SHAPED PIECES FROM FRACTURE SETS AT 45-50°,SOME VERTICAL FRACTURES WITH RIGHT ANGLE BREAKS, IRON OXIDE AND MANGANESE OXIDE STAINING; 39.5-44.5', SLIGHTLY BROKEN TO MASSIVE, MEDIUM HARD, FRACTURES AT 45° TO HORIZONTAL, HEALED FRACTURES.	FRACTURE ZONE 25° 45° 40°
SECOND CORE RUN	40' – 44'	88%	56% FAIR		FRACTURE 45° 55° 45° 45°
	48'			TD = 47.5'	

COREHOLE COMPLETION: 44.5' BELOW LAND SURFACE

WATER DEPTH: 740.26 DATE: 12/29/94

DRILLING METHOD: NX CORE (15 FT.)

LOGGED BY: JOHN R. ISHAM

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICAB

HDR

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: B-25d PAGE: 1 OF 1

CORE LOG

DATE: 12/29/94

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	34'			AUGER REFUSAL	SAPROLITE
FIRST CORE RUN	38' – 42'	88%	27% POOR	GRANITE:WHITE TO CREAM, SOFT TO MEDIUM HARD, BROKEN TO SLIGHTLY BROKEN, WEATHERED, HIGHLY FRACTURED (45°-70°) WITH CONJUGATE SETS AT 90°, COARSE-GRAINED QUARTZ, FELDSPAR PARTIALLY WEATHERED TO KAOLINITE (EARTHY), PATCHY IRON OXIDE STAINING, DENDRITIC MANGANESE OXIDE COATINGS	FRACTURE ZONE 45° 70° FRACTURE ZONE
SECOND CORE RUN	46' – 50'	79%	25% POOR/ V. POOR	GRANITE: SLIGHTLY BROKEN AND HARD FROM 40-45', WHITE TO CREAM, ABUNDANT CONVEX FRACTURES (45-90°), ABUNDANT HEALED FRACTURES (45-90°), CONTAINS GRAY QUARTZ, WEATHERED FELDSPAR, BIOTITE MICA, DENDRITIC MANGANESE OXIDE STAINING, MINOR VUGULAR POROSITY NEAR FRACTURE SURFACES, MINOR INTERGRANULAR POROSITY	45° FRACTURE ZONE 50°
	54'			TD = 52.0'	

COREHOLE COMPLETION: 52' BELOW LAND SURFACE

WATER DEPTH: 737.69 DATE: 1/25/95

DRILLING METHOD: NX CORE (15 FT.)

LOGGED BY: JOHN R. ISHAM

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICABLE

HDR

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: B-34d PAGE: 1 OF 1

CORE LOG

DATE: 12/29/94

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	4'			AUGER REFUSAL	SAPROLITE
FIRST CORE RUN	8' 12'	79%	50% FAIR-POOR	DIORITE: METAMORPHOSED, FOLIATED TO NON-FOLIATED DARK GREEN, MEDIUM-GRAINED, PHANERITIC, 7-9' IS SLIGHTLY BROKEN AND HARD TO VERY HARD, FRACTURED (RIGHT ANGLE BREAK), IRON OXIDE AND MANGANESE OXIDE STAINING; 9.0-15.25' IS SLIGHTLY BROKEN TO MASSIVE, HARD TO VERY HARD, FRACTURES SCARCE (35-45°), HEALED FRACTURES WITH FELDSPAR, MINOR CHLORITE ON FRACTURE SURFACES.	FRACTURE ZONE 30°
SECOND CORE RUN	16' 20'	100%	94% GOOD	DIORITE: SLIGHTLY METAMORPHOSED, MINOR FOLIATION, HARD TO VERY HARD, MINOR FRACTURES (HORIZONTAL TO 35°), CHLORITIZED ZONES, HEALED FRACTURES WITH FELDSPAR, NO IRON OXIDATION ON FRACTURES.	35°
	24' 28'			TD = 22.0'	

COREHOLE COMPLETION: 22' BELOW LAND SURFACE

WATER DEPTH: 742.73 DATE: 12/29/94

DRILLING METHOD: NX CORE (15 FT.)

LOGGED BY: JOHN R. ISHAM

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICAE

HDR

FIELD BOREHOLE LOG

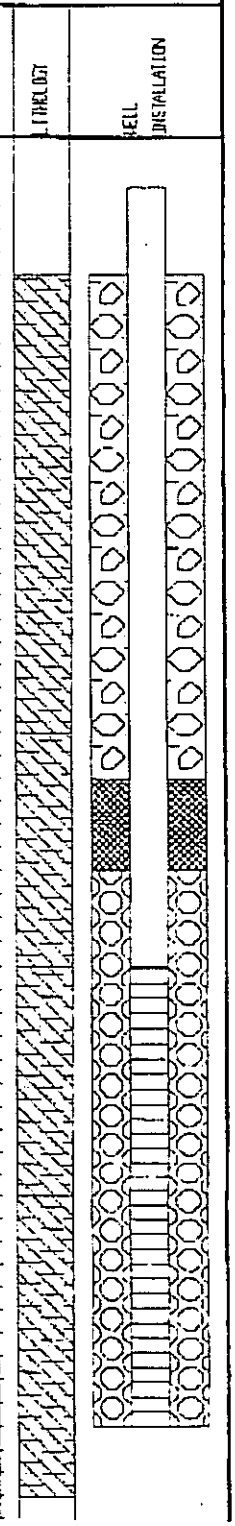
BOREHOLE NUMBER: B-37

PROJECT NUMBER: HDRGN-3
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE B-53
DRILLING METHOD: HOLLOW STEM AUGER
WEATHER: SUNNY, 70 DEGREES
FIELD PARTY: R. BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 5/22/95 DATE COMPLETED: 5/22/95

TOP OF CASING ELEVATION: 783.02
TOTAL DEPTH: 25.0 FT
GROUND SURFACE ELEVATION: -
SHEET: 1 OF: 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	20.25	18.44
Time	10:15 AM	2:30 PM
Date	5/22/95	5/22/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	5 6 10	SS	81	D		16"		CLAYEY SILT: Brown; with trace mica. Mn staining at 55 degree angle. Some iron staining. Very uniform. Dry.
10.0	3 5 5	SS	82	M		14"		SILTY CLAY: Brown silty clay to clayey silt; Moist; No mica; some iron staining. Trace Mn staining. Trace to some whitish clay areas. Mottled with lt. brown.
15.0	2 3 5	SS	83	M		13"		SILTY CLAYEY SAND: light brown to tan. A 1/4" white feldspar layer near top of sample; some mica; Mn staining at 80 degree angle; moist
20.0	2 3 6	SS	84	M		16"		SILTY CLAYEY SAND: Light brown to tan; moist; one, near vertical, iron stain near top of sample.
25.0	2 4 6	SS	85	M		14"		Boring Terminated at 25'.



DRILLING LOG	DIVISION Earth Science	INSTALLATION	SHEET 1 OF 2 SHEETS

1. PROJECT Greensboro Landfill	10. SIZE AND TYPE OF BIT 2.0" (NQ)
2. LOCATION (Coordinates or Station) Guilford County, NC	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) TBM
3. DRILLING AGENCY Engineering Tectonics, P.A.	12. MANUFACTURER'S DESIGNATION OF DRILL Mobil B-57
4. HOLE NO. (As shown on drawing title and file number) MW-11 (CORE LOG)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED --
5. NAME OF DRILLER David Barron	14. TOTAL NUMBER CORE BOXES 9
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 4-11-89; COMPLETED 4-13-89
7. THICKNESS OF OVERBURDEN 19.5'	17. ELEVATION TOP OF HOLE 797.80
8. DEPTH DRILLED INTO ROCK 81.0'	18. TOTAL CORE RECOVERY FOR BORING 100 %
9. TOTAL DEPTH OF HOLE 100.5'	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	RQD	DRILL RATE	FRAC. FREQ.	FRAC ANGLE	WATER RETURN
	5, 10, 15	4" PVC Pit Casing	Overburden (See Boring Log)						
	20, 25		White and black, hard to v/hard, slight to freshly weathered, foliated to massive, granoblastic, fine to med. grained gneiss with an occasional ¼" quartz vein, fractures iron stain, some fractures green and schistose, occasional rehealed hairline fractures	100%	60%	4"/min	11/5ft	0-30°	100°/0
	30			100%	95%	3"/min	5/10ft	30-60°	95%
	35, 40, 45		Foliation/Preferred orientation 75 to 85 degrees from horizontal, all fractures discolored pale green and slightly schistose.	100%	95%	3.5"/min	13/10ft	15-65°	95%
	50		NOTE: Increase in mafic mineral content 50-80%, significantly less fracturing.	100%	100%	3"/min	2/10ft	60-85°	95%
	55, 60, 65		White and black, v. hard, freshly weathered, foliated to massive, granoblastic, fine to medium grained gneiss, fractures green and slightly schistose, foliated at 60 to 80 degrees from horizontal.	100%	96%	2.5"/min	8/10ft	30-80°	95%

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(TRANSLUCENT)

PROJECT Greensboro Landfill HOLE NO. 11

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 2 SHEETS

1. PROJECT Greensboro Landfill	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) MW-11	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
	15. ELEVATION GROUND WATER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	16. DATE HOLE: STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	RQD	DRILL RATE	FRAC. FREQ.	FRAC ANGLE	WATER RETURN
	70		Occasional 2-8 mm pheno cryst between 65 to 67.5 feet.	100%	97%	1.5"/min	6/10ft	30-60°	95%
	75		Mafic and felsic mineral content approx. 50/50.	100%	100%	3"min	4/10ft	20-70°	95%
	80		NOTE: Occasional rehealed hairline fractures at 20 to 80 degrees.						
	85								
	90		NOTE: Increase in fracture frequency.	100%	92%	4"/min	11/10ft	20-70°	95%
	95		NOTE: Abundant rehealed fractures from 95 to 97 ft., major fractures oriented at 60 to 80 degrees.	100%	95%	5"/min	3/5ft	20-80°	95%
	100								
	105		Coring Terminated at 100.5'.						

PROJECT	HOLE NO.

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(TRANSLUCENT)

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: MW-13 PAGE: 2 OF 2

CORE LOG

DATE: 1/6/93

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	14'			PARTIALLY WEATHERED ROCK	
FIRST CORE RUN	18' 22' 26'	92%	79% GOOD	GNEISS: FOLIATED, SLIGHTLY BROKEN TO MASSIVE, HARD TO VERY HARD, CONTAINS QUARTZ, FELDSPAR, BIOTITE MICA, FOLIATION NEARLY VERTICAL TO 70° FROM HORIZONTAL, HEALED FRACTURES WITH SERPENTINE, FINE TO MEDIUM-GRAINED, PYRITE-BEARING FRACTURES	FRACTURE ZONE 60° 65° 50° 50°
SECOND CORE RUN	30' 34'	44%	88% GOOD	GNEISS: FOLIATED, MASSIVE, HARD TO VERY HARD, MOTTLED BLACK, WHITE AND GRAY, CONTAINS QUARTZ, FELDSPAR, BIOTITE MICA, FOLIATION NEARLY VERTICAL TO 70° FROM HORIZONTAL, FRACTURES AT 35° FROM HORIZONTAL, MINIMAL IRON OXIDE STAINING OF FRACTURES	35° 35° 35° 35°
	38'			TD = 34.0'	

COREHOLE COMPLETION: 34' BELOW LAND SURFACE

WATER DEPTH: 718.5 DATE: 12/27/94

DRILLING METHOD: NX CORE (16 FT.)

LOGGED BY: JOHN R. ISHAM

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATION
NA-NOT APPLICAE

HDR

FIELD BOREHOLE LOG

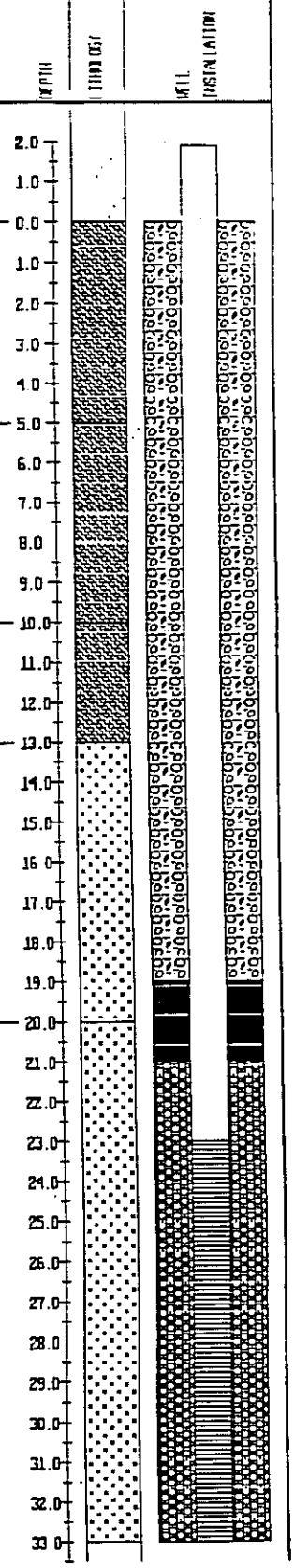
BOREHOLE NUMBER: B-1

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/15/94 DATE COMPLETED 12/15/94

TOP OF CASING ELEVATION 763.21
TOTAL DEPTH 33.0 FT
GROUND SURFACE ELEVATION 760.80
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	27	18.32
Time	5:15 pm	--
Date	12/15/94	12/20/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0	2 3 5	Ss	S1	M	S	15"	HSA	SILTY CLAY: reddish orange; very uniform, some manganese staining and rooting, medium plasticity, soft moist.
5.0	15 25 36	Ss	S2	D	H	16"		CLAYEY SILT: has appearance of mafic very weathered rock; similar to a metagabbro; LAB USC: Silty Clayey Sand. (SC-SM)
10.0	50/4	Ss	S3	D	VH	4"		CLAYEY SILT: weathered to competent mafic rock; auger refusal at 13 feet below grade. LAB USC: ~~Clayey Sand (SC)~~ Silty Sand (SM)
13.0							AH	MAFIC INTRUSIVE: competent mafic intrusive rock; drilled with an air hammer.
15.0		G		U				
18.0				D				
20.0		G		W				MAFIC INTRUSIVE: competent mafic intrusive rock, dark bluish black; drilled with an air hammer, water seam at 31.0 feet; Boring Terminated at 33.0 feet
28.0		G		W				



FIELD BOREHOLE LOG

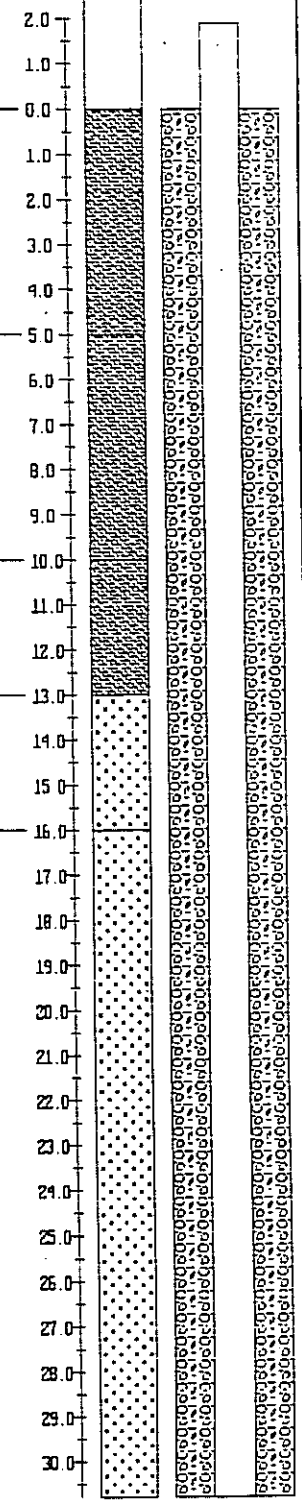
BOREHOLE NUMBER: S-1c

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HSA/AIR ROTARY/CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/16/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762.55
TOTAL DEPTH 43.0 FT
GROUND SURFACE ELEVATION 760.47
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	5.31	4.87
Time	-	3:18 pm
Date	12/20/94	12/27/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0	2 3 5	Ss	S1					SILTY CLAY: reddish orange; very uniform; some manganese staining and roots, medium plasticity, soft and moist.
5.0	15 25 36	Ss	S2					CLAYEY SILT: has appearance of mafic very weathered rock; similar to a mafic intrusive.
10.0	50/6s		S3					CLAYEY SILT: weathered to competent mafic rock; Auger Refusal at 13 feet.
13.0				W				WEATHERED MAFIC INTRUSIVE: drilled with air rotary from 13 to 16 feet.
16.0								MAFIC INTRUSIVE competent rock; Rock Core from 16 to 31 feet.



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-1d

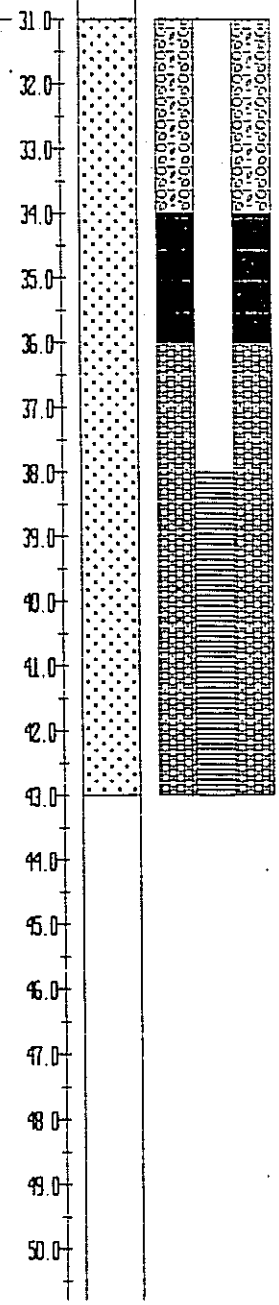
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HSA/AIR ROTARY/CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/16/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762.55
TOTAL DEPTH 43.0 FT
GROUND SURFACE ELEVATION 760.47
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	5.31	4.87
Time	-	3:18 pm
Date	12/20/94	12/27/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
31.0								MAFIC INTRUSIVE: competent rock; Air Hammer from 31 to 43 feet;
32.0								
33.0								
34.0								Boring Terminated at 43 feet.
35.0								
36.0								
37.0								
38.0								
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								
46.0								
47.0								
48.0								
49.0								
50.0								

DEPTH | LITHOLOGY | WELL INSTALLATION



FIELD BOREHOLE LOG

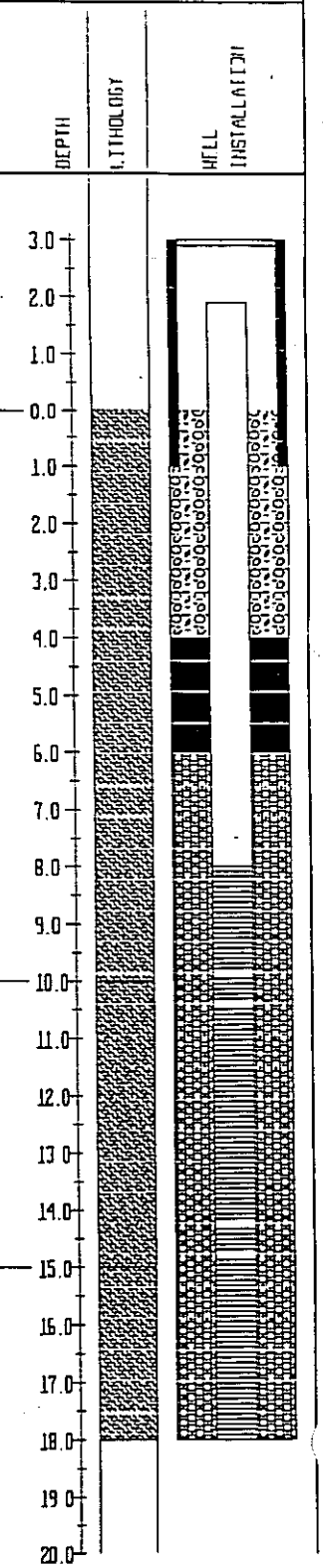
BOREHOLE NUMBER: B-2

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/15/94 DATE COMPLETED 12/19/94

TOP OF CASING ELEVATION 777.58
TOTAL DEPTH 18.5 FT
GROUND SURFACE ELEVATION 774.56
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	Dry	9.83
Time	1:00 pm	-
Date	12/15/94	12/20/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0–5.0								CLAYEY SILT dark gray to green, fine grained; micaceous; interbedded with lt. yellow tan silty sand granite; equigranular with biotite and feldspar. FELSIC GNEISS
5.0	6 15 22	Ss	S1	M	VH	16"		
10.0	6 12 10	Ss	S2	M	H	16"		CLAYEY SILT dark gray to green brown; micaceous with sugary white feldspar vein 1.5 inches thick FELSIC GNEISS
15.0	6 12 23	Ss	S3	W	VH	15"		CLAYEY SILT light greenish brown to yellow brown, micaceous; homogeneous, trace orange staining, FELSIC GNEISS Auger Refusal at 18.5 feet



FIELD BOREHOLE LOG

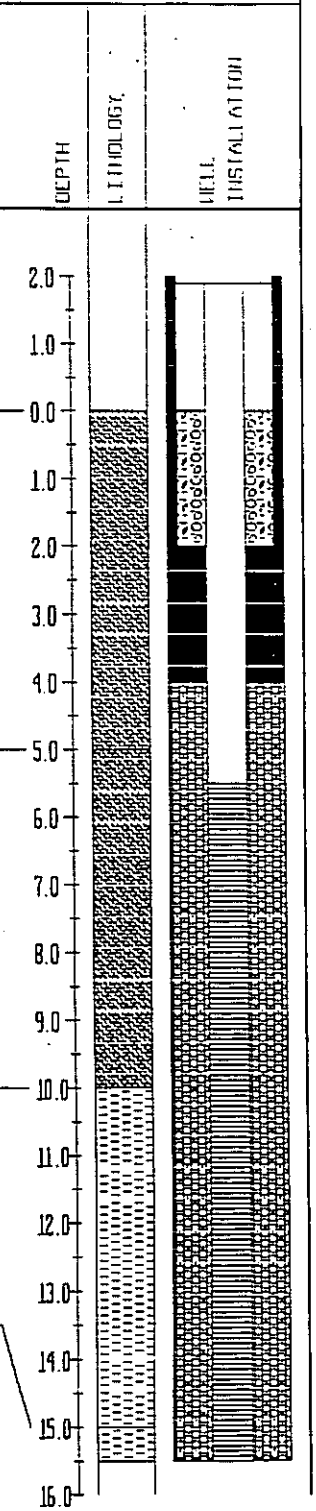
BOREHOLE NUMBER
B-3

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST G SIMMERMAN
DATE BEGUN 12/15/94 DATE COMPLETED 12/15/94

TOP OF CASING ELEVATION 752.65
TOTAL DEPTH 15.5 FT
GROUND SURFACE ELEVATION 749.67
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AD=After Boring		
Depth(Ft)	5.09	4.06
Time	-	-
Date	12/17/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	4 8 8	SS	S1	M	F	13"		CLAYEY SILT: moist; dark brown.
10.0	50/3	SS	S2	M	VH	3"	HSA	CLAYEY SILTY SAND: mottled medium gray to orange brown; with 0.5 to 1 inch manganese nodules (black crystals with orange rinds) and a lg. (1 to 1.5 inch) quartz fragment; moist; soft.
								SANDY SILT: medium to dark gray with clay laminae, very fine textured hornblende/feldspar schist; some orange staining, dry. FELSIC GNEISS
15.0	50/4	SS	S3	W	VH	5"		SANDY SILT: dark gray amphibole interbedded with quartz veins, auger refusal at 15.3'.



FIELD BOREHOLE LOG

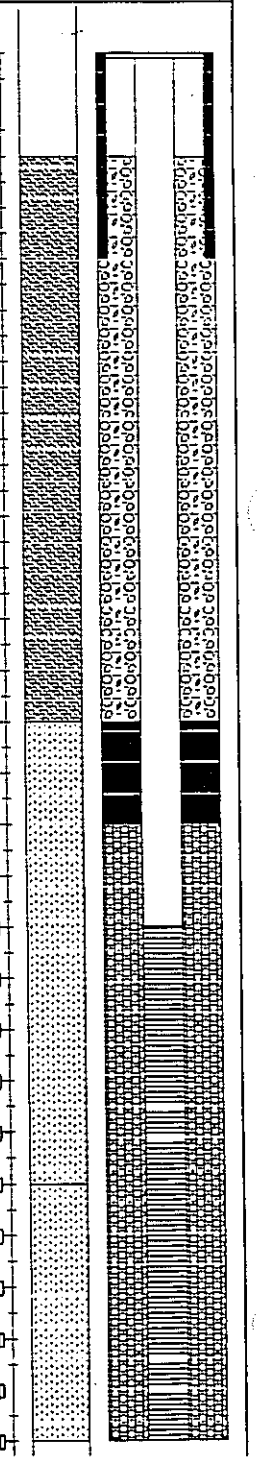
BOREHOLE NUMBER: B-4

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/15/94 DATE COMPLETED 1/6/95

TOP OF CASING ELEVATION 759 43
TOTAL DEPTH 25 0 FT
GROUND SURFACE ELEVATION 756.33
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	13 93 AB	14 19
Time	9 40 am	2 00 pm
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0–5.0							HSA	CLAYEY SILT: (ML) yellow brown to tan; homogeneous; trace manganese.
5.0	15 20 25	Ss	S1	D	VH	16"		
5.0–11.0								CLAYEY SILT: (ML) yellow brown to tan homogeneous; trace manganese staining; trace sand; Auger Refusal at 11.0 feet.
10.0	50/5	Ss	S2	D	VH	8		
11.0–20.0							AH	~~GRANITE~~ dark gray weathered material; some feldspar; drilled with air hammer; water seam at 18.0 feet. CLASSIFIED AS FELSIC GNEISS BY HDR
15.0		G						
18.0		G		W				
20.0		G						
20.0–25.0								~~GRANITE~~ dark gray, some mafics, some mica in cuttings; Boring Terminated at 25.0 feet. CLASSIFIED AS FELSIC GNEISS BY HDR



FIELD BOREHOLE LOG

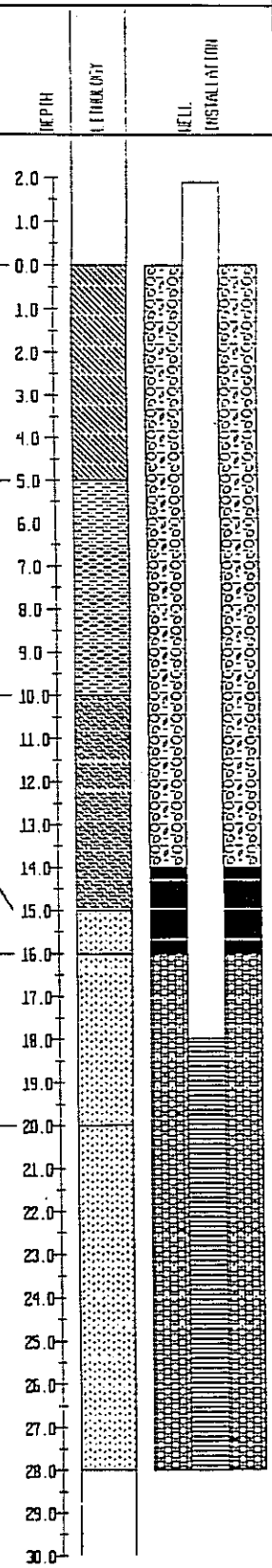
BOREHOLE NUMBER
9-S

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 1/6/95

TOP OF CASING ELEVATION 760.13
TOTAL DEPTH 28.0 FT
GROUND SURFACE ELEVATION 758.14
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD-While Drilling AB-After Boring		
Depth(Ft)	18.24	16.36
Time	11:30am	-
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	CLAYEY SAND: yellow orange; felsic granite.
5.0	9 12 18	Ss	S1	M	VH	12"		SILTY SAND: gray silty fine sand; trace clay; some manganese staining; clear quartz rock fragments 1/8" to 1/4" thick; firm; dry; weathered mafics.
10.0	12 11 12	Ss	S2	D	H	15"		CLAYEY SILT light greenish gray intermediate felsic, with horizontal iron and manganese staining; damp
15.0	50/3	Ss	S3	D	VH	3		GRANITE weathered to competent; Auger Refusal at 16.0 feet.
16.0							AH	GRANITE competent granitic sand rock drilling with an air hammer
17.0		G	S4	D				
20.0		G	S5	D				GRANITE tannish gray to white granitic sand rock, some mafics including biotite, water seam encountered at 22.0 feet; Boring Terminated at 28 feet.
21.0		G	S6	D				
22.0		G	S7	D				
25.0		G	S8	M				



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-6

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 1/5/95

TOP OF CASING ELEVATION 756.21
TOTAL DEPTH 61.0 FT
GROUND SURFACE ELEVATION 753.52
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	DRY at 61'	55.53
Time	11:00 am	11:40 am
Date	1/5/95	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	12, 11, 13	Ss	S1			16"		SANDY CLAY: yellow orange to light tan; medium to coarse grained sandy clay to clayey sand; feldspar relict phenocrysts; feldspar quartz schist; no mafics or accessories; damp; Lab USC: ~~Silty Sand (SM)~~. F-M Silty Sand (SM)
10.0	10, 12, 19	Ss	S2			18"		CLAYEY SAND: yellow orange; grades from sandy clay to clayey sand; felsic (feldspar quartz schist) trace biotite; damp, Lab USC: ~~Silty Sand (SM)~~ silty Clayey Sand (SC-SM)
15.0	11, 20, 50/5	Ss	S3			17"		SANDY CLAY: yellow tan sandy clay to clayey sand, weathered grading to competent rock; auger refusal at 17.0 feet; Lab USC ~~Silty Sand (SM)~~ silty Clayey Sand (SC-SM)
								GRANITE very felsic, some biotite; trace chlorite

WELL INSTALLATION

FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-6

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 1/5/95

TOP OF CASING ELEVATION 756.21
TOTAL DEPTH 61.0 FT
GROUND SURFACE ELEVATION 753.52
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	DRY at 61'	55.53
Time	11:00 am	11:40 am
Date	1/5/95	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
30.0								GRANITE: white; very felsic; some biotite; trace chlorite; Boring Terminated at 61.0 feet.
31.0								
32.0								
33.0								
34.0								
35.0								
36.0								
37.0								
38.0								
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								
46.0								
47.0								
48.0								
49.0								
50.0								
51.0								
52.0								
53.0								
54.0								
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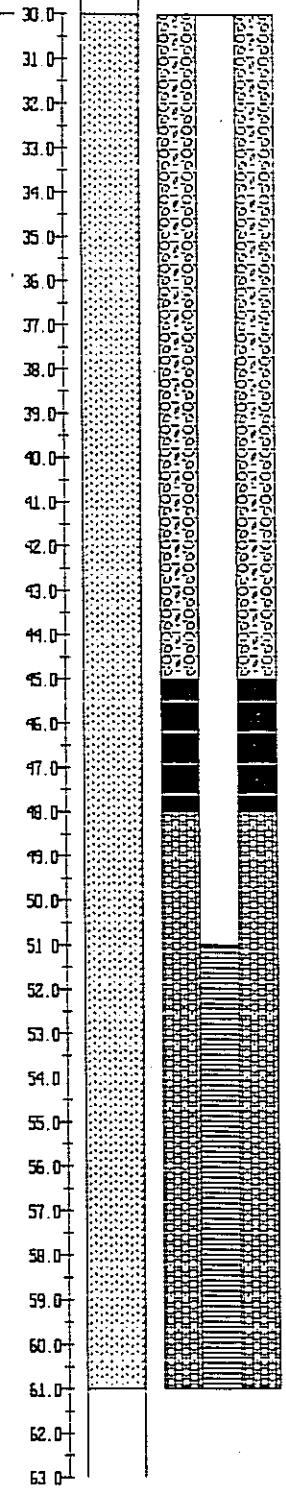
57.0								
58.0								
59.0								
60.0								
61.0								
62.0								
63.0								



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-7

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION 773 75
TOTAL DEPTH 24.5 FT
GROUND SURFACE ELEVATION 773.09
SHEET 1 OF 1

STATIC WATER LEVEL (ALS)		
WD-While Drilling AB-After Boring		
Depth(Ft)	19 08	19 10
Time	-	-
Date	12/20/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY SAND: lt. tan orange; medium to coarse grained; trace clay; very granular sand (quartz feldspar quartzite) trace iron and manganese staining; damp; LAB USC: Silty ~~Clayey~~ Sand (~~C~~-SM).
5.0	11 10 17	Ss	S1	M	H			
10.0	16 26 50/5	Ss	S2	D	VH			SILTY SAND: same as above but slightly darker, with iron and manganese staining and notable feldspar grains; LAB USC: Silty ~~Clayey~~ Sand (~~C~~-SM).
15.0	27 50/6	Ss	S3	D	VH			SILTY SAND whitish tan; fresh; hard and dry, Silty ~~Clayey~~ Sand (~~C~~-SM).
20.0	22 22 24	Ss	S4	D	VH			SILTY SAND whitish tan to lt. orange with white feldspar throughout; hard, dry, LAB USC: Silty ~~Clayey~~ Sand (~~C~~-SM) Auger Refusal at 24.5 feet.
24.0	50/0 5	Ss	S5	W	VH			

LITHOLOGY

WELL INSTALLATION

FIELD BOREHOLE LOG

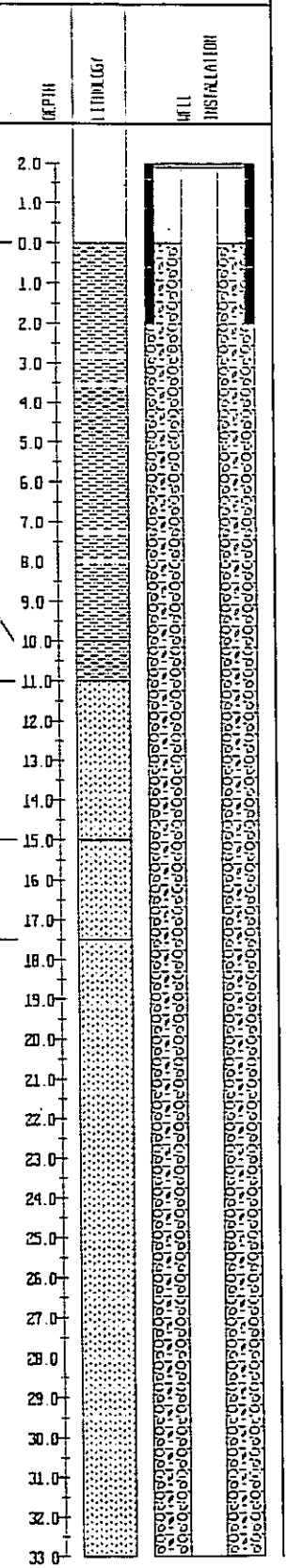
BOREHOLE NUMBER: B-6

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 756.58
TOTAL DEPTH 63.0 FT
GROUND SURFACE ELEVATION 754.93
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	17.26	17.67
Time	4:55 pm	1:30 pm
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY SAND: lt. orange to white tan; quartz and feldspar; medium to coarse grained; dry; trace of weathered biotite; weathered granite.
5.0	19 50/5	Ss	S1	D	VH	9"		
10.0	50/5	Ss	S2	D	VH	5"		SILTY SAND: same as above; hard white, dry; auger refusal at 11'.
11.0		C	S3	D			AH	GRANITE: weathered; tan to white saprolite; soft seam at 14.0 feet.
15.0		C	S4	M				GRANITE: gray brown; hard; fine grained; water seam at 17.0 feet.
20.0		C	S5	D				GRANITE: hard, white to gray; water seam at 53.0 feet; Boring Terminated at 63.0 feet.



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-8

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 756 58
TOTAL DEPTH 63 0 FT
GROUND SURFACE ELEVATION 754.93
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	17.26	17 67
Time	4 55 pm	1.30 pm
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
33.0								GRANITE: hard; white to gray; water seam at 53.0 feet; Boring Terminated at 63.0 feet.
34.0								
35.0		G						
36.0								
37.0								
38.0								
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								
46.0								
47.0								
48.0								
49.0								
50.0								
51.0								
52.0								
53.0								
54.0								
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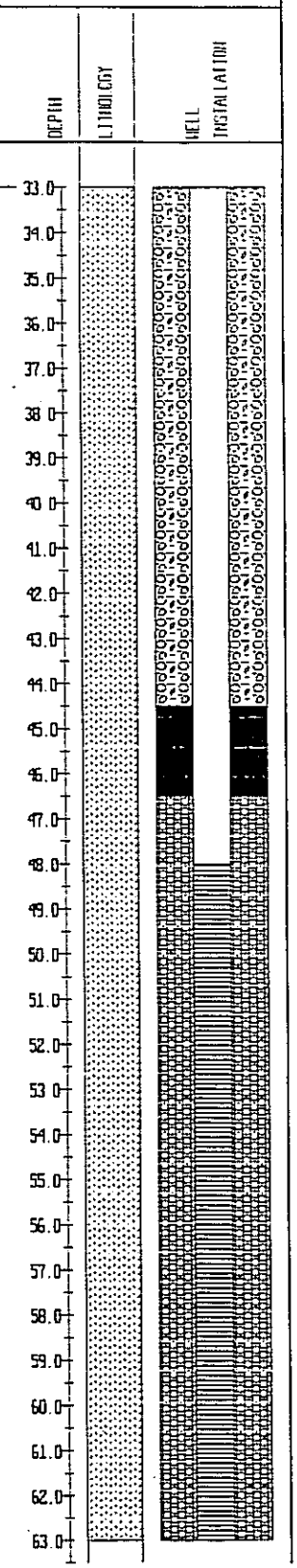
57.0								
58.0								
59.0								
60.0								
61.0								
62.0								
63.0								



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-9A

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION -
TOTAL DEPTH 12.0 FT
GROUND SURFACE ELEVATION -
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	DRY	-
Time	-	-
Date	12/16/94	-

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
2.0									2.0		
1.0									1.0		
0.0								SILTY SAND: lt. orange to white tan; quartz and feldspar; medium to coarse grained; dry; trace of weathered biotite; weathered granite; AUGER REFUSAL AT 12.0 FT.	0.0		
1.0									1.0		
2.0									2.0		
3.0									3.0		
4.0									4.0		
5.0									5.0		
6.0									6.0		
7.0									7.0		
8.0									8.0		
9.0									9.0		
10.0									10.0		
11.0									11.0		
12.0									12.0		
13.0									13.0		
14.0									14.0		
15.0									15.0		
16.0									16.0		
17.0									17.0		
18.0									18.0		
19.0									19.0		

FIELD BOREHOLE LOG

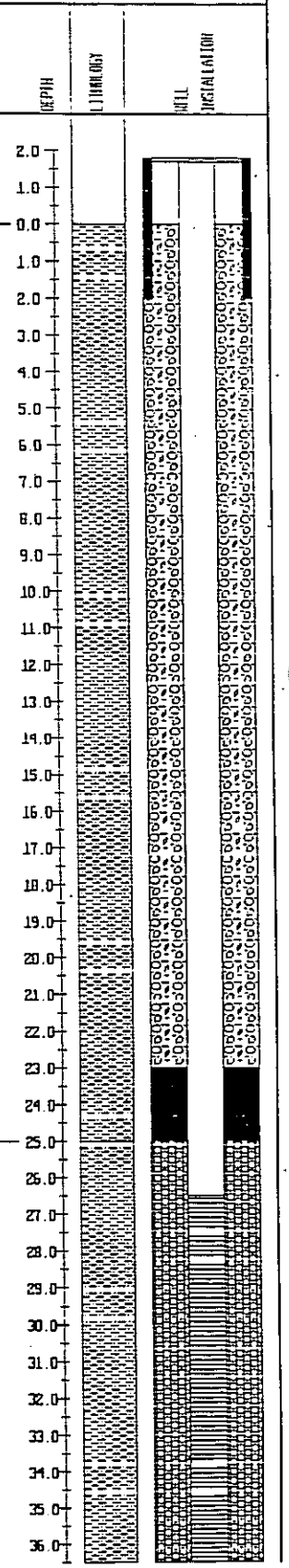
BOREHOLE NUMBER: B-3

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION 761.77
TOTAL DEPTH 36.5 FT
GROUND SURFACE ELEVATION 759.04
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	15.41	14.99
Time	-	-
Date	12/16/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY SAND: orange tan to white silty sand; quartz, feldspar granite with trace biotite; interspersed with manganese modules; ~~Lab USC: Silty Sand (SM)~~.
5.0–6.0	18 24 50/3	Ss	S1	D		16"		
10.0–11.0	18 50/5	Ss	S2	D		14"		
15.0–16.0	34 50/5	Ss	S3	M		12"		Lab USC: Silty Sand (SM)
20.0–21.0	50/6	Ss	S4	M		4"		
25.0–26.0	50/4	Ss	S5	W		12"		SILTY SAND orange tan to white silty sand; quartz, feldspar granite with trace biotite, thin, 1/8" clay lens; wet; Auger Refusal at 36.5 feet.
30.0–31.0	34 50/6	Ss	S6	W		12"		
35.0–36.0	50/2	Ss	S7	W		3"		



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-9c

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762 41
TOTAL DEPTH 67.0 FT
GROUND SURFACE ELEVATION 759 51
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	17.39	16.49
Time	5:00 pm	-
Date	12/27/94	12/29/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0	3 8 11	Ss	S1					SILT AND SAND: brown to white orange mottled silt and coarse sand; moist; weathered rock.
3.0	18 39 40	Ss	S2					SILT AND SAND: same as above with more sand; some dark staining; wet at 23 feet.
8.0	29 50/3	Ss	S3					
13.0	50/1	Ss	S4					
18.0	50/1	Ss	S5					
23.0	50/1	Ss	S6	W				
28.0	36 50/6	Ss	S7					WEATHERED GRANITE: weathered granitic sand rock, very weathered at top to a gray brown mottled silty sand with relict structure, soft zone at 36 feet.
33.0	50/0	Ss	S8					

DEPTH | LITHOLOGY | WELL INSTALLATION

FIELD BOREHOLE LOG

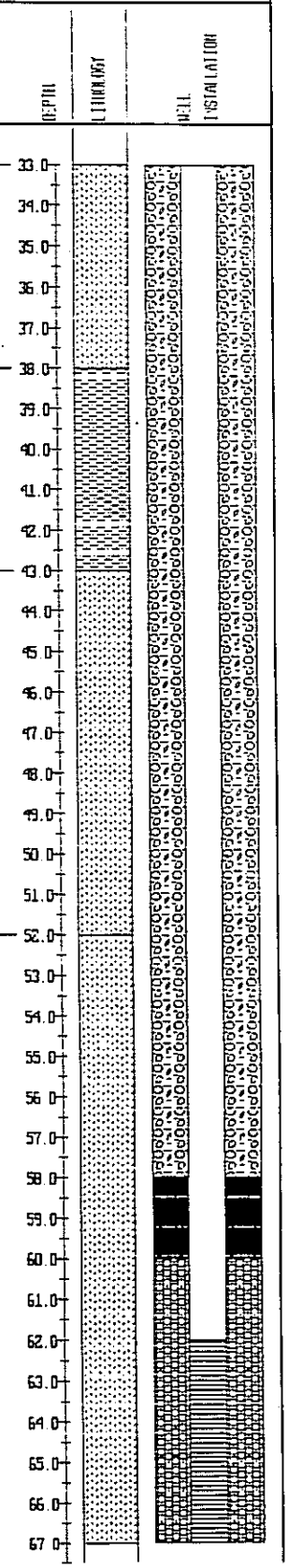
BOREHOLE NUMBER
S-9a

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762 41
TOTAL DEPTH 67.0 FT
GROUND SURFACE ELEVATION 759.51
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=AFter Boring		
Depth(Ft)	17.34	16 49
Time	5 00 pm	-
Date	12/27/94	12/29/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
33.0	50/6	Ss	S8					WEATHERED GRANITE: weathered granitic sand rock; very weathered at top to a gray brown mottled silty sand with relict structure; soft zone at 36 feet.
34.0								
35.0								
36.0								
37.0								
38.0								SILTY SAND: below weathered rock is brown to greenish silty sand; slightly moist.
39.0								
40.0								
41.0								
42.0								
43.0								WEATHERED GRANITE: weathered granite, difficult drilling;
44.0								
45.0								Roller Cone Refusal at 52 feet
46.0								
47.0								
48.0								
49.0								
50.0								
51.0								
52.0								GRANITE light tan to white, some biotite and hornblende, rock core from 52.0 to 67.0 feet;
53.0								
54.0								
55.0								Boring Terminated at 67.0 feet
56.0								
57.0								
58.0								
59.0								
60.0								
61.0								
62.0								
63.0								
64.0								
65.0								
66.0								
67.0								



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-10

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION - 780.91
TOTAL DEPTH 32.5 FT
GROUND SURFACE ELEVATION - 778.09
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=AFter Boring		
Depth(Ft)	.	
Time	-	
Date	-	

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	CGI	LITHOLOGY DESCRIPTION	LITHOLOGY	WELL INSTALLATION
20										
10										
00								SILT AND CLAY red-brown; homogeneous, some tan areas; trace to some white mica present		
10										
20										
30										
40										
50		Ss	S1							
60										
70										
80										
90										
100	3	Ss	S2					SILT AND CLAY similar to above but with minor sand		
110	4 6							Lab USC: Silty Sand (SM)		
120										
130										
140								SILT AND SAND whitish tan to orange, some quartz and feldspar, two manganese stains (horizontal)		
150	2	Ss	S3							
160	3 4									
170										

FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-10

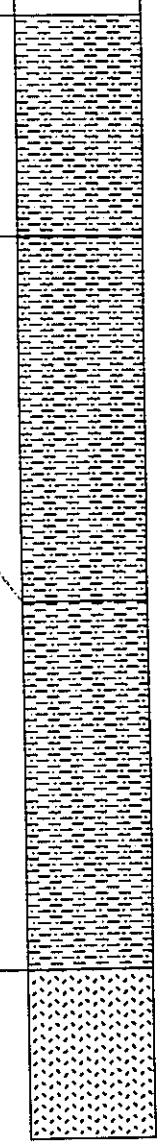
JJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION - 780.91
TOTAL DEPTH 32.5 FT
GROUND SURFACE ELEVATION - 778.09
SHEET 2 OF 2

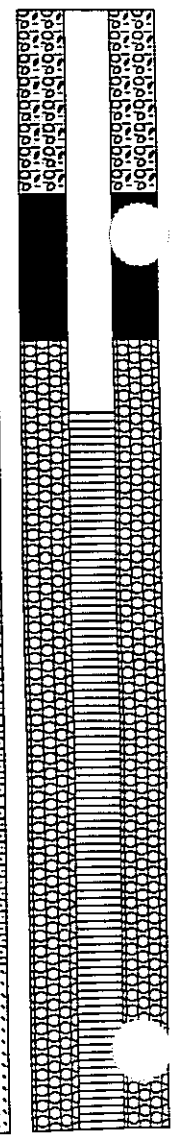
STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)		
Time	-	
Date	-	

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	CGI	LITHOLOGY DESCRIPTION
17.0								
18.0								
19.0								
	3	Ss	S4	W		12"		SILT AND SAND whitish tan to orange, some quartz and feldspar, two manganese stains (horizontal)
20.0	4							
21.0	4		Lab USC: Sandy Elastic Silt (MH)					SILT AND SAND whitish tan to lt orange relict granite structure, small fracture at 45 degree angle, minor manganese staining, trace mica, some feldspar, trace potassium feldspar, moist
22.0								
23.0								
24.0								
25.0	3	Ss	S5			15"		SILT AND SAND lt tan, relict granite structure, 3 horizontal manganese stains and one at a 45 degree angle, some feldspar and mica, more biotite near bottom of sample, one folded biotite or manganese stained layer
	4							
26.0	6							
27.0								
28.0								
29.0								
30.0	10	Ss	S6			12"		GRANITE weathered to competent, very felsic, biotite abundant, one folded biotite layer, auger refusal
	18							
	50/2							
32.0								

LITHOLOGY



WELL INSTALLATION



FIELD BOREHOLE LOG

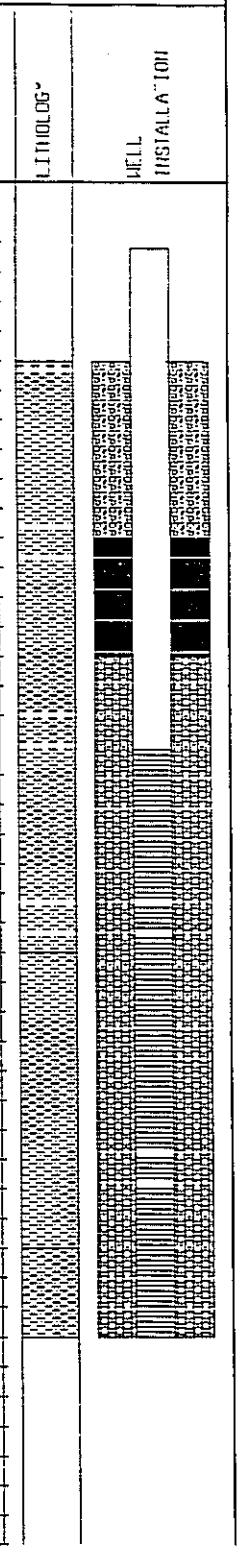
BOREHOLE NUMBER: S-11

PROJECT NUMBER 99016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/99 DATE COMPLETED 12/19/99

TOP OF CASING ELEVATION 772.09
TOTAL DEPTH 16.5 FT
GROUND SURFACE ELEVATION 769.20
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	14.75	14.87
Time	-	-
Date	12/20/99	12/27/99

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY SAND: lt tan to red brown; some clay; one 2" thick layer of silty clay to clayey silt with a manganese stain at a 45 degree angle; this grades into weathered granitic sand rock, some mica; very weathered.
5.0	3 6 8	SS	S1	D		14"		
10.0	7 12 42	SS	S2	D		16"		SILTY SAND weathered sand rock, lt brown to tan, some thin dark laminae near horizontal
15.0	30 50/5	SS	S3	W		6"		SILTY SAND lt brown to tan; weathered granitic rock; some k-spar, lots of feldspar, trace to some mica, auger refusal at 16.5 feet



FIELD BOREHOLE LOG

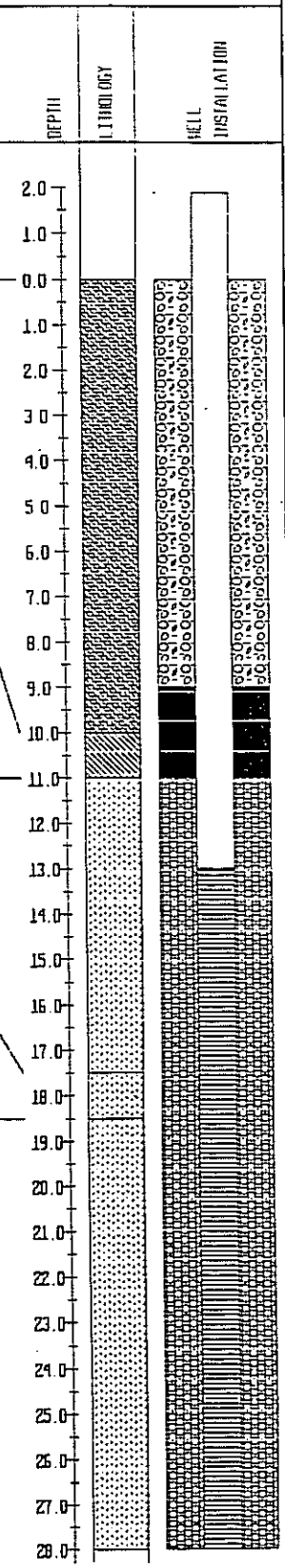
BOREHOLE NUMBER
B-12

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 778.84
TOTAL DEPTH 28.0 FT
GROUND SURFACE ELEVATION 776.06
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	14.14 AB	7.42
Time	11:45 am	12:15 pm
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY CLAY: red brown; some sand; one 1" thick layer of dark possibly weathered biotite; one manganese stain at a 10 degree angle; some very weathered feldspar.
5.0	8 12 16	Ss	S1					
7.0							AR	
8.0–9.0								CLAY: clean white clay grading downward into granitic sand rock; Auger Refusal at 11.0 feet.
10.0	7 50/5	Ss	S2					
11.0							AH	GRANITE: hard; white.
17.0–18.0				W				GRANITE: orange with clay, water bearing seam.
19.0								GRANITE: hard, white. Boring Terminated at 28 feet



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-13

PROJECT NUMBER .94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 1/9/95

TOP OF CASING ELEVATION 793.67
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 791.91
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AA=After Boring		
Depth (ft)	28.71	28.45
Time	10:40 am	4:00 pm
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY CLAY: red-brown; homogeneous; some granitic sand rock at top and bottom of sample.
5.0	5, 7, 13	SS	S1			12"		
10.0	6, 8, 10	SS	S2			12"		
15.0	5, 6, 8	SS	S3			14"		SILTY CLAY: lt. golden brown; very uniform, one manganese stain at a -45 degree angle and one near horizontal, trace mica.
20.0	15, 25, 50/5	SS	S4		VH	16"		SILTY CLAY: lt. tan, some foliation at 45 degree angle; layered with red silty clay and weathered blue gray rock; some appearance of folded foliation; Auger Refusal at 23.0 feet.
								SILTY CLAY: very fine; brown in color, drilled with air hammer.

DEPTH | LITHOLOGY | WELL INSTALLATION

FIELD BOREHOLE LOG

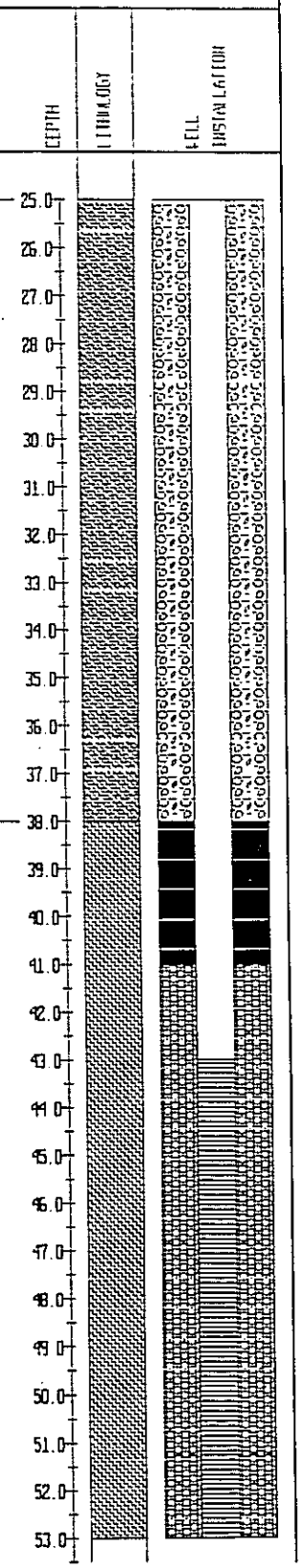
BOREHOLE NUMBER
B-13

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 1/9/95

TOP OF CASING ELEVATION 793 67
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 791.91
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AD=After Boring		
Depth(Ft)	28.71	28.45
Time	10 40 am	4:00 pm
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
25.0								SILTY CLAY: brown; coarsening downward with increasing rock chip content in grab samples.
26.0								
27.0								
28.0								
29.0								
30.0								
31.0								
32.0								
33.0								
34.0								
35.0								
36.0								
37.0								
38.0								GNEISS feldspathic/granitic gneiss, water seam at 46 to 47 feet. Boring Terminated at 53 feet.
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								
46.0								
47.0								
48.0								
49.0								
50.0								
51.0								
52.0								
53.0								



FIELD BOREHOLE LOG

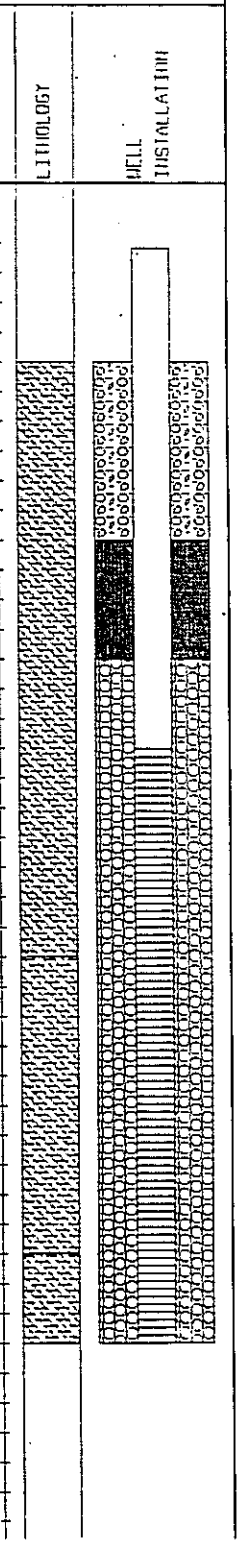
BOREHOLE NUMBER: B-14

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/19/94

TOP OF CASING ELEVATION 790.51
TOTAL DEPTH 16.5 FT
GROUND SURFACE ELEVATION 787.40
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	8.24	7.97
Time	-	2:30pm
Date	12/20/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY CLAYEY SAND: lt.tan; moist to wet; homogeneous; no mica; trace quartz; LAB USC: Sandy Silt (ML)
5.0	6 7 8	SS	S1			16"		
10.0	9 19 23	SS	S2	W		12"		SILTY CLAY: lt. brown, one white sandy clay seam at an angle less than 10 degrees, some mica; LAB USC: Sandy Silt (ML)
15.0	7 12 46	SS	S3			13"		SILTY CLAY: brown, some biotite; one horizontal sandy clay seam, horiz. foliation; auger refusal at 16.5 feet; LAB USC: Silty ~~Clayey~~ Sand (~~SC~~-SM)



FIELD BOREHOLE LOG

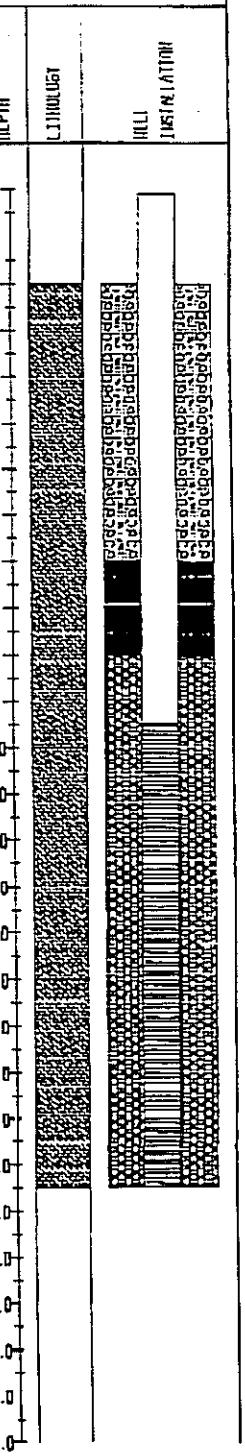
BOREHOLE NUMBER: B-15

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 777.19
TOTAL DEPTH 19.5 FT
GROUND SURFACE ELEVATION 774.15
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	14	13.93
Time	-	-
Date	12/21/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0–10.0								SILTY CLAY: red brown; horizontal to less than 10 degree foliation; some 1/4" thick felsic bands; more mafic near top of sample, gneissic bands.
5.0	7 11 13	SS	S1	D		13"		
10.0–15.0								SILTY CLAY: dark green to black; amphibole present; very weathered foliation at a -30 degree angle; trace biotite; amphibolite gneiss.
10.0	11 40 50/3	SS	S2	M		8"		
14.0				W				
15.0–19.5								SILTY CLAY: weathered to competent dark rock, micaceous; foliated; auger refusal at 19.5 feet.
15.0	50/4	SS	S3			4"		



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-15c

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION -
TOTAL DEPTH 3.0 FT
GROUND SURFACE ELEVATION -
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AG=After Boring		
Depth(ft)	DRY	-
Time	-	-
Date	12/20/94	-

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
2.0									2.0		
1.0									1.0		
0.0								SILTY CLAY: weathered granite sand rock; auger refusal at 3.0 feet.	0.0		
1.0									1.0		
2.0									2.0		
3.0									3.0		
4.0									4.0		
5.0									5.0		
6.0									6.0		
7.0									7.0		
8.0									8.0		
9.0									9.0		
10.0									10.0		
11.0									11.0		
12.0									12.0		
13.0									13.0		
14.0									14.0		
15.0									15.0		
16.0									16.0		
17.0									17.0		
18.0									18.0		
19.0									19.0		

FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-15b

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/19/94

TOP OF CASING ELEVATION -
TOTAL DEPTH 7.0 FT
GROUND SURFACE ELEVATION -
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	DRY	-
Time	-	-
Date	12/20/94	-

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
2.0									2.0		
1.0									1.0		
0.0								WEATHERED GRANITE: weathered granite sand rock; some light brown silty clay at top of split spoon, auger refusal at 7.0 feet	0.0		
1.0									1.0		
2.0									2.0		
3.0									3.0		
4.0									4.0		
5.0		SS	S1	D		5"			5.0		
6.0									6.0		
7.0									7.0		
8.0									8.0		
9.0									9.0		
10.0									10.0		
11.0									11.0		
12.0									12.0		
13.0									13.0		
14.0									14.0		
15.0									15.0		
16.0									16.0		
17.0									17.0		
18.0									18.0		
19.0									19.0		

FIELD BOREHOLE LOG

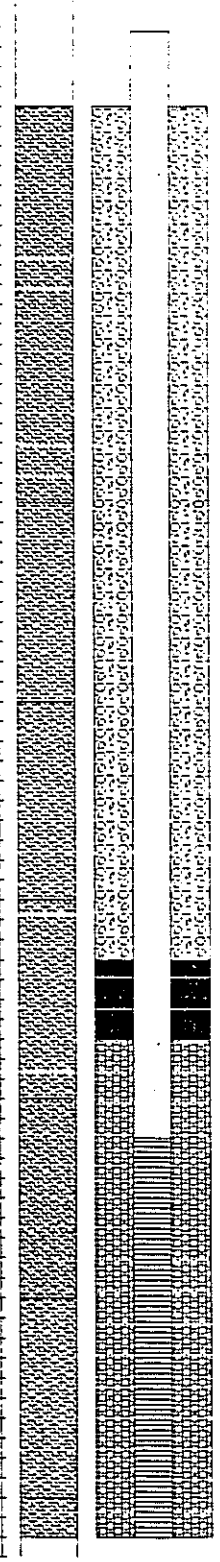
BOREHOLE NUMBER: S-16

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/19/94

TOP OF CASING ELEVATION 785 66
TOTAL DEPTH 36.0 FT
GROUND SURFACE ELEVATION 782 71
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth (Ft)	24.35	24 46
Time	-	-
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	
5.0	3 5 5	SS	S1	D		12"		SILTY CLAYEY SAND brown to green, some iron staining, very weathered mafic rock, amphiboles in sample. Lab USC: Sandy Silt (ML)
10.0	3 3 4	SS	S2	D		15"		SILTY CLAY lt tan with green, amphibole present, iron stains at horizontal and at -45 degree angle, homogeneous
15.0	3 6 11	SS	S3	M		16		SILTY CLAY lt tan with green, weathered amphiboles, one manganese stain near horizontal. Lab USC: Elastic Silt with Sand (MH)
20.0	4 6 7	SS	S4	M		16		SILTY CLAY green, 1/4" white sandy, rest is weathered mafic rock
25.0	9 12 17	SS	S5	W		16		SILTY CLAY green, three horizontal manganese stains, several small ovals of very weathered biotite, overall weathered mafic rock, LAB USC Elastic SILT with SAND (MH)
30.0	12 16 23	SS	S6	W		16		SILTY CLAY two manganese stains at 45 degree angle, bottom of sample has a horizontal foliation, some amphiboles
35.0	32 50.3	SS	S7	W		7"		SILTY CLAY dk green, weathered mafic rock; auger refusal
36.0								



FIELD BOREHOLE LOG

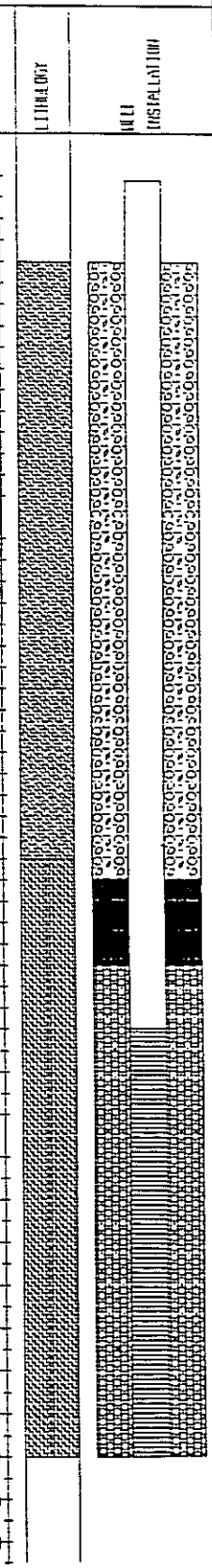
BOREHOLE NUMBER
B-17

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER/CORE
WEATHER SUNNY, COOL
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 789.61
TOTAL DEPTH 28.0 FT
GROUND SURFACE ELEVATION 787.71
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD-While Drilling AB-After Boring		
Depth(Ft)	22.29	13.59
Time	-	-
Date	12/29/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	3 4 5	SS	S1			15"	HSA	SILTY CLAY: brown; two horizontal manganese stains; one of these is 1/4" thick; one thin vertical manganese stain; dark nodes of biotite in bottom of the sample; LAB USC: Sandy SILT (ML).
10.0	3 5 12	SS	S2			13"		SILTY CLAY: brown, some sand; homogeneous; one manganese stain at a less than 10 degree angle; LAB USC Silty Sand (SM)
13.0							AH	Auger Refusal at 14.0 Feet.
14.0							C	GRANITE GNEISS very hard, granite to granite gneiss, drilled by ND rock core; one very fractured section at 14.1 feet, fresh break at 23.0 feet; no fractures from 23.5 to 28.5 feet; first 10 foot core run recovered 96%; second 5 foot core run recovered 71%; Boring Terminated at 28.0 feet.



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-17d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER/AIR ROTARY
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 12/28/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 789.66
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 787.71
SHEET: 1 OF: 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	29.09	34.09
Time	11:05am	-
Date:	1/10/95	12/29/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0							HSA	SILTY CLAY: brown; some manganese stains; dark nodes of biotite in bottom of the sample.
5.0				D				
7.0								Auger Refusal at 12.5 Feet.
10.0				D				
12.0							AH	MAFIC INTRUSIVE: blue in color; competent rock.
15.0				D				
17.0								GNEISS: granite gneiss with dark biotite banding
20.0				D				

DEPTH | LITHOLOGY | WELL INSTALLATION

FIELD BOREHOLE LOG

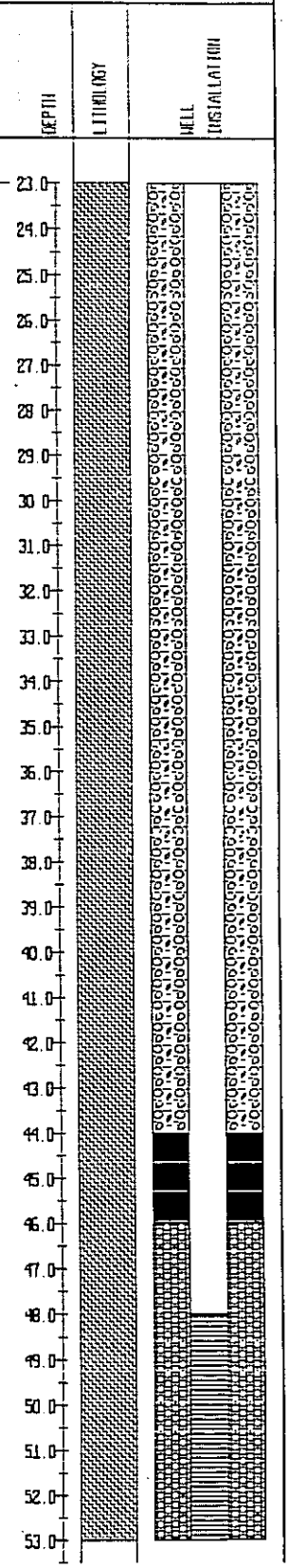
BOREHOLE NUMBER
S-17d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/28/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 789.66
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 787.71
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	29.09	34.09
Time	11:05am	-
Date	1/10/95	12/29/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
23.0								GNEISS more felsic than above; slightly moist at 33.5 feet; a second water seam at 50 feet; 53 feet below grade is a water seam with the most water production; Boring Terminated at 53.0 ft.
24.0								
25.0				D				
26.0								
27.0								
28.0								
29.0								
30.0				D				
31.0								
32.0								
33.0				M				
34.0								
35.0				D				
36.0								
37.0								
38.0								
39.0								
40.0				D				
41.0								
42.0								
43.0								
44.0								
45.0				D				
46.0								
47.0								
48.0								
49.0								
50.0				W				
51.0								
52.0								
53.0				W				



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-18

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY, COOL
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 774.40
TOTAL DEPTH 49.0 FT
GROUND SURFACE ELEVATION 771.60
SHEET 1 OF 2

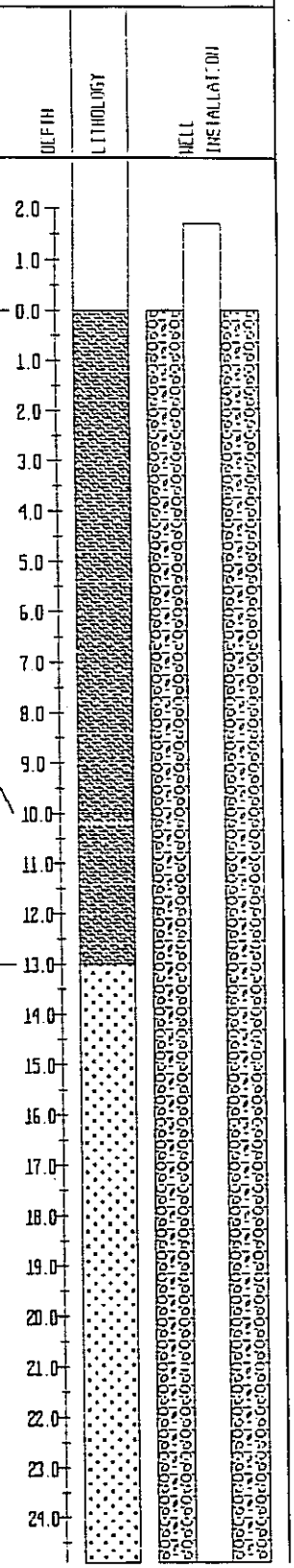
STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	15.64	14.38
Time	-	-
Date	12/29/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0–6.0	3 4 6	SS	S1	D		12"		
10.0–11.0	4 6 11	SS	S2	D		12"		

SILTY CLAY: brown; one near vertical iron stain; bottom of sample varies from dk. green clay to white clay.

SILTY CLAY weathered white granitic sand rock, some quartz; no mica
Auger Refusal at 13 feet.

MAFIC INTRUSIVE air hammer drilling blue mafic rock, Boring Terminated at 49'



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-18

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY, COOL
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 774.40
TOTAL DEPTH 49.0 FT
GROUND SURFACE ELEVATION 771.60
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	15.64	14.38
Time	-	-
Date	12/29/94	11/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
25.0								MAFIC INTRUSIVE: air hammer drilling blue mafic rock; Boring Terminated at 49'.	25.0		
26.0									26.0		
27.0									27.0		
28.0									28.0		
29.0									29.0		
30.0									30.0		
31.0									31.0		
32.0									32.0		
33.0									33.0		
34.0									34.0		
35.0									35.0		
36.0									36.0		
37.0									37.0		
38.0									38.0		
39.0									39.0		
40.0									40.0		
41.0									41.0		
42.0									42.0		
43.0									43.0		
44.0									44.0		
45.0									45.0		
46.0									46.0		
47.0									47.0		
48.0									48.0		
49.0									49.0		

FIELD BOREHOLE LOG

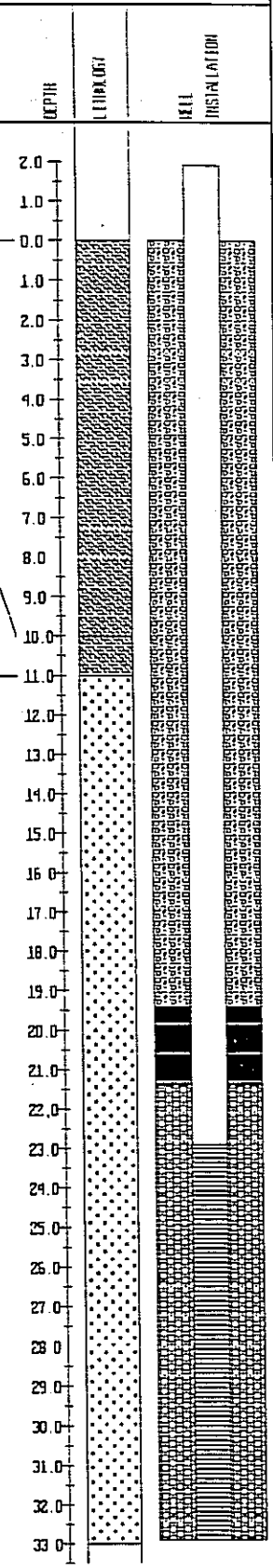
BOREHOLE NUMBER: B-19

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY/ROLLERCONE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/20/94 DATE COMPLETED 1/2/95

TOP OF CASING ELEVATION 778.28
TOTAL DEPTH 33.0 FT
GROUND SURFACE ELEVATION 775.78
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WO=While Drilling AB=After Boring		
Depth(ft)	18.74	19.22
Time	-	-
Date	1/10/94	1/25/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0–6.0	12 24 30	Ss	S1			15"		SILTY CLAY: dk. green to brown; weathered mafic rock; some manganese staining, no foliation.
10.0	10 50/5	Ss	S2			12"		SILTY CLAY: weathered mafic rock; individual amphiboles seen; no foliation; auger refusal at 11.0'.
11.0–33.0								MAFIC INTRUSIVE: hard mafic rock; boring terminated at 33 feet.



FIELD BOREHOLE LOG

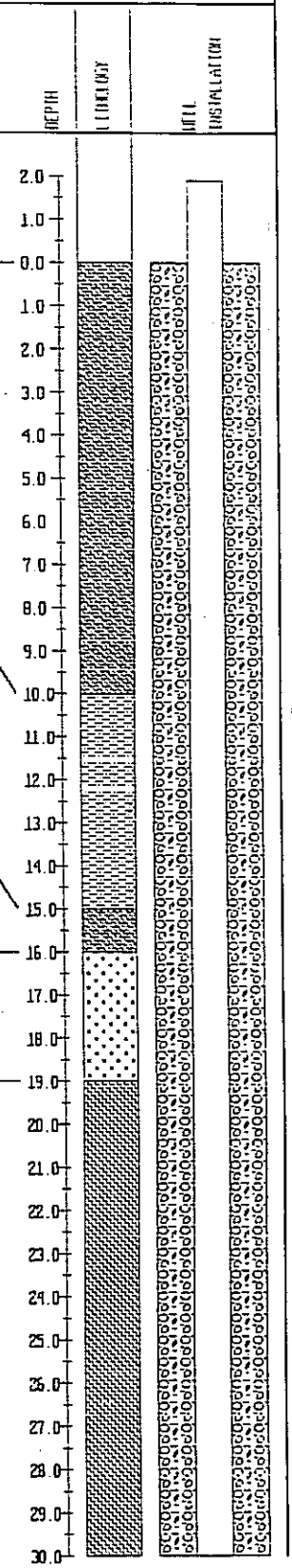
BOREHOLE NUMBER
B-2C

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 1/3/95

TOP OF CASING ELEVATION 772.18
TOTAL DEPTH 63.5 FT
GROUND SURFACE ELEVATION 770.68
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD-While Drilling AB-After Boring		
Depth(ft)	25.96	25.73
Time	1:10pm	-
Date	1/10/95	1/25/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0–6.0	12 24 32	SS	S1					SILTY CLAY: bottom of sample is weathered mafic rock with amphiboles in a honeycomb of thin felsic veins; some iron staining; vertical foliation; above this in the sample is 5" thick layer of granitic sand rock; some quartz; trace to no mica; contact between the sand rock and the mafic is at a 45 degree angle, above the sand rock is more weathered mafic rock with a similar contact between; Lab USC: Sandy Lean Clay (CL).
10.0–11.0	20 33 50/5	SS	S2					SILTY SAND: dk. brown granitic sand rock; some quartz; some biotite; upper 4" of sample is dk. green and has more clay; weathered contact has biotite; vertical foliation in bottom of spoon; Lab USC: Silty Clayey Sand (SC-SM)
15.0	50/4	SS	S3					SILTY CLAY weathered mafic micaceous rock; auger refusal at 16.0'
16.0–19.0								MAFIC INTRUSIVE hard mafic rock, drilling with air hammer, cuttings are green in color
19.0–30.0								GNEISS cuttings are grayish, progressively more banding noted in samples as we progress downward



FIELD BOREHOLE LOG

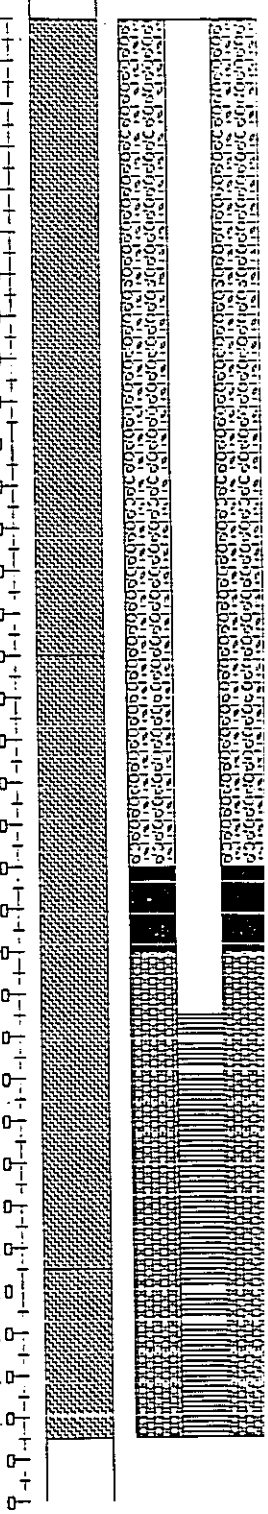
BOREHOLE NUMBER: B-2C

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 1/3/95

TOP OF CASING ELEVATION 772.18
TOTAL DEPTH 63.5 FT
GROUND SURFACE ELEVATION 770 68
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	27 46	25 73
Time	1 10pm	
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
30.0								GNEISS: cuttings are grayish; progessively more banding noted in samples as we progress downward.
31.0								
32.0								
33.0								
34.0								
35.0								
36.0								
37.0								
38.0								
39.0								
40.0								
41.0								
[illegible]								
[illegible]								
44.0								
45.0								GNEISS felsic, banding visible in cuttings.
46.0								
47.0								
48.0								
49.0								
50.0								
51.0								
52.0								
53.0								
54.0								
55.0								
56.0								
57.0								
58.0								
59.0								
60.0				W				GNEISS felsic, water seam at 59 5 feet; Boring Terminated at 63 5 feet
[illegible]								
[illegible]								
63.0								
64.0								
65.0								



FIELD BOREHOLE LOG

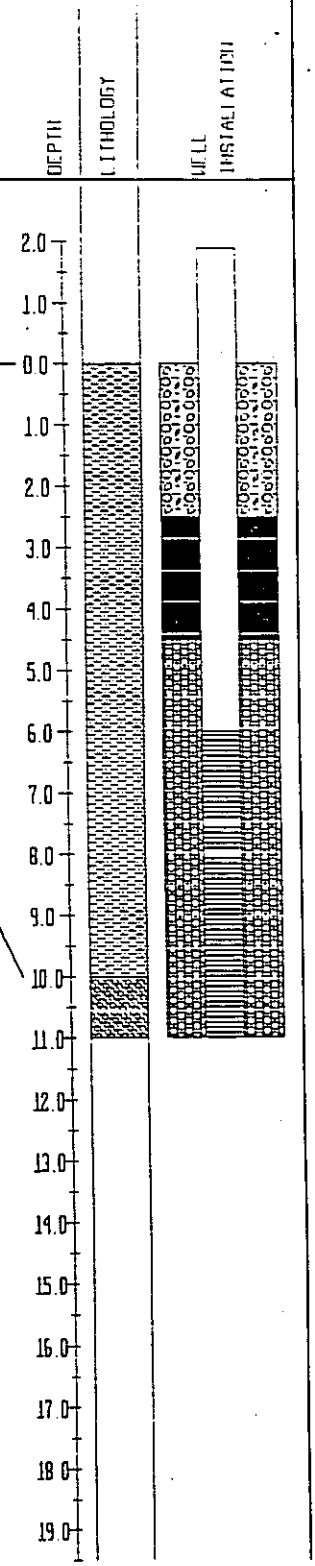
BOREHOLE NUMBER: B-21

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION 759 84
TOTAL DEPTH 11 0 FT
GROUND SURFACE ELEVATION 756 82
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	5 02	5 13
Time	11:55am	-
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	12 50/4	SS	S1			8"		SILTY SAND: white granitic sand rock; weathered feldspar and quartz; some kaolinitic clay; one 2" thick section iron stained. GRANITE
10.0	40 50/6	SS	S2			7"		SILTY CLAY mafic weathered rock; some mica and iron staining; auger refusal at 11.0 ft



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-22

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE DRILLED 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 757.86
TOTAL DEPTH 31.0 FT
GROUND SURFACE ELEVATION 754.92
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	10.27	8.56
Time	-	-
Date	12/20/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	17 50/6	Ss	S1			13"		SAND: white granitic sand rock; quartz; no mica; some feldspar; Lab USC: Silty ~~Clayey~~ Sand (~~SC~~-SM)
10.0	15 24 30	Ss	S2			16"		SAND granitic sand rock; some kaolin, quartz and iron staining; muscovite and biotite present; Lab USC Silty ~~Clayey~~ Sand (~~SC~~-SM)
15.0	24 50/6	Ss	S3			13"		
20.0	24 32 48	Ss	S4	W		11"		SAND granitic sand rock, same as above with more biotite.
25.0	24 28 50/5	Ss	S5	W		12"		SAND granitic sand rock; abundant quartz and biotite; some muscovite and iron staining; Lab USC Silty ~~Clayey~~ Sand (~~SC~~-SM)
30.0	24 36 50/5	Ss	S6	W		6"		SAND granitic sand rock, some as above with pale green clay and less mica; auger refusal at 31.0'

LITHOLOGY

WELL INSTALLATION

FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-22a

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 756.80
TOTAL DEPTH 46.5 FT
GROUND SURFACE ELEVATION 754.92
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	14.66	8.72
Time	-	-
Date	12/29/94	1/10/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
2.0									2.0		
1.0									1.0		
0.0								SAND: white to tan granitic sand rock; quartz, mica; some feldspar.	0.0		
1.0									1.0		
2.0									2.0		
3.0									3.0		
4.0									4.0		
5.0									5.0		
6.0									6.0		
7.0									7.0		
8.0									8.0		
9.0									9.0		
10.0									10.0		
11.0									11.0		
12.0									12.0		
13.0									13.0		
14.0				W				SAND granitic sand rock; biotite present, wet at 14 feet; abundant water at 23.0 feet; auger refusal at 28.5 feet.	14.0		
15.0									15.0		
16.0									16.0		
17.0									17.0		
18.0									18.0		
19.0									19.0		
20.0									20.0		
21.0									21.0		
22.0									22.0		
23.0									23.0		
24.0									24.0		
25.0									25.0		
26.0									26.0		
27.0									27.0		
28.0									28.0		

FIELD BOREHOLE LOG

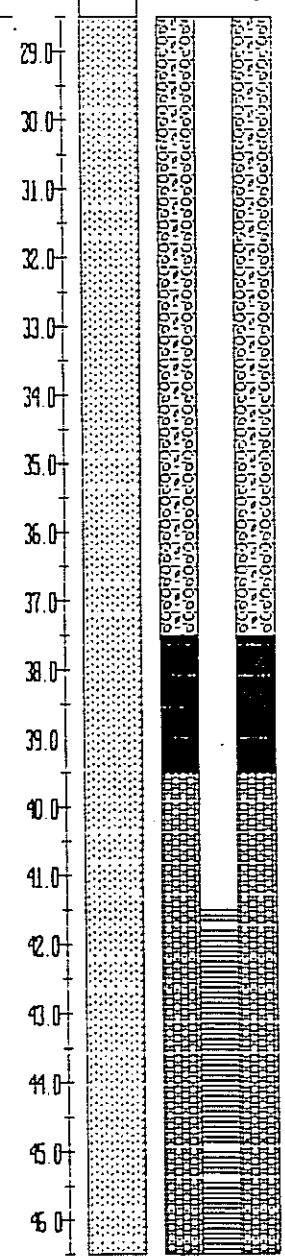
BOREHOLE NUMBER: B-22d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 756 80
TOTAL DEPTH 46 5 FT
GROUND SURFACE ELEVATION 754 92
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	14.66	8.72
Time	-	-
Date	12/29/94	1/10/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
29 0								GRANITE: highly weathered tan to white granite with biotite; soft seam at 45 to 46 feet.
30.0								
31 0								
32 0								
33 0								
34 0								
35 0								
36 0								
37 0								
38 0								
39 0								
40 0								
41 0								
42 0								
43 0								
44 0								
45 0								
46 0								



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-23

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/21/94

TOP OF CASING ELEVATION 768.26
TOTAL DEPTH 31.0 FT
GROUND SURFACE ELEVATION 765.26
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	13.75	14.06
Time	-	-
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0–6.0	10, 19, 30	SS	S1			15"		SAND: white to tan granitic sand rock; abundant biotite in bottom of sample, trace k-spar; some quartz.
10.0–11.0	15, 50/6	SS	S2			13"		SAND: granitic sand rock; has biotite, quartz and clay; upper portion of sample is lt. tan and has gneissic banding.
15.0–16.0	9, 50/6	SS	S3			11"		SAND: granitic sand rock; same as above with no banding.
20.0–21.0	35, 50/5	SS	S4	M		8		SAND: granitic sand rock; overlain by a manganese stained clay (1" thick) and quartz fragments; moist
25.0–26.0	50.2	SS	S5	M		2"		SAND: granitic sand rock, sample has biotite feldspar and quartz; auger refusal at 31.0 feet
30.0–31.0	50.2	SS	S6	W		2"		

WELL INSTALLATION

FIELD BOREHOLE LOG

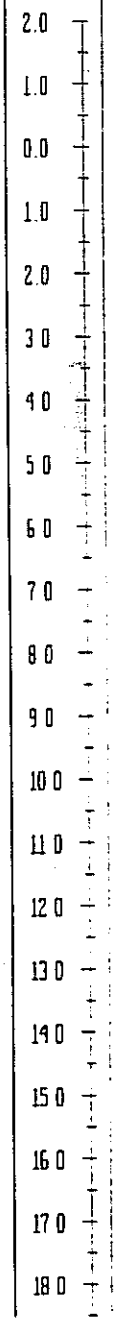
BOREHOLE NUMBER: B-24

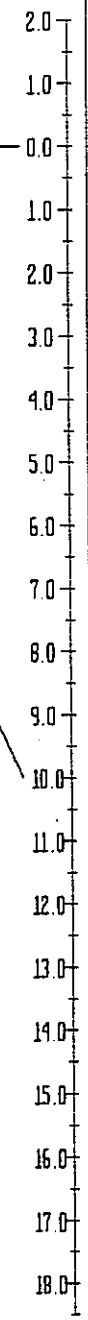
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/22/94

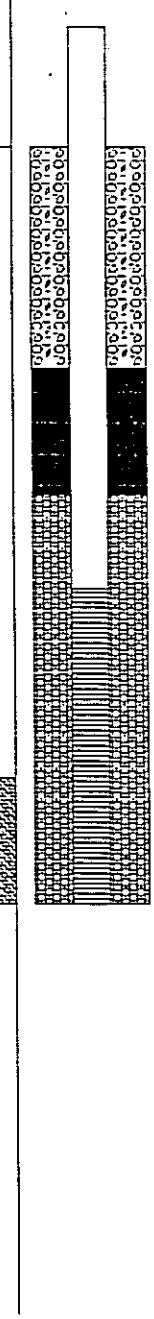
TOP OF CASING ELEVATION 753.03
TOTAL DEPTH 12.0 FT
GROUND SURFACE ELEVATION 750.08
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	9.69	9.30
Time	-	-
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	33 50/6	SS	S1			9"		SAND: large grained white to lt. tan granitic sand rock; abundant quartz and trace to little mica; Lab USC: Poorly Graded Sand with Silt (SP-SM)
10.0	33 38 50/5	SS	S2	W		14"		SILT AND CLAY: weathered mafic rock, blue in color; some mica and iron stains; auger refusal at 12 ft. Lab USC ~~Silty~~ Clayey Sand (SC-~~SM~~)







FIELD BOREHOLE LOG

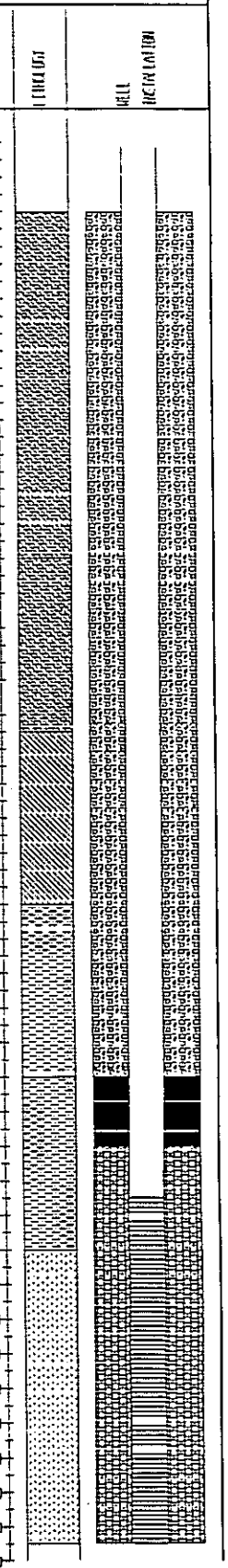
BOREHOLE NUMBER: B-2S

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/21/94

TOP OF CASING ELEVATION 747.96
TOTAL DEPTH 38.5 FT
GROUND SURFACE ELEVATION 744.54
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	6.64	15.72
Time	12:33	--
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	50/6	SS	S1			6"		SILTY CLAY: white; weathered sand rock; slight pink hue; abundant quartz; trace mica.
10.0	41 50/5	SS	S2			10		SILTY CLAY: white very weathered granitic sand rock; abundant quartz and feldspar; some biotite; no structure.
15.0	18 36 32	SS	S3	W		10"		CLAY wet; weathered kaolinitic claystone, white, iron stained at a -45 degree angle; some biotite and quartz also present at top of sample.
20.0	50/6	SS	S4			3"		SILTY SAND whitish to light tan granitic sand rock, quartz and feldspar abundant, some areas of kaolin clay
25.0	50/0	SS	S5			5"		SILTY SAND lt tan, weathered granitic sand rock, lg quartz and feldspar crystals, some biotite, no structure, wet
30.0	34 50/5	SS	S6			9"		GRANITE weathered to competent; abundant quartz, some biotite and feldspar, auger refusal at 38.5 ft
35.0	50/3	SS	S7			3"		



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-25a

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/ROCK CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 747.54
TOTAL DEPTH 52.0 FT
GROUND SURFACE ELEVATION 744.54
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=AFter Boring		
Depth(Ft)	7.54	6.85
Time	9:55am	-
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
2.0									2.0		
1.0									1.0		
0.0								SILTY CLAY: dark blue to green; weathered mafic rock.	0.0		
1.0									1.0		
2.0									2.0		
3.0									3.0		
4.0									4.0		
5.0									5.0		
6.0									6.0		
7.0									7.0		
8.0									8.0		
9.0									9.0		
10.0									10.0		
11.0									11.0		
12.0									12.0		
13.0									13.0		
14.0									14.0		
15.0									15.0		
16.0									16.0		
17.0									17.0		
18.0									18.0		
19.0									19.0		
20.0									20.0		
21.0									21.0		
22.0									22.0		
23.0									23.0		
24.0									24.0		
25.0									25.0		

FIELD BOREHOLE LOG

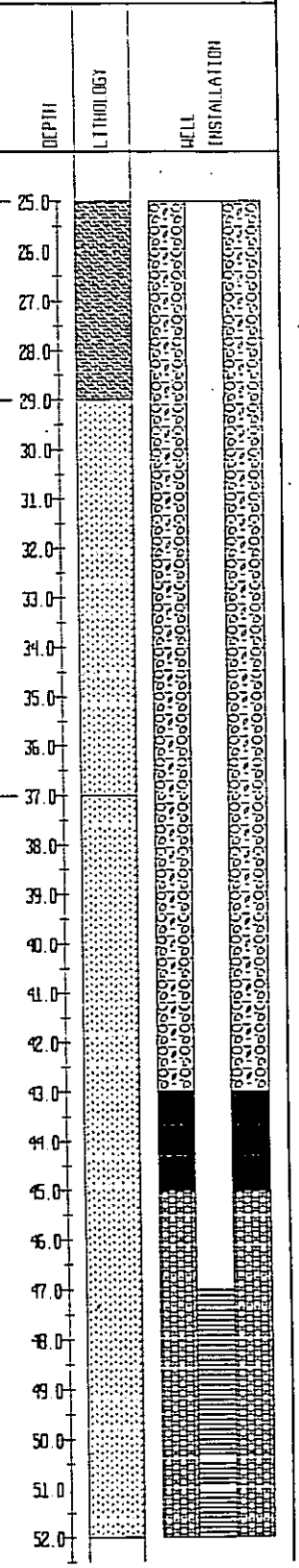
BOREHOLE NUMBER
B-25a

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/ROCK CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 747.54
TOTAL DEPTH 52.0 FT
GROUND SURFACE ELEVATION 744.54
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	7.54	6.85
Time	9:55am	-
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
25.0								SILTY CLAY: dark blue to green; weathered mafic rock; auger refusal at 29 feet.
26.0								
27.0								
28.0								
29.0								GRANITE: weathered; drilled with a rollercone bit.
30.0								
31.0								
32.0								
33.0								
34.0								
35.0								
36.0								
37.0								GRANITE weathered to competent granitic sand rock, drilled with rock core in three runs - 3' run (2' recovery), 5'run (5' recovery), 7' run (3' recovery); Reamed out with air hammer drilling.
38.0								
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								
46.0								
47.0								
48.0								
49.0								
50.0								
51.0								
52.0								



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-26

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/22/94

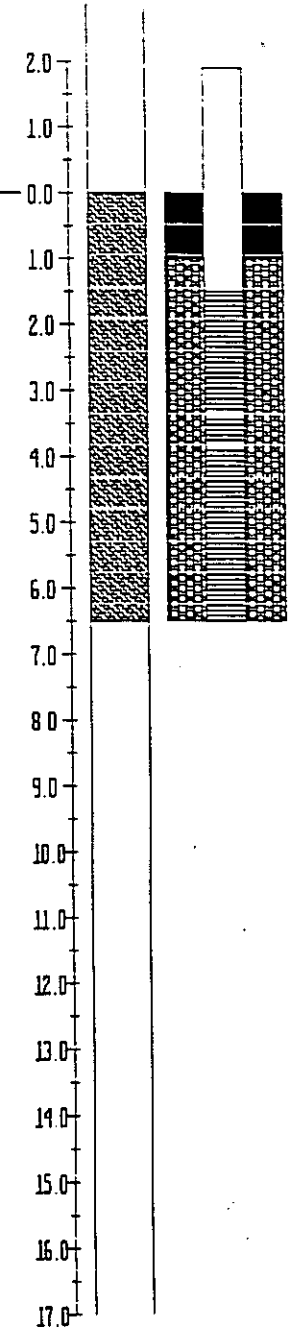
TOP OF CASING ELEVATION 742 55
TOTAL DEPTH 6 5 FT
GROUND SURFACE ELEVATION 739 20
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	12 36	14 42
Time	10 09	12 15PM
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD
5.0	11 39 50/4	SS	S1			16"	

LITHOLOGY DESCRIPTION

SILT AND CLAY blue green; weathered mafic rock; some iron staining-especially in lower 8" of sample; auger refusal at 6.5' Green Stone Dike



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-27

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/21/94 DATE COMPLETED 1/2/95

TOP OF CASING ELEVATION 736.71
TOTAL DEPTH 33.0 FT
GROUND SURFACE ELEVATION 734.82
SHEET 1 OF 1

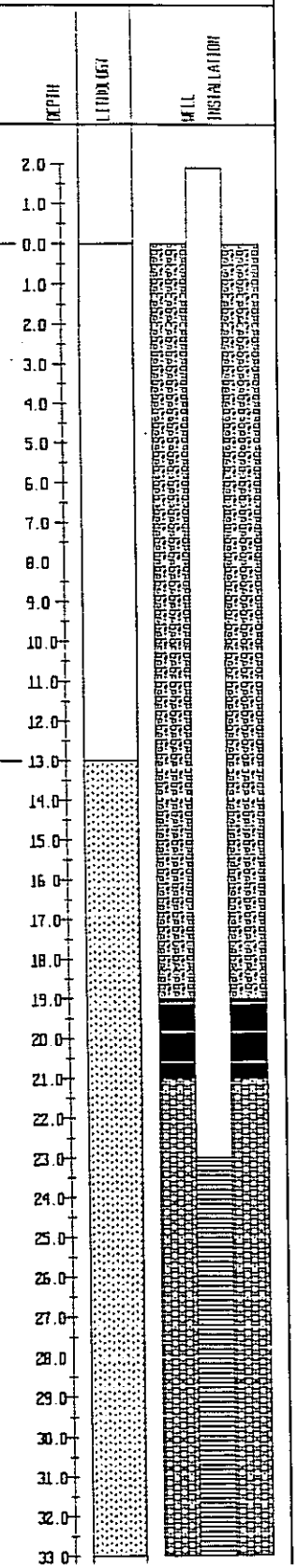
STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	19.18	16.98
Time	-	-
Date	1/2/95	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTENCY	SAMPLE RECOVERY	DRILL METHOD
5.0	50/6	Ss	S1				
10.0	50/5	Ss	S2				
28.0				W			

LITHOLOGY DESCRIPTION

SAND: weathered granitic sand rock; some biotite; some greenish biotite; trace of potassium feldspar; auger refusal at 13 feet.

GRANITE: white granite drilled with air hammer; water seam at 28 feet



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-28

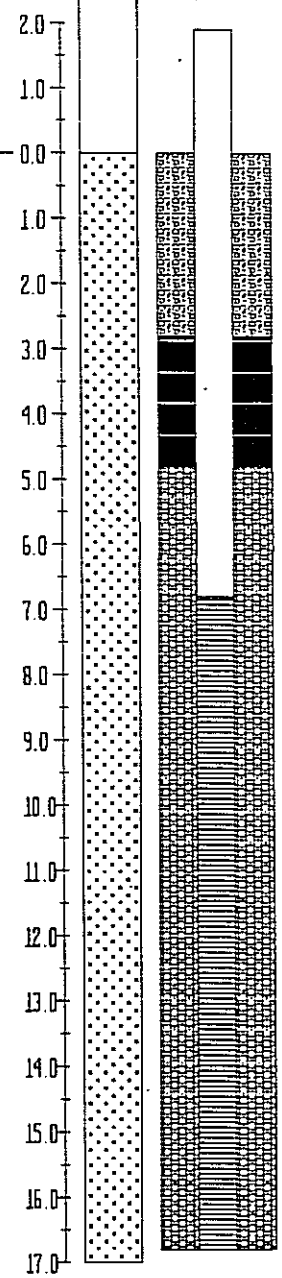
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD AIR HAMMER
WEATHER SUNNY
FIELD PARTY RONNY BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 1/2/95 DATE COMPLETED 1/2/95

TOP OF CASING ELEVATION 742.69
TOTAL DEPTH 16.8 FT
GROUND SURFACE ELEVATION 739.33
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=AFter Boring		
Depth(ft)	4.73	4.18
Time	-	-
Date	1/2/95	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
2.0								
1.0								
0.0							AH	MAFIC INTRUSIVE: mafic intrusive; dark brown to dark gray; drilled with an air hammer; some water sat 9.0 feet, dry at 11.0 feet, wet at 12.5 feet; auger refusal at 0.5'.
1.0								
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0				M				
10.0								
11.0								
12.0				W				
13.0								
14.0								
15.0								
16.0								
17.0								

DEPTH | LITHOLOGY | WELL INSTALLATION



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-29

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION -
TOTAL DEPTH 2.0 FT
GROUND SURFACE ELEVATION -
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AD=After Boring		
Depth(ft)	DRY	-
Time	-	-
Date	12/22/94	-

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
2.0									2.0		
1.0									1.0		
0.0								WEATHERED MAFIC INTRUSIVE: auger refusal at 2.0 feet.	0.0		
1.0									1.0		
2.0									2.0		
3.0									3.0		
4.0									4.0		
5.0									5.0		
6.0									6.0		
7.0									7.0		
8.0									8.0		
9.0									9.0		
10.0									10.0		
11.0									11.0		
12.0									12.0		
13.0									13.0		
14.0									14.0		
15.0									15.0		
16.0									16.0		

FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-29A

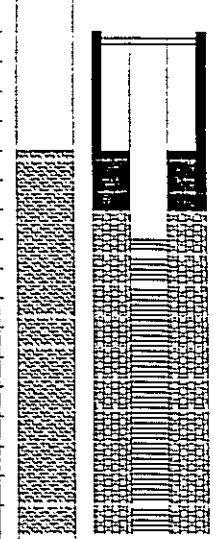
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN
DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION - 746.47
TOTAL DEPTH 8.0 FT
GROUND SURFACE ELEVATION - 743.61
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	-	
Time	-	
Date	-	

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
2.0								
1.0								
0.0								SILTY CLAY very weathered mafic rock; no structure
1.0								
2.0								
3.0								
4.0								
5.0	34 50/5	SS	S1					
6.0								
7.0								auger refusal at 8.0 feet
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								
14.0								
15.0								
16.0								
17.0								
18.0								
19.0								
20.0								

DEPTH | LITHOLOGY | WELL INSTALLATION



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-30

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION 742.26
TOTAL DEPTH 32.0 FT
GROUND SURFACE ELEVATION 739.11
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	14.83	14.74
Time	5:26	-
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	6, 10, 15	Ss	S1	D		14"		SAND: white granite sand rock; some biotite and some quartz; Lab USC: Silty ~~Clayey~~ Sand (~~SC~~-SM).
10.0	6, 12, 17	Ss	S2	D		14"		SAND: white granite sand rock with biotite and quartz, no structure; Lab USC: Silty ~~Clayey~~ Sand (~~SC~~-SM).
15.0	11, 17, 25	Ss	S3	D		13"		
20.0	12, 28, 50/2	Ss	S4	M		12"		SAND white to tan granite sand rock; some biotite, quartz
25.0	35, 50/4	Ss	S5	W		7"		SAND white granite sand rock, quartz; feldspar, biotite almost forms bands, although somewhat discontinuous, also some green biotite; Lab USC Silty ~~Clayey~~ Sand (~~SC~~-SM).
30.0	50/6	Ss	S6	W		5"		SAND white granite sand rock; some biotite, and a few biotite layers; auger refusal at 32 feet.

WELL INSTALLATION

FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-31

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

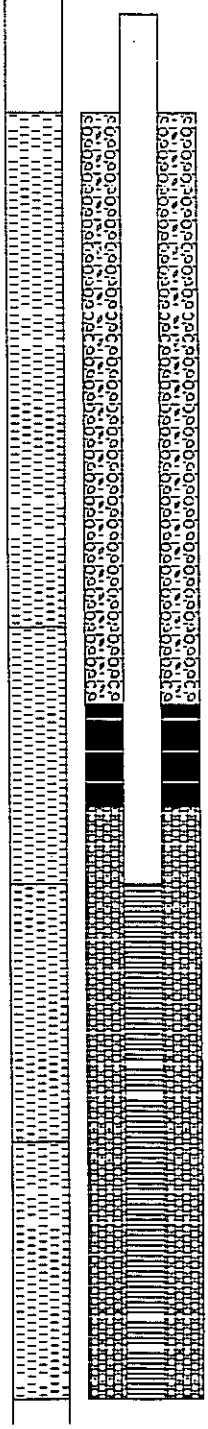
TOP OF CASING ELEVATION 750.1
TOTAL DEPTH 25.0 FT
GROUND SURFACE ELEVATION 747.1
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AR=After Boring		
Depth(ft)	5.87	5.42
Time	5:35	-
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	50/4	Ss	S1			3"		SANDY SILT: Weathered lt. brown granite sand rock; abundant biotite.
10.0	50/2	Ss	S2			2"		SANDY SILT: Weathered granite sand rock; with quartz.
15.0	50/1	Ss	S3			1"		SANDY SILT: Brown granite sand rock with some quartz.
20.0	50/1	Ss	S4			1"		SANDY SILT: Brown granite sand rock in cohesive chunks; auger refusal at 25 feet.

LITHOLOGY

WELL INSTALLATION



FIELD BOREHOLE LOG

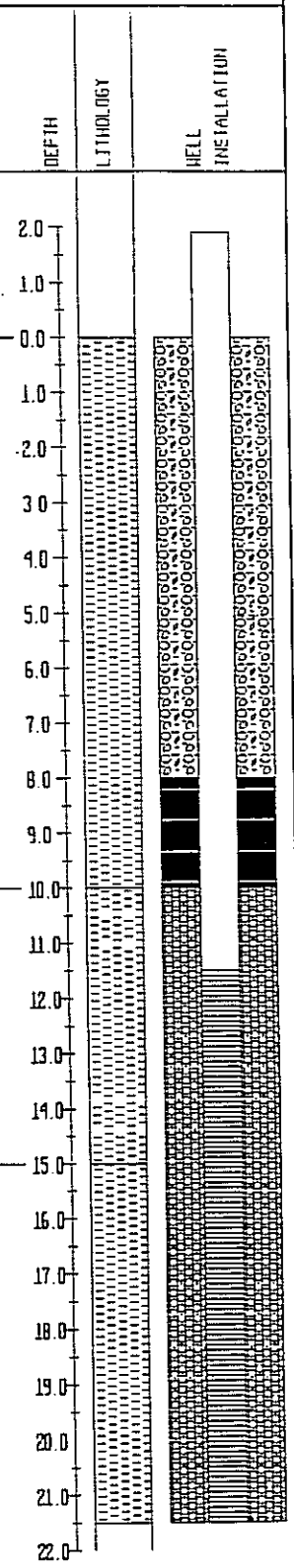
BOREHOLE NUMBER
B-32

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION 744.76
TOTAL DEPTH 21.5 FT
GROUND SURFACE ELEVATION 741.65
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	17.03	14.36
Time	5:20	1:35
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	24 50/6	SS	S1			12"		SANDY SILT: Light tan granite sand rock; little mica; no structure.
10.0	50/1	SS	S2			1"		SANDY SILT Light tan granite sand rock, no structure
15.0	50/1	SS	S3			1"		SANDY SILT Light tan granite sand rock, some quartz; little biotite; auger refusal at 21.5 feet.
20.0	50/1	SS	S4			0"		



FIELD BOREHOLE LOG

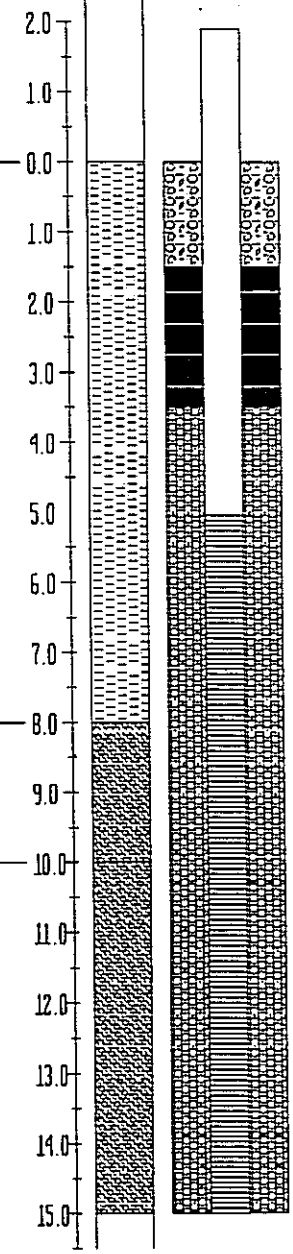
BOREHOLE NUMBER
B-33

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/27/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 760.33
TOTAL DEPTH 15.0 FT
GROUND SURFACE ELEVATION 757.22
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	5.11	4.54
Time	12:21	1:50
Date	12/27/94	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	16 30 50/3	SS	S1			13"		SANDY SILT: tannish white, coarse grained; biotite flakes locally; white weathered feldspar clay; some iron staining; granitic; moist.
8.0				W				CLAYEY SILT: mafic dike; water at 8.0 feet.
10.0	12 16 30	SS	S2			13"		CLAYEY SILT: Dark bluish green to light tan green; some very fine whitish mineral grains visible; locally orangerind iron staining; moist to wet; weathered mafic intrusive; auger refusal at 15.0 ft.
15.0	50/3	SS	S3			8"		



FIELD BOREHOLE LOG

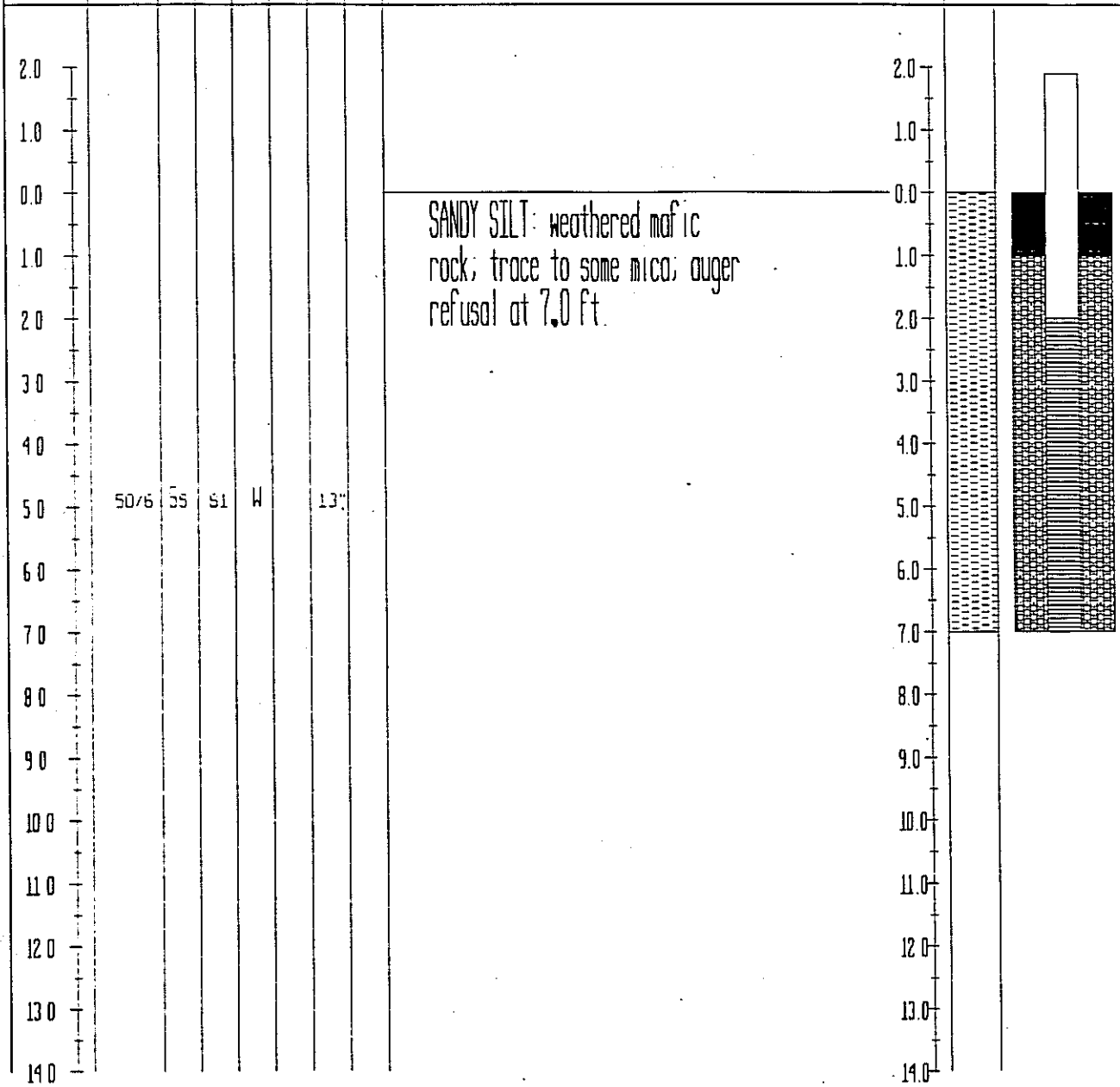
BOREHOLE NUMBER
B-34

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 733.92
TOTAL DEPTH 7.0 FT
GROUND SURFACE ELEVATION 730.97
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	2.58	3.61
Time	-	11:05
Date	1/2/95	1/10/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	50/6	SS	S1	W		13"		SANDY SILT: weathered mafic rock; trace to some mica; auger refusal at 7.0 ft.



FIELD BOREHOLE LOG

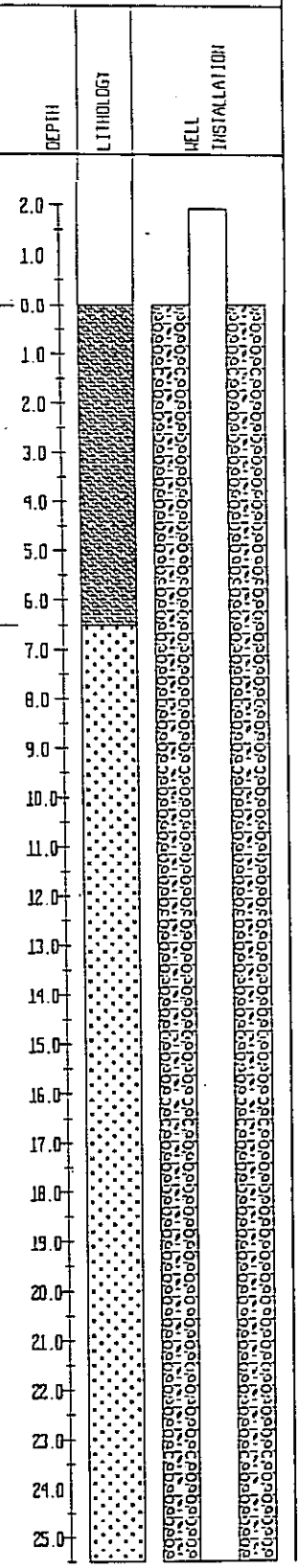
BOREHOLE NUMBER
B-34d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER BIT/AIR ROTARY/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 732.49
TOTAL DEPTH 48.5 FT
GROUND SURFACE ELEVATION 730.97
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	5.61	3.54
Time	-	-
Date	1/25/95	3/11/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0								SILTY CLAY: blue green; weathered mafic rock; trace to some mica.
7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0								MAFIC INTRUSIVE: numerous 30 degree angle fractures in rock core; Rock core from 7.0 to 22 feet below grade; core run #1 from 7.0 ft. to 10 ft. - core blockage at 10 ft. Core #2 from 10 ft. to 20 ft.; Core run #3 from 20 ft. to 22 ft.; boring reamed out to 48.5 ft. with air hammer



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-34d

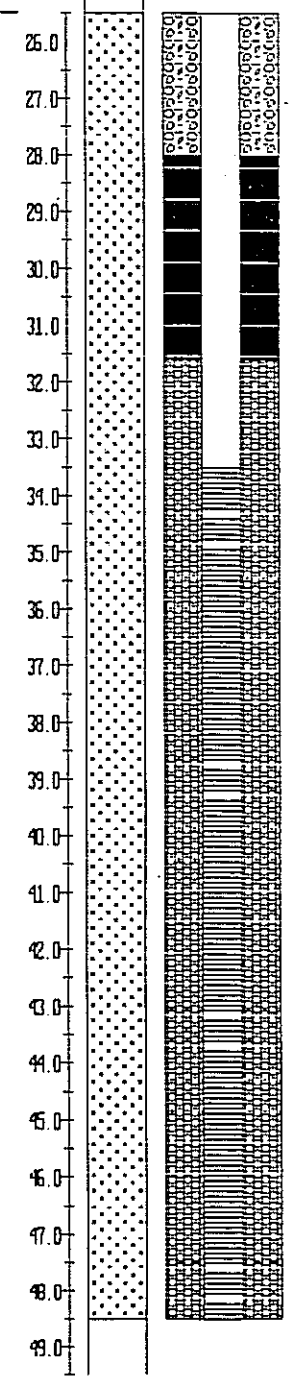
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER BIT/AIR ROTARY/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 732.49
TOTAL DEPTH 48.5 FT
GROUND SURFACE ELEVATION 730.97
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	5.61	3.54
Time	-	-
Date	1/25/95	3/11/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
26.0								MAFIC INTRUSIVE: numerous 30 degree angle fractures in rock core; Rock core from 7.0 to 22 feet below grade; core run #1 from 7.0 ft. to 10 ft. - core blockage at 10 ft. Core #2 from 10 ft. to 20 ft.; Core run #3 from 20 ft. to 22 ft.; boring reamed out to 48.5 ft. with air hammer.
27.0								
28.0								
29.0								
30.0								
31.0								
32.0								
33.0								
34.0								
35.0								
36.0								
37.0								
38.0								
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								
46.0								
47.0								
48.0								
49.0								

DEPTH | LITHOLOGY | WELL INSTALLATION



FIELD BOREHOLE LOG

BOREHOLE NUMBER
B-35

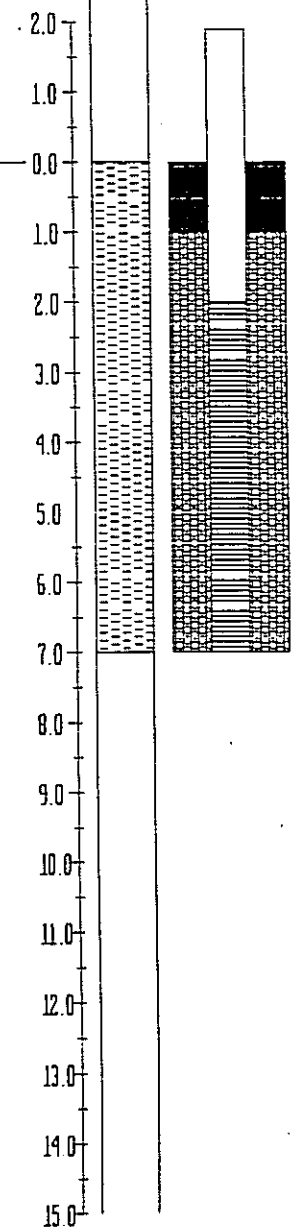
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 746.75
TOTAL DEPTH 7.0 FT
GROUND SURFACE ELEVATION 744.00
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	2.49	1.12
Time	11:05am	-
Date	1/10/95	1/25/95

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
5.0	30 50/1	SS	S1			7"		

SANDY SILT: light tan to orange tan; some clay and biotite; notable white feldspar and quartz; auger refusal at 7.0 feet.



FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-36

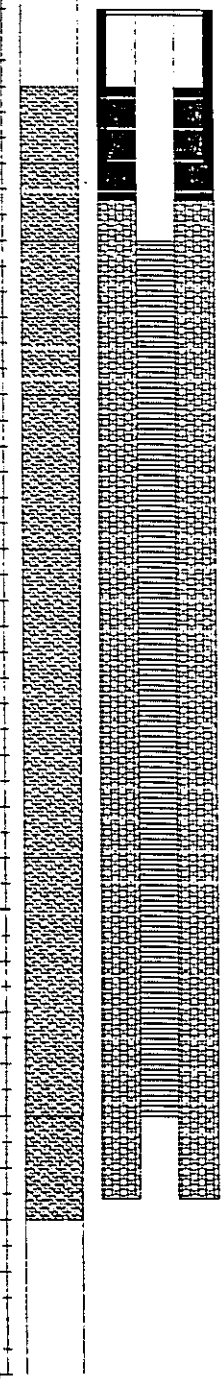
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY, COOL
FIELD PARTY RONNY BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN DATE COMPLETED 1/5/95

TOP OF CASING ELEVATION 783.0
TOTAL DEPTH 22.0 FT
GROUND SURFACE ELEVATION 782.0
SHEET 1 OF 1

STATIC WATER LEVEL (BGS)	
WD=While Drilling AB=After Boring	
Depth(ft)	-
Time	-
Date	-

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0	2, 3, 3	SS	S1			9"	HSA	SILTY CLAY brown; Mn stained; v. uniform; trace amphiboles.
1.0	10, 9, 15	SS	S2			10"		SILTY CLAY tan to green; v. uniform
3.0	12, 16, 40	SS	S3			12"		SILTY CLAY brown to green; subvertical Mn stain
4.0	17, 24, 31	SS	S4			10"		SILTY CLAY mica, brown, tan, green; Mn stained
6.0	10, 16, 27	SS	S5			12"		SILTY CLAY mica, Mn stained at 30 and 45 degree angles.
7.0	18, 27, 18	SS	S6			12"		
9.0	11, 16	SS	S7, S8			10"		SILTY CLAY lower portion of sample abundant biotite, appears to be foliated GNEISS
10.0	50/.6							
15.0	16, 19, 22	SS	S9			12"		SILTY CLAY medium brown, Mn stained from 0 to 10 degree angles, micaceous near top
20.0	50/.3	SS	S10	M		3"		CLAYEY SILTY SAND red brown to white, weathered granitic sand rock
22.0								Boring Terminated at 22.0 feet

DEPTH | LITHOLOGY | WELL INSTALLATION



FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-1

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 10/24/94 DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 771.05
TOTAL DEPTH 45.0
GROUND SURFACE ELEVATION 768
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AR=AFter Boring		
Depth(ft)	20.93 DB	25.38
Time	8:45	-
Date	10/25/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0–5.0	2, 5, 5	Ss	S1					SILTY CLAY: brown to tan; some manganese staining; roots in upper six inches.
5.0–10.0	10, 9, 16	Ss	S2					SILTY SAND: with some clay; brown to light tan; some very weathered potassium feldspar and plagioclase; possibly some very weathered amphibole.
10.0–15.0	6, 9, 11	Ss	S3					SAND brown to tan; minor clay; horizontal manganese staining; one 2 inch thick layer of mica rich brown clay (mica schist).
15.0–20.0	3, 3, 6	Ss	S4	W				SILTY CLAY: weathered greenstone, some horizontal manganese stains; wet.
20.0–25.0	6, 12, 30	Ss	S5					SILTY CLAY: dark green to black; weathered mafic rock; iron stained near top; dry.
25.0	50/4	Ss	S6					

DEPTH: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0

LITHOLOGY

WELL INSTALLATION

FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-1

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 10/24/94 DATE COMPLETED 10/25/94

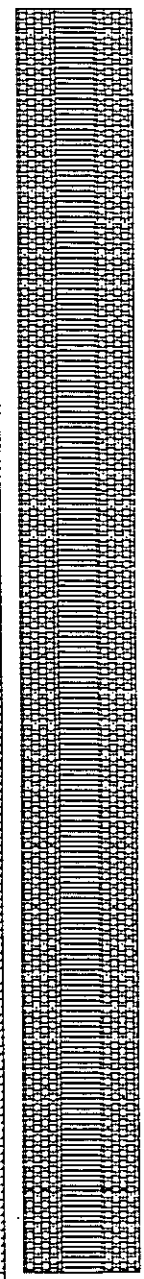
TOP OF CASING ELEVATION 771.05
TOTAL DEPTH 45.0
GROUND SURFACE ELEVATION 768
SHEET 2 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	20.93 DB	25.3B
Time	8:45	-
Date	10/25/94	12/27/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
25.0	50/4	SS	S6					MAFIC INTRUSIVE: weathered; dark greenish black
26.0								
27.0								
28.0								
29.0								
30.0	25	SS	S7					MAFIC INTRUSIVE: weathered; minor iron staining; some very fine felsic streaks; Auger Refusal at 32 feet.
	36							
31.0	45							
32.0								GRANITE bedrock, white with some black staining, significant quartz and feldspar, Boring Terminated at 45 feet.
33.0								
34.0								
35.0								
36.0								
37.0								
38.0								
39.0								
40.0								
41.0								
42.0								
43.0								
44.0								
45.0								

LITHOLOGY

WELL INSTALLATION



FIELD BOREHOLE LOG

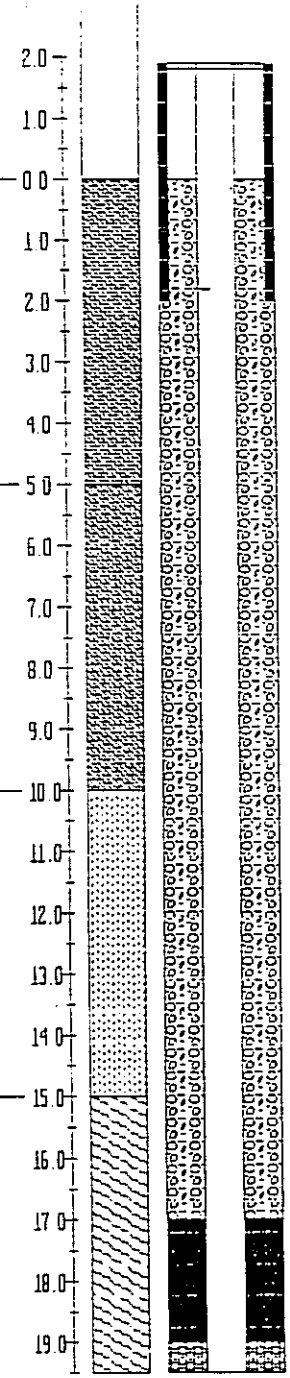
BOREHOLE NUMBER: DW-2

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE WITH AIR/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 10/25/94 DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 769.95
TOTAL DEPTH 40.0
GROUND SURFACE ELEVATION 767
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	22.94 WD	16.8
Time	12:45	-
Date	10/25/94	11/3/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0–5.0	5, 5, 4	SS	S1					SILTY CLAY brown to tan; some broken glass in split spoon.
5.0–10.0	11, 21, 29	SS	S2					SANDY SILTY CLAY light tan; some very weathered rock at 5 feet, some feldspar clay
10.0–15.0	35, 27, 38	SS	S3					GRANITE very weathered, potassium feldspar and plagioclase, some manganese staining, little to no biotite; some weathered chlorite present.
15.0–19.0	31, 36, 50/6"	SS	S4					GREENSTONE tan/brown, some iron staining, weathered; minor feldspar clay



FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-2

PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: ROLLER CONE WITH AIR/AIR HAMMER
WEATHER: SUNNY
FIELD PARTY: RON BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 10/25/94 DATE COMPLETED: 10/25/94

TOP OF CASING ELEVATION: 769.95
TOTAL DEPTH: 40.0
GROUND SURFACE ELEVATION: 767
SHEET: 2 OF: 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(ft)	22.94 WD	16.8
Time	12:45	-
Date:	10/25/94	11/3/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
20.0	50/4"	Ss	S5					GRANITE: potassium feldspar; plagioclase, some amphibole	20.0		
21.0									21.0		
22.0									22.0		
23.0									23.0		
24.0									24.0		
25.0	50/0"	Ss	S6					GRANITE: some water; Roller Cone refusal at 25 feet.	25.0		
26.0									26.0		
27.0									27.0		
28.0									28.0		
29.0									29.0		
30.0									30.0		
31.0									31.0		
32.0									32.0		
33.0									33.0		
34.0								GRANITE: harder than above	34.0		
35.0									35.0		
36.0									36.0		
37.0								GRANITE: very hard; good water bearing fracture at 38 feet Boring Terminated at 40 feet.	37.0		
38.0									38.0		
39.0									39.0		
40.0									40.0		

FIELD BOREHOLE LOG

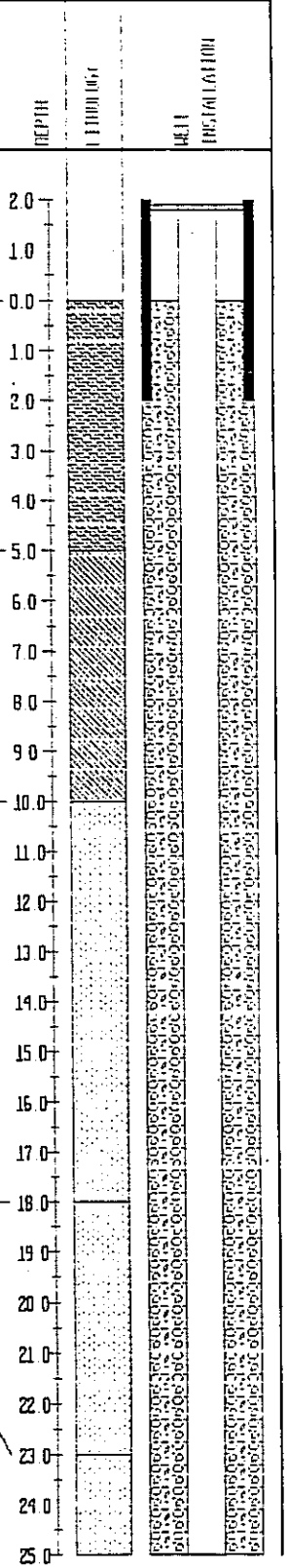
BOREHOLE NUMBER
OW-3

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE WITH AIR/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 762
TOTAL DEPTH 48.0
GROUND SURFACE ELEVATION 759
SHEET 1 OF 2

STATIC WATER LEVEL (SLS)		
WD=While Drilling AF=After Boring		
Depth(ft)	23 DRY WD	15.11
Time		
Date	10/25/94	11/3/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION
0.0–5.0	8 8 6	Ss	S1					CLAY AND SILT: buff to tan; some roots in split spoon.
5.0–10.0	50/6	Ss	S2					SAND AND CLAY: light tan; minor mica, some very weathered rock; some feldspar clay, hard drilling @ 7 feet
10.0–18.0	50/3	Ss	S3					GRANITE very weathered, quartz, feldspar, roller bill refusal at 11.0 feet
18.0–23.0								GRANITE hard, feldspar, potassium feldspar
23.0–25.0								GRANITE possibly granodiorite, rock is granitic but has more mafic constituents than above.



FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-3

PROJECT NUMBER 94015
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE WITH AIR/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 762
TOTAL DEPTH 48.0
GROUND SURFACE ELEVATION 759
SHEET 1 OF 2

STATIC WATER LEVEL (BLS)		
WD=While Drilling AB=After Boring		
Depth(Ft)	23 DRY WD	15 11
Time		
Date	10/25/94	11/3/94

DEPTH	BLOW COUNTS	SAMPLING METHOD	SAMPLE NUMBER	MOISTURE	CONSISTANCY	SAMPLE RECOVERY	DRILL METHOD	LITHOLOGY DESCRIPTION	DEPTH	LITHOLOGY	WELL INSTALLATION
25.0								GRANITE: possibly granodiorite; rock is granitic but has more mafic constituents than above; water bearing zones at 28, 33 and 44 feet below grade; each zone produces more water than the one above it.	25.0		
26.0									26.0		
27.0									27.0		
28.0									28.0		
29.0									29.0		
30.0									30.0		
31.0									31.0		
32.0									32.0		
33.0									33.0		
34.0									34.0		
35.0									35.0		
36.0									36.0		
37.0									37.0		
38.0									38.0		
39.0									39.0		
40.0									40.0		
41.0									41.0		
42.0									42.0		
43.0									43.0		
44.0									44.0		
45.0									45.0		
46.0									46.0		
47.0									47.0		
0								Boring Terminated at 48 feet	48.0		
49.0									49.0		
50.0									50.0		

OWNER: City of Greensboro	BORING NUMBER: B-11 (GSO-11)
PROJECT NAME: Greensboro Landfill	ARCHITECT-ENGINEER: MW-11
SITE LOCATION: Greensboro, NC	JOB. NO.: 88-387-E

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1, 2, 3, 4, 5)

PLASTIC LIMIT % — WATER CONTENTS % — LIQUID LIMIT % (10, 20, 30, 40, 50)

● STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

DEPTH IN FEET	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH FROM-TO	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	STANDARD PENETRATION BLOWS/FT.
	1	ss	2.5 4.0	SILT, w/little sand, brown, black, tan, mottled, firm, (ML). NOTE: Residual Soil/Saprolite with trace quartz rock fragments.	28
5	2	ss	5.0 6.5	CLAYEY SILT, w/trace sand, brown, tan, v/hard, (ML). NOTE: Residual Soil/Saprolite.	
	3	ss	7.5 9.0	SANDY SILT, w/trace clay, green, brown, black, tan, v/hard, (ML). NOTE: Saprolite/Weathered greenstone.	
10	4	ss	10.0 11.5		
15	5	ss	15.0 16.5	NOTE: Layered weathered greenstone/schist (sample described from auger cuttings).	
20				Auger Refusal at 17.5'.	
25					
30					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-STU. THE TRANSITION MAY BE GRADUAL

WATER TABLE DATA — DEPTH BELOW SURFACE: Dry (BAR) ● 0 HRS. 15.81' ● Below TOC HRS. 7-12-89	BORING STARTED 4-11-89	BORING COMPLETED 4-13-89	
	RIG B-50	FOREMAN R. Barron	APP'D BY ABN	AUGER 6" H

ENGINEERING TECTONICS, P. A.

Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N.C. DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANCH, P. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Greensboro Landfill	PERMIT NO.: Well No. 11
ADDRESS: Off White Street in Greensboro, NC	OWNER (print): City Of Greensboro
DRILLING CONTRACTOR: Engineering Tectonics, P.A.	REGISTRATION NO.: 835

Casing Type: SCH 80 PVC dia. 4 in.
Casing Depth: from 0 to 19.5 ft. - dia. 4 in.
Screen Type: Bedrock Open Hole dia. 2 in.
Screen Depth: from - to - ft. - dia. - in.

Grout Depth: from 0 to 19.5 ft. - dia. 6 in.
Bentonite Seal: from - to - ft. - dia. - in.
Sand/Gravel PK: from - to - ft. - dia. - in.
Total Well Depth: from 0 to 100.5 ft. - dia. 2 in.

Static Water Level: 19.81 feet from top of casing

Date Measured 7 / 12 / 89

Yield (gpm): Moderate Method of Testing: Bail

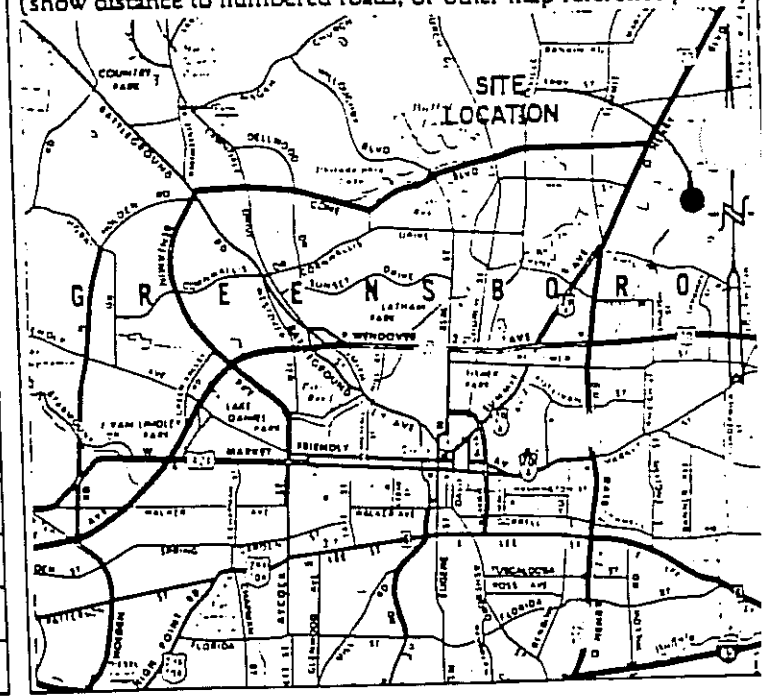
Casing is 1.40 feet above land surface

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
		See Attached Boring Log/Core Log

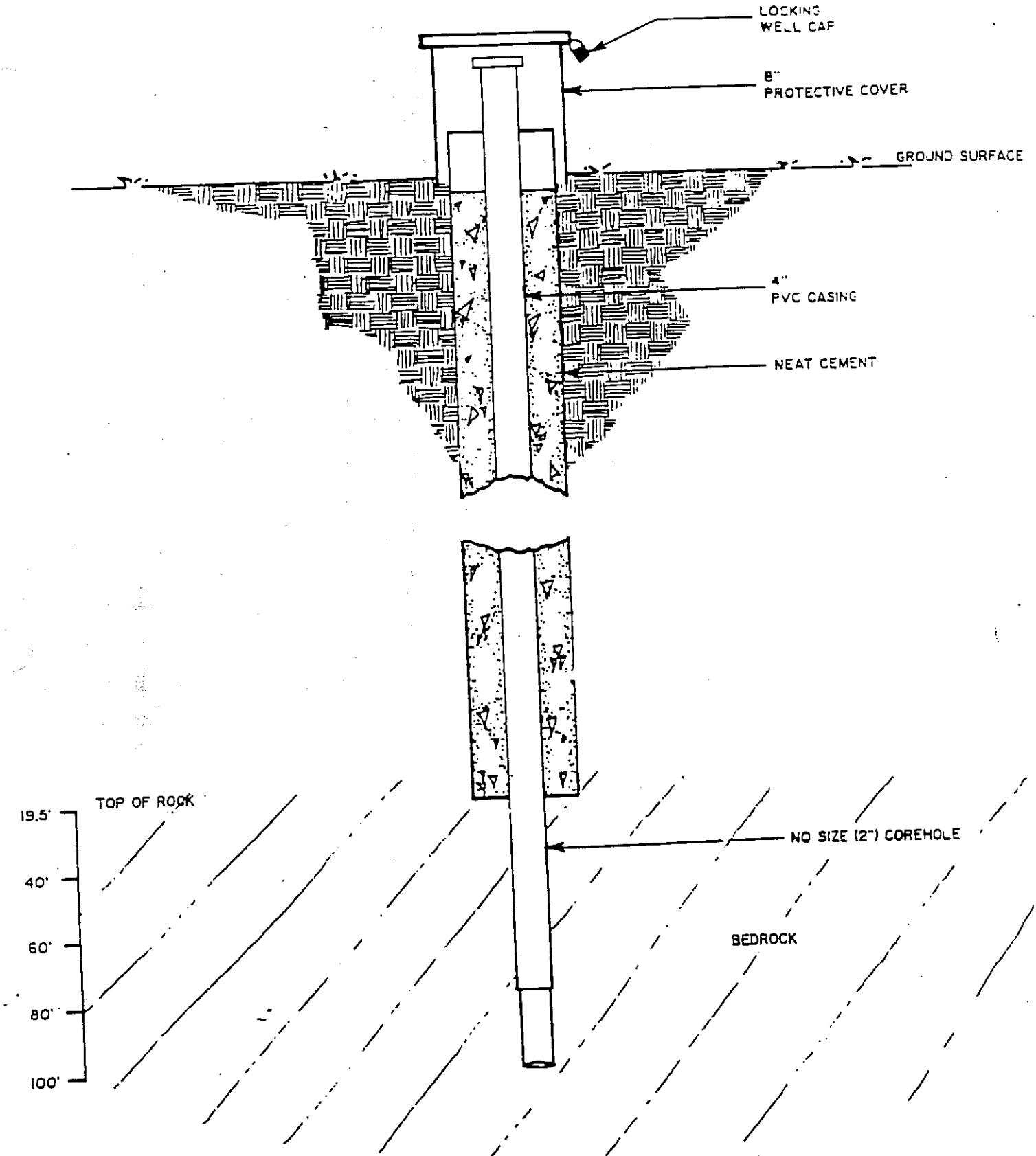
LOCATION SKETCH

(show distance to numbered roads, or other map reference points)



REMARKS:

DATE: 7-14-89 SIGNATURE:



SCHEMATIC OF BEDROCK MONITORING WELL
MW - 11
NOT TO SCALE

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 2 SHEETS

1. PROJECT Greensboro Landfill	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) MW-11	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
	15. ELEVATION GROUND WATER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	16. DATE HOLE: STARTED / COMPLETED
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN	18. TOTAL CORE RECOVERY FOR BORING %
8. DEPTH DRILLED INTO ROCK	19. SIGNATURE OF INSPECTOR
9. TOTAL DEPTH OF HOLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	RQD	DRILL RATE	FRAC. FREQ.	FRAC ANGLE	WATER RETURN
	70		Occasional 2-8 mm pheno cryst between 65 to 67.5 feet.	100%	97%	1.5"/min	6/10ft	30-60°	95%
	75		Mafic and felsic mineral content approx. 50/50.	100%	100%	3"min	4/10ft	20-70°	95%
	80		NOTE: Occasional rehealed hairline fractures at 20 to 80 degrees.						
	85								
	90		NOTE: Increase in fracture frequency.	100%	92%	4"/min	11/10ft	20-70°	95%
	95		NOTE: Abundant rehealed fractures from 95 to 97 ft., major fractures oriented at 60 to 80 degrees.	100%	95%	5"/min	3/5ft	20-80°	95%
	100								
	105		Coring Terminated at 100.5'.						

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT	HOLE NO.

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: MW-13 PAGE: 1 OF 1

BORING LOG

DATE: 1/6/93

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-01 SS-02	4' 8' 12' 16' 20' 24' 28' 32'	53 82+	SS SS			0-1.0' TOPSOIL; 0-0.5' THEN ORANGE SLIGHTLY SANDY SILT 1-2.5' ORANGE CLAYEY, MICACEOUS SANDY SILT; 1.5-2.5' VERY HARD, BROWN AND BLACK SLIGHTLY SANDY, SLIGHTLY CLAYEY SILT, PARTIALLY WEATHERED ROCK 3.5-5.0' BROWN AND BLACK, FINE-GRAINED SLIGHTLY SANDY SILT, VERY HARD PARTIALLY WEATHERED ROCK AUGER REFUSAL AT 5.0' MUD ROTARY DRILLING 5.0-18.5' BG CORE DRILLED FROM 18.5-32.5' OBTAINED 14.0' OF NX CORE (SEE CORE LOG)	SAPROLITE PARTIALLY WEATHERED ROCK BEDROCK
	36' 40'					TD = 32.5'	

BOREHOLE COMPLETION: XXX

WATER DEPTH: 718.5 DATE:

DRILLING METHOD: 6 1/4" HOLLOW-STEM AUGER, TRICONE BIT

LOGGED BY: CHARLES G. LEE, PG

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATI TEST-N NUMBE
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: WHITE STREET LANDFILL (PHASE III) PROJECT NO: 06770-021-018

LOCATION: GREENSBORO, N.C. BORING NUMBER: MW-13 PAGE: 2 OF 2

CORE LOG

DATE: 1/6/93

NUMBER	DEPTH	REC	RQD	DESCRIPTION (ROCK)	FRACTURES (W/ANGLE)
	14'			PARTIALLY WEATHERED ROCK	
FIRST CORE RUN	18' 22' 26'	92%	79% GOOD	GNEISS: FOLIATED, SLIGHTLY BROKEN TO MASSIVE, HARD TO VERY HARD, CONTAINS QUARTZ, FELDSPAR, BIOTITE MICA, FOLIATION NEARLY VERTICAL TO 70° FROM HORIZONTAL, HEALED FRACTURES WITH SERPENTINE, FINE TO MEDIUM-GRAINED, PYRITE-BEARING FRACTURES	FRACTURE ZON 60° 65° 50° 50°
SECOND CORE RUN	30' 34'	44%	88% GOOD	GNEISS: FOLIATED, MASSIVE, HARD TO VERY HARD, MOTTLED BLACK, WHITE AND GRAY, CONTAINS QUARTZ, FELDSPAR, BIOTITE MICA, FOLIATION NEARLY VERTICAL TO 70° FROM HORIZONTAL, FRACTURES AT 35° FROM HORIZONTAL, MINIMAL IRON OXIDE STAINING OF FRACTURES	35° 35° 35° 35°
	38'			TD = 34.0'	

COREHOLE COMPLETION: 34' BELOW LAND SURFACE

WATER DEPTH: 718.5 DATE: 12/27/94

DRILLING METHOD: NX CORE (16 FT.)

LOGGED BY: JOHN R. ISHAM

KEY:
REC-RECOVERY
RQD-ROCK QUALITY DESIGNATI
NA-NOT APPLIC

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-46 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
ST-46		NA	ST			PARTIALLY WEATHERED ROCK AND SAPROLITE (GRANITIC), 24" RECOVERY	GRANITIC INTRUSIVE
SS-46/1	4'	6	SS			WHITE AND GRAY CLAYEY SAND (SC), PARTIALLY WEATHERED ROCK (QUARTZ/ FELDSPAR), DRY	
	8'					T.D. 5.0'	
	12'					Lab USC: Silty Coarse to Fine Sand (SM)	
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: WASH BORING TO 1' BLS, ST AND SS SAMPLING

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRA TEST-N NUMB
ST - SHELBY TUB
T - TYPE
WL - WATER LEVE

HD

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-47 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
BP-47			PB			PARTIALLY WEATHERED GRANITIC ROCK AND SAPROLITE, ABUNDANT FELDSPAR, BRITTLE, DRY, MOTTLED	GRANITIC INTRUSIVE
SS-47/1	4'	50+	SS			WHITE AND GRAY PARTIALLY WEATHERED ROCK AND CLAYEY SAND (SAPROLITE), GRANITIC TEXTURE, DRY, BRITTLE	
	8'					T.D. 5.0'	
	12'					Lab USC: Silty Coarse to Fine Sand (SM)	
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE: 10/6/95

DRILLING METHOD: PB SAMPLER AND SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
PB - PITCHER BA
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRA
TEST-N NUMB
ST - SHELBY TUB
T - TYPE
WL - WATER

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-48 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-48/1		16	SS			LIGHT GREEN CLAYEY SAND (SC), PHANERITIC TEXTURE, SOFT, FINE GRAINED, DRY	MAFIC INTRUSIVE
SS-48/2	4'	33	SS			LIGHT GREEN SAND (SM) WITH MINOR CLAY, SOFT, IRON OXIDE STAINED FRACTURE TRACES, DRY	
	8'					T.D. 5.0'	
	12'						
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: WASH BORING (6"), SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATIO TEST-N NUMBE
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 06770-021-018

LOCATION: WHITE STREET, GREENSBORO, NC BORING NUMBER: B-49 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-49/1		25	SS			LIGHT GREEN SILT (ML), UNIFORM PHANERITIC TEXTURE, SOFT, SLIGHTLY CLAYEY, IRON OXIDE STAINING, NEARLY VERTICAL VEIN FILLINGS	INTERMEDIATE IGNEOUS INTRUSIVE (DIORITE)
SS-49/2	4'	50+	SS				
						T.D. 5.0'	
	8'						
	12'						
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: WASH BORING (6'), SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRAT
TEST-N NUMBE
ST - SHELBY TUBE
T - TYPE
WL - WATER

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-50 PAGE: 1

BORING LOG

DATE: 10/9/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-50/1		20	SS			LIGHT BROWN TO TAN CLAYEY SAND(SC) RELICT GNEISSIC BANDING, MOTTLED, MOIST, NEARLY VERTICAL FOLIATION (QUARTZ, BIOTITE, FELDSPAR)	SHELBY TUBE FROM GROUND SURFACE TO 3' BLS.
SS-50/2	4'	50/4"	SS			WEATHERED GRANITIC ROCK FRAGMENTS, 2" RECOVERED (GNEISSIC FOLIATION)	FELSIC GRANITIC GNEISS
	8'					T.D. 6.0' AUGER REFUSAL	
	12'					Lab USC: Silty Medium to Fine Sand (SM)	
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 6.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS AND ST SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRA
TEST-N NUMB
ST - SHELBY TUB
T - TYPE
WL - WATER LEVE

HD

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, NC BORING NUMBER: B-51 PAGE: 1

BORING LOG

DATE: 10/9/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
						REDDISH-ORANGE TO BROWN CLAY (CL) ROOTED, NO STRUCTURE	FILL MATERIAL
SS-51/1		6	SS				
						BROWN CLAYEY SAND (SC), WEATHERED GNEISS FRAGMENTS, FOLIATION IN ROCK SAMPLES, DRY, BRITTLE	FELSIC GRANITIC GNEISS
SS-51/2	4'	50/5"	SS				
						GREEN SILTY CLAY (CL), VERY BRITTLE, DRY, MINOR HORIZONTAL PARTINGS, MOTTLED	MAFIC INTRUSIVE
SS-51/3		31	SS				
	8'						
SS-51/4		31	SS			GREEN SILTY CLAY (CL), PHANERITIC TEXTURE, VERY DRY, BRITTLE, WEATHERED	
	12'					T.D. 10.0'	
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRAT
TEST-N NUMB
ST - SHELBY TUB
T - TYPE
WL - WATER

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-52 PAGE: 1

BORING LOG

DATE: 10/9/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
						LIGHT BROWN TO TAN SANDY CLAY (CL), MOIST, ROCK FRAGMENTS, NO STRUCTURE	FILL MATERIAL
SS-52/1		6	SS				
						GREEN SILTY CLAY (CL), PHANERITIC TEXTURE, MOTTLED WHITE AND BLACK, SOFT, DRY	
SS-52/2	4'	26	SS				
						LIGHT GREEN TO BROWN SILTY CLAY (CL), VERTICAL IRO-STAINED FRACTURES, PHANERITIC TEXTURE, SOFT, DRY	INTERMEDIATE IGNEOUS INTRUSIVE (DIORITE)
SS-52/3		22	SS				
	8'						
SS-52/4		22	SS			SAME AS ABOVE, SLIGHTLY BRITTLE IN NATURE	
	12'					T.D. 10.0'	
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRA
TEST-N NUMB
ST - SHELBY TUB
T - TYPE
WL - WATER LEVE

HD

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021 -018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-53 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
ST-53			ST			GREENISH-BROWN PARTIALLY WEATHERED ROCK AND SAPROLITE (SILTY SAND), IRON STAINING, NEARLY VERTICAL FRACTURES, CLAY PARTINGS BETWEEN FRACTURES	MAFIC INTRUSIVE
	4'					GREENISH-BROWN PARTIALLY WEATHERED ROCK AND SAPROLITE (SILTY SAND), IRON STAINING, CLAY PARTINGS BETWEEN FRACTURES	
SS-53/1		9	SS				
	8'					SAME AS ABOVE WITH LAYERING OF SILTY CLAY (CL) AND WEATHERED ROCK, MOIST	
SS-53/2		8	SS				
	12'					T.D. 10.0'	
	16'					Lab USC at 0.5-3.0': Sandy Clayed Silt (MH)	
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: WASH BORING (6"), ST AND SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRAT
TEST-N NUMBE
ST - SHELBY TUBE
T - TYPE
WL - WATER

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-54 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-54/1		10	SS			LIGHT TAN TO WHITE CLAY SAND (SC), RELICT PHANERITIC TEXTURE, MOTTLED, SOFT, SLIGHTLY BRITTLE, DRY	GRANITIC INTRUSIVE
SS-54/2	4'	25	SS			SAME AS ABOVE, MORE WEATHERED ROCK FRAGMENTS	
						T.D. 5.0'	

8' 12' 16' 20' 24' 28' 32' 36' 40'

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATI
TEST-N NUMBE
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HD

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-55 PAGE: 1 OF 1

BORING LOG

DATE: 10/9/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-55/1		11	SS			GREENISH-GRAY CLAYEY SAND (SC), RELICT PHANERITIC TEXTURE, ABUNDANT MAFIC MINERALS KAOLINITE ABUNDANT, IRON STAINING, DRY	GNEISS
SS-55/2	4'	17	SS			GREENISH-GRAY CLAYEY SAND (SC), DRY	
SS-55/3	8'	40	SS			GREENISH-GRAY CLAYEY SAND (SC), DRY, WEATHERED ROCK FRAGMENTS	
	12'					TD = 8.5 FT.	
	16'					Lab Use for 0-5': Sandy Silt (ML)	
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 8.5 FT BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW-STEM AUGER, SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER L

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-56 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-56/1		3	SS			REDDISH-ORANGE AND YELLOW SILTY CLAY (CL), SLIGHTLY MICACEOUS, MANGANESE OXIDE STAINING	
SS-56/2	4'	10	SS			TAN TO BROWN CLAYEY SAND (SC), MANGANESE VEINLETS, MOTTLED, 2.5" GRANITIC VEIN AT 4.0', DRY, SOFT	FELSIC
SS-56/3	8'	4	SS			REDDISH-ORANGE SILTY CLAY (CL), VERTICAL MANGANESE VEINS, DRY, SOFT, SLIGHTLY MICACEOUS, MOTTLED	GNEISS
SS-56/4		4	SS				
	12'					T.D. 10.0'	
	16'					Lab USC for 0.5': Sandy Silt (ML)	
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGER, SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPO
SPT - SOIL PENET TEST-#
ST - SHELBY T
T - TYPE
WL - WATER L

HD

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-57 PAGE: 1

BORING LOG

DATE: 10/

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-57/1		9	SS			GREENISH-GRAY CLAYEY SAND (SC), RELICT PHANERITIC TEXTURE, ABUNDANT MAFIC MINERALS, KAOLINITE ABUNDANT, IRON STAINING, DRY	
SS-57/2	4'	48	SS			GREENISH-GRAY CLAYEY SAND (SC), DRY	MAFIC INTRUSIVE GREENSTONE DIKE
SS-57/3		11	SS			GREENISH-GRAY CLAYEY SAND (SC), DRY	
	8'					SAME AS ABOVE, WEATHERED ROCK FRAGMENTS	
SS-57/4		50/3"	SS				
	12'					T.D. 10.0'	
	20'					Lab USC for 0-5': Sandy Silt (ML)	
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGER, SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSP
SPT - SOIL PEN
TEST-N
ST - SHELBY
T - TYPE
WL - WATER

PROJECT: GREENSBORO SOLID WASTE LANDFILL PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. BORING NUMBER: B-58 PAGE: 1

BORING LOG

DATE: 10/6/95

NUMBER	DEPTH	SPT	T	WL	SI	DESCRIPTION (USCS)	COMMENTS
SS-58/1		6	SS			REDDISH-BROWN SANDY CLAY (CL), SOFT, MOIST, SLIGHTLY PLASTIC	BAG SAMPLE FROM UPPER 5'
SS-58/2	4'	10	SS			TAN TO LIGHT BROWN SILTY SAND (SM); UNIFORM PHANERITIC TEXTURE, DRY	GRANITIC INTRUSIVE
SS-58/3		50+	SS			PARTIALLY WEATHERED GRANITIC ROCK, BRITTLE, DRY, MOTTLED APPEARANCE	AUGER REFUSAL
	8'					T.D. 7.5'	
	12'					Lab USC for 0-5': Sandy Silt (ML)	
	16'						
	20'						
	24'						
	28'						
	32'						
	36'						
	40'						

BOREHOLE COMPLETION: 7.5' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATIO TEST-N NUMBE
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

APPENDIX B

GEOTECHNICAL ANALYSES

Soil Boring Depth and SPT Resistance Data
Site Hydrogeologic Investigation
White Street Sanitary Landfill Expansion
Greensboro, North Carolina

Boring Number	Auger Refusal Depth (feet)	Standard Penetration Test Values						
		5.0 - 6.5	10.0 -11.5	15.0 -16.5	20.0 - 21.5	25.0 - 26.5	30.0 -31.5	35.5 - 36.5
B - 1	13.0	2-3-5	15-25-36	50/4"				
B - 1d	13.0	2-3-5	15-25-36	50/4"				
B - 2	18.5	6-15-22	6-12-10	6-12-25				
B - 3	15.3	4-9-8	50/3"	50/4"				
B - 4	11.0	15-20-25	50/6"					
B - 5	16.0	9-32-18	12-11-12	50/3"				
B - 6	17.0	12-11-13	10-12-19	11-20-50/5"				
B - 7	24.5	11-10-12	16-26-50/5"	27-50/6"	22-22-24	50/0.5"		
B - 8	11.0	19-50/5"	50/5"					
B - 8a	12.0	n/a						
B - 9	36.5	18-24-50/3"	18-50/5"	34-50/5"	50/6"	50/4"	34-50/6"	50/2"
B-9d	52.0*	18-39-40	29-50/3"	50/1"	50/1"	50/1"	36-50/6"	50/0"
B - 10	32.5	n/a	3-4-6	2-3-4	3-4-4	3-4-6	10-18-50/2"	
B - 11	16.5	3-6-8	7-12-42	30-50/2"				
B - 12	11.0	6-12-16	7-50/6"					
B - 13	23.0	5-7-13	6-6-10	5-6-7	15-25-50/5"			

*Roller cone refusal.

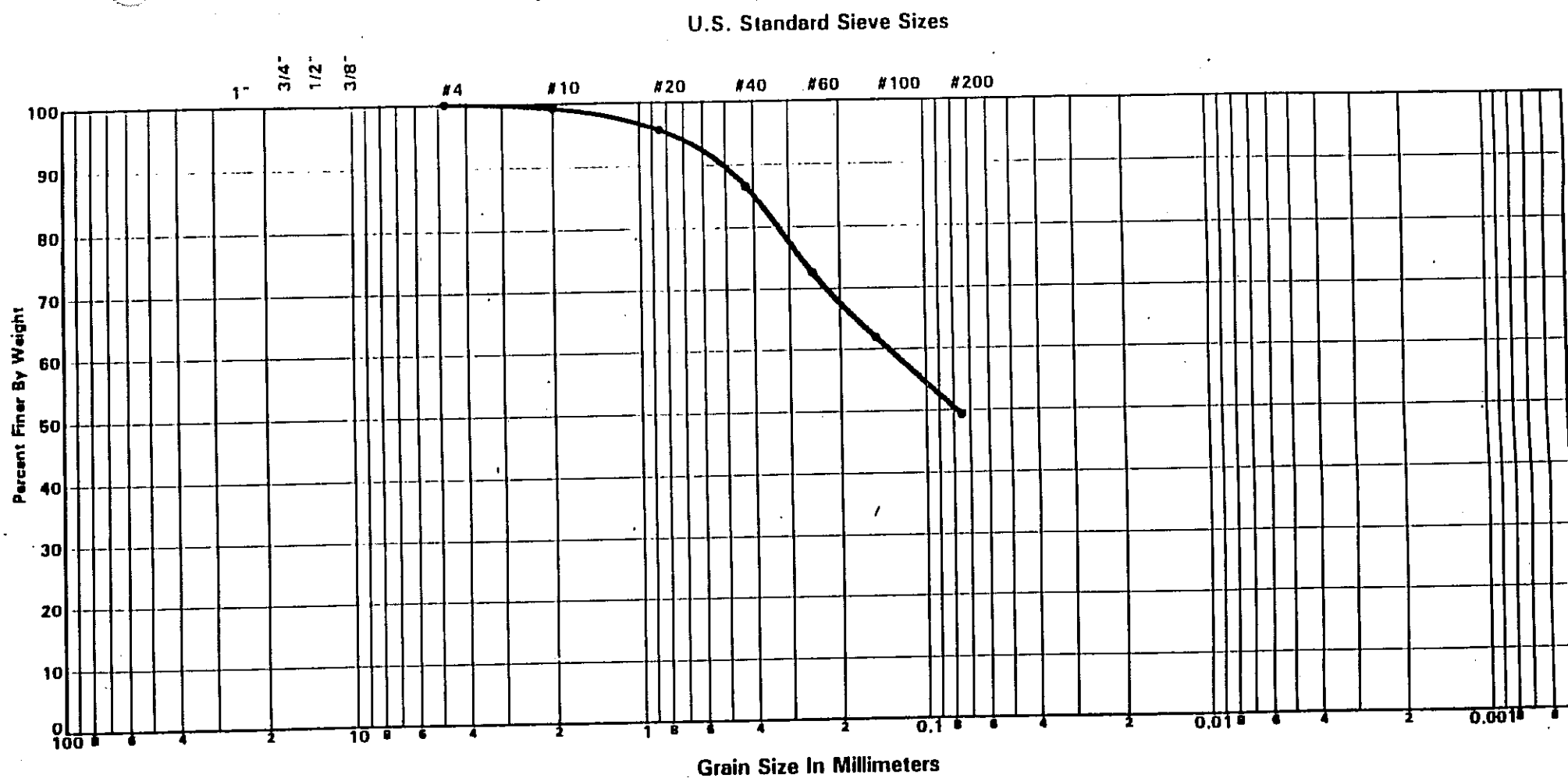
Soil Boring Depth and SPT Resistance Data
Site Hydrogeologic Investigation
White Street Sanitary Landfill Expansion
Greensboro, North Carolina

Boring Number	Auger Refusal Depth (feet)	Standard Penetration Test Values						
		5.0 - 6.5	10.0 -11.5	15.0 -16.5	20.0 - 21.5	25.0 - 26.5	30.0 -31.5	35.5 - 36.5
B - 14	16.5	6-7-8	9-18-23	7-12-46				
B - 15	19.5	7-11-13	11-40-50/5"	50/4"				
B - 15a	3.0	n/a						
B - 15b	7.0	3-4-5						
B - 16	36.0	3-5-9	3-5-8	3-8-11	7-6-7	9-12-17	12-16-23	32-50/3"
B - 17	14.0	3-4-5	3-6-12					
B - 17d	12.5	n/a						
B - 18	13.0	3-4-6	4-6-11					
B - 19	11.0	12-24-30	10-50/5"					
B - 20	16.0	12-24-32	20-33-50/5"					
B - 21	11.0	12-50/4"	40-50/6"					
B - 22	31.0	17-50/6"	15-24-30	24-50/6"	24-32-38	24-28-50/5"	4-36-50/5"	
B - 22d	28.5	n/a						
B - 23	31.0	10-19-30	15-50/6"	9-50/6"	35-50/5"	50/2"	50/2"	
B - 24	12.0	33-50/6"	33-38-50/5"					
B - 25	38.5	50/6"	41-50/5"	18-36-32	50/6"	50/6"	34-50/5"	50/3"

Soil Boring Depth and SPT Resistance Data
Site Hydrogeologic Investigation
White Street Sanitary Landfill Expansion
Greensboro, North Carolina

Boring Number	Auger Refusal Depth (feet)	Standard Penetration Test Values						
		5.0 - 6.5	10.0 -11.5	15.0 -16.5	20.0 - 21.5	25.0 - 26.5	30.0 -31.5	35.5 - 36.5
B - 25d	29.0	n/a						
B - 26	6.5	11-39-50/4"						
B - 27	13.0	50/6"	50/5"					
B - 28	0.5	n/a						
B - 29	2.0	n/a						
B - 29a	8.0	34-50/5"						
B - 30	32.0	6-10-15	8-12-17	11-17-25	12-28-50/2"	35-50/4"	50/6"	
B - 31	25.0	50/4"	50/2"	50/1"	50/1"			
B - 32	21.5	24-50/6"	50/1"	50/1"	50/1"			
B - 33	15.0	18-30-50/3"	12-16-30	50/3"				
B - 34	7.0	50/6"						
B - 34d	7.0*	n/a						
B - 35	7.0	30-50/1"						
B-36	n/a	17-24-31	11-18-50/6"	18-19-22	50/3"			
OW-1	32.0	10-9-16	6-9-11	3-3-6	6-12-30	50/4"	50/4"	25-36-45
OW-2	25.0*	11-21-28	26-27-38	31-36-50/6"	50/4"	50/0"		
OW-3	11.0*	50/6"	50/3"					

*Roller cone refusal.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-1 S-2	5.0'-6.5'	10.9	25.1	20.8	4.3	Green MAFIC ROCK SILTY CLAYEY SAND (SC-SM)

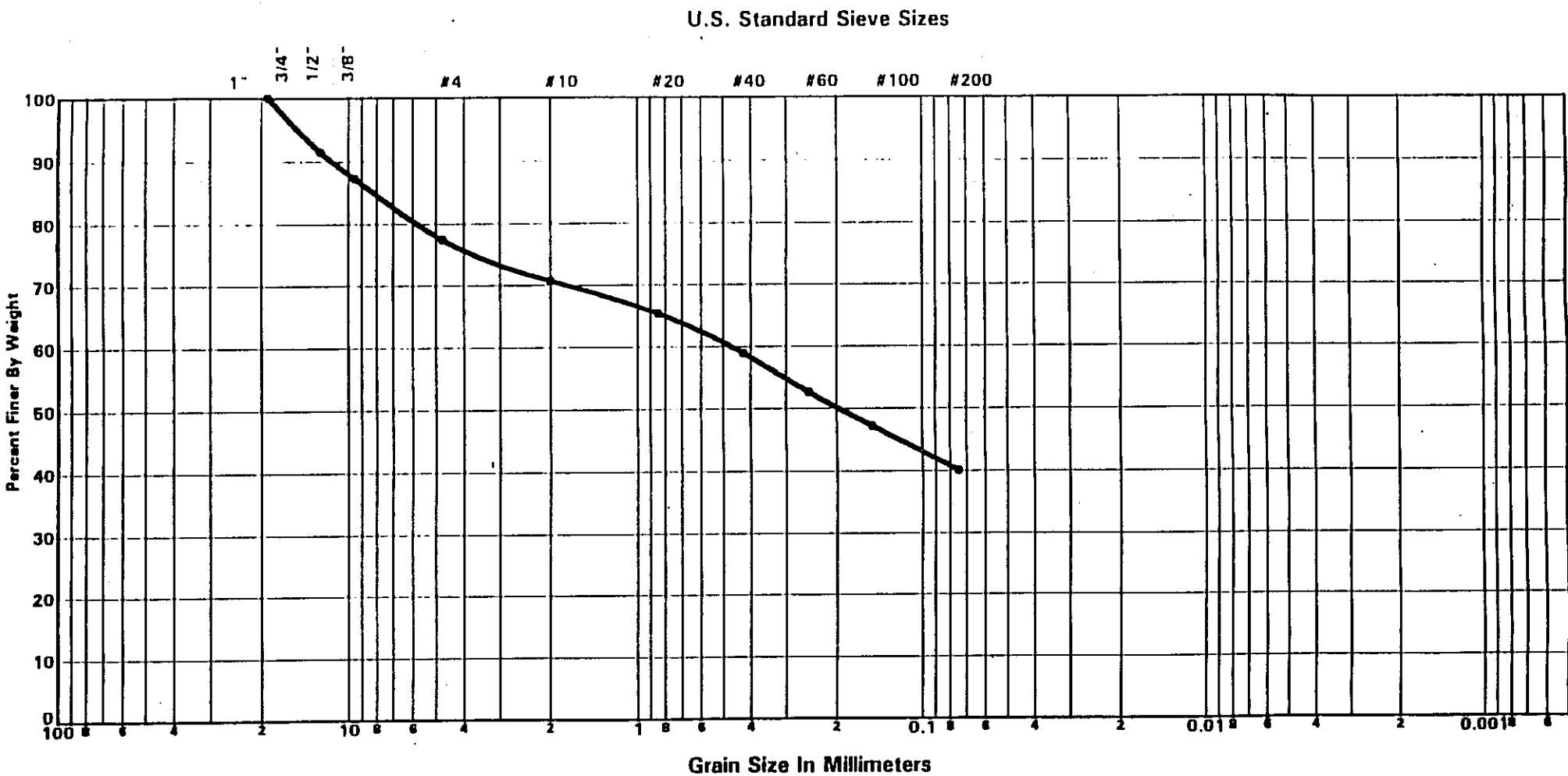
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-1 S-3	10.0'-11.5'	13.8	29.1	19.6	9.5	MAFIC ROCK Brown Green SILTY SAND (SM)

Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

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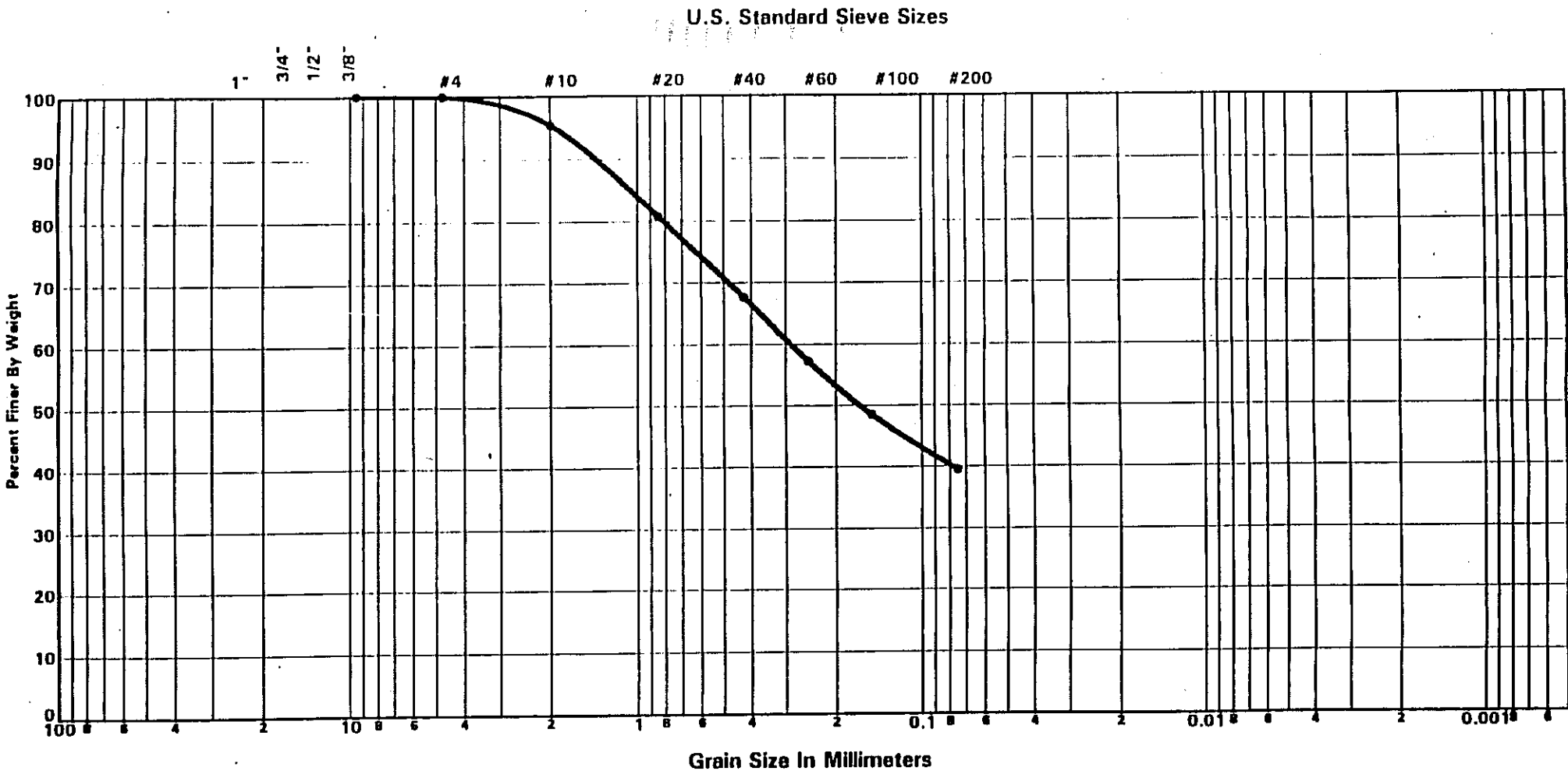


GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-6 S-1	5.0'-6.5'	18.9	28.5	22.6	5.9	GRANITE Yellow Tan F-M SILTY SAND (SM)

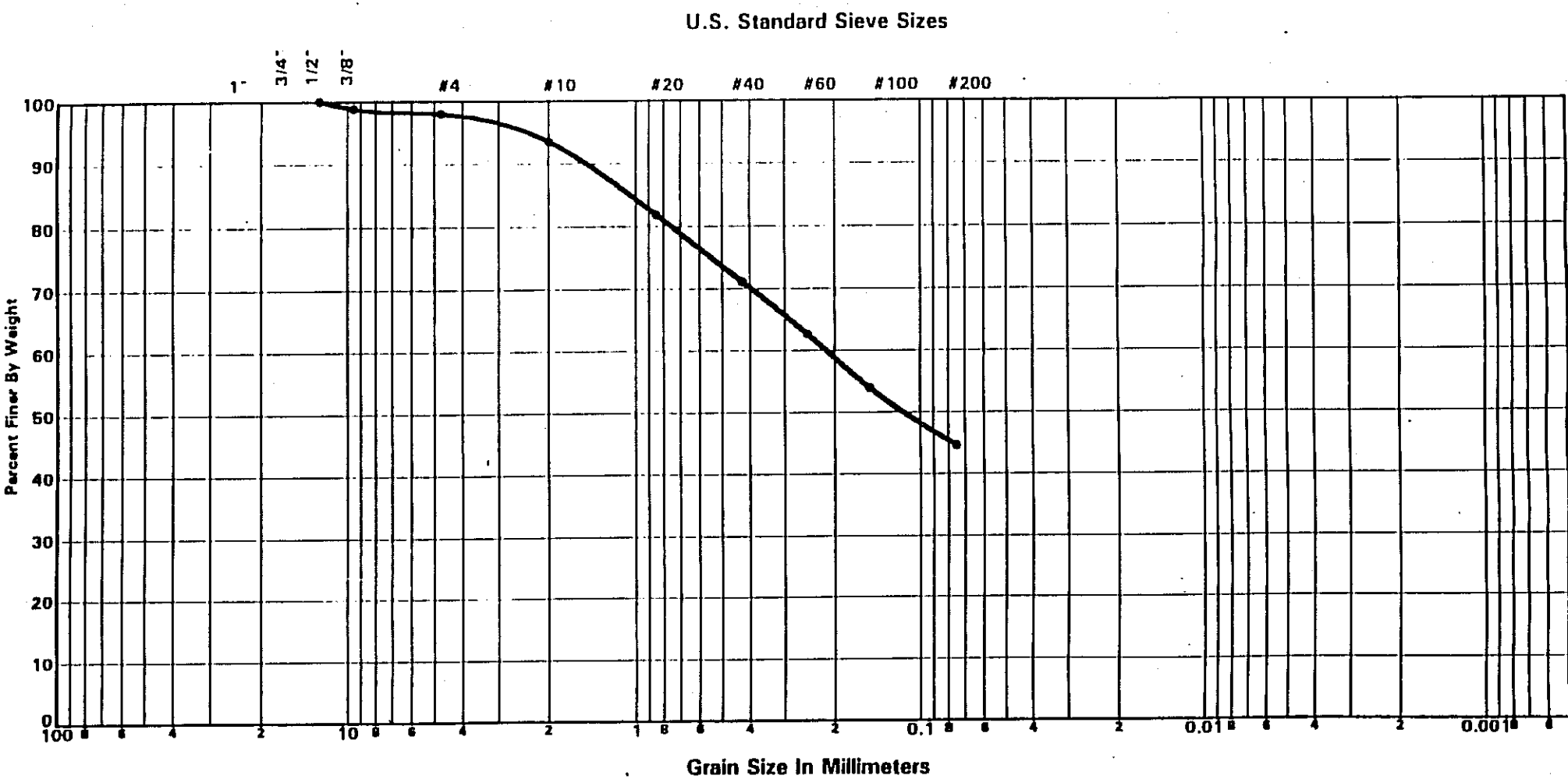
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-6 S-2	10.0'-11.5'	16.5	26.1	21.0	5.1	GRANITE Yellow Tan SILTY CLAYEY SAND (SC-SM)

Project:
Gre boro Landfill
Gre boro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

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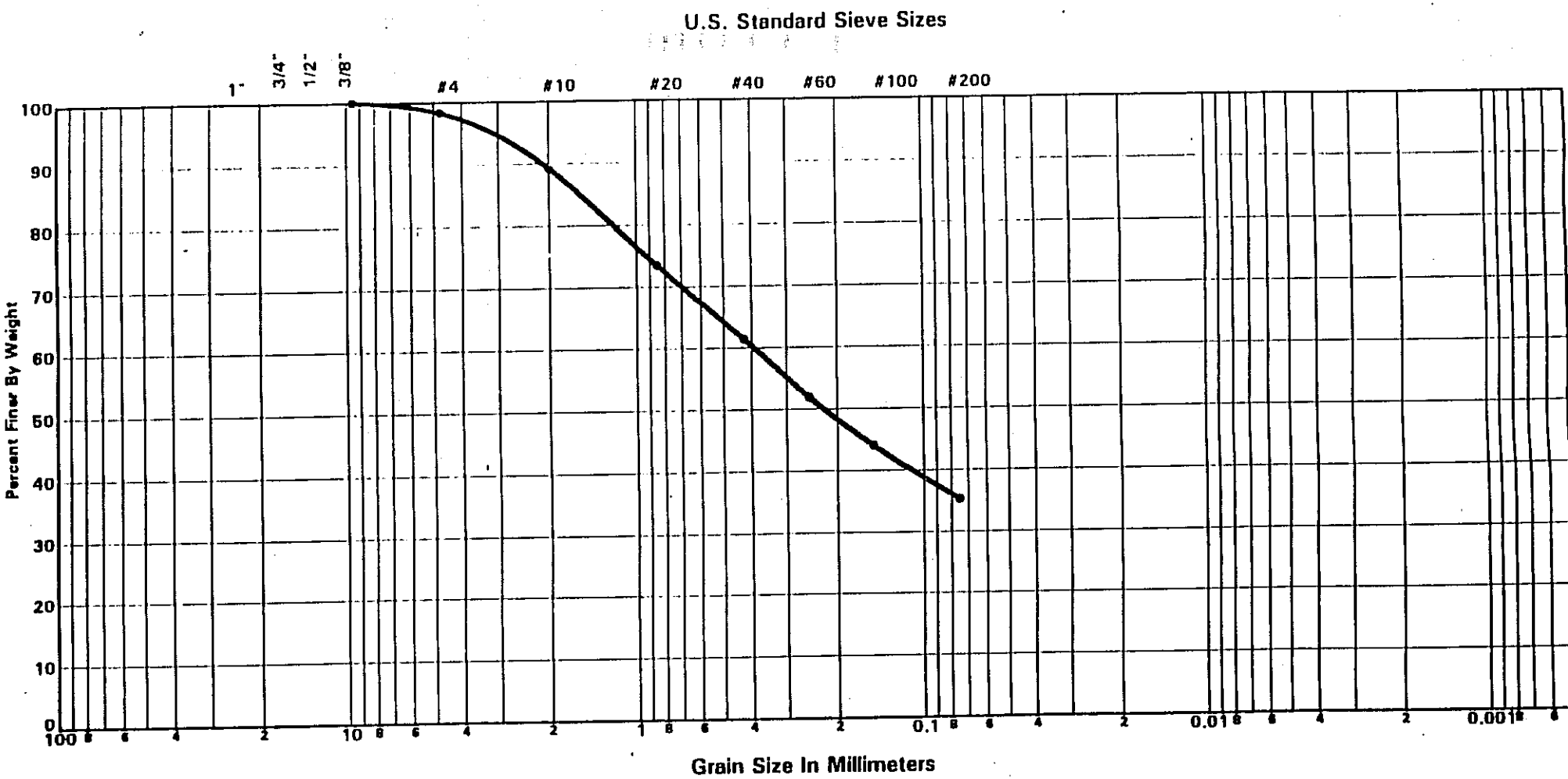


GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

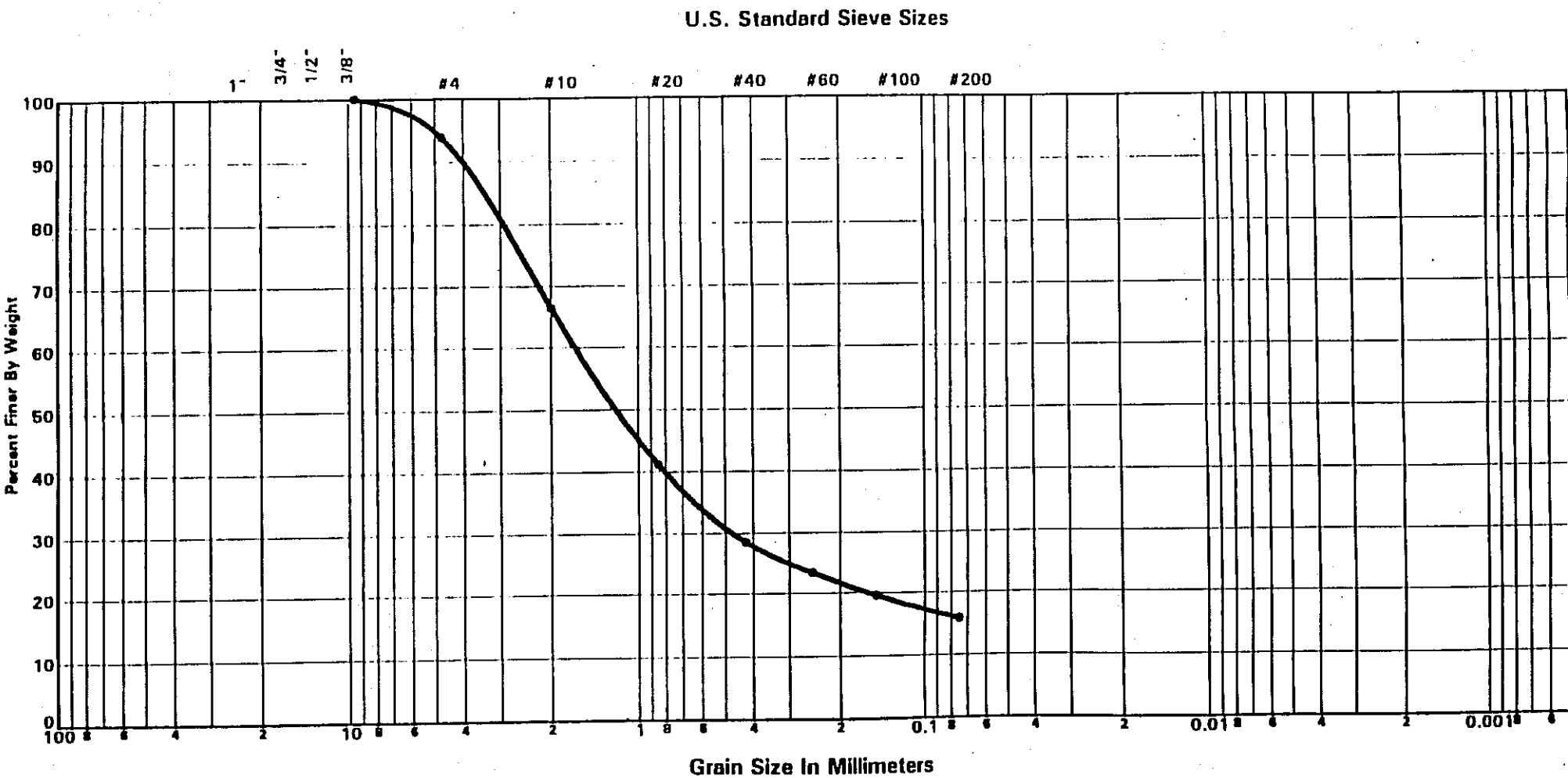
Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-6 S-3	15.0'-16.5'	10.9	NP	NP	NP	Tan Brown GRANITE SILTY CLAYEY SAND (SC-SM)

Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-7 S-1	5.0'-6.5'	7.0	NP	NP	NP	GRANITE Tan Brown Fine-Coarse SAND SILTY SAND (SM)

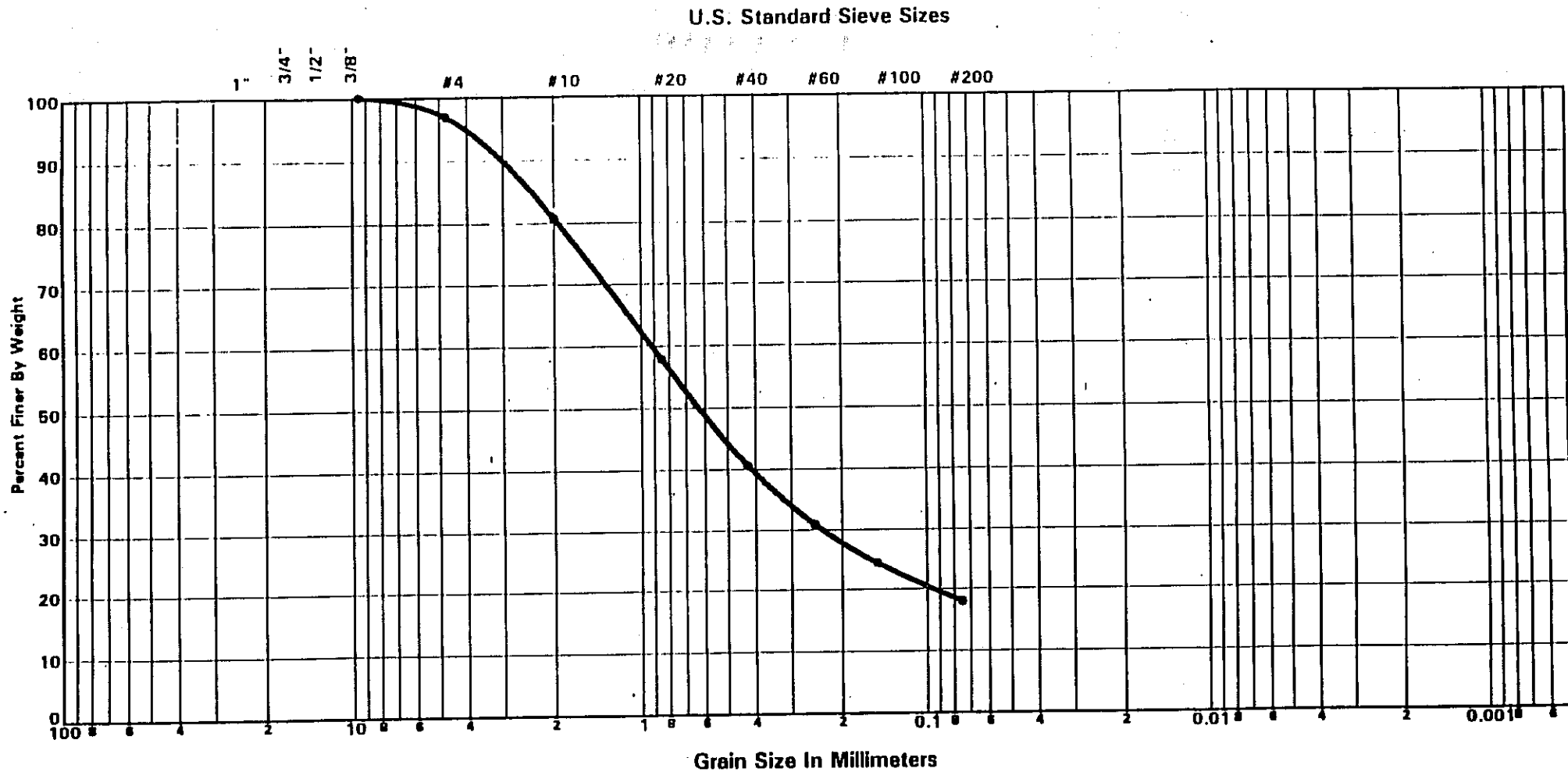
Project:
Gr sboro Landfill
Gr sboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-7 S-2	10.0'-11.5'	6.5	NP	NP	NP	GRANITE Tan Brown Medium-Coarse SAND SILTY SAND (SM)

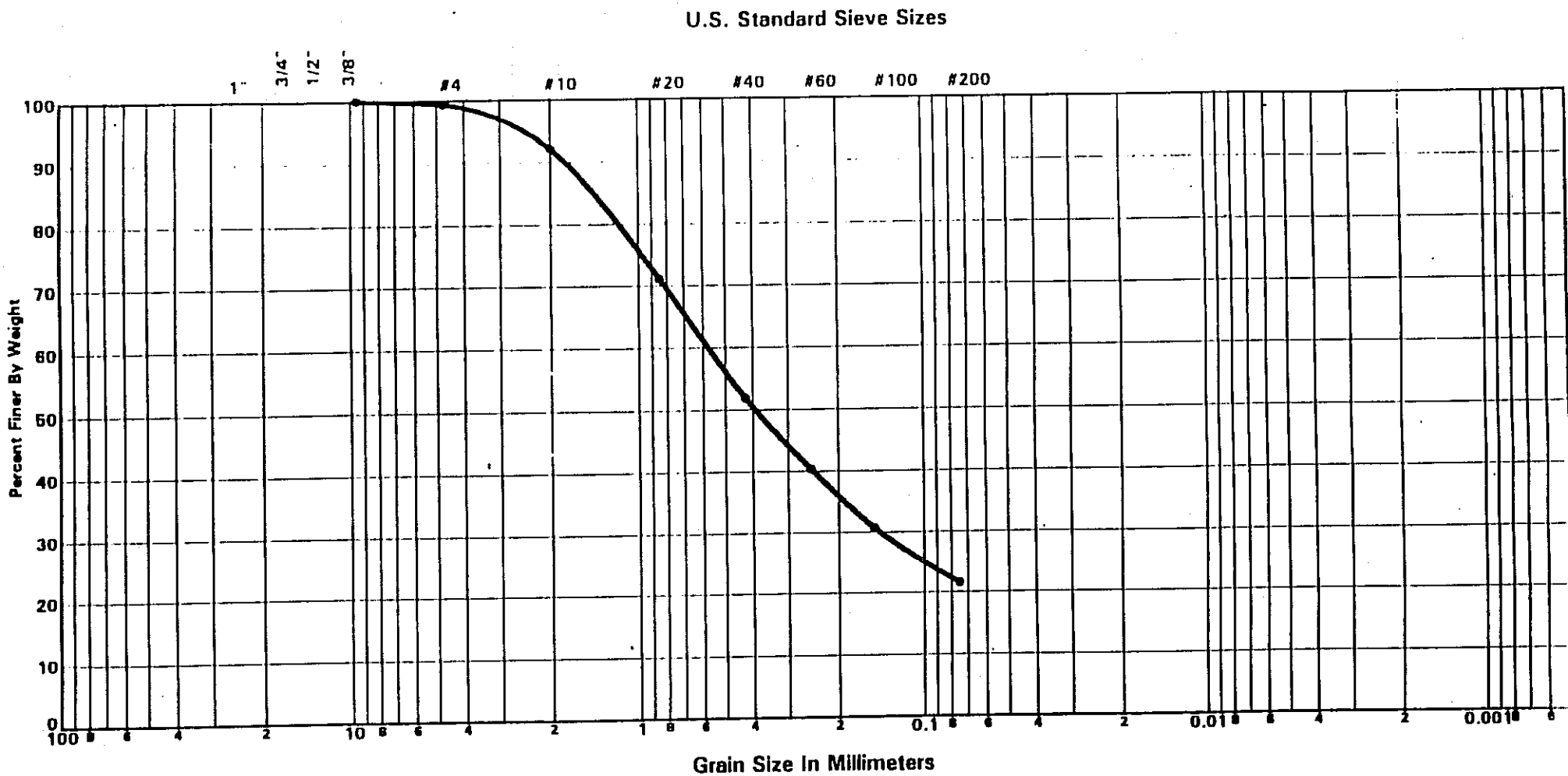
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-7 S-3	15.0'-16.5'	6.1	NP	NP	NP	Tan Brown Fine-Medium SAND GRANITE SILTY SAND (SM)

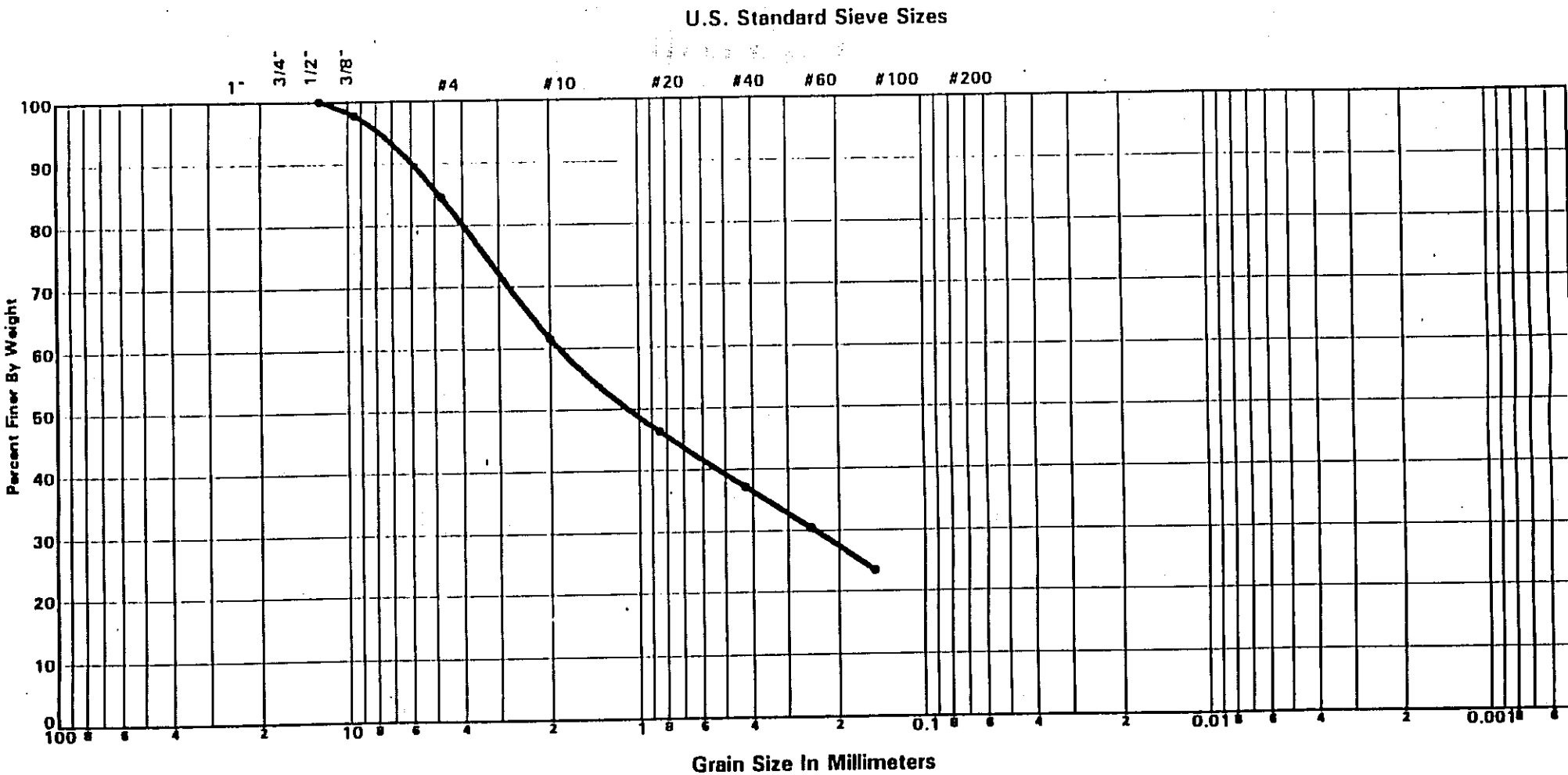
Project:
Gr[illegible]sboro Landfill
Gr[illegible]sboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9[illegible]

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

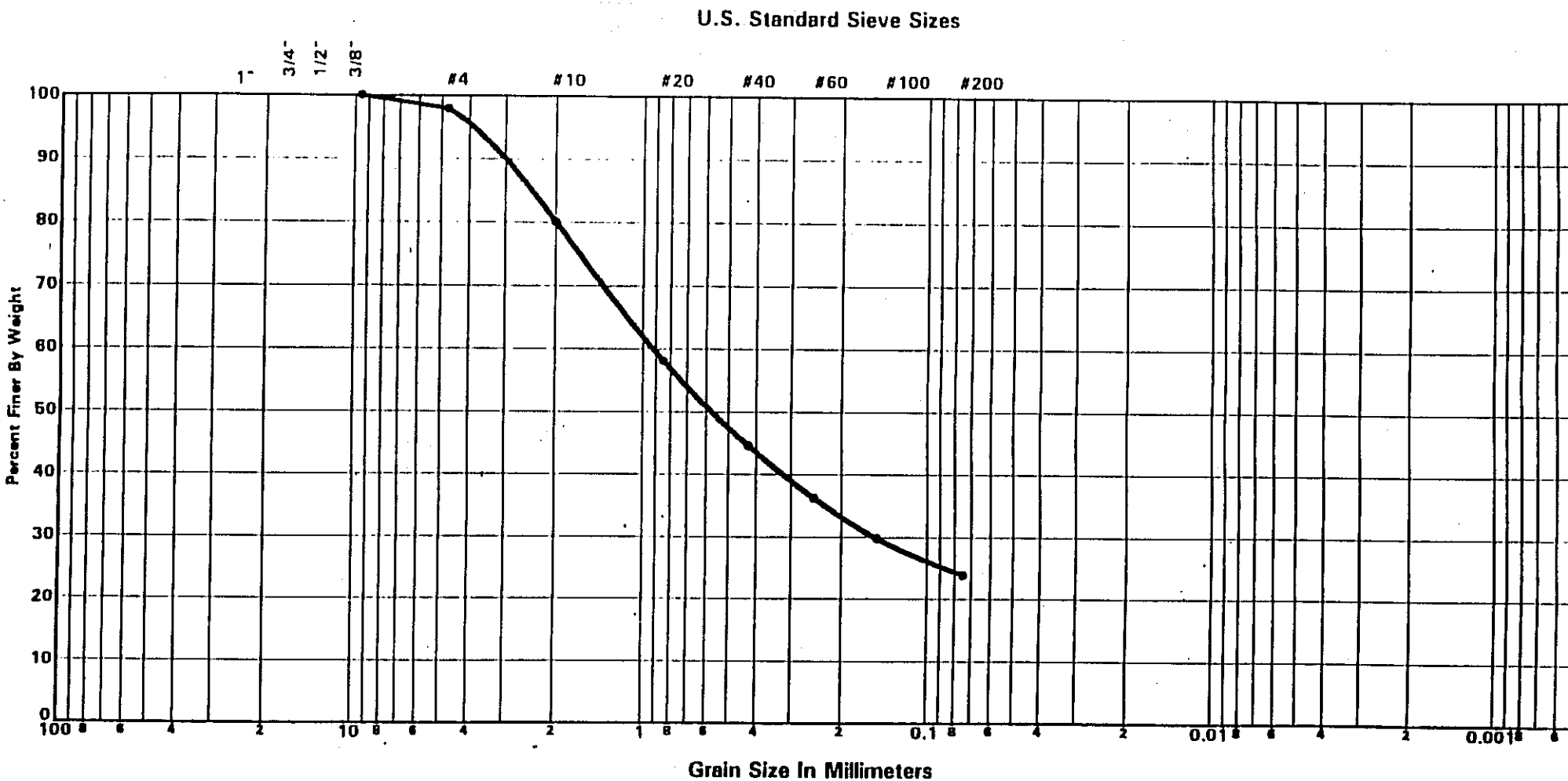
Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-7 S-4	20.0'-21.5'	8.1	NP	NP	NP	GRANITE Tan Brown Fine-Medium SAND SILTY SAND (SM)

Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-9 S-3	15.0'-16.5'	7.0	NP	NP	NP	Tan Brown Fine-Medium SAND GRANITE SILTY SAND (SM)

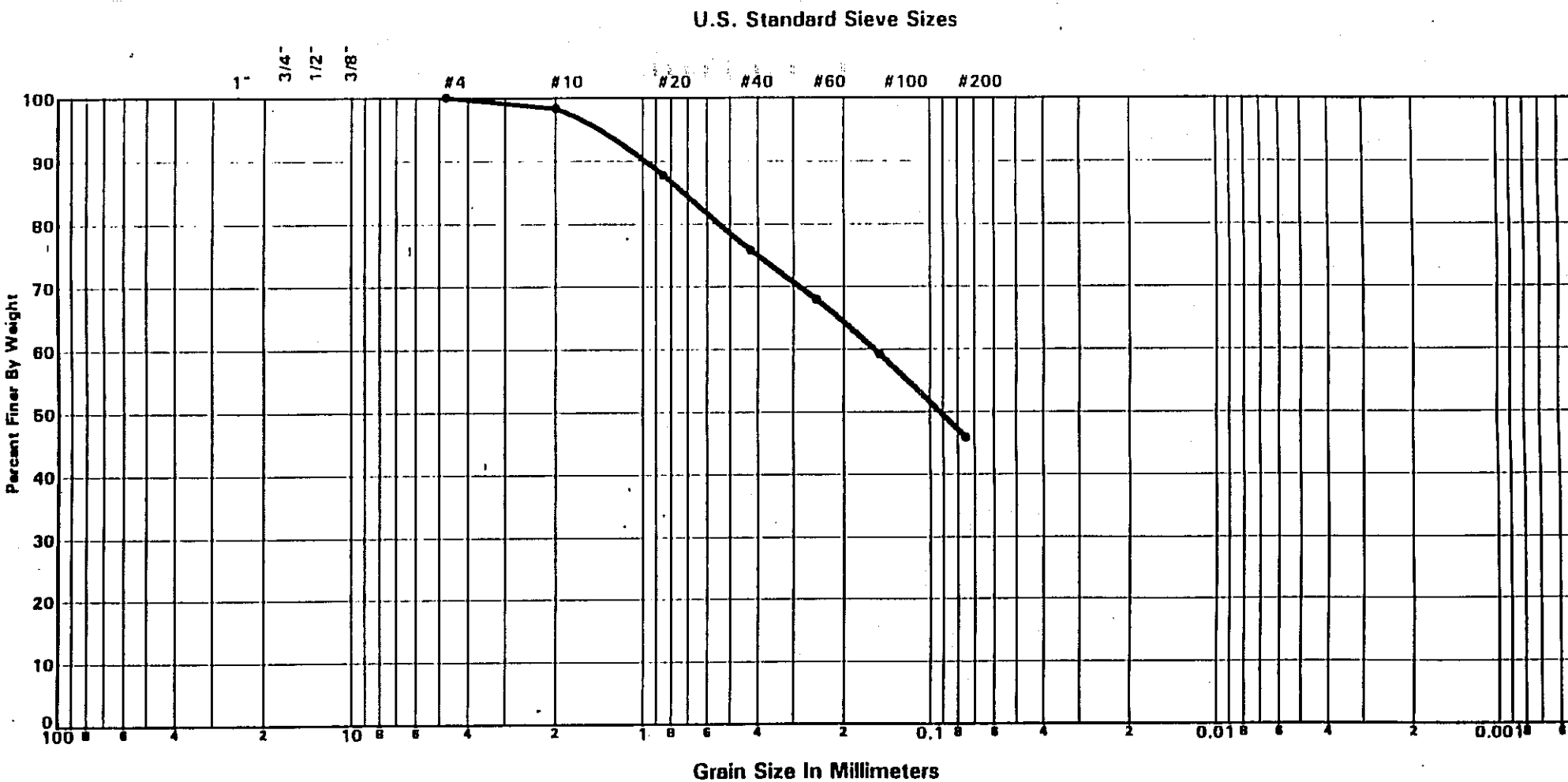
Project:
Greensboro Landfill
Gre[illegible]boro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-10 S-2	10.0'-11.5'	37.6	39.2	37.7	1.5	Light Tan SILTY SAND GNEISS

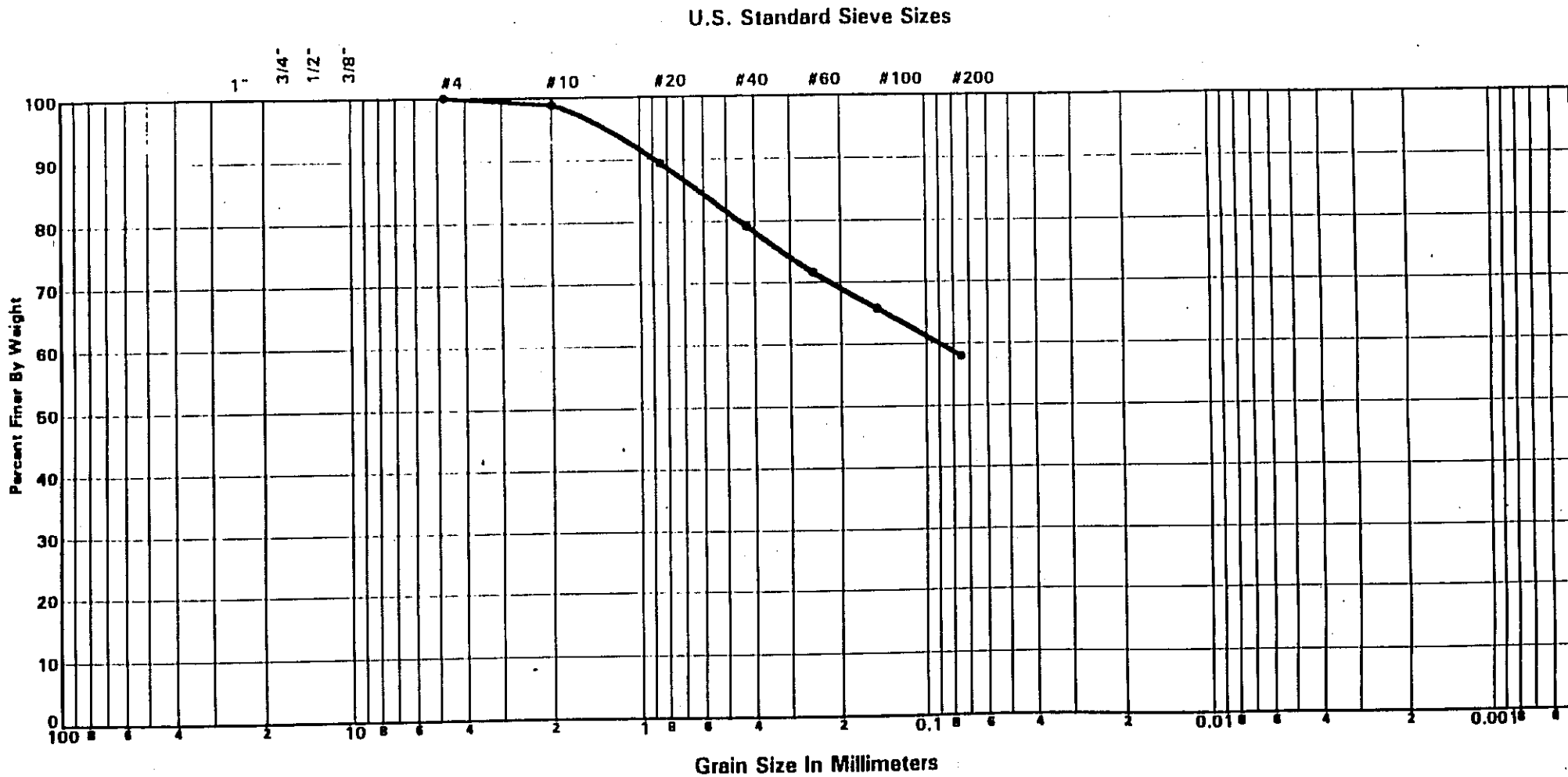
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-10 S-4	20.0'-21.5'	27.5	53.0	34.7	18.3	Orange GNEISS SANDY ELASTIC SILT (MH)

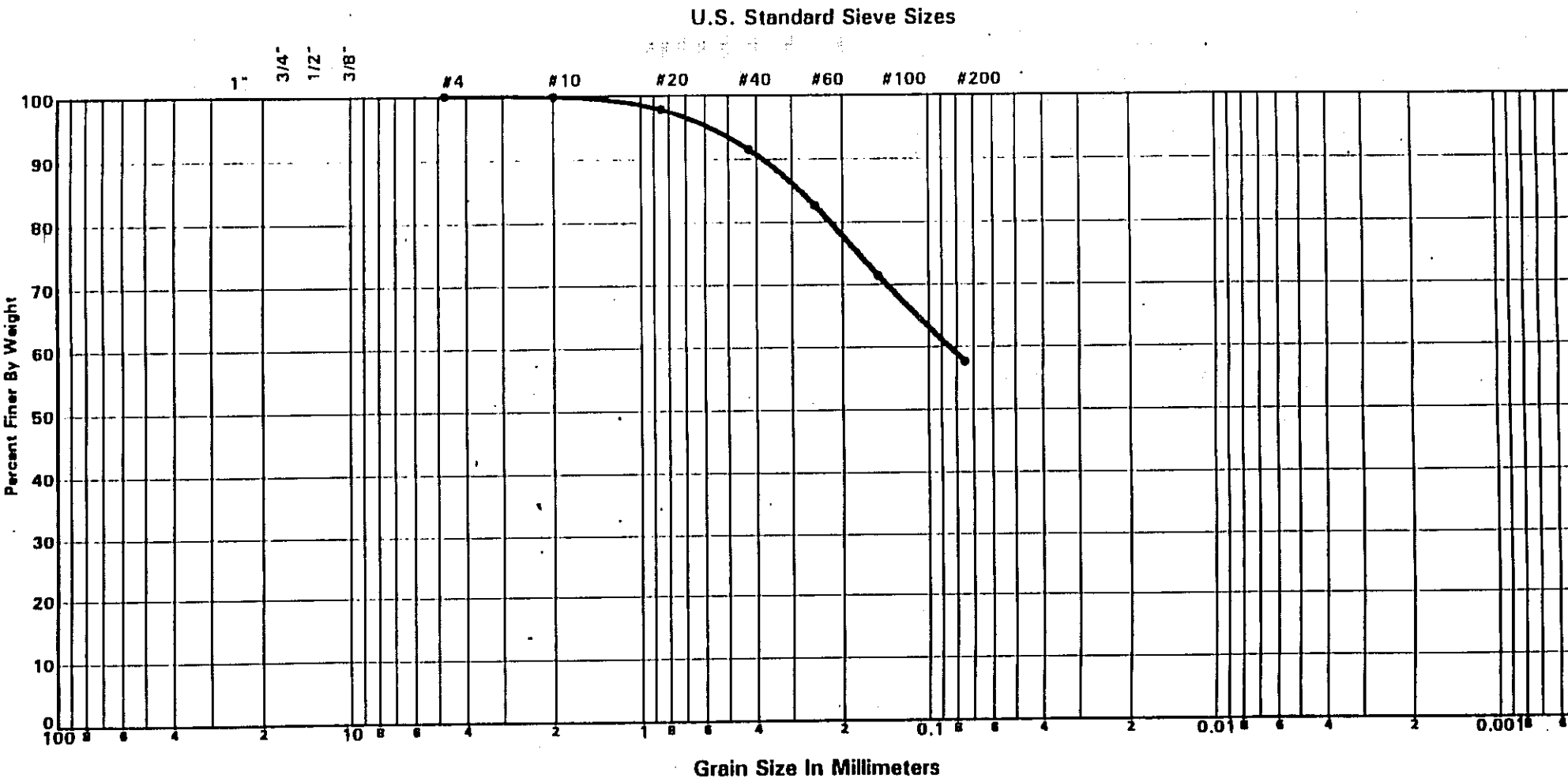
Project:
Gr sboro Landfill
Gr. sboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-14 S-1	5.0'-6.5'	24.9	42.2	26.3	15.9	GNEISS Tan SANDY SILT (ML)

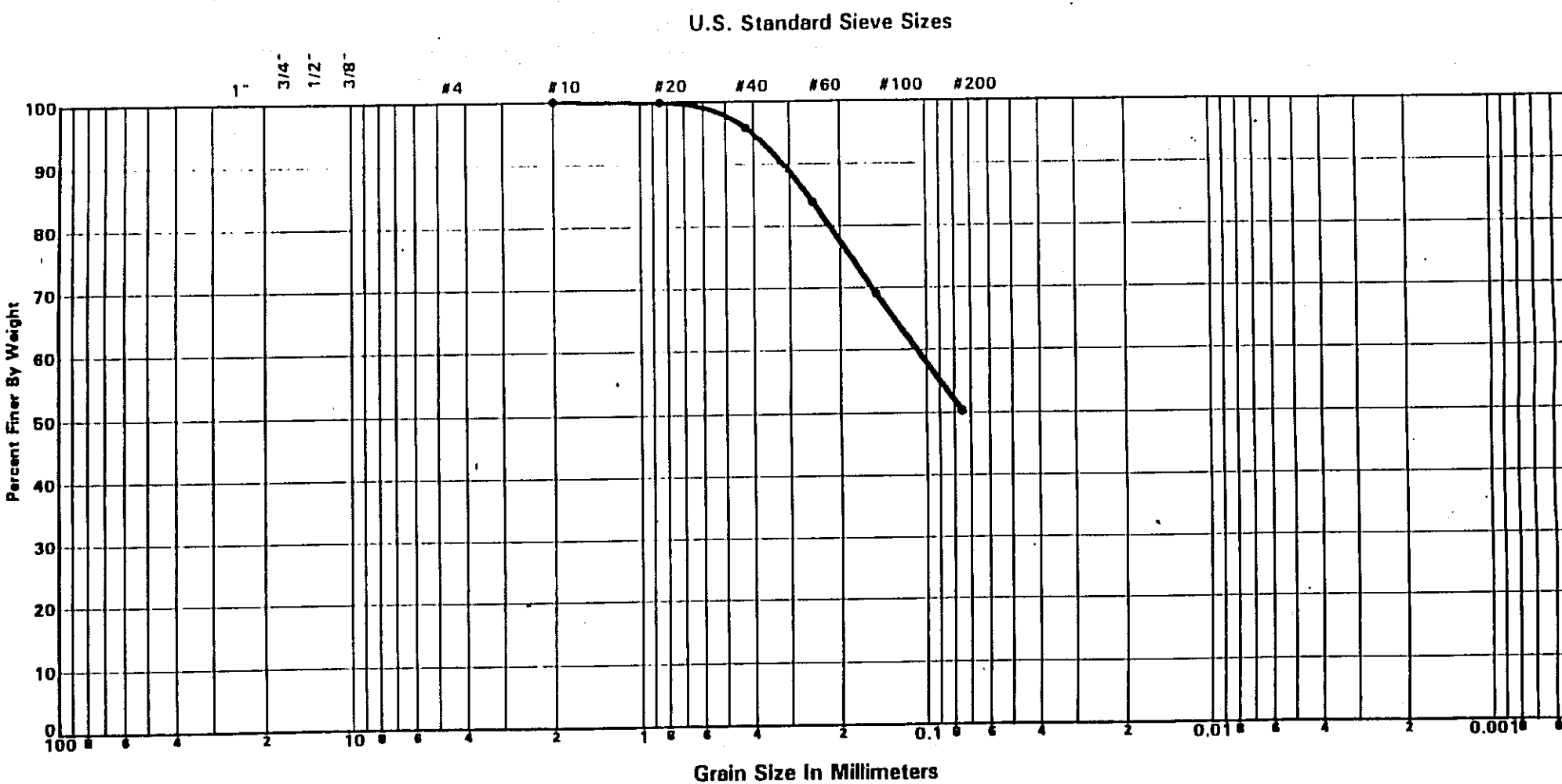
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-14 S-2	10.0'- 11.5'	22.0	38.8	25.8	13.0	Green Brown GNEISS SANDY SILT (ML)

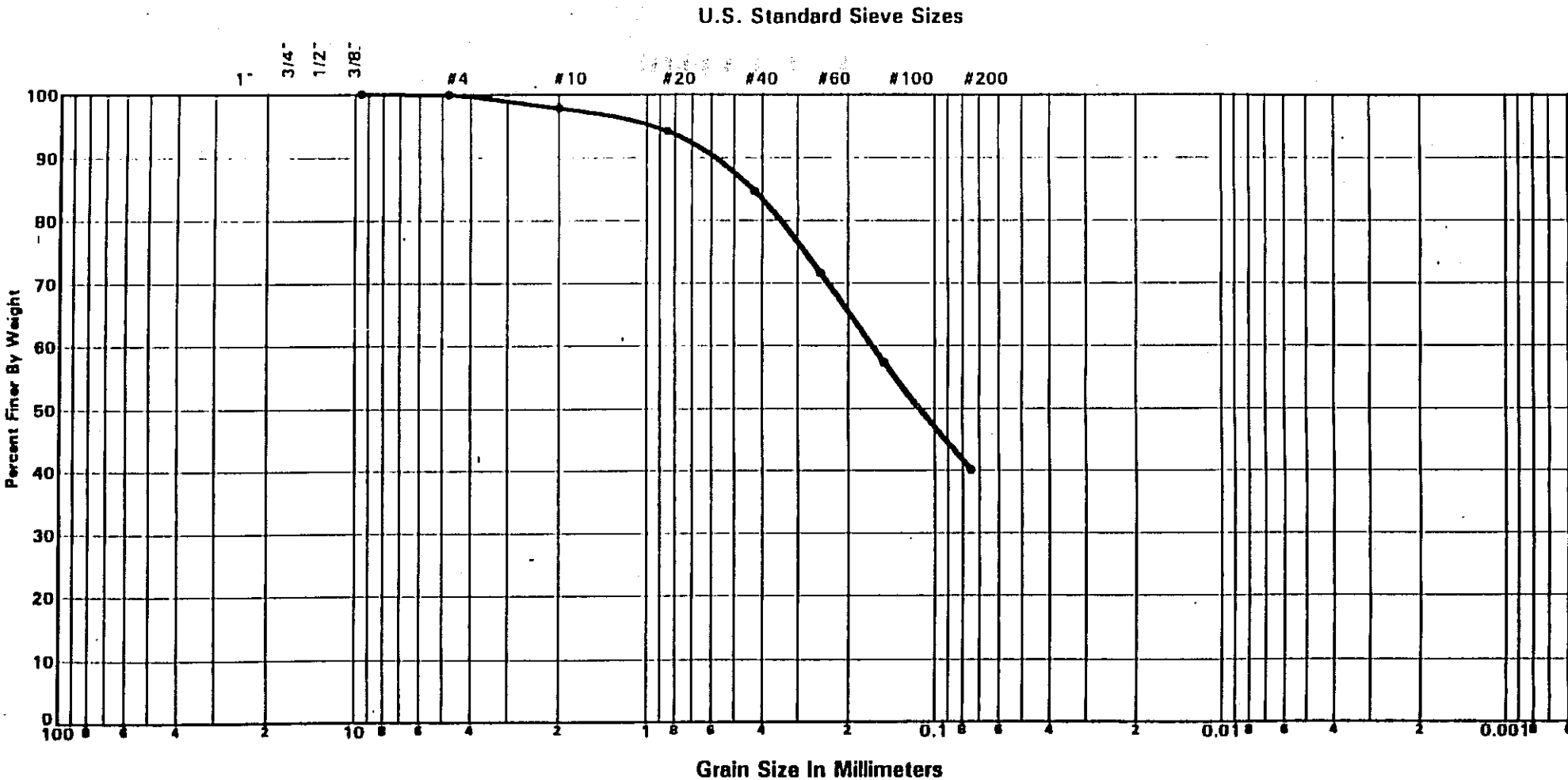
Project:
Greensboro Landfill
G sboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-14 S-3	15.0'-16.5'	22.8	33.5	27.6	6.9	Green Brown GNEISS SILTY SAND (SM)

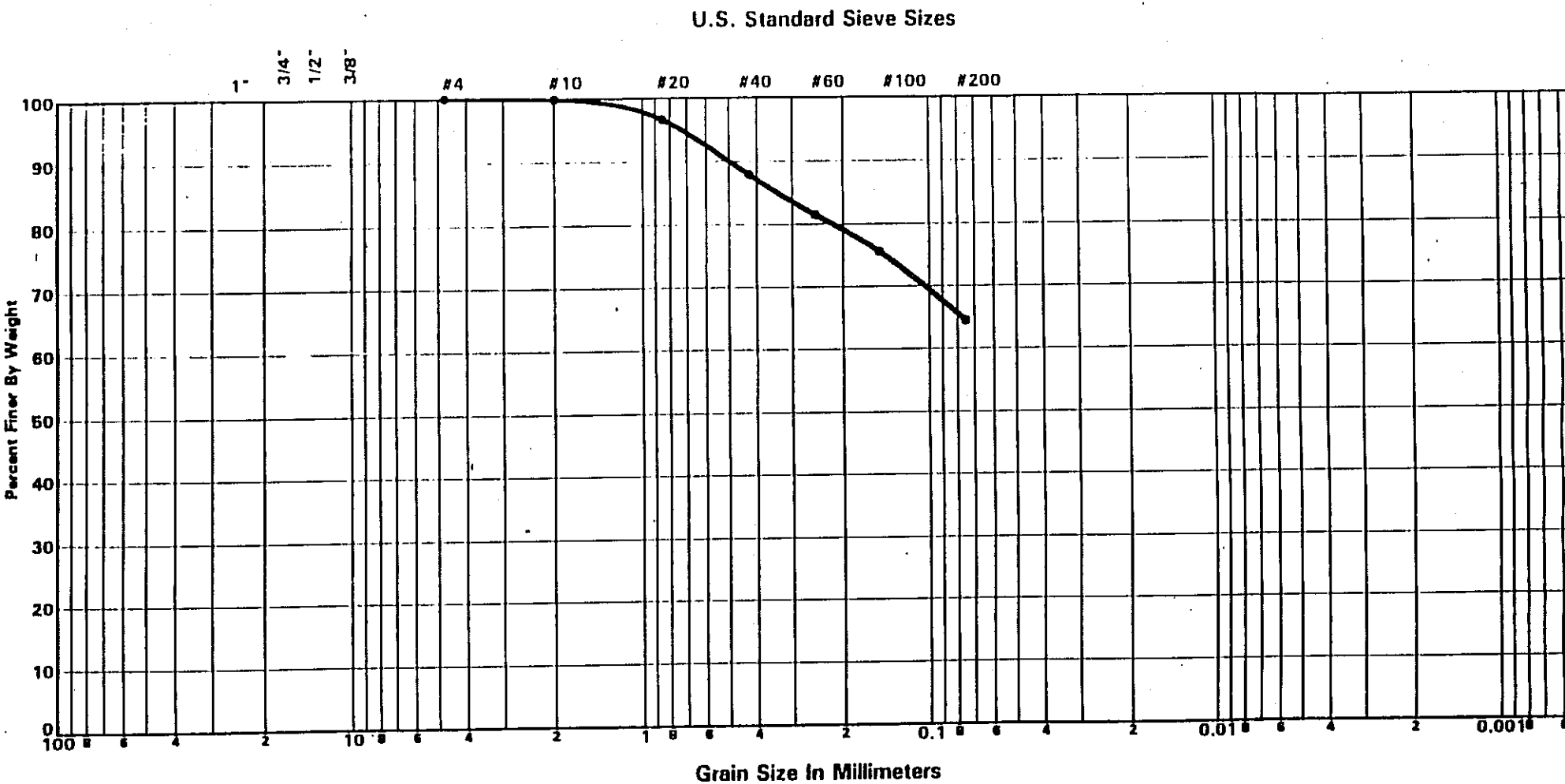
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-16 S-1	5.0'-6.5'	25.3	48.8	40.2	8.6	Green Tan MAFIC ROCK SANDY SILT (ML)

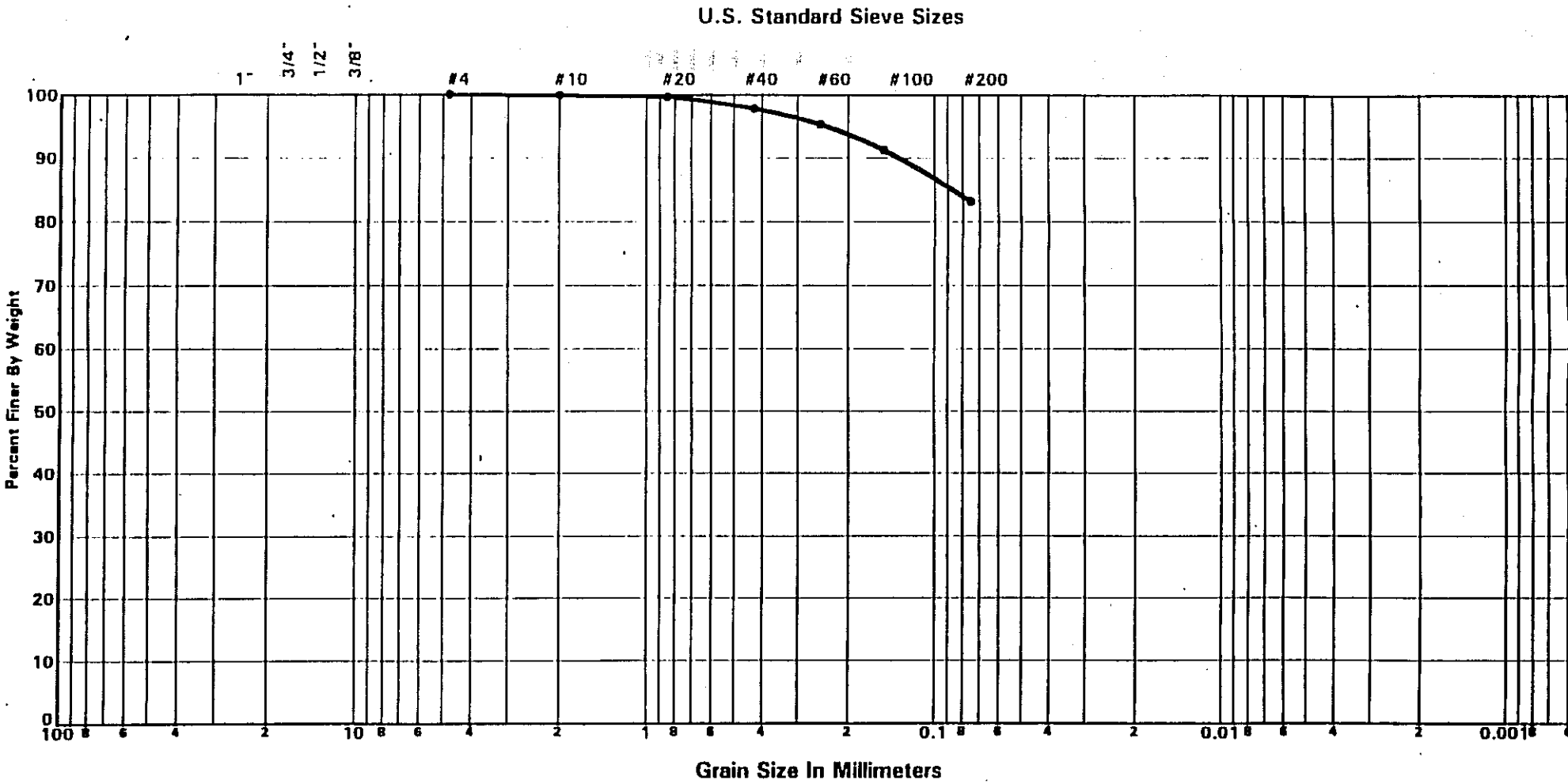
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-16 S-3	15.0'-16.5'	33.6	52.4	31.1	21.3	Yellow Brown MAFIC ROCK ELASTIC SILT WITH SAND (MH)

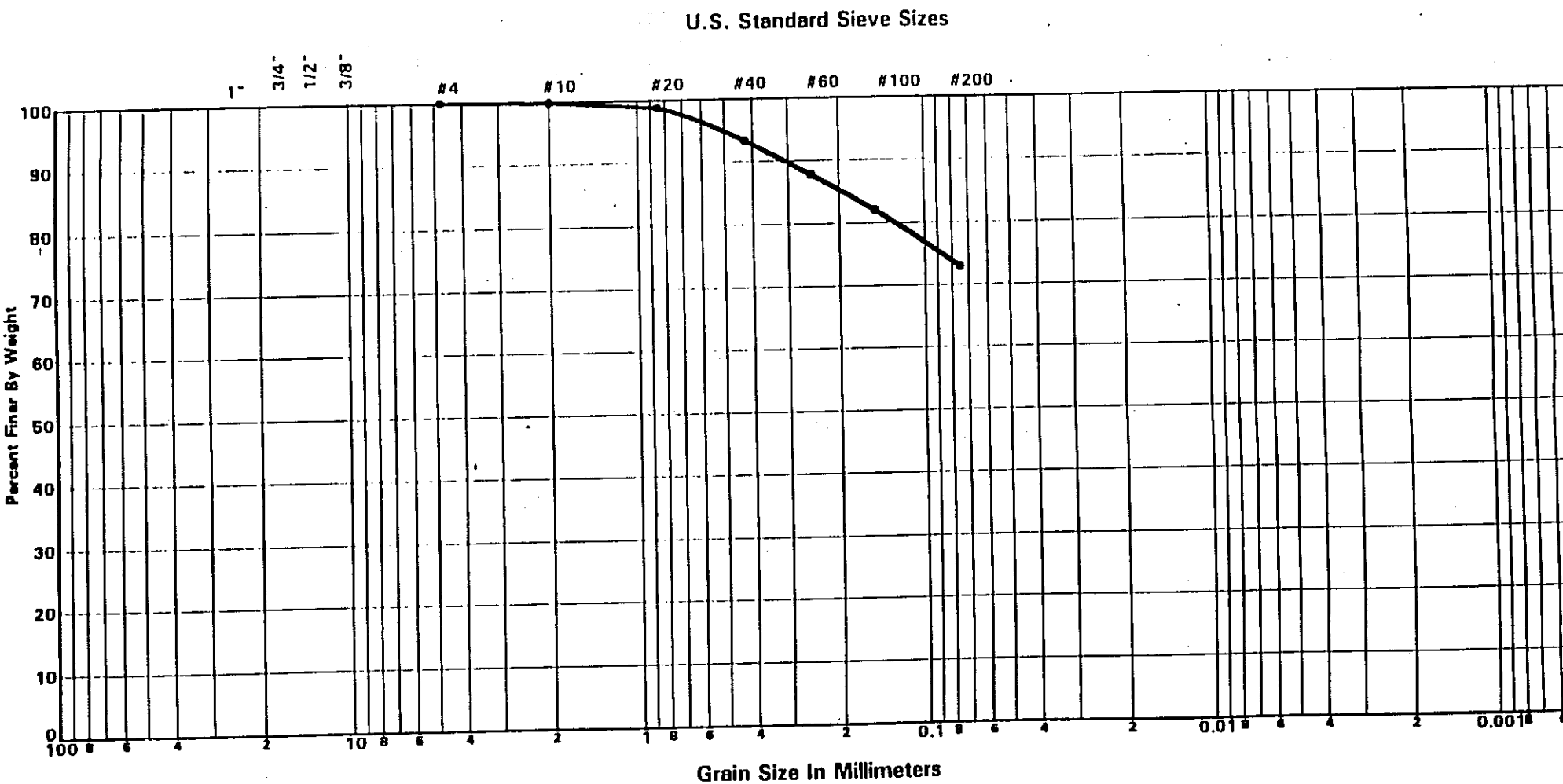
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-16 S-5	25.0'-26.5'	32.9	52.7	34.0	18.7	MAFIC Rock brown Green ELASTIC SILT WITH SAND (MH)

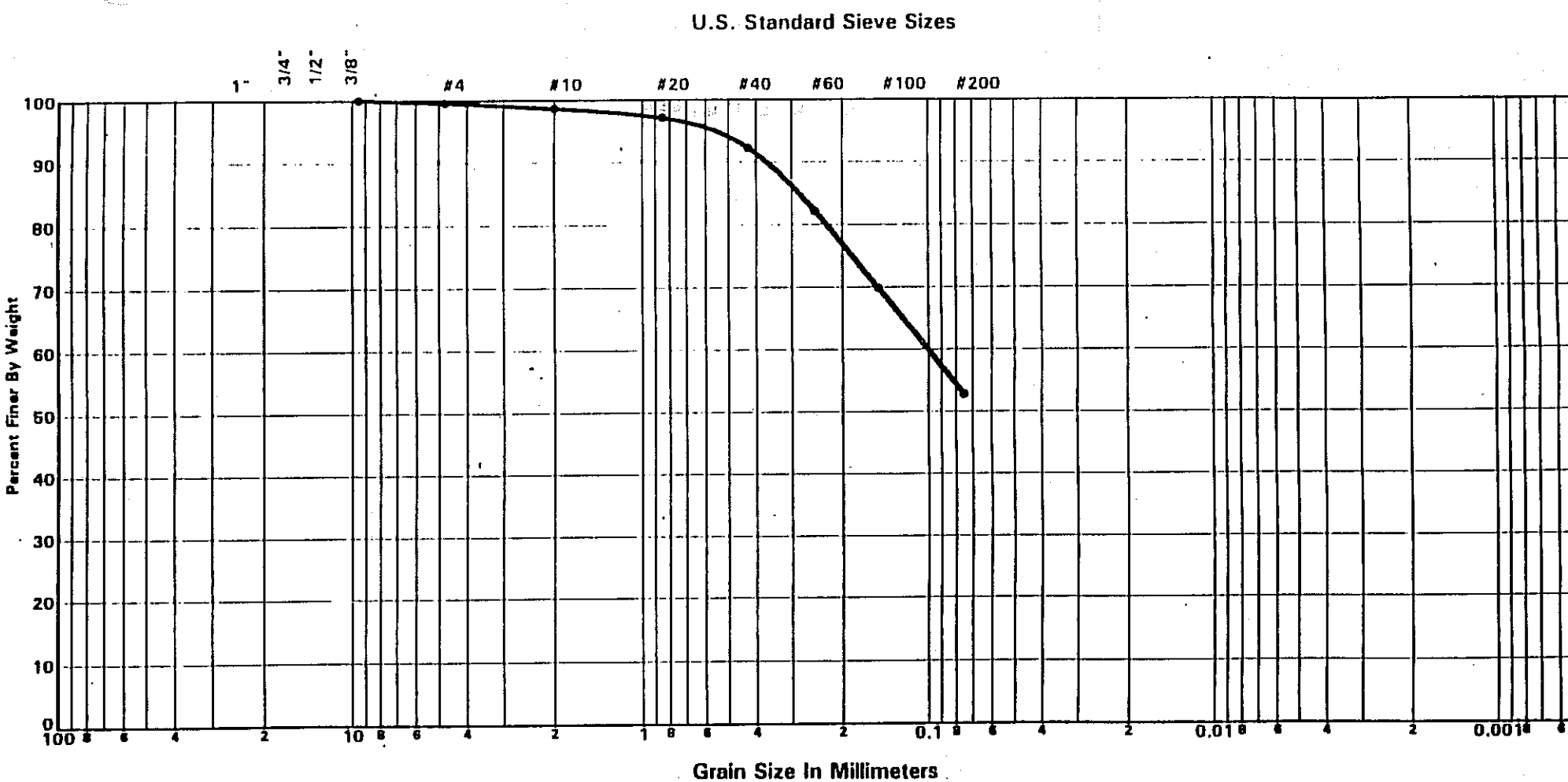
Project:
Gr nsboro Landfill
G nsboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-17 S-1	5.0'-6.5'	34.0	NP	NP	NP	Yellow Red Brown Sandy SILT GNEISS SANDY SILT (ML)

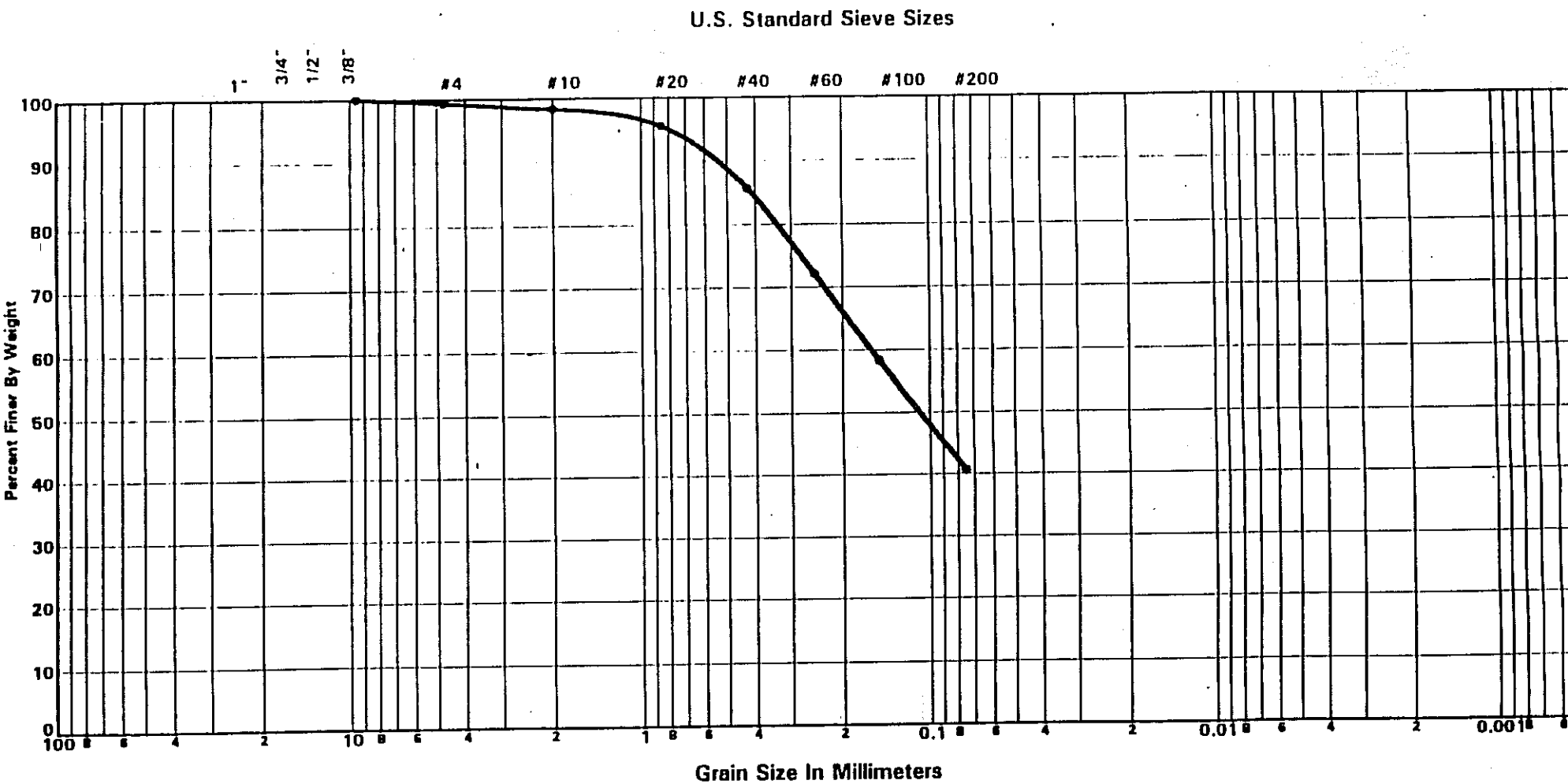
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-17 S-2	10.0'–11.5'	24.2	21.9	23.3	NP	Yellow Brown SILTY SAND (SM) GNEISS

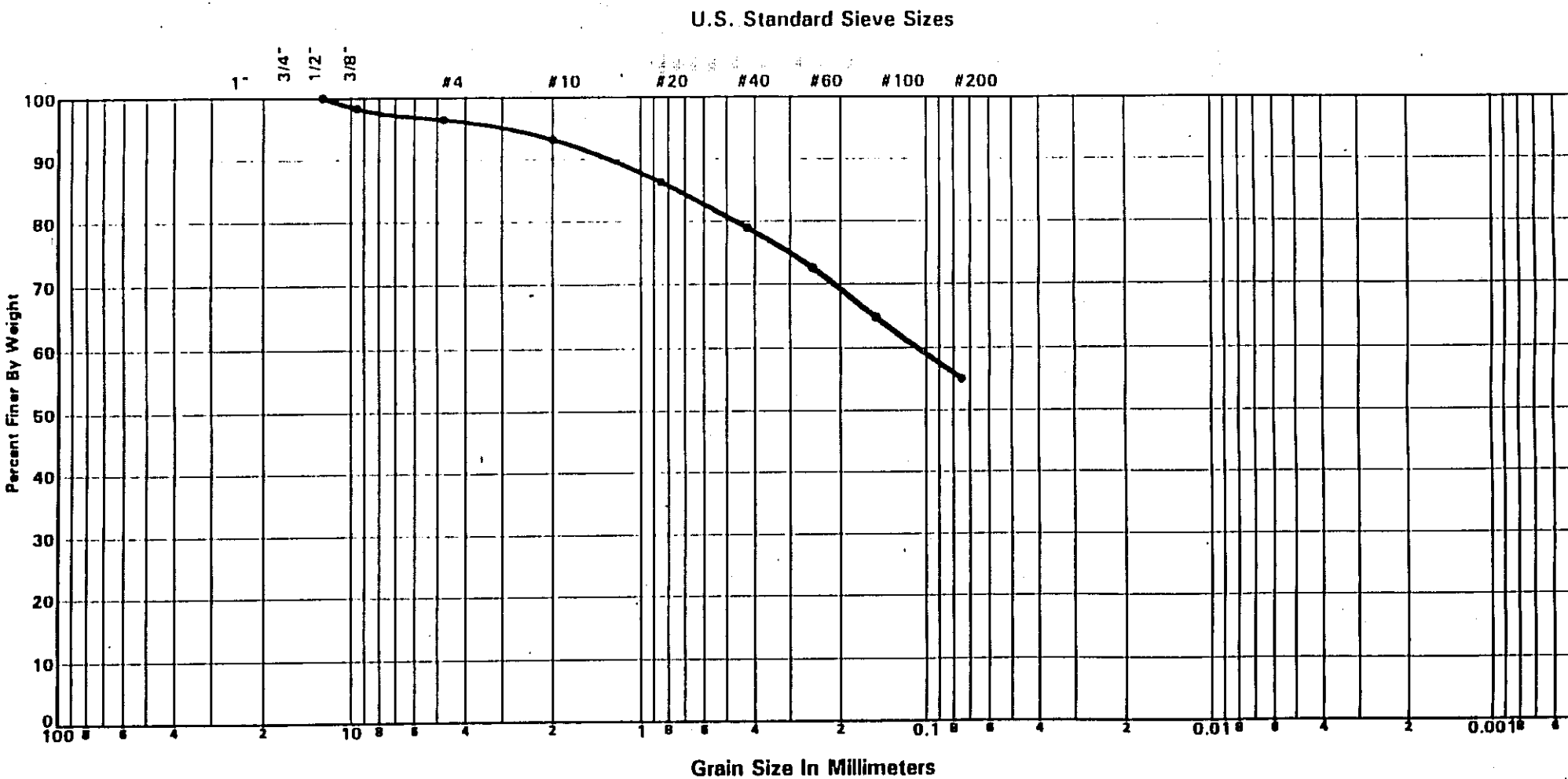
Project:
Gr[illegible]nsboro Landfill
G[illegible]nsboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9[illegible]

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-20 S-1	5.0'- 6.5'	15.3	27.4	19.2	8.2	Green Brown SANDY LEAN CLAY (CL) GREENSTONE DIKE

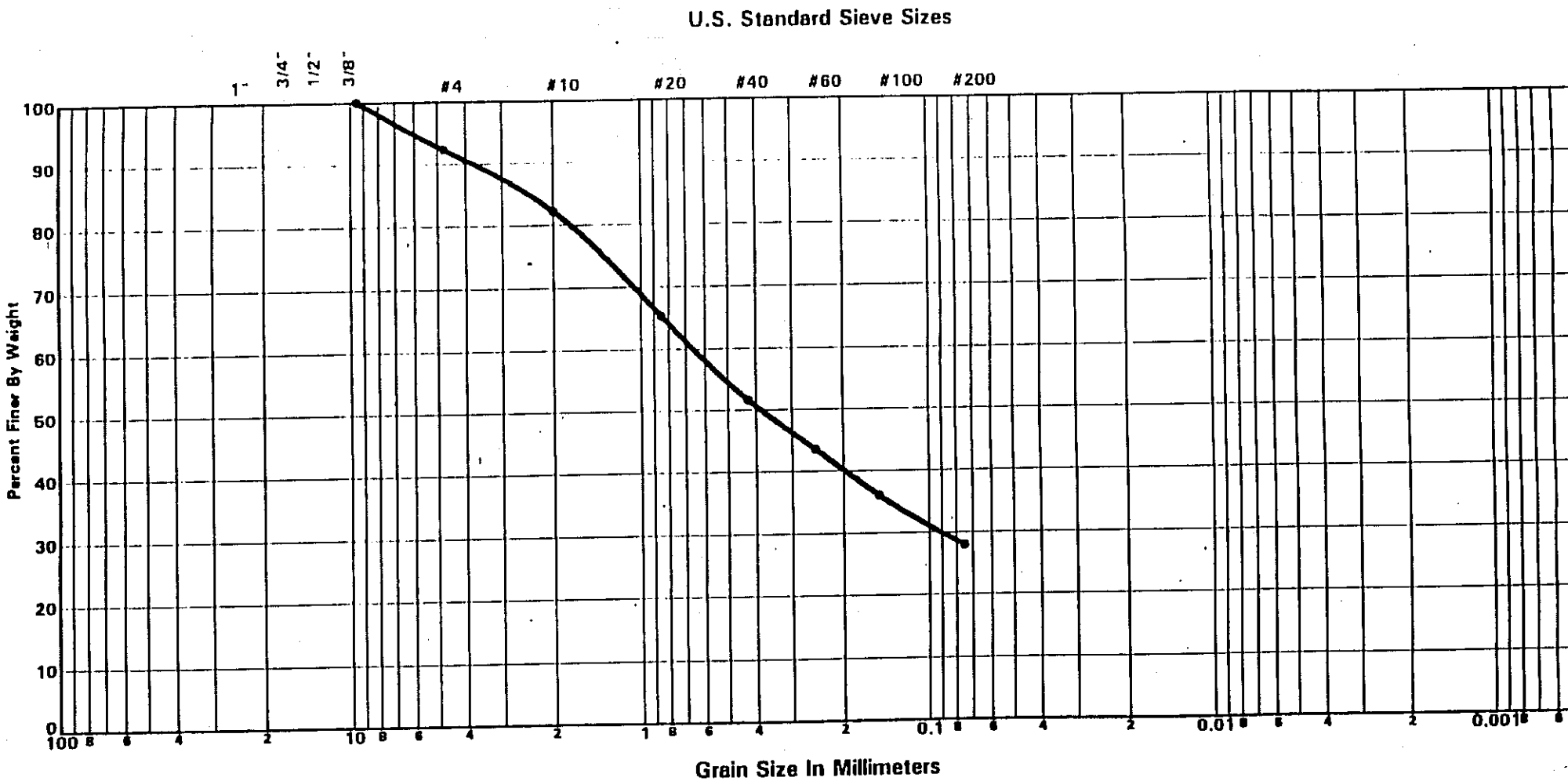
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-20 S-2	10.0'-11.5'	9.2	NP	NP	NP	GNEISS Brown Fine-Medium SILTY CLAYEY SAND (SC-SM)

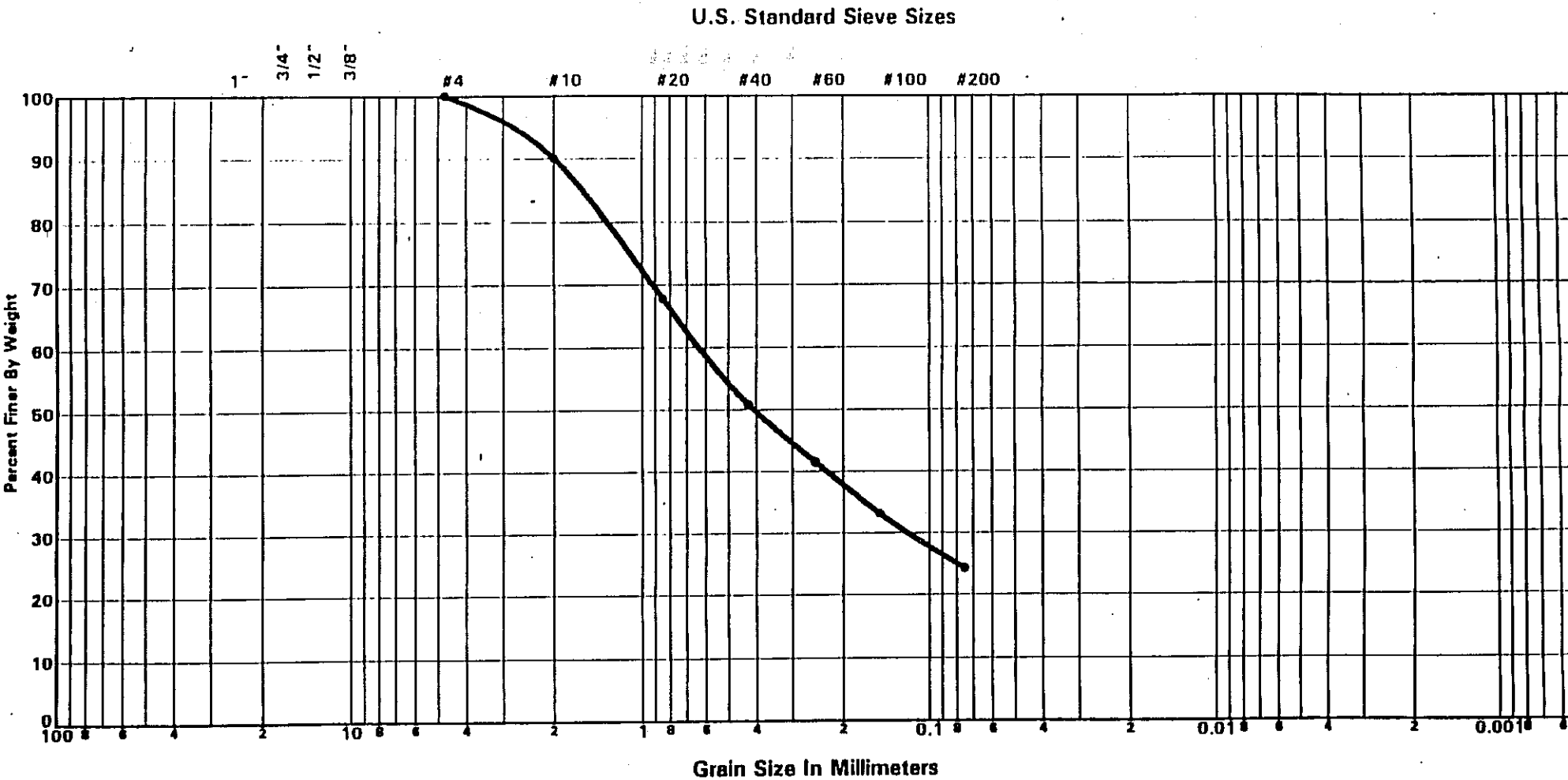
Project:
Gr[illegible]nsboro Landfill
G[illegible]nsboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/9[illegible]

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-22 S-1	5.0'-6.5'	9.5	NP	NP	NP	Tan Fine-Medium SAND GRANITE SILTY SAND (SM)

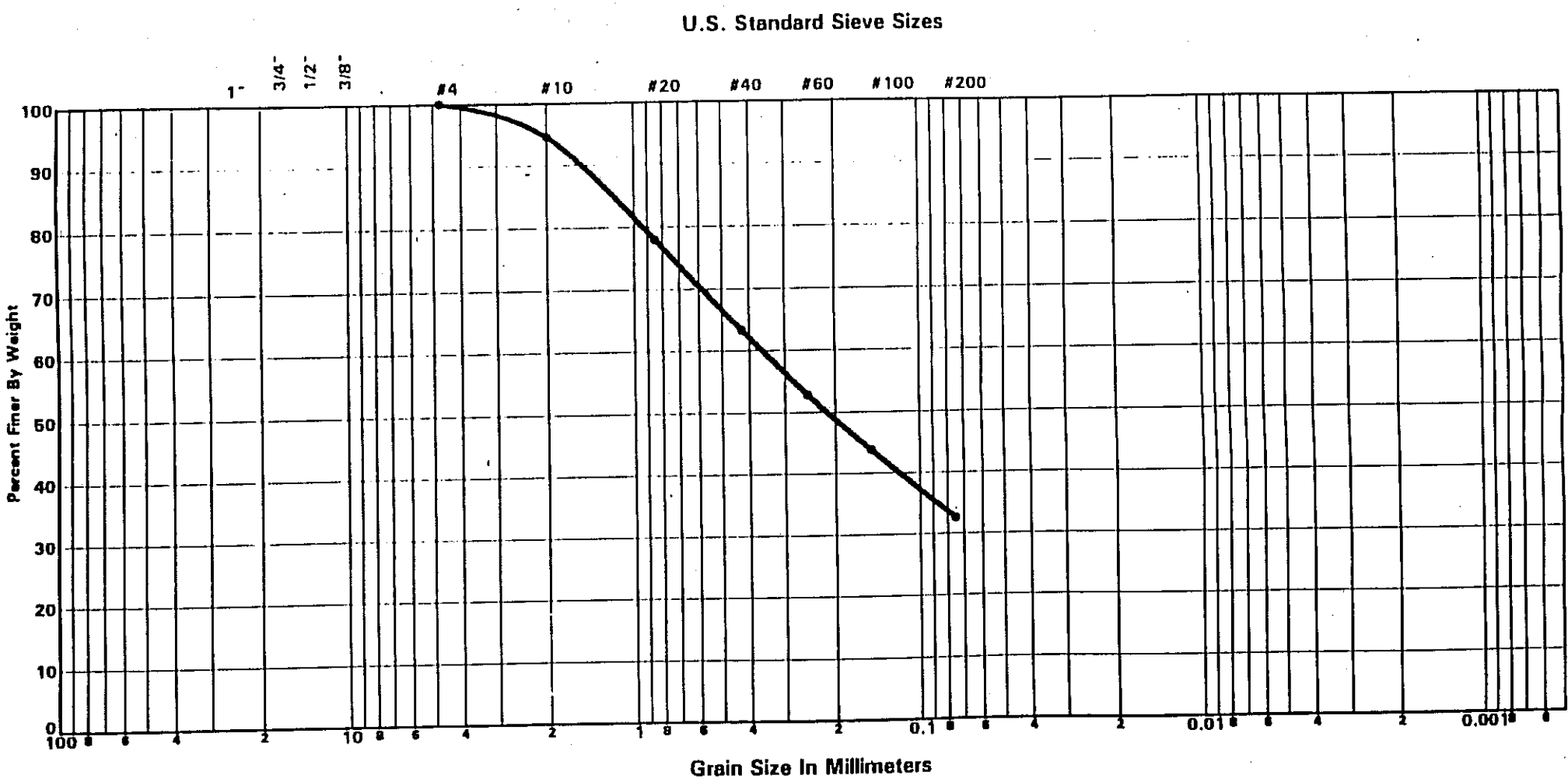
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

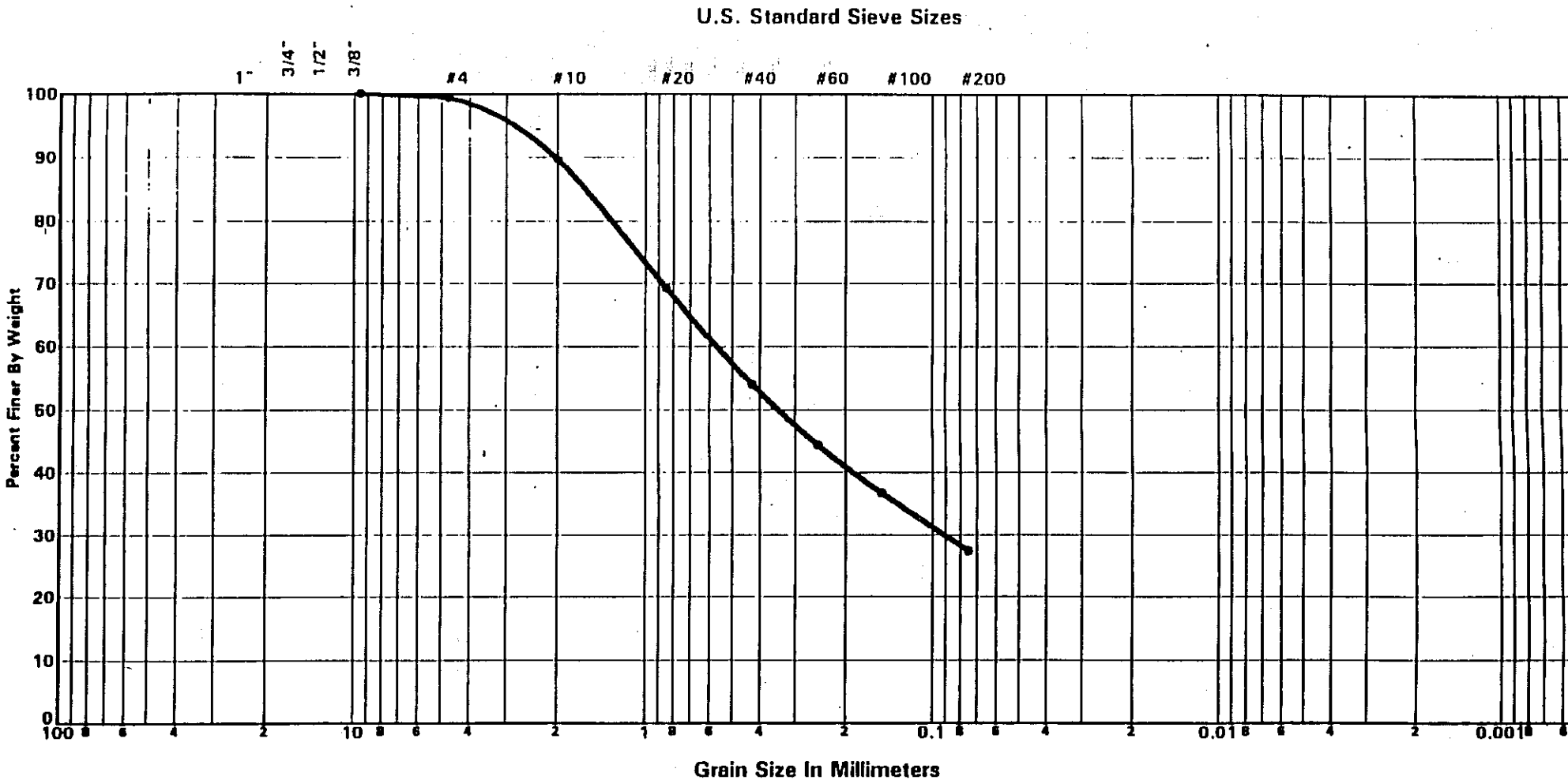
Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-22 S-3	15.0'-16.5'	9.7	NP	NP	NP	Tan Fine-Medium SAND GRANITE SILTY SAND (SM)

Project: Gre[illegible]boro Landfill [illegible]

Job No.: 1-95-085 CA

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-22 S-5	25.0'-26.5'	12.4	NP	NP	NP	Tan Brown Fine-Medium SAND GRANITE SILTY SAND (SM)

Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

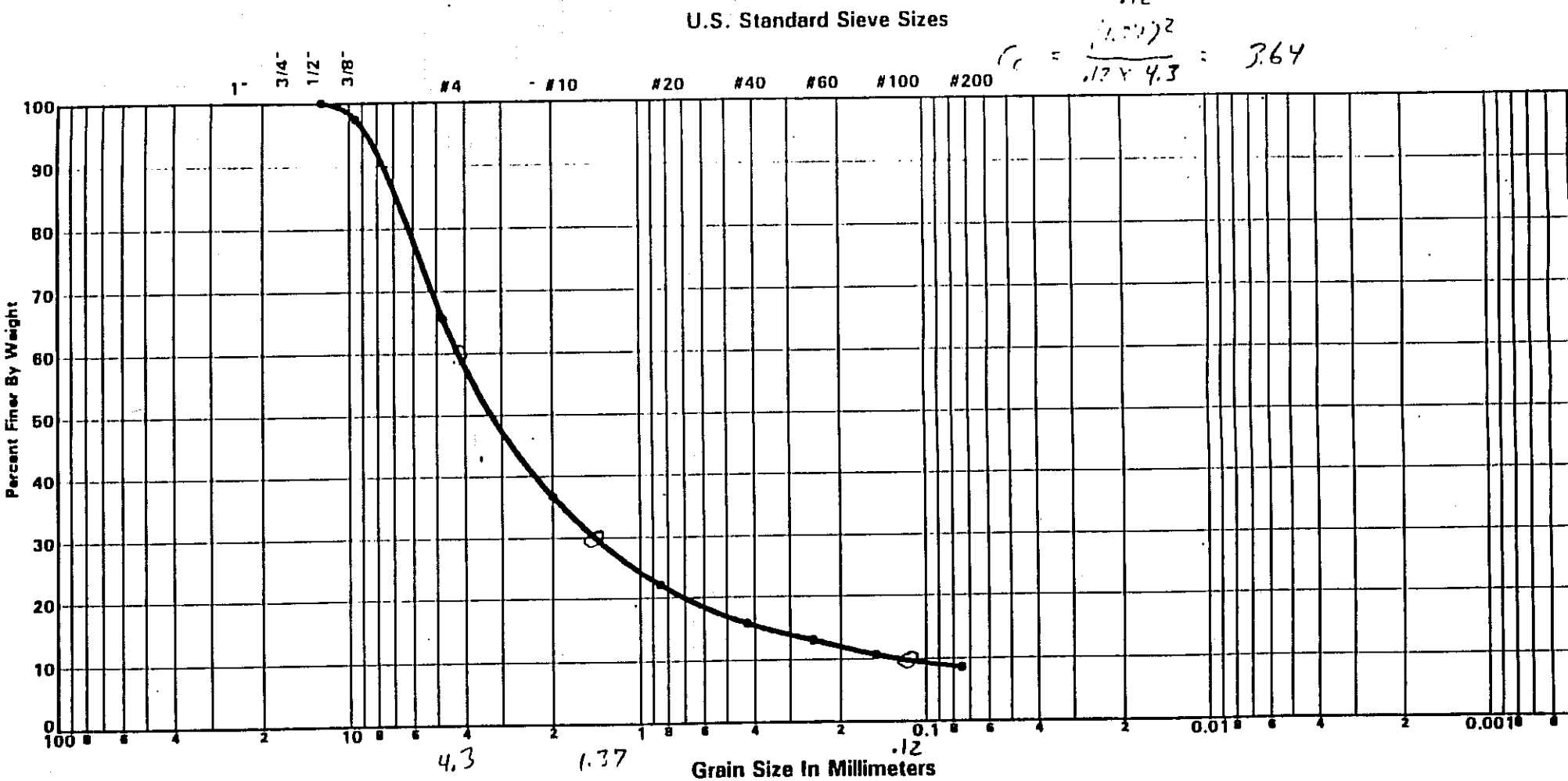
Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.

$C_u = \frac{4.3}{.12} = 35.83$

$C_c = \frac{(1.37)^2}{.12 \times 4.3} = 3.64$



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

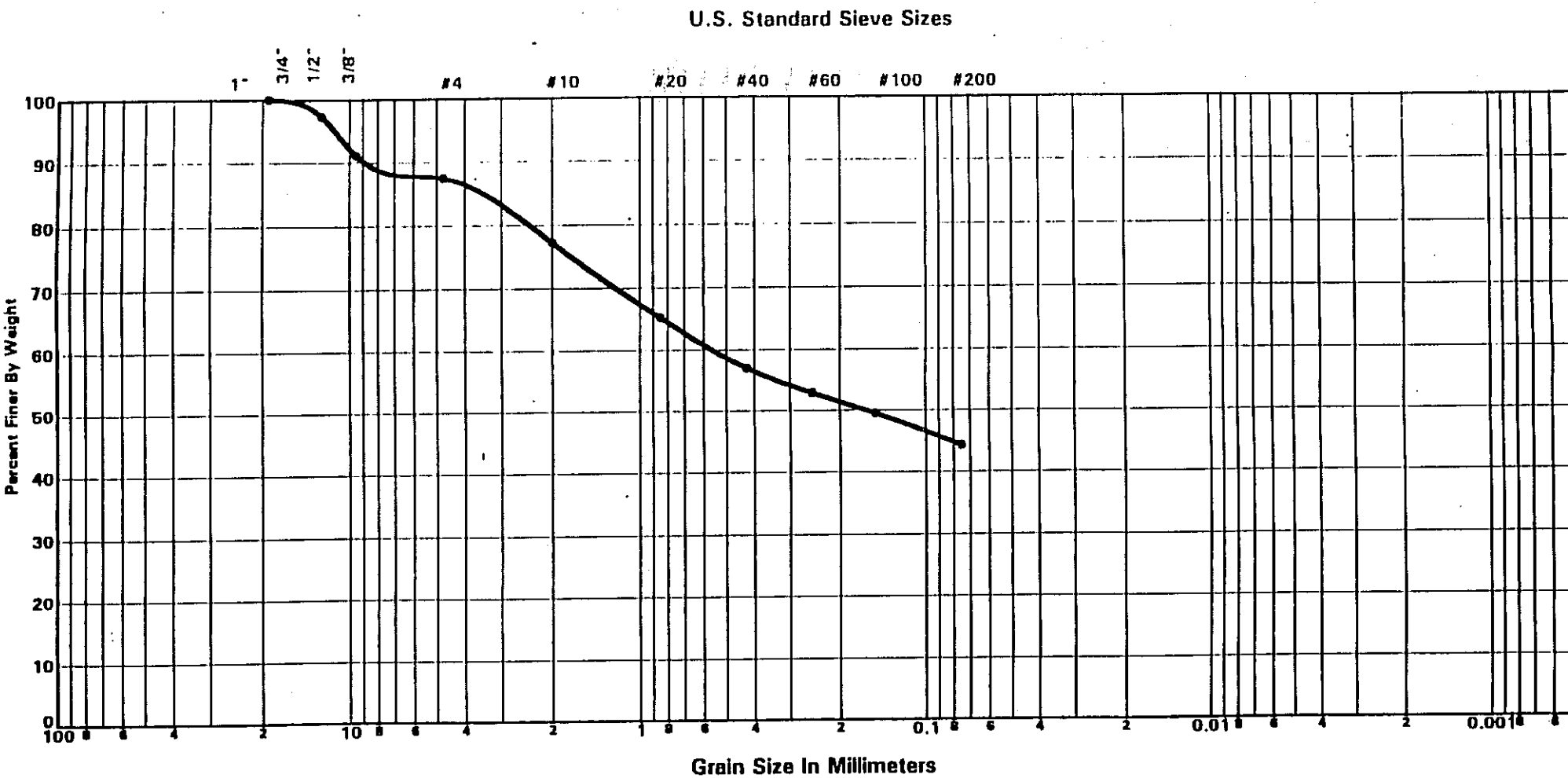
Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-24 S-1	5.0'-6.5'	6.6	NP	NP	NP	Brown Tan SAND GRANITE POORLY GRADED SAND WITH SILT (SP-SM)

Project:
Gr[illegible]sboro Landfill
Gr[illegible]sboro, North Carolina

Job No.: 1-95-085 CA

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-24 S-2	10.0'-11.5'	8.2	NP	NP	NP	Brown Fine SAND CLAYEY SAND (SC) GREENSTONE DIKE

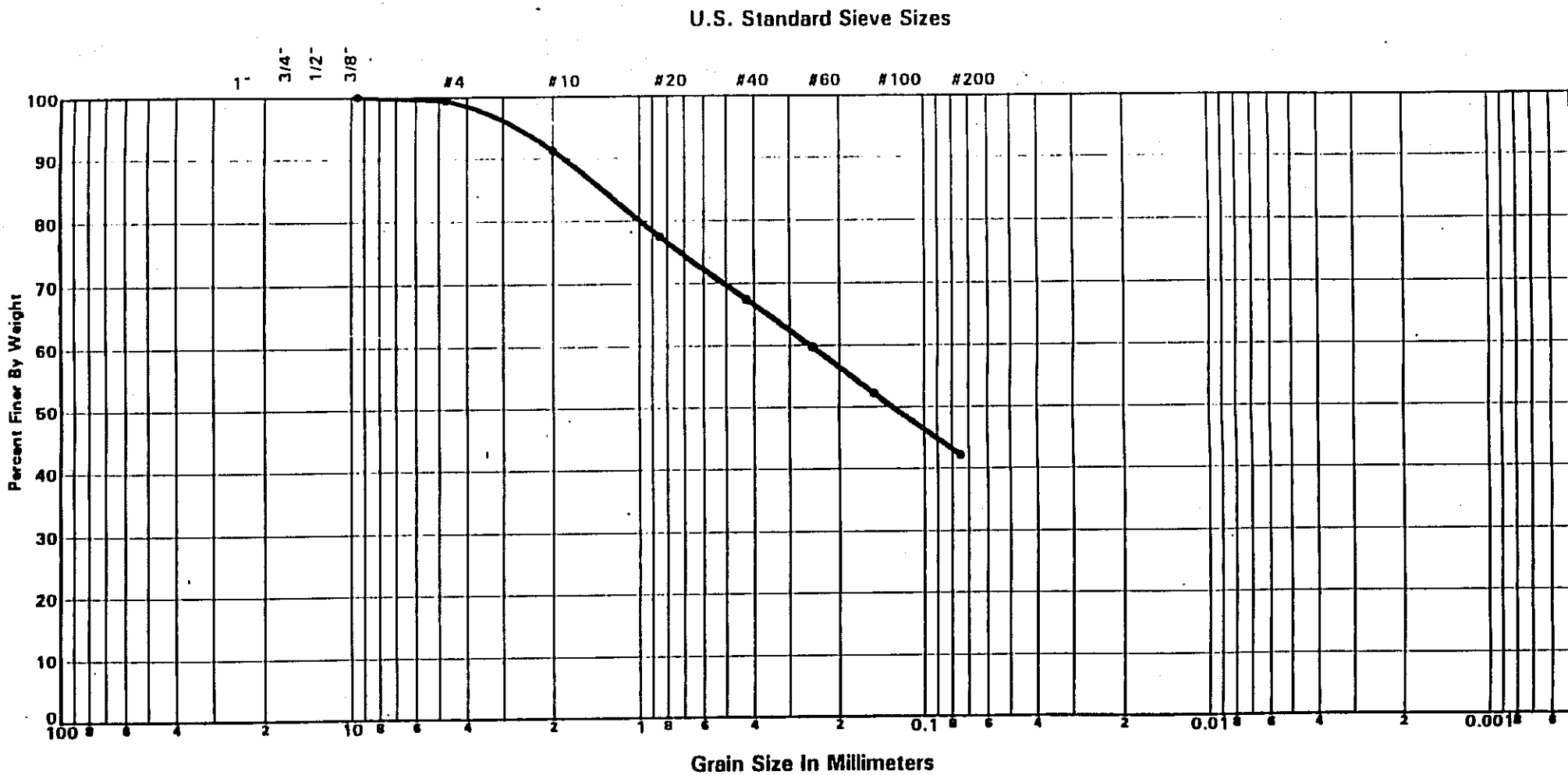
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-30 S-1	5.0'-6.5'	17.7	NP	NP	NP	GRANITE Tan Fine-Medium SAND SILTY SAND (SM)

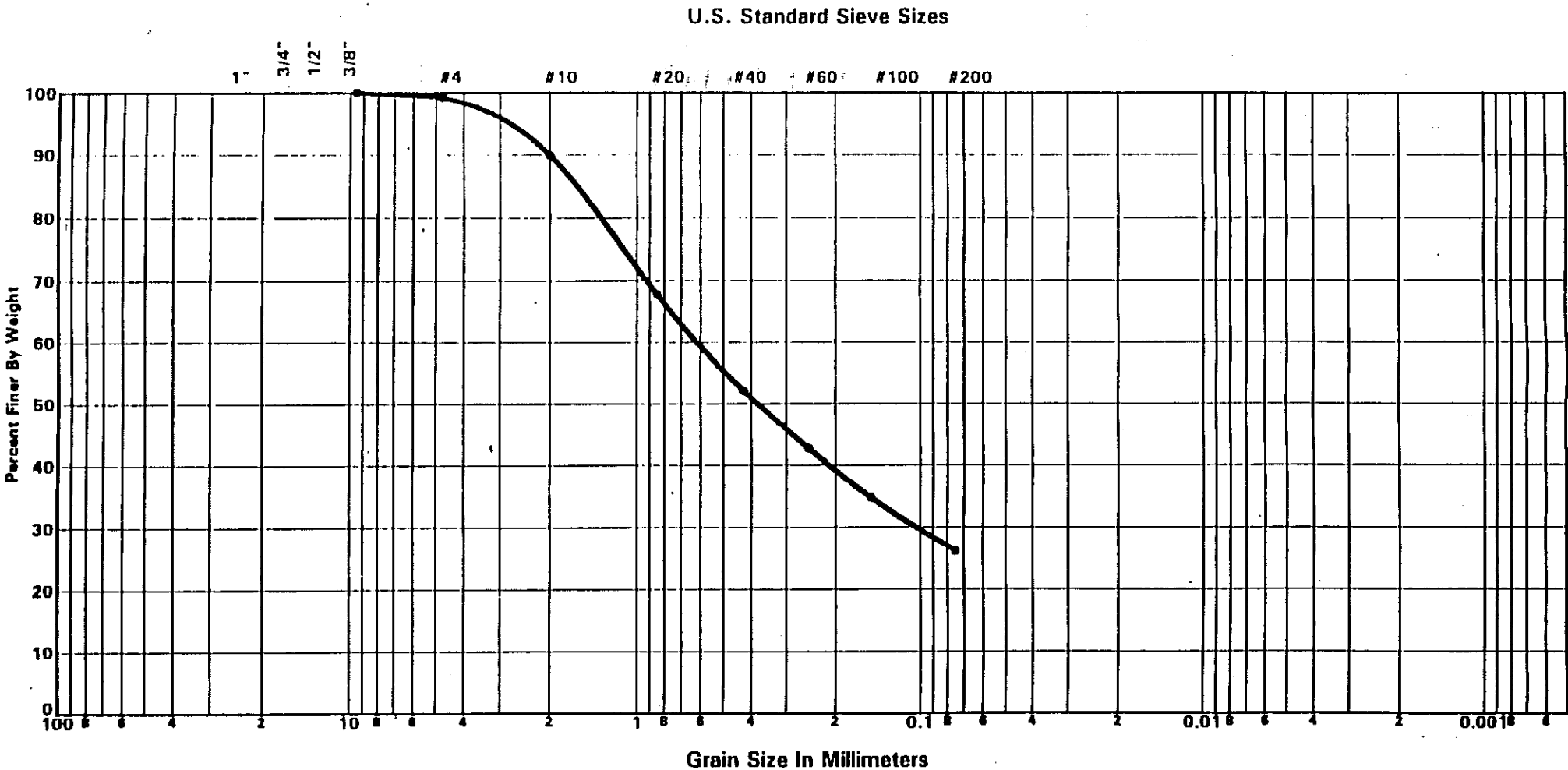
Project:
Greensboro Landfill
Gre boro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-30 S-3	15.0'-16.5'	8.2	NP	NP	NP	Tan Fine-Medium SAND GRANITE SILTY SAND (SM)

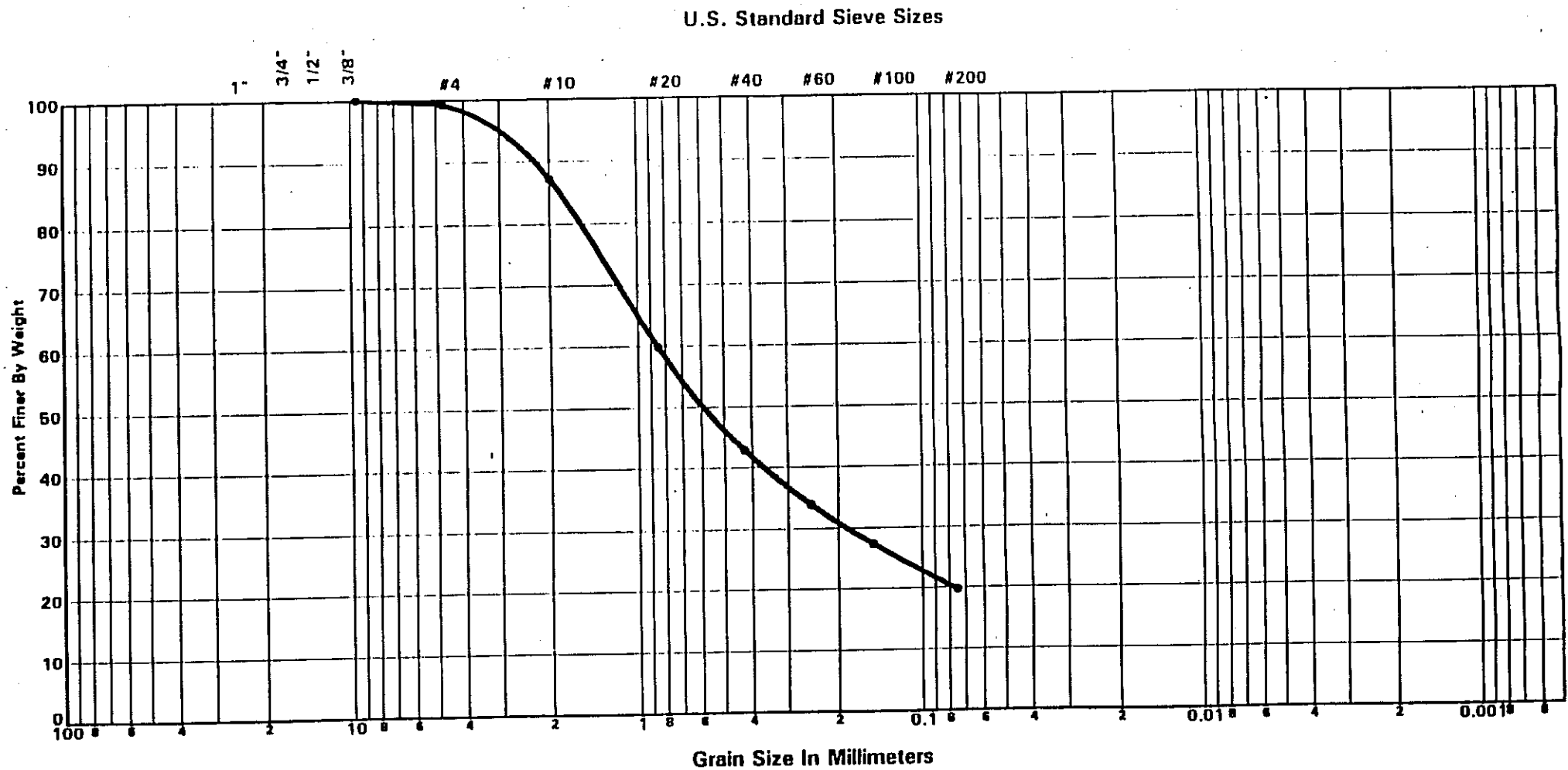
Project:
Greensboro Landfill
Greensboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



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

Boring No.	Elev./Depth	Nat. W.C.	L.L.	P.L.	P.I.	Soil Description or Classification
B-30 S-5	25.0'-26.5'	10.2	NP	NP	NP	Tan Fine-Medium SAND GRANITE SILTY SAND (SM)

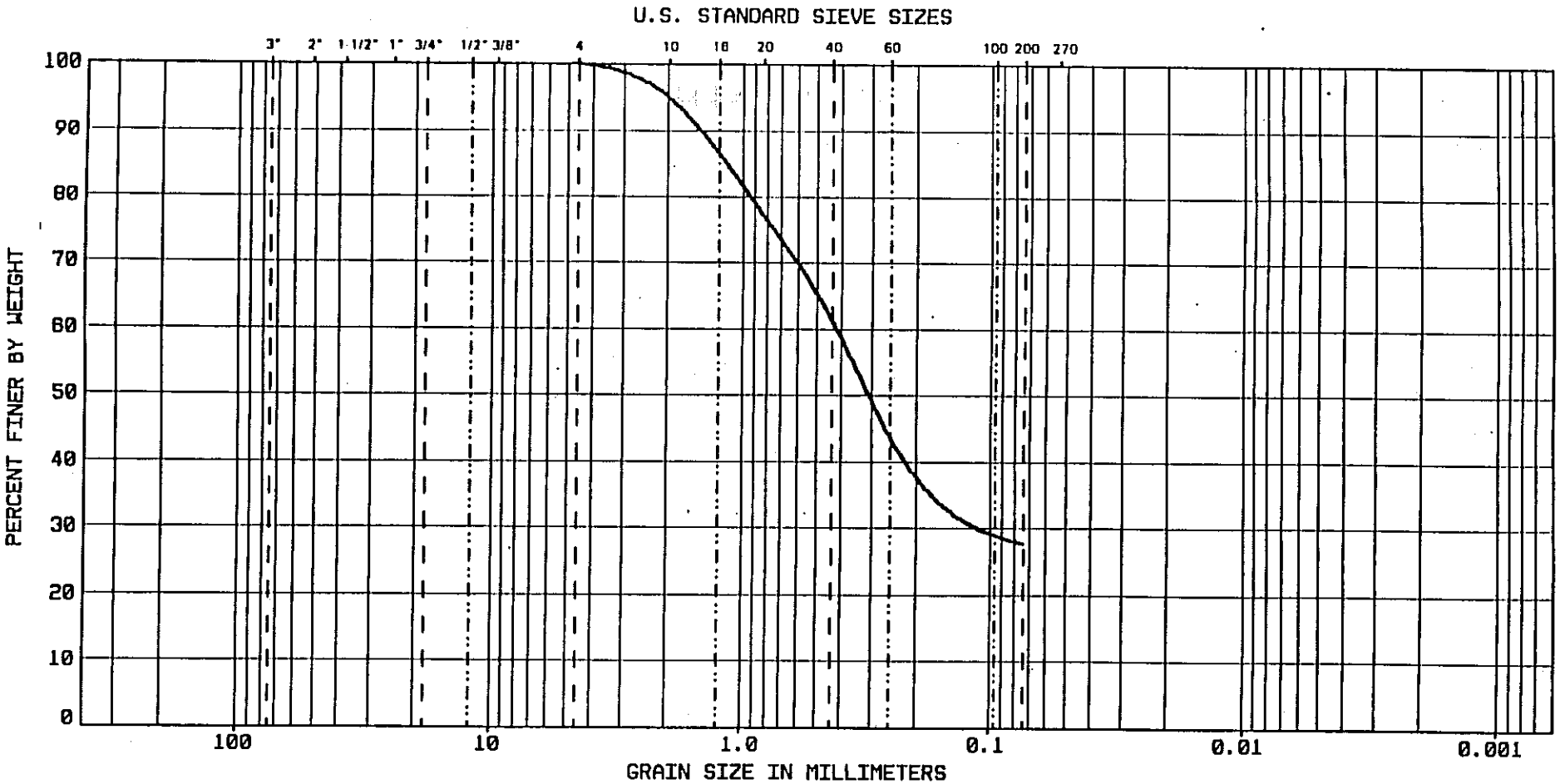
Project:
Gre boro Landfill
Gre. .hboro, North Carolina

Job No.: 1-95-085 CA

Date: 1/30/95

GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.



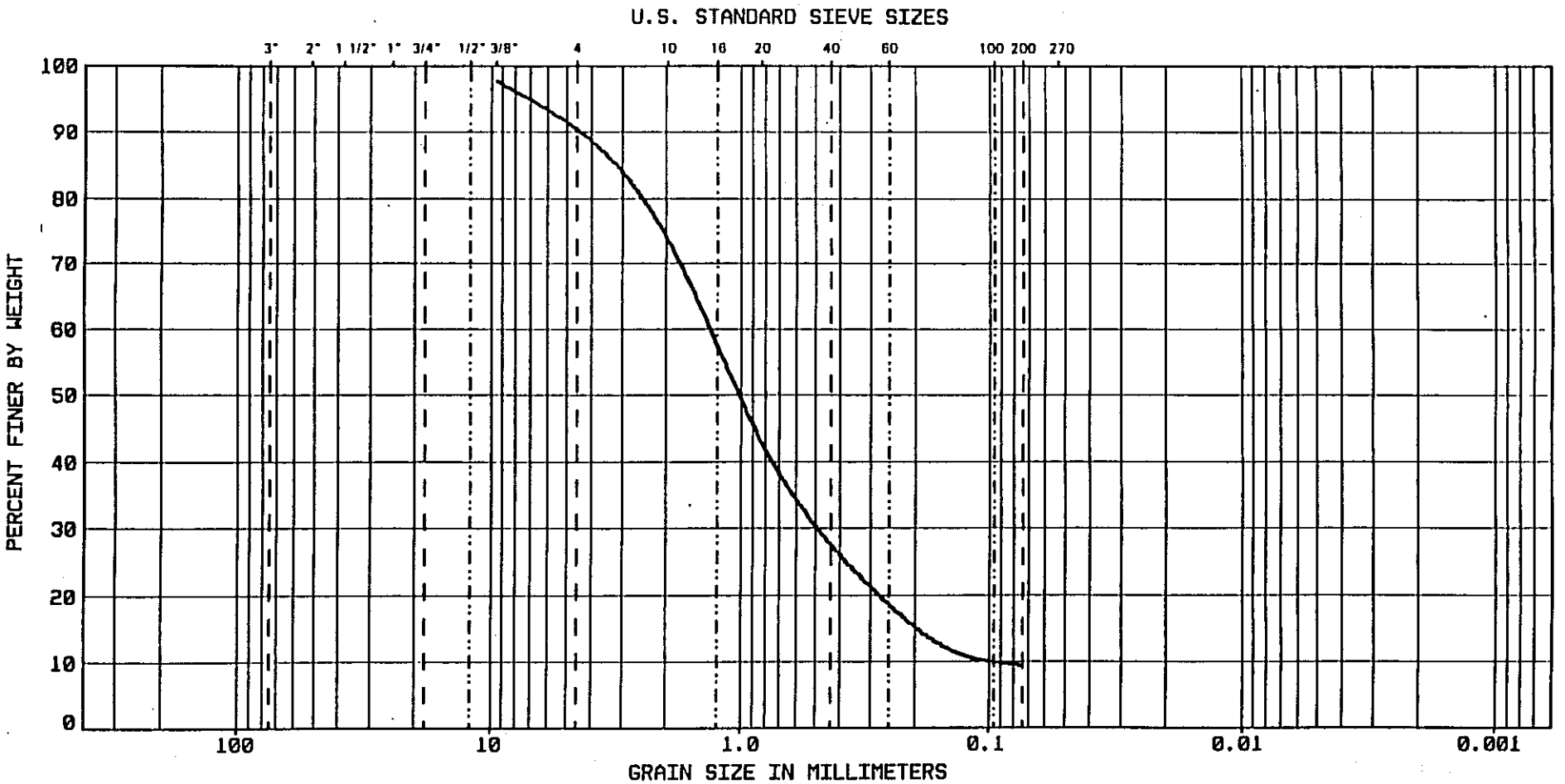
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO.	DEPTH(FT)	NMC %	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-46	1.0-3.0	21.4	36	NP	NP	Tan-Brown Silty Coarse to Fine SAND(SM)

GRAIN SIZE DISTRIBUTION

JOB NO. 011-95-177

TRIGON



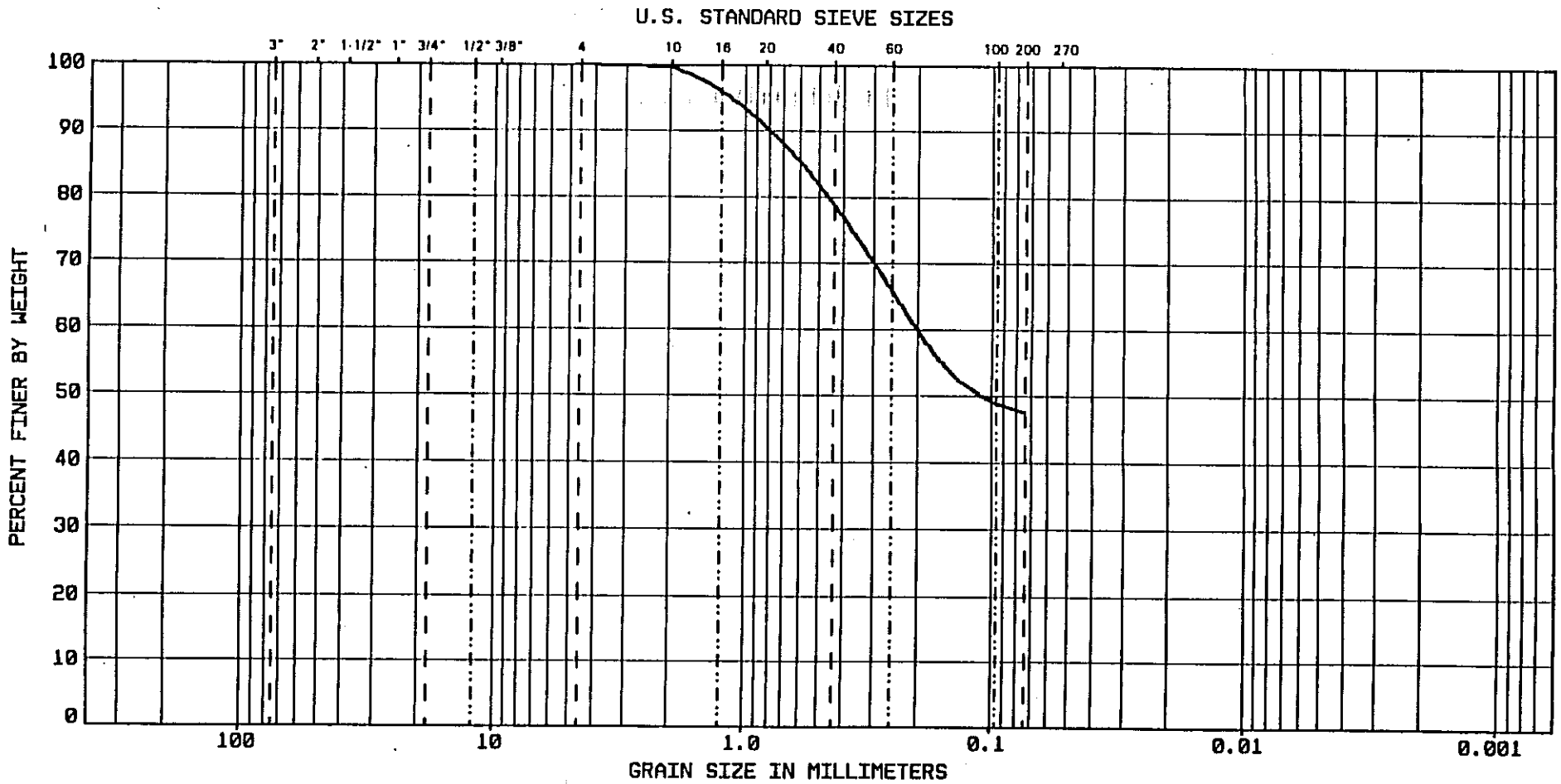
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO.	DEPTH(FT)	NMC %	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-47	1.0-4.0	6.8	24	NP	NP	White-Tan-Brown Sli. Mic. Silty Coarse to Fine SAND(SM)

GRAIN SIZE DISTRIBUTION

JOB NO. 011-95-177

TRIGON



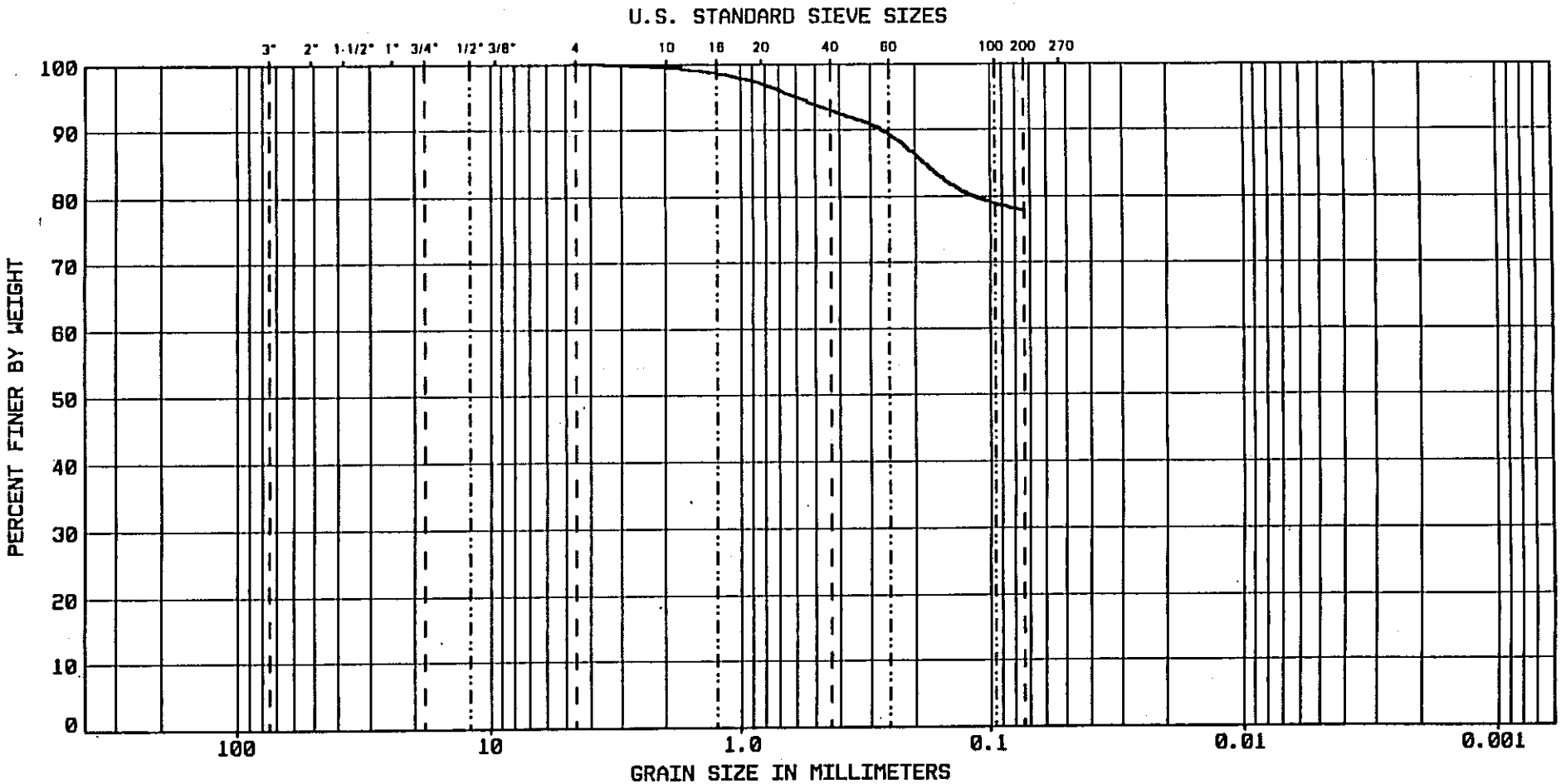
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO.	DEPTH(FT)	NMC %	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-50	0.0-3.0	12.8	31	NP	NP	Tan Silty Medium to Fine SAND(SM)

GRAIN SIZE DISTRIBUTION

JOB NO. 011-95-177

TRIGON



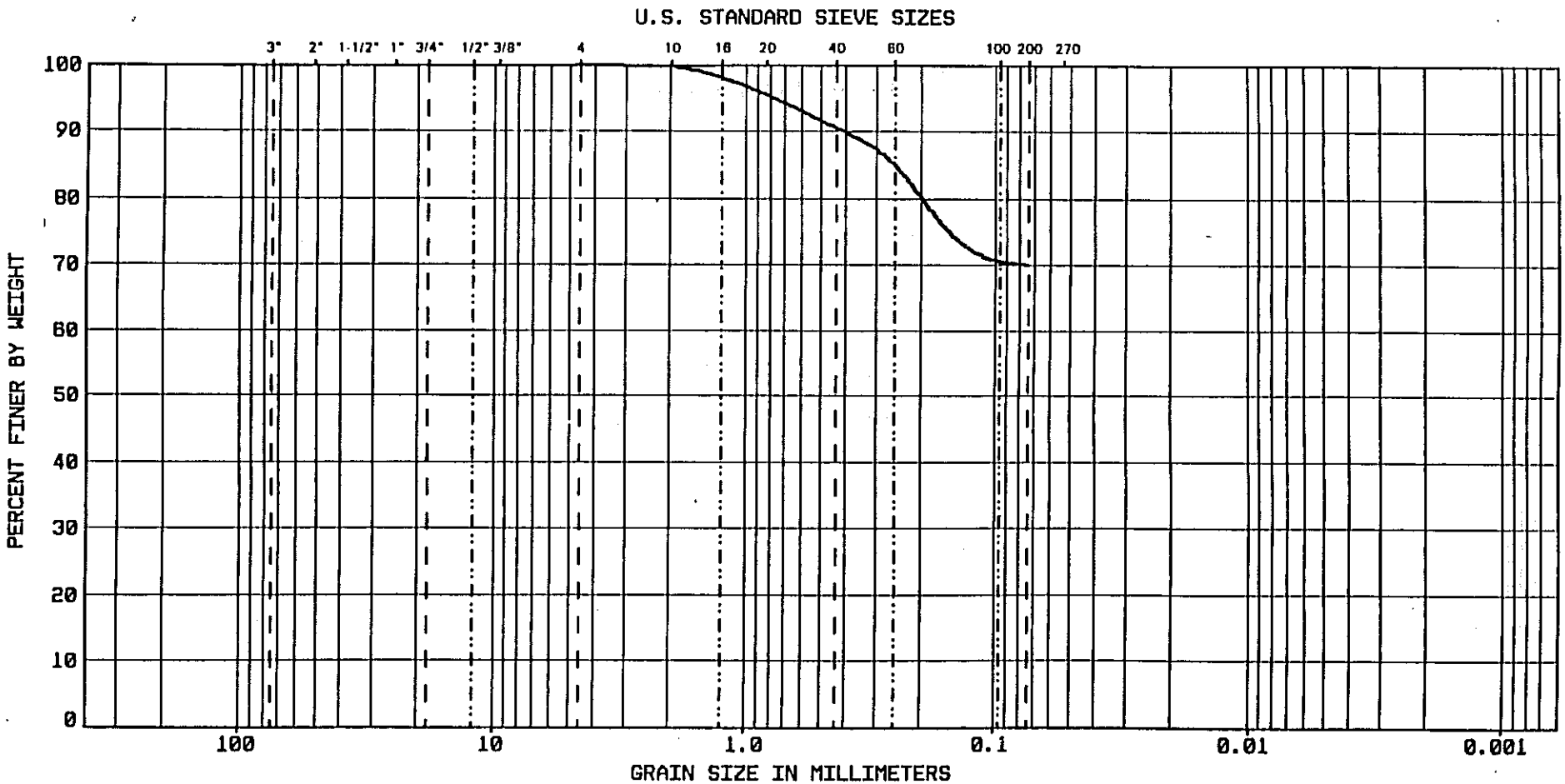
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO.	DEPTH(FT)	NMC %	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-53	0.5-3.0	47.9	58	47	11	Tan-Brown Medium to Fine Sandy Clayey SILT(MH)

GRAIN SIZE DISTRIBUTION

JOB NO. 011-95-177

TRIGON



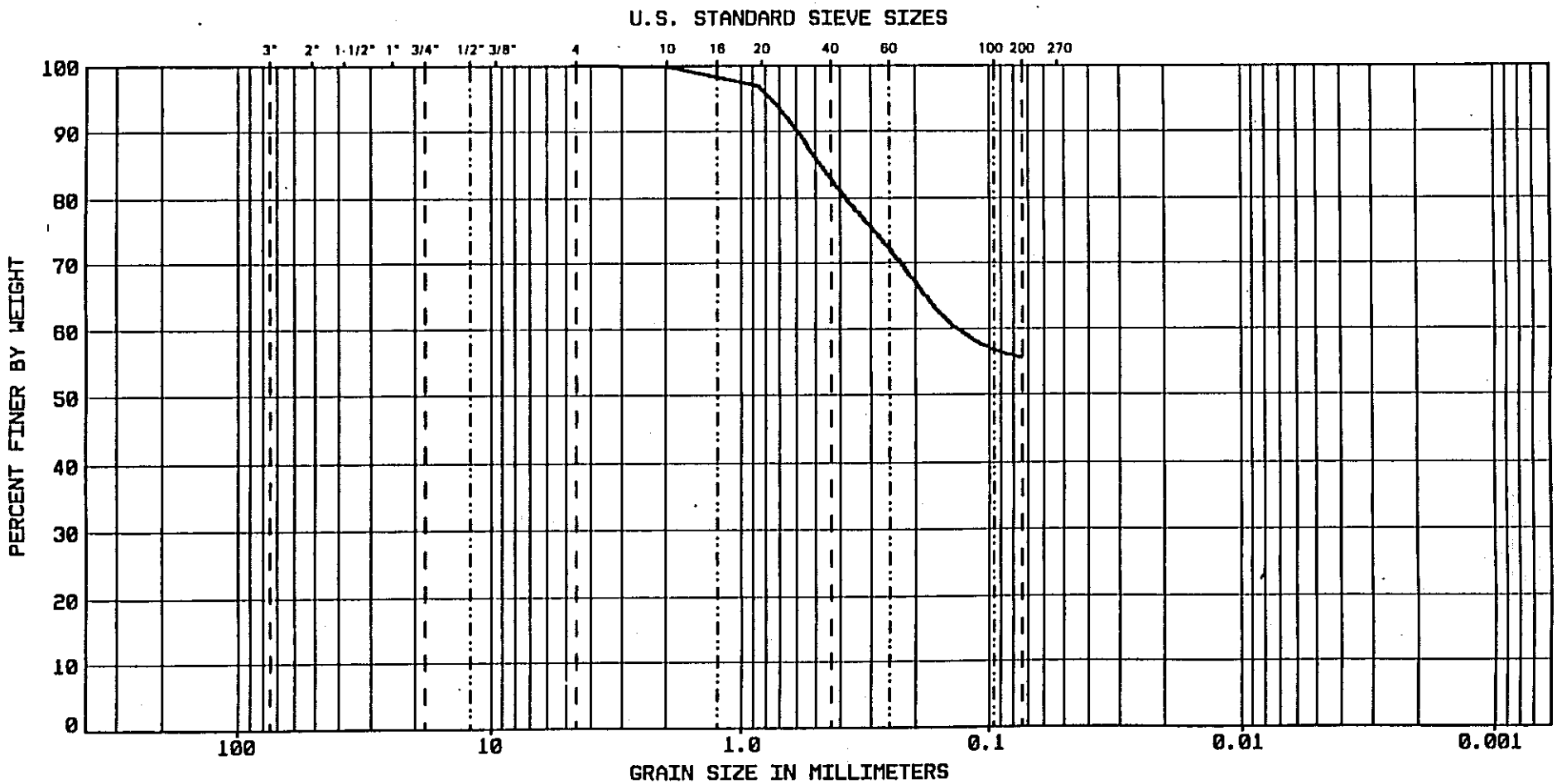
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO.	DEPTH(FT)	NMC %	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-55/56	0.0-5.0	33.6	45	40	5	Orange-Brown Slightly Clayey Medium to Fine Sandy SILT (ML)

GRAIN SIZE DISTRIBUTION

JOB NO. 011-95-177

TRIGON



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

BORING NO.	DEPTH(FT)	NMC %	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
B-57/58	0.0-5.0	10.4	24	NP	NP	Grey-Tan Medium to Fine Sandy SILT (ML)

GRAIN SIZE DISTRIBUTION

JOB NO. 011-95-177

TRIGON

SUMMARY OF LABORATORY TEST DATA[1]

Boring No.	Sample Depth (ft.)	Sample Type[2]	Natural Moisture Content (%)	USCS Class.	Atterberg Limits			Standard Proctor Curve		Undisturbed Data		Permeability* (cm/sec)	Porosity (%)	Percent Passing Sieve No. 200
					L.L.	P.L.	P.I.	Max. Dry Density (pcf)	Opt. Water Content (%)	Dry Unit Weight (pcf)	Moisture Content (%)			
B-46	1.0 - 3.0	UD		SM	36	NP	NP			90.6	21.4	~~5.9 E-7~~	~~42.8~~	27.8
B-47	1.0 - 4.0	PB		SM	24	NP	NP			143.8	6.8	1.0 E-6	17.1	9.5
B-50	0 - 3.0	UD		SM	31	NP	NP			115.2	12.8	~~6.0 E-7~~	31.9	47.6
B-53	0.5 - 3.0	UD		MH	58	47	11			75.6	47.9	~~4.1 E-7~~	57.0	77.9
B-55 B-56	0 - 5.0	Bag	33.6	ML	45	40	5	87.9	32.5			~~2.1 E-7~~		70.1
B-57	0 - 5.0	Bag	10.4	ML	24	NP	NP	124.7	12.8			~~2.8 E-7~~		55.6
B-58	0 - 5.0	Bag	21.1											

[1]Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary.
[2]SS = Split Spoon Sample (ASTM D-1586)
UD = Undisturbed Sample (ASTM D-1587)
PB = Pitcher Barrel
* = Permeability Tests rerun after using improper equipment

TRIGON ENGINEERING CONSULTANTS, IN
GREENSBORO, NORTH CAROLIN

JOB NUMBER: 011-95-177
Page 1 of 1

SUMMARY OF LABORATORY TEST DATA[1]

RE-TEST DATA

Boring No.	Sample Depth (ft.)	Sample Type[2]	Natural Moisture Content (%)	USCS Class.	Atterberg Limits			Standard Proctor Curve		Undisturbed Data		Permeability (cm/sec)	Porosity (%)	Percent Passing Sieve, No. 200
					L.L.	P.L.	P.I.	Max. Dry Density (pcf)	Opt. Water Content (%)	Dry Unit Weight (pcf)	Moisture Content (%)			
B-46	1.0 - 3.0	UD										2.7 E-6	45.0	
B-50	0.5 - 3.0	UD*										2.6 E-6		
B-53	0.5 - 2.0	UD*										3.7 E-7		
B-55 B-56	0 - 5.0	Bag**										3.3 E-7		
B-57	0 - 5.0	Bag**										3.9 E-7		

[1]Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary.
[2]SS = Split Spoon Sample (ASTM D-1586)
UD = Undisturbed Sample (ASTM D-1587)
PB = Pitcher Barrel
*New UD
**New Remolded Sample

TRIGON ENGINEERING CONSULTANTS, INC
GREENSBORO, NORTH CAROLINA

JOB NUMBER: 011-95-177

Porosity Calculations

RETESTED B-46 1.0 - 3.0

W_s = 100.00

W_p = 166.0

W_{pw} = 664.1

T_i = 22°

W_{pwx} = 726.3

T_x = 22°

$$G_s = \frac{.9996(100)}{100 + 664.1 - 726.3} = 2.64$$

$$n = \left(1 - \frac{90.6}{(2.64)(62.4)}\right) \times 100 = \underline{45.0\ \%}$$

B-46 1.0 - 3.0

W_s = 100.00

W_p = 166.0

W_{pw} = 664.0

T_i = 21°

W_{pwx} = 724.7

T_x = 21°

$$G_s = \frac{.9998(100)}{100 + 664.0 - 724.7} = 2.54$$

$$n = \left(1 - \frac{90.6}{(2.54)(62.4)}\right) \times 100 = \underline{42.8\ \%}$$

B-47 1.0 - 4.0

W_s = 100.0

W_p = 166.0

W_{pw} = 664.0

T_i = 23°

W_{pwx} = 728.0

T_x = 23°

$$G_s = \frac{.9993(100)}{100 + 664 - 728.0} = 2.78$$

$$n = \left(1 - \frac{143.8}{(2.78)(62.4)}\right) \times 100 = \underline{17.1\ \%}$$

B-50 0-3.0

w_s = 100.0

w_p = 165.3

w_{pw} = 663.5

T_1 = 23°

w_{pws} = 726.6

T_2 = 23°

$$G_s = \frac{.9993(100)}{100 + 663.5 - 726.6} = 2.71$$

$$n = \left(1 - \frac{115.2}{(2.71)(62.4)}\right) \times 100 = \underline{31.9\ \%}$$

B-53 0.5-3.0

w_s = 100.0

w_p = 165.3

w_{pw} = 663.5

T_1 = 21°

w_{pws} = 728.0

T_2 = 21°

$$G_s = \frac{.9998(100)}{100 + 663.5 - 728.0} = 2.82$$

$$n = \left(1 - \frac{75.6}{(2.82)(62.4)}\right) \times 100 = \underline{57.0\ \%}$$

APPENDIX C

SLUG TEST DATA

HDR Engineering, Inc.

Client:	White Street Landfill	Project No.	06770-021-018
		Sheet	1/1
Project:	Rising Head Tests	Date:	11/27/95
		Well	B-1
		Reference:	Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	19.63	(water in
Le = Screen Interval Open to Aquifer =	10	casing)
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	33	
Yo = Relative Ht. of Water at Time Zero =	0.31	
Yt = Relative Ht. of Water at Time t =	0.085	
n = Porosity =	0.35	
T = Time (in minutes) =	0.8333	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A =	2.25
B =	0.48

Determination of ln Term

ln Re/Rw = 2.343951

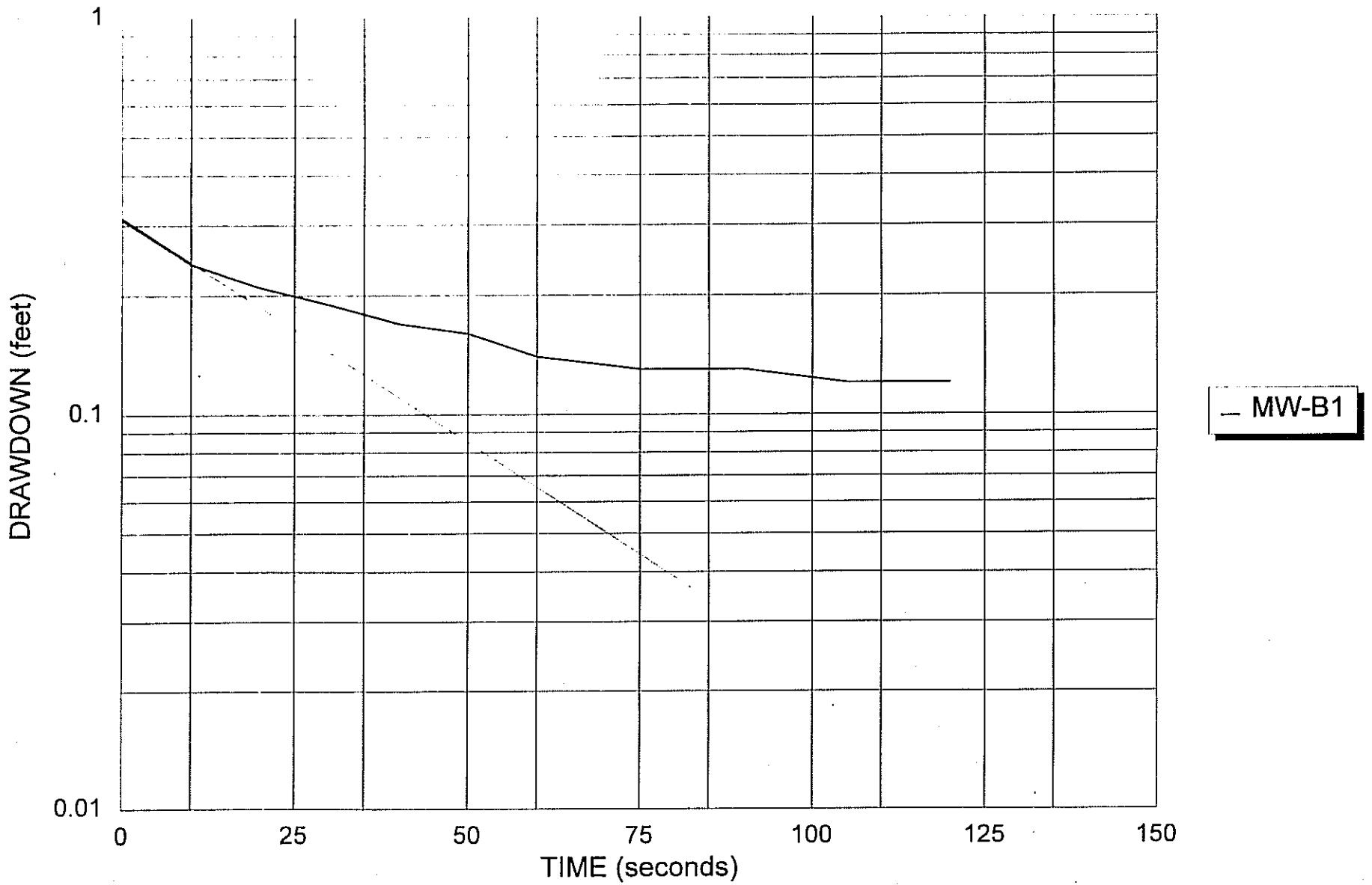
Determination of Hydraulic Conductivity

K = 0.001254 feet/min.

1.805276 feet/day = 6.369×10^{-4} cm/sec

RISING HEAD TEST: MW-B1

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Falling Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-1
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	19.56	(water in
Le = Screen Interval Open to Aquifer =	10	casing)
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	33	
Yo = Relative Ht. of Water at Time Zero =	0.25	
Yt = Relative Ht. of Water at Time t =	0.05	
n = Porosity =	0.35	
T = Time (in minutes) =	2.5	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A =	2.25
B =	0.48

Determination of ln Term

ln Re/Rw = 2.342056

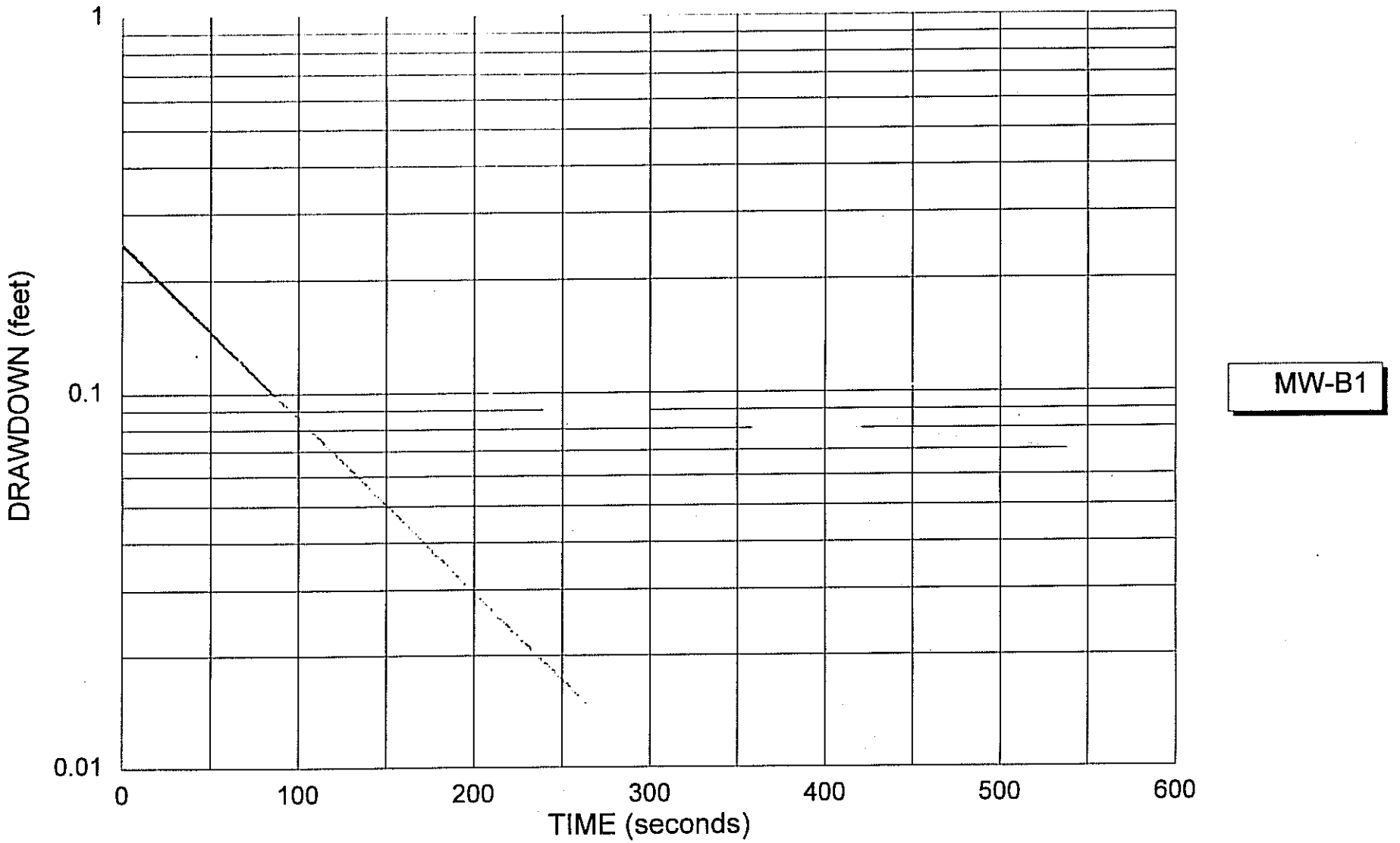
Determination of Hydraulic Conductivity

K = 0.000519 feet/min.

0.74786 feet/day

FALLING HEAD TEST: MW-B1

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Falling Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-14
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	11.73	(water in casing)
Le = Screen Interval Open to Aquifer =	10	
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	16	
Yo = Relative Ht. of Water at Time Zero =	1.24	
Yt = Relative Ht. of Water at Time t =	0.7	
n = Porosity =	0.35	
T = Time (in minutes) =	5	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A =	2.25
B =	0.48

Determination of ln Term

ln Re/Rw = 2.233889

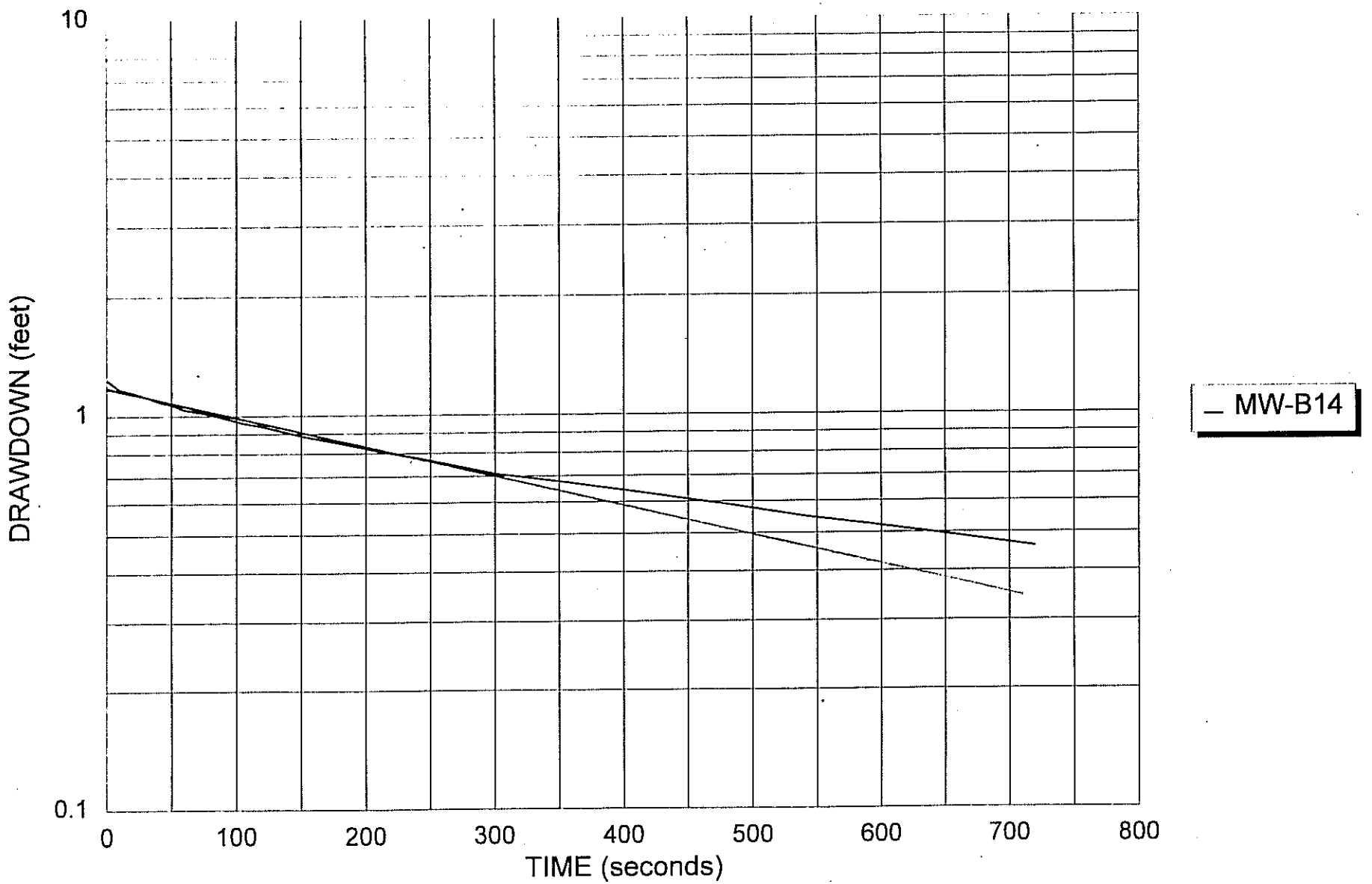
Determination of Hydraulic Conductivity

K = 0.000088 feet/min.

0.126711 feet/day = 4.47×10^{-5} cm/sec

FALLING HEAD TEST: MW-B14

Greensboro White Street Landfill



HDR Engineering, Inc.

Client:	White Street Landfill	Project No.	06770-021-018
		Sheet	1/1
Project:	Falling Head Tests	Date:	11/27/95
		Well	B-17d
		Reference:	Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	27.96	(water in
Le = Screen Interval Open to Aquifer =	5	casing)
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	53	
Yo = Relative Ht. of Water at Time Zero =	1.76	
Yt = Relative Ht. of Water at Time t =	0.8	
n = Porosity =	0.35	
T = Time (in minutes) =	3.33	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

A =	1.9
B =	0.38

Determination of ln Term

ln Re/Rw = 1.93288

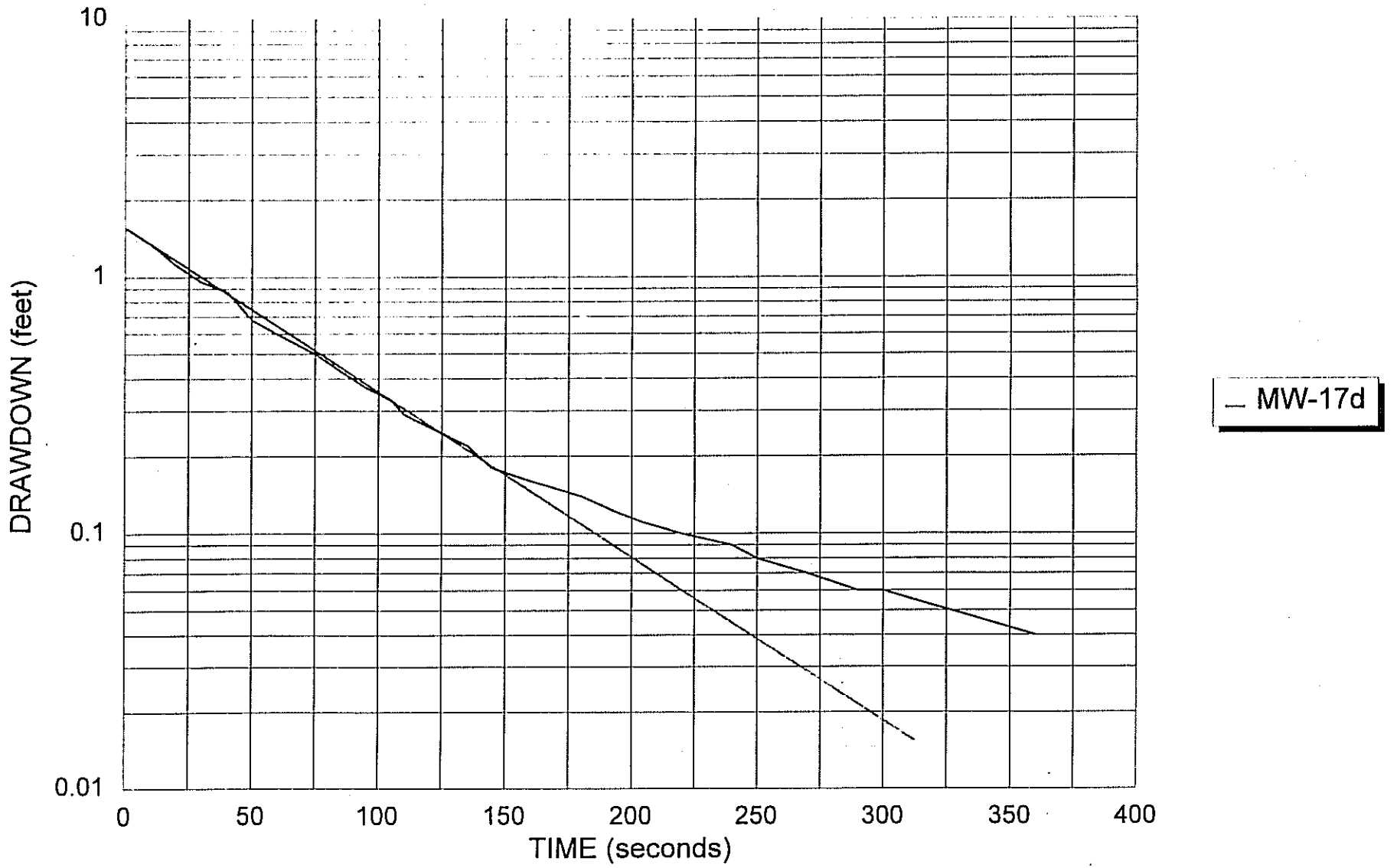
Determination of Hydraulic Conductivity

K = 0.000315 feet/min.

0.454002 feet/day = 1.60×10^{-4} cm/sec

FALLING HEAD TEST: MW-17d

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Rising Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-22
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	20.89	(water in casing)
Le = Screen Interval Open to Aquifer =	10	
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	31	
Yo = Relative Ht. of Water at Time Zero =	1.62	
Yt = Relative Ht. of Water at Time t =	0.09	
n = Porosity =	0.35	
T = Time (in minutes) =	2.92	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A =	2.25
B =	0.48

Determination of ln Term

ln Re/Rw = 2.396367

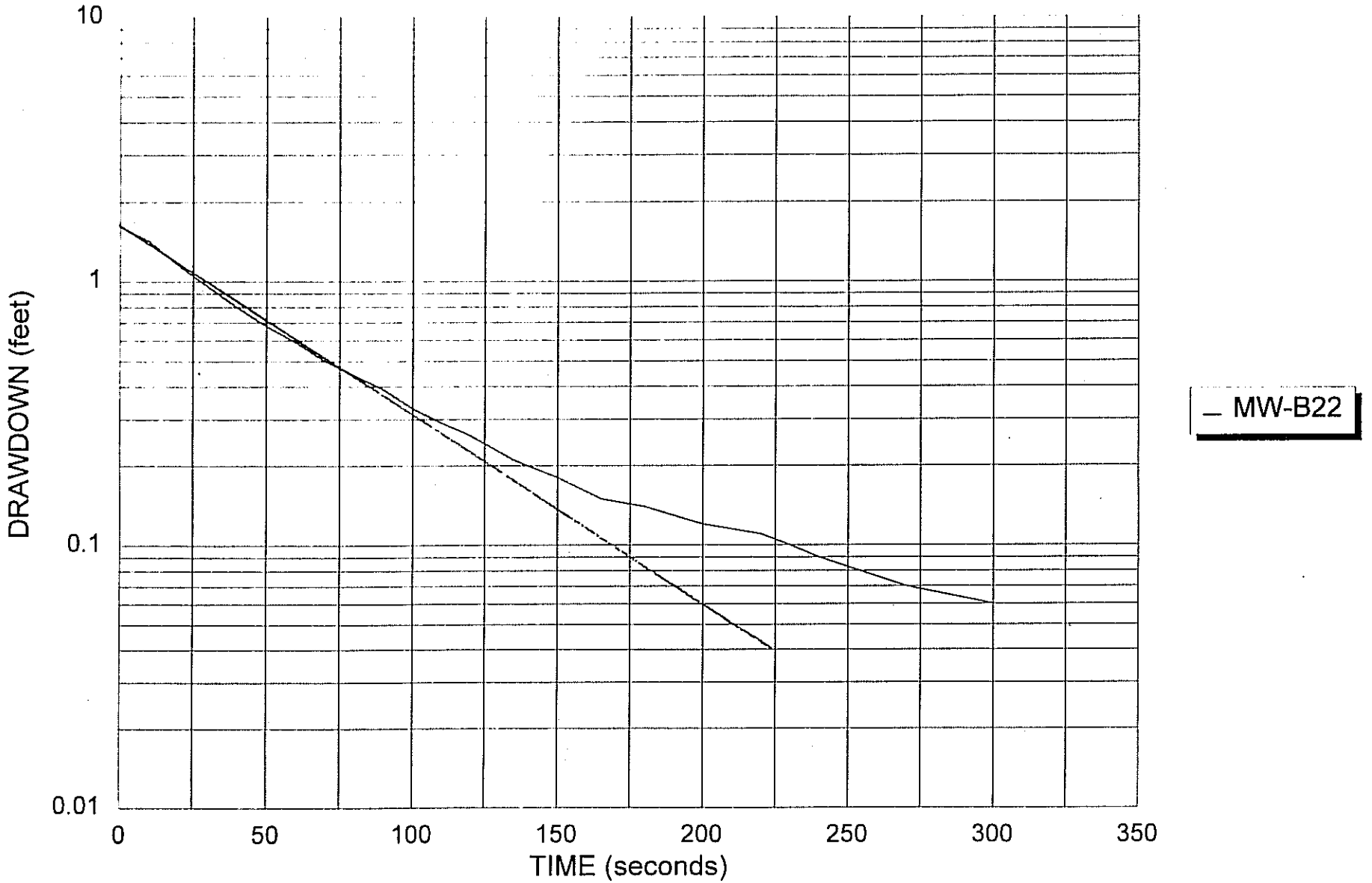
Determination of Hydraulic Conductivity

K = 0.000817 feet/min.

1.176557 feet/day = 4.15×10^{-4} cm/sec

RISING HEAD TEST: MW-B22

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Falling Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-22
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	20.87	(water in
Le = Screen Interval Open to Aquifer =	10	casing)
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	31	
Yo = Relative Ht. of Water at Time Zero =	1.56	
Yt = Relative Ht. of Water at Time t =	0.75	
n = Porosity =	0.35	
T = Time (in minutes) =	0.83	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A =	2.25
B =	0.48

Determination of ln Term

ln Re/Rw = 2.395788

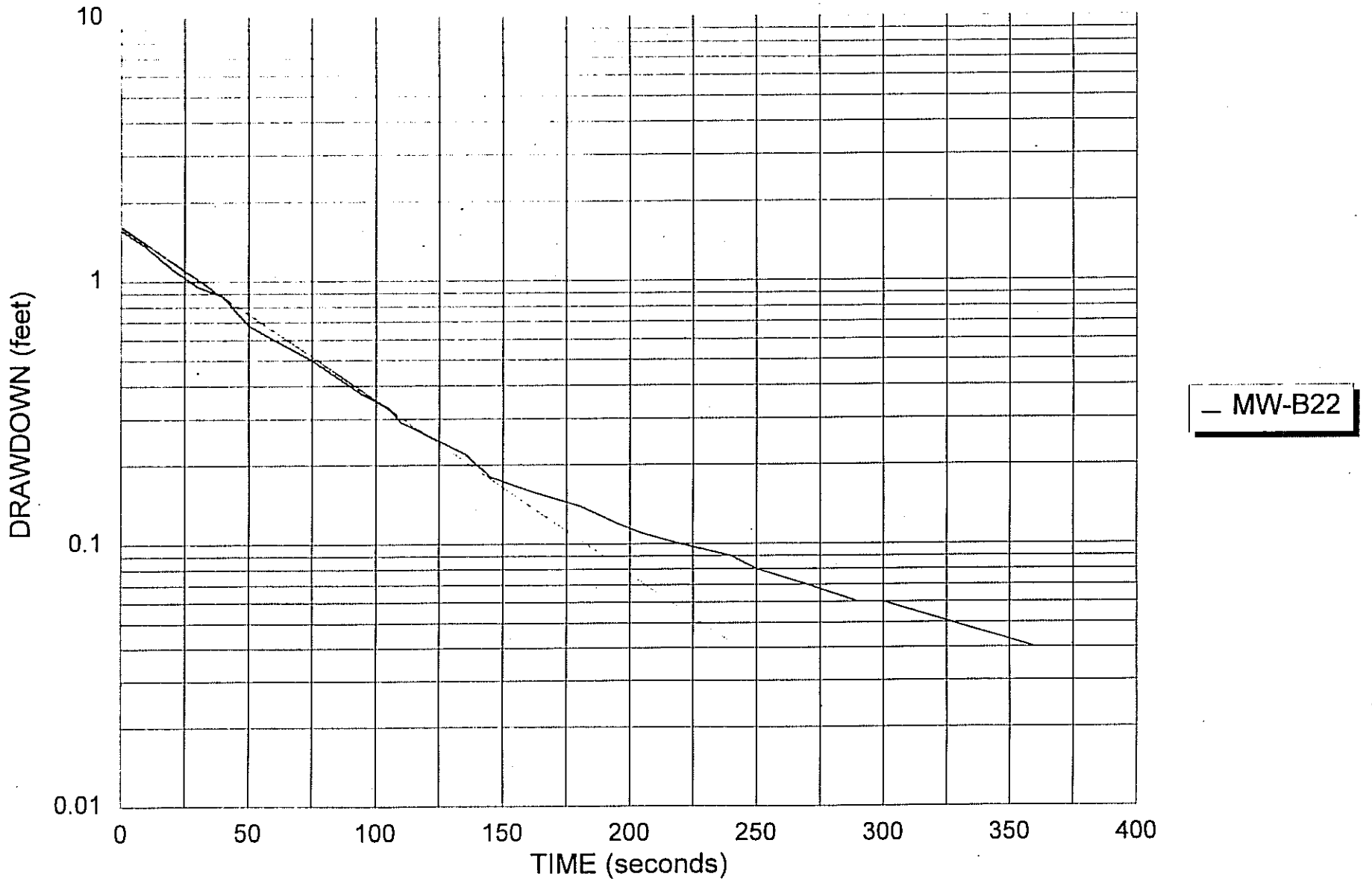
Determination of Hydraulic Conductivity

K = 0.000728 feet/min.

1.048548 feet/day

FALLING HEAD TEST: MW-B22

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Falling Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-22d
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	36.53	(water in casing)
Le = Screen Interval Open to Aquifer =	5	
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	46	
Yo = Relative Ht. of Water at Time Zero =	2.07	
Yt = Relative Ht. of Water at Time t =	2	
n = Porosity =	0.35	
T = Time (in minutes) =	0.83	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

A =	1.9
B =	0.38

Determination of ln Term

ln Re/Rw = 2.106352

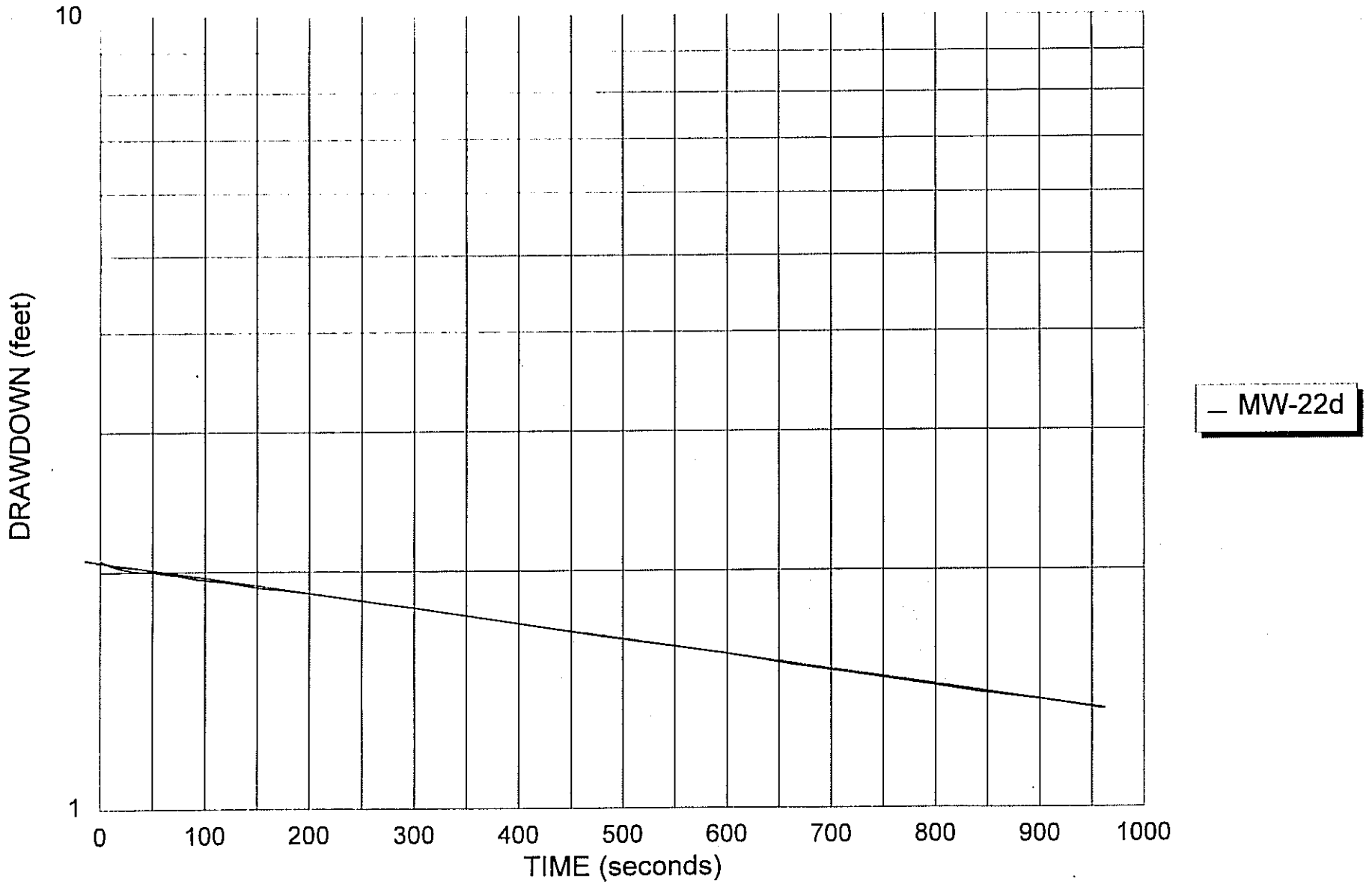
Determination of Hydraulic Conductivity

K = 0.00006 feet/min.

0.086606 feet/day = 3.06×10^{-5} cm/sec

FALLING HEAD TEST: MW-B22d

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Falling Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-25s
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	32.39	(water in casing)
Le = Screen Interval Open to Aquifer =	10	
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	38	
Yo = Relative Ht. of Water at Time Zero =	1.95	
Yt = Relative Ht. of Water at Time t =	0.6	
n = Porosity =	0.35	
T = Time (in minutes) =	7.5	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A =	2.25
B =	0.48

Determination of ln Term

ln Re/Rw = 2.633092

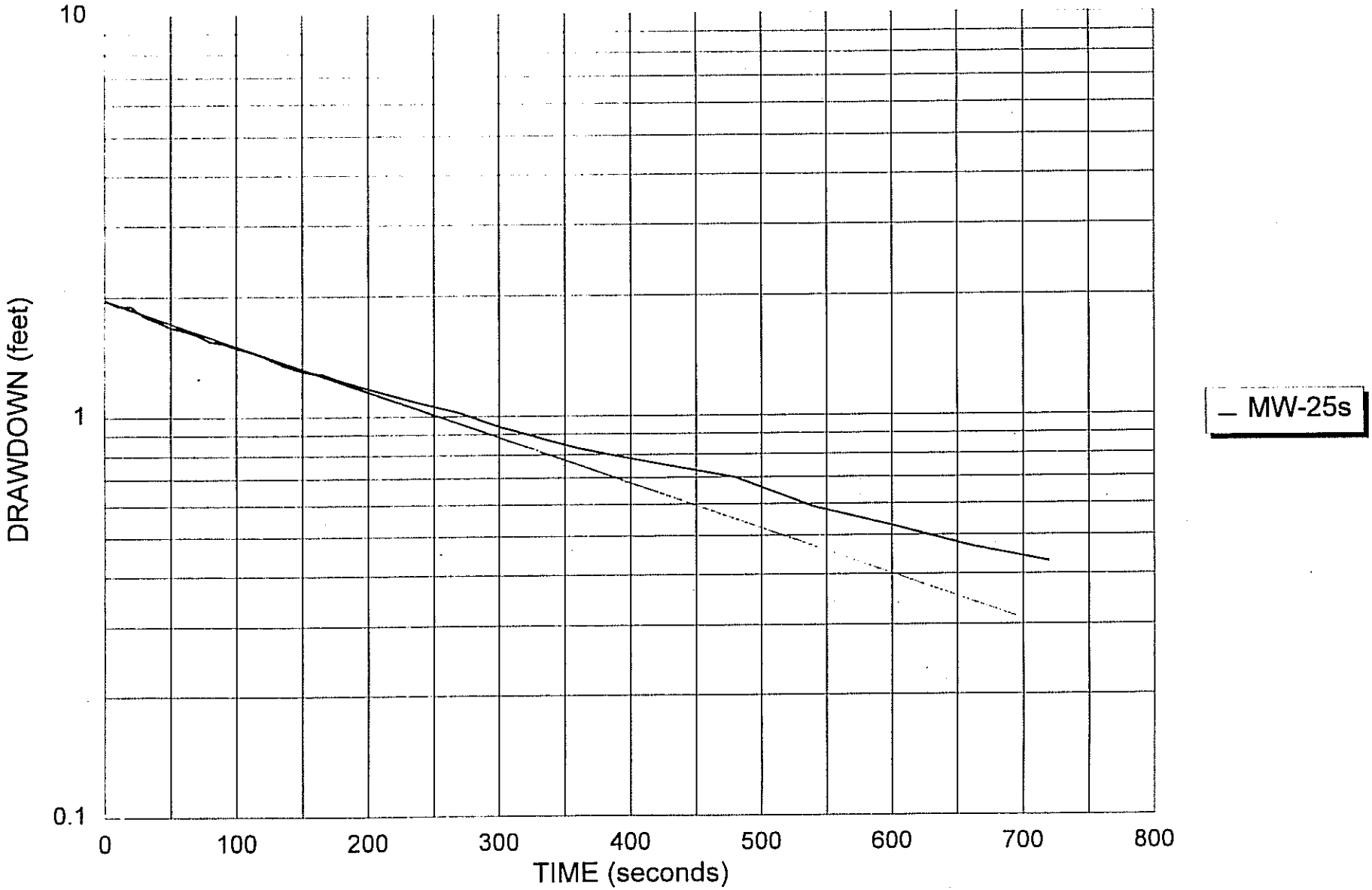
Determination of Hydraulic Conductivity

K = 0.000143 feet/min.

0.205249 feet/day = 7.24×10^{-5} cm/sec

FALLING HEAD TEST: MW-25s

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Falling Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-25d
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	42.05	(water in casing)
Le = Screen Interval Open to Aquifer =	5	
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	52	
Yo = Relative Ht. of Water at Time Zero =	1.9	
Yt = Relative Ht. of Water at Time t =	0.9	
n = Porosity =	0.35	
T = Time (in minutes) =	10	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

A =	1.9
B =	0.38

Determination of ln Term

ln Re/Rw = 2.132193

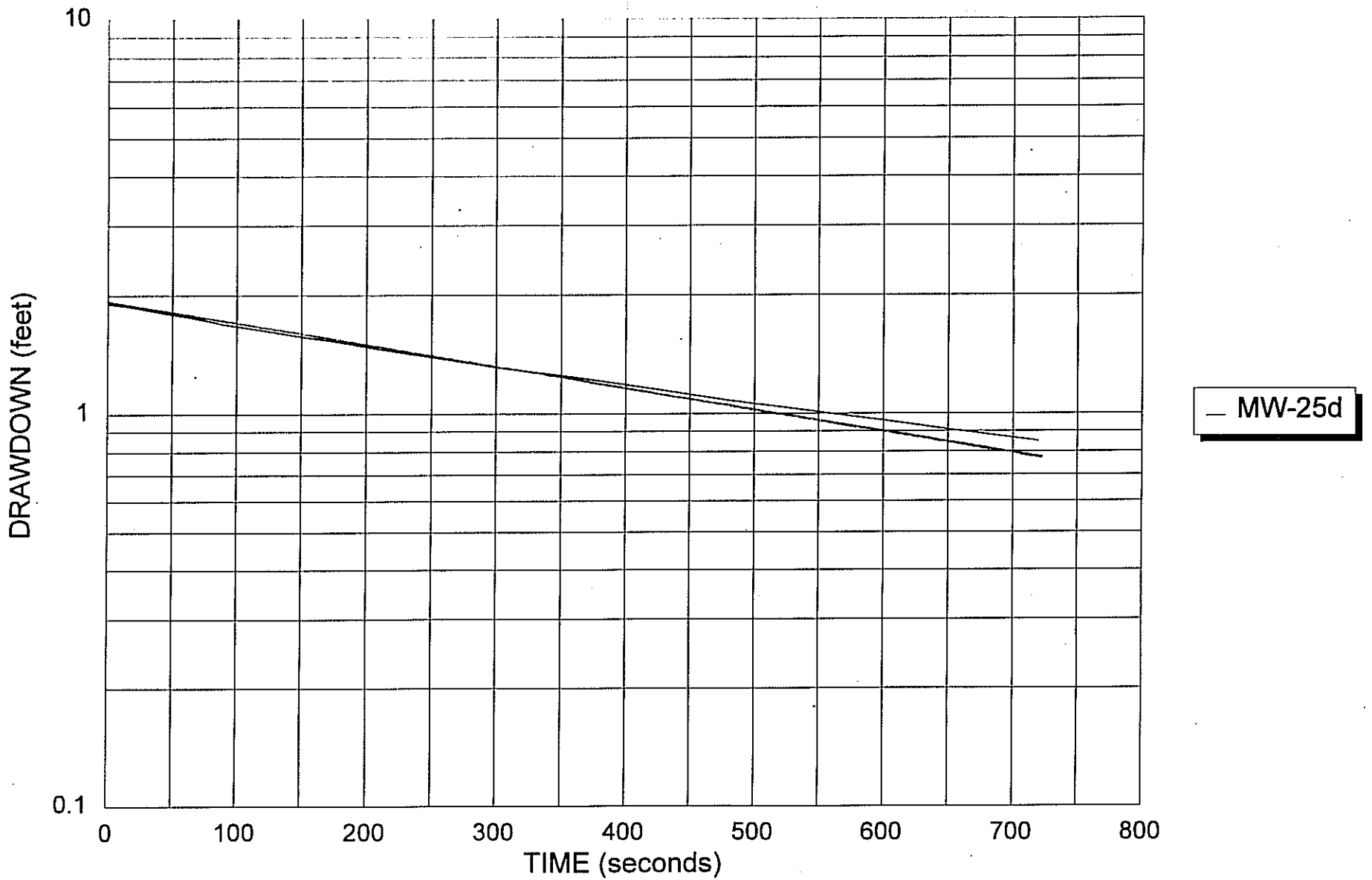
Determination of Hydraulic Conductivity

K = 0.00011 feet/min.

0.158049 feet/day = 5.58×10^{-5} cm/sec

FALLING HEAD TEST: MW-25d

Greensboro White Street Landfill



HDR Engineering, Inc.

Client:	White Street Landfill	Project No.	06770-021-018
		Sheet	1/1
Project:	Falling Head Tests	Date:	11/27/95
		Well	B-31
		Reference:	Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	16.92	(water in
Le = Screen Interval Open to Aquifer =	10	casing)
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	25	
Yo = Relative Ht. of Water at Time Zero =	1.97	
Yt = Relative Ht. of Water at Time t =	0.5	
n = Porosity =	0.35	
T = Time (in minutes) =	9.17	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

A = 2.25

B = 0.48

Determination of ln Term

ln Re/Rw = 2.334245

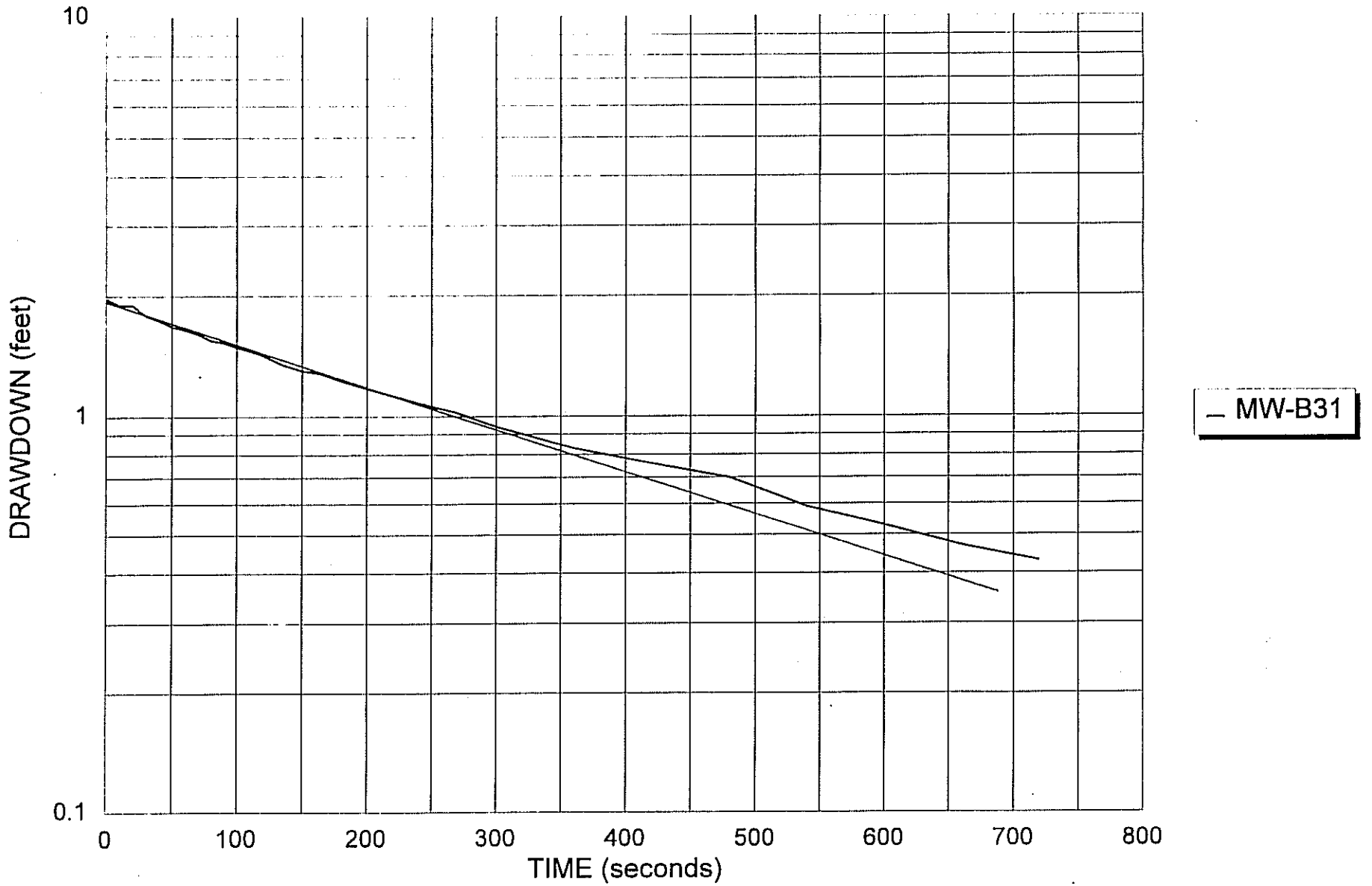
Determination of Hydraulic Conductivity

K = 0.00012 feet/min.

0.173125 feet/day = 6.11×10^{-5} cm/sec

FALLING HEAD TEST: MW-B31

Greensboro White Street Landfill



HDR Engineering, Inc.

Client: White Street Landfill

Project: Rising Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-34
Reference: Bouwer, 1989

Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)

Where: **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1

Lw = Ht. of Water Column in Well =	3.4	(water in
Le = Screen Interval Open to Aquifer =	5	casing)
Rw = Radius of Well Including Sand Pack =	0.375	
Rc = Radius of Casing =	0.083	
H = Aquifer Thickness to First Aquitard =	7	
Yo = Relative Ht. of Water at Time Zero =	0.744	
Yt = Relative Ht. of Water at Time t =	0.06	
n = Porosity =	0.35	
T = Time (in minutes) =	0.2	

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

A =	1.9
B =	0.38

Determination of ln Term

ln Re/Rw = 1.416599

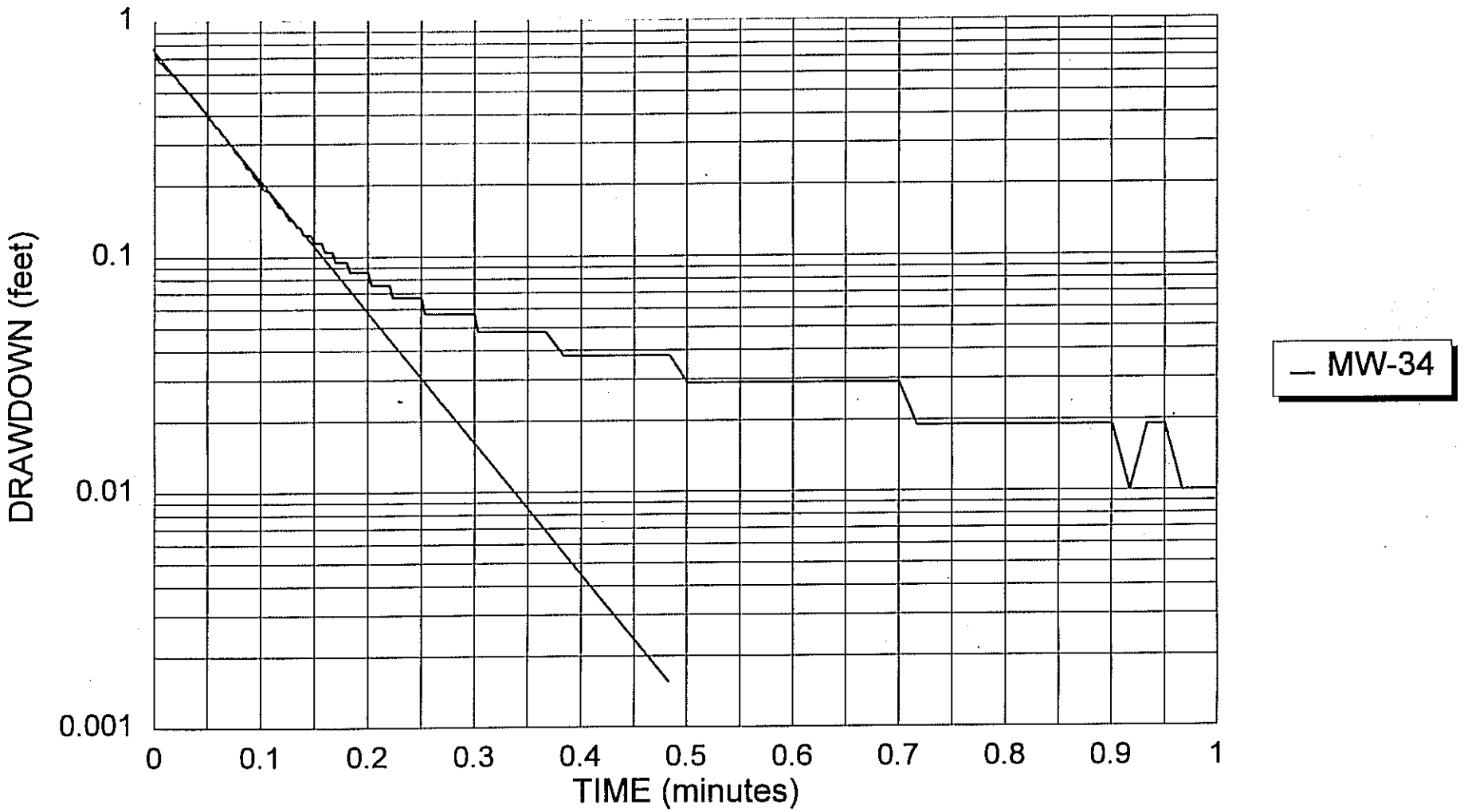
Determination of Hydraulic Conductivity

K = 0.012285 feet/min.

17.69046 feet/day

RISING HEAD TEST: MW-34

Greensboro White Street Landfill



APPENDIX D

MISCELLANEOUS SUPPORT DOCUMENTATION

Job No. 06770-021-018 | No.

HDR Computation

HDR

Project GREENSBORO WHITE STREET LANDFILL	Computed JRI	Date 10/29/96
Subject ESTIMATED LONG-TERM SEASONAL HIGH WATER TABLE	Checked	Date
Task CALCULATION OF LONG-TERM SEASONAL HIGH FACTOR	Sheet 1	Of 1

PROBLEM: SEASONAL HIGH WATER TABLE DATA FOR ON-SITE WELLS DOES NOT TAKE INTO ACCOUNT LONG-TERM EXTREMES IN WATER LEVEL FLUCTUATION.

SOLUTION: DETERMINE MAXIMUM FLUCTUATION IN WATER TABLE FOR THE REGION USING THE HIGHEST HISTORICAL MONTH ON RECORD FOR THE PAST 11 YEARS.

SOURCE OF DATA: USGS WATER RESOURCES DATA, NORTH CAROLINA WATER YEAR 1995 (AND UNPUBLISHED 1996).

CALCULATION:

HIGHEST RECORDED WATER LEVEL IN NC-142 (DAVIE COUNTY)

MARCH 28, 1993 AT 10.64 FT BLS.

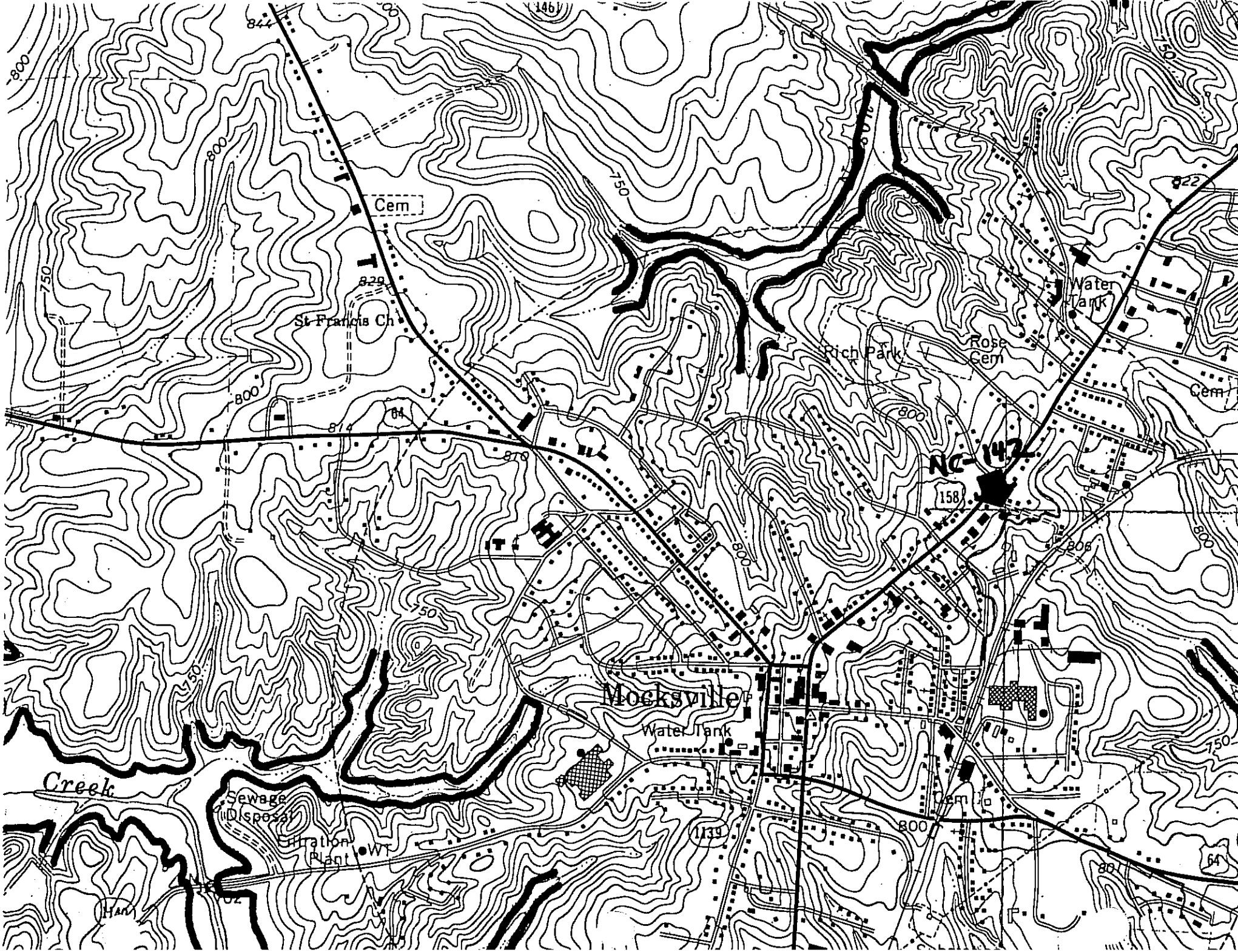
ACTUAL RECORDED WATER LEVEL IN NC-142 ON THE DATE WHICH REPRESENTS THE ON-SITE SEASONAL HIGH (JANUARY 29, 1996)

12.85 FT BLS.

RESULTING DIFFERENCE: 12.85' − 10.64' = 2.21 FT.

ALL ON-SITE DATA FOR THE JANUARY 29, 1996 EVENT WILL BE ADJUSTED TO APPROXIMATE THE LONG-TERM SEASONAL HIGH WATER TABLE BY THE ADDITION OF 2.21 FEET.

ATTACHMENTS: USGS TOPO MAP WITH WELL LOCATION
USGS DATA WITH HYDROGRAPHS FOR NC-142 (1985-1996)



Cem
St Francis Ch
Rich Park
Rose Cem
Water Tank
Cem
NC-142
158
64
Mocksville
Water Tank
Creek
Sewage Disposal
Filtration Plant
WT
1139
Cem
64

DAVIE COUNTY

355359080331701. Local number, NC-142.

LOCATION.--Lat 35°53'59", long 80°33'17", Hydrologic Unit 03040102, 0.5 mi northeast of Mocksville on U.S. Highway 158 at B.C. Brocks Community Center. Owner: U.S. Geological Survey.

AQUIFER.--Unconfined weathered granite of Paleozoic age.

WELL CHARACTERISTICS.--Drilled observation well, drilled to 30.8 ft, diameter 6 in., cased to 30.8 ft, open end, backfilled with gravel from 20 to 30.8 ft.

INSTRUMENTATION.--Digital recorder with a 60-minute punch interval.

DATUM.--Land-surface datum is 835 ft above sea level (from topographic map). Measuring point: Top of casing, 1.00 ft above land-surface datum.

REMARKS.--In October 1982, well replaced nearby NC-110. Well is part of terrane-effects network.

PERIOD OF RECORD.--October 1981 to current year.

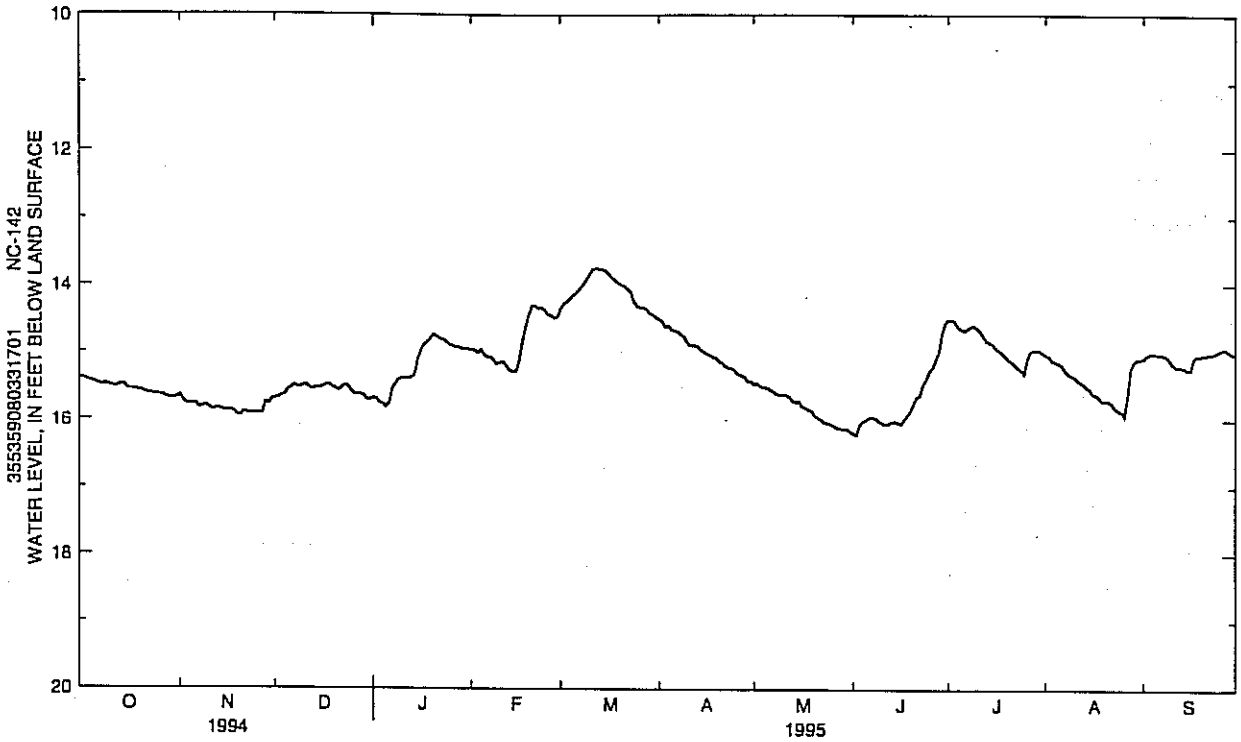
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 10.64 ft below land-surface datum, Mar. 28, 1993; lowest water level recorded, 20.98 ft below land-surface datum, Oct. 24, 25, and 26, 1981.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1994 TO SEPTEMBER 1995

DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.39	15.64	15.69	15.68	14.97	14.36	14.51	15.47	16.20	14.51	15.04	15.09
2	15.39	15.72	15.68	15.70	14.98	14.29	14.55	15.46	16.22	14.51	15.06	15.04
3	15.41	15.77	15.65	15.76	15.02	14.25	14.62	15.50	16.08	14.54	15.12	15.02
4	15.43	15.77	15.63	15.77	14.97	14.20	14.61	15.52	16.02	14.62	15.14	15.02
5	15.44	15.77	15.56	15.82	15.04	14.15	14.67	15.52	16.00	14.65	15.16	15.02
6	15.46	15.77	15.53	15.76	15.09	14.11	14.68	15.55	15.96	14.68	15.19	15.03
7	15.48	15.83	15.49	15.55	15.08	14.06	14.70	15.58	15.96	14.65	15.26	15.03
8	15.49	15.82	15.52	15.48	15.13	14.00	14.74	15.61	15.97	14.61	15.31	15.05
9	15.48	15.79	15.52	15.42	15.18	13.93	14.78	15.63	16.02	14.60	15.34	15.09
10	15.49	15.82	15.49	15.40	15.16	13.85	14.85	15.63	16.04	14.64	15.36	15.15
11	15.51	15.86	15.49	15.39	15.15	13.77	14.90	15.63	16.07	14.69	15.41	15.20
12	15.51	15.85	15.54	15.39	15.22	13.75	14.90	15.66	16.06	14.76	15.44	15.21
13	15.51	15.84	15.54	15.39	15.27	13.76	14.90	15.72	16.03	14.83	15.47	15.21
14	15.48	15.85	15.53	15.35	15.30	13.77	14.95	15.74	16.02	14.85	15.51	15.22
15	15.50	15.87	15.53	15.13	15.29	13.78	14.99	15.73	16.04	14.88	15.55	15.26
16	15.55	15.87	15.52	14.98	15.14	13.83	15.02	15.80	16.06	14.93	15.61	15.25
17	15.55	15.87	15.49	14.90	14.85	13.88	15.04	15.82	16.00	14.97	15.63	15.09
18	15.56	15.88	15.48	14.86	14.62	13.93	15.07	15.85	15.93	15.01	15.67	15.05
19	15.57	15.93	15.52	14.81	14.45	13.97	15.09	15.87	15.87	15.06	15.72	15.05
20	15.57	15.95	15.54	14.75	14.32	14.00	15.13	15.94	15.76	15.11	15.72	15.04
21	15.60	15.89	15.57	14.77	14.31	14.02	15.16	15.97	15.67	15.14	15.72	15.03
22	15.61	15.90	15.54	14.81	14.36	14.06	15.20	16.00	15.63	15.18	15.76	15.03
23	15.62	15.91	15.49	14.82	14.34	14.11	15.23	16.04	15.48	15.22	15.82	15.02
24	15.63	15.91	15.51	14.85	14.39	14.25	15.23	16.05	15.40	15.26	15.85	15.00
25	15.63	15.90	15.57	14.89	14.45	14.32	15.27	16.07	15.28	15.31	15.88	14.97
26	15.64	15.91	15.63	14.91	14.46	14.34	15.32	16.09	15.22	15.11	15.93	14.95
27	15.65	15.90	15.63	14.93	14.50	14.34	15.34	16.12	15.10	14.99	15.64	14.94
28	15.66	15.75	15.63	14.93	14.48	14.37	15.37	16.13	14.99	14.97	15.23	14.98
29	15.69	15.77	15.65	14.96	---	14.43	15.43	16.13	14.72	14.97	15.14	15.01
30	15.69	15.70	15.71	14.96	---	14.45	15.43	16.13	14.56	14.97	15.10	15.03
31	15.68	---	15.71	14.96	---	14.49	---	16.17	---	15.01	15.10	---

WTR YR 1995 MEAN 15.25 HIGH 13.75 LOW 16.22


355359080331701 NC-142
WATER LEVEL, IN FEET BELOW LAND SURFACE
10
12
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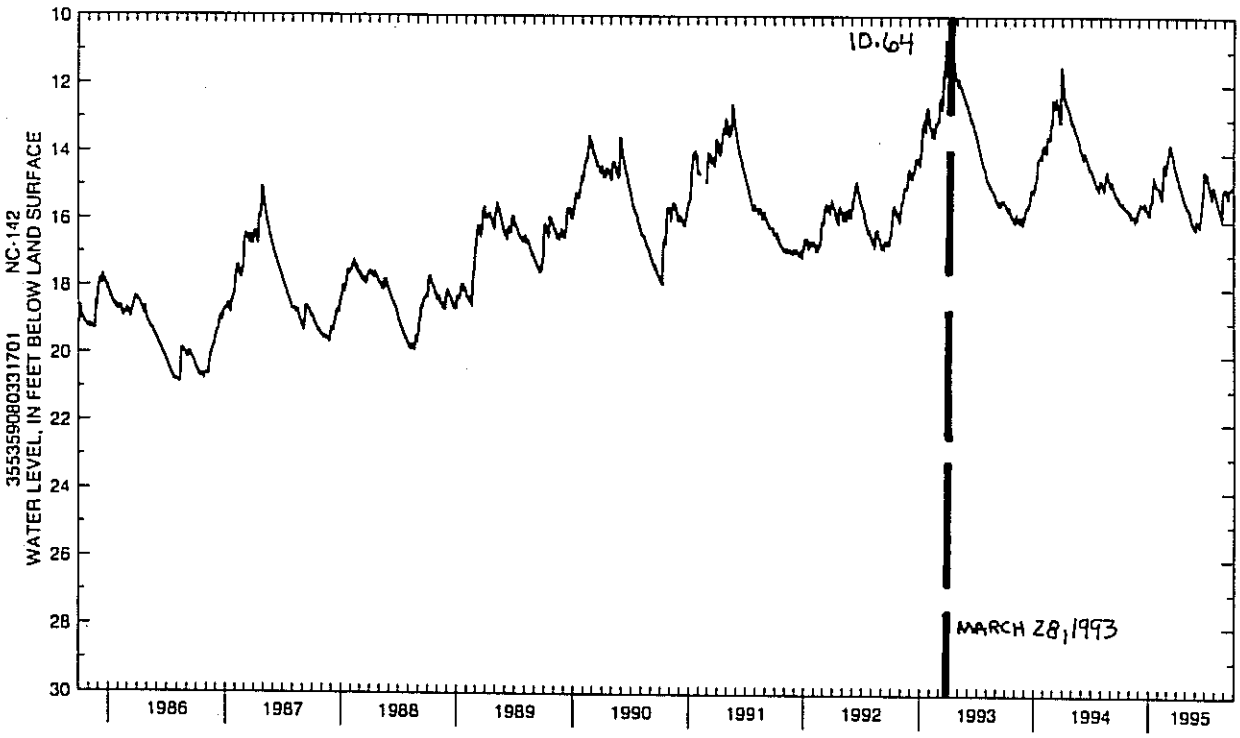
355359080331701 NC-142
WATER LEVEL, IN FEET BELOW LAND SURFACE
10
12
14
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10.64
MARCH 28, 1993
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995

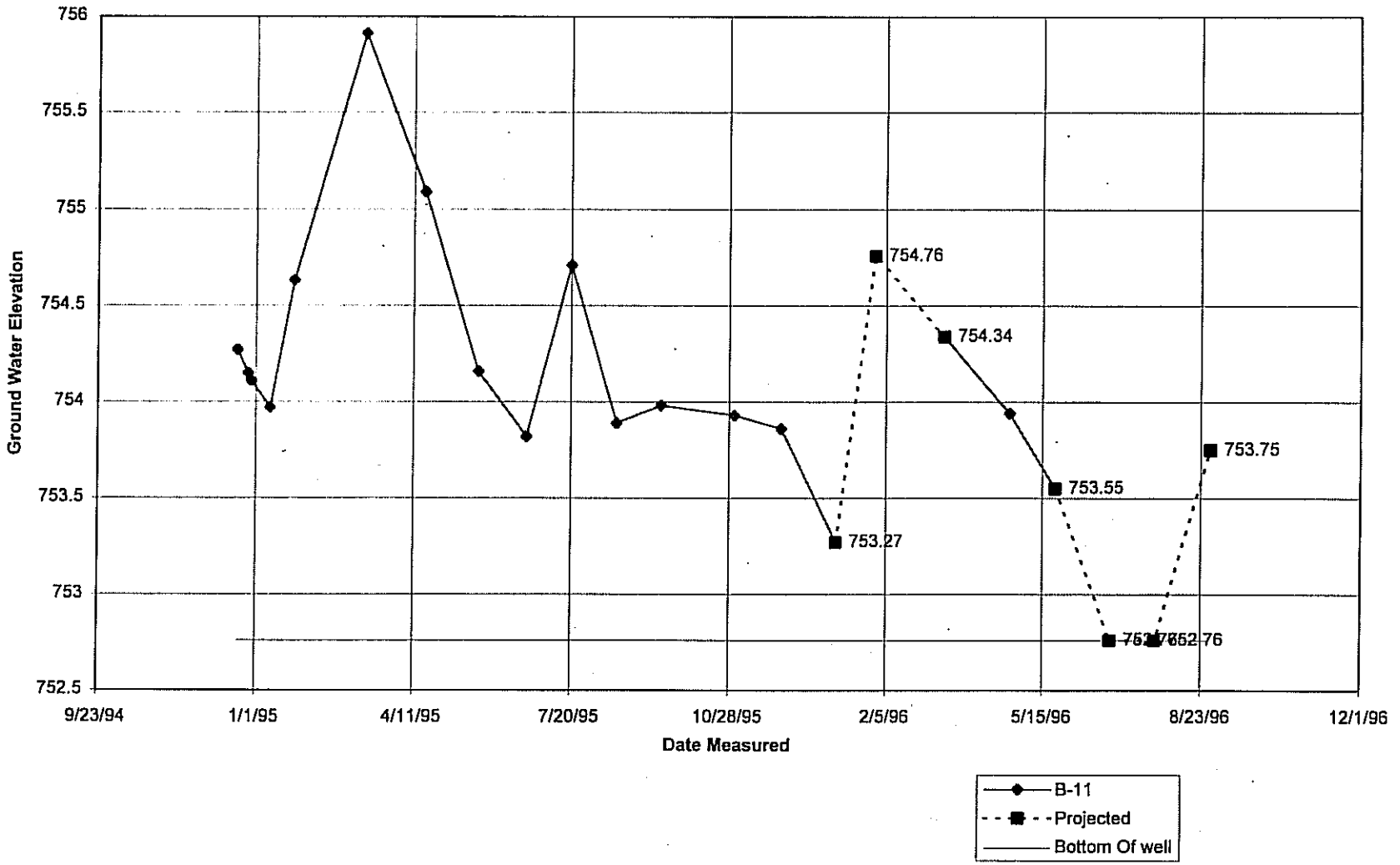
UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - NORTH CAROLINA DISTRICT 10/09/96

STATION NUMBER 355359080331701 DV-025 (NC-142) MOCKSVLL WELL SOURCE AGENCY USGS
LATITUDE 355359 LONGITUDE 0803317 WELL DEPTH 30.75 GEOLOGIC UNIT 000SPRL DATUM 835.00
PROVISIONAL DATA SUBJECT TO REVISION

DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET), WATER YEAR OCTOBER 1995 TO SEPTEMBER 1996
DAILY MEAN VALUES

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.03	14.33	14.16	14.29	12.90	13.14	12.62	12.95	13.82	14.47	15.23	15.72
2	15.03	14.29	14.24	14.28	12.85	13.13	12.67	12.89	13.84	14.49	15.23	15.77
3	15.04	14.27	14.25	14.26	12.71	13.24	12.65	12.89	13.84	14.50	15.25	15.79
4	15.03	14.32	14.27	14.30	12.71	13.31	12.62	12.89	13.86	14.55	15.28	15.74
5	14.79	14.32	14.31	14.39	12.70	13.24	12.69	12.94	13.89	14.61	15.29	15.67
6	14.66	14.29	14.32	14.41	12.68	13.19	12.70	12.98	13.92	14.63	15.31	15.58
7	14.59	14.17	14.33	14.35	12.65	13.13	12.71	13.08	13.93	14.64	15.34	15.53
8	14.56	14.09	14.36	14.25	12.57	13.05	12.77	13.06	13.96	14.66	15.36	15.50
9	14.57	14.06	14.28	14.35	12.51	13.02	12.76	13.08	13.96	14.69	15.38	15.49
10	14.57	14.03	14.26	14.29	12.49	13.00	12.78	13.11	13.93	14.78	15.42	15.49
11	14.59	13.92	14.24	14.33	12.42*	12.92	12.79	13.09	13.90	14.83	15.44	15.45
12	14.63	13.93	14.23	14.26	12.54	12.84	12.77	13.15	13.90	14.84	15.43	15.30
13	14.64	13.87	14.22	14.19	12.57	12.83	12.78	13.22	13.92	14.84	15.40	15.22
14	14.61	13.80	14.19	14.22	12.48	12.86	12.82	13.26	13.95	14.88	15.39	15.22
15	14.59	13.84	14.18	14.14	12.58	12.85	12.82	13.27	13.96	14.93	15.41	15.22
16	14.66	13.87	14.21	14.02	12.64	12.94	12.82	13.24	13.99	14.98	15.43	15.22
17	14.74	13.90	14.29	13.86	12.72	12.97	12.93	13.26	14.02	14.99	15.44	15.19
18	14.75	13.88	14.27	13.68	12.77	12.98	12.93	13.33	14.03	15.02	15.47	15.20
19	14.75	13.88	14.12	13.45	12.84	12.82	12.93	13.36	14.05	15.03	15.49	15.21
20	14.72	13.90	14.20	13.38	12.84	12.79	12.95	13.38	14.07	15.06	15.51	15.22
21	14.68	13.89	14.22	13.26	12.87	12.79	12.97	13.41	14.09	15.12	15.52	15.23
22	14.68	13.96	14.23	13.23	12.86	12.80	12.96	13.48	14.13	15.14	15.54	15.23
23	14.68	13.97	14.24	13.22	12.90	12.84	12.93	13.56	14.17	15.19	15.57	15.26
24	14.66	14.04	14.24	13.16	12.99	12.85	13.00	13.59	14.23	15.22	15.59	15.29
25	14.65	14.05	14.22	13.25	13.04	12.84	12.97	13.62	14.26	15.23	15.61	15.28
26	14.65	14.04	14.25	13.21	13.01	12.88	12.95	13.64	14.32	15.23	15.62	15.34
27	14.63	14.04	14.26	13.02	13.04	12.98	13.06	13.65	14.35	15.23	15.62	15.35
28	14.42	14.09	14.32	12.97	13.05	12.87	13.11	13.68	14.37	15.24	15.63	15.35
29	14.40	14.13	14.35	12.85	13.15	12.70	13.07	13.66	14.41	15.24	15.65	15.38
30	14.37	14.18	14.34	12.78	---	12.69	12.98	13.74	14.43	15.23	15.67	---
31	14.35	---	14.29	12.79	---	12.64	---	13.78	---	15.23	15.70	---
MEAN	14.67	14.04	14.25	13.76	12.76	12.94	12.85	13.30	14.05	14.93	15.46	---
MAX	15.04	14.33	14.36	14.41	13.15	13.31	13.11	13.78	14.43	15.24	15.70	---
MIN	14.35	13.80	14.12	12.78	12.42	12.64	12.62	12.89	13.82	14.47	15.23	---

Estimation of Water Elevation
January 29, 1996
for Monitor Well B-11



11/7/96