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GEOTECHNICAL INVESTIGATION
FOR
CITRUS COUNTY CENTRAL LANDFILL
NEW DISPOSAL CELL
S.R. 44
CITRUS COUNTY, FL

ORDER NO. 26081-001-02
REPORT NO. 21355

Prepared by:

Universal Engineering Sciences, Inc.
4475 SW 35th Terrace
Gainesville, FL 32608
(352) 372-3392

October 14, 2002

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October 14, 2002

SCS Engineers
3012 U. S. Highway 301 North, Suite 700
Tampa, FL 33619-2242

Attention: Mr. Bruce Clark, P. E., D. E. F.

Reference: Citrus County Central Landfill
New 9.5 Acre Waste Disposal Cell
S.R. 44
Citrus County, FL
Order No. 26081-001-02 Report No. 21355

Dear Mr. Clark:

Universal Engineering Sciences, Inc., has completed the subsurface investigation and engineering evaluation for the proposed construction at the above referenced location. Our investigation was performed in accordance with our proposal No.21447, which was authorized by Raymond J. Dever, P.E., D.E.F. with SCS Engineers on October 9, 2001.

This report contains the results of our investigations, an engineering interpretation of these with respect to the project characteristics described to us, and recommendations for side slopes excavations and filling, foundation design and site preparation.

We appreciate the opportunity to have worked with you on this project and look forward to a continued association. If you have any questions concerning this report or if we may further assist you as your plans proceed, please contact us.

Respectfully submitted,

UNIVERSAL ENGINEERING SCIENCES, INC.

Eduardo Suarez
Project Engineer

Andrew T. Schmid, P.E.
Project Engineer
Florida P.E. No. 56002

Jack W. Ray
Regional Manager

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1.0 INTRODUCTION

1.1 GENERAL

In this report, we present the results of the subsurface investigation of the site for the proposed New Disposal Cell for the Citrus County Landfill in Citrus County, FL. We have divided this report into the following sections:

- SCOPE OF SERVICES - Defines what we did
- FINDINGS - Describes what we encountered
- RECOMMENDATIONS - Describes what we encourage you to do
- LIMITATIONS - Describes the restrictions inherent in this report
- SUMMARY - Reviews the material in this report
- APPENDICES - Presents support materials referenced in this report.

2.0 SCOPE OF SERVICES

2.1 PROJECT DESCRIPTION

We understand this project will consist of a new disposal cell for the Citrus County central landfill. The maximum anticipated height of the landfill is approximately 100 feet above natural land surface with the maximum bottom depth of 80 feet below natural land surface.

The project information was provided by Bruce Clark which included a copy of a site plan with existing footprint of the landfill. The area for the proposed construction is approximately 9.5 acres.

The project is located on S.R. 44 west of Inverness in the southwest quadrant of Citrus County. Site topography is shown on the U.S.G.S. topographical map presented in Appendix A.

Our recommendations are based upon the above considerations. If any of this information is incorrect or if you anticipate any changes, inform Universal Engineering Sciences so that we may review our recommendations.

2.2 PURPOSE

The purposes of this investigation were:

- to investigate the general subsurface conditions at the site;

- to interpret and review the subsurface conditions with respect to the proposed construction; and

- to provide geotechnical engineering recommendations for side slope stability for excavation of native soil and slope of waste material, estimated bearing capacity, settlement, and groundwater elevation.

This report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. Universal Engineering Sciences would be pleased to perform these services, if you desire.

2.3 USDA SOIL SURVEY DATA AND USGS SITE TOPOGRAPHY.

Review of the USDA Soil Conservation Service (SCS) Soil Survey of Citrus County indicated that the landfill is located on a SCS classification of Lake Series. This nearly level to moderately, excessive drained, rapidly permeable to moderately rapid permeable soils are formed in sandy marine, eolian, or fluvial deposits. SCS soil map unit descriptions generally compare favorably with our findings for this site. An SCS site map as well as a USGS site topography for the area of the proposed construction are shown in Appendix A.

2.4 FIELD INVESTIGATION

The subsurface conditions were investigated with ten borings advanced to depths of 30 to 120 feet, while performing the Standard Penetration Test.

We performed the Standard Penetration Test in each of the borings according to the procedures of ASTM D-1586, with continuous sampling performed, to detect slight variations in the soil profile. The basic procedure for the Standard Penetration Test is as follows: A standard split-barrel sampler is driven into the soil by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler 1-foot, after seating 6 inches, is designated the penetration resistance, or N-value; this value is an index to soil strength and consistency.

The general location of each boring is shown on the attached drawing. You should consider the indicated depths and locations to be approximate

Jar samples of the soils encountered will be held in our laboratory for your inspection for 90 days and then discarded, unless we are notified otherwise.

2.5 LABORATORY INVESTIGATION

The soil samples recovered from the soil test borings were returned to our laboratory and then an engineer visually examined and reviewed the field descriptions. We selected representative soil samples for laboratory testing consisting of soil gradation determinations, Atterberg Limits tests, wash No. 200 sieve analyses, permeability tests, and L.B.R.test..

We performed these tests to aid in classifying the soils and to help to evaluate the general engineering characteristics of the site soils. See Appendix C: Summary of Laboratory Test Results and Description of Testing Procedures, for further data and explanations.

3.0 FINDINGS

3.1 SURFACE CONDITIONS

A Universal Engineering Sciences engineer performed a visual site inspection of the subject property to gain a "hands-on" familiarity with the project area.

The site is located on S.R. 44 in Citrus County, FL. The existing site is the current county landfill, with a fill mound approximately 60 feet high on the north end of the site.

3.2 GENERAL GEOLOGY

The subject area lies on the eastern flank of the Brooksville Ridge, igneous and metamorphic basement rocks are overlain by 4,000 feet of sedimentary rocks. Generally, these sedimentary rocks are composed of a thick sequence of carbonates (limestones and dolomite)which are overlain clastics that include quartz, silts, clayey sands and clays. Eocene age limestones and dolomite known as the Ocala Group and the Avon Park Limestone cap this thick sequence. Within the Brooksville Ridge the Ocala Group and the Avon Park Limestone are capped by a highly variable sands and clayey sand ranging in thickness from 10 to over 100 feet in some areas.

The general hydrogeology of Citrus County includes an unconfined surficial aquifer and the Florida aquifer. The top of the Floridan Aquifer is defined as the first consistent limestone below which no clay confining bed occurs. The configuration of the top of the aquifer is highly variable due to erosion and dissolution in the limestone that forms its upper boundary.

3.3 SUBSURFACE CONDITIONS

The boring locations and detailed subsurface conditions are illustrated in Appendix B: Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are generally based upon visual characterizations of the recovered soil samples and a limited number of laboratory tests. Also, see Appendix B: Soils Classification Chart, for further explanation of the symbols and placement of data on the Boring Logs.

Groundwater was encountered at approximately 120 feet below the existing ground surface. Based on the Potentiometric Surface Map from U.S. Geological Survey, the Citrus County Soils Survey, and in-situ soils, we estimate the groundwater level will be 5 msl. It should be noted that the borings were preformed during a period of below normal rainfall for Central Florida.

The soil profile in the subjected area consist of loose to medium dense tan to brown fine SAND from surface grade to a depth of approximately 20 to 25 feet below surface grade, where a 10 to 15 feet of medium dense orange and gray clayey SAND is present. Beneath this layer there typically lies a medium dense to very dense orange to tan or white fine SAND to the maximum boring depth of 120 feet. Lenses of gray and orange slightly clayey SAND were encountered from 50 to 60 feet below grade.

4.0 RECOMMENDATIONS

4.1 GENERAL

The following recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. If plans change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

Additionally, if subsurface conditions are encountered during construction which were not encountered in the borings, report those conditions immediately to us for observation and recommendations.

In this section of the report, we present our detailed recommendations for side slope stability for excavation of native soil and slope of waste material, estimated bearing capacity and settlement, site preparation, and construction related services.

4.2 LANDFILL

4.2.1 Foundation Bearing Capacity

We understand that the maximum anticipated height of the landfill is approximately 100 feet above the natural land surface with maximum bottom depth of 80 feet below natural land surface. We estimate that the additional height of 180 feet of fill will dd approximately 9,000 psf of load onto the excavated subgrade. The maximum allowable net soil bearing pressure for the excavated subgrade will be approximately15,000 pounds per square foot (psf), resulting in a factor of safety of more than 1.5. Net bearing pressure is defined as the soil bearing pressure at the base of the foundation in excess of the natural overburden pressure.

4.2.2 Settlement Estimates

Post-construction settlement of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils; (2) landfill size, bearing level, applied loads, and resulting bearing pressures beneath the landfill; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from offsite sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Due to the sandy nature of the surficial soils and the anticipated fill, after the landfill operations, we expect a significant portion of settlement to be elastic in nature and occur relatively quickly, on application of the loads, during and immediately following construction. We estimate that the additional height of fill will add approximately 9,000 psf of load onto the subgrade. We used strain analysis to estimate the amount of additional settlement that can be anticipated. We estimate that the additional landfill will result in approximately less than 6 inches of additional settlement. Differential settlement is estimated to be 3 inches or less.

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. The settlement calculations are based upon the use of stress strain theory and assuming short term end of construction.

We recommend positive drainage be established and maintained on the site during construction. We further recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project.

4.2.3 Landfill Slope Stability

For the existing and the proposed subgrade conditions, and the landfill geometry, we performed slope stability analysis. We used the STABL computer program for the analysis of slope stability by a two-dimensional limiting equilibrium method.
Graphic output indicating the minimum factor of safety for the ten most critical of the trial failure surfaces examined are attached in appendix D. Safety factor were calculated by the modified Bishop method. Assuming properties for landfill waste material, we estimate a factor of safety of 1.3, using a slope of 2H:1V for the additional waste material.

4.2.4 Subgrade Slope Stability

For the excavated native soils, we performed slope stability analysis. We determine the factor of safety for different sides slope for excavated native soils. We used STABL computer program for the analysis of the slope stability.

Appendix D show the different graphic output indicating the ten most critical of the trial failure surfaces examined and their factor of safety. Safety factor were calculated by the modified Bishop method.. We computed the factor of safety for side slopes starting from 0.5H:1V to 2H:1V. We estimate a factor of safety of 1.3 for excavated native soil with a slope of 1.5H:1V.

4.3 FILL SUITABILITY

We believe the onsite soils resulting from excavations will vary, in terms of their suitability for use as engineered backfill and fill. The layer of brown and tan fine sand (approximately 7 percent soil fines, Unified Soil Classification " SM") will be the most suitable for use as engineered fill. These soils may require some moisture conditioning to facilitate compaction. The clayey sands with less than 30 percent soil fines (Unified Soil Classification "SC") can be used as fill but will require stringent moisture control during placement and compaction, particularly during rainy periods. Very clayey sands, sandy clays and clays should not be used as fill.

4.4 CONSTRUCTION RELATED SERVICES

We recommend the owner retain Universal Engineering Sciences to perform construction materials tests and observations on this project. The geotechnical engineering design does not end with the advertisement of the construction documents. The design is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, we are most qualified to address problems that might arise during construction in a timely and cost-effective manner.

5.0 LIMITATIONS

During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. An Association of Engineering Firms Practicing in the Geosciences (ASFE) publication, "Important Information About Your Geotechnical Engineering Report" appears in Appendix E, and will help explain the nature of geotechnical issues.

Further, we present documents in Appendix E: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

6.0 SUMMARY

We understand this project will consist of a new disposal cell for the Citrus County central landfill. The maximum anticipated height of the landfill is approximately 100 feet above natural land surface with the maximum bottom depth of 80 feet below natural land surface.

We have performed field and laboratory investigations to provide geotechnical engineering recommendations for side slope stability for excavation of native soil and slope of waste material, estimated bearing capacity, settlement, and groundwater elevation.

We generally encountered medium dense sandy soils with lenses of clayey sands. These soils should provide good support for the landfill. We estimate the groundwater level will be 5 msl. The geotechnical investigation did not detect any significant indicators of any zones of especially loose or soft soils.

We recommend good practice site preparation procedures. These procedures include: proof-rolling and compacting the subgrade.

We hope this report meets your needs and discusses the problems associated with the proposed drug store. We would be pleased to meet with you and discuss any geotechnical engineering aspects of the project.

APPENDIX A

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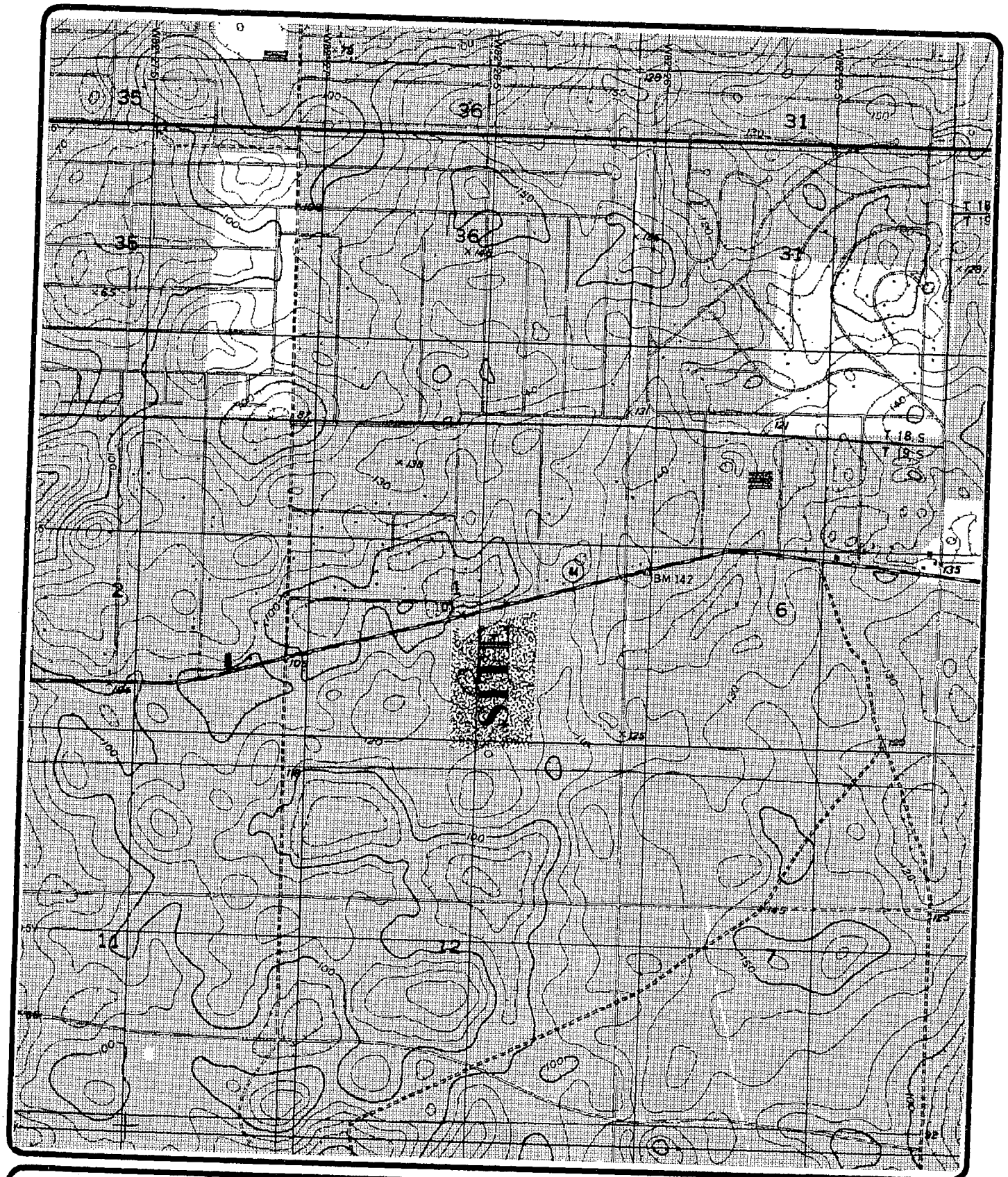
CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

SOIL SURVEY MAP

DRAWN BY:	DATE: 11/16/01	CHECKED BY: ES	DATE: 11/19/01
SCALE: NTS	ORDER NO: 26081-001	REPORT NO: 21607	PAGE NO: A - 2



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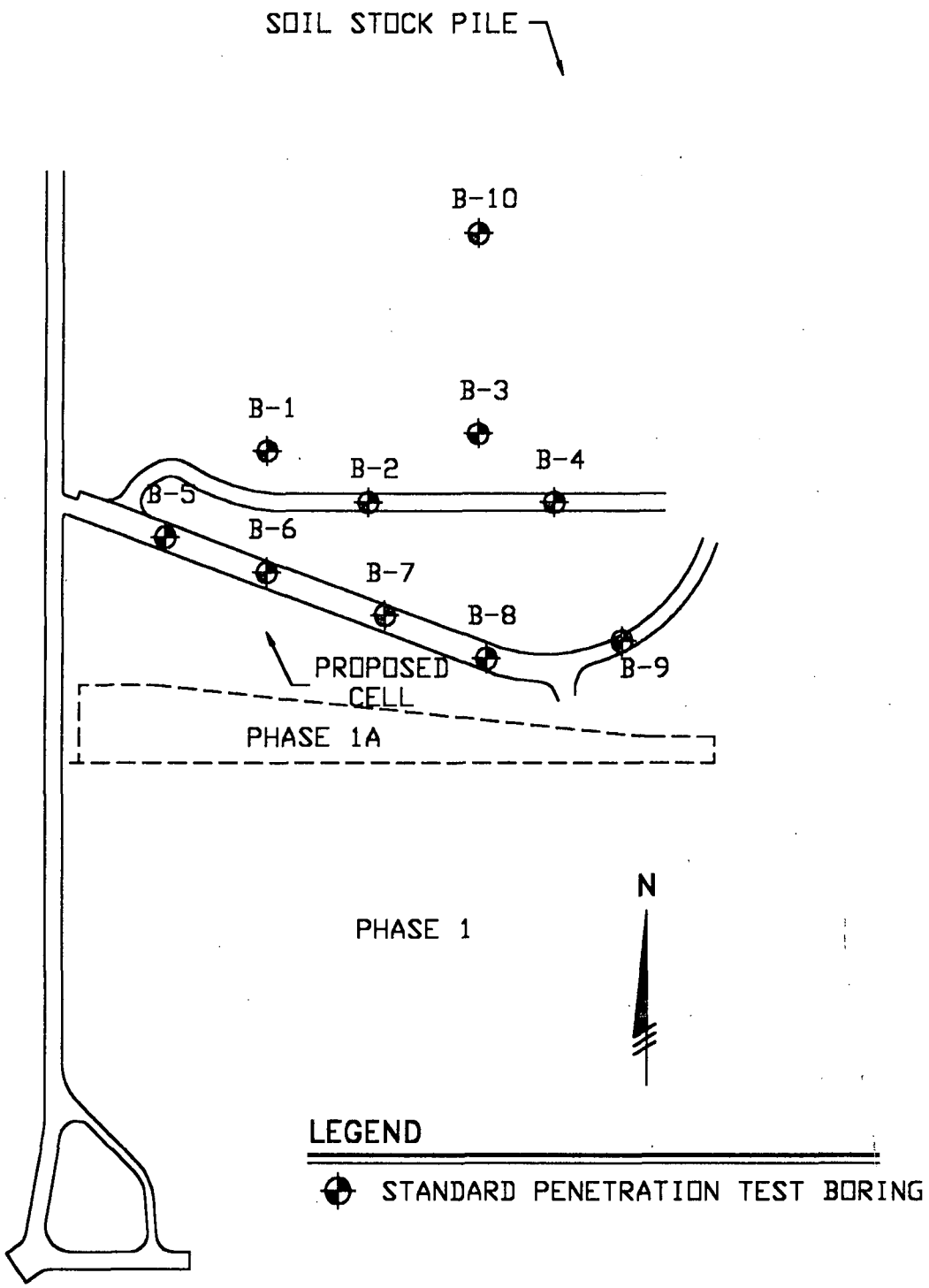
CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

SITE LOCATION MAP

DRAWN BY:	DATE: 11/16/01	CHECKED BY:	DATE: 11/19/01
SCALE: 1" =16,000'	ORDER NO: 26081-001	REPORT NO: 21607	PAGE NO: A - 1

APPENDIX B



26081-A

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CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING LOCATION PLAN

DRAWN BY:	DATE: 11/16/01	CHECKED BY: ES	DATE: 11/19/01
SCALE: NTS	ORDER NO: 26081-001	REPORT NO: 21607	PAGE NO: B - 1

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BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-2

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-1** SHEET: **1 of 2**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 118.70 DATE STARTED: 10/31/01
WATER TABLE (ft): NE DATE FINISHED: 10/31/01
DATE OF READING: 10/31/01 DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Loose orange to tan fine SAND [SP/SM]						
	X	5-2-2	4									
	X	1-2-2	4			Woodchips & clay						
5						Asphalt, rock, trace of phosphate & brown sand						
	X	5-13-20	33									
10						Loose to medium dense brown fine SAND [SP]						
	X	7-4-4	8				4					
15												
	X	4-5-6	11									
20												
	X	4-5-10	15									
25						Medium dense brown fine SAND [SP]						
	X	3-6-8	14									
30						Dense orange fine SAND [SP/SM]						
	X	12-18-24	42									
35						Medium dense orange CLAYEY SAND [SC]						
	X	13-11-12	23				20					
40						Medium dense orange fine SAND [SP/SM]						
	X	5-7-8	15									
45												
	X	10-15-18	33									
50												
	X	9-13-14	27									
55						Very dense orange to tan fine SAND [SM]						
	X	22-29-30	59									
60												

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BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
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PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-1**
SECTION: TOWNSHIP: RANGE:

SHEET: **2 of 2**

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
60						Very dense tan to orange fine SAND [SM] (Continued)						
65	X	17-30-40	70									
70	X	15-32-34	66									
75	X	50 for 4"	50+									
80	X	50 for 3"	50+				17					
85	X	50 for 3"	50+									
90	X	50 for 4"	50+			Boring terminated at 90'						

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PROJECT NO.:	26081-001-01
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PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: B-2 SHEET: 1 of 2
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 120.20 DATE STARTED: 11/5/01
WATER TABLE (ft): NE DATE FINISHED: 11/5/01
DATE OF READING: 11/05/01 DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0	X	5-6-7	13			Medium dense brown to orange fine SAND [SP]						
5	X	2-4-6	10									
10	X	5-7-12	19									
15	X	2-4-6	10				3					
20	X	3-5-12	17									
25	X	4-6-12	18									
30	X	4-12-12	24									
35	X	4-8-9	17			Medium dense orange fine CLAYEY SAND [SC]	19		22	21		
40	X	5-14-16	30									
45	X	10-15-23	38			Dense to very dense orange fine SAND [SM/SP]	8					
50	X	15-15-18	33									
55	X	11-20-30	50									
60	X	16-26-26	52									

BL2T

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PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-2** SHEET: **2 of 2**
SECTION: TOWNSHIP: RANGE:

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
60						Dense to very dense orange fine SAND [SM/SP]						
65	X	10-30-31	61									
70	X	10-24-32	56			Dense to very dense tan & orange fine CLAYEY SAND [SC]						
75	X	13-20-33	53									
80	X	13-14-14	28									
85	X	9-11-11	22				19					
90	X	8-15-15	30			Boring terminated at 90'						

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PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-3** SHEET: **1 of 2**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 107.10 DATE STARTED: 10/29/01
WATER TABLE (ft): NE DATE FINISHED: 10/29/01
DATE OF READING: 10/29/01 DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Orange SAND						
	X	2-2-2	4			Loose to medium dense gray & orange very CLAYEY SAND [SC]						
5	X	2-2-5	7				35		34	17		
10	X	5-10-12	22									
15	X	5-5-10	15			Medium dense gray CLAYEY SAND [SC]						
20	X	2-5-5	10									
25	X	4-7-10	17			Medium dense light gray SAND [SP/SM]	10					
30	X	5-10-13	23			Medium dense tan SAND [SM]						
35	X	6-12-18	30			Dense light gray SAND [SP/SM]						
40	X	5-13-16	29									
45	X	5-16-23	39			Dense tan SAND [SP/SM]						
						tan SAND						
50	X	10-22-26	48									
55	X	6-9-12	21									
60	X	11-15-18	33									

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PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: B-3
SECTION: TOWNSHIP: RANGE:

SHEET: 2 of 2

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
60						Dense tan SAND (Continued)						
65												
70												
75						Very dense tan to white fine SAND [SP/SM]						
80						Boring terminated at 80'						

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BORING LOG

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PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-4** SHEET: **1 of 2**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 119.60 DATE STARTED: 10/30/01
WATER TABLE (ft): 115.0 DATE FINISHED: 10/30/01
DATE OF READING: DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						Very loose to loose orange fine SAND [SP/SM]						
	X	1-2-1	3									
	X	1-1-2	3				9					
5												
	X	8-8-10	18									
10												
	X	7-7-7	14			Medium dense tan to yellow SAND [SP/SM]						
15												
	X	5-10-12	22				8					
20												
	X	8-8-18	26									
25												
	X	7-7-9	16			Medium dense tan SAND [SP/SM]						
30												
						Medium dense tan fine SAND [SP/SM]						
	X	9-12-15	27									
35												
	X	13-22-24	46									
40												
	X	11-17-22	39				8					
45												
	X	12-14-18	32									
50												
	X	12-13-17	30									
55												
						Medium dense to dense white SAND [SP/SM]						
	X	6-7-8	15									
60												
	X	12-16-20	36									
65												

BL21

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-9

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-4**
SECTION: TOWNSHIP: RANGE:

SHEET: **2 of 2**

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
65						Medium dense to dense white SAND [SP/SM] (Continued)						
	X	11-18-22	40				10					
70												
	X	16-16-16	32									
75												
	X	20-24-31	55									
80												
	X	12-20-25	45									
85												
	X	18-18-26	44									
90												
	X	15-19-32	51									
95												
	X	18-22-32	54									
100												
	X	20-25-35	60									
105												
	X	22-29-35	64									
110												
	X	22-30-36	66	▼								
115												
	X	20-30-39	69									
120						Boring terminated at 120'						

BL2I

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-10

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: B-5 SHEET: 1 of 2
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 119.80 DATE STARTED: 10/29/01
WATER TABLE (ft): DATE FINISHED: 10/30/01
DATE OF READING: DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING:

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Brown SAND						
	X	12-15-10	25			Limerock base						
						Medium dense brown to tan SAND [SP/SM]						
	X	3-8-14	22									
5												
	X	8-10-14	24			Medium dense dark brown silty SAND [SP/SM]	7					
10												
	X	2-2-3	5			Loose tan fine SAND [SP/SM]						
15												
	X	3-5-7	12			Loose orange very CLAYEY SAND [SC]	33		31	25		
20												
	X	3-6-7	13									
25						Loose orange fine CLAYEY SAND [SC]	17					
	X	4-5-6	11			Medium tan fine SAND [SP/SM]						
30												
	X	6-6-6	12									
35												
	X	4-6-10	16			Medium dense tan to white fine SAND [SP/SM]						
40												
	X	6-8-9	17									
45												
	X	5-6-9	15									
50												
	X	5-6-8	14									
55												
	X	5-6-6	12			Medium dense gray CLAYEY SAND [SC]						
60												

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-11

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: B-5
SECTION: TOWNSHIP: RANGE:

SHEET: 2 of 2

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
60						Medium dense gray CLAYEY SAND [SC] (Continued)						
	X	5-6-10	16			Medium dense gray & orange CLAYEY SAND [SC]						
65												
	X	6-6-8	14									
70												
	X	8-11-11	22			Medium dense tan to white fine SAND [SM]	15					
75												
	X	10-12-12	24									
80												
	X	12-16-20	36									
85												
	X	13-23-26	49									
90						Boring terminated at 90'						

BL2I

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-12

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-6** SHEET: **1 of 2**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 100.00 DATE STARTED: 11/1/01
WATER TABLE (ft): 100.0 DATE FINISHED: 11/1/01
DATE OF READING: 11/01/01 DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Brown SAND						
	X	2-3-4	7			Loose orange very CLAYEY SAND [SC]						
5	X	4-5-7	12									
						Medium dense orange CLAYEY SAND [SC]	24					
10	X	4-5-7	12			Medium dense tan orange fine SAND [SP/SM]						
15	X	4-6-8	14									
						Medium dense gray CLAYEY SAND [SC]						
20	X	5-7-10	17									
25	X	5-7-7	14				28		29	21		
30	X	5-7-7	14			Medium dense gray & orange slightly CLAYEY SAND [SC]						
35	X	4-8-10	18									
						Dense to very dense tan fine SAND [SP/SM]						
40	X	13-16-18	34									
45	X	12-15-16	31									
50	X	10-16-20	36									
55	X	11-19-22	41				9					
60	X	12-17-17	34									

BL2I

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-13

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-6** SHEET: **2 of 2**
SECTION: TOWNSHIP: RANGE:

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
60						Very dense tan fine SAND [SP/SM]						
65	X	15-26-30	56									
70	X	17-27-34	61									
75	X	18-30-36	66									
80	X	50 for 4"	50+									
85	X	50 for 3"	50+									
90	X	50 for 3"	50+				12				3	
95	X	15-18-50	68									
100	X	25-35-45	80	▼			9					
105	X	50 for 3"	50+			Boring terminated at 105'						

BL2T

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-14

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-7** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 90.50 DATE STARTED: 11/2/01
WATER TABLE (ft): NE DATE FINISHED: 11/2/01
DATE OF READING: 11/02/01 DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Loose to medium dense tan to yellow fine SAND [SP/SM]						
	X	2-3-4	7									
	X	4-4-5	9									
5												
	X	5-12-12	24									
10												
	X	7-8-12	20				8					
15												
	X	8-15-33	48									
20												
	X	10-30-40	70									
25												
	X	9-20-25	45									
30												
	X	50 for 3"	50+									
35												
						Very dense orange SAND [SP/SM]						
	X	50 for 3"	50+									
40												
	X	22-26-39	65				8					
45												
	X	18-26-28	54									
50												
	X	15-35-45	80									
55						Boring terminated at 55'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-15

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-8** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 66.00 DATE STARTED: 10/29/01
WATER TABLE (ft): NE DATE FINISHED: 10/29/01
DATE OF READING: 10/29/01 DRILLED BY: R. WOODARD
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0												
	X	2-3-4	7			Tan SAND						
	X	5-6-7	13			Medium dense white SAND [SP/SM]						
5												
	X	5-6-7	13				8					
10												
	X	5-7-9	16									
15												
	X	5-8-9	17									
20						Medium dense tan & orange SAND [SP/SM]						
	X	5-11-14	25									
25												
	X	6-11-13	24									
30												
						Dense white & orange CLAYEY SAND [SC]						
	X	13-19-23	42				17					
35												
						Dense white SAND [SP/SM]						
	X	13-19-25	44				10				2	
40						Boring terminated at 40'						

BL2I

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-16

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: B-9 SHEET: 1 of 1
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 66.40 DATE STARTED: 11/5/01
WATER TABLE (ft): NE DATE FINISHED: 11/5/01
DATE OF READING: 11/05/01 DRILLED BY: J. STILLSON
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0	X	10-10-20	30			Medium dense brown fine SAND [SM]	14					
5	X	5-7-10	17			Medium dense white fine SAND [SP/SM]						
10	X	4-8-8	16									
15	X	5-5-12	17				9					
20	X	6-8-9	17			Medium dense white to tan fine SAND [SP/SM]						
25	X	8-13-13	26									
30	X	8-9-10	19									
35	X	6-10-20	30			Medium dense tan fine SAND [SP/SM]						
40	X	8-10-18	28									
45	X	8-10-12	22									
						Boring terminated at 45'						

BL2I

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	26081-001-01
REPORT NO.:	21607
PAGE:	B-17

PROJECT: CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FLORIDA

BORING DESIGNATION: **B-10** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: SCS ENGINEERS
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 165.00 DATE STARTED: 10/29/01
WATER TABLE (ft): NE DATE FINISHED: 10/29/01
DATE OF READING: 10/29/01 DRILLED BY: R. WOODARD
EST. WSWT (ft): TYPE OF SAMPLING: ASTMD-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Loose to medium dense orange & tan very CLAYEY SAND [SC]						
	X	4-4-4	8									
	X	8-8-11	19				31					
5												
	X	4-10-12	22									
10												
	X	5-8-11	19									
15												
	X	9-29-25	54									
20												
	X	5-8-12	20									
25												
						Very dense orange & tan SAND [SP/SM]						
	X	8-30-35	65									
30						Boring terminated at 30'						

BL2T

APPENDIX C

SUMMARY OF LABORATORY RESULTS

PROJECT: Citrus County Central Landfill
Citrus County, FL

CLIENT: SCS Engineers

ORDER NO: 26081-001-01

REPORT NO: 21607

DATE: 11/16/01

BORING NO	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	SAMPLE TYPE*	NATURAL MOISTURE (%)	ATTERBERG LIMITS		COEFFICIENT OF PERMEABILITY (FT/DAY)	SIEVE ANALYSIS (% passing)						AASHTO SOIL CLASSIFICATION	UNITED SOIL CLASSIFICATION
					LIQUID LIMIT (%)	PLASTICITY INDEX (%)		No. 4	No. 10	No. 40	No. 60	No. 100	No. 200		
B-1	4	Brown fine SAND	SS					81	80	77	66	28	4		SP
B-1	9	Orange slight clayey SAND	SS					100	100	99	87	48	20		SC
B-1	17	Tan to orange fine SAND	SS					100	100	98	76	33	17		SM
B-2	4	Brown to orange fine SAND	SS					100	100	99	85	34	3		SP
B-2	8	Orange fine slightly clayey SAND	SS		22	1							19		SC
B-2	10	Orange fine SAND	SS					100	100	99	84	34	8		SP-SM
B-2	18	Tan and orange fine SAND	SS					100	100	97	78	30	19		SC
B-3	5	Gray and Orange clayey SAND	SS		34	17							35		SC
B-3	25	Light gray SAND	SS					100	100	99	93	47	10		SP-SM
B-4	5	Orange fine SAND	SS					99	99	99	90	42	9		SP-SM

*SS-Split Spoon
ST-Shelby Tube
A-Auger

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(352) 372-3392

SUMMARY OF LABORATORY RESULTS

PROJECT: Citrus County Central Landfill
Citrus County, FL

CLIENT: SCS Engineers

ORDER NO: 26081-001-01

REPORT NO: 21607

DATE: 11/16/01

BORING NO	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	SAMPLE TYPE*	NATURAL MOISTURE (%)	ATTERBERG LIMITS		COEFFICIENT OF PERMEABILITY (FT/DAY)	SIEVE ANALYSIS (% passing)						AASHTO SOIL CLASSIFICATION	UNIFIED SOIL CLASSIFICATION
					LIQUID LIMIT (%)	PLASTICITY INDEX (%)		No. 4	No. 10	No. 40	No. 60	No. 100	No. 200		
B-4	50	Tan fine SAND	SS					100	100	999	84	28	8		SP-SM
B-4	70	Orange slight clayey SAND	SS					100	100	99	84	26	10		SP-SM
B-5	10	Dark brown silty SAND	SS					99	98	96	82	37	7		SP-SM
B-5	20	Orange clayey SAND	SS		31	6							33		SC
B-5	25	Orange slightly clayey SAND	SS					100	100	98	86	43	17		SC
B-5	75	Tan and white SAND	SS					100	100	99	92	41	15		SM
B-6	5	Orange fine clayey SAND	SS					100	100	99	93	59	24		SC
B-6	25	Gray clayey SAND	SS		29	8							28		SM
B-6	55	Tan fine SAND	SS					100	100	98	89	36	9		SM
B-6	95	Tan fine SAND	SS	46											SM

*SS-Split Spoon
ST-Shelby Tube
A-Auger

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(352) 372-3392

SUMMARY OF LABORATORY RESULTS

PROJECT: Citrus County Central Landfill
Citrus County, FL

CLIENT: SCS Engineers

ORDER NO: 26081-001-01
REPORT NO: 21607
DATE: 11/16/01

BORING NO	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	SAMPLE TYPE*	NATURAL MOISTURE (%)	ATTERBERG LIMITS		COEFFICIENT OF PERMEABILITY (FT/DAY)	SIEVE ANALYSIS (% passing)						AASHTO SOIL CLASSIFICATION	UNIFIED SOIL CLASSIFICATION
					LIQUID LIMIT (%)	PLASTICITY INDEX (%)		No. 4	No. 10	No. 40	No. 60	No. 100	No. 200		
B-6	90	Tan fine SAND	SS				3.1						12		SP-M
B-6	100	White SAND	SS					100	100	98	79	27	9		SP-SM
B-7	20	Yellow SAND	SS					100	100	97	82	30	8		SP-SM
B-7	45	Orange SAND	SS					100	100	97	79	27	8		SP-SM
B-8	10	White SAND	SS					100	100	98	80	28	8		SP-SM
B-8	35	White and orange SAND	SS					100	100	98	78	30	17		SM
B-8	40	White fine SAND	SS				2.2						10		SM
B-9	2	Brown fine SAND	SS					94	93	90	79	37	14		SM
B-9	15	White SAND	SS					98	97	95	74	21	9		SP-SM
B-10	5	Orange tan fine SAND	SS					100	100	99	93	59	31		SC

*SS-Split Spoon
ST-Shelby Tube
A-Auger

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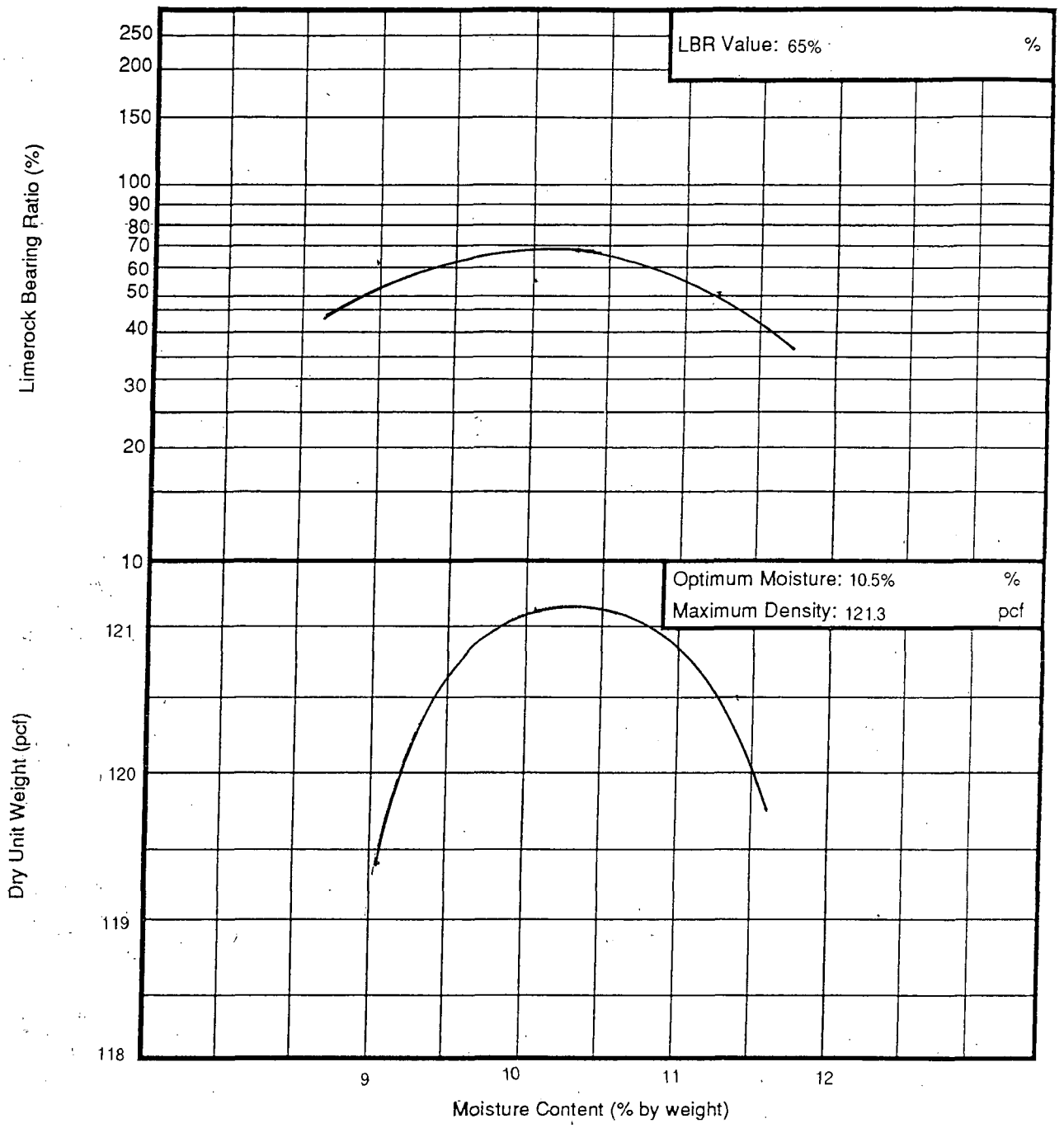

Sample No.:

Location: STOCKPILE

Soil Description: WHITE SILTY CLAYEY SAND

Project Requirement:

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CITRUS COUNTY CENTRAL LANDFILL
S.R. 44
CITRUS COUNTY, FL

LIMEROCK BEARING RATIO

DRAWN BY:	DATE:	CHECKED BY:	DATE:
SCALE:	ORDER NO:	REPORT NO:	PAGE NO:

DESCRIPTION OF LABORATORY TESTING PROCEDURES

SOIL GRADATION TEST ASTM D-442

The soil gradation test is performed by passing a representative soil sample over a standard set of nested sieves. The percentage of the soil grains retained on each sieve are measured and a grain size distribution curve is determined.

ATTERBERG LIMITS TEST ASTM D-4318

The Atterberg Limits are the upper and lower limits of the range of water content over which a soil exhibits plastic behavior, and are defined as the liquid limit and plastic limit, respectively.

The liquid limit is determined as follows: The soil is mixed with distilled water to form a thick paste, which is then placed in a brass cup which is mounted on an edge pivot and rests initially on a rubber base. The base in then leveled off horizontally and divided by cutting a groove with a standard tool. The two halves of the soil gradually flow together as the cup is repeatedly dropped onto its base at a specified rate. The liquid limit is defined as the water content at which 25 blows are required to close the groove over a distance of 1/2 inch.

The plastic limit is determined as follow: The soil is mixed with distilled water until it can be molded. A ball of soil is then rolled into a thread 1/8 inch in diameter between the hand and a glass plate. The soil is molded together again and the process repeated until the thread crumbles when its diameter is 1/8 inch. The water content of the crumbled soil is determined and defined as the plastic limit.

WASH 200 TEST

The Wash 200 test is performed by passing a representative soil sample over a No. 200 sieve and rinsing with water. The percentage of the soil grains passing this sieve is then calculated.

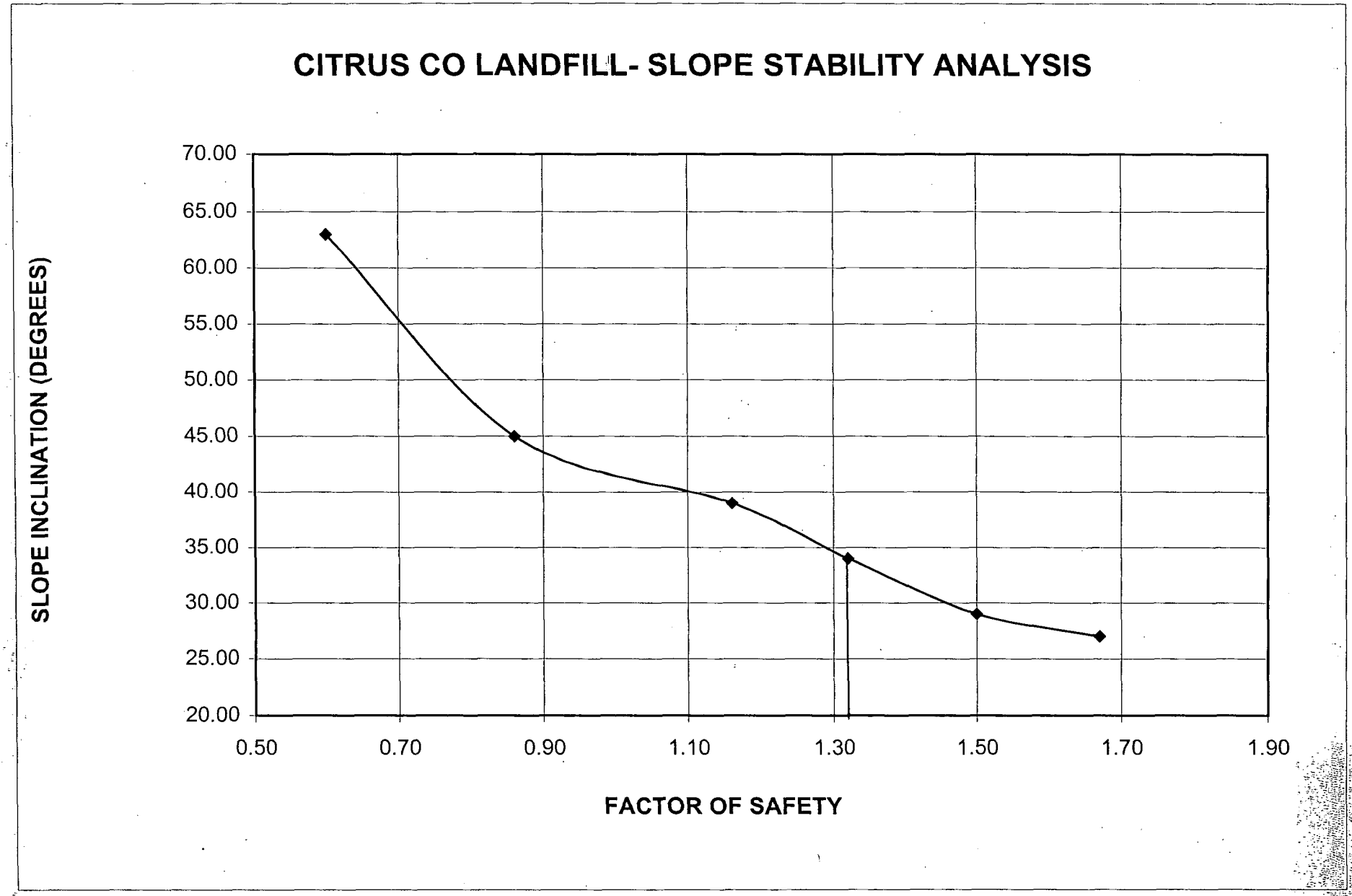
LABORATORY PERMEABILITY TEST

The laboratory permeability test is a Falling Head Test that is performed on soil samples recovered from this site. The data recovered from this test are used to calculate Darcy's Coefficient of Permeability (k) of the soil.

LIMEROCK BEARING RATIO - FM 5-515

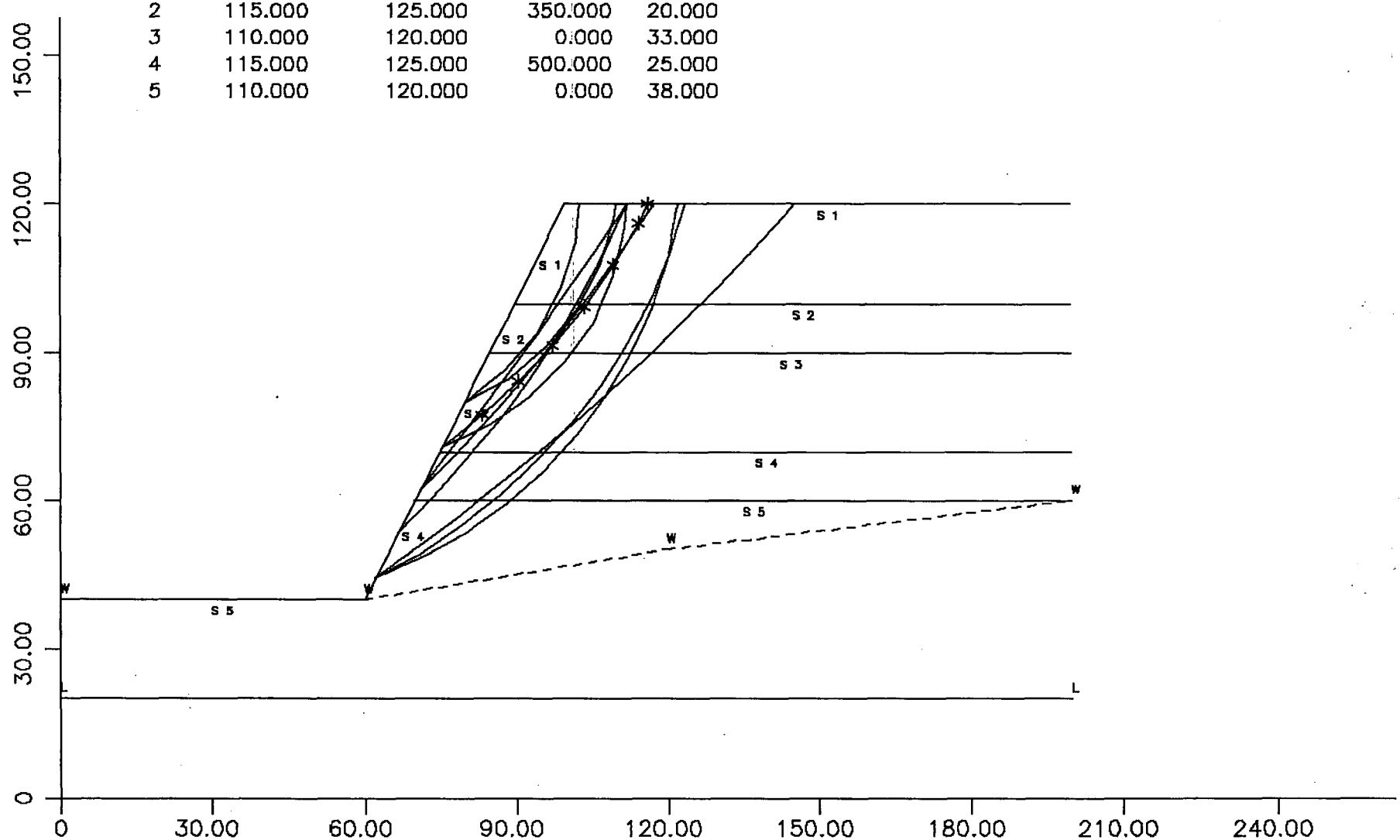
This test method is intended for the determination of the bearing value of soils when they are compacted in the laboratory at moistures varying from the dry to wet side of optimum. The samples are compacted using a 10-pound hammer dropped from a height of 18 inches. The test is useful for evaluating limerock and other soils used for base, stabilized subgrade, and subgrade or embankment material encountered.

APPENDIX D


CITRUS CO LANDFILL- SLOPE STABILITY ANALYSIS
SLOPE INCLINATION (DEGREES)
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
0.50
0.70
0.90
1.10
1.30
1.50
1.70
1.90
FACTOR OF SAFETY

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000

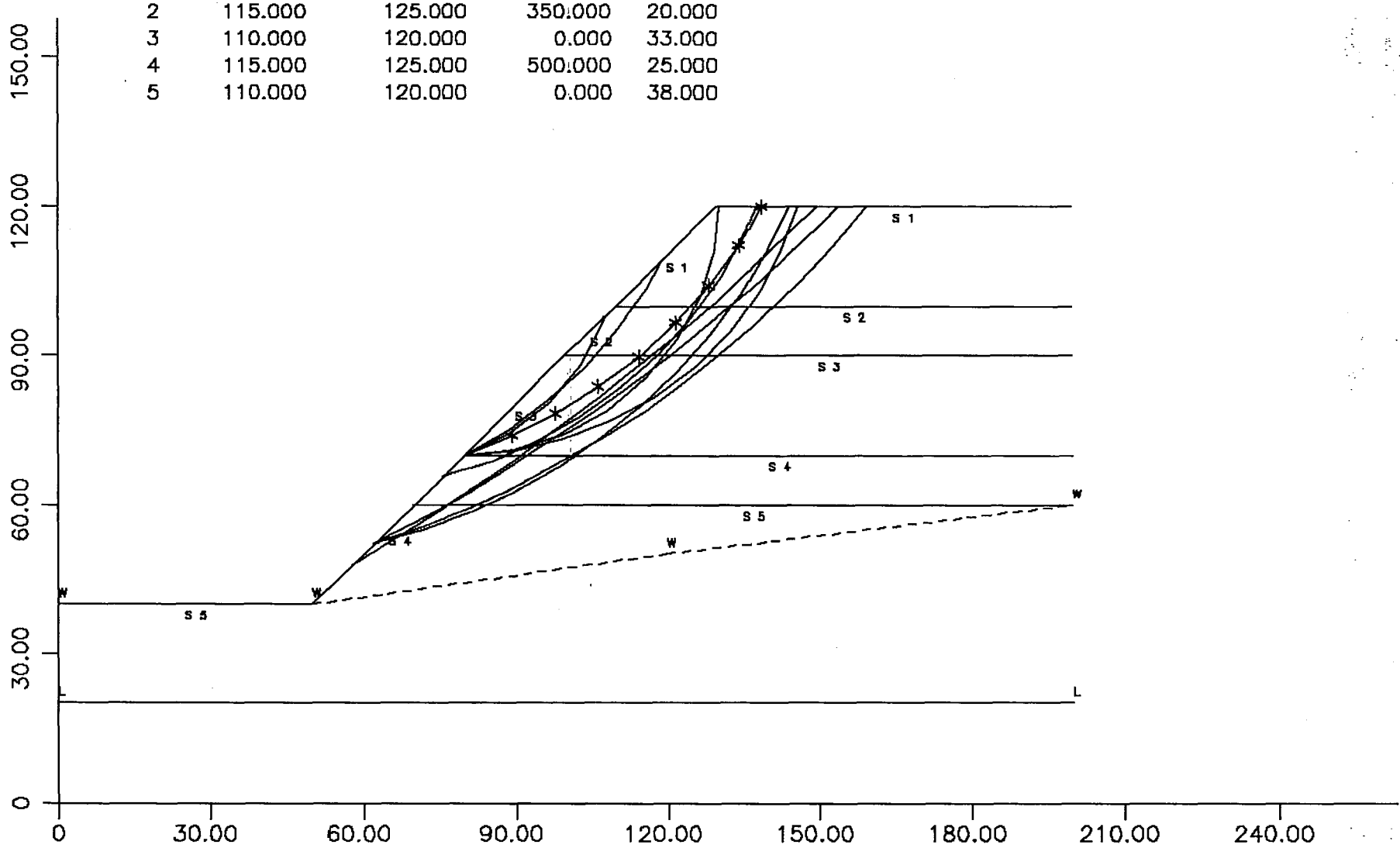
Minimum Factor of Safety 0.598



CITRUS COUNTY CENTRAL LANDFILL 0.5H:1V

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000

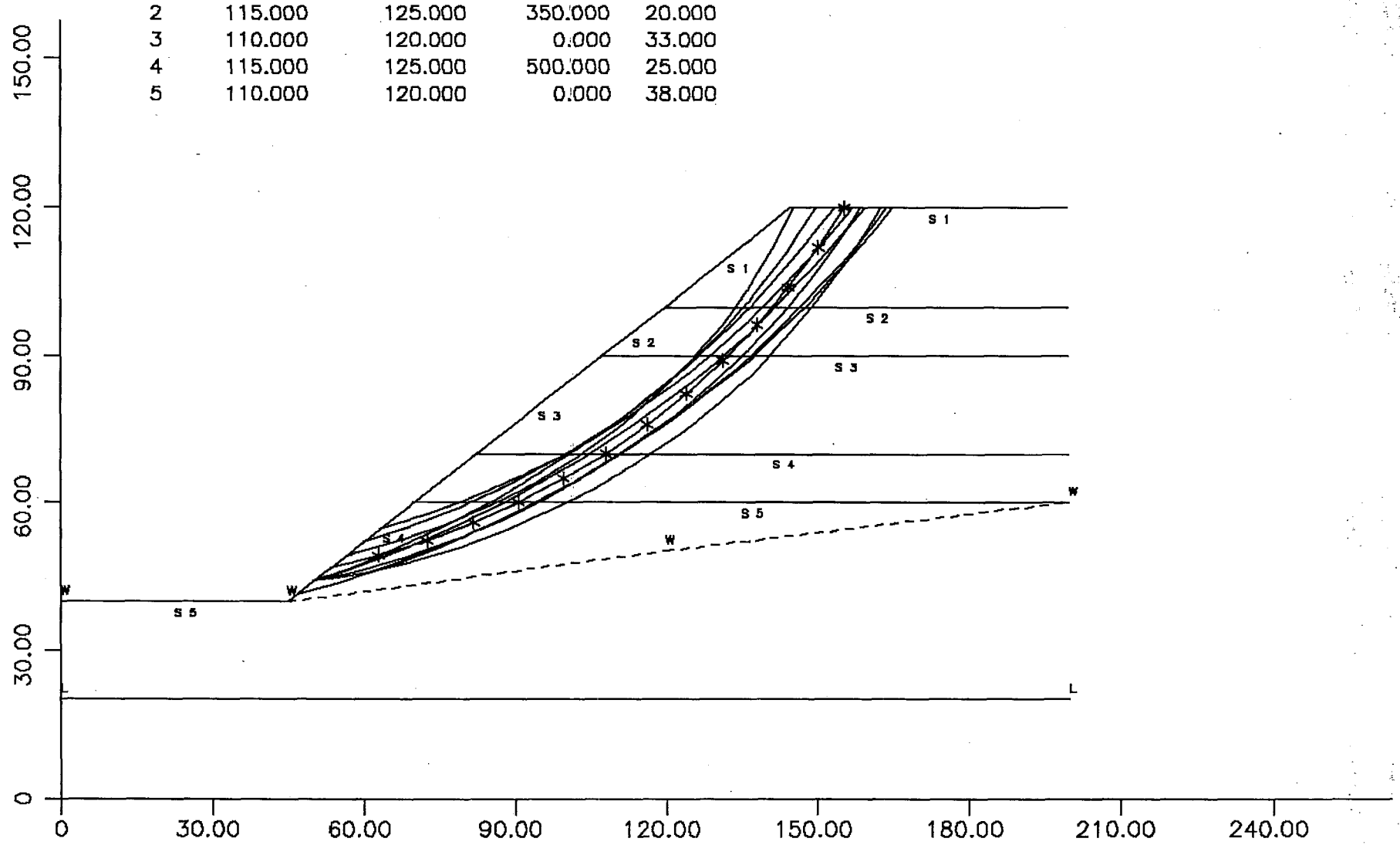
Minimum Factor of Safety 0.855



CITRUS COUNTY CENTRAL LANDFILL - SLOPE 1H:1V

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000

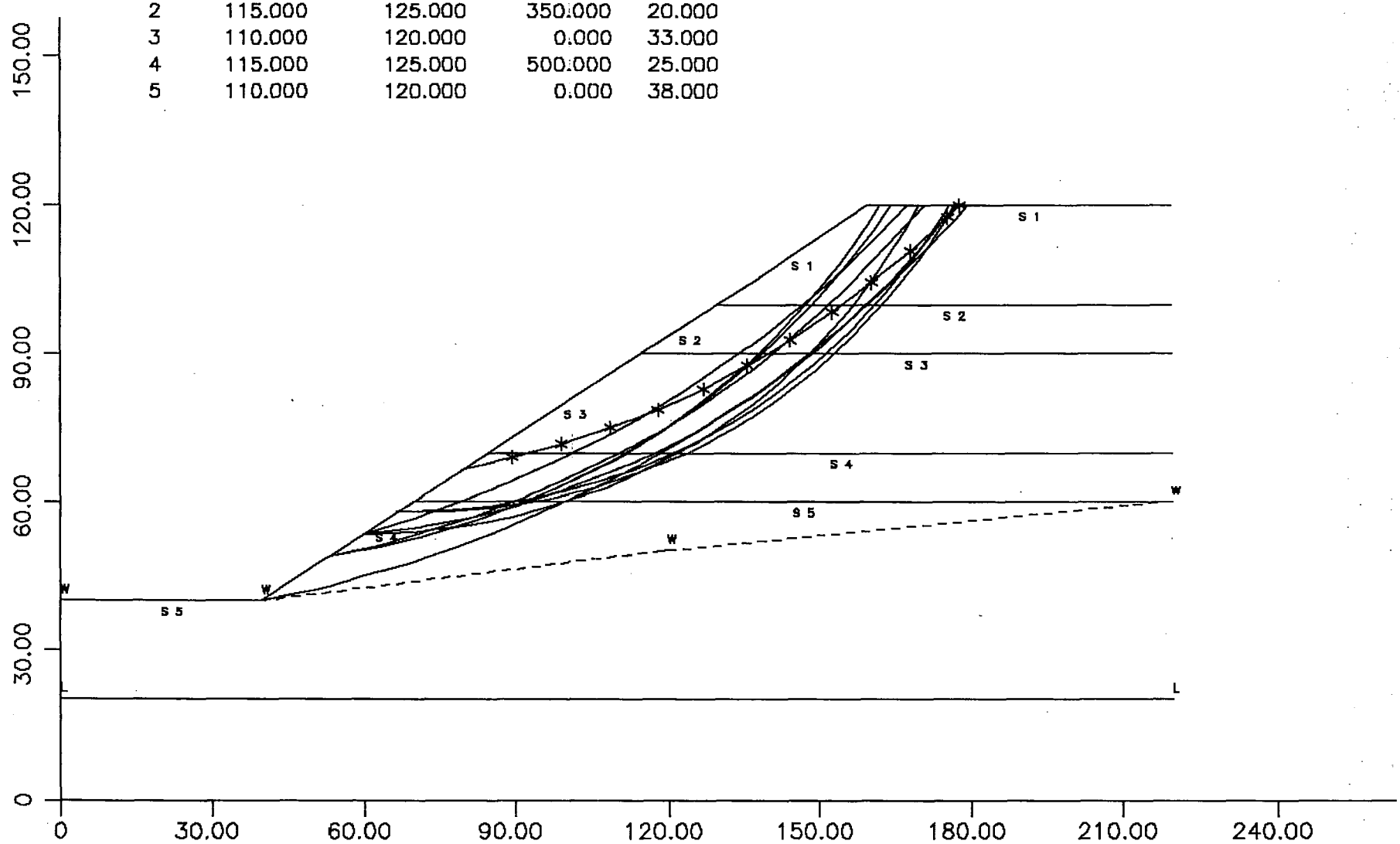
Minimum Factor of Safety 1.157



CITRUS COUNTY CENTRAL LANDFILL - SLOPE 1.25H:1V

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000

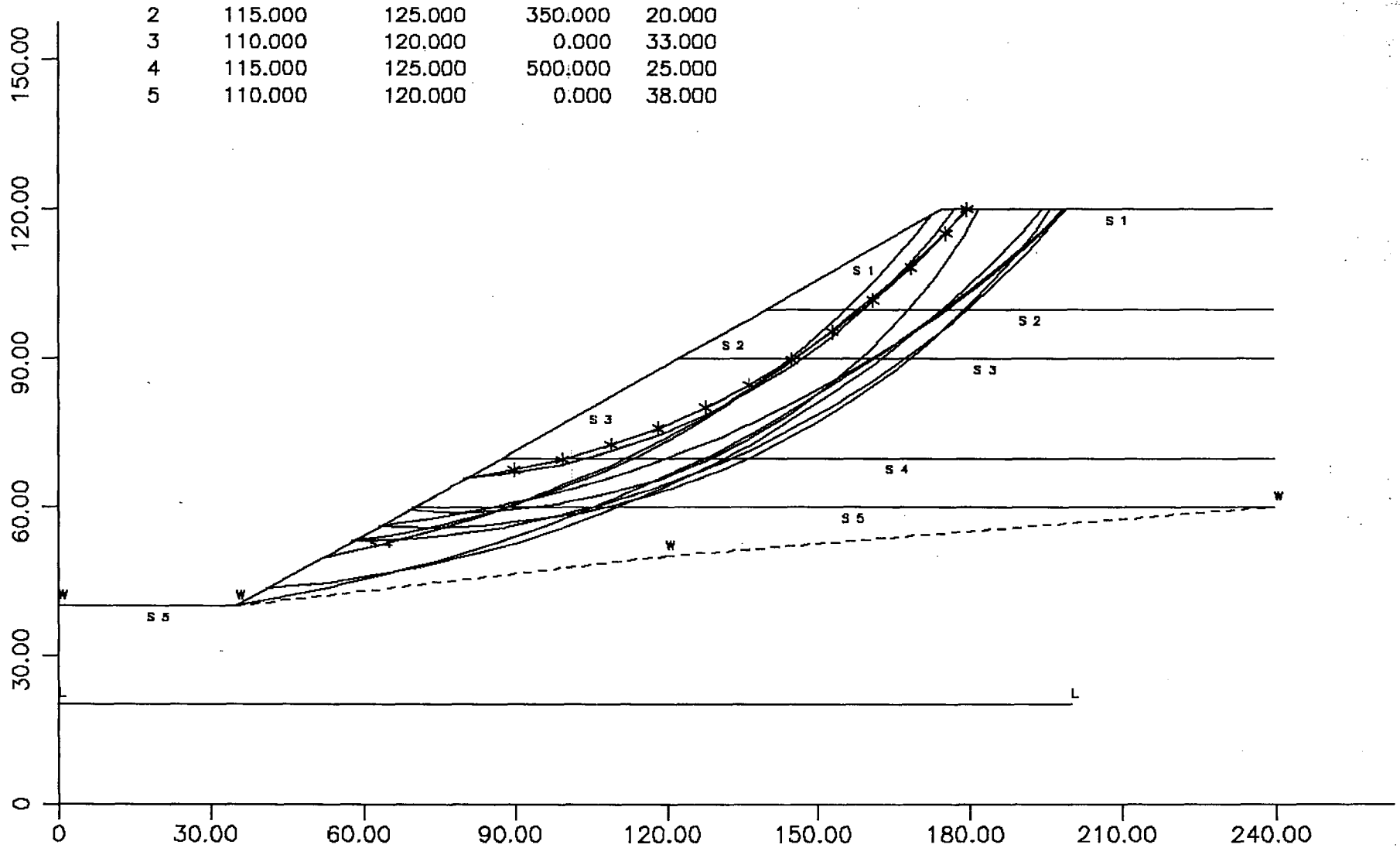
Minimum Factor of Safety 1.320



CITRUS COUNTY CENTRAL LANDFILL - SLOPE 1.5H:1V

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000

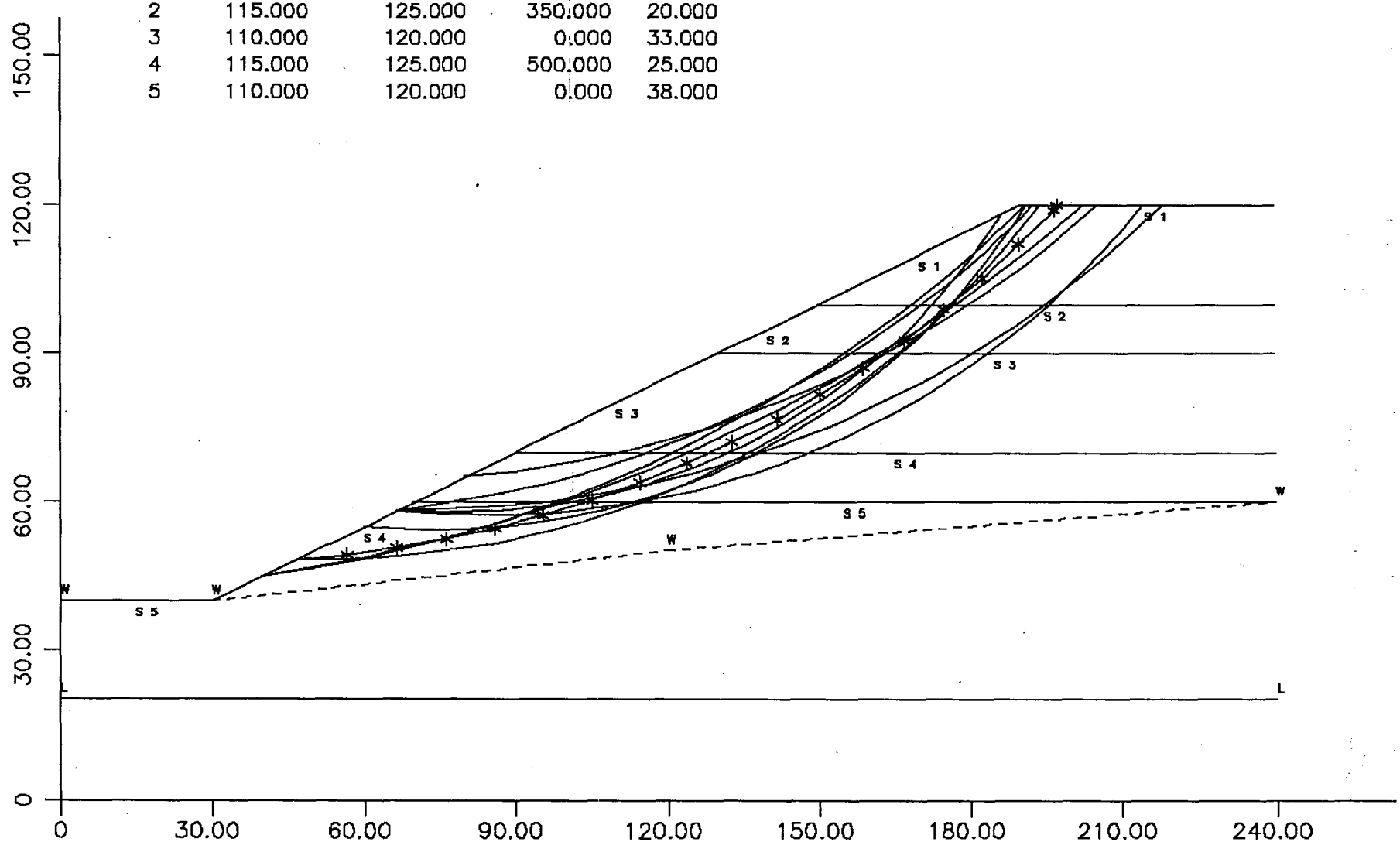
Minimum Factor of Safety 1.498



CITRUS COUNTY CENTRAL LANDFILL - SLOPE 1.75H:1V

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000

Minimum Factor of Safety 1.666



CITRUS COUNTY CENTRAL LANDFILL - SLOPE 2H:1V

** STABL/G **

Slope Stability Program
Portions of this program (c) 1992
by
GEOSOFT
1442 Lincoln Avenue, Suite 146
Orange, CA 92665
U.S.A.

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Input Data Filename:
Output Filename:
Plotted Output Filename:

PROBLEM DESCRIPTION CITRUS COUNTY CENTRAL LANDFILL - SLOPE 1
.5H:1V

BOUNDARY COORDINATES

6 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	40.00	40.00	40.00	5
2	40.00	40.00	85.00	70.00	4
3	85.00	70.00	115.00	90.00	3
4	115.00	90.00	130.00	100.00	2
5	130.00	100.00	160.00	120.00	1
6	160.00	120.00	220.00	120.00	1
7	130.00	100.00	220.00	100.00	2
8	115.00	90.00	220.00	90.00	3
9	85.00	70.00	220.00	70.00	4
10	70.00	60.00	220.00	60.00	5

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	120.0	.0	36.0	.00	.0	0
2	115.0	125.0	350.0	20.0	.00	.0	0
3	110.0	120.0	.0	33.0	.00	.0	0
4	115.0	125.0	500.0	25.0	.00	.0	0
5	110.0	120.0	.0	38.0	.00	.0	0

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	40.00
2	40.00	40.00
3	120.00	50.00
4	220.00	60.00

Searching Routine Will Be Limited To An Area Defined By 1 Boundaries Of Which The First 1 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	20.00	220.00	20.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 120.00 ft.
and X = 180.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	66.67
2	89.75	68.90
3	99.36	71.65
4	108.82	74.89
5	118.10	78.63
6	127.16	82.85
7	136.00	87.54
8	144.57	92.69
9	152.86	98.28
10	160.85	104.30
11	168.50	110.73
12	175.81	117.55
13	178.18	120.00

Circle Center At X = 42.4 ; Y = 253.2 and Radius, 190.3

*** 1.320 ***

Individual data on the 19 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	5.0	628.6	.0	.0	.0	.0	.0	.0	.0
2	4.7	1723.1	.0	.0	.0	.0	.0	.0	.0
3	3.8	2125.5	.0	.0	.0	.0	.0	.0	.0
4	5.8	4333.7	.0	.0	.0	.0	.0	.0	.0
5	9.5	9842.9	.0	.0	.0	.0	.0	.0	.0
6	6.2	8021.7	.0	.0	.0	.0	.0	.0	.0
7	3.1	4455.0	.0	.0	.0	.0	.0	.0	.0

8	9.1	14539.4	.0	.0	.0	.0	.0	.0	.0
9	2.8	4949.6	.0	.0	.0	.0	.0	.0	.0
10	6.0	10885.6	.0	.0	.0	.0	.0	.0	.0
11	4.1	7685.2	.0	.0	.0	.0	.0	.0	.0
12	4.5	8501.6	.0	.0	.0	.0	.0	.0	.0
13	8.3	15685.4	.0	.0	.0	.0	.0	.0	.0
14	2.3	4247.3	.0	.0	.0	.0	.0	.0	.0
15	4.9	8840.8	.0	.0	.0	.0	.0	.0	.0
16	.8	1489.9	.0	.0	.0	.0	.0	.0	.0
17	7.7	10520.3	.0	.0	.0	.0	.0	.0	.0
18	7.3	4713.0	.0	.0	.0	.0	.0	.0	.0
19	2.4	318.2	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.33	48.89
2	63.08	51.14
3	72.70	53.86
4	82.18	57.04
5	91.50	60.67
6	100.63	64.75
7	109.55	69.26
8	118.25	74.21
9	126.69	79.56
10	134.87	85.32
11	142.76	91.46
12	150.34	97.98
13	157.60	104.86
14	164.52	112.08
15	171.08	119.63
16	171.37	120.00

Circle Center At X = 11.7 ; Y = 251.6 and Radius, 206.9

*** 1.323 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	53.33
2	69.92	54.61
3	79.74	56.48
4	89.44	58.94
5	98.96	61.98
6	108.29	65.58
7	117.38	69.75
8	126.20	74.46
9	134.73	79.68

10	142.92	85.42
11	150.75	91.64
12	158.19	98.32
13	165.22	105.43
14	171.80	112.96
15	177.25	120.00

Circle Center At X = 43.9 ; Y = 218.2 and Radius, 165.7

*** 1.328 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.33	48.89
2	63.17	50.69
3	72.88	53.09
4	82.42	56.08
5	91.76	59.65
6	100.87	63.79
7	109.70	68.48
8	118.23	73.70
9	126.42	79.44
10	134.24	85.66
11	141.67	92.36
12	148.67	99.50
13	155.21	107.06
14	161.29	115.01
15	164.64	120.00

Circle Center At X = 29.0 ; Y = 209.8 and Radius, 162.8

*** 1.334 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	40.00	40.00
2	49.78	42.10
3	59.46	44.59
4	69.04	47.47
5	78.49	50.73
6	87.81	54.36
7	96.97	58.36
8	105.97	62.73

9	114.79	67.45
10	123.41	72.52
11	131.82	77.93
12	140.01	83.67
13	147.96	89.73
14	155.66	96.11
15	163.10	102.79
16	170.27	109.76
17	177.16	117.01
18	179.77	120.00

Circle Center At X = -7.6 ; Y = 285.2 and Radius, 249.8

*** 1.335 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.33	48.89
2	63.18	50.62
3	72.90	52.99
4	82.44	55.98
5	91.77	59.57
6	100.85	63.76
7	109.65	68.52
8	118.11	73.84
9	126.22	79.70
10	133.93	86.07
11	141.22	92.91
12	148.05	100.22
13	154.39	107.95
14	160.23	116.07
15	162.68	120.00

Circle Center At X = 31.4 ; Y = 202.5 and Radius, 155.2

*** 1.345 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.67	57.78
2	76.66	58.11
3	86.60	59.23
4	96.42	61.13

5	106.05	63.81
6	115.44	67.24
7	124.54	71.40
8	133.27	76.27
9	141.59	81.82
10	149.45	88.01
11	156.79	94.80
12	163.57	102.15
13	169.74	110.02
14	175.28	118.34
15	176.20	120.00

Circle Center At X = 67.5 ; Y = 184.0 and Radius, 126.2

*** 1.350 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	53.33
2	69.99	53.70
3	79.93	54.87
4	89.73	56.83
5	99.34	59.59
6	108.70	63.11
7	117.75	67.37
8	126.42	72.36
9	134.66	78.02
10	142.41	84.34
11	149.63	91.26
12	156.27	98.74
13	162.28	106.73
14	167.62	115.18
15	170.15	120.00

Circle Center At X = 60.5 ; Y = 177.0 and Radius, 123.7

*** 1.360 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.67	57.78
2	76.67	57.85
3	86.63	58.74

4	96.48	60.45
5	106.16	62.95
6	115.60	66.24
7	124.75	70.30
8	133.52	75.09
9	141.88	80.58
10	149.76	86.74
11	157.11	93.52
12	163.87	100.89
13	170.01	108.78
14	175.49	117.15
15	177.04	120.00

Circle Center At X = 70.8 ; Y = 179.7 and Radius, 121.9

*** 1.366 ***

Failure Surface Specified By 14 Coordinate Points

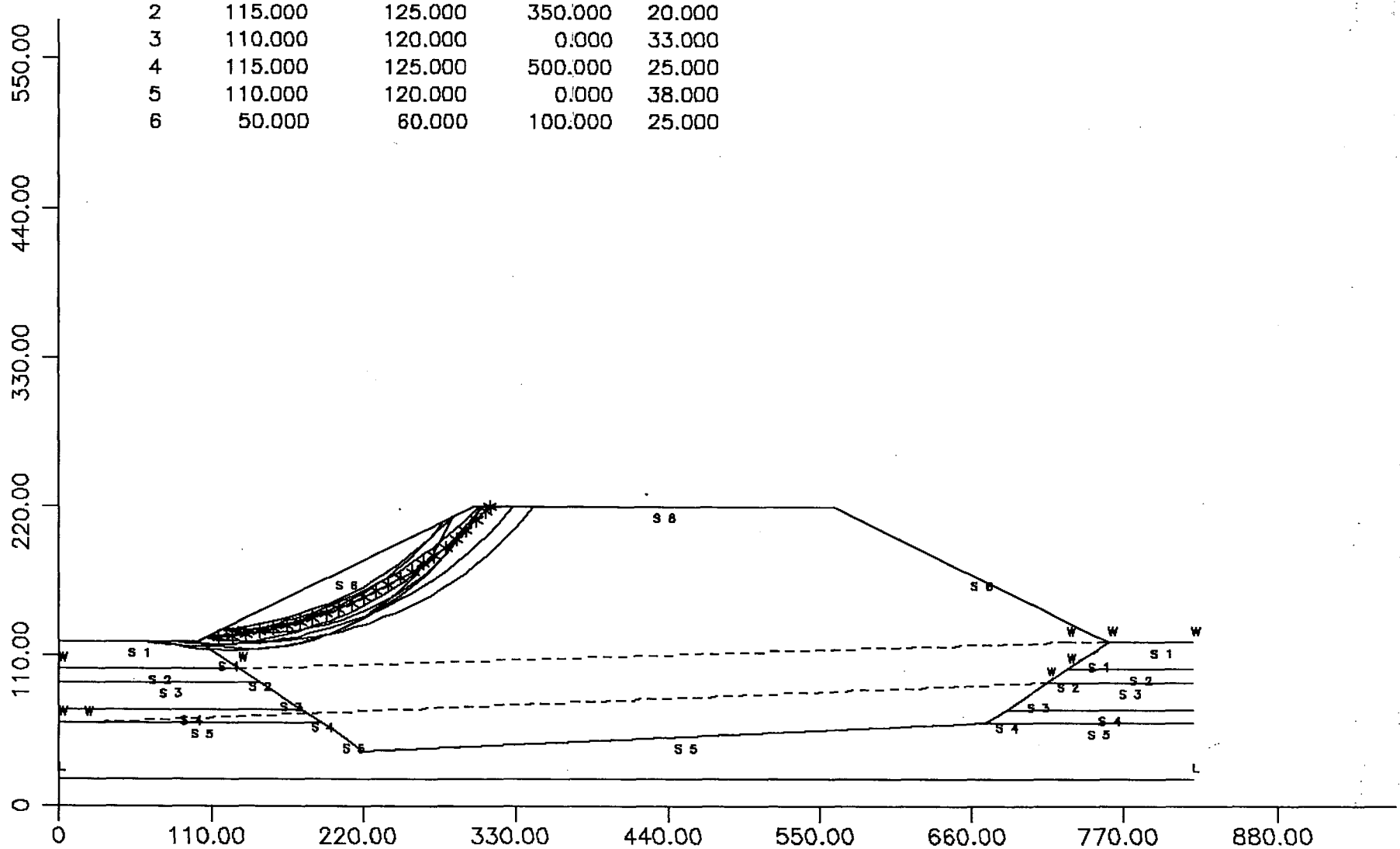
Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	53.33
2	69.54	56.34
3	78.94	59.74
4	88.20	63.53
5	97.28	67.70
6	106.19	72.25
7	114.90	77.17
8	123.39	82.44
9	131.66	88.07
10	139.69	94.03
11	147.46	100.33
12	154.96	106.94
13	162.17	113.86
14	168.06	120.00

Circle Center At X = -7.0 ; Y = 282.9 and Radius, 239.2

*** 1.367 ***

Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000
6	50.000	60.000	100.000	25.000

Minimum Factor of Safety 1.306



CITRUS COUNTY CENTRAL LANDFILL - EMBANKMENT

** STABL/G **

Slope Stability Program
Portions of this program (c) 1992
by
GEOSOFT
1442 Lincoln Avenue, Suite 146
Orange, CA 92665
U.S.A.

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Input Data Filename:
Output Filename:
Plotted Output Filename:

PROBLEM DESCRIPTION Embankment citrus county landfill

BOUNDARY COORDINATES

5 Top Boundaries
23 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	120.00	100.00	120.00	1
2	100.00	120.00	300.00	220.00	6
3	300.00	220.00	560.00	220.00	6
4	560.00	220.00	760.00	120.00	6
5	760.00	120.00	820.00	120.00	1
6	100.00	120.00	130.00	100.00	1
7	.00	100.00	130.00	100.00	2
8	730.00	100.00	760.00	120.00	1
9	730.00	100.00	820.00	100.00	2
10	130.00	100.00	145.00	90.00	2
11	.00	90.00	145.00	90.00	3
12	715.00	90.00	730.00	100.00	2
13	715.00	90.00	820.00	90.00	3
14	145.00	90.00	175.00	70.00	3
15	.00	70.00	175.00	70.00	4
16	685.00	70.00	715.00	90.00	3
17	685.00	70.00	820.00	70.00	4
18	175.00	70.00	190.00	60.00	4

19	.00	60.00	190.00	60.00	5
20	670.00	60.00	685.00	70.00	4
21	670.00	60.00	820.00	60.00	5
22	190.00	60.00	220.00	40.00	5
23	220.00	40.00	670.00	60.00	5

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	120.0	.0	36.0	.00	.0	0
2	115.0	125.0	350.0	20.0	.00	.0	0
3	110.0	120.0	.0	33.0	.00	.0	0
4	115.0	125.0	500.0	25.0	.00	.0	0
5	110.0	120.0	.0	38.0	.00	.0	0
6	50.0	60.0	100.0	25.0	.00	.0	0

2 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	100.00
2	130.00	100.00
3	730.00	120.00
4	820.00	120.00

Piezometric Surface No. 2 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	60.00
2	19.00	60.00
3	715.00	90.00
4	730.00	100.00
5	760.00	120.00
6	820.00	120.00

Searching Routine Will Be Limited To An Area Defined By 1 Boundaries
Of Which The First 1 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	20.00	820.00	20.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 50.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 250.00 ft.
and X = 350.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 40.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.56	122.78
2	115.53	123.50
3	125.47	124.55
4	135.38	125.92
5	145.24	127.62
6	155.03	129.64
7	164.75	131.97

8	174.40	134.62
9	183.95	137.59
10	193.39	140.86
11	202.73	144.44
12	211.95	148.32
13	221.03	152.51
14	229.97	156.98
15	238.76	161.75
16	247.39	166.80
17	255.86	172.13
18	264.14	177.73
19	272.23	183.60
20	280.13	189.74
21	287.83	196.12
22	295.31	202.75
23	302.57	209.63
24	309.61	216.74
25	312.63	220.00

Circle Center At X = 88.4 ; Y = 428.6 and Radius, 306.4

*** 1.306 ***

Individual data on the 25 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	10.0	1063.0	.0	.0	.0	.0	.0	.0	.0
2	9.9	3095.2	.0	.0	.0	.0	.0	.0	.0
3	9.9	4941.0	.0	.0	.0	.0	.0	.0	.0
4	9.9	6594.3	.0	.0	.0	.0	.0	.0	.0
5	9.8	8050.6	.0	.0	.0	.0	.0	.0	.0
6	9.7	9306.9	.0	.0	.0	.0	.0	.0	.0
7	9.6	10361.2	.0	.0	.0	.0	.0	.0	.0
8	9.6	11213.3	.0	.0	.0	.0	.0	.0	.0
9	9.4	11864.1	.0	.0	.0	.0	.0	.0	.0
10	9.3	12315.8	.0	.0	.0	.0	.0	.0	.0
11	9.2	12572.3	.0	.0	.0	.0	.0	.0	.0
12	9.1	12638.5	.0	.0	.0	.0	.0	.0	.0
13	8.9	12520.8	.0	.0	.0	.0	.0	.0	.0
14	8.8	12226.8	.0	.0	.0	.0	.0	.0	.0
15	8.6	11765.4	.0	.0	.0	.0	.0	.0	.0
16	8.5	11146.4	.0	.0	.0	.0	.0	.0	.0
17	8.3	10381.2	.0	.0	.0	.0	.0	.0	.0
18	8.1	9481.8	.0	.0	.0	.0	.0	.0	.0
19	7.9	8461.6	.0	.0	.0	.0	.0	.0	.0
20	7.7	7334.7	.0	.0	.0	.0	.0	.0	.0
21	7.5	6116.3	.0	.0	.0	.0	.0	.0	.0
22	4.7	3247.5	.0	.0	.0	.0	.0	.0	.0
23	2.6	1491.8	.0	.0	.0	.0	.0	.0	.0
24	7.0	2397.6	.0	.0	.0	.0	.0	.0	.0
25	3.0	246.8	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.33	120.00
2	93.28	118.95
3	103.26	118.27
4	113.25	117.95
5	123.25	118.01
6	133.24	118.42
7	143.21	119.21
8	153.14	120.36
9	163.03	121.87
10	172.85	123.75
11	182.60	125.98
12	192.26	128.57
13	201.81	131.52
14	211.26	134.81
15	220.57	138.45
16	229.75	142.42
17	238.77	146.73
18	247.63	151.37
19	256.31	156.33
20	264.81	161.61
21	273.10	167.19
22	281.19	173.08
23	289.05	179.25
24	296.69	185.71
25	304.08	192.45
26	311.21	199.46
27	318.09	206.72
28	324.69	214.22
29	329.41	220.00

Circle Center At X = 116.8 ; Y = 390.4 and Radius, 272.5

*** 1.332 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.56	122.78
2	115.48	124.03
3	125.36	125.59
4	135.18	127.44
5	144.95	129.59
6	154.64	132.04
7	164.26	134.77
8	173.79	137.80
9	183.23	141.11

10	192.56	144.71
11	201.78	148.58
12	210.87	152.74
13	219.84	157.17
14	228.67	161.86
15	237.35	166.82
16	245.88	172.05
17	254.25	177.52
18	262.44	183.25
19	270.46	189.23
20	278.30	195.44
21	285.94	201.89
22	293.39	208.56
23	300.63	215.46
24	305.11	220.00

Circle Center At X = 69.1 ; Y = 451.0 and Radius, 330.3

*** 1.335 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.67	128.33
2	126.59	127.11
3	136.57	126.42
4	146.57	126.26
5	156.56	126.64
6	166.52	127.55
7	176.41	128.99
8	186.22	130.96
9	195.90	133.44
10	205.44	136.45
11	214.81	139.95
12	223.97	143.95
13	232.91	148.44
14	241.60	153.40
15	250.00	158.81
16	258.11	164.66
17	265.89	170.94
18	273.33	177.63
19	280.40	184.70
20	287.08	192.14
21	293.35	199.93
22	299.20	208.04
23	304.61	216.45
24	306.63	220.00

Circle Center At X = 144.5 ; Y = 313.2 and Radius, 187.0

*** 1.351 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	61.11	120.00
2	71.02	118.65
3	80.97	117.68
4	90.96	117.11
5	100.95	116.92
6	110.95	117.12
7	120.94	117.71
8	130.89	118.68
9	140.79	120.05
10	150.64	121.80
11	160.41	123.93
12	170.09	126.43
13	179.67	129.32
14	189.12	132.57
15	198.45	136.19
16	207.62	140.17
17	216.63	144.50
18	225.47	149.18
19	234.12	154.20
20	242.57	159.55
21	250.80	165.23
22	258.80	171.22
23	266.57	177.52
24	274.09	184.11
25	281.34	191.00
26	288.32	198.16
27	295.02	205.59
28	301.42	213.27
29	306.60	220.00

Circle Center At X = 100.8 ; Y = 374.0 and Radius, 257.0

*** 1.367 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.67	128.33
2	126.67	128.34
3	136.65	128.86
4	146.60	129.91
5	156.48	131.47
6	166.26	133.54

7	175.92	136.12
8	185.44	139.20
9	194.78	142.77
10	203.92	146.82
11	212.84	151.34
12	221.51	156.32
13	229.91	161.74
14	238.02	167.60
15	245.81	173.86
16	253.27	180.53
17	260.37	187.57
18	267.09	194.98
19	273.41	202.72
20	278.03	209.02

Circle Center At X = 121.6 ; Y = 320.1 and Radius, 191.9

*** 1.377 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	94.44	120.00
2	104.18	117.72
3	114.04	116.05
4	123.98	114.99
5	133.97	114.54
6	143.97	114.70
7	153.94	115.48
8	163.85	116.86
9	173.65	118.86
10	183.30	121.45
11	192.78	124.63
12	202.05	128.39
13	211.07	132.71
14	219.81	137.57
15	228.23	142.97
16	236.30	148.87
17	244.00	155.25
18	251.29	162.10
19	258.14	169.38
20	264.54	177.07
21	270.45	185.13
22	275.85	193.55
23	280.73	202.28
24	285.06	211.29
25	285.69	212.85

Circle Center At X = 136.3 ; Y = 277.2 and Radius, 162.7

*** 1.399 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.67	128.33
2	126.60	129.45
3	136.49	130.95
4	146.31	132.83
5	156.06	135.08
6	165.70	137.71
7	175.24	140.71
8	184.66	144.08
9	193.94	147.80
10	203.07	151.88
11	212.04	156.31
12	220.83	161.08
13	229.42	166.19
14	237.82	171.62
15	246.00	177.37
16	253.95	183.44
17	261.66	189.80
18	269.12	196.46
19	276.32	203.40
20	283.25	210.61
21	284.87	212.44

Circle Center At X = 92.7 ; Y = 386.7 and Radius, 259.5

*** 1.400 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.56	122.78
2	115.47	121.50
3	125.44	120.63
4	135.42	120.14
5	145.42	120.06
6	155.42	120.37
7	165.39	121.08
8	175.33	122.19
9	185.22	123.69
10	195.04	125.59
11	204.77	127.87
12	214.41	130.54
13	223.94	133.58

14	233.33	137.01
15	242.58	140.81
16	251.68	144.97
17	260.60	149.48
18	269.33	154.35
19	277.86	159.57
20	286.18	165.12
21	294.28	170.99
22	302.13	177.18
23	309.73	183.68
24	317.06	190.48
25	324.12	197.56
26	330.89	204.92
27	337.37	212.54
28	343.21	220.00

Circle Center At X = 142.5 ; Y = 371.4 and Radius, 251.4

*** 1.401 ***

Failure Surface Specified By 29 Coordinate Points

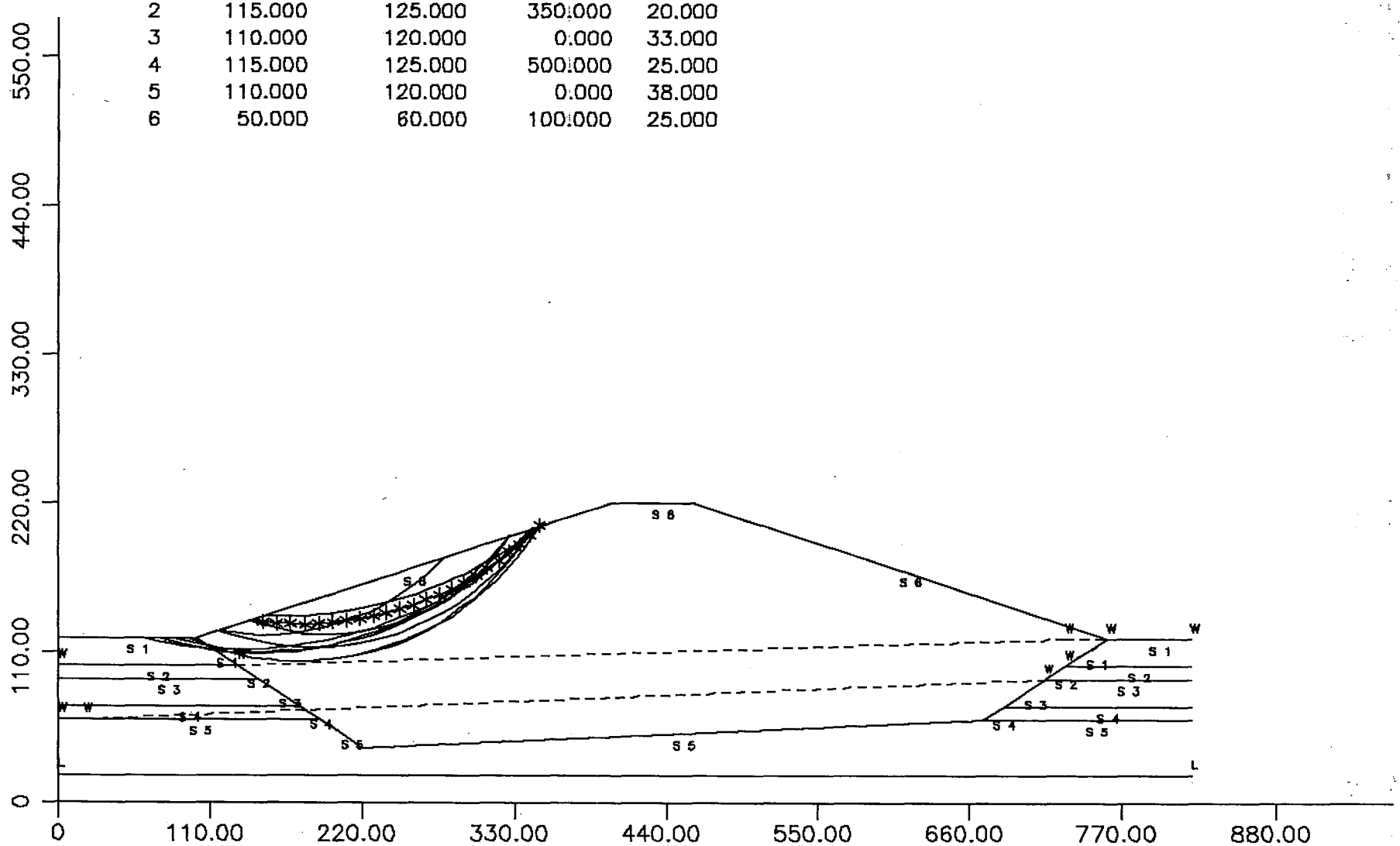
Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.22	120.00
2	81.97	117.76
3	91.81	115.98
4	101.72	114.68
5	111.69	113.86
6	121.68	113.52
7	131.68	113.66
8	141.67	114.27
9	151.61	115.36
10	161.48	116.93
11	171.27	118.97
12	180.95	121.48
13	190.50	124.45
14	199.90	127.87
15	209.12	131.74
16	218.14	136.05
17	226.95	140.79
18	235.52	145.94
19	243.83	151.50
20	251.87	157.45
21	259.61	163.77
22	267.04	170.47
23	274.15	177.51
24	280.90	184.88
25	287.30	192.57
26	293.31	200.55
27	298.94	208.82
28	304.17	217.35
29	305.62	220.00

Circle Center At X = 123.8 ; Y = 322.0 and Radius, 208.5

*** 1.407 ***

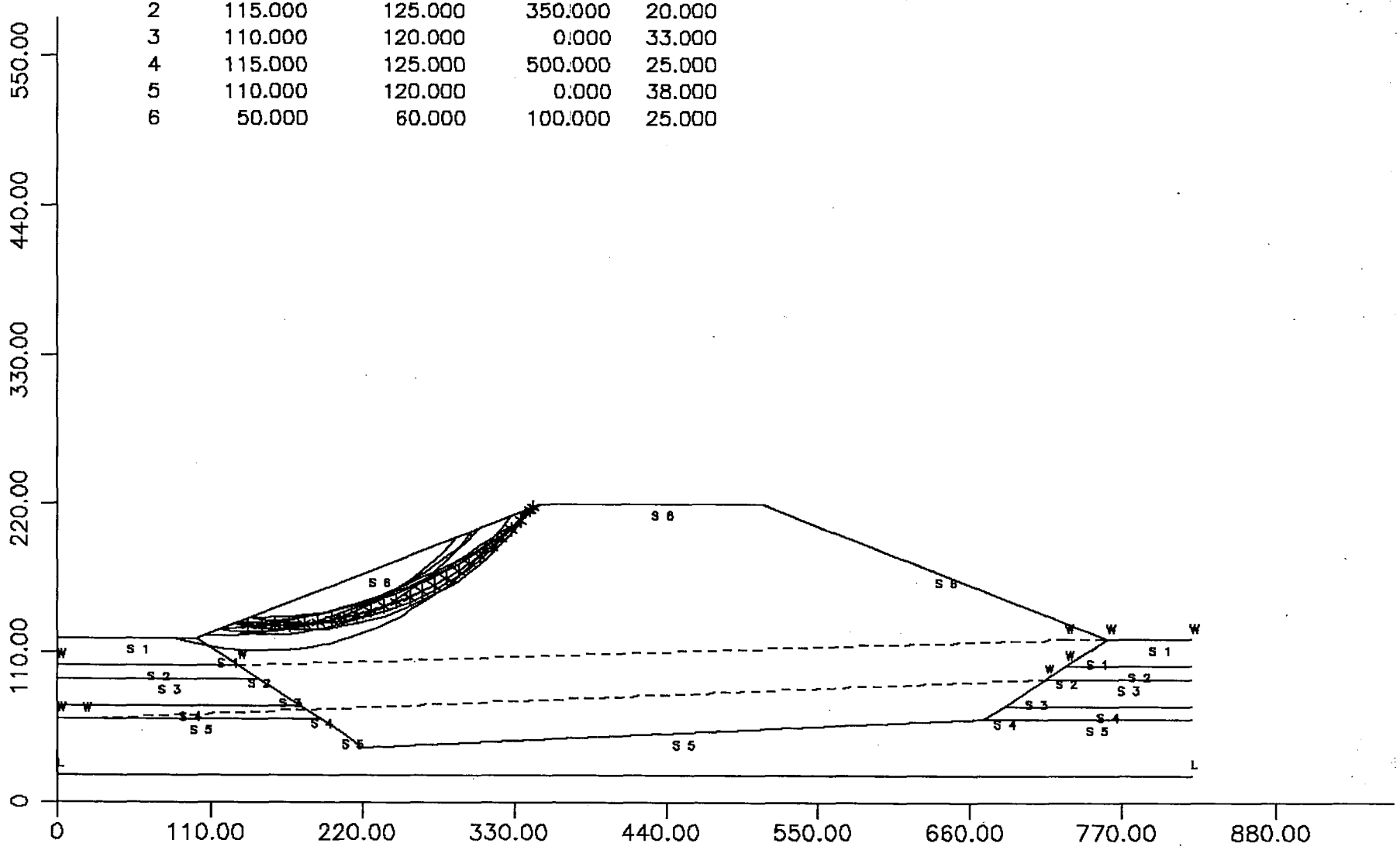
Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000
6	50.000	60.000	100.000	25.000

Minimum Factor of Safety 1.935



Soil	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
1	110.000	120.000	0.000	36.000
2	115.000	125.000	350.000	20.000
3	110.000	120.000	0.000	33.000
4	115.000	125.000	500.000	25.000
5	110.000	120.000	0.000	38.000
6	50.000	60.000	100.000	25.000

Minimum Factor of Safety 1.607



CITRUS COUNTY CENTRAL LANDFILL
NEW DISPOSAL CELL

Computed by E. Suarez date 11/13/01
Ckd by ___ date ___ Rev ___ sheet 1 of 3

Embankment - Settlement Calculations

Assumptions = 1. Increase depth of waste by as much as 180 feet

2. Density of waste and soil = 51 pcf

3. Use soil conditions from B-6

Stress at ground surface due to additional waste

$\Delta\sigma = 180 \text{ ft} \times 51 \text{ pcf} = 9{,}180 \text{ pcf}$

$\Delta\sigma = 9180 \text{ pcf}$

Use Strain Analysis

Depth ft	Δz ft	Soil type	$\bar{N}$	$\Delta\sigma$ ksf	E ksf	ϵ	ρ ft
0 - 10	10	SP-SM	12-18	7.34	310	0.023	0.23
10 - 50	40	SP	31-41	6.88	885	0.007	0.28
50 - 100	50	SP	50+	6.42	-	-	

$E = 500(N+15) \times 20$ psf

$E = (18{,}000 + 750N)\,20$ psf

$\epsilon = \Delta\sigma / E$ unitless

$\rho = \Delta z \cdot \epsilon$ ft

$\Sigma\rho = 0.51'$

$\Sigma\rho = 6''$

CITRUS COUNTY CENTRAL LANDFILL
NEW DISPOSAL CELL

Computed by E. SUAREZ date 11/13/01
Ckd by ___ date _____ Rev _____ sheet 2 of 3

$\Delta\sigma$ = Distribution of vertical stress along vertical section for varying L/H ratio at center line.

after Perloff → for 180' of fill

at $z = 5'$ $\Delta\sigma_1 = 0.8 \times 51 \times 180 = 7344$ psf

at $z = 30'$ $\Delta\sigma = 0.75 \times 51 \times 180 = 6885$ psf

at $z = 75'$ $\Delta\sigma = 0.70 \times 51 \times 180 = 6.426$ psf

for 100' of fill

at $z = 5'$ $\Delta\sigma = 0.8 \times 51 \times 100 = 4080$ psf

at $z = 30'$ $\Delta\sigma = 0.75 \times 51 \times 100 = 3825$ psf

at $z = 75'$ $\Delta\sigma = 0.70 \times 51 \times 100 = 3570$ psf

CITRUS COUNTY CENTRAL LANDFILL

NEW DISPOSAL CELL

Computed by E. SUAREZ date 11/13/01

Ckd by ___ date ___ Rev ___ sheet 3 of 3

Settlement for 180' of waste

Depth ft	Δz (ft)	Soil Type	$\bar{N}$	Δσ ksf	E ksf	ε	ρ ft
0 - 10	10	SP SM	14-18	7.34	310	0.023	0.23
10 - 50	40	SP	31-41	6.88	885	0.007	0.28
50 - 100	50	SP	50+	6.42		—	—

$\Sigma\rho_2$ 0.51'

$\Sigma\rho_1$ 6.1"

Settlement for 100' of waste

Depth ft	Δz ft	Soil Type	$\bar{N}$	Δσ ksf	E ksf	ε	ρ ft
0 - 10	10	SP-SM	14-18	4.08	310	0.013	0.13
10 - 50	40	SP	31-41	3.82	885	0.004	0.16
50 - 100	50	SP	50+	3.57			

$\Sigma\rho_2$ 0.29'

$\Sigma\rho_1$ 3.4"

APPENDIX E

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used*:

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

Published by

ASFE THE ASSOCIATION OF ENGINEERING FIRMS PRACTICING IN THE GEOSCIENCES

8811 Colesville Road/Suite G106/Silver Spring, Maryland 20910/(301) 565-2733

BPCRPT03895M/RP2MD190

CONSTRAINTS AND RESTRICTIONS

WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that is not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of investigation. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.