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GEOTECHNICAL EXPLORATION SERVICES

SLOPE STABILITY AND LIQUEACTION POTENTIAL ANALYSIS
PROCESS POND IMPOUNDMENT DIKES
DEERHAVEN GENERATING STATION (DGS)
10001 NW 13th STREET
GAINESVILLE, ALACHUA COUNTY, FLORIDA

PROJECT NO. 0230.1500077
REPORT NO. 1251804

Prepared For:

Innovative Waste Consulting Services, LLC
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November 20, 2015

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November 20, 2015

Innovative Waste Consulting Services, LLC
6628 NW 9th Boulevard, Suite 3
Gainesville, FL 32608

Attention: Dr. Pradeep Jain, PhD., P.E.

Reference: **Report of Geotechnical Consulting Services**
Deerhaven Generating Station
Process Ponds/Impoundment Dikes
Slope Stability and Liquefaction Potential Analysis
10001 NW 13th Street
Gainesville, Alachua County, Florida
UES Project No. 0230.1500077
UES Report No. 1251804

Dear Dr. Jain:

Universal Engineering Sciences, Inc. (UES) has completed the geotechnical engineering services for the subject project in Gainesville, Alachua County, Florida. This geotechnical Report is submitted in satisfaction of the contracted scope of services as summarized in UES Proposal No. 1174050, dated June 15, 2015.

The following report presents the results of our Geotechnical Exploration, Slope Stability Evaluation and Liquefaction Potential Analysis for the four process water ponds at the Deerhaven Generating Station. This plan was prepared under the supervision, direction and control of the undersigned registered professional engineer (PE). The undersigned PE is familiar with the requirements of 40 CFR 257.73(e). The undersigned PE certifies that this initial safety factor assessment meets the requirements of 40 CFR 257.73(e)(1). This certification was prepared per the requirement of 40 CFR 257.73(e)(2).

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

Sincerely,

UNIVERSAL ENGINEERING SCIENCES, INC.
Certificate of Authorization Number 549

Digitally signed by Eduardo Suarez
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Reviewed by:

For/

Eduardo Suarez, P.E.
Senior Geotechnical Engineer
Florida P.E. No. 60272
Date:

Jeffrey S. Pruett, P.E.
Vice President
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EXECUTIVE SUMMARY

We have prepared this executive summary as a general overview. Please refer to, and rely on, the full report for information about findings, recommendations, and other considerations.

The Deerhaven Generating Station is located in Gainesville, Alachua County, Florida. The Deerhaven coal combustion impoundments consist of process water ponds divided in four cells that receive process water from plant operation.

The purpose of this geotechnical consulting services was to evaluate the subsurface condition of the process water ponds and to perform slope stability analysis and liquefaction potential analysis of the existing process ponds impoundment dikes.

The general profile depicts horizons or layers that are in the stratigraphy sequence of descending lithology as described below. The slope stability sections presents these layers in graphical manner.The site topography ranges from an elevation of +180, NGVD to elevation +195, NGVD. The soils consists of silty sand [SM] to approximate elevations of +186 to +184 feet and +180 to +175 feet, NGVD, and a clayey sand to sandy clay [SC/CH] liner to elevations to +184 to +180 feet, NGVD. Based on the SPT-N values and laboratory strength testing, the silty sands have relative densities of loose to medium dense to very dense and the clayey soils have relative densities of medium dense to very stiff.

Groundwater levels were measured between 4 and 20.5 feet below existing site grades at the time of drilling (approximate elevations +182 to +193 feet, NGVD). Typically, fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall, surface runoff, and other specific site factors that may vary from the time the soil test borings were conducted.

Based on our field exploration, laboratory testing program and site topography information, the factors of safety against slope failure for two loading conditions (long-term, maximum storage pool loading condition and maximum surcharge pool loading condition) as well as the factor of safety against liquefaction potential exceed the requirements presented in the Federal Register, Volume 80, Number 74, Part II, April 17, 2015. The site is not considered to be located in a seismic zone; therefore a seismic factor of safety was not estimated for the surface impoundment.

1.0 INTRODUCTION

Universal Engineering Sciences, Inc. (UES) has completed a geotechnical exploration, slope stability and liquefaction potential analysis for the process ponds at the existing Deerhaven Generating Station (DGS) in Gainesville, Alachua County, Florida.

2.0 PROJECT CONSIDERATIONS

The geotechnical exploration and slope stability analysis was planned and executed based on the United States Environmental Protection Agency's Request for Action Plan regarding Gainesville Regional Utilities – Deerhaven Power Plant, dated June 2, 2014.

The subject site is located within Sections 26 and 27, Township 8 South, Range 19 East in Gainesville, Alachua County, Florida. The Deerhaven Generating Station (DGS) is located approximately 1.25 miles north of NW 43rd Street along the north side of US HWY 441, in Gainesville, Alachua County, Florida. More specifically, the property is an approximately 930-acre parcel of land located at 10001 NW 13th Street in Gainesville, Alachua County, Florida.

The process ponds are situated just northeast of the generating facility. The process ponds are connected to the main plant by roadways that support asphalt/limerock base access roads. The process pond area is approximately 16 acres in area and is adjacent to wooded areas. The top of the ponds are at or near elevation +195 feet which is nearly 150 feet above the potentiometric surface level. The slopes vary in steepness from 3H: 1V to 4H: 1V throughout the sides of the process pond area. The slopes are vegetated with grass along the exterior, and covered with rock/boulders along the interior slopes. Moderately dense wooded areas surround much of the Deerhaven Generating Station (DGS). There are some water management areas/swales at the south side of the process pond area.

If any of the above information is incorrect or changes, please contact UES immediately so that revisions to the recommendations contained in this report can be made, as necessary.

3.0 PURPOSE AND SCOPE OF SERVICES

3.1 Purpose

The purposes of this exploration were:

- to explore and evaluate the subsurface conditions within the suggested areas to gather information concerning the soil conditions on and around the existing process ponds impoundment dikes,

- to conduct a selected laboratory soil testing program to aid in the classification of the prevailing site soils and with the evaluation of relevant soil strength and engineering properties,

- to perform slope stability analysis, and liquefaction potential analysis of the existing process ponds impoundment dikes.

3.2 Scope of Service

A compilation of the services conducted by UES to date for the subsurface exploration program and slope stability analysis for the process ponds impoundment dikes at the existing Deerhaven Generating Station (DGS) in Alachua County, Florida are as follows:

- Advanced six (6) Standard Penetration Test (SPT) borings (B-1 through B-6) in the impoundment dikes areas to depths of 25 feet below existing land surface (bls).
- Collected four (4) Shelby Tube samples for Direct Shear and Triaxial Testing.
- Secured samples of representative soils found in the soil borings for laboratory analysis and classification by one of our geotechnical engineers.
- Measured the existing site groundwater levels at the boring locations.
- Conducted laboratory tests on selected disturbed and "undisturbed" core/soil samples obtained in the field to evaluate their engineering properties.
- Installed six (6) groundwater observation wells/piezometers at the boring locations.
- Prepared a report which documents the results of our subsurface exploration and slope stability/liquefaction potential analysis.

4.0 LITERATURE REVIEW

We reviewed commonly available references for general information about the property along the proposed project. A Site Location Map and a USGS Map is included in **Appendix A**.

4.1 Soil Survey

Based on the Soil Survey for Alachua County, Florida, as prepared by the US Department of Agriculture, Natural Resource Conservation Service, the predominant soil types at the site are identified as Pomona and Surrency soil (Thomas 1985). A summary of characteristics of these soil series was obtained from the Soil Survey and have been presented in Table 1.

Table 1
Summary of NRCS Soil Survey Information

Soil Type	Constituents	Classification	% Passing 200 sieve	Soil Permeability (Inches/Hr)	Seasonal High Water Table
14-Pomona	0-5" - Sand 5-16" - Sand, fine sand 16-24" - Sand, fine sand 24-43" - Sand , fine sand 43-84" - Sandy clay loam, sandy loam, sandy clay	SP, SP-SM SP, SP-SM SP-SM, SM SP, SP-SM SC, SM-SC, SM	2-12 2-12 5-15 2-12 25-50	6.0 - 20 6.0.- 20 0.6 - 20 2.0 - 2.0 0.2 - 20	0 to 1' Apparent
16 - Surrency	0-28" – Sand 28-44" – Sandy loam, sandy clay loam 44-80" – Sandy clay loam	SM SM, SM-SC, SC SM, SM-SC, SC	10-26 22-35 30-44	2.0 – 20 0.6 – 6.0 0.06 – 2.0	0 to 0.5' Apparent

4.2 Topography

According to information obtained from the United States Geologic Survey (USGS) Florida, the natural ground surface elevation across the general site area ranges between approximately +175 feet to +185 feet NGVD. A copy of a portion of the USGS Map for the site area is included in **Appendix A**.

4.3 Geology

The general geology of central Alachua County is characterized by a surface veneer of Pleistocene and Pliocene sands and sandy clays overlying the Miocene-age Hawthorn Group. The Hawthorn Group includes a highly variable mixture of interbedded quartz sands, clays, carbonates, pebbles and grains occurring with thicknesses of up to 150 feet.

The general hydrogeology of Alachua County consists of three aquifer systems; a surficial aquifer, and intermediate aquifer, and the Floridan Aquifer system. The surficial aquifer exists as an unconfined water table situated over the impermeable Hawthorn Group and is usually a subdued reflection of surface topography. The intermediated aquifer system includes all rocks that collectively retard the exchange of water between the overlying surficial aquifer system and the underlying Floridan aquifer system. Water in this system is contained under confined conditions. The Floridan aquifer system is a thick, carbonate sequence that functions regionally as a water-yielding hydraulic unit. Water exists under confined conditions.

Information obtained from the USGS Potentiometric Surface Map dated May 2009 suggests the potentiometric level of the Floridan Aquifer in the general area of the project site to be in the elevation range of +40 to +50 feet, NGVD (SJRWMD 2009).

5.0 FIELD EXPLORATION

5.1 General

The soil borings were performed with a truck-mounted drill rig. The general locations of the soil borings were selected based on the height of the embankments, as well as the observed moisture and/or potential seepage along some areas of the embankments. The approximate locations of the borings are shown on the Boring Location Plan presented in **Appendix B**. UES received horizontal and vertical control data for each boring which is presented in tabular form, Boring Survey Control, in Appendix B with ground surface elevations also presented on the boring logs.

5.2 Standard Penetration Test Borings

The Standard Penetration Test (SPT) borings were performed in general accordance with the procedures of ASTM D 1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils). Continuous sampling was performed within the upper 10 feet. The SPT drilling technique involves driving a standard split-barrel sampler into the soil by a 140-pound hammer, free falling 30 inches. The number of blows required to drive the sampler 1 foot, after an initial seating of 6 inches, is designated the penetration resistance, or N-value, an index to soil strength and consistency.

5.3 Groundwater Observation Level/Piezometers

UES installed six (6) piezometers (PZ-1 and PZ-6) completed to depths of 6 to 12 feet at the borehole locations. The piezometers were completed with 2" PVC riser material connected to a section of 0.010-inch slot screen, 6/20 clean washed silica sand was placed around the annulus of the screen to at least two feet above the screen. A 30/60 fine sand seal was placed on top of the 6/20 silica sand pack to the ground surface.

5.4 Undisturbed Sampling

SPT borings were used to provide access for the Shelby tubes to collect undisturbed soils samples. Four (4) undisturbed samples were collected for shear testing of cohesive soils. The ASTM procedure of Thin Walled Sampling Soils, ASTM-D-1578-13, was used to collect undisturbed soil samples.

6.0 LABORATORY TESTING

6.1 Visual Classification

The soil samples recovered from the soil test borings were returned to our laboratory where an engineer visually reviewed the field descriptions in accordance with ASTM D-2488. We then selected representative soil samples for laboratory testing. Using the results of the laboratory tests, our visual examination, and our review of the field boring logs we classified the soil borings in accordance with the current Unified Soil Classification System (USCS).

6.2 Index Testing

Laboratory testing was performed on selected samples of the soils encountered in the field exploration to better define soil composition and properties. Testing was performed in accordance to ASTM procedures and included Grain Size Analysis (ASTM D-422, Percent Passing No. 200 Sieve (ASTM D-1140), Moisture Content (ASTM D-2216), Atterberg Limits (ASTM D-4318), Consolidated Drained (ASTM D-7181) and Undrained Triaxial Tests (ASTM D-4767) and Direct Shear Test (ASTM D-3080). The test results have been presented on the attached Boring Logs.

The laboratory classification data is presented on the Boring Logs at the approximate depth sampled in Appendix B. All laboratory data is summarized and report sheets included in Appendix C. In addition, the detailed laboratory test procedures are enclosed in **Appendix C**.

7.0 SOIL STRATIGRAPHY

7.1 Generalized Soil Profile

The general profile depicts horizons or layers that are in the stratigraphy sequence of descending lithology as described below. The slope stability sections present these layers in graphical manner.The site topography ranges from an elevation of +180, NGVD to elevation +195, NGVD.

The soils consists of silty sand [SM] to approximate elevations of +186 to +184 feet and +180 to +175 feet, NGVD, and a clayey sand to sandy clay [SC/CH] liner to elevations to +184 to +180 feet, NGVD. Based on the SPT-N values and laboratory strength testing, the silty sands have relative densities of loose to medium dense to very dense and the clayey soils have relative densities of medium dense to very stiff.

The results of our field exploration and laboratory analysis, together with pertinent information obtained from the SPT, such as soil profiles, penetration resistance and stabilized groundwater levels are shown on the boring logs included in **Appendix B**. The Key to Boring Logs is also included in Appendix B. The soil profiles were prepared from field logs after the recovered soil samples were visually classified by a member of our geotechnical staff. The stratification lines shown on the boring logs represent the approximate boundaries between soil types, and may not depict exact subsurface soil conditions. The actual soil boundaries may be more transitional than depicted.

8.0 GROUNDWATER CONSIDERATIONS

8.1 Existing Groundwater Level

Groundwater levels were measured between 4 and 20.5 feet below existing site grades at the time of drilling (approximate elevations +182 to +193 feet, NGVD). Typically, fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall, surface runoff, and other specific site factors that may vary from the time the soil test borings were conducted. Additional water table elevation can be seen in the table below:

Table 2 – Groundwater Elevations

Boring Location No.	Top of Piezometer Elevation Feet (NGVD)	Ground Surface Elevation[1] Feet (NGVD)	Piezometer Depth Below Ground Surface Elevation, Feet	Groundwater Level Readings Water Table Elevations (NGVD)	
				July 17/15	July 30/15
B-1	198.67	195.30	12	192.02	193.07
B-2	198.85	195.42	12	187.35	188.00
B-3	198.72	195.17	12	185.77	186.77
B-4	197.90	194.60	8	186.65	187.30
B-5	191.41	188.1	6	184.96	186.56
B-6	191.70	188.40	6	182.40	184.95

Notes: [1].-Ground surface elevations are estimated based on topography maps provided by IWCS

8.2 Typical Wet Season Groundwater Level

The typical wet season groundwater level is defined as the highest groundwater level sustained for a period of 2 to 4 weeks during the "wet" season of the year, for existing site conditions, in a year with average normal rainfall amounts. Based on historical data, the rainy season in Alachua County, Florida typically occurs between June and September.

To estimate the wet season groundwater level at the soil test boring locations, many factors may be considered, such as the following:

a. Measured groundwater level
b. Drainage characteristics of existing soil types
c. Season of the year (wet/dry season)
d. Current & historical rainfall data (recent and year-to-date)
e. Natural relief points (such as lakes, rivers, swamp areas, etc.)
f. Man-made drainage systems (ditches, canals, etc.)
g. Distances to relief points and man-made drainage systems
h. On-site types of vegetation
i. Area topography (ground surface elevations)
j: Available Published Data

Based on the groundwater levels encountered, the historical rainfall data, our review of our regional hydrogeology and the Alachua County Soil Survey, we estimate that the typical wet season groundwater levels around the process ponds will range approximately 4 to 6 feet below much of the existing land surface (approximate elevations +180 feet, NGVD).

As mentioned previously, we found shallow deposits of silty sands across the site during our site exploration. Due to the poor permeability characteristics of these silty soils, these soils tend to act as an aquiclude (a sediment through which groundwater can not pass easily) to the natural infiltration of the rainwater. Therefore, surface water will most likely temporarily perch on top of these relatively impermeable soils causing isolated areas with temporary groundwater levels significantly higher during periods of heavy rainfall or artificial irrigation.

It should be noted however that peak stage elevations immediately following various intense storm events, may be somewhat higher than the estimated typical wet season levels. Further, it should be understood that changes in the surface hydrology and subsurface drainage from on-site or off-site improvements could have significant effects on the normal and seasonal high groundwater levels.

9.0 ASSESSMENT SAFETY FACTORS

Our assessment program included calculating factors of safety under specific loading conditions to determine the stability of the existing surface impoundment dikes. Static, Seismic and Liquefaction factors of safety were evaluated following the requirements established by Environmental Protection Agency (EPA) in 40 CFR Part 257 and 261 – Hazards and Solid Waste management System; Disposal of Coal Combustion Residuals from Electric Utilities.

Accordingly the following minimum factor of safety should be achieved;

- Long-term- maximum storage pool loading conditions must equal or exceed 1.50
- Maximum surcharge pool loading conditions must equal or exceed 1.40
- Seismic Factor must equal or exceed 1.00
- Liquefaction factor of safety must equal or exceed 1.2

Seismic Impact zones means an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years. Based on the USGS Hazards map included in Appendix D, the maximum expected horizontal acceleration in the impoundments is less than 0.02 g. Therefore the site is not considered to be located in a seismic impact zone. A seismic stability analysis was, therefore, not conducted for these impoundments.

9.1 Slope Stability Analysis

The process ponds are situated just northeast of the generating facility. The process ponds are accessible from the main plant by asphalt/limerock base access roads. The process pond area is approximately 16 acres and is adjacent to wooded areas. The top of the ponds are at or near elevation +195 feet which is nearly 150 feet above the potentiometric surface level (Floridan Aquifer). The slopes vary in steepness from 3H: 1V to 4H: 1V throughout the sides of the process pond area. The slopes are vegetated with grass along the exterior, and covered with rock/rip-rap along the interior slopes. Moderately dense wooded areas surround much of the Deerhaven Generating Station (DGS). There are some water management areas/swales at the south side of the process pond area.

The purpose of the stability analysis was to determine the minimum factor of safety of several potential failure surfaces for critical cross sections. Stability analysis determines whether the existing slope meets the safety requirements. Conventional limit equilibrium methods of slope stability analysis were used to evaluate the equilibrium of soil/fill mass to move under the influence of gravity. We developed the parameters used in our slope stability evaluation from the information obtained during our field exploration and laboratory testing program, from the site topographic information provided by Innovative Waste Consulting Services, LLC. The slope stability analysis also considered a maintenance truck on top the berm with an axle load of 16,000 pounds.

9.1.1 Geometry

Based on drawings received, we developed an internal geometry for the cross sections analyzed. Selections of the cross sections were based on the steepness of slope, height of the fill, phreatic level and subsurface conditions. Based on these conditions six critical cross sections were determined to be the most critical cross sections for the stability for the DGS process ponds.

9.1.2 Failure Modes

Two potential failure scenarios were studied to evaluate if the process ponds meet the required factor of safety against global slope failure:

Foundation Stability: Circular failure surfaces extending through the process ponds and into the foundation soils were generated and evaluated by STABLE/G. Factor of safety values were evaluated using the “Janbu” and “Bishop” methods.

Face Stability: Small circular failure surfaces extending through the process pond soils, including the grass covered surficial layer, were generated and evaluated by STABLE/G. Factor of safety values were evaluated using the Janbu method.

9.1.3 Failure Conditions

A major consideration in characterizing shear strength is determining whether the soil/fill mass will be drained or undrained for each condition. Stability analyses during construction and at the end of construction are usually performed using drained strength in free-draining materials and undrained strengths in materials that drain slowly.

9.1.4 Materials Properties

Soil strength parameters were obtained from laboratory testing performed on representative samples taken from the project site. Below is a summary of the soil materials properties and strength parameters for the layers at the DGS process ponds project site. Most of the index and shear strength parameters were chosen based on the field and laboratory test performed. Certain parameters were selected based on the work by others as noted.

Medium dense Silty Sand Ỹr=119 pcf			
Analysis	Type	Unit	Value
Un-Drained	Cohesion Intercept	PSF	192
Lab Testing Triaxial Test	Friction angle	Degree	31

Medium dense Very Clayey Sand Ỹr=127 pcf			
Analysis	Type	Unit	Value
Un-Drained	Cohesion Intercept	PSF	197
Lab Testing Triaxial Test	Friction angle	Degree	24.9

Medium dense Silty Sand * Ỹr=118 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	175
Lab Testing Direct Shear Test	Friction angle	Degree	31.1

Medium dense Silty-Clayey Sand * Ỹr=120 pcf			
Analysis	Type	Unit	Value
Undrained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	30

Loose Sand with silt Ỹr=110 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	29

Medium dense Sand with silt Ỹr=120 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	32

Medium dense Silty Sand Ỹr=120 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	30

9.1.5 Computational Results

Theoretically, when analyzing slopes, a factor of safety of less than 1.0 indicates unstable and unsafe conditions with the potential for failure to occur at any time. A factor of safety greater than 1.0 indicates the slope is stable. Presented below in Table 3 are the Factors of Safety required by United States Environmental Protection Agency (EPA), in Federal Register, Volume 80, Number 74, Part II, April 17, 2015.

Table 3: Required Minimum Values of Factor of Safety for Slope Stability Analysis*

Condition	Safety Factor
Static safety factor/ long-term maximum storage pool loading condition	1.5
Static safety factor/maximum surcharge pool loading condition	1.4

**Source: EPA, 2015*

Results of the Factor of Safety for all scenarios run by Stable6 are summarized in Table 4 below. The following summary table demonstrates that the process ponds meet and exceed the required safety factors.

A slope stability analysis of the embankments was performed using the data gathered from the laboratory analysis of the soil samples collected from the impoundments. The stability analysis was conducted for both, long-term maximum storage pool loading condition and maximum surcharge pool loading conditions. Maximum surcharge pool loading conditions were considered at the top of the embankment and long-term maximum storage pool loading conditions were considered at maximum operating levels. Slope stability analyses were conducted for the maximum water elevation corresponding to the top of the embankment (EL +195 ft, NGVD for Ash Cells 1 and 2) and EL +188 ft, NGVD for Pump Back Ponds 1 and 2) and for the maximum operating water levels (EL +193 ft, NGVD for Ash Cells 1 and 2) and EL +186 ft, NGVD for Pump Back Ponds 1 and 2).

Foundation stability and face stability were evaluated using failure modes as described above. Table 4 below presents minimum factors from these analyses

Table 4 Factors of Safety

Process Pond	Section/Boring	Static safety factor/ long-term maximum storage pool loading condition	Static safety factor/maximum surcharge pool loading condition
Ash Cell #1	B-1	1.795	1.791
Ash Cell #2	B-2/B-3/B4	1.561	1.510
Pump Back Cell #1	B-5	1.785	1.715
Pump Back Cell #2	B-6	1.834	1.778

The results of our evaluation indicate that factors of safety against shear failure of the existing slope areas exceed the generally required values of 1.5 for long-term maximum storage pool loading condition and 1.4 for maximum surcharge pool loading condition. A more detailed presentation of the results of our slope stability evaluations is included in **Appendix D**: Slope Stability Analysis.

9.2 Liquefaction Potential Analysis

The potential for liquefaction was evaluated following the guidelines established by Environmental Protection Agency (EPA) in 40 CFR Part 257 and 261 – Hazards and Solid Waste management System; Disposal of Coal Combustion Residuals from Electric Utilities and more specifically Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, US EPA Office of Research and Development ,1995.

Due to the expected range of ground motion in Gainesville, Florida (less than 0.5 g) a simplified procedure was applicable. The procedure is comprised of the following steps:

Identifying the potentially liquefiable layers of soils to be analyzed; the first step is assessing the potential for liquefaction of any cohesionless soils at the site. The most critical zone to be analyzed is based on the results of the in-situ testing and laboratory index tests (fine contents, plasticity index, saturation and soil penetration resistance).

Once the zone of concern was defined, and based on total and effective vertical stresses, the Critical Stress Ratio (CSR) values required to cause liquefaction were obtained using relationships between stress ratio causing liquefaction and N_{60} values for sands for M 7.5 Earthquakes developed by Seed et al (1985). CSR values were corrected by earthquake magnitude and stress levels exceeding 1 tsf.

The third step was calculating the equivalent uniform Critical Stress Ratio (CSREQ) based on the calculated total and effective vertical stresses and maximum peak horizontal ground acceleration of 0.02 g.

The factor of safety against liquefaction was obtained by dividing the shear stress ratio required to cause liquefaction by the equivalent uniform cyclic stress ratio. The factor of safety ranged from 6.25 to more than 20. The minimum Liquefaction Factor of safety obtained exceeded the EPA minimum requirement of 1.2 for all critical strata considered.

10.0 LIMITATIONS

10.1 Limitations

This report has been prepared for the exclusive use of Innovative Waste Consulting Services, LLC. and Gainesville Regional Utilities (GRU). The scope is limited to the specific project and locations described herein. Our description of the project's design parameters represents our understanding of the significant aspects relevant to soil and foundation characteristics. In the event that any changes in the design or location of the process ponds as outlined in this report are planned, we should be informed so the changes can be reviewed and the conclusions of this report modified, if required, and approved in writing by UES.

All users of this report are cautioned that there was no requirement for UES to attempt to locate any man-made buried objects or identify any other potentially hazardous conditions that may exist at the site during the course of this exploration. Therefore, no attempt was made by UES to locate or identify such concerns. UES cannot be responsible for any buried man-made objects or subsurface hazards which may be subsequently encountered during construction that are not discussed within the text of this report. We can provide this service if requested. For a further description of the scope and limitations of this report please review the document attached within **Appendix F**, "Important Information About Your Geotechnical Engineering Report" prepared by ASFE.

11.0 REFERENCES

EPA. "40 CFR Parts 257 and 261: Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities." *Federal Register* 80.74 (2015): 21302-1501. Print.

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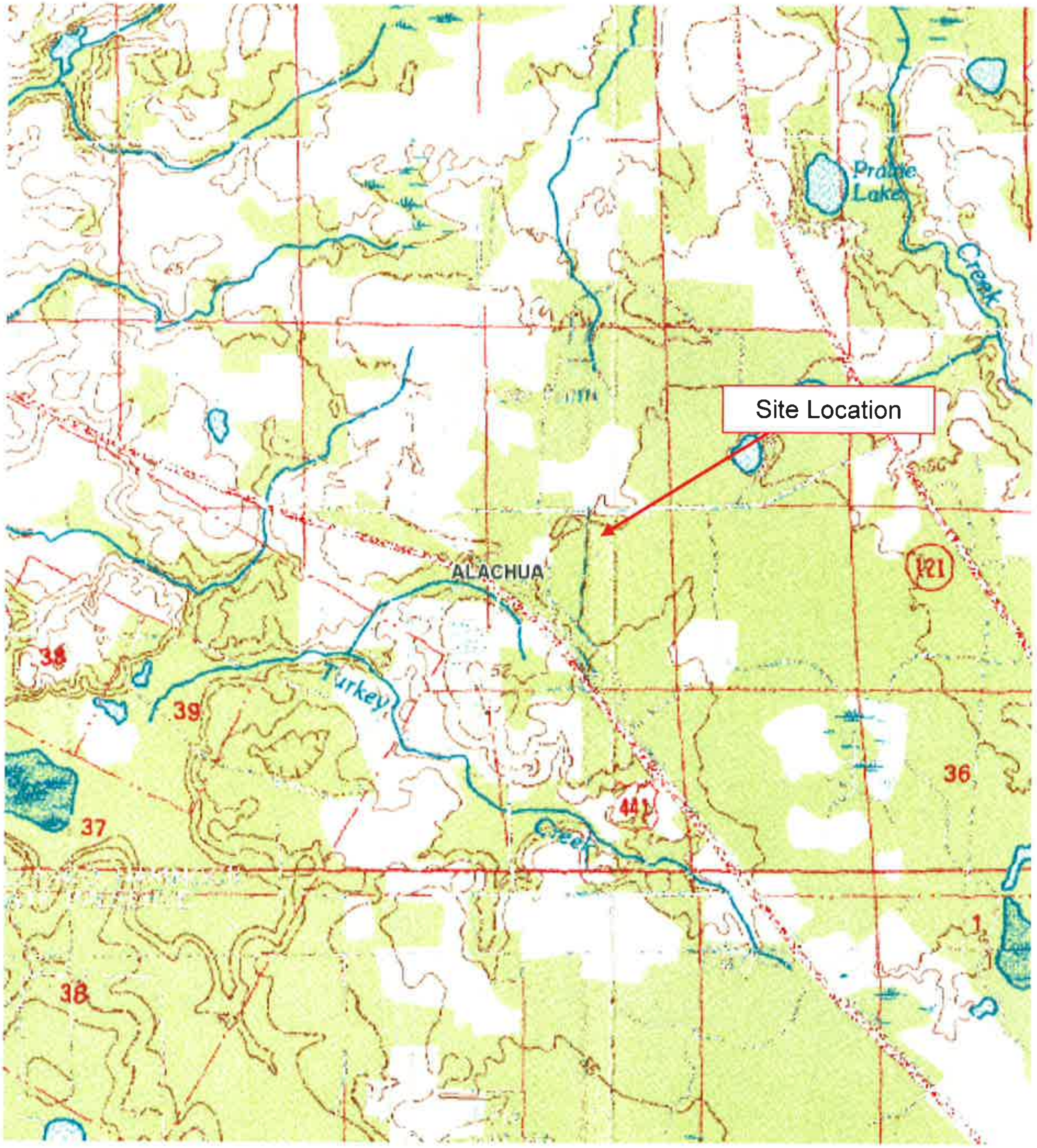
USGS. "USGS Topographic Map." *Welcome to the USGS - U.S. Geological Survey*. United States Geological Survey, n.d. Web. 14 Sept. 2015.

APPENDIX A

SITE LOCATION MAP
USGS SITE LOCATION MAP

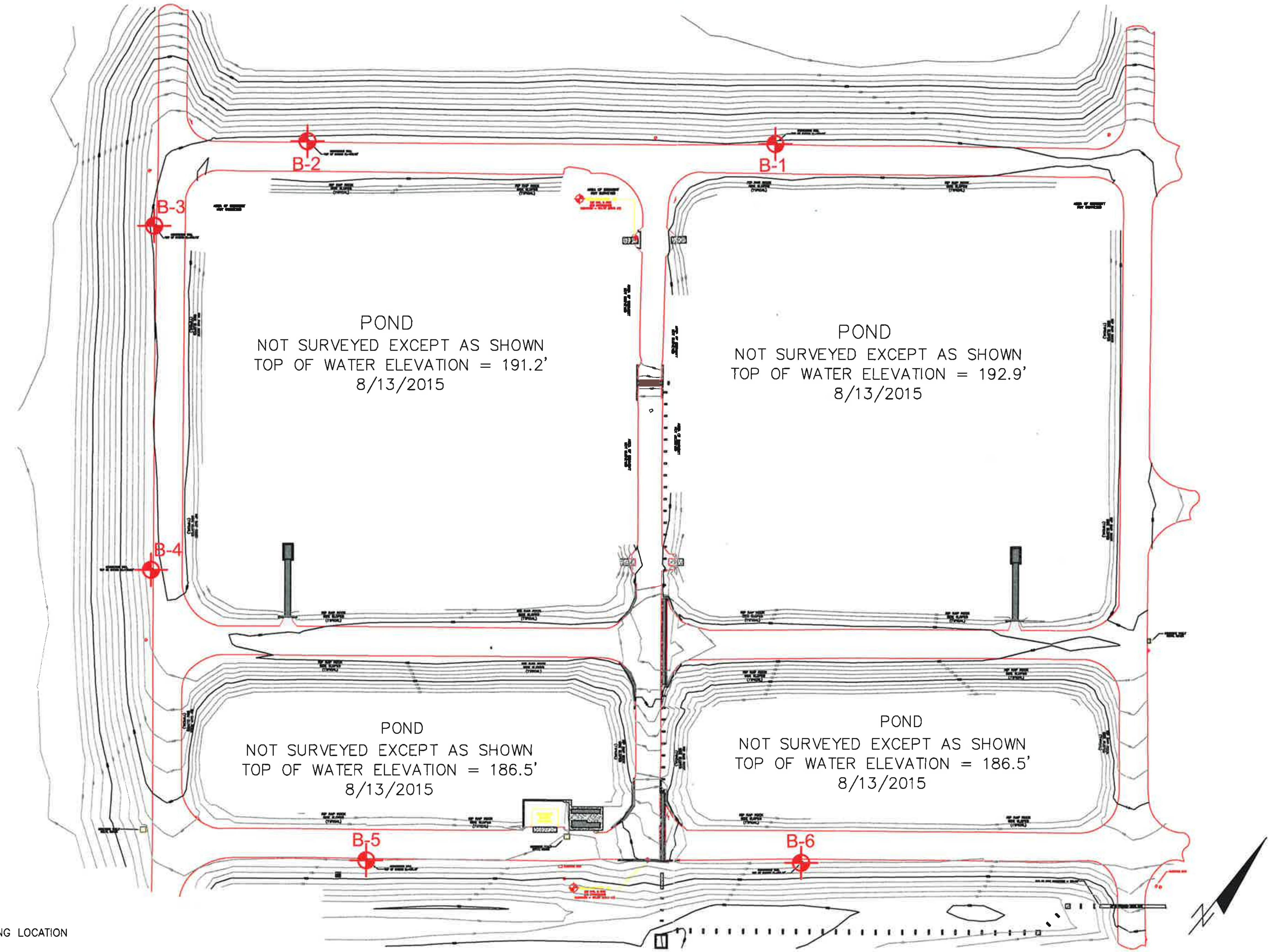
UNIVERSAL ENGINEERING SCIENCES	**GRU Deerhaven Generating Station Gainesville, Alachua County, Florida**		
	Site Location Map		
	DATE: 09-09-15	UES PROJECT NO.: 0230.1500077	APPENDIX NO.: A
	SCALE: N.T.S.	REPORT NO.: 1251804	FIGURE NO.:A 1



UNIVERSAL ENGINEERING SCIENCES	**GRU Deerhaven Generating Station** **Gainesville, Alachua County, Florida**		
	U.S.G.S. Map		
	DATE: 09-09-15	UES PROJECT NO.: 0230.1500077	APPENDIX NO.: A
	SCALE: N.T.S.	REPORT NO.: 1251804	FIGURE NO.:A 2

APPENDIX B

BORING LOCATION PLAN
BORING LOGS
KEY TO BORING LOGS



LEGEND

BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

CLIENT:
INNOVATIVE WASTE CONSULTING SERVICES

DRAWN BY: KD	DATE: 9/10/15
CHECKED BY: ES	DATE: 9/10/15
SCALE: 1"=80'	ACADFILE:0230.1500077-A
PROJECT NO: 0230.1500077.0000	REPORT NO:1251804

GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

BORING LOCATION PLAN

UNIVERSAL
ENGINEERING SCIENCES

PAGE NO:
B - 1

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0230.1500077.0000
REPORT NO.: 1251804
PAGE: B-2

PROJECT: GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

BORING NO: **B-1** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: INNOVATIVE WASTE CONSULTING SERVICES
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 195.30
WATER TABLE (ft): 3.28
DATE OF READING: 7/17/15
EST. WSWT (ft):
DATE STARTED: 7/9/15
DATE FINISHED: 7/9/15
DRILLED BY: R. WOODARD
TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	PI	K (FT/DAY)	ORG. CONT. (%)
0						Medium dense brown silty SAND [SM]						
1–2	X	3-5-5	10									
3				▼		Medium dense brown and gray sand, with silt [SP-SM]						
3–4	X	6-5-5	10									
4–5	X	5-6-5	11									
6–7	X	6-3-4	7				10	13				
7–8	X	4-2-2	4			Loose brown silty SAND [SM]						
9–10	X	2-3-3	6				14	17				
14–15	X	2-4-7	11			Medium dense gray-brown silty clayey SAND [SM-SC]						
19–20	X	6-7-7	14									
23						Loose brown SAND, with trace of silt [SP-SM]						
24–25	X	2-3-4	7									
25						Boring Terminated at 25'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0230.1500077.0000
REPORT NO.: 1251804
PAGE: B-3

PROJECT: GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

BORING NO: **B-2**
SHEET: 1 of 1

SECTION:
TOWNSHIP:
RANGE:

CLIENT: INNOVATIVE WASTE CONSULTING SERVICES
LOCATION: SEE BORING LOCATION PLAN
REMARKS:

GS ELEVATION(ft): 195.42
WATER TABLE (ft): 8.07
DATE OF READING: 7/17/15
EST. WSWT (ft):

DATE STARTED: 7/10/15
DATE FINISHED: 7/10/15
DRILLED BY: R. WOODARD
TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/DAY)	ORG. CONT. (%)
0						Medium dense brown, gray and tan silty SAND, with trace of clay [SM]						
1–2	X	3-4-7	11									
3–4	X	8-9-10	19									
4–5	X	9-10-11	21									
6–7	X	11-9-9	18									
7.5–9	X	8-8-6	14	▼ (8.07)		Medium dense gray very clayey SAND [SC]						
9–10	X	10-6-6	12			Medium dense gray silty SAND [SM]						
13.5–15	X	8-10-6	16									
17						Medium dense light gray SAND, with silt [SP-SM]						
18.5–20	X	5-8-10	18									
21						Medium dense brown silty SAND [SM]						
23.5–25	X	4-8-17	25									
25						Boring Terminated at 25'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.1500077.0000
REPORT NO.:	1251804
PAGE:	B-4

PROJECT: GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

CLIENT: INNOVATIVE WASTE CONSULTING SERVICES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: SHELBY TUBE SAMPLE TAKEN FROM 12' TO 14'

BORING NO: **B-3** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

GS ELEVATION(ft): 195.17 DATE STARTED: 7/10/15
WATER TABLE (ft): 9.4 DATE FINISHED: 7/10/15
DATE OF READING: 7/17/15 DRILLED BY: R. WOODARD
EST. WSWT (ft): TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Medium dense brown and gray silty SAND, with trace of clay [SM]						
2		4-6-10	16									
3.5		9-10-12	22									
5		11-14-15	29									
6.5		19-14-12	26				14	7				
8		14-14-9	23									
9				▼		Medium dense gray and orange clayey SAND [SC]						
9.5		7-4-6	10				32	20	40	22		
12–14	Shelby tube											
14.5		3-4-10	14									
18.5						Medium dense brown silty SAND [SM]						
19.5		10-11-17	28									
22						Medium dense white and light brown silty clayey SAND [SM-SC]						
24.5		2-3-7	10									
25						Boring Terminated at 25'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.1500077.0000
REPORT NO.:	1251804
PAGE:	B-5

PROJECT: GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

BORING NO: **B-4** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: INNOVATIVE WASTE CONSULTING SERVICES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: SHELBY TUBE SAMPLE TAKEN FROM 10' TO 12'

GS ELEVATION(ft): 194.60 DATE STARTED: 7/9/15
WATER TABLE (ft): 7.95 DATE FINISHED: 7/10/15
DATE OF READING: 7/17/15 DRILLED BY: R. WOODARD
EST. WSWT (ft): TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	PI	K (FT/DAY)	ORG. CONT. (%)
0						Loose to medium dense brown and tan silty SAND [SM]						
2		4-4-5	9				13	9				
4		8-9-10	19									
5		11-15-19	34									
7		17-14-12	26									
8		13-13-7	20	▼								
9						Loose gray and green clayey SAND [SC]						
10		5-4-4	8				27	21	25	10		
14						Loose to medium dense brown and light gray silty SAND [SM]						
15		1-2-4	6									
20		7-7-17	24									
25		3-5-7	12			Boring Terminated at 25'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0230.1500077.0000
REPORT NO.: 1251804
PAGE: B-6

PROJECT: GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

BORING NO: **B-5** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: INNOVATIVE WASTE CONSULTING SERVICES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: SHELBY TUBE SAMPLE TAKEN FROM 5' TO 7'

GS ELEVATION(ft): 188.10 DATE STARTED: 7/9/15
WATER TABLE (ft): 3.14 DATE FINISHED: 7/9/15
DATE OF READING: 7/17/15 DRILLED BY: R. WOODARD
EST. WSWT (ft): TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG. CONT. (%)
0						Loose light brown SAND, with trace of silt [SP-SM]						
2		2-3-2	5									
3				▼		Loose gray and orange clayey SAND [SC]						
3.5		1-2-3	5									
5	Shelby tube	1-2-2	4				26	18	26	12		
6.5		2-3-4	7									
7						Medium dense to dense brown and tan silty SAND [SM]						
8		10-14-13	27									
9.5		15-16-19	35									
12						Medium dense gray silty SAND [SM]						
15		5-7-11	18									
16.5						Loose brown SAND, with silt [SP-SM]						
20		3-2-2	4				6	18				
21.5						Medium dense white SAND [SP]						
25		7-9-12	21									
25						Boring Terminated at 25'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.: 0230.1500077.0000
REPORT NO.: 1251804
PAGE: B-7

PROJECT: GRU DEERHAVEN POWER PLANT-POND EMBANKMENT
10001 NW 13TH STREET
GAINESVILLE, FLORIDA

BORING NO: **B-6** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: INNOVATIVE WASTE CONSULTING SERVICES
LOCATION: SEE BORING LOCATION PLAN
REMARKS: SHELBY TUBE SAMPLE TAKEN FROM 4' TO 6'

GS ELEVATION(ft): 188.40
WATER TABLE (ft): 6
DATE OF READING: 7/17/15
EST. WSWT (ft):
DATE STARTED: 7/9/15
DATE FINISHED: 7/9/15
DRILLED BY: R. WOODARD
TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/DAY)	ORG. CONT. (%)
0						Loose brown silty SAND, with trace of clay [SM]						
2	X	3-4-5	9									
2.5						Loose dark gray clayey SAND [SC]						
3.5	X	4-3-3	6				24	13	23	9		
4–6	Shelby tube											
5.5		4-3-5	8	▼ (6)								
6.5						Loose to dense brown and tan silty SAND, with trace of clay [SM]						
7	X	6-4-5	9									
8.5	X	7-8-12	20									
10	X	15-18-18	36									
12.5						Loose light brown SAND, with silt [SP-SM]						
15	X	5-4-4	8				11	18				
18						Medium dense white SAND [SP]						
20	X	4-9-9	18									
25	X	4-9-12	21									
25						Boring Terminated at 25'						

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KEY TO BORING LOGS

SYMBOLS

22	Number of Blows of a 140-lb Weight Falling 30 in. Required to Drive Standard Spoon One Foot
WOR	Weight of Drill Rods
S	Thin-Wall Shelby Tube Undisturbed Sampler Used
90% Rec.	Percent Core Recovery from Rock Core-Drilling Operations
■	Sample Taken at this Level
□	Sample Not Taken at this Level
—	Change in Soil Strata
▼	Free Ground Water Level
▽	Seasonal High Ground Water Level

RELATIVE DENSITY (sand-silt)

Very loose – Less Than 4 Blows/Ft.
Loose – 4 to 10 Blows/Ft.
Medium Dense – 10 to 30 Blows/Ft.
Dense – 30 to 50 Blows/Ft.
Very Dense – More Than 50 Blows/Ft.

CONSISTANCY (clay)

Very Soft – Less Than 2 Blows/Ft.
Soft – 2 to 4 Blows/Ft.
Firm – 4 to 8 Blows/Ft.
Stiff – 8 to 15 Blows/Ft.
Very Stiff – 15 to 30 Blows/Ft.
Hard – More Than 30 Blows/Ft.

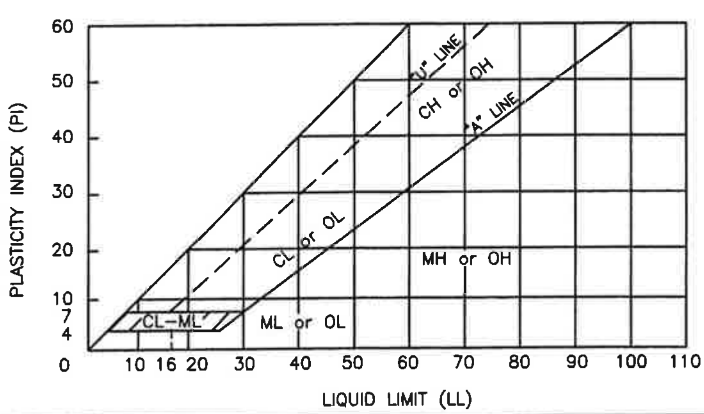
Based on Safety Hammer N-Values

UNIFIED CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 200 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomacaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly organic Soils			PT	Peat, muck and other highly organic soils

* Based on the material passing the 3-in. (75mm) sieve.

PLASTICITY CHART



APPENDIX C

LABORATORY TEST DATA
GRAIN SIEVE ANALYSIS/GRADATION CURVES
SHEAR TEST DATA
DESCRIPTION OF LABORATORY TESTING PROCEDURES
DESCRIPTION OF FIELD TESTING PROCEDURES

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SUMMARY OF LABORATORY RESULTS

PROJECT: GRU Deerhaven Ponds	**REPORT: 1251804**
CLIENT: Innovative Waste Consulting Services, LLC	**September 9, 2015**

BORING NO.	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	SAMPLE TYPE*	NATURAL MOISTURE (%)	ATTERBERG LIMITS		PEMREABILITY (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-1	6	Gray and Brown Sand, with silt	SS	13				100	100	86	53	24	9.5		SP-SM
B-1	15	Gray, Brown and Orange Silty Sand	SS	17				100	99	90	60	30	14		SM
B-3	6	Brown and Gray Silty Sand, with traces of clay	SS	7				100	100	89	60	29	14		SM
B-3	12	Gray and Orange Clayey Sand	SS	20	40	22							32		SC
B-4	1	Brown and Tan Silty Sand	SS	9				100	100	88	58	28	13		SM
B-4	10	Dark Gray and Brown Clayey Sand	SS	21	25	10							27		SC
B-5	5	Gray and Orange Clayey Sand	SS	18	26	12							26		SC
B-5	25	Light Tan Sand, with silt	SS	18				100	100	91	62	27	6.3		SP-SM
B-6	4	Dark Gray Clayey Sand	SS	13	23	9							24		SC
B-6	15	Light Brown Sand, with silt	SS	18				100	100	89	56	25	11		SP-SM

*SS=Sample Spoon
A=Auger

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SUMMARY OF LABORATORY RESULTS

PROJECT: GRU Deerhaven Ponds	REPORT: 1251804
CLIENT: Innovative Waste Consulting Services, LLC	September 9, 2015

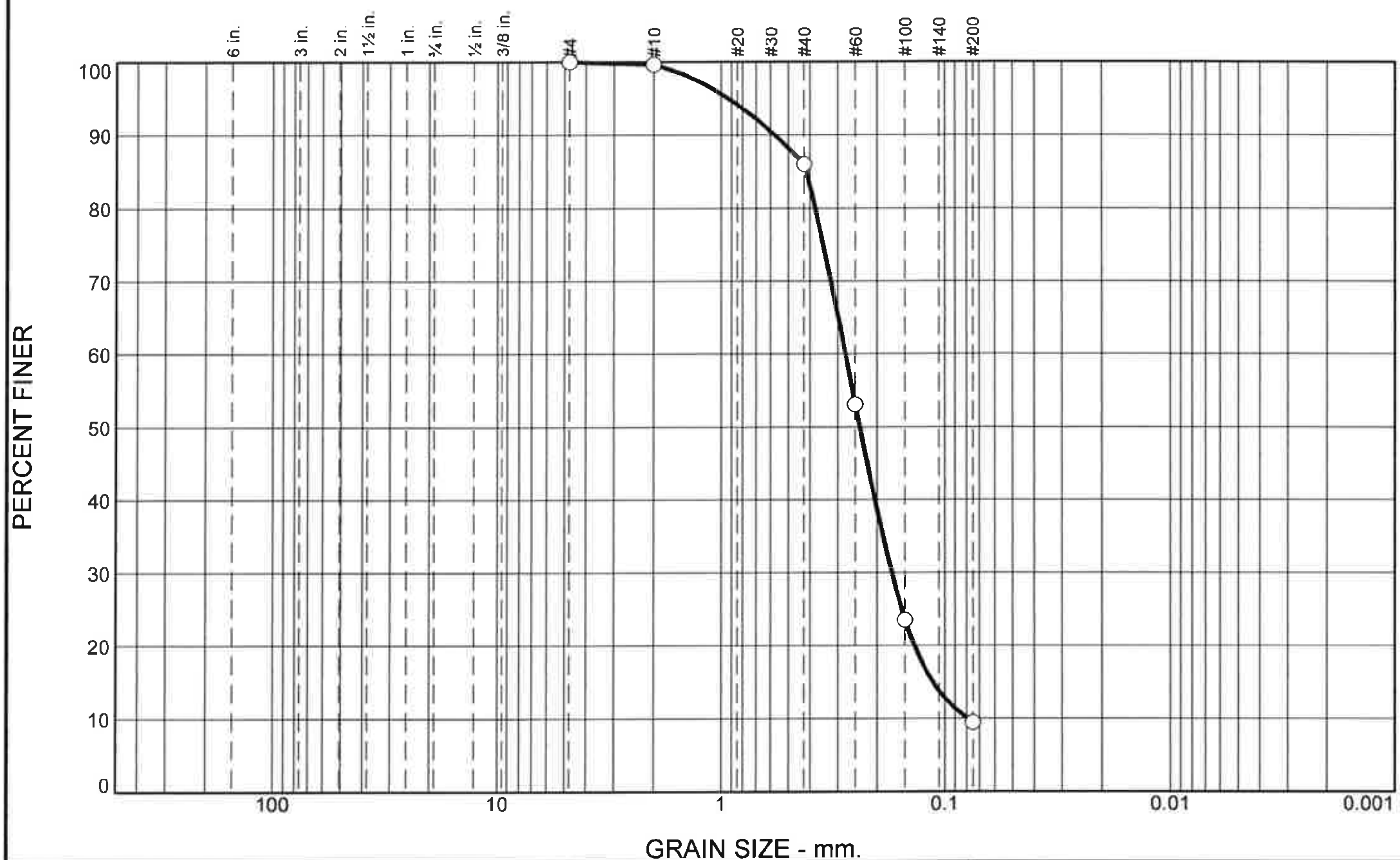
DIRECT SHEAR TEST RESULTS

LOCATION	SAMPLE DEPTH (Feet)	SOILS DESCRIPTION	MOISTURE CONTENT (%)	UNIT WEIGHT (pcf)	FRICTION ANGLE, ϕ (deg)
B-2	12.0 – 13.0	Gray, green and orange clayey Sand	11	118	31.1

DRAINED SHEAR AND CONSOLIDATED UNDRAINED TRIAXIAL TEST – TEST RESULTS

LOCATION	SAMPLE DEPTH (Feet)	SOILS DESCRIPTION	MOISTURE CONTENT (%)	UNIT WEIGHT (pcf)	SHEAR STRENGTH COHESION (psf)	FRICTION ANGLE, ϕ (deg)
B-3	12.0 – 13.0	Gray, green and orange very clayey Sand	21	127	197	24.9
B-4	5.0	Gray, orange silty Sand	11	119	192	31.3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	13.6	76.5	9.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#40	86.0		
#60	53.1		
#100	23.5		
#200	9.5		

* (no specification provided)

Material Description

Gray and Brown SP-SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5765 D_{85}= 0.4165 D_{60}= 0.2769
D_{50}= 0.2389 D_{30}= 0.1722 D_{15}= 0.1134
D_{10}= 0.0793 C_u= 3.49 C_c= 1.35

Classification

USCS= SP-SM AASHTO=

Remarks

Location: B-1
Sample Number: 4 **Depth:** 6 **Date:**

Universal Engineering Sciences

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project No: 0230.1500077.0000 **Figure**

Tested By: PH **Checked By:** ES/TK

GRAIN SIZE DISTRIBUTION TEST DATA

9/24/2015

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project Number: 0230.1500077.0000
Location: B-1
Depth: 6 **Sample Number:** 4
Material Description: Gray and Brown SP-SM
USCS Classification: SP-SM
Tested by: PH **Checked by:** ES/TK

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
57.10	0.00	0.00	#4	0.00	100.0
			#10	0.20	99.6
			#40	8.00	86.0
			#60	26.80	53.1
			#100	43.70	23.5
			#200	51.70	9.5

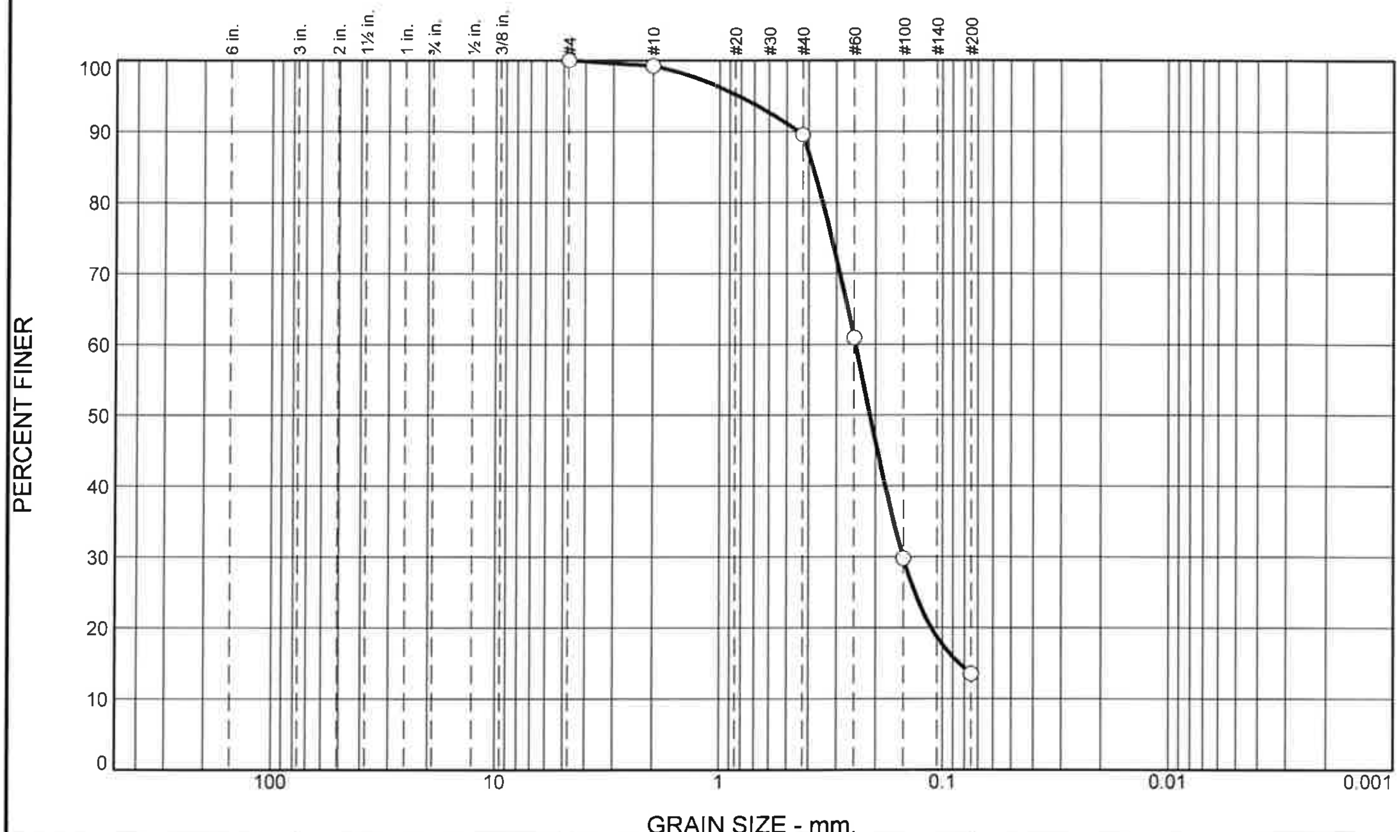
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.4	13.6	76.5	90.5			9.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0793	0.1134	0.1367	0.1722	0.2389	0.2769	0.3792	0.4165	0.5765	0.9314

Fineness Modulus	C_u	C_c
1.24	3.49	1.35

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.8	9.6	76.1	13.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.2		
#40	89.6		
#60	60.9		
#100	29.8		
#200	13.5		

* (no specification provided)

Material Description

Gray, Brown and Orange SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4452 D_{85}= 0.3819 D_{60}= 0.2465
D_{50}= 0.2118 D_{30}= 0.1507 D_{15}= 0.0844
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Location: B-1
Sample Number: 7 **Depth:** 15 **Date:**

Universal Engineering Sciences	**Client:** Innovative Waste Consulting Services, LLC **Project:** GRU Deerhaven Power Plant - Pond Embankments **Project No:** 0230.1500077.0000 **Figure**

Tested By: PH **Checked By:** ES/TK

GRAIN SIZE DISTRIBUTION TEST DATA

9/24/2015

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project Number: 0230.1500077.0000
Location: B-1
Depth: 15 **Sample Number:** 7
Material Description: Gray, Brown and Orange SM
USCS Classification: SM
Tested by: PH **Checked by:** ES/TK

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
51.70	0.00	0.00	#4	0.00	100.0
			#10	0.40	99.2
			#40	5.40	89.6
			#60	20.20	60.9
			#100	36.30	29.8
			#200	44.70	13.5

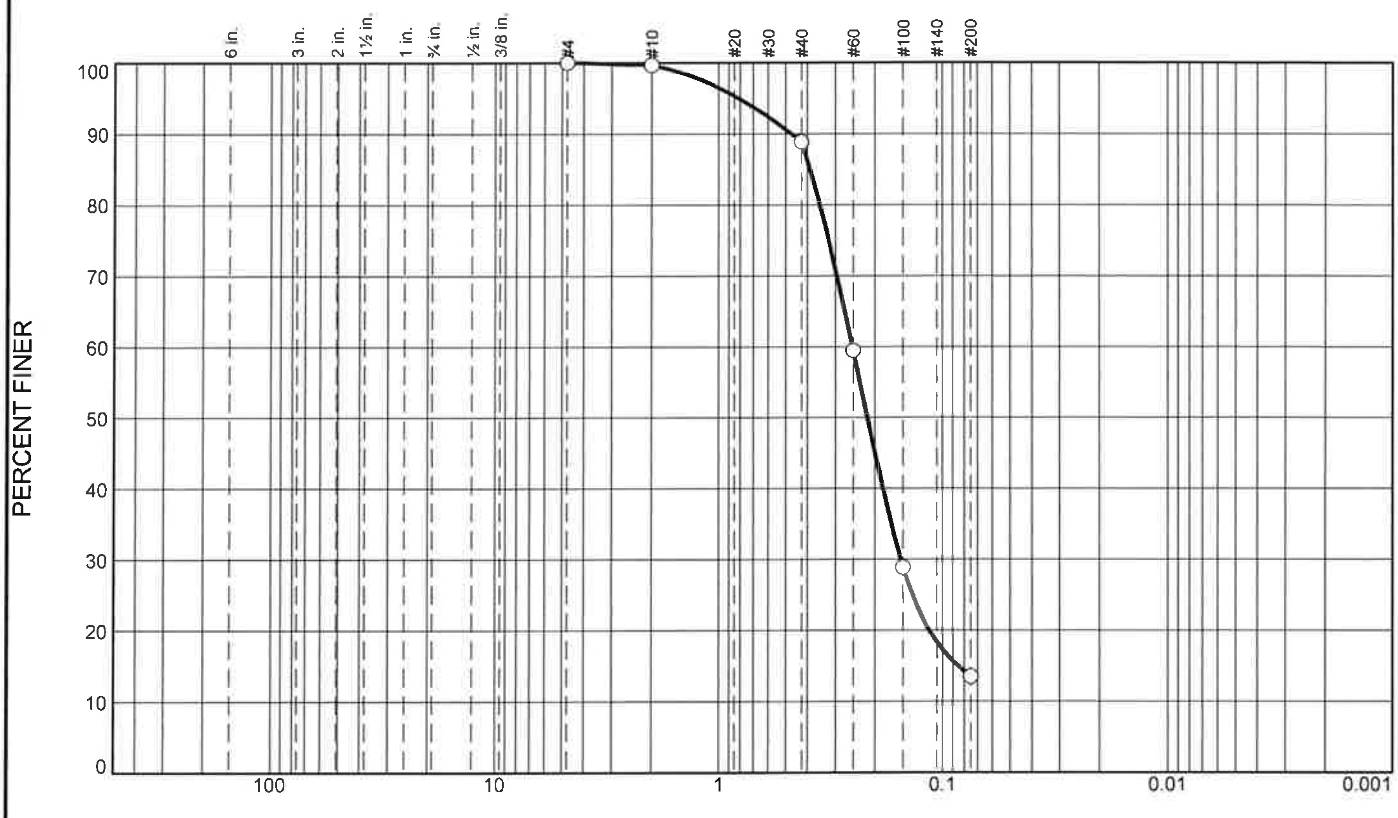
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.8	9.6	76.1	86.5			13.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0844	0.1125	0.1507	0.2118	0.2465	0.3450	0.3819	0.4452	0.8252

Fineness Modulus
1.09

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	10.8	75.4	13.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#40	88.9		
#60	59.5		
#100	28.9		
#200	13.5		

* (no specification provided)

Material Description

Brown and Gray SM, with traces of clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4721 D_{85}= 0.3893 D_{60}= 0.2521
D_{50}= 0.2164 D_{30}= 0.1537 D_{15}= 0.0856
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Location: B-3
Sample Number: 4 **Depth:** 6 **Date:**

Universal Engineering Sciences

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project No: 0230.1500077.0000 **Figure**

Tested By: PH **Checked By:** ES/TK

GRAIN SIZE DISTRIBUTION TEST DATA

9/24/2015

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project Number: 0230.1500077.0000
Location: B-3
Depth: 6
Sample Number: 4
Material Description: Brown and Gray SM, with traces of clay
USCS Classification: SM
Tested by: PH
Checked by: ES/TK

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
59.20	0.00	0.00	#4	0.00	100.0
			#10	0.20	99.7
			#40	6.60	88.9
			#60	24.00	59.5
			#100	42.10	28.9
			#200	51.20	13.5

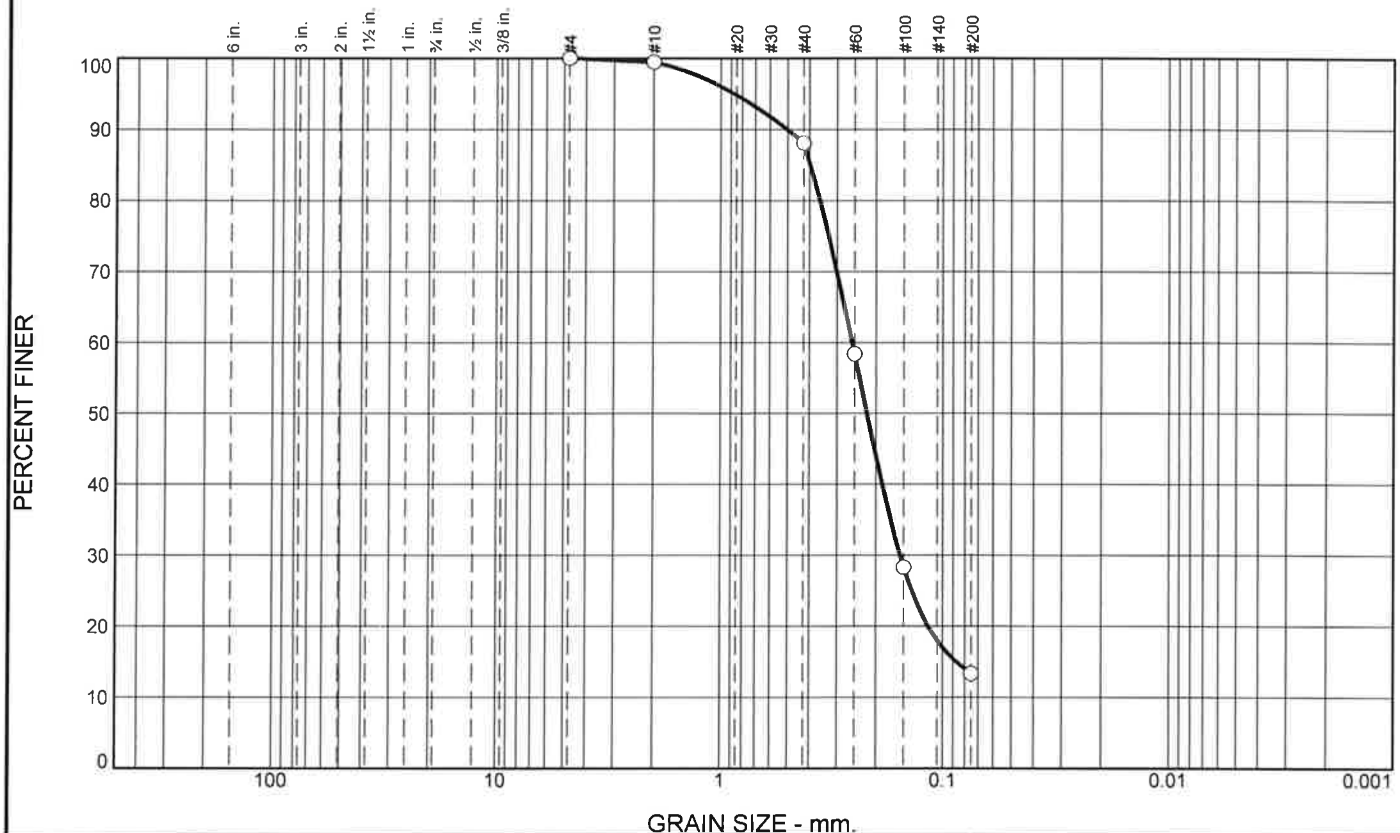
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.3	10.8	75.4	86.5			13.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0856	0.1150	0.1537	0.2164	0.2521	0.3522	0.3893	0.4721	0.8159

Fineness Modulus
1.11

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	11.4	74.8	13.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.5		
#40	88.1		
#60	58.4		
#100	28.3		
#200	13.3		

* (no specification provided)

Material Description

Brown and Tan SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5046 D_{85}= 0.3964 D_{60}= 0.2564
D_{50}= 0.2198 D_{30}= 0.1557 D_{15}= 0.0871
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Location: B-4
Sample Number: 1 **Depth:** 1 **Date:**

Universal Engineering Sciences

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project No: 0230.1500077.0000 **Figure**

Tested By: PH **Checked By:** ES/TK

GRAIN SIZE DISTRIBUTION TEST DATA

9/24/2015

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project Number: 0230.1500077.0000
Location: B-4
Depth: 1
Sample Number: 1
Material Description: Brown and Tan SM
USCS Classification: SM
Tested by: PH
Checked by: ES/TK

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
56.20	0.00	0.00	#4	0.00	100.0
			#10	0.30	99.5
			#40	6.70	88.1
			#60	23.40	58.4
			#100	40.30	28.3
			#200	48.70	13.3

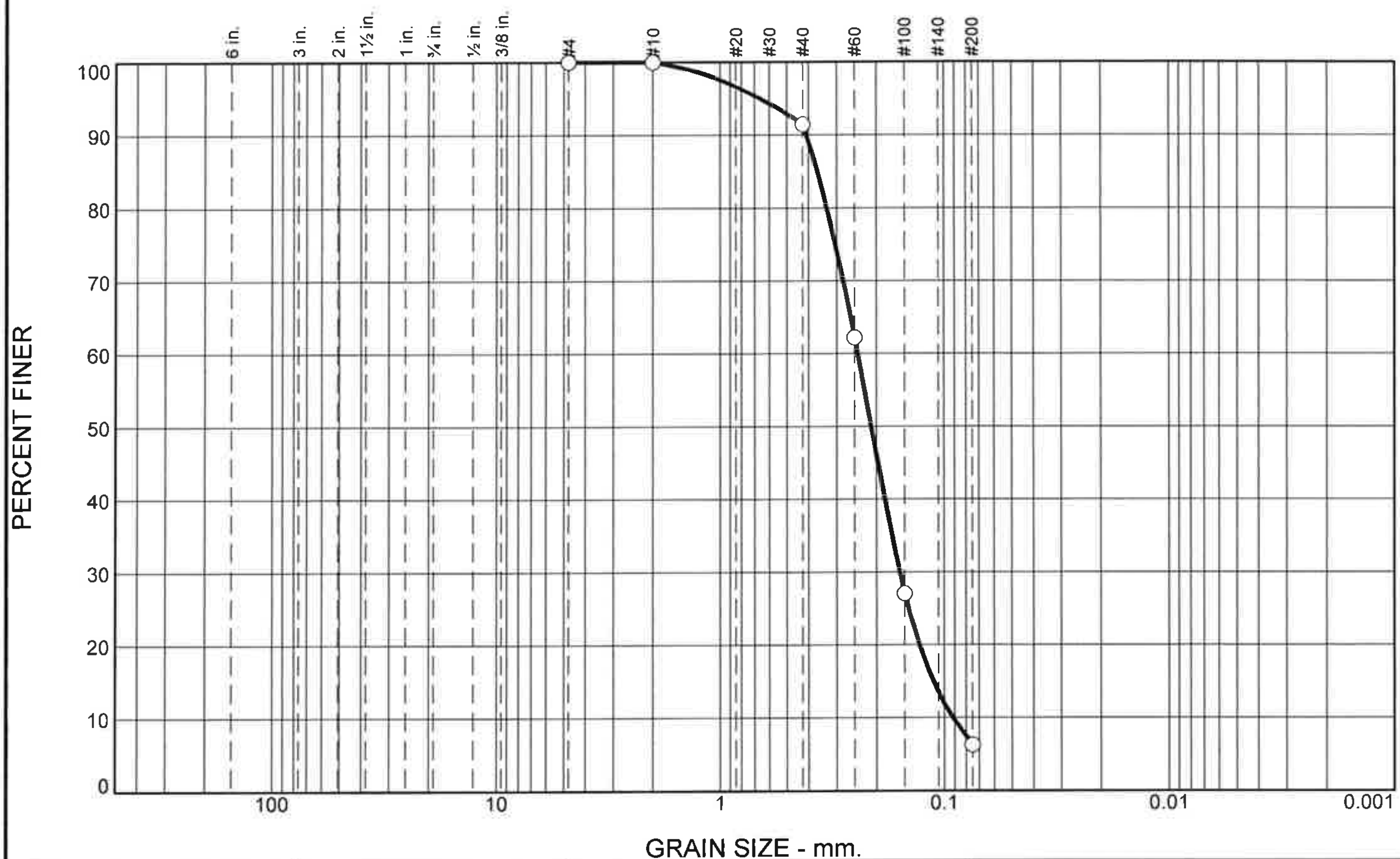
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.5	11.4	74.8	86.7			13.3

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0871	0.1168	0.1557	0.2198	0.2564	0.3585	0.3964	0.5046	0.8689

Fineness Modulus
1.13

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	8.6	85.1	6.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#40	91.4		
#60	62.2		
#100	27.0		
#200	6.3		

* (no specification provided)

Material Description

Light Tan SP-SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4098 D_{85}= 0.3664 D_{60}= 0.2424
D_{50}= 0.2114 D_{30}= 0.1581 D_{15}= 0.1121
D_{10}= 0.0917 C_u= 2.64 C_c= 1.12

Classification

USCS= SP-SM AASHTO=

Remarks

Location: B-5
Sample Number: 8 **Depth:** 25 **Date:**

Universal Engineering Sciences

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project No: 0230.1500077.0000 **Figure**

Tested By: PH **Checked By:** ES/TK

GRAIN SIZE DISTRIBUTION TEST DATA

9/24/2015

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project Number: 0230.1500077.0000
Location: B-5
Depth: 25 **Sample Number:** 8
Material Description: Light Tan SP-SM
USCS Classification: SP-SM
Tested by: PH **Checked by:** ES/TK

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
52.60	0.00	0.00	#4	0.00	100.0
			#10	0.00	100.0
			#40	4.50	91.4
			#60	19.90	62.2
			#100	38.40	27.0
			#200	49.30	6.3

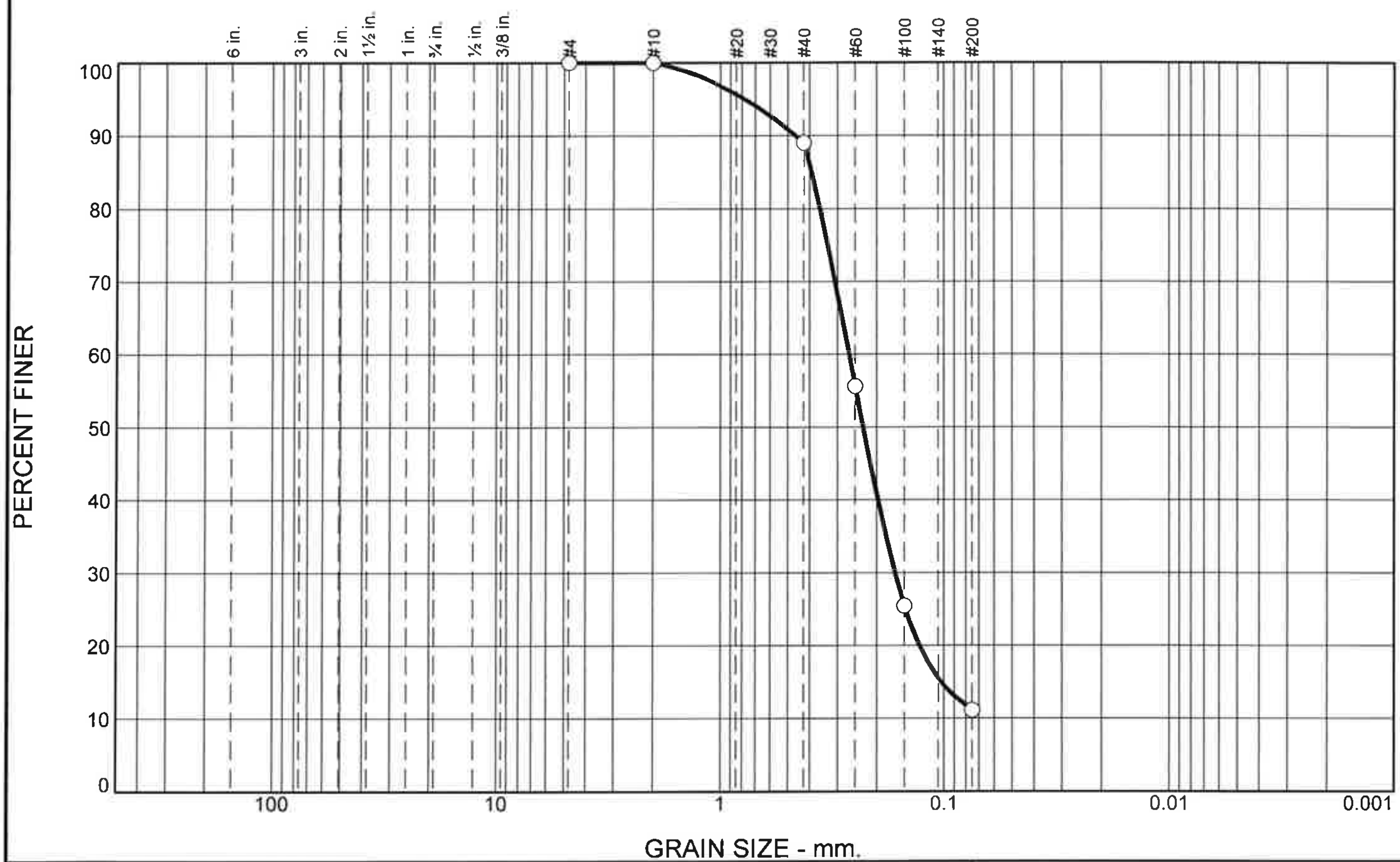
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	8.6	85.1	93.7			6.3

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0917	0.1121	0.1294	0.1581	0.2114	0.2424	0.3325	0.3664	0.4098	0.6607

Fineness Modulus	C_u	C_c
1.06	2.64	1.12

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	11.0	77.8	11.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#40	89.0		
#60	55.6		
#100	25.4		
#200	11.2		

* (no specification provided)

Material Description

Light Brown SP-SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4628 D_{85}= 0.3930 D_{60}= 0.2665
D_{50}= 0.2304 D_{30}= 0.1656 D_{15}= 0.1032
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

Location: B-6
Sample Number: 7 **Depth:** 15 **Date:**

Universal Engineering Sciences

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project No: 0230.1500077.0000 **Figure**

Tested By: PH **Checked By:** ES/TK

GRAIN SIZE DISTRIBUTION TEST DATA

9/24/2015

Client: Innovative Waste Consulting Services, LLC
Project: GRU Deerhaven Power Plant - Pond Embankments
Project Number: 0230.1500077.0000
Location: B-6
Depth: 15 **Sample Number:** 7
Material Description: Light Brown SP-SM
USCS Classification: SP-SM
Tested by: PH **Checked by:** ES/TK

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
54.70	0.00	0.00	#4	0.00	100.0
			#10	0.00	100.0
			#40	6.00	89.0
			#60	24.30	55.6
			#100	40.80	25.4
			#200	48.60	11.2

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.0	77.8	88.8			11.2

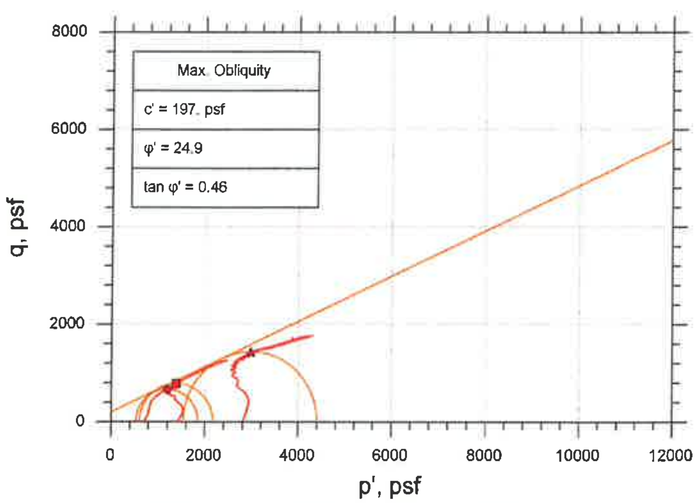
D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.1032	0.1288	0.1656	0.2304	0.2665	0.3604	0.3930	0.4628	0.7791

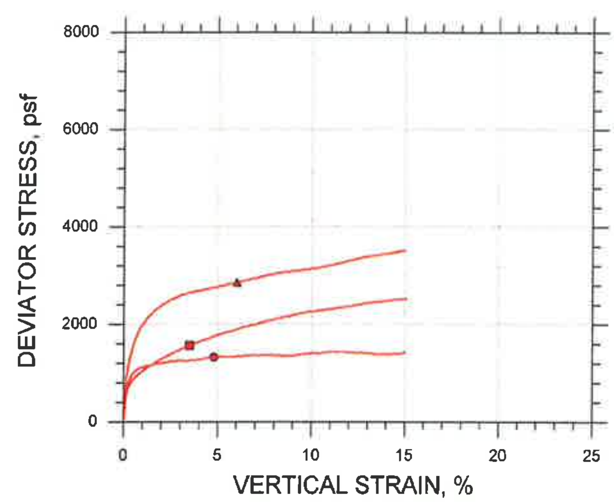
Fineness Modulus
1.16

GeoTesting EXPRESS

Client: Universal Engineering Sciences	
Project Name: Pond Embankment Stability	
Project Location: ---	
Project Number: GTX-303487	
Tested By: jm	Checked By: mcm
Boring ID: B-3	
Preparation: intact	
Description: Gray, green, orange sandy Clay	
Classification: ---	
Group Symbol: ---	
Liquid Limit: ---	Plastic Limit: ---
Plasticity Index: ---	Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

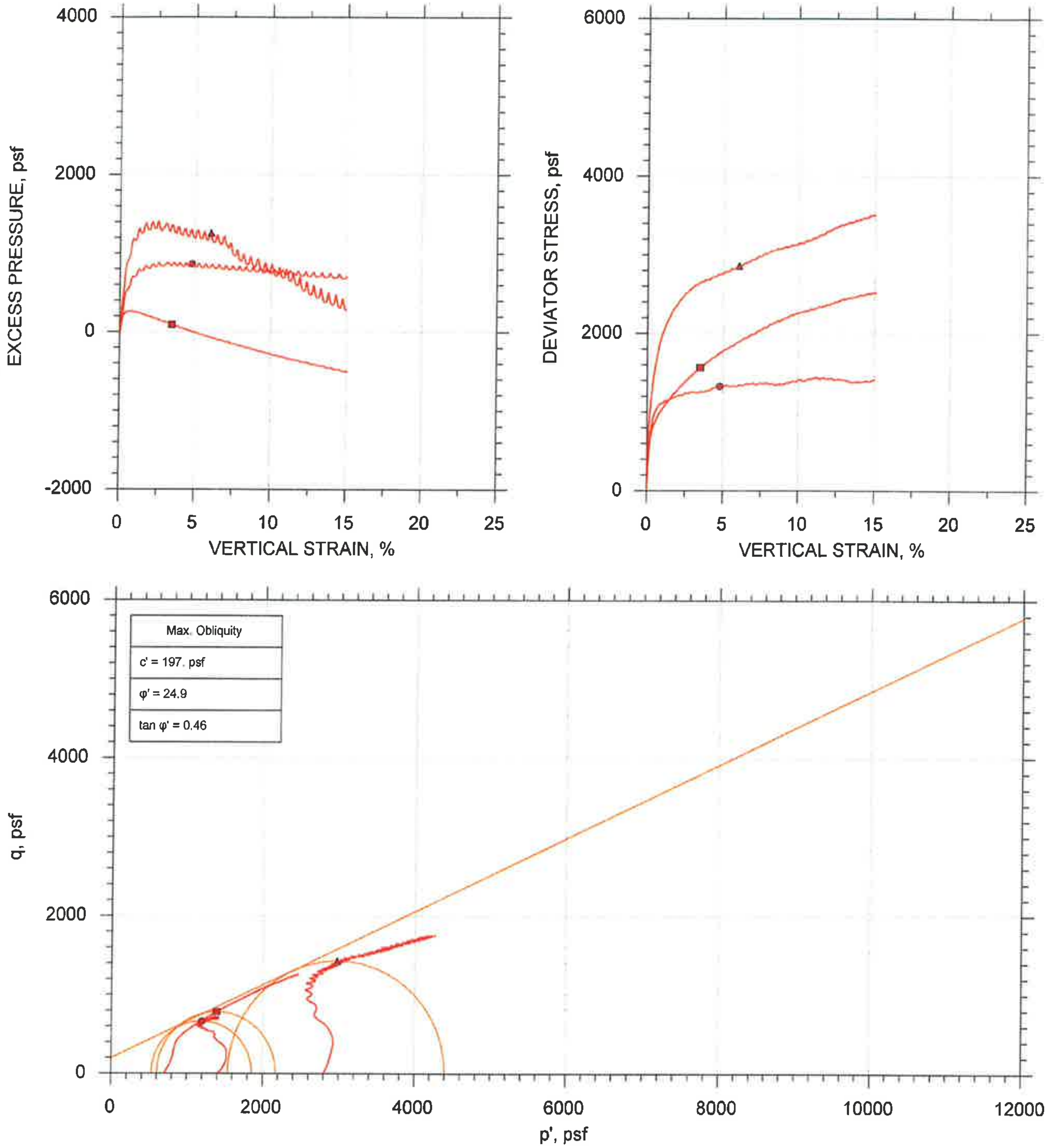




Symbol		■	●	▲	
Sample ID		---	---	---	
Depth, ft		12-13 ft	12-13 ft	12-13 ft	
Test Number		CU-1-1	CU-1-2	CU-1-3	
Initial	Height, in	4.101	4.163	4.250	
	Diameter, in	2.040	2.030	2.040	
	Moisture Content (from Cuttings), %	18.1	22.7	21.5	
	Dry Density, pcf	108.	103.	106.	
	Saturation (Wet Method), %	87.3	96.4	98.4	
	Void Ratio	0.559	0.637	0.590	
Before Shear	Moisture Content, %	19.8	22.1	20.7	
	Dry Density, pcf	110.	106.	108.	
	Cross-sectional Area (Method A), in²	3.235	3.174	3.232	
	Saturation, %	100.0	100.0	100.0	
	Void Ratio	0.536	0.596	0.559	
	Back Pressure, psf	9647.	8494.	1.800e+004	
Vertical Effective Consolidation Stress, psf		700.1	1403.	2800.	
Horizontal Effective Consolidation Stress, psf		700.2	1404.	2802.	
Vertical Strain after Consolidation, %		0.07041	0.3546	0.7990	
Volumetric Strain after Consolidation, %		0.3954	1.821	1.735	
Time to 50% Consolidation, min		2.560	13.69	46.24	
Shear Strength, psf		783.8	664.1	1430.	
Strain at Failure, %		3.48	4.78	6.03	
Strain Rate, %/min		0.01600	0.01600	0.01600	
Deviator Stress at Failure, psf		1568.	1328.	2859.	
Effective Minor Principal Stress at Failure, psf		605.1	529.5	1543.	
Effective Major Principal Stress at Failure, psf		2173.	1858.	4403.	
B-Value		0.95	0.95	0.96	
Notes: - Before Shear Saturation set to 100% for phase calculation. - Moisture Content determined by ASTM D2216. - Deviator Stress includes membrane correction. - Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions. Remarks:					

System A

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



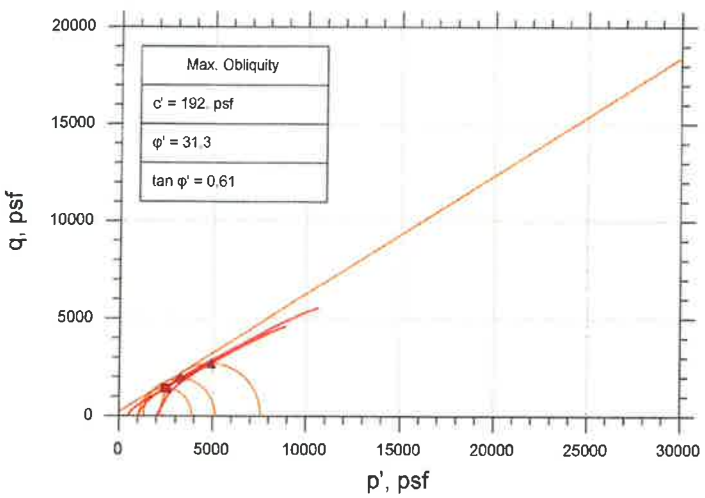
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	---	CU-1-1	12-13 ft	jm	7/21/15	mcm	8/4/15	303487-CU-1-1m.dat
●	---	CU-1-2	12-13 ft	jm	7/21/15	mcm	8/4/15	303487-CU-1-2m.dat
▲	---	CU-1-3	12-13 ft	jm	7/21/15	mcm	8/4/15	303487-CU-1-3m.dat

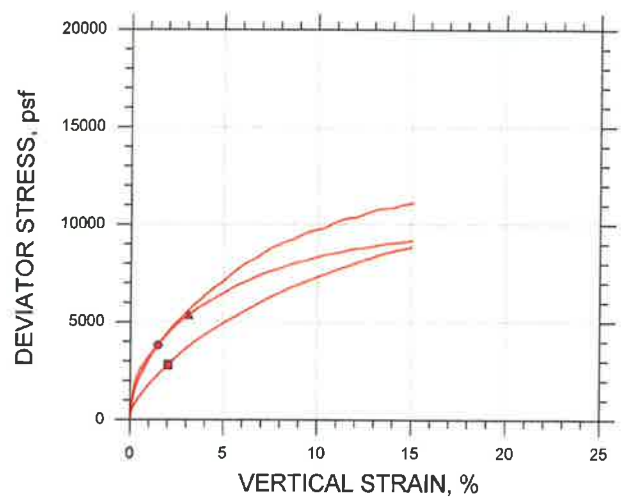
GeoTesting EXPRESS

Project: Pond Embankment Stability	Location: ---	Project No.: GTX-303487
Boring No.: B-3	Sample Type: intact	
Description: Gray, green, orange sandy Clay		
Remarks: System A		

Client: Universal Enginnering Sciences	
Project Name: Pond Embankment Stability	
Project Location: ---	
Project Number: GTX-303467	
Tested By: jm	Checked By: mcm
Boring ID: B-4	
Preparation: reconstituted	
Description: Brown, tan Silty Sand	
Classification: —	
Group Symbol: —	
Liquid Limit: —	Plastic Limit: —
Plasticity Index: —	Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

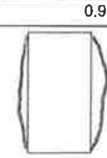




	Symbol	■	●	▲	
	Sample ID	---	---	---	
	Depth, ft	5 ft	5 ft	5 ft	
	Test Number	CU-2-1	CU-2-2	CU-2-3	
Initial	Height, in	4.082	4.062	4.079	
Initial	Diameter, in	2.020	2.020	2.020	
Initial	Moisture Content (from Cuttings), %	11.9	12.1	12.1	
Initial	Dry Density, pcf	107.	108.	107.	
Initial	Saturation (Wet Method), %	56.4	57.5	57.0	
Initial	Void Ratio	0.571	0.567	0.571	
Before Shear	Moisture Content, %	20.2	20.7	20.6	
Before Shear	Dry Density, pcf	109.	108.	108.	
Before Shear	Cross-sectional Area (Method A), in²	3.170	3.193	3.179	
Before Shear	Saturation, %	100.0	100.0	100.0	
Before Shear	Void Ratio	0.547	0.560	0.555	
Before Shear	Back Pressure, psf	2.000e+004	1.942e+004	1.856e+004	
	Vertical Effective Consolidation Stress, psf	499.9	1002.	2002.	
	Horizontal Effective Consolidation Stress, psf	499.9	1002.	2001.	
	Vertical Strain after Consolidation, %	0.01344	0.03090	0.09907	
	Volumetric Strain after Consolidation, %	0.09779	0.2919	0.6374	
	Time to 50% Consolidation, min	0.06000	0.4200	0.04000	
	Shear Strength, psf	1406.	1909.	2683.	
	Strain at Failure, %	2.03	1.48	3.13	
	Strain Rate, %/min	0.06000	0.06000	0.06000	
	Deviator Stress at Failure, psf	2811.	3819.	5366.	
	Effective Minor Principal Stress at Failure, psf	1072.	1324.	2206.	
	Effective Major Principal Stress at Failure, psf	3883.	5142.	7573.	
	B-Value	0.96	0.96	0.96	

Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

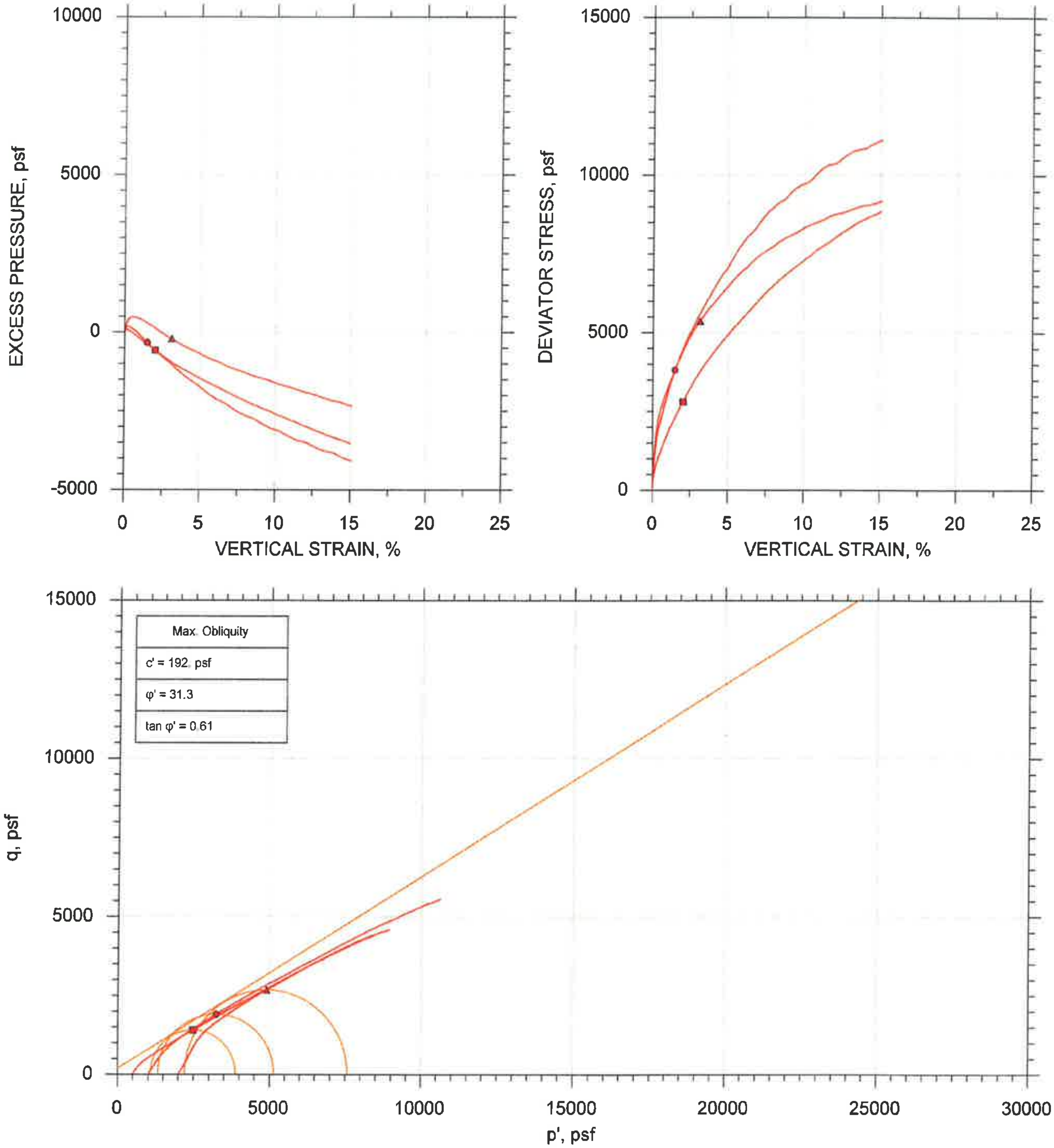




Remarks:

Targe Compaction: 90% of (119.0 pcf) at Optimum Moisture Content (11.0%) + 0-2% - Values Provided by Client

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	---	CU-2-1	5 ft	jm	7/25/15	mcm	8/5/15	303487-CU-2-1m.dat
●	---	CU-2-2	5 ft	jm	7/24/15	mcm	8/5/15	303487-CU-2-2m.dat
▲	---	CU-2-3	5 ft	jm	7/24/15	mcm	8/5/15	303487-CU-2-3m.dat

GeoTesting EXPRESS

Project: Pond Embankment Stability	Location: ---	Project No.: GTX-303487
Boring No.: B-4	Sample Type: reconstituted	
Description: Brown, tan Silty Sand		
Remarks: Targe Compaction: 90% of (119.0 pcf) at Optimum Moisture Content (11.0%) + 0-2% - Values Provided by Client		

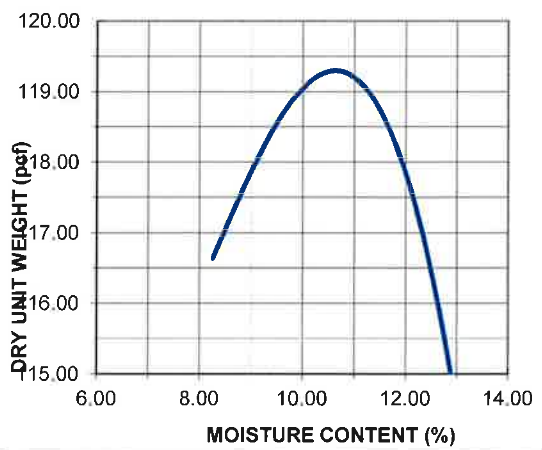
SHEAR DIRECT TEST RESULTS
ASTM D-3080-04

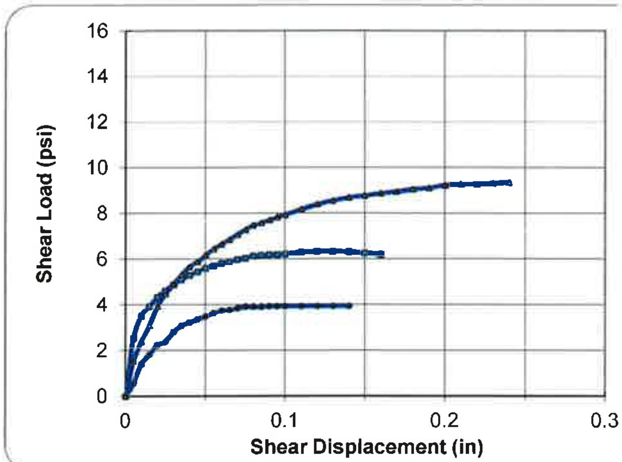
TESTED FOR: Innovative Waste Consulting
6628 NW 9tjh Boulevard, Suite 3
Gainesville, FL

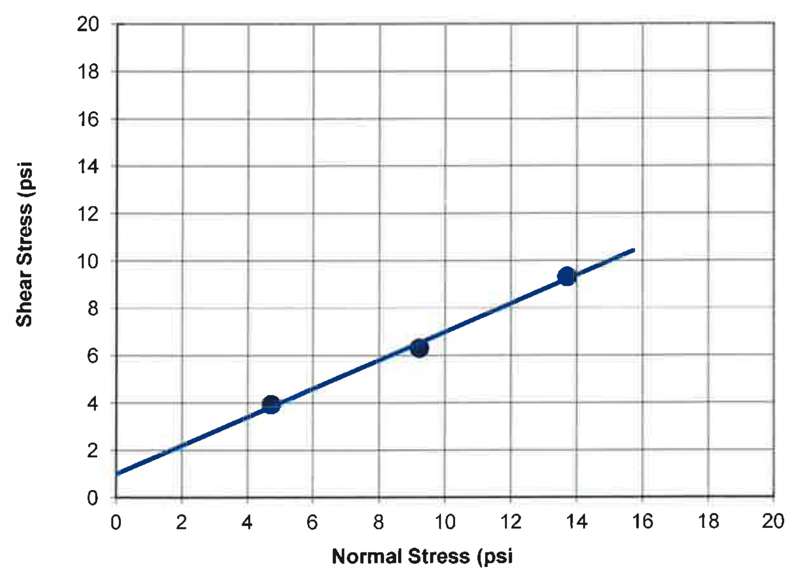
PROJECT: Process Pond Impoundment Dikes
GRU Deerhaven Genrting Facility
1001 NW 13th Street
Gainesville, Alachua County, FL

DATE TESTED: August, 2015

SAMPLE LOCATION:
SOIL DESCRIPTION: Brown Silty Sand with Clay







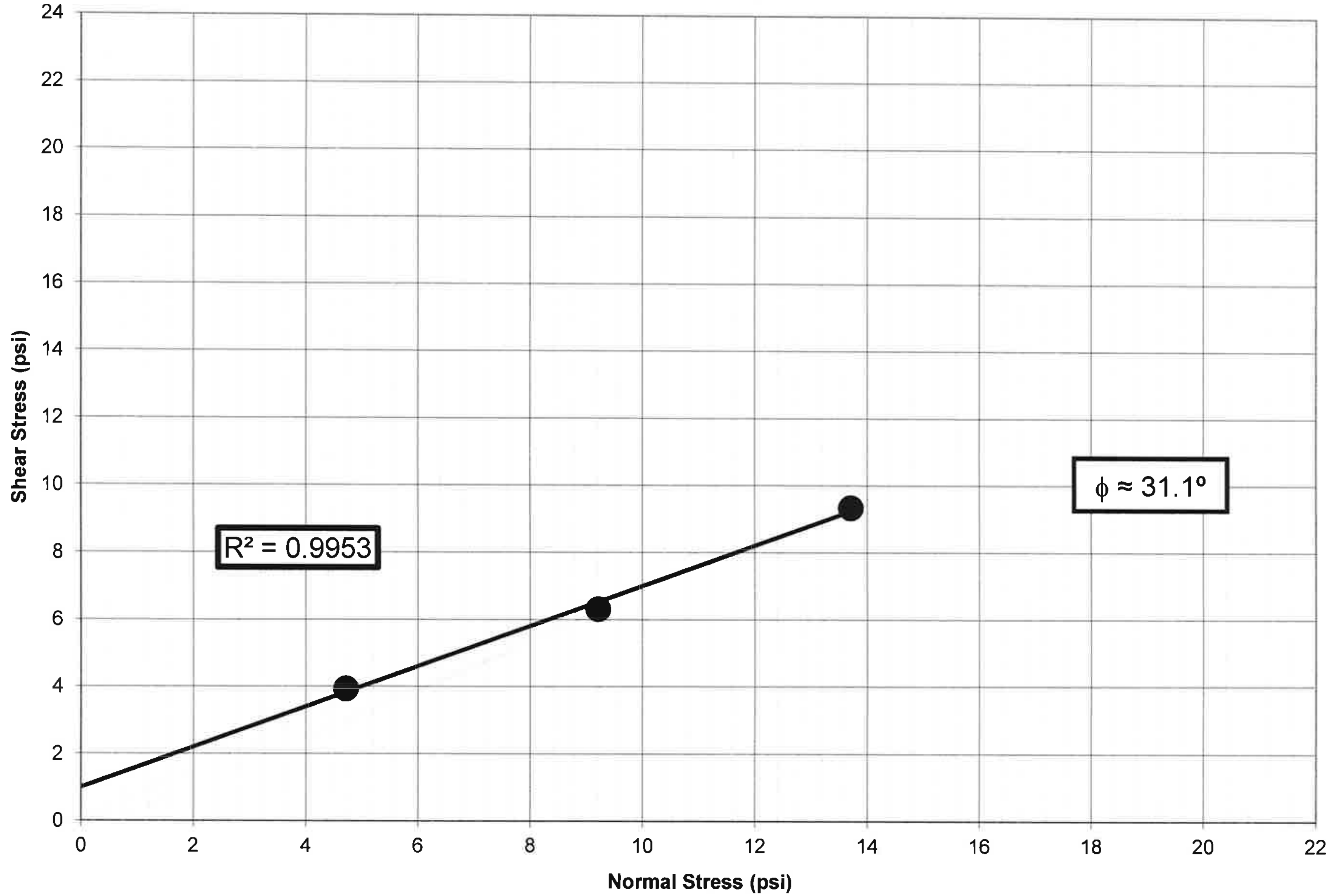
TEST RESULTS

Friction Angle	**31.1**
Opt. Mositure:	**11.0**
Max Density:	**119.0**

UNIVERSAL ENGINEERING SCIENCES
4475 S.W. 35TH TERRACE, GAINESVILLE, FL. 32608
(352)372-3392 (352)336-7914 (FAX)

8.119 . 120

Direct Shear . Drained



APPENDIX C

DESCRIPTION OF LABORATORY TESTING PROCEDURES

UNIFIED SOIL CLASSIFICATION - ASTM D-2487

This practice describes a system for classifying mineral and organo-mineral soils for engineering purposes based on laboratory determination of particle size characteristics, liquid limit, and plasticity index.

WASH 200 TEST - ASTM D-1140

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.

FULL SIEVE GRADATION TEST – ASTM D-422

On occasion it is helpful to evaluate the overall compositional characteristics of a soil and the #200 sieve analysis is supplemented with a full grain size distribution. A set of sieves with varying mesh sizes is used to determine the gradation of the soil particle sizes.

MOISTURE CONTENT DETERMINATION - ASTM D-2216

Moisture content is the ratio of the weight of water to the dry weight of soil. Moisture content is measured by drying a sample at 105 degrees Celsius. The moisture content is expressed as a percent of the oven dried soil mass.

ATTERBERG LIMITS – 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 estimated as follows: The soil is mixed with distilled water to form a thick paste, which is then placed in a brass cup mounted on an edge pivot and rests initially on a rubber base. The base is 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 estimated as follows: 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 cracks when its diameter is 1/8 inch. The water content of the soil at this state is determined and defined as the plastic limit.

TRIAXIAL CONSOLIDATED UNDRAINED (CU) TEST – ASTM D-4767

This test method measure the shear strength characteristics under undrained conditions where soils have been fully consolidated under a set of stresses and stress changes under drained conditions that are similar to the test method. The shear stress is expressed in terms of total stress. This test method determines the strength and stress strain relationship of a cylindrical specimen of either undisturbed soil using a triaxial chamber and no drainage of the specimen is permitted. This test procedure is similar to the CU Test however, the sample is sealed within a rubber membrane and O-rings, and a chamber pressure is applied to the chamber fluid exerting a pressure on the specimen.

SPECIFIC GRAVITY OF SOIL ASTM D-854

This test method determines the ratio of the mass of a unit volume of soil solids to the mass of the same volume of gas free distilled water at 20 degrees Celsius. Soil is placed into a calibrated pycnometer, water is added, and then the soil and water are de-aired. The specific gravity of the soil specimen is determined through the mass of the pycnometer and water, the calibrated mass of the dry pycnometer, the calibrated volume of the pycnometer, the density of the water at the test temperature, the mass of the oven dried soils, and the mass of the pycnometer water and soil solids at the test temperature.

APPENDIX C

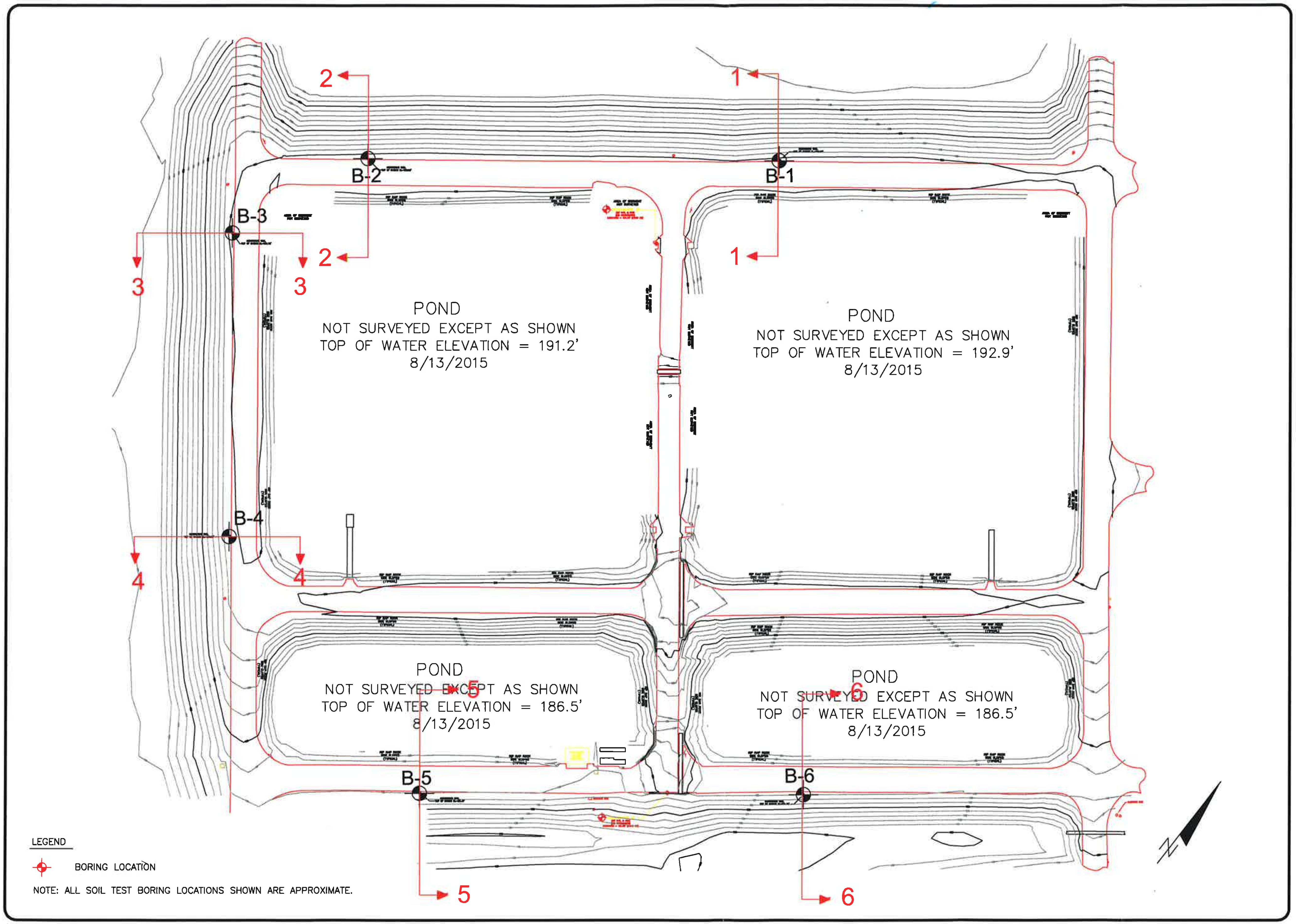
DESCRIPTION OF FIELD TESTING PROCEDURES

STANDARD PENETRATION TESTING – ASTM D-1586

Penetration tests were performed in accordance with ASTM Procedure D-1586, Penetration Test and Split-Barrel Sampling of Soils. This test procedure generally involves driving a 1.4-inch I.D. split-tube sampler into the soil profile in six inch increments for a minimum distance of 18 inches using a 140-pound hammer free-falling 30 inches. The total number of blows required to drive the sampler the second and third 6-inch increments is designated as the N-value, and provides an indication of in-place soil strength, density and consistency.

APPENDIX D

SLOPE STABILITY ANALYSIS



CLIENT: INNOVATIVE WASTE CONSULTING SERVICES

DRAWN BY: KD DATE: 9/10/15

CHECKED BY: ES DATE: 9/10/15

SCALE: 1"=80' ACADFILE:0230.1500077-B

PROJECT NO: 0230.15000077.0000 REPORT NO:1251804

GRU DEERHAVEN POWER PLANT-POND EMBANKMENT

10001 NW 13TH STREET

GAINESVILLE, FLORIDA

CROSS SECTION FOR SLOPE STABILITY

UNIVERSAL ENGINEERING SCIENCES

PAGE NO: D - 1

SLOPE STABILITY ANALYSIS

Soil Parameters

Soil strength parameters were obtained from laboratory testing performed on representative samples taken from the project site. Below is a summary of the soil materials properties and strength parameters for the layer units at the DGS process ponds project site.

Medium dense Silty Sand Ÿr=119 pcf			
Analysis	Type	Unit	Value
Un-Drained	Cohesion Intercept	PSF	192
Lab Testing Triaxial Test	Friction angle	Degree	31

Medium dense Very Clayey Sand Ÿr=127 pcf			
Analysis	Type	Unit	Value
Un-Drained	Cohesion Intercept	PSF	197
Lab Testing Triaxial Test	Friction angle	Degree	24.9

Medium dense Silty Sand * Ÿr=118 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	175
Lab Testing Direct Shear Test	Friction angle	Degree	31.1

Medium dense Silty-Clayey Sand * Ÿr=120 pcf			
Analysis	Type	Unit	Value
Undrained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	30

Loose Sand with silt Ÿr=110 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	29

Medium dense Sand with silt Ÿr=120 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	32

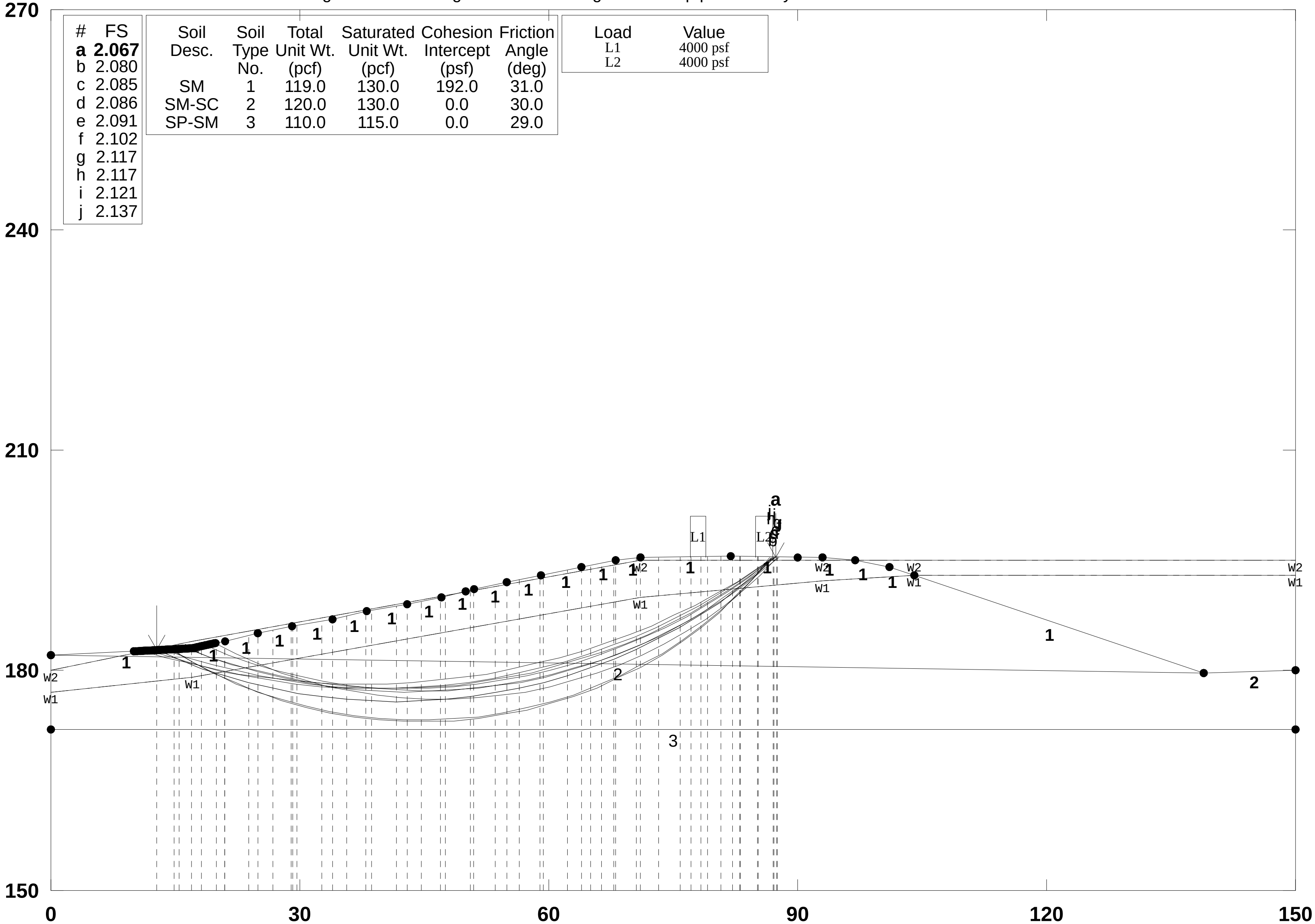
Medium dense Silty Sand Ÿr=120 pcf			
Analysis	Type	Unit	Value
Drained	Cohesion Intercept	PSF	0
FHWA manual	Friction angle	Degree	30

Static Safety Factor/Maximum Surcharge Pool Loading Condition(Top of Embankment)					
Section/Boring	Process Pond	Pond Liquid Elevation (ft, NGVD)	Global-Bishop	Global - Jambu	Surface
B-1	Ash Cell #1	195	2.067	1.791	3.642
B-2	Ash Cell #2	195	1.875	1.621	4.194
B-3	Ash Cell #2	195	2.128	1.787	3.347
B-4	Ash Cell #2	195	1.737	1.510	3.037
B-5	Pump Back Cell #1	188	2.103	1.715	3.199
B-6	Pump Back Cell #1	188	2.150	1.778	3.247

Static Safety Factor/Long-Term, Maximum Storage Pool Loading Condition(Max Operating levels)					
Section/Boring	Process Pond	Pond Liquid Elevation (ft, NGVD)	Global-Bishop	Global - Jambu	Surface
B-1	Ash Cell #1	193	2.118	1.795	5.011
B-2	Ash Cell #2	193	1.879	1.636	3.488
B-3	Ash Cell #2	193	2.195	1.852	4.498
B-4	Ash Cell #2	193	1.827	1.561	3.627
B-5	Pump Back Cell #1	186	2.164	1.785	3.406
B-6	Pump Back Cell #1	186	2.211	1.834	3.453

GRU Process Pond Embankment Section B-1

I:\geotech\esuarez\gru embankments\gru b1 bishop.pl2 Run By: ESuarez 10/5/2015 12:15PM



GSTABL7 v.2 FSmin=2.067

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-1

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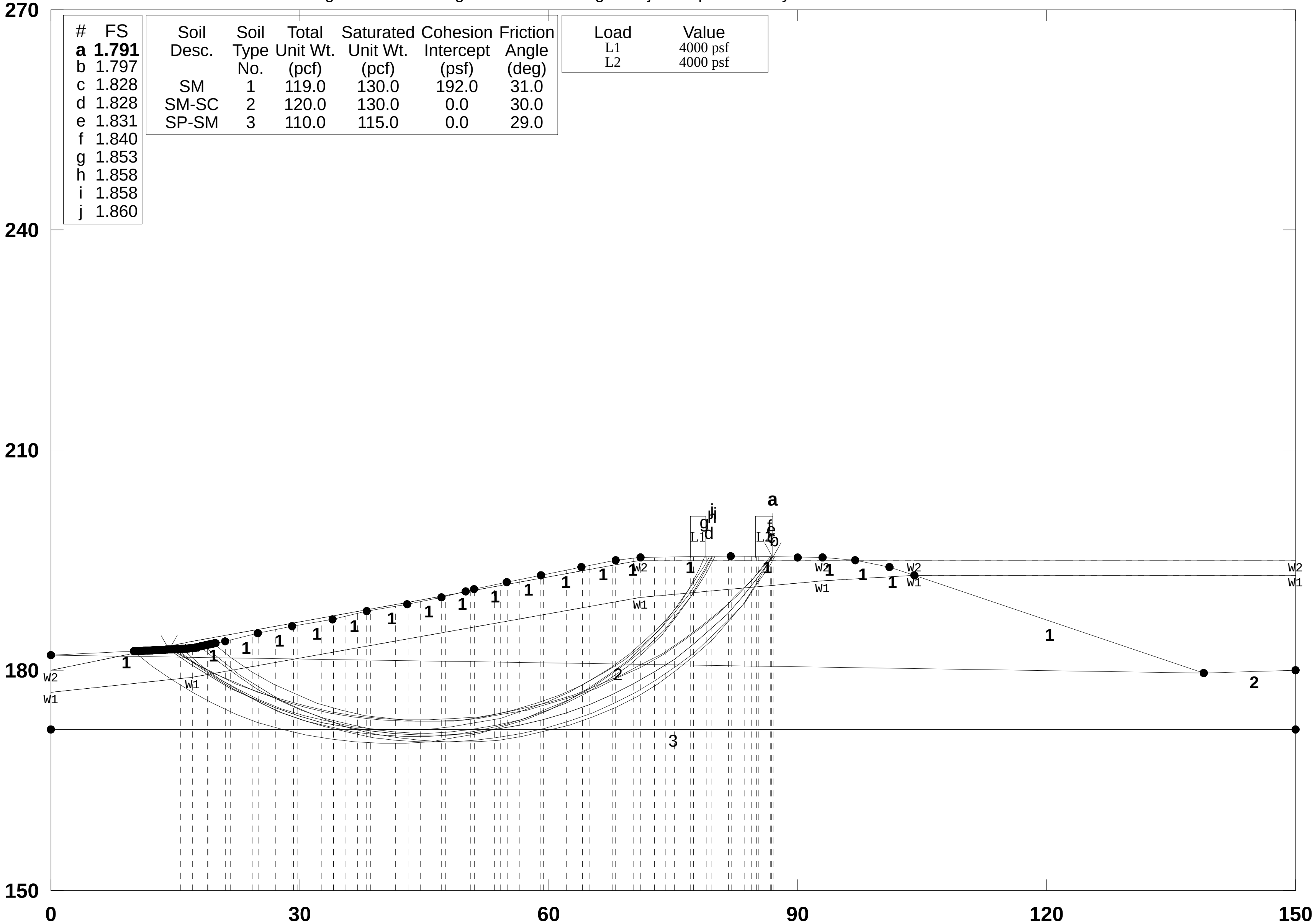

#	FS
a	**1.791**
b	1.797
c	1.828
d	1.828
e	1.831
f	1.840
g	1.853
h	1.858
i	1.858
j	1.860

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM-SC	2	120.0	130.0	0.0	30.0
SP-SM	3	110.0	115.0	0.0	29.0

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.791

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-1

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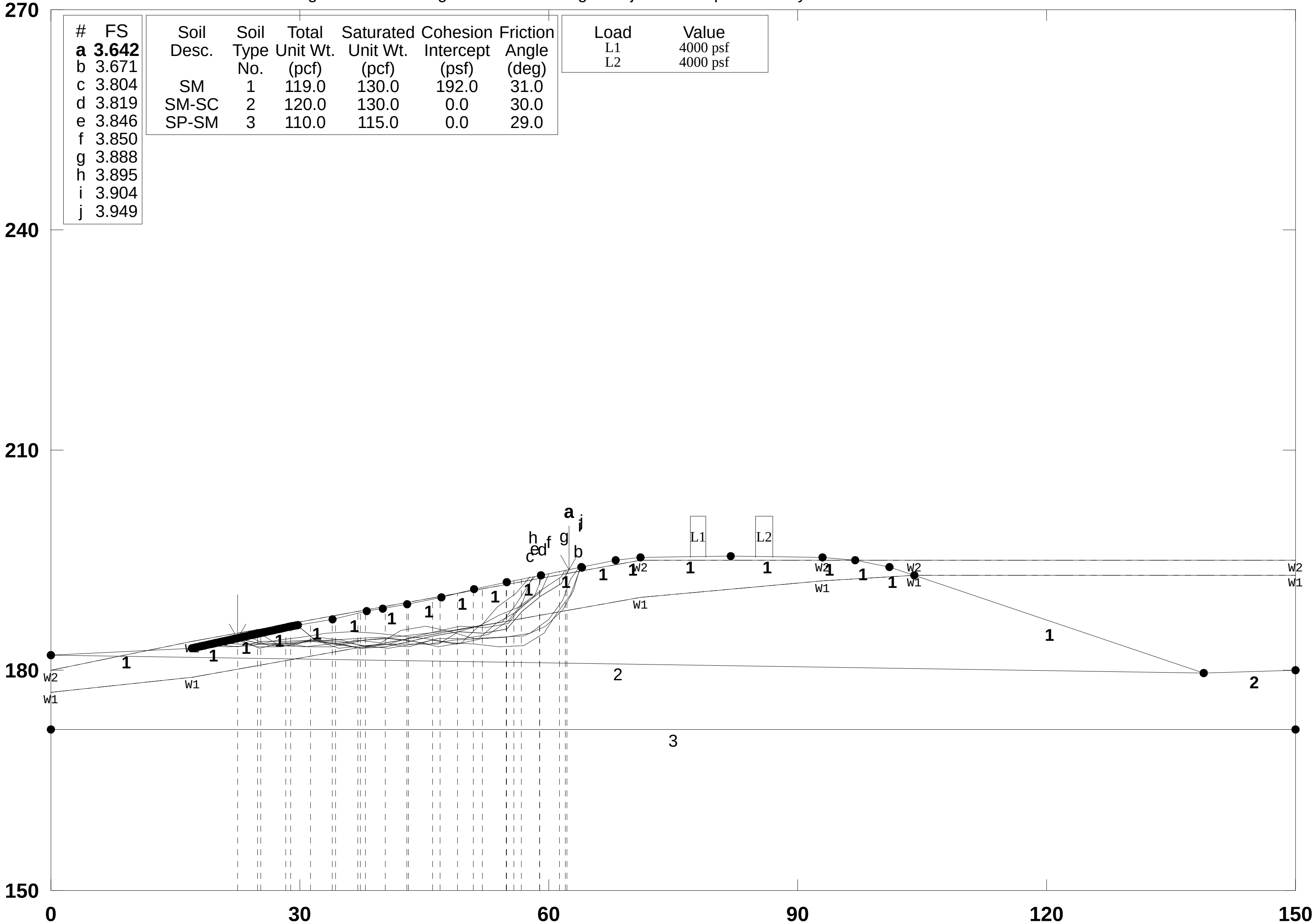

#	FS
a	**3.642**
b	3.671
c	3.804
d	3.819
e	3.846
f	3.850
g	3.888
h	3.895
i	3.904
j	3.949

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM-SC	2	120.0	130.0	0.0	30.0
SP-SM	3	110.0	115.0	0.0	29.0

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.642

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-2

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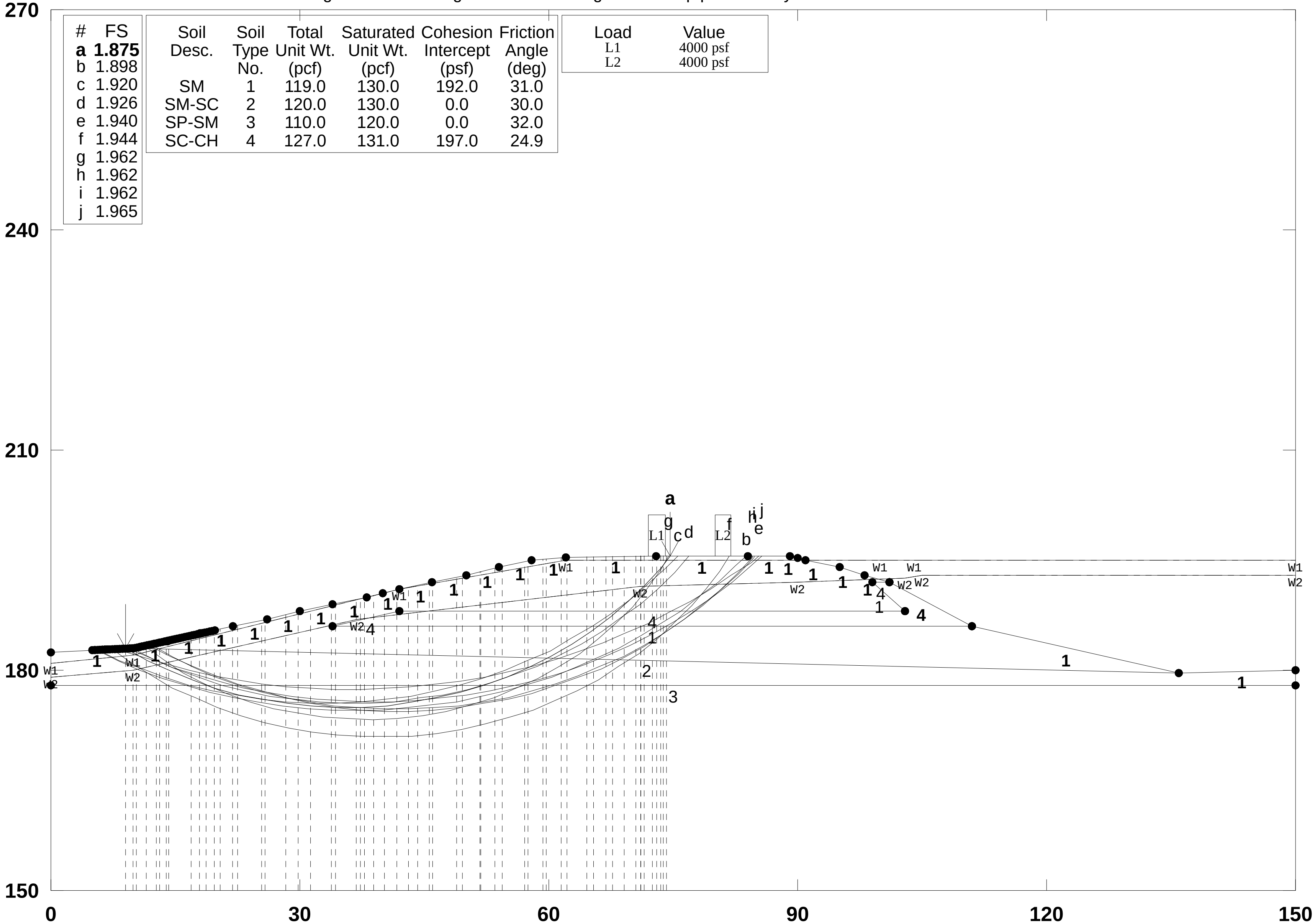

#	FS
a	**1.875**
b	1.898
c	1.920
d	1.926
e	1.940
f	1.944
g	1.962
h	1.962
i	1.962
j	1.965

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM-SC	2	120.0	130.0	0.0	30.0
SP-SM	3	110.0	120.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.875

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-2

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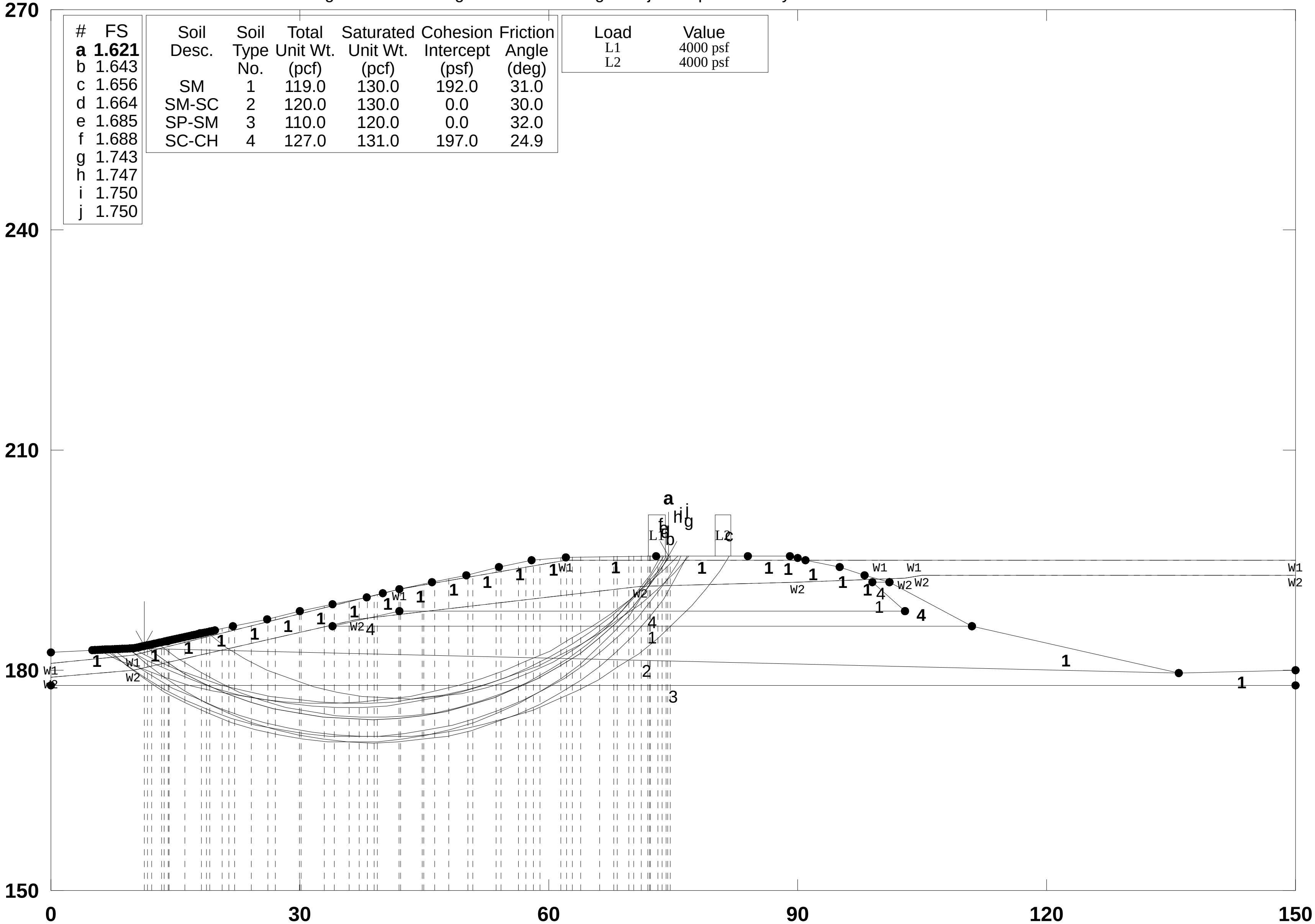

GSTABL7 v.2 FSmin=1.621

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-2

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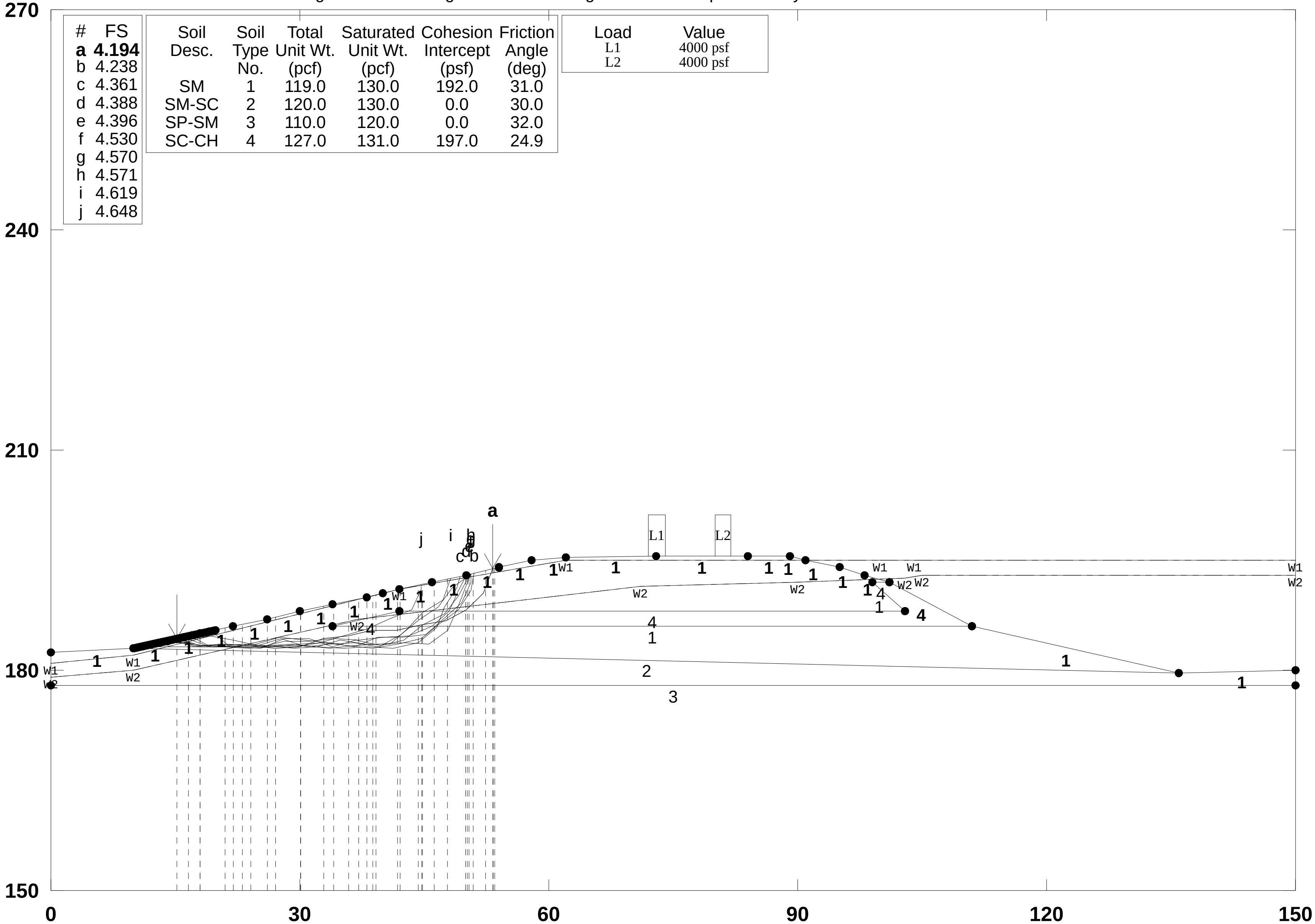

GSTABL7 v.2 FSmin=4.194

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-3

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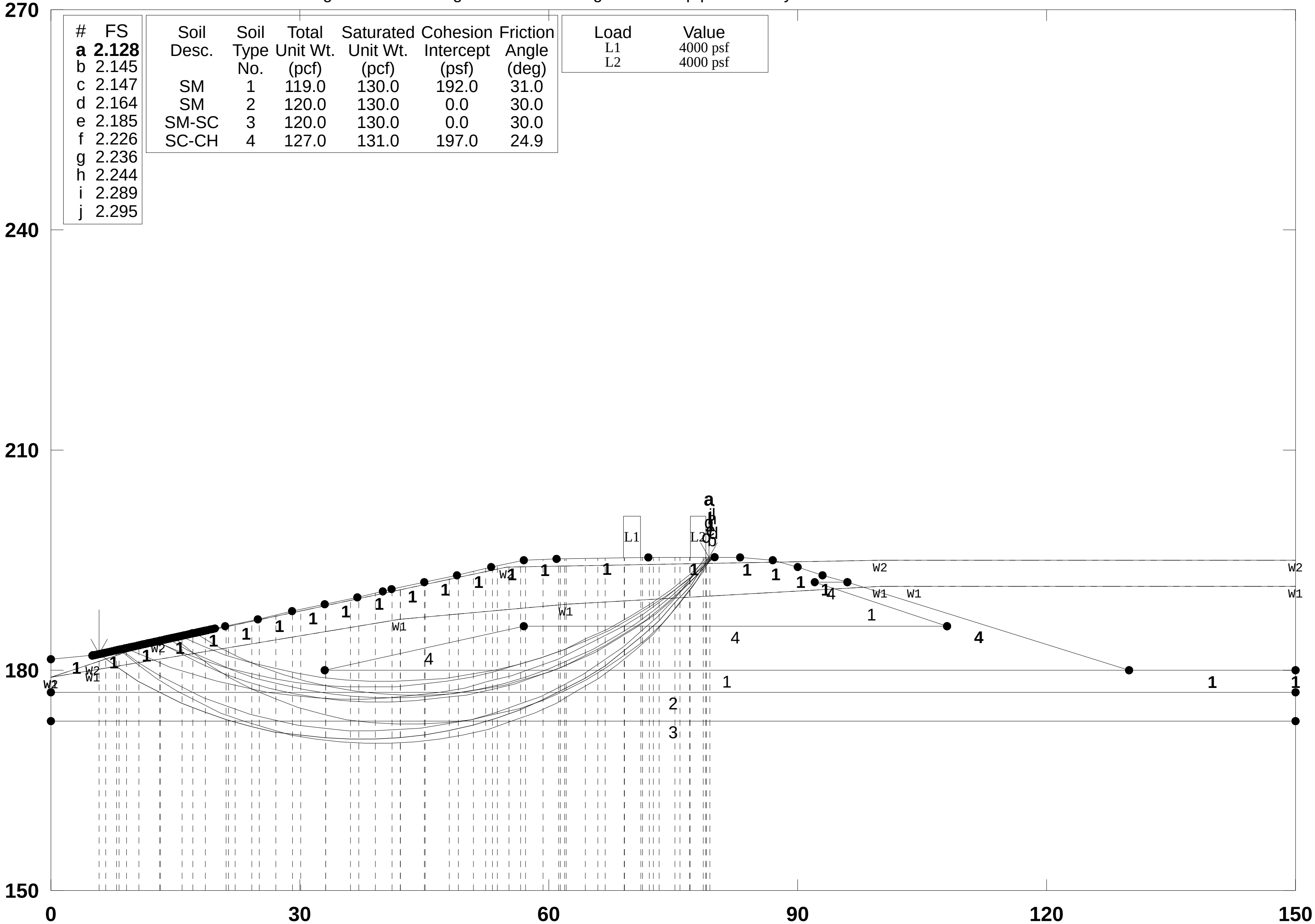

#	FS
a	**2.128**
b	2.145
c	2.147
d	2.164
e	2.185
f	2.226
g	2.236
h	2.244
i	2.289
j	2.295

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SM-SC	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=2.128

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-3

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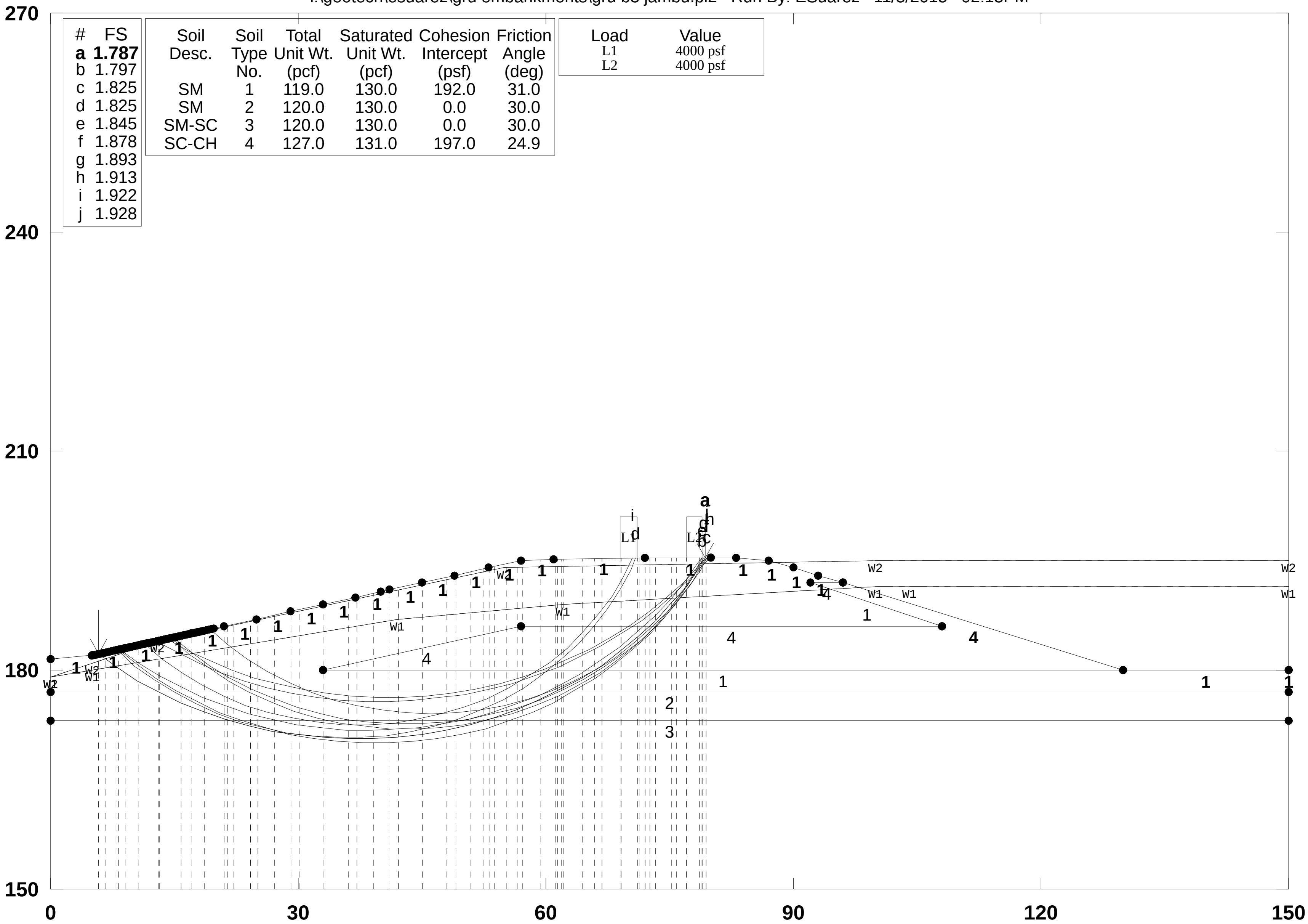

GSTABL7 v.2 FSmin=1.787

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-3

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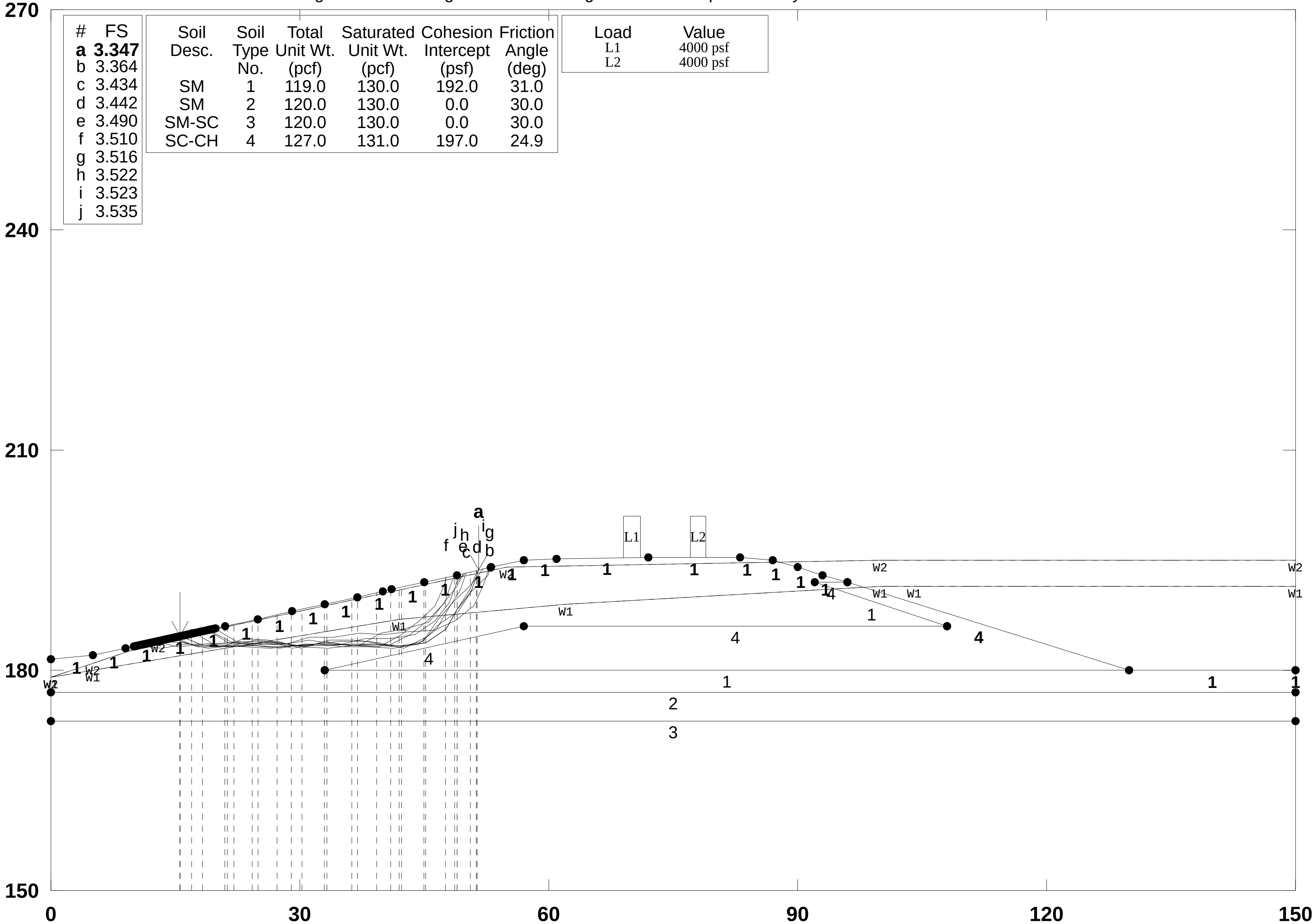

#	FS
a	**3.347**
b	3.364
c	3.434
d	3.442
e	3.490
f	3.510
g	3.516
h	3.522
i	3.523
j	3.535

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SM-SC	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.347

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-4

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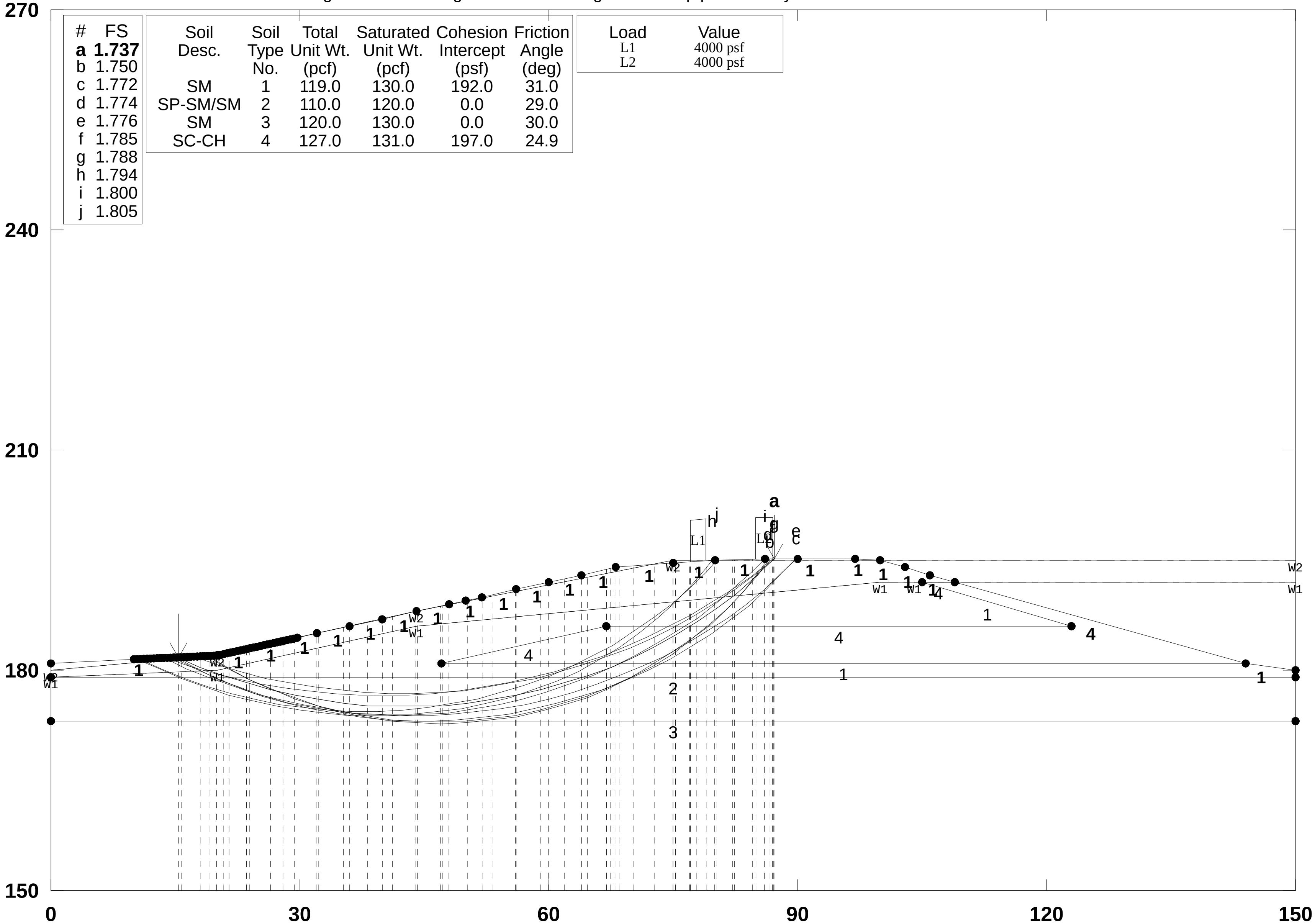
#	FS
a	**1.737**
b	1.750
c	1.772
d	1.774
e	1.776
f	1.785
g	1.788
h	1.794
i	1.800
j	1.805

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SP-SM/SM	2	110.0	120.0	0.0	29.0
SM	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

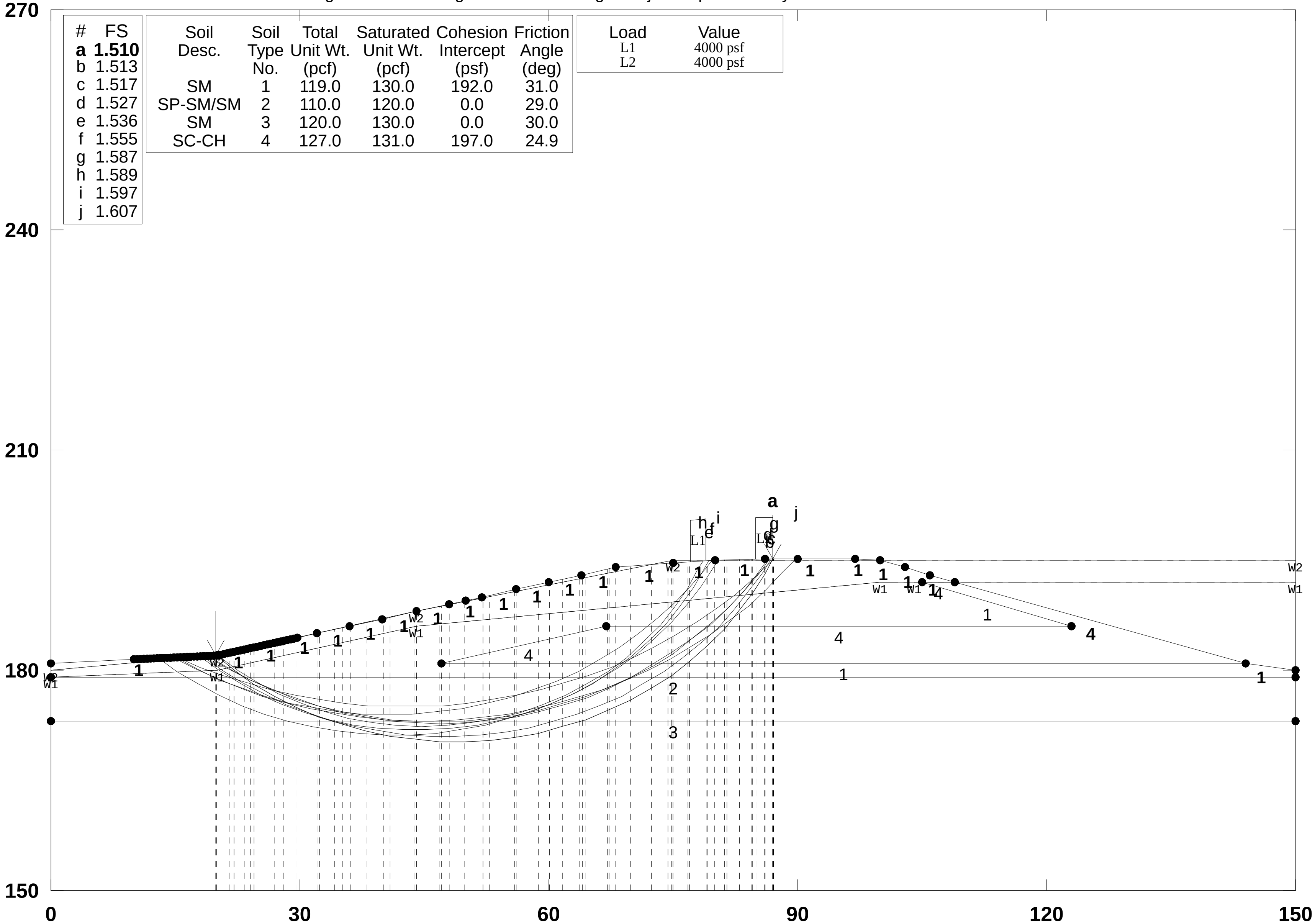


GSTABL7 v.2 FSmin=1.737

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-4

I:\geotech\esuarez\gru embankments\gru b4 jambu.pl2   Run By: ESuarez   11/3/2015   02:45PM



#	FS
a	**1.510**
b	1.513
c	1.517
d	1.527
e	1.536
f	1.555
g	1.587
h	1.589
i	1.597
j	1.607

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SP-SM/SM	2	110.0	120.0	0.0	29.0
SM	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

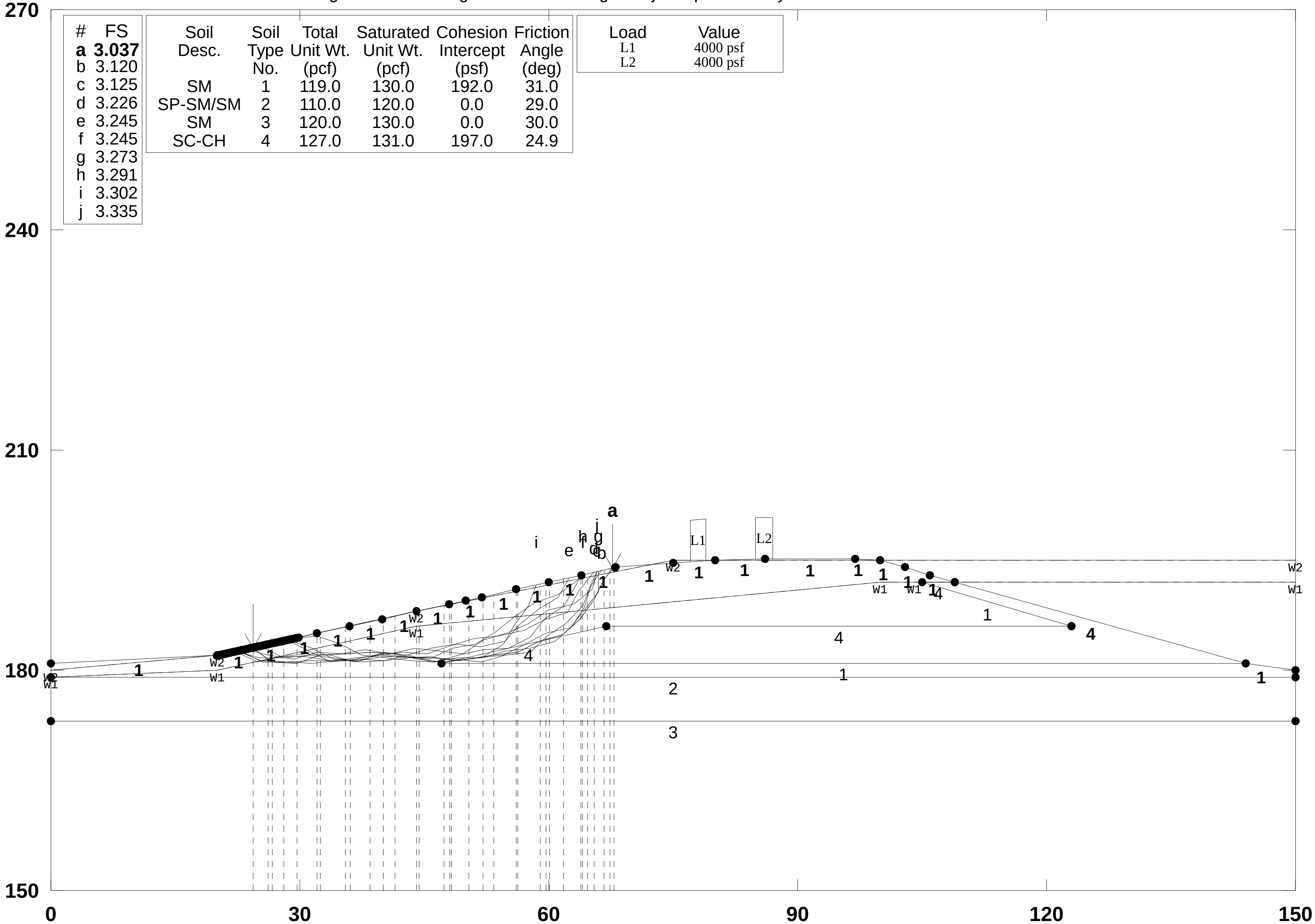
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.510

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-4

I:\geotech\esuarez\gru embankments\gru b4 jrand.pl2   Run By: ESuarez   11/3/2015   02:48PM



#	FS
a	**3.037**
b	3.120
c	3.125
d	3.226
e	3.245
f	3.245
g	3.273
h	3.291
i	3.302
j	3.335

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SP-SM/SM	2	110.0	120.0	0.0	29.0
SM	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.037

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-5

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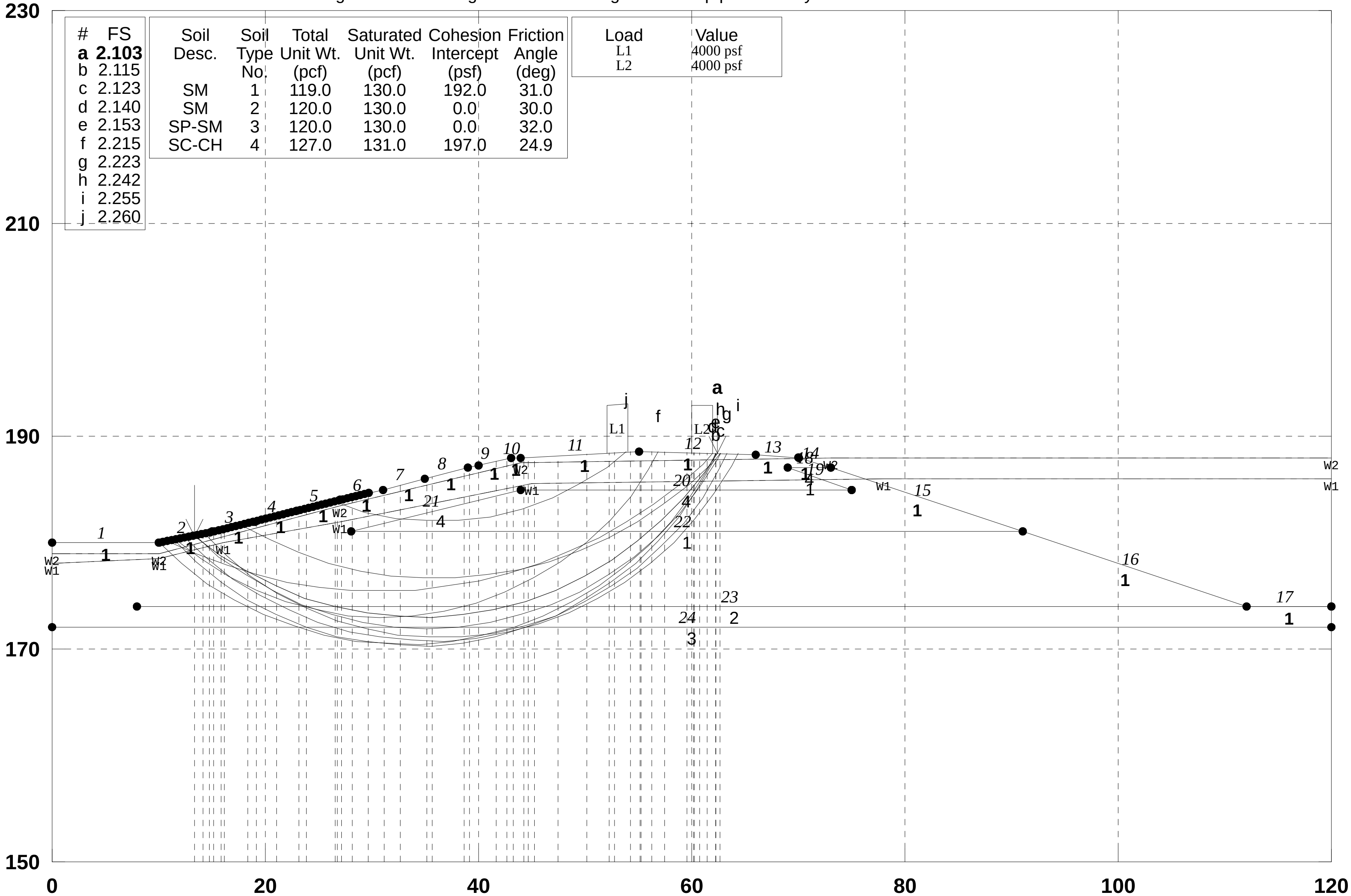


#	FS
a	**2.103**
b	2.115
c	2.123
d	2.140
e	2.153
f	2.215
g	2.223
h	2.242
i	2.255
j	2.260

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

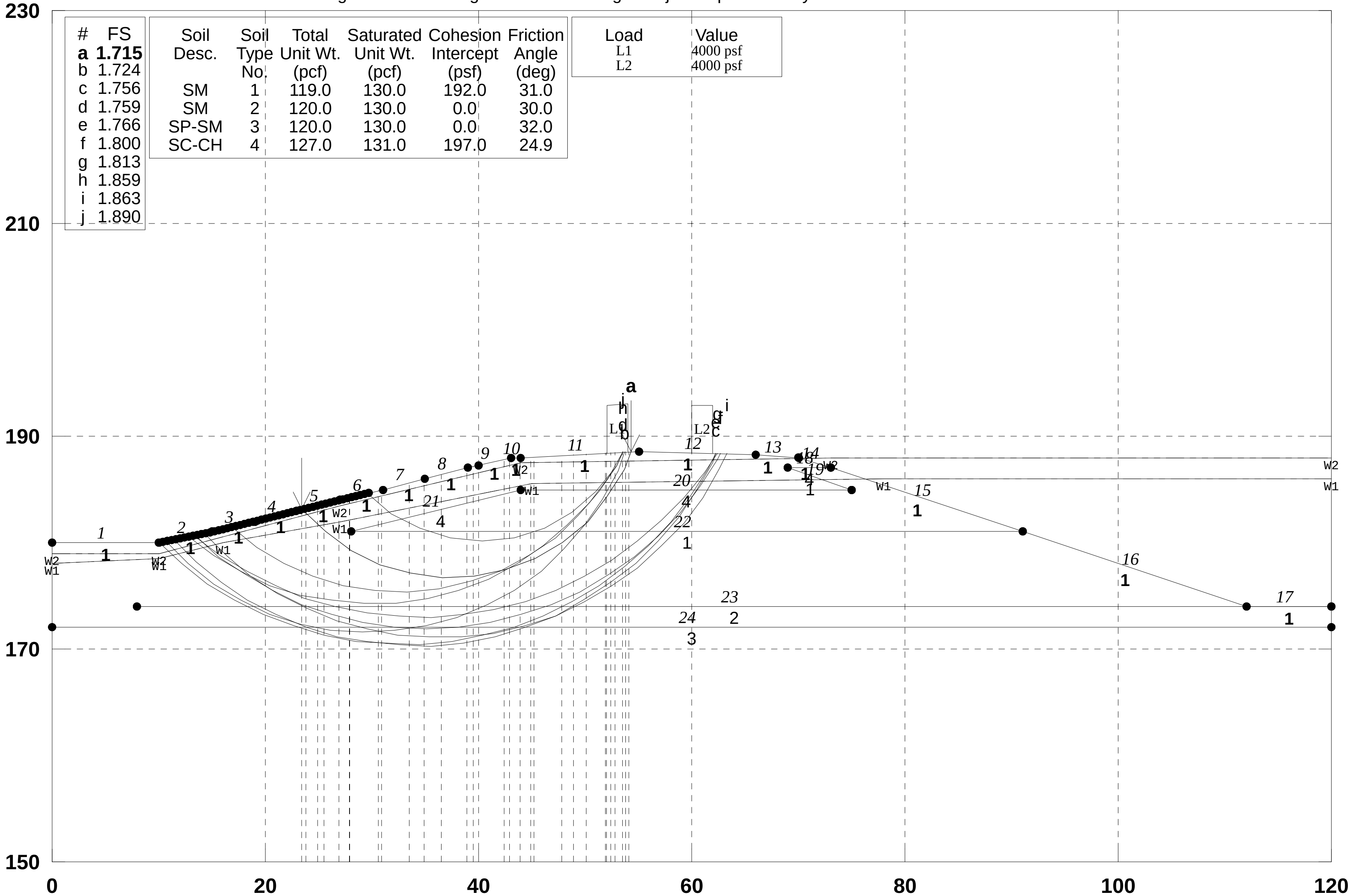
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=2.103

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-5

I:\geotech\esuarez\gru embankments\gru b5 jambu.pl2   Run By: ESuarez   11/9/2015   05:02PM



#	FS
a	**1.715**
b	1.724
c	1.756
d	1.759
e	1.766
f	1.800
g	1.813
h	1.859
i	1.863
j	1.890

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

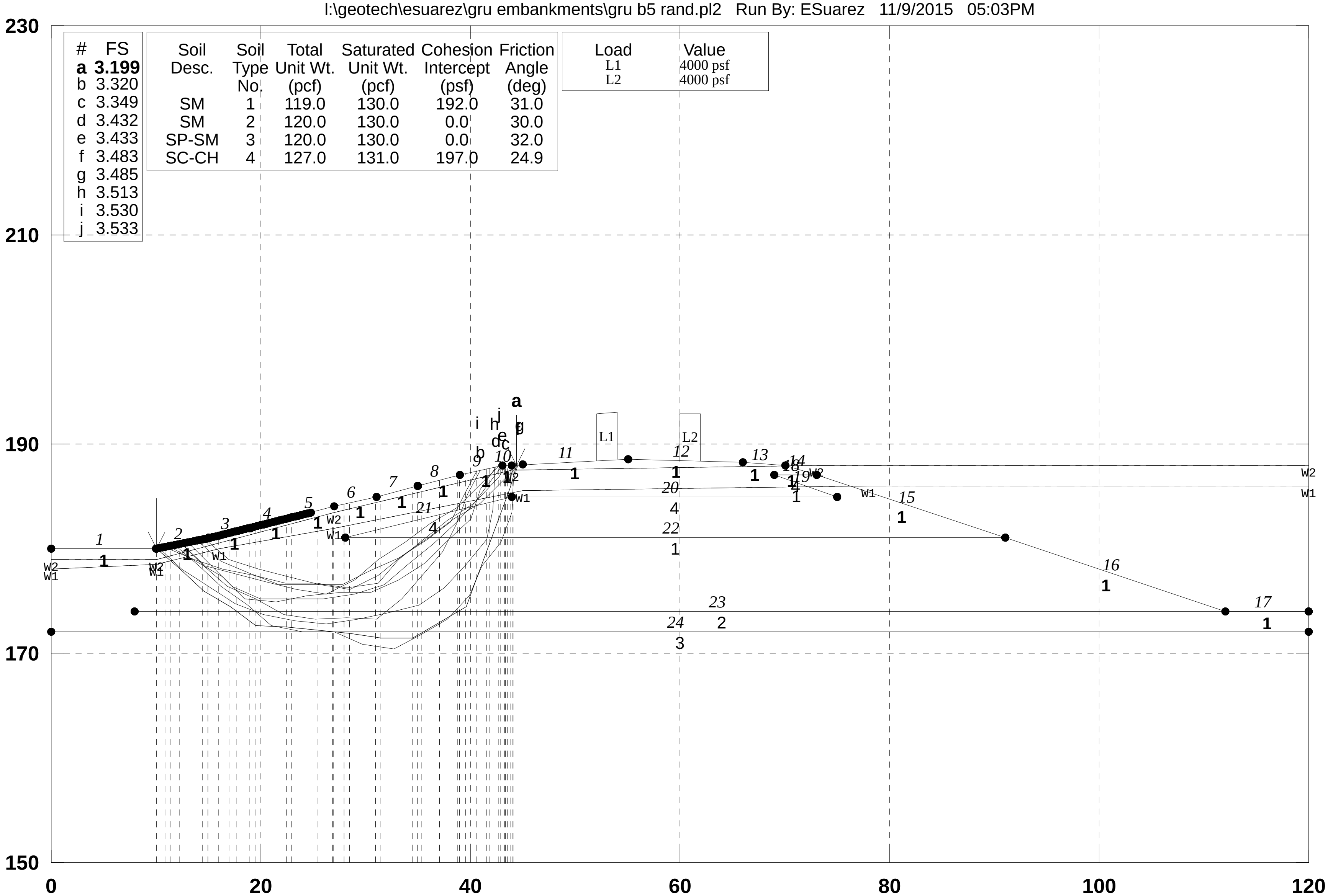
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.715

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-5

I:\geotech\esuarez\gru embankments\gru b5 rand.pl2 Run By: ESuarez 11/9/2015 05:03PM



#	FS
a	**3.199**
b	3.320
c	3.349
d	3.432
e	3.433
f	3.483
g	3.485
h	3.513
i	3.530
j	3.533

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

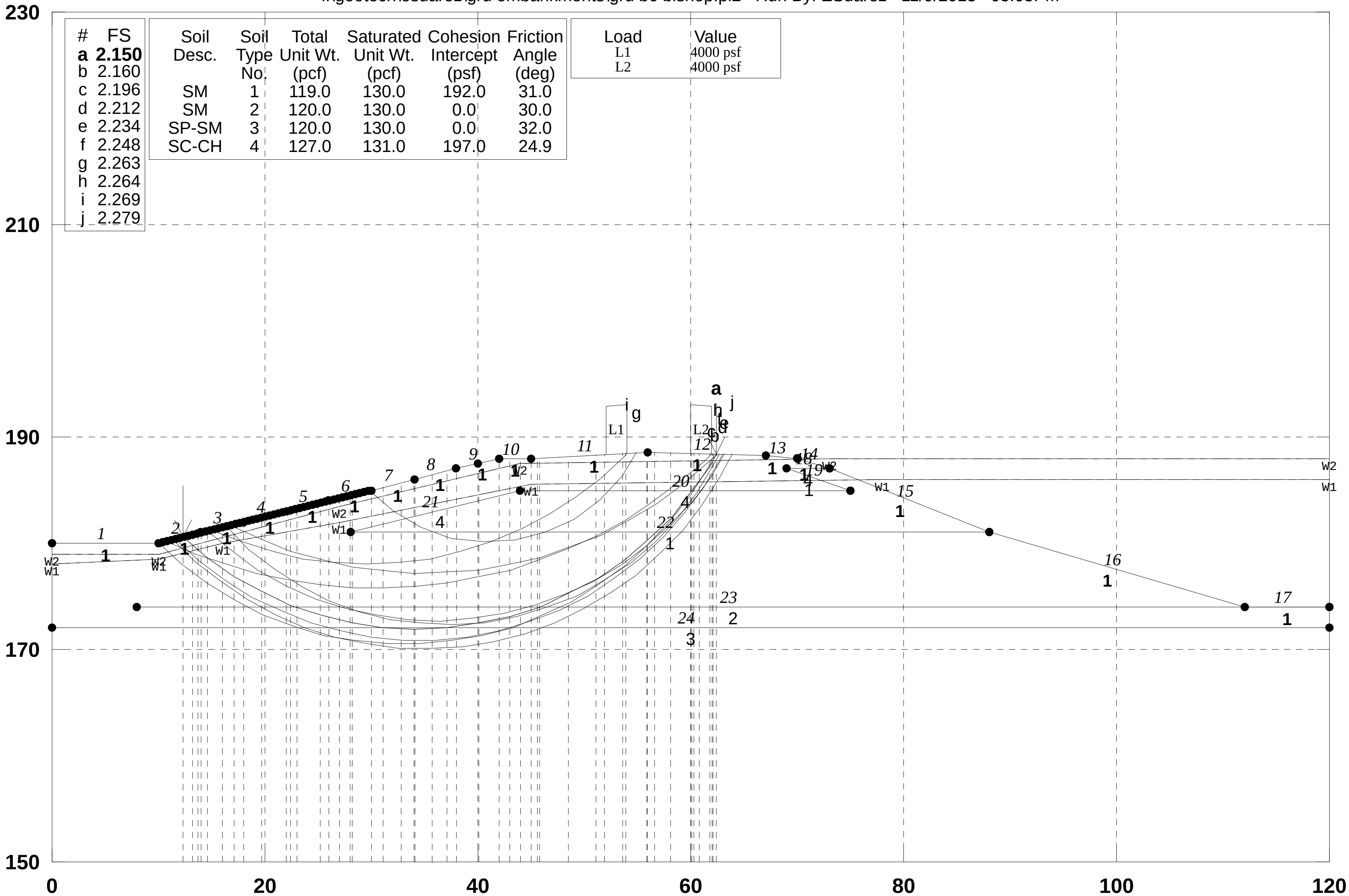
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.199

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-6

I:\geotech\esuarez\gru embankments\gru b6 bishop.pl2 Run By: ESuarez 11/9/2015 05:05PM

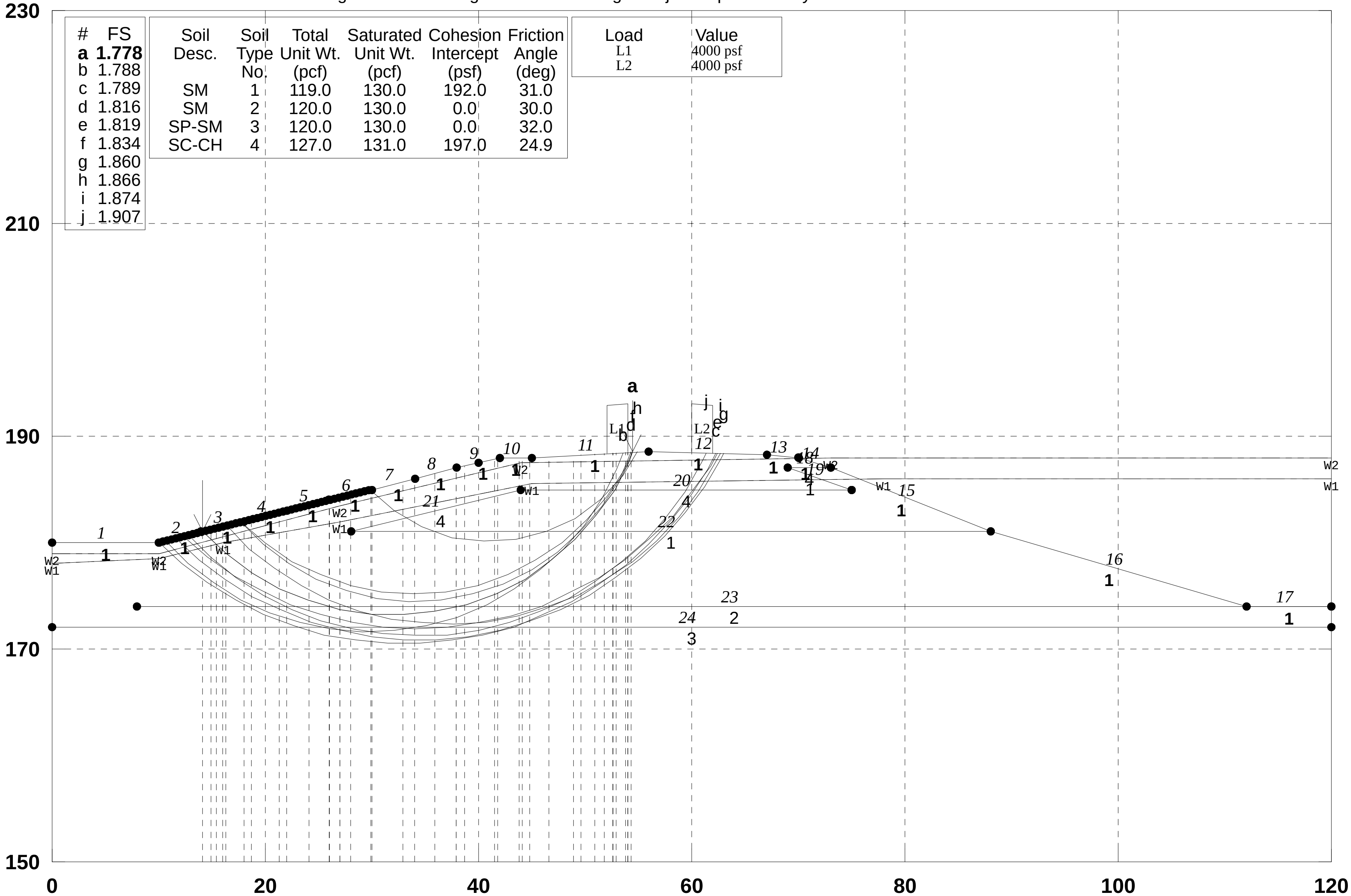


GSTABL7 v.2 FSmin=2.150

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-6

I:\geotech\esuarez\gru embankments\gru b6 jambu.pl2 Run By: ESuarez 11/9/2015 05:06PM

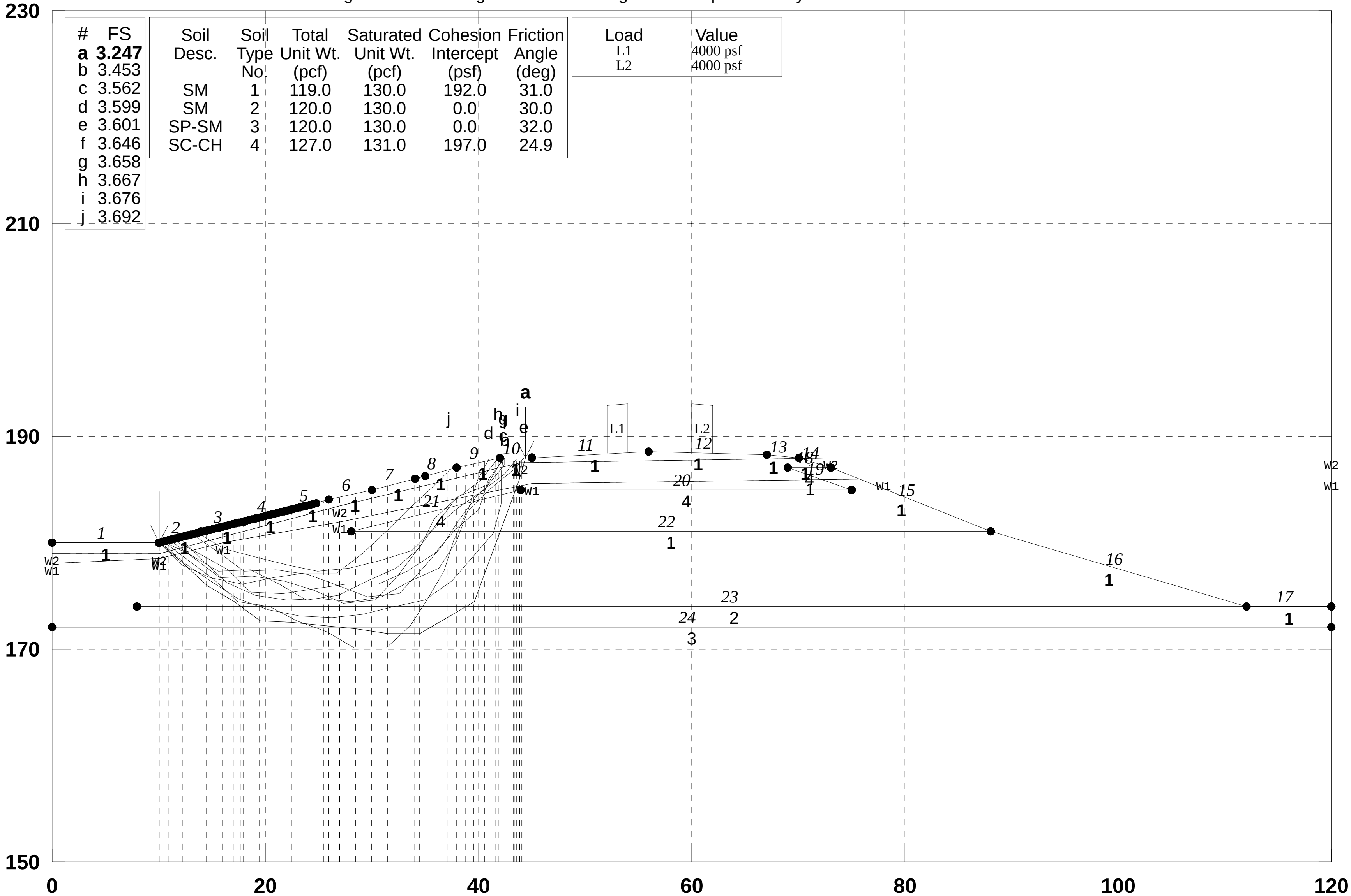


GSTABL7 v.2 FSmin=1.778

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-6

I:\geotech\esuarez\gru embankments\gru b6 rand.pl2   Run By: ESuarez   11/9/2015   05:07PM



#	FS
a	**3.247**
b	3.453
c	3.562
d	3.599
e	3.601
f	3.646
g	3.658
h	3.667
i	3.676
j	3.692

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.247

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-1

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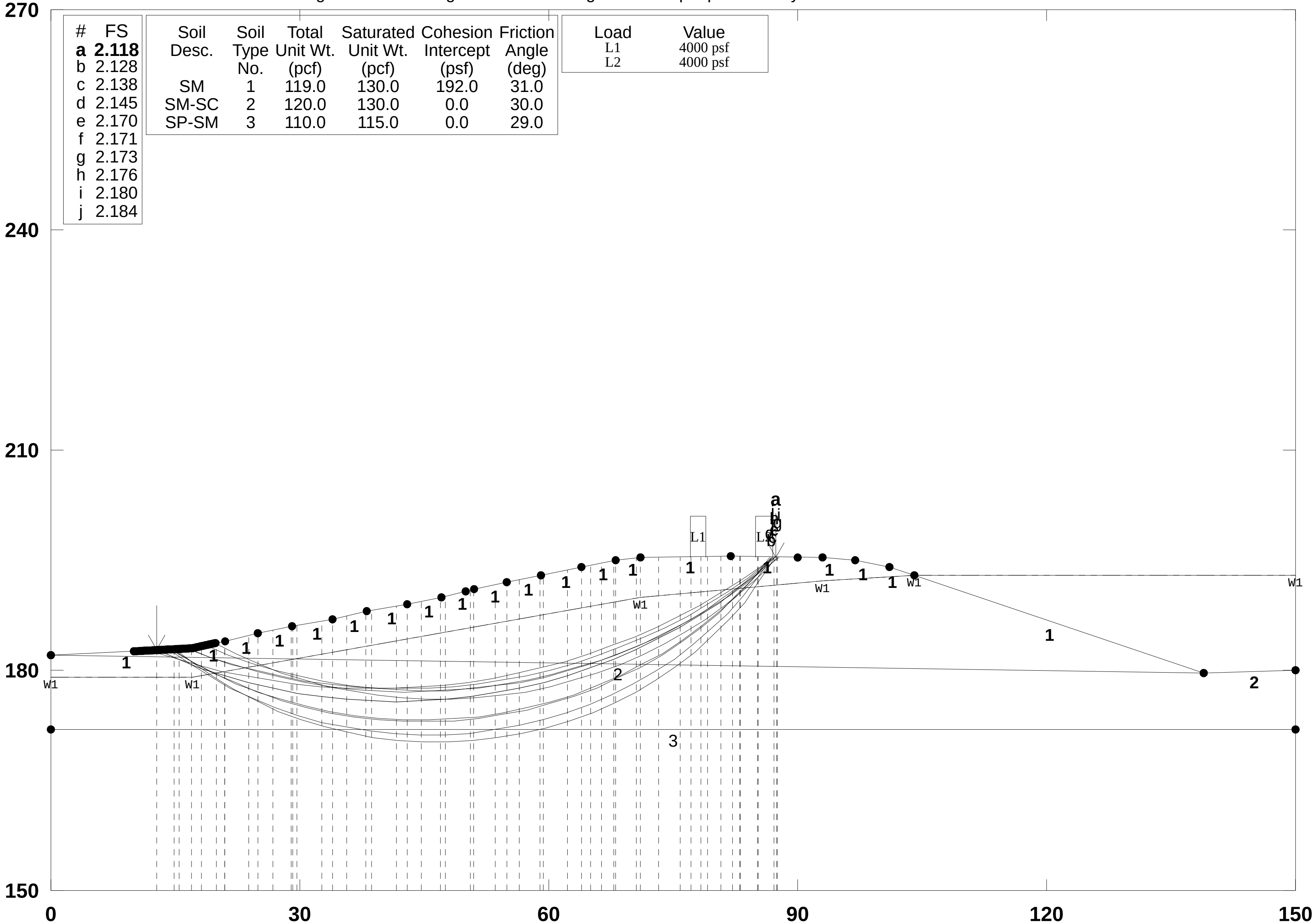


#	FS
a	**2.118**
b	2.128
c	2.138
d	2.145
e	2.170
f	2.171
g	2.173
h	2.176
i	2.180
j	2.184

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM-SC	2	120.0	130.0	0.0	30.0
SP-SM	3	110.0	115.0	0.0	29.0

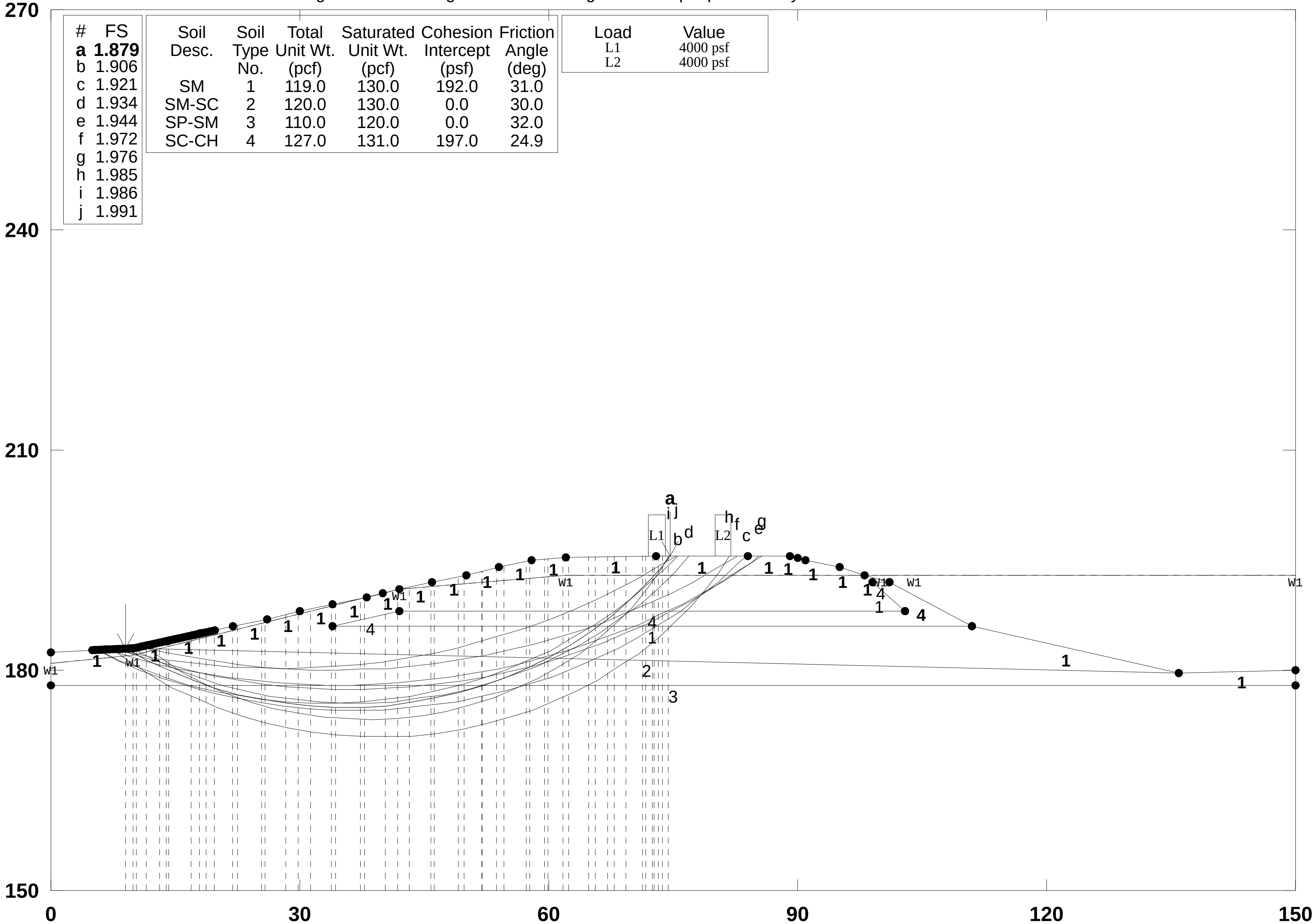
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=2.118

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-2

I:\geotech\esuarez\gru embankments\gru b2 bishop 2.pl2   Run By: ESuarez   11/9/2015   12:22PM



#	FS
a	**1.879**
b	1.906
c	1.921
d	1.934
e	1.944
f	1.972
g	1.976
h	1.985
i	1.986
j	1.991

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM-SC	2	120.0	130.0	0.0	30.0
SP-SM	3	110.0	120.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

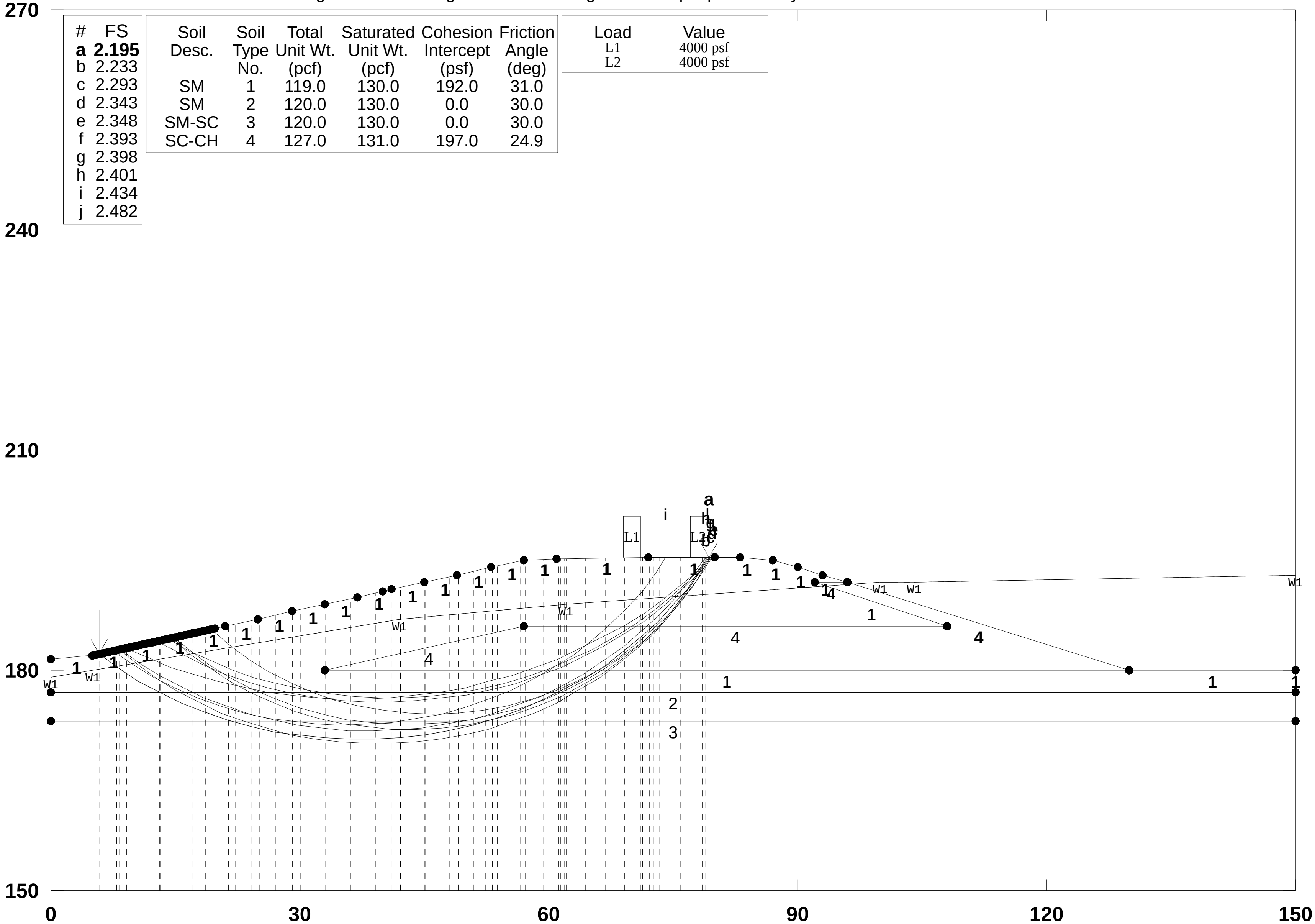
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.879

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-3

I:\geotech\esuarez\gru embankments\gru b3 bishop 3.pl2   Run By: ESuarez   11/9/2015   12:27PM



#	FS
a	**2.195**
b	2.233
c	2.293
d	2.343
e	2.348
f	2.393
g	2.398
h	2.401
i	2.434
j	2.482

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SM-SC	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=2.195

Safety Factors Are Calculated By The Modified Bishop Method

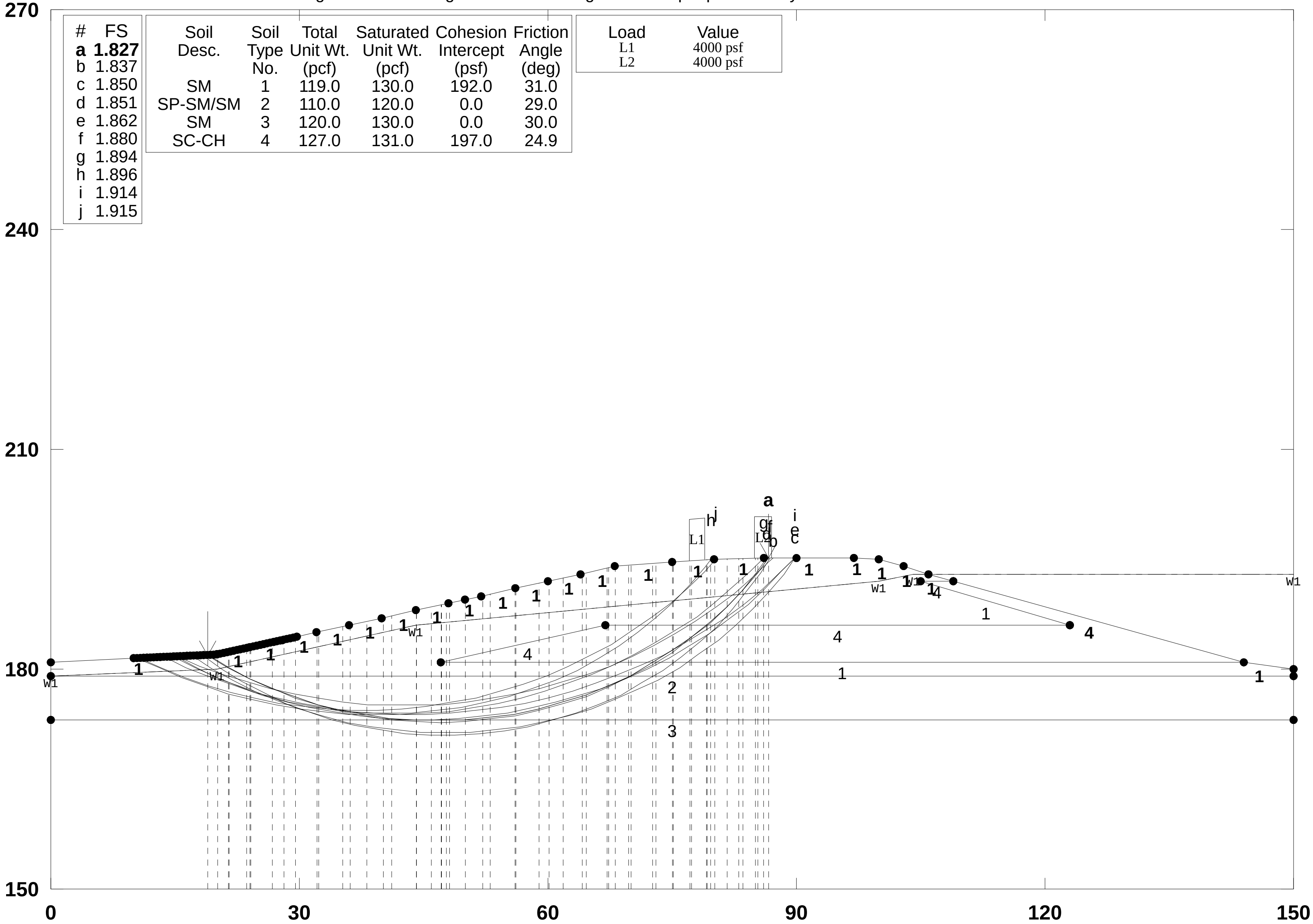
GRU Process Pond Embankment Section B-4

I:\geotech\esuarez\gru embankments\gru b4 bishop 2.pl2   Run By: ESuarez   11/9/2015   12:31PM

#	FS
a	**1.827**
b	1.837
c	1.850
d	1.851
e	1.862
f	1.880
g	1.894
h	1.896
i	1.914
j	1.915

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SP-SM/SM	2	110.0	120.0	0.0	29.0
SM	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf



GSTABL7 v.2 FSmin=1.827

Safety Factors Are Calculated By The Modified Bishop Method

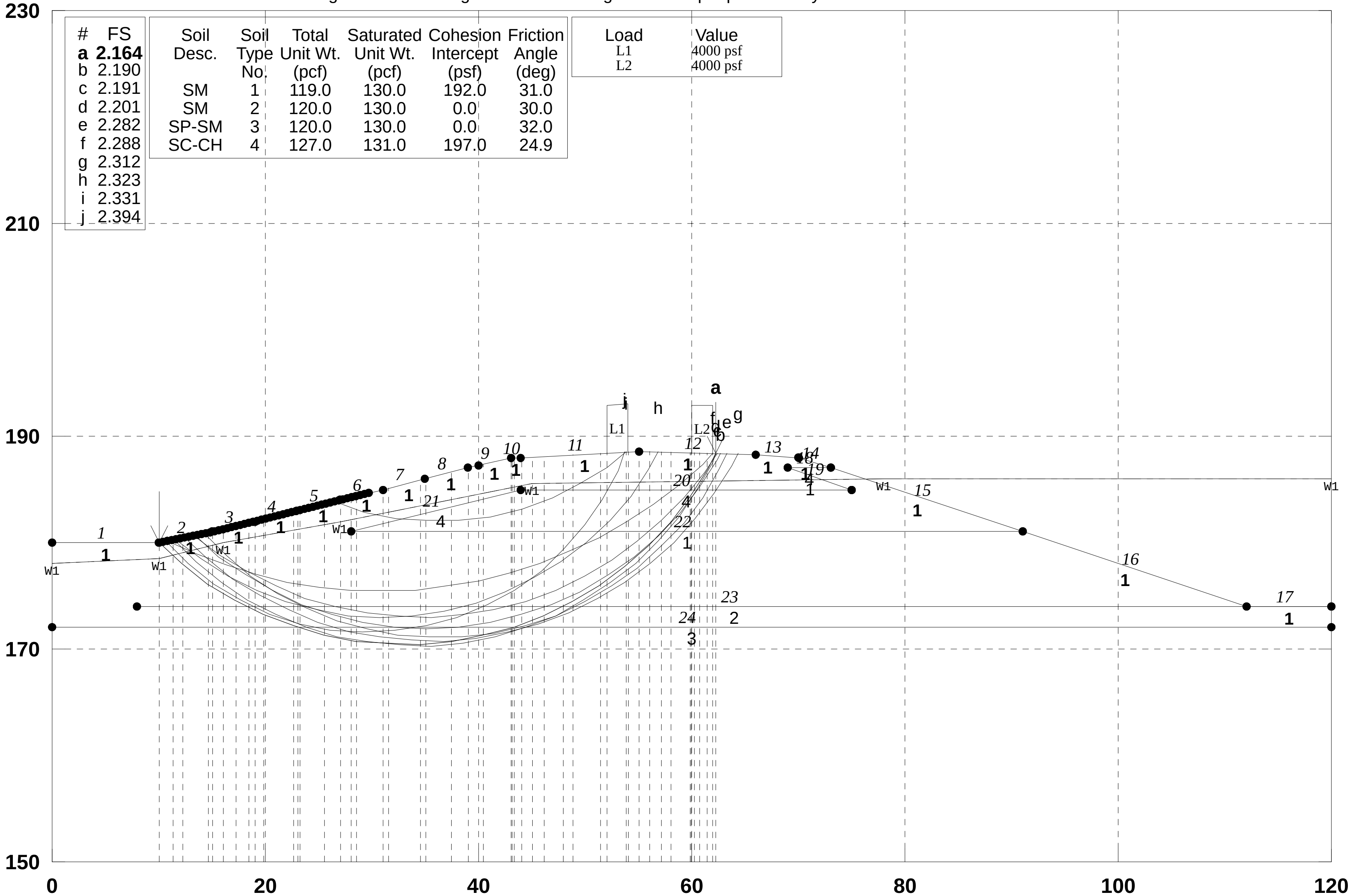
GRU Process Pond Embankment Section B-5

I:\geotech\esuarez\gru embankments\gru b5 bishop 2.pl2   Run By: ESuarez   11/9/2015   05:15PM

#	FS
a	**2.164**
b	2.190
c	2.191
d	2.201
e	2.282
f	2.288
g	2.312
h	2.323
i	2.331
j	2.394

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

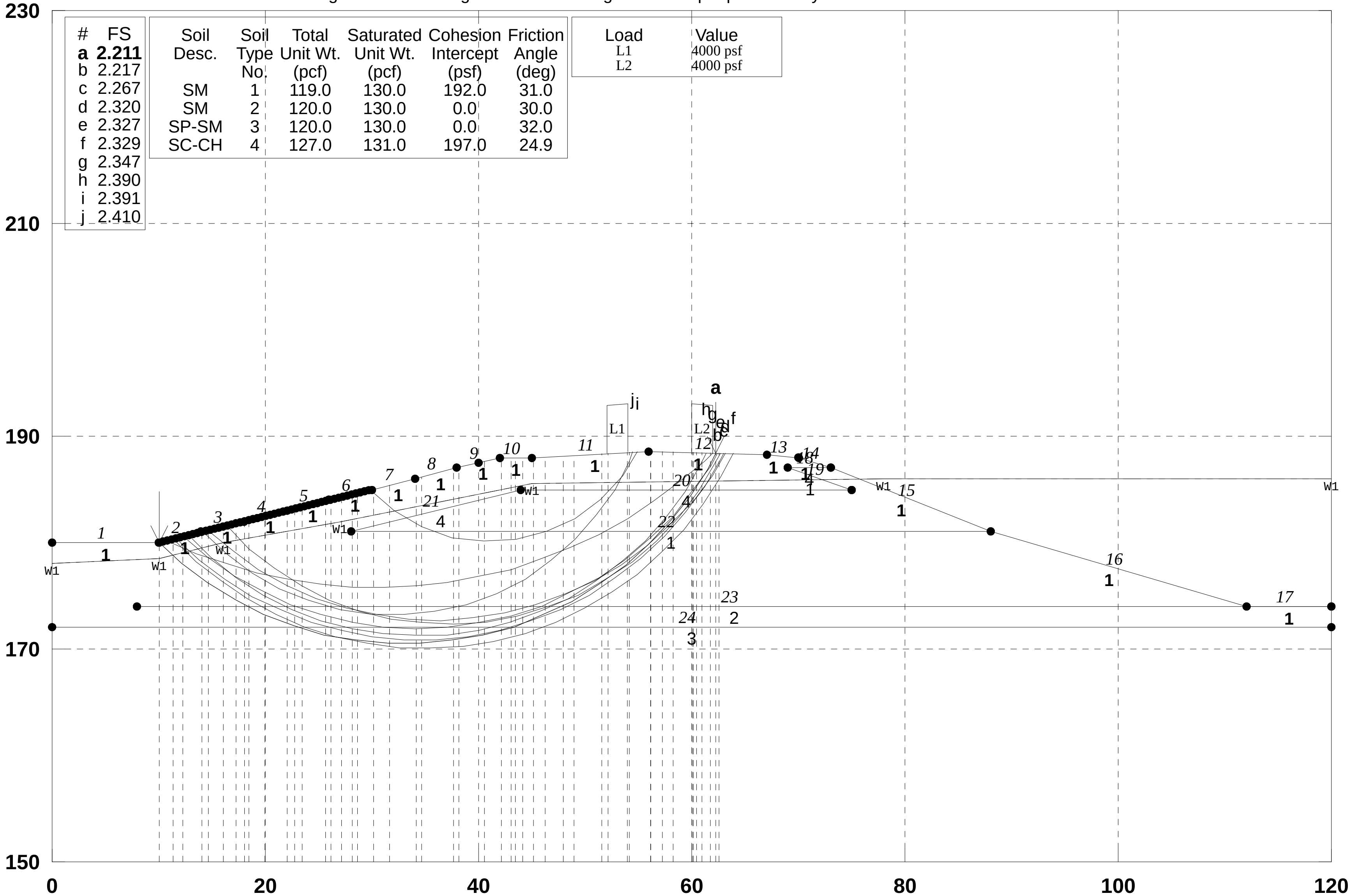
Load	Value
L1	4000 psf
L2	4000 psf



GSTABL7 v.2 FSmin=2.164
Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-6

I:\geotech\esuarez\gru embankments\gru b6 bishop 2.pl2   Run By: ESuarez   11/9/2015   05:17PM



#	FS
a	**2.211**
b	2.217
c	2.267
d	2.320
e	2.327
f	2.329
g	2.347
h	2.390
i	2.391
j	2.410

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

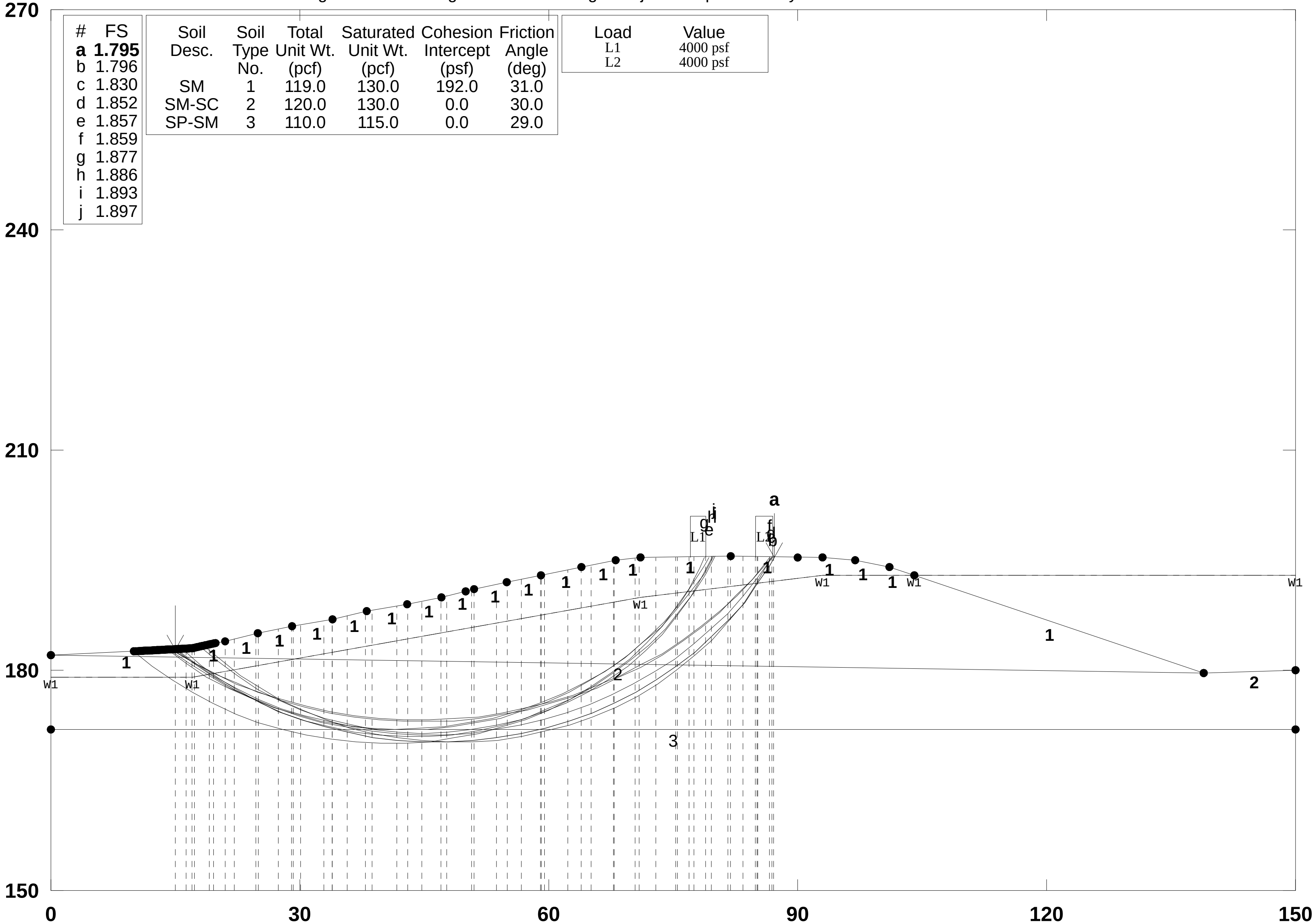
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=2.211

Safety Factors Are Calculated By The Modified Bishop Method

GRU Process Pond Embankment Section B-1

l:\geotech\esuarez\gru embankments\gru b1 jambu 2.pl2   Run By: ESuarez   11/9/2015   12:18PM

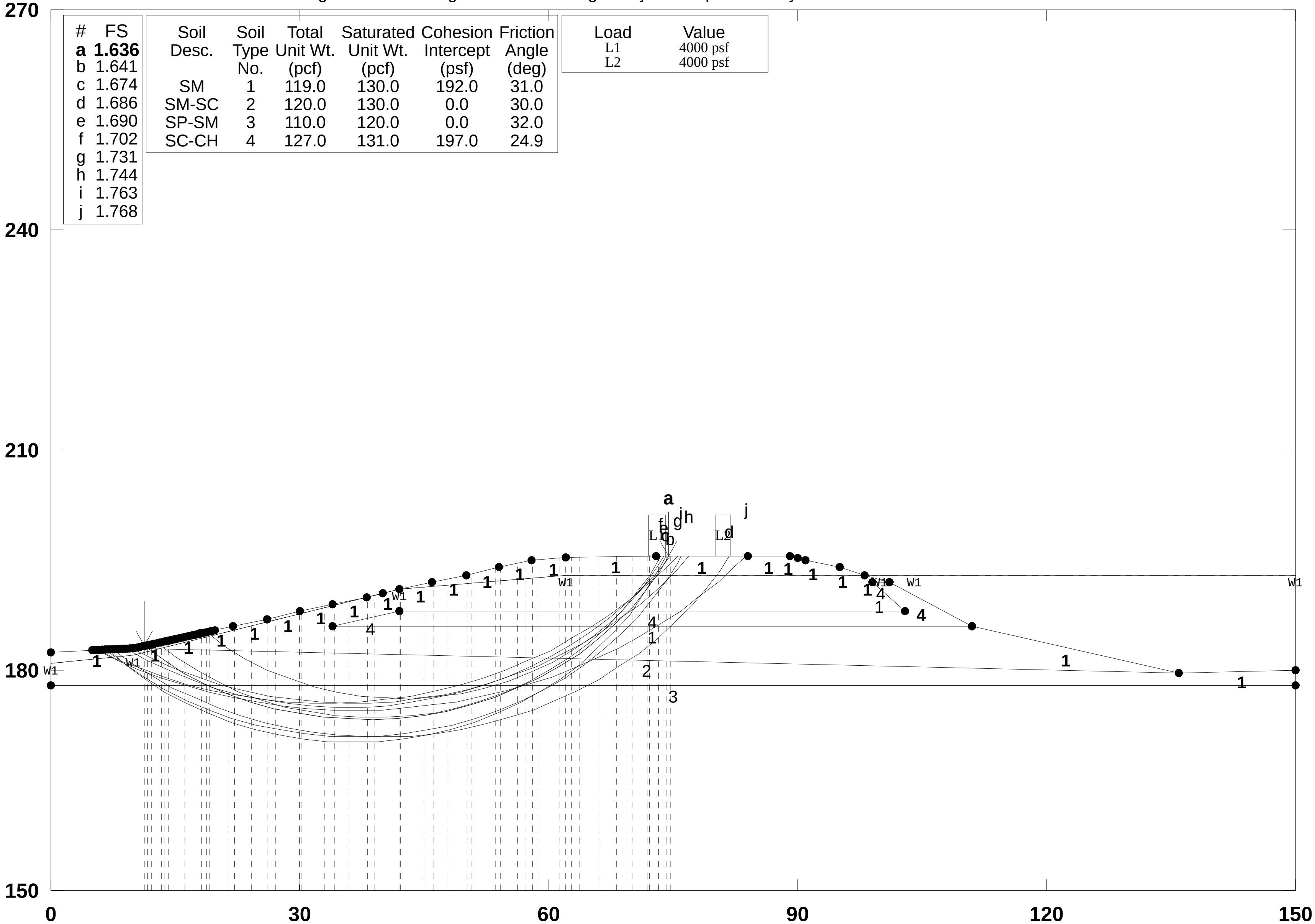


GSTABL7 v.2 FSmin=1.795

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-2

I:\geotech\esuarez\gru embankments\gru b2 jambu 2.pl2   Run By: ESuarez   11/9/2015   12:24PM



#	FS
a	**1.636**
b	1.641
c	1.674
d	1.686
e	1.690
f	1.702
g	1.731
h	1.744
i	1.763
j	1.768

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM-SC	2	120.0	130.0	0.0	30.0
SP-SM	3	110.0	120.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

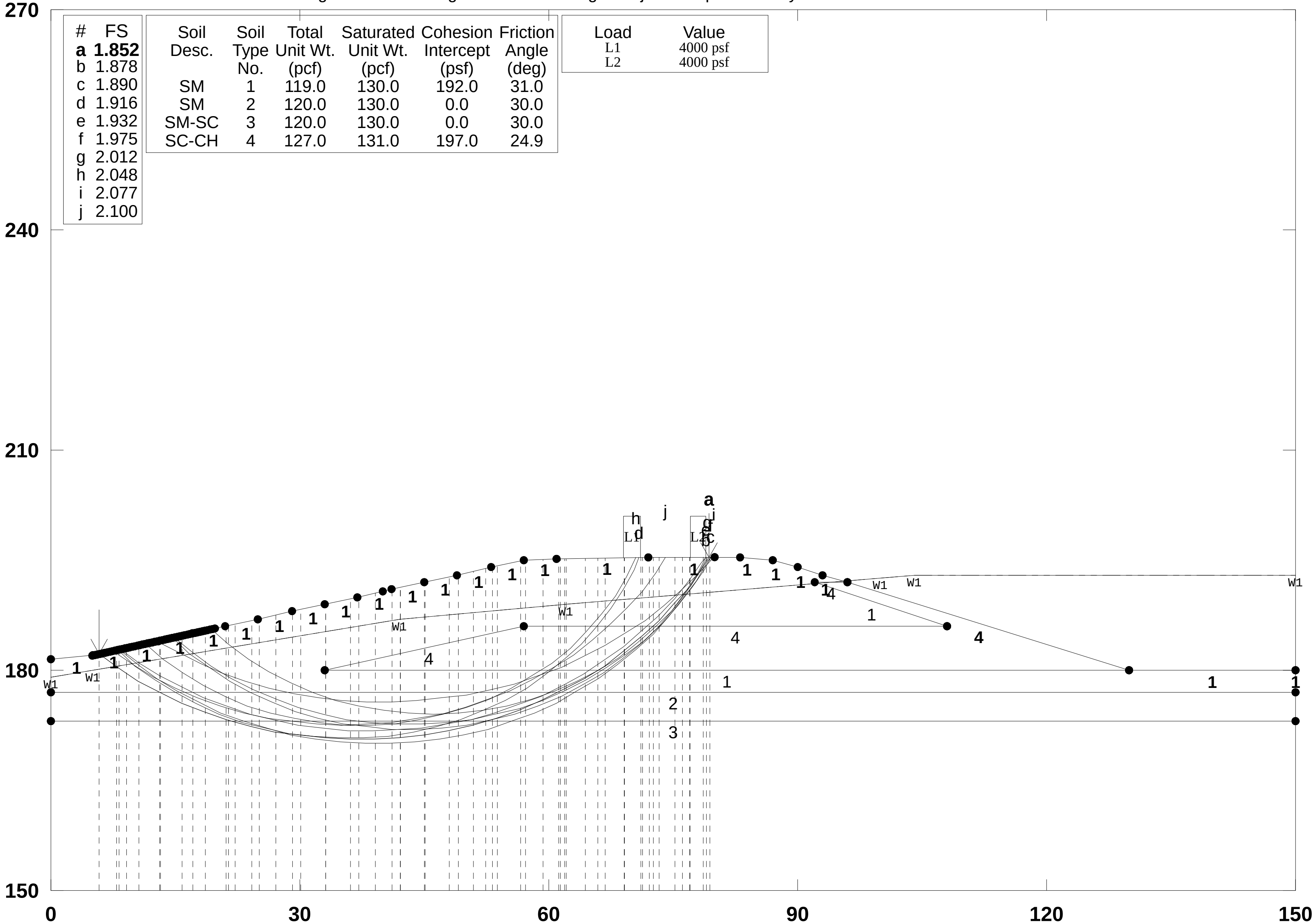
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.636

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-3

I:\geotech\esuarez\gru embankments\gru b3 jambu 3.pl2   Run By: ESuarez   11/9/2015   12:28PM

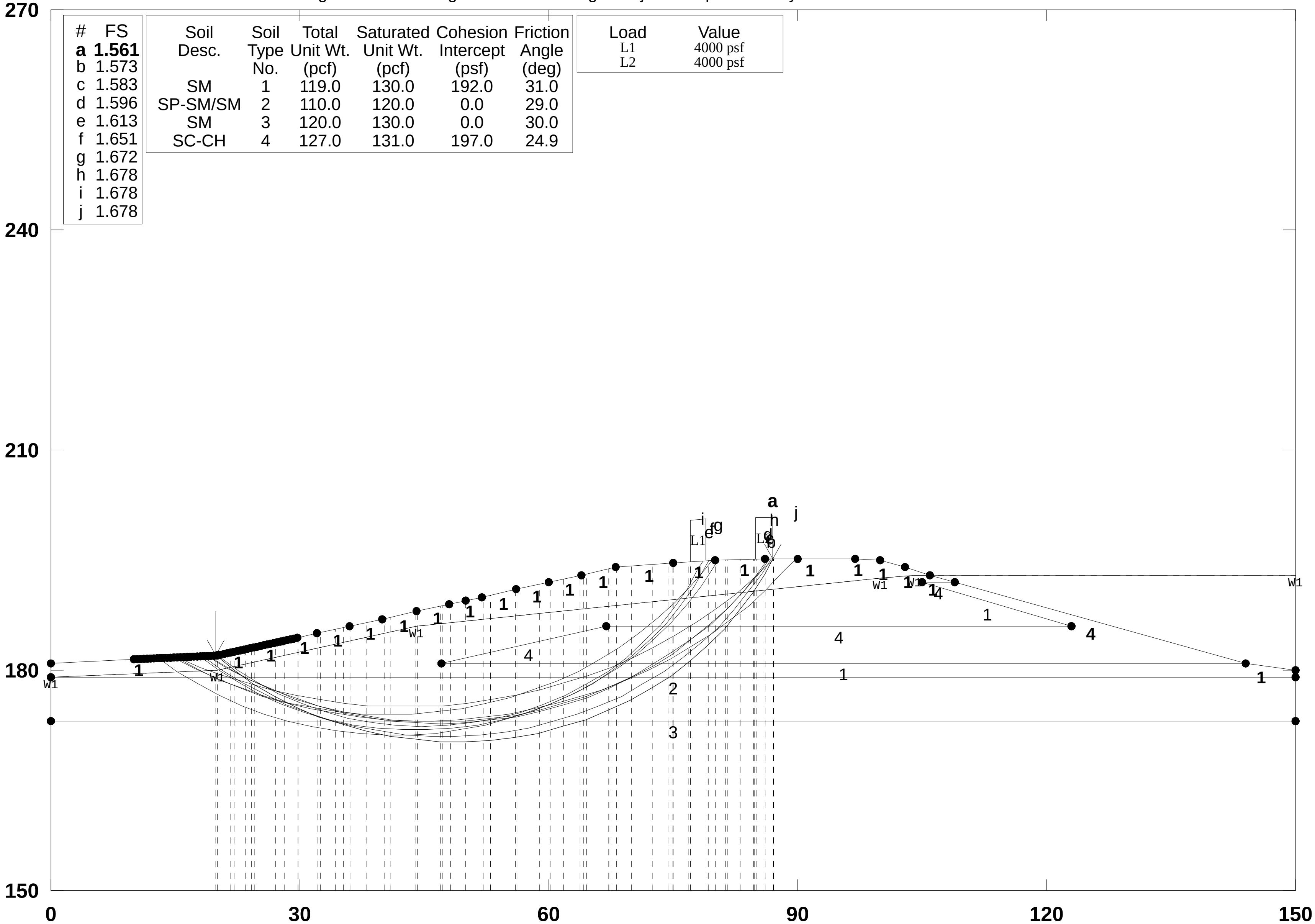


GSTABL7 v.2 FSmin=1.852

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-4

I:\geotech\esuarez\gru embankments\gru b4 jambu 2.pl2   Run By: ESuarez   11/9/2015   12:32PM



#	FS
a	**1.561**
b	1.573
c	1.583
d	1.596
e	1.613
f	1.651
g	1.672
h	1.678
i	1.678
j	1.678

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SP-SM/SM	2	110.0	120.0	0.0	29.0
SM	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

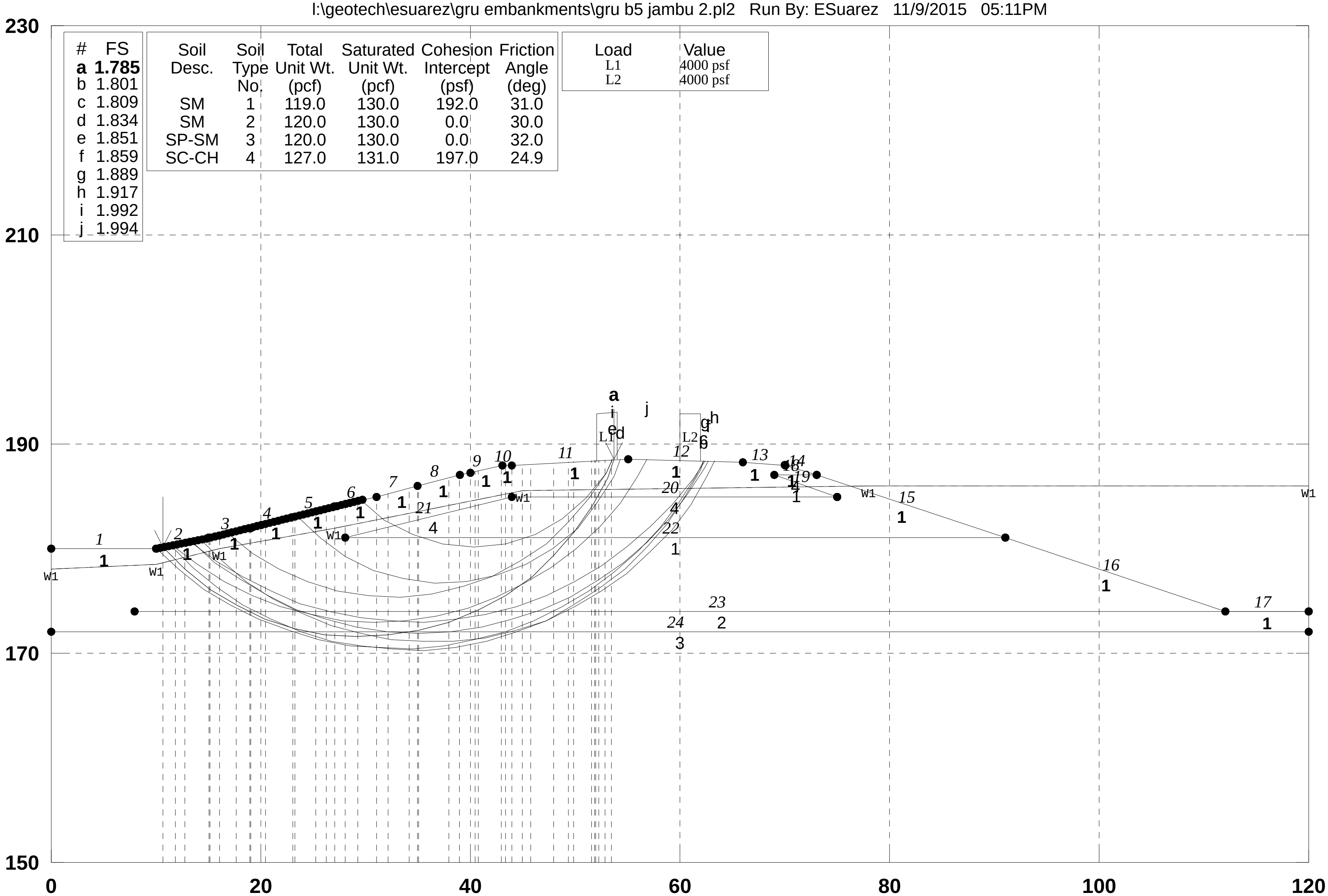
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.561

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-5

I:\geotech\esuarez\gru embankments\gru b5 jambu 2.pl2   Run By: ESuarez   11/9/2015   05:11PM



#	FS
a	**1.785**
b	1.801
c	1.809
d	1.834
e	1.851
f	1.859
g	1.889
h	1.917
i	1.992
j	1.994

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=1.785

Safety Factors Are Calculated By The Simplified Janbu Method

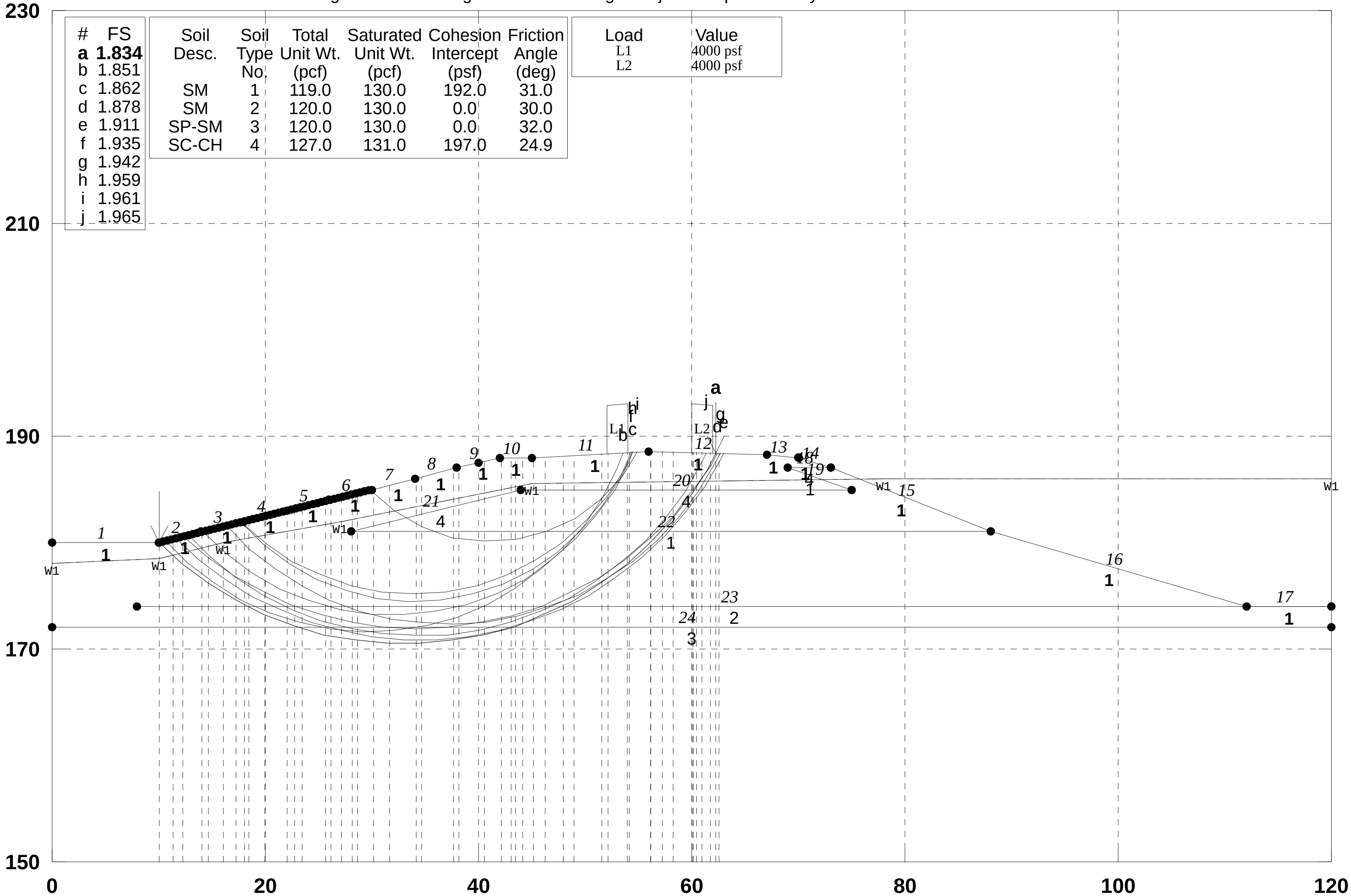
GRU Process Pond Embankment Section B-6

I:\geotech\esuarez\gru embankments\gru b6 jambu 2.pl2   Run By: ESuarez   11/9/2015   05:19PM

#	FS
a	**1.834**
b	1.851
c	1.862
d	1.878
e	1.911
f	1.935
g	1.942
h	1.959
i	1.961
j	1.965

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

Load	Value
L1	4000 psf
L2	4000 psf

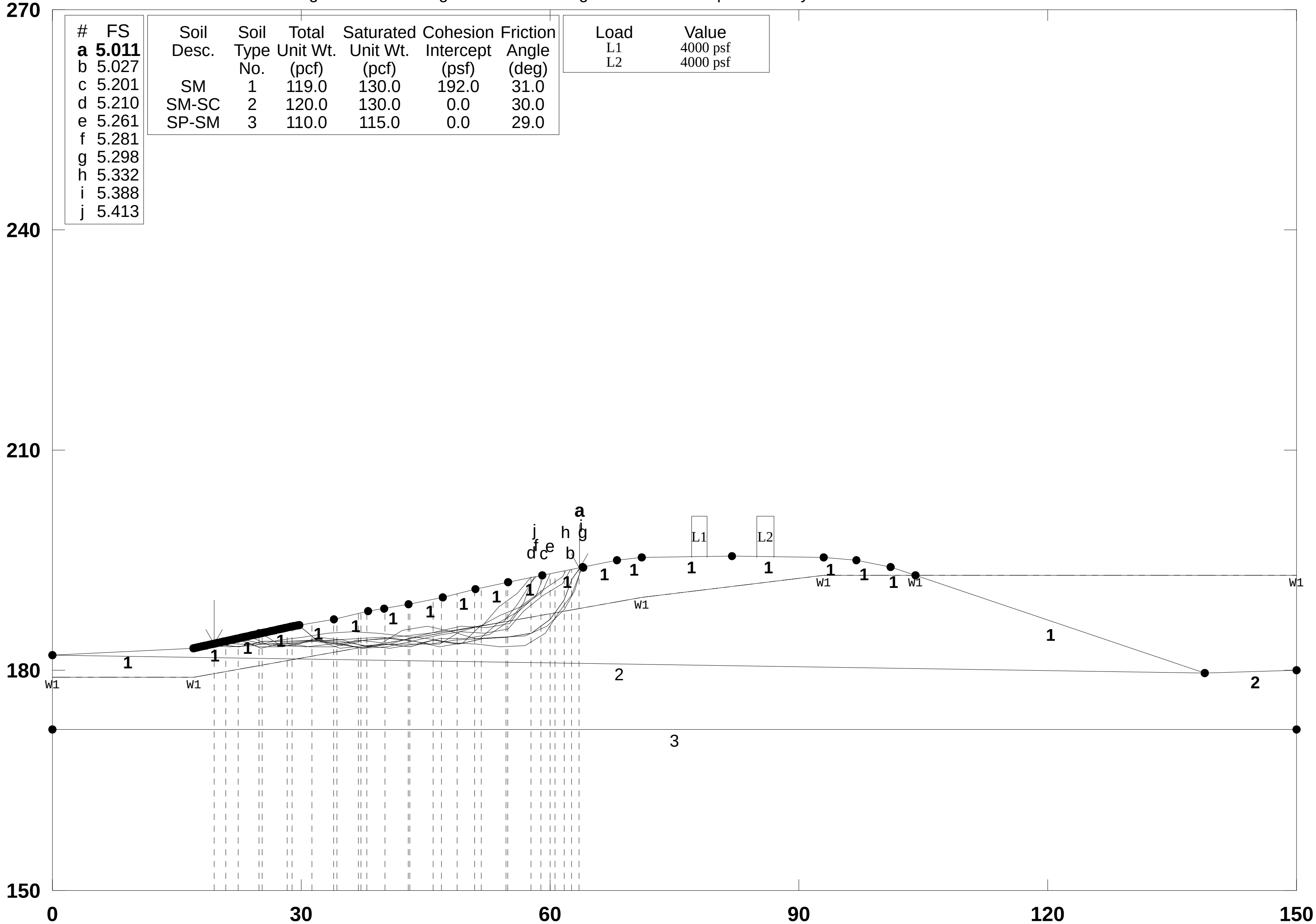


GSTABL7 v.2 FSmin=1.834

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-1

I:\geotech\esuarez\gru embankments\gru b1 rand surf 2.pl2   Run By: ESuarez   11/9/2015   12:20PM

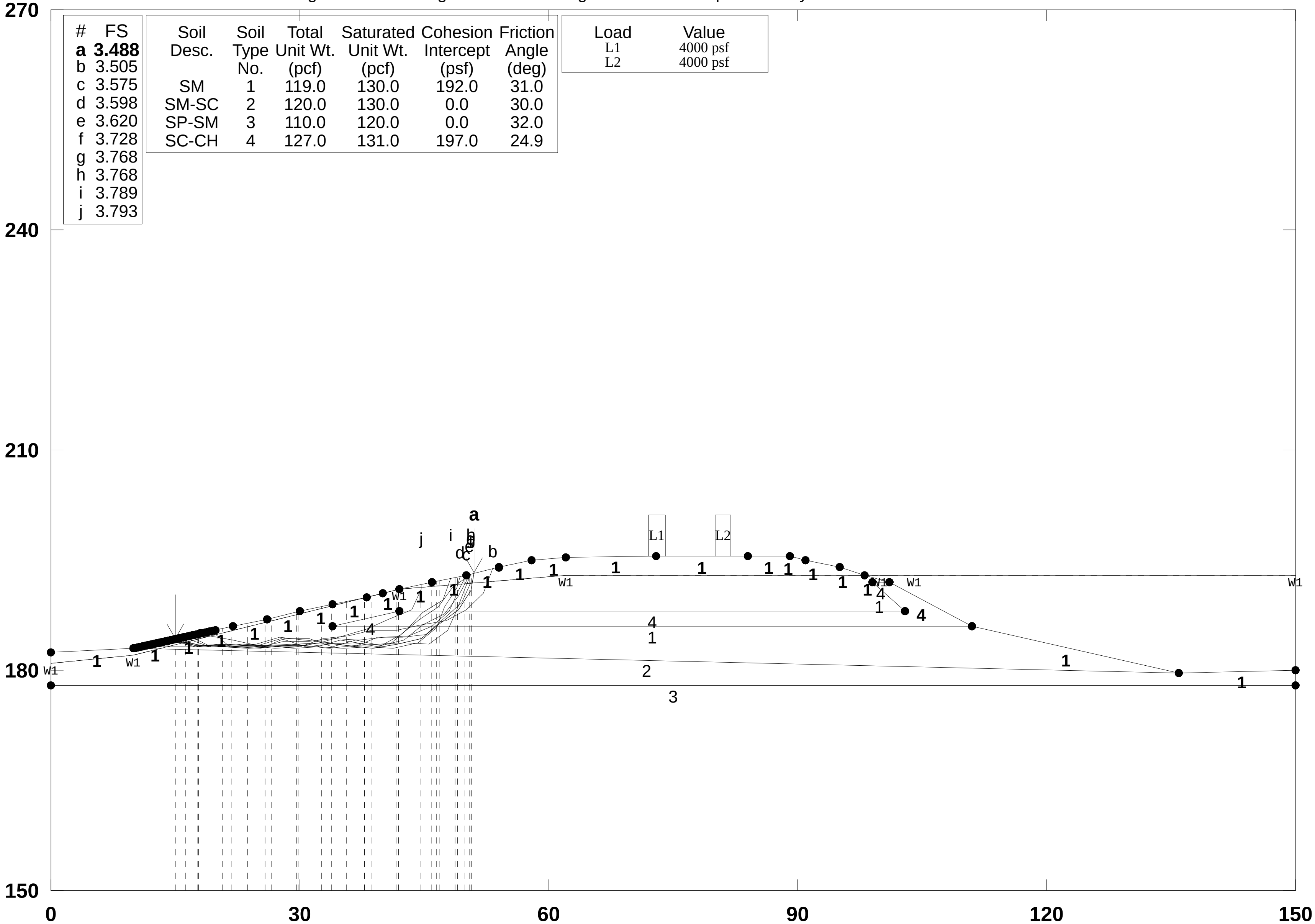


GSTABL7 v.2 FSmin=5.011

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-2

I:\geotech\esuarez\gru embankments\gru b2 rand surf 2.pl2   Run By: ESuarez   11/9/2015   12:25PM

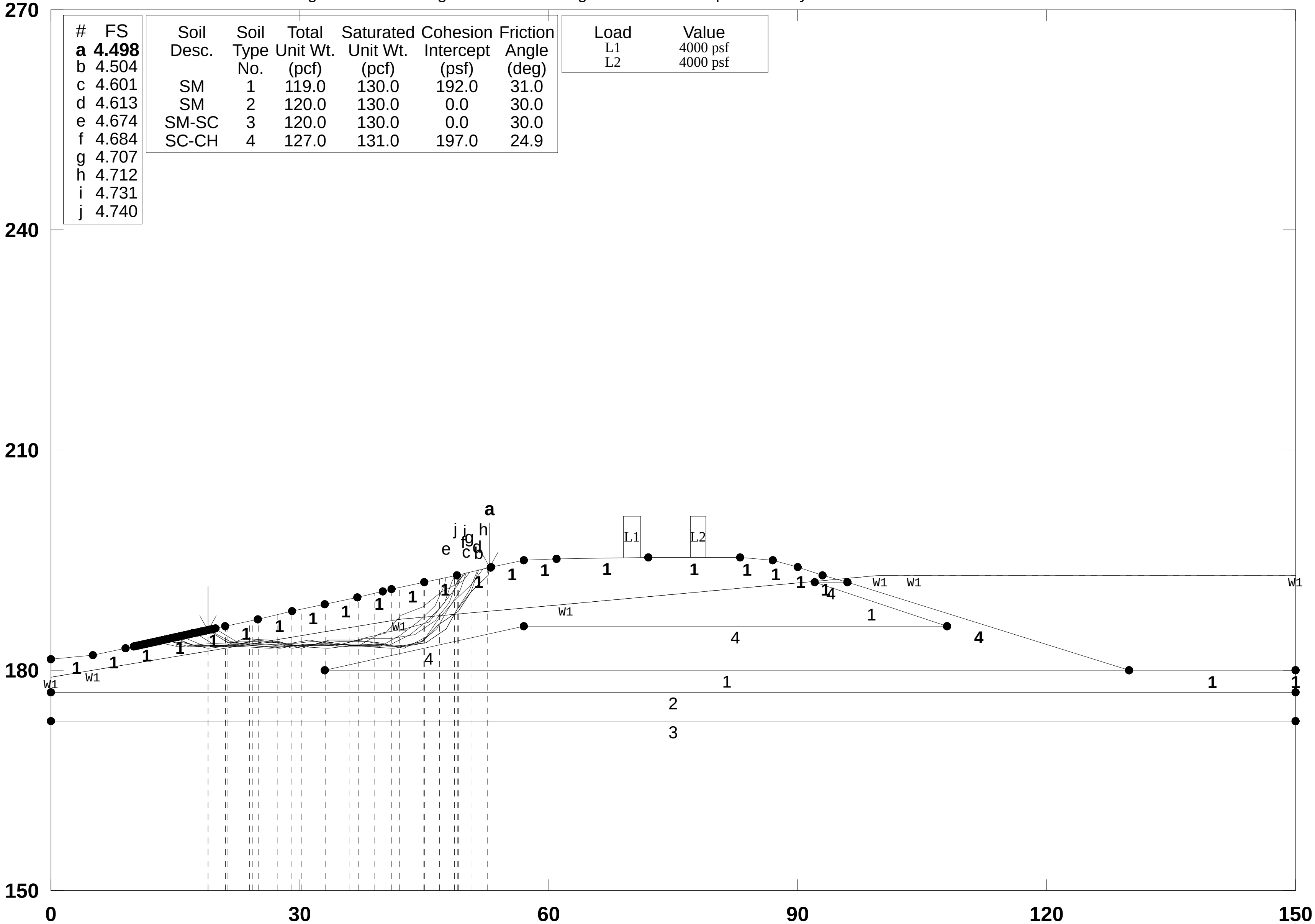


GSTABL7 v.2 FSmin=3.488

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-3

I:\geotech\esuarez\gru embankments\gru b3 rand surf 3.pl2   Run By: ESuarez   11/9/2015   12:30PM



#	FS
a	**4.498**
b	4.504
c	4.601
d	4.613
e	4.674
f	4.684
g	4.707
h	4.712
i	4.731
j	4.740

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SM-SC	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

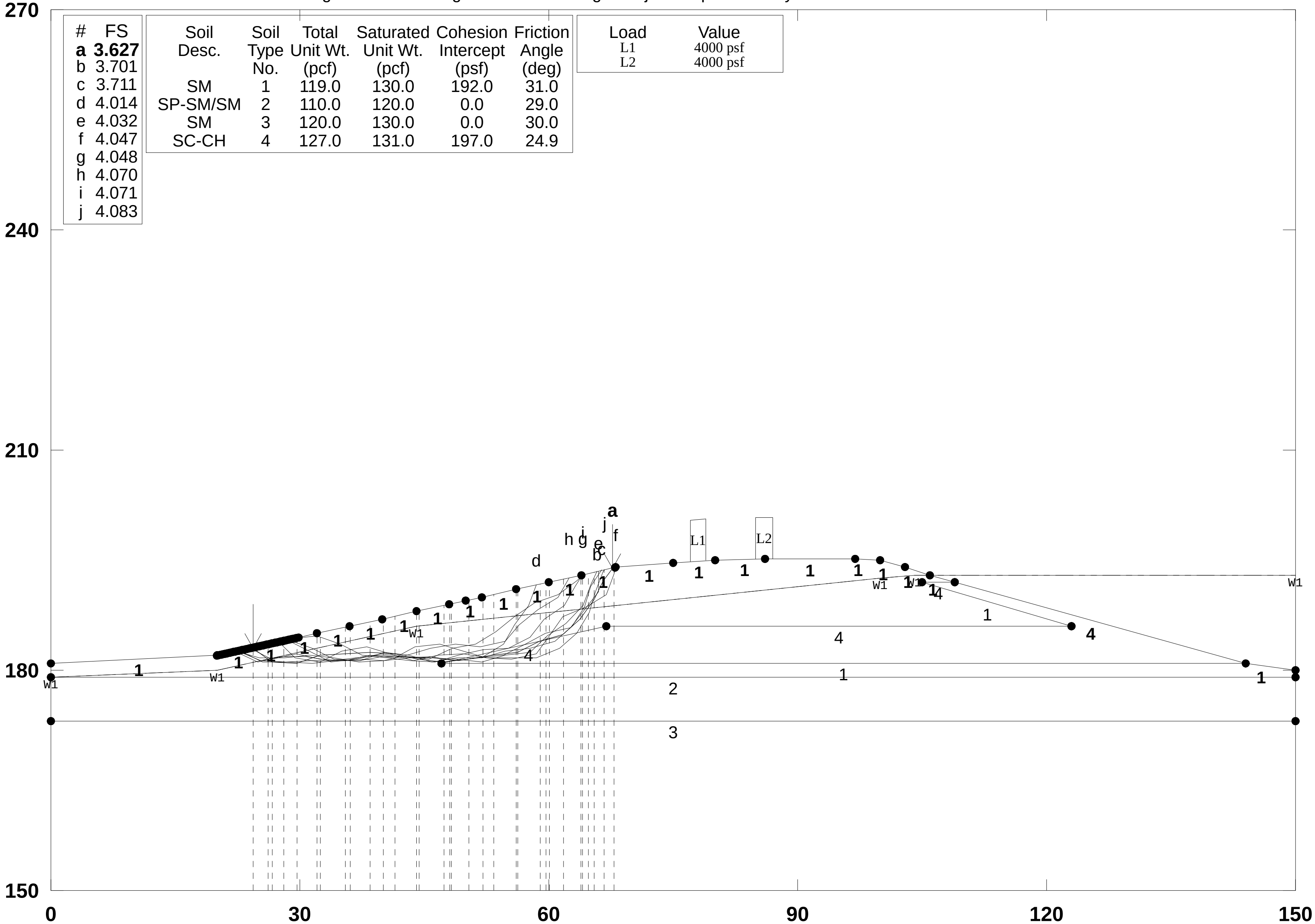
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=4.498

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-4

I:\geotech\esuarez\gru embankments\gru b4 jrand 2.pl2 Run By: ESuarez 11/9/2015 12:32PM



#	FS
a	**3.627**
b	3.701
c	3.711
d	4.014
e	4.032
f	4.047
g	4.048
h	4.070
i	4.071
j	4.083

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SP-SM/SM	2	110.0	120.0	0.0	29.0
SM	3	120.0	130.0	0.0	30.0
SC-CH	4	127.0	131.0	197.0	24.9

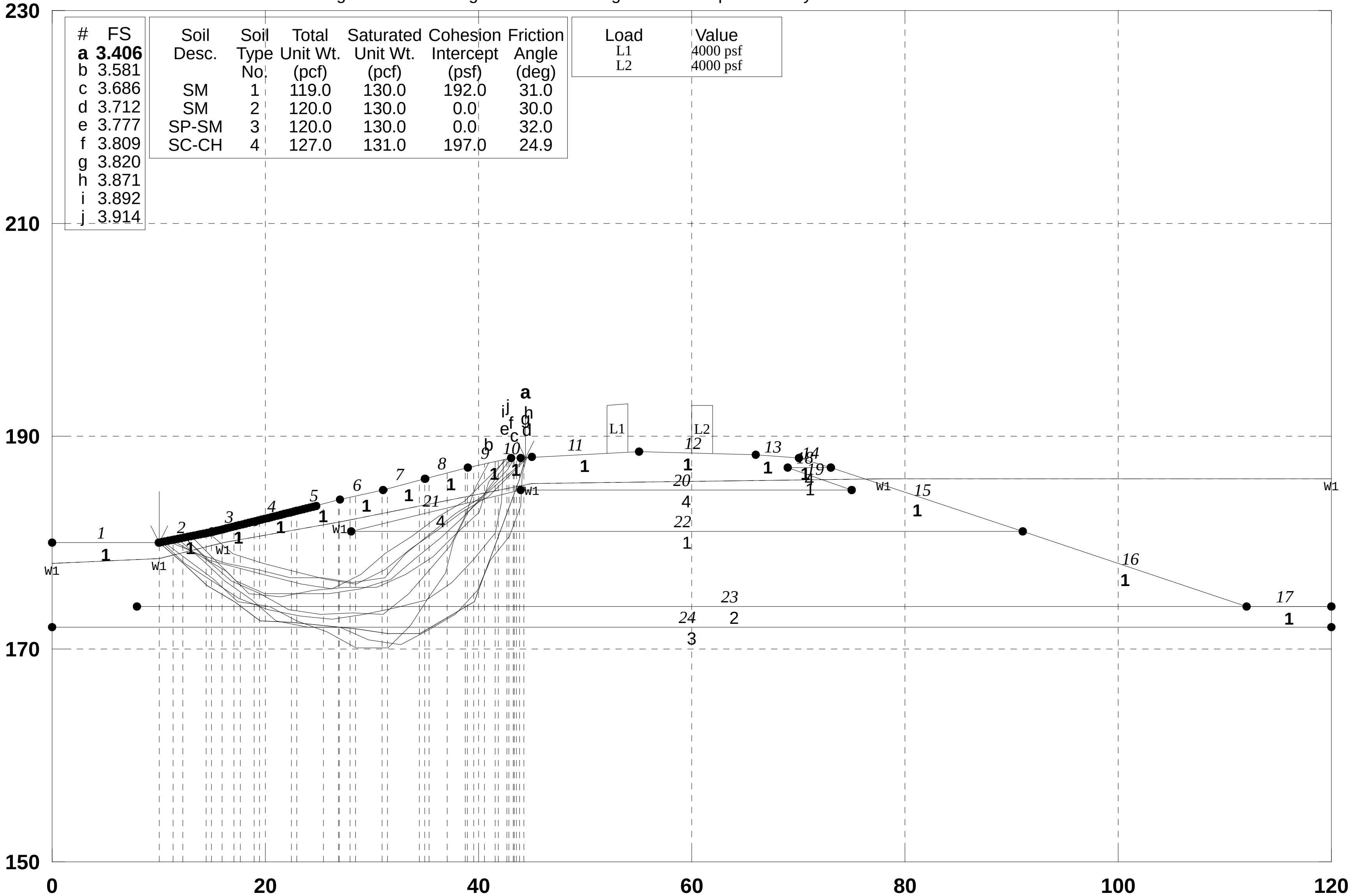
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.627

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-5

I:\geotech\esuarez\gru embankments\gru b5 rand 2.pl2   Run By: ESuarez   11/9/2015   05:13PM



#	FS
a	**3.406**
b	3.581
c	3.686
d	3.712
e	3.777
f	3.809
g	3.820
h	3.871
i	3.892
j	3.914

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
SM	1	119.0	130.0	192.0	31.0
SM	2	120.0	130.0	0.0	30.0
SP-SM	3	120.0	130.0	0.0	32.0
SC-CH	4	127.0	131.0	197.0	24.9

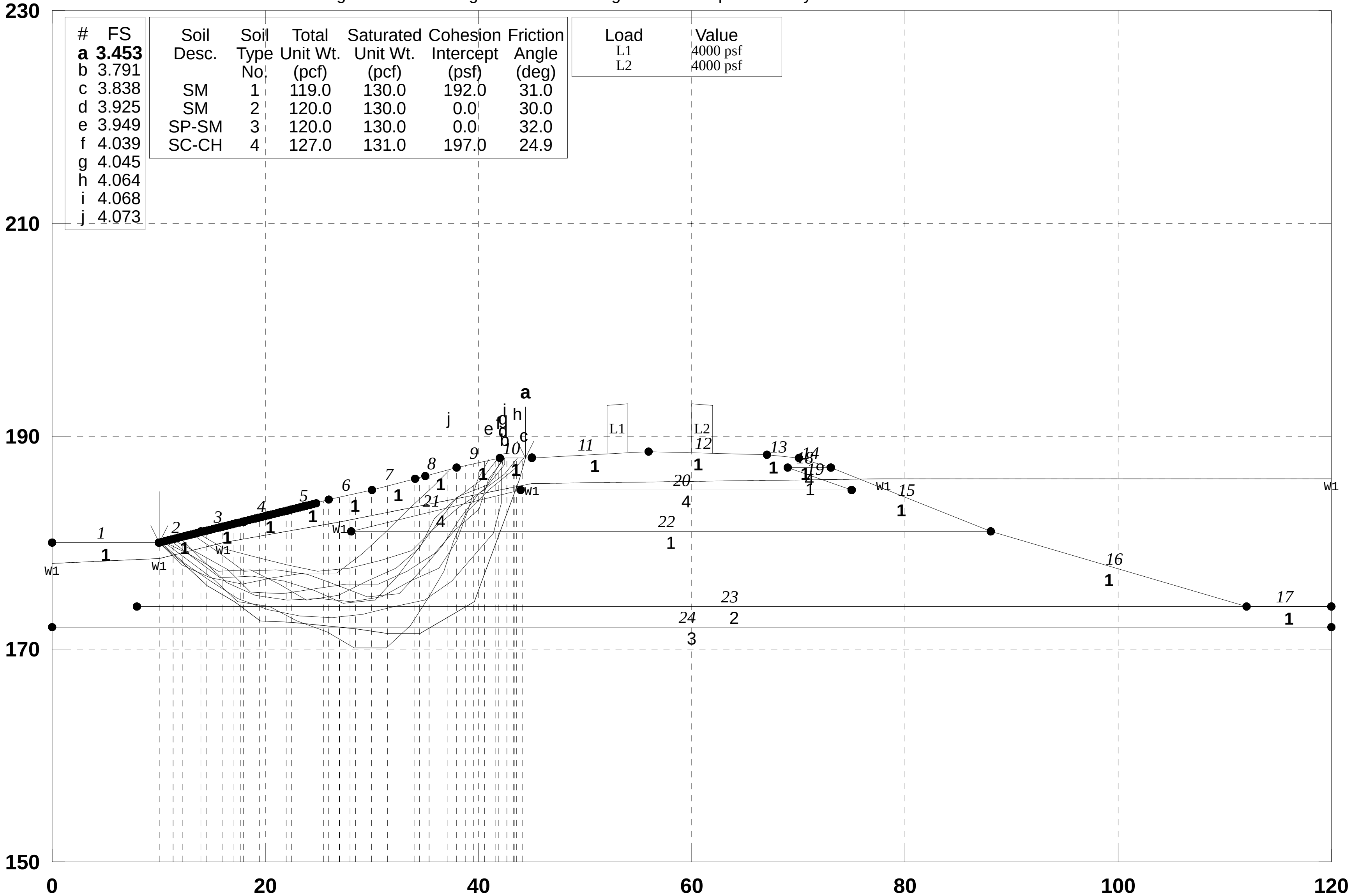
Load	Value
L1	4000 psf
L2	4000 psf

GSTABL7 v.2 FSmin=3.406

Safety Factors Are Calculated By The Simplified Janbu Method

GRU Process Pond Embankment Section B-6

I:\geotech\esuarez\gru embankments\gru b6 rand 2.pl2   Run By: ESuarez   11/9/2015   05:20PM

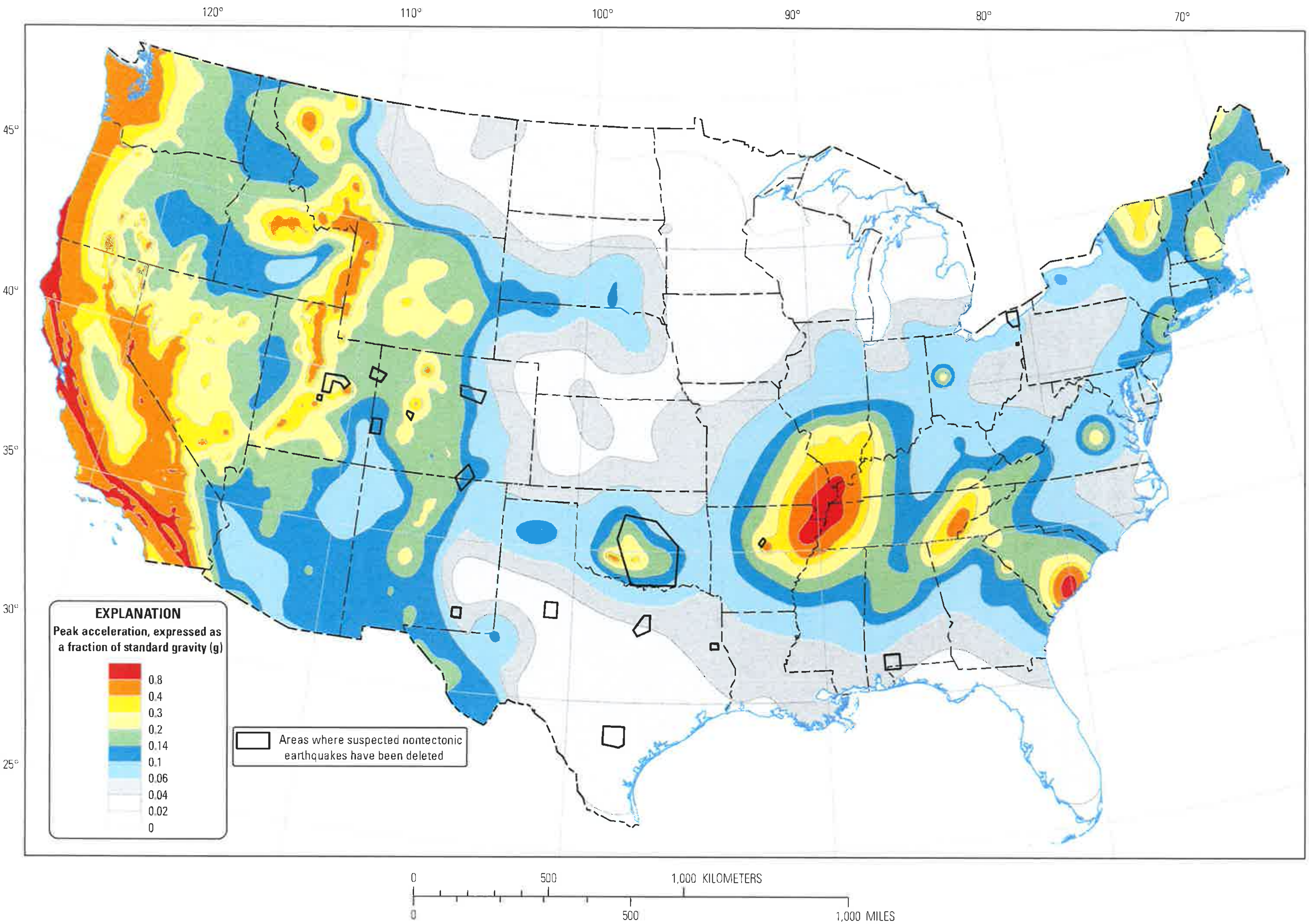


GSTABL7 v.2 FSmin=3.453

Safety Factors Are Calculated By The Simplified Janbu Method

APPENDIX E

LIQUEFACTION POTENTIAL



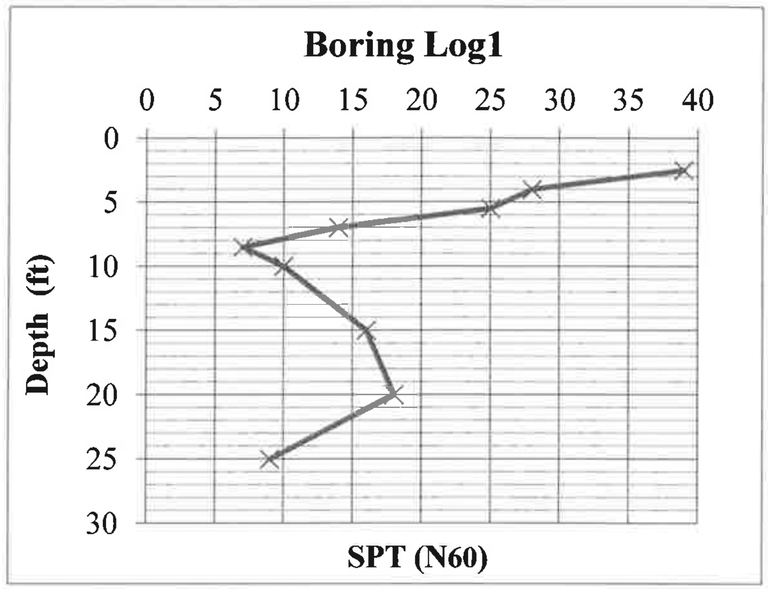
Two-percent probability of exceedance in 50 years map of peak ground acceleration

LIQUEFACTION POTENTIAL

Pek Bedrock Acceleration =	0.02 g	Fig 1	USGS National Seismic Hazard Maps
Maximum maginitude=	7.3	Fig 2/3.3	USGS Seismic Sources Zones in Contiguos States
Level Site Stratigraphy			Boring Logs
Soil Properties			

Zones of Concerns

	Depth	SPT	N60
SM	2.5	10	39
SP-SM	4	10	28
SP-SM	5.5	11	25
SP-SM	7	7	14
SM	8.5	4	7
SM	10	6	10
SC	15	11	16
SC	20	14	18
SC	25	7	9



N<30 Boring Log 1

Zone of Concerns

Saturated

Compute CSR required to liqueafy Strata

Determine Initial бo and бo'

WAter level at 3.75

	Depth;	Sat Un Wt	Dry Un Wt	Sub Un Wt	бo	бo'	Navg	N60
0	3	120	115	57.5	345	345	10	39
3	8	115	110	52.5	895	607.5	9	22
8	14	120	115	57.5	1585	952.5	5	9
14	23	125	120	62.5	2665	1515	13	17
23	25	115	110	52.5	2885	1620	7	9

		Fig 5.4		
Depth	σo'	Cn	Navg	N60
3	345	1.6	10	39
8	607.5	1.5	9	22
14	952.5	1.3	5	9
23	1515	1.1	13	17
25	1620	1	7	9

Determine CSR

		Fig 5.5	15% -200	
Depth	N60	CSR		
3	39	0.5		
8	22	0.32	acceleration base	0.02
14	9	0.12	acceleration ground surface	0.02
23	17	0.22		
25	9	0.13		

Corrected CSR Factor

		Fig 5.6	Fig 5.7	
Depth	CSR	Km	Kl	CSRL
3	0.5	1.04	1.03	0.54
8	0.32	1.04	1.03	0.34
14	0.12	1.04	1.03	0.13
23	0.22	1.04	1.03	0.24
25	0.13	1.04	1.03	0.14

Stress Reduction factor

	Fig 5.3
	rd
3	0.98
8	0.97
14	0.95
23	0.92
25	0.9

Required CSR — Fig 4.6

a= 0.02 g

$$CSR_{EQ} = 0.65\ (a_{max}/g)\ r_d\ (_o/_o')$$

Depth	CSR req	CSRL	FS
3	0.01	0.54	42.04
8	0.02	0.34	18.45
14	0.02	0.13	6.25
23	0.02	0.24	11.20
25	0.02	0.14	6.68

No Liqueafaction Occurs

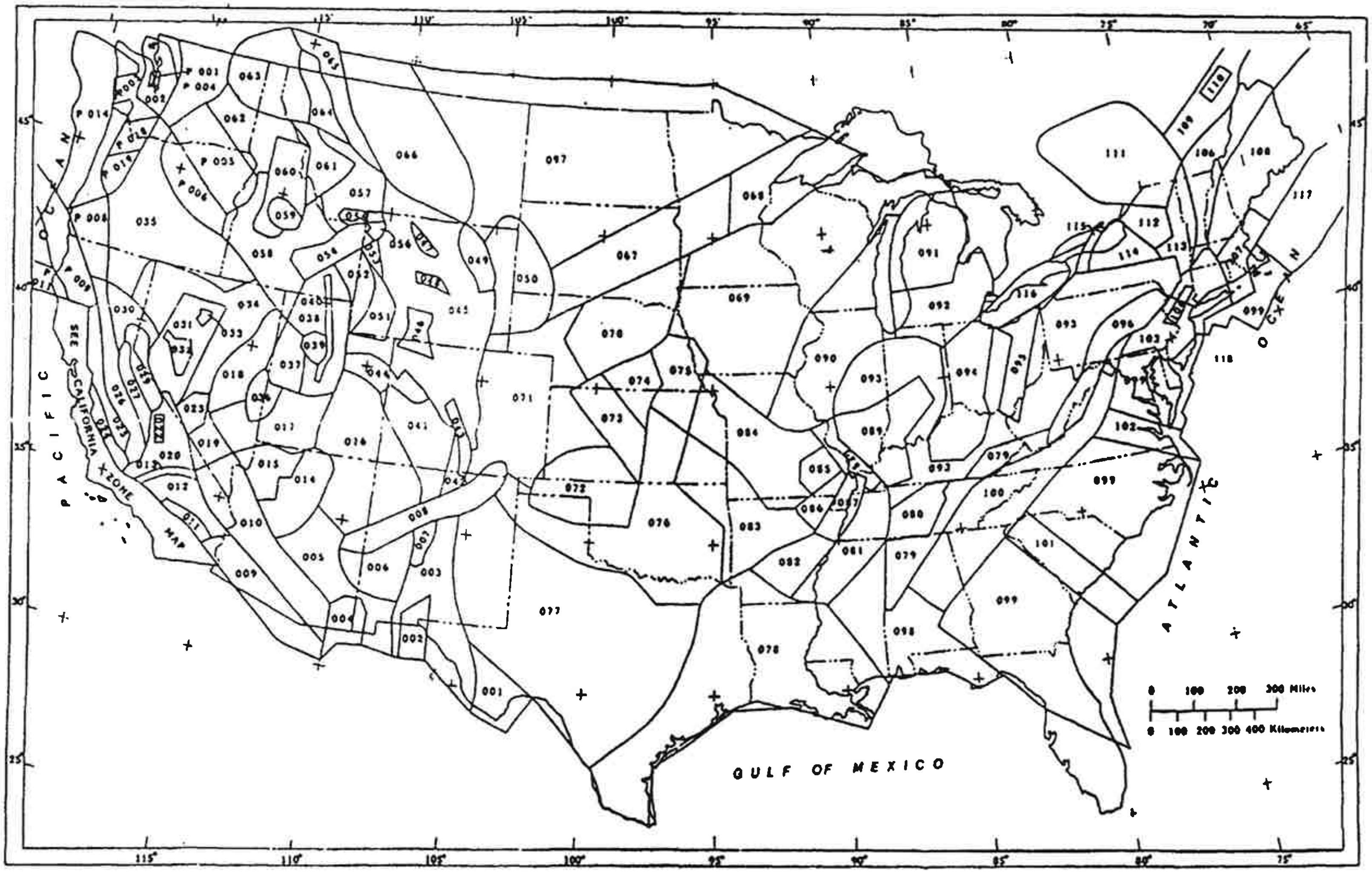


Figure 3.3 **Seismic Source Zones in the Contiguous United States (USGS, 1982).**

Table 3.1: **Parameters for Seismic Source Zones (USGS, 1982).**

Zone No.*	No. of Modified Mercalli Maximum Intensity V's per year	b	Maximum Magnitude M**
p001	0.11010	-0.40	7.3
p002	0.43510	-0.40	7.3
p003	0.12440	-0.54	7.3
p004	0.34840	-0.62	7.3
p005	0.12390	-0.62	7.3
p006	0.02831	-0.62	7.3
p008	0.01642	-0.42	7.3
p009	0.20850	-0.28	7.9
p010	0.45200	-0.28	7.9
p011	0.96370	-0.28	7.9
p012	0.37090	-0.28	7.9
p013	0.69020	-0.28	7.9
p014	0.10940	-0.42	7.3
p015	0.34480	-0.42	7.3
p016	0.04926	-0.42	7.3
p017	0.87860	-0.28	7.9
p018	0.18810	-0.54	7.3
p019	0.04090	-0.54	7.3
c001	0.62770	-0.42	7.3
c002	0.15700	-0.42	7.3
c003	0.31960	-0.42	7.3
c004	0.31960	-0.42	7.3
c005	0.04843	-0.42	6.1
c006	0.15700	-0.42	7.3
c007	0.15700	-0.42	7.3
c008	0.04740	-0.42	6.1
c009	0.04843	-0.42	6.1
c010	0.18190	-0.42	6.1
c011	0.77010	-0.42	7.3
c012	0.19050	-0.42	7.3
c013	0.35840	-0.42	7.3
c014	0.91990	-0.66	7.9
c015	1.49200	-0.45	7.9
c016	0.22560	-0.51	7.9
c017	0.02760	-0.48	7.3
c018	1.09200	-0.49	7.3
c019	0.31980	-0.42	6.7
c020	0.19280	-0.42	6.1
c021	0.10880	-0.42	6.1
c022	0.02422	-0.42	6.1
c023	0.11650	-0.37	7.9
c024,	1.97000	-0.43	8.5
c025	0.05085	-0.55	7.3
c026	0.09145	-0.55	7.3

Table 3.1: (continued)

Zone No.*	No. of Modified Mercalli Maximum Intensity V's per year	b	Maximum Magnitude M**
c027	0.03437	-0.37	7.3
c028	0.13010	-0.37	7.3
c029	0.02350	-0.37	7.3
c030	0.03630	-0.42	6.7
c031	0.47580	-0.51	6.7
c032	0.55190	-0.45	7.9
c033	0.23070	-0.37	7.9
c034	0.67120	-0.51	7.9
c035	0.02325	-0.60	7.3
c036	0.35220	-0.59	6.7
c037	0.81950	-0.51	6.1
c038	0.82680	-0.54	7.9
c039	0.35810	-0.45	7.9
c040	0.15820	-0.42	6.1
c041	0.08448	-0.37	7.9
001	0.22700	-0.73	7.3
002	0.03600	-0.73	7.3
003	0.08800	-0.73	6.1
004	0.22700	-0.54	7.3
005	0.09100	-0.73	7.3
006	0.13500	-0.73	7.3
007	0.41900	-0.73	7.3
008	0.21100	-0.73	6.1
009	0.19400	-0.54	6.1
010	0.20800	-0.54	7.3
011	0.55100	-0.64	7.3
012	0.34900	-0.64	7.3
013	0.05500	-0.64	7.3
014	0.49000	-0.73	7.3
015	0.01800	-0.73	6.7
016	0.14600	-0.73	6.1
017	0.69300	-0.59	7.3
018	0.26100	-0.54	7.3
019	0.11717	-0.54	7.3
020	1.84900	-0.64	7.3
022	0.19600	-0.64	6.1
023	0.15350	-0.54	7.3
024	0.27400	-0.64	7.3
025	0.16800	-0.64	6.1
026	0.47700	-0.64	6.1
027	0.11100	-0.64	5.5
029	1.31900	-0.64	7.3
030	0.58800	-0.64	7.3
031	1.82685	-0.54	7.3

Table 3.1: (continued)

Zone No.*	No. of Modified Mercalli Maximum Intensity V's per year	b	Maximum Magnitude M**
032	0.48114	-0.54	6.1
033	0.08557	-0.54	6.1
034	0.62380	-0.54	7.3
035	0.20070	-0.54	7.3
036	0.01800	-0.58	6.1
037	0.05100	-0.58	7.3
038	0.80600	-0.58	7.3
039	0.12000	-0.58	7.3
040	0.29100	-0.58	7.3
041	0.24400	-0.73	7.3
042	0.01800	-0.73	6.1
043	0.04600	-0.73	7.3
044	0.11300	-0.73	6.1
045	0.45600	-0.73	6.1
046	0.01274	-0.73	6.1
047	0.00427	-0.73	6.1
048	0.00329	-0.73	6.1
049	0.01663	-0.73	6.1
050	0.17000	-0.73	6.1
051	0.01706	-0.73	6.1
052	0.19000	-0.58	7.3
053	0.03600	-0.58	7.3
054	0.01800	-0.58	6.1
055	0.67300	-0.58	7.3
056	0.17700	-0.58	6.1
057	0.66200	-0.58	7.3
058	0.19800	-0.58	7.3
059	0.19200	-0.58	6.1
060	0.03600	-0.58	6.1
061	0.08900	-0.58	7.3
062	0.03600	-0.58	6.1
063	0.12900	-0.58	6.1
064	0.34400	-0.58	7.3
065	0.15200	-0.58	6.1
066	0.01800	-0.73	6.1
067	0.07715	-0.46	6.1
068	0.02894	-0.46	6.1
069	0.00588	-0.46	6.1
070	0.03552	-0.46	6.1
071	0.01176	-0.46	6.1
072	0.02026	-0.46	6.1
073	0.02353	-0.46	6.1
074	0.00270	-0.46	6.1
075	0.06510	-0.46	6.1

Table 3.1: (continued)

Zone No.*	No. of Modified Mercalli Maximum Intensity V's per year	b	Maximum Magnitude M**
076	0.14742	-0.46	6.1
077	0.03469	-0.46	6.1
078	0.04389	-0.46	6.1
079	0.03082	-0.46	6.1
080	0.02987	-0.46	6.1
081	0.02044	-0.46	6.1
082	0.03552	-0.46	6.1
083	0.00996	-0.46	6.1
084	0.04117	-0.46	6.1
085	0.03802	-0.46	6.1
086	0.04626	-0.46	6.1
087	0.29865	-0.46	8.5
088	0.09703	-0.46	6.1
089	0.15689	-0.46	6.1
090	0.06103	-0.46	6.1
091	0.00644	-0.46	6.1
092	0.02661	-0.46	6.1
093	0.02680	-0.46	6.1
094	0.10835	-0.46	6.1
095	0.05901	-0.46	6.1
096	0.02675	-0.46	6.1
097	0.01156	-0.46	6.1
098	0.01215	-0.46	6.1
099	0.24830	-0.50	7.3
100	0.42290	-0.50	7.3
101	0.18720	-0.50	7.3
102	0.09532	-0.50	7.3
103	0.33150	-0.50	7.3
104	0.05544	-0.50	7.3
106	0.01952	-0.50	6.7
107	0.19100	-0.50	7.3
108	0.29390	-0.50	6.7
109	0.10650	-0.50	7.9
110	0.30220	-0.50	7.9
111	0.32430	-0.50	7.9
112	0.01532	-0.50	6.7
113	0.07432	-0.50	6.7
114	0.00754	-0.50	6.7
115	0.05834	-0.50	7.3
116	0.06783	-0.50	6.7
117	0.03950	-0.50	7.3
118	0.01334	-0.50	7.3

*The zones are shown in Figure 3.2
**See text for definition of M

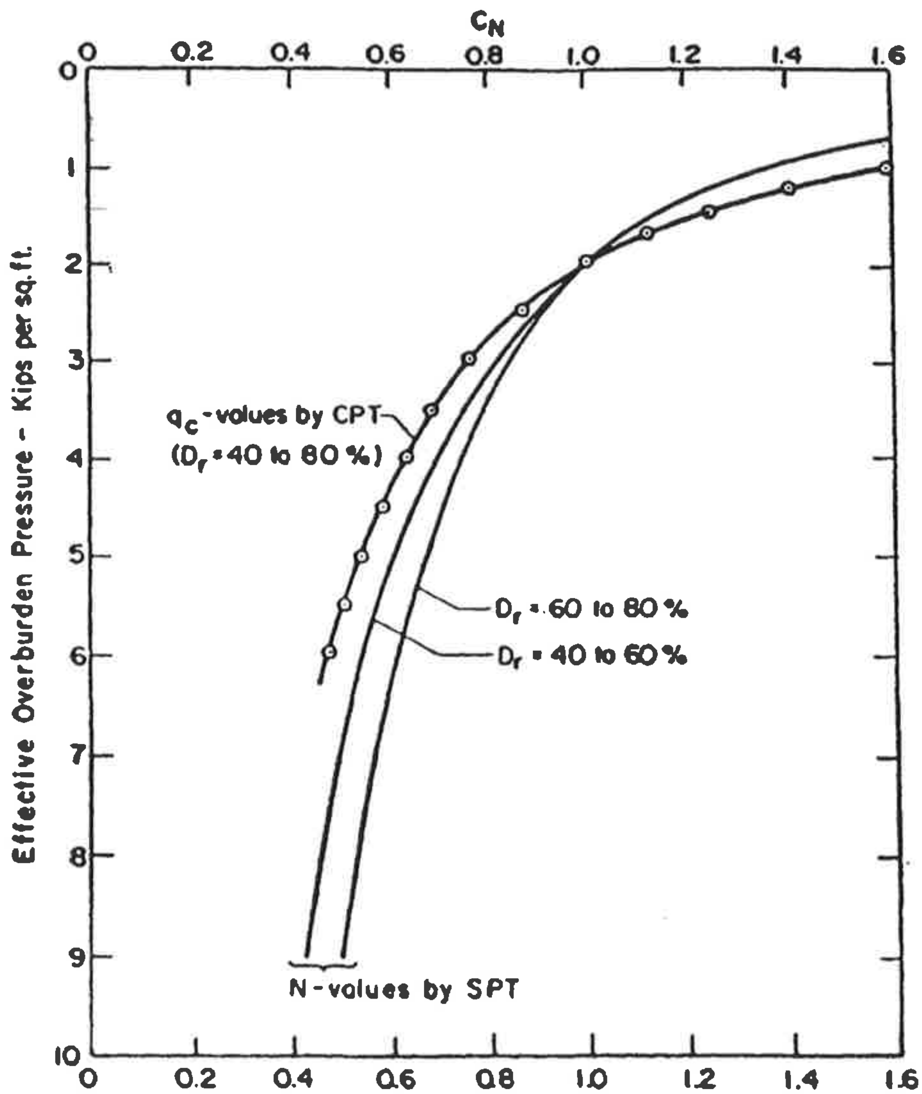


Figure 5.4 Correction Factor for the Effective Overburden Pressure, C_N (Seed et al., 1983).

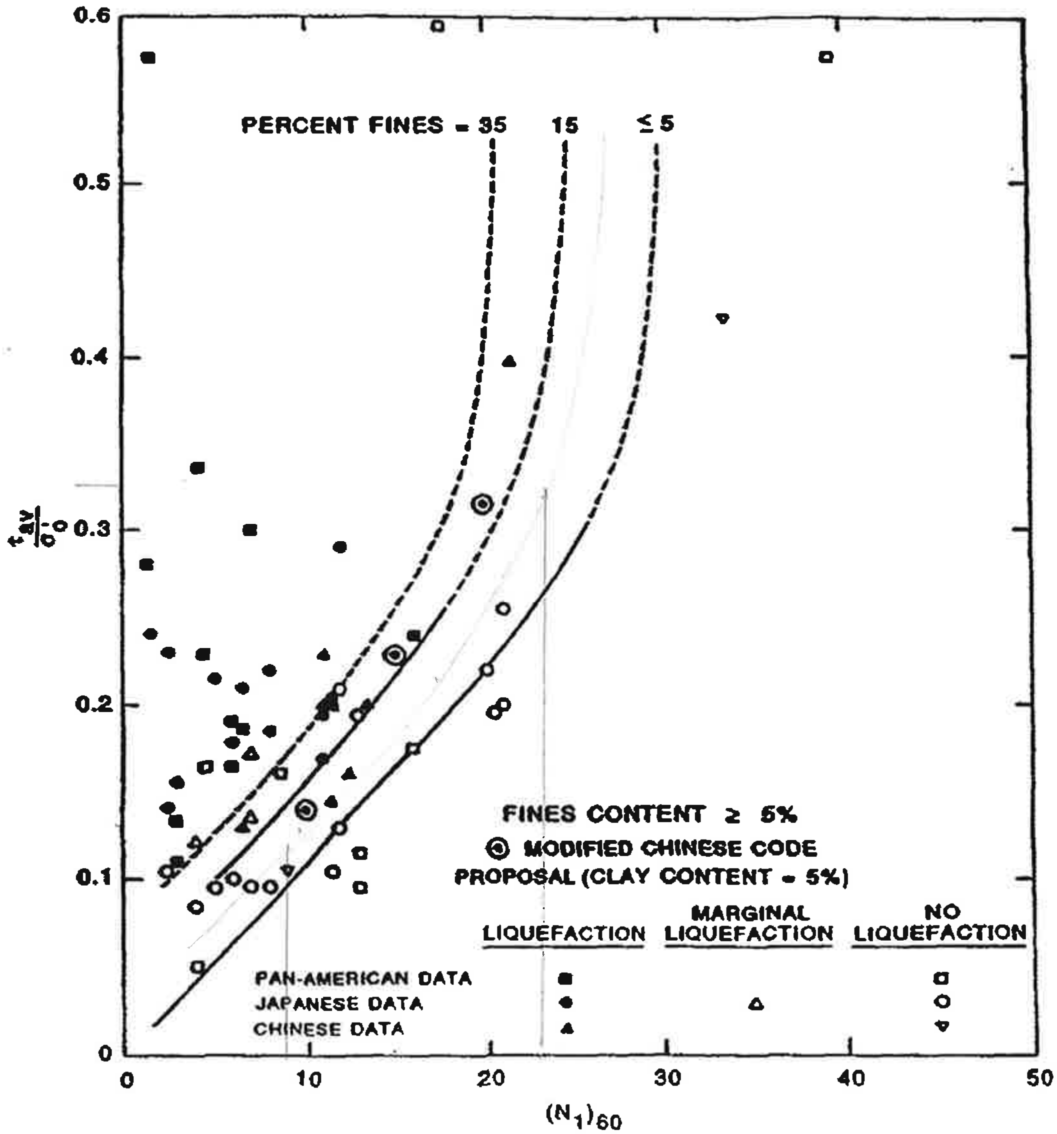


Figure 5.5 Relationships Between Stress Ratio Causing Liquefaction and $(N_1)_{60}$ Values for Sands for M 7.5 Earthquakes (Seed et al., 1985).

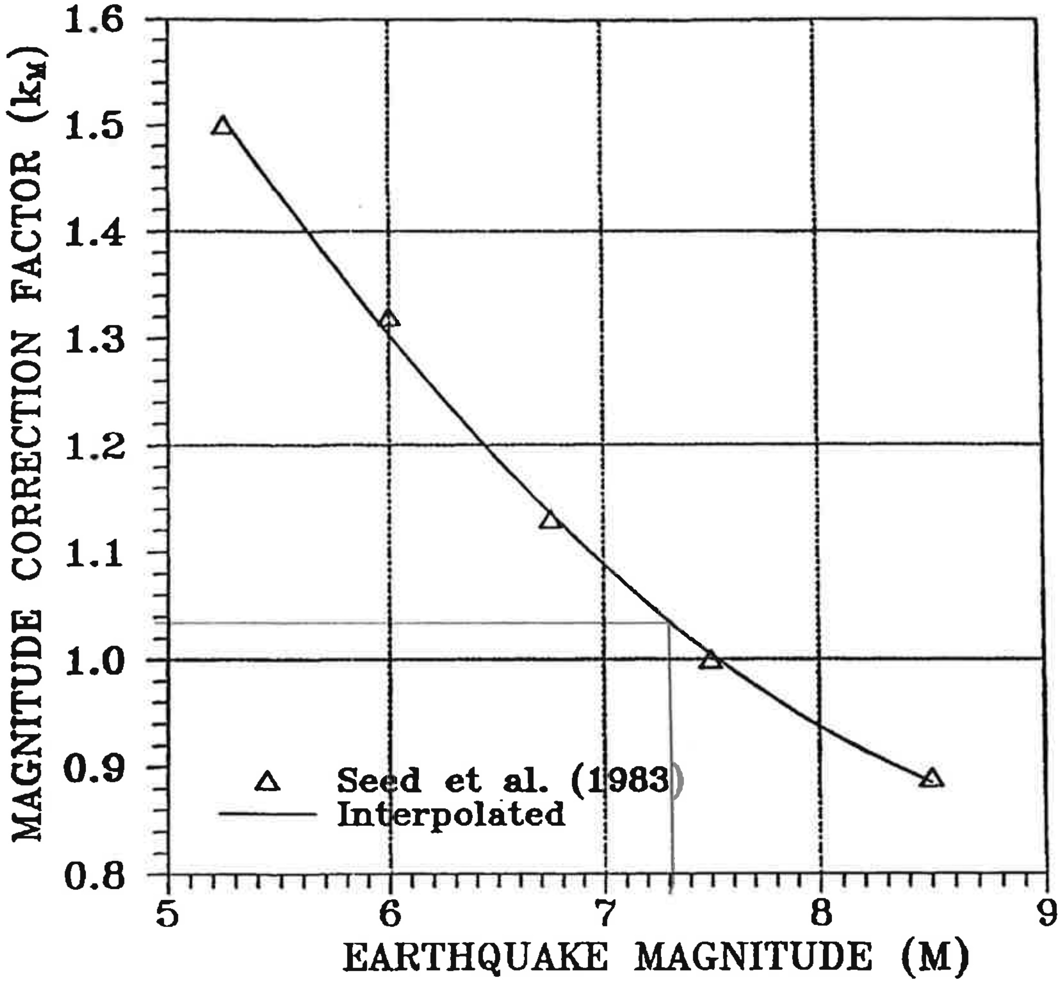


Figure 5.6 Curve for Estimation of Magnitude Correction Factor, k_M (after Seed et al., 1983).

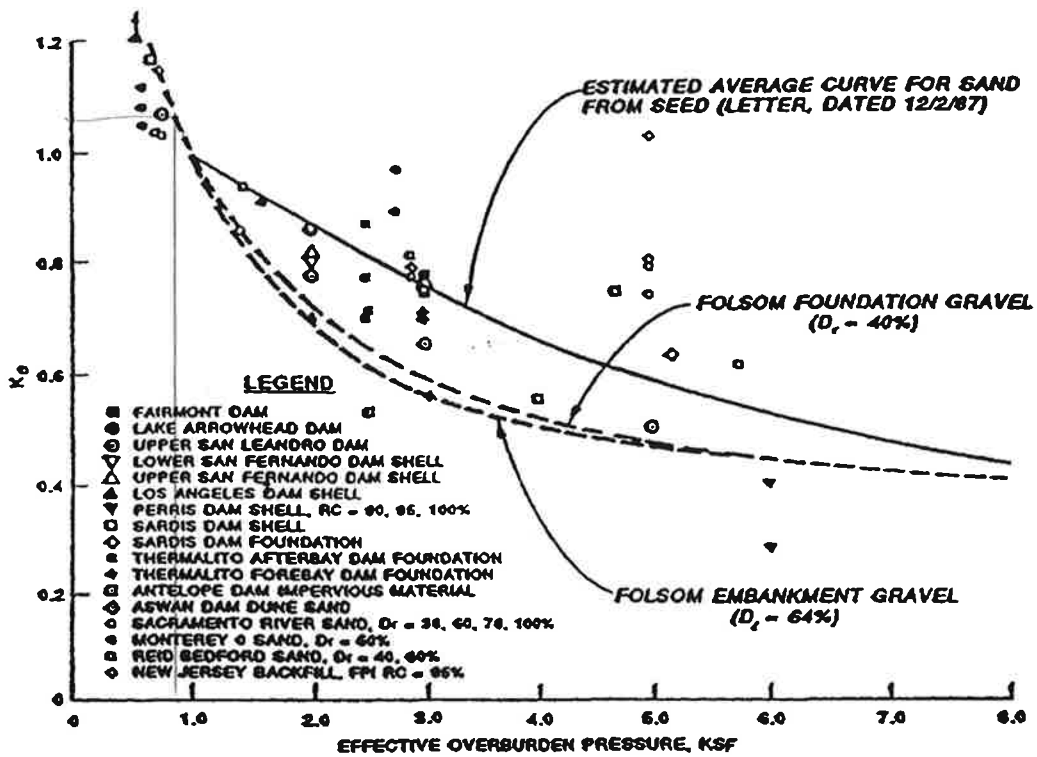


Figure 5.7 Curves for Estimation of Correction Factor k_σ (Harder 1988, and Hynes 1988, as Quoted in Marcuson et al., 1990)

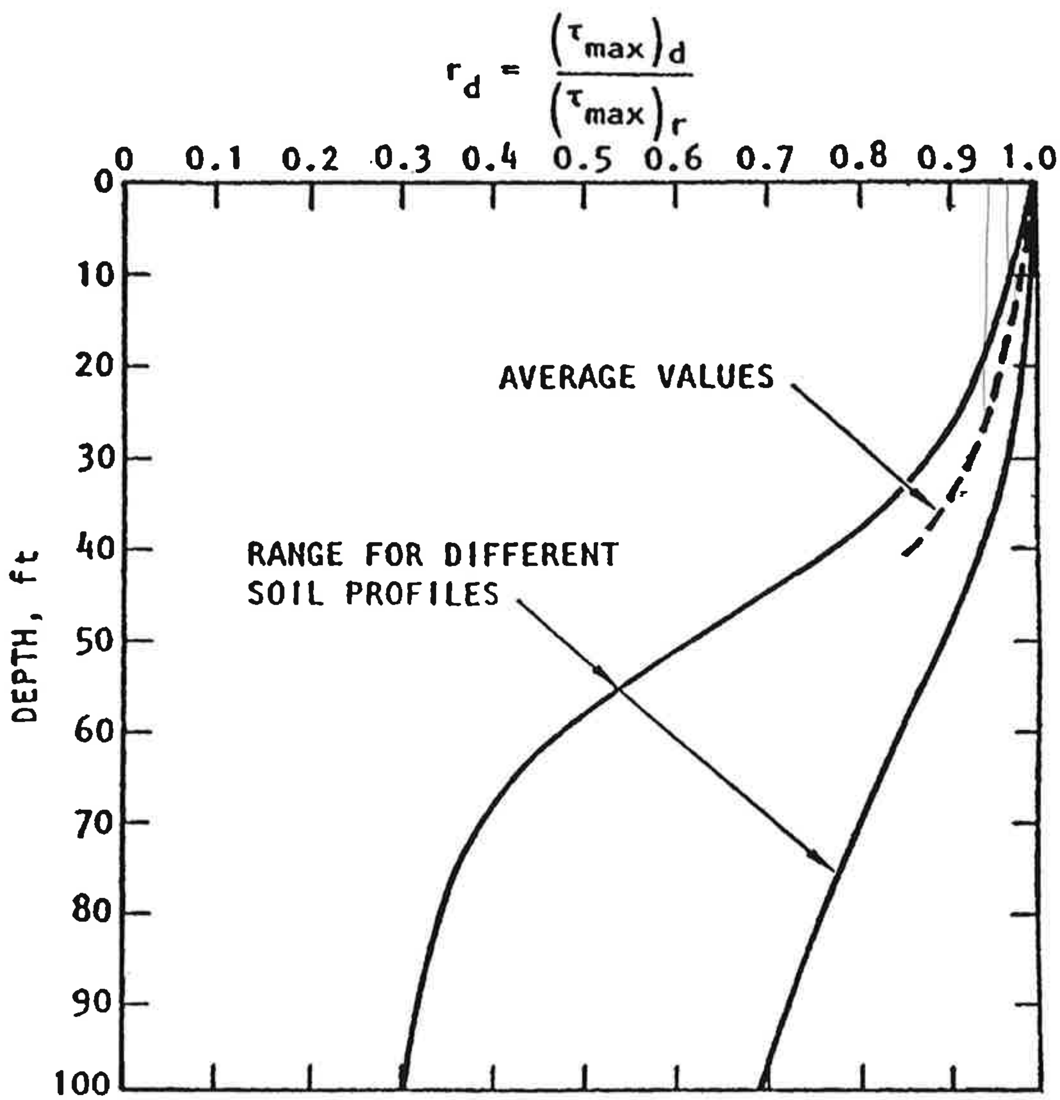


Figure 5.3 Stress Reduction Factor, r_d (Seed and Idriss, 1982).

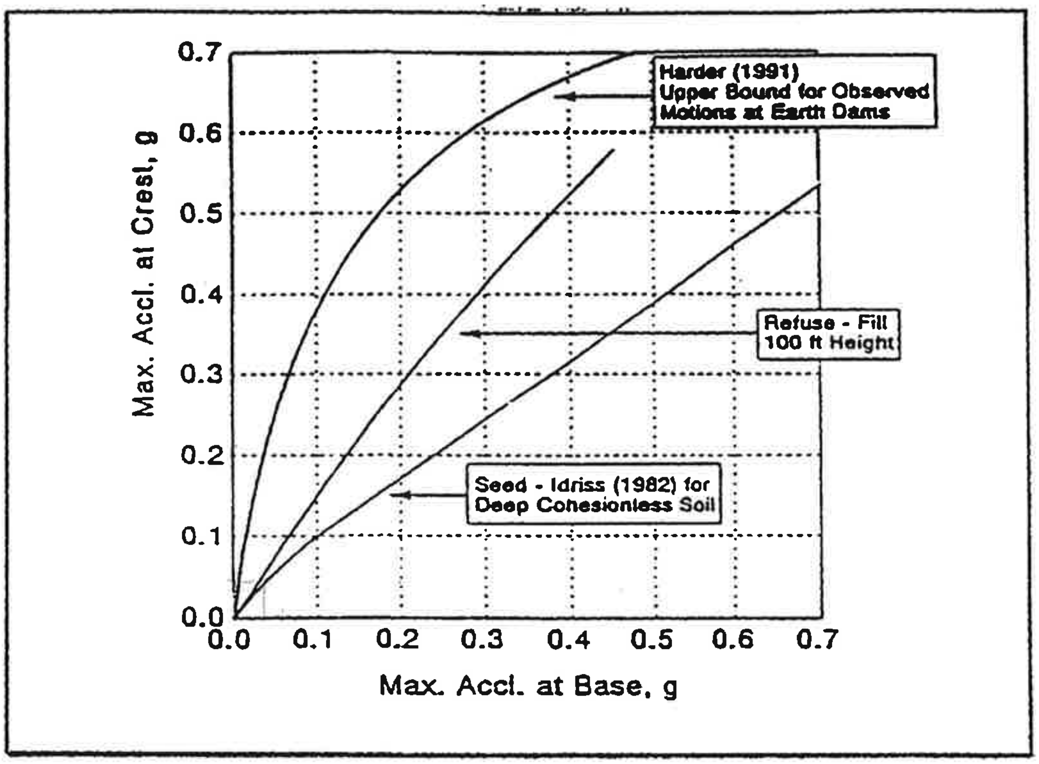


Figure 4.6 Approximate Relationship Between Maximum Accelerations at the Base and Crest for Various Ground Conditions (Singh and Sun, 1995)

APPENDIX F

GBC DOCUMENT
CONSTRAINTS AND RESTRICTIONS

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

CONSTRAINTS & RESTRICTIONS

The intent of this document is to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

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 are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of exploration. 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.

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