CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 3 OF 6

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

STATE OF TEXAS
DAVID E. POE
81734
LICENSED
PROFESSIONAL ENGINEER
5-19-2022

Prepared by

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WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

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PART III – SITE DEVELOPMENT PLAN

APPENDIX IIIE
GEOTECHNICAL REPORT

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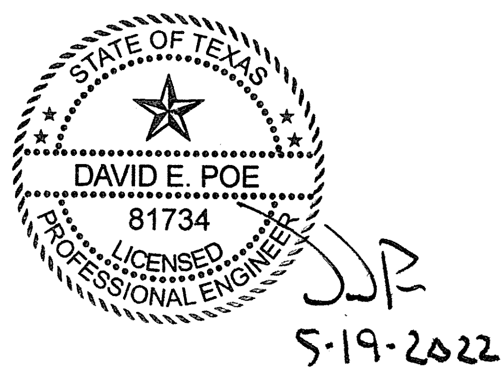

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1 INTRODUCTION

The purpose of this report is to present the geotechnical analysis and design for the proposed major permit amendment for the vertical and lateral expansion of the City of Arlington Landfill. This report is based on the geotechnical testing information that has previously been compiled from the subsurface investigations at the site for previous permit amendments.

This appendix addresses §330.63(e)(5)(A) and (B).

This report contains a compilation of geotechnical testing and design information, including:

- Presentation of the geotechnical (field and laboratory) and geological information compiled during previous permit amendment applications and incorporated into his amendment.
- Slope stability analyses based on the geotechnical testing results and subsurface conditions, including groundwater, for landfill excavations, landfill completion, overliner systems, and sequence of development (interim condition analysis) plans; and
- Settlement and heave analyses, which are also based on the landfill excavation and completion plans.

An independent settlement and strain analysis has been prepared for the West Disposal Area (WDA) overliner system as included in Appendix IIIE-B-3. The analysis includes evaluation of settlement and strain within the overliner system, as well as evaluation of the leachate piping system incorporated into the overliner system design. Analysis of the final cover system over the overliner area is presented in Appendix IIIE-B-2.

This report also provides geotechnical recommendations for construction of the landfill components, including bottom liner, overliner, and final cover systems with geosynthetic materials. The construction quality control and material and construction specifications for the groundwater protection components of the landfill are provided in Appendix IIID – Liner Quality Control Plan (LQCP).

2 LABORATORY TESTING

2.1 Introduction

Numerous geological investigations have been performed at the City of Arlington Landfill for previous permitting efforts, and are discussed in further detail in Appendix IIIG – Geology Report. The information used for the geotechnical studies presented in this appendix were derived from the 2014 permit amendment application prepared by Golder Associates (Golder), which incorporated geological field and laboratory investigations performed by Golder in 2008/2009 and 2010/2011, as well as earlier studies as referenced in Appendix IIIG – Geology Report. Discussion of the investigation findings is presented below.

Previous activities included the sampling and geotechnical testing of samples obtained during the investigations. A brief description of the geological/ geotechnical characteristics for the strata identified at the site is presented in Section 3 of this appendix. Additional geological and hydrogeological discussion is provided in Appendix IIIG – Geology Report of this application.

Laboratory tests were conducted on select samples recovered from the borings drilled to evaluate the physical and engineering properties of the different strata. Laboratory tests were performed in general accordance with ASTM procedures. Available laboratory testing results from the previous investigations are provided in Appendix IIIE-C and on boring logs included in Appendix IIIG – Geology Report. A summary of the laboratory tests performed is given in Table 2-1. The results of laboratory testing are summarized in the material descriptions presented in Section 3 of this appendix.

Table 2-1
Geotechnical Test Methods Performed

Test	Test Method
Sieve Analysis (Passing No. 200)	ASTM D 1140
Atterberg Limits (Liquid & Plastic Limit)	ASTM D 4318
Moisture Content	ASTM D 2216
Unconfined Compression	ASTM D 2166 & Pocket Penetrometer
Triaxial Compression Test	ASTM D 4767
Coefficient of Permeability (Hydraulic Conductivity)	Vertical - ASTM D 5084 Method F Horizontal – ASTM D4044 and D8084 Method F
Consolidation	ASTM D 2435
Hand Penetrometer Testing	ASTM D 2573
Standard Proctor	ASTM D 698

2.2 Classification Tests

Classification tests consisting of Atterberg limits, percent passing the number 200 sieve, dry unit weight, and moisture content were performed on selected soil samples recovered from boreholes. Classification tests were used to characterize the soils according to the Unified Soil Classification System (USCS) and to evaluate physical properties of the soils. The test results for the strata identified at the site are presented in Section 3 of this appendix.

2.2.1 Material Strength Tests

Material strength tests were performed to provide generalized strength parameters that were used to evaluate the soils at the site. Additionally, triaxial testing was performed to develop strength profiles for selected strata. The triaxial testing was performed for both drained (long-term) and undrained (short-term) conditions. The test results for the strata identified at the site are presented in Section 3 of this appendix.

2.2.2 Coefficient of Permeability Tests

Laboratory hydraulic conductivity tests were performed to evaluate the hydrogeological properties of the soils and shale at the site. Additional discussion regarding the permeability testing is presented in Appendix IIIG – Geology Report.

2.2.3 Consolidation Tests

The 2014 permit amendment application incorporated conservative consolidation values for select soil and shale layers. Soil consolidation properties were developed from laboratory test results, and the consolidation properties of the shale and unweathered shale were developed from literature research combined with review of laboratory test results for the stata. This previously developed information was used to calculate the settlement and heave characteristics of the landfill and underlying foundation strata for this application.

The results of the consolidation testing are presented in Appendix IIIE-C. The settlement analyses presented in Appendix IIIE-B incorporate the test results and reference papers from the 2014 permit amendment application.

2.2.4 Moisture-Density Relationships

Standard Proctor laboratory compaction tests were performed during previous liner construction activities at the site. The tests were performed to evaluate the moisture-density relationship of the materials. Remolded samples for coefficient of permeability tests were compacted by static loading the sample to approximately 95 percent of the Standard Proctor maximum dry density at approximately the optimum moisture content determined from the Proctor test. These values were reviewed for comparison with typical landfill liner properties incorporated into the stability analyses. The results to date demonstrate that the upper clays and weathered shales are suitable for liner construction, and able to achieve the $1x10^{-7}$ cm/sec permeability criteria. Sufficient soil quantities suitable for liner and final cover construction is available on-site, although alternatively clayey soils may be imported from off-site borrow areas.

2.3 Conclusion of Laboratory Testing

Classification testing along with unit weight, moisture content, and sieve analysis results were used to support field observations during subsurface explorations. Testing results were also used to support the subsurface characterization which includes the three formations that exist generally across the site. Additionally, soil strength parameters from both field and laboratory were conservatively generalized and selected for use in the geotechnical stability analysis.

3 SITE STATIGRAPHY AND SOIL PROPERTIES

3.1 General

This section of the report includes the generalized stratigraphy for the site, typical properties of subsurface soils, potential uses of materials that may be excavated during construction, and soil material requirements for various components of the landfill.

The laboratory test results for soil samples obtained from the site are summarized in the material descriptions for each subsurface stratum below. Laboratory testing information is presented in Appendix IIIE-C.

3.2 Generalized Site Stratigraphy

The site stratigraphy has been illustrated through a series of five cross-sections, as shown in Appendix IIIG-C of Appendix IIIG – Geology Report. These cross-sections utilize seven previous subsurface investigations performed by EMCON-Baker Shiflett, Golder, Shaw Environmental, and The Carel Corporation. The descriptions from the 2014 permit application have been excerpted below. The results of the subsurface investigations show that the Facility is underlain by five main strata in the upper 100 feet below grade, namely (in order from ground surface down):

- Stratum A — Alluvium: The upper portion of the profile ranging from the ground surface to an approximate elevation of 468 ft-msl consists of interbedded fine- and coarse-grained soils. A majority of the soils are fine-grained and classified as low and high plasticity clays and silts. The coarse-grained soils were found in discontinuous pockets and classified as clayey sand, silty sand, and sand. The landfill is designed to generally penetrate Stratum A.
- Stratum B — Alluvium with gravel: This laterally discontinuous stratum comprises the first water-bearing zone. Stratum B primarily consists of coarse-grained soils with an increasing amount of gravel sized particles. These soils are primarily classified as clayey sand, silty sand, and sand. Discontinuous pockets of well-graded and poorly-graded gravel were also identified. The landfill is designed with a portion of the bottom to be founded on Stratum B and a portion to penetrate Stratum B.

- Stratum C — Weathered Woodbine, Non-Transmissive: This stratum is identified as the weathered upper, non-transmissive portion of the Woodbine formation. The top of this unit is generally identified by a layer of shaley clay, the top of which represents the unconformity surface between the Quaternary age alluvium and the underlying Cretaceous age Woodbine. The materials encountered within this stratum exhibit characteristics of both soil and rock depending on the amount of weathering the materials have experienced. The shale portion of the Woodbine is weathered into a shaley clay or shaley silt. The western expansion of the landfill is designed with a portion of the bottom to be founded on Stratum C and a portion to penetrate Stratum C.
- Stratum D — Transmissive Woodbine: This stratum is composed of sands, sandstone and interbedded sandstone and shale units of the Woodbine. The sandstone portions is variably weathered, with some portions weathered to sand.
- Stratum E – Unweathered/Competent Woodbine Shale: This stratum is composed of the unweathered/competent shale of the Woodbine formation. The bedrock materials were identified as a laterally continuous shale and discontinuous zones of siltstone with a few pockets of limestone at depth. The westernmost portion of the landfill is designed to be primarily founded on Stratum E.

In some areas of the Facility, the near-surface stratigraphy (Stratums A and B) has been disturbed or removed during past sand and gravel mining conducted on the property and by landfilling activities.

3.3 Soil Properties

The physical properties of the strata at the Facility are summarized in the following sections.

3.3.1 Stratum A

This stratum is described as interbedded fine- and coarse-grained soils. A majority of the soils are fine-grained and classified as low and high plasticity clays and silts. The coarse-grained soils were found in discontinuous pockets and classified as clayey sand, silty sand, and sand. Across the Facility, the top of Stratum A was found between approximate elevations of 496 to 456 ft-msl. The average top of layer is approximately at elevation 468 ft-msl. The thickness of this layer ranges between 1 and 72 feet, with an average thickness of approximately 22 feet.

Table 3-1 summarizes the properties of Stratum A. This is a compilation of the results from the former geotechnical studies. The test method listed is the method performed during the investigations.

Table 3-1
Properties of Stratum A[1]

Item		Minimum Value	Maximum Value	Average	Number of Tests	Test Method
Water Content		5	66	18	130	ASTM D2216
Liquid Limit[2]		13	70	41	72	ASTM D4318
Plastic Limit[2]		11	37	17	72	ASTM D4318
Plasticity Index[2]		1	47	23	72	ASTM D4318
Liquidity Index		-0.61	2.00	0.10	62	ASTM D4318
Dry Unit Weight (pcf)		90.2	134.0	109.6	31	ASTM D2937 (Modified)
Wet Unit Weight (pcf)		110.4	154.1	131.6	29	ASTM D2937 (Modified)
Percent Passing #200		4	97	65	65	ASTM D6913
Unconsolidated Undrained Triaxial	C_u (psf)	785	3521	2048	5	ASTM D2850
Consolidated Undrained Triaxial	c' (psf)	170	482	326	2	ASTM D4767
	φ' (deg)	21	28	25		
Consolidation	C_{CE}	0.07	0.13	0.11	4	ASTM D2435
	C_{rE}	0.009	0.020	0.012		
	O'_p (psf)	2000	6200	4050		
Vertical Permeability (cm/sec)		$5.7x10^{-7}$	-	-	1	ASTM D5084[3]
Horizontal Permeability[4] (cm/sec)		$2.7x10^{-9}$	$5.7x10^{-7}$	a. $8.7x10^{-8}$ G. $1.7x10^{-8}$	8	ASTM D5084 Falling Head

[1] Soil samples SH (Shelby tube) and SS (split spoon) samples.
[2] 1 NP (non-plastic) result. The NP result was not incorporated into the average value.
[3] EMCON Baker-Shiflett, Inc. performed this test; we have assumed the test method.
[4] Both the arithmetic and geometric means of the horizontal permeability are reported for the average.

3.3.2 Stratum B

This stratum consists of coarse-grained soils with an increasing amount of gravel sized particles locally found near the base of the unit in some areas. These soils are primarily classified as clayey sand, silty sand, sand, and gravel. Discontinuous pockets of well-graded and poorly-graded gravel were also identified. The Stratum B soils comprise the first water-bearing zone at the Facility. Across the Facility, the top of Stratum B was found between approximate elevations of 488 to 400 ft-msl.

The average top of layer is approximately at elevation 447 ft-msl. The thickness of this layer ranges between 1 to 48 feet, with an average thickness of 10 feet.

Table 3-2 summarizes the properties of Stratum B. This is a compilation of the results from the former geotechnical studies. The test method listed is what was performed during the investigations.

Table 3-2
Properties of Stratum B[1]

Item		Minimum Value	Maximum Value	Average	Number of Tests	Test Method
Water Content		5	25	15	21	ASTM D2216
Liquid Limit		17	25	20	8	ASTM D4318[2]
Plastic Limit		13	25	17	8	ASTM D4318[2]
Plasticity Index[3]		1	8	4	8	ASTM D4318[2]
Dry Unit Weight (pcf)		110.8	116.9	113.9	2	ASTM D2937 (Modified)
Wet Unit Weight (pcf)		131.9	134.4	133.2	2	ASTM D2937 (Modified)
Percent Passing #200		4	58	27	23	ASTM D6913
Unconsolidated Undrained Triaxial	c_u (psf)	3341	..	-	1	ASTM D2850
Consolidated Undrained Triaxial	c' (psf)	620	-	-	1	ASTM D4767[2]
	φ (deg)	22	-	-		
Residual Shear	c (psf)	140	-	-	1	ASTM D3080[2]
	φ(deg)	44	-			
Vertical Permeability (cm/s)		$7.1\text{x}10^{-6}$	-		1	ASTM D5084[3] Falling Head
Horizontal Permeability[4] (cm/s)		$5.5\text{x}10^{-7}$	$6.5\text{x}10^{-2}$	a. $2.1\text{x}10^{-2}$ G. $4.9\text{x}10^{-3}$	13	ASTM D4044 and ASTM D5084 Falling Head

[1] Soil samples are Shelby Tube and Split Spoon samples.
[2] EMCON Baker Shiflett, Inc. performed these tests. The test method is assumed.
[3] 2 NP (Non-Plastic) Results. The NP results were not incorporated into the average value.
[4] Both the arithmetic and geometric means of the horizontal permeability are reported for the average.

3.3.3 Stratum C

Stratum C is described as the non-transmissive, weathered upper portion of the Woodbine Formation. The materials encountered within this stratum exhibit characteristics of both soil and rock depending on the amount of weathering the materials have experienced. The shale portion of the Woodbine is locally weathered into a shaley clay or shaley silt. Lesser weathered portions still retain their shale characteristics. Across the Facility the top of Stratum C was found between approximate elevations of 486 to 395 ft-msl. The average top of layer is approximately at elevation 441 ft-msl. The thickness of this layer ranges between 1 to 48 feet, with an average thickness of approximately 9 feet.

Table 3-3 summarizes the properties of Stratum C. This is a compilation of the results from the former geotechnical studies. The test method listed is the method performed during the investigations.

Table 3-3
Properties of Stratum C[1]

Item		Minimum Value	Maximum Value	Average	Number of Tests	Test Method
Water Content		2	35	16	60	ASTM D2216
Liquid Limit		28	63	49	20	ASTM D4318
Plastic Limit		15	34	24	20	ASTM D4318
Plasticity Index		12	42	26	20	ASTM D4318
Liquidity Index		-0.65	0.58	-0.30	18	ASTM D4318
Dry Unit Weight (pcf)		104.0	144.5	121.4	21	ASTM 02937 (Modified)[2]
Wet Unit Weight (pcf)		121.7	151.9	137.0	20	ASTM D2937 (Modified)[2]
Percent Passing #200		13	97	76	12	ASTM D6913 (Modified)[2]
Consolidated Undrained Triaxial	c' (psf)	2460	-	-	1	ASTM 04767[2]
	φ' (deg)	44	-	-		
Vertical Permeability[3] (cm/sec)		$5.6x10^{-9}$	$1.7x10^{-7}$	a. $5.5x10^{-8}$ G. $3.1x10^{-8}$	5	ASTM 05084 falling head”
Horizontal Permeability[3] (cm/sec)		$3.0x10^{-9}$	$3.2x10^{-7}$	a. $8.8x10^{-8}$ G. $1.8x10^{-8}$	4	ASTM 05084 falling head
Unconfined Compressive Strength (ksf)		7.3	129.3	57.3	3	ASTM D7012
Unconsolidated Undrained Triaxial	c_u (psf)	4648	-	-	1	ASTM 02850

[1] Soil samples are Shelby Tube and Split-Spoon samples. Rock samples are core samples.
[2] EMCON Baker — Shiflett, Inc. performed a portion of these tests; their test method was assumed.
[3] Both the arithmetic and geometric means of the vertical permeability are reported for the average.

3.3.4 Stratum D

This stratum is composed of sands, sandstone and interbedded sandstone and shale units of the Woodbine. The sandstone portions are variably weathered, with some originally sandstone portions weathered to sand. Across the Facility, the top of Stratum D was found between approximate elevations 473 to 393 ft-msl. The average top of Stratum D is at approximate elevation 441 ft-msl. The thickness of this layer ranges between 1 to 52 feet, with an average thickness of approximately 12 feet.

Table 3-4 summarizes the properties of Stratum D. This is a compilation of the results from the former geotechnical studies. The test method listed is the method performed during the investigations.

Table 3-4
Properties of Stratum D[1]

Item	Minimum Value	Maximum Value	Average	Number of Tests	Test Method
Water Content	0	22	12	12	ASTM D2216
Dry Unit Weight (pcf)	100.3	157.9	118.8	8	ASTM D2937 (Modified)
Wet Unit Weight (pcf)	100.4	158.4	129.6	8	ASTM D2937
Percent Passing #200	38.4	-	-	1	ASTM D6913
Vertical Permeability[2] (cm/s)	$6.3x10^{-10}$	$8.5x10^{-8}$	a. $3.2x10^{-8}$ G. $8.0x10^{-9}$	3	ASTM D5084 Falling Head
Horizontal Permeability[2] (cm/s)	$5.2x10^{-10}$	$6.2x10^{-4}$	a. $2.6x10^{-4}$ G. $3.8x10^{-6}$	4	ASTM D5084 Falling Head
Unconfined Compressive Strength (ksf)	4.1	8.9	6.5	2	ASTM D7012
Unconsolidated Undrained Triaxial — C_u (psf)	6147	-	-	1	ASTM D2850

[1] Rock samples are core samples.
[2] Both the arithmetic and geometric means of the vertical permeability are reported for the average.

3.3.5 Stratum E

Stratum E is described as the unweathered/competent shale of the Woodbine formation. The bedrock materials were identified as laterally continuous shale, and discontinuous zones of siltstone with a few pockets of limestone at depth. Within the upper portion of this formation, the bedrock was highly laminated and thinly interbedded intervals, while the lower portion consisted primarily of massive shale. Across the Facility, the top of Stratum E was found between approximate elevations of 472 to 394 ft-rnsl. The average top of Stratum E is at approximate elevation 429 ft-msl. The thickness of this layer ranges between 2 to 81 feet, with an average thickness of approximately 35 feet. Stratum E represents the aquiclude underlying the Facility.

Table 3-5 summarizes the properties of Stratum E. This is a compilation of the results from the former geotechnical studies. The test method listed is the method performed during the investigations.

Table 3-5
Properties of Stratum E[1]

Item	Minimum Value	Maximum Value	Average	Number of Tests	Test Method
Water Content	5	19	11	23	ASTM D2216
Liquid Limit	45	-		1	ASTM D4318[2]
Plastic Limit	18	-	-	1	ASTM D4318[2]
Plasticity Index	27	-	-	1	ASTM D4318[2]
Liquidity Index	-0.22	-	-	1	ASTM D4318[2]
Dry Unit Weight (pcf)	108.0	149.1	127.6	23	ASTM D2937[2] (Modified)
Wet Unit Weight (pcf)	128.0	156.0	141.7	23	ASTM D2937[2] (modified)
Vertical Permeability (cm/sec)	$9.6x10^{-9}$	$3.5x10^{-7}$	a. $1.1X10^{-7}$ G. $4.3X10^{-8}$	5	ASTM D5084 falling head
Horizontal Permeability[3] (cm/sec)	$1.7x10^{-9}$	$1.5x10^{-6}$	a. $5.0x10^{-7}$ G. $1.7x10^{-8}$	3	ASTM D5084 falling head
Unconfined Compressive Strength (ksf)	3.9	284.4	62.3	15	ASTM D7012

[1] Rock samples are core samples.
[2] EMCON Baker-Shiflett, Inc. performed a portion of these tests; the test method was assumed.
[3] Both the arithmetic and geometric means of the vertical and horizontal permeability are reported for the average.

4 CONSTRUCTION CONSIDERATIONS

4.1 General

This section contains recommendations for excavation of the landfill, and soil liner, leachate collection layer, overliner, and final cover materials and construction. Additionally, operational cover soils, final cover construction, and perimeter embankment construction related recommendations are included in this section.

The existing 774.3-acre permit boundary will not be changed with this amendment application. The permitted limit of waste will be changed by 7.8 acres, from approximately 382.7 acres to approximately 390.5 acres. A major component of this amendment application is the rerouting of Hurricane Creek to allow the East Disposal Area and West Disposal Area to be reconfigured into one contiguous disposal area.

The currently developed Subtitle D liners of the landfill include groundwater dewatering systems for temporary groundwater hydrostatic uplift pressure relief. The future Sectors 6 through 12 will also require temporary groundwater uplift control in the bottom sideslopes of the excavation and as described in Appendix IIID-C of Appendix IIID – LQCP.

4.2 Material Requirements for Landfill Components

Construction of the landfill will require clay or clayey soils which can be compacted to have an in-place hydraulic conductivity of $1x10^{-7}$ cm/sec or less for the soil liner portion of the composite liner, overliner, and an in-place hydraulic conductivity of $1x10^{-5}$ cm/s for the soil infiltration layer of the composite final cover system.

Soil will also be required for protective cover on the liner and overliner, operational cover (daily cover, intermediate cover), the infiltration and erosion layer components of the composite final cover, berm construction, and other miscellaneous general fill. Granular material (i.e., gravel) will be used for the leachate collection sumps, leachate collection chimneys and may be used for groundwater dewatering collection trenches. Typical material requirements for various soil structures are summarized in Table 4-1.

Testing requirements and construction quality control and quality assurance for liner soils are detailed in Appendix IIID – LQCP. Testing requirements and construction quality control and quality assurance for final cover soils are detailed in Appendix IIIJ – Closure Plan and in Appendix IIIJ-A – Final Cover System Quality Control Plan (FCSQCP). Liner and final cover details are presented in Appendix IIIA-A – Liner, Overliner, and Final Cover System Details.

Table 4-1
Typical Soil Requirements for Landfill Construction

Landfill Component	Soil Description	Classification	Test Parameters				Material Source
			LL	PI	% – 200	Coefficient of Permeability cm/s	
Soil Liner	clayey sand, sandy clay, or clay	SC, CL, CH	30 min	15 min	30 min	$1x10^{-7}$ max	On site[1]
Final Cover Infiltration Layer	clayey sand, sandy clay, or clay	SC, CL, CH	30 min	15 min	30 min	$1x10^{-5}$ max[2]	On site
Liner Protective Cover	sand or sand with silt and clay	SP-SM, SP, SP-SC, SW, SM or SM-SC				$1x10^{-4}$ min	On site[2]
Final Cover Erosion Layer	clayey sand, sandy clay, or clay	SC, CL, SM	Suitable to support plant growth				On-site
Operational Cover[2] (Daily Cover and Intermediate Cover)	sand, clayey sand, sandy clay, or clay	SP, SC, CL, CH	(2)	(2)	(2)	(2)	On-site
Earth Fill: Perimeter Berm and Subgrade Preparation	clayey sand, sandy clay, or clay	SC, CL, CH	--	--	--	--	On-site

1 If on-site materials meeting the required properties do not exist, an off-site material source can be used for liner soil.

2 If on-site material does not meet the hydraulic conductivity criteria, leachate collection chimney drains will be extended through the protective cover at selected locations and will be exposed adequately for transmission of leachate to the collection system.

4.3 Landfill Excavation

The excavation for the bottom liner construction will be performed in a manner that will achieve reasonable segregation of liner quality material from soils that are not suitable for a liner. Soil materials to be used for liner construction will be stockpiled separately, according to construction material properties outlined in Section 4.4 and visual observation during excavation.

Excavation of the soils encountered will be achieved with equipment such as excavators. Local areas of the hard shale or cemented sands may be encountered intermittently within the excavation and/or as the depth of excavation into Unweathered Shale. These zones can be broken up with an excavator equipped with a hydraulic hammer tool or ripped. The hydraulic hammer may be fitted with a pointed chisel or moil for the hard shale or a blunt tool for harder cemented material. Blasting of hard rock will not be required and will not be used at this site.

Excavation side slopes will be graded no steeper than 3 horizontal to 1 vertical (3H:1V). Temporary slopes during excavation may be steeper. Excavation cut slopes within the future sector construction areas may require erosion protection if an extended period of time occurs between excavation and liner construction. Interim erosion protection can be accomplished by diverting runoff away from the slopes. "Track walking" with a bulldozer up and down the slopes will create the effect of "mini-dikes" with the bulldozer tracks, which will reduce erosion.

Prior to beginning construction of the liner components, the subgrade area will be stripped to a depth sufficient to remove all loose surface soils or soft zones within the exposed excavation. The liner base grades will be proof-rolled with heavy, rubber-tired construction equipment or equivalent to detect soft areas. Soft areas will be undercut to firm material and backfilled with suitable compacted clay fill, as discussed in Appendix IIID – LQCP. Preparation of the liner base grades will result in a surface that is stable and that does not exhibit significant rutting from the construction traffic. The prepared liner base grades will be approved by a Professional of Record (POR), tested to verify that it meets the requirements outlined in Appendix IIID – LQCP, and surveyed to verify grades.

4.4 Soil Liner Construction

The bottom and sides of the landfill excavation consists of 2-foot-thick compacted soil liner. The clay liner will have a maximum hydraulic conductivity of $1x10^{-7}$ cm/s. Details for the liner system are provided in Appendix IIIA (Appendix IIIA-A). Adequate soil liner material will be available from proposed landfill excavations, onsite, or offsite borrow sources to provide material for the liner construction. Preconstruction laboratory tests may be performed to verify that a borrow source soil material is adequate to meet the compacted clay liner requirements listed in

Title 30 TAC §330.339(c)(5) prior to using any soil borrow source as liner. A geosynthetic clay liner may also be used as a substitute for the clay liner.

The soils used for liner construction will have the minimum soil property values listed in Table 4-2 that will be verified by preconstruction testing in a soils laboratory. The following soil liner properties are included in Appendix IIID – LQCP.

Table 4-2
Soil Liner and Overliner Properties

Test	Specifications
Hydraulic Conductivity of Remolded Soils[1]	1.0×10^{-7} cm/s or less
Plasticity Index	15 minimum
Liquid Limit	30 minimum
Percent Passing No. 200 Mesh Sieve	30 minimum
Percent Passing 1-inch Sieve	100

[1] A hydraulic conductivity test will be performed on soil samples remolded per ASTM D 698 in accordance with Appendix IIID – LQCP.

Representative preliminary sampling will be performed on the materials that will be used for soil liner construction. Laboratory tests of samples recovered from soil borings as well as previous testing during liner construction indicate that soils which will achieve a coefficient of permeability of less than 1×10^{-7} cm/s are present at the site. Prior to construction of each new liner area, conformance tests that include liquid limit, plastic limit, percent passing the No. 200 sieve, Standard Proctor (ASTM D698) and remolded hydraulic conductivity tests will be performed for the soils prepared for use as liner. Additional conformance tests will be conducted if there are visual changes in the borrow material or the liquid limit or plasticity index vary by more than 10 points. The soil liner construction and testing procedures are outlined in Appendix IIID – LQCP.

4.5 Drainage Materials

The LCS drainage material will consist of a drainage geocomposite over the entire liner bottom and side slopes. Each sector will have a bottom slope toward an LCS trench (i.e., pipe enveloped in gravel and geotextile) that will collect leachate from the bottom and sideslopes. The leachate collection system details are illustrated in Appendix IIIA (Appendix IIIA-A). The material specifications and construction procedures for the LCS components are presented in Appendix IIID – LQCP. The LCS design and demonstrations are provided in Appendix IIIC – Leachate and Contaminated Water Management Plan.

4.6 Liner and Overliner Protective Cover

The liner protective cover is required to be a minimum of 24 inches thick for both liner and overliner. The purpose of the protective cover is to protect the geosynthetics (i.e., geomembrane and drainage geocomposite) from solid waste placed over the liner system. To ensure passage of leachate into the leachate collection system, drainage passages (chimney drains) will be constructed through the protective cover. The chimney drains will be installed over the LCS collection pipes as shown in Appendix IIIA (Appendix IIIA-A). The protective cover will be placed with construction equipment in one lift such that it covers the leachate collection layer completely. The protective cover material will be free of solid waste and will not require compaction under the density-controlled construction procedures.

4.7 Operational Cover Soils

Operational cover soils include daily cover (placed over the waste each day) and intermediate cover (placed over waste in areas that will not receive additional fill for at least 6 months). All soils excavated at the site may be used for operational cover, including shale that is broken down by equipment or weathering.

4.8 Composite Final Cover Construction

4.8.1 Final Cover Infiltration Layer Construction

The infiltration layer of the final cover system will be constructed with clayey material and will be a minimum of 18 inches thick. As specified in Appendix IIIJ – Closure Plan, for areas of the landfill with a synthetic bottom liner, the infiltration layer will consist of 18 inches of earthen material with a coefficient of permeability equal to or less than 1×10^{-5} cm/s overlain by a synthetic membrane. The purpose of this layer is to reduce infiltration of surface water into the fill. The final cover components material and construction requirements will be in accordance with Appendix IIIJ-A – FCSQCP.

4.8.2 Final Cover Erosion Layer Construction

As shown in Appendix IIIA-A, the composite final cover system will include a 12-inch-thick erosion layer. The erosion layer will protect the infiltration layer and will support vegetative growth. The erosion layer may be spread and placed as a 12-inch thick lift (with soils that will support vegetation) or with two 6-inch-thick lifts (with the upper 6 inches capable of supporting vegetation) over the entire final cover area as the final cover is constructed. After spreading, each lift will be rolled lightly to reduce future erosion but not to the extent that compaction would inhibit plant growth. The top 6 inches of the erosion layer will consist of (1) topsoil stockpiled during the excavation process, (2) other on-site excavated soils amended as necessary to be capable of sustaining vegetation, and/or (3) imported soil materials. Whether placed in a single lift or two lifts, the erosion layer (top of final cover) will sustain vegetative growth.

4.9 Perimeter Embankment Construction

Perimeter embankments (berms) previously were constructed at the landfill, and will be constructed at future sectors as required to prevent surface water flow from entering the landfill excavation. Constructed embankments will have side slopes no steeper than 3H:1V. A sufficient amount of soil is available from the landfill excavations to construct the perimeter embankment and other features that require stable soil fill material.

Prior to beginning embankment fill, the subgrade area will be stripped to a depth sufficient to remove all topsoil and vegetation. Topsoil will be stockpiled for later use. The subgrade area will be proof-rolled with heavy, rubber-tired construction equipment to detect soft areas. Soft areas will be undercut to firm material and backfilled with suitable compacted clay fill. The subgrade preparation will result in a subgrade surface that is stable and does not exhibit significant rutting from construction equipment traffic.

The embankments will be constructed of onsite soils free of organic or other objectionable materials. The general fill placed below the composite liner (i.e., over excavated areas within the liner construction area) will be spread in maximum 12-inch-thick loose lifts, placed horizontally and compacted to a minimum of 95 percent of the maximum dry density as determined by Standard Proctor testing with a moisture content at or above the optimum moisture content determined by the Standard Proctor testing. A minimum of one Standard Proctor test (ASTM D698) will be performed on each representative soil used as fill material. Each lift will receive a minimum of four passes with a heavy tamping roller unless adequate compaction can be demonstrated with fewer passes. Moisture-density field testing and full-time third party CQA monitoring during construction will be performed in accordance with Appendix IIID – LQCP. As necessary, the outside slope of all embankment construction will be vegetated to minimize erosion and desiccation.

4.10 Overliner System Construction

The overliner system consists of a 40-mil-thick LLDPE geomembrane textured on both sides, a drainage geocomposite, a geosynthetic clay liner (GCL), and a 24-inch-thick protective cover soil layer. The geomembrane will be placed over a prepared bedding layer. Requirements for the overliner are set forth in Appendix IIID – LQCP.

The layout and detail drawings of the overliner system are presented in Appendix IIIA-A. Details of the overliner material and construction requirements are provided in Appendix IIID – LQCP.

4.11 General Earth Fill Construction

Earthen fill material may be required for subgrade preparation, embankments, haul roads, and other miscellaneous fill. Material availability, compactability, and long-term maintenance requirements will be considered when evaluating the excavated soils for use as earth fill. Most soils that will be excavated for landfill development are suitable for use as earth fill. General fill material placed below the composite liner (i.e., over-excavated areas within the liner construction area) will be placed in uniform loose lifts not exceeding 9 inches in thickness. General fill material for structural fill (e.g., perimeter berm construction and liner anchor trench backfill) will be placed in uniform loose lifts not exceeding 12 inches in thickness. General and structural fill will be compacted to at least 95 percent of Standard Proctor maximum dry density (ASTM D698) at a moisture content at or above the optimum moisture content when it is used for backfill below the soil liner.

5 SLOPE STABILITY ANALYSIS

5.1 General

This slope stability analysis has been developed to analyze excavation slopes, interim slopes, and landfill completion slopes using critical sections for each condition. The computer model SLIDE2 (RocScience, Inc., 2020) was used to analyze the stability of excavation slopes, interim fill slopes, and the final configuration of the site. SLIDE2 is an industry standard computer program developed by RocScience, Inc.

SLIDE2 is a two-dimensional slope stability program for evaluating the safety factor or probability of failure of circular and non-circular failure surfaces in soil or rock slopes. SLIDE2 analyzes the stability of slip surfaces using vertical slice or non-vertical slice limit equilibrium methods like Bishop, Janbu, Spencer, and Sarma, among others. Individual slip surfaces can be analyzed, or search methods can be applied to locate the critical slip surface for a given slope. SLIDE2 incorporates a windows-based interface that allows input of analysis sections and geological conditions from AutoCAD design drawings. The input file for the SLIDE2 program includes:

- Slope surface geometry.
- Subsurface information to identify different types of soil materials in horizontal and vertical directions so that each subsurface segment is identified with corresponding soil strength parameters.
- Groundwater information. The program is capable of modeling multiple groundwater surfaces that may be applicable to various subsurface soil components identified in the second bullet.
- Material strength information. Each soil section (horizontal or vertical) identified in the second bullet is assigned with strength parameters including cohesion and friction angle for both total and effective stresses.
- Model control and simulation user interface of the model that allows selection of the method of analysis (e.g., Simplified Bishop) and identifying simulation control parameters.

Automatic failure surface generation functions, that use either initiation/ termination ranges of the failure surface or use search boxes to define failure surface location, are used to locate the critical failure surface. The two methods employed for this slope stability analysis are described below.

1. Simplified Janbu Method – This method uses the method of slices to determine the stability of the mass above a failure surface.
2. Simplified Bishop Method – This method uses the method of slices to discretize the soil mass for determining the factor of safety.

In general, the stability of various critical sections were analyzed under static conditions for short-term (excavation and construction) and long-term (after construction) safety. The slope stability analyses are provided in Appendix IIIE-A. The stability of the various liner and final cover configurations with the geosynthetic components were also evaluated by using infinite slope stability analysis (refer to Appendix IIIE-A).

The stability analysis has been developed using demonstrations showing that, for each analyzed section, the forces resisting movement of the slopes are higher than the forces that potentially create movement. Therefore, the ratio of forces resisting movement to the forces potentially creating movement is defined as the factor of safety (FS). When the FS is equal to or greater than 1.0, it means that the slope is stable. In the slope stability analysis a factor of safety greater than 1.0 is desired. The FS value is increased for the increased uncertainty for the system analyzed. A factor of safety of 1.5 has been used for slopes that will stay in place long-term, including final cover configurations. A factor of safety of 1.3 is acceptable for total stress conditions that will be applicable for short periods of time, including interim and excavation slopes. A factor of safety of 1.0 is acceptable for residual or large deformation strength conditions (typical of Rankine-Block analyses of critical geosynthetic interfaces).

5.2 Sections Selected for Analysis

Slope stability analyses were performed on critical sections to evaluate the stability of the excavation, interim fill, overliner, and final cover configuration slopes. The geometries of the slopes analyzed were determined by reviewing the proposed excavation plan and final contour plan. The evaluation locations were selected to analyze critical slopes consisting of profiles that include the landfill configuration as well as natural materials at the toe and below the landfill excavation. The interim fill slope was analyzed using an assumed profile as discussed in Section 5.3. Figures showing the location of the cross sections are included in Appendix IIIE-A.

5.3 Configurations Analyzed

The excavation, overliner, interim, and final landfill configurations were modeled to represent critical slope conditions, and the analysis was performed using circular and block failure surfaces. The maximum final fill and overliner slopes will be 4H:1V, while interim slopes, liner slopes, and excavation slopes will be as steep as 3H:1V. The excavation, liner, and interim fill slopes were analyzed with a slope angle of 3H:1V and a 4:1V final side slope was used to evaluate final cover and overliner. A copy of the top of liner plan and final completion plan showing the locations of the cross sections selected for analysis are included as Sheets IIIE-A-1 and IIIE-A-8 in Appendix IIIE-A. Additionally, the configurations analyzed are graphically illustrated in Sheets IIIE-A-9 through IIIE-A-16 in Appendix IIIE-A. The interim condition was analyzed considering a 3H:1V slope with a horizontal length of approximately 600 feet (200 feet vertically). If the horizontal length of actual interim slopes longer than 600 feet is developed during site operations, an additional analysis will be completed at that time and maintained in the Site Operating Record.

5.4 Input Parameters

The cross sections for slope stability analysis were developed for each of the conditions analyzed (see Figures IIIE-A-9 through IIIE-A-16). The soil parameters were selected based on a review of the boring logs and laboratory test results from the subsurface investigation studies at the site and upon engineering judgment and experience with similar materials. The groundwater surface indicated in the analysis is obtained from Appendix IIIG - Geology Report. For global analysis of the foundation conditions, a groundwater level immediately below the top of the excavation grade was assumed. For analysis of the exterior berm or slope (excavation slope analysis) a perched groundwater level above the sector excavation grade was assumed (as representative of groundwater in the upper units) and represents the highest measured groundwater levels. Table 5-1 summarizes the unit weights and strength parameters used for the stability analyses for the evaluated landfill slopes (excavation, overliner, interim, and final cover slopes).

Note that for analyzing interface failure planes along the overliner and bottom liner, a single 2-foot-thick zone was input into the SLIDE2 model and the weakest strength parameters assigned to this zone.

Table 5-1
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters					Comments
Final Cover System					The final cover system includes the erosion layer, drainage geocomposite (single-sided on top slopes and double-sided on 4H:1V sideslopes), geomembrane liner (smooth or textured on topslopes and textured on 4H:1V sideslopes), and compacted clay infiltration layer. An infinite stability analysis was performed to establish the minimum interface strength requirements for each layer of the final cover system. The minimum interface strength requirements specified are used for the stability analysis in Appendix IIIE-A. For the rotational global stability analysis, the final cover system is modeled as a single layer and the strength parameters represent the compacted clay infiltration layer and the erosion layer. The two geosynthetic layers (i.e., geomembrane and geocomposite) are not included in the global analysis because they provide a negligible contribution to the forces that are resisting movement. The strength values selected for the final cover system represent strength values typically used in the industry and these same strength values have been used in various permit applications approved by TCEQ. The global stability analysis for rotational failure analysis uses the soil material strength parameters (i.e., cohesion of 100 lb/ft^2 and a friction angle of 16 degrees). The global stability analysis is included in Appendix IIIE-A-3. The interface slope stability analysis for the final cover system was performed using an infinite slope stability analysis procedure by Duncan, Buchianani, and De Wet. The purpose of this analysis was to show that the final cover components that are placed on top of each other, such as a geomembrane and compacted clay layer (or geomembrane and geocomposite), will not experience sliding failure due to the lack of strength between these components. The interface strength parameters shown are based on compacted clay internal on the sideslope and smooth geomembrane and compacted clay on the top deck. The interface strength parameters were developed from Geosynthetic Research Institute (GRI) publications (e.g., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" by George R. Koerner, GRI, Folsom, PA, June 14, 2005). Although the strength parameters (i.e., adhesion and interface friction) used for the application were selected based on published data, it should be noted that these strength parameters will also be tested and verified at the time of each final cover construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design (as discussed in Appendix IIIE-A). As noted in Appendix IIIE-A, the strength parameters listed are for the weakest interface (or internal) to provide for a conservative design.
Soil Material Strength Parameters			Interface Strength Parameters		
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion (lb/ft^2)	Friction Angle (degrees)	
100	16	116	Topslope 100	13	
			4H:1V Sideslope 100	16	
Solid Waste					As noted in Appendix IIIE-A, the strength parameters for solid waste were based on information contained in the following references: Pagotto and Rimoldi (1987), Landva and Clark (1990), and Richardson and Reynolds (1991) and Kavazanjian, et al. (1995). These sources list cohesion and friction angle values that range from 210 lb/ft2 to 605 lb/ft2 and 18° (for residual strength or large displacement for direct shear test which requires a factor of safety of 1) to 43°, respectively. The selected strength values are selected to represent peak strength for MSW. The unit weight of waste used for stability analyses is consistent with numerous analyses and permit amendment applications in Texas, including being consistent with the previous amendment application analysis for this landfill.
Material Strength Parameters			Interface Strength Parameters		
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion (lb/ft^2)	Friction Angle (degrees)	
For φ_p < 625 psf C = 500 psf	0	65	Interface strength parameters are not applicable to the solid waste layer because the interface between the waste and final cover and overliner systems is not a critical interface.		
For φ_p > 625 psf C = 0	33				
Overliner					The overliner system includes a geomembrane liner (textured on all slopes), drainage geocomposite (double-sided), a GCL, and 2-foot-thick protective cover layer. Similar to the final cover system discussed above, the overliner system is modeled as a single layer for the global stability analysis (i.e., 2-ft protective cover was not considered separately). In addition, both a translational (using Simplified Jambu and Rankine Blocks) and an infinite stability analysis were performed to establish the minimum interface strength requirements for each layer of the overliner system. For the rotational global stability analysis, the overliner system is modeled as a single layer and the strength parameters represent the protective cover layer (for this analysis the material strength parameters are used). The two geosynthetic layers are not included in the global analysis because they provide a negligible contribution to the forces that are resisting movement. The strength values selected for the overliner system represent strength values typically used in the industry for liner systems (see liner system discussion below). The unit weight of the overliner system is consistent with that selected for the liner system and is based on experience with liner system construction. The global stability analysis is included in Appendix IIIE-A-3 (interim and final landfill conditions). The interface slope stability analysis, which is performed using an infinite slope stability analysis procedure by Duncan, Buchianani, and De Wet for the overliner system, was developed to show that overliner components that are placed on top of each other, such as the geomembrane and geocomposite, will not experience sliding failure due to the lack of strength between these components. The interface strength parameters were developed using materials from Geosynthetic Research Institute (GRI) publications (e.g., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" by George R. Koerner, GRI, Folsom, PA, June 14, 2005). Although the strength parameters (i.e., adhesion and interface friction) used for the application were selected based on published data, it should be noted that these strength parameters will also be tested and verified at the time of each overliner construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design (refer to Appendix IIID). The translational slope stability analysis was performed using Simplified Janbu Method using Rankine Blocks. This analysis is similar to the interface slope stability analysis discussed above. The purpose of this analysis is to test the critical interfaces under a variety of loading conditions (refer to Appendix IIIE-A-2 for more information – i.e., the loading conditions reflect different landfill configurations). SLIDE2 is also used for this analysis. However, for the translational analysis the overliner system strength parameters are modified to reflect the strength parameters (adhesion and friction angle) for the interfaces with the lowest strength parameters. As noted above, these strength parameters will also be tested and verified at the time of each overliner construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design.
Material Strength Parameters			Interface Strength Parameters		
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion (lb/ft^2)	Friction Angle (degrees)	
100	16	120	100	18	

Table 5-1 (Continued)
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters						Comments
Solid Waste						
Material Strength Parameters			**Interface Strength Parameters**			
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**		**Friction Angle (degrees)**	
For φ_p < 625 psf	0	65	Interface strength parameters are not applicable to the solid waste layer because the interface between the waste and final cover and overliner systems is not a critical interface.			See comments listed under Solid Waste above.
For φ_p > 625 psf	33					
Liner System						
Material Strength Parameters			**Interface Strength Parameters**			
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**		**Friction Angle (degrees)**	
Protective Cover		120	Floor Grades	100	22	The liner system includes a 2-foot-thick compacted clay layer, 60-mil geomembrane (smooth or textured geomembrane on the floor of the landfill and textured on the 3H:1V sideslopes), drainage geocomposite (single-sided on floor grades and double-sided on 3H:IV sideslopes), and a 2-foot-thick protective cover soil layer. This system is modeled as two layers for the global stability analysis. In addition, both a translational and an infinite stability analysis were performed to establish the minimum interface strength requirements for each layer of the liner system. The minimum interface strength requirements are specified in Appendix IIID. For the rotational global stability analysis, the liner system is modeled as two layers: the compacted clay liner and the soil protective cover layer. The two geosynthetic layers are not included in the global analysis because they provide a negligible contribution to the forces that are resisting movement. The strength values selected for the liner system represent strength values typically used in the industry and these same strength values have been used in various permit applications approved by TCEQ. Duncan and Wright (2005) provides a comprehensive discussion regarding strength parameters for a liner system. In Chapter 5 – Shear Strengths of Soil and Municipal Solid Waste, a significant amount of data are presented and evaluated for compacted clay liners. The results indicate that the lowest cohesion value for compacted cohesive soils is 9 kPa (187 lb/ft^2) and the lowest reported friction angle value is 19 degrees. Therefore, selected values of 100 lb/ft^2 for cohesion and 16 degrees of friction angle conservatively represent the liner system. Soil properties used in the slope stability analysis are subject to verification at the time of each liner construction. Section 2.4.3 in Appendix IIID – LQCP includes the material strength tests required for soil used for liner construction. Protective cover and compacted clay liner soil unit weight values are based on experience with liner system construction. The global stability analysis is included in Appendices IIIE-A-2 and IIIE-A-3. The interface slope stability analysis, which is performed using an infinite slope stability analysis procedure by Duncan, Buchianani, and De Wet for the liner system, was developed to show that certain landfill components that are placed on top of each other, such as a geomembrane and compacted clay layer will not experience sliding failure due to the lack of strength between these components. The interface strength values presented in this table represent compacted clay liner internal on the sideslopes, and textured geomembrane and compacted clay liner interface on floor grades. These strength values represent the interfaces with the lowest strength at the sideslopes (refer to Appendix IIIE-A-4 for the complete evaluation of interfaces that will occur for the liner system 3H:1V sideslope and the bottom liner interface strength value is obtained from the document referenced in this paragraph). The strength parameters were developed using materials from Geosynthetic Research Institute (GRI) publications (e.g., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" by George R. Koerner, GRI, Folsom, PA, June 14, 2005). Although the strength parameters (i.e., adhesion and interface friction) used for the application were selected based on published data, it should be noted that these strength parameters will also be tested and verified at the time of each liner construction event to ensure that the as-built strength parameters meet the minimum strength parameters from this analysis (refer to Appendix IIIE-A-5). The translational slope stability analysis was performed using simplified Janbu Method using the Rankine Blocks. This analysis is similar to the interface slope stability analysis discussed above. The purpose of this analysis is to test the critical interfaces under a variety of loading conditions (refer to Appendices IIIE-A-2 and IIIE-A-3 for more information – i.e., the loading conditions reflect different landfill configurations). SLIDE2 is also used for this analysis. However, for the translational analysis, the liner system strength parameters are modified to reflect the interface strength parameters. The translational stability analysis uses modified liner system strength parameters to reflect the interface strength parameters. As noted above, these strength parameters will also be tested and verified at the time of each liner construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design.
Effective Stress 100	16					
Total Stress 1,000	0					
Liner System		120	3H:1V Sideslope and Floor Grades	100	16	
Effective Stress 100	16					
Total Stress 1,000	0					

[1] The overliner was modeled with clay/textured geomembrane interface for sideslope and top deck areas.

Table 5-1 (Continued)
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters					Comments
Stratum A – Upper Alluvium Soils					Refer to Section 3.3.1 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft²)	**Friction Angle (degrees)**	**Unit Weight (lb/ft³)**	**Adhesion (lb/ft²)**	**Friction Angle (degrees)**	
Effective 300 Total 3500	Effective 25 Total 0	12.5 130 (SAT)	Interface strength parameters are not applicable to the Upper Sand layer because the interface between the waste and final cover and overliner systems is not a critical interface.		
Stratum B – Upper Transmissive Zone					Refer to Section 3.3.2 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft²)	**Friction Angle (degrees)**	**Unit Weight (lb/ft³)**	**Adhesion (lb/ft²)**	**Friction Angle (degrees)**	
Effective 600 Total 3500	Effective 22 Total 0	125 130 (SAT)	Interface strength parameters are not applicable to the Bounding Shale layer because the interface between the waste and final cover and overliner systems is not a critical interface.		
Stratum C – Weathered Shale					Refer to Section 3.3.3 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft²)	**Friction Angle (degrees)**	**Unit Weight (lb/ft³)**	**Adhesion (lb/ft²)**	**Friction Angle (degrees)**	
Effective 2000 Total 4000	Effective 40 Total 0	125 140 (SAT)	Interface strength parameters are not applicable to the Bounding Shale layer because the interface between the waste and final cover and overliner systems is not a critical interface.		
Stratum D – Transmissive Zone					Refer to Section 3.3.4 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft²)	**Friction Angle (degrees)**	**Unit Weight (lb/ft³)**	**Adhesion (lb/ft²)**	**Friction Angle (degrees)**	
Effective 2000 Total 6000	Effective 40 Total 0	135 140 (SAT)	Interface strength parameters are not applicable to the Bounding Shale layer because the interface between the waste and final cover and overliner systems is not a critical interface.		

[1] Liners on the sideslopes and floor grades are listed separately due to different strength characteristics for clay/smooth geomembrane and clay/textured geomembrane interfaces. The overliner was modeled with clay/textured geomembrane interface for sideslope and top deck areas.

Table 5-1 (Continued)
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters					Comments
Stratum E – Unweathered Shale					Refer to Section 3.3.5 of this appendix for description.
Material Strength Parameters			Interface Strength Parameters		
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion (lb/ft^2)	Friction Angle (degrees)	
Effective 1000 Total 4100	Effective 38.6 Total 0	135 140 (SAT)	Interface strength parameters are not applicable to the Bounding Shale layer because the interface between the waste and final cover and overliner systems is not a critical interface.		

[1] Liners on the sideslopes and floor grades are listed separately due to different strength characteristics for clay/smooth geomembrane and clay/textured geomembrane interfaces.

5.5 Results of Stability Analysis

5.5.1 Stability Analysis Using SLIDE2

The results of the stability analyses using SLIDE2 computer program indicate that the proposed excavation, liner, interim, overliner, and final configuration slopes are stable under the conditions analyzed. Table 5-2 summarizes the results of the stability analyses for the landfill slopes and compares the calculated factor of safety to the recommended minimum factor of safety. The recommended minimum factors of safety for the conditions analyzed were determined using recommendations from the Corps of Engineers "Design and Construction of Levees" manual (EM 1110-2-1913) and the EPA's "Technical Guidance Manual for Design of Solid Waste Disposal Facilities," as 1.3 for short-term slope stability (excavation slopes) and 1.5 for long-term slope stability (interim and final cover slopes).

Table 5-2
Summary of Slope Stability Analyses
for the Excavation Configuration

Analyzed Section-Run	Failure Type	Minimum Factor of Safety Generated[1]		Factor of Safety Acceptable
		Effective Stress	Total Stress	
		1.5	1.3	
Excavation Slope A-1 (Exterior)	Bishop-Circular	1.74	3.33	YES
Excavation Slope A-1 (Interior)	Bishop-Circular	1.65	3.30	YES

[1] Recommended Minimum Factor of Safety for long-term stability analysis using effective stress is 1.5 and short-term stability analysis using total stress is 1.3.

Table 5-3
Summary of Slope Stability Analysis for Overliner Slopes

Slope Designation	Method of Analysis	Minimum Factor of Safety Generated[1]		Factor of Safety Acceptable	
		Effective Stress 1.5	Total Stress 1.3	Effective	Total
Overliner Fill Slope B-1	Bishop-Circular	2.22	2.36	YES	YES
Overliner Fill Slope B-2	Rankine-Block	1.88 (peak)[2]	1.43 (residual)[3,4]	YES	YES
Overliner Slope C-1	Bishop-Circular	2.59	2.25	YES	YES
Overliner Slope C-2	Rankine-Block	1.97	1.54	YES	YES

1 Long-term factor of safety for temporary slopes is 1.5.
2 Peak stress for Rankine-Block.
3 Residual stress for Rankine-Block.
4 An acceptable Factor of Safety for residual stress is 1.0.

Table 5-4
Summary of Slope Stability Analysis for the Interim and Final Landfill Configurations

Slope Designation	Method of Analysis	Minimum Factor of Safety Generated[1,2]		Acceptable Factor of Safety	
		Effective Stress	Total Stress	Effective	Total
Interim Slope D-1	Bishop-Circular	1.94	1.94	YES	YES
Interim Slope D-2	Rankine-Block	1.61 (peak)	1.29 (residual) [2,3]	YES	YES
Final Cover Slope E-1	Bishop-Circular	2.67	2.53	YES	YES
Final Cover Slope E-2	Rankine-Block	2.07 (peak)[2]	1.62 (residual)[2,3]	YES	YES
Final Cover Slope F-1	Bishop-Circular	2.97	2.97	YES	YES
Final Cover Slope F-2	Rankine-Block	3.70 (peak)[2]	2.92 (residual) [2,3]	YES	YES

1 Recommended Minimum Factor of Safety for long-term stability analysis using effective stress is 1.5 and short-term stability analysis using total stress is 1.3.
2 Recommended Minimum Factor of Safety for stability analysis using peak stress is 1.5 and residual stress is 1.0.
3 Residual stress for Rankine-Block.

Computer-generated slope stability analysis output is included in Appendix IIIE-A. The minimum calculated factor of safety for the closed condition is 1.88, which is greater than the recommended minimum factor of safety of 1.5 for long-term slope stability.

5.5.2 Infinite Slope Stability Analysis

Infinite slope stability analysis for the overliner, bottom liner, and final cover systems has been included in this design in addition to the block method analysis discussed in the previous section. The infinite stability analyses address anchor trench design, stability of cover and drainage material on anchored geosynthetics, and shear forces within the liner system. The infinite final cover slope stability analysis addresses the shear forces within the final cover system. These calculations are presented in Appendix IIIE-A-4. As demonstrated in Appendix IIIE-A-4, the liner, overliner and cover systems are structurally stable using the strength parameters shown, which will be verified during each construction event. Prior to each construction event for liner, overliner, and final cover, the POR will perform interface strength testing using the actual material that will be used for each construction event to demonstrate the interfaces comply with the minimum values set forth in the Interface Shear Strength Conformance Test Requirement presented in Appendix IIIE-A-5.

A separate analysis has been prepared for the GCL final cover alternative and is presented in Appendix IIIJ-B – GCL Alternative Final Cover Demonstration. The demonstration presents the alternative of substituting a GCL for the 18-inch-thick compacted clay infiltration layer.

5.5.3 Overliner and Bottom Liner Interface Shear Strength Conformance Testing

Prior to each construction event, interface shear strength conformance testing will be required for the specific geosynthetic and soil liner components to be incorporated into the project. The required interface shear strength conformance testing requirements have been established for the project based on stability analyses performed for the expansion. The description of the interface shear strength conformance testing requirements and supporting stability analyses is presented in Appendix IIIE-A-5. As discussed in the appendix, the conformance testing requirements are applicable to both laboratory stack testing and single interface testing results and will be incorporated into the Geosynthetic Liner Evaluation Report (GLER) prepared for the respective construction event.

6 SETTLEMENT, STRAIN, AND HEAVE ANALYSIS

6.1 General

The purpose of the settlement and heave analysis is to demonstrate that the overliner, bottom liner, and final cover systems will not be adversely impacted by foundation settlement and settlement of waste below the overliner. The settlement analysis also addresses the settlement of the final cover system to demonstrate that the proposed final cover is designed to withstand the potential strain induced by waste settlement.

Settlement of the liner system will occur due to consolidation of the foundation materials from the weight of the landfill components (i.e., protective cover, solid waste and daily cover, and final cover systems). Laboratory consolidation tests indicate that the foundation soils (primarily shale) have low compressibility. Settlement of the overliner system occurs due to consolidation of the waste below the overliner and foundation soils as a result of the weight of the landfill components above the overliner. Settlement of the final cover system will occur due to consolidation of foundation soils and consolidation within the solid waste. Total consolidation of final cover consists of primary and secondary consolidation of deposited waste. Appendix IIIE-B includes details for the foundation heave and settlement as well as overliner and final cover settlement analyses.

6.2 Foundation/Bottom Liner Settlement and Strain

The Foundation/Bottom Liner Settlement Analysis is presented in Appendix IIIE-B-1. Foundation settlement potential has been assessed using estimates of consolidation properties for Stratum II, the primary formation underlying the constructed cells.

Settlement calculations were performed using SETTLE3, a computer-based model developed by RocScience, Inc. (2021). Input parameters include surfaces representing the subsurface strata, vertical loads representing the waste placed in the cell, and the settlement characteristics of the subsurface strata (from laboratory consolidation testing). The SETTLE3 model creates an isopach of the settlement of the bottom liner system, which then can be used to calculate strain within the bottom liner components.

The analysis is performed by creating a horizontal plane within the SETTLE3 program, with subsurface data input from available boring logs that has been normalized to the excavation grades (i.e., grades below the bottom liner system) designed for the landfill. Thus, the horizontal plane within the model represents the soil conditions beneath the excavation grade contours. Vertical fill loads are then calculated by subtracting the final landfill elevation from the excavation grades, and then multiplying the fill height by the unit weight assumed at each fill point. Unit weight values are adjusted based on the total waste thickness, and assume that deeper waste fill heights result in higher waste densities and associated pressures.

For the analysis, a conservative approach of assuming pre-consolidation pressures as equal to the overburden stress was used. This is a conservative approach, in that it results in greater settlement at each analysis point when compared to analyses performed using an assumed or calculated higher pre-consolidation stress value. The results of the analyses are presented in Appendix IIIE-B. As demonstrated in Appendix IIIE-B, even with this more conservative approach the settlement at the site is negligible and will not adversely affect the performance of the leachate collection systems and will not result in detrimental strain on the liner system components.

6.3 Final Cover Settlement and Strain

The Final Cover Settlement Analysis is presented in Appendix IIIE-B-2. Landfill final cover settlement occurs due to settlement of foundation soils and the settlement of waste materials. In general, foundation settlement is insignificant in comparison to the settlement of deposited waste. Waste settlement consists of primary and secondary settlement.

Settlement of solid waste generally begins rapidly as the waste load is placed and continues to occur for long periods of time after the initial placement. Initially, municipal solid waste will undergo primary settlement due to its own weight, final cover, equipment, etc. Primary settlement occurs quickly, generally within the first month after loading. Therefore, the weight of the final cover system is the only remaining factor that contributes to primary consolidation. By the time the construction of the final cover is complete, settlement of the waste due to the weight of the final cover will be complete.

Secondary settlement continues at substantial rates for periods of time well beyond primary settlement. It is a combination of mechanical secondary compression, physico-chemical reaction, and bio-chemical decay.

A strain analysis has been incorporated into the final cover settlement analysis presented in Appendix IIIE-B-2. The purpose of the settlement and strain analysis is to demonstrate that the final cover system will be stable as designed and maintain positive drainage. If it is considered that the waste settlement is uniform, then the sideslopes are expected to maintain positive drainage. Based on the estimates of settlement for the maximum waste thickness (where maximum waste settlement is expected to occur on the top deck of the landfill) and minimum waste thickness (where minimum settlement is expected to occur on the top deck of the landfill), the landfill final cover will be subject to a (compressive) strain of 0.27 percent. That is less than the allowable strain for the final cover soil infiltration layer. A strain demonstration in Appendix IIIE-B-2 shows that the top deck areas of the final cover will be stable and maintain positive drainage after settlement.

6.4 Overliner Settlement

The Overliner Settlement Analysis is presented in Appendix IIIE-B-3. Overliner settlement occurs as foundation materials and underlying in-place solid waste consolidate due to the additional weight of the landfill. In general, foundation settlement is insignificant in comparison to the settlement of underlying in-place solid waste, and therefore the analysis was limited to settlement occurring within the waste. Waste settlement consists of primary and secondary settlement.

Settlement of solid waste generally begins rapidly as the waste load is placed and continues to occur for long periods of time after the initial placement. Initially, municipal solid waste will undergo primary settlement due to its own weight, final cover, equipment, etc. Primary settlement occurs quickly, generally within the first month after loading. Therefore, the weight of the final cover system is the only remaining factor that contributes to primary consolidation. By the time the construction of the final cover is complete, settlement of the waste due to the weight of the final cover will be complete. Secondary settlement continues at substantial rates for periods of time well beyond primary settlement. It is a combination of mechanical secondary compression, physico-chemical reaction, and biochemical decay. Settlement analysis for the overliner system is presented in Appendix IIIE-B-3.

The purpose of the overliner system settlement analysis is to (1) show that positive drainage is maintained for the overliner system consistent with the demonstration included in Appendix IIIC and (2) to verify that the strain induced on the overliner system components due to differential settlement is within acceptable limits. The post-settlement slopes of the overliner system were used to demonstrate that the overliner leachate collection system will maintain positive drainage slopes and the leachate will be conveyed within the thickness of the leachate collection layer.

A strain analysis has been incorporated into the overliner settlement analysis presented in Appendix IIIE-B-3. The purpose of the strain analysis is that the maximum calculated strain is significantly lower than the allowable strain for the overliner system components. The areas of the overliner and overliner leachate drain pipes will be stable and maintain positive drainage after settlement. Based on the foregoing discussion, it is concluded that settlement will not adversely affect the overliner system, and the overliner system will perform as designed.

6.5 Foundation Heave

The foundation heave analysis is presented in Appendix IIIE-B-4. Potential heave (rebound) due to excavation of overburden above the excavation base was estimated using the standard consolidation theory for soils and the recompression index obtained from the rebound portion of the consolidation tests. In order to estimate potential for heave, the load is decreased, instead of increasing the load on the soils, to correspond with the projected weight of excavated soil. Using a maximum excavation depth of approximately 18 feet (existing ground elevation minus bottom of excavation at a given location), a heave of approximately 20 inches was calculated. The depth of floor grade excavation for each individual sector (liner area draining to an LCS sump) is generally uniform (i.e., depth of soil to be removed from the floor grades does not change drastically within a given sector). Where the excavation depth is less, heave will also be less and therefore negligible. These calculations are included in Appendix IIIE-B-4. Heave will occur soon after excavation (before and during liner construction) and will not adversely affect the performance of the liner system.

7 CONCLUSIONS AND RECOMMENDATIONS

This geotechnical analysis has been developed using (1) various geotechnical data obtained from field and laboratory testing performed on the soil samples recovered at the site; (2) general soil stratigraphy of the project area; and (3) known geotechnical characteristics of the founding geological formation, of solid waste, of geosynthetic materials commonly used for landfill development, and of soils used for various components of landfills. It is concluded, based on this geotechnical analysis, that the proposed landfill and its components (e.g., leachate collection system, liner systems, cover systems, excavation and interim fill slopes) will be geotechnically stable and will function as designed. The following summarizes various findings of the geotechnical analysis.

- Geotechnical engineering tests were performed in accordance with industry practice and recognized procedures (e.g., ASTM standards).
- Stability of the proposed landfill excavation slopes, constructed liner slopes, interim fill slopes, overliner slopes, and the final cover are acceptable as designed (see Appendix IIIE-A).
- Stability of the liner, overliner, and final cover system components is acceptable as designed (see Appendix IIIE-A).
- Foundation settlement after filling is expected to be negligible and within the strain limits of the liner system (refer to Appendix IIIE-B).
- Settlement of the final cover system will not adversely affect the final cover system, and the final cover system will function as designed (refer to Appendix IIIE-B).
- Settlement of the overliner system will not adversely affect the overliner system, and the overliner system will perform as designed (i.e., maintain positive drainage to the LCS sumps).
- Foundation heave during excavation is expected to be negligible and is within the strain limits of the liner system (refer to Appendix IIIE-B-4). Settlement of the liner system will not adversely affect the liner system, and the liner system will perform as designed (i.e., maintain positive drainage to the LCS sumps).

APPENDIX IIIE-A

SLOPE STABILITY ANALYSIS

STATE OF TEXAS
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81734
LICENSED
PROFESSIONAL ENGINEER

5-19-2022

CONTENTS

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5-19-2022

INTRODUCTION

This appendix includes the slope stability analysis for the landfill slopes during various phases of the site development and the final landfill configuration. General slope stability for the excavation and interim and closed conditions were evaluated by using the SLIDE2 computer program, as developed by RocScience, Inc. (2020). The Simplified Bishop method was used for circular failure surfaces, and the Simplified Janbu method using Rankine Block was used for the translational (block) slope stability analysis. Infinite slope stability has also been analyzed for the bottom liner, overliner, and final cover system. Soil profiles analyzed for each configuration for the slope stability analysis are provided in the sub-appendices, along with SLIDE2 computer output files as applicable. The stability analysis for the site is provided in the following four appendices.

- Appendix IIIE-A-1 includes the slope stability analysis for the excavated landfill condition.
- Appendix IIIE-A-2 includes the slope stability analysis for the overliner condition.
- Appendix IIIE-A-3 includes the slope stability analysis of the interim and final closure configuration.
- Appendix IIIE-A-4 includes the infinite slope stability evaluation.
- Appendix IIIE-A-5 includes the interface shear strength conformance testing requirements (for use during future cell and overliner and bottom liner designs and construction).

Required:

A. Evaluate the slope stability of the proposed landfill configuration including excavation grades, overliner slopes, interim fill slopes, and final closure condition slopes.

B. Evaluate the veneer stability of the bottom liner, overliner and final cover systems. Analysis is performed by the Infinite Slope Analysis Method.

C. After completing the analysis of the selected sections above using the weakest liner interface for each condition, the worst case section (i.e., the section with the lowest resulting factors of safety) was then re-analyzed to determine the minimum required strength parameters to meet the minimum required factors of safety (for block failure along the liner system interfaces). These strength values will then be used in material specification and conformance testing during future bottom liner and overliner construction projects. For this project, Section B-B was selected as the worst case condition. The results of the conformance testing analysis and the Geosynthetic Conformance Testing Requirements are presented in Appendix IIIE-A-5.

For this slope stability analysis, the analysis description, input parameters, analysis section plans, and the sections analyzed (with analysis results) are presented in Appendix IIIE-A. SLIDE2 computer model output files are presented in Appedices IIIE-A-1 (Excavation Grades), IIIE-A-2 (Overliner Conditions) and IIIE-A-3 (Interim and Final Closure Conditions). Infinite slope stability analyses are presented in Appendix IIIE-A-4.

Given:

1. Site plans showing the sections analyzed for this analysis are presented on Sheets IIIE-A-7 and IIIE-A-8.

2. Modeling parameters were derived from field and laboratory testing, and are summarized in Table IIIE-A-1, below. The results of field and laboratory testing are discussed in Appendix IIIE. Assumptions regarding waste density are discussed in Appendix IIIE.

3. The proposed bottom liner system for the landfill will consist of (from the bottom up) 2-foot-thick compacted clay liner ($k < 1x10^{-7}$ cm/s), 60-mil HDPE geomembrane, geotextile-geonet composite drainage layer, and 2-foot-thick soil protective cover. A GCL may be substituted for the clay liner component. Infinite stability analysis results for the clay liner option of the bottom liner system are presented in Appendix IIIE-A-4.

4. The proposed overliner system for the landfill will consist of (from the bottom up) a bedding layer, GCL, 40-mil LLDPE geomembrane, geotextile-geonet drainage layer, and 2-foot-thick soil protective cover. Infinite stability analysis results for the overliner system are presented in Appendix IIIE-A-4.

5. The proposed final cover system for the landfill will consist of (from the bottom up) an infiltration layer, 40-mil LLDPE geomembrane, geotextile-geonet drainage layer, and 1-foot-thick erosion layer. The infiltration layer may be comprised of 18-inch thick clay or GCL. Infinite stability analysis results for the final cover system are presented in Appendix IIIE-A-4.

6. The bottom liner and overliner systems were analyzed for stability as a single (thickened) layer with assigned strength parameters of the weakest component of the proposed composite liner system.

Method: A. Evaluate the slope stability of the proposed landfill configuration including excavation grades, overliner slopes, interim fill slopes, and final landfill slopes.

1. Determine critical excavation, overliner, interim and final landfill configuration slopes in the proposed design.

2. Select a soil profile for each critical section using available boring logs and geologic cross sections near each section. Information for this effort was derived from Appendix IIIG-Geology Report.
3. Select material properties using unit weights and strength parameters for the proposed sections (See Table IIIE-A-1, below).

4. Perform slope stability analyses:
   a. Analyze the <u>excavation and exterior liner slopes</u> using SLIDE2 computer model and the simplified Bishop method of circular failure surfaces. Analyses were performed for both effective (drained) stress conditions and total (undrained) stress conditions. The effective stress conditions represent long-term conditions, and the total stress conditions represent short-term conditions. Analysis section plans and analysis sections are presented as Sheets IIIE-A-7 through 14, and the SLIDE2 output files and results are presented in Appendix IIIE-A-1.

   b. Analyze the <u>landfill overliner slopes</u> using SLIDE2 computer model and the simplified Bishop method of circular failure surfaces and the Bishops method for block failure surfaces at the overliner interface. Circular failure plane analyses were performed for total (undrained) stress and effective (drained, or long term) stress conditions. The effective stress conditions represent long-term conditions, and the total stress conditions represent short-term conditions. Block failure along the overliner interfaces were performed for peak and residual (or large deformation) conditions. Analysis section plans and analysis sections are presented as Sheets IIIE-A-7 through IIIE-A-14, and the SLIDE2 output files and results are presented in Appendix IIIE-A-2.

   c. Analyze the <u>interim and final closure condition slopes</u> using SLIDE2 computer model and the simplified Bishop method of circular failure surfaces and the Bishops method for block failure surfaces at the bottom liner interface. Circular failure plane analyses were performed for total (undrained) stress and effective (drained, or long term) stress conditions. The effective stress conditions represent long-term conditions, and the total stress conditions represent short-term conditions. Block failure along the overliner interfaces were performed for peak and residual (or large deformation) conditions. Analysis section plans and analysis sections are presented as Sheets IIIE-A-7 through IIIE-A-14, and the SLIDE2 output files and results are presented in Appendix IIIE-A-3.

5. Using the worst case section analyzed for the stability analysis above (Section B-B), develop the minimum strength parameters required to obtain the minimum required stability factors of safety (for peak and residual strength of block failures along the geosynthetic liner interfaces). This information will be used during future conformance testing during landfill cell design and construction to qualify selected geosynthetic materials. The Conformance Testing Requirements worksheet is provided in Appendix IIIE-A-5.

6. Evaluate the stability of the proposed bottom and overliner systems and the final cover system using infinite slope stability analysis. The results of the infinite slope stability analyses are presented in Appendix IIIE-A-4.

    a. Verify that the tensile stress in the liner system will be less than the yield stress by using Koerner's method (reference 4) for determination of shear stress in liner systems considering cohesion/adhesion forces.

    b. Provide anchor trench design considering pullout of the geomembrane (incorporated into the bottom liner infinite slope stability analysis).

    c. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the liner systems.

References:

1. Duncan, J.M. and Buchignani, A.L., *An Engineering Manual for Slope Stability Studies,* Department of Civil Engineering-University of California-Berkeley, 1975.
2. TRI, Interface Friction/Direct Shear Testing & Slope Stability Issues. Short Course, November 12-13, 1998. Austin, Texas.
3. US Army Corps of Engineers, *Slope Stability*, Engineering and Design Manual, EM 1110-2-1902, October 31, 2003.
4. Koerner, Robert M., *Designing with Geosynthetics*, 5th Ed., Prentice-Hall, Inc., 2005.
5. SLIDE 2 (computer program for slope stability analyses), Rocscience Inc.
6. Das, Braja M., *Principles of Geotechnical Engineering*, 5th Ed., Brooks/Cole, 2002.
7. Gilbert, Robert B, *Peak Versus Residual Strength for Waste Containment Systems,* Proceedings the 15th GRI Conference on Hot Topics in Geosynthetics-II (Peak/Residual; RECMs; Installation; Concerns)
8. Cetco Lining Technologies, Laboratory Data Reports, Bentomat Direct Shear Testing Summary, Summary of Bentomat Direct Shear Test Data Internal, Revised 08/02
9. Bouzza, A., Zornberg, J.G., and Adam, D. *Geosynthetics in Waste Containment Facilities: Recent Advances*, 2002.

Solution: A. Slope stability analyses of the proposed slopes.

1. The locations of the critical sections selected for the stability analysis for the proposed slopes are shown on Sheets IIIE-A-7 and IIIE-A-8. Sections analyzed are also shown with the most critical failure surfaces for each of the analyses performed and the resulting factors of safety.

2. The soil profile used for each analysis was based on boring log data from previous site investigations from the undeveloped area of the site and the geologic cross sections (see Appendix IIIG-Geology Report). Generalized soil profiles for the site also are shown in Appendix IIIG-Geology Report of this application.

3. A summary table (IIIE-A-1) presents the assumed material weight and strength properties for the analyses performed for this appendix.

4. The material weight and strength parameter determination for each material type was based on laboratory testing results (Atterberg limits, natural moisture content, unit weight, percent finer than #200 sieve, and Standard Proctor), industry references and engineering judgment based on previous experience with similar materials. Laboratory testing results from previous investigations are included in Appendix IIIE-C.
5. The output from the slope stability analyses are presented in table IIIE-A-2, below.

B. Infinite slope stability of the proposed bottom liner, overliner, and final cover systems.

1. The anchor trench design for bottom liner installations is provided on Sheets IIIE-A-4-7 and 8.

2. Infinite slope stability analysis of the bottom liner system is provided on Sheets IIIE-A-4-9 through 12.

3. Infinite slope stability analysis of the overliner system is provided on Sheets IIIE-A-13 through 16.

4. Infinite slope stability analysis of the final cover system is provided on Sheets IIIE-A-17 through 20.

<u>**Conclusion:**</u> Based on the slope stability analyses provided in this Appendix, the proposed critical slopes for the excavation, overliner, and final cover conditions have adquate factors of safety to be considered stable. In addition, the infinite stability analysis demonstrates that the proposed liner system has adequate factors of safety to be considered stable. Lastly, this appendix presents the minimum strength parameters to be used during future cell and closure designs in selecting the appropriate liner and cover system components and geosynthetics.

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-A
SLOPE STABILITY ANALYSIS PARAMETER SELECTION

Table IIIE-A-1. Summary of Material Properties From SLIDE2 Slope Stability Analyses

Soil Description	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Stress		Total Stress	
			Cohesion (psf)	Angle of Internal Friction (degrees)	Cohesion (psf)	Angle of Internal Friction (degrees)
Final Cover Material	116	120	100	16	100	16
Waste (Overburden: 0-625 psf)	65	65	500	0	500	0
Waste (Overburden: > 625 psf)	65	65	0	33	0	33
Protective Cover	120	124	100	16	100	16
Clay Liner[1]	120	124	100	16	100	16
Compacted Fill	125	130	200	20	2,000	0
Sandstone	135	140	2,000	40	6,000	0
Weathered Shale	125	140	2,000	40	4,000	0
General Fill	116	120	250	30	1,000	0
A-Alluvium	125	130	300	25	3,500	0
B-Alluvium	125	130	600	22	3,500	0
Unweathered Shale[2]	135	140	UCS (psf)[3]	GSI[4]	m_i[5]	D[6]
			50,000	85	6	1

(1)A cohesion of 100 psf and internal friction angle of 16 degrees is used for the clay liner for Peak Stress in the Rankine Block method of the slope stability analysis. An adhesion of 80 psf and an interface friction angle of 8 degrees for the clay liner bottom slope and an adhesion of 80 psf and an interface friction angle of 8 degrees for the clay liner sideslope are used for the Residual Stress in the Rankine Block method of the slope stability analysis to represent the weakest interface of the liner system.

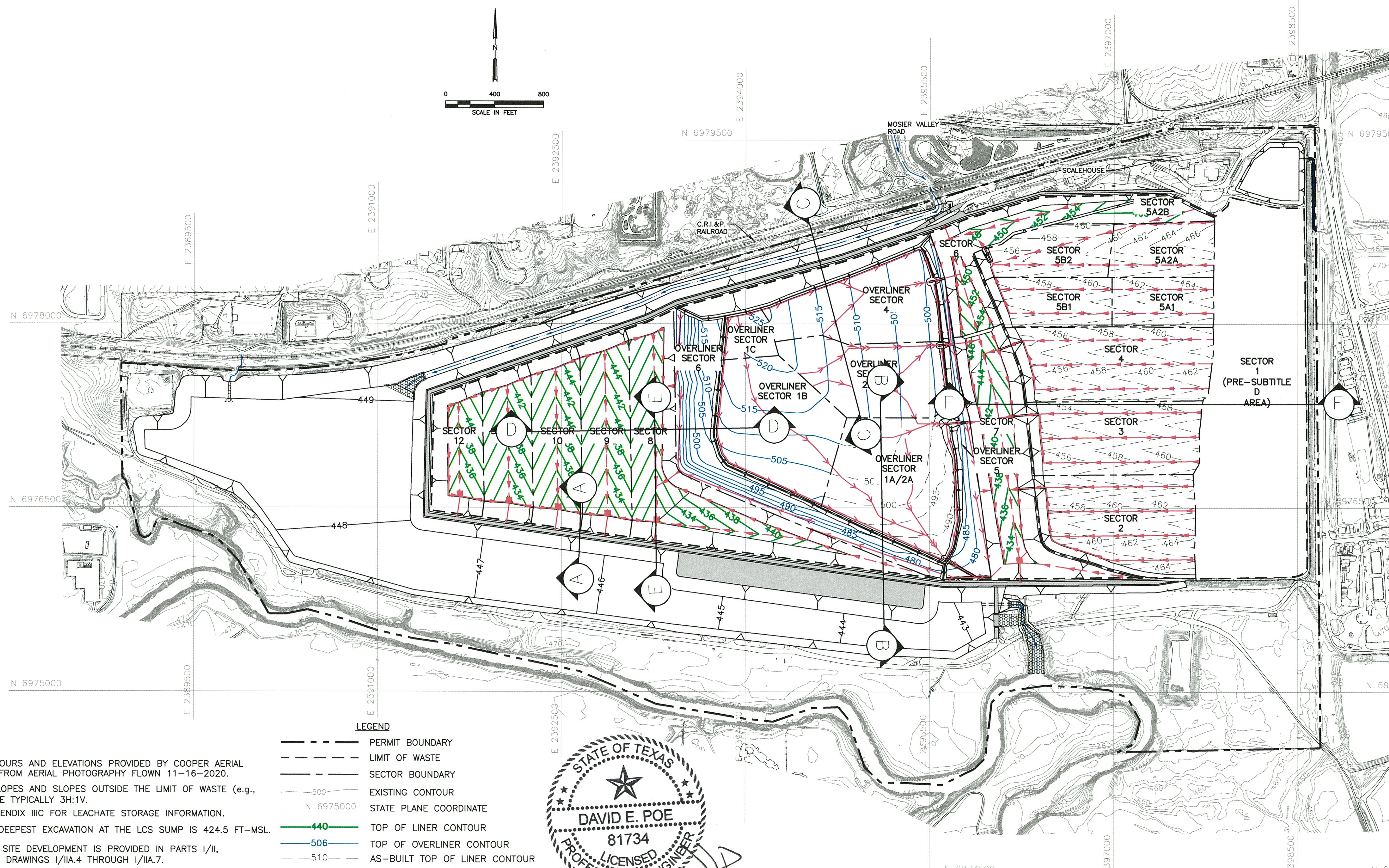
(2)Generalized Hoek-Brown model was used for Unweathered Shale layer.

(3)Unconfined Compression Strength. (4) Geological Strength Index of Unweathered Shale layer. (5) A material constant. (6) A factor which depends upon the degree of disturbance of the rock.

Table IIIE-A-2. SLIDE2 Stability Modeling Output

Analyzed Section-Run[1]	Method	Stress Condition				Factor of Safety Acceptable
		Effective Stress	Total Stress	Peak Stress	Residual Stress	
Recommended Min. Factor of Safety		1.5[2]	1.5[2]	1.5[2]	1.0[2]	
Excavation Slope A-1-Exterior	Bishop-Circular	**1.74**	**3.33**	-	-	YES
Excavation Slope A-2-Interior	Bishop-Circular	**1.65**	**3.30**	-	-	YES
Overliner B-1	Bishop-Circular	**2.22**	**2.36**	-	-	YES
Overliner B-2	Rankine-Block	-	-	**1.88**	**1.43**	YES
Overliner C-1	Bishop-Circular	**2.59**	**2.25**	-	-	YES
Overliner C-2	Rankine-Block	-	-	**1.97**	**1.54**	YES
Interim Slope D-1	Bishop-Circular	**1.94**	**1.94**	-	-	YES
Interim Slope D-2	Rankine-Block	-	-	**1.61**	**1.29**	YES
Final Cover E-1	Bishop-Circular	**2.67**	**2.53**	-	-	YES
Final Cover E-2	Rankine-Block	-	-	**2.07**	**1.62**	YES
Final Cover F-1	Bishop-Circular	**2.97**	**2.97**	-	-	YES
Final Cover F-2	Rankine-Block	-	-	**3.70**	**2.92**	YES

(1) For overliner, interim, and final cover configurations Run 1 represents circular failure, and Run 2 represents block failure.
(2) Recommended minimum factor of safety provided in Reference 3 on Sheet IIIE-A-3.



NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. REFER TO APPENDIX IIIC FOR LEACHATE STORAGE INFORMATION.
4. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 — EXISTING CONTOUR
- N 6975000 — STATE PLANE COORDINATE
- 440 — TOP OF LINER CONTOUR
- 506 — TOP OF OVERLINER CONTOUR
- 510 — AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- (A) — (A) SECTION LOCATION

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☐ DRAFT	
☒ FOR PERMITTING PURPOSES ONLY	
☐ ISSUED FOR CONSTRUCTION	
DATE: 03/2022	DRAWN BY: SRF
FILE: 0023-404-11	DESIGN BY: MB
CAD: SHEET IIIE-A-7.DWG	REVIEWED BY: DEP

Weaver Consultants Group
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REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
SLOPE STABILITY ANALYSIS
SECTION LOCATIONS 1

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TARRANT COUNTY, TEXAS

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SHEET IIIE-A-7

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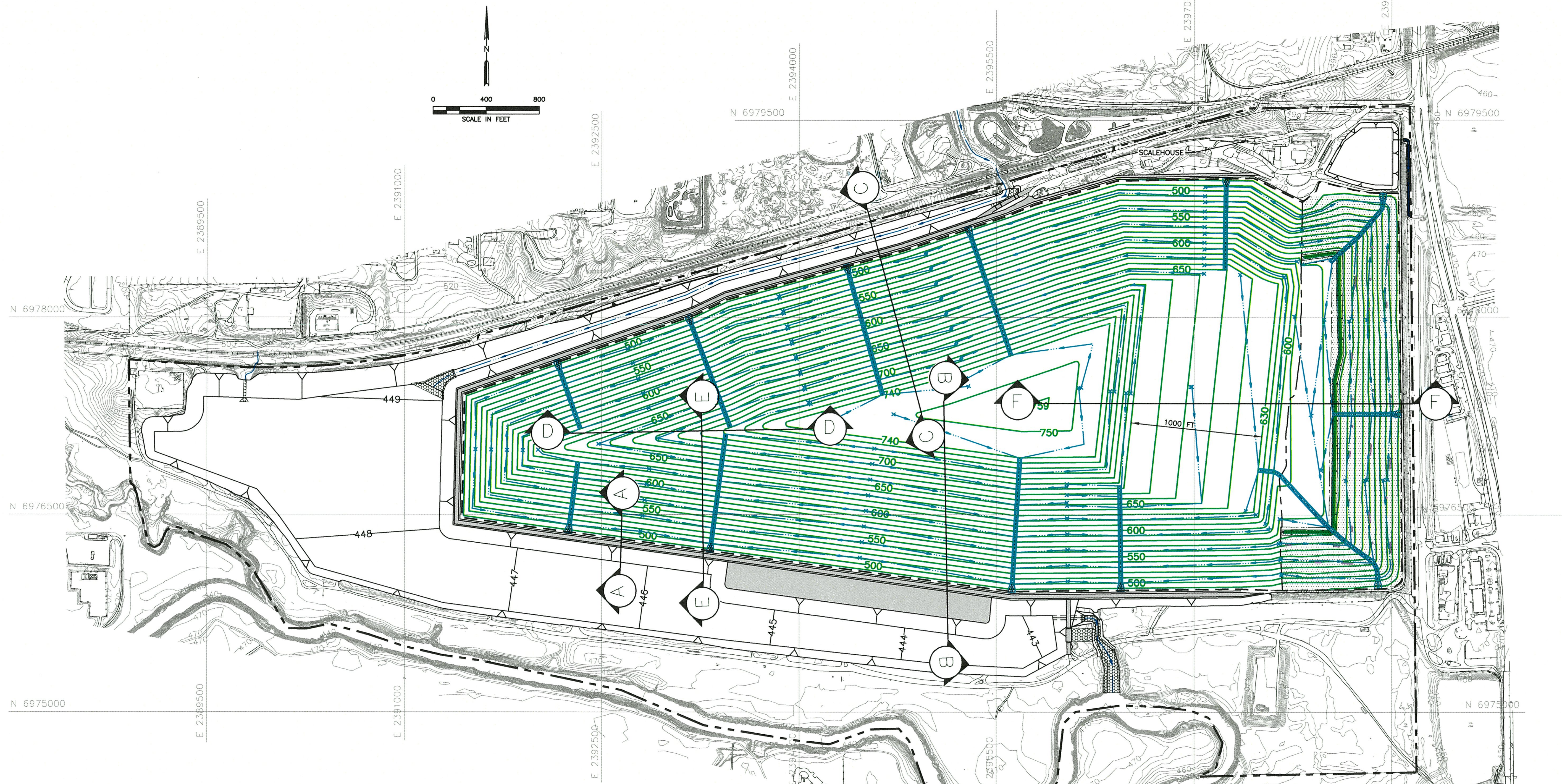

LEGEND

	PERMIT BOUNDARY
	LIMIT OF WASTE
	PRE–SUBTITLE D FINAL COVER LIMIT
500	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
550	FINAL COVER CONTOUR
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE LETDOWN
	EXISTING PRE–SUBTITLE D FINAL COVER
A — A	SECTION LOCATION

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.
2. PERMIT BOUNDARY PROVIDED BY GOLDER ASSOCIATES, INC.
3. REFER TO APPENDIX IIIF–SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
4. MAXIMUM FINAL COVER ELEVATION IS 759 FT–MSL. MAXIMUM TOP OF WASTE ELEVATION IS 757 FT–MSL.
5. TYPICAL SIDESLOPES ARE 4H:1V, TYPICAL TOPSLOPE IS 5%.

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DATE: 03/2022
FILE: 0023–404–96
CAD: SHEET IIIE–A–8.DWG

DRAWN BY: SRF
DESIGN BY: MB
REVIEWED BY: DEP

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SECTION LOCATIONS 2
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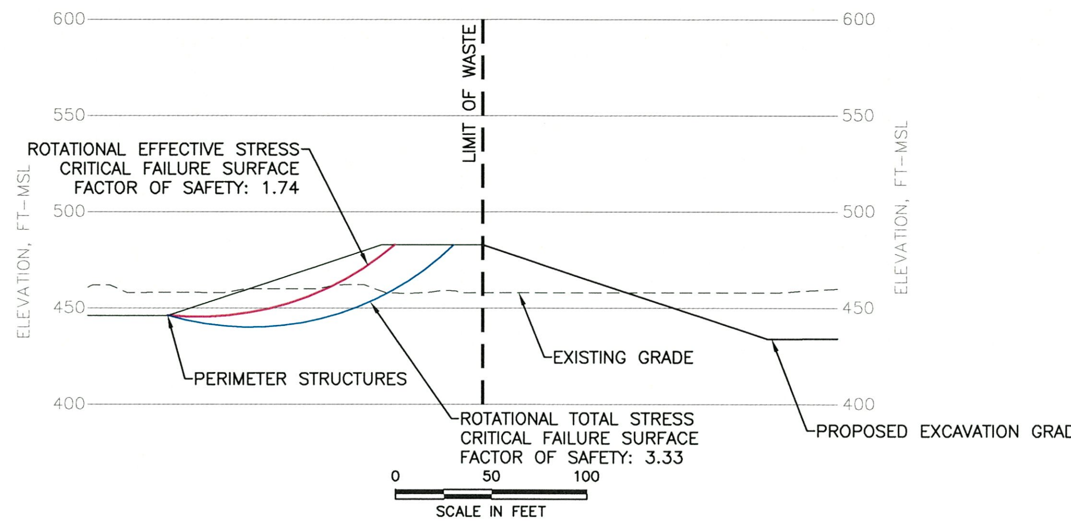
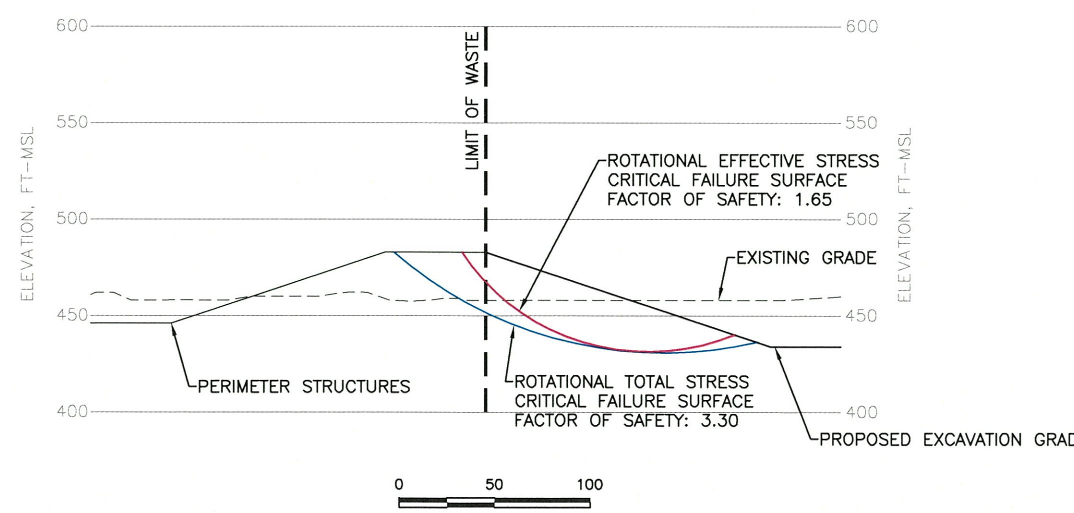
SHEET IIIE–A–8

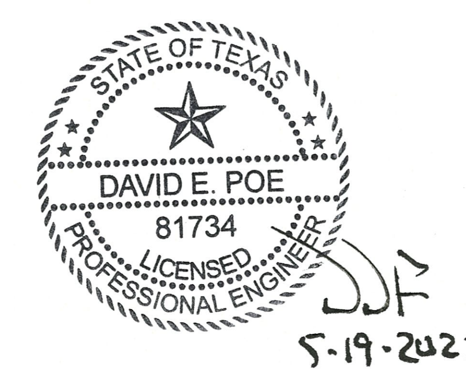
O:\0023\404\EXPANSION 2021\PART III\IIIE\SHEET IIIE-A-8.dwg, jwilson, 1:2

EXCAVATION SECTION A–A – EXTERIOR
MINIMUM FACTOR OF SAFETY (STATIC): 1.74



EXCAVATION SECTION A–A – INTERIOR
MINIMUM FACTOR OF SAFETY (STATIC): 1.65





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DATE: 12/2021
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CAD: SHEET IIIE-A-9.DWG

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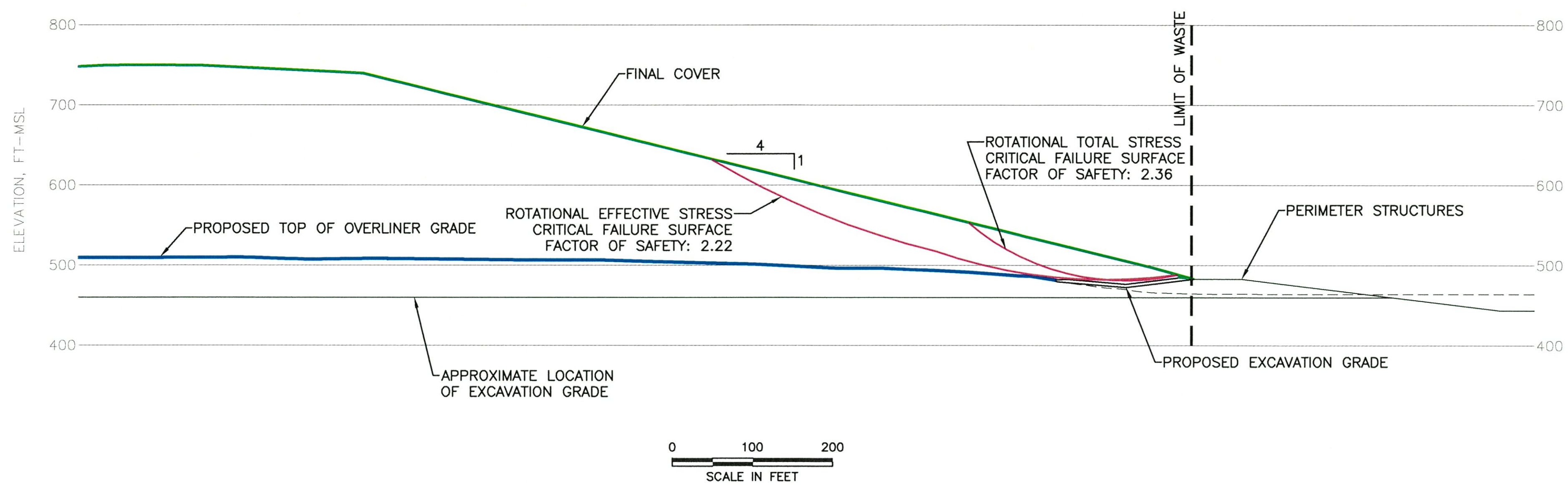
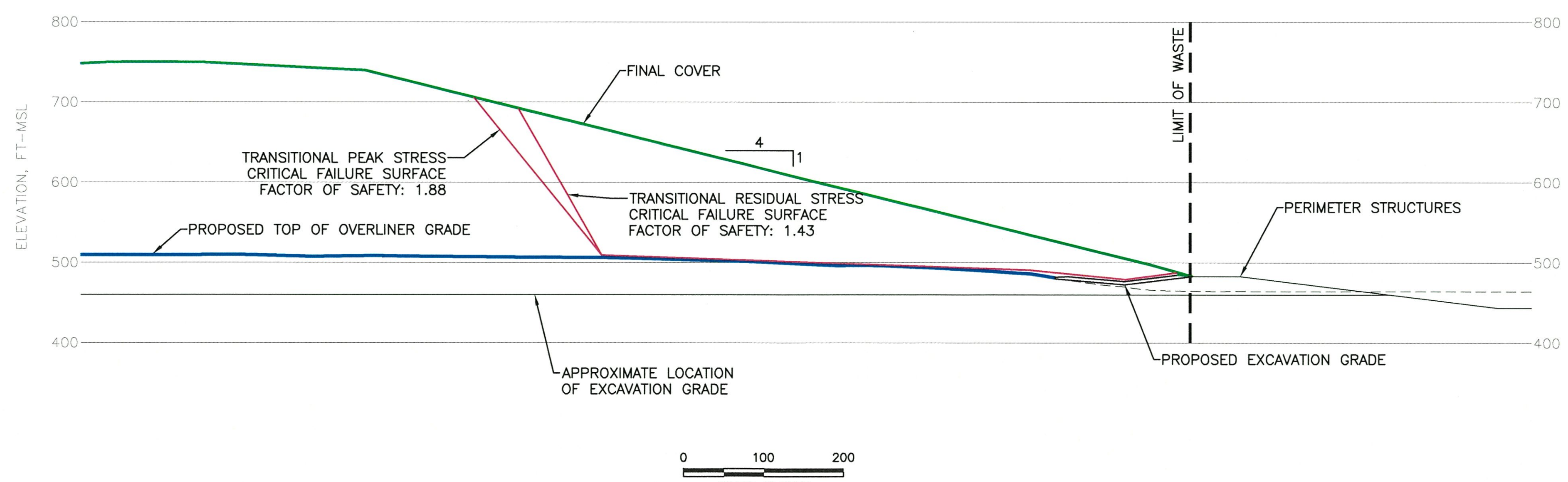
OVERLINER SECTION B–B
MINIMUM FACTOR OF SAFETY (STATIC): 2.22



OVERLINER SECTION B–B
MINIMUM FACTOR OF SAFETY (STATIC): 1.43



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SHEET IIIE-A-10

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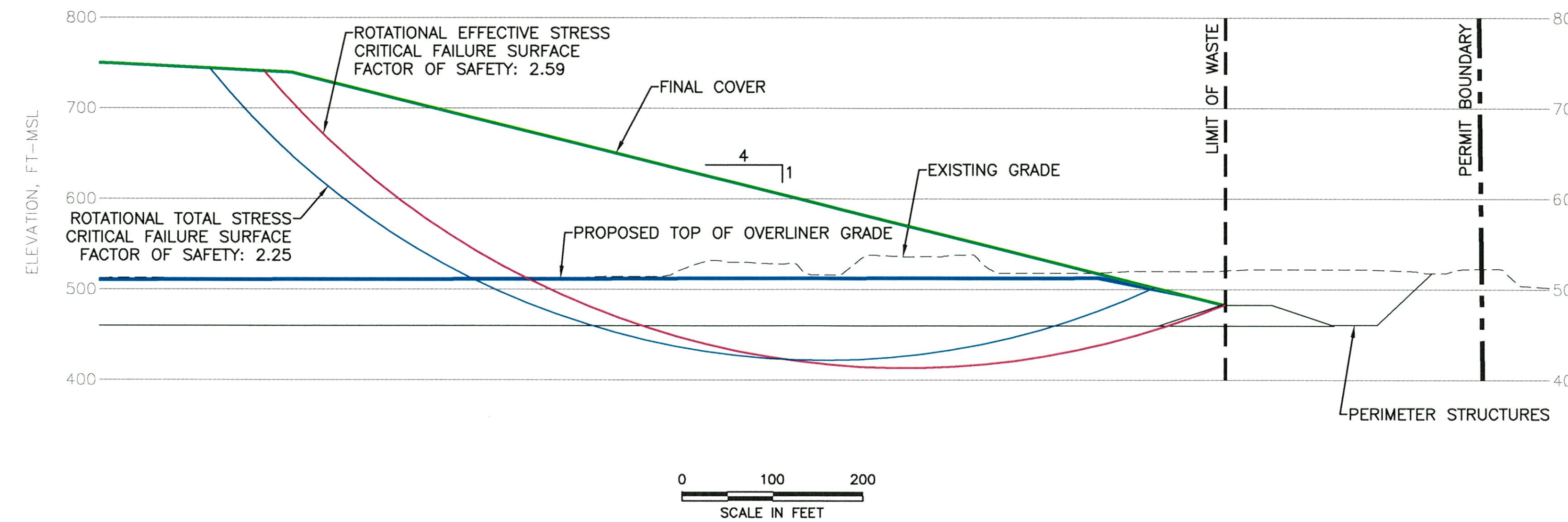
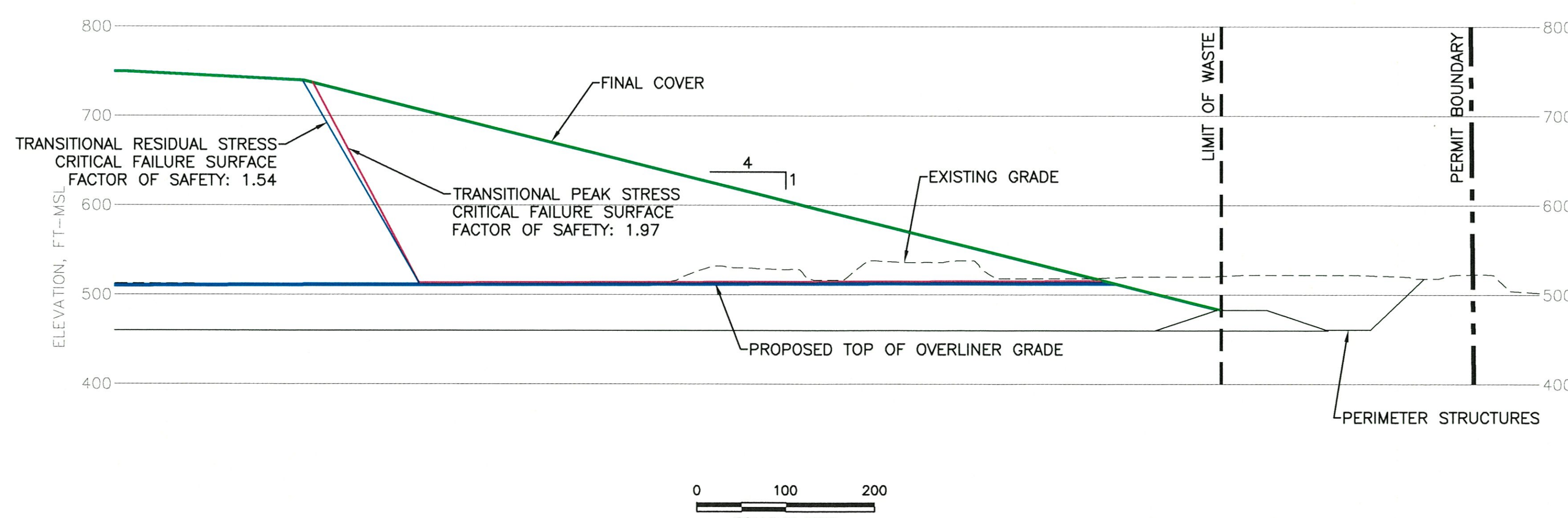
OVERLINER SECTION C–C
MINIMUM FACTOR OF SAFETY (STATIC): 2.25



OVERLINER SECTION C–C
MINIMUM FACTOR OF SAFETY (STATIC): 1.54



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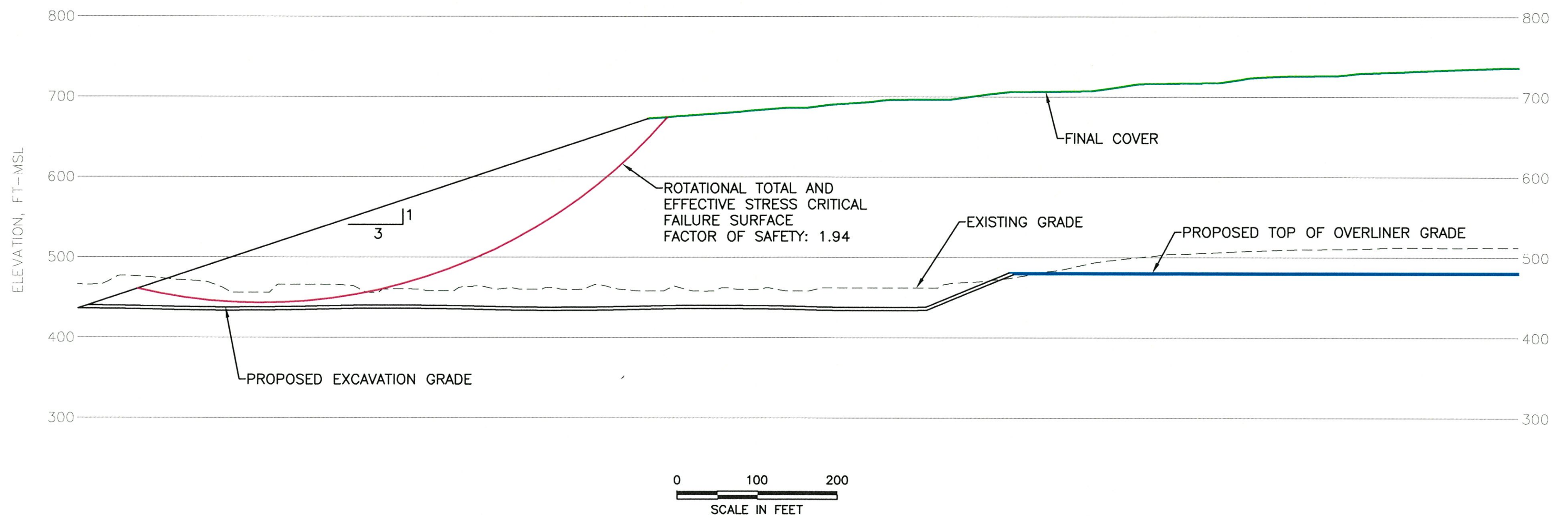
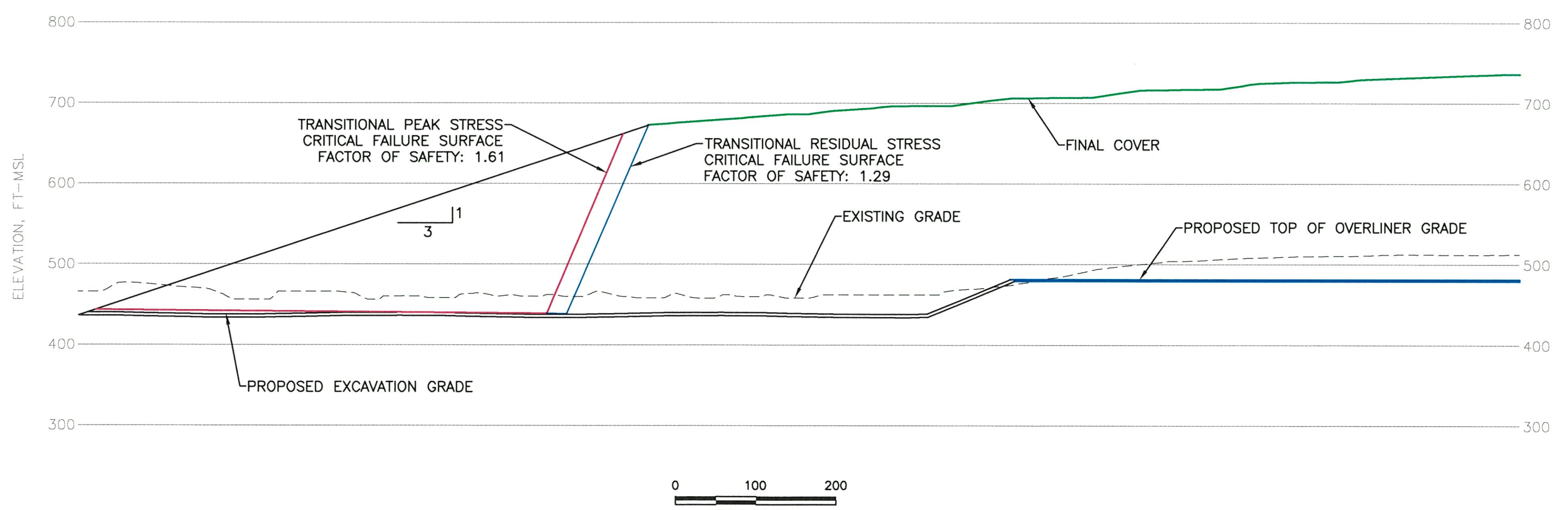
INTERIM SECTION D–D
MINIMUM FACTOR OF SAFETY (STATIC): 1.94



INTERIM SECTION D–D
MINIMUM FACTOR OF SAFETY (STATIC): 1.29



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FILE: 0023–404–11
CAD: SHEET IIIE–A–12.DWG

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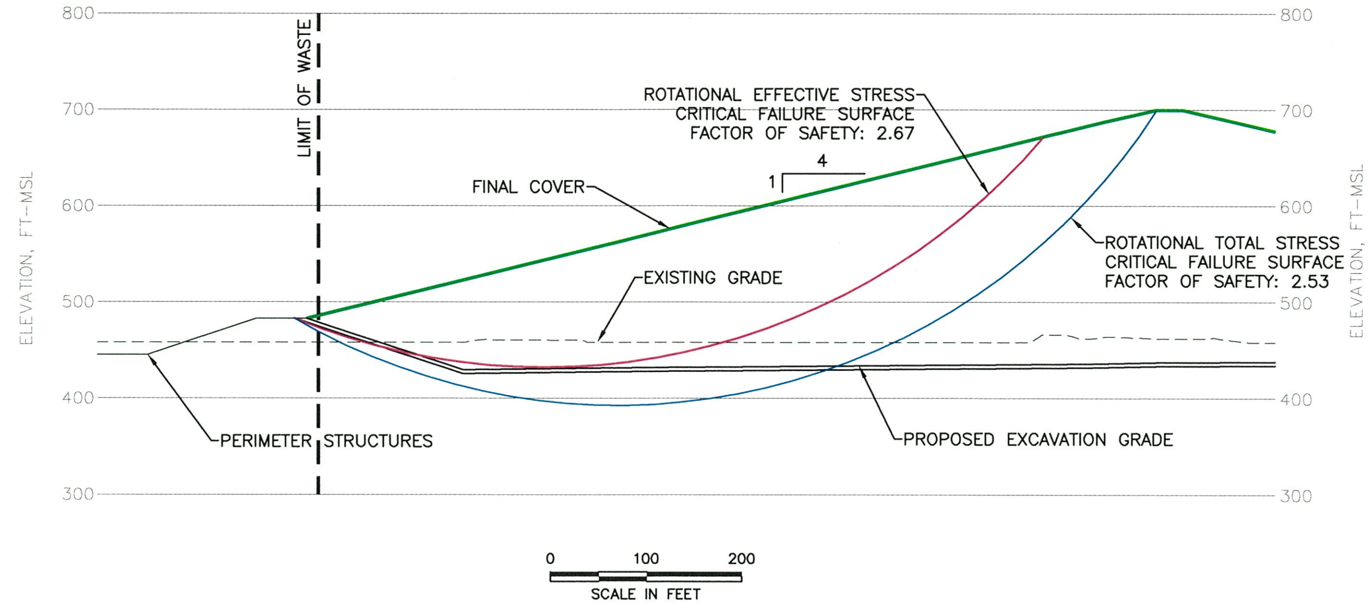
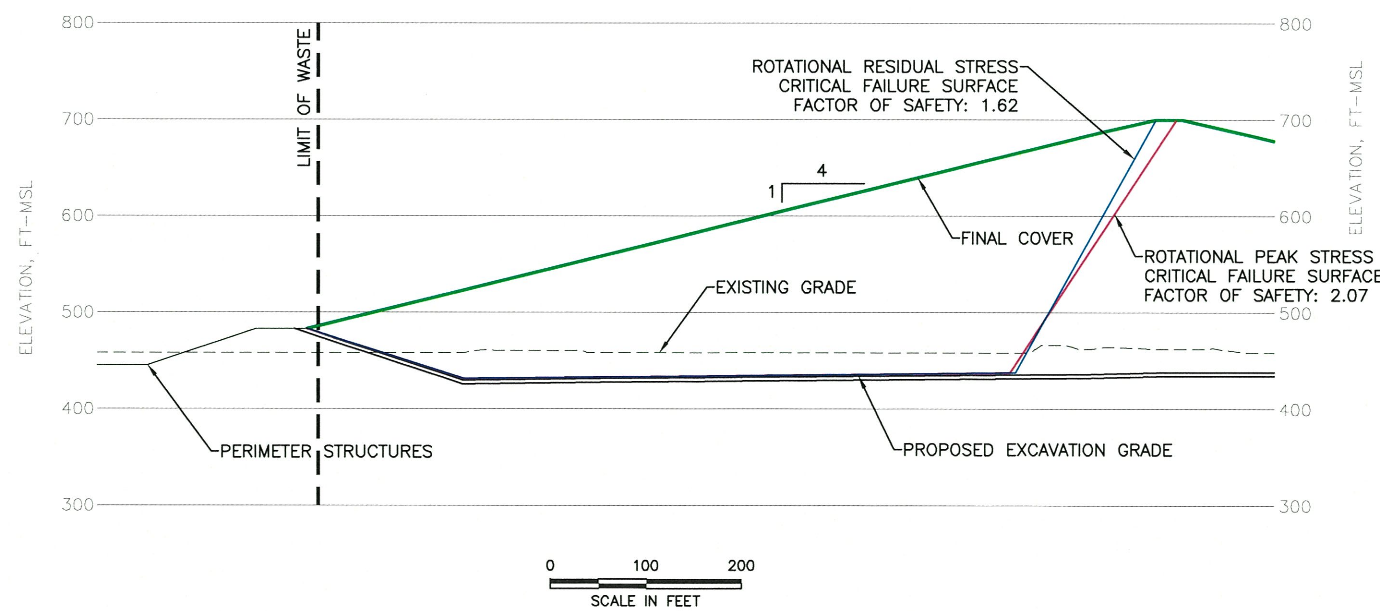
FINAL COVER SECTION E–E
MINIMUM FACTOR OF SAFETY (STATIC): 2.53



FINAL COVER SECTION E–E
MINIMUM FACTOR OF SAFETY (STATIC): 1.62



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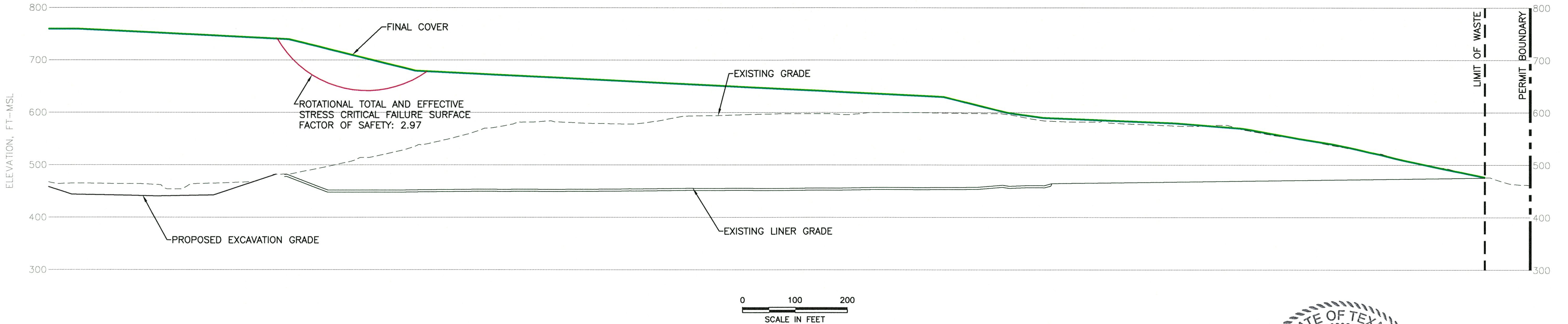
FINAL COVER SECTION F–F
MINIMUM FACTOR OF SAFETY (STATIC): 2.97



FINAL COVER SECTION F–F
MINIMUM FACTOR OF SAFETY (STATIC): 2.92

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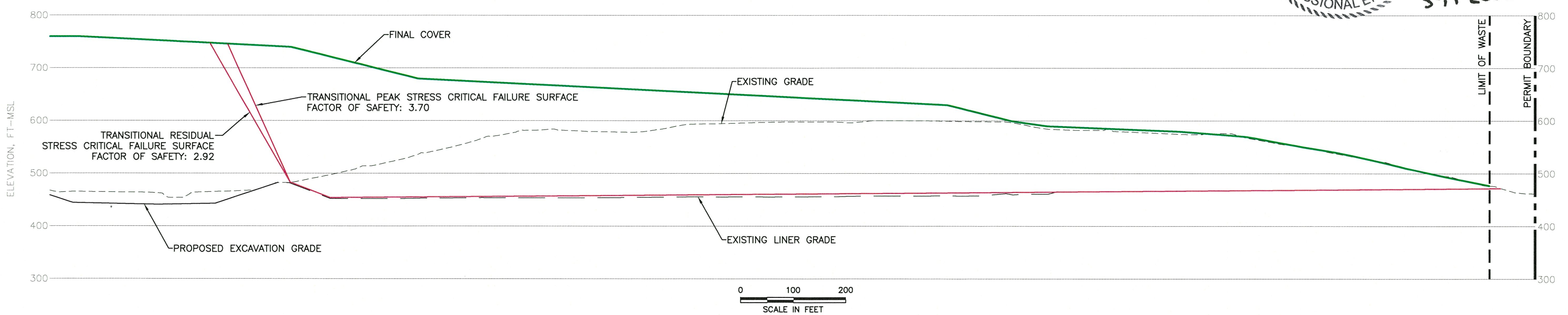

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DATE: 12/2021
FILE: 0023-404-11
CAD: SHEET IIIE-A-14.DWG

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DESIGN BY: MB
REVIEWED BY: DEP

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SHEET IIIE-A-14

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APPENDIX IIIE-A-1

LANDFILL EXCAVATION CONFIGURATION
STABILITY ANALYSIS
SLIDE2 OUTPUT FILES

Includes pages IIIE-A-1-1 through IIIE-A-1-21

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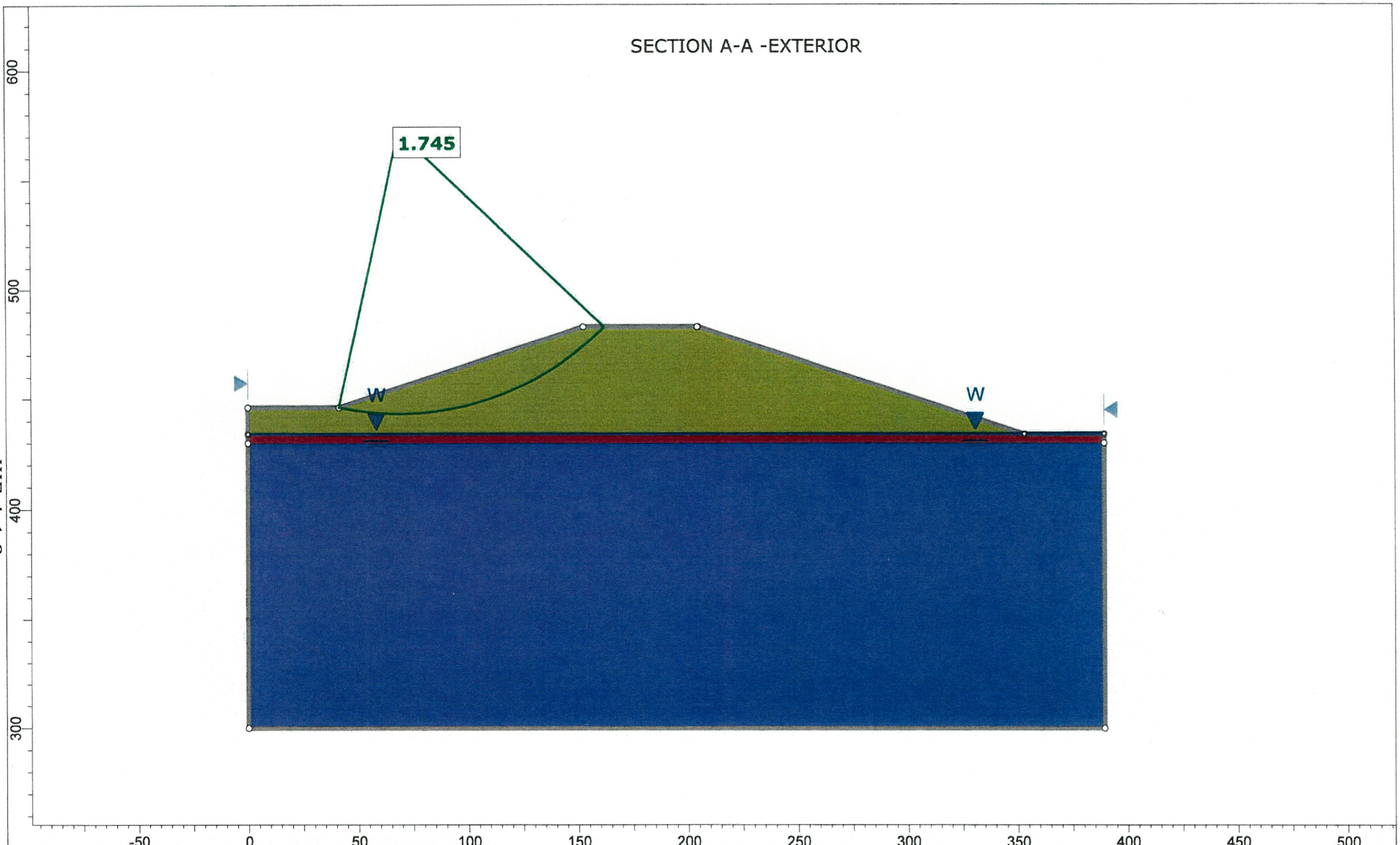
SLOPE STABILITY SECTION A-A
SLIDE2 OUTPUT RESULTS



Weaver Consultants Group	*Project* ARLINGTON LANDFILL		
	Group ENGINEERING	*Scenario* EFFECTIVE STRESS - CIRCULAR	
	Drawn By PREP BY: MB CHKD BY:DEP	*Company* WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	*Date* 12/23/2021	*File Name* Effective_Circular_Section_F.slmd	

Slide Analysis Information

Effective_Circular_Section_F

Project Summary

File Name:	Effective_Circular_Section_F.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.677s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

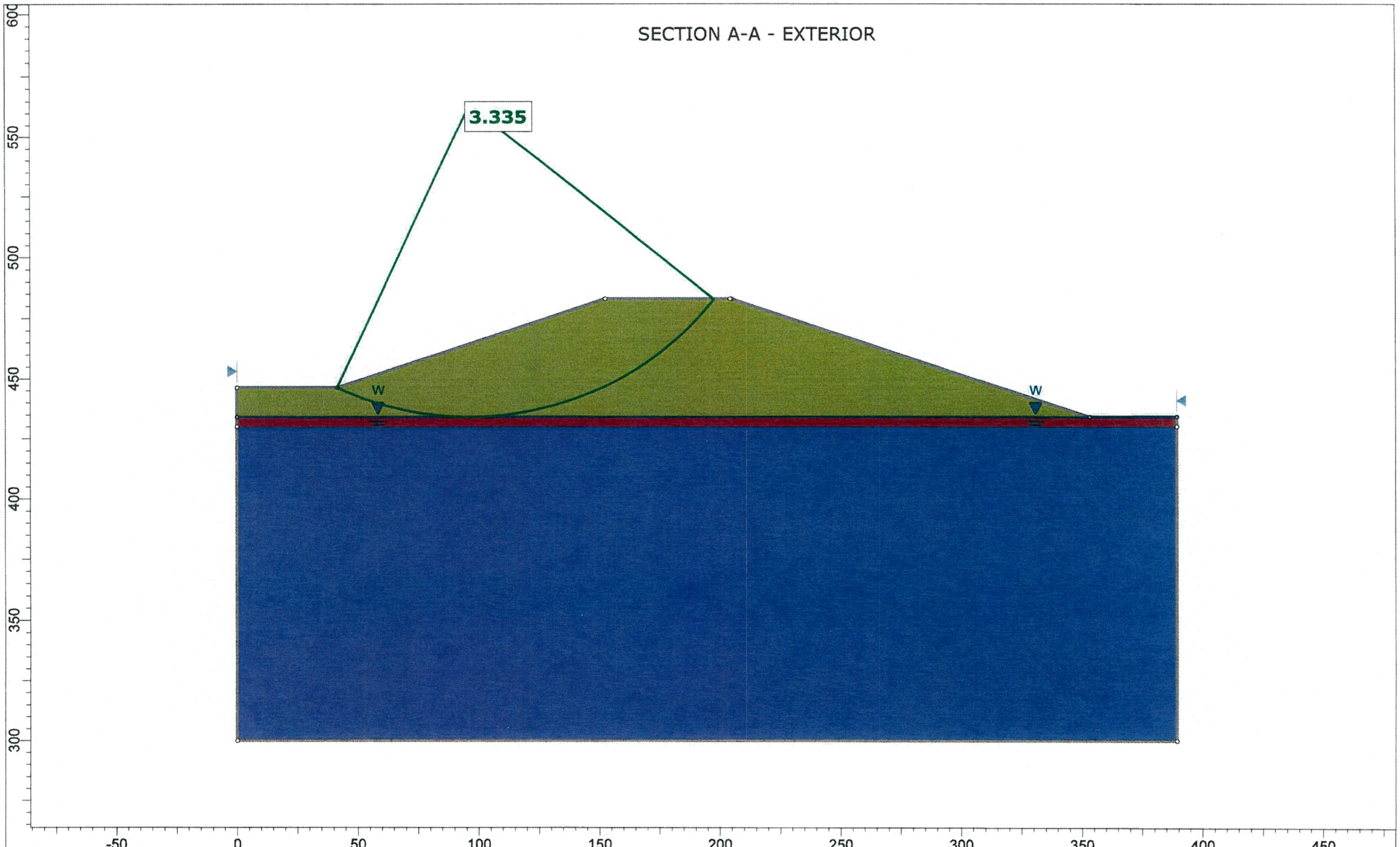
UNWEATHERED SHALE

Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Global Minimums

Method: bishop simplified

FS	1.745190
Center:	68.857, 572.486
Radius:	129.226
Left Slip Surface Endpoint:	41.412, 446.208
Right Slip Surface Endpoint:	162.086, 483.000
Resisting Moment:	1.25574e+07 lb-ft
Driving Moment:	7.1954e+06 lb-ft
Total Slice Area:	1576.12 ft2
Surface Horizontal Width:	120.674 ft
Surface Average Height:	13.061 ft



Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	TOTAL STRESS - CIRCULAR
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Total_Circular_Section_F.slmd

Weaver Consultants Group

SLIDEINTERPRET 9.018

Slide Analysis Information

Total_Circular_Section_F

Project Summary

File Name:	Total_Circular_Section_F.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.694s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
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Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

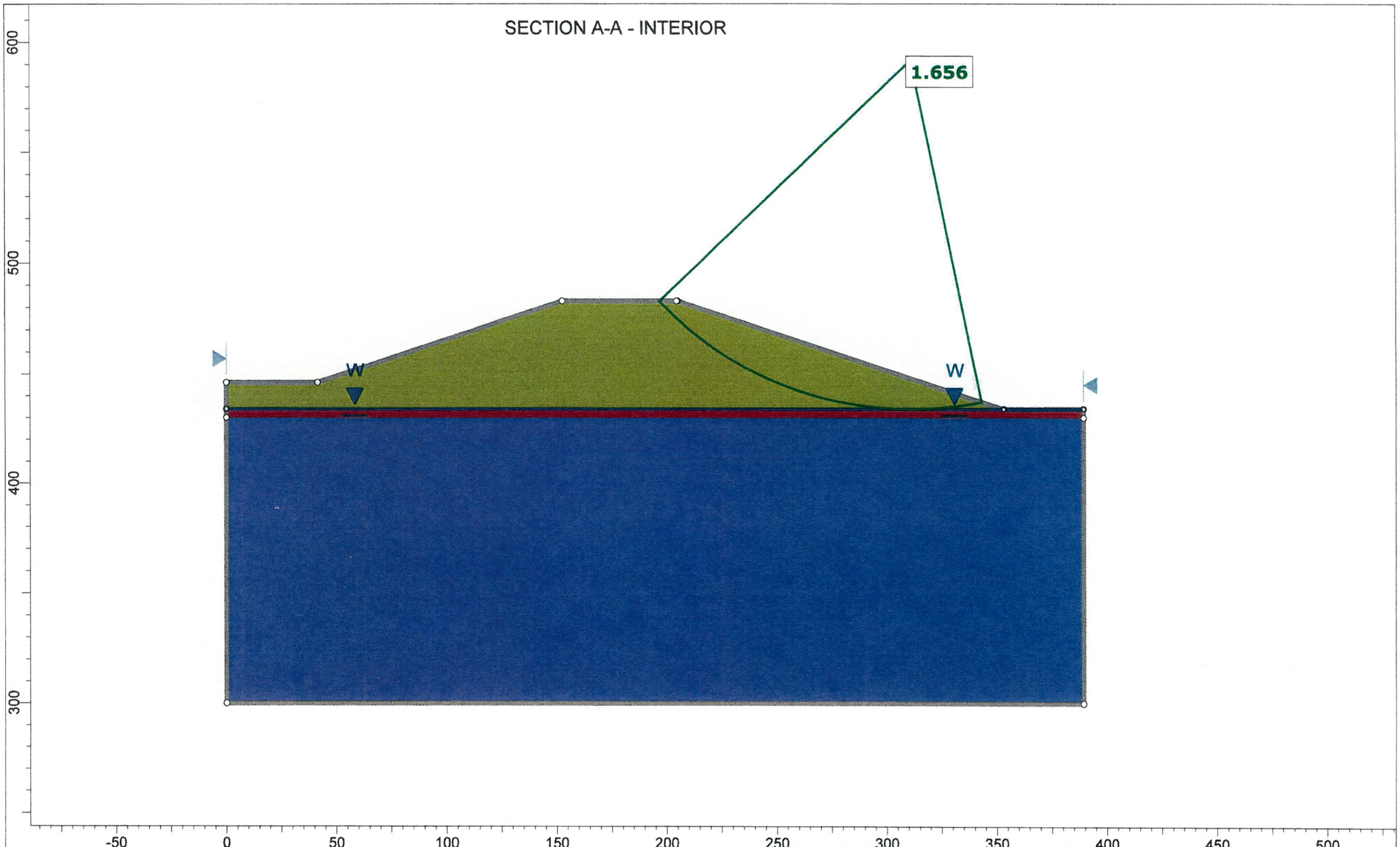
Materials

COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Global Minimums

Method: bishop simplified

FS	3.335150
Center:	96.344, 563.250
Radius:	129.271
Left Slip Surface Endpoint:	41.462, 446.208
Right Slip Surface Endpoint:	197.689, 483.000
Resisting Moment:	4.47672e+07 lb-ft
Driving Moment:	1.34229e+07 lb-ft
Total Slice Area:	3888.97 ft2
Surface Horizontal Width:	156.226 ft
Surface Average Height:	24.8932 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario	EFFECTIVE STRESS - CIRCULAR
	Drawn By: PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name	Effective_Circular_Section_F.slmd

Slide Analysis Information

Effective_Circular_Section_F

Project Summary

File Name:	Effective_Circular_Section_F.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.683s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

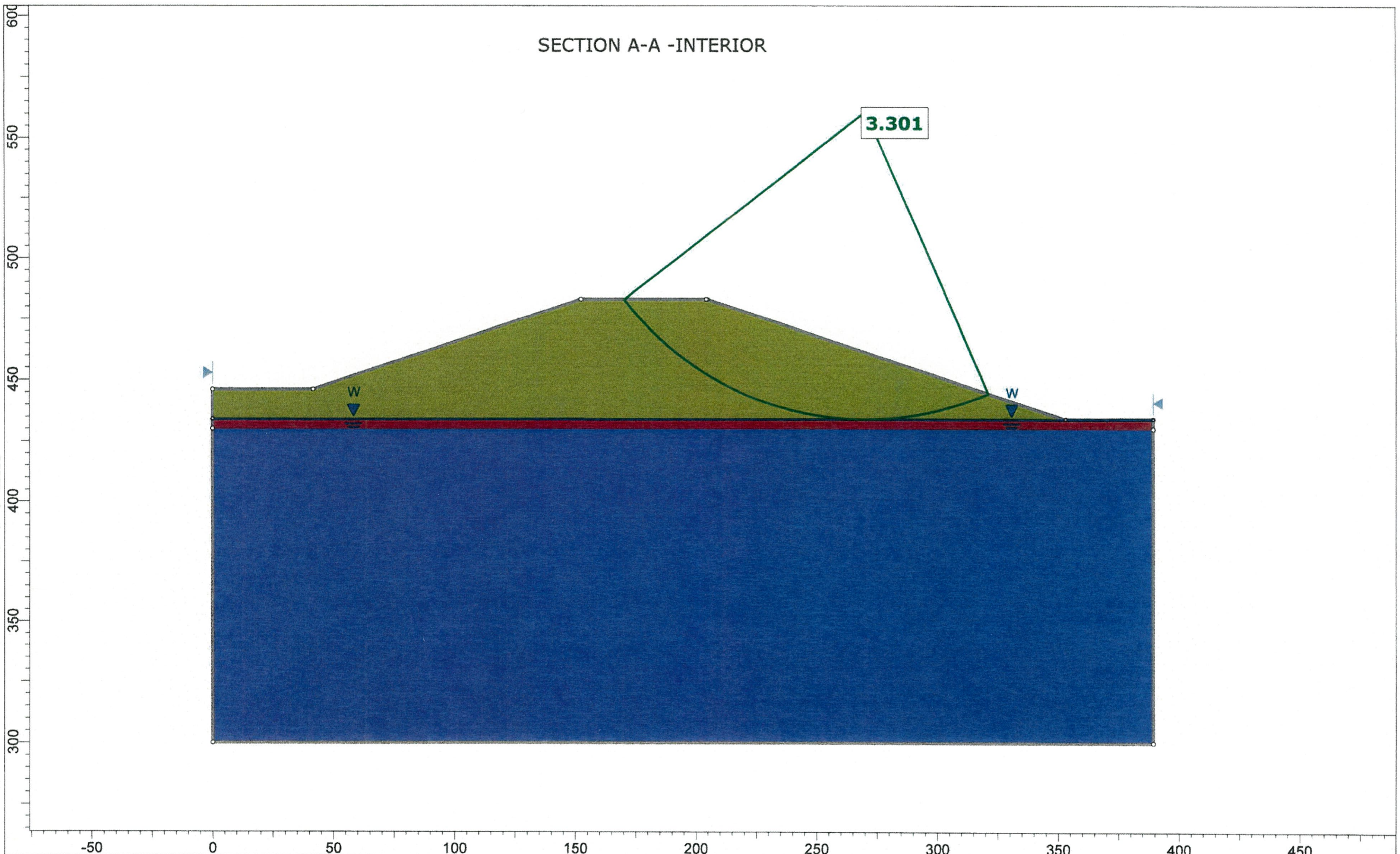
Materials

COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Global Minimums

Method: bishop simplified

FS	1.656340
Center:	311.045, 591.895
Radius:	157.906
Left Slip Surface Endpoint:	196.693, 483.000
Right Slip Surface Endpoint:	343.154, 437.287
Resisting Moment:	2.09711e+07 lb-ft
Driving Moment:	1.26611e+07 lb-ft
Total Slice Area:	2246 ft2
Surface Horizontal Width:	146.461 ft
Surface Average Height:	15.3351 ft



Weaver Consultants Group	Project: ARLINGTON LANDFILL		
	Group: ENGINEERING	Scenario: TOTAL STRESS - CIRCULAR	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Total_Circular_Section_F.slmd	

Slide Analysis Information

Total_Circular_Section_F

Project Summary

File Name:	Total_Circular_Section_F.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.725s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Global Minimums

Method: bishop simplified

FS	3.300790
Center:	270.486, 560.841
Radius:	126.858
Left Slip Surface Endpoint:	170.317, 483.000
Right Slip Surface Endpoint:	321.176, 444.550
Resisting Moment:	4.25237e+07 lb-ft
Driving Moment:	1.28829e+07 lb-ft
Total Slice Area:	3495.97 ft2
Surface Horizontal Width:	150.858 ft
Surface Average Height:	23.1739 ft

APPENDIX IIIE-A-2

OVERLINER SYSTEM LANDFILL CONFIGURATION
STABILITY ANALYSIS
SLIDE2 OUTPUT FILES

Includes pages IIIE-A-2-1 through IIIE-A-2-50

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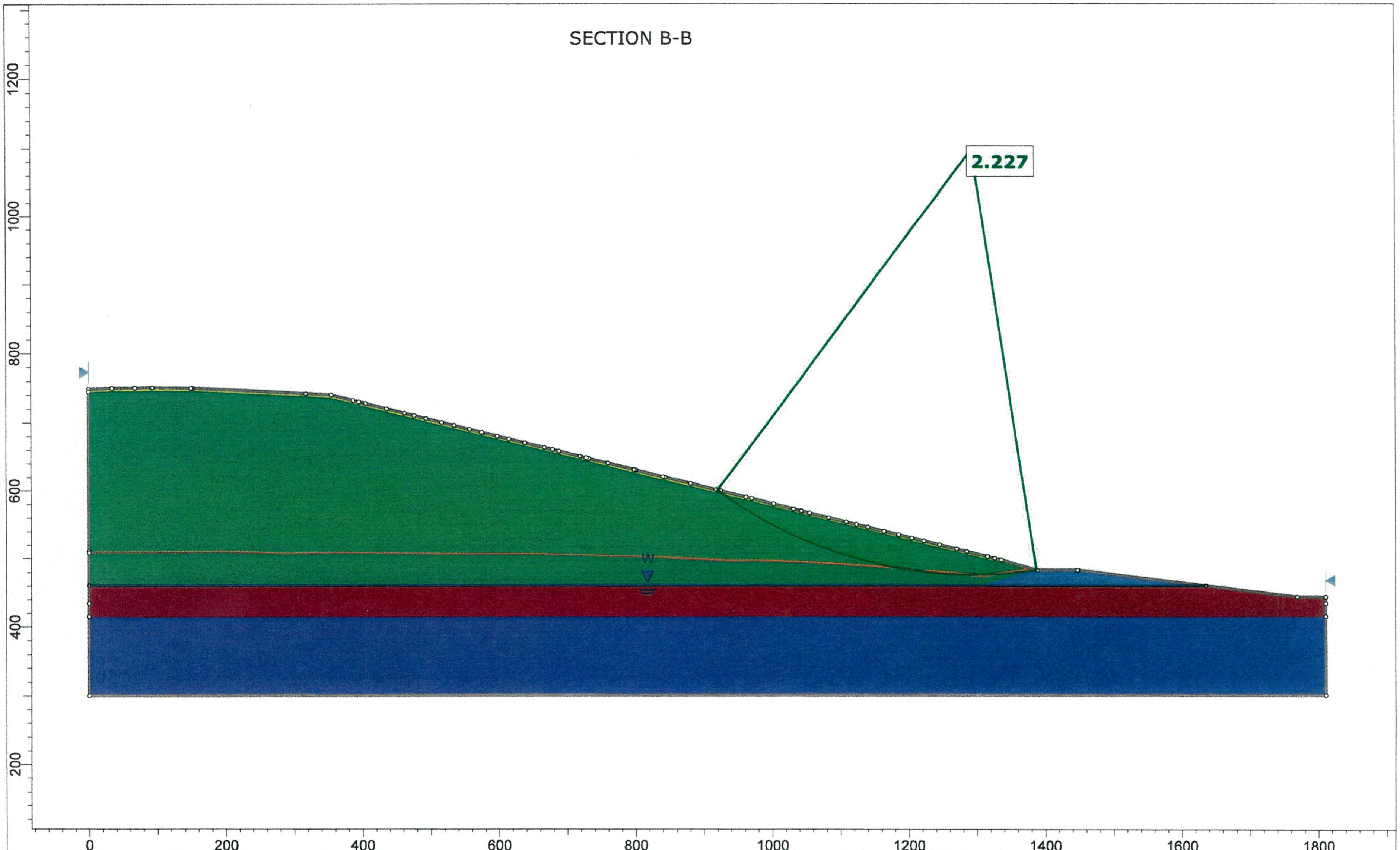
SLOPE STABILITY SECTION B-B – OVERLINER CONDITIONS
SLIDE2 OUTPUT RESULTS



Project	ARLINGTON LANDFILL
Group	ENGINEERING
Scenario	EFFECTIVE STRESS - CIRCULAR
Drawn By	PREP BY: MB CHKD BY:DEP
Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021
File Name	Effective_Circular.slmd

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SLIDEINTERPRET 9.018

Slide Analysis Information

Effective_Circular

Project Summary

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Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

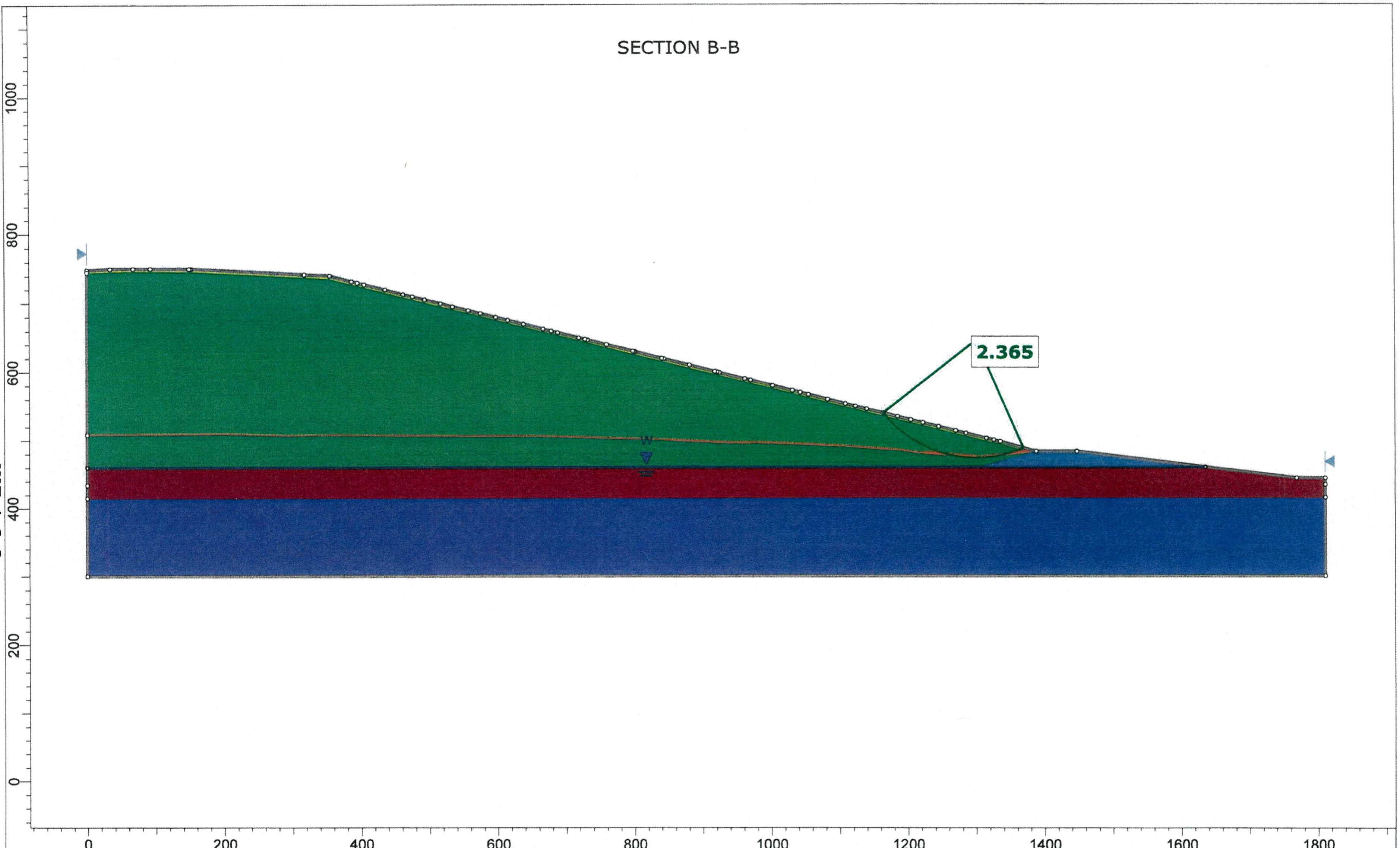
Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.227110
Center:	1293.256, 1097.415
Radius:	621.404
Left Slip Surface Endpoint:	920.593, 600.158
Right Slip Surface Endpoint:	1387.342, 483.175
Resisting Moment:	3.57163e+08 lb-ft
Driving Moment:	1.60371e+08 lb-ft
Total Slice Area:	16001.5 ft2
Surface Horizontal Width:	466.749 ft
Surface Average Height:	34.2829 ft

SECTION B-B



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario: TOTAL STRESS - CIRCULAR	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Total_Circular.slmd	

Slide Analysis Information

Total_Circular

Project Summary

File Name:	Total_Circular.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:01.486s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

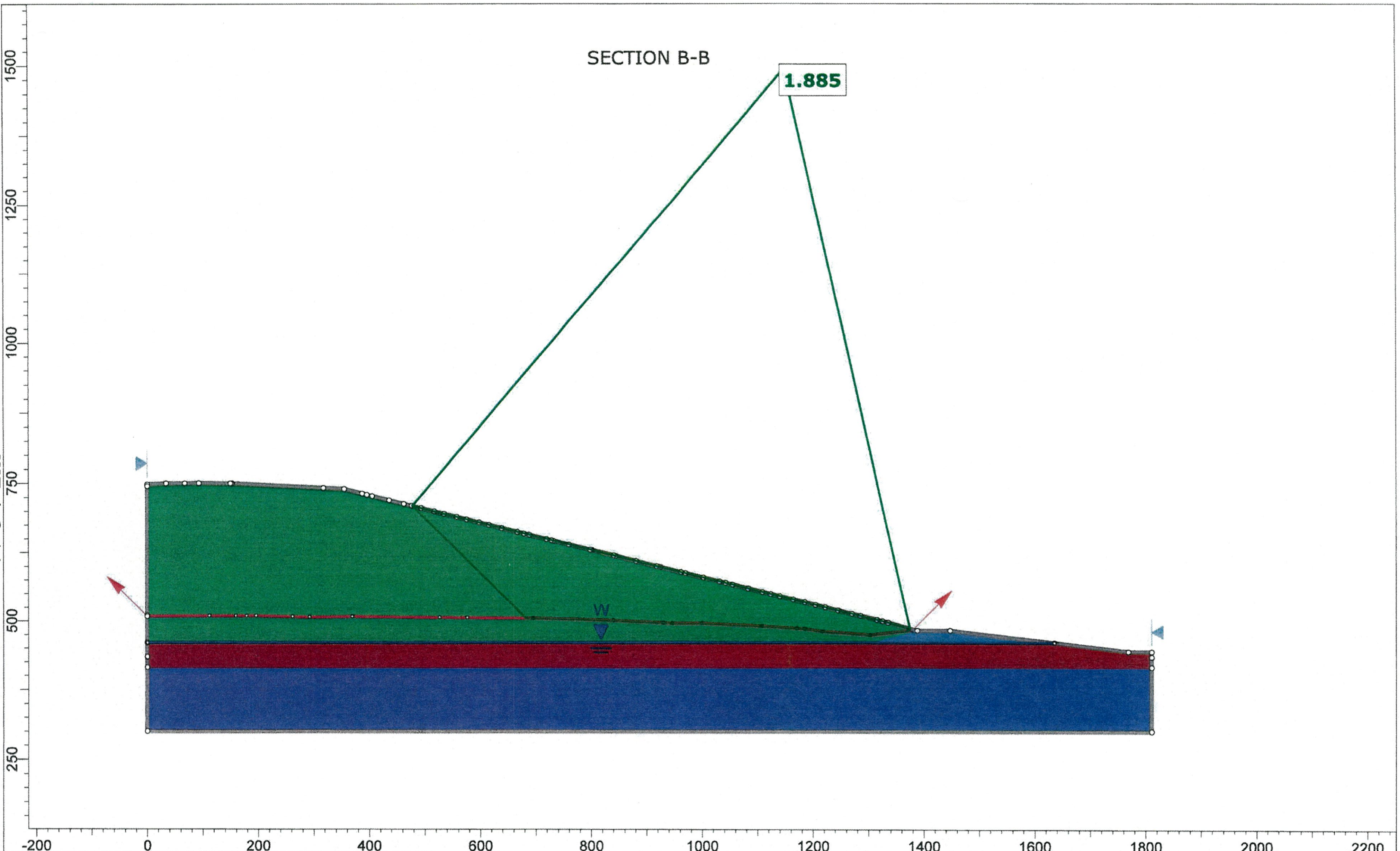
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.364560
Center:	1300.234, 645.647
Radius:	172.105
Left Slip Surface Endpoint:	1164.463, 539.881
Right Slip Surface Endpoint:	1369.565, 488.124
Resisting Moment:	3.25785e+07 lb-ft
Driving Moment:	1.37779e+07 lb-ft
Total Slice Area:	5331.33 ft2
Surface Horizontal Width:	205.102 ft
Surface Average Height:	25.9936 ft



Weaver Consultants Group	Project: ARLINGTON LANDFILL		
	Group: ENGINEERING	Scenario: PEAK STRESS - BLOCK	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Peak_Block.slmd	

Slide Analysis Information

Peak_Block

Project Summary

File Name:	Peak_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.601s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

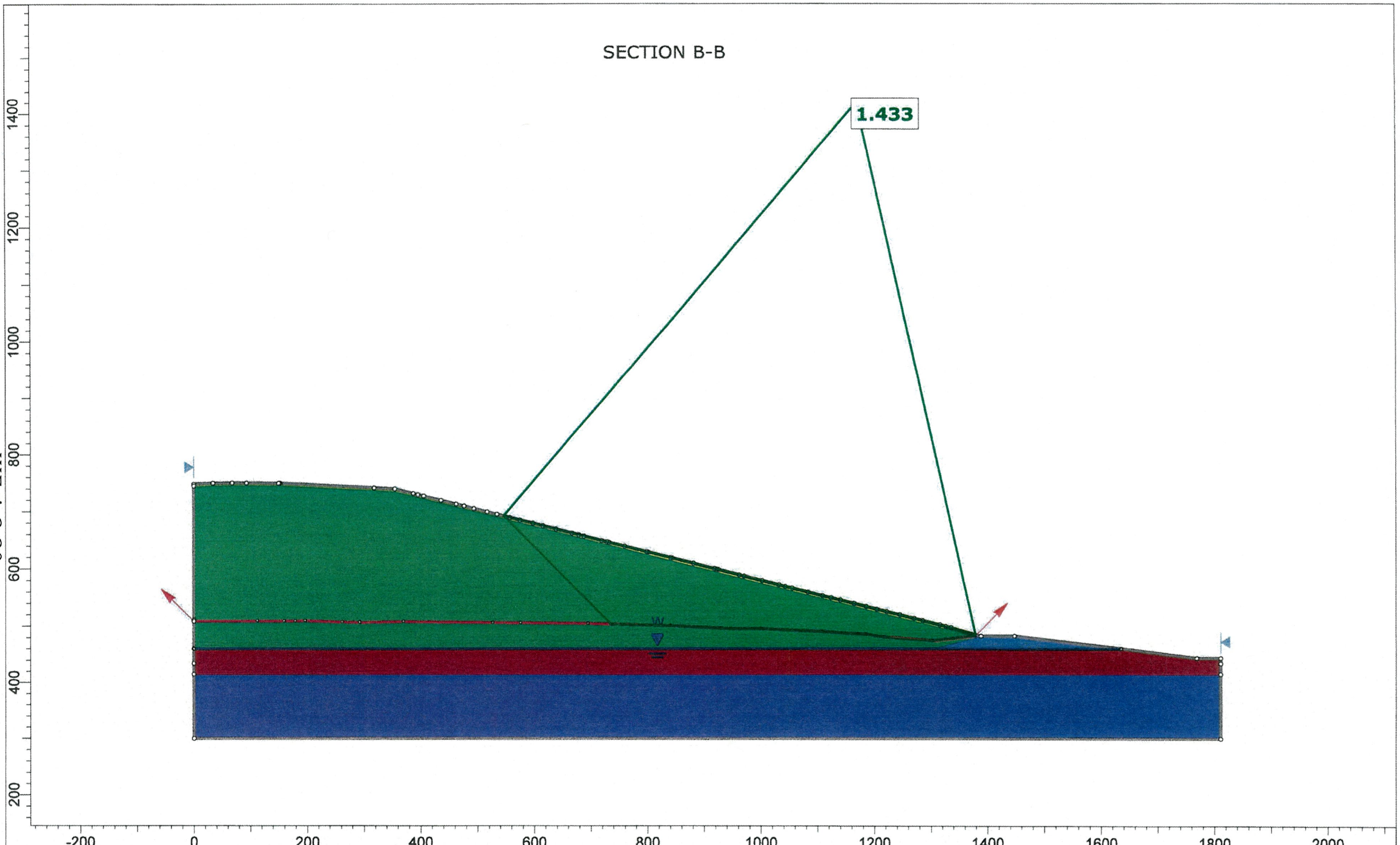
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.885460
Axis Location:	1149.299, 1495.172
Left Slip Surface Endpoint:	477.824, 709.595
Right Slip Surface Endpoint:	1374.875, 486.645
Resisting Moment:	1.9074e+09 lb-ft
Driving Moment:	1.01164e+09 lb-ft
Total Slice Area:	71863.9 ft2
Surface Horizontal Width:	897.051 ft
Surface Average Height:	80.1112 ft



Weaver Consultants Group

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	RESIDUAL STRESS - BLOCK
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Residual_Block.slmd

SLIDEINTERPRET 9.018

Slide Analysis Information

Residual_Block

Project Summary

File Name:	Residual_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.642s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	12
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	80
Friction Angle [deg]	10
Water Surface	None
Ru Value	0

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

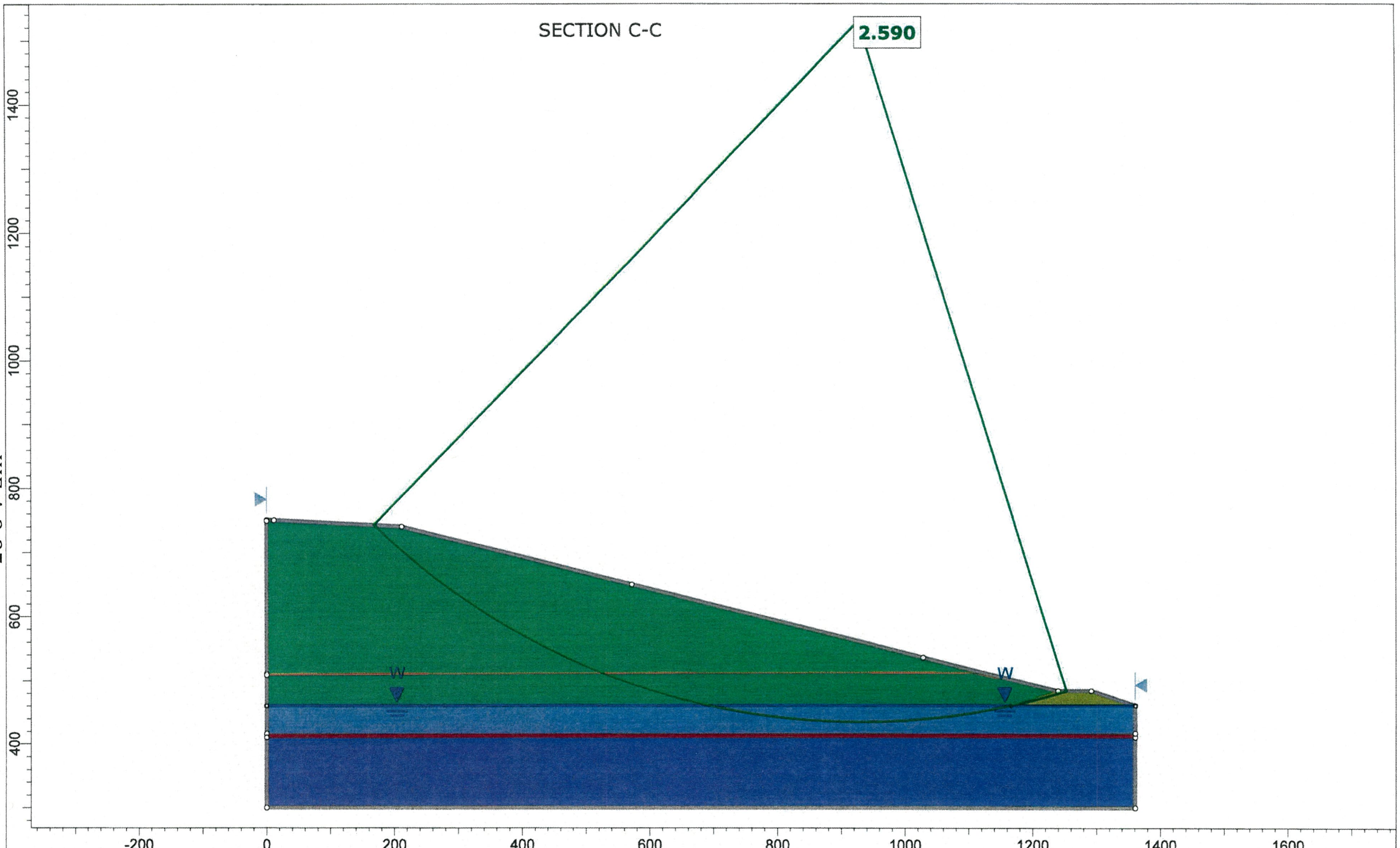
Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.433420
Axis Location:	1169.487, 1420.914
Left Slip Surface Endpoint:	546.655, 692.582
Right Slip Surface Endpoint:	1378.453, 485.650
Resisting Moment:	1.13374e+09 lb-ft
Driving Moment:	7.90934e+08 lb-ft
Total Slice Area:	61698.9 ft2
Surface Horizontal Width:	831.798 ft
Surface Average Height:	74.1753 ft

SLOPE STABILITY SECTION C-C – OVERLINER CONDITIONS
SLIDE2 OUTPUT RESULTS



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario: EFFECTIVE STRESS - CIRCULAR	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Effective_Circular_Section_C.slmd	

Slide Analysis Information

Effective_Circular_Section_C

Project Summary

File Name:	Effective_Circular_Section_C.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.945s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
ALLUVIUM	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	600
Friction Angle [deg]	22
Water Surface	Water Table
Hu Value	1
COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	

Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

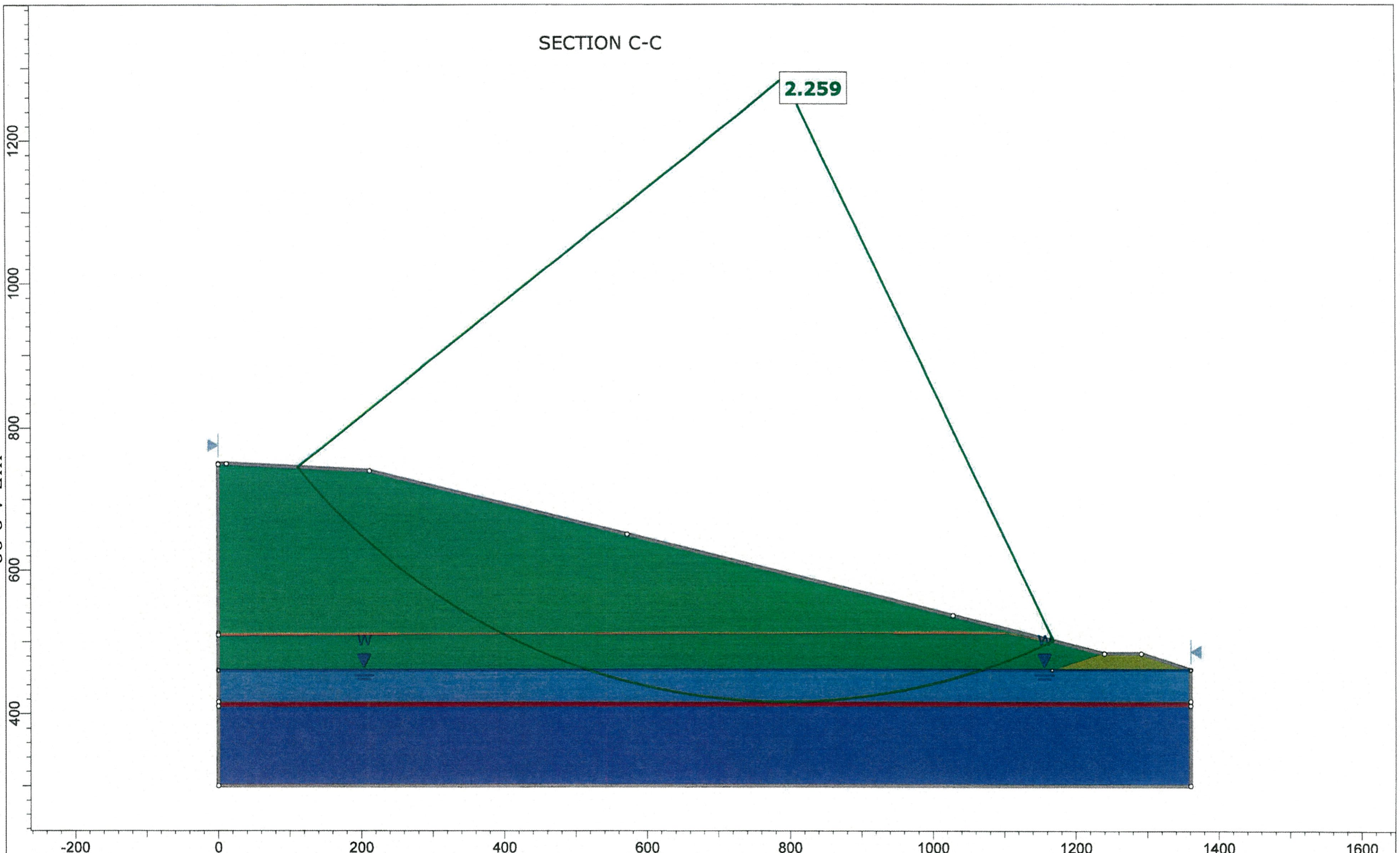
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.590190
Center:	929.582, 1529.071
Radius:	1094.999
Left Slip Surface Endpoint:	168.126, 742.173
Right Slip Surface Endpoint:	1253.319, 483.023
Resisting Moment:	4.83902e+09 lb-ft
Driving Moment:	1.86821e+09 lb-ft
Total Slice Area:	117953 ft2
Surface Horizontal Width:	1085.19 ft
Surface Average Height:	108.693 ft



Weaver Consultants Group	Project: ARLINGTON LANDFILL		
	Group: ENGINEERING	Scenario: TOTAL STRESS - CIRCULAR	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Total_Circular_Section_C.slmd	

Slide Analysis Information

Total_Circular_Section_C

Project Summary

File Name:	Total_Circular_Section_C.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.960s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

ALLUVIUM

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	3500
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	

Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

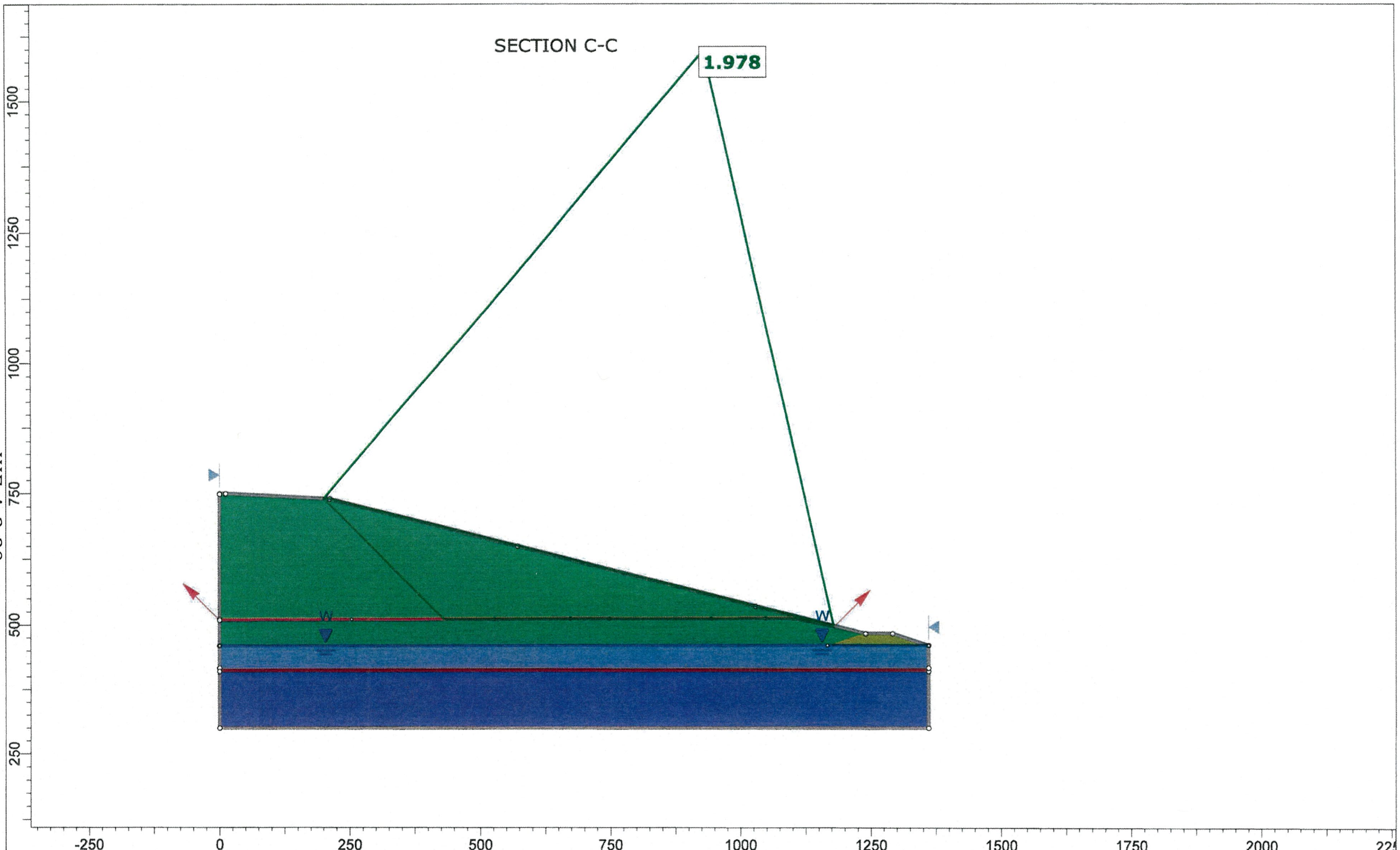
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.259280
Center:	793.563, 1287.788
Radius:	871.944
Left Slip Surface Endpoint:	111.147, 745.022
Right Slip Surface Endpoint:	1168.834, 500.731
Resisting Moment:	3.95979e+09 lb-ft
Driving Moment:	1.75268e+09 lb-ft
Total Slice Area:	149990 ft2
Surface Horizontal Width:	1057.69 ft
Surface Average Height:	141.809 ft



Weaver Consultants Group

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	PEAK STRESS - BLOCK
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Peak_Block.slmd

SLIDEINTERPRET 9.018

Slide Analysis Information

Peak_Block

Project Summary

File Name:	Peak_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.464s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

ALLUVIUM

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	3500
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	

Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

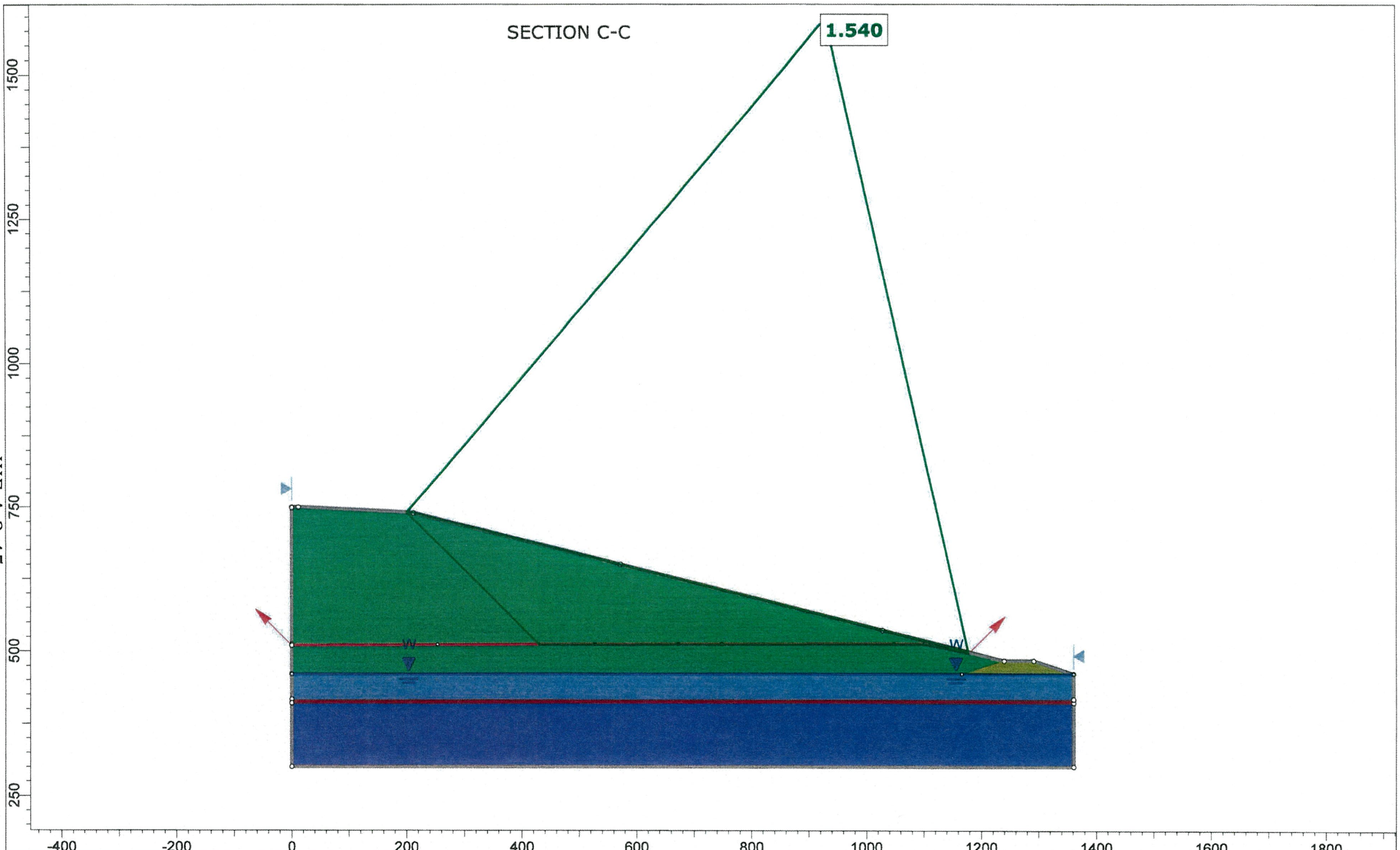
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.977560
Axis Location:	931.605, 1596.910
Left Slip Surface Endpoint:	200.736, 740.543
Right Slip Surface Endpoint:	1178.178, 498.395
Resisting Moment:	2.35571e+09 lb-ft
Driving Moment:	1.19122e+09 lb-ft
Total Slice Area:	80606.2 ft2
Surface Horizontal Width:	977.441 ft
Surface Average Height:	82.4665 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario: RESIDUAL STRESS - BLOCK	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Residual_Block.slmd	

Slide Analysis Information

Residual_Block

Project Summary

File Name:	Residual_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.378s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	12
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	80
Friction Angle [deg]	10
Water Surface	None
Ru Value	0
ALLUVIUM	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	600
Friction Angle [deg]	22
Water Surface	Water Table
Hu Value	1
COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	

Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	
Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

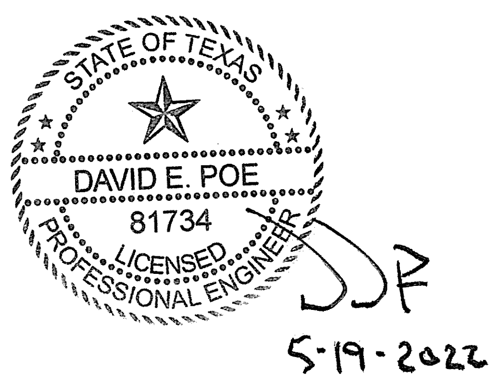
Method: bishop simplified

FS	1.540390
Axis Location:	930.920, 1596.479
Left Slip Surface Endpoint:	200.499, 740.555
Right Slip Surface Endpoint:	1177.407, 498.588
Resisting Moment:	1.79155e+09 lb-ft
Driving Moment:	1.16305e+09 lb-ft
Total Slice Area:	80612.3 ft2
Surface Horizontal Width:	976.908 ft
Surface Average Height:	82.5178 ft

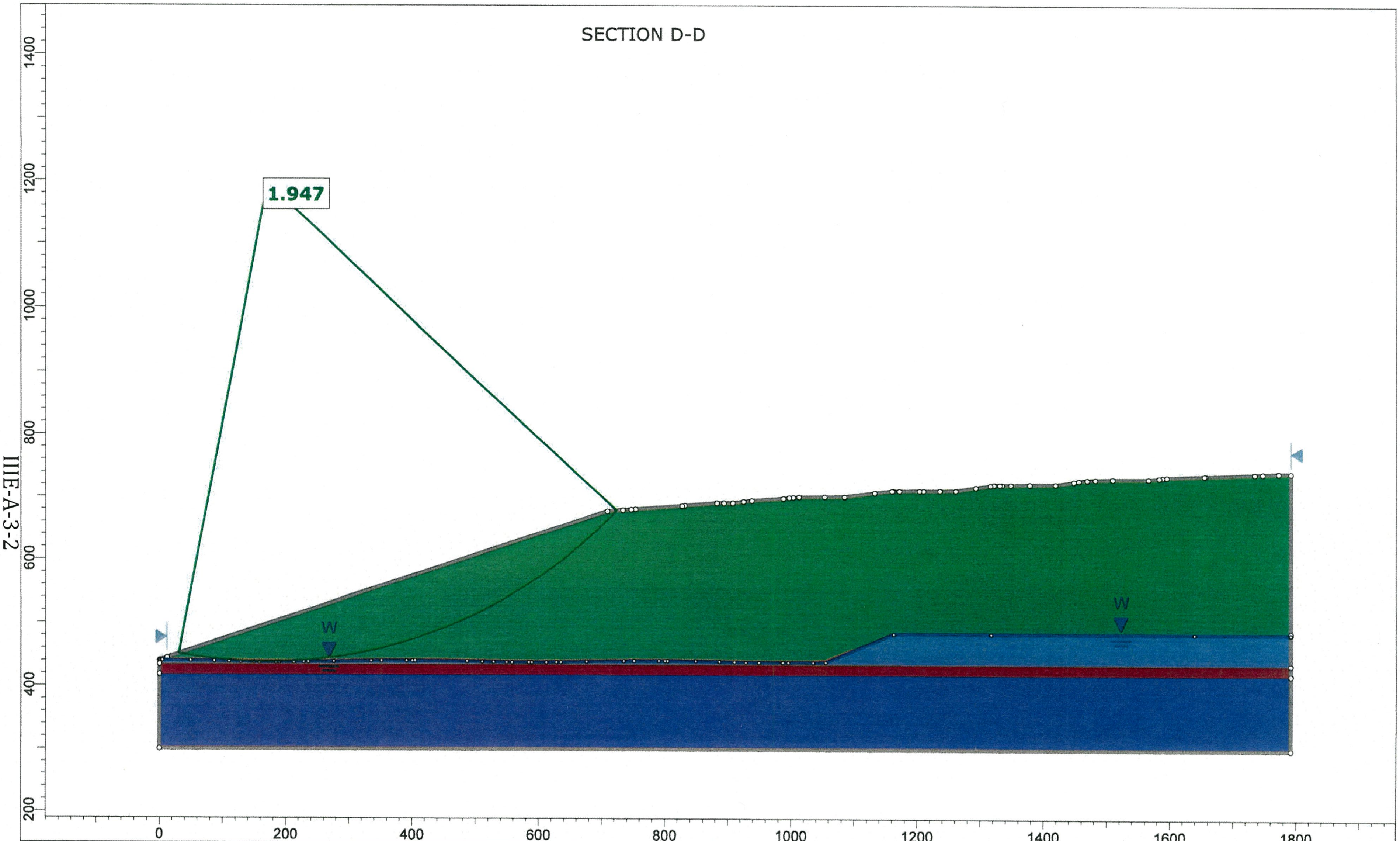
APPENDIX IIIE-A-3

INTERIM AND FINAL CLOSURE CONFIGURATION
STABILITY ANALYSIS
SLIDE2 OUTPUT FILES

Includes pages IIIE-A-3-1 through IIIE-A-3-75



SLOPE STABILITY SECTION D-D – INTERIM FILL SLOPE CONDITIONS
SLIDE2 OUTPUT RESULTS



Weaver Consultants Group

SLIDEINTERPRET 9.018

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	EFFECTIVE STRESS - CIRCULAR
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Effective_Circular_Section_D.slmd

Slide Analysis Information

Effective_Circular_Section_D

Project Summary

File Name:	Effective_Circular_Section_D.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:01.364s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

SANDSTONE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

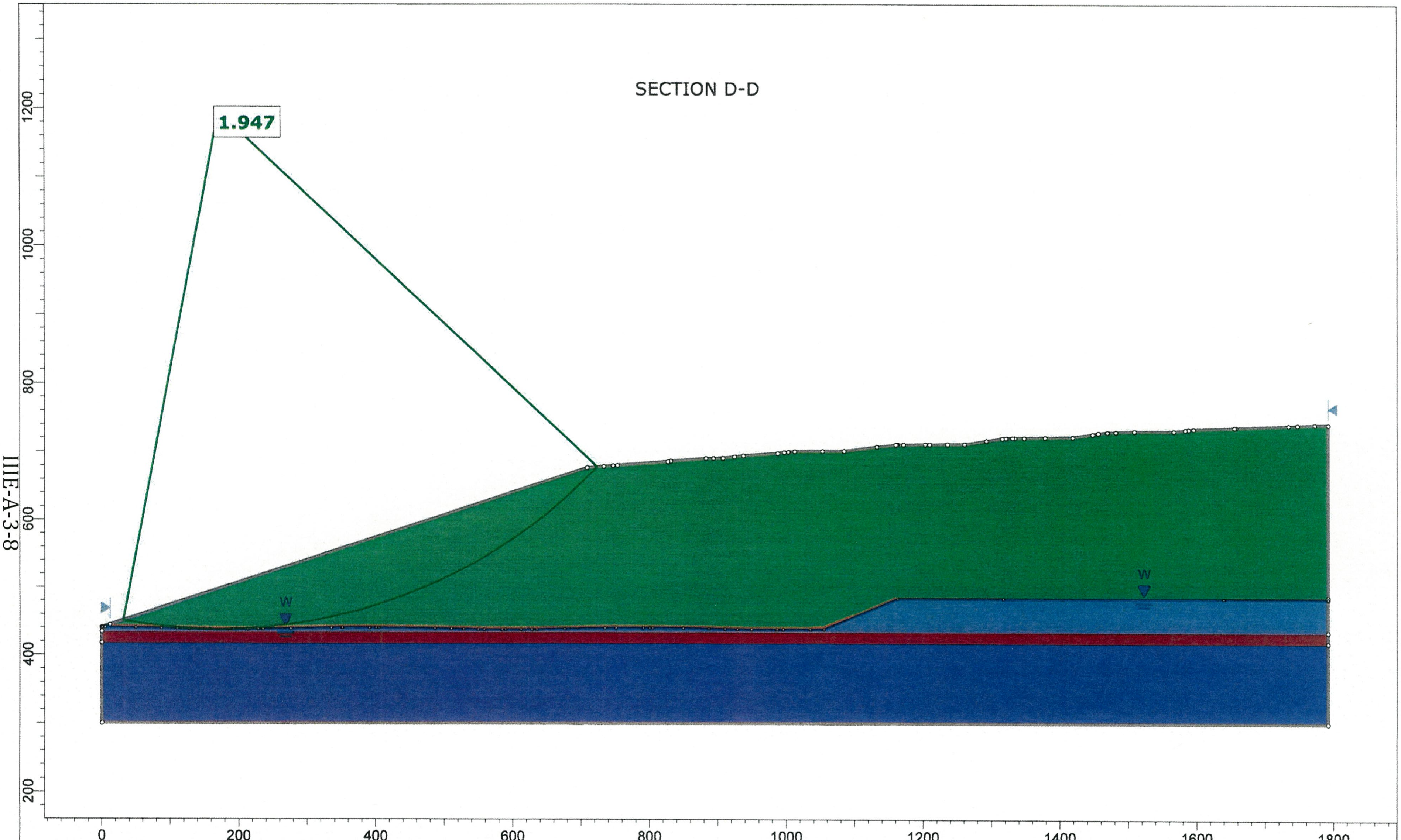
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.947080
Center:	170.448, 1195.683
Radius:	757.877
Left Slip Surface Endpoint:	31.141, 450.719
Right Slip Surface Endpoint:	723.723, 677.741
Resisting Moment:	1.32315e+09 lb-ft
Driving Moment:	6.79559e+08 lb-ft
Total Slice Area:	47236 ft2
Surface Horizontal Width:	692.582 ft
Surface Average Height:	68.2027 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group	ENGINEERING	Scenario: TOTAL STRESS - CIRCULAR
	Drawn By	PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP
SLIDEINTERPRET 9.018	Date	12/23/2021	File Name: Total_Circular_Section_D.slmd

Slide Analysis Information

Total_Circular_Section_D

Project Summary

File Name:	Total_Circular_Section_D.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:01.474s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

SANDSTONE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	6000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

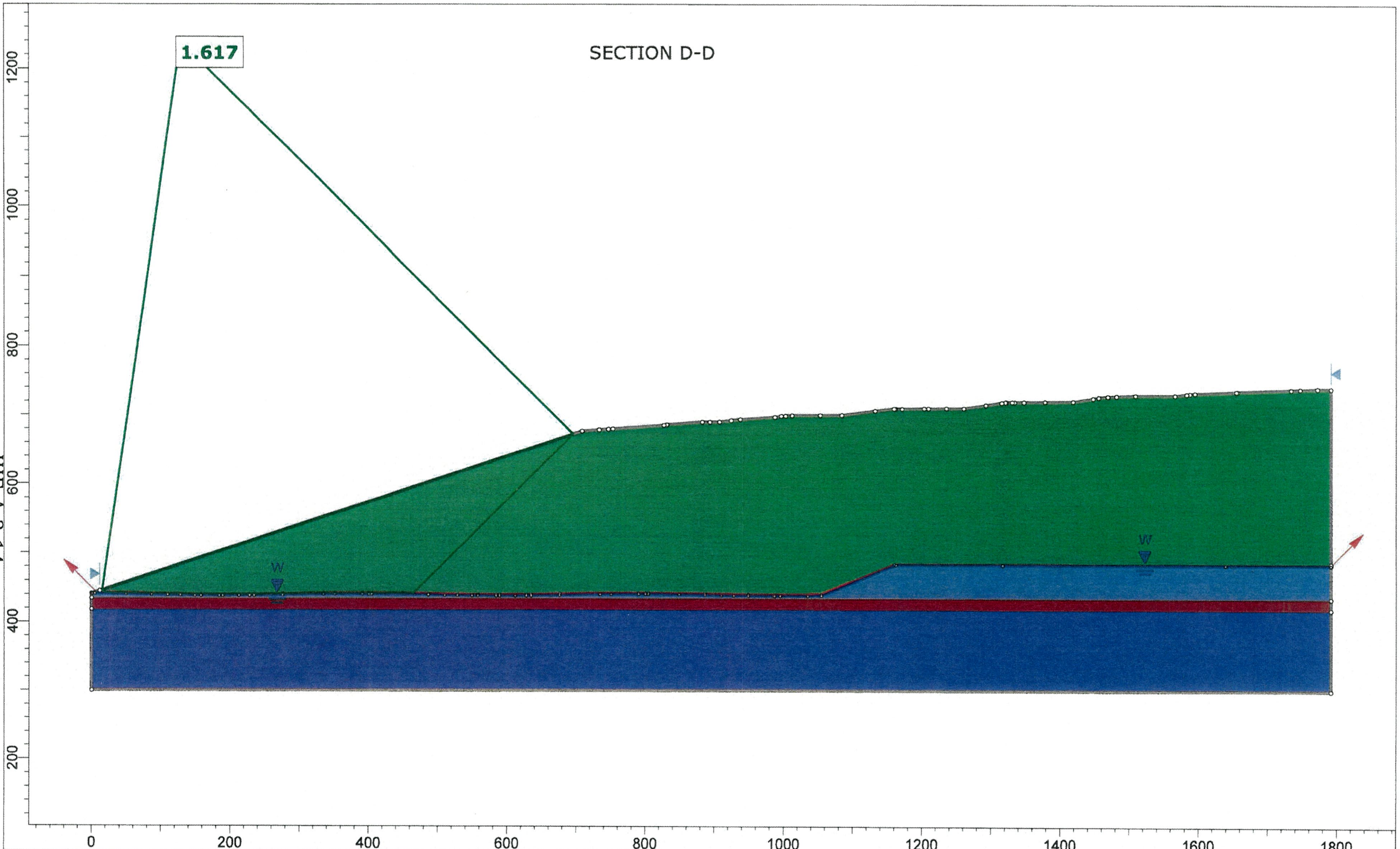
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.947080
Center:	170.448, 1195.683
Radius:	757.877
Left Slip Surface Endpoint:	31.141, 450.719
Right Slip Surface Endpoint:	723.723, 677.741
Resisting Moment:	1.32315e+09 lb-ft
Driving Moment:	6.79559e+08 lb-ft
Total Slice Area:	47236 ft2
Surface Horizontal Width:	692.582 ft
Surface Average Height:	68.2027 ft



Weaver Consultants Group	Project: ARLINGTON LANDFILL		
	Group: ENGINEERING	Scenario: PEAK STRESS - BLOCK	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
	Date: 12/23/2021	File Name: Peak_Block.slmd	

SLIDEINTERPRET 9.018

Slide Analysis Information

Peak_Block

Project Summary

File Name:	Peak_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.581s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

SANDSTONE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	6000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

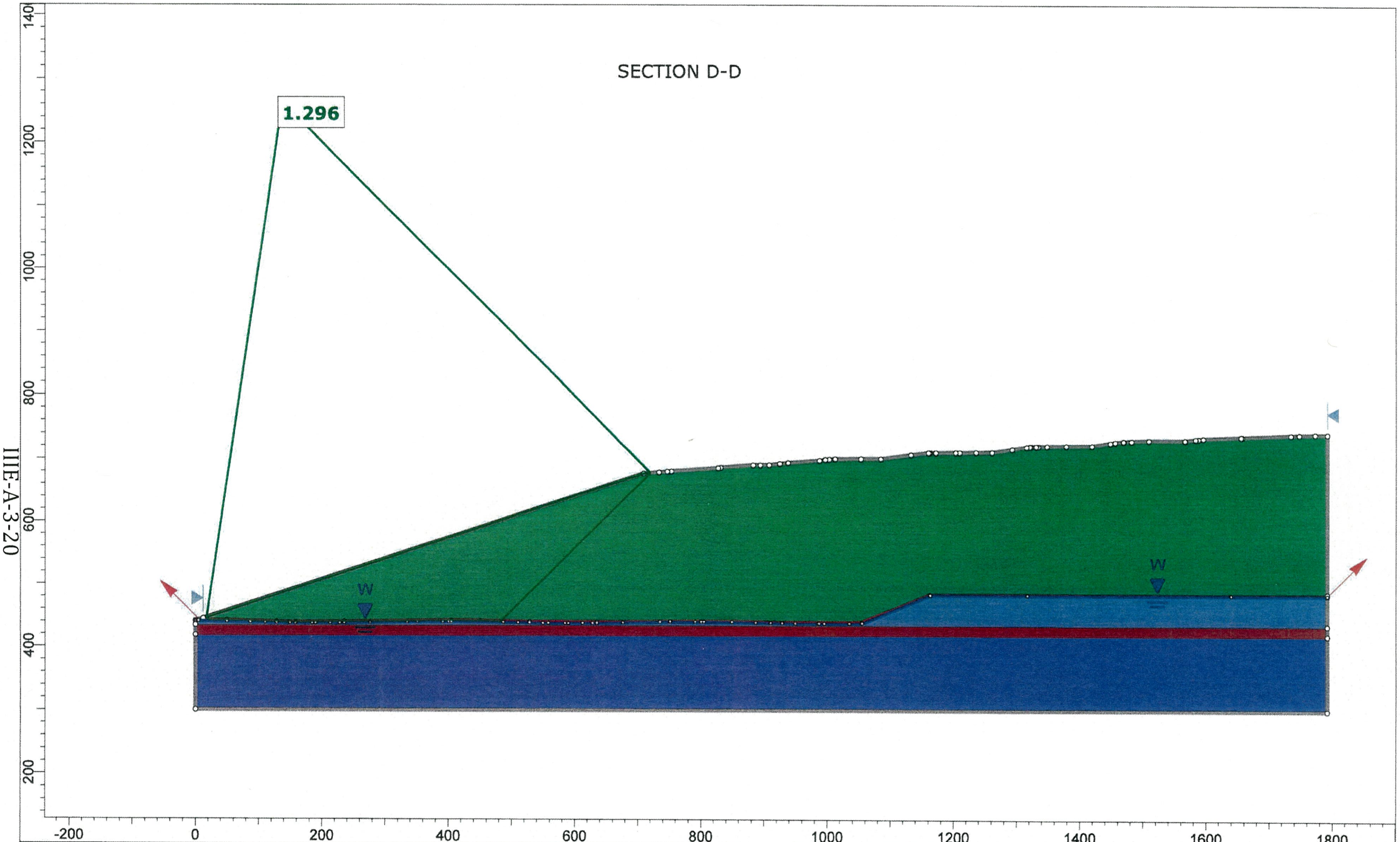
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.616760
Axis Location:	128.873, 1239.128
Left Slip Surface Endpoint:	15.498, 445.505
Right Slip Surface Endpoint:	695.747, 672.254
Resisting Moment:	1.18421e+09 lb-ft
Driving Moment:	7.32461e+08 lb-ft
Total Slice Area:	53354.6 ft2
Surface Horizontal Width:	680.249 ft
Surface Average Height:	78.434 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group	ENGINEERING	Scenario: RESIDUAL STRESS - BLOCK
	Drawn By	PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP
SLIDEINTERPRET 9.018	Date	12/23/2021	File Name: Residual_Block.slmd

Slide Analysis Information

Residual_Block

Project Summary

File Name:	Residual_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.519s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	12
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	80
Friction Angle [deg]	10
Water Surface	None
Ru Value	0

SANDSTONE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

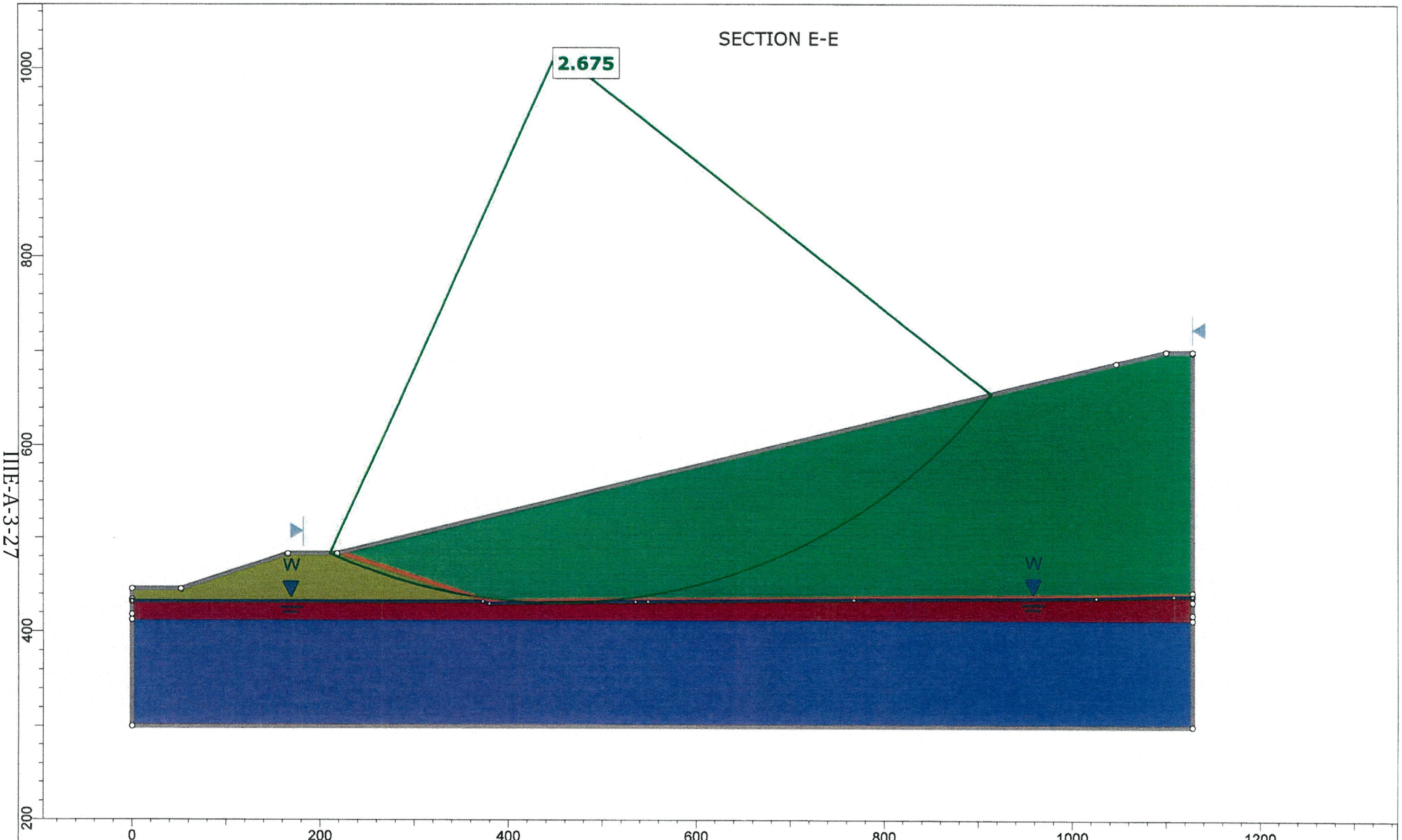
Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.295540
Axis Location:	137.177, 1263.741
Left Slip Surface Endpoint:	17.450, 446.155
Right Slip Surface Endpoint:	719.410, 677.408
Resisting Moment:	1.03163e+09 lb-ft
Driving Moment:	7.96292e+08 lb-ft
Total Slice Area:	57672.6 ft2
Surface Horizontal Width:	701.96 ft
Surface Average Height:	82.1595 ft

SLOPE STABILITY SECTION E-E – FINAL CLOSURE CONDITIONS
SLIDE 2 OUTPUT RESULTS



Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	EFFECTIVE STRESS - CIRCULAR
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Effective_Circular_Section_E.slmd

Weaver Consultants Group

SLIDEINTERPRET 9.018

Slide Analysis Information

Effective_Circular_Section_E

Project Summary

File Name:	Effective_Circular_Section_E.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.954s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

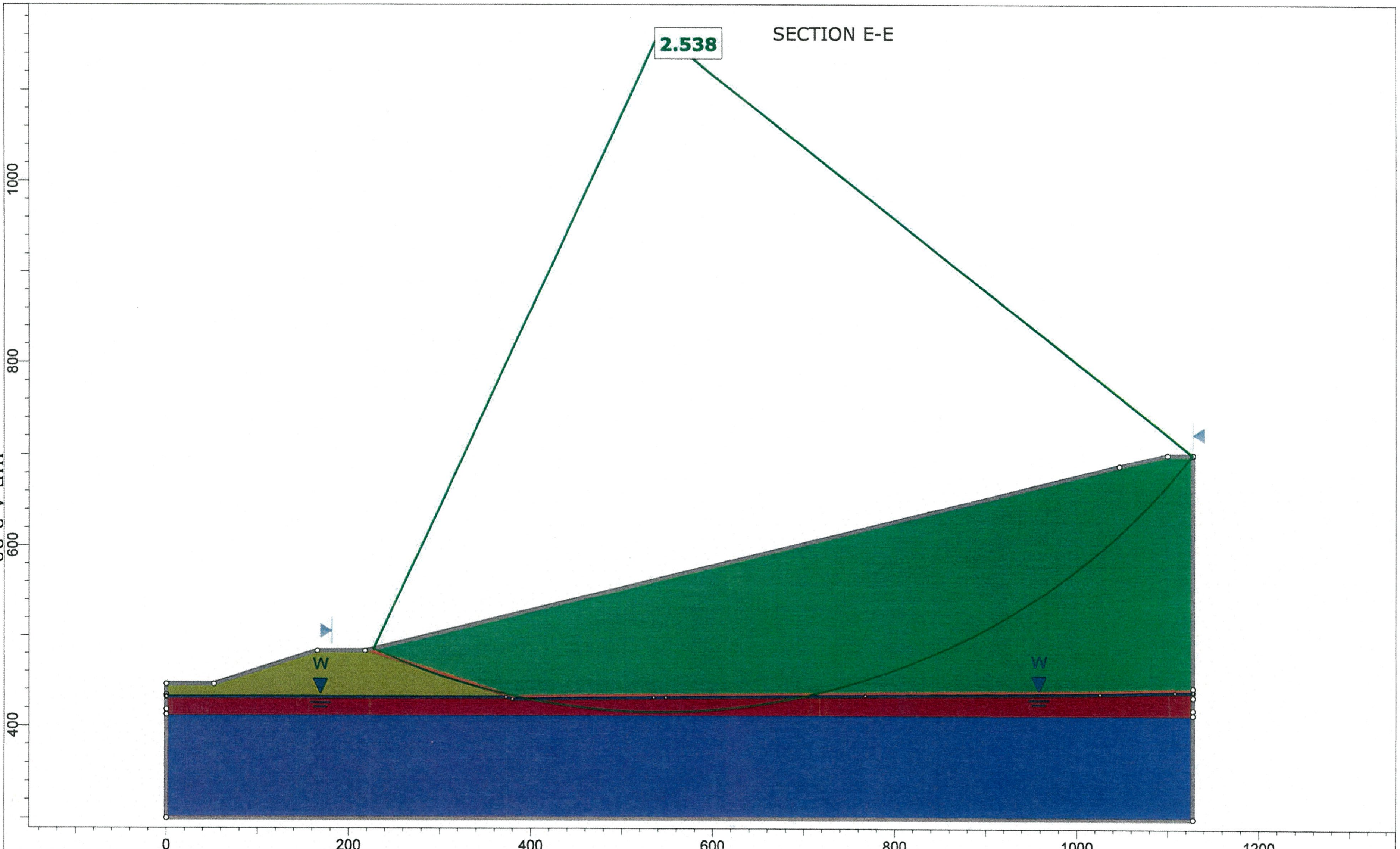
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.674940
Center:	452.398, 1017.253
Radius:	586.564
Left Slip Surface Endpoint:	210.260, 483.000
Right Slip Surface Endpoint:	913.815, 655.104
Resisting Moment:	1.28859e+09 lb-ft
Driving Moment:	4.81727e+08 lb-ft
Total Slice Area:	61148.3 ft2
Surface Horizontal Width:	703.554 ft
Surface Average Height:	86.9134 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario	TOTAL STRESS - CIRCULAR
	Drawn By: PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name	Total_Circular_Section_E.slmd

Slide Analysis Information

Total_Circular_Section_E

Project Summary

File Name:	Total_Circular_Section_E.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.928s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

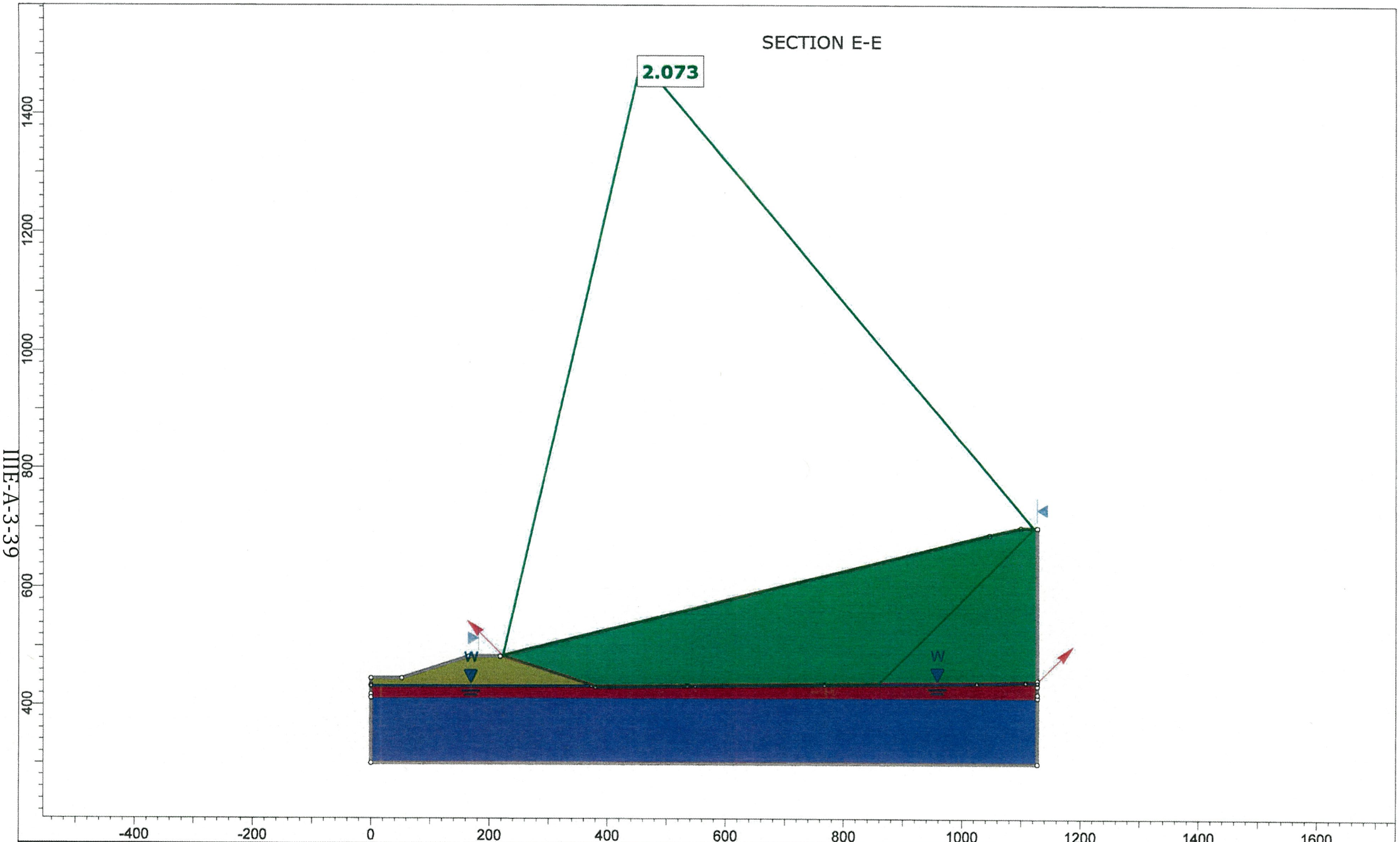
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.538040
Center:	541.475, 1162.731
Radius:	746.728
Left Slip Surface Endpoint:	227.336, 485.295
Right Slip Surface Endpoint:	1127.549, 700.000
Resisting Moment:	2.69103e+09 lb-ft
Driving Moment:	1.06028e+09 lb-ft
Total Slice Area:	104853 ft2
Surface Horizontal Width:	900.213 ft
Surface Average Height:	116.476 ft



Weaver Consultants Group	Project: ARLINGTON LANDFILL		
	Group: ENGINEERING	Scenario: PEAK STRESS - BLOCK	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Peak_Block.slmd	

Slide Analysis Information

Peak_Block

Project Summary

File Name:	Peak_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.495s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

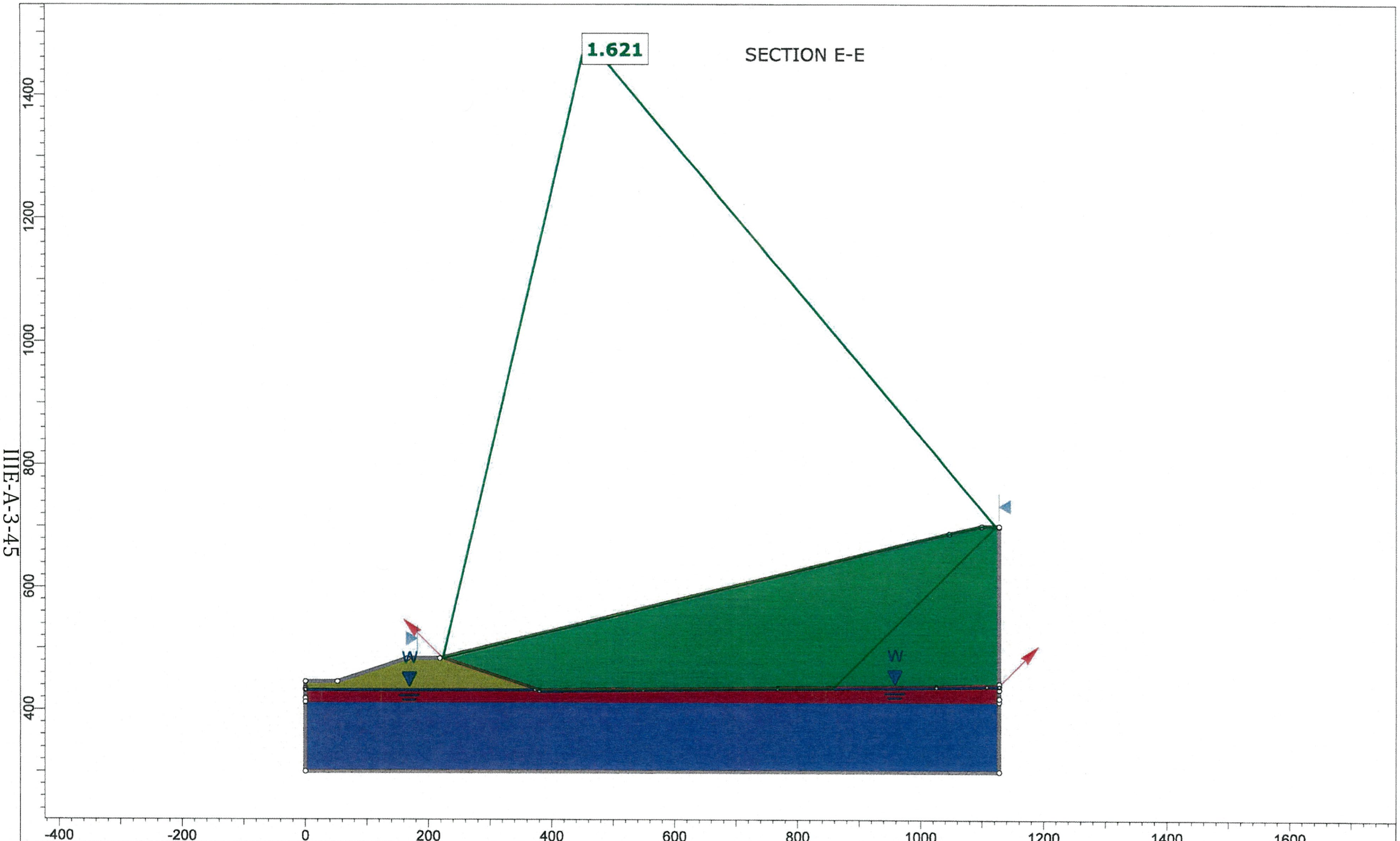
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.072630
Axis Location:	457.010, 1490.868
Left Slip Surface Endpoint:	223.345, 484.308
Right Slip Surface Endpoint:	1122.059, 700.000
Resisting Moment:	2.94586e+09 lb-ft
Driving Moment:	1.42131e+09 lb-ft
Total Slice Area:	105644 ft2
Surface Horizontal Width:	898.714 ft
Surface Average Height:	117.55 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario: RESIDUAL STRESS - BLOCK	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/23/2021	File Name: Residual_Block.slmd	

Slide Analysis Information

Residual_Block

Project Summary

File Name:	Residual_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.374s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	12
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	80
Friction Angle [deg]	10
Water Surface	None
Ru Value	0
COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

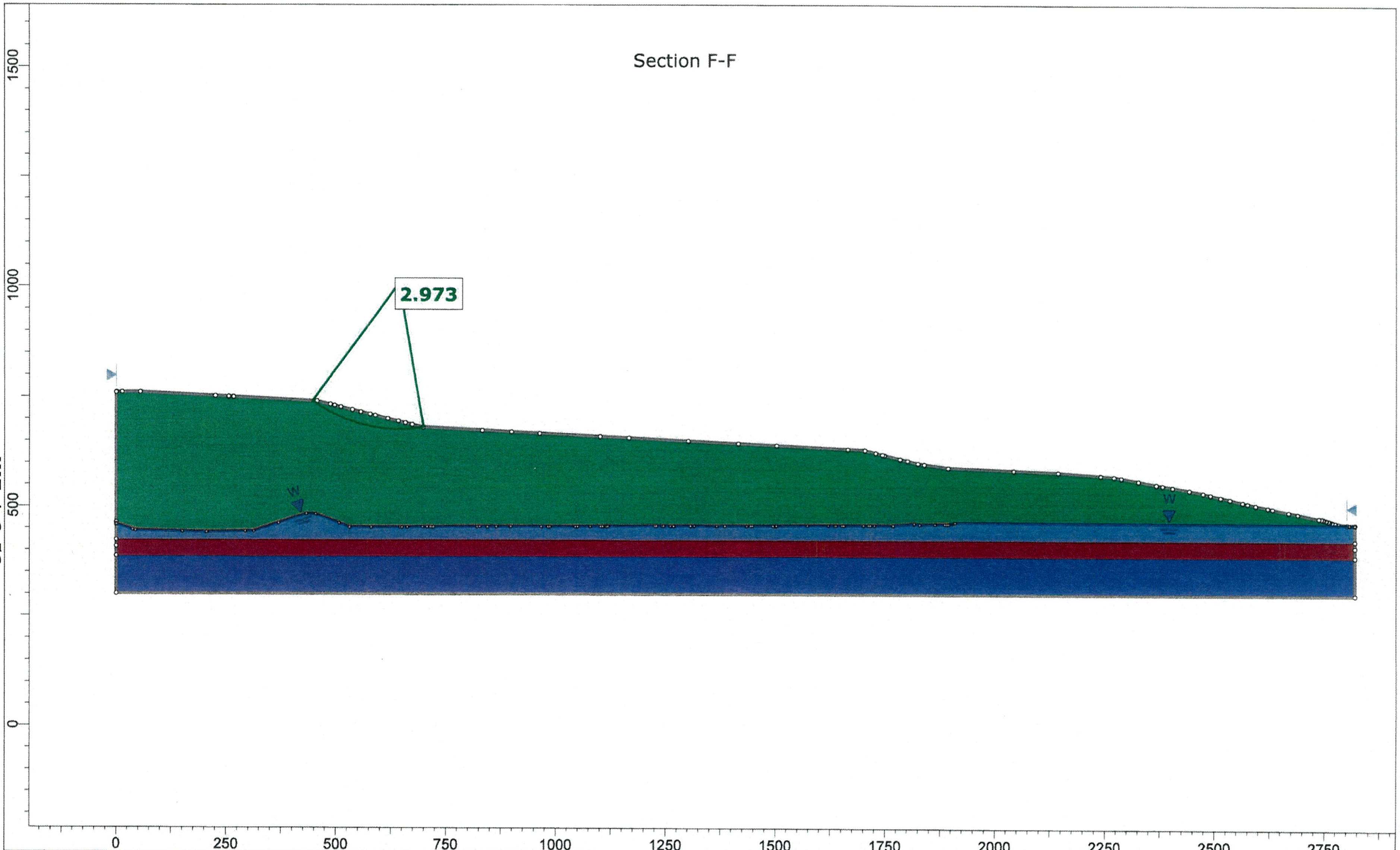
Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.620520
Axis Location:	457.161, 1490.925
Left Slip Surface Endpoint:	223.448, 484.333
Right Slip Surface Endpoint:	1122.206, 700.000
Resisting Moment:	2.24439e+09 lb-ft
Driving Moment:	1.38498e+09 lb-ft
Total Slice Area:	105774 ft2
Surface Horizontal Width:	898.758 ft
Surface Average Height:	117.689 ft

SLOPE STABILITY SECTION F-F – FINAL CLOSURE CONDITIONS
SLIDE2 OUTPUT RESULTS



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING		Scenario: EFFECTIVE STRESS - CIRCULAR
	Drawn By: PREP BY: MB	CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP
SLIDEINTERPRET 9.018	Date: 12/23/2021		File Name: Effective_Circular.slmd

Slide Analysis Information

Effective_Circular

Project Summary

File Name:	Effective_Circular.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:01.702s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

ALLUVIUM

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	600
Friction Angle [deg]	22
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

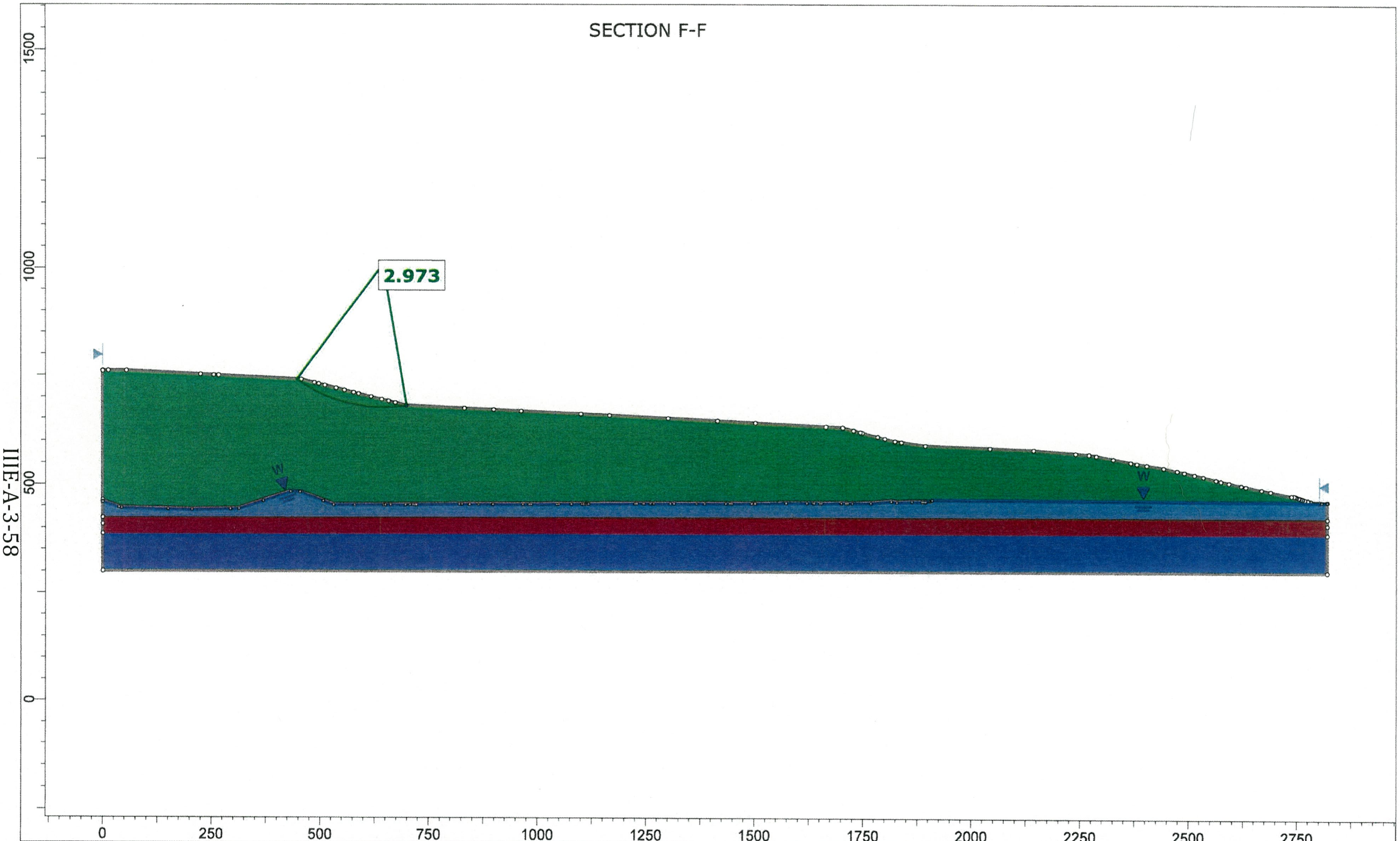
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.972920
Center:	644.674, 1008.145
Radius:	332.725
Left Slip Surface Endpoint:	447.021, 740.490
Right Slip Surface Endpoint:	699.361, 679.945
Resisting Moment:	7.33273e+07 lb-ft
Driving Moment:	2.46651e+07 lb-ft
Total Slice Area:	4802.26 ft2
Surface Horizontal Width:	252.341 ft
Surface Average Height:	19.0309 ft



Weaver Consultants Group

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	TOTAL STRESS - CIRCULAR
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Total_Circular.slmd

SLIDEINTERPRET 9.018

Slide Analysis Information

Total_Circular

Project Summary

File Name:	Total_Circular.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:01.706s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0
ALLUVIUM	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	3500
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

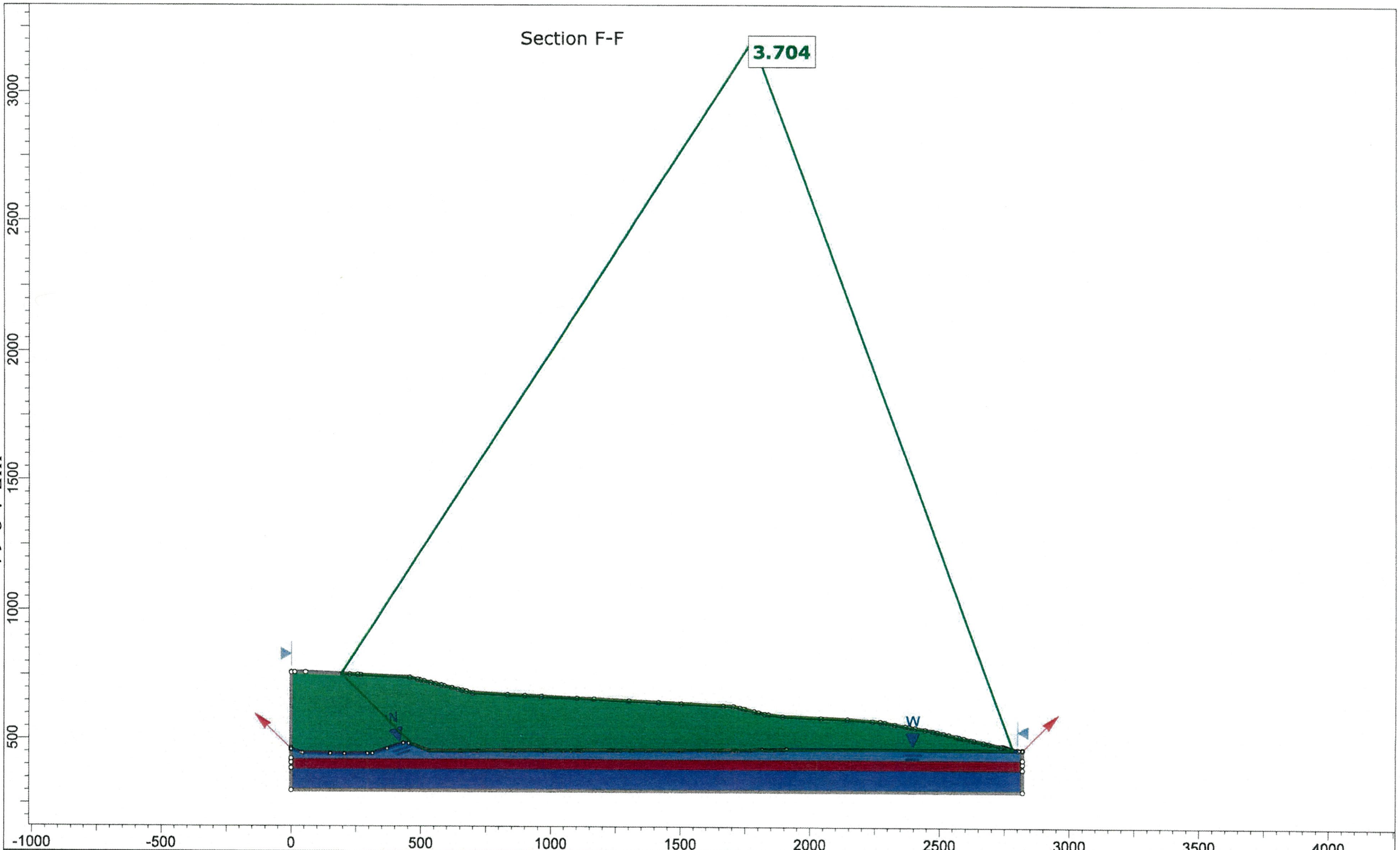
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.972920
Center:	644.674, 1008.145
Radius:	332.725
Left Slip Surface Endpoint:	447.021, 740.490
Right Slip Surface Endpoint:	699.361, 679.945
Resisting Moment:	7.33273e+07 lb-ft
Driving Moment:	2.46651e+07 lb-ft
Total Slice Area:	4802.26 ft2
Surface Horizontal Width:	252.341 ft
Surface Average Height:	19.0309 ft



Weaver Consultants Group

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	PEAK STRESS - BLOCK
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/27/2021	File Name	Peak_Block.slmd

SLIDEINTERPRET 9.018

Slide Analysis Information

Peak_Block

Project Summary

File Name:	Peak_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.756s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	13
Water Surface	None
Ru Value	0

ALLUVIUM

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	3500
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

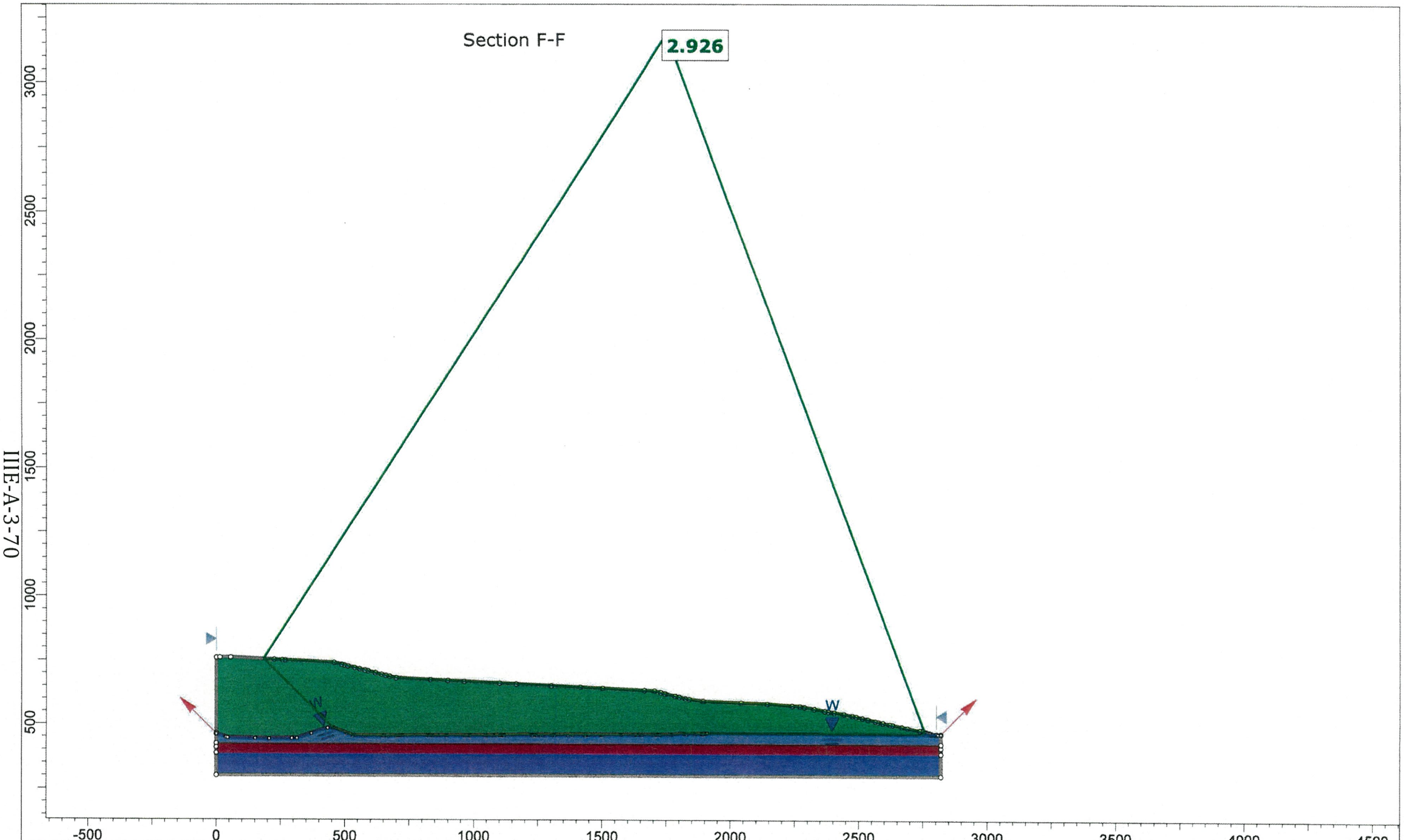
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	3.704080
Axis Location:	1777.573, 3199.388
Left Slip Surface Endpoint:	192.790, 753.129
Right Slip Surface Endpoint:	2783.710, 463.806
Resisting Moment:	2.44722e+10 lb-ft
Driving Moment:	6.60683e+09 lb-ft
Total Slice Area:	394620 ft2
Surface Horizontal Width:	2590.92 ft
Surface Average Height:	152.309 ft



Weaver Consultants Group

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	RESIDUAL STRESS - BLOCK
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/23/2021	File Name	Residual_Block.slmd

SLIDEINTERPRET 9.018

Slide Analysis Information

Residual_Block

Project Summary

File Name:	Residual_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.807s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	12
Water Surface	None
Ru Value	0

WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	80
Friction Angle [deg]	8
Water Surface	None
Ru Value	0

ALLUVIUM	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	600
Friction Angle [deg]	22
Water Surface	Water Table
Hu Value	1

WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE	
Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	2.925760
Axis Location:	1751.410, 3185.579
Left Slip Surface Endpoint:	183.077, 753.612
Right Slip Surface Endpoint:	2755.984, 471.733
Resisting Moment:	1.90328e+10 lb-ft
Driving Moment:	6.50526e+09 lb-ft
Total Slice Area:	397055 ft2
Surface Horizontal Width:	2572.91 ft
Surface Average Height:	154.322 ft

APPENDIX IIIE-A-4

INFINITE SLOPE STABILITY ANALYSIS

Includes pages IIIE-A-4-1 through IIIE-A-4-20

STATE OF TEXAS
DAVID E. POE
81734
LICENSED
PROFESSIONAL ENGINEER

5-19-2022

Required: Evaluate the stability of the bottom liner system components.

Procedure:

A. Bottom Liner System Stability - Anchor Trench Design
1. Verify that the tensile stress in the liner system will be less than the yield stress by using Koerner's method for determination of shear stress in liner systems considering cohesion/ adhesion forces.
2. Provide liner anchor trench design considering pullout of the geomembrane.

B. Infinite Slope Stability Analysis
1. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the bottom liner system using peak and residual shear strength values.

Contents:

- Verification that the tensile stress in the bottom liner system will be less than yield stress is provided on Sheets IIIE-A-4-2 through IIIE-A-4-6.
- Anchor trench design is provided on Sheets IIIE-A-4-7 through IIIE-A-4-8.
- Infinite stability analysis to evaluate the internal stability of the bottom liner system is presented on Sheets IIIE-A-4-9 through IIIE-A-4-11.

References:

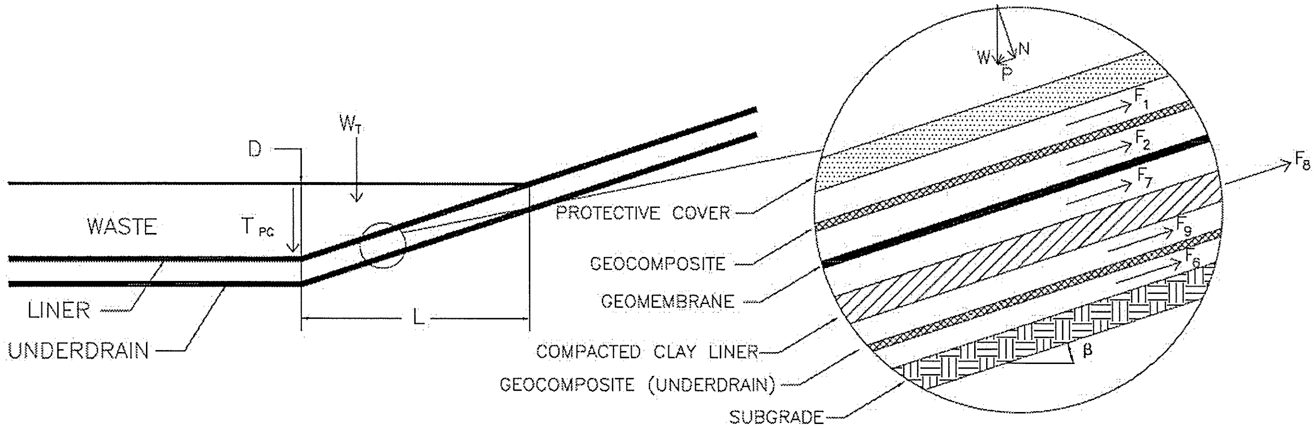
1. Koerner, Robert M., *Designing with Geosynthetics*, 3rd Edition, Prentice-Hall Inc., 1994.
2. Duncan, J.M. and Buchignani, A. L., *An Engineering Manual for Slope Stability Studies,* Department of Civil Engineering - University of California-Berkeley, 1975.
3. USACE, *Slope Stability*, Engineering and Design Manual, EM 1110-2-1902, October 31, 2003.
4. Koerner, Robert M., *Analysis and Design of Veneer Cover Soils*, 1998 Sixth International Conference of Geosynthetics.
5. Koerner, George R. and Narejo, Dhani, *Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces,* GRI Report #30, June 14, 2005.
6. Gilbert, Robert B., *Peak Versus Residual Strength for Waste Containment Systems,*
7. Proceedings of the 15th GRI Conference, December 13, 2001.
8. NAVFAC Design Manual 7.01, September 1986.

A. Liner System Stability - Anchor Trench Design

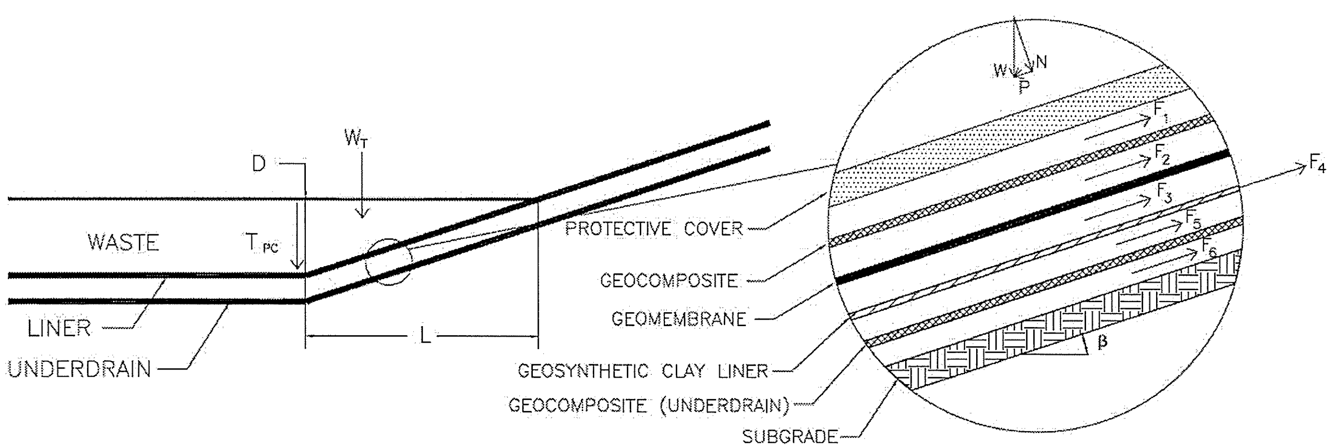
Note: The liner system includes a 2-foot-thick protective cover, drainage geocomposite, geomembrane, either a 2-foot-thick Compacted Clay Liner (CCL) or Geosynthetic Clay Liner (GCL) .

1. Verify that tensile stress in liner system is less than yield stress for the liner system.

CCL OPTION (All Areas)



GCL OPTION (All Areas)



Definition of terms/variables:

W_E = Weight of equipment, lb/ft

Assume a Caterpillar D8T WH Track-Type Tractor

Operational Weight =	85,150	lb
Number of Tracks =	2	
Track Width =	1.84	ft

W_W = Weight of solid waste, lb/ft
W_{PC} = Weight of protective cover, lb/ft
W_T = Combined weight of equipment, solid waste, and protective cover, lb/ft
T_{PC} = Friction force on edge of protective cover, lb/ft
W = Net force of equipment, waste, and protective cover on liner system, lb/ft
N = Normal force on liner system, lb/ft
P = Shearing force on liner system, lb/ft
β = Slope angle, deg
F_n = Resisting force, lb/ft, calculated using the equation:
$(N * \tan(\Delta_n)) + (C_{an} * L / \cos(\beta))$

F_1 = Resistance of protective cover/geocomposite interface, lb/ft
F_2 = Resistance of geocomposite/textured geomembrane interface, lb/ft
F_3 = Resistance of textured geomembrane/geosynthetic clay liner interface, lb/ft
F_4 = Resistance of internal geosynthetic clay liner, lb/ft
F_5 = Resistance of geosynthetic clay liner/geocomposite interface, lb/ft
F_6 = Resistance of geocomposite/subgrade interface, lb/ft
F_7 = Resistance of textured geomembrane/clay liner interface, lb/ft
F_8 = Resistance of internal clay liner, lb/ft
F_9 = Resistance of clay liner/geocomposite interface, lb/ft

Δ_n = Interface friction angle of interface "n", deg
C_{an} = Adhesion of interface "n", psf
ϕ_n = Internal friction angle of material "n", deg
C_n = Cohesion of material "n", psf

γ_{was} = Unit weight of solid waste (including daily cover), pcf
D_{was} = Individual lift height, ft
ϕ_{was} = Internal friction angle of waste, deg
γ_{pc} = Unit weight of protective cover, pcf
D_{pc} = Thickness of protective cover, ft
ϕ_{pc} = Internal friction angle of protective cover, deg
L = Horizontal length of lift, ft

Parameters:

$\beta_{sideslope}$ =	18.43	deg	Δ_7 =	18	deg
Δ_1 =	18	deg	C_{a7} =	100	psf
C_{a1} =	100	psf	ϕ_8 =	16	deg
Δ_2 =	21	deg	C_8 =	100	psf
C_{a2} =	100	psf	Δ_9 =	18	deg
Δ_3 =	18	deg	C_{a9} =	200	psf
C_{a3} =	100	psf	γ_{was} =	59	pcf
ϕ_4 =	24	deg	D_{was} =	10	ft
C_4 =	100	psf	ϕ_{was} =	21	deg
Δ_5 =	16	deg	γ_{pc} =	120	pcf
C_{a5} =	100	psf	D_{pc} =	1	ft
Δ_6 =	18	deg	ϕ_{pc} =	16	deg
C_{a6} =	200	psf	L =	30	ft

Note:
Interface friction strength values are selected conservatively from laboratory testing of similar material/interfaces. Prior to construction, laboratory tests will be performed to verify the assumed values for interface adhesion (or cohesion) and friction angle using project-specific soil and synthetic materials. The interface friction testing will be performed for the specific conditions analyzed. If test results differ from the assumed values, this analysis will be updated for acceptable factor of safety values using the procedure presented in the following sections.

Weight of Equipment

$$W_E = \frac{\text{Operational Weight}}{\text{Number of Tracks x Width of Track}}$$

W_E = 23,139 lb/ft

Weight of Solid Waste

$$W_W = \frac{D_{was} \text{ x } L \text{ x } \gamma_{was}}{2}$$

W_W = 8,850 lb/ft

Weight of Protective Cover

$$W_{PC} = D_{pc} \text{ x } \gamma_{pc} \text{ x } \frac{L}{\cos(\beta_{sideslope})}$$

W_{PC} = 3,795 lb/ft

Combined Weight of Equipment, Solid Waste, and Protective Cover,

$$W_T = W_E + W_W + W_{PC}$$

W_T = 35,783 lb/ft

Friction Force on Edge of Protective Cover

$$T_{PC} = k_o \text{ x } \sigma_v \text{ x } \tan\phi_{pc} \text{ x } D_{pc}$$

where:

$$k_o = 1 - \sin\phi_{pc}$$

$$\sigma_v = \frac{D_{pc} \text{ x } \gamma_{pc}}{2}$$

T_{PC} = 12 lb/ft

Net Force of Equipment, Waste, and Protective Cover on Liner System

$W = W_T - T_{PC}$	$W =$	35,771	lb/ft
$N = W \cos(\beta)$	$N =$	33,936	lb/ft
$P_{sideslope} = W \sin(\beta)$	$P_{sideslope} =$	11,309	lb/ft

Compacted Clay Liner Option:

Resistance of Protective Cover/Geocomposite Interface = F_1 = 14,189 lb/ft

$P_{sideslope} < F_1$ Therefore, protective cover soil is stable on the geocomposite and a driving force equal to P is transferred to the next interface.

Resistance of Geocomposite/Geomembrane Interface = F_2 = 16,189 lb/ft

$P_{sideslope} < F_2$ Therefore, geocomposite is stable on the geomembrane and a driving force equal to P is transferred to the next interface.

Resistance of Geomembrane/Clay Liner Interface = F_7 = 14,189 lb/ft

$P_{sideslope} < F_7$ Therefore, the geomembrane is stable on the clay liner and a driving force equal to P is transferred to the next interface.

Resistance of Internal Clay Liner= F_8 = 12,893 lb/ft

$P_{sideslope} < F_8$ Therefore, the clay liner internally is stable and a driving force equal to P is transferred to the next interface.

Resistance of Clay Liner/Geocomposite Interface = F_9 = 17,351 lb/ft

$P_{sideslope} < F_9$ Therefore, the clay liner is stable on the geocomposite and a driving force equal to P is transferred to the next interface.

Resistance of Geocomposite/Subgrade Interface = F_6 = 17,351 lb/ft

$P_{sideslope} < F_6$ Therefore, the geocomposite is stable on the subgrade and a driving force equal to P is transferred to the next interface.

The Actual Tensile Force on liner system (T_{act}) = 0 lb/ft

Geosynthetic Clay Liner Option:

Resistance of Protective Cover/Geocomposite Interface = F_1 = 14,189 lb/ft

$P_{sideslope} < F_1$ Therefore, protective cover soil is stable on the geocomposite and a driving force equal to P is transferred to the next interface.

Resistance of Geocomposite/Geomembrane Interface = F_2 = 16,189 lb/ft

$P_{sideslope} < F_2$ Therefore, geocomposite is stable on the geomembrane and a driving force equal to P is transferred to the next interface.

Resistance of Geomembrane/Geosynthetic Clay Liner Interface = F_3 = 14,189 lb/ft

$P_{sideslope} < F_3$ Therefore, geomembrane is stable on the geosynthetic clay liner and a driving force equal to P is transferred to the next interface.

Resistance of Internal Geosynthetic Clay Liner = F_4 = 18,272 lb/ft

$P_{sideslope} < F_4$ Therefore, the geosynthetic clay liner internally is stable and a driving force equal to P is transferred to the next interface.

Resistance of Geosynthetic Clay Liner/Geocomposite Interface = F_5 = 12,893 lb/ft

$P_{sideslope} < F_5$ Therefore, the geosynthetic clay liner is stable on the geocomposite and a driving force equal to P is transferred to the next interface.

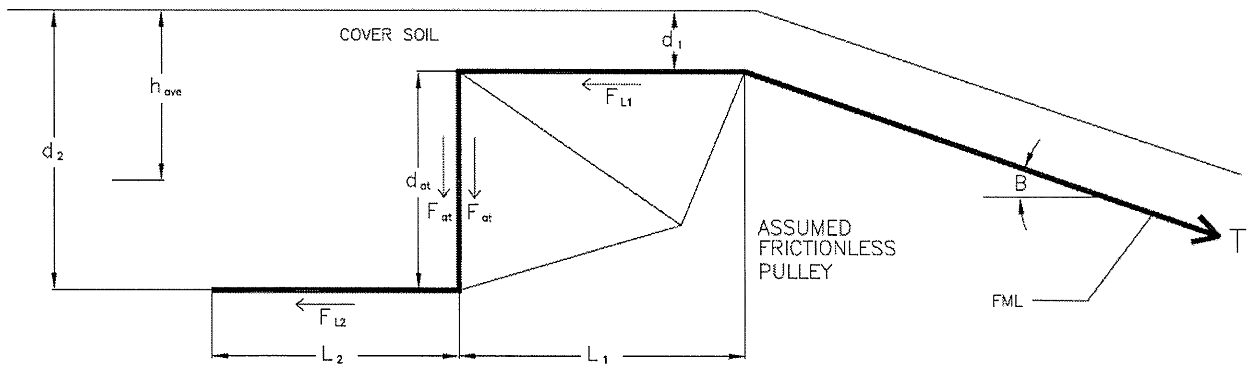
Resistance of Geocomposite/Subgrade Interface = F_6 = 17,351 lb/ft

$P_{sideslope} < F_6$ Therefore, the geocomposite is stable on the subgrade and a driving force equal to P is transferred to the next interface.

The Actual Tensile Force on Liner System (T_{act}) = 0 lb/ft

2. Provide liner anchor trench design considering pullout of the geomembrane.

Force Diagram for Liner System (analyzed for worst case CCL membrane interface)



$T = F_{L1} + F_{L2} + F_{at}$

Where T is the tensile force necessary for pullout

$F_{L1} = (q_1 \tan\Delta)(L_1)$

q_1 = Surcharge pressure = $d_1 \times \gamma_{soil}$
d_1 = Depth of soil, ft
γ_{soil} = Unit weight of soil, pcf
Δ = Interface friction angle, degrees
L_1 = Length of runout, ft

$F_{L2} = (q_2 \tan\Delta)(L_2)$

q_2 = Surcharge pressure = $d_2 \times \gamma_{soil}$
d_2 = Depth of soil, ft
γ_{soil} = Unit weight of soil, pcf
Δ = Interface friction angle, degrees
L_2 = Length of runout, ft

$F_{at} = (V \tan\Delta)(d_{at})$

V = Average horizontal stress = $K_o \times y$
K_o = 1 - sin(r)
r = Internal friction angle of soil, degrees
y = $\gamma_{soil} \times h_{ave}$
γ_{soil} = Unit weight of soil, pcf
h_{ave} = Average depth of trench, ft
Δ = Interface friction angle, degrees
d_{at} = Depth of trench, ft

Parameters:

γ_{soil} =	120	pcf
Δ =	15	deg
r =	16	deg

d_1 =	2.0	ft
L_1 =	6.0	ft
d_2 =	4.0	ft
L_2 =	2.0	ft
d_{at} =	2.0	ft
h_{ave} =	3.0	ft

Calculations:

F_{L1} = 385.8 lb / ft

F_{L2} = 257.2 lb / ft

F_{at} = 139.7 lb / ft

T = 782.8 lb / ft

Compare force required for pullout (T) with the actual tensile force in the geomembrane from Part 1:

T = 783 lb / ft

T_{act} = 0 lb / ft

$T > T_{act}$

Therefore, the runout lengths are sufficient to prevent pullout.

B. Infinite Slope Stability Analysis

Interface friction strength values are selected conservatively from laboratory testing of similar material/interfaces. Prior to construction, laboratory tests will be performed to verify the assumed values for interface adhesion (or cohesion) and friction angle using project-specific soil and synthetic materials. The interface friction testing will be performed for the specific conditions analyzed. If test results differ from the assumed values, this analysis will be updated for acceptable factor of safety values using the procedure presented in the following sections.

LINER SYSTEM

The liner system includes a 2-foot-thick protective cover, drainage geocomposite, geomembrane, and either a 2-foot-thick. Compacted Clay Liner (CCL) or Geosynthetic Clay Liner (GCL) .

1. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the liner, overliner, and final cover systems using peak and residual shear strength values.

The factor of safety is calculated using the following equation:

$$F.S. = A\frac{\tan\Delta}{\tan\beta} + B\frac{C_a}{\gamma H}$$

where:

Δ = Interface friction angle, deg
C_a = Adhesion, psf
β = Slope angle, deg
A = Parameter A from chart on page IIIE-A-4-12
B = Parameter B from chart on page IIIE-A-4-12
γ = Unit weight of soil, pcf
H = Thickness of material above interface, ft

An example using the protective cover/geocomposite interface of the liner system is provided below.

A. Define the shear strength parameters (peak shear strength parameters will be used for this example).

Δ = 18 deg
C_a = 100 psf

B. Calculate the pore pressure, r_u, using the following equation:

$$r_u = (T \times \gamma_w \times \cos^2\beta) / (H \times \gamma)$$

where:
H = Thickness of material above interface, ft
γ_w = Unit weight of water, pcf
β = Slope angle, deg
T = Maximum head above interface, ft
γ = Unit weight of soil, pcf

H =	2	ft
γ_w =	62.4	pcf
β =	18.43	deg (3H:1V)
T =	0	ft
γ =	120	pcf

r_u = 0.00

Since T=0, there is no pore pressure build-up in the protective cover. If the soil material is assumed to be saturated, use a unit weight of 125 pcf for soil.

C. Calculate the slope ratio, b.

b = cot β = 3.0

D. Using r_u and b, determine Parameters A and B from the charts on page IIIE-A-4-12.

A = 1.0
B = 3.3

E. Calculate the factor of safety and compare against the minimum recommended factor of safety.

F.S. =	2.35	>	$F.S._{min}$ =	1.5

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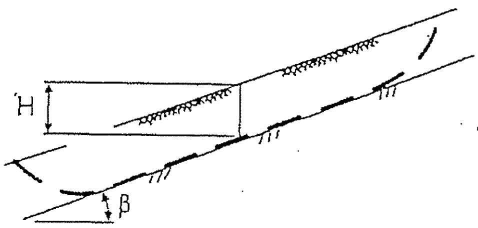
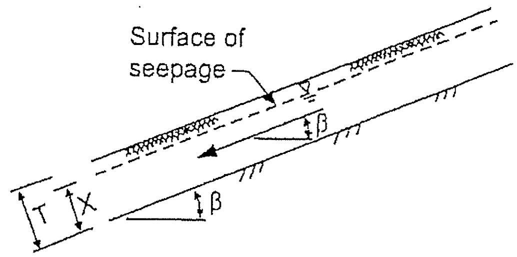
APPENDIX IIIE-A-4
STABILITY ANALYSIS OF THE BOTTOM LINER SYSTEM

Component/Interface	Strength Parameters: Cohesion/Adhesion (psf)		Strength Parameters: Friction Angle (deg)		H (ft)	γ (pcf)	β (deg)	T (ft)	r_u	b	A	B	Factor of Safety Generated		Recommended Minimum Factor of Safety		Acceptable Factor of Safety	
	Peak	Residual	Peak	Residual									Peak	Residual	Peak	Residual	Peak	Residual
Liner System - Compacted Clay Liner Option (3H:1V Maximum Slope)																		
Compacted Clay Liner																		
Protective Cover/Geocomposite	100	80	18	14	2	120	18.43	0	0.00	3.0	1.0	3.3	2.35	1.85	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.53	1.63	1.5	1.0	YES	YES
Textured Geomembrane/Clay Liner	200	80	15	10	2	120	18.43	0	0.00	3.0	1.0	3.3	3.55	1.63	1.5	1.0	YES	YES
Clay Liner Internal	100	-	16	-	2	120	18.43	0	0.00	3.0	1.0	3.3	2.24	-	1.5	-	YES	-
Liner System - Geosynthetic Clay Liner Option (3H:1V Maximum Slope)																		
Geosynthetic Clay Liner																		
Protective Cover/Geocomposite	100	80	24	14	2	120	18.43	0	0.00	3.0	1.0	3.3	2.71	1.85	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	16	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.24	1.63	1.5	1.0	YES	YES
Textured Geomembrane/GCL	100	80	18	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.35	1.63	1.5	1.0	YES	YES
GCL Internal	100	-	24	-	2	120	18.43	0	0.00	3.0	1.0	3.3	2.71	-	1.5	-	YES	-





γ = total unit weight of soil

γ_w = unit weight of water

c' = cohesion intercept

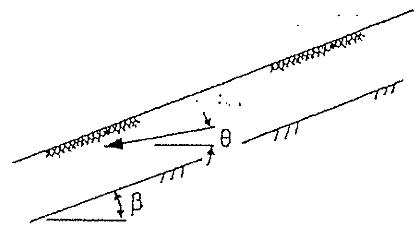
ϕ' = friction angle

r_u = pore pressure ratio = $u/\gamma H$

u = pore pressure at depth H

Seepage parallel to slope

$$r_u = \frac{X}{T}\frac{\gamma_w}{\gamma}\cos^2\beta$$

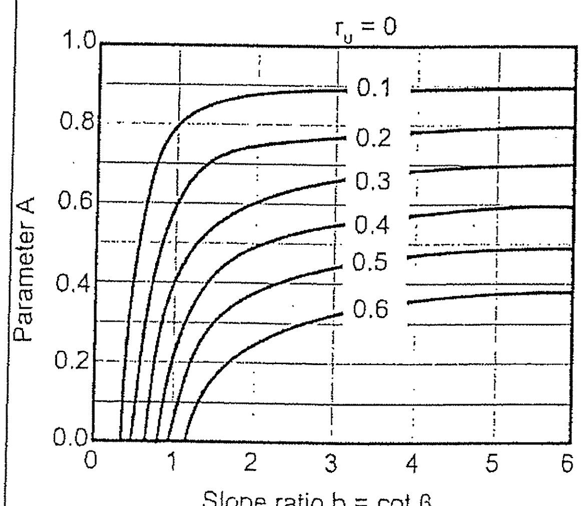


Seepage emerging from slope

$$r_u = \frac{\gamma_w}{\gamma}\frac{1}{1+\tan\beta\tan\theta}$$

Steps.

1. Determine r_u from measured pore pressure or formulas at right.
2. Determine A and B from charts below.
3. Calculate $F = A\dfrac{\tan\phi'}{\tan\beta} + B\dfrac{c'}{\gamma H}$



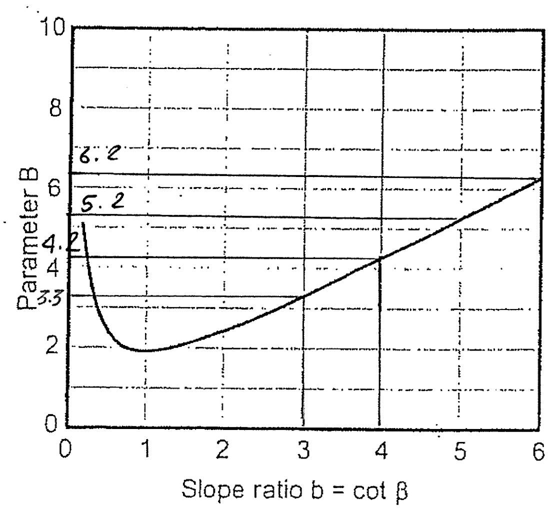


Figure E-7. Slope stability charts for infinite slopes (after Duncan, Buchianani, and DeWet 1987)

Required: Evaluate the stability of the overliner system components.

Procedure:

A. Infinite Slope Stability Analysis
   1. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the over liner system using peak and residual shear strength values.

- Infinite stability analysis to evaluate the internal stability of the over liner system is presented on Sheets IIIE-A-4-14 through IIIE-A-4-15.

Contents:

References:

1. Koerner, Robert M., *Designing with Geosynthetics* , 3rd Edition, Prentice-Hall Inc., 1994.
2. Duncan, J.M. and Buchignani, A. L., *An Engineering Manual for Slope Stability Studies,* Department of Civil Engineering - University of California-Berkeley, 1975.
3. USACE, *Slope Stability*, Engineering and Design Manual, EM 1110-2-1902, October 31, 2003.
4. Koerner, Robert M., *Analysis and Design of Veneer Cover Soils*, 1998 Sixth International Conference of Geosynthetics.
5. Koerner, George R. and Narejo, Dhani, *Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces,* GRI Report #30, June 14, 2005.
6. Gilbert, Robert B., *Peak Versus Residual Strength for Waste Containment Systems,*
7. Proceedings of the 15th GRI Conference, December 13, 2001.
8. NAVFAC Design Manual 7.01, September 1986.

B. Infinite Slope Stability Analysis

Interface friction strength values are selected conservatively from laboratory testing of similar material/interfaces. Prior to construction, laboratory tests will be performed to verify the assumed values for interface adhesion (or cohesion) and friction angle using project-specific soil and synthetic materials. The interface friction testing will be performed for the specific conditions analyzed. If test results differ from the assumed values, this analysis will be updated for acceptable factor of safety values using the procedure presented in the following sections.

OVERLINER SYSTEM

The overliner system includes a 2-foot-thick protective cover, drainage geocomposite, geomembrane, and prepared subgrade.

1. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the liner, overliner, and final cover systems using peak and residual shear strength values.

The factor of safety is calculated using the following equation:

$$F.S. = A\frac{\tan\Delta}{\tan\beta} + B\frac{C_a}{\gamma H}$$

where:
Δ = Interface friction angle, deg
C_a = Adhesion, psf
β = Slope angle, deg
A = Parameter A from chart on page IIIE-A-4-12
B = Parameter B from chart on page IIIE-A-4-12
γ = Unit weight of soil, pcf
H = Thickness of material above interface, ft

An example using the protective cover/geocomposite interface of the liner system is provided below.

A. Define the shear strength parameters (peak shear strength parameters will be used for this example).

Δ = 18 deg
C_a = 100 psf

B. Calculate the pore pressure, r_u, using the following equation:

$$r_u = (T \times \gamma_w \times \cos^2\beta) / (H \times \gamma)$$

where:

H = Thickness of material above interface, ft
γ_w = Unit weight of water, pcf
β = Slope angle, deg
T = Maximum head above interface, ft
γ = Unit weight of soil, pcf

H =	2	ft
γ_w =	62.4	pcf
β =	11.31	deg (5H:1V)
T =	0	ft
γ =	120	pcf

r_u = 0.00

Since T=0, there is no pore pressure build-up in the protective cover. If the soil material is assumed to be saturated, use a unit weight of 125 pcf for soil.

C. Calculate the slope ratio, b.

b = cot β = 5.0

D. Using r_u and b, determine Parameters A and B from the charts on page IIIE-A-4-12.

A = 1.0
B = 5.2

E. Calculate the factor of safety and compare against the minimum recommended factor of safety.

F.S. =	3.8	>	$F.S._{min}$ =	1.5

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APPENDIX IIIE-A-4
INFINITE SLOPE STABILITY ANALYSIS FOR OVERLINER SYSTEM

Component/Interface	Strength Parameters: Cohesion/Adhesion (psf)		Strength Parameters: Friction Angle (deg)		H (ft)	γ (pcf)	β (deg)	T (ft)	r_u	b	A	B	Factor of Safety Generated		Recommended Minimum Factor of Safety		Acceptable Factor of Safety	
	Peak	Residual	Peak	Residual									Peak	Residual	Peak	Residual	Peak	Residual
Overliner System (20% Slope)																		
Geosynthetic Clay Liner																		
Protective Cover/Geocomposite	100	80	18	14	2	120	11.31	0	0.00	5.0	1.0	5.2	3.8	3.0	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	2	120	11.31	0	0.00	5.0	1.0	5.2	4.1	2.6	1.5	1.0	YES	YES
Textured Geomembrane/ GCL	100	80	18	10	2	120	11.31	0	0.00	5.0	1.0	5.2	3.8	2.6	1.5	1.0	YES	YES
GCL (Internal)	100		24		2	120	11.31	0	0.00	5.0	1.0	5.2	4.4		1.5	1.0	YES	
GCL/Soil Subgrade Interface	100	80	25	12	2	120	11.31	0	0.00	5.0	1.0	5.2	4.5	2.8	1.5	1.0	YES	YES
Overliner System (3% Slope)																		
Geosynthetic Clay Liner																		
Protective Cover/Geocomposite	100	80	18	14	2	120	1.72	0	0.00	33.3	1.0	6.2	13.4	10.4	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	2	120	1.72	0	0.00	33.3	1.0	6.2	15.4	7.9	1.5	1.0	YES	YES
Textured Geomembrane/ GCL	100	80	18	10	2	120	1.72	0	0.00	33.3	1.0	6.2	13.4	7.9	1.5	1.0	YES	YES
GCL (Internal)	100		24		2	120	1.72	0	0.00	33.3	1.0	6.2	17.4	0.0	1.5	1.0	YES	
GCL/Soil Subgrade Interface	100	80	25	12	2	120	1.72	0	0.00	33.3	1.0	6.2	18.1	9.1	1.5	1.0	YES	YES

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APPENDIX IIIE-A-4
INFINITE SLOPE STABILITY ANALYSIS FOR FINAL COVER SYSTEM

Required: Evaluate the stability of the final cover system components.

Procedure:

A. Infinite Slope Stability Analysis

1. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the final cover system using peak and residual shear strength values.
2. A separate infinite slope stability analysis for the GCL alternative has been included in the FCSQCP, Appendix IIIJ-B - GCL Alternative Final Cover System Demonstration.
3. Infinite stability analysis to evaluate the internal stability of the final cover system is presented on Sheets IIIE-A-4-18 through IIIE-A-4-20.

Contents:

References:

1. Koerner, Robert M., *Designing with Geosynthetics*, 3rd Edition, Prentice-Hall Inc., 1994.
2. Duncan, J.M. and Buchignani, A. L., *An Engineering Manual for Slope Stability Studies,* Department of Civil Engineering - University of California-Berkeley, 1975.
3. USACE, *Slope Stability*, Engineering and Design Manual, EM 1110-2-1902, October 31, 2003.
4. Koerner, Robert M., *Analysis and Design of Veneer Cover Soils*, 1998 Sixth International Conference of Geosynthetics.
5. Koerner, George R. and Narejo, Dhani, *Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces,* GRI Report #30, June 14, 2005.
6. Gilbert, Robert B., *Peak Versus Residual Strength for Waste Containment Systems,*
7. Proceedings of the 15th GRI Conference, December 13, 2001.
8. NAVFAC Design Manual 7.01, September 1986.

B. Infinite Slope Stability Analysis

Interface friction strength values are selected conservatively from laboratory testing of similar material/interfaces. Prior to construction, laboratory tests will be performed to verify the assumed values for interface adhesion (or cohesion) and friction angle using project-specific soil and synthetic materials. The interface friction testing will be performed for the specific conditions analyzed. If test results differ from the assumed values, this analysis will be updated for acceptable factor of safety values using the procedure presented in the following sections.

The liner, overliner, and final cover systems are described below.

FINAL COVER SYSTEM

The final cover system includes a 1-foot-thick erosion layer, drainage geocomposite, geomembrane, and an 18-inch-thick clay infiltration layer or a layer of reinforced geosynthetic clay liner (GCL). The analysis of the GCL alternative is presented in the FCSQCP, Appendix IIIJ-B.

1. Use Duncan and Buchignani's method for infinite stability analyses to evaluate the internal stability of the liner, overliner, and final cover systems using peak and residual shear strength values.

The factor of safety is calculated using the following equation:

$$F.S. = A\frac{\tan\Delta}{\tan\beta} + B\frac{C_a}{\gamma H}$$

where:

Δ = Interface friction angle, deg
C_a = Adhesion, psf
β = Slope angle, deg
A = Parameter A from chart on page IIIE-A-4-12
B = Parameter B from chart on page IIIE-A-4-12
γ = Unit weight of soil, pcf
H = Thickness of material above interface, ft

An example using the protective cover/geocomposite interface of the liner system is provided below.

A. Define the shear strength parameters (peak shear strength parameters will be used for this example).

Δ = 18 deg
C_a = 100 psf

B. Calculate the pore pressure, r_u, using the following equation:

$$r_u = (T \times \gamma_w \times \cos^2\beta) / (H \times \gamma)$$

where:

H = Thickness of material above interface, ft
γ_w = Unit weight of water, pcf
β = Slope angle, deg
T = Maximum head above interface, ft
γ = Unit weight of soil, pcf

H =	1	ft
γ_w =	62.4	pcf
β =	14.04	deg (3H:1V)
T =	0	ft
γ =	120	pcf

r_u = 0.00

Since T=0, there is no pore pressure build-up in the protective cover. If the soil material is assumed to be saturated, use a unit weight of 125 pcf for soil.

C. Calculate the slope ratio, b.

$b = \cot\beta =$ 4.0

D. Using r_u and b, determine Parameters A and B from the charts on page IIIE-A-4-12.

A =	1.0
B =	4.2

E. Calculate the factor of safety and compare against the minimum recommended factor of safety.

F.S. =	4.80	>	$F.S._{min}$ =	1.5

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APPENDIX IIIE-A-4
INFINITE SLOPE STABILITY ANALYSIS FOR FINAL COVER SYSTEM

Component/Interface	Strength Parameters				H (ft)	γ (pcf)	β (deg)	T (ft)	r_u	b	A	B	Factor of Safety Generated		Recommended Minimum Factor of Safety		Acceptable Factor of Safety	
	Cohesion/Adhesion (psf)		Friction Angle (deg)															
	Peak	Residual	Peak	Residual									Peak	Residual	Peak	Residual	Peak	Residual
Final Cover System - Infiltration Layer Option (4H:1V Maximum Slope) (See Note 1 regarding analysis of the GCL Alternative Final Cover System)																		
Compacted Clay Infiltration Layer Option																		
Erosion Layer/Geocomposite	100	80	18	14	1	120	14.03	0	0.00	4.0	1.0	4.2	4.80	3.80	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	1	120	14.03	0	0.00	4.0	1.0	4.2	5.04	3.51	1.5	1.0	YES	YES
Textured Geomembrane/Clay Infiltration Layer	100	-	24	-	1	120	14.03	0	0.00	4.0	1.0	4.2	5.28	-	1.5	1.0	YES	YES
Clay Infiltration Layer Internal	100	-	16	-	1	120	14.03	0	0.00	4.0	1.0	4.2	4.65	-	1.5	-	YES	-

1. A separate infinite slope stability analysis for the GCL alternative has been included in the FCSQCP, Appendix IIIJ-B - GCL Alternative Final Cover System Demonstration.

APPENDIX IIIE-A-5

INTERFACE SHEAR STRENGTH CONFORMANCE TESTING REQUIREMENTS

Includes Pages IIIE-A-5-1 through IIIE-A-5-16

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5-19-2022

INTERFACE SHEAR STRENGTH CONFORMANCE TESTING REQUIREMENTS

Prior to each construction event, interface shear strength conformance testing will be required for the specific soils and geosynthetics to be incorporated into the project. The required conformance testing requirements have been established for the project based on stability analyses performed for the expansion, as presented in Appendix IIIE-A. The assumed worst-case stability analysis (Section B-B) was selected as the condition to utilize in developing the conformance testing limits, and the stability analyses was iterated to find the minimum factors of safety (FS=1.5 for total stress and FS=1.0 for residual stress conditions). The results of this analysis are presented on Sheets IIIE-A-5-5 through IIIE-A-5-16.

The global stability analysis results represent the minimum interface shear strength required during future conformance testing. These values also are applicable to the internal shear strength of the clay liner and geosynthetic clay liner (GCL) if incorporated into the analysis and future liner designs.

The following values were developed to represent the minimum shear strength at the geosynthetic interfaces required during conformance testing.

Table IIIE-A-5-1
Minimum Shear Strength Values for Future Interface Shear Strength Conformance Testing

Peak Shear Strength Parameters		Residual Shear Strength Parameters		Average Waste Unit Weight (lb/cf)
Cohesion/ Adhesion (psf)	Friction Angle (degrees)	Cohesion/ Adhesion (psf)	Friction Angle (degrees)	
100	11	50	5	65

A graph of the shear strength envelopes represented by the above values (for both Peak and Residual Stress Conditions) are presented on Sheets IIIE-A-5-3 and IIIE-A-5-4. Future laboratory conformance test results will be required to plot within the shaded zone on the graph, with test-specific shear strength values calculated assuming a waste density of 65 lb/cf (consistent with the values used for the graph) and strength parameters developed within the laboratory.

The above values may be used for stack testing of multiple geosynthetic and clay liner layers or testing of individual interfaces. A stack test (i.e., multiple geosynthetic or soil layers tested concurrently) meeting the above strength requirements demonstrates conformance of the individual materials used in the stack. Internal shear strength testing of GCL, clay liner, and protective cover will be performed as stand-alone tests, although interfaces with other materials may be performed as a stack test.

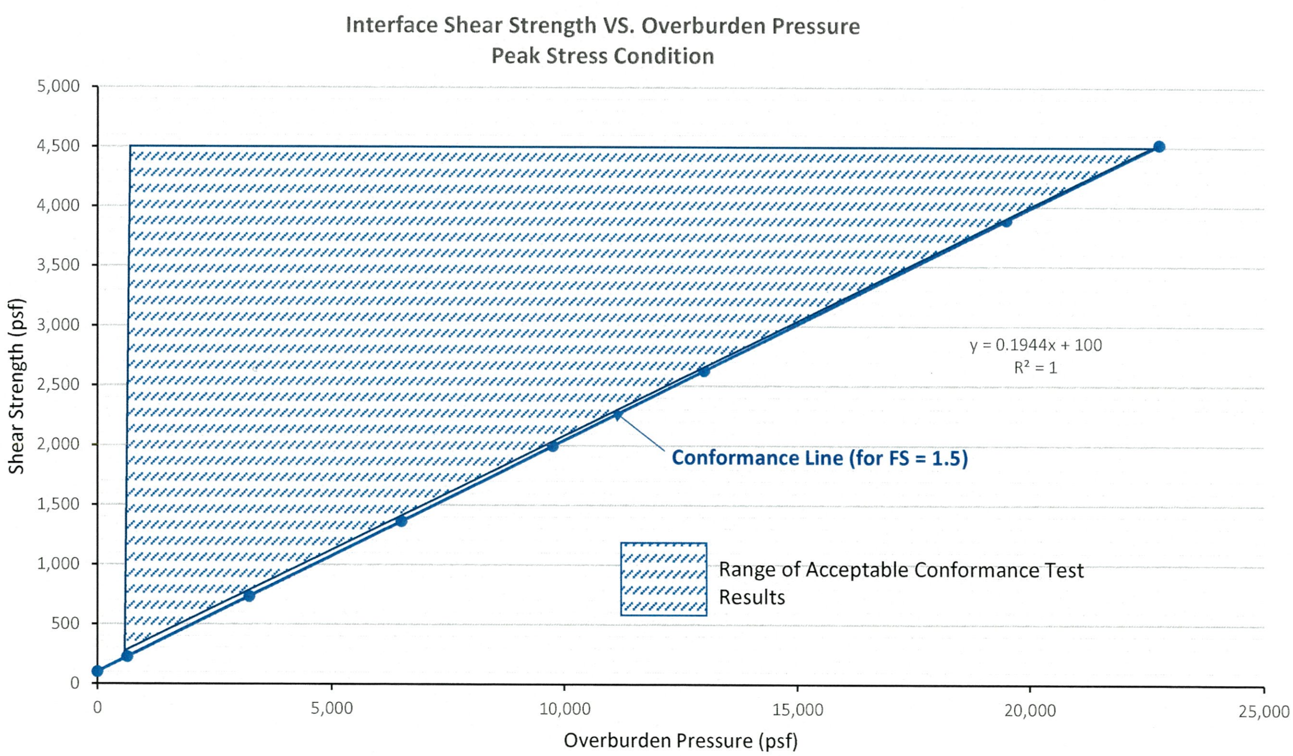
CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-A-5
GEOSYNTHETIC INTERFACE SHEAR STRENGTH TESTING REQUIREMENTS
PEAK STRESS PARAMETERS

Minimum Allowable Peak Shear Strength Parameters[1]

Friction Angle (φ, degrees)	11
Cohesion (c, psf)	100
Unit Weight of Overburden Waste (γ_{waste}, pcf)	65

Peak Shear Strength Calculations[2]

Fill height (H, ft)	Overburden Pressure (psf)	Peak Shear Strength[3] (psf)
0	0	100
10	650	226
50	3,250	732
100	6,500	1,363
150	9,750	1,995
200	13,000	2,627
300	19,500	3,890
350	22,750	4,522



Notes

1. Values shown are minimums developed from global stability analysis, and were used to develop the conformance graph shown
2. Shear strength values calculated based on an overburden stress of 65 pounds per cubic foot.
3. Shear Strength = Cohesion (c) + (H) x (γ_{waste})(tanφ)
4. Laboratory interface shear strength test results plotting below the conformance line for overburden stresses below 650 psf (representing 10 feet of overburden fill) are not considering failing.

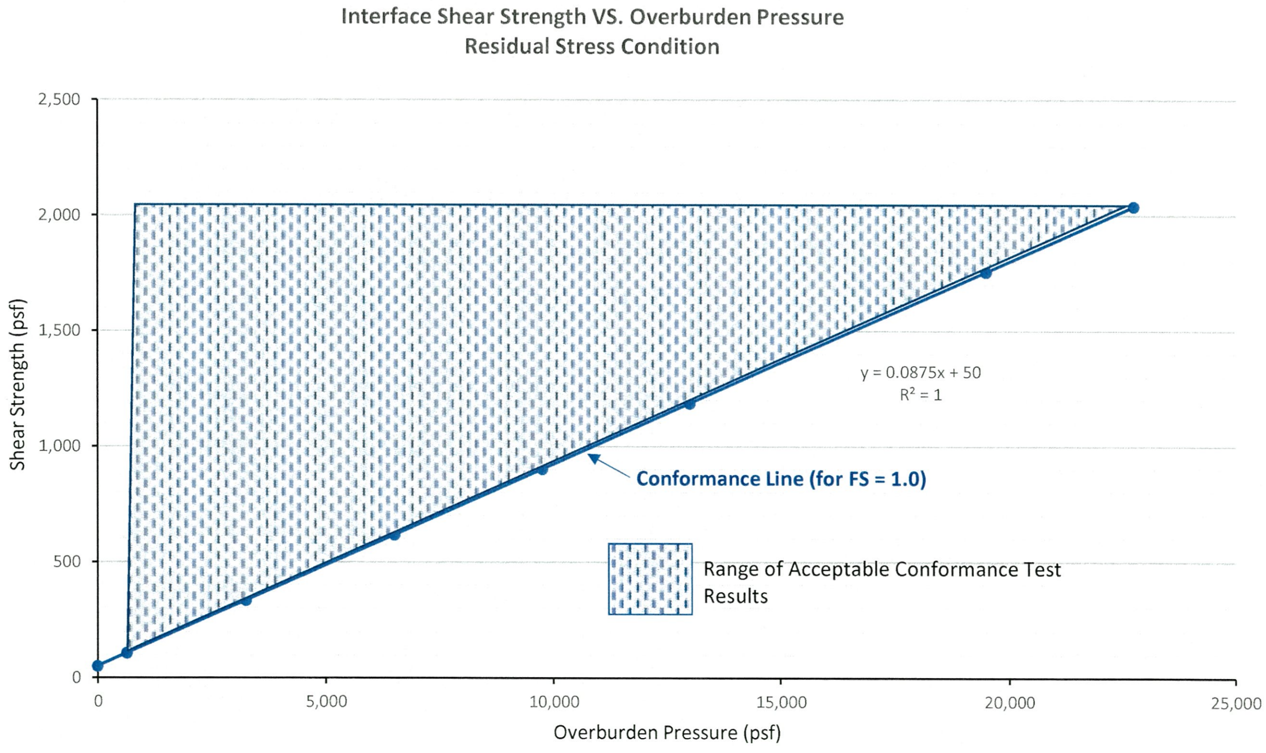
CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-A-5
GEOSYNTHETIC INTERFACE SHEAR STRENGTH TESTING REQUIREMENTS
RESIDUAL STRESS PARAMETERS

Minimum Allowable Residual Shear Strength Parameters[1]

Friction Angle (φ, degrees)	5
Cohesion (c, psf)	50
Unit Weight of Overburden Waste (γ_{waste}, pcf)	65

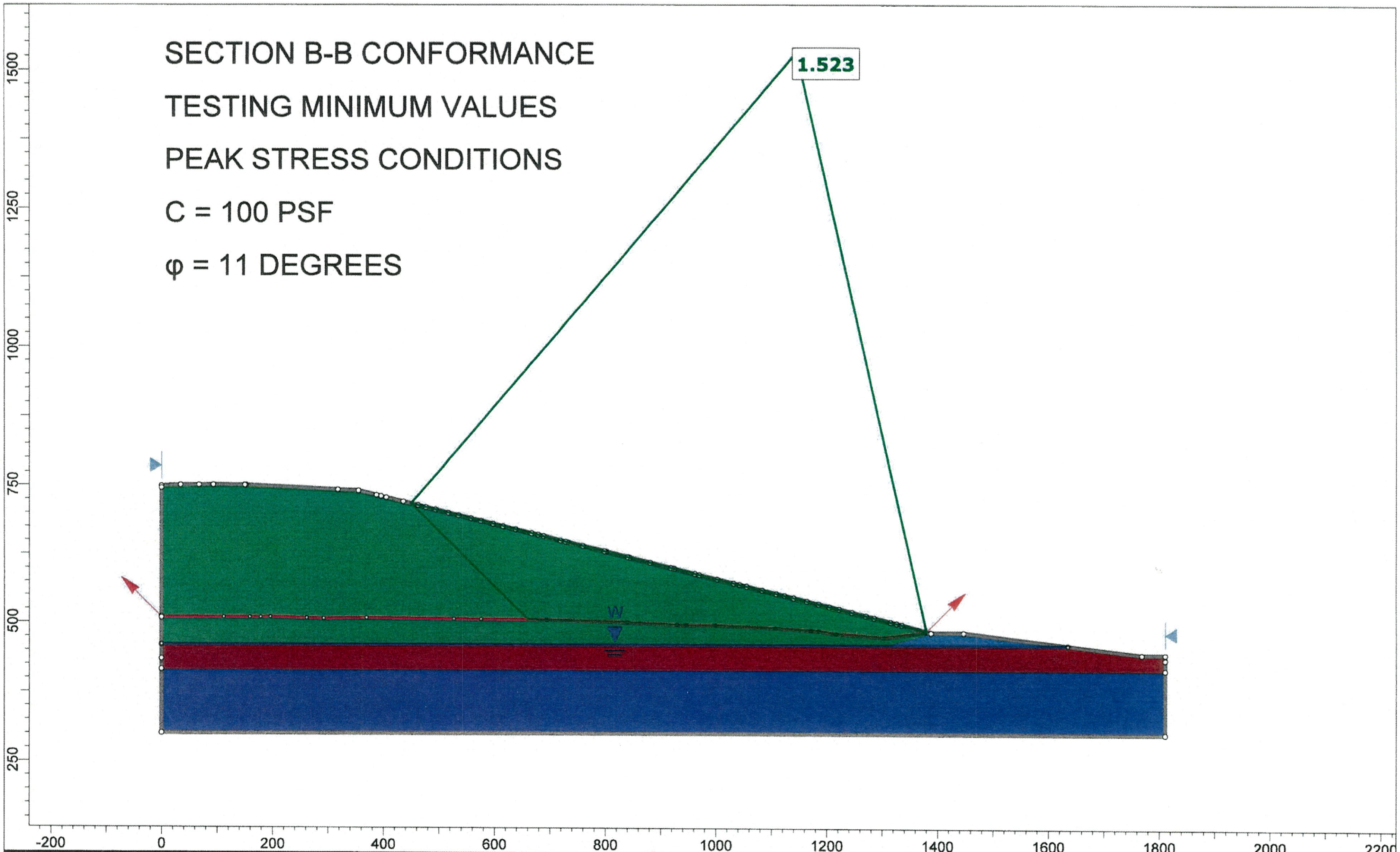
Residual Shear Strength Calculations[2]

Fill height (H, ft)	Overburden Pressure (psf)	Residual Shear Strength[3] (psf)
0	0	50
10	650	107
50	3,250	334
100	6,500	619
150	9,750	903
200	13,000	1,187
300	19,500	1,756
350	22,750	2,040



Notes

1. Values shown are minimums developed from global stability analysis, and were used to develop the conformance graph shown
2. Shear strength values calculated based on an overburden stress of 65 pounds per cubic foot.
3. Shear Strength = Cohesion (c) + (H) x (γ_{waste})(tanφ)
4. Laboratory interface shear strength test results plotting below the conformance line for overburden stresses below 650 psf (representing 10 feet of overburden fill) are not considering failing.



Weaver Consultants Group

SLIDEINTERPRET 9.018

Project	ARLINGTON LANDFILL		
Group	ENGINEERING	Scenario	PEAK STRESS - BLOCK
Drawn By	PREP BY: MB CHKD BY:DEP	Company	WEAVER CONSULTANTS GROUP
Date	12/27/2021	File Name	Peak_Block.slmd

Slide Analysis Information

Peak_Block

Project Summary

File Name:	Peak_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.583s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	16
Water Surface	None
Ru Value	0

WASTE

Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0

LINER

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	100
Friction Angle [deg]	11
Water Surface	None
Ru Value	0

COMPACTED FILL

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	2000
Friction Angle [deg]	0
Water Surface	None
Ru Value	0

WEATHERED SHALE

Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	4000
Friction Angle [deg]	0
Water Surface	Water Table
Hu Value	1

UNWEATHERED SHALE

Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

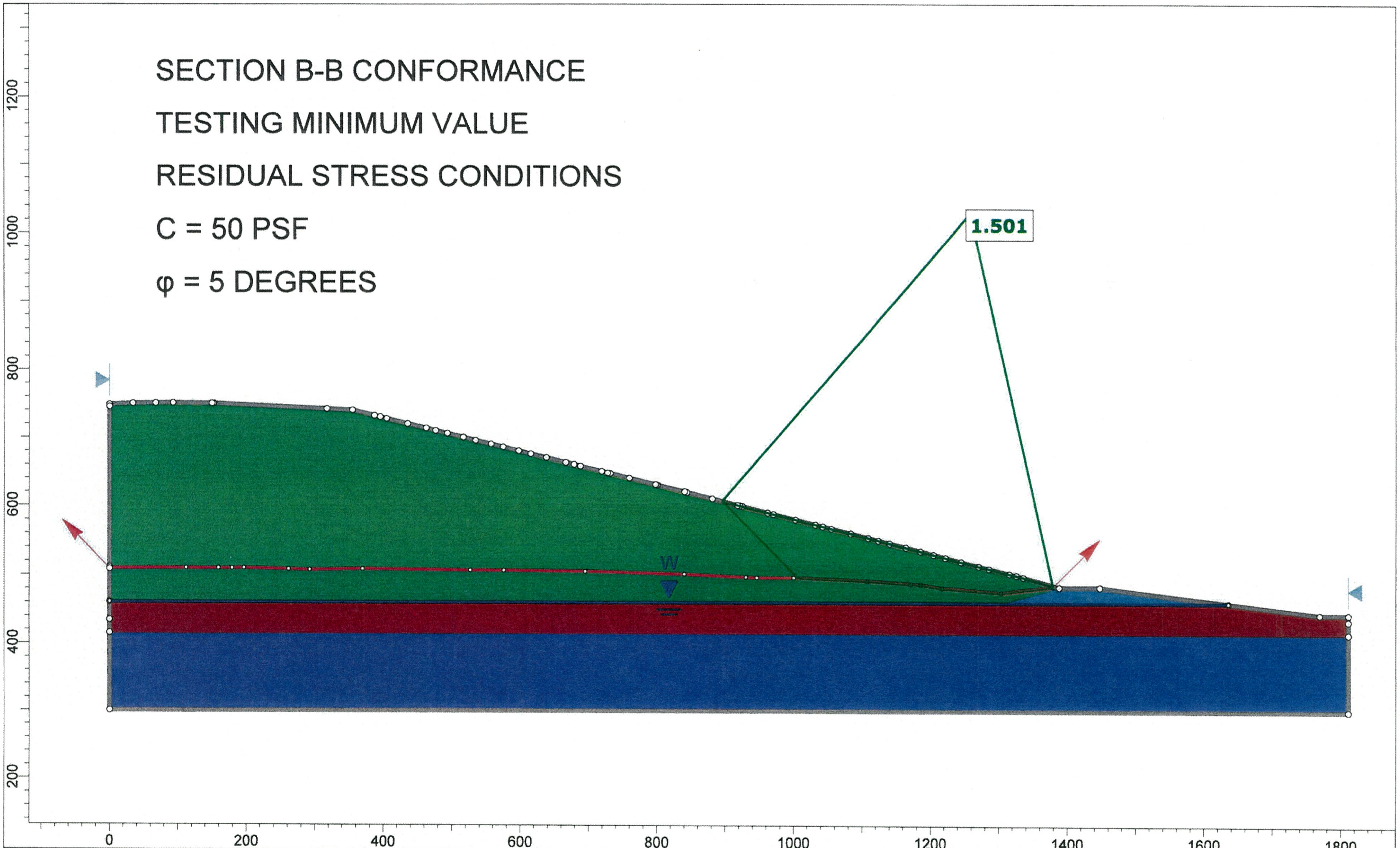
Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.522510
Axis Location:	1146.199, 1531.048
Left Slip Surface Endpoint:	449.813, 716.518
Right Slip Surface Endpoint:	1379.992, 485.221
Resisting Moment:	1.66254e+09 lb-ft
Driving Moment:	1.09197e+09 lb-ft
Total Slice Area:	76262 ft2
Surface Horizontal Width:	930.178 ft
Surface Average Height:	81.9864 ft



Weaver Consultants Group	Project	ARLINGTON LANDFILL	
	Group: ENGINEERING	Scenario: PEAK STRESS - BLOCK	
	Drawn By: PREP BY: MB CHKD BY:DEP	Company: WEAVER CONSULTANTS GROUP	
SLIDEINTERPRET 9.018	Date: 12/29/2021	File Name: Peak_Block.slmd	

Slide Analysis Information

Residual_Block

Project Summary

File Name:	Residual_Block.slmd
Slide Modeler Version:	9.018
Compute Time:	00h:00m:00.575s
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	12/16/2021, 3:01:16 PM

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

FC	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	116
Saturated Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	12
Water Surface	None
Ru Value	0
WASTE	
Color	
Strength Type	Shear Normal function
Unsaturated Unit Weight [lbs/ft3]	65
Saturated Unit Weight [lbs/ft3]	65
Water Surface	None
Ru Value	0
LINER	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	124
Cohesion [psf]	50
Friction Angle [deg]	5
Water Surface	None
Ru Value	0
COMPACTED FILL	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	125
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	200
Friction Angle [deg]	20
Water Surface	None
Ru Value	0
WEATHERED SHALE	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	2000
Friction Angle [deg]	40
Water Surface	Water Table
Hu Value	1
UNWEATHERED SHALE	
Color	

Strength Type	Generalized Hoek-Brown
Unsaturated Unit Weight [lbs/ft3]	135
Saturated Unit Weight [lbs/ft3]	140
Unconfined Compressive Strength (intact) [psf]	50000
GSI	85
mi	6
Disturbance	1
Water Surface	Water Table
Hu Value	1

Shear Normal Functions

Name: User Defined 1

Effective Normal (psf)	Shear (psf)
0	500
208	500
417	500
625	500
626	406.53
834	541.61
1040	675.38
1250	811.76
2500	1623.52
25000	16235.2

Global Minimums

Method: bishop simplified

FS	1.011930
Axis Location:	1258.141, 1029.271
Left Slip Surface Endpoint:	895.634, 606.326
Right Slip Surface Endpoint:	1378.993, 485.499
Resisting Moment:	1.69582e+08 lb-ft
Driving Moment:	1.67583e+08 lb-ft
Total Slice Area:	22349.7 ft2
Surface Horizontal Width:	483.358 ft
Surface Average Height:	46.2384 ft

APPENDIX IIIE-B

SETTLEMENT AND HEAVE ANALYSIS

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CONTENTS

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5-19-2022

INTRODUCTION

This appendix includes the settlement, strain, and heave analyses for the foundation soils and the settlement and strain analyses for the overliner system and final cover systems. The following three appendices are developed for the foundation soils, overliner, and final cover, respectively.

- Appendix IIIE-B-1 includes the settlement, heave, and strain analyses for the foundation soils.
- Appendix IIIE-B-2 includes the settlement and strain analyses for the final cover system.
- Appendix IIIE-B-3 includes the settlement and strain calculations for the WDA overliner system.
- Appendix IIIE-B-4 includes the heave analysis for the foundation.

APPENDIX IIIE-B-1

FOUNDATION/BOTTOM LINER SETTLEMENT ANALYSIS

Includes pages IIIE-B-1-1 through IIIE-B-1-39

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5-19-2022

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-B-1
BOTTOM LINER SYSTEM
SETTLEMENT AND STRAIN

Required: Determine the post-settlement slope of the bottom liner system and verify that the strain induced on the bottom liner system due to settlement is within acceptable limits.

Method:

A. Estimate settlement of subsurface below the bottom liner system. Settlement calculated by consolidation theory using SETTLE3. The program uses the Boussinesq method to approximate 2 dimensional consolidation of the foundation strata.

1. Waste filling and liner and final cover installation will result in loading of the foundation soils causing consolidation and potential differential settlement. The magnitude of consolidation and settlement will be a function of the net stress increase and properties of the foundation soils. Net stress increase is assumed to result from loading of the foundation soils during landfilling.

2. Modeling was performed using SETTLE3, RocScience, Inc (2021). Procedures are described below. Primary settlement (only) was analyzed. Secondary settlement within the shale formation is assumed negligible.

2a. The subgrade conditions were developed from the available boring logs, normalized to the excavation grades proposed for the landfill. Normalization refers to inputting boring information from the proposed excavation grade downward, based on recorded elevations shown on the logs. The borehole locations used to establish the subgrade conditions are shown on Sheet IIIE-B-1-8. For the analysis vertical loads were applied for the closed condition at the locations shown on Sheet IIIE-B-1-9.

2b. Load polygons were developed for input into SETTLE3, for the loading conditions proposed for the landfill. Vertical loads were estimated for each polygon vertex (at the locations shown on Sheet IIIM-B-1-9), and this information inputted into SETTLE3. The load polygons are shown on Sheet IIIM-B-1-10. Loads at the polygon vertices were estimated based on waste fill height and an assumed unit weight of waste (varies based on total waste depth).

2c. The SETTLE3 program calculated total settlement based on Boussinesq equation. The model output files are included in Appendix IIIE-B-1-A. The settlement isopach created by SETTLE3 is presented on Sheet IIIE-B-1-11.

3. Utilizing the settlement values calculated by SETTLE3, post-settlement slopes and strains are calculated, as presented on Sheets IIIE-B-1-5 through IIIE-B-1-7. An example of the calculation method is presented on Sheets IIIE-B-1-3 and IIIE-B-1-4.

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-B-1
BOTTOM LINER SYSTEM
SETTLEMENT AND STRAIN

Description of Contents:

Sheet IIIE-B-1-1 presents the method used for the settlement analyses.
Sheets IIIE-B-1-3 and IIIE-B-1-4 present the method of analysis for post-settlement slopes and strain between designated Evaluation Points.

Sheet IIIE-B-1-8 presents the borehole locations used to develop the subsurface profile for the SETTLE3 model.

Sheet IIIE-B-1-9 presents the final configuration load locations incorporated into the SETTLE3 model.

Sheet IIIE-B-1-10 presents the SETTLE3 load polygons incorporated into model.
Sheet IIIE-B-1-11 presents the SETTLE3 settlement isopach.
Sheet IIIE-B-1-12 presents the Evaluation Points and Evaluation Lines used in analysis of the strain and post-settlement slopes for the bottom liner.

Tables 1A and 1B present the settlement results at the Evaluation Points and distances between the Evaluation Points.

Table 2 presents slope and strain summary results from the analysis.

References:

1. Sowers, George F., Settlement of Solid Waste, *Proceedings of the Eighth International Conference on Soil Mechanics and Foundations Engineering, 1973*.
2. Quian, Xuede, R.M. Koerner, D. H. Gray, Geotechnical Aspects of Landfill Design and Construction, Prentice-Hall, Inc., New Jersey, 2002.
3. Koerner, Robert M., Designing with Geosynthetics, Third Edition. Prentice-Hall, New Jersey, 1994.
4. Acar, Yalcin B. & Daniel, David E., *Geoenvironment 2000 Characterization, Containment, Remediation, and Performance in Environmental Geotechnics,* Volume 2, American Society of Civil Engineers, 1995.
5. Zornberg, Jorge G., et al., *Retention of Free Liquids in Landfills Undergoing* Vertical Expansion, Journal of Geotechnical and Geoenvironmental Engineering, July 1999.
6. Fassett, Jeffrey B., et al., Geotechnical Properties of Municipal Solid Wastes and Their Use in Landfill Design, Waste Tech, 1994.
7. SETTLE3, Version 5.009 Copyright © 2008-2021 Rocscience Inc.
8. Beggs, Ian D. et al, Assessment of Maximum Allowable Strains in Polyethylene and Polypropylene Geomembranes, Geo-Frontiers Congress, Austin, TX, 2005.
9. Golder Associates, *City of Arlington Landfill, Permit Amendment Application*, 2014.

Solution: **A) Estimate settlement of bottom liner system.**

The SETTLE3 model was used to determine waste loading-induced settlement in the bottom liner system. The vertices and polygons developed for the modeling are shown on Sheet IIIE-B-1-10. The analysis was performed for the final contours (at build-out) of the landfill.

Post-settlement slopes were calculated between the points shown on Sheet IIIE-B-1-12. The pre- and post-settlement elevations were determined from AutoCAD surfaces for the design condition and the post-settlement conditions from the SETTLE3 model. The post-settlement condition was generated as output from SETTLE3, which was used to develop the post-settlement surface (isopach) shown on Sheet IIIE-B-1-11. The pre and post-settlement point elevations are presented in Table 1A and 1B, and the strain and slope calculations are presented in Table 2.

B) Verify that strain induced on the bottom liner system components due to settlement is within acceptable limits.

Determine the post-settlement slope of the bottom liner and verify the strain induced on the geocomposite due to settlement is within acceptable limits.

Note that negative values indicate the components are in compression.

$$\text{Strain} = \frac{L_f - L_o}{L_o} x100$$ (Reference 2, Page 472)

L_f = Final distance between evaluation points after total settlement (ft)
L_o = Initial distance between evaluation points before total settlement (ft)

An example calculation of the estimated strain is shown below for Evaluation Points BL8 and BL10. The estimated strain for all evaluation points is shown in Table 2.

Evaluation Point BL8 to Evaluation Point BL10:

Initial Distance:

Evaluation Point BL8 Elev. =	429.6	ft-msl
Evaluation Point BL10 Elev. =	437.5	ft-msl
Plan View Distance=	367.3	ft
L_o=	367.4	ft

Total Settlement:

Total Settlement Point BL8=	0.11	ft
Total Settlement Point BL10=	0.67	ft

Final Distance (after settlement):

Evaluation Point BL17 Elev. =	429.5	ft-msl
Evaluation Point BL18 Elev. =	436.8	ft-msl
Plan View Distance=	367.3	ft
L_f=	367.4	ft

Strain= -0.003%

Conclusions:

- Compacted clay liner component of bottom liner has the smallest allowable tensile strain value which is 0.5 percent (Reference 2, page 469).
- The allowable tensile strain for geosynthetic clay liner is 10 percent (ranges from 10 to 22 percent, Koerner et.al., 1996).
- The allowable tensile strain for an HDPE geomembrane is 6 to 8 percent (Reference 8).
- The allowable tensile strain for a drainage geocomposite (if used) is more than 20 percent for the geotextile (reference 3, page 112) and 200 percent for the geonet (reference 3, page 400).
- The maximum calculated strain (0.015%) represents tensile strain and is acceptable, therefore the system will be stable. The maximium compressive strain is -0.003%.

TABLE 1A. BOTTOM LINER SYSTEM - SETTLEMENT SUMMARY

Evaluation Point[1]	Initial Top of Bottom Liner Elevation (ft-msl)	Post-Settlement Top of Bottom Liner Elevation (ft-msl)	Total Top of Bottom Liner Settlement (ft)
BL1	442.0	441.9	0.06
BL2	437.8	437.2	0.60
BL3	442.3	440.9	1.40
BL4	436.0	435.9	0.08
BL5	430.8	430.7	0.04
BL6	445.0	444.9	0.11
BL7	438.0	437.9	0.12
BL8	429.6	429.5	0.11
BL9	442.0	441.8	0.15
BL10	437.5	436.8	0.67
BL11	456.8	456.2	0.58
BL12	453.3	451.8	1.47
BL13	456.0	454.7	1.32
BL14	464.0	462.9	1.09
BL15	453.0	451.5	1.51
BL16	462.0	461.0	0.96
BL17	456.0	454.8	1.17
BL18	458.0	456.8	1.15

[1] Refer to Sheet IIIE-B-1-12 for Evaluation Point locations BL1 thru BL18. Initial Top of Bottom Liner Elevations shown on Sheet IIIE-B-1-12.

TABLE 1B. DISTANCES BETWEEN SETTLEMENT EVALUATION POINTS

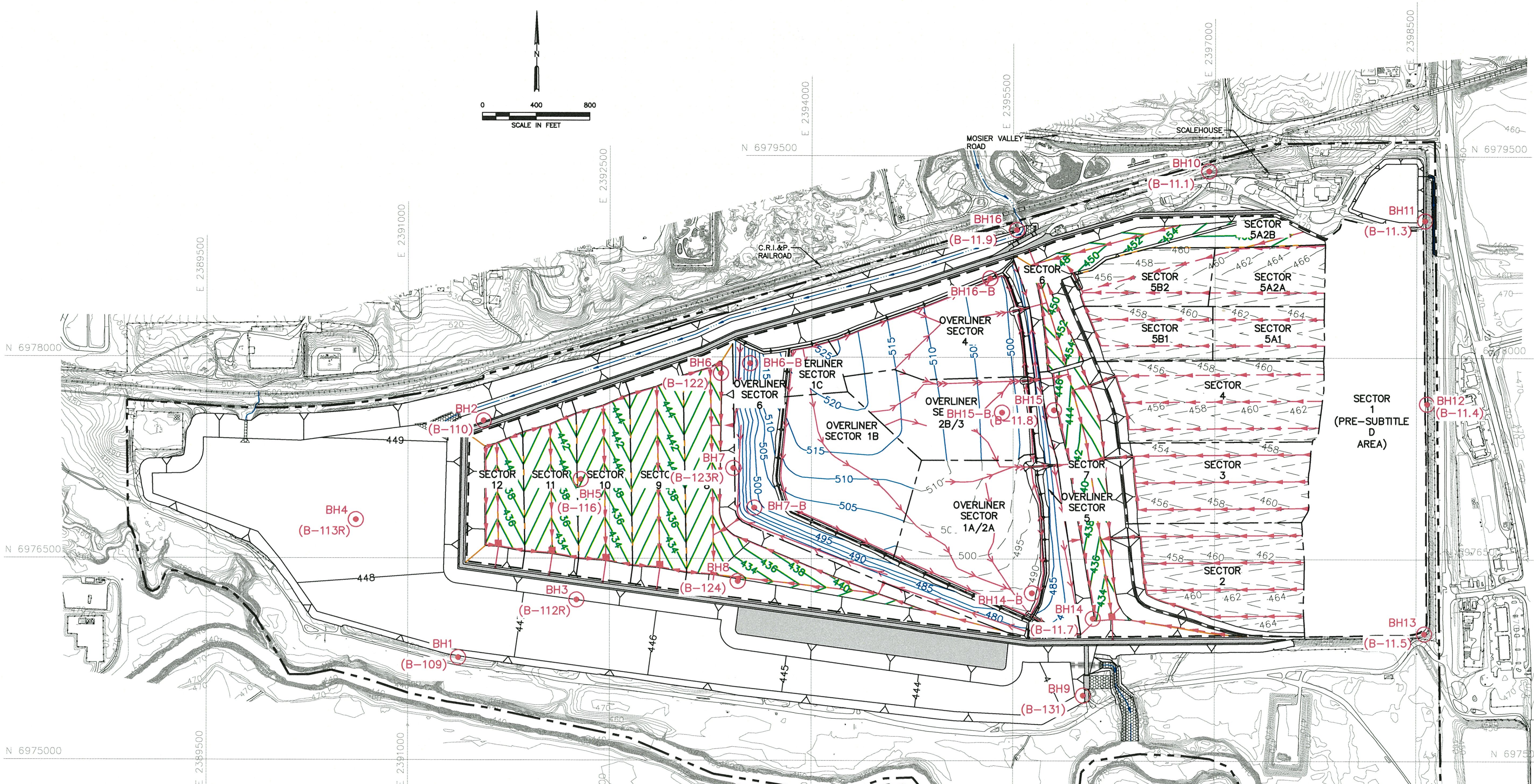
Evaluation Points[1]		
From	To	Distance (ft)
BL1	BL2	217.8
BL3	BL4	632.6
BL4	BL5	524.2
BL6	BL7	700.5
BL7	BL8	843.8
BL8	BL10	367.3
BL7	BL9	178.9
BL11	BL12	155.9
BL13	BL14	1723.4
BL15	BL17	469.7
BL16	BL17	1012.4
BL17	BL18	94.7

[1] Refer to Sheet IIIE-B-1-12 for Evaluation Points BL1 through BL18.

TABLE 2. BOTTOM LINER SYSTEM - SLOPE AND STRAIN SUMMARY

Evaluation Point[1]		Initial Top of Bottom Liner Elevation (ft-msl)		Post-Settlement Top of Bottom Liner Elevation (ft-msl)		Plan View Distance (ft)	L_o (ft)	L_f (ft)	Initial Slope (ft/ft)	Post-Settlement Slope (ft/ft)	Tensile Strain (%)
A	B	A	B	A	B						
BL1	BL2	442.0	437.8	441.9	437.2	217.8	217.9	217.9	0.019	0.022	0.005
BL3	BL4	442.3	436.0	440.9	435.9	632.6	632.6	632.6	0.010	0.008	-0.002
BL4	BL5	436.0	430.8	435.9	430.7	524.2	524.2	524.2	0.010	0.010	0.000
BL6	BL7	445.0	438.0	444.9	437.9	700.5	700.5	700.5	0.010	0.010	0.000
BL7	BL8	438.0	429.6	437.9	429.5	843.8	843.8	843.8	0.010	0.010	0.000
BL10	BL8	437.5	429.6	436.8	429.5	367.3	367.4	367.4	0.022	0.020	-0.003
BL9	BL7	442.0	438.0	441.8	437.9	178.9	178.9	178.9	0.022	0.022	0.000
BL11	BL12	456.8	453.3	456.2	451.8	155.9	156.0	156.0	0.022	0.028	0.015
BL14	BL13	464.0	456.0	462.9	454.7	1723.4	1723.4	1723.4	0.005	0.005	0.000
BL17	BL15	456.0	453.0	454.8	451.5	469.7	469.7	469.7	0.006	0.007	0.000
BL16	BL17	462.0	456.0	461.0	454.8	1012.4	1012.4	1012.4	0.006	0.006	0.000
BL18	BL17	458.0	456.0	456.8	454.8	94.7	94.7	94.7	0.021	0.021	0.000

[1] Refer to Sheet IIIE-B-1-12 for Evaluation Point locations. The "A" and "B" points represent the upgradient and downgradient endpoints, respectively.



NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. REFER TO APPENDIX IIIC FOR LEACHATE STORAGE INFORMATION.
4. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- BH1 BOREHOLE DESIGNATION (FOR WCG ANALYSIS)
- (B-109) BORING DESIGNATION (FOR DRILLING GEOLOGICAL INVESTIGATION)

STATE OF TEXAS
DAVID E. POE
81734
LICENSED PROFESSIONAL ENGINEER
5-19-2022

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DATE: 03/2022
FILE: 0023-404-11
CAD: SHEET IIIE-B-1-8.DWG

DRAWN BY: SRF
DESIGN BY: MB
REVIEWED BY: DEP

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
SETTLE3 SETTLEMENT ANALYSIS EXCAVATION PLAN W/ SETTLE3 BORING LOCATIONS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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SHEET IIIE-B-1-8

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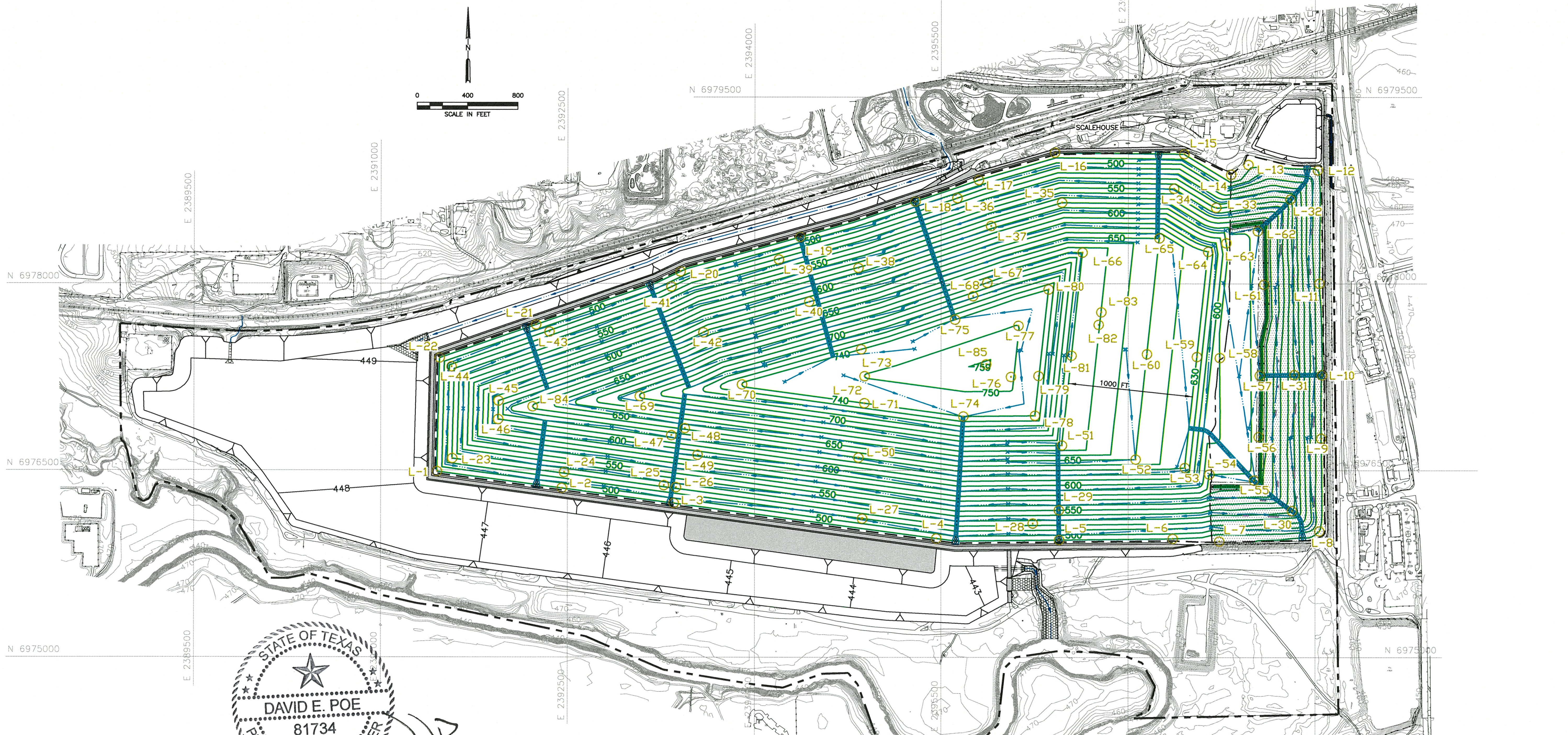

LEGEND

	PERMIT BOUNDARY
	LIMIT OF WASTE
	PRE-SUBTITLE D FINAL COVER LIMIT
500	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
550	FINAL COVER CONTOUR
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE LETDOWN
	EXISTING PRE-SUBTITLE D FINAL COVER
⊙ L-1	LOAD ANALYSIS POINT

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. PERMIT BOUNDARY PROVIDED BY GOLDER ASSOCIATES, INC.
3. REFER TO APPENDIX IIIF-SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
4. MAXIMUM FINAL COVER ELEVATION IS 759 FT-MSL.
   MAXIMUM TOP OF WASTE ELEVATION IS 757 FT-MSL.
5. TYPICAL SIDESLOPES ARE 4H:1V, TYPICAL TOPSLOPE IS 5%.

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FILE: 0023-404-96 DESIGN BY: MB
CAD: IIIE-B-1-9.DWG REVIEWED BY: DEP

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MAJOR PERMIT AMENDMENT
SETTLE3 SETTLEMENT ANALYSIS
FINAL COVER ANALYSIS POINT PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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SHEET IIIE-B-1-9

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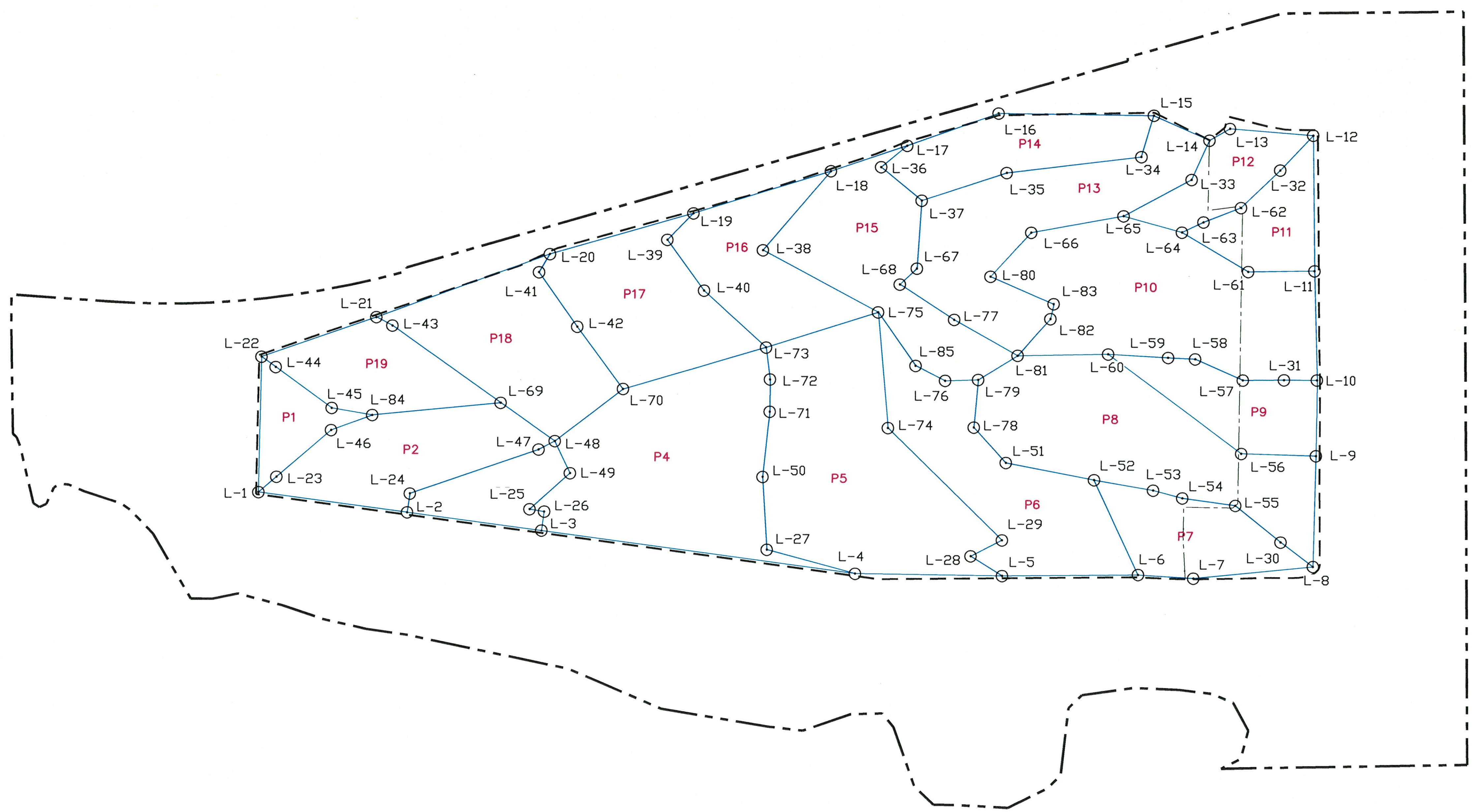

LEGEND

— - — -	PERMIT BOUNDARY
— — — —	LIMIT OF WASTE
⊙ L-1	LOAD ANALYSIS POINT
———	LOAD POLYGONS
P1	POLYGON NO.

N

0 400 800
SCALE IN FEET

STATE OF TEXAS
DAVID E. POE
81734
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MAJOR PERMIT AMENDMENT
SETTLE3 SETTLEMENT ANALYSIS
SETTLEMENT ANALYSIS LOAD POLYGONS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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SHEET IIIE-B-1-10

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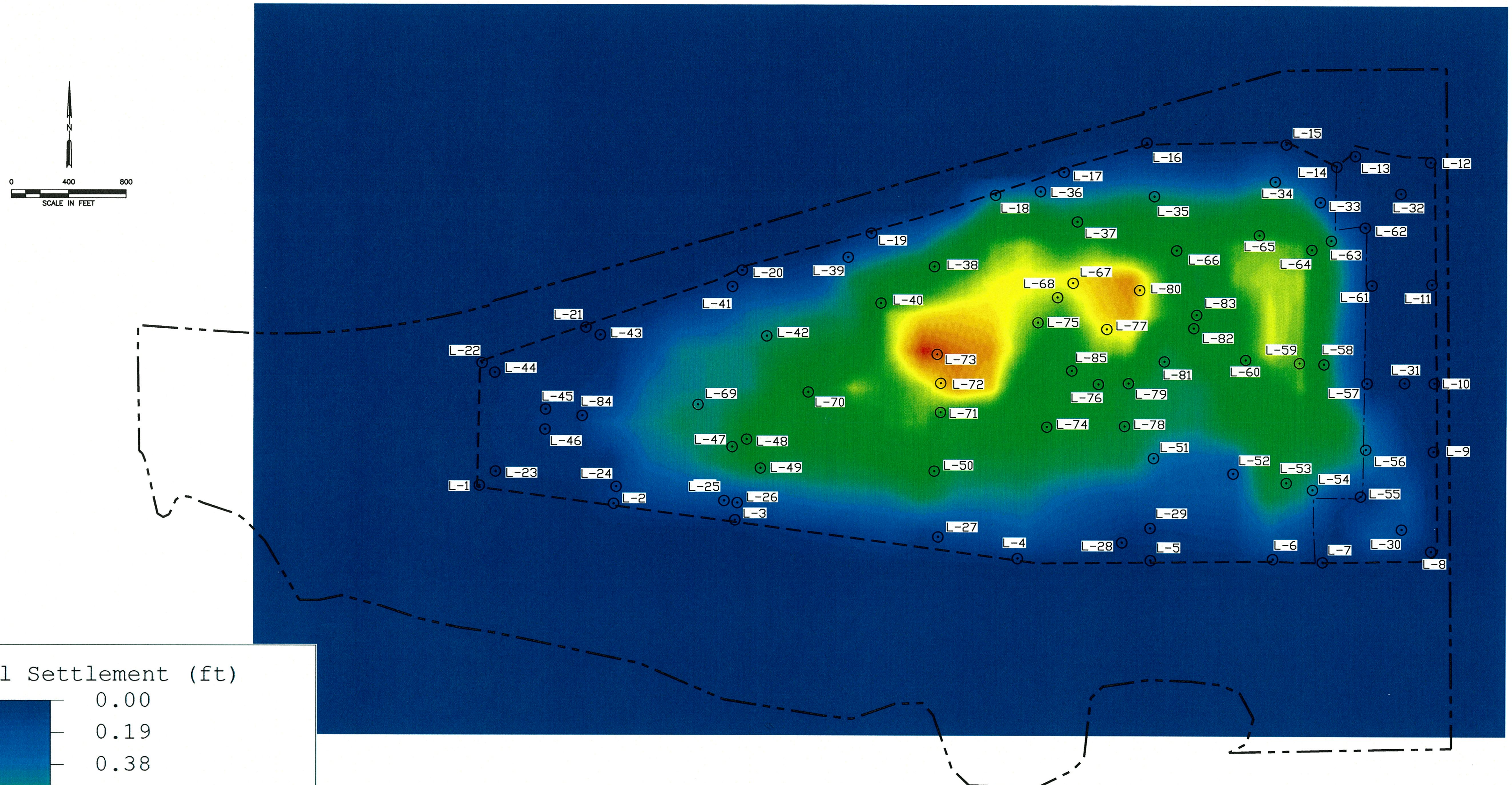

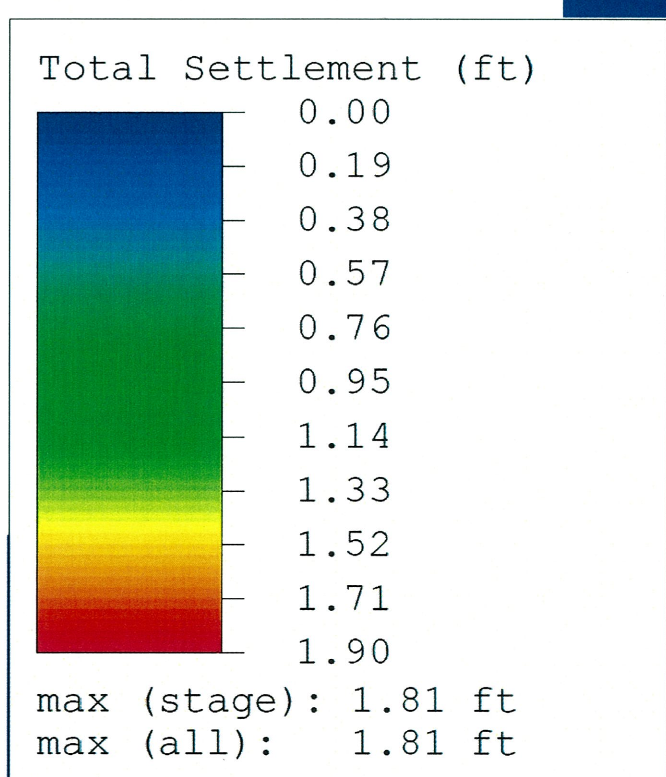

LEGEND

- — · · — PERMIT BOUNDARY
- — — — LIMIT OF WASTE
- L-1 ⊙ LOAD ANALYSIS POINT

NOTES:

1. SETTLEMENT CONTOURS DEVELOPED USING SETTLE3 VERSION 5.009 RELEASED FEBRUARY 10, 2021 (COPYRIGHT 2008).

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NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
SETTLE3 SETTLEMENT ANALYSIS
SETTLEMENT CONTOURS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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SHEET IIIE-B-1-11

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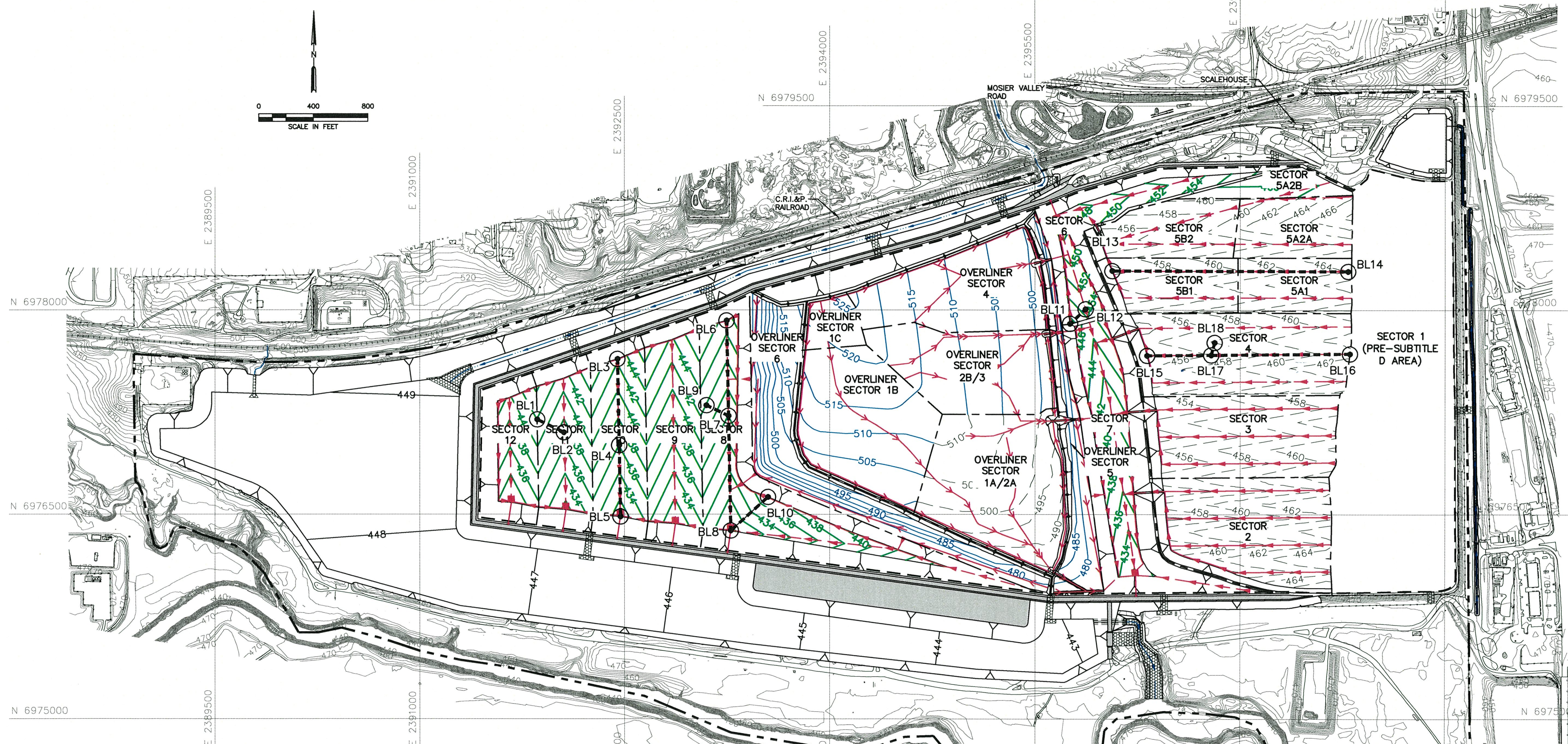

LEGEND

— · — · —	PERMIT BOUNDARY
— — — —	LIMIT OF WASTE
— — – —	SECTOR BOUNDARY
——500——	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
——440——	TOP OF LINER CONTOUR
——506——	TOP OF OVERLINER CONTOUR
— —510— —	AS-BUILT TOP OF LINER CONTOUR
	LEACHATE COLLECTION PIPE
	LEACHATE COLLECTION SUMP
	LEACHATE RISER PIPE
	OVERLINER LEACHATE DRAINAGE PIPE
	OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
BL1	BOTTOM LINER EVALUATION POINT
	BOTTOM LINER EVALUATION LINE

NOTES:

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5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

STATE OF TEXAS
DAVID E. POE
81734
LICENSED PROFESSIONAL ENGINEER
5-19-2022

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DATE: 03/2022
FILE: 0023-404-11
CAD: SHEET IIIE-B-1-12.DWG

DRAWN BY: SRF
DESIGN BY: MB
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REVISIONS

NO.	DATE	DESCRIPTION

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MAJOR PERMIT AMENDMENT
SETTLE3 SETTLEMENT ANALYSIS
BOTTOM LINER STRAIN CALCULATIONS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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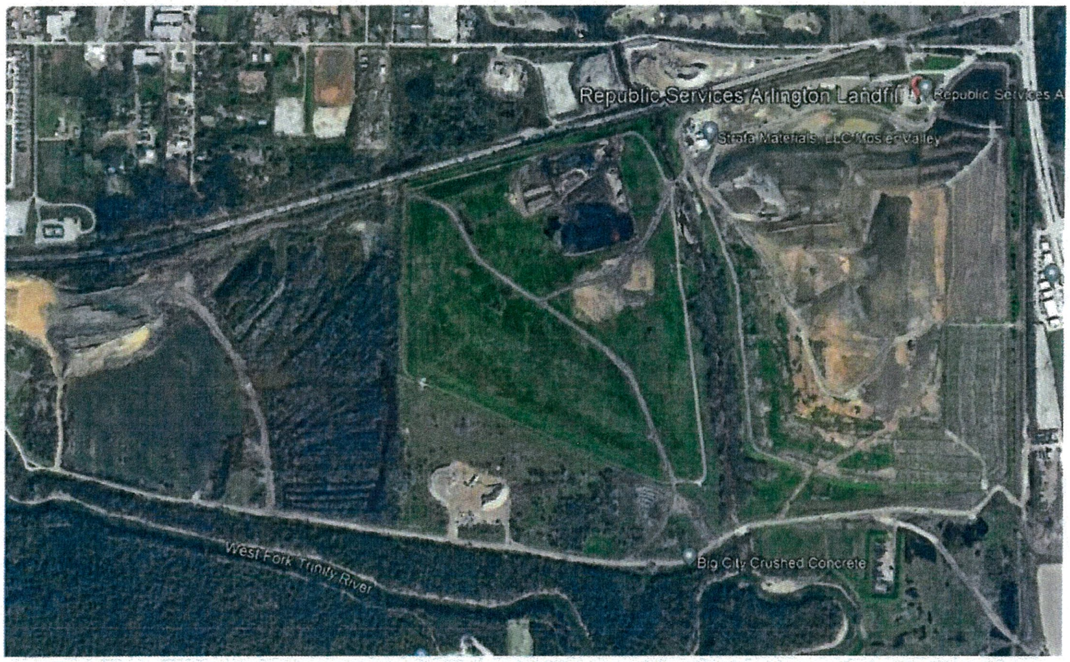


Arlington Landfill Settlement
Report Creation Date: 2021/12/13, 08:56:41

Table of Contents

Settle3 Analysis Information

Arlington Landfill Settlement

Project Settings

Document Name	Arlington_Landfill_Settlement.s3z
Project Title	Arlington Landfill Settlement
Date Created	7/16/2021, 10:08:58 AM
Stress Computation Method	Boussinesq
Minimum settlement ratio for subgrade modulus	0.9
Use average properties to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.80527
Total Consolidation Settlement [ft]	-5.13594e-06	1.66815
Virgin Consolidation Settlement [ft]	0	1.50505
Recompression Consolidation Settlement [ft]	-5.13594e-06	0.192644
Immediate Settlement [ft]	0	0.201271
Loading Stress ZZ [ksf]	-0.00185476	24.3883
Loading Stress XX [ksf]	-14.6571	38.2716
Loading Stress YY [ksf]	-15.8109	28.0979
Effective Stress ZZ [ksf]	-0.00185476	31.5024
Effective Stress XX [ksf]	-14.6571	38.2716
Effective Stress YY [ksf]	-15.8109	34.2947
Total Stress ZZ [ksf]	0.372545	38.1168
Total Stress XX [ksf]	-14.2827	38.646
Total Stress YY [ksf]	-15.4365	40.9091
Modulus of Subgrade Reaction (Total) [ksf/ft]	-0.395186	211.667
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-1.47835	321.853
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-2.64921	568.221
Total Strain	-3.78711e-05	0.077613
Pore Water Pressure [ksf]	0.3744	6.6144
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0005024	31.4983
Over-consolidation Ratio	1	26258.3
Void Ratio	0	0.500057
Hydroconsolidation Settlement [ft]	0	0
Undrained Shear Strength	-5.20256e-08	1.12

Loads

1. Fill Load: "Fill Load 1"

Label	Fill Load 1
Load Type	Flexible
Area of Load	285100 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39145e+06	6.97649e+06	0.335832
2.39157e+06	6.97659e+06	4.52717
2.39194e+06	6.97691e+06	11.4201
2.39222e+06	6.97701e+06	14.1123
2.39194e+06	6.97706e+06	11.329
2.39157e+06	6.97733e+06	3.70435
2.39145e+06	6.97742e+06	0.630962

2. Fill Load: "Fill Load 2"

Label	Fill Load 2
Load Type	Flexible
Area of Load	800553 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39245e+06	6.97636e+06	0.630521
2.39247e+06	6.97648e+06	4.91819
2.39333e+06	6.97678e+06	12.9429
2.39344e+06	6.97684e+06	10.704
2.39308e+06	6.97709e+06	18.8364
2.39222e+06	6.97701e+06	14.1123
2.39194e+06	6.97691e+06	11.4201
2.39157e+06	6.97659e+06	4.52717
2.39145e+06	6.97649e+06	0.335832

3. Fill Load: "Fill Load 3"

Label	Fill Load 3
Load Type	Flexible
Area of Load	343937 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39335e+06	6.97623e+06	0.630521
2.39337e+06	6.97636e+06	4.92873
2.39327e+06	6.97638e+06	5.02688
2.39354e+06	6.97662e+06	9.78055
2.39344e+06	6.97684e+06	10.704
2.39333e+06	6.97678e+06	12.9429
2.39247e+06	6.97648e+06	4.91819
2.39245e+06	6.97636e+06	0.630521

4. Fill Load: "Fill Load 4"

Label	Fill Load 4
Load Type	Flexible
Area of Load	1.60006e+06 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39546e+06	6.97595e+06	0.30014
2.39487e+06	6.97611e+06	3.068
2.39484e+06	6.9766e+06	11.934
2.39488e+06	6.97704e+06	22.074
2.39489e+06	6.97726e+06	23.2239
2.39486e+06	6.97747e+06	21.918
2.3939e+06	6.97719e+06	21.4871
2.39344e+06	6.97684e+06	10.704
2.39354e+06	6.97662e+06	9.78055
2.39327e+06	6.97638e+06	5.02688
2.39337e+06	6.97636e+06	4.92873
2.39335e+06	6.97623e+06	0.630521

5. Fill Load: "Fill Load 5"

Label	Fill Load 5
Load Type	Flexible
Area of Load	1.71018e+06 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39644e+06	6.97594e+06	0.685079
2.39623e+06	6.97607e+06	3.92674
2.39644e+06	6.97618e+06	3.38676
2.39568e+06	6.97693e+06	21.996
2.39561e+06	6.97771e+06	20.559
2.39486e+06	6.97747e+06	21.918
2.39489e+06	6.97726e+06	23.2239
2.39488e+06	6.97704e+06	22.074
2.39484e+06	6.9766e+06	11.934
2.39487e+06	6.97611e+06	3.068
2.39546e+06	6.97595e+06	0.30014

6. Fill Load: "Fill Load 6"

Label	Fill Load 6
Load Type	Flexible
Area of Load	1.08444e+06 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39736e+06	6.97595e+06	0.725122
2.39706e+06	6.97659e+06	13.307
2.39647e+06	6.9767e+06	16.5901
2.39625e+06	6.97694e+06	21.6715
2.39628e+06	6.97726e+06	19.5098
2.39606e+06	6.97725e+06	24.3901
2.39586e+06	6.97735e+06	24.2664
2.39561e+06	6.97771e+06	20.559
2.39568e+06	6.97693e+06	21.996
2.39644e+06	6.97618e+06	3.38676
2.39623e+06	6.97607e+06	3.92674
2.39644e+06	6.97594e+06	0.685079

7. Fill Load: "Fill Load 7"

Label	Fill Load 7
Load Type	Flexible
Area of Load	552222 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39853e+06	6.97601e+06	0.168
2.39831e+06	6.97617e+06	5.4555
2.39801e+06	6.97642e+06	0.186484
2.39765e+06	6.97647e+06	6.9561
2.39745e+06	6.97652e+06	11.123
2.39706e+06	6.97659e+06	13.307
2.39736e+06	6.97595e+06	0.725122
2.39773e+06	6.97593e+06	0.168

8. Fill Load: "Fill Load 8"

Label	Fill Load 8
Load Type	Flexible
Area of Load	1.46984e+06 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39855e+06	6.97676e+06	0.168
2.39804e+06	6.97677e+06	5.6535
2.39715e+06	6.97743e+06	13.3042
2.39654e+06	6.97742e+06	16.2615
2.39628e+06	6.97726e+06	19.5098
2.39625e+06	6.97694e+06	21.6715
2.39647e+06	6.9767e+06	16.5901
2.39706e+06	6.97659e+06	13.307
2.39745e+06	6.97652e+06	11.123
2.39765e+06	6.97647e+06	6.9561
2.39801e+06	6.97642e+06	0.186484
2.39831e+06	6.97617e+06	5.4555
2.39853e+06	6.97601e+06	0.168

9. Fill Load: "Fill Load 9"

Label	Fill Load 9
Load Type	Flexible
Area of Load	511175 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39855e+06	6.97727e+06	0.168
2.39833e+06	6.97727e+06	0.168
2.39805e+06	6.97726e+06	0.168
2.39773e+06	6.9774e+06	7.3572
2.39755e+06	6.97741e+06	11.1375
2.39715e+06	6.97743e+06	13.3042
2.39804e+06	6.97677e+06	5.6535
2.39855e+06	6.97676e+06	0.168

10. Fill Load: "Fill Load 10"

Label	Fill Load 10
Load Type	Flexible
Area of Load	1.60369e+06 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39853e+06	6.978e+06	0.168
2.39809e+06	6.97799e+06	0.168
2.39764e+06	6.97826e+06	10.9448
2.39725e+06	6.97836e+06	12.9679
2.39663e+06	6.97825e+06	16.1279
2.39636e+06	6.97795e+06	22.191
2.39678e+06	6.97777e+06	15.257
2.39676e+06	6.97767e+06	15.6571
2.39654e+06	6.97742e+06	16.2615
2.39715e+06	6.97743e+06	13.3042
2.39755e+06	6.97741e+06	11.1375
2.39773e+06	6.9774e+06	7.3572
2.39805e+06	6.97726e+06	0.168
2.39833e+06	6.97727e+06	0.168
2.39855e+06	6.97727e+06	0.168

11. Fill Load: "Fill Load 11"

Label	Fill Load 11
Load Type	Flexible
Area of Load	415755 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39853e+06	6.97894e+06	0.168
2.3983e+06	6.97868e+06	0.168
2.39804e+06	6.97842e+06	0.168
2.39778e+06	6.97832e+06	7.5582
2.39764e+06	6.97826e+06	10.9448
2.39809e+06	6.97799e+06	0.168
2.39853e+06	6.978e+06	0.168

12. Fill Load: "Fill Load 13"

Label	Fill Load 13
Load Type	Flexible
Area of Load	1.18118e+06 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39745e+06	6.97904e+06	0.678481
2.39737e+06	6.97876e+06	4.8114
2.39647e+06	6.97865e+06	7.3842
2.3959e+06	6.97846e+06	6.05371
2.39587e+06	6.97801e+06	17.5958
2.39576e+06	6.9779e+06	18.865
2.39612e+06	6.97766e+06	23.4936
2.39654e+06	6.97742e+06	16.2615
2.39676e+06	6.97767e+06	15.6571
2.39678e+06	6.97777e+06	15.257
2.39636e+06	6.97795e+06	22.191
2.39663e+06	6.97825e+06	16.1279
2.39725e+06	6.97836e+06	12.9679
2.3977e+06	6.97861e+06	3.93267
2.39782e+06	6.97888e+06	0.258002

13. Fill Load: "Fill Load 12"

Label	Fill Load 12
Load Type	Flexible
Area of Load	410138 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39796e+06	6.97902e+06	0.168
2.39782e+06	6.97888e+06	0.258002
2.3977e+06	6.97861e+06	3.93267
2.39725e+06	6.97836e+06	12.9679
2.39764e+06	6.97826e+06	10.9448
2.39778e+06	6.97832e+06	7.5582
2.39804e+06	6.97842e+06	0.168
2.3983e+06	6.97868e+06	0.168
2.39853e+06	6.97894e+06	0.168

14. Fill Load: "Fill Load 14"

Label	Fill Load 14
Load Type	Flexible
Area of Load	626514 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39579e+06	6.97887e+06	0.952199
2.39563e+06	6.97869e+06	3.13054
2.3959e+06	6.97846e+06	6.05371
2.39647e+06	6.97865e+06	7.3842
2.39737e+06	6.97876e+06	4.8114
2.39745e+06	6.97904e+06	0.678481
2.39641e+06	6.97905e+06	0.168

15. Fill Load: "Fill Load 15"

Label	Fill Load 15
Load Type	Flexible
Area of Load	986409 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39528e+06	6.97868e+06	0.616001
2.39484e+06	6.97812e+06	6.20901
2.39561e+06	6.97771e+06	20.559
2.39586e+06	6.97735e+06	24.2664
2.39606e+06	6.97725e+06	24.3901
2.39628e+06	6.97726e+06	19.5098
2.39654e+06	6.97742e+06	16.2615
2.39612e+06	6.97766e+06	23.4936
2.39576e+06	6.9779e+06	18.865
2.39587e+06	6.97801e+06	17.5958
2.3959e+06	6.97846e+06	6.05371
2.39563e+06	6.97869e+06	3.13054
2.39579e+06	6.97887e+06	0.952199

16. Fill Load: "Fill Load 16"

Label	Fill Load 16
Load Type	Flexible
Area of Load	747870 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39436e+06	6.9784e+06	0.791998
2.39419e+06	6.97819e+06	2.33527
2.39444e+06	6.97785e+06	9.856
2.39486e+06	6.97747e+06	21.918
2.39561e+06	6.97771e+06	20.559
2.39484e+06	6.97812e+06	6.20901
2.39528e+06	6.97868e+06	0.616001

17. Fill Load: "Fill Load 17"

Label	Fill Load 17
Load Type	Flexible
Area of Load	950700 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.3934e+06	6.97812e+06	0.271761
2.39333e+06	6.97797e+06	3.08338
2.39359e+06	6.97761e+06	10.2375
2.3939e+06	6.97719e+06	21.4871
2.39486e+06	6.97747e+06	21.918
2.39444e+06	6.97785e+06	9.856
2.39419e+06	6.97819e+06	2.33527
2.39436e+06	6.9784e+06	0.791998

18. Fill Load: "Fill Load 18"

Label	Fill Load 18
Load Type	Flexible
Area of Load	984840 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

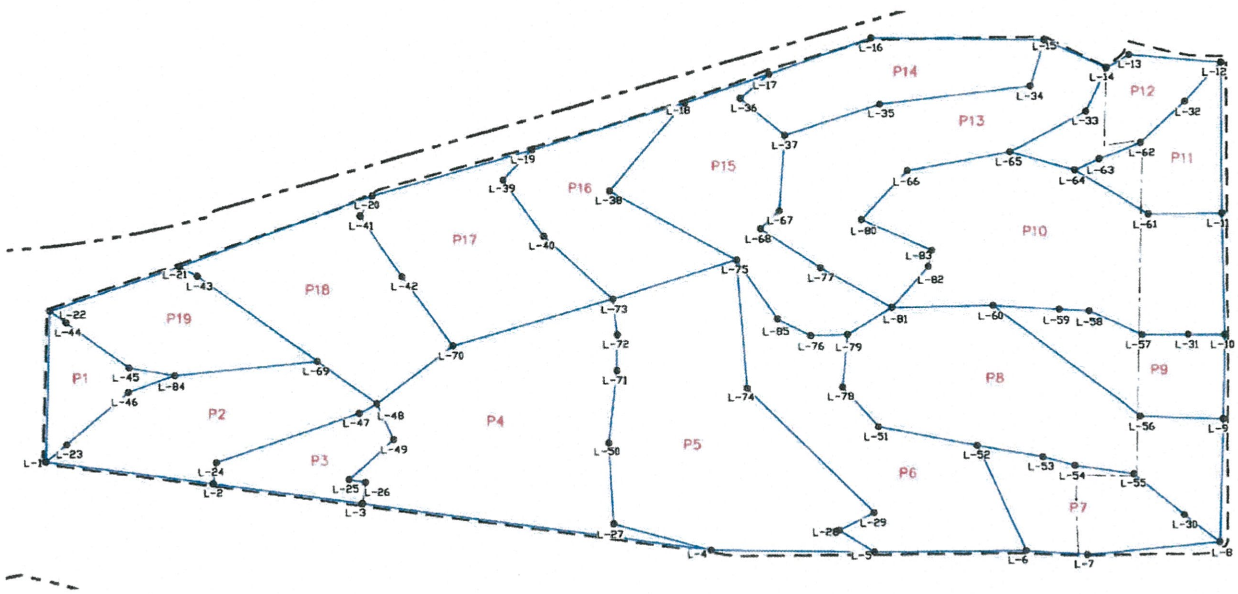
X [ft]	Y [ft]	Load Magnitude [ksf]
2.39224e+06	6.97769e+06	0.630521
2.39235e+06	6.97761e+06	3.445
2.39308e+06	6.97709e+06	18.8364
2.39344e+06	6.97684e+06	10.704
2.3939e+06	6.97719e+06	21.4871
2.39344e+06	6.97684e+06	10.704
2.3939e+06	6.97719e+06	21.4871
2.39359e+06	6.97761e+06	10.2375
2.39333e+06	6.97797e+06	3.08338
2.3934e+06	6.97812e+06	0.271761

19. Fill Load: "Fill Load 19"

Label	Fill Load 19
Load Type	Flexible
Area of Load	597790 ft2
Elevation	450 ft
Installation Stage	Stage 1

Coordinates and Load

X [ft]	Y [ft]	Load Magnitude [ksf]
2.39145e+06	6.97742e+06	0.630962
2.39157e+06	6.97733e+06	3.70435
2.39194e+06	6.97706e+06	11.329
2.39222e+06	6.97701e+06	14.1123
2.39308e+06	6.97709e+06	18.8364
2.39235e+06	6.97761e+06	3.445
2.39224e+06	6.97769e+06	0.630521

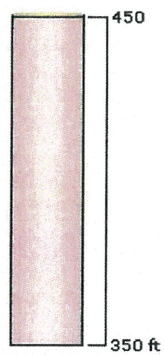


Soil Layers

BH1 (B-109)

XY Location: BH1 (B-109): (2.39137e+06, 6.97576e+06)

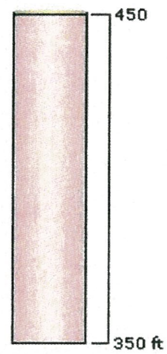
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	0	450
4	D	0	450
5	C	0	450
6	D	0	450
7	C	0	450
8	D	0	450
9	C	0	450
10	D	0	450
11	E	100	450



BH2 (B-110)

XY Location: BH2 (B-110): (2.39156e+06, 6.97752e+06)

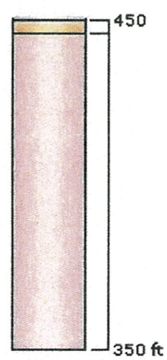
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	0	450
4	D	0	450
5	C	0	450
6	D	0	450
7	C	0	450
8	D	0	450
9	C	0	450
10	D	0	450
11	E	100	450



BH3 (B-112R)

XY Location: BH3 (B-112R): (2.39225e+06, 6.97619e+06)

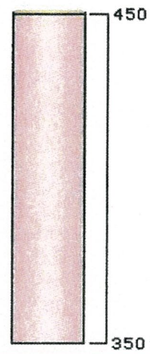
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	4	450
4	D	0	446
5	C	0	446
6	D	0	446
7	C	0	446
8	D	0	446
9	C	0	446
10	D	0	446
11	E	96	446



BH4 (B-113R)

XY Location: BH4 (B-113R): (2.39061e+06, 6.97679e+06)

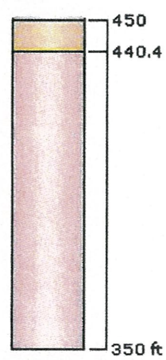
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	0	450
4	D	0	450
5	C	0	450
6	D	0	450
7	C	0	450
8	D	0	450
9	C	0	450
10	D	0	450
11	E	100	450



BH5 (B-116)

XY Location: BH5 (B-116): (2.39228e+06, 6.97709e+06)

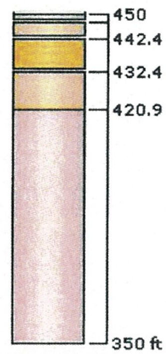
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	9.6	450
4	D	0	440.4
5	C	0	440.4
6	D	0	440.4
7	C	0	440.4
8	D	0	440.4
9	C	0	440.4
10	D	0	440.4
11	E	90.4	440.4



BH6 (B-122)

XY Location: BH6 (B-122): (2.39332e+06, 6.97788e+06)

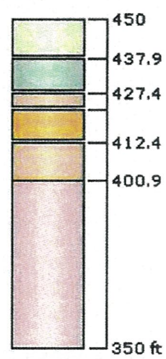
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	2.6	450
3	C	5	447.4
4	D	10	442.4
5	C	11.5	432.4
6	D	0	420.9
7	C	0	420.9
8	D	0	420.9
9	C	0	420.9
10	D	0	420.9
11	E	70.9	420.9



BH6-B (B-122)

XY Location: BH6-B (B-122): (2.39354e+06, 6.97795e+06)

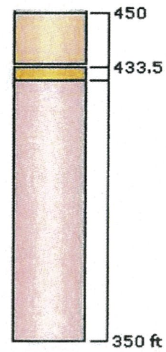
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	12.1	450
2	B	10.5	437.9
3	C	5	427.4
4	D	10	422.4
5	C	11.5	412.4
6	D	0	400.9
7	C	0	400.9
8	D	0	400.9
9	C	0	400.9
10	D	0	400.9
11	E	50.9	400.9



BH7 (B-123R)

XY Location: BH7 (B-123R): (2.39342e+06, 6.97717e+06)

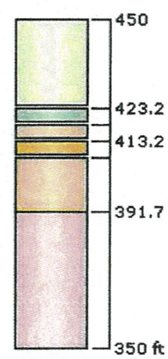
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	16.5	450
4	D	3.8	433.5
5	C	0	429.7
6	D	0	429.7
7	C	0	429.7
8	D	0	429.7
9	C	0	429.7
10	D	0	429.7
11	E	79.7	429.7



BH7-B (B-123R)

XY Location: BH7-B (B-123R): (2.39357e+06, 6.97688e+06)

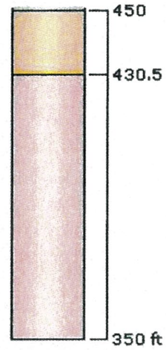
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	26.8	450
2	B	5	423.2
3	C	5	418.2
4	D	5	413.2
5	C	16.5	408.2
6	D	0	391.7
7	C	0	391.7
8	D	0	391.7
9	C	0	391.7
10	D	0	391.7
11	E	41.7	391.7



BH8 (B-124)

XY Location: BH8 (B-124): (2.39345e+06, 6.97633e+06)

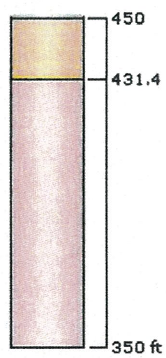
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	19.5	450
4	D	0	430.5
5	C	0	430.5
6	D	0	430.5
7	C	0	430.5
8	D	0	430.5
9	C	0	430.5
10	D	0	430.5
11	E	80.5	430.5



BH9 (B-131)

XY Location: BH9 (B-131): (2.39602e+06, 6.97549e+06)

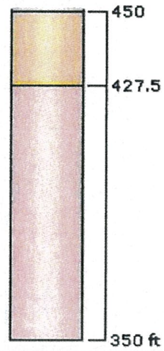
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	18.6	450
4	D	0	431.4
5	C	0	431.4
6	D	0	431.4
7	C	0	431.4
8	D	0	431.4
9	C	0	431.4
10	D	0	431.4
11	E	81.4	431.4



BH10 (B-11.1)

XY Location: BH10 (B-11.1): (2.39688e+06, 6.97932e+06)

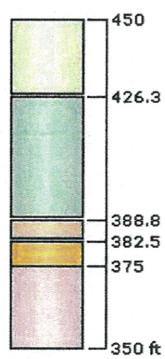
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	22.5	450
4	D	0	427.5
5	C	0	427.5
6	D	0	427.5
7	C	0	427.5
8	D	0	427.5
9	C	0	427.5
10	D	0	427.5
11	E	77.5	427.5



BH11 (B-11.3)

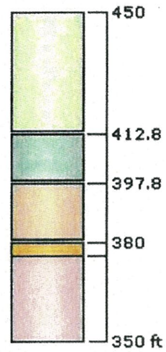
XY Location: BH11 (B-11.3): (2.39856e+06, 6.97902e+06)

Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	23.7	450
2	B	37.5	426.3
3	C	6.3	388.8
4	D	7.5	382.5
5	C	0	375
6	D	0	375
7	C	0	375
8	D	0	375
9	C	0	375
10	D	0	375
11	E	25	375



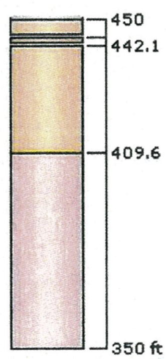
BH12 (B-11.4)

XY Location:		BH12 (B-11.4): (2.39858e+06, 6.97766e+06)	
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	37.2	450
2	B	15	412.8
3	C	17.8	397.8
4	D	4	380
5	C	0	376
6	D	0	376
7	C	0	376
8	D	0	376
9	C	0	376
10	D	0	376
11	E	26	376



BH14 (B-11.7)

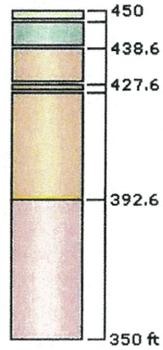
XY Location:		BH14 (B-11.7): (2.39609e+06, 6.97606e+06)	
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	0	450
3	C	5.4	450
4	D	2.5	444.6
5	C	32.5	442.1
6	D	0	409.6
7	C	0	409.6
8	D	0	409.6
9	C	0	409.6
10	D	0	409.6
11	E	59.6	409.6



BH14-B (B-11.7)

XY Location: BH14-B (B-11.7): (2.39564e+06, 6.97624e+06)

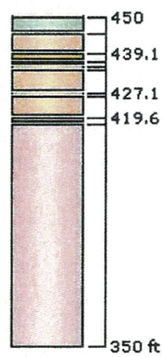
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	3.5	450
2	B	7.9	446.5
3	C	11	438.6
4	D	2.5	427.6
5	C	32.5	425.1
6	D	0	392.6
7	C	0	392.6
8	D	0	392.6
9	C	0	392.6
10	D	0	392.6
11	E	42.6	392.6



BH15 (B-11.8)

XY Location: BH15 (B-11.8): (2.3958e+06, 6.97761e+06)

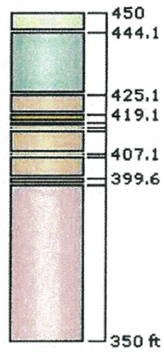
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	4.9	450
3	C	6	445.1
4	D	2.5	439.1
5	C	1.5	436.6
6	D	1	435.1
7	C	7	434.1
8	D	1	427.1
9	C	6.5	426.1
10	D	2.1	419.6
11	E	67.5	417.5



BH15-B (B-11.8)

XY Location: BH15-B (B-11.8): (2.39541e+06, 6.97759e+06)

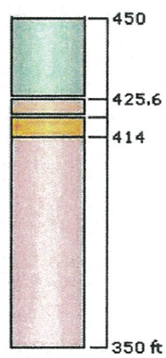
Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	5.9	450
2	B	19	444.1
3	C	6	425.1
4	D	2.5	419.1
5	C	1.5	416.6
6	D	1	415.1
7	C	7	414.1
8	D	1	407.1
9	C	6.5	406.1
10	D	2.1	399.6
11	E	47.5	397.5



BH16 (B-11.9)

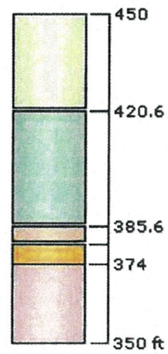
XY Location: BH16 (B-11.9): (2.39552e+06, 6.97895e+06)

Layer #	Type	Thickness [ft]	Elevation [ft]
1	A	0	450
2	B	24.4	450
3	C	5.6	425.6
4	D	6	420
5	C	0	414
6	D	0	414
7	C	0	414
8	D	0	414
9	C	0	414
10	D	0	414
11	E	64	414



BH16-B (B-11.9)

XY Location:		BH16-B (B-11.9): (2.39533e+06, 6.97859e+06)	
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**
1	A	29.4	450
2	B	35	420.6
3	C	5.6	385.6
4	D	6	380
5	C	0	374
6	D	0	374
7	C	0	374
8	D	0	374
9	C	0	374
10	D	0	374
11	E	24	374



Soil Properties

Property	A	B	C	D
Color				
Unit Weight [kips/ft3]	0.11	0.115	0.121	0.119
Saturated Unit Weight [kips/ft3]	0.132	0.133	0.137	0.13
K0	1	1	1	1
Immediate Settlement	Disabled	Disabled	Enabled	Enabled
Es [ksf]	-	-	6500	15000
Esur [ksf]	-	-	6500	15000
Primary Consolidation	Enabled	Enabled	Disabled	Disabled
Material Type	Non-Linear	Non-Linear		
Cc	0.11	0.11	-	-
Cr	0.012	0.012	-	-
e0	0.5	0.5	-	-
Pc [ksf]	4	4	-	-
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	E
Color	
Unit Weight [kips/ft3]	0.128
Saturated Unit Weight [kips/ft3]	0.142
K0	1
Immediate Settlement	Enabled
Es [ksf]	15000
Esur [ksf]	15000
Undrained Su A [kips/ft2]	0
Undrained Su S	0.2
Undrained Su m	0.8
Piezo Line ID	1

APPENDIX IIIE-B-2

FINAL COVER SETTLEMENT ANALYSIS

Includes pages IIIE-B-2-1 through IIIE-B-2-12

STATE OF TEXAS
DAVID E. POE
81734
LICENSED PROFESSIONAL ENGINEER

5-19-2022

Required: Determine the post-settlement slope of the final cover system and verify that the strain induced on the final cover due to settlement is within acceptable limits.

Method:

A. Estimate primary settlement of waste below the final cover system.
B. Estimate secondary settlement of waste below the final cover system.
C. Estimate total settlement of waste below the final cover system.
D. Verify that strain induced on the final cover due to settlement is within acceptable limits.

Description of Contents:

- Sheets IIIE-B-2-3 thru IIIE-B-2-8 present example calculations.
- Table 1 presents the final cover settlement point parameters. and analysis results.
- Table 2 presents the strain calculations along the evaluation lines.
- Sheet IIIE-B-2-9 presents the analysis conclusions.
- Sheet IIIE-B-2-12 provides the final cover analysis points and evaluation lines supporting the strain calculations.

References:

1. Sowers, George F., Settlement of Solid Waste, *Proceedings of the Eighth International Conference on Soil Mechanics and Foundations Engineering, 1973* .
2. Quian, Xuede, R.M. Koerner, D. H. Gray, Geotechnical Aspects of Landfill Design and Construction, Prentice-Hall, Inc., New Jersey, 2002.
3. Koerner, Robert M., Designing with Geosynthetics, Third Edition. Prentice-Hall, New Jersey, 1994.
4. Acar, Yalcin B. & Daniel, David E., *Geoenvironment 2000 Characterization, Containment, Remediation, and Performance in Environmental Geotechnics,* Volume 2, American Society of Civil Engineers, 1995.
5. Zornberg, Jorge G., et al., *Retention of Free Liquids in Landfills Undergoing* Vertical Expansion, Journal of Geotechnical and Geoenvironmental Engineering, July 1999.
6. Fassett, Jeffrey B., et al., Geotechnical Properties of Municipal Solid Wastes and Their Use in Landfill Design, Waste Tech, 1994.
7. SETTLE3, Version 5.009, Copyright 2008-2021, Rockscience Inc.
8. Beggs, Ian D. et al, Assessment of Maximum Allowable Strains in Polyethylene and Polypropylene Geomembranes, Geo-Frontiers Congress, Austin, TX, 2005.

Solution:

A) Estimate primary settlement of waste below the final cover system.

MSW will undergo primary consolidation due to its own weight, final cover, equipment, etc. Primary consolidation occurs quickly, generally within the first month after loading. Therefore, the weight of the final cover system is the only remaining factor that contributes to primary consolidation. In addition, by the time the construction of the final cover is complete, settlement of the waste due to the weight of the final cover will be complete.

Primary settlement is calculated using the following equation:

$$S_p = \frac{H_o C_c}{1+e_o} \log\left(\frac{\sigma'_o + \Delta\sigma}{\sigma'_o}\right)$$

S_p = primary settlement, ft
H_o = waste thickness below the final cover system, ft
C_c = compression index
e_o = void ratio of the waste layer below final cover before settlement (i.e., before final cover placement)
$\Delta\sigma$ = change in loading/increase in overburden pressure, psf
σ'_o = overburden pressure acting at mid-height of refuse below the final cover, psf

For this site assume: C_c = 0.35 x e_o (Ref. 1, p. 210)

The compression index is a function of the void ratio. The compression index can range from C_c=0.15e_o to C_c=0.55e_o for fills that are low and high in organic content, respectively. An average compression index value was chosen because it is consistent with the types of waste accepted in the past. It is also representative of the minimal amount of settlement the site has experienced.

The average void ratio of waste below the final cover is estimated by determining the void ratio at the midpoint of the waste column below the final cover system. The void ratio is calculated for each settlement evaluation point using the following equation.

$e_o = 1.86 - 0.00102\ \sigma'_o$ (Ref. 5, p. 590)

where: σ'_o = overburden pressure in kPa

$\sigma'_o = 0.5\ \gamma_{msw}\ H_o$

$\Delta\sigma = \gamma_{cov}\ T_c$

γ_{msw} = unit weight of waste below the final cover system, pcf

γ_{cov} = unit weight of cover, pcf

T_c = thickness of final cover system, ft

Parameters:

γ_{cov} = 120 pcf

T_c = 4 feet (See Note 1, below)

γ_{msw} = varies (see Note 2, below)

Notes:
1. Tc value includes protective and final cover soils, intermediate cover, and grading soils
2. The value γ_{msw} is selected based on the midpoint of the waste thicknesses below the final cover system using the Unit Weight Profile for Waste/Daily Cover within an MSW Landfill chart developed from Ref. 4.

Example Calculations:

A) Estimate primary settlement of waste below the final cover system.

The settlement points analyzed are shown on Sheet IIIE-B-2-14. An example calculation of the estimated primary settlement is shown below for Evaluation Points FC3 and FC4. The estimated primary settlement for all evaluation points is shown in Table 1.

At Evaluation Point FC3:

Top of Final Cover Elevation (ft-msl)= 740.0

Bottom of Waste Elevation (ft-msl)= 456.0

H_o = 280.0 ft

γ_{msw} = 78.0 pcf

$\sigma'_o = 0.5\ \gamma_{msw}\ H_o$

σ'_o = 10918.7 psf

σ'_o = 522.8 kPa

$e_o = 1.86 - 0.00102\ \sigma'_o$

e_o = 1.33

$C_c = 0.35\ e_o$

$C_c =$ 0.46

$\Delta\sigma =$ 480.0 psf

$$S_p = \frac{280 \times 0.46}{1 + 1.33} \log\left(\frac{10918.7 + 480}{10918.7}\right)$$

$S_p =$ 1.0 ft

At Evaluation Point FC4:

Top of Final Cover Elevation (ft-msl)= 491.3

Bottom of Waste Elevation (ft-msl)= 476.0

$H_o =$ 11.3 ft

$\gamma_{msw} =$ 43.0 pcf

$\sigma'_o = 0.5\ \gamma_{msw}\ H_o$

$\sigma'_o =$ 241.9 psf

$\sigma'_o =$ 11.6 kPa

$e_o = 1.86 - 0.00102\ \sigma'_o$

$e_o =$ 1.85

$C_c = 0.35\ e_o$

$C_c =$ 0.65

$\Delta\sigma =$ 480.0 psf

$$S_p = \frac{11.3 \times 0.65}{1 + 1.85} \log\left(\frac{241.9 + 480}{241.9}\right)$$

$S_p =$ 1.2 ft

B) Estimate secondary settlement of waste below the final cover system.

Secondary consolidation continues at substantial rates for periods of time well beyond primary settlement. It is a combination of mechanical secondary compression, physico-chemical reaction, and bio-chemical decay. The settlement-log time relationship is similar to secondary compression of soils and can be expressed by:

$$S_c = \frac{H'_o\ \alpha}{1 + e'_o} \log\left(t_2/t_1\right)$$

(Ref. 2, p. 451)

Parameters:

S_c = secondary settlement, ft
α = secondary compression index
e'_o = void ratio of the waste layer below the final cover after primary settlement has occurred due to the final cover
H'_o = waste thickness below the final cover system after settlement, ft
t_1 = starting time of secondary settlement in years
t_2 = time at which settlement is determined in years

For this site assume: $\alpha = 0.03 \times e'_o$ (Ref. 1, p. 210)

As reported by Sowers (Ref. 1), the secondary compression index is used to estimate waste decomposition. The secondary compression index ranges from $\alpha = 0.03e'_o$ to $\alpha = 0.09e'_o$ for conditions that are unfavorable and favorable to decay, respectively. An average secondary compression index value was chosen because it is consistent with the types of waste accepted in the past. It is also representative of the minimal amount of settlement the site has experienced.

The void ratio of the waste below the final cover at closure is a function of the overburden pressure caused by placement of the final cover system. The void ratio is calculated for each settlement evaluation point using the following equation.

$$e'_o = 1.86 - 0.00102\,\sigma''_o$$ (Ref. 5, p. 590)

where: σ''_o = overburden pressure in kPa

$\sigma''_o = 0.5\,\gamma'_{msw}\,H'_o$
γ'_{msw} = unit weight of waste below the final cover after primary settlement has occurred, pcf

For this site, the void ratio after primary settlement for the waste/cover soils below the final cover system varies between 1.5 to 1.9. Therefore, the secondary compression index will range between 0.09 to 0.11. Most literature sources report the secondary compression index in terms of the "modified secondary compression index" (Refs. 2, 6). The modified secondary compression index is defined by the following equation:

$$C'_\alpha = \frac{\alpha}{1 + e'_o}$$

The secondary compression index calculated for this site translates to a modified secondary compression index of 0.03 to 0.04 (for a void ratio of 1.5 to 1.9). These values are consistent with reported values for the modified secondary compression index which vary from 0.03 to 0.1 (Refs. 2, 6).

Time frame used for this analysis:

$t_1 =$ 0.083 years
$t_2 =$ 30.0 years (postclosure period)

An example calculation of the estimated secondary settlement using the above secondary settlement period is shown below for Evaluation Points FC3 and FC4. The estimated secondary settlement for all evaluation points is shown in Table 1.

At Evaluation Point FC3:

$H'_o = H_o - S_p$
$H_o' =$ 279.0 ft

$\sigma''_o = 0.5\,\gamma'_{msw}\,H'_o$
$\gamma'_{msw} =$ 77.0 pcf
$\sigma''_o =$ 10740.2 psf
$\sigma''_o =$ 514.3 kPa

$e'_o = 1.86 - 0.00102\,\sigma''_o$
$e'_o =$ 1.34

$\alpha = 0.03\,e'_o$
$\alpha =$ 0.04

$$S_c = \frac{H'_o\,\alpha}{1 + e'_o}\log(t_2/t_1)$$

$$S_c = \frac{279.0 \times 0.04}{1 + 1.34}\log\left(\frac{30}{0.083}\right)$$

$S_c =$ 12.2 ft

At Evaluation Point FC4:

$H'_o = H_o - S_p$

$H_o' =$ 10.1 ft

$\sigma''_o = 0.5\, \gamma'_{msw}\, H'_o$

$\gamma'_{msw} =$ 79.0 pcf

$\sigma''_o =$ 397.1 psf

$\sigma''_o =$ 19.0 kPa

$e'_o = 1.86 - 0.00102\, \sigma''_o$

$e'_o =$ 1.84

$\alpha = 0.03\, e'_o$

$\alpha =$ 0.06

$$S_c = \frac{H'_o\, \alpha}{1 + e'_o} \log (t_2/t_1)$$

$$S_c = \frac{10.1 \times 0.06}{1 + 1.84} \log\left(\frac{30}{0.083}\right)$$

$S_c =$ 0.5 ft

C) Estimate total settlement of waste below the final cover system.

Total settlement is the combination of primary and secondary settlement. An example calculation of the estimated total settlement is shown below for Evaluation Points FC3 and FC4. The estimated total settlement for all evaluation points is shown in Table 1.

At Evaluation Point FC3:				
Thickness of waste column, ft =	280.0	Primary Settlement =	1.0	ft
		Secondary Settlement =	12.2	ft
		Total Settlement =	13.2	ft
At Evaluation Point FC4:				
Thickness of waste column, ft=	11.3	Primary Settlement =	1.2	ft
		Secondary Settlement =	0.5	ft
		Total Settlement =	1.7	ft

D) Verify that strain induced on the final cover due to settlement is within acceptable limits.

Determine the post-settlement slope of the final cover system and verify the strain induced on the geocomposite due to settlement is within acceptable limits.

Note that negative values indicate the components are in compression.

$$\text{Strain} = \frac{L_f - L_o}{L_o} x100$$ (Reference 2, Page 472)

L_f= Final distance between evaluation points after total settlement (ft)
L_o = Initial distance between evaluation points before total settlement (ft)

An example calculation of the estimated strain is shown below for Evaluation Points FC3 and FC4. The estimated strain for all evaluation points is shown in Table 2.

Evaluation Point FC3 to Evaluation Point FC4:

Initial Distance:		
Evaluation Point FC3 Elev. =	740.0	ft-msl
Evaluation Point FC4 Elev. =	491.3	ft-msl
Plan View Distance=	994.9	ft
L_o=	1025.5	ft
Total Settlement:		
Total Settlement Point 1=	13.2	ft
Total Settlement Point 2=	1.7	ft
Final Distance (after settlement):		
Evaluation Point 1 Elev. =	726.8	ft-msl
Evaluation Point 2 Elev. =	489.6	ft-msl
Plan View Distance=	994.9	ft
L_f=	1022.8	ft

Strain= -0.27%

Conclusions:

Strain is acceptable.

- Compacted clay component of final cover has the smallest average allowable tensile strain value which is 0.5 percent (Reference 2, Page 469).
- The allowable tensile strain for an LDPE and LLDPE geomembrane is 8 to 12 percent (Reference 8).
- The allowable tensile strain for a drainage geocomposite is more than 20 percent for the geotextile (reference 3, page 112) and 200 percent for the geonet (reference 3, page 400).
- The maximum calculated strain (-0.27%) represents compression versus tensile strain and is acceptable, therefore the system will be stable. No tensile strain was observed in the analysis results.

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-B-2
FINAL COVER SETTLEMENT SUMMARY

TABLE 1. FINAL COVER EVALUATION - SETTLEMENT SUMMARY[2]

Evaluation Point[1]	Initial Top of Final Cover Elevation (ft-msl)	Initial Top of Waste Elevation (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	γ_{msw} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{msw} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Final Cover Elevation (ft-msl)
FC1	740.0	736.0	464.0	272.0	77.0	10,472.6	480.0	1.35	0.47	1.1	270.9	77.0	10,430.2	1.35	0.04	11.9	13.0	727.0
FC2	760.0	756.0	460.0	296.0	79.0	11,692.0	480.0	1.29	0.45	1.0	295.0	79.0	11,652.5	1.29	0.04	12.8	13.8	746.2
FC3	740.0	736.0	456.0	280.0	78.0	10,918.7	480.0	1.33	0.46	1.0	279.0	78.0	10,879.7	1.33	0.04	12.2	13.2	726.8
FC4	491.3	487.3	476.0	11.3	43.0	241.9	480.0	1.85	0.65	1.2	10.1	43.0	216.1	1.85	0.06	0.5	1.7	489.6
FC5	739.7	735.7	457.5	278.2	78.0	10,848.0	480.0	1.33	0.47	1.0	277.2	78.0	10,809.0	1.33	0.04	12.1	13.1	726.6
FC6	740.2	736.2	448.4	287.7	78.0	11,222.2	480.0	1.31	0.46	1.0	286.7	78.0	11,183.2	1.31	0.04	12.5	13.5	726.7
FC7	491.2	487.2	475.0	12.2	43.0	263.2	480.0	1.85	0.65	1.3	10.9	43.0	235.3	1.85	0.06	0.5	1.8	489.4
FC8	679.9	675.9	459.1	216.8	73.0	7,911.9	480.0	1.47	0.52	1.2	215.6	73.0	7,868.1	1.48	0.04	9.9	11.1	668.8
FC9	628.9	624.9	460.7	164.2	66.0	5,418.9	480.0	1.60	0.56	1.3	162.9	66.0	5,376.0	1.60	0.05	7.7	9.0	619.9

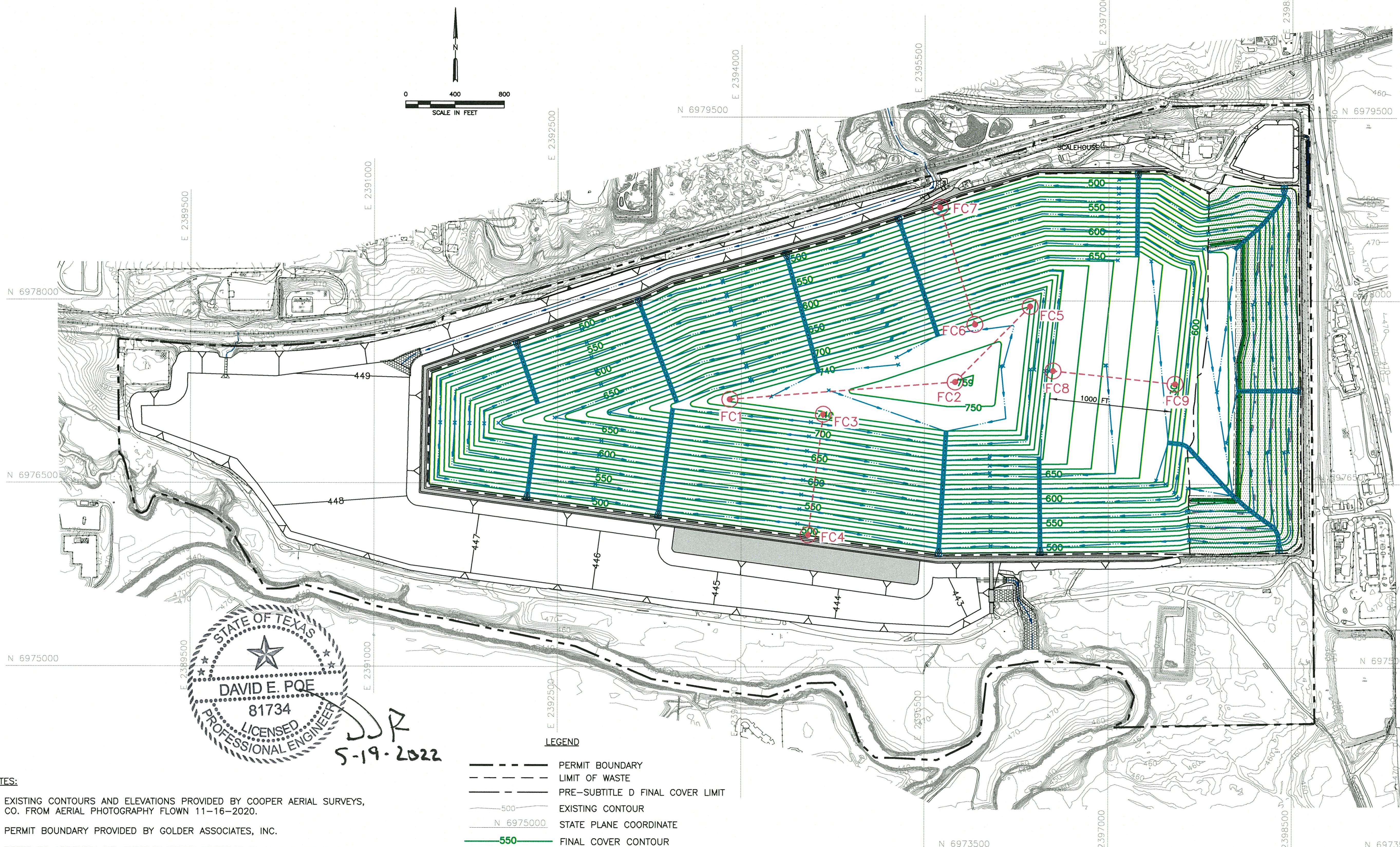
[1] Refer to Sheet IIIE-B-2-12 for Evaluation Point locations (FC1 thru FC9).

[2] Settlement calculations in above table rounded to one significant figure.

TABLE 2. FINAL COVER EVALUATION - FINAL GRADES AND STRAIN SUMMARY

Evaluation Point[1]		Initial Top of Final Cover Elevation (ft-msl)		Post-Settlement Top of Final Cover Elevation (ft-msl)		Plan View Distance (ft)	L_o (ft)	L_f (ft)	Initial Slope (ft/ft)	Post-Settlement Slope (ft/ft)	Tensile Strain (%)
A	B	A	B	A	B						
FC1	FC2	740.0	760.0	727.0	746.2	1,847.7	1,847.8	1,847.8	-0.01	-0.01	0.00
FC3	FC4	740.0	491.3	726.8	489.6	994.9	1,025.5	1,022.8	0.25	0.24	-0.27
FC2	FC5	760.0	739.7	746.2	726.6	870.9	871.1	871.1	0.02	0.02	0.00
FC6	FC7	740.2	491.2	726.7	489.4	999.9	1,030.4	1,027.6	0.25	0.24	-0.27
FC8	FC9	679.9	628.9	668.8	619.9	1,002.4	1,003.7	1,003.6	0.05	0.05	-0.01

[1] Refer to Sheet IIIE-B-2-12 for Evaluation Point locations. The "A" and "B" points represent the upgradient and downgradient endpoints, respectively.



STATE OF TEXAS
DAVID E. POE
81734
LICENSED
PROFESSIONAL ENGINEER
5-19-2022

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. PERMIT BOUNDARY PROVIDED BY GOLDER ASSOCIATES, INC.
3. REFER TO APPENDIX IIIF-SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
4. MAXIMUM FINAL COVER ELEVATION IS 759 FT-MSL. MAXIMUM TOP OF WASTE ELEVATION IS 757 FT-MSL.
5. TYPICAL SIDESLOPES ARE 4H:1V, TYPICAL TOPSLOPE IS 5%.

LEGEND

Symbol	Description
	PERMIT BOUNDARY
	LIMIT OF WASTE
	PRE-SUBTITLE D FINAL COVER LIMIT
500	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
550	FINAL COVER CONTOUR
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE LETDOWN
	EXISTING PRE-SUBTITLE D FINAL COVER
FC2	FINAL COVER EVALUATION POINT
	FINAL COVER EVALUATION LINE

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 03/2022
FILE: 0023-404-96
CAD: IIIE-B-2-12.DWG

DRAWN BY: SRF
DESIGN BY: MB
REVIEWED BY: DEP

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
SETTLE3 SETTLEMENT ANALYSIS
FINAL COVER ANALYSIS POINT PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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SHEET IIIE-B-2-12

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APPENDIX IIIE-B-3

OVERLINER SETTLEMENT AND STRAIN ANALYSIS

Includes pages IIIE-B-3-1 through IIIE-B-3-30

STATE OF TEXAS
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LICENSED
PROFESSIONAL ENGINEER

5-19-2022

Required:

Determine the post-settlement slope of the overliner system and verify that the strain induced on the overliner system components due to settlement is within acceptable limits. The post-settlement slope is also used to support the leachate collection system design included in Appendix IIIC.

Procedure:

A. Estimate the settlement of the foundation soils.
B. Estimate primary settlement of waste below the overliner system.
C. Estimate secondary settlement of waste below the overliner system.
D. Estimate total settlement of waste below the overliner system.
E. Determine the post-settlement slope of the overliner system, and verify that strain induced on the overliner system components due to settlement is within acceptable limits.
F. Determine the post-settlement slope of the leachate collection system pipe.

Notes:

1. Sheets IIIE-B-3-2 through IIIE-B-3-8 present the analysis method for the overliner settlement analysis.
2. Sheets IIIE-B-3-9 through III-B-3-12 (Table IIIE-B-3-1) presents the tabulation of the evaluation point settlement analyses.
3. Sheet IIIE-B-3-13 through IIIE-B-3-14 presents the analysis method for overliner post-settlement slope and strain.
4. Sheet IIIE-B-3-15 (Tables IIIE-B-3-2 and IIIE-B-3-3) presents the post-settlement slope and strain calculations.
5. Sheets IIIE-B-3-16 through IIIE-B-3-19 present the leachate pipe evaluation points settlement calculations.
6. Sheets IIIE-B-3-20 and IIIE-B-3-21 present the leachate pipe post-settlement slope calculations.
7. Sheet IIIE-B-3-22 presents the settlement analysis Evaluation Point Locations.
8. Sheet IIIE-B-3-23 presents the post-settlement total settlement at the evaluation points.
9. Sheet IIIE-B-3-24 presents the post-settlement overliner contours.
10. Sheet IIIE-B-3-25 presents the overliner post-settlement slope and strain evaluation points.
11. Sheet IIIE-B-3-26 presents the overliner leachate pipe layout and evaluation point locations.
12. Sheets IIIE-B-3-27 through IIIE-B-3-30 present the post-settlement leachate pipe profiles.

References:

1. Sowers, George F., *Settlement of Solid Waste* , Proceedings of the Eighth International Conference on Soil Mechanics and Foundations Engineering, 1973.
2. Qian, Xuede, R.M. Koerner, D. H. Gray, Geotechnical Aspects of Landfill Design and Construction, Prentice-Hall, Inc., New Jersey, 2002.
3. Koerner, Robert M., Designing with Geosynthetics, Fifth Edition. Prentice-Hall, New Jersey, 2005.
4. Acar, Yalcin B. & Daniel, David E., *Geoenvironment 2000 Characterization, Containment, Remediation, and Performance in Environmental Geotechnics,* Volume 2, American Society of Civil Engineers, 1995.
5. Zornberg, Jorge G., et al., *Retention of Free Liquids in Landfills Undergoing Vertical Expansion,* Journal of Geotechnical and Geoenvironmental Engineering, July 1999.
6. Fassett, Jeffrey B., et al., Geotechnical Properties of Municipal Solid Wastes and Their Use in Landfill Design, Waste Tech, 1994.
7. Beggs, Ian D. et al, Assessment of Maximum Allowable Strains in Polyethylene and Polypropylene Geomembranes, Geo-Frontiers Congress, Austin, TX, 2005.

Solution:

A. Establish Settlement Grid Across the Overliner Area.

The initial step for the settlement analysis is to establish an analysis grid for the overliner area. The settlement analysis has been performed for each grid point location (as presented in Table IIIE-B-3-1). The settlement of the overliner will include the settlement that occurs within the waste mass located between the overliner and the bottom of the pre-Subtitle D area. For this analysis, and based on shale being the primary foundation stratum existing under the overliner area, settlement of the foundation soils is assumed deminimus (in comparison to the calculated settlement within the waste mass under loading), and has been disregarded for this analysis.

The grid used for this settlement analysis is shown on Sheet IIIE-B-3-22. The total settlement values are shown on Sheet IIIE-B-3-23.

B. Estimate primary settlement of waste below the overliner system.

MSW below the overliner system will undergo primary consolidation due to its own weight, the weight of MSW placed in the pre-Subtitle D area above the overliner system, the overliner and final cover, equipment, etc. Primary consolidation occurs quickly, generally within the first month after loading. Therefore, the weight of the MSW placed above the overliner system, the overliner system, and the final cover system are the main factors that contribute to primary consolidation.

Primary settlement is calculated using the following equation:

$$S_p = \frac{H_o C_c}{1+e_o} \log\left(\frac{\sigma'_o + \Delta\sigma}{\sigma'_o}\right)$$

S_p = primary settlement, ft
H_o = waste thickness below the overliner system, ft
C_c = compression index
e_o = average void ratio of the waste layer below overliner before settlement (i.e., before waste/cover soils are placed above the overliner)
$\Delta\sigma$ = change in loading/increase in overburden pressure, psf
σ'_o = overburden pressure acting at mid-height of refuse below the overliner, psf

For this site assume: C_c = 0.35 x e_o (Ref. 1, p. 210)

The compression index is a function of the void ratio. The compression index can range from C_c=0.15e_o to C_c=0.55e_o for fills that are low and high in organic content, respectively. Final cover was placed over the WDA in 1999. Construction of the overliner began in 2021, approximately 22 years after waste was received in the WDA. A significant amount of waste decomposition will have occurred during this period; therefore, the compression index will likely be relatively low. However, an average value is used to provide a conservative analysis.

The average void ratio of waste below the overliner is estimated by determining the void ratio at the midpoint of the waste column below the overliner. The void ratio is calculated for each settlement evaluation point using the following equation.

$$e_o = 1.86 - 0.00102\,\sigma'_o \qquad \text{(Ref. 5, p. 590)}$$

where:

σ'_o = overburden pressure in kPa

$\sigma'_o = 0.5\,\gamma_{mswb}\,H_o$

$\Delta\sigma = \gamma_{cov}\,T_c + \gamma_{mswa}\,T_{waste} + \gamma_{cov}\,T_p + \gamma_{cov}\,T_s$

γ_{mswb} = unit weight of waste below the overliner system, pcf

γ_{mswa} = unit weight of waste above the overliner system, pcf

γ_{cov} = unit weight of cover (for final cover, overliner protective cover, overliner subgrade), pcf

T_{waste} = waste thickness below the final cover system and above the overliner system, ft

T_c = thickness of final cover system, ft

T_p = thickness of overliner protective cover, ft

T_s = thickness of soil subgrade for overliner, ft

Parameters:

γ_{cov} = 115 pcf

T_c = 1.0 ft

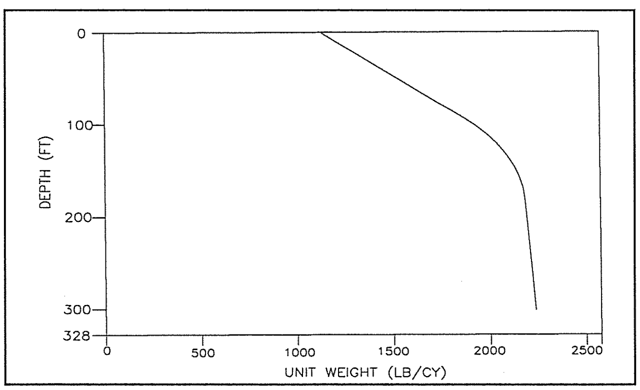
T_p = 2.0 ft

T_s = 1.0 ft

γ_{mswb} = varies (see note below)

γ_{mswa} = varies (see note below)

Note: γ_{mswb} and γ_{mswa} are selected based on the average waste thicknesses lying below and above the overliner system, respectively, using the Unit Weight Profile for Waste/Daily Cover within an MSW Landfill chart from Ref. 4 (reproduced below). Assigning a different unit weight value to each waste column provides a conservative analysis with regards to differential settlement.



An example calculation of the estimated primary settlement is shown below for Evaluation Points 95 and 96. The estimated primary settlement for all evaluation points is shown on Sheets IIIE-B-3-9 through IIIE-B-3-12 (Table IIIE-B-3-1).

At Evaluation Point 96:

Top of Waste Elev. (ft-msl) = 709.0
Top of Overliner Protective Cover Elev. (ft-msl) = 509.8
Top of Waste Below Overliner Elev. (ft-msl) = 506.8
Bottom of Waste Elev. (ft-msl) = 459.8

H_o = Top of Waste Below Overliner Elev. - Bottom of Waste Elev.
= 47.0 ft
γ_{mswb} = 48.0 pcf

T_{waste} = Top of Waste Elev. - Top of Overliner Protective Cover Elev.
= 199.2 ft
γ_{mswa} = 70.9 pcf

$\sigma'_o = 0.5\ \gamma_{mswb}\ H_o$
σ'_o = 1128.7 psf
σ'_o = 54.0 kPa

$e_o = 1.86 - 0.00102\ \sigma'_o$
e_o = 1.8

$C_c = 0.35\ e_o$
C_c = 0.63

$\Delta\sigma$ = 14570.9 psf

$$S_P = \frac{(47 \times 0.63)}{(1 \times 0.18)} \log \left(\frac{(1128.7 + 14570.9)}{1128.7}\right)$$

S_p = 12.1 ft

At Evaluation Point 95:

Top of Waste Elev. (ft-msl) = 702.3
Top of Overliner Protective Cover Elev. (ft-msl) = 509.3
Top of Waste Below Overliner Elev. (ft-msl) = 506.3 (i.e., top of waste elevation below overliner system)
Bottom of Waste Elev. (ft-msl) = 459.6

H_o = Top of Waste Below Overliner Elev. - Bottom of Waste Elev.
= 46.7 ft
γ_{mswb} = 48.0 pcf

T_{waste} = Top of Waste Elev. - Top of Overliner Protective Cover Elev.
= 193.0 ft
γ_{mswa} = 70.0 pcf

$\sigma'_o = 0.5\ \gamma_{mswb}\ H_o$
$\sigma'_o =$ 1121.9 psf
$\sigma'_o =$ 53.7 kPa

$e_o = 1.86 - 0.00102\ \sigma'_o$
$e_o =$ 1.8

$C_c = 0.35\ e_o$
$C_c =$ 0.63

$\Delta\sigma =$ 13980.2 psf

$$S_P = \frac{(46.7 \times 0.63)}{(1 \times 0.18)} \log \left(\frac{(1121.9 + 13980.2)}{1121.9}\right)$$

$S_p =$ 11.9 ft

C. Estimate secondary settlement of waste below the overliner system.

Secondary consolidation continues at substantial rates for periods of time well beyond primary settlement. It is a combination of mechanical secondary compression, physico-chemical reaction, and bio-chemical decay. Secondary settlement is calculated using the following expression:

$$S_c = \frac{H'_o\ \alpha}{1 + e'_o} \log (t_2/t_1)$$ (Ref. 2, p. 451)

Parameters:

S_c = secondary settlement, ft
α = secondary compression index
e'_o = average void ratio of waste layer below the overliner after primary settlement has occurred due to the filling of waste/cover soils above the overliner
H'_o = waste thickness below the overliner system and above the bottom of waste after primary settlement, ft
t_1 = starting time of secondary settlement in years
t_2 = time at which settlement is determined in years

For this site assume: $\alpha =$ 0.06 x e'_o (Ref. 1, p. 210)

As reported by Sowers (Ref. 1), the secondary compression index is used to estimate waste decomposition. The secondary compression index ranges from $\alpha = 0.03e'_o$ to $\alpha = 0.09e'_o$ for conditions that are unfavorable and favorable to decay, respectively. An average secondary compression index value was chosen to provide a conservative analysis. As noted in Step B, a significant amount of waste decomposition will have occurred between closure of the WDA and overliner construction. Therefore, the secondary compression index will likely be relatively low. However, an average value is used to provide a conservative analysis.

The void ratio below the overliner at closure is a function of the overburden pressure caused by waste/cover soil and the final cover system located above the overliner. The void ratio is calculated for each settlement evaluation point using the following equation.

$$e'_o = 1.86 - 0.00102\ \sigma''_o \qquad \text{(Ref. 5, p. 590)}$$

where: σ''_o = overburden pressure in kPa

$\sigma''_o = 0.5\ \gamma'_{mswb}\ H'_o$

γ'_{mswb} = unit weight of waste below the overliner after primary settlement has occurred due to the filling of waste/cover soils above the overliner, pcf

For this site, the void ratio after primary settlement for the waste/cover soils below the overliner varies between 1.8 to 1.9. Therefore, the secondary compression index will be approximately 0.11. Most literature sources report the secondary compression index in terms of the "modified secondary compression index" (Refs. 2, 6). The modified secondary compression index is defined by the following.

$$C'_\alpha = \frac{\alpha}{1 + e'_o}$$

The secondary compression index calculated for this site translates to a modified secondary compression index of 0.04 (for a void ratio of 1.8 to 1.9). These values are consistent with reported values for the modified secondary compression index which vary from 0.03 to 0.1 (Refs. 2, 6).

Time frame used for this analysis:

t_1 = 22 years (see note below)
t_2 = 100 years (see note below)

The time represented by t_1 is the time from when the WDA was closed until the time of first placement of waste in the overliner area. The site life calculated is approximately 33 years. However, to provide a conservative approach, the time, t_2, at which settlement is determined was chosen to be 100 years.

An example calculation of the estimated secondary settlement using the above secondary settlement period is shown below for Evaluation Points 95 and 96. The estimated secondary settlement for all evaluation points is shown on Sheets IIIE-B-3-9 through IIIE-B-3-12.

At Evaluation Point 96:

$H'_o = H_o - S_p$
H_o' = 34.9 ft

$\sigma''_o = 0.5\ \gamma'_{mswb}\ H'_o$
γ'_{mswb} = 81.6 pcf
σ''_o = 1423.5 psf
σ''_o = 68.2 kPa

$e'_o = 1.86 - 0.00102\ \sigma''_o$
e'_o = 1.8

$\alpha = 0.06\ e'_o$
$\alpha =$ 0.11

$$S_c = \frac{H'_o\ \alpha}{1 + e'_o} \log (t_2/t_1)$$

$$S_c = \frac{34.9 \times 0.11}{1 + 1.8} \log (100/22)$$

$S_c =$ 0.9 ft

At Evaluation Point 95:

$H'_o = H_o - S_p$
$H_o' =$ 34.8 ft

$\sigma''_o = 0.5\ \gamma'_{mswb}\ H'_o$
$\gamma'_{mswb} =$ 81.4 pcf
$\sigma''_o =$ 1418.5 psf
$\sigma''_o =$ 67.9 kPa

$e'_o = 1.86 - 0.00102\ \sigma''_o$
$e'_o =$ 1.8

$\alpha = 0.06\ e'_o$
$\alpha =$ 0.11

$$S_c = \frac{H'_o\ \alpha}{1 + e'_o} \log (t_2/t_1)$$

$$S_c = \frac{34.8 \times 0.11}{1+1.8} \log (100/22)$$

$S_c =$ 0.9 ft

D. Estimate total settlement of waste below the overliner system.

Total settlement is the combination of primary and secondary. Total settlement of the overliner is shown on Sheet IIIE-B-3-23. An example calculation of the estimated total settlement is shown below for Evaluation Points 95 and 96. The estimated total settlement for all evaluation points is shown on Sheets IIIE-B-3-9 through IIIE-B-3-12.

At Evaluation Point 96:
Thickness of waste column, ft = 47.0

Primary Settlement =	12.1 ft
Secondary Settlement =	0.9 ft
Total Settlement =	13.0 ft

At Evaluation Point 95:
Thickness of waste column, ft = 46.7

Primary Settlement =	11.9 ft
Secondary Settlement =	0.9 ft
Total Settlement =	12.8 ft

The above calculations are representative of the calculations performed for the overliner, as presented in Table IIIE-B-3-1. The settlement information for the individual evaluation points were used to devevelop the post-settlement contour map presented in Sheet IIIE-B-3-24.

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APPENDIX IIIE-B-3
TABLE IIIE-B-3-1. OVERLINER SYSTEM SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (ft-msl)	Initial Top of Waste Below Overliner Elevation (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (ft-msl)
1	516.9	485.7	484.3	485.3	0.0	0.0	42.0	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	485.7	484.3
2	573.2	479.8	481.5	453.4	0.0	0.0	42.0	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	479.8	481.5
3	617.9	478.9	481.2	453.4	0.0	0.0	42.0	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	478.9	481.2
4	675.5	478.1	480.9	453.4	0.0	0.0	42.0	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	478.1	480.9
5	724.4	477.1	480.5	453.4	0.0	0.0	42.0	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	477.1	480.5
6	745.5	474.6	479.0	456.0	0.0	0.0	44.9	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	474.6	479.0
7	756.0	474.0	479.0	453.4	0.0	0.0	45.2	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	474.0	479.0
8	752.2	471.2	479.0	454.4	0.0	279.0	44.9	42.0	0.0	12168.4	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	471.2	479.0
9	512.3	502.7	501.7	475.0	26.7	7.5	45.2	43.0	604.2	784.0	1.8	0.64	2.2	24.6	47.7	585.3	1.8	0.11	0.6	2.8	499.9	498.9
10	512.7	498.7	497.7	475.0	22.7	12.0	44.7	43.4	508.1	979.5	1.8	0.64	2.4	20.3	48.8	495.8	1.8	0.11	0.5	2.9	495.8	494.8
11	742.7	470.3	479.0	453.8	0.0	0.0	45.2	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	470.3	479.0
12	706.3	469.9	479.0	453.5	0.0	0.0	45.2	42.0	0.0	460.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	469.9	479.0
13	657.9	470.8	479.0	454.5	0.0	185.1	44.9	42.0	0.0	8226.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	470.8	479.0
14	606.1	471.7	479.0	453.9	0.0	132.4	45.2	42.0	0.0	6014.0	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	471.7	479.0
15	555.6	472.9	479.0	453.6	0.0	80.7	42.0	42.0	0.0	3846.4	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	472.9	479.0
16	502.0	473.9	479.0	454.3	0.0	26.1	42.0	42.0	0.0	1555.4	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	473.9	479.0
17	510.9	479.3	479.0	454.9	0.0	29.6	44.9	42.0	0.0	1701.9	1.9	0.65	0.0	0.0	42.0	0.0	1.9	0.11	0.0	0.0	479.3	479.0
18	493.1	497.1	496.1	470.0	26.1	-6.0	45.2	42.0	590.3	206.9	1.8	0.64	0.8	25.4	45.2	572.8	1.8	0.11	0.6	1.4	495.7	494.7
19	495.1	497.1	496.1	470.0	26.1	-4.1	45.2	42.0	590.1	289.4	1.8	0.64	1.0	25.1	45.4	570.2	1.8	0.11	0.6	1.7	495.5	494.5
20	495.6	499.4	498.4	470.0	28.4	-5.8	45.4	42.0	645.3	216.8	1.8	0.64	0.8	27.6	45.7	630.6	1.8	0.11	0.7	1.5	497.9	496.9
21	511.5	515.8	514.8	470.0	44.8	-6.3	47.7	42.0	1067.7	195.1	1.8	0.63	0.7	44.1	48.0	1058.3	1.8	0.11	1.1	1.9	514.0	513.0
22	505.9	509.8	508.8	470.0	38.8	-5.9	46.7	42.0	905.4	213.1	1.8	0.64	0.8	38.0	46.9	891.6	1.8	0.11	1.0	1.8	508.0	507.0
23	509.7	514.1	513.1	470.0	43.1	-6.4	47.7	42.0	1027.2	191.5	1.8	0.63	0.7	42.4	47.7	1010.0	1.8	0.11	1.1	1.8	512.3	511.3
24	523.1	522.4	521.4	470.0	51.4	-1.3	49.1	42.0	1263.4	404.7	1.8	0.63	1.4	50.0	49.1	1229.1	1.8	0.11	1.3	2.7	519.8	518.8
25	536.5	517.5	516.5	470.0	46.5	17.0	48.0	44.0	1116.4	1207.3	1.8	0.63	3.3	43.1	54.2	1169.0	1.8	0.11	1.1	4.4	513.1	512.1
26	549.9	513.6	512.6	470.0	42.6	34.2	47.3	46.2	1007.7	2041.8	1.8	0.63	4.6	38.0	58.9	1117.9	1.8	0.11	1.0	5.6	508.0	507.0
27	563.2	510.1	509.1	470.0	39.1	51.1	46.9	49.1	918.1	2971.9	1.8	0.64	5.5	33.6	63.1	1060.1	1.8	0.11	0.9	6.4	503.7	502.7
28	578.8	507.0	506.0	468.2	37.9	69.8	46.7	52.1	883.2	4096.0	1.8	0.64	6.4	31.4	68.7	1079.8	1.8	0.11	0.8	7.2	499.8	498.8
29	594.7	503.8	502.8	468.5	34.2	89.0	46.2	54.8	790.2	5332.8	1.8	0.64	6.9	27.3	73.2	1001.0	1.8	0.11	0.7	7.6	496.2	495.2
30	617.3	492.3	491.3	473.7	17.6	123.0	44.2	59.7	388.3	7800.6	1.8	0.64	5.3	12.3	77.3	475.0	1.8	0.11	0.3	5.6	486.7	485.7
31	492.4	480.1	479.1	480.1	0.0	10.3	42.0	43.2	0.0	905.5	1.9	0.65	0.0	0.0	44.4	0.0	1.9	0.11	0.0	0.0	480.1	479.1
32	513.7	480.3	479.3	480.3	0.0	31.4	42.0	45.9	0.0	1902.6	1.9	0.65	0.0	0.0	50.9	0.0	1.9	0.11	0.0	0.0	480.3	479.3
33	526.3	506.3	505.3	470.0	35.3	18.0	46.4	44.2	820.3	1253.1	1.8	0.64	3.2	32.1	52.7	846.1	1.8	0.11	0.8	4.0	502.3	501.3
34	544.5	521.5	520.5	470.0	50.5	20.9	48.8	44.4	1232.3	1390.4	1.8	0.63	3.7	46.8	56.0	1309.4	1.8	0.11	1.2	4.9	516.6	515.6
35	557.9	524.1	523.1	469.7	53.4	31.8	49.5	45.9	1321.7	1918.4	1.8	0.63	4.7	48.7	59.7	1454.0	1.8	0.11	1.2	5.9	518.2	517.2
36	571.2	523.3	522.3	467.6	54.7	45.9	49.5	48.0	1354.1	2666.7	1.8	0.63	5.8	48.9	64.0	1565.1	1.8	0.11	1.2	7.0	516.3	515.3
37	584.6	518.3	517.3	466.7	50.6	64.3	48.8	51.2	1234.7	3755.2	1.8	0.63	6.9	43.7	69.0	1508.2	1.8	0.11	1.1	8.0	510.3	509.3
38	598.0	514.2	513.2	467.3	45.9	81.8	48.0	53.9	1102.4	4866.5	1.8	0.63	7.6	38.3	73.0	1398.4	1.8	0.11	1.0	8.6	505.7	504.7
39	611.4	510.8	509.8	469.4	40.3	98.6	46.9	56.3	946.7	6007.4	1.8	0.63	7.9	32.5	75.6	1227.1	1.8	0.11	0.8	8.7	502.1	501.1
40	626.2	507.5	506.5	467.9	38.6	116.7	46.7	58.9	901.5	7325.7	1.8	0.64	8.4	30.3	78.0	1180.2	1.8	0.11	0.8	9.1	498.3	497.3

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TABLE IIIE-B-3-1. OVERLINER SYSTEM SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (ft-msl)	Initial Top of Waste Below Overliner Elevation (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (ft-msl)
41	642.1	504.2	503.2	467.5	35.6	135.9	46.4	61.6	827.5	8835.8	1.8	0.64	8.6	27.0	79.7	1078.2	1.8	0.11	0.7	9.3	494.9	493.9
42	658.0	500.5	499.5	469.5	30.0	155.5	45.7	64.7	684.9	10516.4	1.8	0.64	8.2	21.7	80.5	875.4	1.8	0.11	0.6	8.8	491.7	490.7
43	666.9	491.7	490.7	469.9	20.8	173.1	44.4	67.3	462.5	12117.6	1.8	0.64	6.8	14.0	80.9	567.8	1.8	0.11	0.4	7.1	484.6	483.6
44	558.6	480.0	479.0	470.0	9.0	76.5	43.2	53.0	195.4	4515.0	1.9	0.65	2.8	6.2	65.9	204.4	1.9	0.11	0.2	3.0	477.0	476.0
45	574.7	506.9	505.9	470.0	35.8	65.9	46.4	51.5	832.1	3853.9	1.8	0.64	6.1	29.8	67.3	1001.9	1.8	0.11	0.8	6.8	500.0	499.0
46	592.6	518.8	517.8	468.8	49.0	71.8	48.8	52.4	1195.1	4221.0	1.8	0.63	7.2	41.8	70.9	1479.5	1.8	0.11	1.1	8.3	510.6	509.6
47	606.0	521.2	520.2	464.9	55.3	82.8	49.9	53.9	1378.9	4920.5	1.8	0.63	8.2	47.1	74.2	1746.5	1.8	0.11	1.2	9.4	511.8	510.8
48	619.4	521.0	520.0	465.2	54.8	96.4	49.5	56.0	1357.4	5852.7	1.8	0.63	8.9	45.9	76.4	1753.2	1.8	0.11	1.2	10.1	510.9	509.9
49	632.8	518.9	517.9	464.3	53.6	111.9	49.5	58.3	1326.5	6981.7	1.8	0.63	9.6	44.0	78.4	1723.3	1.8	0.11	1.1	10.7	508.2	507.2
50	646.1	514.8	513.8	463.6	50.1	129.4	48.8	60.8	1222.2	8327.7	1.8	0.63	10.1	40.0	79.8	1598.1	1.8	0.11	1.0	11.1	503.7	502.7
51	659.5	511.3	510.3	463.5	46.9	146.2	48.0	63.1	1126.0	9684.1	1.8	0.63	10.4	36.5	80.5	1469.9	1.8	0.11	0.9	11.3	500.0	499.0
52	673.5	508.0	507.0	464.9	42.0	163.5	47.3	65.9	994.1	11234.2	1.8	0.63	10.3	31.7	80.9	1282.8	1.8	0.11	0.8	11.1	496.8	495.8
53	689.4	504.6	503.6	469.8	33.8	182.9	46.2	68.4	779.7	12976.4	1.8	0.64	9.5	24.3	81.1	984.0	1.8	0.11	0.6	10.1	494.4	493.4
54	705.3	500.9	499.9	469.7	30.1	202.5	45.7	71.1	688.9	14850.2	1.8	0.64	9.2	20.9	81.4	851.9	1.8	0.11	0.5	9.8	491.1	490.1
55	716.2	491.6	490.6	469.8	20.7	222.7	44.4	73.4	460.5	16805.1	1.8	0.64	7.4	13.3	81.7	544.8	1.8	0.11	0.3	7.7	483.8	482.8
56	604.7	480.0	479.0	471.5	7.5	122.7	43.0	59.7	160.5	7784.0	1.9	0.65	2.9	4.6	76.4	175.4	1.9	0.11	0.1	3.0	477.0	476.0
57	625.5	508.6	507.6	460.1	47.5	114.9	48.4	58.6	1150.0	7191.3	1.8	0.63	9.2	38.3	78.4	1501.0	1.8	0.11	1.0	10.2	498.5	497.5
58	640.7	516.3	515.3	461.3	54.0	122.4	49.5	59.7	1336.1	7770.3	1.8	0.63	10.1	43.9	79.5	1742.8	1.8	0.11	1.1	11.2	505.1	504.1
59	654.1	518.5	517.5	461.8	55.7	133.6	49.9	61.4	1388.7	8659.7	1.8	0.63	10.7	44.9	80.2	1801.1	1.8	0.11	1.1	11.9	506.6	505.6
60	667.5	519.8	518.8	463.6	55.1	145.8	49.9	63.1	1375.5	9658.8	1.8	0.63	11.2	43.9	80.7	1772.1	1.8	0.11	1.1	12.3	507.4	506.4
61	680.9	518.9	517.9	462.1	55.8	160.0	49.9	65.3	1391.1	10907.3	1.8	0.63	11.9	43.9	81.0	1778.4	1.8	0.11	1.1	13.0	505.9	504.9
62	694.3	515.2	514.2	461.3	52.9	177.1	49.1	67.9	1299.2	12482.7	1.8	0.63	12.2	40.7	81.2	1652.0	1.8	0.11	1.0	13.2	501.9	500.9
63	707.6	511.8	510.8	460.2	50.6	193.8	48.8	70.0	1235.2	14035.5	1.8	0.63	12.4	38.2	81.5	1557.1	1.8	0.11	1.0	13.4	498.4	497.4
64	721.0	508.4	507.4	462.1	45.3	210.6	48.0	72.0	1087.4	15632.5	1.8	0.63	12.1	33.2	81.8	1356.2	1.8	0.11	0.8	12.9	495.4	494.4
65	736.8	504.9	503.9	462.9	41.0	229.9	46.9	74.2	961.4	17515.3	1.8	0.63	11.9	29.1	81.8	1190.2	1.8	0.11	0.7	12.6	492.3	491.3
66	741.7	501.3	500.3	464.6	35.7	238.4	46.4	74.9	829.2	18325.8	1.8	0.64	11.0	24.7	81.8	1010.4	1.8	0.11	0.6	11.6	489.7	488.7
67	744.1	492.8	491.8	470.0	21.8	249.3	44.7	75.9	488.0	19391.2	1.8	0.64	8.0	13.9	81.8	567.1	1.8	0.11	0.4	8.3	484.5	483.5
68	651.1	480.0	479.0	469.3	9.7	169.1	43.2	66.7	208.6	11746.7	1.8	0.65	3.9	5.8	80.6	233.5	1.8	0.11	0.1	4.0	476.0	475.0
69	664.0	499.4	498.4	458.9	39.4	162.6	46.9	65.6	925.1	11126.2	1.8	0.64	9.9	29.5	80.9	1192.9	1.8	0.11	0.7	10.7	488.7	487.7
70	688.9	514.7	513.7	460.0	53.7	172.2	49.5	67.0	1329.6	12004.2	1.8	0.63	12.1	41.6	81.1	1688.6	1.8	0.11	1.1	13.1	501.5	500.5
71	702.3	516.2	515.2	461.6	53.6	184.0	49.5	68.7	1327.8	13103.3	1.8	0.63	12.5	41.1	81.4	1673.7	1.8	0.11	1.0	13.5	502.7	501.7
72	715.6	516.8	515.8	459.9	55.8	196.9	49.9	70.3	1393.1	14305.7	1.8	0.63	13.2	42.7	81.6	1740.8	1.8	0.11	1.1	14.3	502.5	501.5
73	729.0	516.7	515.7	460.0	55.8	210.3	49.9	72.0	1391.0	15610.4	1.8	0.63	13.6	42.1	81.8	1723.2	1.8	0.11	1.1	14.7	502.0	501.0
74	739.5	514.8	513.8	459.0	54.8	222.7	49.5	73.4	1356.4	16807.6	1.8	0.63	13.9	40.9	81.8	1672.8	1.8	0.11	1.0	14.9	499.9	498.9
75	742.4	512.0	511.0	458.0	53.1	228.3	49.5	74.0	1313.8	17346.4	1.8	0.63	13.7	39.3	81.8	1607.6	1.8	0.11	1.0	14.7	497.3	496.3
76	745.0	508.7	507.7	460.0	47.7	234.3	48.4	74.6	1154.9	17927.8	1.8	0.63	13.1	34.6	81.8	1416.0	1.8	0.11	0.9	14.0	494.8	493.8
77	748.0	505.0	504.0	460.0	44.0	241.0	47.7	75.3	1048.4	18598.3	1.8	0.63	12.6	31.4	81.8	1282.7	1.8	0.11	0.8	13.4	491.6	490.6
78	749.4	501.5	500.5	459.9	40.7	245.8	46.9	75.6	954.0	19043.0	1.8	0.63	12.1	28.5	81.8	1166.9	1.8	0.11	0.7	12.8	488.7	487.7
79	753.9	493.3	492.3	459.9	32.4	258.7	45.9	76.6	744.1	20270.7	1.8	0.64	10.6	21.8	81.8	890.4	1.8	0.11	0.6	11.2	482.1	481.1
80	698.7	480.2	479.2	470.8	8.4	216.6	43.0	72.7	180.4	16213.8	1.9	0.65	3.7	4.7	81.5	189.9	1.9	0.11	0.1	3.9	476.3	475.3

Prep By: MB
Date: 1/27/2022

Chkd By: DEP
Date: 1/27/2022

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APPENDIX IIIE-B-3
TABLE IIIE-B-3-1. OVERLINER SYSTEM SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (ft-msl)	Initial Top of Waste Below Overliner Elevation (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (ft-msl)
81	709.3	499.0	498.0	463.4	34.6	208.4	46.2	71.8	798.6	15425.0	1.8	0.64	10.2	24.4	81.6	994.4	1.8	0.11	0.6	10.8	488.1	487.1
82	734.9	511.3	510.3	463.0	47.3	221.7	48.4	73.4	1144.1	16732.2	1.8	0.63	12.7	34.6	81.8	1413.2	1.8	0.11	0.9	13.6	497.7	496.7
83	739.3	512.6	511.6	464.0	47.6	224.6	48.4	73.6	1152.9	16992.2	1.8	0.63	12.8	34.8	81.8	1422.8	1.8	0.11	0.9	13.7	498.9	497.9
84	739.5	512.8	511.8	459.9	51.9	224.7	49.1	73.6	1276.5	16995.0	1.8	0.63	13.5	38.4	81.8	1571.9	1.8	0.11	1.0	14.5	498.4	497.4
85	739.8	513.0	512.0	465.0	47.0	224.8	48.4	73.6	1137.7	17000.5	1.8	0.63	12.7	34.3	81.8	1401.4	1.8	0.11	0.9	13.6	499.4	498.4
86	740.0	512.1	511.1	456.5	54.6	225.9	49.5	73.8	1352.2	17127.8	1.8	0.63	13.9	40.7	81.8	1663.2	1.8	0.11	1.0	15.0	497.1	496.1
87	746.6	510.9	509.9	455.0	54.9	233.7	49.5	74.6	1359.3	17887.0	1.8	0.63	14.2	40.7	81.8	1664.3	1.8	0.11	1.0	15.2	495.7	494.7
88	748.2	509.3	508.3	457.6	50.7	237.0	48.8	74.7	1235.8	18170.9	1.8	0.63	13.6	37.0	81.8	1514.4	1.8	0.11	0.9	14.6	494.7	493.7
89	749.1	505.1	504.1	459.5	44.6	242.0	47.7	75.3	1063.1	18672.2	1.8	0.63	12.8	31.9	81.8	1302.4	1.8	0.11	0.8	13.6	491.5	490.5
90	749.3	500.0	499.0	459.9	39.2	247.3	46.9	75.8	919.0	19197.1	1.8	0.64	11.8	27.3	81.8	1117.2	1.8	0.11	0.7	12.5	487.5	486.5
91	752.0	492.8	491.8	459.2	32.6	257.3	45.9	76.6	747.6	20164.0	1.8	0.64	10.6	21.9	81.8	895.8	1.8	0.11	0.6	11.2	481.6	480.6
92	677.0	480.3	479.3	470.4	8.9	194.7	43.0	70.0	191.8	14094.4	1.9	0.65	3.8	5.1	81.1	208.0	1.8	0.11	0.1	3.9	476.4	475.4
93	686.6	498.7	497.7	466.0	31.7	185.9	45.9	69.0	728.0	13288.0	1.8	0.64	9.2	22.5	81.1	912.8	1.8	0.11	0.6	9.8	488.9	487.9
94	695.7	505.9	504.9	460.4	44.6	187.7	47.7	69.3	1062.8	13461.5	1.8	0.63	11.4	33.2	81.3	1349.3	1.8	0.11	0.8	12.3	493.7	492.7
95	702.3	507.3	506.3	459.6	46.7	193.0	48.0	70.0	1121.9	13980.2	1.8	0.63	11.9	34.8	81.4	1418.5	1.8	0.11	0.9	12.8	494.5	493.5
96	709.0	507.8	506.8	459.8	47.0	199.2	48.0	70.9	1128.7	14570.9	1.8	0.63	12.1	34.9	81.6	1423.5	1.8	0.11	0.9	13.0	494.8	493.8
97	715.6	508.1	507.1	460.1	46.9	205.6	48.0	71.6	1126.8	15168.6	1.8	0.63	12.3	34.7	81.7	1415.7	1.8	0.11	0.9	13.1	494.9	493.9
98	722.3	508.8	507.8	456.8	51.0	211.4	49.1	72.3	1254.0	15737.3	1.8	0.63	13.0	38.0	81.8	1555.3	1.8	0.11	1.0	14.0	494.9	493.9
99	728.9	509.8	508.8	455.0	53.8	217.1	49.5	73.0	1332.7	16305.9	1.8	0.63	13.6	40.3	81.8	1645.9	1.8	0.11	1.0	14.6	495.2	494.2
100	735.5	507.8	506.8	457.9	48.9	225.7	48.4	73.8	1183.6	17113.6	1.8	0.63	13.1	35.8	81.8	1464.2	1.8	0.11	0.9	14.0	493.8	492.8
101	739.6	504.5	503.5	460.1	43.3	233.2	47.7	74.6	1033.1	17844.5	1.8	0.63	12.3	31.0	81.8	1268.2	1.8	0.11	0.8	13.1	491.3	490.3
102	741.0	500.5	499.5	459.8	39.7	238.4	46.9	74.9	931.9	18323.8	1.8	0.64	11.8	27.9	81.8	1142.1	1.8	0.11	0.7	12.5	488.1	487.1
103	742.3	493.8	492.8	458.4	34.5	246.4	46.2	75.6	796.4	19089.7	1.8	0.64	10.9	23.6	81.8	964.9	1.8	0.11	0.6	11.5	482.4	481.4
104	638.0	480.8	479.8	480.8	0.0	155.2	42.0	64.7	0.0	10498.3	1.9	0.65	0.0	0.0	79.6	0.0	1.9	0.11	0.0	0.0	480.8	479.8
105	652.0	498.0	497.0	460.9	36.1	151.9	46.4	64.0	838.1	10189.7	1.8	0.64	9.1	27.0	80.5	1085.7	1.8	0.11	0.7	9.8	488.2	487.2
106	634.1	496.5	495.5	464.5	31.1	135.6	45.9	61.6	713.4	8815.1	1.8	0.64	7.9	23.2	79.6	921.2	1.8	0.11	0.6	8.5	488.0	487.0
107	652.7	502.1	501.1	457.4	43.7	148.6	47.7	63.4	1040.8	9890.5	1.8	0.63	10.1	33.6	80.6	1354.1	1.8	0.11	0.9	10.9	491.2	490.2
108	659.4	503.2	502.2	457.8	44.5	154.2	47.7	64.4	1059.6	10383.0	1.8	0.63	10.4	34.1	80.7	1376.9	1.8	0.11	0.9	11.2	492.0	491.0
109	666.0	503.5	502.5	460.0	42.4	160.6	47.3	65.3	1003.2	10944.5	1.8	0.63	10.3	32.1	80.9	1298.9	1.8	0.11	0.8	11.1	492.4	491.4
110	672.7	505.0	504.0	457.6	46.4	165.6	48.0	66.1	1115.5	11417.2	1.8	0.63	11.0	35.5	81.0	1435.9	1.8	0.11	0.9	11.9	493.1	492.1
111	679.3	506.0	505.0	455.3	49.7	171.3	48.8	67.0	1212.1	11944.0	1.8	0.63	11.6	38.1	81.1	1545.8	1.8	0.11	1.0	12.5	493.5	492.5
112	686.0	505.6	504.6	458.1	46.5	178.3	48.0	67.9	1117.2	12567.3	1.8	0.63	11.4	35.1	81.2	1425.4	1.8	0.11	0.9	12.3	493.3	492.3
113	692.6	505.0	504.0	460.2	43.8	185.6	47.7	69.0	1044.2	13266.8	1.8	0.63	11.2	32.6	81.3	1324.5	1.8	0.11	0.8	12.1	493.0	492.0
114	699.3	500.7	499.7	459.9	39.8	196.5	46.9	70.3	934.6	14282.8	1.8	0.64	10.9	28.9	81.4	1178.6	1.8	0.11	0.7	11.6	489.1	488.1
115	706.2	489.4	488.4	454.5	33.9	214.8	46.2	72.5	782.8	16034.6	1.8	0.64	10.2	23.7	81.7	968.4	1.8	0.11	0.6	10.8	478.6	477.6
116	624.7	481.4	480.4	466.6	13.8	141.3	43.7	62.5	301.3	9289.0	1.8	0.65	4.7	9.1	79.3	360.0	1.8	0.11	0.2	4.9	476.4	475.4
117	617.2	494.8	493.8	455.8	38.0	120.5	46.7	59.4	887.4	7620.7	1.8	0.64	8.4	29.6	78.5	1161.7	1.8	0.11	0.8	9.2	485.6	484.6
118	608.8	481.1	480.1	464.8	15.2	125.8	44.0	60.3	334.7	8039.5	1.8	0.65	4.8	10.4	77.5	402.7	1.8	0.11	0.3	5.1	476.0	475.0
119	595.1	480.4	479.4	466.3	13.1	112.7	43.7	58.3	286.2	7030.4	1.8	0.65	4.2	8.9	75.3	335.4	1.8	0.11	0.2	4.4	476.0	475.0
120	605.0	494.6	493.6	461.2	32.4	108.4	45.9	57.7	743.7	6717.6	1.8	0.64	7.3	25.1	76.4	957.2	1.8	0.11	0.6	8.0	486.6	485.6

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APPENDIX IIIE-B-3
TABLE IIIE-B-3-1. OVERLINER SYSTEM SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (ft-msl)	Initial Top of Waste Below Overliner Elevation (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_s (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (ft-msl)
121	600.8	496.8	495.8	458.2	37.6	102.0	46.7	56.9	876.7	6259.1	1.8	0.64	7.7	29.8	75.9	1133.1	1.8	0.11	0.8	8.5	488.3	487.3
122	623.1	500.3	499.3	454.0	45.3	120.8	48.0	59.4	1088.3	7638.9	1.8	0.63	9.2	36.1	79.0	1424.5	1.8	0.11	0.9	10.1	490.2	489.2
123	629.7	501.5	500.5	453.5	46.9	126.3	48.0	60.3	1127.5	8070.0	1.8	0.63	9.6	37.3	79.6	1484.0	1.8	0.11	0.9	10.6	490.9	489.9
124	636.4	501.4	500.4	456.7	43.7	133.0	47.7	61.1	1040.7	8582.8	1.8	0.63	9.5	34.2	79.9	1364.4	1.8	0.11	0.9	10.4	491.0	490.0
125	643.0	502.0	501.0	461.2	39.8	139.0	46.9	62.2	932.7	9105.9	1.8	0.64	9.3	30.5	80.1	1221.0	1.8	0.11	0.8	10.0	492.0	491.0
126	649.7	498.4	497.4	461.4	36.1	149.2	46.4	63.7	837.3	9973.0	1.8	0.64	9.0	27.0	80.4	1085.8	1.8	0.11	0.7	9.7	488.7	487.7
127	656.3	491.1	490.1	456.1	33.9	163.3	46.2	65.9	783.4	11217.7	1.8	0.64	9.1	24.8	80.8	1003.6	1.8	0.11	0.6	9.7	481.3	480.3
128	656.2	488.6	487.6	455.6	32.1	165.6	45.9	66.1	736.3	11411.6	1.8	0.64	8.8	23.2	80.9	939.4	1.8	0.11	0.6	9.4	479.2	478.2
129	582.1	480.8	479.8	471.6	8.2	99.3	43.0	56.6	176.4	6075.8	1.9	0.65	2.9	5.3	72.0	191.6	1.9	0.11	0.1	3.0	477.8	476.8
130	570.6	481.3	480.3	463.2	17.1	87.3	44.2	54.8	377.6	5240.5	1.8	0.64	4.5	12.5	70.3	441.2	1.8	0.11	0.3	4.9	476.4	475.4
131	593.3	496.1	495.1	451.8	43.3	95.3	47.7	56.0	1031.1	5790.6	1.8	0.63	8.0	35.3	75.3	1326.8	1.8	0.11	0.9	8.9	487.2	486.2
132	588.7	495.0	494.0	450.7	43.3	91.7	47.7	55.4	1033.1	5535.8	1.8	0.63	7.9	35.5	74.6	1323.3	1.8	0.11	0.9	8.7	486.3	485.3
133	586.8	495.9	494.9	457.2	37.7	88.9	46.7	54.8	880.4	5329.6	1.8	0.64	7.2	30.5	73.4	1119.7	1.8	0.11	0.8	8.0	487.9	486.9
134	593.5	495.9	494.9	465.0	29.9	95.6	45.7	56.0	682.6	5809.3	1.8	0.64	6.6	23.3	74.0	860.3	1.8	0.11	0.6	7.2	488.7	487.7
135	600.1	493.2	492.2	464.5	27.7	104.9	45.4	57.1	629.4	6452.7	1.8	0.64	6.6	21.1	75.4	796.3	1.8	0.11	0.5	7.1	486.1	485.1
136	606.1	487.5	486.5	456.6	29.9	116.7	45.7	58.9	682.2	7326.9	1.8	0.64	7.2	22.6	77.4	875.5	1.8	0.11	0.6	7.8	479.7	478.7
137	556.7	480.7	479.7	463.3	16.4	74.0	44.0	52.7	361.0	4358.9	1.8	0.64	4.2	12.3	66.4	407.5	1.8	0.11	0.3	4.5	476.3	475.3
138	544.7	480.8	479.8	465.9	13.9	61.9	43.7	50.9	304.6	3610.4	1.8	0.65	3.5	10.4	62.5	325.8	1.8	0.11	0.3	3.8	477.1	476.1
139	537.2	484.5	483.5	456.0	27.5	50.7	45.4	48.8	625.1	2933.1	1.8	0.64	4.7	22.8	61.4	699.8	1.8	0.11	0.6	5.3	479.2	478.2
140	543.9	487.5	486.5	456.6	29.9	54.4	45.7	49.5	684.0	3151.4	1.8	0.64	5.1	24.9	62.8	780.8	1.8	0.11	0.6	5.7	481.8	480.8
141	550.5	487.5	486.5	458.4	28.2	61.0	45.4	50.9	639.8	3567.4	1.8	0.64	5.2	22.9	64.7	741.9	1.8	0.11	0.6	5.8	481.7	480.7
142	556.3	487.3	486.3	457.0	29.3	67.0	45.7	51.5	669.4	3911.2	1.8	0.64	5.5	23.8	66.4	789.3	1.8	0.11	0.6	6.1	481.2	480.2
143	528.2	481.2	480.2	462.5	17.6	45.0	44.2	48.0	389.6	2622.2	1.8	0.64	3.6	14.1	58.3	410.5	1.8	0.11	0.4	3.9	477.3	476.3
144	518.1	480.6	479.6	464.4	15.2	35.4	44.0	46.4	334.5	2105.9	1.8	0.65	3.0	12.2	55.1	337.0	1.8	0.11	0.3	3.3	477.3	476.3
145	506.1	480.1	479.1	468.0	11.1	24.0	43.4	44.9	241.9	1536.7	1.8	0.65	2.2	8.9	50.9	227.8	1.8	0.11	0.2	2.4	477.7	476.7
146	527.5	484.0	483.0	455.8	27.2	41.5	45.4	47.3	617.8	2424.9	1.8	0.64	4.3	22.9	58.6	671.7	1.8	0.11	0.6	4.8	479.1	478.1
S1	490.4	493.0	492.0	471.0	21.0	-4.6	44.4	42.0	465.9	267.8	1.8	0.64	0.9	20.0	44.7	447.7	1.8	0.11	0.5	1.4	491.5	490.5
S2	558.3	508.3	507.3	469.7	37.7	48.0	46.7	48.4	879.0	2781.7	1.8	0.64	5.3	32.4	61.9	1003.2	1.8	0.11	0.8	6.1	502.2	501.2
S3	553.9	518.8	517.8	468.9	48.9	33.1	48.4	46.2	1184.2	1988.8	1.8	0.63	4.7	44.2	59.4	1314.1	1.8	0.11	1.1	5.8	513.0	512.0
S4	589.7	509.7	508.7	468.6	40.1	78.0	46.9	53.3	939.9	4615.6	1.8	0.63	7.0	33.1	71.1	1175.7	1.8	0.11	0.8	7.8	501.9	500.9
S5	620.4	492.1	491.1	473.6	17.5	126.3	44.2	60.3	387.1	8069.9	1.8	0.64	5.3	12.2	77.7	474.2	1.8	0.11	0.3	5.6	486.5	485.5
S6	617.0	520.4	519.4	465.0	54.4	94.6	49.5	55.7	1347.5	5726.0	1.8	0.63	8.8	45.6	76.1	1735.1	1.8	0.11	1.2	10.0	510.4	509.4
S7	739.3	511.7	510.7	460.4	50.3	225.6	48.8	73.8	1225.9	17105.9	1.8	0.63	13.3	37.0	81.8	1512.0	1.8	0.11	0.9	14.2	497.5	496.5
S8	739.5	513.3	512.3	459.9	52.4	224.2	49.1	73.6	1288.9	16957.6	1.8	0.63	13.6	38.9	81.8	1589.5	1.8	0.11	1.0	14.6	498.8	497.8
S9	619.1	499.4	498.4	455.5	42.9	117.7	47.3	59.1	1014.6	7420.3	1.8	0.63	8.9	34.0	78.5	1334.5	1.8	0.11	0.9	9.8	489.6	488.6
S10	588.5	480.6	479.6	465.8	13.8	105.8	43.7	57.4	302.4	6535.5	1.8	0.65	4.3	9.6	74.2	355.5	1.8	0.11	0.2	4.5	476.1	475.1
S11	622.2	508.4	507.4	461.3	46.1	111.7	48.0	58.3	1107.1	6974.2	1.8	0.63	9.0	37.1	77.9	1446.0	1.8	0.11	0.9	9.9	498.5	497.5
S12	603.2	480.6	479.6	471.2	8.3	120.7	43.0	59.4	179.0	7632.5	1.9	0.65	3.1	5.2	76.1	198.9	1.9	0.11	0.1	3.2	477.3	476.3
S13	653.1	520.1	519.1	463.7	55.4	131.0	49.9	61.1	1382.9	8461.8	1.8	0.63	10.6	44.8	80.1	1794.6	1.8	0.11	1.1	11.7	508.4	507.4
S14	720.7	494.5	493.5	469.7	23.8	224.2	44.9	73.6	533.5	16958.2	1.8	0.64	8.2	15.6	81.8	637.8	1.8	0.11	0.4	8.6	485.9	484.9
S15	617.0	520.4	519.4	465.0	54.4	94.6	49.5	55.7	1347.5	5726.0	1.8	0.63	8.8	45.6	69.5	1585.6	1.8	0.11	1.2	10.0	510.4	509.4
S16	614.9	497.0	496.0	455.1	40.9	115.9	46.9	58.9	960.7	7278.3	1.8	0.63	8.6	32.3	74.4	1202.0	1.8	0.11	0.8	9.4	487.6	486.6
S17	739.5	515.1	514.1	461.0	53.1	222.4	49.5	73.4	1314.7	16782.9	1.8	0.63	13.6	39.5	81.4	1608.8	1.8	0.11	1.0	14.6	500.5	499.5
S18	581.7	489.9	488.9	458.6	30.4	89.8	45.7	55.1	694.0	5403.4	1.8	0.64	6.5	23.9	68.2	814.4	1.8	0.11	0.6	7.1	482.8	481.8

E. Determine the post-settlement slope of the overliner system and verify that strain induced on the overliner system components due to settlement is within acceptable limits.

Evaluation points for the overliner slope and strain analyses are shown on Sheet IIIE-B-3-25.

An example calculation of the estimated post-settlement slope is shown below for Evaluation Points S1 and S2. The estimated post-settlement slopes for the evaluation points are shown on Sheet IIIE-B-3-15 (Table IIIE-B-3-4).

Prior to Settlement:

Evaluation Point S1 Elev. =	508.3	ft-msl
Evaluation Point S2 Elev. =	493.0	ft-msl
Plan View Distance =	573.0	ft
Initial Slope =	2.7	%

After Settlement:

Evaluation Point S1 Elev. =	502.2	ft-msl
Evaluation Point S2 Elev. =	491.5	ft-msl
Plan View Distance =	573.0	ft
Post-settlement Slope =	1.87	%

An example calculation of the estimated strain is shown below for Evaluation Points S1 and S2. The estimated strain for the evaluation points is shown on Sheet IIIE-B-3-15.

$$\text{Strain} = \frac{L_f - L_o}{L_o} \times 100$$ (Ref. 2, p. 472)

L_f = Final distance between evaluation points after total settlement (ft)
L_o = Initial distance between evaluation points before total settlement (ft)

Initial Distance:

Evaluation Point S1 Elev. =	508.3	ft-msl
Evaluation Point S2 Elev. =	493.0	ft-msl
Plan View Distance =	573.01	ft
L_o =	573.22	ft

Final Distance (after settlement):

Evaluation Point S1 Elev. =	502.2	ft-msl
Evaluation Point S2 Elev. =	491.5	ft-msl
Plan View Distance =	573.01	ft
L_f =	573.11	ft

Strain = -0.018 %

The allowable tensile strain for the overliner system components are listed below.

- Geotextile - 20% (Reference 3, page 11)
- Geonet - 200% (Reference 3, page 401)
- The allowable tensile strain for a geomembrane is 8 to 12% (Reference 7)

As shown on Sheet IIIE-B-3-15, the estimated strain between select points ranges from -0.53% to 0.01%. The estimated strain values are acceptable and the system will be stable. Note that a negative strain value indicates that the component is in compression.

TABLE IIIE-B-3-2. OVERLINER SLOPE EVALUATION

Evaluation Point[1]		Initial Top of Overliner Elevation (in Trench) (ft-msl)		Post-Settlement Top of Overliner Elevation (ft-msl)		Plan View Distance (ft)	Initial Slope (%)	Post-Settlement Slope (%)
A	B	A	B	A	B			
S2	S1	508.3	493.0	502.2	491.5	573.0	2.7	1.87
S3	S4	518.8	509.7	513.0	501.9	489.1	1.9	2.27
S4	S5	509.7	492.1	501.9	486.5	646.7	2.7	2.38
S6	S7	520.4	511.7	510.4	497.5	677.5	1.3	1.91
S8	S9	513.3	499.4	498.8	489.6	576.7	2.4	1.59
S9	S10	499.4	480.6	489.6	476.1	125.3	15.0	10.77
S11	S12	508.4	480.6	498.5	477.3	187.2	14.9	11.33
S13	S14	520.1	494.5	508.4	485.9	1170.9	2.2	1.91
S15	S16	520.4	497.0	510.4	487.6	1228.0	1.9	1.86
S17	S18	515.1	489.9	500.5	482.8	1483.4	1.7	1.19

TABLE IIIE-B-3-3. OVERLINER STRAIN EVALUATION

Evaluation Point[1]		Initial Top of Overliner Elevation (ft-msl)		Post-Settlement Top of Overliner Elevation (ft-msl)		Plan View Distance (ft)	L_o (ft)	L_f (ft)	Strain (%)
A	B	A	B	A	B				
S2	S1	508.3	493.0	502.2	491.5	573.0	573.22	573.11	-0.018
S3	S4	518.8	509.7	513.0	501.9	489.1	489.18	489.23	0.008
S4	S5	509.7	492.1	501.9	486.5	646.7	646.95	646.89	-0.009
S6	S7	520.4	511.7	510.4	497.5	677.5	677.56	677.62	0.010
S8	S9	513.3	499.4	498.8	489.6	576.7	576.88	576.78	-0.017
S9	S10	499.4	480.6	489.6	476.1	125.3	126.67	126.00	-0.530
S11	S12	508.4	480.6	498.5	477.3	187.2	189.22	188.36	-0.458
S13	S14	520.1	494.5	508.4	485.9	1170.9	1171.20	1171.13	-0.006
S15	S16	520.4	497.0	510.4	487.6	1228.0	1228.21	1228.20	-0.001
S17	S18	515.1	489.9	500.5	482.8	1483.4	1483.59	1483.49	-0.007

[1] Refer to Sheet IIIE-B-3-25 for evaluation point locations.

F. Determine the post-settlement slope of the leachate collection system pipe.

Similar to the steps outlined above, the overliner leachate collection system pipes were evaluated to determine their post-settlement slopes. The pipe evaluation points are shown on Sheet IIIE-B-3-26. Pipe profiles depicting the at-construction and post-settlement slopes are presented on Sheets IIIE-B-3-27 through IIIE-B-3-30. The settlement calculations for the pipes are provided on Sheets IIIE-B-3-17 through IIIE-B-3-19. The post-settlement slopes for the leachate collection pipes are presented on Sheets IIIE-B-3-20 and 21.

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APPENDIX IIIE-B-3
TABLE IIIE-B-3-4. OVERLINER TRENCH PIPE SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (in Trench) (ft-msl)	Initial Top of Waste Below Overliner Elevation (in Trench) (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (in Trench) (ft-msl)
1	532.9	520.7	520.7	470.0	50.7	8.1	48.8	43.0	1236.2	809.9	1.8	0.63	2.5	48.2	51.2	1234.2	1.8	0.11	1.2	3.7	517.0	517.0
2	569.2	519.0	519.0	470.0	49.0	46.2	48.4	48.0	1185.8	2679.6	1.8	0.63	5.7	43.3	61.6	1335.3	1.8	0.11	1.1	6.8	512.2	512.2
3	606.6	516.5	516.5	466.4	50.1	86.1	48.8	54.5	1221.9	5149.6	1.8	0.63	8.1	42.0	72.5	1523.4	1.8	0.11	1.1	9.1	507.4	507.4
4	649.4	514.0	514.0	459.1	54.9	131.4	49.5	61.1	1360.4	8483.0	1.8	0.63	10.6	44.3	79.5	1761.8	1.8	0.11	1.1	11.7	502.3	502.3
5	690.7	511.5	511.5	460.0	51.5	175.2	49.1	67.6	1265.8	12305.0	1.8	0.63	11.9	39.6	81.0	1602.7	1.8	0.11	1.0	12.9	498.6	498.6
6	721.0	509.0	509.0	460.8	48.2	208.0	48.4	71.8	1167.3	15398.7	1.8	0.63	12.5	35.7	81.5	1455.9	1.8	0.11	0.9	13.4	495.6	495.6
7	721.4	506.6	506.6	461.3	45.3	210.7	48.0	72.0	1087.5	15641.6	1.8	0.63	12.1	33.2	81.6	1352.5	1.8	0.11	0.8	12.9	493.7	493.7
8	694.0	504.0	504.0	460.1	43.9	186.0	47.7	69.0	1045.6	13290.8	1.8	0.63	11.2	32.6	81.1	1323.2	1.8	0.11	0.8	12.1	491.9	491.9
9	662.9	501.3	501.3	460.1	41.2	157.5	47.3	65.0	975.1	10699.1	1.8	0.63	10.0	31.2	80.4	1255.3	1.8	0.11	0.8	10.8	490.5	490.5
10	647.9	500.7	500.7	457.1	43.6	143.2	47.7	62.8	1038.5	9455.2	1.8	0.63	9.9	33.7	79.9	1346.4	1.8	0.11	0.9	10.7	490.0	490.0
11	631.0	500.0	500.0	456.3	43.7	127.0	47.7	60.6	1040.3	8153.0	1.8	0.63	9.3	34.3	78.5	1347.5	1.8	0.11	0.9	10.2	489.8	489.8
12	616.3	497.7	497.7	455.7	42.0	114.6	47.3	58.6	994.1	7174.1	1.8	0.63	8.7	33.4	76.9	1282.2	1.8	0.11	0.8	9.5	488.2	488.2
13	604.2	497.0	497.0	453.3	43.7	103.2	47.7	57.1	1041.4	6355.9	1.8	0.63	8.4	35.3	75.3	1328.7	1.8	0.11	0.9	9.3	487.7	487.7
14	593.0	494.0	494.0	450.9	43.1	95.0	47.7	55.7	1028.2	5748.2	1.8	0.63	8.0	35.2	73.8	1297.6	1.8	0.11	0.9	8.9	485.1	485.1
15	579.9	493.3	493.3	451.7	41.6	82.6	47.3	53.9	984.8	4912.5	1.8	0.63	7.3	34.3	70.9	1216.7	1.8	0.11	0.9	8.2	485.1	485.1
16	568.7	492.0	492.0	455.4	36.6	72.7	46.4	52.4	849.6	4267.6	1.8	0.64	6.4	30.1	67.6	1018.8	1.8	0.11	0.8	7.2	484.8	484.8
17	557.8	489.0	489.0	456.0	33.0	64.8	45.9	51.2	757.1	3777.1	1.8	0.64	5.8	27.2	64.7	878.7	1.8	0.11	0.7	6.5	482.5	482.5
18	542.5	486.0	486.0	456.3	29.7	52.5	45.7	49.1	678.7	3042.0	1.8	0.64	5.0	24.7	60.8	752.1	1.8	0.11	0.6	5.6	480.4	480.4
19	531.9	483.4	483.4	456.0	27.4	44.6	45.4	47.7	622.0	2584.4	1.8	0.64	4.4	23.0	58.3	669.3	1.8	0.11	0.6	5.0	478.4	478.4
20	534.4	522.1	522.1	470.0	52.1	8.4	49.1	43.0	1279.2	820.0	1.8	0.63	2.5	49.5	51.5	1276.0	1.8	0.11	1.3	3.8	518.3	518.3
21	572.3	520.7	520.7	469.9	50.8	47.5	48.8	48.4	1238.7	2761.3	1.8	0.63	5.8	45.0	62.2	1398.3	1.8	0.11	1.1	7.0	513.8	513.8
22	629.0	518.0	518.0	463.2	54.8	107.0	49.5	57.4	1356.6	6601.2	1.8	0.63	9.5	45.3	76.7	1739.4	1.8	0.11	1.1	10.6	507.4	507.4
23	690.0	515.7	515.7	460.3	55.4	170.4	49.9	66.7	1382.3	11829.5	1.8	0.63	12.2	43.2	81.0	1749.2	1.8	0.11	1.1	13.3	502.4	502.4
24	733.6	514.0	514.0	462.7	51.3	215.6	49.1	72.7	1260.1	16143.4	1.8	0.63	13.2	38.1	81.7	1557.5	1.8	0.11	1.0	14.1	499.9	499.9
25	739.5	511.6	511.6	459.9	51.6	223.9	49.1	73.6	1268.7	16939.1	1.8	0.63	13.4	38.2	81.8	1561.7	1.8	0.11	1.0	14.4	497.2	497.2
26	737.6	509.0	509.0	460.9	48.1	224.6	48.4	73.6	1163.9	16985.7	1.8	0.63	12.9	35.2	81.8	1438.2	1.8	0.11	0.9	13.8	495.2	495.2
27	707.7	506.6	506.6	458.4	48.2	197.2	48.4	70.6	1167.1	14377.4	1.8	0.63	12.2	36.0	81.3	1464.5	1.8	0.11	0.9	13.1	493.5	493.5
28	674.4	504.6	504.6	455.8	48.8	165.8	48.4	66.1	1180.2	11428.2	1.8	0.63	11.3	37.5	80.8	1514.0	1.8	0.11	0.9	12.2	492.4	492.4
29	649.6	502.5	502.5	455.0	47.5	143.1	48.4	62.8	1150.2	9448.0	1.8	0.63	10.3	37.2	80.0	1487.3	1.8	0.11	0.9	11.3	491.3	491.3
30	635.0	501.1	500.1	454.9	45.2	130.9	48.0	60.8	1086.1	8418.4	1.8	0.63	9.6	35.6	79.1	1408.4	1.8	0.11	0.9	10.5	490.6	489.6
31	612.9	498.5	497.5	456.4	41.2	111.3	47.3	58.3	973.2	6950.6	1.8	0.63	8.5	32.7	76.4	1249.3	1.8	0.11	0.8	9.3	489.3	488.3
32	596.0	496.2	495.2	458.4	36.8	96.8	46.4	56.0	855.2	5876.5	1.8	0.64	7.5	29.4	73.4	1078.3	1.8	0.11	0.7	8.2	488.0	487.0

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TABLE IIIE-B-3-4. OVERLINER TRENCH PIPE SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (in Trench) (ft-msl)	Initial Top of Waste Below Overliner Elevation (in Trench) (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (in Trench) (ft-msl)
33	584.9	494.1	493.1	462.6	30.5	87.8	45.7	54.8	698.1	5270.3	1.8	0.64	6.4	24.1	70.9	854.1	1.8	0.11	0.6	7.1	487.1	486.1
34	576.5	491.3	490.3	461.7	28.6	82.2	45.4	53.9	650.5	4887.1	1.8	0.64	6.0	22.6	69.0	779.8	1.8	0.11	0.6	6.6	484.7	483.7
35	568.3	487.7	486.7	460.3	26.4	77.6	45.2	53.3	595.6	4593.9	1.8	0.64	5.6	20.8	67.6	701.4	1.8	0.11	0.5	6.1	481.6	480.6
36	550.5	486.0	485.0	458.2	26.8	61.5	45.2	50.9	605.4	3590.9	1.8	0.64	5.1	21.7	62.8	681.4	1.8	0.11	0.6	5.7	480.3	479.3
37	533.5	484.0	483.0	456.4	26.6	46.5	45.2	48.0	600.2	2692.6	1.8	0.64	4.4	22.1	58.9	651.0	1.8	0.11	0.6	5.0	479.0	478.0
38	519.6	482.0	481.0	455.1	25.9	34.7	45.2	46.2	584.6	2060.6	1.8	0.64	3.8	22.0	55.4	610.1	1.8	0.11	0.6	4.4	477.6	476.6
39	508.9	479.0	478.0	454.1	23.9	26.9	44.9	45.2	535.8	1677.3	1.8	0.64	3.3	20.5	52.7	540.9	1.8	0.11	0.5	3.9	475.1	474.1
40	535.8	524.0	523.0	470.0	53.0	8.8	49.1	43.0	1302.3	836.4	1.8	0.63	2.6	50.4	51.8	1306.5	1.8	0.11	1.3	3.8	520.2	519.2
41	533.0	521.0	520.0	470.0	50.0	9.0	48.8	43.2	1219.4	849.3	1.8	0.63	2.6	47.4	51.5	1221.4	1.8	0.11	1.2	3.8	517.2	516.2
42	529.1	517.0	516.0	470.0	46.0	9.1	48.0	43.2	1104.7	852.4	1.8	0.63	2.6	43.4	50.9	1105.6	1.8	0.11	1.1	3.7	513.3	512.3
43	525.0	513.0	512.0	470.0	42.0	9.0	47.3	43.2	993.2	851.1	1.8	0.63	2.5	39.5	50.3	991.4	1.8	0.11	1.0	3.5	509.5	508.5
44	522.5	510.5	509.5	474.5	35.1	9.0	46.4	43.0	814.0	844.6	1.8	0.64	2.4	32.6	48.8	795.2	1.8	0.11	0.8	3.3	507.3	506.3
45	519.5	507.6	506.6	490.0	16.6	9.0	44.0	43.0	364.9	844.9	1.8	0.64	2.0	14.6	45.9	336.2	1.8	0.11	0.4	2.3	505.2	504.2
46	516.9	504.9	503.9	476.2	27.6	9.0	45.4	43.0	628.2	845.2	1.8	0.64	2.3	25.3	47.7	603.7	1.8	0.11	0.6	3.0	501.9	500.9
47	514.3	502.0	501.0	475.0	26.0	9.3	45.2	43.2	587.1	862.9	1.8	0.64	2.3	23.7	47.3	559.9	1.8	0.11	0.6	2.9	499.1	498.1
48	512.1	497.5	496.5	475.0	21.5	11.6	44.7	43.4	480.4	962.6	1.8	0.64	2.3	19.2	47.3	453.3	1.8	0.11	0.5	2.8	494.7	493.7
49	542.2	508.7	507.7	472.2	35.5	30.5	46.4	45.7	825.2	1853.3	1.8	0.64	4.1	31.4	55.4	870.2	1.8	0.11	0.8	4.9	503.8	502.8
50	559.1	507.3	506.3	469.6	36.8	48.7	46.4	48.4	853.9	2819.0	1.8	0.64	5.3	31.5	60.6	954.0	1.8	0.11	0.8	6.1	501.3	500.3
51	564.8	505.0	504.0	469.7	34.3	56.8	46.2	49.9	791.3	3291.7	1.8	0.64	5.5	28.7	62.5	898.1	1.8	0.11	0.7	6.2	498.8	497.8
52	570.4	502.5	501.5	472.3	29.2	64.9	45.7	51.2	666.8	3783.7	1.8	0.64	5.4	23.7	64.4	763.9	1.8	0.11	0.6	6.0	496.5	495.5
53	575.8	500.0	499.0	473.3	25.7	72.8	45.2	52.4	579.8	4274.5	1.8	0.64	5.4	20.3	66.1	671.4	1.8	0.11	0.5	5.9	494.1	493.1
54	579.3	496.0	495.0	474.2	20.7	80.3	44.4	53.6	460.7	4764.2	1.8	0.64	5.0	15.8	67.6	533.1	1.8	0.11	0.4	5.4	490.6	489.6
55	581.0	489.0	488.0	460.0	27.9	89.0	45.4	55.1	634.8	5362.1	1.8	0.64	6.2	21.8	70.9	771.2	1.8	0.11	0.6	6.7	482.2	481.2
56	582.3	477.9	476.9	478.9	0.0	101.4	42.0	56.9	0.0	6222.4	1.9	0.65	0.0	0.0	71.1	0.0	1.9	0.11	0.0	0.0	477.9	476.9
57	617.3	514.3	513.3	465.2	48.1	100.0	48.4	56.6	1164.1	6113.0	1.8	0.63	8.6	39.5	75.1	1482.6	1.8	0.11	1.0	9.6	504.7	503.7
58	593.7	511.4	510.4	469.3	41.2	79.3	47.3	53.6	973.7	4707.5	1.8	0.63	7.1	34.1	69.8	1188.3	1.8	0.11	0.9	8.0	503.5	502.5
59	573.1	509.0	508.0	469.6	38.4	61.1	46.7	50.9	896.2	3573.9	1.8	0.64	6.1	32.4	64.4	1041.4	1.8	0.11	0.8	6.9	502.1	501.1
60	638.6	512.0	511.0	464.3	46.7	123.6	48.0	60.0	1121.5	7874.0	1.8	0.63	9.5	37.2	78.2	1454.3	1.8	0.11	0.9	10.5	501.5	500.5
61	663.7	509.3	508.3	464.0	44.3	151.4	47.7	64.0	1056.5	10154.5	1.8	0.63	10.2	34.1	80.3	1367.7	1.8	0.11	0.9	11.1	498.2	497.2
62	678.2	505.6	504.6	469.3	35.2	169.6	46.4	66.7	818.0	11780.2	1.8	0.64	9.4	25.8	80.8	1041.0	1.8	0.11	0.7	10.1	495.5	494.5
63	690.6	502.5	501.5	469.6	31.8	185.1	45.9	69.0	731.3	13232.1	1.8	0.64	9.2	22.6	81.0	916.3	1.8	0.11	0.6	9.8	492.7	491.7
64	701.9	499.5	498.5	469.6	28.9	199.4	45.4	70.9	656.1	14589.7	1.8	0.64	8.9	20.0	81.2	810.2	1.8	0.11	0.5	9.4	490.1	489.1
65	709.1	492.7	491.7	469.8	21.9	213.4	44.7	72.5	488.9	15938.8	1.8	0.64	7.6	14.3	81.4	582.7	1.8	0.11	0.4	7.9	484.8	483.8
66	713.8	482.0	481.0	461.0	20.0	228.8	44.4	74.0	444.5	17384.5	1.8	0.64	7.3	12.7	81.7	520.1	1.8	0.11	0.3	7.6	474.4	473.4
67	681.7	518.3	517.3	462.2	55.1	160.4	49.9	65.3	1373.7	10936.0	1.8	0.63	11.8	43.3	80.7	1747.5	1.8	0.11	1.1	12.9	505.4	504.4
68	686.2	516.4	515.4	461.8	53.7	166.7	49.5	66.1	1328.6	11487.4	1.8	0.63	11.9	41.8	80.9	1690.0	1.8	0.11	1.1	12.9	503.5	502.5
69	679.9	514.0	513.0	462.0	51.0	162.9	48.8	65.6	1243.6	11145.2	1.8	0.63	11.5	39.5	80.8	1596.9	1.8	0.11	1.0	12.5	501.5	500.5
70	670.9	512.0	511.0	462.2	48.8	155.9	48.4	64.7	1180.0	10541.3	1.8	0.63	10.9	37.8	80.5	1522.2	1.8	0.11	1.0	11.9	500.1	499.1
71	712.7	516.0	515.0	460.6	54.5	193.7	49.5	70.0	1348.7	14026.8	1.8	0.63	12.9	41.5	81.3	1688.3	1.8	0.11	1.0	14.0	502.1	501.1

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APPENDIX IIIE-B-3
TABLE IIIE-B-3-4. OVERLINER TRENCH PIPE SETTLEMENT SUMMARY

Evaluation Point	Top of Waste Elevation (ft-msl)	Initial Top of Overliner Elevation (in Trench) (ft-msl)	Initial Top of Waste Below Overliner Elevation (in Trench) (ft-msl)	Bottom of Waste Elevation (ft-msl)	H_o (ft)	T_{waste} (ft)	γ_{mswb} (pcf)	γ_{mswa} (pcf)	σ'_o (psf)	$\Delta\sigma$ (psf)	e_o	C_c	S_p (ft)	H'_o (ft)	γ'_{mswb} (pcf)	σ''_o (psf)	e'_o	α	S_c (ft)	Total Settlement (ft)	Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)	Post-Settlement Top of Waste Below Overliner Elevation (in Trench) (ft-msl)
72	716.2	513.2	512.2	460.2	52.1	199.9	49.1	70.9	1279.3	14626.5	1.8	0.63	12.8	39.2	81.4	1597.4	1.8	0.11	1.0	13.8	499.4	498.4
73	739.1	510.0	509.0	459.6	49.4	226.1	48.8	73.8	1204.7	17144.7	1.8	0.63	13.1	36.2	81.8	1482.2	1.8	0.11	0.9	14.1	495.9	494.9
74	739.2	507.0	506.0	461.4	44.6	229.2	47.7	74.2	1062.8	17460.1	1.8	0.63	12.5	32.1	81.8	1313.3	1.8	0.11	0.8	13.3	493.7	492.7
75	737.9	504.5	503.5	462.6	40.9	230.4	46.9	74.2	959.0	17548.8	1.8	0.63	11.9	29.0	81.8	1186.5	1.8	0.11	0.7	12.6	491.9	490.9
76	726.2	502.2	501.2	464.5	36.7	221.0	46.4	73.2	852.3	16640.6	1.8	0.64	10.9	25.8	81.7	1054.5	1.8	0.11	0.7	10.8	491.4	490.4
77	715.4	500.7	499.7	469.6	30.0	211.7	45.7	72.3	685.8	15759.9	1.8	0.64	9.4	20.6	81.4	840.7	1.8	0.11	0.5	9.9	490.8	489.8
78	741.6	505.6	504.6	461.5	43.1	232.9	47.7	74.4	1027.0	17782.8	1.8	0.63	12.3	30.8	81.8	1260.3	1.8	0.11	0.8	13.0	492.6	491.6
79	747.5	504.0	503.0	460.2	42.8	240.5	47.3	75.1	1012.3	18521.5	1.8	0.63	12.4	30.4	81.8	1243.0	1.8	0.11	0.8	13.2	490.8	489.8
80	749.7	502.6	501.6	459.6	42.0	244.1	47.3	75.4	993.1	18876.4	1.8	0.63	12.3	29.7	81.8	1213.2	1.8	0.11	0.8	13.1	489.5	488.5
81	749.1	501.6	500.6	459.9	40.7	244.5	46.9	75.4	955.0	18909.4	1.8	0.63	12.1	28.6	81.8	1169.4	1.8	0.11	0.7	12.8	488.7	487.7
82	749.2	499.6	498.6	459.7	38.9	246.6	46.7	75.6	907.2	19101.9	1.8	0.64	11.8	27.1	81.8	1107.7	1.8	0.11	0.7	12.5	487.1	486.1
83	751.2	486.6	485.6	459.3	26.3	261.6	45.2	76.9	594.3	20564.1	1.8	0.64	9.2	17.1	81.8	697.9	1.8	0.11	0.4	9.7	476.9	475.9
84	752.1	483.0	482.0	455.0	27.0	266.1	45.2	77.1	609.1	20980.9	1.8	0.64	9.5	17.5	81.8	715.7	1.8	0.11	0.4	9.9	473.1	472.1
85	741.5	508.5	507.5	455.9	51.6	230.1	49.1	74.2	1267.2	17527.4	1.8	0.63	13.6	38.0	81.8	1553.1	1.8	0.11	1.0	14.5	493.9	492.9
86	742.6	506.0	505.0	459.8	45.2	233.6	48.0	74.6	1086.6	17874.0	1.8	0.63	12.7	32.6	81.8	1332.3	1.8	0.11	0.8	13.5	492.5	491.5
87	746.4	502.6	501.6	459.7	41.9	240.8	47.3	75.1	991.5	18546.8	1.8	0.63	12.2	29.7	81.8	1213.9	1.8	0.11	0.8	13.0	489.6	488.6
88	743.1	502.3	501.3	459.9	41.4	237.8	47.3	74.9	978.3	18274.4	1.8	0.63	12.1	29.3	81.8	1197.9	1.8	0.11	0.7	12.0	490.3	489.3
89	724.3	502.1	501.1	460.2	40.9	219.2	46.9	73.2	960.4	16511.5	1.8	0.63	11.6	29.3	81.7	1196.4	1.8	0.11	0.7	12.4	489.7	488.7
90	693.4	501.9	500.9	460.5	40.4	188.5	46.9	69.3	949.0	13514.6	1.8	0.63	10.8	29.7	81.1	1202.6	1.8	0.11	0.8	12.2	489.7	488.7
91	663.4	500.6	499.6	460.6	39.0	159.8	46.7	65.3	909.6	10893.4	1.8	0.64	9.8	29.2	80.5	1174.6	1.8	0.11	0.7	11.4	489.2	488.2
92	639.5	499.3	498.3	463.2	35.1	137.2	46.4	61.9	815.4	8957.9	1.8	0.64	8.6	26.6	79.3	1052.4	1.8	0.11	0.7	10.2	489.1	488.1
93	621.5	497.2	496.2	465.0	31.2	121.3	45.9	59.7	716.4	7704.8	1.8	0.64	7.5	23.7	77.1	911.9	1.8	0.11	0.6	9.0	488.2	487.2
94	605.7	494.0	493.0	465.0	28.0	108.7	45.4	57.7	636.2	6733.2	1.8	0.64	6.7	21.3	74.9	796.5	1.8	0.11	0.5	7.3	486.7	485.7
95	585.4	490.1	489.1	463.2	25.9	92.3	45.2	55.4	584.6	5569.6	1.8	0.64	6.0	19.9	71.3	709.3	1.8	0.11	0.5	6.5	483.6	482.6
96	554.1	494.7	493.7	475.0	18.7	56.4	44.2	49.9	413.5	3272.4	1.8	0.64	4.0	14.7	60.6	444.7	1.8	0.11	0.4	4.4	490.3	489.3
97	676.0	496.7	495.7	469.9	25.8	176.3	45.2	67.6	582.8	12377.6	1.8	0.64	7.9	17.9	80.8	724.5	1.8	0.11	0.5	8.3	488.4	487.4
98	621.5	495.3	494.3	473.8	20.5	123.2	44.4	60.0	455.8	7854.7	1.8	0.64	5.9	14.7	76.9	562.9	1.8	0.11	0.4	7.0	488.3	487.3
99	748.2	496.7	495.7	462.8	32.9	248.5	45.9	75.8	756.3	19289.1	1.8	0.64	10.6	22.3	81.8	913.4	1.8	0.11	0.6	11.2	485.5	484.5
100	741.4	495.9	494.9	469.8	25.1	242.5	45.2	75.3	566.1	18710.4	1.8	0.64	8.7	16.4	81.8	669.1	1.8	0.11	0.4	10.5	485.4	484.4
101	755.0	495.7	494.7	459.9	34.8	256.3	46.2	76.4	802.6	20042.1	1.8	0.64	11.1	23.6	81.8	967.0	1.8	0.11	0.6	11.7	484.0	483.0
102	755.5	493.8	492.8	459.5	33.3	258.7	46.2	76.6	768.1	20277.5	1.8	0.64	10.8	22.5	81.8	918.2	1.8	0.11	0.6	11.4	482.4	481.4
103	724.3	489.7	488.7	455.3	33.4	231.6	46.2	74.4	770.5	17682.8	1.8	0.64	10.4	23.0	81.8	939.0	1.8	0.11	0.6	11.0	478.7	477.7
104	744.9	488.6	487.6	459.5	28.1	253.3	45.4	76.3	638.5	19777.4	1.8	0.64	9.6	18.5	81.8	757.8	1.8	0.11	0.5	10.0	478.6	477.6
105	673.9	489.3	488.3	454.6	33.7	181.6	46.2	68.4	777.2	12891.1	1.8	0.64	9.5	24.2	81.0	979.6	1.8	0.11	0.6	10.1	479.2	478.2
106	618.0	485.9	484.9	456.8	28.1	129.1	45.4	60.8	639.2	8311.6	1.8	0.64	7.3	20.8	78.0	812.6	1.8	0.11	0.5	7.8	478.1	477.1
107	587.9	484.7	483.7	456.9	26.8	100.2	45.2	56.6	604.7	6124.3	1.8	0.64	6.3	20.4	73.2	747.8	1.8	0.11	0.5	6.9	477.8	476.8
108	553.5	483.8	482.8	456.8	26.0	66.7	45.2	51.5	586.9	3894.0	1.8	0.64	5.2	20.8	64.4	669.0	1.8	0.11	0.5	6.0	477.8	476.8
109	529.1	481.2	480.2	456.0	24.2	44.9	44.9	47.7	544.4	2600.6	1.8	0.64	4.2	20.1	58.0	581.6	1.8	0.11	0.5	4.7	476.5	475.5

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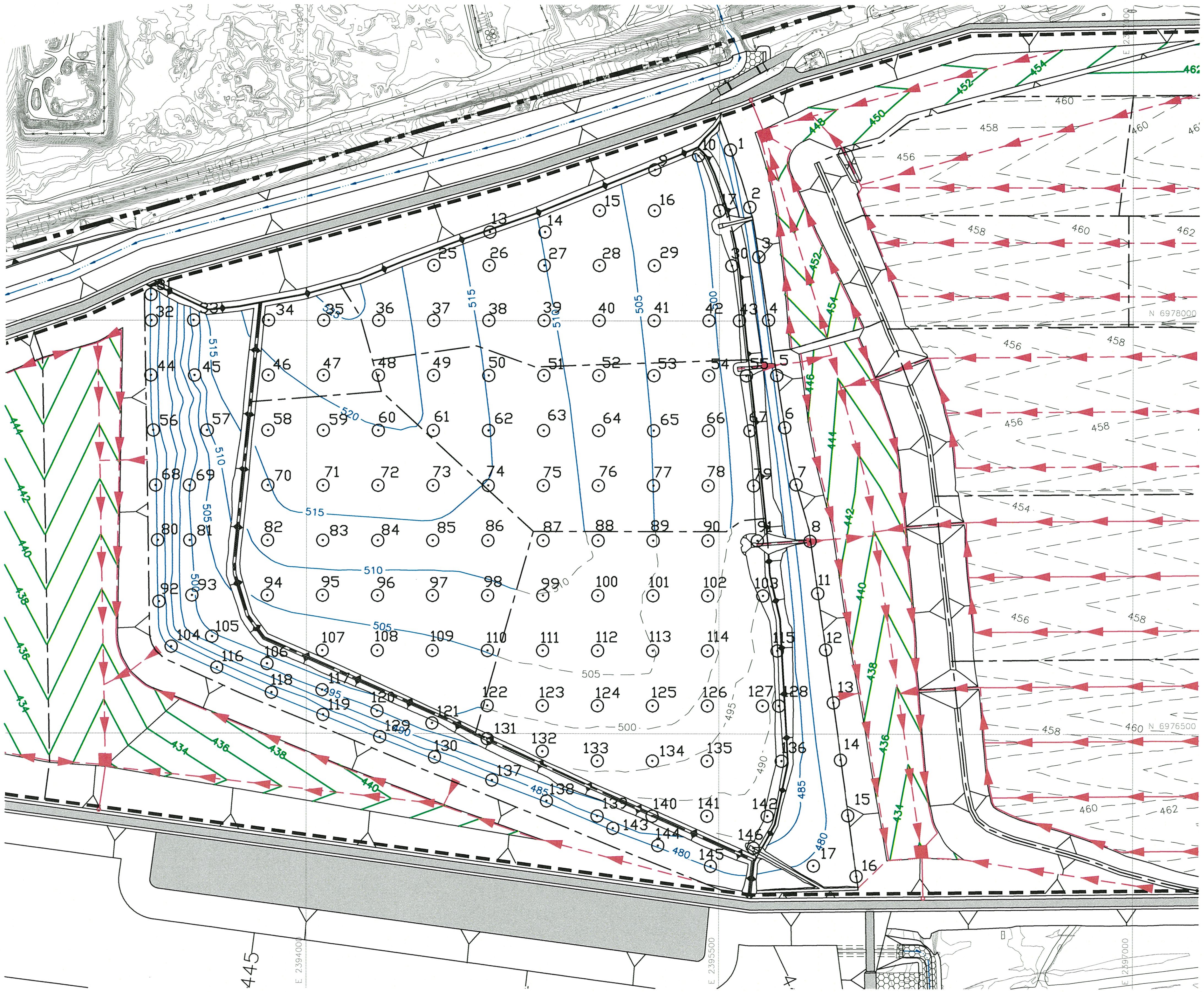
APPENDIX IIIE-B-3
TABLE IIIE-B-3-5. OVERLINER PIPE SLOPE SUMMARY

Evaluation Point		Initial Top of Overliner Elevation (in Trench) (ft-msl)		Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)		Plan View Distance (ft)	Initial Slope (%)	Post-Settlement Slope (%)
A	B	A	B	A	B			
1	2	520.7	519.0	517.0	512.2	155.89	1.1	3.04
2	3	519.0	516.5	512.2	507.4	160.28	1.6	3.04
3	4	516.5	514.0	507.4	502.3	184.49	1.4	2.76
4	5	514.0	511.5	502.3	498.6	176.18	1.4	2.11
5	6	511.5	509.0	498.6	495.6	131.43	1.9	2.27
6	7	509.0	506.6	495.6	493.7	127.94	1.9	1.49
7	8	506.6	504.0	493.7	491.9	117.85	2.2	1.47
8	9	504.0	501.3	491.9	490.5	154.80	1.7	0.91
9	10	501.3	500.7	490.5	490.0	218.83	0.3	0.24
10	11	500.7	500.0	490.0	489.8	233.99	0.3	0.08
11	12	500.0	497.7	489.8	488.2	199.97	1.1	0.80
12	13	497.7	497.0	488.2	487.7	161.14	0.5	0.31
13	14	497.0	494.0	487.7	485.1	154.24	1.9	1.67
14	15	494.0	493.3	485.1	485.1	181.35	0.4	0.01
15	16	493.3	492.0	485.1	484.8	1592.12	0.1	0.02
16	17	492.0	489.0	484.8	482.5	148.87	2.0	1.53
17	18	489.0	486.0	482.5	480.4	209.24	1.4	1.01
18	19	486.0	483.4	480.4	478.4	149.47	1.8	1.35
20	21	522.1	520.7	518.3	513.8	151.84	0.9	2.98
21	22	520.7	518.0	513.8	507.4	227.77	1.2	2.80
22	23	518.0	515.7	507.4	502.4	245.23	0.9	2.04
23	24	515.7	514.0	502.4	499.9	181.82	0.9	1.38
24	25	514.0	511.6	499.9	497.2	181.22	1.3	1.50
25	26	511.6	509.0	497.2	495.2	181.82	1.4	1.08
26	27	509.0	506.6	495.2	493.5	217.69	1.1	0.79
27	28	506.6	504.6	493.5	492.4	202.76	1.0	0.55
28	29	504.6	502.5	492.4	491.3	181.87	1.1	0.60
29	30	502.5	501.1	491.3	490.6	141.55	1.0	0.44
30	31	501.1	498.5	490.6	489.3	110.66	2.3	1.24
31	32	498.5	496.2	489.3	488.0	83.07	2.8	1.52
32	33	496.2	494.1	488.0	487.1	144.85	1.4	0.64
33	34	494.1	491.3	487.1	484.7	138.84	2.0	1.68
34	35	491.3	487.7	484.7	481.6	149.72	2.4	2.12
35	36	487.7	486.0	481.6	480.3	100.26	1.7	1.21
36	37	486.0	484.0	480.3	479.0	93.21	2.2	1.47
37	38	484.0	482.0	479.0	477.6	95.62	2.1	1.48
38	39	482.0	479.0	477.6	475.1	84.80	3.5	2.85
40	41	524.0	521.0	520.2	517.2	164.12	1.8	1.79
41	42	521.0	517.0	517.2	513.3	159.66	2.5	2.44
42	43	517.0	513.0	513.3	509.5	198.74	2.0	1.95
43	44	513.0	510.5	509.5	507.3	140.56	1.7	1.55
44	45	510.5	507.6	507.3	505.2	182.88	1.6	1.12
45	46	507.6	504.9	505.2	501.9	175.15	1.5	1.88
46	47	504.9	502.0	501.9	499.1	175.57	1.7	1.63
47	48	502.0	497.5	499.1	494.7	188.27	2.4	2.34
49	50	508.7	507.3	503.8	501.3	102.99	1.3	2.43
50	51	507.3	505.0	501.3	498.8	150.57	1.6	1.68
51	52	505.0	502.5	498.8	496.5	149.43	1.7	1.53
52	53	502.5	500.0	496.5	494.1	142.29	1.8	1.65
53	54	500.0	496.0	494.1	490.6	91.36	4.4	3.83
54	55	496.0	489.0	490.6	482.2	78.70	8.9	10.66
55	56	489.0	477.9	482.2	477.9	50.28	21.9	8.56

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-B-3
TABLE IIIE-B-3-5. OVERLINER PIPE SLOPE SUMMARY

Evaluation Point		Initial Top of Overliner Elevation (in Trench) (ft-msl)		Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)		Plan View Distance (ft)	Initial Slope (%)	Post-Settlement Slope (%)
A	B	A	B	A	B			
57	58	514.3	511.4	504.7	503.5	195.19	1.5	0.63
58	59	511.4	509.0	503.5	502.1	168.61	1.4	0.79
59	50	509.0	507.3	502.1	501.3	128.05	1.3	0.66
57	60	514.3	512.0	504.7	501.5	147.57	1.6	2.13
60	61	512.0	509.3	501.5	498.2	176.91	1.5	1.91
61	62	509.3	505.6	498.2	495.5	220.81	1.7	1.23
62	63	505.6	502.5	495.5	492.7	175.01	1.8	1.60
63	64	502.5	499.5	492.7	490.1	160.44	1.8	1.62
64	65	499.5	492.7	490.1	484.8	110.48	6.2	4.79
65	66	492.7	482.0	484.8	474.4	85.16	12.6	12.17
67	68	518.3	516.4	505.4	503.5	111.94	1.7	1.70
68	69	516.4	514.0	503.5	501.5	132.39	1.8	1.49
69	70	514.0	512.0	501.5	500.1	129.34	1.5	1.12
70	61	512.0	509.3	500.1	498.2	180.14	1.5	1.07
71	72	516.0	513.2	502.1	499.4	187.58	1.5	1.41
72	73	513.2	510.0	499.4	495.9	204.45	1.6	1.70
73	74	510.0	507.0	495.9	493.7	178.29	1.7	1.25
74	75	507.0	504.5	493.7	491.9	146.05	1.7	1.23
75	76	504.5	502.2	491.9	491.4	154.46	1.5	0.33
76	77	502.2	500.7	491.4	490.8	105.41	1.5	0.61
77	64	500.7	499.5	490.8	490.1	93.11	1.2	0.76
78	79	505.6	504.0	492.6	490.8	132.32	1.2	1.33
79	80	504.0	502.6	490.8	489.5	137.18	1.0	0.94
80	81	502.6	501.6	489.5	488.7	132.22	0.8	0.62
81	82	501.6	499.6	488.7	487.1	100.00	2.0	1.60
82	83	499.6	486.6	487.1	476.9	134.92	9.6	7.56
83	84	486.6	483.0	476.9	473.1	119.25	3.0	3.21
85	86	508.5	506.0	493.9	492.5	158.84	1.5	0.88
86	87	506.0	502.6	492.5	489.6	197.16	1.7	1.48
87	82	502.6	499.6	489.6	487.1	162.62	1.8	1.52
88	89	502.3	502.1	490.3	489.7	147.95	0.1	0.38
89	90	502.1	501.9	489.7	489.7	130.75	0.2	0.02
90	91	501.9	500.6	489.7	489.2	123.49	1.1	0.40
91	92	500.6	499.3	489.2	489.1	98.22	1.3	0.10
92	93	499.3	497.2	489.1	488.2	77.86	2.7	1.16
93	94	497.2	494.0	488.2	486.7	83.92	3.8	1.77
94	95	494.0	490.1	486.7	483.6	107.61	3.6	2.89
95	35	490.1	487.7	483.6	481.6	90.19	2.7	2.27
48	96	497.5	494.7	494.7	490.3	168.69	1.7	2.60
97	98	496.7	495.3	488.4	488.3	223.58	0.6	0.03
99	100	496.7	495.9	485.5	485.4	138.53	0.6	0.10
100	65	495.9	492.7	485.4	484.8	170.94	1.9	0.37
99	101	496.7	495.7	485.5	484.0	155.62	0.6	0.99
101	102	495.7	493.8	484.0	482.4	85.25	2.2	1.84
103	104	489.7	488.6	478.7	478.6	188.95	0.6	0.08
104	83	488.6	486.6	478.6	476.9	131.51	1.5	1.24
105	106	489.3	485.9	479.2	478.1	223.76	1.5	0.51
106	107	485.9	484.7	478.1	477.8	122.29	1.0	0.19
107	108	484.7	483.8	477.8	477.8	140.89	0.6	0.03
108	109	483.8	481.2	477.8	476.5	108.93	2.4	1.19



SCALE IN FEET: 0, 200, 400

LEGEND

Symbol	Description
—— - - ——	PERMIT BOUNDARY
— — — —	LIMIT OF WASTE
————	SECTOR BOUNDARY
——500——	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
——440——	TOP OF LINER CONTOUR
——506——	TOP OF OVERLINER CONTOUR
— —510— —	AS–BUILT TOP OF LINER CONTOUR
	LEACHATE COLLECTION PIPE
	LEACHATE COLLECTION SUMP
	LEACHATE RISER PIPE
	OVERLINER LEACHATE DRAINAGE PIPE
	OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
⊙1	SETTLEMENT EVALUATION POINT

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. LINER AND LEACHATE COLLECTION SYSTEM DETAILS ARE PRESENTED IN APPENDIX IIIA–A–LINER, OVERLINER AND FINAL COVER SYSTEM DETAILS.

STATE OF TEXAS
DAVID E. POE
81734
LICENSED PROFESSIONAL ENGINEER
5-19-2022

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DESIGN BY: MB
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TBPE REGISTRATION NO. F–3727

PREPARED FOR
CITY OF ARLINGTON
AND
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REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
EVALUATION POINT LOCATIONS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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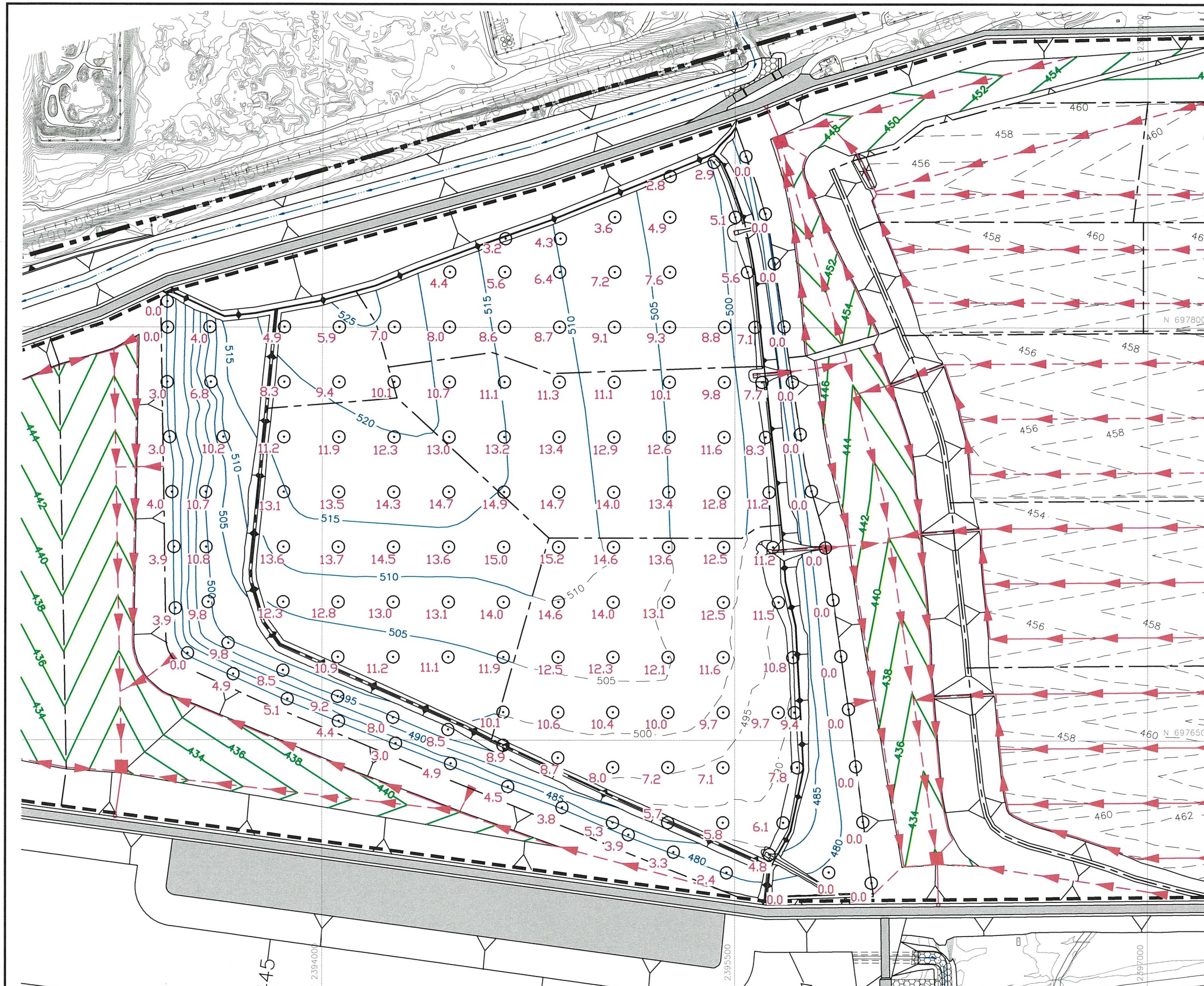

N

0 200 400
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- 1.7 TOTAL SETTLEMENT (FEET)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. LINER AND LEACHATE COLLECTION SYSTEM DETAILS ARE PRESENTED IN APPENDIX IIIA-A-LINER, OVERLINER AND FINAL COVER SYSTEM DETAILS.

STATE OF TEXAS
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81734
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MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
TOTAL SETTLEMENT(POST-SETTLEMENT)

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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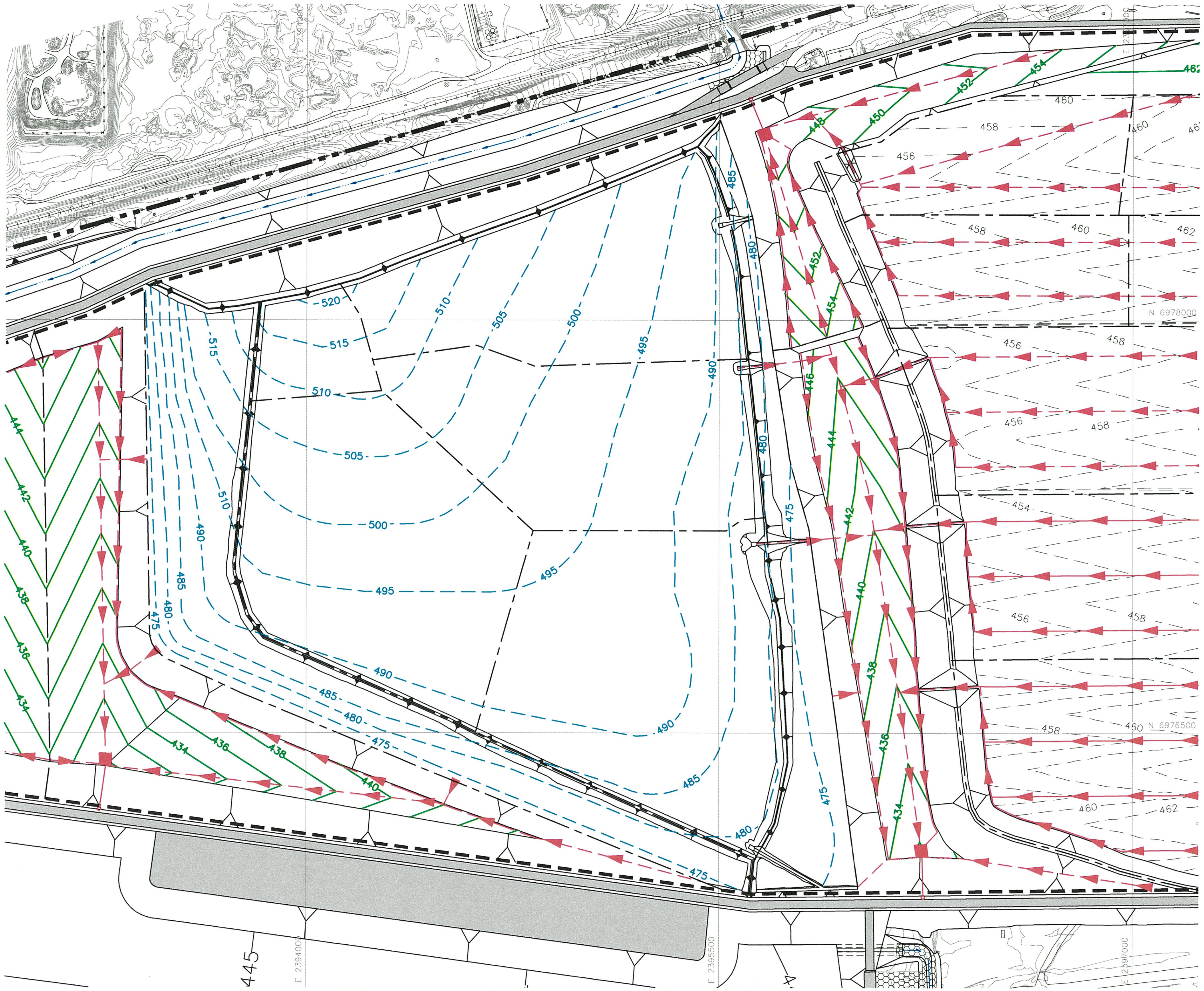

0 200 400
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 515 POST–SETTLEMENT OVERLINER CONTOUR
- 510 AS–BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. LINER AND LEACHATE COLLECTION SYSTEM DETAILS ARE PRESENTED IN APPENDIX IIIA–A–LINER, OVERLINER AND FINAL COVER SYSTEM DETAILS.

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MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
POST SETTLEMENT OVERLINER PLAN
CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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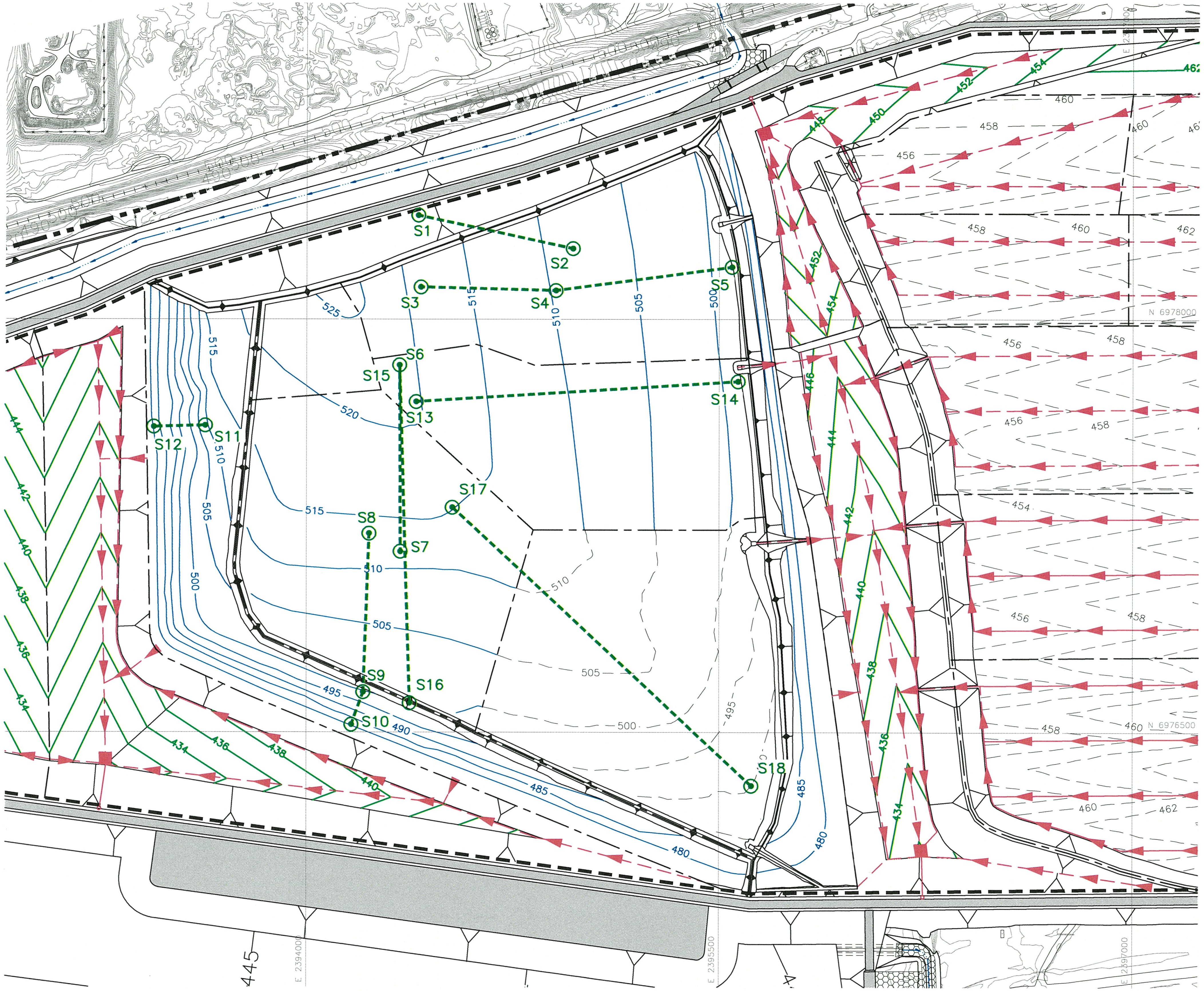

0 200 400
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- S1 OVERLINER STRAIN AND SLOPE EVALUATION POINT
- OVERLINER STRAIN AND SLOPE EVALUATION LINE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. LINER AND LEACHATE COLLECTION SYSTEM DETAILS ARE PRESENTED IN APPENDIX IIIA-A-LINER, OVERLINER AND FINAL COVER SYSTEM DETAILS.

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MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
SLOPE AND STRAIN EVALUATION POINTS

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TARRANT COUNTY, TEXAS

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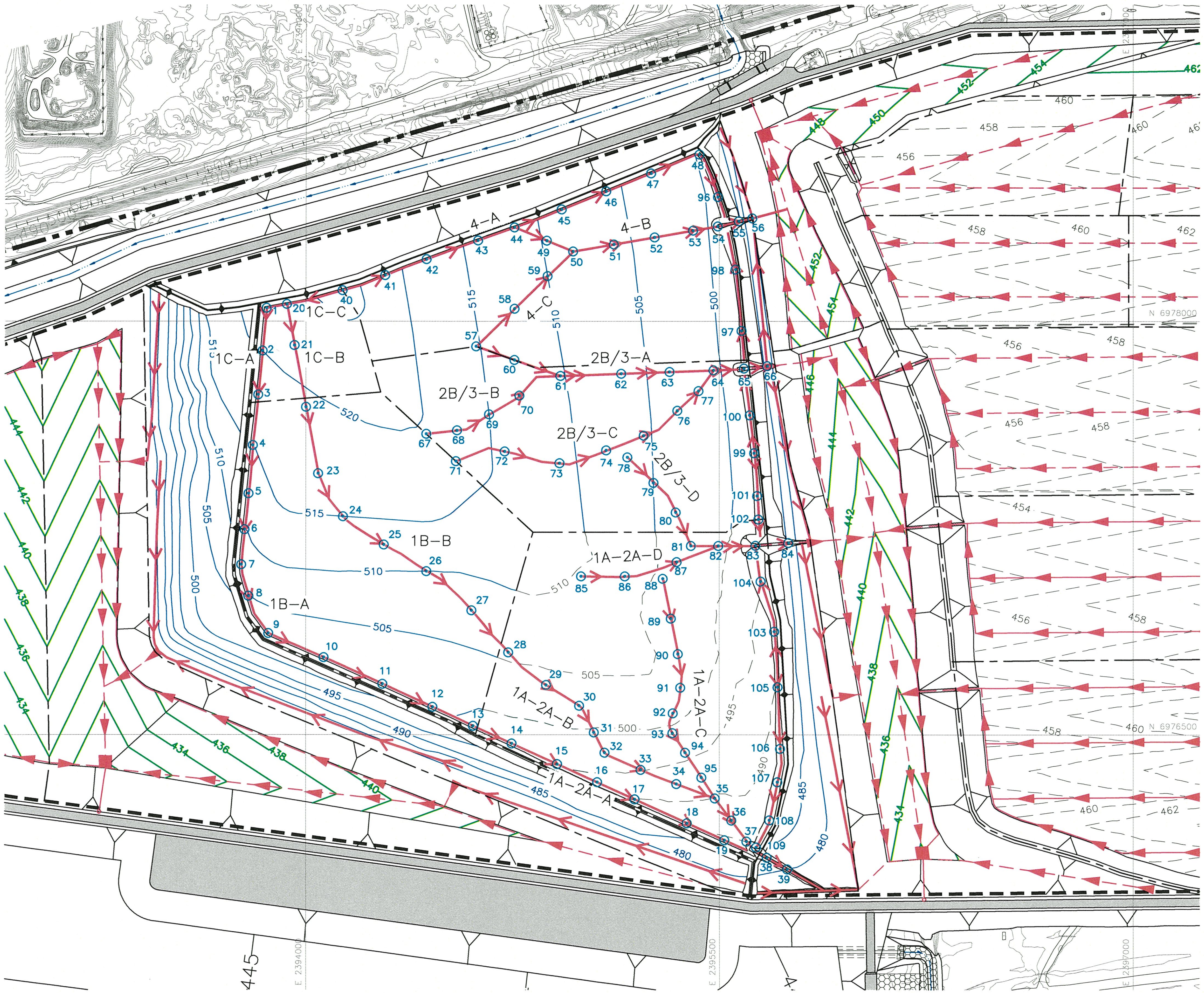

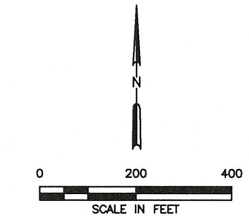

LEGEND

Symbol	Description
— · · —	PERMIT BOUNDARY
— — —	LIMIT OF WASTE
———	SECTOR BOUNDARY
500	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
440	TOP OF LINER CONTOUR
506	TOP OF OVERLINER CONTOUR
510	AS-BUILT TOP OF LINER CONTOUR
	LEACHATE COLLECTION PIPE
■	LEACHATE COLLECTION SUMP
	LEACHATE RISER PIPE
	OVERLINER LEACHATE DRAINAGE PIPE
	OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
1C-A	PIPE PROFILE DESIGNATION
1 ⊙	EVALUATION POINT

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. LINER AND LEACHATE COLLECTION SYSTEM DETAILS ARE PRESENTED IN APPENDIX IIIA-A-LINER, OVERLINER AND FINAL COVER SYSTEM DETAILS.

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MAJOR PERMIT AMENDMENT
OVERLINER PIPE LAYOUT

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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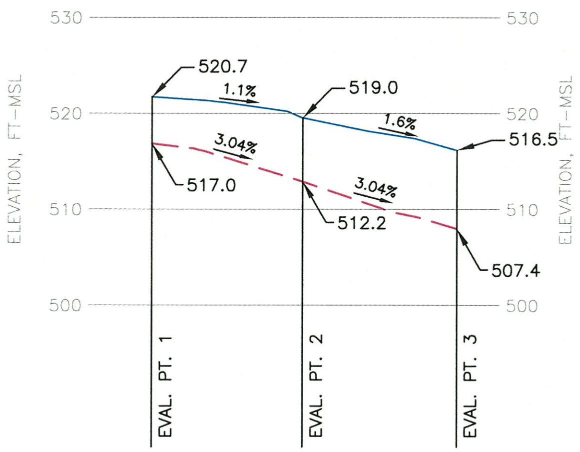
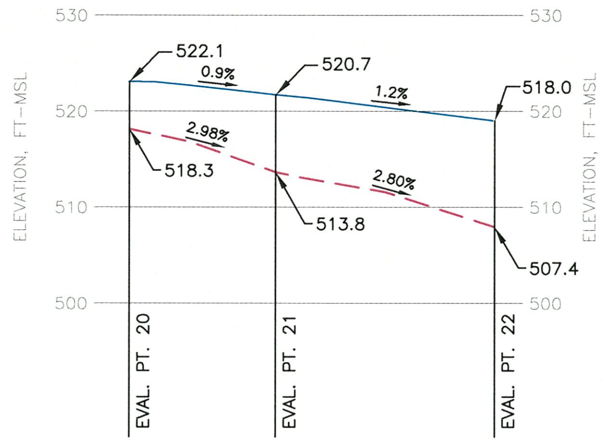
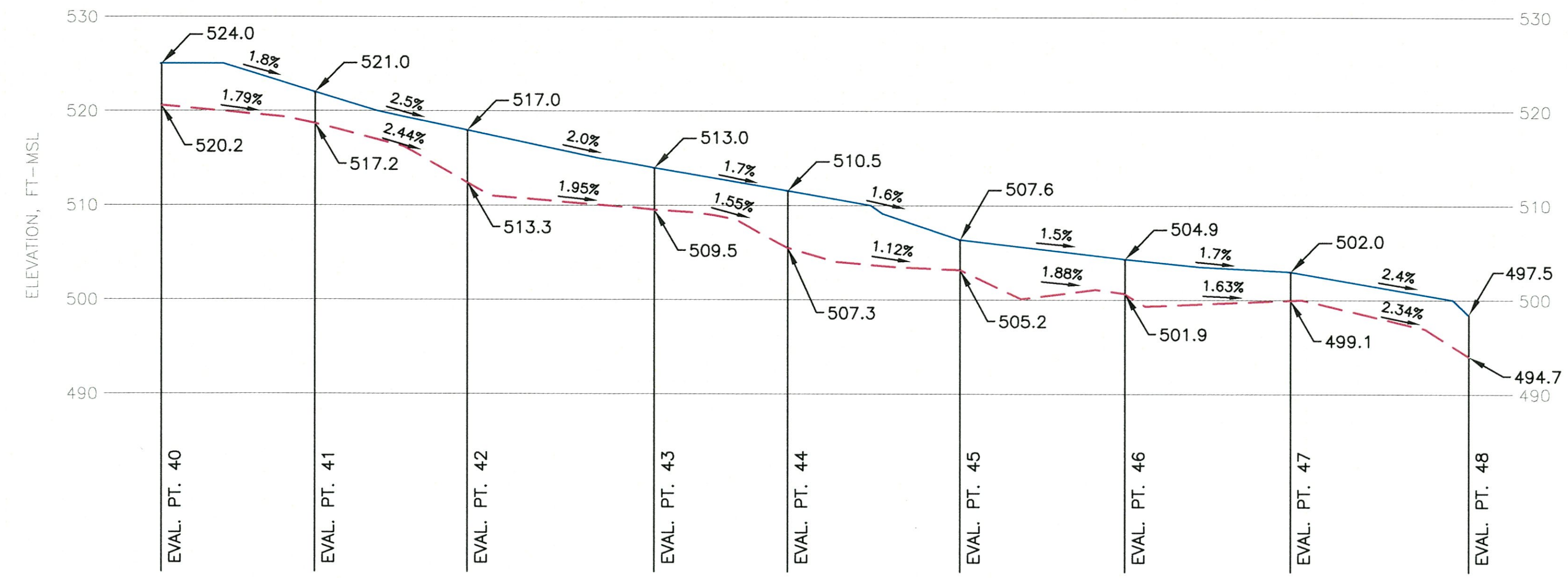


SECTOR 1C–A PIPE PROFILE



SECTOR 1C–B PIPE PROFILE



SECTOR 4–A PIPE PROFILE

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DAVID E. POE
81734
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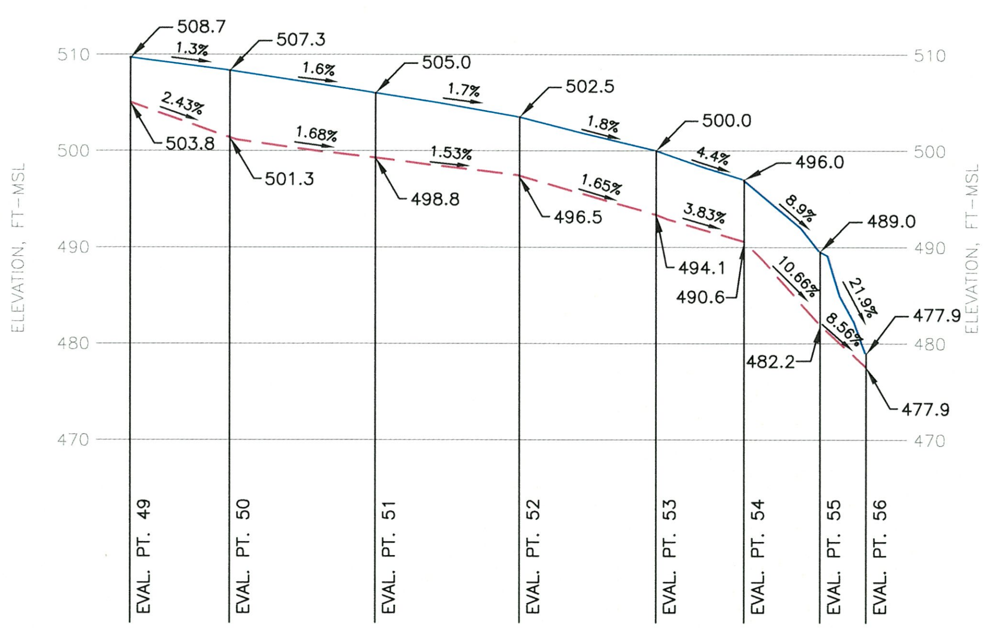
DJR
5-19-2022



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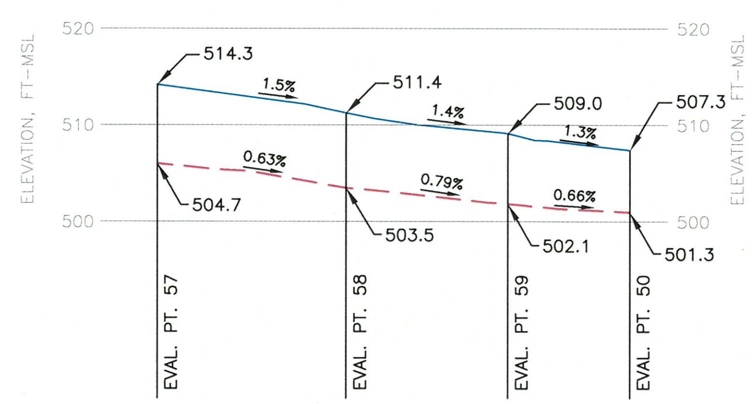
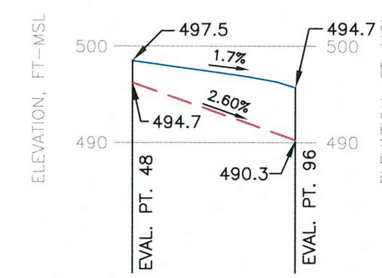
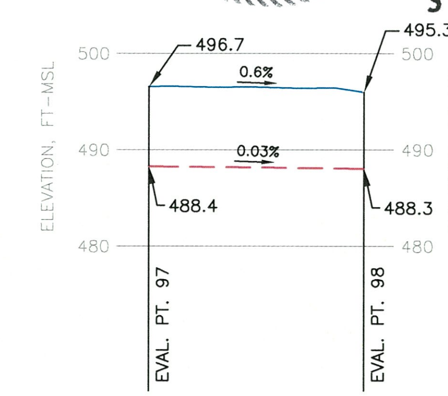


SECTOR 4–C PIPE PROFILE



SECTOR 4–D PIPE PROFILE



SECTOR 4–E PIPE PROFILE

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

SCALE (ALL PROFILES)

0 100 200 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

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TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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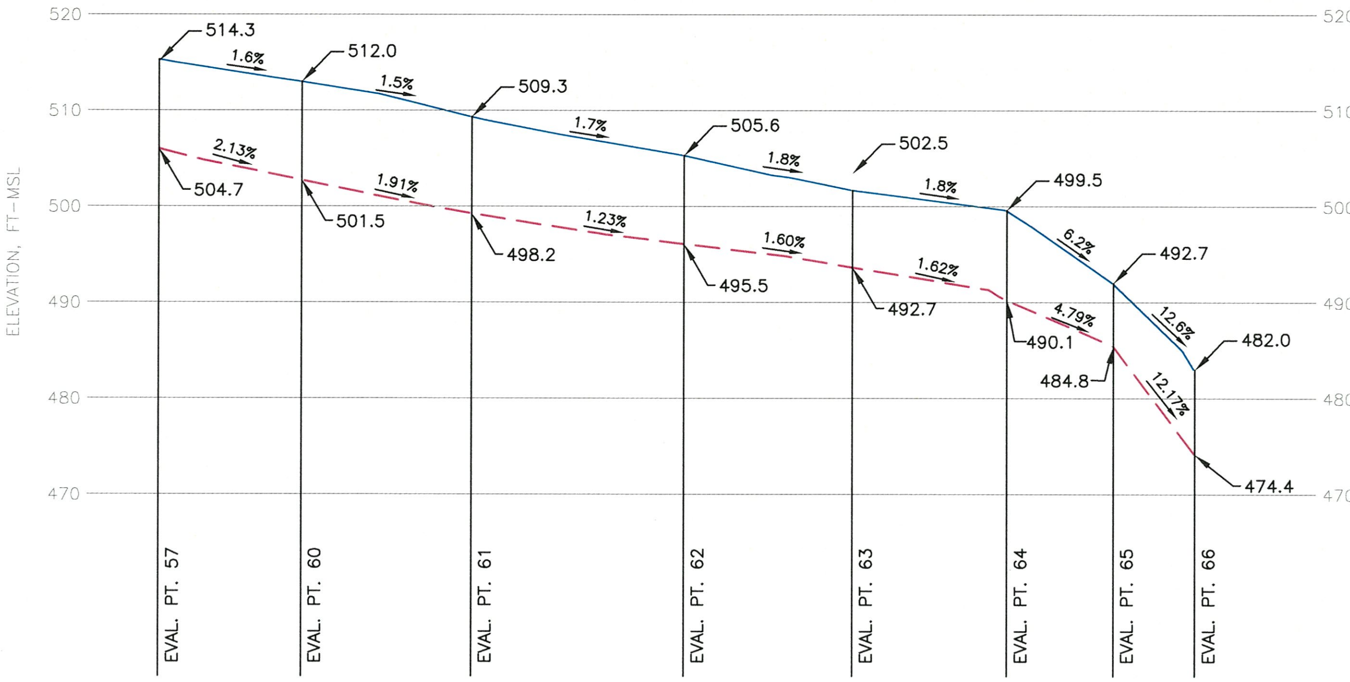
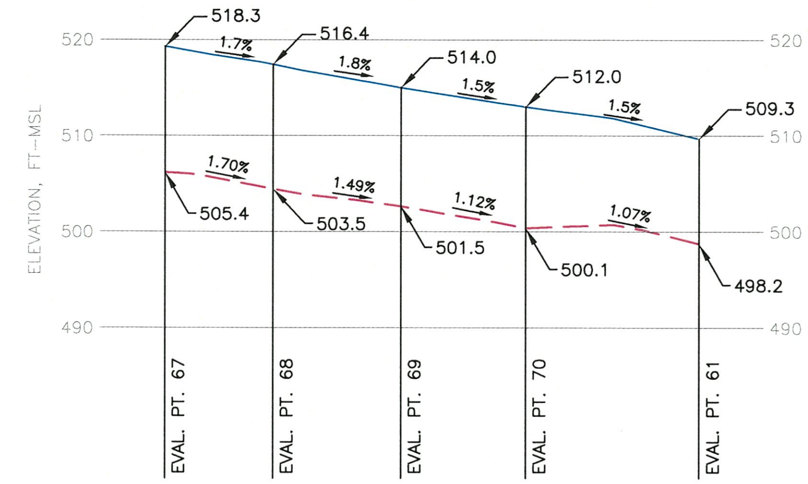


SECTOR 2B/3-A PIPE PROFILE



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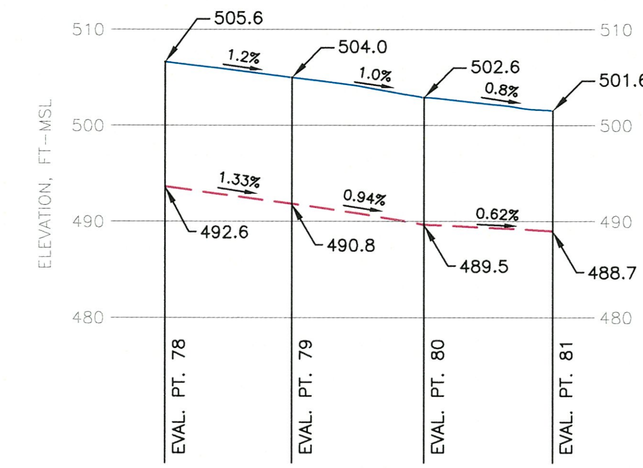

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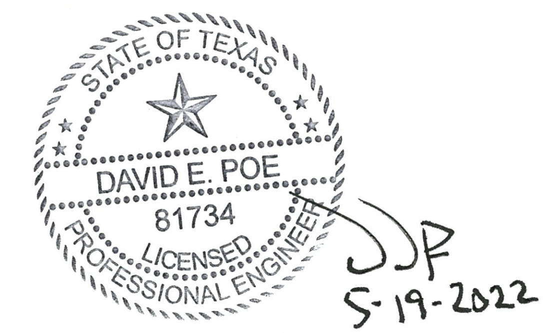

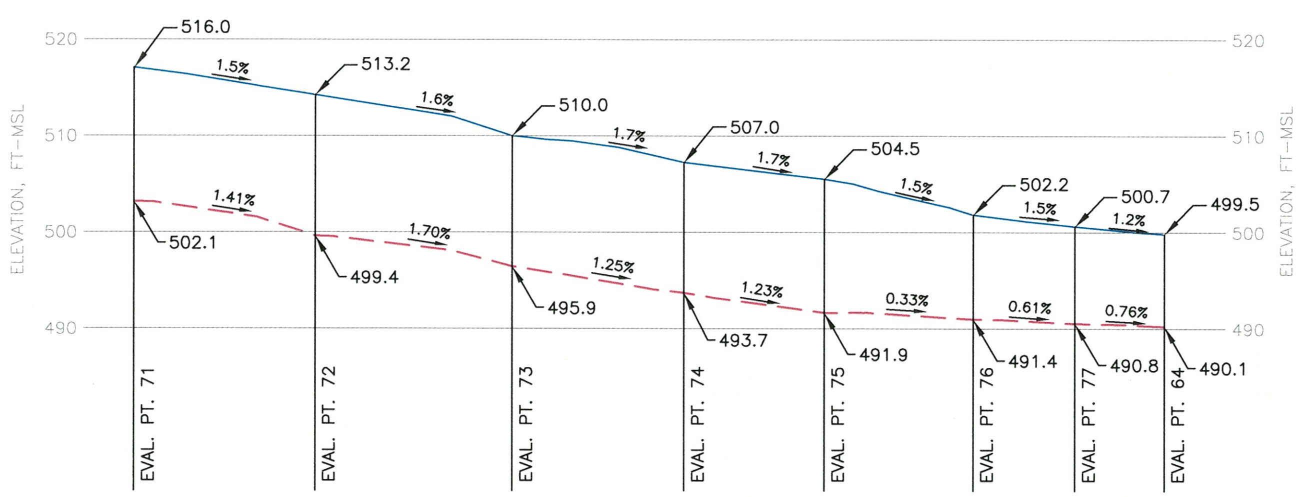

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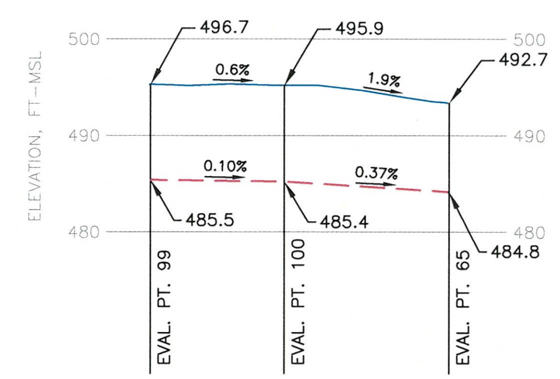

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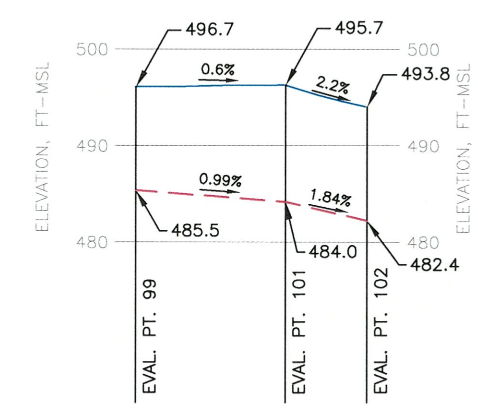

SECTOR 2B/3-F PIPE PROFILE

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

SCALE (ALL PROFILES)

0 100 200 SCALE IN FEET HORIZONTAL

0 10 20 SCALE IN FEET VERTICAL

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FILE: 0023-404-11
CAD: SHEET IIIE-B-3-7.DWG

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DESIGN BY: MB
REVIEWED BY: DEP

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AND
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MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

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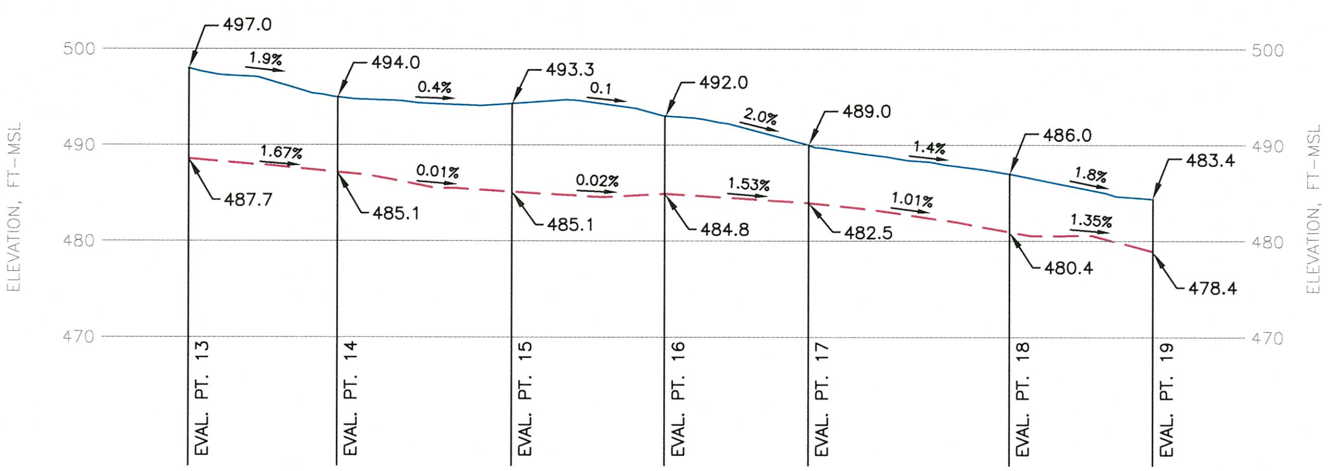
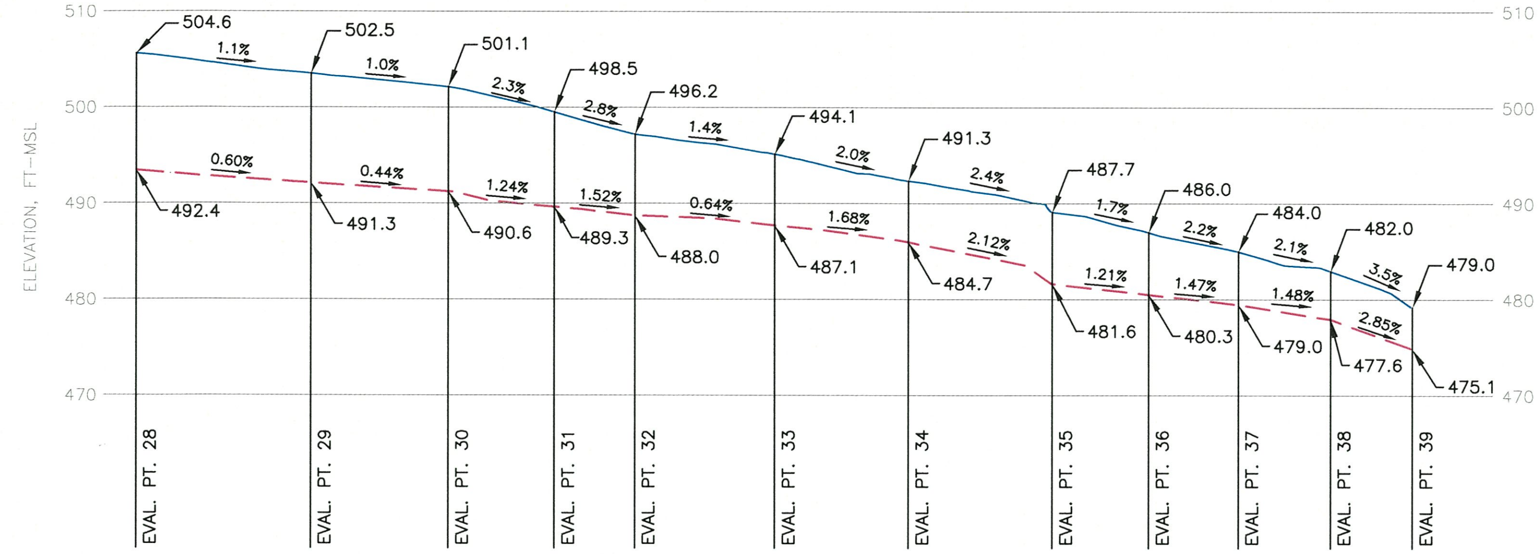
SHEET IIIE-B-3-28

O:\0023\404\EXPANSION 2021\PART III\IIIE\IIIE-B-3-27-30 PIPE PROFILES.dwg, jwilson, 1:2



SECTOR 1A/2A-A PIPE PROFILE



SECTOR 1A/2A-B PIPE PROFILE

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81734
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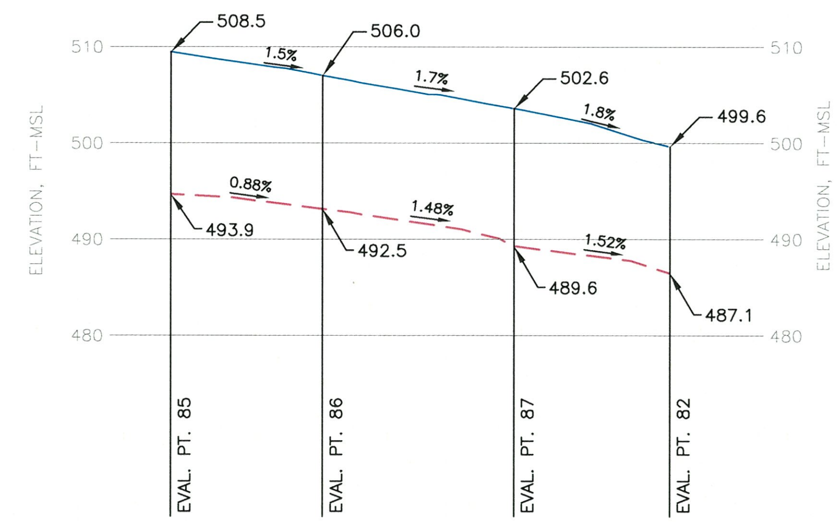
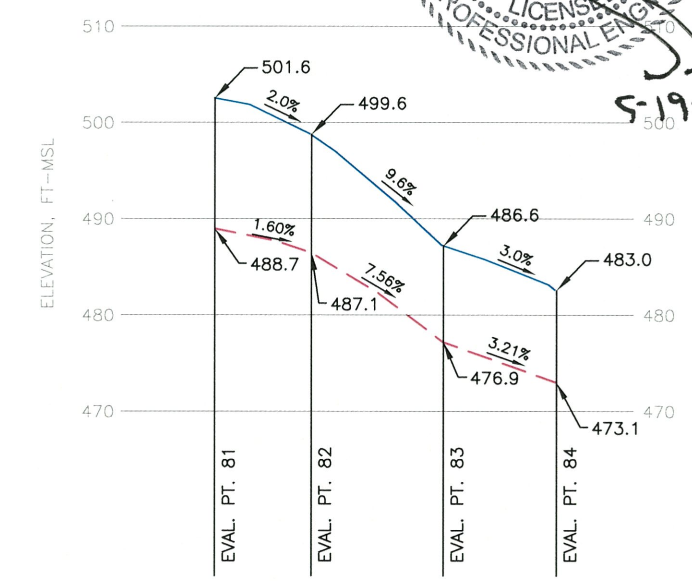
5-19-2022

SECTOR 1A/2A-C PIPE PROFILE



SECTOR 1A/2A-D PIPE PROFILE



SECTOR 1A/2A-E PIPE PROFILE

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

SCALE (ALL PROFILES)

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0 10 20 SCALE IN FEET VERTICAL

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MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
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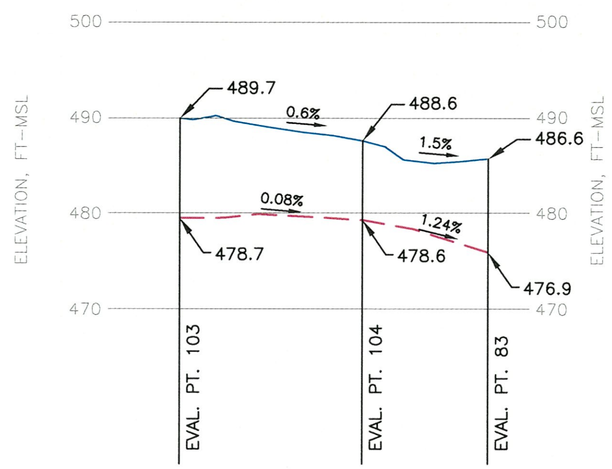
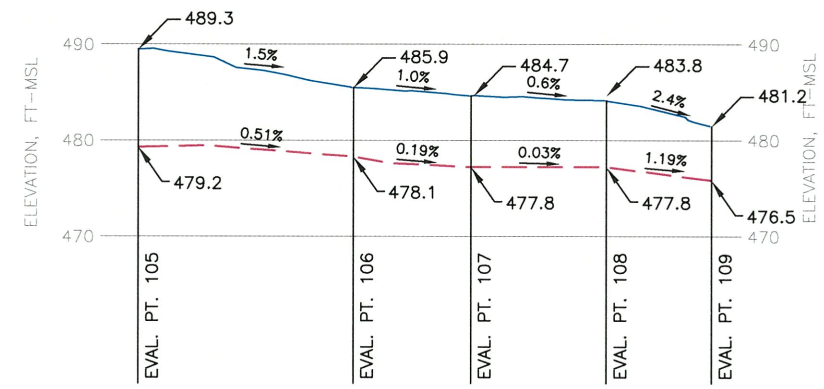
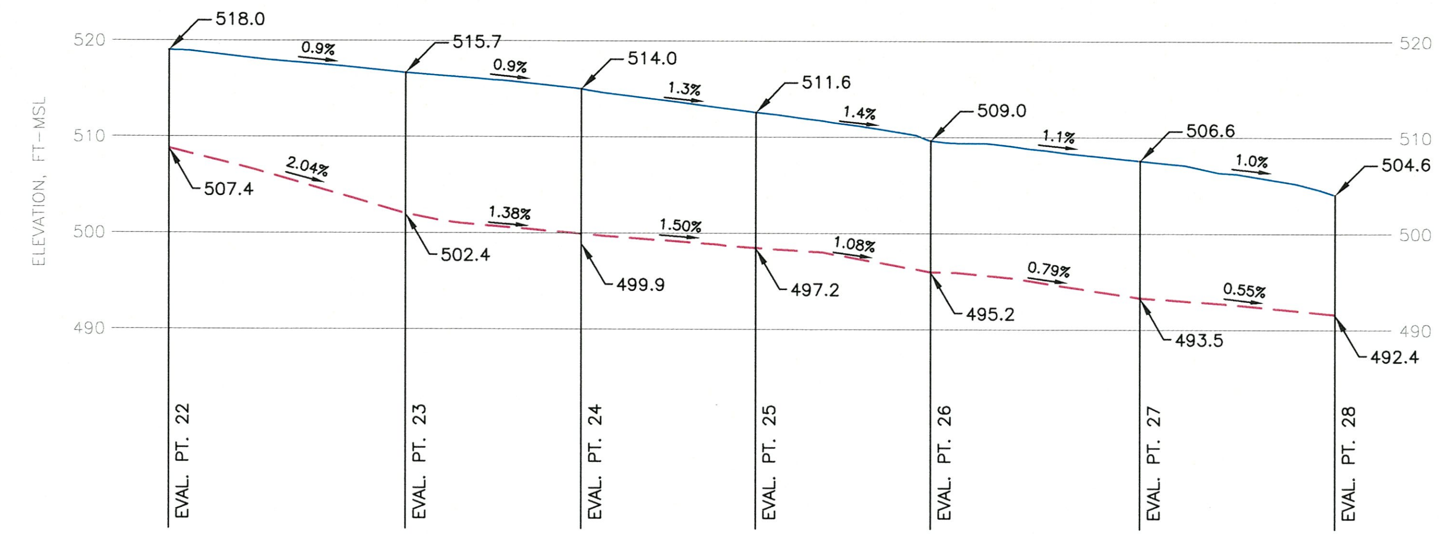
O:\0023\404\EXPANSION 2021\PART III\IIIE\IIIE-B-3-27-30 PIPE PROFILES.dwg, jwilson, 1:2



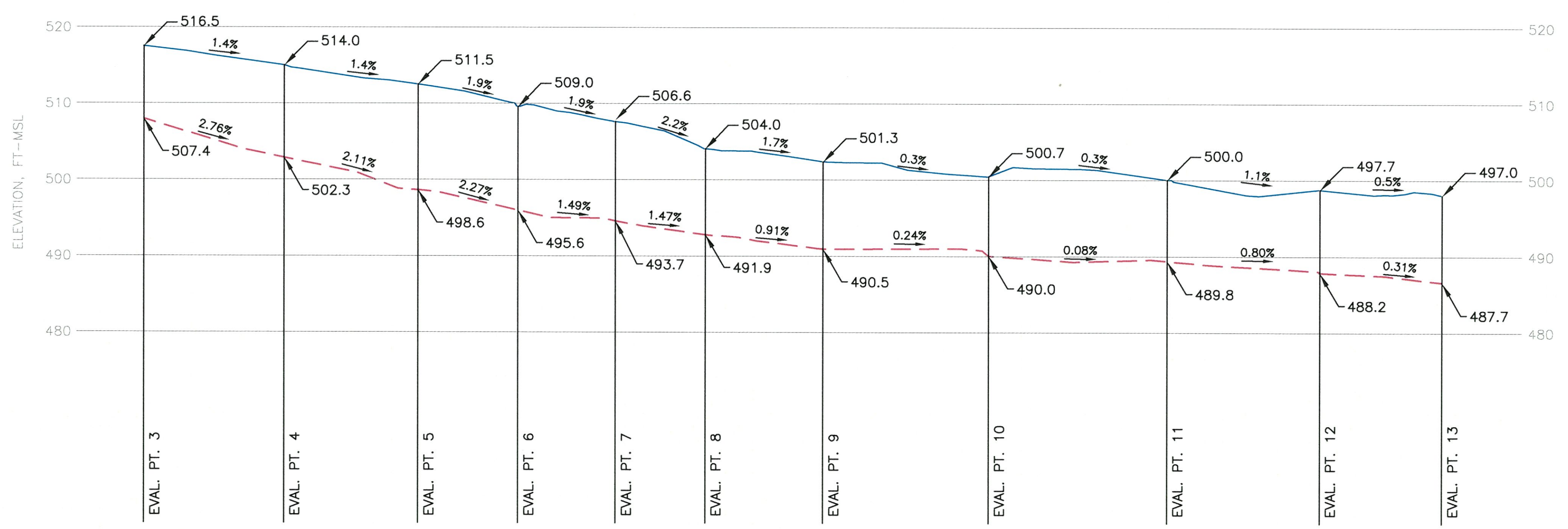
SECTOR 1A/2A-F PIPE PROFILE



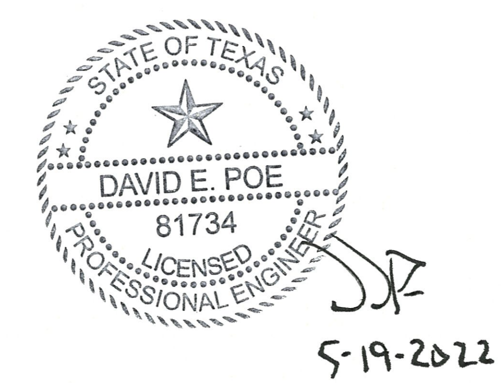
SECTOR 1A/2A-G PIPE PROFILE



SECTOR 1B-B PIPE PROFILE



SECTOR 1B-A PIPE PROFILE



LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

SCALE (ALL PROFILES)

0 100 200 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

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OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

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TARRANT COUNTY, TEXAS

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APPENDIX IIIE-B-4

FOUNDATION HEAVE ANALYSIS

Includes pages IIIE-B-4-1 through IIIE-B-4-4

STATE OF TEXAS
DAVID E. POE
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5-19-2022

Required: Estimate the potential heave of the bottom of excavation resulting from the removal of overburden soils during liner construction.

Method: Heave will be analyzed for the proposed excavation in Sector 11 (West Expansion Area).

References:

1. Terzaghi, Karl and Peck, Ralph, Soil Mechanics in Engineering Principle, Third Edition, John Wiley and Sons, Inc, New York, 1996.
2. Das, Braja M., Principles of Geotechnical Engineering, Fourth Edition, PWS, Boston, 1998.
3. Day, Robert W., *Geotechnical Engineer's Portable Handbook*, McGraw-Hill, New York, 2000.
4. Dunn, I.S., Anderson, L.R., and Kiefer, F.W., Fundamentals of Geotechnical Analysis, 1st Edition, 1980.
5. Coduto, Donald P., Geotechnical Engineering Principles and Practices, 1999.
6. Acar, Yalcin B.& Daniel, David E., *Geoenvironment 2000 Characterization, Containment, Remediation, and Performance in Environmental Geotechnics,* Volume 2, American Society of Civil Engineers, 1995.
7. Golder Associates, *City of Arlington Landfill, Major Permit Amendment,* 2014.

Foundation Heave Calculations

Estimate the potential heave of the excavation bottom in Sector 11.

Note: Evaluation location for the heave analysis is the shown as on Figure IIIE-B-4-4 (Heave Analysis Point 1)

Method: Excavation for liner construction will result in reduced overburden pressure on subgrade strata which may result in heave.

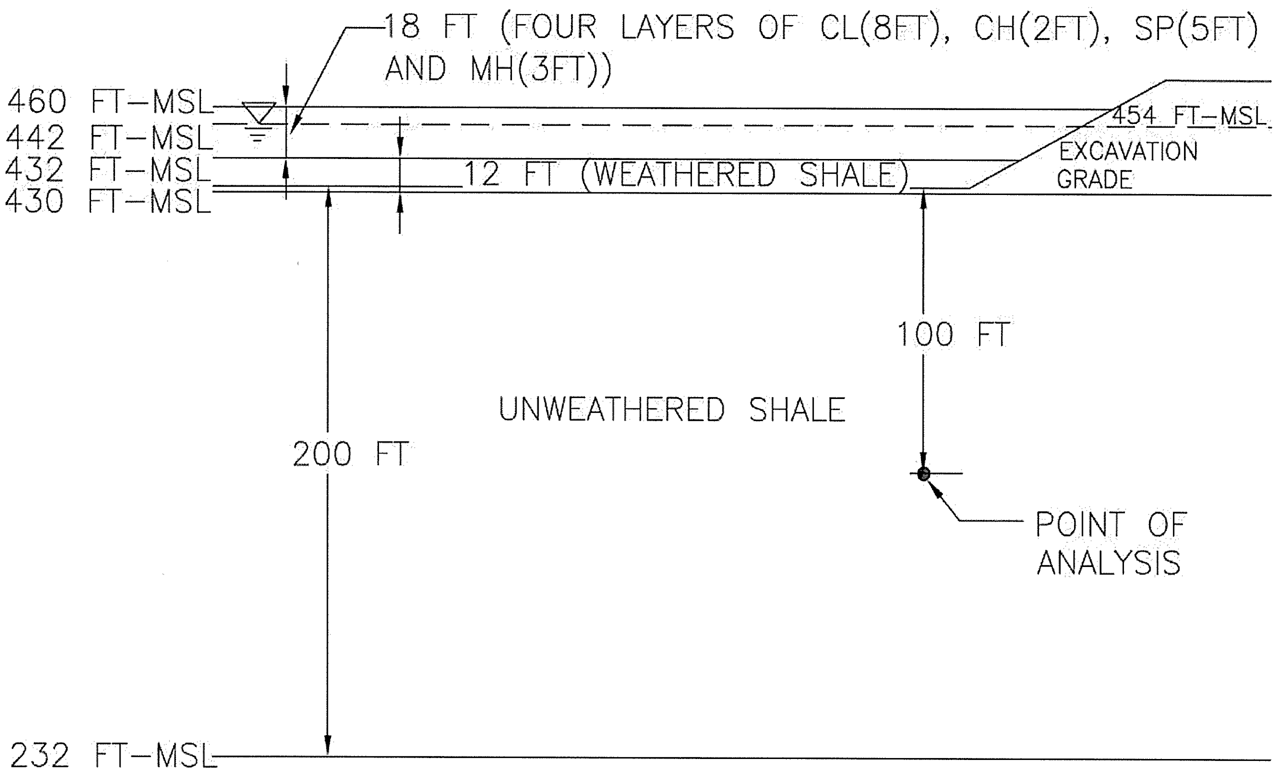
A. Select critical location for heave. The critical location is established as the location that has the estimated highest overburden pressure relief resulting from landfill excavation prior to liner installation. For this analysis it was assumed this point is in Sector 11 (West Expansion Area).

B. Use unit weight values for the excavated soils and consolidation parameter values derived from available field and laboratory results presented in Appendix IIIE-C.

C. Stratum elevations, thicknesses, and water table are shown on the below diagram.

Solution:

Diagram for Heave Analysis in Sector 11 (West Expansion Area)



Definition of Terms/Variables:

e_o = initial void ratio
γ_d = Dry Unit Weight (pcf)
γ_{moist} = Moist Unit Weight (pcf)
γ_{sat} = Saturated Unit Weight (pcf)
γ_w = Unit Weight of Water (pcf)
γ_{waste} = Unit Weight of Waste (pcf)
γ_I = Assumed Unit Weight Stratum I (pcf)
γ_{II} = Assumed Unit Weight Stratum II (pcf)
γ_{III} = Assumed Unit Weight Stratum III (pcf)
P_o = Initial Average Effective Overburden Pressure (psf)
P_c = Preconsolidation Pressure (psf) (pressure in excess of overburden pressure, assumed zero)
ΔP = Change in Vertical Pressure (psf)
D = depth of excavation
D_I = Overburden depth of Stratum I (ft)
D_{II} = Overburden depth of Stratum II (ft)
H_i = thickness of soil layer (Stratum II thickness analyzed for heave)
C_r = Recompression index (rebound portion of consolidation curve during unloading)
C_c = Compression Index

Based on the laboratory test results included in Appendix IIIE-C and Section 3 of the appendix, the material properties of the soil overburden material to be excavated during liner construction are shown in following table:

	e_0	γ_d (pcf)	γ_m (pcf)	γ_{sat} (pcf)	C_c	C_r
Stratum I (Overburden Soil (Four Layers of CL,CH, SP and MH))			128	131	na[2]	na[2]
Stratum II (Weathered Shale)	0.6		122.5	137	0.16	0.05
Stratum III (Unweathered Shale)	0.6		128	142	0.16	0.05

[1]Average unit weight for four layers is used.

[2]Consolidation parameters are not needed for Stratum I as this analysis assumes stratum will be removed entirely from the landfill floor during excavations.

The following parameters were used for Stratum II heave calculations:

H_i = 200 ft

e_o = 0.6

C_r = 0.0500

Pc = 7,200 psf (From lab testing, not used).

Estimate Potential Maximum Heave of the Excavation Bottom

The change in loading is due to the excavation of overburden soils.

$$\Delta P = D_I * \gamma_{I,\,moist} + D_{II} * \gamma_{I,\,sat} + D_{III} * \gamma_{II,\,sat}$$

D_I = 6 ft

D_{II} = 12 ft

D_{III} = 10 ft

ΔP = 3,710 psf

Using the standard consolidation theory:

$$S = C_r H_i \log((P_o - \Delta P) / P_o) \quad \text{(at midpoint of Stratum III)}$$

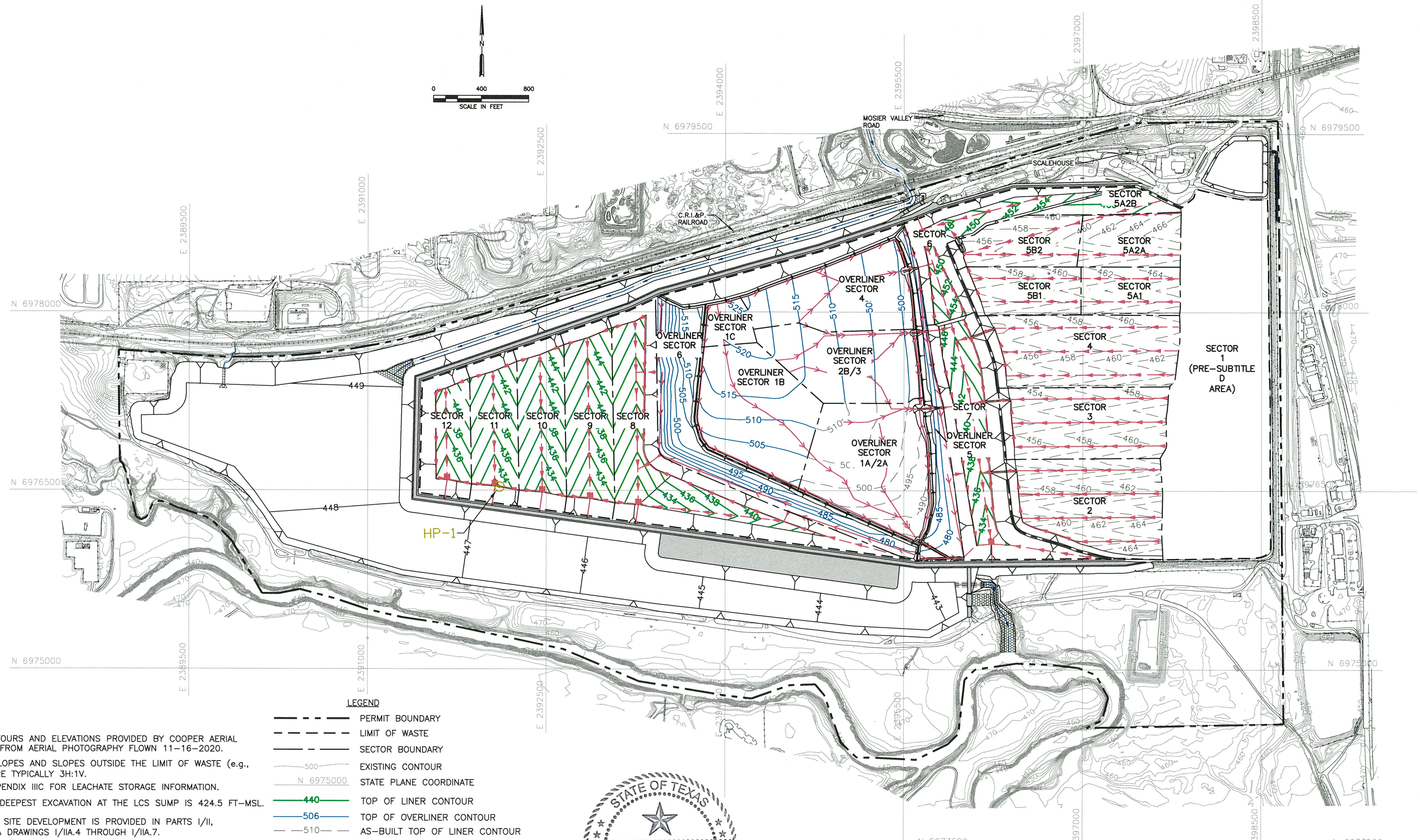
$$P_o = ((H_i/2-2)*(\gamma_{III(sat)} - \gamma_{(w)}) + 2' * (\gamma_{II(sat)} - \gamma_{(w)}) + \Delta P$$

P_o = 11,660.00 psf

S = -1.66 ft

Projected Heave[1] =	**-1.66**	**ft**	**or**	**-20.0**	**inches**

[1] Negative value represents heave or uplift of excavated foundation. Note that heave will be recovered during settlement of sector. As the settlement analysis conservatively does not incorporate actual preconsolidation stresses on formation, the actual heave and settlement will be less than calculated.



NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. REFER TO APPENDIX IIIC FOR LEACHATE STORAGE INFORMATION.
4. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

LEGEND

Symbol	Description
	PERMIT BOUNDARY
	LIMIT OF WASTE
	SECTOR BOUNDARY
500	EXISTING CONTOUR
N 6975000	STATE PLANE COORDINATE
440	TOP OF LINER CONTOUR
506	TOP OF OVERLINER CONTOUR
510	AS-BUILT TOP OF LINER CONTOUR
	LEACHATE COLLECTION PIPE
	LEACHATE COLLECTION SUMP
	LEACHATE RISER PIPE
	OVERLINER LEACHATE DRAINAGE PIPE
	OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
HP-1	HEAVE ANALYSIS POINT

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81734
LICENSED PROFESSIONAL ENGINEER
5-19-2022

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SETTLE3 SETTLEMENT ANALYSIS BOTTOM LINER STRAIN CALCULATIONS

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TARRANT COUNTY, TEXAS

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APPENDIX IIIE-C

LABORATORY TEST RESULTS

Includes pages IIIE-C-1 through IIIE-C-159

STATE OF TEXAS
DAVID E. POE
81734
LICENSED
PROFESSIONAL ENGINEER

5-19-2022

LABORATORY TESTING

Introduction

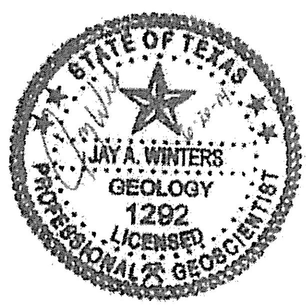
Various geotechnical and geological investigations have been conducted at the City of Arlington Landfill to characterize the subsurface conditions at the site. Based on the previous investigations, the site-specific near-surface soils have been divided into three distinct stratigraphic strata. Description of the strata is provided in Appendix IIIE, Section 3, as well as in Appendix IIIG – Geology Report. Copies of the lithological logs, geological sections, maps of regional geology, and in-depth description of the various strata is provided in Appendix IIIG-Geology Report and has not been reproduced for this appendix.

Geotechnical Data Summary

A summary of the geological field and laboratory testing is provided for each stratum in Section 3 of this appendix, including physical description of the individual stratum and a summary of laboratory testing results for the individual stratum. Further description and background information (e.g., logs, geological cross-sections) is provided in Appendix G – Geology Report.

While the majority of geotechnical test results (both field and laboratory) available for the landfill are summarized in the logs presented in Appendix IIIG – Geology Report, the geotechnical laboratory test results have been compiled and presented in this appendix. Logs of slug tests and permeability tests have been excluded from the results compiled in this appendix as they are not applicable to the stability and settlement analyses presented in this appendix. The information compiled for this appendix was excerpted from the document City of Arlington Landfill, Tarrant County – MSW Permit No. 358B, Part III, Attachment 4 – Geology Report, prepared by Golder Associates, February 2014.

APPENDIX 4-C
LABORATORY TESTING DATA



GOLDER ASSOCIATES INC.
Geoscience Firm Registration
Certificate Number 50369

Boring/ Exploration Point No.	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Moisture Content (%)	Unit Dry Weight (pcf)	Percent Finer		Unconfined Compressive Strength (tsf)
							Percent Passing #200	Percent Passing #40	
G-1	18.2						87		
G-1	5.0	21	18	3	20		46		
G-1	18.2	41	21	20	17	122.9	87		
G-1	28.3				14	122.5	63		
G-2	3.5						46		
G-2	3.8	19	14	5	19				
G-2	18.9				23	108.7			
G-2	26.8						73		
G-3	19.0	51	17	34			90		
G-3	24.0	51	17	34	19	114.0	86		
G-3	34.0	33	13	20	21	113.7	73		
G-3	35.5	32	13	19			73		
G-3	44.0	18	18	NP			33		
G-3	55.0						9		
G-3	60.8	50	23	27	19	114.5			
G-3	62.0	46	26	20	19	117.8	97		
G-4	8.5	18	14	4	13		54		
G-4	9.2				12	116.1			
G-4	13.7	35	17	18	19	111.8	76		
G-4	25.2				17	104.0			
G-4	30.9				13	117.4			
G-5	5.0	25	25	NP	25		42		
G-5	8.5						4		
G-5	11.9				15	127.9			
G-6	4.0	22	18	4	18		45		
G-6	8.5	57	24	33	26	98.4	95		
G-6	14.0				10	134.8			
G-6	15.6				19	119.6			
G-7	3.8	49	16	33	23	103.3	83		
G-7	8.5	21	13	8	15	116.9	46		
G-7	9.6	17	14	3			46		
G-7	15.0						7		
G-7	27.2	36	15	21			97		
G-7	29.1	36	15	21					
G-8	3.5	51	17	34	27		75		
G-8	19.0				10	121.7			
G-8	25.2	45	18	27	12	129.3			
MW-1	10.0	13	12	1			23		
MW-1	16.0	48	17	31	15		22		
MW-1	24.0	17	12	5	19	125.6	55		

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Summary of Material Properties
Arlington Landfill
Tarrant County, Texas

February 7, 1994 | Sheet 1 of 2

PROJECT NO. 1019-002-002

Figure 4-E.1

Boring/ Exploration Point No.	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Moisture Content (%)	Unit Dry Weight (pcf)	Percent Finer		Unconfined Compressive Strength (tsf)
							Percent Passing #200	Percent Passing #40	
MW-2	13.0	29	12	17	17	117.7	61		
MW-2	18.0	18	13	5	16		35		
MW-2	26.0	30	11	19	21		66		
MW-2	37.5	17	16	1	18		34		
MW-2	45.5						56		
MW-2	47.5						58		
MW-3	16.0	39	13	26	21	123.2	69		
MW-3	26.0	35	13	22	17		65		
MW-3	38.0	62	22	40	26	117.8	92		
MW-3	51.0	27	17	10			53		
MW-4	15.0	57	19	38	25		85		
MW-4	35.0	29	14	15	20		61		
MW-4	38.0	23	17	6			31		
MW-5	12.0	58	21	37	26	101.1	83		
MW-5	38.0	51	17	34	23		86		
MW-5	55.0	48	20	28	27		84		
MW-5	61.0	32	15	17			62		
MW-6	4.0	23	16	7			52		
MW-6	12.0	59	23	36	22		95		
MW-6	30.0	21	18	3			39		
MW-7	4.5	31	13	18	19	108.4	66		
MW-7	20.5	28	12	16	15		53		
MW-7	24.5	26	13	13	39		50		
MW-7	29.0						53		
MW-7	31.0						15		
MW-8	7.0	39	15	24	15	128.0	76		
MW-8	20.0	29	15	14			52		
MW-9	4.0	51	18	33	15	134.0	82		
MW-9	13.0	37	15	22	19		74		
MW-9	21.0	31	13	18	13		60		
MW-10	6.0	52	18	34	24		97		
MW-10	16.0	34	13	21	17		82		
MW-10	29.0	56	17	39	21		90		
MW-10	39.0						4		
MW-10	40.5						65		

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ENGINEERING AND ENVIRONMENTAL SERVICES

Summary of Material Properties
Arlington Landfill
Tarrant County, Texas

February 7, 1994 | Sheet 2 of 2

PROJECT NO.
1019-002-002

Figure 4-E.2

Boring/ Exploration Point No.	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Moisture Content (%)	Unit Dry Weight (pcf)	Percent Finer		Unconfined Compressive Strength (tsf)
							Percent Passing #200	Percent Passing #40	
MW-2	13.0	29	12	17	17	117.7	61		
MW-2	18.0	18	13	5	16		35		
MW-2	26.0	30	11	19	21		66		
MW-2	37.5	17	16	1	18		34		
MW-2	45.5						56		
MW-2	47.5						58		
MW-3	16.0	39	13	26	21	123.2	69		
MW-3	26.0	35	13	22	17		65		
MW-3	38.0	62	22	40	26	117.8	92		
MW-3	51.0	27	17	10			53		
MW-4	15.0	57	19	38	25		85		
MW-4	35.0	29	14	15	20		61		
MW-4	38.0	23	17	6			31		
MW-5	12.0	58	21	37	26	101.1	83		
MW-5	38.0	51	17	34	23		86		
MW-5	55.0	48	20	28	27		84		
MW-5	61.0	32	15	17			62		
MW-6	4.0	23	16	7			52		
MW-6	12.0	59	23	36	22		95		
MW-6	30.0	21	18	3			39		
MW-7	4.5	31	13	18	19	108.4	66		
MW-7	20.5	28	12	16	15		53		
MW-7	24.5	26	13	13	39		50		
MW-7	29.0						53		
MW-7	31.0						15		
MW-8	7.0	39	15	24	15	128.0	76		
MW-8	20.0	29	15	14			52		
MW-9	4.0	51	18	33	15	134.0	82		
MW-9	13.0	37	15	22	19		74		
MW-9	21.0	31	13	18	13		60		
MW-10	6.0	52	18	34	24		97		
MW-10	16.0	34	13	21	17		82		
MW-10	29.0	56	17	39	21		90		
MW-10	39.0						4		
MW-10	40.5						65		

EMCON Baker-Shiflett, Inc.
ENGINEERING AND ENVIRONMENTAL SERVICES

Summary of Material Properties
Arlington Landfill
Tarrant County, Texas

February 7, 1994 | Sheet 2 of 2

PROJECT NO. 1019-002-002

Figure 4-E.2

LABORATORY DATA SUMMARY SHEET

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - q_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_c	σ'_p (psf)	
B-101	1	0.0-1.5	496.0	SS	15	6.3	Stiff to very hard, brown to reddish brown, sandy lean CLAY (CL)																					
B-101	2	2.0-3.5	494.0	SS	29	13.4	Compact, brown, poorly-graded SAND with clay (SP-SC)																					
B-101	3	4.0-5.5	492.0	SS	36	18.1	Hard, sandy lean CLAY (CL), moist																					
B-101	4	6.0-7.5	490.0	SS	71	15.7		46	15	31	0.10																	
B-101	5	8.0-10.0	488.0	SH									0.0	36.1		63.9												
B-101		-					Hard, light gray, fat CLAY with sand (CH), shaley																					
B-101	6	13.5-15.0	482.5	SS	Refusal	15.7																						
B-101	7	18.5-20.0	477.5	SS	Refusal	15.5																						
B-101		-					Gray, weak, weathered, SANDSTONE and SHALE, interbedded and laminated																					
B-101	8	23.5-25.0	472.5	SS	Refusal																							
B-101	9	25.0-30.0	471.0	CORE		13.5																						
B-101	10	30.0-35.0	466.0	CORE													116.8	132.7	4.1									
B-101	11	35.0-40.0	461.0	CORE																								
B-101	11	40.0-45.0	456.0	CORE																								
B-101	12	45.0-46.5	451.0	SS	Refusal																							
B-101	13	46.5-50.0	449.5	CORE																								
B-101	14	50.0-55.0	446.0	CORE																								
B-101	15	55.0-56.5	441.0	SS	Refusal		Dark gray, weak, SHALE, slightly weathered																					
B-101	15	56.5-60.0	439.5	CORE																								
B-101	17	60.0-65.0	436.0	CORE																								
B-101	18	65.0-70.0	431.0	CORE			medium strong, unweathered at 55.0'																					
B-101		-					limestone seam at 67.75' and 68.5'																					
B-101	19	70.0-75.0	426.0	CORE																								
B-101	20	75.0-80.0	421.0	CORE			interbedded with seams of limestone between 75.0' and 80.0'																					
B-101	21	80.0-85.0	416.0	CORE																								

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - q_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_c	σ'_p (psf)	
B-101	22	85.0-90.0	411.0	CORE																								
B-101	23	90.0-95.0	406.0	CORE																								
B-101	24	95.0-100.0	401.0	CORE																								
B-101		-					weak at 96.0'																					
B-101		96.5-97.2				19.1											109.0	128.6	3.5									
B-101	25	100.0-105.0	396.0	CORE																								
B-101	26	105.0-110.0	391.0	CORE																								
B-101		-					BORING TERMINATED AT 110.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits LL	PL	PI	LI	USCS	Particle Size Analysis Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Consolidation Type	Cc_r	Cr_r	σ'$_p$ (psf)	Permeability (cm/sec)
B-102	1	0.0-1.5	472.9	SS	8	11.2	Loose, reddish brown, medium to fine, well-graded SAND (SW), slightly moist	25	15	10	-0.38																	
B-102		-					Very stiff, reddish brown, sandy lean CLAY (CL), slightly moist																					
B-102	2	2.0-4.0	470.9	SH		18.8																						
B-102	3	4.0-6.0	468.9	SH		17.3	with occasional iron stone at 4.0'																					
B-102	4	6.0-8.0	466.9	SH		16.0	Very stiff, brown, lean CLAY with sand (CL), slightly moist	43	15	28	0.08																	
B-102	5	8.0-10.0	464.9	SH		19.6	Very stiff to hard, gray with occasional reddish brown and light brown, elastic SILT (MH), slightly moist	61	32	29	-0.55	MH	0.3	9.2	90.5		116.6	135.3		3521			749					2.8E-09 (h)
B-102		-					Very stiff, reddish brown with mottled gray and yellowish brown, fat CLAY (CH), slightly moist																					
B-102		-					Very dense, brown with occasional gray, fine, poorly-graded SAND (SP), wet																					
B-102	6	15.0-16.0	457.9	SS	88"	19.8																						
B-102	7	20.0-21.5	452.9	SS	Refusal		Very dense, light brown, fine, clayey SAND (SC), wet						0.2	83.7	16.2													
B-102	8	25.0-25.5	447.9	SS	Refusal																							
B-102	9	30.0-31.5	442.9	SS	Refusal																							
B-102		-					Hard, dark gray, fat CLAY (CH), shaley																					
B-102	10	31.5-35.0	441.4	CORE																								
B-102	11	35.0-40.0	437.5	CORE			Medium strong, unweathered, gray and dark gray, SHALE																					
B-102		-					with occasional seams of limestone between 35.0' and 40.0'																					
B-102	12	40.0-45.0	432.9	CORE																								
B-102	13	45.0-50.0	427.9	CORE																								
B-102	14	50.0-55.0	422.9	CORE																								
B-102		-					with occasional seams of limestone between 50.0' and 55.0'																					
B-102	15	55.0-60.0	417.9	CORE																								
B-102	16	60.0-64.0	412.9	CORE																								
B-102		-					BORING TERMINATED AT 64.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	
B-103	1	0.0-1.5	455.7	SS	12	4.8	Compact, reddish and light brown, fine, poorly-graded SAND with clay (SP-SC), dry																					
B-103	2	2.0-3.5	483.7	SS	14	6.1	Compact, reddish and light brown, fine, poorly-graded SAND (SP), slightly moist																					
B-103	3	4.0-5.5	481.7	SS	14	4.5																						
B-103	4	6.0-7.5	475.7	SS	17	17.9																						
B-103		-					Very stiff to hard, gray with brown, fat CLAY with sand (CH), shaley																					
B-103	5	8.0-10.0	477.7	SH																								
B-103		-					gray at 10.0'																					
B-103	6	13.0-15.0	472.7	Sh																								
B-103	7	15.0-20.0	470.7	CORE			Dark gray, weak to medium strong, SHALE, slightly weathered																					
B-103		-					Interbedded with weathered sandstone between 15.0' and 40.0'																					
B-103	8	20.0-25.0	465.7	CORE																								
B-103	9	25.0-30.0	460.7	CORE																								
B-103	10	30.0-35.0	455.7	CORE																								
B-103	11	35.0-40.0	450.7	CORE																								
B-103	12	40.0-45.0	445.7	CORE																								
B-103	13	45.0-50.0	440.7	CORE			strong at 45.0'																					
B-103		48.1-46.5				10.4											130.2	143.7	33.2									
B-103	14	50.0-55.0	435.7	CORE																								
B-103	15	55.0-60.0	430.7	CORE																								
B-103		-					limestone seam at 57.5'																					
B-103	16	60.0-65.0	425.7	CORE																								
B-103	17	65.0-70.0	420.7	CORE																								
B-103	18	70.0-75.0	415.7	CORE		8.3	Interbedded with seams of limestone between 70.0' and 75.0'										135.0	147.3	34.0									
B-103	19	75.0-80.0	410.7	CORE																								
B-103		-					high angle fracture at 77.3'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	Atterberg Limits: USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: φ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: C_c	Consolidation: C_r	Consolidation: σ'_p (psf)	Permeability (cm/sec)
B-103	20	20.0-85.0	405.7	CORE																								
B-103	21	85.0-90.0	400.7	CORE																								
B-103		-					high angle fracture at 89.5'																					
B-103	22	90.0-95.0	395.7	CORE																								
B-103	23	95.0-100.0	390.7	CORE																								
B-103	24	100.0-102.0	385.7	CORE																								
B-103		-					BORING TERMINATED AT 102.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	PL	PI	LI	USCS	Particle Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - q_u (ksf)	UU - q_u (psf)	CU: c' (psf)	φ' (deg)	Confining Pressure (psf)	Consolidation: Type	Cc_c	Cr_c	σ'p (psf)	Permeability (cm/sec)
B-104	1	0.0-1.5	466.5	SS	7		Firm to very stiff, brown, fat CLAY (CH)																					
B-104	2	2.0-4.0	464.5	SH		24.5																						
B-104	3	4.0-6.0	462.5	SH		24.9		70	23	47	0.04	CH	0.0	5.5		94.5	92.0	114.9			170	28	1939					
B-104	4	6.0-8.0	460.5	SH		21.2	hard at 6.0'										100.9	126.0			170	28	3950					
B-104	5	8.0-9.5	458.5	SS	31	15.7											108.3	131.3			170	28	7321					6.3E-08 (h)
B-104	6	13.5-15.0	453.0	SS	33			59	19	40	-0.08	CH	0.0	11.0		89.0												
B-104	7	18.5-20.0	448.0	SS	17	15.9	very stiff at 18.5'																					
B-104	8	23.0-25.0	443.5	SH		15.9	Soft to firm, brown, lean CLAY (CL)																					
B-104	9	28.5-30.0	438.0	SS	8	24.0	firm to stiff at 28.5'	31	13	18	0.15						102.0	125.2		2095			2851	ILC	0.12	0.009	6200	
B-104		-					Soft to firm, brown, sandy lean CLAY (CL), wet																					
B-104	10	33.5-35.0	433.0	SS	4																							
B-104	11	38.5-40.0	428.0	SS	2	25.9																						
B-104	12	43.5-45.0	423.0	SS	9								0.0	41.9		58.1												
B-104		-					Loose, brown, clayey SAND (SC), wet																					
B-104	13	48.5-50.0	418.0	SS	Refusal		very dense at 48.5'																					
B-104	14	50.0-55.0	416.5	CORE			Hard, dark gray, fat CLAY (CH), shaley																					
B-104		-					occasional seams of limestone between 50.0' and 55.0'																					
B-104	15	55.0-60.0	411.5	CORE			Medium strong, dark gray, SHALE, unweathered																					
B-104	16	60.0-65.0	406.5	CORE			strong at 60.0'																					
B-104	17	65.0-70.0	401.5	CORE																								
B-104	18	70.0-75.0	396.5	CORE																								
B-104	19	75.0-80.0	391.5	CORE																								
B-104		-					high angle fractures at 76.0' and 77.5'																					
B-104	20	80.0-81.0	386.5	CORE																								
B-104		-					BORING TERMINATED AT 81.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	ϕ' (deg)	Confining Pressure (psf)	Type	Cc_r	Cr_r	σ'_p (psf)	Permeability (cm/sec)
B-104		-					Boring B-104 was converted into piezometer PZ-104.																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	φ' (deg)	Confining Pressure (psf)	Type	C_c	C_r	σ'_p (psf)	
B-105	1	0.0-2.0	479.9	SH		26.7	Hard, brown and yellowish brown, elastic SILT (MH), trace sand, moist	60	37	23	-0.45																	
B-105	2	2.0-3.5	477.9	SS	Refusal	15.1																						
B-105	3	4.0-5.5	475.9	SS	44	23.8	Hard, dark brown, fat CLAY (CH), shaly, slightly moist																					
B-105	4	6.0-7.5	473.9	SS	70	19.6																						
B-105	5	8.0-9.5	471.9	SS	Refusal			80	30	30	-0.35																	
B-105	6	10.0-15.0	469.9	CORE																								
B-105	7	15.0-20.0	464.9	CORE																								
B-105	8	20.0-25.0	459.9	CORE																								
B-105		-					Medium strong, gray, fine grained, SANDSTONE and SHALE, interbedded and laminated																					
B-105	9	25.0-30.0	454.9	CORE																								
B-105	10	30.0-35.0	449.9	CORE		13.0	highly weathered at 30.0'																					
B-105		-					Medium strong, bluish gray, weathered, SHALE										116.4	131.5										
B-105	11	35.0-40.0	444.9	CORE																								
B-105		-					Medium strong, bluish gray, unweathered, SHALE																					
B-105	12	40.0-45.0	439.9	CORE																								
B-105		-					dark gray at 42.0'																					
B-105	13	45.0-50.0	434.9	CORE																								
B-105	14	50.0-55.0	429.9	CORE																								
B-105		-					limestone seam at 54.0'																					
B-105	15	55.0-60.0	424.9	CORE																								
B-105	16	60.0-65.0	419.9	CORE																								
B-105	17	65.0-70.0	414.9	CORE																								
B-105		-					limestone seam at 66.0'																					
B-105	18	70.0-75.0	409.9	CORE																								
B-105	19	75.0-80.0	404.9	CORE																								

Golder Associates

Project: CITY OF ARLINGTON LANDFILL

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample								Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_r	σ'_p (psf)	Permeability (cm/sec)
B-105	20	80.0-85.0	395.9	CORE			Soft zone between 80.0' and 85.0'																					
B-105	21	85.0-90.0	394.9	CORE																								
B-105	22	90.0-94.0	389.9	CORE																								
B-105							BORING TERMINATED AT 94.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

Permit Issued: February 12, 2014

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	$Cc_ε$	$Cr_ε$	$σ'_p$ (psf)	
B-106	1	0.0-1.5	467.7	SS	12	17.5	Stiff, brown, sandy lean CLAY (CL), moist																					
B-106	2	1.5-4.0	466.2	SH		25.1																						
B-106		-					with occasional dark brown, light brown, and reddish brown at 2.0'																					
B-106	3	4.0-6.0	463.7	SH		26.0	Stiff, light brown and reddish brown, sandy elastic SILT (MH), moist	58	34	24	-0.33	MH	0.0	34.6		65.4												
B-106	4	6.0-7.0	461.7	SH		21.5																						
B-106	5	7.0-8.5	460.7	SS	32	19.7	Hard, dark gray, elastic SILT (MH), shaly, with occasional light brown sand partings, slightly moist																					
B-106	6	9.0-10.5	458.7	SS	Refusal	15.3		51	23	22	-0.52																	
B-106	7	15.0-15.5	452.7	SS	Refusal		Strong, gray, SANDSTONE, unweathered																					
B-106	8	16.5-20.0	451.2	CORE			Medium strong, gray, highly weathered, SILTSTONE, interbedded with shale, with shell fragments and iron concretions																					
B-106	9	20.0-25.0	447.7	CORE																								
B-106		22.4-				15.7																						
B-106	10	25.0-30.0	442.7	CORE			Medium strong, gray, sandy, SHALE, unweathered										115.7	133.9										9.7E-09 (v)
B-106	11	30.0-35.0	437.7	CORE																								
B-106	12	35.0-40.0	432.7	CORE																								
B-106	13	40.0-45.0	427.7	CORE																								
B-106		-					seams of limestone between 42.5' and 45.0'																					
B-106	14	45.0-50.0	422.7	CORE																								
B-106		-					occasional seams of limestone between 45.0' and 50.0'																					
B-106	15	50.0-55.0	417.7	CORE																								
B-106	16	55.0-57.0	412.7	CORE																								
B-106		-					BORING TERMINATED AT 57.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	φ' (deg)	Confining Pressure (psf)	Type	Cc_{ϵ}	Cr_{ϵ}	σ'_p (psf)	
B-107	1	0.0-1.5	472.0	SS	29		Compact, reddish brown and light brown, poorly-graded SAND with CLAY (SP-SC), moist																					
B-107	2	2.0-3.5	471.0	SS	Refusal	9.5	Hard, gray, lean CLAY (CL), shaly, with light brown sand partings, moist																					
B-107	3	4.0-5.5	469.0	SS	Refusal																							
B-107	4	6.0-7.5	467.0	SS	50	13.0		43	24	19	-0.58	CL	0.0	5.3		94.7												
B-107	5	8.0-9.5	465.0	SS	Refusal																							
B-107	6	15.0-16.5	458.0	SS	Refusal		Hard, dark gray, sandy fat CLAY (CH), shaley																					
B-107		-					Strong, dark gray, unweathered, SHALE																					
B-107	7	17.5-25.0	455.5	CORE																								
B-107	8	25.0-35.0	448.0	CORE		10.1	Medium strong, dark gray, highly weathered, SILTSTONE										127.9	140.8	35.4									
B-107		-					gray, unweathered at 30.0'																					
B-107	9	35.0-40.0	438.0	CORE			Weak, gray, unweathered, SHALE																					
B-107	10	40.0-45.0	433.0	CORE																								
B-107	11	45.0-55.0	428.0	CORE			medium strong at 45.0'																					
B-107		-					Medium strong, gray, unweathered, SHALE																					
B-107	12	55.0-65.0	418.0	CORE																								
B-107	13	65.0-75.0	408.0	CORE		7.2	Strong, light gray, unweathered, LIMESTONE, with occasional seams of shale										137.2	147.1	64.3									
B-107		-					Medium strong, dark gray, SHALE, unweathered																					
B-107	14	75.0-80.0	398.0	CORE																								
B-107	15	80.0-85.0	393.0	CORE																								
B-107		-					BORING TERMINATED AT 85.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	$Cc_ε$	$Cr_ε$	$σ'_p$ (psf)	
B-108	1	0.0-1.5	466.1	SS	18	7.8	Stiff to very stiff, brown, sandy lean CLAY (CL), moist																					
B-108	2	2.0-3.5	464.1	SS	13	11.6	with layers of degraded trash at 2.0'																					
B-108	3	4.0-5.5	462.1	SS	2		soft at 4.0'																					
B-108	4	6.0-7.5	460.1	SS	2	19.3																						
B-108	5	8.0-9.5	458.1	SS	2																							
B-108	6	15.0-16.5	451.1	SS	16	13.4	very stiff at 15.0'																					
B-108	7	20.0-21.5	446.1	SS	Refusal	23.9	Hard, dark gray, fat CLAY (CH), shaly, moist	39	17	22	-0.16	CL	8.0	34.4		57.6												
B-108	8	25.0-26.5	441.1	SS	Refusal	12.4																						
B-108	9	30.0-31.5	435.1	SS	36			55	24	31	-0.37																	
B-108	10	35.0-36.5	431.1	SS	Refusal		Weak, brown, SANDSTONE, weathered																					
B-108	11	35.5-40.0	429.6	CORE																								
B-108	12	40.0-45.0	425.1	CORE																								
B-108		-					Hard, dark gray, fat CLAY (CH), shaly																					
B-108	13	45.0-50.0	421.1	CORE																								
B-108	14	50.0-55.0	416.1	CORE			Strong, gray, shale, unweathered																					
B-108	15	55.0-50.0	411.1	CORE																								
B-108	16	60.0-55.0	406.1	CORE																								
B-108	17	65.0-70.0	401.1	CORE																								
B-108	18	70.0-75.0	396.1	CORE																								
B-108		-					limestone seam at 72.5'																					
B-108		72.5-				13.0																						
B-108		-					weathered zone of clayey shale at 74.5'										116.4	129.0										
B-108	19	75.0-80.0	391.1	CORE																								1.5E-06 (h)
B-108		-					limestone seam at 75.25'																					
B-108		-					limestone seam at 77.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT		Soil Description	Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/ 1 ft)	Moisture Content (%)		LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - q_u (ksf)	UU - c_u (psf)	c' (psf)	φ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'$_p$ (psf)	
B-105	20	80.0-81.0	356.1	CORE																								
B-105		-					BORING TERMINATED AT 81.0'																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - c_u (psf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	$Cc_ε$	$Cr_ε$	$σ'_p$ (psf)	Permeability (cm/sec)
B-109	1	0.0-1.5	464.3	SS	18	15.2	Very stiff, brown, fat CLAY with sand (CH), slightly moist																					
B-109		-					sea shell at 0.5'																					
B-109		-					iron stone at 1.5'																					
B-109	2	2.0-4.0	462.3	SH																								
B-109	3	4.0-6.0	460.3	SH																								
B-109	4	6.0-8.0	458.3	SH		22.4																						
B-109	5	8.0-10.0	458.3	SH													100.4	122.9										
B-109		-					Hard, reddish brown, sandy fat CLAY (CH), shaley																					2.7E-08 (h)
B-109	6	13.5-15.0	450.8	SS	Refusal	15.8																						
B-109	7	15.0-20.0	449.3	CORE									0.0	46.6	53.4													
B-109	8	20.0-25.0	444.3	CORE			Reddish brown, SILTSTONE, highly weathered																					
B-109	9	25.0-30.0	439.3	CORE																								
B-109	10	30.0-35.0	434.3	CORE			Medium strong, blue gray, SHALE, unweathered, with seams of cemented sand																					
B-109	11	35.0-40.0	429.3	CORE			gray at 35.0'																					
B-109	12	40.0-45.0	424.3	CORE																								
B-109		-					limestone seams between 41.0' and 42.0'																					
B-109	13	45.0-50.0	419.3	CORE																								
B-109		-					limestone seam at 49.0'																					
B-109	14	50.0-55.0	414.3	CORE																								
B-109	15	55.0-60.0	409.3	CORE																								
B-109	16	60.0-65.0	404.3	CORE																								
B-109	17	65.0-70.0	399.3	CORE			wash at 65.0'																					
B-109	18	70.0-75.0	394.3	CORE																								
B-109	19	75.0-80.0	389.3	CORE			high angle fracture at 75.0'																					
B-109		-					BORING TERMINATED AT 80.0'																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	Atterberg Limits: USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: $Cc_ε$	Consolidation: $Cr_ε$	Consolidation: $σ'_p$ (psf)	Permeability (cm/sec)
B-110	1	0.0-1.5	483.0	SS	15	8.3	Compact, reddish brown, clayey SAND (SC), slightly moist																					
B-110	2	2.0-3.5	481.0	SS	16	9.8																						
B-110		-					Very stiff to hard, reddish brown, sandy fat CLAY (CH), moist																					
B-110	3	4.0-5.5	479.0	SS	41	10.5																						
B-110		-					Dense, reddish brown, fine to coarse, clayey SAND with gravel (SC), wet						20.6	52.9		26.5												
B-110	4	5.0-7.5	477.0	SS	29	19.4	Very stiff, dark gray, fat CLAY (CH), shaley, with occasional sand partings, moist	55	20	35	-0.02																	
B-110	5	8.0-9.5	475.0	SS	Refusal	11.5	Hard, light gray, lean CLAY with sand (CL), moist																					
B-110		-					Strong, yellowish brown, SANDSTONE																					
B-110	6	13.5-15.0	469.5	SS	Refusal																							
B-110		-					Hard, dark gray, fat CLAY with sand (CH), shaley, moist																					
B-110	7	18.5-20.0	464.5	SS	Refusal	17.9		50	19	31	-0.05																	
B-110	8	23.5-25.0	459.5	SS	Refusal																							
B-110	9	25.0-30.0	458.0	CORE			Weak to medium strong, dark gray, SHALE, unweathered																					
B-110	10	30.0-35.0	453.0	CORE																								
B-110		31.3-31.9				14.1																						
B-110	11	35.0-40.0	448.0	CORE			with seams of sandstone between 35.0' and 40.0'										120.6	137.6	9.5									
B-110	12	40.0-45.0	443.0	CORE																								
B-110	13	45.0-50.0	438.0	CORE			strong at 45.0'																					
B-110	14	50.0-55.0	433.0	CORE			Strong, dark gray, SHALE, unweathered																					
B-110	15	55.0-60.0	428.0	CORE																								
B-110	16	60.0-65.0	423.0	CORE			limestone seam at 60.0'																					
B-110	17	65.0-70.0	418.0	CORE																								
B-110		-					limestone seam at 66.0'																					
B-110		-					limestone seam at 68.0'																					
B-110	18	70.0-75.0	413.0	CORE																								

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	φ' (deg)	Confining Pressure (psf)	Type	$Cc_ε$	$Cr_ε$	σ'$_p$ (psf)	Permeability (cm/sec)
B-110	19	75.0-80.0	408.0	CORE																								
B-110		-					limestone seam at 75.5'																					
B-110	20	80.0-85.0	403.0	CORE																								
B-110	21	85.0-90.0	398.0	CORE																								
B-110	22	90.0-95.0	393.0	CORE																								
B-110		-					weak zone and high angle fractures between 92.3' and 95.0'																					
B-110	23	95.0-97.0	388.0	CORE			strong at 95.0'																					
B-110		95.3-				10.2											129.0	142.1										2.1E-09 (h)
B-110		-					BORING TERMINATED AT 97.0'																					
B-110		-					Boring B-110 was converted into piezometer PZ-110.																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	$Cc_ε$	$Cr_ε$	σ'$_p$ (psf)	
B-111	1	0.0-1.5	464.5	SS	17	11.0	Compact, light brown, clayey SAND (SC), dry																					
B-111		-					Stiff, brown, lean CLAY with sand (CL), moist																					
B-111	2	2.0-4.0	462.5	SH		19.8		37	19	18	0.04	CL	9.0	16.2		81.6	101.1	121.1										2.7E-09 (h)
B-111	3	4.0-6.0	460.5	SH		21.3																						
B-111	4	6.0-7.5	458.5	SS	3	19.0	Firm, light brown, sandy lean CLAY (CL), moist						0.5	36.2		63.3												
B-111	5	7.5-9.0	457.0	SS	6	5.2																						
B-111		-					reddish brown at 8.0'																					
B-111		-					Loose, brown, poorly-graded SAND (SP), wet																					
B-111	6	15.0-18.0	449.5	SS	16	14.4																						
B-111		-					Very stiff, gray, fat CLAY (CH), shaly, moist																					
B-111	7	18.0-19.5	446.5	SS	Refusal		Strong, light gray, fine, SANDSTONE, highly weathered																					
B-111		19.0-				0.3											157.9	156.4										5.2E-10 (h)
																												6.3E-10 (v)
B-111	8	19.5-23.0	445.0	CORE																								
B-111		-					Hard, gray, fat CLAY (CH), shaly																					
B-111		21.0-				11.8											118.5	132.5										2.2E-08 (h)
B-111	9	23.0-26.0	441.5	CORE			Strong, light gray, SILTSTONE																					
B-111		25.2-				1.7											138.8	141.2										3.4E-05 (v)
B-111	10	28.0-37.0	436.5	CORE																								
B-111		-					Medium strong, gray, sandy SHALE, unweathered																					
B-111	11	37.0-43.0	427.5	CORE																								
B-111	12	43.0-48.0	421.5	CORE			possible sea shells and gypsum crystals at 43.0'																					
B-111		-					limestone seam at 45.5'																					
B-111	13	48.0-58.0	416.5	CORE																								
B-111	14	58.0-68.0	406.5	CORE																								

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Project: CITY OF ARLINGTON LANDFILL

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	PL	PI	LI	USCS	Particle Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UU - c_u (psf)	CU: c' (psf)	ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	Cc_c	Cr_r	σ'_p (psf)	Permeability (cm/sec)
B-111		-					limestone seam at 55.0'																					
B-111		-					limestone seam at 63.0'																					
B-111	15	68.0-78.0	396.5	CORE																								
B-111	16	78.0-79.0	385.5	CORE																								
B-111		-					BORING TERMINATED AT 75.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	
B-112R	1	0.0-1.5	460.0	SS	13		Stiff, brown, lean CLAY with sand (CL), moist																					
B-112R	2	2.0-4.0	458.0	SH		23.1																						
B-112R	3	4.0-6.0	456.0	SH		25.4		49	21	28	0.16	CL	2.2	25.6		72.2	97.8	119.4										1.6E-08 (h)
B-112R		-					soft to firm at 5.0'																					
B-112R	4	6.0-8.0	454.0	SH			reddish and dark brown at 6.0'																					
B-112R	5	8.0-10.0	452.0	SH		22.4	Reddish and dark brown, fat CLAY with sand (CH), moist	58	22	35	0.01						90.2	110.4						ILC	0.13	0.02	5000	
B-112R		-					Brown, medium to fine, poorly-graded SAND (SP), wet																					
B-112R	6	15.0-16.5	445.0	SS	76	15.3	Hard, gray, sandy, elastic SILT (MH), shaly, slightly moist	51	29	22	-0.62																	
B-112R	7	18.0-19.5	442.0	SS	Refusal		Strong, brown, SILTSTONE																					
B-112R	8	19.5-20.0	440.5	CORE																								
B-112R	9	20.0-25.0	440.0	CORE			interbedded with shale between 20.0' to 30.0'																					
B-112R	10	25.0-30.0	435.0	CORE																								
B-112R		25.5-				13.3											119.4	135.3										1.7E-07 (v)
B-112R	11	30.0-35.0	430.0	CORE			Weak, gray, sandy SHALE, unweathered																					
B-112R	12	35.0-40.0	425.0	CORE																								
B-112R	13	40.0-45.0	420.0	CORE			medium strong at 40.0'																					
B-112R	14	45.0-50.0	415.0	CORE																								
B-112R		-					with limestone seams between 45.0' and 60.0'																					
B-112R	15	50.0-55.0	410.0	CORE		5.7	strong at 50.0'										141.6	149.7	123.6									
B-112R	16	55.0-60.0	405.0	CORE			medium strong at 55.0'																					
B-112R	17	60.0-65.0	400.0	CORE																								
B-112R	18	65.0-70.0	395.0	CORE																								
B-112R	19	70.0-75.0	390.0	CORE																								
B-112R		-					BORING TERMINATED AT 75.0'																					
B-112R		-					Boring B-112R was converted into piezometer PZ-112R.																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits LL	PL	PI	LI	USCS	Particle Size Analysis Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Consolidation Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	Permeability (cm/sec)
B-113R	1	0.0-1.5	459.7	SH		21.0	Dark brown, clayey SAND (SC), moist																					
B-113R		-					Dense, reddish brown and dark brown, medium, poorly-graded SAND (SP), wet																					
B-113R	2	1.5-3.0	458.2	SS	41	19.4																						
B-113R		-					Hard, dark brown, elastic SILT with sand (MH), shaley, with occasional light brown sand partings, slightly moist	58	31	27	-0.43	MH	0.3	20.9		78.8												
B-113R	3	3.0-5.0	456.7	SS	Refusal	14.5																						
B-113R	4	5.0-6.5	454.7	SS	Refusal	16.8	Weak, dark gray, sandy SHALE, moderately weathered																					
B-113R	5	6.5-10.0	453.2	CORE		6.5																						
B-113R	6	10.0-15.0	449.7	CORE			Medium strong, gray, SILTSTONE																					
B-113R		-					brown at 11.0'																					
B-113R	7	15.0-20.0	444.7	CORE		10.4																						
B-113R		-					Medium strong, gray, SHALE, unweathered						0.0	8.2		91.8												
B-113R	8	20.0-25.0	439.7	CORE																								
B-113R	9	25.0-30.0	434.7	CORE																								
B-113R	10	30.0-35.0	429.7	CORE																								
B-113R		-					limestone seam at 32.5'																					
B-113R	11	35.0-40.0	424.7	CORE																								
B-113R		-					limestone seams between 35.0' and 40.0'																					
B-113R	12	40.0-45.0	419.7	CORE																								
B-113R		-					limestone seams between at 44.5' and 47.0'																					
B-113R	13	45.0-47.0	414.7	CORE																								
B-113R		-					BORING TERMINATED AT 47.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	$C_{c\varepsilon}$	$C_{r\varepsilon}$	σ'_p (psf)	
B-114	1	0.0-1.5	461.7	SS	10	9.2	Stiff, reddish brown, sandy lean CLAY (CL), moist																					
B-114	2	2.0-3.5	459.7	SS	3	15.2	soft at 2.0'																					
B-114	3	4.0-5.5	457.7	SS	11	28.3	Stiff, dark brown, fat CLAY with sand (CH), moist	54	29	25	-0.03		5.2	43.5		50.3												
B-114	4	6.0-8.0	455.7	SH		13.9																						
B-114	5	8.0-9.5	453.7	SS	7		Loose, reddish brown, fine to medium, poorly-graded SAND (SP)																					
B-114	6	15.0-16.5	446.7	SS	59	17.2	Hard, dark gray, fat CLAY (CH), shaly, moist	55	30	25	-0.51																	
B-114	7	20.0-21.5	441.7	SS	Refusal																							
B-114	8	21.5-30.0	440.2	CORE																								
B-114	9	30.0-40.0	431.7	CORE																								
B-114		-					Strong, gray, SILTSTONE and SANDSTONE, highly laminated																					
B-114		-					Strong, dark gray, SHALE, unweathered, trace fossils																					
B-114	10	40.0-45.0	421.7	CORE																								
B-114	11	45.0-50.0	416.7	CORE			medium strong with weak zones at 45.0'																					
B-114		-					limestone seam at 45.5'																					
B-114		-					limestone seam at 47.0'																					
B-114	12	50.0-55.0	411.7	CORE			limestone seams between 50.0' and 51.0'																					
B-114	13	55.0-60.0	406.7	CORE																								
B-114	14	60.0-65.0	401.7	CORE			with interbedded limestone seams between 60.0' and 65.0'																					
B-114	15	65.0-70.0	396.7	CORE			strong, limestone seam at 65.0'																					
B-114	16	70.0-75.0	391.7	CORE																								
B-114	17	75.0-77.0	386.7	CORE																								
B-114		-					BORING TERMINATED AT 77.0'																					
B-114		-					Boring B-114 was converted into piezometer PZ-114.																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	Cc_r	Cr_r	c'_a (psf)	Permeability (cm/sec)
B-115	1	0.0-1.5	463.1	SS	15	8.5	Compact, light brown, fine, clayey SAND (SC), moist						0.0	55.2		44.8												
B-115	2	2.0-3.5	461.1	SS	10	14.1	reddish brown at 2.0'																					
B-115	3	4.0-5.5	459.1	SS	4	19.5																						
B-115		-					Soft to firm, light reddish brown, sandy CLAY, very moist																					
B-115	4	6.0-7.5	457.1	SS	9	19.1	Loose, light reddish brown, clayey SAND (SC), wet						0.0	59.9		40.1												
B-115	5	7.5-9.0	455.6	SS	3	16.4																						
B-115		-					Very loose, brown, medium to fine, poorly-graded SAND (SP), wet																					
B-115	6	15.0-16.5	448.1	SS	65	17.7																						
B-115		-					Hard, gray, fat CLAY (CH), shaly, moist																					
B-115	7	20.0-21.5	443.1	SS	Refusal		Medium strong, light brown, moderately weathered, SILTSTONE																					
B-115	8	21.5-25.0	441.6	CORE																								
B-115	9	25.0-30.0	438.1	CORE																								
B-115		25.2-				7.5											131.5	141.3										3.0E-09 (h)
B-115	10	30.0-35.0	433.1	CORE			Interbedded with shale at 30.0'																					
B-115		-					Medium strong, gray, SHALE																					
B-115	11	35.0-40.0	428.1	CORE																								
B-115	12	40.0-45.0	423.1	CORE			limestone seams between 40.0' and 45.0'																					
B-115		-					limestone layer between 42.0' and 43.0'																					
B-115	13	45.0-50.0	418.1	CORE		9.4											133.3	145.8	52.6									
B-115	14	50.0-55.0	413.1	CORE																								
B-115		-					limestone layer between 52.0' and 53.0'																					
B-115	15	55.0-60.0	408.1	CORE			strong at 55.0'																					
B-115		-					seam of limestone at 57.5'																					
B-115	16	60.0-65.0	403.1	CORE			with interbedded layers of limestone between 60.0' and 65.0'																					
B-115	17	65.0-70.0	398.1	CORE																								

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_e	Cr_e	$σ'_p$ (psf)	
B-115	18	70.0-75.0	393.1	CORE																								
B-115	19	75.0-77.0	388.1	CORE																								
B-115		-					BORING TERMINATED AT 77.0'																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits LL	PL	PI	LI	USCS	Particle Size Analysis Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Consolidation Type	Cc_ε	Cr_ε	σ'_p (psf)	Permeability (cm/sec)
B-116	1	0.0-1.5	465.4	SS	8	8.7	Loose, reddish brown, medium to fine, poorly-graded SAND (SP), with clay, moist																					
B-116	2	2.0-3.5	463.4	SS	7	10.6	light brown at 2.0'																					
B-116	3	4.0-5.5	461.4	SS	4	12.8																						
B-116		-					Soft to firm, reddish brown, lean CLAY with sand (CL), moist																					
B-116	4	6.0-8.0	459.4	SH		18.9		39	17	22	0.09	CL	1.5	20.4	78.1													
B-116	5	8.0-10.0	457.4	SH		15.0	firm to stiff, brown at 8.0'																					
B-116		-					Firm, reddish brown, sandy lean CLAY (CL)																					
B-116	6	15.0-17.0	450.4	SS	7	21.9							8.1	32.9	59.0													
B-116		-					dark brown at 15.5'																					
B-116		-					Hard, gray, fat CLAY (CH), shaley, with sand																					
B-116	7	19.0-20.5	446.4	SS	Refusal																							
B-116	8	24.0-25.5	441.4	SS	Refusal		Medium strong, gray, unweathered, SHALE, with seams of sandstone																					
B-116	9	25.5-26.0	439.9	CORE																								
B-116	10	26.0-30.0	439.4	CORE																								
B-116	11	30.0-35.0	435.4	CORE		1.5	Medium strong, unweathered, SILTSTONE										120.0	121.8										3.2E-07 (h)
B-116	12	35.0-40.0	430.4	CORE			Medium Strong, unweathered, gray, SHALE																					
B-116		-					seams of limestone at 37.8'																					
B-116	13	40.0-45.0	425.4	CORE																								
B-116	14	45.0-50.0	420.4	CORE		11.7											125.8	140.5	25.9									
B-116	15	50.0-55.0	415.4	CORE			seams of limestone between 50.0' and 55.0'																					
B-116	16	55.0-60.0	410.4	CORE																								
B-116	17	60.0-65.0	405.4	CORE																								
B-116		-					seam of limestone at 63.0'																					
B-116	18	65.0-70.0	400.4	CORE		5.8											142.6	151.1	140.6									
B-116	19	70.0-75.0	395.4	CORE																								

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_c	σ'_p (psf)	
B-116	20	75.0-80.0	390.4	CORE		11.3																						
B-116		-					layer of hard limestone between 76.0' and 77.0'										126.5	140.8	28.6									
B-116	21	80.0-85.0	385.4	CORE																								
B-116	22	85.0-87.0	380.4	CORE																								
B-116		-					BORING TERMINATED AT 87.0'																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'$_p$ (psf)	
B-117R	1	0.0-1.5	455.6	SS	12	8.8	Compact, reddish brown, clayey SAND (SC), moist																					
B-117R		-					Stiff, reddish brown, sandy lean CLAY (CL), moist																					
B-117R	2	2.0-3.5	457.5	SS	11	11.9							22.8	50.9		26.3												
B-117R		-					Compact, reddish brown, fine to coarse, clayey SAND with gravel (SC)																					
B-117R	3	4.0-5.5	455.6	SS	1	15.5	Very loose, reddish brown, fine to coarse, well-graded SAND with clay (SW-SC), wet																					
B-117R	4	6.0-7.5	453.6	SS	2																							
B-117R	5	8.0-9.5	451.6	SS	5	17.1	loose at 8.0'						1.7	91.7		5.6												
B-117R		-					Hard, dark gray, fat CLAY (CH), shaley, moist																					
B-117R	6	15.0-16.5	444.6	SS	Refusal	13.5																						
B-117R	7	20.0-21.5	439.6	SS	Refusal																							
B-117R		-					Weak to medium strong, light brown, SILTSTONE, moderately weathered																					
B-117R	8	21.5-25.0	438.1	CORE																								
B-117R	9	25.0-30.0	434.6	CORE																								
B-117R	10	30.0-35.0	429.6	CORE			Weak, gray, SHALE, unweathered																					
B-117R	11	35.0-40.0	424.6	CORE			dark gray, strong at 35.0'																					
B-117R	12	40.0-45.0	419.6	CORE			medium strong at 40.0'																					
B-117R		-					limestone seam at 43.5'																					
B-117R	13	45.0-50.0	414.6	CORE			weak at 45.0'																					
B-117R	14	50.0-55.0	409.6	CORE																								
B-117R		-					limestone seam at 52.0'																					
B-117R	15	55.0-60.0	404.6	CORE			medium strong at 55.0'																					
B-117R		-					limestone seam at 55.5'																					
B-117R		-					limestone seam at 57.5'																					
B-117R	16	60.0-65.0	399.6	CORE			weak at 60.0'																					
B-117R	17	65.0-70.0	394.6	CORE																								

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	C_c	C_r	σ'_p (psf)	
B-117R	18	70.0-72.0	389.6	CORE																								
B-117R		-					BORING TERMINATED AT 72.0'																					
B-117R		-					Boring B-117R was converted into piezometer PZ-117R.																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	Atterberg Limits: USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - q_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	UCS / UU / CU Triaxial: CU c' (psf)	UCS / UU / CU Triaxial: CU ϕ' (deg)	UCS / UU / CU Triaxial: Confining Pressure (psf)	Consolidation: Type	Consolidation: $Cc_ε$	Consolidation: $Cr_ε$	Consolidation: $σ'_p$ (psf)	Permeability (cm/sec)
B-118R	1	0.0-1.5	464.3	SS	4		Soft to firm, reddish brown, sandy lean CLAY (CL), slightly moist																					
B-118R		-					TRASH, with layers of sandy lean clay																					
B-118R	2	2.0-3.5	462.3	SS	8		-																					
B-118R	3	4.0-5.5	460.3	SS	4																							
B-118R		-					Very soft to firm, reddish brown, sandy lean CLAY (CL), moist																					
B-118R	4	6.0-7.5	458.3	SS	2	18.5		34	15	19	0.18	CL	1.9	41.2		56.9												
B-118R	5	8.0-9.5	456.3	SS	5	21.2	trash at 8.0'																					
B-118R		-					Stiff, dark brown, lean CLAY with sand (CL), shaley, moist																					
B-118R	6	13.5-15.0	450.8	SS	14	34.9		47	18	29	0.58																	
B-118R		-					Compact, brown, well-graded SAND with gravel (SW), wet																					
B-118R	7	18.5-20.0	445.8	SS	Refusal																							
B-118R		-					Weak, gray, SANDSTONE and SHALE, weathered, interbedded and highly laminated																					
B-118R	8	23.5-25.0	440.8	SS	Refusal																							
B-118R	9	28.5-30.0	435.8	SS	Refusal																							
B-118R	10	30.0-35.0	434.3	CORE																								
B-118R		31.2-31.9				11.8											122.6	137.3	8.9									
B-118R		31.9-				19.1											105.4	116.0										
																												1.5E-08 (h)
B-118R	11	35.0-40.0	429.3	CORE			Medium strong, gray, SHALE, sandy, unweathered																					9.6E-09 (v)
B-118R		-					Weak, gray, SANDSTONE and SHALE, weathered, interbedded and highly laminated																					
B-118R	12	40.0-45.0	424.3	CORE			Medium strong, gray, SHALE, sandy, unweathered																					
B-118R	13	45.0-50.0	419.3	CORE																								
B-118R	14	50.0-55.0	414.3	CORE																								
B-118R	15	55.0-60.0	409.3	CORE																								
B-118R	16	60.0-65.0	404.3	CORE		12.2	very strong at 60.0'										126.5	141.9	44.5									

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	PL	PI	LI	USCS	Particle Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UU - c_u (psf)	CU: c' (psf)	CU: ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	$Cc_ε$	$Cr_ε$	$σ'_p$ (psf)	Permeability (cm/sec)
B-118R	17	65.0-70.0	359.3	CORE			limestone seams between 65.0' and 70.0'																					
B-118R	18	70.0-75.0	354.3	CORE																								
B-118R	19	75.0-78.0	349.3	CORE																								
B-118R		-					BORING TERMINATED AT 78.0'																					
B-118R		-					Boring B-118R was converted into piezometer PZ-118R.																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	PL	PI	LI	USCS	Particle Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UU - c_u (psf)	CU: c' (psf)	φ' (deg)	Confining Pressure (psf)	Consolidation: Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	Permeability (cm/sec)
B-119R	1	0.0-1.5	464.9	SS	4	14.5	Soft to firm, dark brown, lean CLAY with sand (CL), slightly moist																					
B-119R	2	2.0-4.0	462.9	SH		18.1	very stiff at 2.0'	41	19	22	-0.04	CL	2.1	16.1		81.8												
B-119R	3	4.0-6.0	460.9	SH		20.0		NP	NP	NP							107.4	128.8			482	21	1981					
B-119R		4.1-4.2																			482	21	3996					
B-119R		4.2-4.3																			482	21	5053					
B-119R	4	5.0-8.0	458.9	SH		19.7	stiff, reddish brown at 5.0'						9.0	85.5		5.4												
B-119R	5	8.0-10.0	456.9	SH		19.0	Loose, reddish brown, medium to fine, poorly-graded SAND with silt (SP-SM), moist										110.8	131.9		3341			1080					5.5E-07 (h)
B-119R	6	15.0-16.5	449.9	SS	11	11.3	with gravel, coarse to fine at 15.0'						53.9	35.1		8.0												
B-119R		-					Compact, brown, fine, well-graded GRAVEL with clay and sand (GW-GC), wet																					
B-119R	7	19.0-20.5	445.9	SS	13	20.3																						
B-119R		-					Hard, gray, fat CLAY (CH), shaly, moist																					
B-119R	8	25.0-25.5	439.9	SS	Refusal																							
B-119R		-					Medium strong, gray, highly weathered SILTSTONE																					
B-119R	9	26.5-33.0	436.4	CORE																								
B-119R	10	33.0-43.0	431.9	CORE			Strong, gray, sandy SHALE, unweathered																					
B-119R	11	43.0-53.0	421.9	CORE																								
B-119R		-					limestone seam at 49.5'																					
B-119R	12	53.0-63.0	411.9	CORE			occasional seams of limestone between 53.0' and 63.0'																					
B-119R	13	63.0-73.0	401.9	CORE																								
B-119R		65.0-66.0				14.1											122.5	139.6	18.5									
B-119R	14	73.0-78.0	391.9	CORE																								
B-119R		-					BORING TERMINATED AT 78.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: Cc_c	Consolidation: Cr_c	Consolidation: σ'$_p$ (psf)	Permeability (cm/sec)
B-120R	1	0.0-1.5	465.4	SS	5		Firm, brown and yellowish brown, lean CLAY with sand (CL), slightly moist																					
B-120R	2	1.5-4.0	464.9	SH		10.5		25	16	9	-0.61																	
B-120R		-					hard at 2.0'																					
B-120R	3	4.0-5.5	462.4	SS	6		Firm, brown, sandy lean CLAY (CL), slightly moist																					
B-120R	4	5.5-8.0	460.9	SH		15.3	very stiff at 5.5'	44	15	29	0.01						111.2	128.2										
B-120R	5	8.0-9.5	458.4	SH		17.2	mottled yellowish brown, reddish brown, and brown at 8.0'	40	16	24	0.05													ILC	0.07	0.009	3000	
B-120R	6	15.0-16.5	451.4	SS	8	25.8	firm to stiff at 15.0'						0.2	47.4		52.4												
B-120R	7	20.0-21.5	446.4	SS	Refusal																							
B-120R		-					Hard, gray, fat CLAY (CH), shaly, moist																					
B-120R	8	25.0-26.5	441.4	SS	Refusal	17.3	Very dense, light brown, fine, poorly-graded SAND (SP), moist																					
B-120R	9	30.0-31.5	436.4	SS	Refusal		Weak, gray, weathered, sandy SHALE																					
B-120R	10	31.5-38.0	434.9	CORE																								
B-120R	11	38.0-45.0	428.4	CORE		5.1	Medium strong, brown, SILTSTONE										144.5	151.9	129.3									
B-120R	12	45.0-55.0	421.4	CORE			occasional sand seams at 45.0'																					
B-120R		-					gray at 46.0'																					
B-120R		-					Medium strong, gray, sandy SHALE, unweathered, occasional seams of sandstone																					
B-120R	13	55.0-60.0	411.4	CORE		12.9											127.0	143.4	26.4									
B-120R	14	60.0-69.0	406.4	CORE			with limestone seams between 60.0' and 79.0'																					
B-120R	15	69.0-79.0	397.4	CORE																								
B-120R		-					BORING TERMINATED AT 79.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	PL	PI	LI	USCS	Particle Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - q_u (ksf)	UU - q_u (psf)	CU: c' (psf)	CU: ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	$Cc_ε$	$Cr_ε$	σ'_p (psf)	Permeability (cm/sec)
B-121R	1	0.0-1.5	464.4	SS	8		Firm to stiff, brown, lean CLAY with sand (CL), moist																					
B-121R	2	2.0-3.5	462.4	SS	10	17.5		44	15	29	0.09																	
B-121R	3	4.0-6.0	460.4	SH		15.5	very stiff at 4.0'										113.7	131.3										
B-121R	4	6.0-8.0	458.4	SH																								7.2E-09 (h)
B-121R	5	8.0-9.5	456.4	SS	8	18.0	Firm to stiff, brown, sandy lean CLAY, moist										115.5	136.3		2942			965					
B-121R	6	13.5-15.0	450.9	SS	11	16.2	Compact, coarse to fine, poorly-graded SAND with clay (SP-SC), wet						9.3	85.6		5.1												
B-121R		-					Hard, gray, fat CLAY (CH), shaley, moist																					
B-121R	7	15.5-20.0	444.9	SS	Refusal																							
B-121R	8	23.5-25.0	440.9	SS	Refusal	22.3	Very dense, gray, fine, poorly-graded SAND (SP), moist																					
B-121R	9	28.5-30.0	435.9	SS	Refusal	18.0	Hard, dark gray, sandy fat CLAY (CH), shaley																					
B-121R	10	33.5-35.0	430.9	SS	Refusal																							
B-121R	11	38.5-40.0	425.9	SS	Refusal	10.2																						
B-121R	12	43.5-45.0	420.9	SS	Refusal																							
B-121R	13	45.0-50.0	419.4	CORE			Dark gray, medium strong, unweathered, SHALE																					
B-121R	14	50.0-55.0	414.4	CORE																								
B-121R	15	55.0-60.0	409.4	CORE																								
B-121R		56.4-57.1				14.5									-		119.3	136.6	25									
B-121R		-					limestone seams between 57.5' and 59.3'																					
B-121R	16	60.0-65.0	404.4	CORE																								
B-121R	17	65.0-70.0	399.4	CORE																								
B-121R	18	70.0-75.0	394.4	CORE																								
B-121R	19	75.0-77.0	389.4	CORE																								
B-121R		-					BORING TERMINATED AT 77.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	Atterberg Limits: USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - q_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	UCS / UU / CU Triaxial: CU c' (psf)	UCS / UU / CU Triaxial: CU φ' (deg)	UCS / UU / CU Triaxial: Confining Pressure (psf)	Consolidation: Type	Consolidation: Cc_ϵ	Consolidation: Cr_ϵ	Consolidation: σ'_p (psf)	Permeability (cm/sec)
B-122	1	0.0-1.5	451.9	SS	5		Firm to very stiff, brown, sandy lean CLAY (CL), moist																					
B-122	2	2.0-4.0	459.9	SH		19.1																						
B-122	3	4.0-6.0	457.9	SH			Stiff to very stiff, brown, lean CLAY with sand (CL)										107.5	128.0										6.8E-09 (h)
B-122	4	6.0-7.5	455.9	SS	10	20.9	Stiff, brown, sandy lean clay (CL), moist																					
B-122	5	8.0-9.5	453.9	SS	32	10.2	Dense, brown, coarse to fine, well-graded SAND with clay and gravel (SW-SC)						15.7	74.1		10.2												
B-122	6	13.5-15.0	448.4	SS	27	10.1	compact at 13.5'																					
B-122	7	18.5-20.0	443.4	SS	52	21.1	Hard, dark gray, sandy fat CLAY (CH), shaley																					
B-122	8	23.5-25.0	438.4	SS	Refusal	26.0	Very dense, gray, poorly-graded SAND (SP), with seams of sandstone																					
B-122	9	28.5-30.0	433.4	SS	Refusal																							
B-122	10	33.5-35.0	428.4	SS	Refusal		Hard, gray, sandy fat CLAY (CH), shaley																					
B-122	11	39.5-41.0	422.4	SS	Refusal		Strong, gray, unweathered, clayey SILTSTONE																					
B-122	12	42.0-45.0	419.9	CORE																								
B-122	13	45.0-50.0	416.9	CORE			Strong, dark gray, unweathered, SHALE																					
B-122		-					with shells between 45.0' and 50.0'																					
B-122	14	50.0-55.0	411.9	CORE																								
B-122	15	55.0-60.0	406.9	CORE			Interbedded with limestone seams between 55.0' and 60.0'																					
B-122	16	60.0-65.0	401.9	CORE																								
B-122	17	65.0-70.0	396.9	CORE																								
B-122	18	70.0-75.0	391.9	CORE																								
B-122		-					BORING TERMINATED AT 75.0'																					
B-122		-					Boring B-122 was converted into piezometer PZ-122.																					

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Project: CITY OF ARLINGTON LANDFILL

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	φ' (deg)	Confining Pressure (psf)	Type	C_c	C_r	σ'$_p$ (psf)	Permeability (cm/sec)
B-123R	1	0.0-1.5	472.7	SS	12	14.7	Stiff, dark brown, fat CLAY with sand (CH), moist																					
B-123R	2	2.0-3.5	470.7	SS	10	13.7	Stiff, brown, fat CLAY (CH), moist																					
B-123R	3	4.0-5.5	468.7	SS	10	22.7	Stiff, brown, sandy fat CLAY (CH), moist																					
B-123R	4	6.0-7.5	466.7	SS	11																							
B-123R	5	8.0-9.5	464.7	SS	8	23.5		64	20	44	0.08	CH	1.5	32.6		65.5												
B-123R		-					with layers of trash between 13.0' and 15.0'																					
B-123R	6	13.5-15.0	459.2	SS	17	65.7	very stiff at 13.5'																					
B-123R	7	18.5-20.0	454.2	SS	5		firm at 18.5'																					
B-123R	8	23.5-25.0	449.2	SS	17		Compact, brown, coarse to fine, well-graded SAND with gravel (SW)																					
B-123R	9	28.5-30.0	444.2	SS	Refusal	14.5	Hard, gray, fat CLAY (CH), shaley, moist																					
B-123R	10	33.5-35.0	439.2	SS	Refusal		Very dense, gray, fine, poorly-graded SAND (SP)																					
B-123R	11	38.5-40.0	434.2	SS	Refusal		Weak, gray, weathered, SHALE, with siltstone and sand laminations																					
B-123R	12	40.0-45.0	432.7	CORE																								
B-123R	13	45.0-50.0	427.7	CORE																								
B-123R	14	50.0-55.0	422.7	CORE			Weak, gray, weathered, SILTSTONE																					
B-123R	15	55.0-60.0	417.7	CORE			Medium strong to strong, gray, unweathered, SHALE																					
B-123R	16	60.0-65.0	412.7	CORE																								
B-123R	17	65.0-70.0	407.7	CORE			limestone seam at 65.0'																					
B-123R	18	70.0-75.0	402.7	CORE																								
B-123R	19	75.0-80.0	397.7	CORE																								
B-123R	20	80.0-84.0	392.7	CORE																								
B-123R		82.5-83.3				4.6											149.1	156.0	254.4									
B-123R		-					limestone seam between 83.0' and 84.0'																					
B-123R	21	84.0-85.0	388.7	CORE																								
B-123R		-					BORING TERMINATED AT 85.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - q_u (ksf)	UU - c_u (psf)	c' (psf)	ϕ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	
B-124	1	0.0-1.5	462.5	SS	11	9.0	Stiff, brown, sandy lean CLAY (CL), dry																					
B-124	2	2.0-3.5	460.5	SS	9		TRASH																					
B-124	3	4.0-5.5	458.5	SS	6		with sandy clay at 4.0'																					
B-124	4	6.0-7.5	456.5	SS	5																							
B-124	5	8.0-9.5	454.5	SS	6	10.9	Firm, light and dark brown, lean CLAY with sand (CL), moist	31	17	14	-0.44																	
B-124		-					Compact, brown, fine grained, poorly-graded GRAVEL (GP)																					
B-124	6	15.0-16.5	447.5	SS	16	24.8							4.1	22.4		73.4												
B-124		-					Very stiff, brown, lean CLAY with sand (CL), moist																					
B-124		-					Hard, gray to dark gray, fat CLAY (CH), shaly, moist																					
B-124	7	20.0-21.5	442.5	SS	Refusal	19.9							0.0	10.3		89.7												
B-124	8	25.0-26.5	437.5	SS	Refusal	16.2	light brown, fine grained sand partings at 25.0'																					
B-124	9	30.0-31.5	432.5	SS	Refusal																							
B-124	10	35.0-36.5	427.5	SS	Refusal		Medium strong, brown, SILTSTONE, weathered, with occasional shale seams																					
B-124	11	36.5-40.0	426.0	CORE																								
B-124	12	40.0-45.0	422.5	CORE			Medium strong, brown, SILTSTONE and SHALE, interbedded, weathered																					
B-124		41.6-				10.1											117.4	129.3										5.1E-09 (h)
B-124	13	45.0-50.0	417.5	CORE																								
B-124	14	50.0-55.0	412.5	CORE			Medium strong, gray, SHALE, unweathered																					
B-124		-					high angle fracture at 52.0'																					
B-124		-					high angle fracture at 54.0'																					
B-124		-					high angle fracture at 54.75'																					
B-124	15	55.0-60.0	407.5	CORE																								
B-124		57.3-				11.5											122.3	136.7										1.5E-08 (v)
B-124	16	60.0-65.0	402.5	CORE																								
B-124		-					limestone seam at 62.5'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	PL	PI	LI	USCS	Particle Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UU - c_u (psf)	CU: c' (psf)	CU: φ' (deg)	Confining Pressure (psf)	Consolidation: Type	Cc_c	Cr_r	σ'$_p$ (psf)	Permeability (cm/sec)
B-124	17	65.0-70.0	397.5	CORE			limestone seam at 65.0'																					
B-124	18	70.0-75.0	392.5	CORE																								
B-124	19	75.0-80.0	387.5	CORE																								
B-124		-					shells at 79.75'																					
B-124		-					BORING TERMINATED AT 80.0'																					
B-124		-					Boring B-124 was converted into piezometer PZ-124.																					

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Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - q_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_e	Cr_e	σ'_p (psf)	
B-125	1	0.0-1.5	464.9	SS	20	7.2	Very stiff, brown, lean CLAY with sand (CL), moist																					
B-125	2	2.0-3.5	462.9	SS	4		TRASH, with layers of brown sandy lean clay																					
B-125	3	4.0-5.5	460.9	SS	5																							
B-125	4	6.0-7.5	458.9	SS	6																							
B-125	5	8.0-9.5	456.9	SS	6	20.0		55	18	37	0.05																	
B-125		-					Firm, brown, fat CLAY (CH), trace sand, moist																					
B-125	6	13.0-15.0	451.9	SH		25.5	Firm to stiff, brown, lean CLAY (CL), trace sand, moist	37	15	22	0.50						99.6	125.4		785			1696	ILC	0.1	0.01	2000	
B-125		-					fine gravel at 14.5'																					
B-125		-					Hard, gray, fat CLAY (CH), shaley, moist																					
B-125	7	18.5-20.0	446.4	SS	Refusal																							
B-125	8	23.5-25.0	441.4	SS	Refusal																							
B-125	9	25.0-30.0	439.9	CORE			Weathered, gray, SANDSTONE and SHALE, interbedded																					
B-125		25.5-				13.5											120.1	136.3										4.1E-08 (v)
B-125		26.0-				12.8											123.0	138.7										8.5E-08 (v)
B-125	10	30.0-35.0	434.9	CORE																								
B-125	11	35.0-40.0	429.9	CORE		12.0							4.5	57.1		38.4												
B-125	12	40.0-45.0	424.9	CORE																								
B-125	13	45.0-50.0	419.9	CORE			Weathered, gray, SILTSTONE																					
B-125	14	50.0-55.0	414.9	CORE																								
B-125		-					Medium strong, bluish gray, SHALE, unweathered																					
B-125	15	55.0-60.0	409.9	CORE			limestone seam at 55.0'																					
B-125	16	60.0-65.0	404.9	CORE			strong at 60.0'																					
B-125	17	65.0-70.0	399.9	CORE																								
B-125	18	70.0-75.0	394.9	CORE																								
B-125	19	75.0-80.0	389.9	CORE			very strong at 75.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - q_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_c	σ'_p (psf)	
B-125	20	80.0-81.0	384.9	CORE																								
B-125		-					BORING TERMINATED AT 81.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: φ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: C_c	Consolidation: C_r	Consolidation: σ'_p (psf)	Permeability (cm/sec)
B-126	1	0.0-1.5	465.3	SS	14	6.5	Compact, dark and reddish brown, clayey SAND (SC), slightly moist																					
B-126	2	2.0-3.5	463.3	SS	13																							
B-126		-					broken glass at 3.0'																					
B-126	3	4.0-5.5	461.3	SS	8		Degraded TRASH with occasional layers of clay																					
B-126	4	6.0-7.5	459.3	SS	2																							
B-126		8.0-9.5	457.3	SS	2																							
B-126	5	14.0-15.5	451.3	SS	2		with clayey sand at 14.0'																					
B-126	6	19.0-20.5	445.3	SS	50	19.3	Hard, dark gray, elastic SILT (MH), shaly, moist	57	34	23	-0.64																	
B-126	7	24.0-25.5	441.3	SS	Refusal	25.1																						
B-126	8	29.0-30.5	436.3	SS	Refusal	13.7																						
B-126	9	33.0-34.5	432.3	SS	Refusal	12.7	Hard, dark gray, lean CLAY (CL), with sand partings	36	20	16	-0.46																	
B-126	10	39.0-40.5	426.3	SS	Refusal		Medium strong to strong, light brown, SILTSTONE, slightly weathered, laminated with shale																					
B-126	11	40.5-45.0	424.8	CORE																								
B-126	12	45.0-50.0	420.3	CORE			Strong, dark brown, SHALE, slightly weathered																					
B-126	13	50.0-55.0	415.3	CORE																								
B-126	14	55.0-60.0	410.3	CORE			Medium strong, gray, SHALE, unweathered																					
B-126	15	60.0-65.0	405.3	CORE			occasional sandstone seams at 60.0'																					
B-126	16	65.0-70.0	400.3	CORE																								
B-126	17	70.0-75.0	395.3	CORE																								
B-126	18	75.0-80.0	390.3	CORE			seams of limestone between 75.0' and 80.0'																					
B-126		-					BORING TERMINATED AT 80.0'																					
B-126		-					Boring B-126 was converted into piezometer PZ-126.																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: Cc_t	Consolidation: Cr_t	Consolidation: σ'ₚ (psf)	Permeability (cm/sec)
B-127	1	0.0-1.5	468.2	SS	11		Stiff to very stiff, brown, lean CLAY with sand (CL), slightly moist																					
B-127	2	2.0-3.5	464.2	SS	27	18.4																						
B-127	3	4.0-5.5	462.2	SS	14																							
B-127	4	6.0-7.5	460.2	SS	32		hard at 6.0'																					
B-127	4	8.0-10.0	458.2	SH																								
B-127		-					Soft to firm, reddish brown, sandy lean CLAY (CL), moist																					
B-127	5	13.5-15.0	452.7	SS	4	16.5																						
B-127		-					Hard, dark brown, fat CLAY (CH), shaley, moist																					
B-127	6	19.5-21.0	446.7	SS	37	17.6		63	21	42	-0.05																	
B-127	7	23.5-25.0	442.7	SS	Refusal																							
B-127	8	28.5-30.0	437.7	SS	Refusal																							
B-127	9	30.0-35.0	436.2	CORE			Medium strong, dark gray, SILTSTONE, with seams of shale																					
B-127	10	35.0-40.0	431.2	CORE																								
B-127	11	40.0-45.0	426.2	CORE			Weak, gray, SHALE, sandy, slightly weathered																					
B-127	12	45.0-50.0	421.2	CORE			sandstone seam at 45.0'																					
B-127	13	50.0-55.0	416.2	CORE																								
B-127		-					medium strong at 55.0'																					
B-127	14	55.0-60.0	411.2	CORE			weathered sandstone layers from 56.0' to 57.0'																					
B-127	15	60.0-65.0	406.2	CORE																								
B-127		-					limestone seam at 61.0'																					
B-127	16	65.0-70.0	401.2	CORE																								
B-127	17	70.0-75.0	396.2	CORE																								
B-127	18	75.0-80.0	391.2	CORE																								
B-127		-					BORING TERMINATED AT 80.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	
B-128	1	0.0-1.5	463.2	SS	24		Very stiff to firm, reddish and light brown, lean sandy CLAY (CL), slightly moist																					
B-128	2	2.0-3.5	461.3	SS	7	9.0																						
B-128		-					trash at 3.0'																					
B-128	3	4.0-5.5	459.8	SS	10																							
B-128	4	6.0-7.5	457.3	SS	6	20.1	Very loose to loose, reddish brown, clayey SAND (SC), wet																					
B-128	5	8.0-9.5	455.8	SS	2	19.3	Soft, brown, sandy lean CLAY (CL), moist	33	20	13	-0.05	CL	4.1	35.7		60.2												
B-128		-					dark brown at 9.0'																					
B-128	6	14.0-15.5	449.8	SS	2	23.3																						
B-128	7	19.0-20.5	444.8	SS	62		hard at 19.0'																					
B-128		-					limestone fragments at 20.0'																					
B-128	8	24.0-25.5	439.8	SS	Refusal	15.8	Hard, dark brown, fat CLAY (CH), shaly, moist	50	28	22	-0.65																	
B-128	9	29.0-30.5	434.8	SS	Refusal																							
B-128	10	30.5-35.0	433.3	CORE																								
B-128		-					Medium strong, dark gray, SILTSTONE																					
B-128	11	35.0-40.0	428.3	CORE		13.1	Medium strong, light brown, fine grained, SANDSTONE, highly weathered										107.7	121.8										4.1E-04 (h)
B-128		-					Hard, dark gray, fat CLAY (CH), shaly																					
B-128	12	40.0-45.0	423.8	CORE																								
B-128		-					Weak, gray, SHALE, slightly weathered																					
B-128	13	45.0-50.0	418.8	CORE			sandstone seam at 45.0'																					
B-128	14	50.0-55.0	413.8	CORE																								
B-128		-					Strong, light gray, LIMESTONE, unweathered																					
B-128		-					BORING TERMINATED AT 55.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N' Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU φ' (deg)	Confining Pressure (psf)	Type	$Cc_ε$	$Cr_ε$	σ'$_p$ (psf)	
B-129	1	0.0-1.5	464.2	SS	Refusal		Hard, light brown, lean sandy CLAY (CL)																					
B-129		-					CONCRETE																					
B-129	2	2.0-3.5	462.2	SS	19	2.1	Very stiff, reddish and yellowish brown, sandy lean CLAY (CL), with trash, slightly moist	45	14	31	-0.19																	
B-129	3	4.0-5.5	460.2	SS	32		TRASH																					
B-129	4	6.0-7.5	458.2	SS	6																							
B-129	5	8.0-9.5	456.2	SS	5																							
B-129	6	13.0-15.0	451.2	SH		25.0	Soft to firm, dark brown, lean CLAY with sand (CL), moist	42	16	26	0.35						100.7	125.8		893			1701					
B-129	7	18.5-20.0	445.7	SS	18																							
B-129		-					Compact, clayey SAND with gravel (SC)																					
B-129		-					Hard, dark gray, fat CLAY (CH), shaley																					
B-129	8	23.5-25.0	440.7	SS	62	22.5		60	26	34	-0.10	CH	0.0	7.1		92.9												
B-129	9	28.5-30.0	435.7	SS	Refusal																							
B-129	10	30.0-35.0	434.2	CORE			Medium strong, gray, SILTSTONE, with seams of sandy shale																					
B-129	11	35.0-40.0	429.2	CORE																								
B-129	12	40.0-45.0	424.2	CORE																								
B-129		40.7-41.1				5.0											136.5	148.9	7.3									
B-129	13	45.0-50.0	419.2	CORE			Medium strong, gray, SANDSTONE, highly weathered, laminated																					
B-129	14	50.0-55.0	414.2	CORE			Weak, gray, SHALE and SANDSTONE, interbedded, weathered																					
B-129	15	55.0-60.0	409.2	CORE																								
B-129	16	60.0-65.0	404.2	CORE																								
B-129		-					Weak to moderate strong, dark gray, SHALE, slightly weathered																					
B-129	17	65.0-70.0	399.2	CORE																								
B-129		65.7-				12.5											116.9	132.0										2.2E-08 (v)
B-129	18	70.0-75.0	394.2	CORE			strong at 70.0'																					
B-129	19	75.0-80.0	389.2	CORE																								

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample				Sample Type	SPT N Value (blows/ 1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)					LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - q_u (ksf)	UU - c_u (psf)	CU c' (psf)	CU ϕ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_c	σ'_p (psf)	
B-126		78.4-				15.2											115.1	132.5										1.7E-09 (h)
B-126		-					BORING TERMINATED AT 80.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

Permit Issued: February 12, 2014

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits LL	PL	PI	LI	USCS	Particle Size Analysis Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial UCS - c_u (ksf)	UU - c_u (psf)	CU c' (psf)	φ' (deg)	Confining Pressure (psf)	Consolidation Type	Cc_ε	Cr_ε	σ'p (psf)	Permeability (cm/sec)
B-130	1	0.0-1.5	464.6	SS	13	11.5	Stiff, brown, lean CLAY with sand (CL)																					
B-130	2	2.0-3.5	462.6	SS	13	8.3		38	19	19	-0.56																	
B-130	3	4.0-5.5	460.6	SS	5		TRASH, with occasional layers of sandy clay, degraded																					
B-130	4	6.0-7.5	458.6	SS	5	16.9																						
B-130	5	8.0-9.5	456.6	SS	5																							
B-130	6	15.0-16.5	445.6	SS	3	24.0																						
B-130		-					Soft, brown, sandy fat CLAY (CH), moist																					
B-130	7	20.0-21.5	444.5	SS	44	12.3	Dense, brown, fine, well-graded GRAVEL (GW)	28	16	12	-0.31																	
B-130		-					Hard, light brown, lean clay with sand (CL)																					
B-130	8	21.5-25.0	443.1	CORE			Hard, dark gray, fat CLAY (CH), shaley																					
B-130	9	25.0-30.0	439.6	CORE			Weak, light brown, SANDSTONE, with clay, slightly weathered																					
B-130		-					Weak, dark gray, SHALE, slightly weathered, with occasional sandstone seams																					
B-130	10	30.0-35.0	434.6	CORE																								
B-130	11	35.0-40.0	429.6	CORE																								
B-130	12	40.0-45.0	424.6	CORE																								
B-130	13	45.0-50.0	419.6	CORE			sandstone seams between 45.0' and 50.0'																					
B-130	14	50.0-55.0	414.6	CORE			Strong, light gray, SANDSTONE																					
B-130		51.0-				0.1											100.3	100.4										6.2E-04 (h)
																												4.7E-04 (v)
B-130		-					Moderately strong, dark gray, SHALE, sandy, unweathered																					
B-130		-					lignite between 54.5' and 55.0'																					
B-130	15	55.0-60.0	409.6	CORE			blueish gray, limestone seam at 55.0'																					
B-130	16	60.0-65.0	404.6	CORE			strong, interbedded sandstone between 60.0' and 65.0'																					
B-130	17	65.0-70.0	399.6	CORE																								
B-130	18	70.0-75.0	394.6	CORE																								

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - q_u (ksf)	UU - c_u (psf)	c' (psf)	φ' (deg)	Confining Pressure (psf)	Type	C_c	C_r	σ'_p (psf)	Permeability (cm/sec)
B-130	15	75.0-80.0	385.6	CORE			dark gray at 75.0'																					
B-130		-					BORING TERMINATED AT 80.0'																					
B-130		-					Boring B-130 was converted into piezometer PZ-130.																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	Atterberg Limits: USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	UCS / UU / CU Triaxial: CU c' (psf)	UCS / UU / CU Triaxial: CU φ' (deg)	UCS / UU / CU Triaxial: Confining Pressure (psf)	Consolidation: Type	Consolidation: Cc_c	Consolidation: Cr_r	Consolidation: $σ'_p$ (psf)	Permeability (cm/sec)
B-131	1	0.0-1.5	465.4	SS	32		Hard, light brown, sandy fat CLAY (CH), slightly moist																					
B-131	2	2.0-4.0	463.4	SH			TRASH, with layers of brown sandy fat clay																					
B-131	3	4.0-5.5	461.4	SS	5																							
B-131	4	6.0-7.5	459.4	SS	5		Firm, brown, sandy lean CLAY (CL), moist																					
B-131	5	8.0-9.5	457.4	SS	5	20.4		35	13	22	0.34	CL	1.7	31.4		66.9												
B-131	6	14.0-15.5	451.4	SS	5																							
B-131	7	19.0-21.0	446.4	SH		25.3	soft at 19.0'	48	19	29	0.22																	
B-131		-					Hard, dark gray, fat CLAY (CH), shaley, moist																					
B-131	8	24.5-26.0	440.9	SS	Refusal																							
B-131	9	28.5-30.0	436.9	SS	71																							
B-131	10	33.5-35.0	431.9	SS	Refusal																							
B-131	11	38.5-40.0	426.9	SS	Refusal																							
B-131	12	40.0-45.0	425.4	CORE																								
B-131	13	45.0-50.0	420.4	CORE			Weak, gray, SILTSTONE, weathered																					
B-131	14	50.0-54.0	415.4	CORE			Weak, gray, SHALE, slightly weathered																					
B-131		-					with occasional seams of sandstone at 53.0'																					
B-131	15	54.0-59.0	411.4	CORE																								
B-131	16	59.0-60.0	405.4	CORE																								
B-131	17	60.0-65.0	406.4	CORE																								
B-131		-					BORING TERMINATED AT 65.0'																					

Golder Associates

Project: CITY OF ARLINGTON LANDFILL
Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	ϕ' (deg)	Confining Pressure (psf)	Type	Cc_i	Cr_i	c'_a (psf)	
B-11.1		-					GRAVEL/road base material																					
B-11.1		-	483.0	SS	17		Very stiff, brown, CLAY, and light brown, loose SAND																					
B-11.1		-	479.5	SS	10		gray and red, with loose to compact clayey sand at 4.0'																					
B-11.1		-	474.5	SS	37		Dense, brown and gray, silty SAND and sandy silt, with clay, dry																					
B-11.1		-					Very stiff, gray, SHALE, slightly moist																					
B-11.1		-	469.5	SS	28																							
B-11.1		-	464.5	SS	50		some gray fine sand, wet at 19.0'																					
B-11.1		-	463.5	CORE			sandy at 20.0'																					
B-11.1		-	455.5	CORE																								
B-11.1		-	453.5	CORE																								
B-11.1		-	448.5	CORE																								
B-11.1		-	443.5	CORE			dark gray at 40.0'																					
B-11.1		-	438.5	CORE			gray and dark gray, with fine sand lenses and clayey sand at 45.0'																					
B-11.1		-	433.5	CORE			unweathered, gray and dark gray at 50.0'																					
B-11.1		53.3-				10.4											129.2	142.6										2.45E-08
B-11.1		-	428.5	CORE																								
B-11.1		-					BORING TERMINATED AT 60.0'																					

Golder Associates

Project: Republic / Arlington Landfill Permit Amendment / TX

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits					Particle Size Analysis				Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial					Consolidation				Permeability (cm/sec)
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type				LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)			UCS - c_u (ksf)	UU - c_u (psf)	c' (psf)	ϕ' (deg)	Confining Pressure (psf)	Type	Cc_c	Cr_c	σ'_p (psf)	
B-11.2		-					Parking lot GRAVEL																					
B-11.2		-	491.2	SS	11		Stiff, dark gray, CLAY																					
B-11.2		-					Red and brown, sandy, silty, CLAY, moist																					
B-11.2		-					Compact, orange and brown, clayey fine SAND, with some gray mottled, dry																					
B-11.2		-	487.7	SS	23																							
B-11.2		-	482.7	SS	47																							
B-11.2		-					Very dense, orange and brown, sandy SILT, dry																					
B-11.2		-					Very hard, yellow and brown, SAND, some silt, wet																					
B-11.2		-	477.7	SS	50																							
B-11.2		-					Very stiff to hard, light gray, CLAY, moist																					
B-11.2		-	472.7	SS	50																							
B-11.2		-					Dense, gray, silty SAND, moist																					
B-11.2		-	467.7	SS	50																							
B-11.2		-	466.7	CORE																								
B-11.2		-					Hard, gray and light brown, SHALE																					
B-11.2		-					light gray at 28.5'																					
B-11.2		-	491.7	CORE																								
B-11.2		-					dark gray at 33.75'																					
B-11.2		-	456.7	CORE			light gray at 35.0'																					
B-11.2		-					slickensided at 35.0'																					
B-11.2		-					with small fine sand lense at 38.25'																					
B-11.2		-	451.7	CORE			hard, dark gray, some coarse sand at 40.0'																					
B-11.2		-	446.7	CORE			unweathered at 45.0'																					
B-11.2		45.0-				10.6											126.9	140.3										3.51E.07
B-11.2		-					BORING TERMINATED AT 50.0'																					

Golder Associates

Project: Republic / Arlington Landfill Permit Amendment / TX

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	Atterberg Limits: USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: φ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: C_c	Consolidation: C_r	Consolidation: σ'$_p$ (psf)	Permeability (cm/sec)
B-11.3		-					Brown and light brown, silty SAND, with gravel, dry																					
B-11.3		-	472.8	SS	2		Firm to stiff, brown, CLAY																					
B-11.3		-	469.3	SH			Loose, SAND, and gray clay, moist																					
B-11.3		-	464.3	SH			Stiff, brown and light brown, CLAY, trace silt, moist																					
B-11.3		-	459.3	SH			Stiff, gray and light gray, sandy CLAY, moist																					
B-11.3		-	454.3	SH			very stiff, trace fine sand and silt at 19.0'																					
B-11.3		-	449.3	SH			stiff, gray and dark gray at 24.0'																					
B-11.3		-	444.3	SH																								
B-11.3		-	439.3	SH			gray and brown at 34.0'																					
B-11.3		-					Very loose, orangish brown, SAND, wet																					
B-11.3		-	434.3	SS	3		Very loose, clayey SAND, wet																					
B-11.3		-	429.3	SS	1		Very loose, gray, clayey silty SAND, wet																					
B-11.3		-	424.3	SS	10		Stiff, gray and brown, CLAY, with sand and silt, wet																					
B-11.3		-																										
B-11.3		-	422.8	CORE			No recovery																					
B-11.3		-	418.3	CORE																								
B-11.3		-	413.3	SS	6		Very loose, brown, fine SAND, wet																					
B-11.3		-	408.3	SS	37		dense at 65.0'																					
B-11.3		-	403.3	SS	9		loose at 70.0'																					
B-11.3		-					Brown, cemented, SANDSTONE																					
B-11.3		-	398.3	CORE																								
B-11.3		-	393.3	CORE			Gray, SHALE, with small lenses of fine sand																					
B-11.3		-					trace fine sand at 82.5'																					
B-11.3		-	388.3	CORE			unweathered at 85.0'																					
B-11.3		90.0-	383.3	CORE		12.4											121.8	137.0										1.25E-07

Golder Associates

Project: Republic / Arlington Landfill Permit Amendment / TX

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample					SPT			Atterberg Limits					Particle Size Analysis						UCS / UU / CU Triaxial					Consolidation				
																					CU							
Borehole Number	Sample Number	Depth Interval (ft-bgs)	Elevation of Top (ft)	Sample Type	N Value (blows/1 ft)	Moisture Content (%)	Soil Description	LL	PL	PI	LI	USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS - q_u (ksf)	UU - c_u (psf)	c' (psf)	ϕ' (deg)	Confining Pressure (psf)	Type	Cc_ϵ	Cr_ϵ	σ'_p (psf)	Permeability (cm/sec)
B-113		-					BORING TERMINATED AT 35.0'																					

Golder Associates

Project: Republic / Arlington Landfill Permit Amendment / TX

Location: Arlington, Texas

SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

Sample: Borehole Number	Sample: Sample Number	Sample: Depth Interval (ft-bgs)	Sample: Elevation of Top (ft)	Sample Type	SPT N Value (blows/1 ft)	Moisture Content (%)	Soil Description	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Atterberg Limits: LI	USCS	Particle Size Analysis: Gravel (%)	Particle Size Analysis: Sand (%)	Particle Size Analysis: Silt (%)	Particle Size Analysis: Clay (%)	Dry Unit wt (pcf)	Moist Unit wt (pcf)	UCS / UU / CU Triaxial: UCS - c_u (ksf)	UCS / UU / CU Triaxial: UU - c_u (psf)	CU: c' (psf)	CU: ϕ' (deg)	Confining Pressure (psf)	Consolidation: Type	Consolidation: Cc_r	Consolidation: Cr_c	Consolidation: σ'_p (psf)	Permeability (cm/sec)
B-11.5		-	475.8	SS	20		Brown, SAND, with silt and gravel (roadbase)																					
B-11.5		-					Stiff, gray, CLAY																					
B-11.5		-	469.8	SH			stiff, brown and gray, moist at 4.0'																					
B-11.5		-	464.8	SH																								
B-11.5		-	459.8	SH			gray and dark gray, mottled, trace fine sand and silt at 14.0'																					
B-11.5		-	454.8	SH																								
B-11.5		-	449.8	SH																								
B-11.5		-	444.8	SH			very stiff at 29.0'																					
B-11.5		-	439.8	SH																								
B-11.5		-	434.8	SH																								
B-11.5		-	429.8	SH																								
B-11.5		-	424.8	SH			Firm, wet at 49.0'																					
B-11.5		-																										
B-11.5		-	419.8	SH			stiff, dark gray at 54.0'																					
B-11.5		-	414.8	SH																								
B-11.5		-	409.8	SS	3		Very loose, gray, sandy CLAY, to clayey sand, wet																					
B-11.5		-	404.8	SS	7		Loose, gray, silty SAND, with gravel, wet																					
B-11.5		-	399.8	SS	17		compact at 74.0'																					
B-11.5		-	394.5	SS	50		Fine, gray, SAND, wet																					
B-11.5		-	393.8	CORE			Light brown, cemented, SANDSTONE																					
B-11.5		-	388.5	CORE			Gray and dark gray, unweathered, SHALE																					
B-11.5		-	383.8	CORE																								
B-11.5		-	378.8	CORE			trace fine sand lenses at 95.0'																					
B-11.5		95.5-				24.2											94.5	117.4										9.58E-09
B-11.5		-					BORING TERMINATD AT 100.0'																					

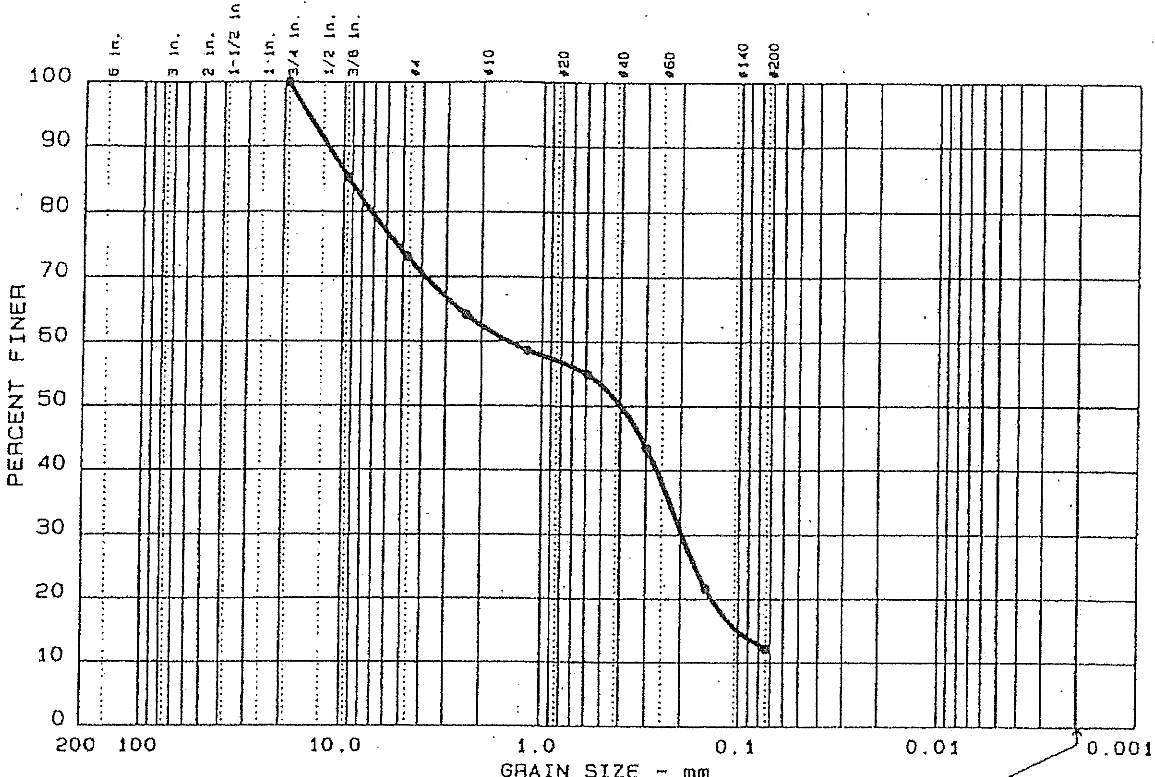
Golder Associates

Project: Republic / Arlington Landfill Permit Amendment / TX

Location: Arlington, Texas

GRADATION TEST RESULTS

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	4	0.0	26.9	61.0	12.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			9.33	1.46	0.39	0.197	0.1008			

MATERIAL DESCRIPTION	USCS	AASHTO
●		

Project No.: 1019-002-002

Project: Arlington Landfill

● Location: G-1 8.5 - 10.0'

Date: 1/18/94

GRAIN SIZE DISTRIBUTION TEST REPORT

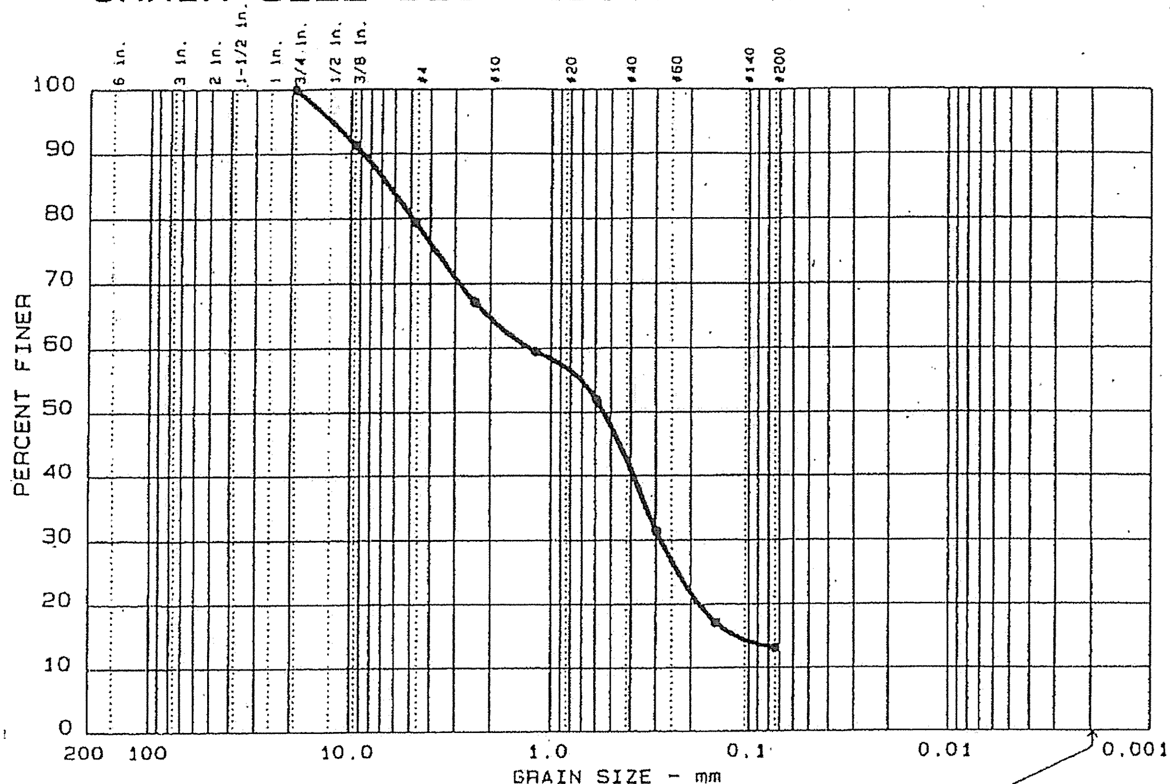
EMCON Baker-Shiflett, Inc.

Remarks:

4.E.3

Permit Issued: February 12, 2014

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	20.5	66.3	13.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			6.38	1.26	0.54	0.282	0.1174			

MATERIAL DESCRIPTION	USCS	AASHTO
●		

Project No.: 1019-002-002
Project: Arlington Landfill
● Location: G-4 25.2 - 25.8'

Date: 1/19/94

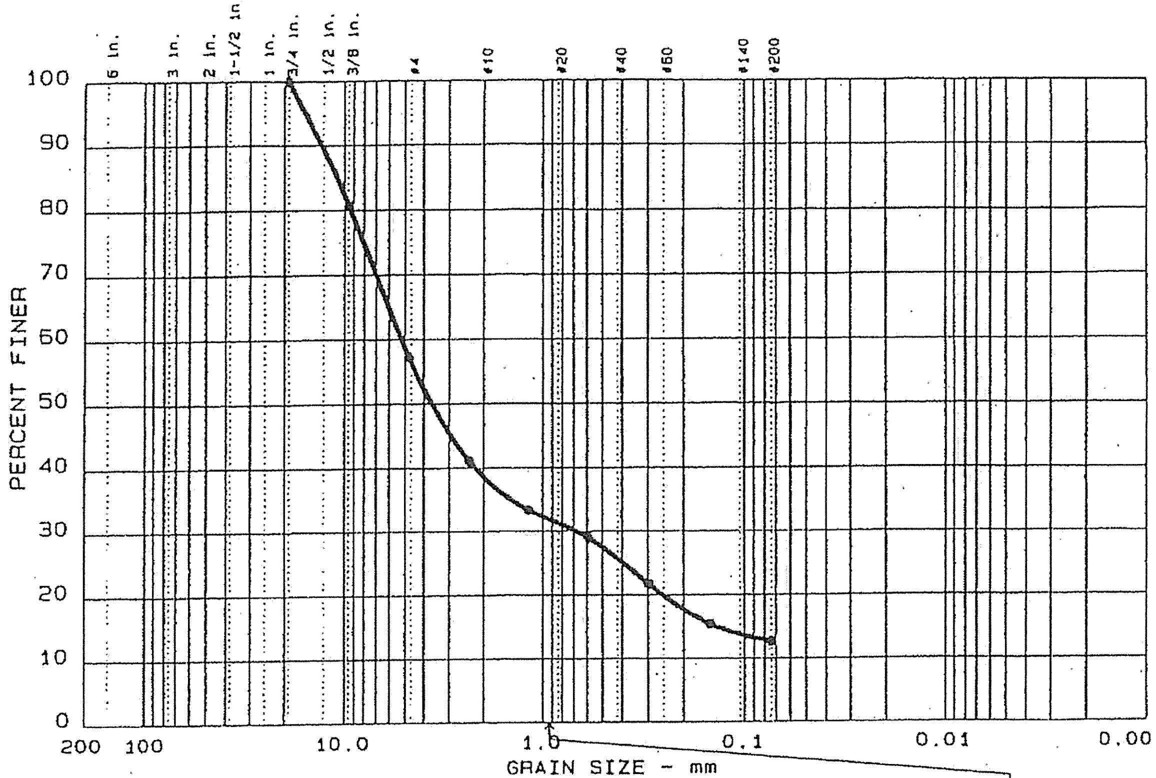
Remarks:

GRAIN SIZE DISTRIBUTION TEST REPORT
EMCON Baker-Shiflett, Inc.

4-E.4

Permit Issued: February 12, 2014

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	42.8	44.6	12.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			10.94	5.18	3.66	0.667	0.1393			

MATERIAL DESCRIPTION	USCS	AASHTO
●		

Project No.: 1019-002-002
Project: Arlington Landfill
● Location: G-8 8.5 - 10.0'

Date: 1/21/94

Remarks:

GRAIN SIZE DISTRIBUTION TEST REPORT

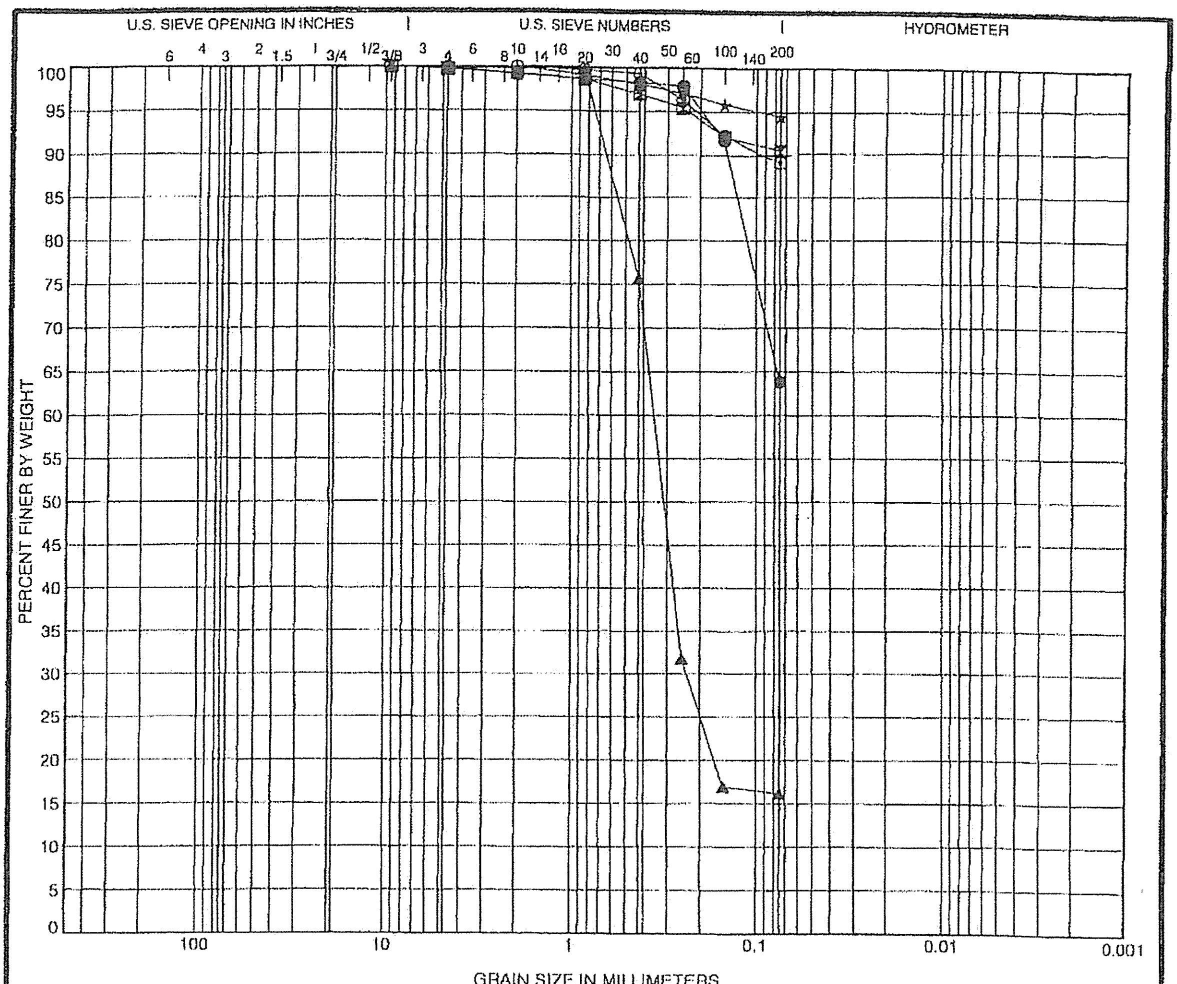
EMCON Baker-Shiflett, Inc.

4-E.5

Figure 4-E.5

Permit Issued: February 12, 2014

HYDRAULIC CONDUCTIVITY TEST RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-101	6.00ft						
⊠	B-102	6.00ft	ELASTIC SILT(MH)	61	32	29		
▲	B-102	15.00ft						
★	B-104	2.00ft	FAT CLAY(CH)	70	23	47		
⊙	B-104	8.00ft	FAT CLAY(CH)	59	19	40		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-101	6.00 ft	4.75				0.00	36.14	63.86	
⊠	B-102	6.00 ft	9.5				0.27	9.15	90.58	
▲	B-102	15.00 ft	9.5	0.352	0.235		0.15	83.68	16.16	
★	B-104	2.00 ft	4.75				0.00	5.51	94.49	
⊙	B-104	8.00 ft	2				0.00	11.03	88.97	

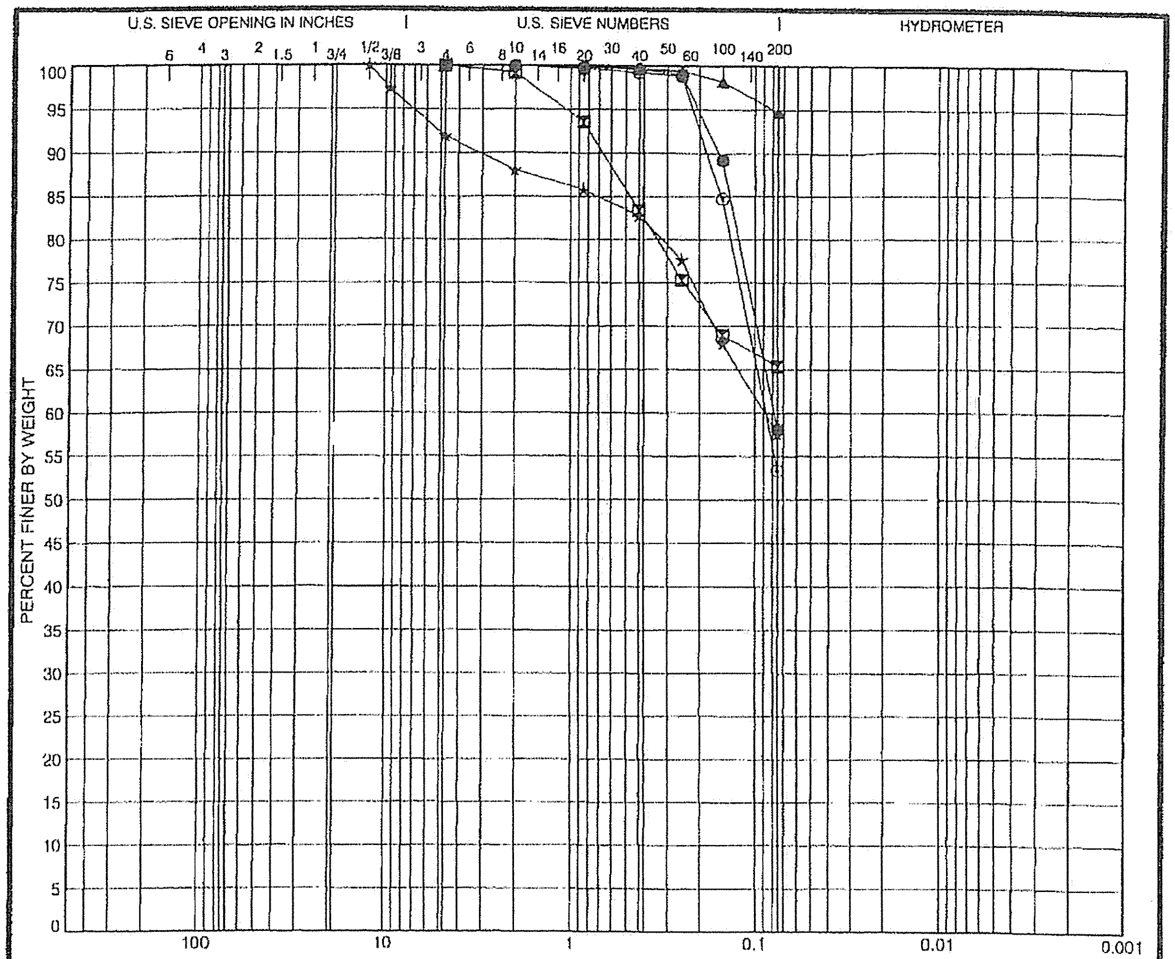
Golder Associates

GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas

CAN GRAIN SIZE 94077GINT.GPJ GLDR LDN.GDT 1/4/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-104	38.50ft						
⊠	B-106	4.00ft	SANDY ELASTIC SILT(MH)	58	34	24		
▲	B-107	6.00ft	LEAN CLAY(CL)	43	24	19		
★	B-108	15.00ft	SANDY LEAN CLAY(CL)	39	17	22		
⊙	B-109	13.50ft						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-104	38.50 ft	4.75	0.078			0.00	41.93	58.07	
⊠	B-106	4.00 ft	4.75				0.00	34.63	65.37	
▲	B-107	6.00 ft	2				0.00	5.25	94.75	
★	B-108	15.00 ft	12.5	0.088			8.02	34.41	57.57	
⊙	B-109	13.50 ft	4.75	0.087			0.00	46.63	53.37	

Golder Associates

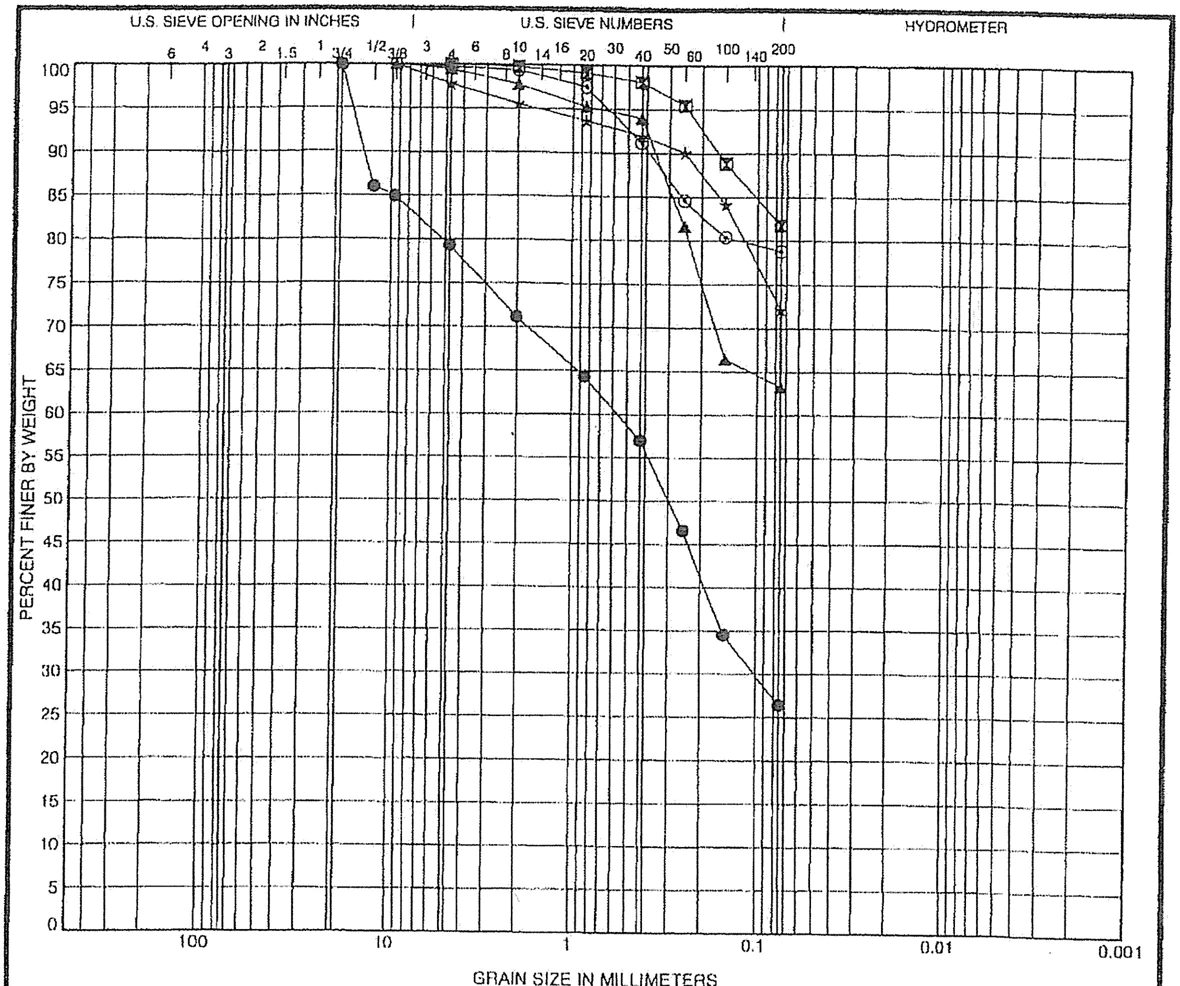
GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas

CAN GRAIN SIZE 94077GINT.GPJ GLDR LDN.GDT 1/4/11

Permit Issued: February 12, 2014



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-110	4.00ft						
⊠	B-111	2.00ft	LEAN CLAY with SAND(CL)	37	19	18		
▲	B-111	6.00ft						
★	B-112R	4.00ft	LEAN CLAY with SAND(CL)	49	21	28		
⊙	B-113R	1.50ft	ELASTIC SILT with SAND(MH)	58	31	27		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-110	4.00 ft	19	0.562	0.102		20.62	52.91	26.46	
⊠	B-111	2.00 ft	4.75				0.00	18.21	81.79	
▲	B-111	6.00 ft	9.5				0.55	36.17	63.28	
★	B-112R	4.00 ft	9.5				2.23	25.60	72.17	
⊙	B-113R	1.50 ft	9.5				0.27	20.92	78.81	

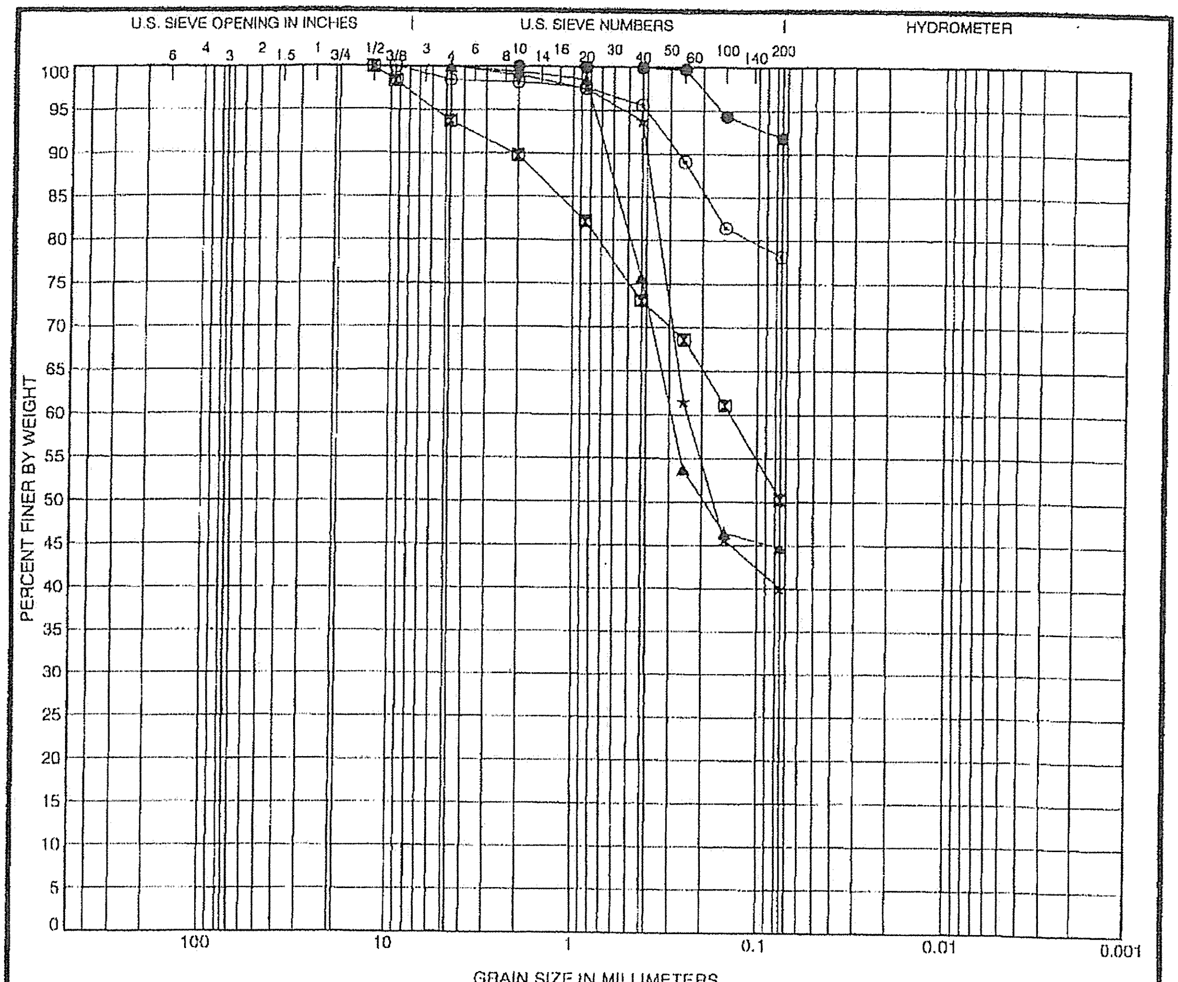
CAN_GRAIN_SIZE 9407GINT.GPJ GLDR_LDN.GDT 1/4/11

Golder Associates

GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● B-113R	15.00ft						
⊠ B-114	2.00ft						
▲ B-115	0.00ft						
★ B-115	6.00ft						
⊙ B-116	6.00ft	LEAN CLAY with SAND(CL)	39	17	22		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-113R	15.00 ft	2				0.00	8.15	91.85	
⊠ B-114	2.00 ft	12.5	0.14			6.24	43.48	50.28	
▲ B-115	0.00 ft	4.75	0.291			0.00	55.23	44.77	
★ B-115	6.00 ft	4.75	0.238			0.00	59.91	40.09	
⊙ B-116	6.00 ft	9.5				1.53	20.36	78.10	

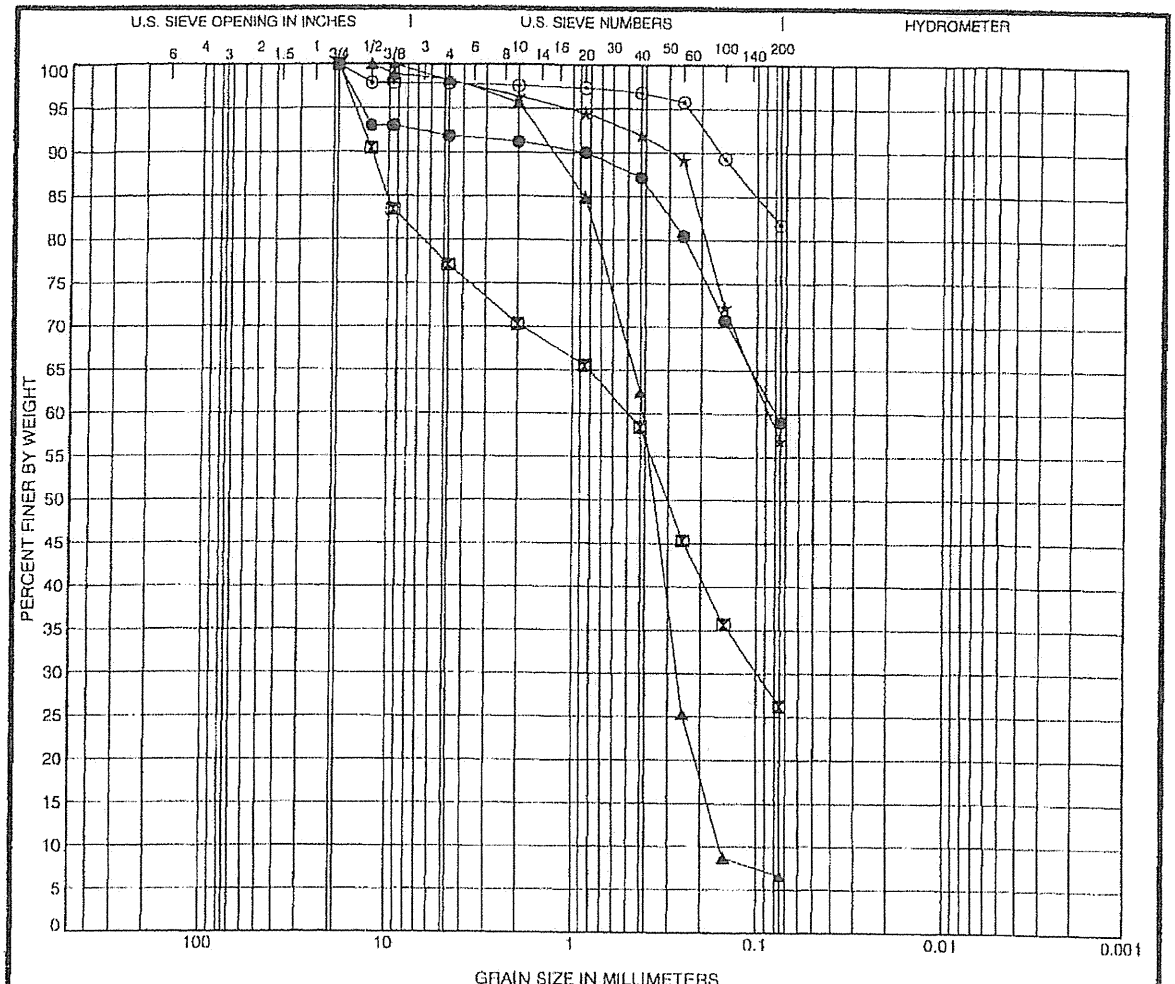
CAN GRAIN SIZE 54077GINT.GPJ GLDR LDN.GDT 1/4/11

Golder Associates

GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-116	15.00ft						
⊠	B-117R	2.00ft						
▲	B-117R	8.00ft					1.12	2.63
★	B-118R	6.00ft	SANDY LEAN CLAY(CL)	34	15	19		
⊙	B-119R	2.00ft	LEAN CLAY with SAND(CL)	41	19	22		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-116	15.00 ft	19	0.079			8.12	32.86	59.01	
⊠	B-117R	2.00 ft	19	0.495	0.099		22.84	50.89	26.27	
▲	B-117R	8.00 ft	12.5	0.41	0.267	0.156	1.68	91.70	6.62	
★	B-118R	6.00 ft	9.5	0.086			1.89	41.20	56.91	
⊙	B-119R	2.00 ft	19				2.14	16.09	81.77	

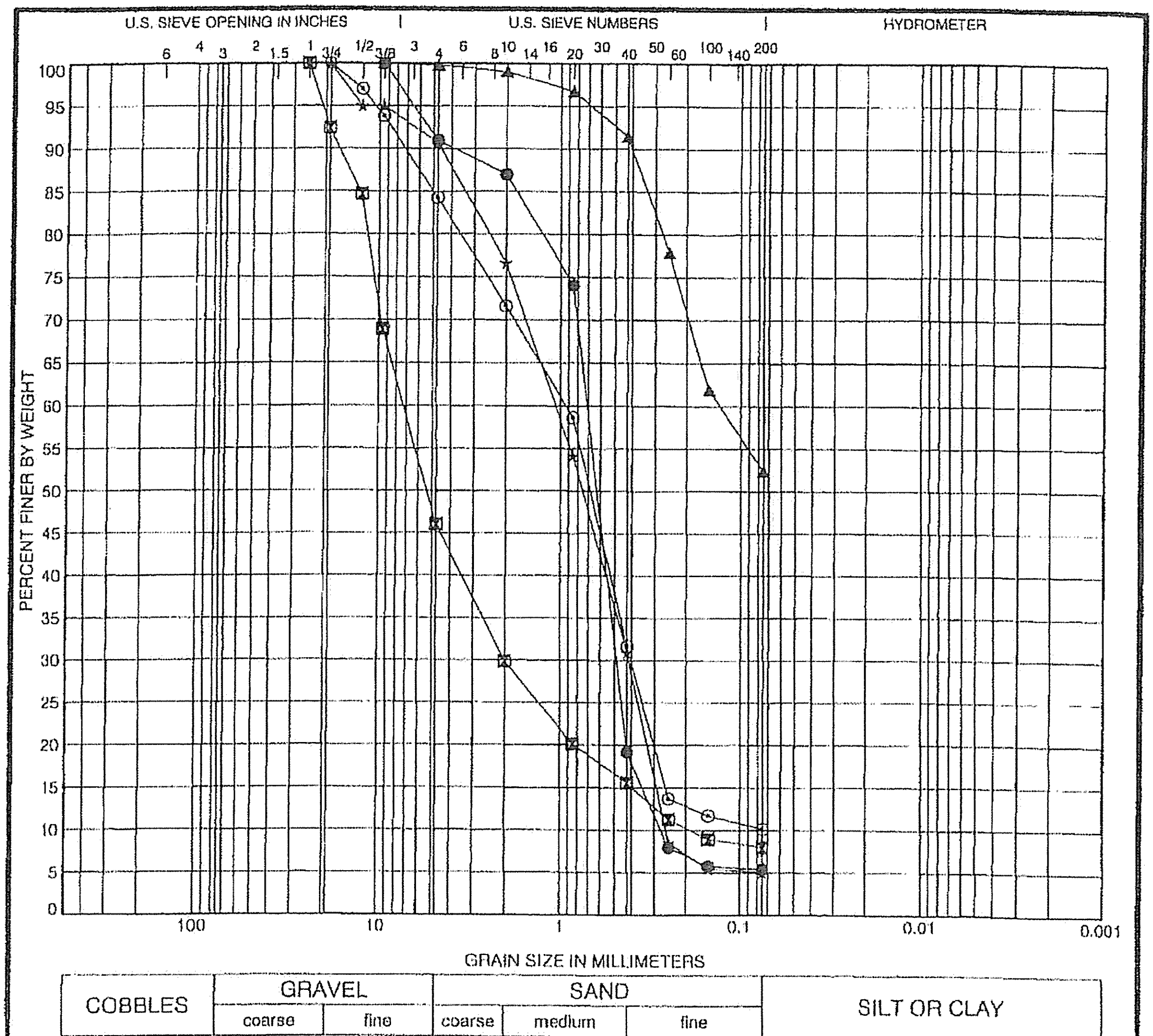
Golder Associates

GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas

CAN_GRAIN_SIZE_94077GINT.GPJ GLDR_LDN.GDT 1/4/11



Symbol	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-119R	6.00ft					1.21	2.58
⊠	B-119R	15.00ft					2.96	38.38
▲	B-120R	15.00ft						
★	B-121R	13.50ft					0.63	4.11
⊙	B-122	8.00ft					2.52	13.38

Symbol	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
●	B-119R	6.00 ft	9.5	0.711	0.487	0.275	9.04	85.54	5.42
⊠	B-119R	15.00 ft	25	7.247	2.013	0.189	53.95	38.06	7.99
▲	B-120R	15.00 ft	9.5	0.13			0.22	47.41	52.37
★	B-121R	13.50 ft	19	1.062	0.416	0.259	9.35	85.57	5.08
⊙	B-122	8.00 ft	19	0.931	0.404		15.71	74.12	10.17

Golder Associates

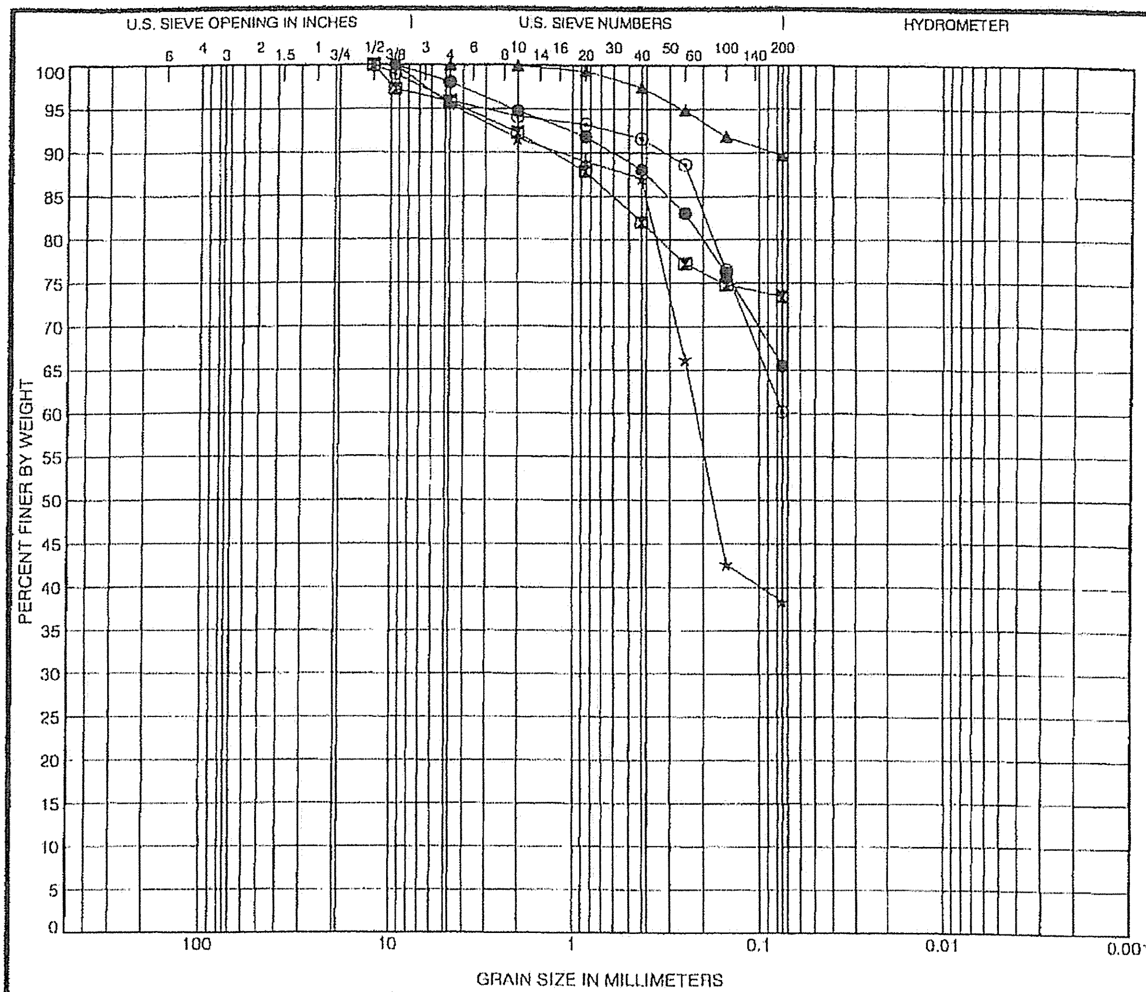
GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas

CAN GRAIN SIZE 94077GINT.GPJ GLDR LDN.GDT 1/4/11

Permit Issued: February 12, 2014



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-123R	8.00ft	SANDY FAT CLAY(CH)	64	20	44		
⊠	B-124	15.00ft						
▲	B-124	20.00ft						
★	B-125	35.00ft						
⊙	B-128	8.00ft	SANDY LEAN CLAY(CL)	33	20	13		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-123R	8.00 ft	9.5				1.92	32.59	65.49	
⊠	B-124	15.00 ft	12.5				4.14	22.43	73.43	
▲	B-124	20.00 ft	4.75				0.00	10.29	89.71	
★	B-125	35.00 ft	9.5	0.218			4.50	57.12	38.38	
⊙	B-128	8.00 ft	12.5				4.06	35.70	60.24	

Golder Associates

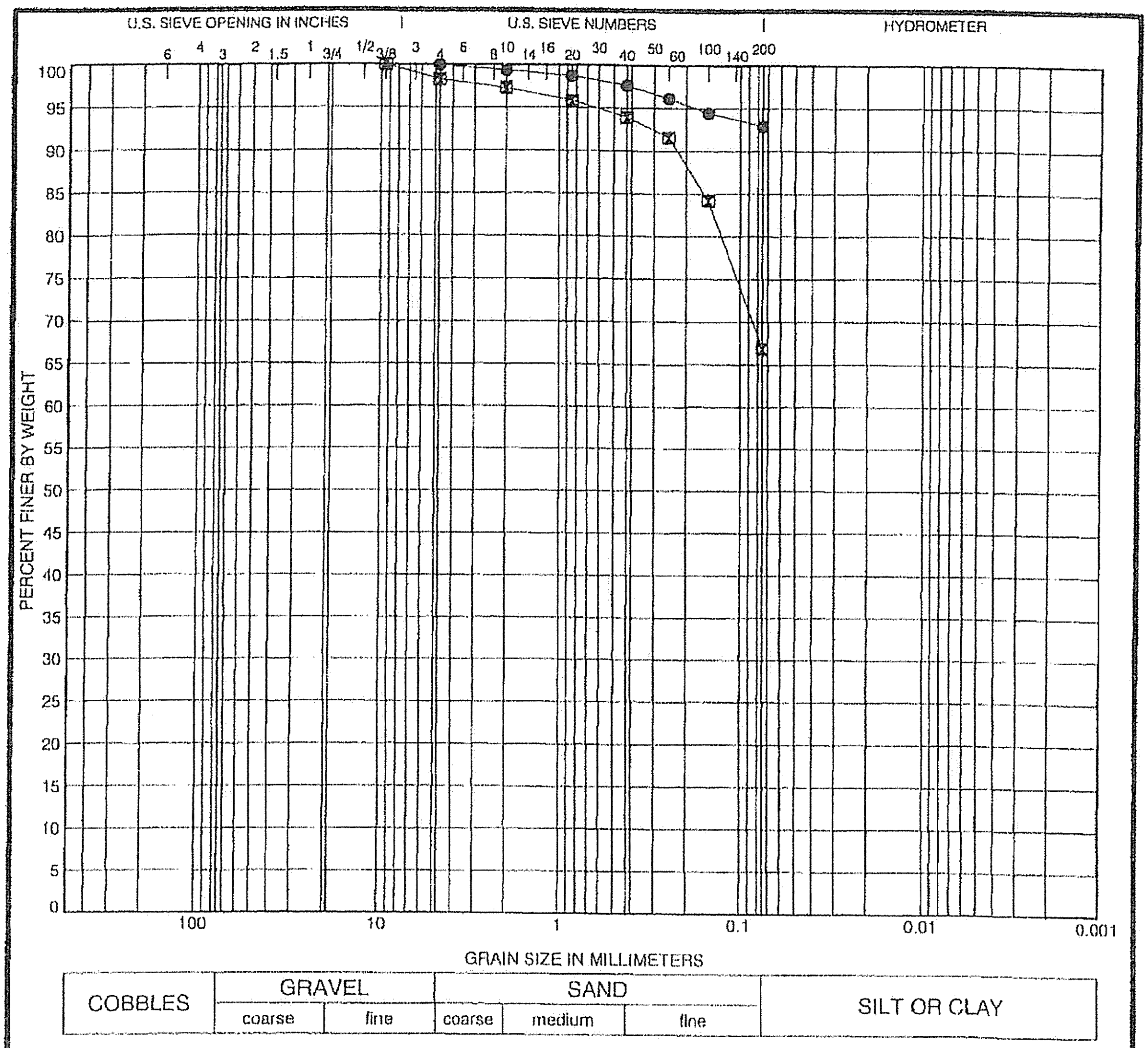
GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas

CAN_GRAIN_SIZE 94077GINT.GPJ GLDR_LDN.GDT 1/4/11

Permit Issued: February 12, 2014



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● B-129	23.50ft	FAT CLAY(CH)	60	26	34		
⊠ B-131	8.00ft	SANDY LEAN CLAY(CL)	35	13	22		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-129	23.50 ft	4.75				0.00	7.10	92.90	
⊠ B-131	8.00 ft	9.5				1.70	31.42	66.88	

CAN GRAIN SIZE 94077GINT.GPJ GLDR_LDN.GDT 1/4/11

Golder Associates

GRAIN SIZE DISTRIBUTION

PROJECT: CITY OF ARLINGTON LANDFILL

LOCATION: Arlington, Texas

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Arlington Landfill	SAMPLE ID	S-2	-
PROJECT NO.	093-94479	SAMPLE TYPE	Remold	
REMARKS		SAMPLE DEPTH	-	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	
Wt Dry Soil & Tare (gm)	(w2)	
Weight of Tare (gm)	(w3)	
Weight of Water (gm)	(w4=w1-w2)	
Weight of Dry Soil (gm)	(w5=w2-w3)	
Moisture Content (%)	(w4/w5)*100	

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	
Dry Soil & Tare (gm)	
Tare Weight (gm)	
Moisture Content (%)	

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	157.40
Tare Weight (gm)	8.41
(W6) Total Dry Weight (gm)	148.99

SIEVE ANALYSIS

Tare Weight: 8.41

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) ((wt ret/w6)*100)	% PASS (100-%ret)	SIEVE	
12.0"	8.41	0.00	0.00	100.00	12.0"	cobbles
3.0"	8.41	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	8.41	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	8.41	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	8.41	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	8.41	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	8.41	0.00	0.00	100.00	0.75"	fine gravel
0.50"	8.41	0.00	0.00	100.00	0.50"	fine gravel
0.375"	8.41	0.00	0.00	100.00	0.375"	fine gravel
#4	8.41	0.00	0.00	100.00	#4	coarse sand
#10	13.13	4.72	3.17	96.83	#10	medium sand
#20	15.65	7.24	4.86	95.14	#20	medium sand
#40	19.77	11.36	7.62	92.38	#40	fine sand
#60	26.55	18.14	12.18	87.82	#60	fine sand
#100	37.29	28.88	19.38	80.62	#100	fine sand
#200	46.26	37.85	25.40	74.60	#200	fines
PAN					PAN	

% COBBLES	0.00
% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	3.17
% M SAND	4.46
% F SAND	17.78
% FINES	74.60
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

LL	52
PL	21
PI	31
Gs	-

DESCRIPTION: Dark gray, CLAY with sand

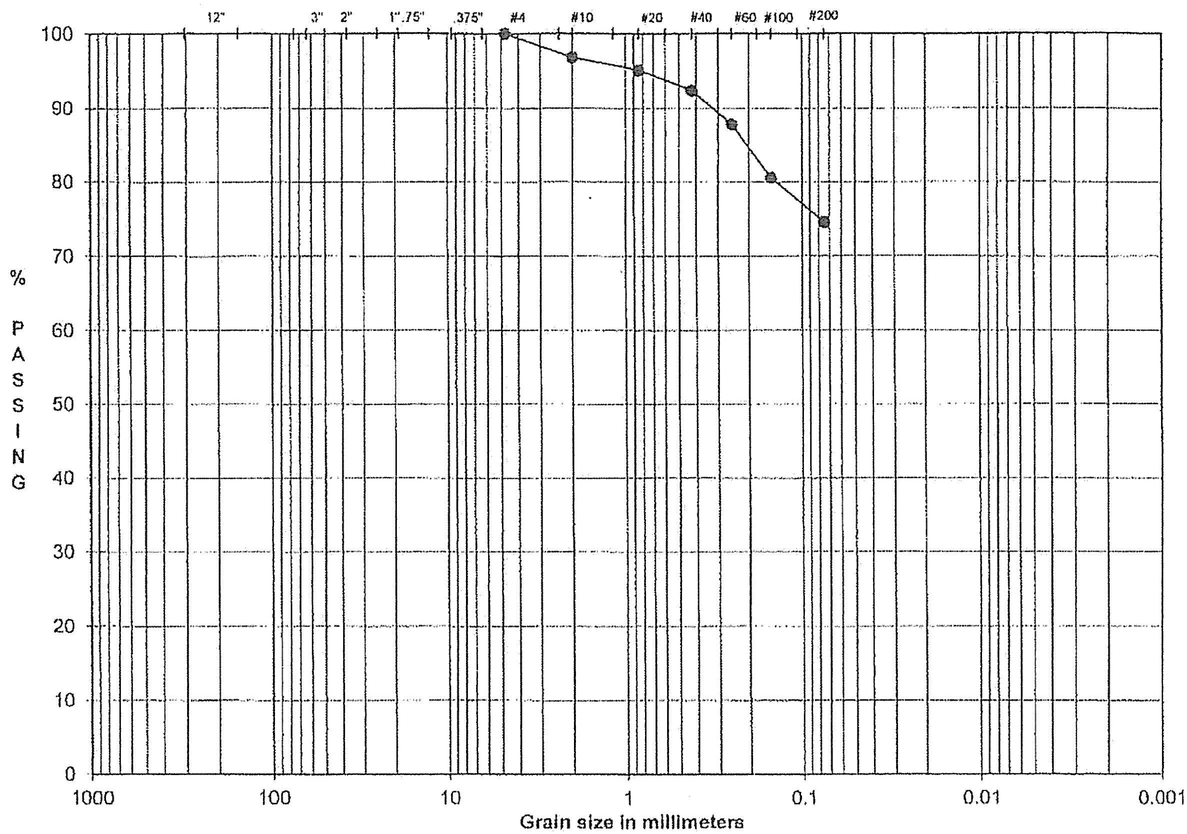
USCS: CH

TECH	MR
DATE	06/21/2010
CHECK	KR
REVIEW	SBK

Golder Associates Inc.

Permit Issued: February 12, 2014

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES

SAMPLE ID	S-2
SAMPLE TYPE	Remold
SAMPLE DEPTH	-

LL	52
PL	21
PI	31

DESCRIPTION	Dark gray, CLAY with sand
USCS	CH

Arlington Landfill
093-94479

TECH	MR
DATE	06/21/2010
CHECK	KR
REVIEW	SBK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-101, C-9
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	25.0 - 26.0'

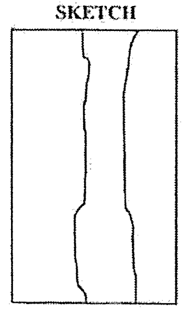
SAMPLE DATA	
Height (in)	3.280
Diameter (in)	1.877
Height/Diameter Ratio	1.75
Area (in^2)	2.77
Volume (ft^3)	0.0053
Weight (gm)	316.24
Wet Density (pcf)	132.68
Dry Density (pcf)	116.82
Machine Speed (in/min)	0.016
Strain rate (%/min)	0.49

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	316.26	323.47
Wt. Dry Soil & Tare (gm)	278.45	285.79
Wt. Tare (gm)	0.00	8.28
Wt. Moisture (gm)	37.81	37.68
Wt. Dry Soil (gm)	278.45	277.51
Moisture (%)	13.58%	13.58%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	2.77	0.0	0.0
0.1	0.002	10.5	0.06	2.77	546.1	3.8
0.2	0.004	12.1	0.12	2.77	628.9	4.4
0.4	0.006	12.9	0.18	2.77	670.1	4.7
0.5	0.009	13.7	0.27	2.77	711.0	4.9
0.6	0.010	13.7	0.30	2.78	710.8	4.9
0.8	0.013	16.1	0.40	2.78	834.5	5.8
0.9	0.015	17.7	0.46	2.78	916.9	6.4
1.1	0.017	20.9	0.52	2.78	1082.0	7.5
1.2	0.019	24.2	0.58	2.78	1252.1	8.7
1.3	0.021	27.4	0.64	2.78	1416.8	9.8
1.4	0.023	29.8	0.70	2.79	1539.9	10.7
1.6	0.025	33.0	0.76	2.79	1704.3	11.8
1.7	0.027	37.1	0.82	2.79	1914.8	13.3
2.4	0.038	45.9	1.16	2.80	2361.0	16.4
3.0	0.049	70.1	1.49	2.81	3593.6	25.0
3.7	0.059	96.7	1.80	2.82	4941.8	34.3
4.4	0.070	121.6	2.13	2.83	6193.1	43.0
5.0	0.081	142.6	2.47	2.84	7237.8	50.3
5.7	0.091	160.3	2.77	2.85	8110.7	56.3
6.6	0.106	162.7	3.23	2.86	8193.4	56.9
7.4	0.118	147.4	3.60	2.87	7394.9	51.4
7.9	0.127	111.1	3.87	2.88	5557.9	38.6
8.5	0.137	78.9	4.18	2.89	3934.5	27.3
				UNCONFINED COMPRESSIVE STRENGTH	8193.4	56.9
				SHEAR STRENGTH	4096.7	28.4

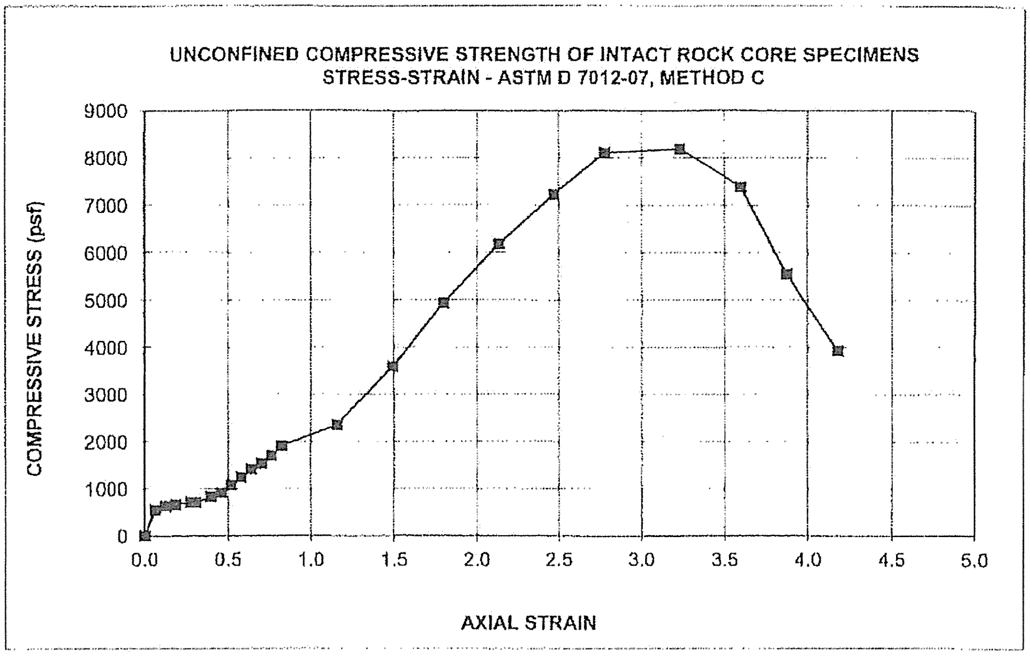
TIME TO FAILURE (min)	6.6
STRAIN @ FAILURE (%)	3.2
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH



Description	Gray SANDSTONE	LL	-	TECH	DA
		PL	-	DATE	8/5/10
		PI	-	CHECK	DA
USCS	-			REVIEW	AK

Golder Associates Inc.



DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SANDSTONE	-	-	-	B-101, C-9
	SAMPLE TYPE		Core	25.0 - 26.0'

USCS	-

Note: Non-ASTM due to the length of the sample received.
Specimen contained several horizontal fractures prior to shearing.

SAMPLE DATA

Wet Density (pcf)	132.7	TIME TO FAILURE (min)	6.6
Dry Density (pcf)	116.8	STRAIN @ FAILURE (%)	3.2
Moisture Content	13.6%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	8193.4
SHEAR STRENGTH (psf)	4096.7

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-101, C-24
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	96.5 - 97.2'

SAMPLE DATA

Height (in)	3.585
Diameter (in)	1.992
Height/Diameter Ratio	1.80
Area (in²)	3.12
Volume (ft³)	0.0065
Weight (gm)	377.42
Wet Density (pcf)	128.63
Dry Density (pcf)	107.98
Machine Speed (in/min)	0.018
Strain rate (%/min)	0.50

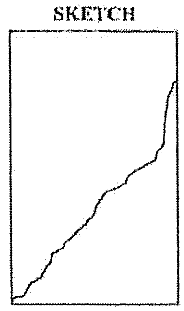
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	377.42	384.21
Wt. Dry Soil & Tare (gm)	316.84	323.88
Wt. Tare (gm)	0.00	8.33
Wt. Moisture (gm)	60.58	60.33
Wt. Dry Soil (gm)	316.84	315.55
Moisture (%)	19.12%	19.12%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in²)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	3.12	0.0	0.0
0.3	0.006	9.7	0.17	3.12	447.4	3.1
0.7	0.013	12.9	0.36	3.13	593.9	4.1
1.4	0.026	25.0	0.73	3.14	1146.8	8.0
1.8	0.033	33.8	0.92	3.15	1547.4	10.7
2.2	0.039	43.5	1.09	3.15	1988.1	13.8
2.5	0.046	53.2	1.28	3.16	2426.6	16.9
2.9	0.052	61.2	1.45	3.16	2786.8	19.4
3.3	0.059	69.3	1.65	3.17	3149.3	21.9
3.6	0.066	76.5	1.84	3.17	3469.7	24.1
4.0	0.072	82.2	2.01	3.18	3721.8	25.8
4.4	0.079	87.8	2.20	3.19	3967.5	27.6
5.5	0.099	103.1	2.76	3.21	4632.2	32.2
7.3	0.132	124.0	3.68	3.24	5518.5	38.3
9.1	0.165	140.9	4.60	3.27	6210.7	43.1
11.0	0.198	155.4	5.52	3.30	6783.8	47.1
12.8	0.231	167.5	6.44	3.33	7240.7	50.3
13.8	0.249	173.2	6.95	3.35	7447.0	51.7
15.6	0.282	181.2	7.87	3.38	7713.9	53.6
17.5	0.315	186.9	8.79	3.42	7877.0	54.7
19.6	0.353	189.3	9.85	3.46	7885.5	54.8
20.9	0.376	183.6	10.49	3.48	7593.6	52.7
22.1	0.398	159.5	11.10	3.51	6551.6	45.5
22.8	0.411	128.9	11.46	3.52	5273.1	36.6
				UNCONFINED COMPRESSIVE STRENGTH	7885.5	54.8
				SHEAR STRENGTH	3942.7	27.4

TIME TO FAILURE (min)	19.6
STRAIN @ FAILURE (%)	9.8
TYPE OF FAILURE	Shear

FAILURE SKETCH



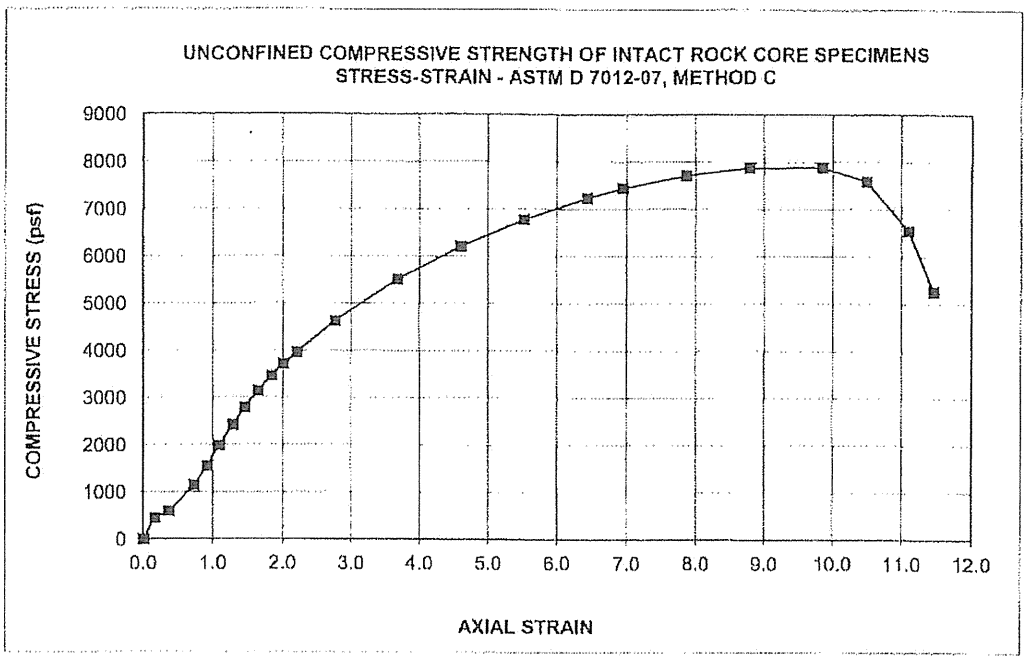
Description: Dark Gray SHALE

USCS: -

LL	-
PL	-
PI	-

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.



DESCRIPTION	LL	PL	PI	SAMPLE ID
Dark Gray SHALE	-	-	-	B-101, C-24
	SAMPLE TYPE		Core	96.5 - 97.2'

USCS	-

Note: Non-ASTM due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	128.6	TIME TO FAILURE (min)	19.6
Dry Density (pcf)	108.0	STRAIN @ FAILURE (%)	9.8
Moisture Content	19.1%	TYPE OF FAILURE	Shear

UNCONFINED COMPRESSIVE STRENGTH (psf)	7885.5
SHEAR STRENGTH (psf)	3942.7

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	**SAMPLE ID**	B-103, C-13
PROJECT NO.	093-94479	**SAMPLE TYPE**	Core
REMARKS	-	**SAMPLE DEPTH**	48.1 - 48.5'

SAMPLE DATA

Height (in)	2.441
Diameter (in)	1.944
Height/Diameter Ratio	1.26
Area (in^2)	2.97
Volume (ft^3)	0.0042
Weight (gm)	273.36
Wet Density (pcf)	143.67
Dry Density (pcf)	130.19
Machine Speed (in/min)	0.012
Strain rate (%/min)	0.49

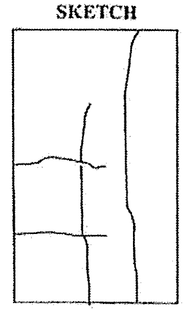
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	273.36	280.39
Wt. Dry Soil & Tare (gm)	247.72	254.87
Wt. Tare (gm)	0.00	8.30
Wt. Moisture (gm)	25.64	25.52
Wt. Dry Soil (gm)	247.72	246.57
Moisture (%)	10.35%	10.35%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	2.97	0.0	0.0
0.1	0.001	14.5	0.05	2.97	703.1	4.9
0.2	0.003	17.7	0.11	2.97	858.8	6.0
0.3	0.004	31.4	0.16	2.97	1521.4	10.6
0.4	0.005	45.1	0.22	2.97	2183.2	15.2
0.6	0.007	62.8	0.28	2.98	3039.3	21.1
0.7	0.008	85.4	0.34	2.98	4127.9	28.7
0.8	0.010	117.6	0.39	2.98	5682.5	39.5
0.9	0.011	154.6	0.45	2.98	7468.2	51.9
1.0	0.012	186.9	0.51	2.98	9019.1	62.6
1.1	0.014	215.0	0.56	2.98	10373.4	72.0
1.3	0.015	237.6	0.62	2.99	11454.6	79.5
1.4	0.017	244.0	0.68	2.99	11758.8	81.7
1.5	0.018	246.4	0.74	2.99	11868.1	82.4
1.9	0.023	305.2	0.93	3.00	14671.4	101.9
2.5	0.030	538.8	1.21	3.00	25822.9	179.3
3.0	0.037	782.0	1.50	3.01	37370.6	259.5
3.6	0.044	1026.8	1.79	3.02	48926.3	339.8
4.2	0.051	1255.5	2.07	3.03	59649.1	414.2
4.9	0.059	1401.0	2.42	3.04	66327.3	460.6
5.4	0.065	1332.1	2.65	3.05	62917.4	436.9
5.9	0.071	1028.4	2.90	3.06	48446.6	336.4
6.8	0.082	726.4	3.34	3.07	34065.3	236.6
7.7	0.093	624.2	3.79	3.09	29132.5	202.3
				UNCONFINED COMPRESSIVE STRENGTH	66327.3	460.6
				SHEAR STRENGTH	33163.7	230.3

TIME TO FAILURE (min)	4.9
STRAIN @ FAILURE (%)	2.4
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH



Description: Dark Gray SHALE

USCS: -

LL	-
PL	-
PI	-

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

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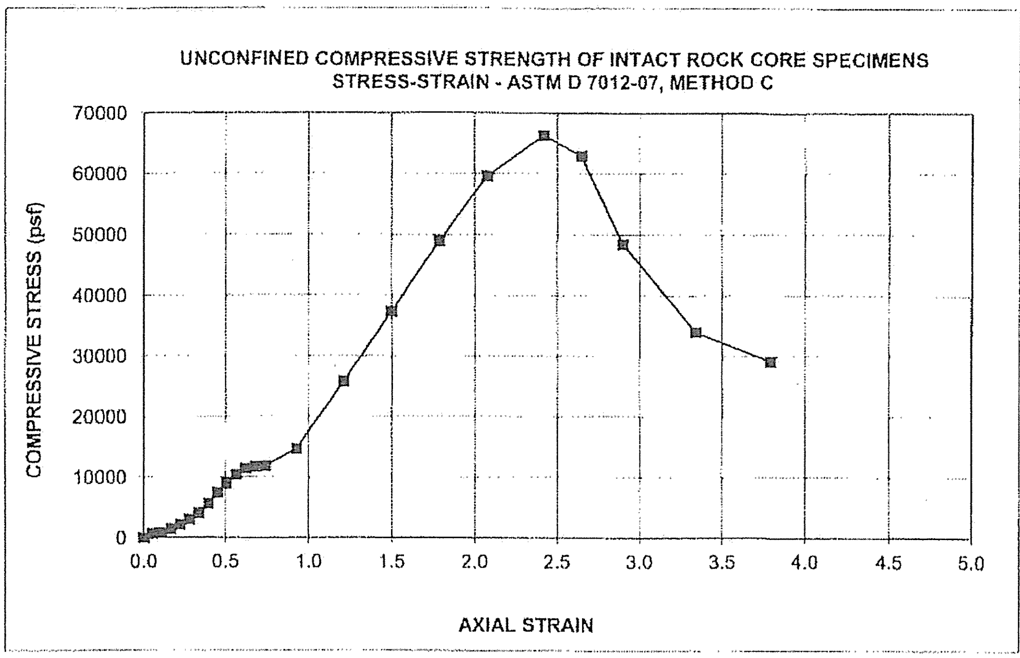


DESCRIPTION	LL	PL	PI	SAMPLE ID
Dark Gray SHALE	-	-	-	B-103, C-13
	SAMPLE TYPE		Core	48.1 - 48.5'

USCS	-

Note: Non-ASTM due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	143.7	TIME TO FAILURE (min)	4.9
Dry Density (pcf)	130.2	STRAIN @ FAILURE (%)	2.4
Moisture Content	10.4%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	66327.3
SHEAR STRENGTH (psf)	33163.7

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	**SAMPLE ID**	B-103, C-18
PROJECT NO.	093-94479	**SAMPLE TYPE**	Core
REMARKS	-	**SAMPLE DEPTH**	70.0 - 70.85'

SAMPLE DATA

Height (in)	4.296
Diameter (in)	1.937
Height/Diameter Ratio	2.22
Area (in^2)	2.95
Volume (ft^3)	0.0073
Weight (gm)	489.72
Wet Density (pcf)	147.30
Dry Density (pcf)	136.02
Machine Speed (in/min)	0.021
Strain rate (%/min)	0.49

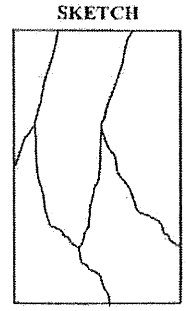
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	489.72	494.18
Wt. Dry Soil & Tare (gm)	452.21	456.97
Wt. Tare (gm)	0.00	8.37
Wt. Moisture (gm)	37.51	37.21
Wt. Dry Soil (gm)	452.21	448.60
Moisture (%)	8.29%	8.29%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	2.95	0.0	0.0
0.0	0.001	42.7	0.02	2.95	2085.6	14.5
0.1	0.003	85.4	0.06	2.95	4169.1	29.0
0.2	0.004	115.2	0.10	2.95	5622.5	39.0
0.3	0.006	150.6	0.14	2.95	7349.7	51.0
0.3	0.007	178.8	0.17	2.95	8722.0	60.6
0.4	0.009	210.2	0.21	2.95	10250.1	71.2
0.5	0.010	233.6	0.24	2.95	11385.5	79.1
0.6	0.012	253.7	0.28	2.96	12361.7	85.8
0.6	0.014	261.7	0.32	2.96	12749.8	88.5
0.7	0.015	264.2	0.36	2.96	12862.4	89.3
0.8	0.017	265.0	0.39	2.96	12897.7	89.6
0.9	0.019	268.2	0.43	2.96	13049.1	90.6
0.9	0.020	292.4	0.46	2.96	14219.9	98.7
1.3	0.027	477.6	0.64	2.97	23189.6	161.0
1.6	0.034	666.0	0.80	2.97	32287.0	224.2
2.0	0.043	939.1	1.00	2.98	45428.7	315.5
2.4	0.050	1107.4	1.16	2.98	53484.9	371.4
2.8	0.059	1345.7	1.37	2.99	64860.3	450.4
3.0	0.064	1413.0	1.49	2.99	68020.1	472.4
3.6	0.076	1071.1	1.76	3.00	51420.4	357.1
4.0	0.084	738.5	1.95	3.01	35383.1	245.7
4.4	0.093	487.2	2.16	3.01	23295.9	161.8
4.8	0.101	394.6	2.35	3.02	18830.3	130.8
				UNCONFINED COMPRESSIVE STRENGTH	68020.1	472.4
				SHEAR STRENGTH	34010.1	236.2

TIME TO FAILURE (min)	3.0
STRAIN @ FAILURE (%)	1.5
TYPE OF FAILURE	Shear

FAILURE SKETCH



Description	Dark Gray SHALE	LL	-
		PL	-
		PI	-
USCS	-		

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

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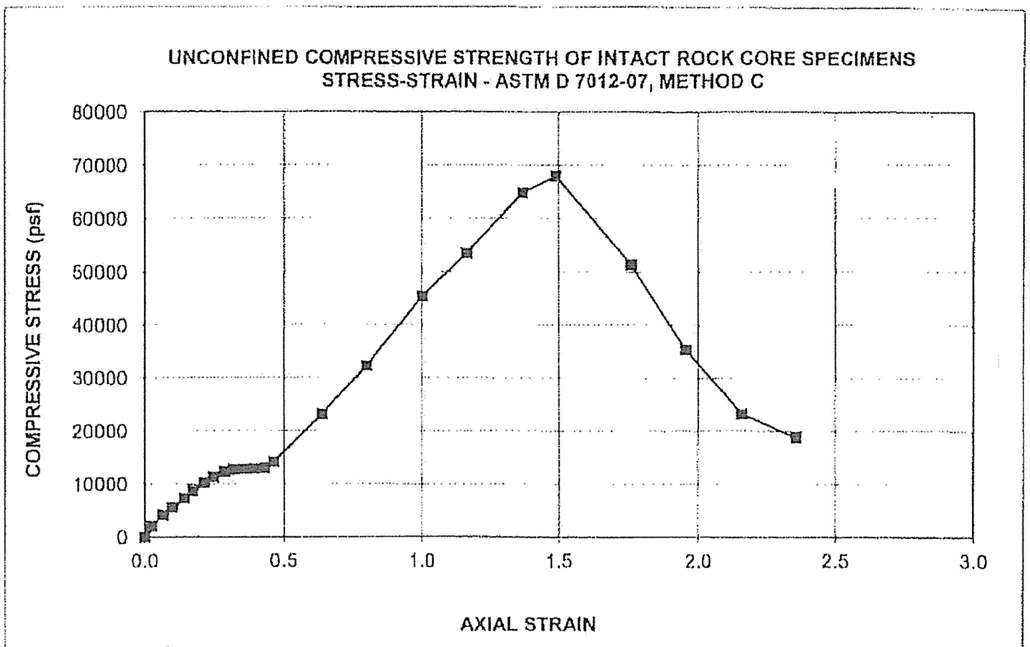


DESCRIPTION	LL	PL	PI	SAMPLE ID
Dark Gray SHALE	-	-	-	B-103, C-18
	SAMPLE TYPE		Core	70.0 - 70.85'

USCS	-

SAMPLE DATA

Wet Density (pcf)	147.3	TIME TO FAILURE (min)	3.0
Dry Density (pcf)	136.0	STRAIN @ FAILURE (%)	1.5
Moisture Content	8.3%	TYPE OF FAILURE	Shear

UNCONFINED COMPRESSIVE STRENGTH (psf)	68020.1
SHEAR STRENGTH (psf)	34010.1

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-107, C-8
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	25'

SAMPLE DATA

Height (in)	3.778
Diameter (in)	2.036
Height/Diameter Ratio	1.86
Area (in^2)	3.26
Volume (ft^3)	0.0071
Weight (gm)	454.94
Wet Density (pcf)	140.84
Dry Density (pcf)	127.94
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.50

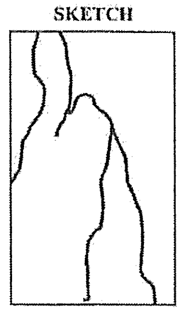
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	454.94	460.43
Wt. Dry Soil & Tare (gm)	413.26	419.02
Wt. Tare (gm)	0.00	8.39
Wt. Moisture (gm)	41.68	41.41
Wt. Dry Soil (gm)	413.26	410.63
Moisture (%)	10.08%	10.08%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	3.26	0.0	0.0
0.1	0.001	13.7	0.03	3.26	605.8	4.2
0.1	0.003	14.5	0.08	3.26	640.9	4.5
0.2	0.004	17.7	0.12	3.26	782.8	5.4
0.3	0.006	23.4	0.16	3.26	1031.6	7.2
0.4	0.008	30.6	0.20	3.26	1351.2	9.4
0.5	0.009	39.5	0.24	3.26	1741.5	12.1
0.6	0.011	49.1	0.28	3.26	2166.8	15.0
0.6	0.012	60.4	0.33	3.27	2663.2	18.5
0.7	0.014	72.5	0.37	3.27	3194.4	22.2
0.8	0.016	87.0	0.41	3.27	3831.3	26.6
1.0	0.020	132.1	0.52	3.27	5811.6	40.4
1.4	0.028	224.7	0.73	3.28	9866.0	68.5
1.8	0.034	266.6	0.90	3.29	11685.1	81.1
2.1	0.040	371.3	1.06	3.29	16246.6	112.8
2.4	0.047	541.2	1.23	3.30	23642.4	164.2
2.8	0.053	773.1	1.40	3.30	33717.5	234.1
3.2	0.061	1171.8	1.61	3.31	50994.8	354.1
3.5	0.067	1561.6	1.78	3.31	67842.6	471.1
3.7	0.070	1631.0	1.85	3.32	70802.6	491.7
3.7	0.071	1497.2	1.87	3.32	64983.7	451.3
3.9	0.074	1229.8	1.96	3.32	53327.4	370.3
4.1	0.079	931.0	2.09	3.33	40318.4	280.0
4.3	0.082	210.2	2.16	3.33	9096.1	63.2
				UNCONFINED COMPRESSIVE STRENGTH	70802.6	491.7
				SHEAR STRENGTH	35401.3	245.8

TIME TO FAILURE (min)	3.7
STRAIN @ FAILURE (%)	1.9
TYPE OF FAILURE	SHEAR

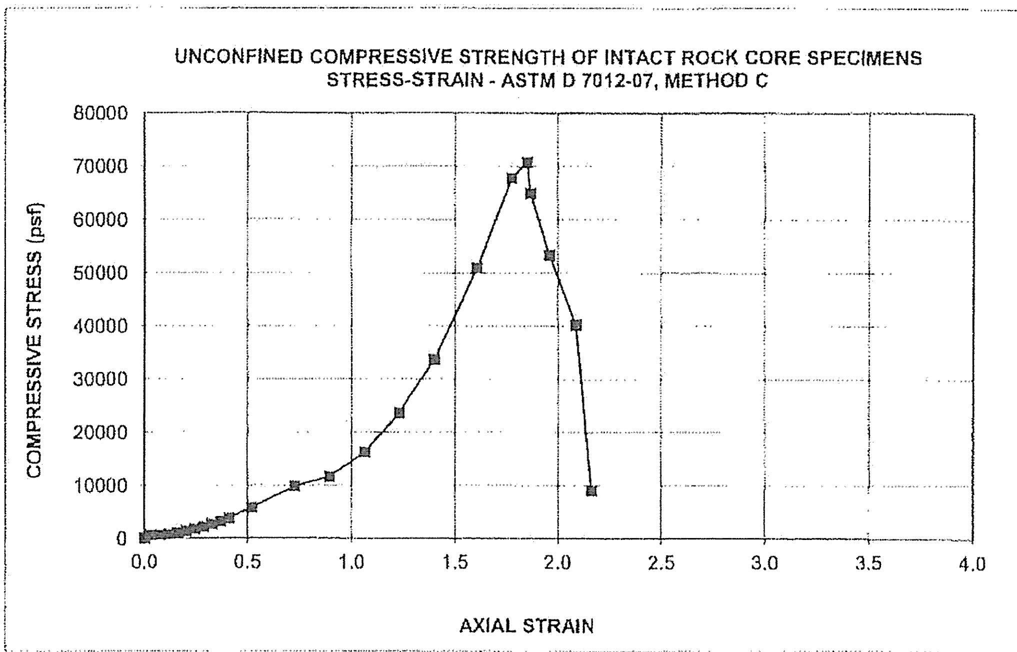
FAILURE SKETCH



Description	Dark Gray SANDSTONE
USCS	-
LL	-
PL	-
PI	-
TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014



DESCRIPTION	LL	PL	PI	SAMPLE ID
Dark Gray SANDSTONE	-	-	-	B-107, C-8
	SAMPLE TYPE		Core	25'

USCS	-

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	140.8	TIME TO FAILURE (min)	3.7
Dry Density (pcf)	127.9	STRAIN @ FAILURE (%)	1.9
Moisture Content	10.1%	TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	70802.6
SHEAR STRENGTH (psf)	35401.3

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-107, C-13
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	65'

SAMPLE DATA

Height (in)	2.169
Diameter (in)	1.981
Height/Diameter Ratio	1.09
Area (in^2)	3.08
Volume (ft^3)	0.0039
Weight (gm)	258.19
Wet Density (pcf)	147.06
Dry Density (pcf)	137.21
Machine Speed (in/min)	0.011
Strain rate (%/min)	0.51

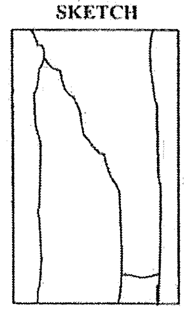
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	258.19	261.55
Wt. Dry Soil & Tare (gm)	240.90	244.59
Wt. Tare (gm)	0.00	8.36
Wt. Moisture (gm)	17.29	16.96
Wt. Dry Soil (gm)	240.90	236.23
Moisture (%)	7.18%	7.18%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.08	0.0	0.0
0.1	0.001	97.5	0.07	3.08	4549.8	31.6
0.2	0.003	155.4	0.12	3.09	7253.6	50.4
0.3	0.004	206.2	0.17	3.09	9616.5	66.8
0.4	0.005	234.4	0.22	3.09	10925.3	75.9
0.5	0.006	250.5	0.27	3.09	11670.4	81.0
0.6	0.007	257.7	0.32	3.09	12002.1	83.3
0.7	0.008	262.6	0.37	3.09	12220.8	84.9
0.8	0.009	269.0	0.42	3.10	12514.2	86.9
0.9	0.010	284.3	0.47	3.10	13219.2	91.8
1.0	0.011	317.3	0.52	3.10	14747.1	102.4
1.1	0.012	380.1	0.57	3.10	17657.7	122.6
1.2	0.014	452.6	0.63	3.10	21013.8	145.9
1.6	0.018	731.3	0.81	3.11	33887.5	235.3
2.1	0.023	1145.2	1.06	3.12	52934.3	367.6
2.6	0.029	1586.5	1.32	3.12	73144.5	507.9
3.1	0.034	2041.6	1.57	3.13	93886.0	652.0
3.6	0.040	2674.6	1.83	3.14	122676.8	851.9
4.0	0.044	2741.4	2.05	3.15	125459.1	871.2
4.5	0.050	3322.9	2.30	3.15	151677.6	1053.3
5.0	0.055	3705.0	2.54	3.16	168708.8	1171.6
5.4	0.060	3580.6	2.76	3.17	162677.0	1129.7
5.8	0.064	2071.4	2.96	3.18	93913.4	652.2
6.3	0.069	1895.8	3.18	3.18	85757.2	595.5
				UNCONFINED COMPRESSIVE STRENGTH	168708.8	1171.6
				SHEAR STRENGTH	84354.4	585.8

TIME TO FAILURE (min)	5.0
STRAIN @ FAILURE (%)	2.5
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH



Description	Gray LIMESTONE
USCS	-

LL	-
PL	-
PI	-

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

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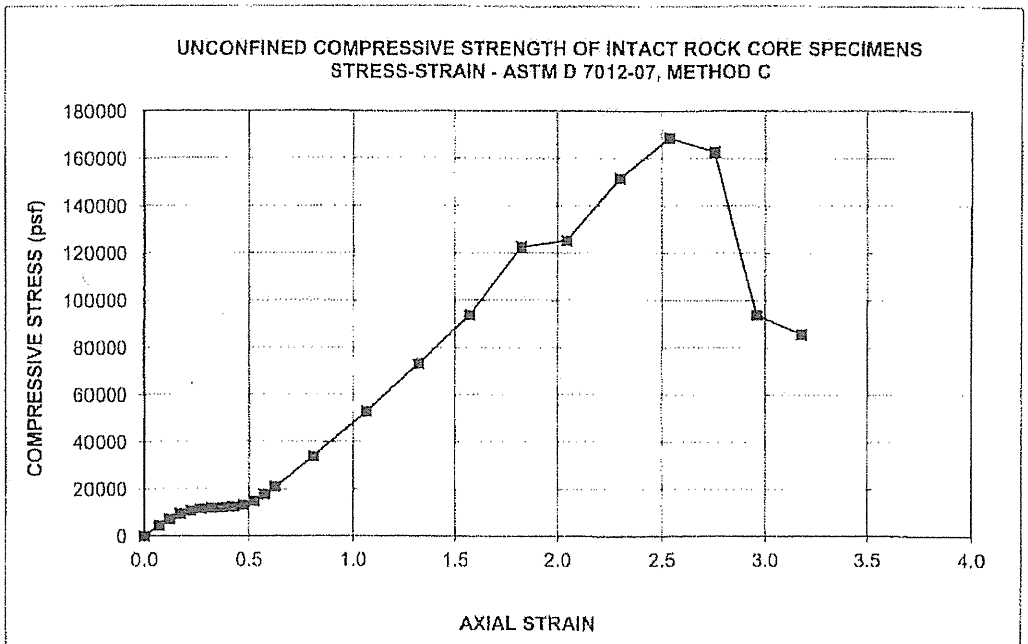
Permit Issued: February 12, 2014



DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray LIMESTONE	-	-	-	B-107, C-13
	SAMPLE TYPE		Core	65'

USCS	-

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	147.1	TIME TO FAILURE (min)	5.0
Dry Density (pcf)	137.2	STRAIN @ FAILURE (%)	2.5
Moisture Content	7.2%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	168708.8
SHEAR STRENGTH (psf)	84354.4

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-110, C-10
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	31.25 - 31.85'

SAMPLE DATA

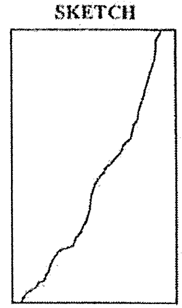
Height (in)	2.880
Diameter (in)	1.964
Height/Diameter Ratio	1.47
Area (in^2)	3.03
Volume (ft^3)	0.0050
Weight (gm)	315.32
Wet Density (pcf)	137.62
Dry Density (pcf)	120.56
Machine Speed (in/min)	0.014
Strain rate (%/min)	0.49

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	315.32	322.93
Wt. Dry Soil & Tare (gm)	276.25	283.96
Wt. Tare (gm)	0.00	8.40
Wt. Moisture (gm)	39.07	38.97
Wt. Dry Soil (gm)	276.25	275.56
Moisture (%)	14.14%	14.14%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.03	0.0	0.0
0.0	0.001	13.7	0.02	3.03	651.0	4.5
0.1	0.002	13.7	0.06	3.03	650.8	4.5
0.2	0.003	13.7	0.10	3.03	650.6	4.5
0.3	0.004	14.5	0.14	3.03	688.3	4.8
0.3	0.005	15.3	0.17	3.03	726.5	5.0
0.4	0.006	15.3	0.21	3.04	726.2	5.0
0.5	0.007	16.9	0.24	3.04	802.3	5.6
0.6	0.008	23.4	0.28	3.04	1107.2	7.7
0.6	0.009	33.0	0.32	3.04	1564.6	10.9
0.7	0.010	48.3	0.36	3.04	2289.1	15.9
0.8	0.011	62.8	0.39	3.04	2974.4	20.7
0.9	0.013	98.3	0.46	3.04	4649.0	32.3
1.1	0.015	133.7	0.53	3.05	6320.7	43.9
1.4	0.020	193.3	0.70	3.05	9123.6	63.4
1.8	0.026	240.0	0.90	3.06	11305.2	78.5
2.2	0.031	256.9	1.06	3.06	12082.0	83.9
2.6	0.036	263.4	1.26	3.07	12360.0	85.8
3.0	0.042	292.4	1.47	3.07	13692.4	95.1
3.4	0.048	318.1	1.67	3.08	14868.7	103.3
3.8	0.054	362.4	1.87	3.09	16904.0	117.4
4.5	0.063	409.9	2.19	3.10	19057.3	132.3
4.7	0.066	363.2	2.31	3.10	16866.2	117.1
5.0	0.071	317.3	2.45	3.11	14712.4	102.2
		UNCONFINED COMPRESSIVE STRENGTH			19057.3	132.3
		SHEAR STRENGTH			9528.7	66.2

TIME TO FAILURE (min)	4.5
STRAIN @ FAILURE (%)	2.2
TYPE OF FAILURE	Shear

FAILURE SKETCH

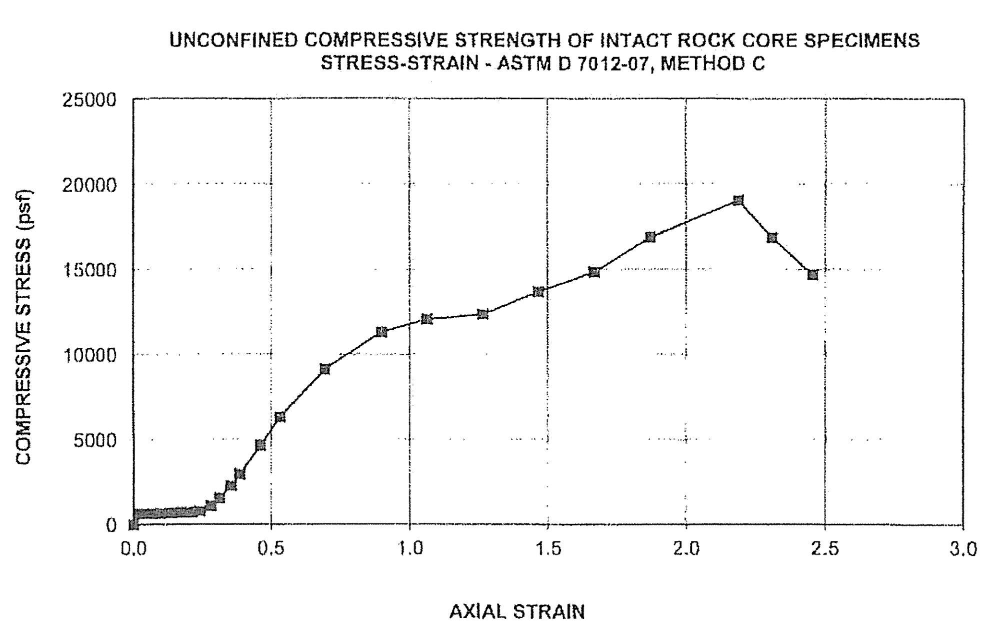


Description	Dark Gray SHALE
USCS	-

LL	-
PL	-
PI	-

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.



DESCRIPTION	LL	PL	PI	SAMPLE ID
Dark Gray SHALE	-	-	-	B-110, C-10
	SAMPLE TYPE		Core	31.25 - 31.85'

USCS	-

Note: Non-ASTM due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	137.6	TIME TO FAILURE (min)	4.5
Dry Density (pcf)	120.6	STRAIN @ FAILURE (%)	2.2
Moisture Content	14.1%	TYPE OF FAILURE	Shear

UNCONFINED COMPRESSIVE STRENGTH (psf)	19057.3
SHEAR STRENGTH (psf)	9528.7

093-94479

REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-112R, C-15
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	50'

SAMPLE DATA

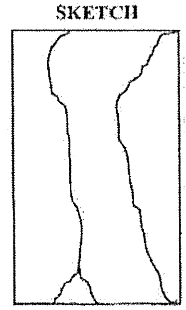
Height (in)	3.225
Diameter (in)	1.963
Height/Diameter Ratio	1.64
Area (in^2)	3.03
Volume (ft^3)	0.0056
Weight (gm)	383.61
Wet Density (pcf)	149.66
Dry Density (pcf)	141.64
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.59

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	383.61	389.79
Wt. Dry Soil & Tare (gm)	363.06	369.36
Wt. Tare (gm)	0.00	8.37
Wt. Moisture (gm)	20.55	20.43
Wt. Dry Soil (gm)	363.06	360.99
Moisture (%)	5.66%	5.66%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.03	0.0	0.0
0.2	0.005	17.7	0.15	3.03	841.9	5.8
0.3	0.006	19.3	0.20	3.03	917.9	6.4
0.4	0.008	29.8	0.24	3.03	1414.4	9.8
0.5	0.009	50.7	0.29	3.04	2407.2	16.7
0.6	0.011	95.0	0.34	3.04	4504.7	31.3
0.6	0.012	133.7	0.38	3.04	6337.2	44.0
0.7	0.014	180.4	0.42	3.04	8547.4	59.4
0.8	0.015	215.0	0.46	3.04	10182.8	70.7
0.8	0.016	229.5	0.50	3.04	10865.2	75.5
0.9	0.017	238.4	0.54	3.04	11281.6	78.3
1.2	0.022	323.8	0.70	3.05	15297.5	106.2
1.5	0.029	691.0	0.89	3.05	32584.9	226.3
1.8	0.035	1223.3	1.09	3.06	57571.6	399.8
2.2	0.041	1616.3	1.29	3.07	75916.3	527.2
2.5	0.048	2590.0	1.48	3.07	121408.3	843.1
2.8	0.054	3558.0	1.68	3.08	166451.2	1155.9
3.2	0.060	4485.8	1.87	3.08	209436.9	1454.4
3.5	0.066	5306.0	2.05	3.09	247297.4	1717.3
3.5	0.067	4236.2	2.08	3.09	197367.7	1370.6
3.8	0.072	3140.9	2.23	3.10	146116.8	1014.7
4.0	0.076	2239.7	2.37	3.10	104045.9	722.5
4.3	0.082	1522.1	2.54	3.11	70581.6	490.2
4.6	0.088	1164.5	2.73	3.11	53895.8	374.3
				UNCONFINED COMPRESSIVE STRENGTH	247297.4	1717.3
				SHEAR STRENGTH	123648.7	858.7

TIME TO FAILURE (min)	3.5
STRAIN @ FAILURE (%)	2.0
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH

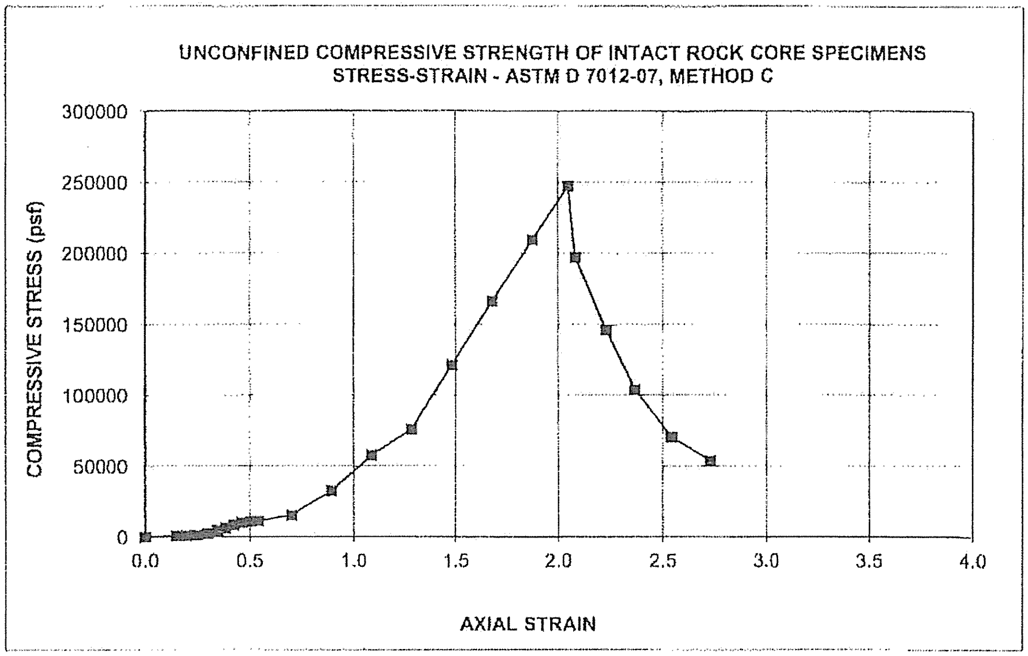


Description	Gray Sandy SHALE
USCS	-

LL	-
PL	-
PI	-

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.



DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray Sandy SHALE	-	-	-	B-112R, C-15
	SAMPLE TYPE		Core	50'

USCS	-

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	149.7	TIME TO FAILURE (min)	3.5
Dry Density (pcf)	141.6	STRAIN @ FAILURE (%)	2.0
Moisture Content	5.7%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	247297.4
SHEAR STRENGTH (psf)	123648.7

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-115, C-13
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	45'

SAMPLE DATA

Height (in)	3.861
Diameter (in)	2.003
Height/Diameter Ratio	1.93
Area (in^2)	3.15
Volume (ft^3)	0.0070
Weight (gm)	466.03
Wet Density (pcf)	145.86
Dry Density (pcf)	133.33
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.49

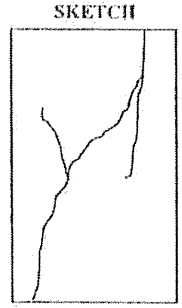
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	466.03	472.16
Wt. Dry Soil & Tare (gm)	426.00	432.31
Wt. Tare (gm)	0.00	8.25
Wt. Moisture (gm)	40.03	39.85
Wt. Dry Soil (gm)	426.00	424.06
Moisture (%)	9.40%	9.40%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.15	0.0	0.0
0.1	0.002	20.1	0.06	3.15	919.9	6.4
0.2	0.003	34.6	0.09	3.15	1581.6	11.0
0.2	0.005	57.2	0.12	3.15	2609.9	18.1
0.3	0.006	83.8	0.16	3.16	3821.8	26.5
0.4	0.007	115.2	0.19	3.16	5253.3	36.5
0.4	0.009	149.8	0.22	3.16	6830.7	47.4
0.5	0.010	184.4	0.25	3.16	8407.0	58.4
0.6	0.011	212.6	0.29	3.16	9688.9	67.3
0.6	0.012	237.6	0.32	3.16	10822.6	75.2
0.7	0.014	252.9	0.35	3.16	11516.3	80.0
0.8	0.015	260.9	0.38	3.16	11878.9	82.5
1.1	0.021	338.3	0.55	3.17	15373.0	106.8
1.4	0.028	622.5	0.71	3.17	28247.0	196.2
1.8	0.034	935.0	0.88	3.18	42355.2	294.1
2.1	0.040	1307.1	1.04	3.18	59111.8	410.5
2.4	0.047	1667.9	1.21	3.19	75303.4	522.9
2.8	0.053	2001.3	1.37	3.19	90206.0	626.4
3.1	0.059	2288.8	1.53	3.20	102993.2	715.2
3.3	0.062	2340.0	1.61	3.20	105219.5	730.7
3.4	0.065	2220.4	1.68	3.20	99765.7	692.8
3.5	0.066	1410.2	1.72	3.21	63335.9	439.8
3.7	0.070	659.6	1.81	3.21	29596.7	205.5
3.9	0.074	351.9	1.92	3.21	15774.9	109.5
				UNCONFINED COMPRESSIVE STRENGTH	105219.5	730.7
				SHEAR STRENGTH	52609.8	365.3

TIME TO FAILURE (min)	3.3
STRAIN @ FAILURE (%)	1.6
TYPE OF FAILURE	SHEAR

FAILURE SKETCH



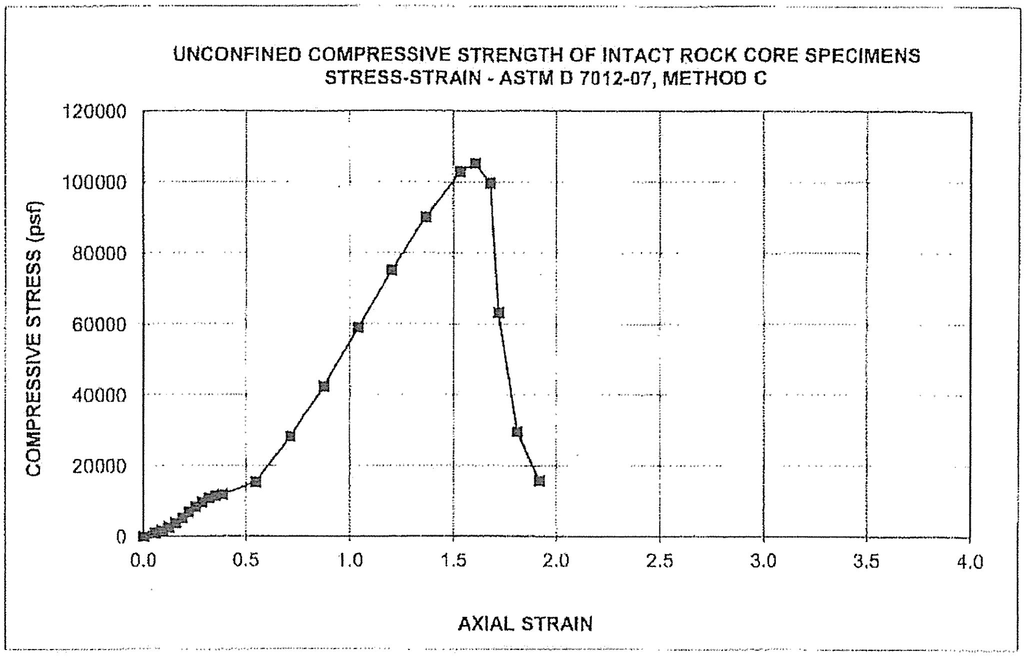
Description	Gray SHALE
USCS	-

LL	-
PL	-
PI	-

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014



DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SHALE	-	-	-	B-115, C-13
	SAMPLE TYPE		Core	45'
USCS	-			

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	145.9	TIME TO FAILURE (min)	3.3
Dry Density (pcf)	133.3	STRAIN @ FAILURE (%)	1.6
Moisture Content	9.4%	TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	105219.5
SHEAR STRENGTH (psf)	52609.8

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/15/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	**SAMPLE ID**	B-116, C-16
PROJECT NO.	093-94479	**SAMPLE TYPE**	Core
REMARKS	-	**SAMPLE DEPTH**	45'

SAMPLE DATA

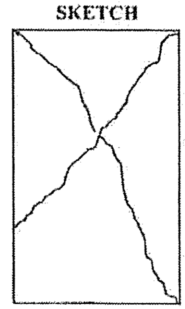
Height (in)	3.927
Diameter (in)	2.026
Height/Diameter Ratio	1.94
Area (in^2)	3.22
Volume (ft^3)	0.0073
Weight (gm)	467.26
Wet Density (pcf)	140.54
Dry Density (pcf)	125.81
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.48

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	467.26	465.87
Wt. Dry Soil & Tare (gm)	418.26	417.90
Wt. Tare (gm)	0.00	8.41
Wt. Moisture (gm)	49.00	47.97
Wt. Dry Soil (gm)	418.26	409.49
Moisture (%)	11.71%	11.71%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.22	0.0	0.0
0.1	0.003	41.9	0.07	3.23	1869.3	13.0
0.2	0.004	62.0	0.10	3.23	2767.4	19.2
0.3	0.005	84.6	0.14	3.23	3772.4	26.2
0.3	0.007	109.5	0.17	3.23	4884.2	33.9
0.4	0.008	134.5	0.20	3.23	5995.7	41.6
0.5	0.009	161.1	0.23	3.23	7178.3	49.8
0.6	0.011	191.7	0.27	3.23	8538.5	59.3
0.6	0.012	207.8	0.31	3.23	9253.1	64.3
0.7	0.013	222.3	0.34	3.23	9895.2	68.7
0.8	0.015	231.1	0.37	3.24	10286.3	71.4
0.8	0.016	237.6	0.41	3.24	10568.6	73.4
0.9	0.017	259.3	0.44	3.24	11532.4	80.1
1.0	0.020	274.6	0.51	3.24	12204.8	84.8
1.5	0.028	492.9	0.71	3.25	21859.8	151.8
1.8	0.034	653.2	0.87	3.25	28920.8	200.8
2.1	0.041	781.2	1.03	3.26	34534.6	239.8
2.5	0.048	902.8	1.23	3.26	39828.7	276.6
2.9	0.055	994.6	1.39	3.27	43807.5	304.2
3.3	0.063	1113.8	1.60	3.28	48956.9	340.0
3.6	0.069	1181.5	1.76	3.28	51847.5	360.1
3.9	0.074	963.2	1.89	3.29	42212.8	293.1
4.1	0.078	637.8	1.98	3.29	27925.8	193.9
4.4	0.084	436.5	2.14	3.29	19081.4	132.5
				UNCONFINED COMPRESSIVE STRENGTH	51847.5	360.1
				SHEAR STRENGTH	25923.8	180.0

TIME TO FAILURE (min)	3.6
STRAIN @ FAILURE (%)	1.8
TYPE OF FAILURE	SHEAR

FAILURE SKETCH



Description	Gray SHALE	**LL**	-
		PL	-
		PI	-
USCS	-		

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

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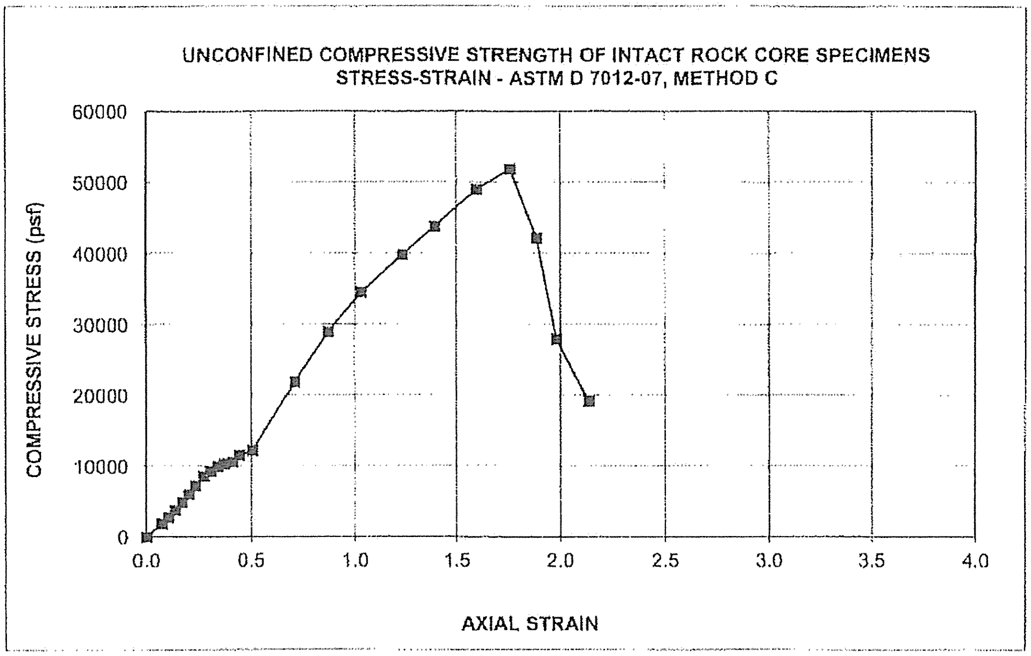


DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SHALE	-	-	-	B-116, C-16
	SAMPLE TYPE		Core	45'

USCS	-

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	140.5	TIME TO FAILURE (min)	3.6
Dry Density (pcf)	125.8	STRAIN @ FAILURE (%)	1.8
Moisture Content	11.7%	TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	51847.5
SHEAR STRENGTH (psf)	25923.8

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-116, C-18
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	65'

SAMPLE DATA

Height (in)	4.004
Diameter (in)	2.026
Height/Diameter Ratio	1.98
Area (in^2)	3.22
Volume (ft^3)	0.0075
Weight (gm)	512.20
Wet Density (pcf)	151.10
Dry Density (pcf)	142.78
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.47

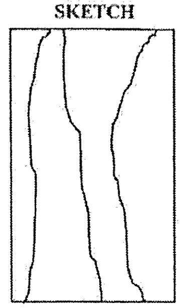
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	512.20	506.38
Wt. Dry Soil & Tare (gm)	484.00	478.95
Wt. Tare (gm)	0.00	8.20
Wt. Moisture (gm)	28.20	27.43
Wt. Dry Soil (gm)	484.00	470.75
Moisture (%)	5.83%	5.83%

TIME	DEFLECT	FORCE	% STRAIN	Ac	COMPRESSIVE STRESS	
(min)	(inch)	(lbs)	(in/in)	(in^2)	(psf)	(psi)
0.0	0.000	0.0	0.00	3.22	0.0	0.0
0.1	0.001	79.7	0.03	3.22	3560.3	24.7
0.1	0.003	178.8	0.07	3.23	7980.5	55.4
0.2	0.004	214.2	0.09	3.23	9560.2	66.4
0.2	0.005	234.4	0.12	3.23	10456.0	72.6
0.3	0.007	246.4	0.17	3.23	10989.7	76.3
0.4	0.008	261.7	0.19	3.23	11669.2	81.0
0.4	0.009	266.6	0.21	3.23	11882.2	82.5
0.5	0.010	273.0	0.26	3.23	12163.5	84.5
0.6	0.011	287.5	0.28	3.23	12806.4	88.9
0.7	0.014	424.4	0.34	3.23	18894.0	131.2
1.0	0.018	960.0	0.46	3.24	42683.7	296.4
1.2	0.023	1676.7	0.58	3.24	74462.5	517.1
1.5	0.028	2493.4	0.70	3.25	110600.2	768.1
1.7	0.033	3355.1	0.81	3.25	148645.0	1032.3
2.0	0.037	4226.5	0.93	3.25	187027.7	1298.8
2.2	0.042	5081.8	1.05	3.26	224606.4	1559.8
2.5	0.047	5907.3	1.17	3.26	260779.0	1811.0
2.7	0.052	6322.0	1.29	3.27	278751.0	1935.8
2.8	0.053	6382.0	1.32	3.27	281296.2	1953.4
2.8	0.053	4203.9	1.34	3.27	185270.2	1286.6
2.9	0.056	1191.9	1.40	3.27	52494.6	364.5
3.1	0.060	1026.0	1.49	3.27	45148.0	313.5
				UNCONFINED COMPRESSIVE STRENGTH	281296.2	1953.4
				SHEAR STRENGTH	140648.1	976.7

TIME TO FAILURE (min)	2.8
STRAIN @ FAILURE (%)	1.3
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH

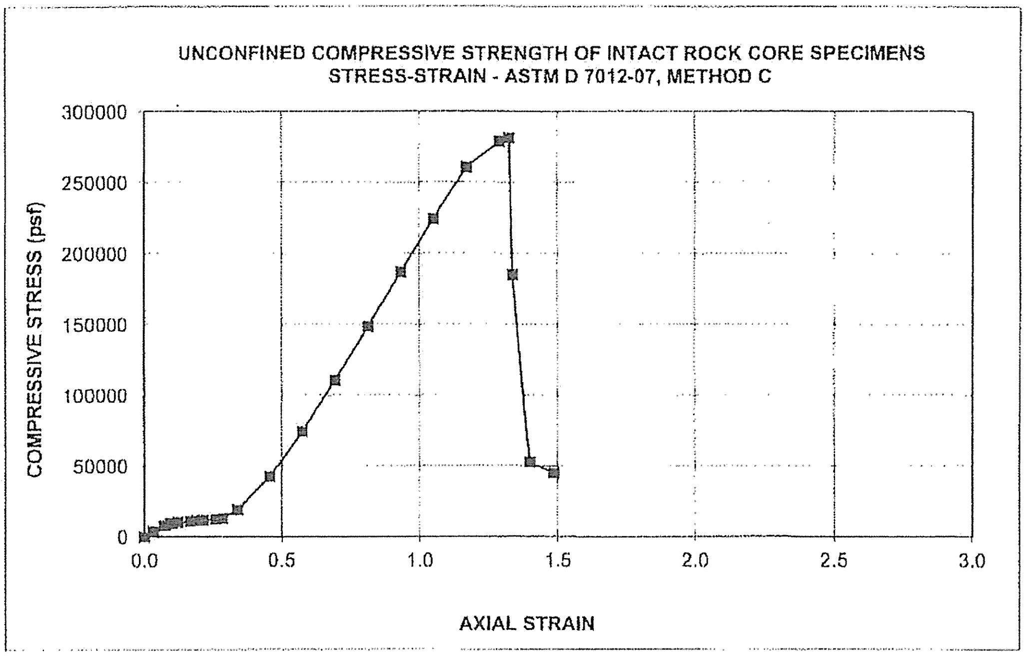


Description	Gray SHALE
USCS	-

LL	-
PL	-
PI	-

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.



DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SHALE	-	-	-	B-116, C-18
	SAMPLE TYPE		Core	65'

USCS	-

SAMPLE DATA

Wet Density (pcf)	151.1	TIME TO FAILURE (min)	2.8
Dry Density (pcf)	142.8	STRAIN @ FAILURE (%)	1.3
Moisture Content	5.8%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	281296.2
SHEAR STRENGTH (psf)	140648.1

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-116, C-20
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	75'

SAMPLE DATA

Height (in)	3.253
Diameter (in)	1.984
Height/Diameter Ratio	1.64
Area (in^2)	3.09
Volume (ft^3)	0.0058
Weight (gm)	371.80
Wet Density (pcf)	140.78
Dry Density (pcf)	126.50
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.58

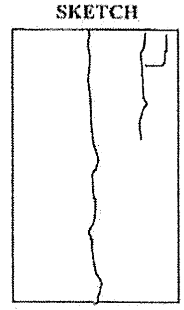
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	371.80	378.48
Wt. Dry Soil & Tare (gm)	334.10	340.95
Wt. Tare (gm)	0.00	8.34
Wt. Moisture (gm)	37.70	37.53
Wt. Dry Soil (gm)	334.10	332.61
Moisture (%)	11.28%	11.28%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.09	0.0	0.0
0.1	0.002	48.3	0.05	3.09	2250.1	15.6
0.1	0.003	104.7	0.09	3.09	4872.6	33.8
0.2	0.004	153.8	0.12	3.10	7156.9	49.7
0.2	0.005	205.4	0.15	3.10	9552.0	66.3
0.3	0.006	230.3	0.17	3.10	10710.3	74.4
0.3	0.007	246.4	0.20	3.10	11455.5	79.6
0.4	0.008	252.9	0.23	3.10	11751.9	81.6
0.4	0.009	256.9	0.26	3.10	11935.2	82.9
0.5	0.010	262.6	0.32	3.10	12190.1	84.7
0.6	0.011	265.8	0.35	3.10	12336.0	85.7
0.6	0.012	283.5	0.38	3.10	13154.6	91.4
0.9	0.016	484.8	0.51	3.11	22468.7	156.0
1.1	0.021	690.2	0.64	3.11	31942.0	221.8
1.3	0.026	869.8	0.79	3.12	40194.6	279.1
1.6	0.030	1001.1	0.93	3.12	46194.7	320.8
1.8	0.035	1109.8	1.08	3.13	51135.1	355.1
2.1	0.040	1204.0	1.23	3.13	55393.5	384.7
2.3	0.043	1245.0	1.32	3.13	57224.2	397.4
2.5	0.047	1243.5	1.45	3.14	57081.0	396.4
2.8	0.053	1038.1	1.63	3.14	47567.7	330.3
2.9	0.056	815.8	1.72	3.15	37346.0	259.3
3.2	0.060	703.1	1.85	3.15	32143.2	223.2
				UNCONFINED COMPRESSIVE STRENGTH	57224.2	397.4
				SHEAR STRENGTH	28612.1	198.7

TIME TO FAILURE (min)	2.3
STRAIN @ FAILURE (%)	1.3
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH



Description	Gray SHALE
USCS	-
LL	-
PL	-
PI	-

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

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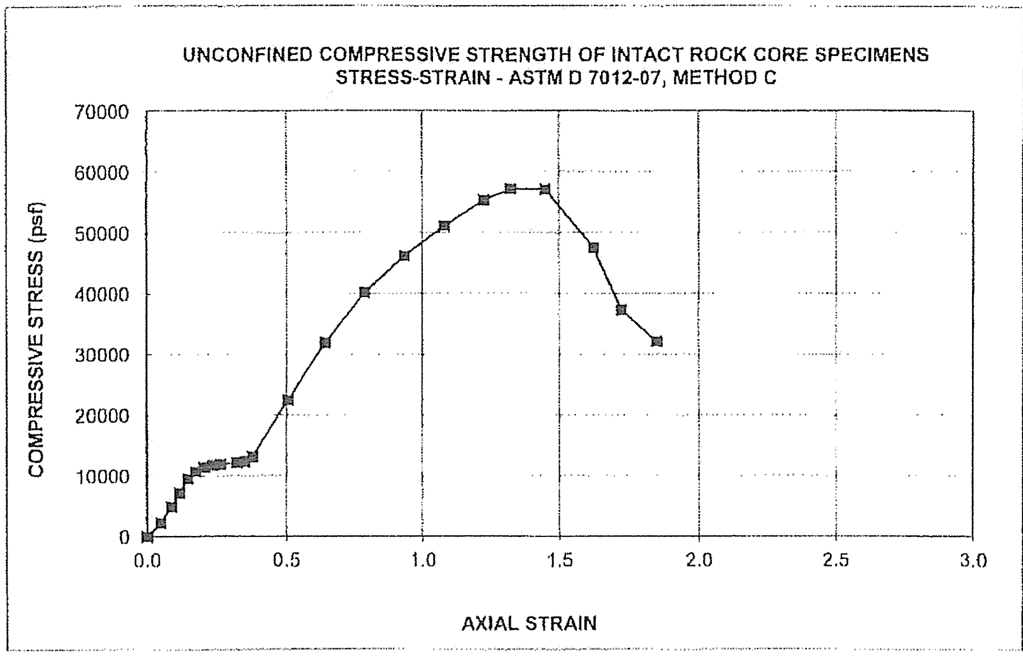


DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SHALE	-	-	-	B-116, C-20
	SAMPLE TYPE		Core	75'

USCS	-

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	140.8	TIME TO FAILURE (min)	2.3
Dry Density (pcf)	126.5	STRAIN @ FAILURE (%)	1.3
Moisture Content	11.3%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	57224.2
SHEAR STRENGTH (psf)	28612.1

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-118R, C-10
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	31.2 - 31.9'

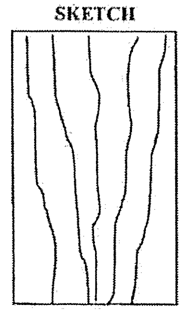
SAMPLE DATA	
Height (in)	2.117
Diameter (in)	2.031
Height/Diameter Ratio	1.04
Area (in^2)	3.24
Volume (ft^3)	0.0040
Weight (gm)	247.42
Wet Density (pcf)	137.37
Dry Density (pcf)	122.84
Machine Speed (in/min)	0.011
Strain rate (%/min)	0.52

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	247.42	250.72
Wt. Dry Soil & Tare (gm)	221.26	225.10
Wt. Tare (gm)	0.00	8.42
Wt. Moisture (gm)	26.16	25.62
Wt. Dry Soil (gm)	221.26	216.68
Moisture (%)	11.82%	11.82%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.24	0.0	0.0
0.1	0.001	15.3	0.06	3.24	680.1	4.7
0.2	0.003	18.5	0.13	3.24	822.6	5.7
0.4	0.004	24.2	0.20	3.25	1072.2	7.4
0.5	0.006	30.6	0.27	3.25	1356.9	9.4
0.6	0.007	38.7	0.34	3.25	1712.6	11.9
0.8	0.009	47.5	0.41	3.25	2103.6	14.6
0.9	0.010	56.4	0.48	3.26	2494.1	17.3
1.0	0.012	65.2	0.55	3.26	2884.0	20.0
1.2	0.013	74.1	0.61	3.26	3273.4	22.7
1.3	0.014	83.0	0.68	3.26	3662.2	25.4
1.4	0.016	92.9	0.75	3.26	4099.0	28.5
1.6	0.017	101.0	0.82	3.27	4451.0	30.9
2.0	0.022	130.5	1.03	3.27	5739.4	39.9
2.6	0.029	179.6	1.38	3.28	7873.0	54.7
3.3	0.036	227.9	1.72	3.30	9956.1	69.1
4.0	0.044	269.0	2.07	3.31	11709.2	81.3
4.6	0.051	321.3	2.42	3.32	13937.9	96.8
5.3	0.058	380.1	2.76	3.33	16429.4	114.1
5.9	0.065	415.6	3.05	3.34	17908.3	124.4
6.3	0.069	376.9	3.26	3.35	16206.1	112.5
6.9	0.076	322.2	3.61	3.36	13801.9	95.8
7.6	0.084	289.1	3.96	3.37	12342.8	85.7
8.2	0.091	182.0	4.28	3.38	7744.0	53.8
				UNCONFINED COMPRESSIVE STRENGTH	17908.3	124.4
				SHEAR STRENGTH	8954.2	62.2

TIME TO FAILURE (min)	5.9
STRAIN @ FAILURE (%)	3.0
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH



Description	Gray SANDSTONE	LL	-
		PL	-
		PI	-
USCS	-		

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

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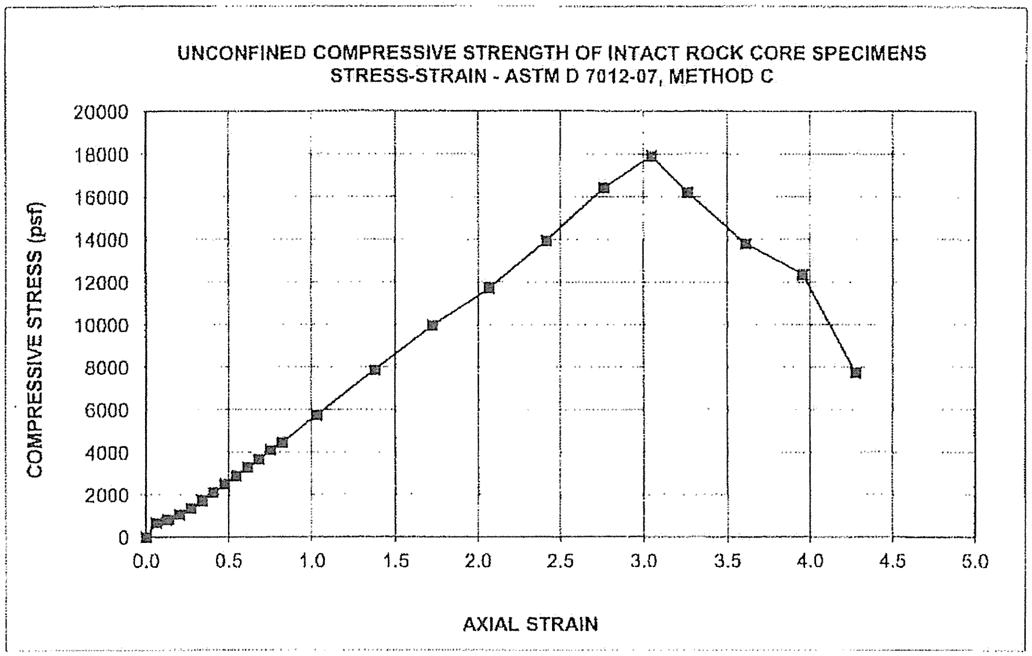


DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SANDSTONE	-	-	-	B-118R, C-10
	SAMPLE TYPE		Core	31.2 - 31.9'

USCS	-

Note: Non-ASTM due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	137.4	TIME TO FAILURE (min)	5.9
Dry Density (pcf)	122.8	STRAIN @ FAILURE (%)	3.0
Moisture Content	11.8%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	17908.3
SHEAR STRENGTH (psf)	8954.2

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-118R, C-16
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	60.0 - 61.25'

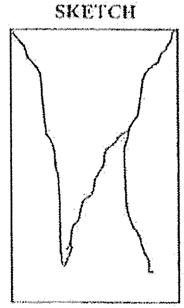
SAMPLE DATA	
Height (in)	4.572
Diameter (in)	2.019
Height/Diameter Ratio	2.26
Area (in^2)	3.20
Volume (ft^3)	0.0085
Weight (gm)	545.50
Wet Density (pcf)	141.91
Dry Density (pcf)	126.52
Machine Speed (in/min)	0.022
Strain rate (%/min)	0.48

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	545.50	552.77
Wt. Dry Soil & Tare (gm)	486.34	493.73
Wt. Tare (gm)	0.00	8.41
Wt. Moisture (gm)	59.16	59.04
Wt. Dry Soil (gm)	486.34	485.32
Moisture (%)	12.17%	12.17%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	3.20	0.0	0.0
0.1	0.001	12.1	0.03	3.20	543.6	3.8
0.1	0.003	13.7	0.07	3.20	615.8	4.3
0.2	0.005	13.7	0.11	3.21	615.5	4.3
0.3	0.007	15.3	0.15	3.21	687.6	4.8
0.4	0.009	26.6	0.19	3.21	1193.2	8.3
0.5	0.011	67.7	0.23	3.21	3035.7	21.1
0.6	0.012	129.7	0.27	3.21	5816.4	40.4
0.6	0.014	188.5	0.31	3.21	8450.1	58.7
0.7	0.016	228.7	0.35	3.21	10251.1	71.2
0.8	0.018	244.0	0.39	3.21	10932.9	75.9
0.9	0.020	269.8	0.43	3.22	12082.6	83.9
1.0	0.022	278.7	0.47	3.22	12474.3	86.6
1.1	0.025	372.9	0.54	3.22	16680.0	115.8
1.5	0.034	740.1	0.75	3.23	33041.0	229.5
2.0	0.043	1089.7	0.95	3.23	48549.0	337.1
2.4	0.052	1403.7	1.15	3.24	62411.9	433.4
2.8	0.062	1689.6	1.35	3.25	74971.3	520.6
3.2	0.071	1938.5	1.55	3.25	85840.9	596.1
3.4	0.076	2017.4	1.65	3.26	89240.0	619.7
3.5	0.077	1759.7	1.69	3.26	77809.0	540.3
3.5	0.078	464.7	1.70	3.26	20545.6	142.7
4.0	0.089	190.9	1.95	3.27	8417.7	58.5
4.8	0.106	174.8	2.31	3.28	7679.3	53.3
				UNCONFINED COMPRESSIVE STRENGTH	89240.0	619.7
				SHEAR STRENGTH	44620.0	309.9

TIME TO FAILURE (min)	3.4
STRAIN @ FAILURE (%)	1.7
TYPE OF FAILURE	Shear

FAILURE SKETCH



Description	Gray SHALE	LL	-
		PL	-
		PI	-
USCS	-		

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

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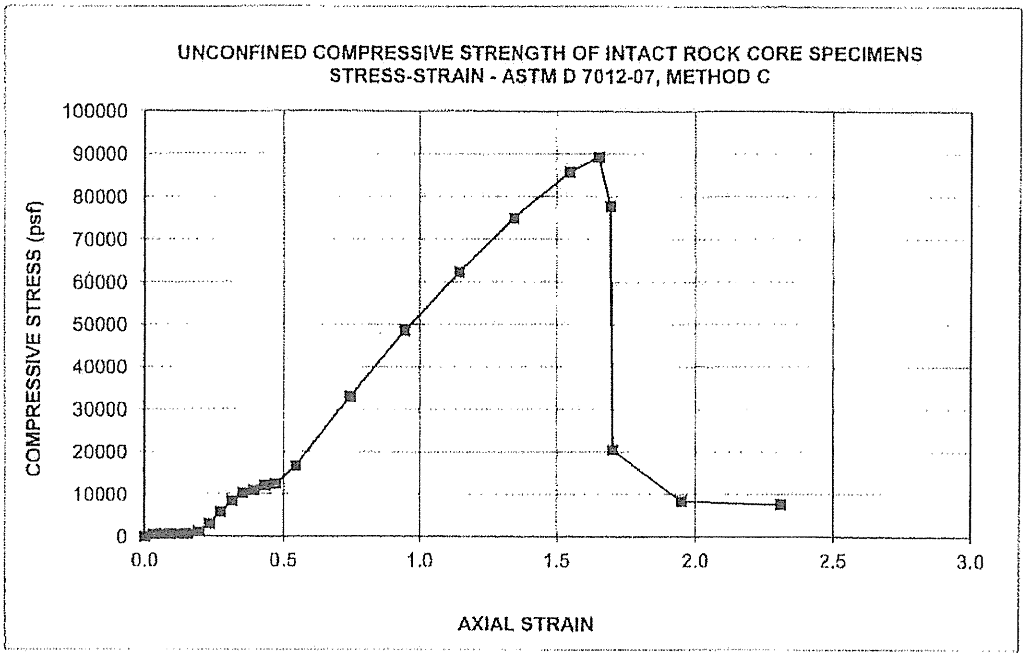


DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SHALE	-	-	-	B-118R, C-16
	SAMPLE TYPE		Core	60.0 - 61.25'

USCS	-

SAMPLE DATA

Wet Density (pcf)	141.9	TIME TO FAILURE (min)	3.4
Dry Density (pcf)	126.5	STRAIN @ FAILURE (%)	1.7
Moisture Content	12.2%	TYPE OF FAILURE	Shear

UNCONFINED COMPRESSIVE STRENGTH (psf)	89240.0
SHEAR STRENGTH (psf)	44620.0

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-119R, C-13
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	65'

SAMPLE DATA

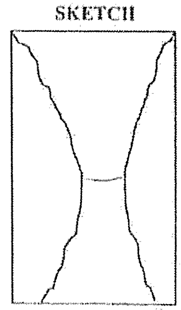
Height (in)	3.991
Diameter (in)	1.954
Height/Diameter Ratio	2.04
Area (in^2)	3.00
Volume (ft^3)	0.0069
Weight (gm)	439.12
Wet Density (pcf)	139.71
Dry Density (pcf)	122.45
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.48

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	439.12	420.64
Wt. Dry Soil & Tare (gm)	384.87	369.72
Wt. Tare (gm)	0.00	8.48
Wt. Moisture (gm)	54.25	50.92
Wt. Dry Soil (gm)	384.87	361.24
Moisture (%)	14.10%	14.10%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in²)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	3.00	0.0	0.0
0.1	0.002	58.0	0.05	3.00	2783.4	19.3
0.2	0.003	96.7	0.09	3.00	4637.1	32.2
0.2	0.005	132.1	0.12	3.00	6335.0	44.0
0.3	0.006	173.2	0.16	3.00	8302.0	57.7
0.4	0.008	210.2	0.20	3.00	10073.9	70.0
0.5	0.009	236.0	0.24	3.01	11304.4	78.5
0.6	0.011	246.4	0.28	3.01	11801.3	82.0
0.6	0.012	249.7	0.31	3.01	11951.7	83.0
0.7	0.014	253.7	0.34	3.01	12140.8	84.3
0.8	0.015	272.2	0.38	3.01	13021.9	90.4
0.9	0.016	282.7	0.41	3.01	13518.4	93.9
0.9	0.018	314.1	0.45	3.01	15014.5	104.3
1.3	0.025	461.5	0.62	3.02	22022.8	152.9
1.6	0.031	558.1	0.78	3.02	26592.3	184.7
2.0	0.037	605.6	0.94	3.03	28810.4	200.1
2.4	0.045	642.7	1.13	3.03	30511.6	211.9
2.7	0.052	677.3	1.29	3.04	32104.1	222.9
3.1	0.060	727.2	1.49	3.04	34401.5	238.9
3.5	0.067	769.1	1.69	3.05	36309.3	252.1
3.7	0.071	782.8	1.78	3.05	36921.5	256.4
4.1	0.077	716.8	1.94	3.06	33753.3	234.4
4.3	0.081	544.4	2.04	3.06	25610.2	177.8
4.4	0.084	47.5	2.10	3.06	2234.0	15.5
				UNCONFINED COMPRESSIVE STRENGTH	36921.5	256.4
				SHEAR STRENGTH	18460.7	128.2

TIME TO FAILURE (min)	3.7
STRAIN @ FAILURE (%)	1.8
TYPE OF FAILURE	SHEAR

FAILURE SKETCH



Description: Gray Sandy SHALE

USCS: -

LL	-
PL	-
PI	-

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

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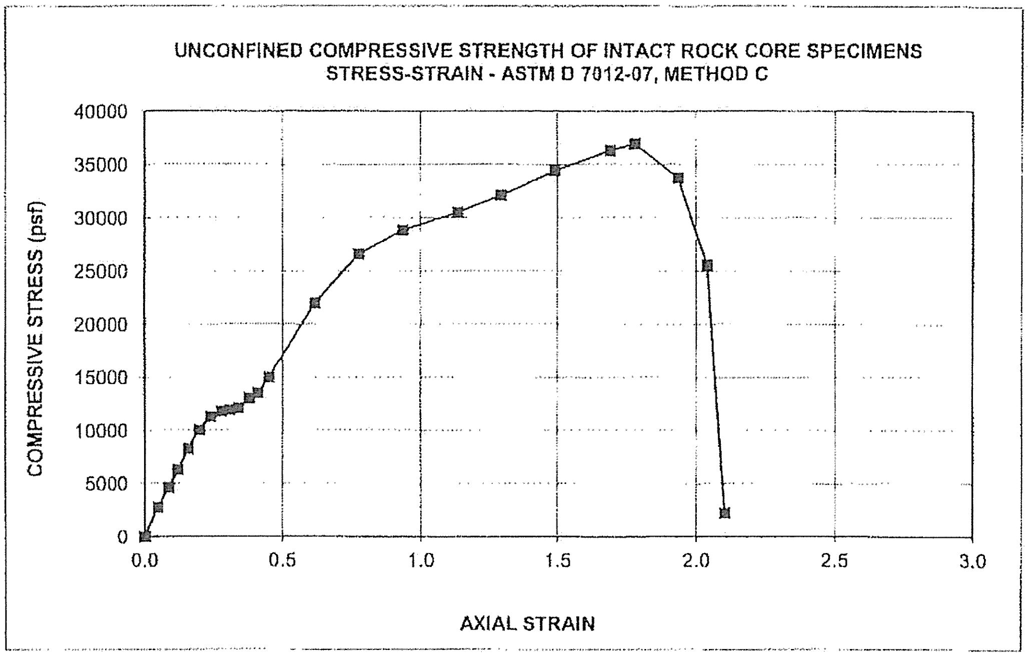


DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray Sandy SHALE	-	-	-	B-119R, C-13
	SAMPLE TYPE		Core	65'

USCS	-

SAMPLE DATA

Wet Density (pcf)	139.7	TIME TO FAILURE (min)	3.7
Dry Density (pcf)	122.5	STRAIN @ FAILURE (%)	1.8
Moisture Content	14.1%	TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	36921.5
SHEAR STRENGTH (psf)	18460.7

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

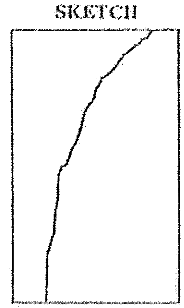
PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-120R, C-11
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	38'

SAMPLE DATA		WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Height (in)	3.676	Tare No.	-	-
Diameter (in)	2.046	Wt. Wet Soil & Tare (gm)	481.99	488.77
Height/Diameter Ratio	1.80	Wt. Dry Soil & Tare (gm)	458.48	465.34
Area (in^2)	3.29	Wt. Tare (gm)	0.00	8.32
Volume (ft^3)	0.0070	Wt. Moisture (gm)	23.51	23.43
Weight (gm)	481.99	Wt. Dry Soil (gm)	458.48	457.02
Wet Density (pcf)	151.86	Moisture (%)	5.13%	5.13%
Dry Density (pcf)	144.45			
Machine Speed (in/min)	0.019			
Strain rate (%/min)	0.52			

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.29	0.0	0.0
0.1	0.003	25.0	0.07	3.29	1092.9	7.6
0.2	0.004	45.1	0.11	3.29	1973.1	13.7
0.3	0.006	79.7	0.15	3.29	3486.7	24.2
0.4	0.007	119.2	0.20	3.29	5210.5	36.2
0.4	0.008	145.0	0.22	3.30	6335.3	44.0
0.5	0.009	169.9	0.25	3.30	7424.2	51.6
0.5	0.010	186.0	0.28	3.30	8125.9	56.4
0.6	0.011	198.1	0.30	3.30	8651.3	60.1
0.6	0.012	217.5	0.33	3.30	9492.9	65.9
0.7	0.013	225.5	0.35	3.30	9841.8	68.3
0.8	0.015	252.9	0.41	3.30	11030.6	76.6
1.0	0.020	351.9	0.54	3.31	15331.0	106.5
1.3	0.025	631.4	0.67	3.31	27468.9	190.8
1.5	0.029	1047.0	0.80	3.31	45490.3	315.9
1.8	0.034	1633.3	0.93	3.32	70871.5	492.2
2.0	0.039	2341.2	1.06	3.32	101455.4	704.6
2.3	0.044	3168.3	1.19	3.33	137119.1	952.2
2.6	0.050	4421.4	1.36	3.33	191017.3	1326.5
3.0	0.056	5527.9	1.53	3.34	238404.3	1655.6
3.3	0.062	6003.9	1.69	3.34	258523.8	1795.3
3.3	0.064	5834.8	1.73	3.35	251134.1	1744.0
3.4	0.064	1187.9	1.74	3.35	51123.4	355.0
3.5	0.067	947.9	1.83	3.35	40755.2	283.0
		UNCONFINED COMPRESSIVE STRENGTH			258523.8	1795.3
		SHEAR STRENGTH			129261.9	897.7

TIME TO FAILURE (min)	3.3
STRAIN @ FAILURE (%)	1.7
TYPE OF FAILURE	SHEAR

FAILURE SKETCH



Description	Brown SANDSTONE	LL	-
		PL	-
		PI	-
USCS	-		

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

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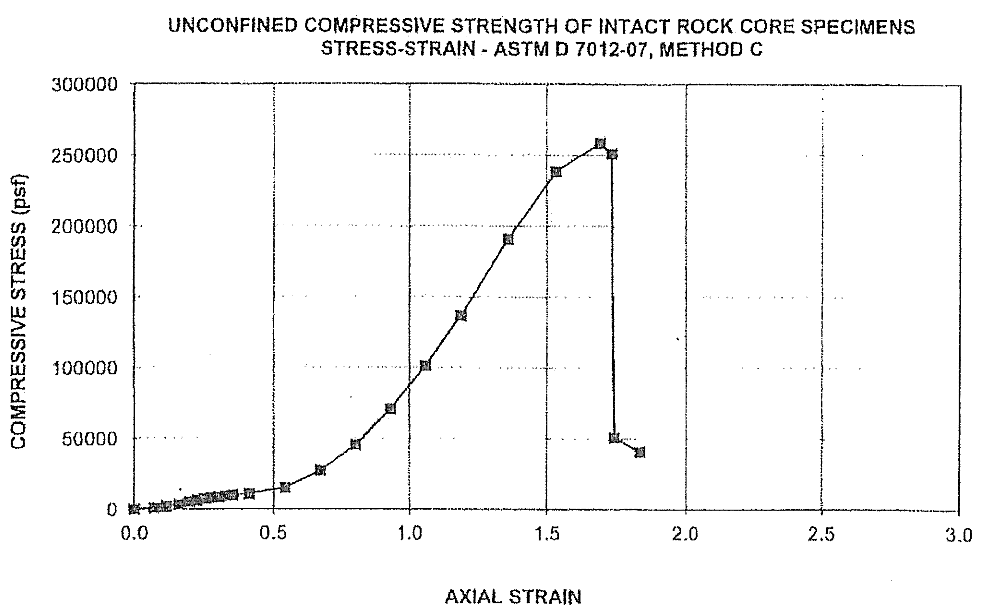


DESCRIPTION	LL	PL	PI	SAMPLE ID
Brown SANDSTONE	-	-	-	B-120R, C-11
	SAMPLE TYPE		Core	38'

USCS	-

Note: Not tested in accordance with ASTM standards due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	151.9	TIME TO FAILURE (min)	3.3
Dry Density (pcf)	144.5	STRAIN @ FAILURE (%)	1.7
Moisture Content	5.1%	TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	258523.8
SHEAR STRENGTH (psf)	129261.9

093-94479

REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHTOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-120R, C-13
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	55'

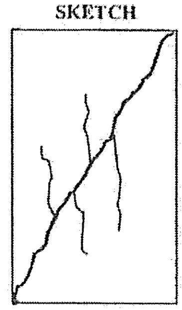
SAMPLE DATA	
Height (in)	3.939
Diameter (in)	1.953
Height/Diameter Ratio	2.02
Area (in^2)	3.00
Volume (ft^3)	0.0068
Weight (gm)	444.11
Wet Density (pcf)	143.31
Dry Density (pcf)	126.98
Machine Speed (in/min)	0.019
Strain rate (%/min)	0.48

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	444.11	437.47
Wt. Dry Soil & Tare (gm)	393.49	388.56
Wt. Tare (gm)	0.00	8.39
Wt. Moisture (gm)	50.62	48.91
Wt. Dry Soil (gm)	393.49	380.17
Moisture (%)	12.87%	12.87%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.00	0.0	0.0
0.1	0.002	29.0	0.05	3.00	1393.3	9.7
0.2	0.004	58.0	0.10	3.00	2784.6	19.3
0.3	0.007	104.7	0.17	3.00	5024.4	34.9
0.5	0.009	156.2	0.23	3.00	7492.9	52.0
0.6	0.012	207.0	0.30	3.00	9919.1	68.9
0.7	0.014	237.6	0.35	3.01	11380.0	79.0
0.8	0.016	252.9	0.40	3.01	12107.5	84.1
0.9	0.018	259.3	0.45	3.01	12409.8	86.2
1.0	0.020	269.8	0.50	3.01	12904.6	89.6
1.1	0.022	312.5	0.55	3.01	14938.7	103.7
1.2	0.023	372.1	0.59	3.01	17779.3	123.5
1.3	0.025	421.2	0.63	3.01	20118.4	139.7
1.4	0.027	480.8	0.68	3.02	22954.0	159.4
1.5	0.029	533.2	0.73	3.02	25440.9	176.7
1.6	0.031	584.7	0.78	3.02	27886.6	193.7
1.9	0.036	690.2	0.92	3.02	32870.5	228.3
2.4	0.046	804.6	1.17	3.03	38223.7	265.4
2.9	0.055	914.1	1.41	3.04	43321.3	300.8
3.4	0.065	1026.8	1.65	3.05	48544.5	337.1
3.9	0.075	1121.0	1.90	3.05	52859.8	367.1
4.2	0.079	1040.5	2.01	3.06	49011.3	340.4
4.2	0.080	788.4	2.04	3.06	37126.2	257.8
4.5	0.086	53.2	2.19	3.06	2499.3	17.4
				UNCONFINED COMPRESSIVE STRENGTH	52859.8	367.1
				SHEAR STRENGTH	26429.9	183.5

TIME TO FAILURE (min)	3.9
STRAIN @ FAILURE (%)	1.9
TYPE OF FAILURE	SHEAR

FAILURE SKETCH



Description	Gray Sandy SHALE	LL	-	TECH	DW/DA
		PL	-	DATE	6/16/10
		PI	-	CHECK	DA
USCS	-			REVIEW	AK

Golder Associates Inc.

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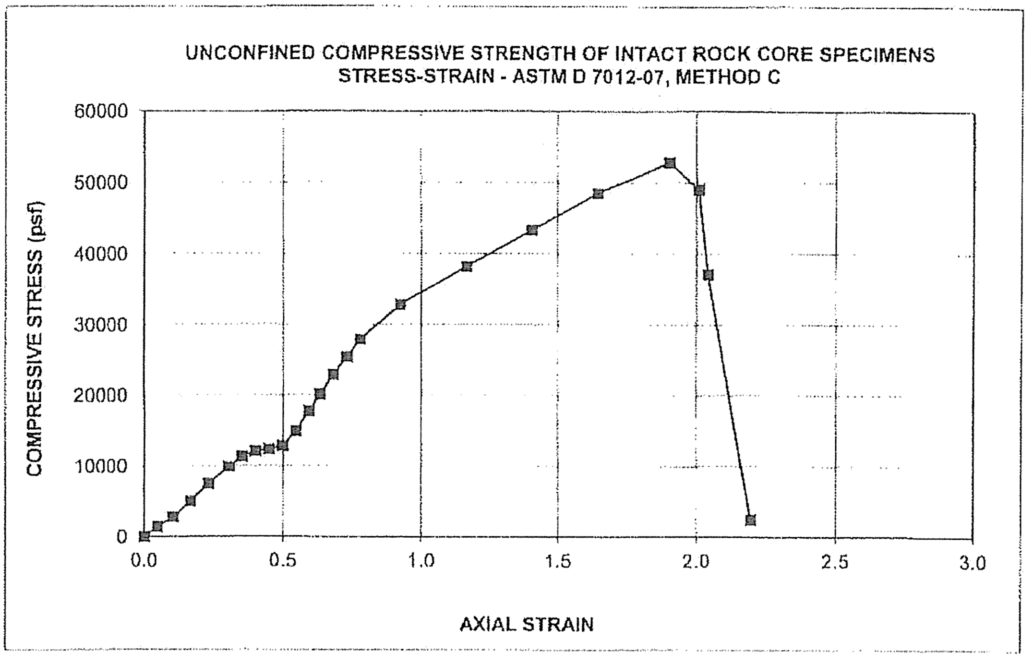


DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray Sandy SHALE	-	-	-	B-120R, C-13
	SAMPLE TYPE		Core	55'

USCS	-

SAMPLE DATA

Wet Density (pcf)	143.3	TIME TO FAILURE (min)	3.9
Dry Density (pcf)	127.0	STRAIN @ FAILURE (%)	1.9
Moisture Content	12.9%	TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	52859.8
SHEAR STRENGTH (psf)	26429.9

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DW/DA
DATE	6/16/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-121R, C-15
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	56.4 - 57.1'

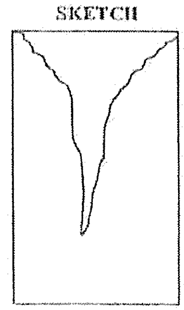
SAMPLE DATA	
Height (in)	4.657
Diameter (in)	1.994
Height/Diameter Ratio	2.34
Area (in^2)	3.12
Volume (ft^3)	0.0084
Weight (gm)	521.55
Wet Density (pcf)	136.56
Dry Density (pcf)	119.25
Machine Speed (in/min)	0.023
Strain rate (%/min)	0.49

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	521.55	526.86
Wt. Dry Soil & Tare (gm)	455.43	461.13
Wt. Tare (gm)	0.00	8.42
Wt. Moisture (gm)	66.12	65.73
Wt. Dry Soil (gm)	455.43	452.71
Moisture (%)	14.52%	14.52%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in²)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	3.12	0.0	0.0
0.0	0.001	32.2	0.02	3.12	1485.4	10.3
0.1	0.003	58.0	0.06	3.12	2672.6	18.6
0.2	0.006	124.8	0.12	3.13	5749.2	39.9
0.4	0.008	186.0	0.18	3.13	8563.4	59.5
0.4	0.010	208.6	0.21	3.13	9598.2	66.7
0.5	0.011	231.1	0.25	3.13	10632.3	73.8
0.6	0.013	239.2	0.28	3.13	10999.0	76.4
0.6	0.015	255.3	0.31	3.13	11735.8	81.5
0.7	0.016	266.6	0.35	3.13	12250.3	85.1
0.8	0.018	286.7	0.38	3.13	13171.1	91.5
0.8	0.019	312.5	0.41	3.14	14350.1	99.7
1.0	0.024	402.7	0.51	3.14	18474.1	128.3
1.4	0.031	552.5	0.67	3.14	25304.7	175.7
1.7	0.039	651.5	0.84	3.15	29791.9	206.9
2.0	0.047	745.8	1.00	3.15	34044.1	236.4
2.4	0.054	840.0	1.17	3.16	38281.9	265.8
2.7	0.062	927.8	1.33	3.16	42212.0	293.1
3.0	0.070	1004.3	1.50	3.17	45617.8	316.8
3.4	0.077	1070.3	1.66	3.18	48534.4	337.0
3.6	0.084	1102.5	1.79	3.18	49927.6	346.7
3.8	0.088	836.0	1.89	3.18	37819.1	262.6
4.0	0.093	547.6	2.00	3.19	24748.3	171.9
4.2	0.098	128.1	2.10	3.19	5781.3	40.1
				UNCONFINED COMPRESSIVE STRENGTH	49927.6	346.7
				SHEAR STRENGTH	24963.8	173.4

TIME TO FAILURE (min)	3.6
STRAIN @ FAILURE (%)	1.8
TYPE OF FAILURE	Shear

FAILURE SKETCH



Description	Dark Gray SHALE
USCS	-

LL	-
PL	-
PI	-

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

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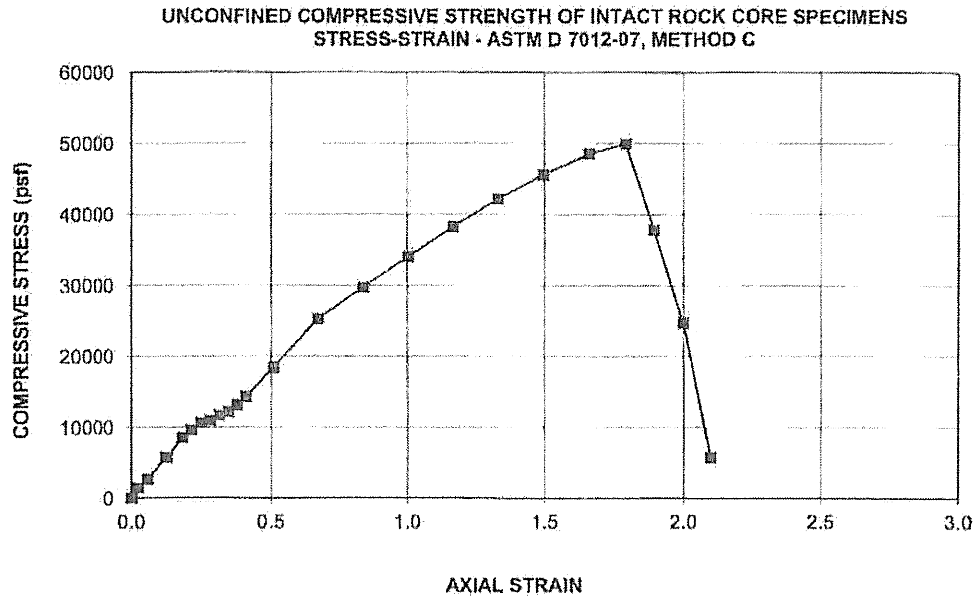


DESCRIPTION	LL	PL	PI	SAMPLE ID
Dark Gray SHALE	-	-	-	B-121R, C-15
	SAMPLE TYPE		Core	56.4 - 57.1'

USCS	-

SAMPLE DATA

Wet Density (pcf)	136.6	TIME TO FAILURE (min)	3.6
Dry Density (pcf)	119.2	STRAIN @ FAILURE (%)	1.8
Moisture Content	14.5%	TYPE OF FAILURE	Shear

UNCONFINED COMPRESSIVE STRENGTH (psf)	49927.6
SHEAR STRENGTH (psf)	24963.8

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-123, C-20
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	82.8 - 83.3'

SAMPLE DATA

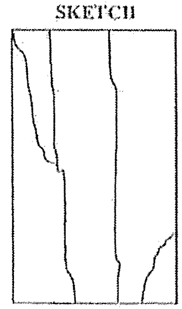
Height (in)	2.769
Diameter (in)	2.003
Height/Diameter Ratio	1.38
Area (in^2)	3.15
Volume (ft^3)	0.0050
Weight (gm)	357.39
Wet Density (pcf)	155.97
Dry Density (pcf)	149.08
Machine Speed (in/min)	0.014
Strain rate (%/min)	0.51

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	357.39	361.73
Wt. Dry Soil & Tare (gm)	341.60	346.12
Wt. Tare (gm)	0.00	8.34
Wt. Moisture (gm)	15.79	15.61
Wt. Dry Soil (gm)	341.60	337.78
Moisture (%)	4.62%	4.62%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0.0	0.00	3.15	0.0	0.0
0.1	0.001	16.1	0.04	3.15	735.9	5.1
0.2	0.002	17.7	0.08	3.15	809.1	5.6
0.3	0.004	23.4	0.13	3.16	1066.1	7.4
0.3	0.005	48.3	0.18	3.16	2204.8	15.3
0.4	0.006	98.3	0.23	3.16	4480.2	31.1
0.6	0.008	174.8	0.29	3.16	7964.1	55.3
0.7	0.010	227.1	0.35	3.16	10343.0	71.8
0.8	0.011	238.4	0.40	3.16	10850.3	75.3
0.9	0.013	262.6	0.46	3.17	11942.8	82.9
1.0	0.014	271.4	0.52	3.17	12338.5	85.7
1.1	0.016	316.5	0.58	3.17	14380.3	99.9
1.7	0.023	1075.2	0.84	3.18	48722.1	338.3
2.2	0.031	2366.1	1.14	3.19	106899.8	742.4
2.8	0.040	4207.2	1.43	3.20	189513.0	1316.1
3.4	0.048	6354.2	1.73	3.21	285368.7	1981.7
4.0	0.056	8665.6	2.02	3.22	388005.7	2694.5
4.6	0.064	10953.0	2.32	3.23	488948.1	3395.5
4.8	0.068	11915.0	2.44	3.23	531204.1	3688.9
5.1	0.072	12777.0	2.59	3.23	568799.4	3950.0
5.1	0.072	9599.8	2.60	3.24	427284.1	2967.3
5.3	0.075	1014.7	2.70	3.24	45120.9	313.3
5.6	0.078	1055.8	2.82	3.24	46887.6	325.6
5.8	0.081	1003.5	2.92	3.25	44522.5	309.2
		UNCONFINED COMPRESSIVE STRENGTH			568799.4	3950.0
		SHEAR STRENGTH			284399.7	1975.0

TIME TO FAILURE (min)	5.1
STRAIN @ FAILURE (%)	2.6
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH

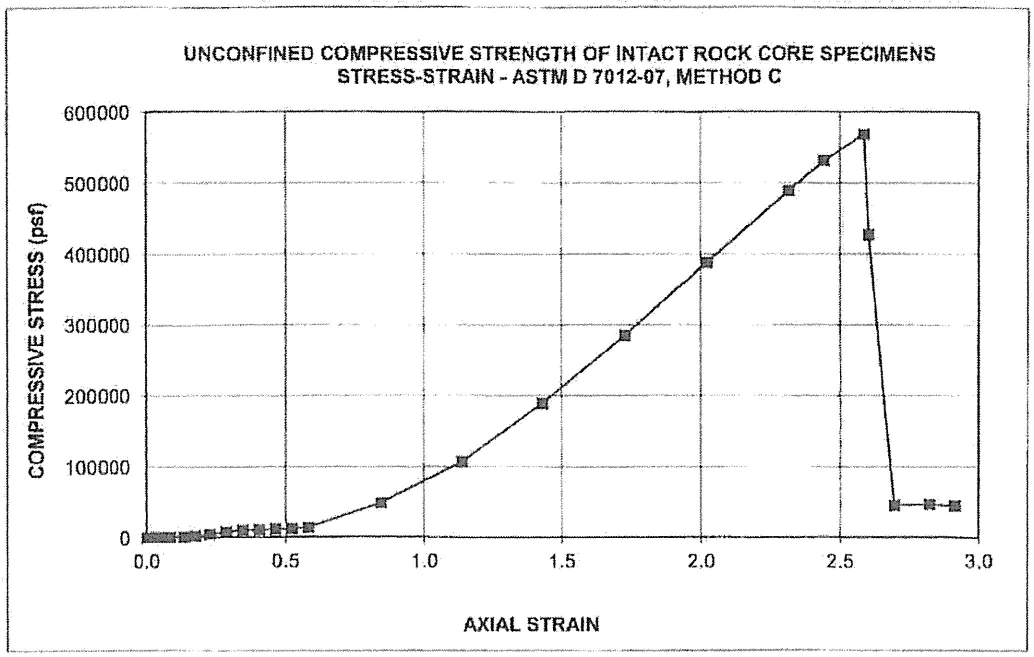


Description	Gray SHALE	LL	-
		PL	-
		PI	-
USCS	-		

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014



DESCRIPTION	LL	PL	PI	SAMPLE ID
Gray SHALE	-	-	-	B-123, C-20
	SAMPLE TYPE		Core	82.8 - 83.3'

USCS	-

Note: Non-ASTM due to the length of the sample received.

SAMPLE DATA

Wet Density (pcf)	156.0	TIME TO FAILURE (min)	5.1
Dry Density (pcf)	149.1	STRAIN @ FAILURE (%)	2.6
Moisture Content	4.6%	TYPE OF FAILURE	Long. Splitting

UNCONFINED COMPRESSIVE STRENGTH (psf)	568799.4
SHEAR STRENGTH (psf)	284399.7

093-94479
REPUBLIC/SOIL BORING PLAN/TX

TECH	DA
DATE	8/4/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012-07, METHOD C

PROJECT TITLE	REPUBLIC/SOIL BORING PLAN/TX	SAMPLE ID	B-129, C-12
PROJECT NO.	093-94479	SAMPLE TYPE	Core
REMARKS	-	SAMPLE DEPTH	40.7 - 41.1'

SAMPLE DATA

Height (in)	2.701
Diameter (in)	1.910
Height/Diameter Ratio	1.41
Area (in^2)	2.87
Volume (ft^3)	0.0045
Weight (gm)	302.65
Wet Density (pcf)	148.92
Dry Density (pcf)	136.63
Machine Speed (in/min)	0.014
Strain rate (%/min)	0.52

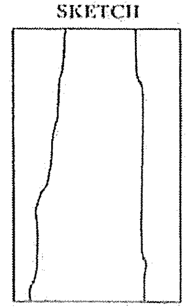
WATER CONTENT

	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	
Wt. Wet Soil & Tare (gm)	302.65	309.57
Wt. Dry Soil & Tare (gm)	277.69	284.73
Wt. Tare (gm)	0.00	8.39
Wt. Moisture (gm)	24.96	24.84
Wt. Dry Soil (gm)	277.69	276.34
Moisture (%)	8.99%	8.99%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	Ac (in²)	COMPRESSIVE STRESS (psf)	(psi)
0.0	0.000	0.0	0.00	2.87	0.0	0.0
0.2	0.003	12.9	0.12	2.87	647.0	4.5
0.5	0.008	15.3	0.28	2.87	767.3	5.3
0.8	0.011	20.9	0.42	2.88	1048.0	7.3
1.1	0.015	26.6	0.55	2.88	1328.5	9.2
1.3	0.018	33.0	0.68	2.88	1648.2	11.4
1.5	0.021	37.9	0.78	2.89	1888.0	13.1
1.7	0.024	44.3	0.87	2.89	2207.0	15.3
1.9	0.026	50.7	0.97	2.89	2525.4	17.5
2.0	0.029	55.6	1.06	2.90	2763.2	19.2
2.2	0.031	62.0	1.16	2.90	3080.9	21.4
2.4	0.034	68.5	1.25	2.90	3397.6	23.6
3.1	0.043	94.2	1.59	2.91	4660.6	32.4
4.0	0.056	133.7	2.06	2.93	6580.3	45.7
4.9	0.069	176.4	2.54	2.94	8639.5	60.0
5.8	0.081	218.3	3.01	2.95	10638.7	73.9
6.7	0.094	253.7	3.49	2.97	12305.1	85.5
7.6	0.107	280.3	3.96	2.98	13527.4	93.9
8.6	0.120	297.2	4.44	3.00	14272.6	99.1
9.1	0.128	304.4	4.74	3.01	14573.6	101.2
9.7	0.135	294.8	5.01	3.02	14072.0	97.7
10.6	0.148	268.2	5.49	3.03	12739.4	88.5
11.5	0.161	260.1	5.96	3.05	12294.5	85.4
12.4	0.174	235.2	6.43	3.06	11059.6	76.8
				UNCONFINED COMPRESSIVE STRENGTH	14573.6	101.2
				SHEAR STRENGTH	7286.8	50.6

TIME TO FAILURE (min)	9.1
STRAIN @ FAILURE (%)	4.7
TYPE OF FAILURE	Long. Splitting

FAILURE SKETCH



Description	Gray SANDSTONE	LL	-
		PL	-
		PI	-
USCS	-		

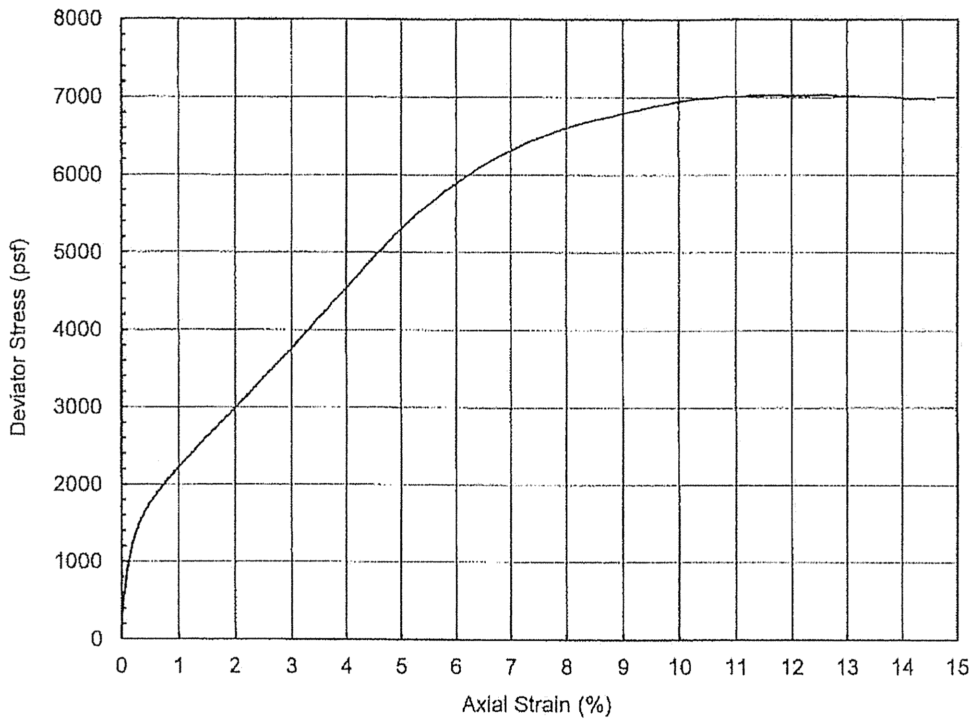
TECH	DA
DATE	8/5/10
CHECK	DA
REVIEW	AK

Golder Associates Inc.

Permit Issued: February 12, 2014

UNCONSOLIDATED-UNDRAINED TRIAXIAL TEST RESULTS

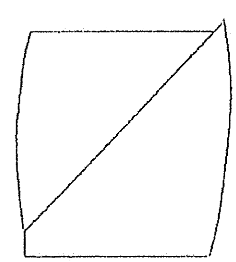
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Brown Lean CLAY with sand						
LL	43	PI	28	LI	0.0	USCS	CL

Depth (ft)	6.00	Confining Pressure (psi)	5.2
Specimen Height (inch)	5.7	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	7042
Initial Specimen Weight (g)	1259.1	Axial Strain at Peak Stress (%)	12.6
Moist Unit Weight (pcf)	135.3		
Initial Water Content (%)	16		
Initial Dry Unit Weight (pcf)	116.6		

Project Title	City of Arlington Landfill
Project Number	093-94479
Sample Type	Shelby Tube
Sample ID	B-102 SH-4
Comments	

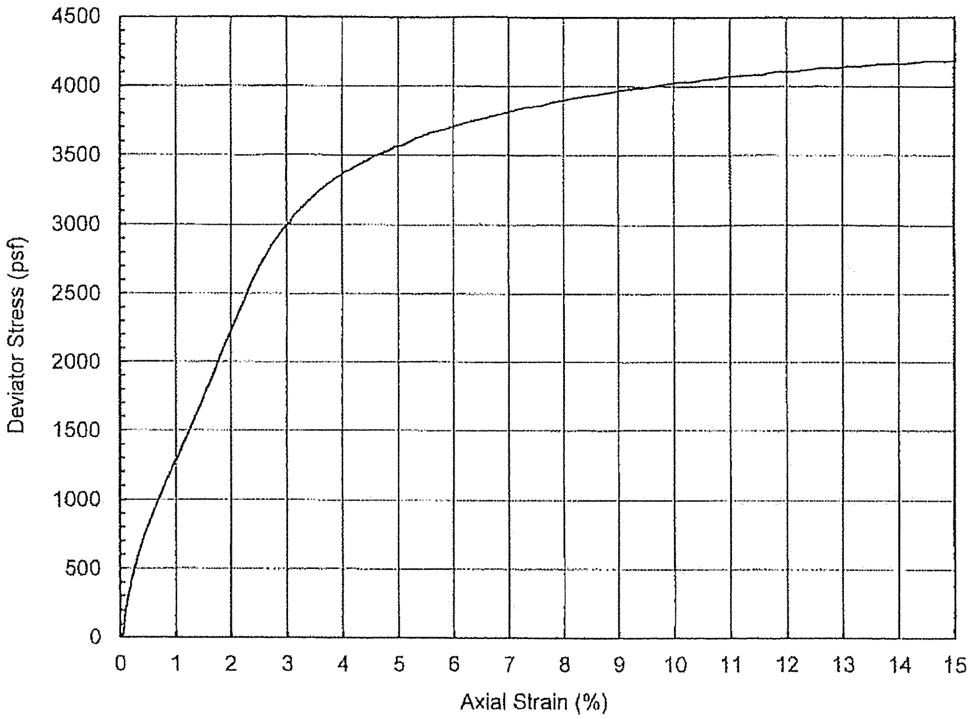


Failure Sketch

Performed by	PN
Date	30-Jul-10
Check	DM
Review	PCM

Golder Associates

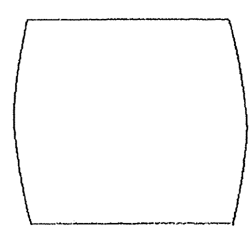
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Brown Lean CLAY						
LL	31	PI	18	LI	0.3	USCS	CL

Depth (ft)	23.00	Confining Pressure (psi)	19.8
Specimen Height (inch)	5.5	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.9	Peak Deviator Stress (psf)	4190
Initial Specimen Weight (g)	1205.8	Axial Strain at Peak Stress (%)	15
Moist Unit Weight (pcf)	129.1		
Initial Water Content (%)	18		
Initial Dry Unit Weight (pcf)	109.5		

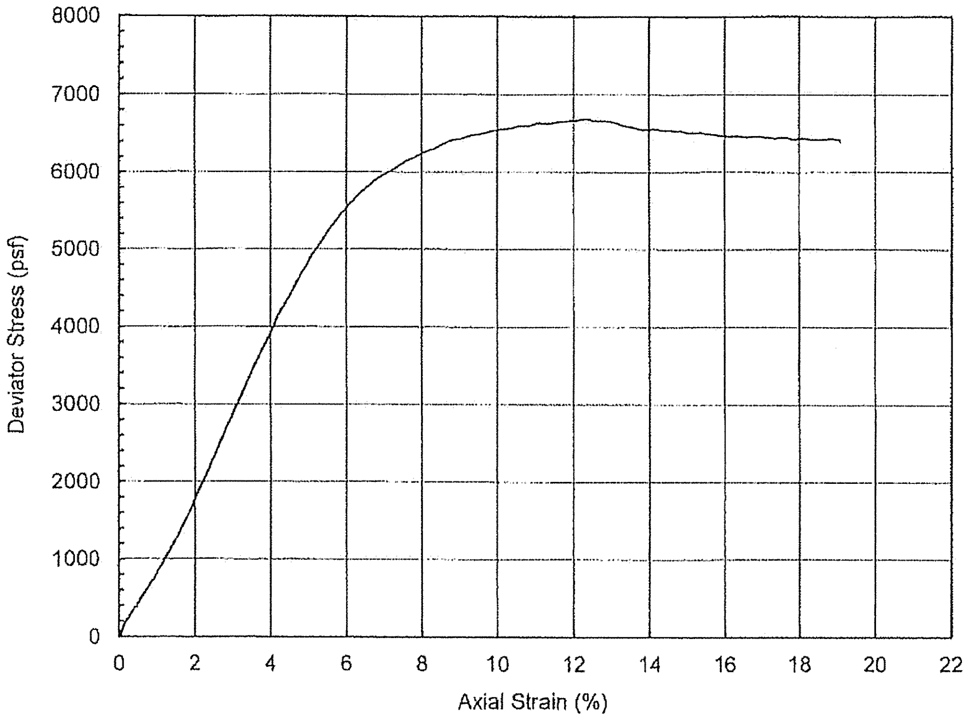
Project Title	City of Arlington Landfill
Project Number	093-94479
Sample Type	Shelby Tube
Sample ID	B-104 SH-8
Comments	


Failure Sketch

Performed by	PN
Date	30-Jul-10
Check	DM
Review	PCM

Golder Associates

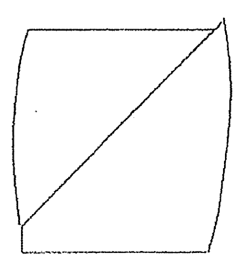
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Light Reddish Brown SAND with silt						
LL	NP	PI	NP	LI	-	USCS	SP-SM

Depth (ft)	8.00	Confining Pressure (psi)	7.5
Specimen Height (inch)	5.7	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	6681
Initial Specimen Weight (g)	1224.5	Axial Strain at Peak Stress (%)	12.3
Moist Unit Weight (pcf)	131.8		
Initial Water Content (%)	19		
Initial Dry Unit Weight (pcf)	111.2		

Project Title	City of Arlington Landfill
Project Number	093-94479
Sample Type	Shelby Tube
Sample ID	B-119R SH-5
Comments	

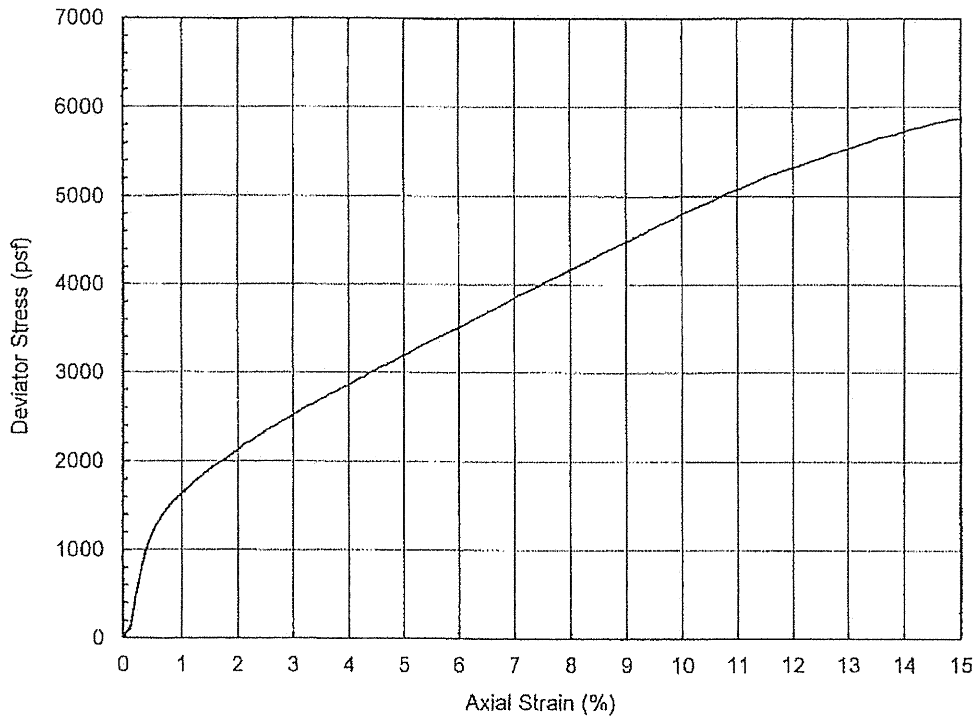


Failure Sketch

Performed by	PN
Date	6-Jul-10
Check	SBK
Review	PCM

Golder Associates

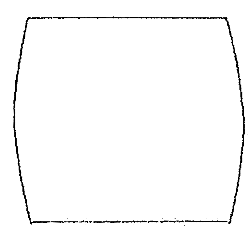
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Brown Lean CLAY with sand						
LL	-	PI	-	LI	-	USCS	CL

Depth (ft)	8.00	Confining Pressure (psi)	6.7
Specimen Height (inch)	5.5	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	5884
Initial Specimen Weight (g)	1150.2	Axial Strain at Peak Stress (%)	15
Moist Unit Weight (pcf)	132.8		
Initial Water Content (%)	15		
Initial Dry Unit Weight (pcf)	115.4		

Project Title	City of Arlington Landfill
Project Number	093-94479
Sample Type	Shelby Tube
Sample ID	B-121R SH-4
Comments	

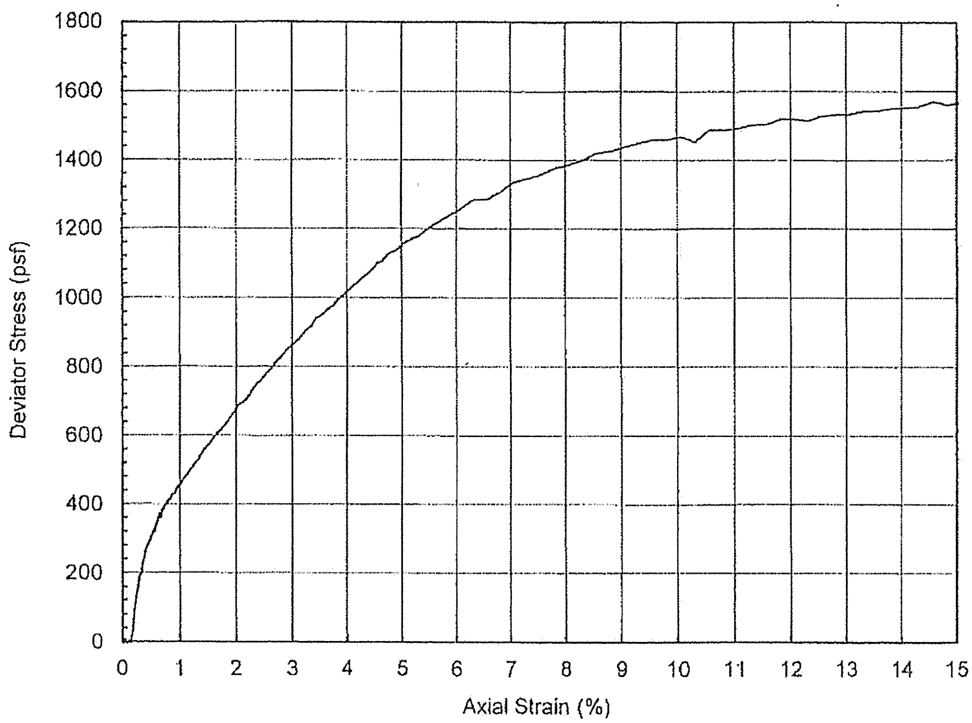


Failure Sketch

Performed by	PN
Date	30-Jul-10
Check	DM
Review	PCM

Golder Associates

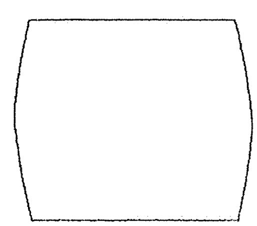
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Brown Lean CLAY						
LL	37	PI	22	LI	0.5	USCS	CL

Depth (ft)	13.0	Confining Pressure (psf)	1698
Specimen Height (inch)	5.3	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	1570
Initial Specimen Weight (g)	1105.6	Axial Strain at Peak Stress (%)	15.1
Moist Unit Weight (pcf)	125.5		
Initial Water Content (%)	26		
Initial Dry Unit Weight (pcf)	99.9		

Project Title	City of Arlington Landfill
Project Number	093-94479
Sample Type	Shelby Tube
Sample ID	B-125 SH-5
Comments	

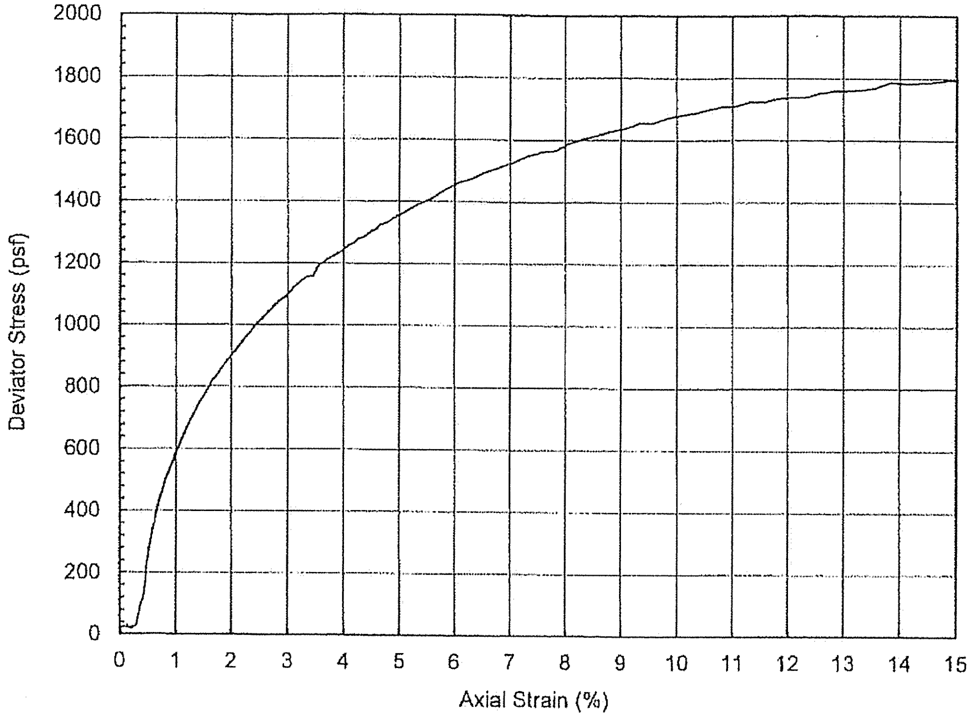


Failure Sketch

Golder Associates

Performed by	PN
Date	6-Jul-10
Check	SBK
Review	PCM

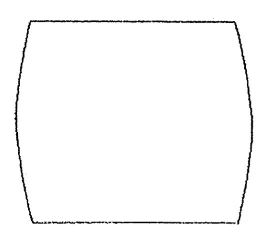
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Dark Brown Lean CLAY with sand						
LL	42	PI	26	LI	0.3	USCS	CL

Depth (ft)	13.0	Confining Pressure (psf)	1701
Specimen Height (inch)	5.6	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	1795
Initial Specimen Weight (g)	1179.3	Axial Strain at Peak Stress (%)	15.1
Moist Unit Weight (pcf)	125.9		
Initial Water Content (%)	25		
Initial Dry Unit Weight (pcf)	101.0		

Project Title	City of Arlington Landfill
Project Number	093-94479
Sample Type	Shelby Tube
Sample ID	B-129 SH-6
Comments	

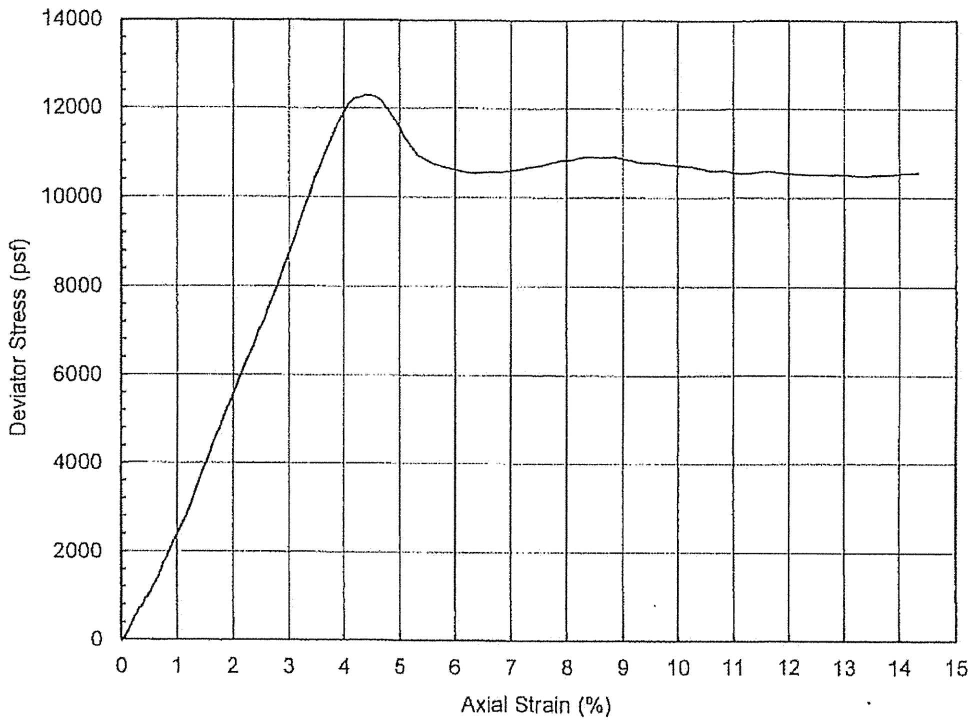


Failure Sketch

Golder Associates

Performed by	PN
Date	6-Jul-10
Check	SBK
Review	PCM

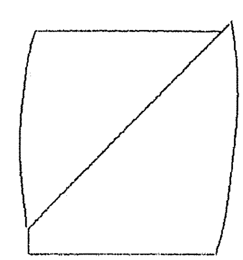
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Gray, interbedded, SHALE and SANDSTONE						
LL	-	PI	-	LI	-	USCS	-

Depth (ft)	31.2	Confining Pressure (psf)	3928
Specimen Height (inch)	4.1	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.0	Peak Deviator Stress (psf)	12294
Initial Specimen Weight (g)	443.1	Axial Strain at Peak Stress (%)	4.4
Moist Unit Weight (pcf)	131.5		
Initial Water Content (%)	13		
Initial Dry Unit Weight (pcf)	116.5		

Project Title	City of Arlington Landfill
Project Number	073-9407711
Sample Type	Core Barrel
Sample ID	B-105 C-10
Comments	



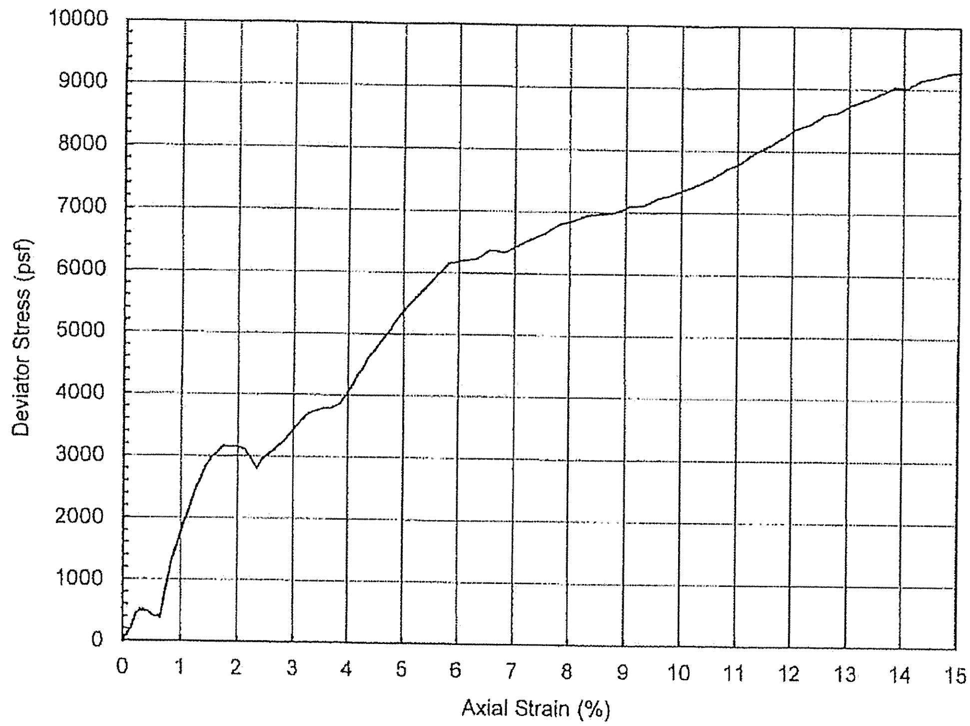
Failure Sketch

Golder Associates

Performed by	PN
Date	27-Dec-10
Check	SBK
Review	PCM

Permit Issued: February 12, 2014

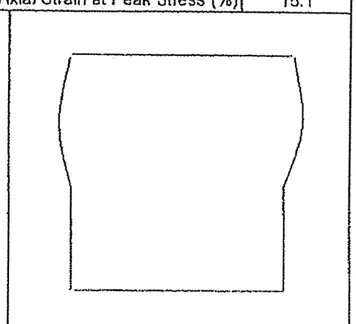
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Dark gray, SILTSTONE						
LL	-	PI	-	LI	-	USCS	-

Depth (ft)	26.5	Confining Pressure (psf)	3354
Specimen Height (inch)	4.3	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.0	Peak Deviator Stress (psf)	9295
Initial Specimen Weight (g)	480.0	Axial Strain at Peak Stress (%)	15.1
Moist Unit Weight (pcf)	136.4		
Initial Water Content (%)	14		
Initial Dry Unit Weight (pcf)	119.8		

Project Title	City of Arlington Landfill
Project Number	073-9407711
Sample Type	Core Barrel
Sample ID	B-107 C-8
Comments	



Failure Sketch

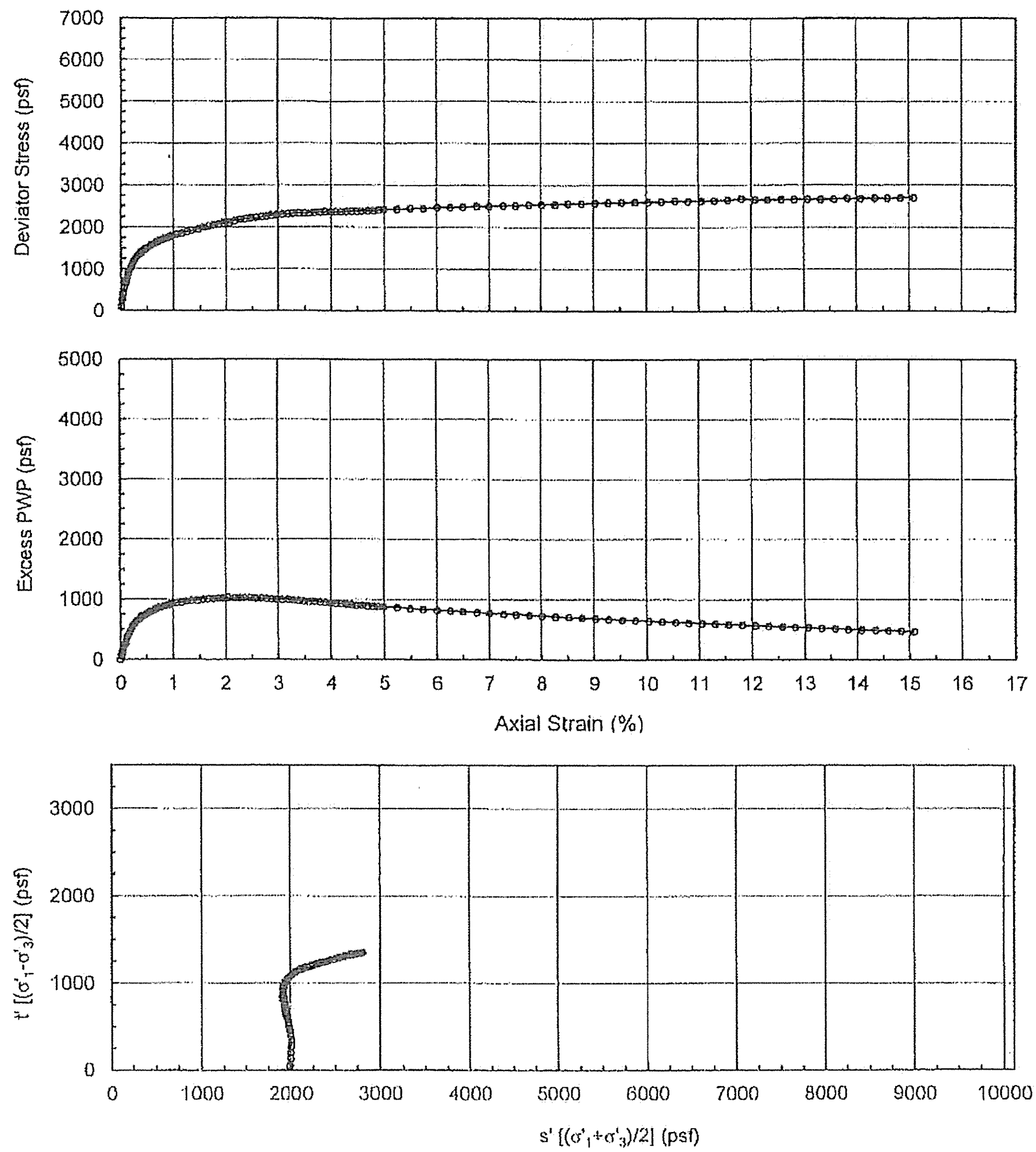
Golder Associates

Performed by	PN
Date	27-Dec-10
Check	SBK
Review	PCM

CONSOLIDATED UNDRAINED WITH PORE PRESSURES TRIAXIAL TEST RESULTS

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 29-Jul-10
Boring Number: B-104 **Specimen Name:** SH-2 **Depth (ft):** 2.0

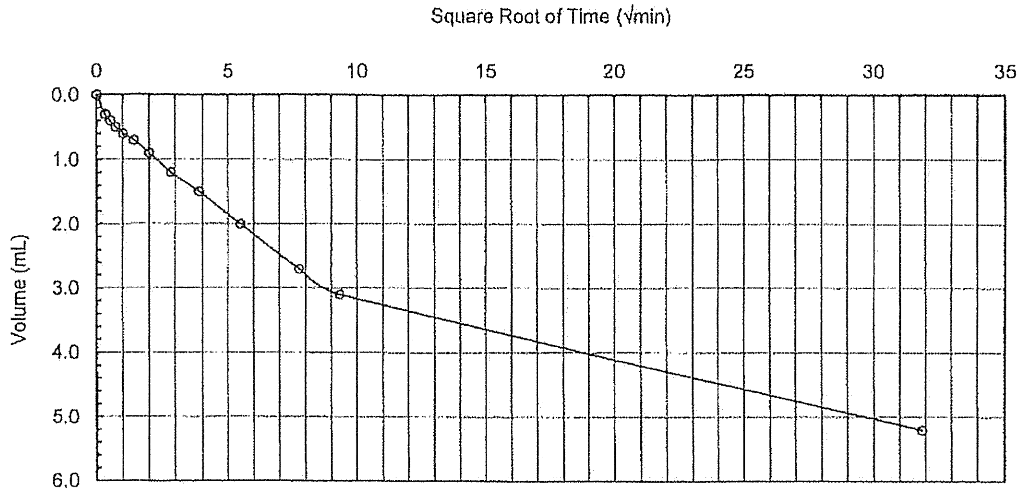


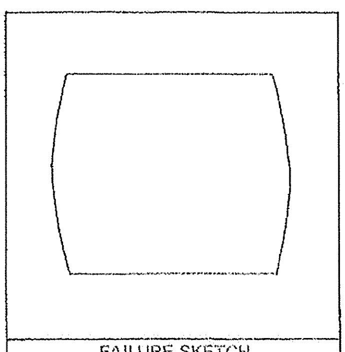
Specimen Description: Brown Fat CLAY			
Initial Specimen Diameter (inch) =	2.95	Initial Specimen Height (inch) =	5.52
Initial Water Content (%) =	24.9	Water Content at End of Test (%) =	28.1
Initial Moist Unit Weight (pcf) =	114.9	B-value =	1.00
Back Pressure (BP, psf) =	5760	Consolidation Stress (σ'_3, psf) =	1939
Initial Lateral Stress (σ'_3, psf) =	1939	Consolidation t_{50} (min) =	28
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =	105	Rebound Stress (σ'_3, psf) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA
LL = 70 PI = 47	USCS	CH Performed by	DM
Comments: Stage I		Reviewed by	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill
Project Number: 093-94479
Date: 29-Jul-10
Boring Number: B-104
Specimen Name: SH-2
Depth (ft): 2.0





Consolidation Stress (σ'_3, psf) =			1939
Consolidation t_{50} (min) =			28
Consolidation Volume Change (mL) =			5.2
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	70	PI =	47
USCS	CH		
Gs =	2.65	assumed	

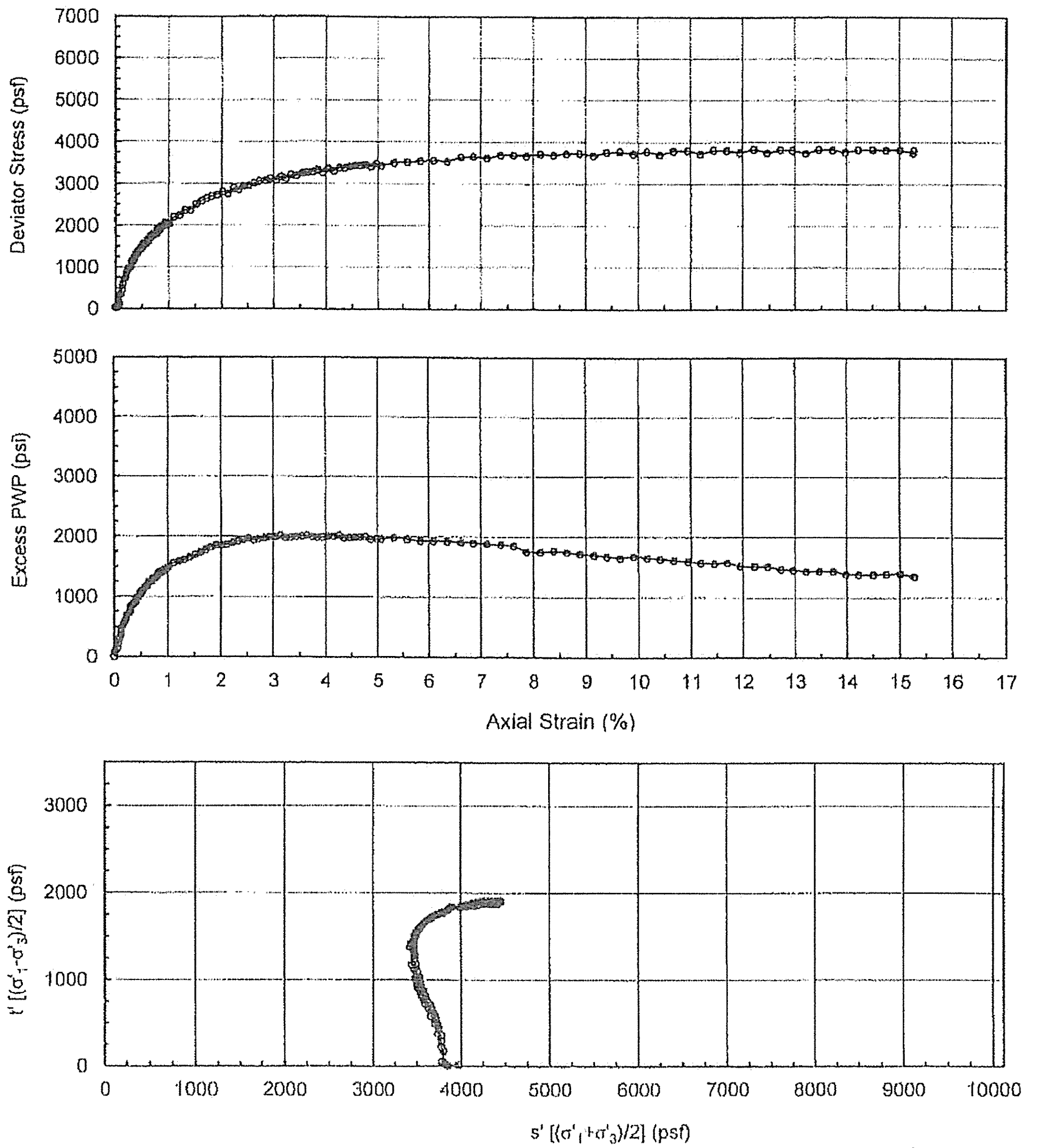
Performed by	DM
Reviewed by	PCM

Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 03-Aug-10
Boring Number: B-104 **Specimen Name:** SH-3 **Depth (ft):** 4.0



Specimen Description: Brown Fat CLAY

Initial Specimen Diameter (inch) =	2.85	Initial Specimen Height (inch) =	5.61
Initial Water Content (%) =	24.9	Water Content at End of Test (%) =	25.8
Initial Moist Unit Weight (pcf) =	126.0	B-value =	0.95
Back Pressure (BP, psf) =	5760	Consolidation Stress (σ'_3, psf) =	3950
Initial Lateral Stress (σ'_3, psf) =	3950	Consolidation t_{50} (min) =	100
Initial Deviator Stress (σ_1 - σ_3, psf) =	32	Rebound Stress (σ'_3, psf) =	NA
Test Strain Rate (%/hour) =	0.2	Rebound t_{50} (min) =	NA

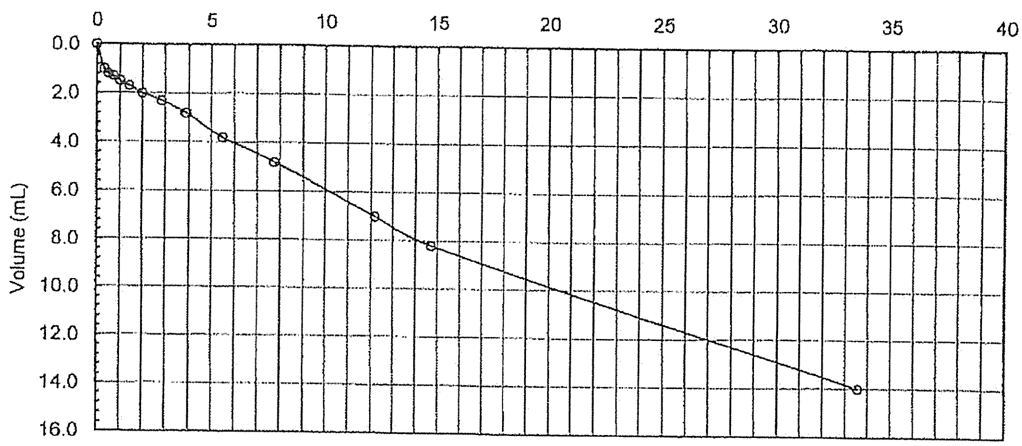
LL =	-	PI =	-	USCS	CH	Performed by	SBK
Comments: Stage 2						Reviewed by	PCM

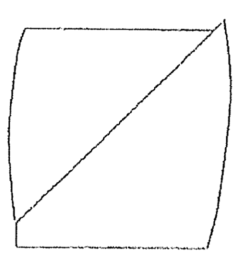
Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill
Boring Number: B-104
Project Number: 093-94479
Specimen Name: SH-3
Date: 03-Aug-10
Depth (ft): 4.0





FAILURE SKETCH

Consolidation Stress (σ'_3, psf) =	3950
Consolidation t_{50} (min) =	100
Consolidation Volume Change (mL) =	14.0
Unloading Stress (psf) =	NA
Unloading t_{50} (min) =	NA
Unloading Volume Change (mL) =	NA

LL =	-	PI =	-
USCS	CH		
Gs =	2.65	assumed	

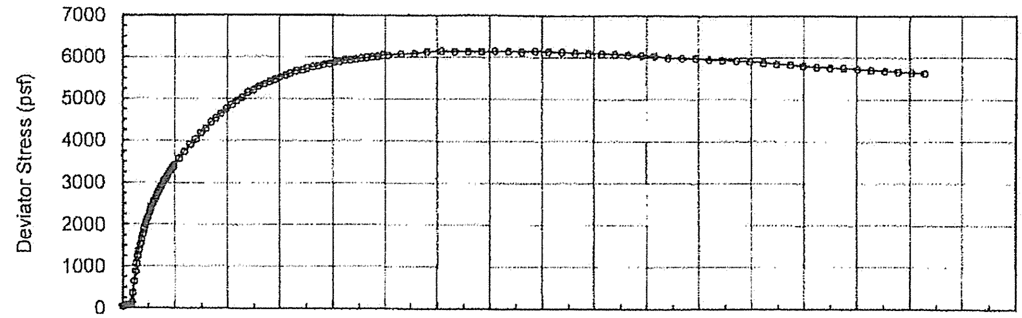
Performed by	SBK
Reviewed by	PCM

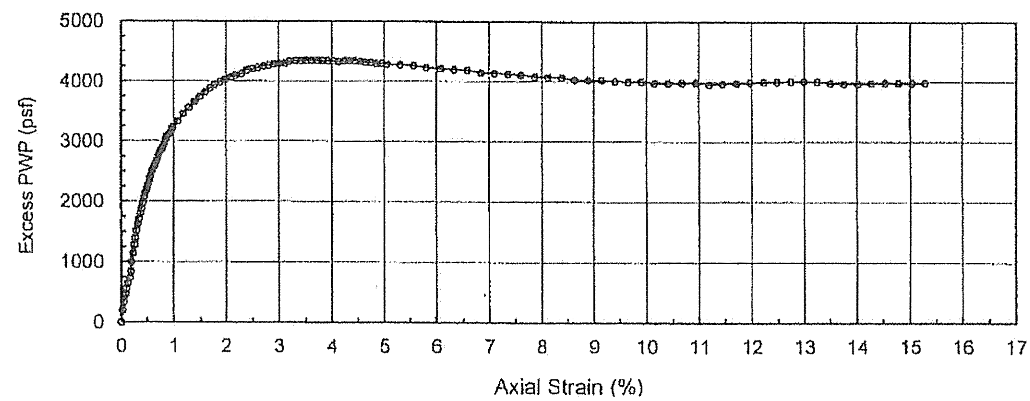
Golder Associates

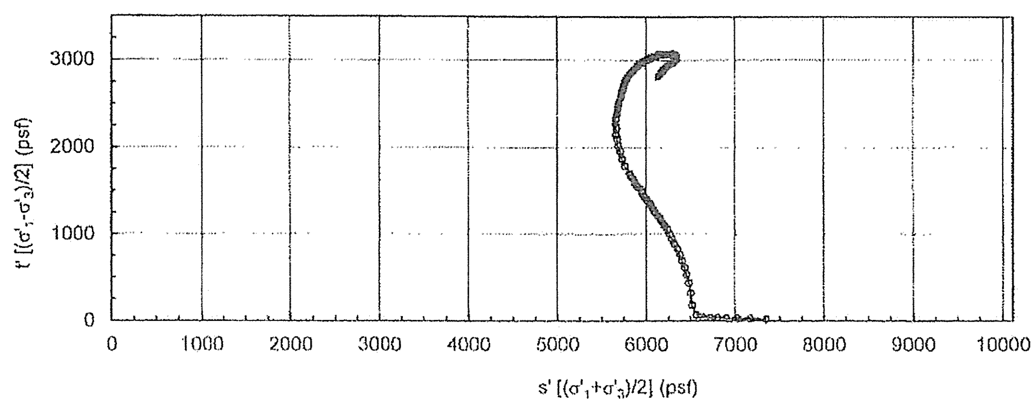
Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title:	City of Arlington Landfill	**Project Number:**	093-94479	**Date:**	03-Aug-10
Boring Number:	B-104	**Specimen Name:**	SH-4	**Depth (ft):**	6.0







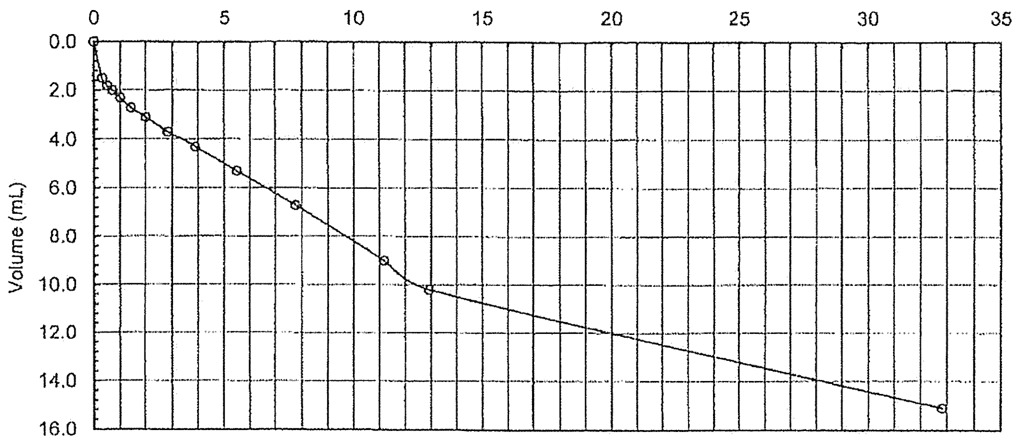
Specimen Description:	Brown Fat CLAY				
Initial Specimen Diameter (inch) =		2.86	Initial Specimen Height (inch) =		5.49
Initial Water Content (%) =		21.2	Water Content at End of Test (%) =		22.2
Initial Moist Unit Weight (pcf) =		131.2	B-value =		0.99
Back Pressure (BP, psf) =		2880	Consolidation Stress (σ'_3, psf) =		7321
Initial Lateral Stress (σ'_3, psf) =		7321	Consolidation t_{50} (min) =		60
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =		44	Rebound Stress (σ'_3, psf) =		NA
Test Strain Rate (%/hour) =		0.4	Rebound t_{50} (min) =		NA
LL = -	PI = -	USCS	CH	Performed by	SBK
Comments: Stage 3				Reviewed by	PCM

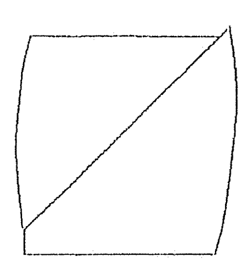
Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill
Project Number: 093-94479
Date: 03-Aug-10
Boring Number: B-104
Specimen Name: SH-4
Depth (ft): 6.0





FAILURE SKETCH

Consolidation Stress (σ'_3, psf) =			7321
Consolidation t_{50} (min) =			60
Consolidation Volume Change (mL) =			15.1
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	-	PI =	-
USCS	CH		
Gs =	2.65	assumed	

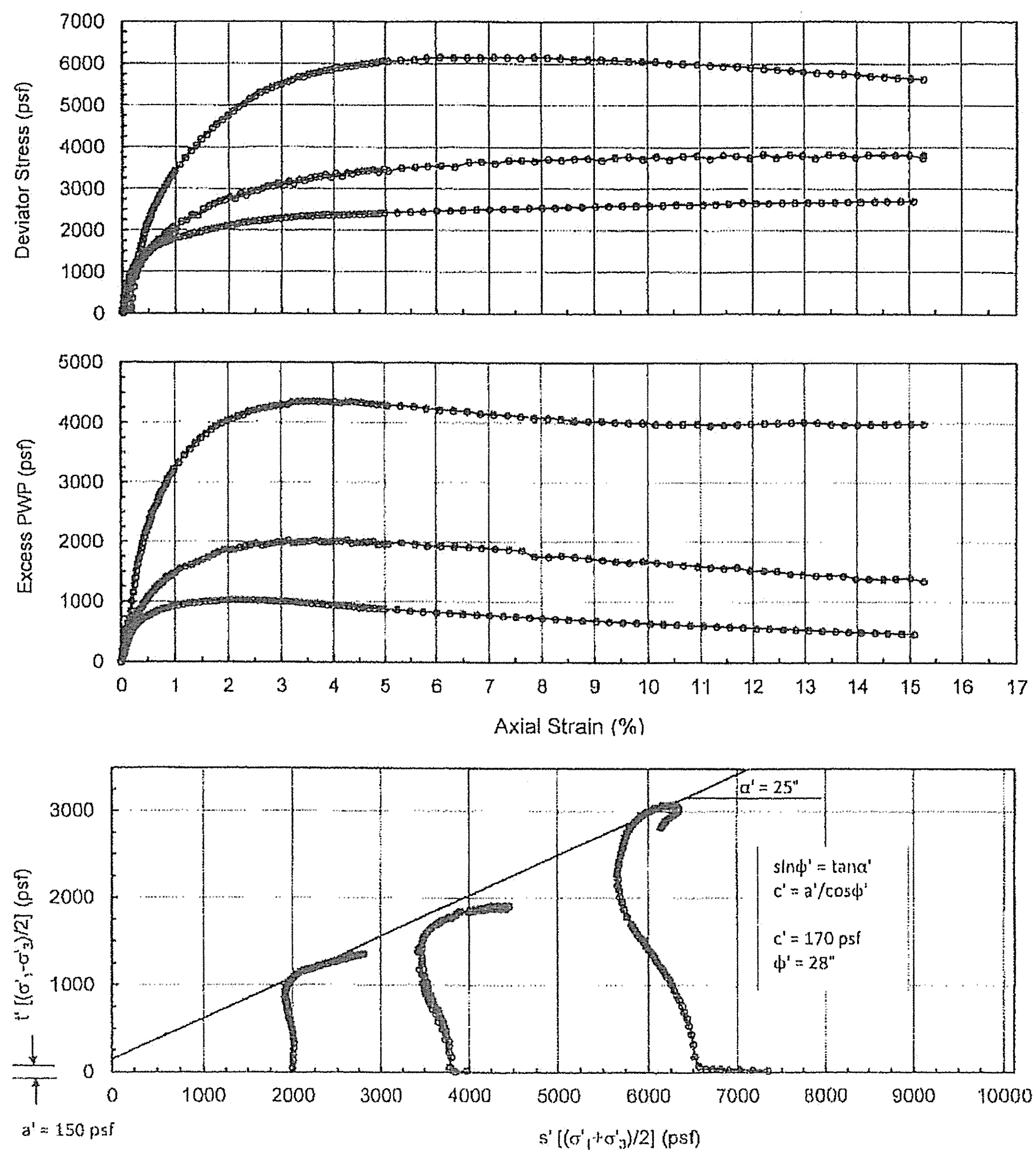
Performed by SBK
Reviewed by PCM

Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title:	City of Arlington Landfill	**Project Number:**	093-94479	**Date:**	03-Aug-10
Boring Number:	B-104	**Specimen Name:**	SH-4	**Depth (ft):**	6.0



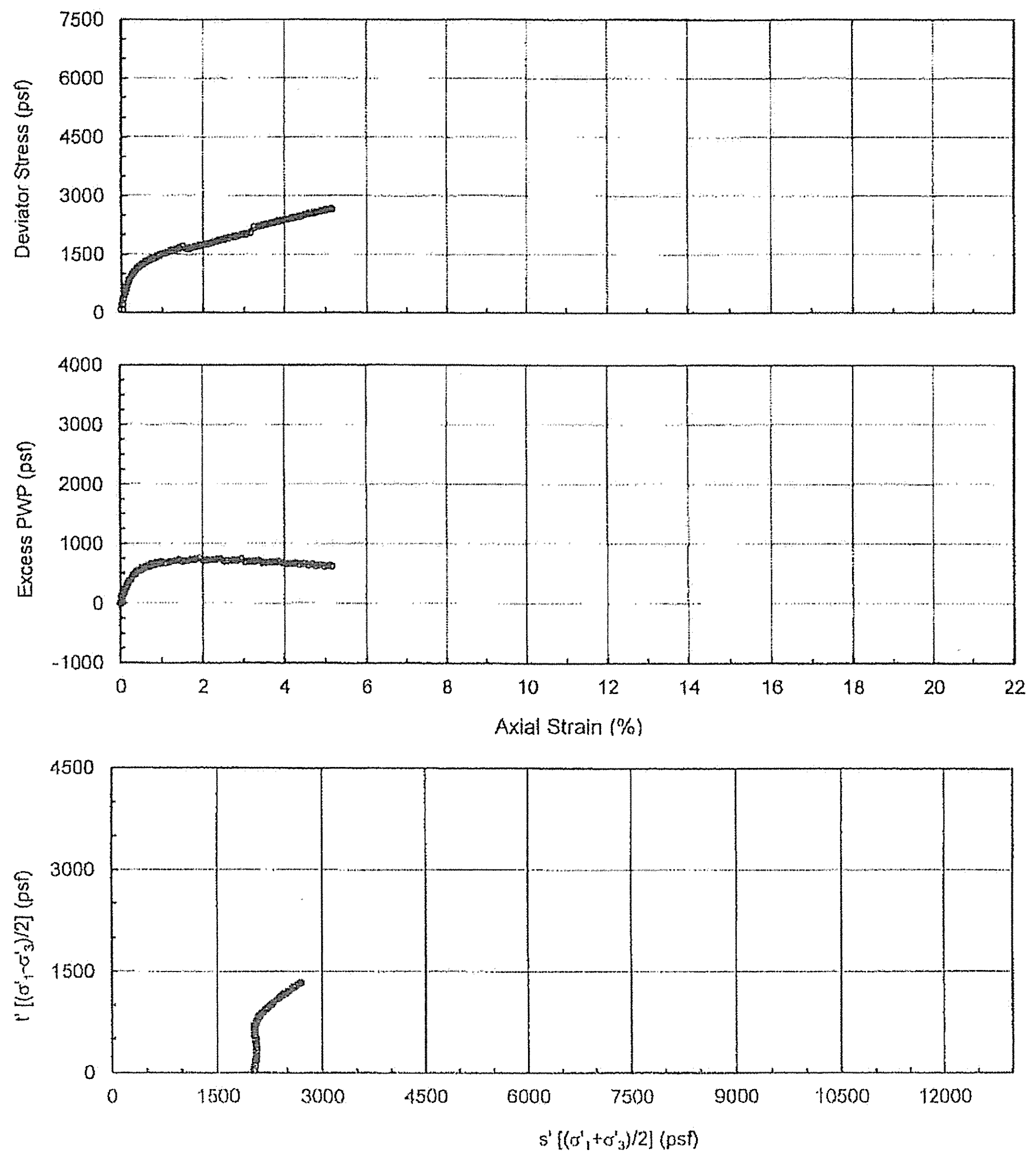
Specimen Description:	Brown Fat CLAY		
Initial Specimen Diameter (inch) =		Initial Specimen Height (inch) =	
Initial Water Content (%) =		Water Content at End of Test (%) =	
Initial Moist Unit Weight (pcf) =		B-value =	
Back Pressure (BP, psf) =		Consolidation Stress (σ'_3, psf) =	
Initial Lateral Stress (σ'_3, psf) =		Consolidation t_{50} (min) =	
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =		Rebound Stress (σ'_3, psf) =	
Test Strain Rate (%/hour) =		Rebound t_{50} (min) =	

LL =	-	PI =	-	USCS	CH	Performed by	SBK
Comments: 3 Stages on 3 Specimen						Reviewed by	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 23-Jul-10
Boring Number: B-119R **Specimen Name:** SH-3 **Depth (ft):** 4.0

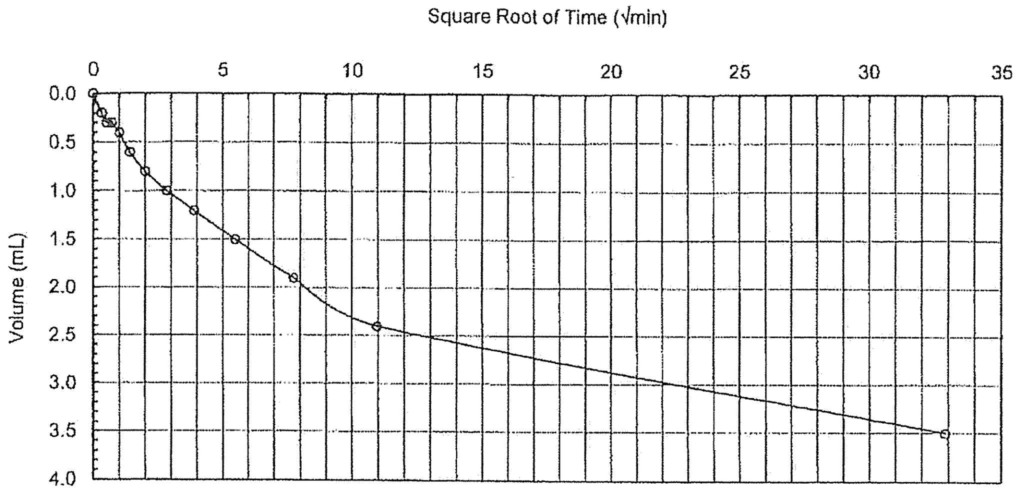


Specimen Description: Dark Brown Lean CLAY with sand					
Initial Specimen Diameter (inch) =		2.85	Initial Specimen Height (inch) =		5.59
Initial Water Content (%) =		18.3	Water Content at End of Test (%) =		-
Initial Moist Unit Weight (pcf) =		127.1	B-value =		0.96
Back Pressure (BP, psf) =		2880	Consolidation Stress (σ'_3, psf) =		1981
Initial Lateral Stress (σ'_3, psf) =		1981	Consolidation t_{50} (min) =		31
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =		72	Rebound Stress (σ'_3, psf) =		NA
Test Strain Rate (%/hour) =		0.8	Rebound t_{50} (min) =		NA
LL = 41	PI = 22	USCS	CL	Performed by	DM
Comments: Stage 1				Reviewed by	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill
Boring Number: B-119R
Project Number: 093-94479
Specimen Name: SH-3
Date: 23-Jul-10
Depth (ft): 4.0



FAILURE SKETCH

Consolidation Stress (σ'_3, psf) =	1981
Consolidation t_{50} (min) =	31
Consolidation Volume Change (mL) =	3.5
Unloading Stress (psf) =	NA
Unloading t_{50} (min) =	NA
Unloading Volume Change (mL) =	NA

LL =	41	PI =	22
USCS	CL		
Gs =	2.65	assumed	

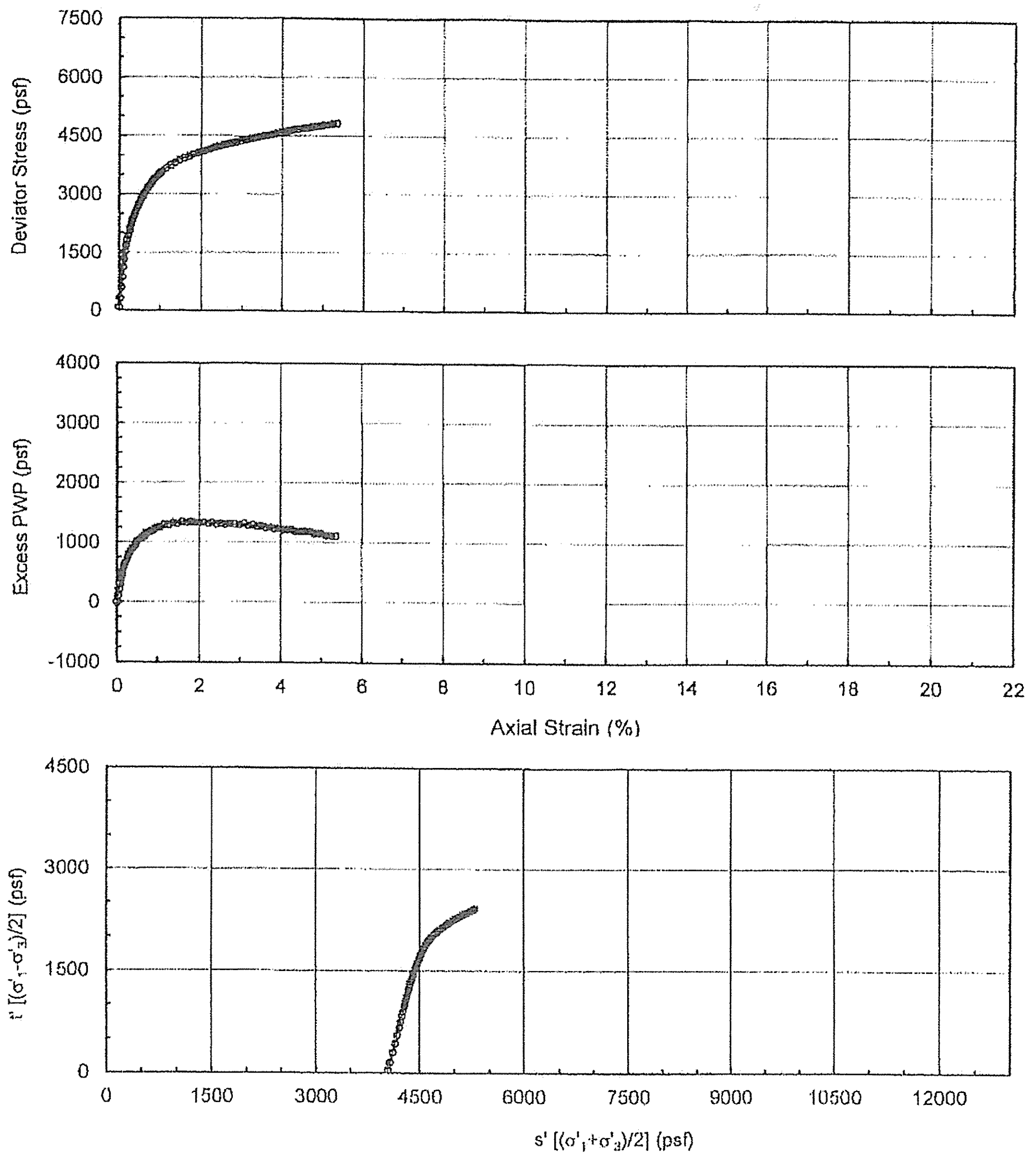
Performed by DM
Reviewed by PCM

Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 26-Jul-10
Boring Number: B-119R **Specimen Name:** SH-3 **Depth (ft):** 4.0



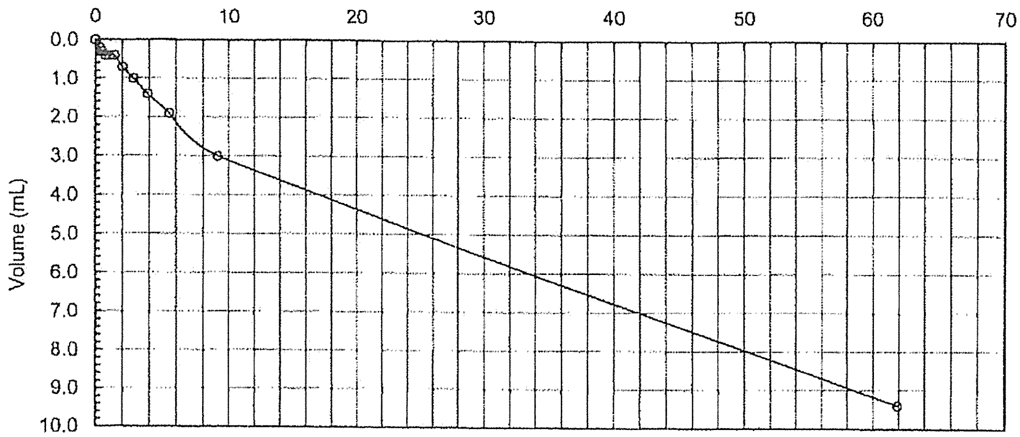
Specimen Description: Dark Brown Lean CLAY with sand					
Initial Specimen Diameter (Inch) =		2.91	Initial Specimen Height (Inch) =		5.31
Initial Water Content (%) =		-	Water Content at End of Test (%) =		-
Initial Moist Unit Weight (pcf) =		-	B-value =		-
Back Pressure (BP, psf) =		2880	Consolidation Stress (σ'_3, psf) =		3996
Initial Lateral Stress (σ'_3, psf) =		3996	Consolidation t_{50} (min) =		33
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =		89	Rebound Stress (σ'_3, psf) =		NA
Test Strain Rate (%/hour) =		0.7	Rebound t_{50} (min) =		NA
LL = 41	PI = 22	USCS	CL	Performed by	DM
Comments: Stage 2				Reviewed by	PCM

Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill
Boring Number: B-119R
Project Number: 093-94479
Specimen Name: SH-3
Date: 26-Jul-10
Depth (ft): 4.0



FAILURE SKETCH

Consolidation Stress (σ'_3, psf) =			3996
Consolidation t_{50} (min) =			33
Consolidation Volume Change (mL) =			9.4
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	41	PI =	22
USCS	CL		
Gs =	2.65	assumed	

Performed by DM
Reviewed by PCM

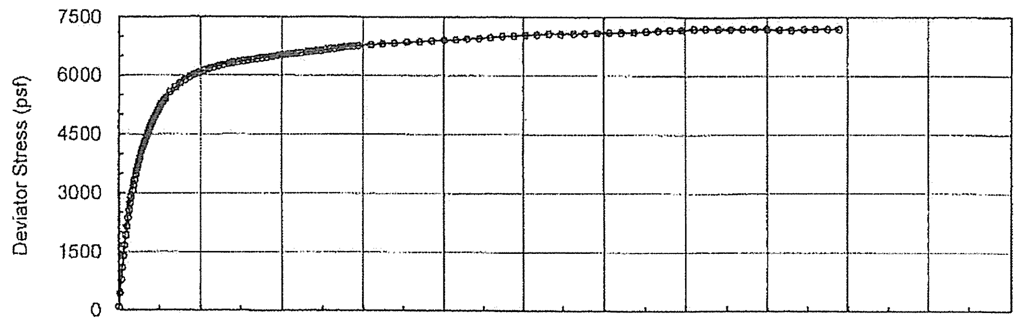
Golder Associates

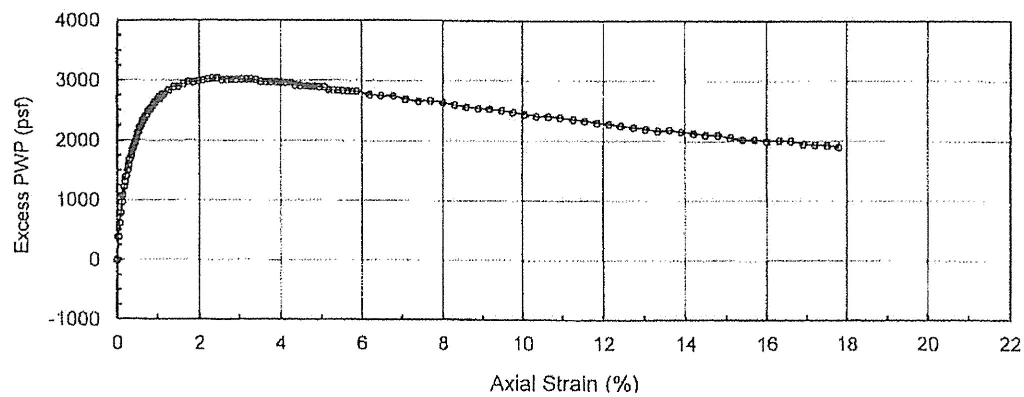
Permit Issued: February 12, 2014

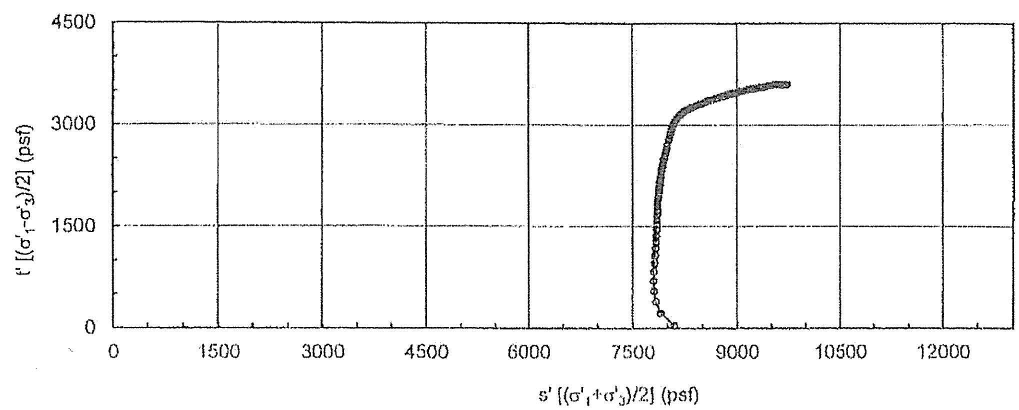
Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 27-Jul-10

Boring Number: B-119R **Specimen Name:** SH-3 **Depth (ft):** 4.0







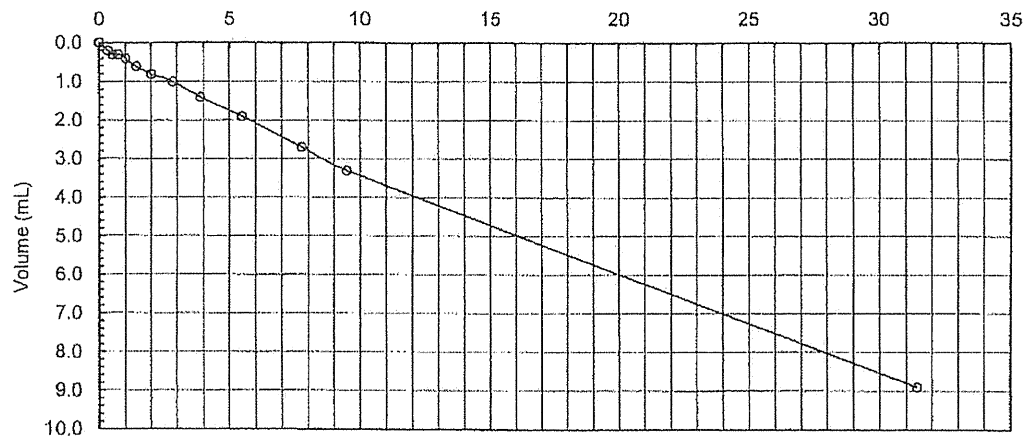
Specimen Description:	Dark Brown Lean CLAY with sand					
Initial Specimen Diameter (inch) =			3.03	Initial Specimen Height (inch) =		4.79
Initial Water Content (%) =			-	Water Content at End of Test (%) =		17.3
Initial Moist Unit Weight (pcf) =			-	B-value =		-
Back Pressure (BP, psf) =			2880	Consolidation Stress (σ'_3, psf) =		8053
Initial Lateral Stress (σ'_3, psf) =			8053	Consolidation t_{50} (min) =		93
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =			86	Rebound Stress (σ'_3, psf) =		NA
Test Strain Rate (%/hour) =			0.3	Rebound t_{50} (min) =		NA
LL =	41	PI =	22	USCS	CL	Performed by: DM
Comments:	Stage 3				Reviewed by	PCM

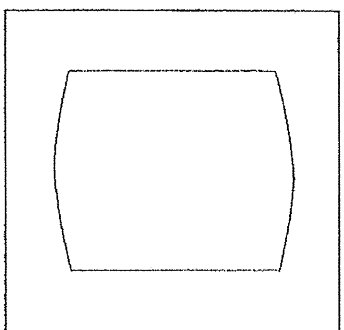
Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title:	City of Arlington Landfill	**Project Number:**	093-94479	**Date:**	27-Jul-10
Boring Number:	B-119R	**Specimen Name:**	SH-3	**Depth (ft):**	4.0





Consolidation Stress (σ'_3, psf) =			8053
Consolidation t_{50} (min) =			93
Consolidation Volume Change (mL) =			8.9
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	41	PI =	22
USCS	CL		
Gs =	2.65	assumed	

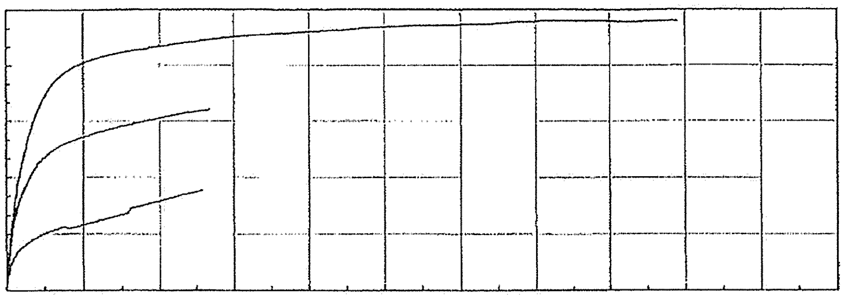
Performed by	DM
Reviewed by	PCM

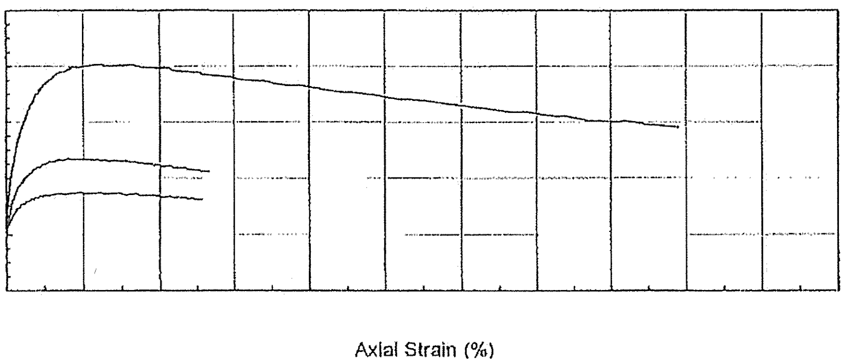
Golder Associates

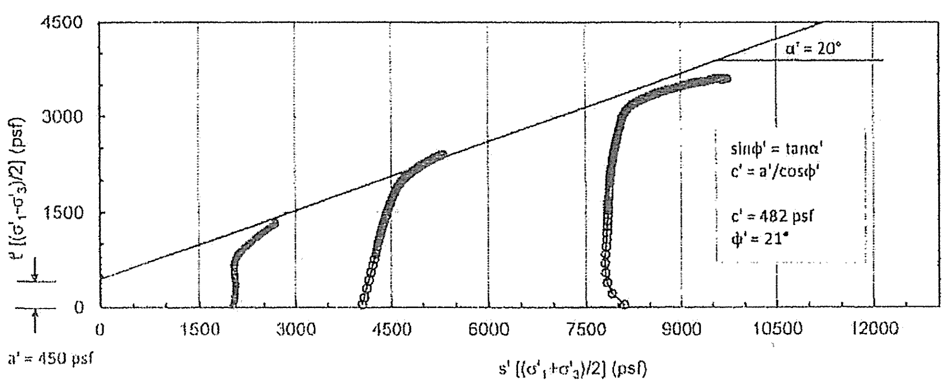
Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 27-Jul-10
Boring Number: B-119R **Specimen Name:** SH-3 **Depth (ft):** 4.0





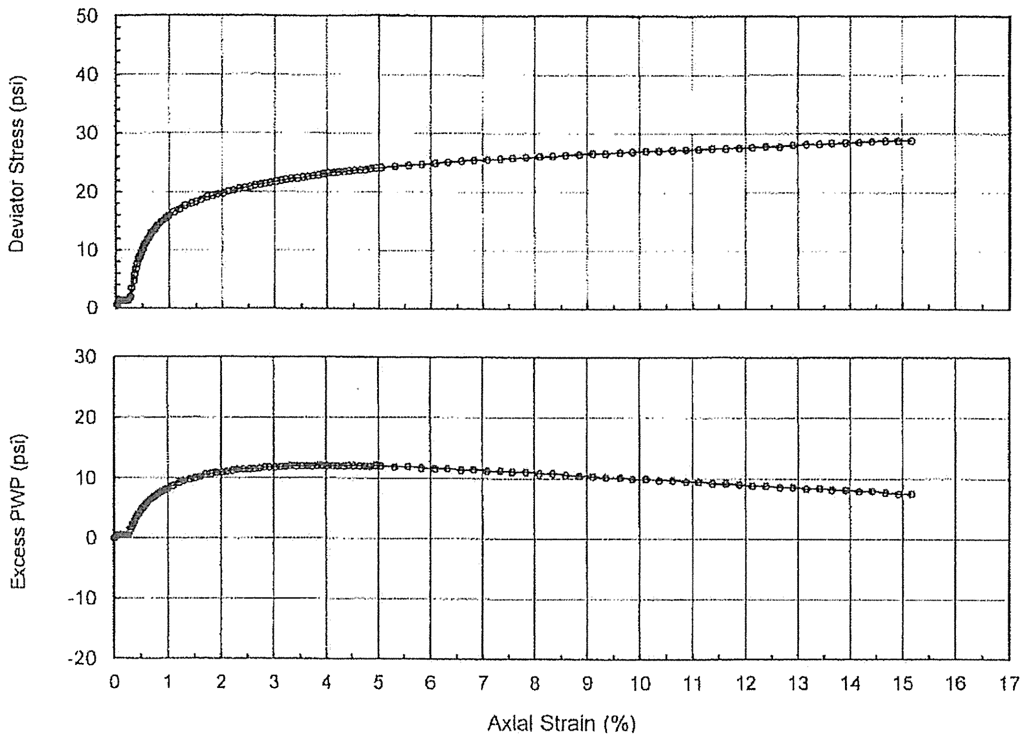


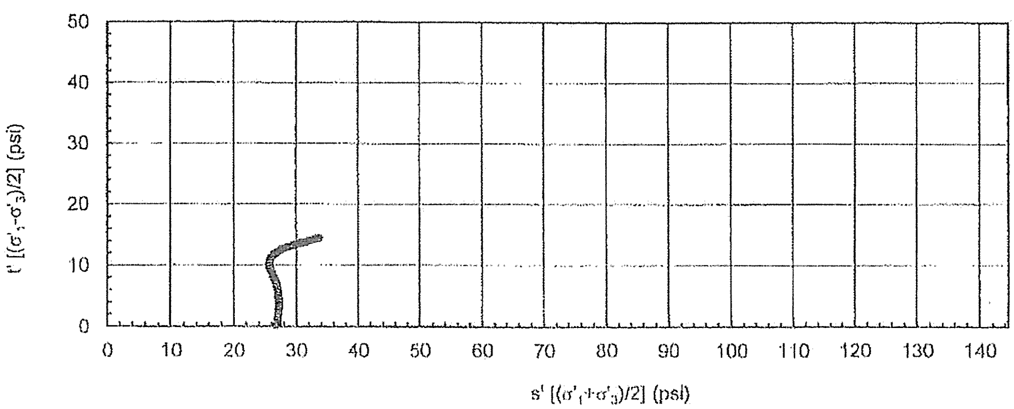
Specimen Description:	Dark Brown Lean CLAY with sand						
Initial Specimen Diameter (inch) =				Initial Specimen Height (inch) =			
Initial Water Content (%) =				Water Content at End of Test (%) =			
Initial Moist Unit Weight (pcf) =				B-value =			
Back Pressure (BP, psf) =				Consolidation Stress (σ'_3, psf) =			
Initial Lateral Stress (σ'_3, psf) =				Consolidation t_{50} (min) =			
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =				Rebound Stress (σ'_3, psf) =			
Test Strain Rate (%/hour) =				Rebound t_{50} (min) =			
LL =	41	PI =	22	USCS	CL	Performed by	DM
Comments: 3 Stages on 1 Specimen						Reviewed by	PCM

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 18-Jun-10
Boring Number: N/A **Specimen Name:** S-1 **Depth (ft):** -



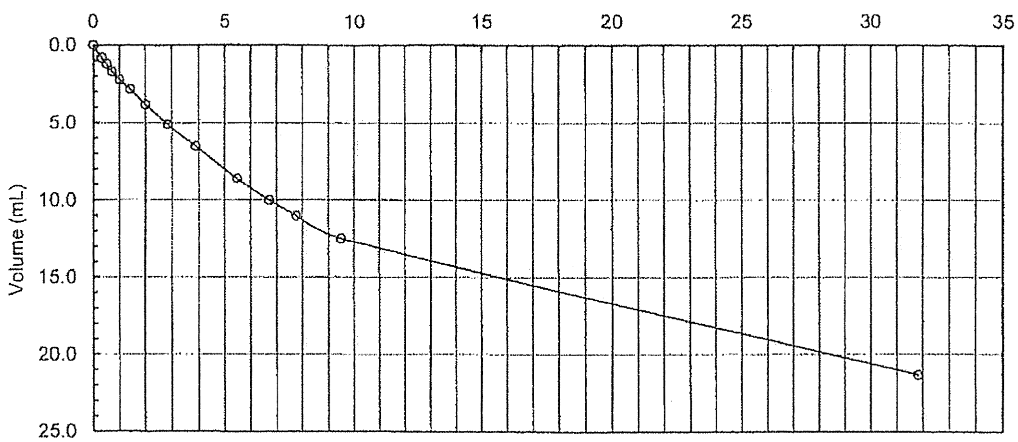


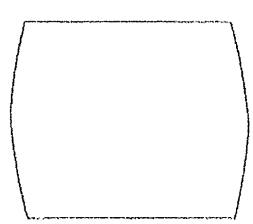
Specimen Description: Dark Gray CLAY with sand			
Initial Specimen Diameter (inch) =	2.76	Initial Specimen Height (inch) =	5.56
Initial Water Content (%) =	15.1	Water Content at End of Test (%) =	20.9
Initial Moist Unit Weight (pcf) =	127.5	B-value =	0.96
Back Pressure (BP, psi) =	50.0	Consolidation Stress (σ'_3, psi) =	26.7
Initial Lateral Stress (σ'_3, psi) =	26.7	Consolidation t_{50} (min) =	26
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psi) =	-0.4	Rebound Stress (σ'_3, psi) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA
LL = 52	PI = 31	USCS CH	Performed by SBK
Comments: Stage 1, Remolded sample prepared with Standard Proctor effort.			Reviewed by PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 18-Jun-10
Boring Number: N/A **Specimen Name:** S-1 **Depth (ft):** -





FAILURE SKETCH

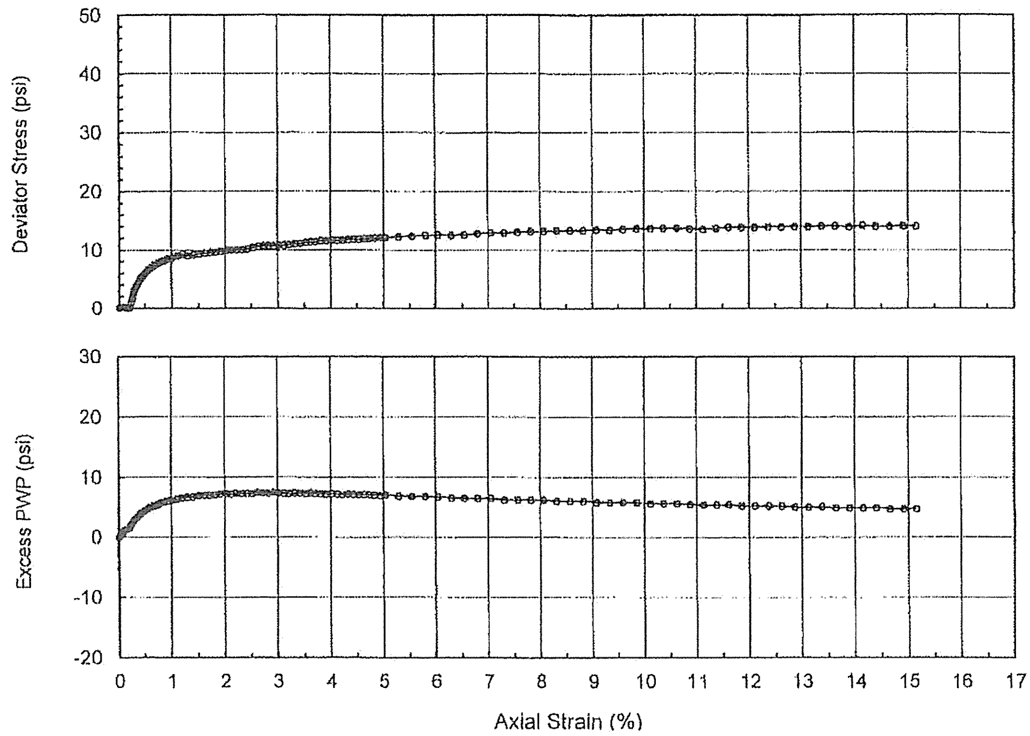
Consolidation Stress (σ'_3, psi) =			26.7
Consolidation t_{50} (min) =			26
Consolidation Volume Change (mL) =			21.3
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	52	PI =	31
USCS	CH		
Gs =	2.65	assumed	

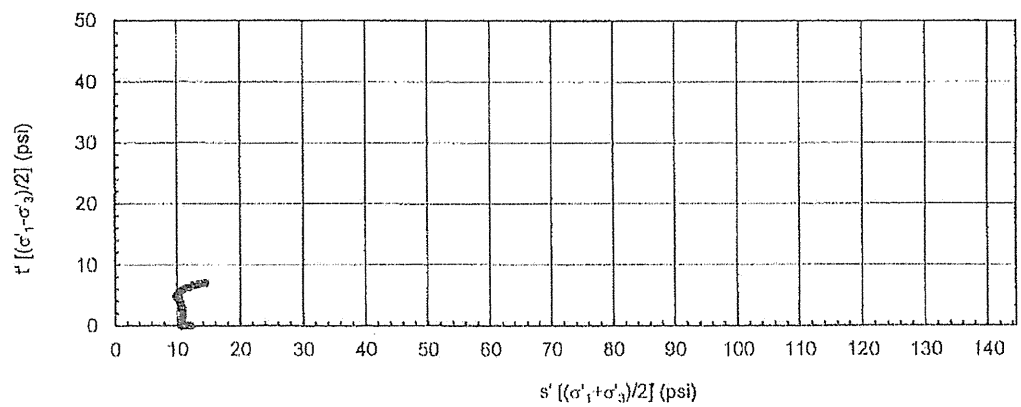
Performed by SBK
Reviewed by PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 17-Jun-10
Boring Number: N/A **Specimen Name:** S-2 **Depth (ft):** -





Specimen Description: Dark Gray CLAY with sand

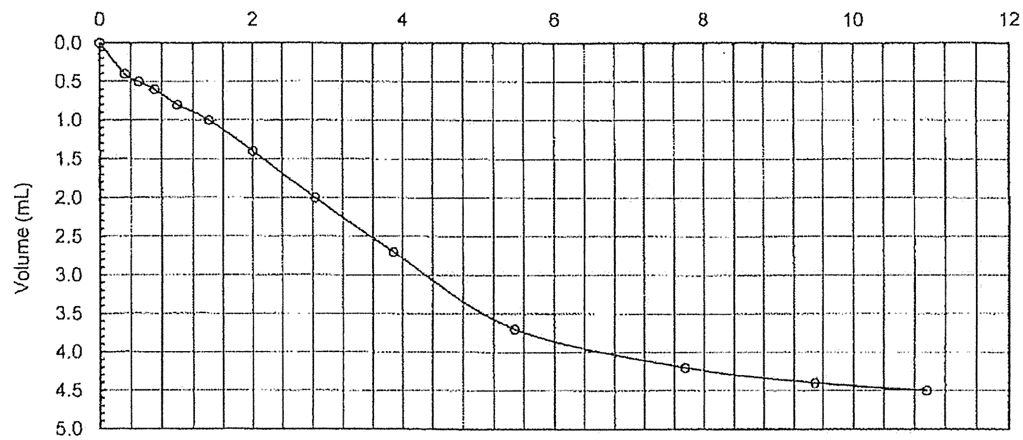
Initial Specimen Diameter (inch) =	2.85	Initial Specimen Height (inch) =	5.73
Initial Water Content (%) =	17.7	Water Content at End of Test (%) =	22.2
Initial Moist Unit Weight (pcf) =	126.2	B-value =	0.98
Back Pressure (BP, psi) =	30.0	Consolidation Stress (σ'_3, psi) =	12.1
Initial Lateral Stress (σ'_3, psi) =	12.1	Consolidation t_{50} (min) =	10
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psi) =	0.1	Rebound Stress (σ'_3, psi) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA
LL = 52 PI = 31	USCS	CH Performed by	SBK
Comments: Stage 2, Remolded sample prepared with Standard Proctor effort.		Reviewed by	PCM

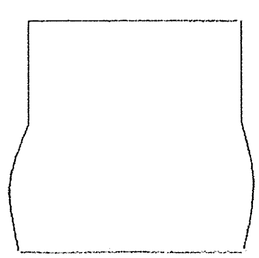
Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Landfill **Project Number:** 093-94479 **Date:** 17-Jun-10
Boring Number: N/A **Specimen Name:** S-2 **Depth (ft):** -




FAILURE SKETCH

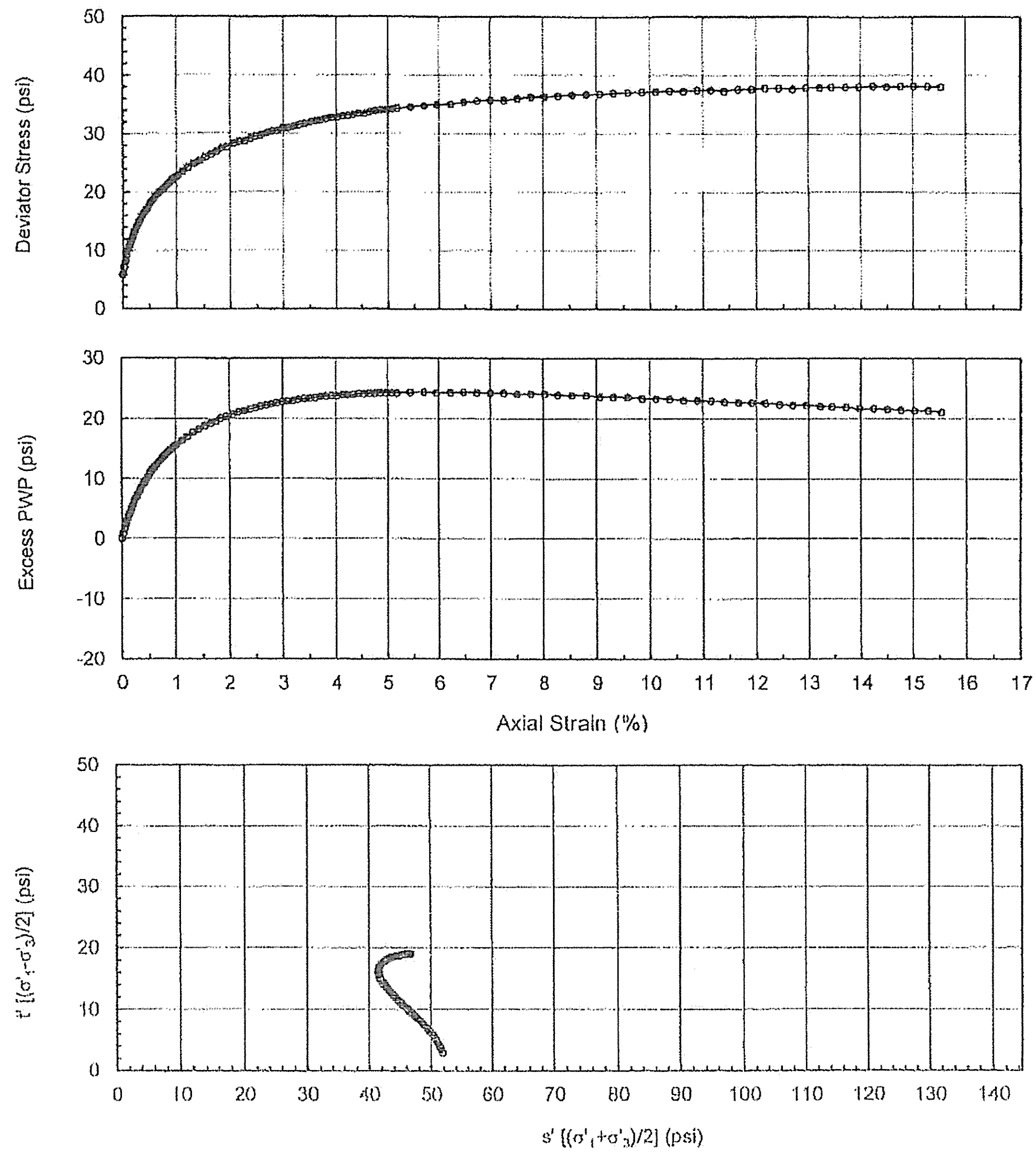
Consolidation Stress (σ'_3, psi) =			12.1
Consolidation t_{50} (min) =			10
Consolidation Volume Change (mL) =			4.5
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	52	PI =	31
USCS	CH		
Gs =	2.65	assumed	

Performed by SBK
Reviewed by PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Levee **Project Number:** 093-94479 **Date:** 23-Jun-10
Boring Number: N/A **Specimen Name:** S-3 **Depth (ft):** -



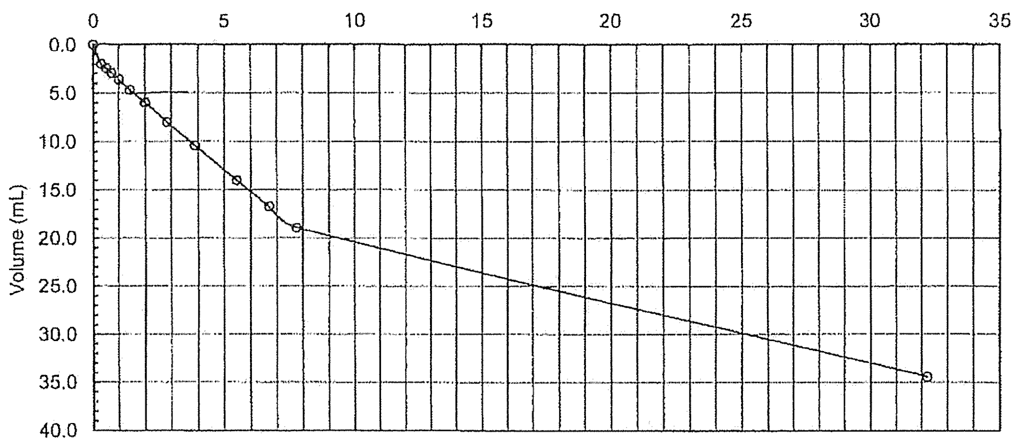
Specimen Description: Dark Gray CLAY with sand			
Initial Specimen Diameter (inch) =	2.82	Initial Specimen Height (inch) =	5.52
Initial Water Content (%) =	17.6	Water Content at End of Test (%) =	20.7
Initial Moist Unit Weight (pcf) =	127.5	B-value =	0.95
Back Pressure (BP, psi) =	40.0	Consolidation Stress (σ'_3, psi) =	48.9
Initial Lateral Stress (σ'_3, psi) =	48.9	Consolidation t_{50} (min) =	21
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psi) =	5.9	Rebound Stress (σ'_3, psi) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA
LL = 52 PI = 31	USCS	CH Performed by	SBK
Comments: Stage 3, Remolded sample prepared with Standard Proctor effort.		Reviewed by	PCM

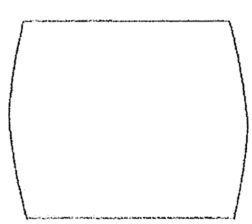
Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Levee **Project Number:** 093-94479 **Date:** 23-Jun-10
Boring Number: N/A **Specimen Name:** S-3 **Depth (ft):** -





FAILURE SKETCH

Consolidation Stress (σ'_3, psi) =			48.9
Consolidation t_{50} (min) =			21
Consolidation Volume Change (mL) =			34.4
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	52	PI =	31
USCS	CH		
Gs =	2.65	assumed	

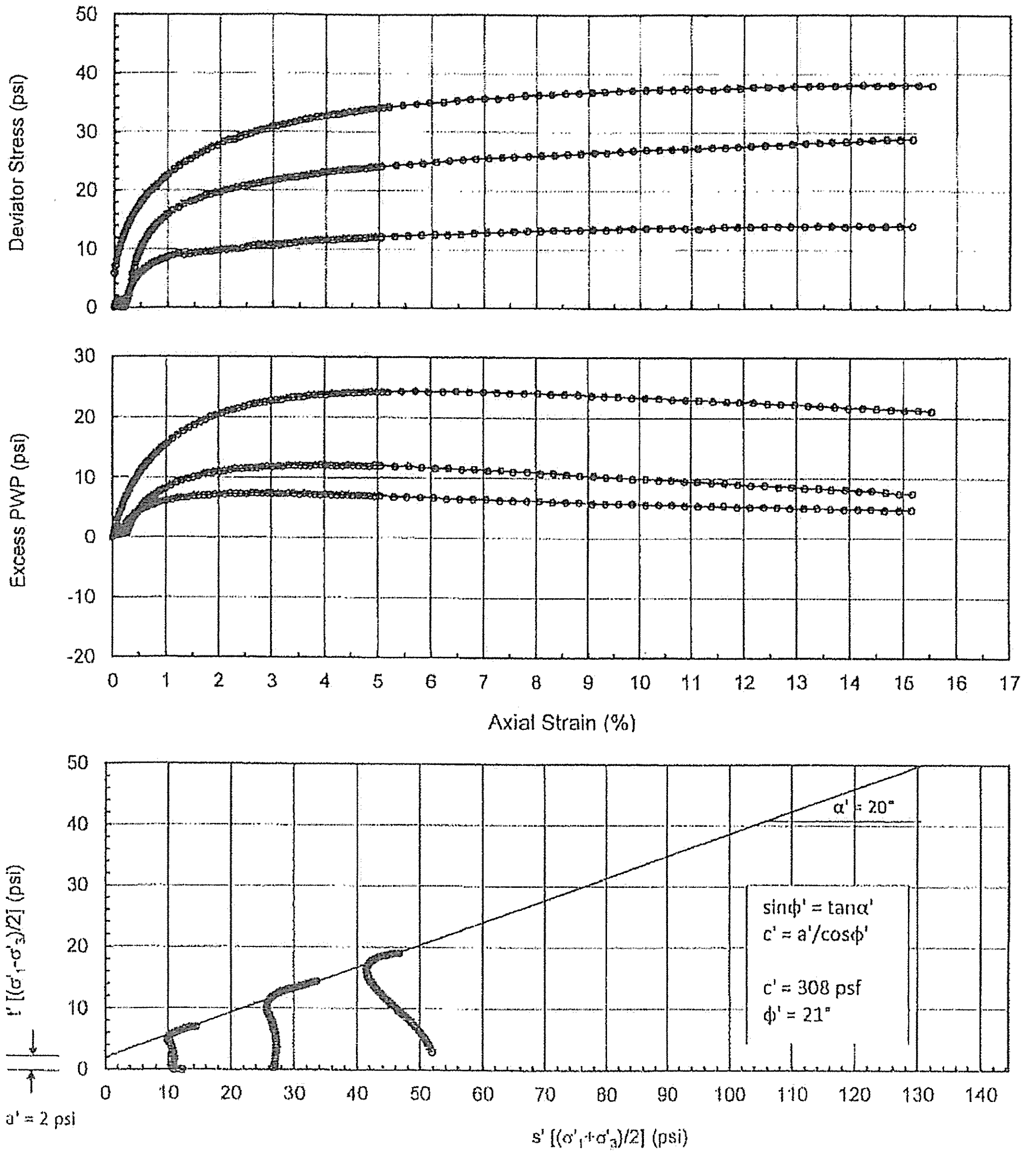
Performed by	SBK
Reviewed by	PCM

Golder Associates

Permit Issued: February 12, 2014

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: City of Arlington Levee **Project Number:** 093-94479 **Date:** 23-Jun-10
Boring Number: N/A **Specimen Name:** - **Depth (ft):** -

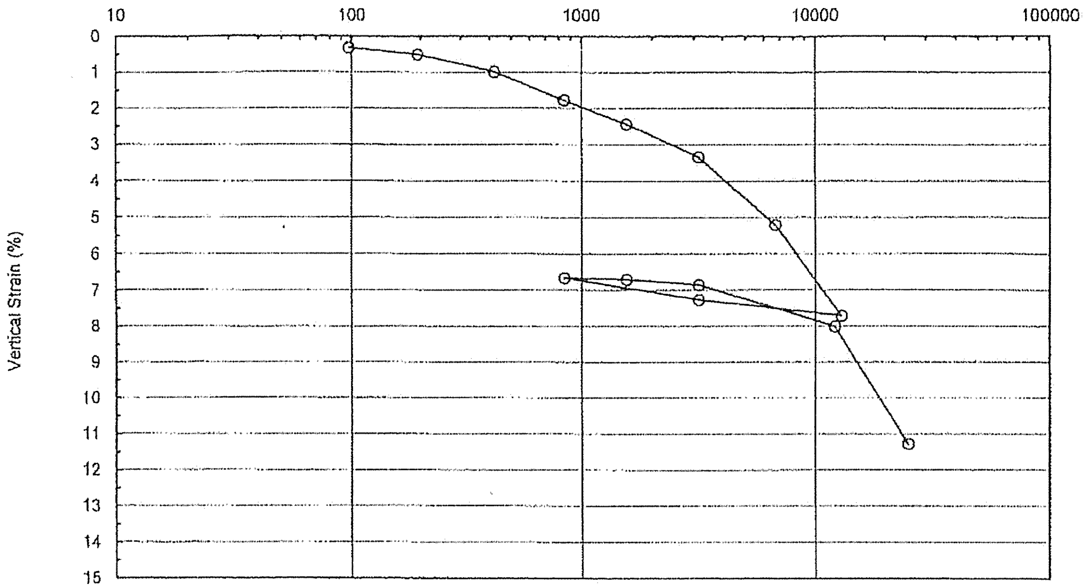


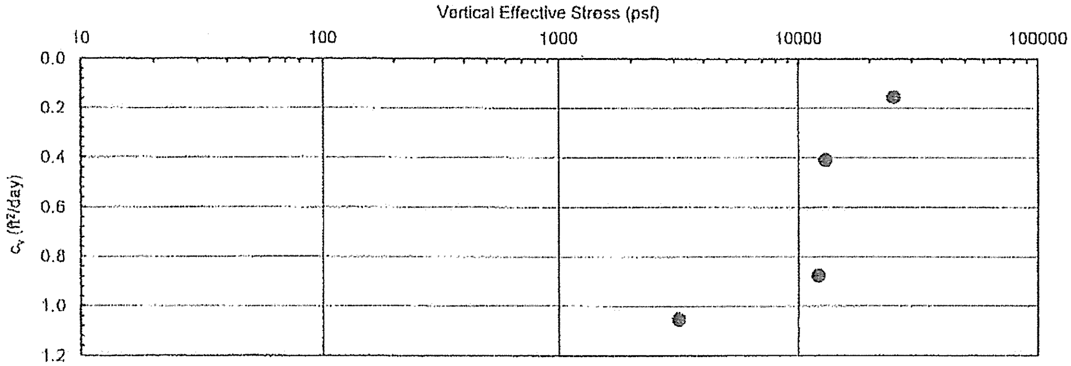
Specimen Description:	Dark Gray CLAY with sand				
Initial Specimen Diameter (inch) =			Initial Specimen Height (inch) =		
Initial Water Content (%) =			Water Content at End of Test (%) =		
Initial Moist Unit Weight (pcf) =			B-value =		
Back Pressure (BP, psi) =			Consolidation Stress (σ'3, psi) =		
Initial Lateral Stress (σ'3, psi) =			Consolidation t_{50} (min) =		
Initial Deviator Stress (σ1 - σ3, psi) =			Rebound Stress (σ'3, psi) =		
Test Strain Rate (%/hour) =			Rebound t_{50} (min) =		
LL = 52	PI = 31	USCS	CH	Performed by	SBK
Comments: 3 Stages on 3 Remolded Samples (prepared with Standard Proctor effort)				Reviewed by	PCM

Golder Associates

CONSOLIDATION TEST RESULTS

One Dimensional Consolidation of Soils
ASTM D-2435





Boring Number	B-104	G_s	2.65	assumed
Sample Number	SH-8	$C_{Cε}$	0.12	
Sample Depth (ft)	23.0	$C_{Rε}$	0.009	
		$σ'_P$	6200	psf

Specimen Height (inch)	0.79
Specimen Diameter (inch)	2.50

	Initial	Final
Dry Unit Weight (pcf)	108.0	121.7
Wet Unit Weight (pcf)	125.2	140.1
Moisture Content (%)	15.9	15.1
Void Ratio	0.53	0.40
Degree of Saturation (%)	79	100

DESCRIPTION	Brown CLAY				
LL	31	PI	18	USCS	CL

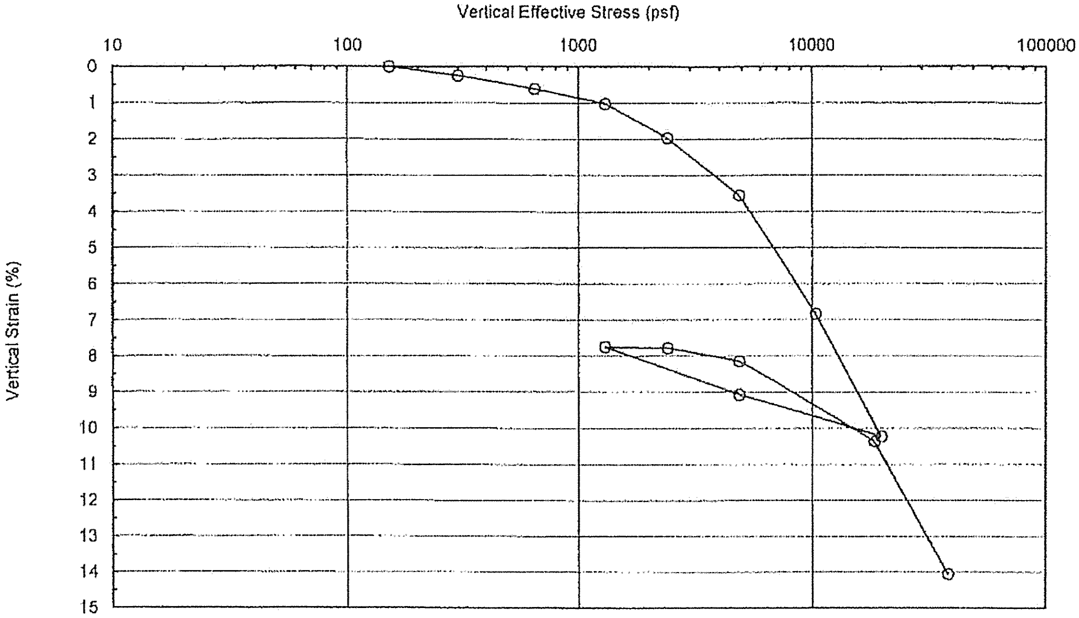
Date	19-Jul-10
Tech	PN
Check	SBK
Review	PCM

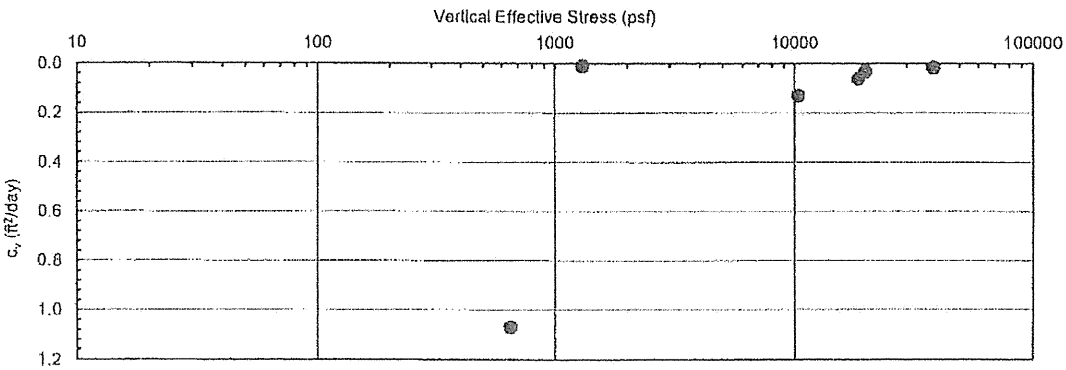
Golder Associates

Project: City of Arlington Landfill
Project Number: 093-94479

Permit Issued: February 12, 2014

One Dimensional Consolidation of Soils
ASTM D-2435





Boring Number	BH-112R	G_s	2.65	assumed
Sample Number	SH-5	$C_{Cε}$	0.13	
Sample Depth (ft)	8.0	$C_{Rε}$	0.02	
		σ'_p	5000	psf

Specimen Height (inch)	0.79
Specimen Diameter (inch)	2.50

	Initial	Final
Dry Unit Weight (pcf)	90.2	104.9
Wet Unit Weight (pcf)	118.0	129.5
Moisture Content (%)	30.9	23.4
Void Ratio	0.83	0.62
Degree of Saturation (%)	98	100

DESCRIPTION: Reddish and dark brown fat CLAY wih sand

LL	58	PI	36	USCS	CH

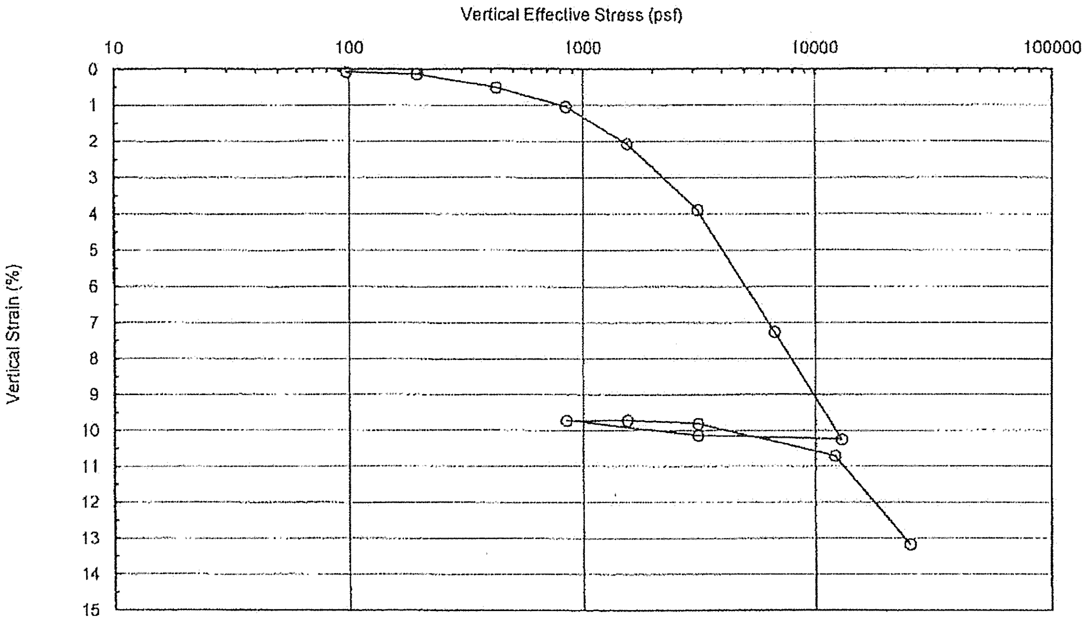
Golder Associates

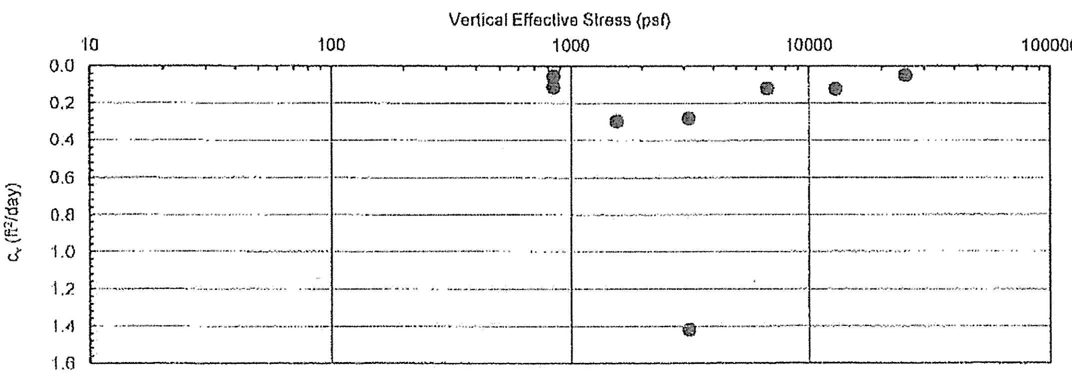
Project: City of Arlington Landfill
Project Number: 093-94479

Date	19-Jul-10
Tech	PN
Check	SBK
Review	PCM

Permit Issued: February 12, 2014

One Dimensional Consolidation of Soils
ASTM D-2435





Boring Number	B-125	G_s	2.70	assumed	
Sample Number	SH-6	$C_{Cε}$	0.10		
Sample Depth (ft)	13.0	$C_{Rε}$	0.01		
		$σ'_p$	2000	psf	

	Initial	Final
Dry Unit Weight (pcf)	101.4	116.7
Wet Unit Weight (pcf)	125.5	136.0
Moisture Content (%)	23.8	16.5
Void Ratio	0.66	0.44
Degree of Saturation (%)	97	100

Specimen Height (inch)	0.79
Specimen Diameter (inch)	2.50

DESCRIPTION	Brown Lean CLAY				
LL	37	PI	22	USCS	CL

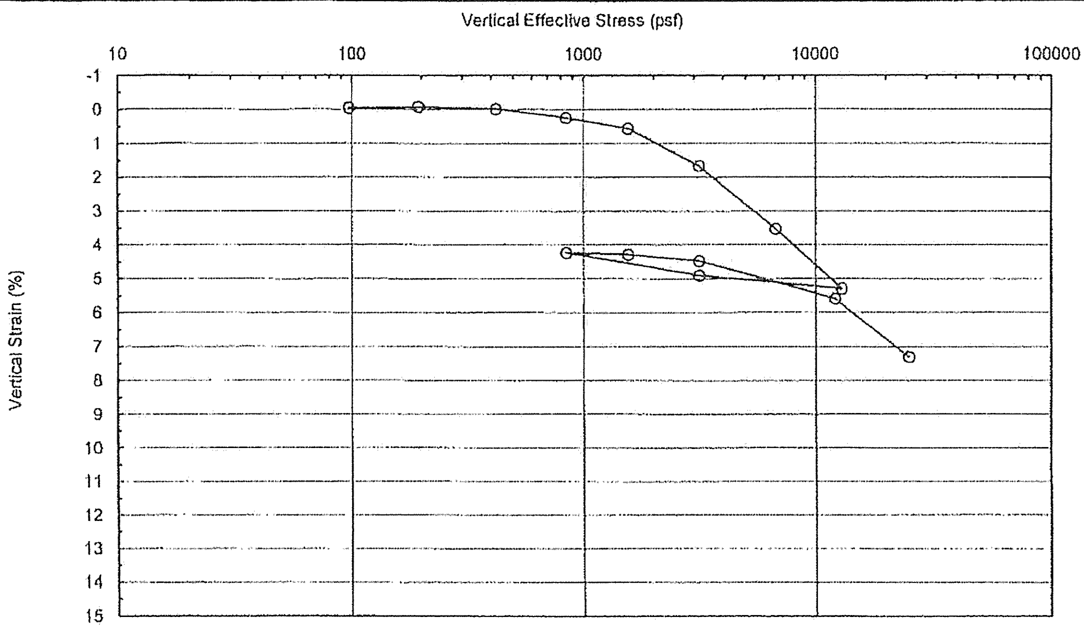
Date	6-Jul-10
Tech	PN
Check	SBK
Review	PCM

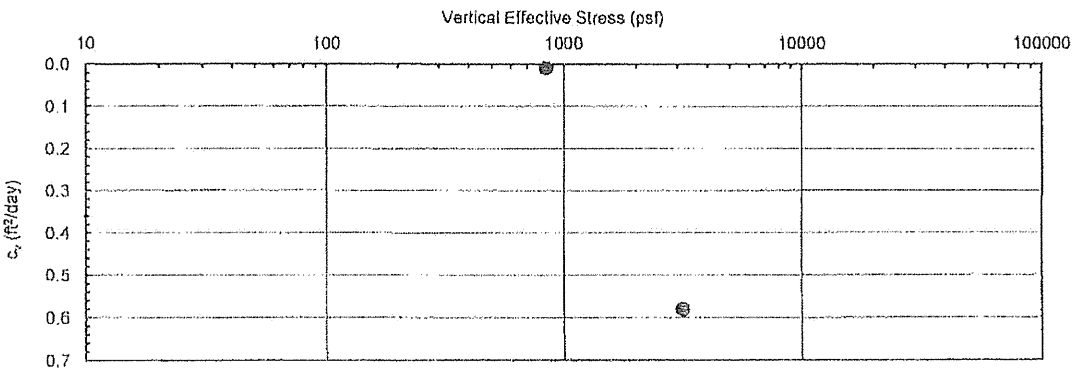
Golder Associates

Project: City of Arlington Landfill
Project Number: 093-94479

Permit Issued: February 12, 2014

One Dimensional Consolidation of Soils
ASTM D-2435





Boring Number	BH-120R
Sample Number	SH-4
Sample Depth (ft)	5.5

G_s	2.65	assumed
$C_{C\varepsilon}$	0.07	
$C_{R\varepsilon}$	0.009	
σ'_p	3000	psf

Specimen Height (inch)	0.79
Specimen Diameter (inch)	2.50

	Initial	Final
Dry Unit Weight (pcf)	111.2	120.0
Wet Unit Weight (pcf)	128.4	137.1
Moisture Content (%)	15.4	14.3
Void Ratio	0.49	0.38
Degree of Saturation (%)	84	100

DESCRIPTION Brown Sandy CLAY

LL	44	PI	29	USCS	CL

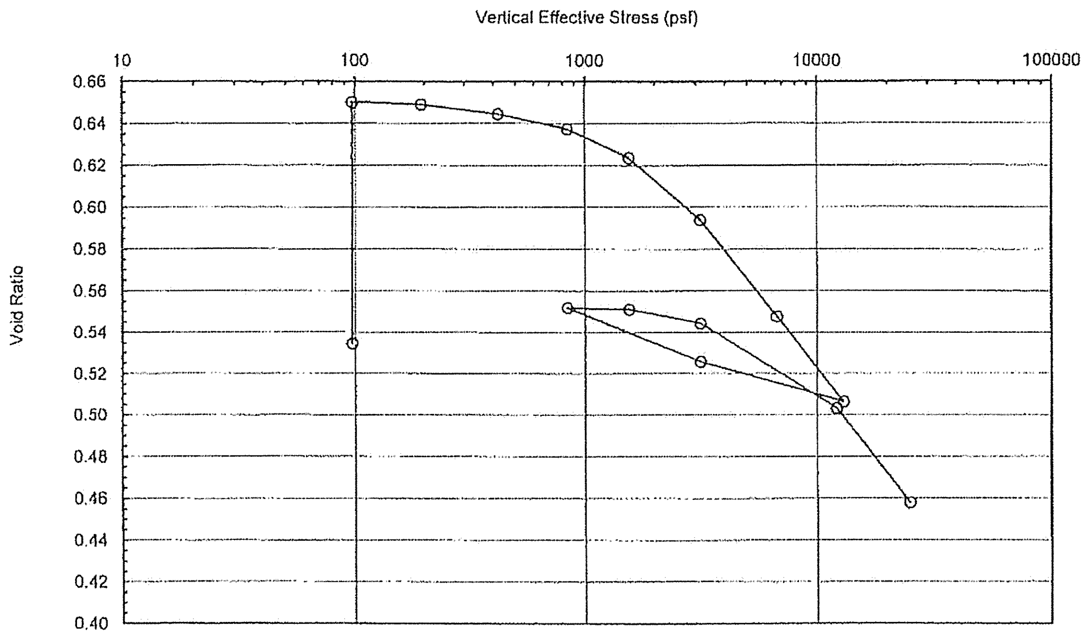
Date	19-Jul-10
Tech	PN
Check	SBK
Review	PCM

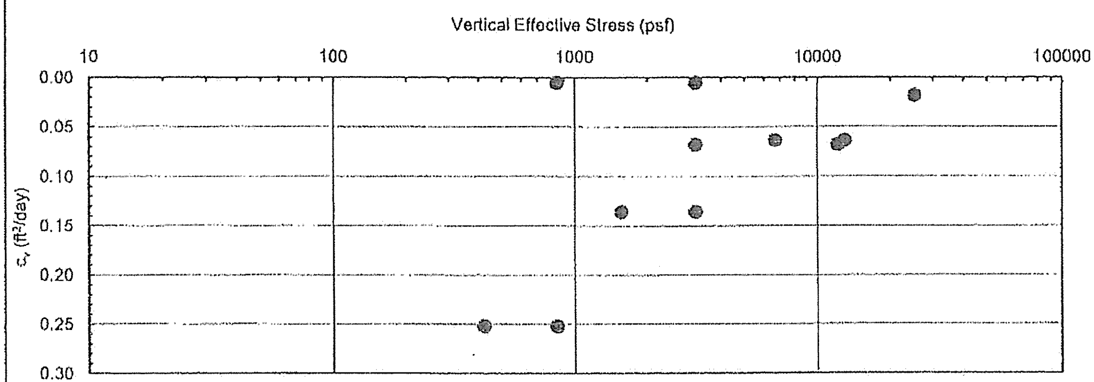
Golder Associates

Project: City of Arlington Landfill
Project Number: 093-94479

Permit Issued: February 12, 2014

One Dimensional Consolidation of Soils
ASTM D-2435





Boring Number	NA	G_s	2.70	assumed
Sample Number	S-4	C_C	0.15	
Sample Depth (ft)	NA	C_R	0.04	
		σ'_p	2500	psf

Specimen Height (inch)	0.785
Specimen Diameter (inch)	2.50

	Initial	Final
Dry Unit Weight (pcf)	109.6	115.5
Wet Unit Weight (pcf)	127.4	135.9
Moisture Content (%)	16.2	17.6
Void Ratio	0.54	0.48
Degree of Saturation (%)	82	100

DESCRIPTION: Dark gray CLAY with sand (remolded sample)

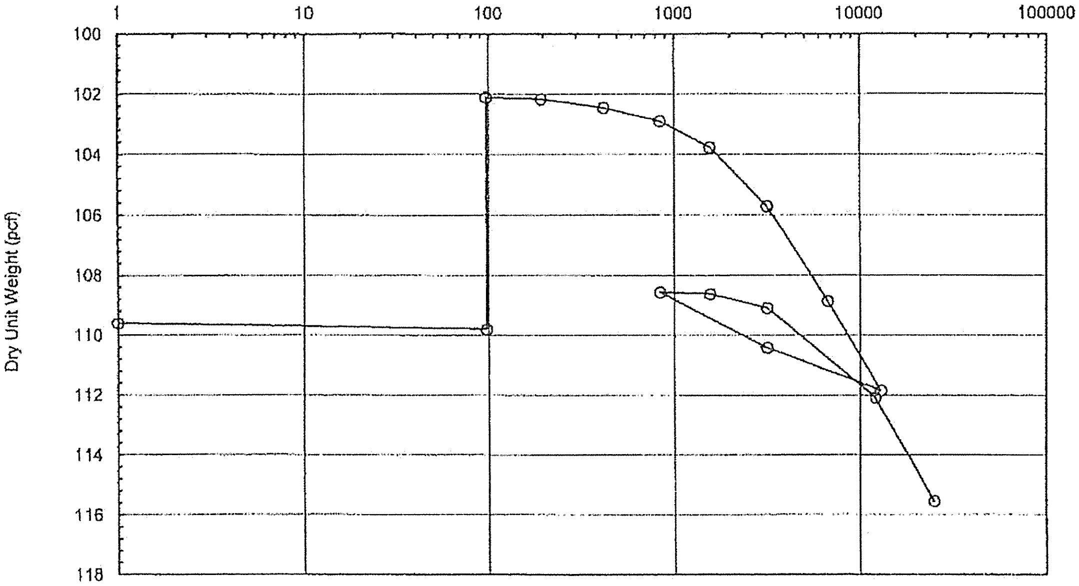
LL	52	PI	31	USCS	CH

Date	17-Jun-10
Tech	PN
Check	SBK
Review	PCM

Golder Associates

Project: City of Arlington Landfill
Project Number: 093-94479

One Dimensional Consolidation of Soils
ASTM D 4546-03, Test Method B



Boring Number	NA
Sample Number	S-4
Sample Depth (ft)	NA

Specimen Height (inch)	0.785
Specimen Diameter (inch)	2.50

	Initial	Final
Dry Unit Weight (pcf)	109.6	115.5
Wet Unit Weight (pcf)	127.4	135.9
Moisture Content (%)	16.2	17.6
Void Ratio	0.54	0.48
Degree of Saturation (%)	82	100

Sealing Pressure (psf)	97
Heave (%)	7.52
Swell Pressure (psf)	7800

Loads (psf)	Dry Unit Weight (pcf)	Void Ratio	Heave (%)
97	107.76	0.535	-
97	100.22	0.650	7.52
194	100.27	0.649	7.46
421	100.56	0.644	7.16
841	100.99	0.637	6.70
1553	101.84	0.624	5.81
3138	103.74	0.594	3.87
6696	106.85	0.548	0.85
12940	109.77	0.506	-1.84
3138	108.38	0.526	-0.57
841	106.55	0.552	1.14
1553	106.61	0.551	1.08
3138	107.07	0.544	0.64
12099	110.00	0.503	-2.04
25071	113.41	0.458	-4.99

DESCRIPTION: Dark gray CLAY with sand (remolded sample)

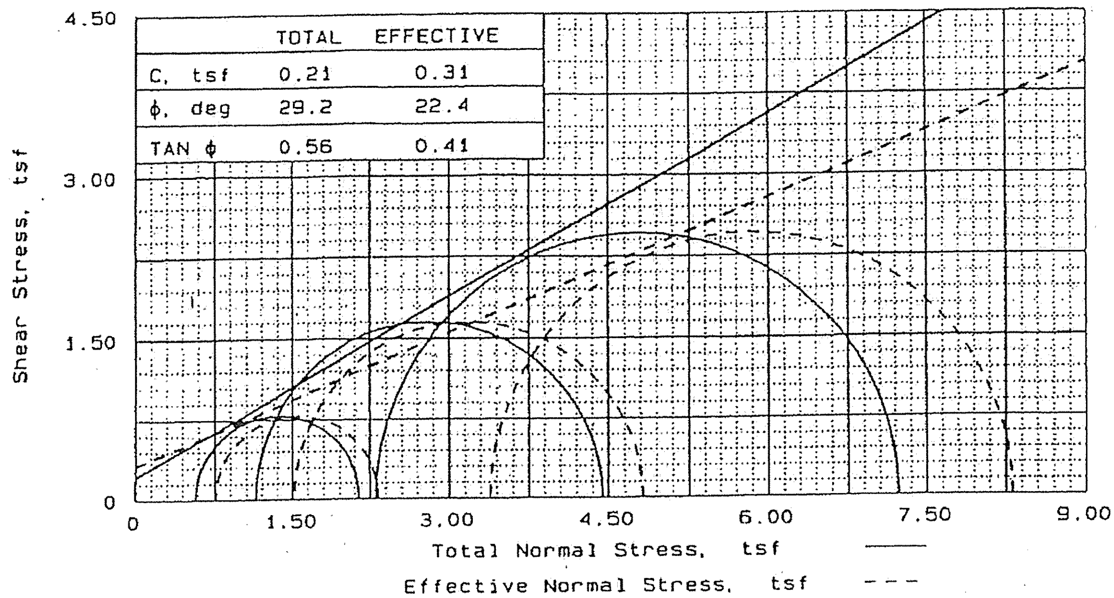
LL	52	PI	31	USCS	CH

Golder Associates

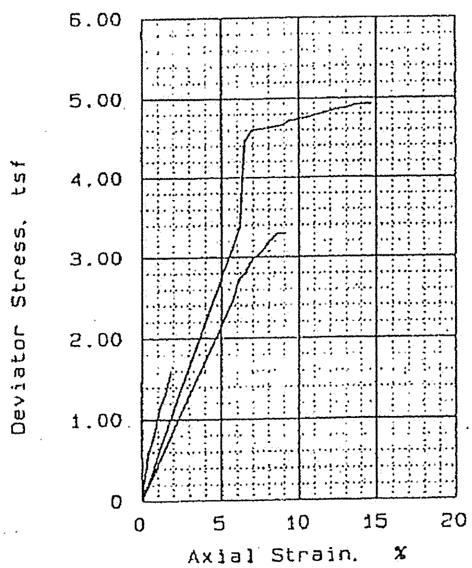
Project: City of Arlington Landfill
Project Number: 093-94479

Date	17-Jun-10
Tech	PN
Check	SBK
Review	PCM

CONSOLIDATED-UNDRAINED WITH PORE PRESSURES TRIAXIAL TESTS RESULTS



	TOTAL	EFFECTIVE
C, tsf	0.21	0.31
φ, deg	29.2	22.4
TAN φ	0.56	0.41



SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	14.8	14.8	14.8
	DRY DENSITY, pcf	114.9	114.9	114.9
	SATURATION, %	89.0	87.5	87.5
	VOID RATIO	0.439	0.450	0.450
	DIAMETER, in	1.45	1.45	1.45
	HEIGHT, in	3.40	3.40	3.40
AT TEST	WATER CONTENT, %	15.8	15.8	15.8
	DRY DENSITY, pcf	114.9	114.9	114.9
	SATURATION, %	95.1	93.5	93.5
	VOID RATIO	0.439	0.450	0.450
	DIAMETER, in	1.45	1.45	1.45
	HEIGHT, in	3.40	3.40	3.40
Strain rate, in/min				
BACK PRESSURE, tsf		2.52	2.52	2.52
CELL PRESSURE, tsf		3.10	3.67	4.82
FAILURE STRESS, tsf		1.57	3.30	4.92
PORE PRESSURE, tsf		2.33	2.15	1.44
ULTIMATE STRESS, tsf		1.57	3.30	4.92
PORE PRESSURE, tsf		2.33	2.15	1.44
$\bar{\sigma}_1$ FAILURE, tsf		2.34	4.83	8.31
$\bar{\sigma}_3$ FAILURE, tsf		0.76	1.52	3.39

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Undisturbed
DESCRIPTION: Silty Clayey Sand
Light Brown
LL= 21 PL= 13 PI= 8
SPECIFIC GRAVITY= 2.67
REMARKS:

CLIENT: City of Arlington

PROJECT: Arlington Landfill

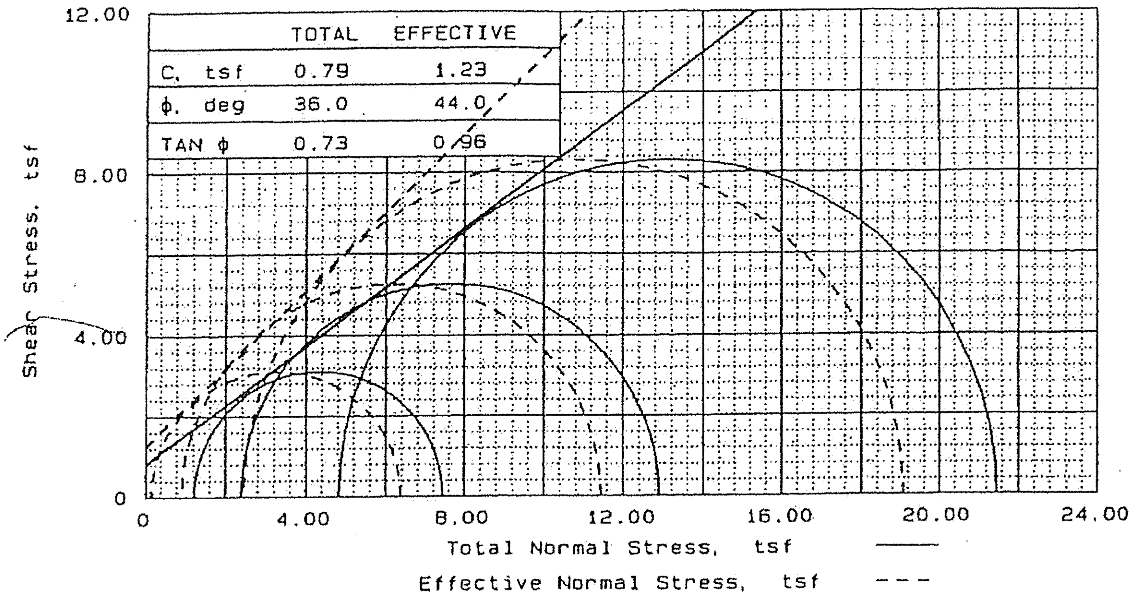
SAMPLE LOCATION: G-7 @ 9.6 - 10.0

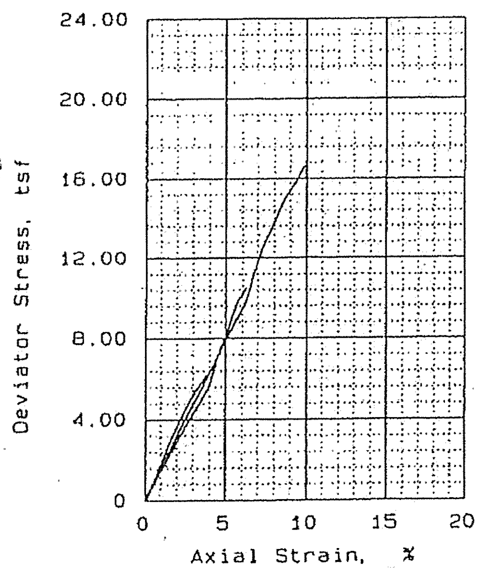
PROJ. NO.: 1019002002 DATE: 1/19/94

TRIAXIAL SHEAR TEST REPORT

EMCON Baker-Shiflett, Inc.

Figure 4-E.10





	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	9.0	9.0	9.0
	DRY DENSITY, pcf	133.0	133.0	133.0
	SATURATION, %	90.5	90.5	90.5
	VOID RATIO	0.267	0.267	0.267
	DIAMETER, in	2.00	2.00	2.00
	HEIGHT, in	3.85	3.85	3.85
AT TEST	WATER CONTENT, %	9.6	9.6	9.6
	DRY DENSITY, pcf	133.0	133.0	133.0
	SATURATION, %	97.2	97.2	97.2
	VOID RATIO	0.267	0.267	0.267
	DIAMETER, in	2.00	2.00	2.00
	HEIGHT, in	3.85	3.85	3.85
	Strain rate, in/min			
	BACK PRESSURE, tsf	3.60	3.60	3.60
	CELL PRESSURE, tsf	4.82	5.98	8.42
	FAILURE STRESS, tsf	6.21	10.53	16.65
	PORE PRESSURE, tsf	4.66	5.05	5.99
	ULTIMATE STRESS, tsf	6.21	10.53	16.65
	PORE PRESSURE, tsf	4.66	5.05	5.99
	$\bar{\sigma}_1$ FAILURE, tsf	6.37	11.46	19.08
	$\bar{\sigma}_3$ FAILURE, tsf	0.16	0.93	2.44

TYPE OF TEST:
CU with pore pressures

SAMPLE TYPE: Core Sample

DESCRIPTION: Shale, Dk. gray

LL= 36 PL= 15 PI= 21

SPECIFIC GRAVITY= 2.78

REMARKS:

CLIENT: City of Arlington

PROJECT: Arlington Landfill

SAMPLE LOCATION: G-7 @ 27.2 - 27.8

PROJ. NO.: 1019002002 DATE: 1/26/94

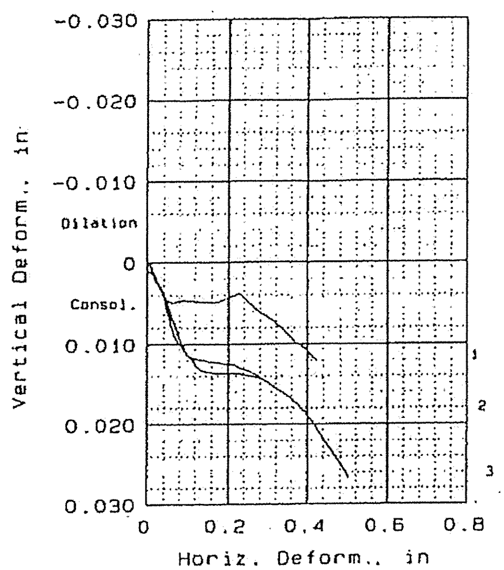
TRIAXIAL SHEAR TEST REPORT

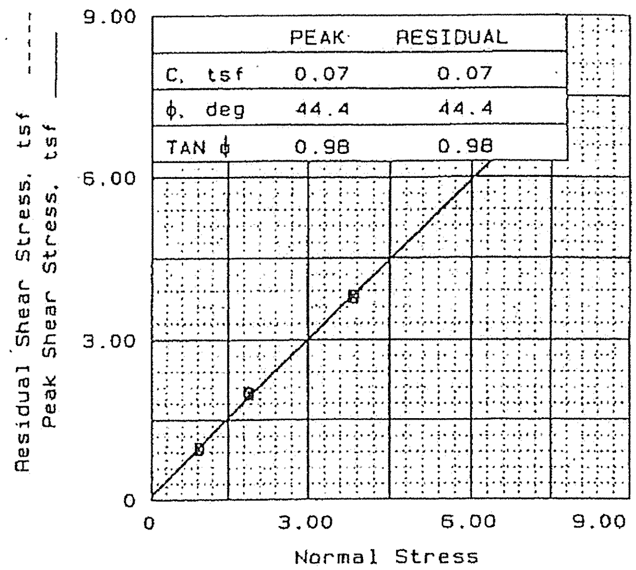
EMCON Baker-Shiflett, Inc.

Figure 4-E 11

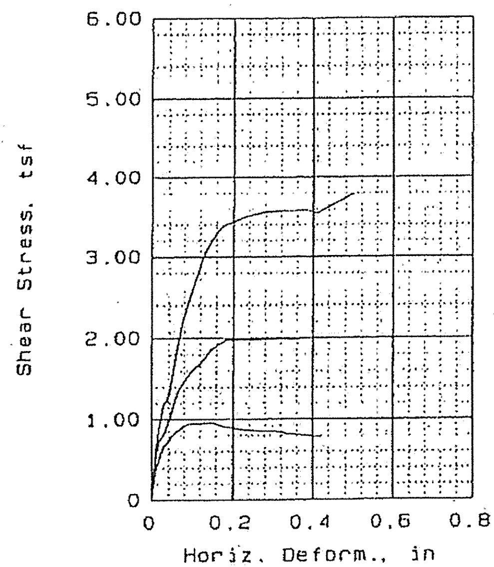
Permit Issued: February 12, 2014

DIRECT SHEAR TEST RESULTS





	PEAK	RESIDUAL
C, tsf	0.07	0.07
ϕ, deg	44.4	44.4
TAN ϕ	0.98	0.98



	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	8.0	8.0	8.0
	DRY DENSITY, pcf	120.0	120.0	120.0
	SATURATION, %	56.1	56.1	56.1
	VOID RATIO	0.379	0.379	0.379
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	14.3	14.3	14.3
	DRY DENSITY, pcf	120.0	120.0	120.0
	SATURATION, %	99.8	99.8	99.8
	VOID RATIO	0.379	0.379	0.379
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	1.00	1.00	1.00
	NORMAL STRESS, tsf	0.97	1.94	3.88
	MAXIMUM SHEAR, tsf	0.96	1.99	3.79
	RESIDUAL SHEAR, tsf	0.96	1.99	3.79
	Strain rate, in/min	0.001		

SAMPLE DATA

SAMPLE TYPE: Bag

DESCRIPTION: Silty sand w/gvl. tan

LL= PL= PI=

SPECIFIC GRAVITY= 2.65

REMARKS:

CLIENT: City of Arlington

PROJECT: Arlington Landfill

SAMPLE LOCATION: G-1 9.0

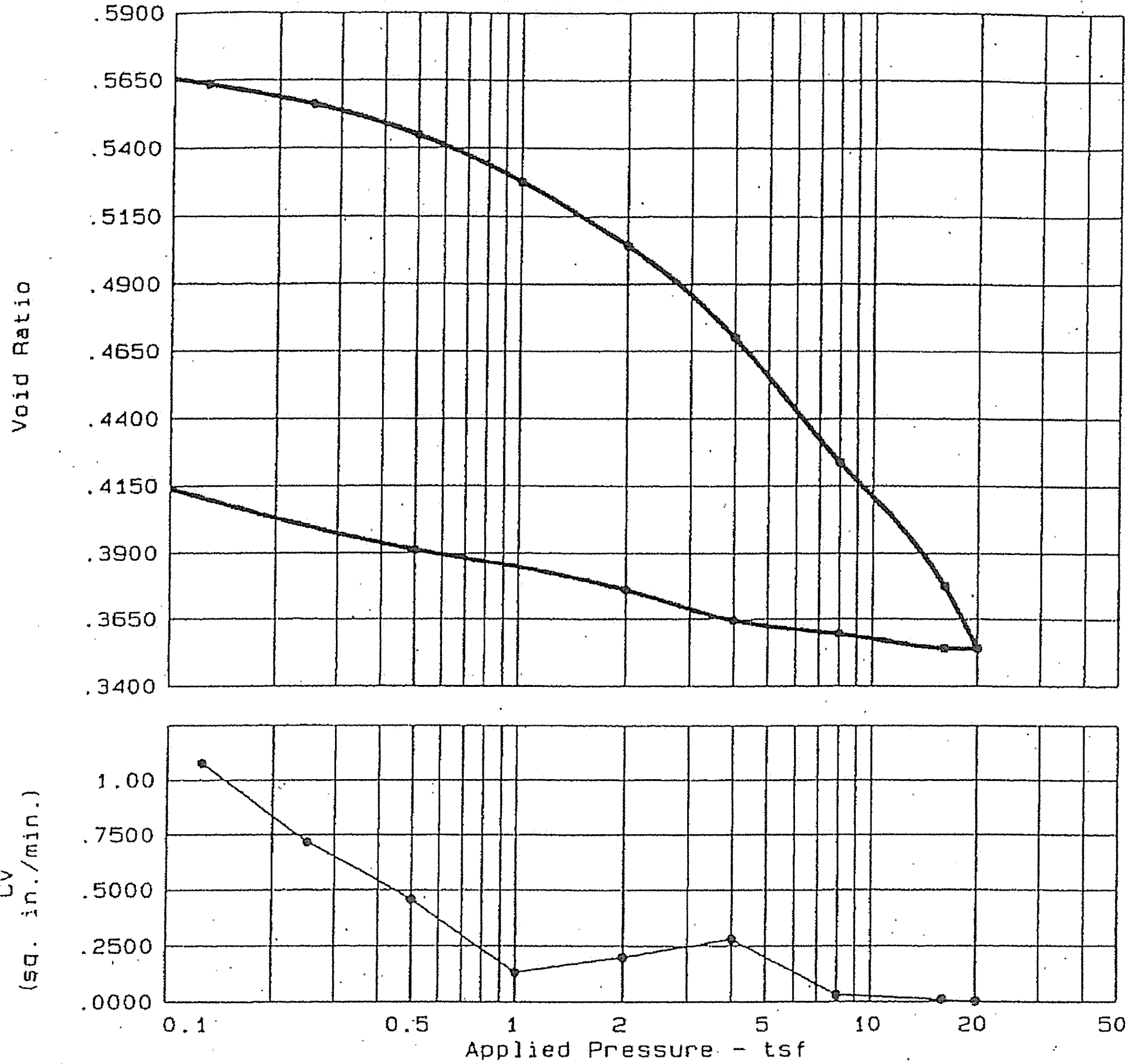
PROJ. NO.: 1019002002 DATE: 1/31/94

DIRECT SHEAR TEST REPORT

EMCON Baker-Shiflett, Inc.

CONSOLIDATION TESTS RESULTS

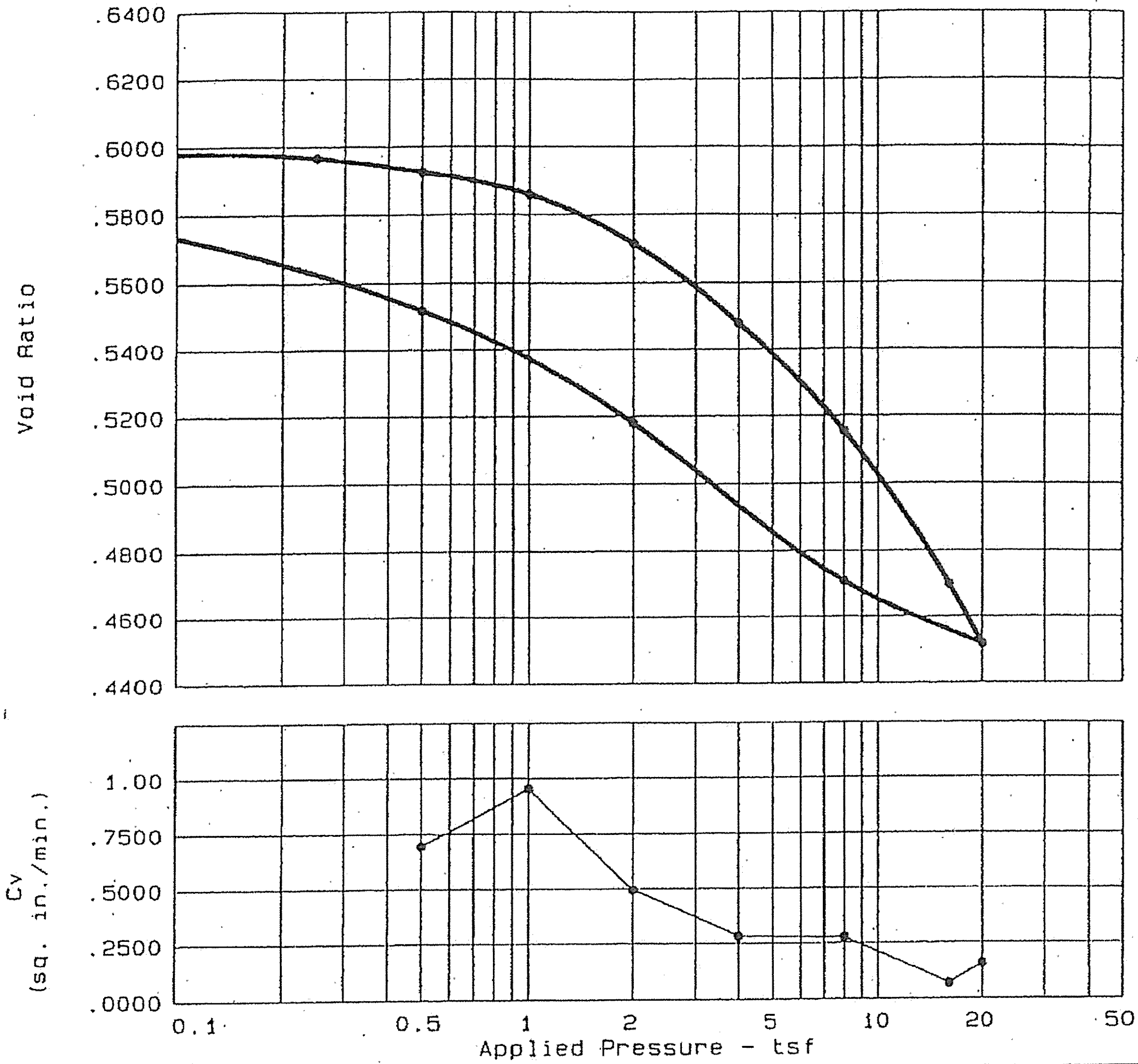
CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Initial void ratio
98.7 %	20.7	107.6	33	20	2.70	0.5659

TEST RESULTS	MATERIAL DESCRIPTION
	Lean CLAY w/sand Dark brown & gray
Project No.: 1019-002-002 Project: Arlington Landfill Location: Arlington, Texas Date: 1/31/94	Remarks: G-3 34.0 - 35.5
CONSOLIDATION TEST REPORT EMCON Baker-Shiflett, Inc.	4-6.13

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Initial void ratio
84.0 %	18.6	105.5			2.70	0.5981

TEST RESULTS	MATERIAL DESCRIPTION
	Shale w/clay dk.gray

Project No.: 1019-002-002
Project: Arlington Landfill
Location: Arlington, Texas

Date: 2/11/94

CONSOLIDATION TEST REPORT

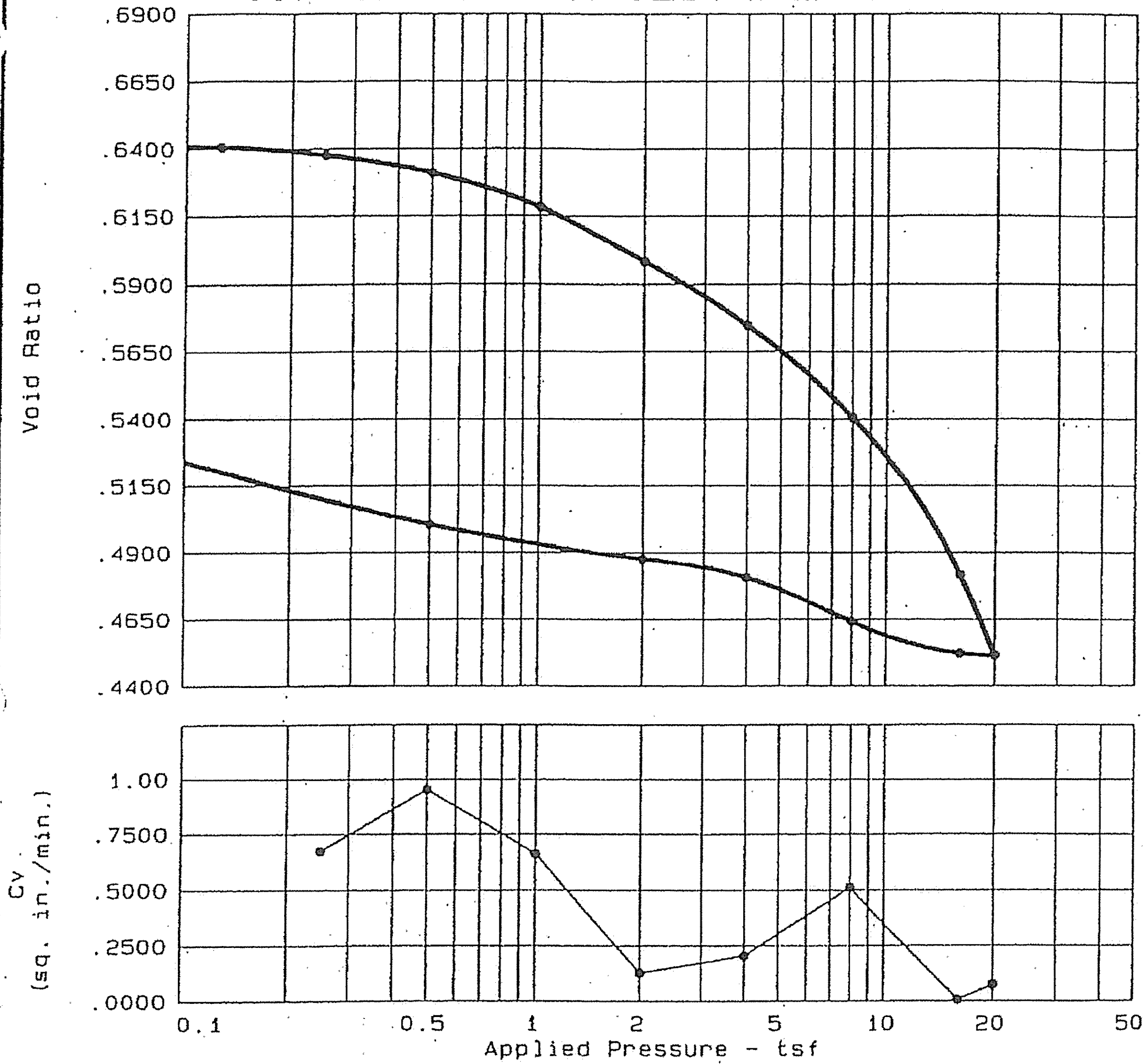
EMCON Baker-Shiflett, Inc.

Remarks:
G-3 62.0 - 63.1

4-E.14

Permit Issued: February 12, 2014

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_0
89.4 %	20.8	104.6	51	34	2.75		0.31	0.6410

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.31	Fat CLAY Dark gray to brown

Project No.: 1019-002-002
Project: Arlington Landfill
Location: Arlington, Texas

Date: 1/31/94

Remarks:
G-3 19.0 - 20.5

CONSOLIDATION TEST REPORT

EMCON Baker-Shiflett, Inc.

4-E.15

Permit Issued: February 12, 2014