GORDON GEOTECHNICAL ENGINEERING, INC.

REPORT
FINAL SLOPE STABILITY ANALYSIS
PROPOSED WASATCH ROCK DEVELOPMENT
6695 WASATCH BOULEVARD
COTTONWOOD HEIGHTS, UTAH

October 7, 2020

Job No. 528-006-20

Prepared for:
Rockworth Companies
4655 South 2300 East, Suite 205
Holladay, Utah 84117

Prepared by:
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October 7, 2020
Job No. 528-006-20

Rockworth Companies
4655 South 2300 East, Suite 205
Holladay, Utah 84117

Attention: Mr. Tom Henriod

Ladies and Gentlemen:

Re: Report
Final Slope Stability Analysis
Proposed Wasatch Rock Development
6695 Wasatch Boulevard
Cottonwood Heights, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our finalized slope stability analysis performed at the site of the proposed Wasatch Rock development located at 6695 Wasatch Boulevard in Cottonwood Heights, Utah. This report has been prepared to address review comments provided by GeoStrata in a memorandum dated June 17, 2020[1] pertaining to the geotechnical and slope stability analysis for the site dated May 13, 2020[2] as well as a geologic hazard study for the site dated May 11, 2020[3]. This report incorporates all data from previous reports as well as additional data and analysis performed in conjunction with this current study.

Revised geologic cross-sections: A-A', B-B', and C-C' as well as a new geologic cross-section: D-D', were prepared by Western Geologic and are included with Appendix A of this report. The geologic cross-sections enclosed with this report are based on additional subsurface data

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1 "Review of Geotechnical Study and Slope Stability Analysis, Proposed Wasatch Rock Development, 6695 South Wasatch Boulevard, Cottonwood Heights, Utah," Dated June 17, 2020.

2 "Report, Geotechnical Study and Slope Stability Analysis, Proposed Wasatch Rock Development, 6695 Wasatch Boulevard, Cottonwood Heights, Utah," G^2 Job No. 528-005-20.

3 "Geologic Hazards Evaluation, AJ Rock LLC Property, 6695 South Wasatch Boulevard, Cottonwood Heights, Utah," Western Geologic Project No. 5342.

collected in conjunction with this study as well as additional geologic analysis and are considered finalized geologic cross-sections.

The general location of the site with respect to major topographic features and existing facilities, as of 1998, is presented on Figure 1, Vicinity Map. A detailed location of the site showing existing roadways and surrounding facilities, on an air photograph base, is presented on Figure 2, Area Map. The locations of all previous explorations plus the new borings drilled in conjunction with this study are presented on Figure 3, Site Plan. The location of the new borings drilled in conjunction with this study are also presented on Figure 4, Site Plan of the geologic hazard evaluation supplemental data letter which is enclosed with Appendix A.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of our study were planned in discussions between Mr. Tom Henriod of Rockworth Companies and Mr. Patrick Emery of Gordon Geotechnical Engineering, Inc. (G^2).

In general, the objectives of this study were to:

1. Further define and evaluate the general subsurface soil and groundwater conditions along the cross-sections used for the slope stability analysis.

2. Provide updated slope stability recommendations to be utilized in the design and construction of the proposed facilities.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of 7 borings to depths of 41 to 81 feet below existing grade.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of our Professional Services Agreement No. 20-0821 dated August 28, 2020.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical

properties of the soils encountered in the exploration borings, measured and projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, G^2 must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

2. PROPOSED CONSTRUCTION

Currently, a hotel, an apartment, condominium, senior living center, three mixed-use pads, and three retail pads are planned for the site. Additionally, Wasatch Boulevard along the western boundary of the site will be re-aligned to bi-sect the site in a generally north-south direction.

Apartment Structure

An apartment structure is planned for the eastern portion of the site. The proposed apartment structure will consist of a two-level reinforced concrete parking structure with four- to five-levels of wood-frame apartments on top. The lowest level of the parking structure will be established at an elevation of 4,480 feet. Due to the extremely variable topography in the area, creating a pad for this structure will require cuts on the order of 15 to 20 feet and fills on the order of 15 to 20 feet.

Maximum column and wall loads for the apartment structure are anticipated to be on the order of 120 to 500 kips and 5 to 15 kips per lineal foot, respectively.

Condominium Structure

A condominium structure is planned for the north side of the site. The proposed condominium structure will consist of a 5-level reinforced concrete parking structure with 10-levels of steel-frame residential space on top. The lowest level of the parking structure will be established at an elevation of 4,893.2 feet. The mass excavation for this structure will need to extend to depths ranging from 25 to 50 feet below existing grades. The final site grading around the structure will require fills on the order of 10 to 15 feet.

Maximum column and wall loads for the condominium structure are anticipated to be very large, on the order of 1,000 to 1,500 kips and 15 to 30 kips per lineal foot, respectively. Detailed structural loads will be needed to finalize geotechnical recommendations for this structure.

Due the high loads, we anticipate that the condominium may be supported upon a continuous mat. If an average real uniform load of 145 pounds per square foot (bearing load plus frequently applied load) is imposed by each floor, an average uniform load of 75 pounds per square foot is imposed by the roof and the structure is supported upon a three and one-half foot

thick mat, the pressure imposed by the base of the mat will be on the order of 2,500 to 2,800 pounds per square foot.

Senior Living Center

A senior living center is planned for the southeast corner of the site. The proposed senior living structure will consist of a one-level reinforced concrete parking with two- to three-levels of wood-frame residential space on top. The lowest level of the parking structure will be established at an elevation of 4,853 feet. Creating a pad at the bottom of footing elevation for this structure will require fills on the order of 1 to 15 feet.

Maximum column and wall loads for the senior living structure are anticipated to be on the order of 120 to 250 kips and 5 to 10 kips per lineal foot, respectively.

Hotel

A hotel is planned for the northwest corner of the site. The proposed hotel structure will consist of four-levels of wood-framing established slab-on-grade. The lowest level of the parking structure will be established at an elevation of 4,843 feet. The pad for this structure will be established near existing grade; however, the contour maps indicate fills up to 10 or 15 feet in height may need to be removed from the area. It should be noted that the existing topography has likely changed due to the gravel pit operations.

Maximum column and wall loads for the hotel structure are anticipated to be on the order of 90 to 180 kips and 5 to 10 kips per lineal foot, respectively.

Mixed-Use and Retail Structures

Mixed-use structures are planned for Pads B and C and along the western portion of the site. Retail structures are planned for Pads A, D, and E in the central portion of the site. The mixed-use structures will be three levels in height and the retail structures will be one level in height. These structures will be of wood-frame construction established slab-on-grade. Generally these pads will require cuts and fills on the order of 5 to 10 feet.

Maximum column and wall loads for the mixed-use structures are anticipated to be on the order of 90 to 180 kips and 5 to 7 kips per lineal foot, respectively.

Final site grading will require cuts up to 30 feet in the northern portions of the site and fills on the order of 5 to 10 feet in the southwest portion of the site. Fills up to 35 feet in height are planned for the eastern portion of the site and will buttress the existing gravel pit cut slope. Final site grading slopes are generally not anticipated to not exceed 50 percent or 2.0:1.0 (H:V) with localized areas of up to 56 percent or 1.8:1.0 (H:V). Proposed grading information is based on the conceptual grading plan for the site by McNeil Engineering.

3. INVESTIGATIONS

3.1 FIELD PROGRAM

In order to further define and evaluate the subsurface soil and groundwater conditions along the cross-sections used for slope stability analysis at the site, 7 additional borings were drilled to depths of 41 to 81 feet below existing grade utilizing a truck-mounted drill rig equipped ODEX percussion drilling methods. The locations of all previous explorations plus the new borings drilled in conjunction with this study are presented on Figure 3, Site Plan. The location of the new borings drilled in conjunction with this study are also presented on Figure 4, Site Plan of the geologic hazard evaluation supplemental data letter which is enclosed with Appendix A.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the excavation operations, a continuous log of the subsurface conditions encountered was maintained. In addition, samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered is presented on Figures 4A through 4G, Log of Borings. Soils were classified in accordance with the nomenclature described on Figure 5, Unified Soil Classification System.

A 3.25-inch outside diameter, 2.42-inch inside diameter drive sampler (Dames & Moore) was utilized in the majority of the subsurface sampling at the site. Additionally, a 2.0-inch outside diameter, 1.38-inch inside diameter drive sampler (SPT) was utilized at select locations and depths. The blow counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

Subsequent to drilling the borings, a one and one-quarter inch slotted PVC pipe was inserted into select borings as a means of obtaining static groundwater levels and monitoring groundwater fluctuations.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program was performed. The program included moisture and density, partial gradation, Atterberg limits, hydrometer, residual ring shear, and direct shear tests. The following paragraphs describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected undisturbed samples. The results of these tests are presented on the boring and test pit logs, Figures 4A through 4G.

3.2.3 Partial Gradation Test

To aid in classifying the soils and to provide general index parameters, a partial gradation test was performed upon representative samples of the soils encountered in the exploration borings. The results of the tests are tabulated below:

Boring No.	Depth (feet)	Percent Passing No. 4 Sieve	Percent Passing No. 200 Sieve	Soil Classification
B-4	10.0	-	39.7	SM
B-4	35.0	-	82.7	ML
B-5	20.0	25.0	1.3	GP
B-5	30.0	-	99.7	CL
B-5	40.0	94.4	76.6	CL
B-6	5.0	63.2	6.3	SP-SM/GP-GM
B-6	25.0	-	99.8	CL
B-7	15.0	35.6	3.3	GP/SP
B-8	5.0	88.7	40.7	SM
B-8	35.0	1.0	0.7	GP
B-9	25.0	92.6	17.1	SM
B-9	45.0	-	6.7	SP-SM
B-10	60.0	85.0	7.5	SP-SM
B-10	80.0	1.6	0.4	GP

3.2.4 Atterberg Limits Tests

Atterberg limits tests were performed upon representative samples of the soils encountered in the exploration borings. Results are tabulated on the following page.

Boring No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Unified Soils Classification
B-5	32.5	42	24	18	CL
B-6	30.0	33	16	17	CL

3.2.5 Hydrometer Tests

To determine the percent clay fraction for use in fully softened and residual shear strength correlations, hydrometer tests were performed upon representative samples of the soils encountered in the exploration borings. Results are tabulated below:

Boring No.	Depth (feet)	Percent Passing No. 200 Sieve	Percent Silt	Percent Clay	Unified Soils Classification
B-5	30.0	99.7	41.4	56.2	CL
B-6	25.0	99.8	51.2	48.3	CL

3.2.6 Residual Ring Shear Tests

To determine strength parameters of soils which may have been subjected to past deformation, residual ring shear tests were performed on select samples encountered in the exploration borings. The results of the residual ring shear test are tabulated below:

Boring No.	Depth (feet)	Soil Classification	Lowest Secant Residual Friction Angle (Degrees)
B-5	32.5	CL	28.0
B-6	25.0	CL	22.2

A detailed report of the residual shear test results is provided in Appendix B.

3.2.7 Direct Shear Test

A direct shear test was performed on a representative undisturbed sample of the fine sand soils encountered in the exploration borings. The results of the direct shear test are tabulated on the following page.

Boring No.	Depth (feet)	Soil Classification	Friction Angle	Cohesion (psf)
B-4	5.0	SP	34	159

A detailed report of the direct shear test results is provided in Appendix B.

4. SITE CONDITIONS

4.1 SUBSURFACE SOIL

Subsurface soil conditions encountered in the additional exploration borings were relatively consistent with conditions encountered in previous explorations. The dominant soil type at the site is fine to coarse sands and gravels with varying amounts of silt. The sand and gravel soils are generally dense to very dense, slightly moist, light brown to tan in color, and will exhibit high strength and low compressibility characteristics.

The sand and gravel sequence contains interbedded layers of thinly layered silty fine sand and sand with limited fines. The sand soils are medium dense to dense, slightly moist to saturated, light brown to tan in color, and will exhibit moderate strength and compressibility characteristics.

At the locations of Borings B-5 and B-6, a layer of clay exhibiting distorted bedding, floating gravel clasts, and inclusions of woody debris was encountered at depths of 28 to the maximum depth of 41 feet at Boring B-5, and 23 to 37 feet below existing grade at Boring B-6. Based on the revised geologic cross-sections, this clay layer is interpreted as a pre-Lake Bonneville landslide deposit. The relict landslide deposit was not encountered in any of the other borings.

The lines designating the interface between soil types on the borings and test pit logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

4.2 GROUNDWATER

On September 28, 2020 G^2 returned to the site and measured the groundwater within the piezometers placed in the borings drilled in conjunction with this and previous studies. The latest groundwater measurements are tabulated on the following page.

Boring No.	Groundwater Depth (feet) September 28, 2020
B-1	No Groundwater
B-2	31.0
B-3	No Groundwater
B-4	31.4
B-5	26.5
B-6	18.2
B-7	No Groundwater
B-8	No Groundwater
B-9	No Groundwater
B-10	No Piezometer Installed

Seasonal and longer-term groundwater fluctuations on the order of one to two feet are projected, with the highest seasonal levels generally occurring during the late spring and early summer months.

5. DISCUSSIONS

5.1 SLOPE STABILITY

5.1.1 General

In order to evaluate the stability of the proposed slopes at the site, a slope stability analysis was performed with the computer program, SLIDE (Version 6.0), utilizing the modified Bishops method for a circular failure surfaces. The analysis included both long-term static and seismic conditions of the proposed site grading and development plans.

5.1.2 Geometry

The geometry for the slope stability models was developed from the geologic cross-sections provided with the concurrent Geologic Hazards Evaluation report. Topography was obtained from 2013 lidar data with 0.5-meter resolution. Four cross-sections (A-A', B-B', C-C', and D-D') for slope stability analysis were selected based on the locations of the proposed developments and the most adverse topographic and geologic conditions.

The locations and elevations of the proposed structures were obtained from the conceptual site grading plans by McNeil Engineering. The topography from the 2013 LiDAR data set was modified to show the proposed site grading plans for the proposed development.

The subsurface profile was developed utilizing stratigraphic information obtained from additional borings drilled in conjunction with this study as well as numerous borings, test pits, and trenches drilling and excavated in conjunction with previous studies.

5.1.3 Soil Strength

The soil parameters were selected for analysis based upon direct shear test results performed on undisturbed and laboratory recompacted samples. Strength parameters for the more coarse-grained granular soils were selected based upon our experience with similar soils in the area. These coarse-grained sand and gravel soils are projected to exhibit relatively high strengths based on their performance history in gravel pit cut slopes which have been known to stand near-vertical for extended periods of time. The cohesive characteristic and friction angle of these granular soils may be explained by a slight cementation and interlocking of particles. Strength parameters of concrete washout are estimated as being equal to that of site grading fill.

The table on the following page summarizes the soil strength values utilized for static and seismic conditions.

Soil Type	Soil Parameter	Parameter Units
Lacustrine Sand and Gravel	Cohesion	200 (psf)
	Friction Angle	36
	Unit Weight	120 (pcf)
Laminated Silty Fine Sand Beds, Poorly Graded Sand Beds, Lacustrine Sand	Cohesion	0 (psf)
	Friction Angle	33
	Unit Weight	120 (pcf)
Lacustrine Fines	Cohesion	150 (psf)
	Friction Angle	27
	Unit Weight	120 (pcf)
Site Grading Fill (Compacted Washout Fines)	Cohesion	350 (psf)
	Friction Angle	33
	Unit Weight	120 (pcf)
Site Grading Fill (Compacted Sand and Gravel)	Cohesion	250 (psf)
	Friction Angle	38
	Unit Weight	120 (pcf)
Concrete Washout	Cohesion	350 (psf)
	Friction Angle	33
	Unit Weight	130 (pcf)
Pre-Lake Bonneville Landslide Deposits	Cohesion	0 (psf)
	Friction Angle	21
	Unit Weight	120 (pcf)
Pre-Lake Bonneville Alluvial Fan Deposits	Cohesion	200 (psf)
	Friction Angle	36
	Unit Weight	120 (pcf)

The shear strength parameters used for the pre-Lake Bonneville landslide deposits is based upon laboratory residual ring shear testing and published correlations by Stark and Hussain from 2013 as well as Gamez and Stark from 2014. The lowest secant residual friction angle obtained from laboratory testing on the landslide deposit samples was measured to be 22.2 degrees.

Based on the shear strength correlations, the residual strength of the pre-Lake Bonneville landslide deposits is approximately 20 degrees (based on the tested percent clay fraction, liquid limit, and average confining pressure conditions). Considering the interpreted age of the deposit (>18,000 years old), some re-bonding of the clay particles has likely occurred. The fully softened shear strength of 26.0 degrees may in fact be more realistic of the current conditions. Despite the age of the landslide, we have conservatively selected a friction angle of 21 degrees and 0 pounds per square foot (psf) cohesion to represent lower-bound residual strength conditions for the relict landslide materials.

Fully softened and residual shear strength correlations are included with Appendix C.

5.1.4 Analysis Results

The results of the stability analyses are tabulated below:

Profile	Condition	Seismic Coefficient	Lowest Factor of Safety	Recommended Minimum Allowable Factor of Safety
A-A’	Static	--	1.63	1.5
A-A’	Seismic	0.3*	1.07	1.0
B-B’	Static	--	1.96	1.5
B-B’	Seismic	0.3*	1.02	1.0
C-C’	Static	--	1.90	1.5
C-C’	Seismic	0.3*	1.07	1.0
D-D’	Static	--	1.83	1.5
D-D’	Seismic	0.3*	1.01	1.0

* Approximately one-half of the geometric mean PGA.

6. CONCLUSIONS

The results of the slope stability analysis indicate that the proposed slopes will meet the required factors of safety provided that the following recommendations are followed:

- The condominium structure at Section A-A' incorporates a deep cut for below-grade parking. A structural element must extend a minimum of 5 feet below the bottom of footings on the cut side to assure an adequate factor of safety. This may consist of deep foundations, soil improvement, or a permanent shoring solution such as soil nails. A depth of 5 feet is shallower than previously recommended in the May 13, 2020 report. This is due to the lack of groundwater encountered to depths of 81 feet at boring locations B-9 and B-10. The projected groundwater is deeper in the updated slope stability models resulting in more favorable slope stability conditions.

- Section B-B' indicates that concrete washout material may remain in place provided that any loose or raveling material is removed and the concrete washout is competent.

- The slope at Section C-C' is the steepest with an average grade of approximately 53 percent. The stability analysis indicates that compacted bank-run sand and gravel fill material will be required for slopes that exceed 50 percent or 2:1 (H:V).

- Compacted washout fines may be utilized for slopes that do not exceed 50 percent or 2:1 (H:V).

- It is recommended that all fill slopes on the northern and eastern portions of the site incorporate subdrains near the toe of the existing slopes to intercept potential seepage from up-gradient runoff.

- Fill slopes must be benched into the existing slope as fill placement progresses to avoid a planar interface at the base of the fill. Individual benches may be on the order of five feet in height.

- Site grading fill comprising slopes must be compacted to a minimum of 90 percent of the Modified Proctor dry density.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

Gordon Geotechnical Engineering, Inc.

Reviewed by:

Jordan K. Culp, State of Utah No. 10975604
Project Engineer

Patrick R. Emery, State of Utah No. 7941710
Senior Engineer

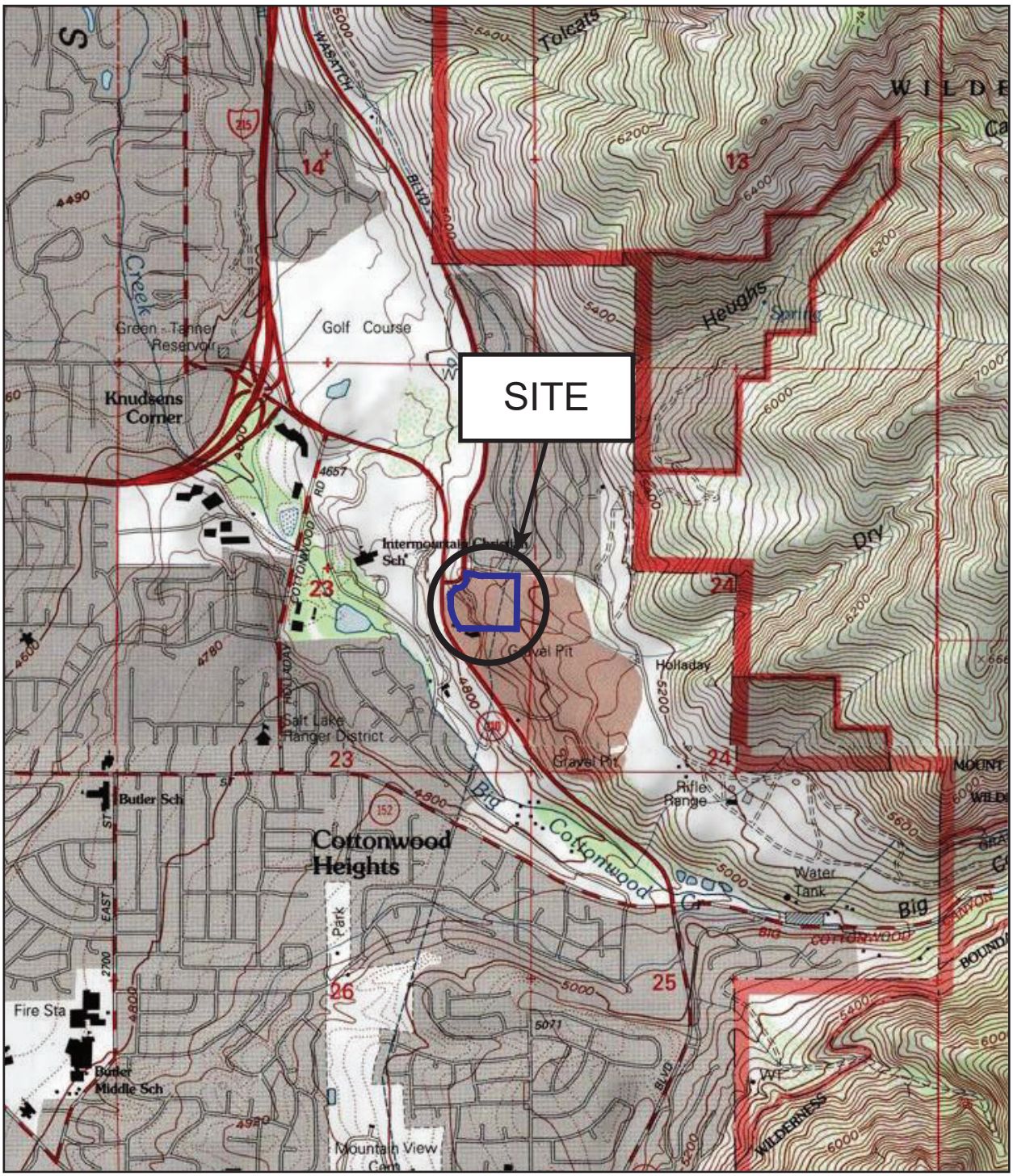
JKC/PRE:sn

Encl.	Figure	1,	Vicinity Map
	Figure	2,	Area Map
	Figure	3,	Site Plan
	Figures	4A	through 4G, Log of Borings
	Figure	5,	Unified Soil Classification System
	Appendix	A,	Updated Geologic Hazards Evaluation Letter
	Appendix	B,	Laboratory Shear Strength Test Results
	Appendix	C,	Residual and Fully Softened Shear Strength Correlations
	Appendix	D,	Slope Stability Analysis Results

Addressee (3 + email)

ROCKWORTH COMPANIES
JOB NO. 528-006-20

GORDON GEOTECHNICAL ENGINEERING, INC.



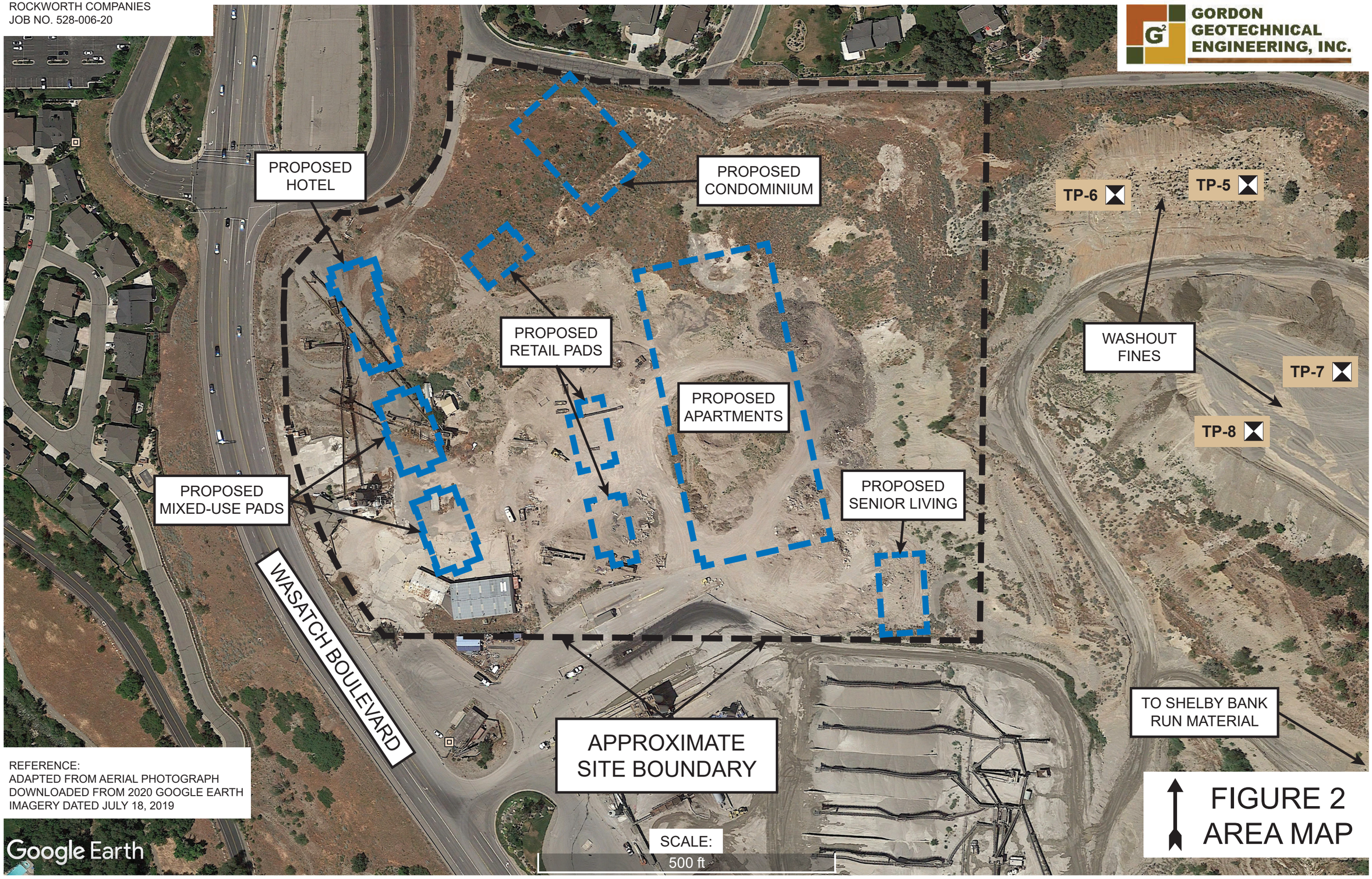
SCALE IN FEET
1000 0 1000 2000

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAPS TITLED "SUGAR HOUSE, UTAH", AND "DRAPER, UTAH", BOTH DATED 1998

FIGURE 1
VICINITY MAP

ROCKWORTH COMPANIES
JOB NO. 528-006-20

GORDON GEOTECHNICAL ENGINEERING, INC.

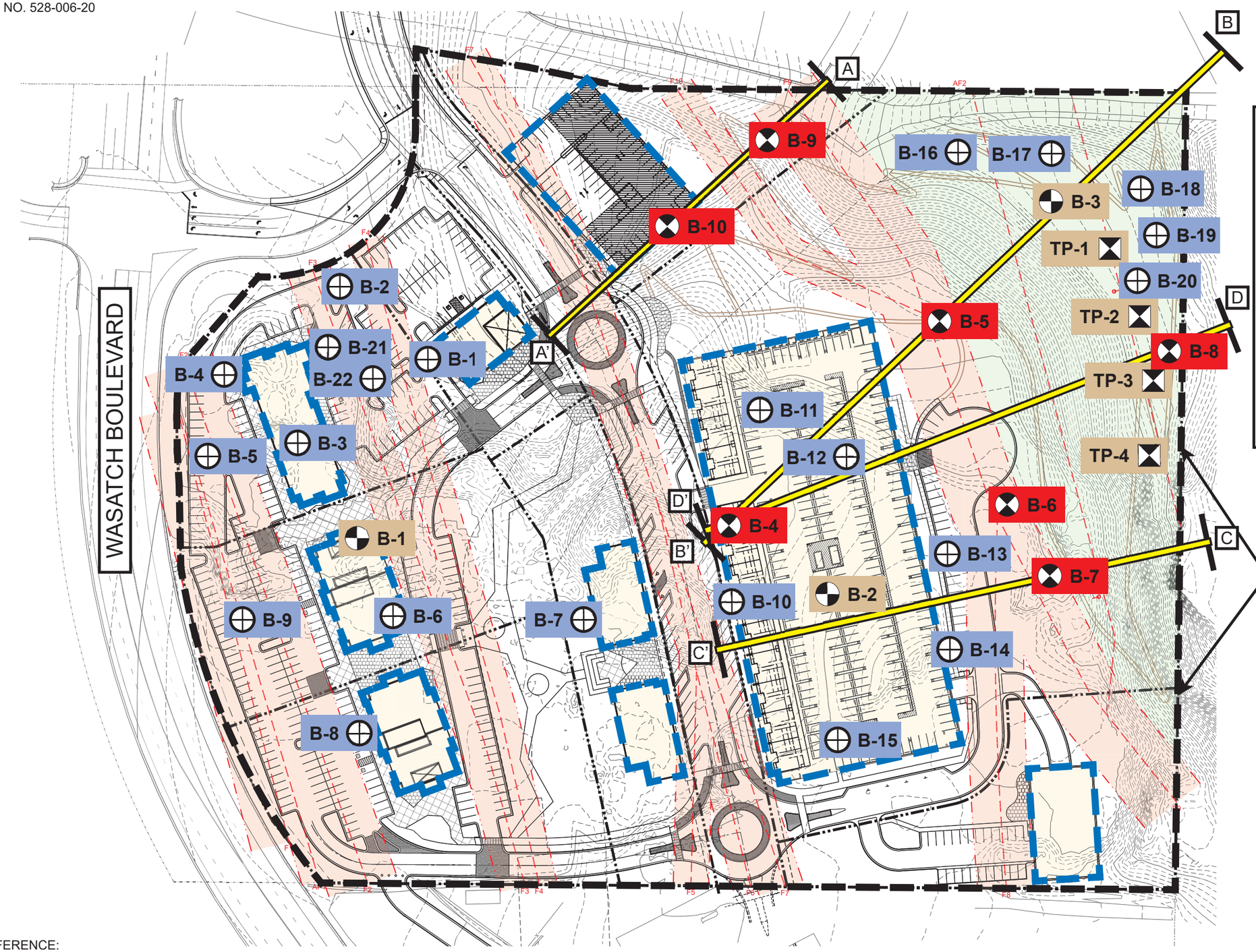


REFERENCE:
ADAPTED FROM AERIAL PHOTOGRAPH DOWNLOADED FROM 2020 GOOGLE EARTH IMAGERY DATED JULY 18, 2019

FIGURE 2
AREA MAP

ROCKWORTH COMPANIES
JOB NO. 528-006-20

GORDON GEOTECHNICAL ENGINEERING, INC.



KEY

- Deep Borings for Slope Stability Analysis.
- Borings, 5/13/20 Study.
- Test Pits, 5/13/20 Study.
- Borings, Previous GSH Study (2016).
- Cross-Sections for Stability Analysis.
- Proposed Buildings.

APPROXIMATE SITE BOUNDARY

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"WASATCH ROCK CONCEPTUAL GRADING PLAN"
BY MCNEIL ENGINEERING, DATED JUNE 04, 2019

SCALE IN FEET
57 0 57 115

FIGURE 3
SITE PLAN

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-4

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-28-20
Elevation: ---
Water Level: 18.0' (08-28-20), 31.4' (09-28-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY FINE SAND, FILL with some gravel; pale brown (SM-FILL)												
			5		U	50+						slightly moist
FINE SAND with trace gravel; light brownish-gray (SP)												
FINE SANDY SILT brown (ML)			10		U	96	16.4	107	39.7			moist
SILTY FINE SAND brown (SM)												moist
			15		U	50 4"						moist
FINE AND COARSE GRAVEL with some sand; grayish-brown (GP)												
grades brown			20		U	36						
			25			50 2"						moist

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-4

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-28-20
Elevation: ---
Water Level: 18.0' (08-28-20), 31.4' (09-28-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
FINE TO COARSE SAND with some gravel and alternating layers of silty fine sand; brown (SP-SM)					U	2"	26.2	99				
SILTY FINE SAND yellowish-brown (SM)			30		U	50+						moist
FINE TO COARSE SAND with some gravel; dark brown (SP)												saturated
FINE SANDY SILT brown (ML)			35		U	75	22.2	102	82.7			saturated
SILTY FINE SAND brown (SM)												
SILTY CLAY with some fine sand; olive brown (CL)			40		U	76						saturated
Stopped drilling at 40.0'. Stopped sampling at 41.0'. Installed slotted PVC pipe to 40.0'.			45									
			50									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-5

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-28-20
Elevation: ---
Water Level: 28.0' (08-28-20), 26.5' (09-28-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL, FILL frequent debris at surface including rebar and concrete; pale brown (SM/GM-FILL)												
			5		U	50+						no recovery
												no recovery rocks/boulder
					U	50+						
			10		U	50+						no recovery
			15		U	50+						no recovery lost air circulations for drill at 15' to 20' possible void or factured space
FINE AND COARSE GRAVEL with some sand; gray (GP)												
			20		U	32	10.1		1.3			slightly moist
			25			50+						

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-5

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-28-20
Elevation: ---
Water Level: 28.0' (08-28-20), 26.5' (09-28-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
					U	50+						
SILTY CLAY with trace fine sand; woody debris and distorted bedding; dark gray (CL)												saturated
			30		U	21	31.9		99.7			
grades dark gray					U	51				42	24	
grades with slightly layered abundant and moderately organic; very dark gray			35		U	55						
			40		U	90	22.4	104	76.6			
Stopped drilling at 40.0'. Stopped sampling at 41.0'. Installed slotted PVC pipe to 40.0'.			45									
			50									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-6

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-31-20
Elevation: ---
Water Level: 18.0' (08-31-20), 18.2' (09-28-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL, FILL with occasional cobbles and boulders; pale brown (SM/GM-FILL)												
FINE AND COARSE GRAVEL AND FINE TO COARSE SAND with some silt; dark grayish-brown (GP-GM/SP-SM)			5		U	87	4.4	99	6.3			slightly moist
			10		U	54						
CLEAN COARSE GRAVEL with trace sand; dark grayish-brown (GP)			15		U	46						moist
												saturated
grades brown			20		U	12						
SILTY CLAY with trace fine sand; dark gray (CL)												saturated
			25			22						

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-6

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-31-20
Elevation: ---
Water Level: 18.0' (08-31-20), 18.2' (09-28-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
grades slightly layered; approximately 30° from horizontal					U	22	33.6		99.8			
grades layered; approximately 10° from horizontal; abundant organics; dark gray with black organics					U	55						
grades with trace coarse gravel; slightly layered; approximately 30° from horizontal; abundant organics; very dark gray			30		U	50				33	16	
grades with some fine sand and trace coarse gravel; abundant organics; very dark greenish-gray					U	80						
grades with some fine sand and coarse gravel; yellowish-red			35		U	85						
SILTY FINE AND COARSE GRAVEL with some sand; brown (GM)			40		U	50+						saturated
Stopped drilling at 40.0'. Stopped sampling at 41.0'. Installed slotted PVC pipe to 40.0'.			45 50									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-7

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-31-20
Elevation: ---
Water Level: Groundwater not encountered. (08-31-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY FINE AND COARSE GRAVEL AND FINE TO COARSE SAND AND, FILL with occasional cobbles and boulders; frequent debris at surface including asphalt concrete, concrete, rebar, steel; pale brown (GM/SM-FILL)												
CLEAN FINE TO COARSE SAND AND FINE AND COARSE GRAVEL dark grayish-brown (GP/SP)			5		U	50+						slightly moist
CLEAN FINE AND COARSE SAND with some fine and coarse gravel; grayish-brown (SP)			10		U	59						slightly moist
CLEAN FINE AND COARSE GRAVEL with some coarse sand; grayish-brown (GP/SP)			15		U	80	1.1		3.3			moist
grades with trace sand			20		U	50+						sligtly moist
			25			50+						

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4D

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-7

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 08-31-20
Elevation: ---
Water Level: Groundwater not encountered. (08-31-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
grades with some sand					U	50+						
			30		U	75						
grades with trace sand			35		U	50+						
CLEAN FINE TO COARSE SAND with some gravel; dark grayish-brown (SP)			40		U	67						slightly moist
Stopped drilling at 40.0'.												
Stopped sampling at 41.0'.												
Installed slotted PVC pipe to 40.0'.			45									
			50									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4D
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-8

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-01-20
Elevation: ---
Water Level: No groundwater encountered. (09-01-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY FINE TO COARSE SAND, FILL with some gravel; major roots (topsoil) to 3"; dark brown (SM-FILL)												slightly moist
			5		U	70	4.7		40.7			
			10		U	50+						
			15		U	62						moist
SILTY FINE AND COARSE GRAVEL with occasional cobbles; very dark grayish-brown (GM)												slightly moist
			20		U	63						sligtly moist
CLEAN FINE AND COARSE GRAVEL AND FINE TO COARSE SAND dark grayish-brown (GP-SP)												
FINE AND COARSE GRAVEL with trace silt; light gray (GP)			25			50+						slightly moist

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4E

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-8

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-01-20
Elevation: ---
Water Level: No groundwater encountered. (09-01-20)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
					U	50+						
			30		U	50+						
grades with clean coarse gravel with occasional cobbles; gray			35		U	50+	0.3		0.7			
grades with some fine to coarse sand; gray			40		U	68						
Stopped drilling at 40.0'. Stopped sampling at 41.0'. Installed slotted PVC pipe to 40.0'.			45 50									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4E
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-9

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-14-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY CLAY, FILL with trace fine sand; major roots (topsoil) to 3"; pale brown (CL-FILL)												slightly moist
SILTY FINE SAND, FILL with some fine and coarse gravel; pale brown (SM-FILL)			5		U	72						slightly moist medium dense
SILT, FILL with some fine sand; pale brown (ML-FILL) WASHOUT FINES			10		U	39						sligtly moist very sitff
COARSE GRAVEL with trace silt; grayish-brown (GP)			15		U	90						slightly moist dense
grades fine and coarse gravel with trace silt; pale brown			20		U	70						medium dense
FINE TO COARSE SAND with some fine and coarse gravel and silt; grayish-brown (SP)			25			20						moist loose

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4F

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-9

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-14-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
SILTY FINE TO COARSE SAND grayish-brown (SM)					U	20	5.6	100	17.1			
SILTY FINE SAND brown (SM)												moist medium dense
grades grayish-brown			30		U	66						
FINE AND COARSE GRAVEL AND FINE TO COARSE SAND with trace silt; grayish-brown (GP-SP)			35		U	50+						slightly moist
			40		U	92						dense
FINE SAND with some silt; brown (SP-SM)			45		U	88	3.2	103	6.7			moist dense
FINE TO COARSE SAND with some silt and fine and coarse gravel with occasional cobbles; grayish-brown (SP-SM)			50			96						slightly moist dense

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4F (con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-9

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-14-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
					U	96	1.9	116				
FINE AND COARSE GRAVEL with trace silt; grayish-brown (GP) boulder from 52' to 54'												slightly moist
			55		U	50+						
grades with some fine to coarse sand			60		U	84						dense
			65		U	50+						
FINE SAND with some gravel and trace silt; dark grayish-brown (SP)			70		U	65						sligthly moist dense
FINE AND COARSE GRAVEL with some fine to coarse sand and silt; dark grayish-brown (GP)			75			50+						moist

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4F
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-9

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-14-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
FINE AND COARSE GRAVEL AND FINE TO COARSE SAND with trace silt; dark grayish-brown (GP/SP)					U	50+						moist
			80		U	76						dense
Stopped drilling at 79.5'.												
Stopped sampling at 81.0'.												
Installed slotted PVC pipe to 79.5'.			85									
			90									
			95									
			100									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4F
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-10

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-15-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
FINE SANDY SILT, FILL major roots (topsoil) to 3"; pale brown (ML-FILL) WASHOUT FINES												slightly moist
			5		U	38						very sitff
			10		U	29						
			15		U	27						
			20		U	33						moist
SILTY FINE TO COARSE SAND, FILL with trace gravel; brown (SM-FILL)												moist hard
			25			86						

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4G

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-10

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-15-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
					U	86						
			30		U	36						very stiff
SILTY FINE AND COARSE GRAVEL AND FINE TO COARSE SAND, FILL brown (GM-SM)			35		U	60	2.1	99	7.5			moist medium dense
FINE TO COARSE SAND, FILL with some fine and coarse gravel and trace silt; grayish-brown (SP-FILL)			40		U	39						moist medium dense
FINE AND COARSE GRAVEL, FILL with asphalt concrete, debris; dark grayish-brown (GP-FILL)			45		U	50+						moist dense
SILTY FINE TO MEDIUM SAND, FILL with some fine and coarse gravel; tire debris including rubber and steel; grayish-brown (SM-FILL)			50			58						moist medium dense

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4G
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-10

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-15-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
					U	58						
					B							
FINE AND COARSE GRAVEL with trace fine to coarse sand and silt; grayish-brown (GP)												slightly moist dense
			55		U	50+						
FINE TO COARSE SAND with some fine and coarse gravel and silt; grayish-brown (SP-SM)												slightly moist medium dense
			60		U	55						
FINE AND COARSE GRAVEL with some fine to coarse sand and trace silt; grayish-brown (GP)												slightly moist dense
			65		U	50+						
FINE AND COARSE GRAVEL AND FINE TO COARSE SAND with some silt; grayish-brown (GP-SP)			70		U	59						slightly moist medium dense
			75			50+						

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4G
(con't)

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

BOREHOLE B-10

Project Name: Proposed Gravel Pit Development
Project No.: 528-006-20
Location: 6695 Wasatch Boulevard, Cottonwood Heights, Utah
Client: Rockworth Companies
Drilling Method: 4.25" Casing ODEX
Date Drilled: 09-15-20
Elevation: ---
Water Level: No groundwater encountered.
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
FINE AND COARSE GRAVEL with trace silt; gray (GP)					U	50+	0.3		0.4			slgithly moist medium dense
			80		U	50+						dense
Stopped drilling at 79.5'.												
Stopped sampling at 81.0'.												
			85									
			90									
			95									
			100									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4G
(con't)

GORDON GEOTECHNICAL ENGINEERING, INC.

UNIFIED SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES				GRAPH SYMBOL	LETTER SYMBOL [1]	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size. [2] (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).		GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		SW	Well graded sands, gravelly sands, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		SM	Silty sands, poorly graded sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).		SC	Clayey sands, poorly graded sand-clay mixtures.

IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	GRAPH SYMBOL	LETTER SYMBOL [1]	TYPICAL DESCRIPTIONS
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity.
		Medium to high	None to very slow	Medium		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Slight to medium	Slow	Slight		OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to very high	None	High		CH	Inorganic clays of high plasticity, fat clays.
		Medium to high	None to very slow	Slight to medium		OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.				Pt	Peat and other highly organic soils.

[1] Boundary classifications: –Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW–GC, well graded gravel–sand mixture with clay binder.
[2] All sieve sizes on this chart are U.S. standard.

GENERAL NOTES

1. In general, Unified Soil Classification Designations presented on the logs were evaluated by visual methods only. There rore, actual designations (based on laboratory testing) may differ.

2. Lines seperating strata on the logs represent approximate boundaries only Actual transitions may be gradual.

3. Logs represent general soil conditions observed at teh point of exploration onthe date indicated.

4. No warranty is provided as to the continuity of soil conditions between individual sample locations.

FINE - GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by Thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1 " by Thumb . Molded by light finger pressure.
Medium Stiff	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2 " by Thumb with moerate effort. Molded by strong finger pressure.
Stiff	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2 " by Thumb but penetrated only with great effort
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by Thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty by Thumbnail

LOG KEY SYMBOLS

- Bulk / Bag Sample
- Standard Penetration Split Spoon Sampler
- Rock Core
- Water Level
- Thin Wall
- No Recovery
- 3-3/4" ID D&M Sampler
- 3" ID D&M Sampler
- California Sampler

COARSE -GRAINDE SOIL

APPERENT DENSITY	SPT (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	<4	0 - 15	Easily penetrated with 1/2 " reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrated with 1/2 " reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Dense	30 - 50	65 - 85	Difficult to penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Very Dense	>50	85 - 100	Penetrated only a few inches with 1/2 " reinforcing rod driven with 5-lb hammer

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2 "
LAYER	1/2 - 12 "

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness
Frequent	More than on per foot of thichness

CEMENTATION

DESCRIPTION	DESCRIPTION
Weakely	Crumbles or breaks with handling of slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumbles or breaks with finger pressure

MODIFIERS

DESCRIPTION	%
Trace	<5
Some	5 - 12
With	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually soil below Water Table

FIGURE 5

APPENDIX A

Updated Geologic Hazards Evaluation Letter

WESTERN GEOLOGIC & ENVIRONMENTAL LLC
2150 SOUTH 1300 EAST, SUITE 500
SALT LAKE CITY, UTAH 84106 USA

Phone: 801.359.7222 Fax: 801.990.4601 Email: kthomas@westerngeologic.com

October 4, 2020

Patrick R. Emery – Principal Engineer
Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

Subject: Supplemental Data
Geologic Hazards Evaluation
AJ Rock LLC Property
6695 South Wasatch Boulevard
Cottonwood Heights, Utah

Dear Mr. Emery:

Western Geologic & Environmental, LLC prepared a geologic hazards evaluation report for the subject site dated May 11, 2020 (Western Geologic, 2020). This letter provides supplemental information with regard the site to address review comments provided in GeoStrata (2020) and additional subsurface information obtained by Gordon Geotechnical in August and September 2020.

Figure 4 provides a site plan at scale of 1 inch equals 100 feet (1:1,200) showing locations of the subsurface exploration we conducted at the site, as well as locations of ten (10) Gordon Geotechnical borings, site boundaries, proposed development, and faults and setback zones (as defined in Western Geologic, 2020). Borings B-4 through B-10 are the new borings conducted in August and September 2020. Based on additional subsurface data from these borings, we have revised Figures 14 through 16 from Western Geologic (2020) and included one additional geologic cross section (D-D', Figure 17). Cross Section A-A' is based on the stratigraphic sequence in trenches T-5, T-6, and T-9 and subsurface data from borings B-9 and B-10. Cross Section B-B' is based on the stratigraphic sequence in trenches T-5 and T-6, as well as data from borings B-3, B-4, and B-5. Cross section C-C' is based on the stratigraphic sequence in trenches T-6, T-7, and T-8, as well as data from borings B-2 and B-7. Cross section D-D' is at a scale of 1 inch equals 50 feet, and is based on the stratigraphic sequence in trenches T-5 and T-6, as well as data from borings B-4 and B-8. Cross sections B-B' and D-D' show a pre-Lake Bonneville landslide that was encountered in trench T-6 and at depth in borings B-5 and B-6. The inferred extent of the concealed landslide deposit is shown on Figure 4 based on a lack of evidence for it in the remaining explorations. Inferred groundwater levels are based on static groundwater depths measured in the borings by Gordon Geotechnical in September 2020. The topographic profiles are based on geoprocessed 2013 LIDAR data. The LIDAR data provide a snapshot of topographic conditions at the time it was acquired; past, present, and future topographic conditions may vary.

We believe the attached cross sections provide a conservative basis for slope stability analyses by Gordon Geotechnical and are adequate based on available data. However, units and contacts should be considered approximate and inferred. Some variation should be expected that cannot be anticipated. GeoStrata (2020; current review comment 4) recommends that a site-specific geologic map for the site be provided. As indicated on the revised Figure 4, we consider the entire site to be underlain by man-made fill overlying lacustrine gravel and sand deposited during the transgressive stage of Lake Bonneville, including cobbles, and lesser silt and clay. The native sediments have a mixed depositional provenance and have been mapped as separate, differing units by McKean (2018) and Personius and Scott (1992, 2009). However, these sediments are similar in composition and have been consistently observed throughout the site. We do not consider their provenance to be a significant detail from the perspective of the Cottonwood Heights City's Sensitive Lands Evaluation & Development Standards (SLEDS; Cottonwood Heights City Municipal Code Title 19, Chapter 19.72).

This letter is not a stand-alone document and should be included as a supplement to our prior report. No changes to the recommendations provided in Western Geologic (2020; Section 6.0) appear needed at this time. If you have any questions, please call.

Sincerely,
Western Geologic & Environmental LLC

Bill. D. Black, P.G.
Subcontract Geologist

Reviewed By:

Kevin J. Thomas, P.G.
Principal Geologist

ATTACHMENTS

Figure 4. Site Plan (11"x17")
Figure 14. Cross Section A-A' (11"x17")
Figure 15. Cross Section B-B' (11"x17")
Figure 16. Cross Section C-C' (11"x17")
Figure 17. Cross Section D-D' (11"x17")

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WG&E Project No. 5342

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REFERENCES

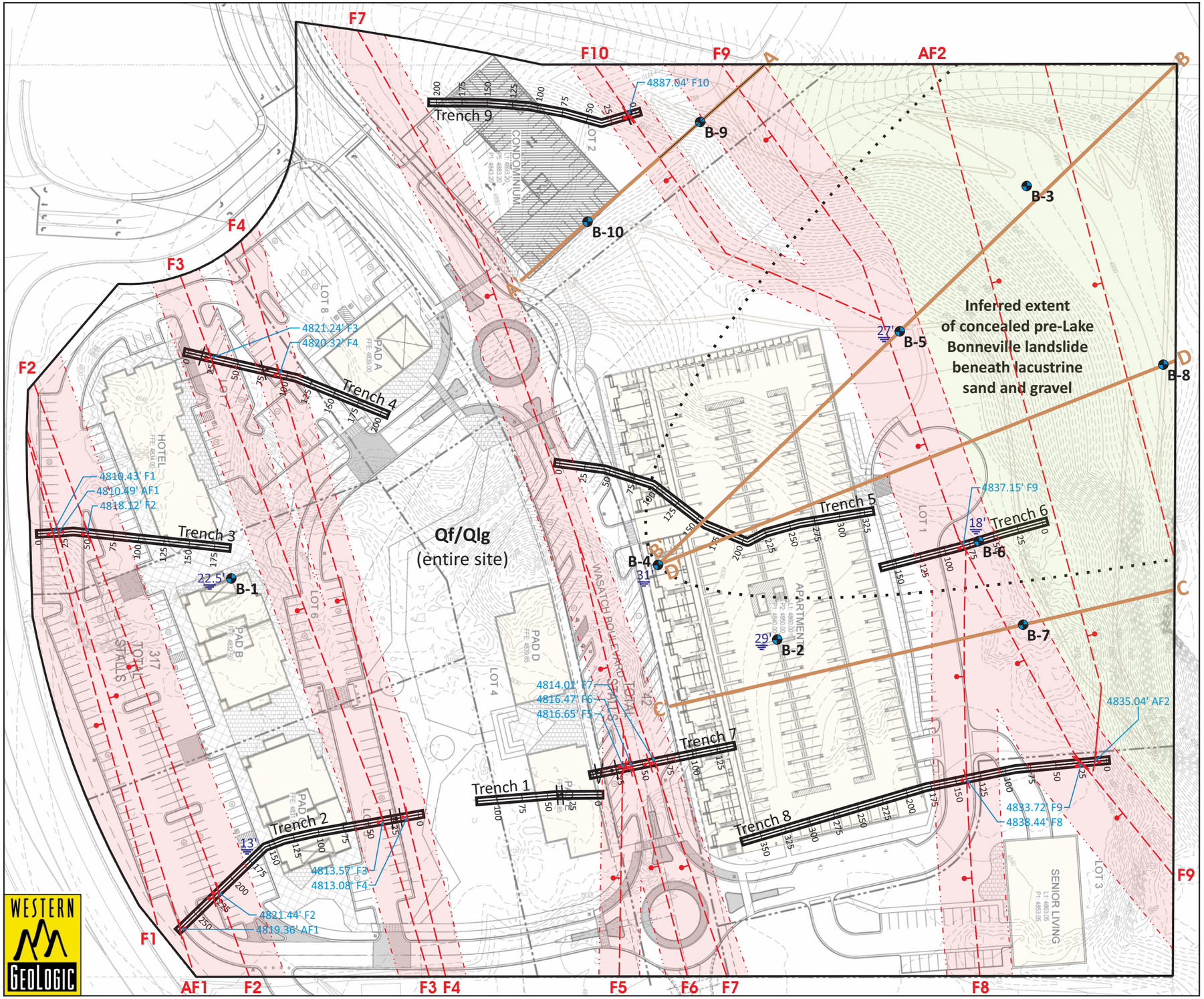
GeoStrata, 2020, Review of Geologic Hazards Evaluation AJ Rock LLC Property, 6695 South Wasatch Boulevard Cottonwood Heights, Utah (May 11, 2020): unpublished consultant's report prepared for City of Cottonwood Heights dated June 16, 2020, 19 p.

McKean, A.P., 2018, Interim geologic map of the Sugar House Quadrangle, Salt Lake County, Utah: Utah Geological Survey Open-File Report 687DM, scale 1:24,000, 28 p. pamphlet.

Personius, S.F., and Scott, W.E., 1992, Surficial geologic map of the Salt Lake City segment and parts of adjacent segments of the Wasatch fault zone, Davis, Salt Lake, and Utah Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Series, Map I-2106, scale 1:50,000.

____, 2009, Surficial geologic map of the Salt Lake City segment and parts of adjacent segments of the Wasatch fault zone, Davis, Salt Lake, and Utah Counties, Utah, digitized from U.S. Geological Survey Miscellaneous Investigations Series Map I-2106 (1992): Utah Geological Survey Map 243DM, 2 plates, scale 1:50,000.

Western Geologic, 2020, Geologic Hazards Evaluation--AJ Rock LLC Property, 6695 South Wasatch Boulevard, Cottonwood Heights, Utah: unpublished consultant's report prepared for Gordon Geotechnical Engineering, Inc. dated May 11, 2020, 22 p. with trench logs.



EXPLANATION

Faults based on trenching and air photo evidence; bar and ball on downthrown side.

Trench for this study, stations denote distance in feet on logged wall; blue tags denote elevation of highest fault point in trench at time of surveying.

Setback zones (see text for explanation).

Unexplored area, no structures intended for human occupation should be placed in this area without additional exploration.

Cross section location (Figures 14 to 17)

Gordon Geotechnical boring

0 100 200 feet
Scale 1 inch equals 100 feet

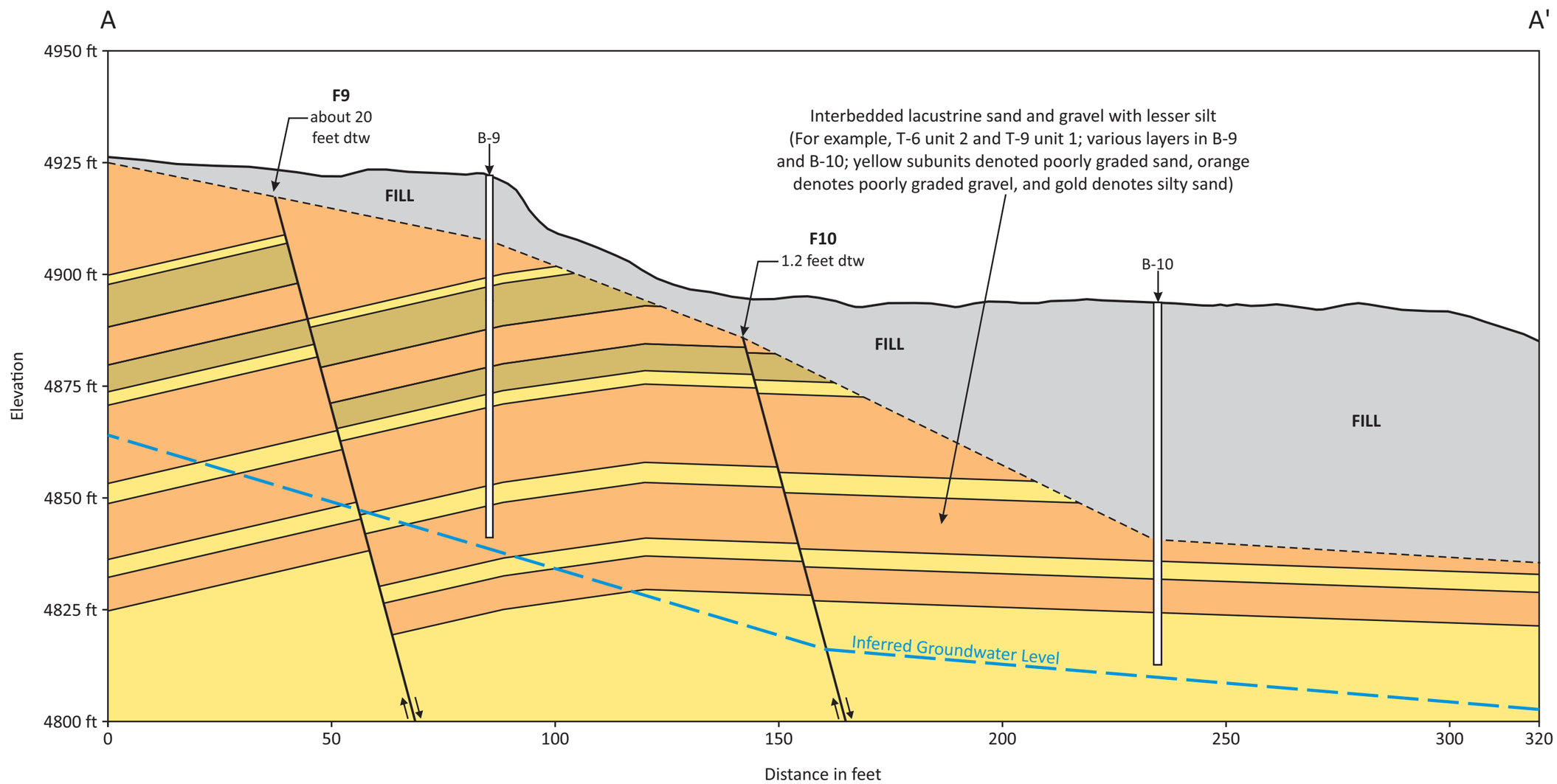
Source: McNeil Engineering concept grading plan SK-02 dated April 24, 2020. Western Geologic (2020) Figure 4 revised September 30, 2020 to add cross section D-D' and seven additional boring locations (B-4 through B-10).

Site-Specific Mapping: Surficial geology of the entire site is man-made fill overlying mixed lacustrine sand and gravel deposited during the transgressive stage of late Pleistocene Lake Bonneville. McKean (2018) maps the site in units Qaly, Qldb and Qlgb, as shown on Western Geologic (2020) Figure 2. No evidence for their mapped alluvium (unit Qaly) was observed in the subsurface exploration conducted at the site and these deposits (if present) were likely removed by gravel mining activities or very limited. McKean (2018) distinguishes units Qldb and Qlgb by their inferred depositional mechanism, but both units are similar in composition. Unit descriptions are provided in Western Geologic (2020). We do not map these units separately given their similar composition, a lack of proof for their origin, and that their depositional provenance (whether lacustrine or deltaic/outwash) poses no difference from a geologic hazard perspective.

SITE PLAN

GEOLOGIC HAZARDS EVALUATION
AJ Rock LLC Property
6695 South Wasatch Boulevard
Cottonwood Heights, Utah

FIGURE 4

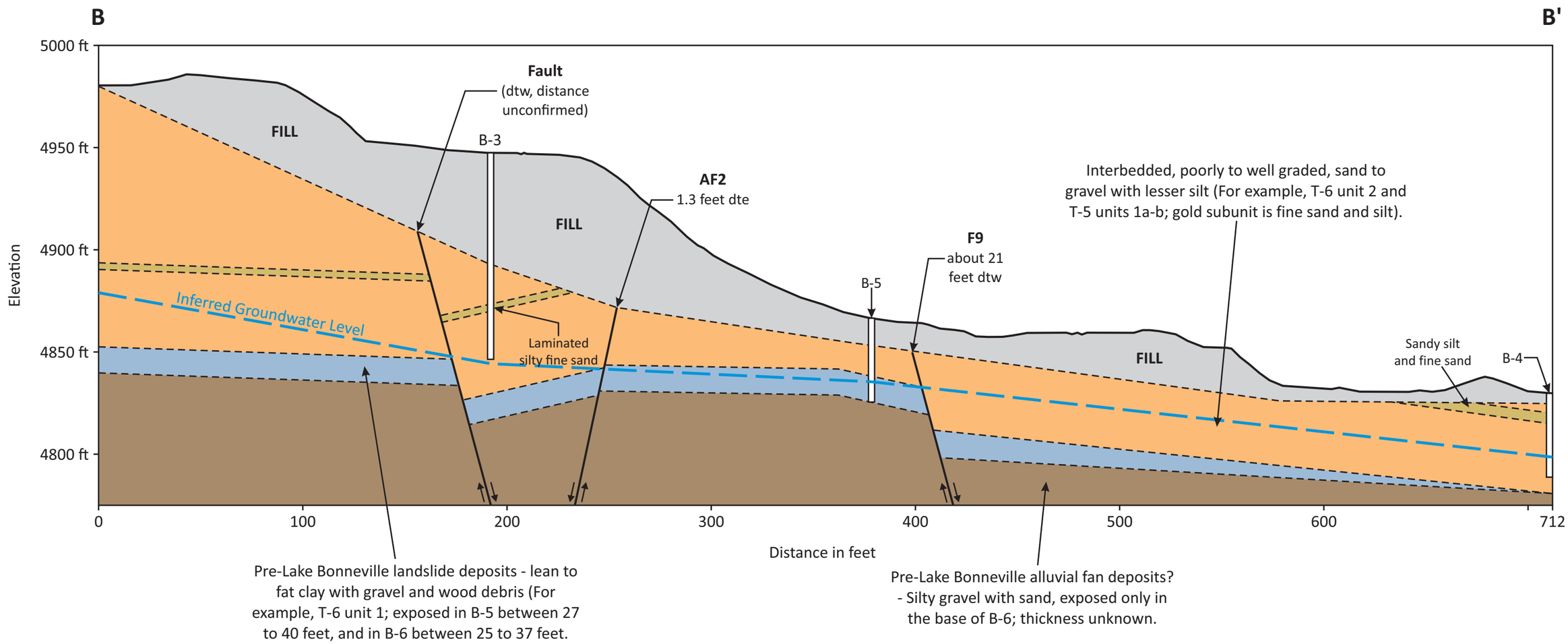


SCALE: 1 inch = 25 feet (no vertical exaggeration)
Profile east to west trending 228°N
Unit and textural contacts are approximate and inferred.
Revised September 30, 2020 based on additional subsurface
data from Gordon Geotechnical borings B-9 and B-10.

CROSS SECTION A-A'

GEOLOGIC HAZARDS EVALUATION
AJ Rock LLC Property
6695 South Wasatch Boulevard
Cottonwood Heights, Utah

FIGURE 14

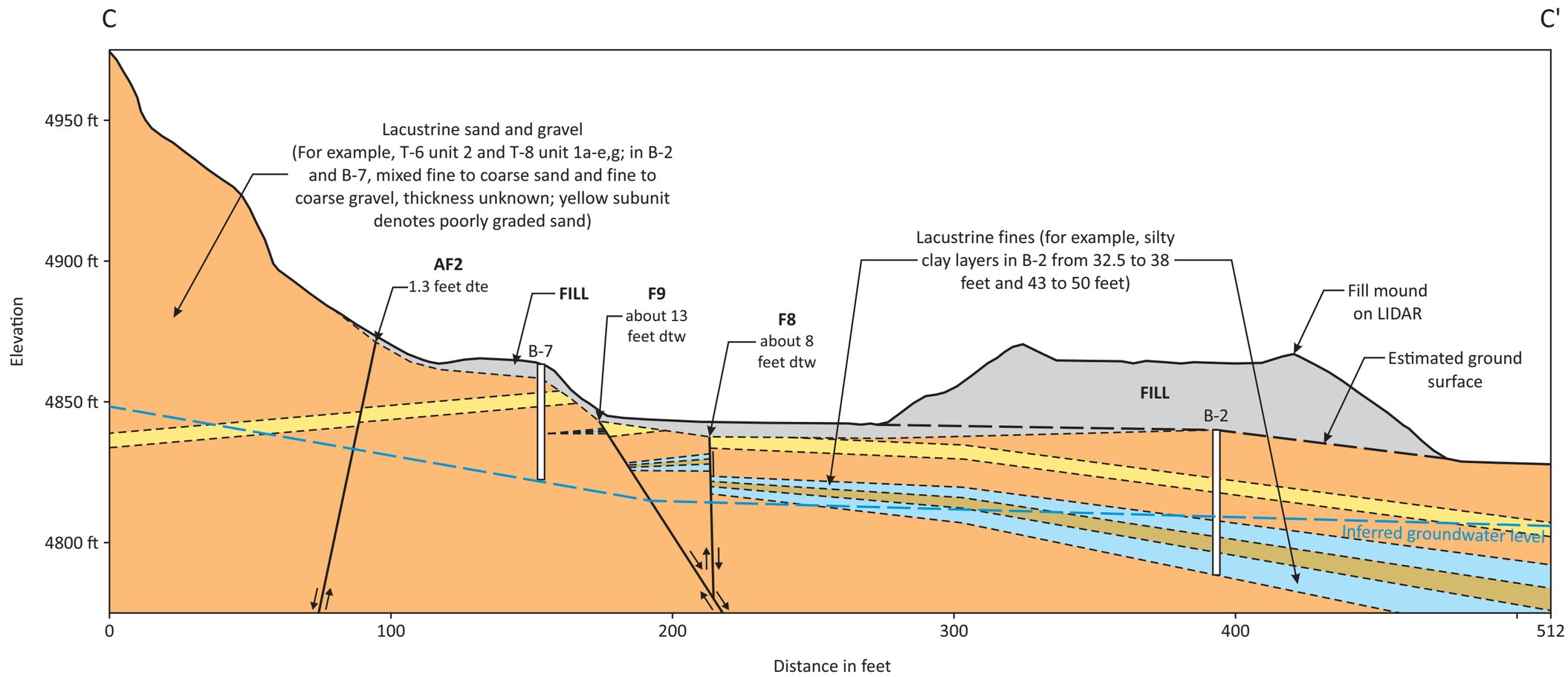


SCALE: 1 inch = 50 feet (no vertical exaggeration)
Profile east to west trending 226°N
Units and contacts are approximate and inferred.
Revised October 1, 2020 based on additional subsurface
data from Gordon Geotechnical borings B-4 and B-5

CROSS SECTION B-B'

GEOLOGIC HAZARDS EVALUATION
AJ Rock LLC Property
6695 South Wasatch Boulevard
Cottonwood Heights, Utah

FIGURE 15

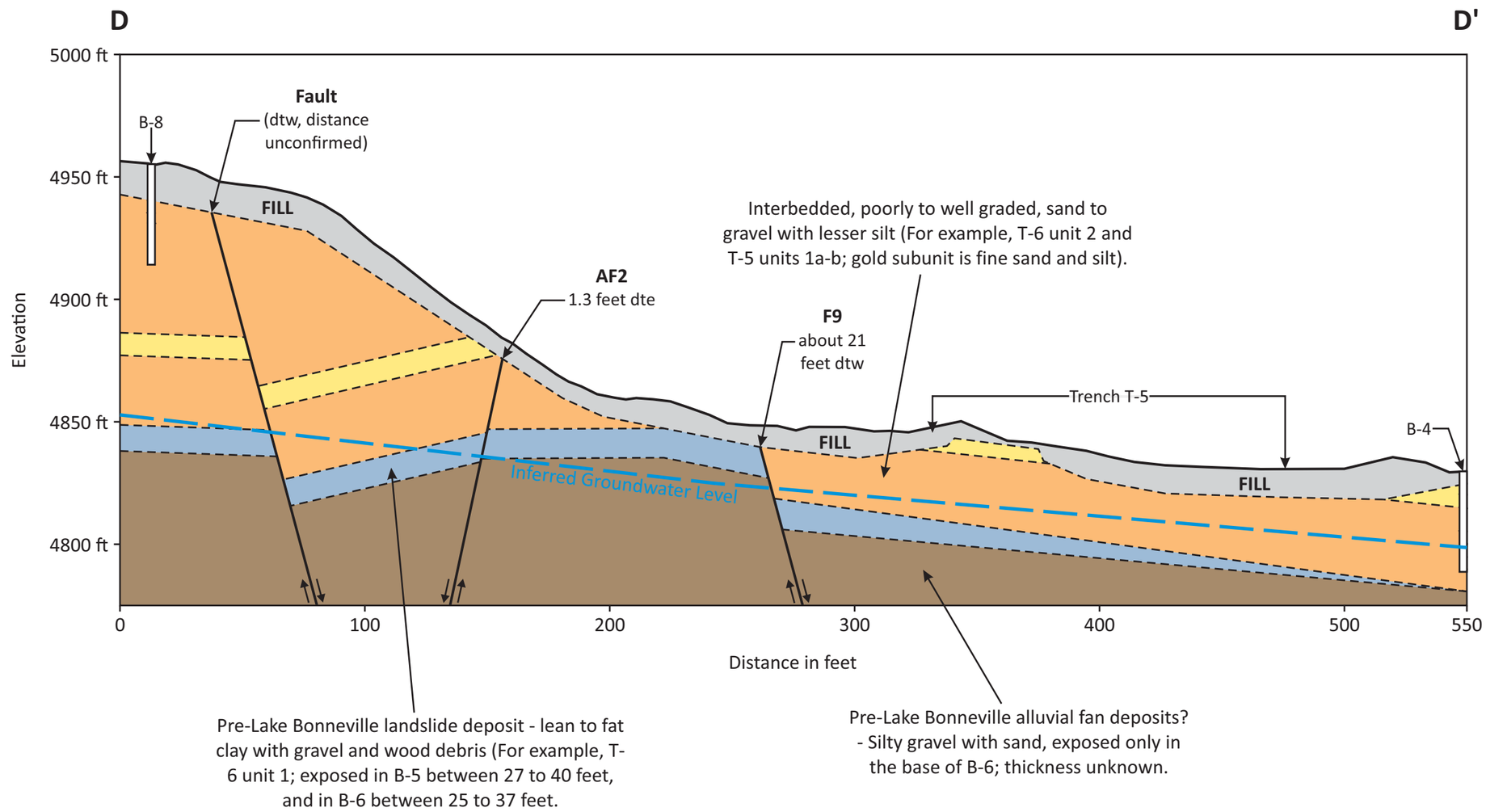


SCALE: 1 inch = 40 feet (no vertical exaggeration)
Profile east to west trending 257 N
Units and contacts are approximate and inferred.
Revised October 1, 2020 based on additional subsurface data from Gordon Geotechnical boring B-7.

CROSS SECTION C-C'

GEOLOGIC HAZARDS EVALUATION
AJ Rock LLC Property
6695 South Wasatch Boulevard
Cottonwood Heights, Utah

FIGURE 16



SCALE: 1 inch = 50 feet (no vertical exaggeration)
Profile east to west trending 248°N
Units and contacts are approximate and inferred.

CROSS SECTION D-D'

GEOLOGIC HAZARDS EVALUATION
AJ Rock LLC Property
6695 South Wasatch Boulevard
Cottonwood Heights, Utah

FIGURE 17

Appendix B

Laboratory Shear Strength Test Results

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

© IGES 2004, 2020

Project: Gordon Geotechnical Engineering
No: M02106-017 (528-005-20)
Location: Gravel Pit
Date: 9/11/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.: B-5
Sample:
Depth: 32.5'
Description: Grey lean clay

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.4
Estimated percent retained on No.40: Not requested
As-received water content (%): Not requested

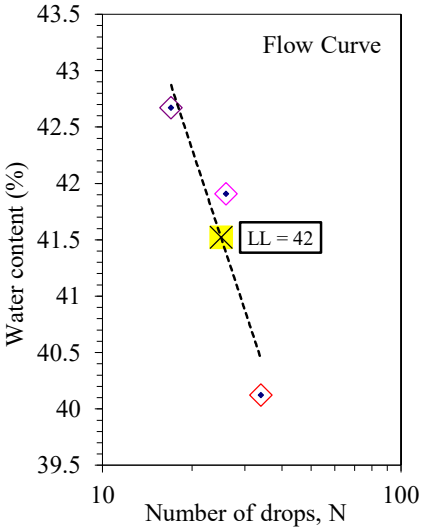
Plastic Limit

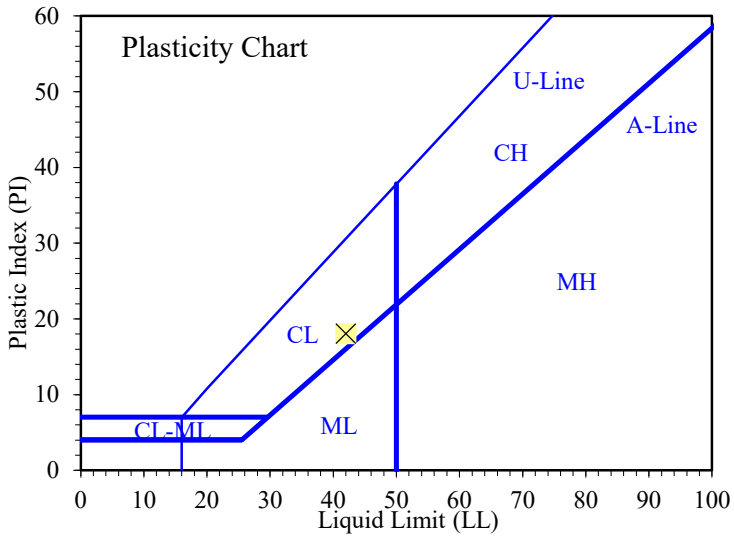
Determination No	1	2				
Wet Soil + Tare (g)	13.36	14.21				
Dry Soil + Tare (g)	12.13	12.82				
Water Loss (g)	1.23	1.39				
Tare (g)	7.05	7.07				
Dry Soil (g)	5.08	5.75				
Water Content, w (%)	24.21	24.17				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	26	17			
Wet Soil + Tare (g)	14.19	16.81	14.94			
Dry Soil + Tare (g)	12.18	14.10	12.67			
Water Loss (g)	2.01	2.71	2.27			
Tare (g)	7.17	7.65	7.35			
Dry Soil (g)	5.01	6.45	5.32			
Water Content, w (%)	40.12	41.91	42.67			
One-Point LL (%)		42				

Liquid Limit, LL (%)	**42**
Plastic Limit, PL (%)	**24**
Plasticity Index, PI (%)	**18**





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Reviewed:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

© IGES 2004, 2020

Project: Gordon Geotechnical Engineering
No: M02106-017 (528-005-20)
Location: Gravel Pit
Date: 9/11/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.: B-6
Sample:
Depth: 30'
Description: Grey lean clay

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.4
Estimated percent retained on No.40: Not requested
As-received water content (%): Not requested

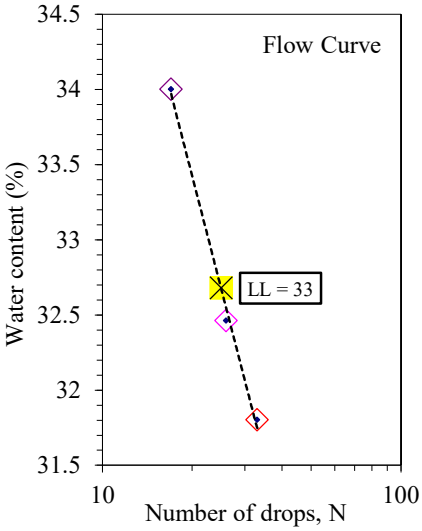
Plastic Limit

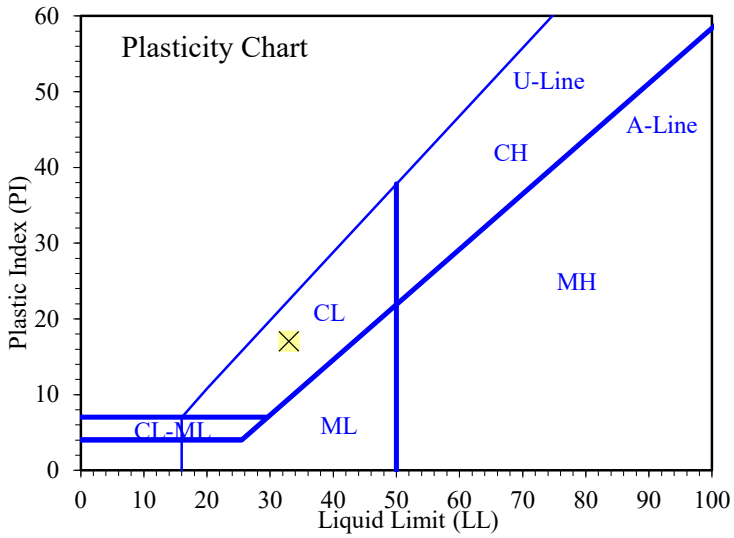
Determination No	1	2				
Wet Soil + Tare (g)	14.11	13.82				
Dry Soil + Tare (g)	13.12	12.86				
Water Loss (g)	0.99	0.96				
Tare (g)	7.05	7.08				
Dry Soil (g)	6.07	5.78				
Water Content, w (%)	16.31	16.61				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	33	26	17			
Wet Soil + Tare (g)	14.56	15.71	15.42			
Dry Soil + Tare (g)	12.76	13.60	13.38			
Water Loss (g)	1.80	2.11	2.04			
Tare (g)	7.10	7.10	7.38			
Dry Soil (g)	5.66	6.50	6.00			
Water Content, w (%)	31.80	32.46	34.00			
One-Point LL (%)		33				

Liquid Limit, LL (%)	**33**
Plastic Limit, PL (%)	**16**
Plasticity Index, PI (%)	**17**





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Reviewed:_____

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Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2020

Project: Gordon Geotechnical Engineering
No: M02106-017 (528-005-20)
Location: Gravel Pit
Date: 9/10/2020
By: EH/DNB

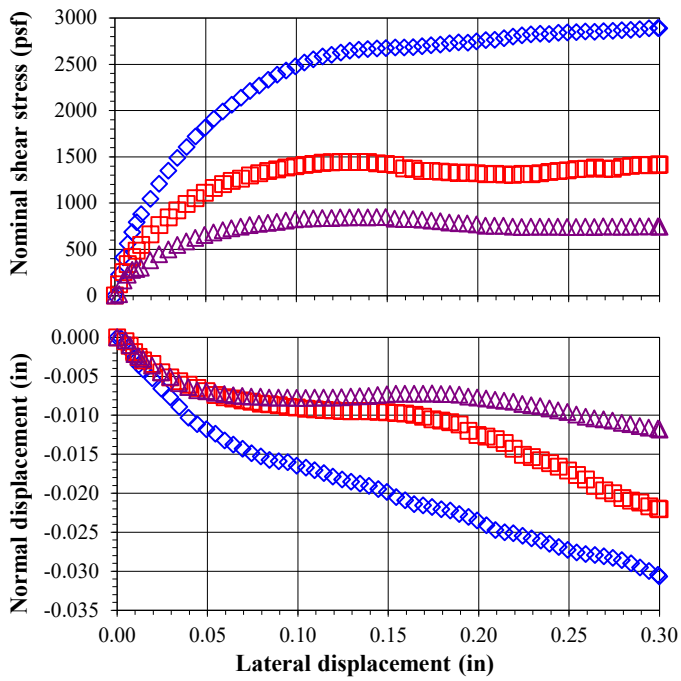
Boring No.: B-4
Sample:
Depth: 5'
Sample Description: Brown sand
Sample type: Undisturbed-trimmed from ring

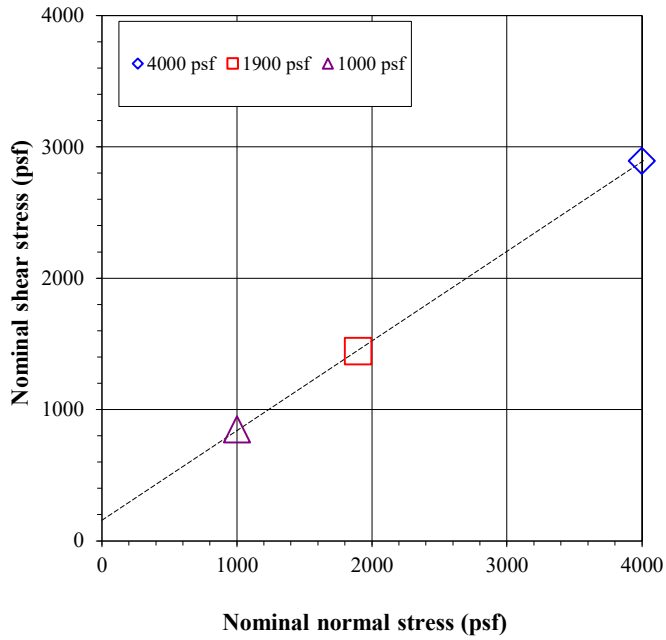
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0192
Specific gravity, Gs: 2.65 Assumed

	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	4000		1900		1000	
Peak shear stress (psf)	2892		1443		850	
Lateral displacement at peak (in)	0.299		0.129		0.149	
Load Duration (min)	1000		1000		1000	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	0.998	0.937	1.001	0.948	0.983	0.915
Sample diameter (in)	2.411	2.411	2.415	2.415	2.421	2.421
Wt. rings + wet soil (g)	169.87	190.99	169.49	191.70	160.42	182.19
Wt. rings (g)	44.51	44.51	44.31	44.31	39.43	39.43
Wet soil + tare (g)	368.42		368.42		368.42	
Dry soil + tare (g)	363.23		363.23		363.23	
Tare (g)	126.88		126.88		126.88	
Water content (%)	2.2	19.4	2.2	20.3	2.2	20.6
Dry unit weight (pcf)	102.6	109.2	101.8	107.5	99.7	107.0
Void ratio, e, for assumed Gs	0.61	0.51	0.63	0.54	0.66	0.55
Saturation (%)*	9.5	100.0	9.3	100.0	8.8	100.0

ϕ' (deg)	34	Average of 3 samples	Initial	Pre-shear
c' (psf)	159	Water content (%)	2.2	20.1
		Dry unit weight (pcf)	101.3	107.9

*Pre-shear saturation set to 100% for phase calculations





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Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2020

Project: Gordon Geotechnical Engineering **Boring No.:** B-4

No: M02106-017 (528-005-20) **Sample:**

Location: Gravel Pit **Depth:** 5'

Nominal normal stress = 4000 psf			Nominal normal stress = 1900 psf			Nominal normal stress = 1000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.002	226	0.000	0.002	121	0.000	0.002	15	0.000
0.005	412	-0.001	0.005	252	0.000	0.005	164	0.000
0.007	560	-0.002	0.007	339	-0.001	0.007	226	-0.001
0.010	686	-0.003	0.010	415	-0.002	0.010	276	-0.002
0.012	792	-0.004	0.012	485	-0.003	0.012	290	-0.002
0.014	880	-0.004	0.014	547	-0.003	0.014	303	-0.003
0.020	1047	-0.005	0.020	663	-0.003	0.019	380	-0.004
0.024	1209	-0.007	0.024	762	-0.004	0.024	446	-0.004
0.029	1351	-0.008	0.030	846	-0.005	0.029	500	-0.005
0.034	1488	-0.009	0.034	922	-0.006	0.034	547	-0.006
0.039	1604	-0.010	0.040	992	-0.006	0.039	585	-0.006
0.044	1719	-0.011	0.044	1051	-0.007	0.044	625	-0.007
0.049	1812	-0.012	0.049	1110	-0.007	0.049	656	-0.007
0.054	1910	-0.012	0.054	1162	-0.007	0.054	683	-0.007
0.059	1991	-0.013	0.060	1204	-0.008	0.059	707	-0.007
0.064	2064	-0.014	0.064	1238	-0.008	0.064	728	-0.007
0.069	2139	-0.014	0.069	1264	-0.008	0.069	745	-0.008
0.074	2210	-0.015	0.074	1297	-0.008	0.074	762	-0.008
0.079	2272	-0.015	0.079	1322	-0.009	0.079	775	-0.008
0.084	2332	-0.016	0.084	1345	-0.009	0.084	788	-0.008
0.089	2386	-0.016	0.089	1365	-0.009	0.089	798	-0.008
0.094	2434	-0.016	0.094	1383	-0.009	0.094	812	-0.008
0.099	2478	-0.016	0.099	1398	-0.009	0.099	824	-0.008
0.104	2519	-0.017	0.104	1413	-0.009	0.104	830	-0.008
0.109	2553	-0.017	0.109	1422	-0.009	0.109	833	-0.008
0.114	2584	-0.017	0.114	1436	-0.009	0.114	836	-0.008
0.119	2603	-0.018	0.119	1440	-0.009	0.119	837	-0.008
0.124	2627	-0.018	0.124	1442	-0.009	0.124	847	-0.008
0.129	2646	-0.019	0.129	1443	-0.009	0.129	846	-0.008
0.134	2657	-0.019	0.134	1443	-0.009	0.134	847	-0.008
0.139	2665	-0.019	0.139	1442	-0.009	0.139	846	-0.008
0.144	2672	-0.019	0.144	1429	-0.010	0.144	848	-0.007
0.149	2676	-0.020	0.149	1423	-0.010	0.149	850	-0.007
0.154	2681	-0.021	0.154	1411	-0.010	0.154	832	-0.007
0.159	2680	-0.021	0.159	1376	-0.010	0.159	827	-0.007
0.164	2687	-0.021	0.164	1371	-0.010	0.164	828	-0.007
0.169	2697	-0.022	0.169	1348	-0.010	0.169	821	-0.007
0.174	2706	-0.022	0.174	1346	-0.011	0.174	812	-0.007
0.179	2711	-0.022	0.179	1339	-0.011	0.179	804	-0.007
0.184	2726	-0.022	0.184	1333	-0.011	0.184	791	-0.007
0.189	2736	-0.023	0.189	1324	-0.011	0.189	783	-0.007
0.194	2733	-0.023	0.194	1329	-0.012	0.194	780	-0.008
0.199	2747	-0.024	0.199	1322	-0.013	0.199	768	-0.008
0.204	2762	-0.024	0.204	1313	-0.013	0.204	754	-0.008
0.209	2764	-0.025	0.209	1315	-0.013	0.209	755	-0.008
0.214	2782	-0.025	0.214	1308	-0.014	0.214	754	-0.008
0.219	2798	-0.025	0.219	1304	-0.014	0.219	745	-0.008
0.224	2815	-0.025	0.224	1315	-0.015	0.224	742	-0.009
0.229	2824	-0.026	0.229	1312	-0.015	0.229	744	-0.009
0.234	2830	-0.026	0.234	1323	-0.016	0.234	746	-0.009
0.239	2826	-0.026	0.239	1335	-0.016	0.239	746	-0.009
0.244	2839	-0.027	0.244	1346	-0.017	0.244	745	-0.009
0.249	2846	-0.027	0.249	1354	-0.017	0.249	743	-0.010
0.254	2847	-0.028	0.254	1366	-0.018	0.254	741	-0.010
0.259	2855	-0.028	0.259	1370	-0.018	0.259	744	-0.010
0.264	2850	-0.028	0.264	1385	-0.019	0.264	742	-0.010
0.269	2857	-0.028	0.269	1371	-0.020	0.269	747	-0.011
0.274	2863	-0.028	0.274	1371	-0.020	0.274	745	-0.011
0.279	2868	-0.029	0.279	1393	-0.021	0.279	745	-0.011
0.284	2871	-0.029	0.284	1404	-0.021	0.284	745	-0.011
0.289	2880	-0.030	0.289	1411	-0.021	0.289	748	-0.011
0.294	2890	-0.030	0.294	1410	-0.022	0.294	749	-0.012
0.299	2892	-0.030	0.299	1415	-0.022	0.299	748	-0.012
0.300	2889	-0.031	0.300	1415	-0.022	0.300	745	-0.012

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

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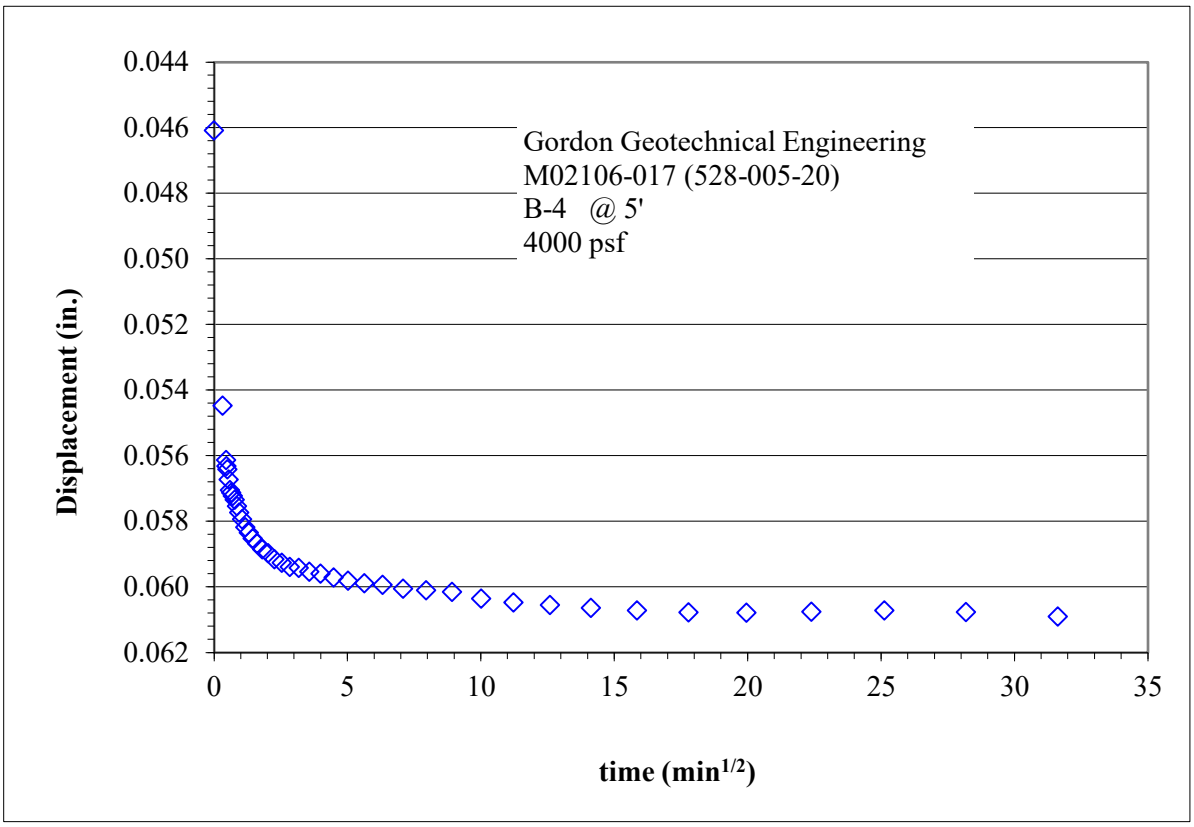
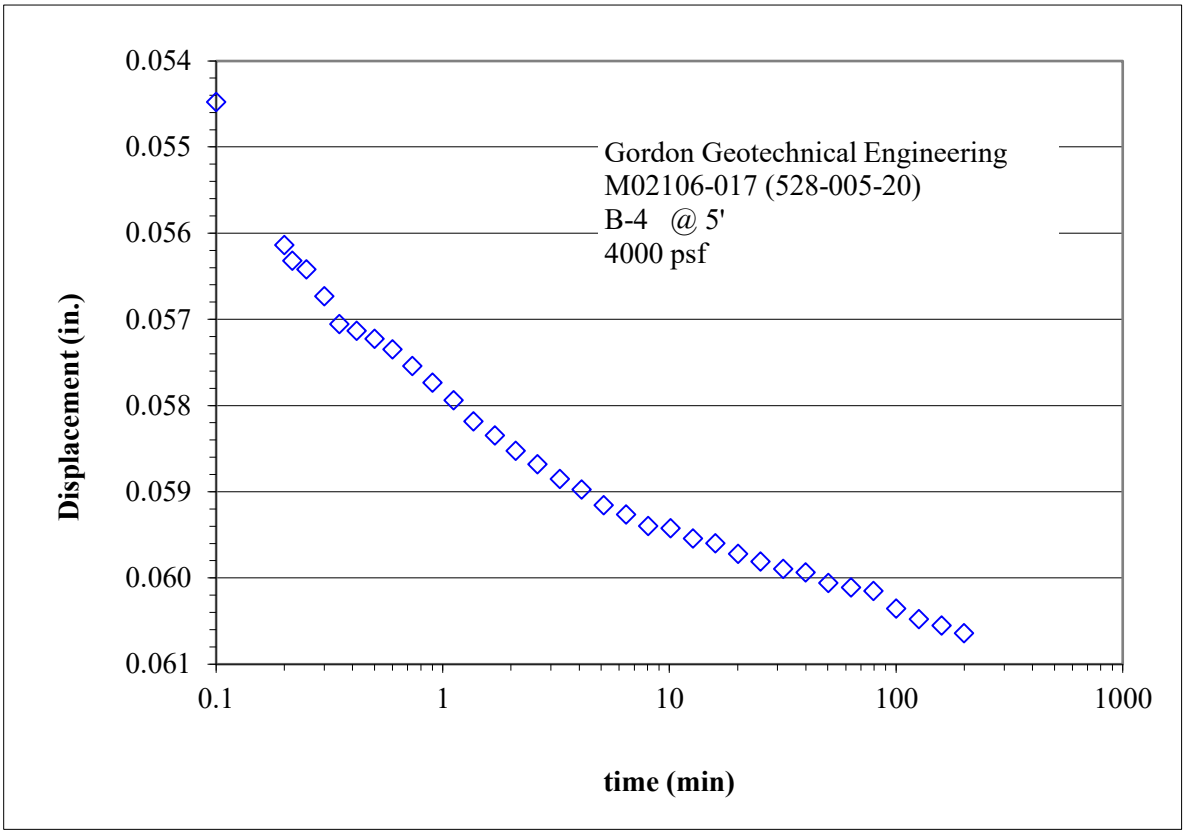
Project: Gordon Geotechnical Engineering
No: M02106-017 (528-005-20)
Location: Gravel Pit

Boring No.: B-4
Sample:
Depth: 5'





Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils (*ASTM 6467*)

© IGES 2007, 2020

Project: Gordon Geotechnical Engineering
No: M02106-017 (528-005-20)
Location: Gravel Pit
Date: 9/18/2020
By: JDF

Boring No.: B-5
Sample:
Depth: 32.5'
Sample Description: Grey clay
Engineering Classification: Not requested

Sample preparation: Screened over No.40 / remolded near liquid limit
Test type: Residual with multi-staged sample
Ring friction remarks: Modified upper platen
Ring shear device: Bromhead type, WF 25850 #1
Sample presheared: Yes
Failure surface location: Near center

inner/outter/avg. dia. (mm)	70	100	85
inner/outter/avg. radii (mm)	35	50	42.5
Thickness (mm)/area (cm^2):	5	40.1	

LL (%):	42	CF [a] (%):	N/A
PL (%):	24	Gs assum.:	2.8
% Finer No. 200 (tested sample):			89.9

LL, PL = liquid and plastic limits, respectively
[a]CF = %<0.002 mm and passing No. 10

	τ stress	σ stress	Horz. def	Vert. def
Units:	(psf)	(psf)	(deg.)	(in)
Conversion:	20885.434	2048.2	1	3.94E-05

	Sample 1 Initial	Sample 1 Final	Sample 2 Initial	Sample 2 Final	Sample 3 Initial	Sample 3 Final
Sample thickness (mm)	4.61					
Wt. container + wet soil (g)	732.43					
Wt. container (g)	697.39					
Wet soil + tare (g)	75.55		Staged			51.23
Dry soil + tare (g)	60.46					45.39
Tare (g)	23.92					23.92
Water content (%)	41.3					27.2
Dry density (g/cm^3)	1.34					
Saturation (%)	100.0					

	Sample 1	Sample 2	Sample 3
Normal load on lever arm (kg)	3	7	15
Conversion factor (kg/cm^2) to (psf):	2048.1614	2048.1614	2048.1614
Residual deformation (deg.)	8.661	39.897	25.101
Normal stress (psf)	2024	4070	8160
Residual shear stress (psf)	1075	3161	5532
Peak shear stress (psf)	1555	3235	5597
Secant residual friction angle (deg)	28.0	37.8	34.1
Secant peak friction angle (deg)	37.5	38.5	34.4
Shear rate (deg/min)	0.0274	0.0274	0.0274
Peak friction angle (deg)	35.4		
Residual friction angle (deg)	34.6		

Entered by:_____
Reviewed:_____

Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils *(ASTM 6467)*

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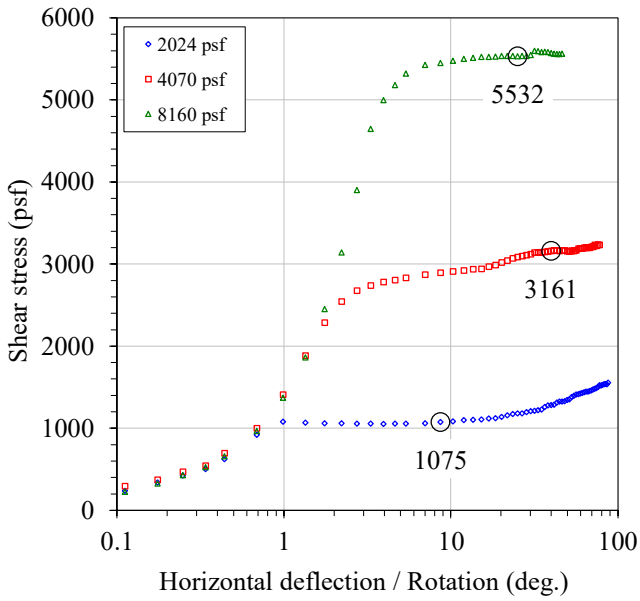
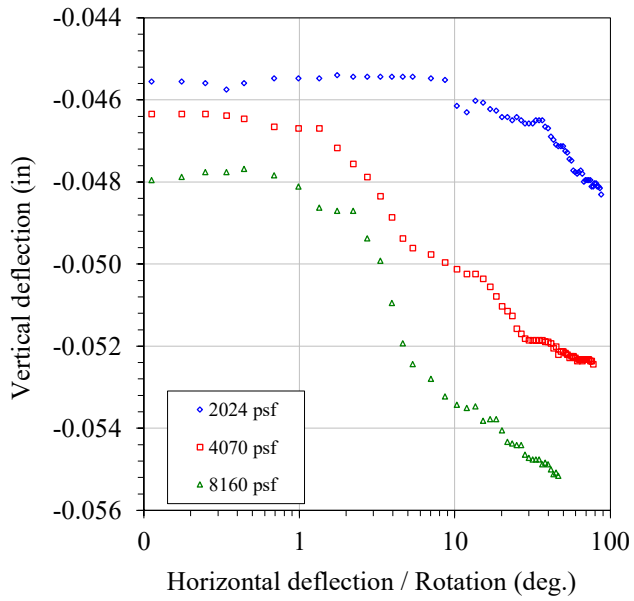
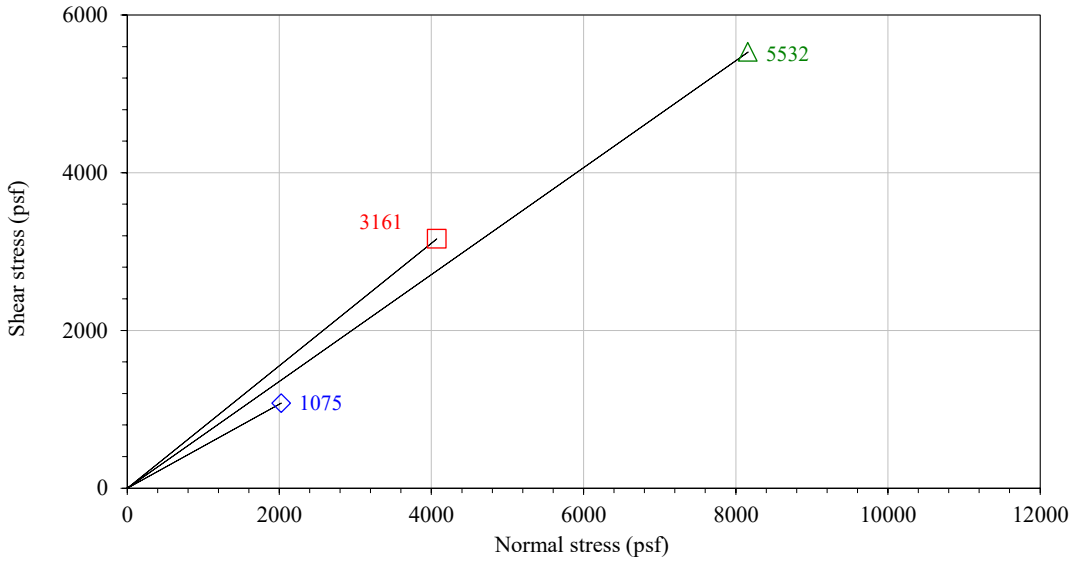
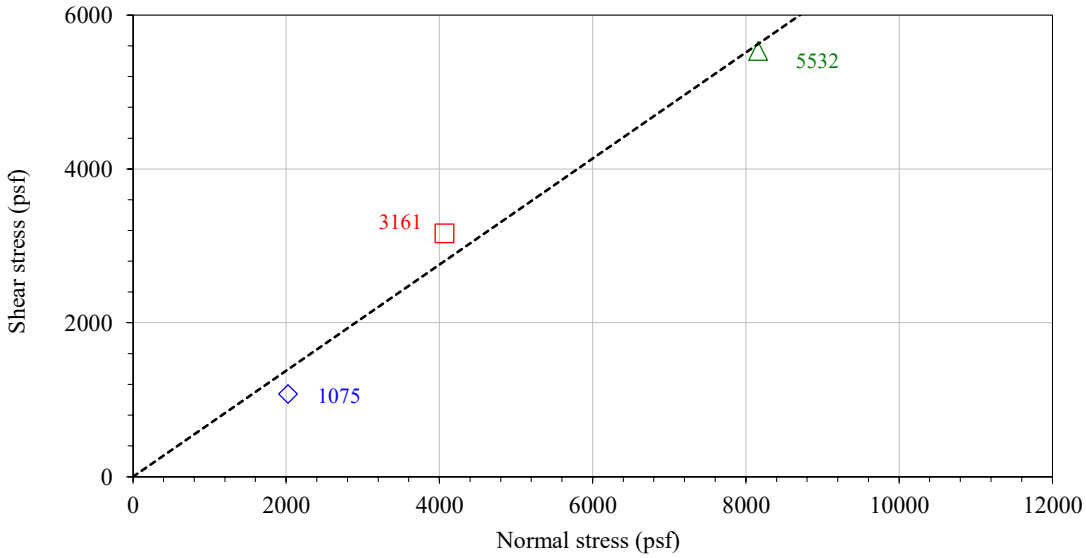




*Horizontal deflection (in) = Degrees rotation * 0.0292*





Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils (*ASTM 6467*)

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Project: Gordon Geotechnical Engineering
No: M02106-017 (528-005-20)
Location: Gravel Pit
Date: 9/18/2020
By: JDF

Boring No.: B-6
Sample:
Depth: 30'
Sample Description: Grey clay
Engineering Classification: Not requested

Sample preparation: Screened over No.40 / remolded near liquid limit
Test type: Residual with multi-staged sample
Ring friction remarks: Modified upper platen
Ring shear device: Bromhead type, WF 25850 #2
Sample presheared: Yes
Failure surface location: Near center

inner/outter/avg. dia. (mm)	70	100	85
inner/outter/avg. radii (mm)	35	50	42.5
Thickness (mm)/area (cm^2):	5	40.1	

LL (%):	33	CF [a] (%):	N/A
PL (%):	16	Gs assum.:	2.8
% Finer No. 200 (tested sample):			90.7

LL, PL = liquid and plastic limits, respectively
[a]CF = %<0.002 mm and passing No. 10

	τ stress	σ stress	Horz. def	Vert. def
Units:	(psf)	(psf)	(deg.)	(in)
Conversion:	20885.434	2048.2	1	3.94E-05

	Sample 1 Initial	Sample 1 Final	Sample 2 Initial	Sample 2 Final	Sample 3 Initial	Sample 3 Final
Sample thickness (mm)	4.46					
Wt. container + wet soil (g)	734.20					
Wt. container (g)	698.24					
Wet soil + tare (g)	62.18					62.79
Dry soil + tare (g)	50.31		Staged			58.65
Tare (g)	12.71					36.60
Water content (%)	31.6					18.8
Dry density (g/cm^3)	1.53					
Saturation (%)	100.0					

	Sample 1	Sample 2	Sample 3
Normal load on lever arm (kg)	3	7	15
Conversion factor (kg/cm^2) to (psf):	2048.1614	2048.1614	2048.1614
Residual deformation (deg.)	33.321	57.981	41.541
Normal stress (psf)	2023	4068	8159
Residual shear stress (psf)	826	1943	4139
Peak shear stress (psf)	927	1966	4190
Secant residual friction angle (deg)	22.2	25.5	26.9
Secant peak friction angle (deg)	24.6	25.8	27.2
Shear rate (deg/min)	0.0274	0.0274	0.0274
Peak friction angle (deg)	26.8		
Residual friction angle (deg)	26.4		

Entered by:_____
Reviewed:_____

Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils *(ASTM 6467)*

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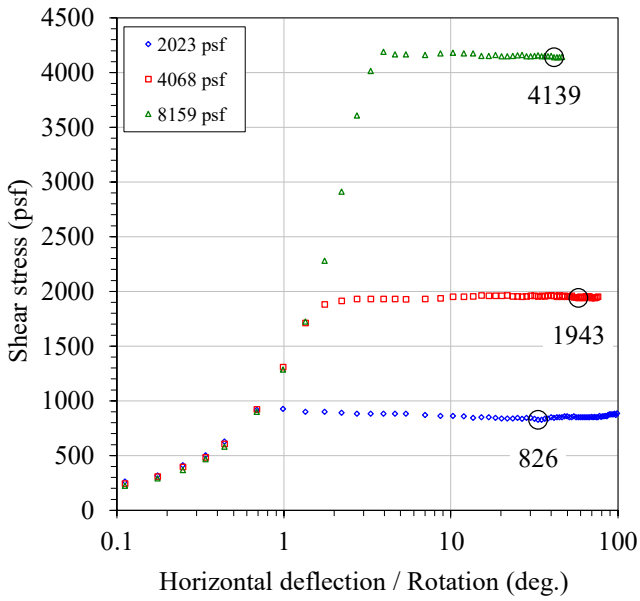
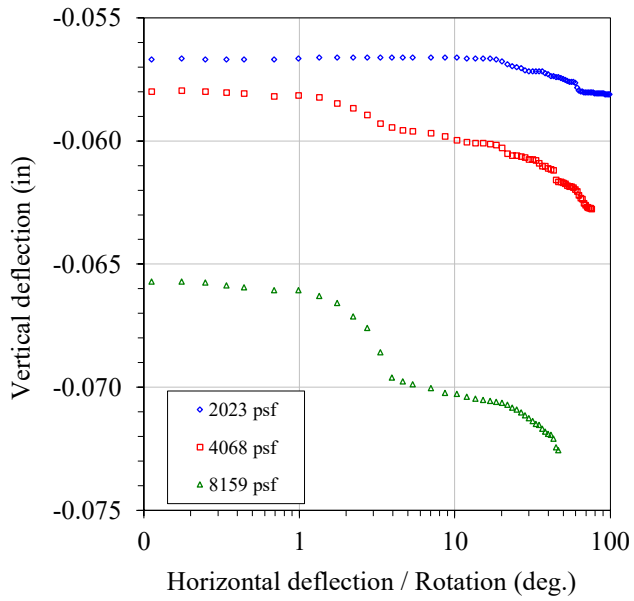
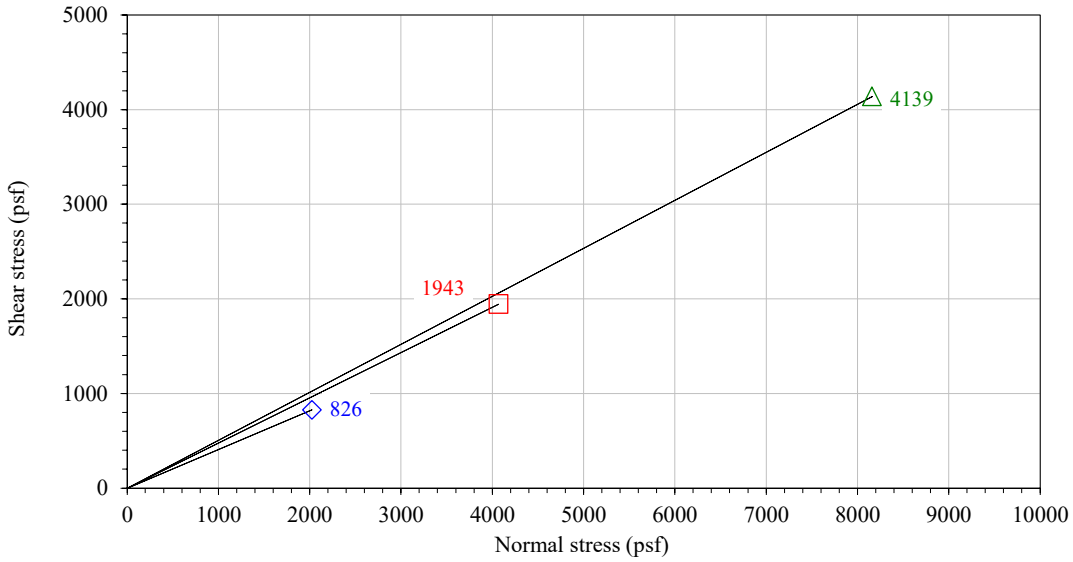
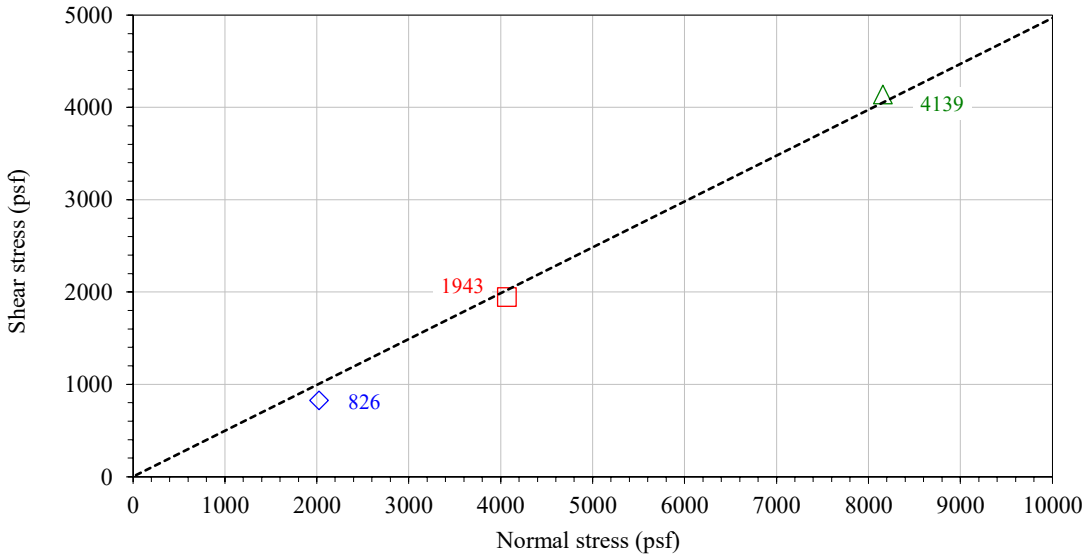




*Horizontal deflection (in) = Degrees rotation * 0.0292*



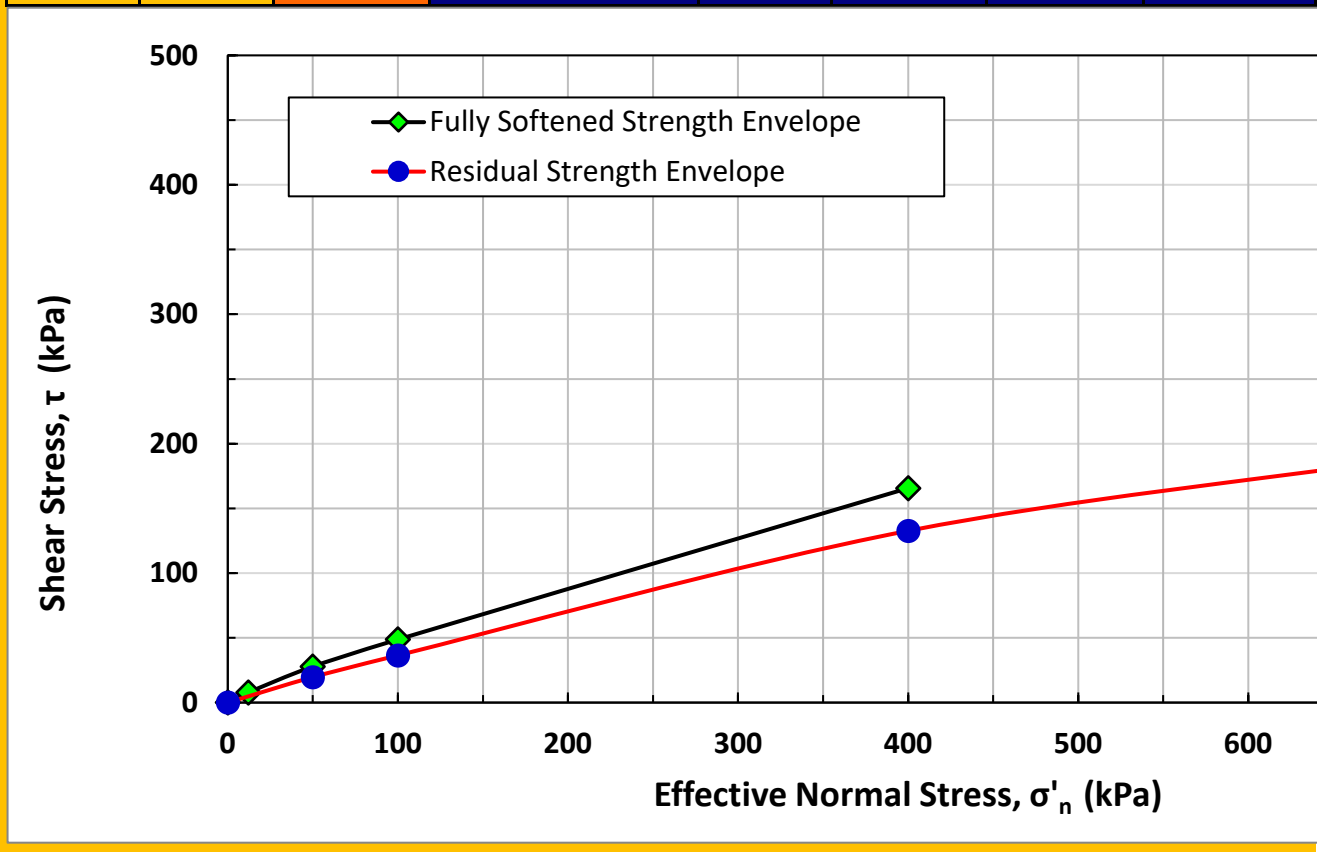


Appendix C

Residual and Fully Softened Shear Strength Correlations

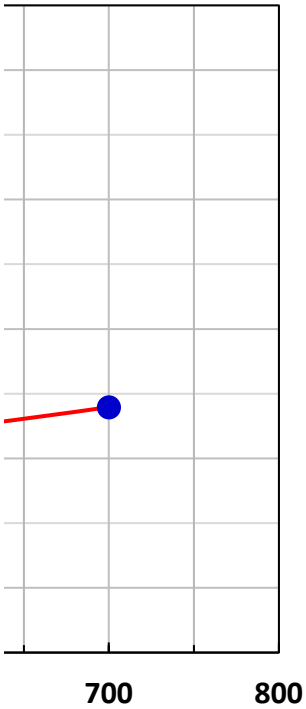
Drained Residual and Fully Softened Secan

Equations developed by Stark and Hussain (2							
Input		Output		Secant Friction Angle, ϕ' (degre			
CF (%)	LL (%)		σ'_n (kPa/psf)	12/250	50/1,044	100/2,088	400/8,354
56	42		Residual	NA	21.5	20.0	18.4
			Fully Softened	32.8	29.1	26.0	22.5



nt Friction Angles & Shear Stresses

013) and Gamez and Stark (2014)						
ees)	Shear Stress, τ (kPa)					
700/14,620	0	12	50	100	400	700
15.2	0.00	NA	19.7	36.5	132.7	189.7
NA	0.00	7.7	27.9	48.7	165.7	NA



Important Notes:

Correlation only valid in the following ranges of CF and LL:	LL (%)	
	Minimum	Maximum
Fully Softened Strength		
Group #1 (CF ≤ 20%)	30	79
Group #2 (20%≤ CF ≤ 45%)	30	130
Group #3 (CF ≥ 50%)	30	300
Residual Strength		
Group #1 (CF ≤ 20%)	30	79
Group #2 (20%≤ CF ≤ 45%)	30	130
Group #3 (CF ≥ 50%)	40	300

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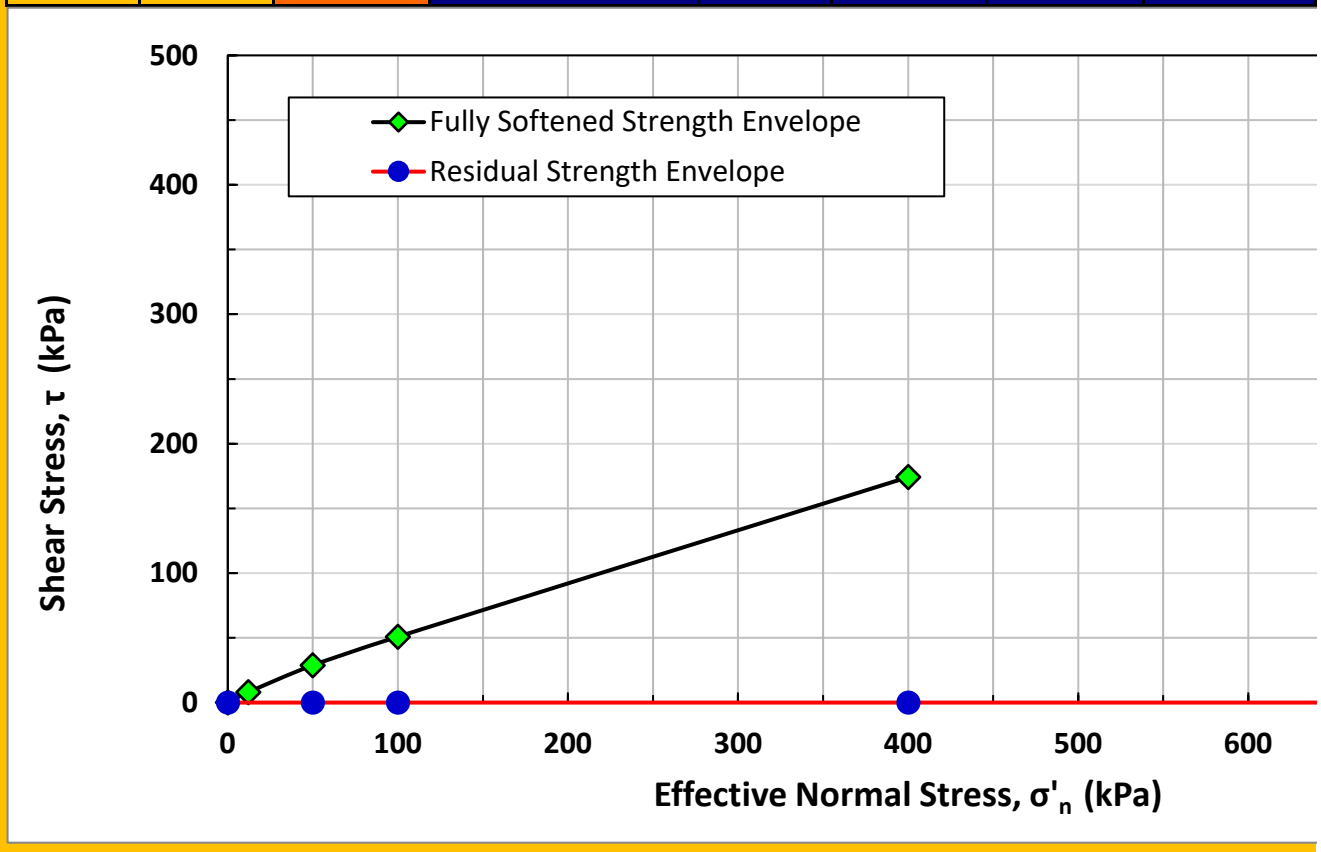
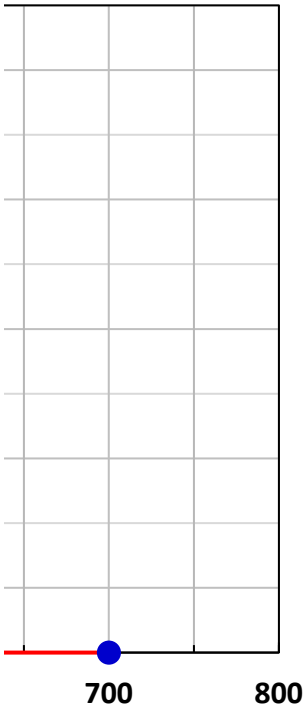
Drained Residual and Fully Softened Secan

Equations developed by Stark and Hussain (2							
Input		Output		Secant Friction Angle, ϕ' (degre			
CF (%)	LL (%)		σ'_n (kPa/psf)	12/250	50/1,044	100/2,088	400/8,354
59	33		Residual	NA	NA	NA	NA
			Fully Softened	33.5	30.0	27.0	23.5



nt Friction Angles & Shear Stresses

013) and Gamez and Stark (2014)						
ees)	Shear Stress, τ (kPa)					
700/14,620	0	12	50	100	400	700
NA	0.00	NA	NA	NA	NA	NA
NA	0.00	8.0	28.8	50.9	174.2	NA



Important Notes:

Correlation only valid in the following ranges of CF and LL:	LL (%)	
	Minimum	Maximum
Fully Softened Strength		
Group #1 (CF ≤ 20%)	30	79
Group #2 (20%≤ CF ≤ 45%)	30	130
Group #3 (CF ≥ 50%)	30	300
Residual Strength		
Group #1 (CF ≤ 20%)	30	79
Group #2 (20%≤ CF ≤ 45%)	30	130
Group #3 (CF ≥ 50%)	40	300

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Appendix D

Slope Stability Analysis Results

Slide Analysis Information

Cottonwood Gravel Pit Development

Project Summary

File Name: Updated A-A' Grading
Slide Modeler Version : 6.039
Project Title : Cottonwood Gravel Pit Development
Analysis : Updated A-A': Proposed Grading - Seismic
Author: JKC
Company: G2
Date Created: 5/11/2020, 4:50:55 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction : Left to Right
Data Output: Standard
Maximum Material Properties : 20
Maximum Support Properties : 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices : 25
Tolerance : 0.005
Maximum number of iterations : 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight : 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment : 10
Composite Surfaces: Disabled
Reverse Curvature : Invalid Surfaces
Minimum Elevation : Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal) : 0.3

Material Properties

Property	Laminated Silty Fine Sand Beds	Site Grading Fill	Concrete	Lacustrine Sand and Gravel
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Infinite strength	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	120
Cohesion [psf]	0	350		200
Friction Angle [deg]	33	33		36
Water Surface	Water Table	Water Table	None	Water Table
Hu Value	1	1		1
Ru Value			0	

Global Minimums

Method: bishop simplified

FS: 1.070610
Center: 208.558, 4959.645
Radius: 122.943
Left Slip Surface Endpoint: 92.321, 4919.596
Right Slip Surface Endpoint: 248.024, 4843.208
Resisting Moment=4.32624e+007 lb-ft
Driving Moment=4.04091e+007 lb-ft
Total Slice Area=4246.81 ft2

Method: janbu simplified

FS: 0.863690
Center: 208.558, 4913.194
Radius: 77.202
Left Slip Surface Endpoint: 131.689, 4906.038
Right Slip Surface Endpoint: 241.147, 4843.208
Resisting Horizontal Force=175156 lb
Driving Horizontal Force=202799 lb
Total Slice Area=2635.62 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1450
Number of Invalid Surfaces: 3401

Error Codes:

Error Code -99 reported for 2594 surfaces
Error Code -103 reported for 484 surfaces
Error Code -114 reported for 323 surfaces

Method: janbu simplified

Number of Valid Surfaces: 1450
Number of Invalid Surfaces: 3401

Error Codes:

Error Code -99 reported for 2594 surfaces
Error Code -103 reported for 484 surfaces
Error Code -114 reported for 323 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.07061

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	8.15729	7703.76	Site Grading Fill	350	33	378.2	404.904	84.5455	0	84.5455
2	2.06897	4274.39	Lacustrine Sand and Gravel	200	36	721.567	772.517	788.002	0	788.002
3	3.67924	9270.8	Laminated Silty Fine Sand Beds	0	33	776.27	831.082	1279.75	0	1279.75
4	5.28741	16536.7	Lacustrine Sand and Gravel	200	36	1189.17	1273.14	1477.05	0	1477.05
5	4.28284	15771.7	Laminated Silty Fine Sand Beds	0	33	1285.9	1376.7	2119.94	0	2119.94
6	6.61138	27709.6	Lacustrine Sand and Gravel	200	36	1761.35	1885.72	2320.2	0	2320.2
7	6.61138	31084.3	Lacustrine Sand and Gravel	200	36	2085.44	2232.69	2797.76	0	2797.76
8	6.61138	33747.4	Lacustrine Sand and Gravel	200	36	2375.64	2543.38	3225.38	0	3225.38
9	6.61138	35819.1	Lacustrine Sand and Gravel	200	36	2634.38	2820.39	3606.67	0	3606.67
10	6.61138	37382.4	Lacustrine Sand and Gravel	200	36	2863.5	3065.69	3944.28	0	3944.28
11	6.61138	38497.1	Lacustrine Sand and Gravel	200	36	3064.32	3280.69	4240.2	0	4240.2
12	6.61138	39207.7	Lacustrine Sand and Gravel	200	36	3237.77	3466.39	4495.81	0	4495.81
13	6.61138	39547.6	Lacustrine Sand and Gravel	200	36	3384.44	3623.42	4711.93	0	4711.93
14	6.61138	39546.3	Lacustrine Sand and Gravel	200	36	3504.91	3752.39	4889.45	0	4889.45
15	6.61138	39227.5	Lacustrine Sand and Gravel	200	36	3599.54	3853.7	5028.88	0	5028.88
16	6.61138	38598.9	Lacustrine Sand and Gravel	200	36	3667.41	3926.37	5128.9	0	5128.9
17	6.61138	26479.8	Lacustrine Sand and Gravel	200	36	2657.09	2844.71	3640.12	0	3640.12
18	6.61138	4795.51	Lacustrine Sand and Gravel	200	36	642.998	688.4	672.225	0	672.225
19	6.61138	5087.09	Lacustrine Sand and Gravel	200	36	695.497	744.606	749.586	0	749.586
20	6.61138	5095.74	Lacustrine Sand and Gravel	200	36	722.239	773.236	788.992	0	788.992
21	6.61138	4821.54	Lacustrine Sand and Gravel	200	36	720.478	771.351	786.398	0	786.398
22	6.61138	4262.07	Lacustrine Sand and Gravel	200	36	686.741	735.232	736.684	0	736.684
23	6.61138	3412.33	Lacustrine Sand and Gravel	200	36	616.539	660.073	633.237	0	633.237
24	6.61138	2264.46	Lacustrine Sand and Gravel	200	36	503.941	539.524	467.315	0	467.315
25	6.61138	807.414	Lacustrine Sand and Gravel	200	36	340.894	364.965	227.055	0	227.055

Global Minimum Query (janbu simplified) - Safety Factor: 0.86369

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.95178	3993.57	Site Grading Fill	350	33	261.028	225.447	-191.795	0	-191.795
2	1.26557	2781.6	Lacustrine Sand and Gravel	200	36	640.587	553.269	486.232	0	486.232
3	2.75549	7393.61	Laminated Silty Fine Sand Beds	0	33	757.846	654.544	1007.91	0	1007.91
4	4.61295	15552.9	Lacustrine Sand and Gravel	200	36	1255.26	1084.16	1216.94	0	1216.94
5	4.61295	18590.2	Lacustrine Sand and Gravel	200	36	1695.06	1464.01	1739.76	0	1739.76
6	4.61295	20856.7	Lacustrine Sand and Gravel	200	36	2084.15	1800.06	2202.3	0	2202.3
7	4.61295	22594.7	Lacustrine Sand and Gravel	200	36	2433.36	2101.67	2617.42	0	2617.42
8	4.61295	23931.5	Lacustrine Sand and Gravel	200	36	2749.1	2374.37	2992.75	0	2992.75
9	4.61295	24944	Lacustrine Sand and Gravel	200	36	3035.59	2621.81	3333.33	0	3333.33
10	4.61295	25683.1	Lacustrine Sand and Gravel	200	36	3295.86	2846.6	3642.74	0	3642.74
11	4.61295	26187.6	Lacustrine Sand and Gravel	200	36	3532.49	3050.98	3924.04	0	3924.04
12	4.61295	26479.6	Lacustrine Sand and Gravel	200	36	3746.69	3235.98	4178.66	0	4178.66
13	4.61295	26576.6	Lacustrine Sand and Gravel	200	36	3939.46	3402.47	4407.81	0	4407.81
14	4.61295	26492.5	Lacustrine Sand and Gravel	200	36	4111.59	3551.14	4612.44	0	4612.44
15	4.61295	15615.5	Lacustrine Sand and Gravel	200	36	2617.2	2260.45	2835.97	0	2835.97
16	4.61295	3519.52	Lacustrine Sand and Gravel	200	36	777.175	671.238	648.604	0	648.604
17	4.61295	3817.36	Lacustrine Sand and Gravel	200	36	865.022	747.111	753.034	0	753.034
18	4.61295	3960.56	Lacustrine Sand and Gravel	200	36	933.362	806.135	834.274	0	834.274
19	4.61295	3950.69	Lacustrine Sand and Gravel	200	36	979.837	846.275	889.521	0	889.521
20	4.61295	3787.63	Lacustrine Sand and Gravel	200	36	1001.4	864.899	915.154	0	915.154
21	4.61295	3469.61	Lacustrine Sand and Gravel	200	36	993.992	858.501	906.35	0	906.35
22	4.61295	2993.06	Lacustrine Sand and Gravel	200	36	952.033	822.261	856.47	0	856.47
23	4.61295	2352.46	Lacustrine Sand and Gravel	200	36	867.539	749.285	756.026	0	756.026
24	4.61295	1539.94	Lacustrine Sand and Gravel	200	36	728.569	629.258	590.823	0	590.823
25	4.61295	544.778	Lacustrine Sand and Gravel	200	36	516.171	445.812	338.331	0	338.331

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.07061

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	92.3207	4919.6	0	0	0
2	100.478	4901.05	794.863	0	0
3	102.547	4897.38	3472.54	0	0
4	106.226	4891.5	10920.9	0	0
5	111.514	4884.16	20437	0	0
6	115.796	4878.96	30697.2	0	0
7	122.408	4871.93	43664.8	0	0
8	129.019	4865.9	56094.6	0	0
9	135.631	4860.67	67385.2	0	0
10	142.242	4856.12	77113.5	0	0
11	148.853	4852.17	84975	0	0
12	155.465	4848.76	90749.7	0	0
13	162.076	4845.83	94281.3	0	0
14	168.687	4843.35	95463.9	0	0
15	175.299	4841.29	94234	0	0
16	181.91	4839.62	90564.2	0	0
17	188.522	4838.35	84461.5	0	0
18	195.133	4837.44	78148.6	0	0
19	201.744	4836.89	75704.2	0	0
20	208.356	4836.7	72774.4	0	0
21	214.967	4836.87	69397.3	0	0
22	221.579	4837.39	65669	0	0
23	228.19	4838.28	61755.3	0	0
24	234.801	4839.53	57908.2	0	0
25	241.413	4841.17	54491.1	0	0
26	248.024	4843.21	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.86369

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	131.689	4906.04	0	0	0
2	135.641	4887.83	-3324.82	0	0
3	136.906	4884.45	-1656.67	0	0
4	139.662	4878.36	4613.11	0	0
5	144.275	4870.44	13125	0	0
6	148.888	4864.21	21727	0	0
7	153.501	4859.08	29674.9	0	0
8	158.114	4854.75	36545.8	0	0
9	162.727	4851.07	42068.4	0	0
10	167.34	4847.92	46055.5	0	0
11	171.953	4845.22	48371.8	0	0
12	176.566	4842.93	48916.5	0	0
13	181.179	4841.01	47612.4	0	0
14	185.791	4839.43	44399.8	0	0
15	190.404	4838.16	39232.9	0	0
16	195.017	4837.19	34590.2	0	0
17	199.63	4836.51	32501.5	0	0
18	204.243	4836.11	29955.7	0	0
19	208.856	4835.99	26938.7	0	0
20	213.469	4836.15	23465.6	0	0
21	218.082	4836.58	19586.2	0	0
22	222.695	4837.3	15393.4	0	0
23	227.308	4838.3	11038.1	0	0
24	231.921	4839.61	6752.91	0	0
25	236.534	4841.24	2892.78	0	0
26	241.147	4843.21	0	0	0

List Of Coordinates

Water Table

X	Y
0	4864.79
157.693	4817.97
331.863	4803.21

External Boundary

X	Y
0	4801.35
331.863	4801.35
331.863	4842.32
314.08	4843.21
230.112	4843.21
192.612	4843.21
192.612	4885.43
191.67	4885.43
170.003	4892.84
84.737	4922.21
84.424	4922.32
84.112	4922.37
83.799	4922.39
83.486	4922.4
83.173	4922.4
82.861	4922.41
82.548	4922.4
82.235	4922.39
81.923	4922.4
81.61	4922.39
81.297	4922.36
80.985	4922.34
80.672	4922.31
80.359	4922.28
80.047	4922.27
79.734	4922.27
79.421	4922.28
79.109	4922.31
78.796	4922.34
78.483	4922.37
78.171	4922.37
77.858	4922.37
77.545	4922.38
77.233	4922.39
76.92	4922.4
76.607	4922.42
76.294	4922.44
75.982	4922.47
75.669	4922.5
75.356	4922.51
75.044	4922.52
74.731	4922.52
74.418	4922.51
74.106	4922.51
73.793	4922.54
73.48	4922.57
73.168	4922.6
72.855	4922.63
72.542	4922.65
72.23	4922.67
71.917	4922.69
71.604	4922.72
71.292	4922.75
70.979	4922.77
70.666	4922.8
70.354	4922.83
70.041	4922.86
69.728	4922.89
69.415	4922.88
69.103	4922.86
68.79	4922.86
68.477	4922.87
68.165	4922.89
67.852	4922.92
67.539	4922.97
67.227	4923.01
66.914	4923.04

66.601	4923.06
66.289	4923.08
65.976	4923.1
65.663	4923.13
65.351	4923.15
65.038	4923.19
64.725	4923.23
64.413	4923.26
64.1	4923.27
63.787	4923.27
63.474	4923.27
63.162	4923.27
62.849	4923.29
62.536	4923.31
62.224	4923.33
61.911	4923.35
61.598	4923.37
61.286	4923.39
60.973	4923.41
60.66	4923.42
60.348	4923.44
60.035	4923.45
59.722	4923.46
59.41	4923.47
59.097	4923.48
58.784	4923.49
58.472	4923.48
58.159	4923.46
57.846	4923.42
57.534	4923.38
57.221	4923.32
56.908	4923.23
56.595	4923.12
56.283	4923.02
55.97	4922.93
55.657	4922.84
55.345	4922.74
55.032	4922.65
54.719	4922.56
54.407	4922.47
54.094	4922.4
53.781	4922.32
53.469	4922.24
53.156	4922.15
52.843	4922.05
52.531	4921.95
52.218	4921.84
51.905	4921.8
51.593	4921.79
51.28	4921.78
50.967	4921.78
50.655	4921.77
50.342	4921.77
50.029	4921.77
49.716	4921.78
49.404	4921.81
49.091	4921.85
48.778	4921.89
48.466	4921.92
48.153	4921.96
47.84	4922
47.528	4922.03
47.215	4922.06
46.902	4922.08
46.59	4922.11
46.277	4922.15
45.964	4922.19
45.652	4922.23
45.339	4922.29
45.026	4922.34
44.714	4922.39
44.401	4922.44
44.088	4922.49
43.776	4922.54
43.463	4922.59
43.15	4922.63
42.837	4922.67
42.525	4922.72
42.212	4922.75
41.899	4922.78
41.587	4922.82
41.274	4922.86
40.961	4922.9
40.649	4922.94
40.336	4922.98
40.023	4923
39.711	4923.02
39.398	4923.06
39.085	4923.1
38.773	4923.16
38.46	4923.21
38.147	4923.26
37.835	4923.3
37.522	4923.34
37.209	4923.38
36.897	4923.41
36.584	4923.44
36.271	4923.48
35.958	4923.53
35.646	4923.57
35.333	4923.61
35.02	4923.66
34.708	4923.69
34.395	4923.7
34.082	4923.71
33.77	4923.73
33.457	4923.76
33.144	4923.8
32.832	4923.85
32.519	4923.92

32.206	4923.95
31.894	4923.96
31.581	4923.96
31.268	4923.97
30.956	4923.97
30.643	4923.97
30.33	4923.97
30.017	4923.98
29.705	4924
29.392	4924.03
29.079	4924.05
28.767	4924.07
28.454	4924.09
28.141	4924.1
27.829	4924.12
27.516	4924.12
27.203	4924.13
26.891	4924.14
26.578	4924.15
26.265	4924.16
25.953	4924.17
25.64	4924.2
25.327	4924.22
25.015	4924.25
24.702	4924.27
24.389	4924.28
24.077	4924.29
23.764	4924.3
23.451	4924.32
23.138	4924.35
22.826	4924.38
22.513	4924.4
22.2	4924.44
21.888	4924.47
21.575	4924.5
21.262	4924.51
20.95	4924.51
20.637	4924.52
20.324	4924.53
20.012	4924.54
19.699	4924.55
19.386	4924.56
19.074	4924.59
18.761	4924.62
18.448	4924.65
18.136	4924.67
17.823	4924.69
17.51	4924.72
17.198	4924.73
16.885	4924.74
16.572	4924.75
16.259	4924.76
15.947	4924.76
15.634	4924.77
15.321	4924.78
15.009	4924.79
14.696	4924.81
14.383	4924.83
14.071	4924.85
13.758	4924.87
13.445	4924.88
13.133	4924.9
12.82	4924.91
12.507	4924.92
12.195	4924.95
11.882	4924.99
11.569	4925.02
11.257	4925.06
10.944	4925.1
10.631	4925.15
10.319	4925.19
10.006	4925.22
9.693	4925.26
9.38	4925.31
9.068	4925.35
8.755	4925.4
8.442	4925.45
8.13	4925.49
7.817	4925.52
7.504	4925.53
7.192	4925.53
6.879	4925.53
6.566	4925.54
6.254	4925.55
5.941	4925.59
5.628	4925.63
5.316	4925.67
5.003	4925.71
4.69	4925.77
4.378	4925.84
4.065	4925.9
3.752	4925.95
3.44	4925.99
3.127	4926.02
2.814	4926.04
2.501	4926.06
2.189	4926.08
1.876	4926.1
1.563	4926.13
1.251	4926.17
0.938	4926.21
0.625	4926.24
0.3127	4926.27
0	4926.29
0	4924.53
0	4894.97
0	4888.66
0	4880.54
0	4874.62

Material Boundary

X	Y
0	4924.53
82.38	4907.9
108.081	4898.17
120.312	4893.44
142.481	4885.33

Material Boundary

X	Y
0	4894.97
39.8299	4904.13

Material Boundary

X	Y
0	4888.66
41.3671	4898.43
39.8299	4904.13

Material Boundary

X	Y
0	4874.62
45.0216	4884.87

Material Boundary

X	Y
44.7635	4885.83
82.733	4894.4
84.622	4894.84
108.081	4898.17

Material Boundary

X	Y
44.7635	4885.83
45.0216	4884.87
46.402	4879.75
82.793	4888.14
84.794	4888.56
120.312	4893.44

Material Boundary

X	Y
48.4962	4871.98
82.866	4879.83
84.692	4880.23
118.551	4885.19
139.812	4884.33
140.148	4883.09

Material Boundary

X	Y
48.4962	4871.98
49.9944	4866.42
84.604	4874.36
117.598	4879.22
141.364	4878.29

Material Boundary

X	Y
140.148	4883.09
141.364	4878.29
141.782	4877.02

Material Boundary

X	Y
142.481	4885.33
146.944	4883.09
152.813	4880.13
159.612	4876.71
167.901	4872.54
191.67	4860.59

Material Boundary

X	Y
191.67	4871.08
191.67	4885.43

Material Boundary

X	Y
0	4880.54
43.5063	4890.49
44.7635	4885.83

Material Boundary

X	Y
191.67	4871.08
191.67	4868.47
191.67	4860.59
191.67	4838.21
192.612	4838.21
192.612	4843.21

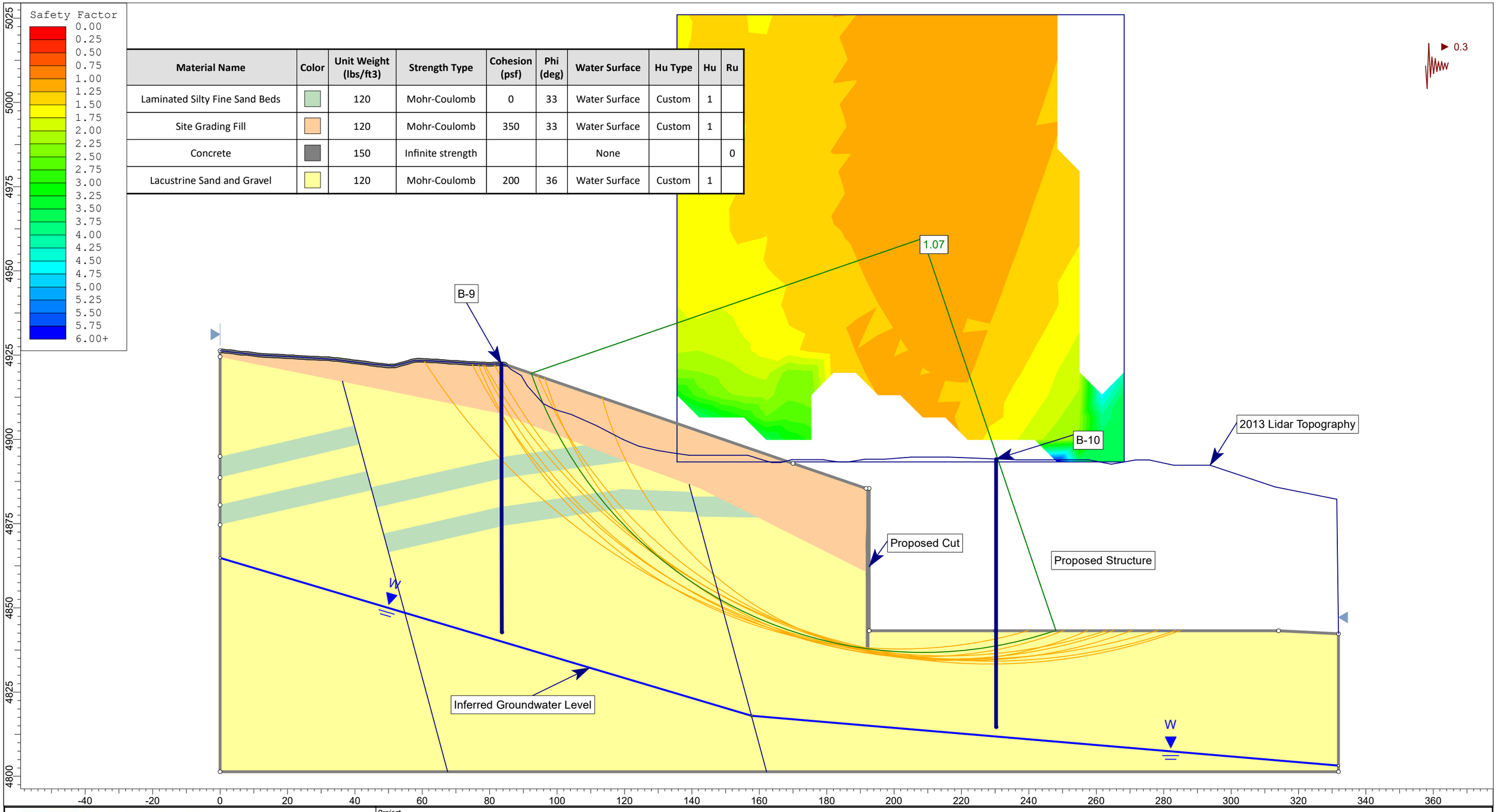
Material Boundary

X	Y
140.148	4883.09
146.944	4883.09

Material Boundary

X	Y
141.782	4877.02
159.612	4876.71

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Laminated Silty Fine Sand Beds		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Concrete		150	Infinite strength			None			0
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	



GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Cottonwood Gravel Pit Development		
Analysis Description	Updated A-A': Proposed Grading - Seismic		
Drawn By JKC	*Scale* 1:322	*Company* G2	
Date 5/11/2020, 4:50:55 PM		*File Name* Updated A-A' Grading.slim	

Slide Analysis Information

Cottonwood Gravel Pit Development

Project Summary

File Name: Updated A-A' Grading
Slide Modeler Version: 6.039
Project Title: Cottonwood Gravel Pit Development
Analysis: Updated A-A': Proposed Grading - Static
Author: JKC
Company: G2
Date Created: 5/11/2020, 4:50:55 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Laminated Silty Fine Sand Beds	Site Grading Fill	Concrete	Lacustrine Sand and Gravel
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Infinite strength	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	120
Cohesion [psf]	0	350		200
Friction Angle [deg]	33	33		36
Water Surface	Water Table	Water Table	None	Water Table
Hu Value	1	1		1
Ru Value			0	

Global Minimums

Method: bishop simplified

FS: 1.626100
Center: 208.558, 4913.194
Radius: 77.202
Left Slip Surface Endpoint: 131.689, 4906.038
Right Slip Surface Endpoint: 241.147, 4843.208
Resisting Moment=1.92082e+007 lb-ft

Driving Moment=1.18125e+007 lb-ft
Total Slice Area=2635.62 ft2

Method: janbu simplified

FS: 1.434120
Center: 208.558, 4913.194
Radius: 77.202
Left Slip Surface Endpoint: 131.689, 4906.038
Right Slip Surface Endpoint: 241.147, 4843.208
Resisting Horizontal Force=195357 lb
Driving Horizontal Force=136221 lb
Total Slice Area=2635.62 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1396
Number of Invalid Surfaces: 3455

Error Codes:

Error Code -99 reported for 2594 surfaces
Error Code -103 reported for 484 surfaces
Error Code -108 reported for 54 surfaces
Error Code -114 reported for 323 surfaces

Method: janbu simplified

Number of Valid Surfaces: 1396
Number of Invalid Surfaces: 3455

Error Codes:

Error Code -99 reported for 2594 surfaces
Error Code -103 reported for 484 surfaces
Error Code -108 reported for 54 surfaces
Error Code -114 reported for 323 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.6261

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.95178	3993.57	Site Grading Fill	350	33	218.218	354.844	7.45957	0	7.45957
2	1.26557	2781.6	Lacustrine Sand and Gravel	200	36	504.248	819.958	853.298	0	853.298
3	2.75549	7393.61	Laminated Silty Fine Sand Beds	0	33	569.678	926.354	1426.46	0	1426.46
4	4.61295	15552.9	Lacustrine Sand and Gravel	200	36	922.994	1500.88	1790.51	0	1790.51
5	4.61295	18590.2	Lacustrine Sand and Gravel	200	36	1200.42	1952	2411.42	0	2411.42
6	4.61295	20856.7	Lacustrine Sand and Gravel	200	36	1432.44	2329.29	2930.71	0	2930.71
7	4.61295	22594.7	Lacustrine Sand and Gravel	200	36	1630.19	2650.86	3373.32	0	3373.32
8	4.61295	23931.5	Lacustrine Sand and Gravel	200	36	1800.06	2927.08	3753.51	0	3753.51
9	4.61295	24944	Lacustrine Sand and Gravel	200	36	1946.13	3164.61	4080.44	0	4080.44
10	4.61295	25683.1	Lacustrine Sand and Gravel	200	36	2071.24	3368.04	4360.43	0	4360.43
11	4.61295	26187.6	Lacustrine Sand and Gravel	200	36	2177.64	3541.06	4598.58	0	4598.58
12	4.61295	26479.6	Lacustrine Sand and Gravel	200	36	2266.53	3685.6	4797.52	0	4797.52
13	4.61295	26576.6	Lacustrine Sand and Gravel	200	36	2338.85	3803.2	4959.39	0	4959.39
14	4.61295	26492.5	Lacustrine Sand and Gravel	200	36	2395.31	3895.01	5085.74	0	5085.74
15	4.61295	15615.5	Lacustrine Sand and Gravel	200	36	1495.55	2431.91	3071.95	0	3071.95
16	4.61295	3519.52	Lacustrine Sand and Gravel	200	36	435.324	707.881	699.039	0	699.039
17	4.61295	3817.36	Lacustrine Sand and Gravel	200	36	474.513	771.606	786.749	0	786.749
18	4.61295	3960.56	Lacustrine Sand and Gravel	200	36	500.791	814.337	845.562	0	845.562
19	4.61295	3950.69	Lacustrine Sand and Gravel	200	36	513.379	834.805	873.733	0	873.733
20	4.61295	3787.63	Lacustrine Sand and Gravel	200	36	511.27	831.376	869.014	0	869.014
21	4.61295	3469.61	Lacustrine Sand and Gravel	200	36	493.166	801.938	828.497	0	828.497
22	4.61295	2993.06	Lacustrine Sand and Gravel	200	36	457.372	743.732	748.383	0	748.383
23	4.61295	2352.46	Lacustrine Sand and Gravel	200	36	401.641	653.109	623.651	0	623.651
24	4.61295	1539.94	Lacustrine Sand and Gravel	200	36	322.941	525.134	447.509	0	447.509
25	4.61295	544.778	Lacustrine Sand and Gravel	200	36	217.053	352.95	210.517	0	210.517

Global Minimum Query (janbu simplified) - Safety Factor: 1.43412

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.95178	3993.57	Site Grading Fill	350	33	227.16	325.775	-37.3033	0	-37.3033
2	1.26557	2781.6	Lacustrine Sand and Gravel	200	36	531.891	762.795	774.621	0	774.621

3	2.75549	7393.61	Laminated Silty Fine Sand Beds	0	33	606.766	870.175	1339.95	0	1339.95
4	4.61295	15552.9	Lacustrine Sand and Gravel	200	36	987.539	1416.25	1674.03	0	1674.03
5	4.61295	18590.2	Lacustrine Sand and Gravel	200	36	1294.05	1855.83	2279.06	0	2279.06
6	4.61295	20856.7	Lacustrine Sand and Gravel	200	36	1553.2	2227.48	2790.58	0	2790.58
7	4.61295	22594.7	Lacustrine Sand and Gravel	200	36	1776.26	2547.37	3230.88	0	3230.88
8	4.61295	23931.5	Lacustrine Sand and Gravel	200	36	1969.74	2824.85	3612.79	0	3612.79
9	4.61295	24944	Lacustrine Sand and Gravel	200	36	2137.85	3065.93	3944.6	0	3944.6
10	4.61295	25683.1	Lacustrine Sand and Gravel	200	36	2283.48	3274.78	4232.07	0	4232.07
11	4.61295	26187.6	Lacustrine Sand and Gravel	200	36	2409	3454.79	4479.84	0	4479.84
12	4.61295	26479.6	Lacustrine Sand and Gravel	200	36	2515.6	3607.67	4690.27	0	4690.27
13	4.61295	26576.6	Lacustrine Sand and Gravel	200	36	2604.26	3734.82	4865.26	0	4865.26
14	4.61295	26492.5	Lacustrine Sand and Gravel	200	36	2675.68	3837.24	5006.23	0	5006.23
15	4.61295	15615.5	Lacustrine Sand and Gravel	200	36	1675.99	2403.57	3032.96	0	3032.96
16	4.61295	3519.52	Lacustrine Sand and Gravel	200	36	489.446	701.924	690.839	0	690.839
17	4.61295	3817.36	Lacustrine Sand and Gravel	200	36	535.306	767.693	781.362	0	781.362
18	4.61295	3960.56	Lacustrine Sand and Gravel	200	36	566.934	813.051	843.791	0	843.791
19	4.61295	3950.69	Lacustrine Sand and Gravel	200	36	583.332	836.568	876.16	0	876.16
20	4.61295	3787.63	Lacustrine Sand and Gravel	200	36	583.226	836.416	875.953	0	875.953
21	4.61295	3469.61	Lacustrine Sand and Gravel	200	36	564.972	810.237	839.919	0	839.919
22	4.61295	2993.06	Lacustrine Sand and Gravel	200	36	526.414	754.941	763.81	0	763.81
23	4.61295	2352.46	Lacustrine Sand and Gravel	200	36	464.68	666.407	641.954	0	641.954
24	4.61295	1539.94	Lacustrine Sand and Gravel	200	36	375.84	539	466.595	0	466.595
25	4.61295	544.778	Lacustrine Sand and Gravel	200	36	254.346	364.762	226.775	0	226.775

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.6261

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	131.689	4906.04	0	0	0
2	135.641	4887.83	-724.749	0	0
3	136.906	4884.45	1524.12	0	0
4	139.662	4878.36	8647.16	0	0
5	144.275	4870.44	18576.3	0	0
6	148.888	4864.21	28080.8	0	0
7	153.501	4859.08	36530.4	0	0
8	158.114	4854.75	43611.4	0	0
9	162.727	4851.07	49151.6	0	0
10	167.34	4847.92	53054	0	0
11	171.953	4845.22	55267.5	0	0
12	176.566	4842.93	55770.2	0	0
13	181.179	4841.01	54561.1	0	0
14	185.791	4839.43	51655	0	0
15	190.404	4838.16	47080.2	0	0
16	195.017	4837.19	43169.4	0	0
17	199.63	4836.51	41640	0	0
18	204.243	4836.11	39768.3	0	0
19	208.856	4835.99	37564.5	0	0
20	213.469	4836.15	35065.2	0	0
21	218.082	4836.58	32335.1	0	0
22	222.695	4837.3	29472	0	0
23	227.308	4838.3	26613.6	0	0
24	231.921	4839.61	23948.8	0	0
25	236.534	4841.24	21734	0	0
26	241.147	4843.21	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.43412

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	131.689	4906.04	0	0	0
2	135.641	4887.83	-1578.01	0	0
3	136.906	4884.45	367.521	0	0
4	139.662	4878.36	6855.77	0	0
5	144.275	4870.44	15549.5	0	0
6	148.888	4864.21	23777	0	0
7	153.501	4859.08	30926.4	0	0
8	158.114	4854.75	36690.5	0	0
9	162.727	4851.07	40899.5	0	0
10	167.34	4847.92	43456.9	0	0
11	171.953	4845.22	44310.7	0	0
12	176.566	4842.93	43437.8	0	0
13	181.179	4841.01	40835.4	0	0
14	185.791	4839.43	36516.4	0	0
15	190.404	4838.16	30506.9	0	0
16	195.017	4837.19	25700.7	0	0
17	199.63	4836.51	23908.7	0	0
18	204.243	4836.11	21746.4	0	0
19	208.856	4835.99	19228.8	0	0
20	213.469	4836.15	16397.7	0	0

21	218.082	4836.58	13323.9	0	0
22	222.695	4837.3	10113	0	0
23	227.308	4838.3	6912.8	0	0
24	231.921	4839.61	3926.31	0	0
25	236.534	4841.24	1430.89	0	0
26	241.147	4843.21	0	0	0

List Of Coordinates

Water Table

X	Y
0	4864.79
157.693	4817.97
331.863	4803.21

External Boundary

X	Y
0	4801.35
331.863	4801.35
331.863	4842.32
314.08	4843.21
230.112	4843.21
192.612	4843.21
192.612	4885.43
191.67	4885.43
170.003	4892.84
84.737	4922.21
84.424	4922.32
84.112	4922.37
83.799	4922.39
83.486	4922.4
83.173	4922.4
82.861	4922.41
82.548	4922.4
82.235	4922.39
81.923	4922.4
81.61	4922.39
81.297	4922.36
80.985	4922.34
80.672	4922.31
80.359	4922.28
80.047	4922.27
79.734	4922.27
79.421	4922.28
79.109	4922.31
78.796	4922.34
78.483	4922.37
78.171	4922.37
77.858	4922.37
77.545	4922.38
77.233	4922.39
76.92	4922.4
76.607	4922.42
76.294	4922.44
75.982	4922.47
75.669	4922.5
75.356	4922.51
75.044	4922.52
74.731	4922.52
74.418	4922.51
74.106	4922.51
73.793	4922.54
73.48	4922.57
73.168	4922.6
72.855	4922.63
72.542	4922.65
72.23	4922.67
71.917	4922.69
71.604	4922.72
71.292	4922.75
70.979	4922.77
70.666	4922.8
70.354	4922.83
70.041	4922.86
69.728	4922.89
69.415	4922.88
69.103	4922.86
68.79	4922.86

68.477	4922.87	
68.165	4922.89	
67.852	4922.92	
67.539	4922.97	
67.227	4923.01	
66.914	4923.04	
66.601	4923.06	
66.289	4923.08	
65.976	4923.1	
65.663	4923.13	
65.351	4923.15	
65.038	4923.19	
64.725	4923.23	
64.413	4923.26	
64.1	4923.27	
63.787	4923.27	
63.474	4923.27	
63.162	4923.27	
62.849	4923.29	
62.536	4923.31	
62.224	4923.33	
61.911	4923.35	
61.598	4923.37	
61.286	4923.39	
60.973	4923.41	
60.66	4923.42	
60.348	4923.44	
60.035	4923.45	
59.722	4923.46	
59.41	4923.47	
59.097	4923.48	
58.784	4923.49	
58.472	4923.48	
58.159	4923.46	
57.846	4923.42	
57.534	4923.38	
57.221	4923.32	
56.908	4923.23	
56.595	4923.12	
56.283	4923.02	
55.97	4922.93	
55.657	4922.84	
55.345	4922.74	
55.032	4922.65	
54.719	4922.56	
54.407	4922.47	
54.094	4922.4	
53.781	4922.32	
53.469	4922.24	
53.156	4922.15	
52.843	4922.05	
52.531	4921.95	
52.218	4921.84	
51.905	4921.8	
51.593	4921.79	
51.28	4921.78	
50.967	4921.78	
50.655	4921.77	
50.342	4921.77	
50.029	4921.77	
49.716	4921.78	
49.404	4921.81	
49.091	4921.85	
48.778	4921.89	
48.466	4921.92	
48.153	4921.96	
47.84	4922	
47.528	4922.03	
47.215	4922.06	
46.902	4922.08	
46.59	4922.11	
46.277	4922.15	
45.964	4922.19	
45.652	4922.23	
45.339	4922.29	
45.026	4922.34	
44.714	4922.39	
44.401	4922.44	
44.088	4922.49	
43.776	4922.54	
43.463	4922.59	

43.15	4922.63
42.837	4922.67
42.525	4922.72
42.212	4922.75
41.899	4922.78
41.587	4922.82
41.274	4922.86
40.961	4922.9
40.649	4922.94
40.336	4922.98
40.023	4923
39.711	4923.02
39.398	4923.06
39.085	4923.1
38.773	4923.16
38.46	4923.21
38.147	4923.26
37.835	4923.3
37.522	4923.34
37.209	4923.38
36.897	4923.41
36.584	4923.44
36.271	4923.48
35.958	4923.53
35.646	4923.57
35.333	4923.61
35.02	4923.66
34.708	4923.69
34.395	4923.7
34.082	4923.71
33.77	4923.73
33.457	4923.76
33.144	4923.8
32.832	4923.85
32.519	4923.92
32.206	4923.95
31.894	4923.96
31.581	4923.96
31.268	4923.97
30.956	4923.97
30.643	4923.97
30.33	4923.97
30.017	4923.98
29.705	4924
29.392	4924.03
29.079	4924.05
28.767	4924.07
28.454	4924.09
28.141	4924.1
27.829	4924.12
27.516	4924.12
27.203	4924.13
26.891	4924.14
26.578	4924.15
26.265	4924.16
25.953	4924.17
25.64	4924.2
25.327	4924.22
25.015	4924.25
24.702	4924.27
24.389	4924.28
24.077	4924.29
23.764	4924.3
23.451	4924.32
23.138	4924.35
22.826	4924.38
22.513	4924.4
22.2	4924.44
21.888	4924.47
21.575	4924.5
21.262	4924.51
20.95	4924.51
20.637	4924.52
20.324	4924.53
20.012	4924.54
19.699	4924.55
19.386	4924.56
19.074	4924.59
18.761	4924.62
18.448	4924.65
18.136	4924.67

17.823	4924.69
17.51	4924.72
17.198	4924.73
16.885	4924.74
16.572	4924.75
16.259	4924.76
15.947	4924.76
15.634	4924.77
15.321	4924.78
15.009	4924.79
14.696	4924.81
14.383	4924.83
14.071	4924.85
13.758	4924.87
13.445	4924.88
13.133	4924.9
12.82	4924.91
12.507	4924.92
12.195	4924.95
11.882	4924.99
11.569	4925.02
11.257	4925.06
10.944	4925.1
10.631	4925.15
10.319	4925.19
10.006	4925.22
9.693	4925.26
9.38	4925.31
9.068	4925.35
8.755	4925.4
8.442	4925.45
8.13	4925.49
7.817	4925.52
7.504	4925.53
7.192	4925.53
6.879	4925.53
6.566	4925.54
6.254	4925.55
5.941	4925.59
5.628	4925.63
5.316	4925.67
5.003	4925.71
4.69	4925.77
4.378	4925.84
4.065	4925.9
3.752	4925.95
3.44	4925.99
3.127	4926.02
2.814	4926.04
2.501	4926.06
2.189	4926.08
1.876	4926.1
1.563	4926.13
1.251	4926.17
0.938	4926.21
0.625	4926.24
0.3127	4926.27
0	4926.29
0	4924.53
0	4894.97
0	4888.66
0	4880.54
0	4874.62

Material Boundary

X	Y
0	4924.53
82.38	4907.9
108.081	4898.17
120.312	4893.44
142.481	4885.33

Material Boundary

X	Y
0	4894.97
39.8299	4904.13

Material Boundary

X	Y
0	4888.66
41.3671	4898.43
39.8299	4904.13

Material Boundary

X	Y
0	4874.62
45.0216	4884.87

Material Boundary

X	Y
44.7635	4885.83
82.733	4894.4
84.622	4894.84
108.081	4898.17

Material Boundary

X	Y
44.7635	4885.83
45.0216	4884.87
46.402	4879.75
82.793	4888.14
84.794	4888.56
120.312	4893.44

Material Boundary

X	Y
48.4962	4871.98
82.866	4879.83
84.692	4880.23
118.551	4885.19
139.812	4884.33
140.148	4883.09

Material Boundary

X	Y
48.4962	4871.98
49.9944	4866.42
84.604	4874.36
117.598	4879.22
141.364	4878.29

Material Boundary

X	Y
140.148	4883.09
141.364	4878.29
141.782	4877.02

Material Boundary

X	Y
142.481	4885.33
146.944	4883.09
152.813	4880.13
159.612	4876.71
167.901	4872.54
191.67	4860.59

Material Boundary

X	Y
191.67	4871.08
191.67	4885.43

Material Boundary

X	Y
0	4880.54
43.5063	4890.49
44.7635	4885.83

Material Boundary

X	Y
191.67	4871.08

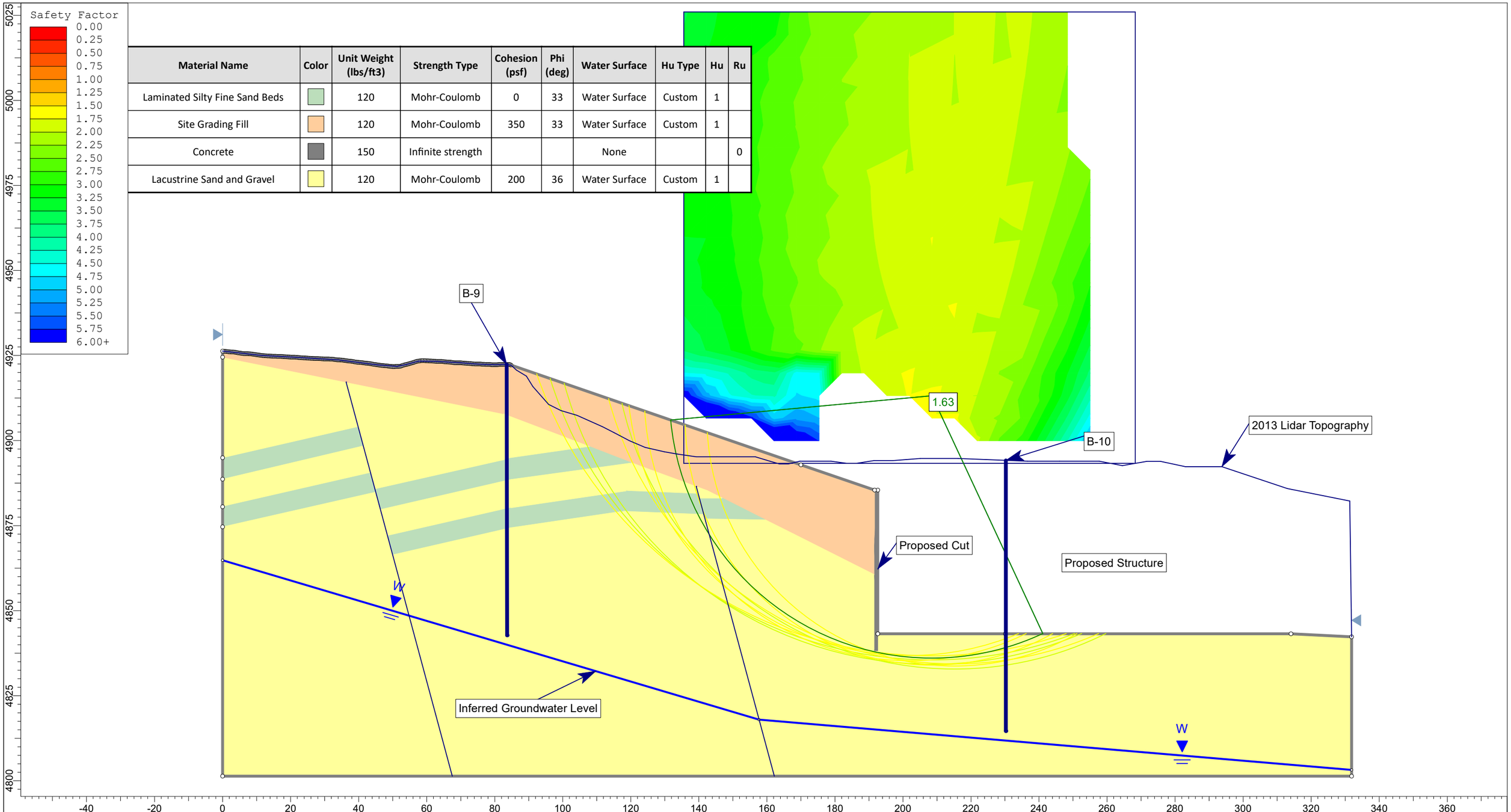
191.67	4868.47
191.67	4860.59
191.67	4838.21
192.612	4838.21
192.612	4843.21

Material Boundary

X	Y
140.148	4883.09
146.944	4883.09

Material Boundary

X	Y
141.782	4877.02
159.612	4876.71



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Laminated Silty Fine Sand Beds		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Concrete		150	Infinite strength			None			0
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Cottonwood Gravel Pit Development		
Analysis Description	Updated A-A': Proposed Grading - Static		
Drawn By: JKC	Scale: 1:322	Company: G2	
Date: 5/11/2020, 4:50:55 PM		File Name: Updated A-A' Grading.slim	

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: Updated B-B' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: B-B' Proposed Grading - Seismic
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:21:49 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Laminated Silty Fine Sand Bed	Site Grading Fill	Concrete	Concrete Washout	Pre-Lake Bonneville Landslide Deposits	Lacustrine Sand and Gravel	Pre-Lake Bonneville Alluvial Fan Deposits
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	130	120	120	120
Cohesion [psf]	0	350		350	0	200	200
Friction Angle [deg]	33	33		33	21	36	36
Water Surface	Water Table	Water Table	None	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1		1	1	1	1
Ru Value			0				

Global Minimums

Method: bishop simplified

FS: 1.024470
Center: 435.799, 5187.081
Radius: 364.327
Left Slip Surface Endpoint: 158.571, 4950.695
Right Slip Surface Endpoint: 546.578, 4840.005
Resisting Moment=4.57268e+008 lb-ft
Driving Moment=4.46346e+008 lb-ft
Total Slice Area=17891.5 ft2

Method: janbu simplified

FS: 0.912776
Center: 420.225, 5078.064
Radius: 253.939
Left Slip Surface Endpoint: 202.384, 4947.564
Right Slip Surface Endpoint: 508.615, 4840.005
Resisting Horizontal Force=889960 lb
Driving Horizontal Force=975005 lb
Total Slice Area=14459.1 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 2700
Number of Invalid Surfaces: 2151

Error Codes:

Error Code -99 reported for 928 surfaces
Error Code -103 reported for 1188 surfaces
Error Code -114 reported for 35 surfaces

Method: janbu simplified

Number of Valid Surfaces: 2700
Number of Invalid Surfaces: 2151

Error Codes:

Error Code -99 reported for 928 surfaces
Error Code -103 reported for 1188 surfaces
Error Code -114 reported for 35 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.02447

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	15.6759	15718.1	Concrete Washout	350	33	575.12	589.193	368.325	0	368.325
2	15.6759	45798.4	Concrete Washout	350	33	1356.1	1389.28	1600.35	0	1600.35
3	15.6759	73681.1	Concrete Washout	350	33	2143.76	2196.22	2842.92	0	2842.92
4	15.6759	99195.3	Concrete Washout	350	33	2920.9	2992.37	4068.89	0	4068.89
5	15.6759	120539	Concrete Washout	350	33	3626.48	3715.22	5181.98	0	5181.98
6	15.6759	132851	Concrete Washout	350	33	4105.64	4206.11	5937.9	0	5937.9
7	16.055	141475	Lacustrine Sand and Gravel	200	36	4635.67	4749.1	6261.32	0	6261.32
8	16.055	144006	Lacustrine Sand and Gravel	200	36	4872.94	4992.18	6595.87	0	6595.87
9	16.055	144578	Lacustrine Sand and Gravel	200	36	5048	5171.52	6842.71	0	6842.71
10	16.055	143804	Lacustrine Sand and Gravel	200	36	5177.31	5304	7025.03	0	7025.03
11	14.6382	129114	Pre-Lake Bonneville Landslide Deposits	0	21	2948.16	3020.3	7868.13	0	7868.13
12	14.6382	125947	Pre-Lake Bonneville Landslide Deposits	0	21	2883.19	2953.74	7805.01	110.213	7694.79
13	14.6382	121625	Pre-Lake Bonneville Landslide Deposits	0	21	2759.85	2827.38	7666.16	300.569	7365.59
14	14.6382	116605	Pre-Lake Bonneville Landslide Deposits	0	21	2628.75	2693.08	7466.88	451.167	7015.71
15	14.6382	111187	Pre-Lake Bonneville Landslide Deposits	0	21	2503.33	2564.59	7225.8	544.803	6681
16	14.6382	104711	Pre-Lake Bonneville Landslide Deposits	0	21	2376.33	2434.48	6900.22	558.21	6342.01
17	14.8831	98735.3	Lacustrine Sand and Gravel	200	36	4319.96	4425.67	6351.7	535.566	5816.13
18	14.8831	89859.1	Lacustrine Sand and Gravel	200	36	4069.72	4169.31	5939.01	475.724	5463.29
19	14.8831	79895	Lacustrine Sand and Gravel	200	36	3779.2	3871.68	5431.5	377.871	5053.63
20	14.8831	70373.8	Lacustrine Sand and Gravel	200	36	3521.38	3607.55	4932.12	242.024	4690.09
21	14.8831	42810.3	Lacustrine Sand and Gravel	200	36	2352.46	2410.02	3109.83	68.0088	3041.83
22	14.8831	24329.5	Lacustrine Sand and Gravel	200	36	1505.15	1541.98	1847.08	0	1847.08
23	14.8831	20026.2	Lacustrine Sand and Gravel	200	36	1321.69	1354.03	1588.39	0	1588.39
24	14.8831	14580.5	Lacustrine Sand and Gravel	200	36	1061.05	1087.02	1220.88	0	1220.88
25	22.8381	8876.2	Site Grading Fill	350	33	717.4	734.955	592.78	0	592.78

Global Minimum Query (janbu simplified) - Safety Factor: 0.912776

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	12.4604	15066.2	Concrete Washout	350	33	598.228	546.048	301.887	0	301.887
2	12.4604	42490.5	Concrete Washout	350	33	1475.9	1347.17	1535.51	0	1535.51
3	12.4604	64042.2	Concrete Washout	350	33	2276.32	2077.77	2660.52	0	2660.52
4	12.4604	78045.8	Concrete Washout	350	33	2891.84	2639.6	3525.68	0	3525.68
5	12.4604	87797.9	Concrete Washout	350	33	3393.8	3097.78	4231.22	0	4231.22
6	12.4604	95069.6	Concrete Washout	350	33	3826.13	3492.4	4838.86	0	4838.86
7	12.0303	96681.7	Lacustrine Sand and Gravel	200	36	4375.47	3993.82	5221.75	0	5221.75
8	12.0303	99552.1	Lacustrine Sand and Gravel	200	36	4688.03	4279.12	5614.43	0	5614.43
9	12.0303	101442	Lacustrine Sand and Gravel	200	36	4961.97	4529.17	5958.59	0	5958.59
10	12.0303	102189	Lacustrine Sand and Gravel	200	36	5185.86	4733.53	6239.88	0	6239.88
11	13.211	111792	Pre-Lake Bonneville Landslide Deposits	0	21	3076.91	2808.53	7316.5	0	7316.5
12	13.211	110081	Pre-Lake Bonneville Landslide Deposits	0	21	3055.81	2789.27	7382.87	116.586	7266.28
13	13.211	107129	Pre-Lake Bonneville Landslide Deposits	0	21	2965.19	2706.55	7361.08	310.265	7050.82
14	13.211	103563	Pre-Lake Bonneville Landslide Deposits	0	21	2868.1	2617.93	7276.75	456.813	6819.94

15	13.211	99161.3	Pre-Lake Bonneville Landslide Deposits	0	21	2768.21	2526.76	7113.84	531.408	6582.43
16	13.211	93635	Pre-Lake Bonneville Landslide Deposits	0	21	2657.45	2425.66	6852.69	533.621	6319.07
17	11.8401	78332.4	Lacustrine Sand and Gravel	200	36	4936.86	4506.25	6425.19	498.145	5927.05
18	11.8401	72219.1	Lacustrine Sand and Gravel	200	36	4763.87	4348.35	6138.48	428.764	5709.71
19	11.8401	65320.2	Lacustrine Sand and Gravel	200	36	4551.11	4154.14	5767.3	324.885	5442.41
20	11.8401	57632.4	Lacustrine Sand and Gravel	200	36	4294.71	3920.11	5306.64	186.354	5120.29
21	11.8401	50505.5	Lacustrine Sand and Gravel	200	36	4093.42	3736.38	4880.19	12.7869	4867.41
22	11.8401	32120.6	Lacustrine Sand and Gravel	200	36	2826.28	2579.76	3275.46	0	3275.46
23	11.8401	11795.6	Lacustrine Sand and Gravel	200	36	1262.75	1152.61	1311.16	0	1311.16
24	11.8401	7174.3	Lacustrine Sand and Gravel	200	36	922.96	842.456	884.264	0	884.264
25	9.36096	1836.15	Site Grading Fill	350	33	696.552	635.796	440.086	0	440.086

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.02447

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	158.571	4950.7	0	0	0
2	174.247	4933.46	2019.88	0	0
3	189.922	4918.23	18798.8	0	0
4	205.598	4904.7	45680.7	0	0
5	221.274	4892.61	78680.2	0	0
6	236.95	4881.81	113803	0	0
7	252.626	4872.15	146429	0	0
8	268.681	4863.34	169345	0	0
9	284.736	4855.55	185484	0	0
10	300.791	4848.69	194468	0	0
11	316.846	4842.72	196177	0	0
12	331.484	4838.01	228702	0	0
13	346.123	4833.96	255712	0	0
14	360.761	4830.57	277720	0	0
15	375.399	4827.8	294780	0	0
16	390.037	4825.64	306956	0	0
17	404.675	4824.09	314194	0	0
18	419.559	4823.12	285476	0	0
19	434.442	4822.76	253807	0	0
20	449.325	4823.01	220001	0	0
21	464.208	4823.86	184306	0	0
22	479.091	4825.34	157448	0	0
23	493.974	4827.43	138408	0	0
24	508.857	4830.15	120354	0	0
25	523.74	4833.53	104768	0	0
26	546.578	4840.01	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.912776

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	202.384	4947.56	0	0	0
2	214.845	4928.72	2733.84	0	0
3	227.305	4912.94	21272.8	0	0
4	239.766	4899.4	48047.6	0	0
5	252.226	4887.64	76804	0	0
6	264.686	4877.33	104346	0	0
7	277.147	4868.27	128918	0	0
8	289.177	4860.55	145438	0	0
9	301.207	4853.74	156976	0	0
10	313.237	4847.76	163184	0	0
11	325.268	4842.55	163824	0	0
12	338.479	4837.64	192486	0	0
13	351.69	4833.55	215254	0	0
14	364.901	4830.23	232574	0	0
15	378.112	4827.64	244447	0	0
16	391.323	4825.78	250799	0	0
17	404.534	4824.61	251667	0	0
18	416.374	4824.15	219482	0	0
19	428.214	4824.25	183994	0	0
20	440.054	4824.9	145808	0	0
21	451.894	4826.11	105700	0	0
22	463.734	4827.88	63600.2	0	0
23	475.574	4830.23	31981.7	0	0
24	487.414	4833.18	16666.9	0	0
25	499.254	4836.74	4712.32	0	0
26	508.615	4840.01	0	0	0

List Of Coordinates

Water Table

X	Y
0	4879.21
171.95	4848.36
192.094	4844.37
246.705	4841.97
378.309	4835.94
402.191	4833.27
712.49	4799.42

External Boundary

X	Y
0	4775.17
712.49	4775.17
712.49	4781.05
712.49	4814.75
712.49	4820.31
712.49	4825.73
712.49	4840.01
707.49	4840.01
468.96	4840.01
468.96	4862.27
465.069	4862.27
456	4862.27
241.44	4943.5
240.74	4943.78
240.05	4944.06
239.35	4944.32
238.65	4944.57
237.96	4944.79
237.26	4945.01
236.57	4945.22
235.87	4945.4
235.18	4945.53
234.48	4945.64
233.78	4945.77
233.09	4945.91
232.39	4946.02
231.7	4946.11
231	4946.19
230.31	4946.31
229.61	4946.43
228.91	4946.54
228.22	4946.64
227.52	4946.69
226.83	4946.73
226.13	4946.73
225.43	4946.79
224.74	4946.87
224.04	4946.95
223.35	4947
222.65	4947.04
221.96	4947.08
221.26	4947.13
220.56	4947.15
219.87	4947.15
219.17	4947.15
218.48	4947.17
217.78	4947.2
217.09	4947.23
216.39	4947.25
215.69	4947.29
215	4947.31
214.3	4947.33
213.61	4947.36
212.91	4947.39
212.21	4947.42
211.52	4947.42
210.82	4947.4
210.13	4947.39
209.43	4947.41
208.74	4947.47
208.04	4947.47
207.34	4947.45
206.65	4947.45
205.95	4947.49
205.26	4947.5
204.56	4947.49
203.87	4947.51
203.17	4947.54
202.47	4947.56
201.78	4947.57
201.08	4947.59
200.39	4947.59
199.69	4947.6
198.99	4947.64
198.3	4947.67
197.6	4947.69
196.91	4947.68
196.21	4947.66
195.52	4947.64
194.82	4947.63
194.12	4947.64
193.43	4947.65
192.73	4947.67
192.04	4947.69

191.34	4947.69
190.65	4947.68
189.95	4947.77
189.25	4947.88
188.56	4947.97
187.86	4948.04
187.17	4948.1
186.47	4948.11
185.78	4948.11
185.08	4948.13
184.38	4948.15
183.69	4948.18
182.99	4948.23
182.3	4948.32
181.6	4948.44
180.9	4948.49
180.21	4948.49
179.51	4948.52
178.82	4948.55
178.12	4948.53
177.43	4948.52
176.73	4948.56
176.03	4948.61
175.34	4948.66
174.64	4948.68
173.95	4948.7
173.25	4948.77
172.56	4948.86
171.86	4948.95
171.16	4949.04
170.47	4949.13
169.77	4949.26
169.08	4949.38
168.38	4949.54
167.68	4949.72
166.99	4949.89
166.29	4950.04
165.6	4950.12
164.9	4950.17
164.21	4950.24
163.51	4950.27
162.81	4950.3
162.12	4950.35
161.42	4950.4
160.73	4950.47
160.03	4950.54
159.34	4950.61
158.64	4950.69
157.94	4950.76
157.25	4950.85
156.55	4950.91
155.86	4950.95
155.16	4950.99
154.46	4951.06
153.77	4951.19
153.07	4951.33
152.38	4951.47
151.68	4951.55
150.99	4951.6
150.29	4951.65
149.59	4951.72
148.9	4951.82
148.2	4951.91
147.51	4951.98
146.81	4952.06
146.12	4952.12
145.42	4952.17
144.72	4952.17
144.03	4952.17
143.33	4952.18
142.64	4952.19
141.94	4952.23
141.24	4952.26
140.55	4952.3
139.85	4952.44
139.16	4952.57
138.46	4952.69
137.77	4952.77
137.07	4952.81
136.37	4952.82
135.68	4952.81
134.98	4952.84
134.29	4952.89
133.59	4953.03
132.9	4953.17
132.2	4953.27
131.5	4953.38
130.81	4953.55

130.11	4954.06
129.42	4954.61
128.72	4955.17
128.02	4955.79
127.33	4956.4
126.63	4956.98
125.94	4957.58
125.24	4958.2
124.55	4958.9
123.85	4959.58
123.15	4960.24
122.46	4960.9
121.76	4961.48
121.07	4962
120.37	4962.6
119.68	4963.28
118.98	4963.93
118.28	4964.54
117.59	4965.09
116.89	4965.6
116.2	4966.05
115.5	4966.49
114.8	4966.93
114.11	4967.37
113.41	4967.72
112.72	4968.02
112.02	4968.3
111.33	4968.69
110.63	4969.23
109.93	4969.77
109.24	4970.31
108.54	4970.75
107.85	4971.2
107.15	4971.67
106.46	4972.12
105.76	4972.56
105.06	4973.01
104.37	4973.46
103.67	4973.88
102.98	4974.27
102.28	4974.64
101.58	4975.05
100.89	4975.46
100.19	4975.89
99.497	4976.29
98.802	4976.72
98.106	4977.19
97.41	4977.66
96.714	4978.13
96.019	4978.6
95.323	4979.06
94.627	4979.39
93.931	4979.67
93.235	4979.98
92.54	4980.35
91.844	4980.7
91.148	4981.03
90.452	4981.39
89.756	4981.63
89.061	4981.81
88.365	4981.93
87.669	4982.03
86.973	4982.13
86.278	4982.24
85.582	4982.36
84.886	4982.47
84.19	4982.57
83.494	4982.65
82.799	4982.7
82.103	4982.74
81.407	4982.76
80.711	4982.78
80.015	4982.8
79.32	4982.85
78.624	4982.9
77.928	4982.99
77.232	4983.11
76.537	4983.25
75.841	4983.41
75.145	4983.48
74.449	4983.52
73.753	4983.56
73.058	4983.58
72.362	4983.58
71.666	4983.56
70.97	4983.53
70.274	4983.57
69.579	4983.62

68.883	4983.65
68.187	4983.7
67.491	4983.74
66.796	4983.8
66.1	4983.86
65.404	4983.92
64.708	4983.99
64.012	4984.08
63.317	4984.18
62.621	4984.27
61.925	4984.35
61.229	4984.42
60.533	4984.48
59.838	4984.56
59.142	4984.63
58.446	4984.67
57.75	4984.73
57.054	4984.81
56.359	4984.85
55.663	4984.9
54.967	4984.96
54.271	4985.05
53.576	4985.16
52.88	4985.25
52.184	4985.33
51.488	4985.37
50.792	4985.39
50.097	4985.42
49.401	4985.5
48.705	4985.56
48.009	4985.61
47.313	4985.64
46.618	4985.69
45.922	4985.71
45.226	4985.75
44.53	4985.84
43.835	4985.94
43.139	4986
42.443	4986.04
41.747	4985.98
41.051	4985.89
40.356	4985.74
39.66	4985.44
38.964	4985.13
38.268	4984.83
37.572	4984.55
36.877	4984.28
36.181	4984.06
35.485	4983.85
34.789	4983.7
34.094	4983.56
33.398	4983.43
32.702	4983.31
32.006	4983.18
31.31	4983.05
30.615	4982.92
29.919	4982.82
29.223	4982.7
28.527	4982.59
27.831	4982.46
27.136	4982.28
26.44	4982.12
25.744	4981.98
25.048	4981.91
24.353	4981.85
23.657	4981.81
22.961	4981.8
22.265	4981.78
21.569	4981.73
20.874	4981.66
20.178	4981.59
19.482	4981.49
18.786	4981.37
18.09	4981.26
17.395	4981.13
16.699	4980.98
16.003	4980.95
15.307	4980.98
14.612	4981.02
13.916	4981.05
13.22	4981.06
12.524	4981.04
11.828	4981
11.133	4980.92
10.437	4980.83
9.741	4980.74
9.045	4980.73
8.349	4980.77

7.654	4980.77
6.958	4980.73
6.262	4980.7
5.566	4980.69
4.871	4980.69
4.175	4980.69
3.479	4980.73
2.783	4980.79
2.087	4980.88
1.392	4980.98
0.696	4981.08
0	4981.14
0	4980.03
0	4893.47
0	4890.25
0	4852.22
0	4839.88
0	4838.18
0	4832.05

Material Boundary

X	Y
0	4980.03
156.102	4908.99
192.227	4892.17

Material Boundary

X	Y
0	4890.25
162.481	4884.42
161.416	4888.49
0	4893.47

Material Boundary

X	Y
166.519	4869.14
224.256	4882.27

Material Boundary

X	Y
362.716	4855.32
397.653	4850.04
465.069	4840.01
506.574	4836.04

Material Boundary

X	Y
529.861	4832.63
576.292	4826.63
636.835	4825.75
638.487	4825.73
672.929	4825.73
712.49	4825.73

Material Boundary

X	Y
465.069	4862.27
465.069	4840.01
468.96	4840.01

Material Boundary

X	Y
130.81	4953.55
192.227	4892.17
224.256	4882.27
232.415	4879.56
253.415	4871.86
362.716	4855.32
291.486	4903.45

Material Boundary

X	Y
166.519	4869.14
167.634	4864.87
232.415	4879.56

Material Boundary

X	Y
241.44	4943.5
256.855	4934.43

264.158	4926.42
272.992	4919.7
280.531	4914.17
291.486	4903.45

Material Boundary

X	Y
506.574	4836.04
529.861	4832.63

Material Boundary

X	Y
0	4839.88
175.505	4834.76
172.301	4847.02
0	4852.22

Material Boundary

X	Y
177.86	4825.75
246.705	4841.97

Material Boundary

X	Y
244.224	4830.92
361.95	4828.89
405.897	4819.57
402.191	4833.27
362.769	4841.78
247.195	4844.15

Material Boundary

X	Y
407.955	4811.97
712.49	4781.05
411.549	4798.69
407.955	4811.97

Material Boundary

X	Y
636.835	4825.75
712.49	4814.75

Material Boundary

X	Y
672.929	4825.73
712.49	4820.31

Material Boundary

X	Y
244.224	4830.92
246.705	4841.97
247.195	4844.15

Material Boundary

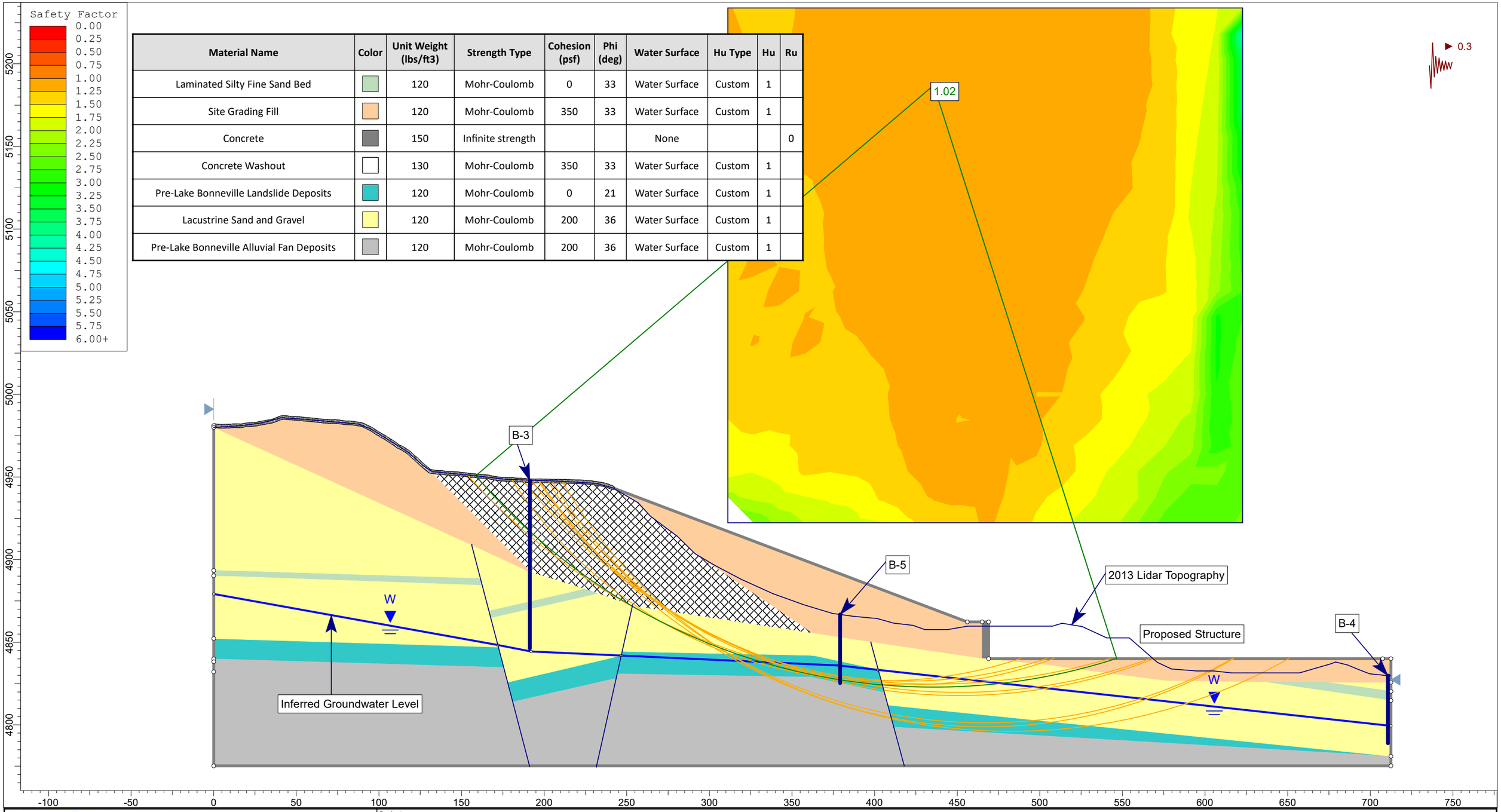
X	Y
177.86	4825.75
180.891	4814.15
243.691	4828.54
244.224	4830.92

Material Boundary

X	Y
175.505	4834.76
177.86	4825.75

Material Boundary

X	Y
405.897	4819.57
407.955	4811.97



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Laminated Silty Fine Sand Bed		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Concrete		150	Infinite strength			None			0
Concrete Washout		130	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Pre-Lake Bonneville Landslide Deposits		120	Mohr-Coulomb	0	21	Water Surface	Custom	1	
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	
Pre-Lake Bonneville Alluvial Fan Deposits		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	B-B' Proposed Grading - Seismic		
Drawn By: JKC	Scale: 1:658	Company: G2	
Date: 5/11/2020, 5:21:49 PM		File Name: Updated B-B' Grading.slim	

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: Updated B-B' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: B-B' Proposed Grading - Static
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:21:49 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Laminated Silty Fine Sand Bed	Site Grading Fill	Concrete	Concrete Washout	Pre-Lake Bonneville Landslide Deposits	Lacustrine Sand and Gravel	Pre-Lake Bonneville Alluvial Fan Deposits
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	150	130	120	120	120
Cohesion [psf]	0	350		350	0	200	200
Friction Angle [deg]	33	33		33	21	36	36
Water Surface	Water Table	Water Table	None	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1		1	1	1	1
Ru Value			0				

Global Minimums

Method: bishop simplified

FS: 1.961590
Center: 420.225, 5078.064
Radius: 253.939
Left Slip Surface Endpoint: 202.384, 4947.564
Right Slip Surface Endpoint: 508.615, 4840.005
Resisting Moment=2.78263e+008 lb-ft
Driving Moment=1.41856e+008 lb-ft
Total Slice Area=14459.1 ft2

Method: janbu simplified

FS: 1.778910
Center: 435.799, 5046.917
Radius: 227.600
Left Slip Surface Endpoint: 231.743, 4946.105

Right Slip Surface Endpoint : 530.612, 4840.005
Resisting Horizontal Force=855062 lb
Driving Horizontal Force=480667 lb
Total Slice Area=12954.9 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 2383
Number of Invalid Surfaces: 2468

Error Codes:

Error Code -99 reported for 928 surfaces
Error Code -103 reported for 1188 surfaces
Error Code -107 reported for 50 surfaces
Error Code -108 reported for 266 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 35 surfaces

Method: janbu simplified

Number of Valid Surfaces: 2379
Number of Invalid Surfaces: 2472

Error Codes:

Error Code -99 reported for 928 surfaces
Error Code -103 reported for 1188 surfaces
Error Code -107 reported for 50 surfaces
Error Code -108 reported for 271 surfaces
Error Code -114 reported for 35 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.96159

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	12.4604	15066.2	Concrete Washout	350	33	385.727	756.638	626.169	0	626.169
2	12.4604	42490.5	Concrete Washout	350	33	921.304	1807.22	2243.93	0	2243.93
3	12.4604	64042.2	Concrete Washout	350	33	1383.03	2712.93	3638.59	0	3638.59
4	12.4604	78045.8	Concrete Washout	350	33	1716.03	3366.15	4644.46	0	4644.46
5	12.4604	87797.9	Concrete Washout	350	33	1971.61	3867.49	5416.47	0	5416.47
6	12.4604	95069.6	Concrete Washout	350	33	2179.77	4275.82	6045.24	0	6045.24
7	12.0303	96681.7	Lacustrine Sand and Gravel	200	36	2487.82	4880.09	6441.59	0	6441.59
8	12.0303	99552.1	Lacustrine Sand and Gravel	200	36	2618.41	5136.25	6794.16	0	6794.16
9	12.0303	101442	Lacustrine Sand and Gravel	200	36	2723.9	5343.18	7078.98	0	7078.98
10	12.0303	102189	Lacustrine Sand and Gravel	200	36	2798.99	5490.48	7281.72	0	7281.72
11	13.211	111792	Pre-Lake Bonneville Landslide Deposits	0	21	1543.84	3028.39	7889.23	0	7889.23
12	13.211	110081	Pre-Lake Bonneville Landslide Deposits	0	21	1515.91	2973.59	7863.03	116.586	7746.44
13	13.211	107129	Pre-Lake Bonneville Landslide Deposits	0	21	1454.59	2853.31	7743.39	310.265	7433.12
14	13.211	103563	Pre-Lake Bonneville Landslide Deposits	0	21	1391.44	2729.44	7567.23	456.813	7110.41
15	13.211	99161.3	Pre-Lake Bonneville Landslide Deposits	0	21	1328.16	2605.31	7318.48	531.408	6787.08
16	13.211	93635	Pre-Lake Bonneville Landslide Deposits	0	21	1260.82	2473.22	6976.57	533.621	6442.95
17	11.8401	78332.4	Lacustrine Sand and Gravel	200	36	2334.59	4579.5	6526.02	498.145	6027.87
18	11.8401	72219.1	Lacustrine Sand and Gravel	200	36	2208.99	4333.14	6117.54	428.764	5688.78
19	11.8401	65320.2	Lacustrine Sand and Gravel	200	36	2066.97	4054.55	5630.22	324.885	5305.34
20	11.8401	57632.4	Lacustrine Sand and Gravel	200	36	1907.8	3742.33	5061.95	186.354	4875.6
21	11.8401	50505.5	Lacustrine Sand and Gravel	200	36	1775.54	3482.89	4531.3	12.7869	4518.51
22	11.8401	32120.6	Lacustrine Sand and Gravel	200	36	1194.53	2343.18	2949.84	0	2949.84
23	11.8401	11795.6	Lacustrine Sand and Gravel	200	36	518.698	1017.47	1125.16	0	1125.16
24	11.8401	7174.3	Lacustrine Sand and Gravel	200	36	367.267	720.428	716.308	0	716.308
25	9.36096	1836.15	Site Grading Fill	350	33	275.156	539.744	292.18	0	292.18

Global Minimum Query (janbu simplified) - Safety Factor: 1.77891

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	11.2238	12755.7	Concrete Washout	350	33	369.624	657.527	473.549	0	473.549
2	11.2238	33285.3	Concrete Washout	350	33	835.826	1486.86	1750.62	0	1750.62
3	11.2238	48521.6	Concrete Washout	350	33	1226.71	2182.21	2821.36	0	2821.36
4	11.2238	60303.1	Concrete Washout	350	33	1558.93	2773.19	3731.39	0	3731.39
5	11.2238	69678.3	Concrete Washout	350	33	1845.48	3282.95	4516.35	0	4516.35
6	11.2238	76887.2	Concrete Washout	350	33	2085.71	3710.29	5174.4	0	5174.4
7	12.3303	90588.9	Lacustrine Sand and Gravel	200	36	2419.26	4303.64	5648.17	0	5648.17
8	12.3303	94826	Lacustrine Sand and Gravel	200	36	2604.99	4634.04	6102.93	0	6102.93
9	12.3303	97467.5	Lacustrine Sand and Gravel	200	36	2749.24	4890.65	6456.12	0	6456.12
10	11.5564	92484.7	Pre-Lake Bonneville Landslide Deposits	0	21	1572.76	2797.79	7288.5	0	7288.5
11	11.5564	92463	Pre-Lake Bonneville Landslide Deposits	0	21	1564.9	2783.82	7391.94	139.848	7252.09
12	11.5564	91602.6	Pre-Lake Bonneville Landslide Deposits	0	21	1523.76	2710.63	7426.45	365.018	7061.43

13	11.5564	90290	Pre-Lake Bonneville Landslide Deposits	0	21	1481.39	2635.26	7412.5	547.412	6865.09
14	11.5564	88103.8	Pre-Lake Bonneville Landslide Deposits	0	21	1438.44	2558.86	7314.69	648.633	6666.06
15	11.5564	85045.3	Pre-Lake Bonneville Landslide Deposits	0	21	1387.96	2469.05	7135.3	703.226	6432.08
16	12.4442	87176	Lacustrine Sand and Gravel	200	36	2567.07	4566.58	6730.67	720.578	6010.09
17	12.4442	81612.2	Lacustrine Sand and Gravel	200	36	2454.35	4366.06	6431.45	697.356	5734.09
18	12.4442	75026.5	Lacustrine Sand and Gravel	200	36	2319.95	4126.99	6036.47	631.426	5405.04
19	12.4442	67422.7	Lacustrine Sand and Gravel	200	36	2162.99	3847.77	5543.68	522.961	5020.72
20	12.4442	63585.9	Lacustrine Sand and Gravel	200	36	2147.05	3819.41	5353.44	371.743	4981.7
21	12.4442	30399.6	Lacustrine Sand and Gravel	200	36	1115.23	1983.89	2632.47	177.161	2455.31
22	12.4442	22284.8	Lacustrine Sand and Gravel	200	36	930.502	1655.28	2003.03	0	2003.03
23	12.4442	17494.3	Lacustrine Sand and Gravel	200	36	778.291	1384.51	1630.34	0	1630.34
24	12.4442	11555.7	Lacustrine Sand and Gravel	200	36	574.217	1021.48	1130.67	0	1130.67
25	13.1997	4397.84	Site Grading Fill	350	33	376.278	669.365	491.779	0	491.779

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.96159

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	202.384	4947.56	0	0	0
2	214.845	4928.72	6996.6	0	0
3	227.305	4912.94	30937.9	0	0
4	239.766	4899.4	62957.3	0	0
5	252.226	4887.64	96227	0	0
6	264.686	4877.33	127501	0	0
7	277.147	4868.27	155151	0	0
8	289.177	4860.55	174956	0	0
9	301.207	4853.74	189737	0	0
10	313.237	4847.76	199326	0	0
11	325.268	4842.55	203653	0	0
12	338.479	4837.64	221967	0	0
13	351.69	4833.55	234146	0	0
14	364.901	4830.23	240677	0	0
15	378.112	4827.64	241856	0	0
16	391.323	4825.78	237980	0	0
17	404.534	4824.61	229461	0	0
18	416.374	4824.15	204814	0	0
19	428.214	4824.25	178087	0	0
20	440.054	4824.9	149972	0	0
21	451.894	4826.11	121289	0	0
22	463.734	4827.88	92247.9	0	0
23	475.574	4830.23	71181.1	0	0
24	487.414	4833.18	61730.7	0	0
25	499.254	4836.74	54834.6	0	0
26	508.615	4840.01	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.77891

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	231.743	4946.11	0	0	0
2	242.967	4926.01	5357.79	0	0
3	254.191	4909.73	24465	0	0
4	265.414	4896.02	49361	0	0
5	276.638	4884.22	75840.6	0	0
6	287.862	4873.95	101465	0	0
7	299.086	4864.95	124587	0	0
8	311.416	4856.31	143505	0	0
9	323.746	4848.81	157094	0	0
10	336.077	4842.33	164994	0	0
11	347.633	4837.09	184970	0	0
12	359.189	4832.6	200037	0	0
13	370.746	4828.81	210509	0	0
14	382.302	4825.69	216472	0	0
15	393.859	4823.21	217949	0	0
16	405.415	4821.35	215152	0	0
17	417.859	4820.02	192091	0	0
18	430.303	4819.38	165618	0	0
19	442.747	4819.42	136452	0	0
20	455.192	4820.14	105483	0	0
21	467.636	4821.55	71165	0	0
22	480.08	4823.67	51701.8	0	0
23	492.524	4826.5	34425.4	0	0
24	504.968	4830.08	18880.1	0	0
25	517.412	4834.45	6778.77	0	0
26	530.612	4840.01	0	0	0

List Of Coordinates

Water Table

X	Y
0	4879.21
171.95	4848.36
192.094	4844.37
246.705	4841.97
378.309	4835.94

402.191	4833.27
712.49	4799.42

External Boundary

X	Y
0	4775.17
712.49	4775.17
712.49	4781.05
712.49	4814.75
712.49	4820.31
712.49	4825.73
712.49	4840.01
707.49	4840.01
468.96	4840.01
468.96	4862.27
465.069	4862.27
456	4862.27
241.44	4943.5
240.74	4943.78
240.05	4944.06
239.35	4944.32
238.65	4944.57
237.96	4944.79
237.26	4945.01
236.57	4945.22
235.87	4945.4
235.18	4945.53
234.48	4945.64
233.78	4945.77
233.09	4945.91
232.39	4946.02
231.7	4946.11
231	4946.19
230.31	4946.31
229.61	4946.43
228.91	4946.54
228.22	4946.64
227.52	4946.69
226.83	4946.73
226.13	4946.73
225.43	4946.79
224.74	4946.87
224.04	4946.95
223.35	4947
222.65	4947.04
221.96	4947.08
221.26	4947.13
220.56	4947.15
219.87	4947.15
219.17	4947.15
218.48	4947.17
217.78	4947.2
217.09	4947.23
216.39	4947.25
215.69	4947.29
215	4947.31
214.3	4947.33
213.61	4947.36
212.91	4947.39
212.21	4947.42
211.52	4947.42
210.82	4947.4
210.13	4947.39
209.43	4947.41
208.74	4947.47
208.04	4947.47
207.34	4947.45
206.65	4947.45
205.95	4947.49
205.26	4947.5
204.56	4947.49
203.87	4947.51
203.17	4947.54
202.47	4947.56
201.78	4947.57
201.08	4947.59
200.39	4947.59
199.69	4947.6
198.99	4947.64
198.3	4947.67
197.6	4947.69
196.91	4947.68
196.21	4947.66
195.52	4947.64
194.82	4947.63
194.12	4947.64
193.43	4947.65

192.73	4947.67
192.04	4947.69
191.34	4947.69
190.65	4947.68
189.95	4947.77
189.25	4947.88
188.56	4947.97
187.86	4948.04
187.17	4948.1
186.47	4948.11
185.78	4948.11
185.08	4948.13
184.38	4948.15
183.69	4948.18
182.99	4948.23
182.3	4948.32
181.6	4948.44
180.9	4948.49
180.21	4948.49
179.51	4948.52
178.82	4948.55
178.12	4948.53
177.43	4948.52
176.73	4948.56
176.03	4948.61
175.34	4948.66
174.64	4948.68
173.95	4948.7
173.25	4948.77
172.56	4948.86
171.86	4948.95
171.16	4949.04
170.47	4949.13
169.77	4949.26
169.08	4949.38
168.38	4949.54
167.68	4949.72
166.99	4949.89
166.29	4950.04
165.6	4950.12
164.9	4950.17
164.21	4950.24
163.51	4950.27
162.81	4950.3
162.12	4950.35
161.42	4950.4
160.73	4950.47
160.03	4950.54
159.34	4950.61
158.64	4950.69
157.94	4950.76
157.25	4950.85
156.55	4950.91
155.86	4950.95
155.16	4950.99
154.46	4951.06
153.77	4951.19
153.07	4951.33
152.38	4951.47
151.68	4951.55
150.99	4951.6
150.29	4951.65
149.59	4951.72
148.9	4951.82
148.2	4951.91
147.51	4951.98
146.81	4952.06
146.12	4952.12
145.42	4952.17
144.72	4952.17
144.03	4952.17
143.33	4952.18
142.64	4952.19
141.94	4952.23
141.24	4952.26
140.55	4952.3
139.85	4952.44
139.16	4952.57
138.46	4952.69
137.77	4952.77
137.07	4952.81
136.37	4952.82
135.68	4952.81
134.98	4952.84
134.29	4952.89
133.59	4953.03
132.9	4953.17
132.2	4953.27

131.5	4953.38
130.81	4953.55
130.11	4954.06
129.42	4954.61
128.72	4955.17
128.02	4955.79
127.33	4956.4
126.63	4956.98
125.94	4957.58
125.24	4958.2
124.55	4958.9
123.85	4959.58
123.15	4960.24
122.46	4960.9
121.76	4961.48
121.07	4962
120.37	4962.6
119.68	4963.28
118.98	4963.93
118.28	4964.54
117.59	4965.09
116.89	4965.6
116.2	4966.05
115.5	4966.49
114.8	4966.93
114.11	4967.37
113.41	4967.72
112.72	4968.02
112.02	4968.3
111.33	4968.69
110.63	4969.23
109.93	4969.77
109.24	4970.31
108.54	4970.75
107.85	4971.2
107.15	4971.67
106.46	4972.12
105.76	4972.56
105.06	4973.01
104.37	4973.46
103.67	4973.88
102.98	4974.27
102.28	4974.64
101.58	4975.05
100.89	4975.46
100.19	4975.89
99.497	4976.29
98.802	4976.72
98.106	4977.19
97.41	4977.66
96.714	4978.13
96.019	4978.6
95.323	4979.06
94.627	4979.39
93.931	4979.67
93.235	4979.98
92.54	4980.35
91.844	4980.7
91.148	4981.03
90.452	4981.39
89.756	4981.63
89.061	4981.81
88.365	4981.93
87.669	4982.03
86.973	4982.13
86.278	4982.24
85.582	4982.36
84.886	4982.47
84.19	4982.57
83.494	4982.65
82.799	4982.7
82.103	4982.74
81.407	4982.76
80.711	4982.78
80.015	4982.8
79.32	4982.85
78.624	4982.9
77.928	4982.99
77.232	4983.11
76.537	4983.25
75.841	4983.41
75.145	4983.48
74.449	4983.52
73.753	4983.56
73.058	4983.58
72.362	4983.58
71.666	4983.56
70.97	4983.53

70.274	4983.57
69.579	4983.62
68.883	4983.65
68.187	4983.7
67.491	4983.74
66.796	4983.8
66.1	4983.86
65.404	4983.92
64.708	4983.99
64.012	4984.08
63.317	4984.18
62.621	4984.27
61.925	4984.35
61.229	4984.42
60.533	4984.48
59.838	4984.56
59.142	4984.63
58.446	4984.67
57.75	4984.73
57.054	4984.81
56.359	4984.85
55.663	4984.9
54.967	4984.96
54.271	4985.05
53.576	4985.16
52.88	4985.25
52.184	4985.33
51.488	4985.37
50.792	4985.39
50.097	4985.42
49.401	4985.5
48.705	4985.56
48.009	4985.61
47.313	4985.64
46.618	4985.69
45.922	4985.71
45.226	4985.75
44.53	4985.84
43.835	4985.94
43.139	4986
42.443	4986.04
41.747	4985.98
41.051	4985.89
40.356	4985.74
39.66	4985.44
38.964	4985.13
38.268	4984.83
37.572	4984.55
36.877	4984.28
36.181	4984.06
35.485	4983.85
34.789	4983.7
34.094	4983.56
33.398	4983.43
32.702	4983.31
32.006	4983.18
31.31	4983.05
30.615	4982.92
29.919	4982.82
29.223	4982.7
28.527	4982.59
27.831	4982.46
27.136	4982.28
26.44	4982.12
25.744	4981.98
25.048	4981.91
24.353	4981.85
23.657	4981.81
22.961	4981.8
22.265	4981.78
21.569	4981.73
20.874	4981.66
20.178	4981.59
19.482	4981.49
18.786	4981.37
18.09	4981.26
17.395	4981.13
16.699	4980.98
16.003	4980.95
15.307	4980.98
14.612	4981.02
13.916	4981.05
13.22	4981.06
12.524	4981.04
11.828	4981
11.133	4980.92
10.437	4980.83
9.741	4980.74

9.045	4980.73
8.349	4980.77
7.654	4980.77
6.958	4980.73
6.262	4980.7
5.566	4980.69
4.871	4980.69
4.175	4980.69
3.479	4980.73
2.783	4980.79
2.087	4980.88
1.392	4980.98
0.696	4981.08
0	4981.14
0	4980.03
0	4893.47
0	4890.25
0	4852.22
0	4839.88
0	4838.18
0	4832.05

Material Boundary

X	Y
0	4980.03
156.102	4908.99
192.227	4892.17

Material Boundary

X	Y
0	4890.25
162.481	4884.42
161.416	4888.49
0	4893.47

Material Boundary

X	Y
166.519	4869.14
224.256	4882.27

Material Boundary

X	Y
362.716	4855.32
397.653	4850.04
465.069	4840.01
506.574	4836.04

Material Boundary

X	Y
529.861	4832.63
576.292	4826.63
636.835	4825.75
638.487	4825.73
672.929	4825.73
712.49	4825.73

Material Boundary

X	Y
465.069	4862.27
465.069	4840.01
468.96	4840.01

Material Boundary

X	Y
130.81	4953.55
192.227	4892.17
224.256	4882.27
232.415	4879.56
253.415	4871.86
362.716	4855.32
291.486	4903.45

Material Boundary

X	Y
166.519	4869.14
167.634	4864.87
232.415	4879.56

Material Boundary

X	Y

241.44	4943.5
256.855	4934.43
264.158	4926.42
272.992	4919.7
280.531	4914.17
291.486	4903.45

Material Boundary

X	Y
506.574	4836.04
529.861	4832.63

Material Boundary

X	Y
0	4839.88
175.505	4834.76
172.301	4847.02
0	4852.22

Material Boundary

X	Y
177.86	4825.75
246.705	4841.97

Material Boundary

X	Y
244.224	4830.92
361.95	4828.89
405.897	4819.57
402.191	4833.27
362.769	4841.78
247.195	4844.15

Material Boundary

X	Y
407.955	4811.97
712.49	4781.05
411.549	4798.69
407.955	4811.97

Material Boundary

X	Y
636.835	4825.75
712.49	4814.75

Material Boundary

X	Y
672.929	4825.73
712.49	4820.31

Material Boundary

X	Y
244.224	4830.92
246.705	4841.97
247.195	4844.15

Material Boundary

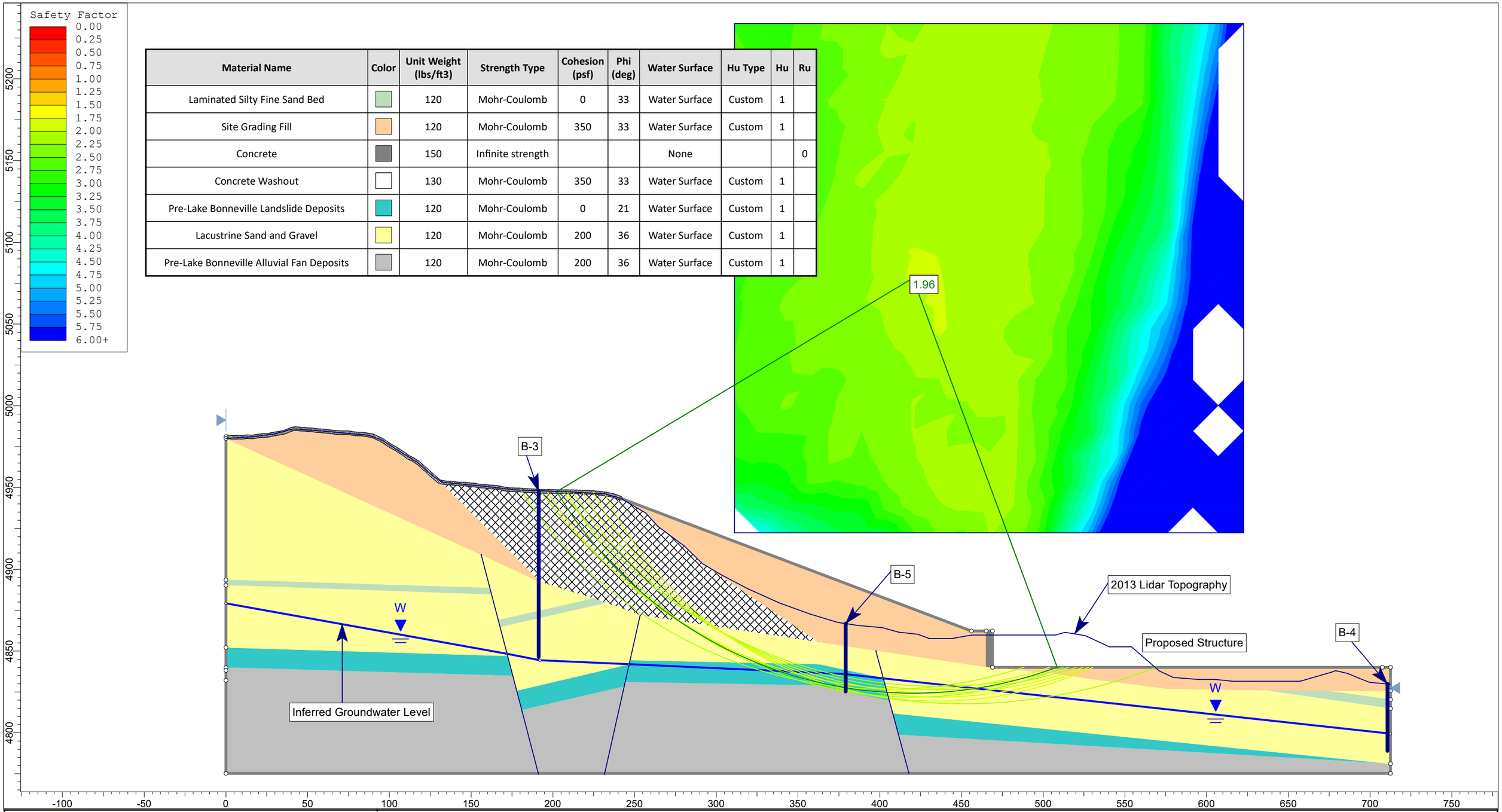
X	Y
177.86	4825.75
180.891	4814.15
243.691	4828.54
244.224	4830.92

Material Boundary

X	Y
175.505	4834.76
177.86	4825.75

Material Boundary

X	Y
405.897	4819.57
407.955	4811.97



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Laminated Silty Fine Sand Bed		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Concrete		150	Infinite strength			None			0
Concrete Washout		130	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Pre-Lake Bonneville Landslide Deposits		120	Mohr-Coulomb	0	21	Water Surface	Custom	1	
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	
Pre-Lake Bonneville Alluvial Fan Deposits		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	B-B' Proposed Grading - Static		
Drawn By: JKC	Scale: 1:665	Company: G2	
Date: 5/11/2020, 5:21:49 PM		File Name: Updated B-B' Grading.slim	

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: Updated C-C' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: C-C' Proposed Grading - Seismic
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:40:35 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Concrete	Poorly Graded Sand Bed	Site Grading Fill	Lacustrine Fines	Lacustrine Sand and Gravel
Color					
Strength Type	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	150	120	120	120	120
Cohesion [psf]		0	250	150	200
Friction Angle [deg]		33	38	27	36
Water Surface	None	Water Table	Water Table	Water Table	Water Table
Hu Value		1	1	1	1
Ru Value	0				

Global Minimums

Method: bishop simplified

FS: 1.070140
Center: 232.885, 5153.309
Radius: 292.386
Left Slip Surface Endpoint: 2.858, 4972.817
Right Slip Surface Endpoint: 213.449, 4861.569
Resisting Moment=1.05679e+008 lb-ft
Driving Moment=9.87527e+007 lb-ft
Total Slice Area=4054.15 ft2

Method: janbu simplified

FS: 0.987518
Center: 165.438, 5018.416
Radius: 168.466
Left Slip Surface Endpoint: 3.331, 4972.566
Right Slip Surface Endpoint: 222.960, 4860.074
Resisting Horizontal Force=621355 lb
Driving Horizontal Force=629208 lb
Total Slice Area=8769.67 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3644
Number of Invalid Surfaces: 1207

Error Codes:

Error Code -99 reported for 1004 surfaces
Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -108 reported for 15 surfaces
Error Code -109 reported for 5 surfaces
Error Code -1000 reported for 99 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3617
Number of Invalid Surfaces: 1234

Error Codes:

Error Code -99 reported for 1004 surfaces
Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -108 reported for 42 surfaces
Error Code -109 reported for 5 surfaces
Error Code -1000 reported for 99 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.07014

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	8.42367	2930.48	Site Grading Fill	250	38	258.264	276.379	33.7633	0	33.7633
2	8.42367	8347.93	Site Grading Fill	250	38	528.231	565.281	403.542	0	403.542
3	8.42367	12938.1	Site Grading Fill	250	38	775.966	830.392	742.868	0	742.868
4	8.42367	16806.6	Site Grading Fill	250	38	1001.2	1071.42	1051.37	0	1051.37
5	8.42367	20035	Site Grading Fill	250	38	1203.87	1288.31	1328.97	0	1328.97
6	8.42367	22688.3	Site Grading Fill	250	38	1384	1481.07	1575.7	0	1575.7
7	8.42367	24818.6	Site Grading Fill	250	38	1541.67	1649.8	1791.66	0	1791.66
8	8.42367	26469.1	Site Grading Fill	250	38	1676.93	1794.55	1976.94	0	1976.94
9	8.42367	27675.4	Site Grading Fill	250	38	1789.85	1915.39	2131.6	0	2131.6
10	8.42367	28467.6	Site Grading Fill	250	38	1880.42	2012.31	2255.66	0	2255.66
11	8.42367	28871.2	Site Grading Fill	250	38	1948.6	2085.28	2349.05	0	2349.05
12	8.42367	28907.8	Site Grading Fill	250	38	1994.31	2134.19	2411.66	0	2411.66
13	8.42367	28596.3	Site Grading Fill	250	38	2017.4	2158.9	2443.29	0	2443.29
14	8.42367	27952.8	Site Grading Fill	250	38	2017.67	2159.19	2443.65	0	2443.65
15	8.42367	26991.2	Site Grading Fill	250	38	1994.82	2134.74	2412.36	0	2412.36
16	8.42367	25723.8	Site Grading Fill	250	38	1948.54	2085.21	2348.96	0	2348.96
17	8.42367	24161.1	Site Grading Fill	250	38	1878.38	2010.13	2252.87	0	2252.87
18	8.42367	22312.2	Site Grading Fill	250	38	1783.85	1908.97	2123.38	0	2123.38
19	8.42367	20185.2	Site Grading Fill	250	38	1664.35	1781.09	1959.71	0	1959.71
20	8.42367	17786.9	Site Grading Fill	250	38	1519.2	1625.76	1760.89	0	1760.89
21	8.42367	15123.3	Site Grading Fill	250	38	1347.6	1442.12	1525.84	0	1525.84
22	8.42367	12199.3	Site Grading Fill	250	38	1148.64	1229.2	1253.32	0	1253.32
23	8.42367	9019.19	Site Grading Fill	250	38	921.26	985.877	941.88	0	941.88
24	8.42367	5586.36	Site Grading Fill	250	38	664.272	710.864	589.879	0	589.879
25	8.42367	1903.58	Site Grading Fill	250	38	376.308	402.702	195.449	0	195.449

Global Minimum Query (janbu simplified) - Safety Factor: 0.987518

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	0.517316	47.1129	Site Grading Fill	250	38	86.9371	85.852	-210.101	0	-210.101
2	9.01834	11939.5	Lacustrine Sand and Gravel	200	36	399.898	394.906	268.266	0	268.266
3	9.01834	28712.6	Lacustrine Sand and Gravel	200	36	1075.71	1062.28	1186.83	0	1186.83
4	9.01834	39769.7	Lacustrine Sand and Gravel	200	36	1657.29	1636.6	1977.31	0	1977.31

5	9.01834	47709.1	Lacustrine Sand and Gravel	200	36	2160.19	2133.23	2660.86	0	2660.86
6	9.01834	53535.6	Lacustrine Sand and Gravel	200	36	2594.92	2562.53	3251.74	0	3251.74
7	9.01834	57772.8	Lacustrine Sand and Gravel	200	36	2968.81	2931.75	3759.93	0	3759.93
8	9.01834	60736.4	Lacustrine Sand and Gravel	200	36	3287.08	3246.05	4192.52	0	4192.52
9	9.01834	62633.8	Lacustrine Sand and Gravel	200	36	3553.44	3509.09	4554.57	0	4554.57
10	9.01834	63609.9	Lacustrine Sand and Gravel	200	36	3770.51	3723.45	4849.62	0	4849.62
11	9.01834	63769.5	Lacustrine Sand and Gravel	200	36	3940.03	3890.85	5080.01	0	5080.01
12	9.01834	63190.9	Lacustrine Sand and Gravel	200	36	4062.98	4012.27	5247.14	0	5247.14
13	9.01834	61933.6	Lacustrine Sand and Gravel	200	36	4139.79	4088.12	5351.54	0	5351.54
14	9.01834	60043.5	Lacustrine Sand and Gravel	200	36	4170.21	4118.16	5392.89	0	5392.89
15	9.01834	57555.6	Lacustrine Sand and Gravel	200	36	4153.47	4101.63	5370.12	0	5370.12
16	9.01834	54496.7	Lacustrine Sand and Gravel	200	36	4088.14	4037.11	5281.33	0	5281.33
17	8.94924	50512.6	Poorly Graded Sand Bed	0	33	3417.7	3375.04	5197.1	0	5197.1
18	8.94924	46433	Poorly Graded Sand Bed	0	33	3247.97	3207.43	4939.01	0	4939.01
19	8.94924	41837.5	Poorly Graded Sand Bed	0	33	3027.7	2989.91	4604.06	0	4604.06
20	9.49803	38799.1	Site Grading Fill	250	38	3573.81	3529.2	4197.18	0	4197.18
21	9.49803	32433.6	Site Grading Fill	250	38	3176.34	3136.69	3694.79	0	3694.79
22	9.49803	25449.4	Site Grading Fill	250	38	2682.39	2648.91	3070.46	0	3070.46
23	9.49803	17833.8	Site Grading Fill	250	38	2074.96	2049.06	2302.69	0	2302.69
24	9.49803	9567.6	Site Grading Fill	250	38	1330.09	1313.49	1361.21	0	1361.21
25	9.49803	2037.89	Site Grading Fill	250	38	572.458	565.313	403.582	0	403.582

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.07014

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2.85752	4972.82	0	0	0
2	11.2812	4962.57	-949.866	0	0
3	19.7049	4953.2	887.319	0	0
4	28.1285	4944.59	4630.85	0	0
5	36.5522	4936.64	9591.62	0	0
6	44.9759	4929.3	15224.8	0	0
7	53.3996	4922.49	21097.4	0	0
8	61.8232	4916.18	26865.7	0	0
9	70.2469	4910.33	32258.7	0	0
10	78.6706	4904.9	37065.9	0	0
11	87.0943	4899.86	41128.5	0	0
12	95.5179	4895.2	44332.2	0	0
13	103.942	4890.89	46602.6	0	0
14	112.365	4886.92	47900.7	0	0
15	120.789	4883.26	48220.5	0	0
16	129.213	4879.92	47586.4	0	0
17	137.636	4876.87	46052.2	0	0
18	146.06	4874.11	43700	0	0
19	154.484	4871.63	40639.8	0	0
20	162.907	4869.42	37009.6	0	0
21	171.331	4867.47	32976	0	0
22	179.755	4865.79	28734.9	0	0
23	188.178	4864.36	24513	0	0
24	196.602	4863.18	20569.9	0	0
25	205.026	4862.25	17199.9	0	0
26	213.449	4861.57	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.987518

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3.33135	4972.57	0	0	0
2	3.84866	4970.78	-407.184	0	0
3	12.867	4946.98	5949.28	0	0
4	21.8853	4930.25	24715.5	0	0
5	30.9037	4917.02	47851.7	0	0
6	39.922	4906.05	71865	0	0
7	48.9404	4896.72	94832.9	0	0
8	57.9587	4888.69	115584	0	0
9	66.977	4881.72	133371	0	0
10	75.9954	4875.65	147715	0	0
11	85.0137	4870.39	158324	0	0
12	94.0321	4865.83	165042	0	0
13	103.05	4861.93	167822	0	0
14	112.069	4858.63	166712	0	0
15	121.087	4855.89	161841	0	0
16	130.105	4853.7	153423	0	0
17	139.124	4852.02	141751	0	0
18	148.073	4850.85	132385	0	0
19	157.022	4850.16	120625	0	0
20	165.971	4849.95	107031	0	0
21	175.469	4850.25	83456.8	0	0
22	184.968	4851.09	59909.4	0	0
23	194.466	4852.47	37804	0	0
24	203.964	4854.41	18957.5	0	0
25	213.462	4856.94	5749.66	0	0
26	222.96	4860.07	0	0	0

List Of Coordinates

Water Table

X	Y
0	4848.35
192.778	4814.7
214.242	4814.7
512.1	4805.41

External Boundary

X	Y
0	4775.45
443.37	4775.45
456.835	4775.45
479.933	4775.45
501.665	4775.45
512.1	4775.45
512.1	4777.98
512.1	4792.19
512.1	4802.11
512.1	4807.12
512.1	4825.89
512.1	4840.13
285.619	4840.13
285.619	4849.93
285.619	4860.07
283.166	4860.07
216.279	4860.07
0.5	4974.06
0	4974.32
0	4839.04
0	4835.82
0	4833.68
0	4831.97
0	4821.58
0	4812.51

Material Boundary

X	Y
86.517	4878.28
92.518	4874.52
97.519	4871.68
103.02	4868.48
108.52	4865.82
112.52	4864.6
116.02	4863.93
117.52	4863.9
122.02	4864.43
126.02	4865.25
129.03	4865.54
130.03	4865.67
132.03	4865.7
134.53	4865.47
137.03	4865.28
139.03	4865.12
140.03	4865.02
141.53	4864.78
144.03	4864.81
146.03	4864.89
148.03	4864.82
151.03	4864.22
153.03	4863.68
155.03	4862.59
158.03	4860.95
159.763	4859.13
162.03	4856.42
163.53	4855.01
165.03	4853.12
169.53	4849.97
172.03	4848.31
174.53	4846.35
177.53	4845.01
180.54	4844.55
184.04	4844.27
189.04	4843.96
193.54	4843.72
197.54	4843.47
201.04	4843.4
204.54	4843.14
208.54	4842.96
213.54	4842.81
220.54	4842.74
226.54	4842.81
232.55	4842.81
234.05	4842.61
236.55	4842.6
241.05	4842.56
248.05	4842.39

255.05	4842.28
261.05	4842.28
264.55	4842.08
268.05	4842.16
270.55	4842.24
272.55	4842.16
274.55	4842.55
277.55	4843.74
279.55	4844.97
283.06	4848.01

Material Boundary

X	Y
0.5	4974.06
4.41427	4970.22
6.798	4963.88
8.552	4960.07
10.468	4955.78
13.373	4949.66
17.96	4944.61
24.382	4940.79
29.886	4936.05
37.226	4930.85
43.953	4926.27
48.235	4921.07
51.751	4915.26
54.809	4909.29
57.867	4901.34
59.702	4896.91
66.583	4891.71
77.286	4884.37
86.017	4878.61
86.0366	4878.6
86.517	4878.28

Material Boundary

X	Y
283.06	4848.01
283.166	4848.09
285.619	4849.93

Material Boundary

X	Y
86.017	4878.61
86.0366	4878.6
96.658	4870.04
106.472	4864.36
114.261	4861.94
120.285	4861.17
146.915	4861.17
152.572	4859.79
157.631	4857.63
161.448	4853.81
164.452	4851.25
166.337	4849.64
169.174	4847.22
174.527	4843.26
185.824	4841.26
199.361	4839.61
205.038	4838.7
211.889	4837.59
213.693	4837.23
242.768	4837.23
291.744	4837.23
329.831	4838.56
355.144	4838.56
375.863	4840.04
394.322	4840.04
407.641	4838.17
432.02	4834.97
453.283	4832.4
478.09	4829.18

Material Boundary

X	Y
478.09	4829.18
512.1	4825.89

Material Boundary

X	Y
283.166	4860.07
283.166	4848.09
283.166	4840.13

285.619	4840.13

Material Boundary

X	Y
0	4839.04
90.0663	4846.88

Material Boundary

X	Y
0	4833.68
88.8412	4841.03

Material Boundary

X	Y
90.3222	4848.1
161.448	4853.81

Material Boundary

X	Y
89.2143	4842.81
166.337	4849.64

Material Boundary

X	Y
176.31	4840.47
156.327	4838.6
177.279	4838.95

Material Boundary

X	Y
177.974	4837.87
199.361	4839.61

Material Boundary

X	Y
183.807	4828.74
213.829	4831.67

Material Boundary

X	Y
213.783	4833.54
304.557	4829.63
512.1	4802.11

Material Boundary

X	Y
242.768	4837.23
307.115	4834.33
512.1	4807.12

Material Boundary

X	Y
214.004	4824.47
302.801	4820.11
512.1	4792.19

Material Boundary

X	Y
214.187	4816.97
310.528	4805.54
456.835	4775.45

Material Boundary

X	Y
88.8412	4841.03
89.2143	4842.81
90.0663	4846.88
90.3222	4848.1

Material Boundary

X	Y
174.527	4843.26
176.31	4840.47

Material Boundary

X	Y
213.693	4837.23
213.783	4833.54
213.829	4831.67
214.004	4824.47
214.187	4816.97

Material Boundary

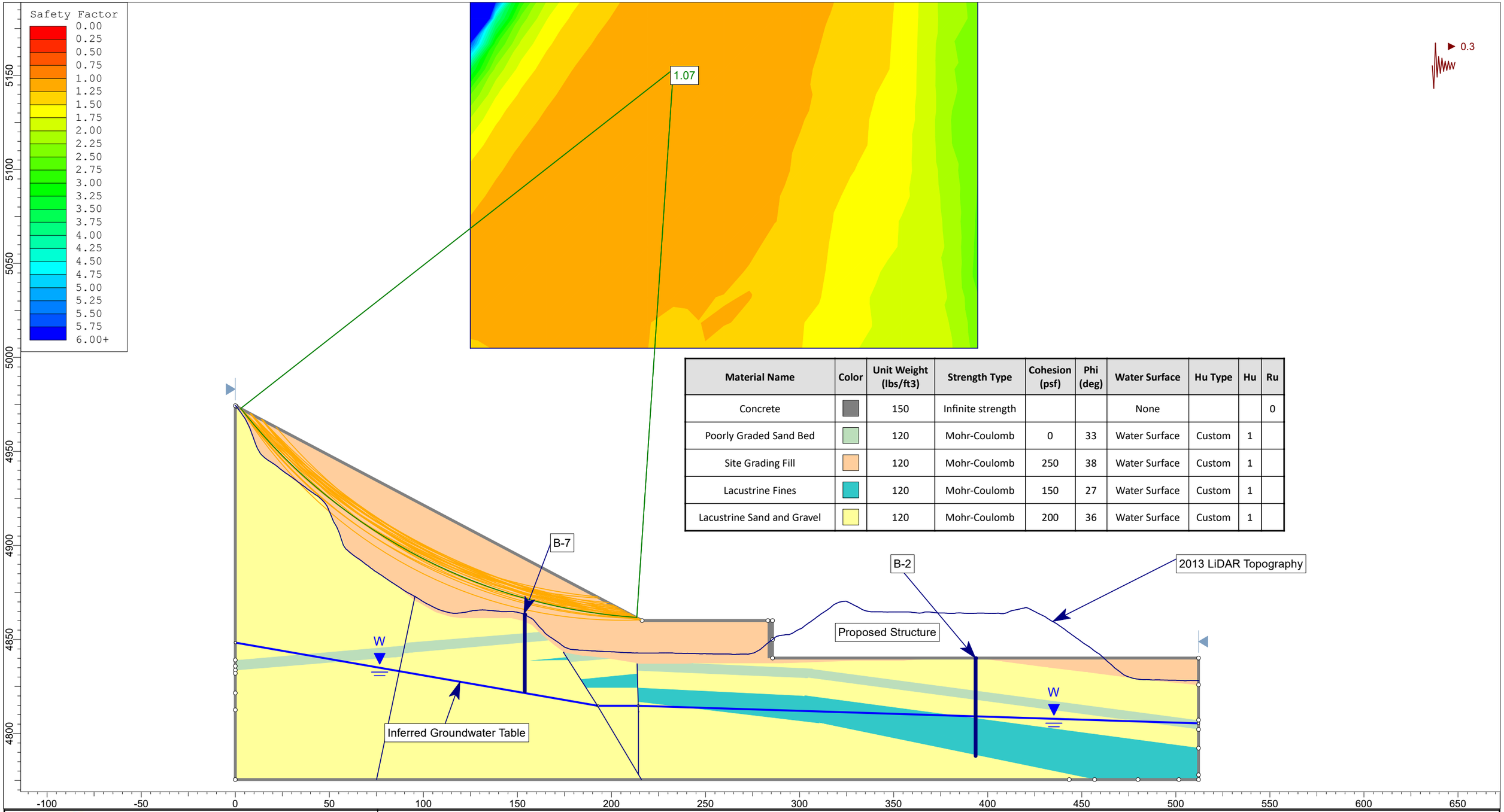
X	Y
183.807	4828.74
186.535	4824.47
214.004	4824.47

Material Boundary

X	Y
176.31	4840.47
177.279	4838.95

Material Boundary

X	Y
177.279	4838.95
177.974	4837.87



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Concrete		150	Infinite strength			None			0
Poorly Graded Sand Bed		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	250	38	Water Surface	Custom	1	
Lacustrine Fines		120	Mohr-Coulomb	150	27	Water Surface	Custom	1	
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	C-C' Proposed Grading - Seismic		
Drawn By	JKC	Scale	1:579	Company	G2
Date	5/11/2020, 5:40:35 PM	File Name	Updated C-C' Grading.slim

Slide Analysis Information

Gravel Pit Development

Project Summary

File Name: Updated C-C' Grading
Slide Modeler Version: 6.039
Project Title: Gravel Pit Development
Analysis: C-C' Proposed Grading - Static
Author: JKC
Company: G2
Date Created: 5/11/2020, 5:40:35 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Concrete	Poorly Graded Sand Bed	Site Grading Fill	Lacustrine Fines	Lacustrine Sand and Gravel
Color					
Strength Type	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	150	120	120	120	120
Cohesion [psf]		0	250	150	200
Friction Angle [deg]		33	38	27	36
Water Surface	None	Water Table	Water Table	Water Table	Water Table
Hu Value		1	1	1	1
Ru Value	0				

Global Minimums

Method: bishop simplified

FS: 1.899350
Center: 232.885, 5153.309
Radius: 292.386
Left Slip Surface Endpoint: 2.858, 4972.817
Right Slip Surface Endpoint: 213.449, 4861.569
Resisting Moment=1.19616e+008 lb-ft
Driving Moment=6.29773e+007 lb-ft
Total Slice Area=4054.15 ft2

Method: janbu simplified

FS: 1.758320
Center: 165.438, 5018.416
Radius: 168.466
Left Slip Surface Endpoint: 3.331, 4972.566

Right Slip Surface Endpoint : 222.960, 4860.074
Resisting Horizontal Force=678636 lb
Driving Horizontal Force=385956 lb
Total Slice Area=8769.67 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3600
Number of Invalid Surfaces: 1251

Error Codes:

Error Code -99 reported for 1004 surfaces
Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -107 reported for 13 surfaces
Error Code -108 reported for 46 surfaces
Error Code -109 reported for 5 surfaces
Error Code -1000 reported for 99 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3569
Number of Invalid Surfaces: 1282

Error Codes:

Error Code -99 reported for 1004 surfaces
Error Code -102 reported for 2 surfaces
Error Code -103 reported for 73 surfaces
Error Code -106 reported for 9 surfaces
Error Code -107 reported for 13 surfaces
Error Code -108 reported for 77 surfaces
Error Code -109 reported for 5 surfaces
Error Code -1000 reported for 99 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.89935

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	8.42367	2930.48	Site Grading Fill	250	38	183.098	347.767	125.137	0	125.137
2	8.42367	8347.93	Site Grading Fill	250	38	369.977	702.716	579.45	0	579.45
3	8.42367	12938.1	Site Grading Fill	250	38	537.429	1020.77	986.532	0	986.532
4	8.42367	16806.6	Site Grading Fill	250	38	686.187	1303.31	1348.18	0	1348.18
5	8.42367	20035	Site Grading Fill	250	38	816.958	1551.69	1666.09	0	1666.09
6	8.42367	22688.3	Site Grading Fill	250	38	930.392	1767.14	1941.86	0	1941.86
7	8.42367	24818.6	Site Grading Fill	250	38	1027.07	1950.77	2176.89	0	2176.89
8	8.42367	26469.1	Site Grading Fill	250	38	1107.52	2103.56	2372.45	0	2372.45
9	8.42367	27675.4	Site Grading Fill	250	38	1172.17	2226.36	2529.61	0	2529.61
10	8.42367	28467.6	Site Grading Fill	250	38	1221.41	2319.89	2649.34	0	2649.34
11	8.42367	28871.2	Site Grading Fill	250	38	1255.58	2384.79	2732.4	0	2732.4
12	8.42367	28907.8	Site Grading Fill	250	38	1274.94	2421.56	2779.46	0	2779.46
13	8.42367	28596.3	Site Grading Fill	250	38	1279.71	2430.62	2791.07	0	2791.07
14	8.42367	27952.8	Site Grading Fill	250	38	1270.07	2412.31	2767.63	0	2767.63
15	8.42367	26991.2	Site Grading Fill	250	38	1246.14	2366.85	2709.45	0	2709.45
16	8.42367	25723.8	Site Grading Fill	250	38	1207.99	2294.4	2616.72	0	2616.72
17	8.42367	24161.1	Site Grading Fill	250	38	1155.68	2195.04	2489.54	0	2489.54
18	8.42367	22312.2	Site Grading Fill	250	38	1089.19	2068.75	2327.9	0	2327.9
19	8.42367	20185.2	Site Grading Fill	250	38	1008.48	1915.45	2131.67	0	2131.67
20	8.42367	17786.9	Site Grading Fill	250	38	913.449	1734.96	1900.66	0	1900.66
21	8.42367	15123.3	Site Grading Fill	250	38	803.975	1527.03	1634.52	0	1634.52
22	8.42367	12199.3	Site Grading Fill	250	38	679.875	1291.32	1332.83	0	1332.83
23	8.42367	9019.19	Site Grading Fill	250	38	540.928	1027.41	995.042	0	995.042
24	8.42367	5586.36	Site Grading Fill	250	38	386.854	734.772	620.479	0	620.479
25	8.42367	1903.58	Site Grading Fill	250	38	217.325	412.776	208.344	0	208.344

Global Minimum Query (janbu simplified) - Safety Factor: 1.75832

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	0.517316	47.1129	Site Grading Fill	250	38	71.8635	126.359	-158.253	0	-158.253
2	9.01834	11939.5	Lacustrine Sand and Gravel	200	36	315.806	555.288	489.013	0	489.013
3	9.01834	28712.6	Lacustrine Sand and Gravel	200	36	808.328	1421.3	1680.98	0	1680.98
4	9.01834	39769.7	Lacustrine Sand and Gravel	200	36	1204.38	2117.68	2639.47	0	2639.47
5	9.01834	47709.1	Lacustrine Sand and Gravel	200	36	1529.35	2689.09	3425.95	0	3425.95
6	9.01834	53535.6	Lacustrine Sand and Gravel	200	36	1797.23	3160.1	4074.22	0	4074.22

7	9.01834	57772.8	Lacustrine Sand and Gravel	200	36	2016.86	3546.28	4605.76	0	4605.76
8	9.01834	60736.4	Lacustrine Sand and Gravel	200	36	2194.29	3858.26	5035.17	0	5035.17
9	9.01834	62633.8	Lacustrine Sand and Gravel	200	36	2333.78	4103.54	5372.76	0	5372.76
10	9.01834	63609.9	Lacustrine Sand and Gravel	200	36	2438.45	4287.57	5626.06	0	5626.06
11	9.01834	63769.5	Lacustrine Sand and Gravel	200	36	2510.53	4414.32	5800.52	0	5800.52
12	9.01834	63190.9	Lacustrine Sand and Gravel	200	36	2551.68	4486.67	5900.09	0	5900.09
13	9.01834	61933.6	Lacustrine Sand and Gravel	200	36	2563.03	4506.62	5927.55	0	5927.55
14	9.01834	60043.5	Lacustrine Sand and Gravel	200	36	2545.3	4475.46	5884.66	0	5884.66
15	9.01834	57555.6	Lacustrine Sand and Gravel	200	36	2498.89	4393.85	5772.34	0	5772.34
16	9.01834	54496.7	Lacustrine Sand and Gravel	200	36	2423.83	4261.87	5590.69	0	5590.69
17	8.94924	50512.6	Poorly Graded Sand Bed	0	33	1988.4	3496.25	5383.75	0	5383.75
18	8.94924	46433	Poorly Graded Sand Bed	0	33	1863.35	3276.36	5045.15	0	5045.15
19	8.94924	41837.5	Poorly Graded Sand Bed	0	33	1711.8	3009.89	4634.82	0	4634.82
20	9.49803	38799.1	Site Grading Fill	250	38	1985.01	3490.29	4147.39	0	4147.39
21	9.49803	32433.6	Site Grading Fill	250	38	1727.25	3037.06	3567.27	0	3567.27
22	9.49803	25449.4	Site Grading Fill	250	38	1425.2	2505.96	2887.5	0	2887.5
23	9.49803	17833.8	Site Grading Fill	250	38	1074.42	1889.18	2098.06	0	2098.06
24	9.49803	9567.6	Site Grading Fill	250	38	668.976	1176.27	1185.58	0	1185.58
25	9.49803	2037.89	Site Grading Fill	250	38	278.429	489.567	306.631	0	306.631

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.89935

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2.85752	4972.82	0	0	0
2	11.2812	4962.57	-259.941	0	0
3	19.7049	4953.2	2053.28	0	0
4	28.1285	4944.59	6021.5	0	0
5	36.5522	4936.64	10949.3	0	0
6	44.9759	4929.3	16304.9	0	0
7	53.3996	4922.49	21680.8	0	0
8	61.8232	4916.18	26766.3	0	0
9	70.2469	4910.33	31327.6	0	0
10	78.6706	4904.9	35193.8	0	0
11	87.0943	4899.86	38246.1	0	0
12	95.5179	4895.2	40410	0	0
13	103.942	4890.89	41649	0	0
14	112.365	4886.92	41960.4	0	0
15	120.789	4883.26	41371.3	0	0
16	129.213	4879.92	39936.3	0	0
17	137.636	4876.87	37735.4	0	0
18	146.06	4874.11	34872.3	0	0
19	154.484	4871.63	31474.1	0	0
20	162.907	4869.42	27690.1	0	0
21	171.331	4867.47	23691.9	0	0
22	179.755	4865.79	19673.6	0	0
23	188.178	4864.36	15852.1	0	0
24	196.602	4863.18	12467.8	0	0
25	205.026	4862.25	9785.95	0	0
26	213.449	4861.57	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.75832

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3.33135	4972.57	0	0	0
2	3.84866	4970.78	-320.705	0	0
3	12.867	4946.98	8460.8	0	0
4	21.8853	4930.25	29283.4	0	0
5	30.9037	4917.02	53319.4	0	0
6	39.922	4906.05	77085.5	0	0
7	48.9404	4896.72	98835.9	0	0
8	57.9587	4888.69	117613	0	0
9	66.977	4881.72	132884	0	0
10	75.9954	4875.65	144374	0	0
11	85.0137	4870.39	151977	0	0
12	94.0321	4865.83	155711	0	0
13	103.05	4861.93	155686	0	0
14	112.069	4858.63	152090	0	0
15	121.087	4855.89	145179	0	0
16	130.105	4853.7	135273	0	0
17	139.124	4852.02	122756	0	0
18	148.073	4850.85	111227	0	0
19	157.022	4850.16	97983.7	0	0
20	165.971	4849.95	83604.2	0	0
21	175.469	4850.25	63475.9	0	0
22	184.968	4851.09	44051.8	0	0
23	194.466	4852.47	26491.8	0	0
24	203.964	4854.41	12186.3	0	0
25	213.462	4856.94	2825.03	0	0
26	222.96	4860.07	0	0	0

List Of Coordinates

Water Table

X	Y
0	4848.35
192.778	4814.7
214.242	4814.7
512.1	4805.41

External Boundary

X	Y
0	4775.45
443.37	4775.45
456.835	4775.45
479.933	4775.45
501.665	4775.45
512.1	4775.45
512.1	4777.98
512.1	4792.19
512.1	4802.11
512.1	4807.12
512.1	4825.89
512.1	4840.13
285.619	4840.13
285.619	4849.93
285.619	4860.07
283.166	4860.07
216.279	4860.07
0.5	4974.06
0	4974.32
0	4839.04
0	4835.82
0	4833.68
0	4831.97
0	4821.58
0	4812.51

Material Boundary

X	Y
86.517	4878.28
92.518	4874.52
97.519	4871.68
103.02	4868.48
108.52	4865.82
112.52	4864.6
116.02	4863.93
117.52	4863.9
122.02	4864.43
126.02	4865.25
129.03	4865.54
130.03	4865.67
132.03	4865.7
134.53	4865.47
137.03	4865.28
139.03	4865.12
140.03	4865.02
141.53	4864.78
144.03	4864.81
146.03	4864.89
148.03	4864.82
151.03	4864.22
153.03	4863.68
155.03	4862.59
158.03	4860.95
159.763	4859.13
162.03	4856.42
163.53	4855.01
165.03	4853.12
169.53	4849.97
172.03	4848.31
174.53	4846.35
177.53	4845.01
180.54	4844.55
184.04	4844.27
189.04	4843.96
193.54	4843.72
197.54	4843.47
201.04	4843.4
204.54	4843.14
208.54	4842.96
213.54	4842.81
220.54	4842.74
226.54	4842.81
232.55	4842.81
234.05	4842.61
236.55	4842.6
241.05	4842.56
248.05	4842.39
255.05	4842.28

261.05	4842.28
264.55	4842.08
268.05	4842.16
270.55	4842.24
272.55	4842.16
274.55	4842.55
277.55	4843.74
279.55	4844.97
283.06	4848.01

Material Boundary

X	Y
0.5	4974.06
4.41427	4970.22
6.798	4963.88
8.552	4960.07
10.468	4955.78
13.373	4949.66
17.96	4944.61
24.382	4940.79
29.886	4936.05
37.226	4930.85
43.953	4926.27
48.235	4921.07
51.751	4915.26
54.809	4909.29
57.867	4901.34
59.702	4896.91
66.583	4891.71
77.286	4884.37
86.017	4878.61
86.0366	4878.6
86.517	4878.28

Material Boundary

X	Y
283.06	4848.01
283.166	4848.09
285.619	4849.93

Material Boundary

X	Y
86.017	4878.61
86.0366	4878.6
96.658	4870.04
106.472	4864.36
114.261	4861.94
120.285	4861.17
146.915	4861.17
152.572	4859.79
157.631	4857.63
161.448	4853.81
164.452	4851.25
166.337	4849.64
169.174	4847.22
174.527	4843.26
185.824	4841.26
199.361	4839.61
205.038	4838.7
211.889	4837.59
213.693	4837.23
242.768	4837.23
291.744	4837.23
329.831	4838.56
355.144	4838.56
375.863	4840.04
394.322	4840.04
407.641	4838.17
432.02	4834.97
453.283	4832.4
478.09	4829.18

Material Boundary

X	Y
478.09	4829.18
512.1	4825.89

Material Boundary

X	Y
283.166	4860.07
283.166	4848.09
283.166	4840.13
285.619	4840.13

Material Boundary

X	Y
0	4839.04
90.0663	4846.88

Material Boundary

X	Y
0	4833.68
88.8412	4841.03

Material Boundary

X	Y
90.3222	4848.1
161.448	4853.81

Material Boundary

X	Y
89.2143	4842.81
166.337	4849.64

Material Boundary

X	Y
176.31	4840.47
156.327	4838.6
177.279	4838.95

Material Boundary

X	Y
177.974	4837.87
199.361	4839.61

Material Boundary

X	Y
183.807	4828.74
213.829	4831.67

Material Boundary

X	Y
213.783	4833.54
304.557	4829.63
512.1	4802.11

Material Boundary

X	Y
242.768	4837.23
307.115	4834.33
512.1	4807.12

Material Boundary

X	Y
214.004	4824.47
302.801	4820.11
512.1	4792.19

Material Boundary

X	Y
214.187	4816.97
310.528	4805.54
456.835	4775.45

Material Boundary

X	Y
88.8412	4841.03
89.2143	4842.81
90.0663	4846.88
90.3222	4848.1

Material Boundary

X	Y
174.527	4843.26
176.31	4840.47

Material Boundary

X	Y
213.693	4837.23

213.783	4833.54
213.829	4831.67
214.004	4824.47
214.187	4816.97

Material Boundary

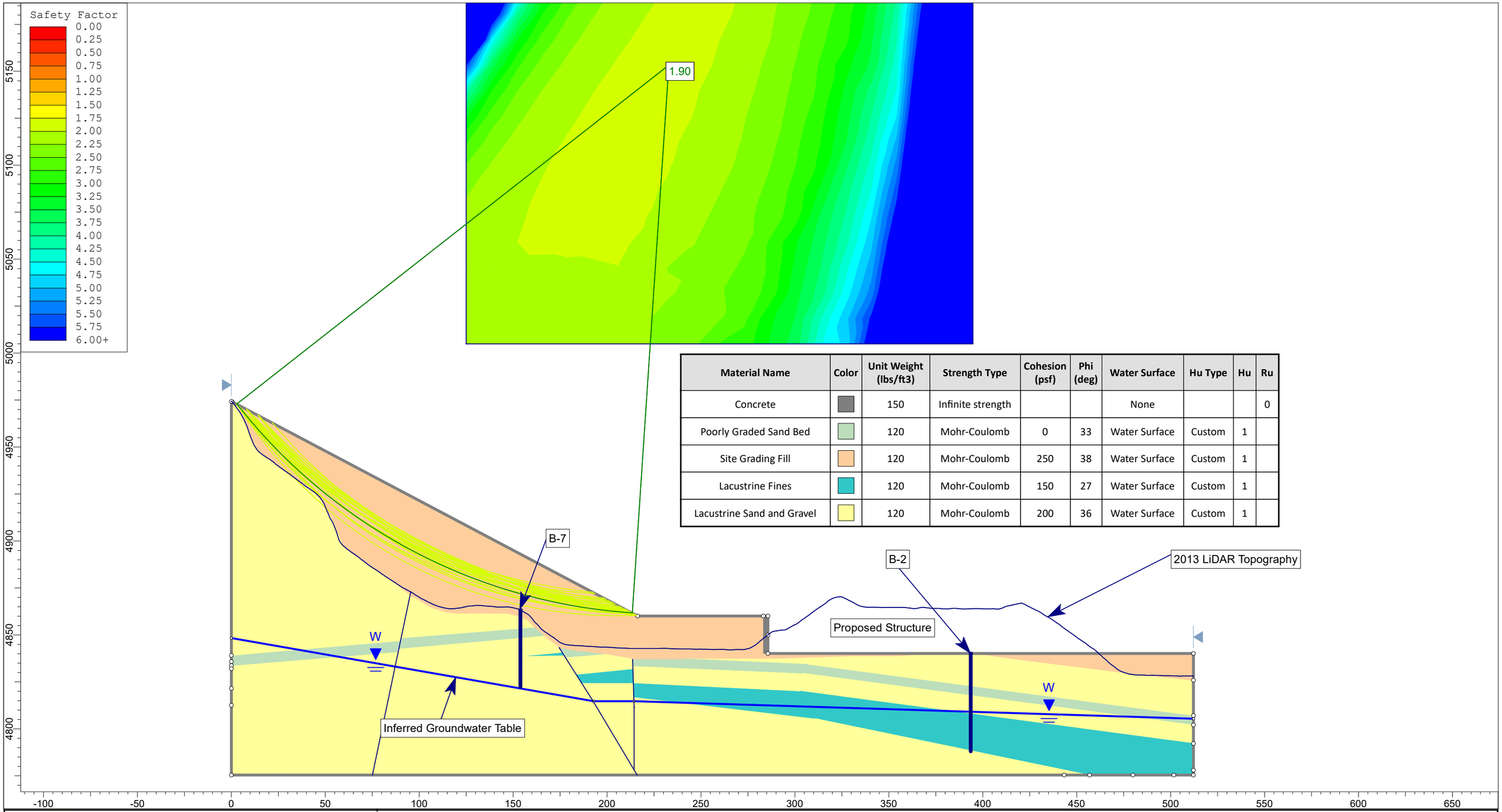
X	Y
183.807	4828.74
186.535	4824.47
214.004	4824.47

Material Boundary

X	Y
176.31	4840.47
177.279	4838.95

Material Boundary

X	Y
177.279	4838.95
177.974	4837.87



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Concrete		150	Infinite strength			None			0
Poorly Graded Sand Bed		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	250	38	Water Surface	Custom	1	
Lacustrine Fines		120	Mohr-Coulomb	150	27	Water Surface	Custom	1	
Lacustrine Sand and Gravel		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Gravel Pit Development		
Analysis Description	C-C' Proposed Grading - Static		
Drawn By JKC	*Scale* 1:579	*Company* G2	
Date 5/11/2020, 5:40:35 PM		*File Name* Updated C-C' Grading.slim	

Slide Analysis Information

Cottonwood Gravel Pit Slope Stability

Project Summary

File Name: D-D' Grading
Slide Modeler Version: 6.039
Project Title: Cottonwood Gravel Pit Slope Stability
Analysis: D-D' Proposed Grading - Seismic
Author: JKC
Company: G2
Date Created: 10/1/2020, 3:59:15 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.3

Material Properties

Property	Lacustrine Sand	Site Grading Fill	Concrete	Pre-Lake Bonneville Landslide Deposits	Lacustrine Sand and Gravel Deposits	Pre-Lake Bonneville Alluvial Fan Deposits
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120	120
Cohesion [psf]	0	350		0	200	200
Friction Angle [deg]	33	33		21	36	36
Water Surface	Water Table	Water Table	None	Water Table	Water Table	Water Table
Hu Value	1	1		1	1	1
Ru Value			0			

Global Minimums

Method: bishop simplified

FS: 1.008860
Center: 170.145, 5013.088
Radius: 176.419
Left Slip Surface Endpoint: 3.166, 4956.152
Right Slip Surface Endpoint: 257.843, 4860.010
Resisting Moment=1.17161e+008 lb-ft
Driving Moment=1.16132e+008 lb-ft
Total Slice Area=9821.3 ft2

Method: janbu simplified

FS: 0.865233
Center: 158.596, 4988.980
Radius: 152.586
Left Slip Surface Endpoint: 9.670, 4955.761
Right Slip Surface Endpoint: 240.142, 4860.013
Resisting Horizontal Force=531582 lb
Driving Horizontal Force=614380 lb
Total Slice Area=9585.71 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3667
Number of Invalid Surfaces: 1140

Error Codes:

Error Code -99 reported for 341 surfaces
Error Code -103 reported for 500 surfaces
Error Code -106 reported for 5 surfaces
Error Code -114 reported for 294 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3667
Number of Invalid Surfaces: 1140

Error Codes:

Error Code -99 reported for 341 surfaces
Error Code -103 reported for 500 surfaces
Error Code -106 reported for 5 surfaces
Error Code -114 reported for 294 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.00886

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	6.09708	5456.26	Site Grading Fill	350	33	350.372	353.476	5.35294	0	5.35294
2	9.94925	27364.3	Lacustrine Sand and Gravel Deposits	200	36	918.031	926.165	999.479	0	999.479
3	9.94925	41636.8	Lacustrine Sand and Gravel Deposits	200	36	1554.28	1568.05	1882.96	0	1882.96
4	9.94925	51689.9	Lacustrine Sand and Gravel Deposits	200	36	2101.04	2119.66	2642.18	0	2642.18
5	9.94925	59036	Lacustrine Sand and Gravel Deposits	200	36	2572.95	2595.75	3297.46	0	3297.46
6	3.66686	23240.5	Lacustrine Sand	0	33	2563.62	2586.33	3982.6	0	3982.6
7	8.87523	58648.7	Lacustrine Sand and Gravel Deposits	200	36	3094.49	3121.91	4021.67	0	4021.67
8	8.87523	61325.9	Lacustrine Sand and Gravel Deposits	200	36	3387.36	3417.37	4428.34	0	4428.34
9	11.2684	80248.7	Lacustrine Sand	0	33	3259.26	3288.14	5063.29	0	5063.29
10	11.6405	84175.1	Lacustrine Sand and Gravel Deposits	200	36	3910.59	3945.24	5154.88	0	5154.88
11	11.6405	83931.9	Lacustrine Sand and Gravel Deposits	200	36	4093.31	4129.58	5408.6	0	5408.6
12	11.6405	82281.9	Lacustrine Sand and Gravel Deposits	200	36	4205.54	4242.8	5564.43	0	5564.43
13	11.6405	79341.1	Lacustrine Sand and Gravel Deposits	200	36	4246.9	4284.53	5621.88	0	5621.88
14	11.1519	72142.9	Pre-Lake Bonneville Landslide Deposits	0	21	2278.98	2299.17	5989.53	0	5989.53
15	11.1519	67325.7	Pre-Lake Bonneville Landslide Deposits	0	21	2177.72	2197.01	5723.41	0	5723.41
16	11.1519	61532.9	Pre-Lake Bonneville Landslide Deposits	0	21	2037.8	2055.85	5355.68	0	5355.68
17	11.1519	54784.4	Pre-Lake Bonneville Landslide Deposits	0	21	1857.94	1874.4	4882.97	0	4882.97
18	11.1519	47088.5	Pre-Lake Bonneville Landslide Deposits	0	21	1636.16	1650.66	4300.13	0	4300.13
19	11.1519	38443.6	Pre-Lake Bonneville Landslide Deposits	0	21	1369.74	1381.88	3599.91	0	3599.91
20	11.1519	29222.1	Pre-Lake Bonneville Landslide Deposits	0	21	1068.93	1078.4	2809.33	0	2809.33
21	11.1519	24382.8	Pre-Lake Bonneville Landslide Deposits	0	21	917.214	925.341	2410.6	0	2410.6
22	11.1519	20219.9	Pre-Lake Bonneville Landslide Deposits	0	21	783.945	790.891	2060.34	0	2060.34
23	9.72279	13393.9	Site Grading Fill	350	33	1641.28	1655.82	2010.79	0	2010.79
24	9.72279	8623.14	Site Grading Fill	350	33	1299.54	1311.05	1479.9	0	1479.9
25	9.72279	3019.04	Site Grading Fill	350	33	832.345	839.72	754.103	0	754.103

Global Minimum Query (janbu simplified) - Safety Factor: 0.865233

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.52801	4096.59	Site Grading Fill	350	33	295.487	255.665	-145.263	0	-145.263
2	10.9535	31800	Lacustrine Sand and Gravel Deposits	200	36	922.965	798.58	823.874	0	823.874
3	10.9535	51992.7	Lacustrine Sand and Gravel Deposits	200	36	1831.55	1584.72	1905.9	0	1905.9
4	10.9535	64599.2	Lacustrine Sand and Gravel Deposits	200	36	2582.65	2234.59	2800.37	0	2800.37
5	6.49443	42574.5	Lacustrine Sand	0	33	2800.98	2423.5	3731.85	0	3731.85
6	13.6886	96310.8	Lacustrine Sand and Gravel Deposits	200	36	3594.38	3109.98	4005.24	0	4005.24
7	10.638	79096.1	Lacustrine Sand	0	33	3688.45	3191.37	4914.27	0	4914.27
8	9.0885	69022.4	Lacustrine Sand and Gravel Deposits	200	36	4452.82	3852.73	5027.55	0	5027.55
9	9.0885	69353.5	Lacustrine Sand and Gravel Deposits	200	36	4704.34	4070.35	5327.07	0	5327.07
10	9.0885	68864.8	Lacustrine Sand and Gravel Deposits	200	36	4901.7	4241.11	5562.11	0	5562.11
11	9.0885	67626.5	Lacustrine Sand and Gravel Deposits	200	36	5045.29	4365.35	5733.11	0	5733.11
12	9.0885	65690.8	Lacustrine Sand and Gravel Deposits	200	36	5134.61	4442.63	5839.47	0	5839.47

13	9.19886	63842.9	Pre-Lake Bonneville Landslide Deposits	0	21	2822.08	2441.76	6360.99	0	6360.99
14	9.19886	60532.4	Pre-Lake Bonneville Landslide Deposits	0	21	2746.19	2376.09	6189.92	0	6189.92
15	9.19886	56589.4	Pre-Lake Bonneville Landslide Deposits	0	21	2634.89	2279.79	5939.05	0	5939.05
16	9.19886	52026.8	Pre-Lake Bonneville Landslide Deposits	0	21	2486.95	2151.79	5605.61	0	5605.61
17	9.19886	46849.9	Pre-Lake Bonneville Landslide Deposits	0	21	2300.52	1990.49	5185.4	0	5185.4
18	9.19886	41056.8	Pre-Lake Bonneville Landslide Deposits	0	21	2072.98	1793.61	4672.5	0	4672.5
19	9.19886	34640.6	Pre-Lake Bonneville Landslide Deposits	0	21	1800.8	1558.11	4059.02	0	4059.02
20	9.19886	27586.1	Pre-Lake Bonneville Landslide Deposits	0	21	1479.2	1279.85	3334.12	0	3334.12
21	9.19886	20202.6	Pre-Lake Bonneville Landslide Deposits	0	21	1120.05	969.106	2524.61	0	2524.61
22	9.19886	15844.4	Pre-Lake Bonneville Landslide Deposits	0	21	911.114	788.326	2053.66	0	2053.66
23	3.11952	4508.83	Lacustrine Sand and Gravel Deposits	200	36	2212.47	1914.3	2359.53	0	2359.53
24	10.8558	11500.8	Site Grading Fill	350	33	1861.14	1610.32	1940.72	0	1940.72
25	10.8558	4075.45	Site Grading Fill	350	33	1209.14	1046.19	1072.03	0	1072.03

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.00886

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3.1661	4956.15	0	0	0
2	9.26319	4940.69	-419.803	0	0
3	19.2124	4921.75	17579.8	0	0
4	29.1617	4907.03	42288.7	0	0
5	39.1109	4894.96	68758.1	0	0
6	49.0602	4884.78	94396.5	0	0
7	52.7271	4881.42	105352	0	0
8	61.6023	4874.01	125230	0	0
9	70.4775	4867.52	142269	0	0
10	81.7459	4860.41	165540	0	0
11	93.3864	4854.24	177017	0	0
12	105.027	4849.13	182148	0	0
13	116.667	4844.97	180938	0	0
14	128.308	4841.7	173603	0	0
15	139.46	4839.36	183829	0	0
16	150.612	4837.75	188888	0	0
17	161.763	4836.87	189331	0	0
18	172.915	4836.69	185883	0	0
19	184.067	4837.22	179463	0	0
20	195.219	4838.46	171232	0	0
21	206.371	4840.43	162530	0	0
22	217.523	4843.15	153041	0	0
23	228.675	4846.66	143117	0	0
24	238.397	4850.41	123623	0	0
25	248.12	4854.84	107000	0	0
26	257.843	4860.01	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 0.865233

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	9.66994	4955.76	0	0	0
2	14.1979	4939.67	-2446.45	0	0
3	25.1515	4914.99	17320.2	0	0
4	36.105	4897.99	45245.7	0	0
5	47.0586	4884.86	73134.1	0	0
6	53.553	4878.31	92156.7	0	0
7	67.2417	4866.76	118093	0	0
8	77.8796	4859.49	138330	0	0
9	86.9681	4854.25	144920	0	0
10	96.0566	4849.8	146694	0	0
11	105.145	4846.06	143598	0	0
12	114.234	4842.99	135681	0	0
13	123.322	4840.53	123086	0	0
14	132.521	4838.64	128298	0	0
15	141.72	4837.33	129299	0	0
16	150.919	4836.59	126454	0	0
17	160.118	4836.4	120230	0	0
18	169.316	4836.77	111211	0	0
19	178.515	4837.7	100123	0	0
20	187.714	4839.2	87871.7	0	0
21	196.913	4841.28	75590.6	0	0
22	206.112	4843.98	64539.8	0	0
23	215.311	4847.33	54044.3	0	0
24	218.43	4848.62	45454.6	0	0
25	229.286	4853.76	18726.1	0	0
26	240.142	4860.01	0	0	0

List Of Coordinates

Water Table

X	Y
0	4852.96
147.867	4835.46
265.332	4823.1
549.94	4798.86

External Boundary

X	Y
0	4775.32
80.8919	4775.32
135.292	4775.32
277.991	4775.32
549.94	4775.32
549.94	4780.89
549.94	4814.96
549.94	4825.69
549.94	4840
386.68	4839.99
340.34	4840
340.34	4860
213.21	4860.02
208.909	4860
208.382	4860
203.538	4860
202.796	4859.99
202.47	4860.15
162.727	4880.02
106.439	4908.16
75.8676	4923.44
11.278	4955.72
10.741	4955.73
10.204	4955.74
9.667	4955.76
9.13	4955.77
8.593	4955.78
8.056	4955.79
7.519	4955.8
6.982	4955.81
6.445	4955.81
5.908	4955.83
5.37	4955.88
4.833	4955.94
4.296	4956.01
3.759	4956.08
3.222	4956.15
2.685	4956.21
2.148	4956.3
1.611	4956.4
1.074	4956.51
0.537	4956.59
0	4956.64
0	4942.62
0	4886.57
0	4877.28
0	4848.68
0	4837.67

Material Boundary

X	Y
38.613	4934.59
51.8611	4884.68
54.3133	4875.44
57.2378	4864.43
59.6996	4855.15
61.9863	4846.54
64.6989	4836.32
67.0961	4827.29
69.9215	4816.65
80.8919	4775.32

Material Boundary

X	Y
0	4942.62
38.613	4934.59
61.2808	4930.72
75.8676	4923.44

Material Boundary

X	Y
515.311	4819.06
549.94	4814.96

Material Boundary

X	Y
260.719	4840.52
264.153	4827.55
266.279	4819.53
269.569	4807.11
277.991	4775.32

Material Boundary

X	Y
0	4886.57
51.8611	4884.68

Material Boundary

X	Y
0	4877.28
54.3133	4875.44

Material Boundary

X	Y
57.2378	4864.43
142.951	4884.45

Material Boundary

X	Y
59.6996	4855.15
153.573	4877.55

Material Boundary

X	Y
135.292	4775.32
147.275	4834.11
147.692	4836.15
149.858	4846.77
150.072	4847.83
155.824	4876.04

Material Boundary

X	Y
0	4848.68
61.9863	4846.54

Material Boundary

X	Y
0	4837.67
64.6989	4836.32

Material Boundary

X	Y
67.0961	4827.29
149.858	4846.77

Material Boundary

X	Y
69.9215	4816.65
147.275	4834.11

Material Boundary

X	Y
150.072	4847.83
225.616	4847.25

Material Boundary

X	Y
147.692	4836.15
224.325	4836.15
264.153	4827.55

Material Boundary

X	Y
266.279	4819.53
533.953	4783.07
549.94	4780.89

Material Boundary

X	Y
269.569	4807.11
533.953	4783.07

Material Boundary

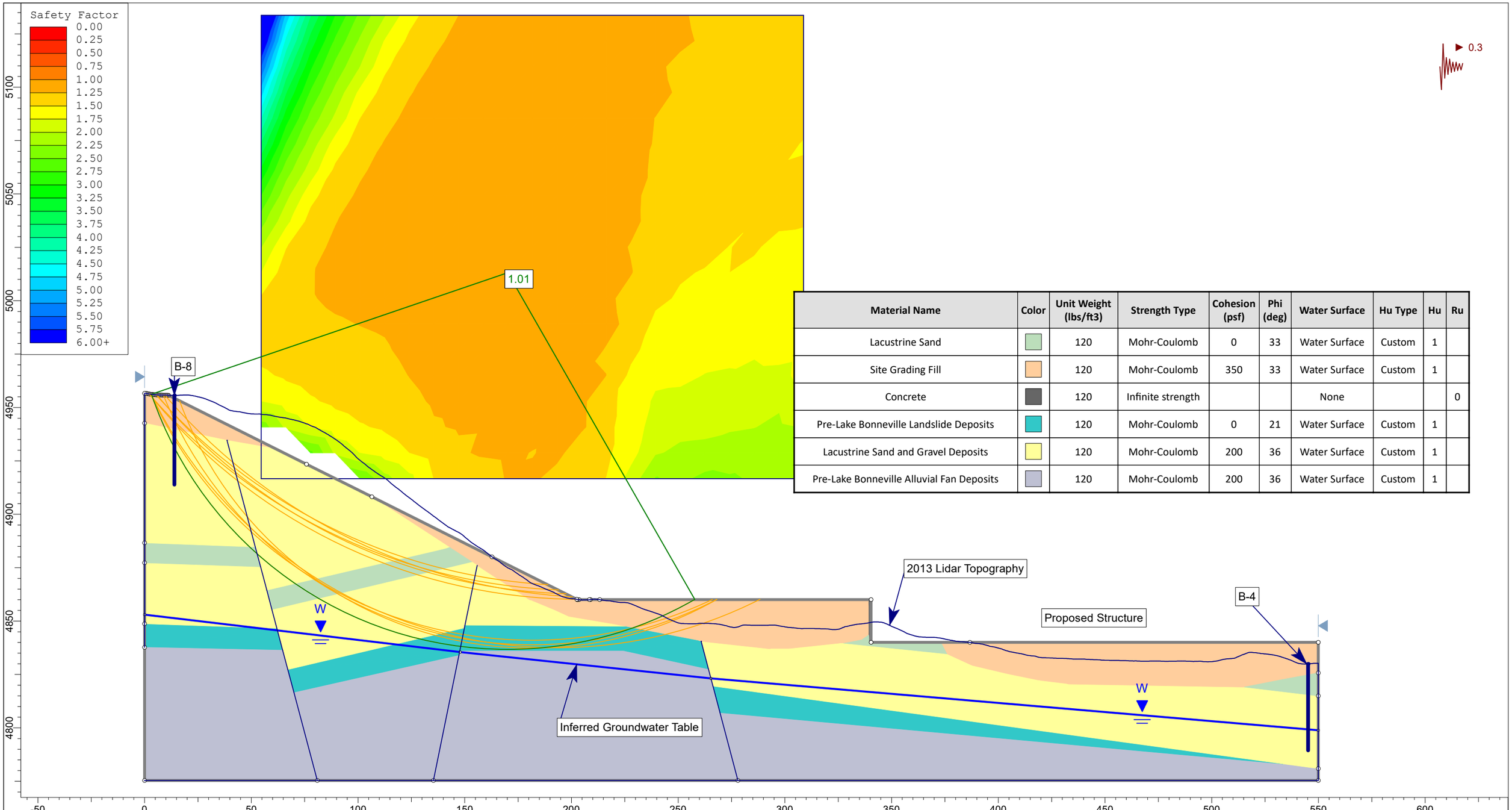
X	Y
326.309	4839.51
376.002	4834.36

Material Boundary

X	Y
340.34	4840
339.34	4840
339.34	4843.78
339.34	4860
340.34	4860

Material Boundary

X	Y
106.439	4908.16
142.951	4884.45
153.573	4877.55
155.824	4876.04
180.81	4859.7
191.837	4855.12
198.71	4851.97
218.903	4848.53
225.616	4847.25
260.719	4840.52
293.371	4836.94
302.25	4836.94
326.309	4839.51
335.904	4841.38
339.34	4843.78
340.2	4844.38
340.336	4844.36
340.34	4840
373.138	4839.8
376.002	4834.36
387.602	4829.06
404.5	4825.05
419.107	4822.04
432.05	4820.51
515.311	4819.06
532.967	4822.57
549.94	4825.69



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Lacustrine Sand		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Concrete		120	Infinite strength			None			0
Pre-Lake Bonneville Landslide Deposits		120	Mohr-Coulomb	0	21	Water Surface	Custom	1	
Lacustrine Sand and Gravel Deposits		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	
Pre-Lake Bonneville Alluvial Fan Deposits		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Cottonwood Gravel Pit Slope Stability		
Analysis Description	D-D' Proposed Grading - Seismic		
Drawn By: JKC	Scale: 1:513	Company: G2	
Date: 10/1/2020, 3:59:15 PM		File Name: D-D' Grading.slim	

Slide Analysis Information

Cottonwood Gravel Pit Slope Stability

Project Summary

File Name: D-D' Grading
Slide Modeler Version: 6.039
Project Title: Cottonwood Gravel Pit Slope Stability
Analysis: D-D' Proposed Grading - Static
Author: JKC
Company: G2
Date Created: 10/1/2020, 3:59:15 PM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Lacustrine Sand	Site Grading Fill	Concrete	Pre-Lake Bonneville Landslide Deposits	Lacustrine Sand and Gravel Deposits	Pre-Lake Bonneville Alluvial Fan Deposits
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Infinite strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120	120
Cohesion [psf]	0	350		0	200	200
Friction Angle [deg]	33	33		21	36	36
Water Surface	Water Table	Water Table	None	Water Table	Water Table	Water Table
Hu Value	1	1		1	1	1
Ru Value			0			

Global Minimums

Method: bishop simplified

FS: 1.832340
Center: 204.792, 5121.572
Radius: 261.548
Left Slip Surface Endpoint: 2.071, 4956.312
Right Slip Surface Endpoint: 202.712, 4860.033
Resisting Moment=9.83525e+007 lb-ft
Driving Moment=5.36758e+007 lb-ft
Total Slice Area=4099.92 ft2

Method: janbu simplified

FS: 1.635220
Center: 158.596, 4988.980
Radius: 152.586
Left Slip Surface Endpoint: 9.670, 4955.761

Right Slip Surface Endpoint : 240.142, 4860.013
Resisting Horizontal Force=588106 lb
Driving Horizontal Force=359650 lb
Total Slice Area=9585.71 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 3600
Number of Invalid Surfaces: 1207

Error Codes:

Error Code -99 reported for 341 surfaces
Error Code -103 reported for 500 surfaces
Error Code -106 reported for 5 surfaces
Error Code -107 reported for 1 surface
Error Code -108 reported for 66 surfaces
Error Code -114 reported for 294 surfaces

Method: janbu simplified

Number of Valid Surfaces: 3594
Number of Invalid Surfaces: 1213

Error Codes:

Error Code -99 reported for 341 surfaces
Error Code -103 reported for 500 surfaces
Error Code -106 reported for 5 surfaces
Error Code -107 reported for 1 surface
Error Code -108 reported for 72 surfaces
Error Code -114 reported for 294 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.83234

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	7.73298	3839.8	Site Grading Fill	350	33	259.501	475.494	193.243	0	193.243
2	7.73298	10523.7	Site Grading Fill	350	33	488.348	894.82	838.95	0	838.95
3	7.84729	14607.9	Lacustrine Sand and Gravel Deposits	200	36	609.95	1117.64	1263.02	0	1263.02
4	7.84729	17892	Lacustrine Sand and Gravel Deposits	200	36	745.997	1366.92	1606.13	0	1606.13
5	7.84729	20629.4	Lacustrine Sand and Gravel Deposits	200	36	865.462	1585.82	1907.42	0	1907.42
6	7.84729	22874.4	Lacustrine Sand and Gravel Deposits	200	36	968.98	1775.5	2168.49	0	2168.49
7	7.84729	24671	Lacustrine Sand and Gravel Deposits	200	36	1057.11	1936.98	2390.74	0	2390.74
8	7.84729	26055.2	Lacustrine Sand and Gravel Deposits	200	36	1130.34	2071.16	2575.42	0	2575.42
9	7.84729	27056.9	Lacustrine Sand and Gravel Deposits	200	36	1189.08	2178.8	2723.59	0	2723.59
10	7.84729	27701.4	Lacustrine Sand and Gravel Deposits	200	36	1233.71	2260.58	2836.14	0	2836.14
11	7.84729	28010	Lacustrine Sand and Gravel Deposits	200	36	1264.51	2317.02	2913.83	0	2913.83
12	7.84729	28000.8	Lacustrine Sand and Gravel Deposits	200	36	1281.74	2348.59	2957.28	0	2957.28
13	7.84729	27689.4	Lacustrine Sand and Gravel Deposits	200	36	1285.59	2355.63	2966.97	0	2966.97
14	7.84729	27089.2	Lacustrine Sand and Gravel Deposits	200	36	1276.2	2338.43	2943.29	0	2943.29
15	8.24005	27493.6	Lacustrine Sand	0	33	1048.38	1920.99	2958.07	0	2958.07
16	8.24005	26217.4	Lacustrine Sand	0	33	1011.53	1853.47	2854.09	0	2854.09
17	8.34556	24946.1	Lacustrine Sand and Gravel Deposits	200	36	1161.85	2128.9	2654.91	0	2654.91
18	8.34556	23029.9	Lacustrine Sand and Gravel Deposits	200	36	1093.92	2004.43	2483.58	0	2483.58
19	8.34556	20820.8	Lacustrine Sand and Gravel Deposits	200	36	1011.09	1852.66	2274.69	0	2274.69
20	8.34556	18325.5	Lacustrine Sand and Gravel Deposits	200	36	913.226	1673.34	2027.88	0	2027.88
21	8.34556	15549.1	Lacustrine Sand and Gravel Deposits	200	36	800.097	1466.05	1742.58	0	1742.58
22	8.34556	12495.9	Lacustrine Sand and Gravel Deposits	200	36	671.437	1230.3	1418.09	0	1418.09
23	8.15141	8997.71	Site Grading Fill	350	33	564.998	1035.27	1055.22	0	1055.22
24	8.15141	5573.5	Site Grading Fill	350	33	425.104	778.935	660.501	0	660.501
25	8.15141	1899.51	Site Grading Fill	350	33	271.341	497.189	226.651	0	226.651

Global Minimum Query (janbu simplified) - Safety Factor: 1.63522

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.52801	4096.59	Site Grading Fill	350	33	237.756	388.784	59.7217	0	59.7217
2	10.9535	31800	Lacustrine Sand and Gravel Deposits	200	36	705.703	1153.98	1313.04	0	1313.04
3	10.9535	51992.7	Lacustrine Sand and Gravel Deposits	200	36	1320.87	2159.91	2697.59	0	2697.59
4	10.9535	64599.2	Lacustrine Sand and Gravel Deposits	200	36	1789.15	2925.66	3751.55	0	3751.55
5	6.49443	42574.5	Lacustrine Sand	0	33	1859.03	3039.93	4681.09	0	4681.09
6	13.6886	96310.8	Lacustrine Sand and Gravel Deposits	200	36	2363	3864.03	5043.1	0	5043.1
7	10.638	79096.1	Lacustrine Sand	0	33	2322.34	3797.54	5847.7	0	5847.7
8	9.0885	69022.4	Lacustrine Sand and Gravel Deposits	200	36	2783.52	4551.67	5989.56	0	5989.56
9	9.0885	69353.5	Lacustrine Sand and Gravel Deposits	200	36	2884.94	4717.51	6217.82	0	6217.82
10	9.0885	68864.8	Lacustrine Sand and Gravel Deposits	200	36	2949.98	4823.87	6364.22	0	6364.22
11	9.0885	67626.5	Lacustrine Sand and Gravel Deposits	200	36	2980.09	4873.1	6431.98	0	6431.98
12	9.0885	65690.8	Lacustrine Sand and Gravel Deposits	200	36	2976.1	4866.58	6422.99	0	6422.99

13	9.19886	63842.9	Pre-Lake Bonneville Landslide Deposits	0	21	1554.3	2541.63	6621.19	0	6621.19
14	9.19886	60532.4	Pre-Lake Bonneville Landslide Deposits	0	21	1494.83	2444.38	6367.83	0	6367.83
15	9.19886	56589.4	Pre-Lake Bonneville Landslide Deposits	0	21	1417.25	2317.52	6037.34	0	6037.34
16	9.19886	52026.8	Pre-Lake Bonneville Landslide Deposits	0	21	1321.42	2160.82	5629.12	0	5629.12
17	9.19886	46849.9	Pre-Lake Bonneville Landslide Deposits	0	21	1206.95	1973.63	5141.49	0	5141.49
18	9.19886	41056.8	Pre-Lake Bonneville Landslide Deposits	0	21	1073.17	1754.87	4571.6	0	4571.6
19	9.19886	34640.6	Pre-Lake Bonneville Landslide Deposits	0	21	919.148	1503.01	3915.47	0	3915.47
20	9.19886	27586.1	Pre-Lake Bonneville Landslide Deposits	0	21	743.545	1215.86	3167.42	0	3167.42
21	9.19886	20202.6	Pre-Lake Bonneville Landslide Deposits	0	21	553.67	905.373	2358.58	0	2358.58
22	9.19886	15844.4	Pre-Lake Bonneville Landslide Deposits	0	21	442.07	722.881	1883.17	0	1883.17
23	3.11952	4508.83	Lacustrine Sand and Gravel Deposits	200	36	936.443	1531.29	1832.36	0	1832.36
24	10.8558	11500.8	Site Grading Fill	350	33	781.824	1278.45	1429.69	0	1429.69
25	10.8558	4075.45	Site Grading Fill	350	33	470.89	770.009	646.757	0	646.757

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.83234

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2.07064	4956.31	0	0	0
2	9.80362	4947.25	-252.459	0	0
3	17.5366	4938.97	2926.82	0	0
4	25.3839	4931.26	7895.28	0	0
5	33.2312	4924.15	13461.9	0	0
6	41.0785	4917.6	19186.8	0	0
7	48.9258	4911.54	24734.1	0	0
8	56.773	4905.94	29849.2	0	0
9	64.6203	4900.76	34342.2	0	0
10	72.4676	4895.97	38076.3	0	0
11	80.3149	4891.55	40958.6	0	0
12	88.1622	4887.47	42934.1	0	0
13	96.0095	4883.72	43980.3	0	0
14	103.857	4880.29	44103.3	0	0
15	111.704	4877.15	43335.4	0	0
16	119.944	4874.17	43532.8	0	0
17	128.184	4871.5	42847.4	0	0
18	136.53	4869.09	39557.9	0	0
19	144.875	4866.98	35686.6	0	0
20	153.221	4865.16	31407.4	0	0
21	161.566	4863.62	26920.6	0	0
22	169.912	4862.36	22453.4	0	0
23	178.258	4861.37	18260.6	0	0
24	186.409	4860.67	14405.9	0	0
25	194.56	4860.22	11242.8	0	0
26	202.712	4860.03	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.63522

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	9.66994	4955.76	0	0	0
2	14.1979	4939.67	-115.454	0	0
3	25.1515	4914.99	24562.4	0	0
4	36.105	4897.99	55932.8	0	0
5	47.0586	4884.86	85624.7	0	0
6	53.553	4878.31	104205	0	0
7	67.2417	4866.76	130075	0	0
8	77.8796	4859.49	147896	0	0
9	86.9681	4854.25	153986	0	0
10	96.0566	4849.8	155446	0	0
11	105.145	4846.06	152418	0	0
12	114.234	4842.99	145124	0	0
13	123.322	4840.53	133865	0	0
14	132.521	4838.64	132072	0	0
15	141.72	4837.33	126653	0	0
16	150.919	4836.59	118101	0	0
17	160.118	4836.4	106990	0	0
18	169.316	4836.77	93987.9	0	0
19	178.515	4837.7	79870.3	0	0
20	187.714	4839.2	65548.5	0	0
21	196.913	4841.28	52103.8	0	0
22	206.112	4843.98	40648.3	0	0
23	215.311	4847.33	30282.9	0	0
24	218.43	4848.62	24999.4	0	0
25	229.286	4853.76	9161.17	0	0
26	240.142	4860.01	0	0	0

List Of Coordinates

Water Table

X	Y
0	4852.96
147.867	4835.46
265.332	4823.1
549.94	4798.86

External Boundary

X	Y
0	4775.32
80.8919	4775.32
135.292	4775.32
277.991	4775.32
549.94	4775.32
549.94	4780.89
549.94	4814.96
549.94	4825.69
549.94	4840
386.68	4839.99
340.34	4840
340.34	4860
213.21	4860.02
208.909	4860
208.382	4860
203.538	4860
202.796	4859.99
202.47	4860.15
162.727	4880.02
106.439	4908.16
75.8676	4923.44
11.278	4955.72
10.741	4955.73
10.204	4955.74
9.667	4955.76
9.13	4955.77
8.593	4955.78
8.056	4955.79
7.519	4955.8
6.982	4955.81
6.445	4955.81
5.908	4955.83
5.37	4955.88
4.833	4955.94
4.296	4956.01
3.759	4956.08
3.222	4956.15
2.685	4956.21
2.148	4956.3
1.611	4956.4
1.074	4956.51
0.537	4956.59
0	4956.64
0	4942.62
0	4886.57
0	4877.28
0	4848.68
0	4837.67

Material Boundary

X	Y
38.613	4934.59
51.8611	4884.68
54.3133	4875.44
57.2378	4864.43
59.6996	4855.15
61.9863	4846.54
64.6989	4836.32
67.0961	4827.29
69.9215	4816.65
80.8919	4775.32

Material Boundary

X	Y
0	4942.62
38.613	4934.59
61.2808	4930.72
75.8676	4923.44

Material Boundary

X	Y
515.311	4819.06
549.94	4814.96

Material Boundary

X	Y
260.719	4840.52
264.153	4827.55
266.279	4819.53
269.569	4807.11
277.991	4775.32

Material Boundary

X	Y
0	4886.57
51.8611	4884.68

Material Boundary

X	Y
0	4877.28
54.3133	4875.44

Material Boundary

X	Y
57.2378	4864.43
142.951	4884.45

Material Boundary

X	Y
59.6996	4855.15
153.573	4877.55

Material Boundary

X	Y
135.292	4775.32
147.275	4834.11
147.692	4836.15
149.858	4846.77
150.072	4847.83
155.824	4876.04

Material Boundary

X	Y
0	4848.68
61.9863	4846.54

Material Boundary

X	Y
0	4837.67
64.6989	4836.32

Material Boundary

X	Y
67.0961	4827.29
149.858	4846.77

Material Boundary

X	Y
69.9215	4816.65
147.275	4834.11

Material Boundary

X	Y
150.072	4847.83
225.616	4847.25

Material Boundary

X	Y
147.692	4836.15
224.325	4836.15
264.153	4827.55

Material Boundary

X	Y
266.279	4819.53
533.953	4783.07
549.94	4780.89

Material Boundary

X	Y
269.569	4807.11
533.953	4783.07

Material Boundary

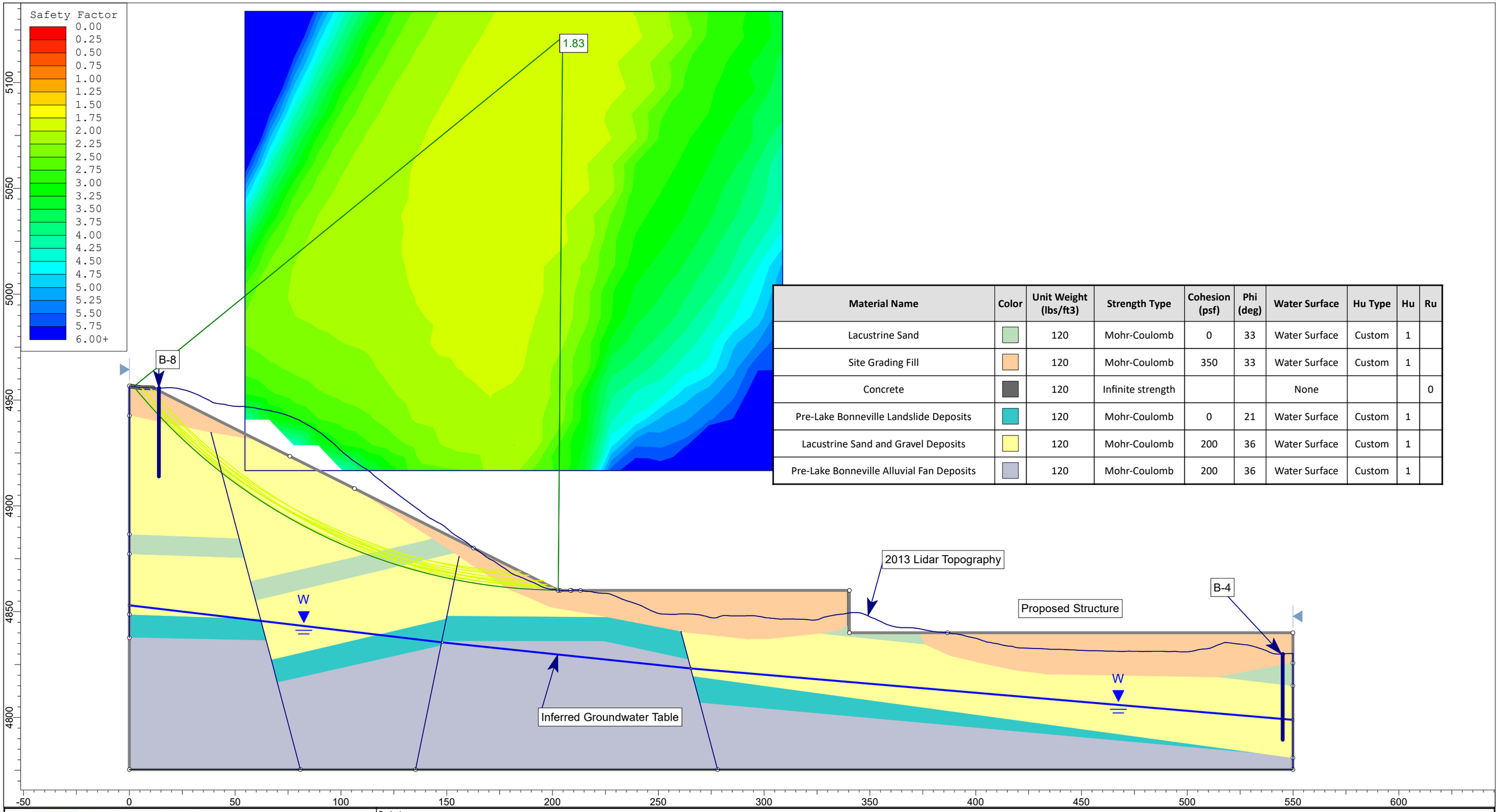
X	Y
326.309	4839.51
376.002	4834.36

Material Boundary

X	Y
340.34	4840
339.34	4840
339.34	4843.78
339.34	4860
340.34	4860

Material Boundary

X	Y
106.439	4908.16
142.951	4884.45
153.573	4877.55
155.824	4876.04
180.81	4859.7
191.837	4855.12
198.71	4851.97
218.903	4848.53
225.616	4847.25
260.719	4840.52
293.371	4836.94
302.25	4836.94
326.309	4839.51
335.904	4841.38
339.34	4843.78
340.2	4844.38
340.336	4844.36
340.34	4840
373.138	4839.8
376.002	4834.36
387.602	4829.06
404.5	4825.05
419.107	4822.04
432.05	4820.51
515.311	4819.06
532.967	4822.57
549.94	4825.69



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Lacustrine Sand		120	Mohr-Coulomb	0	33	Water Surface	Custom	1	
Site Grading Fill		120	Mohr-Coulomb	350	33	Water Surface	Custom	1	
Concrete		120	Infinite strength			None			0
Pre-Lake Bonneville Landslide Deposits		120	Mohr-Coulomb	0	21	Water Surface	Custom	1	
Lacustrine Sand and Gravel Deposits		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	
Pre-Lake Bonneville Alluvial Fan Deposits		120	Mohr-Coulomb	200	36	Water Surface	Custom	1	

GORDON GEOTECHNICAL ENGINEERING, INC.

SLIDEINTERPRET 6.039

Project	Cottonwood Gravel Pit Slope Stability		
Analysis Description	D-D' Proposed Grading - Static		
Drawn By	JKC	Scale	1:513
Company	G2		
Date	10/1/2020, 3:59:15 PM	File Name	D-D' Grading.slim