Geologic and Geotechnical Engineering Review
Vesting Tentative Tract Map 52905
APN: 2826-020-012 & 2826-020-013
City of Santa Clarita, Los Angeles County, California

for

Jemstreet Properties

April 17, 2017 W.O. 6946

MDN 19085

GeoSoils Consultants Inc.

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GeoSoils Consultants Inc.
GEOTECHNICAL GEOLOGIC ENVIRONMENTAL

April 17, 2017
W.O. 6946

JEMTREET PROPERTIES
1435 Reynolds Court
Thousand Oaks, California 91362

Subject: **Geologic and Geotechnical Engineering Investigation Report, Proposed 43-Lot Residential Development, Tentative Tract 52905, APN: 2826-020-012 and 2826-020-013, Santa Clarita, Los Angeles County, California**

1.0 INTRODUCTION

As requested, GeoSoils Consultants, Inc. (GSC) has prepared this geologic and geotechnical engineering report for the subject property. The purpose of this report is to evaluate the geologic and geotechnical engineering characteristics of the underlying earth materials in order to evaluate their suitability to relative the planned improvements.

This report has been prepared for exclusive use of JemStreet Properties and their consultants, and is non-transferable. This report has been prepared in accordance with generally accepted geotechnical engineering practices in the County of Los Angeles at the time it was prepared.

The site was explored by drilling three borings with an 8-inch diameter hollow-stem limited access rig on January 31, 2017, and by excavating eight backhoe test pits on February 15 2017. The field exploration procedures, boring logs, and test pit logs are attached as Appendix A. Laboratory test procedures and results are enclosed in Appendix B. Stability Analyses are included as Appendix C. The geologic site conditions are shown on the Geologic Map, Plate 1. The Geologic Cross-Sections are included as Plates 2A and 2B.

MDN 19085

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 Site Description

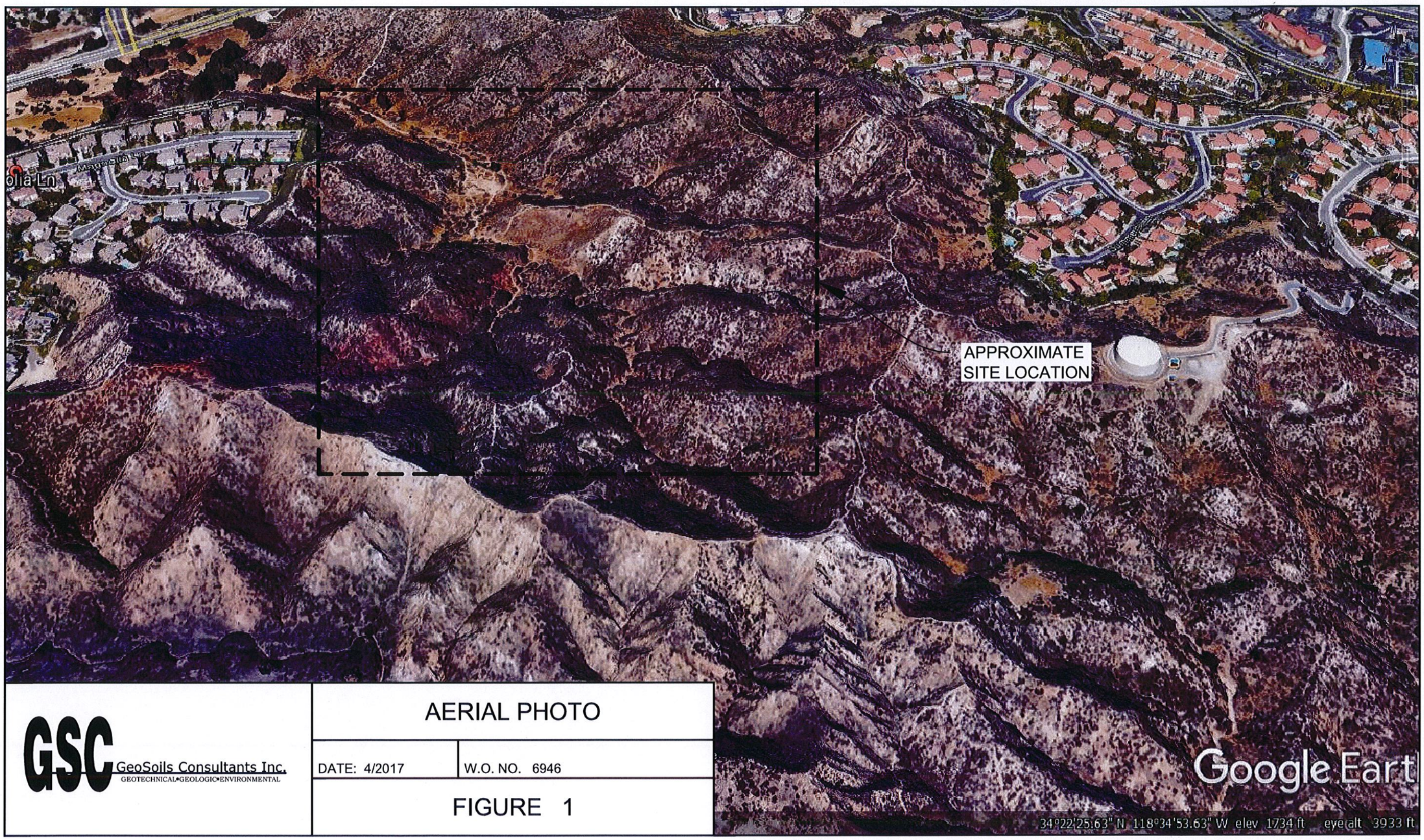
The subject site is located in the Santa Clarita Valley and is bounded by Tract No. 43896 (previously graded under the observation and testing by GeoSoils, Inc.) and Pico Canyon Road. The Legal descriptions include Tentative Tract 52905 and APN: 2826-020-012 and 2826-020-013. The currently vacant site occupies approximately 94.83 acres of hillside terrain. The site is accessible from Pico Canyon Park property and a permit was required to gain access for exploratory equipment. An aerial photograph showing the approximate location of the site is included as Figure 1.

2.2 Proposed Development

According to the conceptual grading plans prepared by Civil Design and Drafting, Inc. dated April 2017, proposed development consists of a cut/fill grading operation to create 37 lots for residential construction (Lots 1 through 37), 5 lots used as desilting basins (Lots 38 through 42), and the final lot will be used as an infiltration/retention basin (Lot 43). Each of the basins will be provided with stand pipe and drainage pipes, and will outlet into the infiltration/retention basin on Lot 43. In addition, the basin on Lot 43 will be provided with a stand pipe, which will allow water to overflow the basin and enter the natural drainage course. The Geologic Map is included as Plate 1 and Geologic Cross Sections are included as Plate 2A and 2B.

3.0 GRADING

Grading of the site will consist of a cut/fill operation to create level building sites and associated streets and basins. The grading will consist of a balanced cut and fill operation of several thousand cubic yards. The main cut areas are located near the steeper regions of the tract and the major fill areas are located in the regions of lower elevation, which include the drainages located in the tract. The grading will involve the removal and recompaction of artificial fill, alluvium, and weathered bedrock material, in addition to the mass-excavation.



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AERIAL PHOTO

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FIGURE 1

Site grading will create cut and fill slopes to a maximum height of approximately 80 feet. The highest cut slope is shown on Section 5-5' and the highest fill slope is shown on Section 2-2'. All slopes are designed at gradients of 2:1 or flatter with terrace benches at approximately 25-foot intervals. Drainage swales are located at the top of all cut slopes located at the base of natural slopes.

4.0 GEOLOGIC CONDITIONS

Geologic conditions of Tentative Tract 52905 were determined through research, field mapping, and subsurface exploration, and the results were superimposed on the Geologic Map, Plate 1. During grading, a geologist should be present to confirm the geologic conditions encountered on the site are consistent with those presented herein. The following sections present our findings concerning subsurface soil conditions, groundwater conditions, and expansion potential and sulfate content of surficial site soils.

4.1 Regional Geologic Setting

The subject property is located within the Transverse Ranges of Geomorphic Provinces of California. The Transverse Ranges consist of generally east-west trending mountains and valleys, which are in contrast to the north-northwest regional trend elsewhere in the state. The structure of the Transverse Ranges is controlled by the effects of north-south compressive deformation (crustal shortening), which is attributed to the convergence between the big bend of the San Andreas Fault north of the San Gabriel Mountains and the motion of the Pacific Plate. The valleys and mountains of the Transverse Ranges are typically bounded by a series of east-west trending, generally north dipping reverse faults with left-lateral oblique movement.

The Transverse Ranges are characterized by a very thick, nearly continuous sequence of Upper Cretaceous through Quaternary sediementary rocks that have been deformed into a series of east-west trending folds associated with thrust and reverse faults. This documentation has created interbasin highlands, and intervening lowlands.

4.2 Local Regional Setting

The property is located within the southern part of the Newhall USGS 7.5-minute quadrangle, and the northern part of the Oat Mountain USGS 7.5-minute quadrangle. Bedrock of the Saugus Formation, Pico Formation, alluvium, and artificial fill underlie the site. The distributions of these materials are shown on Plate 1 and are discussed in greater detail below. A Regional Geologic Map is included as Figure 2.

4.3 Geologic Structure

Bedding on the site strikes northwest and dips steeply to the north at angles ranging from approximately 60 to 85 degrees. The backhoe test pits excavated on the site encountered mostly massive sandstone. Bedding attitudes were obtained from field mapping; however, most natural outcrops on the site also expose massive sandstone.

4.4 Subsurface Soil and Rock Conditions

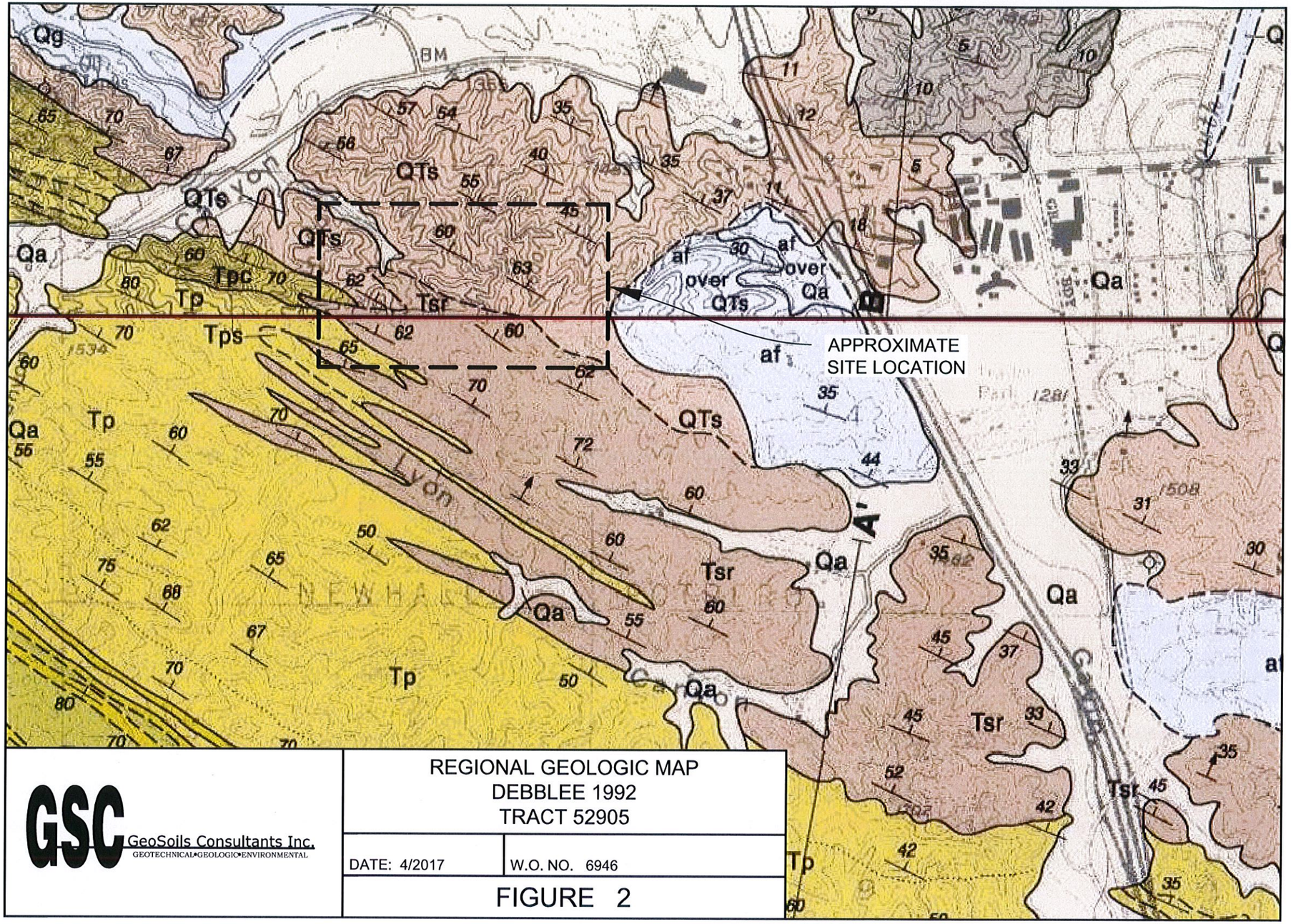
We offer the following general description of materials encountered during our subsurface explorations.

Artificial Fill (af):

The artificial fill on site was observed in two borings (B-1 through B-2) and in only three of the test pits (TP-1 through TP-3). The fill on site had a maximum thickness of approximately 10 feet and is anticipated to span the entire paved dirt access road and the flat component of the site due to past grading activities from the surrounding area. The artificial fill is mainly comprised of dark brown to medium yellow brown, silty fine to medium sand. It is loose and moderately moist. It contains roots, rock fragments and minimal trash. All fill on the site should be removed and if deemed suitable by the geotechnical engineer, re-compacted in areas of proposed development.

Alluvium (Qal):

Alluvium is located within the active drainage areas of Lyons Canyon and its tributaries.



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REGIONAL GEOLOGIC MAP
DEBBLEE 1992
TRACT 52905

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FIGURE 2

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It also underlies the artificial fill on site and was observed in all three borings (B-1 through B-3), as well as all eight test pits (TP-1 through TP-8). The alluvium on site had a maximum thickness of approximately 14 feet. The alluvium consists of medium brown, silty fine sand to silty medium to coarse sand. It contains coarse pebble to cobble sized rock fragments. It is moderately moist and slightly to moderately dense. As such, at depth the alluvial sediments are not suitable for structural support or placement of compacted fill.

Saugus Formation (QTs):

Review of regional geologic maps (Figure 2) indicate bedrock of the Saugus Formation, Sunshine Ranch (member of the Saugus Formation), and possibly Pico Formation at the southern part of the site underline the tract. For the purposes of this report, we have assigned all bedrock to the non-marine Saugus Formation of Pleistocene and Pliocene age. The Saugus Formation generally consists of sandstone and conglomerate with occasional zones of siltstone.

According to the field exploration data, the bedrock underlying the site mainly comprises of light to medium gray, fine grained sandstone to siltstone and conglomerate comprised of a coarse to fine grained sandy matrix with coarse pebble size clasts. The bedrock is non-porous, dense, very hard, and slightly moist to dry.

The enclosed exploration logs in Appendix B provide a detailed description of the soil strata encountered in our subsurface explorations.

4.5 Surface and Subsurface Water Conditions

Surface water on the site is limited to landscape irrigation and natural precipitation falling directly on the site. Springs or seeps were not observed on the site.

At the time of our explorations (January 31, 2017 and February 15, 2017), groundwater was not encountered in any of our borings or test pits. The groundwater maps from the Seismic Hazards Zone Report for the Oat Mountain 7.5 minute quadrangle and the Newhall 7.5 minute quadrangle published by the California Geological Survey indicate that the

historically high groundwater level does not exceed approximately 75 feet below the existing ground surface. Groundwater is not anticipated to be a factor for the proposed development.

4.6 Slope Stability

Slope stability analyses have been performed and the results are presented in Appendix C. Analyses were performed on the highest natural slope and highest proposed cut and fill slopes. Analyses were performed on Sections 2-2' (highest fill slope), 5-5' (highest cut slope), and 9-9' (highest natural slope above areas of proposed development). In addition, rapid drawdown analyses were performed on Section 1-1', which passes through the proposed infiltration/retention basin on Lot 43. Surficial stability analyses are also included in Appendix C.

The results of the analyses indicate factors of safety above minimum code values, with the exception of portions of the steeper natural slopes. Restricted Use Areas are therefore recommended for the natural slopes and are shown on Plate 1. Additional discussion regarding natural slopes is provided in Sections 5.1.2 and 6.4.

4.6.1 Shear Strengths

The shear strengths used throughout our analyses were based on data obtained during our investigation of the site. A total of 4 shear tests were performed for the various on-site materials. In addition, summaries of shear tests were performed and are included in Appendix C.

4.7 Expansion Potential and Sulfate Content of Surficial Site Soils

Due to the variability of surficial soil throughout the site and the extensive grading that will be performed, the final foundation design for the proposed structures should be based on expansion index and sulfate tests performed at the completion of grading. Surficial soil samples for testing should be obtained from various locations within the actual finished building pad and the results will be presented in a final compaction report.

Preliminary testing indicates that on site soils are sandy and have a low expansion index. Chemical tests were performed on samples obtained from Boring B-1 at 15 to 20 feet and B-2 at 20 to 23 feet. The results are presented in Appendix B.

5.0 FAULTING AND SEISMICITY

The project site is not within an Alquist-Priolo Earthquake Fault Zone and there are no active faults on or adjacent to the property. However, this site has experienced earthquake-induced ground shaking in the past and can be expected to experience further shaking in the future.

Earthquake Characterization: Earthquakes are characterized by magnitude, which is a quantitative measure of the earthquake strength, based on strain energy released during a seismic event. The magnitude of an earthquake is constant for any given site and is independent of the site in question.

Earthquake Intensity: The intensity of an earthquake at a random site is not constant and is subject to variations. The intensity is an indirect measurement of ground motion at a particular site and is affected by the earthquake magnitude, the distance between the site and the hypocenter (the location on the fault at depth where the energy is released), and the geologic conditions between the site and the hypocenter. Intensity, which is often measured by the Mercalli scale, generally increases with increasing magnitude and decreases with increasing distance from the hypocenter. Topography may also affect the intensity of an earthquake from one site to another. Topographic effects such as steep sided ridges or slopes may result in a higher intensity than sites located in relatively flat-lying areas.

Seismic Design Criteria

The 2016 CBC (California Building Code) seismic coefficient criteria are provided here for structural design consideration.

Under the Earthquake Design Regulations of Chapter 16, Section 1613 of the CBC 2016, and based on the mapped values, the following coefficients and factors apply to the lateral-force design for the proposed improvements at the site.

2016 CBC Section 1613, Earthquake Loads	
Site Class Definition	D
Mapped Spectral Response Acceleration Parameter, S_s (Table 1613.3.1 for 0.2 second)	3.089
Mapped Spectral Response Acceleration Parameter, S_1 (Table 1613.3.1 for 1.0 second)	0.980
Site Coefficient, F_a (Table 1613.3.3(1) short period)	1.0
Site Coefficient, F_v (Table 1613.3.3(2) 1-second period)	1.5
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter S_{MS} (Eq. 16-37)	3.089
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter S_{M1} (Eq. 16-38)	1.470
Design Spectral Response Acceleration Parameter, S_{DS} (Eq. 16-39)	2.060
Design Spectral Response Acceleration Parameter, S_{D1} (Eq. 16-40)	0.980
Notes: Location: Longitude: -118.57934, Latitude: 34.37667 1. Site Class Designation: Class D is recommended based on subsurface condition. 2. Ss, SMs, and SDs are spectral response accelerations for the period of 0.2 second. 3. S1, SM1, and SD1 are spectral response accelerations for the period of 1.0 second.	

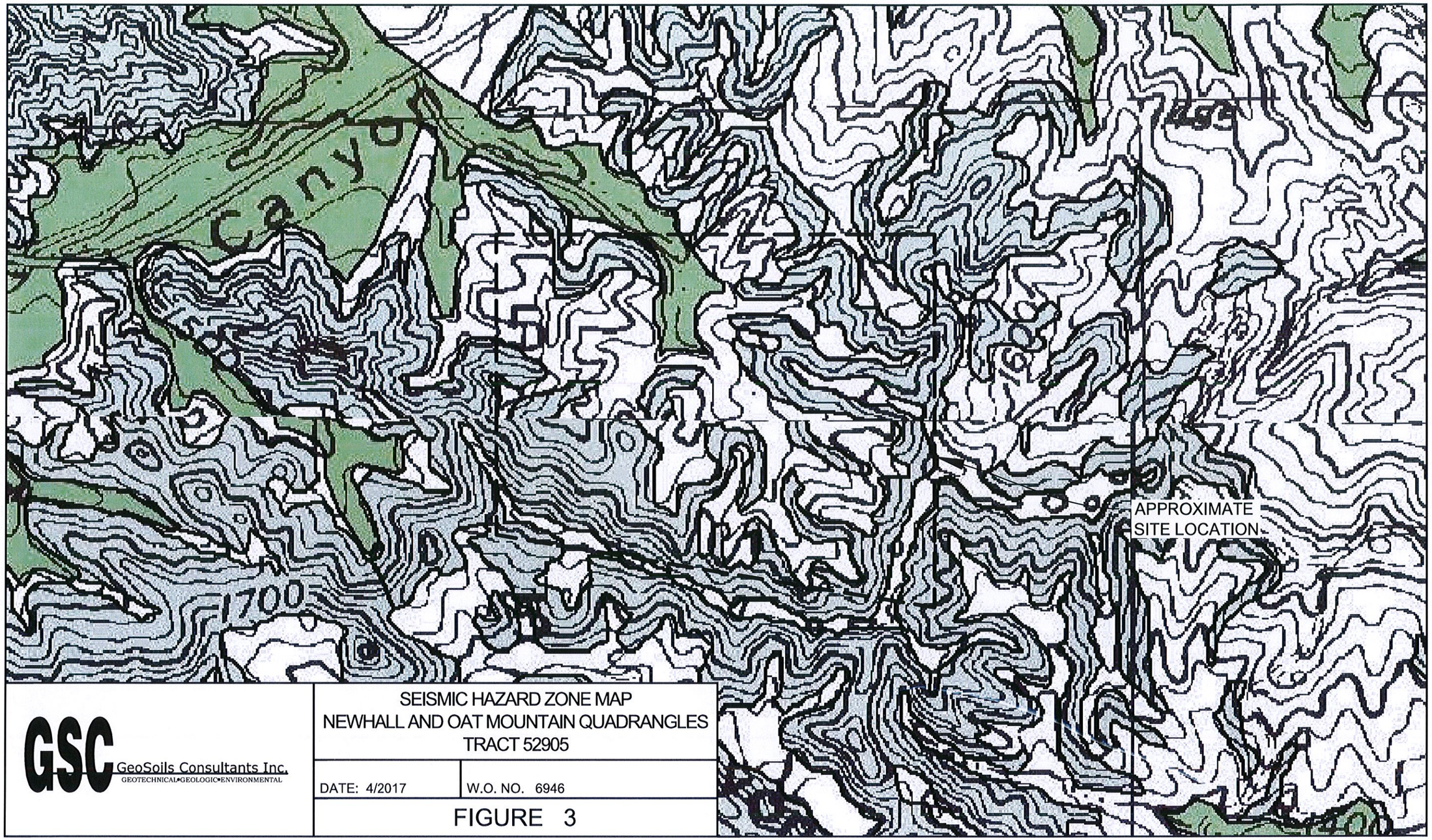
Conformance to the above criteria for seismic excitation does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive. Following a major earthquake, a building may be damaged beyond repair, yet not collapse.

5.1 Secondary Earthquake Effects

Ground shaking produced during an earthquake can result in a number of potentially damaging phenomena classified as secondary earthquake effects. These secondary effects include ground rupture, landslides, seiches and tsunamis, seismically-induced settlement, and liquefaction. Review of the State Seismic Hazard Zone maps for the Newhall and Oat Mountain Quadrangles indicate the canyon bottoms are mostly within zone of potential liquefaction and the slopes are in areas of potential seismic instability (Figure 3). The site is not located within a Fault Hazard Zone. Descriptions of each of these phenomenon and how it could potentially affect the proposed site are described below:

5.1.1 Ground Rupture

Ground rupture occurs when movement on a fault breaks the ground surface and usually occurs along pre-existing fault traces where zones of weakness already exist. The State has established Earthquake Fault Zones for the purpose of mitigating the hazard of fault rupture by prohibiting the location of most human



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SEISMIC HAZARD ZONE MAP
NEWHALL AND OAT MOUNTAIN QUADRANGLES
TRACT 52905

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FIGURE 3

occupancy structures across the traces of active faults. Earthquake fault zones are regulatory zones that encompass surface traces of active faults with a potential for future surface fault rupture. The site is not located within a State established Earthquake Fault Zone and there are no know active faults within the limits of the property; therefore, the ground rupture hazard potential for the site is considered remote.

5.1.2 Landsliding

Earthquake-induced landsliding often occurs in areas where previous landslides have moved and in areas where the topographic, geologic, geotechnical and subsurface groundwater conditions are conducive to permanent ground displacements. The natural slopes on the site are located mostly within zones of potential seismic instability. Slope stability analyses have been performed and the results are included in Appendix C. The results of the analyses indicate that portions of the steeper natural slopes above the site have factors of safety less than the required values. As a result, Restricted Use Areas are recommended for these slopes and are shown on Plate 1.

5.1.3 Seiches and Tsunamis

A seiche is the resonant oscillation of a body of water, typically a lake or swimming pool caused by earthquake shaking (waves). The hazard exists where water can be splashed out of the body of water and impact nearby structures. No bodies of constant water are near the site, therefore, the hazards associated with seiches are considered low.

Tsunamis are seismic sea waves generated by undersea earthquakes or landslides. When the ocean floor is offset or tilted during an earthquake, a set of waves are generated similar to the concentric waves caused by an object dropped in water. Tsunamis can have wavelengths of up to 120 miles and travel as fast as 500 miles per hour across hundreds of miles of deep Ocean. Upon reaching shallow coastal waters, the once two-foot high wave can become up to

50 feet in height causing great devastation to structures within reach. Tsunamis can generate seiches as well. Due to the proximity of the site relative to the ocean, seiches and tsunamis are not considered a hazard to the site.

5.1.4 Seismic Settlement

Seismically-induced settlement in unsaturated (dry) and saturated soils generally occur due to the dissipation of pore pressure.

The potential for seismically-induced settlement is greatest in loose granular soils (i.e., sands, silty sands, sandy silts), whereas cohesive soils (i.e., clays and silts) are generally not prone to settlement. It should be realized that granular soils are susceptible to settlement during a seismic event whether the soils liquefy or not.

All alluvium will be removed and recompacted in areas of proposed grading. The resulting fill will be underlying by shallow bedrock composed of hard sandstone and siltstone. Therefore, seismic settlement is not considered to be a hazard to the site.

5.1.5 Liquefaction

Liquefaction describes a phenomenon where cyclic stresses, which are produced by earthquake-induced ground motions, create excess pore pressures in cohesionless soils. As a result, the soils may acquire a high degree of mobility, which can lead to lateral spreading, consolidation and settlement of loose sediments, ground oscillation, flow failure, loss of bearing strength, ground fissuring, and sand boils, and other damaging deformations. This phenomenon occurs only below the water table, but after liquefaction has developed, it can propagate upward into overlying, non-saturated soil as excess pore water escapes. The canyon areas on the site are located within zones of potential liquefaction; however all alluvium will be removed to firm bedrock and replaced as compacted fill; therefore, the liquefaction hazard is considered to be low.

6.0 CONCLUSIONS AND RECOMMENDATIONS

"111" STATEMENT

Provided that the recommendations in this report are implemented, it is GSC's opinion that the proposed development will be safe from the hazards of landslide, settlement or slippage. Furthermore, the completed development will not adversely affect the stability of the adjacent properties nor be adversely affected by adjacent properties.

The recommendations provided in this report are applicable for development on the proposed lots provided the structures are constructed with roof gutters and downspouts and the yards has positive drainage that is maintained away from structures. Therefore, it is important that information regarding drainage and site maintenance be passed on to future homeowners. Geologic constraints associated with the proposed lots, as well as recommended mitigation, are presented below.

As in most of Southern California, the site lies within a seismically-active area, therefore earthquake resistant structural design is recommended.

The following geotechnical recommendations for site preparation, foundation design, slabs-on-grade, and drainage should be incorporated into final design and construction. All such work and design shall be in conformance with local governmental regulations or the recommendations contained herein, whichever is more restrictive.

6.1 Removals

Based on the results of the subsurface exploration, laboratory testing, and engineering analyses, removals of artificial fill, alluvium and weathered bedrock material will be required in areas of proposed grading. Removals should extend into hard/dense bedrock of the Saugus Formation (QTs). Removals at the toe of fill slopes should extend laterally beyond the toe at a distance equal to the depth of removal.

The laboratory testing results indicate that the Saugus Formation bedrock is suitable for structural support, provided that the loose surficial soils and upper section of the weathered

bedrock are removed. Recommendations for processing, subgrade preparation, fill placement, and grading are presented in the *Grading* section of this report (6.8).

6.2 Cut Slopes

All cut slopes should be planned at a gradient of 2:1 or less and slope stability analyses indicate factors of safety above minimum requirements. Bedrock materials should perform well at this gradient where geologic structure is favorable. Stabilization of cut slopes may be required during grading if adverse geologic structure is exposed; however, bedding on the site is poorly defined and steeply dipping; therefore, the potential for cut slope instability is low.

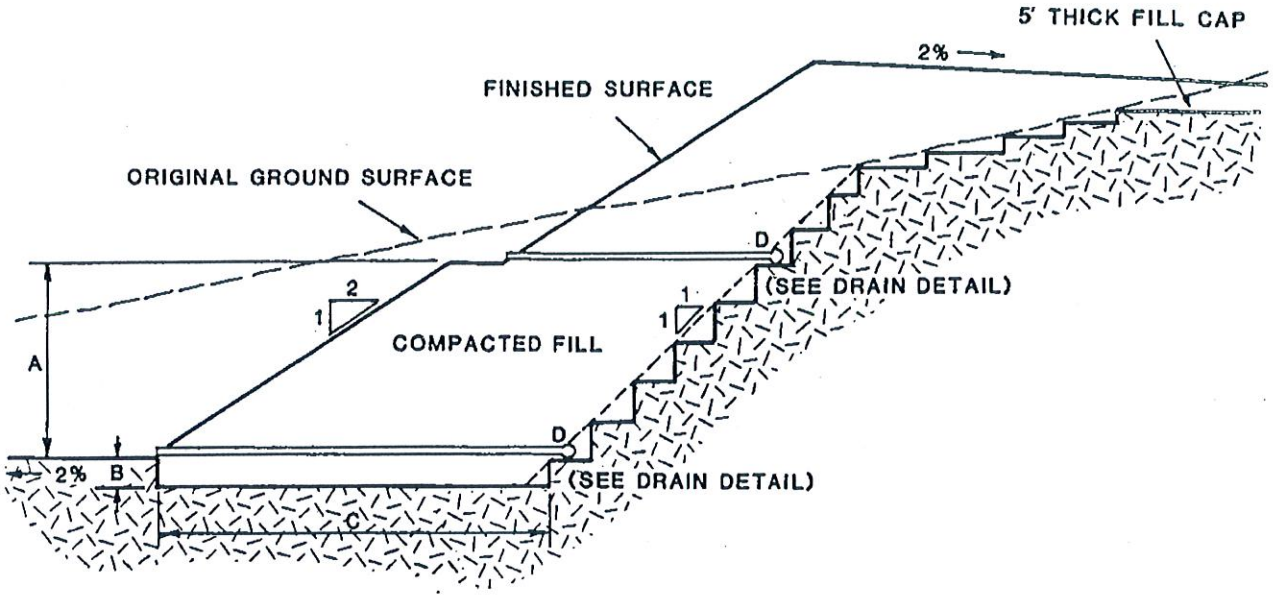
During grading, detailed mapping will be performed on all cut slopes. If conditions differ from those anticipated, or if weak bedding planes are exposed, additional recommendations will be provided. Adequate area exists on the site to stabilize or buttress any slope with adverse geology. Details for stabilization and buttress fills are presented on the *Typical Buttress Section Design* figure (Figure 4) and *Typical Stabilization Fill Design* (Figure 5).

6.3 Fill Slopes

Fill slopes should be constructed at slope ratios of 2:1 (Horizontal: Vertical) between benches or flatter. Slope stability analyses were performed on Section 2-2' and the results indicate factors of safety above minimum requirements. Surficial stability analyses are included in Appendix C. Confirmatory shear testing shall be performed during grading to ensure fill slopes are constructed with material that meets the shear test result used in the slope stability analyses. The results of the testing shall be submitted in monthly progress reports.

The infiltration/retention basin on Lot 43 shall be constructed with fill slopes at a gradient of 3:1 up to the high water level. Rapid drawdown analyses indicate factors of safety above minimum requirements at these gradients (Appendix C).

To maintain safety factors for surficial stability, intermediate drainage terraces are recommended for all fill slopes steeper than 5:1 with slope height greater than 30 feet. Fill



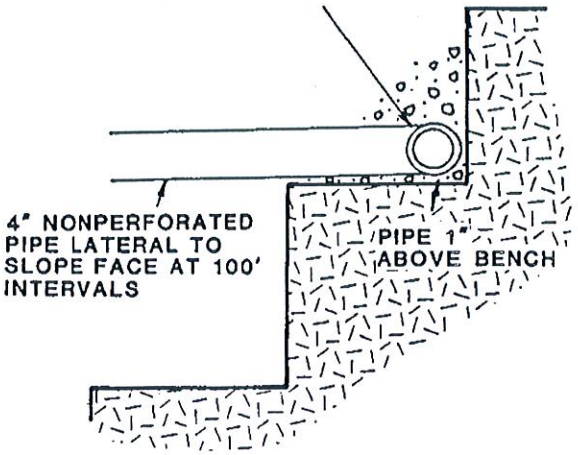
A. BUTTRESS SLOPE TO HAVE A BENCH AT LEAST EVERY 25' IN ELEVATION

B. BUTTRESS KEY DEPTH VARIES, SEE REPORT

C. BUTTRESS KEY WIDTH VARIES, SEE REPORT

D. BACKDRAINS & LATERAL DRAINS LOCATED AT ELEVATION OF EVERY BENCH DRAIN. FIRST DRAIN AT ELEVATION JUST ABOVE LOWER LOT GRADE. ADDITIONAL DRAINS MAY BE REQUIRED AT DISCRETION OF GEOSOILS, INC. (SEE DRAIN DETAIL)

4" PERFORATED PIPE (SCHEDULE 40 OR SDR 35 P.V.C.) OR EQUIVALENT PLACED IN 1 CUBIC FOOT PER LINEAR FOOT OF GRADED FILTER MATERIAL*. PIPE TO EXTEND FULL LENGTH OF BUTTRESS.



* GRADED FILTER MATERIAL TO CONFORM TO STATE OF CALIFORNIA DEPT. OF PUBLIC WORKS STANDARD SPECIFICATIONS FOR CLASS 2 PERMEABLE MATERIAL

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TYPICAL BUTTRESS SECTION DESIGN

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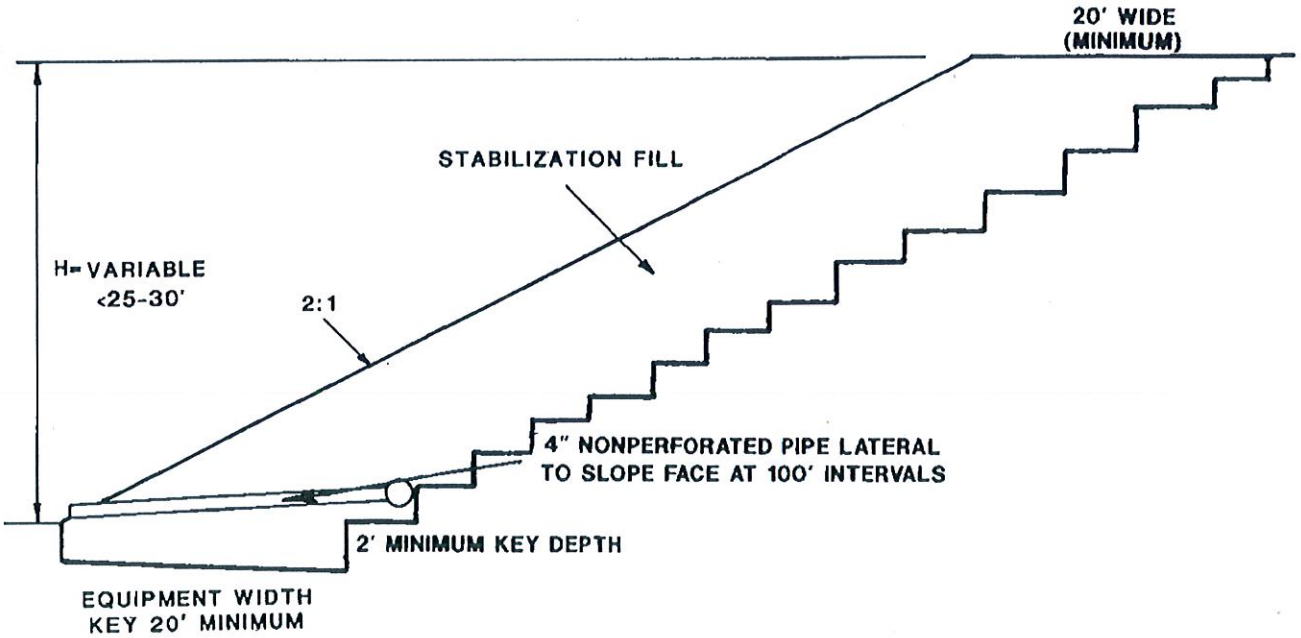
FIGURE 4



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TYPICAL STABILIZATION FILL DESIGN

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FIGURE 5

FORM 87/6-8

slopes should be built in accordance with recommendations included herein. Fill over cut slopes should be constructed in accordance with the *Typical Fill Over Cut Slope Design* detail (Figure 6) and fill over natural slopes should be in accordance with the *Typical Fill Over Natural Slope Design* detail (Figure 7).

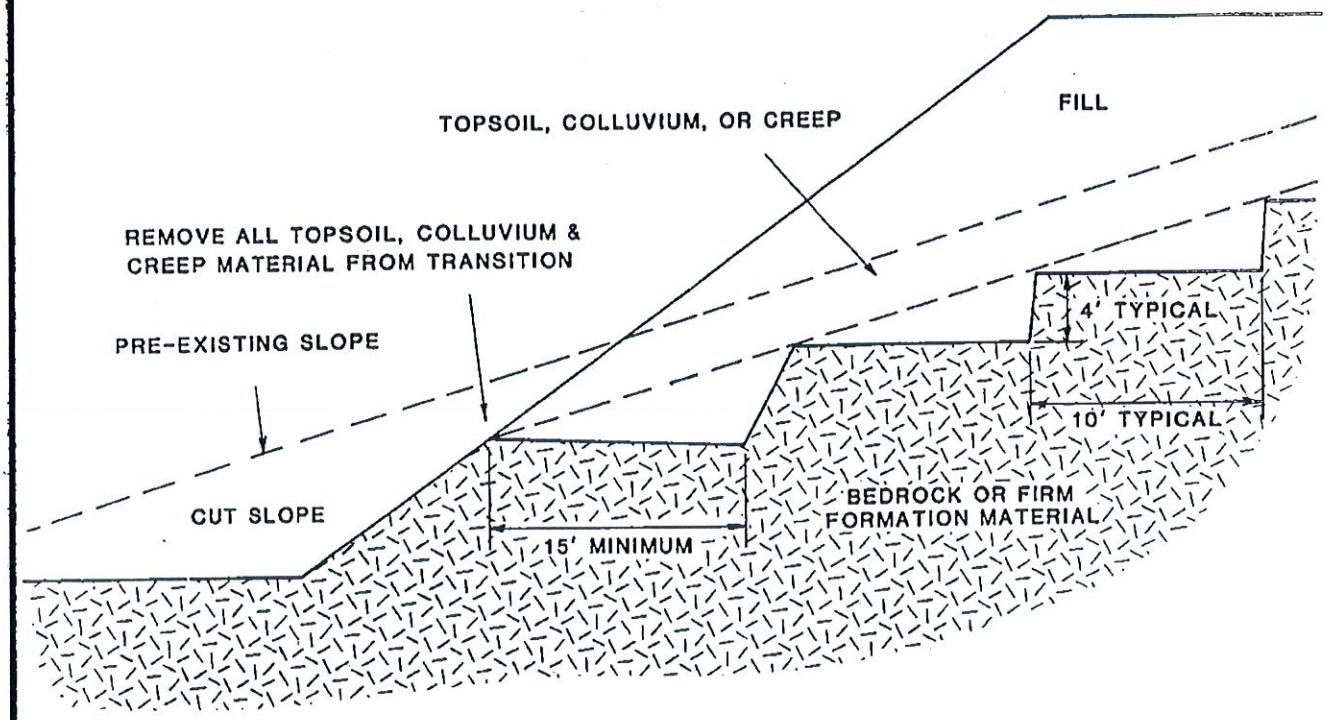
Fill slopes to the maximum height proposed are considered to be stable based on the shear strengths for fill material and the 2:1 gradients proposed. Additional remolded shear testing may be required to verify proposed fill material meets the minimum criteria.

6.4 Natural Slopes

Natural slopes ascend above the western, southern, and eastern portions of the tract. The steepest natural slopes are located above Lots 9 and 10. Slope stability analyses were performed on Cross-Section 9-9'. Portions of the natural slopes have factors of safety slightly below 1.5; therefore, the natural slopes above the development shall be located within Restricted Use Areas as shown on Plate 1. As shown on Section 8-8', a natural drainage swale will remain between the top of the proposed cut slope and the toe of the natural slope. This swale is approximately 10 to 20 lower than the top of the proposed cut slope.

With the exception of a portion of natural slope above Lot 19, no other natural slopes descend directly onto building pads. Due to the configuration of the natural slopes, the toes of the slope are all located within designated desilting basins. The slope above Lot 19 is at a gradient of approximately 3:1 or flatter, and is considered surficially stable.

The project civil engineer had determined design volumes for the basins and all basins are designed to exceed the minimum requirements. The basins will be provided with large-diameter pipes to transport water and minor debris to the main basin on Lot 43 at the northern part of the site.



TYPICAL FILL OVER CUT SLOPE DESIGN

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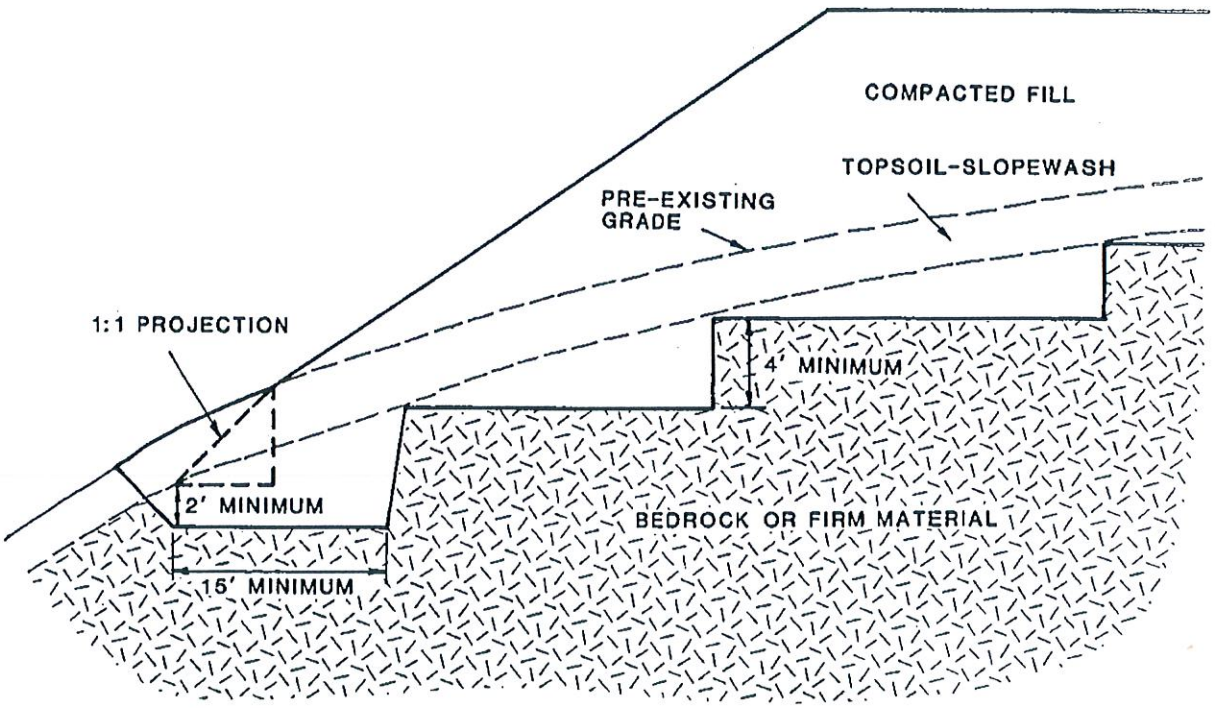
FIGURE 6

FORM 87/6-4



TYPICAL FILL OVER NATURAL SLOPE DESIGN

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FIGURE 7

FORM 87/6-3

6.5 Subdrains

Subdrain systems should be provided in all canyon bottoms, stabilization fills, and shear keys prior to fill placement, (see Figure 8), *Canyon Subdrain Design and Construction Methods*).

Filter material should be Class 2 permeable filter, or No. 2 and No. 3 concrete aggregate gradations per standard specifications for Public Works Construction, or approved equivalent, inspected and tested to verify its suitability. The filter should be clean with a wide range of sizes.

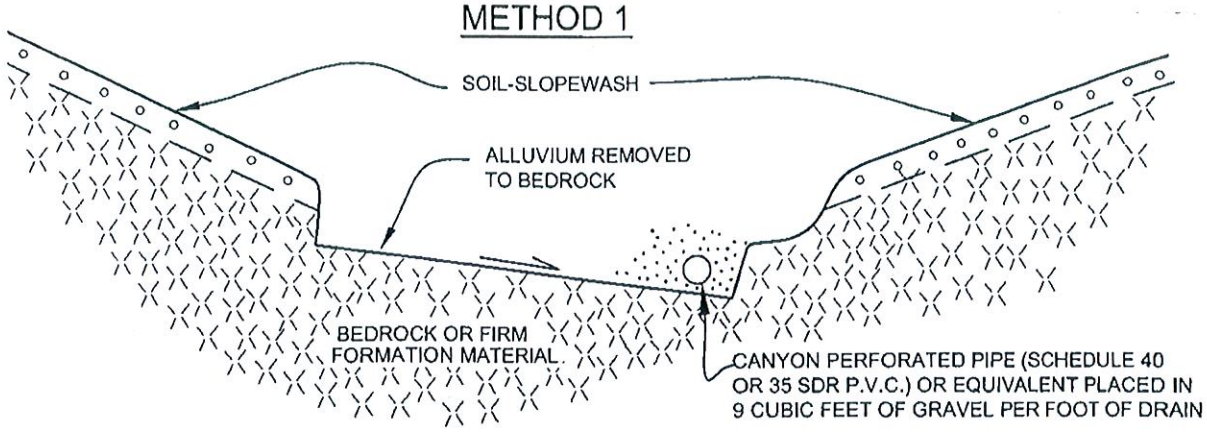
Subdrain pipe should consist of Schedule 40 or equivalent and should be a minimum of 6 inches in diameter for lengths up to 500 feet. For lengths over 500, 8-inch diameter pipe should be used and for lengths over 1,000 feet, and two, 8-inch pipes should be used.

During grading, the Engineering Geologist should evaluate the necessity of placing additional subdrains. The Engineering Geologist and Geotechnical Engineer should inspect all subdrain systems prior to cover with compacted fill.

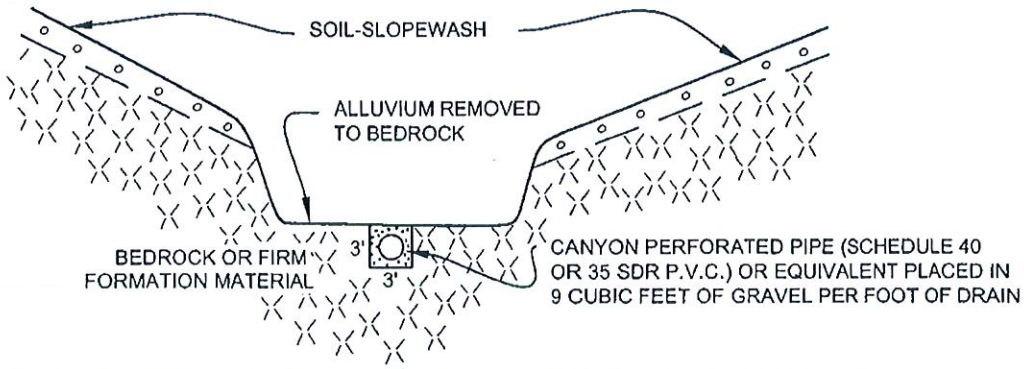
6.6 Lot Fill Caps

All cut and transition lots on the site should be over-excavated a minimum of five feet and provided with a compacted fill blanket. The project surveyors should verify the fill cap. The purpose of the cap is to provide a uniform bearing material for foundation support and to mitigate potential differential expansion. Deeper fill caps may be recommended if higher expansive materials are exposed. In addition, deeper fill caps may be recommended to mitigation large differential fill thicknesses across lots. The final fill cap thicknesses will be determined during the 40-scale review stage and confirmed grading. Recommendations for processing, subgrade preparation, fill placement, and grading are presented in the *Grading* section of this report.

METHOD 1

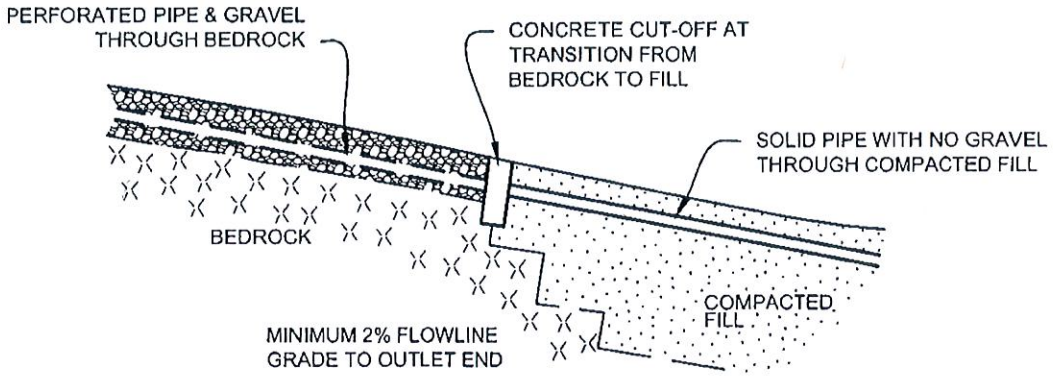


METHOD 2



GRAVEL TO CONFORM TO STATE OF CALIFORNIA DEPT. OF PUBLIC WORKS STANDARD SPECIFICATIONS FOR CLASS 2 PERMEABLE MATERIAL AS ALTERNATE 3/4" GRAVEL MAY BE USED SURROUNDED WITH GEOTEXTILE FILTER FABRIC APPROVED BY THE GEOTECHNICAL ENGINEER.
(NOTE: CITY OF LOS ANGELES DOES NOT ALLOW GEOTEXTILE FABRIS WRAP AROUND SUBDRAIN SYSTEMS.)

LONGITUDINAL SECTION



GSC GeoSoils Consultants Inc.
GEOTECHNICAL•GEOLOGIC•ENVIRONMENTAL

CANYON SUBDRAIN DESIGN & CONSTRUCTION METHODS

DATE 4/2017 | W.O. NO. 6946

Geotechnical•Geologic•Environmental FIGURE 8

FORM 87/7-1

6.7 Rock Hardness

The results of the exploratory borings and test pits indicate that the bedrock material is rippable with heavy duty grading equipment. Deeper cuts within the bedrock material may encounter hard bedrock that may be difficult to rip. The grading contractor should consider performing additional studies on the deeper cut areas to verify rippability, as hard rock layer may exist. GeoSoils Consultants, Inc. is not responsible for variations in rock hardness during grading.

6.8 Grading

Grading of the site will consist of a cut/fill operation to create level building sites and associated streets and parks. The grading will consist of a balanced cut and fill. The main cut areas are located at the northern part of the tract. The major fill is located in the central and southern areas. The grading will involve the removal and recompaction of artificial fill, alluvium and weathered bedrock material, in addition to the mass-excavation. Site grading will create cut and fill slopes to a maximum height on the order of 82 and 50 feet, respectively. We offer the following recommendations and construction considerations concerning earthwork grading at the site.

6.8.1 General

Monitoring: We recommend that all earthwork (i.e., clearing, site preparation, fill placement, etc.) should be conducted with engineering control under observation and testing by the Geotechnical Engineer and in accordance with the requirements within the *Grading* section of this report.

Job Site Safety: At all times, safety should have precedence over production work. If an unsafe job condition is observed, it should be brought to the attention of the grading contractor or the developer's representative. Once this condition is noted, it should be corrected as soon as possible, or work related to the unsafe condition should be terminated.

The contractor for the project should realize that services provided by GSC do not include supervision or direction of the actual work performed by the contractor, his

employees, or agents. GSC will use accepted geotechnical engineering and testing procedures; however, our testing and observations will not relieve the contractor of his primary responsibility to produce a completed project conforming to the project plans and specifications. Furthermore, our firm will not be responsible for job or site safety on this project, as this is the responsibility of the contractor.

6.8.2 Site Preparation

Existing Structure Location: The General Contractor should locate all surface and subsurface structures on the site or on the approved grading plan prior to preparing the ground surface.

Existing Structure Removal: Any underground structures (e.g., septic tanks, wells, pipelines, foundations, utilities, etc.) that have not been located prior to grading, should be removed or treated in a manner recommended by the Geotechnical Engineer.

Clearing and Stripping: The construction areas should be cleared and stripped of all vegetation, trees, bushes, sod, topsoil, artificial fill, debris, asphalt, concrete and other deleterious material prior to fill placement.

Lot Fill Caps: Please refer to the *Lot Fill Caps* section of this report for specific recommendations for fill caps.

Removals: Please refer to the *Removals* section of this report for specific recommendations for removals.

Subgrade Preparation: We recommend that the subgrade for foundations, pavement areas, over-excavations, and for those areas receiving any additional fill be prepared by scarifying the upper 12 inches and moisture conditioning, as required to obtain at least optimum moisture, but not greater than 120 percent of optimum. The scarified areas shall be compacted to at least 90 percent of the maximum laboratory density, as determined by ASTM D-1557-12 compaction method. All areas to receive fill should be observed by the Geotechnical Engineer prior to fill placement.

Subgrade Inspection: Prior to placing fill, the ground surface to receive fill should be observed, tested, and approved by the Geotechnical Engineer.

6.8.3 Fill Placement

Laboratory Testing: Representative samples of materials to be utilized as compacted fill should be analyzed in a laboratory to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material should be conducted.

On-Site Fill Material: The on-site soils, in our opinion, are adequate for re-use in controlled fills provided the soils do not contain any organic matter, debris, or any individual particles greater than six inches in diameter.

Import Fill Material: All imported fill shall not contain any organic matter, debris, nor any individual particles greater than six inches in diameter. The imported fill shall consist of a granular material with a non-expansive or a low expansive potential (plasticity index less than 15 percent). All imported fill materials shall be approved by the Geotechnical Engineer prior to use in controlled areas.

Rock Fragments: Rock fragments less than six inches in diameter may be utilized in the fill, provided they are not placed in concentrated pockets, surrounded with fine grained material, and the distribution of the rocks is supervised by the Geotechnical Engineer. Rocks greater than six inches in diameter should be taken off-site, placed in fill areas designated as suitable for rock disposal, or placed in accordance with the recommendations of the Geotechnical Engineer.

Subgrade Verification and Compaction Testing: Regardless of material or location, all fill material should be placed over properly compacted subgrades in accordance with the *Site Preparation* section of this report. The condition of all subgrades shall be verified by the Geotechnical Engineer before fill placement or earthwork grading begins. Earthwork monitoring and field density testing shall be performed during grading to provide a basis for opinions concerning the degree of soil compaction attained.

Fill Placement: Approved on-site or imported fill material shall be evenly placed, watered, processed, and compacted in controlled horizontal layers not exceeding eight inches in loose thickness, and each layer should be thoroughly compacted with approved equipment. All fill material should be moisture conditioned, as required to obtain at least optimum moisture, but not greater than 120 percent of optimum moisture content. The fill should be placed and compacted in horizontal layers, unless otherwise recommended by the Geotechnical Engineer.

Compaction Criteria - Shallow Fills: For fills less than 40 feet in vertical thickness, each layer shall be compacted to at least 90 percent of the maximum laboratory density for material used as determined by ASTM D-1557-12. The field density shall be determined by the ASTM D-1556-07 method or equivalent. Where moisture content of the fill or density testing yields compaction results less than 90 percent, additional compaction effort and/or moisture conditioning, as necessary, shall be performed, until the fill material is in accordance with the requirements of the Geotechnical Engineer.

Compaction Criteria - Deep Fills: For all fills greater than 40 feet in vertical thickness, the portion of the fill below a depth of 40 feet should be placed at a minimum relative compaction of at least 95 percent. Where moisture content of the fill or density testing yields compaction results less than 95 percent, additional compaction effort and/or moisture conditioning, as necessary, shall be performed, until the fill material is in accordance with the requirements of the Geotechnical Engineer.

Fill Material - Moisture Content: All fill material placed must be moisture conditioned, as required to obtain at least optimum moisture, but not greater than 120 percent. If excessive moisture in the fill results in failing results or an unacceptable "pumping" condition, then the fill should be allowed to dry until the moisture content is within the necessary range to meet the required compaction requirements or reworked until acceptable conditions are obtained.

Keying and Benching: All fills should be keyed and benched through all topsoil, slopewash, alluvium or creep material, into sound bedrock or firm material where the

slope receiving fill is steeper than 5:1 (Horizontal:Vertical) or as determined by Geotechnical Engineer. The standard acceptable bench height is four feet into suitable material. The key for side hill fills should be a minimum of 15 feet within bedrock or firm materials, with a minimum toe embedment of 2 feet into bedrock, unless otherwise specified by the Geotechnical Engineer. The recommended design is shown on the *Typical Fill Over Natural Slope Design* plan (Figure 7).

Drainage Devices: Drainage terraces and subdrain devices should be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendations of the Geotechnical Engineer and Engineering Geologist.

Slope Face - Compaction Criteria: The Contractor should be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses and stabilization fills. This may be achieved by either overbuilding the slope a minimum of five feet, or cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction. If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor should rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Geotechnical Engineer. Slope testing will include testing the outer six inches to three feet of the slopeface during and after placement of the fill. In addition, during grading, density tests will be taken periodically on the flat surface of the fill three to five feet horizontally from the face of the slope.

Cut-Fill Transition: Where a cut-fill transition is present beneath planned structures, the cut area should be over-excavated three feet below the bottom of proposed footings and the excavated material should be replaced as compacted fill to reduce the transition condition. These guidelines should also be followed in areas where lots are underlain by soils or rock with differential expansion potential and also for lots located above descending buttress and stabilization fills. In addition, where the sloped natural contact between the bedrock and the fill is steep, the upper portion of the natural slope may

need to be laid back to further soften transition condition, or the fill cap thickness increased.

Slope Face - Contractor's Responsibility: The Contractor should prepare a written detailed description of the method or methods he would employ to obtain the required slope compaction. Such documents should be submitted to the Geotechnical Engineer for review and comments prior to the start of grading.

Slope Face - Vegetation: All fill slopes should be planted or protected from erosion by methods specified in the geotechnical report, or required by the controlling governmental agency.

6.8.4 Grading Control

Grading Inspection: Earthwork monitoring and field density testing shall be performed by the Geotechnical Engineer during grading to provide a basis for opinions concerning the degree of soil compaction attained. The Contractor should receive a copy of the Geotechnical Engineer's *Daily Field Engineering Report* which will indicate the results of field density tests for that day. Where failing tests occur or other field problems arise, the Contractor shall be notified of such conditions by written communication from the Geotechnical Engineer in the form of a conference memorandum, to avoid any misunderstanding arising from oral communication.

Subgrade Inspection: All processed ground to receive fill and over-excavations should be inspected and approved by the Geotechnical Engineer prior to placing any fill. The Contractor should be responsible for notifying the Geotechnical Engineer when such areas are ready for inspection. Inspection of the subgrade may also be required by the controlling governmental agency within the respective jurisdictions.

Subgrade Testing: Density tests should also be made on the prepared subgrade to receive fill, as required by the Geotechnical Engineer.

Density Testing Intervals: In general, density tests should be conducted at minimum intervals of 2 feet of fill height or every 500 cubic yards. Due to the variability that can

occur in fill placement and different fill material characteristics, a higher number of density tests may be warranted to verify that the required compaction is being achieved.

6.8.5 Cut Slopes

Observation: The Engineering Geologist should observe all cut slopes. Additional recommendations may be provided at the 40-scale grading plan review stage.

Change of Conditions: If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or faults planes, or areas of unstable material are encountered during grading, these conditions should be analyzed by the Engineering Geologist and Geotechnical Engineer; and recommendations should be made to treat these problems.

Protection: Cut slopes that face in the same direction as the prevailing drainage should be protected from slopewash by a non-erosive interceptor swale placed at the top of the slope.

Criteria: Unless otherwise specified in the geotechnical and geological report, no cut slopes should be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

Drainage Devices: Drainage terraces should be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Geotechnical Engineer or Engineering Geologist.

6.8.6 Utility Trenching and Backfill

Utility Trenching: Open excavations and excavations that are shored shall conform to all applicable Federal, State and local regulations.

Backfill Placement: Approved on-site or imported fill material shall be evenly placed, watered, processed, and compacted in controlled horizontal layers not exceeding eight inches in loose thickness, and each layer should be thoroughly compacted with

approved equipment. All fill material should be moisture conditioned, as required to obtain at least optimum moisture, but not greater than 120 percent of optimum moisture content. The fill should be placed and compacted on a horizontal plane, unless otherwise recommended by the Geotechnical Engineer.

Backfill Compaction Criteria: Each layer of utility trench backfill shall be compacted to at least 90 percent of the maximum laboratory density determined by ASTM D-1557-12. The field density shall be determined by the ASTM D-1556-07 method or equivalent. Where moisture content of the fill or density testing yields compaction results less than 90 percent, additional compaction effort and/or moisture conditioning, as necessary, shall be performed, until the compaction criteria is reached.

Exterior Trenches Adjacent to Footings: Exterior trenches, paralleling a footing and extending below a 1H: 1V plane projected from the outside bottom edge of the footing should be compacted to 90 percent of the laboratory standard. Sand backfill, unless it is similar to the in-place fill, should not be allowed in these trench backfill areas. Density testing, along with probing, should be accomplished to verify the desired results.

Pipe Bedding: We recommend that a minimum of 6 inches of bedding material should be placed in the bottom of the utility trench. All bedding materials shall extend at least 4 inches above the bottom of utilities which require protection during subsequent trench backfilling. All trenches shall be wide enough to allow for compaction around the haunches of the pipe or materials, such as pea gravel, or controlled density fill (CDF) shall be used below the spring line of the pipes to eliminate the need for mechanical compaction in this portion of the trenches.

Groundwater Migration: Backfilled utility trenches may act as French drains to some extent, and considerable groundwater flow along utility bedding and backfill should be expected. Wherever buried utilities, or structures which they may intersect, could be adversely affected by such drainage, provisions shall be made to collect groundwater migrating along the trench lines. These situations include where buried utilities enter buildings, particularly where they enter below grade mechanical rooms, and where

buried utilities enter junction boxes or switching stations that are intended to remain dry. Mitigation measures include, but are not limited to, placement of perforated drain pipes below and continuous with bedding materials, and placement of seepage barriers such as lean mix concrete or controlled density fill (CDF).

6.8.7 Construction Considerations

Erosion Control: Erosion control measures, when necessary, should be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

Compaction Equipment: It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the project site to handle the amount of fill being placed and the type of fill material to be compacted. If necessary, excavation equipment should be shut down to permit completion of compaction in accordance with the recommendations contained herein. Sufficient watering devices/equipment should also be provided by the Contractor to achieve optimum moisture content in the fill material.

Final Grading Considerations: Care should be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

6.9 Foundation Design Recommendations

In order to minimize the potential effects of seismic activity, expansive soils, and/or hydroconsolidation, we recommend either a post-tensioned slab foundation and/or mat foundation system be utilized for the proposed structures. Conventional foundation system consisting of spread footings and slab-on-grade floors are also provided as an alternative. We offer the following recommendations and comments for post-tension slab foundation, mat foundation, conventional spread footings, and conventional slab-on-grade floors.

6.9.1 Post-Tension Slab Foundation

These post-tensioned slabs should be designed in accordance with the recommendations of either the California Foundation Slab Method or Post-Tensioning Institute. Based on review of laboratory data for the on-site materials, the average soil modulus of subgrade reaction, K, to be used for design is 100 pounds per cubic inch. Specific recommendations for the design of California Foundation Slab and Post Tension Institute methods are presented below. A surface bearing value of 1,000 pounds per square foot can also be used in design.

1. **California Foundation Slab (Spanability) Method**

It is recommended that slabs be designed for a free span of 15 feet regardless of the expansion index of the soil. From a soil expansion/shrinkage standpoint, a common contributing factor to distress of structures using post-tensioned slabs is fluctuation of moisture in soils underlying the perimeter of the slab, compared to the center, causing a "dishing" or "arching" of the slabs. To mitigate this possibility, a combination of soil presaturation and construction of a perimeter "cut off" wall should be employed.

All slab foundation areas should be moisture conditioned to at least optimum moisture, but no more than 5 percent above optimum moisture for a depth of at least 12 inches below subgrade low EI soil, 18 inches for medium EI soil, and 24 inches for high EI soil. A continuous perimeter curtain wall should extend to a depth of at least 12 inches below exterior grade for low EI soil, 18 inches for medium EI soil, and 24 inches for high EI soil to preserve this moisture. The cut-off walls may be integrated into the slab design or independent of the slab and should be a minimum of 6 (six) inches wide.

2. **Post-Tensioning Institute Method**

Post-tensioned slabs should have sufficient stiffness to resist excessive bending due to non-uniform swell and shrinkage of subgrade soils. The differential movement can

occur at the corner, edge, or center of slab. The potential for differential uplift can be evaluated using design specifications of the Post-Tensioning Institute. The following table presents suggested minimum coefficients to be used in the Post-Tensioning Institute design method.

Suggested Coefficients	
Thornthwaite Moisture Index	-20 in/yr
Thornthwaite Moisture Index	9 (feet)
Constant Soil Suction: (pf)	3.8

The coefficients are considered minimums and may not be adequate to represent worst case conditions such as adverse drainage, excess watering, and/or improper landscaping and maintenance. The above parameters are applicable provided structures have gutters and downspouts, yard drains, and positive drainage is maintained away from structure perimeters. Also, the values may not be adequate if the soils below the foundation become saturated or dry such that shrinkage occurs. The parameters are provided with the expectation that subgrade soils below the foundations are maintained in a relatively uniform moisture condition. Responsible irrigation of landscaping adjacent to the foundation must be practiced since over-irrigation of landscaping can cause problems. Therefore, it is important that information regarding drainage, site maintenance, settlements and affects of expansive soils be passed on to future homeowners.

Based on the above parameters, the following values were obtained from the Post Tensioning Institute Design manual. If a stiffer slab is desired, higher values of ym may be warranted.

Expansion Index of Soil Subgrade	Low EI	Medium EI	High EI
em center lift	9.0 feet	8.5 feet	6.5 feet
em edge lift	4.7 feet	4.5 feet	3.5 feet
Ym center lift	0.34 inch	0.56 inch	0.58 inch
Ym edge lift	0.48 inch	0.77 inch	1.23 inch

Deepened footings/edges around the slab perimeter must be used as indicated above to minimize non-uniform surface moisture migration (from an outside source) beneath the slab. An edge depth of at least 12 inches should be considered for low EI soil, 18 inches for medium EI soil, and 24 inches for high EI soil. The bottom of the deepened footing/edge should be designed to resist tension, using cable or reinforcement per the Structural Engineer. Other applicable recommendations in the referenced reports should be adhered to during the design and construction phase of the project.

3. Mat Foundation

Mat foundation could either be designed as a beam on an elastic foundation or using the method of static equilibrium. The static equilibrium method assumes the mat moves as a rigid body when the loads are applied and that the reaction pressures are distributed linearly across the bottom of the mat. For mat foundation, the criteria under post-tensioned slab may be used for design.

The aforementioned parameters are applicable provided that the recommendations in the *Drainage* section of this report are followed.

6.9.2 Conventional Spread Footings

We offer the following alternate foundation recommendations and comments for purposes of footing design and construction.

Bearing Subgrades: All footings should be constructed on firm, unyielding compacted fill. All compacted fill should be compacted to at least 90 percent of the Modified Proctor maximum laboratory density, as determined by ASTM D-1557-12 compaction method.

Subgrade Preparation: Pre-moistening of all areas to receive concrete is recommended. The moisture content of the subgrade soils should be equal to or greater than optimum moisture, and verified by the Geotechnical Engineer to a maximum depth of 18 inches below adjacent grade in the footing areas within 48

hours of concrete placement. Footings subgrades shall be prepared in accordance with the *Grading* section of this report.

Subgrade Verification: All footing subgrades should consist of firm, unyielding compacted fill. Under no circumstances should footings be cast atop loose, soft, or slough, debris, existing artificial fill, unprocessed alluvium, or surfaces covered by standing water. We recommend that the condition of all subgrades be verified by the Geotechnical Engineer before any concrete is placed.

Footing Depth and Width: Footings should be continuous and be founded at a minimum depth of 12 inches and 18 inches below the lowest adjacent ground surface for one- and two-story structures, respectively, and should have a minimum width of 15 inches. Footings should be reinforced according to structural design.

Bearing Pressures: The allowable bearing capacity values shown in Table 7 include dead and live loads and may be used for design of footings and foundations. All foundations should be founded in firm, unyielding certified compacted fill and should be reinforced according to structural design. The bearing values may be increased by one-third when considering short duration loading conditions, such as seismic or wind loads.

TABLE 7
BEARING CAPACITY VALUES

Bearing Subgrade	Minimum Embedment Depth (inches)	Allowable Bearing Capacity (psf)	Bearing Capacity Increase per Foot Deeper (%)	Bearing Capacity Increase per Foot Wider (%)	Maximum Allowable Bearing Capacity (psf)
Compacted Fill	12	1,500	20	10	3,000

Lateral Capacity: To resist lateral loads, the allowable passive earth pressures shown in Table 8, expressed as an equivalent fluid pressure, may be used on that portion of shallow foundations which have a minimum embedment as previously recommended. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

TABLE 8 LATERAL BEARING PRESSURE VALUES			
Soil Type	Allowable Passive Pressure(pcf)	Maximum Allowable Passive Pressure(psf)	Coefficient of Friction (Concrete/Soil)
Compacted Fill	250	2,500	0.4

6.10.3 Conventional Slab-On-Grade Floor

We offer the following alternate floor slab recommendations and comments for purposes of slab-on-grade floor design and construction:

Reinforcement: Concrete slabs should be reinforced with at least No. 4 rebar at 16 inches on-center in both directions. All slab reinforcement should be properly positioned at mid-height in the slab during placement of concrete.

Thickness: The design engineer should determine the actual thickness of the slabs based on proposed loadings and use. However, minimum slab thickness of four inches is recommended.

Moisture Barrier: Concrete slabs should be underlain with a minimum 6 mil polyvinyl chloride membrane vapor barrier with a minimum overlap of 12 inches in all directions. This membrane should be sandwiched between two, two-inch layers of sand.

Slab Sectioning: To minimize transgression of shrinkage cracks, slabs must not exceed 20-foot sections. Sectioning can be performed by expansion joints, plastic joints, saw cutting, or proper tooling during concrete placement. It is suggested that slabs not be tied structurally to heavily loaded walls or columns, until most of the dead loads are in place to permit minor differential settlement.

Subgrade Preparation: All areas to receive concrete should be presaturated to a depth of 18 inches, such that the soil within this zone is approximately at optimum moisture to not more than 5 percent above optimum moisture content. The Geotechnical Engineer should verify all subgrades that are pre-soaked within 24 hours of concrete placement.

6.9.4 Settlement

Assuming the foundation elements are founded in the recommended bearing soils, we estimate that total static settlement will not exceed ¾ inch, with differential settlements on the order of one-half the total settlement. The majority of the settlement will most likely occur during the initial loading of the foundation; however, if any disturbed, loose, yielding, or soft soils are left within the footing area prior to concrete placement, settlements greater than predicted herein may be realized.

Additional foundation settlement can also occur due to leakage from any appurtenant plumbing; therefore, it is imperative that all underground plumbing fixtures be *absolutely* leak-free.

Once foundation plans, are available which include loading details of total dead and real live loads, they should be reviewed by the Geotechnical Engineer to ensure that total and/or differential settlements are within tolerable limits.

6.10 Backfilled Retaining Walls

Footing Depths: The retaining walls should have a minimum embedment depth of 18 inches and a minimum width of 15 inches.

Foundation Subgrade: All retaining wall foundation subgrades should consist of firm, unyielding certified fill material or competent bedrock. Under no circumstances should footings be cast atop loose or soft soil, slough, debris, existing uncontrolled fill, or surfaces covered by standing water. We recommend that the condition of all subgrades be verified by the Geotechnical Engineer prior to concrete placement.

Wall Drainage: To preclude the build-up of hydrostatic pressure, we recommend that a four-inch-diameter perforated drain pipe be installed behind the heel of the wall and that a curtain drain be placed behind the entire wall. This curtain drain should consist of pea gravel, washed rock, or a mixture of these materials wrapped in approved filter material, extending outward at least one foot from the wall and extending from the footing drain

upward to within about three feet of the ground surface. The enclosed *Retaining Wall Backfill and Subdrain Detail* (Figure 9) illustrates the recommended drainage detail behind backfilled retaining walls. In areas where the foundation is founded in undisturbed bedrock, a subdrain should be provided. The backside of all subterranean walls should be waterproofed.

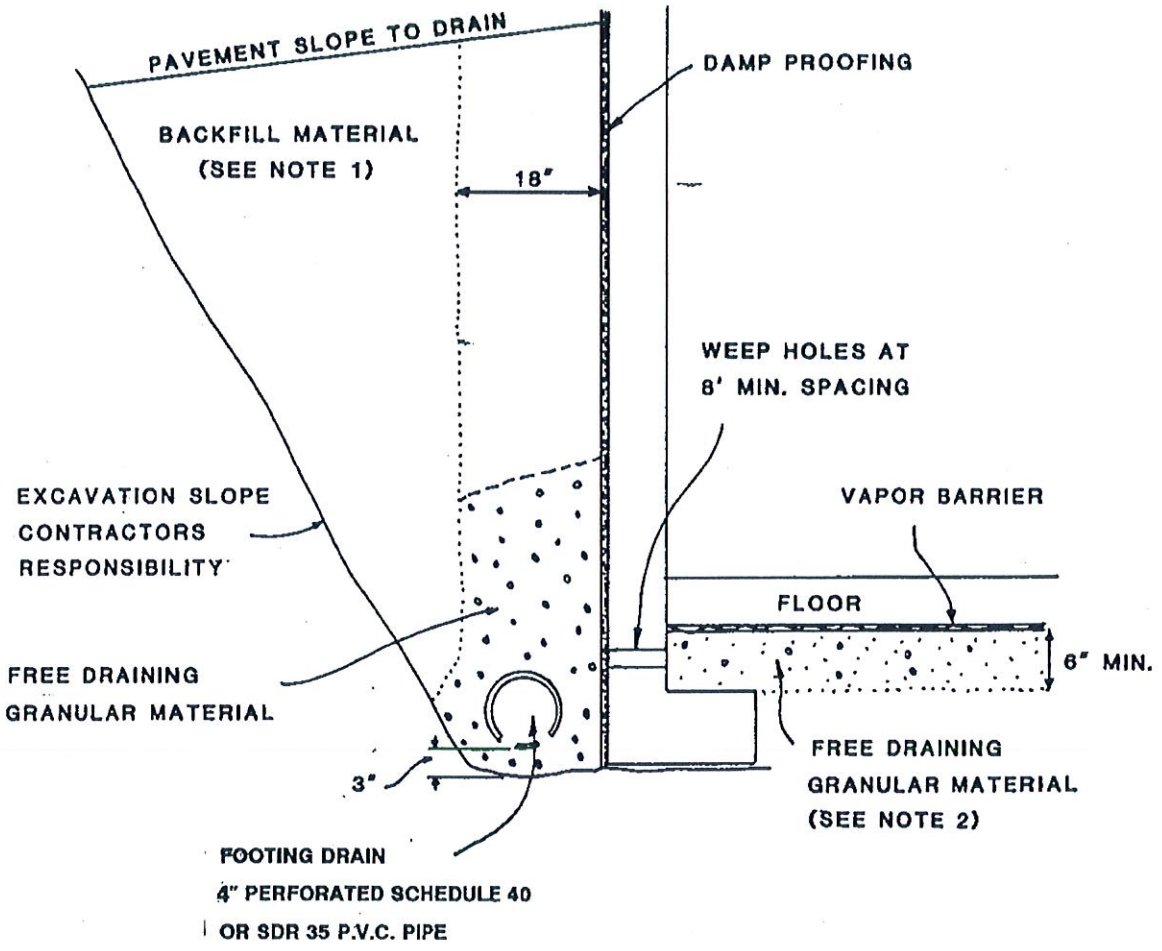
Backfill Soil: To allow the dissipation of potential hydrostatic pressure behind the retaining wall, we recommend that all retaining wall backfill placed behind the curtain drain should consist of clean, free-draining, granular material. On-site granular soils can be used for this purpose provided their moisture content is near optimum. In the latter case, a geotextile should be placed between the curtain drain and backfill to prevent fines infiltration into the drainage rock.

Backfill Compaction: To prevent the build-up of lateral soil pressures in excess of the recommended design pressures, overcompaction of the fill behind the wall should be avoided; however, a lesser degree of compaction may permit excessive post-construction settlements. Backfill above a 45-degree plane projected upward from the base should be placed in horizontal lifts not exceeding 8 inches in loose depth and compacted by small, hand-operated compaction equipment. Remaining backfill should be compacted in accordance with the compaction recommendations provided in the *Fill Placement* section of this report.

Grading and Capping: To retard the infiltration of surface water into the wall backfill soils, the backfill surface of exterior walls should be adequately sloped to drain away from the wall. We also recommend that the backfill surface directly behind the wall be capped with asphalt, concrete, or three feet of low-permeability soil.

Applied Loads: Overturning and sliding loads applied to retaining walls can be classified as active, at-rest, surcharge, and hydrostatic pressures.

- *Active and At-Rest Pressures*: Yielding (cantilever) retaining walls should be designed to withstand an appropriate *active* lateral earth pressure, whereas non-yielding (restrained) walls should be designed to withstand an appropriate *at-rest*



BACKFILLED WALL

NOTE NO.1 – IF WET CONDITIONS RENDER ON-SITE SOIL UNSUITABLE FOR REQUIRED DEGREE OF COMPACTION , BACKFILL THE ZONE SHOWN ABOVE WITH FREE DRAINING GRANULAR SOIL WITH NOT MORE THAN 5% (BY WEIGHT BASED ON MINUS 3/4" PORTION PASSING NO.200 SIEVE (BY WET SIEVING) WITH NO PLASTIC FINES.

NOTE NO.2 – FREE DRAINING GRANULAR MATERIAL BENEATH FLOOR SLAB SHOULD BE HYDRAULICALLY CONNECTED TO THE FOOTING DRAIN.

GeoSoils Consultants Inc.
GEOTECHNICAL · GEOLOGIC · ENVIRONMENTAL

BACKFILLED WALL DETAIL

DATE 4/2017 | W.O. NO. 6946

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FIGURE 9

lateral earth pressure. These pressures act over the entire back of the wall and vary with the backslope inclination. For retaining walls up to 15 feet in height with various backslope angles, we recommend using the active and at-rest pressures (given as equivalent fluid unit weights) provided in Table 9.

TABLE 9
RETAINING PRESSURE
UP TO 15 FEET IN HEIGHT

Backslope Angle	Static Active Pressure (pcf)	Static At-Rest Pressure (pcf)
Level	30	45
5H:1V	33	50
4H:1V	35	55
3H:1V	38	60
2H:1V	43	67
1.5H:1V	55	85

- Seismic Pressures For Retaining Walls

  The following seismic design criteria must be incorporated in to the design of the retaining walls:

  $\Delta P_{AE}=3/8\gamma H^2 k_h$

  H = Height of wall

  $K_h = 0.83=0.4S_{DS}$

  γ = 120 pcf

  ΔP_{AE} + 3/8 (120 pcf)(0.83)H^2 = 37.1H^2

  ΔP_{AE} acts at 0.6H above the wall base.

- *Surcharge Pressures*: Any anticipated, superimposed loading (i.e., upper retaining walls, traffic surcharge or other structures, etc.) within a 45-degree plane projected upward from the wall bottom, except retained earth, shall be considered as surcharge and provided for in the design. For a uniformly distributed load behind the wall, a corresponding uniform distributed lateral soil pressure equal to 30 percent of the surcharge should be added to the equivalent

fluid pressure. A vertical component equal to one-third of the horizontal force so obtained may be assumed at the plane of application of the force.

- *Hydrostatic Pressures*: If groundwater is allowed to saturate the backfill soils, hydrostatic pressures will act against a retaining wall. However, if an adequate drainage system is included with each retaining wall, we do *not* expect that hydrostatic pressures will develop.

Resisting Forces: Active pressures, at-rest pressures, seismic pressures, and surcharge pressures for conventional retaining wall foundations are resisted by a combination of passive lateral earth pressure, base friction, and subgrade bearing capacity. Passive pressure acts over the embedded front of the wall (neglecting the upper 1 foot for paved foreslopes, or the upper 2 feet for soil foreslopes) and varies with the foreslope inclination, whereas base friction and bearing capacity act along the bottom of the footings. For retaining walls with a level foreslope and zero hydrostatic pressure behind the wall, we recommend the resisting design values presented in Table 10.

TABLE 10
RECOMMENDED RESISTING FORCES

Design Parameters	Allowable Value	
	Compacted Fill	Bedrock
Bearing Capacity	1,500 psf	2,500 psf
Maximum Bearing Capacity	3,000 psf	5,000 psf
Passive Pressure	250 pcf	350 pcf
Base Friction Coefficient	0.4	0.40

The recommended bearing capacities in the table above may be increased by 20 percent for each additional foot of depth deeper than the minimum recommended depth of 18 inches, plus 10 percent for each additional foot of width wider than the minimum recommended width of 15 inches.

6.11 Temporary and Permanent Slopes and Excavations

We offer the following recommendations and construction considerations for temporary and permanent slopes and excavations.

Safety: Temporary excavation slope stability is a function of many factors including soil type, density, cut inclination, depth, the presence of groundwater, and the length of time that the cut is to remain open. As the cut is deepened, or as the length of time an excavation is open, the likelihood of bank failure increases. For this reason, maintenance of safe slopes and worker safety should remain the responsibility of the contractor, who is present at the site, able to observe changes in the soil conditions, and monitor the performance of the excavation.

Maintenance: If seepage or surface runoff is not controlled, flatter temporary slopes would be necessary. Larger cobbles and boulders should be scaled from the excavation sidewalls prior to worker entry to prevent injury to workmen from falling rocks. In all cases, cut slopes and any excavation shoring should conform to applicable Federal, State and/or local safety guidelines.

Cut/Fill Slopes: We tentatively recommend that temporary and permanent cut and fill slopes in natural soil, bedrock and compacted fill soils not exceed the inclinations shown in Table 11.

TABLE 11
MAXIMUM SLOPE INCLINATIONS

Soil Type	Maximum Inclination (Horizontal:Vertical)	
	Temporary*	Permanent
Natural Soil/Compacted Fill	1H:1V*	2H:1V
Bedrock	1H:1V*	2H:1V

* or as shown on the geologic cross-sections

Excavations: Shallow excavations used for construction that are less than 4 feet in depth and are made in properly engineered fill or firm native soils should stand with vertical sides. Excavations deeper than 4 feet should be sloped at angles provided in Table 11 or shored. All open excavations and excavations that are shored shall conform to all applicable Federal, State and Local regulations.

Surcharge: Surcharge loads should be setback from the top of temporary excavations a minimum horizontal distance of ten feet.

Excavation Inspection: The soils exposed in temporary excavation slopes should be observed by the Geotechnical Engineer so that modifications of the slopes can be made if variations in soil conditions occur.

Limitations: The values listed in Table 11 assume that the slopes will be protected from erosion and that significant drainage will not occur over the face of the slope. It is further assumed that no loads will be imposed above the slope within one half the slope height from the slope face. The temporary cut/fill slopes should be stabilized and/or supported within three weeks. In no conditions should the temporary excavations exceed those shown on the geologic cross-sections.

6.12 Desilting/Infiltration Basins

Five water desilting basins are proposed on the site (Lot 38 through lot 42) and will be maintained by HOA. In addition, a Water Quality/Infiltration Basin is proposed on Lot 43 and is also to be maintained by the HOA. Large diameter drainage pipes will be provided in each of the desilting basins and will outlet in the proposed Water Quality/Infiltratin Basin on Lot 43. Infiltration testing will be performed on the Water Quality Basin when access is available and the results will be provided to the Project Civil Engineer. Due to its remote location and distance from access roads, it is not currently feasible to provide enough water to the area to perform the full testing in accordance with the latest County requirements.

6.13 On-Site Drainage

Seasonal precipitation and/or landscape water should not be allowed to pond within the site, especially next to slopes and foundations of any structures. Surface runoff should be collected and disposed of in such a manner as to prevent concentrated erosion. Roof gutters and yard drains should be provided. All pad drainage should be directed toward the street or an approved water course area swale via non-erosive channel, pipe and/or dispersions devices. We recommend that all planters proposed adjacent to structures be self-contained, provided with a subdrain system, and/or allowed to have positive drainage away from structure to drain excess landscape water.

We recommend that lot drainage be verified after house construction and that notices be posted cautioning homeowners not to modify drainage in any way without approval by the County of Los Angeles, Grading Department. At no time should drainage be directed toward any descending slope or allowed to pond. All slope or fill backdrains should continue to remain unobstructed and be allowed to drain freely.

Leakage from any of the appurtenant plumbing will create an artificial groundwater condition which could likely render settlement or slope stability problems; therefore, it is imperative that all underground plumbing fixtures be *absolutely* leak-free.

LIMITATIONS

The findings and recommendations of this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice for the County of Los Angeles at this time. We make no other warranty, either express or implied. The conclusions and recommendations contained in this report are based on site conditions disclosed in our subsurface investigation and the referenced reports. However, soil/rock conditions can vary significantly between borings, trenches, and natural outcrops, therefore, further refinements of our recommendations contained herein may be necessary due to changes in the building plans or what is encountered during site grading.

The recommendations provided in this report are applicable for preliminary development planning for the referenced lots provided that surface water will be kept from infiltrating into the subgrade adjacent to the house foundation system. This may include, but not be limited to rain water, roof water, landscape water and/or leaky plumbing. The lots are to be fine graded at the completion of construction to include positive drainage away from the structure and roof water will be collected via gutters, downspouts, and transported to the street in buried drain pipes. Homebuyers should be cautioned against constructing open draining planters adjacent to the houses, or obstructing the yard drainage in any way.
Since our investigation was based on the site conditions observed, selective laboratory testing, and engineering analyses, the conclusions and recommendations contained herein

are professional opinions. Further, these opinions have been derived in accordance with standard engineering practices, and no warranty is expressed or implied.

CLOSURE

We appreciate this opportunity to be of continued service to you. If you have any questions regarding the content of this report or any other aspects of the project, please do not hesitate to contact us.

Very truly yours,

GEOSOILS CONSULTANTS, INC.

RUDY F. RUBERTI	KAREN L. MILLER	ELIZETTE VIRAMONTES
CEG 1708	GE 2257	Staff Geologist

RFR.KLM.JG.W:Updated G&G Eng. Rev.

Encl: References
Plate 1, Geologic Map
Plates 2A through 2B, Geologic Cross-Sections
Appendix A, Field Exploration Procedures, Boring Logs, and Test Pit Logs
Appendix B, Laboratory Testing Procedures and Results
Plates SH-1 through SH-5, Shear Test Diagrams
Plates SH-SUM 1 and SH –SUM 2, Shear Summaries
Appendix C, Slope Stability Analyses

cc: (2) Addressee
(2) Civil Drafting and Design

MDN 19085

REFERENCES

1. Debblee, T. W., Jr. June 1992, "Geologic Map of the Oat Mountain and Canoga Peak (North ½) Quadrangles, Los Angeles County, California"

2. Yerkes, R. F. and Campbell, R. H., 1995, "Preliminary Geologic Map of the Newhall 7.5' Quadrangle, Southern California"

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6634 Valjean Avenue
Van Nuys, CA 91406

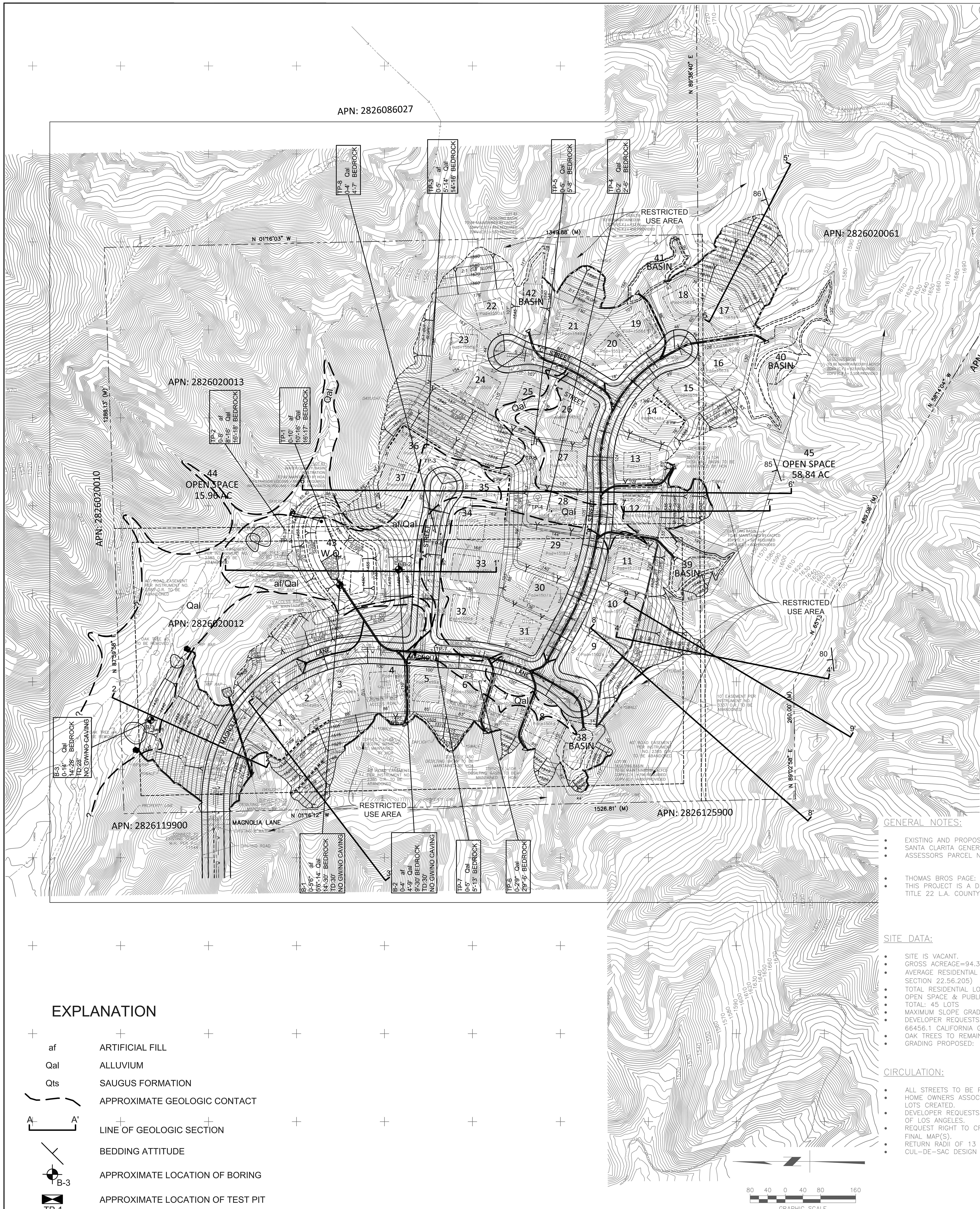
GEOLOGIC MAP
TT 52905
JEMSTREET PROPERTIES

WORK ORDER	DATE	SCALE
6946	3/2017	1" = 80'

REVISED

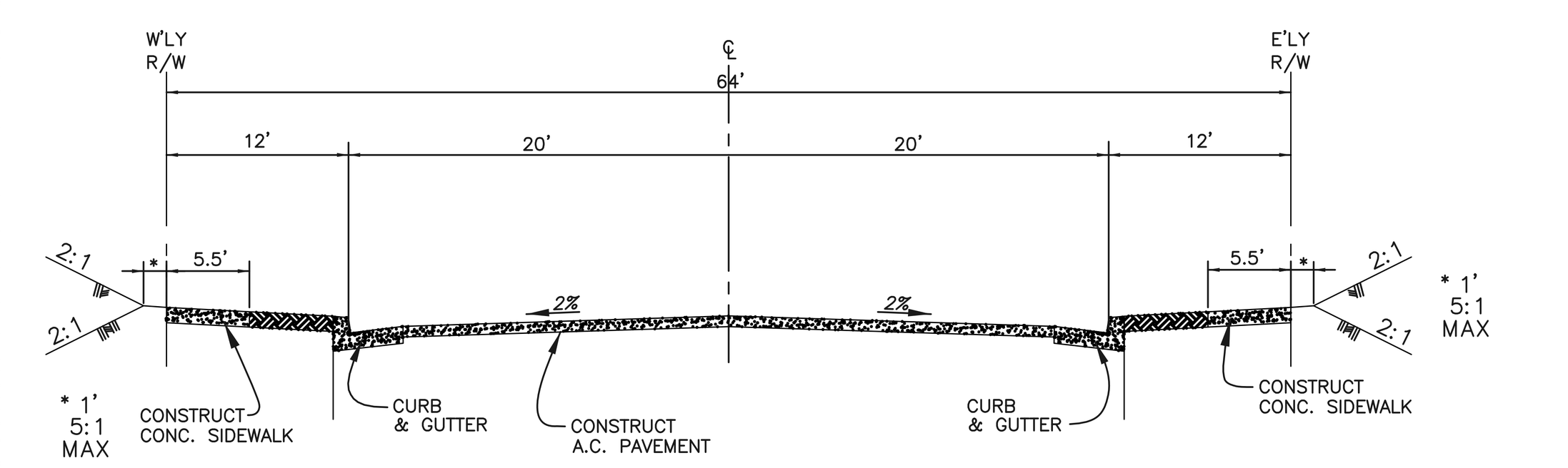
PLATE 1

MDN 19085

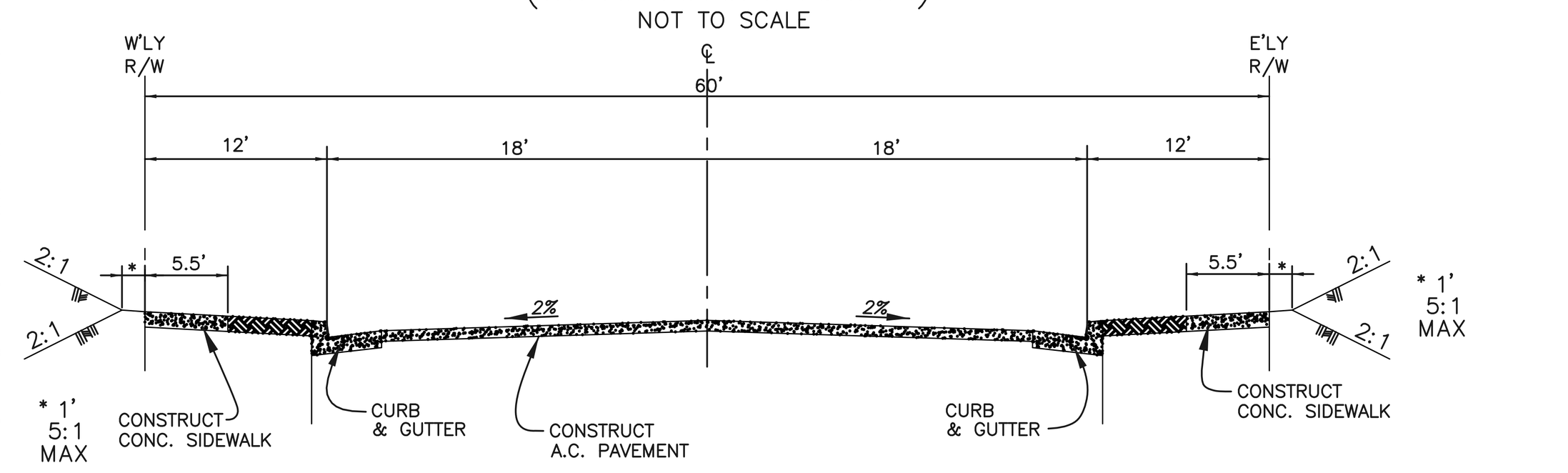


EXPLANATION

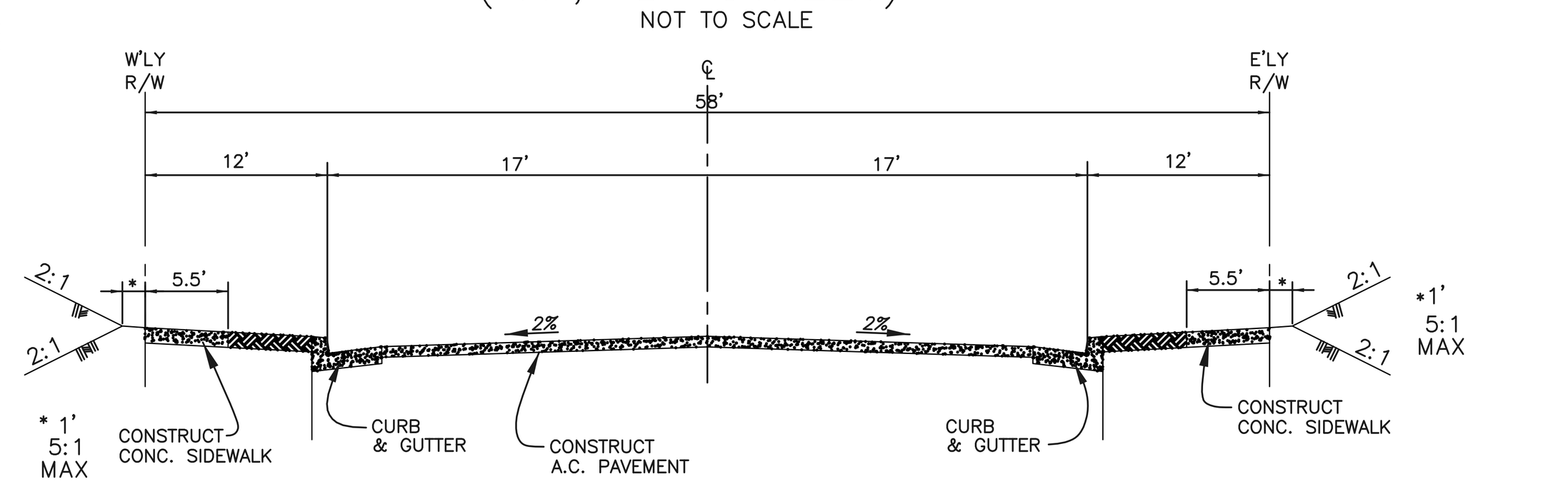
af	ARTIFICIAL FILL
Qal	ALLUVIUM
Qts	SAUGUS FORMATION
(dashed line)	APPROXIMATE GEOLOGIC CONTACT
A — A'	LINE OF GEOLOGIC SECTION
(symbol)	BEDDING ATTITUDE
B-3	APPROXIMATE LOCATION OF BORING
TP-1	APPROXIMATE LOCATION OF TEST PIT



TYPICAL SECTION 64' R/W **
(MAGNOLIA LANE)
NOT TO SCALE



TYPICAL SECTION 60' R/W **
("A", "B" STREET)
NOT TO SCALE



TYPICAL SECTION 58' R/W **
("C" STREET)
NOT TO SCALE

***—Permission is requested to use the alternate street section on all local streets.*

UTILITIES & SERVICES:

SEWER	L.A. COUNTY SANITATION DISTRICT #32
WATER	VALENCIA WATER COMPANY
GAS	SO. CALIFORNIA GAS CO.
ELECTRICAL	SO. CALIFORNIA EDISON CO.
TELEPHONE	PACIFIC TELEPHONE CO.
SCHOOLS	NEWHALL ELEMENTARY SCHOOL DISTRICT, HART HIGH SCHOOL DISTRICT
FIRE	L.A. COUNTY FIRE DEPARTMENT
POLICE	L.A. COUNTY SHERIFF'S DEPARTMENT
CABLE T.V.	STEVENSON RANCH CABLE

GENERAL NOTES:

- EXISTING AND PROPOSED ZONING — A-2-2
- SANTA CLARITA GENERAL PLAN — RL2
- ASSESSORS PARCEL NUMBERS: — 2826-020-012, 2826-020-013, & 2826-020-061
- THOMAS BROS PAGE: — 4640 GRID C2
- THIS PROJECT IS A DENSITY CONTROLLED DEVELOPMENT UNDER SECTION 22.56.205 OF TITLE 22 L.A. COUNTY ZONING CODE.

SITE DATA:

- SITE IS VACANT.
- GROSS ACREAGE=94.38 ACRES
- AVERAGE RESIDENTIAL LOT SIZE: 2.4 ACRES (DENSITY CONTROLLED DEVELOPMENT SECTION 22.56.205)
- TOTAL RESIDENTIAL LOTS: 37 (LOTS 1 THRU 37)
- OPEN SPACE & PUBLIC FACILITY LOTS 38 THRU 45
- TOTAL: 45 LOTS
- MAXIMUM SLOPE GRADE: 2 FT HORIZONTAL TO 1 FT VERTICAL
- DEVELOPER REQUESTS PERMISSION TO RECORD MULTIPLE FINAL MAPS PER SECTION 66456.1 CALIFORNIA GOVT. CODE (SUBDIVISION MAP ACT)
- OAK TREES TO REMAIN
- GRADING PROPOSED: RAW CUT—375,000 CUBIC YARDS; RAW FILL—375,000 CUBIC YARDS

CIRCULATION:

- ALL STREETS TO BE PUBLIC RIGHTS—OF—WAY.
- HOME OWNERS ASSOCIATION TO BE ESTABLISHED TO MAINTAIN ANY COMMON OPEN SPACE LOTS CREATED.
- DEVELOPER REQUESTS RIGHT TO ADJUST LOT LINES TO THE SATISFACTION OF THE COUNTY OF LOS ANGELES.
- REQUEST RIGHT TO CREATE ADDITIONAL OPEN SPACE LOTS PRIOR TO RECORDATION OF FINAL MAP(S).
- RETURN RADII OF 13 FEET AT ALL LOCAL STREET INTERSECTIONS.
- CUL—DE—SAC DESIGN PER L.A.C.O. STD. PLATE 12—01, 2—04

LOT AREA SUMMARY:

LOT NO.	NET AREA FT²	GROSS AREA FT²	TYPE
1	10355	10355	SINGLE FAMILY DETACHED
2	10510	10510	SINGLE FAMILY DETACHED
3	10365	10365	SINGLE FAMILY DETACHED
4	10152	10152	SINGLE FAMILY DETACHED
5	10179	11331	SINGLE FAMILY DETACHED
6	10462	10462	SINGLE FAMILY DETACHED
7	10328	11558	SINGLE FAMILY DETACHED
8	10011	11278	SINGLE FAMILY DETACHED
9	12435	12435	SINGLE FAMILY DETACHED
10	13142	13142	SINGLE FAMILY DETACHED
11	12129	13222	SINGLE FAMILY DETACHED
12	11178	12250	SINGLE FAMILY DETACHED
13	12036	12036	SINGLE FAMILY DETACHED
14	12498	12498	SINGLE FAMILY DETACHED
15	11278	11278	SINGLE FAMILY DETACHED
16	11534	11534	SINGLE FAMILY DETACHED
17	11737	13715	SINGLE FAMILY DETACHED
18	11817	11817	SINGLE FAMILY DETACHED
19	10001	11596	SINGLE FAMILY DETACHED
20	11348	11348	SINGLE FAMILY DETACHED
21	11478	11478	SINGLE FAMILY DETACHED
22	12135	12135	SINGLE FAMILY DETACHED
23	16449	16449	SINGLE FAMILY DETACHED
24	12718	12718	SINGLE FAMILY DETACHED
25	14176	14176	SINGLE FAMILY DETACHED
26	14887	14887	SINGLE FAMILY DETACHED
27	12962	12965	SINGLE FAMILY DETACHED
28	14059	14093	SINGLE FAMILY DETACHED
29	13242	13309	SINGLE FAMILY DETACHED
30	13012	13066	SINGLE FAMILY DETACHED
31	13277	12049	SINGLE FAMILY DETACHED
32	13793	14575	SINGLE FAMILY DETACHED
33	15445	14606	SINGLE FAMILY DETACHED
34	16624	15631	SINGLE FAMILY DETACHED
35	28923	30318	SINGLE FAMILY DETACHED
36	22179	26578	SINGLE FAMILY DETACHED
37	13296	11326	SINGLE FAMILY DETACHED
38	--	18689	BASIN LOT
39	--	23591	BASIN LOT
40	--	45095	BASIN LOT
41	--	12936	BASIN LOT
42	--	17669	BASIN LOT
43	--	77541	WATER QUALITY BASIN LOT
44	--	695071	OPEN SPACE
45	--	2562832	OPEN SPACE

Plot Date: Wed, April 12, 2017

UNDERGROUND SERVICE ALERT
call: TOLL FREE
1-800-422-4133
CALL TWO WORKING DAYS BEFORE YOU DIG

REVISION BLOCK

REV#	APPR	DATE	REVISION DESCRIPTION	PLAN CHR APPR	CITY ENGR APPR	DATE

REGISTERED PROFESSIONAL ENGINEER — IMAD ABOUJAWDAH — No. 51299 — Exp. 6-30-18 — CIVIL — STATE OF CALIFORNIA

PREPARED BY:
CIVIL Design & Drafting inc.
885 Patriot Drive, Unit C
Moorpark, California 93021
Phone: 805-522-2622
Fax: 805-426-8016
email: CDD@civildesignanddrafting.com
IMAD ABOUJAWDAH R.C.E. C51299
DATE

CANYON VIEW ESTATES

MAJOR LAND DIVISION
VESTING TENTATIVE TRACT NO. 74650
LOCATED IN THE UNINCORPORATED TERRITORY OF THE COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

SCALE: AS NOTED

SHEET 1 OF 2 SHTS

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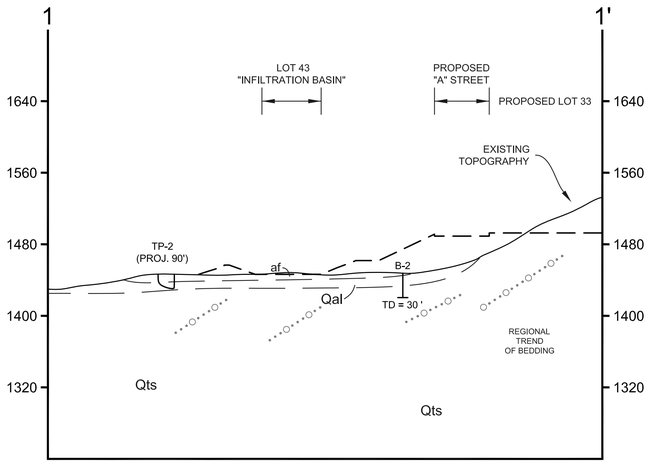

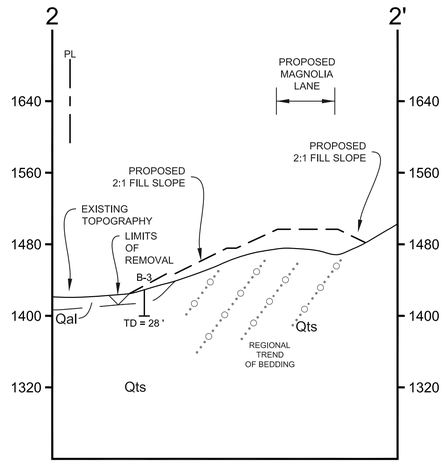

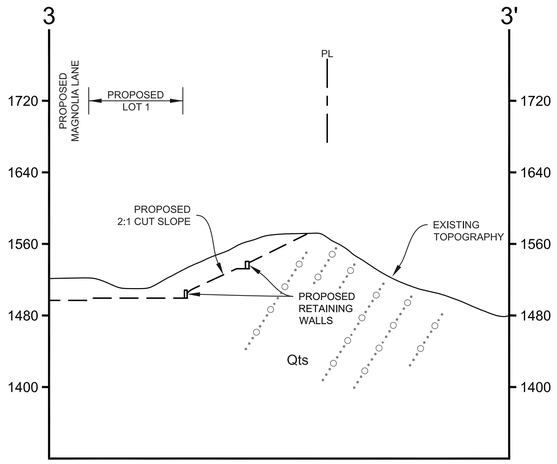

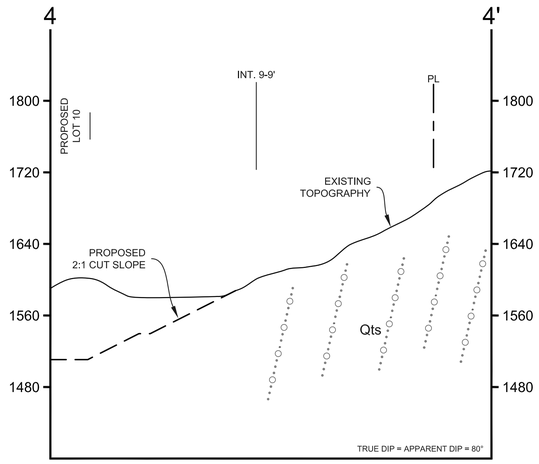

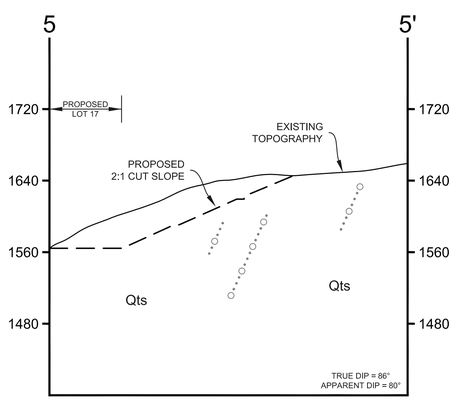

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6634 Valjean Avenue
Van Nuys, CA 91406

GEOLOGIC MAP
TT 52905
JEMSTREET PROPERTIES

WORK ORDER	DATE	SCALE
6946	3/2017	1" = 80'

REVISED

PLATE 2A

MDN 19085

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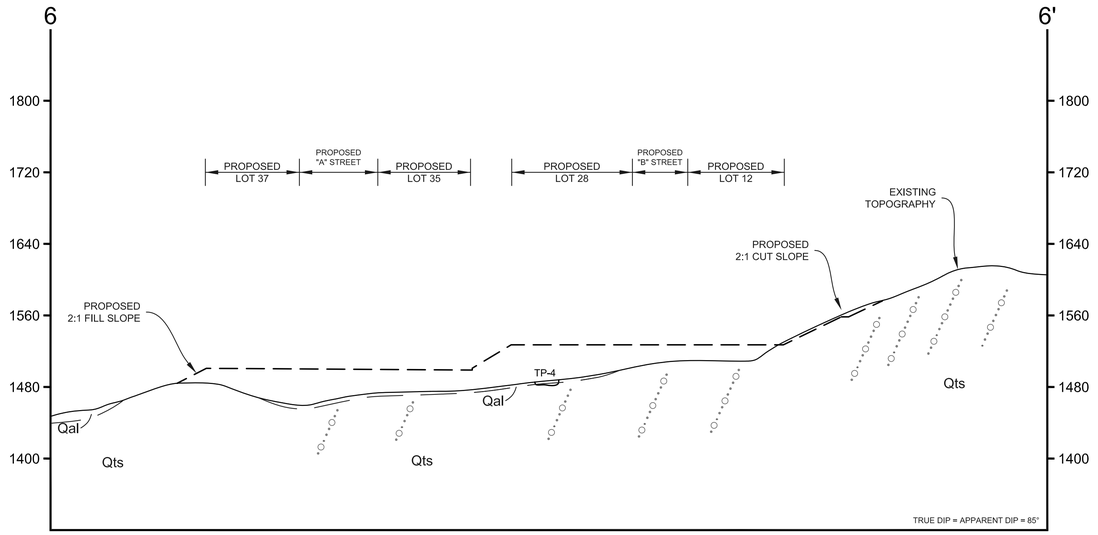

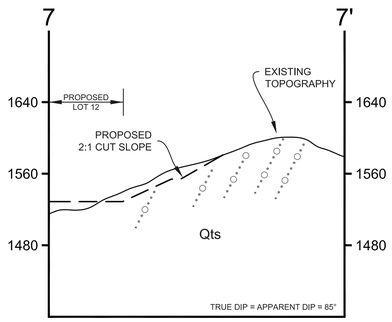

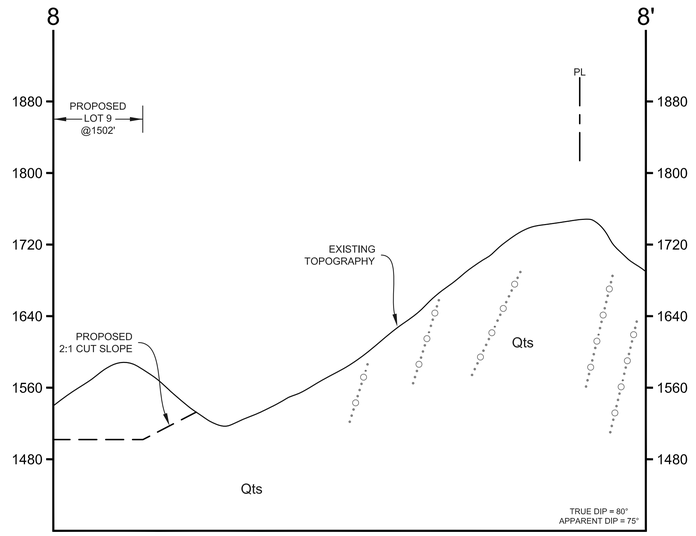

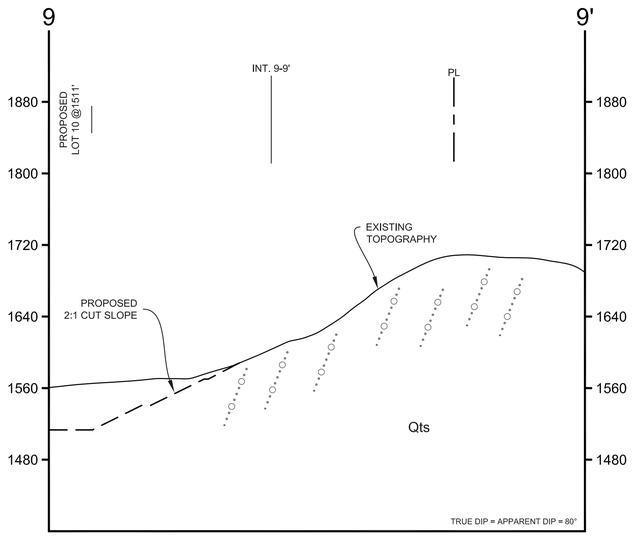

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GEOLOGIC MAP
TT 52905
JEMSTREET PROPERTIES

WORK ORDER	DATE	SCALE
6946	3/2017	1" = 80'

REVISED

MDN 19085

PLATE 2B

April 17, 2017
W.O. 6946

APPENDIX A

FIELD EXPLORATION, BORING LOGS, AND TEST PIT LOGS

April 17, 2017
W.O. 6946

APPENDIX B

FIELD EXPLORATION PROCEDURES

Hollow-Stem Borings

Our exploratory borings were drilled with a limited-access drill rig operated by an independent drilling company working under subcontract to GSC. A total of 3 hollow-stem borings were drilled with an 8-inch diameter auger drill rig explored subsurface conditions to a maximum depth of 30 feet on January 31, 2017. The locations of the borings are shown on the Geologic Map, Plate 1. The borings were continuously logged and classified by one of our geologists by visual examination in accordance with the Unified Soil Classification System. The boring logs are included as Plates A-1 through A-3.

Undisturbed soil samples were collected by driving a ring sampler with a 140-pound hammer weight falling 30 inches. The soil samples were retained in a series of brass rings, each having an inside diameter of 2.36 (6.0 centimeters) and a height of 1.00 inch (2.54 centimeters). The central portions of the samples were retained in close-fitting, moisture-tight containers for shipment to our laboratory.

The enclosed *Boring Logs* describes the vertical sequence of soils and materials encountered in each boring, based primarily on our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our log indicates the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our log also graphically indicates the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples.

Appendix A

Test Pits

GSC explored the subsurface conditions with eight (8) backhoe-dug test pits on February 15, 2017. Locations of the test pits are shown on the Geologic Map, Plate 1 and are included herein.

The soil samples were retained in a series of brass rings, each having an inside diameter of 2.36 (6.0 centimeters) and a height of 1.00 inch (2.54 centimeters). The central portions of the samples were retained in close-fitting, moisture-tight containers for shipment to our laboratory.

GEOTECHNICAL BORING LOG

PROJECT NAME	Jemstreet Properties			**W.O.**	6946
DRILLING COMPANY	Choice Drilling	**DATE STARTED**	1/31/2017	**BORING NO.**	B-1
TYPE OF DRILL RIG	Limited Access Rig	**LOGGED BY**	EV	**SHEET**	1 of 1
DRILLING METHOD	Hollow Stem	**DROP (in)**		**ELEVATION**	1448
DIAMETER OF HOLE (in)	8	**HAMMER WEIGHT**		**GW ELEV.**	

BORING LOCATION

Depth (ft)	Sample Type	Blows/12 in	GEOTECHNICAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Other Tests
			0-5' 6" Artificial Fill (af)			
			@5' Medium yellow brown, silty very fine to fine SAND. It is moderately moist, and slightly dense.	17.5	111.2	
5		12/18/28	**5'6"-14 Alluvium (Qal)**			
10		30/50-3	@10' Medium grey brown, very fine sandy silt. It is slightly moist, slightly to moderately dense, and micaceous.	12.9	120.9	
15		60-6"	**14'-30' Bedrock- Saugus Formation (Qts)** @15' Medium grey to brown, siltstone with interbedded claystone. It is micaceous, slightly moist, moderately hard, and slightly oxidized.	12.7	120.5	
20		55-6"	@20' Medium gray to brown, siltstone with interbedded claystone. It is micaceous, slightly oxidized, slightly moist and moderately hard.	12.7	115.4	
25		65-6"	@25' Medium grey silty claystone. It is slightly moist, and hard.	16.3	111.6	
			@30' Medium grey siltstone. It is slightly moist, and very hard.	12.7	118.5	
30		74-6"	Total Depth 30' No Caving No groundwater or seepage			

SAMPLE KEY

Standard Penetration Test

California Ring

TESTS

SIEVE	GRAIN SIZE ANALYSIS
MAX	MAXIMUM DRY DENSITY
DS	DIRECT SHEAR
CONS	CONSOLIDATION
HYDR	HYDROMETER ANALYSIS
EXPAN	EXPANSION INDEX

PLATE A-1

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GEOTECHNICAL BORING LOG

PROJECT NAME	Jemstreet Properties			**W.O.**	6946
DRILLING COMPANY	Choice Drilling	**DATE STARTED**	1/31/2017	**BORING NO.**	B-2
TYPE OF DRILL RIG	Limited Access Rig	**LOGGED BY**	EV	**SHEET**	1 of 1
DRILLING METHOD	Hollow Stem	**DROP (in)**		**ELEVATION**	
DIAMETER OF HOLE (in)	8	**HAMMER WEIGHT**		**GW ELEV.**	

BORING LOCATION

Depth (ft)	Sample Type	Blows/12 in	GEOTECHNICAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Other Tests
			0-4' Artificial Fill (af) @0'- 4' Light brown, silty fine to coarse SAND, contains coarse pebble fragments. It is slightly dense to loose and slightly moist.			
5		25/17/11	**4'-9' Alluvium (Qal)** @5' Medium brown to grey brown,silty very fine sand. It is slightly dense and slightly moist.	5.5	126.9	
10		33/50-4	**9'-30' Bedrock- Saugus Formation (Qts)** @10' Medium grey brown, siltstone to very fine sandy siltstone. It is moderately hard, and slightly moist.	14.5	119	
15		43/50-2	@15' Light gray to white, very fine sandy micaceous, slitstone. It is slighty moist and moderately hard.	10.3	104.1	
20		50-5"	@20' Light gray brown to medium gray brown, micaceous slitstone. It is slighty moist and moderately hard.	10.5	113.6	
25		65-6"	@25' Medium gray to brown, micaceous slitstone to gray claystone. It is slighty moist and very hard.	11.5	118.6	
			@30' Light gray brown siltstone to gray,medium to fine sandstone. It is hard dense, slightly moist, and slightly oxidized.	11.7	118.7	
30		55-3"	Total Depth 30' No Caving No groundwater or seepage			

SAMPLE KEY

Standard Penetration Test

California Ring

TESTS

SIEVE	GRAIN SIZE ANALYSIS
MAX	MAXIMUM DRY DENSITY
DS	DIRECT SHEAR
CONS	CONSOLIDATION
HYDR	HYDROMETER ANALYSIS
EXPAN	EXPANSION INDEX

PLATE A-2

GeoSoils Consultants Inc.
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GEOTECHNICAL BORING LOG

PROJECT NAME	Jemstreet Properties			**W.O.**	6946
DRILLING COMPANY	Choice Drilling	**DATE STARTED**	1/31/2017	**BORING NO.**	B-3
TYPE OF DRILL RIG	Limited Access Rig	**LOGGED BY**	EV	**SHEET**	1 of 1
DRILLING METHOD	Hollow Stem	**DROP (in)**		**ELEVATION**	
DIAMETER OF HOLE (in)	8	**HAMMER WEIGHT**		**GW ELEV.**	

BORING LOCATION

Depth (ft)	Sample Type	Blows/12 in	GEOTECHNICAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Other Tests
			0-14' Alluvium (Qal)			
5		8/8/10	@5' Medium brown, silty medium to fine sand. Contains granitic rock fragments. It is slightly dense and moderately moist.	9.3	120.8	
10		18/23/30	@10' Light brown to gray, silty fine sand. It is moderately dense and dry.	3.1	120.4	
			14'-28' Bedrock- Saugus Formation (Qts)			
15		18/39/50-5"	@15' Very light brown to gray, medium to fine grained sandstone. It is hard and dry.	3.6	115.1	
20		50-4"	@20' Very light gray to white, conglomerate with a coarse to fine grained matrix. Contains minimal gravel sized fragments. It is very hard and dry to slightly moist.	2.9	115.9	
25		40-2"	@25' Light gray to white, conglomerate with fine to very coarse pebble fragments. Slightly moist to dry and very hard.	3.5	114.6	
		50-3"	@28' Light gray to white, conglomerate, contains a fine to medium grained sand matrix. It also contains coarse pebble granitic rock fragments. It is dry to slightly moist	4.2	118.4	
30			Total Depth 28' No Caving No groundwater or seepage			

SAMPLE KEY

Standard Penetration Test

California Ring

TESTS

SIEVE	GRAIN SIZE ANALYSIS
MAX	MAXIMUM DRY DENSITY
DS	DIRECT SHEAR
CONS	CONSOLIDATION
HYDR	HYDROMETER ANALYSIS
EXPAN	EXPANSION INDEX

PLATE A-3

GeoSoils Consultants Inc.
GEOTECHNICAL · GEOLOGIC · ENVIRONMENTAL

TEST PIT LOG 1

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** **WORK ORDER NO.:** 6946
ADDRESS: **LOGGED BY:** EV **DATE**: 2/15/17

Depth	Material Type	Material Description	Comments
0'10'	Artificial Fill (af):	Dark brown, silty fine SAND, contains roots and trash. It is slightly dense and moderately moist. @9': Dark gray, angular bedrock fragments.	Refusal @ 17'
10'-16'	Alluvium (Qal):	Medium yellow brown, silty medium to fine SAND, contains rounded cobble size fragments. It is porous, moderately dense and slightly moist.	
16'-17'	Bedrock: Saugus Formation (Qts):	Medium yellow to light gray, medium grained sandstone to medium gray MUDSTONE. It is hard, dense and slightly moist.	

Scale: **H**: 1"=6' **V**: 1"=6' **Pit Orient.**: N20°W **Natural Slope Angle**: 0° **T.D.**: 17'

Illustration

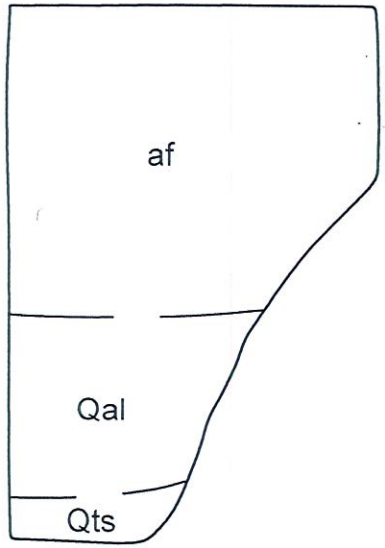

Plate TP-1

TEST PIT LOG 2

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** _____ **WORK ORDER NO.:** 6946
ADDRESS: _____ **LOGGED BY:** EV **DATE:** 2/15/17

Depth	Material Type	Material Description	Comments
0'-8'	Artificial Fill (af):	Dark brown, silty fine SAND, contains roots and rock fragments. It is slightly dense and moderately moist.	
8'-16'	Alluvium (Qal):	Medium yellow brown, silty medium to fine SAND, contains rounded cobble size fragments. It is porous, moderately dense and slightly moist. @15'-16': light brown, medium to fine sand, moderately dense.	Bulk Sample @ 15'-16'
16'-18'	Bedrock: Saugus Formation (Qts):	Medium gray to gray brown, MUDSTONE. It is hard, dense and slightly moist.	

Scale: H: 1"=6' V: 1"=6' **Pit Orient.:** N10°E **Natural Slope Angle:** 0° **T.D.:** 18'

Illustration

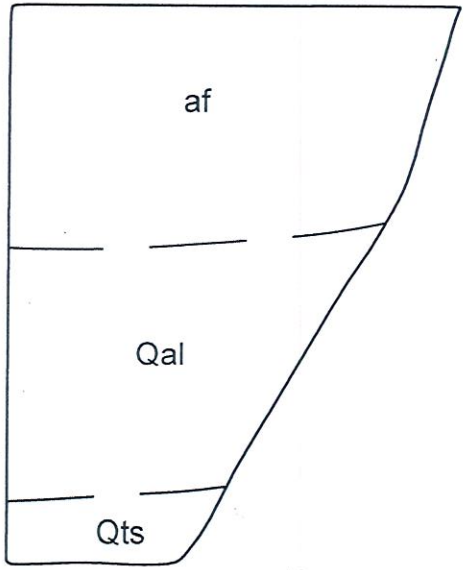

Plate TP-2

TEST PIT LOG 3

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** _____ **WORK ORDER NO.:** 6946
ADDRESS: _____ **LOGGED BY:** EV **DATE**: 2/15/17

Depth	Material Type	Material Description	Comments
0'-5'	Artificial Fill (af):	Dark brown, silty medium to fine SAND. It is slightly dense and moderately moist.	
5'-14'	Alluvium (Qal):	Light brown, silty fine to medium SAND, contain coarse pebble to cobble size rock fragments. It is moderately dense and moderately moist. @13'-14': light gray brown, medium grained sand, moderately dense.	Bulk Sample @ 14'-16'
14'-16'	Bedrock: Saugus Formation (Qts):	Light gray to white, fine to medium grained sandstone with gravel to cobble granitic fragments. It is hard and slightly moist.	

Scale: H: 1"=6' V: 1"=6' **Pit Orient.**: N70°E **Natural Slope Angle:** __ **T.D.:** 16'

Illustration

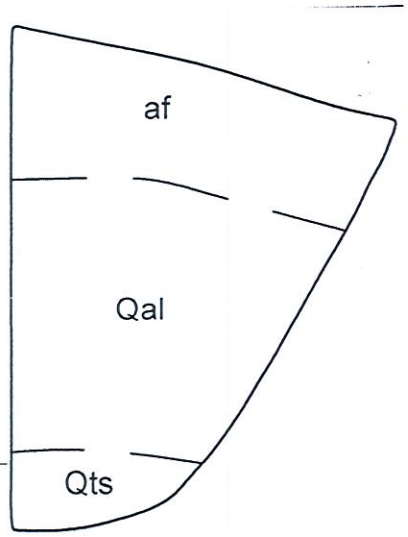

Plate TP-3

TEST PIT LOG 4

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** _____ **WORK ORDER NO.:** 6946
ADDRESS: _____ **LOGGED BY:** EV **DATE:** 2/15/17

Depth	Material Type	Material Description	Comments
0'-2'	Alluvium (Qal):	Medium brown, medium to coarse SAND, contains coarse pebble to fine pebble rock fragments. It contains roots and is slightly dense and moderately moist.	Ring Sample @ 6' Moisture: @6': 12.9%
2'-6'	Bedrock: Saugus Formation (Qts):	Light gray fine grained sandstone to silty fine sandstone. It is moderately dense and slightly moist and heavily oxidized.	Dry Density: @6': 10.9pcf

Scale: H: 1"=6' V: 1"=6' **Pit Orient.:** N5°E **Natural Slope Angle:** _____ **T.D.:** 6'

Illustration

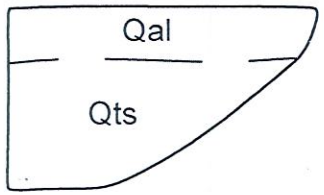

Plate TP-4

TEST PIT LOG 5

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** _____ **WORK ORDER NO.:** 6946
ADDRESS: _____ **LOGGED BY:** EV **DATE:** 2/15/17

Depth	Material Type	Material Description	Comments
0'-5'	Alluvium (Qal):	Black to light gray, medium to coarse SAND, contains coarse pebble to cobble rock fragments. It contains roots and is slightly dense, porous, and moderately moist.	Bulk Sample @ 8'
5'-8'	Bedrock: Saugus Formation (Qts):	Light gray medium grained sandstone. It is hard, dense and moderately moist. @ 7'-8': Black medium to coarse sandstone. It is very hard and slightly moist.	

Scale: H: 1"=6' V: 1"=6' **Pit Orient.:** N80°W **Natural Slope Angle:** __ **T.D.:** 8'

Illustration

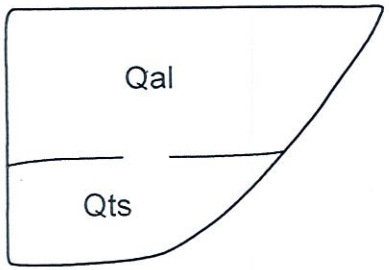

Plate TP-5

TEST PIT LOG 6

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** **WORK ORDER NO.:** 6946
ADDRESS: **LOGGED BY:** EV **DATE**: 2/15/17

Depth	Material Type	Material Description	Comments
0'-2'9"	Alluvium (Qal):	Dark brown, Medium to fine grained SAND, contains cobble sized rock fragments. It contains roots and is slightly dense, porous, and moderately moist.	Bulk Sample @ 8' Moisture: @6': 13.5% Dry Density: @6': 102.5pcf
2'9"-6'	Bedrock: Saugus Formation (Qts):	Medium olive brown, siltstone to fine grained sandstone. It is hard, dense, non-porous, and moderately moist.	

Scale: **H**: 1"=6' **V**: 1"=6' **Pit Orient.**: N40°E **Natural Slope Angle:** **T.D.:** 6'

Illustration

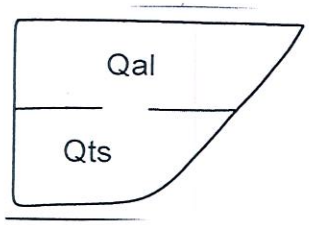

Plate TP-6

TEST PIT LOG 7

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** _____ **WORK ORDER NO.:** 6946
ADDRESS: _____ **LOGGED BY:** EV **DATE:** 2/15/17

Depth	Material Type	Material Description	Comments
0'-5'	Alluvium (Qal):	Medium brown, fine to medium SAND to medium to coarse SAND contains rootlets and rock fragments. It is moderately dense and moderately moist.	Bulk Sample @ 7'-8'
5'-13'	Bedrock: Saugus Formation (Qts):	Medium brown, claystone to sillty claystone, contains caliche. It is dense, hard and moderately moist. @10'-13': dark gray, claystone with mica and caliche. It is very hard, dense, and slightly moist.	

Scale: H: 1"=6' V: 1"=6' **Pit Orient.:** N60°E **Natural Slope Angle:** __ **T.D.:** 13'

Illustration

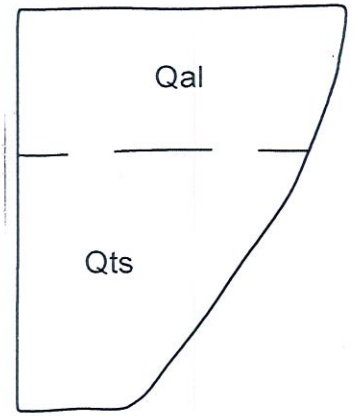

Plate TP-7

TEST PIT LOG 8

GEOSOILS CONSULTANTS, INC.

CLIENT: Jemstreet Properties **ELEVATION:** **WORK ORDER NO.:** 6946
ADDRESS: **LOGGED BY:** EV **DATE**: 2/15/17

Depth	Material Type	Material Description	Comments
0'-4'	Alluvium (Qal):	Dark brown, sitly fine SAND to light gray, medium to coarse SAND, contains gravel sized rock fragments. It is slightly dense and moderately moist.	Ring Sample @ 7' Moisture: @7': 10.4% Dry Density: @7': 110.9pcf
4'-7'	Bedrock: Saugus Formation (Qts):	Light olive-gray brown, siltstone. It is very hard, dense and slightly moist.	

Scale: **H**: 1"=6' **V**: 1"=6' **Pit Orient.**: N15°E **Natural Slope Angle:** **T.D.**: 7'

Illustration

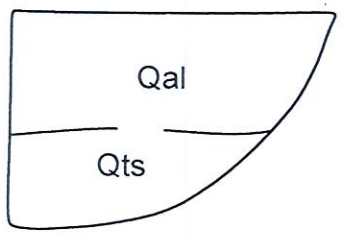

Plate TP-8

April 17, 2017
W.O. 6946

APPENDEX B

LABORATORY TESTING PROCEDURES AND RESULTS

APPENDIX B

LABORATORY TESTING PROCEDURES AND RESULTS

Moisture-Density

The field moisture content and dry unit weights were determined for each undisturbed ring sample obtained from our subsurface exploration. Once the dry unit weights had been determined, in-place densities of underlying soil profile were estimated. In those cases where ring samples were obtained, the moisture content and dry unit weights are presented on the enclosed boring logs (B-1 through B-3) and test pits (TP-1 through TP-8).

Compaction Tests

Four compaction tests were performed to determine to moisture density relationships of the typical surficial soils encountered on the site. The laboratory standard used was in accordance with ASTM Test Designation D-1557-12. A summary of the compaction test results is shown in Table C-1.

Table C-1

Boring No. and Sample Depth	Description	Maximum Dry Density (psf)	Optimum Moisture (%)
B-1 @ 15'-20'	Medium Gray-Brown, Siltstone with Claystone	122.0	13.5
B-2 @ 20'-23'	Light Brown- Medium Gray Siltstone with Claystone	124.0	11.0
TP-5 @ 8'	Dark Grey (10YR 1/4) silty CLAY	131.0	9.0
TP-7 @ 7'-8'	Brown (10YR 4/2) sandy, silty CLAY	105.5	19.5

Expansion Index Test

To determine the expansion potential of the near-surface on-site soil material, an expansion index test was performed in accordance with ASTM Test Method D-4829. The test indicates a low potential for expansion.

Shear Tests

Multiple shear test were performed in a strain-control type Direct Shear Machine. The shear testing was performed in series corresponding to the date the samples were collected. The sample was sheared under varying confining loads in order to determine the Coulomb shear strength parameters: cohesion (c), and angle of internal friction (ϕ) for peak and residual

APPENDIX B

strength conditions. The samples were tested in an artificially-saturated condition. The results are plotted and a linear approximation is drawn of the failure curve. The results are shown on the Shear Test Diagrams included with this appendix as Plates SH-1 through SH-11.

Sulfates

Soluble sulfates react chemically with the hydrated lime and calcium aluminate of hardened cement to form calcium aluminate and calcium sulfo-aluminate. The effect is disintegration of the concrete. In addition to the potential detrimental effects of high concentration of sulfate to certain mixtures of concrete, sulfates may catalyze reaction of certain clay minerals in soil columns which undergo large, isolated volume changes which prove detrimental to some structures. Type V cement is normally used where sulfates are present. Testing for soluble sulfates was performed on one representative sample of the material concentrated with in the subject site by American Analytics (see Plate AA-1 this appendix). The results indicate that the soluble sulfate content is less than 6,000 ppm within the soil samples;-therefore, the soils will have a severe effect on the cement used at the site.

SULFATE EXPOSURE	RECOMMENDATIONS FOR CONCRETE IN SULFATE ENVIRONMENTS (AFTER TABLE 19-A-4)				
	SOLUBLE SULFATES IN SOIL %	SULFATES IN WATER, PPM	CEMENT TYPE	MAXIMUM WATER/ CEMENT RATIO	MINIMUM CEMENT CONTENT, LBS
Negligible	0.0-0.10%	0-150			
Moderate	0.10-0.20%	150-1,500	LI	0.55	470
Severe	0.20-2.0	1,500-10,000	V	0.45	660
Very Severe	Over 2.0	Over 10,000	V+Pozzolan	0.45	660

Table 1 - Laboratory Tests on Soil Samples

GeoSoils Consultants, Inc.
Jemstreet Properties
Your #6946, HDR Lab #17-0065LAB
13-Feb-17

Sample ID			B-1 @ 15-20'	B-2 @ 20-23'
Resistivity		**Units**		
as-received		ohm-cm	7,200	9,200
minimum		ohm-cm	480	760
pH			6.8	6.8
Electrical Conductivity		mS/cm	1.86	1.54
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	1,550	1,520
magnesium	Mg^{2+}	mg/kg	326	211
sodium	Na^{1+}	mg/kg	376	106
potassium	K^{1+}	mg/kg	63	80
Anions				
carbonate	CO_3^{2-}	mg/kg	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	122	125
fluoride	F^{1-}	mg/kg	12	8.7
chloride	Cl^{1-}	mg/kg	4.9	ND
sulfate	SO_4^{2-}	mg/kg	5,320	4,350
phosphate	PO_4^{3-}	mg/kg	ND	5.2
Other Tests				
ammonium	NH_4^{1+}	mg/kg	2.7	ND
nitrate	NO_3^{1-}	mg/kg	ND	ND
sulfide	S^{2-}	qual	na	na
Redox		mV	na	na

Minimum resistivity per CTM 643, Chlorides per CTM 422, Sulfates per CTM 417

Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

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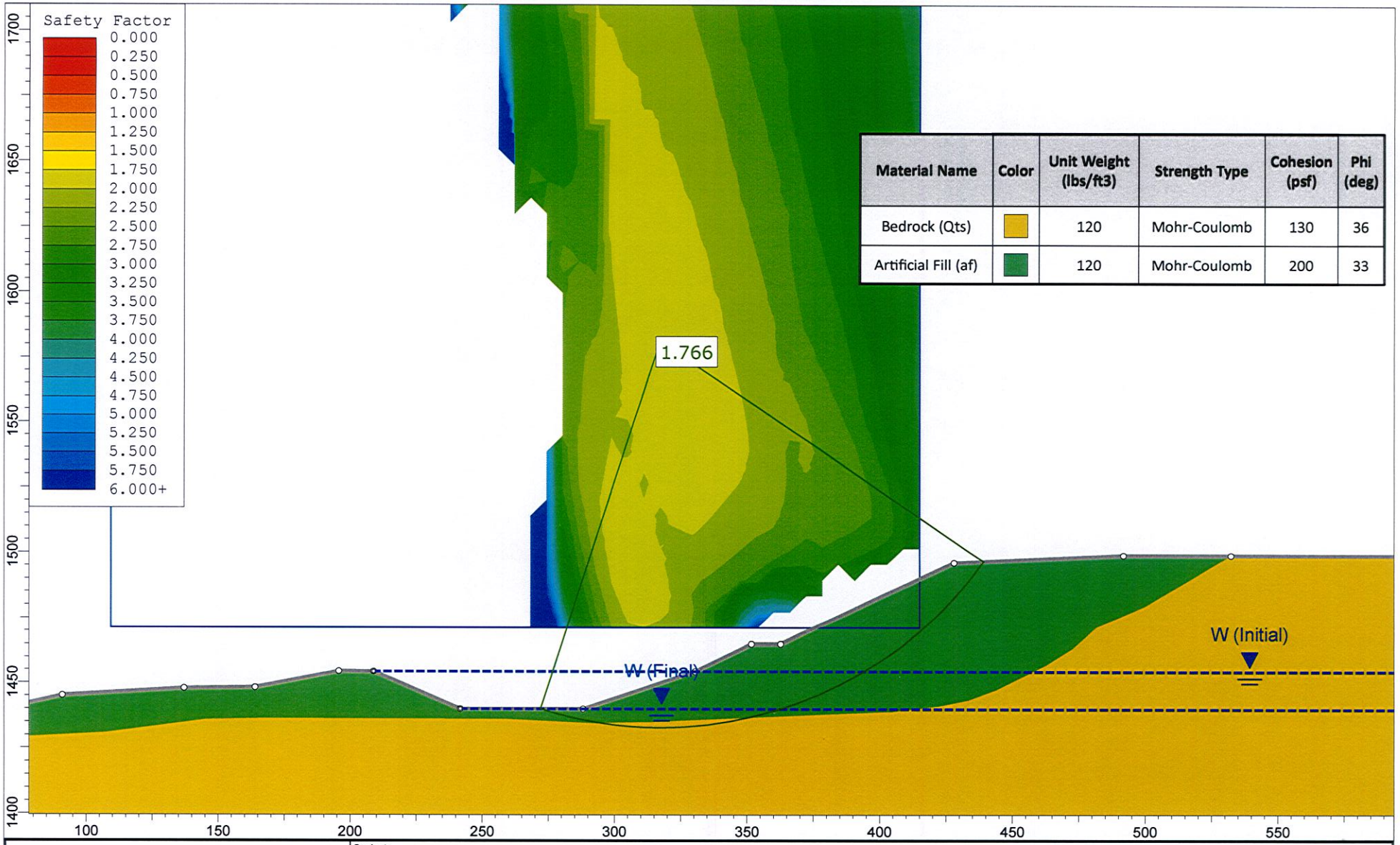
April 17, 2017
W.O. 6946

APPENDIX C

SLOPE STABILITY ANALYSES



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock (Qts)		120	Mohr-Coulomb	130	36
Artificial Fill (af)		120	Mohr-Coulomb	200	33

rocscience

SLIDEINTERPRET 7.009

Project	# 6946			
Analysis Description	1-1' Rapid Drawdown (Static)			
Drawn By	JG	Scale	1:600	Company: GeoSoils Consultants, Inc.
Date	4/6/2017			File Name: 6946 1-1 Static.slim

Slide Analysis Information

6946

Project Summary

File Name:	6946 1-1 Static.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	1-1' Rapid Drawdown (Static)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/6/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	Rapid Drawdown
Rapid Drawdown Method:	Effective Stress using B-Bar

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
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced Seismic Analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Bedrock (Qts)	Artificial Fill (af)
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120
Cohesion [psf]	130	200
Friction Angle [deg]	36	33
Water Surface	Water Table	Water Table
Hu Value	1	1
Rapid Drawdown Undrained Behaviour	Yes	Yes
RD Shear Strength Envelope Properties	CR: 0 PhiR: 0	CR: 0 PhiR: 0

Global Minimums

Method: spencer

FS	1.765970
Center:	317.172, 1581.267
Radius:	148.386
Left Slip Surface Endpoint:	272.061, 1439.904
Right Slip Surface Endpoint:	439.141, 1496.758
Resisting Moment:	.10591e+007 lb-ft
Driving Moment:	.75875e+007 lb-ft
Resisting Horizontal Force:	86973 lb
Driving Horizontal Force:	05875 lb
Total Slice Area:	575.51 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 6621
Number of Invalid Surfaces: 21990

Error Codes:

Error Code -103 reported for 251 surfaces
Error Code -106 reported for 4 surfaces
Error Code -107 reported for 831 surfaces
Error Code -108 reported for 4 surfaces
Error Code -110 reported for 19677 surfaces
Error Code -111 reported for 2 surfaces
Error Code -112 reported for 28 surfaces
Error Code -114 reported for 1193 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-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 (spencer) - Safety Factor: 1.76597

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice	Base Material	Base Cohesion	Base Friction	Shear Stress	Shear Strength	Base Normal	Pore Pressure	Effective Normal

			Base [degrees]		[psf]	Angle [degrees]	[psf]	[psf]	Stress [psf]	[psf]	Stress [psf]
1	3.26246	195.73	-17.0397	Artificial Fill (af)	200	33	166.761	294.494	176.705	31.1971	145.508
2	3.26246	571.286	-15.7266	Artificial Fill (af)	200	33	195.477	345.207	314.658	91.0567	223.601
3	3.26246	915.342	-14.4218	Artificial Fill (af)	200	33	220.001	388.516	436.183	145.895	290.288
4	3.26246	1228.47	-13.1247	Artificial Fill (af)	200	33	240.718	425.1	542.43	195.805	346.625
5	3.26246	1512.22	-11.8344	Artificial Fill (af)	200	33	258.043	455.697	634.772	241.032	393.74
6	3.26246	2011.24	-10.5501	Artificial Fill (af)	200	33	290.573	513.144	802.77	320.57	482.2
7	3.26246	2669	-9.27119	Artificial Fill (af)	200	33	332.984	588.039	1022.94	425.41	597.53
8	3.44737	3502.37	-7.96092	Bedrock (Qts)	130	36	360.819	637.196	1226.39	528.297	698.096
9	3.44737	4170.07	-6.61883	Bedrock (Qts)	130	36	402.054	710.015	1427.33	629.012	798.322
10	3.44737	4803.95	-5.28037	Bedrock (Qts)	130	36	438.47	774.324	1611.46	724.626	886.836
11	3.44737	5404.26	-3.9448	Bedrock (Qts)	130	36	470.422	830.751	1779.68	815.176	964.5
12	3.44737	5971.18	-2.61137	Bedrock (Qts)	130	36	498.227	879.854	1932.78	900.691	1032.09
13	3.44737	6504.86	-1.27936	Bedrock (Qts)	130	36	522.167	922.132	2071.47	981.192	1090.27
14	3.44737	7005.38	0.0519557	Bedrock (Qts)	130	36	542.496	958.031	2196.38	1056.69	1139.69
15	3.44737	7472.74	1.3833	Bedrock (Qts)	130	36	559.44	987.955	2308.06	1127.19	1180.87
16	3.44737	7906.94	2.7154	Bedrock (Qts)	130	36	573.207	1012.27	2407.02	1192.68	1214.34
17	3.44737	8307.88	4.04896	Bedrock (Qts)	130	36	583.983	1031.3	2493.68	1253.16	1240.52
18	3.44737	8734.01	5.38473	Bedrock (Qts)	130	36	607.348	1072.56	2588.15	1290.83	1297.32
19	3.44737	9298.18	6.72345	Bedrock (Qts)	130	36	672.141	1186.98	2726.19	1271.38	1454.81
20	3.44737	9839.61	8.06586	Bedrock (Qts)	130	36	735.601	1299.05	2852.52	1243.46	1609.06
21	3.44737	10346.9	9.41275	Bedrock (Qts)	130	36	795.002	1403.95	2963.81	1210.38	1753.43
22	3.44737	10819.7	10.7649	Bedrock (Qts)	130	36	850.513	1501.98	3060.48	1172.1	1888.38
23	3.44737	11257.5	12.1232	Bedrock (Qts)	130	36	902.292	1593.42	3142.76	1128.55	2014.21
24	3.37612	11328.2	13.4742	Artificial Fill (af)	200	33	886.261	1565.11	3182.29	1080.21	2102.08
25	3.37612	11070.7	14.8187	Artificial Fill (af)	200	33	863.69	1525.25	3067.8	1027.1	2040.7
26	3.37612	10691.4	16.1716	Artificial Fill (af)	200	33	831.52	1468.44	2921.93	968.687	1953.24
27	3.37612	10294.4	17.5339	Artificial Fill (af)	200	33	800.591	1413.82	2773.98	904.861	1869.11
28	3.37612	10302.9	18.9065	Artificial Fill (af)	200	33	812.177	1434.28	2736.13	835.503	1900.63
29	3.37612	10467.3	20.2904	Artificial	200	33	840.394	1484.11	2737.83	760.48	1977.35

				Fill (af)							
30	3.37612	10593.9	21.6868	Artificial Fill (af)	200	33	866.221	1529.72	2727.23	679.646	2047.59
31	3.37612	10681.7	23.0969	Artificial Fill (af)	200	33	889.721	1571.22	2704.33	592.833	2111.49
32	3.37612	10729.5	24.522	Artificial Fill (af)	200	33	910.95	1608.71	2669.08	499.858	2169.22
33	3.37612	10736	25.9634	Artificial Fill (af)	200	33	929.954	1642.27	2621.42	400.513	2220.91
34	3.37612	10699.6	27.4228	Artificial Fill (af)	200	33	946.788	1672	2561.24	294.567	2266.68
35	3.37612	10618.6	28.9017	Artificial Fill (af)	200	33	961.483	1697.95	2488.4	181.761	2306.64
36	3.37612	10491.2	30.402	Artificial Fill (af)	200	33	974.088	1720.21	2402.72	61.8046	2340.91
37	3.22825	9868.22	31.8918	Artificial Fill (af)	200	33	963.454	1701.43	2311.99	-62.6736	2311.99
38	3.22825	9662.89	33.3722	Artificial Fill (af)	200	33	929.076	1640.72	2218.52	-191.691	2218.52
39	3.22825	9410.79	34.8783	Artificial Fill (af)	200	33	891.233	1573.89	2115.61	-328.242	2115.61
40	3.22825	9109.35	36.4126	Artificial Fill (af)	200	33	849.907	1500.91	2003.23	-472.741	2003.23
41	3.22825	8755.62	37.9778	Artificial Fill (af)	200	33	805.082	1421.75	1881.33	-625.663	1881.33
42	3.22825	8346.24	39.5771	Artificial Fill (af)	200	33	756.734	1336.37	1749.86	-787.548	1749.86
43	3.22825	7877.33	41.2143	Artificial Fill (af)	200	33	704.842	1244.73	1608.74	-959.024	1608.74
44	3.22825	7344.35	42.8936	Artificial Fill (af)	200	33	649.369	1146.77	1457.89	-1140.82	1457.89
45	3.22825	6742	44.62	Artificial Fill (af)	200	33	590.292	1042.44	1297.24	-1333.79	1297.24
46	3.22825	6063.96	46.3995	Artificial Fill (af)	200	33	527.574	931.68	1126.69	-1538.95	1126.69
47	3.22825	5251.63	48.2391	Artificial Fill (af)	200	33	457.634	808.168	936.497	-1757.52	936.497
48	3.22825	3946.22	50.1476	Artificial Fill (af)	200	33	357.182	630.772	663.33	-1990.99	663.33
49	3.22825	2451.45	52.1357	Artificial Fill (af)	200	33	249.45	440.521	370.369	-2241.2	370.369
50	3.22825	838.243	54.2172	Artificial Fill (af)	200	33	140.914	248.849	75.2211	-2510.49	75.2211

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.76597

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	272.061	1439.9	0	0	0
2	275.323	1438.9	720.564	220.739	17.032
3	278.586	1437.99	1647.16	504.595	17.032
4	281.848	1437.15	2730.63	836.506	17.032
5	285.111	1436.39	3928.32	1203.41	17.032
6	288.373	1435.7	5203.84	1594.15	17.032
7	291.636	1435.09	6639.29	2033.89	17.032
8	294.898	1434.56	8270.07	2533.47	17.032
9	298.346	1434.08	10104.8	3095.52	17.032
10	301.793	1433.68	12061.3	3694.89	17.0321
11	305.24	1433.36	14085.9	4315.09	17.032
12	308.688	1433.12	16130.1	4941.33	17.032
13	312.135	1432.97	18151	5560.42	17.032
14	315.582	1432.89	20110	6160.55	17.0321
15	319.03	1432.89	21972.8	6731.18	17.032
16	322.477	1432.98	23708.6	7262.94	17.032
17	325.925	1433.14	25290.5	7747.53	17.032
18	329.372	1433.38	26694.5	8177.65	17.032
19	332.819	1433.71	27946.6	8561.21	17.032
20	336.267	1434.11	29155	8931.41	17.032
21	339.714	1434.6	30296.6	9281.1	17.032
22	343.161	1435.17	31342.5	9601.53	17.032
23	346.609	1435.83	32267.7	9884.94	17.032
24	350.056	1436.57	33050	10124.6	17.032
25	353.432	1437.38	33466.9	10252.3	17.032
26	356.808	1438.27	33641.8	10305.9	17.032
27	360.185	1439.25	33587.5	10289.3	17.0321
28	363.561	1440.32	33330.6	10210.5	17.0319
29	366.937	1441.47	32907.8	10081	17.032
30	370.313	1442.72	32326.8	9903.04	17.032
31	373.689	1444.07	31588.6	9676.92	17.032
32	377.065	1445.51	30697.7	9404	17.032
33	380.441	1447.05	29661.4	9086.53	17.032
34	383.817	1448.69	28490.5	8727.83	17.032
35	387.193	1450.44	27199.4	8332.3	17.032
36	390.57	1452.31	25806.4	7905.58	17.032
37	393.946	1454.29	24334.4	7454.64	17.032
38	397.174	1456.29	22799.4	6984.41	17.032
39	400.402	1458.42	21080.3	6457.78	17.032
40	403.63	1460.67	19195.9	5880.5	17.032
41	406.859	1463.05	17168.7	5259.49	17.032
42	410.087	1465.57	15025.6	4602.97	17.032
43	413.315	1468.24	12798.3	3920.66	17.032
44	416.543	1471.07	10524.2	3224.01	17.0321
45	419.772	1474.07	8247.35	2526.51	17.032
46	423	1477.25	6019.72	1844.09	17.032
47	426.228	1480.64	3902.91	1195.62	17.032
48	429.456	1484.26	1993.83	610.793	17.032
49	432.685	1488.13	581.123	178.022	17.032
50	435.913	1492.28	-151.7	-46.4721	17.032
51	439.141	1496.76	0	0	0

List Of Coordinates

Water Table

X	Y
208.906	1454.29
622	1454.29

Drawdown Line

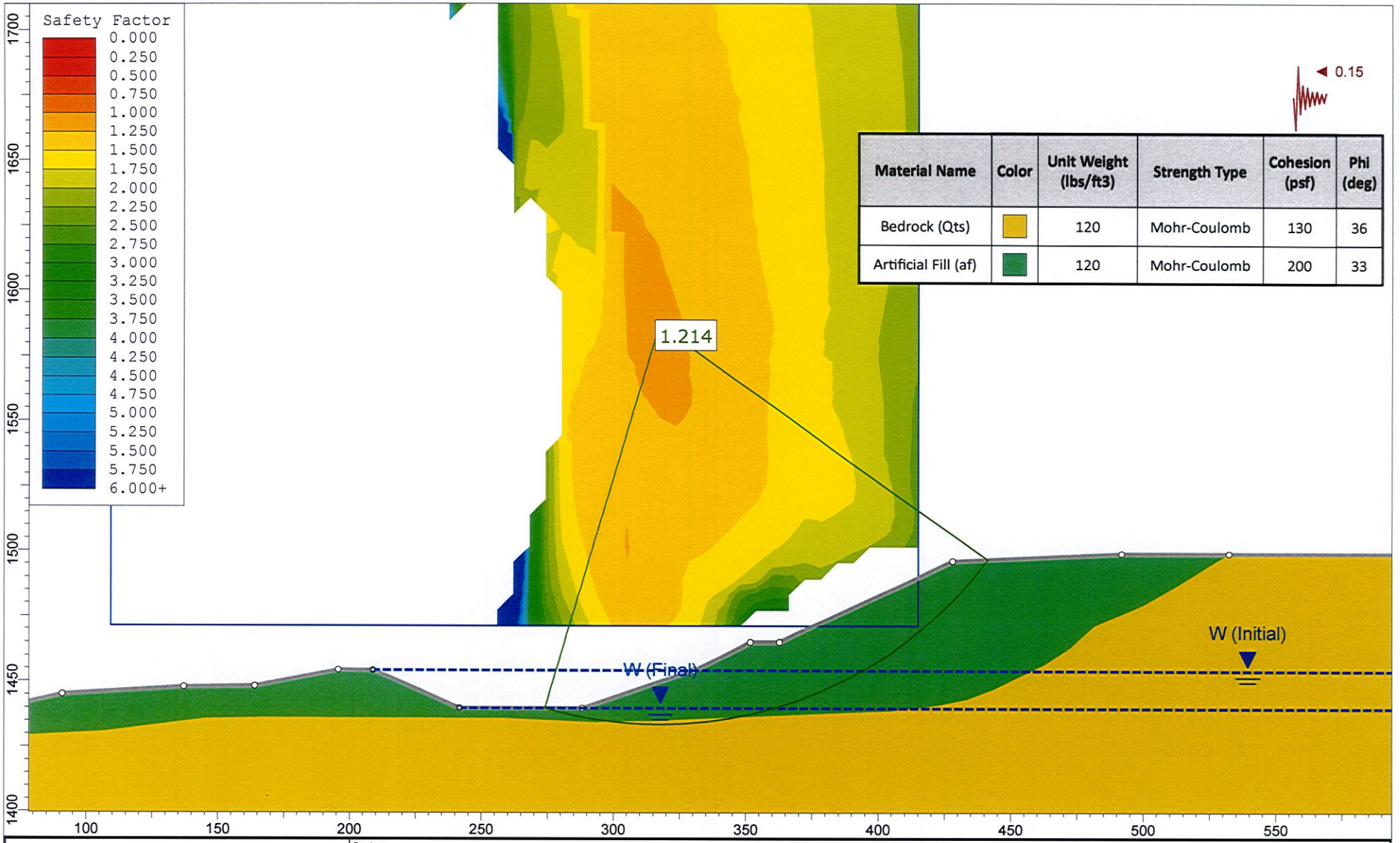
X	Y
241.715	1439.9
622	1439.9

External Boundary

X	Y
622	1240
622	1499.23
532.386	1499.23
491.904	1499.23
428.049	1496.24
362.781	1465.15
351.746	1465.15
330.417	1454.29
288.148	1439.9
241.715	1439.9
208.906	1454.29
195.722	1454.44
163.961	1448.14
137.089	1447.84
90.964	1445.1
59.681	1438.03
37.761	1434.6
0	1433
0	1425.64
0	1240

Material Boundary

X	Y
0	1425.64
34.635	1426.57
60.256	1427.03
76.672	1429.33
107.356	1431.01
145.098	1435.92
167.037	1436.38
258.629	1436.23
294.069	1434.54
314.167	1435
384.433	1438.07
404.859	1439.01
422.471	1441.13
433.478	1443.41
444.045	1447.37
462.83	1456.98
471.493	1462.63
481.683	1471.7
501.815	1480.52
520.207	1491.71
532.386	1499.23



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock (Qts)		120	Mohr-Coulomb	130	36
Artificial Fill (af)		120	Mohr-Coulomb	200	33

Project	# 6946			
Analysis Description	1-1' Rapid Drawdown (Seismic)			
Drawn By	JG	Scale	1:600	Company: GeoSoils Consultants, Inc.
Date	4/6/2017			File Name: 6946 1-1 Seismic.slim

SLIDEINTERPRET 7.009

Slide Analysis Information

6946

Project Summary

File Name:	6946 1-1 Seismic.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	1-1' Rapid Drawdown (Seismic)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/6/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	Rapid Drawdown
Rapid Drawdown Method:	Effective Stress using B-Bar

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
Minimum Area: Not Defined
Minimum Weight: Not Defined

Seismic

Advanced Seismic Analysis: No
Staged pseudostatic analysis: No

Loading

Seismic Load Coefficient (Horizontal): 0.15

Material Properties

Property	Bedrock (Qts)	Artificial Fill (af)
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120
Cohesion [psf]	130	200
Friction Angle [deg]	36	33
Water Surface	Water Table	Water Table
Hu Value	1	1
Rapid Drawdown Undrained Behaviour	Yes	Yes
RD Shear Strength Envelope Properties	CR: 0 PhiR: 0	CR: 0 PhiR: 0

Global Minimums

Method: spencer

FS	1.214300
Center:	317.172, 1587.380
Radius:	153.665
Left Slip Surface Endpoint:	274.000, 1439.904
Right Slip Surface Endpoint:	441.346, 1496.861
Resisting Moment:	.05623e+007 lb-ft
Driving Moment:	.51686e+007 lb-ft
Resisting Horizontal Force:	79590 lb
Driving Horizontal Force:	47896 lb
Total Slice Area:	521.45 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 6378
Number of Invalid Surfaces: 22233

Error Codes:

Error Code -103 reported for 251 surfaces
Error Code -106 reported for 4 surfaces
Error Code -107 reported for 14 surfaces
Error Code -108 reported for 2 surfaces
Error Code -110 reported for 20485 surfaces
Error Code -111 reported for 76 surfaces
Error Code -112 reported for 208 surfaces
Error Code -114 reported for 1193 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-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 (spencer) - Safety Factor: 1.2143

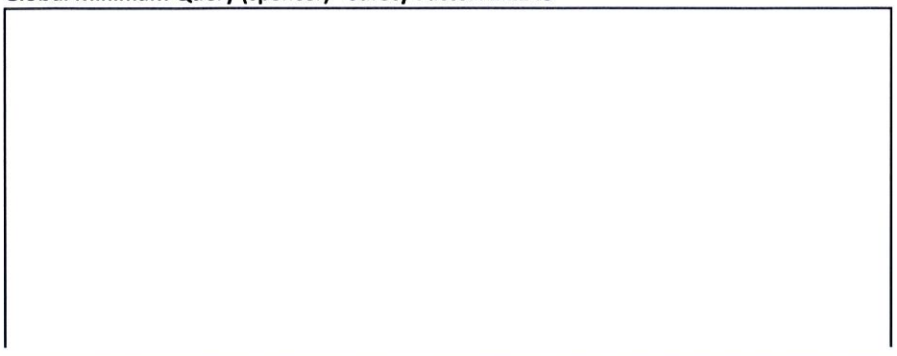
Slice Number	Width [ft]	Weight [lbs]	Angle of Slice	Base Material	Base Cohesion	Base Friction	Shear Stress	Shear Strength	Base Normal	Pore Pressure	Effective Normal

			Base [degrees]		[psf]	Angle [degrees]	[psf]	[psf]	Stress [psf]	[psf]	Stress [psf]
1	3.24874	177.852	-15.6875	Artificial Fill (af)	200	33	317.702	385.786	314.554	28.4674	286.086
2	3.24874	518.686	-14.433	Artificial Fill (af)	200	33	358.429	435.24	445.259	83.022	362.237
3	3.24874	830.028	-13.1855	Artificial Fill (af)	200	33	390.851	474.61	555.719	132.856	422.863
4	3.24874	1112.35	-11.9444	Artificial Fill (af)	200	33	416.114	505.287	648.144	178.045	470.099
5	3.24874	1455.73	-10.7089	Artificial Fill (af)	200	33	446.737	542.473	760.371	233.007	527.364
6	3.24874	2085	-9.4784	Artificial Fill (af)	200	33	509.641	618.857	978.713	333.729	644.984
7	3.24874	2713.5	-8.25233	Artificial Fill (af)	200	33	566.741	688.194	1186.08	434.328	751.752
8	3.24874	3314.36	-7.03006	Artificial Fill (af)	200	33	615.58	747.499	1373.58	530.504	843.075
9	3.26201	3904.83	-5.80851	Bedrock (Qts)	130	36	657.03	797.832	1541.66	622.473	919.191
10	3.26201	4455.46	-4.58712	Bedrock (Qts)	130	36	698.324	847.975	1698.46	710.249	988.208
11	3.26201	4978.71	-3.36781	Bedrock (Qts)	130	36	732.34	889.28	1838.72	793.661	1045.06
12	3.26201	5474.71	-2.15003	Bedrock (Qts)	130	36	759.849	922.685	1963.77	872.728	1091.04
13	3.26201	5943.53	-0.933222	Bedrock (Qts)	130	36	781.523	949.003	2074.72	947.464	1127.26
14	3.26201	6385.24	0.283165	Bedrock (Qts)	130	36	797.943	968.942	2172.58	1017.88	1154.7
15	3.26201	6799.82	1.49968	Bedrock (Qts)	130	36	809.621	983.123	2258.19	1083.97	1174.22
16	3.26201	7187.27	2.71687	Bedrock (Qts)	130	36	817.007	992.091	2332.3	1145.73	1186.57
17	3.26201	7547.51	3.93529	Bedrock (Qts)	130	36	820.497	996.33	2395.56	1203.16	1192.4
18	3.26201	7929.26	5.1555	Bedrock (Qts)	130	36	842.289	1022.79	2469.4	1240.58	1228.82
19	3.26201	8439.2	6.37806	Bedrock (Qts)	130	36	928.07	1126.95	2595.93	1223.74	1372.19
20	3.26201	8933.12	7.60354	Bedrock (Qts)	130	36	1012.16	1229.06	2711.5	1198.78	1512.72
21	3.26201	9399.2	8.83253	Bedrock (Qts)	130	36	1089.83	1323.38	2811.93	1169.38	1642.55
22	3.26201	9837.18	10.0656	Bedrock (Qts)	130	36	1161.56	1410.48	2897.93	1135.5	1762.43
23	3.4513	10853	11.3395	Artificial Fill (af)	200	33	1159.52	1408.01	2956.02	1095.84	1860.18
24	3.4513	11257.1	12.6553	Artificial Fill (af)	200	33	1214.07	1474.25	3012.24	1050.07	1962.17
25	3.4513	11131.2	13.9778	Artificial Fill (af)	200	33	1192.9	1448.54	2921.66	999.084	1922.58
26	3.4513	10757.7	15.308	Artificial Fill (af)	200	33	1141.04	1385.57	2768.42	942.806	1825.61
27	3.4513	10348.9	16.6467	Artificial Fill (af)	200	33	1089.92	1323.49	2611.15	881.136	1730.02
28	3.4513	10269.3	17.9948	Artificial Fill (af)	200	33	1088.45	1321.71	2541.25	813.963	1727.29
29	3.4513	10466.9	19.3533	Artificial	200	33	1126.57	1368	2539.72	741.164	1798.56

				Fill (af)							
30	3.4513	10626.3	20.7232	Artificial Fill (af)	200	33	1161.31	1410.18	2526.12	662.604	1863.52
31	3.4513	10746.4	22.1057	Artificial Fill (af)	200	33	1192.86	1448.49	2500.63	578.128	1922.5
32	3.4513	10826.1	23.5018	Artificial Fill (af)	200	33	1221.37	1483.11	2463.39	487.566	1975.82
33	3.4513	10864.2	24.9129	Artificial Fill (af)	200	33	1247.01	1514.24	2414.48	390.728	2023.75
34	3.4513	10859.2	26.3404	Artificial Fill (af)	200	33	1269.9	1542.04	2353.97	287.402	2066.57
35	3.4513	10809.5	27.7857	Artificial Fill (af)	200	33	1290.2	1566.69	2281.87	177.349	2104.52
36	3.4513	10713.5	29.2504	Artificial Fill (af)	200	33	1308.02	1588.33	2198.14	60.305	2137.84
37	3.38356	10363.5	30.7217	Artificial Fill (af)	200	33	1291.82	1568.66	2107.55	-62.7353	2107.55
38	3.38356	10177	32.201	Artificial Fill (af)	200	33	1241.14	1507.12	2012.78	-191.952	2012.78
39	3.38356	9940.57	33.7048	Artificial Fill (af)	200	33	1186.36	1440.6	1910.36	-328.851	1910.36
40	3.38356	9651.5	35.2354	Artificial Fill (af)	200	33	1127.56	1369.2	1800.41	-473.836	1800.41
41	3.38356	9306.84	36.7954	Artificial Fill (af)	200	33	1064.79	1292.98	1683.04	-627.364	1683.04
42	3.38356	8903.18	38.388	Artificial Fill (af)	200	33	998.131	1212.03	1558.39	-789.961	1558.39
43	3.38356	8436.58	40.0165	Artificial Fill (af)	200	33	927.634	1126.43	1426.57	-962.229	1426.57
44	3.38356	7902.49	41.6848	Artificial Fill (af)	200	33	853.375	1036.25	1287.72	-1144.87	1287.72
45	3.38356	7295.61	43.3977	Artificial Fill (af)	200	33	775.431	941.606	1141.97	-1338.7	1141.97
46	3.38356	6609.64	45.1605	Artificial Fill (af)	200	33	693.894	842.595	989.509	-1544.68	989.509
47	3.38356	5582.02	46.9797	Artificial Fill (af)	200	33	588.136	714.174	791.758	-1763.97	791.758
48	3.38356	4125.34	48.8633	Artificial Fill (af)	200	33	454.571	551.985	542.01	-1997.95	542.01
49	3.38356	2560.46	50.8207	Artificial Fill (af)	200	33	321.615	390.537	293.4	-2248.34	293.4
50	3.38356	874.893	52.8642	Artificial Fill (af)	200	33	190.445	231.257	48.1318	-2517.28	48.1318

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.2143



Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	274	1439.9	0	0	0
2	277.249	1438.99	1295.89	575.926	23.9616
3	280.497	1438.16	2758.69	1226.03	23.9615
4	283.746	1437.39	4331.15	1924.87	23.9615
5	286.995	1436.71	5966.07	2651.47	23.9616
6	290.244	1436.09	7671.03	3409.2	23.9616
7	293.492	1435.55	9550.32	4244.4	23.9616
8	296.741	1435.08	11549.5	5132.87	23.9615
9	299.99	1434.68	13609.1	6048.23	23.9616
10	303.252	1434.35	15685.3	6970.95	23.9616
11	306.514	1434.08	17747	7887.23	23.9616
12	309.776	1433.89	19750	8777.41	23.9616
13	313.038	1433.77	21656.2	9624.56	23.9616
14	316.3	1433.72	23432.7	10414.1	23.9616
15	319.562	1433.73	25051.5	11133.5	23.9615
16	322.824	1433.82	26488.4	11772.1	23.9615
17	326.086	1433.97	27723.2	12320.9	23.9616
18	329.348	1434.2	28738.9	12772.3	23.9616
19	332.61	1434.49	29579.5	13145.8	23.9614
20	335.872	1434.86	30404.5	13512.5	23.9615
21	339.134	1435.29	31196.4	13864.5	23.9616
22	342.396	1435.8	31928.1	14189.6	23.9615
23	345.658	1436.38	32576.1	14477.6	23.9615
24	349.109	1437.07	32917.4	14629.3	23.9615
25	352.561	1437.85	33098.6	14709.8	23.9615
26	356.012	1438.7	33049.7	14688.1	23.9615
27	359.463	1439.65	32771.9	14564.7	23.9616
28	362.915	1440.68	32299.1	14354.5	23.9615
29	366.366	1441.8	31679	14078.9	23.9615
30	369.817	1443.01	30931.3	13746.6	23.9615
31	373.268	1444.32	30060.2	13359.5	23.9616
32	376.72	1445.72	29073.4	12921	23.9616
33	380.171	1447.22	27981.8	12435.8	23.9615
34	383.622	1448.83	26799.9	11910.5	23.9615
35	387.074	1450.53	25546	11353.3	23.9616
36	390.525	1452.35	24242.6	10774	23.9615
37	393.976	1454.29	22916.2	10184.5	23.9615
38	397.36	1456.3	21509.4	9559.33	23.9616
39	400.743	1458.43	19907.4	8847.36	23.9616
40	404.127	1460.68	18132.2	8058.41	23.9616
41	407.51	1463.07	16209.4	7203.88	23.9616
42	410.894	1465.61	14168.7	6296.94	23.9616
43	414.278	1468.29	12044.3	5352.77	23.9615
44	417.661	1471.13	9875.31	4388.84	23.9616
45	421.045	1474.14	7707.05	3425.2	23.9615
46	424.428	1477.34	5591.5	2485	23.9615
47	427.812	1480.74	3588.82	1594.96	23.9615
48	431.195	1484.37	1877.32	834.329	23.9616
49	434.579	1488.24	702.155	312.055	23.9615
50	437.963	1492.39	191.79	85.2361	23.9615
51	441.346	1496.86	0	0	0

List Of Coordinates

Water Table

X	Y
208.906	1454.29
622	1454.29

Drawdown Line

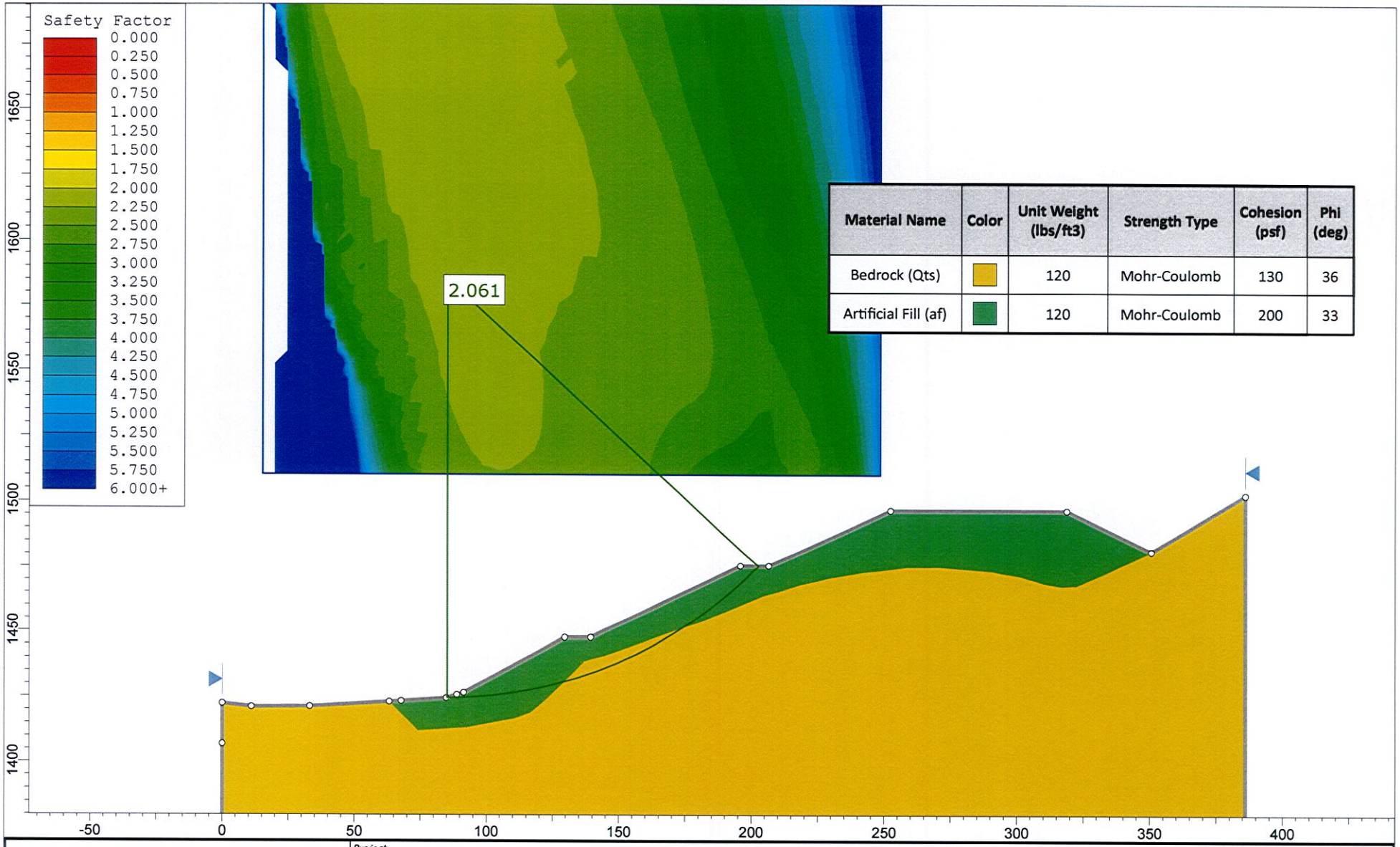
X	Y
241.715	1439.9
622	1439.9

External Boundary

X	Y
622	1240
622	1499.23
532.386	1499.23
491.904	1499.23
428.049	1496.24
362.781	1465.15
351.746	1465.15
330.417	1454.29
288.148	1439.9
241.715	1439.9
208.906	1454.29
195.722	1454.44
163.961	1448.14
137.089	1447.84
90.964	1445.1
59.681	1438.03
37.761	1434.6
0	1433
0	1425.64
0	1240

Material Boundary

X	Y
0	1425.64
34.635	1426.57
60.256	1427.03
76.672	1429.33
107.356	1431.01
145.098	1435.92
167.037	1436.38
258.629	1436.23
294.069	1434.54
314.167	1435
384.433	1438.07
404.859	1439.01
422.471	1441.13
433.478	1443.41
444.045	1447.37
462.83	1456.98
471.493	1462.63
481.683	1471.7
501.815	1480.52
520.207	1491.71
532.386	1499.23



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock (Qts)		120	Mohr-Coulomb	130	36
Artificial Fill (af)		120	Mohr-Coulomb	200	33

Project	# 6946			
Analysis Description	2-2' Global (Static)			
Drawn By	JG	Scale	1:600	Company: GeoSoils Consultants, Inc.
Date	4/7/2017			File Name: 6946 2-2 Static.slim

SLIDEINTERPRET 7.009

Slide Analysis Information

6946

Project Summary

File Name:	6946 2-2 Static.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	2-2' Global (Static)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/7/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
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
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced Seismic Analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Bedrock (Qts)	Artificial Fill (af)
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120
Cohesion [psf]	130	200
Friction Angle [deg]	36	33
Water Surface	None	None
Ru Value	0	0

Global Minimums

Method: spencer

FS	2.061040
Center:	85.152, 1585.163
Radius:	160.582
Left Slip Surface Endpoint:	85.164, 1424.581
Right Slip Surface Endpoint:	202.622, 1475.676
Resisting Moment:	.98314e+007 lb-ft
Driving Moment:	.62205e+006 lb-ft
Resisting Horizontal Force:	11835 lb
Driving Horizontal Force:	4261.4 lb
Total Slice Area:	295.92 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 27626
Number of Invalid Surfaces: 985

Error Codes:

Error Code -102 reported for 17 surfaces
Error Code -103 reported for 2 surfaces
Error Code -106 reported for 77 surfaces
Error Code -107 reported for 92 surfaces
Error Code -108 reported for 301 surfaces
Error Code -111 reported for 1 surface
Error Code -1000 reported for 495 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-111 = safety factor equation did not converge
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.06104

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	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	2.31406	99.5515	0.41726	Artificial Fill (af)	200	33	126.738	261.212	94.2589	0	94.2589
2	2.31406	294.023	1.24304	Artificial Fill (af)	200	33	155.822	321.156	186.565	0	186.565
3	2.31406	486.062	2.06907	Artificial Fill (af)	200	33	183.861	378.944	275.549	0	275.549
4	2.31406	776.348	2.89554	Artificial Fill (af)	200	33	226.015	465.825	409.334	0	409.334
5	2.31406	1094.38	3.72261	Artificial Fill (af)	200	33	271.322	559.206	553.128	0	553.128
6	2.31406	1403.09	4.55045	Artificial Fill (af)	200	33	314.224	647.628	689.288	0	689.288
7	2.31406	1702.46	5.37925	Artificial Fill (af)	200	33	354.788	731.232	818.027	0	818.027
8	2.31406	1992.43	6.20918	Artificial Fill (af)	200	33	393.078	810.15	939.546	0	939.546
9	2.31406	2272.98	7.04043	Artificial Fill (af)	200	33	429.154	884.504	1054.04	0	1054.04

10	2.31406	2544.06	7.87316	Artificial Fill (af)	200	33	463.072	954.41	1161.69	0	1161.69
11	2.31406	2805.61	8.70757	Artificial Fill (af)	200	33	494.886	1019.98	1262.66	0	1262.66
12	2.31406	3057.57	9.54385	Artificial Fill (af)	200	33	524.644	1081.31	1357.1	0	1357.1
13	2.31406	3299.88	10.3822	Artificial Fill (af)	200	33	552.394	1138.51	1445.17	0	1445.17
14	2.31406	3532.45	11.2228	Artificial Fill (af)	200	33	578.18	1191.65	1527.01	0	1527.01
15	2.31406	3755.21	12.0658	Artificial Fill (af)	200	33	602.046	1240.84	1602.74	0	1602.74
16	2.31406	3968.06	12.9115	Artificial Fill (af)	200	33	624.025	1286.14	1672.5	0	1672.5
17	2.31406	4170.91	13.7601	Artificial Fill (af)	200	33	644.155	1327.63	1736.4	0	1736.4
18	2.31406	4363.66	14.6118	Artificial Fill (af)	200	33	662.476	1365.39	1794.54	0	1794.54
19	2.31406	4546.18	15.4667	Artificial Fill (af)	200	33	679.016	1399.48	1847.03	0	1847.03
20	2.37393	4719	16.3364	Bedrock (Qts)	130	36	715.459	1474.59	1850.67	0	1850.67
21	2.37393	4521.61	17.2211	Bedrock (Qts)	130	36	680.482	1402.5	1751.45	0	1751.45
22	2.37393	4306.22	18.1101	Bedrock (Qts)	130	36	643.801	1326.9	1647.4	0	1647.4
23	2.37393	4079.18	19.0036	Bedrock (Qts)	130	36	606.335	1249.68	1541.11	0	1541.11
24	2.37393	3916.75	19.902	Bedrock (Qts)	130	36	578.13	1191.55	1461.1	0	1461.1
25	2.37393	3983.41	20.8055	Bedrock (Qts)	130	36	580.188	1195.79	1466.93	0	1466.93
26	2.37393	4055.51	21.7144	Bedrock (Qts)	130	36	582.769	1201.11	1474.26	0	1474.26
27	2.37393	4115.14	22.6291	Bedrock (Qts)	130	36	583.589	1202.8	1476.58	0	1476.58
28	2.37393	4162.05	23.5499	Bedrock (Qts)	130	36	582.667	1200.9	1473.96	0	1473.96
29	2.37393	4195.98	24.4773	Bedrock (Qts)	130	36	580.023	1195.45	1466.47	0	1466.47
30	2.37393	4216.64	25.4115	Bedrock (Qts)	130	36	575.685	1186.51	1454.16	0	1454.16
31	2.37393	4223.73	26.353	Bedrock (Qts)	130	36	569.674	1174.12	1437.1	0	1437.1
32	2.37393	4216.92	27.3022	Bedrock (Qts)	130	36	561.998	1158.3	1415.34	0	1415.34
33	2.37393	4195.86	28.2597	Bedrock (Qts)	130	36	552.682	1139.1	1388.91	0	1388.91
34	2.37393	4160.16	29.2258	Bedrock (Qts)	130	36	541.745	1116.56	1357.88	0	1357.88
35	2.37393	4109.42	30.2011	Bedrock (Qts)	130	36	529.196	1090.7	1322.28	0	1322.28
36	2.37393	4043.18	31.1862	Bedrock (Qts)	130	36	515.051	1061.54	1282.16	0	1282.16
37	2.37393	3960.97	32.1817	Bedrock (Qts)	130	36	499.321	1029.12	1237.53	0	1237.53
38	2.37393	3862.25	33.1881	Bedrock (Qts)	130	36	482.019	993.461	1188.45	0	1188.45
39	2.36546	3733.34	34.2044	Artificial	200	33	455.287	938.365	1136.98	0	1136.98

				Fill (af)							
40	2.36546	3600.89	35.2313	Artificial Fill (af)	200	33	437.022	900.72	1079.01	0	1079.01
41	2.36546	3450.28	36.2714	Artificial Fill (af)	200	33	417.351	860.178	1016.58	0	1016.58
42	2.36546	3280.79	37.3255	Artificial Fill (af)	200	33	396.279	816.746	949.705	0	949.705
43	2.36546	3091.6	38.3947	Artificial Fill (af)	200	33	373.804	770.426	878.38	0	878.38
44	2.36546	2881.86	39.4799	Artificial Fill (af)	200	33	349.932	721.224	802.615	0	802.615
45	2.36546	2650.59	40.5823	Artificial Fill (af)	200	33	324.661	669.139	722.412	0	722.412
46	2.36546	2396.72	41.7032	Artificial Fill (af)	200	33	297.991	614.171	637.767	0	637.767
47	2.36546	2119.05	42.844	Artificial Fill (af)	200	33	269.921	556.317	548.68	0	548.68
48	2.36546	1700.75	44.0062	Artificial Fill (af)	200	33	230.615	475.306	423.934	0	423.934
49	2.36546	1043.13	45.1918	Artificial Fill (af)	200	33	172.448	355.423	239.331	0	239.331
50	2.36546	352.577	46.4026	Artificial Fill (af)	200	33	113.66	234.257	52.7521	0	52.7521

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.06104

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	85.1642	1424.58	0	0	0
2	87.4782	1424.6	291.206	121.98	22.7278
3	89.7923	1424.65	641.825	268.847	22.7278
4	92.1064	1424.73	1043.55	437.12	22.7277
5	94.4204	1424.85	1517.79	635.768	22.7277
6	96.7345	1425	2061.32	863.444	22.7278
7	99.0485	1425.18	2660.31	1114.35	22.7278
8	101.363	1425.4	3301.71	1383.01	22.7277
9	103.677	1425.65	3973.27	1664.31	22.7277
10	105.991	1425.94	4663.48	1953.43	22.7277
11	108.305	1426.26	5361.54	2245.83	22.7277
12	110.619	1426.61	6057.34	2537.29	22.7278
13	112.933	1427	6741.4	2823.82	22.7277
14	115.247	1427.43	7404.85	3101.73	22.7277
15	117.561	1427.89	8039.45	3367.55	22.7277
16	119.875	1428.38	8637.52	3618.07	22.7278
17	122.189	1428.91	9191.93	3850.3	22.7278
18	124.503	1429.48	9696.1	4061.48	22.7277
19	126.817	1430.08	10144	4249.09	22.7277
20	129.131	1430.72	10530	4410.79	22.7278
21	131.505	1431.42	10937.9	4581.65	22.7278
22	133.879	1432.15	11261.9	4717.37	22.7278
23	136.253	1432.93	11508.7	4820.75	22.7278
24	138.627	1433.75	11685.7	4894.9	22.7278
25	141.001	1434.61	11800.2	4942.84	22.7277
26	143.375	1435.51	11852	4964.55	22.7278
27	145.749	1436.45	11839.4	4959.28	22.7278
28	148.123	1437.44	11761.3	4926.56	22.7278
29	150.497	1438.48	11617.2	4866.18	22.7277
30	152.871	1439.56	11407	4778.13	22.7277
31	155.245	1440.69	11131.3	4662.67	22.7278
32	157.619	1441.86	10791.4	4520.29	22.7278
33	159.992	1443.09	10389	4351.73	22.7278
34	162.366	1444.36	9926.52	4158	22.7277
35	164.74	1445.69	9406.99	3940.38	22.7277
36	167.114	1447.07	8834.16	3700.44	22.7278
37	169.488	1448.51	8212.47	3440.03	22.7278
38	171.862	1450	7547.13	3161.33	22.7278
39	174.236	1451.56	6844.15	2866.86	22.7277
40	176.602	1453.16	6091.25	2551.49	22.7277
41	178.967	1454.84	5320.71	2228.73	22.7278
42	181.332	1456.57	4541.73	1902.43	22.7277
43	183.698	1458.37	3764.61	1576.91	22.7277
44	186.063	1460.25	3000.86	1256.99	22.7277
45	188.429	1462.2	2263.31	948.053	22.7278
46	190.794	1464.22	1566.28	656.083	22.7278
47	193.16	1466.33	925.728	387.768	22.7278
48	195.525	1468.53	359.455	150.568	22.7278
49	197.891	1470.81	-64.541	-27.0348	22.7277
50	200.256	1473.19	-227.227	-95.1803	22.7277
51	202.622	1475.68	0	0	0

List Of Coordinates

External Boundary

X	Y
386	1320
386	1503.05
350.671	1481.63
318.787	1497.09
252.442	1497.09
206.548	1475.68
195.92	1475.68
139.398	1447.66
129.575	1447.66
91.411	1426.56
88.8798	1425.76
84.808	1424.47
67.739	1423.34
63.2505	1423.07
33.117	1421.25
11.056	1421.09
0	1422.37
0	1406.94
0	1320

Material Boundary

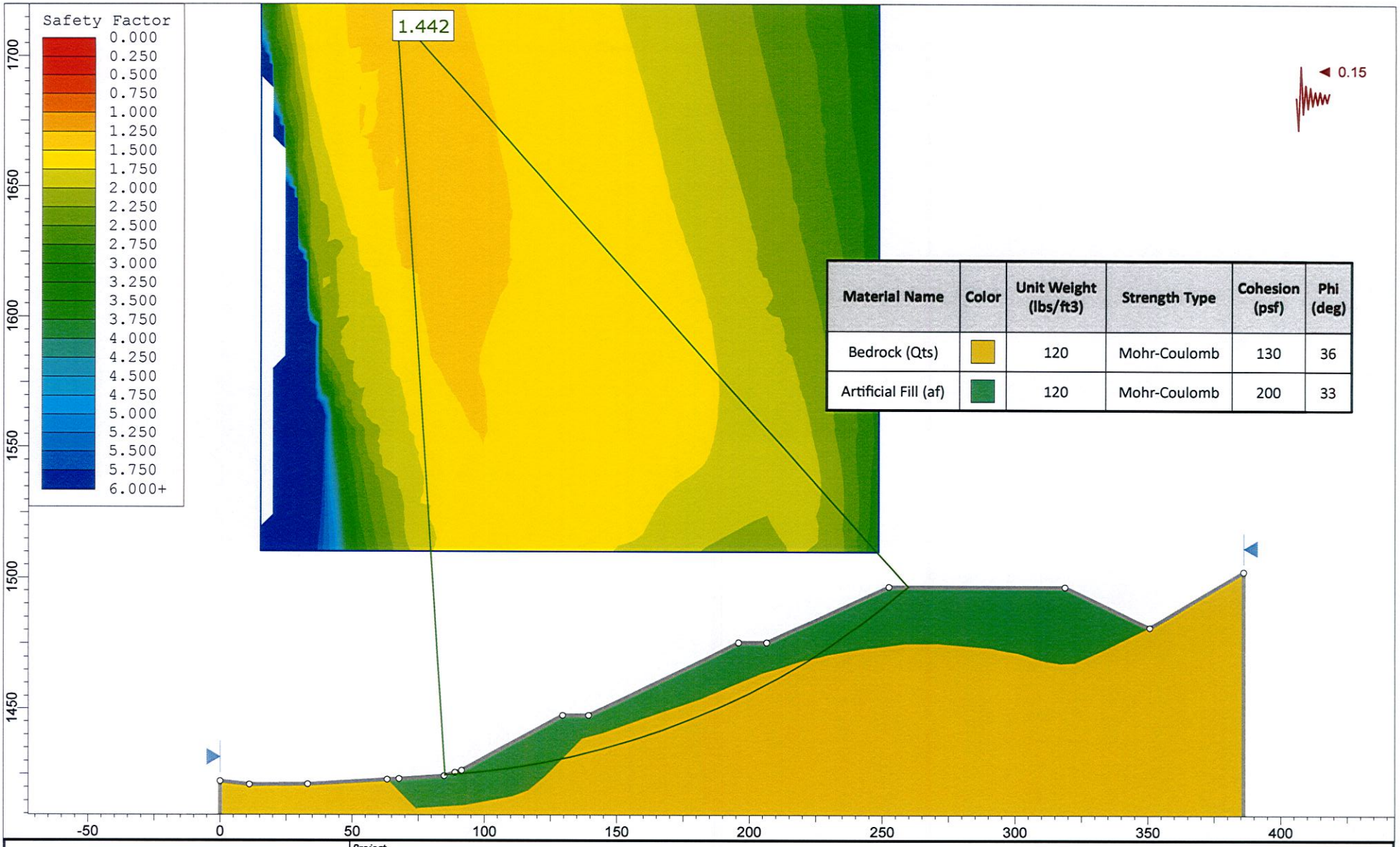
X	Y
88.8798	1425.76
136.893	1438.74
144.583	1440.81
183.792	1455.02
205.04	1464.06
218.775	1468.64
228.87	1470.98
243.427	1473.45
258.571	1475.44
269.605	1475.44
290.971	1473.68
301.419	1471.92
311.632	1468.75
317.149	1467.93
322.549	1468.28
333.936	1473.33
350.671	1481.63

Material Boundary

X	Y
63.2505	1423.07
74.0749	1412.15
92.475	1413.35
110.438	1416.7
116.49	1419.02
122.864	1424.36
131.491	1433.12
136.893	1438.74

Material Boundary

X	Y
0	1406.94
19.488	1408.27
35.827	1409.42
56.67	1411.18
74.0749	1412.15



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock (Qts)		120	Mohr-Coulomb	130	36
Artificial Fill (af)		120	Mohr-Coulomb	200	33

Project	# 6946			
Analysis Description	2-2' Global (Seismic)			
Drawn By	JG	Scale	1:600	Company: GeoSoils Consultants, Inc.
Date	4/7/2017			File Name: 6946 2-2 Seismic.slim

SLIDEINTERPRET 7.009

Slide Analysis Information

6946

Project Summary

File Name:	6946 2-2 Seismic.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	2-2' Global (Seismic)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/7/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
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
Minimum Area: Not Defined
Minimum Weight: Not Defined

Seismic

Advanced Seismic Analysis: No
Staged pseudostatic analysis: No

Loading

Seismic Load Coefficient (Horizontal): 0.15

Material Properties

Property	Bedrock (Qts)	Artificial Fill (af)
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120
Cohesion [psf]	130	200
Friction Angle [deg]	36	33
Water Surface	None	None
Ru Value	0	0

Global Minimums

Method: spencer

FS	1.442470
Center:	66.482, 1715.854
Radius:	291.883
Left Slip Surface Endpoint:	85.119, 1424.567
Right Slip Surface Endpoint:	259.715, 1497.093
Resisting Moment:	.08789e+007 lb-ft
Driving Moment:	.22045e+007 lb-ft
Resisting Horizontal Force:	92177 lb
Driving Horizontal Force:	33227 lb
Total Slice Area:	377.99 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 27681
Number of Invalid Surfaces: 930

Error Codes:

Error Code -102 reported for 17 surfaces
Error Code -103 reported for 2 surfaces
Error Code -106 reported for 77 surfaces
Error Code -108 reported for 84 surfaces
Error Code -111 reported for 255 surfaces
Error Code -1000 reported for 495 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-111 = safety factor equation did not converge
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.44247

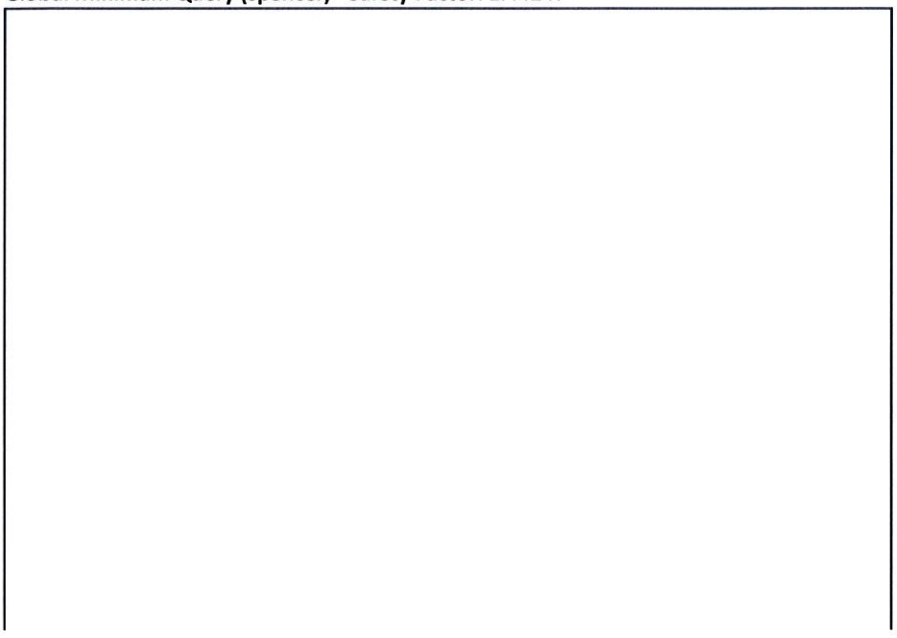
Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.39071	170.589	3.99453	Artificial Fill (af)	200	33	195.969	282.679	127.315	0	127.315
2	3.39071	507.069	4.66203	Artificial Fill (af)	200	33	243.03	350.564	231.848	0	231.848
3	3.39071	1030.03	5.33017	Artificial Fill (af)	200	33	315.46	455.041	392.729	0	392.729
4	3.39071	1655.76	5.99904	Artificial	200	33	400.496	577.704	581.614	0	581.614

				Fill (af)							
5	3.39071	2265.2	6.66873	Artificial Fill (af)	200	33	481.098	693.97	760.647	0	760.647
6	3.39071	2858.28	7.33934	Artificial Fill (af)	200	33	557.4	804.033	930.13	0	930.13
7	3.39071	3434.94	8.01095	Artificial Fill (af)	200	33	629.531	908.08	1090.35	0	1090.35
8	3.39071	3995.08	8.68368	Artificial Fill (af)	200	33	697.614	1006.29	1241.57	0	1241.57
9	3.39071	4538.64	9.35762	Artificial Fill (af)	200	33	761.764	1098.82	1384.06	0	1384.06
10	3.39071	5065.51	10.0329	Artificial Fill (af)	200	33	822.092	1185.84	1518.07	0	1518.07
11	3.39071	5575.59	10.7095	Artificial Fill (af)	200	33	878.701	1267.5	1643.81	0	1643.81
12	3.39071	6068.77	11.3877	Artificial Fill (af)	200	33	931.7	1343.95	1761.52	0	1761.52
13	3.39071	6544.95	12.0675	Artificial Fill (af)	200	33	981.171	1415.31	1871.41	0	1871.41
14	3.48642	6887.43	12.7587	Bedrock (Qts)	130	36	1049.1	1513.3	1903.94	0	1903.94
15	3.48642	6552.44	13.4614	Bedrock (Qts)	130	36	990.419	1428.65	1787.44	0	1787.44
16	3.48642	6195.78	14.1661	Bedrock (Qts)	130	36	930.259	1341.87	1667.99	0	1667.99
17	3.48642	6231.31	14.8731	Bedrock (Qts)	130	36	923.277	1331.8	1654.14	0	1654.14
18	3.48642	6557.3	15.5824	Bedrock (Qts)	130	36	954.162	1376.35	1715.45	0	1715.45
19	3.48642	6863.79	16.2942	Bedrock (Qts)	130	36	981.587	1415.91	1769.9	0	1769.9
20	3.48642	7150.58	17.0085	Bedrock (Qts)	130	36	1005.64	1450.61	1817.66	0	1817.66
21	3.48642	7417.44	17.7256	Bedrock (Qts)	130	36	1026.41	1480.57	1858.91	0	1858.91
22	3.48642	7664.14	18.4456	Bedrock (Qts)	130	36	1043.99	1505.92	1893.79	0	1893.79
23	3.48642	7890.42	19.1686	Bedrock (Qts)	130	36	1058.43	1526.76	1922.47	0	1922.47
24	3.48642	8096.03	19.8947	Bedrock (Qts)	130	36	1069.82	1543.19	1945.09	0	1945.09
25	3.48642	8280.68	20.6243	Bedrock (Qts)	130	36	1078.23	1555.32	1961.78	0	1961.78
26	3.48642	8444.08	21.3573	Bedrock (Qts)	130	36	1083.73	1563.25	1972.7	0	1972.7
27	3.48642	8585.9	22.094	Bedrock (Qts)	130	36	1086.37	1567.06	1977.95	0	1977.95
28	3.48642	8705.82	22.8346	Bedrock (Qts)	130	36	1086.23	1566.85	1977.66	0	1977.66
29	3.48642	8803.48	23.5793	Bedrock (Qts)	130	36	1083.36	1562.71	1971.95	0	1971.95
30	3.48642	8878.5	24.3282	Bedrock (Qts)	130	36	1077.8	1554.7	1960.93	0	1960.93
31	3.48642	8930.49	25.0815	Bedrock (Qts)	130	36	1069.64	1542.92	1944.72	0	1944.72
32	3.48642	8959.02	25.8396	Bedrock (Qts)	130	36	1058.9	1527.43	1923.4	0	1923.4
33	3.48642	8694.84	26.6025	Bedrock (Qts)	130	36	1017.01	1467.01	1840.23	0	1840.23

34	3.48642	7958.88	27.3705	Bedrock (Qts)	130	36	926.425	1336.34	1660.38	0	1660.38
35	3.48642	7191.19	28.1439	Bedrock (Qts)	130	36	834.763	1204.12	1478.4	0	1478.4
36	3.48642	6623.53	28.9229	Bedrock (Qts)	130	36	765.829	1104.68	1341.54	0	1341.54
37	3.48642	6473.32	29.7078	Bedrock (Qts)	130	36	740.646	1068.36	1291.54	0	1291.54
38	3.48642	6308.3	30.499	Bedrock (Qts)	130	36	714.472	1030.61	1239.58	0	1239.58
39	3.48642	6116.04	31.2965	Bedrock (Qts)	130	36	686.145	989.743	1183.34	0	1183.34
40	3.48642	5895.85	32.101	Bedrock (Qts)	130	36	655.702	945.831	1122.89	0	1122.89
41	3.63842	5886.84	32.9304	Artificial Fill (af)	200	33	614.87	886.932	1057.78	0	1057.78
42	3.63842	5582.29	33.7855	Artificial Fill (af)	200	33	582.433	840.142	985.731	0	985.731
43	3.63842	5243.23	34.6493	Artificial Fill (af)	200	33	547.981	790.446	909.206	0	909.206
44	3.63842	4868.58	35.5221	Artificial Fill (af)	200	33	511.545	737.888	828.275	0	828.275
45	3.63842	4457.19	36.4046	Artificial Fill (af)	200	33	473.153	682.509	742.999	0	742.999
46	3.63842	4007.8	37.2972	Artificial Fill (af)	200	33	432.834	624.35	653.442	0	653.442
47	3.63842	3519.05	38.2006	Artificial Fill (af)	200	33	390.615	563.451	559.665	0	559.665
48	3.63842	2989.47	39.1152	Artificial Fill (af)	200	33	346.524	499.85	461.729	0	461.729
49	3.63842	2047.5	40.042	Artificial Fill (af)	200	33	273.761	394.892	300.107	0	300.107
50	3.63842	690.011	40.9815	Artificial Fill (af)	200	33	172.523	248.859	75.2357	0	75.2357

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.44247



Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	85.1188	1424.57	0	0	0
2	88.5095	1424.8	609.348	315.885	27.4021
3	91.9002	1425.08	1293.98	670.796	27.4021
4	95.291	1425.4	2085.85	1081.3	27.4021
5	98.6817	1425.75	2989.45	1549.72	27.4021
6	102.072	1426.15	3980.88	2063.68	27.4021
7	105.463	1426.59	5037.64	2611.5	27.4021
8	108.854	1427.06	6138.6	3182.23	27.4021
9	112.244	1427.58	7263.95	3765.61	27.4021
10	115.635	1428.14	8395.09	4351.99	27.4021
11	119.026	1428.74	9514.63	4932.36	27.4021
12	122.417	1429.38	10606.3	5498.29	27.4022
13	125.807	1430.06	11655	6041.94	27.4022
14	129.198	1430.79	12646.6	6555.98	27.4022
15	132.684	1431.58	13771.4	7139.05	27.4021
16	136.171	1432.41	14753	7647.94	27.4022
17	139.657	1433.29	15602.1	8088.07	27.4021
18	143.144	1434.22	16357.7	8479.77	27.4021
19	146.63	1435.19	17035.8	8831.33	27.4021
20	150.117	1436.21	17627.9	9138.25	27.4021
21	153.603	1437.28	18126.1	9396.53	27.4021
22	157.089	1438.39	18523.8	9602.68	27.4021
23	160.576	1439.55	18815.1	9753.68	27.4021
24	164.062	1440.77	18995.1	9846.99	27.4021
25	167.549	1442.03	19059.8	9880.55	27.4021
26	171.035	1443.34	19006.2	9852.75	27.4021
27	174.521	1444.7	18832	9762.44	27.4021
28	178.008	1446.12	18535.8	9608.9	27.4021
29	181.494	1447.59	18117.2	9391.88	27.402
30	184.981	1449.11	17576.4	9111.58	27.4022
31	188.467	1450.68	16914.9	8768.63	27.4021
32	191.953	1452.32	16134.6	8364.11	27.402
33	195.44	1454	15238.5	7899.57	27.402
34	198.926	1455.75	14270.1	7397.56	27.402
35	202.413	1457.55	13312.2	6901.03	27.4022
36	205.899	1459.42	12389.3	6422.6	27.4022
37	209.386	1461.35	11483.9	5953.21	27.4021
38	212.872	1463.34	10528.2	5457.81	27.4022
39	216.358	1465.39	9529.67	4940.16	27.4021
40	219.845	1467.51	8498.58	4405.64	27.4021
41	223.331	1469.7	7446.46	3860.23	27.4021
42	226.97	1472.05	6309.94	3271.06	27.4021
43	230.608	1474.49	5194.03	2692.57	27.4021
44	234.246	1477	4116.87	2134.17	27.4021
45	237.885	1479.6	3098.16	1606.08	27.4021
46	241.523	1482.28	2159.28	1119.36	27.402
47	245.162	1485.05	1323.4	686.045	27.402
48	248.8	1487.92	615.625	319.139	27.4022
49	252.439	1490.87	63.1486	32.736	27.4021
50	256.077	1493.93	-164.597	-85.3266	27.4021
51	259.715	1497.09	0	0	0

List Of Coordinates

External Boundary

X	Y
386	1320
386	1503.05
350.671	1481.63
318.787	1497.09
252.442	1497.09
206.548	1475.68
195.92	1475.68
139.398	1447.66
129.575	1447.66
91.411	1426.56
88.8798	1425.76
84.808	1424.47
67.739	1423.34
63.2505	1423.07
33.117	1421.25
11.056	1421.09
0	1422.37
0	1406.94
0	1320

Material Boundary

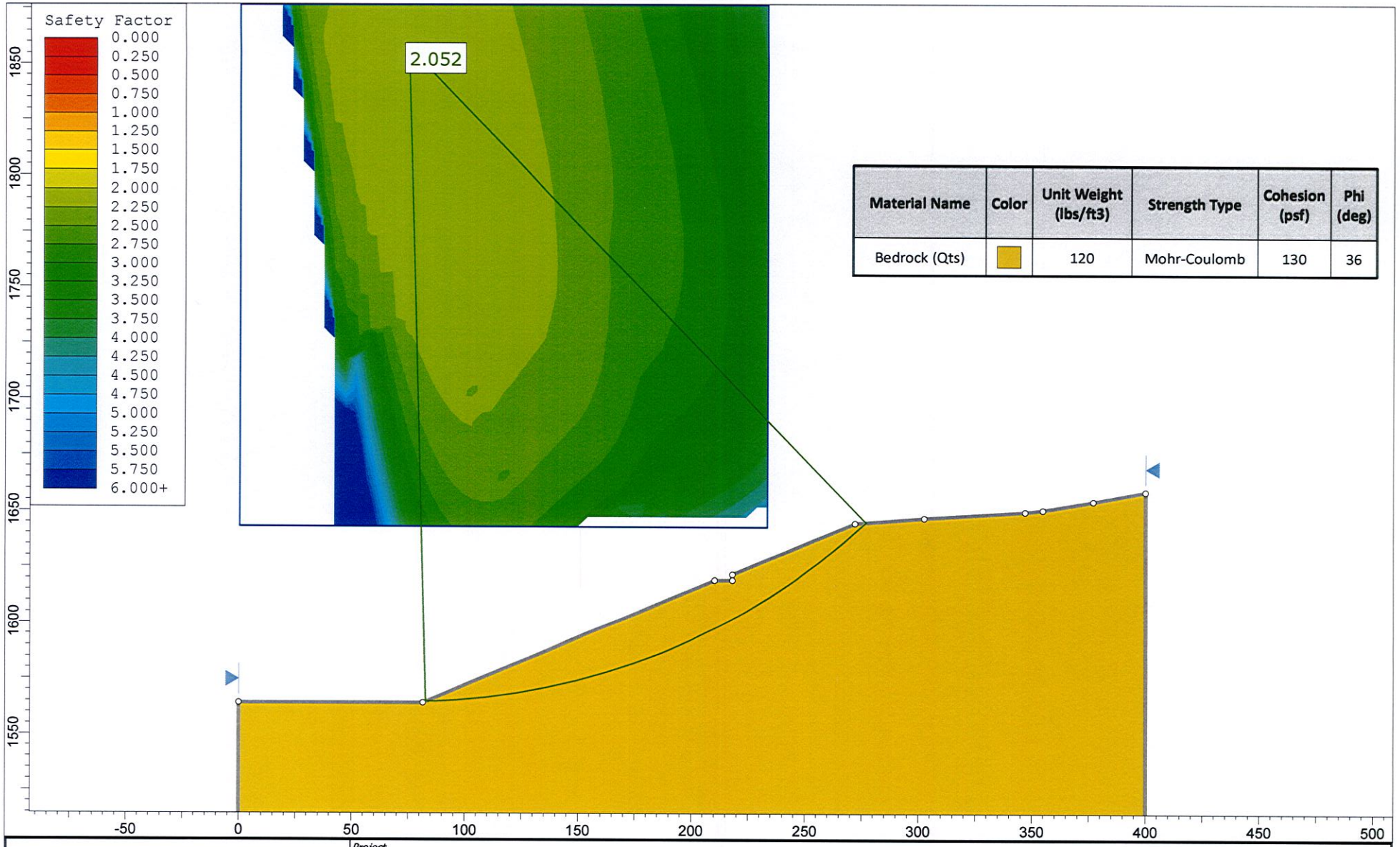
X	Y
88.8798	1425.76
136.893	1438.74
144.583	1440.81
183.792	1455.02
205.04	1464.06
218.775	1468.64
228.87	1470.98
243.427	1473.45
258.571	1475.44
269.605	1475.44
290.971	1473.68
301.419	1471.92
311.632	1468.75
317.149	1467.93
322.549	1468.28
333.936	1473.33
350.671	1481.63

Material Boundary

X	Y
63.2505	1423.07
74.0749	1412.15
92.475	1413.35
110.438	1416.7
116.49	1419.02
122.864	1424.36
131.491	1433.12
136.893	1438.74

Material Boundary

X	Y
0	1406.94
19.488	1408.27
35.827	1409.42
56.67	1411.18
74.0749	1412.15



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock (Qts)		120	Mohr-Coulomb	130	36

SLIDEINTERPRET 7.009

Project	# 6946			
Analysis Description	5-5' Global (Static)			
Drawn By	JG	Scale	1:700	Company: GeoSoils Consultants, Inc.
Date	4/7/2017			File Name: 6946 5-5 Static.slim

Slide Analysis Information

6946

Project Summary

File Name:	6946 5-5 Static.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	5-5' Global (Static)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/7/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	Rapid Drawdown
Rapid Drawdown Method:	Effective Stress using B-Bar

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
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced Seismic Analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Bedrock (Qts)
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	130
Friction Angle [deg]	36
Water Surface	None
Ru Value	0
Rapid Drawdown Undrained Behaviour	Yes
RD Shear Strength Envelope Properties	CR: 0 PhiR: 0

Global Minimums

Method: spencer

FS	2.052030
Center:	74.851, 1857.551
Radius:	293.091
Left Slip Surface Endpoint:	82.692, 1564.565
Right Slip Surface Endpoint:	276.967, 1645.297
Resisting Moment:	.91166e+007 lb-ft
Driving Moment:	.85553e+007 lb-ft
Resisting Horizontal Force:	47328 lb
Driving Horizontal Force:	20529 lb
Total Slice Area:	945.26 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 14952
Number of Invalid Surfaces: 13659

Error Codes:

Error Code -102 reported for 462 surfaces
Error Code -103 reported for 145 surfaces
Error Code -106 reported for 246 surfaces
Error Code -108 reported for 2430 surfaces
Error Code -111 reported for 45 surfaces
Error Code -114 reported for 215 surfaces
Error Code -116 reported for 10116 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-111 = safety factor equation did not converge
-114 = Surface with Reverse Curvature.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.05203

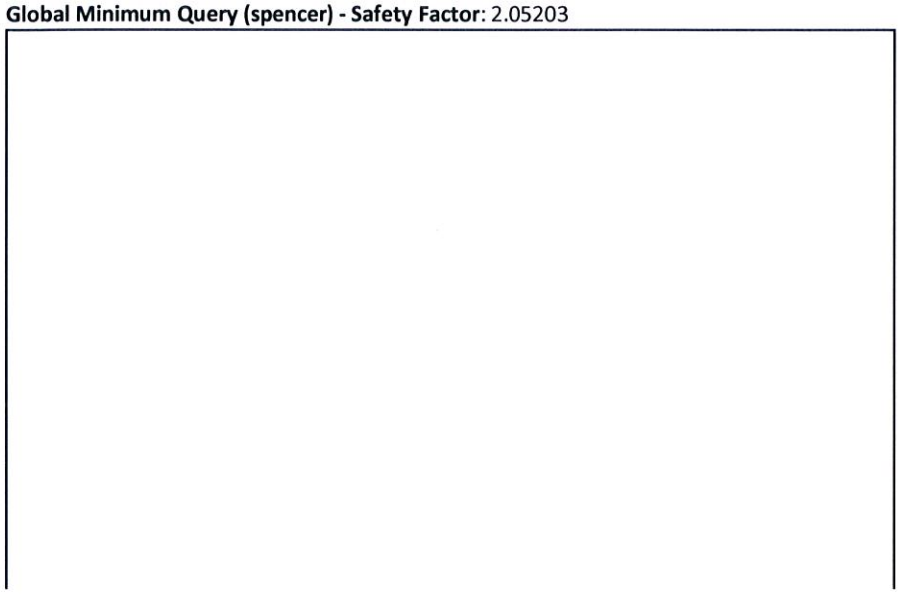
Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.8855	358.699	1.91283	Bedrock (Qts)	130	36	109.271	224.227	129.692	0	129.692
2	3.8855	1064.06	2.67303	Bedrock (Qts)	130	36	180.166	369.706	329.928	0	329.928
3	3.8855	1745.32	3.4337	Bedrock	130	36	247.1	507.057	518.974	0	518.974

				(Qts)							
4	3.8855	2402.44	4.19497	Bedrock (Qts)	130	36	310.186	636.511	697.152	0	697.152
5	3.8855	3035.34	4.95699	Bedrock (Qts)	130	36	369.53	758.287	864.763	0	864.763
6	3.8855	3643.94	5.71989	Bedrock (Qts)	130	36	425.233	872.59	1022.09	0	1022.09
7	3.8855	4228.17	6.48381	Bedrock (Qts)	130	36	477.389	979.616	1169.4	0	1169.4
8	3.8855	4787.91	7.24889	Bedrock (Qts)	130	36	526.088	1079.55	1306.94	0	1306.94
9	3.8855	5323.04	8.01527	Bedrock (Qts)	130	36	571.415	1172.56	1434.96	0	1434.96
10	3.8855	5833.44	8.7831	Bedrock (Qts)	130	36	613.451	1258.82	1553.68	0	1553.68
11	3.8855	6318.95	9.55252	Bedrock (Qts)	130	36	652.271	1338.48	1663.32	0	1663.32
12	3.8855	6779.41	10.3237	Bedrock (Qts)	130	36	687.943	1411.68	1764.08	0	1764.08
13	3.8855	7214.65	11.0967	Bedrock (Qts)	130	36	720.545	1478.58	1856.16	0	1856.16
14	3.8855	7624.47	11.8718	Bedrock (Qts)	130	36	750.13	1539.29	1939.73	0	1939.73
15	3.8855	8008.66	12.6492	Bedrock (Qts)	130	36	776.772	1593.96	2014.96	0	2014.96
16	3.8855	8366.99	13.4289	Bedrock (Qts)	130	36	800.519	1642.69	2082.03	0	2082.03
17	3.8855	8699.22	14.2111	Bedrock (Qts)	130	36	821.426	1685.59	2141.09	0	2141.09
18	3.8855	9005.08	14.9961	Bedrock (Qts)	130	36	839.554	1722.79	2192.28	0	2192.28
19	3.8855	9284.28	15.7839	Bedrock (Qts)	130	36	854.944	1754.37	2235.75	0	2235.75
20	3.8855	9536.53	16.5748	Bedrock (Qts)	130	36	867.643	1780.43	2271.62	0	2271.62
21	3.8855	9761.5	17.369	Bedrock (Qts)	130	36	877.702	1801.07	2300.03	0	2300.03
22	3.8855	9958.84	18.1666	Bedrock (Qts)	130	36	885.158	1816.37	2321.09	0	2321.09
23	3.8855	10128.2	18.968	Bedrock (Qts)	130	36	890.05	1826.41	2334.91	0	2334.91
24	3.8855	10269.1	19.7731	Bedrock (Qts)	130	36	892.424	1831.28	2341.61	0	2341.61
25	3.8855	10381.2	20.5824	Bedrock (Qts)	130	36	892.307	1831.04	2341.28	0	2341.28
26	3.8855	10464	21.396	Bedrock (Qts)	130	36	889.734	1825.76	2334.02	0	2334.02
27	3.8855	10517.1	22.2141	Bedrock (Qts)	130	36	884.743	1815.52	2319.92	0	2319.92
28	3.8855	10539.9	23.037	Bedrock (Qts)	130	36	877.36	1800.37	2299.07	0	2299.07
29	3.8855	10531.9	23.865	Bedrock (Qts)	130	36	867.619	1780.38	2271.55	0	2271.55
30	3.8855	10492.4	24.6984	Bedrock (Qts)	130	36	855.538	1755.59	2237.44	0	2237.44
31	3.8855	10420.9	25.5373	Bedrock (Qts)	130	36	841.152	1726.07	2196.8	0	2196.8
32	3.8855	10316.8	26.3821	Bedrock (Qts)	130	36	824.481	1691.86	2149.72	0	2149.72

33	3.8855	10170.2	27.2332	Bedrock (Qts)	130	36	804.891	1651.66	2094.39	0	2094.39
34	3.8855	9500.1	28.0909	Bedrock (Qts)	130	36	747.703	1534.31	1932.87	0	1932.87
35	3.8855	8681.02	28.9554	Bedrock (Qts)	130	36	680.974	1397.38	1744.4	0	1744.4
36	3.8855	9148.58	29.8272	Bedrock (Qts)	130	36	706.486	1449.73	1816.46	0	1816.46
37	3.8855	8865.42	30.7067	Bedrock (Qts)	130	36	678.801	1392.92	1738.26	0	1738.26
38	3.8855	8544.46	31.5943	Bedrock (Qts)	130	36	648.962	1331.69	1653.99	0	1653.99
39	3.8855	8184.61	32.4905	Bedrock (Qts)	130	36	616.984	1266.07	1563.67	0	1563.67
40	3.8855	7784.73	33.3956	Bedrock (Qts)	130	36	582.886	1196.1	1467.37	0	1467.37
41	3.8855	7343.56	34.3103	Bedrock (Qts)	130	36	546.685	1121.82	1365.12	0	1365.12
42	3.8855	6859.75	35.2351	Bedrock (Qts)	130	36	508.393	1043.24	1256.96	0	1256.96
43	3.8855	6331.84	36.1705	Bedrock (Qts)	130	36	468.025	960.401	1142.95	0	1142.95
44	3.8855	5758.26	37.1173	Bedrock (Qts)	130	36	425.596	873.335	1023.11	0	1023.11
45	3.8855	5137.28	38.076	Bedrock (Qts)	130	36	381.12	782.07	897.498	0	897.498
46	3.8855	4467.03	39.0475	Bedrock (Qts)	130	36	334.613	686.635	766.143	0	766.143
47	3.8855	3745.47	40.0325	Bedrock (Qts)	130	36	286.086	587.058	629.087	0	629.087
48	3.8855	2970.36	41.032	Bedrock (Qts)	130	36	235.557	483.371	486.373	0	486.373
49	3.8855	2119.64	42.0469	Bedrock (Qts)	130	36	181.874	373.21	334.749	0	334.749
50	3.8855	775.958	43.0783	Bedrock (Qts)	130	36	104.595	214.632	116.485	0	116.485

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.05203

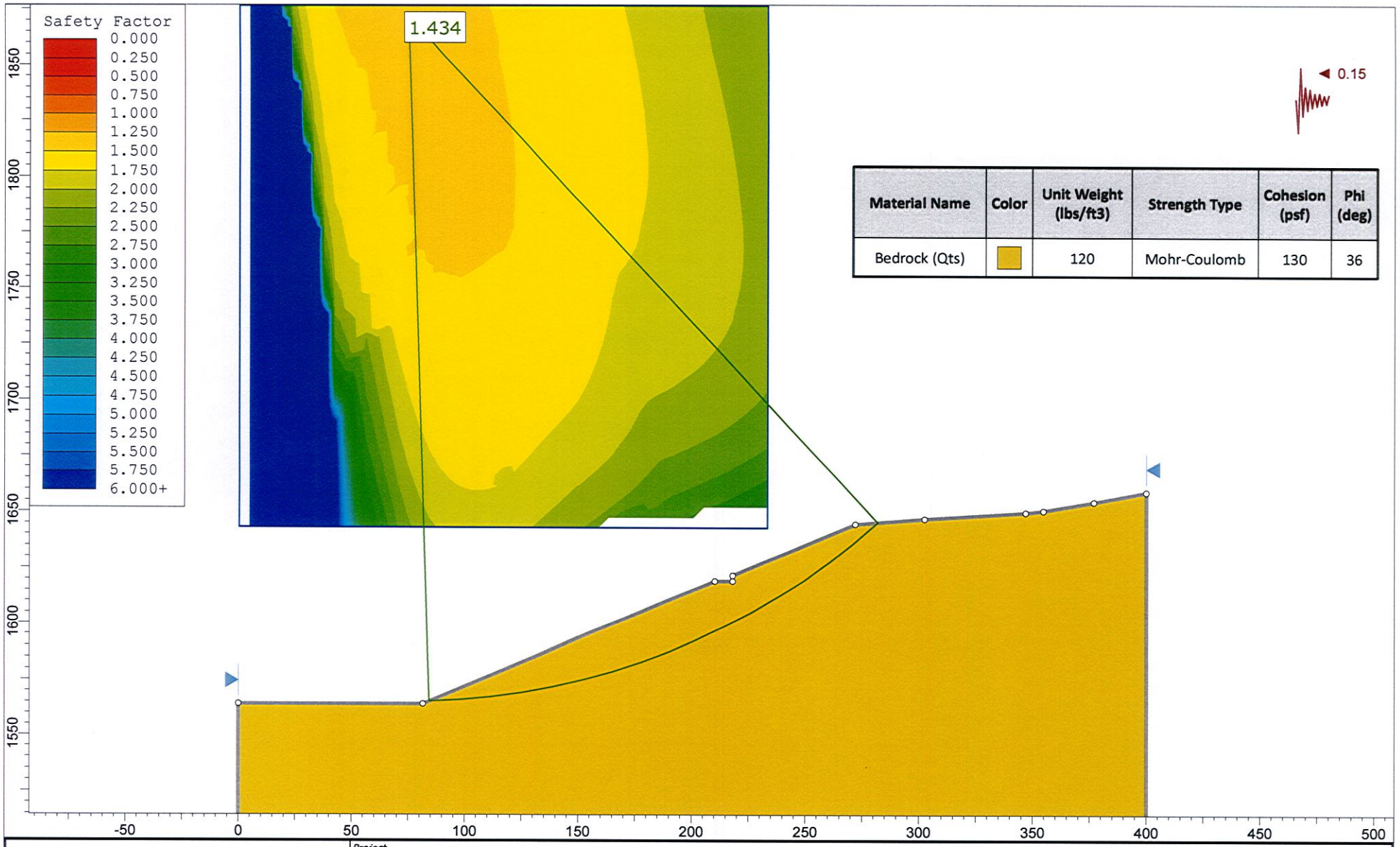


Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	82.6916	1564.56	0	0	0
2	86.5771	1564.69	407.611	161.365	21.5976
3	90.4626	1564.88	1047.58	414.717	21.5977
4	94.3481	1565.11	1886.4	746.79	21.5977
5	98.2336	1565.39	2892.57	1145.12	21.5978
6	102.119	1565.73	4036.52	1597.98	21.5977
7	106.005	1566.12	5290.46	2094.4	21.5977
8	109.89	1566.56	6628.4	2624.06	21.5977
9	113.776	1567.06	8025.96	3177.33	21.5977
10	117.661	1567.6	9460.4	3745.2	21.5977
11	121.547	1568.2	10910.5	4319.26	21.5977
12	125.432	1568.86	12356.5	4891.71	21.5977
13	129.318	1569.57	13780.1	5455.29	21.5977
14	133.203	1570.33	15164.4	6003.3	21.5977
15	137.089	1571.14	16493.8	6529.57	21.5976
16	140.974	1572.02	17753.9	7028.43	21.5977
17	144.86	1572.94	18931.8	7494.74	21.5977
18	148.745	1573.93	20015.7	7923.82	21.5976
19	152.631	1574.97	20994.9	8311.5	21.5977
20	156.516	1576.07	21860.3	8654.06	21.5976
21	160.402	1577.22	22603.4	8948.26	21.5977
22	164.287	1578.44	23217.4	9191.31	21.5976
23	168.173	1579.71	23696.2	9380.89	21.5977
24	172.058	1581.05	24035.3	9515.12	21.5977
25	175.944	1582.45	24231	9592.58	21.5976
26	179.829	1583.91	24280.8	9612.3	21.5977
27	183.715	1585.43	24183.5	9573.78	21.5977
28	187.6	1587.01	23938.9	9476.97	21.5977
29	191.486	1588.67	23548.2	9322.29	21.5977
30	195.371	1590.39	23013.5	9110.63	21.5977
31	199.257	1592.17	22338.4	8843.36	21.5977
32	203.142	1594.03	21527.6	8522.36	21.5977
33	207.028	1595.96	20587	8150.02	21.5977
34	210.913	1597.96	19525.3	7729.69	21.5977
35	214.799	1600.03	18421.1	7292.55	21.5976
36	218.684	1602.18	17316	6855.1	21.5977
37	222.57	1604.41	16013.7	6339.54	21.5977
38	226.455	1606.71	14639.1	5795.34	21.5977
39	230.341	1609.1	13207.1	5228.44	21.5977
40	234.226	1611.58	11734.5	4645.45	21.5976
41	238.112	1614.14	10239.8	4053.74	21.5977
42	241.997	1616.79	8743.63	3461.44	21.5977
43	245.883	1619.54	7268.66	2877.53	21.5977
44	249.768	1622.38	5839.85	2311.89	21.5977
45	253.654	1625.32	4484.61	1775.37	21.5977
46	257.539	1628.36	3233.02	1279.89	21.5977
47	261.425	1631.51	2118.07	838.504	21.5977
48	265.31	1634.78	1175.93	465.527	21.5976
49	269.196	1638.16	446.266	176.668	21.5976
50	273.081	1641.66	-20.3394	-8.05197	21.5976
51	276.967	1645.3	0	0	0

List Of Coordinates

External Boundary

X	Y
400	1480
400	1659.19
376.988	1654.84
354.774	1650.96
347.016	1650.14
302.568	1647.31
272.113	1644.92
218.154	1621.86
218.154	1619.37
210.322	1619.37
81.553	1564.08
0	1564.08
0	1480



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock (Qts)		120	Mohr-Coulomb	130	36

SLIDEINTERPRET 7.009

Project	# 6946			
Analysis Description	5-5' Global (Seismic)			
Drawn By	JG	Scale	1:700	Company: GeoSoils Consultants, Inc.
Date	4/7/2017			File Name: 6946 5-5 Seismic.slim

Slide Analysis Information

6946

Project Summary

File Name:	6946 5-5 Seismic.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	5-5' Global (Seismic)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/7/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	Rapid Drawdown
Rapid Drawdown Method:	Effective Stress using B-Bar

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
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced Seismic Analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.15

Material Properties

Property	Bedrock (Qts)
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	130
Friction Angle [deg]	36
Water Surface	None
Ru Value	0
Rapid Drawdown Undrained Behaviour	Yes
RD Shear Strength Envelope Properties	CR: 0 PhiR: 0

Global Minimums

Method: spencer

FS	1.433790
Center:	74.851, 1871.538
Radius:	306.433
Left Slip Surface Endpoint:	84.289, 1565.251
Right Slip Surface Endpoint:	281.957, 1645.688
Resisting Moment:	.20863e+007 lb-ft
Driving Moment:	.72513e+007 lb-ft
Resisting Horizontal Force:	47088 lb
Driving Horizontal Force:	72332 lb
Total Slice Area:	093.67 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 17293
Number of Invalid Surfaces: 11318

Error Codes:

Error Code -102 reported for 462 surfaces
Error Code -103 reported for 145 surfaces
Error Code -106 reported for 246 surfaces
Error Code -108 reported for 15 surfaces
Error Code -111 reported for 119 surfaces
Error Code -114 reported for 215 surfaces
Error Code -116 reported for 10116 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-111 = safety factor equation did not converge
-114 = Surface with Reverse Curvature.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.43379

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	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	3.95337	367.706	2.13467	Bedrock (Qts)	130	36	172.04	246.669	160.581	0	160.581
2	3.95337	1090.98	2.87458	Bedrock (Qts)	130	36	277.199	397.445	368.107	0	368.107
3	3.95337	1789.97	3.61498	Bedrock	130	36	375.579	538.502	562.254	0	562.254

				(Qts)							
4	3.95337	2464.61	4.35598	Bedrock (Qts)	130	36	467.451	670.226	743.558	0	743.558
5	3.95337	3114.85	5.09772	Bedrock (Qts)	130	36	553.067	792.982	912.518	0	912.518
6	3.95337	3740.59	5.84031	Bedrock (Qts)	130	36	632.668	907.113	1069.6	0	1069.6
7	3.95337	4341.76	6.58388	Bedrock (Qts)	130	36	706.478	1012.94	1215.26	0	1215.26
8	3.95337	4918.24	7.32858	Bedrock (Qts)	130	36	774.708	1110.77	1349.91	0	1349.91
9	3.95337	5469.92	8.07451	Bedrock (Qts)	130	36	837.556	1200.88	1473.94	0	1473.94
10	3.95337	5996.66	8.82183	Bedrock (Qts)	130	36	895.215	1283.55	1587.73	0	1587.73
11	3.95337	6498.33	9.57067	Bedrock (Qts)	130	36	947.858	1359.03	1691.62	0	1691.62
12	3.95337	6974.76	10.3212	Bedrock (Qts)	130	36	995.655	1427.56	1785.94	0	1785.94
13	3.95337	7425.78	11.0734	Bedrock (Qts)	130	36	1038.76	1489.37	1871.01	0	1871.01
14	3.95337	7851.19	11.8277	Bedrock (Qts)	130	36	1077.33	1544.66	1947.12	0	1947.12
15	3.95337	8250.79	12.584	Bedrock (Qts)	130	36	1111.5	1593.66	2014.55	0	2014.55
16	3.95337	8624.36	13.3425	Bedrock (Qts)	130	36	1141.41	1636.54	2073.57	0	2073.57
17	3.95337	8971.67	14.1035	Bedrock (Qts)	130	36	1167.18	1673.49	2124.43	0	2124.43
18	3.95337	9292.44	14.8669	Bedrock (Qts)	130	36	1188.93	1704.68	2167.36	0	2167.36
19	3.95337	9586.42	15.6331	Bedrock (Qts)	130	36	1206.79	1730.28	2202.6	0	2202.6
20	3.95337	9853.29	16.4022	Bedrock (Qts)	130	36	1220.86	1750.45	2230.36	0	2230.36
21	3.95337	10092.8	17.1743	Bedrock (Qts)	130	36	1231.23	1765.33	2250.84	0	2250.84
22	3.95337	10304.5	17.9497	Bedrock (Qts)	130	36	1238.02	1775.06	2264.23	0	2264.23
23	3.95337	10488.1	18.7285	Bedrock (Qts)	130	36	1241.31	1779.78	2270.73	0	2270.73
24	3.95337	10643.2	19.5108	Bedrock (Qts)	130	36	1241.2	1779.62	2270.51	0	2270.51
25	3.95337	10769.4	20.297	Bedrock (Qts)	130	36	1237.77	1774.7	2263.74	0	2263.74
26	3.95337	10866.3	21.0872	Bedrock (Qts)	130	36	1231.1	1765.14	2250.58	0	2250.58
27	3.95337	10933.4	21.8816	Bedrock (Qts)	130	36	1221.27	1751.04	2231.17	0	2231.17
28	3.95337	10970.2	22.6805	Bedrock (Qts)	130	36	1208.35	1732.52	2205.68	0	2205.68
29	3.95337	10976.2	23.484	Bedrock (Qts)	130	36	1192.41	1709.67	2174.23	0	2174.23
30	3.95337	10950.8	24.2925	Bedrock (Qts)	130	36	1173.53	1682.6	2136.97	0	2136.97
31	3.95337	10893.5	25.1062	Bedrock (Qts)	130	36	1151.77	1651.39	2094.02	0	2094.02
32	3.95337	10797.7	25.9253	Bedrock (Qts)	130	36	1126.63	1615.35	2044.4	0	2044.4

33	3.95337	10181	26.7501	Bedrock (Qts)	130	36	1052.66	1509.29	1898.43	0	1898.43
34	3.95337	9390.34	27.581	Bedrock (Qts)	130	36	964.318	1382.63	1724.1	0	1724.1
35	3.95337	9914.54	28.4182	Bedrock (Qts)	130	36	998.877	1432.18	1792.29	0	1792.29
36	3.95337	9683.14	29.2621	Bedrock (Qts)	130	36	963.802	1381.89	1723.08	0	1723.08
37	3.95337	9415.28	30.1131	Bedrock (Qts)	130	36	926.203	1327.98	1648.87	0	1648.87
38	3.95337	9110.02	30.9714	Bedrock (Qts)	130	36	886.113	1270.5	1569.76	0	1569.76
39	3.95337	8766.37	31.8375	Bedrock (Qts)	130	36	843.582	1209.52	1485.84	0	1485.84
40	3.95337	8383.24	32.7118	Bedrock (Qts)	130	36	798.673	1145.13	1397.2	0	1397.2
41	3.95337	7959.47	33.5948	Bedrock (Qts)	130	36	751.419	1077.38	1303.95	0	1303.95
42	3.95337	7493.82	34.4869	Bedrock (Qts)	130	36	701.869	1006.33	1206.17	0	1206.17
43	3.95337	6984.94	35.3887	Bedrock (Qts)	130	36	650.069	932.062	1103.94	0	1103.94
44	3.95337	6431.38	36.3006	Bedrock (Qts)	130	36	596.061	854.627	997.363	0	997.363
45	3.95337	5831.58	37.2234	Bedrock (Qts)	130	36	539.89	774.089	886.512	0	886.512
46	3.95337	5183.82	38.1576	Bedrock (Qts)	130	36	481.6	690.513	771.48	0	771.48
47	3.95337	4486.26	39.1039	Bedrock (Qts)	130	36	421.233	603.959	652.349	0	652.349
48	3.95337	3658.29	40.0631	Bedrock (Qts)	130	36	352.984	506.105	517.663	0	517.663
49	3.95337	2285.63	41.036	Bedrock (Qts)	130	36	247.08	354.261	308.668	0	308.668
50	3.95337	771.491	42.0235	Bedrock (Qts)	130	36	131.893	189.106	81.3526	0	81.3526

Interslice Data

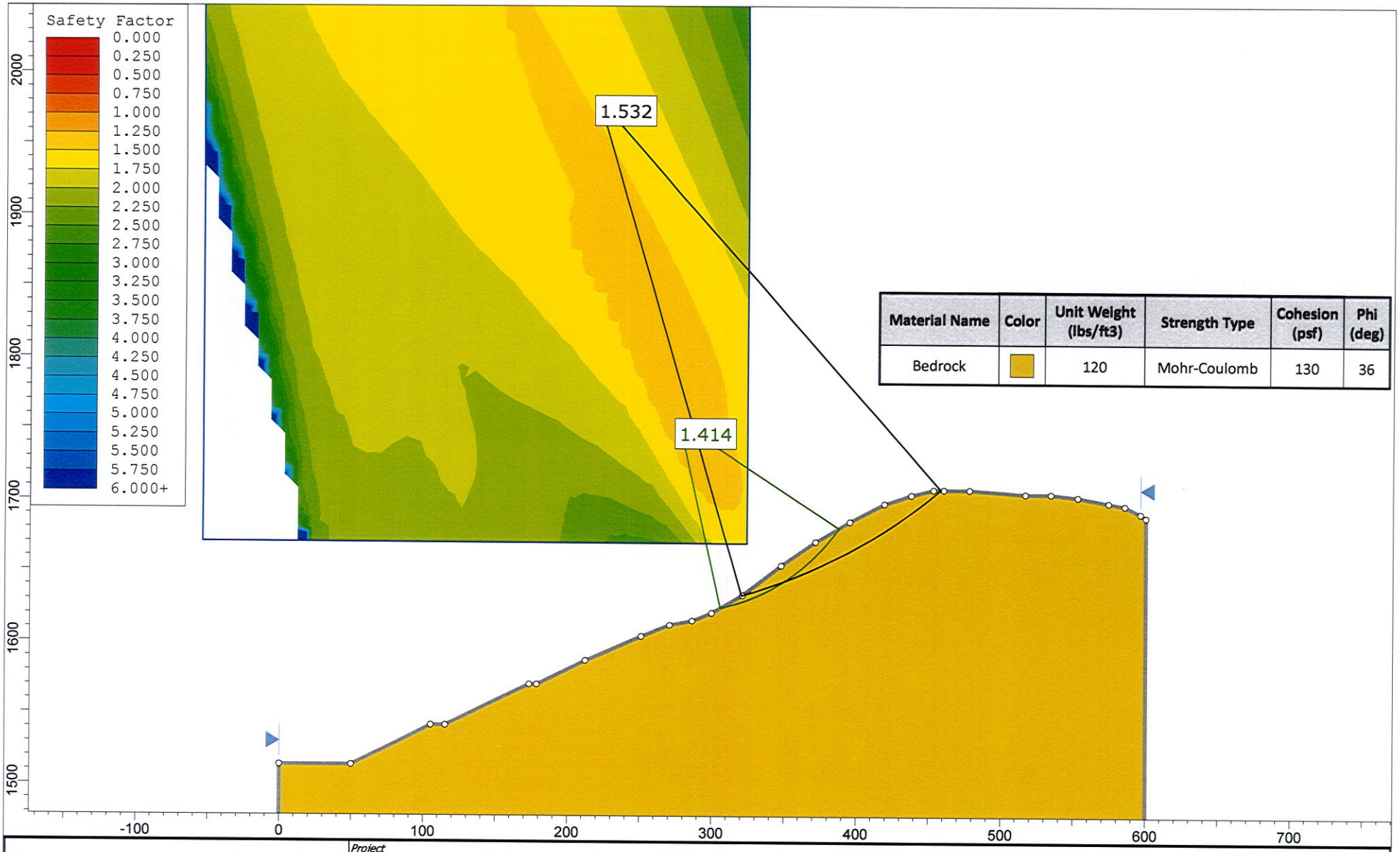
Global Minimum Query (spencer) - Safety Factor: 1.43379

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	84.2887	1565.25	0	0	0
2	88.242	1565.4	602.556	303.767	26.7541
3	92.1954	1565.6	1463.7	737.898	26.7541
4	96.1488	1565.85	2542.29	1281.64	26.754
5	100.102	1566.15	3800.05	1915.72	26.7541
6	104.056	1566.5	5201.47	2622.22	26.7541
7	108.009	1566.9	6713.58	3384.52	26.7541
8	111.962	1567.36	8305.86	4187.24	26.7541
9	115.916	1567.87	9950.06	5016.13	26.7541
10	119.869	1568.43	11620.1	5858.06	26.7541
11	123.822	1569.04	13292	6700.92	26.7541
12	127.776	1569.71	14943.7	7533.6	26.7541
13	131.729	1570.43	16555.1	8345.93	26.7541
14	135.683	1571.2	18107.7	9128.64	26.7541
15	139.636	1572.03	19584.8	9873.31	26.7541
16	143.589	1572.91	20971.5	10572.4	26.7541
17	147.543	1573.85	22254.2	11219	26.754
18	151.496	1574.85	23421	11807.3	26.7542
19	155.449	1575.89	24461.4	12331.8	26.7542
20	159.403	1577	25366.4	12788	26.7541
21	163.356	1578.16	26128.2	13172	26.754
22	167.31	1579.39	26740.5	13480.7	26.7541
23	171.263	1580.67	27198.3	13711.5	26.7541
24	175.216	1582.01	27497.9	13862.5	26.754
25	179.17	1583.41	27636.7	13932.5	26.7541
26	183.123	1584.87	27613.7	13920.9	26.7541
27	187.076	1586.39	27428.6	13827.6	26.7541
28	191.03	1587.98	27083	13653.4	26.7541
29	194.983	1589.63	26579.1	13399.3	26.754
30	198.937	1591.35	25920.7	13067.4	26.754
31	202.89	1593.14	25112.7	12660.1	26.7541
32	206.843	1594.99	24161.4	12180.5	26.7541
33	210.797	1596.91	23074.9	11632.7	26.7539
34	214.75	1598.9	21933.9	11057.6	26.7542
35	218.703	1600.97	20784.2	10477.9	26.754
36	222.657	1603.11	19419	9789.72	26.7541
37	226.61	1605.32	17967	9057.69	26.754
38	230.564	1607.62	16442.3	8289.05	26.754
39	234.517	1609.99	14860.6	7491.7	26.7541
40	238.47	1612.44	13239.4	6674.36	26.754
41	242.424	1614.98	11597.3	5846.57	26.7541
42	246.377	1617.61	9955.15	5018.7	26.7541
43	250.33	1620.32	8335.23	4202.05	26.7541
44	254.284	1623.13	6761.88	3408.87	26.7541
45	258.237	1626.04	5261.47	2652.47	26.7541
46	262.191	1629.04	3862.53	1947.22	26.7541
47	266.144	1632.15	2595.95	1308.7	26.7541
48	270.097	1635.36	1495.16	753.758	26.7541
49	274.051	1638.68	623.362	314.256	26.7541
50	278.004	1642.13	196.973	99.3003	26.7541
51	281.957	1645.69	0	0	0

List Of Coordinates

External Boundary

X	Y
400	1480
400	1659.19
376.988	1654.84
354.774	1650.96
347.016	1650.14
302.568	1647.31
272.113	1644.92
218.154	1621.86
218.154	1619.37
210.322	1619.37
81.553	1564.08
0	1564.08
0	1480



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock		120	Mohr-Coulomb	130	36

SLIDEINTERPRET 7.009

Project	# 6946			
Analysis Description	9-9' Global (Static)			
Drawn By	JG	Scale	1:1100	Company: GeoSoils Consultants, Inc.
Date	4/11/2017			File Name: 6946 9-9 Static.slim

Slide Analysis Information

6946

Project Summary

File Name:	6946 9-9 Static.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	9-9' Global (Static)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/11/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
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
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced Seismic Analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Bedrock
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	130
Friction Angle [deg]	36
Water Surface	None
Ru Value	0

Global Minimums

Method: bishop simplified

FS	1.414080
Center:	276.659, 1755.326
Radius:	133.206
Left Slip Surface Endpoint:	305.646, 1625.312
Right Slip Surface Endpoint:	387.555, 1681.528
Resisting Moment:	.18071e+006 lb-ft
Driving Moment:	.78519e+006 lb-ft
Total Slice Area:	51.387 ft2

Method: spencer

FS	1.411940
Center:	286.106, 1745.880
Radius:	120.139
Left Slip Surface Endpoint:	310.674, 1628.279
Right Slip Surface Endpoint:	387.558, 1681.530
Resisting Moment:	.05776e+006 lb-ft
Driving Moment:	.99863e+006 lb-ft
Resisting Horizontal Force:	8223.9 lb
Driving Horizontal Force:	4154.4 lb
Total Slice Area:	25.712 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 16652
Number of Invalid Surfaces: 1839

Error Codes:

Error Code -103 reported for 32 surfaces
Error Code -106 reported for 84 surfaces
Error Code -108 reported for 42 surfaces
Error Code -114 reported for 471 surfaces
Error Code -1000 reported for 1210 surfaces

Method: spencer

Number of Valid Surfaces: 16379
Number of Invalid Surfaces: 2112

Error Codes:

Error Code -103 reported for 32 surfaces
Error Code -106 reported for 84 surfaces
Error Code -108 reported for 52 surfaces
Error Code -111 reported for 263 surfaces
Error Code -114 reported for 471 surfaces
Error Code -1000 reported for 1210 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-111 = safety factor equation did not converge
-114 = Surface with Reverse Curvature.
-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: 1.41408

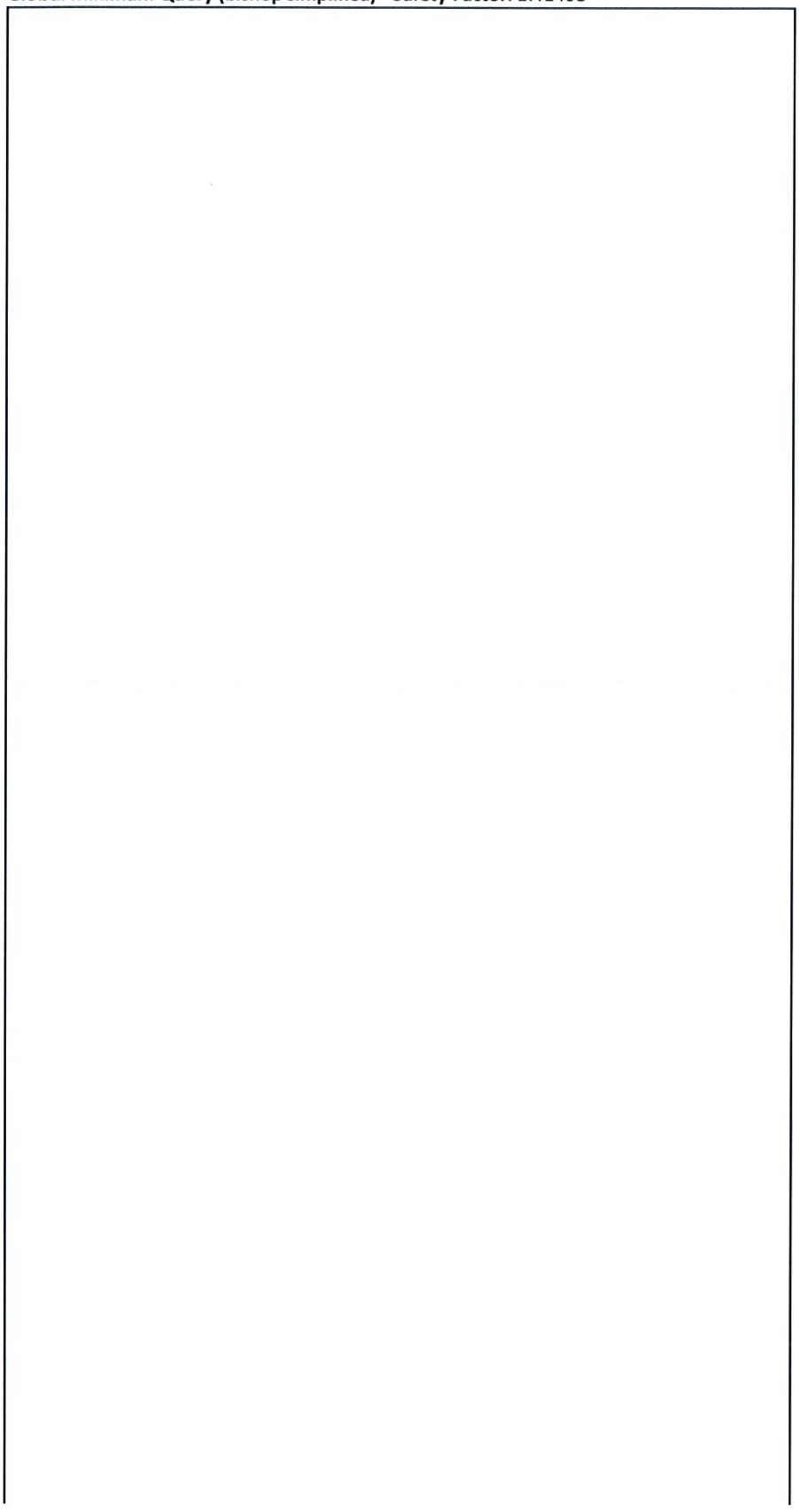
Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.63817	58.0574	12.9299	Bedrock	130	36	98.5426	139.347	12.8651	0	12.8651
2	1.63817	172.024	13.654	Bedrock	130	36	129.728	183.446	73.5626	0	73.5626
3	1.63817	281.674	14.3803	Bedrock	130	36	159.332	225.308	131.18	0	131.18
4	1.63817	386.966	15.1089	Bedrock	130	36	187.364	264.948	185.74	0	185.74
5	1.63817	487.856	15.84	Bedrock	130	36	213.837	302.382	237.263	0	237.263
6	1.63817	584.297	16.5739	Bedrock	130	36	238.759	337.624	285.769	0	285.769
7	1.63817	676.24	17.3105	Bedrock	130	36	262.139	370.686	331.276	0	331.276
8	1.63817	763.631	18.05	Bedrock	130	36	283.987	401.58	373.798	0	373.798
9	1.63817	846.414	18.7928	Bedrock	130	36	304.308	430.316	413.35	0	413.35
10	1.63817	933.796	19.5388	Bedrock	130	36	325.569	460.381	454.73	0	454.73
11	1.63817	1058.68	20.2882	Bedrock	130	36	356.42	504.007	514.777	0	514.777
12	1.63817	1183.96	21.0413	Bedrock	130	36	386.949	547.177	574.194	0	574.194
13	1.63817	1304.37	21.7982	Bedrock	130	36	415.779	587.945	630.308	0	630.308
14	1.63817	1419.84	22.5592	Bedrock	130	36	442.912	626.313	683.114	0	683.114
15	1.63817	1530.27	23.3244	Bedrock	130	36	468.348	662.282	732.622	0	732.622
16	1.63817	1635.59	24.094	Bedrock	130	36	492.09	695.854	778.833	0	778.833
17	1.63817	1735.7	24.8682	Bedrock	130	36	514.133	727.025	821.735	0	821.735
18	1.63817	1830.51	25.6474	Bedrock	130	36	534.478	755.794	861.329	0	861.329
19	1.63817	1919.9	26.4316	Bedrock	130	36	553.119	782.154	897.612	0	897.612
20	1.63817	2003.79	27.2213	Bedrock	130	36	570.053	806.101	930.575	0	930.575
21	1.63817	2082.04	28.0166	Bedrock	130	36	585.275	827.626	960.201	0	960.201
22	1.63817	2154.53	28.8178	Bedrock	130	36	598.778	846.72	986.481	0	986.481
23	1.63817	2221.13	29.6252	Bedrock	130	36	610.553	863.371	1009.4	0	1009.4
24	1.63817	2281.7	30.4391	Bedrock	130	36	620.593	877.568	1028.94	0	1028.94
25	1.63817	2336.09	31.2599	Bedrock	130	36	628.885	889.294	1045.08	0	1045.08
26	1.63817	2383.63	32.0879	Bedrock	130	36	635.302	898.368	1057.56	0	1057.56
27	1.63817	2412.96	32.9235	Bedrock	130	36	637.194	901.043	1061.25	0	1061.25
28	1.63817	2430.67	33.767	Bedrock	130	36	636.196	899.632	1059.31	0	1059.31
29	1.63817	2441.47	34.6189	Bedrock	130	36	633.463	895.768	1053.99	0	1053.99
30	1.63817	2445.17	35.4797	Bedrock	130	36	628.981	889.43	1045.26	0	1045.26
31	1.63817	2441.53	36.3498	Bedrock	130	36	622.731	880.592	1033.1	0	1033.1
32	1.63817	2430.31	37.2297	Bedrock	130	36	614.696	869.229	1017.46	0	1017.46
33	1.63817	2411.23	38.12	Bedrock	130	36	604.855	855.313	998.307	0	998.307
34	1.63817	2384.02	39.0213	Bedrock	130	36	593.187	838.814	975.599	0	975.599
35	1.63817	2348.36	39.9343	Bedrock	130	36	579.669	819.699	949.29	0	949.29
36	1.63817	2303.91	40.8596	Bedrock	130	36	564.278	797.934	919.333	0	919.333
37	1.63817	2250.29	41.798	Bedrock	130	36	546.985	773.481	885.675	0	885.675
38	1.63817	2187.11	42.7504	Bedrock	130	36	527.764	746.301	848.267	0	848.267
39	1.63817	2113.92	43.7176	Bedrock	130	36	506.586	716.353	807.047	0	807.047
40	1.63817	2030.23	44.7008	Bedrock	130	36	483.418	683.592	761.953	0	761.953
41	1.63817	1925.23	45.7009	Bedrock	130	36	456.116	644.984	708.813	0	708.813
42	1.63817	1785.31	46.7193	Bedrock	130	36	422.081	596.856	642.571	0	642.571
43	1.63817	1632.19	47.7572	Bedrock	130	36	385.949	545.763	572.25	0	572.25
44	1.63817	1466.02	48.8163	Bedrock	130	36	347.878	491.928	498.149	0	498.149
45	1.63817	1285.95	49.8983	Bedrock	130	36	307.839	435.309	420.223	0	420.223
46	1.63817	1091.04	51.0052	Bedrock	130	36	265.805	375.869	338.41	0	338.41
47	1.63817	880.212	52.1392	Bedrock	130	36	221.751	313.574	252.668	0	252.668
48	1.63817	652.214	53.3028	Bedrock	130	36	175.656	248.392	162.953	0	162.953
49	1.63817	405.613	54.499	Bedrock	130	36	127.504	180.301	69.2341	0	69.2341
50	1.63817	138.735	55.7314	Bedrock	130	36	77.288	109.291	-28.503	0	-28.503

Global Minimum Query (spencer) - Safety Factor: 1.41194

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	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	1.53769	53.1147	12.1752	Bedrock	130	36	131.175	185.212	75.9929	0	75.9929
2	1.53769	157.392	12.9265	Bedrock	130	36	166.887	235.634	145.393	0	145.393
3	1.53769	257.746	13.6801	Bedrock	130	36	200.076	282.496	209.893	0	209.893
4	1.53769	354.14	14.4361	Bedrock	130	36	230.829	325.916	269.655	0	269.655
5	1.53769	446.536	15.1946	Bedrock	130	36	259.223	366.007	324.835	0	324.835
6	1.53769	534.89	15.956	Bedrock	130	36	285.334	402.875	375.581	0	375.581
7	1.53769	620.428	16.7202	Bedrock	130	36	309.653	437.211	422.84	0	422.84
8	1.53769	735.539	17.4875	Bedrock	130	36	342.674	483.835	487.012	0	487.012
9	1.53769	861.445	18.258	Bedrock	130	36	378.013	533.731	555.689	0	555.689
10	1.53769	983.109	19.032	Bedrock	130	36	410.841	580.083	619.488	0	619.488
11	1.53769	1100.47	19.8096	Bedrock	130	36	441.228	622.987	678.541	0	678.541
12	1.53769	1213.48	20.5911	Bedrock	130	36	469.241	662.54	732.979	0	732.979
13	1.53769	1322.05	21.3765	Bedrock	130	36	494.942	698.829	782.924	0	782.924
14	1.53769	1426.13	22.1662	Bedrock	130	36	518.394	731.941	828.499	0	828.499
15	1.53769	1525.63	22.9604	Bedrock	130	36	539.651	761.955	869.813	0	869.813
16	1.53769	1620.49	23.7592	Bedrock	130	36	558.769	788.949	906.964	0	906.964
17	1.53769	1710.6	24.563	Bedrock	130	36	575.801	812.996	940.063	0	940.063
18	1.53769	1795.88	25.372	Bedrock	130	36	590.793	834.164	969.2	0	969.2
19	1.53769	1876.24	26.1864	Bedrock	130	36	603.794	852.521	994.468	0	994.468
20	1.53769	1951.58	27.0066	Bedrock	130	36	614.848	868.129	1015.95	0	1015.95
21	1.53769	2021.78	27.8328	Bedrock	130	36	623.998	881.048	1033.73	0	1033.73
22	1.53769	2086.72	28.6653	Bedrock	130	36	631.283	891.334	1047.88	0	1047.88
23	1.53769	2146.29	29.5045	Bedrock	130	36	636.742	899.042	1058.49	0	1058.49
24	1.53769	2200.34	30.3507	Bedrock	130	36	640.412	904.223	1065.63	0	1065.63
25	1.53769	2243.57	31.2043	Bedrock	130	36	641.061	905.14	1066.89	0	1066.89
26	1.53769	2271.3	32.0657	Bedrock	130	36	637.7	900.394	1060.35	0	1060.35
27	1.53769	2292.83	32.9353	Bedrock	130	36	632.717	893.358	1050.67	0	1050.67
28	1.53769	2308.22	33.8135	Bedrock	130	36	626.194	884.149	1038	0	1038
29	1.53769	2317.28	34.7008	Bedrock	130	36	618.159	872.803	1022.38	0	1022.38
30	1.53769	2319.8	35.5978	Bedrock	130	36	608.636	859.358	1003.87	0	1003.87
31	1.53769	2315.55	36.5049	Bedrock	130	36	597.651	843.847	982.527	0	982.527
32	1.53769	2304.32	37.4228	Bedrock	130	36	585.224	826.301	958.378	0	958.378
33	1.53769	2285.82	38.352	Bedrock	130	36	571.378	806.751	931.467	0	931.467
34	1.53769	2259.79	39.2934	Bedrock	130	36	556.133	785.226	901.839	0	901.839
35	1.53769	2225.93	40.2476	Bedrock	130	36	539.507	761.752	869.53	0	869.53
36	1.53769	2183.89	41.2155	Bedrock	130	36	521.519	736.354	834.572	0	834.572
37	1.53769	2133.31	42.1978	Bedrock	130	36	502.184	709.054	796.998	0	796.998
38	1.53769	2073.79	43.1958	Bedrock	130	36	481.519	679.876	756.837	0	756.837
39	1.53769	2004.89	44.2103	Bedrock	130	36	459.536	648.837	714.116	0	714.116
40	1.53769	1923.52	45.2426	Bedrock	130	36	435.769	615.28	667.93	0	667.93
41	1.53769	1809.21	46.2941	Bedrock	130	36	406.663	574.184	611.366	0	611.366
42	1.53769	1678.64	47.3661	Bedrock	130	36	375.55	530.254	550.902	0	550.902
43	1.53769	1536.38	48.4604	Bedrock	130	36	343.404	484.866	488.433	0	488.433
44	1.53769	1381.64	49.5789	Bedrock	130	36	310.235	438.033	423.971	0	423.971
45	1.53769	1213.55	50.7236	Bedrock	130	36	276.049	389.764	357.534	0	357.534
46	1.53769	1031.13	51.897	Bedrock	130	36	240.852	340.068	289.134	0	289.134
47	1.53769	833.212	53.102	Bedrock	130	36	204.65	288.953	218.78	0	218.78
48	1.53769	618.474	54.3417	Bedrock	130	36	167.446	236.423	146.479	0	146.479
49	1.53769	385.351	55.62	Bedrock	130	36	129.242	182.482	72.2349	0	72.2349
50	1.53769	131.991	56.9416	Bedrock	130	36	87.9644	124.2	-7.98237	0	-7.98237

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.41408



Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	305.646	1625.31	0	0	0
2	307.284	1625.69	156.247	0	0
3	308.922	1626.09	339.037	0	0
4	310.56	1626.51	544.397	0	0
5	312.199	1626.95	768.527	0	0
6	313.837	1627.41	1007.8	0	0
7	315.475	1627.9	1258.77	0	0
8	317.113	1628.41	1518.15	0	0
9	318.751	1628.95	1782.82	0	0
10	320.389	1629.5	2049.84	0	0
11	322.028	1630.08	2317.69	0	0
12	323.666	1630.69	2588.57	0	0
13	325.304	1631.32	2859.26	0	0
14	326.942	1631.97	3125.97	0	0
15	328.58	1632.66	3385.1	0	0
16	330.219	1633.36	3633.22	0	0
17	331.857	1634.09	3867.07	0	0
18	333.495	1634.85	4083.56	0	0
19	335.133	1635.64	4279.78	0	0
20	336.771	1636.45	4453.01	0	0
21	338.409	1637.3	4600.69	0	0
22	340.048	1638.17	4720.48	0	0
23	341.686	1639.07	4810.22	0	0
24	343.324	1640	4867.96	0	0
25	344.962	1640.96	4891.95	0	0
26	346.6	1641.96	4880.7	0	0
27	348.238	1642.99	4832.94	0	0
28	349.877	1644.05	4748.84	0	0
29	351.515	1645.14	4628.56	0	0
30	353.153	1646.27	4472.12	0	0
31	354.791	1647.44	4279.83	0	0
32	356.429	1648.65	4052.34	0	0
33	358.067	1649.89	3790.65	0	0
34	359.706	1651.18	3496.15	0	0
35	361.344	1652.5	3170.64	0	0
36	362.982	1653.88	2816.37	0	0
37	364.62	1655.29	2436.08	0	0
38	366.258	1656.76	2033.07	0	0
39	367.897	1658.27	1611.24	0	0
40	369.535	1659.84	1175.16	0	0
41	371.173	1661.46	730.149	0	0
42	372.811	1663.14	285.828	0	0
43	374.449	1664.88	-141.997	0	0
44	376.087	1666.68	-543.4	0	0
45	377.726	1668.55	-907.443	0	0
46	379.364	1670.5	-1221.67	0	0
47	381.002	1672.52	-1471.89	0	0
48	382.64	1674.63	-1641.84	0	0
49	384.278	1676.83	-1712.87	0	0
50	385.916	1679.12	-1663.44	0	0
51	387.555	1681.53	0	0	0

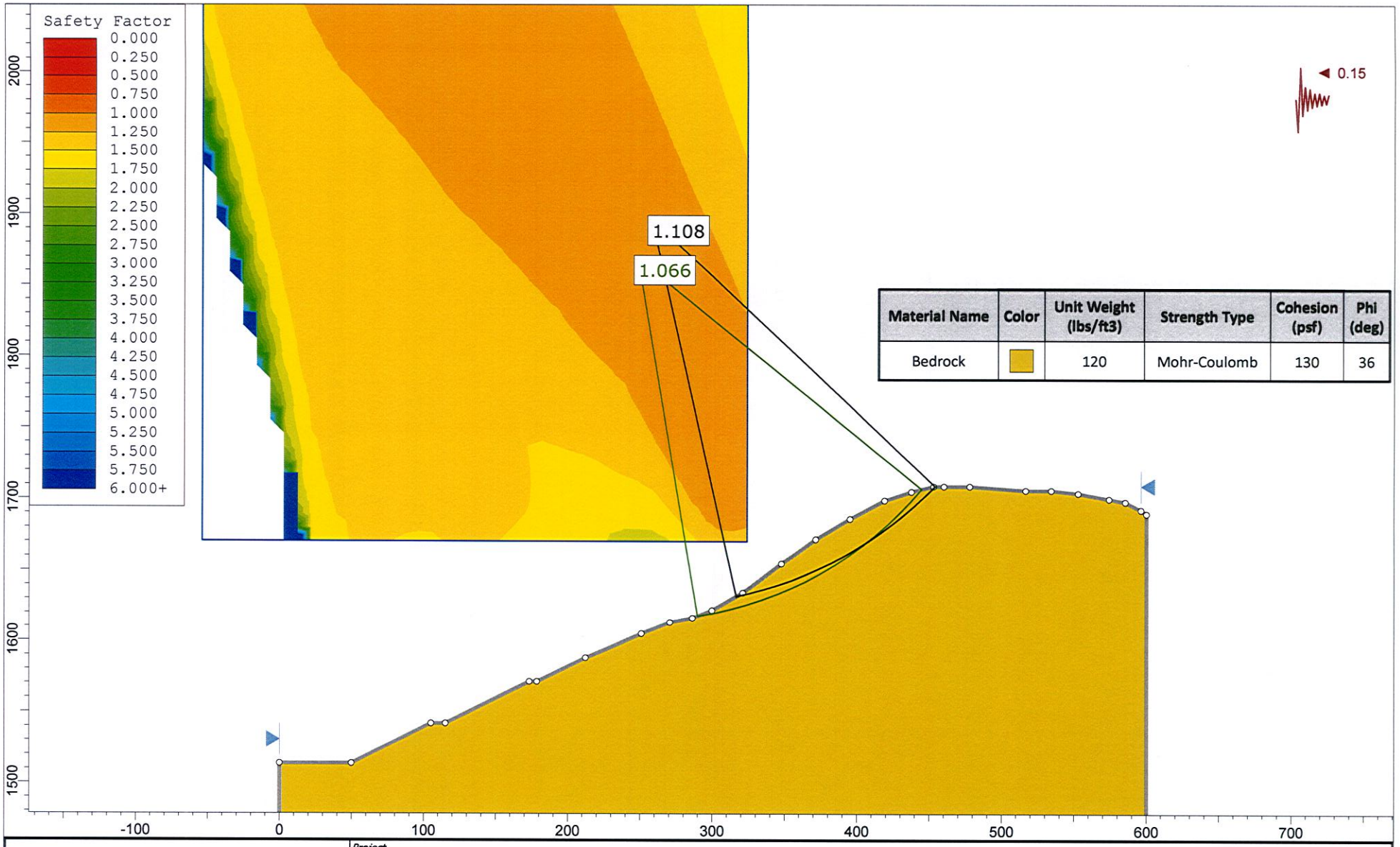
Global Minimum Query (spencer) - Safety Factor: 1.41194

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	310.674	1628.28	0	0	0
2	312.212	1628.61	176.405	109.35	31.794
3	313.749	1628.96	381.598	236.544	31.7938
4	315.287	1629.34	610.557	378.471	31.7939
5	316.825	1629.73	858.6	532.227	31.7939
6	318.362	1630.15	1121.37	695.11	31.7938
7	319.9	1630.59	1394.8	864.608	31.7939
8	321.438	1631.05	1675.42	1038.56	31.794
9	322.976	1631.54	1966.17	1218.79	31.794
10	324.513	1632.05	2265.28	1404.2	31.7939
11	326.051	1632.58	2568.15	1591.94	31.7939
12	327.589	1633.13	2870.48	1779.35	31.7939
13	329.126	1633.71	3168.26	1963.94	31.7939
14	330.664	1634.31	3457.75	2143.39	31.7939
15	332.202	1634.94	3735.5	2315.56	31.7939
16	333.739	1635.59	3998.3	2478.46	31.7939
17	335.277	1636.26	4243.21	2630.28	31.7939
18	336.815	1636.97	4467.54	2769.33	31.7939
19	338.352	1637.7	4668.82	2894.1	31.7939
20	339.89	1638.45	4844.86	3003.22	31.7938
21	341.428	1639.24	4993.67	3095.47	31.7939
22	342.965	1640.05	5113.52	3169.76	31.7939
23	344.503	1640.89	5202.89	3225.16	31.7939
24	346.041	1641.76	5260.53	3260.89	31.7939
25	347.579	1642.66	5285.37	3276.29	31.7939
26	349.116	1643.59	5276.97	3271.08	31.7939
27	350.654	1644.55	5235.67	3245.48	31.7939
28	352.192	1645.55	5161.56	3199.54	31.7939
29	353.729	1646.58	5054.97	3133.47	31.7939
30	355.267	1647.64	4916.48	3047.62	31.7939
31	356.805	1648.75	4746.9	2942.5	31.7939
32	358.342	1649.88	4547.35	2818.8	31.7938
33	359.88	1651.06	4319.19	2677.38	31.794
34	361.418	1652.28	4064.12	2519.26	31.7939
35	362.955	1653.53	3784.12	2345.7	31.7939
36	364.493	1654.84	3481.53	2158.13	31.7939
37	366.031	1656.18	3159.04	1958.22	31.7939
38	367.568	1657.58	2819.74	1747.89	31.7938
39	369.106	1659.02	2467.13	1529.32	31.7939
40	370.644	1660.52	2105.21	1304.97	31.7938
41	372.181	1662.07	1739.18	1078.08	31.7939
42	373.719	1663.68	1380.68	855.855	31.7939
43	375.257	1665.35	1037.77	643.288	31.7938
44	376.795	1667.08	717.846	444.978	31.7939
45	378.332	1668.89	429.23	266.071	31.7939
46	379.87	1670.77	181.259	112.359	31.794
47	381.408	1672.73	-15.5065	-9.61216	31.7939
48	382.945	1674.78	-149.054	-92.3956	31.7939
49	384.483	1676.92	-205.625	-127.463	31.794
50	386.021	1679.17	-169.322	-104.959	31.7939
51	387.558	1681.53	0	0	0

List Of Coordinates

External Boundary

X	Y
600	1400
600	1689.93
596.265	1692.6
585.362	1698.11
574.157	1700.17
552.836	1704.17
534.241	1706.16
516.615	1706.16
477.91	1709.13
460.102	1709.13
452.941	1709.13
437.624	1705.31
419.067	1699.05
395.184	1686.15
371.546	1671.83
347.843	1654.93
321.091	1634.43
299.898	1621.92
286.348	1616.36
270.714	1613.23
251.084	1604.9
212.345	1588.05
178.645	1570.85
173.433	1570.85
115.238	1541.84
105.163	1541.84
49.854	1513.7
0	1513.7
0	1400



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock		120	Mohr-Coulomb	130	36

SLIDEINTERPRET 7.009

Project	# 6946			
Analysis Description	9-9' Global (Seismic)			
Drawn By	JG	Scale	1:1100	Company: GeoSoils Consultants, Inc.
Date	4/11/2017			File Name: 6946 9-9 Seismic.slim

Slide Analysis Information

6946

Project Summary

File Name:	6946 9-9 Seismic.slim
Slide Modeler Version:	7.009
Project Title:	# 6946
Analysis:	9-9' Global (Seismic)
Author:	JG
Company:	GeoSoils Consultants, Inc.
Date Created:	4/11/2017

General Settings

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

Analysis Options

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

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
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
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced Seismic Analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.15

Material Properties

Property	Bedrock
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	130
Friction Angle [deg]	36
Water Surface	None
Ru Value	0

Global Minimums

Method: bishop simplified

FS	1.066130
Center:	248.320, 1868.685
Radius:	254.327
Left Slip Surface Endpoint:	289.746, 1617.755
Right Slip Surface Endpoint:	444.696, 1707.073
Resisting Moment:	.07821e+007 lb-ft
Driving Moment:	.7632e+007 lb-ft
Total Slice Area:	498.89 ft2

Method: spencer

FS	1.066400
Center:	248.320, 1868.685
Radius:	254.327
Left Slip Surface Endpoint:	289.746, 1617.755
Right Slip Surface Endpoint:	444.696, 1707.073
Resisting Moment:	.07946e+007 lb-ft
Driving Moment:	.7632e+007 lb-ft
Resisting Horizontal Force:	72202 lb
Driving Horizontal Force:	61480 lb
Total Slice Area:	498.89 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 16681
Number of Invalid Surfaces: 1810

Error Codes:

Error Code -103 reported for 32 surfaces
Error Code -106 reported for 84 surfaces
Error Code -108 reported for 13 surfaces
Error Code -114 reported for 471 surfaces
Error Code -1000 reported for 1210 surfaces

Method: spencer

Number of Valid Surfaces: 16357
Number of Invalid Surfaces: 2134

Error Codes:

Error Code -103 reported for 32 surfaces
Error Code -106 reported for 84 surfaces
Error Code -108 reported for 29 surfaces
Error Code -111 reported for 308 surfaces
Error Code -114 reported for 471 surfaces
Error Code -1000 reported for 1210 surfaces

Error Codes

The following errors were encountered during the computation:

-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).
-111 = safety factor equation did not converge
-114 = Surface with Reverse Curvature.
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

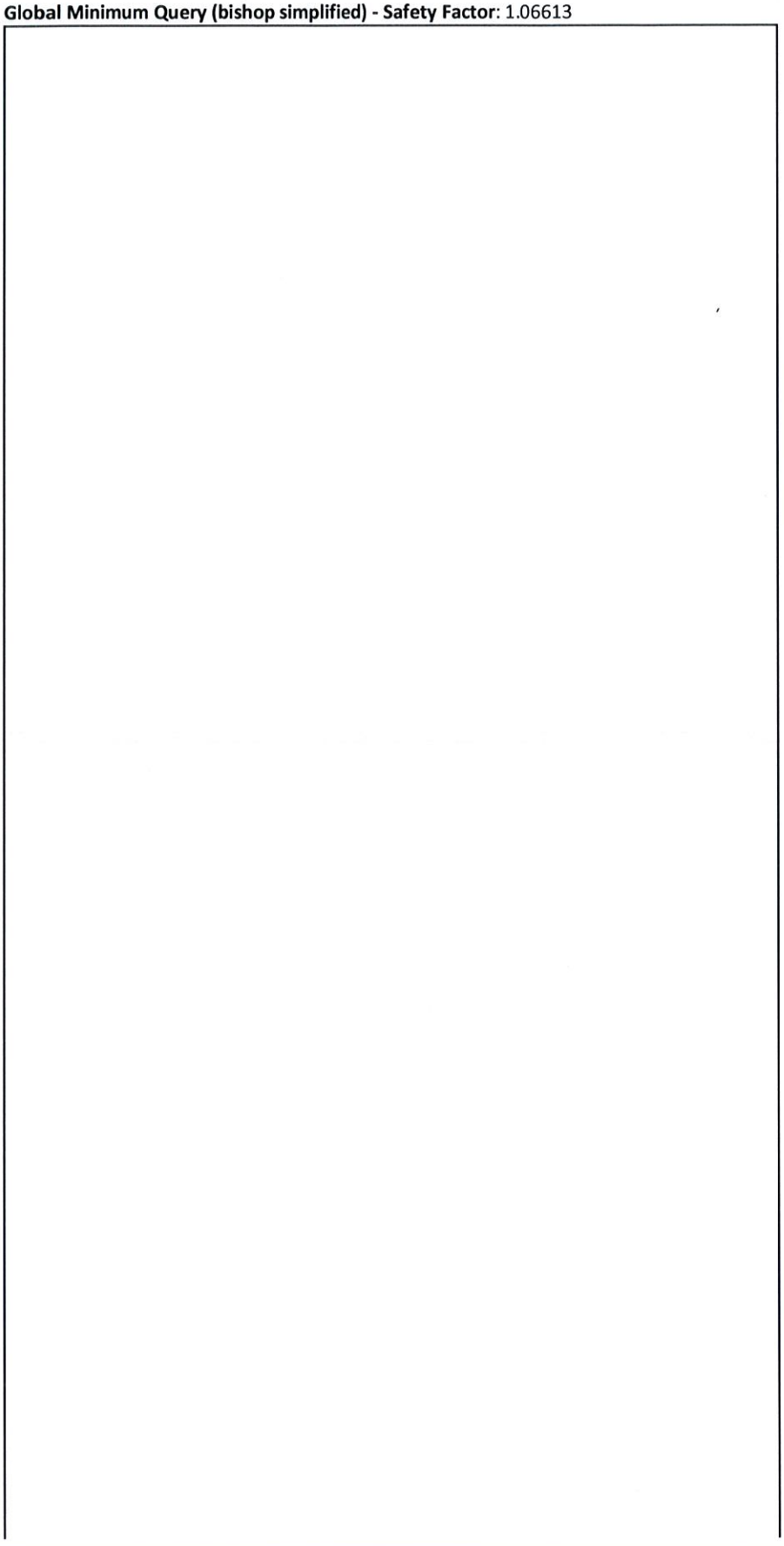
Global Minimum Query (bishop simplified) - Safety Factor: 1.06613

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	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	3.09901	137.611	9.72855	Bedrock	130	36	136.279	145.291	21.0462	0	21.0462
2	3.09901	405.476	10.4377	Bedrock	130	36	187.561	199.964	96.2978	0	96.2978
3	3.09901	658.575	11.1484	Bedrock	130	36	235.181	250.734	166.176	0	166.176
4	3.09901	951.137	11.8609	Bedrock	130	36	289.648	308.802	246.1	0	246.1
5	3.09901	1373.8	12.5753	Bedrock	130	36	368.094	392.436	361.211	0	361.211
6	3.09901	1789.26	13.2916	Bedrock	130	36	443.944	473.302	472.514	0	472.514
7	3.09901	2189.47	14.0101	Bedrock	130	36	515.732	549.837	577.858	0	577.858
8	3.09901	2574.32	14.7308	Bedrock	130	36	583.509	622.096	677.311	0	677.311
9	3.09901	2943.63	15.4539	Bedrock	130	36	647.32	690.127	770.95	0	770.95
10	3.09901	3297.26	16.1796	Bedrock	130	36	707.211	753.979	858.832	0	858.832
11	3.09901	3714.57	16.9079	Bedrock	130	36	777.711	829.141	962.285	0	962.285
12	3.09901	4237.89	17.6391	Bedrock	130	36	866.205	923.487	1092.14	0	1092.14
13	3.09901	4746.32	18.3732	Bedrock	130	36	950.56	1013.42	1215.93	0	1215.93
14	3.09901	5238.32	19.1105	Bedrock	130	36	1030.57	1098.72	1333.33	0	1333.33
15	3.09901	5713.68	19.8511	Bedrock	130	36	1106.27	1179.43	1444.41	0	1444.41
16	3.09901	6172.15	20.5951	Bedrock	130	36	1177.69	1255.57	1549.21	0	1549.21
17	3.09901	6613.5	21.3428	Bedrock	130	36	1244.85	1327.17	1647.77	0	1647.77
18	3.09901	7037.46	22.0943	Bedrock	130	36	1307.79	1394.27	1740.12	0	1740.12
19	3.09901	7441.81	22.8499	Bedrock	130	36	1366.18	1456.53	1825.8	0	1825.8
20	3.09901	7785.98	23.6097	Bedrock	130	36	1413.23	1506.69	1894.85	0	1894.85
21	3.09901	8094.79	24.3739	Bedrock	130	36	1453.37	1549.48	1953.74	0	1953.74
22	3.09901	8385.01	25.1427	Bedrock	130	36	1489.51	1588.01	2006.79	0	2006.79
23	3.09901	8656.29	25.9165	Bedrock	130	36	1521.69	1622.32	2054	0	2054
24	3.09901	8908.27	26.6953	Bedrock	130	36	1549.9	1652.39	2095.39	0	2095.39
25	3.09901	9140.55	27.4795	Bedrock	130	36	1574.15	1678.25	2130.98	0	2130.98
26	3.09901	9352.72	28.2693	Bedrock	130	36	1594.45	1699.89	2160.76	0	2160.76
27	3.09901	9521.81	29.0651	Bedrock	130	36	1607.21	1713.49	2179.48	0	2179.48
28	3.09901	9578.75	29.867	Bedrock	130	36	1601.67	1707.59	2171.36	0	2171.36
29	3.09901	9604.5	30.6754	Bedrock	130	36	1591	1696.21	2155.71	0	2155.71
30	3.09901	9608.17	31.4906	Bedrock	130	36	1576.73	1681	2134.77	0	2134.77
31	3.09901	9589.18	32.3131	Bedrock	130	36	1558.86	1661.95	2108.55	0	2108.55
32	3.09901	9546.92	33.143	Bedrock	130	36	1537.38	1639.05	2077.03	0	2077.03
33	3.09901	9480.73	33.9809	Bedrock	130	36	1512.29	1612.3	2040.21	0	2040.21
34	3.09901	9389.9	34.8271	Bedrock	130	36	1483.57	1581.68	1998.07	0	1998.07
35	3.09901	9237.36	35.6821	Bedrock	130	36	1445.86	1541.48	1942.73	0	1942.73
36	3.09901	9018.81	36.5464	Bedrock	130	36	1398.8	1491.3	1873.67	0	1873.67
37	3.09901	8773.15	37.4205	Bedrock	130	36	1348.31	1437.47	1799.58	0	1799.58
38	3.09901	8499.44	38.3049	Bedrock	130	36	1294.39	1379.99	1720.46	0	1720.46
39	3.09901	8196.66	39.2002	Bedrock	130	36	1237.03	1318.83	1636.28	0	1636.28
40	3.09901	7863.68	40.107	Bedrock	130	36	1176.2	1253.98	1547.03	0	1547.03
41	3.09901	7499.29	41.0262	Bedrock	130	36	1111.91	1185.44	1452.68	0	1452.68
42	3.09901	7093.66	41.9583	Bedrock	130	36	1042.97	1111.94	1351.52	0	1351.52
43	3.09901	6491.21	42.9043	Bedrock	130	36	948.663	1011.4	1213.14	0	1213.14
44	3.09901	5790.84	43.8651	Bedrock	130	36	843.194	898.954	1058.37	0	1058.37
45	3.09901	5052.96	44.8416	Bedrock	130	36	735.053	783.662	899.688	0	899.688
46	3.09901	4275.65	45.8349	Bedrock	130	36	624.263	665.545	737.116	0	737.116
47	3.09901	3456.77	46.8463	Bedrock	130	36	510.851	544.634	570.696	0	570.696
48	3.09901	2589.89	47.8772	Bedrock	130	36	394.349	420.427	399.738	0	399.738
49	3.09901	1604.61	48.929	Bedrock	130	36	266.468	284.09	212.086	0	212.086
50	3.09901	543.4	50.0034	Bedrock	130	36	133.236	142.047	16.5815	0	16.5815

Global Minimum Query (spencer) - Safety Factor: 1.0664

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	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	3.09901	137.611	9.72855	Bedrock	130	36	215.618	229.935	137.548	0	137.548
2	3.09901	405.476	10.4377	Bedrock	130	36	280.751	299.393	233.149	0	233.149
3	3.09901	658.575	11.1484	Bedrock	130	36	339.413	361.95	319.251	0	319.251
4	3.09901	951.137	11.8609	Bedrock	130	36	405.165	432.068	415.759	0	415.759
5	3.09901	1373.8	12.5753	Bedrock	130	36	499.137	532.28	553.692	0	553.692
6	3.09901	1789.26	13.2916	Bedrock	130	36	587.416	626.42	683.263	0	683.263
7	3.09901	2189.47	14.0101	Bedrock	130	36	668.419	712.802	802.158	0	802.158
8	3.09901	2574.32	14.7308	Bedrock	130	36	742.471	791.771	910.848	0	910.848
9	3.09901	2943.63	15.4539	Bedrock	130	36	809.878	863.654	1009.79	0	1009.79
10	3.09901	3297.26	16.1796	Bedrock	130	36	870.928	928.758	1099.39	0	1099.39
11	3.09901	3714.57	16.9079	Bedrock	130	36	942.656	1005.25	1204.68	0	1204.68
12	3.09901	4237.89	17.6391	Bedrock	130	36	1033.08	1101.68	1337.4	0	1337.4
13	3.09901	4746.32	18.3732	Bedrock	130	36	1116.52	1190.66	1459.88	0	1459.88
14	3.09901	5238.32	19.1105	Bedrock	130	36	1192.99	1272.2	1572.1	0	1572.1
15	3.09901	5713.68	19.8511	Bedrock	130	36	1262.74	1346.59	1674.49	0	1674.49
16	3.09901	6172.15	20.5951	Bedrock	130	36	1326.05	1414.1	1767.41	0	1767.41
17	3.09901	6613.5	21.3428	Bedrock	130	36	1383.16	1475	1851.23	0	1851.23
18	3.09901	7037.46	22.0943	Bedrock	130	36	1434.29	1529.53	1926.29	0	1926.29
19	3.09901	7441.81	22.8499	Bedrock	130	36	1479.32	1577.55	1992.39	0	1992.39
20	3.09901	7785.98	23.6097	Bedrock	130	36	1511.42	1611.78	2039.5	0	2039.5
21	3.09901	8094.79	24.3739	Bedrock	130	36	1535.56	1637.52	2074.92	0	2074.92
22	3.09901	8385.01	25.1427	Bedrock	130	36	1554.95	1658.2	2103.39	0	2103.39
23	3.09901	8656.29	25.9165	Bedrock	130	36	1569.8	1674.03	2125.17	0	2125.17
24	3.09901	8908.27	26.6953	Bedrock	130	36	1580.23	1685.16	2140.5	0	2140.5
25	3.09901	9140.55	27.4795	Bedrock	130	36	1586.43	1691.77	2149.59	0	2149.59
26	3.09901	9352.72	28.2693	Bedrock	130	36	1588.53	1694.01	2152.67	0	2152.67
27	3.09901	9521.81	29.0651	Bedrock	130	36	1583.24	1688.37	2144.91	0	2144.91
28	3.09901	9578.75	29.867	Bedrock	130	36	1560.69	1664.32	2111.8	0	2111.8
29	3.09901	9604.5	30.6754	Bedrock	130	36	1533.72	1635.56	2072.22	0	2072.22
30	3.09901	9608.17	31.4906	Bedrock	130	36	1503.91	1603.77	2028.47	0	2028.47
31	3.09901	9589.18	32.3131	Bedrock	130	36	1471.35	1569.05	1980.69	0	1980.69
32	3.09901	9546.92	33.143	Bedrock	130	36	1436.15	1531.51	1929.02	0	1929.02
33	3.09901	9480.73	33.9809	Bedrock	130	36	1398.4	1491.25	1873.6	0	1873.6
34	3.09901	9389.9	34.8271	Bedrock	130	36	1358.17	1448.35	1814.55	0	1814.55
35	3.09901	9237.36	35.6821	Bedrock	130	36	1310.88	1397.92	1745.15	0	1745.15
36	3.09901	9018.81	36.5464	Bedrock	130	36	1256.49	1339.92	1665.31	0	1665.31
37	3.09901	8773.15	37.4205	Bedrock	130	36	1200.28	1279.98	1582.81	0	1582.81
38	3.09901	8499.44	38.3049	Bedrock	130	36	1142.32	1218.17	1497.74	0	1497.74
39	3.09901	8196.66	39.2002	Bedrock	130	36	1082.68	1154.57	1410.19	0	1410.19
40	3.09901	7863.68	40.107	Bedrock	130	36	1021.41	1089.23	1320.27	0	1320.27
41	3.09901	7499.29	41.0262	Bedrock	130	36	958.574	1022.22	1228.04	0	1228.04
42	3.09901	7093.66	41.9583	Bedrock	130	36	893.297	952.612	1132.23	0	1132.23
43	3.09901	6491.21	42.9043	Bedrock	130	36	809.176	862.905	1008.76	0	1008.76
44	3.09901	5790.84	43.8651	Bedrock	130	36	718.02	765.696	874.96	0	874.96
45	3.09901	5052.96	44.8416	Bedrock	130	36	626.688	668.3	740.907	0	740.907
46	3.09901	4275.65	45.8349	Bedrock	130	36	535.215	570.753	606.644	0	606.644
47	3.09901	3456.77	46.8463	Bedrock	130	36	443.637	473.094	472.229	0	472.229
48	3.09901	2589.89	47.8772	Bedrock	130	36	351.606	374.953	337.148	0	337.148
49	3.09901	1604.61	48.929	Bedrock	130	36	252.945	269.741	192.337	0	192.337
50	3.09901	543.4	50.0034	Bedrock	130	36	141.098	150.467	28.1706	0	28.1706

Global Minimum Query (bishop simplified) - Safety Factor: 1.06613



Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	289.746	1617.75	0	0	0
2	292.845	1618.29	390.401	0	0
3	295.944	1618.86	855.715	0	0
4	299.043	1619.47	1384.09	0	0
5	302.142	1620.12	1978.64	0	0
6	305.241	1620.81	2663.31	0	0
7	308.34	1621.54	3424.44	0	0
8	311.439	1622.32	4247.06	0	0
9	314.538	1623.13	5116.89	0	0
10	317.637	1623.99	6020.4	0	0
11	320.736	1624.89	6944.7	0	0
12	323.835	1625.83	7890.56	0	0
13	326.934	1626.81	8862.41	0	0
14	330.033	1627.84	9843.99	0	0
15	333.132	1628.92	10819.5	0	0
16	336.231	1630.04	11773.9	0	0
17	339.33	1631.2	12692.7	0	0
18	342.429	1632.41	13562.2	0	0
19	345.528	1633.67	14369.4	0	0
20	348.627	1634.97	15101.6	0	0
21	351.726	1636.33	15745.6	0	0
22	354.825	1637.73	16291	0	0
23	357.924	1639.19	16729.3	0	0
24	361.023	1640.69	17052.3	0	0
25	364.122	1642.25	17252.7	0	0
26	367.221	1643.86	17324	0	0
27	370.32	1645.53	17260.1	0	0
28	373.419	1647.25	17057.4	0	0
29	376.518	1649.03	16718.7	0	0
30	379.617	1650.87	16244.6	0	0
31	382.716	1652.77	15635.9	0	0
32	385.815	1654.73	14894.3	0	0
33	388.914	1656.75	14022.5	0	0
34	392.013	1658.84	13024.2	0	0
35	395.112	1661	11904.3	0	0
36	398.211	1663.22	10674.9	0	0
37	401.31	1665.52	9352.06	0	0
38	404.409	1667.89	7946.45	0	0
39	407.508	1670.34	6470.39	0	0
40	410.607	1672.87	4937.78	0	0
41	413.706	1675.48	3364.24	0	0
42	416.805	1678.17	1767.27	0	0
43	419.904	1680.96	168.869	0	0
44	423.003	1683.84	-1359.72	0	0
45	426.102	1686.82	-2768.41	0	0
46	429.201	1689.9	-4021.75	0	0
47	432.3	1693.09	-5080.86	0	0
48	435.399	1696.4	-5903.05	0	0
49	438.498	1699.82	-6439.65	0	0
50	441.597	1703.38	-6608.95	0	0
51	444.696	1707.07	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.0664

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	289.746	1617.75	0	0	0
2	292.845	1618.29	576.821	436.539	37.1185
3	295.944	1618.86	1256	950.543	37.1185
4	299.043	1619.47	2017.77	1527.05	37.1185
5	302.142	1620.12	2864.51	2167.87	37.1185
6	305.241	1620.81	3827.93	2896.98	37.1185
7	308.34	1621.54	4886.11	3697.82	37.1185
8	311.439	1622.32	6016.12	4553.01	37.1185
9	314.538	1623.13	7196.81	5446.56	37.1185
10	317.637	1623.99	8408.75	6363.76	37.1185
11	320.736	1624.89	9634.12	7291.12	37.1185
12	323.835	1625.83	10873.7	8229.2	37.1184
13	326.934	1626.81	12132.9	9182.17	37.1184
14	330.033	1627.84	13390.5	10134	37.1186
15	333.132	1628.92	14626.7	11069.5	37.1185
16	336.231	1630.04	15823.2	11975	37.1184
17	339.33	1631.2	16963	12837.6	37.1184
18	342.429	1632.41	18030.7	13645.7	37.1186
19	345.528	1633.67	19012.3	14388.5	37.1184
20	348.627	1634.97	19894.7	15056.3	37.1184
21	351.726	1636.33	20664.5	15639	37.1186
22	354.825	1637.73	21312.4	16129.2	37.1184
23	357.924	1639.19	21831	16521.7	37.1184
24	361.023	1640.69	22214.1	16811.7	37.1185
25	364.122	1642.25	22456.6	16995.2	37.1185
26	367.221	1643.86	22554.3	17069.2	37.1186
27	370.32	1645.53	22504.1	17031.2	37.1186
28	373.419	1647.25	22305.1	16880.5	37.1184
29	376.518	1649.03	21963.6	16622.1	37.1185
30	379.617	1650.87	21483.3	16258.6	37.1185
31	382.716	1652.77	20868.3	15793.1	37.1184
32	385.815	1654.73	20123.3	15229.3	37.1184
33	388.914	1656.75	19254	14571.5	37.1186
34	392.013	1658.84	18267.2	13824.6	37.1184
35	395.112	1661	17170.2	12994.4	37.1184
36	398.211	1663.22	15977.6	12091.9	37.1186
37	401.31	1665.52	14707	11130.3	37.1185
38	404.409	1667.89	13370.7	10119	37.1186
39	407.508	1670.34	11982	9068.01	37.1185
40	410.607	1672.87	10555.2	7988.22	37.1186
41	413.706	1675.48	9105.9	6891.36	37.1185
42	416.805	1678.17	7650.74	5790.1	37.1185
43	419.904	1680.96	6210.03	4699.76	37.1185
44	423.003	1683.84	4847.35	3668.48	37.1185
45	426.102	1686.82	3605.51	2728.66	37.1185
46	429.201	1689.9	2513.08	1901.9	37.1185
47	432.3	1693.09	1600.58	1211.32	37.1185
48	435.399	1696.4	900.782	681.714	37.1185
49	438.498	1699.82	450.342	340.82	37.1185
50	441.597	1703.38	312.312	236.358	37.1185
51	444.696	1707.07	0	0	0

List Of Coordinates

External Boundary

X	Y
600	1400
600	1689.93
596.265	1692.6
585.362	1698.11
574.157	1700.17
552.836	1704.17
534.241	1706.16
516.615	1706.16
477.91	1709.13
460.102	1709.13
452.941	1709.13
437.624	1705.31
419.067	1699.05
395.184	1686.15
371.546	1671.83
347.843	1654.93
321.091	1634.43
299.898	1621.92
286.348	1616.36
270.714	1613.23
251.084	1604.9
212.345	1588.05
178.645	1570.85
173.433	1570.85
115.238	1541.84
105.163	1541.84
49.854	1513.7
0	1513.7
0	1400